2000

WORKSHOP MANUAL

TROOPER

RODEO

AMIGO

ISUZU

TROOPER(UX)

CONTENTS

TROOPER

GENERAL INFORMATION

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GENERAL INFORMATION

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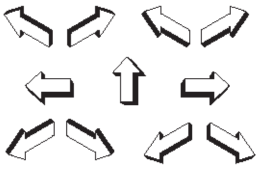
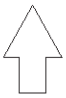
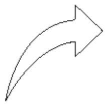
General Repair Instruction

1. If a floor jack is used, the following precautions are recommended.
   Park vehicle on level ground, “block” front or rear wheels, set jack against the recommended lifting points (see “Lifting Instructions” in this section), raise vehicle and support with chassis stands and then perform the service operations.
2. Before performing service operations, disconnect ground cable from the battery to reduce the chance of cable damage and burning due to short circuiting.
3. Use a cover on body, seats and floor to protect them against damage and contamination.
4. Brake fluid and anti–freeze solution must be handled with reasonable care, as they can cause paint damage.
5. The use of proper tools and recommended essential and available tools, where specified, is important for efficient and reliable performance of service repairs.
6. Use genuine Isuzu parts.
7. Used cotter pins, plastic clips, gaskets, O–rings, oil seals, lock washers and self–locking nuts should be discarded and new ones should be installed, as normal function of the parts cannot be maintained if these parts are reused.
8. To facilitate proper and smooth reassembly operation, keep disassembled parts neatly in groups. Keeping fixing bolts and nuts separate is very important, as they vary in hardness and design depending on position of installation.
9. Clean the parts before inspection or reassembly. Also clean oil ports, etc. using compressed air, and make certain they are free from restrictions.
10. Lubricate rotating and sliding faces of the parts with oil or grease before installation.
11. When necessary, use a sealer on gaskets to prevent leakage.
12. Carefully observe all specifications for bolt and nut torques.
13. When removing or replacing parts that require refrigerant to be discharged from the air conditioning system, be sure to use the Vehicle Refrigerant Recovery and Recycling Equipment (VRRRE) to recover and recycle Refrigerant–134a.
14. When a service operation is completed, make a final check to be sure the service has been done properly and the problem has been corrected.
15. SUPPLEMENTAL RESTRAINT SYSTEM
    The vehicle is equipped with a Supplemental Restraint System. (SRS)—Air Bag.
    This system is not to be serviced without consulting the appropriate service information.
    Consult Sections 9J1 and 9J “SRS System” if work is to be done on the front of the vehicle such as bumper, sheet metal, seats, wiring, steering wheel or column.
    Also review SRS system information if any arc welding is to be done on the vehicle.
    The SRS system equipped vehicle can be identified by:
    1. “AIR BAG” warning light on the instrument panel.
    2. A Code “J” or “K” for fifth digit of vehicle Identification Number.

Illustration Arrows

Arrows are designed for specific purposes to aid your understanding of technical illustrations.

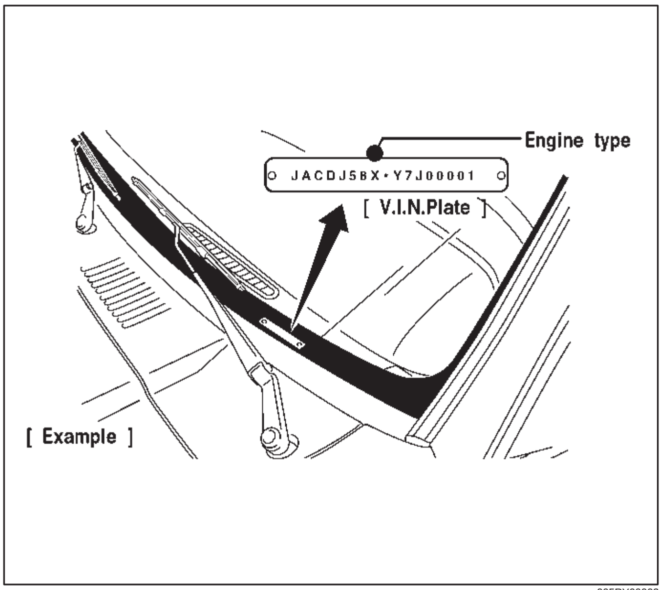
Arrow Type	Application
	Front of vehicle
	Up Side
	Task Related
	View Detall
A 	View Angle
	Dimension (1:2)
	Sectioning (1:3)

Arrow Type	Application
	• Ambient/Clean air flow • Cool air flow
	• Gas other than ambient air • Hot air flow
	• Ambient air mixed with another gas • Can indicate temperature change
	Motion or direction
	Lubrication point oil or fluid
	Lubrication point grease
	Lubrication point jelly

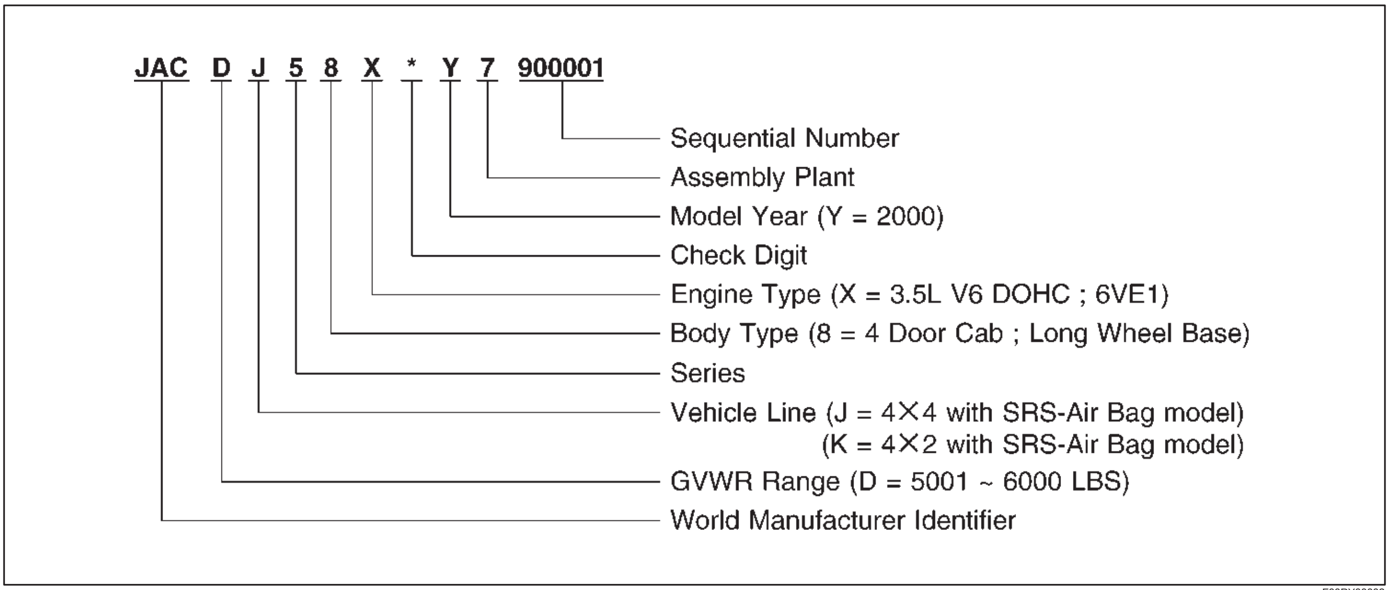
Identification

Vehicle Identification Number (VIN)

This is the legal identification of the vehicle. it is located on the left bottom of the windshield. It can be easily seen through the windshield from outside the vehicle.



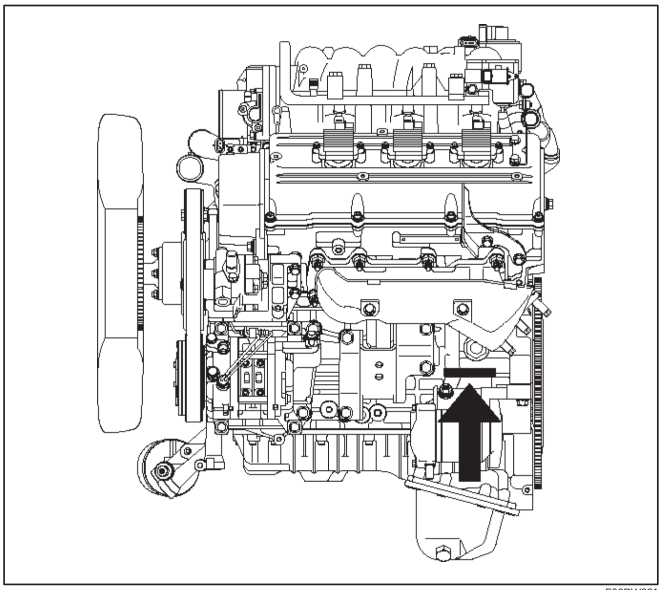
905RY00002



F00RY00002

Engine Serial Number

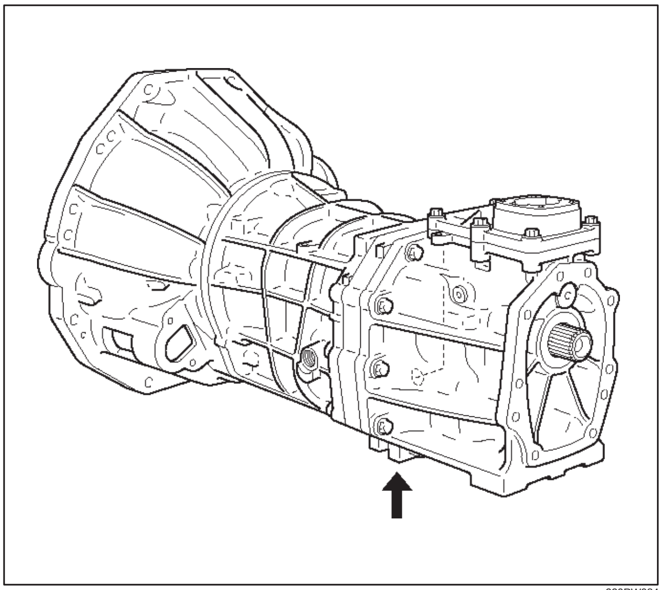
The gasoline engine serial number is stamped on the left rear lower area of the cylinder block above the starter.



F06RW001

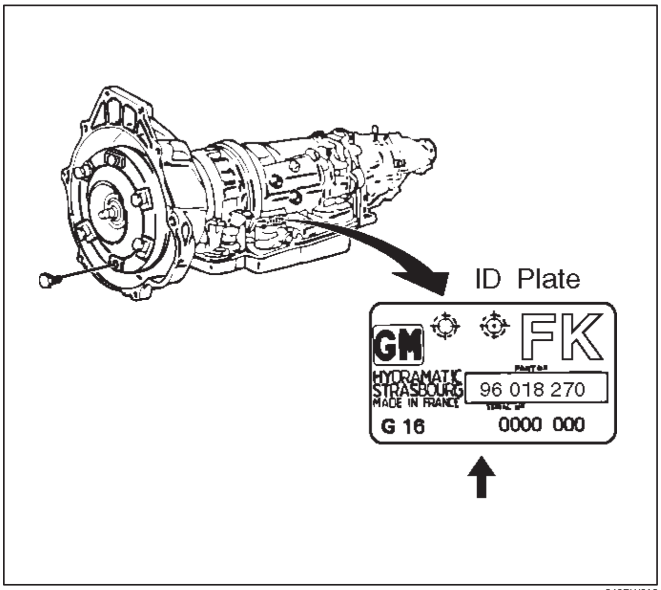
Transmission Serial Number

Manual : Stamped on the left side of the transmission intermediate plate.



220RW084

Automatic : Stamped on the identification plate, located on the left side of the transmission above the mode switch.



240RW012

Theft Prevention Standard

The 11 major components listed below will be marked with 17 digit V.I.N. at the stage of production. In addition its service parts will be marked with manufacturer's trade mark, "R" mark and "DOT" mark.

Reference Figure No.	COMPONENT		INDICATION	
			PRODUCTION	SERVICE PARTS
0A-10	ENGINE	1– 6VE1	V.I.N. plate	R DOT Mark stamping
0A-11	TRANSMISSION	2– Manual transmission – Automatic transmission	V.I.N. plate	R DOT Mark stamping
0A-11	BODY	3– Engine hood 4– Front door 5– Rear door 6– Fender 7– Rear Quarter panel 8– Front bumper 9– Back door left side 10– Back door right side 11– Rear bumper	V.I.N. label	R DOT Mark label

Anti Theft Stamping/Plate/Label

	STAMPING/PLATE	LABEL
PRODUCTION	Example JACDJ58X*Y7900001	Example JACDJ58X*Y7900001
SERVICE PARTS	R DOT	R DOT

Anti Theft Stamping/Label/Plate Location

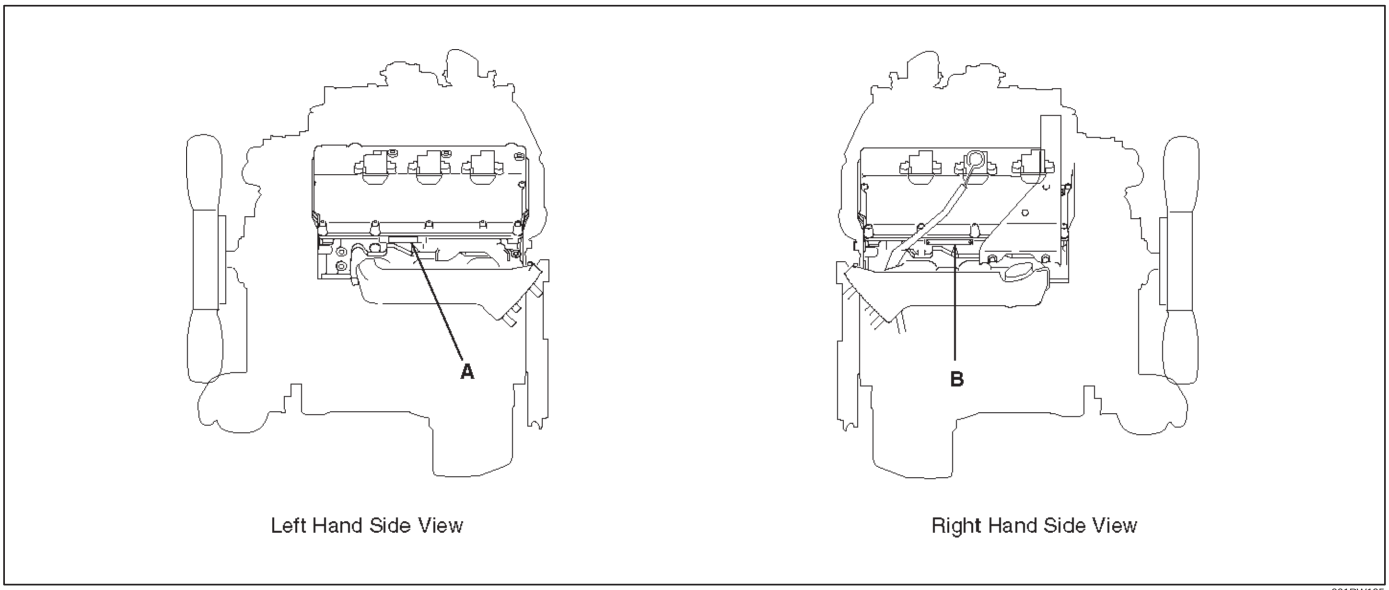
The stamping, label and plate locations are indicated by arrows in the illustration below.

NOTE:

A. VIN plate locations for production.

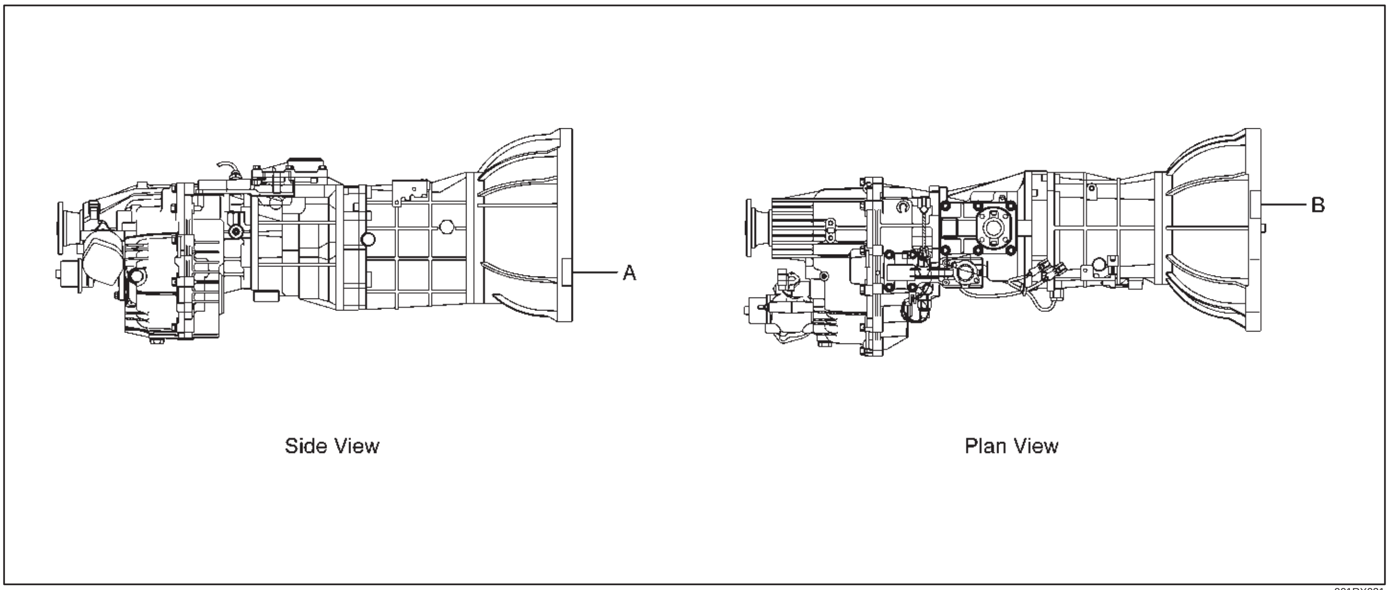
B. Stamping locations for service parts.

Engine



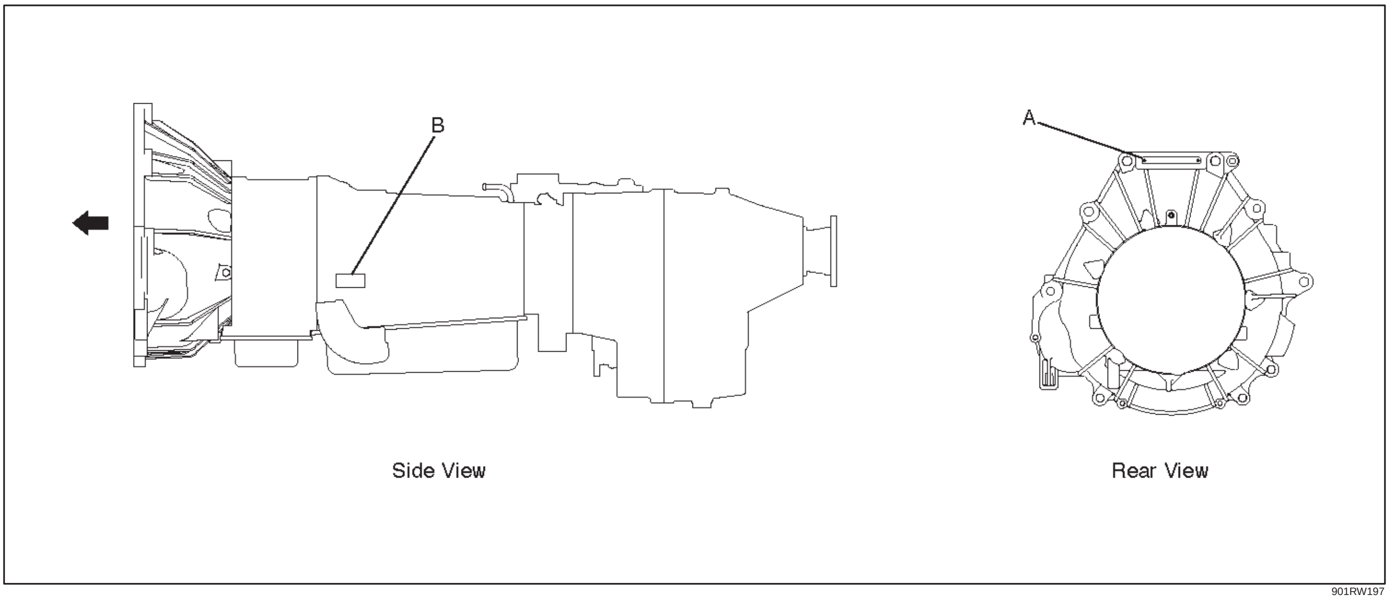
901RW195

Manual Transmission (AR–5)

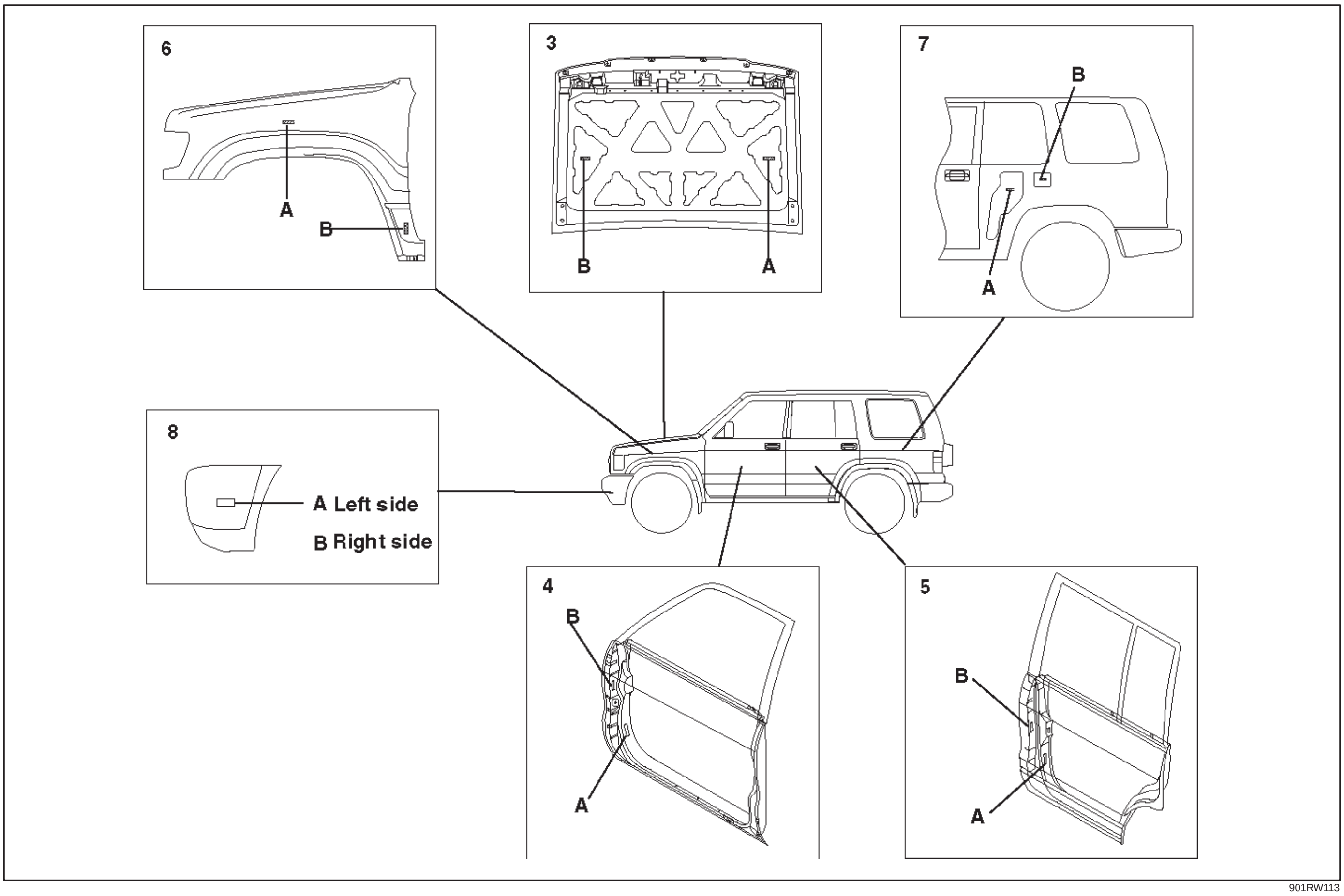


901RX021

Automatic Transmission (THM)



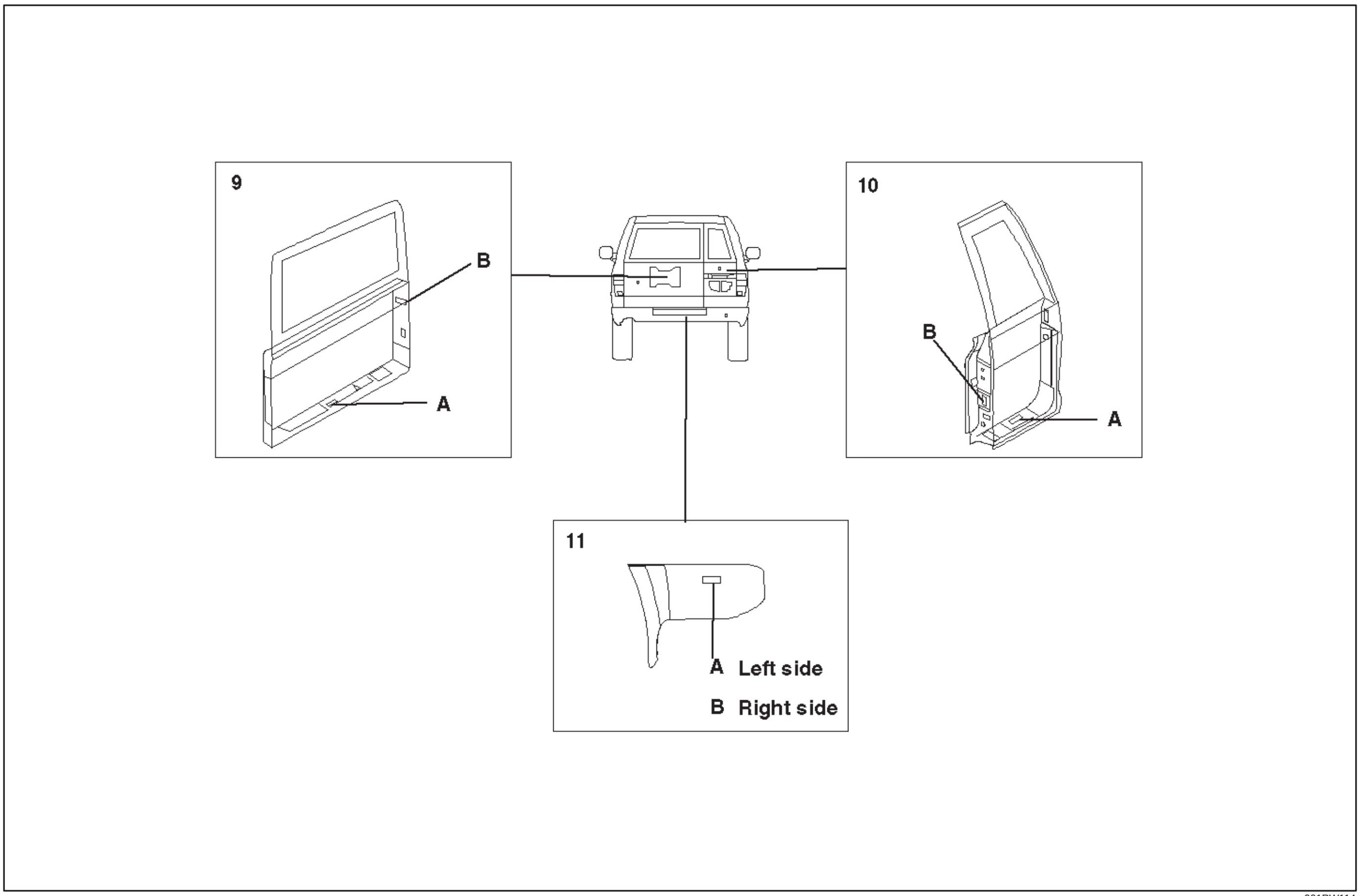
Body



Legend

(3) Engine Hood
(4) Front Door
(5) Rear Door
(6) Fender
(7) Rear Quarfer Panel
(8) Front Bumper

Body



901RW114

Legend

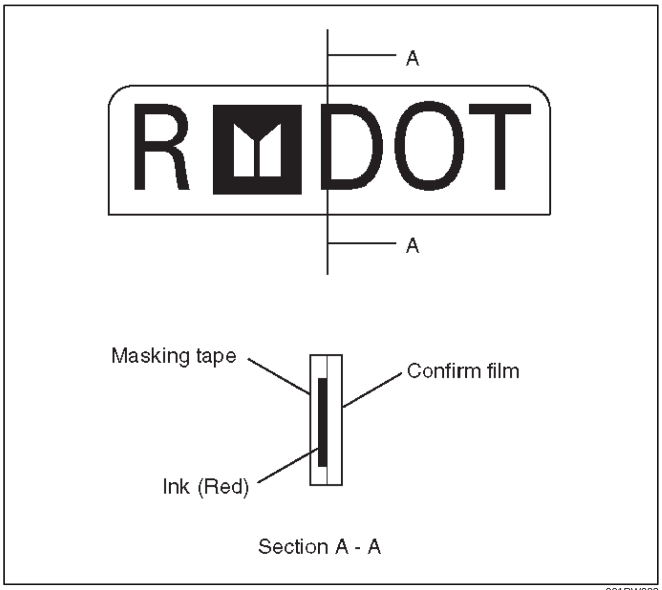
(9) Back Door Left Side
(10) Back Door Right Side
(11) Rear Bumper

Body Label Instructions

Do not peel off the masking tape until completion of paint work when replacing these parts, as the tape is affixed on the label attached to service parts for body of the anti–theft component.

NOTE: Be sure to pull off the masking tape after paint work has been completed.

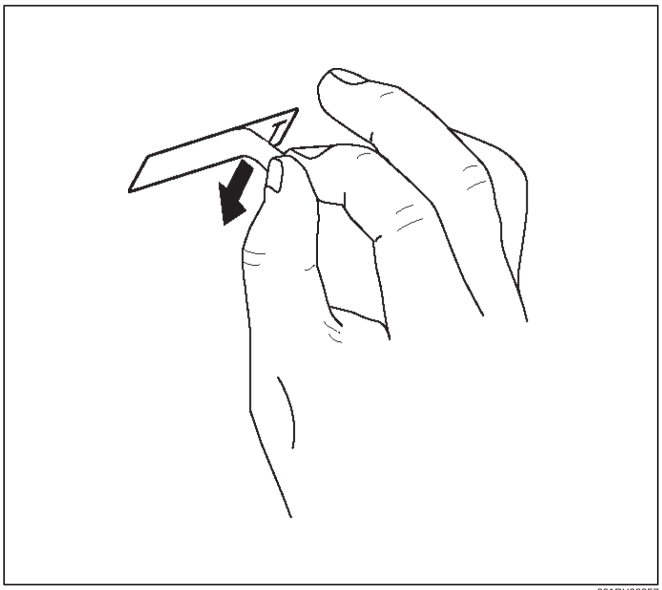
Do not attempt to remove this label for any reason.



901RW083

Precautions in pulling off the masking tape

1. Use only your finger nail or a similar blunt instrument to peel off the masking tape. Use of a sharp object will damage the underlying anti–theft label.
2. Be careful not to damage the paint around the label.



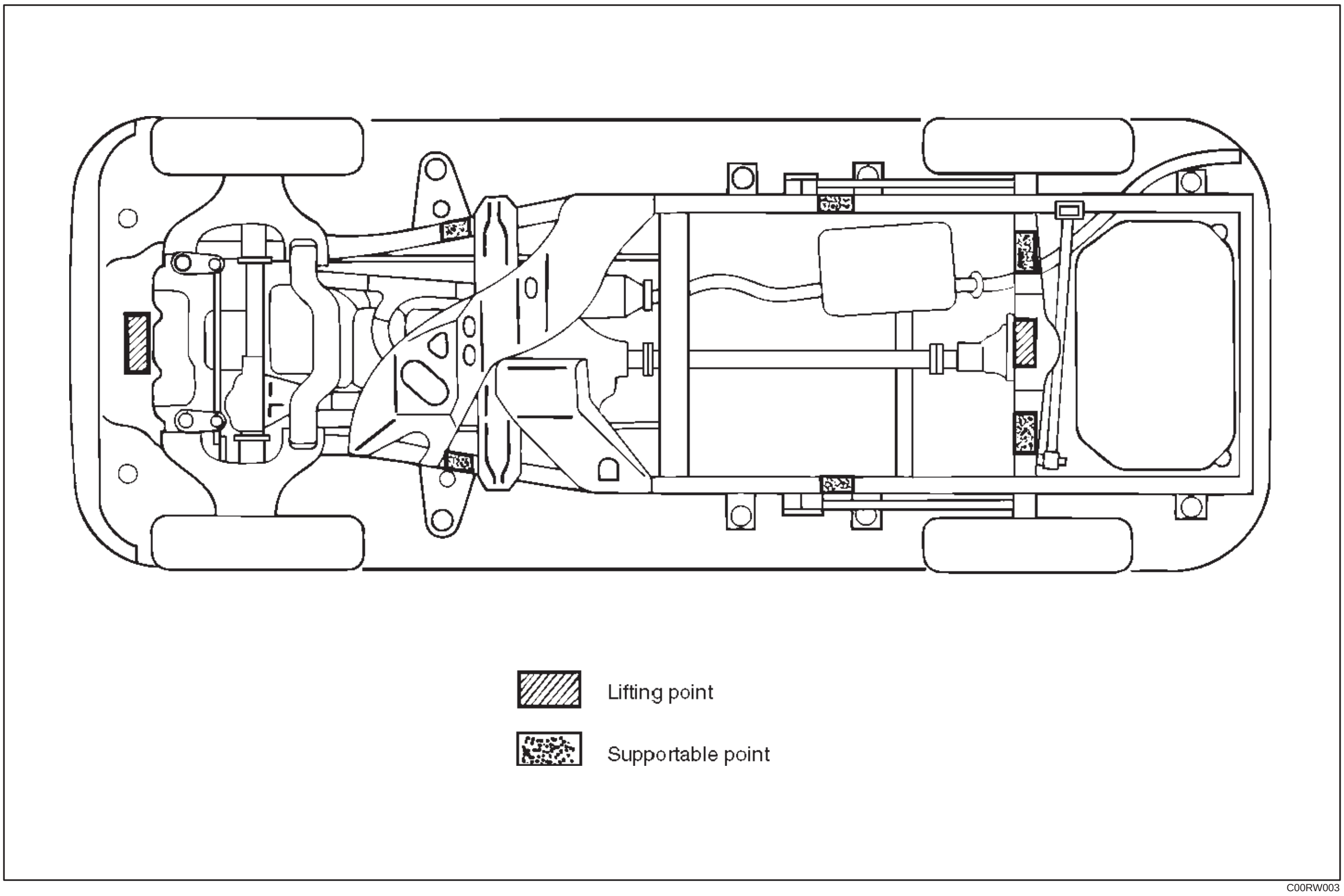
901RY00057

Lifting Instructions

CAUTION:

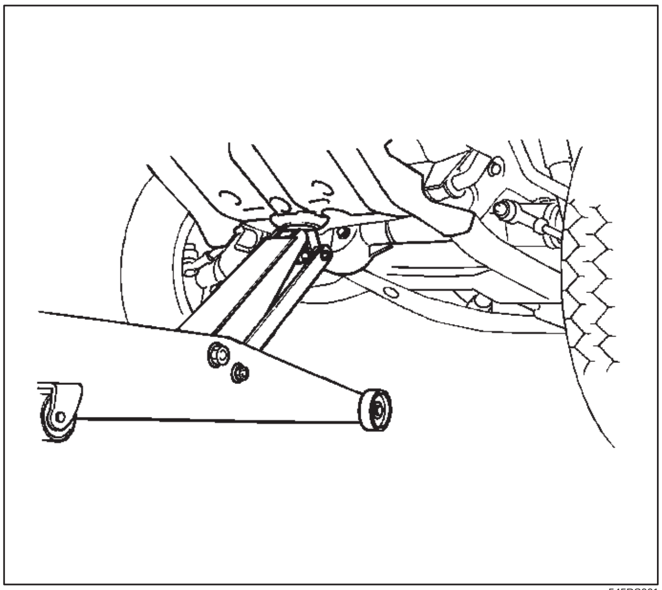
- If a lifting device other than the original jack is used, it is most important that the device be applied only to the correct lifting points. Raising the vehicle from any other point may result in serious damage.
- When jacking or lifting a vehicle at the frame side rail or other prescribed lift points, be certain that lift pads do not contact the catalytic converter, brake pipes or cables, or fuel lines. Such contact may result in damage or unsatisfactory vehicle performance.

Lifting Points and Supportable Point Locations



Lifting Point; Front

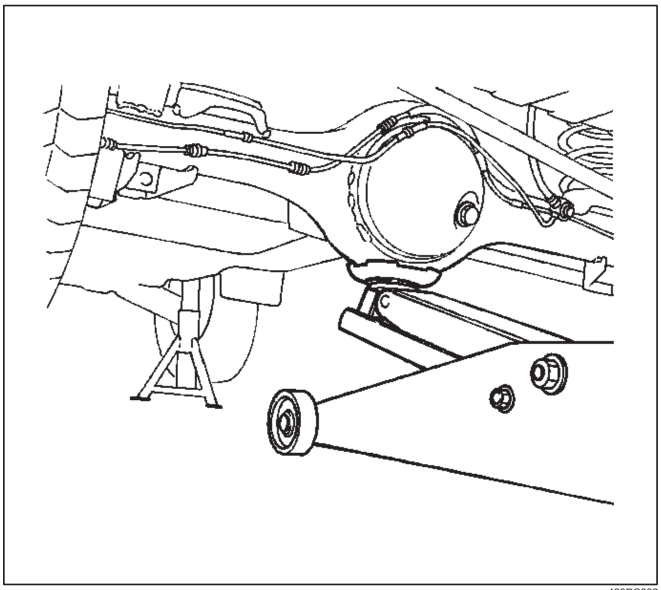
- When using a floor jack, lift on the center of the skid plate.



545RS001

Lifting Point; Rear

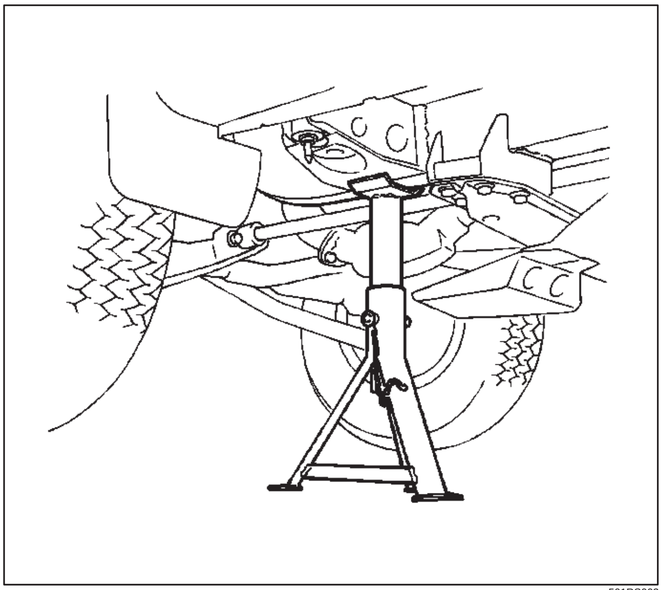
- Position the floor jack at the center of the rear axle case when lifting the vehicle.



420RS002

Supportable Point; Front

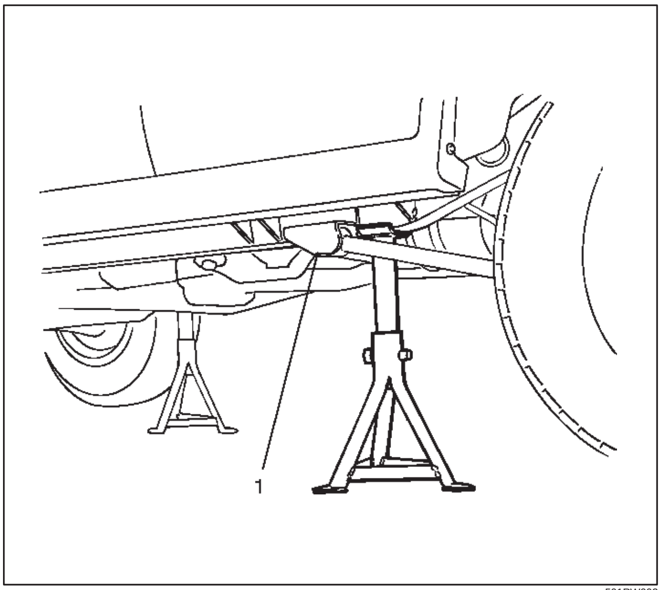
- Position the chassis stands at the bottom of the frame sidemember, behind the front wheel.



501RS003

Supportable Point; Rear

- Position the chassis stands at the bottom of the frame sidemember, just behind the trailing link bracket.



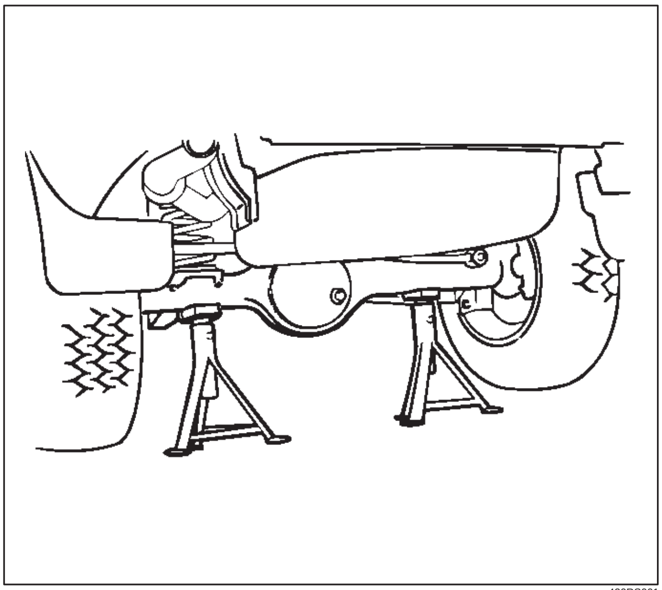
501RW002

Legend

(1) Trailing Link Bracket

Supportable Point; Rear

- Position the chassis stands at the bottom of the rear axle case.



420RS001

Standard Bolts Torque Specifications

The torque values given in the following table should be applied where a particular torque is not specified.

Strength Class	4.8	8.8		9.8
		Refined	Non-Refined	
Bolt Identification				
	 No mark			
Bolt Diameter × Pitch (mm)				
M 6X1.0	4—8 (3—6)	5—10 N·m (4—7 lb ft)		—
M 8X1.25	8—18 N·m (6—13 lb ft)	12—23 N·m (9—17 lb ft)		17—30 N·m (12—22 lb ft)
M 10X1.25	21—34 N·m (15—25 lb ft)	28—46 N·m (20—34 lb ft)		37—63 N·m (27—46 lb ft)
* M10X1.5	20—33 N·m (14—25 lb ft)	28—45 N·m (20—33 lb ft)		36—60 N·m (27—44 lb ft)
M12X1.25	49—74 N·m (36—54 lb ft)	61—91 N·m (45—67 lb ft)		76—114 N·m (56—84 lb ft)
* M12X1.75	45—69 N·m (33—51 lb ft)	57—84 N·m (42—62 lb ft)		72—107 N·m (53—79 lb ft)
M14X1.5	77—115 N·m (56—85 lb ft)	93—139 N·m (69—103 lb ft)		114—171 N·m (84—126 lb ft)
* M14X2.0	72—107 N·m (53—79 lb ft)	88—131 N·m (65—97 lb ft)		107—160 N·m (79—118 lb ft)
M16X1.5	104—157 N·m (77—116 lb ft)	135—204 N·m (100—150 lb ft)		160—240 N·m (118—177 lb ft)
* M16X2.0	100—149 N·m (74—110 lb ft)	130—194 N·m (95—143 lb ft)		153—230 N·m (113—169 lb ft)
M18X1.5	151—226 N·m (111—166 lb ft)	195—293 N·m (144—216 lb ft)		230—345 N·m (169—255 lb ft)
M20X1.5	206—310 N·m (152—229 lb ft)	270—405 N·m (199—299 lb ft)		317—476 N·m (234—351 lb ft)
M22X1.5	251—414 N·m (185—305 lb ft)	363—544 N·m (268—401 lb ft)		425—637 N·m (313—469 lb ft)
M24X2.0	359—539 N·m (265—398 lb ft)	431—711 N·m (318—524 lb ft)		554—831 N·m (409—613 lb ft)

The asterisk * indicates that the bolts are used for female–threaded parts that are made of soft materials such as casting, etc.

Abbreviations Charts

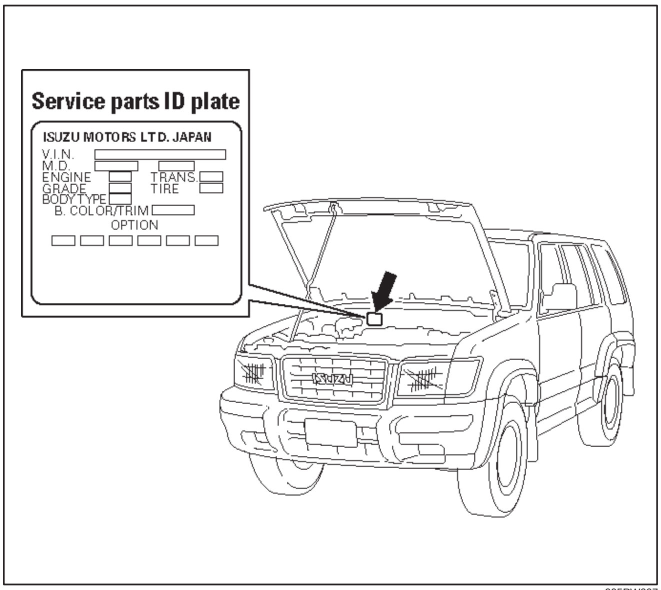
List of automotive abbreviations which may be used in this manual

A — Ampere(s)
ABS — Antilock Brake System
AC — Alternating Current
A/C — Air Conditioning
ACCEL — Accelerator
ACC — Accessory
ACL — Air Cleaner
Adj — Adjust
A/F — Air Fuel Ratio
AIR — Secondary Air Injection System
Alt — Altitude
AMP — Ampere(s)
ANT — Antenna
ASM — Assembly
A/T — Automatic Transmission/Transaxle
ATDC — After Top Dead Center
ATF — Automatic Transmission Fluid
Auth — Authority
Auto — Automatic
BARO — Barometric Pressure
Bat — Battery
B+ — Battery Positive Voltage
Bbl — Barrel
BHP — Brake Horsepower
BPT — Backpressure Transducer
BTDC — Before Top Dead Center
° C — Degrees Celsius
CAC — Charge Air Cooler
Calif — California
cc — Cubic Centimeter
CID — Cubic Inch Displacement
CKP — Crankshaft Position
CL — Closed Loop
CLCC — Closed Loop Carburetor Control
CMP — Camshaft Position
CO — Carbon Monoxide
Coax — Coaxial
Conn — Connector
Conv — Converter
Crank — Crankshaft
Cu. In. — Cubic Inch
CV — Constant Velocity
Cyl — Cylinder(s)
DI — Distributor Ignition
Diff — Differential
Dist — Distributor
DLC — Data Link Connector
DOHC — Double Overhead Camshaft
DTC — Diagnostic Trouble Code
DTM — Diagnostic Test Mode
DTT — Diagnostic Test Terminal
DVM — Digital Voltmeter (10 meg.)
DVOM — Digital Volt Ohmmeter
EBCM — Electronic Brake Control Module
ECM — Engine Control Module
ECT — Engine Coolant Temperature
EEPROM — Electronically Erasable Programmable Read Only Memory
EGR — Exhaust Gas Recirculation
EI — Electronic Ignition
ETR — Electronically Tuned Receiver
EVAP — Evaporation Emission
Exh — Exhaust
° F — Degrees Fahrenheit
Fed — Federal (All States Except Calif.)
FF — Front Drive Front Engine
FL — Fusible Link
FLW — Fusible Link Wire
FP — Fuel Pump
FRT — Front
ft — Foot
FWD — Front Wheel Drive
4WD — Four Wheel Drive
4 x 4 — Four Wheel Drive
4 A/T — Four Speed Automatic Transmission/Transaxle
Gal — Gallon
GEN — Generator
GND — Ground
Gov — Governor
g — Gram
Harn — Harness
HC — Hydrocarbons
HD — Heavy Duty
Hg — Hydrargyrum (Mercury)
HiAlt — High Altitude
HO2S — Heated Oxygen Sensor
HVAC — Heater–Vent–Air–Conditioning
IAC — Idle Air Control
IAT — Intake Air Temperature
IC — Integrated Circuit / Ignition Control
ID — Identification / Inside Diameter
IGN — Ignition
INJ — Injection
IP — Instrument Panel
IPC — Instrument Panel Cluster
Int — Intake
ISC — Idle Speed Control
J/B — Junction Block
kg — Kilograms
km — Kilometers
km/h — Kilometer per Hour
kPa — Kilopascals
kV — Kilovolts (thousands of volts)
kW — Kilowatts
KS — Knock Sensor
L — Liter
lb ft — Foot Pounds
lb in — Inch Pounds
LF — Left Front
LH — Left Hand
LR —Left Rear
LS — Left Side
LWB — Long Wheel Base
L–4 — In–Line Four Cylinder Engine
MAF — Mass Air Flow
MAN — Manual
MAP — Manifold Absolute Pressure
Max — Maximum
MC — Mixture Control
MFI — Multiport Fuel Injection
MIL — Malfunction Indicator Lamp
Min — Minimum
mm — Millimeter
MPG — Miles Per Gallon
MPH — Miles Per Hour
M/T — Manual Transmission/Transaxle
MV — Millivolt

N — Newtons
NA — Natural Aspirated
NC — Normally Closed
N·M — Newton Meters
NO — Normally Open
NOX — Nitrogen, Oxides of
OBD — On-Board Diagnostic
OD — Outside Diameter
O/D — Over Drive
OHC — Overhead Camshaft
OL — Open Loop
O2 — Oxygen
O2S — Oxygen Sensor
PAIR — Pulsed Secondary Air Injection System
P/B — Power Brakes
PCM — Powertrain Control Module
PCV — Positive Crankcase Ventilation
PRESS — Pressure
PROM — Programmable Read Only Memory
PNP — Park/Neutral Position
P/S — Power Steering
PSI — Pounds per Square Inch
PSP — Power Steering Pressure
Pt. — Pint
Pri — Primary
PWM — Pulse Width Modulate
Qt. — Quart
REF — Reference
RF — Right Front
RFI — Radio Frequency Interference
RH — Right Hand
RPM — Revolutions Per Minute
RPM Sensor — Engine Speed Sensor
RPO — Regular Production Option
RR — Right Rear
RS — Right Side
RTV — Room Temperature Vulcanizing
RWAL — Rear Wheel Antilock Brake
RWD — Rear Wheel Drive
SAE — Society of Automotive Engineers
Sec — Secondary
SFI — Sequential Multiport Fuel Injection
SI — System International
SIR — Supplemental Inflatable Restraint System
SOHC — Single Overhead Camshaft
Sol — Solenoid
SPEC — Specification
Speedo — Speedometer
SRS — Supplemental Restraint System
ST — Start / Scan Tool
Sw — Switch
SWB — Short Wheel Base
SYN — Synchronize
Tach — Tachometer
TB — Throttle Body
TBI — Throttle Body Fuel Injection
TCC — Torque Converter Clutch
TCM — Transmission Control Module
TDC — Top Dead Center
Term — Terminal
TEMP — Temperature
TOD— Torque On Demand
TP — Throttle Position
TRANS — Transmission/Transaxle
TURBO — Turbocharger
TVRS — Television & Radio Suppression
TVV — Thermal Vacuum Valve
TWC — Three Way Catalytic Converter
3 A/T — Three Speed Automatic Transmission/Transaxle
2WD — Two Wheel Drive
4 x 2 — Two Wheel Drive
U–joint — Universal Joint
V — Volt(s)
VAC — Vacuum
VIN — Vehicle Identification Number
VRRRE — Vehicle Refrigerant Recovery and Recycling Equipment
V–ref — ECM Reference Voltage
VSS — Vehicle Speed Sensor
VSV — Vacuum Switch Valve
V–6 — Six Cylinder “V” Engine
V–8 — Eight Cylinder ”V” Engine
W — Watt(s)
w/ — With
w/b — Wheel Base
w/o — Without
WOT — Wide Open Throttle

Service Parts Identification Plate

The Vehicle Information Plate (Service Parts ID plate) is provided on all vehicle models.
It is located on the center dash wall inside the engine compartment. The plate lists the VIN (Vehicle Identification Number), paint information and all production options and special equipment on the vehicle when it was shipped from the factory.



905RW007

TROOPER

GENERAL INFORMATION

MAINTENANCE AND LUBRICATION

CONTENTS

Maintenance Schedule List

Normal Vehicle Use

The maintenance instructions in this Maintenance Schedule are based on the assumption that the vehicle will be used as designed:

- to carry passengers and cargo within the limitations specified on the tire placard located on the inside of the glove compartment door;
- to be driven on reasonable road surfaces within legal operating limits;
- to be driven on a daily basis, as a general rule, for at least several miles/kilometers;
- to be driven on unleaded fuel

Unusual or severe operating conditions will require more frequent vehicle maintenance, as specified in the following sections.

Severe Driving Conditions

If the vehicle is usually operated under any of the severe driving conditions listed below, it is recommended that the applicable maintenance services be performed at the specified interval shown in the chart below.

Severe driving conditions:

- Towing a trailer, using a camper or car top carrier.
- Repeated short trips of less than 8 km (5 miles) with outside temperature remaining below freezing.
- Extensive idling and/or low speed driving for long distances, such as police, taxi or door-to-door delivery use.
- Operating on dusty, rough, muddy or salt spread roads.

ITEMS	INTERVAL
REPLACE TIMING BELT	Every 75,000 miles (120,000 km)
CHANGE ENGINE OIL AND OIL FILTER	Every 3,000 miles (4,800 km) or 3 months
CHANGE AUTOMATIC TRANSMISSION FLUID	Every 20,000 miles (32,000 km)
CHANGE FRONT AND REAR AXLE OIL	Every 15,000 miles (24,000 km)
CHANGE POWER STEERING FLUID	Every 30,000 miles (48,000 km)

Mileage Only Items

	MILEAGE ONLY ITEMS	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	DESCRIPTION
1	CHANGE FRONT AND REAR AXLE OIL		■		■				■				■				■	
2	CHANGE MANUAL TRANSMISSION OIL		■		■				■				■				■	
3	• CHECK AND ADJUST OR CHANGE AUTOMATIC TRANSMISSION FLUID (IF NECESSARY)																■	
4	CHECK AUTOMATIC TRANSMISSION FLUID LEAKAGE		■		■		■		■		■		■		■		■	
5	CHANGE TRANSFER CASE OIL		■		■				■				■				■	
6	CHECK EXTENSION OIL LEVEL (2WD ONLY)		■		■				■				■				■	
7	• REPLACE AIR CLEANER FILTER				■				■				■				■	
8	REPLACE SPARK PLUGS	Replace every 100,000 miles																
9	CHANGE ENGINE COOLANT				■				■				■				■	
10	*(1) REPLACE TIMING BELT	Replace every 100,000 miles																
11	CHECK AND ADJUST VALVE CLEARANCE (IF NECESSARY)	If noisy																
12	ROTATE TIRES	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
13	REPACK FRONT WHEEL BEARINGS				■				■				■				■	
14	CLEAN RADIATOR CORE AND A/C CONDENSER								■								■	

*(1) : Replacement of the timing belt is recommended at every 100,000 miles (160,000 km).

• : UNDER SEVERE DRIVING CONDITIONS, MORE FREQUENT MAINTENANCE IS REQUIRED. REFER TO "SCHEDULED MAINTENANCE UNDER SEVERE DRIVING CONDITIONS".

SHADED AREA INDICATES SERVICE TO BE PERFORMED.

Mileage/Months

IN THOUSANDS OF MILES (USE ODOMETER READING) (x 1000 miles)

	MILEAGE/MONTHS whichever comes first	EVERY MONTHS	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	DESCRIPTION
1	CHECK BATTERY FLUID LEVEL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
2	CHECK ENGINE COOLANT LEVEL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
3	CHECK BRAKE AND CLUTCH FLUID LEVEL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
4	CHECK FLUID LEAKS	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
5	• CHANGE ENGINE OIL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
6	• REPLACE ENGINE OIL FILTER	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
7	CHECK COOLING AND HEATER HOSES	12		■		■		■		■		■		■		■		■	
8	*(2) CHECK EXHAUST SYSTEM	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
9	*(2) CHECK FUEL LINE AND FUEL TANK/CAP	12								■								■	
10	CHECK ENGINE DRIVE BELT	24				■				■				■				■	
11	CHECK TIRES AND WHEELS	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
12	CHECK STEERING OPERATION	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
13	CHECK BRAKE LINES AND HOSE	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
14	CHECK DISC BRAKES	12		■		■		■		■		■		■		■		■	
15	CHECK BRAKE PEDAL PLAY	12		■		■		■		■		■		■		■		■	
16	CHECK PARKING BRAKE	12		■		■		■		■		■		■		■		■	
17	LUBE ACCELERATOR LINKAGE	6	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
18	CHECK SUSPENSION AND STEERING	12		■		■		■		■		■		■		■		■	
19	• CHECK POWER STEERING FLUID LEVEL	6	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	

SHADED AREA INDICATES SERVICE TO BE PERFORMED.

*(2); This service is recommended for vehicles sold in California, and it is required for vehicles sold in other areas.

• UNDER SEVERE DRIVING CONDITIONS, ADDITIONAL MAINTENANCE IS REQUIRED. REFER TO "MAINTENANCE SCHEDULE UNDER SEVERE DRIVING CONDITIONS" LATER IN THIS SECTION

IN THOUSANDS OF MILES (USE ODOMETER READING) (x 1000 miles)

	MILEAGE/MONTHS whichever comes first	EVERY MONTHS	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	DESCRIPTION
20	LUBE BODY AND CHASSIS	6																	
21	*LUBE FRONT PROPELLER SHAFT	6																	
22	LUBE REAR PROPELLER SHAFT	6																	
23	CHECK PROPELLER SHAFT FLANGE TORQUE	12																	
24	CHECK SHIFT ON THE FLY SYSTEM GEAR OIL	12																	
25	CHECK AUTO CRUISE CONTROL LINKAGE AND HOSES	12																	
26	CHECK CLUTCH LINES AND HOSE	12																	
27	LUBE CLUTCH PEDAL SPRING, BUSHING AND CLEVIS PIN	6																	
28	CHECK CLUTCH PEDAL FREE PLAY	12																	
29	CHECK STARTER SAFETY SWITCH	12																	
30	CHECK ACCELERATOR LINKAGE	12																	
31	LUBE KEY LOCK CYLINDER	12																	

* Except TOD system model

- UNDER SEVERE DRIVING CONDITIONS, ADDITIONAL MAINTENANCE IS REQUIRED. REFER TO "MAINTENANCE SCHEDULE UNDER SEVERE DRIVING CONDITIONS" LATER IN THIS SECTION

SHADED AREA INDICATES SERVICE TO BE PERFORMED.

Explanation of Complete Vehicle Maintenance Schedule

Brief explanations of the services listed in the preceding Maintenance Scheduled are presented below.
Replace all questionable parts and note any necessary repairs as you perform these maintenance procedures.

Front and Rear Axle Lubricant Replacement

Replace the front and rear axle lubricant at 15,000 miles (24,000 km) and 30,000 miles (48,000 km) and after every 30,000 miles (48,000 km) or operation thereafter.

Manual Transmission Lubricant Replacement

Replace the transmission lubricant at 15,000 miles (24,000 km) and 30,000 miles (48,000 km) and after every 30,000 miles (48,000 km) of operation thereafter.

Automatic Transmission Fluid Replacement

Check the fluid leakage at 15,000 miles (24,000 km) and 30,000 miles (48,000 km) and after every 15,000 miles (24,000 km) or operation thereafter.
Replace the transmission fluid at 120,000 miles (192,000 km) of operation thereafter.

Transfer Case Lubricant Replacement

Replace the transfer case lubricant at 15,000 miles (24,000 km) and 30,000 miles (48,000 km) and after every 30,000 miles (48,000 km) of operation thereafter.

Extension Lubricant Level Check (2WD only)

Check oil level at 15,000 miles (24,000 km) and 30,000 miles (48,000 km) and after every 30,000 miles (48,000 km) or operation thereafter.

Air Cleaner Element Replacement

Replace the air cleaner under normal operating conditions every 30,000 miles (48,000 km).
Operation of the vehicle in dusty areas will necessitate more frequent replacement.

Spark Plug Replacement

Replace the plugs at 100,000 miles (160,000 km) intervals with the type specified at the end of this section.

Cooling System Service

Drain, flush and refill system with new engine coolant. Refer to “Recommended Fluids and Lubricants” in this section, or ENGINE COOLING (SEC.6B).

Timing Belt Replacement

Replacement of the timing belt is recommended at every 100,000 miles (160,000 km).
Failure to replace the timing belt may result in serious damage to the engine.

Valve Clearance Adjustment

Incorrect valve clearance will result in increased engine noise and reduced engine output.
Retorque the camshaft bearing cap bolts before checking and adjusting the valve clearance.
Check and adjust the valve clearance if noise occurs.

Tire Rotation

Rotate tires every 7,500 miles (12,000 km).

Front Wheel Bearings Lubricant Replacement

Clean and repack the front wheel bearings at 30,000 miles (48,000 km) intervals.
Refer to FRONT DRIVING AXLE (SEC. 4C).

Radiator Core and Air Conditioning Condenser Cleaning

Clean the front of the radiator core and air conditioning condenser, at 60,000 miles (96,000 km) intervals.

Fluid Level Check

A fluid loss in any system (except windshield washer) may indicate a problem. Repair the system at once.

Engine oil level

Check level and add if necessary. The best time to check the engine oil level is when the oil is warm. After stopping the engine with the vehicle on a level surface, wait a few minutes for the oil to drain back to the oil pan. Pull out the oil level indicator (dipstick). Wipe it clean and push the oil level indicator back down all the way. Pull out the oil level indicator, keeping the tip down, and look at the oil level on it.

Add oil, if needed, to keep the oil level above the “ADD” mark and between the “ADD” and “FULL” marks in the operating range area. Avoid overfilling the engine since this may cause engine damage. Push the oil level indicator back down all the way after taking the reading. If you check the oil level when the oil is cold, do not run the engine first. The cold oil will not drain back to the pan fast enough to give a true oil level.

Engine coolant level and condition

Check engine coolant level in the coolant reservoir and add engine coolant if necessary. Inspect the engine coolant and replace it if dirty or rusty.

Windshield washer fluid level

Check washer fluid level in the reservoir and add if necessary.

Power steering system reservoir level

Check and keep at the proper level.

Brake master cylinder reservoir level

Check fluid. Keep fluid at proper level. A low fluid level can indicate worn disc brake pads which may need to be serviced.

Hydraulic clutch system

Check fluid level in the reservoir. Add fluid as required.

Battery fluid level

Check fluid level in the battery.

Fluid Leak Check

Check for fuel, water, oil or other fluid leaks by looking at the surface beneath the vehicle after it has been parked for a while. Water dripping from the air conditioning system after use is normal. If you notice gasoline fumes or fluid at any time, locate the source and correct it at once.

Engine Oil and Oil Filter Replacement

Always use API SE, SF, SG, SH or ILSAC GF–1 quality oils of the proper viscosity.

When choosing an oil, consider the range of temperatures the car will be operated in before the next oil change. Then, select the recommended oil viscosity from the chart.

Always change the oil and the oil filter as soon as possible after driving in a dust storm.

Engine Cooling System Inspection

Inspect the coolant/anti–freeze. If the coolant is dirty or rusty, drain, flush and refill with new coolant. Keep coolant at the proper mixture for proper freeze protection, corrosion inhibitor level and best engine operating temperature. Inspect hoses and replace if cracked, swollen or deteriorated. Tighten the hose clamps if equipped with screw–type clamps. Clean outside of radiator and air conditioning condenser. Wash filler cap and neck. To help ensure proper operation, a pressure test of both the cooling system and the cap is also recommended.

Exhaust System Inspection

Visually inspect the exhaust pipes, muffler, heat shields and hangers for cracks, deterioration, or damage.

Be alert to any changes in the sound of the exhaust system or any smell of fumes. These are signs the system may be leaking or overheating. Repair the system at once, if these conditions exist. (See also “Engine Exhaust Gas Safety” and “Three Way Catalytic Converter” in the Owner’s manual.)

Fuel Cap, Fuel Lines, and Fuel Tank Inspection

Inspect the fuel tank, the fuel cap and the fuel lines every 60,000 miles (96,000 km) for damage which could cause leakage.

Inspect the fuel cap and the gasket for correct sealing and physical damage. Replace any damaged parts.

Drive Belt Inspection

Check the serpentine belt driving for cracks, fraying, wear, and correct tension every 30,000 miles (48,000 km). Replace as necessary.

Wheel Alignment, Balance and Tires Operation

Uneven or abnormal tire wear, or a pull right or left on a straight and level road may show the need for a wheel alignment. A vibration of the steering wheel or seat at normal highway speeds means a wheel balancing is needed. Check tire pressure when the tires are “cold” (include the spare).

Maintain pressure as shown in the tire placard, which is located on the driver’s door lock pillar.

Steering System Operation

Be alert for any changes in steering action. An inspection or service is needed when the steering wheel is harder to turn or has too much free play, or if there are unusual sounds when turning or parking.

Brake Systems Operation

Watch for the “BRAKE” light coming on. Other signs of possible brake trouble are such things as repeated pulling to one side when braking, unusual sounds when braking or between brake applications, or increased brake pedal travel. If you note one of these conditions, repair the system at once.

For convenience, the following should be done when wheels are removed for rotation: Inspect lines and hoses for proper hookup, bindings, leaks, crack, chafing etc. Inspect disc brake pads for wear and rotors for surface condition.

Inspect other brake parts, including parking brake drums, linings etc., at the same time. Check parking brake adjustment.

Inspect the brakes more often if habit or conditions result in frequent braking.

Parking Brake and Transmission Park Mechanism Operation

Park on a fairly steep hill and hold the vehicle with the parking brake only. This checks holding ability. On automatic transmission vehicles, shifting from “P” position to the other positions cannot be made unless the brake pedal is depressed when the key switch is in the “ON” position or the engine is running.

WARNING: BEFORE CHECKING THE STARTER SAFETY SWITCH OPERATION BELOW, BE SURE TO HAVE ENOUGH ROOM AROUND THE VEHICLE. THEN FIRMLY APPLY BOTH THE PARKING BRAKE AND THE REGULAR BRAKE. DO NOT USE THE ACCELERATOR PEDAL. IF THE ENGINE STARTS, BE READY TO TURN OFF THE KEY PROMPTLY. TAKE THESE PRECAUTIONS BECAUSE THE VEHICLE COULD MOVE WITHOUT WARNING AND POSSIBLY CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.

Starter Safety Switch Operation (Automatic Transmission)

Check by trying to start the engine in each gear while setting the parking brake and the foot brake. The starter should crank only in “P” (Park) or “N” (Neutral).

Starter Safety Switch Operation (Manual Transmission)

To check, place the shift lever in “Neutral”, push the clutch pedal halfway and try to start. The starter should not crank. The starter should crank only when the clutch pedal is fully depressed.

Accelerator Linkage Lubrication

Lubricate the accelerator pedal fulcrum pin with chassis grease.

Steering and Suspension Inspection

Inspect the front and rear suspension and steering system for damaged, loose or missing parts or signs of wear. Inspect power steering lines and hoses for proper hookup, binding, leaks, cracks, chafing, etc.

Body and Chassis Lubrication

Lubricate the key lock cylinders, the hood latch, the hood and door hinges, the door check link, the parking cable guides, the underbody contact points, and the linkage.

Propeller Shaft Inspection and Lubrication

Except TOD model : yoke and universal joints with grease containing MOS2 (disulfide molybdenum type grease) at the interval shown in the Maintenance Schedule.
All models : check for play in normal direction of rotation of sliding yoke and universal joints. Also check the propeller shaft flange–to–pinion bolts for proper torque to 63 N•m (46 lb ft) for front and rear propeller shaft.

Auto Cruise Control Inspection

Check to see if the clearance between cruise link and accelerator link is normal. Also check that the connected properly.

Clutch Lines and Hoses Inspection

Check lines and hoses for proper attachment, binding, leaks, cracks, chafing, deterioration, etc. Any questionable parts should be replaced or repaired at once. When abrasion or wear is evident on lines or hoses, the cause must be corrected.

Clutch Control Lubrication

Lubricate the clutch pedal bushing, the clevis pin, and pedal spring every 15,000 miles (24,000 km) or 6 months. If a squeaking noise arises from around the bushing or the clevis pin at the clutch pedal arm when the clutch pedal is depressed, lubricate them.

Clutch Pedal Free Play Inspection

Note the clutch pedal free play. It should be 5 – 15 mm (0.2 – 0.6 in). Adjust clutch control when there is little or no free play.

Accelerator Linkage Inspection

Inspect for interference, binding, and damaged or missing parts. Check accelerator pedal for smooth operation and even pedal effort. Replace parts as needed.

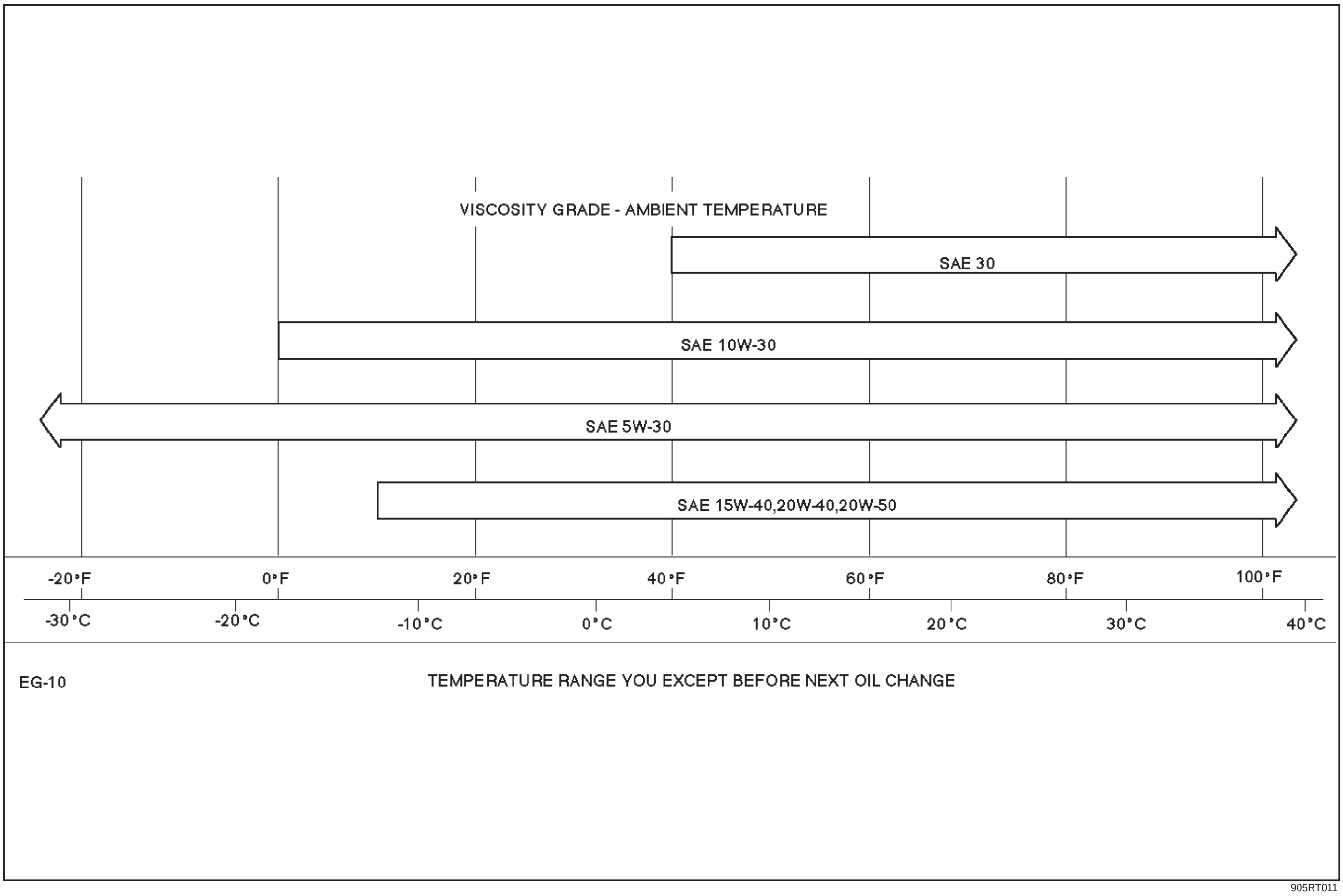
Recommended Fluids and Lubricants

USAGE	FLUID/LUBRICANT
Engine	API SE, SF, SG, SH or ILSAC GF-1 Engine oil (See oil chart on the following page for proper viscosity)
Engine coolant	Mixture of water and good quality ethylene glycol base type antifreeze.
Brake system	DOT-3 hydraulic brake fluid.
Power steering system	DEXRON® -III Automatic transmission fluid.
Automatic transmission	DEXRON® -III Automatic transmission fluid.
Manual transmission	Engine oil (See oil chart on following page for proper viscosity)
Rear axle and front axle	GL-5 gear lubricant (Standard differential) GL-5 Limited slip differential gear lubricant together with limited slip differential lubricant additive (Part No. 8-01052-358-0) or equivalent (If equipped with optional limited slip diferential) (See oil chart in this section for proper viscosity)
Clutch system a. Pivot points b. Clutch fork joint c. Master cylinder	 Engine oil Chassis grease DOT-3 hydraulic brake fluid
Hood latch assembly a. Pivots and spring anchor b. Release pawl	 Engine oil Chassis grease
Hood and door hinges	Engine oil
Chassis lubrication	Chassis grease
Parking brake cables	Chassis grease
Front wheel bearings	Wheel bearing grease
Shift on the fly system	GL-5 gear lubricant
Transfer Case (Except TOD and 2WD model)	SAE40 (Areas where ambient temperatures of 32˚C (90˚F) and higher are regularly encountered.) SAE5W–30SF (Other areas)
TOD system	DEXRON® -III Automatic transmission fluid.
Extension assembly	DEXRON® -III Automatic transmission fluid.
Propeller shafts (Except TOD model) Sliding yoke and Univeral joint	Grease containing MoS_2 or multipurpose type grease NLGI No.2
Body door hinge pins and linkage, fuel door hinge, rear compartment lid hinges	Engine oil
Windshield washer solvent	Washer fluid
Key lock cylinder	Synthetic light weight engine oil (SAE 5W-30)
Accelerator linkage	Chassis grease

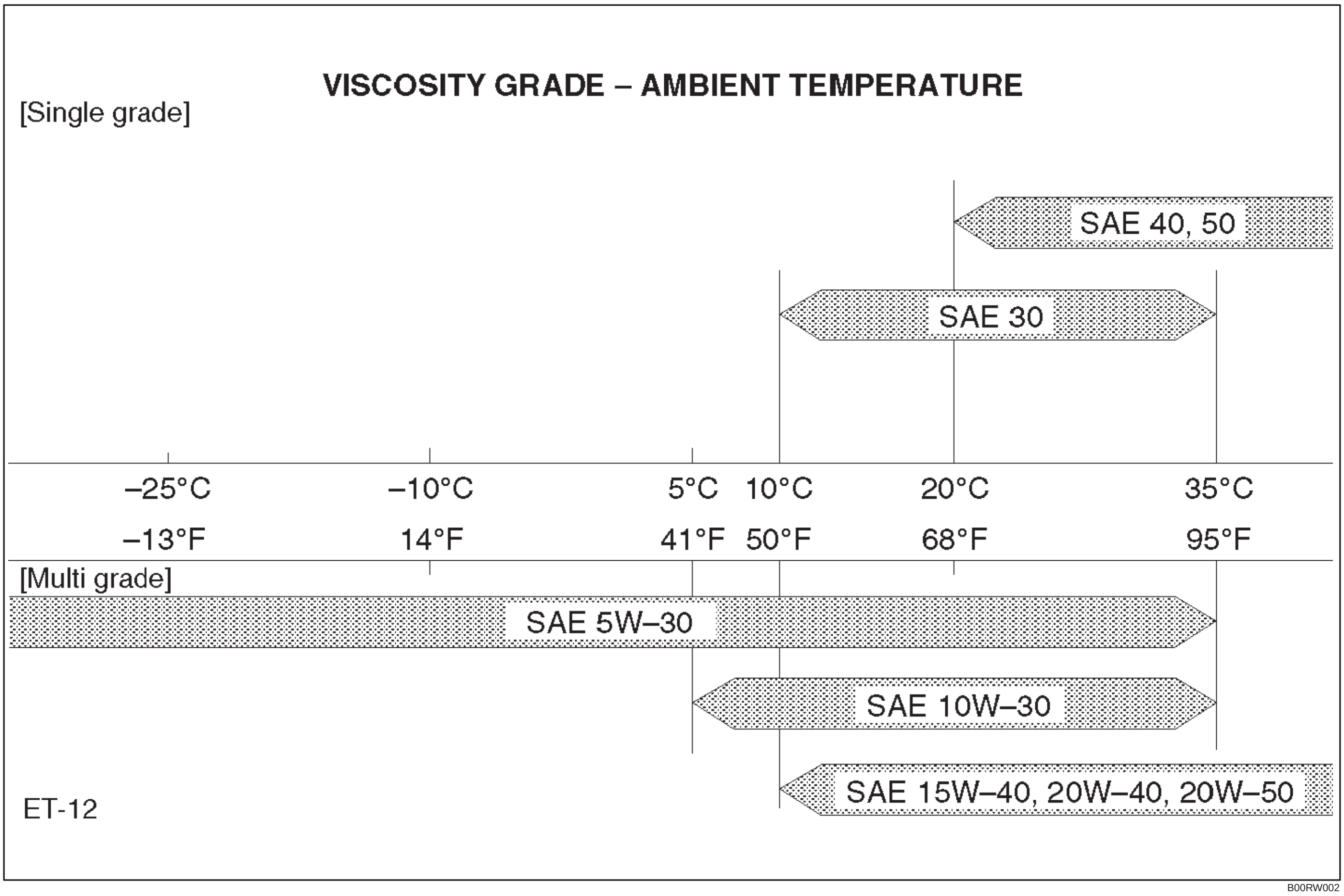
Lubricant Viscosity Chart

Lubricants should be carefully selected according to the lubrication chart. It is also important to select viscosity of lubricants according to the ambient temperature by referring to the following table.

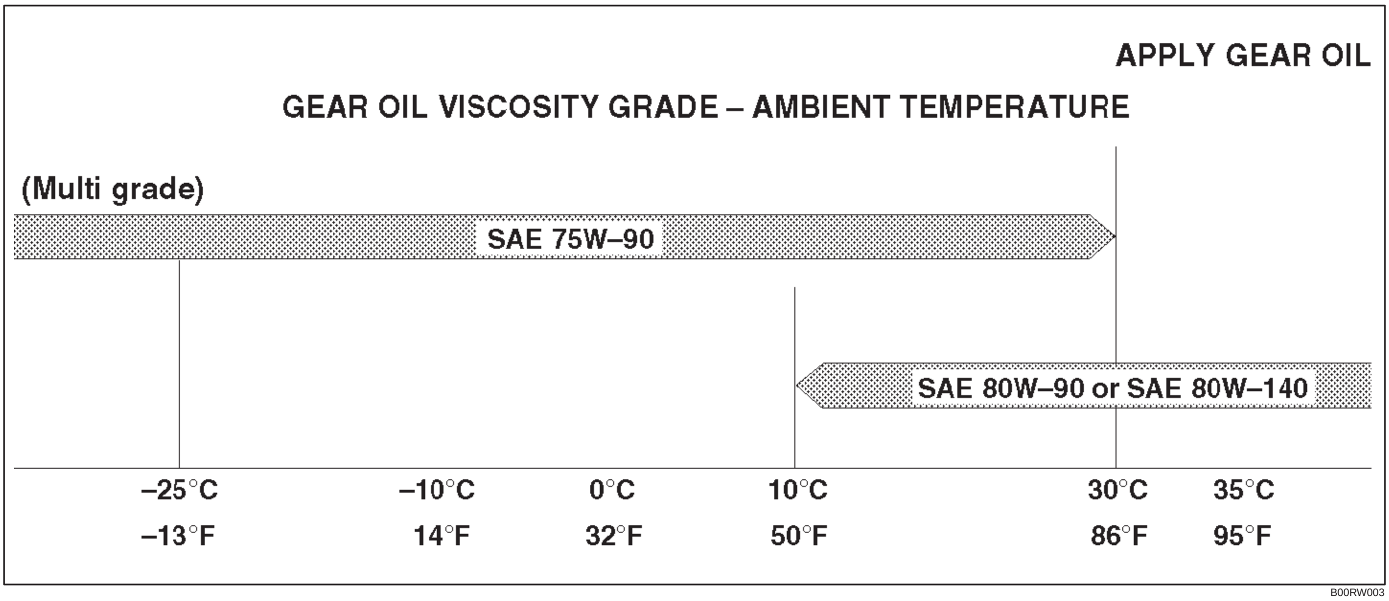
Oil Viscosity Chart for Gasoline Engine



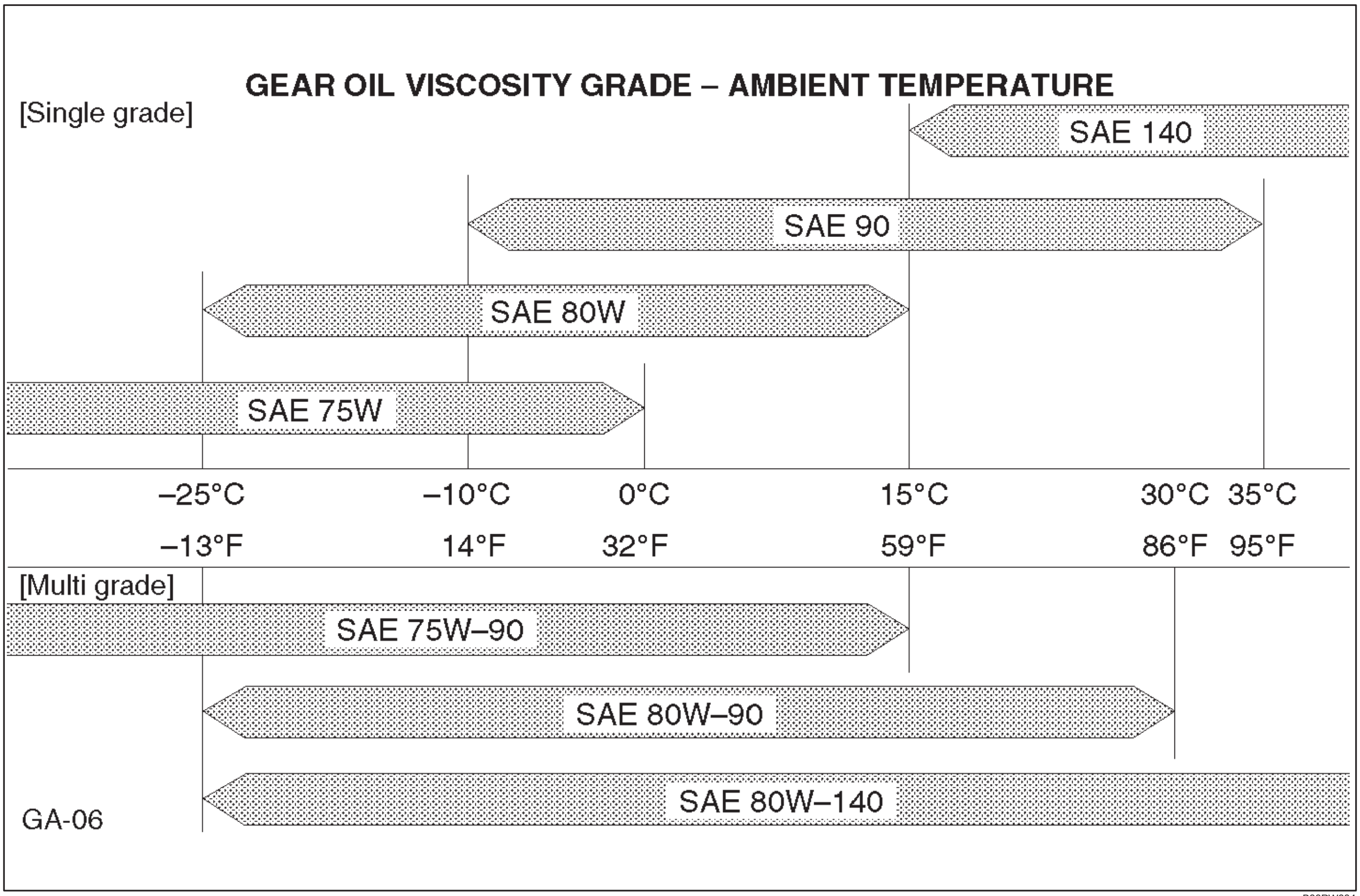
Oil Viscosity Chart for Manual Transmission and Transfer Case



Oil Viscosity Chart for Front Axle



Oil Viscosty Chart for Rear Axle



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Recommended Liquid Gasket

Type	Brand Name	Manufacturer	Remarks
RTV* Silicon Base	Three Bond 1207B Three Bond 1207C Three Bond 1215 Three Bond 1280 Three Bond 1281	Three Bond Three Bond Three Bond Three Bond Three Bond	For Engine Repairs For Axle Case Repairs. T/M Repairs. T/M
Water Base	Three Bond 1141E	Three Bond	For Engine Repairs
Solvent	Three Bond 1104 Belco Bond 4 Belco Bond 401 Belco Bond 402	Three Bond Isuzu Isuzu Isuzu	For Engine Repairs
Anaerobic	LOCTITE 515 LOCTITE 518 LOCTITE 17430	Loctite Loctite Loctite	All

* RTV: Room Temperature Vulcanizer

NOTE:

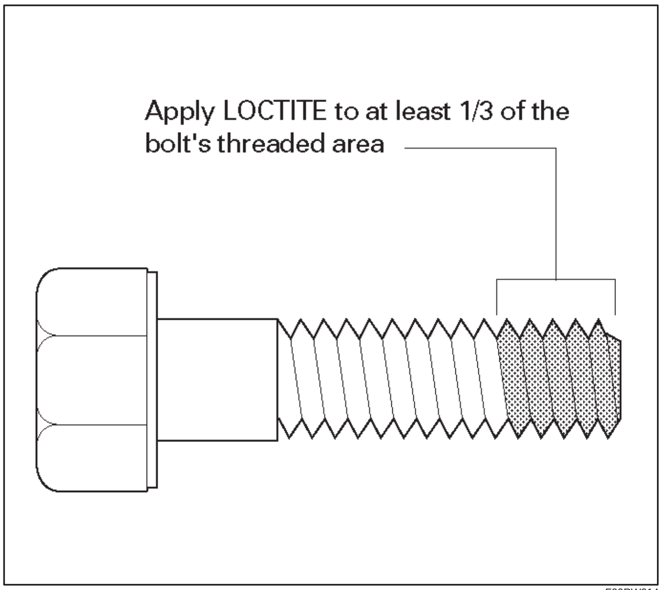
1. It is very important that the liquid gaskets listed above or their exact equivalent be used on the vehicle.
2. Be careful to use the specified amount of liquid gasket.
   Follow the manufacturer's instructions at all times.
3. Be absolutely sure to remove all lubricants and moisture from the connecting surfaces before applying the liquid gasket.
   The connecting surfaces must be perfectly dry.
4. Do not apply LOCTITE 17430, LOCTITE 515 and LOCTITE 518 between two metal surfaces having a clearance of greater than 0.25 mm (0.01 in). Poor adhesion will result.

Recommended Thread Locking Agents

LOCTITE Type	LOCTITE Color
LOCTITE 242	Blue
LOCTITE 262	Red
LOCTITE 271	Red

Application Steps

1. Completely remove all lubricant and moisture from the bolts and the female-threaded surfaces of the parts to be joined.
   The surfaces must be perfectly dry.
2. Apply LOCTITE to the bolts.



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3. Tighten the bolts to the specified torque.
   After tightening, be sure to keep the bolts free from vibration and torque for at least an hour until LOCTITE hardens.

NOTE: When the application procedures are specified in this manual, follow them.

Maintenance Service Data

Service Data and Specifications

ENGINE	Valve clearance (cold)	Intake 0.28±0.05 mm (0.011 in) Exhaust 0.3±0.05 mm (0.015 in)
	Spark plug type	K16PR-P11/PK16PR11/RC10PYP4
	Spark plug gap	1.05 mm (0.04 in)
CLUTCH	Clutch pedal free play	5-15 mm (0.197-0.591 in)
BRAKE	Brake pedal free play	6-10 mm (0.24-0.39 in)
	Parking brake travel	6-7 notches
WHEEL ALIGNMENT	Toe-in	0±2 mm (0±0.08 in)
	Camber	0˚±30’
	Caster	2˚ 10’±45’
PROPELLER SHAFT	Flange torque	63 N•m (46 lb ft) (Except TOD model) 43 N•m (32 lb ft) (TOD model)
WHEEL AND TIRES	Wheel nut torque	118 N•m (87 lb ft)
	Tire inflation pressure (Front)	210 kPa (30 psi)
	* Tire inflation pressure (Rear)	240 kPa (35 psi)

* Unless otherwise specified on tire information label on the vehicle.

Approximate Capacities

	Items	Metric Measure	U.S. Measure
Fuel tank		85 L	22.5 Gal.
* Crankcase	Oil Change with Filter	4.7 L	5.0 Qt
	Oil Change without Filter	4.0 L	4.3 Qt
Coolant	M/T	8.5 L	9.0 Qt
	A/T	8.8 L	9.3 Qt
Transmission	Manual	2.7 L	2.86 Qt
	Automatic	8.6 L	9.1 Qt
Transfer		1.45 L	1.5 Qt
Transfer with TOD		1.9 L	2.0 Qt
Extention		0.185 L	0.195 Qt
Axle	Rear	3.0 L	3.2 Qt
	Front (4WD vehicle only)	1.4 L	1.5 Qt
Shift on the fly system		0.12 L	0.13 Qt
Power steering		1.0 L	1.1 Qt
Air conditioning (R-134a)		0.6 Kg	1.32 Ibs

*Crankcase capacities shown are approximate refill capacities. After refill, recheck oil level.

TROOPER

HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

HVAC SYSTEMS

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Heating and Ventilation System

General Description

Heater

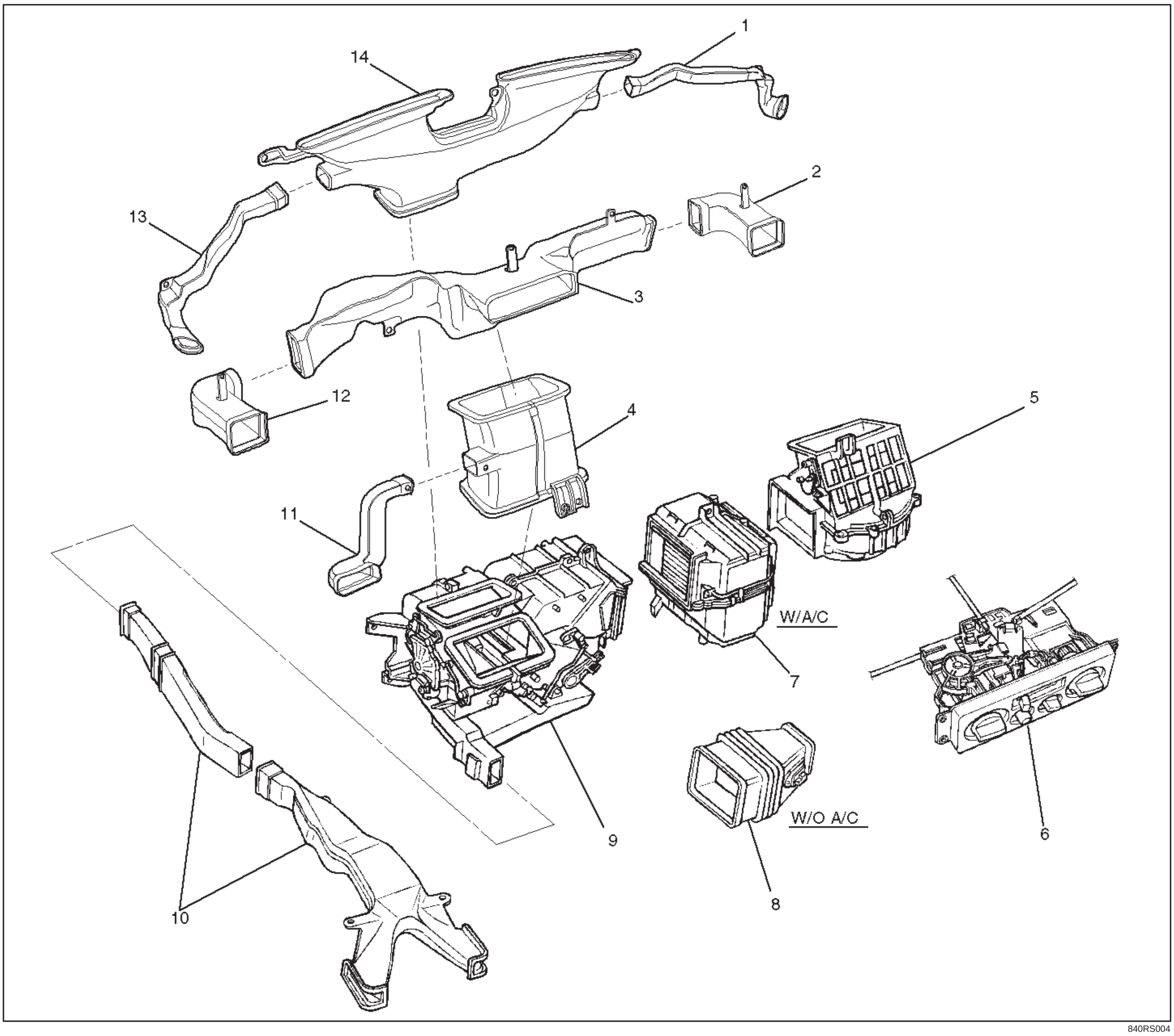
When the engine is warming up, the warmed engine coolant is sent out into the heater core. The heater system supplies warm air into the passenger compartment to warm it up.

Outside air is circulated through the heater core of the heater unit and then back into the passenger compartment. By controlling the mixture of outside air and heater core air, the most comfortable passenger compartment temperature can be selected and maintained.

The temperature of warm air sent to the passenger compartment is controlled by the temperature control knob. This knob acts to open and close the air mix door, thus controlling the amount of air passed through the heater core.

The air selector knob, with its different modes, also allows you to select and maintain the most comfortable passenger compartment temperature.

The air source select lever is used to select either “FRESH” for the introduction of the outside air, or “RECIRC” for the circulation of the inside air. When the lever is set to “FRESH”, the outside air is always taken into the passenger compartment. When setting the lever to “RECIRC” position, the circulation of air is restricted only to the inside air with no introduction of the outside air and the air in the passenger compartment gets warm quickly. However, the lever is normally set to “FRESH” to prevent the windshield from clouding.



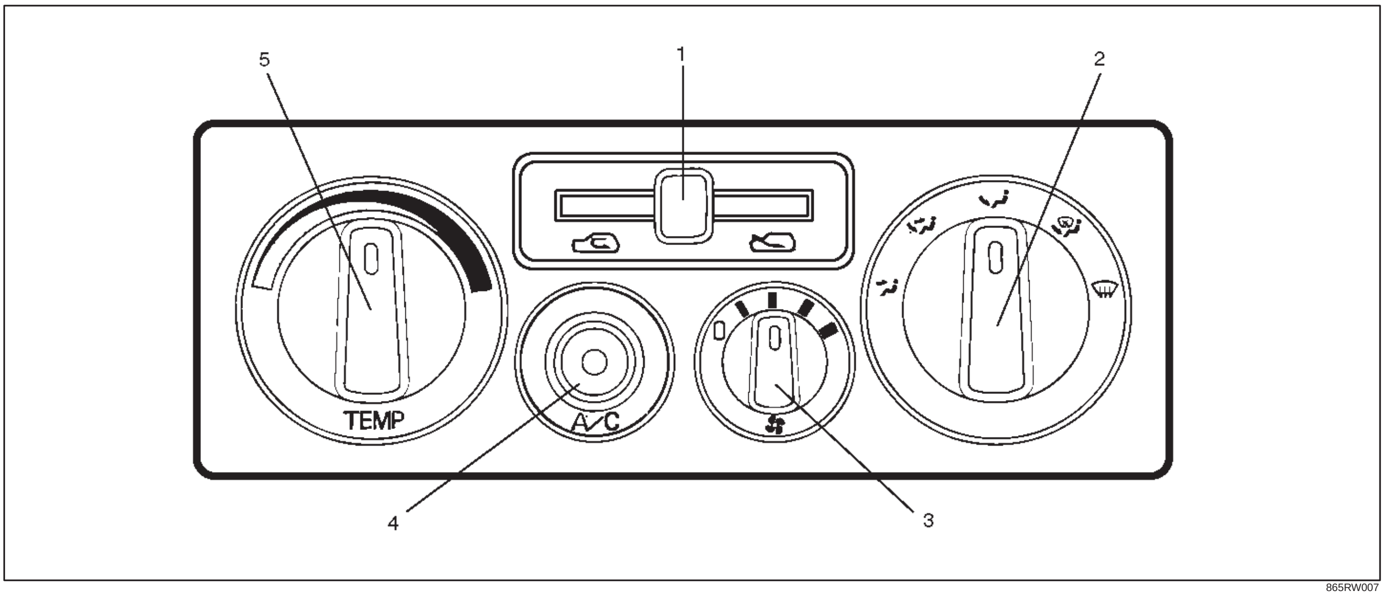
Legend

(1) Side Defroster Hose
(2) Vent Box
(3) Upper Center Vent Box
(4) Lower Center Vent Box
(5) Blower Assembly
(6) Control Lever Assembly
(7) Evaporator Assembly
(8) Duct
(9) Heater Unit
(10) Rear Heater Duct
(11) Lap Vent Nozzle
(12) Vent Box
(13) Side Defroster Hose
(14) Defroster Nozzle

Control Lever Assembly

The vehicle has cable-type-control to control the mode and temperature of the heater unit and the mode door for the air source of the blower assembly.

The fan control is used to control the amount of air sent out by the resistor at four levels from “LOW” to “HIGH”.



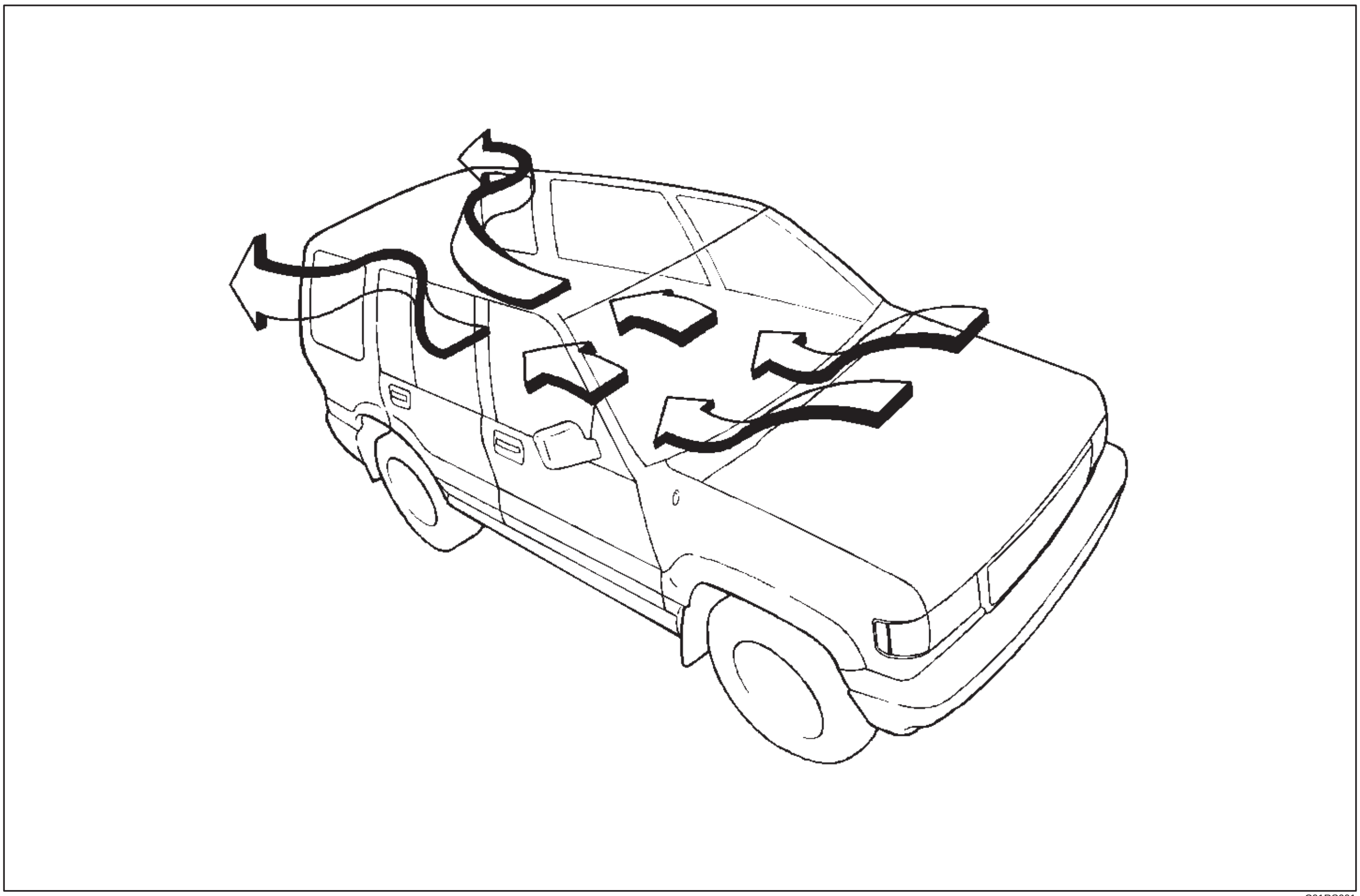
Legend

(1) Air Source Select Lever
(2) Air Select Knob
(3) Fan Control Knob (Fan Switch)
(4) Air Conditioning (A/C) Switch (W/ A/C)
(5) Temperature Control Knob

Ventilation

Set “AIR SOURCE SELECT LEVER” to “FRESH” position and turn on the blower fan. Heating can be done in this lever position, sending in fresh air from outside.

The blower fan also serves to deliver fresh outside air to the vehicle interior to assure adequate ventilation.



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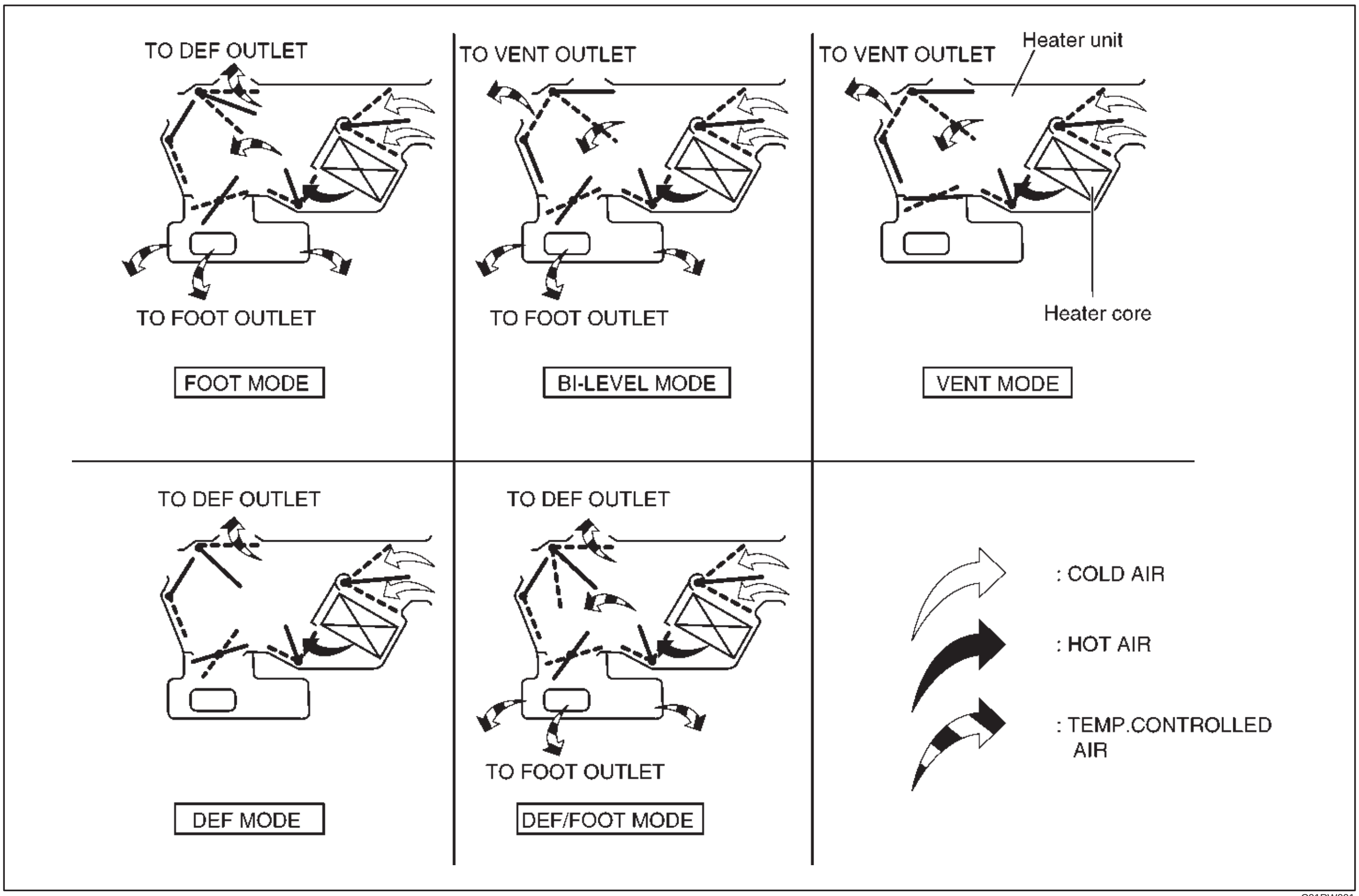
Air Select Knob

The air select knob allows you to direct heated air into the passenger compartment through different outlets.

1. **Vent** – In this position, air is discharged from the upper air outlet. Air quantity is controlled by the fan control knob.
2. **Bi-Level** – In this position, air flow is divided between the upper air outlets and the floor air outlets, with warmer air delivered to the floor outlets than the air delivered to the upper air outlets.
3. **Foot** – In this position, air flow is delivered to the foot while sending approx 30% op total amount air to the wind shield.
4. **Def/Foot** – In this position, air flow is delivered to the foot, while sending approx. 40% of total amount of air to the windshield.
   Selecting this mode allows air conditioning system to work when the fan switch is turned to on position, even if the A/C switch is off.
5. **Defrost** – In this position, most of the air is delivered to the windshield and a small amount is delivered to the side windows.

Moving the air source select lever to the "CIRC" position provides quickest heat delivery by closing the blower assembly mode door. In this position, outside air is not delivered to the passenger compartment.
Selecting this mode allows air conditioning system to work when the fan switch is turned to on position, even if the A/C switch is off.



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Air Source Select Lever

The intake of outside air and the circulation of inside air are controlled by sliding this lever left or right.

Fan Control Knob

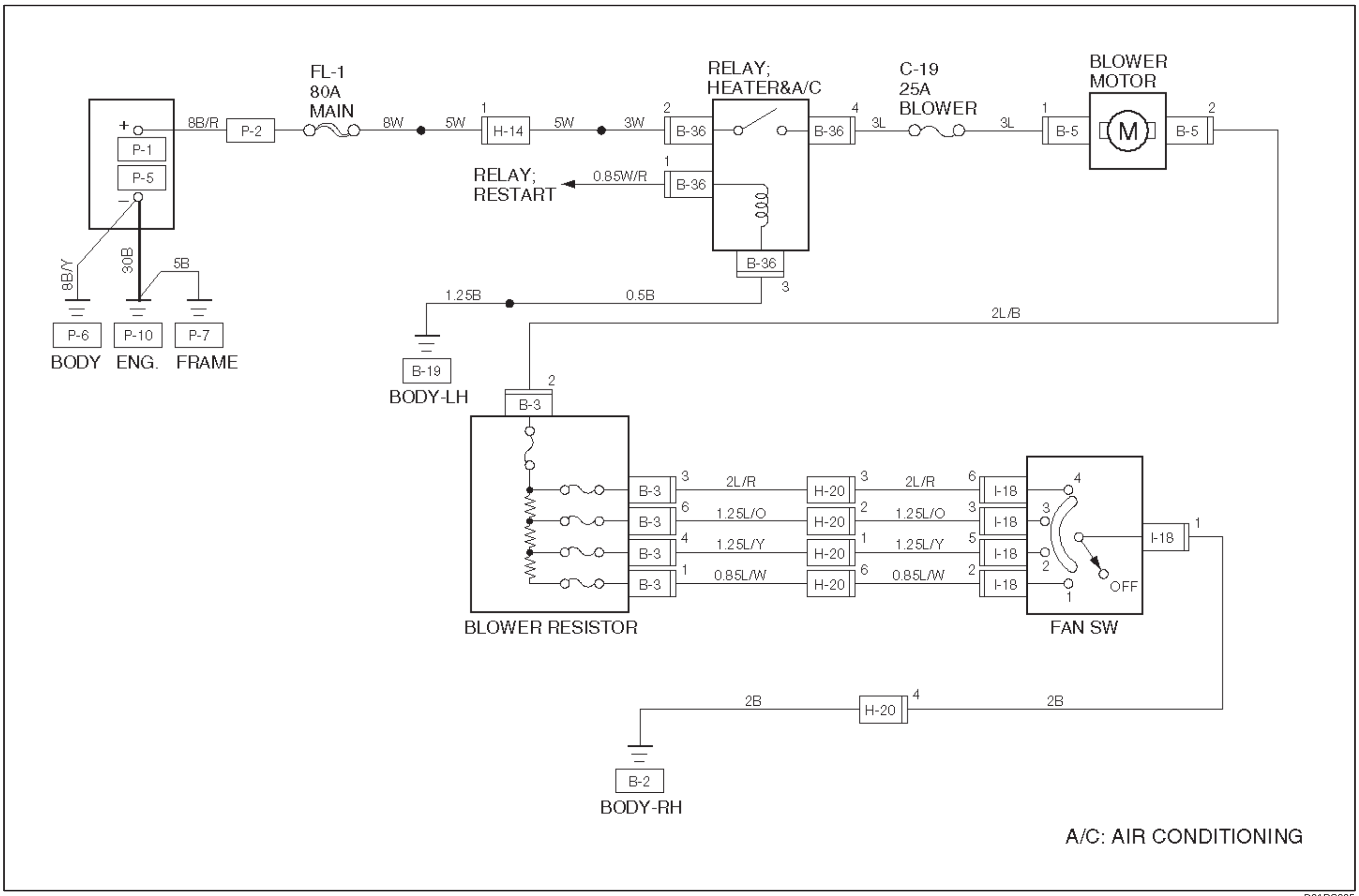
This knob controls the blower motor speed to regulate the amount of air delivered to the defrost, foot, and ventilation ducts:

1. Low
2. Medium Low
3. Medium High
4. High

Temperature Control Knob

When the temperature control knob is in the "COLD" position, the air mix door closes to block the air flow to the heater core.
When the temperature control knob is in the "HOT" position, the air mix door opens to allow air to pass through the heater core and heat the passenger compartment
Placing the knob in a intermediate position will cause a lesser or greater amount air to reach the heater core. In this mode the passenger compartment temperature can be regulated

Wiring Diagram



D01RS005

Diagnosis

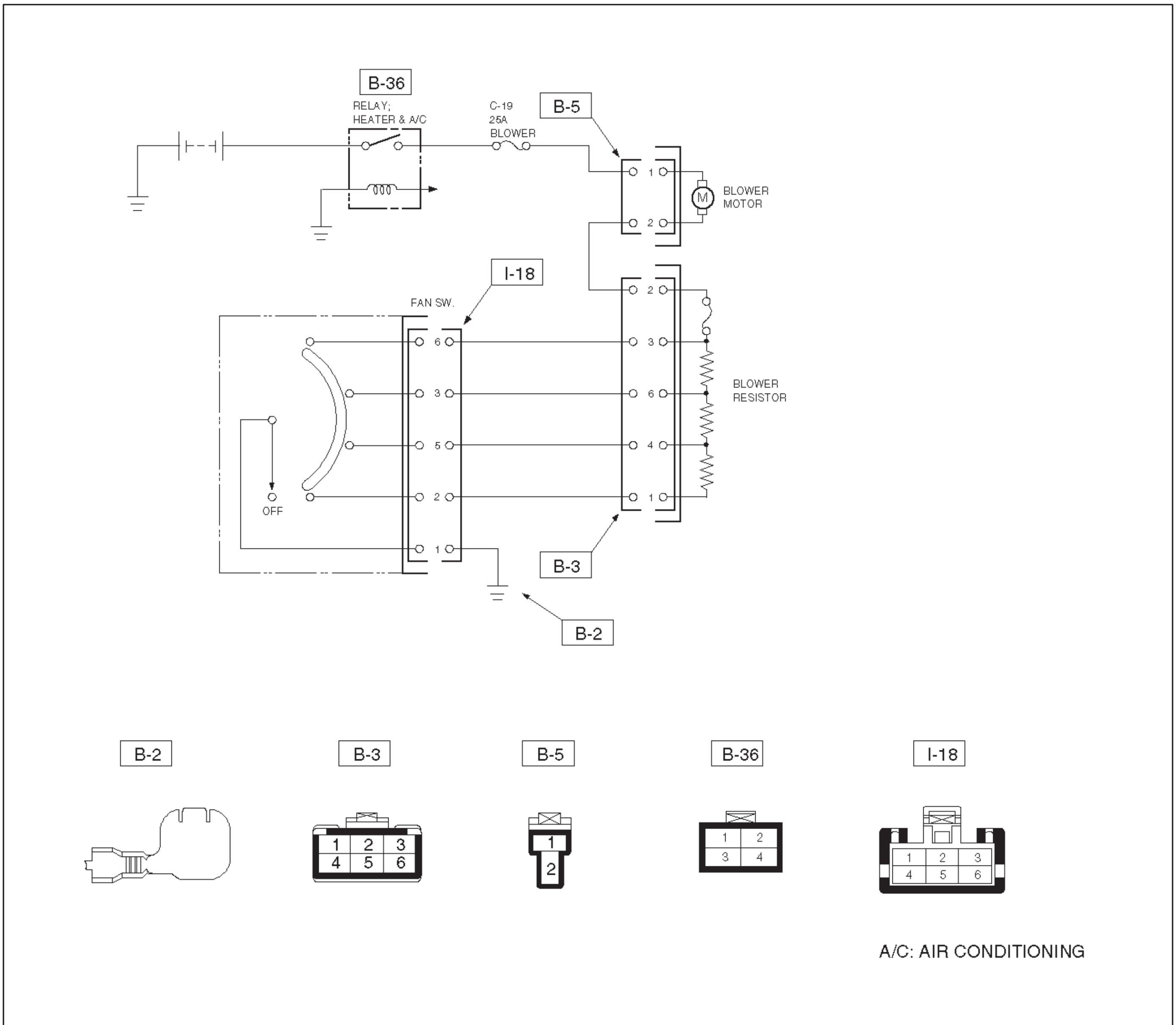
Heating Cycle diagnosis

Condition	Possible cause	Correction
No heating or insufficient heating.	Blower motor does not run or runs improperly.	Refer to “FAN CONTROL LEVER (FAN SWITCH) DIAGNOSIS”.
	Engine coolant temperature is low.	Check the engine coolant temperature after warming up the engine and check the thermostat. Replace as necessary.
	Insufficient engine coolant.	Add engine coolant as required.
	Circulation volume of engine coolant is insufficient.	Check if the water hose to the heater core is clogged, collapsed or twisted. Repair or replace as necessary.
	Heater core clogged or collapsed.	Clean or replace as necessary.
	The heater cores is not provided with air sent from the blower motor.	Repair the temperature control link unit or mode doors.
	Duct connections defective or unsealing.	Repair or replace as necessary.
Control lever moves but mode door does not operate.	Cable attaching clip is not correct.	Repair
	Link unit of heater or blower assembly defective.	Repair
The mode door cannot be set to the mode selected.	Link unit of heater unit or blower assembly defective.	Repair.
	Control cable is not adjusted.	Adjust.

Fan Control Lever (Fan Switch) Diagnosis

Current flows to the blower motor through the heater and the A/C relay (B-36) to activate the rotation of the blower motor by turning “ON” the fan control knob (fan switch). Blower motor speed is controlled in stages by the resistor, by operating the switch from “LOW” to “HIGH”.

For the inspection of the relays, switches and units in each table, refer to “INDIVIDUAL INSPECTION” in this section.



D01RS004

Condition	Possible cause	Correction
Blower motor does not run.	—	Refer to Chart A
Blower motor does not run in certain position (s).	—	Refer to Chart B, C, D and E
Blower motor does not stop at “OFF” position.	—	Refer to Chart F

Chart “A” Blower Motor Dose Not Run

Step	Action	Yes	No
1	Is relay (B-36) OK?	Go to Step 2	Replace
2	Is fuse C-19 (25A) OK?	Go to Step 3	Replace
3	Is resistor OK?	Go to Step 4	Replace
4	Is fan control knob OK?	Go to Step 5	Replace control lever assembly.
5	Is blower motor OK?	Go to Step 6	Replace
6	1. Turn the ignition switch “ON”. 2. Turn fan control knob “ON”. 3. Check to see if battery voltage is present at chassis side connector terminal No. B5-1 Is there a battery voltage?	Poor ground or open circuit either between chassis side connector terminal No. B5-2 and No. B3-2 or No. I18-1 and body ground (No. B-2).	Open circuit between No. C-19 (25A) fuse and No. B5-1.

Chart “B” Blower Motor Does Not Run At Low Position

Step	Action	Yes	No
1	Is resistor OK?	Go to Step 2	Replace
2	Is fan control knob (Fan Switch) OK?	Open circuit between chassis side connector terminal No. B3-1 and No.I18-2.	Replace control lever assembly.

Chart “C” Blower Motor Dose Not Run At Medium Low Position

Step	Action	Yes	No
1	Is resistor OK?	Go to Step 2	Replace
2	Is fan control knob (Fan Switch) OK?	Open circuit between the chassis side connector terminal No. B3-4 and No. I18-5.	Replace control lever assembly.

Chart “D” Blower Motor Dose Not Run At Medium High Position

Step	Action	Yes	No
1	Is resistor OK?	Go to Step 2	Replace
2	Is fan control knob (Fan Switch) OK?	Open circuit between chassis side connector terminal No. B3-6 and No. I18-3.	Replace control lever assembly.

Chart “E” Blower Motor Dose Not Run At High Position

Step	Action	Yes	No
1	Is resistor OK?	Go to Step 2	Replace
2	Is fan control knob (Fan Switch) OK?	Open circuit between Chassis side connector terminal No. B3-3 and No. I18-6.	Replace control lever assembly.

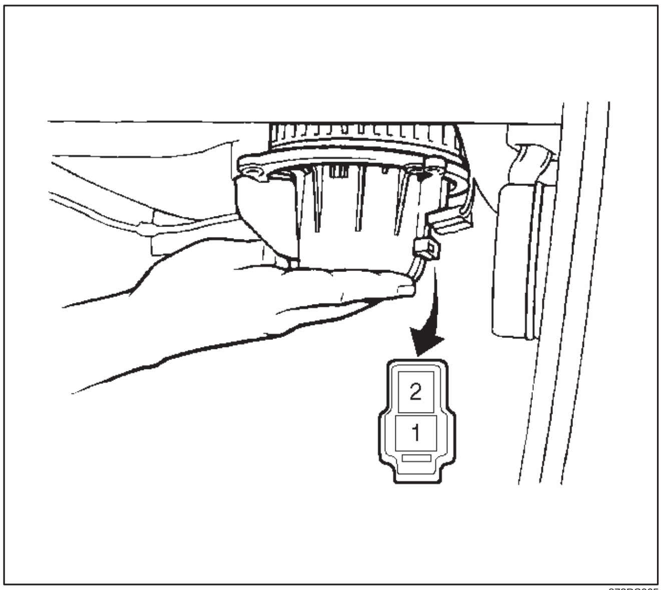
Chart “F” Blower Motor Does Not Stop In The “OFF” Position

Step	Action	Yes	No
1	Is the fan control knob (Fan Switch) OK?	Short circuit between chassis side connector terminal No. B5-2 and No. B3-2,No. B3-3 and No. I18-6, No. B3-6 and No. I18-3, No. B3-4 and No. I18-5 or No. B3-1 and No. I18-2	Replace control lever assembly.

Individual Inspection

Blower Motor

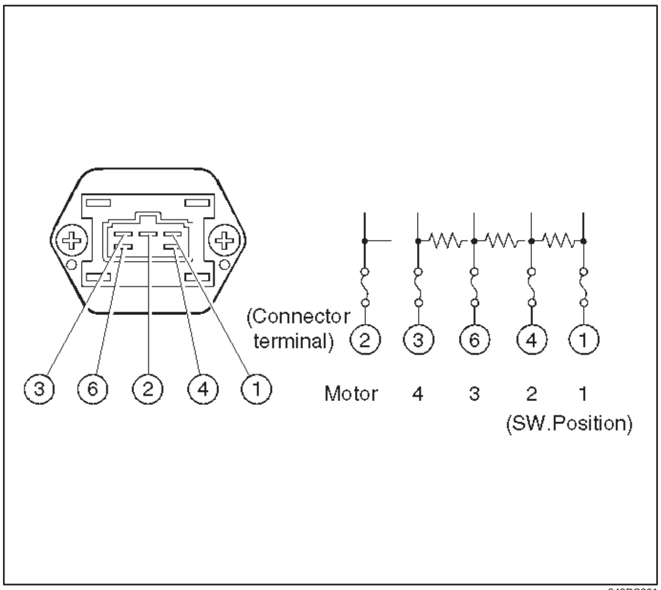
1. Disconnect the blower motor (B-5) connector from the blower motor.
2. Connect the battery positive terminal to the No. 1 terminal of the blower motor and the negative to the No. 2.
3. Be sure to check to see if the blower motor operates correctly.



873RS005

Resistor

1. Disconnect the resistor (B-3) connector.
2. Check for continuity and resistance between the terminals of the resistor.

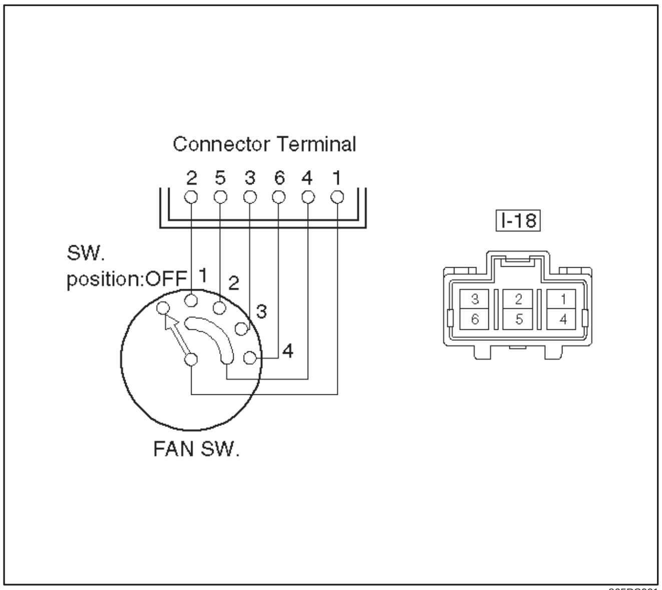


840RS001

Fan switch position	Resistor terminals with continuity	Resistance
1	1 — 2	2.4 Ω
2	2 — 4	0.90 Ω
3	2 — 6	0.28 Ω
4	2 — 3	—

Fan Control Knob (Fan Switch)

1. Check for continuity between the terminals of the fan switch.

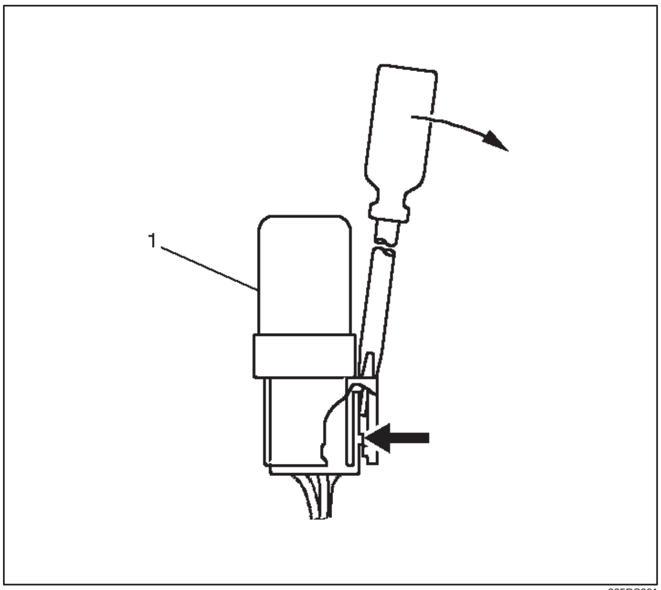


865RS001

Fan switch position	Switch connector terminals with continuity
OFF	No continuity
1	1 – 2 – 4
2	1 – 4 – 5
3	1 – 3 – 4
4	1 – 4 – 6

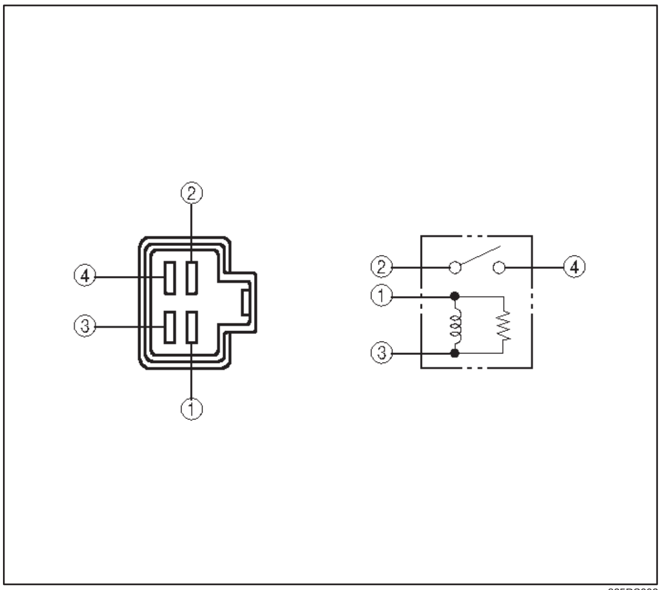
Heater & A/C Relay

1. Disconnect the heater and the A/C relay (B-36).
   - When removing the connector for relay, unfasten the tang lock of the connector by using a screwdriver, then pull the relay (1) out.



825RS001

2. Check for continuity between the heater and the A/C relay (B-36) terminals.

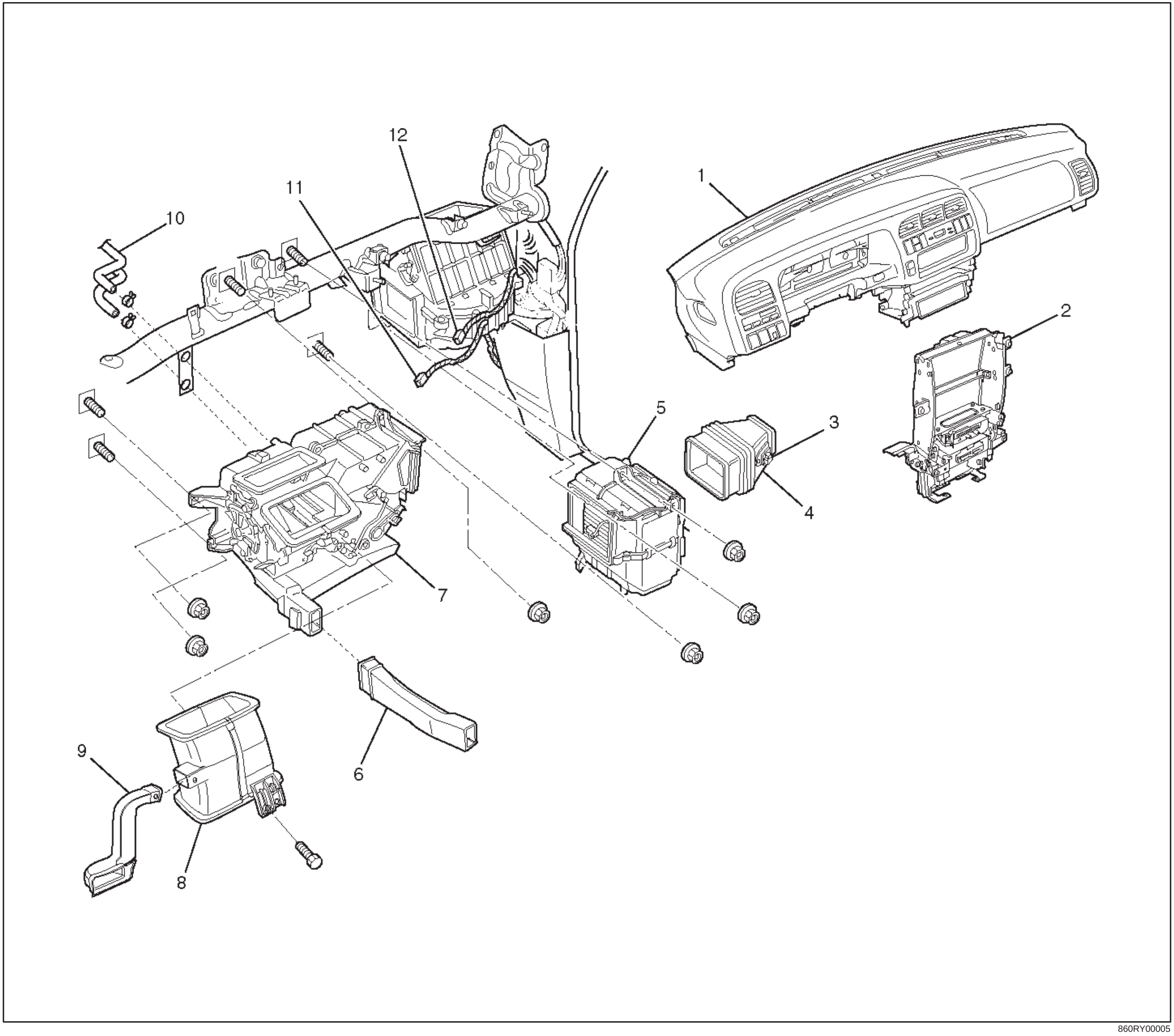


825RS002

Condition	Relay terminals with continuity
Normal	1 – 3 (Approx 85–105Ω)
When battery voltage is applied between 1 – 3	2 – 4

Heater Unit

Heater Unit and Associated Parts



Legend

(1) Instrument Panel Assembly
(2) Instrument Panel Center Bracket
(3) Resistor
(4) Duct
(5) Evaporator Assembly (A/C only)
(6) Rear Heater Duct
(7) Heater Unit Assembly
(8) Center Ventilation Lower Duct
(9) Driver Lap Vent Nozzle
(10) Water Hose
(11) Electro Thermo Connector (With A/C)
(12) Resistor Connector

Removal

1. Disconnect the battery ground cable.
2. Drain the engine coolant.
3. Discharge and recover refrigerant (with air conditioning)
   - Refer to Refrigerant Recovery in this section.
4. Remove the Instrument panel assembly.
   - Refer to Instrument Panel Assembly in Body and Accessories section.
5. Disconnect the water hoses at the heater unit.
6. Disconnect resistor connector.
7. Remove duct.

8. Remove evaporator assembly (A/C only).
   - Refer to Evaporator Assembly in this section.
9. Remove instrument panel center bracket.
   - Refer to Cross Beam Assembly in Body and Accessories section.
10. Remove rear heater duct.
11. Remove heater unit assembly.
12. Remove driver lap vent nozzle.
13. Remove center ventilation lower duct.

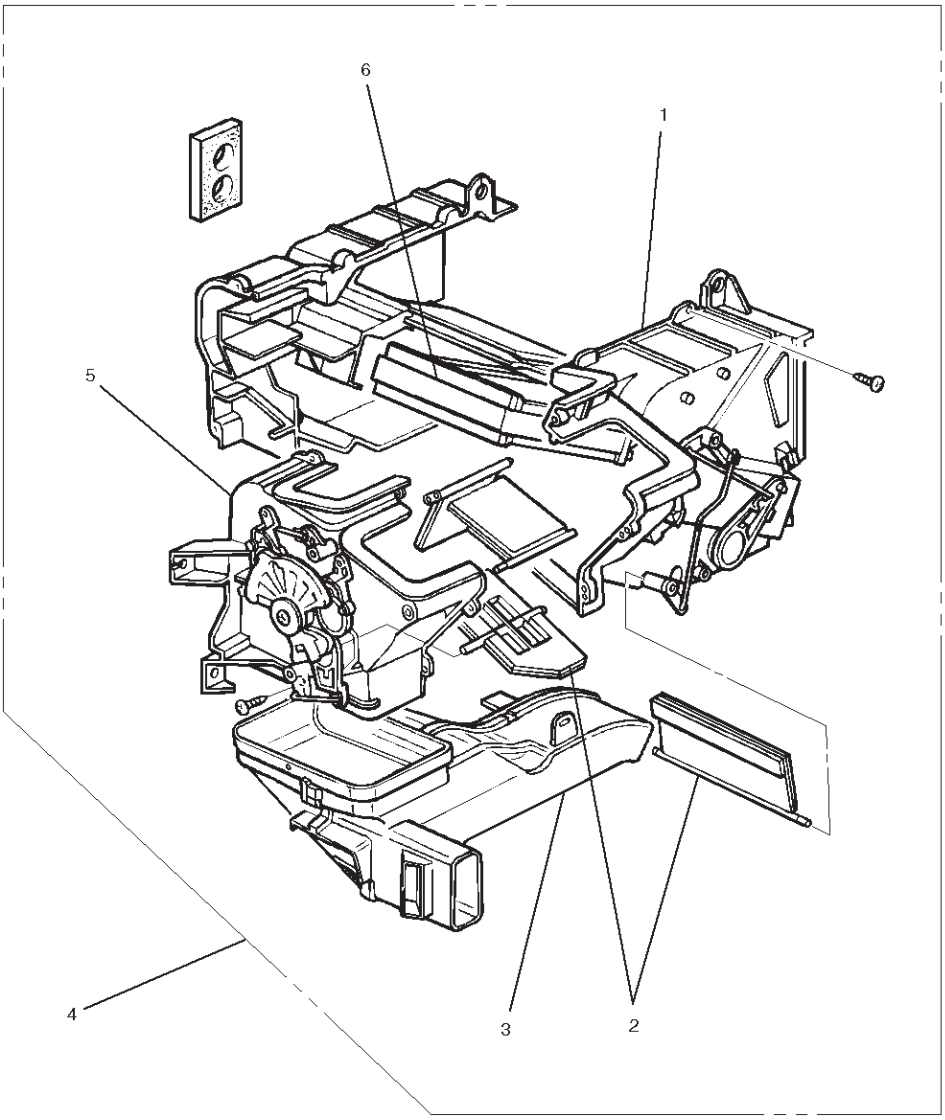
Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. When handling the PCM and the control unit, be careful not to make any improper connection of the connectors.
2. Adjust the control lever assembly cables.
   - Refer to Control Lever Assembly in this section.
3. When installing the heater unit, defroster nozzle and center vent duct, be sure that the proper seal is made, without any gap between them.

Heater Core and / or Mode Door

Disassembled View



860RS001

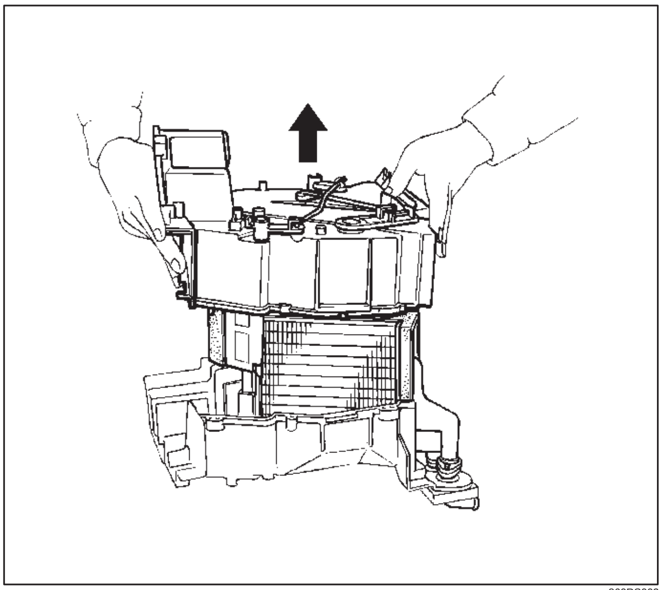
Legend

(1) Case (Temperature Control)
(2) Mode Door
(3) Duct
(4) Heater Unit
(5) Case (Mode Control)
(6) Heater Core

Removal

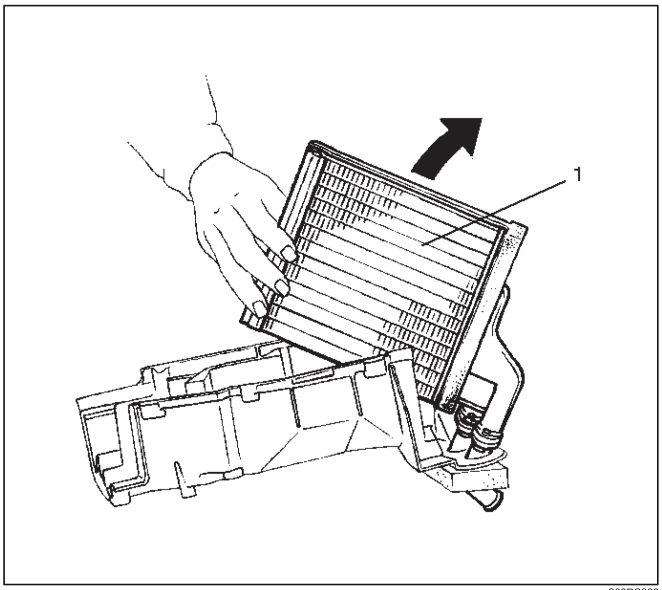
1. Disconnect the battery ground cable.
2. Drain the engine coolant.
3. Discharge and recover refrigerant (with air conditioning).
   - Refer to Refrigerant Recovery in this section.
4. Remove heater unit.
   - Refer to Heater Unit in this section.
5. Remove duct.
6. Remove case (Mode control) and do not remove link unit at this step.

7. Remove case (Temperature control). Separate two halves of core case.



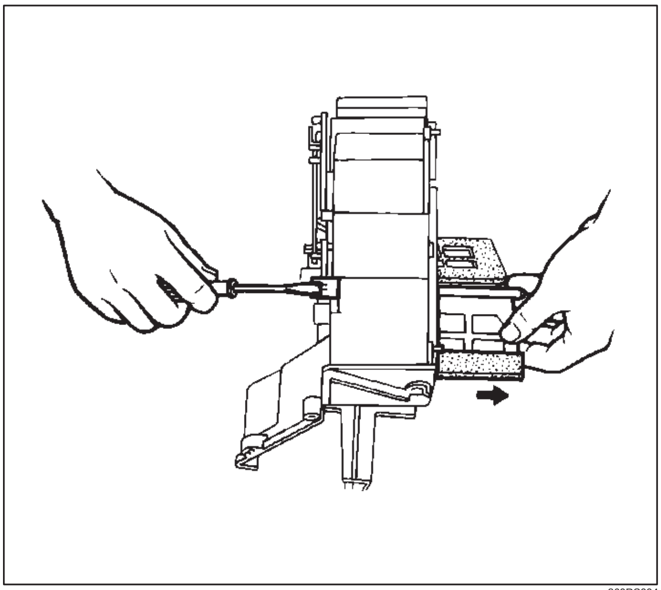
860RS002

8. Remove heater core (1).



860RS003

9. Pull out the mode door while raising up the catch of the door lever.



860RS004

Inspection

Check for foreign matter in the heater core, stains or core fin damage.

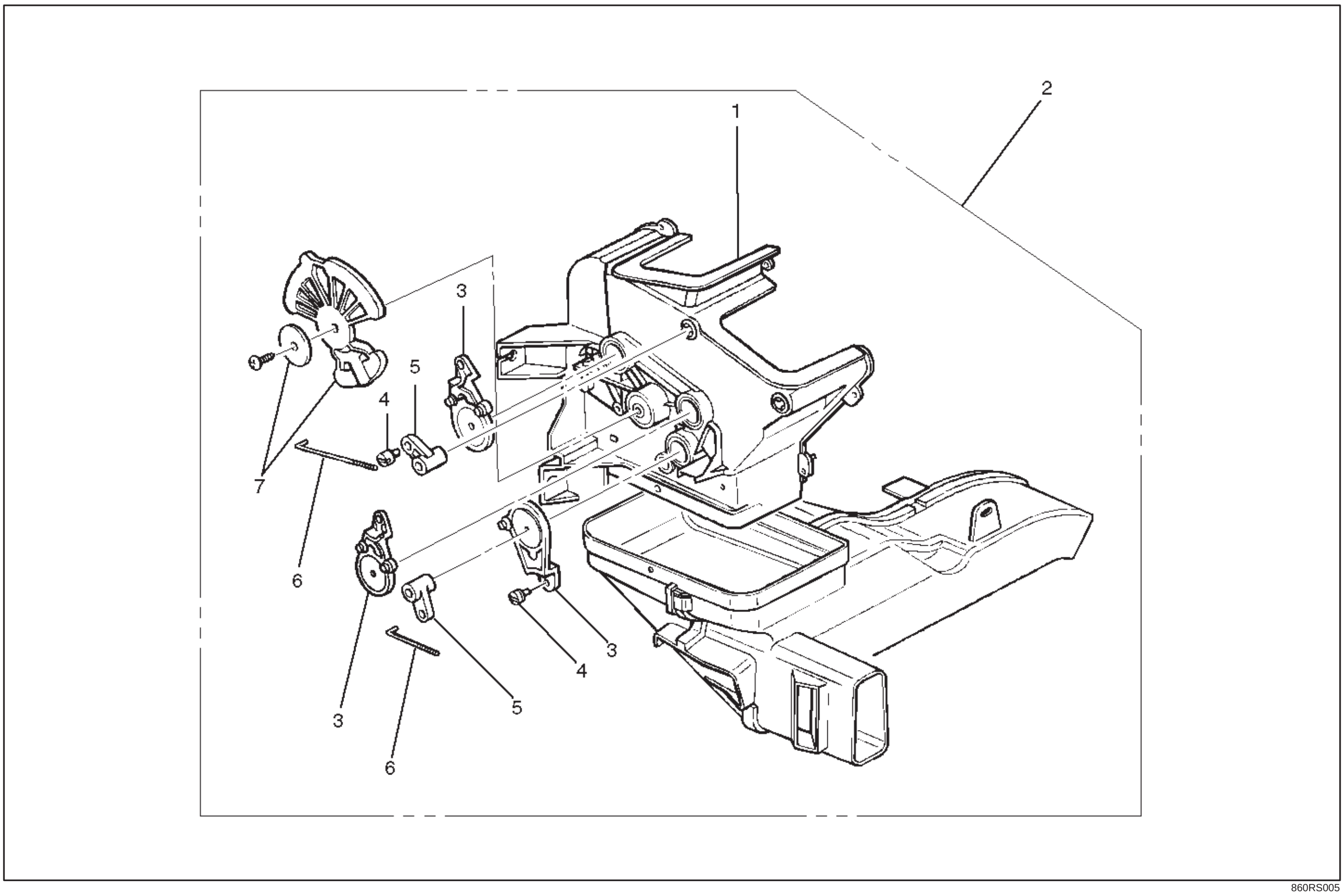
Installation

To install, follow the removal steps in the reverse order, noting the following point:

1. Check that each mode door operates properly.

Heater Mode Control Link Unit

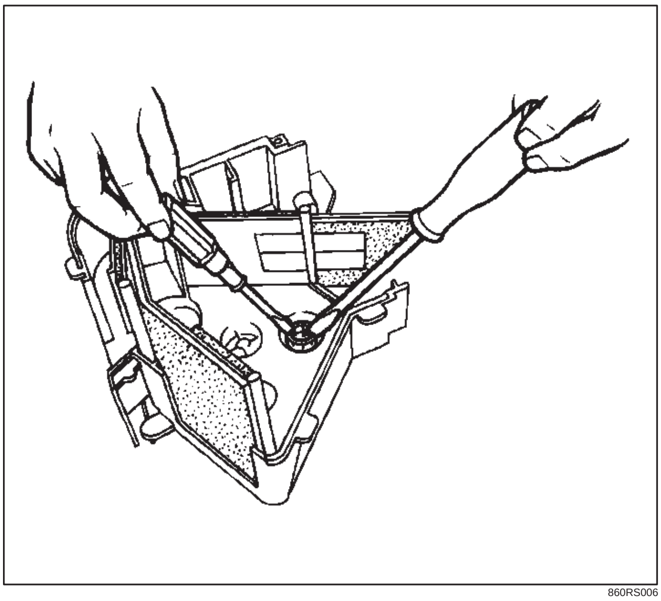
Disassembled View



Legend
- (1) Case (Mode Control)
- (2) Heater Unit
- (3) Mode Sub-lever
- (4) Clip
- (5) Door Lever
- (6) Rod
- (7) Washer and Mode Main Lever

Removal

1. Disconnect the battery ground cable.
2. Drain engine coolant.
3. Discharge and recover refrigerant (with air conditioning).
   - Refer to Refrigerant Recovery in this section.
4. Remove heater unit.
   - Refer to Heater Unit in this section.
5. Remove the case (Mode control) from heater unit.
6. Remove washer and the mode main lever.
7. Remove rod.
8. Press the tab of the sub-lever inward, and take out the sub-lever.
9. Pull out the door lever while raising up the catch of the door lever.



10. Remove clip.

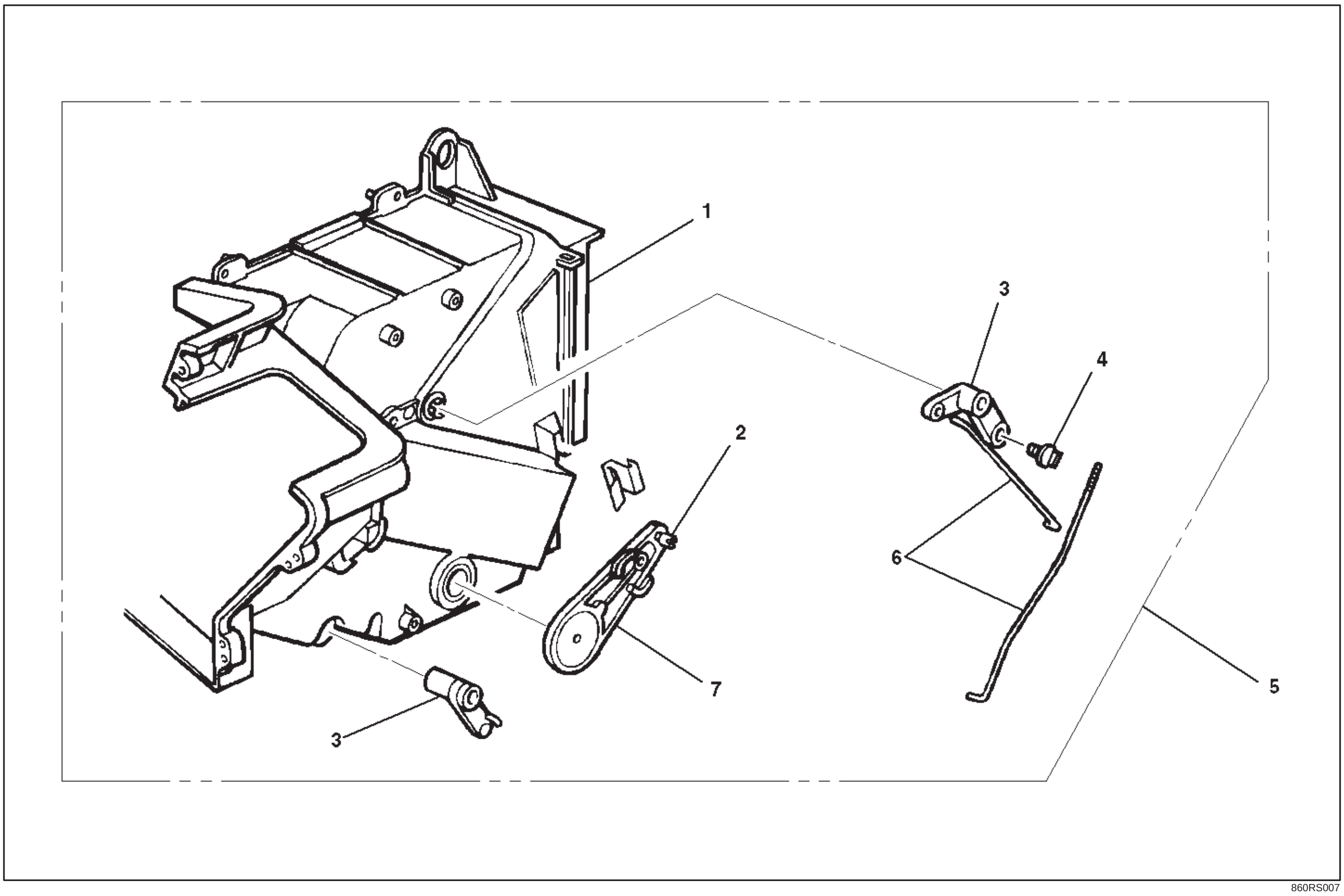
Installation

To install, follow the remove steps in the reverse order, noting the following points:

1. Apply grease to the mode sub-lever and to the abrasive surface of the heater unit.
2. After installing the link unit, check to see if the link unit operates correctly.

Heater Temperature Control Link Unit

Disassembled View



Legend

(1) Case (Temperature control)
(2) Clip
(3) Door Lever
(4) Clip
(5) Heater Unit
(6) Rod
(7) Sub-lever

Removal

1. Disconnect the battery ground cable.
2. Drain engine coolant.
3. Discharge and recover refrigerant (with air conditioning).
   - Refer to Refrigerant Recovery in this section.
4. Remove heater unit.
   - Refer to Heater Unit in this section.
5. Remove the case (Temperature control) from the heater unit.
6. Remove rod.
7. Remove sub-lever.
8. Pull out the door lever while raising up the catch of the door lever.
9. Remove clip.

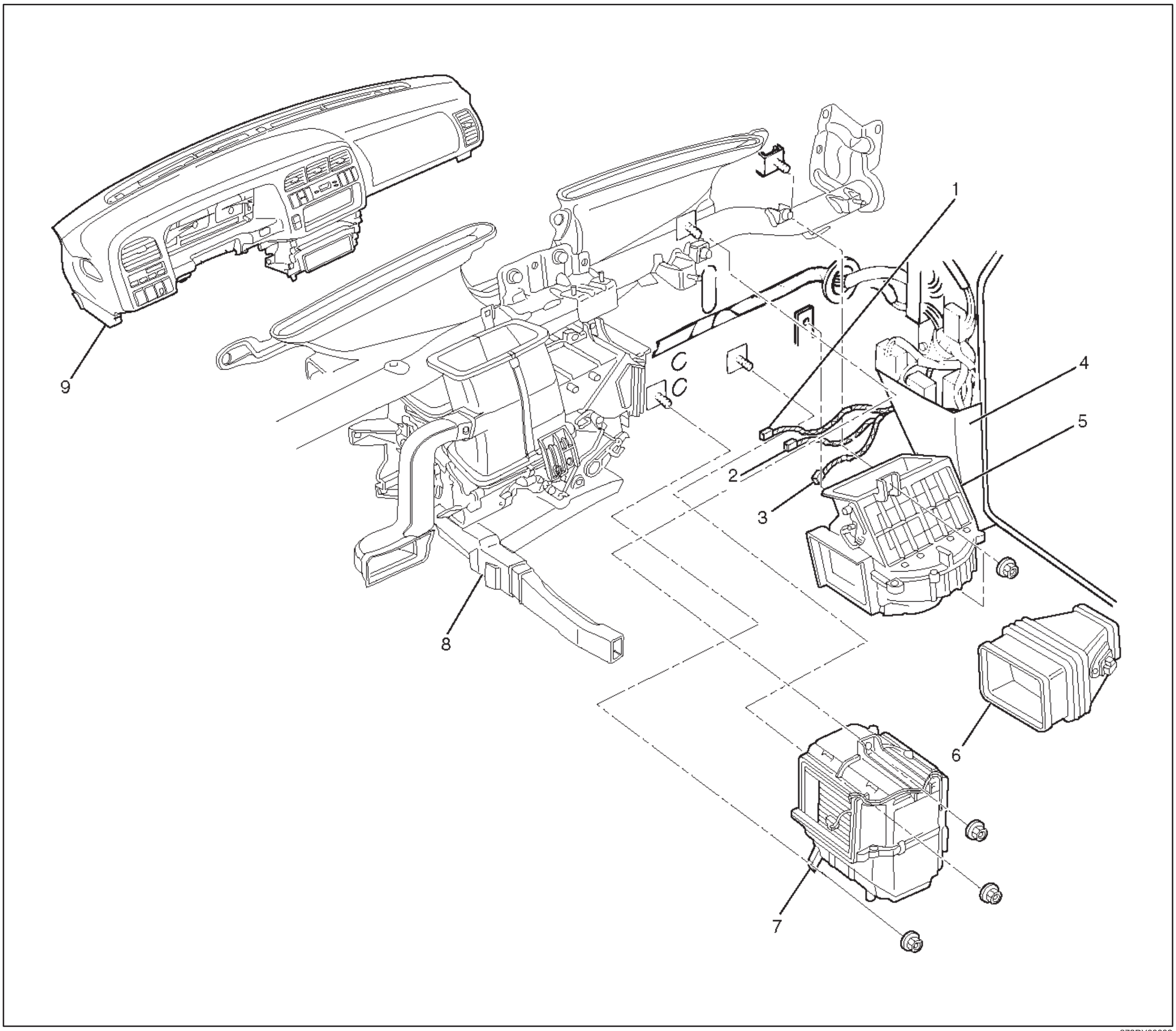
Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Apply grease to the sub-lever and to the abrasive surface of the heater unit.
2. After installing the link unit, check to see if the link unit operates correctly.

Blower Assembly

Blower Assembly and Associated Parts



Legend

(1) Electro Thermo Connector
(2) Blower Motor Connector
(3) Resistor Connector
(4) Dash Side Trim Panel (RH)
(5) Blower Assembly
(6) Duct
(7) Evaporator Assembly (A/C only)
(8) Heater Unit
(9) Instrument Panel Assembly

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant (with air conditioning).
   - Refer to Refrigerant Recovery in this section.
3. Remove instrument panel assembly.
   - Refer to Instrument Panel Assembly in Body and Accessories section.
4. Disconnect resistor connector.
5. Remove duct.
6. Remove evaporator assembly (A/C only).
   - Refer to Evaporator Assembly in this section.
7. Remove dash side trim panel (RH).
8. Disconnect blower motor connector.
9. Remove blower assembly.

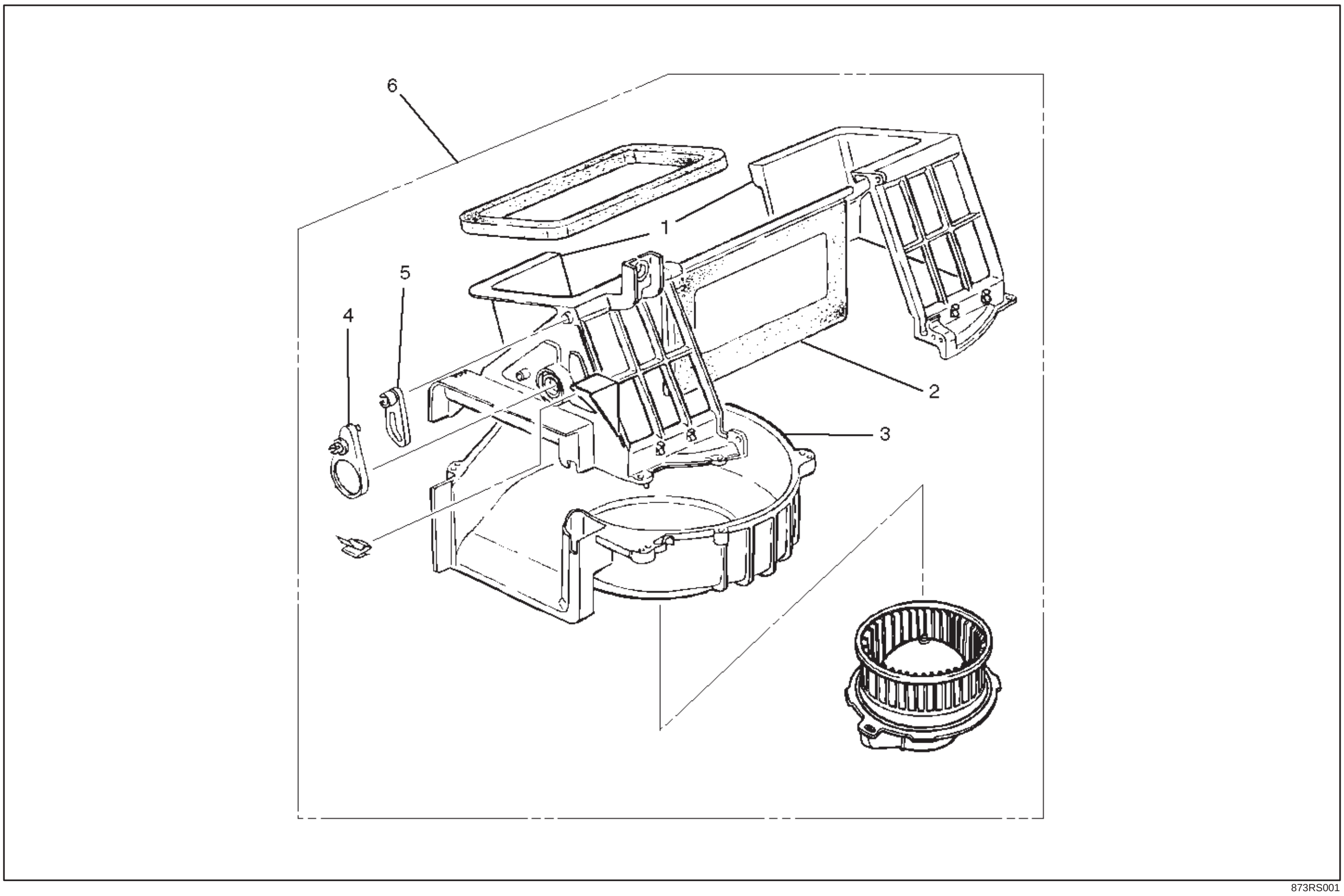
Installation

To install, follow the removal steps in the reverse order, noting the following point:

1. Adjust the control lever assembly cables.
   - Refer to Control Lever Assembly in this section.

Blower Link Unit and / or Mode door

Disassembled View



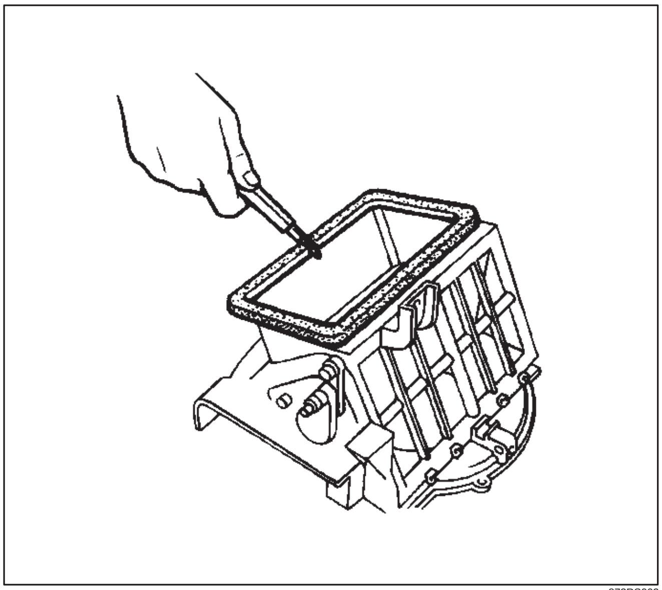
Legend

(1) Upper Case
(2) Mode Door
(3) Lower Case
(4) Sub Lever
(5) Door Lever
(6) Blower Assembly

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant (with air conditioning).
   - Refer to Refrigerant Recovery in this section.
3. Remove blower assembly.
   - Refer to Blower Assembly in this section.

4. Remove lower case.
5. Separate the upper case and slit the lining parting face with a knife.



873RS002

6. Pull out the mode door while lifting up the catch of door lever.
7. Remove sub-lever.
8. Remove door lever.

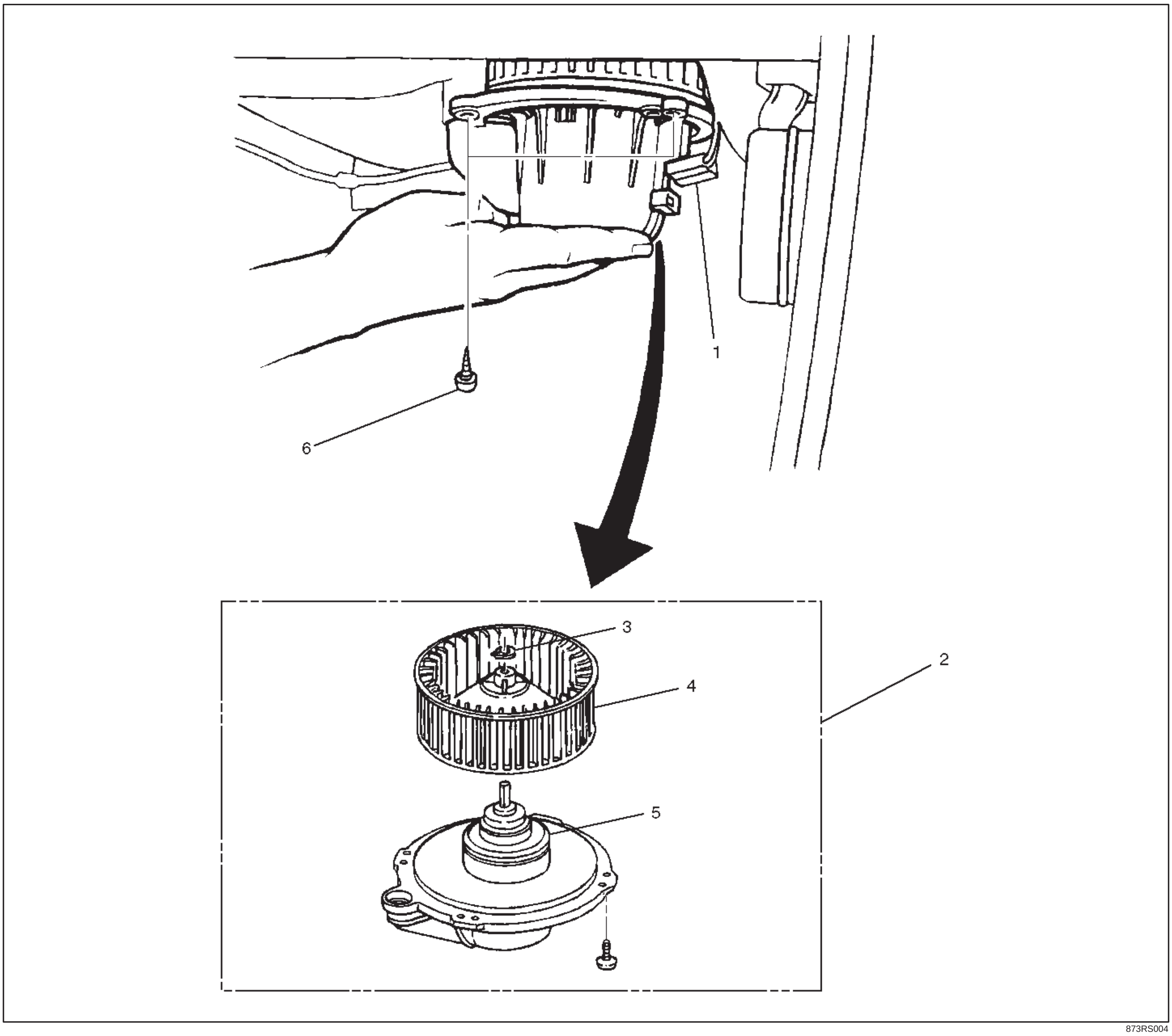
Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Apply grease to the door lever and to the abrasive surface of the upper case.
2. Apply an adhesive to the parting face of the lining when assembling the upper case.

Blower Motor

Blower Motor and Associated Parts



Legend

(1) Blower Motor Connector
(2) Blower Motor Assembly
(3) Clip
(4) Fan
(5) Blower Motor
(6) Attaching Screw

Removal

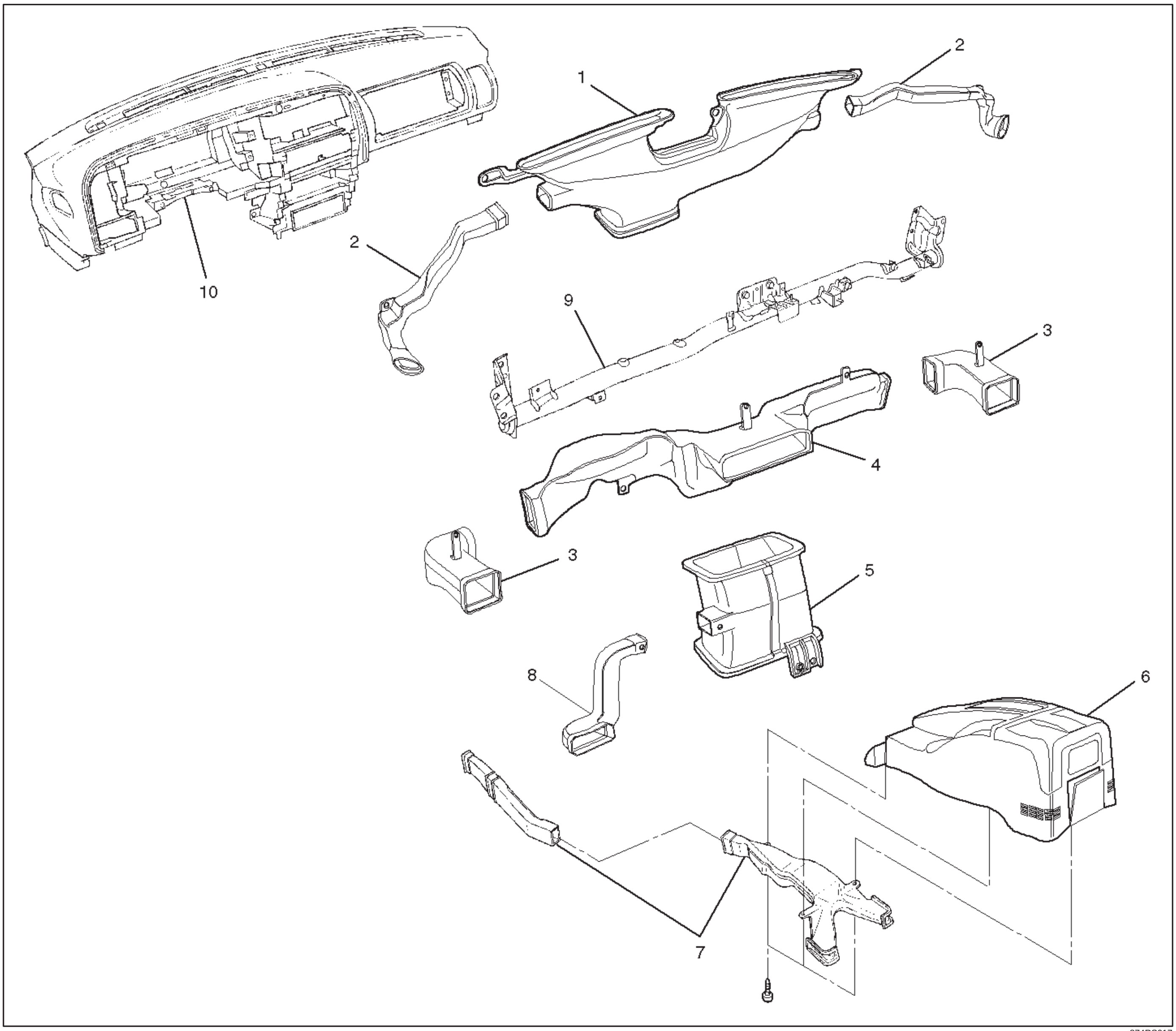
1. Disconnect the battery ground cable.
2. Remove blower motor connector.
3. Remove attaching screw.
4. Remove blower motor assembly.
5. Remove clip.
6. Remove fan.
7. Remove blower motor.

Installation

To install, follow the removal steps in the reverse order.

Rear Heater Duct, Defroster Nozzle and Ventilation Duct

Rear Heater Duct, Defroster Nozzle, Ventilation Duct and Associated Parts



Legend

(1) Center Defroster Nozzle
(2) Side Defroster Nozzle
(3) Side Ventilation Duct
(4) Center Ventilation Upper Duct
(5) Center Ventilation Lower Duct
(6) Center Console
(7) Rear Heater Duct
(8) Driver Lap Duct
(9) Cross Beam Assembly
(10) Instrument Panel Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove instrument panel assembly.
   - Refer to Instrument Panel Assembly in Body and Accessories section.
3. Remove center ventilation upper duct.
4. Remove side ventilation duct.
5. Remove center ventilation lower duct.
6. Remove driver lap duct.
7. Remove center console.
8. Remove rear heater duct.
   - Refer to Consoles in Body and Accessories section.
9. Remove cross beam assembly.
   - Refer to Cross Beam Assembly in Body and Accessories section.

10. Remove side defroster nozzle.
11. Remove center defroster nozzle.

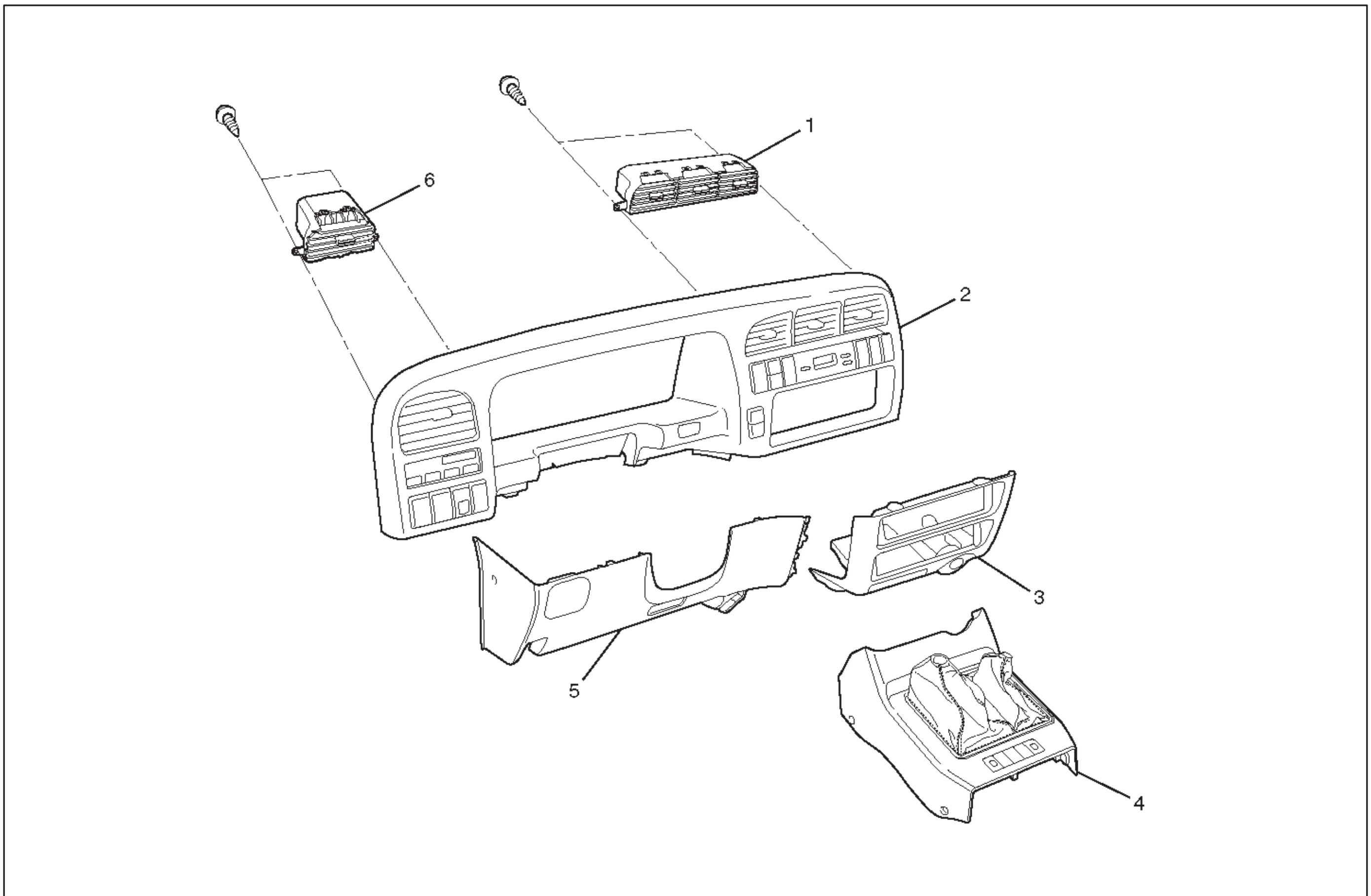
Installation

To install, follow the removal steps in the reverse order, noting the following point:

1. Connect each duct and nozzle securely leaving no clearance between them and making no improper matching.

Center and / or Drive Side Vent

Center Vent, Drive Side Vent and Associated Parts



740RS003

Legend

(1) Center Vent
(2) Meter Cluster Assembly
(3) Lower Cluster Assembly
(4) Front Console Assembly
(5) Instrument Panel Driver Lower Cover Assembly
(6) Side Vent

Removal

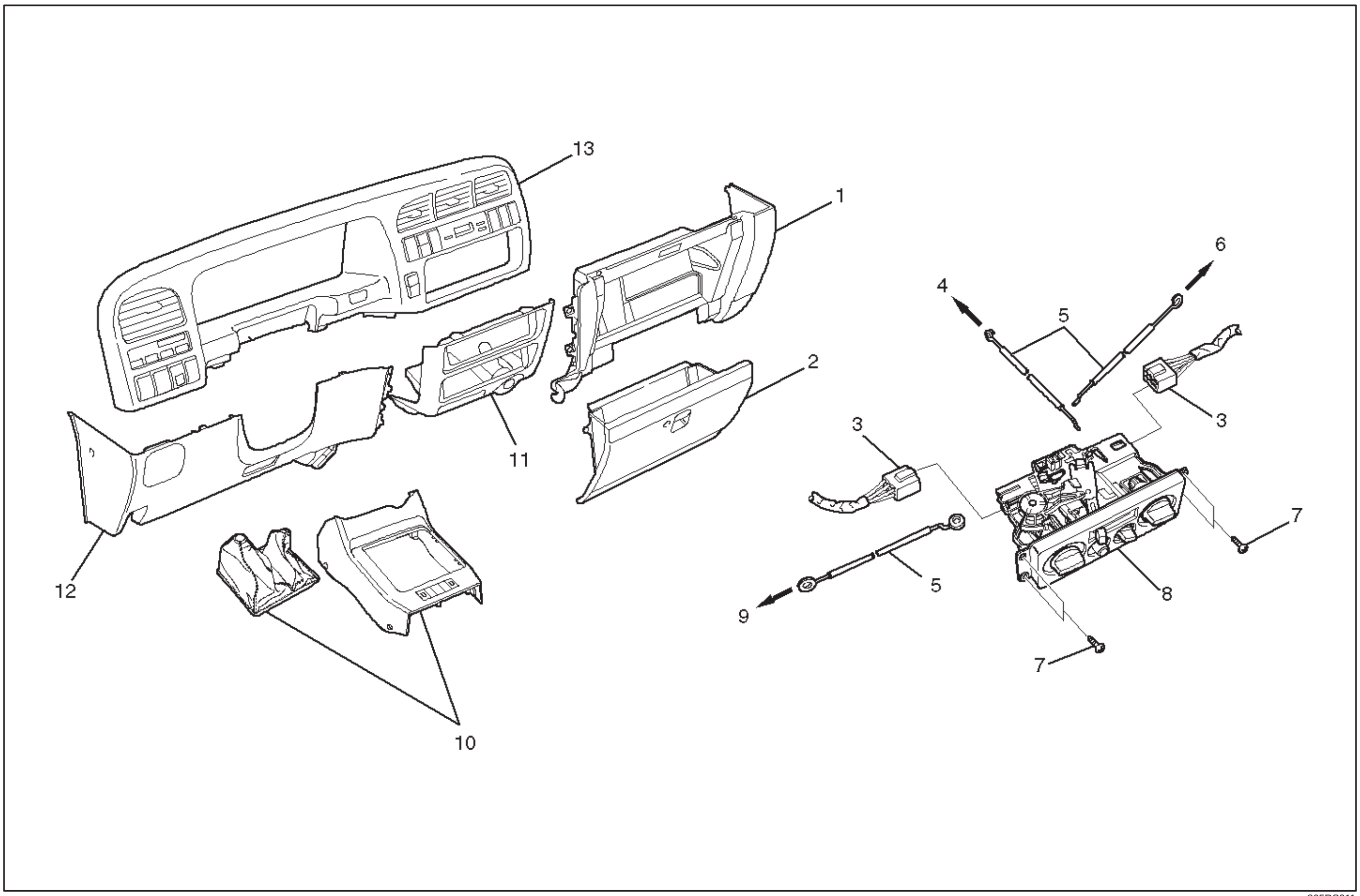
1. Disconnect the battery ground cable.
2. Remove front console assembly.
3. Remove lower cluster assembly.
4. Remove instrument panel driver lower cover assembly.
5. Remove meter cluster assembly.
   - Refer to Instrument Panel Assembly in Body and Accessories section.
6. Remove screws and the center vent from center cluster while prying up the center vent catch portions.
7. Remove screws and the side vent from the center cluster while prying up the vent catch portions.

Installation

To install, follow the removal steps in the reverse order.

Control Lever Assembly and / or Control Cable

Control Lever Assembly, Control Cable and Associated Parts



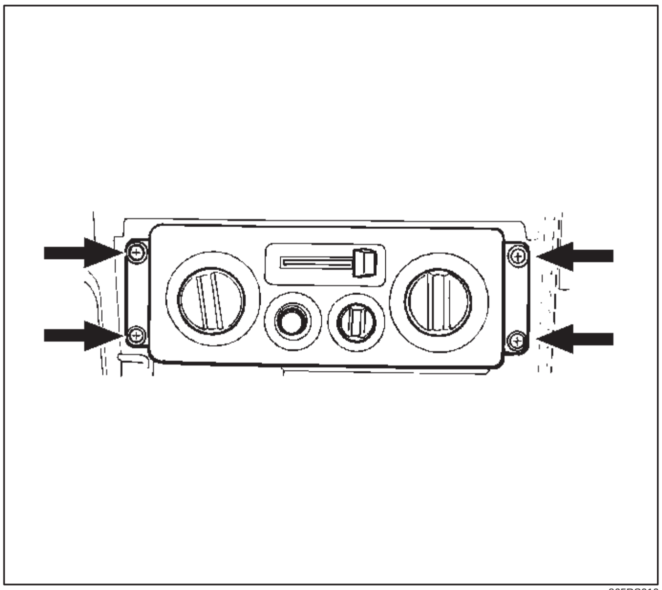
Legend

(1) Instrument Panel Passenger Lower Cover Assembly
(2) Glove Box
(3) Fan Switch and Air Conditioning Switch Connector
(4) Temp Control Link Connection
(5) Control Cable
(6) Blower Assembly Connection
(7) Attaching Screws
(8) Control Lever Assembly
(9) Mode Control Link Connection
(10) Front Console Assembly
(11) Lower Cluster Assembly
(12) Instrument Panel Driver Lower Cover Assembly
(13) Meter Cluster Assembly

Removal

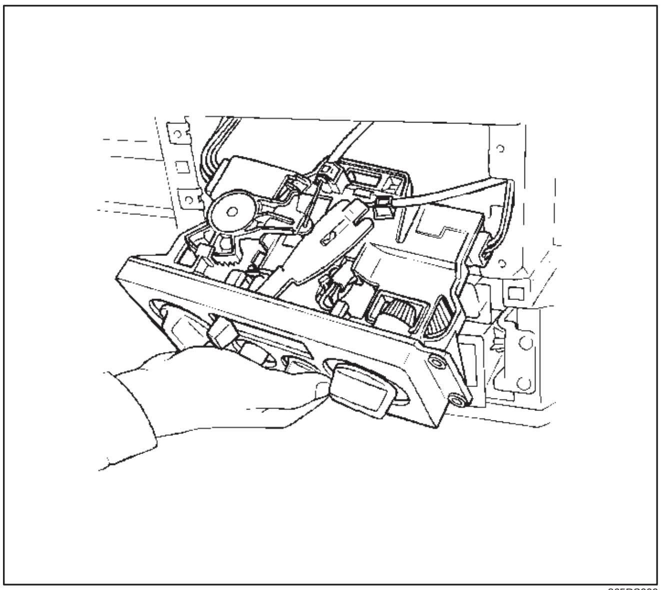
1. Disconnect the battery ground cable.
2. Remove front console assembly.
3. Remove lower cluster assembly.
4. Remove glove box.
5. Remove instrument panel passenger lower cover assembly.
6. Remove instrument panel driver lower cover assembly.
7. Remove meter cluster assembly.
   - Refer to Instrument Panel Assembly in Body and Accessories section.

8. Remove attaching screws.
   - Remove the four attaching screws.



865RS010

9. Pull the control lever assembly out and disconnect the fan switch and air conditioning switch connectors.



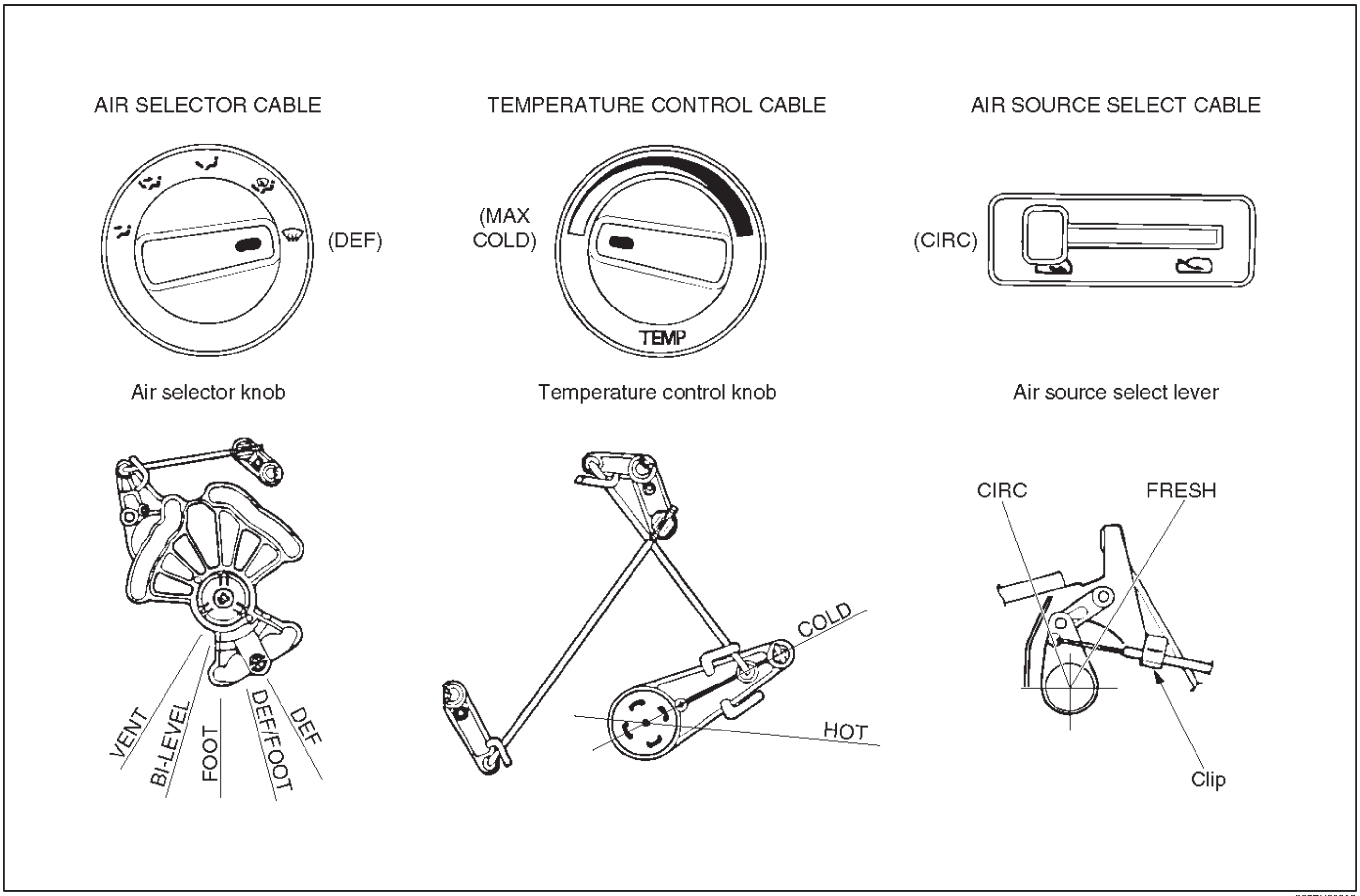
865RS009

10. Remove control lever assembly.
11. Remove control cable.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Adjust the control cable.



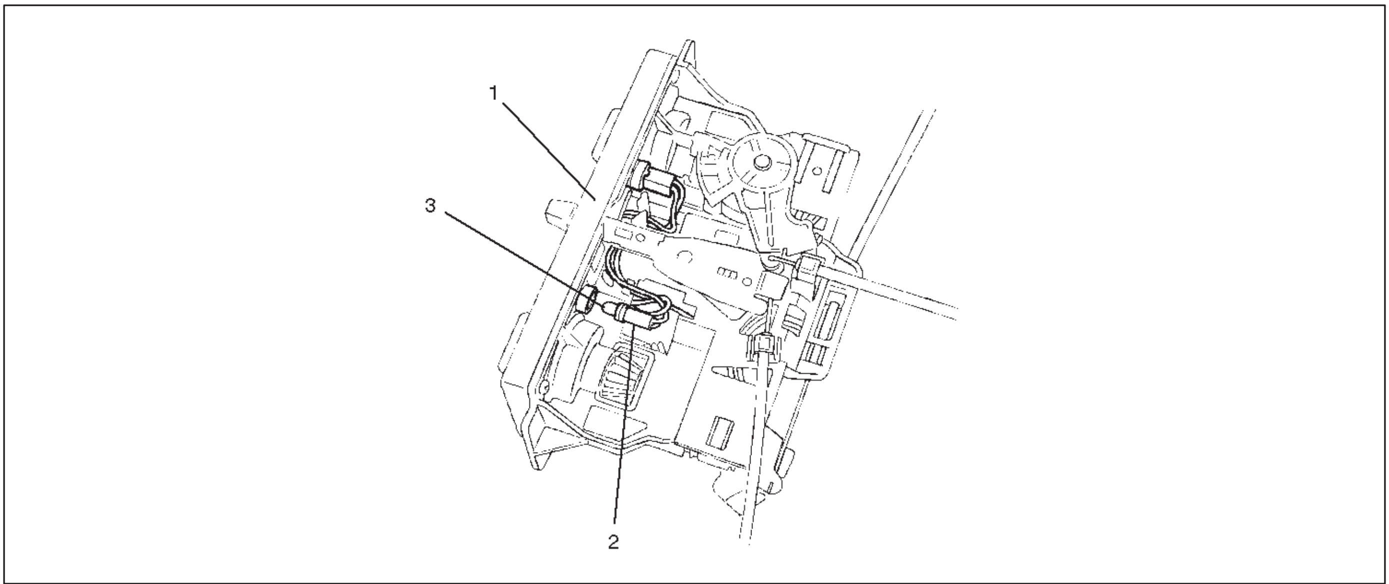
865RY00013

- Air source control cable.
  1. Slide the control lever to the left (“CIRC” position).
  2. Connect the control cable at the “CIRC” position of the link unit of the blower assembly and secure it with the clip.
- Temperature control cable.
  1. Turn the control knob to the left (“MAX COLD” position).
  2. Connect the control cable at the “COLD” position of the temperature control link of the heater unit and secure it with the clip.
- Air select control cable
  1. Turn the control knob to the right (“DEFROST” position).
  2. Connect the control cable at the “DEFROST” position of the mode control link of the heater unit and secure it with the clip.

2. Check the control cable operation.

Control Panel Illumination Bulb

Control Panel Illumination Bulb and Associated Parts



Legend

(1) Control Lever Assembly
(2) Bulb Socket
(3) Illumination Bulb

Removal

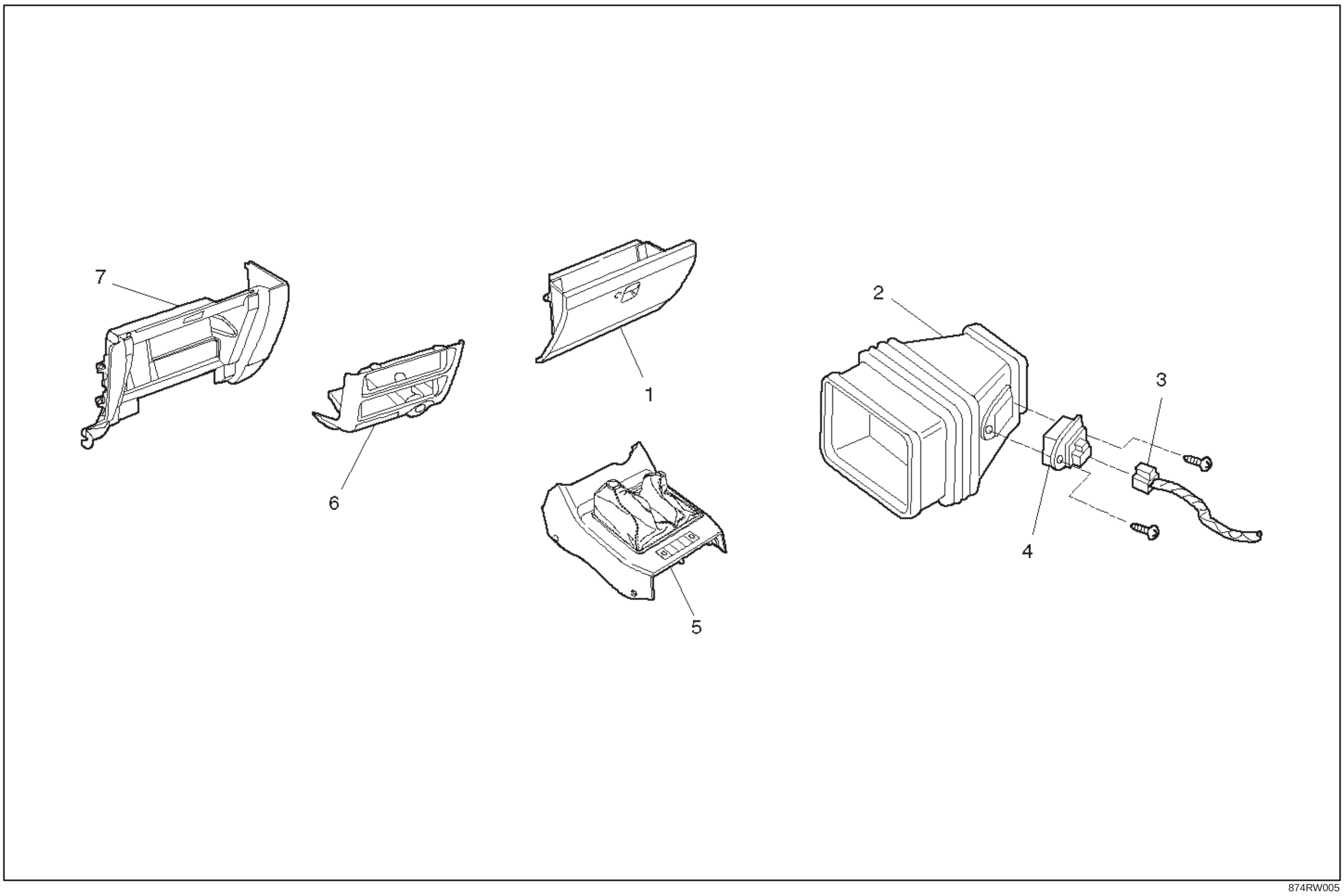
1. Disconnect the battery ground cable.
2. Remove control lever assembly.
   - Refer to Control Lever Assembly in this section.
3. Pull out the bulb socket from the panel by turning it counterclockwise.
4. Pull the illumination bulb from the socket.

Installation

To install, follow the removal steps in the reverse order.

Resistor

Resistor and Associated Parts



Legend

(1) Glove Box
(2) Duct (Heater only)
(3) Resistor Connector
(4) Resistor
(5) Front Console
(6) Lower Cluster
(7) Instrument Panel Passenger Lower Cover Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove front console.
3. Remove lower cluster.
4. Remove glove box.
5. Remove instrument panel passenger lower cover assembly.
   - Refer to Instrument Panel Assembly in Body and Accessories section.
6. Remove resistor connector.
7. Remove duct (heater only).
8. Remove resistor.

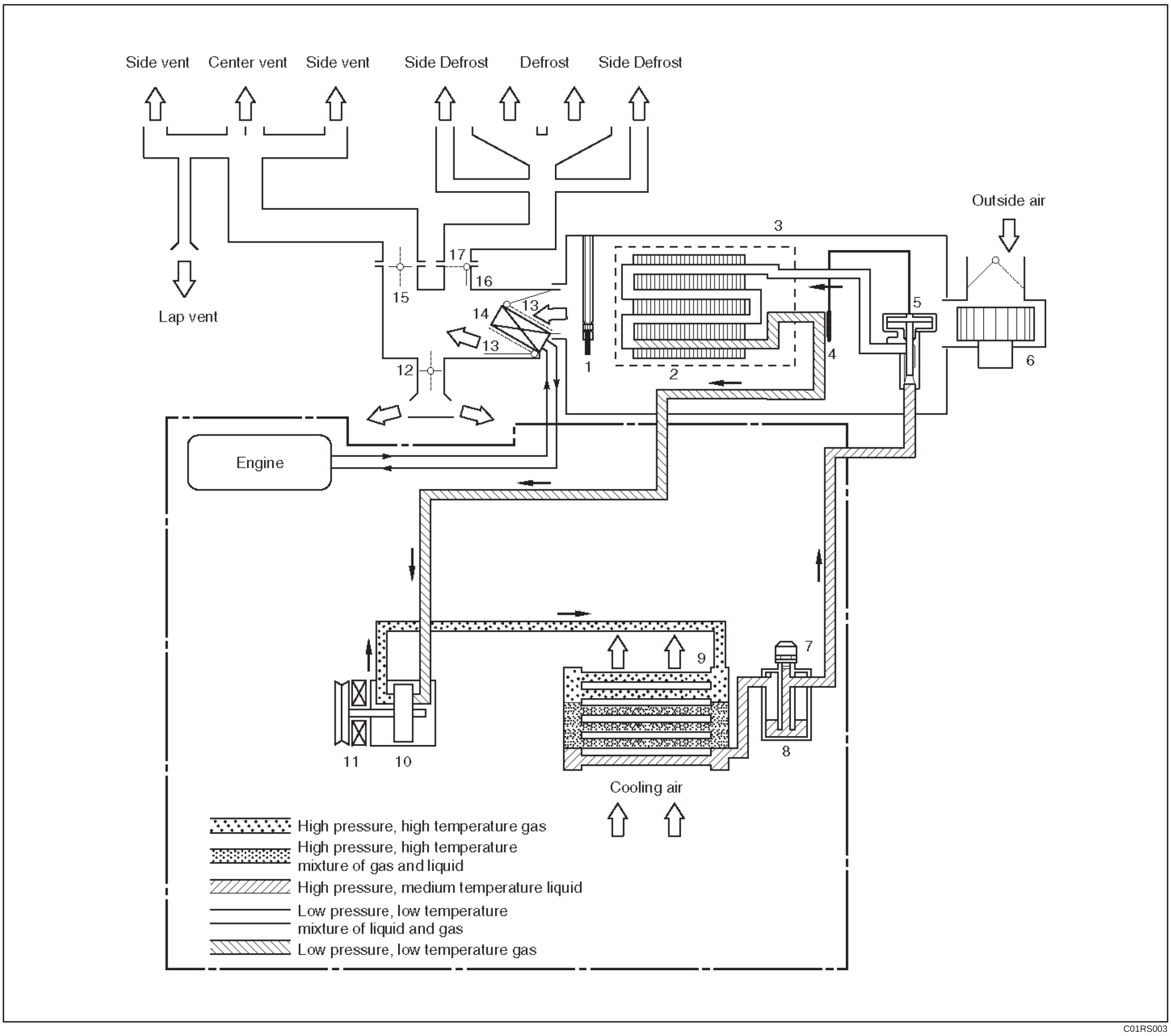
Installation

To install, follow the removal steps in the reverse order.

Air Conditioning System

General Description

Air Conditioning Refrigerant Cycle Construction



Legend
- (1) Electronic Thermostat
- (2) Evaporator Core
- (3) Evaporator Assembly
- (4) Temperature Sensor
- (5) Expansion Valve
- (6) Blower Motor
- (7) Dual Pressure Switch
- (8) Receiver/Drier
- (9) Condenser
- (10) Compressor
- (11) Magnetic Clutch
- (12) Mode (HEAT) Control Door
- (13) Temp. Control Door (Air Mix Door)
- (14) Heater Core
- (15) Mode (VENT) Control Door
- (16) Heater Unit
- (17) Mode (DEF) Control Door

The refrigeration cycle includes the following four processes as the refrigerant changes repeatedly from liquid to gas and back to liquid while circulating.

Evaporation

The refrigerant is changed from a liquid to a gas inside the evaporator. The refrigerant mist that enters the

evaporator vaporizes readily. The liquid refrigerant removes the required quantity of heat (latent heat of vaporization) from the air around the evaporator core cooling fins and rapidly vaporizes. Removing the heat cools the air, which is then radiated from the fins and lowers the temperature of the air inside the vehicle.
The refrigerant liquid sent from the expansion valve and the vaporized refrigerant gas are both present inside the evaporator as the liquid is converted to gas.
With this change from liquid to gas, the pressure inside the evaporator must be kept low enough for vaporization to occur at a lower temperature. Because of that, the vaporized refrigerant is sucked into the compressor.

Compression

The refrigerant is compressed by the compressor until it is easily liquefied at normal temperature.
The vaporized refrigerant in the evaporator is sucked into the compressor. This action maintains the refrigerant inside the evaporator at a low pressure so that it can easily vaporize, even at low temperatures close to 0°C(32°F).
Also, the refrigerant sucked into the compressor is compressed inside the cylinder to increase the pressure and temperature to values such that the refrigerant can easily liquefy at normal ambient temperatures.

Condensation

The refrigerant inside the condenser is cooled by the outside air and changes from gas to liquid.
The high temperature, high pressure gas coming from the compressor is cooled and liquefied by the condenser with outside air and accumulated in the receiver/drier. The heat radiated to the outside air by the high temperature, high pressure gas in the compressor is called heat of condensation. This is the total quantity of heat (heat of vaporization) the refrigerant removes from the vehicle interior via the evaporator and the work (calculated as the quantity of heat) performed for compression.

Expansion

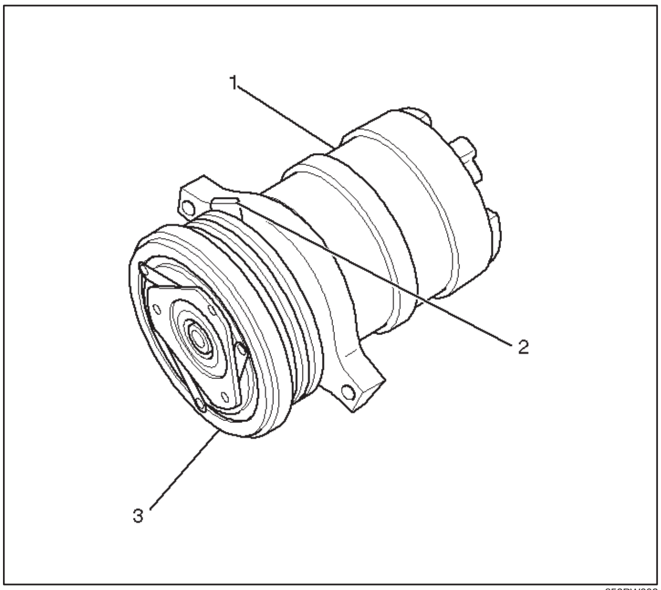
The expansion valve lowers the pressure of the refrigerant liquid so that it can easily vaporize.
The process of lowering the pressure to encourage vaporization before the liquefied refrigerant is sent to the evaporator is called expansion. In addition, the expansion valve controls the flow rate of the refrigerant liquid while decreasing the pressure.
That is, the quantity of refrigerant liquid vaporized inside the evaporator is determined by the quantity of heat which must be removed at a prescribed vaporization temperature. It is important that the quantity of refrigerant be controlled to exactly the right value.

Compressor

The compressor performs two main functions:
It compresses low-pressure and low-temperature refrigerant vapor from the evaporator into high-pressure and high-temperature refrigerant vapor to the condenser.
It pumps refrigerant and refrigerant oil through the air conditioning system.
This vehicle is equipped with six-cylinder axle plate compressor (1).
The specified amount of the compressor oil is 240cc (8.0 fl. oz.).
The oil used in the HFC-134a system compressor differs from that used in R-12 systems.
Also, compressor oil to be used varies according to the compressor model. Be sure to avoid mixing two or more different types of oil.
If the wrong oil is used, lubrication will be poor and the compressor will seize or malfunction.
The magnetic clutch connector is a waterproof type.

Magnetic Clutch

The compressor is driven by the drive belt from the crank pulley of the engine. If the compressor is activated each time the engine is started, this causes too much load to the engine. The magnetic clutch (3) transmits the power from the engine to the compressor and activates it when the air conditioning is ON. Also, it cuts off the power from the engine to the compressor when the air conditioning is OFF. Refer to Compressor in this section for magnetic clutch repair procedure.



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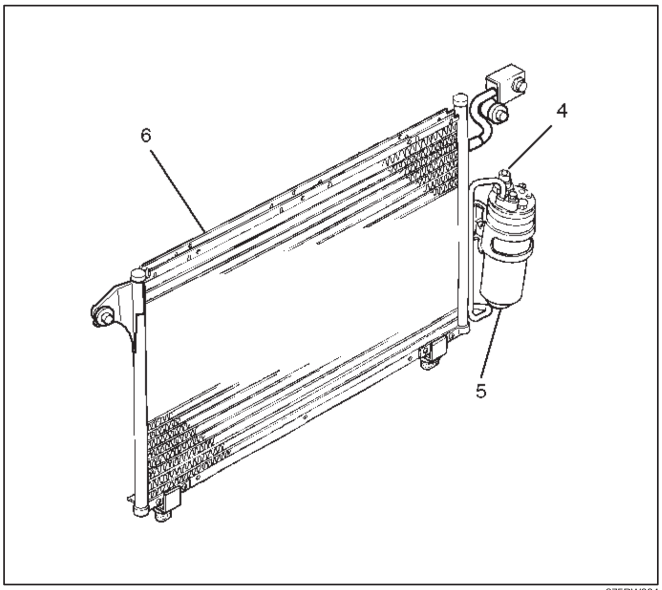
Condenser

Also, it functions to cool and liquefy the high-pressure and high-temperature vapor sent from the compressor by the radiator fan or outside air.
A condenser may malfunction in two ways: it may leak, or it may be restricted. A condenser restriction will result in excessive compressor discharge pressure. If a partial restriction is present, the refrigerant expands after passing through the restriction.
Thus, ice or frost may form immediately after the restriction. If air flow through the condenser or radiator is blocked, high discharge pressures will result. During normal condenser operation, the refrigerant outlet line will be slightly cooler than the inlet line.
The vehicle is equipped with the parallel flow type condenser. A larger thermal transmission area on the inner surface of the tube allows the radiant heat to increase and the ventilation resistance to decrease.

The refrigerant line connection has a bolt at the block joint, for easy servicing.
The condenser assembly (6) is located in front of the radiator. It provides rapid heat transfer from the refrigerant to the cooling fins.



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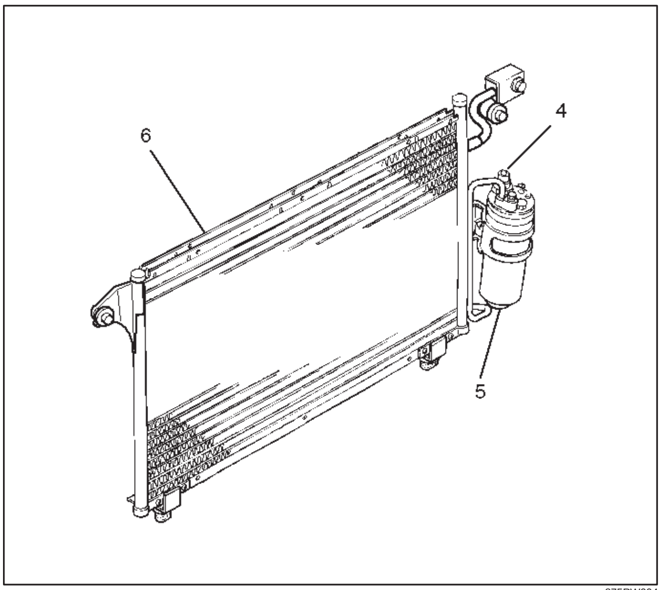
Receiver / Drier

The receiver/drier (5) performs four functions:

- As the quantity of refrigerant circulated varies depending on the refrigeration cycle conditions, sufficient refrigerant is stored for the refrigeration cycle to operate smoothly in accordance with fluctuations in the quantity circulated.
- The liquefied refrigerant from the condenser is mixed with refrigerant gas containing air bubbles. If refrigerant containing air bubbles. Is sent to the expansion valve, the cooling capacity will decrease considerably. Therefore, the liquid and air bubbles are separated and only the liquid is sent to the expansion valve.
- The receiver/drier utilizes a filter and drier to remove the dirt and water mixed in the cycling refrigerant.
- The sight glass, installed on top of the receiver/drier, shows the state of the refrigerant.

A receiver/drier may fail due to a restriction inside the body of the unit. A restriction at the inlet to the receiver/drier will cause high pressure.
Outlet restrictions will be indicated by low pressure and little or no cooling. An excessively cold receiver/drier outlet may indicate a restriction.
The receiver/drier of this vehicle is made of aluminum with a smaller tank. It has a 300cc refrigerant capacity.
The refrigerant line connection has a bolt at the block joint, for easy servicing.



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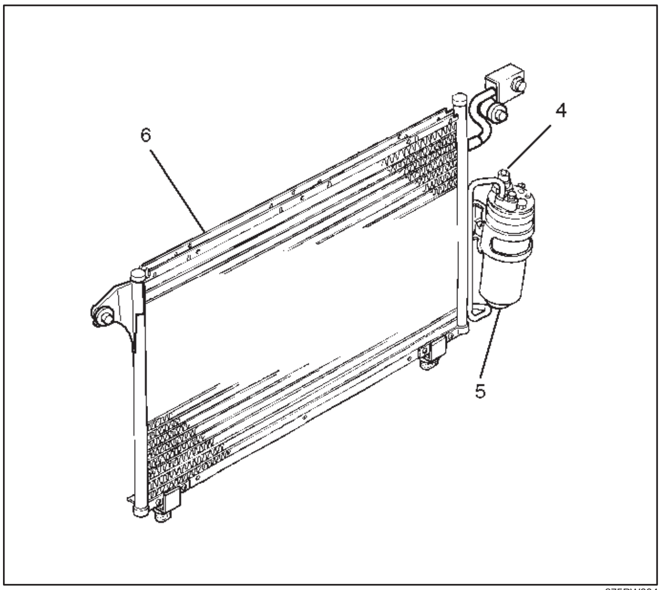
Pressure Switch

The pressure switch (Dual pressure switch) (4) is installed on the upper part of the receiver/drier, to detect excessively high pressure (high pressure switch) and prevent compressor seizure due to the refrigerant leaking (low pressure switch), so that the compressor is able to be turned “ON” or “OFF”.
The pressure characteristics of HFC-134a refrigerant differ from those of R-12. Thus, the pressure switch operation for HFC-134a systems has been changed from R-12.

Compressor	ON (kPa/psi)	OFF (kPa/psi)
Low-pressure control	186.3±29.4 (27.0±4.3)	176.5±19.6 (25.6±2.8)
High-pressure control	2353.6±196.1 (341.3±28.4)	2942.0±196.1 (426.6±28.4)



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Expansion Valve

This expansion valve (1) is an external pressure type and it is installed at the evaporator intake port.

The expansion valve converts the high pressure liquid refrigerant sent from the receiver/drier to a low pressure liquid refrigerant by forcing it through a tiny port before sending it to the evaporator (2).

This type of expansion valve consists of a temperature sensor, diaphragm, ball valve, ball seat, spring adjustment screw, etc.

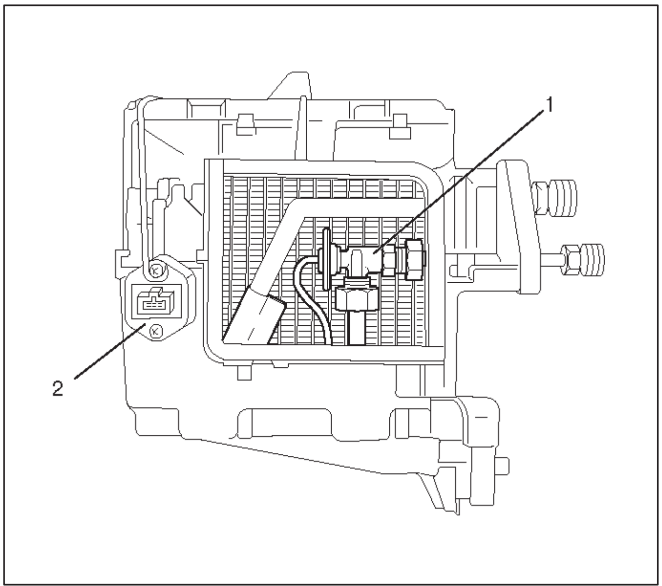
The temperature sensor contacts the evaporator outlet pipe, and converts changes in temperature to pressure. It then transmits these to the top chamber of the diaphragm.

The refrigerant pressure is transmitted to the diaphragm's bottom chamber through the external equalizing pressure tube.

The ball valve is connected to the diaphragm. The opening angle of the expansion valve is determined by the force acting on the diaphragm and the spring pressure.

The expansion valve regulates the flow rate of the refrigerant. Accordingly, when a malfunction occurs to this expansion valve, both discharge and suction pressure get low, resulting in insufficient cooling capacity of the evaporator.

The calibration has been changed to match the characteristics of HFC-134a.



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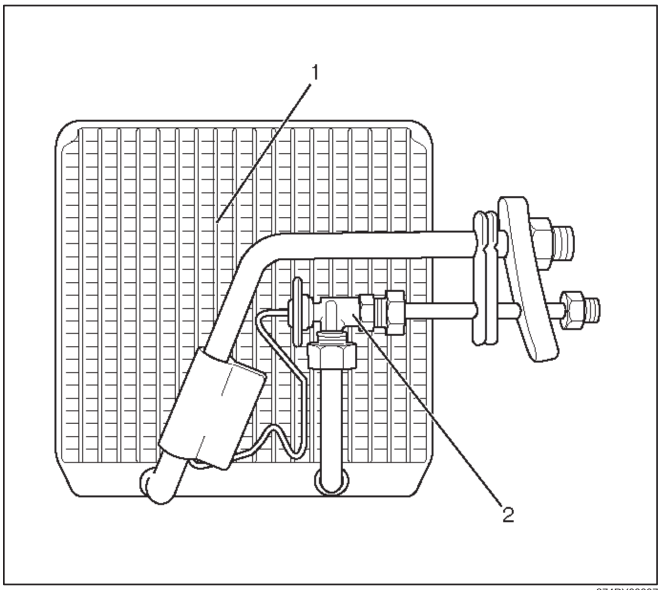
Evaporator

The evaporator cools and dehumidifies the air before the air enters the passenger compartment. High-pressure liquid refrigerant flows through the expansion valve (2) into the low-pressure area of the evaporator. The heat in the air passing through the evaporator core (1) is lost to the cooler surface of the core, thereby cooling the air.

As heat is lost between the air and the evaporator core surface, moisture in the vehicle condenses on the outside surface of the evaporator core and is drained off as water.

When the evaporator malfunctions, the trouble will show up as an inadequate supply of cool air. The cause is typically a partially plugged core due to dirt, or a malfunctioning blower motor.

The evaporator core with a laminate louver fin is a single-sided tank type where only one tank is provided under the core.



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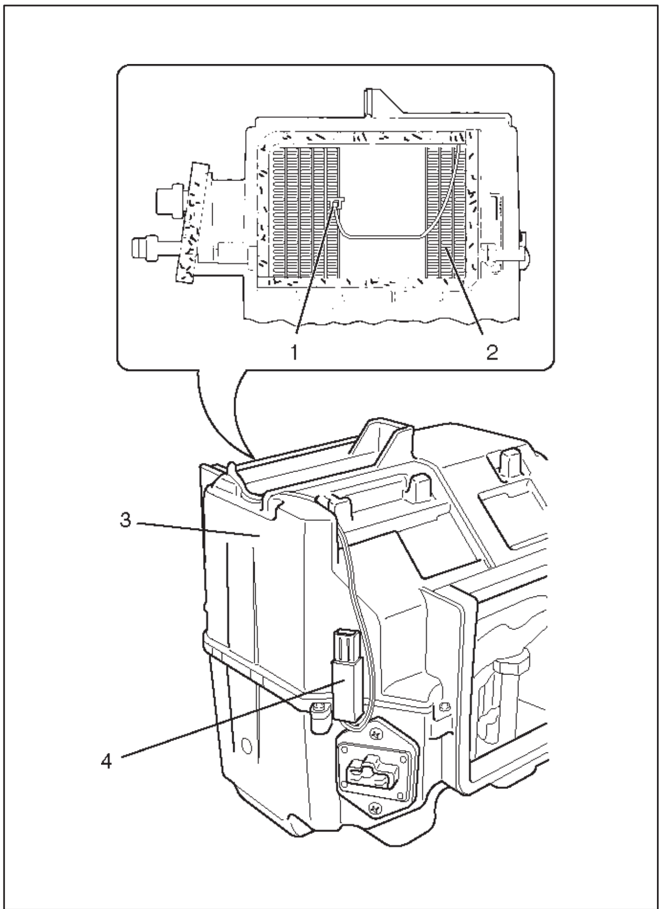
Electronic Thermostat

The thermostat consists of the thermo sensor (1) and thermostat unit (4) which functions electrically to reduce the noises being generated while the system is in operation.

The electronic thermo sensor (1) is mounted at the evaporator core (2) outlet and senses the temperature of the cool air from the evaporator (3). Temperature signals are input to the thermostat unit. This information is compared by the thermo unit and results in the output to operate the A/C thermostat relay and turn the magnetic clutch ON or OFF to prevent evaporator freeze-up.

A characteristic of the sensor is that the resistance decreases as the temperature increases and the resistance increases as the temperature decreases.



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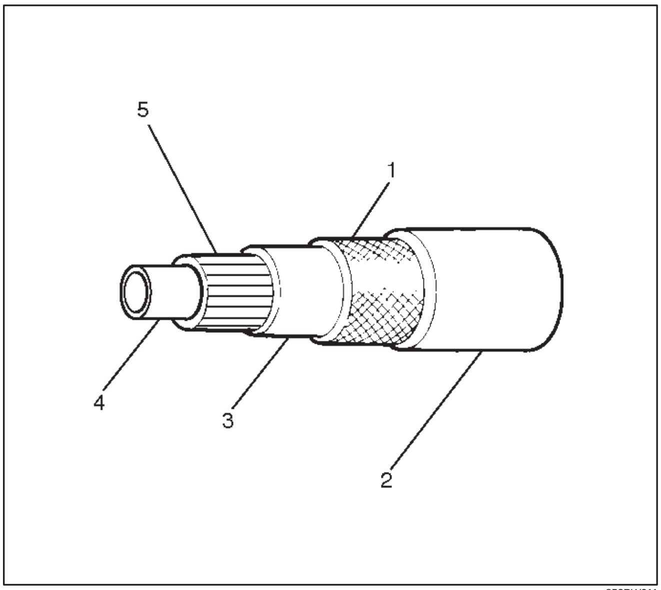
Refrigerant Line

Restriction in the refrigerant line will be indicated by:

1. Suction line — A restricted suction line will cause low suction pressure at the compressor, low discharge pressure and little or no cooling.
2. Discharge line — A restriction in the discharge line generally will cause the discharge line to leak.
3. Liquid line — A liquid line restriction will be evidenced by low discharge and suction pressure and insufficient cooling.

Refrigerant flexible hoses that have a low permeability to refrigerant and moisture are used. These low permeability hoses have a special nylon layer on the inside.



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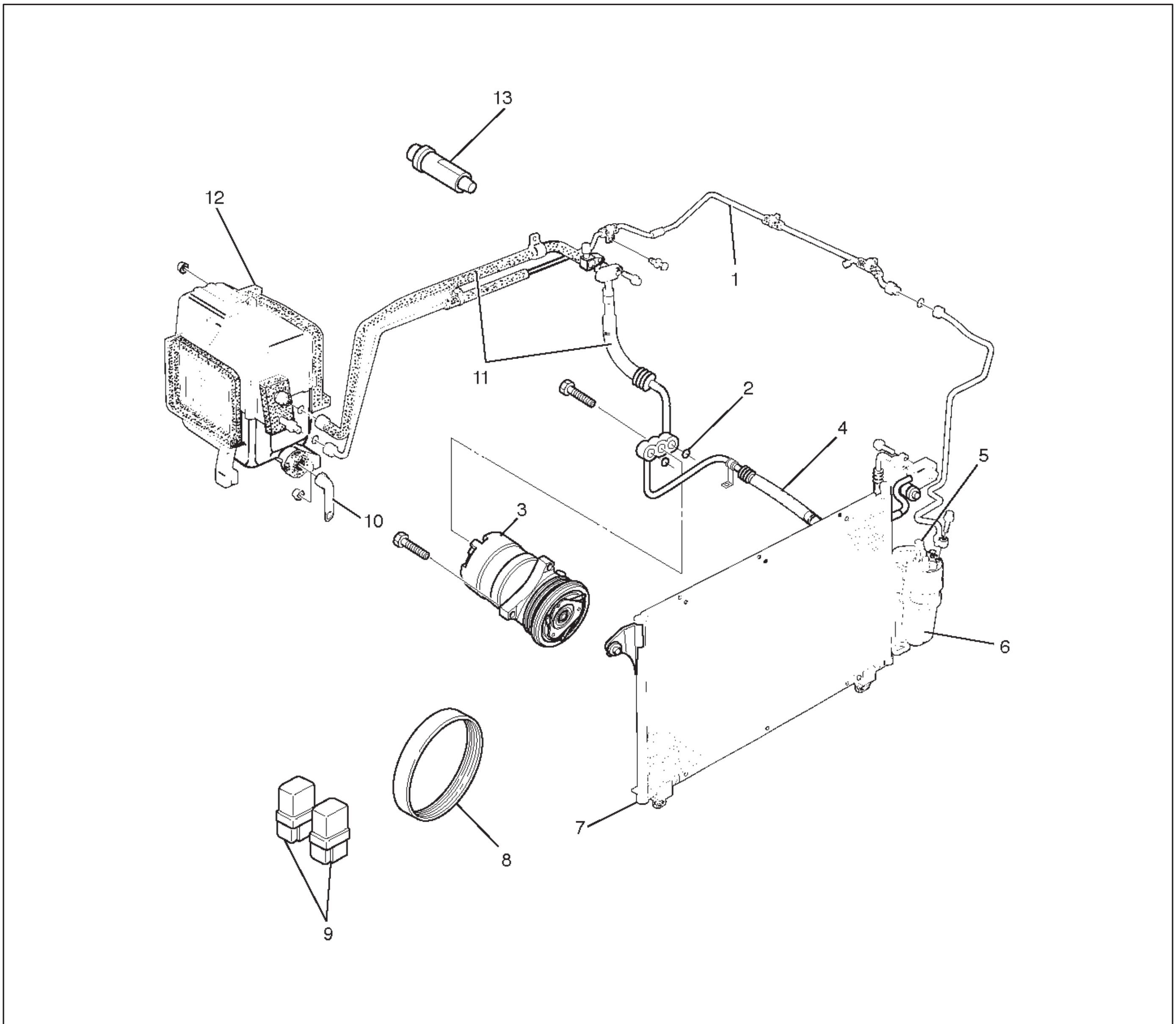
Legend

(1) Pressure Resistance Layer (Polyester Braid)
(2) Moisture Resistance AND Outer Protector Layer
(3) Heat Resistance Layer
(4) Heat Resistance Core Layer (Neoprene)
(5) Low Permeation Layer (Nylon Barner)

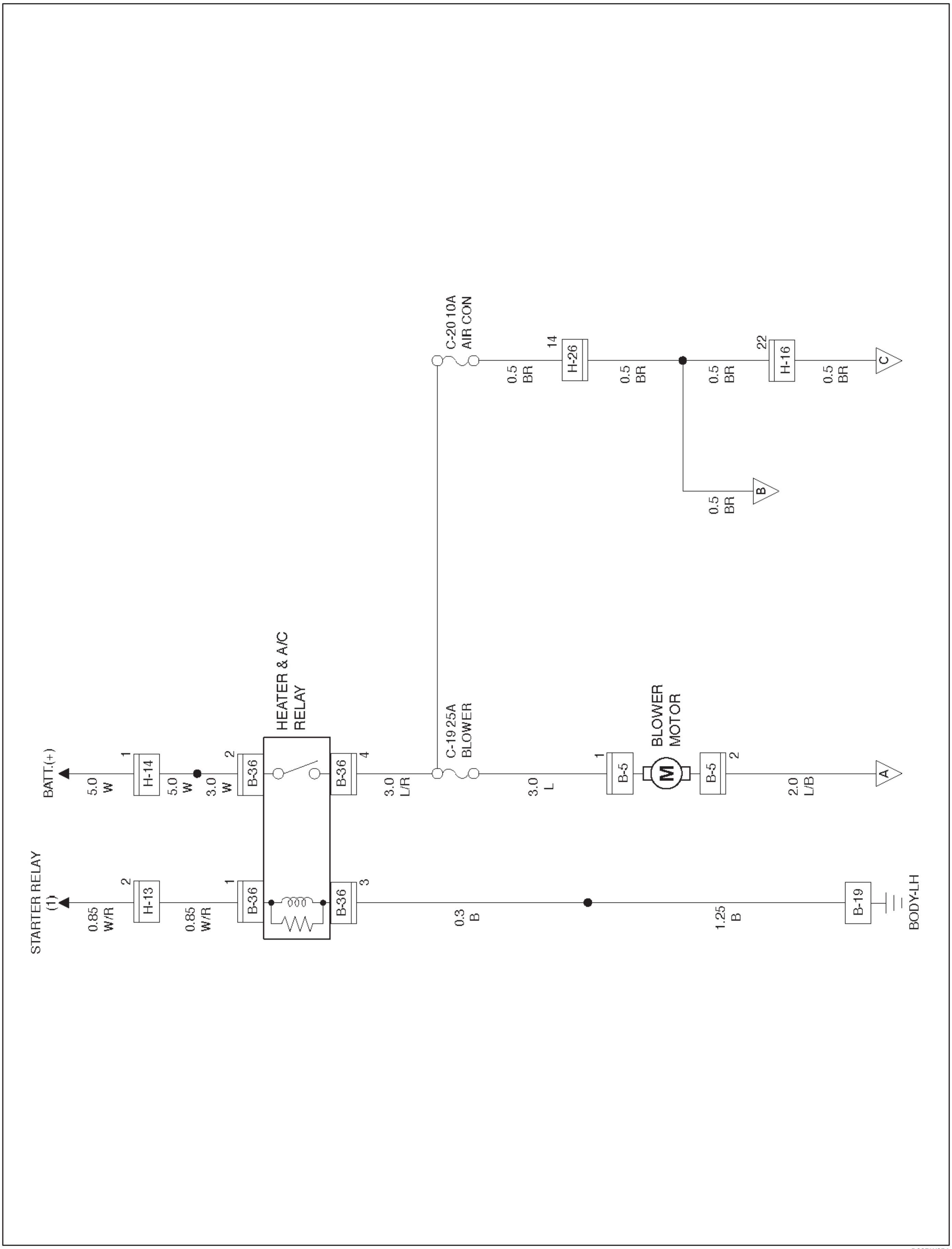
Air Conditioning Parts



Legend

(1) Liquid Line (High-Pressure Pipe)
(2) O-ring
(3) Compressor
(4) Discharge Line (High-Pressure Hose)
(5) Pressure Switch
(6) Receiver Drier
(7) Condenser Assembly
(8) Drive Belt
(9) Relay
(10) Drain Hose
(11) Suction Line (Low-Pressure Hose)
(12) Evaporator Assembly
(13) A/C Switch

Wiring Diagram



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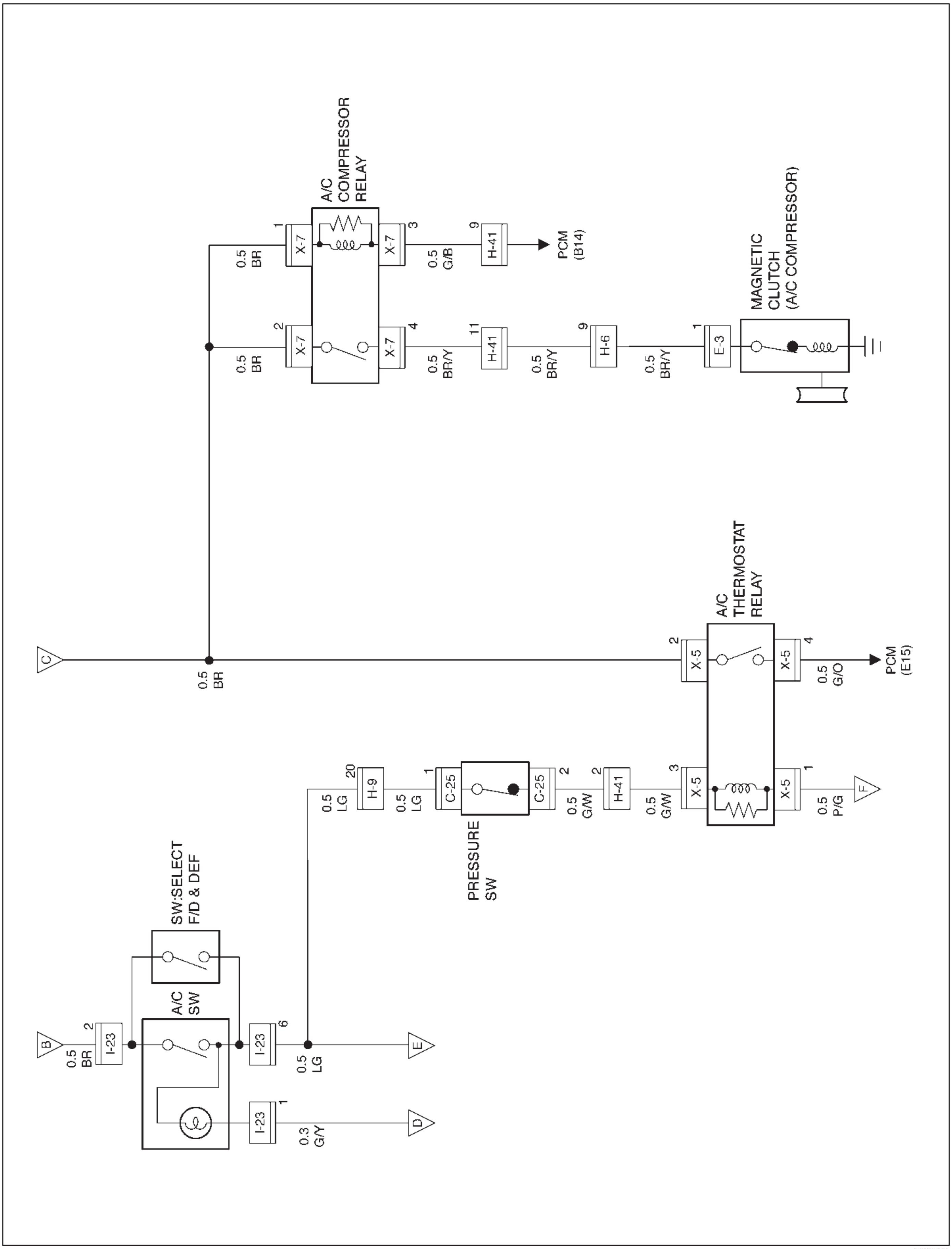
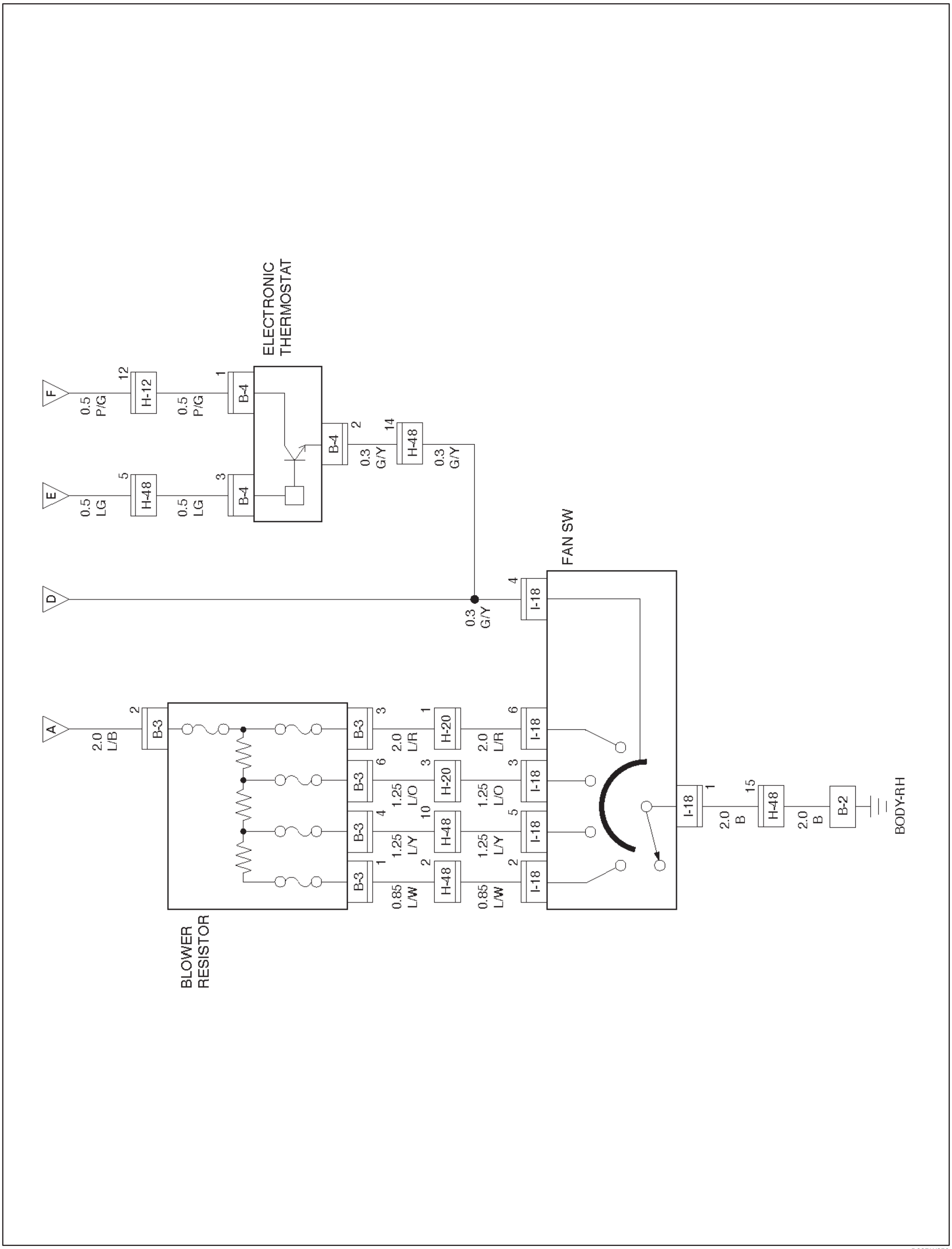

A/C COMPRESSOR RELAY
PCM (B14)
MAGNETIC CLUTCH (A/C COMPRESSOR)
A/C THERMOSTAT RELAY
PCM (E15)
PRESSURE SW
SW:SELECT F/D & DEF
A/C SW
X-7
H-41
H-6
E-3
X-5
H-9
C-25
I-23
0.5 BR
0.5 G/B
0.5 BR/Y
0.5 G/O
0.5 LG
0.5 G/W
0.5 P/G
0.3 G/Y
B
C
D
E
F

D08RX003


ELECTRONIC THERMOSTAT
FAN SW
BLOWER RESISTOR
BODY-RH
A
D
E
F
0.5 P/G
0.5 LG
0.3 G/Y
2.0 L/B
2.0 L/R
1.25 L/O
1.25 L/Y
0.85 L/W
2.0 B
H-12
H-48
H-20
B-4
B-3
B-2
I-18

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Diagnosis

Air Conditioning Cycle Diagnosis

Condition	Possible cause	Correction
No cooling or insufficient cooling.	Magnetic clutch does not run.	Refer to "Magnetic Clutch Diagnosis" in this section.
	Compressor is not rotating properly. Drive belt is loose or broken.	Adjust the drive belt to the specified tension or replace the drive belt.
	Compressor is not rotating properly. Magnetic clutch face is not clean and slips.	Clean the magnetic clutch face or replace.
	Compressor is not rotating properly. Incorrect clearance between magnetic drive plate and pulley.	Adjust the clearance. Refer to Compressor in this section.
	Compressor is not rotating properly. Compressor oil leaks from the shaft seal or shell.	Replace the compressor
	Compressor is not rotating properly. Compressor is seized.	Replace the compressor
	Insufficient or excessive charge of refrigerant.	Discharge and recover the refrigerant. Recharge to the specified amount.
	Leaks in the refrigerant system.	Check the refrigerant system for leaks and repair as necessary. Discharge and recover the refrigerant. Recharge to the specified amount.
	Condenser is clogged or insufficient radiation.	Clean the condenser or replace as necessary.
	Temperature control link unit of the heat unit is defective.	Repair the link unit.
	Unsteady operation due to a foreign substance in the expansion valve.	Replace the expansion valve.
	Poor operation of the electronic thermostat.	Check the electronic thermostat and replace as necessary.
Insufficient velocity of cooling air.	Evaporator clogged or frosted.	Check the evaporator core and replace or clean the core.
	Air leaking from the cooling unit or air duct.	Check the evaporator and duct connection, then repair as necessary.
	Blower motor does not rotate properly.	Refer to Fan Control Knob (Fan Switch) Diagnosis in this section.

*For the execution of the charging and discharging operation in the table above, refer to Recovery, Recycling, Evacuating and Charging in this section.

Checking The Refrigerant System With Manifold Gauge

Since Refrigerant-134a (HFC-134a) is used in the air conditioning system in this vehicle, be sure to use manifold gauges, charging hoses and other air conditioning service tools for HFC-134a when checking the refrigerant system.

Conditions:

- Run the engine at idling
- Air conditioning switch is “ON”
- Run the blower motor at “HIGH” position
- Temperature control lever set to “MAX COLD”
- Air source selector lever at “CIRC”
- Open the engine hood
- Close all the doors

Normal Pressure:

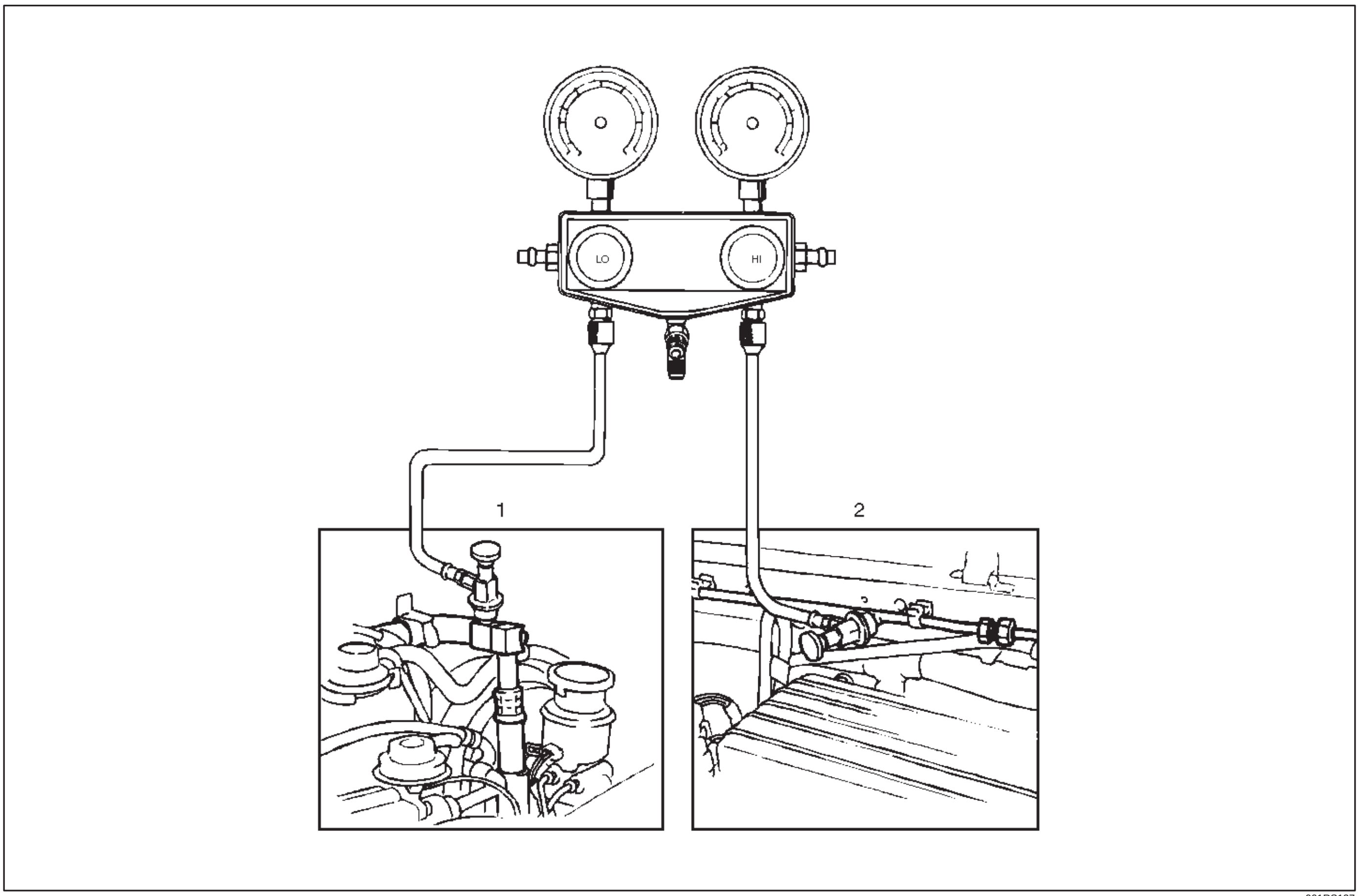
- At ambient temperature: approx. 25–30˚C (77–86˚F).
- At low-pressure side: approx. 147.1–294.2 kPa (21.3–42.7 psi).
- At high-pressure side: approx. 1372.9–1863.3 kPa (199.1–270.2 psi).

Refer to the table on the refrigerant pressure-temperature relationship in this section.

HFC-134a Pressure-Temperature Relationship			
Pressure		Temperature	
(kPa)	(psi)	(˚C)	(˚F)
36	5.3	–20	–4.4
67	9.7	–15	5
104	15	–10	14
147	21	–5	23
196	28	0	32
255	37	5	41
314	45	10	50
392	57	15	59
471	68	20	68
569	82	25	77
677	98	30	86
785	114	35	95
912	132	40	104
1059	154	45	113
1216	176	50	122

Connect The Manifold Gauge

Low-pressure hose (LOW) — Suction side
High pressure hose (HI) — Discharge side



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Legend

(1) Low Side
(2) High Side

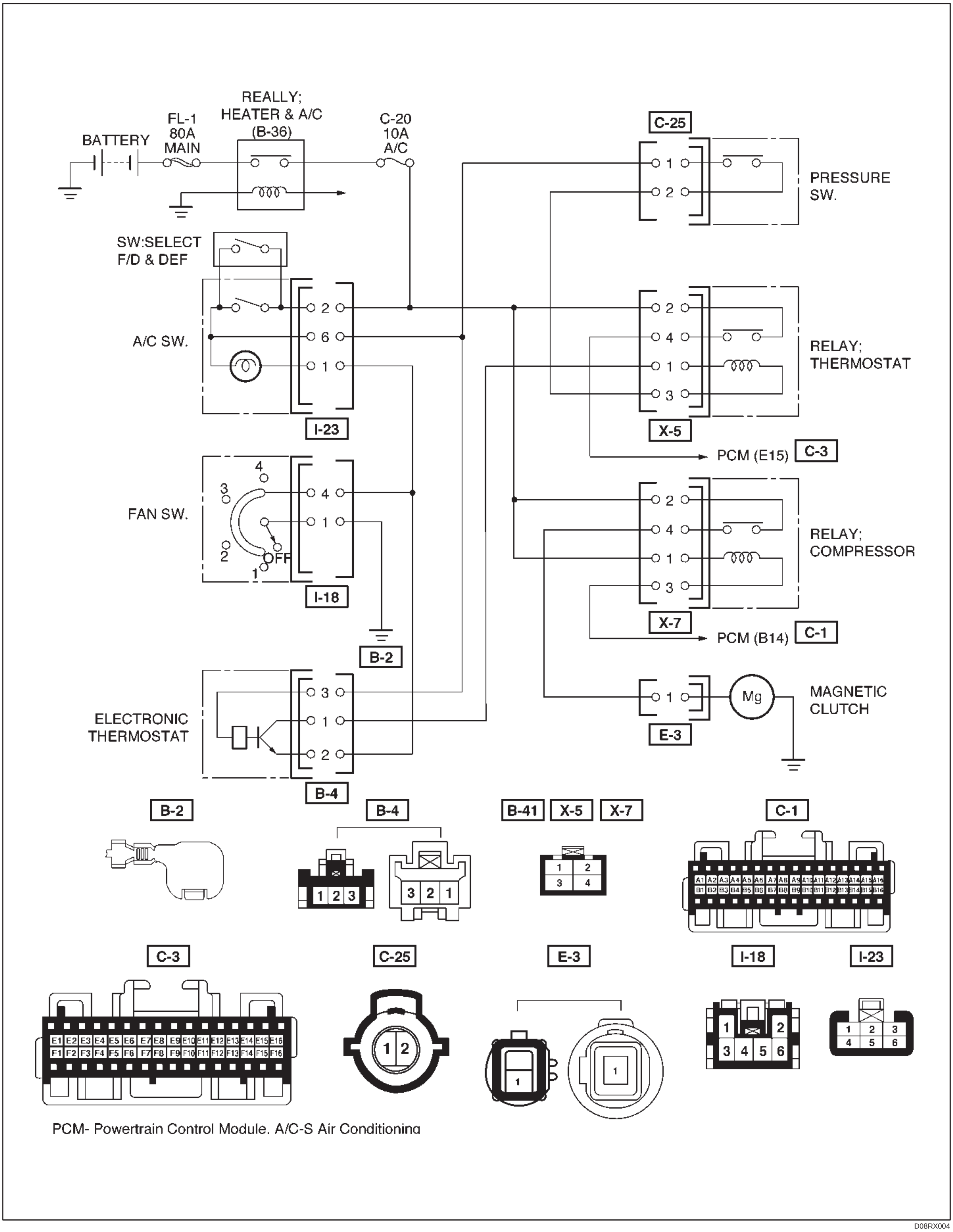
Condition	Possible cause	Correction
Discharge (High Gauge) Pressure Abnormally High	Condenser clogged or dirty.	Clean the condenser fins
	Cooling fan does not operate properly.	Check the cooling fan operation.
Discharge (High Gauge) Pressure Abnormally High. Insufficient cooling.	Excessive refrigerant in system.	Discharge and recover refrigerant. Recharge to specified amount.
Discharge (High Gauge) Pressure Abnormally High. High pressure gauge drop. (After stopping A/C, the pressure drops approx. 196 kPa (28 psi) quickly)	Air in system.	Evacuate and charge refrigerant system.
Discharge (High Gauge) Pressure Abnormally Low. Insufficient cooling	Insufficient refrigerant in system.	Check for leaks. Discharge and recover the refrigerant. Recharge to the specified amount.
Discharge (High Gauge) Pressure Abnormally Low. Low pressure gauge indicates vacuum.	Clogged or defective expansion valve.	Replace the expansion valve.

Condition	Possible cause	Correction
Discharge (High Gauge) Pressure Abnormally Low. Frost or dew on refrigerant line before and after the receiver/drier or expansion valve, and low pressure gauge indicates vacuum.	Restriction caused by debris or moisture in the receiver/drier.	Check system for restriction and replace the receiver/drier.
Discharge (High Gauge) Pressure Abnormally Low. High and low pressure gauge balanced quickly. (After turned off A/C)	Compressor seal defective	Repair or replace the compressor.
	Poor compression due to a defective compressor gasket.	Repair or replace the compressor.
Suction (Low Gauge) Pressure Abnormally High. Low pressure gauge (Low pressure gauge is lowered after condenser is cooled by water.)	Excessive refrigerant in system.	Discharge and recover refrigerant Recharge to specified amount.
Suction (Low Gauge) Pressure Abnormally High. Low pressure hose temperature. (Low pressure hose temperature around the compressor refrigerant line connector is lower than around evaporator.)	Unsatisfactory valve operation due to defective temperature sensor of expansion valve.	Replace the expansion valve.
	Expansion valve opens too long.	Replace the expansion valve.
Suction (Low Gauge) Pressure Abnormally High. High and low pressure gauge balanced quickly. (After turned off A/C)	Compressor gasket is defective.	Repair or replace the compressor.
Suction (Low Gauge) Pressure Abnormally Low. Insufficient cooling.	Insufficient refrigerant in system.	Check for leaks. Discharge and recover the refrigerant. Recharge to specified amount.
Suction (Low Gauge) Pressure Abnormally Low. Frost on the expansion valve inlet line	Expansion valve clogged.	Replace the expansion valve.
Suction (Low Gauge) Pressure Abnormally Low Receiver/drier inlet and outlet refrigerant line temperature. (A distinct difference in temperature develops.)	Receiver/Drier clogged.	Replace the receiver/drier.
Suction (Low Gauge) Pressure Abnormally Low. Expansion valve outlet refrigerant line. (Not cold and low pressure gauge indicates vacuum.)	Expansion valve temperature sensor is defective.	Replace the expansion valve.
Suction (Low Gauge) Pressure Abnormally Low. When the refrigerant line is clogged or blocked, the low pressure gauge reading will decrease, or a vacuum reading may be shown.	Clogged or blocked refrigerant line.	Replace refrigerant line.
Suction (Low Gauge) Pressure Abnormally Low. Evaporator core is frozen.	Thermo switch defective.	Replace thermo switch.

Condition	Possible cause	Correction
Suction (Low Gauge) and Discharge (High Gauge) Pressure Abnormally High. Insufficient cooling.	Excessive refrigerant in system.	Discharge and recover the refrigerant, the Recharge to the specified amount.
	Condenser clogged or dirty.	Clean the condenser fins.
Suction (Low Gauge) and Discharge (High Gauge) Pressure Abnormally High. Suction (Low) pressure hose (Not cold).	Air in system.	Evacuate and charge refrigerant.
Suction (Low Gauge) and Discharge (High Gauge) Pressure Abnormally Low. Insufficient cooling	Insufficient refrigerant in system.	Check for leaks. Discharge and recover refrigerant. Recharge to specified amount.

A/C — Air Conditioning

Magnetic Clutch Diagnosis



When the air conditioning switch and the fan control knob (fan switch) are turned on with the engine running, current flows through the thermostat and the compressor relay to activate the magnetic clutch.

The air conditioning can be stopped by turning off the air conditioning switch or the fan control knob (fan switch). However, even when the air conditioning is in operation, the electronic thermostat, the pressure switch or the Powertrain Control Module (PCM) is used to stop the air conditioning temporarily by turning off the magnetic clutch in the prearranged conditions to reduce the engine load which is being caused by the rise in the engine coolant temperature, and the acceleration of the vehicle, etc.

For the inspection of the relays, switches and units in the table, refer to “Individual Inspection” in this section.

Magnetic Clutch Does Not Run

Step	Action	Yes	No
1	Are No. C-20 (10A) fuse and No. C-19 (25A) fuse OK?	Go to Step 2	Replace
2	Are heater and A/C (B-36), thermostat (X-5), and compressor (X-7) relays OK?	Go to Step 3	Replace
3	Is pressure switch (dual pressure switch) OK?	Go to Step 4	Switch defective or insufficient refrigerant.
4	Are air conditioning switch and fan control knob (Fan Switch) OK?	Go to Step 5	Replace
5	1. Turn the ignition switch “ON” (Engine is running). 2. Air conditioning switch and fan control knob (Fan Switch) “ON”. 3. Check to see if battery voltage is present at chassis side connector terminal No. E3-1. Is there a battery voltage?	Go to Step 6	Go to Step 7
6	Check to see if continuity between compressor side connector terminal No. E3-1 and the magnetic clutch side connector terminal. Is there a continuity?	Magnetic clutch defective.	Compressor defective.
7	Check to see if battery voltage is present at chassis side connector terminal No. C25-1 Is there a battery voltage?	Go to Step 8	Open circuit between No.C-20 (10A) fuse and No. C25-1.
8	1. Disconnect thermostat relay (X-5). 2. Check to see if battery voltage is present at the chassis side relay terminal NO. X5-2 Is there a battery voltage?	Go to Step 9	Open circuit between No. C25-2 and No.X5-2.
9	Check to see if voltage (approx. 10V) is present between chassis side relay terminal No. X5-1 and No. X5-3. Is there a battery voltage?	Go to Step 10	Go to Step 16
10	1. Reconnect thermostat relay and disconnect compressor relay (X-7). 2. Check to see if battery voltage is present at the chassis side relay terminal No. X7-2. Is there a battery voltage?	Go to Step 11	Open circuit between No. X5-4 and No. X7-2.
11	Check to see if continuity between chassis side relay terminal No. X7-4 and the chassis side connector terminal No. E3-1. Is there a continuity?	Go to Step 12	Open circuit.
12	Check to see if battery voltage is present between chassis side relay terminal No. X7-1 and No. X7-3. Is there a battery voltage?	Go to Step 13	Go to Step 14
13	Check to see if battery voltage is present at chassis side relay terminal No. X7-1. Is there a battery voltage?	Go to Step 15	Open circuit between No. C-20 (10A) fuse and No. X7-1.

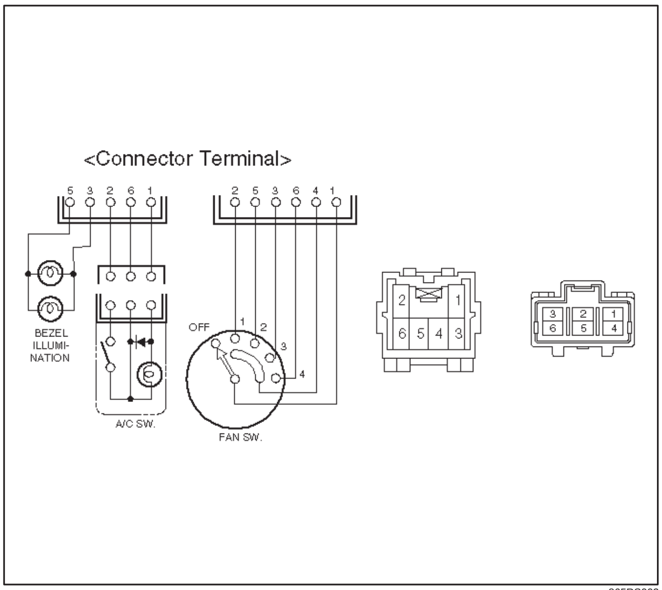
Magnetic Clutch Does Not Run (Cont'd)

Step	Action	Yes	No
14	Check to see if battery voltage is present at chassis side connector terminal No. C1-B14. Is there a battery voltage?	Power train control module (PCM) defective. Refer to Driveability and Emissions in Engine section.	Open circuit between No. X7-3 and No. C1-B14.
15	Check to see if continuity between chassis side relay terminal No. X-54 and chassis side connector terminal No. C3-E15. Is there a continuity?	Power train control module (PCM) defective. Refer to Driveability and Emissions in Engine section.	Open circuit
16	Check to see if battery voltage is present at chassis side relay terminal No. X5-1. Is there a battery voltage?	Go to Step 17	Go to Step 20
17	1. Reconnect thermostat relay. 2. Check to see if battery voltage is present at chassis side connector terminal No. B4-3. Is there a battery voltage?	Go to Step 18	Open circuit between No.I23-6 and No.B4-3.
18	Check to see if battery voltage (appox 10V) is present at chassis side connector terminal No. B4-1. Is there a battery voltage?	Go to Step 19	Open circuit between No. X5-3 and No. B4-1.
19	Check to see if continuity between chassis side connector terminal No. B4-2 and No. I18-4. Is there a continuity?	Electronic thermostat defective.	Open circuit between No. B4-2 and No. I18-4 or poor ground (Fan Switch Ground Circuit).
20	Check to see if battery voltage is present at chassis side connector terminal No. I23-2. Is there a battery voltage?	Open circuit between X5-1 and No.I23-6.	Open circuit between No. C-20 (10A) fuse and No.I23-2.

Individual Inspection

Fan Control Knob (Fan Switch) And Air Conditioning (A/C) Switch

1. Check for continuity between the fan switch and the A/C switch side connector terminals.



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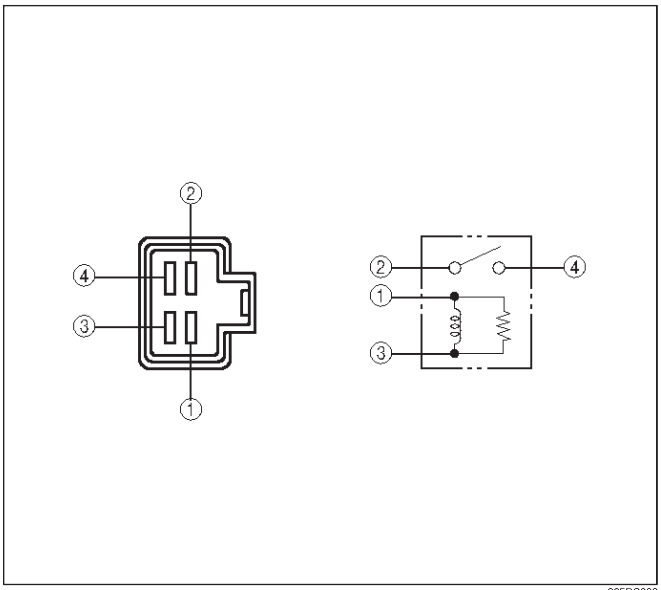
Fan swtich position	Fan switch connector terminals with continuity
OFF	No continuity
1	1 – 2 – 4
2	1 – 4 – 5
3	1 – 3 – 4
4	1 – 4 – 6

A/C switch position	A/C switch connector terminals with continuity
OFF	1 – 6
ON	1 – 2 – 6

Heater And A/C (B-36), Thermostat (X-5) And Compressor (X-7) Relay

1. Disconnect relays and check for continuity and resistance between relay terminals.
   - For handling of these relays, refer to Heater &A/C Relay in this section.

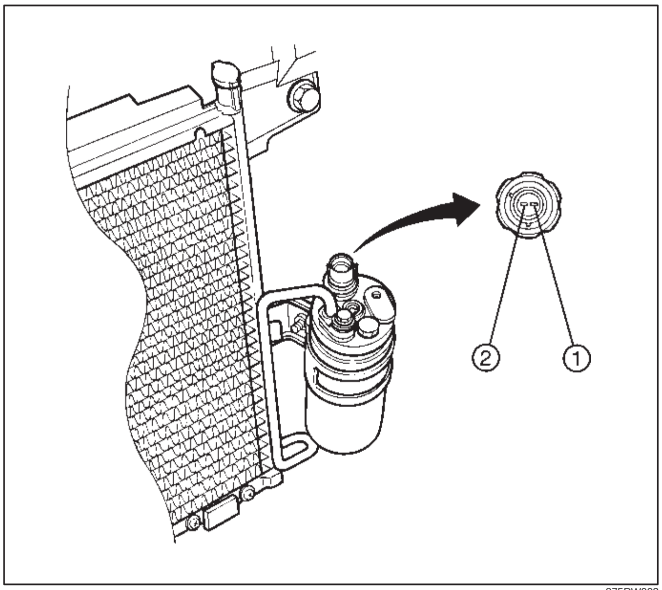


825RS003

Condition	Relay terminals with continuity
Normal	1 – 3 (Approx 85–105Ω)
When battery voltage is applied between 1 – 3	2 – 4

Pressure Switch

1. Disconnect pressure switch connector and check for continuity between pressure switch side connector terminals (1) and (2).



875RW003

General Repair Procedure

Precautions For Replacement or Repair of Air Conditioning Parts

There are certain procedures, practices and precautions that should be followed when servicing air conditioning systems:

- Keep your work area clean.
- Always wear safety goggles and protective gloves when working on refrigerant systems.
- Beware of the danger of carbon monoxide fumes caused by running the engine.
- Beware of discharged refrigerant in enclosed or improperly ventilated garages.
- Always disconnect the negative battery cable and discharge and recover the refrigerant whenever repairing the air conditioning system.
- When discharging and recovering the refrigerant, do not allow refrigerant to discharge too fast; it will draw compressor oil out of the system.
- Keep moisture and contaminants out of the system. When disconnecting or removing any lines or parts, use plugs or caps to close the fittings immediately.

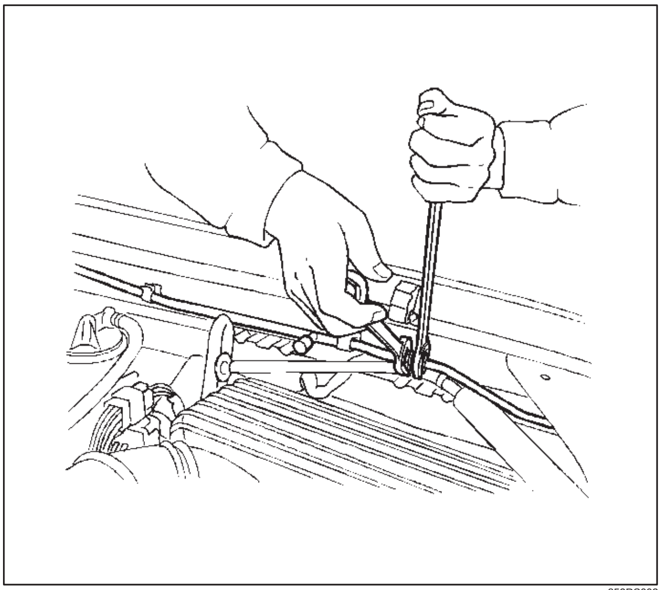
  Never remove the caps or plugs until the lines or parts are reconnected or installed.
- When disconnecting or reconnecting the lines, use two wrenches to support the line fitting, to prevent from twisting or other damage.
- Always install new O-rings whenever a connection is disassembled.
- Before connecting any hoses or lines, apply new specified compressor oil to the O-rings.
- When removing and replacing any parts which require discharging the refrigerant circuit, the operations described in this section must be performed in the following sequence:

  1. Use the J-39500 (ACR4: HFC-134a Refrigerant Recovery / Recycling / Recharging / System) or equivalent to thoroughly discharge and recover the refrigerant.
  2. Remove and replace the defective part.
  3. After evacuation, charge the air conditioning system and check for leaks.

Repair Of Refrigerant Leaks

Refrigerant Line Connections

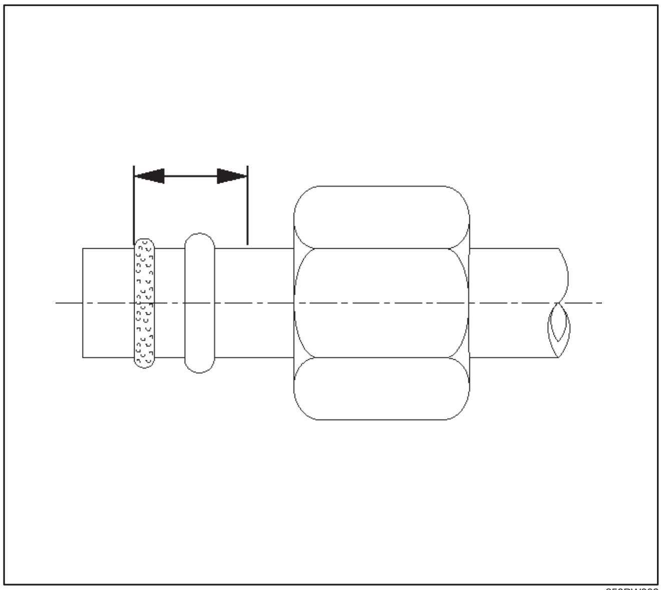
Install new O-rings, if required. When disconnecting or connecting lines, use two wrenches to prevent the connecting portion from twisting or becoming damaged.



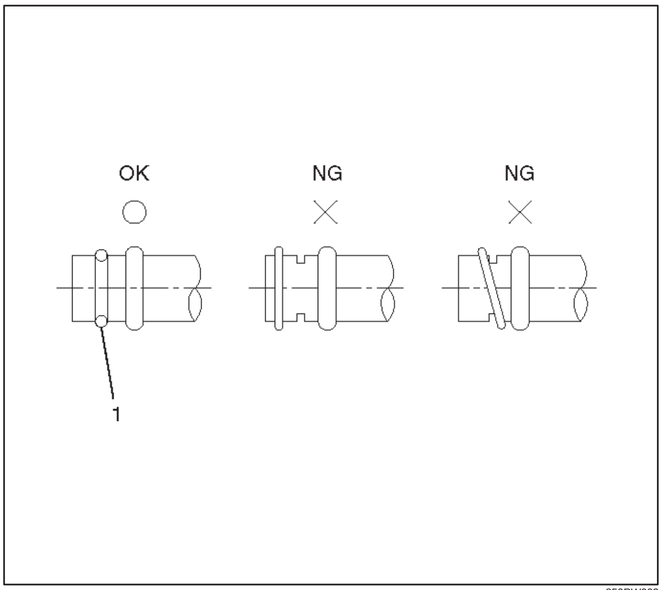
852RS003

When connecting the refrigerant line at a block joint, securely insert the projecting portion of the joint portion into the connecting hole on the unit side and secure with a bolt. Apply the specified compressor oil to the O-rings prior to connecting.

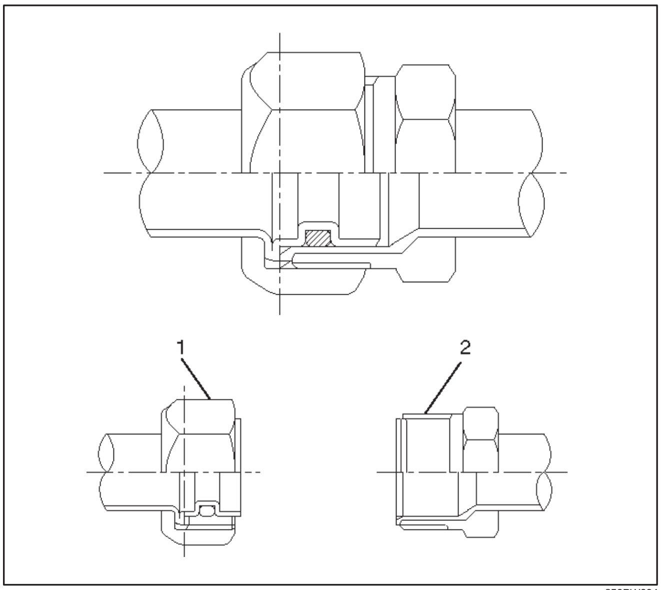
CAUTION: Compressor (PAG) oil to be used varies according to the compressor model. Be sure to apply oil specified for the model of compressor.



O-rings (2) must be closely aligned with the raised portion (1) of refrigerant line.



Insert the nut into the union.
First, tighten the nut by hand as much as possible, then tighten the nut to the specified torque.



Leak Check

Inspection of refrigerant leak

Refrigerant leak may cause an adverse effect not only on the performance and durability of each component of the air-conditioner, but also on the global atmosphere.

Therefore, it is most important to repair refrigerant leak when there is any leak found.

Inspection flow of refrigerant leak

Step	Action	Yes	No
1	1. Evacuate the refrigerant system. 2. Charge the refrigerant. Is there any refrigerant leak?	Repair refrigerant system	Go To Step 2
2	1. Operate the compressor for more than 5 minutes to raise the pressure on the high pressure side. Is there any refrigerant leak at high pressure components?	Repair refrigerant system	Compressor operation to be confirmed

Inspection steps

Check the components of the air conditioner to see if there occurs any refrigerant leak along the flow of refrigerant.

NOTE:

- To avoid an error in the detection of refrigerant leak, make sure there is no refrigerant vapor or cigarette smoke around the vehicle before conducting the inspection.
  Also, select a location where the refrigerant vapor will not be blown off by wind.
- Inspection should be conducted chiefly on the pipe connections and sections where a marked oil contamination is found.
  When refrigerant is leaking, oil inside is also leaking at the same time.
- It is not possible to visually check the leak from inside the cooling unit. Follow the method below when checking.
  Remove the drain hose or resistor of the cooling unit, and insert a leak detector to see if there occurs any leak.

High pressure side

1. Discharger section of compressor
2. Inlet/outlet section of condenser
3. Inlet/outlet section of receiver driver
4. Inlet section of cooling unit

Low pressure side

1. Outlet section of cooling unit
2. Intake section of compressor

Major checking points of refrigerant leak

Compressor

- Pipe connection
- Sealing section of shaft
- Mating section of cylinder

Condenser

- Pipe connection
- Welds of condenser body

Receiver drier

- Pipe connection
- Attaching section of pressure switch
- Section around the sight glass

Evaporator unit (cooling unit)

- Pipe connection
- Connections of expansion valve
- Brazed sections of evaporator

NOTE:

- The evaporator and expansion valve are contained in the case. Remove the drain hose or the resistor of the cooling unit and insert a leak detector when checking for any leak.

Flexible hose

- Pipe connection
- Caulking section of the hose
- Hose (cracks, pinholes, flaws)

Pipe

- Pipe connection
- Pipe (cracks, flaws)

Charge Valve

NOTE:

- The charge valve, which is used to connect the gauge manifold, is normally provided with a resin cap. When the valve inside gets deteriorated, refrigerant will leak out.

Leak at Refrigerant Line Connections

1. Check the torque on the refrigerant line fitting and, if too loose, tighten to the specified torque.
   - Use two wrenches to prevent twisting and damage to the line.
   - Do not over tighten.
2. Perform a leak test on the refrigerant line fitting.

3. If the leak is still present, discharge and recover the refrigerant from the system.
4. Replace the O-rings.
   - O-rings cannot be reused. Always replace with new ones.
   - Be sure to apply the specified compressor oil to the new O-rings.
5. Retighten the refrigerant line fitting to the specified torque.
   - Use two wrenches to prevent twisting and damage to the line.
6. Evacuate, charge and retest the system.

Leaks In The Hose

If the compressor inlet or outlet hose is leaking, the entire hose must be replaced. The refrigerant hose must not be cut or spliced for repair.

1. Locate the leak.
2. Discharge and recover the refrigerant.
3. Remove the hose assembly.
   - Cap the open connections at once.
4. Connect the new hose assembly.
   - Use two wrenches to prevent twisting or damage to the hose fitting.
   - Tighten the hose fitting to the specified torque.
5. Evacuate, charge and test the system.

Compressor Leaks

If leaks are located around the compressor shaft seal or shell, replace or repair the compressor.

Recovery, Recycling, Evacuation and Charging of HFC-134a

Air conditioning systems contain HFC-134a. This is a chemical mixture which requires special handling procedures to avoid personal injury.

- Always wear safety goggles and protective gloves.
- Always work in a well-ventilated area. Do not weld or steam clean on or near any vehicle-installed air conditioning lines or components.
- If HFC-134a should come in contact with any part of the body, flush the exposed area with cold water and immediately seek medical help.
- If it is necessary to transport or carry any container of HFC-134a in a vehicle, do not carry it in the passenger compartment.
- If it is necessary to fill a small HFC-134a container from a large one,never fill the container completely. Space should always be allowed above the liquid for expansion.
- HFC-134a and R-12 should never be mixed as their compositions are not the same.
- HFC-134a PAG oil tends to absorb moisture more quickly than R-12 mineral oil and, therefore, should be handled more carefully.
- Keep HFC-134a containers stored below 40˚C (100˚F).

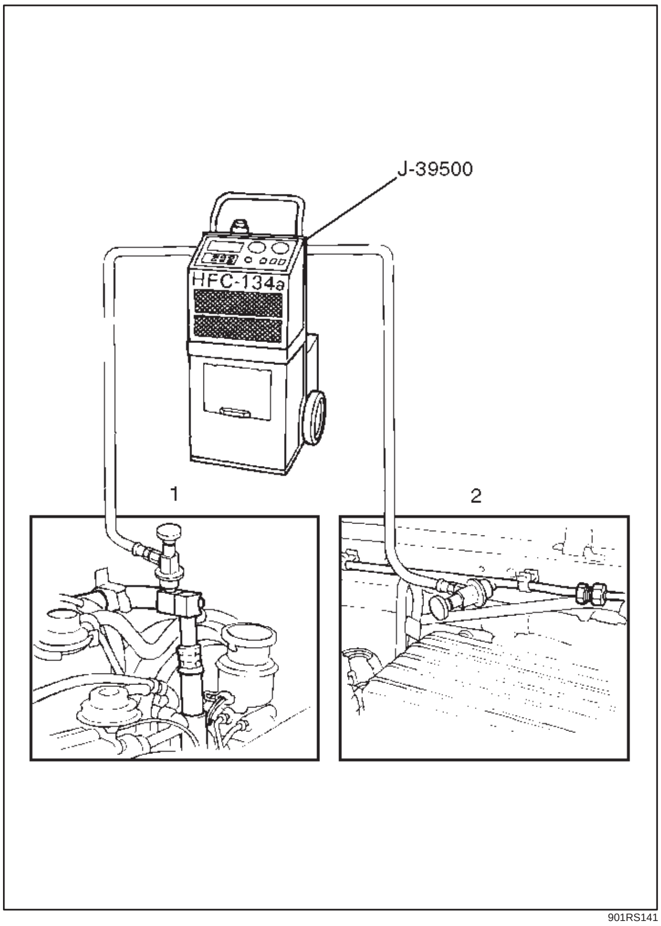
WARNING:

- **SHOULD HFC-134A CONTACT YOUR EYE(S), CONSULT A DOCTOR IMMEDIATELY.**
- **DO NOT RUB THE AFFECTED EYE(S). INSTEAD, SPLASH QUANTITIES OF FRESH COLD WATER OVER THE AFFECTED AREA TO GRADUALLY RAISE THE TEMPERATURE OF THE REFRIGERANT ABOVE THE FREEZING POINT.**
- **OBTAIN PROPER MEDICAL TREATMENT AS SOON AS POSSIBLE. SHOULD THE HFC-134A TOUCH THE SKIN, THE INJURY MUST BE TREATED THE SAME AS SKIN WHICH HAS BEEN FROSTBITTEN OR FROZEN.**

Refrigerant Recovery

The refrigerant must be discharged and recovered by using the J-39500 (ACR4:HFC-134a Refrigerant Recovery/Recycling/Recharging/System) or equivalent before removing or mounting air conditioning parts.

1. Connect the high and low charging hoses of the ACR4(or equivalent) as shown below.



Legend

(1) Low Side
(2) High Side

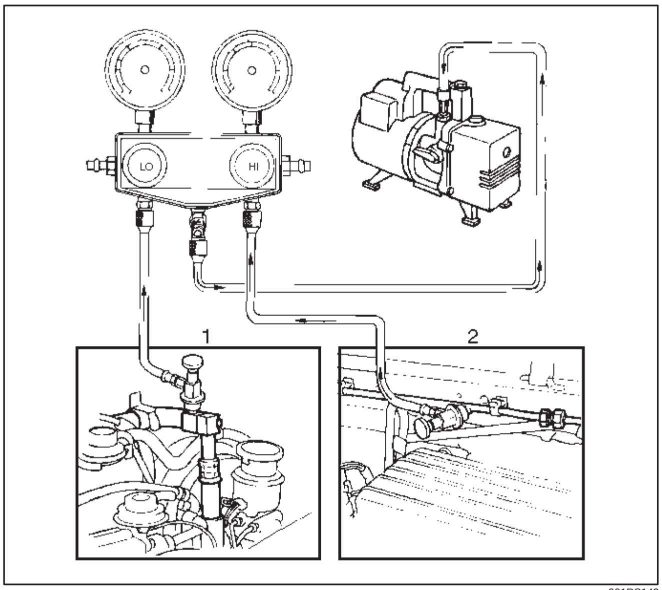
2. Recover the refrigerant by following the Manufacturer's Instructions.
3. When a part is removed, put a cap or a plug on the connecting portion so that dust, dirt or moisture cannot get into it.

Refrigerant Recycling

Recycle the refrigerant recovered by J-39500 (ACR4:HFC-134a Refrigerant Recovery / Recycling / Recharging / System) or equivalent.

For the details of the actual operation, follow the steps in the ACR4(or equivalent) Manufacturer's Instructions.

Evacuation of The Refrigerant System



901RS142

Legend

(1) Low Side
(2) High Side

NOTE: Explained below is a method using a vacuum pump. Refer to the ACR4(or equivalent) manufacturer's instructions when evacuating the system with a ACR4(or equivalent).

Air and moisture in the refrigerant will cause problems in the air conditioning system. Therefore, before charging the refrigerant, be sure to evacuate air and moisture thoroughly from the system.

1. Connect the gauge manifold.
   - High-pressure valve (HI) — Discharge-side.
   - Low-pressure valve (LOW) — Suction-side.
2. Discharge and recover the refrigerant.
3. Connect the center hose of the gauge manifold set to the vacuum pump inlet.
4. Operate the vacuum pump, open shutoff valve and then open both hand valves.
5. When the low-pressure gauge indicates approximately 750 mmHg (30 inHg), continue the evacuation for 5 minutes or more.
6. Close both hand valves and stop the vacuum pump.
7. Check to ensure that the pressure does not change after 10 minutes or more.
   - If the pressure changes, check the system for leaks.
   - If leaks occur, retighten the refrigerant line connections and repeat the evacuation steps.
8. If no leaks are found, again operate the vacuum pump for 20 minutes or more. After confirming that the gauge manifold pressure is at 750 mmHg (30 inHg), close both hand valves.
9. Close positive shutoff valve. Stop the vacuum pump and disconnect the center hose from the vacuum pump.

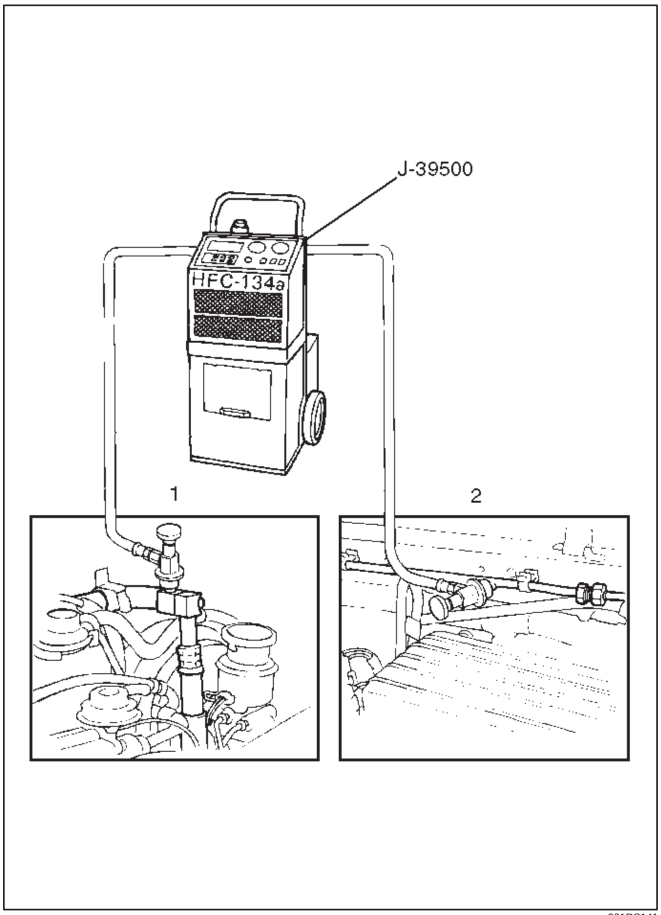
Charging The Refrigerant System

There are various methods of charging refrigerant into the air conditioning system.

These include using J-39500 (ACR4:HFC-134a Refrigerant Recovery/Recycling/Recharging/System) or equivalent and direct charging with a weight scale charging station.

Charging Procedure

- **ACR4(or equivalent) Method**
  For the charging of refrigerant recovered by ACR4(or equivalent), follow the manufacturer's instruction.



901RS141

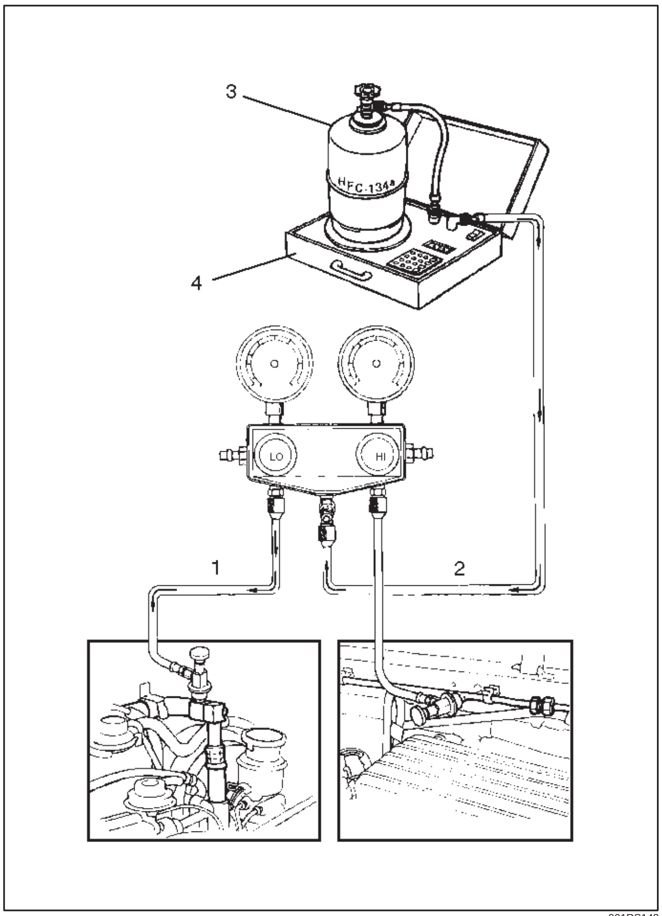
Legend

(1) Low Side
(2) High Side

- **Direct charging with a weight scale charging station method**

1. Make sure the evacuation process is correctly completed.
2. Connect the center hose of the manifold gauge to the weight scale.

3. Connect the low pressure charging hose of the manifold gauge to the low pressure side service valve of the vehicle.
4. Connect the high pressure charging hose of the manifold gauge to the high pressure side service valve of the vehicle.

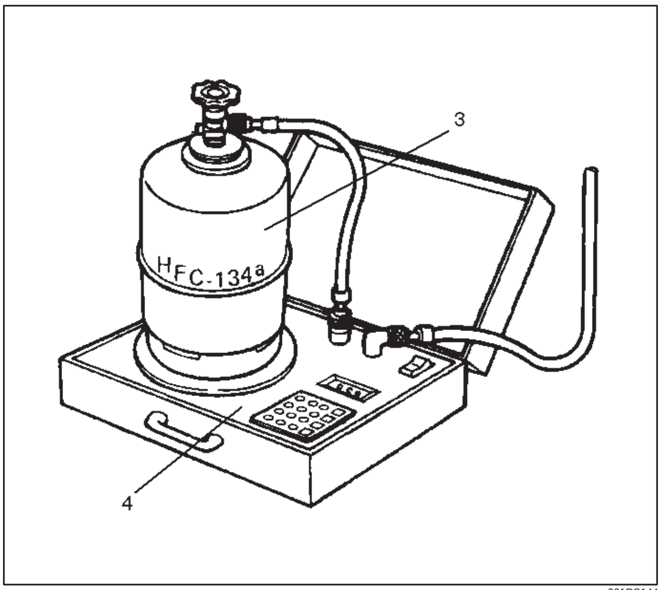


901RS143

Legend

(1) Low Side
(2) High Side
(3) Refrigerant Container
(4) Weight Scale

5. Place the refrigerant container(3) up right on a weight scale(4).
   Note the total weight before charging the refrigerant.
   a. Open the refrigerant container valve.
   b. Open the low side vale on the manifold gauge set. Refer to the manufacturer's instructions for a weight scale charging station.



901RS144

6. Perform a system leak test:
   - Charge the system with approximately 200 g (0.44 lbs) of HFC-134a.
   - Make sure the high pressure valve of the manifold gauge is closed.
   - Check to ensure that the degree of pressure does not change.
   - Check for refrigerant leaks by using a HFC-134a leak detector.
   - If a leak occurs, recover the refrigerant. Repair the leak and start all over again from the first step of evacuation.
7. If no leaks are found, continue charging refrigerant to the air conditioning system.
   - Charge the refrigerant until the scale reading decreases by the amount of the charge specified.

   Specified amount: 600 g (1.32 lbs)

   - If charging the system becomes difficult:

   1. Run the engine at idle and close all the vehicle doors.
   2. Turn A/C switch "ON".
   3. Set the fan switch to its highest position.
   4. Set the air source selector lever to "CIRC".
   5. Slowly open the low side valve on the manifold gauge set.

WARNING: BE ABSOLUTELY SURE NOT TO OPEN THE HIGH PRESSURE VALVE OF THE MANIFOLD GAUGE. SHOULD THE HIGH PRESSURE VALVE BE OPENED, THE HIGH PRESSURE REFRIGERANT WOULD FLOW BACKWARD, AND THIS MAY CAUSE THE REFRIGERANT CONTAINER TO BURST.

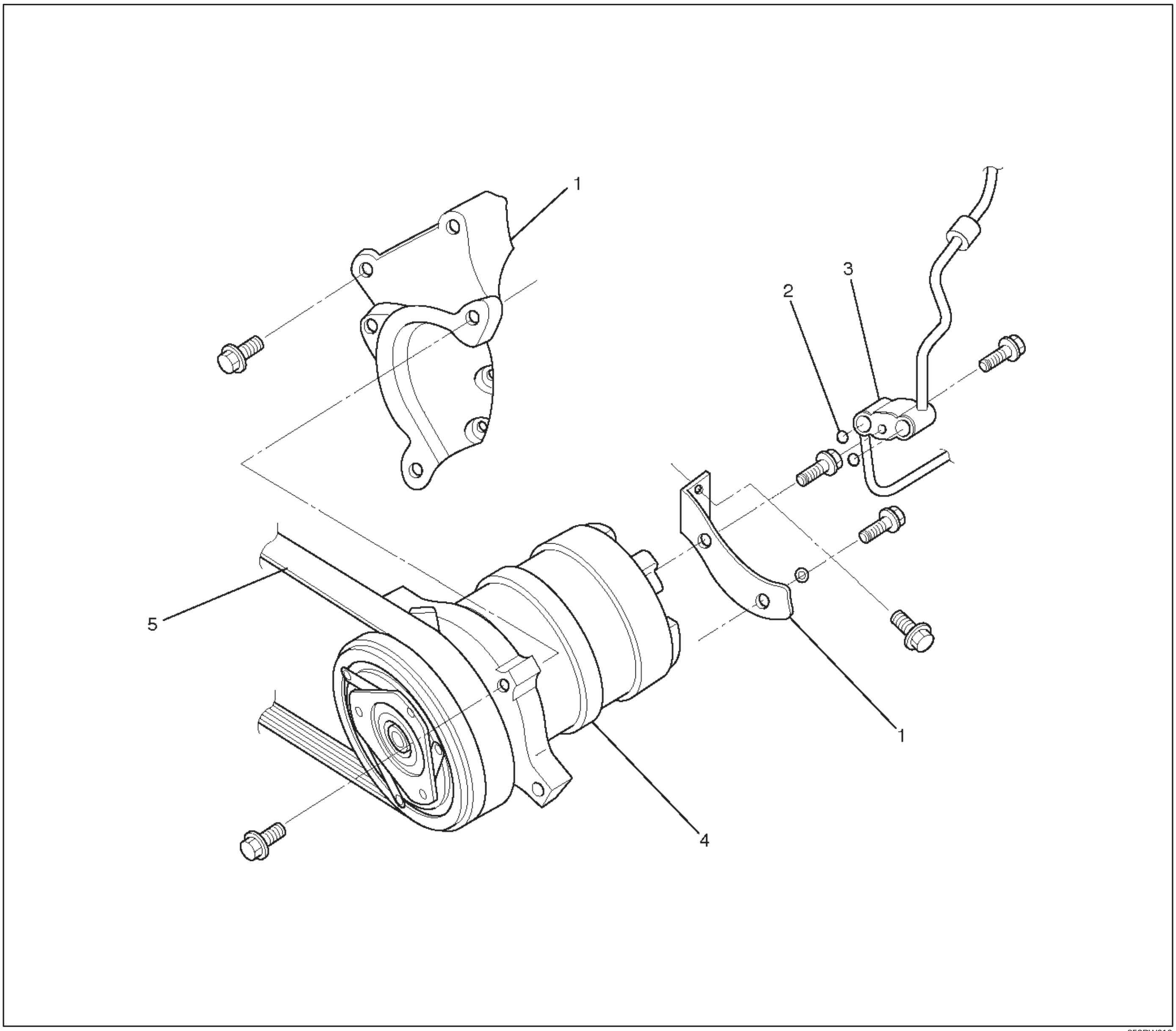
8. When finished with the refrigerant charging, close the low pressure valve of the manifold gauge and container valve.
9. Check for refrigerant leaks.

Checking The A/C System

1. Run the engine and close all the vehicle doors.
2. Turn A/C switch "ON", set the fan switch to its highest position.
3. Set the air source lever to "CIRC", set the temperature lever to the full cool position.
4. Check the high and low pressure of the manifold gauge.
   - Immediately after charging refrigerant, both high and low pressures might be slightly high, but they settle down to the pressure guidelines shown below:
   - The ambient temperature should be between 25–30°C (77–86°F).
   - The pressure guideline for the high-pressure side is approximately 1372.9–1863.3 kPa (199.1–270.2 psi).
   - The pressure guideline for the low-pressure side is approximately 147.1–294.2 kPa (21.3–42.7 psi).
   - If an abnormal pressure is found, refer to Checking The Refrigerant System With Manifold Gauge in this section.
5. Put your hand in front of the air outlet and move the temperature control lever of the control panel to different positions. Check if the outlet temperature changes as selected by the control knob.

Compressor Assembly

Compressor Assembly and Associated Parts

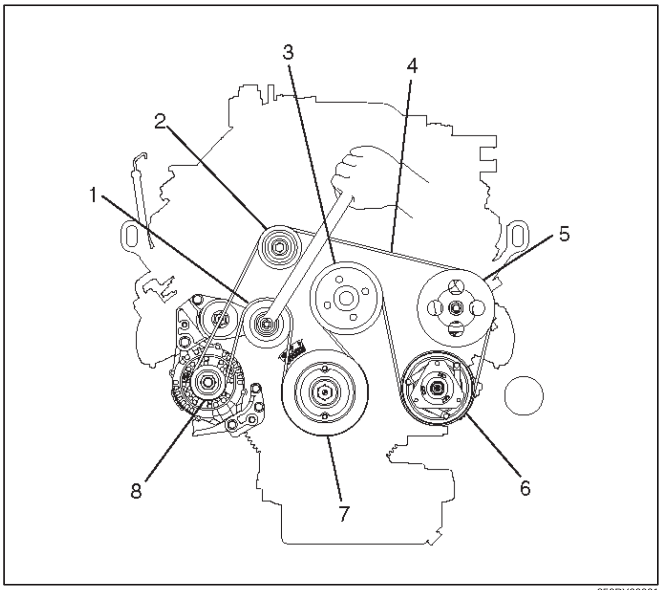


Legend
- (1) Compressor Bracket
- (2) Seal Washer
- (3) Refrigerant Line Connector
- (4) Compressor
- (5) Drive Belt

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant
   - Refer to Refrigerant Recovery in this section.
3. Disconnect magnetic clutch harness connector.

4. Remove drive belt.
   - Move drive belt tensioner to loose side using wrench then remove drive belt.



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Legend

(1) Auto Tensioner
(2) Idle Pulley
(3) Cooling Fan Pulley
(4) Drive Belt
(5) Power Steering Oil Pump
(6) Air Conditioner Compressor
(7) Crankshaft Pulley
(8) Generator

5. Disconnect refrigerant line connector.
   - When removing the line connector, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
6. Remove compressor.

Installation

1. Install compressor.
   - Tighten the compressor fixing bolts to the specified torque.

Torque: 19 N•m (14 lb•ft)

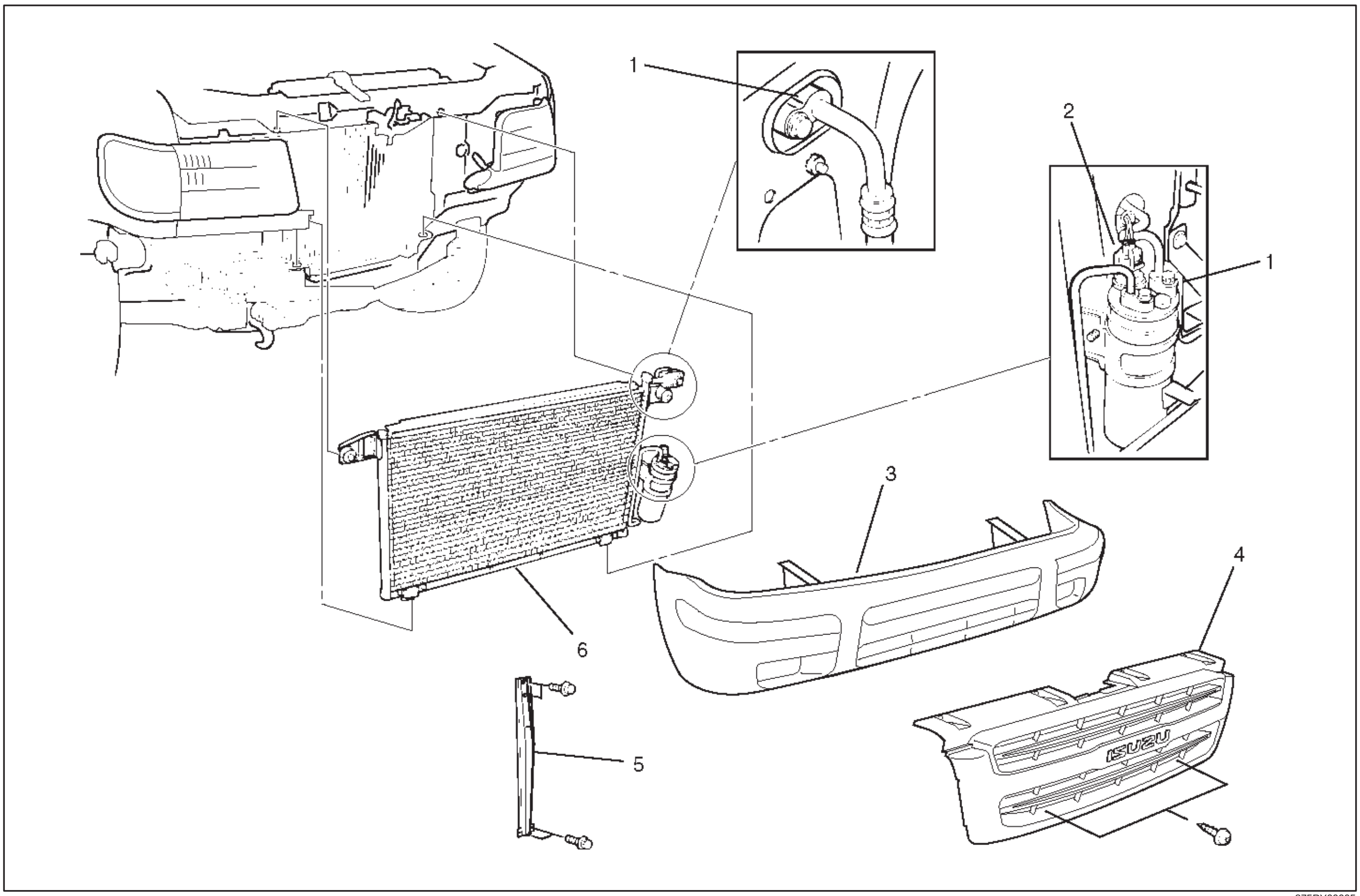
2. Connect refrigerant line connector.
   - Tighten the refrigerant line connector fixing bolts to the specified torque.

Torque: 15 N•m (11 lb•ft)

   - O-rings cannot be reused. Always replace with new ones.
   - Be sure to apply new compressor oil to the O-rings when connecting refrigerant lines.
3. Install drive belt.
   - Move serpentine belt tensioner to loose side using wrench, then install serpentine belt to normal position.
4. Connect magnetic clutch harness connector.

Condenser Assembly

Condenser Assembly and Associated Parts



Legend

(1) Refrigerant Line
(2) Pressure Switch Connector
(3) Front Bumper Assembly
(4) Radiator Grille
(5) Engine Hood Front End Stay
(6) Condenser Assembly

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to Refrigerant Recovery in this section.
3. Remove radiator grille.
4. Remove front bumper assembly.
   - Refer to Bumpers in Body and Accessories section.
5. Remove engine hood front end stay.
6. Disconnect pressure switch connector.
7. Disconnect refrigerant line.
   - When removing the line connector, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
8. Remove condenser assembly.
   - Handle with care to prevent damaging the condenser or radiator fin.

Installation

1. Install condenser assembly.
   - If installing a new condenser, be sure to add 30cc (1.0 fl. oz.) of new compressor oil to a new one.
   - Tighten the condenser fixing bolts to the specified torque.

   Torque: 6 N•m (52 lb•in)
2. Connect refrigerant line.
   - Tighten the inlet line connector fixing bolt to the specified torque.

   Torque: 15 N•m (11 lb•ft)
   - Tighten the outlet line connector fixing bolt to the specified torque.

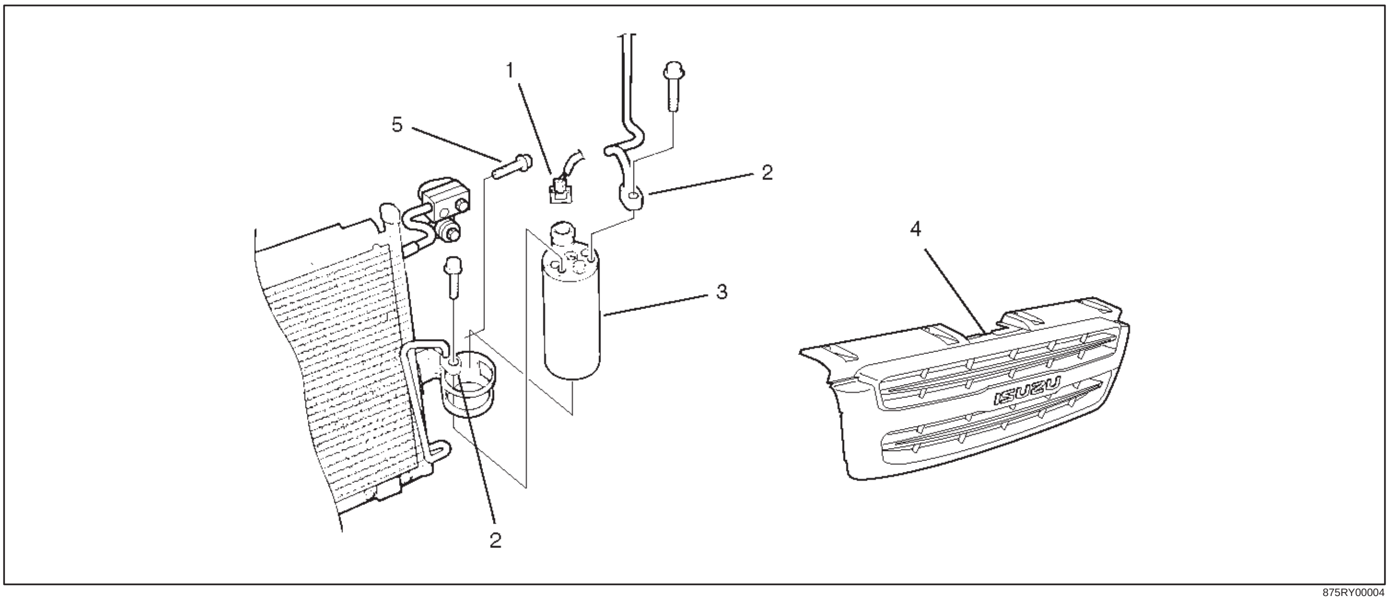
   Torque: 6 N•m (52 lb•in)
   - O-rings cannot be reused. Always replace with new ones.

- Be sure to apply new compressor oil to the O-rings when connecting the refrigerant line.

3. Connect pressure switch connector.
4. Install engine hood front end stay.
5. Install front bumper assembly.
6. Install radiator grille.

Receiver / Drier

Receiver / Drier and Associated Parts



Legend

(1) Pressure Switch Connector
(2) Refrigerant Line
(3) Receiver / Drier
(4) Radiator Grille
(5) Bracket Bolt

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to Refrigerant Recovery in this section.
3. Remove radiator grille.
4. Disconnect pressure switch connector.
5. Disconnect refrigerant line.
   - When removing the line connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
6. Remove bracket bolt.
7. Remove receiver/drier.
   - Loosen the bolt, then, using care not to touch or bend the refrigerant line, carefully pull out the receiver/drier.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

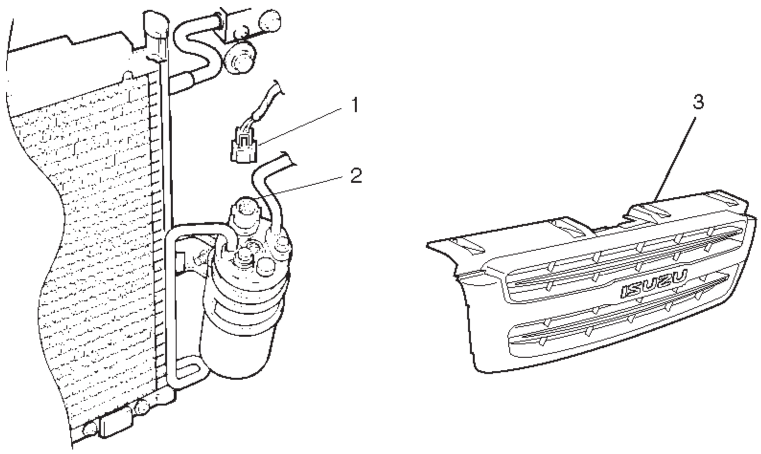
1. If installing a new receiver/drier, be sure to add 30cc (1.0 fl. oz.) of new compressor oil to a new one.
2. Put the receiver/drier in the bracket and connect with the refrigerant line. Check that no excessive force is imposed on the line. Fasten the bracket bolt to the receiver/drier.
3. Tighten the refrigerant line to the specified torque.

   Torque: 6 N•m (52 lb•in)

4. O-rings cannot be reused. Always replace with new ones.
5. Be sure to apply new compressor oil to the O-rings when connecting the refrigerant line.

Pressure Switch

Pressure Switch and Associated Parts



Legend
(1) Pressure Switch Connector
(2) Pressure Switch
(3) Radiator Grille

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to “Refrigerant Recovery in this section.
3. Remove radiator grille.
4. Disconnect pressure switch connector.
5. Disconnect pressure switch.
   - When removing the switch connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.

Installation

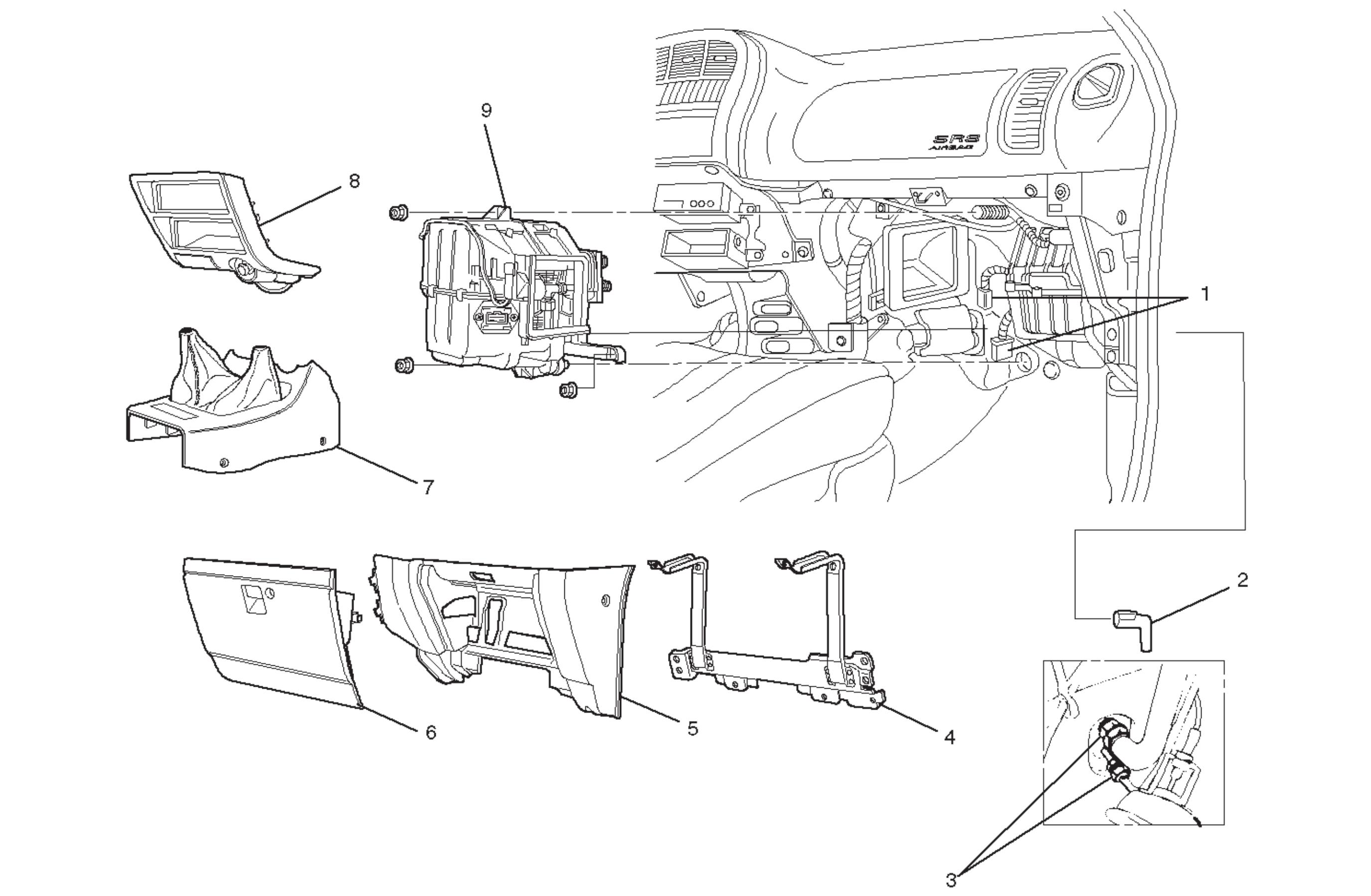
To install, follow the removal steps in the reverse order, noting the following point:

1. O-ring cannot be reused. Always replace with a new one.
2. Be sure to apply new compressor oil to the O-ring when connecting pressure switch.
3. Tighten the pressure switch to the specified torque.

Torque: 13 N•m (113 lb•in)

Evaporator Assembly

Evaporator Assembly and Associated Parts



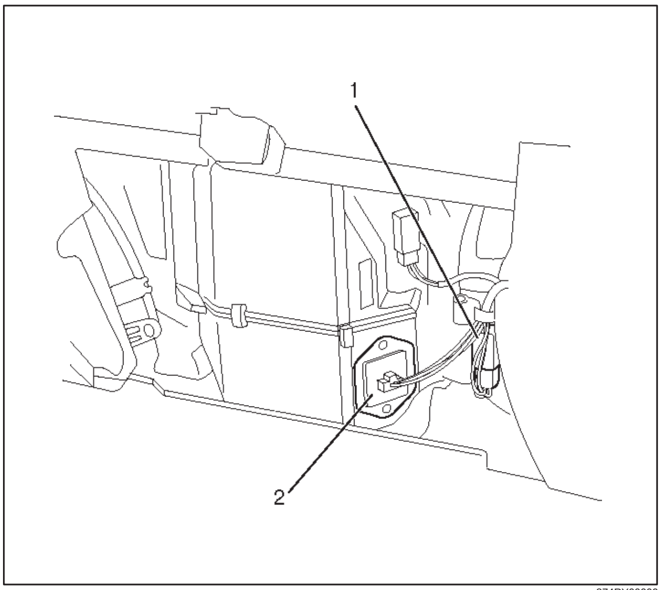
874RT002

Legend

(1) Resistor and Electronic Thermostat Connector
(2) Drain Hose
(3) Refrigerant Line
(4) Passenger Knee Bolster Reinforcement Assembly
(5) Instrument Panel Passenger Lower Cover Assembly
(6) Glove Box
(7) Front Console Assembly
(8) Lower Cluster Assembly
(9) Evaporator Assembly

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to Refrigerant Recovery in this section.
3. Remove front console assembly.
4. Remove lower cluster assembly.
5. Remove glove box.
6. Remove instrument panel passenger lower cover assembly.
7. Remove passenger knee bolster reinforcement assembly.
   - Refer to Instrument Panel Assembly in Body and Accessories section.
8. Disconnect resistor (2) and electronic thermostat connector (1).



874RY00009

9. Disconnect drain hose.
10. Disconnect refrigerant line.
    - Use a back-up wrench when disconnecting and reconnecting the refrigerant lines.
    - When removing the refrigerant line connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
11. Remove evaporator assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. To install a new evaporator assembly, add 50cc (1.7 fl. oz.) of new compressor oil to the new core.
2. Tighten the refrigerant outlet line to the specified torque.

Torque: 25 N•m (18 lb•ft)

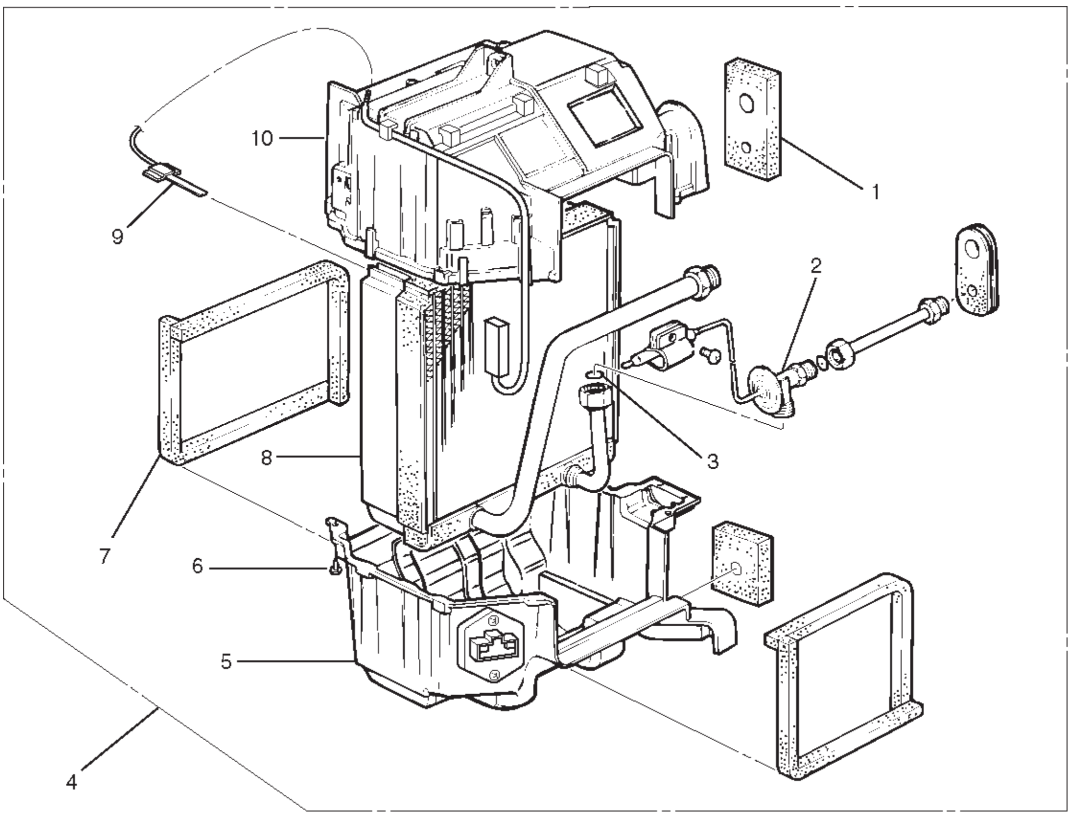
3. Tighten the refrigerant inlet line to the specified torque.

Torque: 15 N•m (11 lb•ft)

4. O-rings cannot be reused. Always replace with new ones.
5. Be sure to apply new compressor oil to the O-rings when connecting lines.

Electronic Thermostat, Evaporator Core and/or Expansion Valve

Disassembled View



874RX017

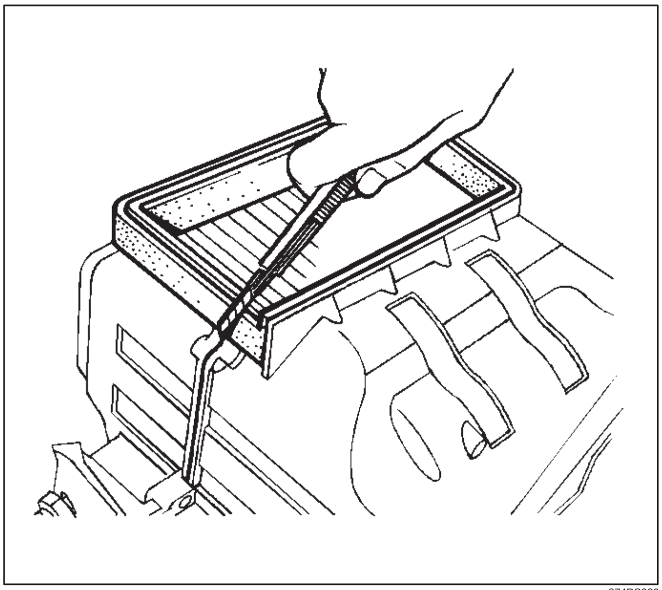
Legend

(1) Lining
(2) Expansion Valve
(3) O-ring
(4) Evaporator Assembly
(5) Lower Case
(6) Attaching Screw
(7) Lining
(8) Evaporator Core
(9) Electronic Thermostat
(10) Upper Case

Removal

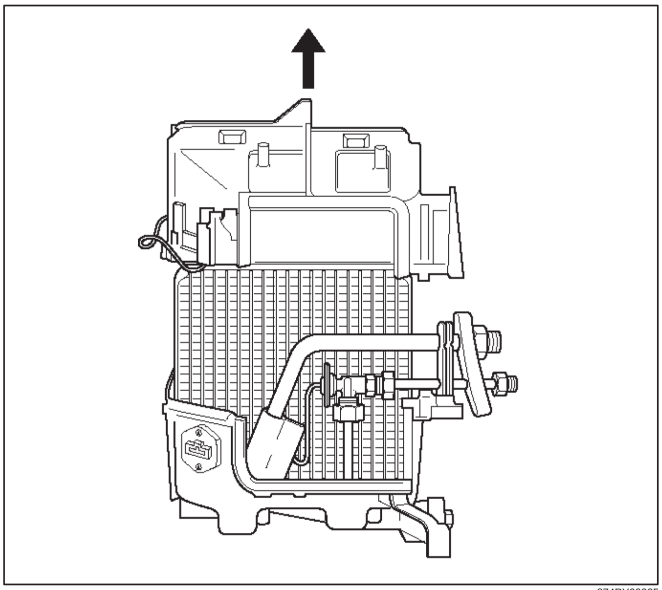
1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to Refrigerant Recovery in this section.

3. Remove evaporator assembly.
   - Refer to Evaporator Assembly in this section.
4. Remove the electronic thermostat sensor fixing clip. Pull the sensor from the evaporator assembly.
5. Remove clip.
6. Remove attaching screw.
7. Remove upper case.
8. Remove lower case.
   - Slit the case parting face with a knife since the lining is separated when removing the evaporator.



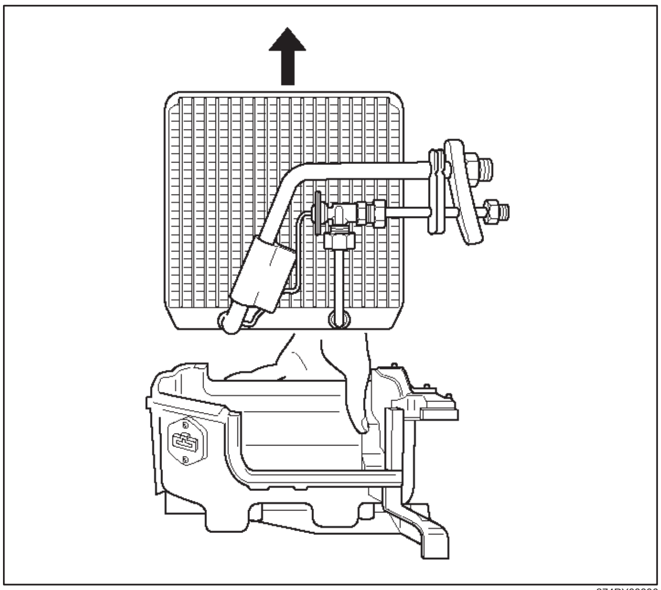
874RS006

   - Lift to remove the upper case.



874RY00005

9. Remove evaporator core.



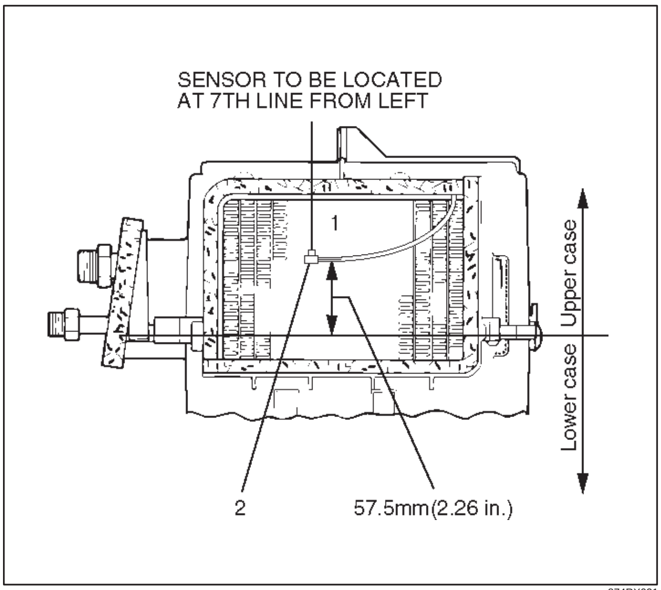
874RY00006

10. Remove expansion valve.
    - Tear off the insulator carefully.
    - Remove the sensor fixing clip.
    - Use a back-up wrench when disconnecting all refrigerant pipes.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. The sensor is installed on the core with the clip.
2. The sensor must not interfere with the evaporator core.
3. When installing the new evaporator core, install the thermo sensor (2) to the evaporator core (1) specified position with the clip in the illustration.



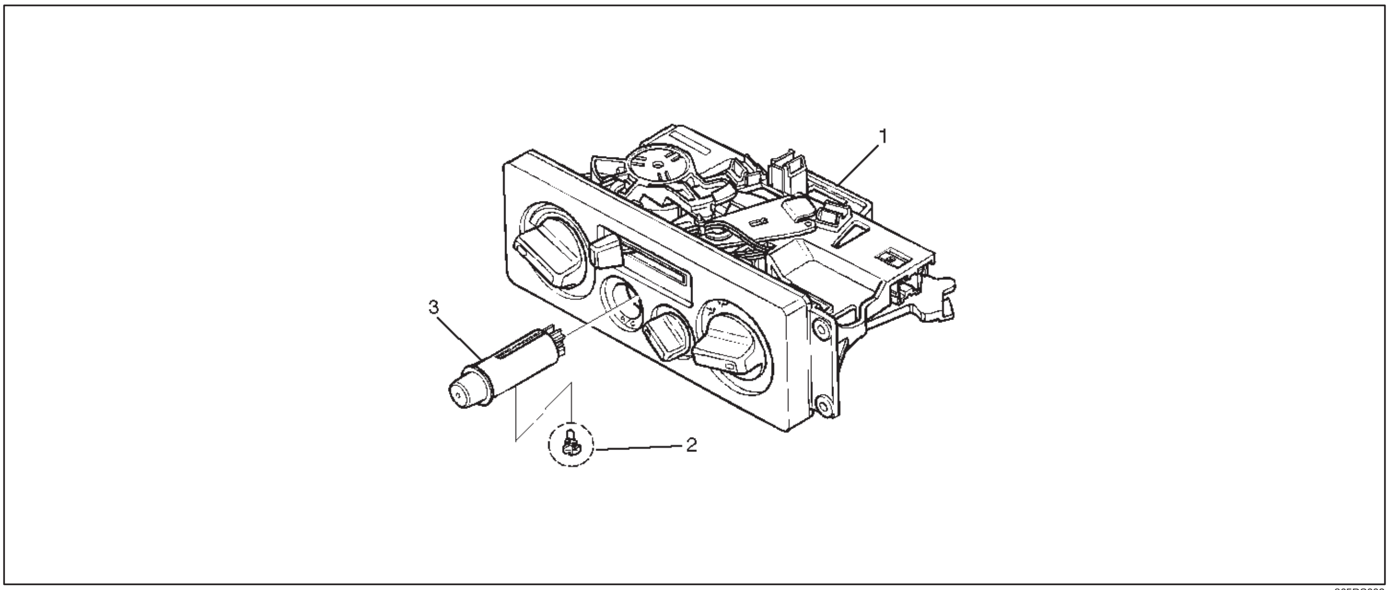
874RX021

4. O-rings cannot be reused. Always replace with new ones.
5. Be sure to apply new compressor oil to the O-rings when connecting lines.

6. Be sure to install the sensor and the insulator on the place where they were before.
7. To install a new evaporator core, add 50cc (1.7 fl. oz.) of new compressor oil to the new core.
8. Tighten the refrigerant lines to the specified torque. Refer to Main Data and Specifications for Torque Specifications in this section.
9. Apply an adhesive to the parting face of the lining when assembling the evaporator assembly.

Air Conditioning Switch and Illumination Bulb

Air Conditioning Switch, Illumination Bulb and Associated Parts

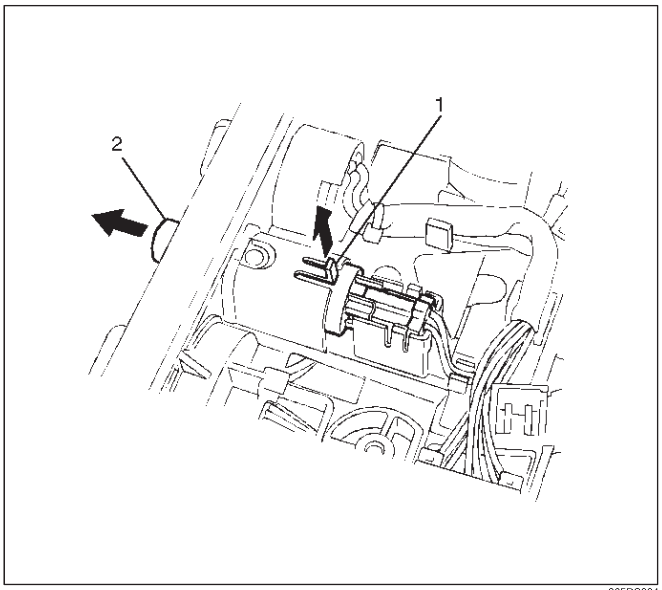


865RS003

Legend
(1) Control Lever Assembly
(2) Illumination Bulb
(3) A/C Switch

Removal

1. Disconnect the battery ground cable.
2. Remove control lever assembly.
   - Refer to Control Lever Assembly in this section.
3. Lift up the catch portion (1) of the switch and remove the air conditioning switch (2) while pushing it toward the outside.



865RS004

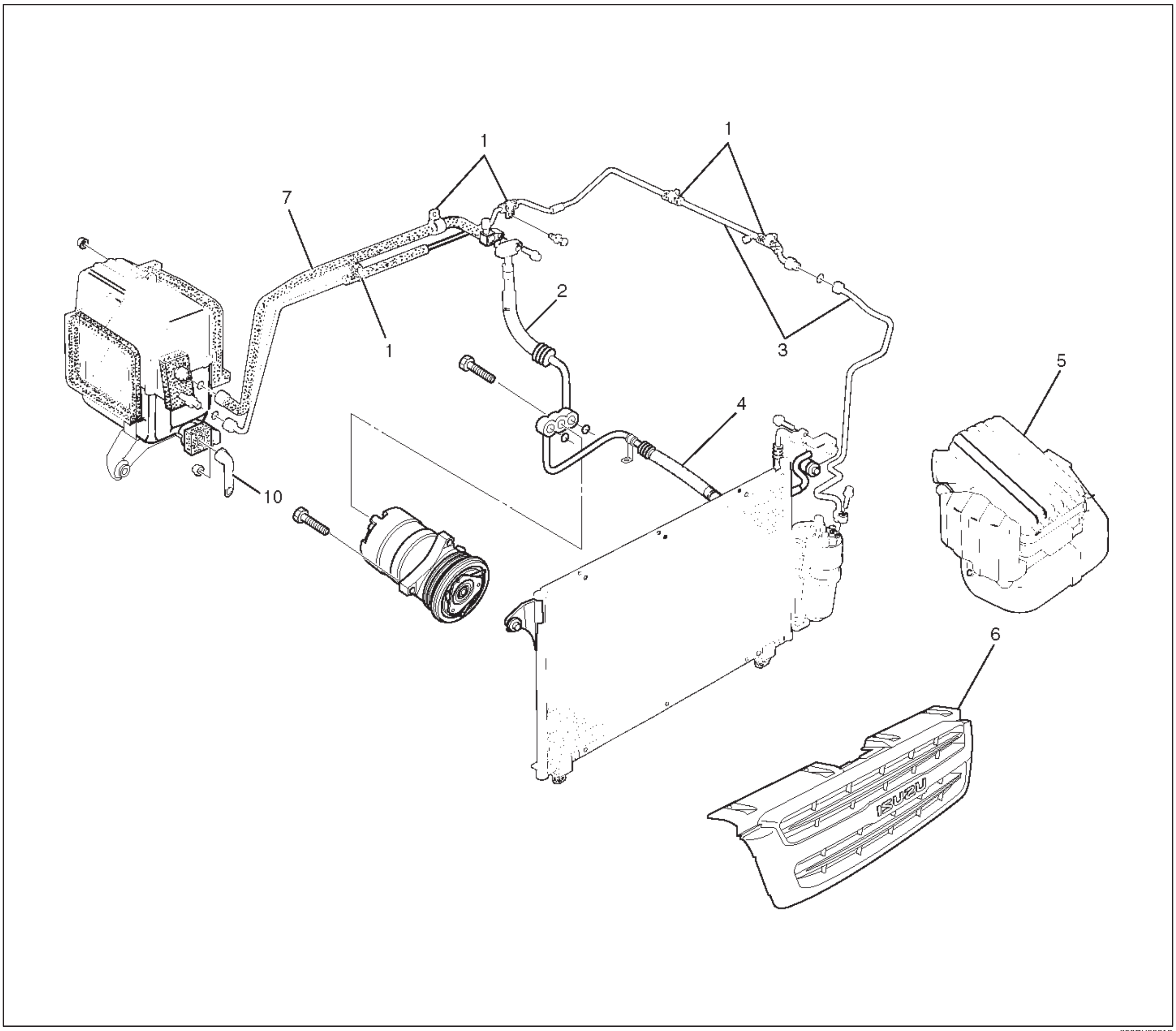
4. Turn the illumination bulb counterclockwise to remove.

Installation

To install, follow the removal steps in the reverse order.

Refrigerant Line

Refrigerant Line and Associated Parts



852RY00013

Legend

(1) Clip and Clamp
(2) Suction Line (Low Pressure Hose)
(3) Liquid Line (High-Pressure Pipe)
(4) Discharge Line (High Pressure Hose)
(5) Air Cleaner
(6) Radiator Grille
(7) Suction Line (Low-Pressure Pipe)

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to Refrigerant Recovery in this section.
3. Remove radiator grille.
4. Remove air cleaner.
5. Remove clip and clamp.
6. Disconnect liquid line (High-pressure pipe).
7. Disconnect suction line (Low-pressure pipe) using a back-up wrench.
8. Disconnect suction line (Low-pressure hose) using a back-up wrench.
9. Disconnect discharge line (High-pressure hose) using a back-up wrench.
   - Use a backup wrench when disconnecting and reconnecting the refrigerant lines.

- When removing the refrigerant line connecting part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

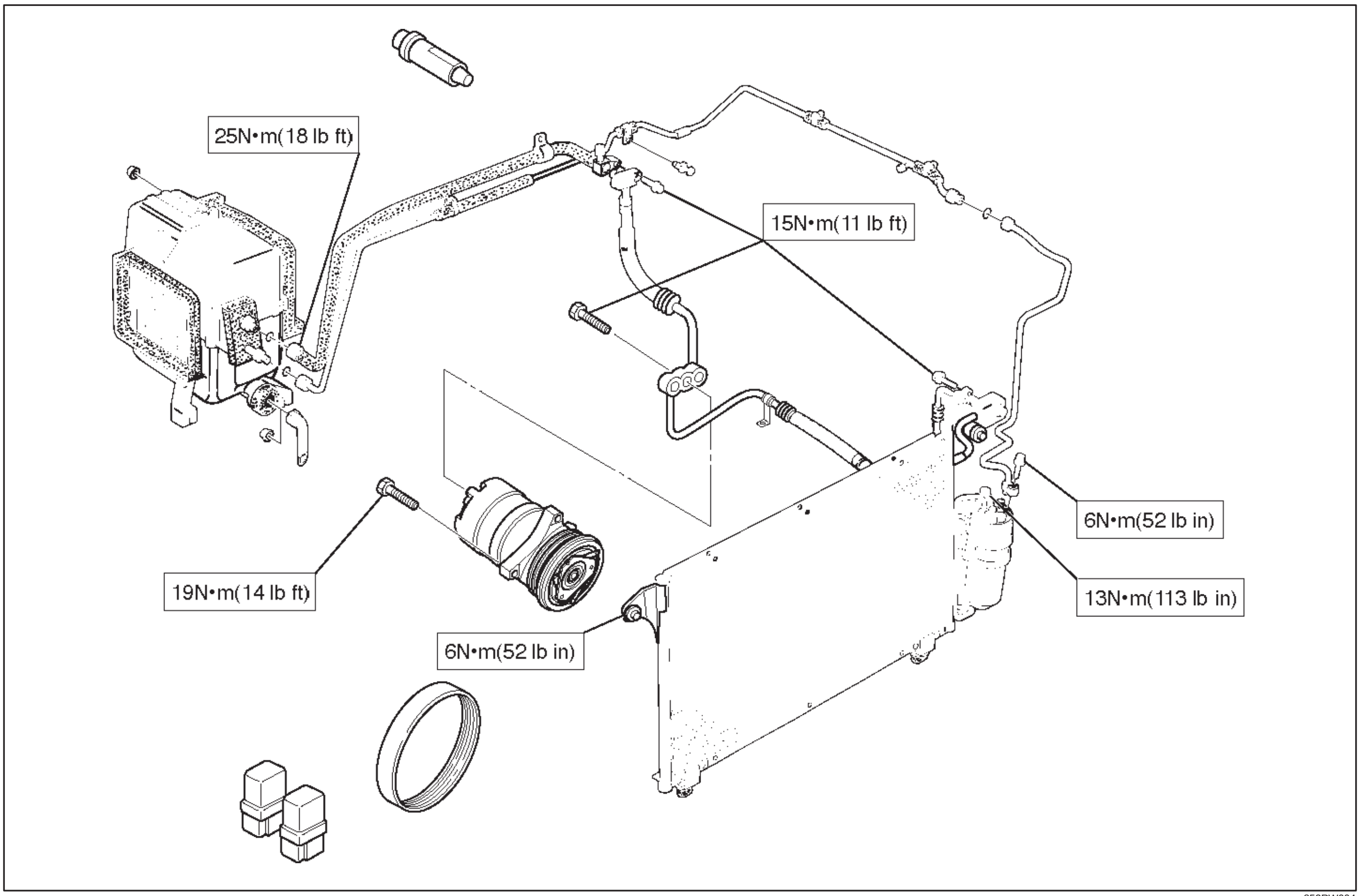
1. O-rings cannot be reused. Always replace with new ones.
2. Be sure to apply new compressor oil to the O-rings when connecting lines.
3. Tighten the refrigerant line to the specified torque.
   Refer to Main Data and Specifications for Torque Specifications in this section.

Main Data And Specifications

General Specifications

HEATER UNIT	
Temperature control	Reheat air mix system
Capacity	4.3 kw (3,700 Kcal./hr.)
Air flow	280 m^3/hr
HEATER CORE	
Type	Plate and corrugate fin type
Element dimension	171 mm (6.7 in.) × 161 mm (6.3 in.) × 25 mm (0.98 in.)
Radiating area	Approx. 0.75 m^2
EVAPORATOR ASSEMBLY	
Capacity	4.9 kw (4,200 Kcal./hr.)
Air flow	470 m^3/hr
EVAPORATOR CORE	
Type	Al-laminate louver fin type
Element dimension	235 mm (9.3 in.) × 225.3 mm (8.9 in.) × 60 mm (2.4 in.)
EXPANSION VALVE	
Type	Internal pressure equalizer type
THERMOSTAT SWITCH	
Type	Electronic thermostat OFF: Below 3.5 ± 0.5 ˚C (38.3 ± 0.9 ˚F) ON: Above 5.0 ± 0.5 ˚C (41.0 ± 0.9 ˚F)
CONDENSER	
Type	Parallel flow
Radiation performance	15.9 kw (13,700 Kcal./hr.)
RECEIVER/DRIER	
Type	Assembly includes sight glass with dual pressure switch
Internal volume	300 cc (10 fl.oz.)
PRESSURE SWITCH	
Type	Dual pressure switch
	Low pressure control ON: 186.3±29.4 kPa (27.0±4.3 psi) OFF: 176.5±19.6 kPa (25.6±2.8 psi)
	High pressure control DIFF: 2353.6±196.1 kPa (341.3±28.4 psi) OFF: 2942.0±196.1 kPa (426.6±28.4 psi)
REFRIGERANT	
Type	HFC-134a
Specified amount	600 g (1.32 lbs.)

Torque Specifications



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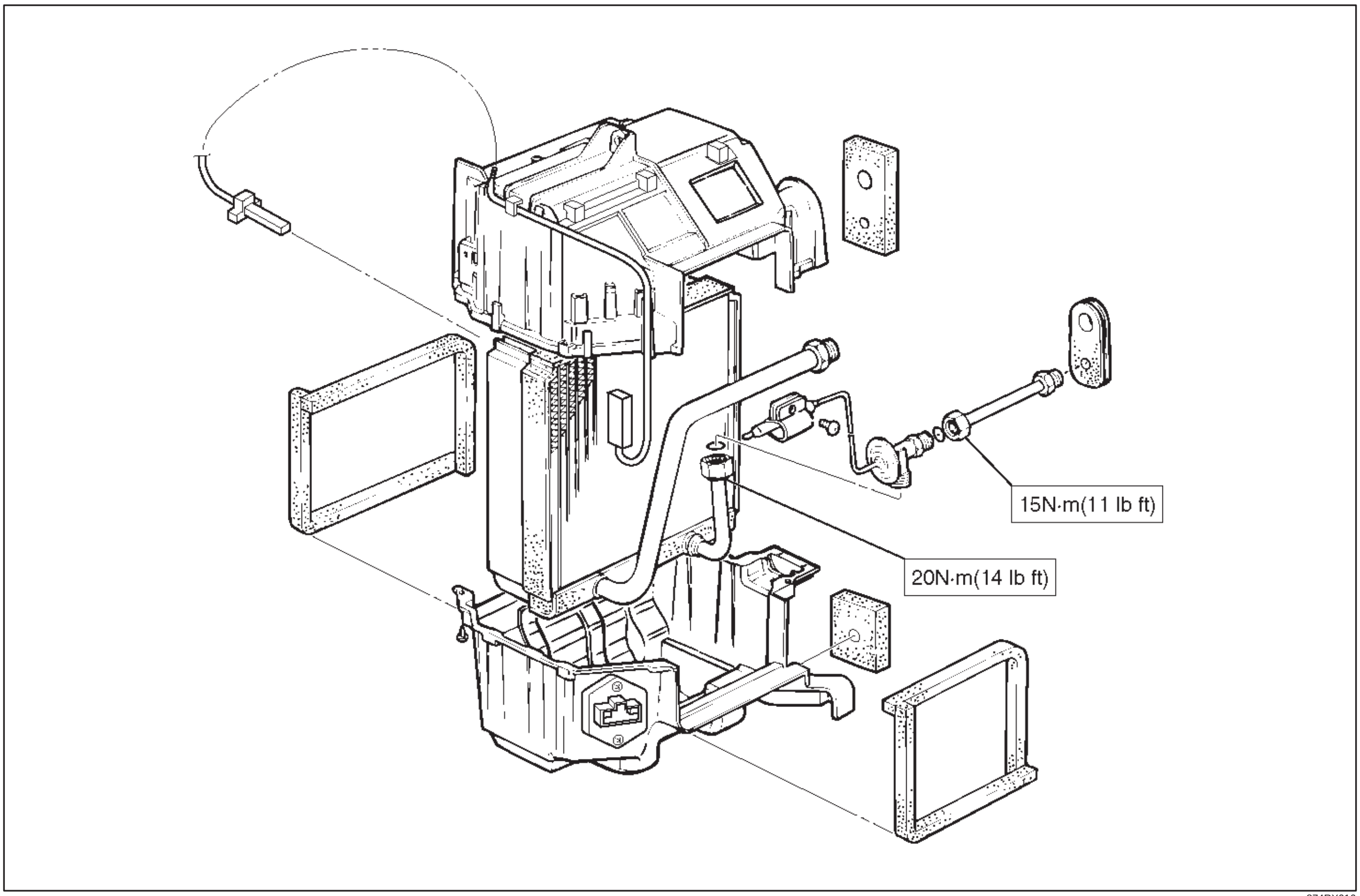


874RX016

Compressor

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS ON-VEHICLE SERVICE INFORMATION. FAILURE TO FOLLOW CAUTIONS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

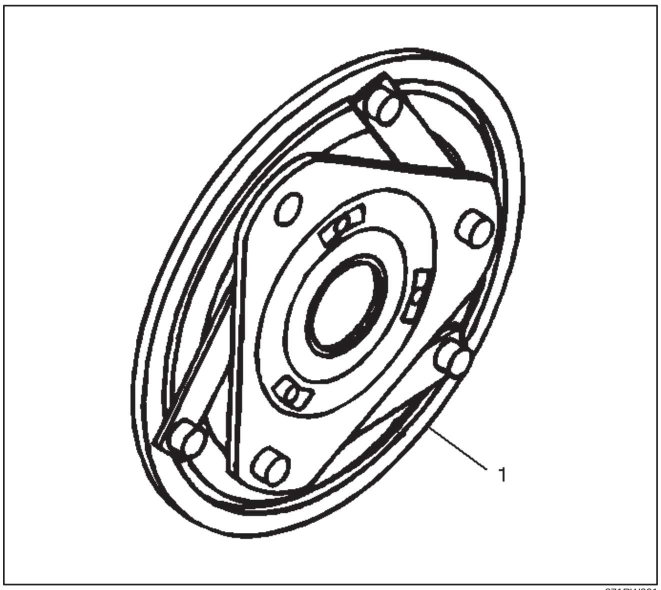
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The HD6/HT6 Automotive Conditioning Compressor and Clutch Assembly is a light weight, six cylinder axial design consisting of three double ended pistons and weighs 5.8 kg (12.7 lbs.)

Although this compressor is the same for all vehicle applications, there are differences in installations, mounting brackets, pulleys, torque cushions and switches, none of which will affect the following overhaul procedures.

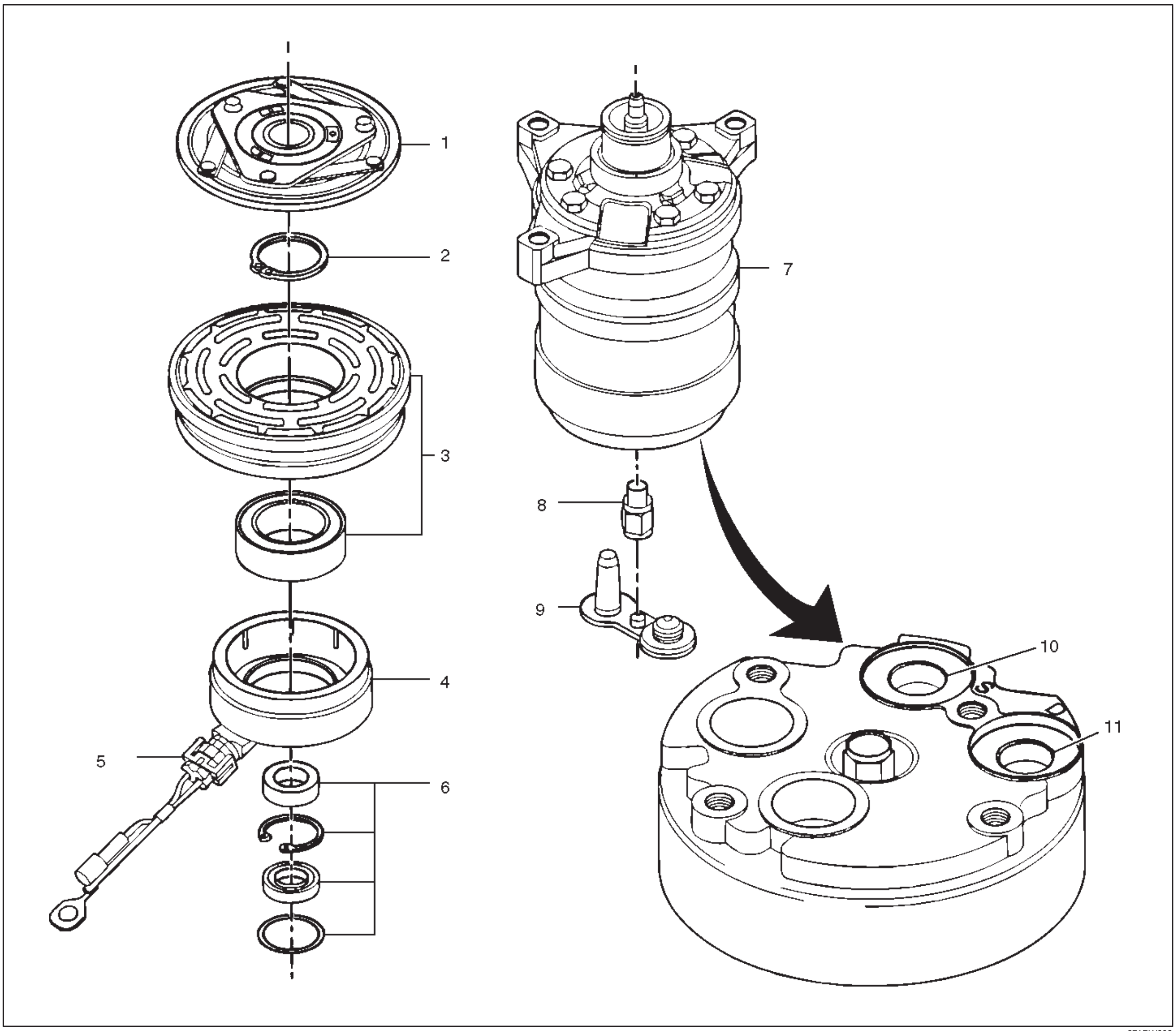
This compressor has a clutch driver design without torque cushion (1).



871RW001

Service compressors are supplied with either the control switches assembled in the rear head or a plug may be found where a control switch is required. If the service compressor requires control switches, the plug may be removed from the appropriate rear head switch cavity of the replaced compressor and assembled as prescribed in this manual.

When servicing the compressor, keep dirt or foreign material from getting on or into the compressor parts and system. Clean tools and a clean work area are important for proper service. The compressor connections and the outside of the compressor should be cleaned before any “on vehicle” repairs, or before removal of the compressor. The parts must be kept clean at all times and any parts to be reassembled should be cleaned with solvent, and dried with dry air. When necessary to use a cloth on any part, it should be of a non-lint producing type



Legend

(1) Clutch Driver
(2) Rotor Bearing Retainer
(3) Pulley Rotor and Bearing Assembly
(4) Clutch Coil Assembly
(5) Connector
(6) Shaft Seal Parts
(7) Pump Assembly
(8) High Pressure Relief Valve
(9) Shipping Cap
(10) Special 134a Suction Port
(11) Special 134a Discharge Port

The operations described below are based on bench overhaul with the compressor removed from the vehicle, except as noted. They have been prepared in order of accessibility of the components. When a compressor is removed from the vehicle for servicing, the amount of PAG lubricant remaining in the compressor should be drained, measured and recorded. This PAG lubricant should then be discarded and an equal amount of new PAG lubricant added to the compressor.

The service compressor is shipped without PAG oil. When service procedures require, use only Isuzu approved PAG oil.

Metric Thread Size Information

Compressor to mounting bracket bolts (Front)

M10 × 1.5 – 6H

Compressor to mounting bracket bolts (Rear)

M8 × 1.25 – 6H

Suction-discharge port screw

M10 × 1.5 – 6H

Compressor shaft

M9 × 1.25 – 6H

Internal hub-clutch drive assembly

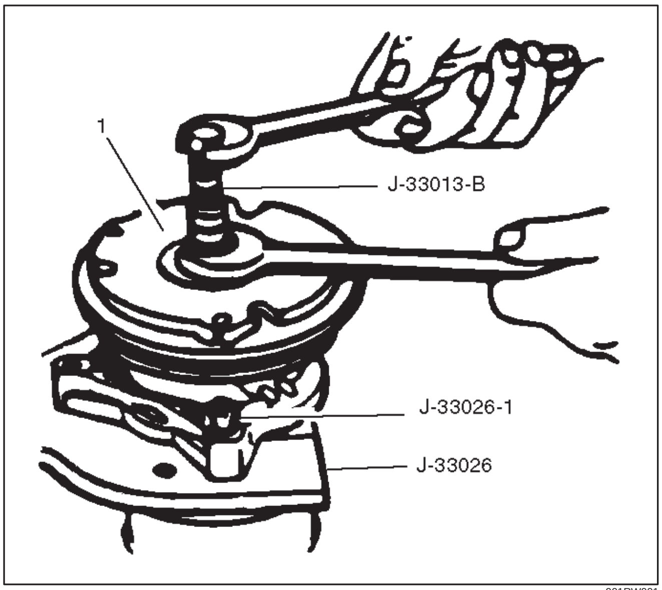
M22 × 1.5 – 6H

Compressor Clutch Plate and Hub Assembly

Removal

1. Clamp the holding fixture J-33026 in a vise and attach compressor to holding fixture with thumb screws J-33026-1.
2. With center screw forcing tip in place to thrust against the end of the shaft, thread the Clutch Plate and Hub Assembly Installer-Remover J-33013-B into the hub. Hold the body of the remover with a wrench and turn the center screw into the remover body to remove the clutch plate and hub assembly (1).

CAUTION: Do not drive or pound on the clutch hub or shaft. Internal damage to compressor may result. The forcing tip on J-33013-B remover-installer center screw must be flat or the end of the shaft/axial plate assembly will be damaged.

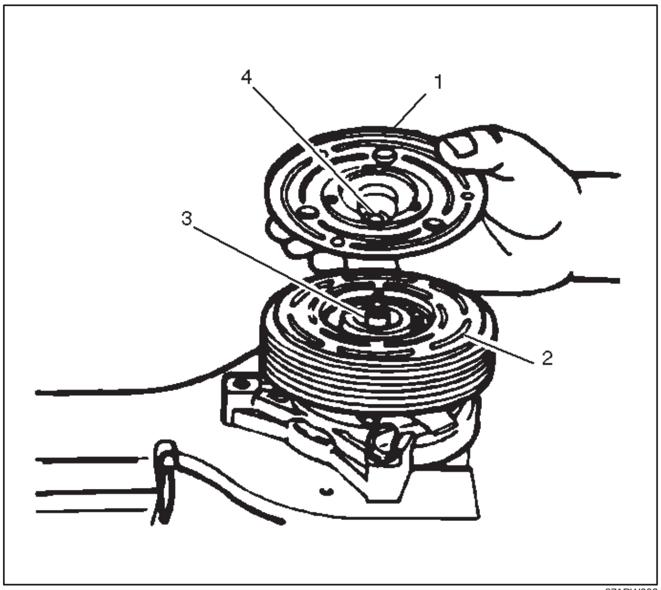


901RW001

3. Remove the shaft key and retain for reassembly.

Installation

1. Install the shaft key into the hub key groove. Allow the key to project approximately 3.2 mm (1/8 in) out of the keyway. The shaft key is curved slightly to provide an interference fit in the hub key groove.
2. Be sure the frictional surface of the clutch plate and the clutch rotor (2) are clean before installing the clutch plate and hub assembly (1).
3. Align the shaft key (4) with the shaft keyway (3) and place the clutch plate and the hub assembly onto the compressor shaft.



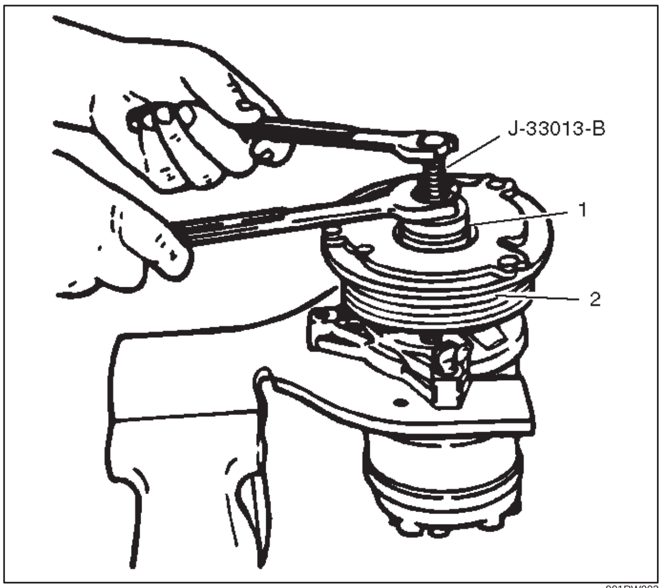
871RW003

4. Remove the forcing tip on J-33013-B clutch plate and hub assembly installer-remover center screw and reverse the body direction on the center screw, as shown in Figure.
5. Install the clutch plate and hub installer-remover J-33013-B with bearing as shown in Figure.

   The body of the J-33013-B installer-remover should be backed off sufficiently to allow the center screw to be threaded onto the end of the compressor shaft.
6. Hold the center screw with a wrench. Tighten the hex portion of the installer-remover J-33013-B body to press the hub onto the shaft. Tighten the body several turns, remove the installer and **check to see that the shaft key is still in place in the keyway before installing the clutch plate and hub assembly to its finial position**. The air gap (2) between frictional surfaces of the clutch plate and clutch rotor should be 0.50–0.76 mm (.020–.030 in).

CAUTION: If the center screw is threaded fully onto the end of the compressor shaft. or if the body of the

installer is held and the center screw is rotated, the key will wedge and will break the clutch hub.



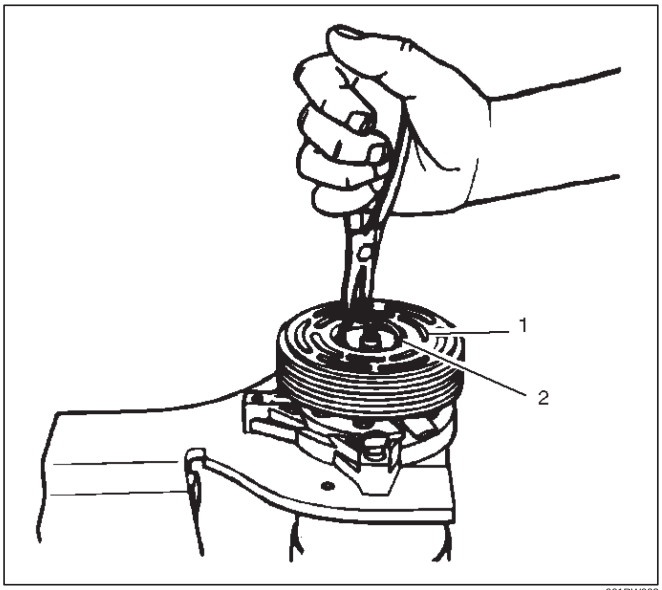
901RW002

7. Remove installer J-33013-B, check for proper positioning of the shaft key (even or slightly above the clutch hub).
8. Spin the pulley rotor by hand to see that the rotor is not rubbing the clutch drive plate.

Compressor Clutch Rotor and/or Bearing

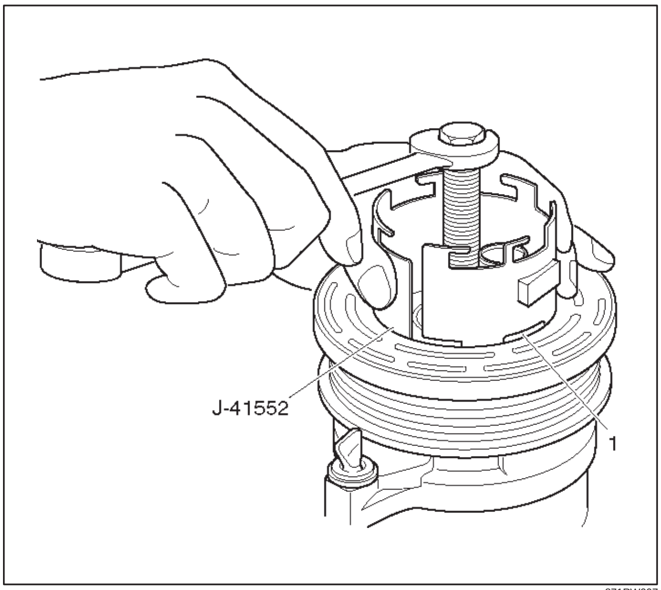
Removal

1. Remove the clutch plate and hub assembly as described previously.
2. Remove rotor (1) and bearing assembly retaining ring (2), using snap ring pliers.



901RW003

3. Install pulley rotor and bearing puller guide J-33023-A to the front head and install J-41552 pulley rotor and bearing puller down into the inner circle of slots (1) in the rotor. Turn the J-41552 puller clockwise in the slots in the rotor.
4. Hold the J-41552 puller in place and tighten the puller screw against the puller guide to remove the pulley rotor and bearing assembly.

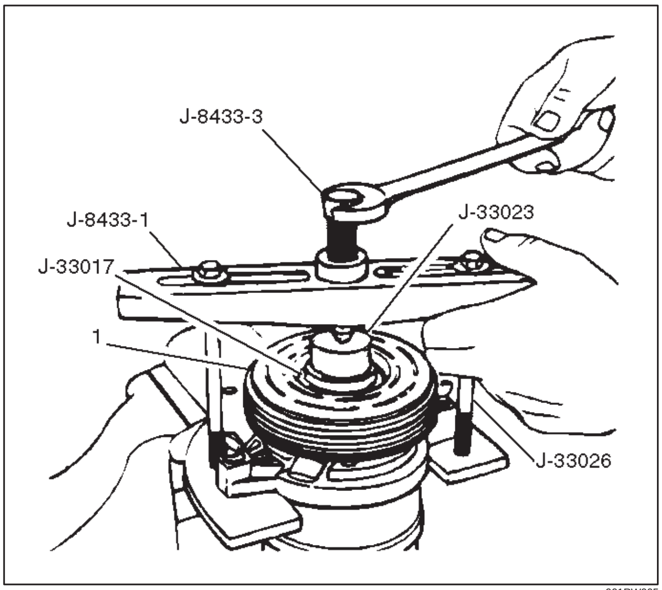


871RW007

Installation

1. With the compressor mounted to the J-34992 holding fixture, position the rotor and bearing assembly on the front head.
2. Position the J-33017 pulley, rotor and bearing installer and J-33023-A puller pilot directly over the inner race of the bearing.

3. Position puller crossbar J-8433-1 on the puller pilot J-33023-A and assemble the two J-33026 through bolts and washers through the puller bar slots and thread them into the J-33026 holding fixture. The thread of the through bolts should engage the full thickness of the holding fixture.
4. Tighten the center screw in the J-8433-1 puller crossbar to force the pulley rotor (1) and bearing assembly onto the compressor front head. Should the J-33017 pulley rotor and bearing installer slip off direct in-line contact with the inner race of the bearing, loosen the J- 8433-1 center forcing screw and realign the installer and pilot so that the J-33017 installer will properly clear the front head.



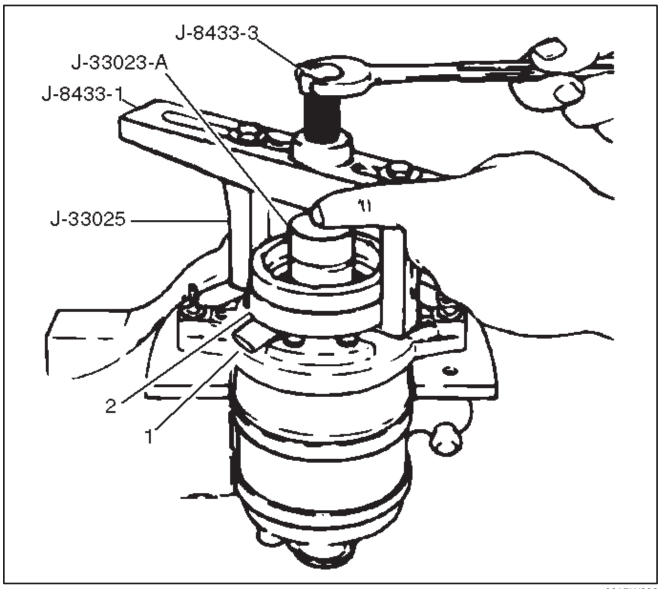
901RW005

5. Install rotor and bearing assembly retainer ring, using snap ring pliers .
6. Reinstall clutch plate and hub assembly as described previously.

Compressor Clutch Coil

Removal

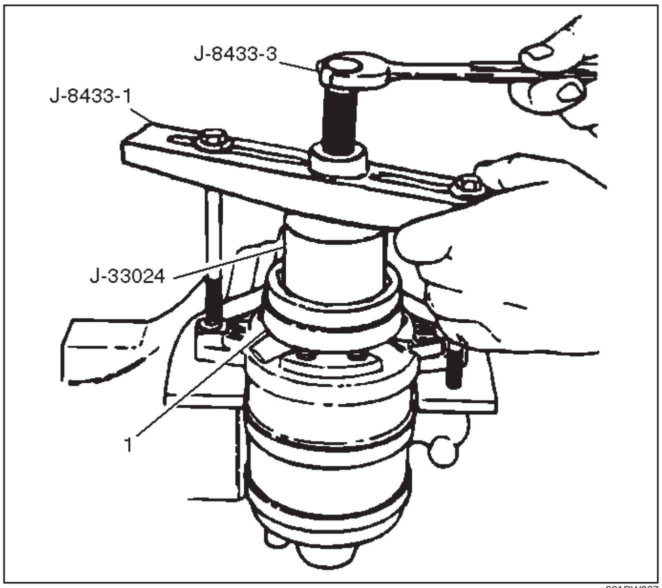
1. Perform Steps 1 through 4 of “Clutch Rotor and/or Bearings” removal procedure. **Mark clutch coil terminal location (1) on compressor front head.**
2. Install J-33023-A puller pilot on front head of compressor. Also install J-8433-1 puller crossbar with J-33025 puller legs as shown in figure.
3. Tighten J-8433-3 forcing screw against the puller pilot to remove the clutch coil (2).



901RW006

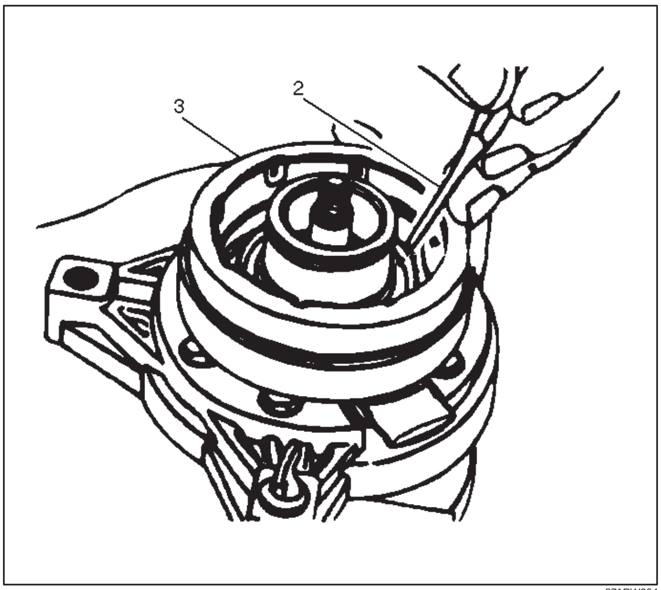
Installation

1. Place the clutch coil assembly (1) on the front head with the terminals positioned at the “marked” location.
2. Place the J-33024 clutch coil installer over the internal opening of the clutch coil housing and align installer with the compressor front head.
3. Center the J-8433-1 puller crossbar in the counter-sunk center hole of the J-33024 clutch coil installer. Install the J-33026 through bolts and washers through the crossbar slots and thread them into the holding fixture J-33026 to full fixture thickness.



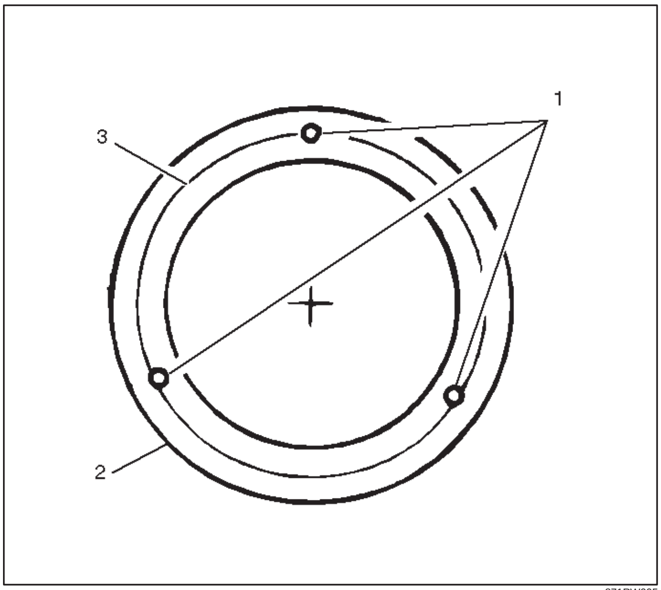
901RW007

4. Turn the center forcing screw of J-8433-1 puller crossbar to force the clutch coil onto the front head. Be sure clutch coil and J-33024 installer stay “in-line” during installation.
5. When coil is fully seated on the front head, use a 1/8 in diameter drift punch (2) and stake the front head at three places 120 degrees apart, to ensure clutch coil (3) remains in position.



871RW004

- Stake size should be only one-half the area of the punch tip and be only approximately 0.28–0.35 mm (.010–.015 in) deep.



871RW005

Legend

(1) Stake Front Head 0.28–0.35 mm Deep (0.10–015 in)
(2) Clutch Coil Housing
(3) Front Head Surface

6. Install rotor and bearing assembly and the clutch plate and hub assembly as described previously.

Compressor Shaft Seal

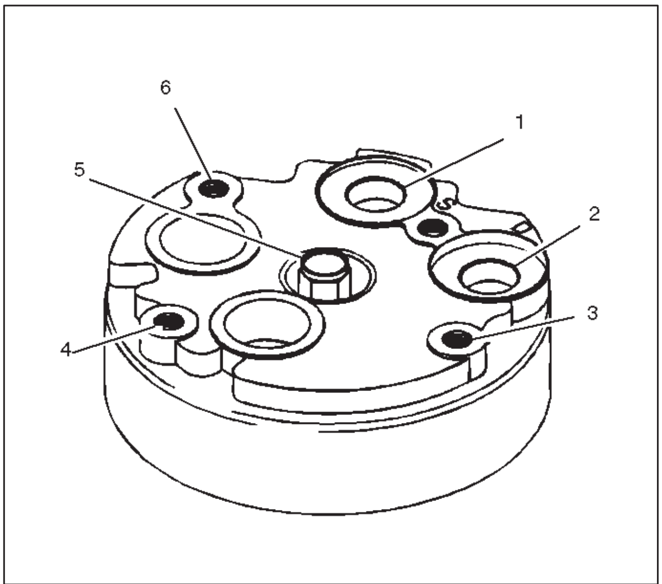
Service Precaution

When replacing the shaft seal assembly, pressure relief valve or control switches, it will be necessary to recover the refrigerant. Other than clutch repair procedures, the same holds true for any disassembly of the compressor. A clean workbench covered with a sheet of clean paper, and a place (clean trays, etc) for all parts being removed and replaced is important, as is the use of proper clean service tools.

CAUTION: Any attempt to use makeshift or inadequate service tools or equipment may result in damage and/or improper compressor operation.

All parts required for servicing the internal compressor are protected by a preservative process and packaged in a manner which will eliminate the necessity of cleaning, washing or flushing of the parts. The parts can be used in the internal assembly just as they are removed from the service package. **Seals and protective packaging should be left intact until just prior to installation**.

If the compressor rear head, front head or cylinder and shaft assembly is to be serviced or replaced, the oil in the compressor must be drained, measured, recorded and replaced.



871RW006

Legend

(1) Suction Port
(2) Discharge Port
(3) Mounting Boss
(4) Mounting Boss
(5) Pressure Relief Valve
(6) Mounting Boss

Seal Leak Detection

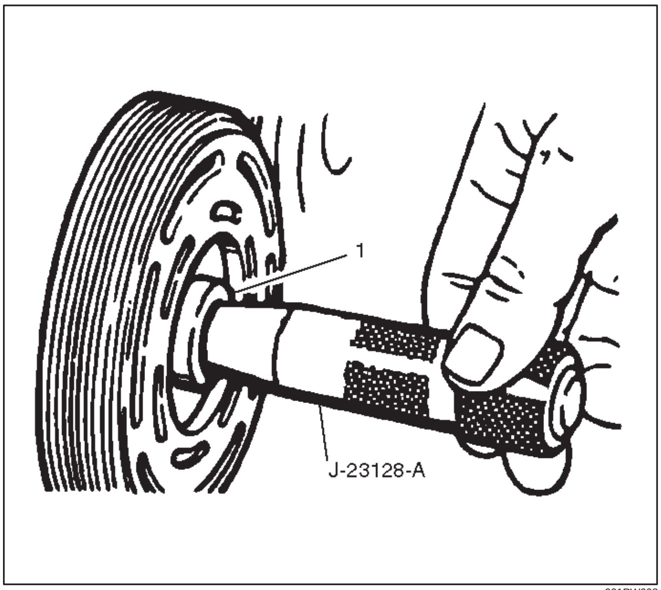
A shaft seal should not be changed because of small amounts of oil found on an adjacent surface but only after actual refrigerant leakage is found using an approved leak detector.

CAUTION: Handling and care of seal protector is important. If seal protector is nicked or the bottom flared, the new seal may be damaged during installation.

Removal

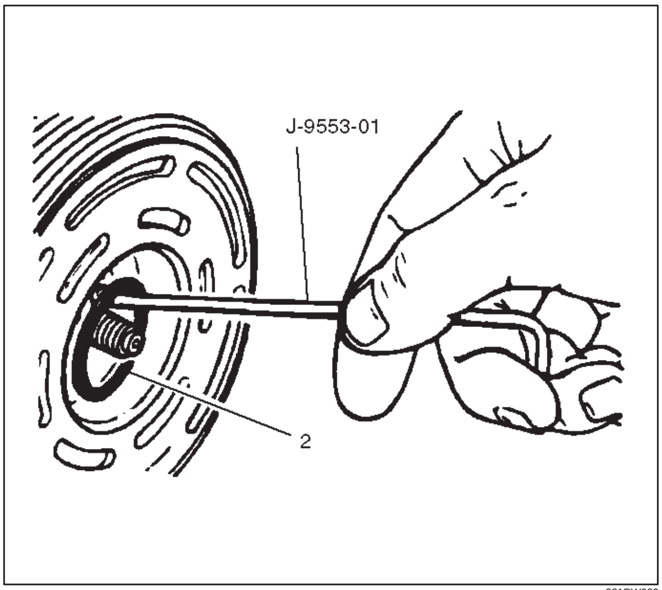
1. Recover the refrigerant using Refrigerant Recovery System.
2. Loosen and reposition compressor in mounting brackets, if necessary.
3. Remove clutch plate and hub assembly from compressor as described previously.
4. Remove the shaft seal retainer ring, using snap ring pliers.
5. Thoroughly clean inside of compressor neck area surrounding the shaft, the exposed portion of the seal, the retainer ring groove and the shaft itself. Any dirt or foreign material getting into compressor may cause damage.
6. Fully engage the knurled tangs of Seal Remover-Installer J-23128-A into the recessed portion of the Seal (1) by turning the handle clockwise. Remove the Seal from the compressor with a rotary-pulling motion.

   Discard the seal. The handle must be hand-tightened securely. Do not use a wrench or pliers.



901RW008

7. Remove and discard the seal seat O-ring (2) from the compressor neck using O-ring remover J-9553-01.



901RW009

8. Recheck the shaft and inside of the compressor neck for dirt or foreign material and be sure these areas are perfectly clean before installing new parts.

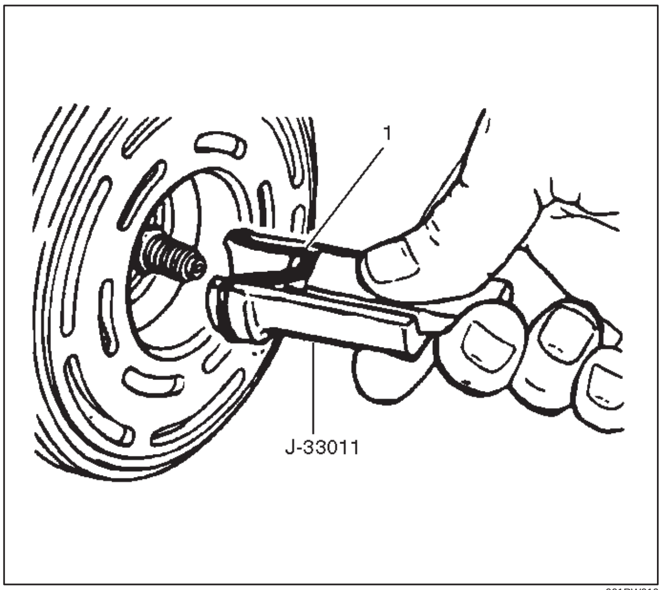
Cleaning

Thoroughly clean O-ring seal groove in front head.

CAUTION: Seals should not be re-used. Always use a new specification service seal on rebuild. Be sure that the seal to be installed is not scratched or damaged in anyway. Make sure that the seal seat and seal are free of lint and dirt that could damage the seal surface or prevent sealing.

Installation

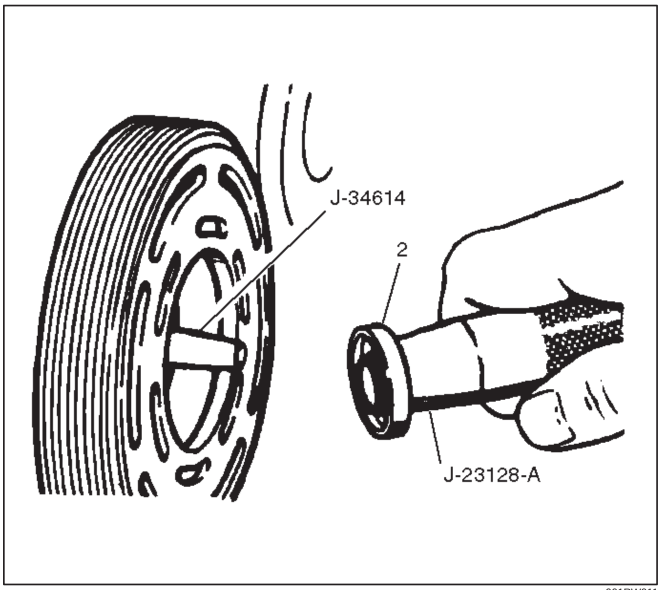
1. Dip the new seal seat O-ring (1) in clean 525 viscosity refrigerant oil and assemble onto O-ring installer J-33011.



901RW010

2. Insert the O-ring installer J-33011 into the compressor neck until the installer “bottoms”. Lower the moveable slide of the O-ring installer to release the O-ring into the seal O-ring lower groove (The compressor neck top groove is for the shaft seal retainer ring.) Rotate the installer to seat the O-ring and remove the installer.
3. Dip the new seal in clean 525 viscosity refrigerant oil and assemble seal to Seal Installer J-23128-A, by turning handle clockwise. The stamped steel case side of the lip seal must be engaged with knurled tangs of installer so that flared-out side of lip seal is facing and installed towards the compressor. Install seal protector J-34614, in the seal lip and place over the compressor shaft, and push the seal in place with a rotary motion or place the seal protector J-34614 over end of compressor shaft, and slide the new seal onto the shaft with a rotary motion until it stops. Take care not to dislodge the O-ring. Be sure the seal (2) makes good contact with the O-ring. Disengage the installer from the seal and remove the installer J-23128-A and the seal protector J-34614.

CAUTION: Handling and care of seal protector is important. If seal protector is nicked or the bottom flared, the new seal may be damaged during installation.



901RW011

4. Install the new seal retainer ring with its flat side against the Seal, using Snap-Ring Pliers. Use the sleeve from O-ring installer J-33011 to press in on the seal retainer ring so that it snaps into its groove.
5. To leak test, install compressor leak test fixture J-39893 on rear head of compressor and connect gage charging lines and Refrigerant Recovery System. Pressurize suction and high-side of compressor with R-134a Refrigerant. Temporarily install (M9 $\times$ 1.25 thread on shaft) nut and, with the compressor in horizontal position, rotate the compressor shaft in normal direction of rotation several times by hand. Leak test the seal area and correct and leak found. Recover the refrigerant. Remove shaft nut.

6. Remove any excess oil resulting from installing the new seal parts from the shaft and inside the compressor neck.
7. Install the clutch plate and hub assembly as described previously.
8. Reinstall compressor belt and tighten bracket.
9. Evacuate and charge the refrigerant system.

Compressor Pressure Relief Valve

Removal

1. Recover the refrigerant using Refrigerant Recovery System.
2. Remove old pressure relief valve.

Installation

1. Clean valve seat area on rear head.
2. Lubricate O-ring of new pressure relief valve and O-ring assembly with new 525 viscosity refrigerant oil. Install new valve and torque in place, 9.0 N·m (6.1 ft lbs)
3. Evacuate and recharge the system.
4. Leak test system.

Compressor Oil

Compressor Oil Check

The oil used to lubricate the compressor is circulating with the refrigerant.
Whenever replacing any component of the system or a large amount of gas leakage occurs, add oil to maintain the original amount of oil.

(Oil Capacity)	
Capacity total in system	150 cc (5.0 fl.oz)
Compressor (Service parts) charging amount	150 cc (5.0 fl.oz)

Checking and Adjusting Oil Quantity for Used Compressor

1. Perform oil return operation. Refer to Oil Return Operation in this section.
2. Discharge and recover refrigerant and remove the compressor.
3. Drain the compressor oil and measure the extracted oil with a measuring cylinder.
4. If the amount of oil drained is much less than 90 cc (3.0 fl. oz.), some refrigerant may have leaked out. Conduct a leak tests on the connections of each system, and if necessary, repair or replace faulty parts.
5. Check the compressor oil contamination. (Refer to Contamination of Compressor Oil in this section.)
6. Adjust the oil level following the next procedure below.

(Collected Amount)	(Charging Amount)
more than 90 cc (3.0 fl.oz)	same as collected amount
less than 90 cc (3.0 fl.oz)	90 cc (3.0 fl.oz)

7. Install the compressor, then evacuate, charge and perform the oil return operation.
8. Check system operation.

When it is impossible to preform oil return operation, the compressor oil should be checked in the following order:

1. Discharge and recover refrigerant and remove the compressor.
2. Drain the compressor oil and measure the extracted oil with a measuring cylinder.
3. Check the oil for contamination.
4. If more than 90 cc (3.0 fl. oz.) of oil is extracted from the compressor, supply the same amount of oil to the compressor to be installed. If the amount of oil extracted is less than 90 cc (3.0 fl. oz.), recheck the compressor oil in the following order:
5. Supply 90 cc (3.0 fl. oz.) of oil to the compressor and install it onto the vehicle.
6. Evacuate and recharge with the proper amount of refrigerant.
7. Perform the oil return operation.
8. Remove the compressor and recheck the amount of oil.
9. Adjust the compressor oil, if necessary.

(Collected Amount)	(Charging Amount)
more than 90 cc (3.0 fl.oz)	same as collected amount
less than 90 cc (3.0 fl.oz)	90 cc (3.0 fl.oz)

Checking and Adjusting for Compressor Replacement

The oil is not charged in compressor (service parts). So it is necessary to charge the proper amount of oil to the new compressor.

1. Perform oil return operation.
2. Discharge and recover the refrigerant and remove the compressor.
3. Drain the compressor oil and measure the extracted oil.
4. Check the compressor oil for contamination.
5. Adjust the oil level as required.

(Amount of oil drained from used compressor)	(Charging amount of oil to new compressor)
more than 90 cc (3.0 fl.oz)	same as drained amount
less than 90 cc (3.0 fl.oz)	90 cc (3.0 fl.oz)

6. Evacuate, charge and perform the oil return operation.
7. Check the system operation.

Contamination of Compressor Oil

Unlike engine oil, no cleaning agent is added to the compressor oil. Even if the compressor runs for a long period of time (approximately one season), the oil never becomes contaminated as long as there is nothing wrong with the compressor or its method of use.

Inspect the extracted oil for any of the following conditions:

- The capacity of the oil has increased.
- The oil has changed to red.
- Foreign substances, metal powder, etc., are present in the oil.

If any of these conditions exists, the compressor oil is contaminated. Whenever contaminated compressor oil is discovered, the receiver/drier must be replaced.

Oil Return Operation

There is close affinity between the oil and the refrigerant. During normal operation, part of the oil recirculates with the refrigerant in the system. When checking the amount of oil in the system, or replacing any component of the system, the compressor must be run in advance for oil return operation. The procedure is as follows:

1. Open all the doors and the engine hood.
2. Start the engine and air conditioning switch to “ON” and set the fan control knob at its highest position.
3. Run the compressor for more than 20 minutes between 800 and 1,000 rpm in order to operate the system.
4. Stop the engine.

Replacement of Component Parts

When replacing the system component parts, supply the following amount of oil to the component parts to be installed.

(Component parts to be installed)	(Amount of Oil)
Evaporator	50 cc (1.7 fl. oz.)
Condenser	30 cc (1.0 fl. oz.)
Receiver/dryer	30 cc (1.0 fl. oz.)
Refrigerant line (one piece)	10 cc (0.3 fl. oz.)

Compressor Leak Testing (External and Internal)

Bench-Check Procedure

1. Install test plate J-39893 on rear head of compressor.
2. Using Refrigerant Recovery System, attach center hose of manifold gage set on charging station to a refrigerant drum standing in an upright drum.
3. Connect charging station high and low pressure lines to corresponding fittings on test plate J-39893. Suction port (low-side) of compressor has large internal opening. Discharge port (high-side) has smaller internal opening into compressor and deeper recess.
4. Open low pressure control, high pressure control and refrigerant control on charging station to allow refrigerant vapor to flow into compressor.
5. Using a leak detector, check for leaks at pressure relief valve, rear head switch location, compressor front and rear head seals, center cylinder seal, through bolt head gaskets and compressor shaft seal. After checking, shut off low pressure control and high-pressure control on charging station.
6. If an external leak is present, perform the necessary corrective measures and recheck for leaks to make certain the leak has been connected.
7. Recover the refrigerant.
8. Disconnect both hoses from the test plate J-39893.
9. Add 90 ml (3 oz.) new PAG lubricant to the compressor assembly. Rotate the complete compressor assembly (not the crankshaft or drive plate hub) slowly several turns to distribute oil to all cylinder and piston areas.
10. Install a M9 $\times$ 1.25 threaded nut on the compressor crankshaft if the drive plate and clutch assembly are not installed.
11. Using a box-end wrench or socket and handle, rotate the compressor crankshaft or clutch drive plate on the crankshaft several turns to insure piston assembly to cylinder wall lubrication.
12. Using Refrigerant Recovery System, connect the charging station high-pressure line to the test plate J-39893 high-side connector.
13. Using Refrigerant Recovery System, connect the charging station low-pressure line to the low pressure port of the test plate J-39893. Oil will drain out of the compressor suction port if the compressor is positioned with the suction port downward.

14. Attach the compressor to the J-34992 holding fixture and mount the compressor in a vise so that the compressor will be in a horizontal position and the shaft can be turned with a wrench.
15. Using a wrench, rotate the compressor crankshaft or drive plate hub ten complete revolutions at a speed of approximately one-revolution per second turning the compressor at less than one-revolution per second can result in a lower pump-up pressure and disqualify a good pumping compressor.
16. Observe the reading on high-pressure gauge at the completion of the tenth revolution of the compressor. The pressure reading for a good pumping compressor should be 690 kPa (100 psi) or above. A pressure reading of less than 620 kPa (90 psi) would indicate one or more suction and/or discharge valves leaking an internal leak, or an inoperative valve, and the refrigerant must be recovered and the compressor disassembled and checked for cause of leak. Repair as needed, reassemble and repeat the pump-up test. Externally leak test.
17. When the pressure pump-up test is completed, recover the refrigerant from the high-side and remove the test plate J-39893.
18. Tilt the compressor so that the compressor suction and discharge ports are down. Drain the PAG lubricant from the compressor.
19. Allow the compressor to drain for 10 minutes, then refill with the proper amount of PAG lubricant, per oil balance procedure described previously. The PAG lubricant may be poured into the suction port. If further assembly or processing is required, a shipping plate or test plate J-39893 should be installed to keep out air, dirt and moisture until the compressor is installed.

Special Tools

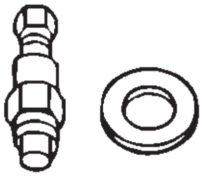
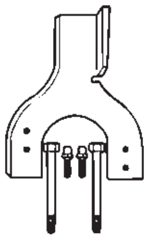
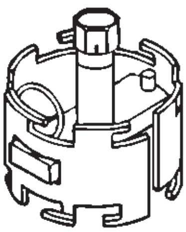
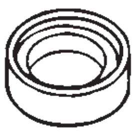
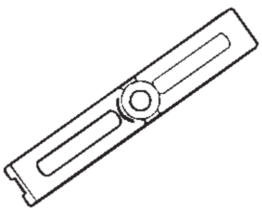
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RW012	**J-33013-B** Hub and Clutch Drive Plate Asm. remover
 901RW013	**J-33026** Compressor Holding Fixture
 901RW015	**J-33023-A** Puller Pilot
 901RW016	**J-41552** Pulley Puller
 901RW017	**J-33017** Pulley and Bearing Assembly Installer
 901RW018	**J-8433-1** Puller Bar

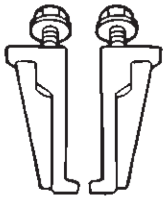
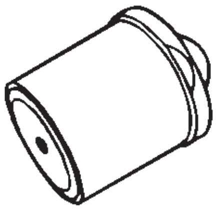
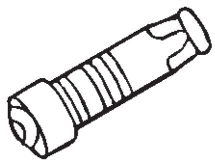
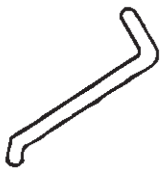
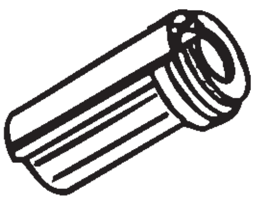
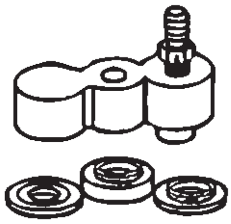
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RW019	**J-8433-3** Forcing Screw
 90RW020	**J-33025** Clutch Coil Installer Adapter
 901RW021	**J-33024** Clutch Coil Installer Adapter
 901RW024	**J-23128-A** Seal Seat Remover and Installer
 901RW025	**J-9553-01** O-Ring Remover
 901RW026	**J-33011** O-Ring Installer

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RW027	**J-34614** Shaft Seal Protector
 901RW032	**J-39893** Pressure Testing Connector

Automatic Air Conditioning System

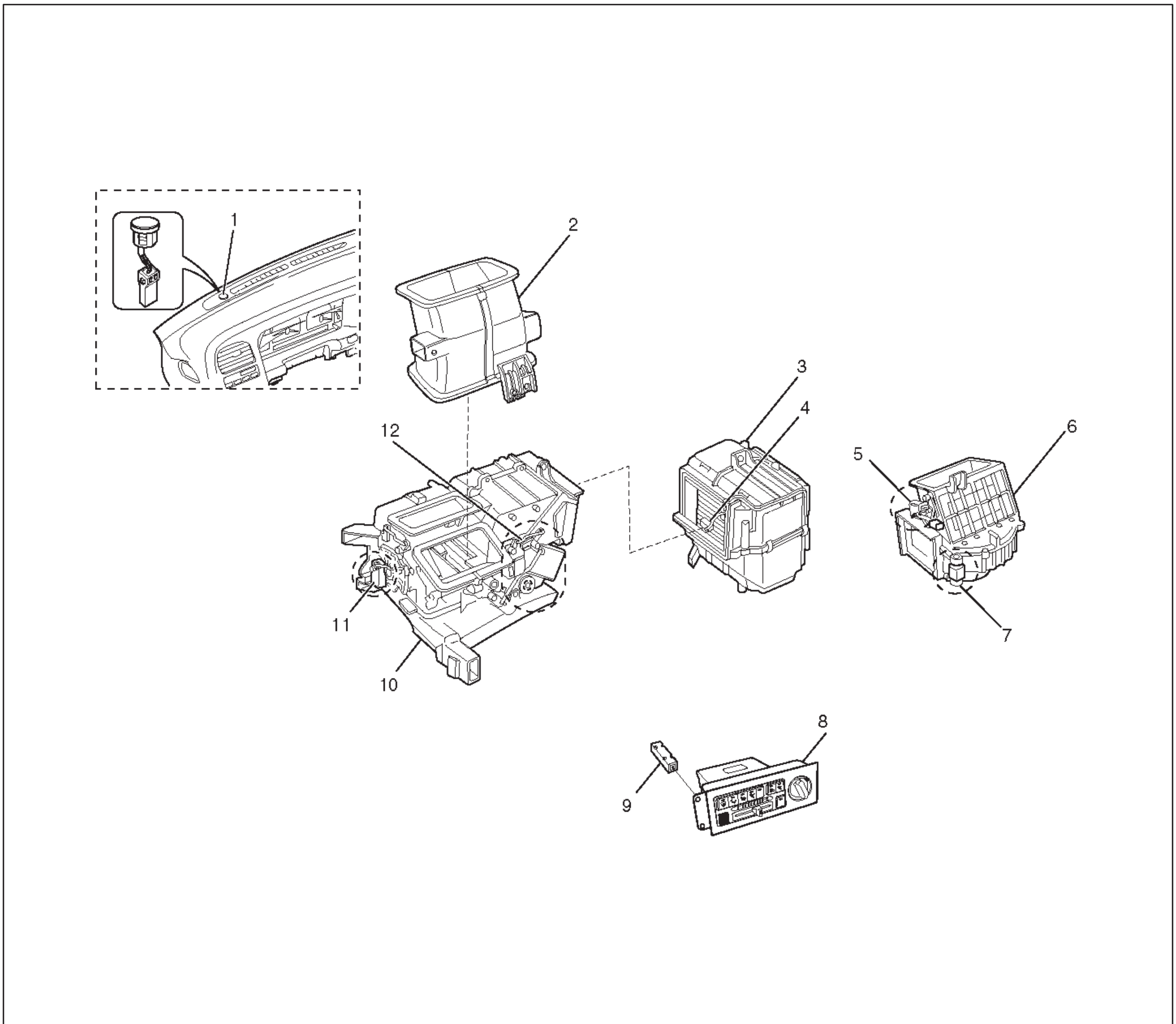
General Description

Using a variety of sensors, this automatic heater and air conditioner accurately senses outside air temperature, solar radiation quantity, evaporator’s blowing temperature, and interior temperature, then enters these data to the automatic heater/air conditioner control unit (equipped with the built-in micro-computer). The data provided to the control unit enables to automatically control blow temperature and blow air quantity, turn on or off the compressor and switch the blow port as well as switching between the fresh air intake and interior air circulation.

Resetting the automatic function allows you to switch to the manual control mode.

The self-diagnoisis function of the automatic heater and air conditioner control unit (with the built–in micro–computer) allows the unit to access and diagnose a failed part easier and quicker.

Full Automatic Air Conditioner Parts Configuration

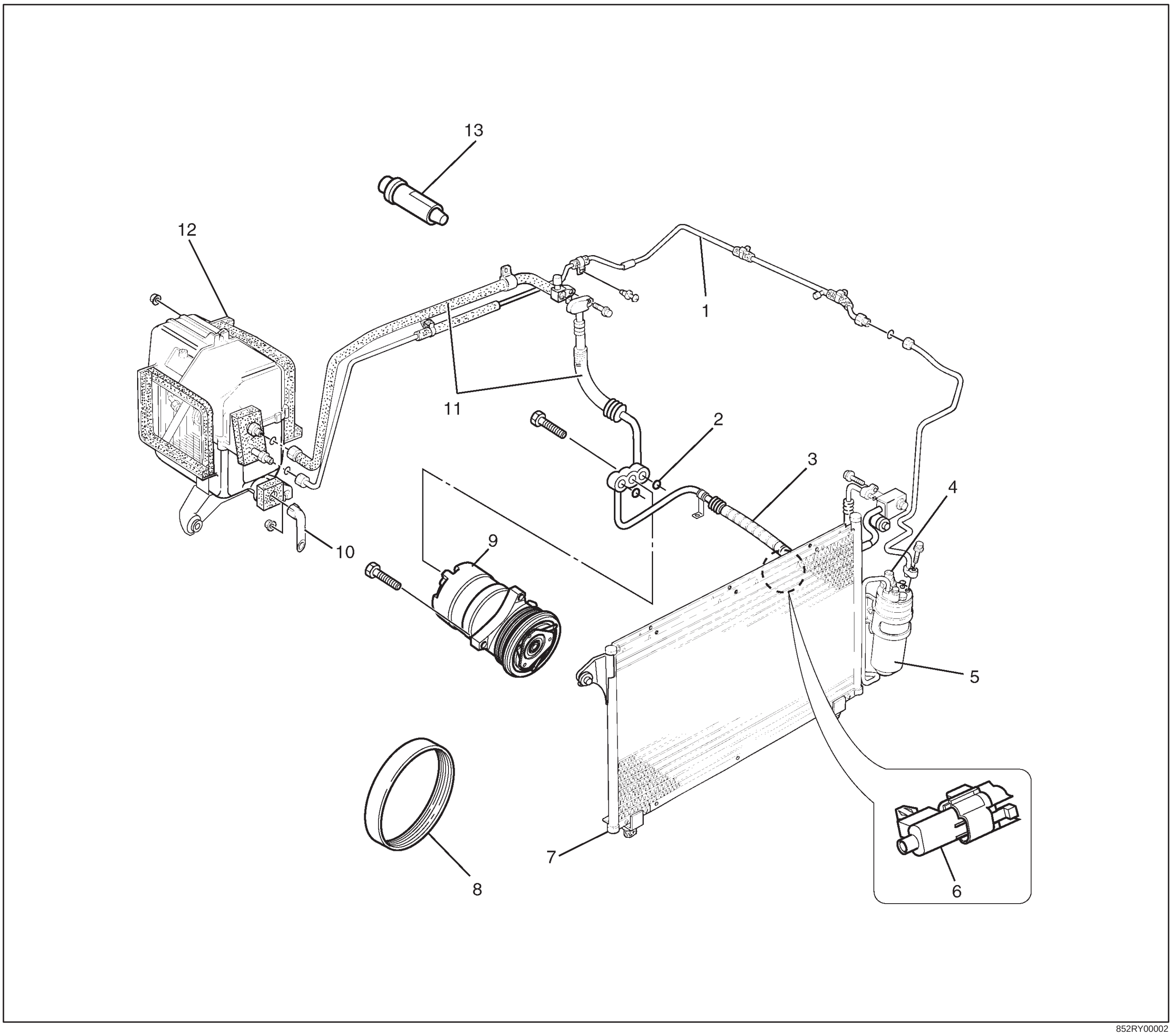


865RY00008

Legend

(1) Sun Sensor
(2) Lower Center Vent Box
(3) Evaporator Assembly
(4) Duct Sensor
(5) Intake Actuator
(6) Blower Unit
(7) Max – High Relay
(8) Automatic Air Conditioner Control Unit
(9) In Car Sensor
(10) Heater Unit
(11) Mode Actuator
(12) Mix Actuator

Refrigerant Line and Associated Parts

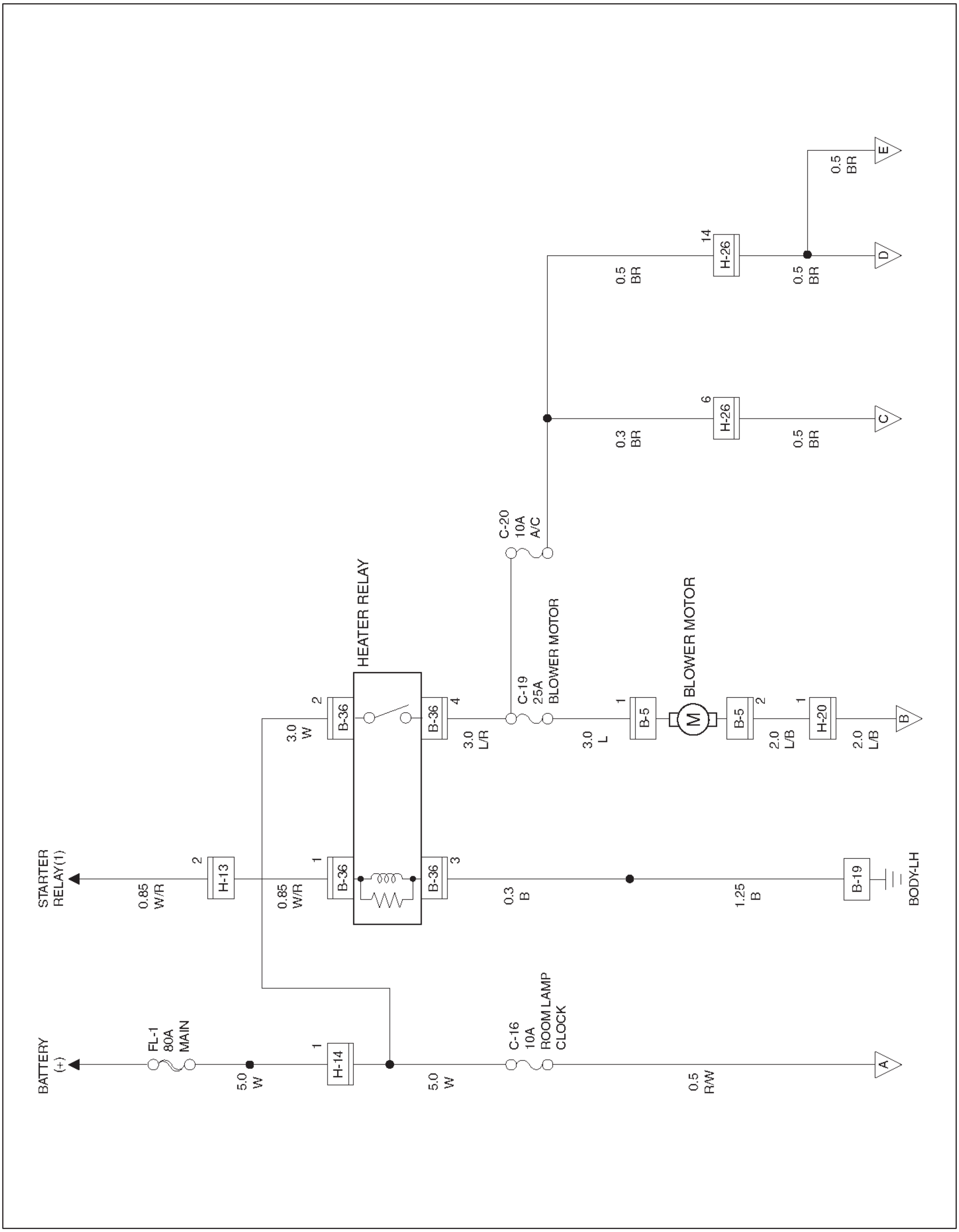


Legend

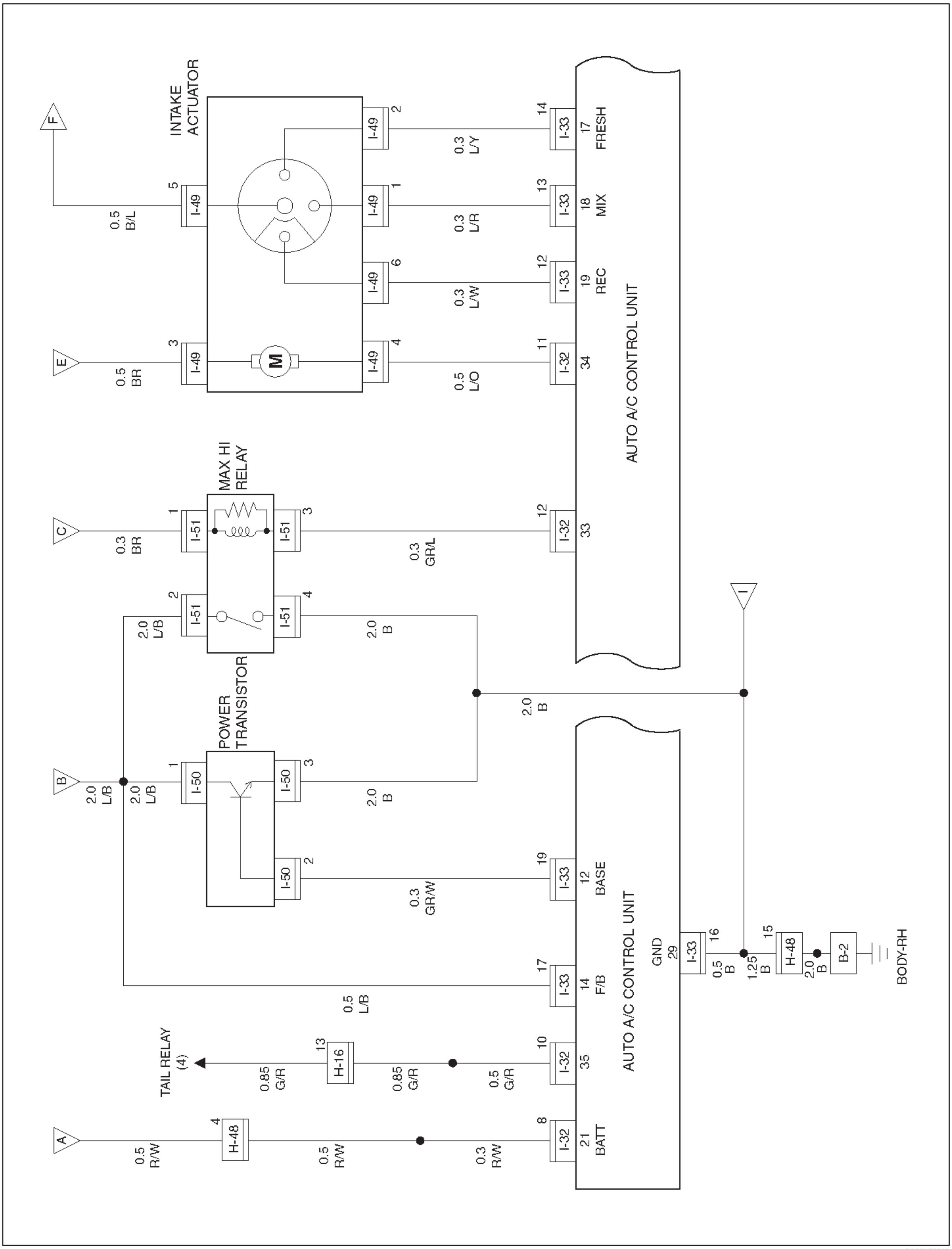
(1) Liquid Line (High Pressure Pipe)
(2) O – Ring
(3) Discharge Line (High Pressure Hose)
(4) Pressure Switch
(5) Receiver Drier
(6) Ambient Sensor
(7) Condenser Assembly
(8) Drive Belt
(9) Compressor
(10) Drain Hose
(11) Suction Line (Low-Pressure Hose)
(12) Evaporator Assembly
(13) A/C Switch

Circuit Diagram

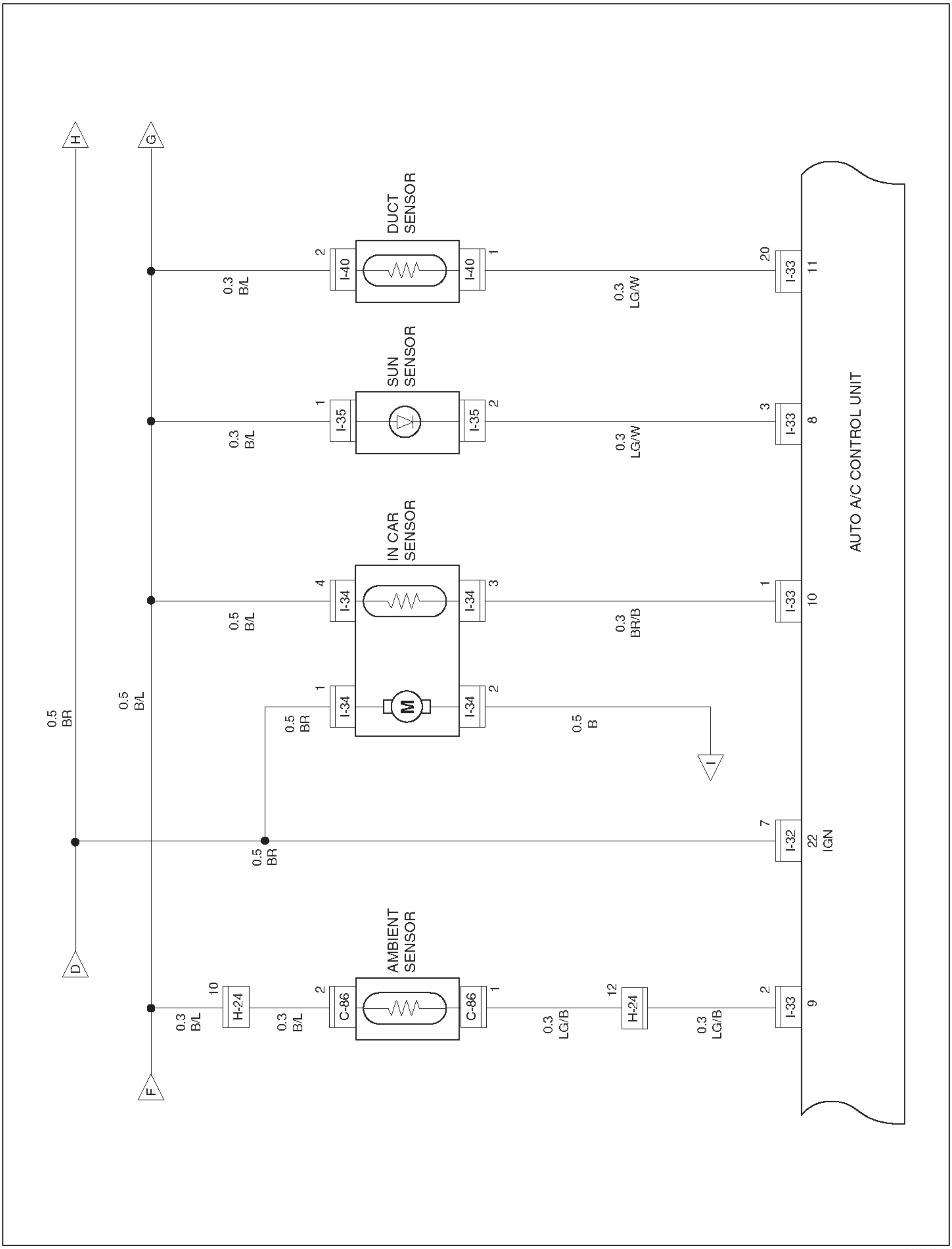
6VE1 Engine



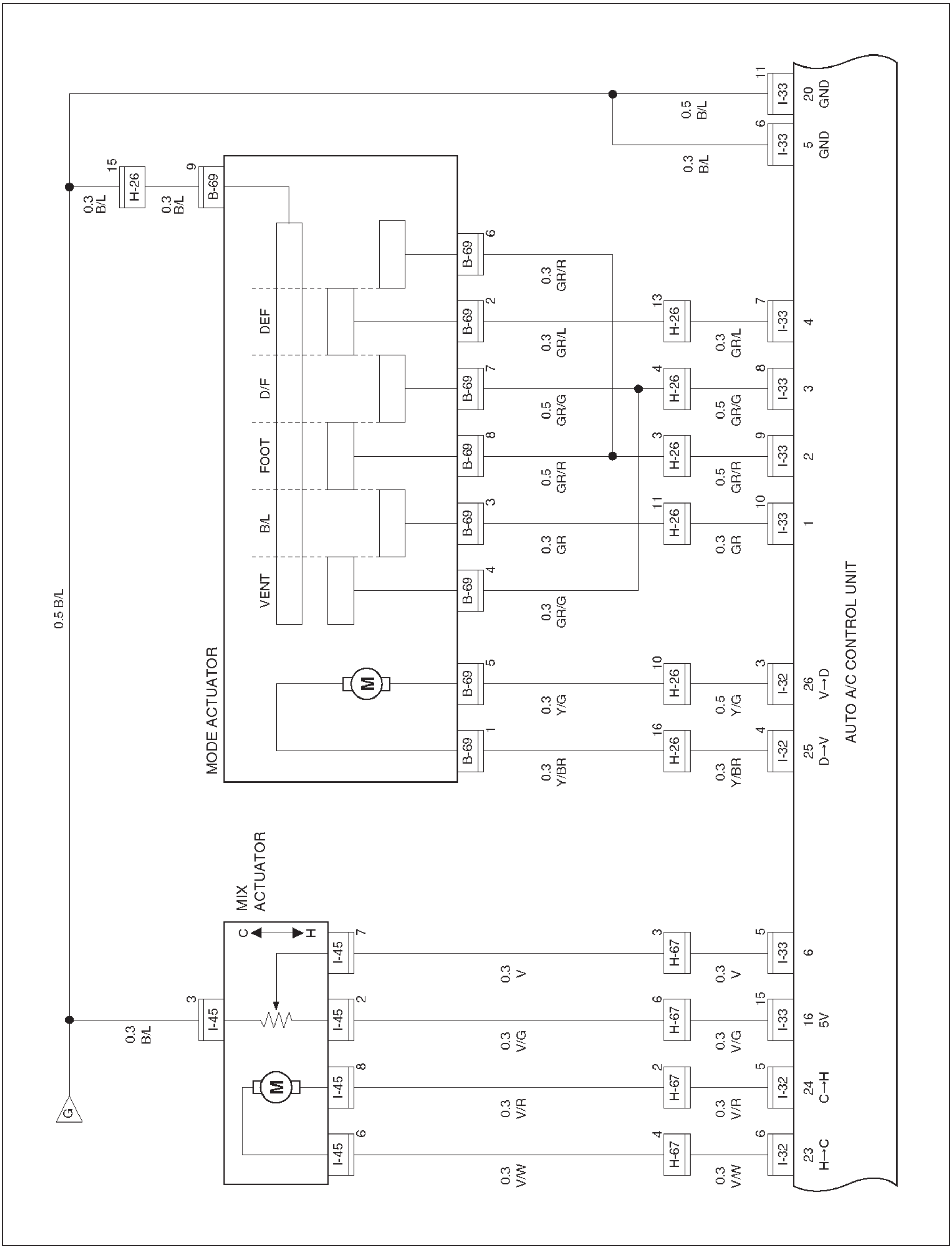
D08RY00109


INTAKE ACTUATOR
MAX HI RELAY
POWER TRANSISTOR
AUTO A/C CONTROL UNIT
AUTO A/C CONTROL UNIT
TAIL RELAY (4)
BODY-RH
FRESH
MIX
REC
BASE
F/B
GND
BATT
I-49
I-51
I-50
I-33
I-32
H-48
H-16
B-2
0.5 B/L
0.5 BR
0.3 BR
2.0 L/B
0.3 L/Y
0.3 L/R
0.3 L/W
0.5 L/O
0.3 GR/L
2.0 B
0.3 GR/W
0.5 L/B
0.85 G/R
0.5 G/R
0.5 R/W
0.3 R/W
0.5 B
1.25 B
M

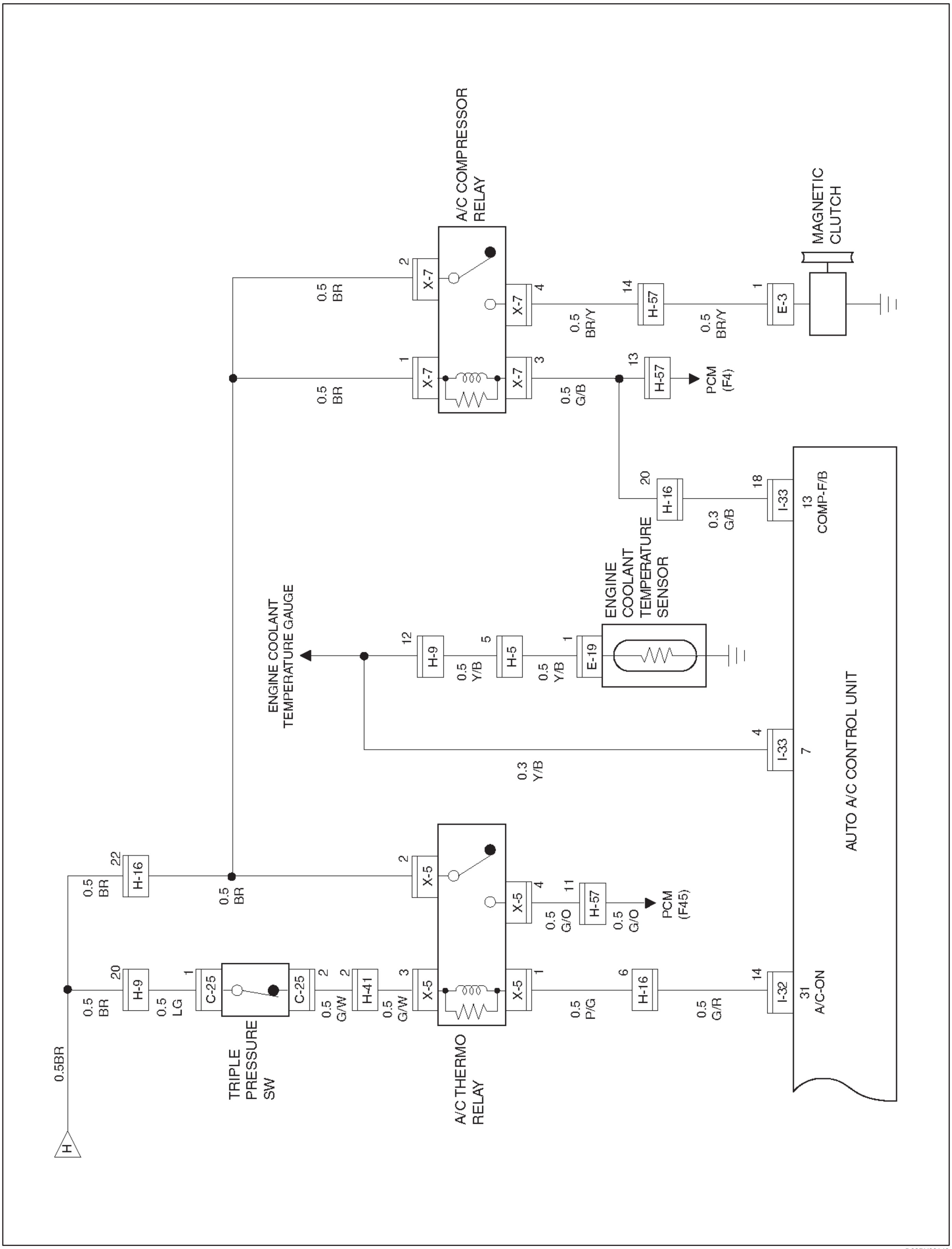
D08RY00110


H
G
D
F
I
DUCT SENSOR
SUN SENSOR
IN CAR SENSOR
AMBIENT SENSOR
M
AUTO A/C CONTROL UNIT
I-40
I-35
I-34
I-33
I-32
C-86
H-24
0.3 B/L
0.5 B/L
0.5 BR
0.3 LG/W
0.3 BR/B
0.5 B
0.3 LG/B
IGN

D08RY00155


MODE ACTUATOR
MIX ACTUATOR
AUTO A/C CONTROL UNIT
VENT
B/L
FOOT
D/F
DEF
0.5 B/L
G
C
H
M
B-69
H-26
H-67
I-33
I-32
I-45
GND
5V
V→D
D→V
C→H
H→C

D08RY00147


A/C COMPRESSOR RELAY
MAGNETIC CLUTCH
PCM (F4)
PCM (F45)
ENGINE COOLANT TEMPERATURE GAUGE
ENGINE COOLANT TEMPERATURE SENSOR
13 COMP-F/B
AUTO A/C CONTROL UNIT
31 A/C-ON
TRIPLE PRESSURE SW
A/C THERMO RELAY
0.5BR
X-7
X-5
H-57
E-3
H-16
I-33
I-32
H-9
H-5
E-19
C-25
H-41
0.5 BR
0.5 BR/Y
0.5 G/B
0.3 G/B
0.5 Y/B
0.3 Y/B
0.5 LG
0.5 G/W
0.5 G/O
0.5 P/G
0.5 G/R

D08RY00148

Functions and Features

Automatic interior temperature control

This function enables to maintain the interior temperature at the level specified from the temperature control switch despite of changes in factors such as vehicle speeds, outside air temperature and number of passengers.

Maximum cooling and heating function

You can select FC (Full cool, namely maximum cooling temperature) or FH (Full heat, maximum heating temperature) from the temperature control lever.

Automatic air flow control

Air flow is automatically and consecutively fine tuned according to the specified interior temperature and changes in aperture of the heater unit mix door.

Mode (blow port) control

This function automatically selects either one of the VENT, BI-LEVEL, FOOT or DEF mode for the blow port according to changes of temperature on the blow port. Using the mode switch allows you to select a desired blow port manually.

Intake (switching between the fresh air intake and circulation of interior air) control

The intake (switching between fresh air intake and circulation of interior air) mode automatically selects either FRESH (fresh air intake), MIX or RECIRC (interior air circulation) according to changes of the blow port temperature. Using the intake switch allows you to select a desired intake port manually (in the manual operation, FRESH and RECIRC modes alone are available). Pressing the DEF (defrost) mode switch selects the FRESH (fresh air intake).

Cooler start-up timing control

This function is used for maintaining the air flow at “LOW” level until the evaporator is sufficiently cooled down. It is intended to prevent a large volume of hot air being blowing into inside of a vehicle when the cooler is turned on in hot summer season.

Heater start-up timing control

This function is used for maintained the air flow at “LOW” level and also for maintaining the defrost mode until temperature of coolant in the heater core is sufficiently heated. It is intended to prevent a large volume of cool air being blown into inside of a vehicle when the heater is turned on in cold winter season.

Solar radiation quantity offset control

The photodiode on the sun sensor determines solar radiation quantity accurately to offset interior temperature quickly.

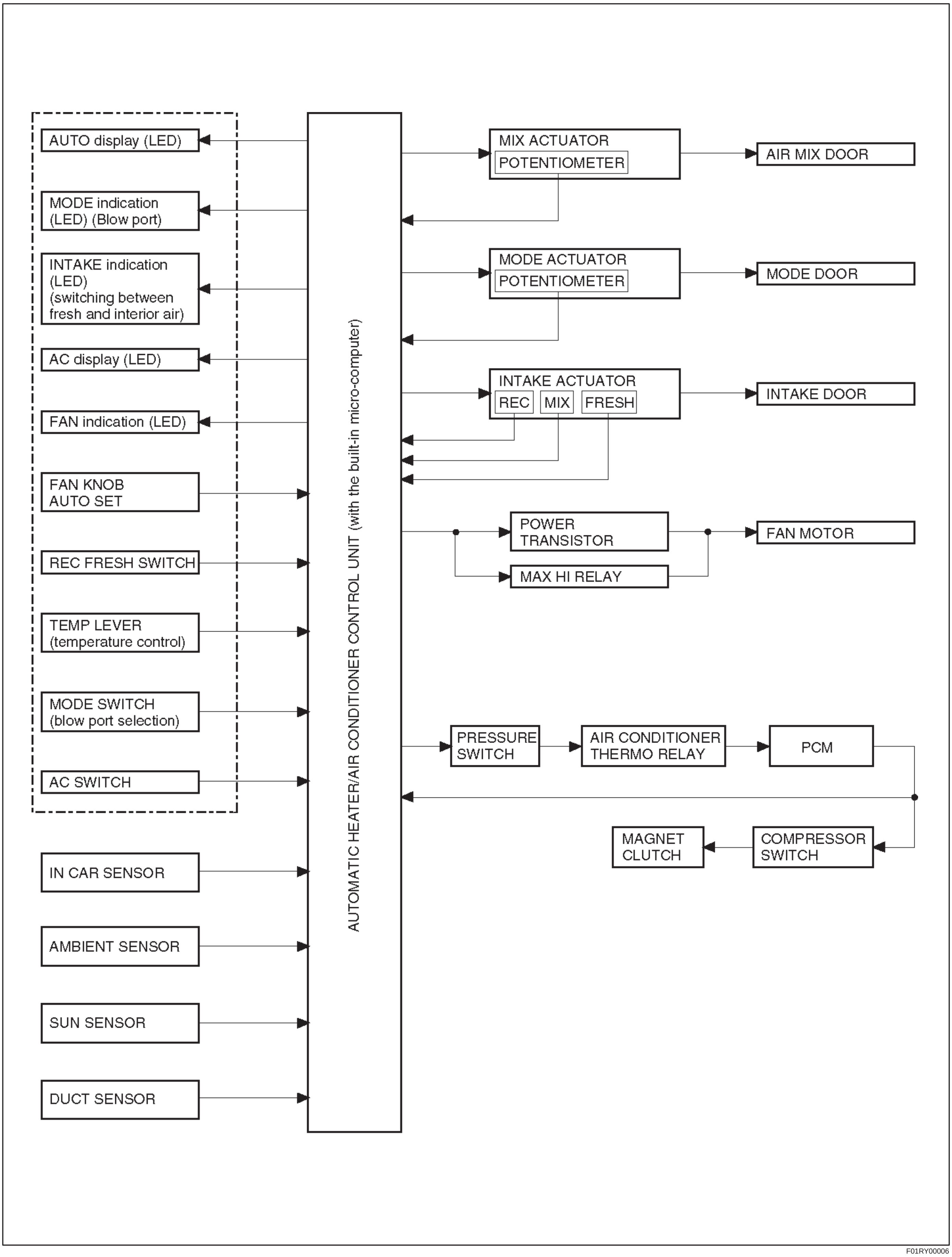
Switch position storing function

This function is used for storing switch positions being selected in the immediately preceding operation, namely the last time the ignition has been turned off. It simplifies the setup procedures when restarting the system.

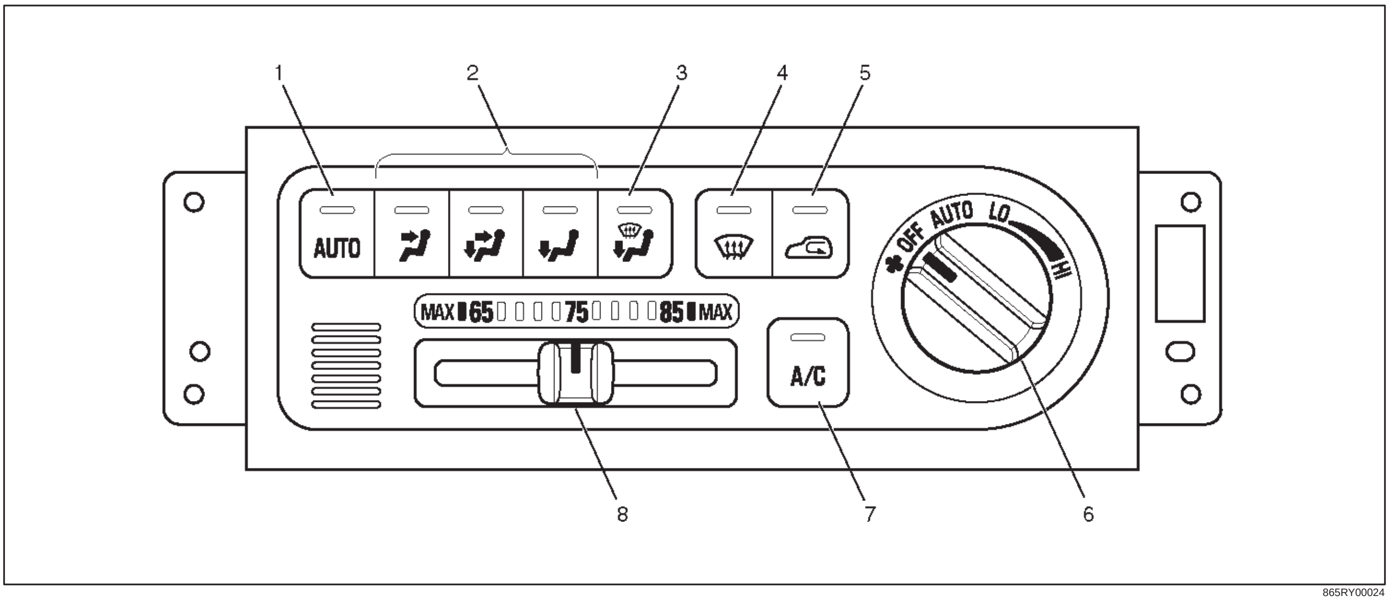
Self-diagnosis function

The self-diagnosis function turned on from the panel switch makes your troubleshooting easier (for detail of this function, refer to the section titled “Self-Diagnosis”).

Automatic Air Conditioner Block Diagram



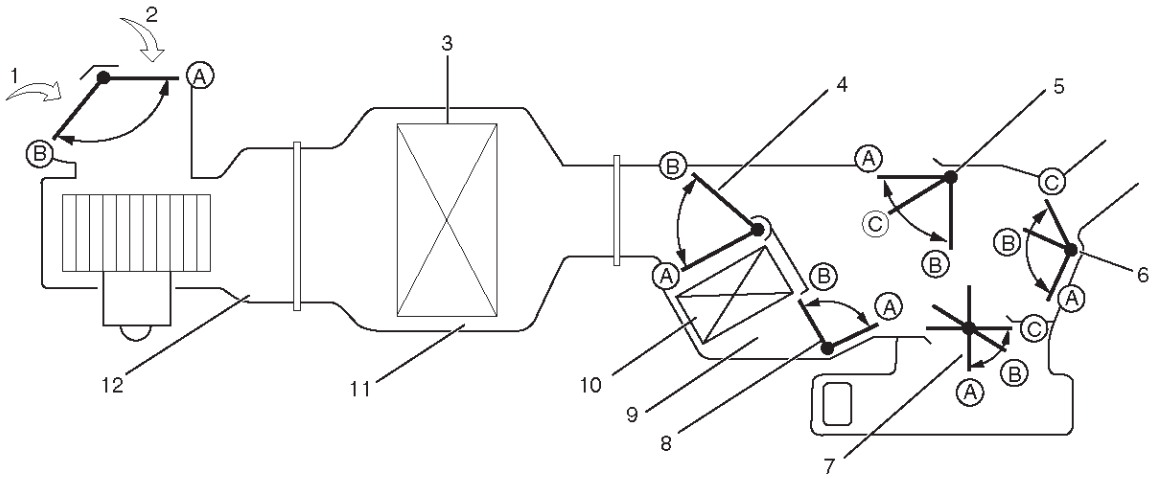
Control Panel Layout



Legend

(1) Auto Switch
(2) Mode Switch
(3) DEF/FOOT Switch
(4) DEF Switch
(5) Intake Switch
(6) Fan Switch
(7) Air Conditioning Switch
(8) Temperature Control Knob

Air Control Functions



	Mode Position					Display of Intake Status		Set Temperature		
	VENT	BI-LEVEL	FOOT	DEF/FOOT	DEF	ON	OFF	Blue FULL COLD	White 65~85°C	Red FULL HOT
Vent Door	A	B	C	C	C	—	—	—	—	—
Foot Door	C	B	A	B	C	—	—	—	—	—
DEF Door	A	A	A	C	B	—	—	—	—	—
Intake Door	—	—	—	—	—	A	B	—	—	—
Air Mix Door	—	—	—	—	—	—	—	A	A ~ B	B
Sub Air Mix Door	—	—	—	—	—	—	—	B	B ~ A	A

C01RY00004

Legend

(1) Interior Air Intake
(2) Fresh Air Intake
(3) Evaporator Core
(4) Air Mix Door
(5) DEF Door
(6) VENT Door
(7) FOOT Door
(8) Sub Air Mix Door
(9) Heater Unit
(10) Heater Core
(11) Evaporator Unit
(12) Blower Unit

Operation and Functions of Control Panel Switches

Auto Switch

1. Pressing this switch turns on the automatic control mode. It resets all manual switches except that for the fan control. However, when the Manual REC is selected for the intake or the Manual Open is selected, the modes are maintained.
2. It causes the A/C (air conditioner) to the ON mode (this function, however, available only when the fan is turned on and also the compressor is turned on because of the given outside air temperature level).

Indication

- The AUTO LED is turned off.
- Currently selected mode for the Mode and Intake are respectively indicated.
- The A/C LED remains turned on even if the compressor has been turned off because of the given outside air temperature level. Pressing the air conditioning switch in this state turns off the A/C LED.

Mode Switch

1. Pressing the VENT, B/L or FOOT switch selects the corresponding mode.
2. When the Auto is selected for the Mode and Intake, pressing the mode switch fixes the Intake to the immediately preceding status.

Indication

- The AUTO LED is turned off.
- Currently selected blow port is indicated.

DEF Switch

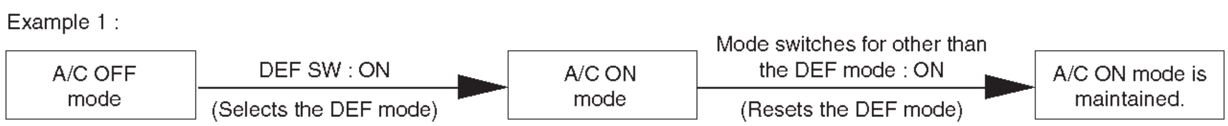
Press this switch to select the DEF mode.

Blow port	Intake port	A/C	MIX
DEF	Auto FRESH *1	ON mode *2	Auto

*1: When the manual REC is selected for the Intake, the manual REC is maintained.
*2: The ON mode is enabled only when the fun is turned on, and also the compressor is turned on because of the given outside air temperature level.

Indication

- The AUTO LED is turned off.
- The DEF LED and the A/C LED are turned on.
- The indication of the intake LED depends on the system condition.



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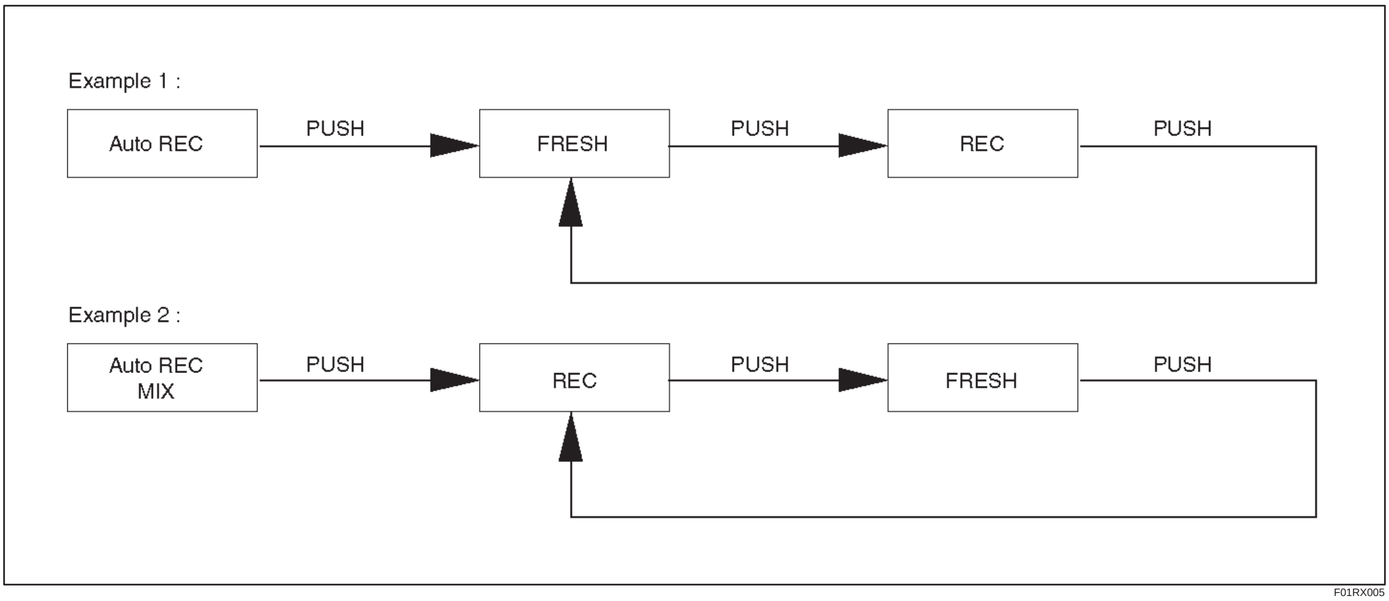
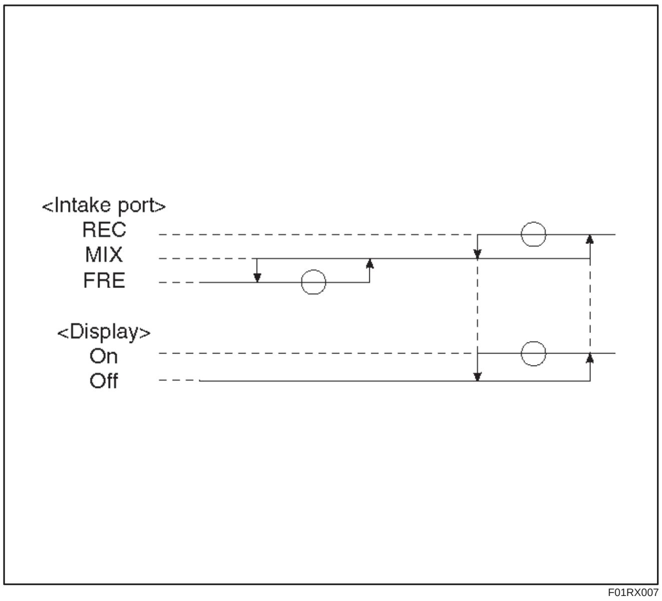
Intake Switch

Pressing this switch sequentially selects a different intake port in the following order.



Indication

- The Auto LED maintains unaffected.
- Currently selected intake port is indicated.



Fan Switch

1. Sets the fan to the specified mode.
2. Even when the fan switch is turned off, status display for the Mode, Intake is maintained.

Temperature Control Knob

1. This knob is operable only when the fan is turned on. It may be used for the MAX control of each block except the fan.
2. When the manual mode is selected for the fan control, this manual mode is maintained.

MAX Control

	Mix	Fan	Mode	Intake	A/C
MAX/COOL	Full cool	MAX/HI	VENT	REC*1	ON mode*2
MAX/HEAT	Full hot	AUTO/HI	FOOT*3	FRESH	Current status is maintained

*1: In the A/C: OFF mode, FRESH shall be selected.

*2: The ON mode is available only when ON is selected for the fan as well as for the cold outside air ON/OFF selection.

*3: When the MAX control is selected from the DEF mode, this DEF mode shall be maintained.

Indication

- As long as the MAX control is selected, the immediately preceding indication shall be maintained for the AUTO.
- Status display is provided for others.

Air Conditioning Switch

Pressing this switch turns on or off the A/C (air conditioning) control. (The compressor remains turned off if the fan is turned off and also the compressor has been turned off because of the given outside air temperature level.)

Indication

1. The A/C LED remains turned on even if the compressor has been turned off because of the given outside air temperature level. In this case, however, the AUTO or DEF switch must be turned on and the A/C ON mode must also be turned on (by the MAX/C mode).
2. Pressing the A/C switch from the above state (1) turns off the A/C LED.

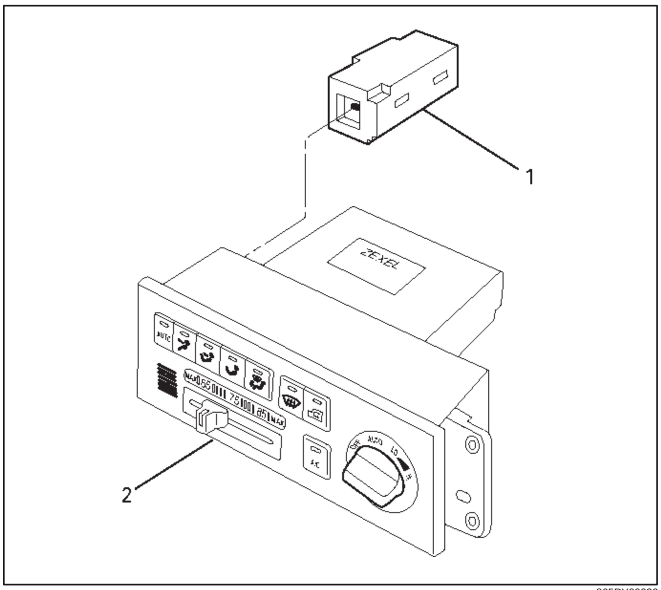
Overview of Construction, Movement and Control of Major Parts of Automatic Air Conditioner System

Automatic Heater/Air Conditioner Control Unit

Equipped with the built-in micro-computer, this control unit operates on signals from sensors and input signals from switches to offer total control of the blower fan, and actuators used for the mode door, intake door and air mix door.
Its self-diagnosis function enables quicker access to a failed part and its more accurate troubleshooting.

In Car Sensor

It is a sensor used for detecting room temperature of a vehicle. This sensor converts a given room temperature into a resistance value before entering the data to the automatic heater/air conditioner control unit.
This in car sensor unites the power driven aspirator and the motor fan so that a small amount of room air may be constantly fed to the sensor.
This sensor is provided on the control panel.



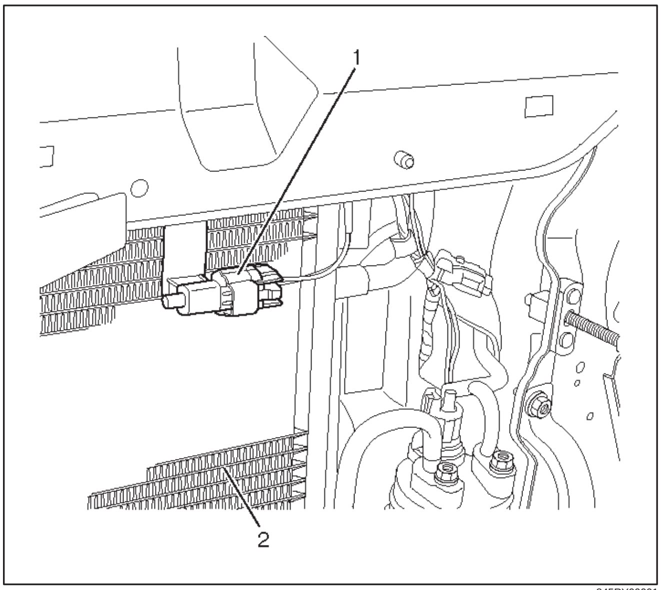
865RY00020

Legend

(1) In Car Sensor
(2) Automatic Air Conditioner Control Unit

Ambient Sensor

This sensor is used for detecting temperature outside the vehicle. It converts a given outside air temperature into a resistance value before entering the data to the automatic heater/air conditioner control unit.
Thermal effects from the condenser and radiator during idling after a run can be measured and offset the automatic amplifier.
This sensor is provided on the side plate situated at upper right side of the condenser.



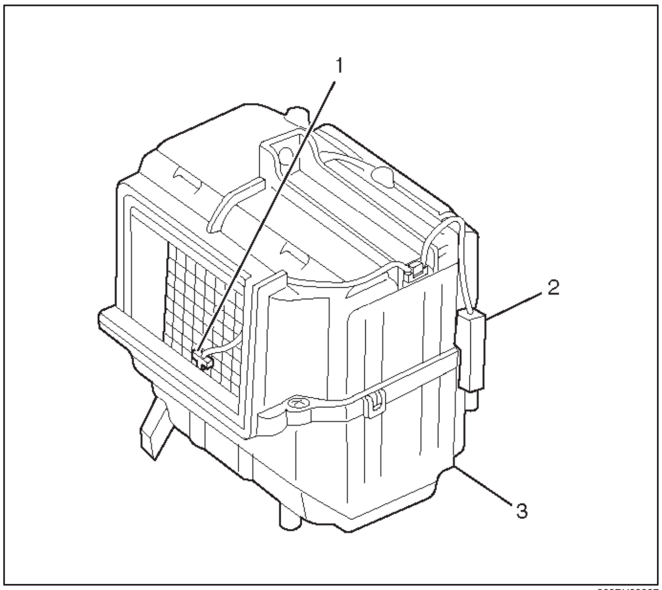
845RY00001

Legend

(1) Ambient Sensor
(2) Condenser Assembly

Duct Sensor

The duct sensor is the sensor to detect temperature change of the side of evaporator blower coming by fresh recirculation of intake door or “on” “off” of compressor.
The temperature is converted to resistant rate.
And it works as thermostat to control to prevent freezing of evaporator.
This sensor is installed in the upper case of evaporator.



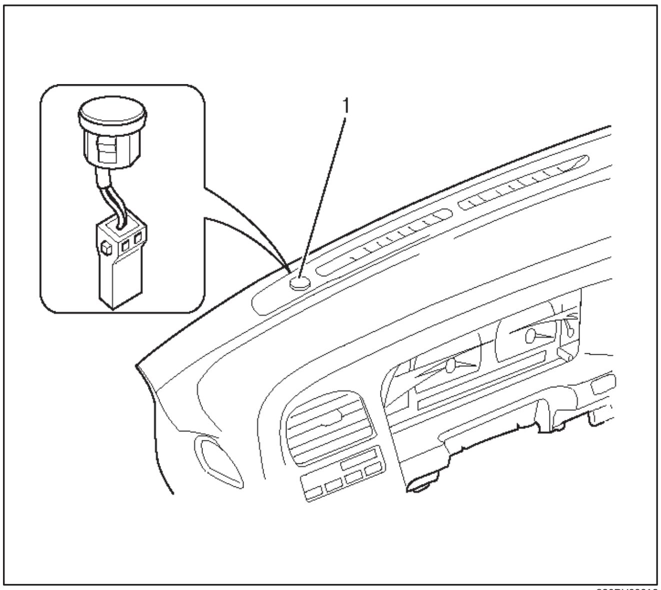
860RY00007

Legend

(1) Duct Sensor
(2) Electro Thermo
(3) Evaporator

Sun Sensor

It is a photodiode used for detecting quantity of solar radiation. This sensor converts the offset signal generated by changes in the interior temperature (which results from fluctuations in solar radiation) into photoelectric current to enter into the automatic heater/air conditioner control unit.
This sensor is provided at top of the defroster grill.



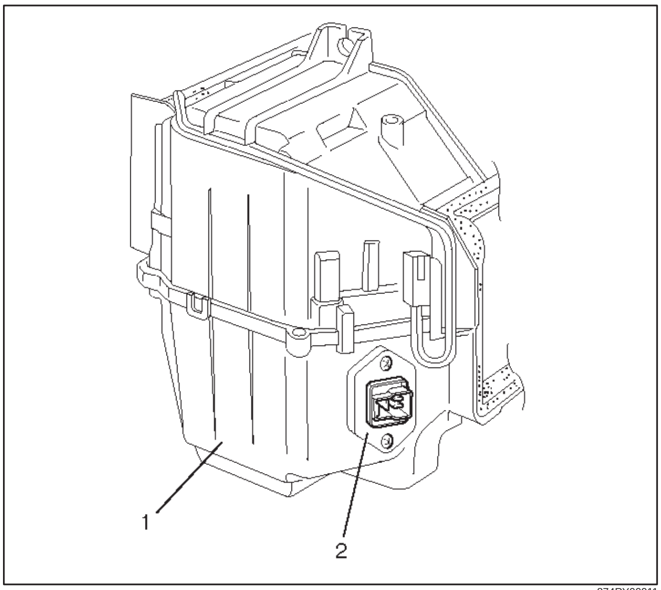
826RY00012

Legend

(1) Sun Sensor

Power Transistor

Receiving base current from the automatic heater/air conditioner control unit, the power transistor implements stage–less speed change of the blower fan motor. This transistor is provided on the evaporator.



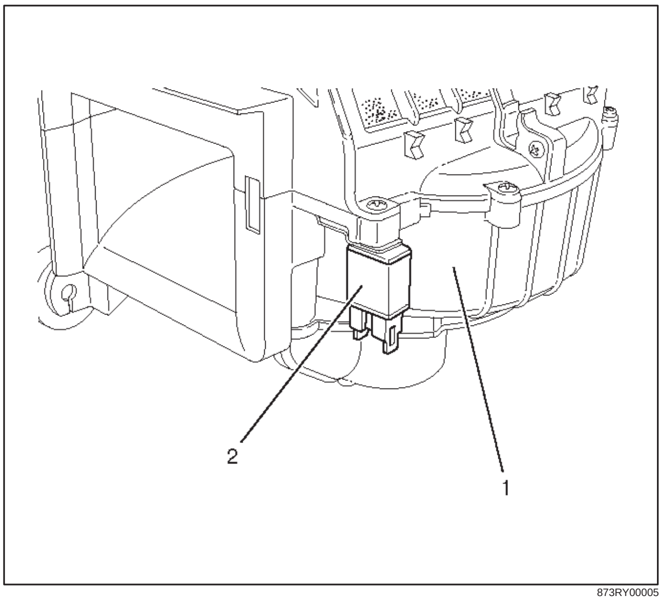
874RY00011

Legend

(1) Evaporator Assembly
(2) Power Transistor

Max Hi Relay

This relay turned on or off by the signal from the automatic heater/air conditioner control unit. As the Max Hi relay is turned on, supply voltage is directly fed to the blower fan motor to select the Max Hi mode.



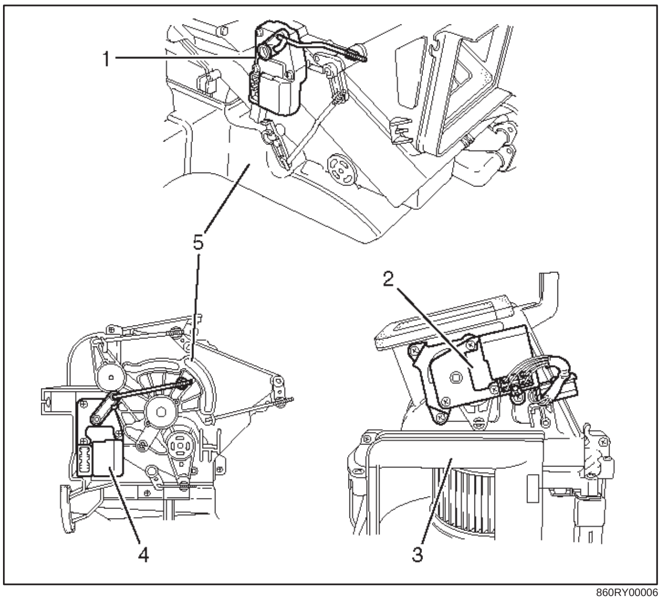
Legend

(1) Blower Unit
(2) Max High Relay

Actuator

The actuators are power driven type containing a small motor. Receiving output current from the automatic heater/air conditioner control unit, actuators drive the heater and blower unit mode doors.

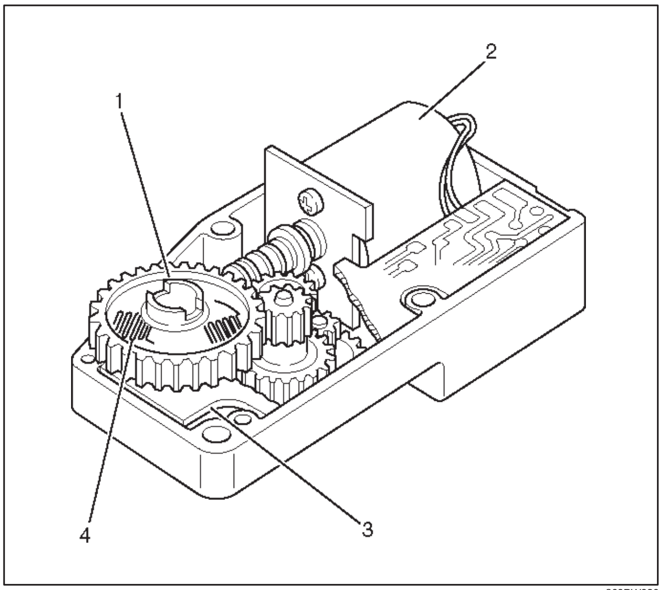
Actuators consist of the mode actuator used for switching the mode (blow port selection), the mix actuator used for changing aperture of the air mix door, the intake actuator used for switching the intake mode(fresh air/interior air) and the cold air bypassing actuator.



Legend

(1) Mix Actuator
(2) Intake Actuator
(3) Blower Unit
(4) Mode Actuator
(5) Heater Unit

The actuator changes the motor speed using the gear and drives each door rotating the output axis united with the sliding contact.



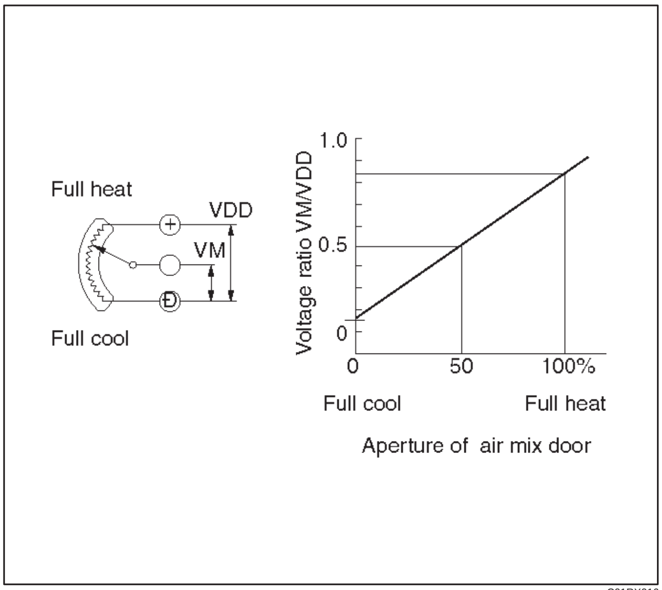
860RW026

Legend

(1) Output Axis
(2) Motor
(3) Printed Circuit Board
(4) Sliding Contact

The mode and mix actuators are common actuators with the built–in potentiometer. For the intake actuator, the contact switch type is selected.

The potentiometer is a register assembled to the printed circuit board of the mix and mode actuators. It detects the air mix door position specified by rotation of the output axis as a ratio of the variable terminal (VM) voltage against the reference voltage (VDD: 5V), then signals the value to the automatic heater/air conditioner control unit.



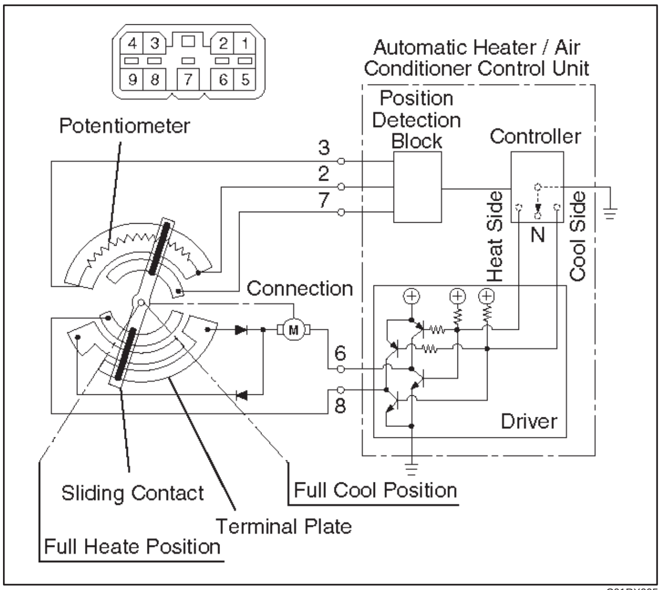
C01RX016

Movement of Mix Actuator

Position of the air mix door is determined by the controller on the automatic heater/air conditioner control unit.

As the heat or cool side of the controller is grounded, the transistor on the driver is activated and, thus, the motor rotation is turned on. The sliding contact connected to the motor sends the position detection signal from the potentiometer to the automatic heater/air conditioner control unit. As the set temperature and interior temperature are balanced, the controller returns to the neutral and the motor rotation is stopped.

I-45		Rotation direction	Remarks
(+) side	(-) side		
8	6	Clockwise	Full heat side
6	8	Counter clockwise	Full cool side

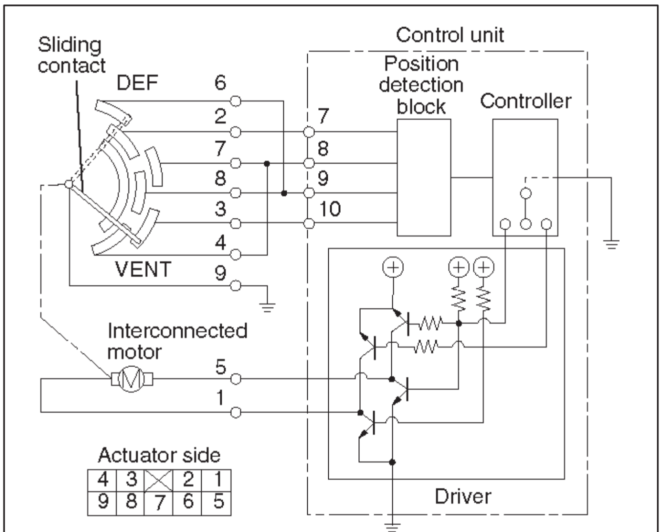


C01RX005

Movement of Mode Actuator

As target position of the mode door is decided on the controller of the control unit, the control unit reads the position detection signal from the actuator to select the clockwise or counter clockwise motor rotation direction.
Grounding the controller VENT or DEF side after the direction selection activates the transistor on the driver, thus turning on the motor rotation. Accompanying the motor rotation, the sliding contact rotates, too. When the target position is reached, the controller on the control unit returns to the neutral and the motor stops.

Conduction pin		Rotation direction	Remarks
(+) side	(-) side		
5	1	Clockwise	VENT to DEF direction
1	5	Counter clockwise	DEF to VENT direction



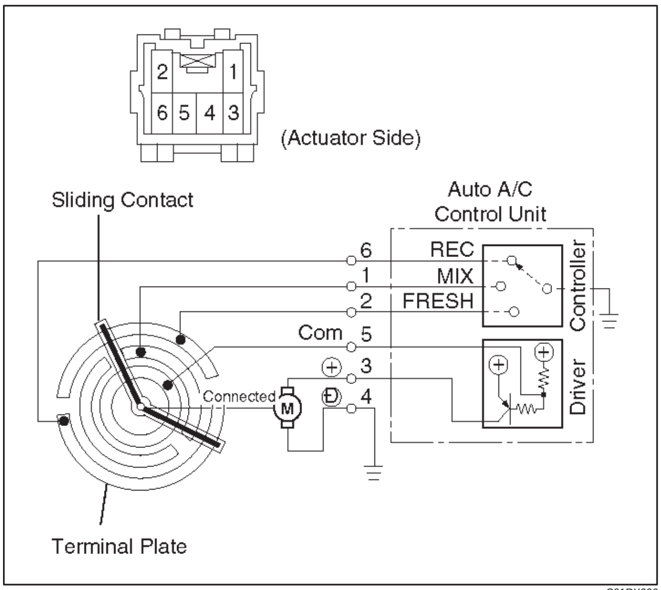
	7	8	9	10
VENT	H	L	H	L
Mid point between VENT - B/L	H	H	H	L
B/L	H	H	L	L
Mid point between B/L - FOOT	H	H	L	H
FOOT	H	L	L	H
Mid point between FOOT - D/F	H	L	H	H
D/F	L	L	H	H
Mid point between D/F - DEF	L	H	H	H
DEF	L	H	L	H

C01RX017

Movement of Intake Actuator

The controller on the automatic heater/air conditioner control unit selects an intake mode to be used.
As the Terminal No.5 I-49 is grounded via the sliding contact on the terminal plate, the transistor on the driver is activated, thus turning on the motor rotation. Then, accompanying move of the motor, the sliding contact rotates until grounding of the Terminal No.5 I-49 is removed, thus stopping the motor.

Grounding terminal	Rotation direction	Remarks
No.5 I-49	Clockwise	RE-CIRCULATION→MIX→FRESH



C01RX006

Overview of Automatic Control of Automatic Air Conditioner

The full automatic heater and air conditioner on this vehicle has the following features:

- Interior temperature control.
- Air flow control.
- Mode (blow port) control.
- Intake (switching between fresh air and interior air) control.
- Heater start timing control.
- Cooler start timing control.
- Evaporator anti-freeze control.

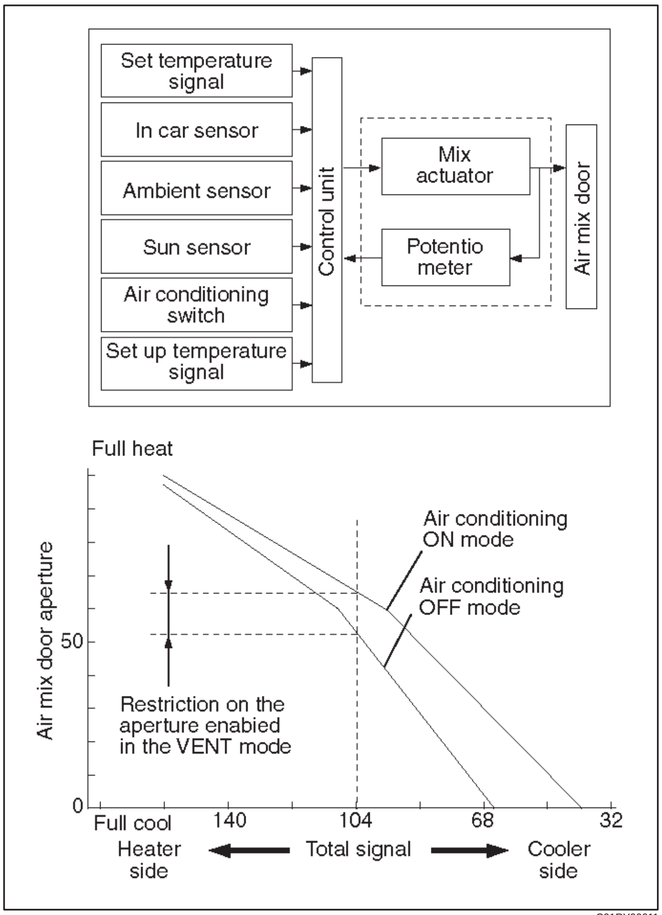
Interior Temperature Control

The automatic heater/air conditioner control unit operates on the setup temperature signal from the temperature control switch and other sensor signals to derive the total signal. Then, the control unit compares this signal against the signal from the potentiometer to determine rotation direction of the mix actuator. The mix actuator moves the air mix door to the aperture specified by the total signal so that the specified interior temperature is achieved.

If the compressor is turned off in the A/C (air conditioning) mode, aperture of the air mix door is offset according to the outside air temperature or the specified interior temperature. This function removes the difference in the blowing temperature in this state and that of when the compressor is turned on.

When FH or FC is selected for the setup temperature, the air mix door is accordingly fixed to the Full Heat or Full Cool mode.

When the VENT mode is selected, aperture of the air mix door is controlled so that excessively heated air may not be blown from the VENT blow port.



C01RY00011

Air Flow Control

In the Auto Mode

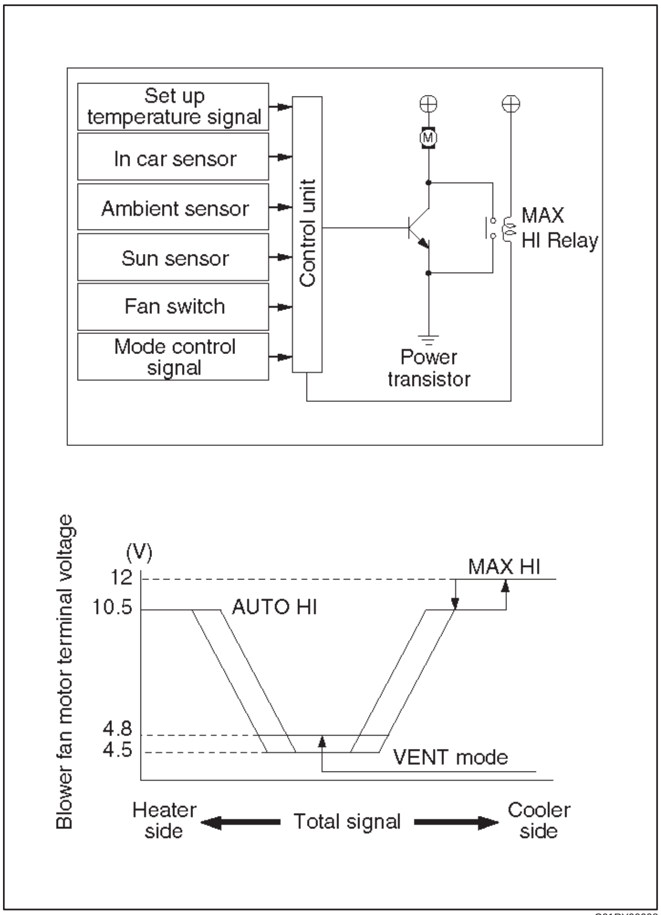
- The automatic heater/air conditioner control unit operates on the setup temperature signal and other sensor signals to derive the total signal. Then, the control unit adjusts base potential of the power transistor to match it to the voltage pattern of the target fan so that stage-less fan speed control can be achieved.

When solar radiation quantity is detected in the VENT or B/L mode, the control unit increases the minimum fan voltage to offset.

When FH or FC is selected from the temperature control switch, air flow is accordingly fixed to MAX HI or AUTO HI.

In the Manual Mode

- Air flow specified from the fan switch is entered to the automatic heater/air conditioner control unit as the manual signal. The signal modifies the air flow to the level specified from the fan switch so that the required fan voltage is attained.



C01RY00008

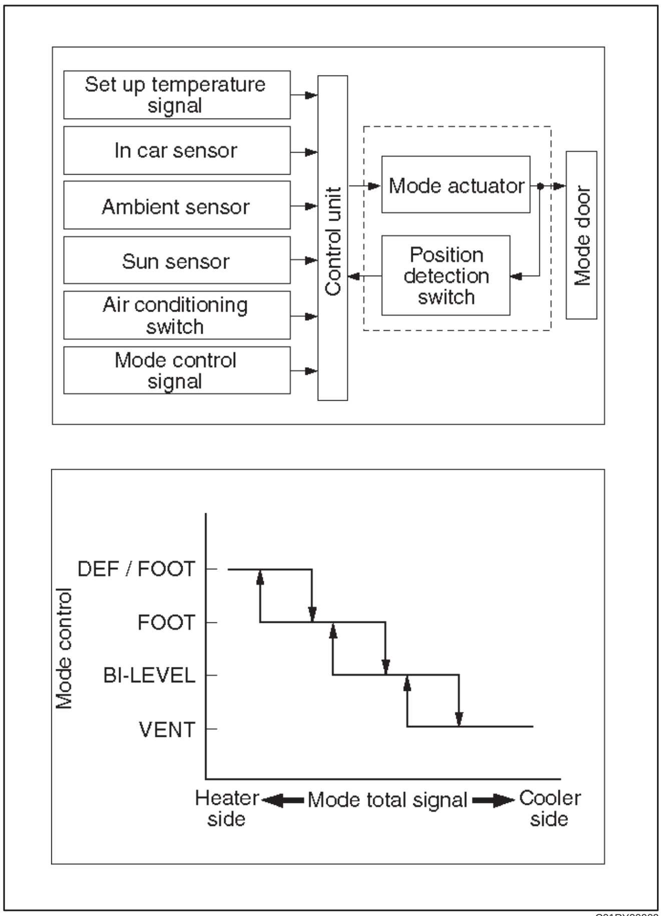
Mode (Blow Port) Control

The automatic heater/air conditioner control unit operates on the setup temperature from the control switch, and temperature and solar radiation quantify from the sensors to determine the total mode control signal. According to the pattern specified by this signal, the control unit selects either one of the VENT, BI-LEVEL, FOOT or DEF/FOOT mode.

The mode actuator determines the rotation direction comparing the target position against the current position being determined by the position detection signal.

When FH or FC is selected for the temperature from the temperature control switch, mode is accordingly fixed to the VENT or FOOT.

- In the manual operation of the mode switch, you can select a desired blow port mode pressing the corresponding mode switch.
- Operating the DEF mode switch selects the DEF for the blow port mode.



C01RY00009

Intake (Fresh air/interior air switching) Control

In the Full Auto mode, the automatic heater/air conditioner control unit operates on the setup temperature signal and other sensor input signals to derive the total signal. According to the pattern specified by this signal, the control unit provides the intake control.

When the fan is turned off or the A/C (air conditioning) is turned off, the intake is fixed to the FRESH mode.

When FC or FH is selected from the control switch, the intake mode is accordingly fixed to the RECIRC or FRESH.

In the Manual Operation

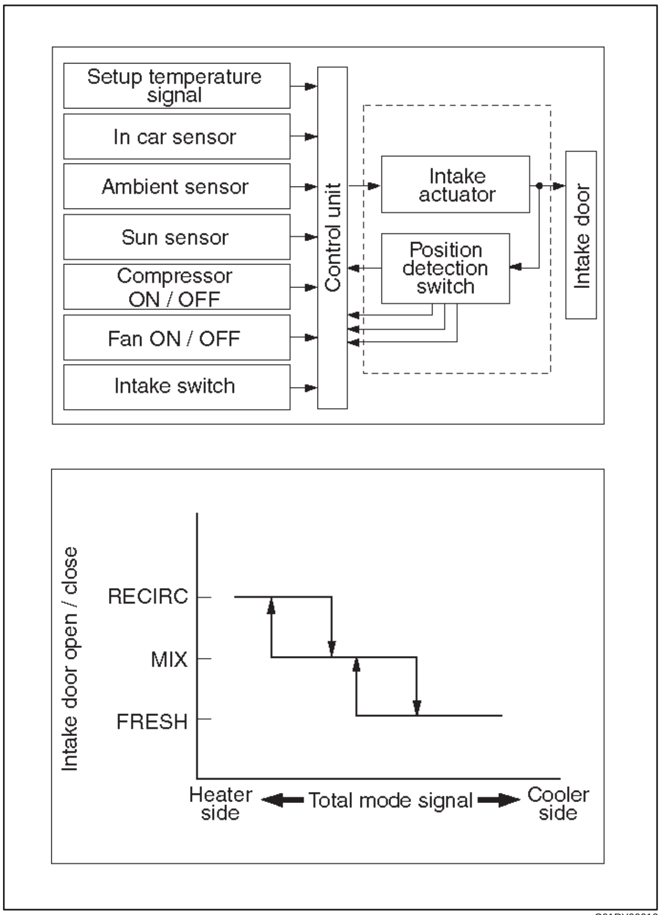
- Pressing the FRESH (fresh air intake) or the RECIRC (room air circulation) accordingly selects the FRESH or RECIRC mode.

When the DEF Mode Switch is depressed

- The intake mode is fixed to the FRESH. When the MANU REC is selected, however, the mode is fixed the RECIRC.

When the Mode Switch is depressed

- If the automatic intake control is selected, the intake is fixed to the currently selected mode.



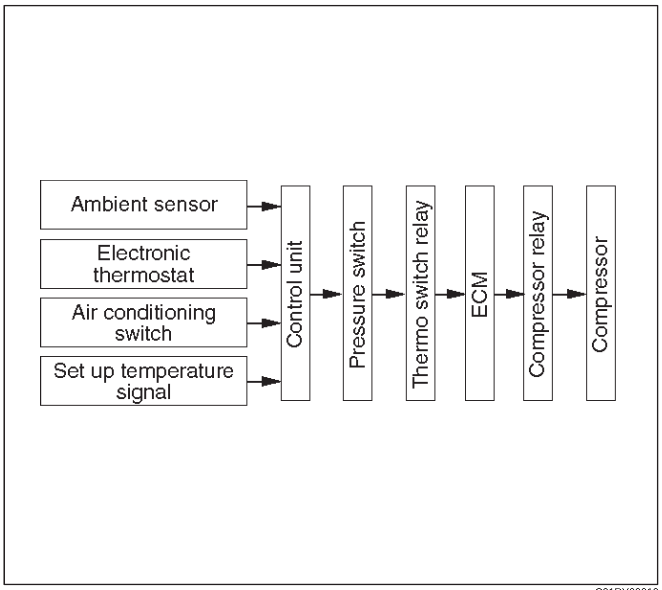
C01RY00012

Compressor Control

In the automatic control mode, the automatic heater/air conditioner control unit turns on or off the compressor with the evaporator anti–freeze mechanism using the evaporation sensor. And, when outside air is detected to be low through the outside air temperature sensor signal, the control unit turns off the compressor using the compressor control function.

Manual Control

- In the automatic control mode, pressing the A/C (air conditioning) switch turns off the compressor.
- Pressing the DEF mode switch automatically turns on the compressor.



C01RY00010

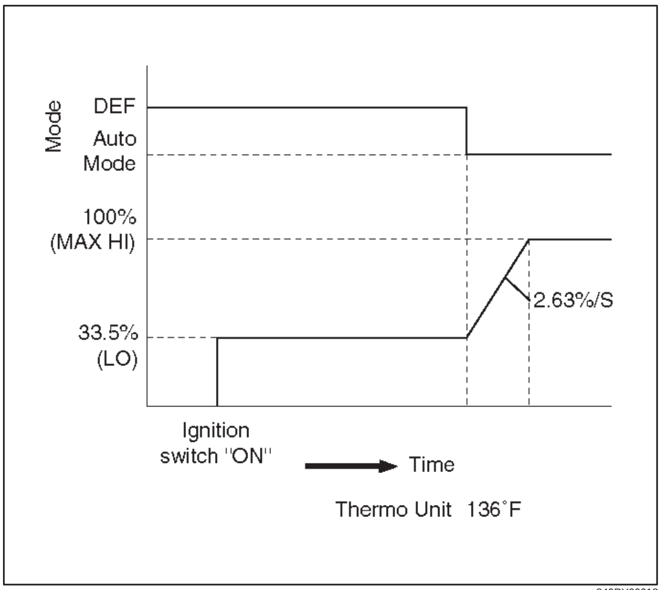
Heating Start Timing Control

When the automatic heater/air conditioner is started, heating is turned on under following conditions.

- The detected temperature of thermo unit is 136˚F or less.
- The temperature setting signal and the total signal by each sensor meet the condition of heating.

When the detected temperature by the coolant temperature sensor is 136˚F or less, the blower fan motor is set to work at low speed and the "DEF" mode is selected.

When the detected temperature by the coolant temperature sensor is 77˚F or more, the blow mode changes automatic control. And the blower fan speed is controlled to be lineally up from "LO" to "MAX HI".



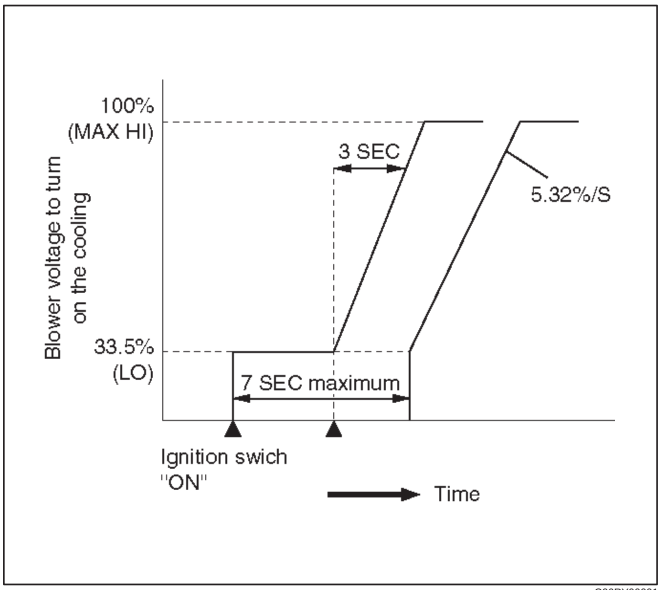
840RY00018

Cooling Start Timing Control

When the automatic heater/air conditioner is started, cooling is turned on under following conditions.

- The in car sensor is 86˚F or more.
- The temperature setting signal and the signals from each sensor meet the specified condition.

The blower fan speed is set to "LO" for maximum 7 seconds when cooling start conditions meet, and then, is controlled to be lineally up to "MAX HI" by 5.32%/S.



C06RY00001

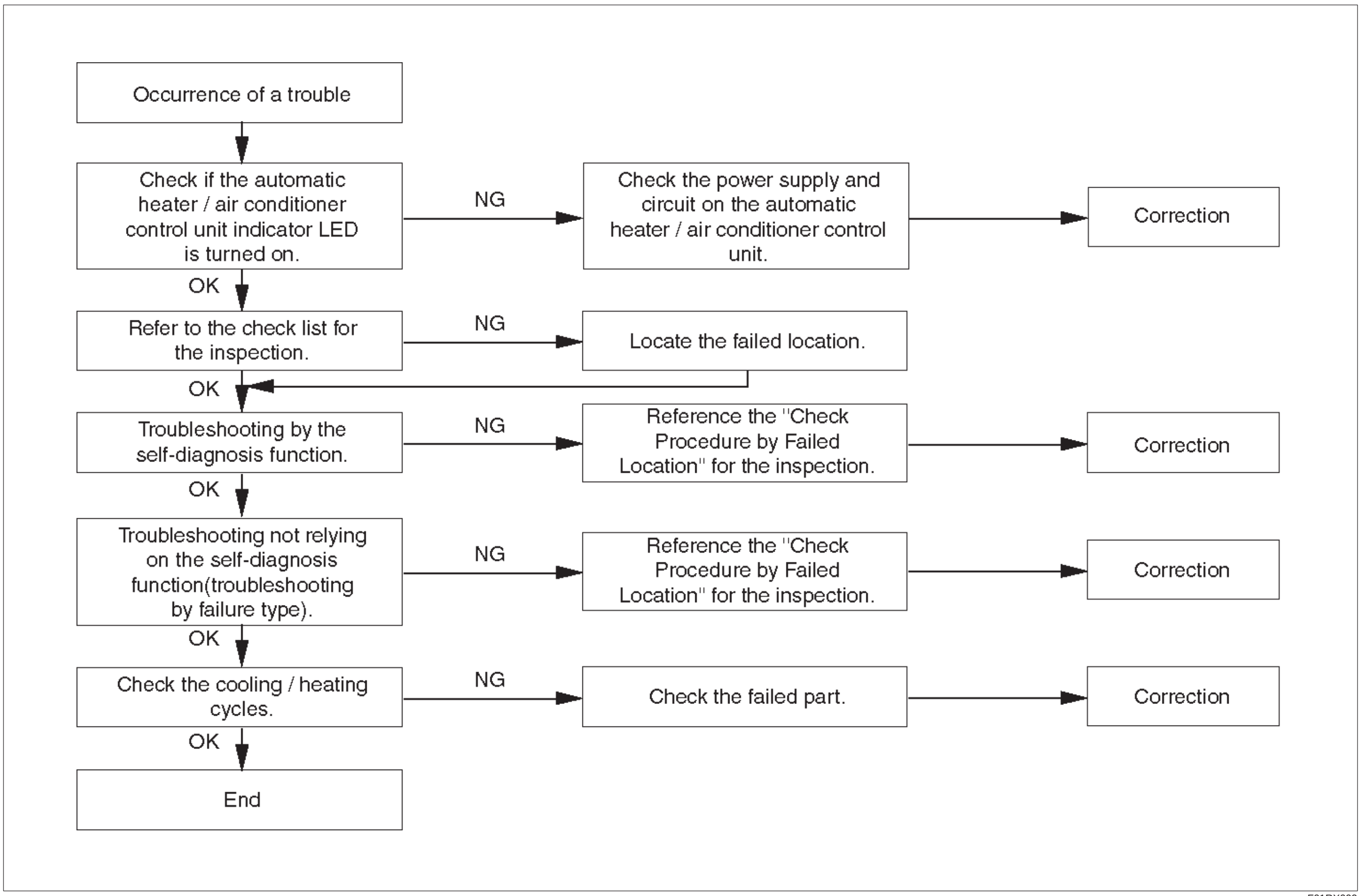
Troubleshooting

Troubleshooting, Its Overview and Procedures

The full automatic heater and air conditioner equips with the “Self-Diagnosis Function” to check its major components.
This function makes access to the sensors, actuators and blower fan motor system easier when checking them up and, when a failed part is located, this function restores its original performance.

When implementing the troubleshooting, this self-diagnosis function narrows the range to be searched at the first step, then check relevant parts one by one according to the “Checking Procedures by Failed Location”. As for a location this function is unappreciable, the system accurately determines characteristics of a given trouble and checks relevant parts according to the “Checking Procedures by Failed Location”.
The following illustrates basic troubleshooting flow.

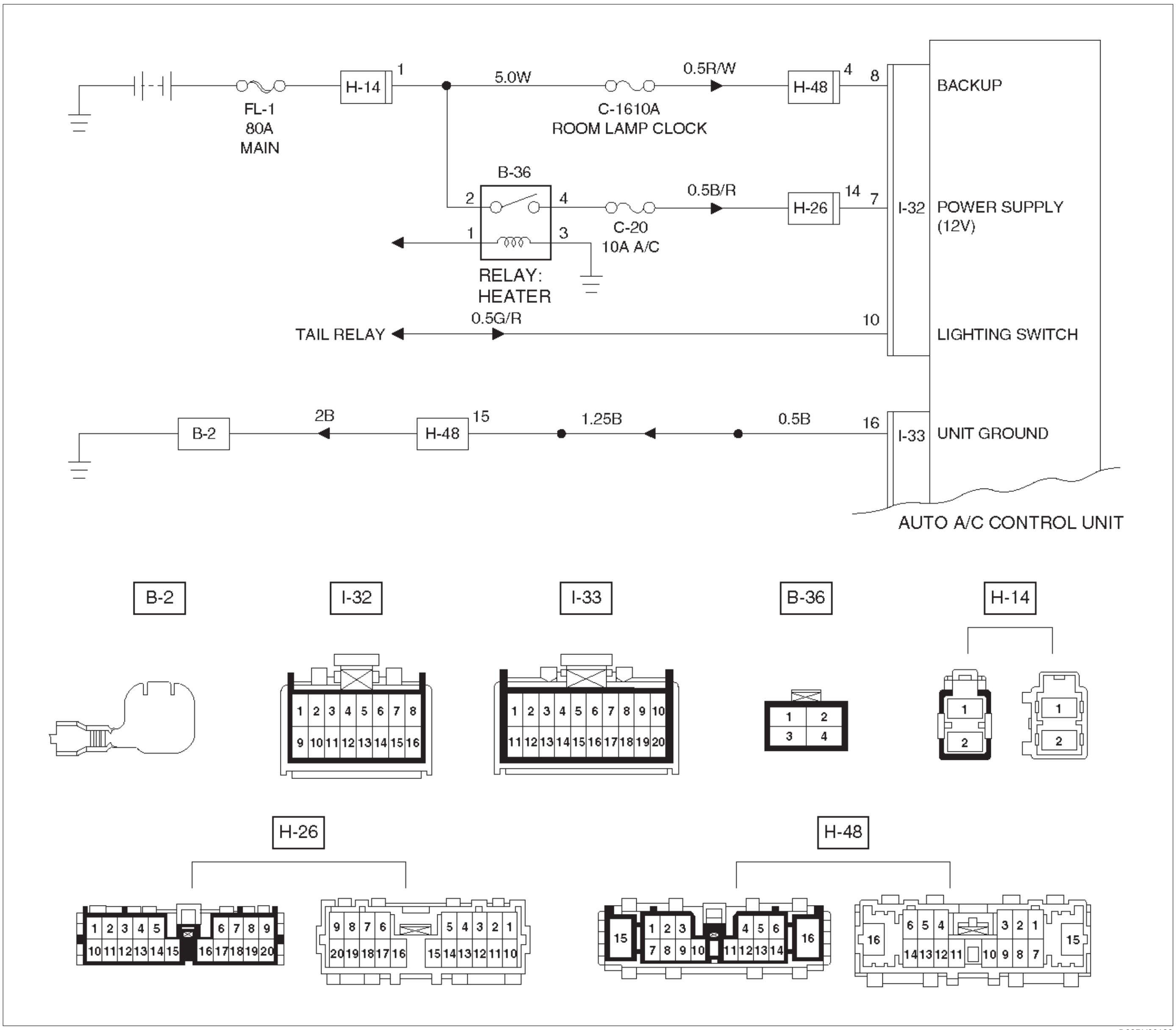
Basic Troubleshooting Flow



F01RX009

Auto Air Conditioner Control Unit Power Supply Diagnosis

This check is required because a trouble on the auto amplifier (control unit) power supply circuit or grounding circuit prevents accurate troubleshooting.



Condition	Possible cause	Correction
Power source does not supply to auto air conditioner control unit.	—	Refer to Chart A

Chart "A": Check of Auto Amplifier Power Supply System

Step	Action	Value(s)	Yes	No
1	Is the fuse C–16 normal?	—	Go to Step 2	Replace the fuse
2	Is the fuse C–20 normal?	—	Go to Step 3	Replace the fuse
3	Disconnect the auto A/C control unit connector I–32. Is the battery voltage applied between the harness side connector terminal No.I32–8 and the ground?	Approx. 12V	Go to Step 5	Go to Step 4
4	Repair an open circuit between the fuse C–16 and terminal No.I32–8. Is the action complete?	—	Go to Step 4	—
5	Is there continuity between the harness side connector terminal No.I33–16 and the ground?	—	Go to Step 7	Go to Step 6
6	Repair an open circuit between terminal No.I33–16 and the ground No.B–2. Is the action complete?	—	Go to Step 5	—
7	Turn the lighting switch on. Is the battery voltage applied between the harness side connector terminal No.I32–10 and the ground?	Approx. 12V	Go to Step 9	Go to Step 8
8	Repair an open circuit between the lighting switch and terminal No.I32–10. Is the action complete?	—	Go to Step 7	—
9	Turn the starter switch on. Is the battery voltage applied between the harness side connector terminal No.I32–7 and the ground?	Approx. 12V	—	Go to Step 10
10	Repair an open circuit between the fuse C–20 and terminal No.I32–7. Is the action complete?	—	Verify repair	—

Performance and Movement checklist for Automatic Air Conditioner Related Parts

Start the engine, and when the engine coolant reached 122˚F check performance and movement of the related parts according the following checklist.

Performance Check Using the Manual Switch

No.	Item	Checking Approach		Acceptance criteria
		Condition	Operation	
1	Blowing temperature (check movement of air mix door)	Auto switch must be turned on(FAN–AUTOMODE –AUTO)	1. Select FC for the setup temperature. 2. Select FH for the setup temperature. → Then, select the MAX Control.	1. Cold air shall be blown out. 2. Hot air shall be blown out.
2	Airflow volume(check movement of the mode door)	Set temperature to 77˚F.	1. Turn the fan knob off. 2. Turn the fan knob from LOW to HI.	1. The fan shall be stopped, thus stopping air blow, too. 2. Airflow volume shall change from LOW to HI.
3	Blowing temperature(check movement of the mode door)	Set temperature to 77˚F.Set the fan knob to HI.	Push the mode switch to change the blow port mode sequentially from the VENT through BI-LEVEL, FOOT up to DEF.	LED corresponding to each mode shall be turned on and the blow port mode shall be switched smoothly.
4	The interior/outside air switching mode (check movement of intake door)	Set temperature to 77˚F.	Turn the LED off using the interior/outside air switch (this introduces the outside air intake mode). Then, the set fan knob to HI and press the interior/outside switch to turn on the LED.	The LED indication shall be switched from OFF to ON accompanying a change in air blowing sound.
5	Compressor	Set the temperature to 64.4˚F (FC). (Outside air temperature is 32˚F or above and interior temperature at ordinary temperature.)	Push the “OFF” switch. 1. Push the Auto switch. 2. Push the Air Conditioner switch.	1. As the fan knob is set to the Auto position, the A/C switch LED shall come on and the compressor shall be turned on. 2. As the A/C LED comes off, the compressor shall be turned off.

Check of Auto Function

No.	Item	Checking Approach		Acceptance criteria
		Condition	Operation	
1	Auto function	FAN KNOB “AUTO” MODE SW “AUTO”	Select FC for the temperature.	The LED shall come on. Cold air shall be blown out. The following LEDs shall come on: ● Blow port mode:  ● Intake mode ● Fan speed: MAX Hi ● A/C
			Change the temperature gradually starting with 68˚F up to 86˚F.	**The following phenomena shall be recognized.** ● Temperature of blown air: Cold air is changed to hot air. ● Change in the air flow volume. ● The blow port mode LED indication changes in the following sequence:  (VENT) (BI-LEVEL) (FOOT)
			Select FH for the temperature.	Cold air shall be blown out. The following LEDs shall come on. ● Blow port mode:  ● Fan speed: Max Hi.

Troubleshooting With Self-Diagnosis Function

Overview of Self-Diagnosis Function

The self-diagnosis is implemented in 3 steps for each target. For detail of check procedure contained in each step, refer to the relevant section of "Check Procedure by Failed Location" listed in the Self–Diagnosis Operation Procedure.

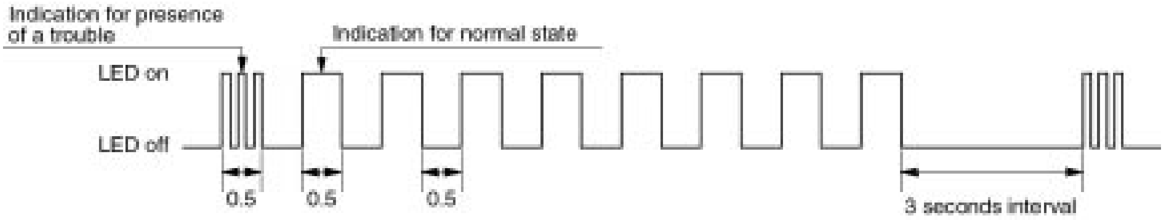
For turning on the self-diagnosis function and switching of the check step, refer to the flow chart given below. You can reset the self–diagnosis function by turning the ignition switch off or turning the DEF switch on for 5 seconds.

Self-Diagnosis Operation Procedure

Step	Action	Value(s)	Yes	No
1	1. Set the IG to the OFF position. 2. Apply 60W bulb light to the sun sensor. 3. Set the temperature setting lever on the automatic heater/air conditioner panel to the center position (77°F). 4. Set the fan switch on the same panel to the Auto position. Is the action complete?	—	Go to Step 2	—
2	While pushing both the Auto switch and the DEF switch on the automatic heater/air conditioner panel, start the engine. Is the current trouble diagnosing function turned on approximately in 10 seconds?	—	Go to Step 3	—
3	Does the A/C LED flash every 0.5 second interval?	—	Go to Step 4	Refer to *1.
4	Push the A/C switch once. Does the A/C LED flash every 0.5 second interval?	—	Go to Step 5	Refer to *2.
5	Refer to *3 chart "Check of Output Equipment". Does each output equipment function normally according to operation of the temperature setting level?	—	Go to Step 6	Repair or replace the output equipment or repair the harness
6	Push the DEF switch for 5 seconds consecutively or turn on and off the IG. Is the action complete?	—	Go to Step 1	—

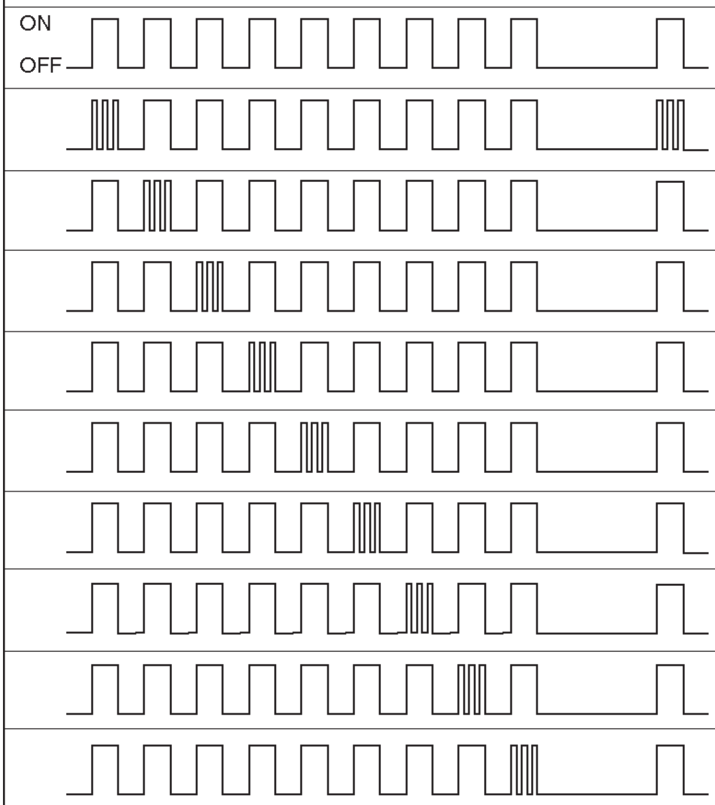
*1Displaying the Current Trouble Diagnosing Table

Start the engine while holding down both the Auto switch and the DEF switch on the control panel, and the table will appear in approximately 10 seconds to the indicator lamp (LED) of the air conditioning switch. Result of the diagnosis along the following 9 items will be shown one by one in 0.5 second interval irrespective of presence or absence of a trouble for a given item. When the display 9 items is completed, it is repeated with 3 seconds of interval in between. A failed item is indicated by flashing of the LED that is repeated 3 times within 0.5 seconds. If a trouble is indicated, you can locate the failed section by knowing when in the total sequence it has been displayed.



F01RX010

Item for Current Trouble Diagnosis



Display pattern	Failed part
ON / OFF	Normal pattern
	In car sensor
	Ambient sensor
	Sun sensor (Note 1)
	Duct sensor
	Temperature control lever (Note 2)
	Fan switch (Note 3)
	Mix actuator
	Mode (blow port) control
	Intake (fresh air/interior air switching) control

F01RY00008

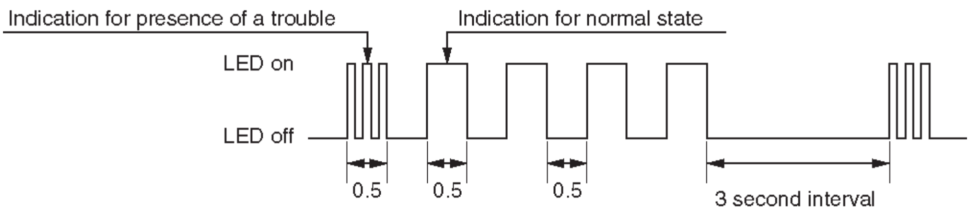
As shown above, display of result along nine items is repeated with 3-second interval in between.
Note 1: When checking the sun sensor, apply sufficient light using a 60W bulb. Otherwise, it can be diagnosed as failed.
Note 2: If the temperature setting lever is set on both ends (one set to 64.4˚F, blue scale = Full cool and the other to 87.8˚F, red scale = Full hot), they can be diagnosed as failed.
Note 3: Likewise, the fan switch can be diagnosed as failed if set on both ends.

*2 Displaying the Past Trouble Diagnosing Table

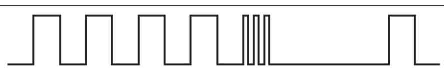
The past trouble diagnosis displays only the items on which trouble has recurred 16 times in the past.
If you press the air conditioning switch once while the current trouble diagnosis is taking place, display of the past trouble diagnosis will appear on the indicator lamp (LED) of the air conditioning switch.
Results of the diagnosis along the following five items are displayed one by one in 0.5 second interval irrespective of presence or absence of a trouble. A failed item is indicated by flashing of the LED that is repeated 3 times within 0.5 seconds. You can locate the failed section by counting in what sequence it has been displayed.
Past trouble code can be cleared by disconnecting one of the following sources for at least thirty (30) seconds.

NOTE: To prevent system damage, the ignition key must be "OFF" when disconnecting or reconnecting battery power.

- The No.16 fuse (Room lamp, Clock)
- The negative battery cable. (Disconnecting the negative battery cable will result in the loss of other on-board memory data, such as preset radio tuning).

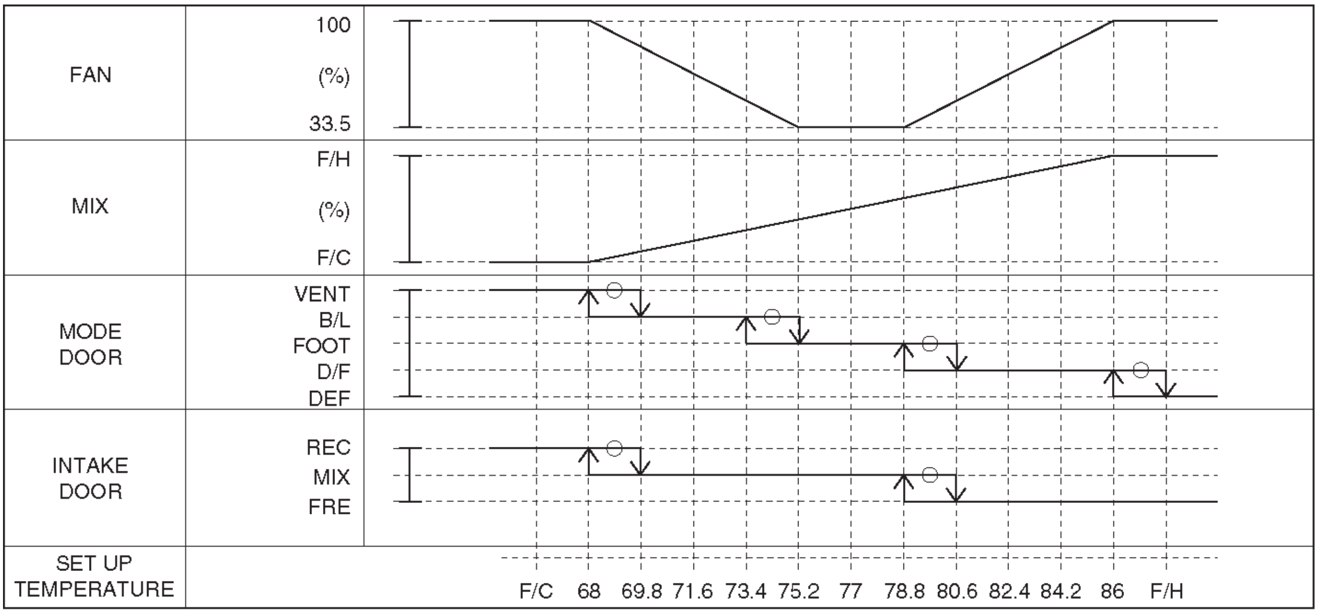


F01RX011

Display pattern	Failed part
	Normal pattern
	In car sensor
	Ambient sensor
	Sun sensor
	Duct sensor
	Mix actuator

F01RY00007

*3Check of Output Equipment

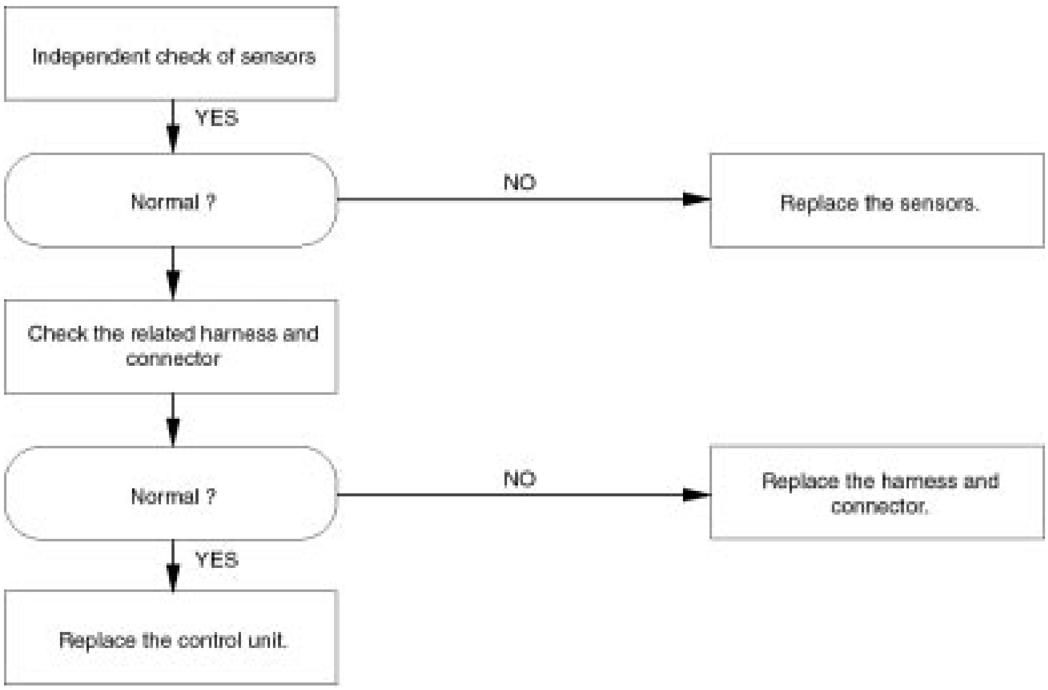


F01RY00004

Inspection By Failed Location

Inspection of the Sensors

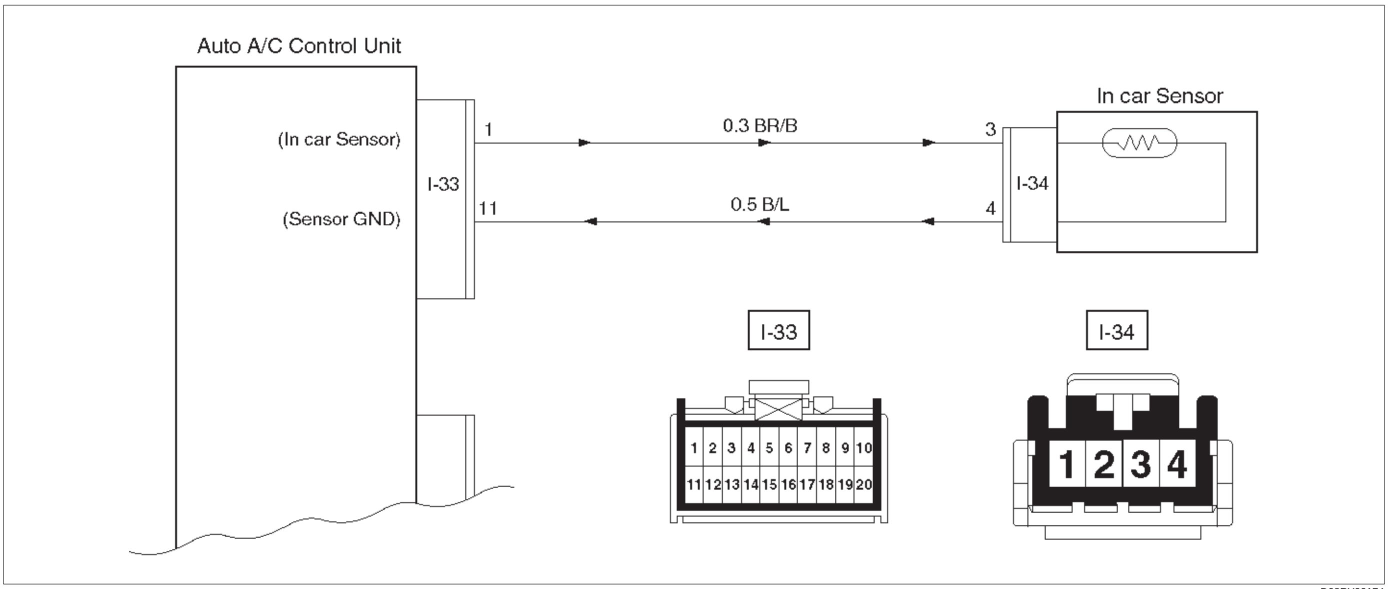
When the self-diagnosis function has determined that trouble is present on the sensors, check them according to the following flow chart.



Sensors	Allowable range	Check method
In car sensor	Refer to the sensor resistance curve.	Chart 1
Ambient sensor	Refer to the sensor resistance curve.	Chart 2
Sun sensor	100 ohms maximum in forward and 0.02 mA minimum when exposed to 60W incandescent lamp.	Chart 3

F01RY00005

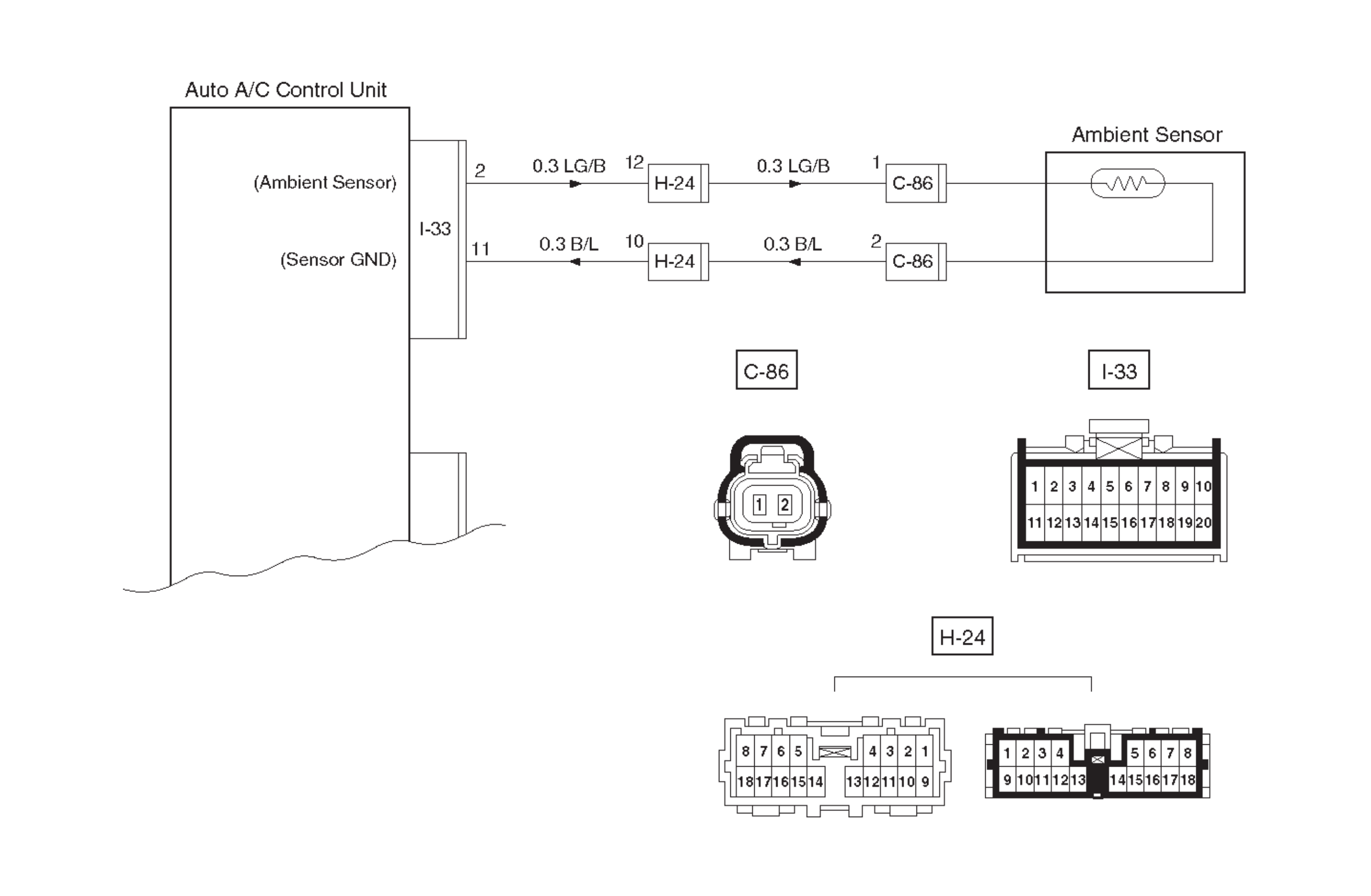
Chart 1: In Car Sensor



D08RY00174

Step	Action	Value(s)	Yes	No
1	Disconnect the in car sensor connector. (No.I-34) Is performance of the sensor normal? (Refer to the later section on “Individual Inspection”)	—	Go to Step 2	Replace the in car sensor
2	Is there continuity between the harness side connector No.I33–1 and No.I34–3?	—	Go to Step 4	Go to Step 3
3	Repair an open circuit between terminal No.I33–1 and No.I34–3. Is the action complete?	—	Go to Step 2	—
4	Is there continuity between the harness side connector No.I33–11 and No.I34–4?	—	Go to Step 6	Go to Step 5
5	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

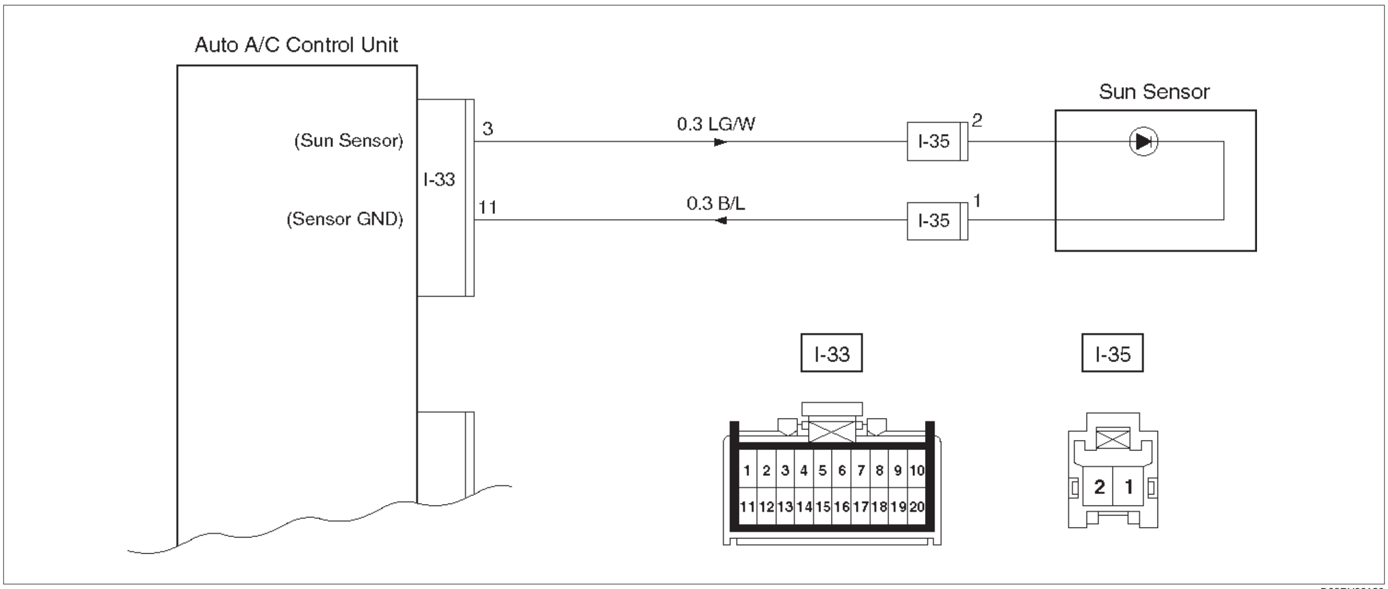
Chart 2: Ambient Sensor



D08RY00140

Step	Action	Value(s)	Yes	No
1	Disconnect ambient sensor connector. (No.C–86) Is performance of the ambient sensor normal? (Refer to the later section on “Individual inspection”)	—	Go to Step 2	Replace the ambient sensor
2	Connect the ambient sensor connector. Is resistance between the harness side connector No.I33–2 and No.I33–11 normal?	Refer to the later section on “Individual inspection”	Go to Step 4	Go to Step 3
3	Repair an open circuit between terminal No.I33–2 and No.C86–1 or No.I33–11 and No.C86–2. Is the action complete?	—	Verify repair	—
4	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

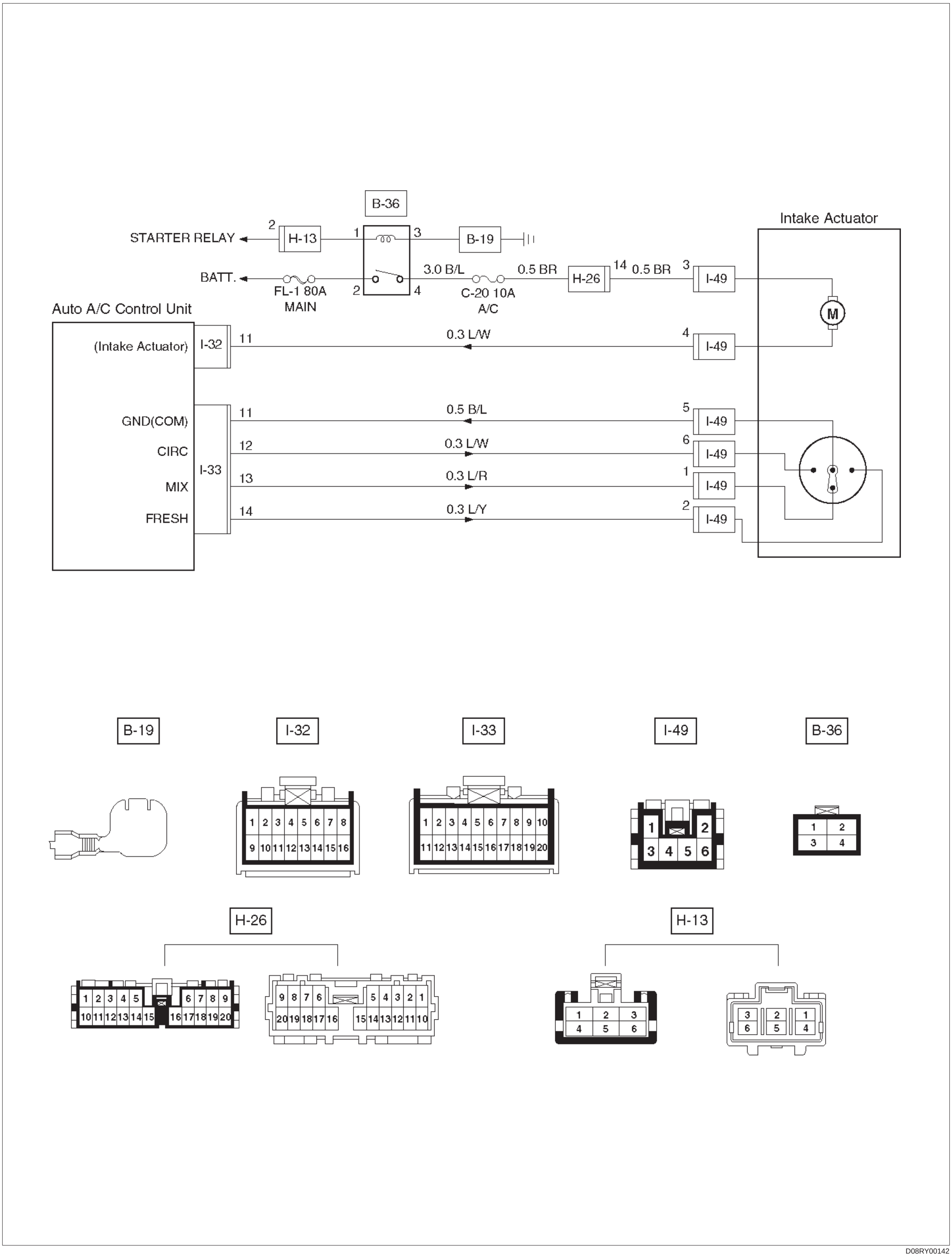
Chart 3: Sun Sensor



D08RY00139

Step	Action	Value(s)	Yes	No
1	Disconnect the sun sensor connector. (No.I–35) Is performance of the sun sensor normal? (Refer to the later section on individual inspection)	—	Go to Step 2	Replace the sun sensor.
2	Is there continuity between the harness side connector terminal No.I33–3 and No.I35–2?	—	Go to Step 4	Go to Step 4
3	Repair an open circuit between terminal No.I33–3 and No.I35–2. Is the action complete?	—	Go to Step 2	—
4	Is there continuity between the harness side connector terminal No.I33–11 and No.I35–1?	—	Go to Step 6	Go to Step 5
5	Repair an open circuit between terminal No.I33–11 and I35–1. Is the action complete?	—	Go to Step 4	—
6	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

Inspection of the Intake Actuator System



Condition	Possible cause	Correction
Does not work at all	—	Refer to Chart A
Control failure	—	Refer to Chart B

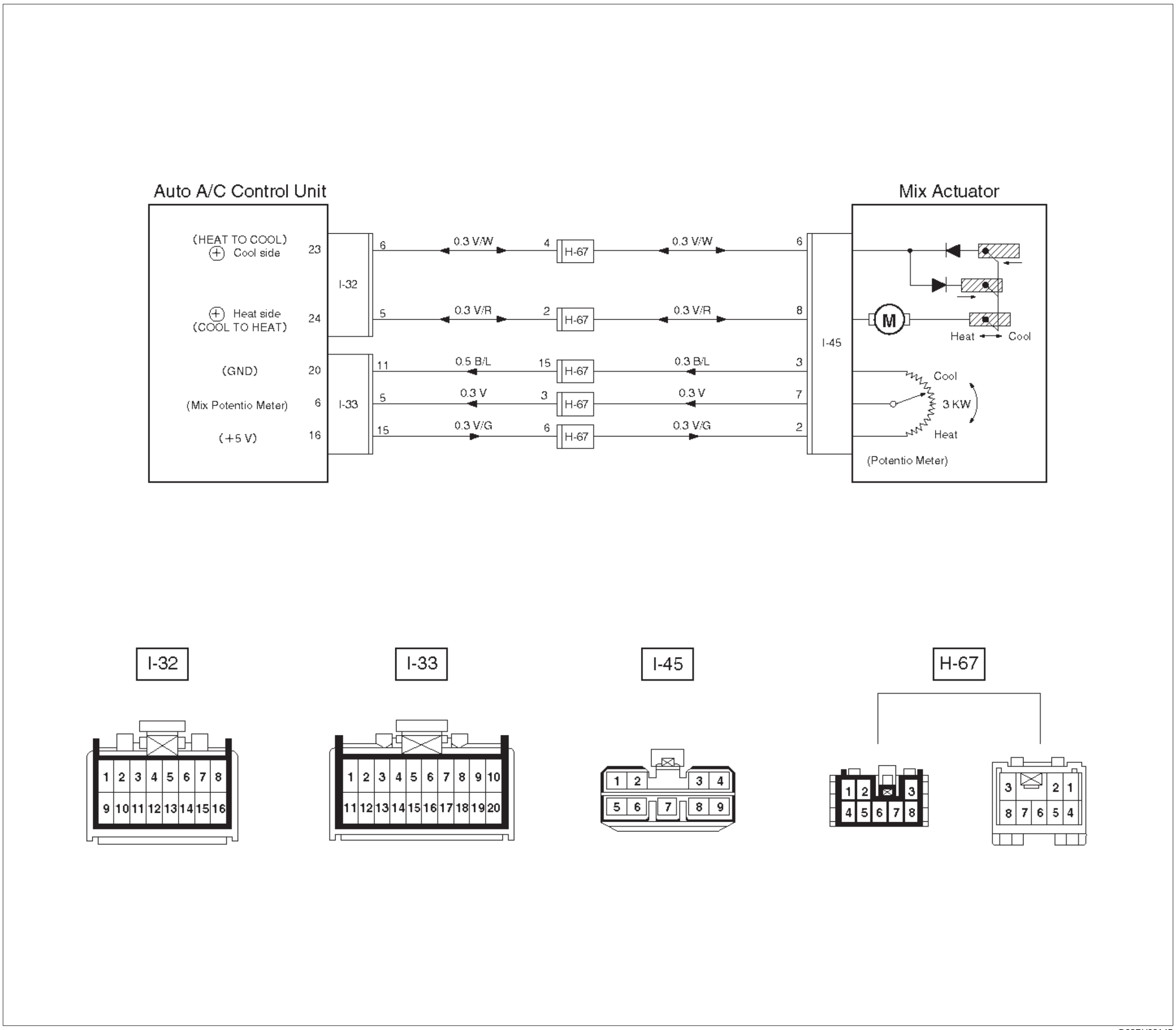
Chart A: Does Not Work At All

Step	Action	Value(s)	Yes	No
1	Is the fuse FL–1 normal?	—	Go to Step 2	Replace the fuse
2	Is the fuse C–20 normal?	—	Go to Step 3	Replace the fuse
3	Is the relay B–36 normal?	—	Go to Step 4	Replace the relay
4	Turn on the ignition switch. (the engine is run.) Is the battery voltage applied between the harness side connector terminal No.I49–3 and ground?	Approx 12V	Go to Step 6	Go to Step 5
5	Repair an open circuit between terminal No.I49–3 and No.B36–4. Is the action complete?	—	Go to Step 4	—
6	Is the battery voltage applied between the harness side connector terminal No.I49–4 and ground?	Approx 12V	Go to Step 8	Go to Step 7
7	Replace the intake actuator motor. Is the action complete?	—	Go to Step 6	—
8	Is there continuity between the harness side connector terminal No.I32–11 and No.B49–4?	—	Go to Step 10	Go to Step 9
9	Repair an open circuit between No.I32–11 and I49–4. Is the action complete?	—	Verify repair	—
10	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

Chart B: Failure on the Intake Control

Step	Action	Value(s)	Yes	No
1	Is the fuse No.C–20 normal?	—	Go to Step 2	Replace the fuse
2	Is the relay No.B–36 normal?	—	Go to Step 3	Replace the relay
3	Turn on the ignition switch. (the engine is run.) Is the intake actuator stopped?	—	Go to Step 5	Go to Step 4
4	Replace or repair the auto air conditioner control unit. Is the action complete?	—	Verify repair	—
5	Is there continuity between the harness side connector terminal No.I49–5 and No.I33–11?	—	Go to Step 7	Go to Step 6
6	Repair an open circuit between terminal No.I49–5 and No.I33–11. Is the action complete?	—	Go to Step 5	—
7	Is there continuity between the harness side connector terminal No.I49–6 and No.I33–12?	—	Go to Step 9	Go to Step 8
8	Repair an open circuit between terminal No.I49–6 and No.I33–12. Is the action complete?	—	Go to Step 7	—
9	Is there continuity between the harness side connector terminal No.I49–1 and No.I33–13?	—	Go to Step 11	Go to Step 10
10	Repair an open circuit between terminal No.I49–1 and I33-13. Is the action complete?	—	Go to Step 9	—
11	Is there continuity between the harness side connector terminal No.I49–2 and No.I33–14?	—	Go to Step 13	Go to Step 12
12	Repair an open circuit between harness No.I49–2 and No.I33–14. Is the action complete?	—	Go to Step 11	—
13	1. Disconnect the intake actuator connector No.I49. 2. Is the battery voltage applied between harness side connector terminal No.I49–6 and ground? No.I49–2 and ground? No.I49–1 and ground?	—	Go to Step 14	Go to Step 15
14	Replace or repair the intake actuator. Is the action complete?	—	Verify repair	—
15	Replace or repair the air conditioner control unit. Is the action complete?	—	Verify repair	—

Inspection of the Mix Actuator System



D08RY00145

Condition	Possible cause	Correction
Does not work at all	—	Refer to Chart A
Control failure	—	Refer to Chart B

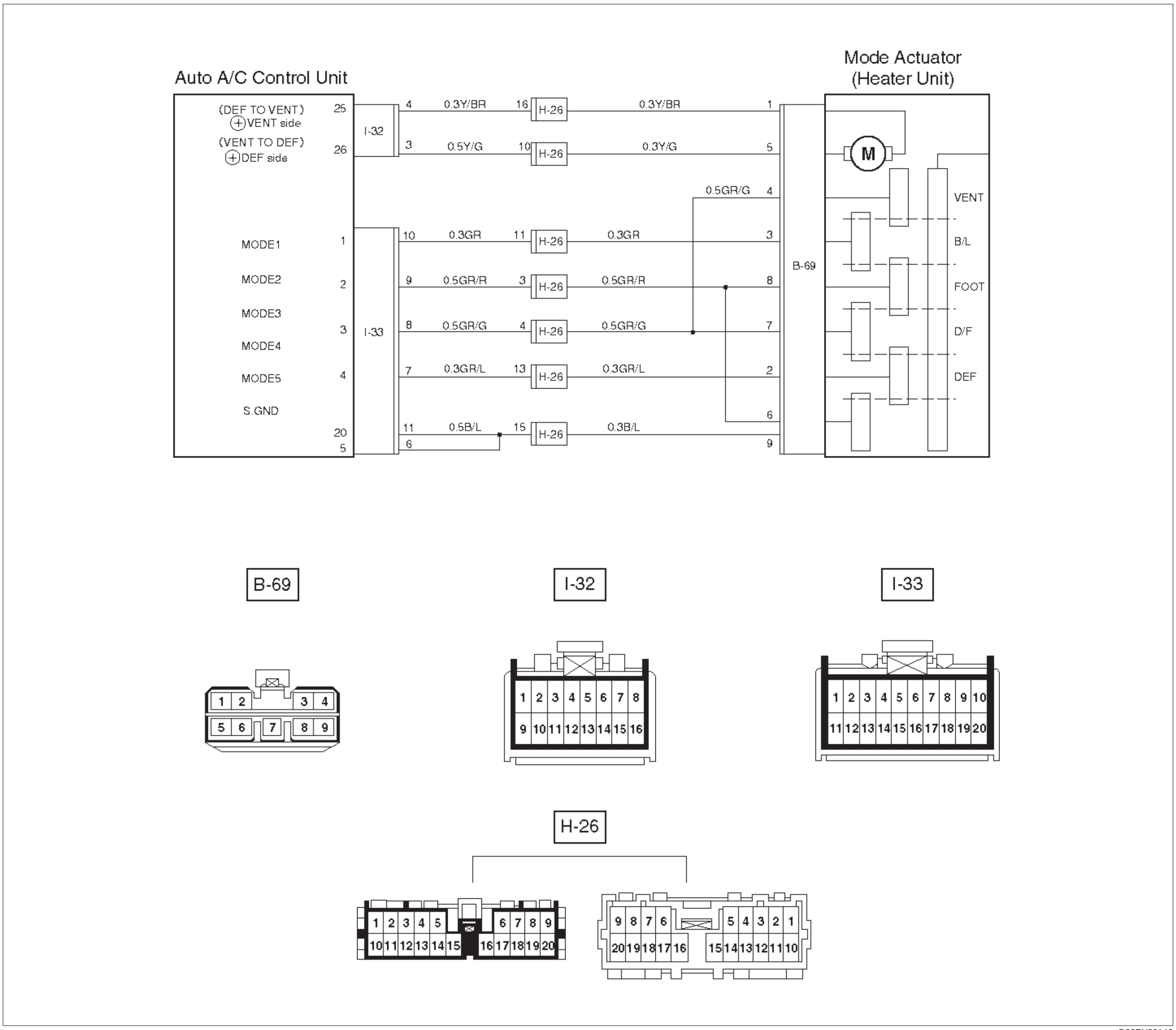
Chart A: Does Not work At All

Step	Action	Value(s)	Yes	No
1	1. Turn on the ignition switch (the engine is run). 2. Disconnect the mix actuator connector (I–45). 3. Short-circuit the chassis harness side connector terminal No.I45–3 and No.I45–7. 4. Using the temperature control lever, select FH for the temperature. Is the battery voltage applied on a regular interval basis between the harness side connector terminal No.I45–6 (-) and No.I45–8 (+)?	—	Go to Step 3	Go to Step 2
2	Replace the auto air conditioner control unit.	—	Varify repair	—
3	Using the temperature control lever, select FC for the temperature. Is the battery voltage applied on a regular interval basis between the harness side connector terminal No.I45–6 (+) and No.I45–8 (-)?	—	Go to Step 5	Go to Step 4
4	Replace the auto air conditioner control unit.	—	Verify repair	—
5	Is there continuity between the harness side connector terminal No.I32–6 and No.I45–6?	—	Go to Step 7	Go to Step 6
6	Repair an open circuit between terminal No.I32–6 and No.I45–6. Is the action complete?	—	Go to Step 5	—
7	Is there continuity between the harness side connector terminal No.I32–5 and No.I45–8?	—	Go to Step 9	Go to Step 8
8	Repair an open circuit between terminal No.I32–5 and No.I45–8. Is the action complete?	—	Verify repair	—
9	Replace the mix actuator. Is the action complete?	—	Verify repair	—

Chart B: Mix Actuator Control Failure

Step	Action	Value(s)	Yes	No
1	Turn the ignition switch (the engine is run). Dose the mix actuator fully stroke when FH and FC of the temperature control lever?	—	Go to Step 3	Go to Step 2
2	Repair or replace the air mix door or the link unit. Is the action complete?	—	Varify repair	—
3	Is there continuity between the harness side connector terminal No.I45–3 and No.I33–11?	—	Go to Step 5	Go to Step 4
4	Repair an open circuit between terminal No.I45–3 and No.I33–11. Is the action complete?	—	Go to Step 3	—
5	Is there continuity between harness side connector terminal No.I45–7 and No.I33–5?	—	Go to Step 7	Go to Step 6
6	Repair an open circuit between terminal No.I45–7 and No.I33–5. Is the action complete?	—	Go to Step 5	—
7	Is there continuity between the harness side connector terminal No.I45–2 and No.I33–15?	—	Go to Step 9	Go to Step 8
8	Repair an open circuit between terminal No.I45–2 and No.I33–15. Is the action complete?	—	Go to Step 7	—
9	Is sum of the voltage between the following chassis harness side connector terminals approximately 5V? No.I33–15 and No.I33–5, No.I33–5 and No.I33–11	—	Go to Step 11	Go to Step 10
10	Replace the actuator. Is the action complete?	—	Verify repair	—
11	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

Inspection of the Mode Actuator System



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Condition	Possible cause	Correction
Does not work at all	—	Refer to Chart A
Control failure	—	Refer to Chart B

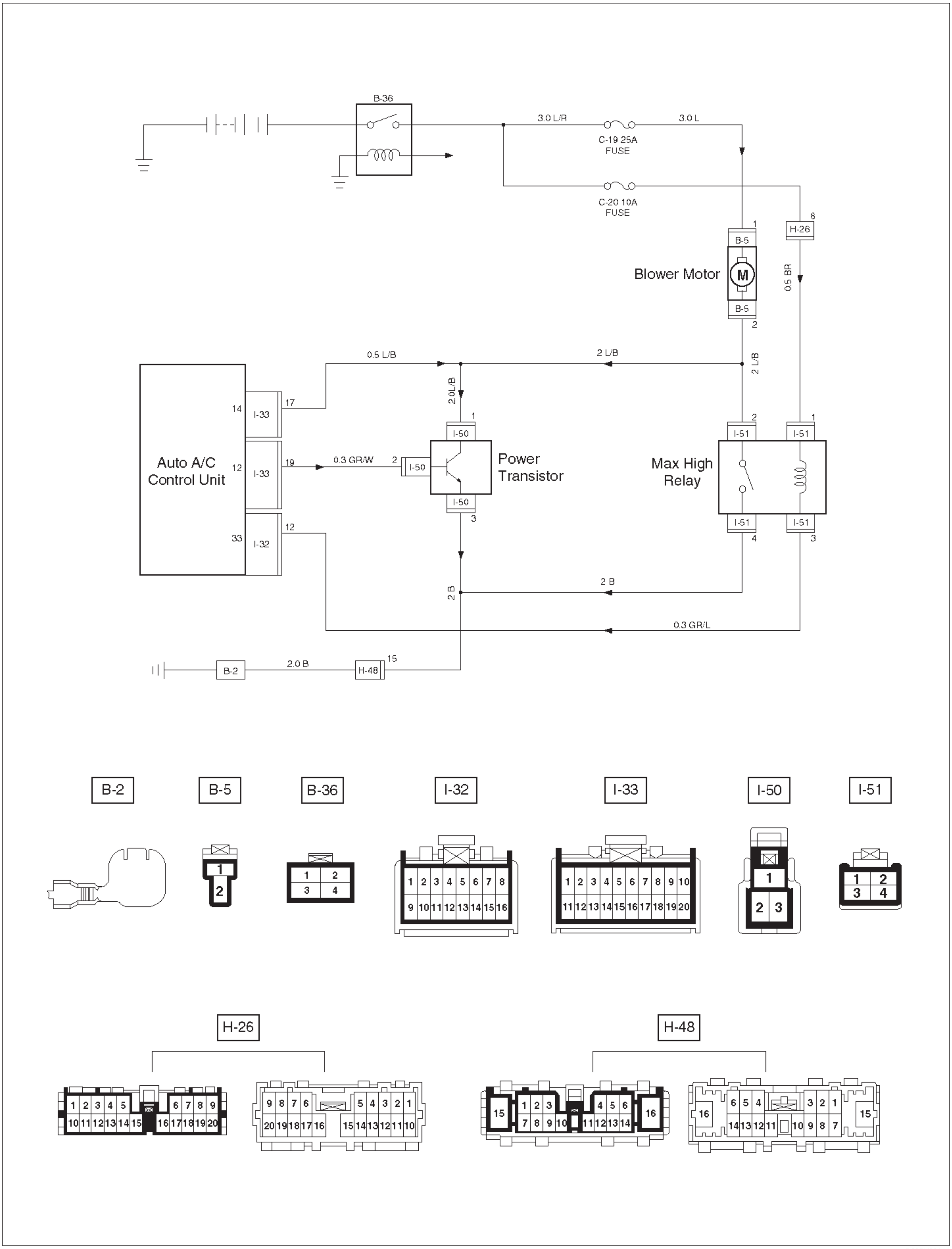
Chart A: Does Not Work At All

Step	Action	Value(s)	Yes	No
1	1. Turn on the ignition switch (the engine is run). 2. Disconnect the mode actuator connector (B–69) 3. Select VENT pressing the mode actuator. Is the battery voltage provided on a regular interval between the harness side connector terminal No.B69–1 (+) and No.B69–5 (-)?	—	Go to Step 3	Go to Step 2
2	Replace the auto air conditioner control unit. Is the action complete?	—	Varify repair	—
3	Turn on the DEF mode switch. Is the battery voltage provided on a regular interval between the chassis side connector terminal No.B69–5 (+) and No.B69–1 (-)?	—	Go to Step 5	Go to Step 4
4	Replace the auto air conditioner control unit.	—	Varify repair	—
5	Is there continuity between the harness side connector terminal No.B69–1 and No.I32–4?	—	Go to Step 7	Go to Step 6
6	Repair an open circuit between terminal No.B69–1 and No.I32–4. Is the action complete?	—	Go to Step 5	—
7	Is there continuity between the harness side connector terminal No.B69–5 and No.I32–3?	—	Go to Step 9	Go to Step 8
8	Repair an open circuit between terminal No.B69–5 and No.I32–3. Is the action complete?	—	Verify repair	—
9	Replace the mode actuator.	—	Verify repair	—

Chart B: Mode Actuator Control Failure

Step	Action	Value(s)	Yes	No
1	Turn on the ignition switch (the engine is run). Dose the mode actuator fully stroke when the defrost mode and the vent mode are selected?	—	Go to Step 3	Go to Step 2
2	Repair or replace the mode door or the link unit. Is the action complete?	—	Go to Step 1	—
3	Is there continuity between the harness side connector terminal No.B69–9 and No.I33–11?	—	Go to Step 5	Go to Step 4
4	Repair an open circuit between terminal No.B69–9 and No.I33–11. Is the action complete?	—	Go to Step 3	—
5	Is there continuity between the harness side connector terminal No.B69–3 and No.I33–10?	—	Go to Step 7	Go to Step 6
6	Repair an open circuit between terminal No.B69–3 and No.I33–10. Is the action complete?	—	Go to Step 5	—
7	Is there continuity between harness side connector terminal No.B69–4 and No.I33–8?	—	Go to Step 9	Go to Step 8
8	Repair an open circuit between terminal No.B69–4 and No.I33–8. Is the action complete?	—	Go to Step 7	—
9	Is sum of the voltage between the following harness side connector terminal approximately 5V? Voltage between No.I33–8 and No.I33–10 plus voltage between No.I33–8 and No.I33–11	5V	Go to Step 11	Go to Step 10
10	Replace the actuator. Is the action complete?	—	Verify repair	—
11	Dose the mode actuator work normally through manual operation?	—	Go to Step 13	Go to Step 12
12	Replace the sensor. Is the action complete?	—	Verify repair	—
13	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

Inspection of the Fan Motor System



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Condition	Possible cause	Correction
The fan dose not rotate at all	—	Refer to Chart A
The fan dose not rotate in the MAX–HI mode	—	Refer to Chart B
The fan dose not rotate in any mode other than MAX–HI	—	Refer to Chart C
The fan dose not stop	—	Refer to Chart D

Chart A: Fan Does Not Rotate At All

Step	Action	Value(s)	Yes	No
1	Are the fuse No.C–19 and No.C–20 normal?	—	Go to Step 2	Replace the fuse
2	Are the relay No.B–36 and No.I–51 normal?	—	Go to Step 3	Replace the relay
3	Turn on the ignition switch (the engine is run). Is the battery voltage applied between the harness side connector terminal No.B5–1 and ground?	—	Go to Step 5	Go to Step 4
4	Repair an open circuit between terminal No.B5–1 and No.C–19 fuse. Is the action complete?	—	Go to Step 3	—
5	Is there continuity between the harness side connector terminal No.B5–2 and ground (No.B–2)?	—	Go to Step 7	Go to Step 6
6	Repair an open circuit between terminal No.B5–2 and ground. Is the action complete?	—	—	—
7	Is the battery voltage applied between the harness side connector terminal No.B5–2 and No.B5–1?	—	Go to Step 8	Go to Step 9
8	Replace the blower motor. Is the action complete?	—	Verify repair	—
9	Refer to chart B and C. Is the action complete?	—	Verify repair	—

Chart B: Fan Does Not Rotate in MAX HI Mode

Step	Action	Value(s)	Yes	No
1	Is the MAX-HI relay (I–51) normal?	—	Go to Step 2	Replace the relay
2	1. Turn on the ignition switch (the engine is run). 2. Set the fan switch to the MAX-HI. Is there continuity between the harness side connector terminal No.B5–2 and No.I51–2?	—	Go to Step 4	Go to Step 3
3	Repair an open circuit between terminal No.B5–2 and No.I51–2. Is the action complete?	—	Go to Step 3	—
4	Is there continuity between the harness side connector terminal No.I51–4 and ground (No.B–2)?	—	Go to Step 6	Go to Step 5
5	Repair an open circuit between terminal No.I51–4 and ground (No.B–2). Is the action complete?	—	Go to Step 4	—
6	Is the battery voltage applied between the harness side connector terminal No.I51–1 and ground?	—	Go to Step 8	Go to Step 7
7	Repair an open circuit between terminal No.I51–1 and No.C–20 fuse. Is the action complete?	—	Go to Step 6	—
8	Is the battery voltage applied between the harness side connector terminal No.I32–12 and ground?	—	Go to Step 10	Go to Step 9
9	Repair an open circuit between terminal No.I51–3 and No.I32–12. Is the action complete?	—	Verify repair	—
10	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

Chart C: Fan Does Not Rotate In Any Mode Other Than MAX HI

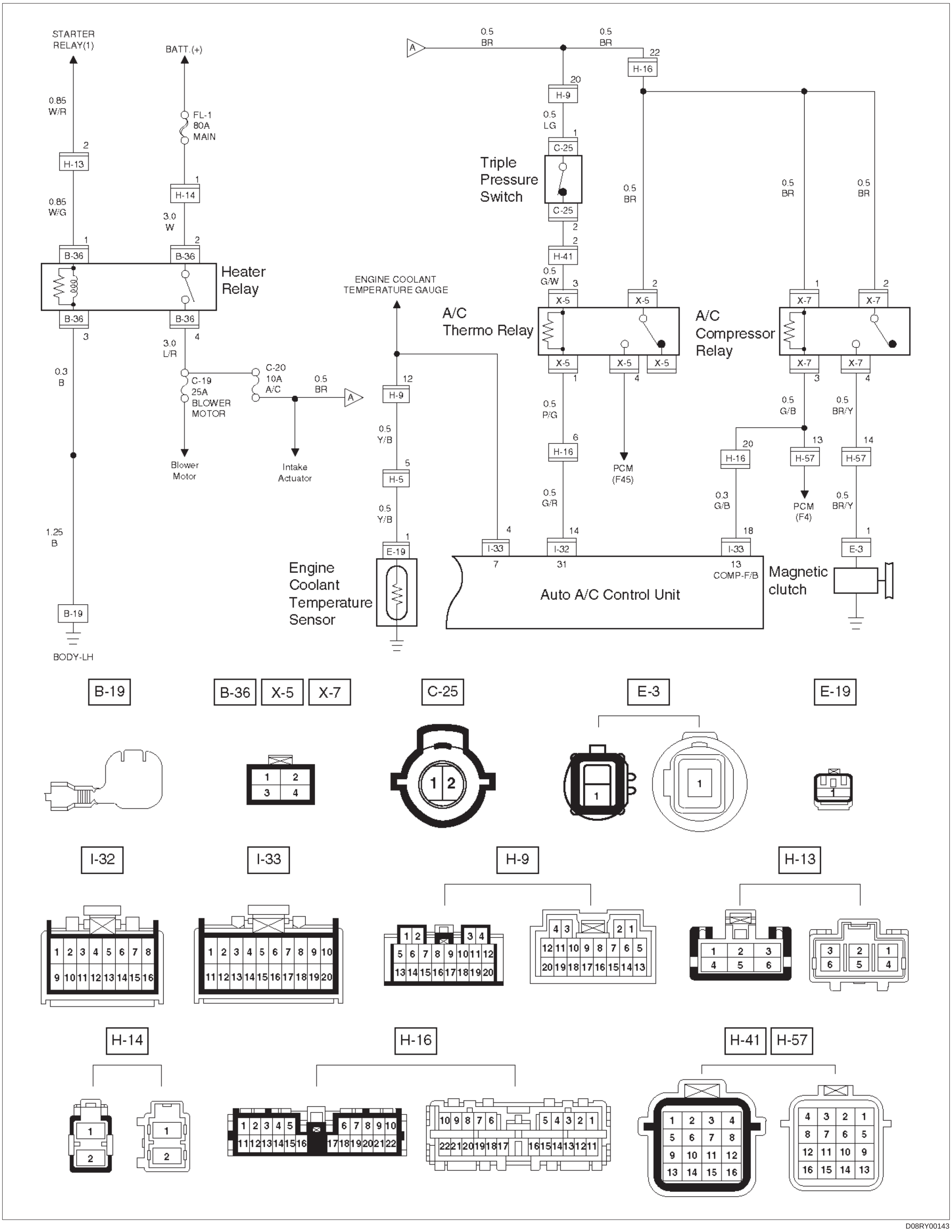
Step	Action	Value(s)	Yes	No
1	Is the power transistor performance normal? (Refer to the later section on “individual inspection”)	—	Go to Step 2	Replace the power transistor
2	Is there continuity between the harness side connector terminal No.B5–2 and No.I50–1, No.B5–2 and No.I33–17?	—	Go to Step 4	Go to Step 3
3	Repair an open circuit between terminal. No.B5–2 and I50–1 No.B5–2 and I33–17	—	Go to Step 2	—
4	Is there continuity between the harness side connector terminal No.I50–3 and ground (No.B–2)?	—	Go to Step 6	Go to Step 5
5	Repair an open circuit between terminal No.I50–3 and ground. Is the action complete?	—	Go to Step 4	—
6	Is there continuity between the harness side connector terminal No.I50–2 and No.I33–19?	—	Go to Step 8	Go to Step 7
7	Repair an open circuit between terminal No.I50–2 and No.I33–19. Is the action complete?	—	Go to Step 6	—
8	Replace the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

Chart D: Fan Does Not Stop

Step	Action	Value(s)	Yes	No
1	1. Disconnect the max high relay, the power transistor connector I–50 and the auto A/C control unit connector I–33. 2. Turn on the ignition switch. Does the blower motor stop?	—	Go to Step 3	Go to Step 2
2	Repair a short circuit between connector No.B5–2 and No.I51–2, No.B5–2 and No.I50–1, or No.B5–2 and I33–17. Is the action complete?	—	Verify repair	—
3	Is the max high relay normal? (Refer to the later section on “individual inspection”.)	—	Go to Step 4	Replace the relay
4	Reinstall the max high relay. Does the blower motor start operating?	—	Go to Step 6	Go to Step 5
5	Repair a short circuit between connector No.I51–3 and No.I32–12. Is the action complete?	—	Go to Step 4	—
6	Is the power transistor normal? (Refer to the later section on “individual inspection”.)	—	Go to Step 7	Replace the power transistor
7	Reinstall the power transistor. Does the blower motor start operating?	—	Replace the auto A/C control unit	—

Inspection of the Magnetic Clutch System

6VE1 Engine



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Condition	Possible cause	Correction
Magnetic clutch does not work	—	Refer to Chart A

Chart A: Magnetic Clutch Does Not work

Step	Action	Value(s)	Yes	No
1	Is the fuse No.C–20 normal?	—	Go to Step 2	Replace the fuse
2	Is the relay No.X–7 (compressor relay) No.X–5 (A/C thermo relay) and No.B–36 (heater relay) normal?	—	Go to Step 3	Replace the fuse
3	Is the thermo unit normal?	—	Go to Step 4	Replace the thermo unit
4	Is the pressure switch normal?	—	Go to Step 5	Replace the pressure switch
5	1. Turn the ignition switch on. (the engine is run.) 2. Push the air conditioner switch on. Is the battery voltage applied between the harness side connector terminal No.E3–1 and the ground?	—	Go to Step 6	Go to Step 7
6	Repair or replace the magnetic clutch. Is the action complete?	—	Verify repair	—
7	Is there continuity between the harness side connector terminal No.X7–4 and No.E3–1?	—	Go to Step 9	Go to Step 8
8	Repair an open circuit between terminal No.X7–4 and No.E3–1. Is the action complete?	—	Go to Step 7	—
9	Is the battery voltage applied between the harness side connector terminal No.X7–2 and ground, No.X7–1 and ground?	—	Go to Step 11	Go to Step 10
10	Repair an open circuit between terminal No.X7–2 and fuse No.C–20, No.X7–1 and fuse No.C–20. Is the action complete?	—	Go to Step 9	—
11	Is the battery voltage applied between the harness side connector terminal No.I33–18 and ground?	—	Go to Step 13	Go to Step 12
12	Repair an open circuit between terminal No.I33–18 and No.X7–3. Is the action complete?	—	Go to Step 11	—
13	Is the battery voltage applied between the harness side connector terminal No.C25–1 and ground?	—	Go to Step 15	Go to Step 14
14	Repair an open circuit between terminal No.C25–1 and fuse No.C–20. Is the action complete?	—	Go to Step 13	—
15	Is the battery voltage applied between the harness side connector terminal No.X5–3 and ground, No.X5–2 and ground?	—	Go to Step 17	Go to Step 16
16	Repair an open circuit between terminal No.X5–3 and No.C25–2, No.X5–2 and fuse No.C–20. Is the action complete?	—	Go to Step 15	—
17	Is the battery voltage applied between the harness side connector terminal No.I32–14 and ground?	—	Go to Step 19	Go to Step 18

Chart A: Magnetic Clutch Does Not work (Cont'd)

Step	Action	Value(s)	Yes	No
18	Repair an open circuit between terminal No.X5–1 and I32–14. Is the action complete?	—	Go to Step 17	—
19	Is there continuity between the harness side connector terminal No.I33–4 and ground?	—	Go to Step 21	Go to Step 20
20	Repair an open circuit between terminal No.I33–4 and No.E19–1. Is the action complete?	—	Go to Step 20	—
21	Dose the thermo relay "ON" when connecting ground to the harness connector terminal No.H16–6?	—	Go to Step 23	Go to Step 22
22	Failure on the auto air conditioner control unit. Is the action complete?	—	Verify repair	—

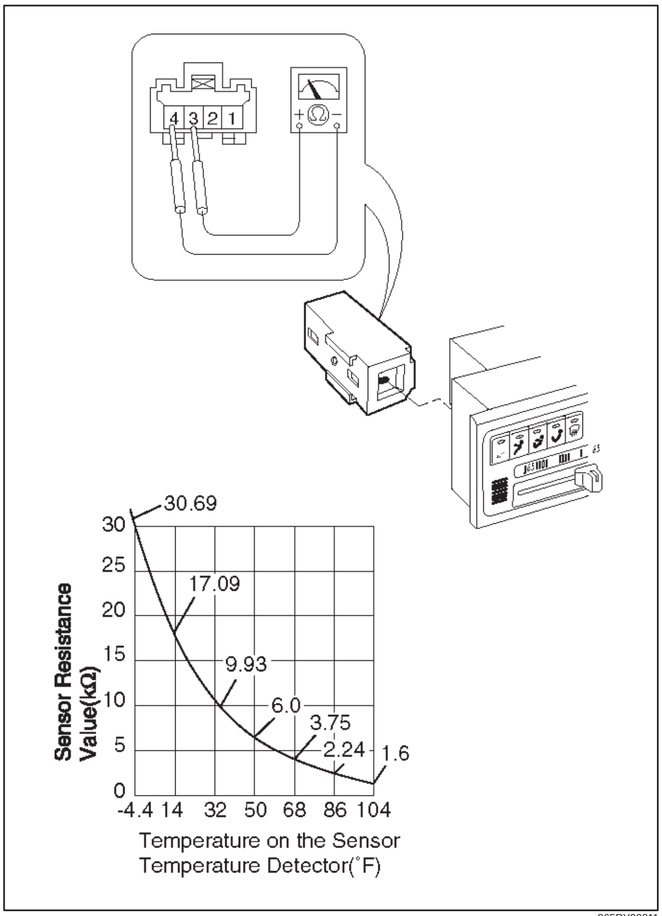
CAUTION: There are conditions which air conditioner system dose not operate except trouble as follows.

1. **The throttle is griater than 90%.**
2. **The ignition voltage is below 10.5 volts.**
3. **The engine speed greater than 4500 RPM for 5 seconds or 5400 RPM.**
4. **The engine coolant temperature (ECT) is greater than 257°F.**
5. **The intake air temperature (IAT) is less than 41°F.**
6. **The power steering pressure switch signals a high pressure condition.**

Individual Inspection

In Car Sensor

1. Disconnect the in car sensor connector (I–34).
2. Measure resistance between the in car sensor side terminal No.I34–3 and No.I34–4.



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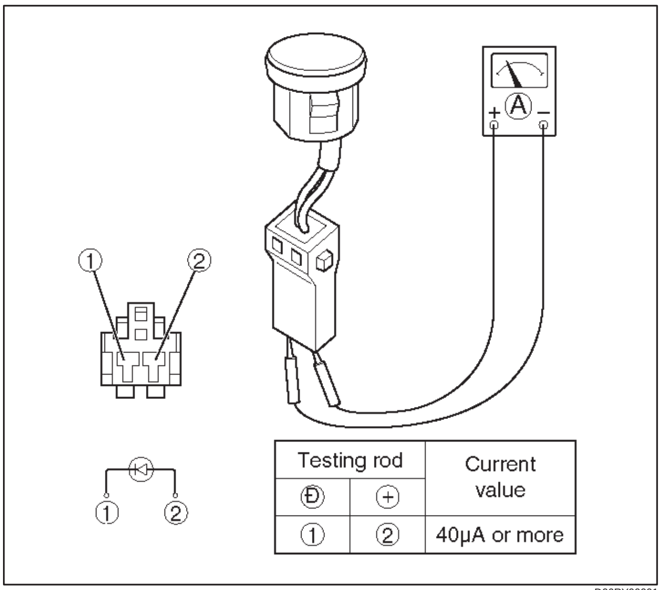
Sun Sensor

1. Disconnect the sun sensor connector (I–35).
2. Measure the current value on the sun sensor when placed it approximately 15 cm away from 60W incandescent lamp.

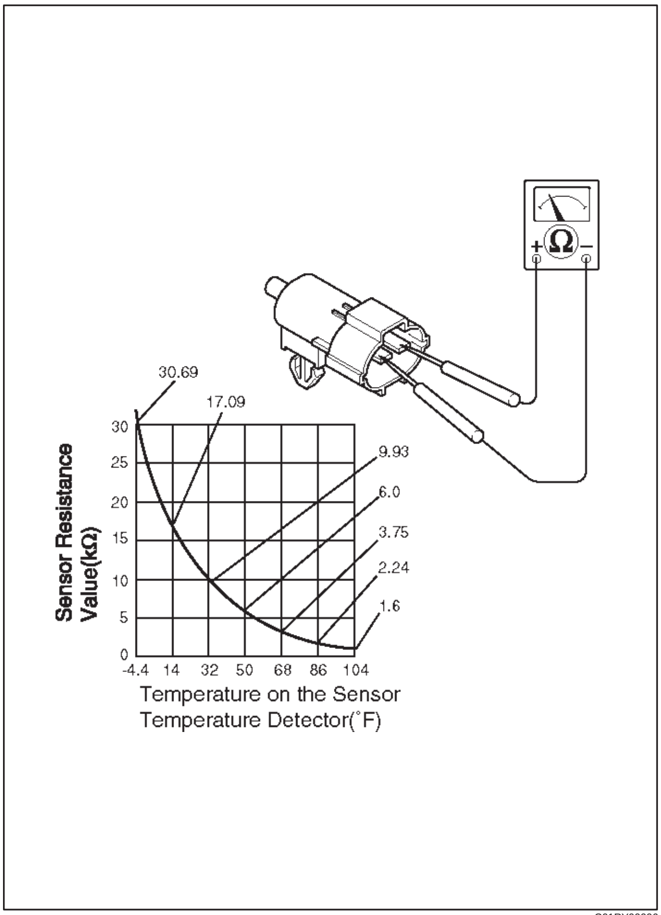


Testing rod		Current value
Ð	+	
1	2	40μA or more

D06RY00001

Ambient Sensor

1. Disconnect the connector (C–86) on the ambient sensor.
2. Measure resistance between the ambient sensor side terminals.



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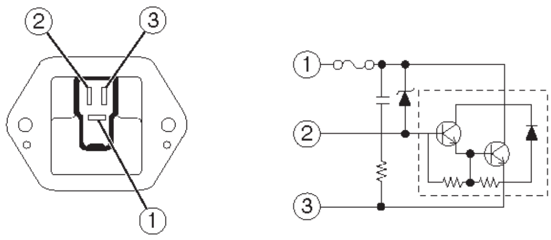
Power Transistor

1. Remove the power transistor connector (I–50) from the evaporator assembly.
2. Check the conduction between the power transistor side terminals.

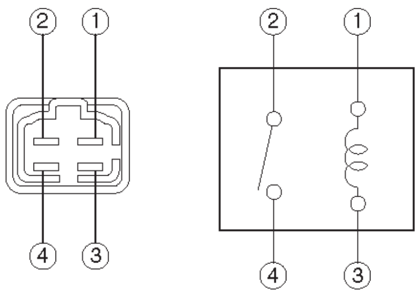


Terminal No.	1	2	3	Conduction
Testing rod	⊖	⊕		Conducted (50Ω maximum)
	⊖		⊕	Conducted (100Ω maximum)
	⊕	⊖		Not conducted
	⊕	⊖		Conducted (220Ω maximum)
		⊖	⊕	Not conducted

C01RY00002

MAX HI Relay

1. Remove the MAX – HI relay connector (I–51) from the blower assembly.
2. Check the conduction between the MAX – HI relay side terminals.



No continuity between terminals (2) and (4).
Continuity between terminal (2) and (4) when battery voltage is applied between (1) and (3).

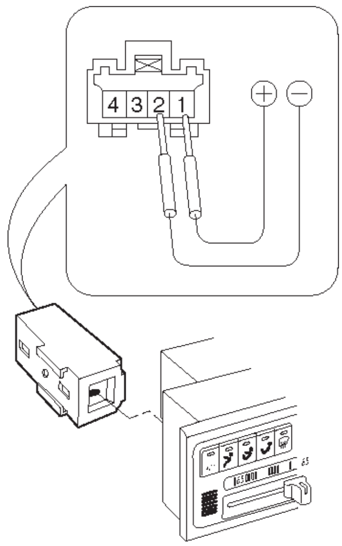
C01RY00003

In Car Sensor

1. Turn on the ignition switch (the engine is started). Start the air conditioner in “Full Auto”.
2. Make sure that the in car sensor suctions cigarette smokes and such.

In Car Sensor

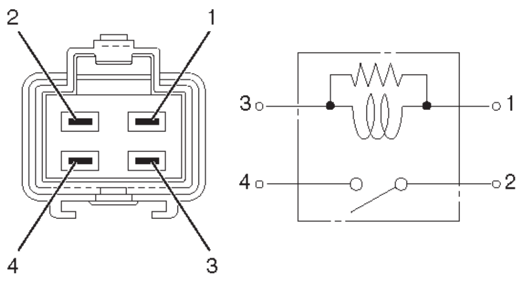
1. Dismount the in car sensor from the automatic heater/air conditioner control unit. Connect (+) end and (–) end of the battery to the aspirator motor side terminals No.I34–1 and No.I34–2, respectively, then check if the motor runs normally.



C01RY00005

Heater (B–36), Thermostat (X–5), And Compressor (X–7) Relay

1. Disconnect relays and check for continuity and resistance between relay terminals.
   - For handling of these relays, refer to Heater Relay in this section.



2 – 4 ...No continuity

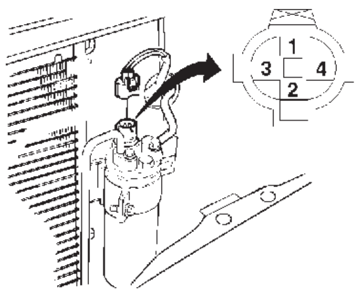
(When battery voltage is applied between 1 and 3)

2 – 4 ...Continuity

901RY00041

Triple Pressure Switch (V6, A/T)

1. Disconnect the connector and check for continuity between pressure switch side connector terminals (1) and (2).
2. Reconnect the connector to activate the A/C switch, and check to see if there is continuity between the chassis side connector terminal (3) and (4) and the fan operates.

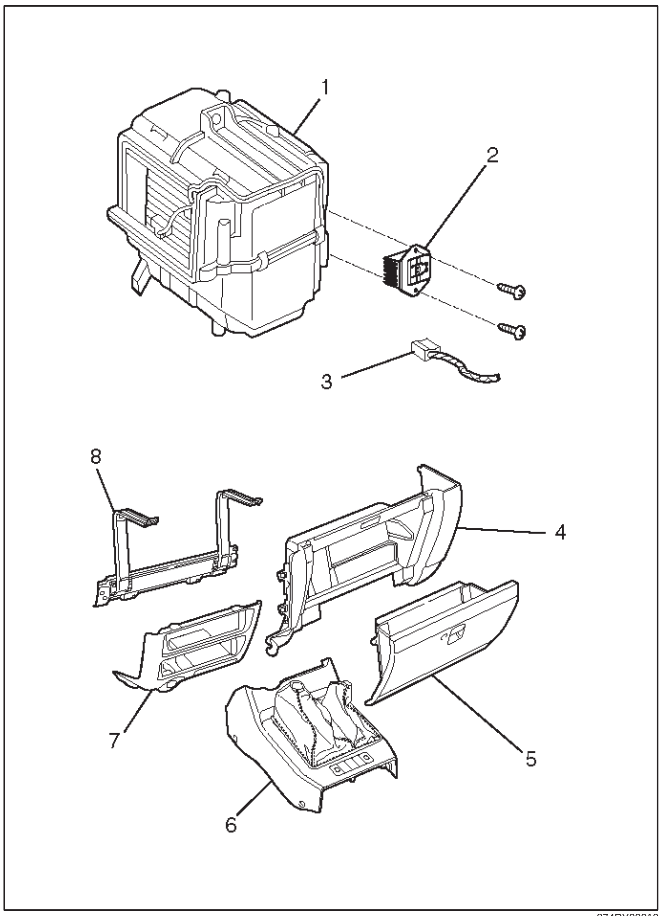


Terminal	Conducted
1-2	ON / OFF kpa (psi): 176.5 (25.6), 186.3 (27.0), 2353.6 (341.3), 2942.0 (426.6)
3-4	ON / OFF kpa (psi): 1078.7 (156.4), 1471.0 (213.3)

875RX009

On-Vehicle Service

Power Transistor



874RY00010

Legend

(1) Evaporator Assembly
(2) Power Transistor
(3) Power Transistor Connector
(4) Instrument Panel Passenger Lower Cover
(5) Glove Box
(6) Front Console
(7) Lower Cluster
(8) Passenger Knee Bolster Reinforcement

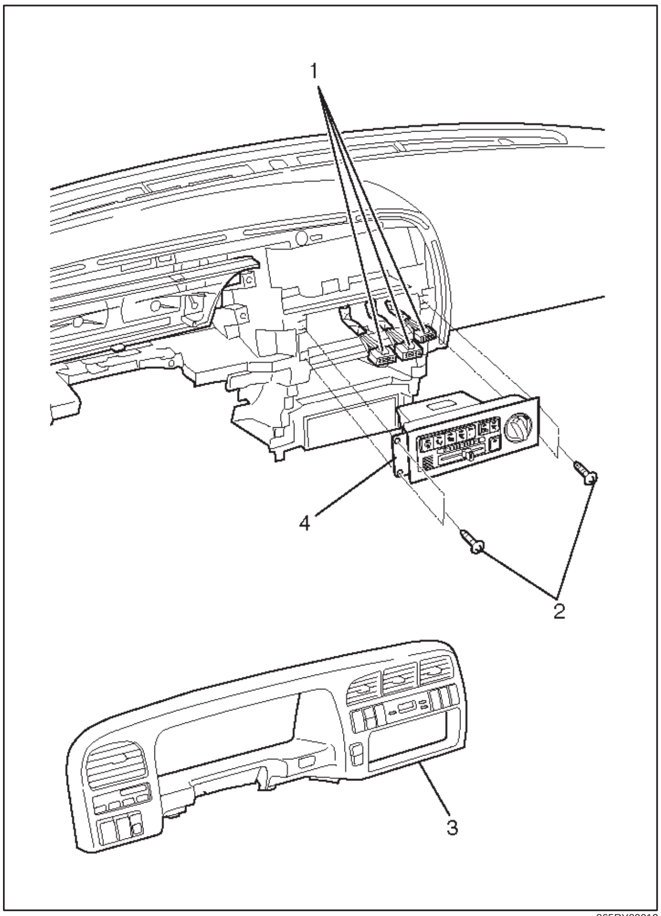
Removal

1. Remove front console.
2. Remove lower cluster.
3. Remove glove box.
4. Remove instrument panel passenger lower cover.
5. Remove passenger knee bolster reinforcement.
6. Disconnect the power transistor connector.
7. Remove power transistor.

Installation

To install, follow the removal step in the reverse order.

Automatic Heater/Air Conditioner Control Unit



865RY00012

Legend

(1) Connector
(2) Set Screw
(3) Instrument Panel Cluster
(4) Automatic Heater/Air Conditioner Control Unit

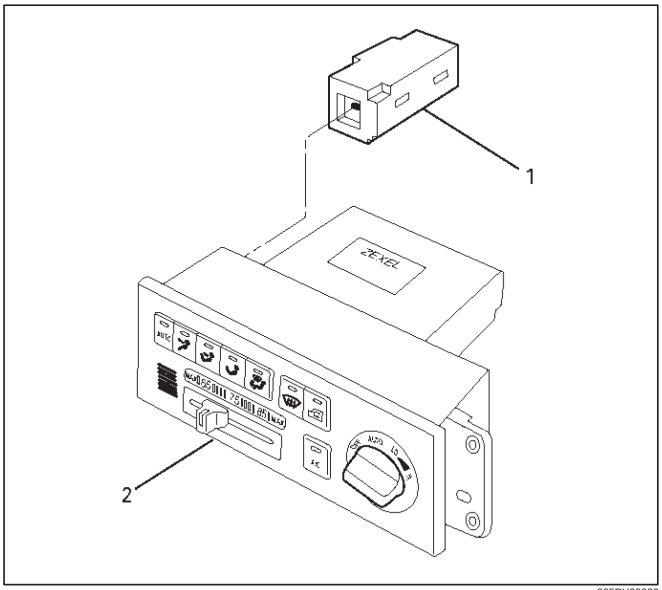
Removal

1. Disconnect the battery ground cable.
2. Remove instrument panel cluster.
   - Refer to Instrument Panel Assembly in Body Stractur section.
3. Disconnnect the automatic heater/air conditioner control unit connector.
4. Remove automatic heater/air conditioner control unit.

Installation

To install, follow the removal step in the reverse order.

In Car Sensor



865RY00020

Legend

(1) In Car Sensor
(2) Automatic Heater/Air Conditioner Control Unit

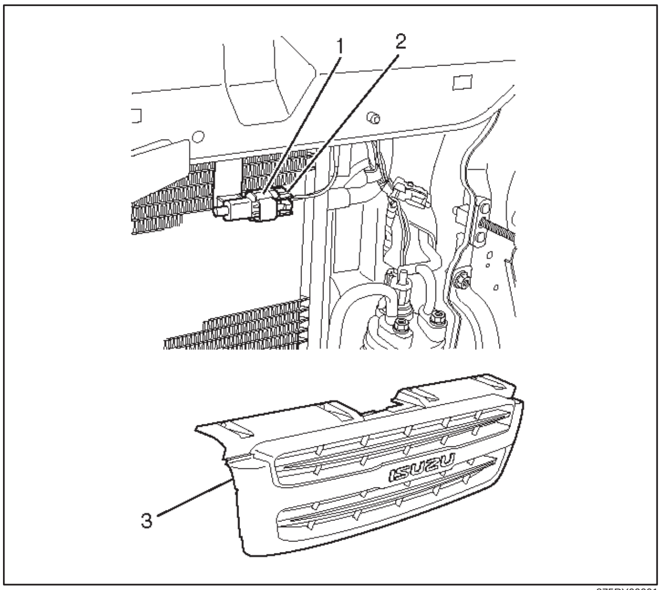
Removal

1. Disconnect the battery ground cable.
2. Remove the automatic heater/air conditioner control unit.
   - Refer to the automatic heater/air conditioner control unit section.
3. Remove in car sensor.

Installation

To install, follow the removal step in the reverse order.

Ambient Sensor



875RY00001

Legend

(1) Ambient Sensor
(2) Sensor Connector
(3) Radiator Grille

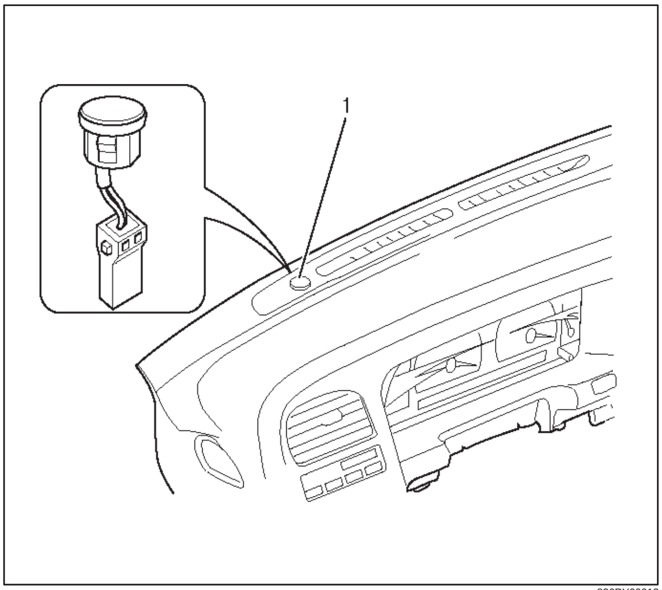
Removal

1. Disconnect the battery ground cable.
2. Remove radiator grille.
   - Refer to Radiator Grille in Body Structure section.
3. Disconnect the ambient sensor connector.
4. Remove the ambient sensor.

Installation

To install, follow the removal step in the reverse order.

Sun Sensor



826RY00012

Legend

(1) Sun Sensor

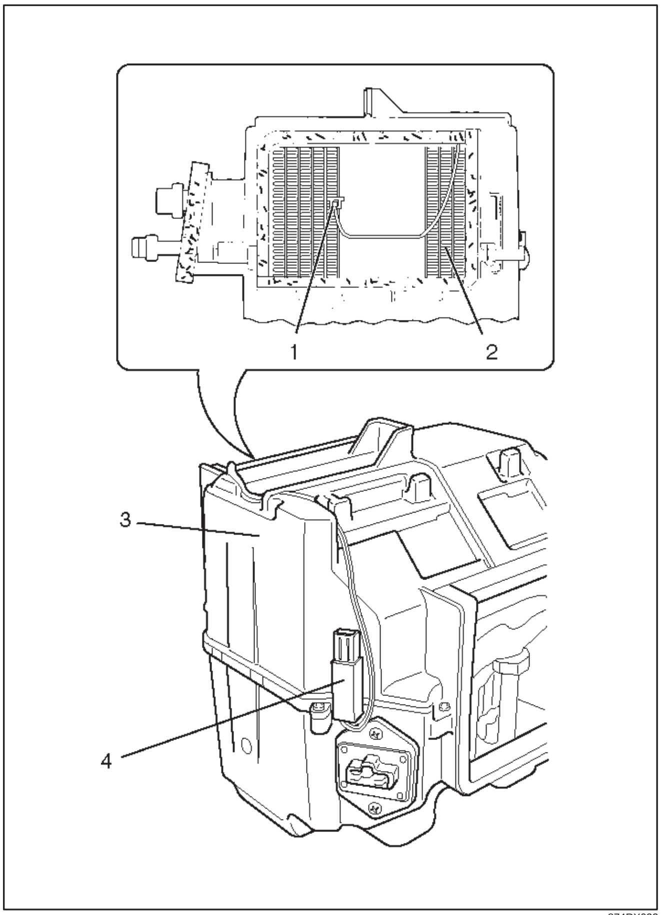
Removal

1. Disconnect the battery ground cable.
2. Remove the sun sensor.
3. Disconnect the sun sensor connector.

Installation

To install, follow the removal step in the reverse order.

Electronic Thermostat



874RX022

Legend

(1) Duct Sensor
(2) Evaporator Core
(3) Evaporator Assembly
(4) Thermostat Assembly

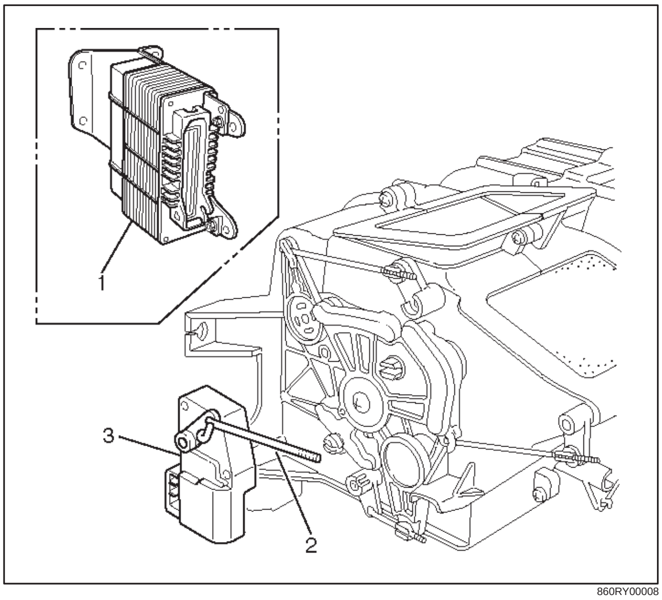
Removal

1. Disconnect the battery ground cable.
2. Remove evaporator assembly.
   - Refer to evaporator assembly section.
3. Remove electronic thermostat.

Installation

To install, follow the removal step in the reverse order.

Mode Actuator



Legend

(1) A/T Control Unit
(2) Actuator Rod
(3) Mode Actuator

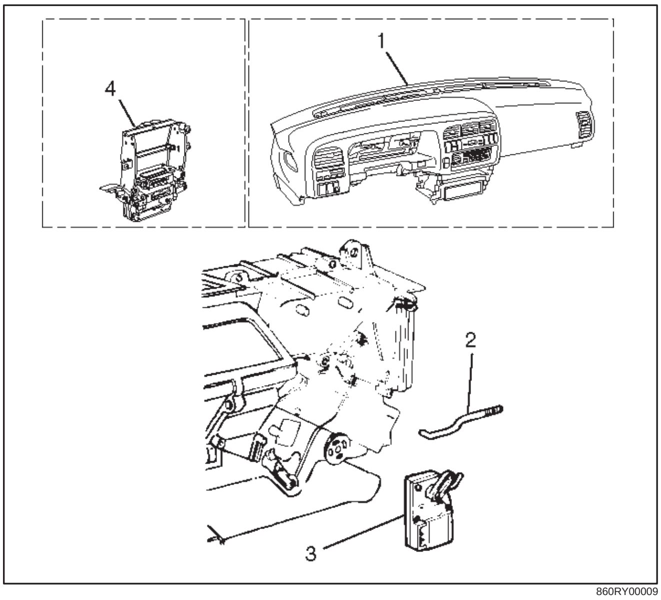
Removal

1. Disconnect the battery ground cable.
2. Remove the PCM.
   - The connector shall remain connected.
3. Remove the actuator rod.
4. Remove the mode actuator.

Installation

To install, follow the remove step in the reverse order.

Mix Actuator



Legend

(1) Instrument Panel Assembly
(2) Actuator Rod
(3) Mix Actuator
(4) Instrument Panel Center Bracket

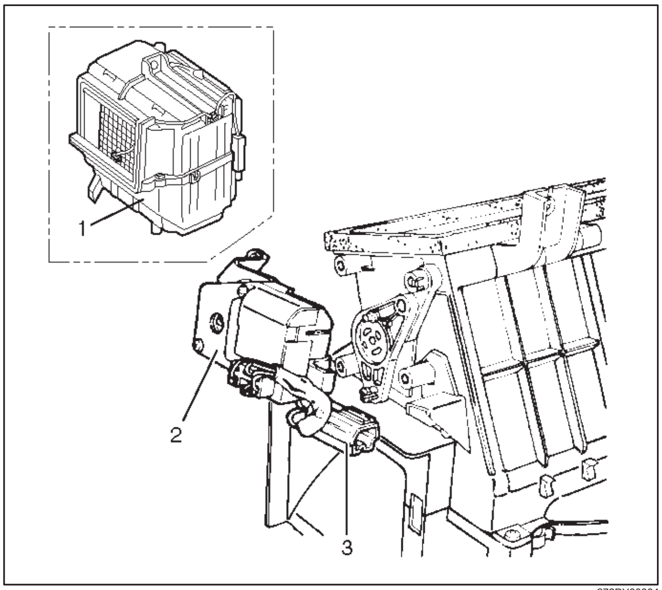
Removal

1. Disconnect the battery ground cable.
2. Remove the instrument panel assembly.
   - Refer to the Instrument Panel Assembly in Body and Accessories section.
3. Remove the instrument panel center bracket.
4. Remove the actuator rod.
5. Remove the mix actuator.

Installation

To install, follow the remove step in the reverse order.

Intake Actuator



873RY00004

Legend

(1) Evaporator Assembly
(2) Intake Actuator
(3) Intake Actuator Connector

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to Refrigerant Recovery in this section.
3. Remove the evaporator assembly.
   - Refer to Evaporator Assembly section.
4. Disconnect the intake actuator connector.
5. Remove the intake actuator.

Installation

To install, follow the remove step in the reverse order.

TROOPER

STEERING

POWER ASSISTED SYSTEM

CONTENTS

Service Precaution

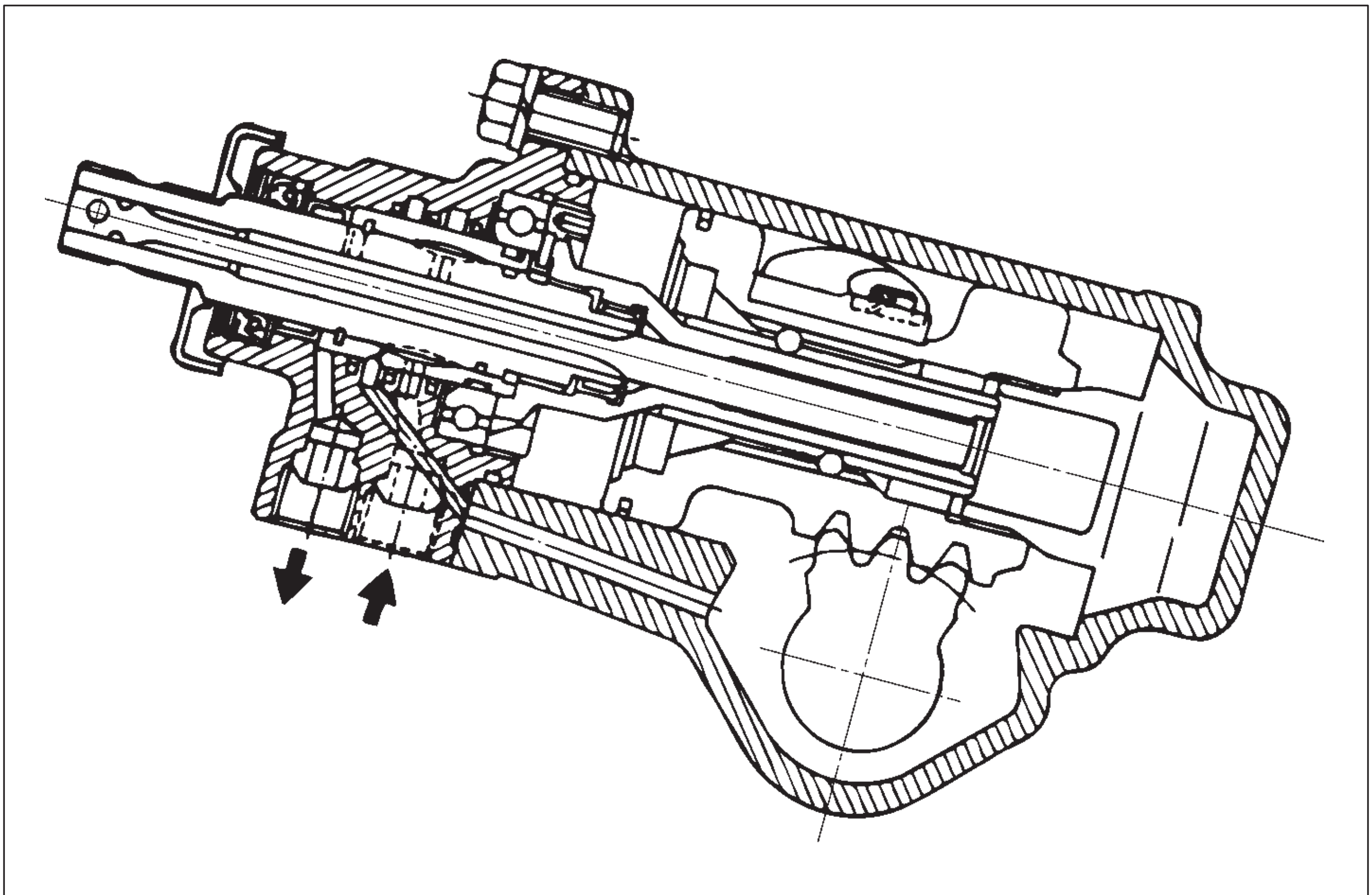
WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The hydraulic power steering system consists of a pump, an oil reservoir, a steering gear, a pressure hose and a return hose.

Power Steering Gear



A03RS001

The power steering gear has a recirculating ball system which acts as a rolling thread between the worm shaft and the rack piston. When the worm shaft is turned right, the rack piston moves up in gear.

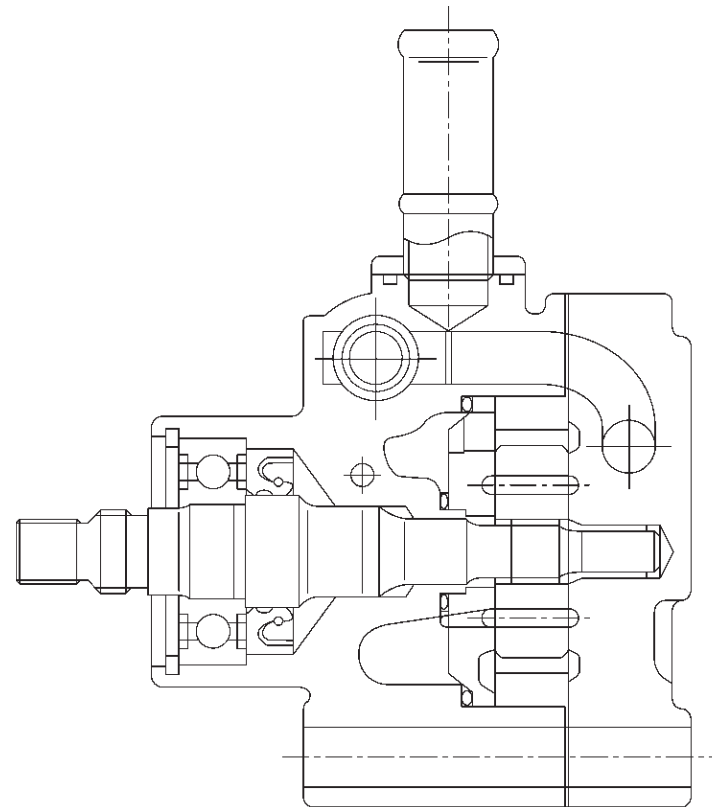
Turning the worm shaft left moves the rack piston down in gear. The rack piston teeth mesh with the sector gear, which is part of the sector shaft.

Turning the worm shaft turns the sector shaft, which turns the wheels through the steering linkage.

The control valve in the steering gear directs the power steering fluid to either side of the rack piston.

The rack piston converts the hydraulic pressure into a mechanical force. If the steering system becomes damaged and loses hydraulic pressure, the vehicle can be controlled manually.

Hydraulic Pump



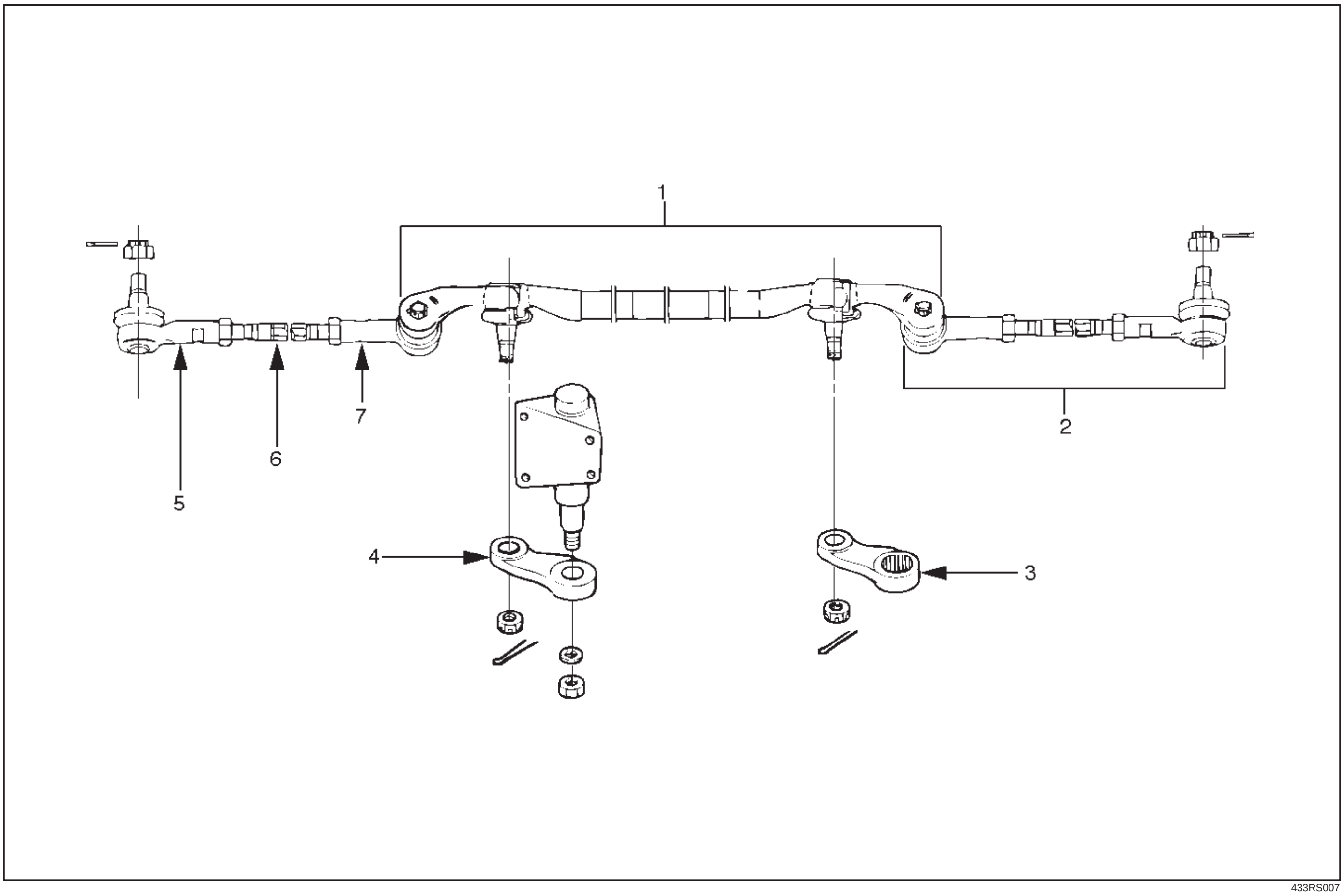
442RV006

The hydraulic pump is a vane-type design. There are two openings at the rear of the pump housing. The larger opening contains the cam ring, pressure plate, thrust plate, rotor and vane assembly, and end plate. The smaller opening contains the pressure line union, flow control valve and spring.

Pressure Switch

When hydraulic pressure reaches 3650 ± 350 kPa (530 ± 50 psi), the pressure switch of the power steering pump closes causing the Powertrain Control Module (PCM) to actuate the idle air control valve, which increases the engine rpm to prevent the overload-induced engine speed slow down. The switch opens when hydraulic pressure drops to 3150 ± 350 kPa (460 ± 50 psi).

Steering Linkage



Legend

(1) Center Track Rod Assembly
(2) Outer Track Rod Assembly
(3) Pitman Arm
(4) Relay Lever
(5) Rod End,Outer
(6) Track Rod
(7) Rod End,Inner

The steering linkage consists of a pitman arm, relay lever, center track rod, and two adjustable outer track rods.
When the steering wheel is turned, the gear rotates the pitman arm which forces the center track rod to one side. The outer track rods, connected to the center track rod by ball studs, transfers the steering force to the wheels. The outer track rods are adjustable and are used for toe-in adjustments. The center track rod is supported by the pitman arm and relay lever. The relay lever pivots on a support attached to the frame.
The overall condition of the steering linkage affects steering performance. If parts are bent, damaged, worn or poorly lubricated, improper and possibly dangerous steering action will result.
Whenever any steering linkage components are repaired or replaced, check the steering geometry and front end alignment. Refer to Front End Alignment Inspection and Adjustment in this section.

Steering Column

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLE-SHOOTING THE SRS SYSTEM, DO NOT USE ELECTRICAL TEST EQUIPMENT, SUCH AS BATTERY-POWERED OR A/C-POWERED VOLT-METER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN SPECIFIED IN THIS MANUAL. DO NOT USE A NON-POWERED PROBE-TYPE TESTER.

INSTRUCTION IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

When servicing a vehicle equipped with Supplemental Restraint System, pay close attention to all WARNINGS and CAUTIONS.

For detailed explanation about SRS, refer to Restraints section.

The steering column has three important features in addition to the steering function:

1. The column is energy absorbing, designed to compress in a front-end collision to minimize the possibility of injury to the driver of the vehicle.
2. The ignition switch and lock are mounted conveniently on the column.
3. With the column mounted lock, the ignition and steering operation can be locked to prevent theft of the vehicle.

The column can be disassembled and reassembled. However, to ensure the energy absorbing action, use only the specified screws, bolts and nuts as designated, and tighten them to the specified torque.

Handle the column with care when it is removed from the vehicle. A sharp blow on the end of steering shaft or shift lever, or dropping the assembly could shear or loosen the fasteners that maintain column rigidity.

Diagnosis

Since the problems in steering, suspension, wheels and tires involve several systems, they must all be considered when diagnosing a complaint. To identify the symptom, always road test the vehicle first. Proceed with the following preliminary inspections and correct any defects which are found.

1. Inspect tires for proper pressure and uneven wear.
2. Raise vehicle on a hoist, then inspect front and rear suspension and steering linkage for loose or damaged parts.
3. Spin the front wheels. Inspect for out-of-round tires, out-of-balance tires, loose and/or rough wheel bearings.

General Diagnosis

Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.

Condition	Possible cause	Correction
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower ball joints.	Replace ball joints
	Excessive wheel runout.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial runout of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering gear.	Tighten housing bolts.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.
Hard Steering	Bind in steering linkage ball studs, upper or lower ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Steering gear misadjustment.	Check and adjust pinion torque.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to “Power steering system diagnosis”
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering gear or linkage.	Retighten or repair.
	Steering gear misadjustment.	Inspect and adjust steering gear preload.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.

Condition	Possible cause	Correction
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering gear.	Retighten mounting bolt.
	Faulty steering gear.	Check and adjust steering gear.
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Steering gear misadjustment.	Check or adjust steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.

Power Steering System

There is some noise in all power steering systems. One of the most common is a hissing sound when the steering wheel is fully turned and the car is not moving. This noise will be most evident when the steering wheel is operated while the brakes are applied. There is no relationship between this noise and steering performance. Do not replace the valve unless the “hissing” noise is extremely objectionable. A replacement valve will also have a slight noise, and is not always a cure for the condition.

Condition	Possible cause	Correction
Rattle or Chucking Noise	Pressure hose touching other parts of vehicle.	Adjust hose position. Do not bend tubing by hand.
	Tie rod ends loose.	Tighten or replace tie rod end.
	Loose steering gear mounting.	Tighten steering gear mounting.
	Steering gear misadjustment.	Check and adjust steering gear preload.
Poor Return of Steering Wheel to Center	Improper front wheel alignment.	Adjust front wheel alignment.
	Wheel bearing worn.	Replace front wheel bearing.
	Tie rod end binding.	Replace tie rod end.
	Ball joint binding.	Replace ball joint.
	Tight or frozen steering shaft bearing.	Replace steering assembly.
	Steering gear misadjustment.	Adjust the steering gear.
	Sticky or plugged steering gear valve.	Repair or replace steering gear valve.
	Entry of air in the power steering system.	Bleed the system.
Momentary Increase In Effort When Turning Wheel Fast To Right or Left	High internal leakage.	Repair steering gear.
	Power steering fluid level low.	Replenish fluid.
Steering Wheel Surges or Jerks When Turning Especially During Parking	Insufficient pump pressure.	Repair pump assembly.
	Sticky steering gear valve.	Repair or replace steering gear.
	Power steering fluid level low.	Replenish fluid.
Excessive Wheel Kick Back or Loose Steering	Air in system.	Bleed hydraulic system.
	Tie rod end loose.	Tighten tie rod end.
	Wheel bearing worn.	Replace wheel bearing.
Hard Steering or Lack of Power Assist	Sticky steering gear valve.	Repair or replace steering gear valve.
	Insufficient pump pressure.	Repair pump assembly.
	Excessive internal pump leakage.	Repair pump assembly.
	Excessive internal steering gear leakage.	Repair steering gear.
	Power steering fluid level low.	Replenish fluid.
Unstable Engine Idling or Stalling When Turning	Pressure switch of the power steering pump or its harness is faulty.	Repair or replace.

Power Steering Pump

Foaming milky power steering fluid, low fluid level, and possible low pressure can be caused by air in the fluid, or loss of fluid due to internal pump leakage. Check for leak and correct. Bleed the system. Extremely cold temperatures will cause air bubbles in the system if the fluid level is low. If the fluid level is correct and the pump still foams, remove the pump from the vehicle and check the housing for cracks. If the housing is cracked, replace the pump housing.

Condition	Possible cause	Correction
Low Pressure Due to Steering Pump	Relief valve sticking or inoperative.	Replace relief valve.
	Side plate not flat against cam ring.	Replace side plate.
	Extreme wear of cam ring.	Replace cam ring.
	Scored side plate or rotor.	Replace side plate or rotor.
	Vanes sticking in rotor slots.	Repair or replace vanes and rotor.
	Cracked or broken side plate.	Replace side plate.
	High internal leakage.	Repair internal leakage.
Low Pressure Due to Steering Gear	Scored housing bore.	Replace housing.
Growling Noise In Steering Pump	Excessive back pressure in hoses or steering unit caused by restriction.	Repair steering unit or pump.
	Scored side plate or rotor.	Replace side plate or rotor.
	Worn cam ring.	Replace cam ring.
Groaning Noise In Steering Pump	Air in the fluid.	Bleed hydraulic system.
	Low fluid level.	Replenish fluid.
	Pump mounting loose.	Tighten mounting bolt.
Rattling Noise In Steering Pump	Vanes sticking in rotor slots.	Repair or replace vanes and rotor.
	Vane improperly installed.	Repair rotor and vane.
Swishing Noise In Steering Pump	Damaged relief valve.	Replace relief valve.
Whining Noise In Steering Pump	Scored side plate and vanes.	Replace side plate and vanes.

Steering Column Lock System

Condition	Possible cause	Correction
Will Not Unlock	Damaged lock cylinder.	Replace lock cylinder.
	Damaged park lock cable.	Replace park lock cable.
Will Not Lock	Lock spring broken or worn.	Replace lock cylinder.
	Damaged lock cylinder.	Replace lock cylinder.
	Ignition switch stuck.	Repair or replace ignition switch.
	Park lock cable damaged.	Replace park lock cable.
Key Cannot be Removed in “OFF-LOCK”	Ignition switch is not set correctly.	Correct ignition switch.
	Damaged lock cylinder.	Replace lock cylinder.
	Faulty shift lock mechanism.	Repair or replace the shift lock mechanism.

Column

Condition	Possible cause	Correction
Noise in Column	Universal joint loose.	Tighten joint.
	Shaft lock snap ring not seated.	Place snap ring in proper position.

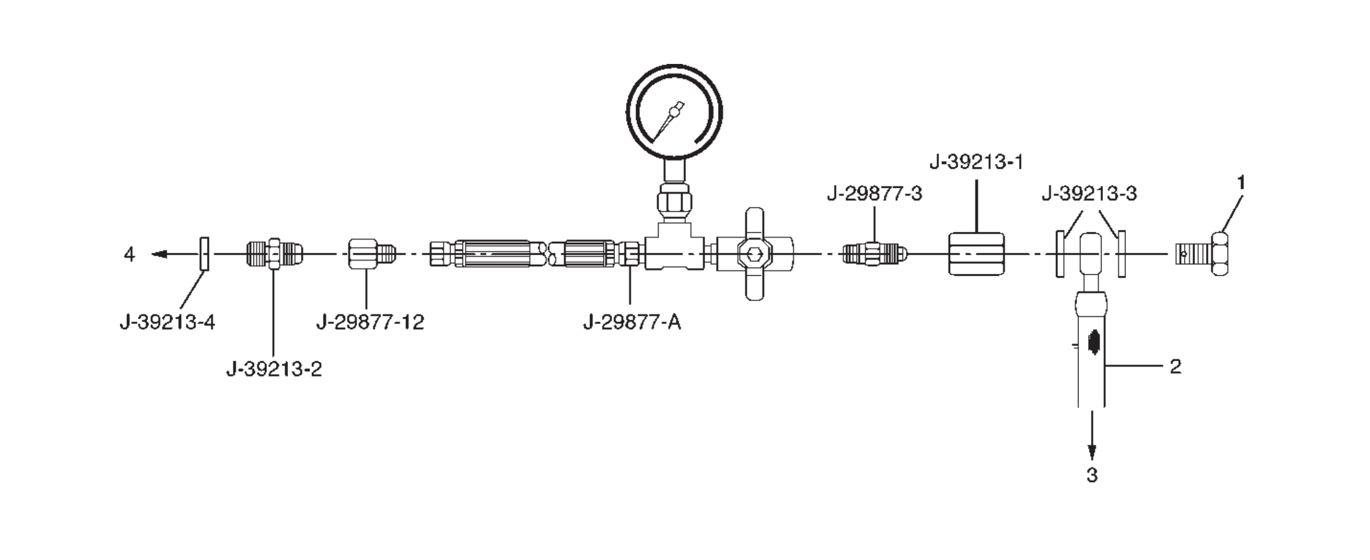
Turn Signal Switch

This diagnosis covers mechanical problems only. Refer to Turn Signal Switch in Electrical section for electrical diagnosis.

Condition	Possible cause	Correction
Turn Signal Will Not Stay In Turn Position	Foreign material or loose parts preventing movement of yoke.	Repair or replace signal switch.
	Broken or missing detent or canceling spring.	Replace signal switch.
Turn Signal Will Not Cancel	Loose switch mounting screws.	Tighten mounting screws.
	Switch or anchor bosses broken.	Replace turn signal switch.
	Broken, missing or out of position detent, return or canceling spring.	Replace turn signal switch.
	Worn canceling cam.	Replace turn signal switch.
Turn Signal Difficult To Operate	Turn signal switch arm loose.	Tighten arm screw.
	Broken or distorted yoke.	Replace turn signal switch.
	Loose or misplaced springs.	Replace turn signal switch.
	Foreign parts and/or material.	Repair turn signal switch.
	Loose turn signal switch mounting screws.	Tighten mounting screws.
Turn Signal Will Not Indicate Lane Change	Broken lane change pressure pad or spring hanger.	Replace turn signal switch.
	Broken, missing or misplaced lane change spring.	Replace turn signal switch.
	Base of wire damaged.	Replace turn signal switch.
Hazard Switch Cannot Be Turned Off	Foreign material between hazard switch to turn signal switch body.	Repair or replace hazard switch.
No Turn Signal Lights	Electrical failure in chassis harness.	Refer to Electrical section.
	Inoperative turn signal flasher unit.	Replace flasher unit.
	Loose chassis harness connector.	Repair loose connector.
Front or Rear Turn Signal Lights Not Flashing	Burned-out or damaged turn signal bulb.	Replace bulb.
	High resistance connection to ground at bulb socket.	Repair bulb socket.
	Loose chassis harness connector.	Repair loose connector.

Power Steering System Test

Test Procedure



F02RX001

Legend

(1) Bolt (M16 × 1.5)
(2) Hose (Vehicle Side)
(3) To Power Steering Gear
(4) To Power Steering Pump

Test of fluid pressure in the power steering system is performed to determine whether or not the oil pump and power steering unit are functioning normally.

The power steering system test is the method used to identify and isolate hydraulic circuit difficulties. Prior to performing this test, the following inspections and corrections, if necessary, must be made.

- Inspect pump reservoir for proper fluid level.
- Inspect pump belt for proper tension.
- Inspect pump driver pulley condition.

1. Place a container under the pump to catch the fluid when disconnecting or connecting the hoses.
2. With the engine NOT running,disconnect the pressure hose at the power steering pump and install power steering tester J-29877-A. The gauge must be between the shutoff valve and pump. Open the shutoff valve.
3. Check the fluid level. Fill the reservoir with power steering fluid, to the “Full” mark. Start the engine, then turn the steering wheel and momentarily hold it against a stop (right or left). Turn the engine off and check the connections at tester for leakage.
4. Bleed the system. Refer to Bleeding the Power Steering System in this section.
5. Start the engine and check the pump fluid level. Add power steering fluid if required. When the engine is at normal operating temperature, increase engine speed to 1500 rpm.

CAUTION: Do not leave shutoff valve fully closed for more than 5 seconds, as the pump could become damaged internally.

6. Fully close the shutoff valve. Record the highest pressures.
   - If the pressure recorded is within 9300–9800 kPa (1350–1420 psi), the pump is functioning within its specifications.
   - If the pressure recorded is higher than 9800 kPa (1420 psi), the valve in the pump is defective.
   - If the pressure recorded is lower than 9300 kPa (1350 psi), the valve or the rotating group in the pump is defective.

7. If the pump pressures are within specifications, leave the valve open and turn (or have someone else turn) the steering wheel fully in both directions. Record the highest pressures and compare with the maximum pump pressure recorded in step 6. If this pressure cannot be built in either side of the power steering gear, the power steering gear is leaking internally and must be disassembled and repaired.
8. Shut the engine off, remove the testing gauge.
9. Reconnect the pressure hose, check the fluid level and make the needed repairs.
10. If the problem still exists, the steering and front suspension must be thoroughly examined.

Maintenance

The hydraulic system should be kept clean and fluid level in the reservoir should be checked at regular intervals and fluid added when required. Refer to Recommended Fluids and Lubricants in General Information section for the type of fluid to be used and the intervals for filling.

If the system contains some dirt, flush it as described in this section. If it is exceptionally dirty, both the pump and the gear must be completely disassembled before further usage.

All tubes, hoses, and fittings should be inspected for leakage at regular intervals. Fittings must be tight. Make sure the clips, clamps and supporting tubes and hoses are in place and properly secured.

Power steering hoses and lines must not be twisted, kinked or tightly bent. Air in the system will cause spongy action and noisy operation. When a hose is disconnected or when fluid is lost, for any reason, the system must be bled after refilling. Refer to Bleeding the Power Steering System in this section.

- Inspect belt for tightness.
- Inspect pulley for looseness or damage. The pulley should not wobble with the engine running.
- Inspect hoses so they are not touching any other parts of the vehicle.
- Inspect fluid level and fill to the proper level.

Fluid Level

1. Run the engine until the power steering fluid reaches normal operating temperature, about 55˚C (130˚F), then shut the engine off.
2. Check the level of fluid in the reservoir.
3. If the fluid level is low, add power steering fluid as specified in General Information to the proper level and install the receiver cap.
4. When checking the fluid level after the steering system has been serviced, air must be bled from the system. Refer to Bleeding the Power Steering System in this section.

Bleeding The Power Steering System

When a power steering pump or gear has been installed, or an oil line has been disconnected, the air that has entered the system must be bled out before the vehicle is operated. If air is allowed to remain in the power steering fluid system, noisy and unsatisfactory operation of the system may result.

Bleeding Procedure

When bleeding the system, and any time fluid is added to the power steering system, be sure to use only power steering fluid as specified in General Information.

1. Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two minutes.
2. Start the engine and let it run for a few seconds. Do not turn the steering wheel. Then turn the engine off.
3. Add fluid if necessary.
4. Repeat the above procedure until the fluid level remains constant after running the engine.
5. Raise and support the front end of the vehicle so that the wheels are off the ground.
6. Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.
7. Add power steering fluid if necessary.
8. Lower the vehicle, set the steering wheel at the straight forward position after turning it to its full steer positions 2 or 3 times, and stop the engine.
9. Check the fluid level and refill as required.
10. If the fluid is extremely foamy, allow the vehicle to set a few minutes, then repeat the above procedure.

Flushing The Power Steering System

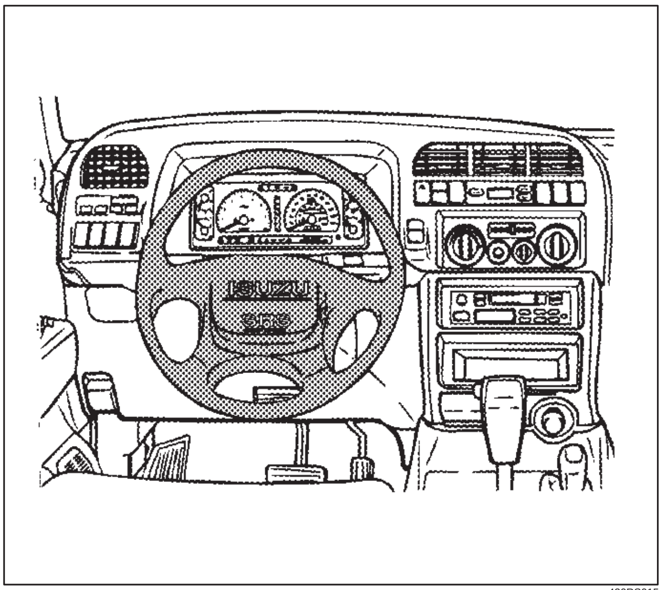
1. Raise and support the front end of the vehicle off the ground until the wheels are free to turn.
2. Remove the fluid return line at the pump inlet connector and plug the connector port on the pump. Position the line toward a large container to catch the draining fluid.
3. While running the engine at idle, fill the reservoir with new power steering fluid. Turn the steering wheel in both directions. Do not contact or hold the steering wheel to the wheel stops. This will cause the pump to go to pressure relief mode, which may cause a sudden fluid overflow at the reservoir.

4. Install all the lines and hoses. Fill the system with new power steering fluid and bleed the system as described in Bleeding The Power Steering System. Operate the engine for about 15 minutes.

   Remove the pump return line at the pump inlet and plug the connection on the pump. While refilling the reservoir, check the draining fluid for contamination. If foreign material is still evident, replace all lines, disassemble and clean or replace the power steering system components. Do not re-use any drained power steering fluid.

Steering Wheel Free Play Adjustment

Inspection



430RS015

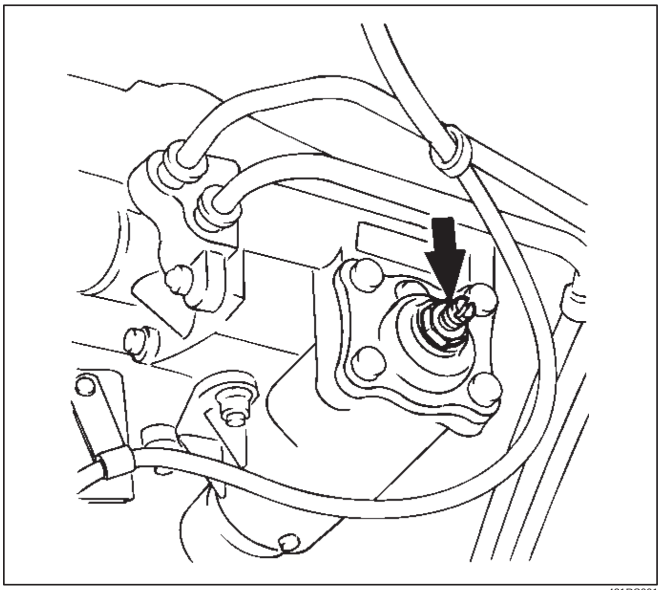
1. With the tires in the straight-ahead position, check the amount of steering wheel play by turning the wheel in both directions until the tires begin to move.

NOTE: The wheel free play should be checked with the engine running.

Free play: 0 – 30 mm (0 – 1.18 in)

2. Also check the steering wheel for play and looseness in the mount by moving it back and forth and sideways. When test driving, check for hard steering, steering shimmy and tendency to pull to one side.

Adjustment



431RS001

1. Align the front wheels properly in the straight ahead position.
2. Loosen the lock nut on the adjusting screw of the steering gear.
3. Turn the adjust screw clockwise to decrease free play or counter-clockwise to increase.
4. After check of specified free play, tighten the lock nut to specified torque.

Torque: 41 N·m (30 lb ft)

Front End Alignment Inspection and Adjustment

General Description

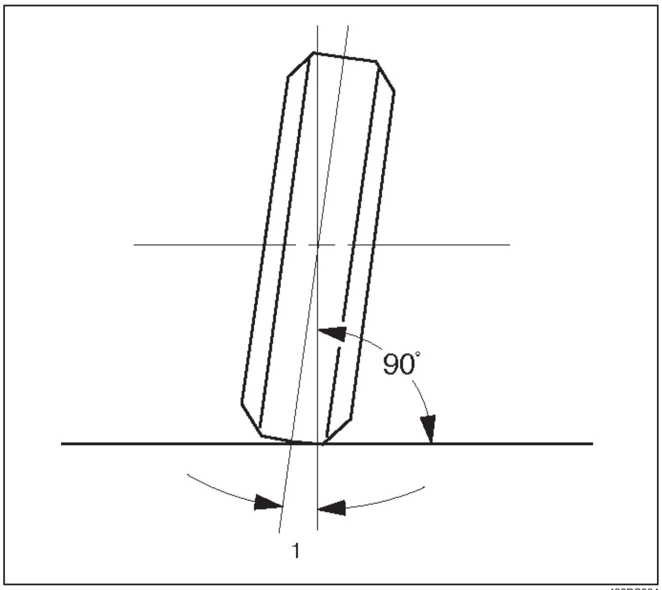
“Front End Alignment” refers to the angular relationship between the front wheels, the front suspension attaching parts and the ground.

Proper front end alignment must be maintained in order to insure efficient steering, good directional stability and to prevent abnormal tire wear.

The most important factors of front end alignment are wheel toe-in, wheel camber and axle caster.

Camber:

This illustration is viewed from the front of the vehicle.

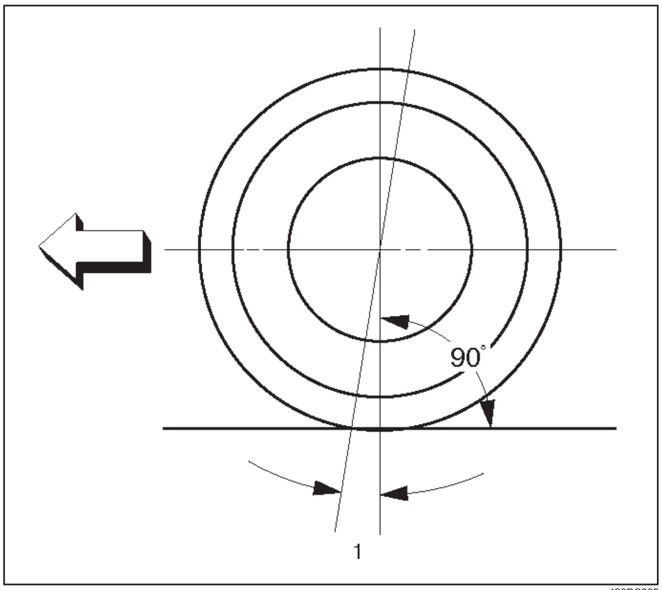


480RS004

Camber is the vertical tilting inward or outward of the front wheels. When the wheels tilt outward at the top, the camber is positive (+). When the wheels tilt inward at the top, the camber is negative (–). The amount of tilt measured in degrees from the vertical is called the camber angle (1). If camber is extreme or unequal between the wheels, improper steering and excessive tire wear will result. Negative camber causes wear on the inside of the tire, while positive camber causes wear to the outside.

Caster:

This illustration is viewed from the side of the vehicle.

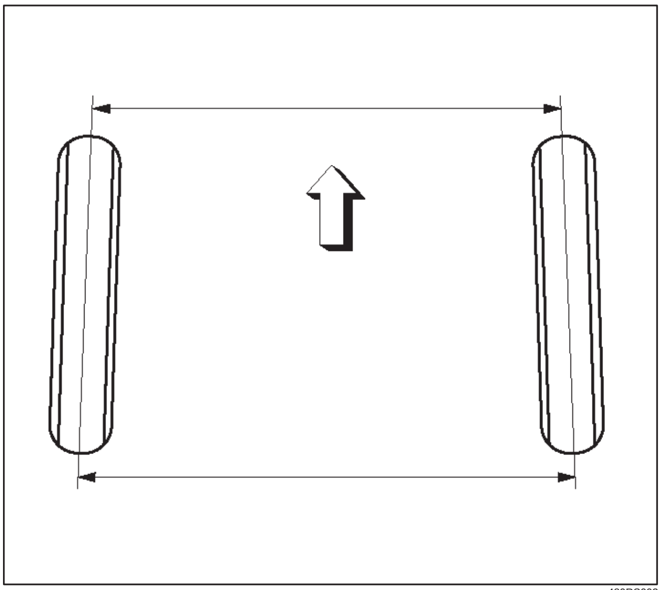


480RS005

Caster(1) is the vertical tilting of the wheel axis either forward or backward (when viewed from the side of the vehicle). A backward tilt is positive(+) and a forward tilt is negative (–). On the short and long arm type suspension you cannot see a caster angle without a special instrument, but if you look straight down from the top of the upper control arm to the ground, the ball joints do not line up (fore and aft) when a caster angle other than 0 degree is present. With a positive angle, the lower ball joint would be slightly ahead (toward the front of the vehicle) of the upper ball joint center line.

Toe-in:

This illustration is viewed from the top of the vehicle.



480RS003

Toe-in is the measured amount the front wheels are turned in. The actual amount of toe-in is normally a fraction of a degree. Toe-in is measured from the center of the tire treads or from the inside of the tires. The purpose of toe-in is to insure parallel rolling of the front wheels and to offset any small deflections of the wheel support system which occurs when the vehicle is rolling forward. Incorrect toe-in results in excessive toe-in and unstable steering. Toe-in is the last alignment to be set in the front end alignment procedure.

Inspection

Before making any adjustments affecting caster, camber or toe-in, the following front end inspection should be made.

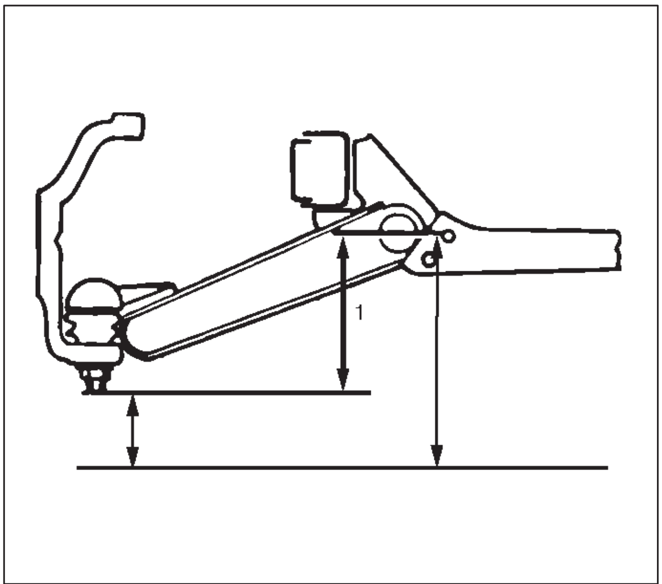
1. Inspect the tires for proper inflation pressure. Refer to Main Data and Specifications in Wheel and Tire System section.
2. Make sure that the vehicle is unladen condition (With no passenger or loading).
3. Make sure that the spare tire is installed at the normal position.
4. Inspect the front wheel bearings for proper adjustment. Refer to Front Hub and Disc Overhaul in Suspension section.
5. Inspect the ball joints, tie rod ends and relay rods. If excessive looseness is noted, correct before adjusting. Refer to Steering Linkage in this section.

6. Inspect the wheels and tires for run-out. Refer to Wheel Replacement in Wheel and Tire System section.
7. Inspect the trim height. If not within specifications, the correction must be made before adjusting caster.
8. Inspect the steering gear for looseness at the frame.
9. Inspect the shock absorbers for leaks or any noticeable noise. Refer to Shock Absorber Replacement in Suspension section.
10. Inspect the control arms or stabilizer bar attachment for looseness. Refer to Suspension section .
11. Inspect the front end alignment using alignment equipment. Follow the manufacturer's instructions.
12. Park the vehicle must be on a level surface.

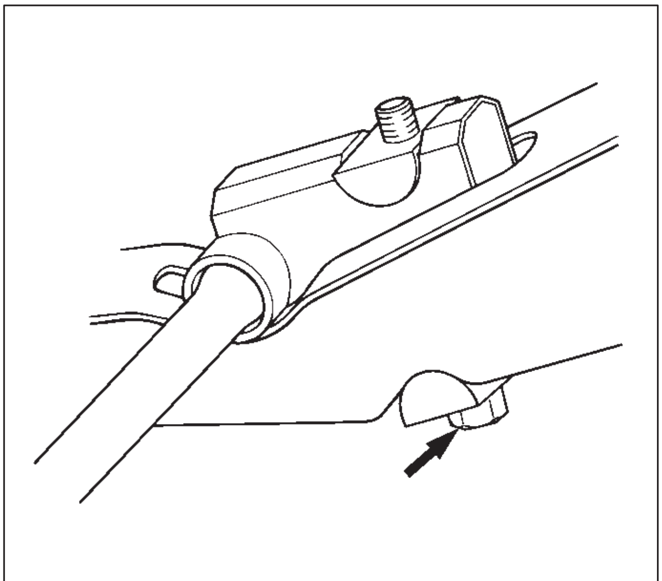
Trim Height Adjustment

Adjust the trim height(1) by means of the adjusting bolt on the height control arms.

CAUTION: When adjusting front end alignment, be sure to begin with trim height first, as it may change other adjusted alignments.



450RS003



410RS001

1. Check and adjust the tire inflation pressures.
2. Park the vehicle on a level ground and move the front of the vehicle up and down several times to settle the suspension.
3. Make necessary adjustment with the adjusting bolt on the height control arms.

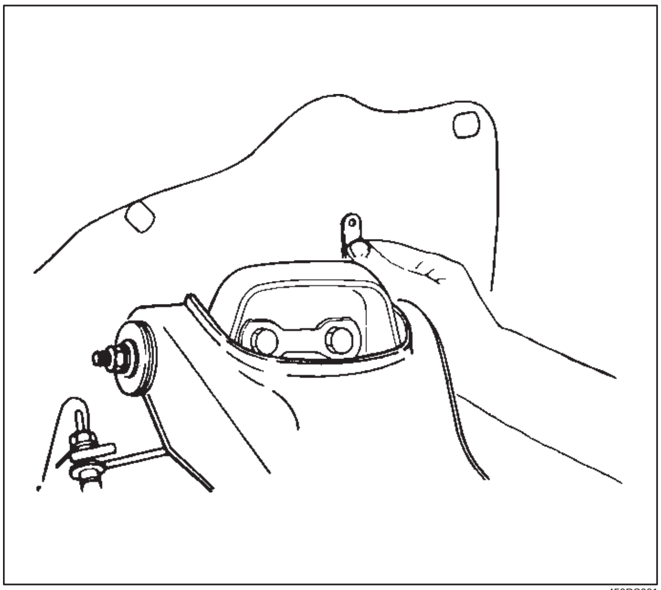
Trim height: 129 mm (5.08 in)

Caster Adjustment

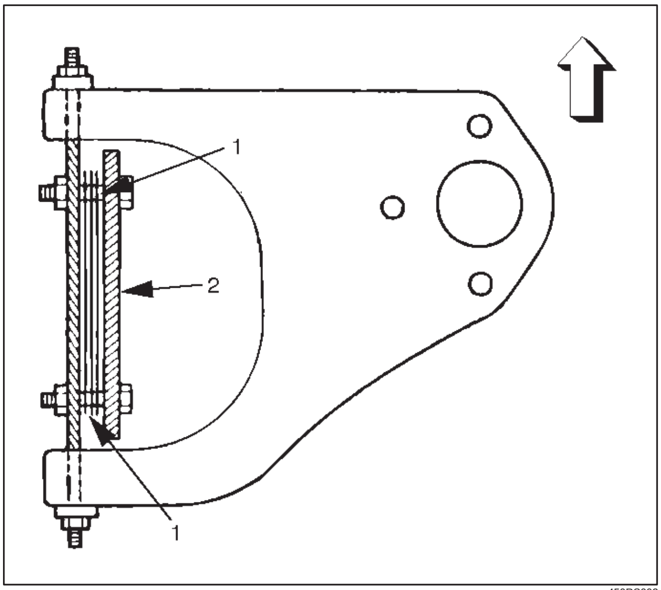
The caster angle can be adjusted by means of the caster shims(1) installed between the chassis frame(2) and fulcrum pins.

Caster angle: 2°10' ± 45'

CAUTION: Left and right side must be equal within 30'.



450RS001



450RS002

NOTE: Difference of the caster shim front/rear thickness should be 3.6 mm (0.142 in) or less. Overall thickness of caster shim and camber shim should be 10.8 mm (0.425 in) or less.

Tighten the fulcrum pin bolt to the specified torque.

Torque: 152 N·m (112 lb ft)

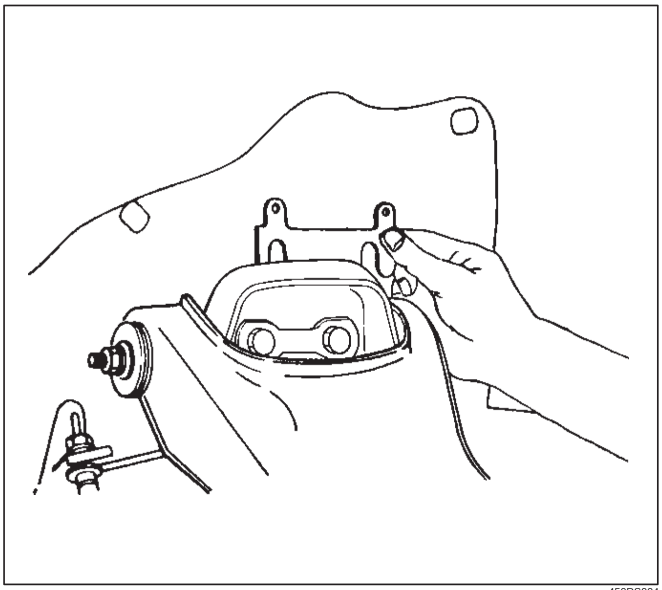
Camber Adjustment

The camber angle can be adjusted by means of the camber shims(2) installed in position between the chassis frame(1) and fulcrum pins

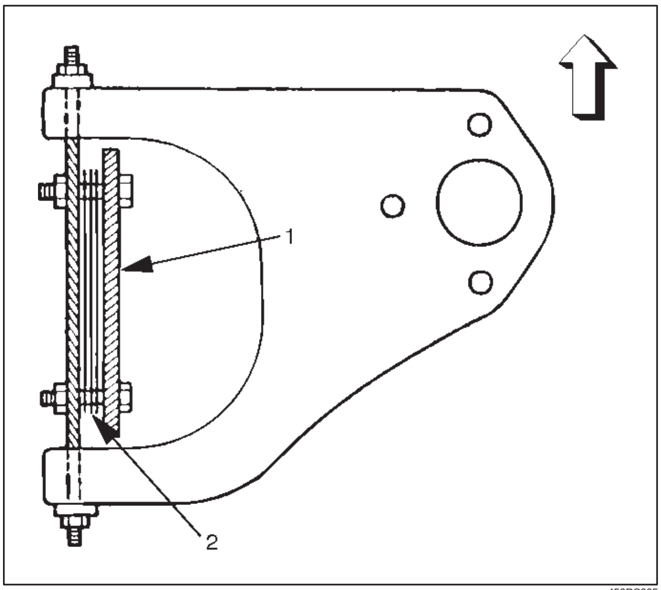
Camber angle: 0° ± 30'

King pin inclination: 12°30' ± 30'

CAUTION: Left and right side must be equal within 30'.



450RS004



450RS005

NOTE: Overall thickness of caster shim and camber shim should be 10.8 mm (0.425 in) or less.

Tighten the fulcrum pin bolt to the specified torque.

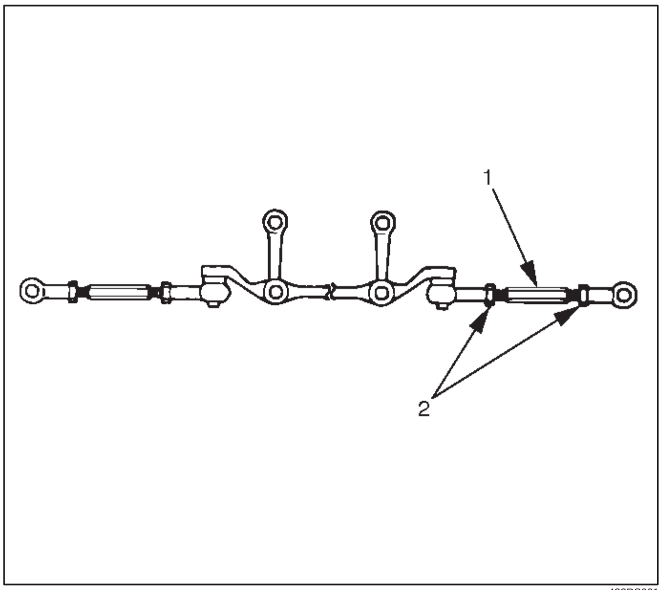
Torque: 152 N·m (112 lb ft)

	Position of shims		Camber angle	Caster angle
	Front side	Rear side		
Caster shim	When added	When removed	Decreases	Decreases
	When removed	When added	Increases	Increases
	—	When removed	Unchanged	Decreases
	—	When added	Unchanged	Increases
Camber shim	When added		Decreases	Unchanged
	When removed		Increases	Unchanged

Toe-in Adjustment

1. To adjust the toe-in angle, loosen the lock nuts(2) on the outer track rods(1) and turn the outer track rods. Turn both rods the same amount, to keep the steering wheel centered .

Toe-in: 0 ± 2 mm (0 ± 0.08 in)

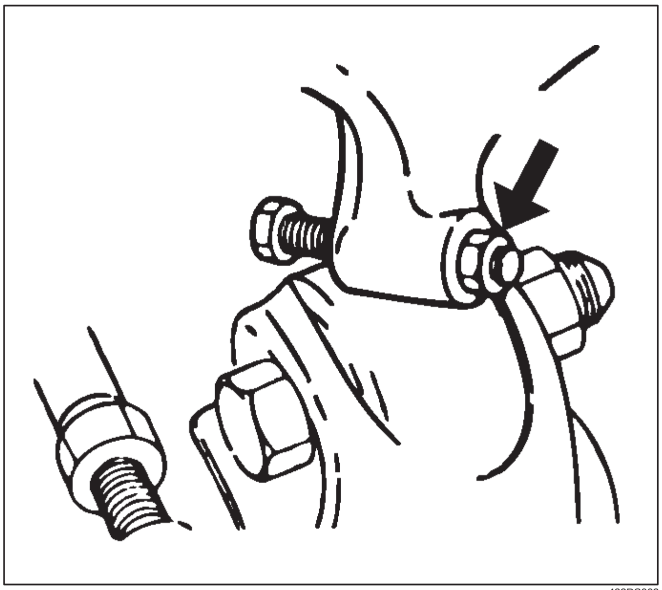


2. Tighten the lock nut to the specified torque.

Torque: 118 N·m (87 lb ft)

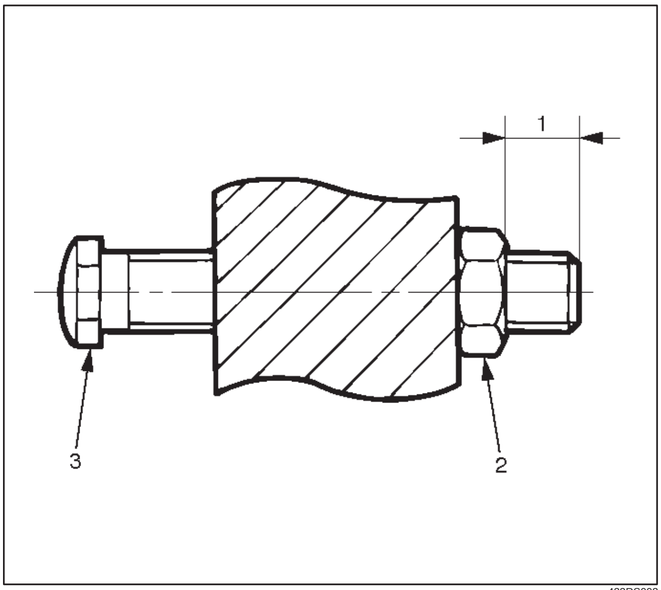
Maximum Steering Angle Adjustment

The maximum steering angle of the front wheels can be adjusted with the stop bolts under the frame side members.



1. Position each front wheel on the turning radius gauge in a straight-ahead position.
2. Set the parking brake firmly.
3. Adjust the inside wheel angle of each side with the stop bolts.

NOTE: The maximum protruding length(1) of stop bolt(3) from the lock nut(2) should be 10 mm or less



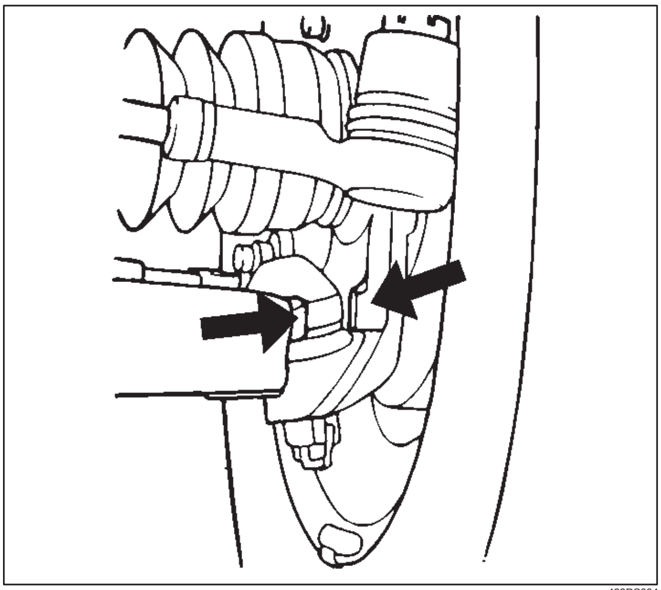
4. Similarly adjust the inside wheel angle of the other side with stop bolt.

Inside wheel: 34° (+0° to –2°)

Outside wheel: 32°

NOTE: Maximum steering angles should be set after adjusting front wheel alignment.

5. If the stop between the lower link end and the knuckle comes ahead of the stop bolt, adjust the stop bolt so that inner stop bolt touches the drop arm (relay lever).



6. Tighten the lock nut to the specified torque.

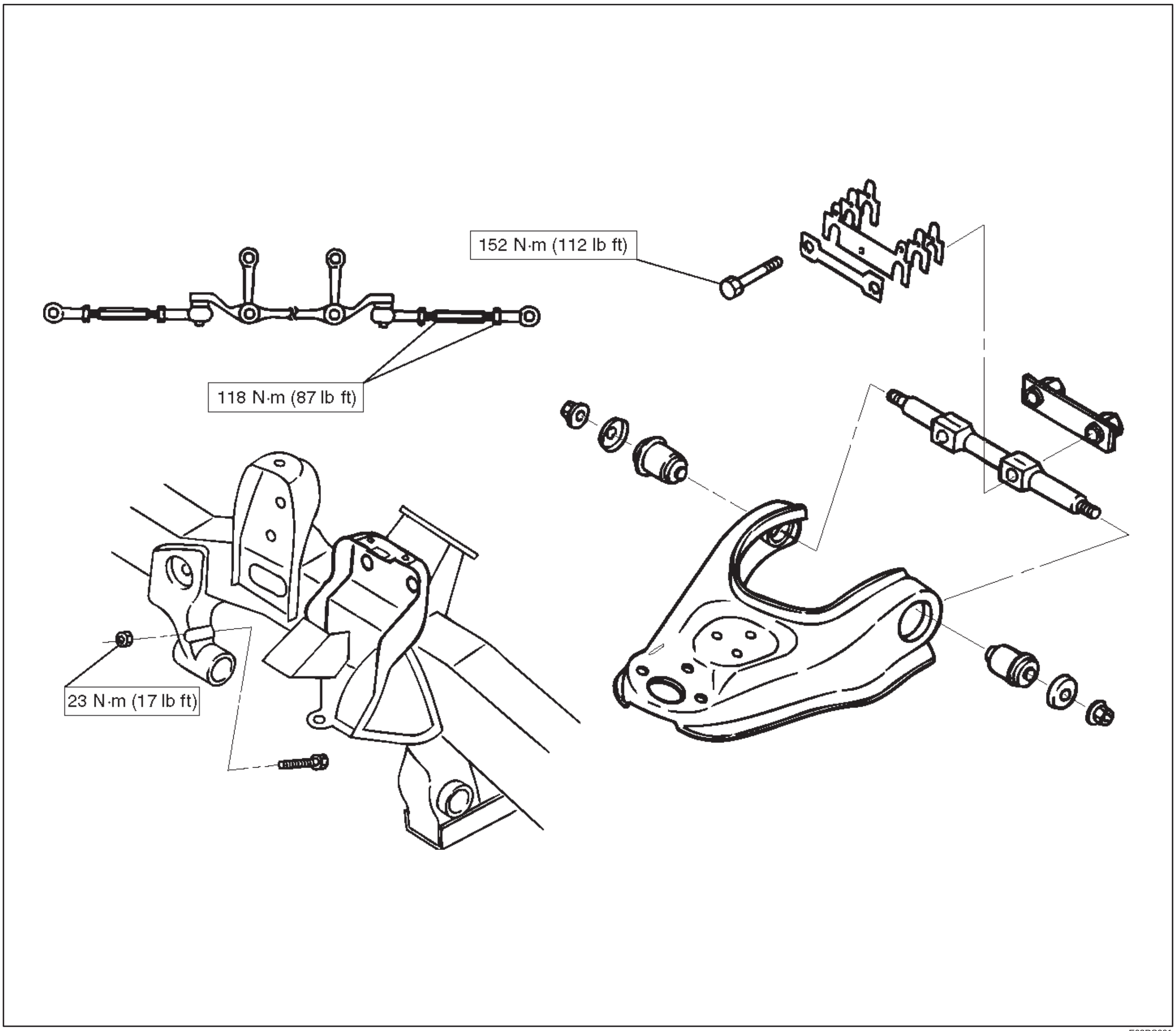
Torque: 23 N·m (17 lb ft)

Main Data and Specifications

General Specification

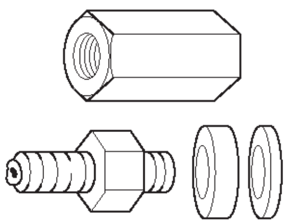
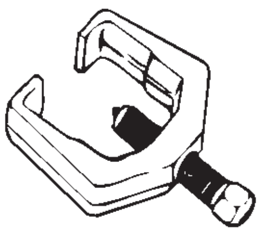
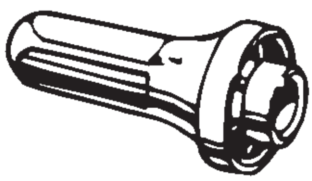
Caster		2˚10' ± 45'
Camber		0˚ ± 30'
King pin inclination		12˚30' ± 30'
Toe-in		0 ± 2 mm (0 ± 0.08 in)
Max. steering angle	inside	34˚ (+0˚ to –2˚)
	outside	32˚

Torque Specification



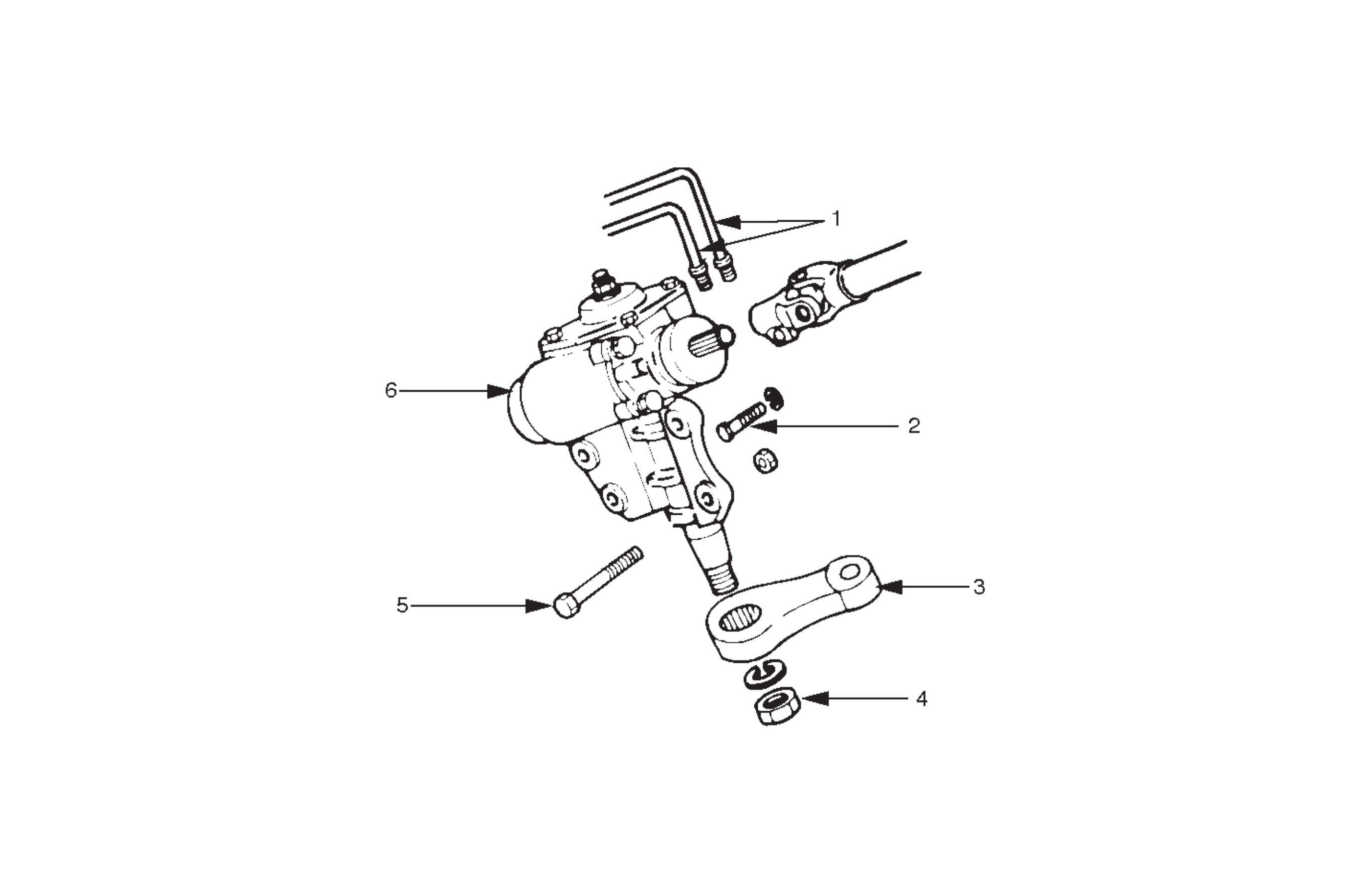
E03RS001

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS276	**J–29877–A** Tester: Power steering
 901RS278	**J–39213** Adapter: Power steering tester
 901RS279	**J–29107** Remover: Pitman arm
 901RS280	**J–26508** Installer: Extension housing oil seal

Power Steering Gear

Power Steering Gear and Associated Parts

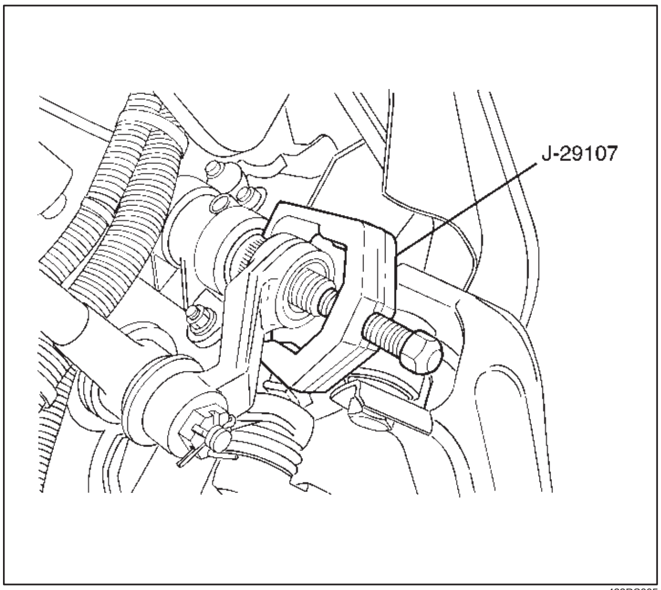


431RS002

Legend
(1) Pipe
(2) Universal Joint Bolt
(3) Pitman Arm
(4) Nut
(5) Gear Box Mounting Bolt and Nut
(6) Gear Box

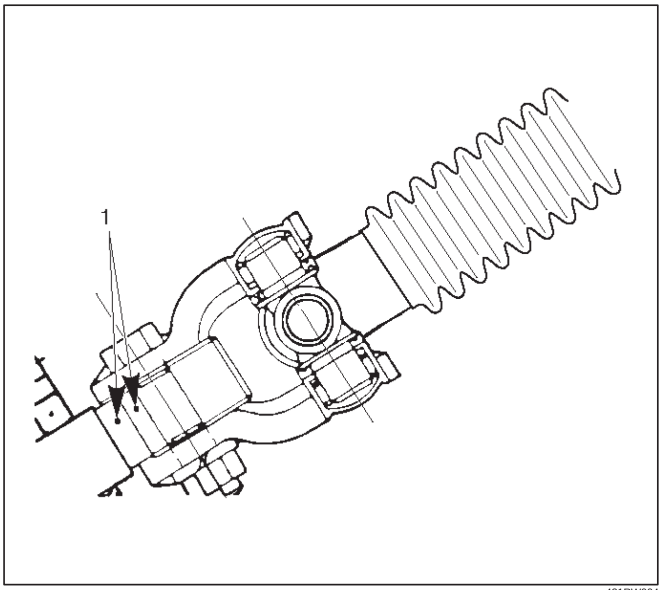
Removal

1. Remove the stone guard.
2. Remove the lower fan shroud. Refer to Radiator in Engine section.
3. Disconnect stabilizer bar at the stabilizer links. Loosen stabilizer bracket fixing nuts.
4. Remove pipe.
5. Remove nut.
6. Use Pitman arm remover J–29107 to remove pitman arm.



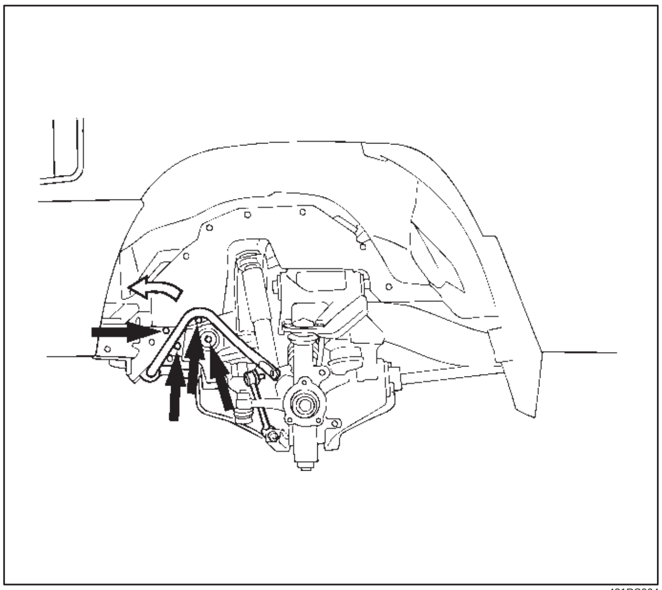
433RS005

7. Make a setting mark(1) across the coupling flange and worm shaft to ensure reassembly of the parts in the original position, then remove universal joint bolt.



431RW004

8. Push the stabilizer bar aside and remove the gear box mounting bolts and nuts.

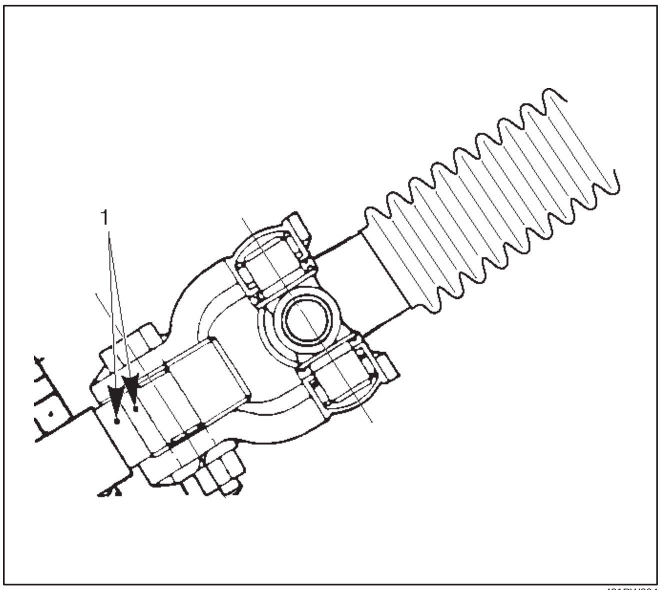


431RS004

9. Remove gear box.

Installation

1. Align the setting marks(1) made at removal, then install gear box.



431RW004

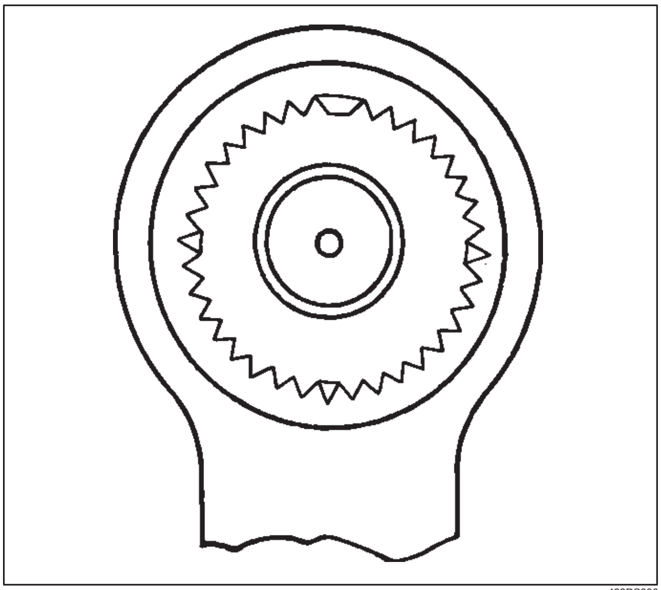
2. Tighten gear box mounting bolt and nut to specified torque.

Torque: 44 N·m (33 lb ft)

3. Tighten gear universal joint bolt to specified torque.

Torque: 25 N·m (18 lb ft)

4. Align the notched tooth and install pitman arm.



433RS006

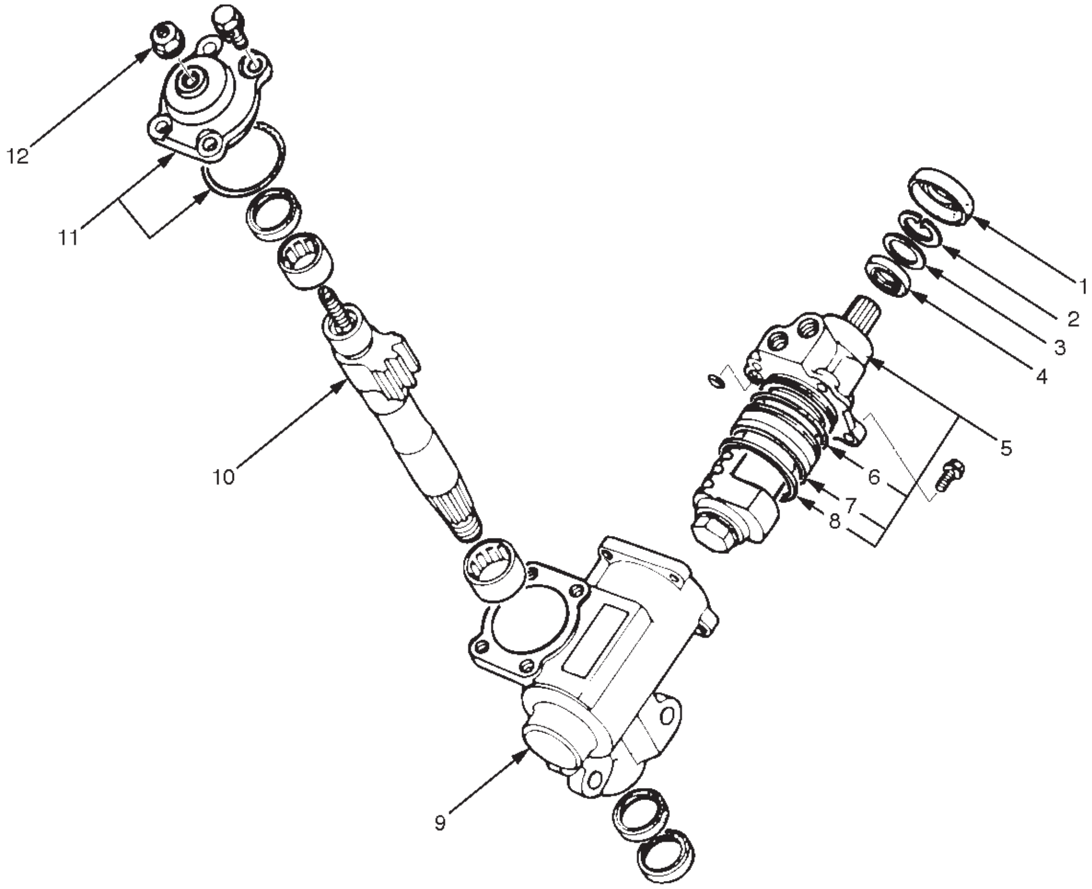
5. Install nut and tighten Nut to specified torque.

Torque: 216 N·m (159 lb ft)

6. Install Pipe and tighten to specified torque.

Torque: 44 N·m (33 lb ft)

Steering Gear Disassembled View



440RS001

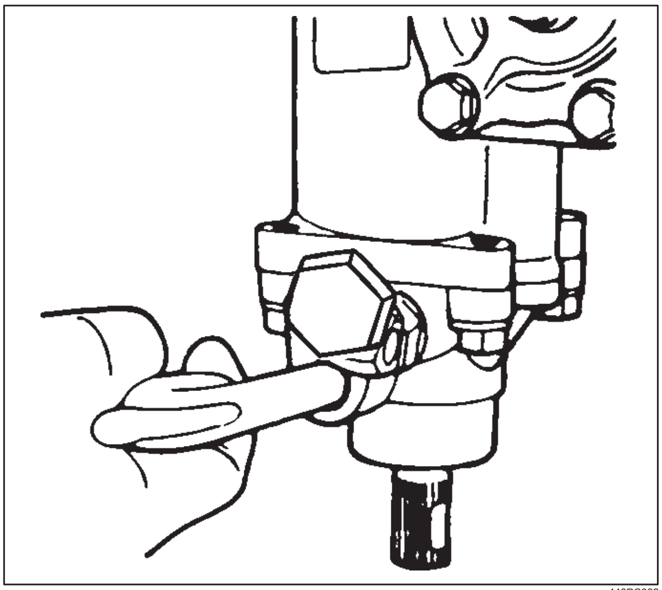
Legend

(1) Dust Cover
(2) Retaining Ring
(3) Back Up Ring
(4) Oil Seal
(5) Ball-nut and Valve Housing Assembly
(6) O-ring
(7) Seal Ring
(8) O-ring
(9) Gear Box
(10) Sector Shaft
(11) Top Cover Assembly
(12) Lock Nut

Disassembly

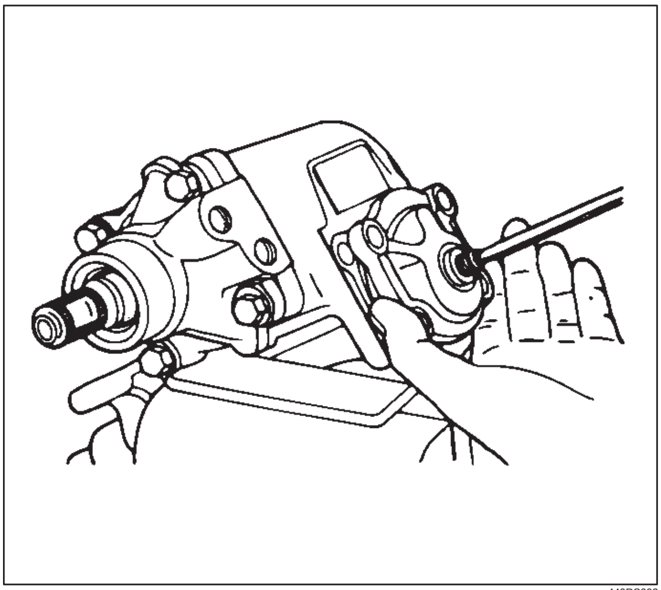
CAUTION: Do not clamp the steering gear assembly in a vise by the power cylinder housing.

1. Remove dust cover.
2. Remove retaining ring.
3. Remove back up ring.
4. Remove oil seal.
   - Clean the faces of the extended stub shaft.
   - Plug the hose fitting on the inlet side.
   - Remove the oil seal by blowing compressed air through the hole in the outlet side.



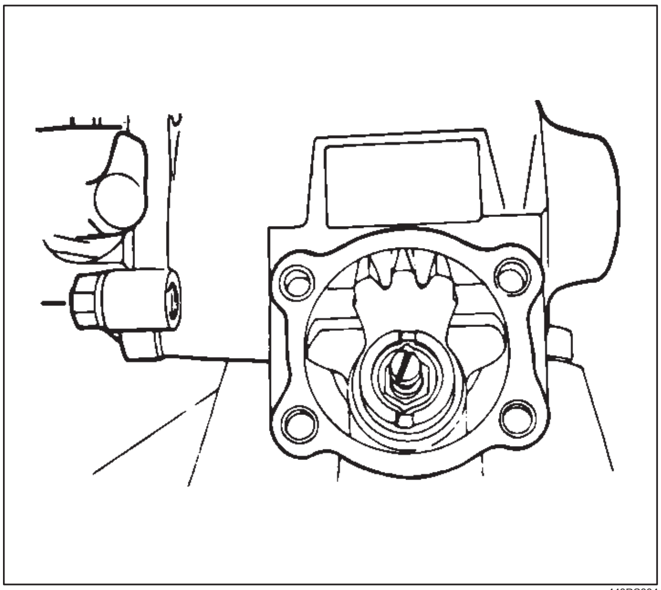
440RS002

5. Remove lock nut.
   - Remove the adjusting screw lock nut and turn the adjusting screw counter-clockwise to remove the preload between the sector gear and the rack piston.
6. Remove the top cover bolts and the top cover assembly.



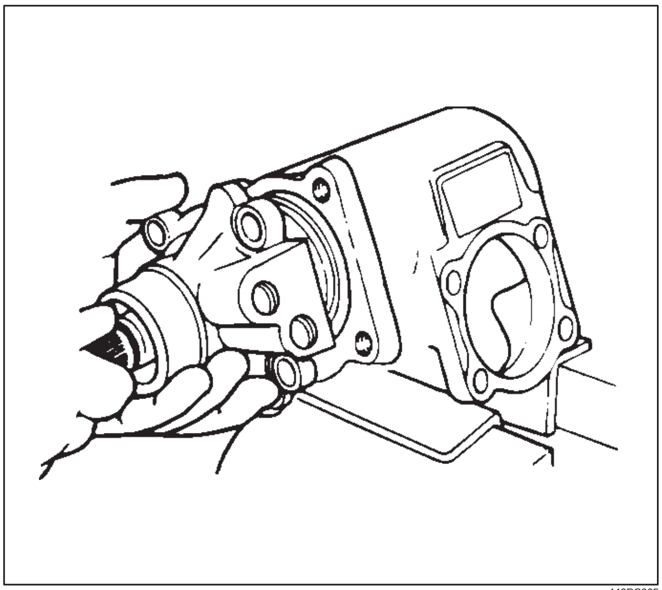
440RS003

   - Holding the top cover stationary, turn the adjusting screw clockwise to raise and free to cover, then remove the cover with O-ring.
7. Bring the stub shaft into straight-ahead position. Do not force the sector shaft off the gear box with a hammer or other impact tools then remove sector shaft.



440RS004

8. Remove ball-nut and valve housing assembly.



440RS005

- Always keep the ball nut and valve housing assembly in a horizontal position to prevent them from traveling to the end of the worm shaft and damaging the ball tubes.

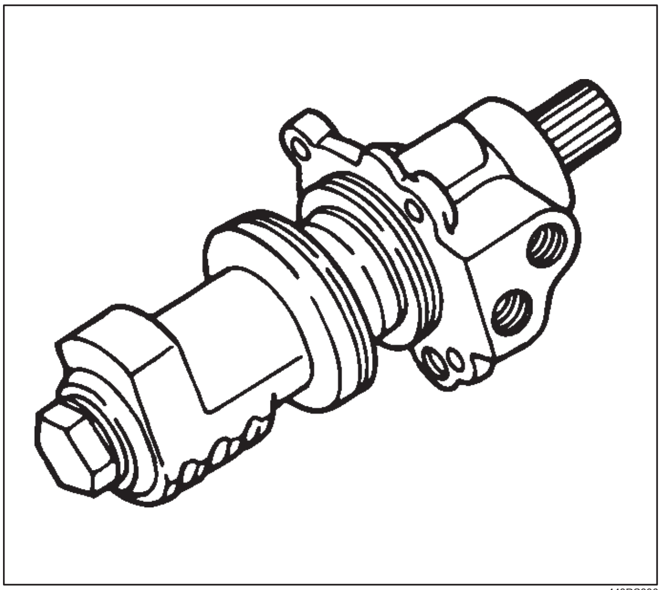
9. Remove O-ring.
10. Remove seal ring.
11. Remove O-ring.
12. Remove gear box.

Inspection and Repair

Inspect the following parts for wear, damage or any other abnormal conditions.

- Bearing
- Ball-nut and valve housing
- Sector shaft
- Top cover
- Gear box
- Needle bearing
- Dust seal
- Seal ring
- Gasket

Ball-nut Rotation



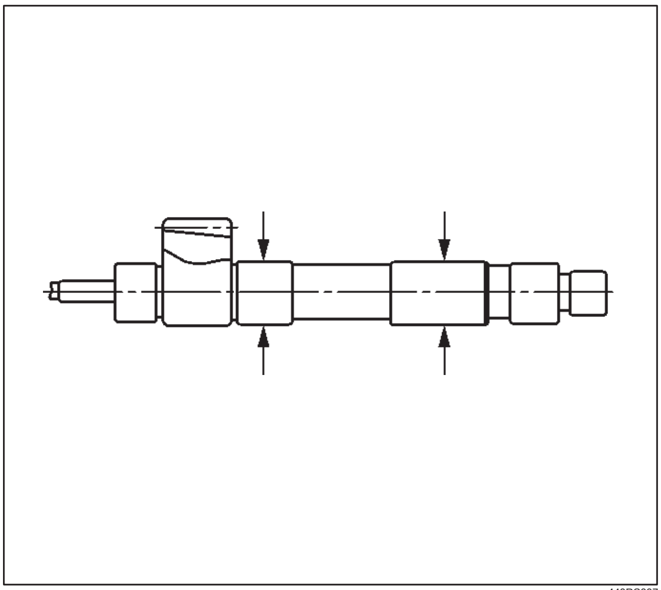
440RS006

Hold the ball nut and valve housing assembly vertically and see if the ball-nut lowers by turning smoothly. If the ball-nut does not lower smoothly, check the worm shaft for bending and foreign matter.

NOTE: When testing the ball nut and valve housing assembly, do not let it travel all the way to the end of worm shaft, or damage to the ball tubes will result.

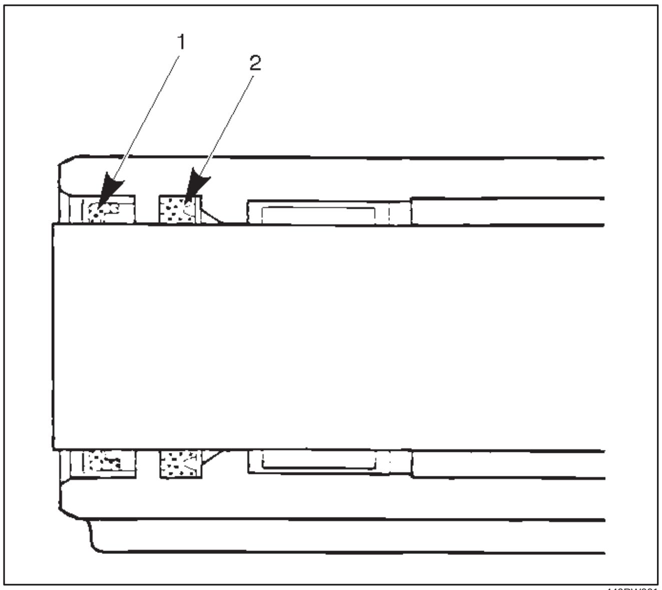
- Check sector shaft outside diameter.

Limit: 31.7 mm (1.25 in)



440RS007

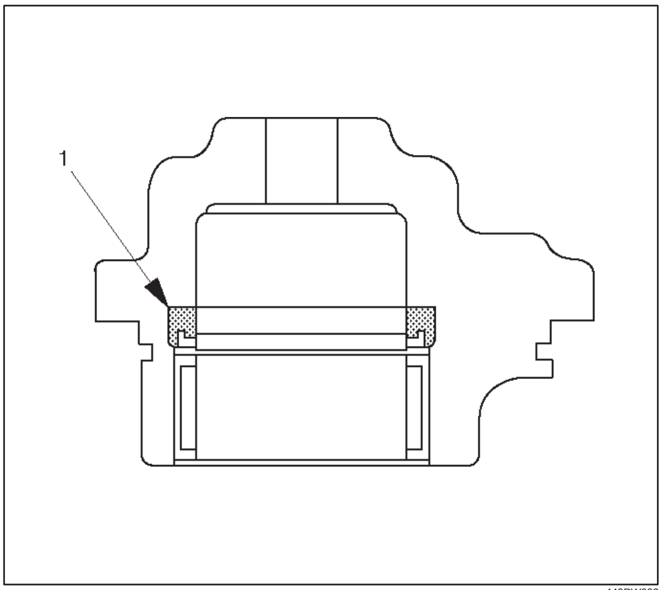
Dust Seal and Seal Ring Setting



440RW001

- Note the dust seal (1) and the seal ring(2) installation direction. Always install a new part.
- Apply a thin coat of power steering fluid to lip of each part.

Gasket Setting

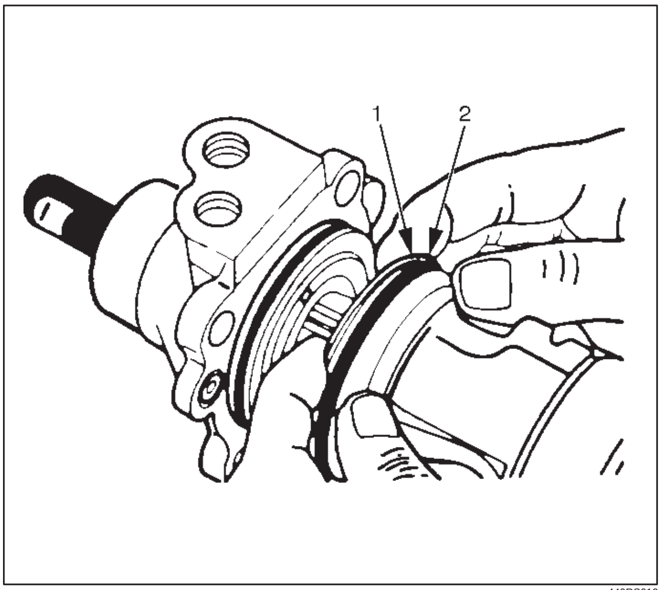


440RW002

- Note the gasket(1) installation direction.
- Apply a thin coat of power steering fluid to lip of each part.

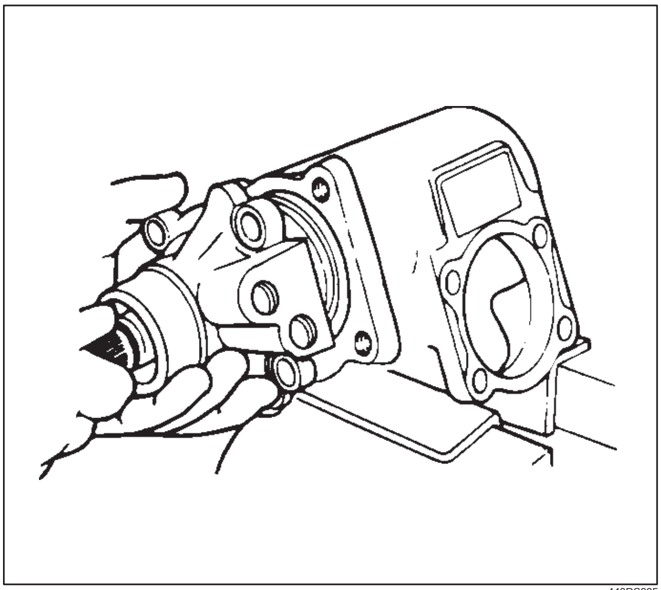
Reassembly

1. Install gear box.
2. Apply a thin coat of power steering fluid to the new O-ring(2) and be sure to discard used part, then install o-ring.
3. Apply a thin coat of power steering fluid to the new seal ring(1) and be sure to discard used part, then install seal ring.
4. Apply a thin coat of power steering fluid to the new O-ring and be sure to discard used part, then install o-ring.



440RS010

5. Install ball-nut and valve housing assembly.
   - Always keep the ball screw and valve housing assembly in a horizontal position (avoid holding it vertically), or the rack piston will fall off onto the end of the worm, causing the rack piston to slip out of the worm shaft and ball to fall out.

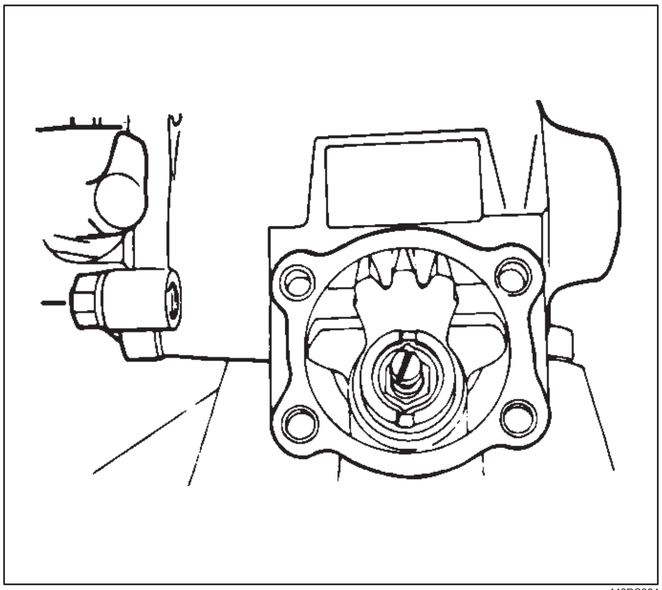


440RS005

   - Be careful not to drop the O-ring into the valve housing.
   - Tighten the valve housing bolts to the specified torque.

Torque: 47 N·m (35 lb ft)

6. Install sector shaft.
   - Tape the sector shaft serrations to protect the seal ring from damage.
   - Align the center tooth of ball nut with that of the sector shaft.

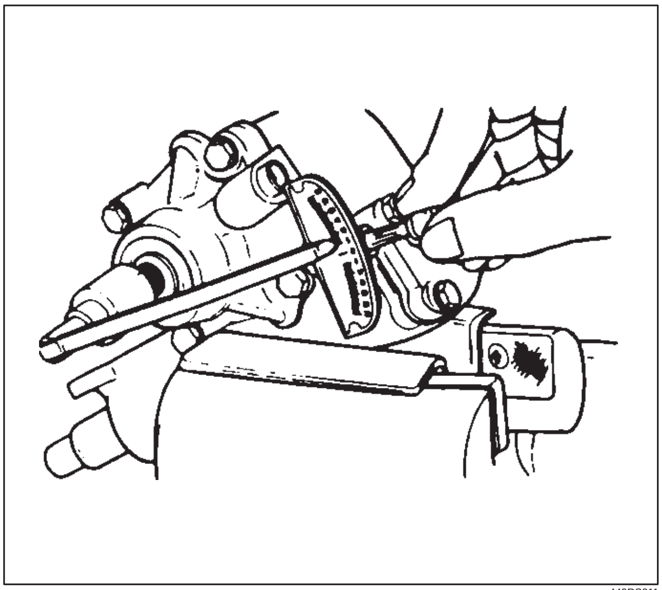


440RS004

7. Install O-ring.
8. Install top cover assembly and tighten the fixing bolts to specified torque.

Torque: 47 N·m (35 lb ft)

9. Adjust the backlash between the worm gear and the ball nut.

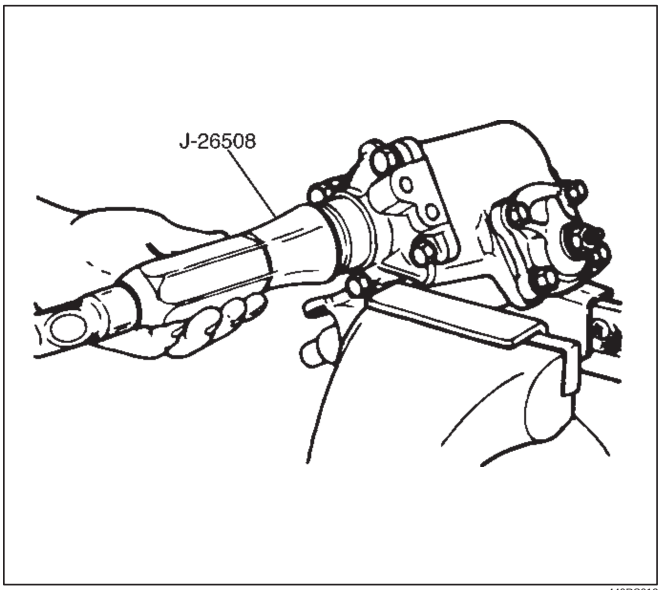


440RS011

- With the worm gear rotating, set it to the straight ahead position.
- Set the worm shaft preload to below 10kg·cm with the sector shaft adjusting screw.
- Measure the worm shaft preload with the worm gear turned 450° both to the right and to the left. The worm gear preload in these positions should be 0.4–0.6 N·m (4–6 kg·cm) lower than in the straight ahead position.
- Lock the sector shaft adjusting screw with the lock nut.

Lock nut torque: 41 N·m (30 lb ft)

10. Apply a thin coat of power steering fluid to oil seal lip of each part, then use installer J–26508 to install oil seal.



440RS012

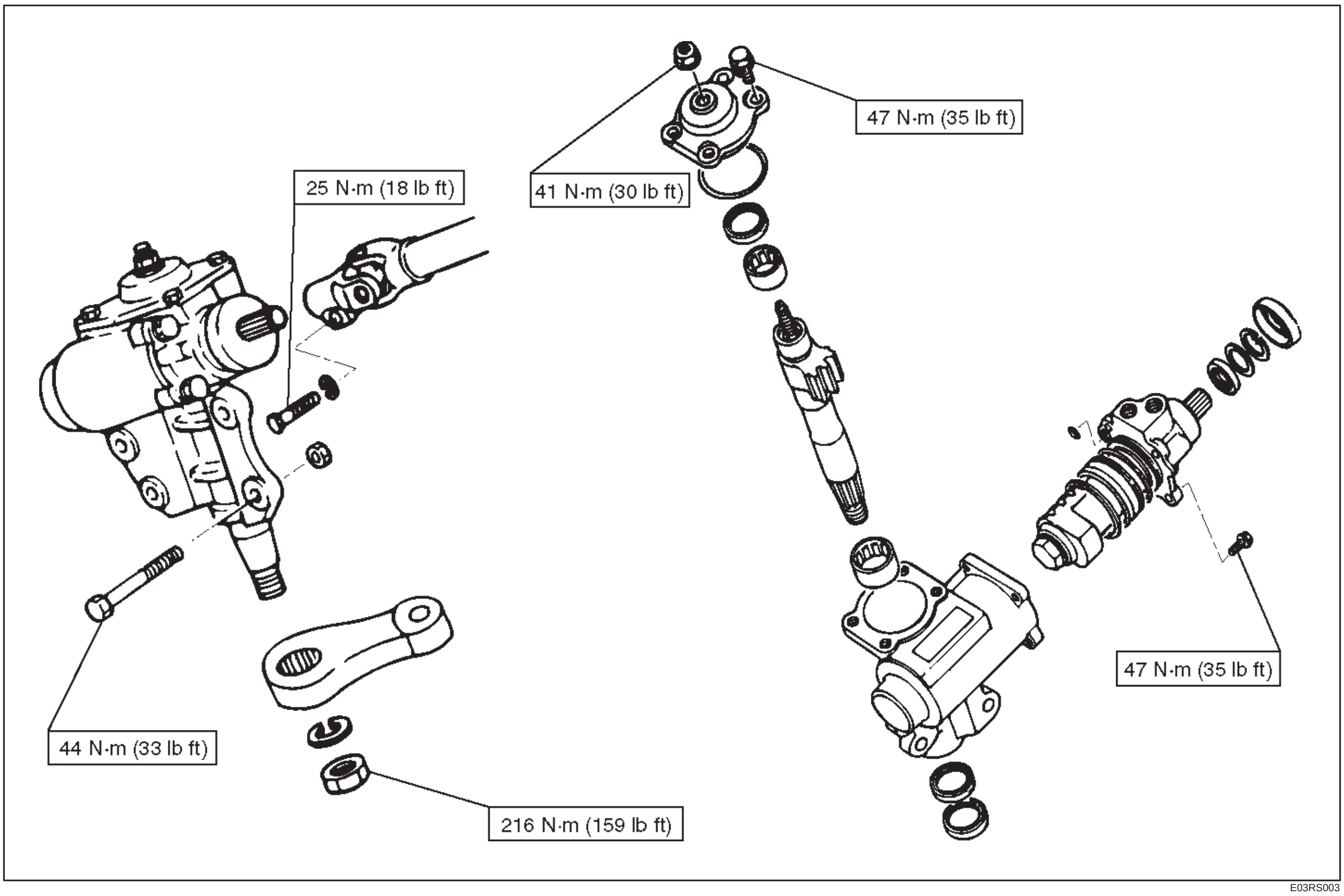
11. Install back up ring and position the chamfered face (outer circumference) towards the oil seal.
12. Install retaining ring and position the chamfered face (outer circumference) towards the oil seal.
13. Install dust cover.

Main Data and Specifications

General Specifications

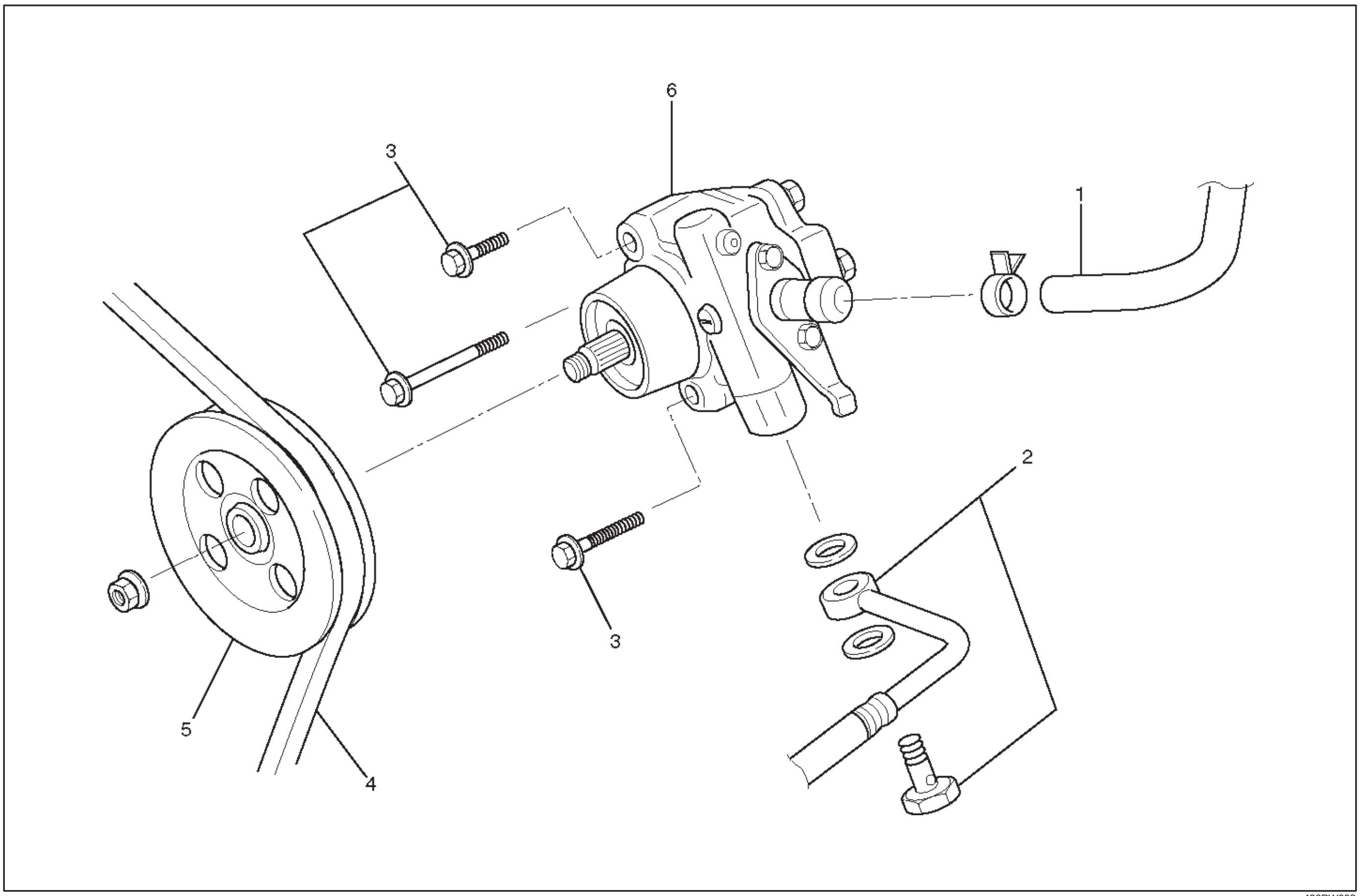
Steering unit	Type	Integral, ball screw
	Gear ratio	16.3 : 1

Torque Specifications



Power Steering Pump

Power Steering Pump and Associated Parts

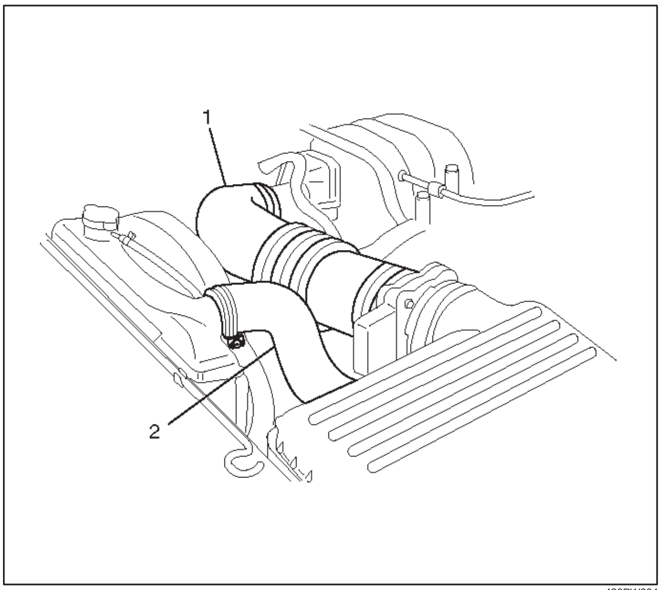


Legend

(1) Hose, Suction
(2) Hose, Flexible
(3) Bolt
(4) Belt
(5) Pulley
(6) Pump Assembly

Removal

1. Drain the engine coolant.
2. Place a drain pan below the pump.
3. Remove the air cleaner duct (1) and the radiator upper hose (2).



4. Remove the drive belt.
5. Remove the pulley from the power steering pump.
6. Disconnect the suction hose.
7. Disconnect the flexible hose.
8. Remove the power steering pump fixing bolt.
9. Remove the pump assembly.

CAUTION: When removing the prmp assembly, be careful not to damage the wiring harnessunder the pump housing.

Installation

1. Install the adjust plate and tighten the mounting bolts to the specified torque.

   Torque: 56 N·m (41 lb ft)

2. Install the pump assembly. Connect the harness under the pump housing.
3. Tighten the fixing bolt to the specified torque.

   Torque: 46 N·m (34 lb ft)

4. Connect the flexible hose, then tighten the eye bolt to specified torque.

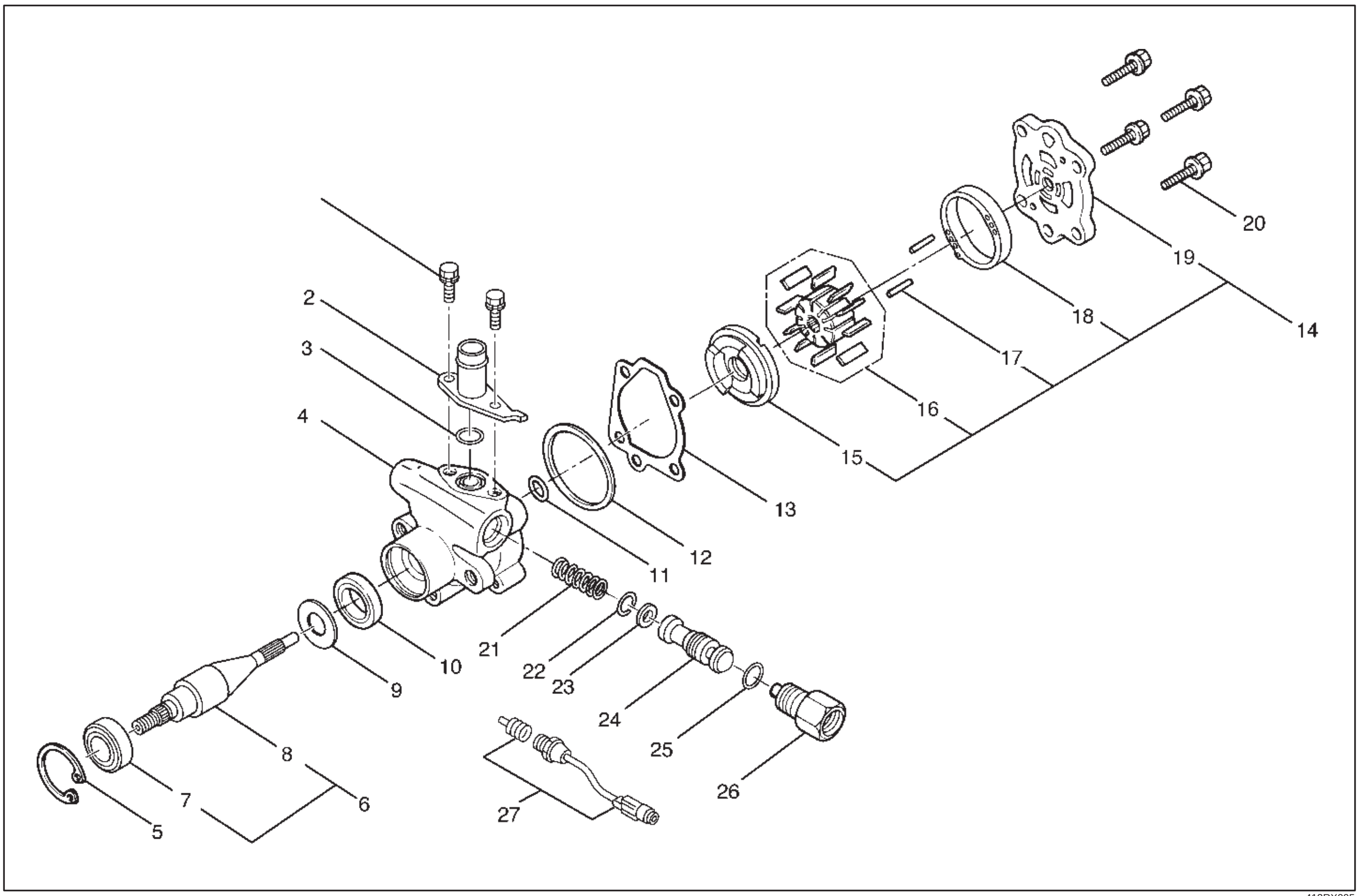
   Torque: 54 N·m (40 lb ft)

5. Connect the suction hose.
6. Install the pulley onto the power steering pump and tighten the nut to the specified torque.

   Torque: 78 N·m (58 lb ft)

7. Install the air cleaner duct and the radiator upper hose.
8. Refill the engine coolant.
9. Fill and bleed the power steering system. Refer to Bleeding the Power Steering System in this section.

Power Steering Pump Disassembled View



Legend

- (1) Bolt
- (2) Suction Pipe
- (3) O-ring
- (4) Front Housing
- (5) Snap Ring
- (6) Shaft Assembly
- (7) Bearing
- (8) Shaft
- (9) Retaining Ring
- (10) Oil Seal
- (11) O-ring
- (12) O-ring
- (13) Gasket
- (14) Rear Housing Assembly and Pump Cartridge
- (15) Side Plate
- (16) Rotor and Vane
- (17) Pin
- (18) Cam
- (19) Rear Housing
- (20) Bolt
- (21) Spring
- (22) Retaining Ring
- (23) Filter
- (24) Valve
- (25) O-ring
- (26) Connector
- (27) Pressure Switch

Disassembly

1. Clean the oil pump with solvent (plug the discharge and suction ports to prevent the entry of solvent). Be careful not to expose the oil seal of shaft assembly to solvent.
2. Remove the bolt.
3. Remove the suction pipe.
4. Remove the O-ring.
5. Remove the connector.
6. Remove the O-ring.
7. Remove the valve.
8. Remove the retaining ring.
9. Remove the filter.
10. Remove the spring.
11. Remove the snap ring.
12. Remove the shaft assembly.
13. Remove the retaining ring.
14. Remove the oil seal.

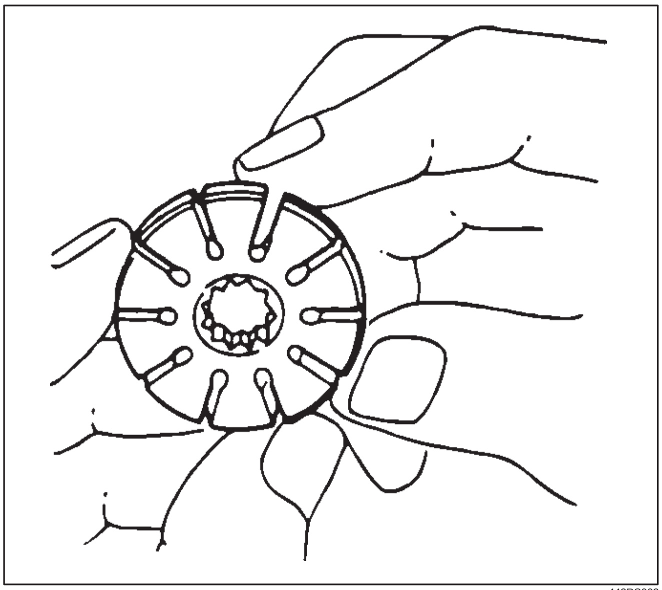
CAUTION: When removing the oil seal, be careful not to damage the housing.

15. Remove the bolt.
16. Remove the rear housing assembly and the pump cartridge.
17. Remove the gasket.
18. Remove the O-ring.
19. Remove the O-ring.
20. Remove the front housing.
21. Remove the side plate.
22. Remove the rotor and vane.
23. Remove the cam.
24. Remove the pin.
25. Remove the rear housing.
26. Remove the pressure switch.

Inspection and Repair

Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

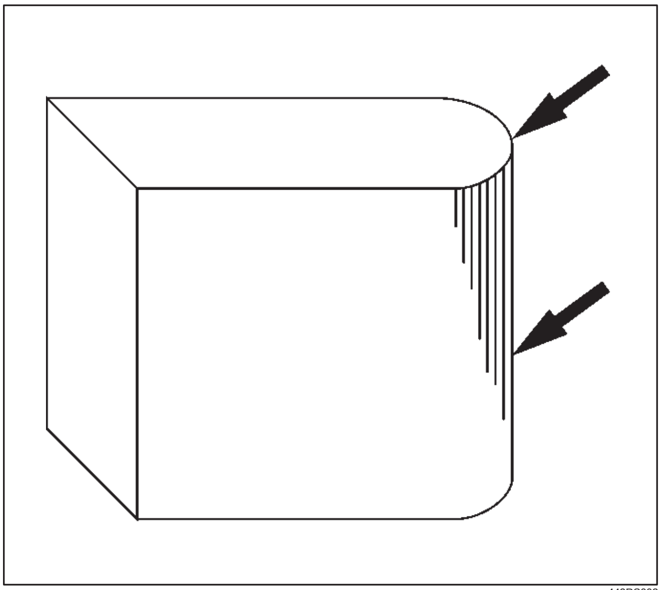
Rotor



442RS002

Check that the groove in the vane is free from excessive wear and that the vane slides smoothly. When part replacement becomes necessary, the pump cartridge should be replaced as a subassembly.

Vane



442RS003

Sliding faces of the vane should be free from wear. (Particularly the curved face at the tip that contact with the cam should be free from wear and distortion). When part replacement becomes necessary, the pump cartridge should be replaced as a subassembly.

Cam

The inner face of the arm should have a uniform contact pattern without a sign of step wear. When part replacement becomes necessary, the pump cartridge should be replaced as a subassembly.

Side Plate

The sliding faces of parts must be free from step wear (more than 0.01 mm), which can be felt by the finger nail. The parts with minor scores may be reused after lapping the face.

Valve

The sliding face of the valve must be free from burrs and damage. The parts with minor scores may be reused after smoothing with emery cloth (#800 or finer).

Shaft

Oil seal sliding faces must be free from a step wear which can be felt by the finger nail. Needle bearing fitting face must be free from damage and wear.

O-ring, Oil Seal, Retaining Ring

Be sure to discard used parts, and always use new parts for installation. Prior to installation, lubricate all seals and rings with power steering fluid.

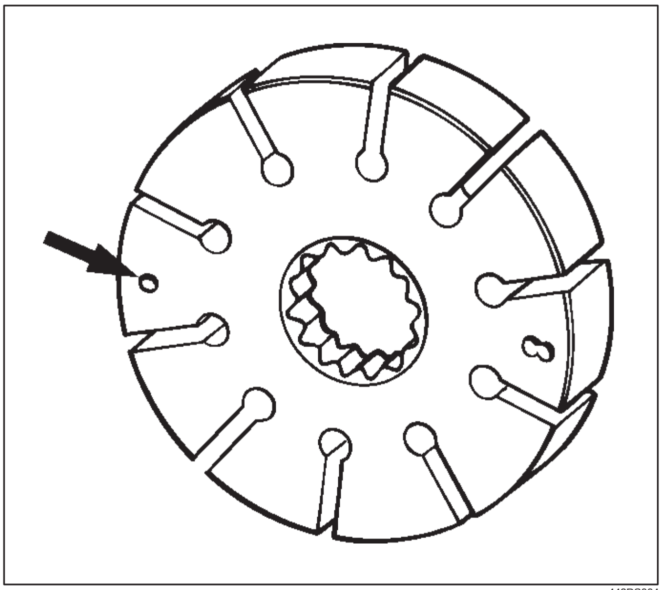
Pressure Switch

Check the switch operation as follows:
With engine idling and A/C on, turn the steering wheel fully to the left; compressor should interrupt and engine idle speed will increase. Shut off A/C and again turn

steering fully to the left; engine idle will increase. If system fails to function properly, disconnect connector at the pressure switch and repeat system check while testing continuity across disconnected SW connector.

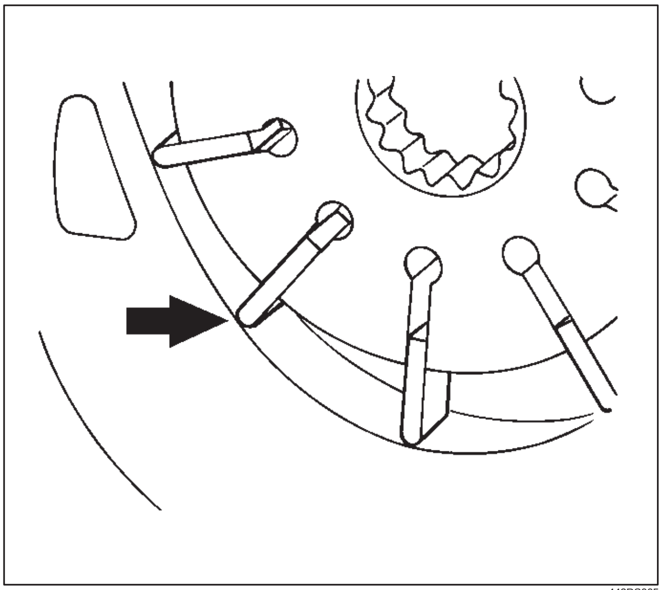
Reassembly

1. Install rear housing.
2. Install pin.
3. Install cam.
4. Install the rotor with punch mark facing the front housing.



442RS004

5. Install the vanes with curved face in contact with the inner wall of the cam.



442RS005

6. Install side plate.

CAUTION: When installing side plate, be careful not to damage its inner surface. Damaged side plate may cause poor pump performance, pump seizure or oil leakage.

7. Install front housing.
8. Install a new o-ring and be sure to discard used parts.
9. Install a new o-ring and be sure to discard used parts.
10. Install a new gasket and be sure to discard used parts.
11. Install rear housing and pump cartridge.
12. Install bolt and tighten it to the specified torque.

    Torque: 17.6 N·m (12.8 lb ft)

13. Install a new oil seal and be sure to discard used parts.

CAUTION: When installing the oil seal, be careful not to damage the oil seal contacting surface of the housing.

14. Install shaft assembly.
15. Install snap ring.
16. Install spring.
17. Install retaining ring.
18. Install filter.
19. Install valve.
20. Install retaining ring.
21. Install a new o-ring and be sure to discard used parts.
22. Install connector and tighten it to the specified torque.

    Torque: 19.6 N·m (14.3 lb ft)

23. Install a new o-ring and be sure to discard used parts.
24. Install suction pipe.
25. Install bolt and tighten it to the specified torque.

    Torque: 15.7 N·m (11.5 lb ft)

26. Install pressure switch and tighten it to the specified torque.

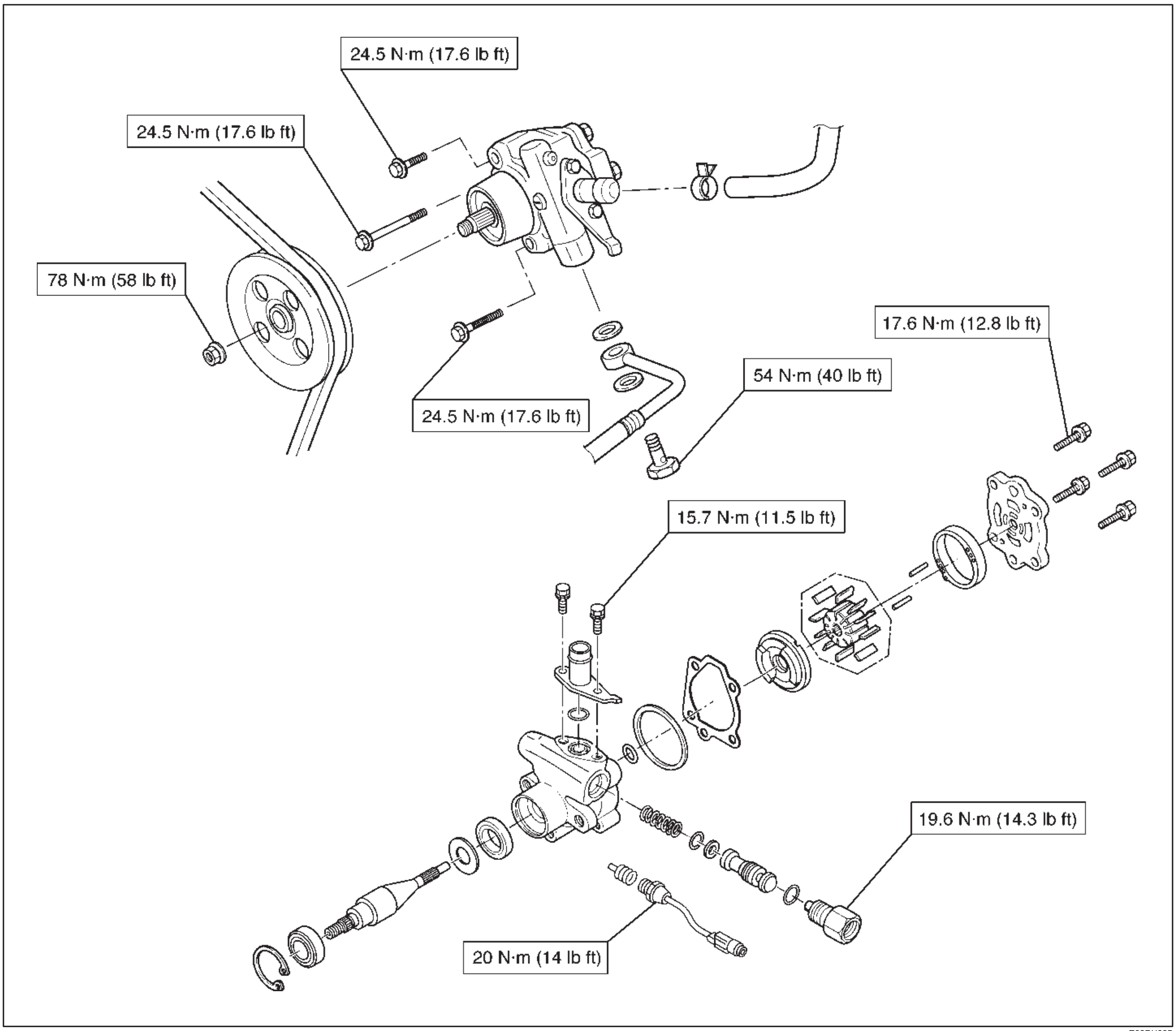
    Torque: 20 N·m (14 lb ft)

Main Data and Specifications

General Specifications

Oil pump	Type	Vane
	Operating fluid	ATF DEXRON®–III

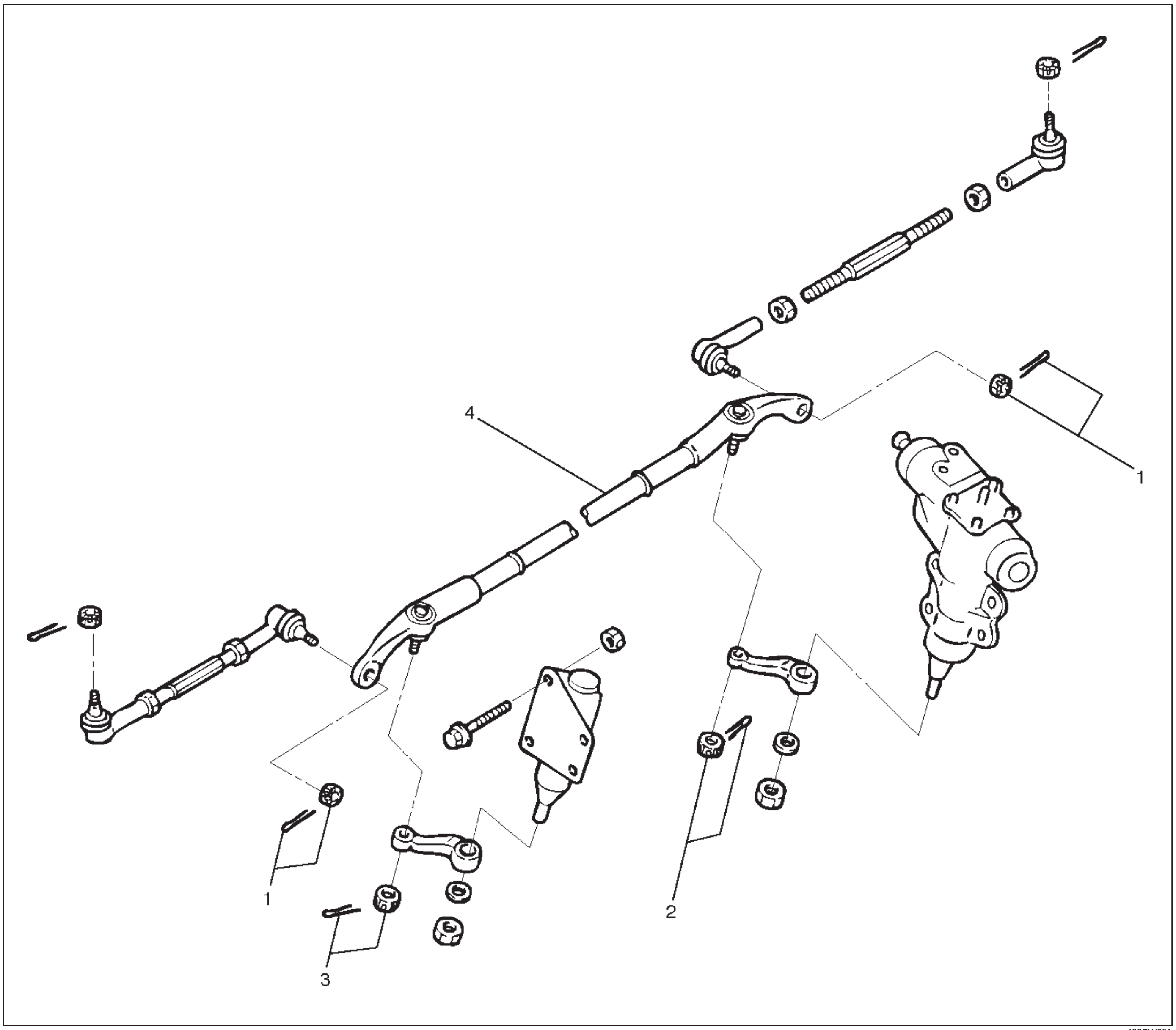
Torque Specifications



E02RX005

Center Track Rod Assembly

Center Track Rod Assembly and Associated Parts



433RW001

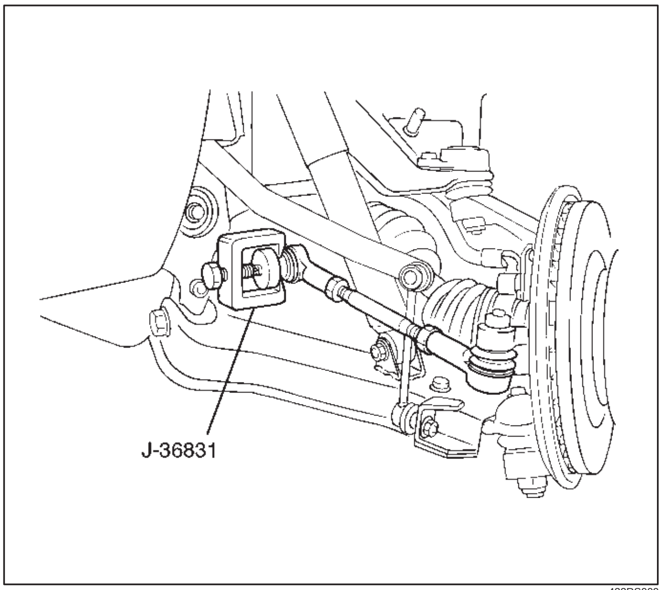
Legend

(1) Nut and Cotter Pin
(2) Nut and Cotter Pin, Pitman Arm
(3) Nut and Cotter Pin, Relay Lever
(4) Center Track Rod Assembly

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove nut and cotter pin, then use remover J–36831 to disconnect outer track rod assembly from the center track rod.

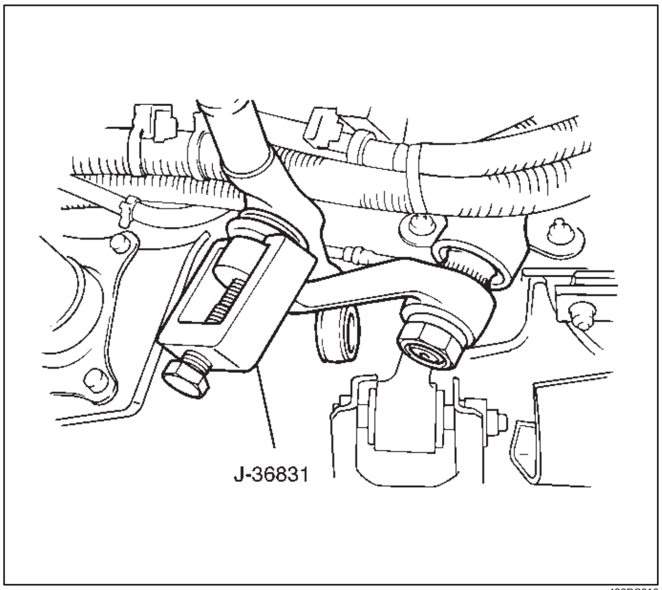
CAUTION: Be careful not to damage the ball joint boot.



433RS009

3. Remove nut and cotter pin then use remover J–36831 to remove pitman arm from the center track rod.

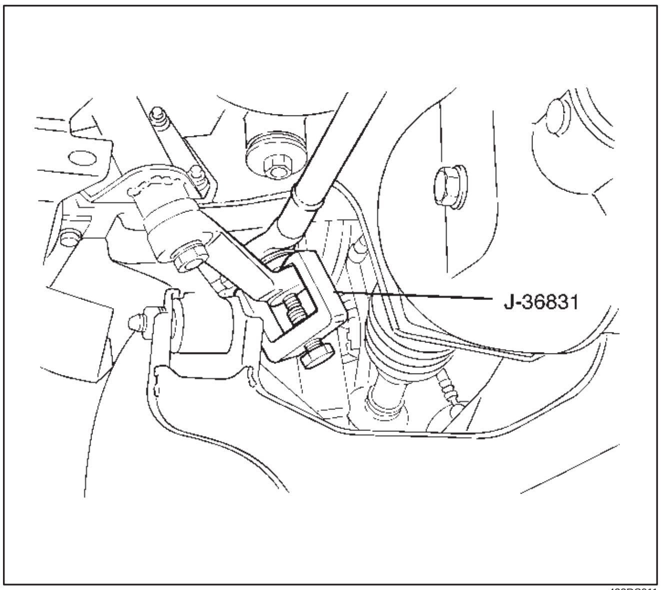
CAUTION: Be careful not to damage the ball joint boot.



433RS010

4. Remove nut and cotter pin then use remover J–36831 to remove relay lever from the center track rod.

CAUTION: Be careful not to damage the ball joint boot.



433RS011

5. Remove center track rod assembly.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion, bending, deteriorations or any other abnormal condition are found through inspection.
Check the ball joint (Boot, screws and tapered surfaces).

Installation

1. Install center track rod assembly.
2. Install nut, cotter pin and relay lever, then tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

   Torque: 59 N·m (43 lb ft)

3. Install nut, cotter pins and pitman arm, then tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

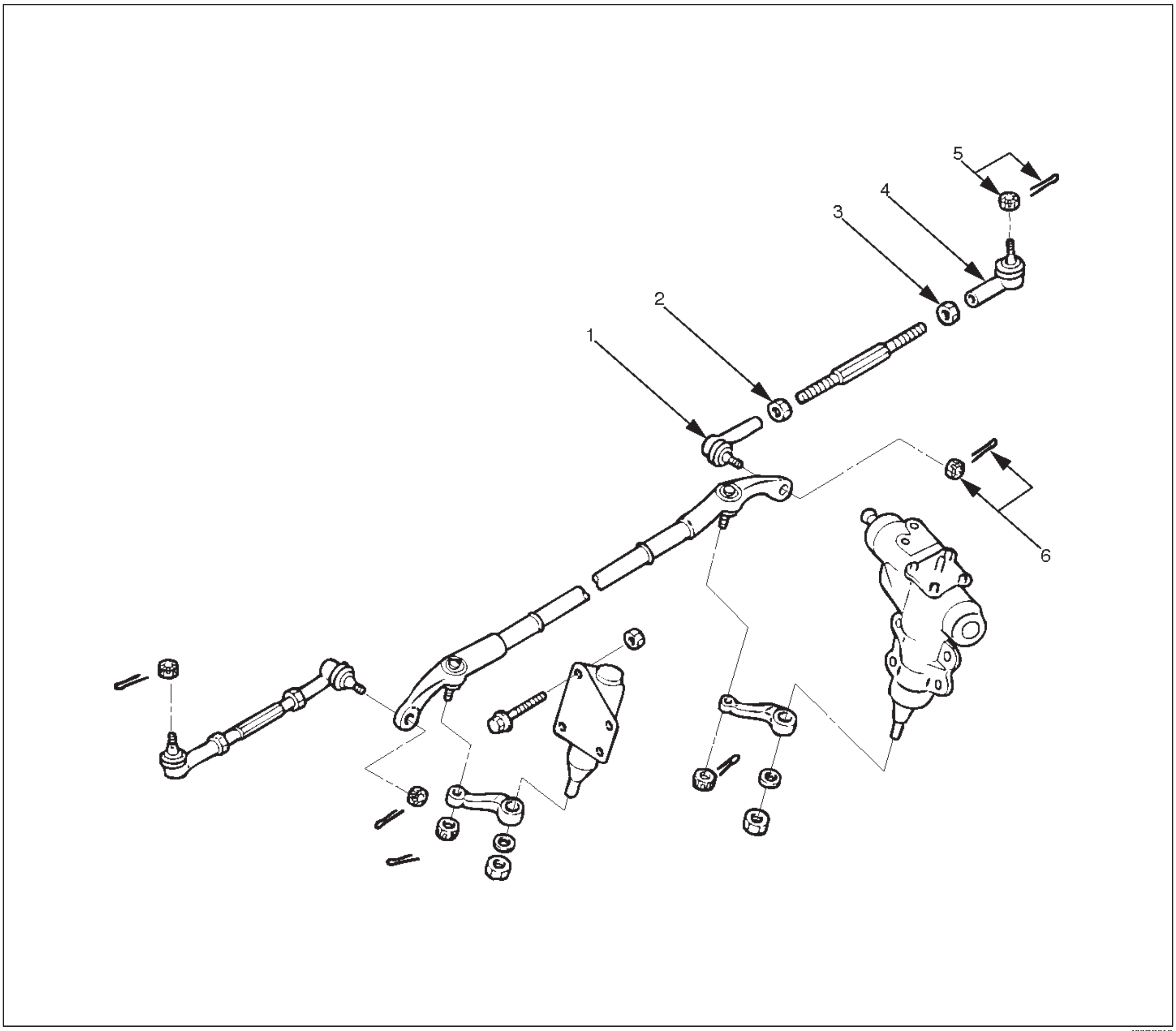
   Torque: 98 N·m (72 lb ft)

4. Install nut and cotter pins, then tighten the nut to the specified torque, with fust enough additional torque to align cotter pen holes. Install new cotter pin.

   Torque: 98 N·m (72 lb ft)

Outer Track Rod Assembly

Outer Track Rod Assembly and Associated Parts



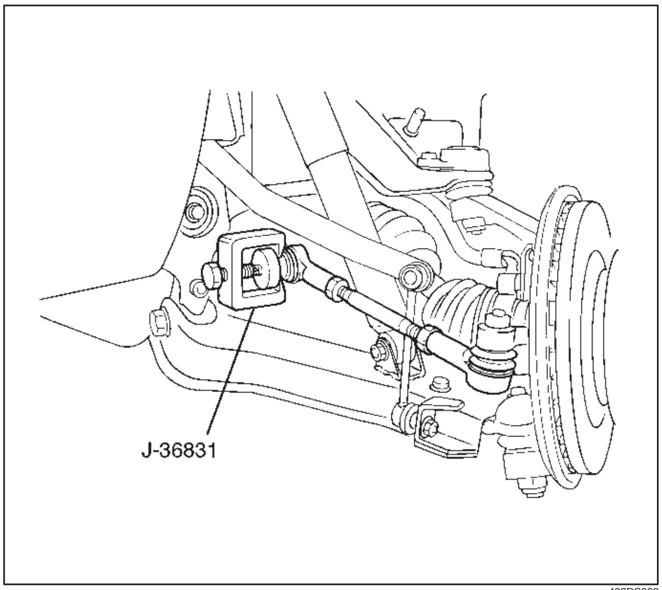
Legend

(1) Rod End Assembly, Inner
(2) Lock Nut, Inner (Left-hand threads)
(3) Lock Nut, Outer
(4) Rod End Assembly, Outer
(5) Nut and Cotter Pin, Knuckle Arm
(6) Nut and Cotter Pin, Center Track Rod

Removal

1. Remove wheel and tire assembly. Refer to Wheel Replacement in Suspension section.
2. Remove nut and cotter pin, then use remover J–36831 to disconnect outer track rod assembly at the center track rod.

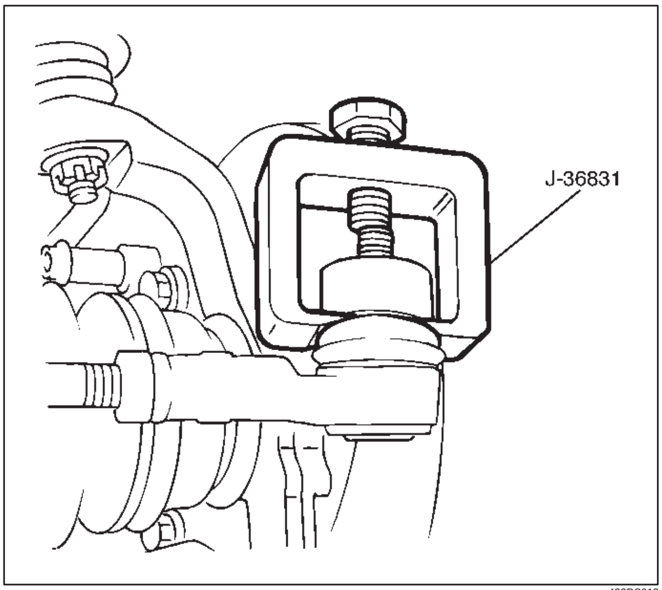
CAUTION: Be careful not to damage the ball joint boot.



433RS009

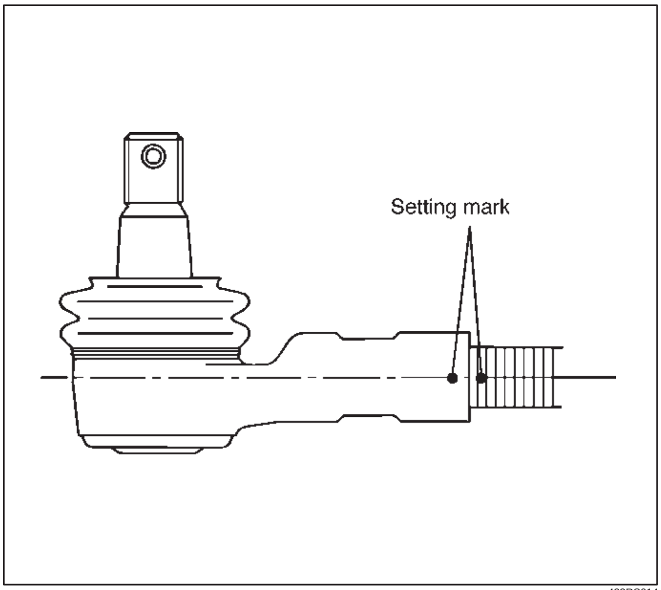
3. Remove nut and cotter pin then use remover J–36831 to remove outer track rod assembly from the knuckle arm.

CAUTION: Be careful not to damage the ball joint boot.



433RS013

4. Remove outer lock nut.
5. Apply setting marks (1) to ensure reassembly of the parts in their original position, then remove outer rod end assembly.

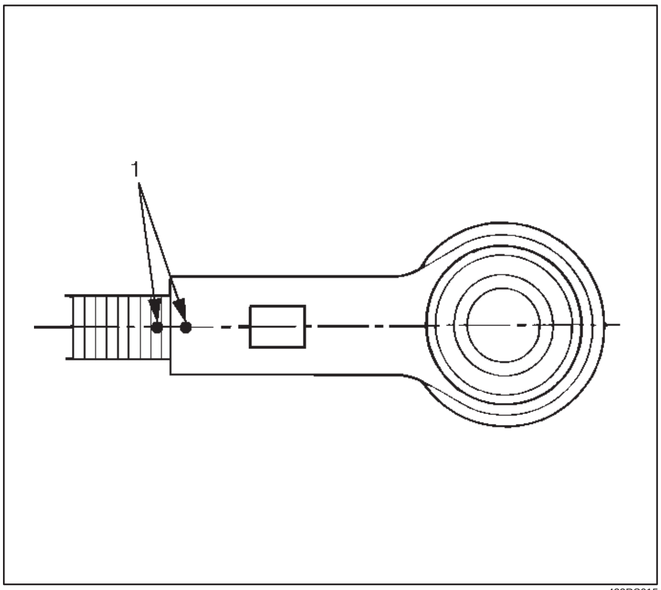


433RS014

6. Remove inner lock nut.

NOTE: For either outer rod, the screw on the right side of the vehicle is threaded counterclockwise.

7. Apply setting marks (1) to ensure reassembly of the parts in their original position, then remove inner rod end.



433RS015

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion, bending, deteriorations or any other abnormal condition are found through inspection.
Check the following parts:

- Rod end assembly
- Ball joint (Boot, screws and tapered surfaces)

Installation

1. Install inner rod end and align the setting marks applied during disassembly.
2. Tighten the inner lock nut to specified torque.

Torque: 118 N·m (87 lb ft)

NOTE: For either outer rod, the screw on the right side of the vehicle is threaded counterclockwise.

3. Install outer rod end assembly and align the setting marks applied during disassembly.
4. Tighten the outer lock nut to specified torque.

Torque: 118 N·m (87 lb ft)

5. Install knuckle arm nut and cotter pin then tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

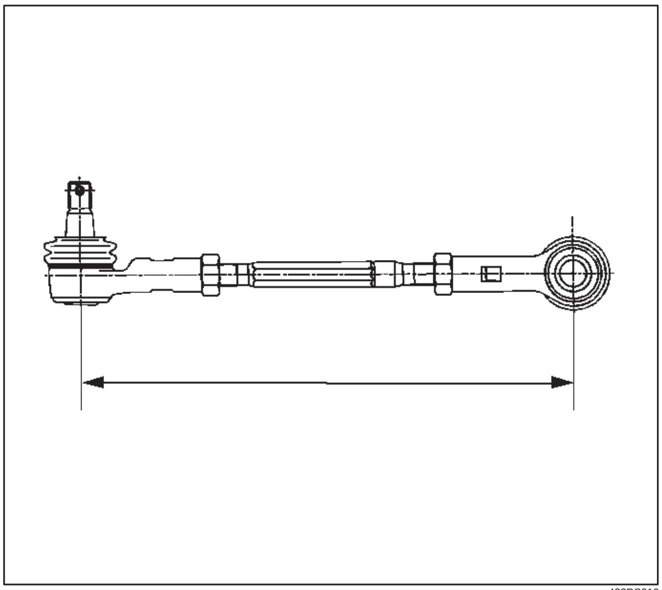
Torque: 98 N·m (72 lb ft)

6. Install center track rod and nut and cotter pin then tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

Torque: 98 N·m (72 lb ft)

NOTE: If replacing the track rod, adjust the new track rod length.

Rod length: 328.3 mm (12.93 in)

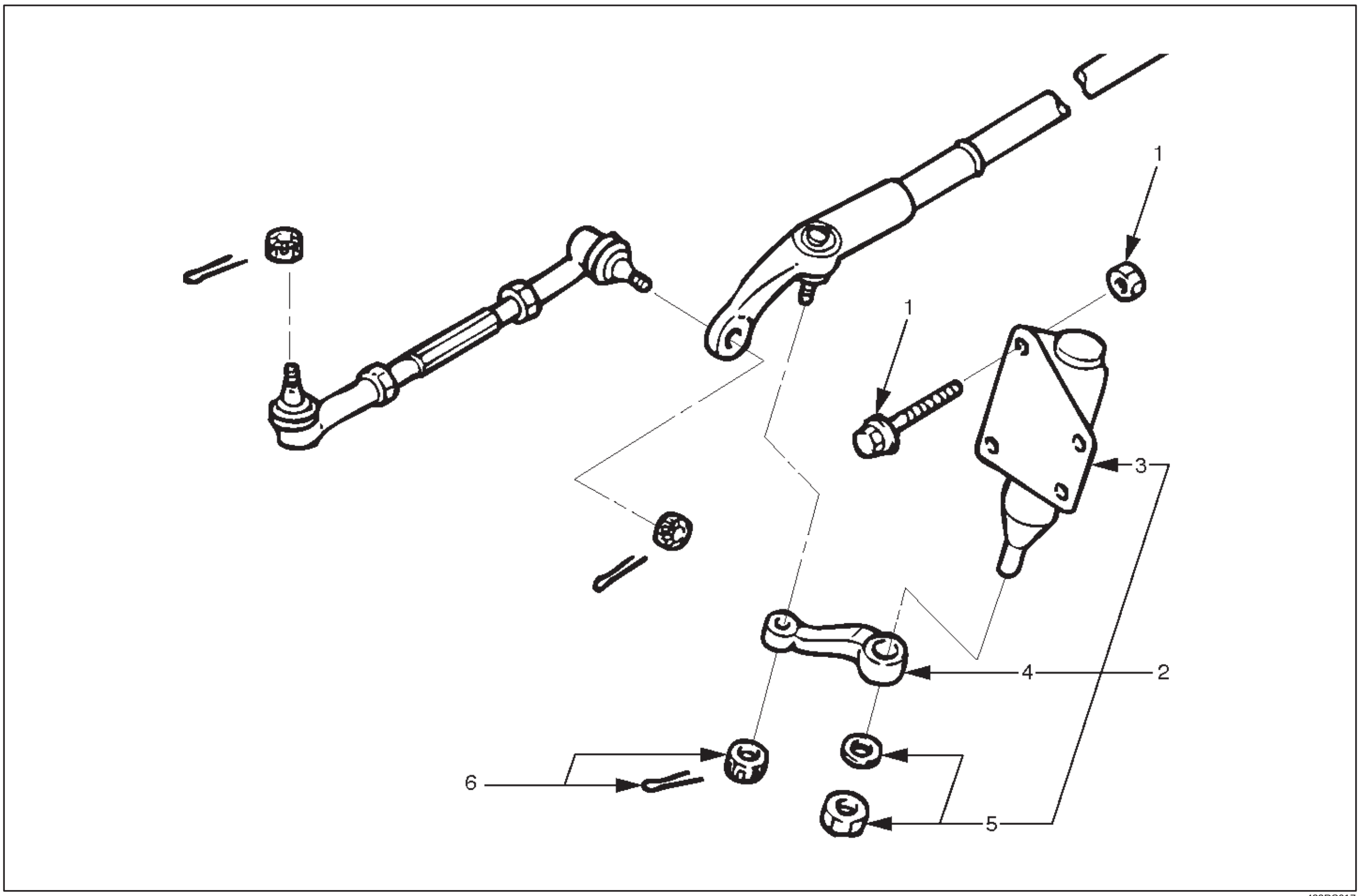


433RS016

NOTE: Adjust the toe-in. Refer to Front End Alignment Inspection and Adjustment in this section.

Relay Lever

Relay Lever and Associated Parts



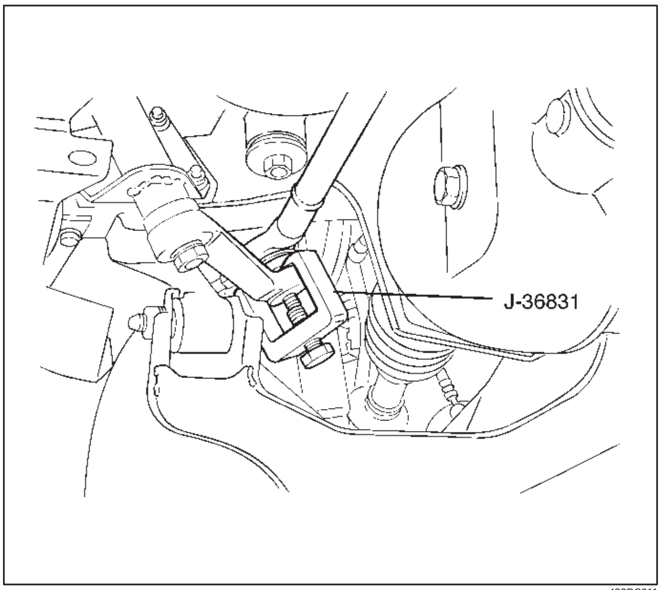
433RS017

Legend

(1) Bolt and Nut
(2) Relay Lever and Bracket
(3) Bracket
(4) Relay Lever
(5) Nut and Washer
(6) Nut and Cotter Pin

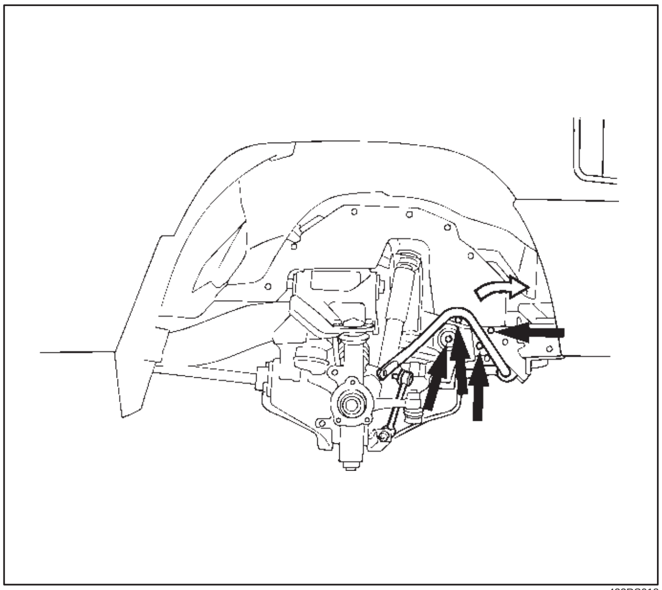
Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove nut and cotter pin then use remover J–36831 to disconnect relay lever at the center track rod.



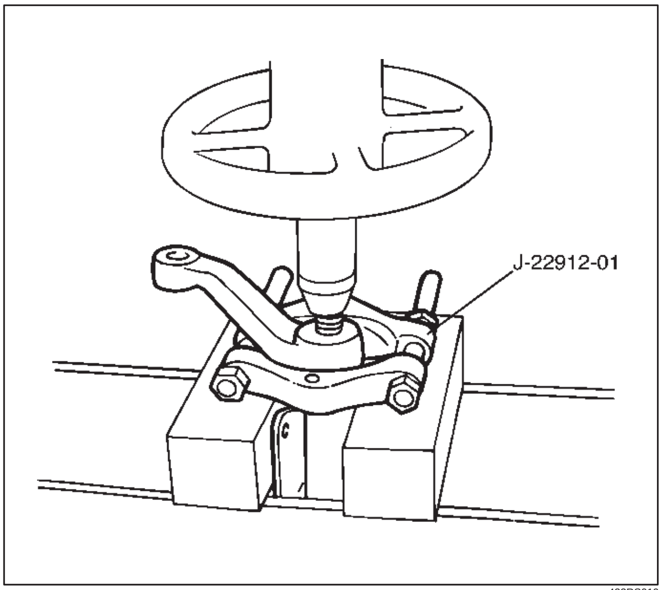
433RS011

3. Remove stabilizer bar bolt and nut and push the stabilizer bar aside, then remove the relay lever bolts and nuts.



433RS018

4. Remove relay lever and bracket.
5. Remove relay lever nut and washer.
6. Remove relay lever, use remover J–22912–01 to remove relay lever from the bracket.



433RS019

7. Remove bracket.

Installation

1. Install bracket.
2. Install relay lever.
3. Install nut and washer and tighten the nut to the specified torque.

   Torque: 118 N·m (87 lb ft)

4. Install relay lever and bracket.
5. Install bolt and nut and tighten it to the specified torque.

   Torque: 44 N·m (33 lb ft)

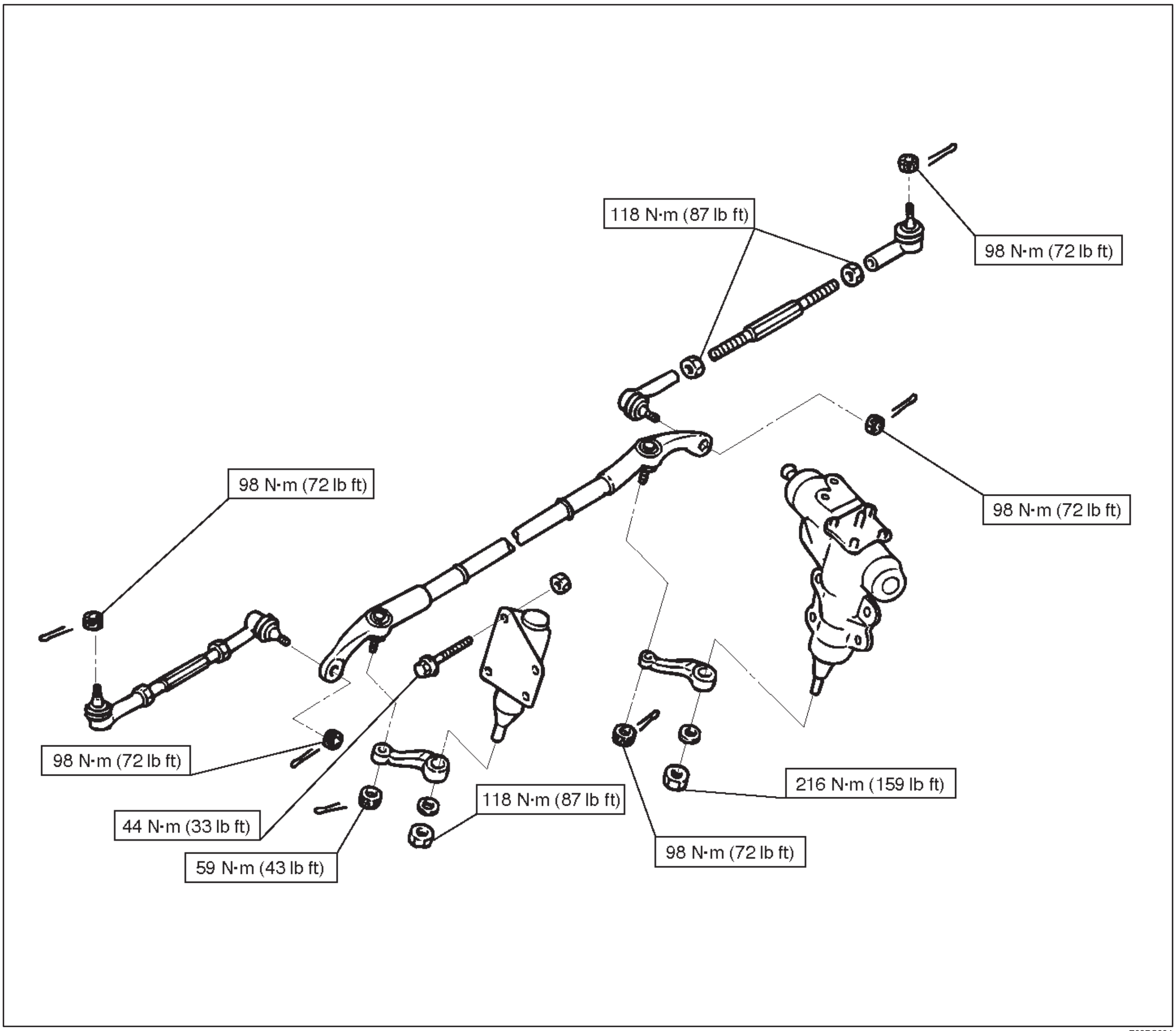
6. Install nut and cotter pin and tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

   Torque: 59 N·m (43 lb ft)

Steering Linkage and Associated Parts

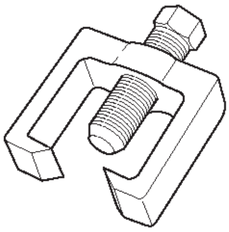
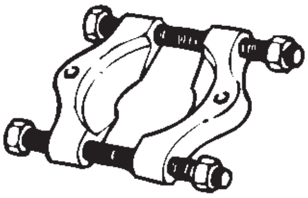
Main Data and Specifications

Torque Specifications



E03RS004

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–36831** Tie rod end remover
	**J–22912–01** Relay lever remover

Supplemental Restraint System Steering Wheel & Column

Service Precaution

This steering wheel and column repair section covers the Supplemental Restraint System (SRS) steering column. The following repair procedures are specific to SRS components. When servicing a vehicle equipped with Supplemental Restraint System, pay close attention to all WARNINGS and CAUTIONS.
For detailed explanation about SRS, refer to Restraints section.

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

SAFE HANDLING OF INFLATOR MODULES REQUIRES FOLLOWING THE PROCEDURES DESCRIBED BELOW FOR BOTH LIVE AND DEPLOYED MODULES.

SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY (AIR BAG). AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY (AIR BAG) SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY-PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY (AIR BAG) IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AN AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE.

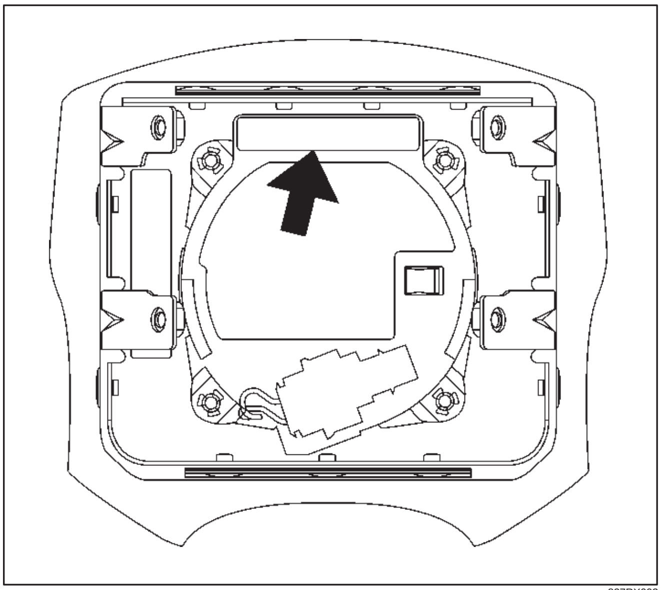
NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

TO AVOID DEPLOYMENT WHEN TROUBLE SHOOTING THE SRS SYSTEM, DO NOT USE ELECTRICAL TEST EQUIPMENT, SUCH AS BATTERY-POWERED OR A/C-POWERED VOLT-METER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN SPECIFIED IN THIS MANUAL. DO NOT USE A NON-POWERED PROBE-TYPE TESTER.

INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

CAUTION:

- **Never use the air bag assembly from another vehicle. Use only the air bag assembly for “UX”.**
- **The driver’s air bag assembly (Inflator module) for 1999 model has different characteristic to the parts for 1998 model.**
  When replace the driver’s air bag assembly, confirm the parts number and use only the parts for 1999 model. (The driver’s air bag assembly for 1999 model has “yellow” bar codes label. 1998 model has “white” bar codes label.)



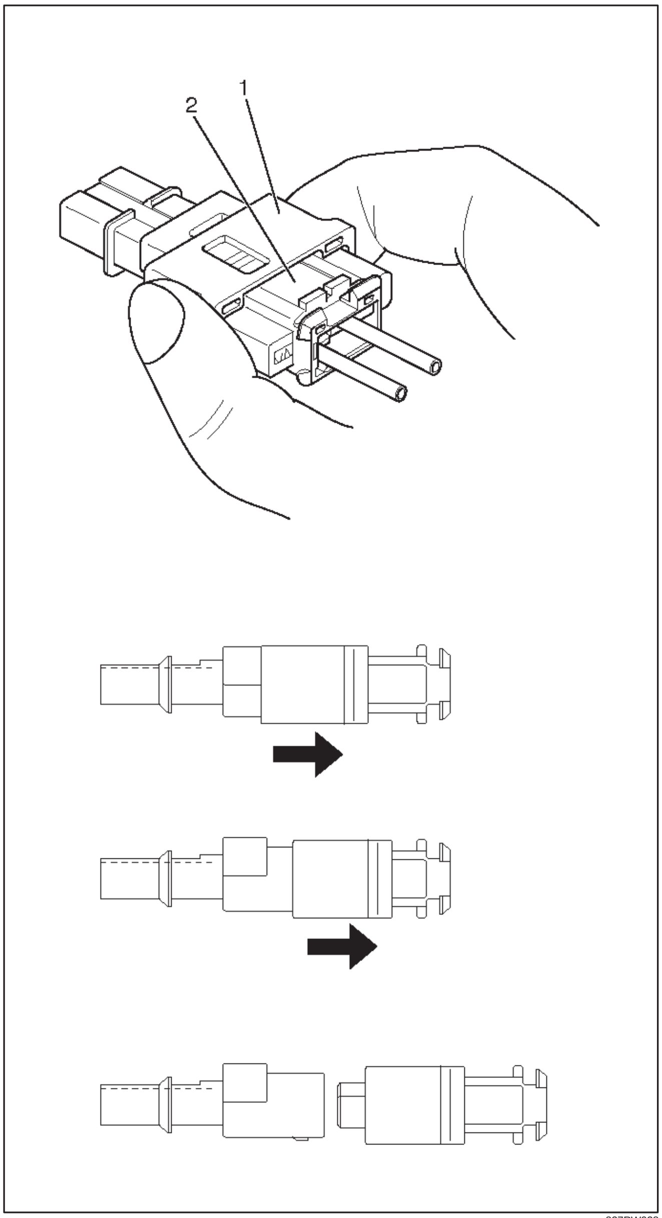
827RX003

SRS Connectors

CAUTION: The special tellow color connectors are used for supplemental restraint system-air bag circuit.
When removing the cable harness, do not pull the cables. Otherwise, cable disconnection may occur.
When connect the SRS connector, insert the connector completely. Imperfect locking may cause malfunction of SRS circuit.

Removal

To remove the connector, hold the cover insulator(1) and pull it. The cover insulator slides and lock will be released. Do not hold the socket insulator(2).

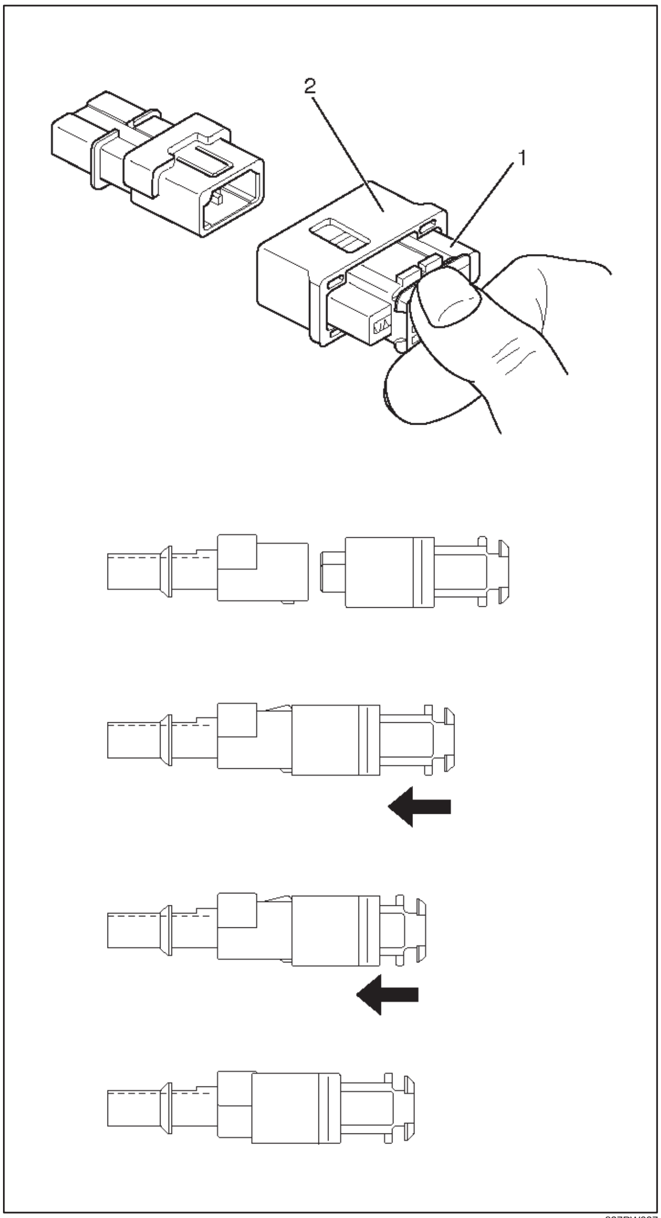


827RW028

Installation

To install the connector, hold the soket insulator(1) and insert it. The cover insulator slides and connector will be locked.

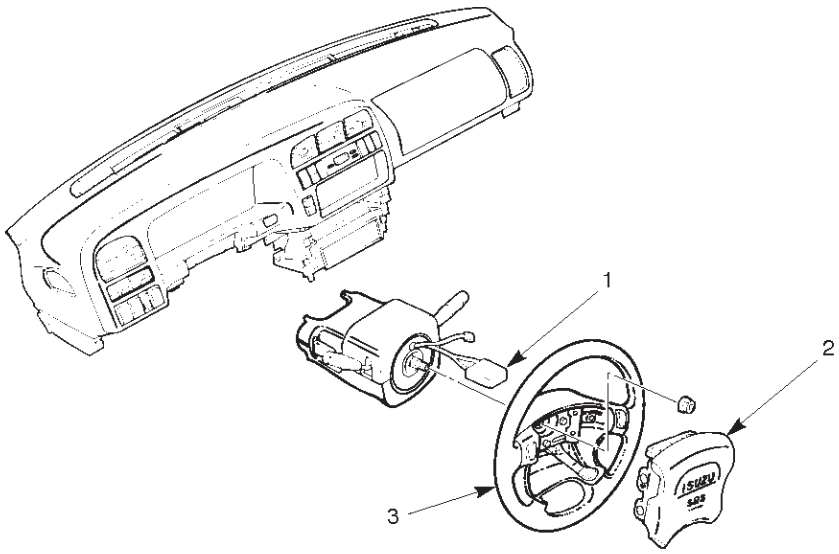
Do not hold the cover insulator(2).



827RW027

Inflator Module

Inflator Module and Associated Parts



827RS048

Legend

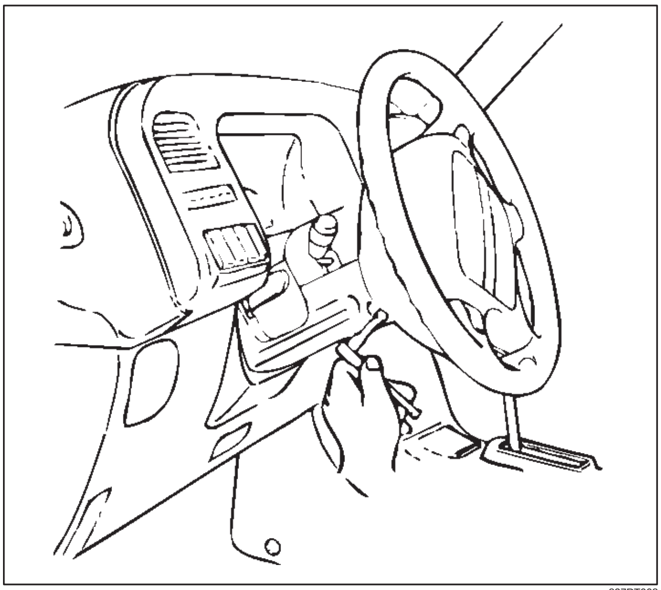
(1) Module Connector

(2) Inflator Module

(3) Fixing Bolt

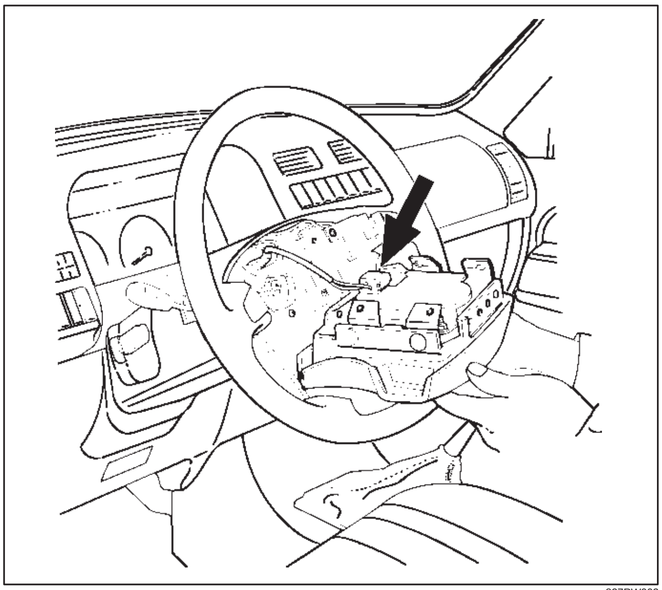
Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.
5. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly .



827RT008

6. Disconnect the yellow 2-way SRS connector located behind the inflator module.

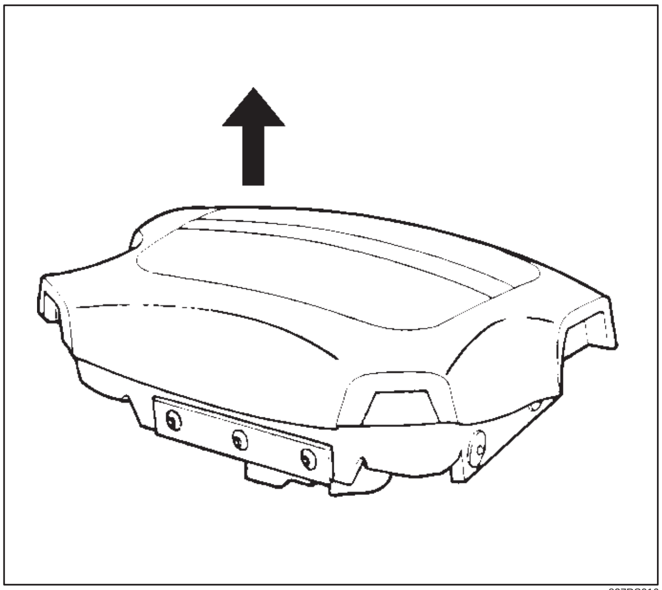


827RW002

7. Remove inflator module.

Inspection and Repair

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE URETHANE COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT .



827RS016

The inflator module consists of a cover, air bag, inflator, and retainer. Inspect the inflator module mainly for the following:

- Check for holes, cracks, severe blemishes and deformation on the cover.
- Check that the retainer is not deformed.
- Check for defects such as damage and breakage in the lead wire for the igniter.

If an abnormality is found as the result of the inspection, replace the inflator module with a new one.

Installation

1. Install inflator module.

CAUTION:

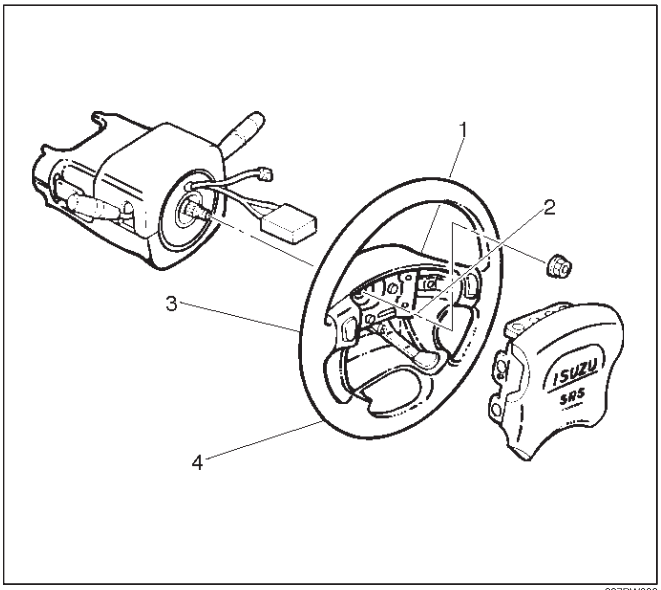
- **Never use the air bag assembly from another vehicle. Use only the air bag assembly for “UX”.**
- **The driver’s air bag assembly (Inflator module) for 1999 model has different characteristic to the parts for 1998 model.**
  When replace the driver’s air bag assembly, confirm the parts number and use only the parts for 1999 model. (The driver’s air bag assembly for 1999 model has “yellow” bar codes label. 1998 model has “white” bar codes label.)

2. Support the module and carefully connect the module connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

3. Secure the module with one bolt to relieve weight on the wire connector and tighten bolts to specified sequence as illustrated.

Torque: 8 N·m (69 lb in)

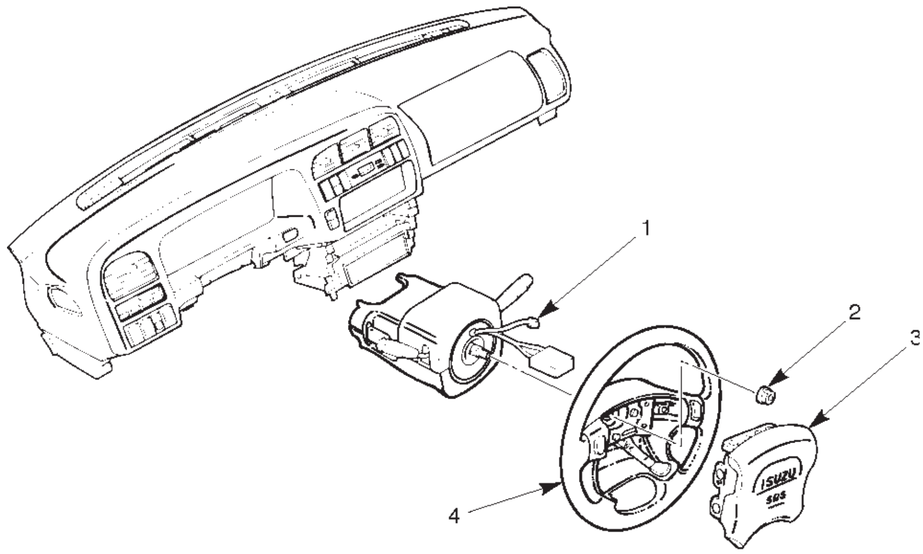


827RW003

4. Connect the yellow 2-way SRS connector located under the steering column.
5. Connect the battery “–” terminal cable.
6. Set ignition to “ON” while watching warning light. Light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

Steering Wheel

Steering Wheel and Associated Parts



827RT022

Legend

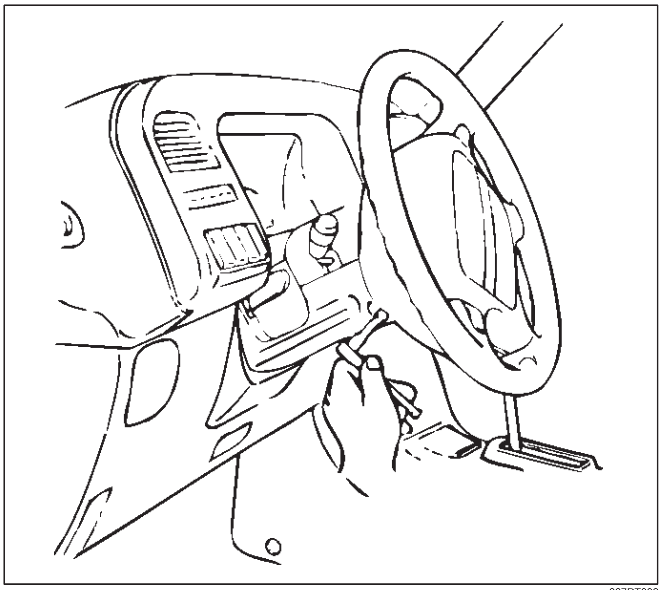
(1) Horn Lead
(2) Steering Wheel Fixing Nut
(3) Inflator Module
(4) Steering Wheel

CAUTION: Once the steering column is removed from the vehicle, the column is extremely susceptible to damage. Dropping the column assembly on its end could collapse the steering shaft or loosen the slide block which maintains column rigidity. Leaning on the column assembly could cause the jacket to bend or deform. Any of the above damage could impair the column's collapsible design. If it is necessary to remove the steering wheel, use only the specified steering wheel puller. Under no conditions should the end of the shaft be hammered upon, as hammering could loosen slide block which maintains column rigidity.

Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

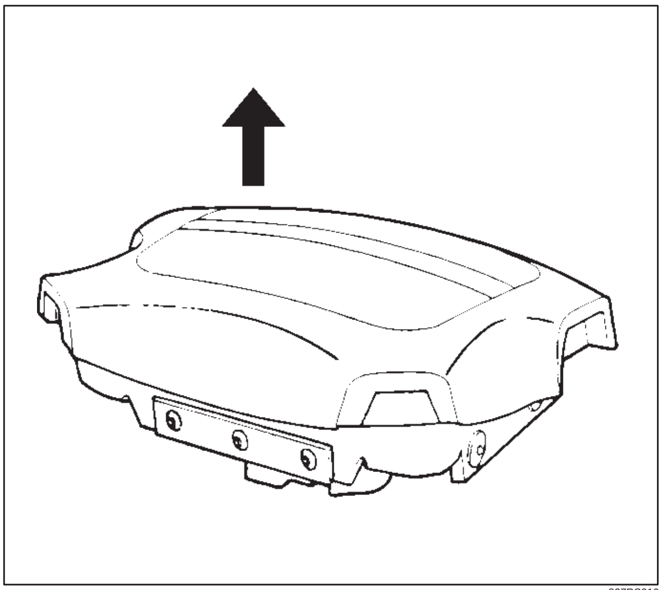
5. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.



827RT008

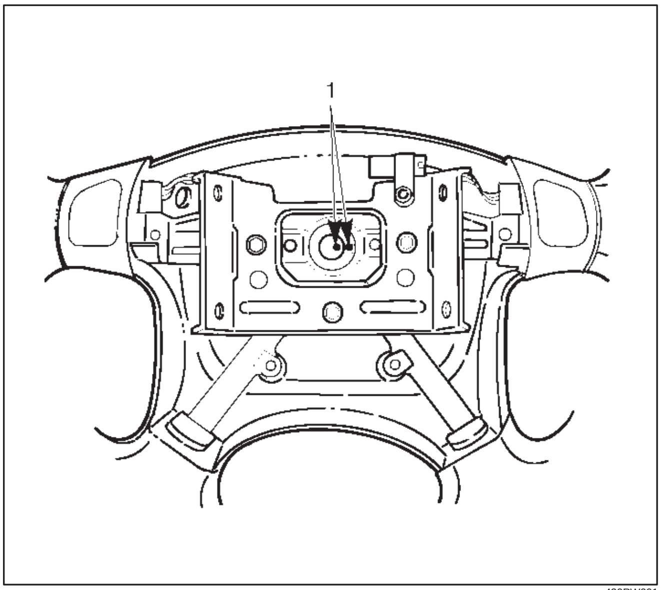
6. Disconnect the yellow 2-way SRS connector located behind the inflator module.

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE URETHANE COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



827RS016

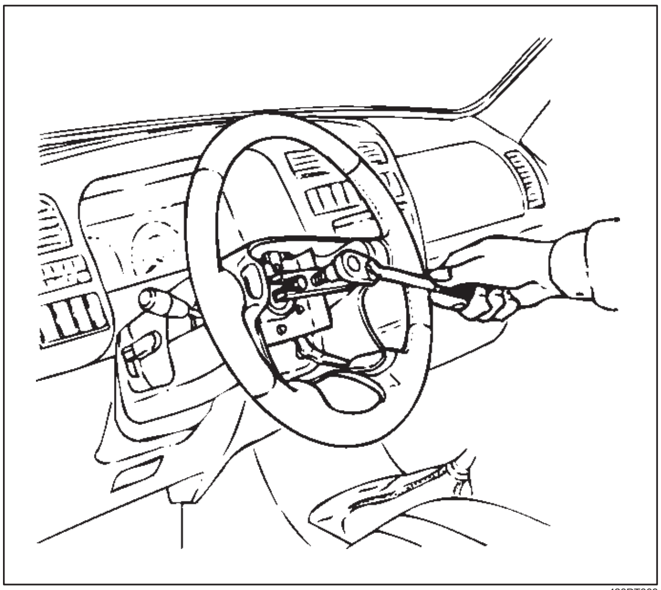
7. Disconnect horn lead.
8. Remove steering wheel fixing nut.
9. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position, then remove steering wheel.



430RW001

10. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



430RT009

Installation

1. Install steering wheel by aligning the setting marks made when removing.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

2. Tighten the steering wheel fixing nut to the specified torque.

Torque: 34 N·m (25 lb ft)

3. Connect horn lead.
4. Support the module and carefully connect the module connector.

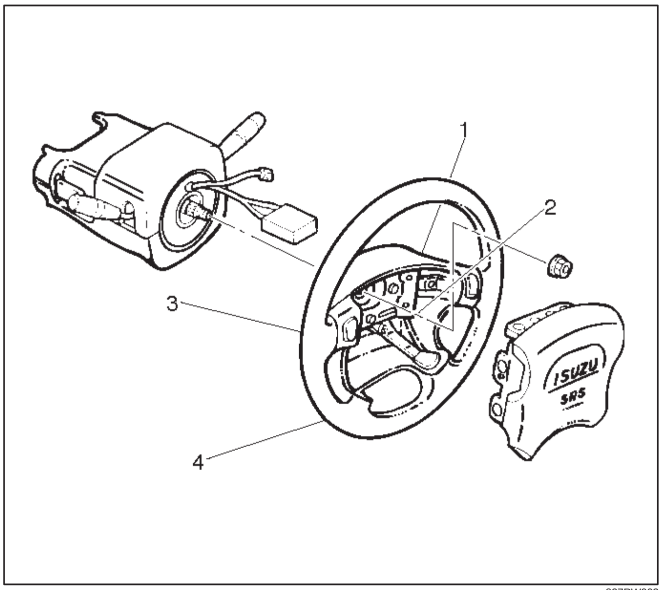
CAUTION:

- **Never use the air bag assembly from another vehicle. Use only the air bag assembly for “UX”.**
- **The driver’s air bag assembly (Inflator module) for 1999 model has different characteristic to the parts for 1998 model.**
  When replace the driver’s air bag assembly, confirm the parts number and use only the parts for 1999 model. (The driver’s air bag assembly for 1999 model has “yellow” bar codes label. 1998 model has “white” bar codes label.)

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinches.

- Secure the module with one bolt to relieve weight on the wire connector.
- Tighten bolts to specified sequence as illustrated.

Torque: 8 N·m (69 lb in)

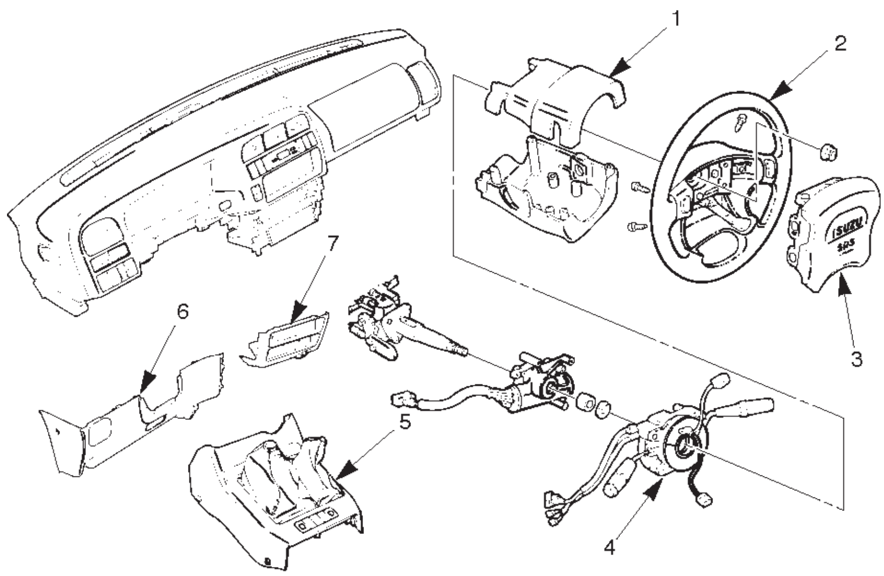


827RW003

5. Connect the yellow 2-way SRS connector located under the steering column.
6. Connect the battery “–” terminal cable.
7. Turn the ignition switch to “ON” while watching warning light. Light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

Combination Switch

Combination Switch and Associated Parts



Legend

(1) Steering Column Cover
(2) Steering Wheel
(3) Inflator Module
(4) Combination Switch and SRS Coil Assembly
(5) Front Console Assembly
(6) Steering Lower Cover
(7) Lower Cluster Assembly

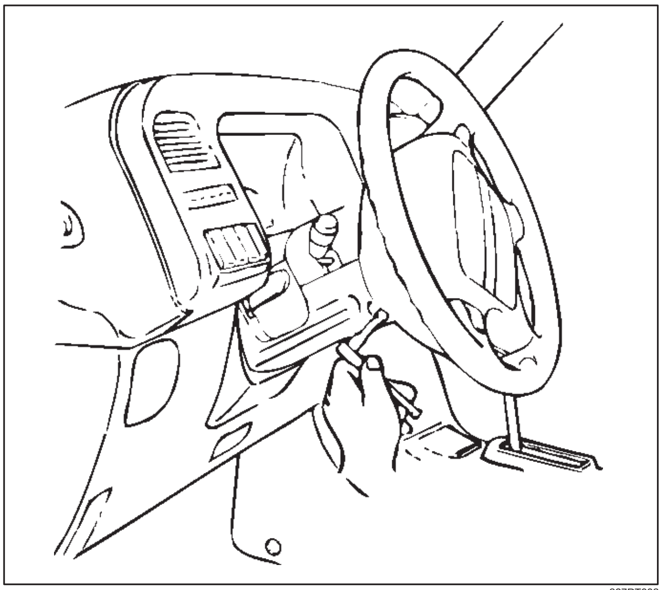
Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

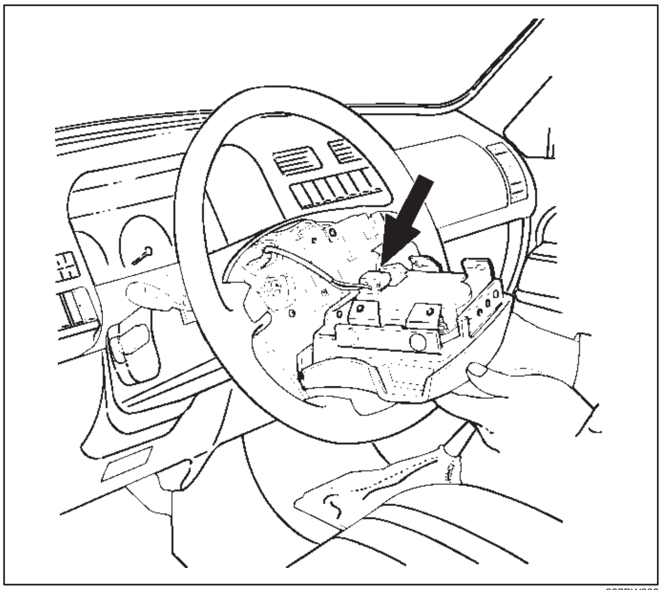
CAUTION: The wheels of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering wheel. Failure to do so will cause the coil assembly to become uncentered which will cause damage to the coil assembly.

5. Remove the transmission (for M/T) and transfer control lever knob. Disconnect the wiring harness connectors then remove front console assembly.
6. Remove lower cluster assembly.
7. Remove the engine hood opening lever, then remove steering lower cover.

8. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly. Disconnect the yellow 2-way SRS connector located behind the inflator module, then remove inflator module.

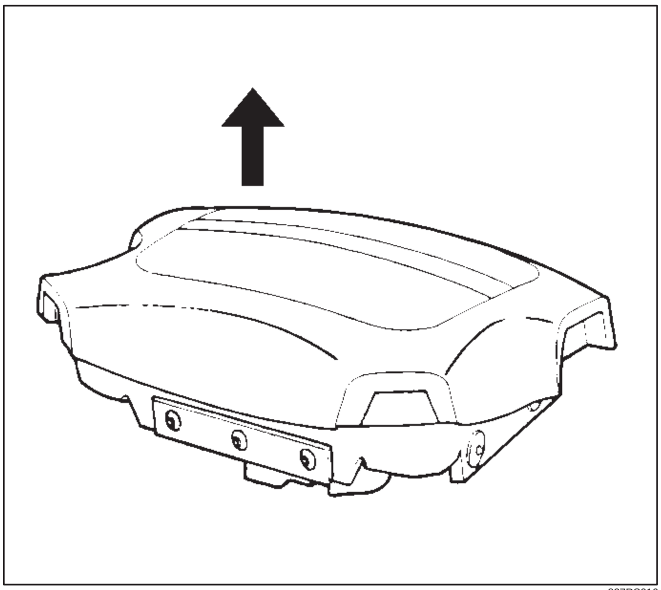


827RT008



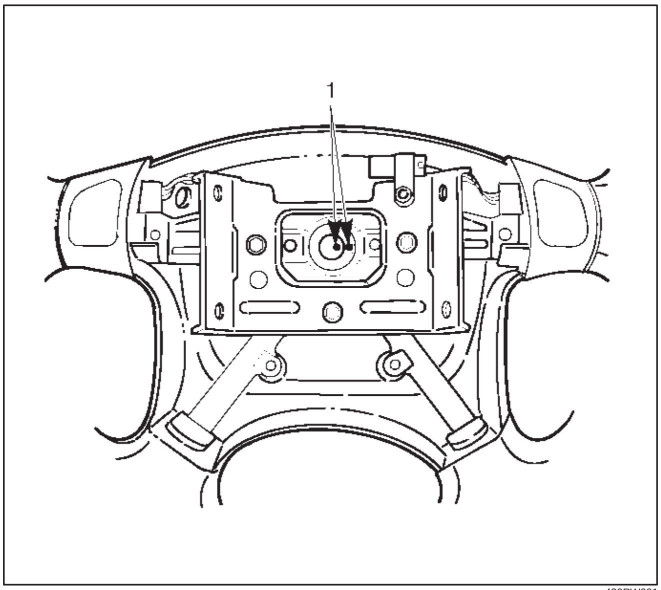
827RW002

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE URETHANE COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



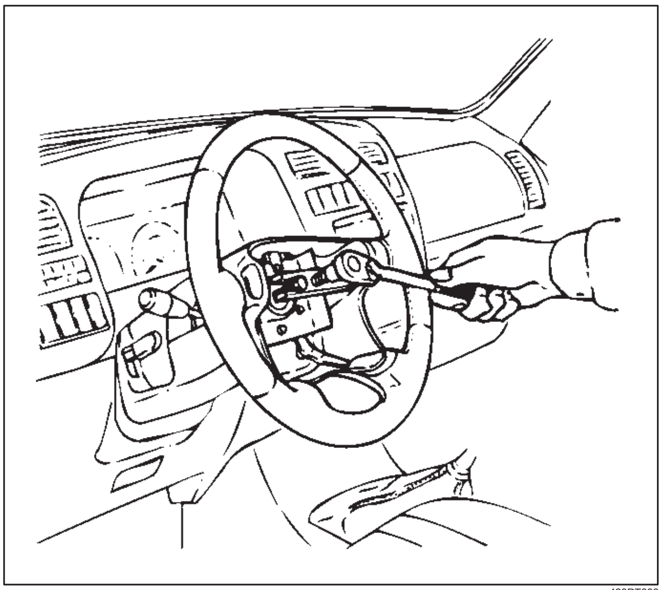
827RS016

9. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position. Move the front wheels to the straight ahead posision, then use steering wheel remover J–29752 to remove the steering wheel.



430RW001

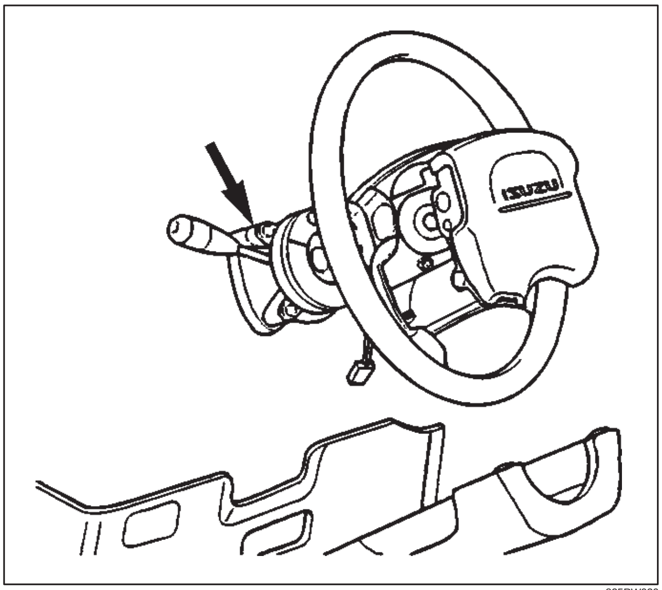
CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



430RT009

10. Remove steering column cover.
11. Disconnect the wiring harness connectors located under the steering column, then remove combination switch and SRS coil assembly.

NOTE: The SRS coil is a part of the combination switch assembly, which can not be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.

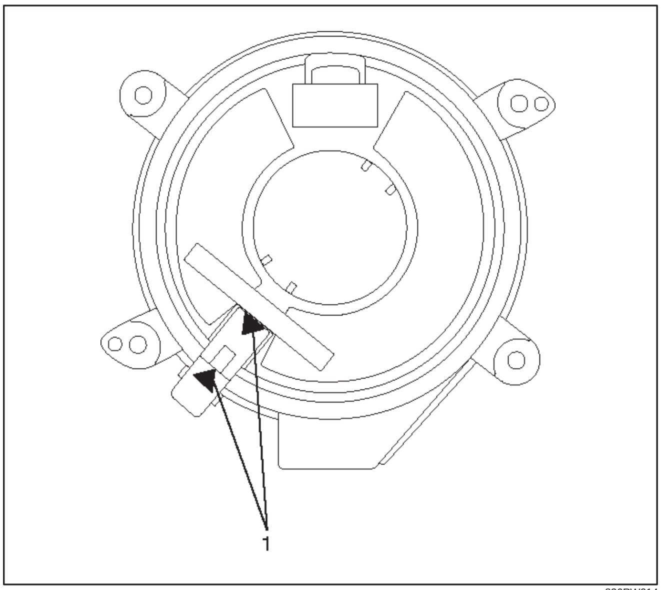


825RW030

Installation

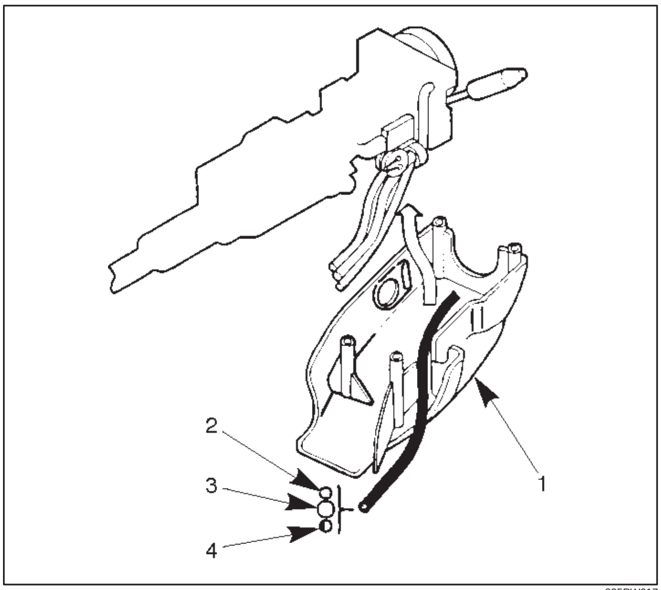
1. Install combination switch and SRS coil assembly. After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2-way connector located under the steering column. Then turn the SRS coil counterclockwise to full, return about 3 turns and align the neutral mark.

CAUTION: When turning the SRS coil counterclockwise to full, stop turning if resistance is felt. Forced further turning may damage to the cable in the SRS coil.



826RW014

2. When installing the steering column cover, be sure to route each wire harness as illustrated so that the harnesses do not catch on any moving parts.



825RW017

Legend

(1) Steering Column Cover
(2) Starter Switch Harness
(3) Combination Switch Harness
(4) Inflator Module Harness

3. Align the setting marks made when removing then install steering wheel.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

4. Tighten the steering wheel fixing nut to the specified torque.

Torque: 34 N·m (25 lb ft)

5. Support the inflator module and carefully connect the module connector.

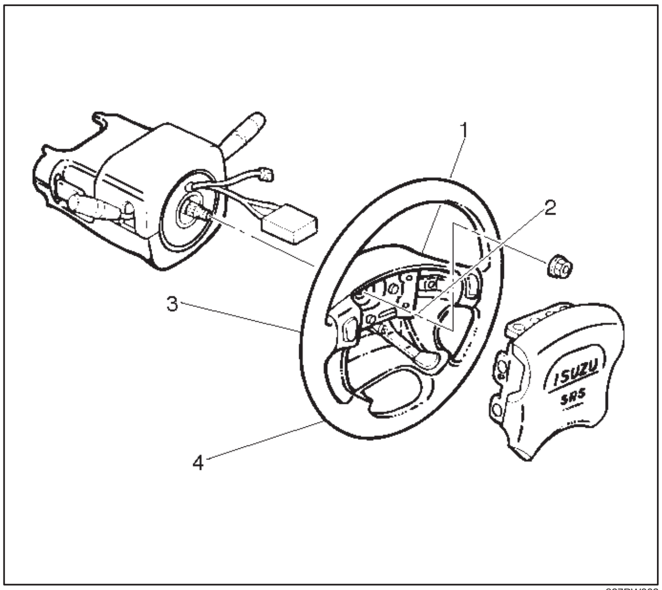
CAUTION:

- **Never use the air bag assembly from another vehicle. Use only the air bag assembly for “UX”.**
- **The driver’s air bag assembly (Inflator module) for 1999 model has different characteristic to the parts for 1998 model.**
  When replace the driver’s air bag assembly, confirm the parts number and use only the parts for 1999 model. (The driver’s air bag assembly for 1999 model has “yellow” bar codes label. 1998 model has “white” bar codes label.)

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

6. Secure the module with one bolt to relieve weight on the wire connector.
7. Tighten bolts to specified sequence as illustrated.

Torque: 8 N·m (69 lb in)

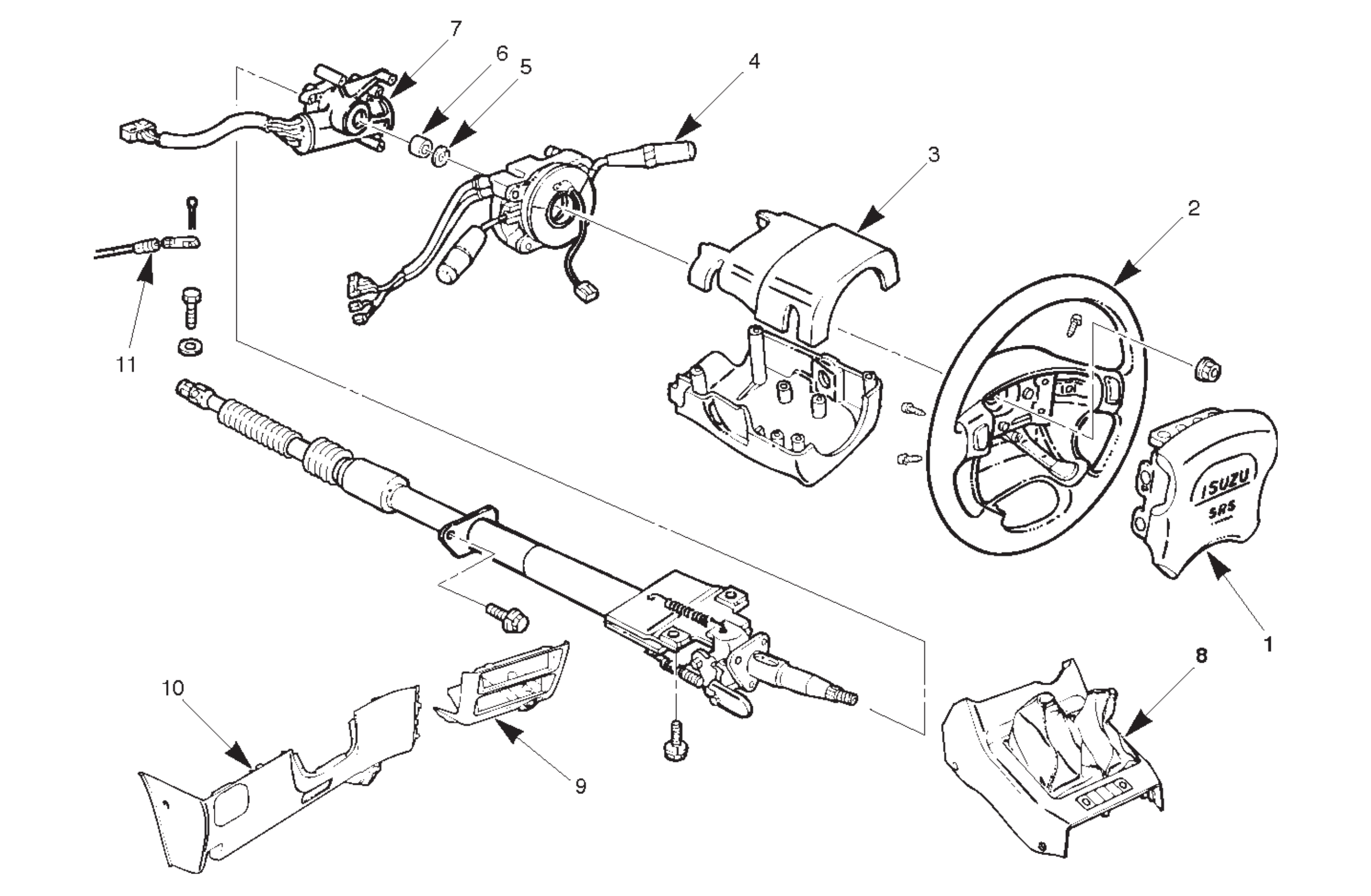


827RW003

8. Install steering lower cover then Install the engine hood opening lever.
9. Install lower cluster assembly
10. Install the transmission (for M/T) and transfer control lever knob, then install front console assembly.
11. Connect the wiring harness connectors.
12. Connect the battery “–” terminal cable.
13. Turn the ignition switch to “ON” while watching warning light and check the light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

Lock Cylinder

Lock Cylinder and Associated Parts



431RW003

Legend

(1) Inflator Module
(2) Steering Wheel
(3) Steering Column Cover
(4) Combination Switch and SRS Coil Assembly
(5) Snap Ring
(6) Cushion Rubber
(7) Lock Cylinder Assembly
(8) Front Console Assembly
(9) Lower Cluster Assembly
(10) Steering Lower Cover
(11) Shift Lock Cable (for A/T)

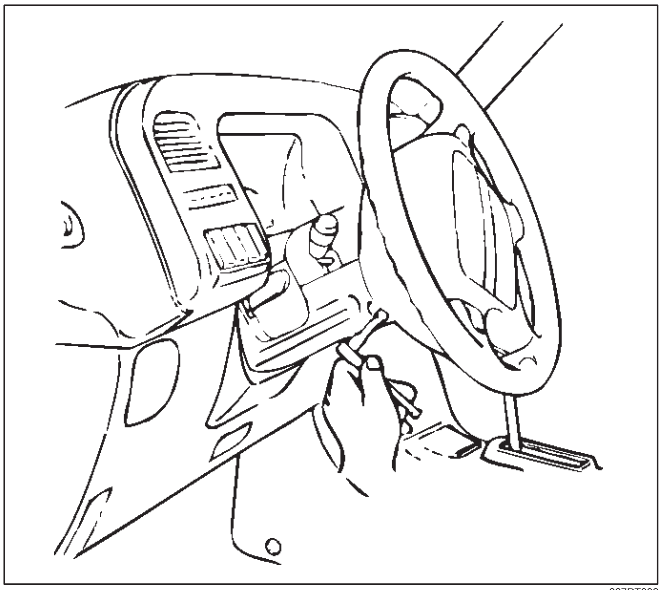
Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

CAUTION: The wheels of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering wheel. Failure to do so will cause the coil assembly to become uncentered which will cause damage to the coil assembly.

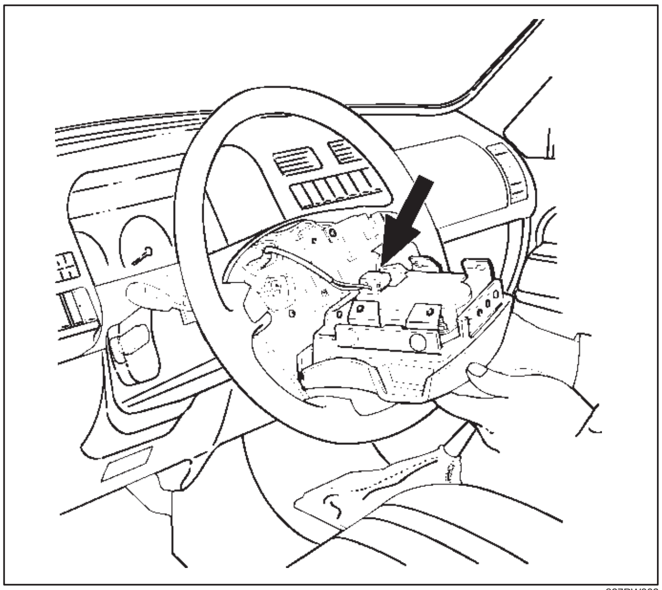
5. Remove the transmission (for M/T) and transfer control lever knob and disconnect the wiring harness connectors, then remove front console assembly.
6. Remove lower cluster assembly.
7. Remove the engine hood opening lever and steering lower cover.

8. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.



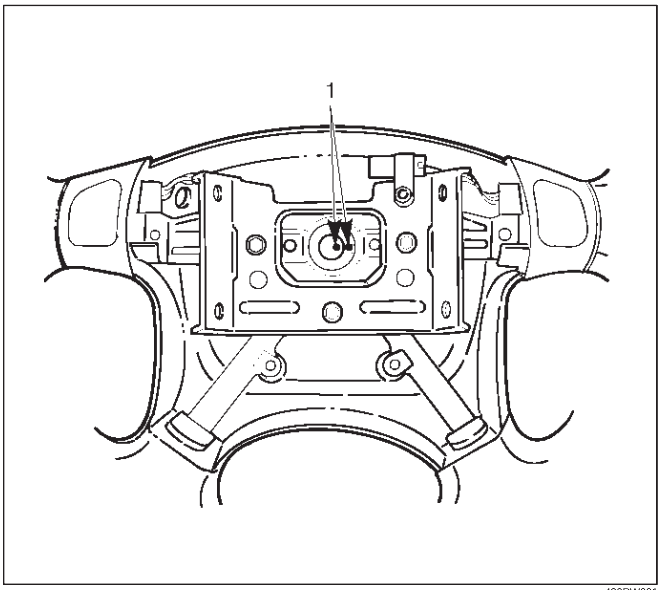
827RT008

9. Disconnect the yellow 2-way SRS connector located behind the inflator module.



827RW002

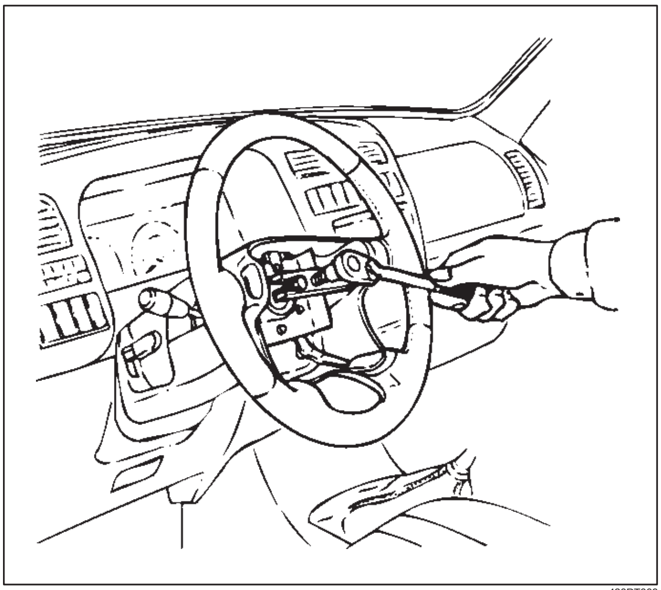
10. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position.



430RW001

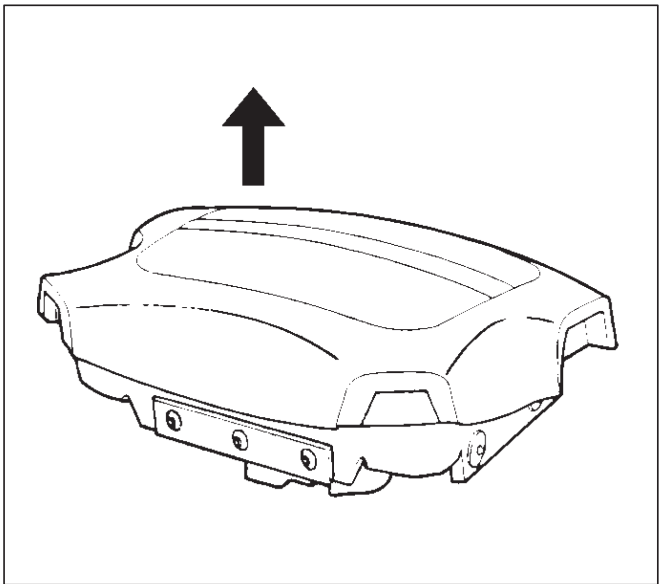
11. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



430RT009

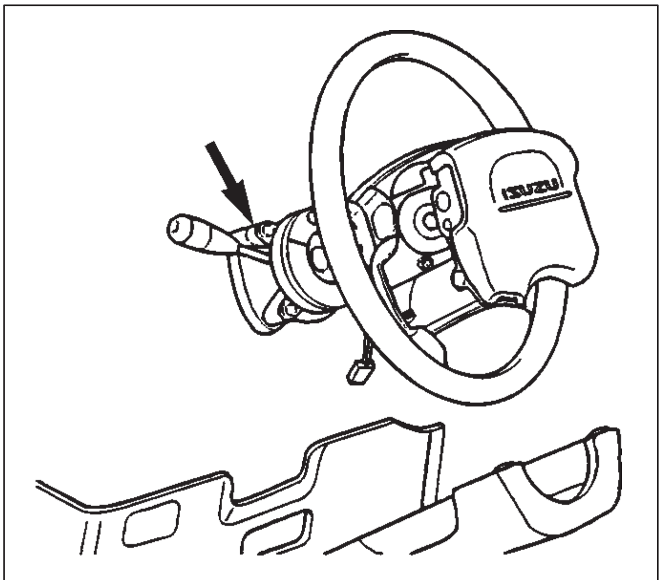
WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE URETHANE COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



827RS016

12. Remove steering column cover.
13. Disconnect the wiring harness connectors located under the steering column.
14. Remove the combination switch assembly with SRS coil.

NOTE: The SRS coil is a part of the combination switch assembly, which can not be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.



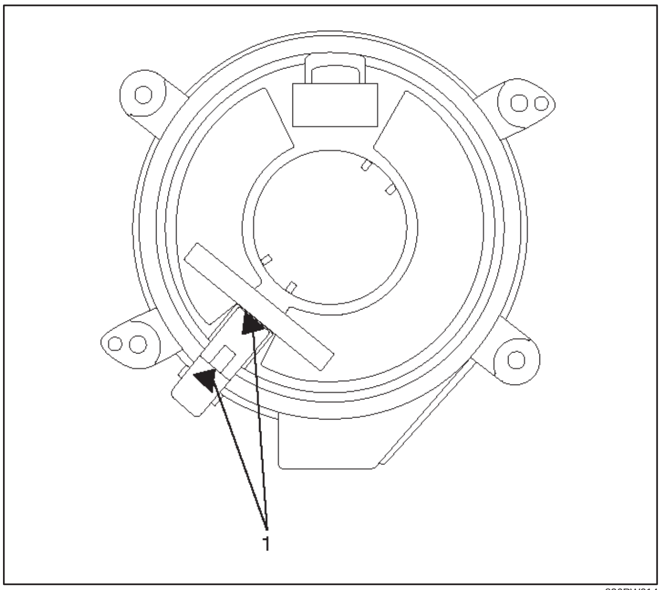
825RW030

15. Remove snap ring.
16. Remove cushion rubber.
17. Remove shift lock cable (for A/T).
18. Disconnect the starter switch harness connector located under the steering column, then remove lock cylinder assembly.

Installation

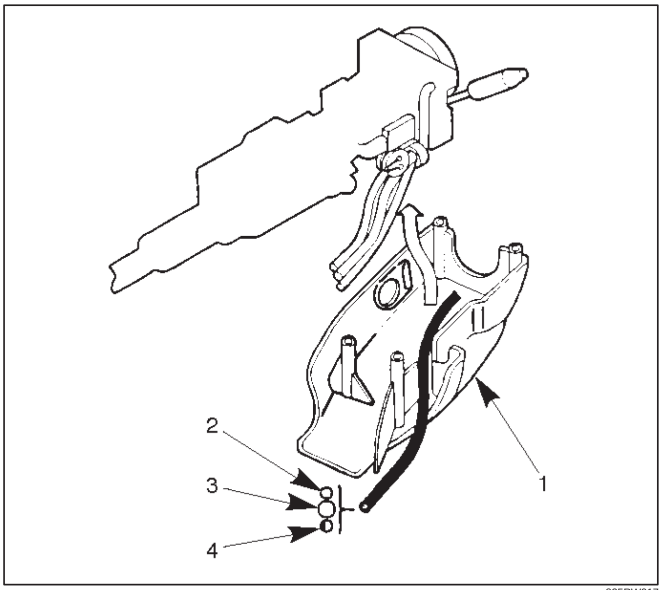
1. Install lock cylinder assembly.
2. Install shift lock cable (for A/T).
3. Install cushion rubber.
4. Install snap ring.
5. Install Combination switch and SRS coil assembly. After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2-way connector located under the steering column.
6. Turn the SRS coil counterclockwise to full, return about 3 turns and align the neutral mark.

CAUTION: When turning the SRS coil counterclockwise to full, stop turning if resistance is felt. Forced further turning may damage to the cable in the SRS coil.



826RW014

7. When installing the steering column cover, be sure to route each wire harness as illustrated so that the harnesses do not catch on any moving parts.



825RW017

Legend

(1) Steering Column Cover
(2) Starter Switch Harness
(3) Combination Switch Harness
(4) Inflator Module Harness

8. Install steering wheel by aligning the setting marks made during removal.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

9. Tighten the steering wheel fixing nut to the specified torque.

Torque: 34 N·m (25 lb ft)

10. Support inflator module and carefully connect the module connector, then install inflator module.

CAUTION:

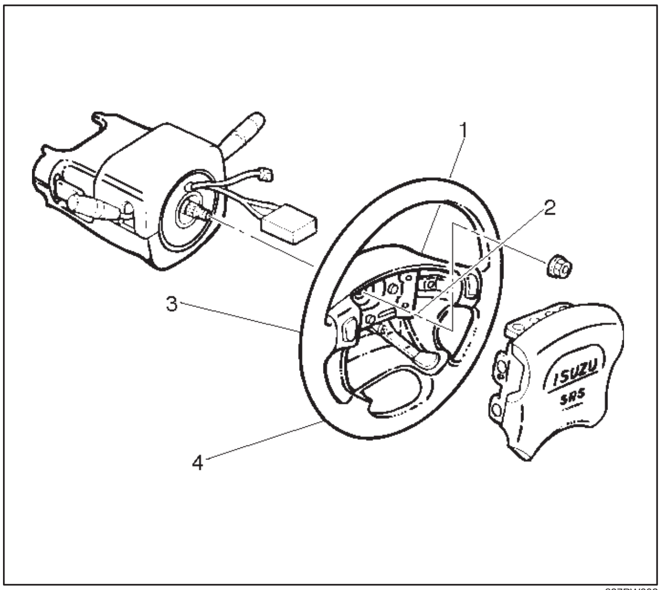
- **Never use the air bag assembly from another vehicle. Use only the air bag assembly for "UX".**
- **The driver's air bag assembly (Inflator module) for 1999 model has different characteristic to the parts for 1998 model.**
  When replace the driver's air bag assembly, confirm the parts number and use only the parts for 1999 model. (The driver's air bag assembly for 1999 model has "yellow" bar codes label. 1998 model has "white" bar codes label.)

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

11. Secure the inflator module with one bolt to relieve weight on the wire connector.

12. Tighten fixing bolts to specified sequence as illustrated.

Torque: 8 N·m (69 lb in)



827RW003

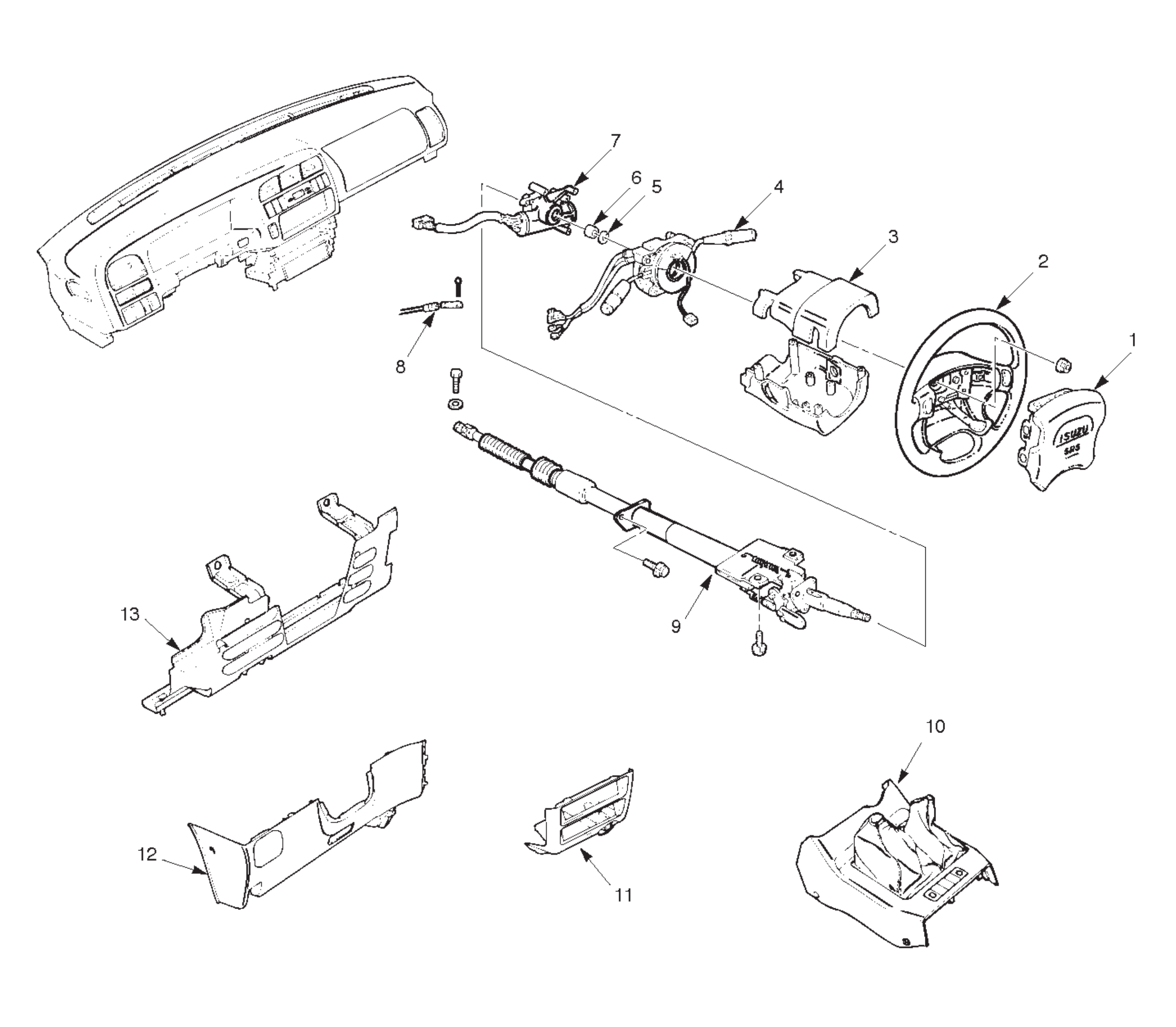
13. Install steering lower cover, then install the engine hood opening lever.
14. Install lower cluster assembly.
15. Connect the wiring harness connectors, then install front console assembly and install the transmission (for M/T) and transfer control lever knob.
16. Connect the yellow 2-way SRS connector located under the steering column.
17. Connect the battery "–" terminal cable.

System Inspection

Turn the ignition switch to "ON" while watching warning light.The light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section .

Steering Column

Steering Column and Associated Parts



Legend

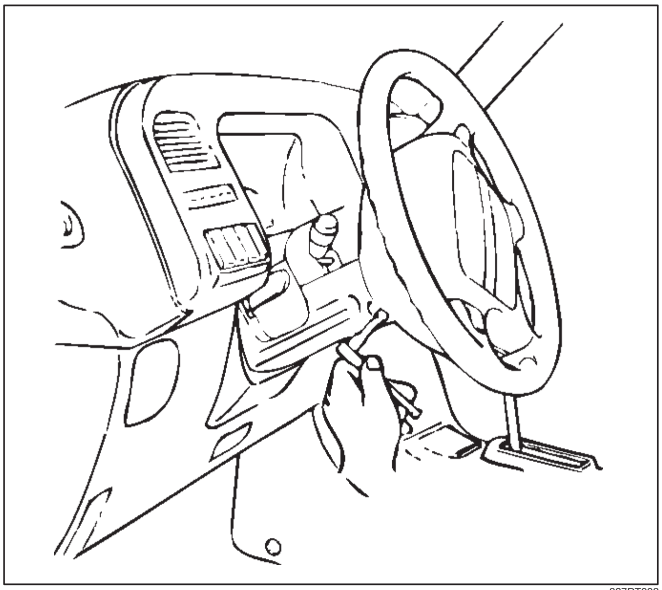
(1) Inflator Module
(2) Steering Wheel
(3) Steering Column Cover
(4) Combination Switch and SRS Coil Assembly
(5) Snap Ring
(6) Cushion Rubber
(7) Lock Cylinder Assembly
(8) Shift Lock Cable (For A/T)
(9) Steering Column Assembly
(10) Front Console Assembly
(11) Lower Cluster Assembly
(12) Steering Lower Cover
(13) Driver Knee Bolster (reinforcement)

Removal

1. Turn the steering wheel so that the vehicle’s wheels are pointing straight ahead.
2. Turn the ignition switch to “LOCK”.
3. Disconnect the battery “–” terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

CAUTION: The wheel of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering column from the steering gear. Failure to do so will cause the SRS coil assembly to become uncentered which will cause damage to the SRS coil assembly.

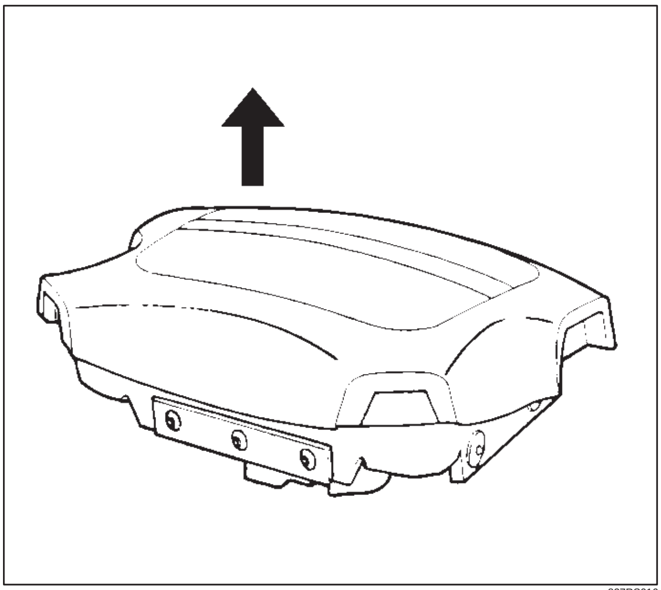
5. Disconnect the transmission (for M/T) and transfer control lever knob.
6. Disconnect the wiring harness connectors.
7. Remove front console assembly.
8. Remove lower cluster assembly.
9. Remove the engine hood opening lever, then remove steering lower cover.
10. Remove driver knee bolster (reinforcement).
11. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.



827RT008

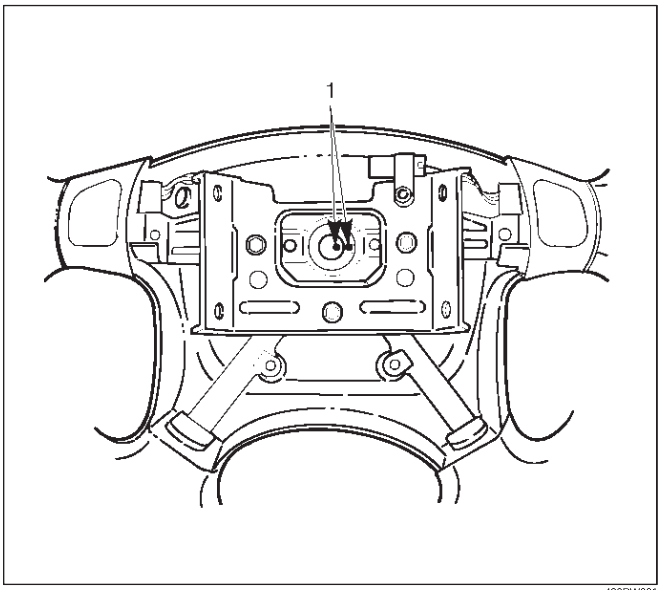
12. Disconnect the yellow 2-way SRS connector located behind the inflator module.
13. Remove inflator module.

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE URETHANE COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.

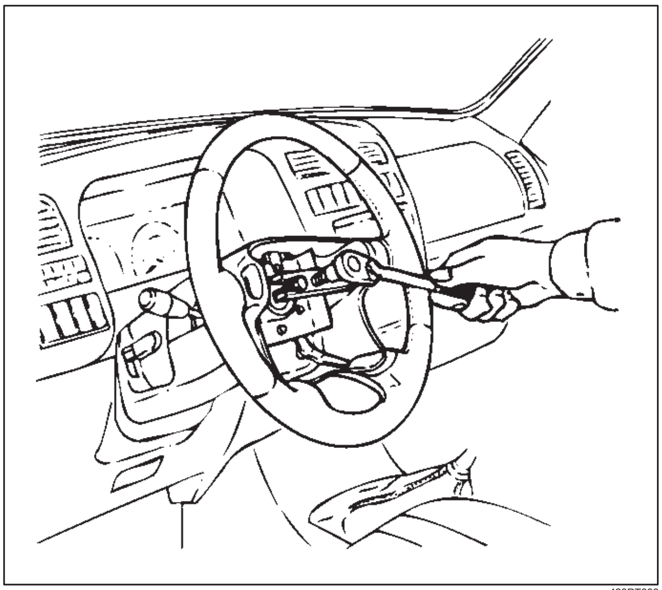


827RS016

14. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.



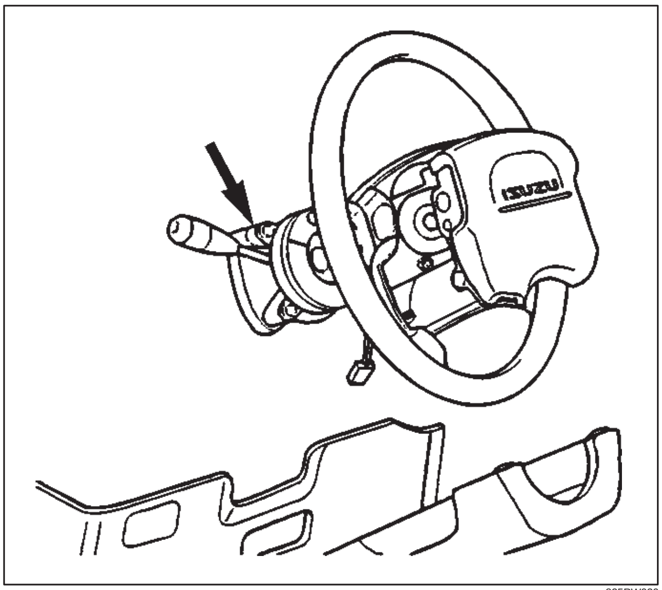
430RW001



430RT009

15. Remove steering column cover.
16. Disconnect the wiring harness connectors located under the steering column.
17. Remove the combination switch assembly with SRS coil.

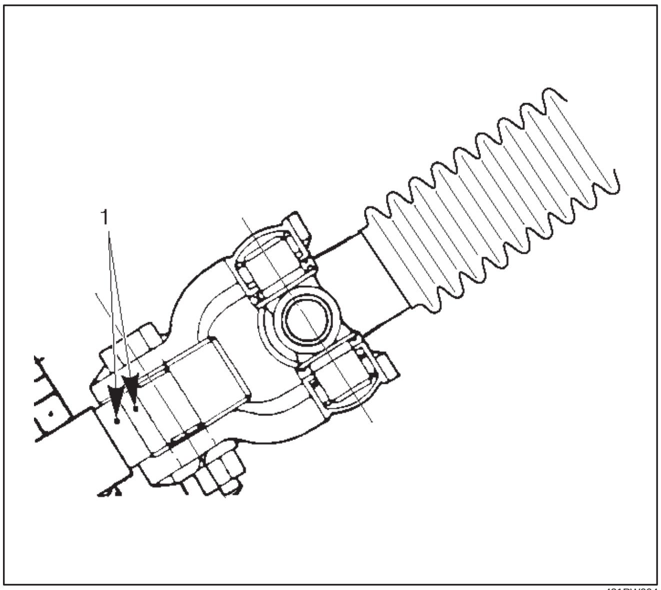
NOTE: SRS coil is a part of combination switch assembly, which can not be replaced singly. Therefore, be sure not to remove the SRS coil from the combination switch assembly.



825RW030

18. Remove snap ring.
19. Remove cushion rubber.
20. Remove shift lock cable (For A/T).
21. Disconnect the starter switch harness connector located under the steering column, then remove lock cylinder assembly.
22. Apply a setting mark (1) across the universal joint and steering shaft to reassemble the parts in their original position, then remove steering column assembly.

NOTE: A setting mark can be easily made if the shaft is withdrawn a little by loosening the steering shaft universal joint.



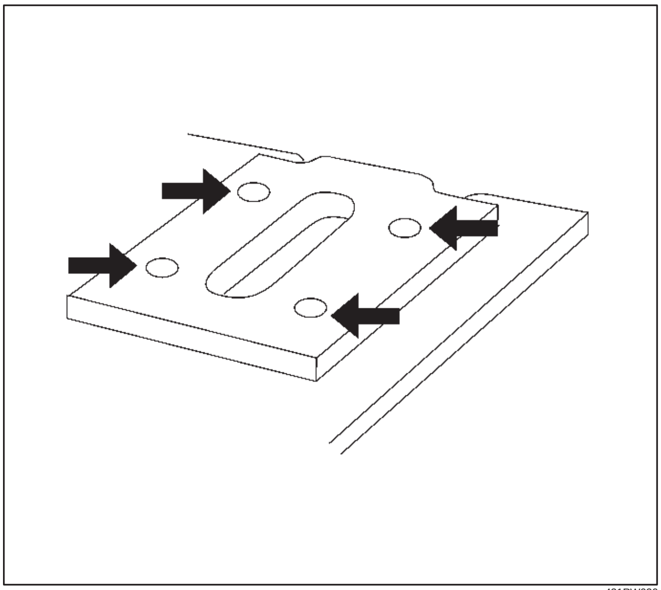
431RW004

Inspection

If the abnormal conditions are found through inspection, replace the steering column assembly.

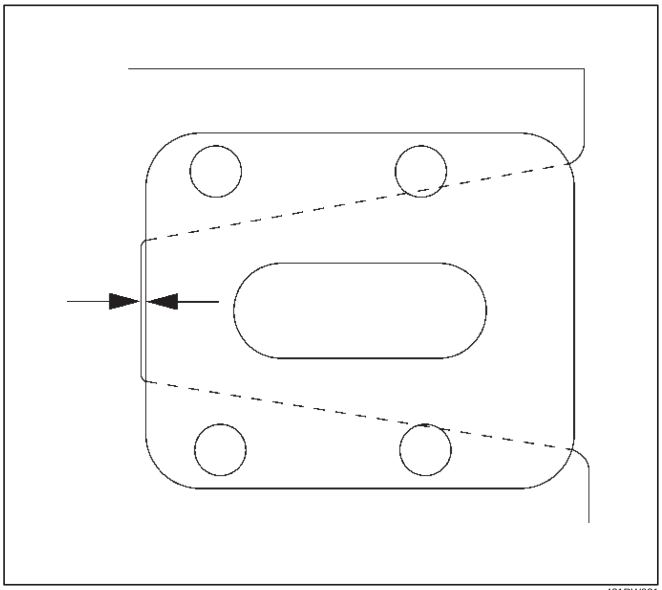
Column Capsule

Check capsules on steering column bracket assembly; all must be securely seated in bracket slots and checked for any loose conditions when pushed or pulled by hand.



431RW030

Check clearance between capsule and bracket. It must be within 1 mm (0.039 in).

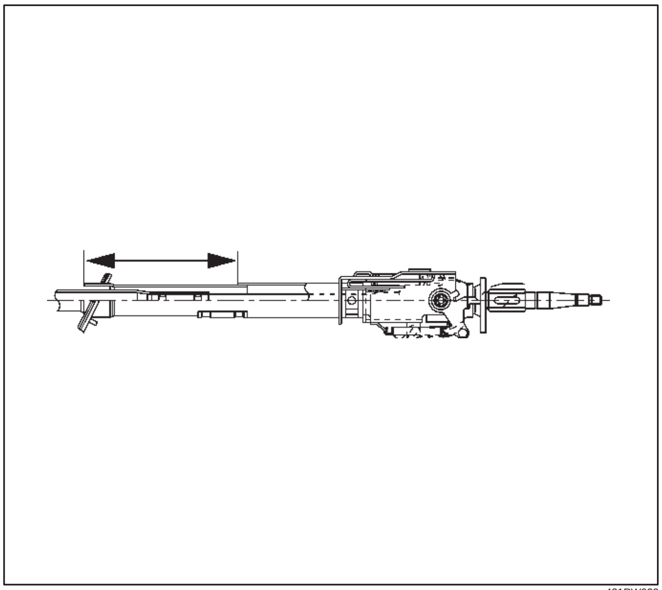


431RW031

Column Tube

Check for collapse by measuring the distance as shown in the figure.

Standard distance: 162.2–165.8 mm (6.386–6.528 in)



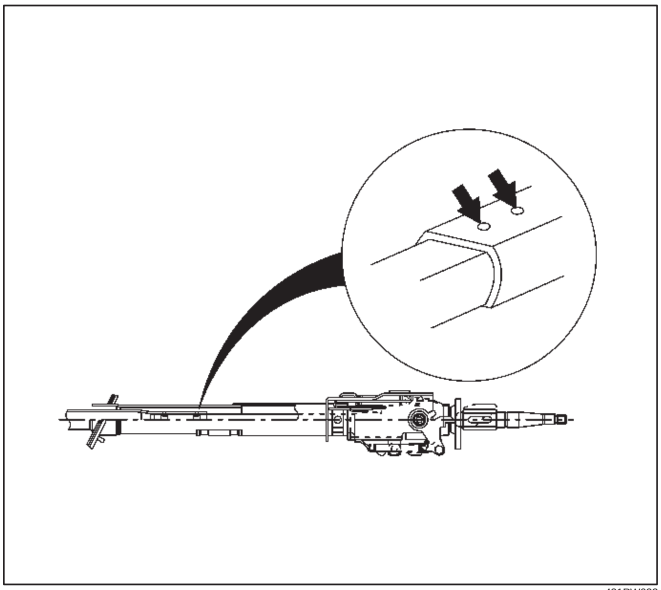
431RW032

Column Universal Joint for Tilt Mechanism

If the resistance is felt when checked by rotate the joint, replace the steering column assembly.

Sheared Injected Plastic Pin

Check the sheared injected plastic pins for any loose conditions or damage.

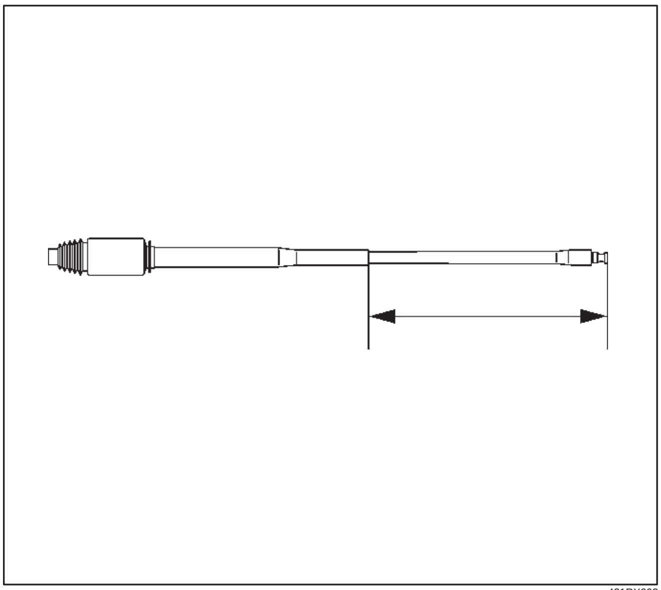


431RW033

Shaft Length

Check the shaft length from the upper end of the slide joint to the end of the shaft. If column length is not in specifications, steering column should be replaced.

Standard length: 308–310 mm (12.126–12.205 in)



431RX003

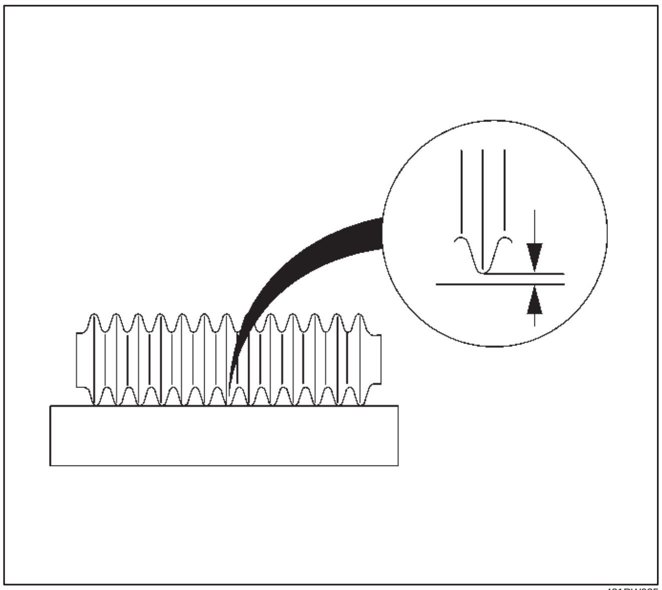
Shaft Universal Joint (Lower End)

If the resistance is felt when checked by rotate the joint, replace the steering column assembly.

Shaft Bellows Pipe

Check the shaft bellows pipe for bend by using straight edge. Measure the clearance between the bellows pipe and the straight edge (at center of the bellows pipe).

Standard: Less than 1 mm (0.039 in)



431RW035

Tilt Mechanism

Tilt mechanism should moves smoothly.
While locked the tilt mechanism, be sure the steering column latch securely by pushing the steering wheel upward and downward.

Installation

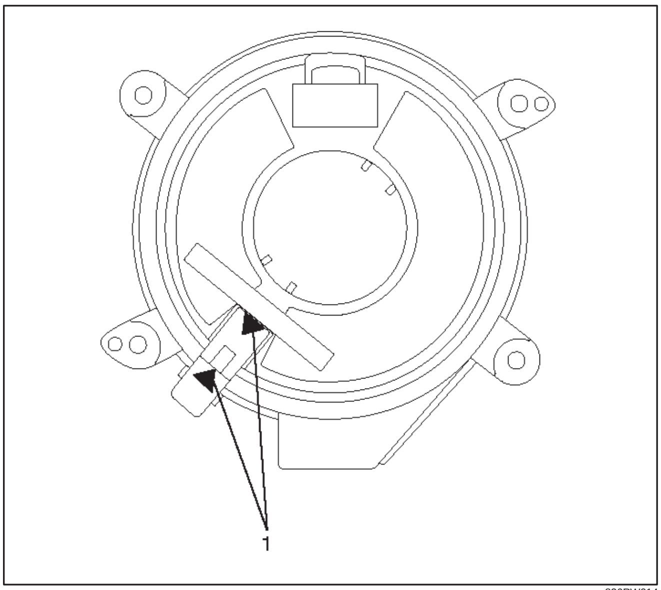
1. Install steering column assembly.
2. Align the setting marks on the universal joint and steering shaft made during removal.
3. Tighten the steering column fixing bolt (dash panel) to the specified torque.

   Torque: 19 N·m (14 lb ft)
4. Tighten the steering column fixing bolt (pedal bracket) to the specified torque.

   Torque: 17 N·m (13 lb ft)
5. Tighten the universal joint to the specified torque.

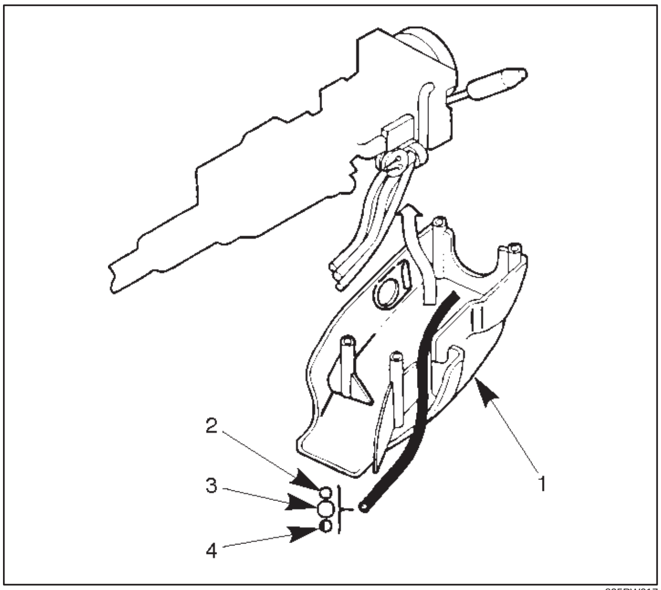
   Torque: 25 N·m (18 lb ft)
6. Install lock cylinder assembly.
7. Install shift lock cable (For A/T).
8. Install cushion rubber.
9. Install snap ring.
10. Install Combination switch and SRS coil assembly. After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2-way connector located under the steering column.
11. Turn the SRS coil counterclockwise to full, return about 3 turns and align the neutral mark.

CAUTION: When turning the SRS coil counterclockwise to full, stop turning if resistance is felt. Forced further turning may damage to the cable in the SRS coil.



826RW014

12. When installing the steering column cover, be sure to route each wire harness as illustrated so that the harnesses do not catch any moving parts.



825RW017

Legend

(1) Steering Column Cover
(2) Starter Switch Harness
(3) Combination Switch Harness
(4) Inflator Module Harness

13. Install steering wheel and align the setting marks made when removing.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

14. Tighten the steering wheel fixing nut to the specified torque.

    Torque: 34 N·m (25 lb ft)
15. Support the module and carefully connect the module connector then install inflator module.

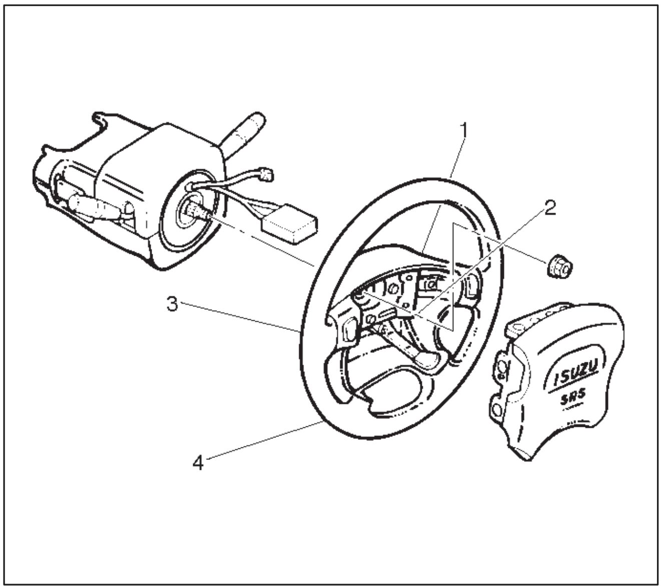
CAUTION:

- **Never use the air bag assembly from another vehicle. Use only the air bag assembly for “UX”.**
- **The driver’s air bag assembly (Inflator module) for 1999 model has different characteristic to the parts for 1998 model.**
  When replace the driver’s air bag assembly, confirm the parts number and use only the parts for 1999 model. (The driver’s air bag assembly for 1999 model has “yellow” bar codes label. 1998 model has “white” bar codes label.)

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

16. Secure the module with one bolt to relieve weight on the wire connector.
17. Tighten bolts to specified sequence as illustrated.

    Torque: 8 N·m (69 lb in)



827RW003

18. Install driver knee bolster (reinforcement).
19. Install steering lower cover.
20. Install the engine hood opening lever.
21. Install lower cluster assembly.
22. Connect the wiring harness connectors then install front console assembly.
23. Install the transmission (for M/T) and transfer control lever knob.
24. Connect the yellow 2-way SRS connector located under the steering column.
25. Connect the battery “–” terminal cable.

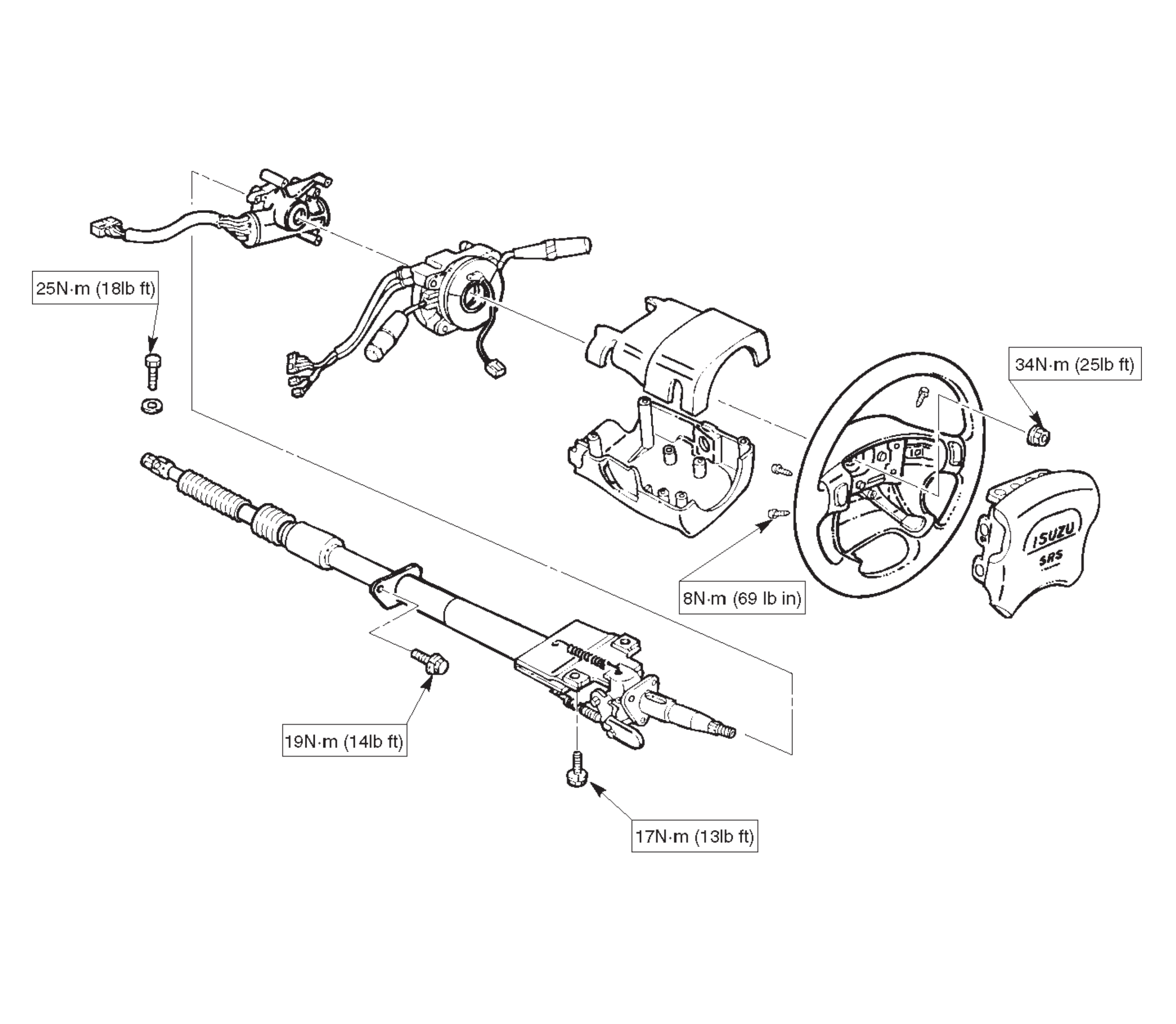
System Inspection

Turn the ignition switch “ON” while watching warning light. The light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

Supplemental Restraint System Steering Wheel & Column and Associated Parts

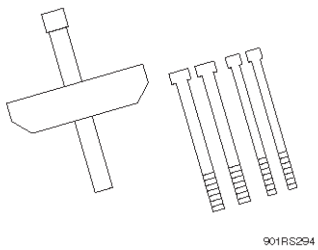
Main Data and Specifications

Torque Specifications



E03RW001

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–29752** Steering wheel remover

TROOPER

SUSPENSION

CONTENTS

FRONT SUSPENSION

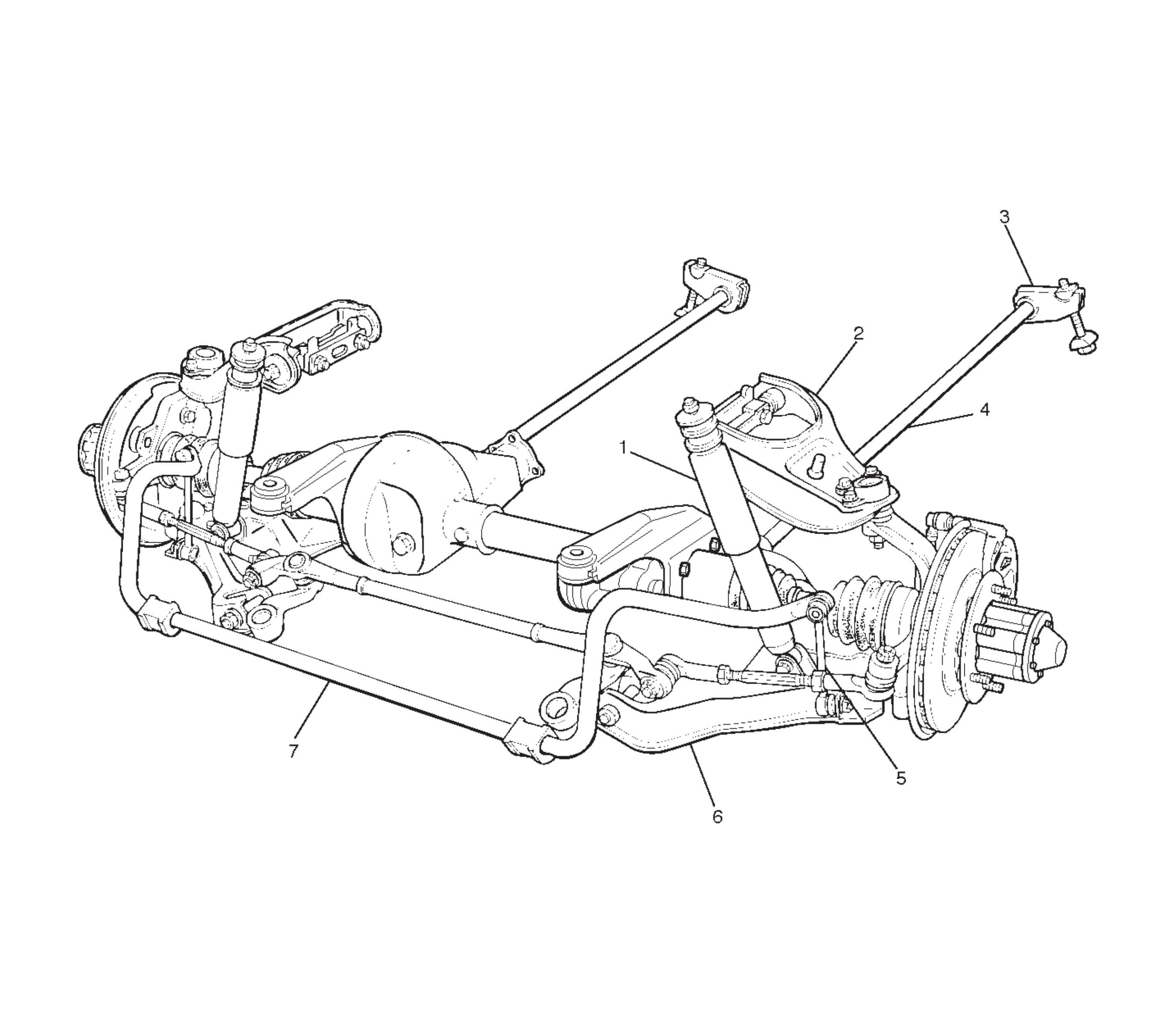
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNING COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



C03RW001

Legend

(1) Shock Absorber
(2) Upper Control Arm
(3) Height Control Arm
(4) Torsion Bar
(5) Link
(6) Lower Control Arm
(7) Stabilizer Bar

The front suspension is designed to allow each wheel to compensate for changes in the road surface level without greatly affecting the opposite wheel. Each wheel is independently connected to the frame by a steering knuckle, ball joint assemblies, and upper and lower control arms. The front wheels are held in proper relationship to each other by two outer track rods which are connected to steering arms on the knuckles, and to a center track rod.

All models have a front suspension system consisting of control arms, stabilizer bar, shock absorber and a torsion bar. The front end of the torsion bar is attached to the lower control arm. The rear of the torsion bar is mounted into a height control arm at the crossmember. Vehicle trim height is controlled by adjusting this arm.

Shock absorbers are mounted between the brackets on the frame and the lower control arms. The lower portion of each shock absorber is attached to the lower control arm. The upper portion of each shock absorber extends through a frame bracket and is secured with two rubber bushings, three retainers and a nut.

Ball joint assemblies are bolted to the outer end of the upper and lower control arm and are attached to the steering knuckle.

The inner ends of the upper control arm have pressed in bushings. Bolts, passing through the bushing, attach the control arm to the frame. The inner ends of the lower

control arm are attached to the frame by bolts passing through the bushings, which are pressed in the frame.
Side roll of the front suspension is controlled by a spring steel stabilizer bar. It is mounted in rubber bushings, which are held to the crossmember by brackets. The ends of the stabilizer bar are connected to the lower control arms by links.

General Diagnosis

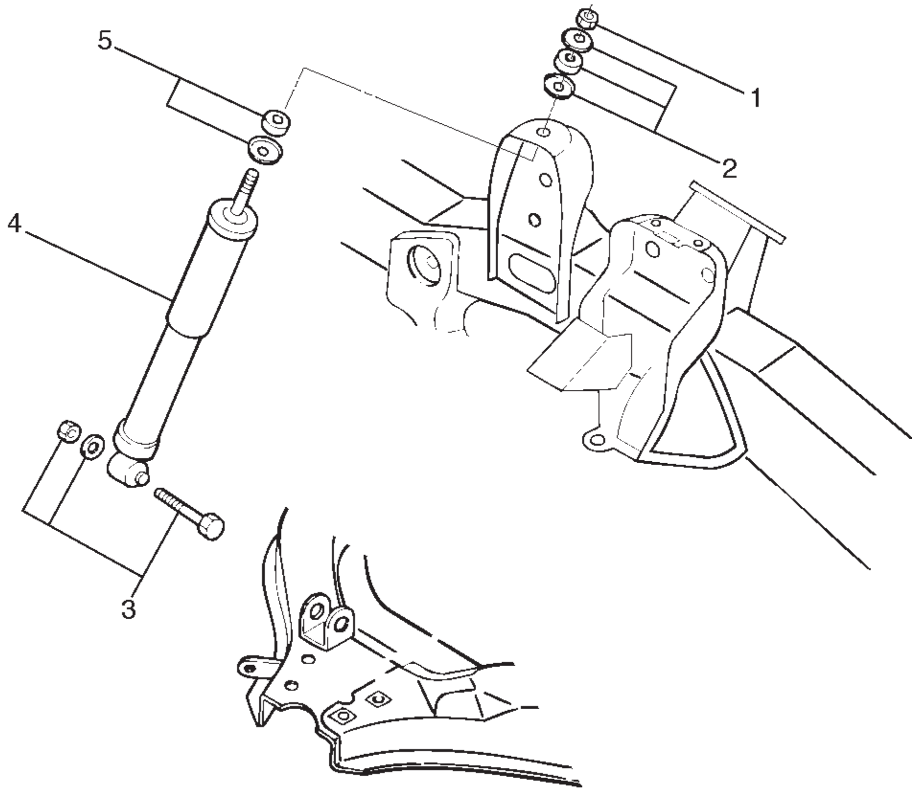
Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower ball joints.	Replace ball joints.
	Excessive wheel runout.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial runout of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering gear.	Tighten housing bolts.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.

Condition	Possible cause	Correction
Hard Steering	Bind in steering linkage ball studs, upper or lower ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Steering gear misadjustment.	Check and adjust pinion torque.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to Steering section.
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering gear or linkage.	Retighten or repair.
	Steering gear misadjustment.	Inspect and adjust steering gear preload.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering gear.	Retighten mounting bolt.
	Faulty steering gear.	Check and adjust steering gear.

Condition	Possible cause	Correction
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Steering gear misadjustment.	Check or adjust steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.
Low or Uneven Trim Height	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
	Incorrect springs.	Adjust or replace torsion bar.
Suspension Bottoms	Vehicle overloaded.	Reduce load.
	Faulty shock absorber.	Replace shock absorber.
	Incorrect, broken or sagging springs.	Replace springs.
Body Leans	Loose stabilizer bar.	Tighten stabilizer bar bolts or replace bushings.
	Faulty shock absorber, struts or mounting.	Replace shock absorber.
	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
Cupped Tires	Worn wheel bearings.	Replace wheel bearing.
	Excessive tire or wheel run out.	Replace tire or wheel.
	Worn ball joints.	Replace ball joints.
	Tire out of balance.	Adjust tire balance.

Shock Absorber

Shock Absorber and Associated Parts



Legend

(1) Nut
(2) Rubber Bushing and Washer
(3) Bolt, Nut and Washer
(4) Shock Absorber
(5) Rubber Bushing and Washer

Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel Replacement in this section.
3. Remove bolt,nut and washer.
4. Remove nut.
5. Remove rubber bushing and washer.
6. Remove shock absorber.
7. Remove rubber bushing and washer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- Shock absorber
- Rubber bushing

Installation

1. Install rubber bushing and washer.
2. Install shock absorber.
3. Install rubber bushing and washer.
4. Install nut, then tighten it to the specified torque.

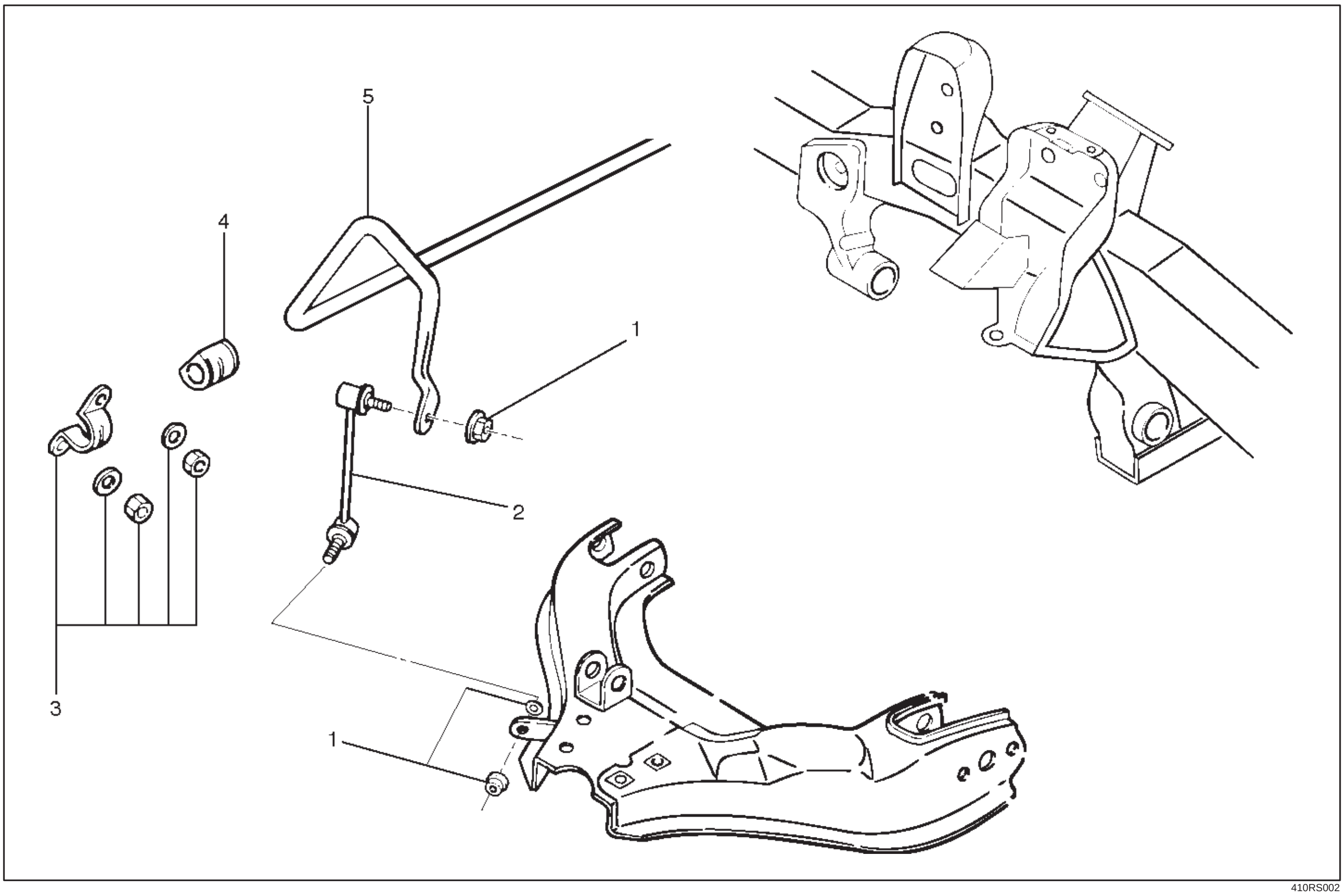
   Torque: 20 N·m (14 lb ft)

5. Install bolt, nut and washer, then tighten to the specified torque.

   Torque: 82 N·m (61 lb ft)

Stabilizer Bar

Stabilizer Bar and Associated Parts



Legend

(1) Nut and Washer
(2) Link
(3) Bracket
(4) Rubber Bushing
(5) Stabilizer Bar

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove the stone guard.
3. Remove wheel and tire assembly. Refer to Wheel Replacement in this section.
4. Remove nut and washer.

CAUTION: Be careful not to break the ball joint boot.

5. Remove link.
6. Remove bracket.
7. Remove stabilizer bar.
8. Remove rubber bushing.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- Stabilizer bar
- Rubber bushing
- Link ball joint

Installation

1. Install rubber bushing.
2. Install stabilizer bar.
3. Install bracket, then tighten it to the specified torque.

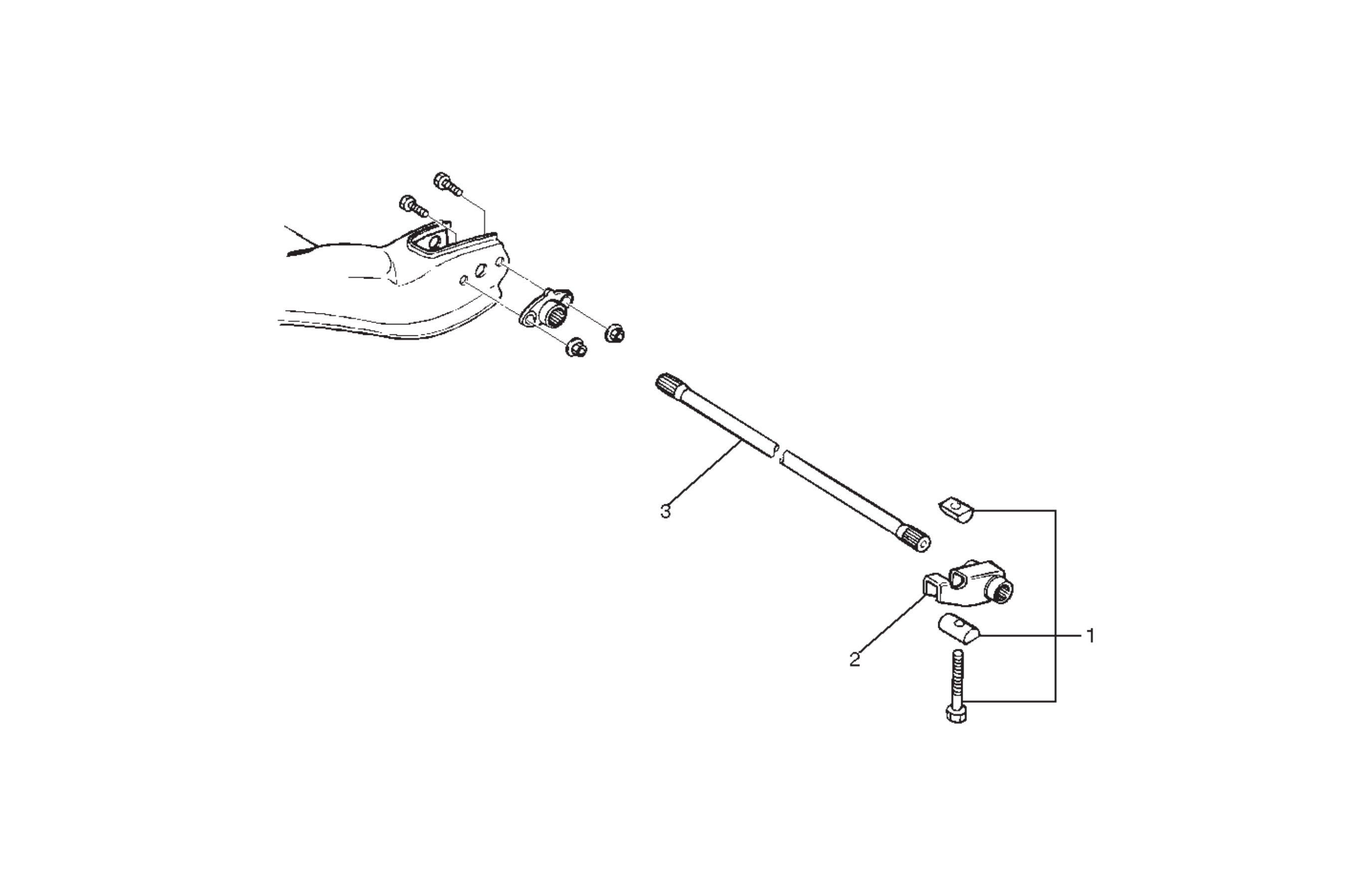
Torque: 22 N·m (16 lb ft)

4. Install link.
5. Install nut and washer, then tighten the nut to the specified torque.

Torque: 50 N·m (37 lb ft)

Torsion Bar

Torsion Bar and Associated Parts



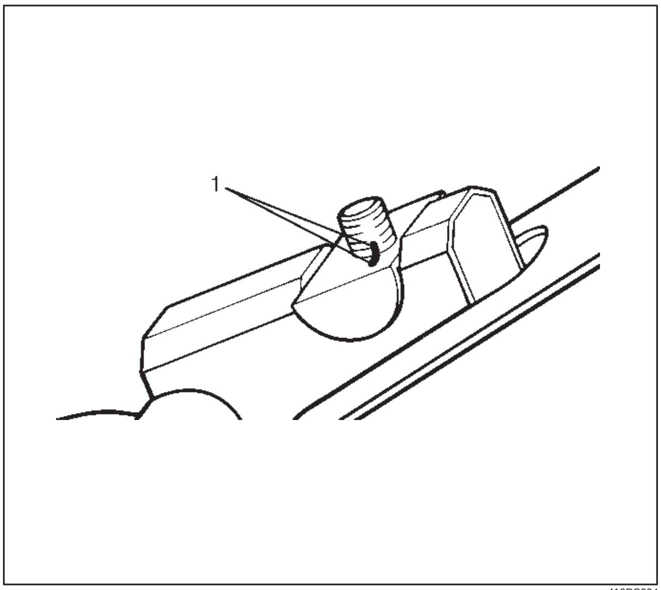
410RS003

Legend

(1) Adjust Bolt, End Piece and Seat
(2) Height Control Arm
(3) Torsion Bar

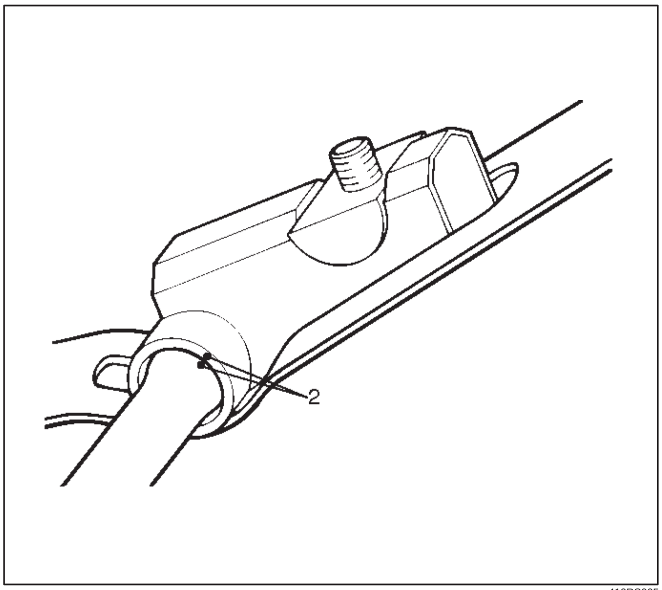
Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Apply the setting marks(1) to the adjust bolt and end piece, then remove adjust bolt, end piece and seat.



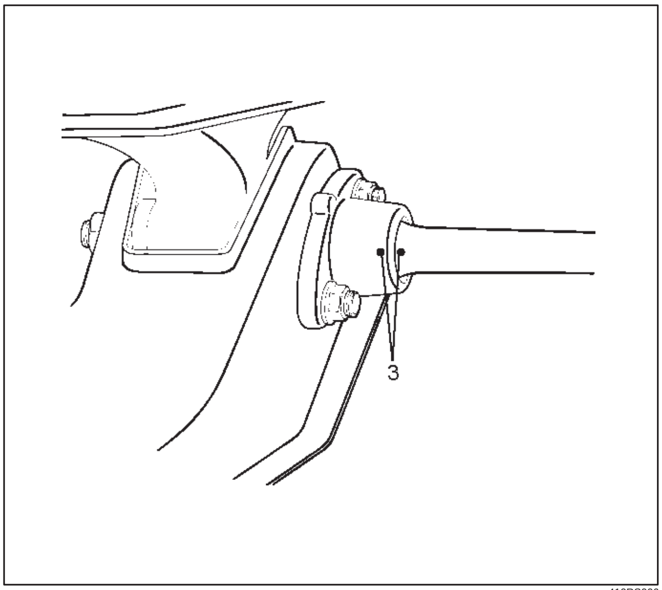
410RS004

3. Apply the setting marks(2) to the height control arm and torsion bar, then remove height control arm.



410RS005

4. Apply the setting marks(3) to the torsion bar and lower control arm, then remove torsion bar.



410RS006

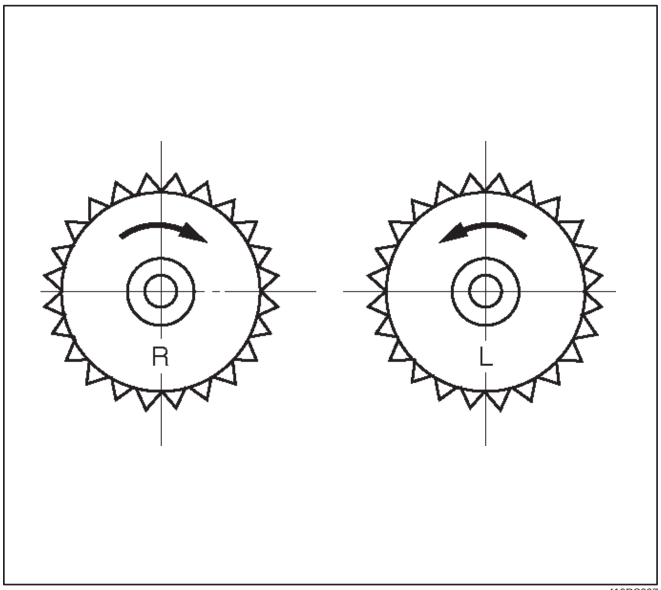
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

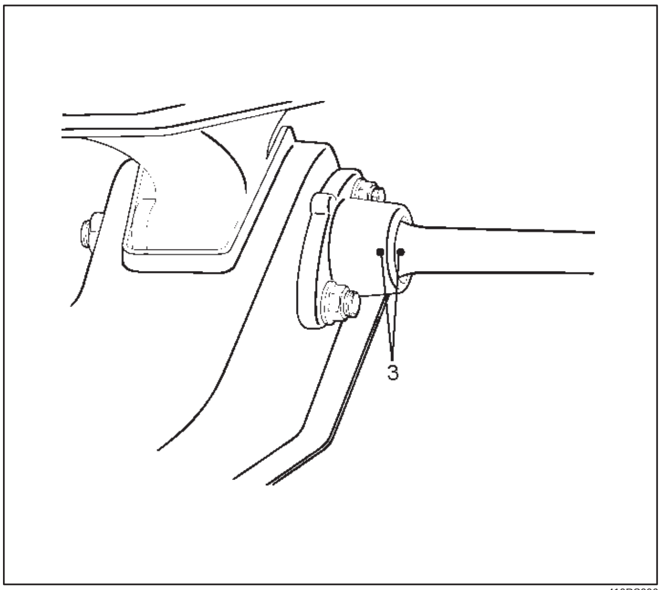
- Torsion bar
- Height control arm
- Adjust bolt
- Rubber seat

Installation

1. Apply grease to the serrated portions, then install torsion bar. Make sure the bars are on their correct respective sides and align the setting marks(3).

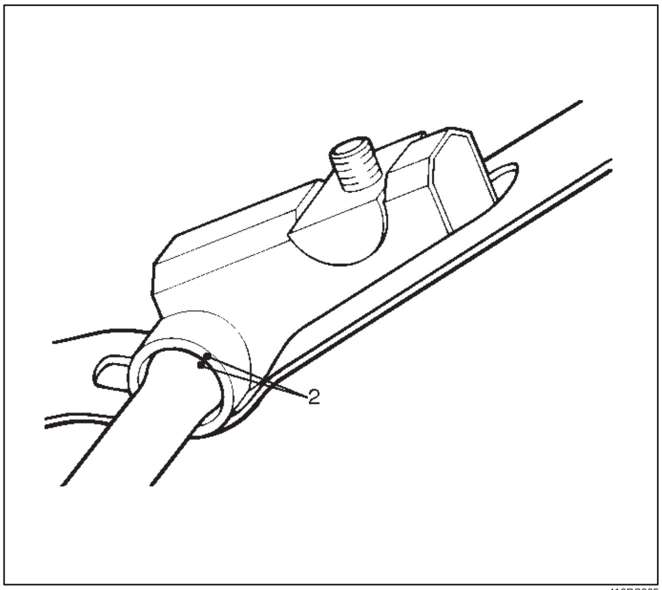


410RS007



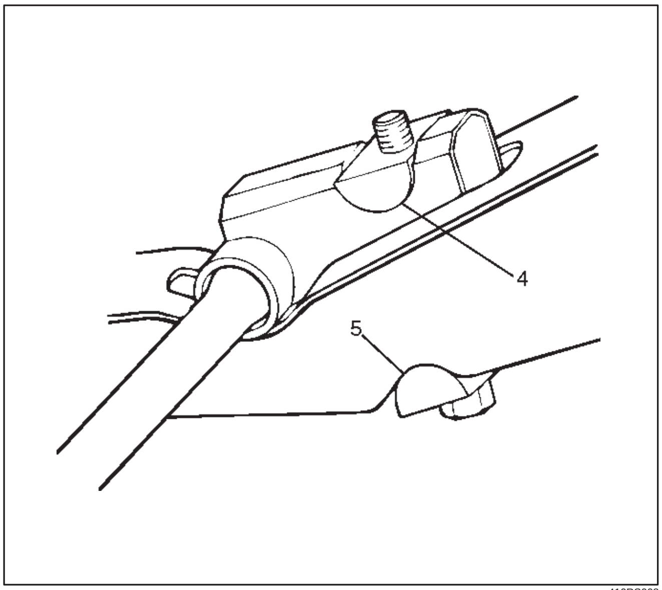
410RS006

2. Apply grease to the portion that fits into the bracket then install height control arm and align the setting marks(2).



410RS005

3. Apply grease to the bolt portion of the end piece(4). Apply grease to the portion of the seat(5) that fits into the bracket.

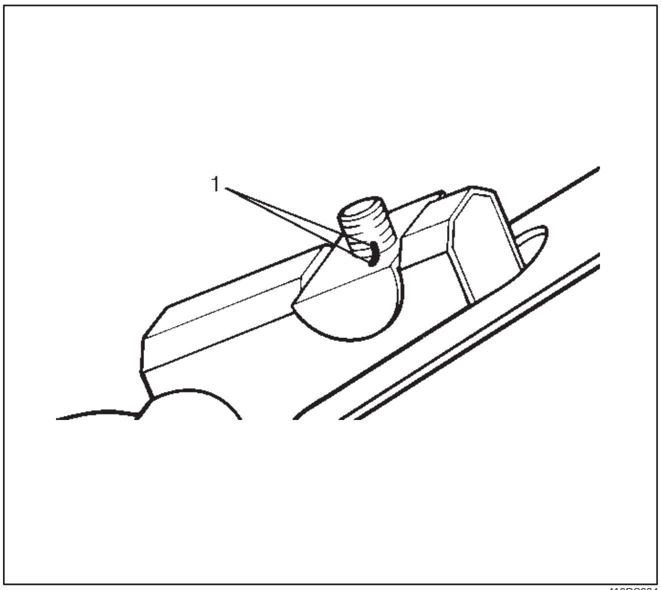


410RS008

4. Apply grease to the serrated portions.

5. Install adjust bolt and seat, then turn the adjust bolt to the setting mark(1) applied during disassembly.

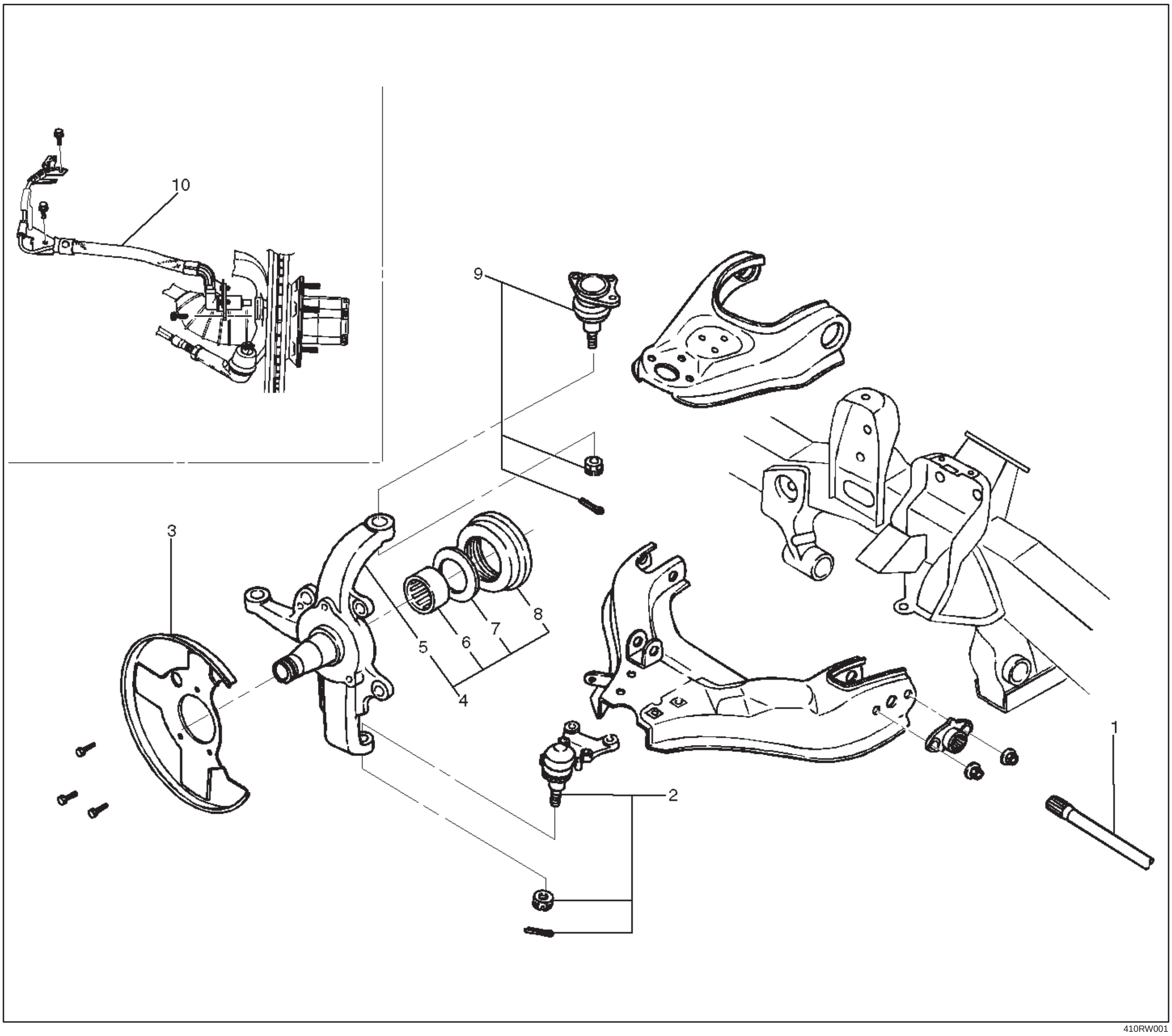
NOTE: Adjust the trim height. Refer to Front End Alignment Inspection and Adjustment in Steering section.



410RS004

Knuckle

Knuckle and Associated Parts



Legend

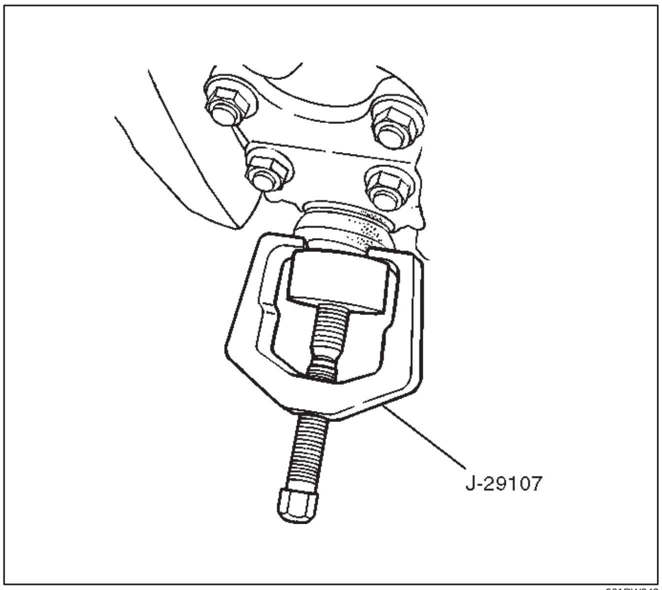
(1) Torsion Bar
(2) Lower Ball Joint
(3) Back Plate
(4) Knuckle Assembly
(5) Knuckle
(6) Needle Bearing
(7) Thrust Washer
(8) Oil Seal
(9) Upper Ball Joint
(10) Wheel Speed Sensor

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel Replacement in this section.
3. Remove the brake caliper. Refer to Disc Brakes in Brake section.
4. Remove the hub assembly. Refer to Front Hub and Disk in Driveline/Axle section.
5. Remove outer track rod from the knuckle. Refer to Outer Track Rod Assembly Replacement in Steering section.
6. Remove the speed sensor from the knuckle.
7. Loosen torsion bar by height control arm adjust bolt, then remove torsion bar. Refer to Torsion Bar Replacement in this section.

8. Remove wheel speed sensor.
9. Remove back plate.
10. Remove lower ball joint by using remover J–29107.

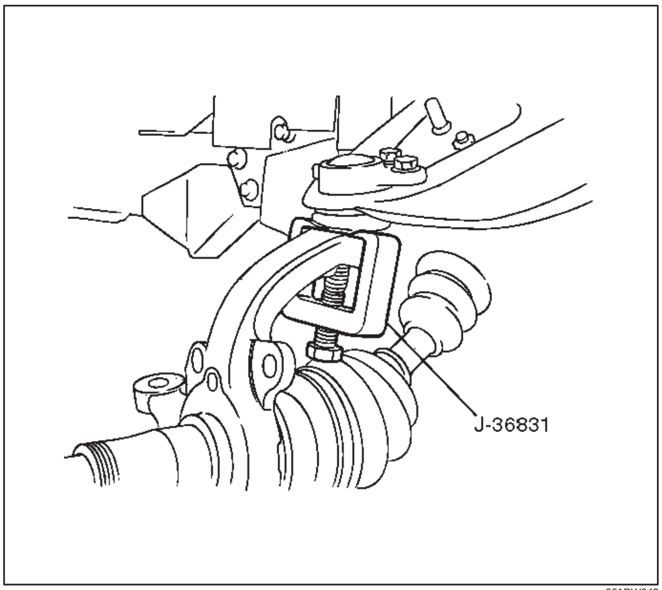
CAUTION: Be careful not to damage the ball joint boot.



901RW042

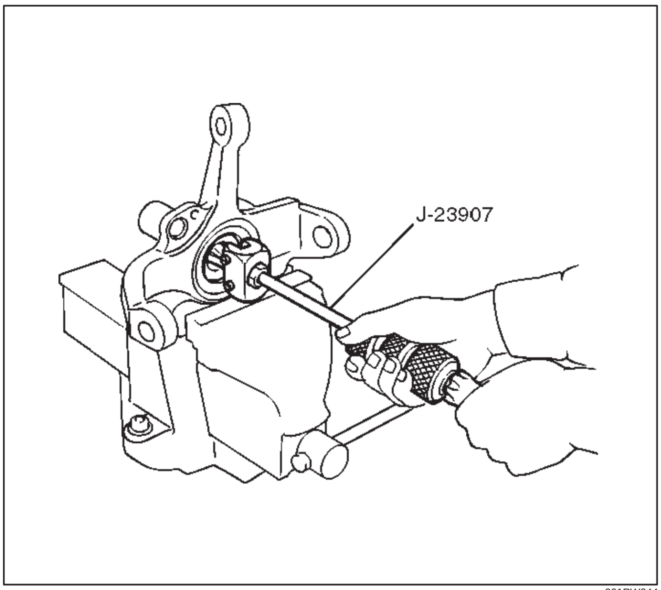
11. Remove upper ball joint by using remover J–36831.

CAUTION: Be careful not to damage the ball joint boot.



901RW043

12. Remove knuckle assembly.
13. Remove oil seal.
14. Remove washer.
15. Remove needle bearing by using remover J–23907.



901RW044

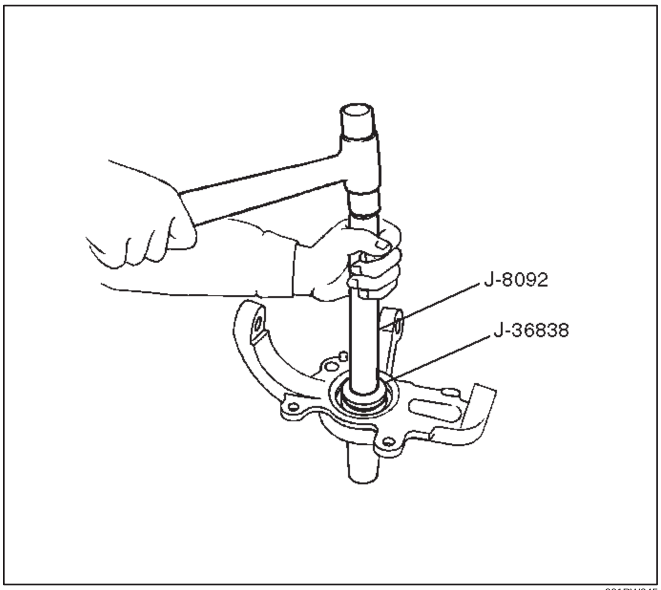
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- Knuckle
- Knuckle arm
- Needle bearing
- Thrust washer

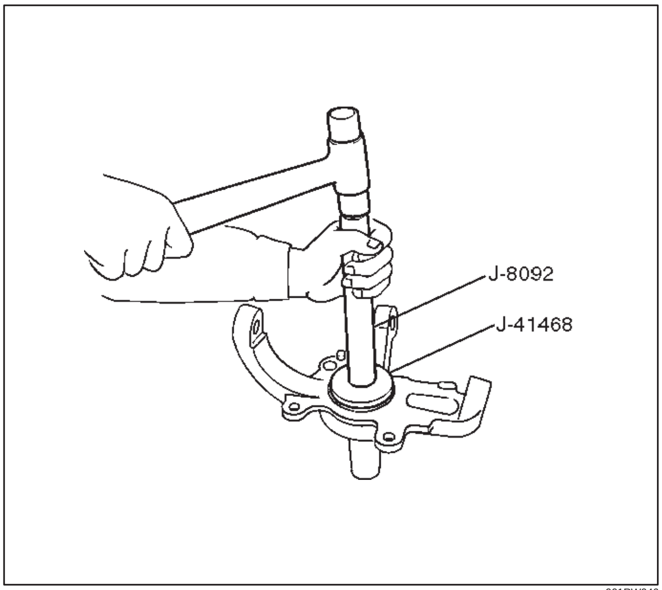
Installation

1. Apply appropriate amount of multipurpose type grease to the new bearing (Approx. 5 g)and install needle bearing by using installer J–36838 and J–8092.



901RW045

2. Apply multipurpose type grease to the thrust washer, and install washer with chamfered side facing knuckle.
3. Use a new oil seal, and apply multipurpose type grease to the area surrounded by the lip (approx. 2 g). Then use installer J–41468 and J–8092 to install oil seal. After fitting the oil seal to the installer, drive it to the knuckle using a hammer or bench press until the tool front face contacts with the thrust washer.



901RW046

4. Install knuckle assembly.
5. Install upper ball joint and tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

Torque: 98 N·m (72 lb ft)

6. Install lower ball joint and tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

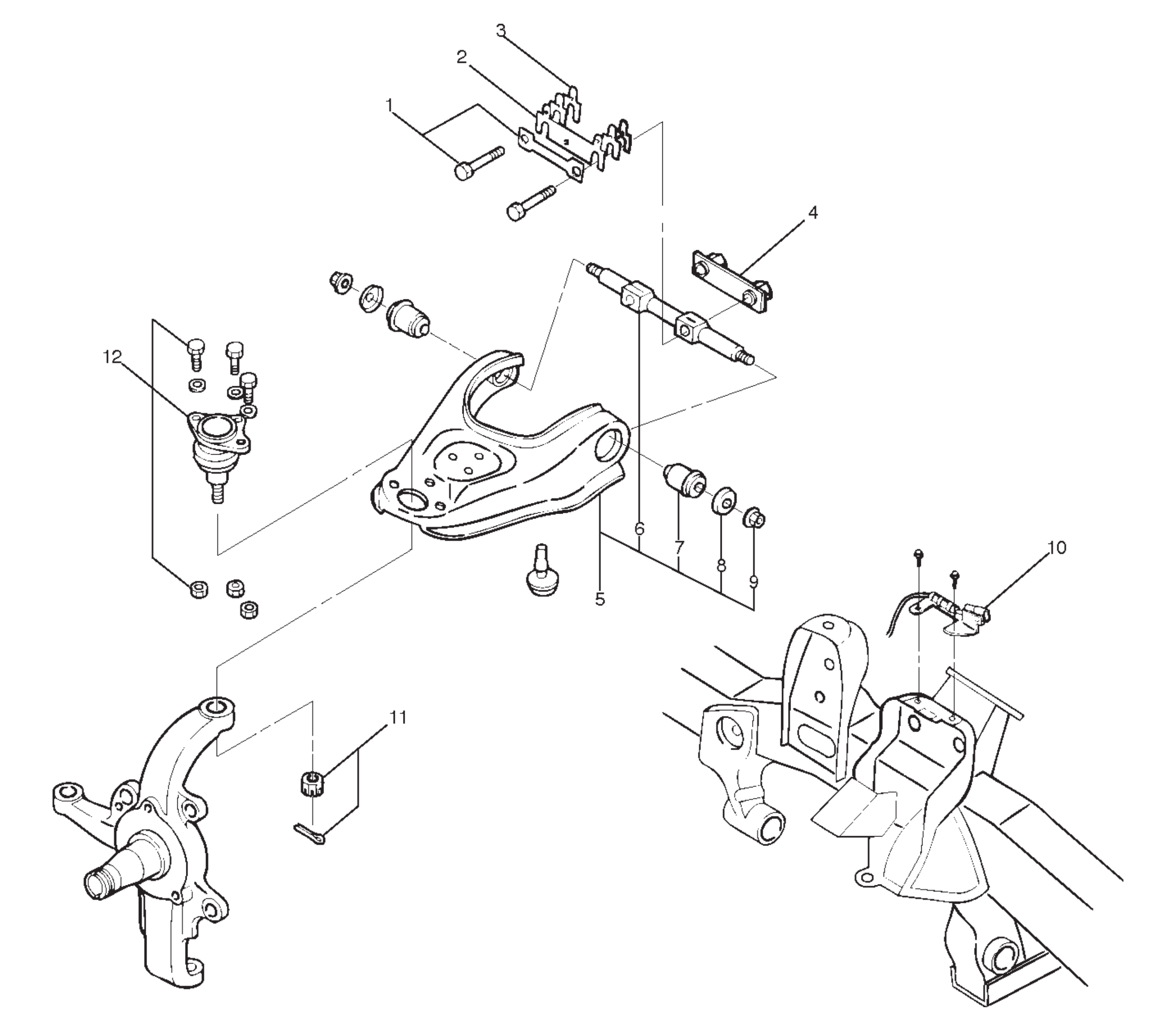
Torque: 147 N·m (108 lb ft)

7. Install back plate.
8. Install wheel speed sensor.
9. Install torsion bar, refer to Torsion Bar Replacement in this section.

NOTE: Adjust the trim height. Refer to Front End Alignment Inspection and Adjustment in Steering section.

Upper Control Arm

Upper Control Arm and Associated Parts



450RS007

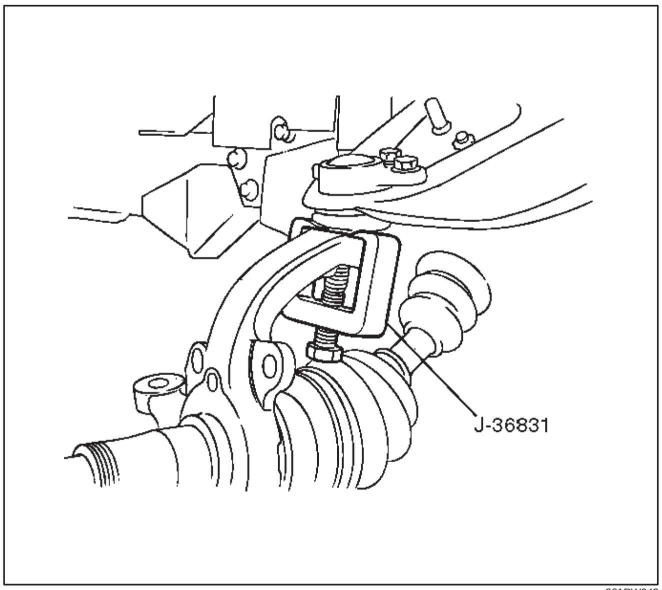
Legend

(1) Bolt and Plate
(2) Camber Shims
(3) Caster Shims
(4) Nut Assembly
(5) Upper Control Arm Assembly
(6) Fulcrum Pin
(7) Bushing
(8) Plate
(9) Nut
(10) Speed Sensor Cable
(11) Nut and Cotter Pin
(12) Upper Ball Joint

Removal

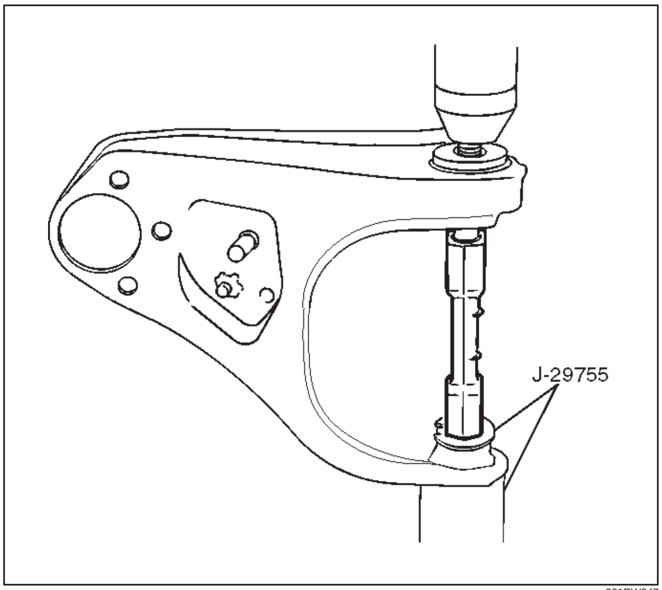
1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel Replacement in this section.
3. Remove the brake caliper and disconnect brake pipe. Refer to Disc Brakes in Brake section.
4. Support lower control arm with a jack.
5. Remove speed sensor cable.
6. Remove nut and cotter pin then use remover J–36831.

CAUTION: Be careful not to break the ball joint boot.

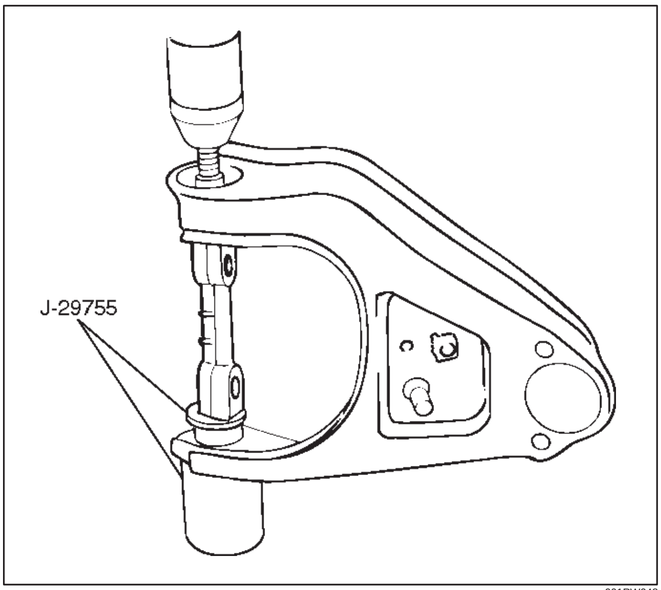


901RW043

7. Remove upper ball joint.
8. Remove bolt and plate.
9. Remove nut assembly.
10. Remove camber shims and note the positions and number of shims.
11. Remove caster shims and note the positions and number of shims.
12. Remove upper control arm assembly.
13. Remove nut.
14. Remove plate.
15. Remove bushing by using remover J–29755.



901RW047



901RW048

16. Remove fulcrum pin.

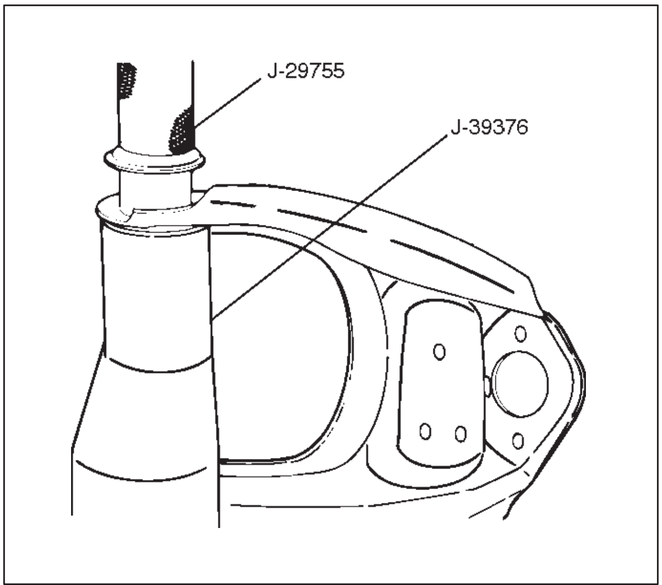
Inspection and Repair

Make necessary parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

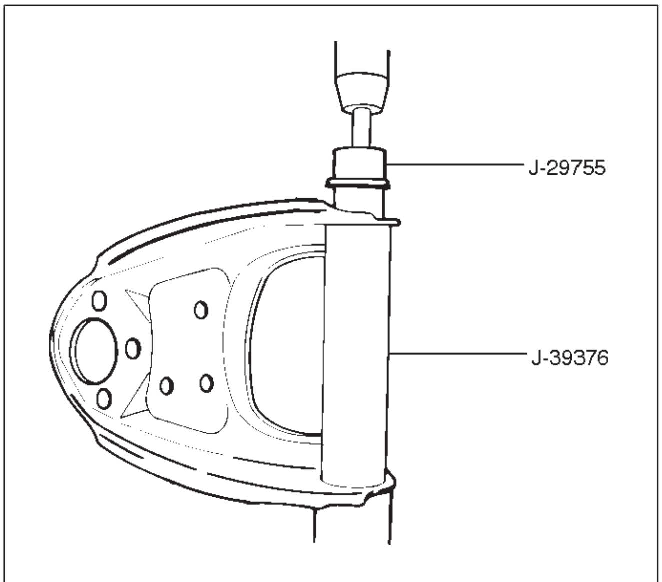
- Upper control arm
- Bushing
- Fulcrum pin

Installation

1. Install fulcrum pin.
2. Install bushing by using installer J–29755 and J–39376.



901RW049



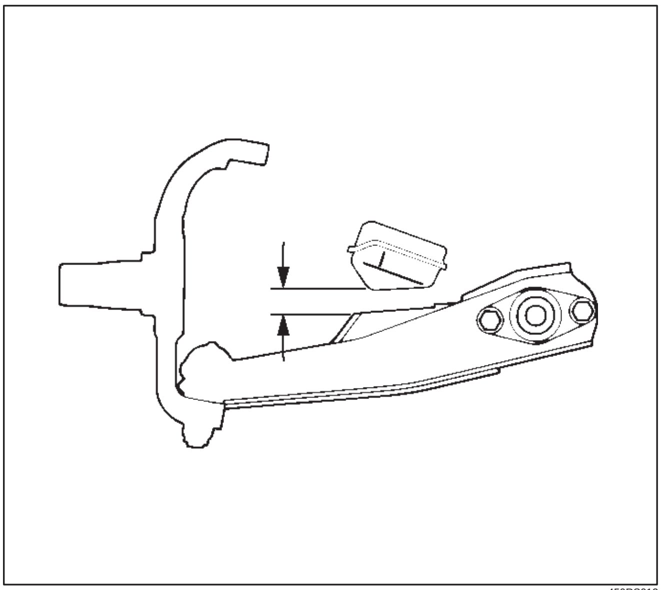
901RW050

3. Install plate.
4. Install nut and tighten fulcrum pin nut finger–tight.

NOTE: Torque fulcrum pin nut after adjusting buffer clearance.

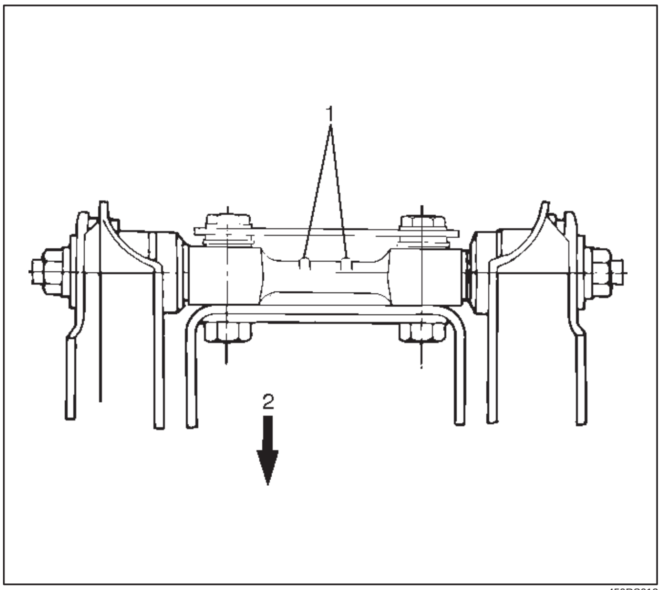
Buffer clearance: 20 mm (0.79 in)

Torque: 108 N·m (80 lb ft)



450RS012

5. Install upper control arm assembly with the fulcrum pin projections turned inward.



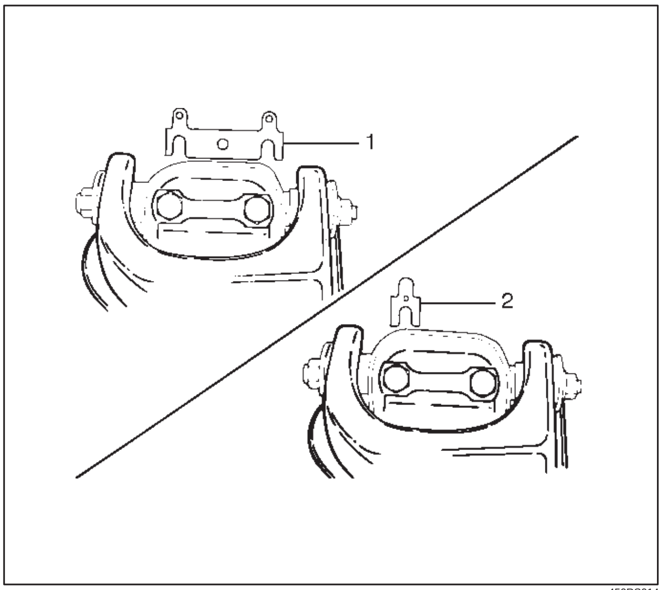
450RS013

Legend

(1) Projection
(2) Outward

6. Install the caster shims(2) between the chassis frame and fulcrum pin.

7. Install the camber shims(1) between the chassis frame and fulcrum pin.



450RS014

8. Install nut assembly.
9. Install bolt and plate, then tighten the bolt to the specified torque.

Torque: 152 N·m (112 lb ft)

10. Install upper ball joint and tighten it to the specified torque.

Torque: 57 N·m (42 lb ft)

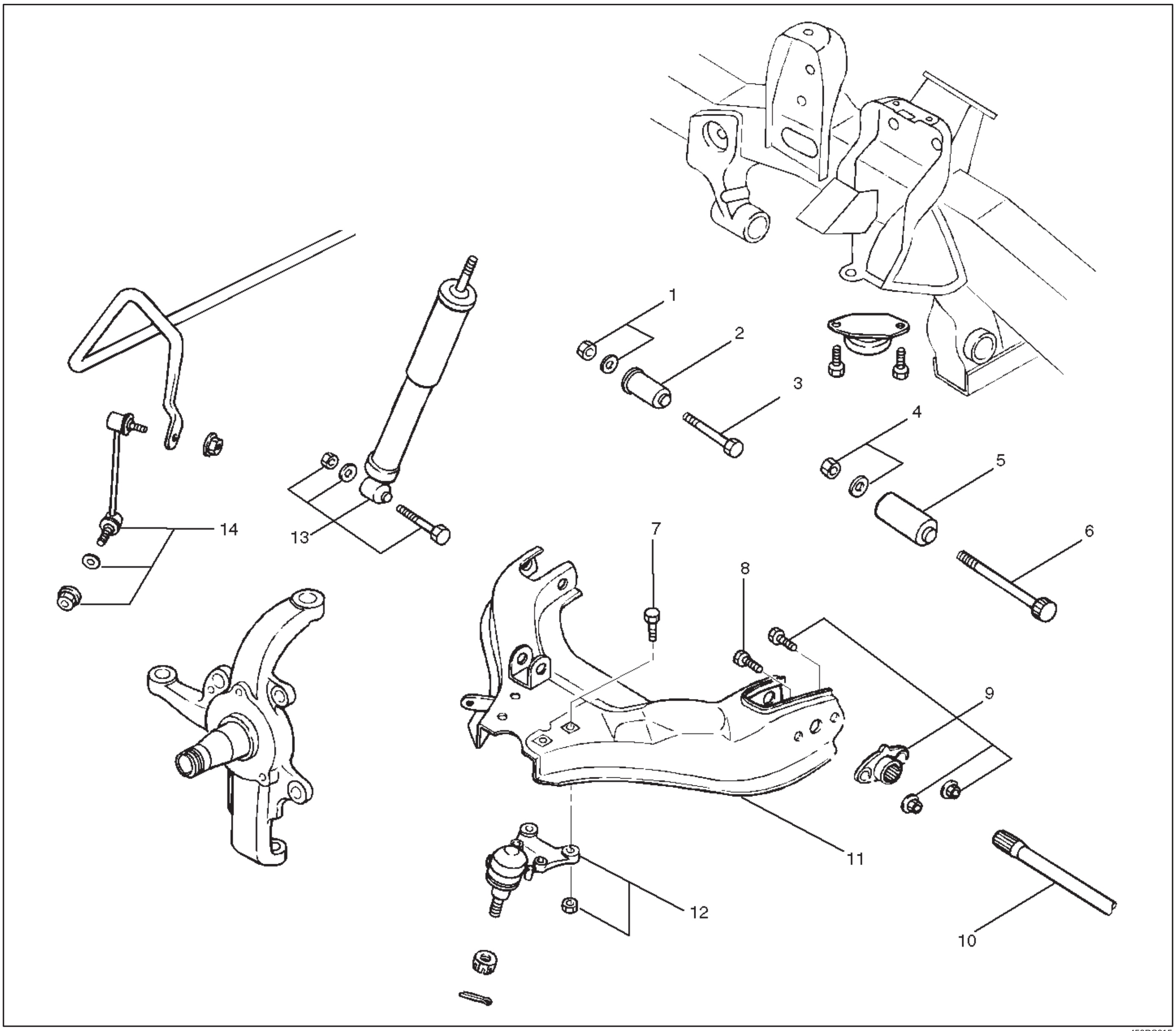
11. Install nut and cotter pin then tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

Torque: 98 N·m (72 lb ft)

12. Install speed sensor cable.

Lower Control Arm

Lower Control Arm and Associated Parts



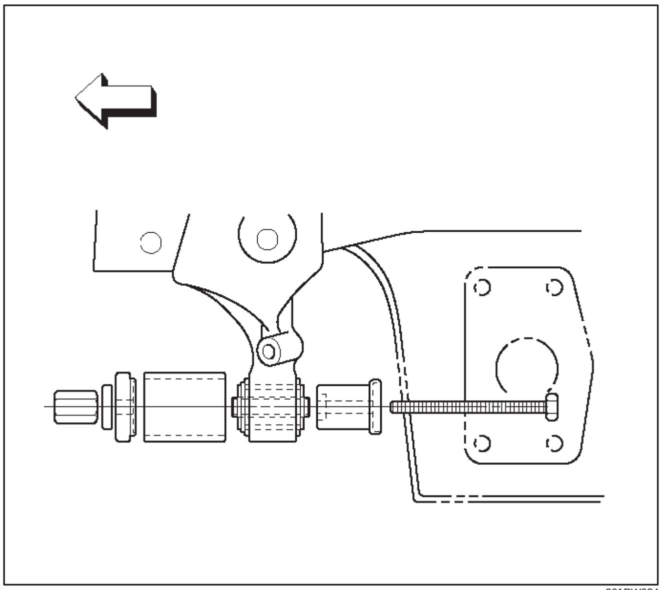
Legend

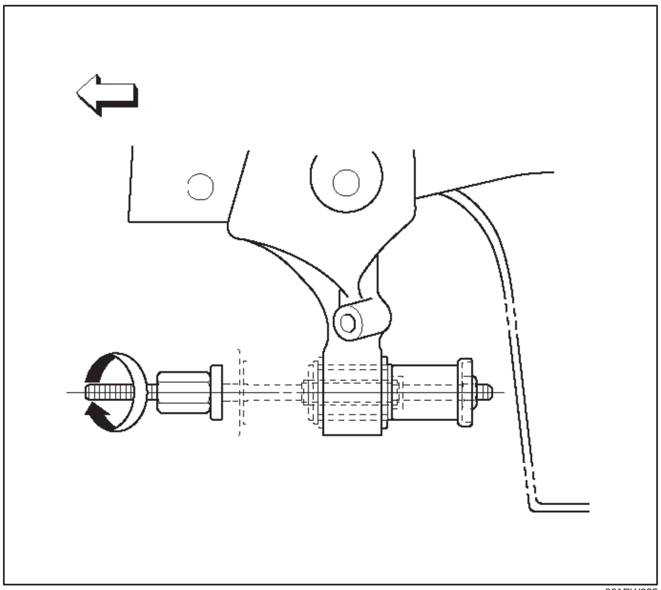
(1) Nut and Washer, Front
(2) Bush, Front
(3) Bolt, Front
(4) Nut and Washer, Rear
(5) Bush, Rear
(6) Bolt, Rear
(7) Bolt, Lower Ball Joint
(8) Bolt, Torsion Bar Arm
(9) Torsion Bar Arm Bracket
(10) Torsion Bar
(11) Lower Control Arm
(12) Lower Ball Joint
(13) Shock Absorber
(14) Stabilizer Link

Removal

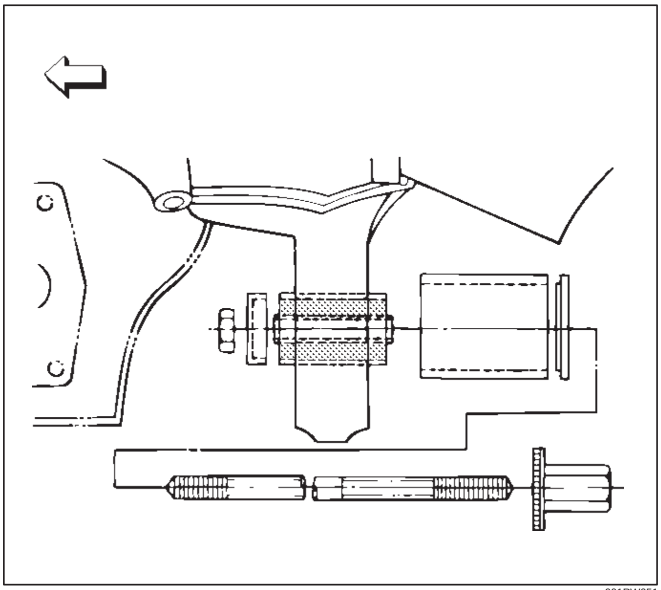
1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel Replacement in this section.
3. Remove the outer track rod from the knuckle. Refer to Steering Linkage in Steering section.
4. Remove the retaining ring from the front axle driving shaft to release the shaft from hub. Refer to Front Hub and Disc in Driveline/Axle section.
5. Support lower control arm with a jack.
6. Remove front nut and washer.

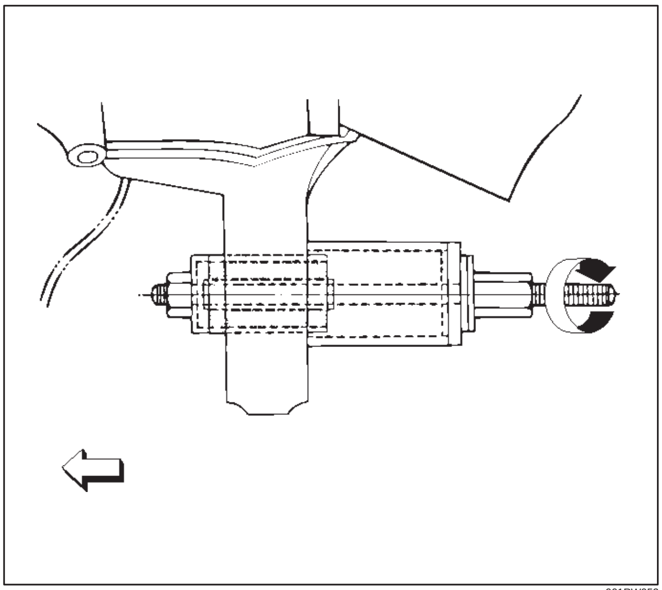
7. Remove rear nut and washer.
8. Remove torsion bar, refer to Torsion Bar Replacement in this section.
9. Remove torsion bar arm bracket.
10. Disconnect the stabilizer link at the lower control arm.
11. Remove the shock absorber lower end from the lower control arm.
12. Remove the lower ball joint from the lower control arm.
13. Remove front bolt.
14. Remove rear bolt.
15. Remove lower control arm.
16. Remove torsion bar arm bolt.
17. Remove lower ball joint bolt.
18. Remove front bushing by using remover J–36833.


901RW034


901RW035

19. Remove rear bushing by using remover J–36834.


901RW051



901RW052

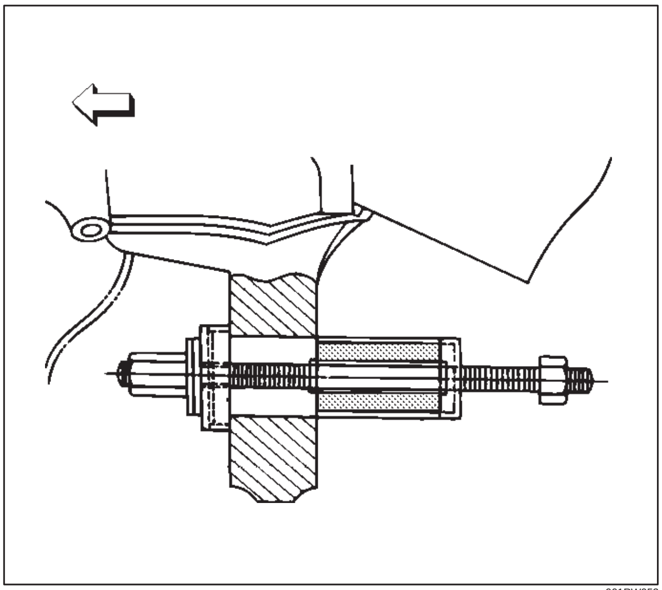
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- Lower control arm
- Bushing

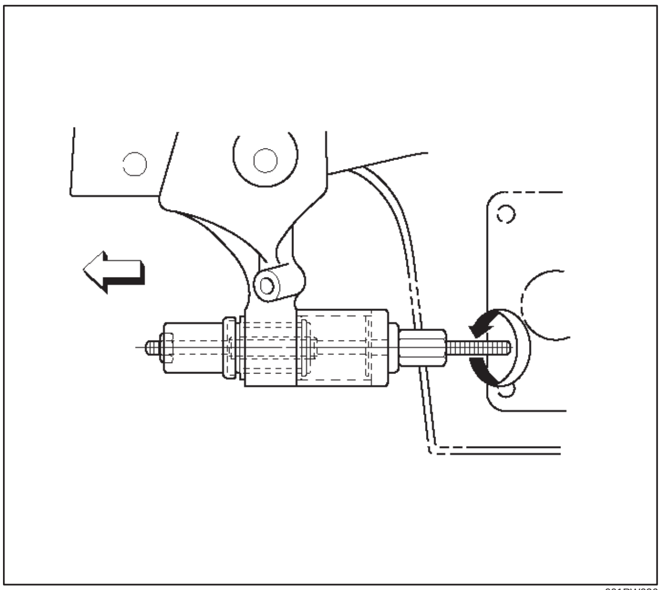
Installation

1. Install rear bushing by using installer J–36834.



901RW053

2. Install front bushing by using installer J–36833.



901RW036

3. Install lower ball joint bolt.
4. Install torsion bar arm bolt.
5. Install lower control arm.
6. Install rear bolt.
7. Install front bolt.
8. Install lower ball joint and tighten it to the specified torque.

   Torque: 103 N·m (76 lb ft)

9. Install shock absorber and tighten it to the specified torque.

   Torque: 82 N·m (61 lb ft)

10. Install stabilizer link and tighten it to the specified torque.

    Torque: 50 N·m (37 lb ft)

11. Install torsion bar arm bracket and tighten it to the specified torque.

    Torque: 116 N·m (85 lb ft)

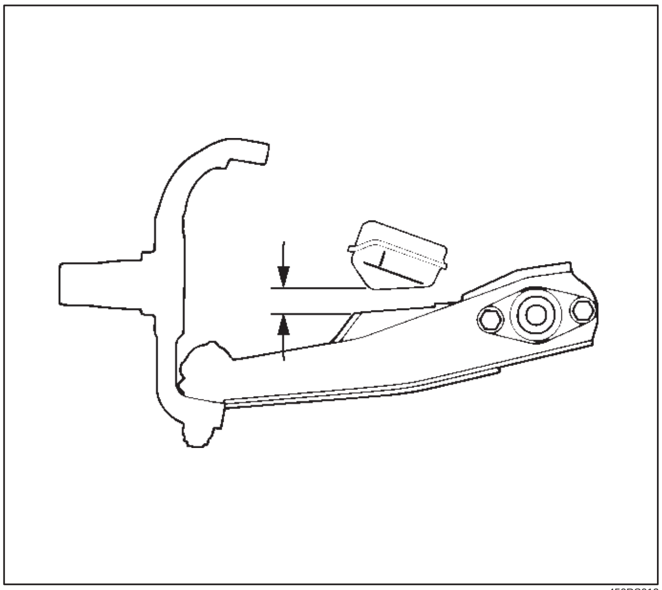
12. Install Torsion bar, refer to Torsion Bar Replacement in this section.

13. Install rear nut and washer and tighten lower link nut finger–tight.

NOTE: Torque lower control arm nut after adjusting buffer clearance.

Buffer clearance: 20 mm (0.79 in)

Torque: 196 N·m (145 lb ft)



450RS012

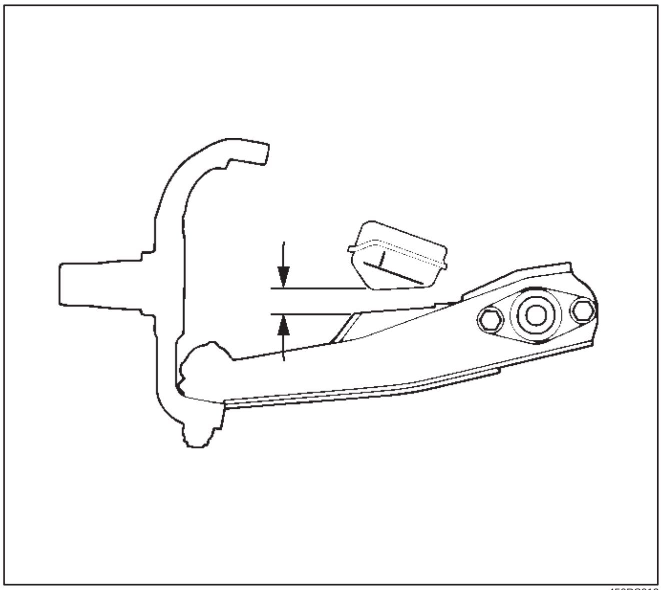
14. Install front nut and washer then tighten lower link nut finger-tight.

NOTE: Torque lower control arm nut after adjusting buffer clearance .

Buffer clearance: 20 mm (0.79 in)

Torque: 157 N·m (116 lb ft)

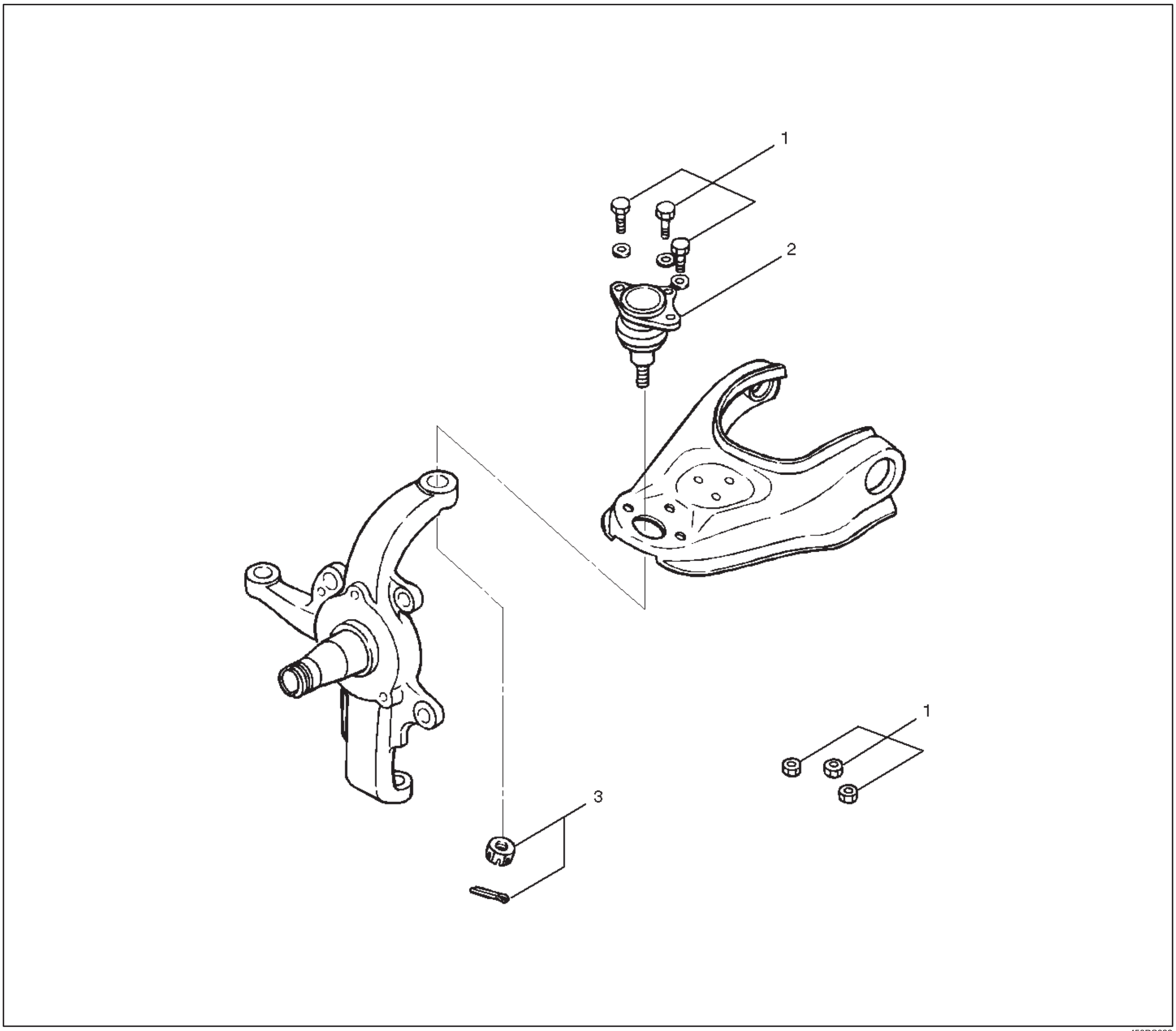
NOTE: Adjust the trim height. Refer to Front End Alignment Inspection and Adjustment in Steering section.



450RS012

Upper Ball Joint

Upper Ball Joint and Associated Parts



Legend

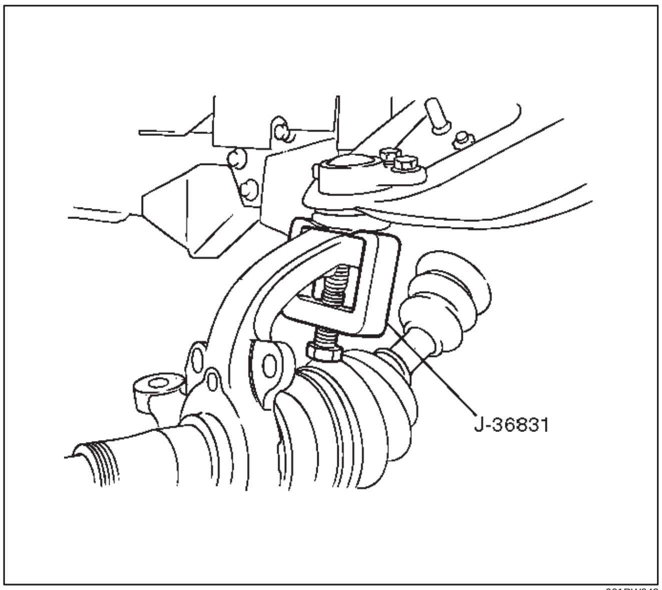
(1) Bolt, Nut and Washer
(2) Upper Ball Joint
(3) Nut and Cotter Pin

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove the speed sensor from the knuckle.

3. Remove upper ball joint nut and cotter pin, then use remover J–36831 to remove the upper ball joint from the knuckle.

CAUTION: Be careful not to break the ball joint boot.



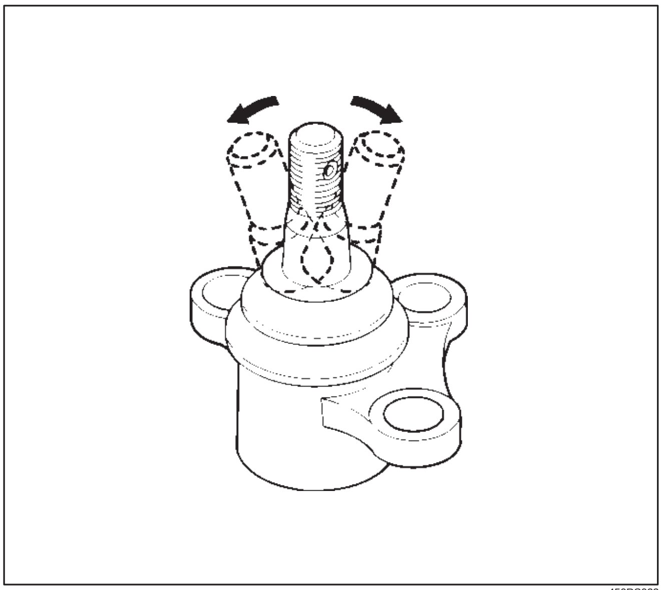
901RW043

4. Remove bolt and washer.
5. Remove upper ball joint.

Inspection and Repair

Make necessary parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

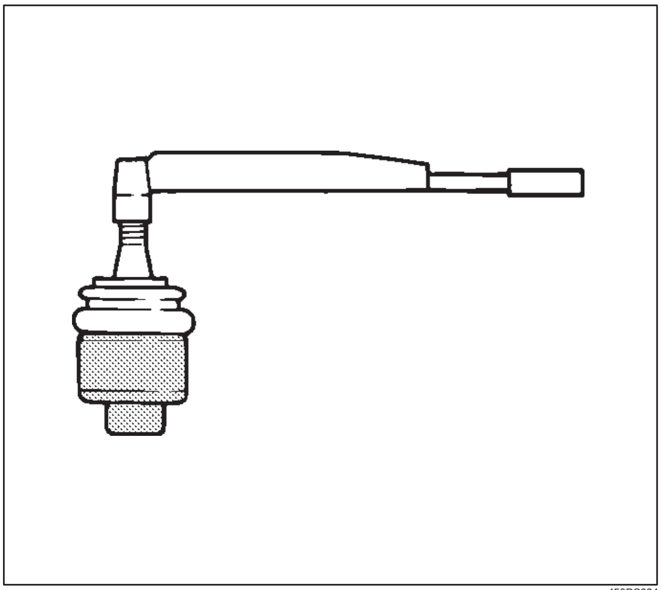
- Inspect the lower end boot for damage or grease leak. Move the ball joint as shown in the figure to confirm its normal movement.
- Inspect screw/taper area of ball for damage.
- If any defects are found by the above inspections, replace the ball joint assembly with new one.



450RS023

- After moving the ball joint 4 or 5 times, attach nut then measure the preload.

Starting torque: 0.5 –3.2 N·m (0.4–2.4 lb ft)



450RS024

If the above limits specified are exceeded, replace the ball joint assembly.

Installation

1. Install upper ball joint.
2. Install bolt and nut, then tighten them to the specified torque.

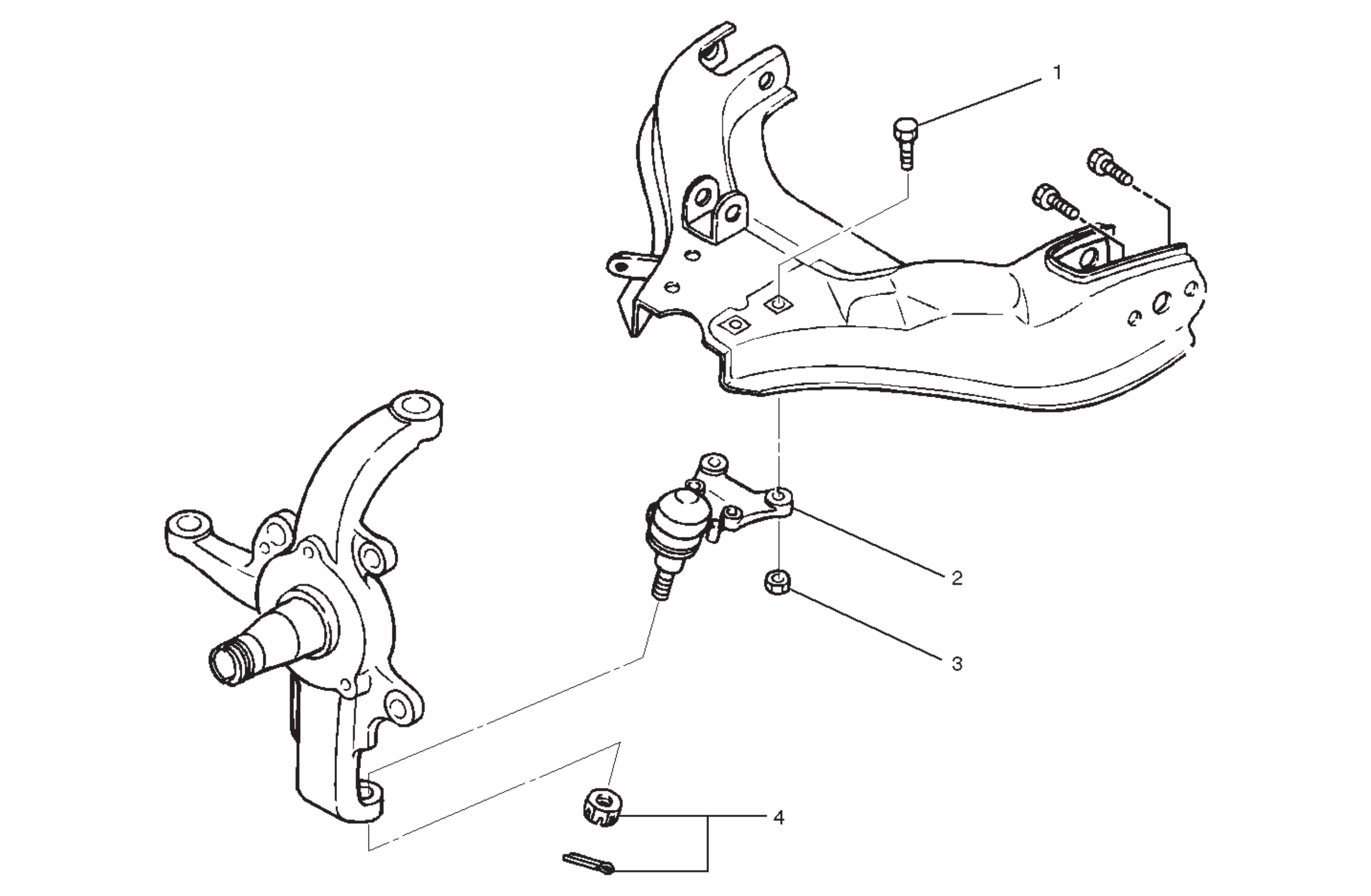
   Torque: 57 N·m (42 lb ft)

3. Install nut and cotter pin, then tighten the nut to the specified torque with just enough additional torque to align cotter pin holes. Install new cotter pin.

   Torque: 98 N·m (72 lb ft)

Lower Ball Joint

Lower Ball Joint and Associated Parts



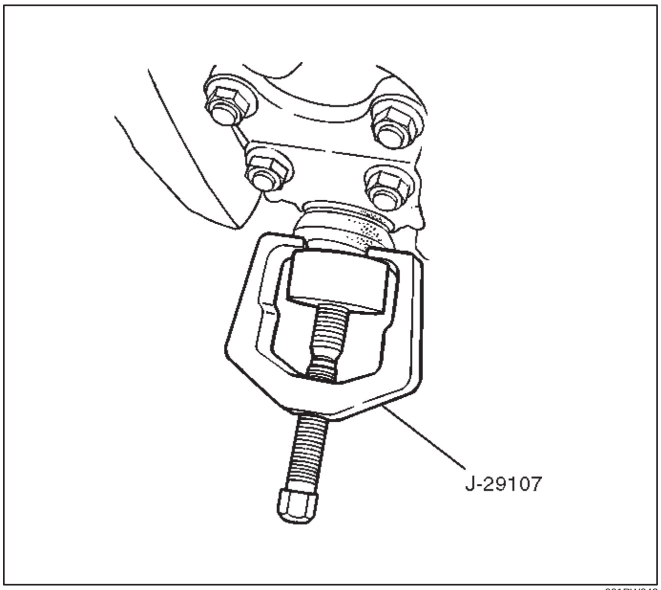
450RS025

Legend
(1) Bolt
(2) Lower Ball Joint
(3) Nut
(4) Nut and Cotter Pin

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel Replacement in this section.
3. Remove the outer track rod from the knuckle. Refer to Steering Linkage in Steering section.
4. Remove the retaining ring from the front axle driving shaft to release the shaft from hub. Refer to Front Hub and Disc in Driveline/Axle section.
5. Support lower control arm with a jack.
6. Remove lower ball joint nut and cotter pin, then use remover J–29107 to remove the lower ball joint from the knuckle.

CAUTION: Be careful not to damage the ball joint boot.



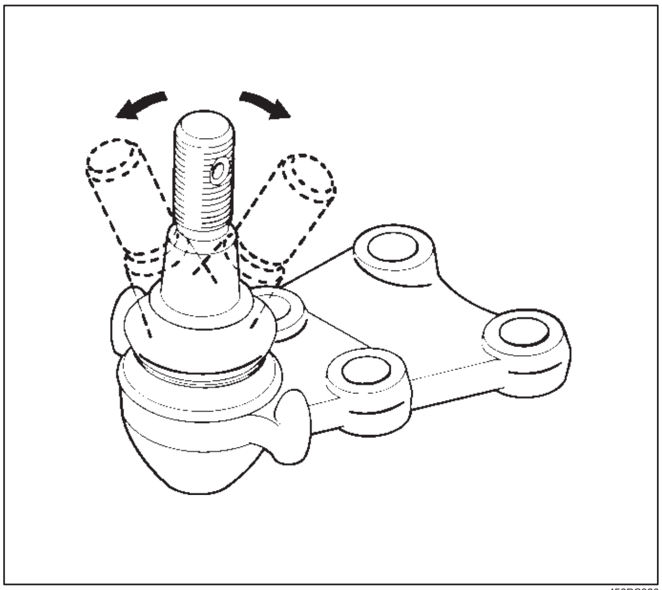
901RW042

7. Remove nut.
8. Remove lower ball joint.
9. Remove bolt.

Inspection and Repair

Make necessary parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

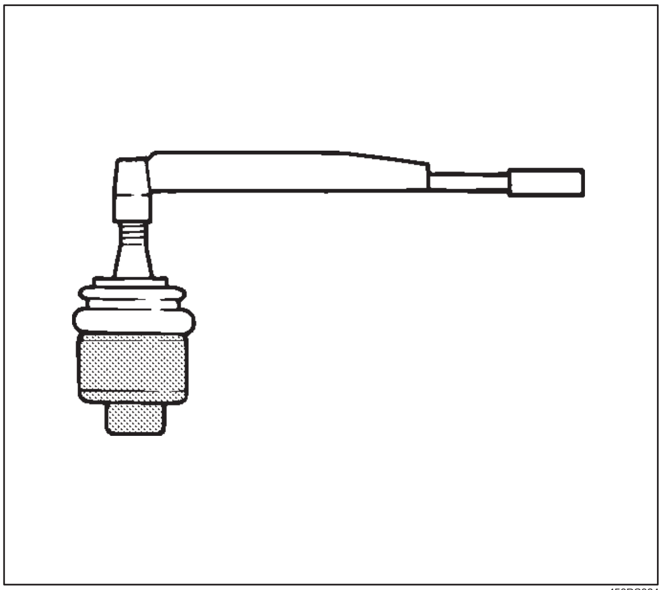
- Inspect the lower end boot for damage or grease leak. Move the ball joint as shown in the figure to confirm its normal movement .
- Inspect screw/taper area of ball for damage.
- If any defects are found by the above inspections, replace the ball joint assembly with new one.



450RS026

- After moving the ball joint 4 or 5 times, attach nut the measure the preload.

Starting torque: 0.5–6.4 N·m (0.4–4.7 lb ft)



450RS024

- If the above limits specified are exceeded, replace the ball joint assembly.

Installation

1. Install bolt.
2. Install lower ball joint.
3. Install nut and tighten it to the specified torque.

Torque: 103 N·m (76 lb ft)

4. Install nut, then tighten it to the specified torque with just enough additional torque to align cotter pin holes. Install new cotter pin.

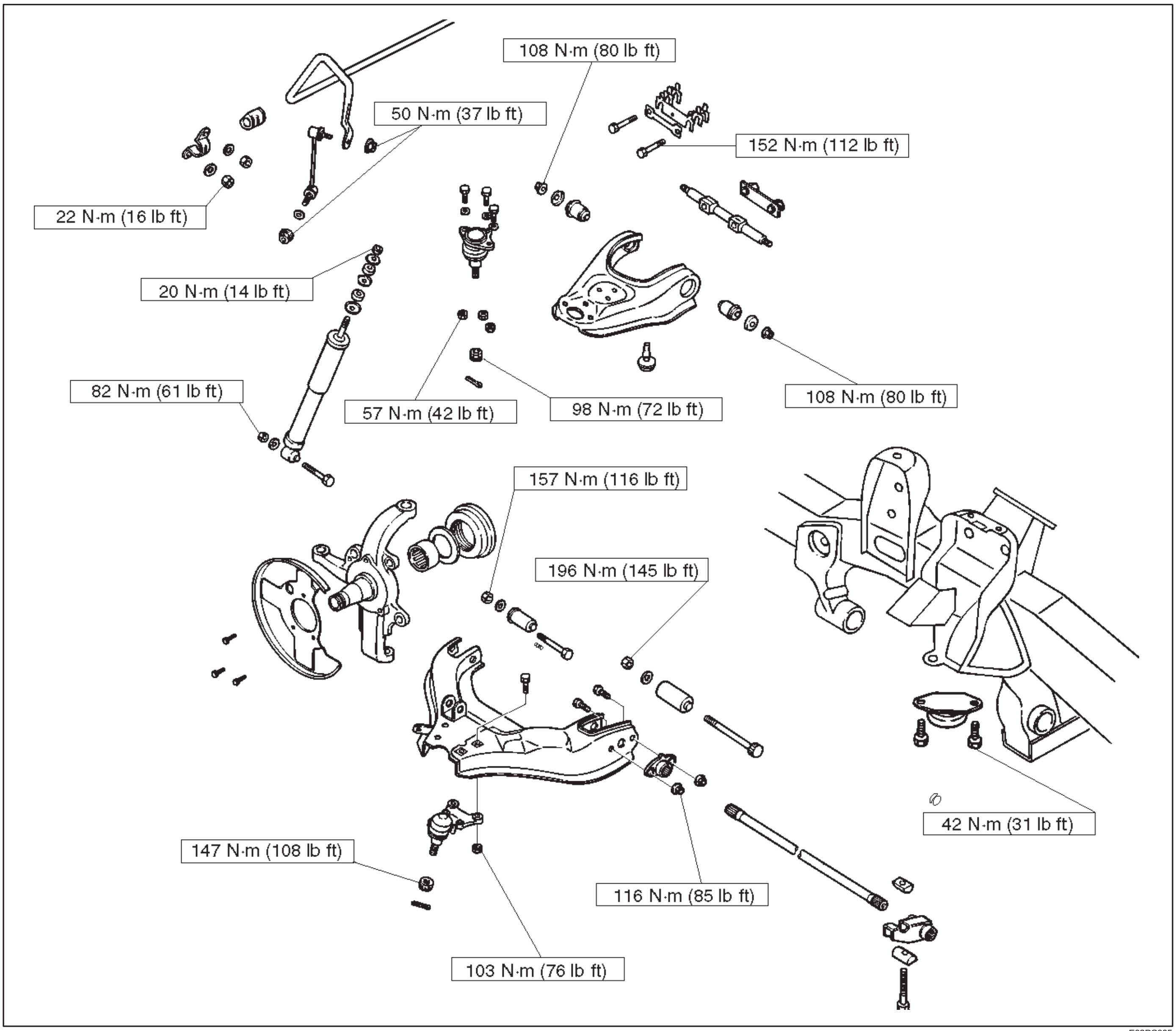
Torque: 147 N·m (108 lb ft)

Main Data and Specifications

General Specifications

Front suspension	Type	Independent wishbone arms, torsion bar spring with stabilizer bar.
Torsion bar spring	Length	1217 mm (47.9 in)
	Diameter	26.6 mm (1.05 in)
Front shock absorber	Type	Hydraulic, double acting, telescopic
	Piston diameter	30.0 mm (1.18 in)
	Stroke	130.0 mm (5.12 in)
	Compressed length	390.0 mm (15.35 in)
	Extended length	260.0 mm (10.24 in)
Stabilizer bar	Diameter	26.0 mm (1.02 in)

Torque Specifications



E03RS005

Special Tools

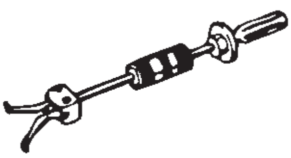
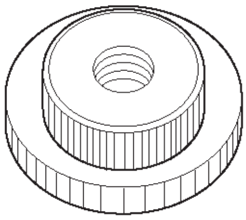
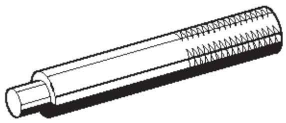
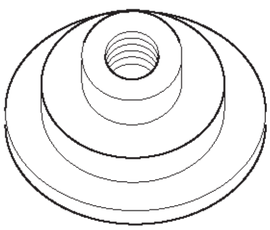
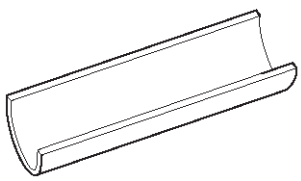
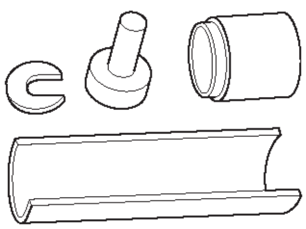
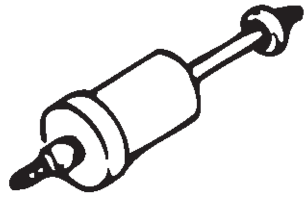
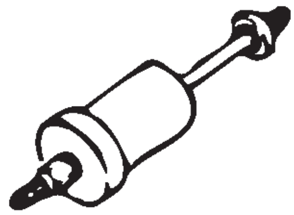
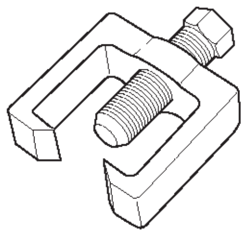
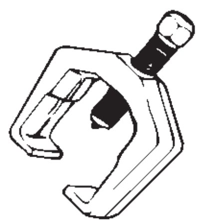
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–23907** Remover; Needle bearing
	**J–36838** Installer; Needle bearing
	**J–8092** Grip
	**J–41468** Installer; Oil seal
	**J–39376** Installer; Upper arm bushing
	**J–29755** Remover and Installer Upper arm bushing

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–36833** Remover and Installer kit; Lower arm front bushing
	**J–36834** Remover and Installer kit; Lower arm rear bushing
	**J–36831** Tie rod end remover
	**J–29107** Lower end remover

TROOPER

SUSPENSION

REAR SUSPENSION

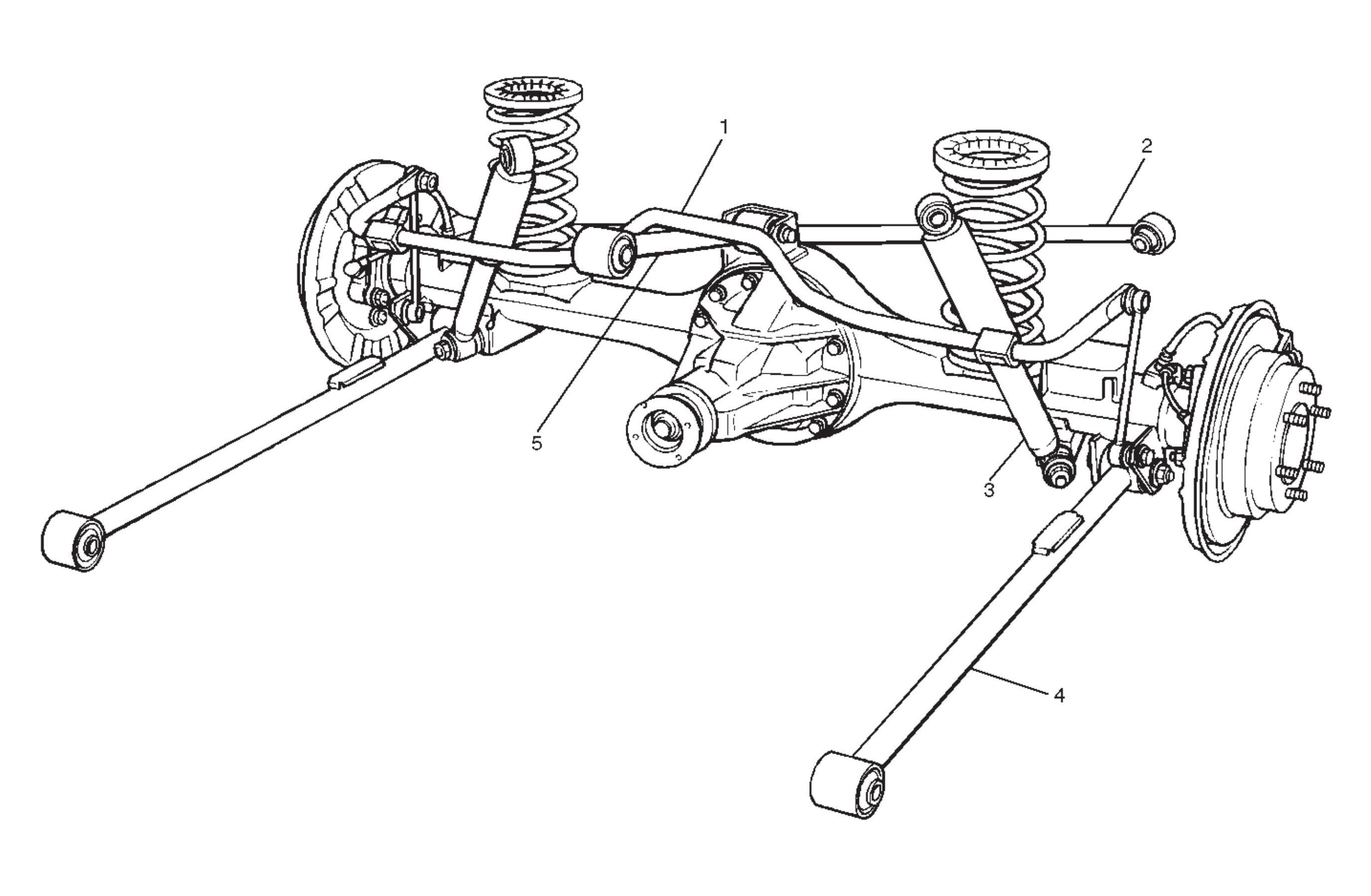
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



C03RS003

Legend

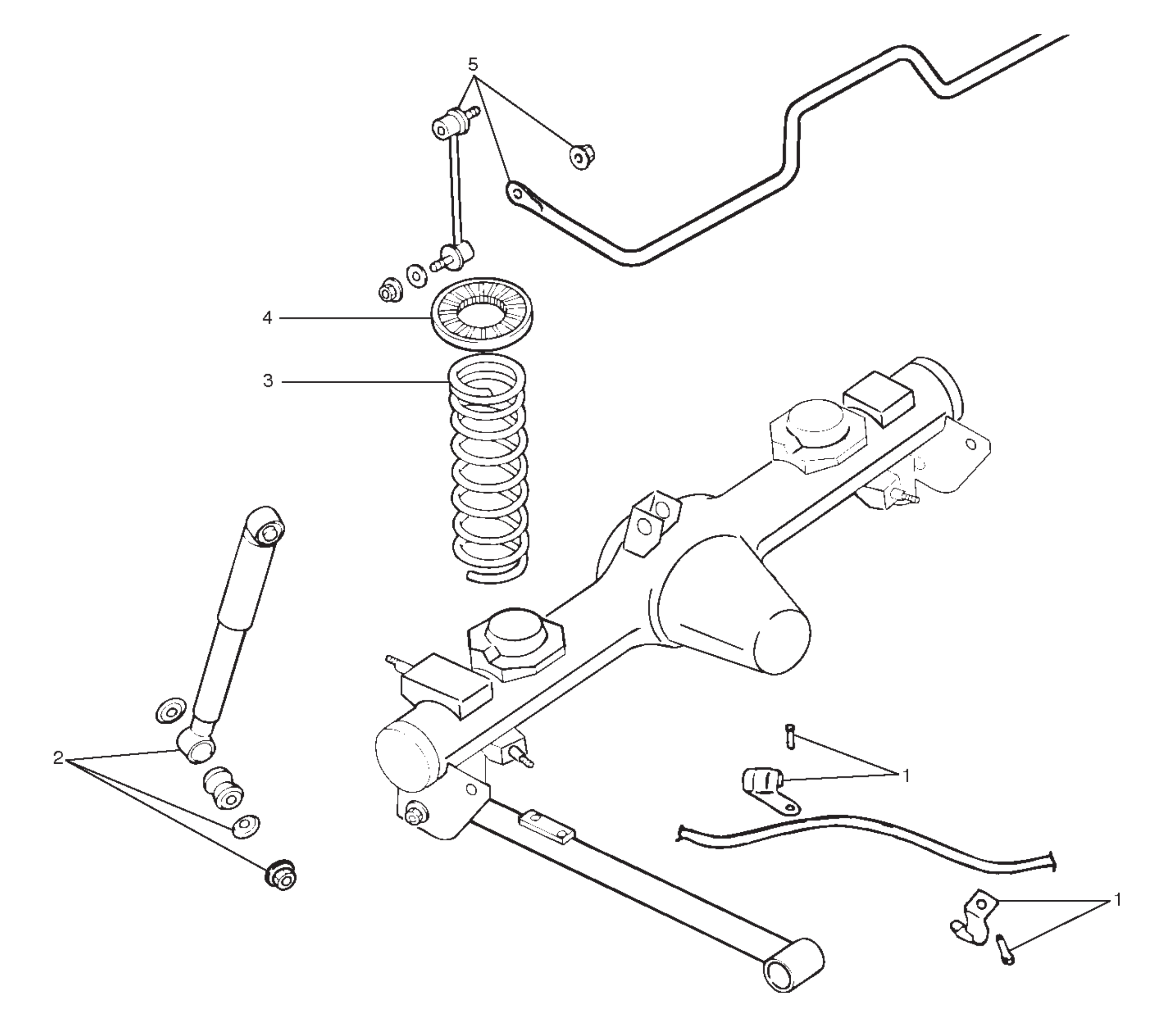
(1) Stabilizer Bar
(2) Lateral Rod
(3) Shock Absorber
(4) Trailing Link
(5) Center Link

The rear suspension is a 4-link, coil spring type suspension with a stabilizer bar, consisting of two trailing links, center link, lateral rod, shock absorber, and stabilizer. In this suspension, the links are specially arranged to enable the rear axle to move freely, thereby expanding suspension stroke, reducing friction, and improving lateral rigidity and roll control. All these result in improved stability, riding comfort, and rough road maneuverability.

Each link connects the axle housing with the frame through a runner bushing. The axle housing is supported by the trailing links and center link longitudinally and by the lateral rod latitudinally.

Coil Spring

Coil Spring and Associated Parts



Legend
(1) Parking Brake Cable Bracket
(2) Shock Absorber
(3) Coil Spring
(4) Insulator
(5) Stabilizer Bar

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Support the rear axle case with a jack.
3. Remove the parking brake cable bracket from the trailing link.
4. Disconnect the stabilizer bar at the stabilizer link.
5. Remove the shock absorber from the axle case.
6. Remove spring insulator.
7. Remove the lower insulator and coil spring while lowering the rear axle case.

CAUTION: Be sure not to let the brake hose, parking brake cable, and breather hose extend to their full length.

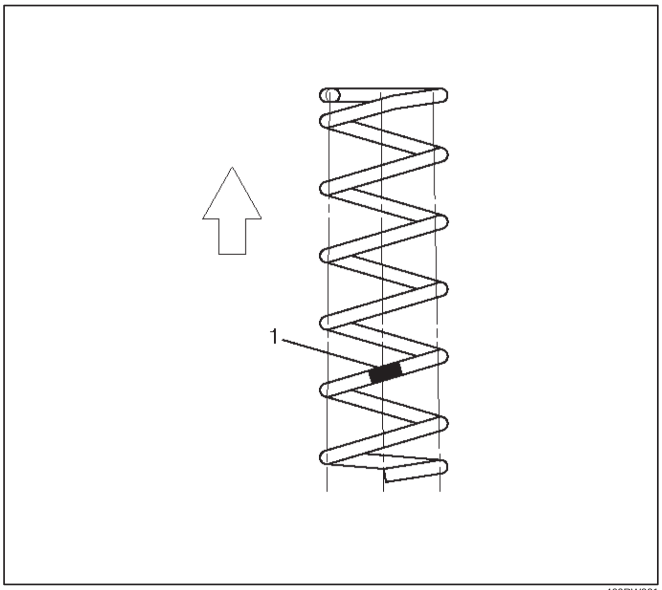
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- Coil spring
- Insulator

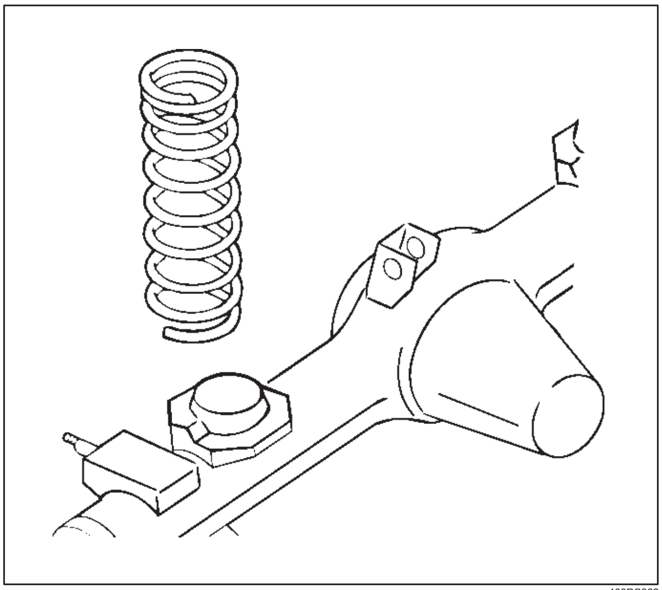
Installation

1. Install coil spring and make sure that the coil spring is installed in the proper position. Paint mark(1) should be downward.



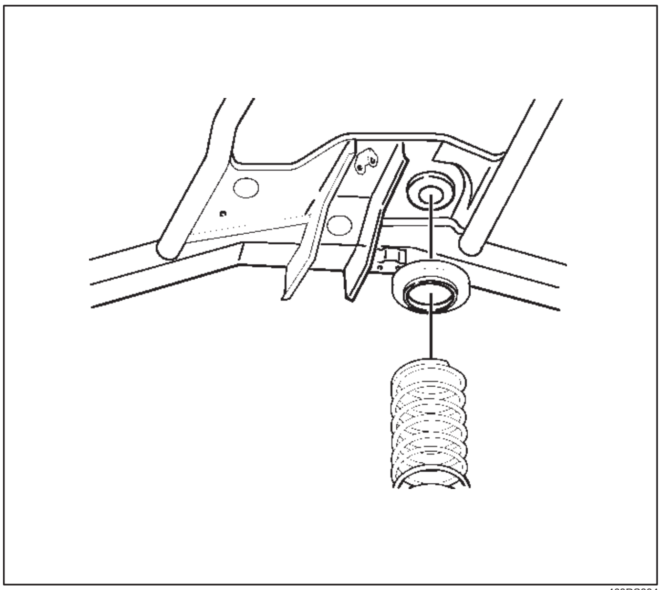
460RW001

2. Fit the end of the coil spring to the coil spring seat and mount the coil spring on the rear axle case.



460RS003

3. Install the insulator on the coil spring. Jack up the axle case gently with the top of the coil spring set to the spring seat on the frame side.



460RS004

4. Install shock absorber and tighten the nut lightly,then retighten it to the specified torque after the vehicle is at curb height.

NOTE: When mounting shock absorber, be sure not to use grease on bushings or any other nearby part.

Torque: 78 N·m (58 lb ft)

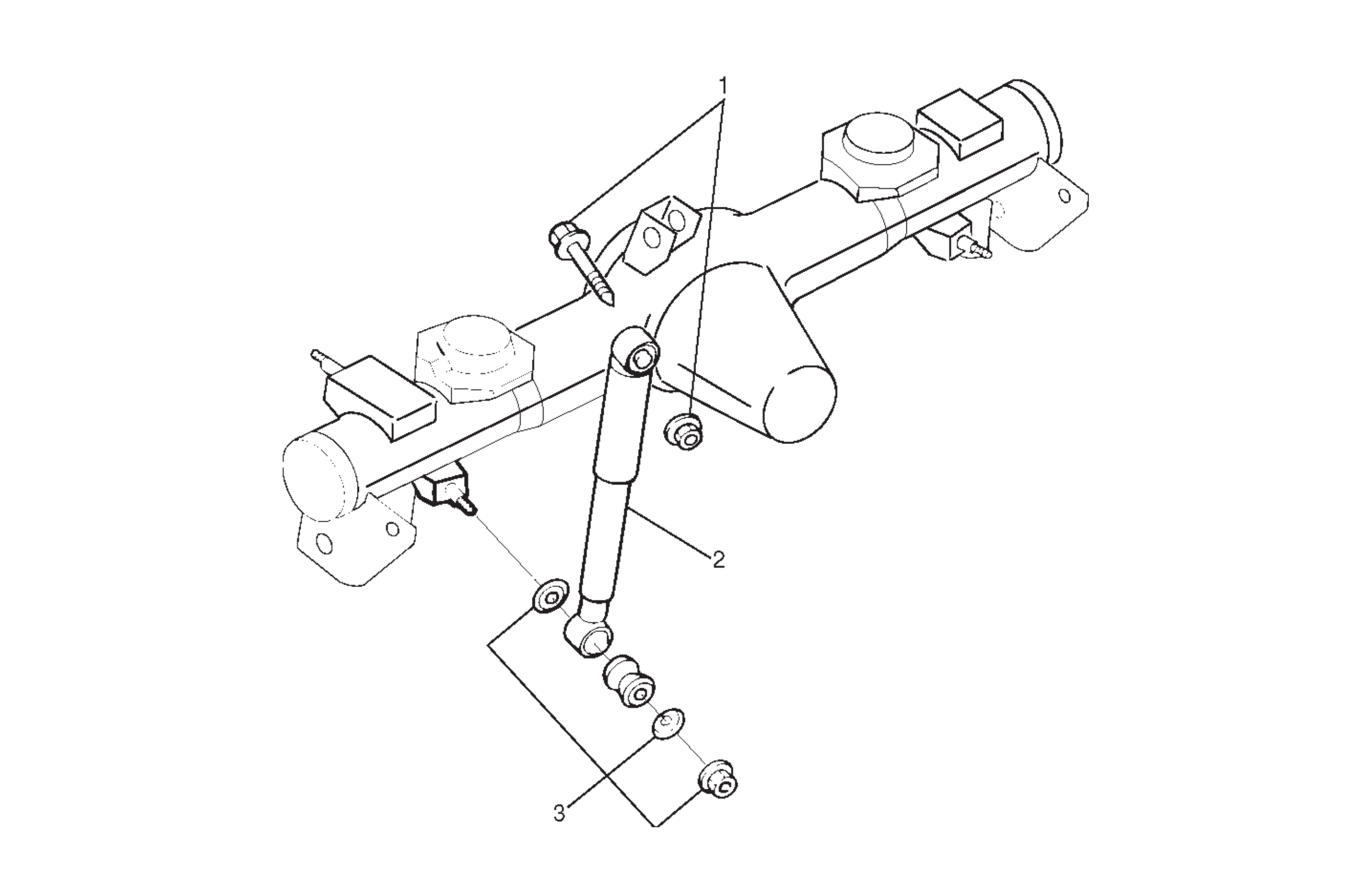
5. Install stabilizer bar.

Torque: 50 N·m (37 lb ft)

6. Install parking brake cable bracket.

Shock Absorber

Shock Absorber and Associated Parts



Legend
(1) Bolt and Nut
(2) Shock Absorber
(3) Nut and Washer

Removal

1. Remove shock absorber fixing nut and washer.
2. Remove shock absorber fixing bolt and nut.
3. Remove shock absorber.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- Shock absorber
- Rubber bushing (Axle side)

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

Installation

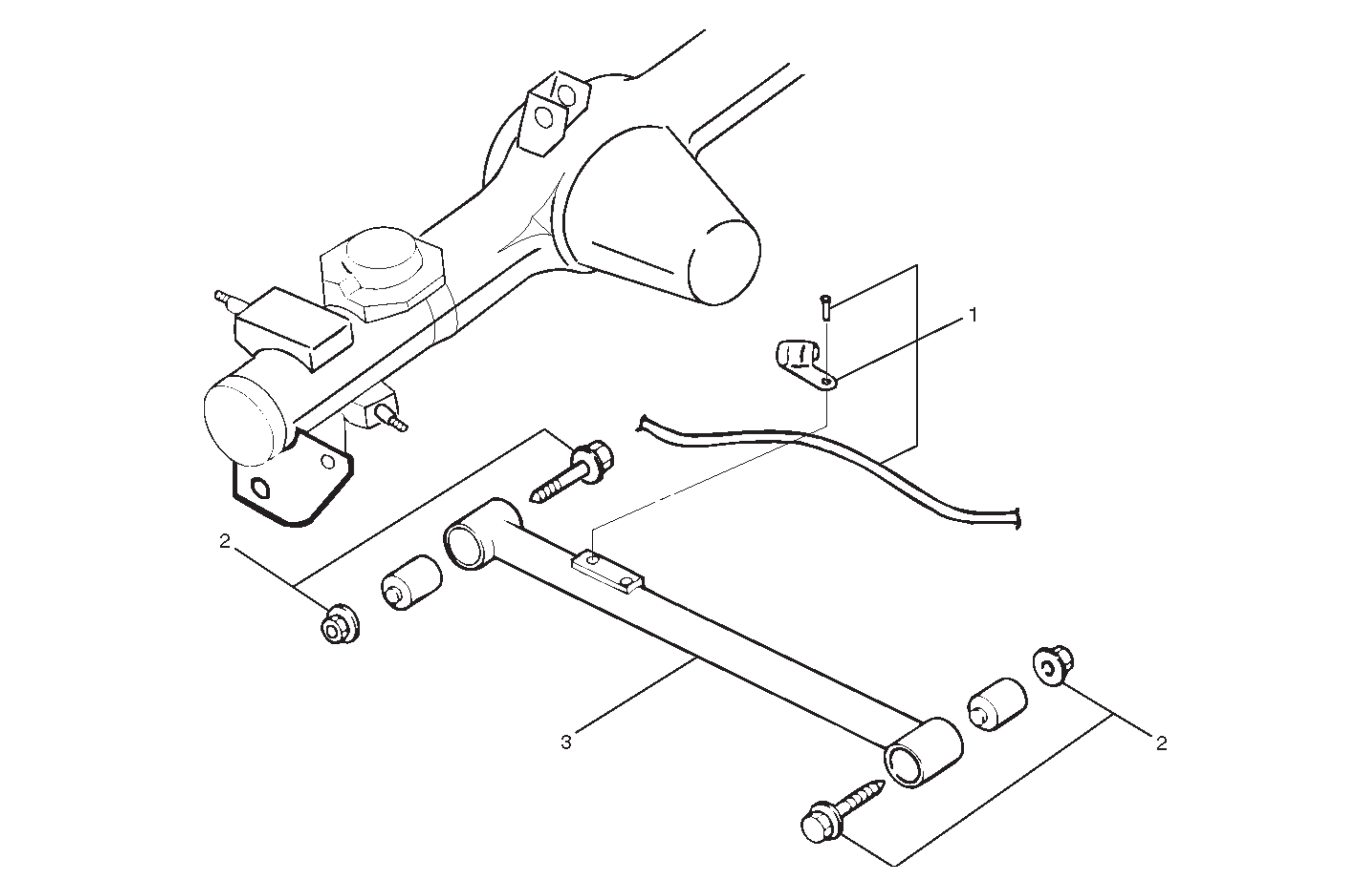
1. Install shock absorber. When mounting shock absorber, be sure not to use grease on bushings or any other nearby part.
2. Install bolt and nut, then tighten the bolt and nut lightly. Retighten to the bolt and nut specified torque after the vehicle is at curb height.

   Torque: 95 N·m (70 lb ft)
3. Install nut and washer, then tighten the nut lightly. Retighten to the nut specified torque after the vehicle is at curb height.

   Torque: 78 N·m (58 lb ft)

Trailing Link

Trailing Link and Associated Parts



460RW017

Legend

(1) Parking Brake Cable

(2) Bolt and Nut

(3) Trailing Link

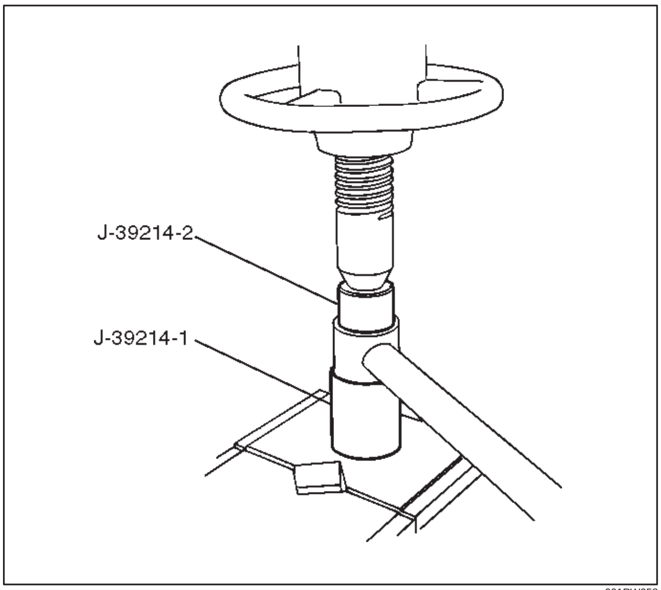
Removal

1. Remove the parking brake cable from the trailing link.
2. Remove the trailing link fixing bolt and nut.
3. Remove trailing link.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

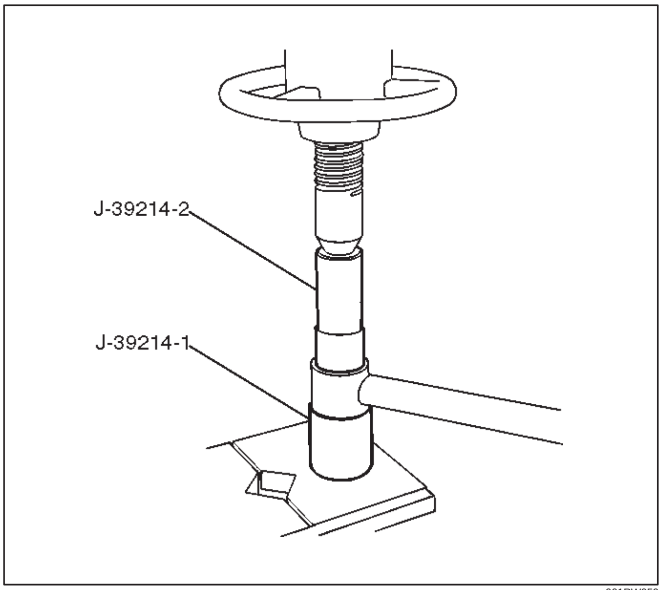
1. Trailing link
2. Rubber bushing
   - Remove the rubber bushing by using remover J–39214.



901RW058

- Install the rubber bushing by using installer J–39214.

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

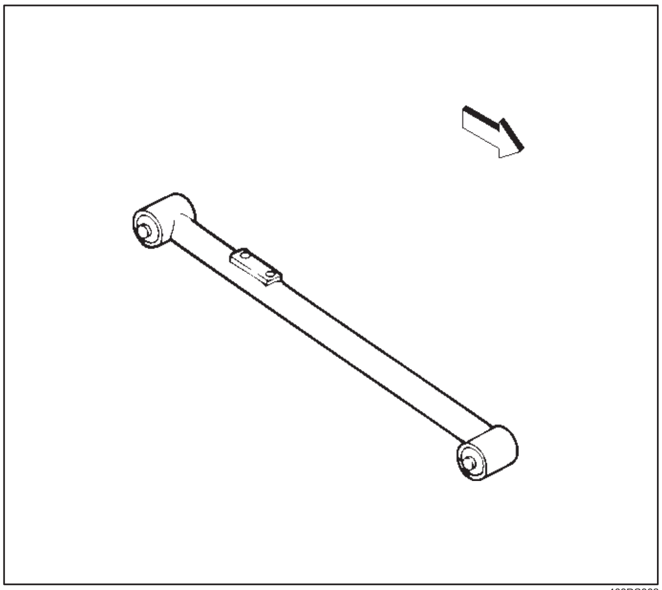


901RW059

Installation

1. Install trailing link. Make sure that the trailing link is in its correct position.

NOTE: When mounting trailing link, be sure not to use grease on bushings or any other nearby part.



460RS008

2. Install bolt and nut. Tighten the bolts and nuts lightly, then retighten them to the specified torque after the vehicle is at curb height.

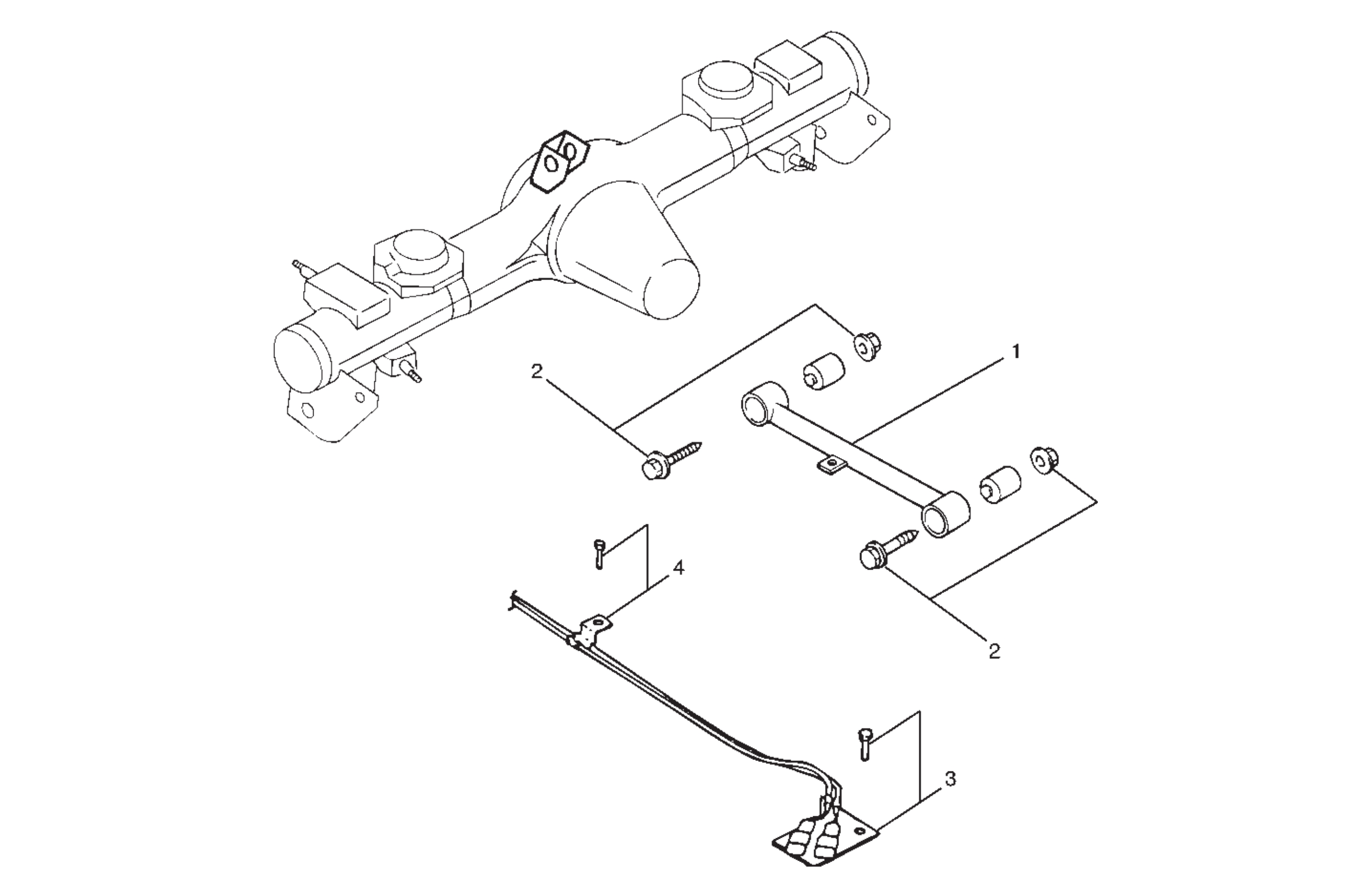
   Torque: 137 N·m (101 lb ft)

3. Install parking brake cable.

CAUTION: The parking brake cable should not be overstrained or slackened.

Center Link

Center Link and Associated Parts



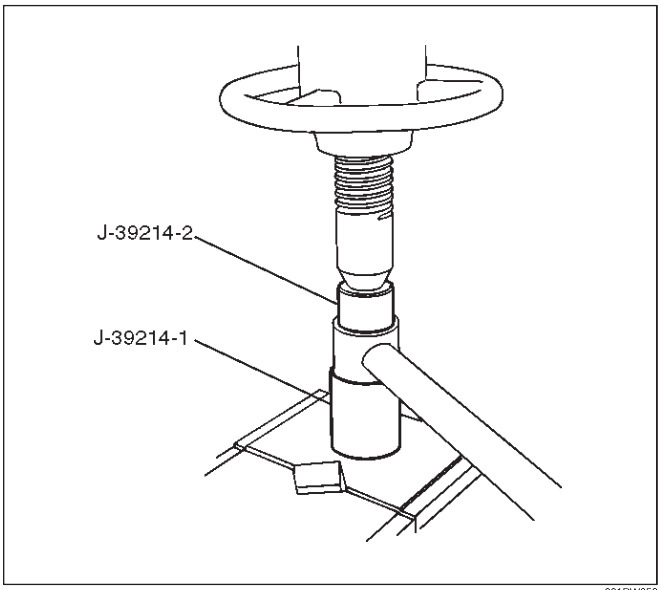
460RX001

Legend

(1) Center Link
(2) Bolt and Nut
(3) Speed Sensor Cable Bracket
(4) Speed Sensor Cable

Removal

1. Remove the speed sensor cable from the center link.
2. Remove the speed sensor cable bracket from the frame.
3. Remove bolt and nut.
4. Remove center link.



901RW058

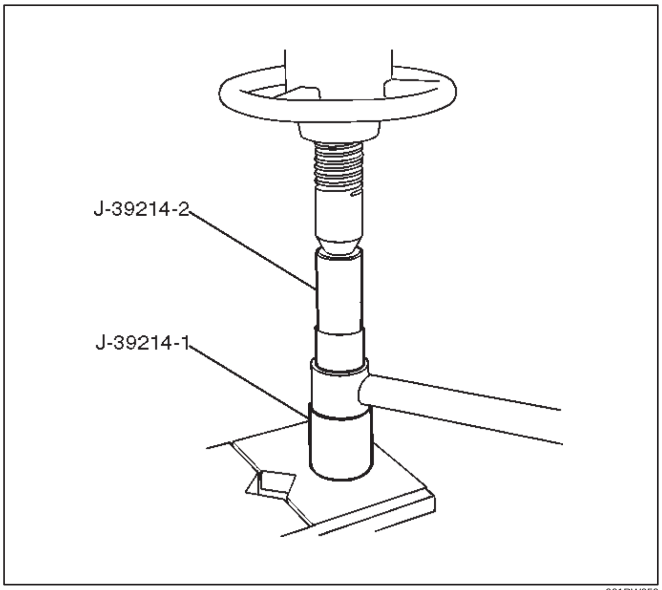
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

1. Center link
2. Rubber bushing
   - Remove the rubber bushing by using remover J–39214.

- Install the rubber bushing by using to installer J–39214.

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

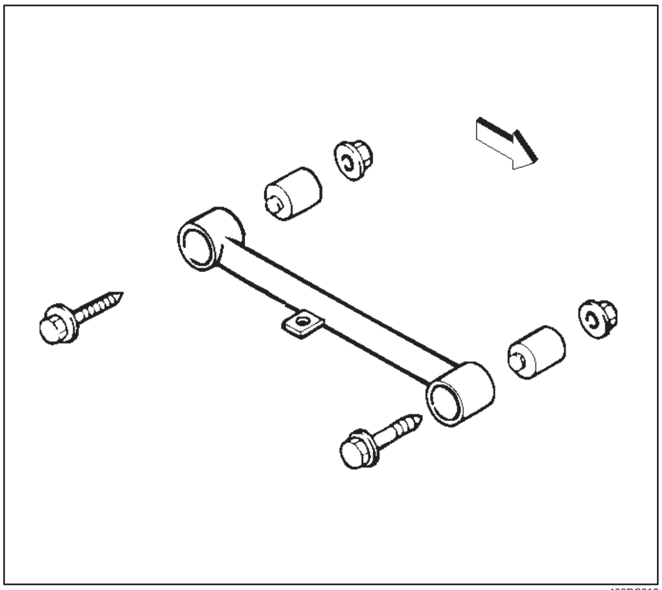


901RW059

Installation

1. Install center link. Make sure that the center link is in its correct position.

NOTE: When mounting center link, be sure not to use grease bushings or any other nearby part.



460RS010

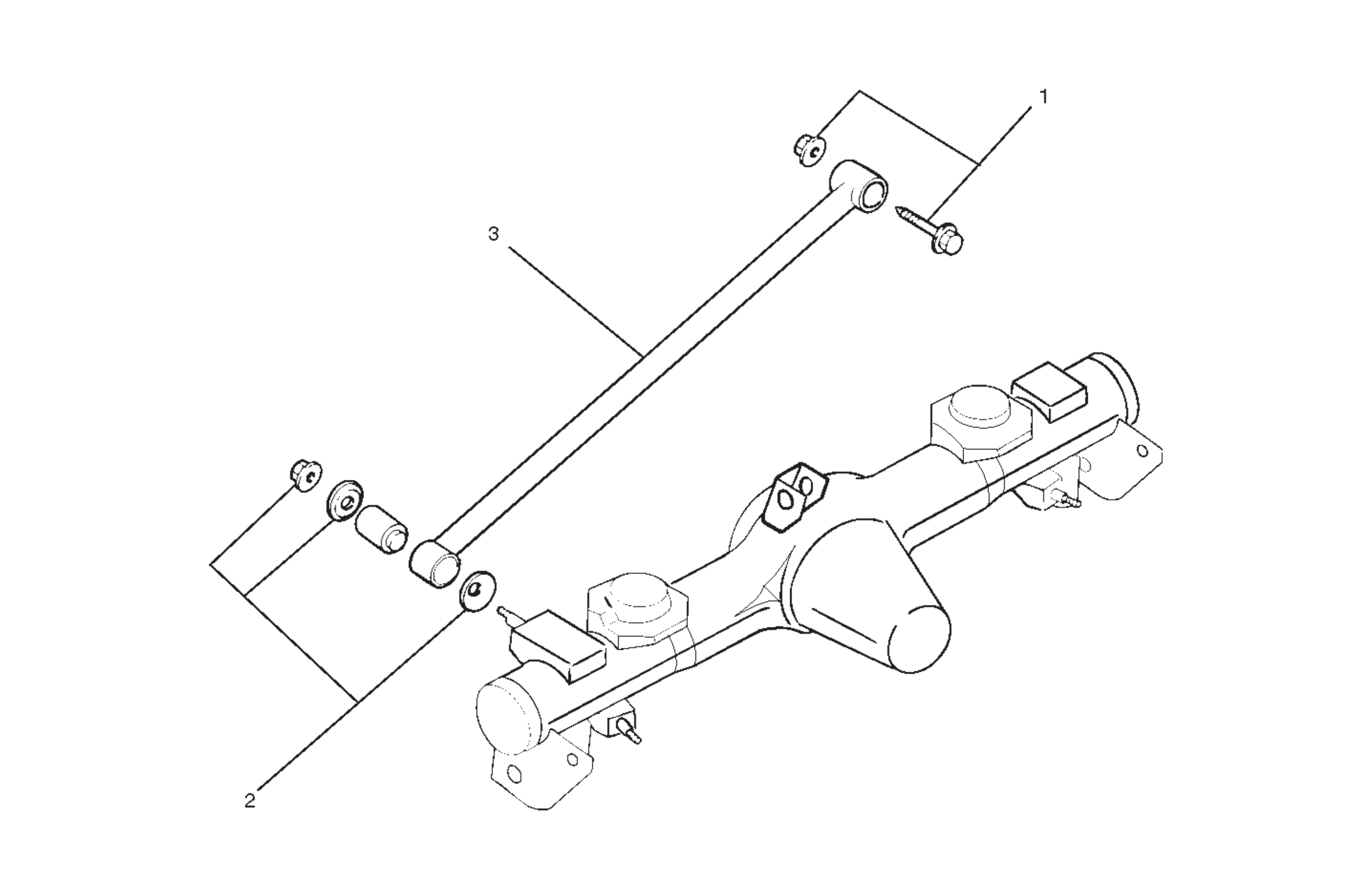
2. Install bolt and nut. Tighten the bolts and nuts lightly, then retighten them to the specified torque after the vehicle is at curb height.

Torque: 137 N·m (101 lb ft)

3. Install speed sensor cable bracket.
4. Install speed sensor cable.

Lateral Rod

Lateral Rod and Associated Parts



460RW019

Legend
(1) Bolt and Nut
(2) Nut and Washer
(3) Lateral Rod

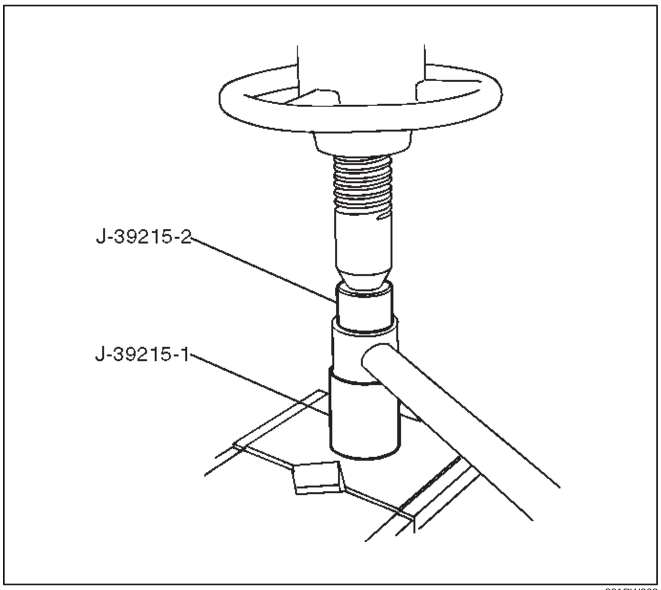
Removal

1. Remove nut and washer.
2. Remove bolt and nut.
3. Remove lateral rod.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

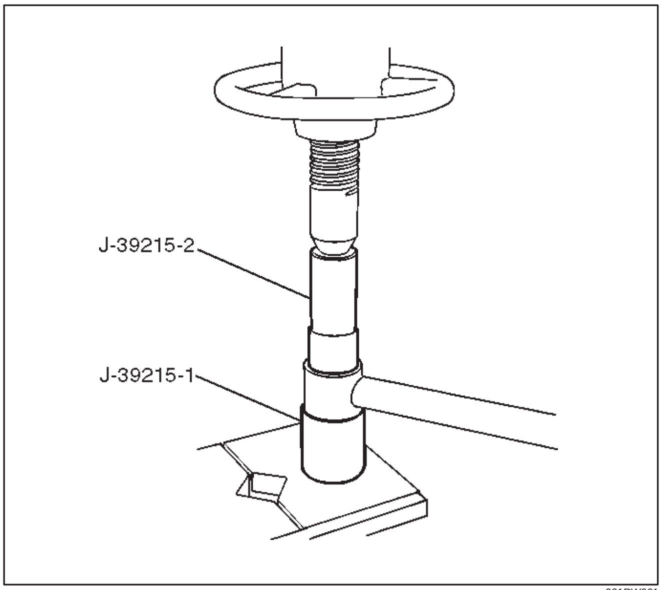
1. Lateral rod
2. Rubber bushing (Frame side)
   - Remove the rubber bushing (Frame side) by using remover J–39214.



901RW060

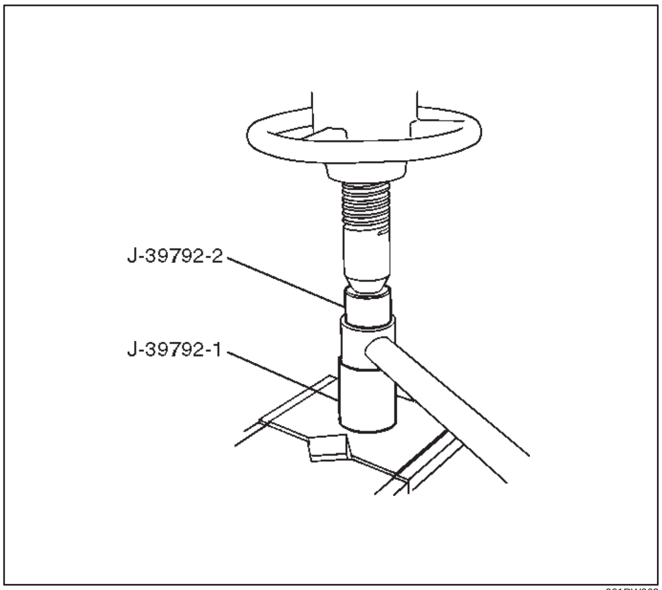
- Install the rubber bushing (Frame side) by using Installer J–39215.

NOTE: When mounting rubber bushings, do not use grease on bushings or any other nearby parts.



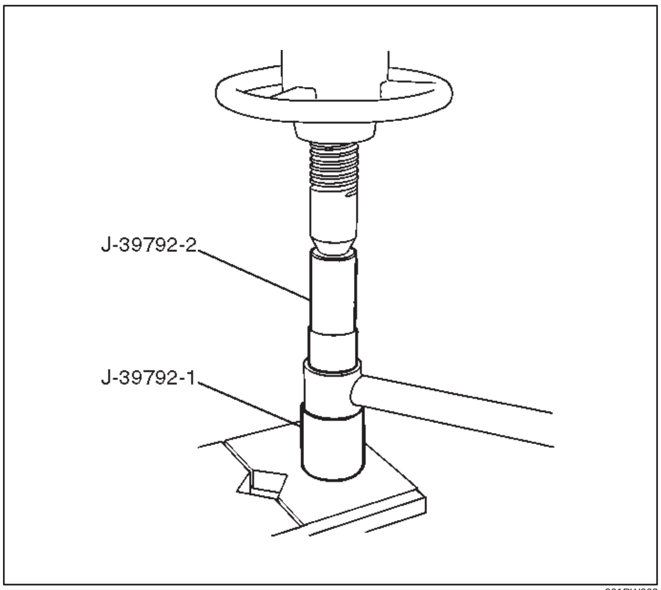
901RW061

3. Rubber bushing (Axle side)
   - Remove the rubber bushing (Axle side) by using remover J–39792.



901RW062

- Install the rubber bushing (Axle side) by using installer J–39792.

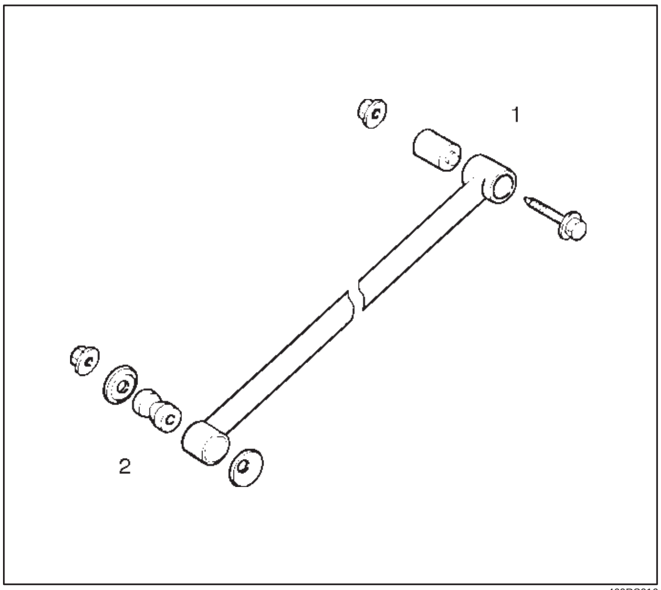


901RW063

Installation

1. Install lateral rod and make sure that the lateral rod is in its correct position.

NOTE: When mounting lateral rod, be sure not to use grease on bushings or any other nearby part.



460RS016

Legend
(1) Frame Side
(2) Axle Side

2. Install bolt and nut. Tighten the bolt and nut lightly, then retighten them to the specified torque after the vehicle is at curb height.

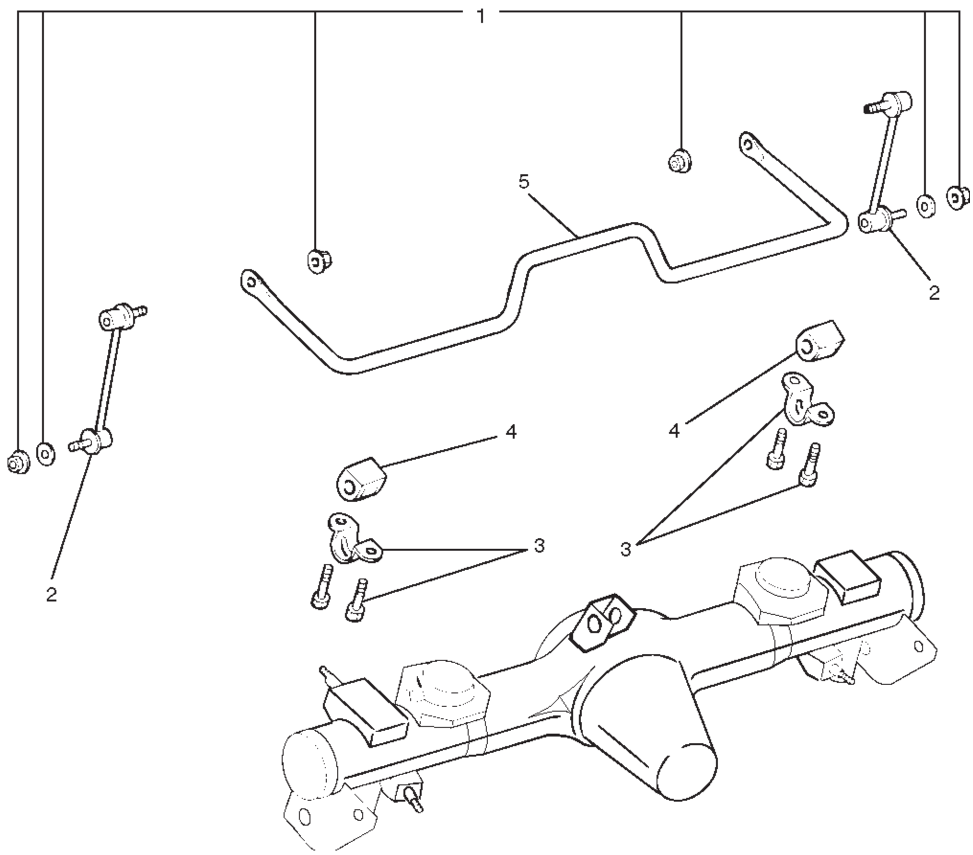
Torque: 137 N·m (101 lb ft)

3. Install nut and washer. Tighten the nut lightly, then retighten the nut to the specified torque after the vehicle is at curb height.

Torque: 78 N·m (58 lb ft)

Stabilizer Bar

Stabilizer Bar and Associated Parts



Legend

(1) Nut and Washer
(2) Link
(3) Bracket
(4) Rubber Bushing
(5) Stabilizer Bar

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel Replacement in this section.
3. Remove nut and washer.
4. Remove link.

CAUTION: Be careful not to damage the ball joint boot.

5. Remove bracket.
6. Remove rubber bushing.
7. Remove stabilizer bar.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- Stabilizer bar
- Rubber bushing
- Link ball joint

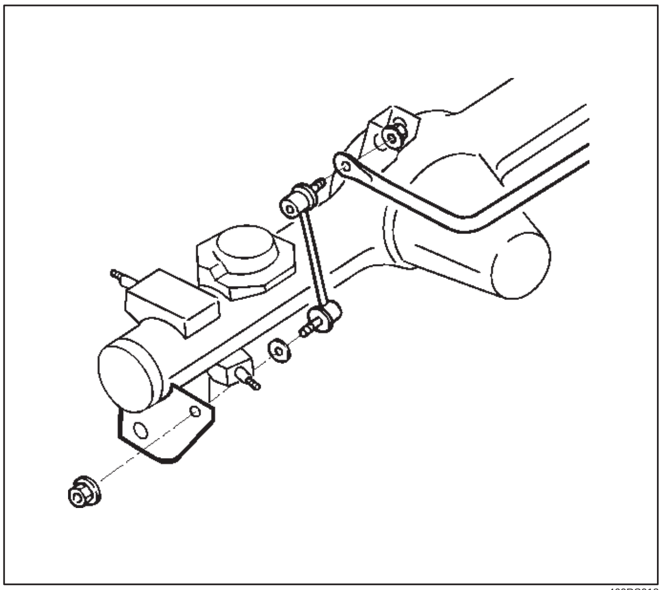
Installation

1. Install stabilizer bar.
2. Install rubber bushing.
3. Install bracket and tighten to the specified torque.

Torque: 22 N·m (16 lb ft)

4. Install link.
5. Install nut and washer, then tighten the nut to the specified torque.

Torque: 50 N·m (37 lb ft)



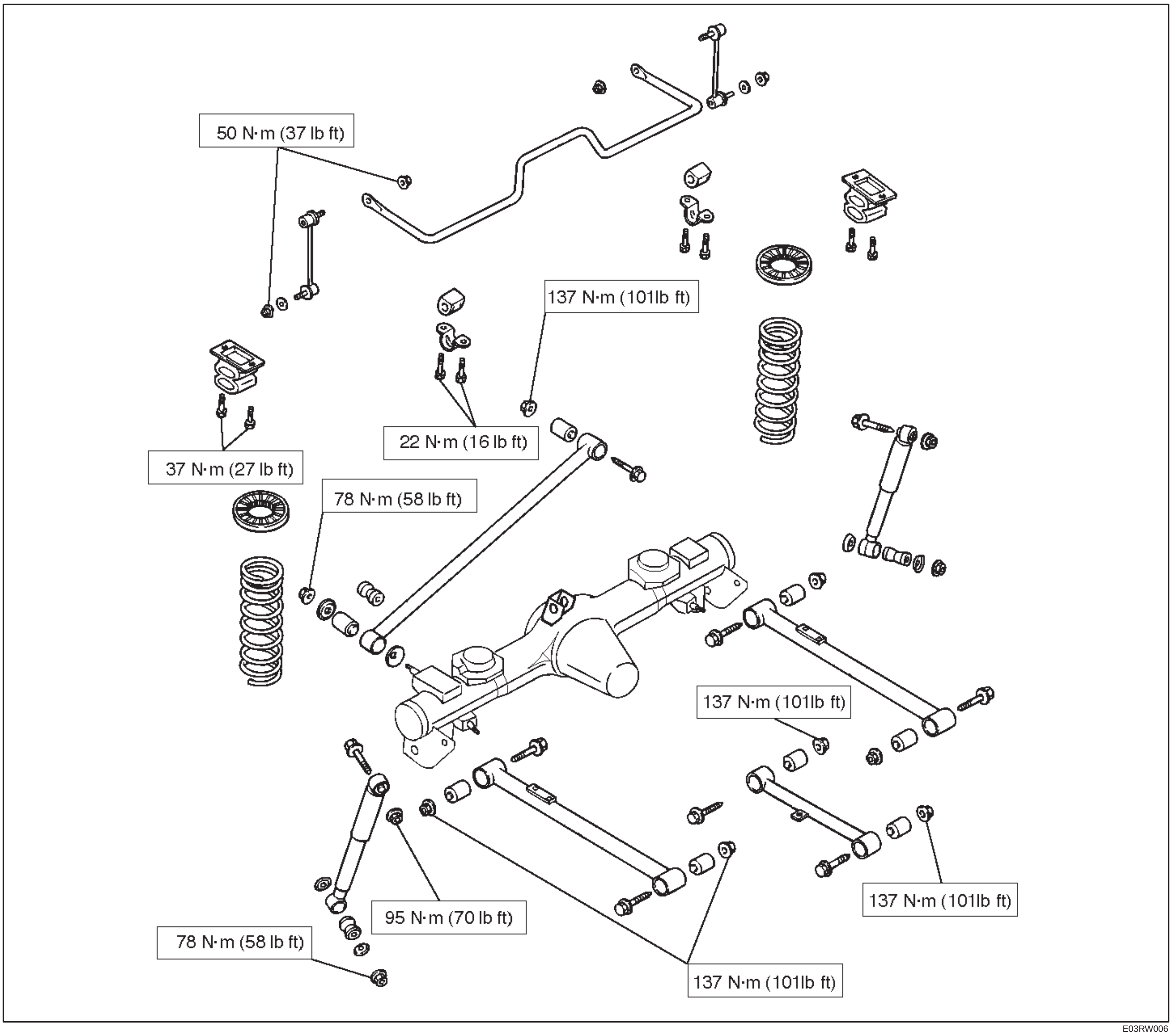
460RS018

Main Data and Specifications

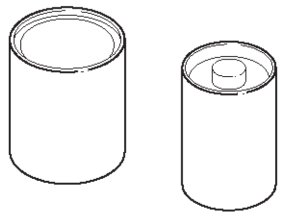
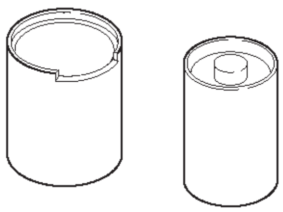
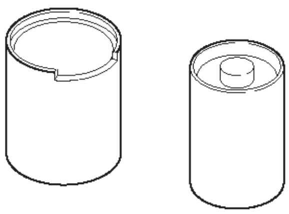
General Specifications

Rear suspension	Type	4–Link, coil spring type with stabilizer bar.
Coil spring	Free length	402mm (15.83in)
	Spring diameter	12.7mm (0.5in)
	Coil diameter (inner)	105mm (4.13in)
	Effective No. of turns	5.32
	Total No. of turns	6.82
Shock absorber	Type	Hydraulic, double acting, telescopic
	Piston diameter	25.0mm (0.98in)
	Stroke	175mm (6.89in)
	Extended length	489mm (19.25in)
	Compressed length	314mm (12.36in)
Stabilizer bar	Diameter	19.0mm (0.75in)

Torque Specifications



Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS291	**J–39214** Remover and Installer; Trailing center link bushing
 901RS292	**J–39792** Remover and Installer; Lateral rod bushing (axle side)
 901RS293	**J–39215** Remover and Installer; Lateral rod bushing

TROOPER

SUSPENSION

WHEEL AND TIRE SYSTEM

CONTENTS

Service Precaution

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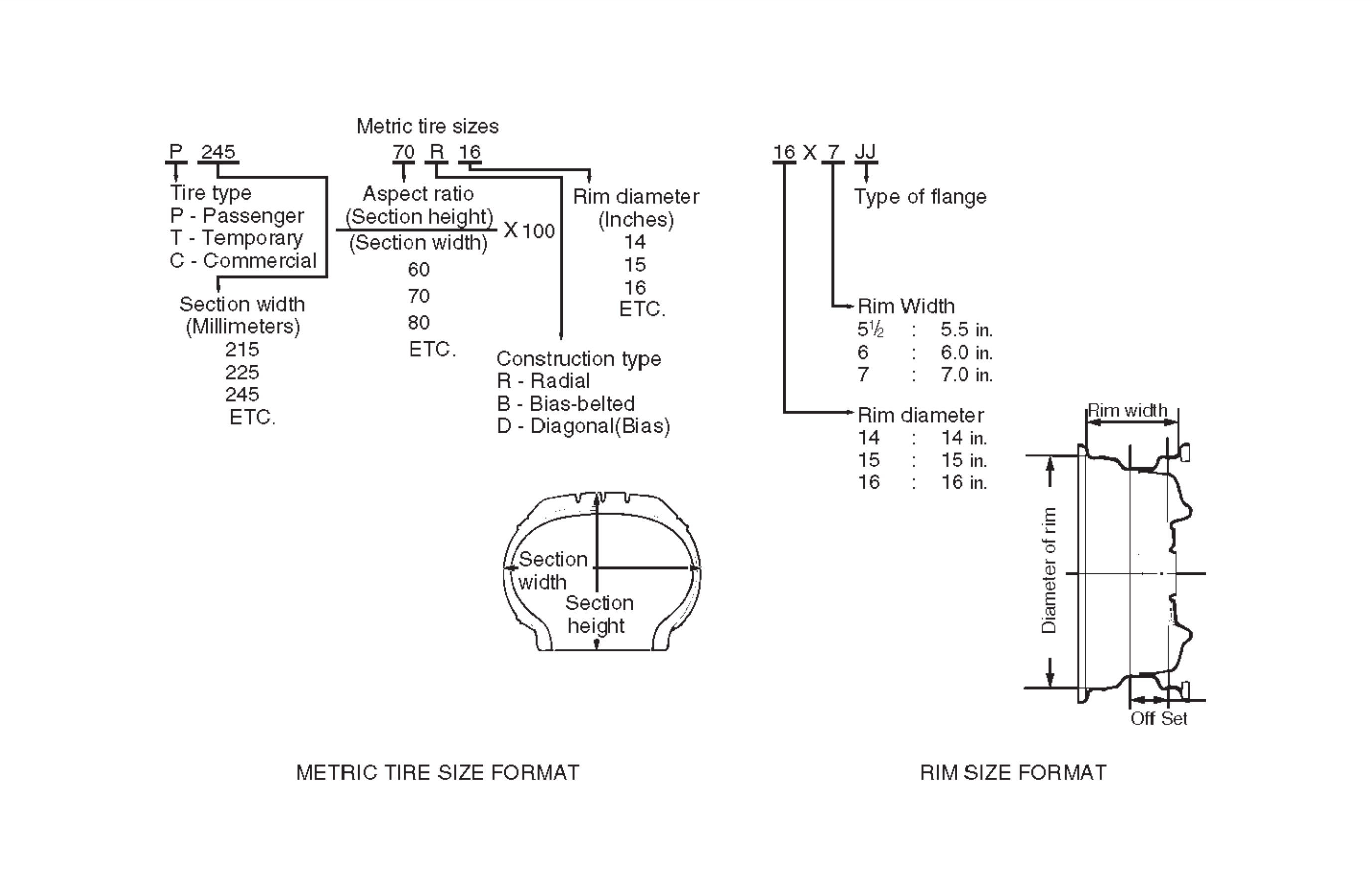
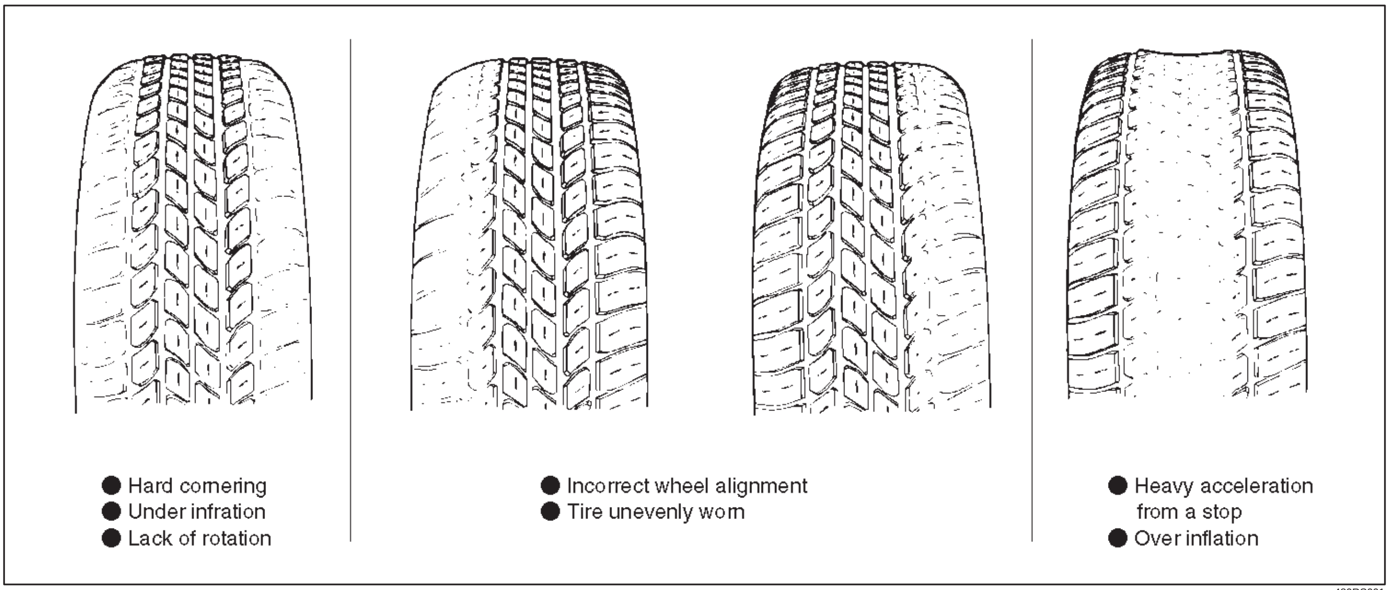
General Description



480RS008

Replacement wheels or tires must be equivalent to the originals in load capacity, specified dimension and mounting configuration. Improper size or type may affect bearing life, brake performance, speedometer/odometer calibration, vehicle ground clearance and tire clearance to the body and chassis. All model are equipped with metric sized tubeless steel belted radial tires. Correct tire pressures and driving habits have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase premature and uneven wear.

Diagnosis



480RS001

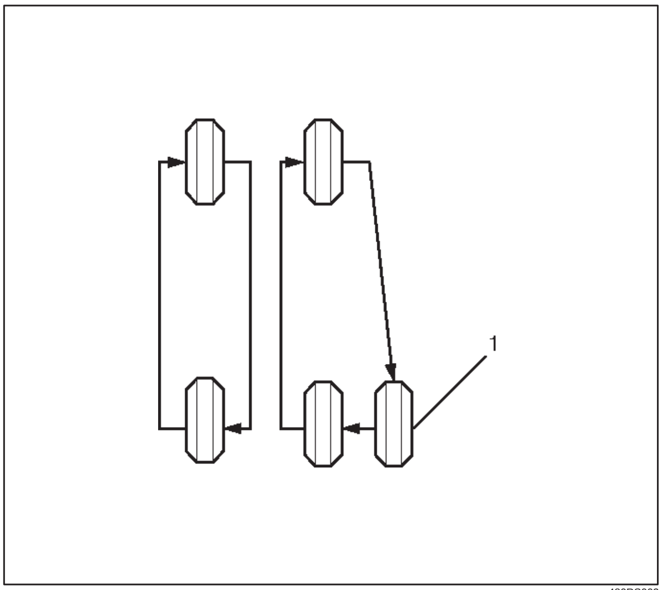
Irregular and Premature Wear

Irregular and/or premature wear has many causes. Some of them are incorrect inflation pressures, lack of tire rotation, poor driving habits or improper wheel alignment. Incorrect inflation is common cause of tire premature wear.

NOTE: Due to their design, radial tires tend to wear faster in the shoulder area, particularly on the front tires. This makes regular rotation especially necessary. After rotation, be sure to check wheel nut torque, and set tire pressures.

Tire Rotation

Tire rotation is recommended to equalize wear for longer tire life.



480RS002

Legend

(1) Spare Tire

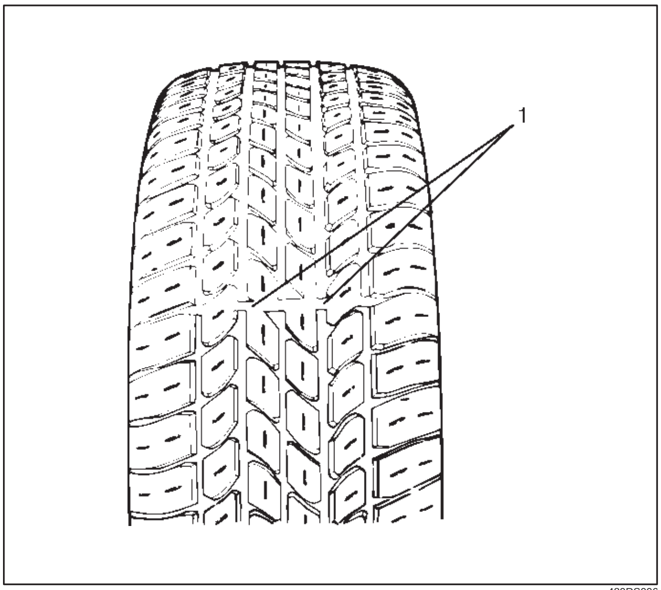
If the following conditions are noted, rotate the tires:

- Front tire wear is different from rear.
- Uneven wear exists across the tread of any tire.
- Left and right front tire wear is unequal.
- Left and right rear tire wear is unequal.

Check wheel alignment if the following conditions are noted:

- Left and right front tire wear is unequal.
- Wear is uneven across the tread of any front tire.
- Front tire treads have a scuffed appearance with “feather” edges on one side of the tread ribs or blocks.

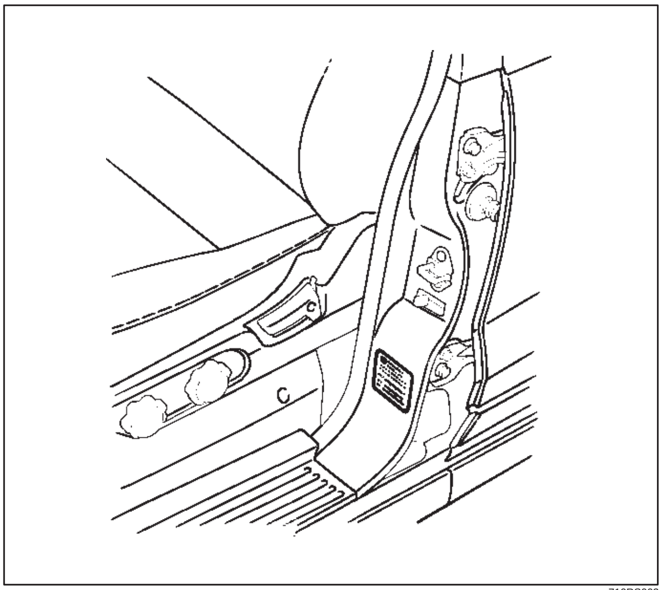
Tread Wear Indicators



480RS006

The original equipment tires have built-in tread wear indicators(1) to show when tires need replacement. These indicators may appear as wide bands. When the indicators appear in two or more grooves at three locations, tire replacement is recommended.

Inflation of Tires



710RS003

Tire pressure, in cold condition (after vehicle has set for three hours or more, and driven less than one mile), should be checked monthly or before any extended trip. Tire pressure increases approximately 15% when the tires become hot during driving. Tire pressure specification is shown on the label located on the left door lock pillar.

NOTE: Check the tire pressure whenever irregular wear is found. Tire inflation greatly affects tire wear. If the alignment check does not reveal any alignment problems, check the condition of the shock absorbers and wheel/tire balance.

Diagnosis List

If the following conditions are noted, rotation is required.

1. Front tire wear is different from rear.
2. Uneven wear exists across the tread of any tire.
3. Left and right front tire wear is unequal.
4. Left and right rear tire wear is unequal.

If the following conditions are noted, check the wheel alignment.

1. Left and right front tire wear is unequal.
2. Uneven wear exists across the tread of any tire.
3. Front tire treads have scuffed appearance with “feather” edges on one side of tread ribs or blocks.
4. There is cupping, flat spotting etc.

Higher than recommended pressure can cause:

1. Hard ride.
2. Poor steering stability.
3. Rapid and uneven wear at center of the tread.

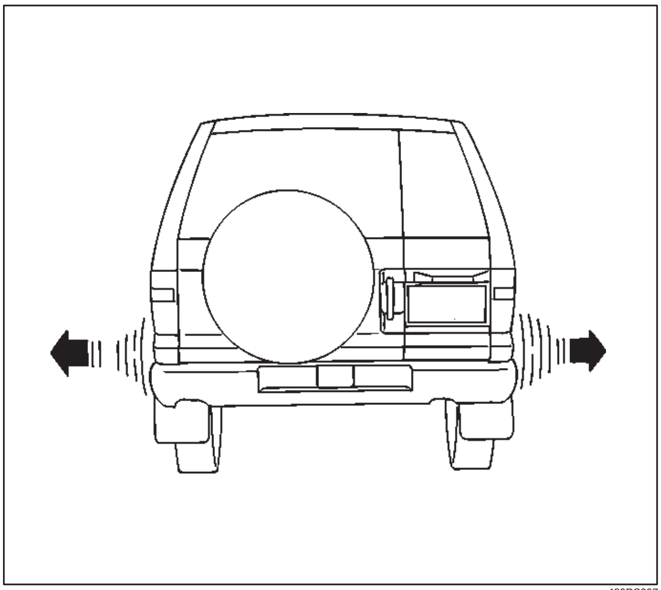
Lower than recommended pressure can cause:

1. Tire squeal on turns.
2. Hard steering.
3. Rapid and uneven wear on the edges of the tread.
4. Tire rim bruises and rupture.
5. Tire cord breakage.
6. High tire temperatures.
7. Reduced handling.
8. Reduced fuel economy.

Unequal pressure on same axle can cause:

1. Uneven braking.
2. Steering lead.
3. Reduced handling.
4. Swerve on acceleration.

Radial Tire Waddle



480RS007

Waddle is side-to-side movement at the front and/or rear of the car. It can be caused by the steel belt not being straight within the tire, or by excessive lateral runout of the tire or wheel. It is most noticeable at low speed, about 8 to 48 km/h (5 to 30 mph). It may also cause rough ride at 80 to 113 km/h (50 to 70 mph).

The car can be road tested to see which end of the car has the faulty tire. If the tire causing the waddle is on the rear, the rear end of the car will “waddle”. From the driver’s seat, it feels as if someone is pushing on the side of the car.

If the faulty tire is on the front, the waddle is more easily seen. The front sheet metal appears to be moving back and forth. It feels as if the driver’s seat is the pivot point in the car.

Another more time-consuming method of determining the faulty tire is substituting tire and wheel assemblies that are known to be good. Follow these steps:

1. Drive the car to determine if the waddle is coming from the front or rear.
2. Install tire and wheel assemblies known to be good (from a similar car) in place of those on the end of the car which is waddling. If the waddle cannot be isolated to front or rear, start with the rear tires.
3. Road test again. If improvement is noted, install the original tire and wheel assemblies one at a time until the faulty tire is found. If no improvement is noted, install tires known to be good in place of all four. Then, install the originals one at a time until the faulty tire is found.

Radial Tire Lead/Pull

“Lead/Pull” is vehicle deviation from a straight path, on a level road with no pressure on the steering wheel.
Lead is usually caused by:

1. Poorly manufactured radial tires.
2. Uneven brake adjustment.
3. Wheel alignment.

The way in which a tire is built can produce lead in a car. An example of this is placement of the belt. Off-center belts on radial tires can cause the tire to develop a side force while rolling straight down the road and the tire will tend to roll like a cone.
The “Radial Tire Lead/Pull Correction” chart should be used to make sure that front wheel alignment is not mistaken for tire lead.
Rear tires will not cause lead/pull.

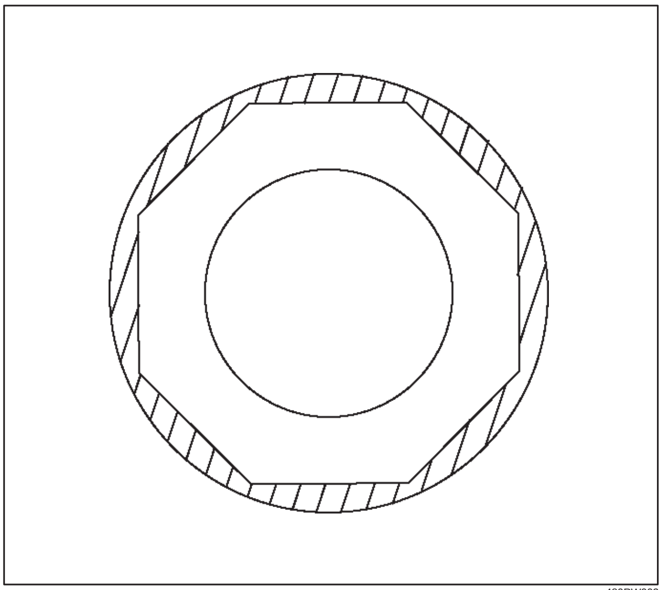
Radial Tire Lead/Pull Correction Chart

Step	Action	Yes	No
1	1. Inflate tires to recommended pressure. 2. Road test vehicle on level uncrowned road. Was a problem corrected?	End	Go to Step 2
2	Switch front tires side to side and road test again. Was a problem corrected?	If roughness results,replace tires	Go to Step 3
3	Did the vehicle lead in same direction?	Go to Step 4	Go to Step 5
4	Put tires back in original position and check alignment. Was a problem corrected?	End	Go to Step 5
5	Install known good tire on one front side. Was a problem corrected?	Replace tire	Install a known good tire in place of other front tire. If lead corrected, replace tire

Typical examples of abnormal tire ahead wear and major causes:

CAUTION: Similar wear patterns can be caused by worn suspension parts, misalignment of wheels and tires, and other suspension related problems.

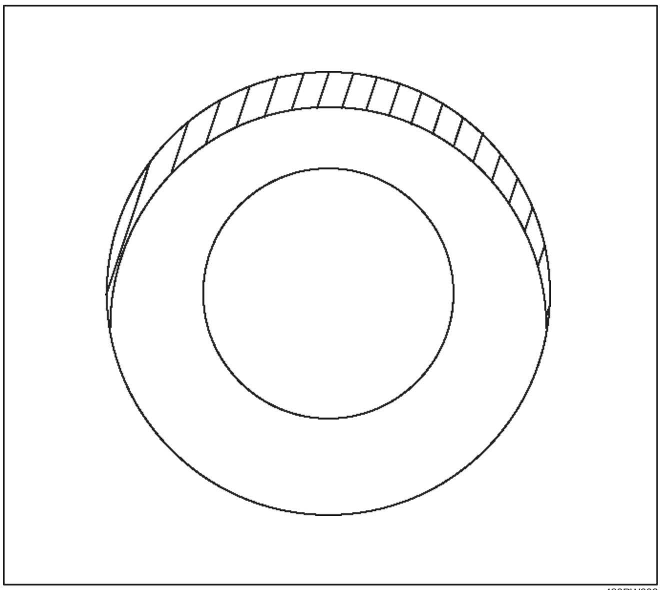
Spotty wear – wear localized on shoulder sections, and in an extreme cases, the tire becomes polygonal in shape.



480RW002

1. Tire or wheel out of round or distorted.
2. Hub or knuckle out of round or distorted.
3. Play in hub bearings or ball joint.
4. Rotating parts out of balance.

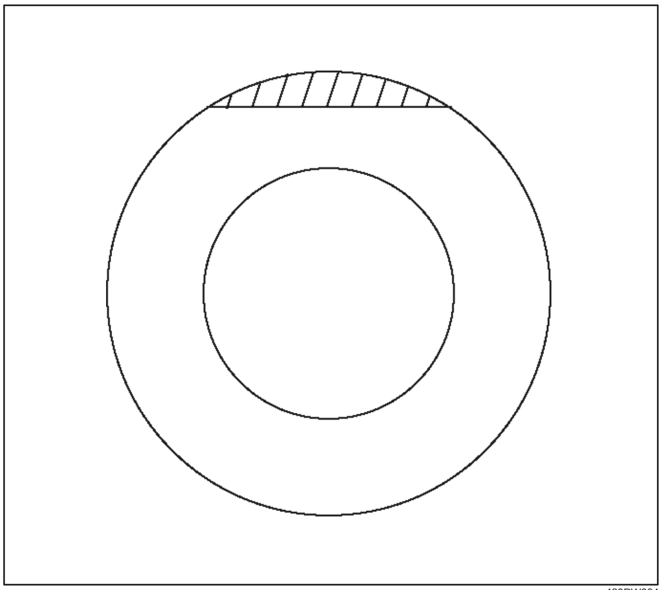
Tread wear one-sided.



480RW003

1. Rotating parts out of balance.
2. Tire or wheel out of round.
3. Hub or knuckle out of round or distorted.

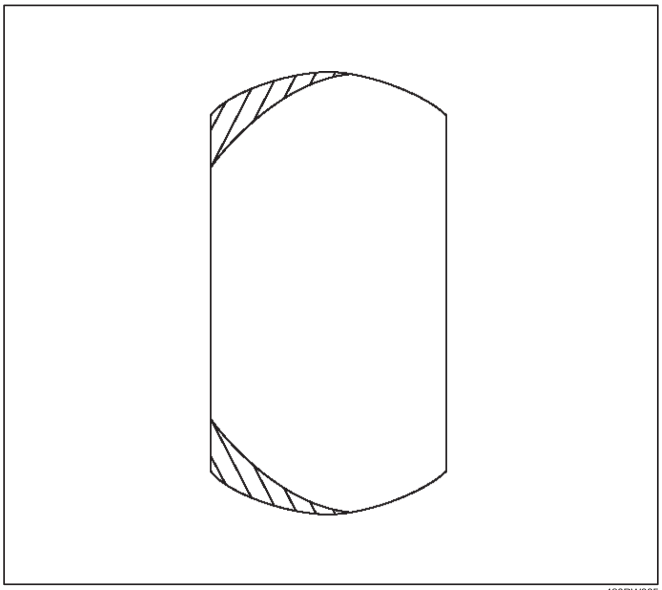
Localized tread wear.



480RW004

1. Once spotty wear develops in tread due to hard braking or abrupt starting, localized wear tends to be promoted.

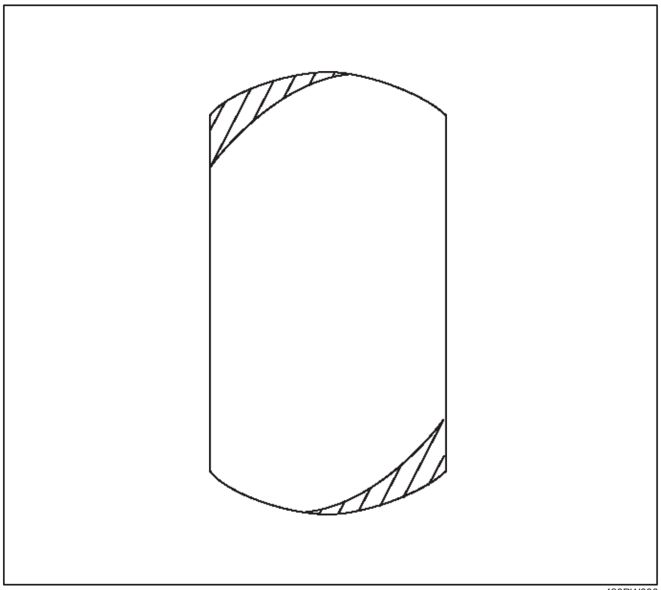
Shoulder wear (generally wear develops in outer shoulder):



480RW005

1. Camber or toe-in incorrect.
2. Shoulder wear caused by repeated hard-cornering.

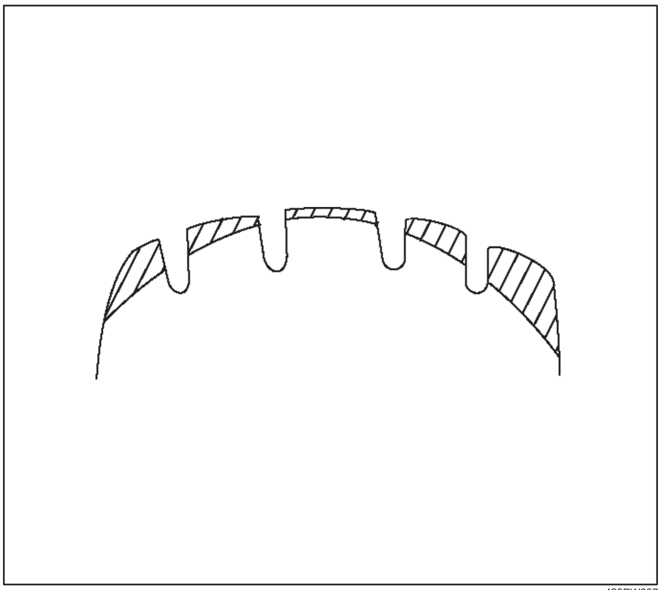
Wear in shoulders at points opposed to each other.



480RW006

1. Tire or wheel out of round or distorted.
2. Play in bearings or ball joint.

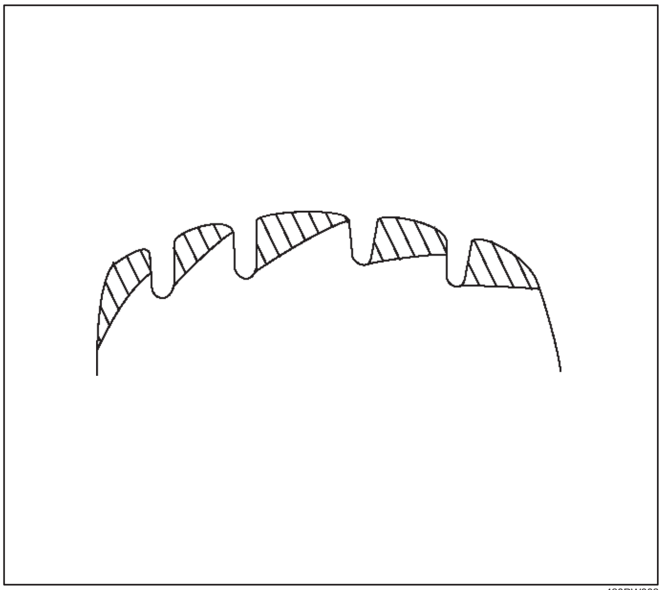
Premature wear in shoulders.



480RW007

1. Flexing of tire excessive due to under-inflation.

One sided feather edging.

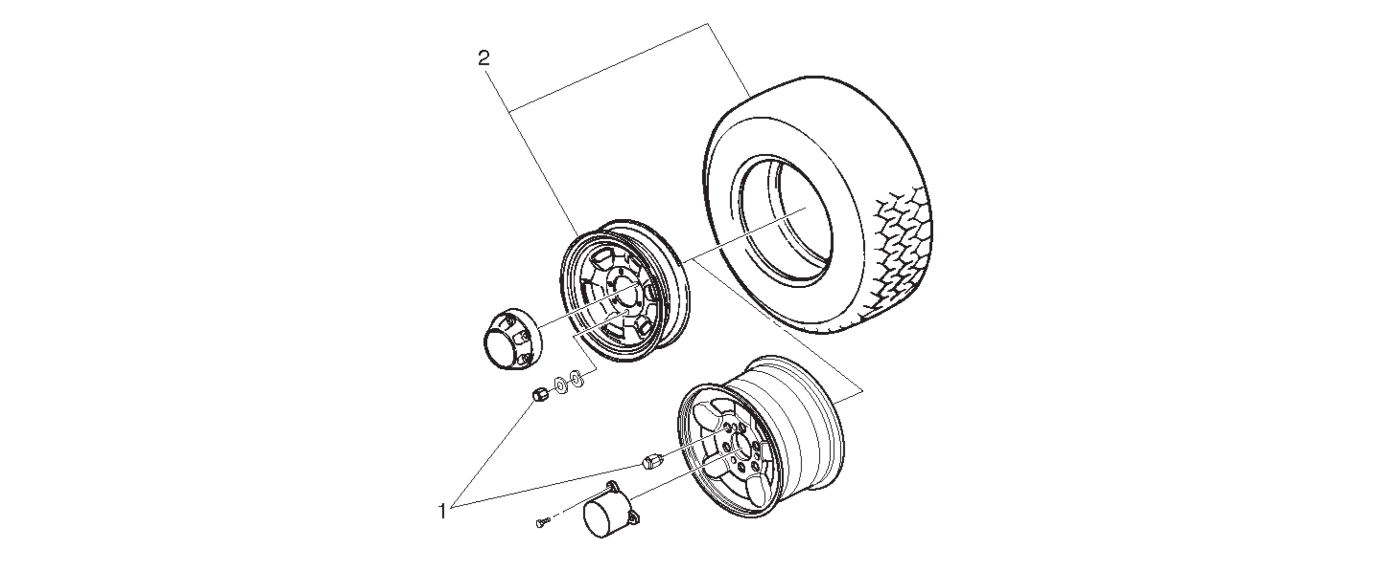


480RW008

1. Wear caused by repeated hard-cornering.
2. Camber or toe-in incorrect.

Wheel

Wheel and Associated Parts



480RW001

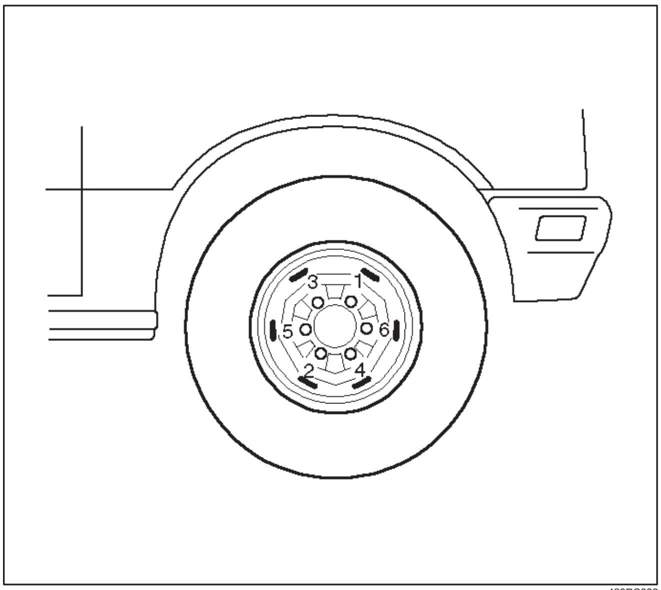
Legend

(1) Wheel Lug Nut
(2) Wheel and Tire

Removal

1. Loosen wheel lug nut by approximately 180 g (half a rotation), then raise the vehicle and remove the nuts.
2. Remove wheel and tire.

NOTE: Never use heat to loosen a tight wheel lug nut. The application of heat to the hub can shorten the life of the wheel and may cause damage to wheel bearings.



480RS020

Installation

1. Install wheel and tire.
2. Install wheel lug nut, and lower the vehicle. Tighten the wheel lug nuts to the specified torque in numerical order.

Torque: 118 N·m (87 lb ft)

CAUTION: Before installing wheels, remove any build-up of corrosion on the wheel mounting surface and brake disc mounting surface by scraping and wire brushing. Installing wheels without good metal-to-metal contact at mounting surfaces can cause wheel nuts to loosen, which can later allow a wheel to come off while the vehicle is moving.

NOTE: Valve caps should be on the valve stems to keep dust and water out.

Tire

Tire Replacement

When replacement is necessary, the original metric the size should be used. Most metric tire sizes do not have exact corresponding alphanumeric tire sizes. It is recommended that new tires be installed in pairs on the same axle. If necessary to replace only one tire, it should be paired with tire having the most tread, to equalize braking traction.

CAUTION: Do not mix different types of tires such as radial, bias and bias-belted tires except in emergencies, because vehicle handling may be seriously affected and may result in loss of control.

Tire Dismounting

Remove valve cap on valve step and deflate the tire. Then use a tire changing machine to mount or dismount tires. Follow the equipment manufacturer's instruction. Do not use hand tools or tire lever alone to change tires as they may damage the tire beads or wheel rim.

Tire Mounting

Rim bead seats should be cleaned with a wire brush or coarse steel wool to remove lubricants, and light rust. Before mounting a tire, the bead area should be well lubricated with an approved tire lubricant.
After mounting, inflate the tire to 196kPa (28 psi) so that beads are completely seated. Inflate the air to specified pressure and install valve cap to the stem.

WARNING: NEVER STAND OVER TIRE WHEN INFLATING. BEAD MAY BREAK WHEN BEAD SNAPS OVER RIM'S SAFETY HUMP AND CAUSE SERIOUS PERSONAL INJURY.

NEVER EXCEED 240 KPA (35 PSI) PRESSURE WHEN INFLATING. IF 240 KPA (35 PSI) PRESSURE WILL NOT SEAT BEADS, DEFLATE, RE-LUBRICATE AND RE-INFLATE. OVER INFLATION MAY CAUSE THE BEAD TO BREAK AND CAUSE SERIOUS PERSONAL INJURY.

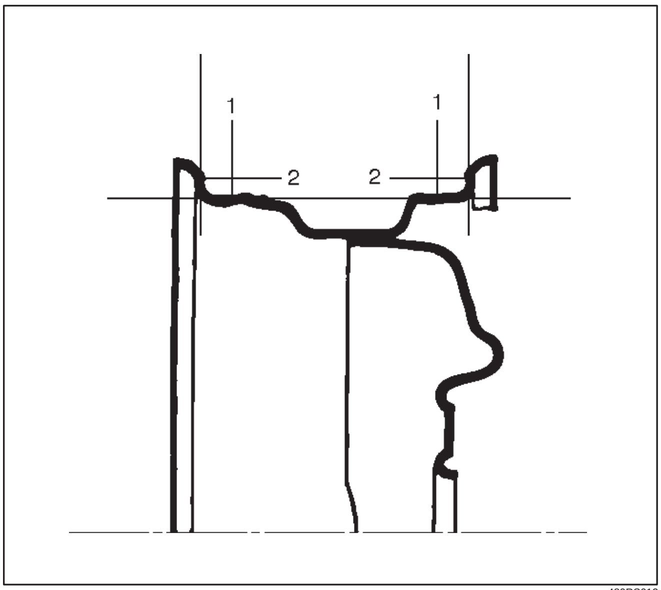
Tire Repair

There are many different materials on the market used to repair tires.
Manufacturers have published detailed instructions on how and when to repair tires. These instructions can be obtained from the tire manufacturer if they are not included with the repair kit.

Wheel Inspection

Damaged wheels and wheels with excessive run-out must be replaced.
Wheel run out at rim (Base on hub Bore):

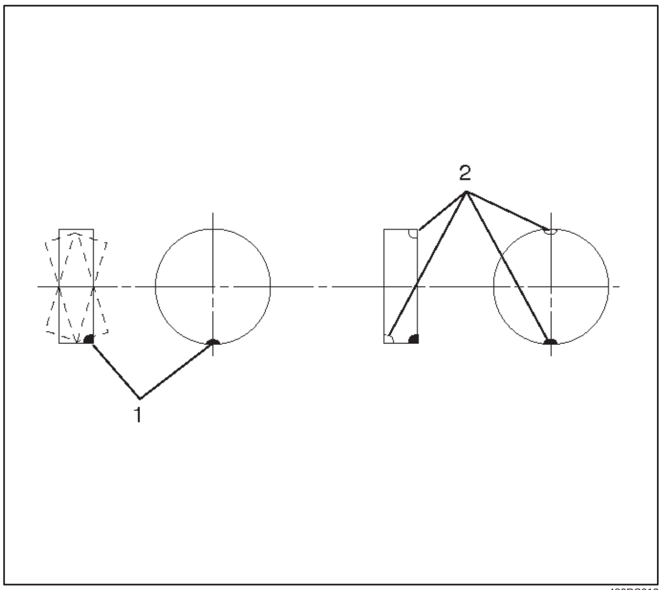
Steel	Aluminum
1– Vertical play: Less than 1.5 mm (0.059 in)	1– Vertical play: Less than 0.7 mm (0.028 in)
2– Horizontal play: Less than 1.5 mm (0.059 in)	2– Horizontal play: Less than 0.7 mm (0.028 in)



480RS012

General Balance Procedure

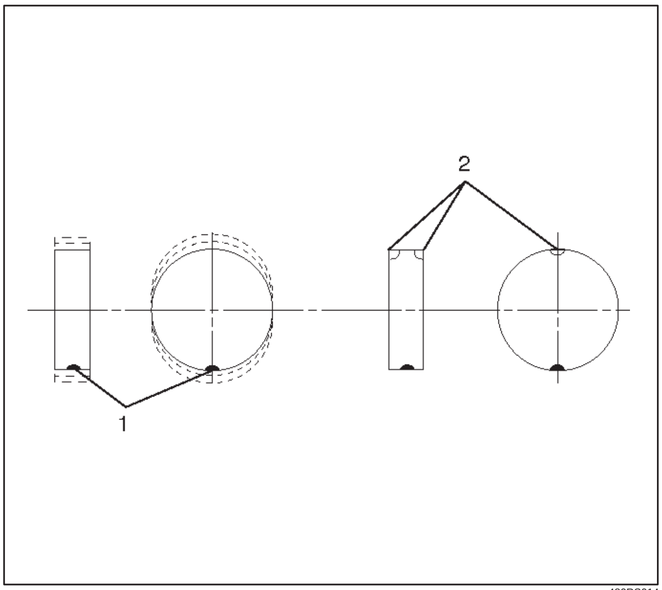
Deposits of mud, etc. must be cleaned from the inside of the rim.
The tire should be inspected for the following: match mount paint marks, bent rims, bulges, irregular tire wear, proper wheel size and inflation pressure. Then balance according to the equipment manufacturer's recommendations.
There are two types of wheel and tire balance.
Static balance is the equal distribution of weight around the wheel.
Assemblies that are statically unbalanced cause a bouncing action called tramp. This condition will eventually cause uneven tire wear.



480RS013

Legend
- (1) Heavy Spot Wheel Shimmy
- (2) Add Balance Weights Here

Dynamic balance is the equal distribution of weight on each side of the wheel center-line so that when the tire spins there is no tendency for the assembly to move from side to side. Assemblies that are dynamically unbalanced may cause shimmy.



480RS014

Legend
- (1) Heavy Spot Wheel Hop
- (2) Add Balance Weights Here

WARNING: STONES SHOULD BE REMOVED FROM THE TREAD TO AVOID OPERATOR INJURY DURING SPIN BALANCING AND TO OBTAIN A GOOD BALANCE.

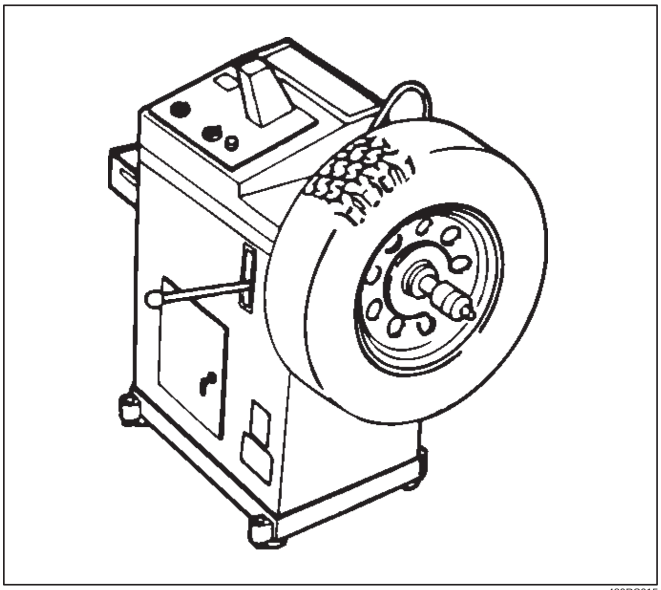
Balancing Wheel and Tire

On-vehicle Balancing

On-Vehicle balancing methods vary with equipment and tool manufacturers. Be sure to follow each manufacturer's instructions during balancing operation.

Off-vehicle Balancing

Most electronic off-vehicle balancers are more accurate than the on-vehicle spin balancers. They are easy to use and give a dynamic balance. Although they do not correct for drum or disc unbalance (as on- vehicle spin balancing does), they are very accurate.



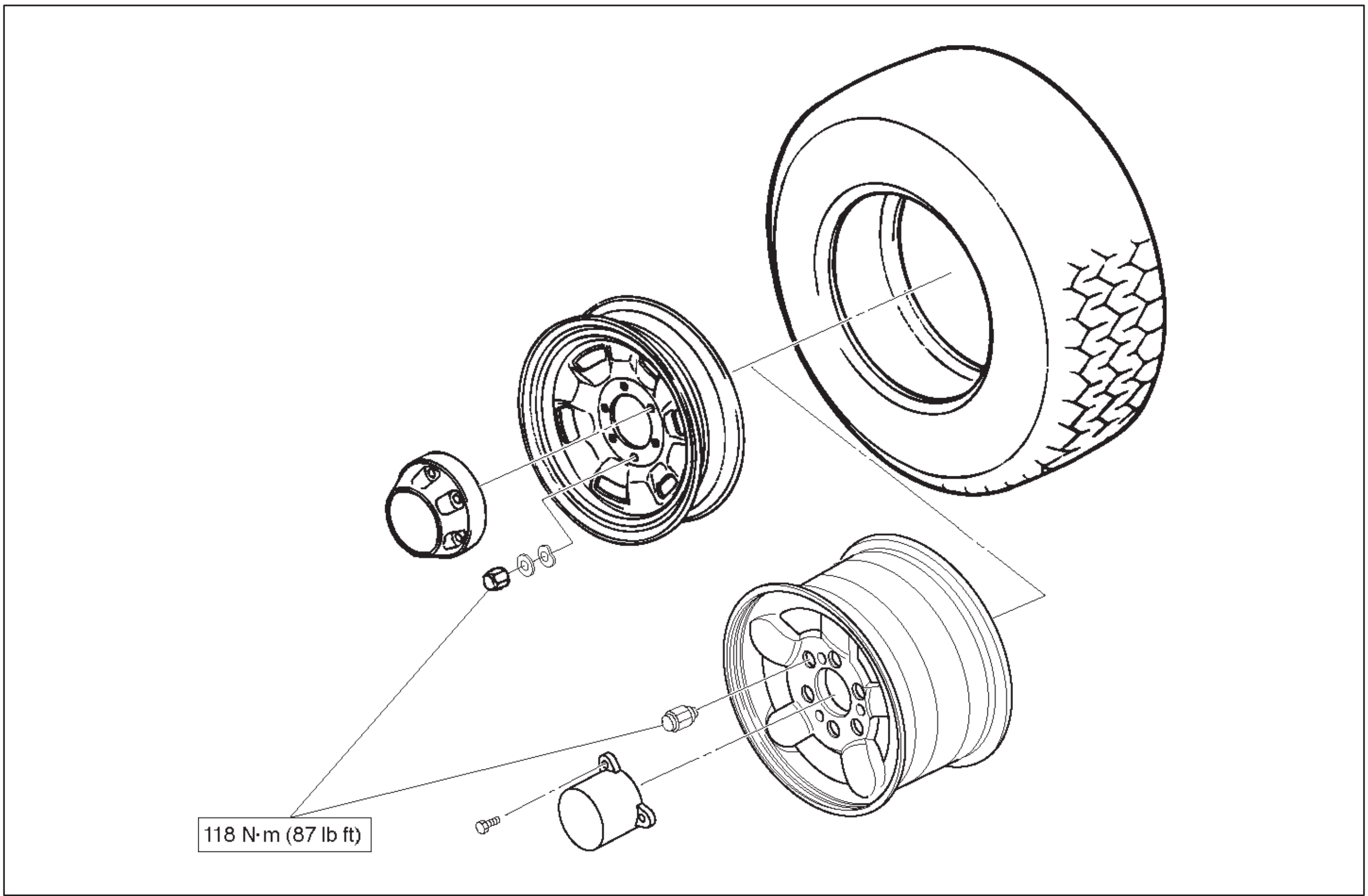
480RS015

Main Data and Specifications

General Specifications

Wheels	Size	16 x 7JJ
	Offset	38.0 mm (1.50 in)
	P.C.D., wheel studs	139.7 mm (5.50 in)
Standard tire	Size	P245/70R16
	Pressure(Front)	210 kPa (30 psi)
	Pressure(Rear)	240 kPa (35 psi)

Torque Specifications



E03RW002

TROOPER

DRIVELINE/AXLE

CONTENTS

DIFFERENTIAL (FRONT)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM(SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE REFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED , do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally,such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specification. Following these instructions can help you avoid damage to parts and systems.

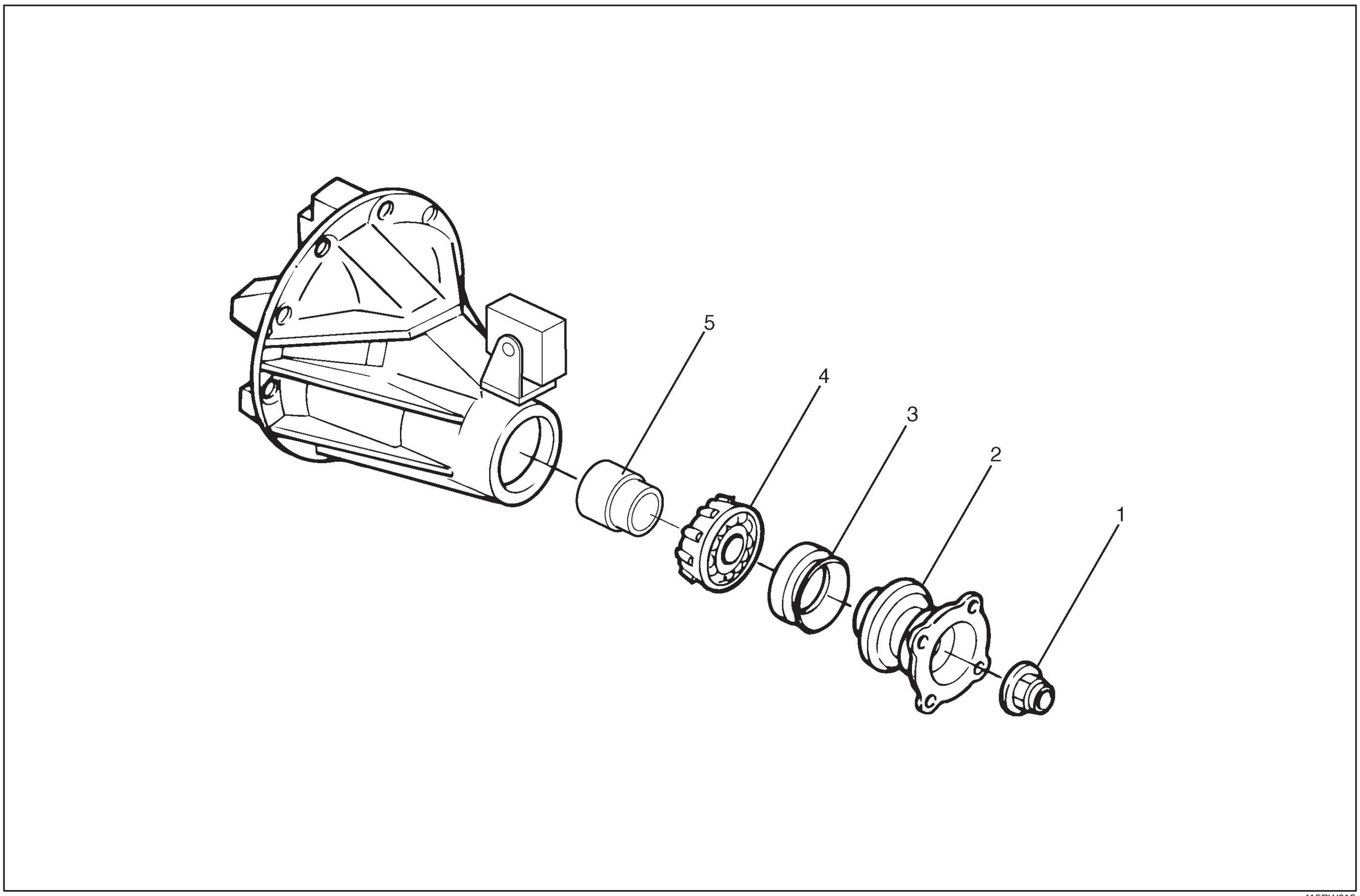
Front Drive Axle

Diagnosis

Condition	Possible cause	Correction
Oil Leak At Front Axle	Worn or defective oil seal.	Replace the oil seal.
	Front axle housing cracked.	Repair or replace.
Oil Leak At Pinion Shaft	Too much gear oil.	Correct the oil level.
	Oil seal worn or defective.	Replace the oil seal.
	Pinion flange loose or damaged.	Tighten or replace.
Noises In Front Axle Drive Shaft Joint	Broken or worn drive shaft joints and bellows (BJ and DOJ).	Replace the drive shaft joints and bellows.
“Clank” When Accelerating From “Coast”	Loose drive shaft joint to output shaft bolts.	Tighten.
	Damaged inner drive shaft joint.	Replace.
Shudder or Vibration During Acceleration	Excessive drive shaft joint angle.	Repair.
	Worn or damaged drive shaft joints.	Replace.
	Sticking spider assembly (inner drive shaft joint).	Lubricate or replace.
	Sticking joint assembly (outer drive shaft joint).	Lubricate or replace.
Vibration At Highway Speeds	Out of balance or out of round tires.	Balance or replace.
	Front end out of alignment.	Align.
Noises in Front Axle	Insufficient gear oil.	Replenish the gear oil.
	Wrong or poor grade gear oil.	Replace the gear oil.
	Drive pinion to ring gear backlash incorrect.	Adjust the backlash.
	Worn or chipped ring gear, pinion gear or side gear.	Replace the ring gear, pinion gear or side gear.
	Pinion shaft bearing worn.	Replace the pinion shaft bearing.
	Wheel bearing worn.	Replace the wheel bearing.
	Differential bearing loose or worn.	Tighten or replace.
Wanders and Pulls	Wheel bearing preload too tight.	Adjust the wheel bearing preload.
	Incorrect front alignment.	Adjust the front alignment.
	Steering linkage loose or worn.	Tighten or replace.
	Steering gear out of adjustment.	Adjust or replace the steering gear.
	Tire worn or improperly inflated.	Adjust the inflation or replace.
	Front or rear suspension parts loose or broken.	Tighten or replace.
Front Wheel Shimmy	Wheel bearing worn or improperly adjusted.	Adjust or replace.
	Incorrect front alignment.	Adjust the front alignment.
	Worn ball joint or bush.	Replace the ball joint or bush.
	Steering linkage loose or worn.	Tighten or replace.
	Steering gear out of adjustment.	Tighten or replace.
	Tire worn or improperly inflated.	Replace or adjust the inflation.
	Shock absorber worn.	Replace the shock absorber.

Pinion Shaft Oil Seal

Pinion Shaft Oil Seal and Associated Parts

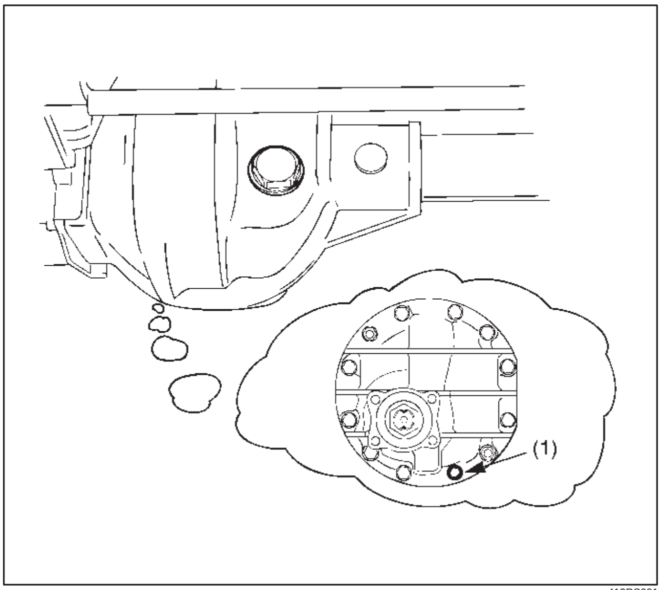


415RW015

Legend
(1) Flange Nut
(2) Flange
(3) Oil Seal
(4) Outer Bearing
(5) Collapsible Spacer

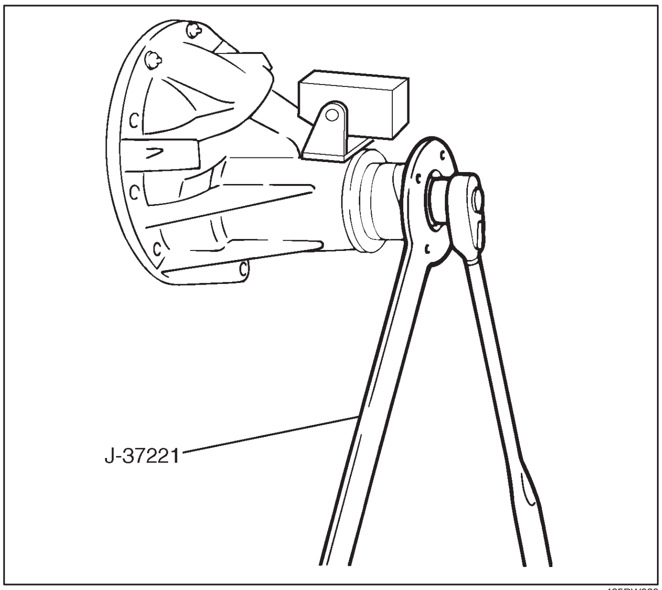
Removal

1. Raise the vehicle and support it at the frame.
   The hoist must remain under the front axle housing.
2. Drain the front axle oil by loosening the drain plug(1).



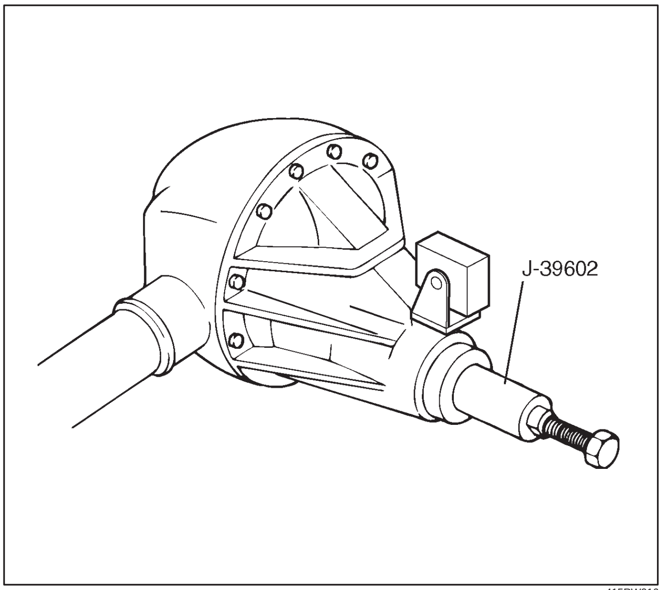
412RS001

3. Remove the front propeller shaft. Refer to Front Propeller Shaft in this section.
4. Remove flange nut by using pinion flange holder J–37221.



425RW039

5. Remove flange.
6. Remove oil seal.
7. Remove outer bearing by using remover J–39602.



415RW016

8. Remove collapsible spacer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

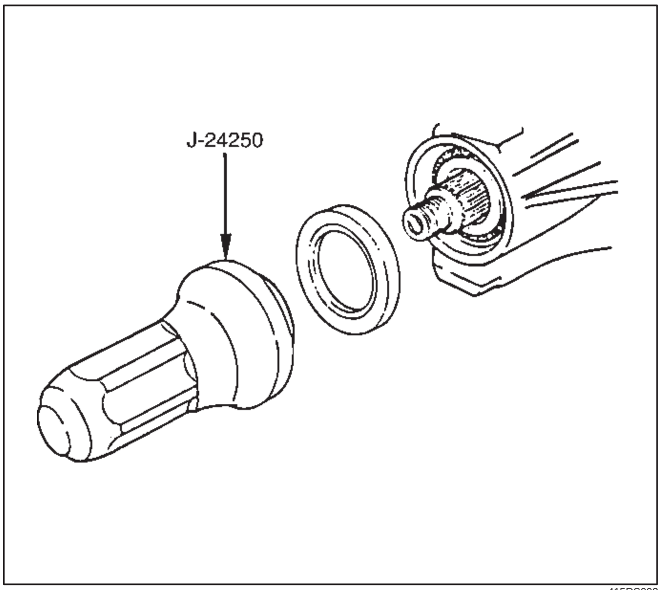
1. Seal surface of the pinion.
2. Cage bore for burns.

Installation

1. Install collapsible spacer. Discard the used collapsible spacer and install a new one.
2. Install outer bearing.

NOTE: Do not drive in, but just temporarily set in the outer bearing by hand, which should be indirectly pressed in finally by tightening the flange nut.

3. Install oil seal, use oil seal installer J–24250 to install a new oil seal that has been soaked in axle lubricant.



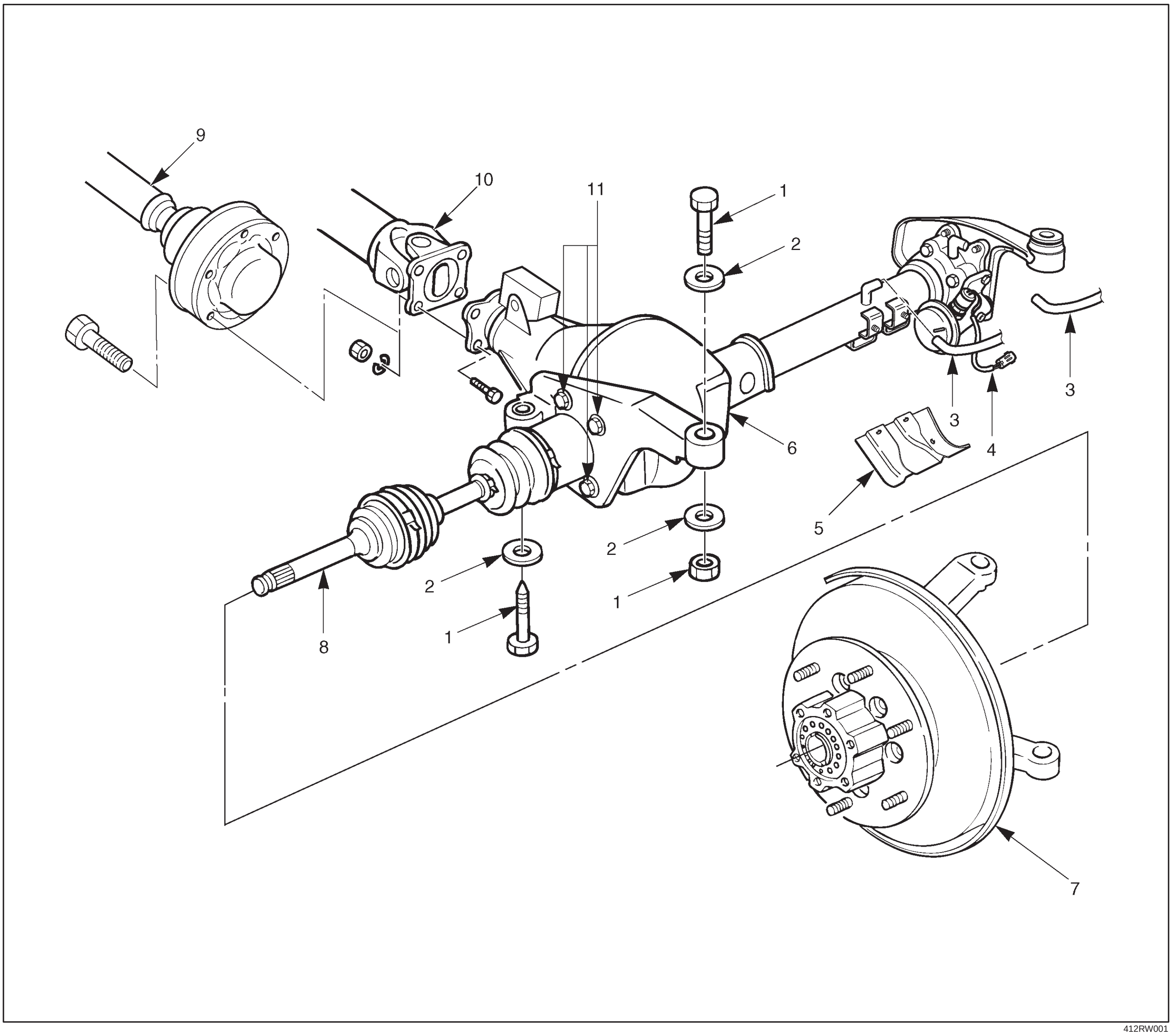
415RS002

4. Install flange.
5. Install flange nut, refer to Differential Assembly Overhaul for flange nut reassembly in this section.

NOTE: Discard the used nut and install a new one.

Front Drive Axle Assembly

Front Drive Axle Assembly and Associated Parts



Legend

(1) Mounting Bolt and Nut
(2) Washer and Spacer
(3) Breather Hose
(4) Shift Switch Connector
(5) Protector
(6) Front Axle Case Assembly and Front Drive Shaft Assembly (LH side)
(7) Hub Assembly (Disc, Back Plate and Knuckle)
(8) Front Drive Shaft Assembly (RH side)
(9) Propeller Shaft (with TOD)
(10) Propeller Shaft
(11) Bolt

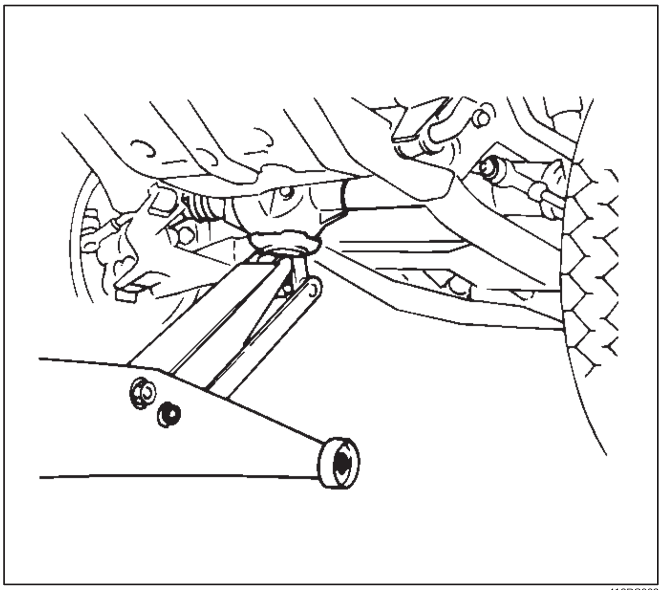
Removal

1. Jack up the vehicle and support it using jack stands.
2. Remove the tire and wheel.

3. Remove the drain bolt to drain differential oil.

NOTE:

a. During the work, be sure that the diff case is supported by the jack.

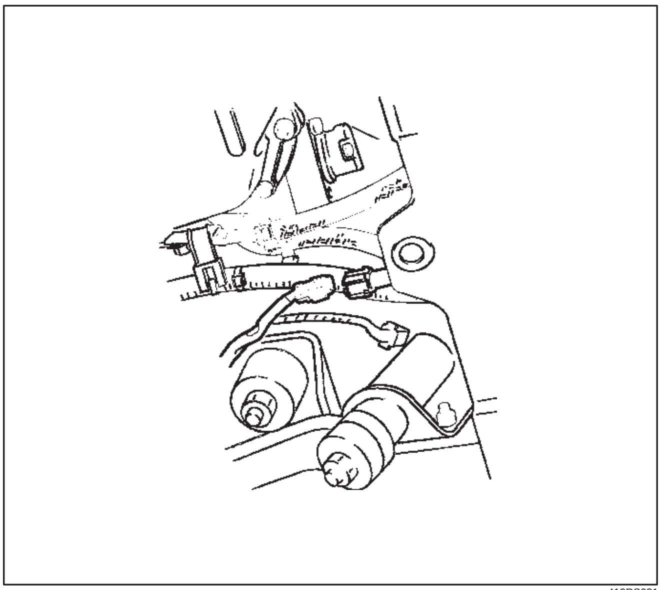


412RS003

b. Remove the brake caliper fixing bolt and hang the caliper. Refer to Disc Brakes in Brake section.

c. Remove the antilock brake system speed sensor. Refer to Front Wheel Speed Sensor in Brake section.

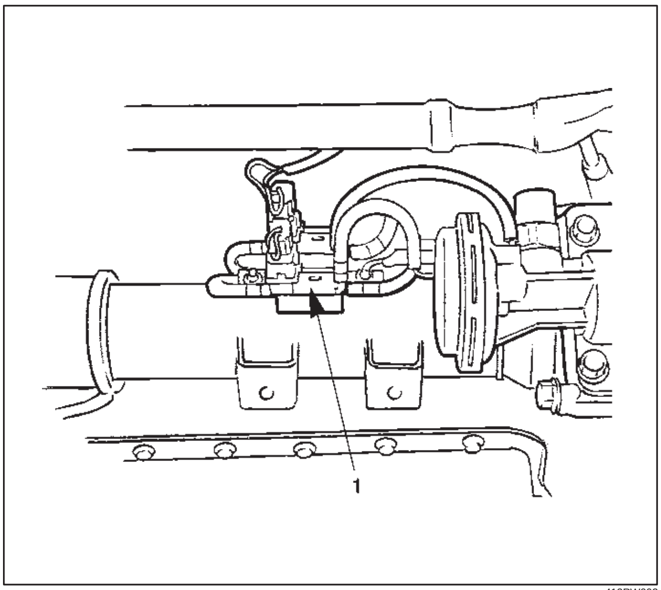
4. Remove the hub assembly (Disc, back plate and knuckle), refer to Front Hub and Disc in this section.
5. Disconnect the knuckle and the suspension arm. Refer to Suspension section.
6. Remove steering link and arm assembly, refer to Steering Linkage in Steering section.
7. Remove suspension crossmember.
8. Remove propeller shaft, refer to Front Propeller Shaft in this section.
9. Remove protector.
10. Remove breather hose.
11. Remove the hose clip.
12. Disconnect breather hose from front drive axle tube and disconnect housing.
13. Disconnect vacuum hose from actuator.
14. Disconnect shift switch connector.



412RS031

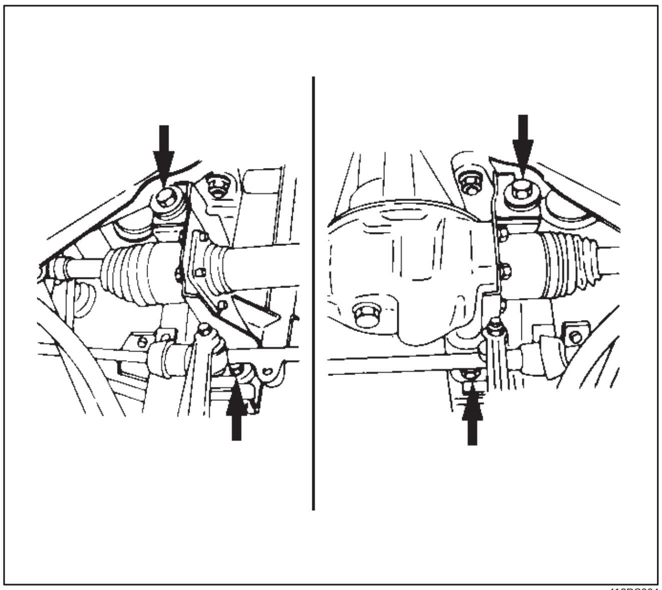
15. Remove VSV assembly (1).

NOTE: Be sure not to remove hose and connector from VSV asm.



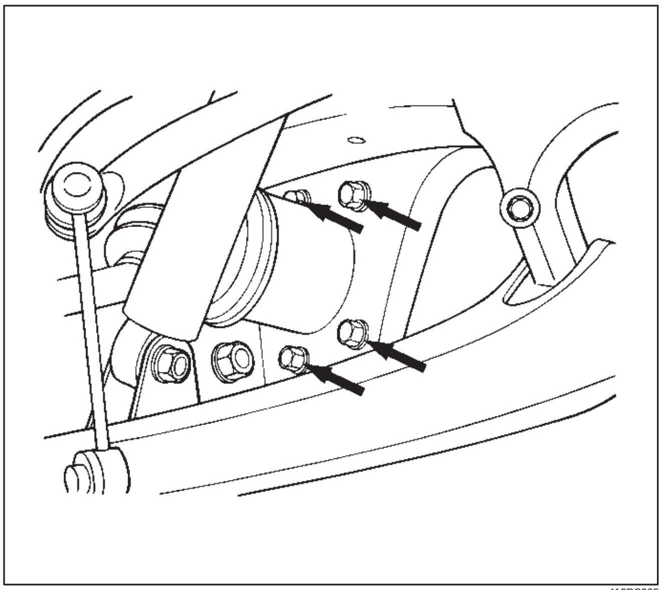
412RW002

16. Remove mounting bolt and nut.



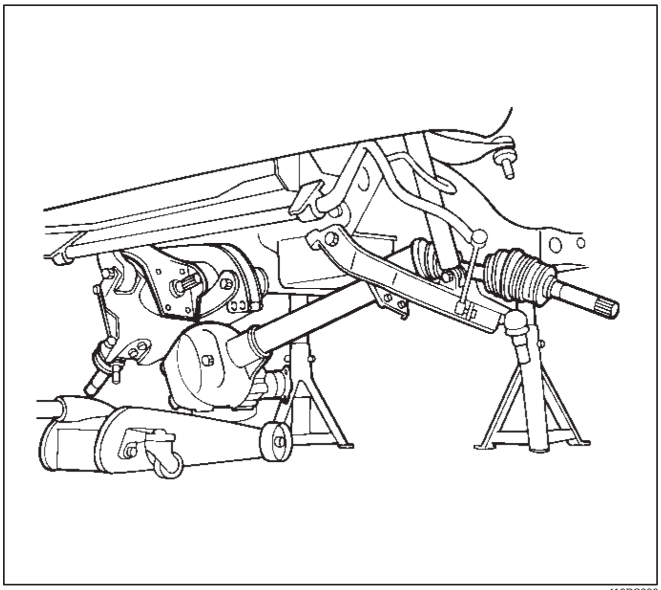
412RS004

17. Remove washer and spacer.
18. Remove the mounting bracket fixing bolt.



412RS005

19. Lower the vehicle and disconnect the RH front drive shaft assembly, then remove the front axle case assembly and front drive shaft assembly (LH).



412RS006

20. Remove front drive shaft assembly (RH).

Installation

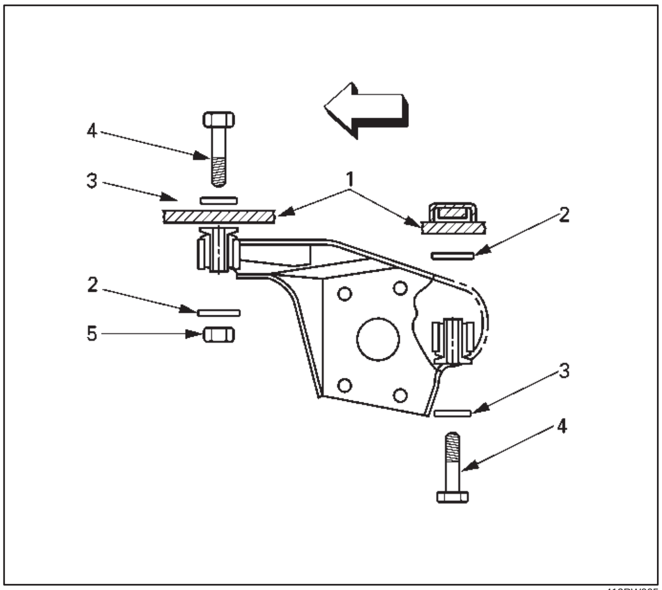
1. Install front drive shaft assembly (RH) and lay the assembly on the lower arm.
2. Install front axle case assembly and front drive shaft assembly (LH) and place the axle case on the jack, connect to the front drive shaft assembly (RH) before installing to the vehicle.
3. Install bolt and tighten the mounting bracket fixing bolt to the specified torque.

Torque: 116 N·m (85lb ft)

4. Install washer and spacer.

5. Tighten the mounting bolt and nut to the specified torque.

   Torque: 152 N·m (112lb ft)



412RW005

Legend

(1) Frame
(2) Spacer
(3) Washer
(4) Bolt
(5) Nut

6. Install VSV assembly and tighten nuts to specified torque.

   Torque: 8 N·m (69lb in)

7. Install the shift switch connector.

NOTE: Be careful not to permit the entry of dust into the connector.

8. Install the actuator side of vacuum hose.

NOTE: Be careful not to permit the entry of dust into the hose.

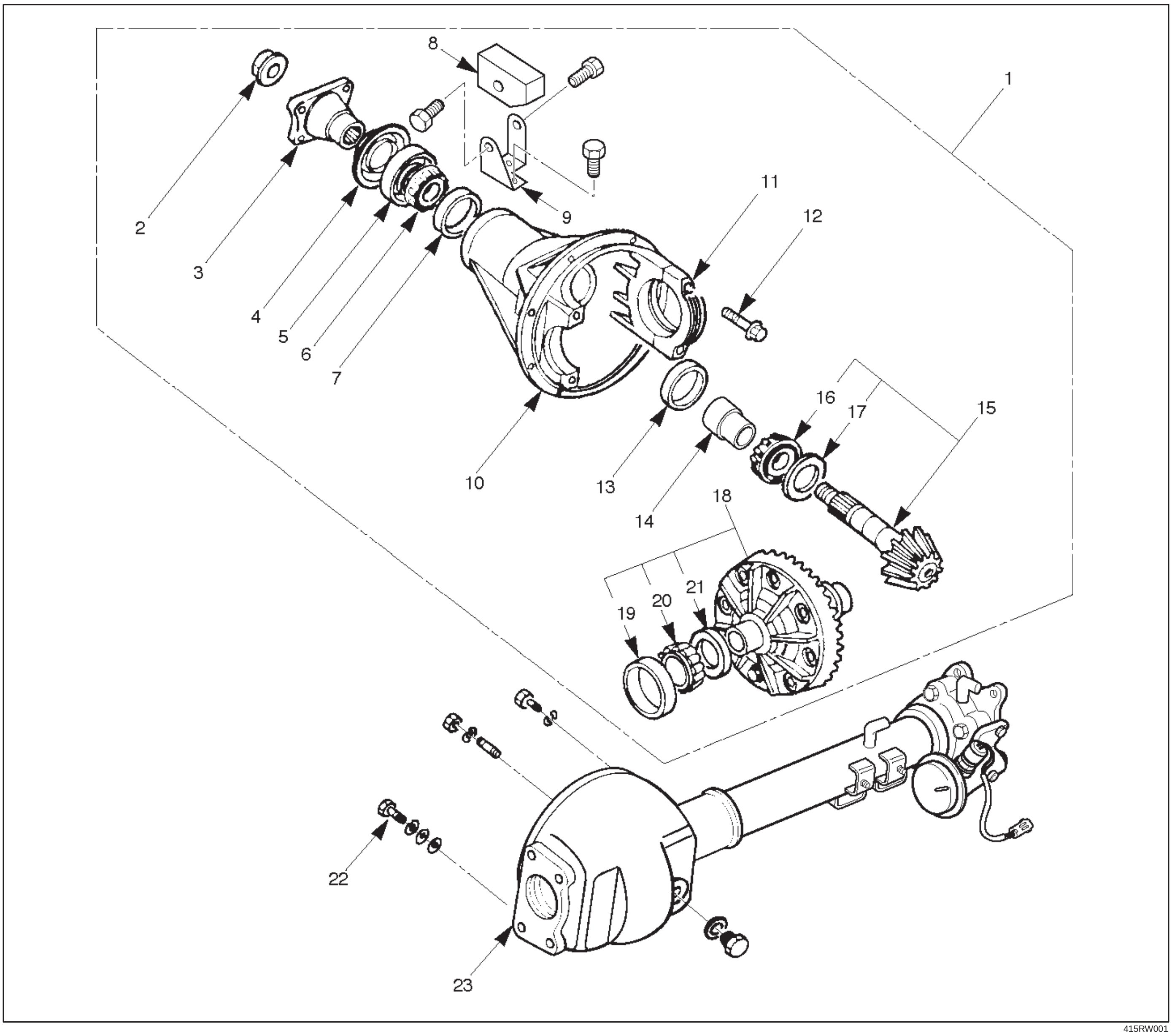
9. Connect breather hose and install the hose clip.
10. Install protector and tighten bolts to specified torque.

    Torque: 26 N·m (20lb ft)

11. Install propeller shaft, refer to Front Propeller Shaft in this section.
12. Install suspension crossmember.
13. Steering link and arm assembly, refer to Steering Linkage in Steering section.
14. Install hub assembly (Disc, back plate and knuckle), refer to Front Hub and Disc in this section.

Differential Assembly

Disassembled View



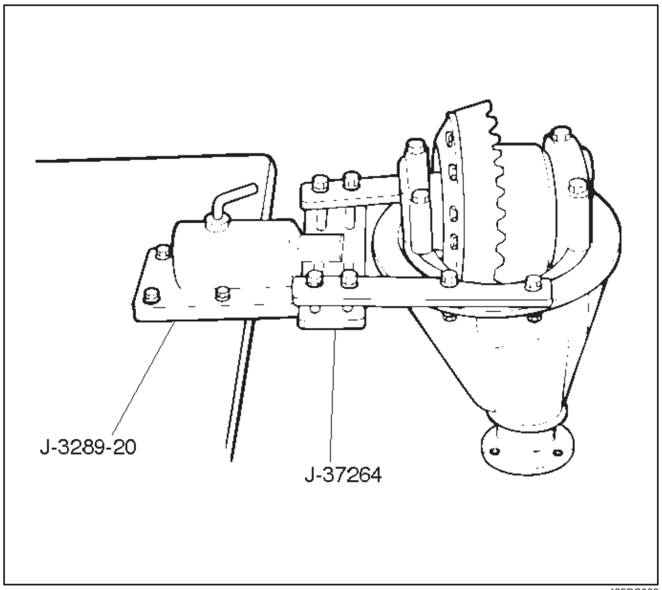
Legend

(1) Differential Assembly
(2) Flange Nut
(3) Flange
(4) Dust Cover
(5) Oil Seal
(6) Outer Bearing
(7) Outer Bearing Outer Race
(8) Damper
(9) Bracket
(10) Differential Carrier
(11) Bearing Cap
(12) Bolt
(13) Inner Bearing Outer Race
(14) Collapsible Spacer
(15) Pinion Gear
(16) Inner Bearing
(17) Adjust Shim
(18) Diff Cage Assembly
(19) Side Bearing Outer Race
(20) Side Bearing
(21) Adjust Shim
(22) Bolt
(23) Axle Case

Disassembly

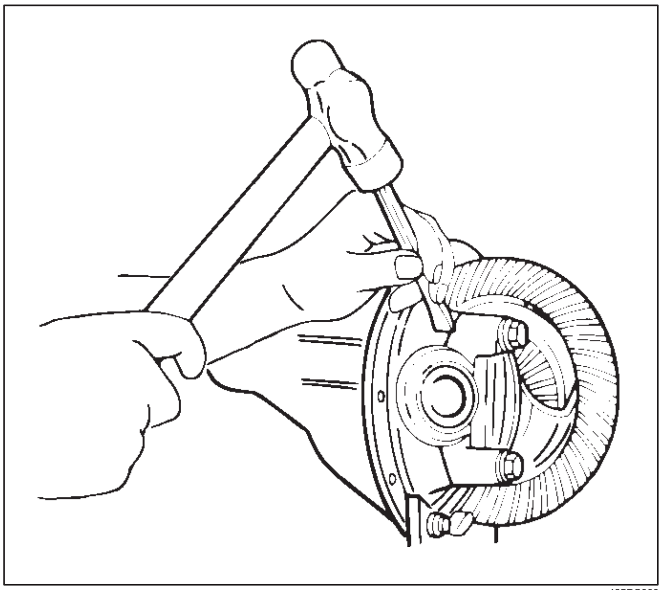
1. Remove differential carrier fixing bolt.
2. Remove differential assembly.

3. Using holding fixture J–37264 and holding fixture base J–3289–20, fix the differential assembly to the bench.



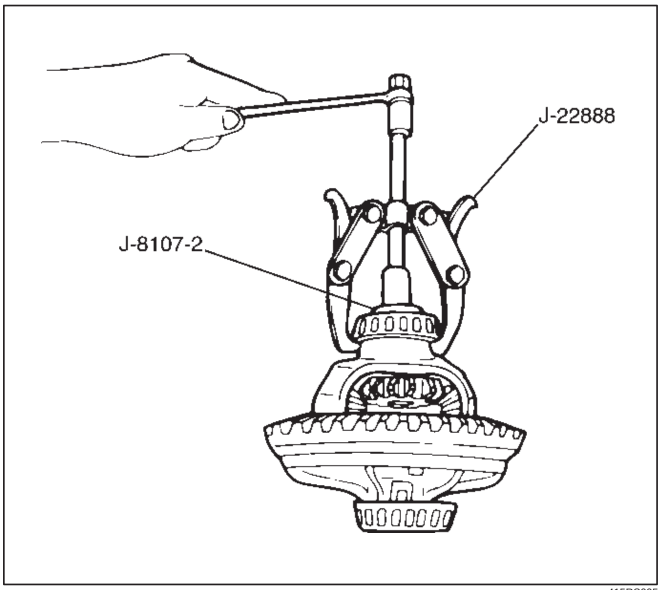
425RS008

4. Remove bearing cap bolt.
5. Apply a setting mark to the side bearing cap and the differential carrier then remove bearing cap.



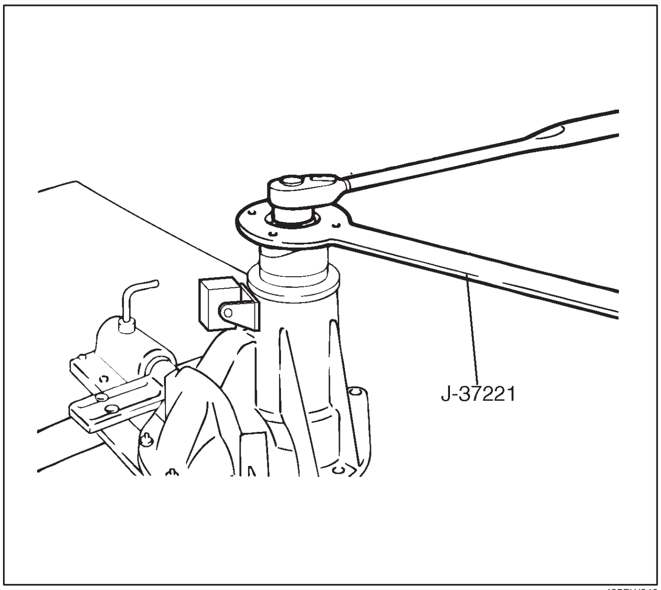
425RS009

6. Remove differential cage assembly.
7. Remove side bearing outer race, after removal, keep the right and left hand side bearing assemblies separate to maintain inner and outer race combinations.
8. Remove side bearing, using remover J–22888 and adapter J–8107–2.



415RS005

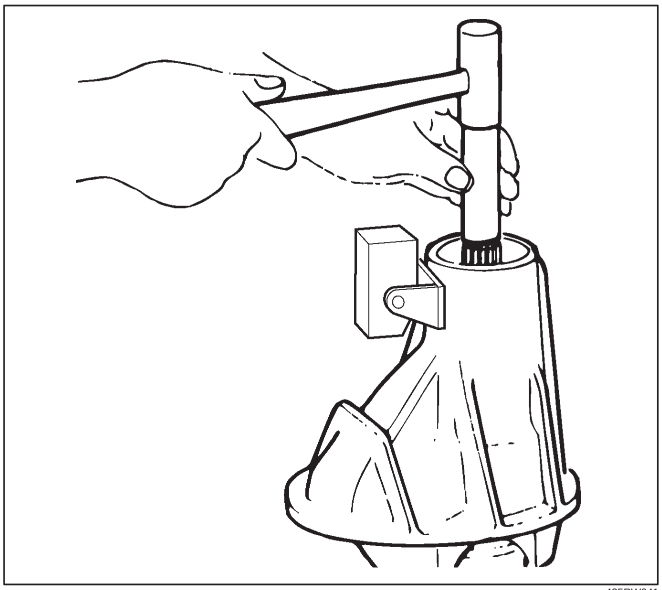
9. Remove adjust shim, note the thickness and position of the shims removed.
10. Remove the flange nut using holding wrench J–37221 after raising up its staked parts completely.



425RW040

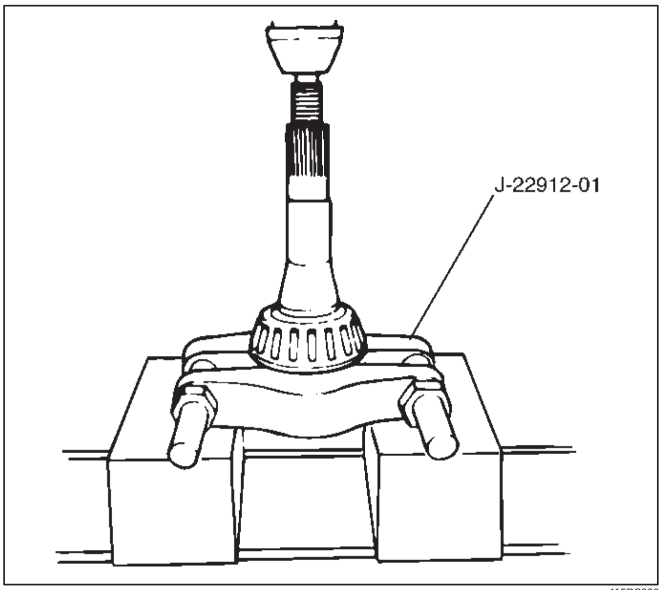
11. Remove flange.
12. Remove dust cover.

13. Remove the drive pinion assembly using a soft metal rod and a hammer.



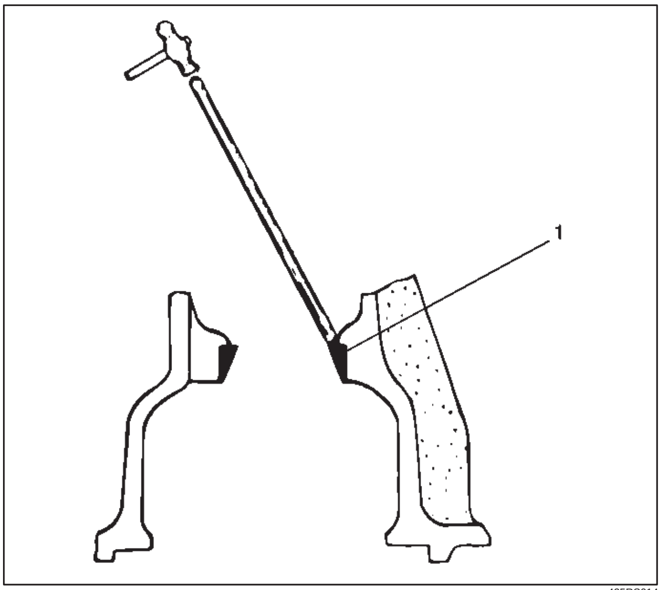
425RW041

14. Remove collapsible spacer.
15. Remove the inner bearing using a separator J–22912–01 and a press.

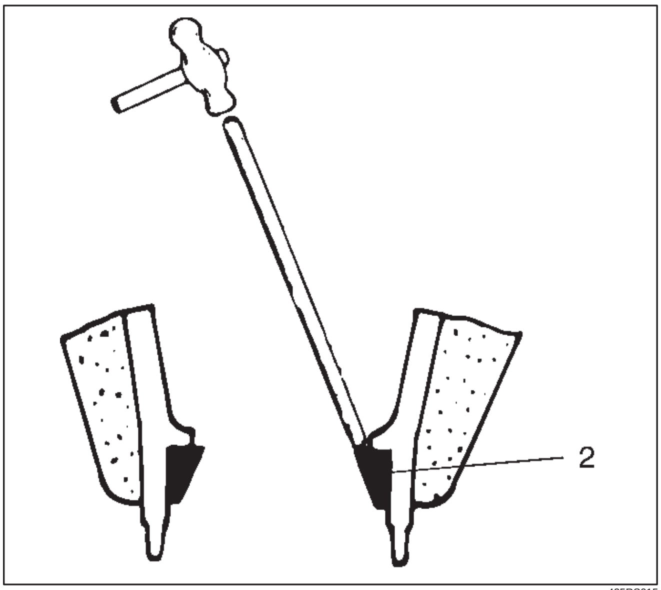


415RS006

16. Remove adjust shim.
17. Remove inner bearing outer race.
18. Remove oil seal.
19. Remove outer bearing.
20. Remove the inner bearing outer race (1) and the outer bearing outer race (2) by using a brass bar and a hammer.

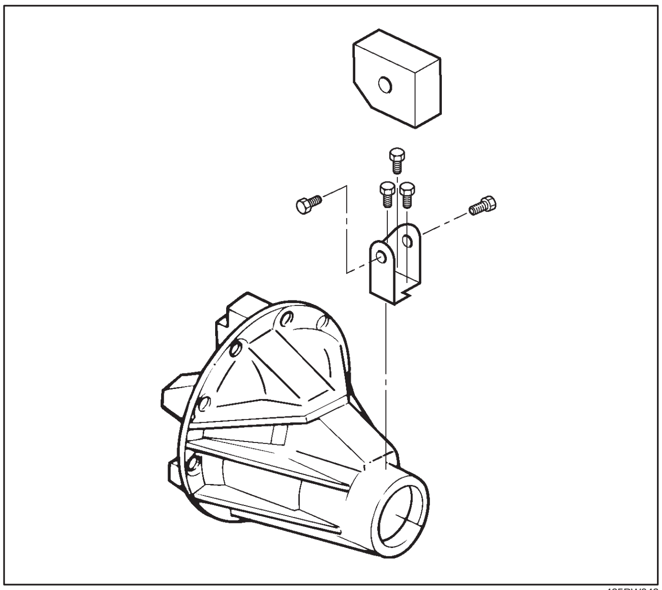


425RS014



425RS015

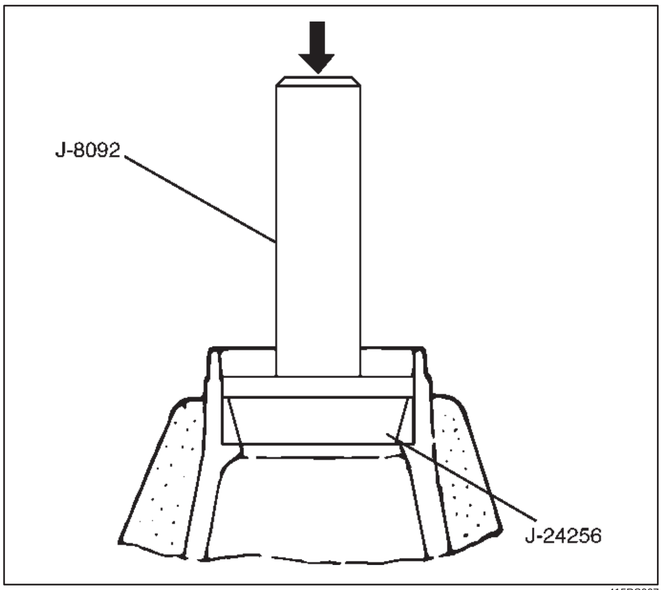
21. Remove damper and bracket.



425RW042

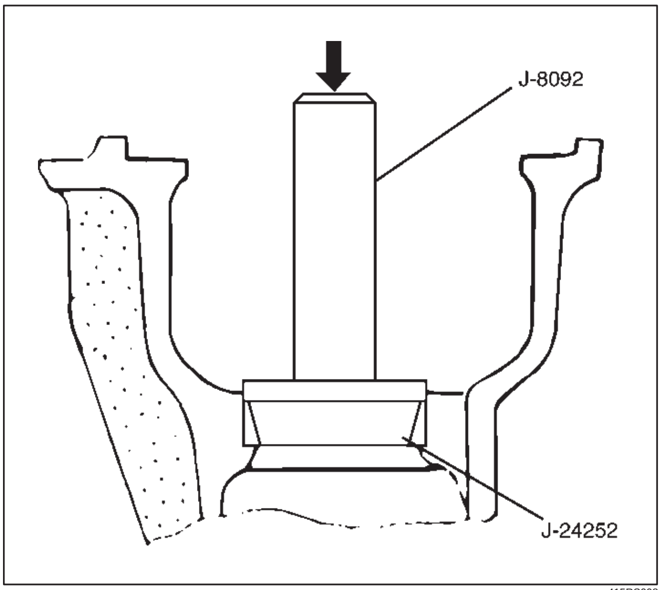
Reassembly

1. Using installer J–24256 and grip J–8092, install outer bearing outer race.



415RS007

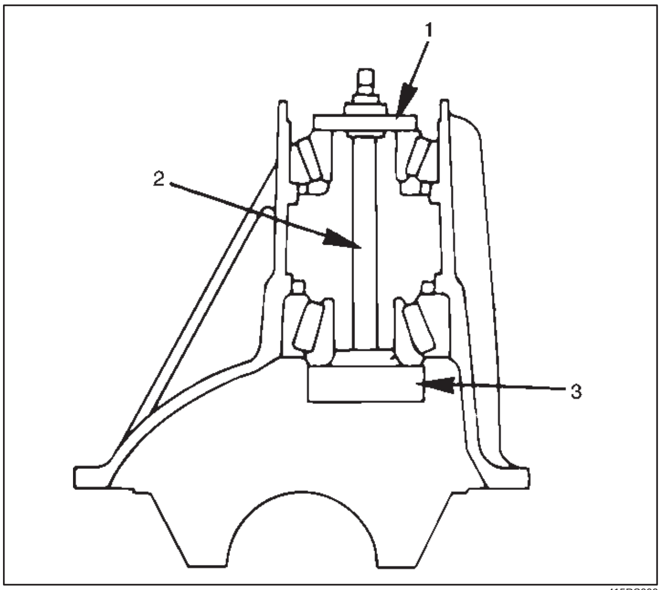
2. Using installer J–24252 and grip J–8092, install Inner bearing outer race.



415RS008

3. Install adjust shim and adjust drive pinion mounting distance
   1. Apply gear oil to the inner and outer drive pinion bearing.
      Clean the pinion setting gauge set.
      Then install the gauge set together with the inner and outer bearings.
   2. Tighten the nut to the specified torque.

Torque: 2.3 N·m (20 lb in)



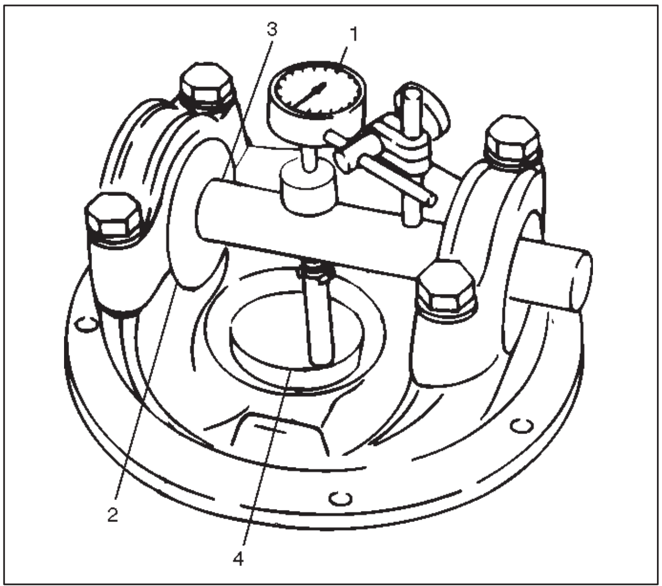
415RS009

Legend

(1) Pilot : J–21777–42
(2) Nut and Bolt : J–23597–9
(3) Gauge Plate : J–23597–7

3. Clean the side bearing bores. Install the dial indicator with the discs and arbor. Install and tighten the bearing caps to the specified torque.

Torque: 98 N·m (72 lb ft)

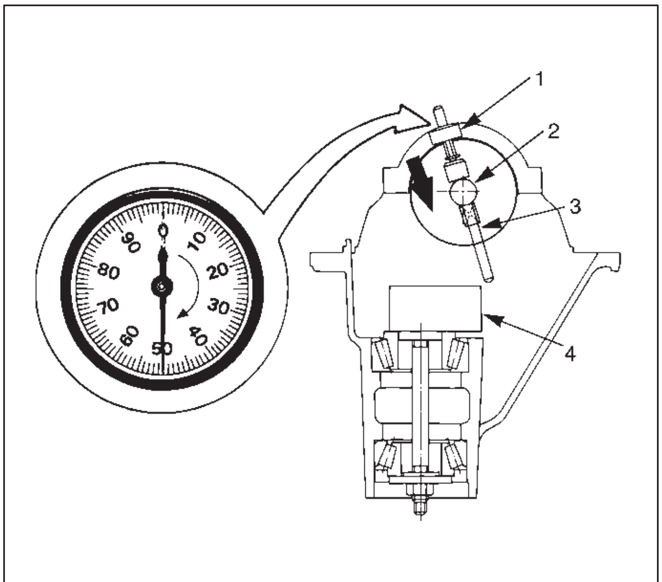


415RS010

Legend

(1) Dial Indicator: J–8001
(2) Disc (2 pcs.): J–23597–8
(3) Arbor: J–23597–1
(4) Gauge Plate: J–23597–42

4. Set the dial indicator to “0”. Place it on the mounting post of the gauging arbor with the contact button touching the indicator pad. Force the dial indicator downward until the needle has made a half turn clockwise. Tighten down the dial indicator in this position.



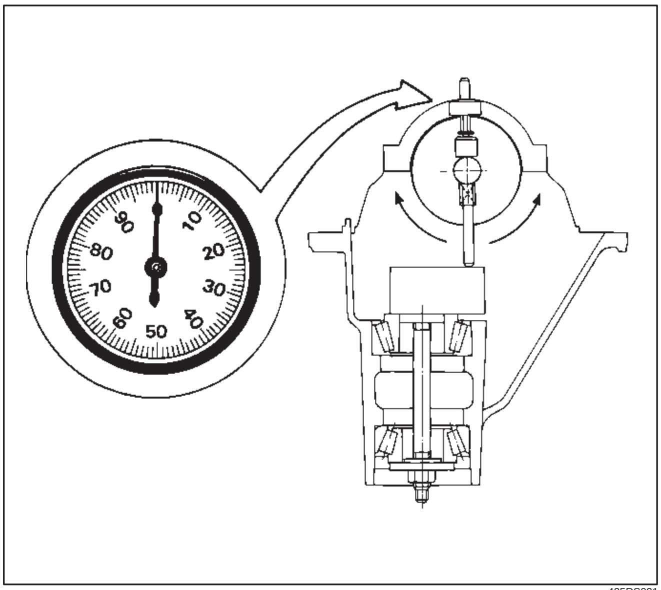
425RS020

Legend

(1) Dial Indicator
(2) Ganging Arbor
(3) Plunger
(4) Gauge Plate

5. Position the plunger on the gauge plate. Move the gauging arbor slowly back and forth and locate the position at which the dial indicator shows the greatest defection. At this point, once again set the dial indicator to “0”.

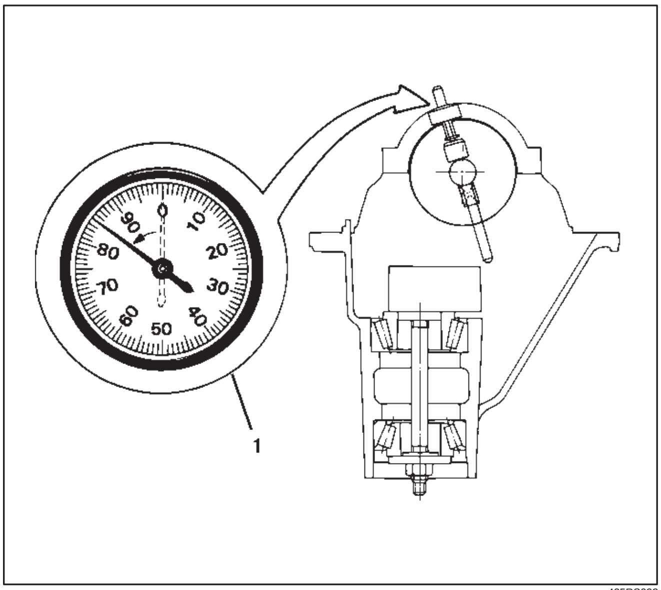
   Repeat the procedure to verify the “0” setting.



425RS021

6. After the ZERO setting is obtained, rotate the gauging arbor until the dial indicator rod does not touch the gauging plate.

   Record the number the dial indicator needle points to.



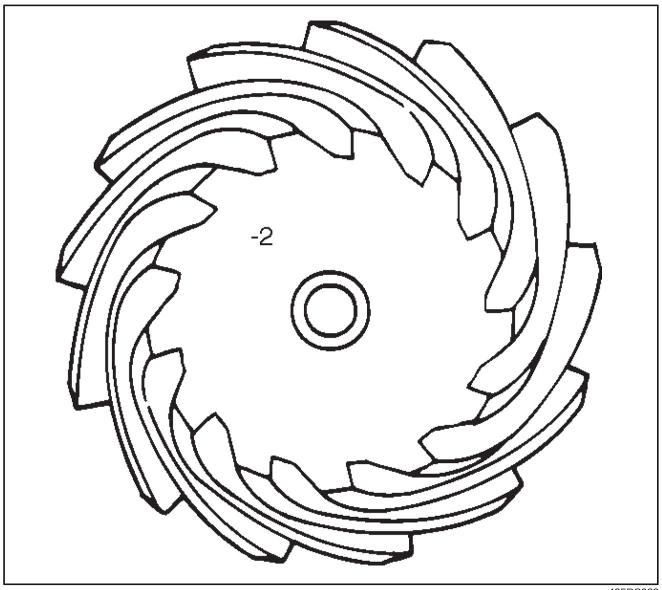
425RS022

Legend

(1) Example=Dial indicator reading of 0.085

7. Record the pinion depth code on the head of the drive pinion.

   The number indicates a necessary change in the pinion mounting distance. A plus number indicates the need for a greater mounting distance (which can be achieved by decreasing the shim thickness). A minus number indicates the need for a smaller mounting distance (which can be achieved by increasing the shim thickness). If examination reveals pinion depth code “0”, the pinion is “nominal”.



425RS023

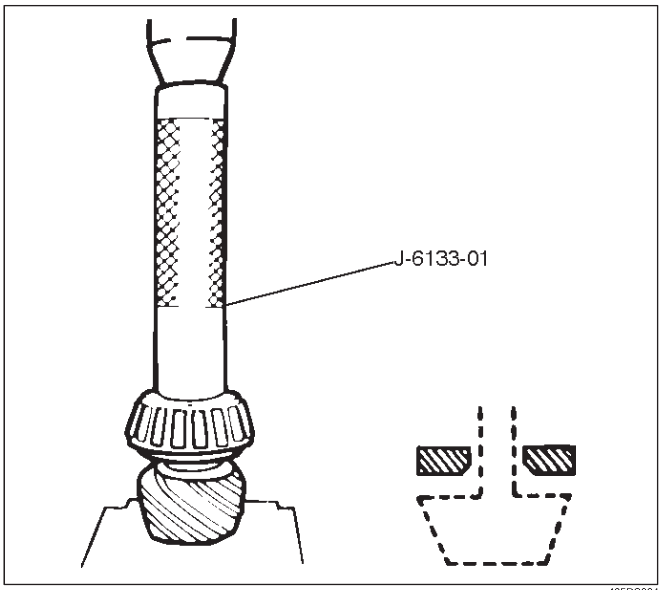
8. Select the shim using the chart;

Pinion marking	+10	+8	+6	+4	+2	0	–2	–4	–6	–8	–10
Dial indicator reading (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)	mm (Inches)
0.081											2.18 (0.0858)
0.082										2.18 (0.0858)	2.20 (0.0866)
0.083									2.18 (0.0858)	2.20 (0.0866)	2.23 (0.0882)
0.084								2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)
0.085							2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)
0.086						2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)
0.087					2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)
0.088				2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)
0.089			2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)
0.090		2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)
0.091	2.18 (0.0858)	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)
0.092	2.20 (0.0866)	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)
0.093	2.24 (0.0882)	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)
0.094	2.26 (0.0890)	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)
0.095	2.28 (0.0898)	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)
0.096	2.32 (0.0914)	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)
0.097	2.34 (0.0921)	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)	
0.098	2.36 (0.0929)	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)		
0.099	2.38 (0.0937)	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)			
0	2.42 (0.0953)	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)				
0.001	2.44 (0.0961)	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)					
0.002	2.46 (0.0969)	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)						
0.003	2.48 (0.0977)	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)							
0.004	2.52 (0.0992)	2.54 (0.1000)	2.56 (0.1008)								
0.005	2.54 (0.1000)	2.56 (0.1008)									
0.006	2.56 (0.1008)										

NOTE: When ordering shims, find the part number in the parts catalog by using the thickness of shims listed in the above table.

4. Place the shim on the drive pinion, with the chamfered side turned towards the pinion head then install the inner bearing onto the pinion using an installer J–6133–01 and a press.

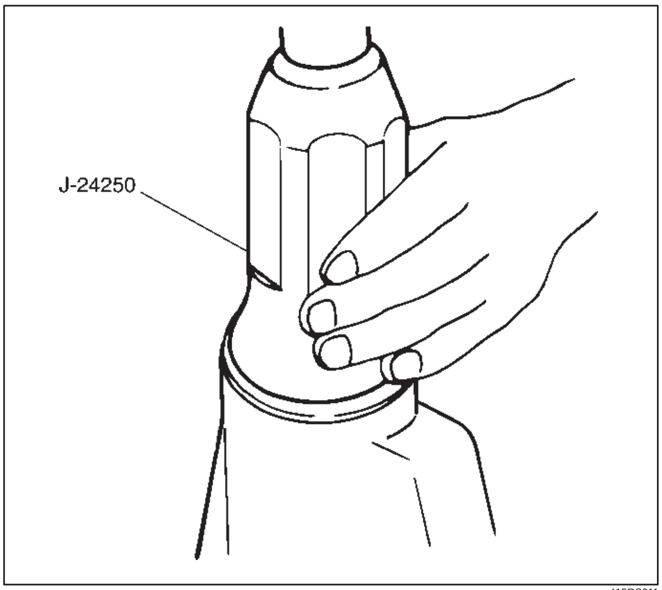
NOTE: Do not apply pressure to the roller cage and apply pressure only to the inner race.



425RS024

5. Discard the used collapsible spacer and install a new one.
6. Install pinion gear.
7. Install outer bearing.
8. Use oil seal installer J–24250 to install a new oil seal that has been soaked in rear axle lubricant.

NOTE: Take care to use a front differential oil seal, NOT the rear differential oil seal.

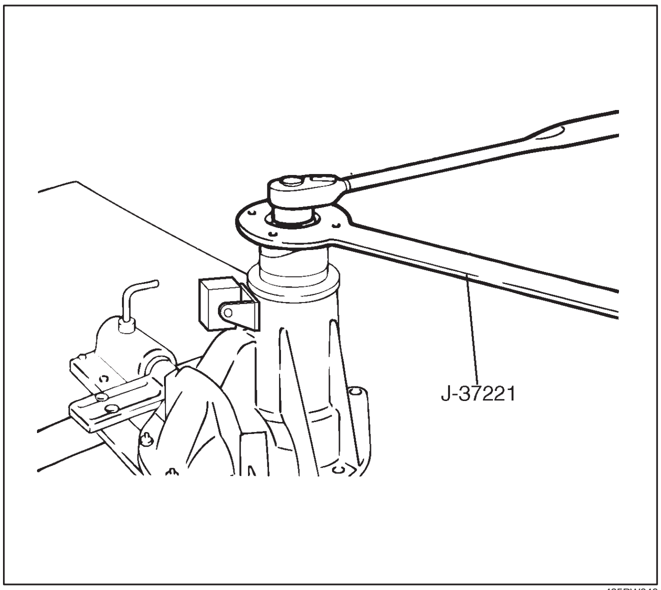


415RS011

9. Install dust cover.
10. Install flange.
11. Install flange nut.
    1. Apply lubricant to the pinion threads.
    2. Tighten the nut to the specified torque using the pinion flange holder J–37221.

Torque: 177–275N·m (130–203 lb ft)

NOTE: Discard used flange nut and install new one and do not over tighten the flange nut.



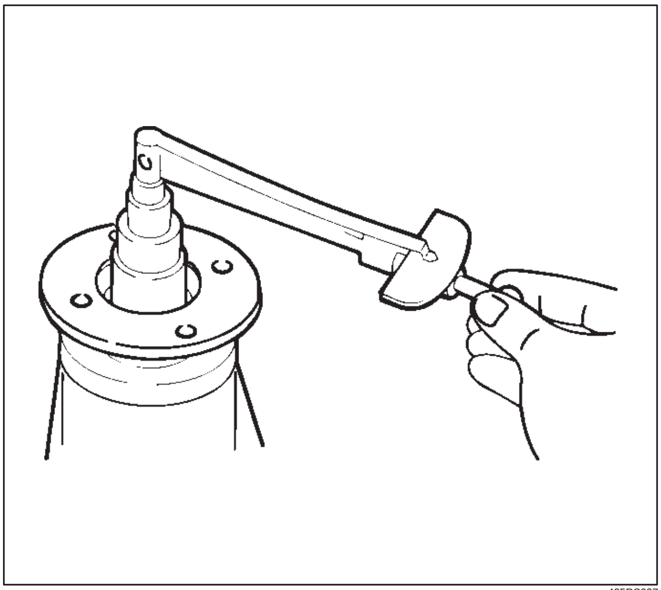
425RW040

3. Adjust pinion bearing preload.
   a. Measure the bearing preload by using a torque meter. Note the scale reading required to rotate the flange.
   b. Continue tightening flange nut until the specified starting torque is obtained.

Starting torque:

New bearing 0.7–1.1 N·m(5.64–9.98 lb in)

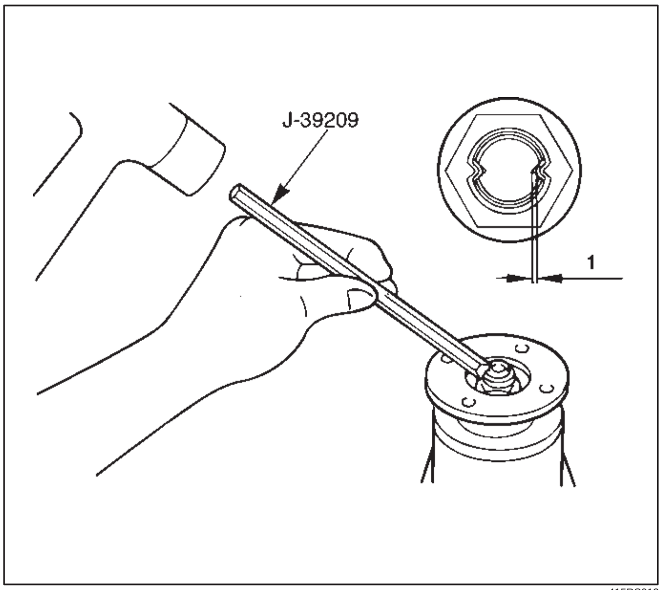
Used bearing 0.4–0.5N·m(2.86–4.94lb in)



425RS027

4. Using punch J–39209, stake the flange nut at two points.

NOTE: When staking, be sure to turn the nut to insure that there is no change in bearing preload. Make sure of preload again as instructed in 3).

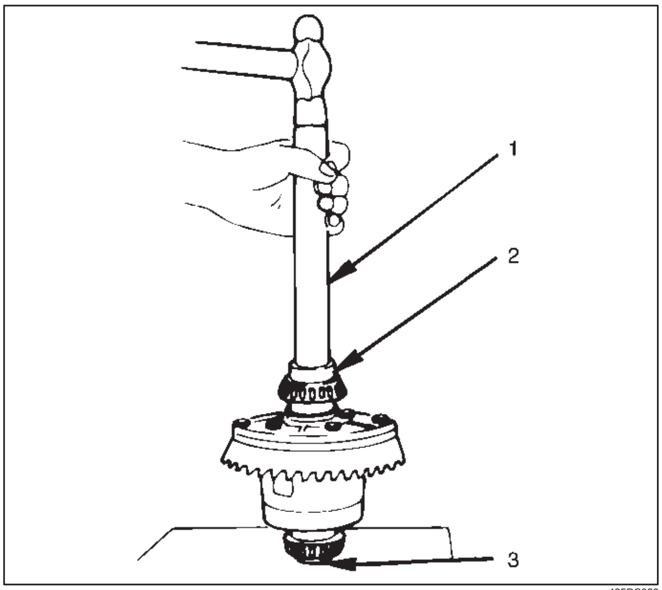


415RS012

Legend

(1) 1.3mm or less

12. Install adjust shim.
    1. Attach the side bearing to the differential assembly without shims. Support the opposite side using a pilot to prevent bearing damage.

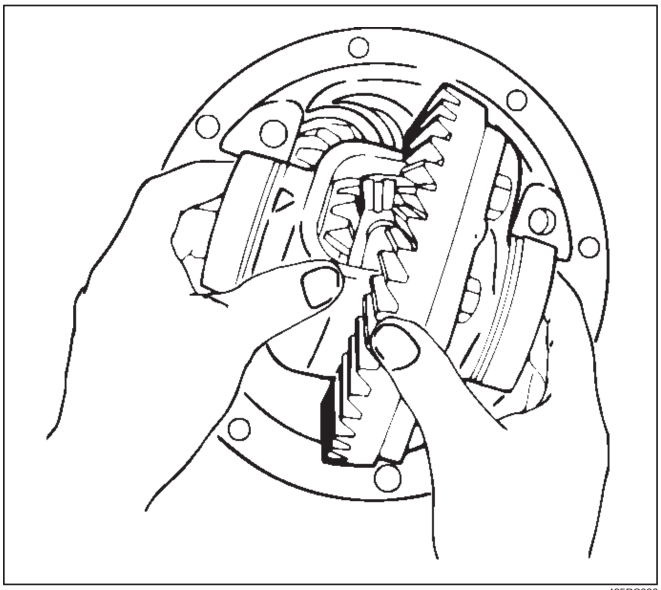


425RS029

Legend

(1) Drive handle:J–8092
(2) Installer:J–24244
(3) Pilot:J–8107–2

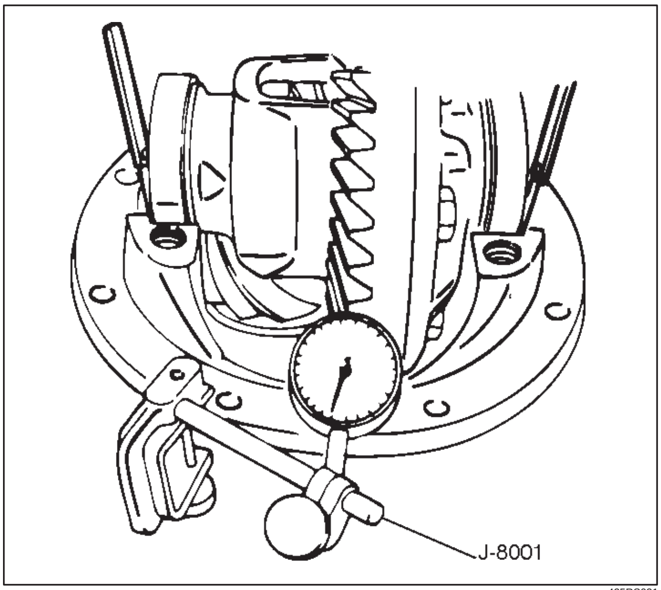
2. Insert the differential cage assembly with bearing outer races into the side bearing bores of the carrier.



425RS030

3. Using two sets of feeler gauges, insert a feeler stock of sufficient thickness between each bearing outer race and the carrier to remove all end play. Make certain the feeler stock is pushed to the bottom of the bearing bores.

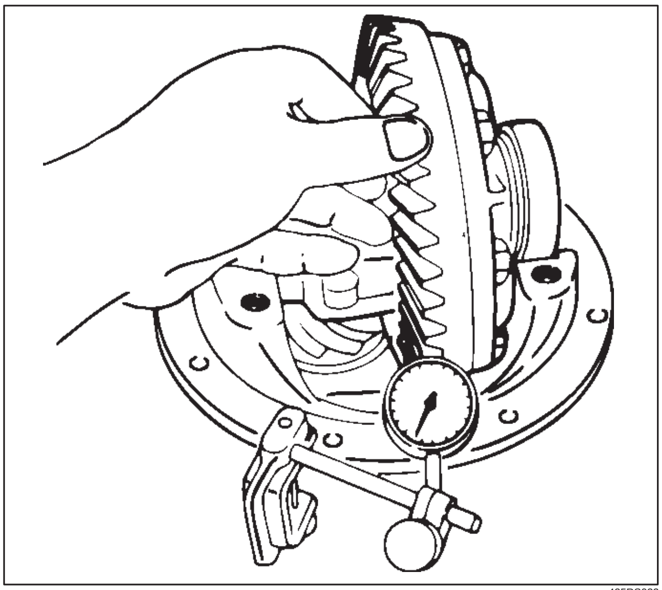
   Mount the dial indicator J–8001 on the carrier so that the indicator stem is at right angles to a tooth on the ring gear.



425RS031

4. Adjust feeler gauge thickness from side to side until ring gear backlash is in the specified range.

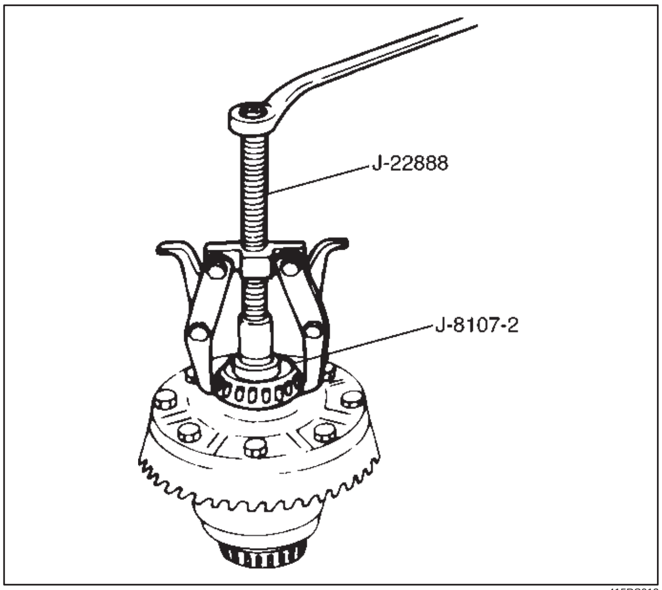
Backlash: 0.13–0.18 mm(0.005 –0.007 in)



425RS032

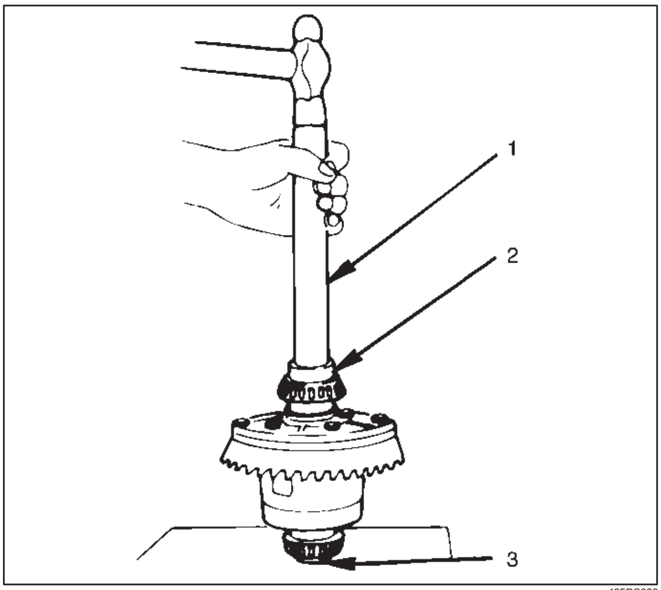
With zero end play and correct backlash established, remove the feeler gauge packs, determine the thickness of the shims required and add 0.05 mm (0.002 in) to each shim pack to provide side bearing preload. Always use new shims.

5. Use bearing remover J–22888 and pilot J–8107–2 to remove side bearing.



415RS013

13. Install the side bearings together with the selected shims.

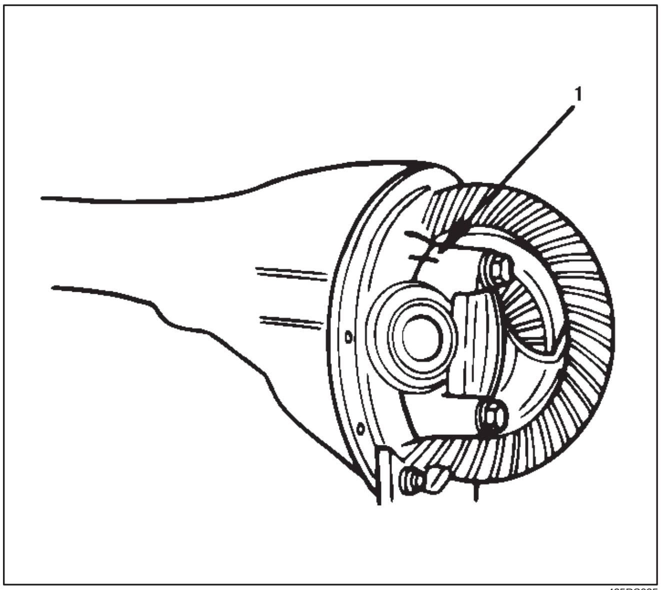


425RS029

Legend

(1) Drive Handle:J–8092
(2) Installer: J–24244
(3) Pilot: J–8107–2

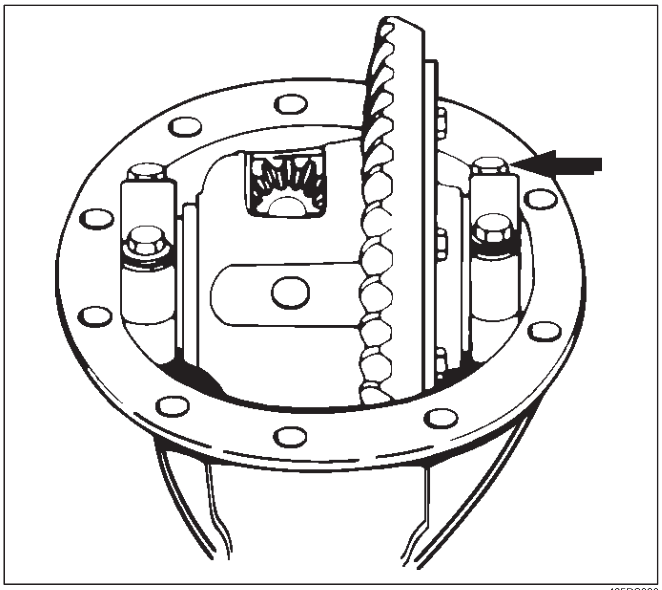
14. Install side bearing outer race.
15. Install differential cage assembly.
16. Install bearing cap then align the setting marks(1) applied at disassembly.



425RS035

17. Tighten the cap bolt to the specified torque.

Torque: 98 N·m (72 lb ft)

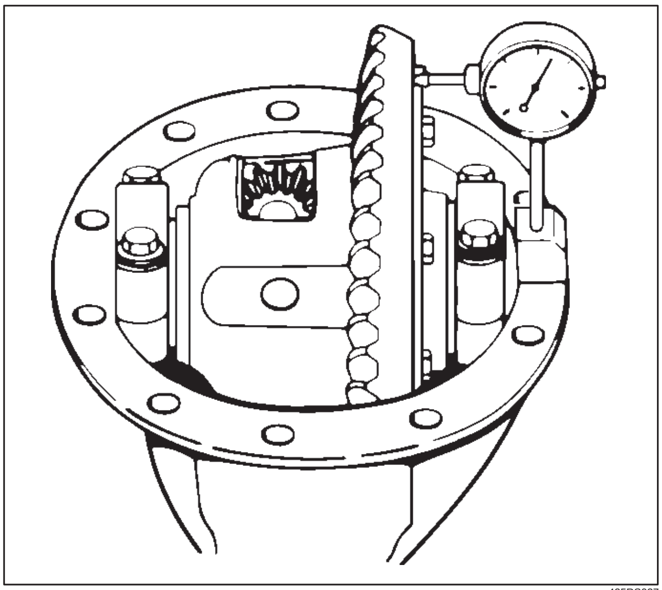


425RS036

1. Measure the amount of run–out of the ring gear at its rear face.

Standard: 0.02 mm (0.001 in)

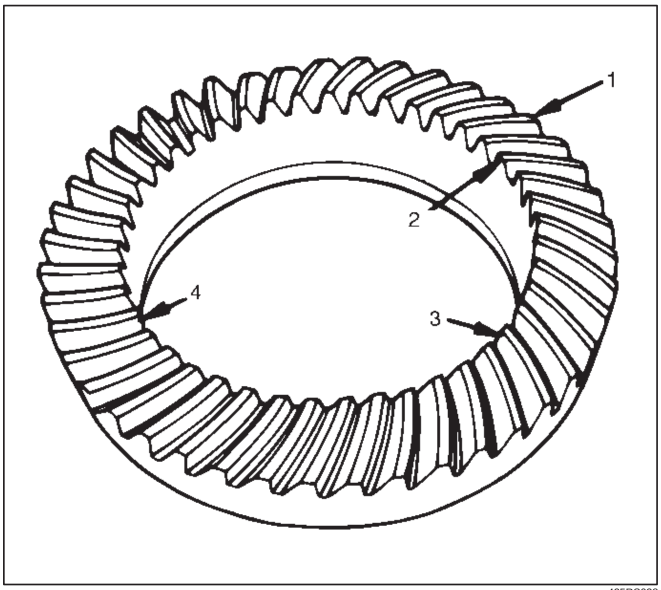
Limit: 0.05 mm (0.002 in)



425RS037

Gear Tooth Contact Pattern Check and Adjustment

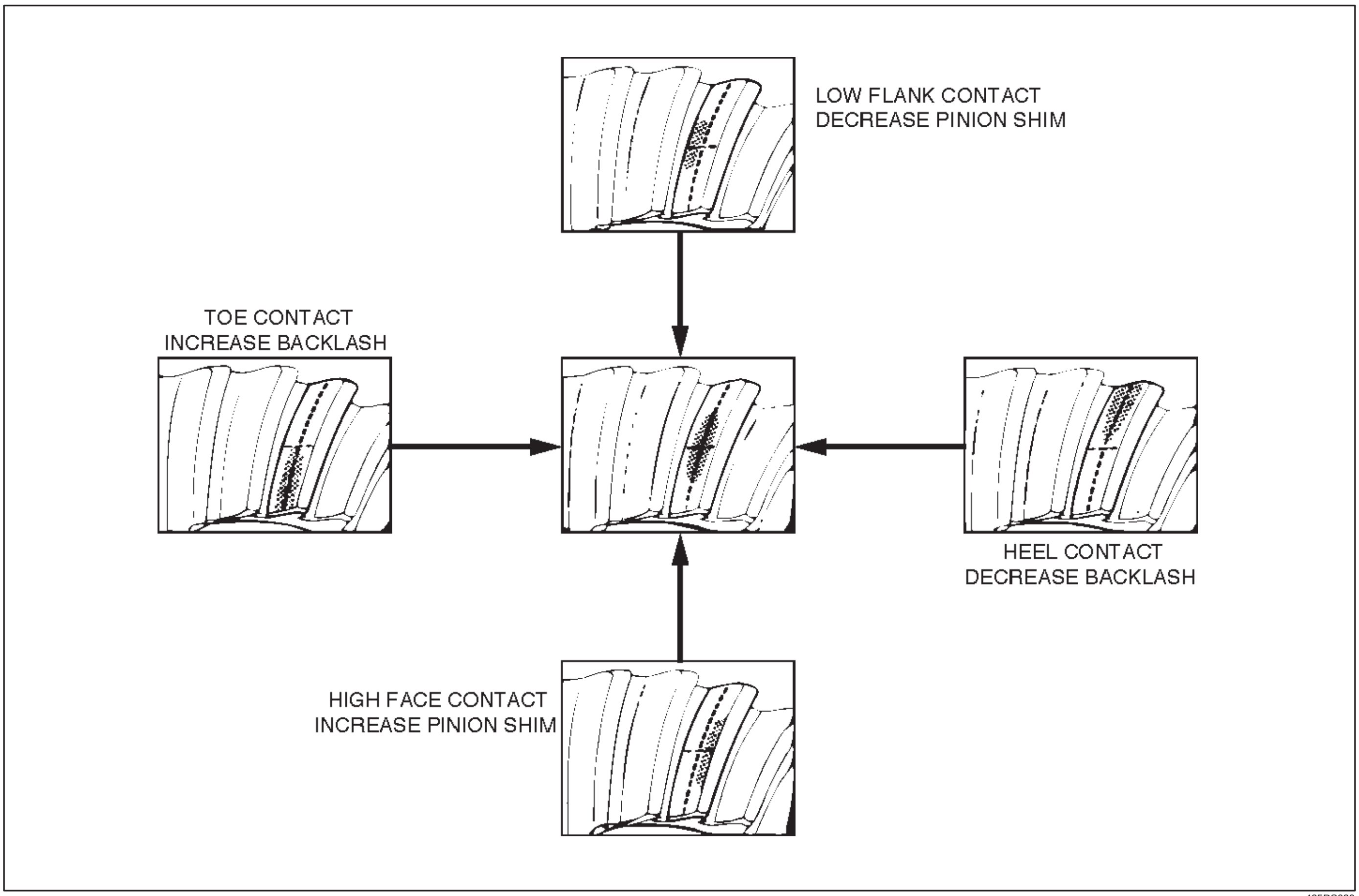
1. Apply a thin coat of prussian blue or equivalent to the faces of the 7–8 teeth of the ring gear. Check the impression of contact on the ring gear teeth and make necessary adjustment as described in illustration if the contact is abnormal.



425RS038

Legend

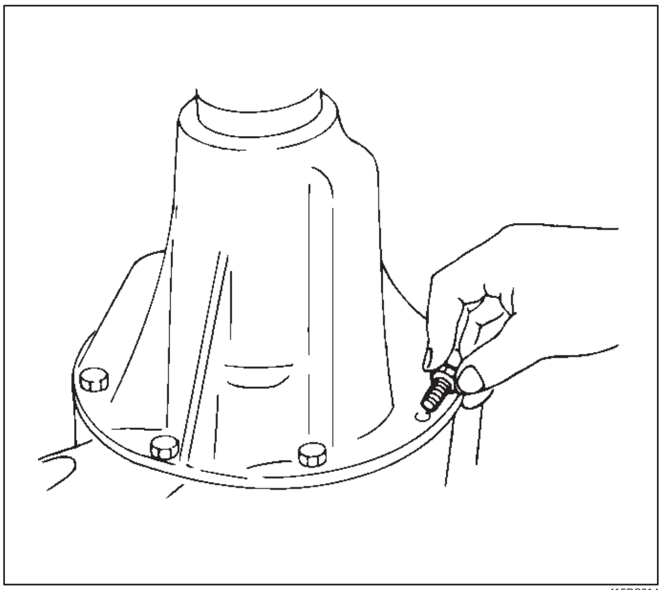
(1) Heel
(2) Toe
(3) Concave Side(Coast)
(4) Convex Side(Drive)



425RS039

18. Install differential assembly.
    1. Clean the faces of the front axle case and differential carrier.
       Apply Three Bond TB1215 or equivalent to the sealing side of the axle case and the carrier.
    2. Attach the differential case and the carrier assembly to the front axle case and tighten the nuts and bolts.

Torque: 25 N·m (19 lb ft)



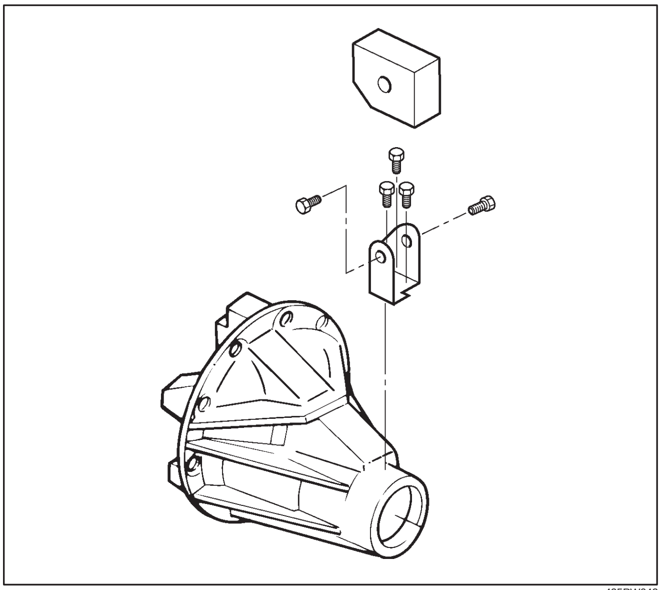
415RS014

3. Fill the axle case with hypoid gear lubricant, to just below the filler hole.

Lubricant capacity: 1.4 liter(1.5 US qt)

19. Install damper.
    1. Clean the faces and bolt thread hole of differential carrier.
    2. Install the bracket with new bolts.
    3. Install the damper to the bracket with new bolts.

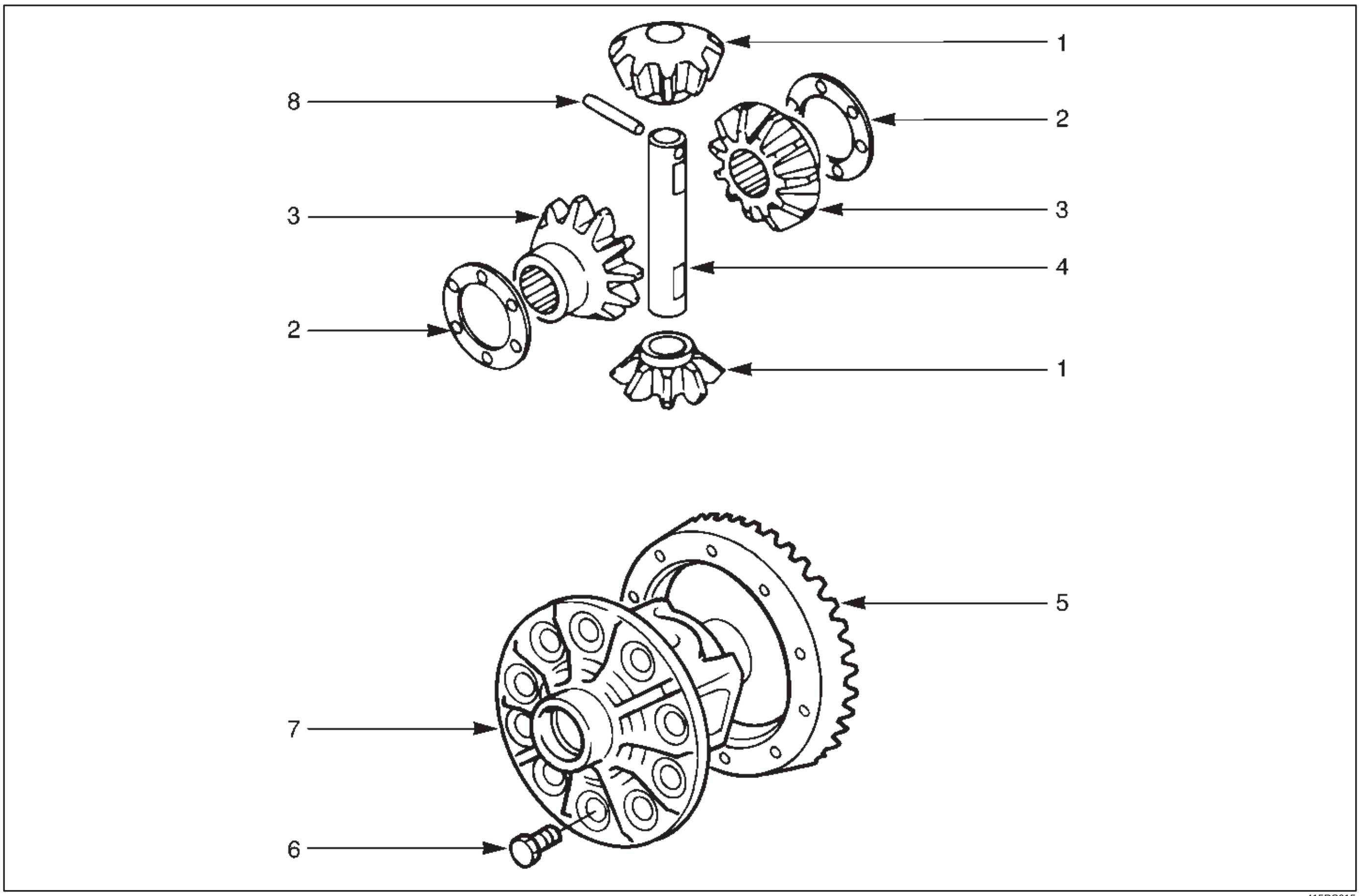
Torque: 25 N·m (19 lb ft)



425RW042

Differential Cage Assembly

Disassembled View

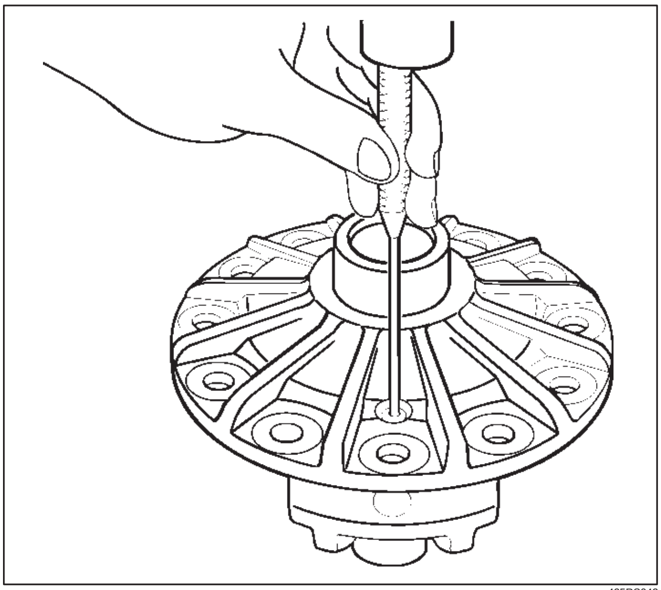


415RS015

Legend
(1) Pinion Gear
(2) Thrust Washer
(3) Side Gear
(4) Cross Pin
(5) Ring Gear
(6) Bolt
(7) Differential Cage
(8) Lock Pin

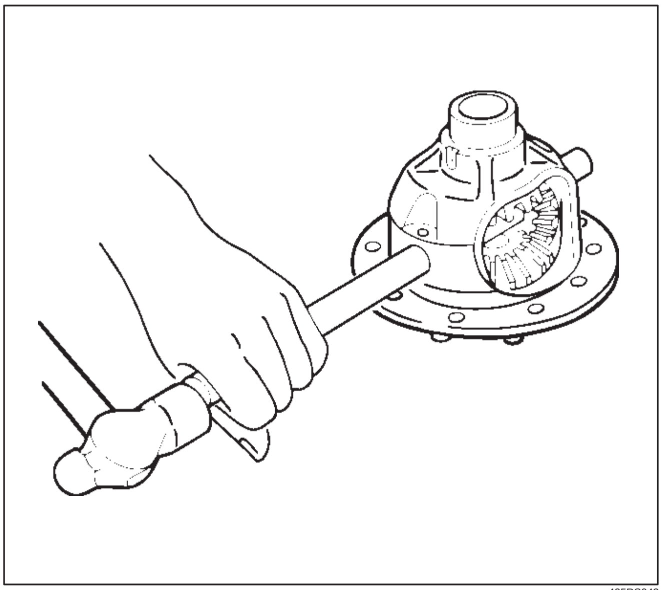
Disassembly

1. Remove bolt.
2. Remove ring gear.
3. Remove lock pin, break staking on the lock pin, using a 5 mm (0.20 in) diameter drill.



425RS042

4. Remove the cross pin, using a soft metal rod and a hammer.



425RS043

5. Remove pinion gear.
6. Remove side gear.
7. Remove thrust washer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

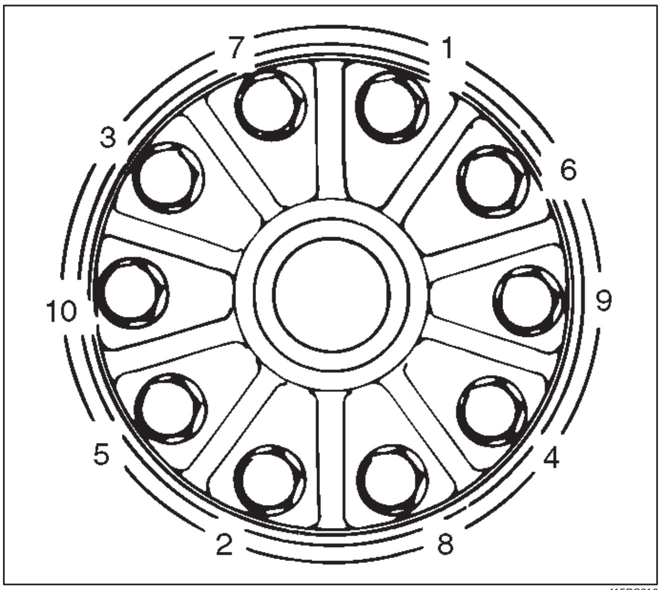
1. Ring gear, pinion gear
2. Bearing
3. Side gear, pinion gear, cross pin
4. Differential cage, carrier
5. Thrust washer
6. Oil seal

Ring gear replacement:

1. The ring gear should always be replaced with the drive pinion as a set.
2. Clean the ring gear threaded holes to remove the locking agent.
3. When installing the ring gear, apply LOCTITE 271 or equivalent to all the threaded area and half of the unthreaded area of the bolt.
4. Discard used bolts and install new ones.

Torque: 108 N·m (80 lb ft)

5. Tighten the fixing bolts in a diagonal sequence as illustrated.

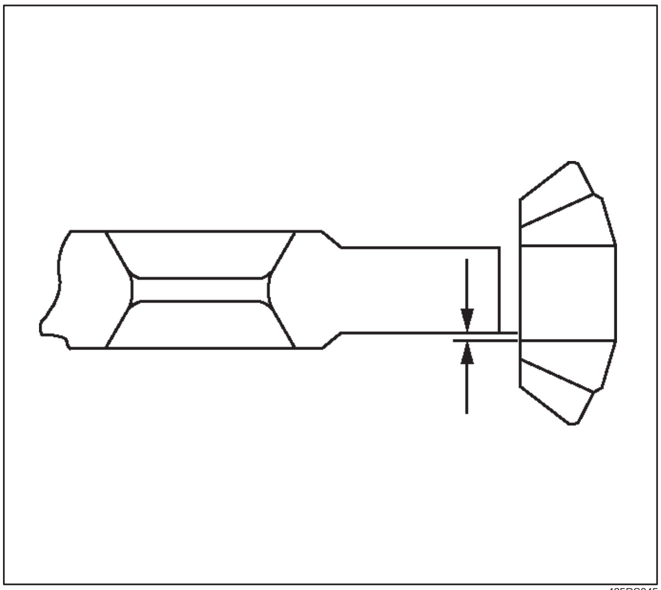


415RS016

Clearance between the differential pinion and the cross pin measurement:

Standard: 0.06 – 0.12 mm (0.002–0.005 in)

Limit: 0.2 mm (0.008 in)

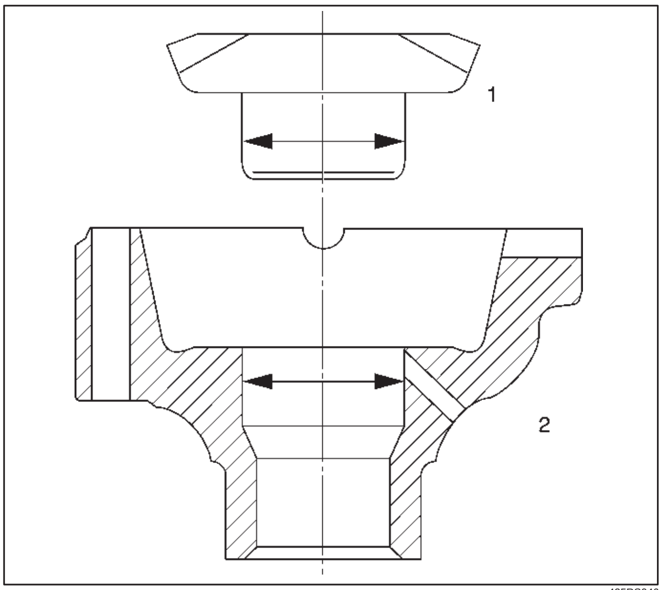


425RS045

Clearance between the side gear and the differential box:

Standard: 0.03–0.10 mm (0.001–0.004 in)

Limit: 0.15 mm(0.006 in)



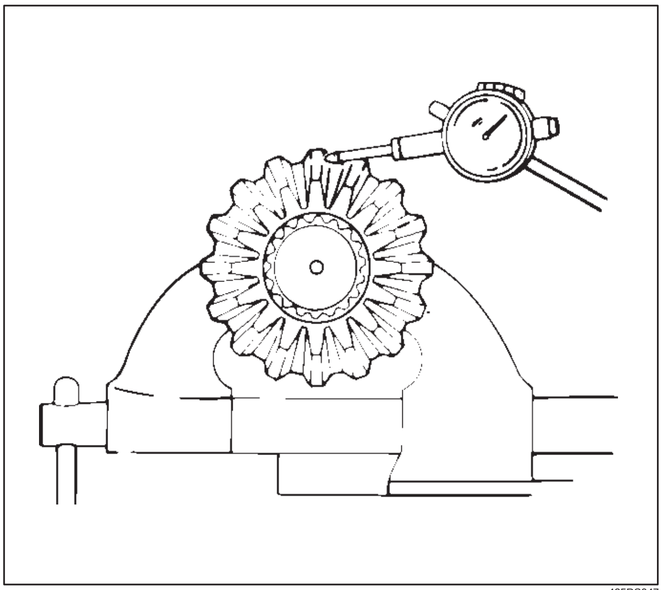
425RS046

Legend
(1) Side Gear
(2) Differential Box

Play in splines between the side gear and the axle shaft:

Standard: 0.08–0.36 mm(0.003 –0.014 in)

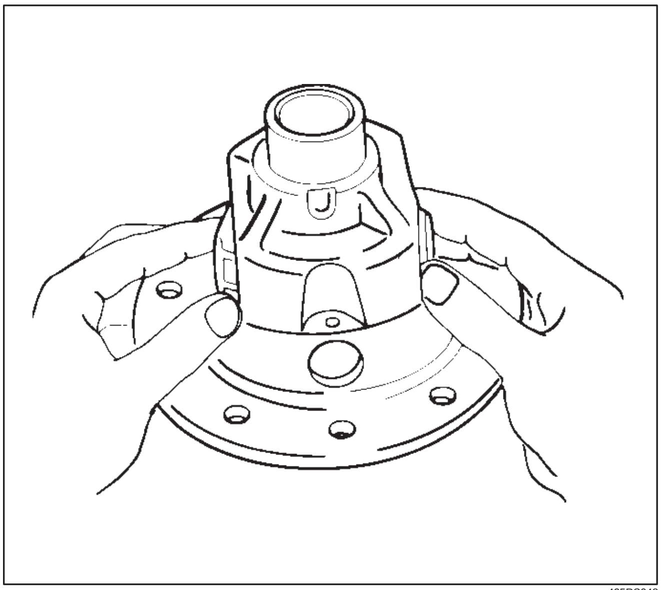
Limit:0.5m (0.02 in)



425RS047

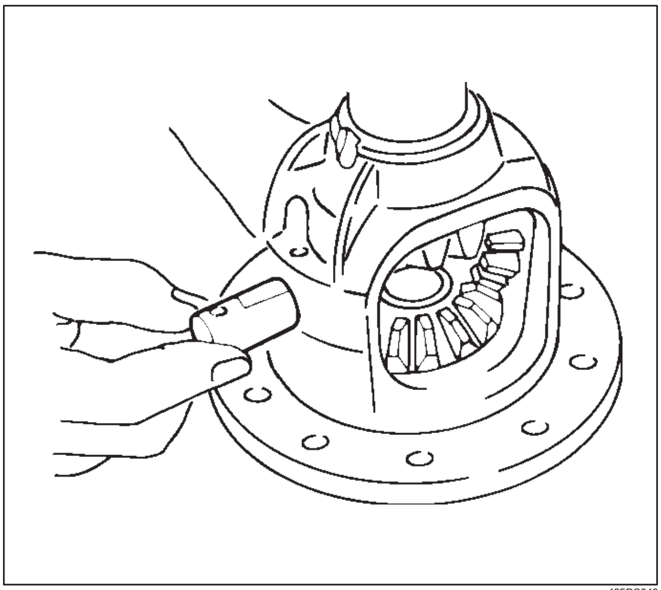
Reassembly

1. Install thrust washer.
2. Install side gear.
3. Install the pinion gear by engaging it with the side gears while turning both pinion gears simultaneously in the same direction.



425RS048

4. Install cross pin.
   1. Be sure to install the cross pin so that it is in alignment with the lock pin hole in the differential cage.



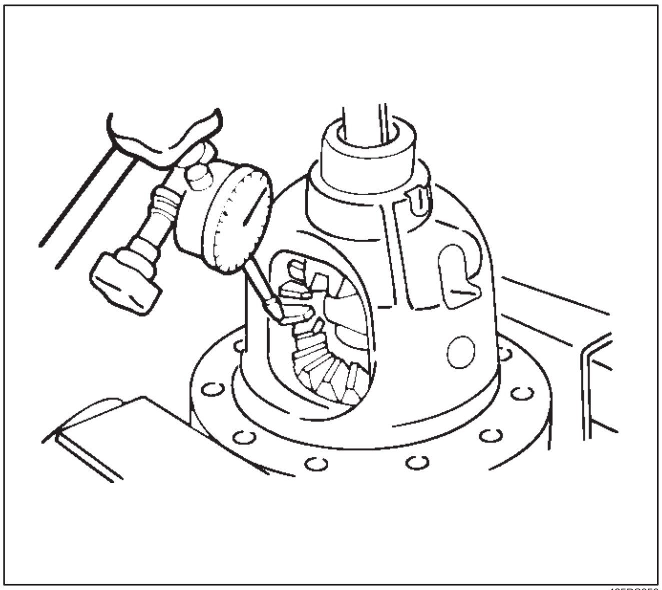
425RS049

   2. Adjust the backlash between the side gear and the pinion gear.

Backlash:0.03 – 0.08 mm (0.001– 0.003 in)

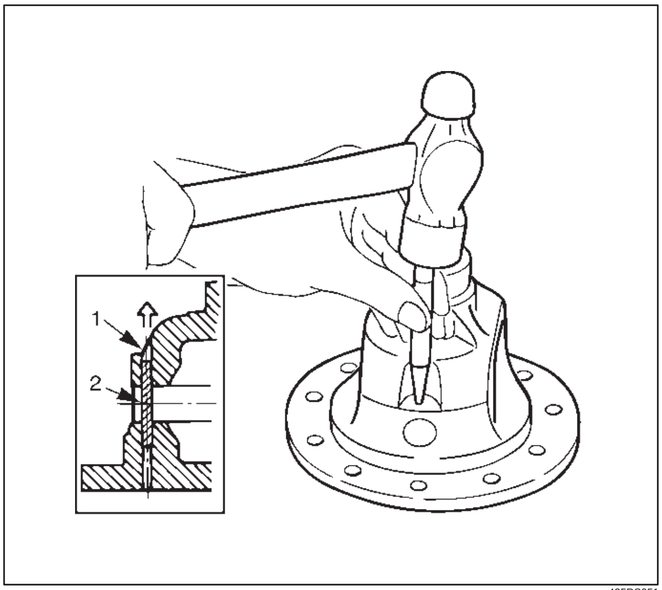
Thickness of thrust washers available:

1.00 mm, 1.05 mm, 1.10 mm (0.039 in, 0.041 in, 0.043 in)



425RS050

5. Install lock pin. After lock pin installation, stake the cage to secure the lock pin.



425RS051

Legend

(1) Staked Portion

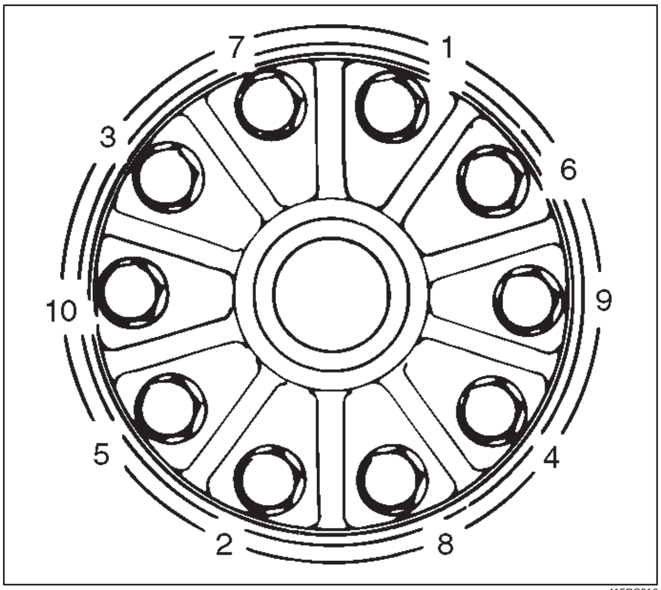
(2) Lock Pin

6. Clean the ring gear threaded holes to remove the locking agent. When installing the ring gear, apply LOCTITE 271 or equivalent to all the threaded area and half of the unthreaded area of the bolt.

7. Tighten the bolts in diagonal sequence as illustrated.

Torque: 108 N·m (80 lb ft)

NOTE: Discard used bolts and install new ones.



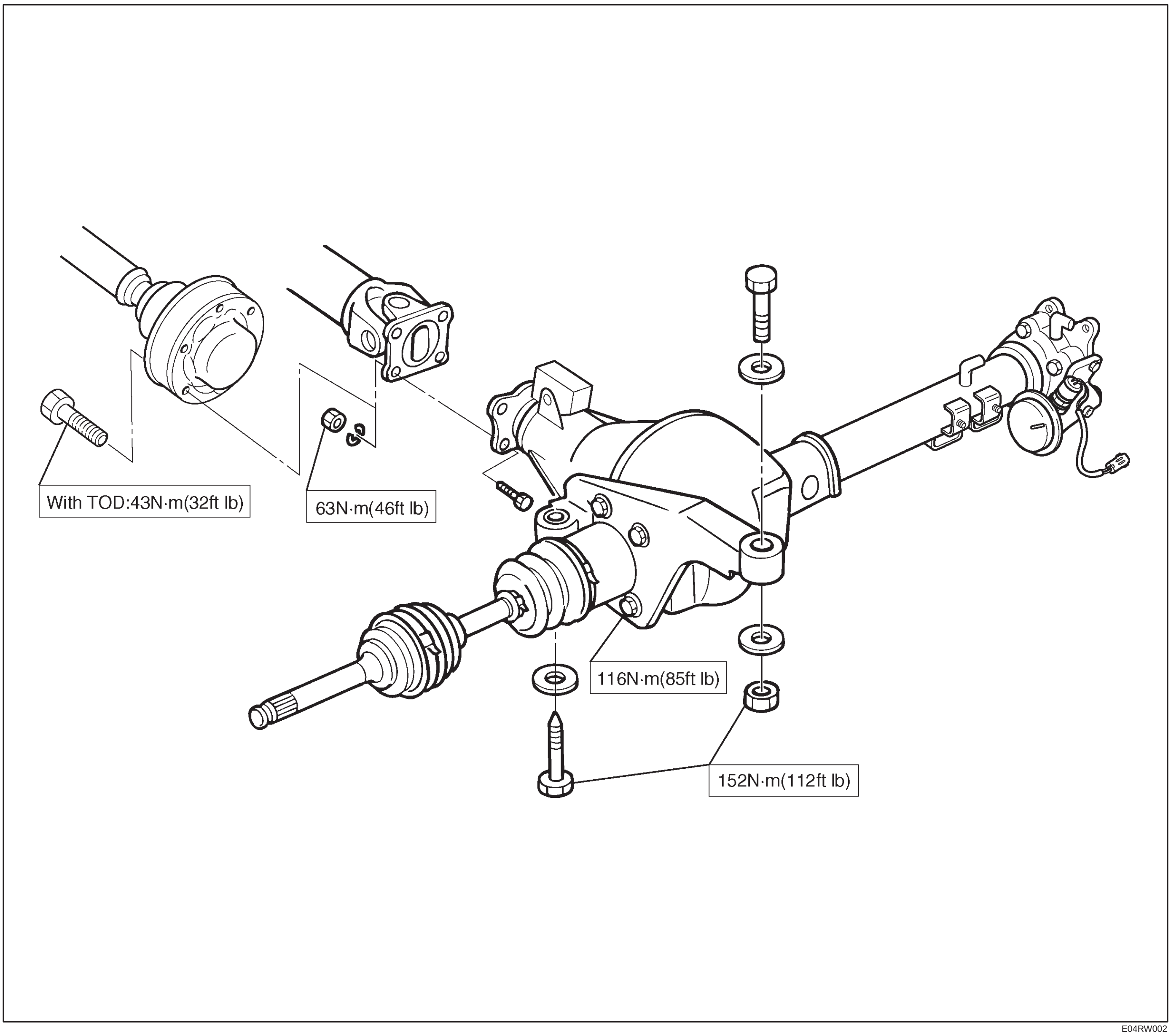
415RS016

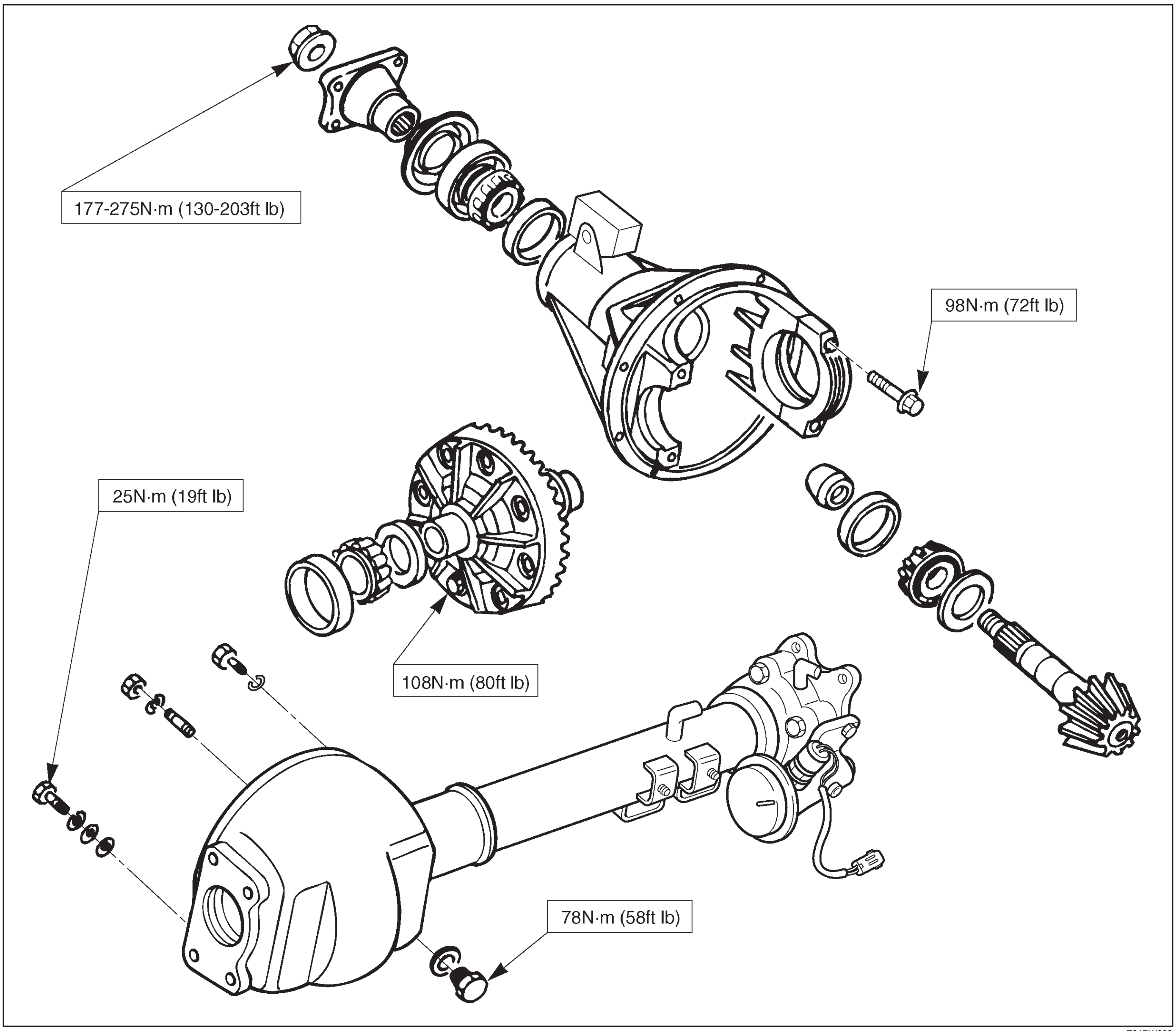
Main Data and Specifications

General Specifications

Axle tube Type		It consists of the duct, a cast iron housing and the axle tube.
Gear type		Hypoid
Gear ratio	(to 1)	4.300
Differential type		Two pinion
Oil capacity	liter (US qt)	1.4 (1.5) (Differential) 0.12 (0.13) (Actuator Housing: Shift on the fly)
Type of lubricant		75W–90 GL–5 (Multi grade type) Refer to General Information
Axle shaft type		Constant velocity joint (Birfield joint type and double offset joint)
Hub locking Type		Rigid

Torque Specifications




177-275N·m (130-203ft lb)
98N·m (72ft lb)
25N·m (19ft lb)
108N·m (80ft lb)
78N·m (58ft lb)
E04RW003

Special Tools

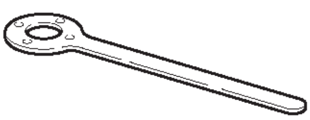
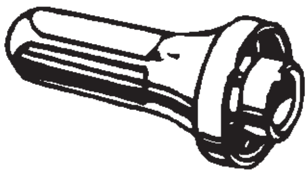
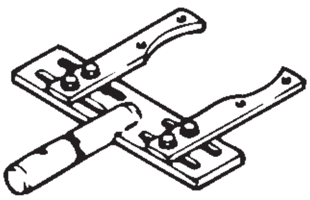
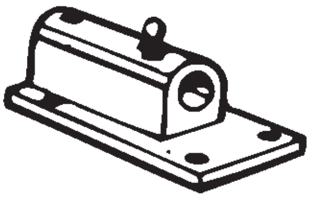
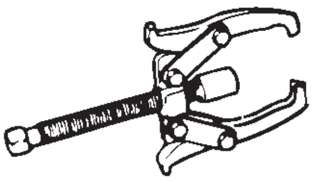
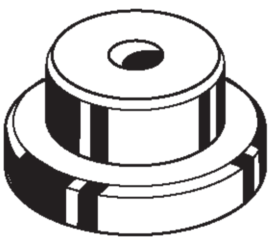
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–37221** Holder; Pinion flange
	**J–24250** Installer; Oil seal
	**J–37264** Differential holding fixture (Use with J–3289–20 base)
	**J–3289–20** Holding fixture base
	**J–22888** Puller; Side bearing
	**J–8107–2** Adapter; Side bearing plug

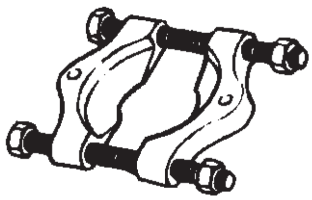
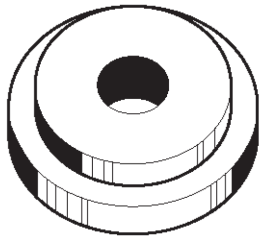
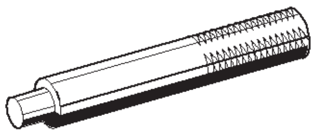
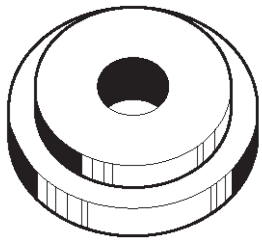
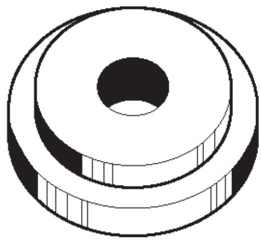
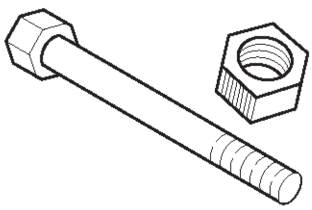
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–22912–01** Separator
	**J–24256** Installer; Outer bearing outer race
	**J–8092** Driver handle
	**J–24252** Installer; Inner bearing outer race
	**J–21777–42** Pilot
	**J–23597–9** Nut and bolt

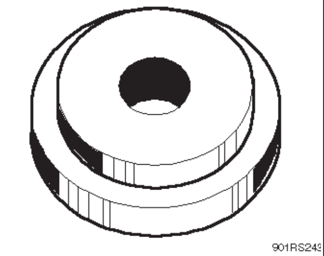
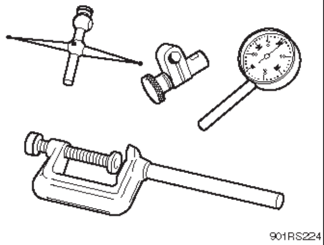
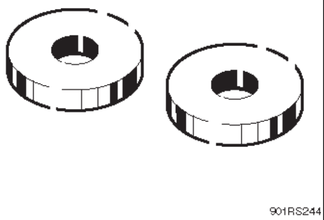
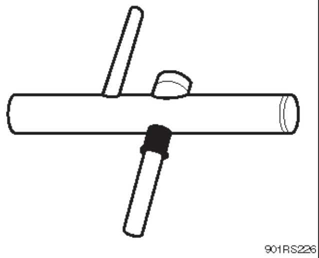
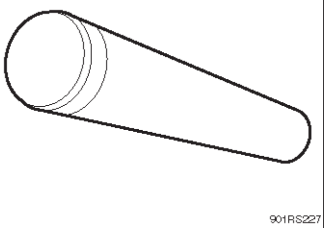
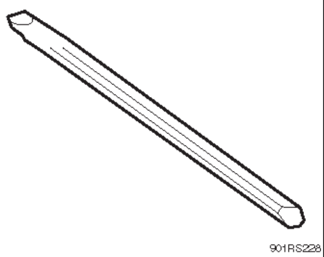
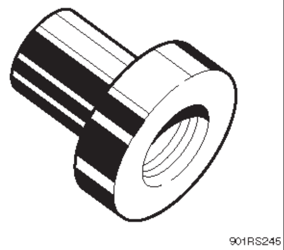
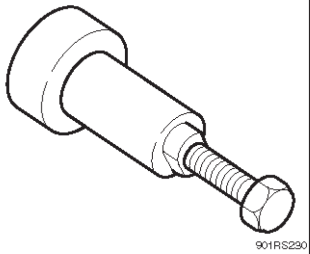
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–23597–7** Gauge plate
	**J–8001** Dial indicator
	**J–23597–8** Disc
	**J–23597–1** Arbor
	**J–6133–01** Installer; Pinion bearing
	**J–39209** Punch; End nut lock

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–24244** Installer; Side bearing
	**J–39602** Remover; Outer bearing

TROOPER

DRIVELINE/AXLE

DIFFERENTIAL (REAR)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM(SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE REFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED , do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally,such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specification. Following these instructions can help you avoid damage to parts and systems.

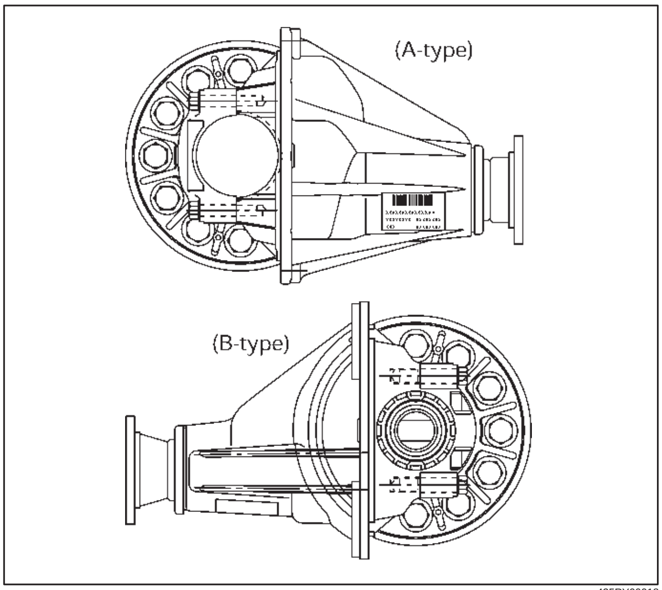
The ϕ244 differential has two N types A-type and B-type.

A-type: the sticker with bar code is attached.

B-type: the sticker with no bar code on the lower part of carrier is attached.

In case of Work Shop Manual;

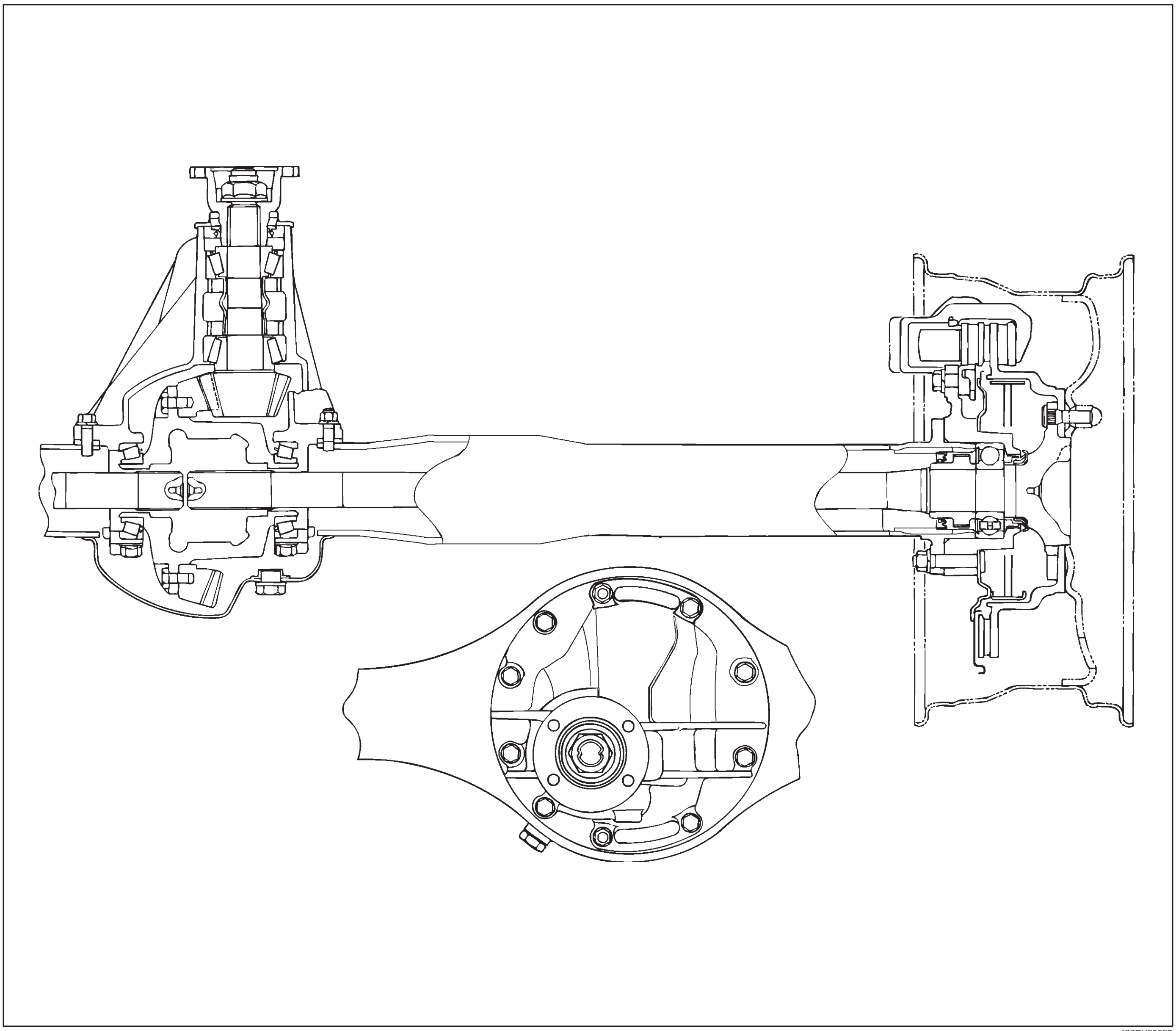
A-type: Refer to ’98 UBS Work Shop Manual.
B-type: Described in ’00UBS Work Shop Manual.



425RY00018

General Description

The rear axle assembly is of the semi–floating type in which the vehicle weight is carried on the axle housing .
The center line of the pinion gear is below the center line of the ring gear (hypoid drive).
All parts necessary to transmit power from the propeller shaft to the rear wheels are enclosed in a banjo type axle housing.
The 9.61 inch ring gear rear axle uses a conventional ring and pinion gear set to transmit the driving force of the engine to the rear wheels. This gear set transfers this driving force at a 90 degree angle from the propeller shaft to the drive shafts.
The axle shafts are supported at the wheel end of the shaft by a roller bearing.
The pinion gear is supported by two tapered roller bearings. The pinion depth is set by a shim pack located between the gear end of the pinion and the roller bearing that is pressed onto the pinion. The pinion bearing preload is set by crushing a collapsible spacer between the bearings in the axle housing.



420RY00003

The ring gear is bolted onto the differential cage with 12 bolts.
The differential cage is supported in the axle housing by two tapered roller bearings. The differential and ring gear are located in relationship to the pinion by using selective shims and spacers between the bearing and the axle housing. To move the ring gear, shims are deleted from one side and an equal amount are added to the other side. These shims are also used to preload the bearings which are pressed onto the differential cage. Two bearing caps are used to hold the differential into the rear axle housing.
The differential is used to allow the wheels to turn at different rates of speed while the rear axle continues to transmit the driving force. This prevents tire scuffing when going around corners and prevents premature wear on internal axle parts.
The rear axle is sealed with a pinion seal, a seal at each axle shaft end, and by a liquid gasket between the differential carrier and the axle housing.

Diagnosis

Many noises that seem to come from the rear axle actually originate from other sources such as tires, road surface, wheel bearings, engine, transmission, muffler, or body drumming. Investigate to find the source of the noise before disassembling the rear axle. Rear axles, like any other mechanical device, are not absolutely quiet but should be considered quiet unless some abnormal noise is present.

To make a systematic check for axle noise, observe the following:

1. Select a level asphalt road to reduce tire noise and body drumming.
2. Check rear axle lubricant level to assure correct level, and then drive the vehicle far enough to thoroughly warm up the rear axle lubricant.
3. Note the speed at which noise occurs. Stop the vehicle and put the transmission in neutral. Run the engine speed slowly up and down to determine if the noise is caused by exhaust, muffler noise, or other engine conditions.
4. Tire noise changes with different road surfaces; axle noises do not. Temporarily inflate all tires to 344 kPa (50 psi) (for test purposes only). This will change noise caused by tires but will not affect noise caused by the rear axle.

   Rear axle noise usually stops when coasting at speeds under 48 km/h (30 mph); however, tire noise continues with a lower tone. Rear axle noise usually changes when comparing pull and coast, but tire noise stays about the same.

   Distinguish between tire noise and rear axle noise by noting if the noise changes with various speeds or sudden acceleration and deceleration. Exhaust and axle noise vary under these conditions, while tire noise remains constant and is more pronounced at speeds of 32 to 48 km/h (20 to 30 mph). Further check for tire noise by driving the vehicle over smooth pavements or dirt roads (not gravel) with the tires at normal pressure. If the noise is caused by tires, it will change noticeably with changes in road surface.
5. Loose or rough front wheel bearings will cause noise which may be confused with rear axle noise; however, front wheel bearing noise does not change when comparing drive and coast. Light application of the brake while holding vehicle speed steady will often cause wheel bearing noise to diminish. Front wheel bearings may be checked for noise by jacking up the wheels and spinning them or by shaking the wheels to determine if bearings are loose.
6. Rear suspension rubber bushings and spring insulators dampen out rear axle noise when correctly installed. Check to see that there is no link or rod loosened or metal–to–metal contact.
7. Make sure that there is no metal–to–metal contact between the floor and the frame.

After the noise has been determined to be in the axle, the type of axle noise should be determined, in order to make any necessary repairs.

Gear Noise

Gear noise (whine) is audible from 32 to 89 km/h (20 to 55 mph) under four driving conditions.

1. Driving under acceleration or heavy pull.
2. Driving under load or under constant speed.
3. When using enough throttle to keep the vehicle from driving the engine while the vehicle slows down gradually (engine still pulls slightly).
4. When coasting with the vehicle in gear and the throttle closed. The gear noise is usually more noticeable between 48 and 64 km/h (30 and 40 mph) and 80 and 89 km/h (50 and 55 mph).

Bearing Noise

Bad bearings generally produce a rough growl or grating sound, rather than the whine typical of gear noise. Bearing noise frequently "wow–wows" at bearing rpm, indicating a bad pinion or rear axle side bearing. This noise can be confused with rear wheel bearing noise.

Rear Wheel Bearing Noise

Rear wheel bearing noise continues to be heard while coasting at low speed with transmission in neutral. Noise may diminish by gentle braking. Jack up the rear wheels, spin them by hand and listen for noise at the hubs. Replace any faulty wheel bearings.

Knock At Low Speeds

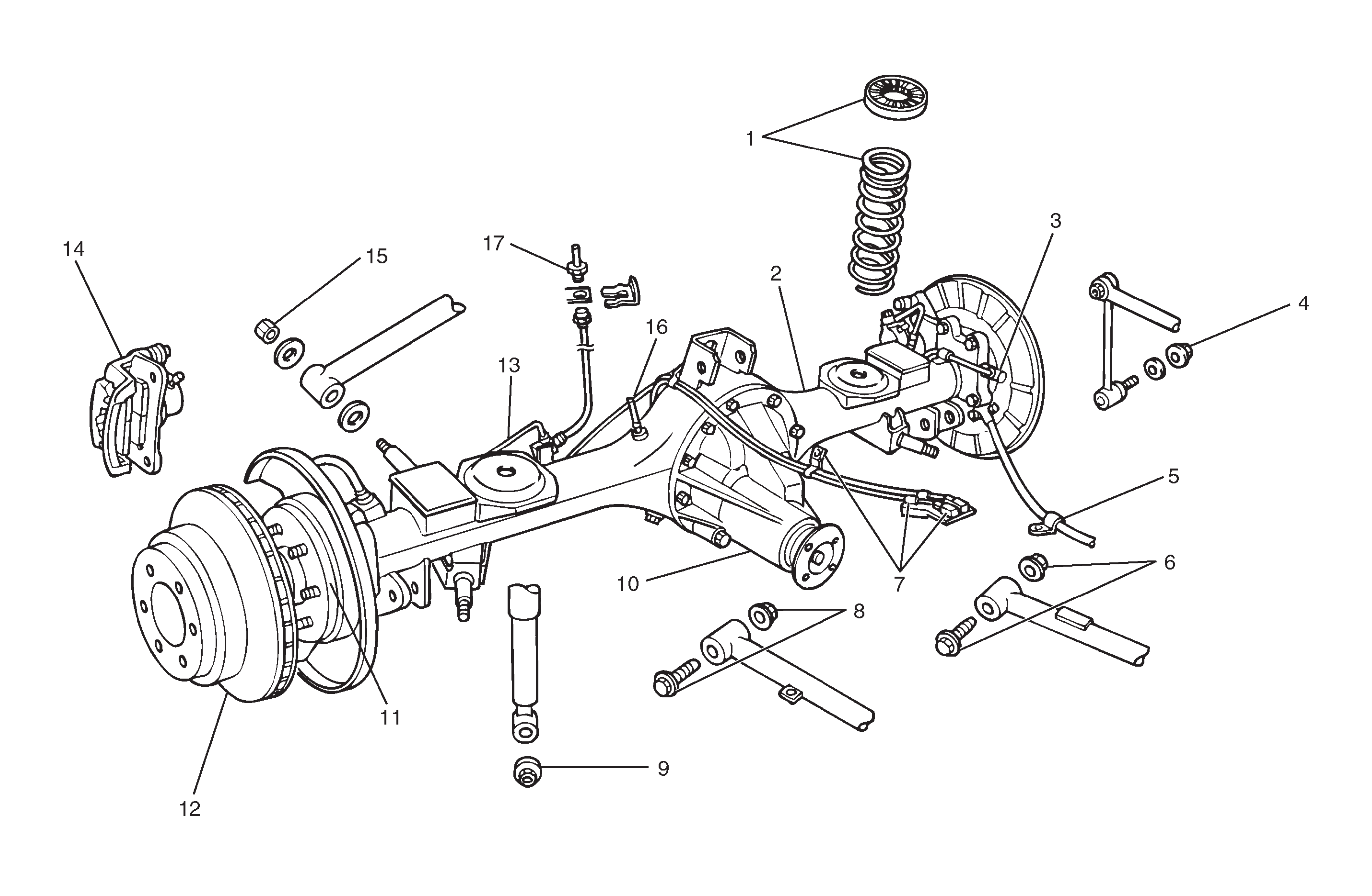
Low speed knock can be caused by worn universal joints or a side gear hub counter bore in the cage that is worn oversize. Inspect and replace universal joints or cage and side gears as required.

Backlash Clunk

Excessive clunk on acceleration and deceleration can be caused by a worn rear axle pinion shaft, a worn cage, excessive clearance between the axle and the side gear splines, excessive clearance between the side gear hub and the counterbore in the cage, worn pinion and side gear teeth, worn thrust washers, or excessive drive pinion and ring gear backlash. Remove worn parts and replace as required. Select close–fitting parts when possible. Adjust pinion and ring gear backlash.

Axle Housing

Axle Housing and Associated Parts



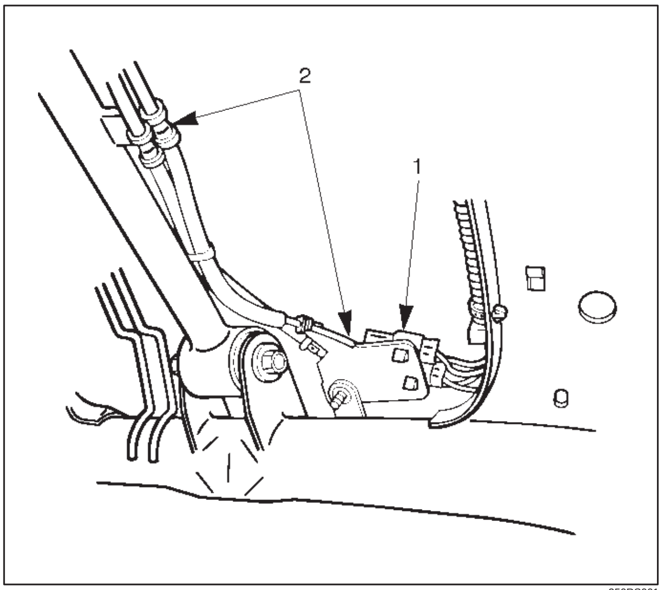
Legend

(1) Coil Spring and Insulator
(2) Axle Housing Assembly
(3) ABS Speed Sensor and Harness
(4) Nut
(5) Parking Brake Cable
(6) Bolt and Nut
(7) Antilock Brake System (ABS) Connector and Bracket
(8) Bolt and Nut
(9) Nut
(10) Differential Assembly
(11) Axle Shaft Assembly
(12) Brake Disc
(13) Brake Pipe
(14) Brake Caliper
(15) Nut
(16) Breather Hose
(17) Flare Nut

Removal

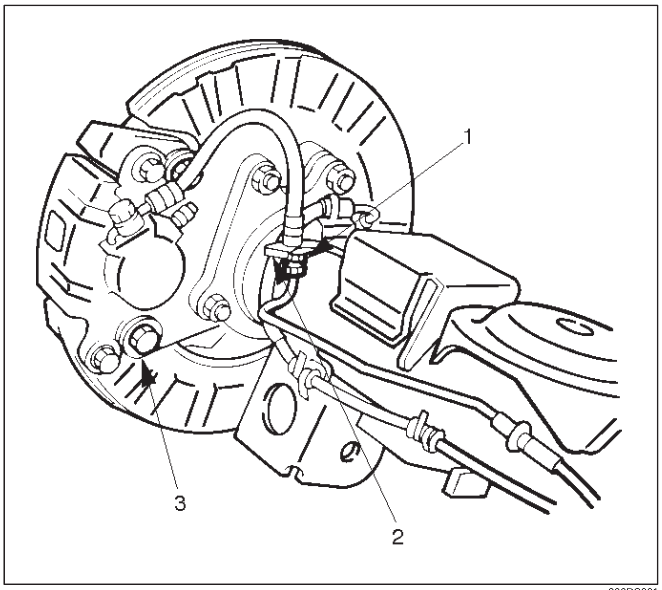
1. Raise the vehicle and support it with suitable safety stands.
   The hoist must remain under the rear axle housing.
2. Remove brake fluid. Refer to Hydraulic Brakes in Brake section.
3. Remove rear wheels and tires. Refer to Wheel in Suspension section.
4. Remove propeller shaft. Refer to Rear Propeller Shaft in this section.
5. Drain the rear axle oil into a proper container.
6. Remove parking brake cable, release the connection between the cable fixing clip equalizer. Refer to Parking Brakes in Brake section.
7. Move the clip aside and pull out the breather hose.

8. Disconnect the ABS connectors (1) and remove the brackets (2) attached to the frame and center link.



350RS001

9. Loosen the brake tube flare nut, remove the clip and take out the brake tube.
10. Remove the shock absorber fixing nut from the axle housing.
11. Remove the stabilizer linkage mounting nut from the axle housing.
12. Remove the lateral rod fixing nut from the axle housing.
13. Remove the center link mounting bolt and nut from the axle housing.
14. Remove the trailing link fixing bolt and nut from the axle housing.
15. Jack down and remove the coil spring and insulator.
16. Axle housing assembly can be separated from the vehicle on completion of steps 1 – 11.
17. Remove the brake caliper fixing bolt (3), loosen the flare nut (1), release the clip (2) and take out the brake caliper together with the flexible hose.

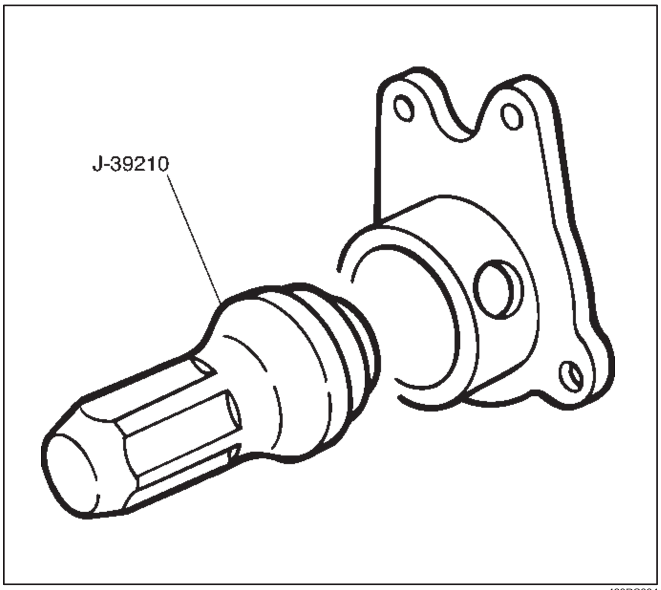


306RS001

18. Remove brake disc.
19. Remove antilock brake system speed sensor fixing bolt and the clip and bracket on the axle housing.
20. Remove the brake pipe clip and fixing bolt on the axle housing and take out the brake pipe.
21. Remove the bearing holder fixing nut and take out the axle shaft assembly, be sure not to damage the oil seal by the spline of the shaft, Refer to Axle Shaft in this section.
22. Remove differential assembly, refer to Differential Assembly in this section.

Oil Seal Replacement

Remove the oil seal, carefully not to damage the housing, and mount new oil seal using oil seal installer J–39210.



420RS004

Installation

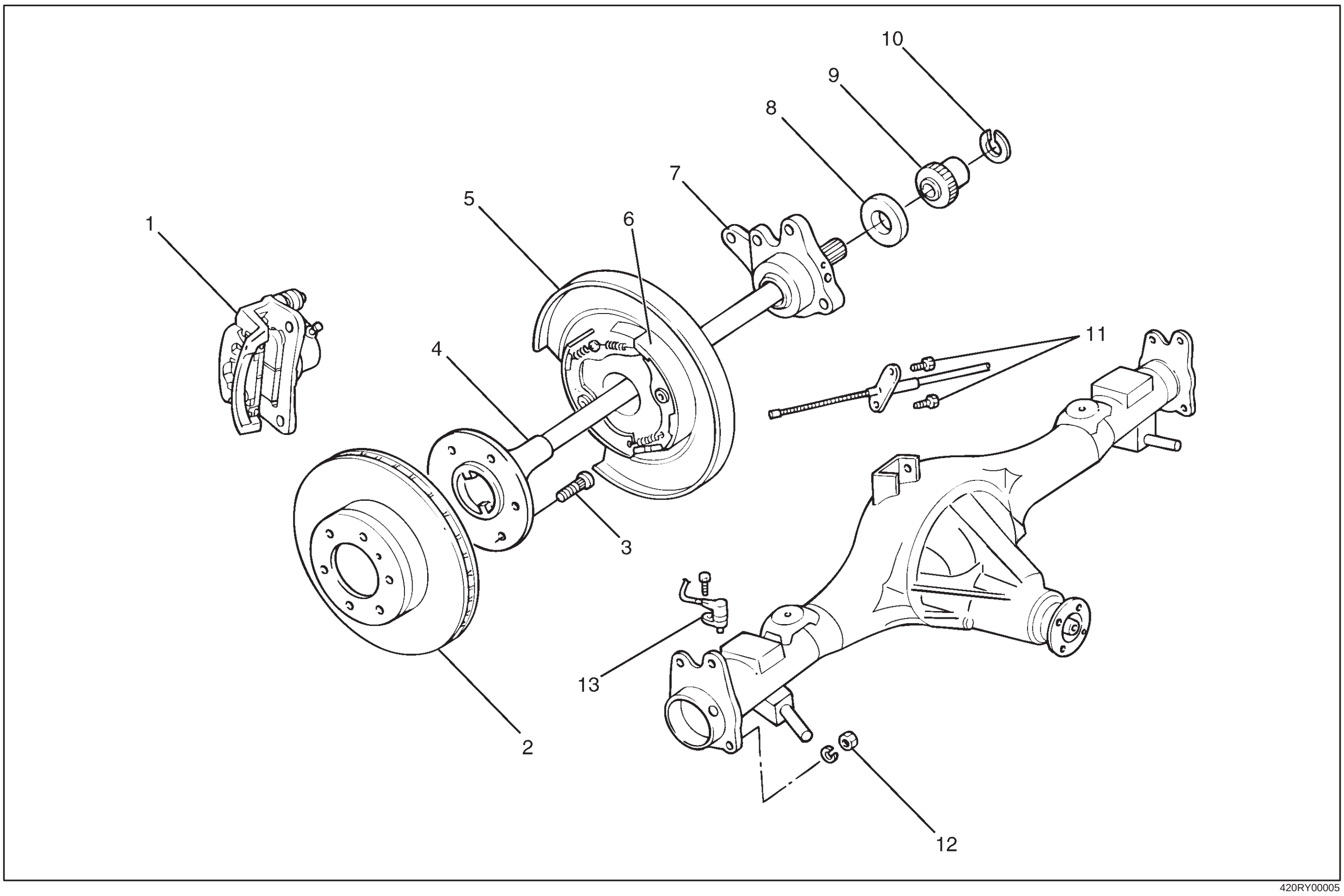
1. Install differential assembly, refer to Differential Assembly in this section.
2. Install axle shaft assembly then tighten the bearing holder mounting nut to the specified torque. Be sure not to damage the oil seal by the spline of the shaft.

   Torque: 74N·m (54lb ft)
3. Install brake pipe.
4. Connect antilock brake system (ABS) speed sensor and harness, refer to 4–Wheel Anti–Lock Brake System (ABS) in Brake section.
5. Install brake disc.
6. Install brake caliper. Refer to Disk Brakes in Brake section.
7. Install axle housing assembly.
8. Install coil spring and insulator.
9. Install the trailing link fixing bolt and nut to the axle housing. For the procedures in items 9–13, refer to Suspension section.
10. Install the center link bolt and nut to the axle housing.
11. Install the lateral rod fixing nut to the axle housing.
12. Install the stabilizer linkage mounting nut to the axle housing.

13. Install the shock absorber fixing nut to the axle housing.
14. Install brake tube flare nut, Refer to Disk Brakes in Brake section.
15. Install ABS connector and bracket.
16. Connect breather hose.
17. Install parking brake cable, Refer to Parking Brakes in Brake section.
18. Bleed brakes. Refer to Hydraulic Brakes in Brake section.

Axle Shaft

Axle Shaft and Associated Parts



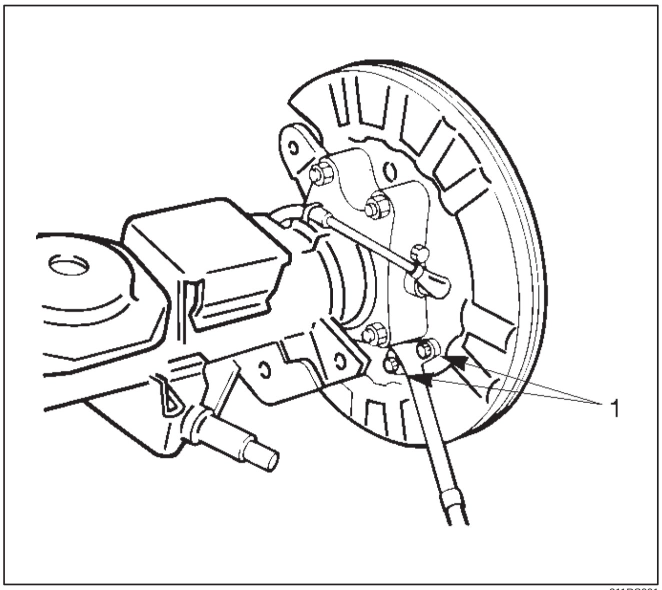
Legend

(1) Brake Caliper
(2) Brake Disc
(3) Wheel Pin
(4) Axle Shaft Assembly
(5) Back Plate
(6) Parking Brake Assembly
(7) Bearing Holder
(8) Bearing
(9) Retainer
(10) Snap Ring
(11) Bolt
(12) Nut
(13) Antilock Brake System (ABS) Speed Sensor

Removal

1. Raise the vehicle.
2. Remove tires and wheels. Refer to Wheel in Steering section.
3. Remove brake caliper. Use a wire to attach the brake caliper to the frame. Refer to Disk Brakes in Brake section.
4. Remove brake disc.
5. Remove ABS sensor.
6. Remove Parking brake assembly. Refer to Parking Brakes in Brake section.

7. Remove the parking brake cable mounting bolts(Behind the back plate)(1).

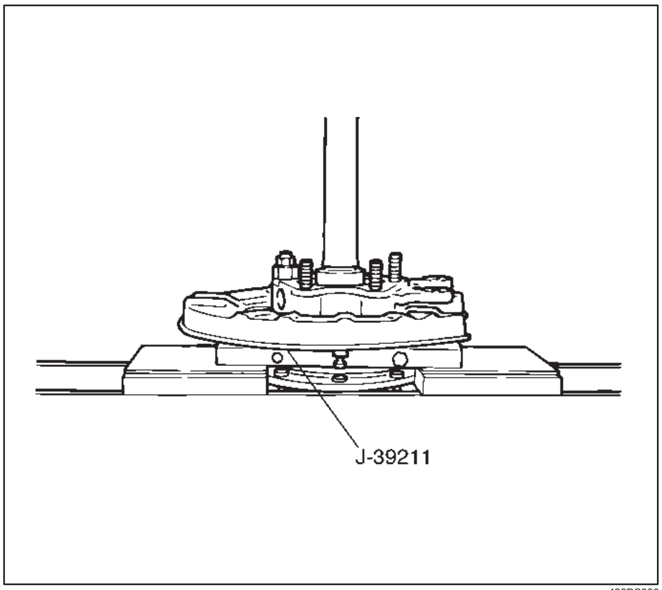


311RS001

8. Remove the bearing holder mounting nuts.
9. Remove axle shaft assembly.

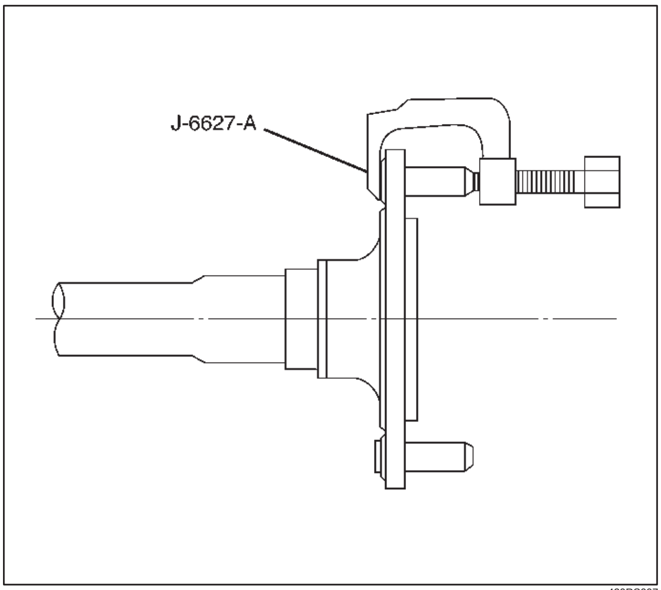
NOTE: Be sure not to damage the oil seal.

10. Remove snap ring.
11. Using a bearing remover J–39211 and press, remove retainer together with the bearing holder.



420RS006

12. Remove bearing.
13. Remove bearing holder.
14. Remove back plate.
15. Remove the wheel pins using a remover J–6627–A.



420RS007

Inspection and Repair

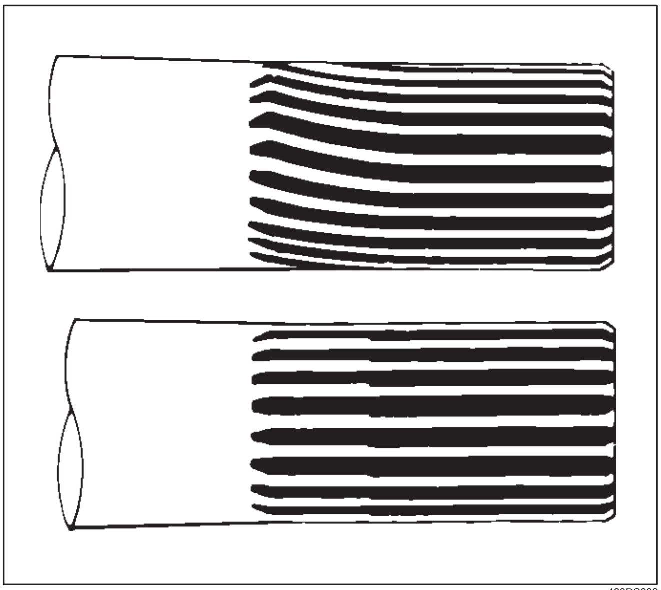
Make necessary correction or parts replacement if wear, corrosion or any other abnormal conditions are found through inspection.

Visual Check:

Check the following parts for wear, damage, noise or any other abnormal conditions:

1. Axle shaft
2. Bearing

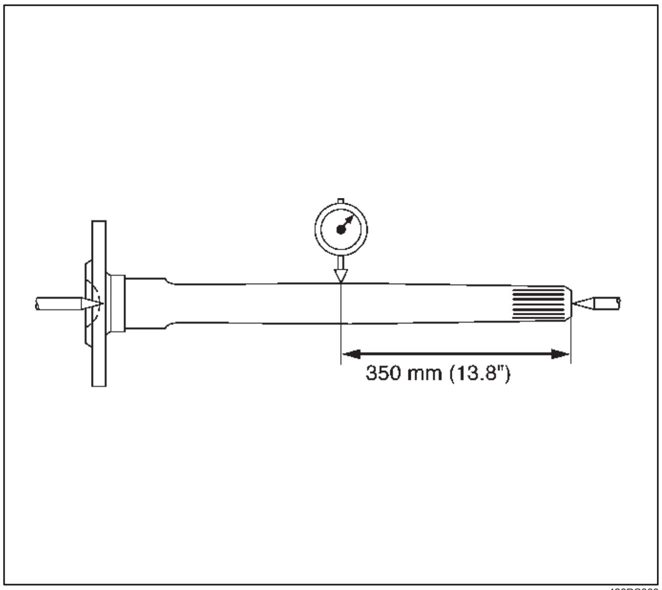
When checking the axle shaft, pay special attention to the splined portions and replace the shaft if distortion or step wear is noticeable. Correct slight step wear with a grinder.



420RS008

Axle Shaft Run–out

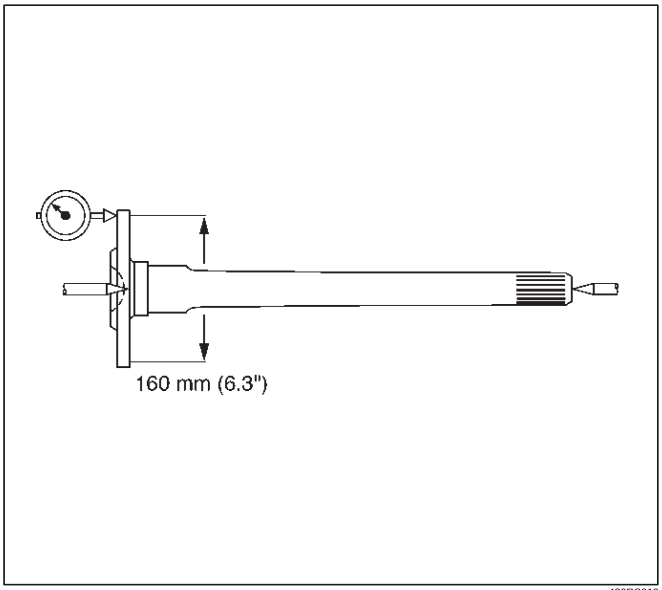
Limit: 1.0 mm (0.039 in)



420RS009

Axle Shaft Flange Run–out

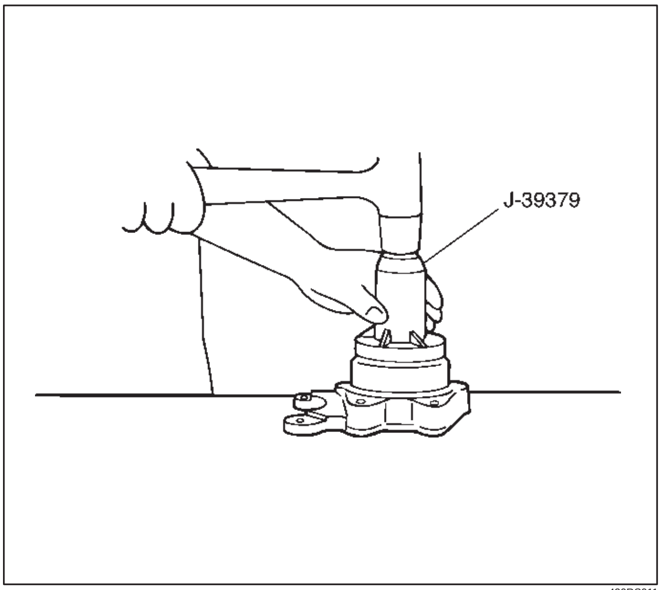
Limit: 0.08 mm (0.003 in)



420RS010

Oil Seal Replacement

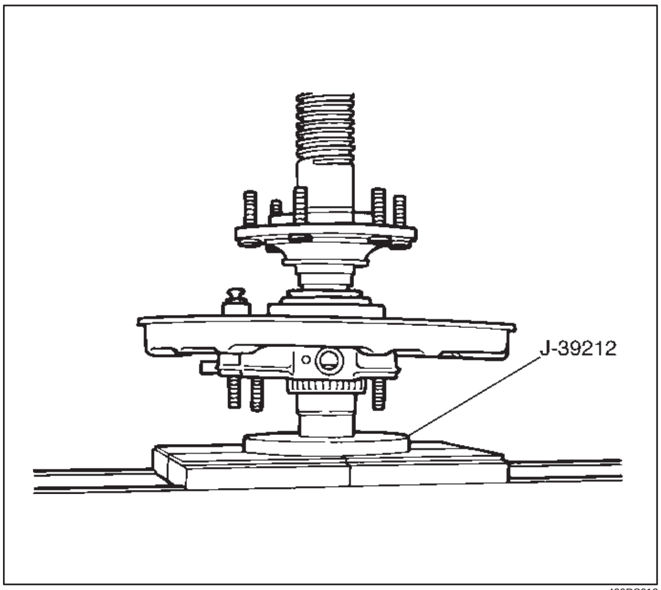
Remove the oil seal carefully not to damage the bearing holder bore .
When installing, use oil seal installer J–39379.



420RS011

Installation

1. Install wheel pin.
2. Install back plate.
3. Install bearing holder.
4. Install bearing.
5. Install retainer by using a bearing installer J–39212, press fit together with the bearing.



420RS012

6. Install snap ring.
7. Install axle shaft assembly.

NOTE: Be sure not to damage the oil seal.

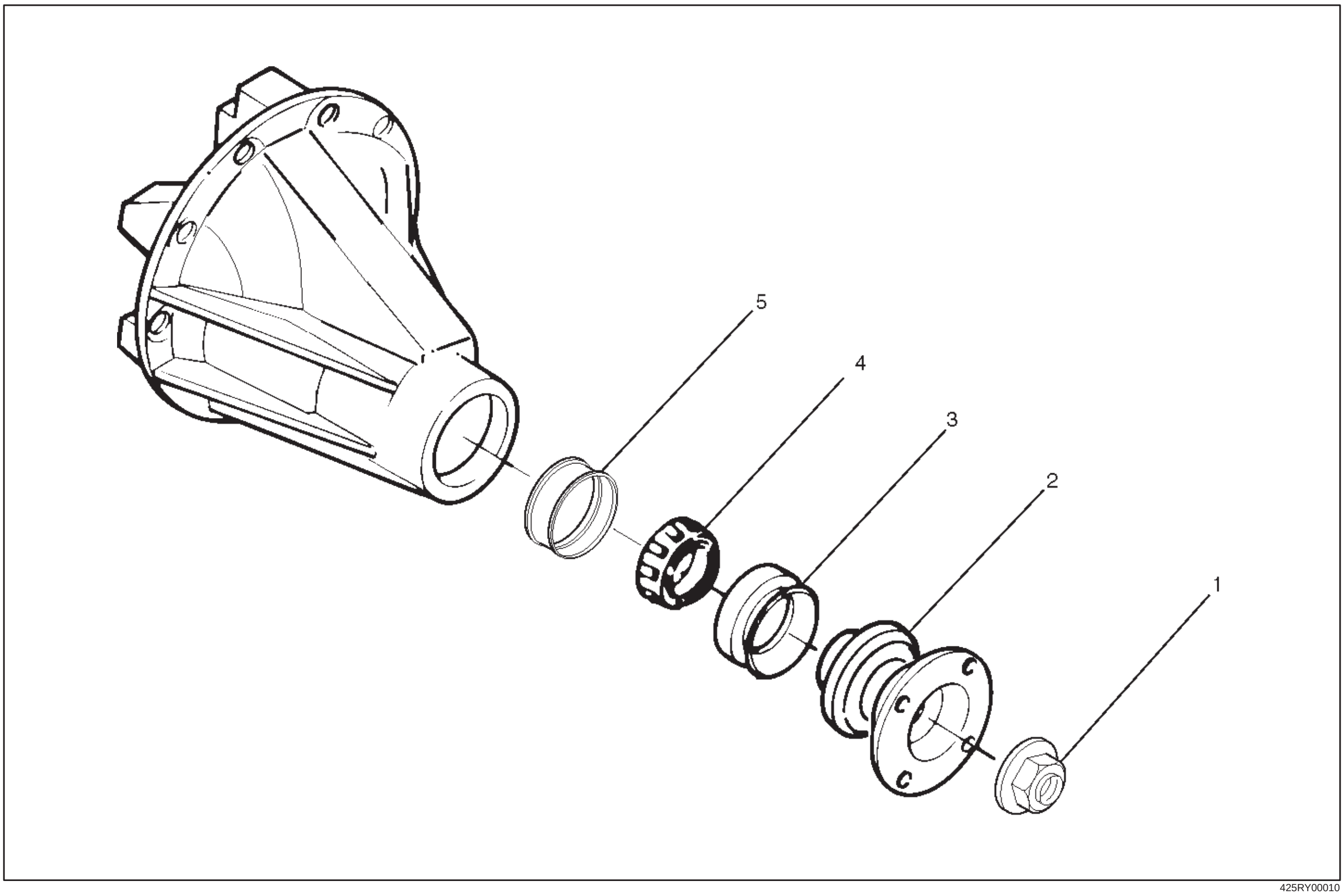
8. Tighten the bearing holder mounting nut to the specified torque.

Torque: 74N·m (54 lb ft)

9. Fix the parking brake cable mounting bolt (Behind the back plate).
10. Install parking brake assembly, refer to Parking Brakes in Brake section.
11. Install antilock brake system sensor.
12. Install brake disc.
13. Install brake caliper, refer to Disk Brakes in Brake section.

Pinion Oil Seal

Pinion Oil Seal and Associated Parts



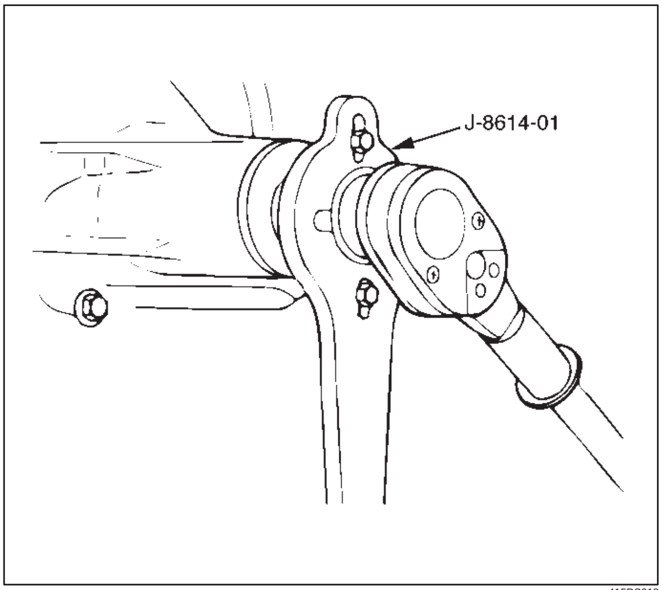
Legend

(1) Flange Nut and Washer
(2) Flange
(3) Oil Seal
(4) Outer Bearing
(5) Collapsible Spacer

Removal

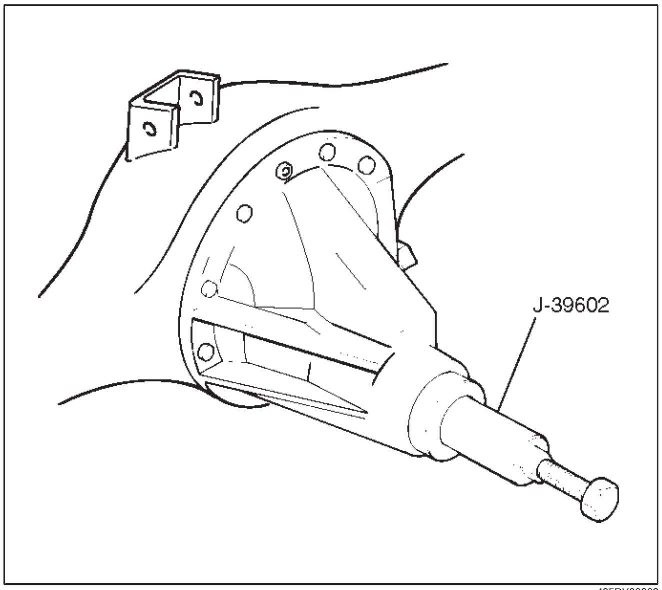
1. Remove the rear propeller shaft. Refer to Rear Propeller Shaft in this section.
2. Drain the rear axle oil.

3. Remove flange nut and washer by using pinion flange holder J–8614–01 after raising up its staked parts completely.



415RS018

4. Remove flange.
5. Remove oil seal.
6. Remove outer bearing by using remover J–39602.



425RY00003

7. Remove collapsible spacer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

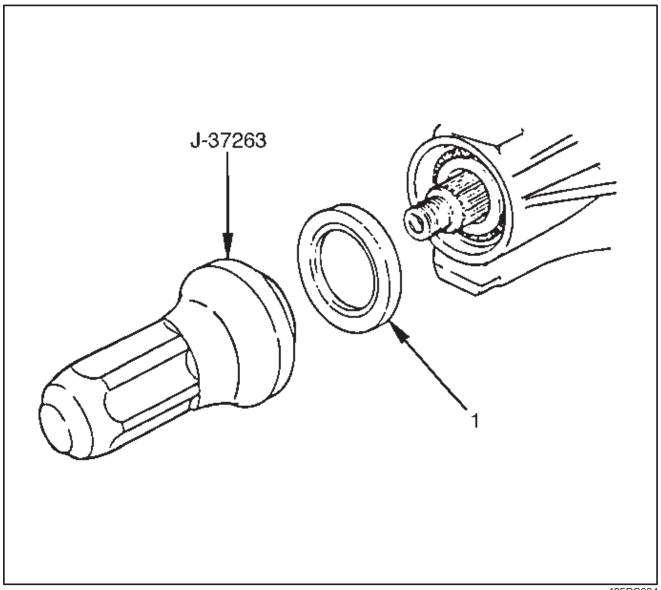
1. Seal surface of the pinion.
2. Cage bore for burns.

Installation

1. Install collapsible spacer, discard the used collapsible spacer and install a new one.
2. Install outer bearing.

NOTE: Do not drive in, but just temporarily set in the outer bearing by hand, which should be indirectly pressed in finally by tightening the flange nut.

3. By using the seal installer J–37263, install a new oil seal (1) that has grease on seal lip.



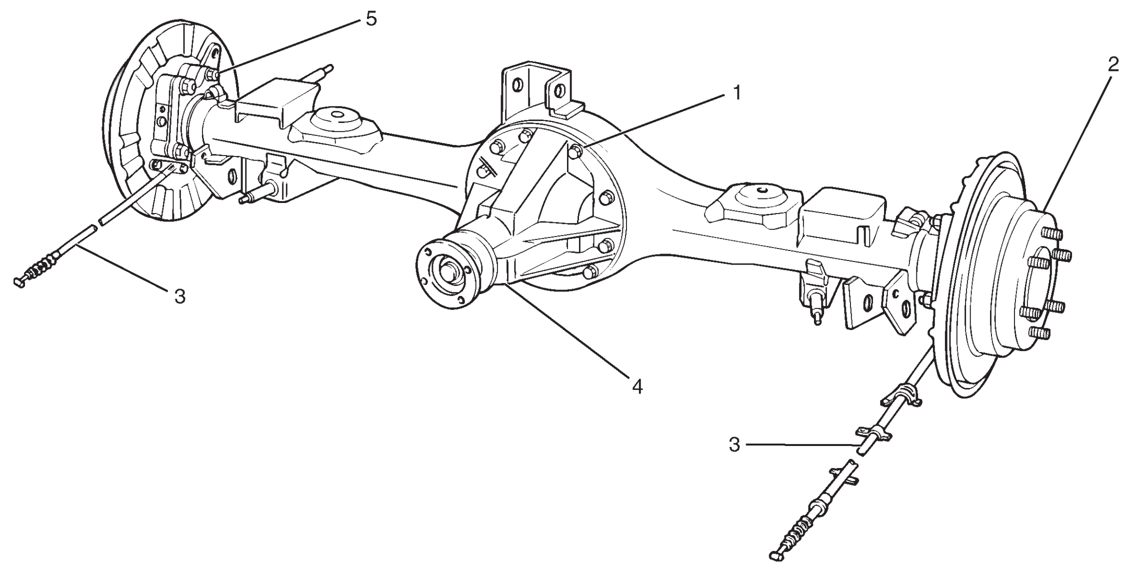
425RS004

4. Install flange.
5. Install flange nut and washer. Refer to Differential Assembly in this section for flange nut reassembly.

NOTE: Discard the used nut and install a new one.

Differential Assembly

Differential Assembly and Associated Parts



425RY00004

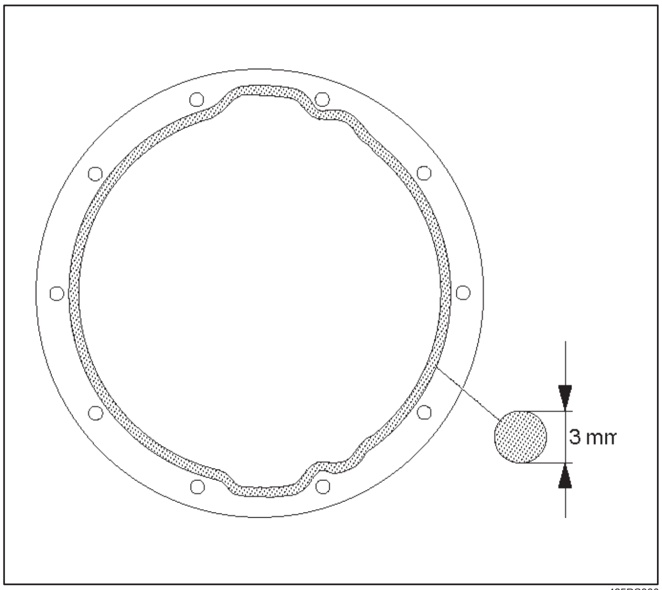
Legend
- (1) Bolt and Nut
- (2) Axle Shaft Assembly
- (3) Parking Brake Cable
- (4) Differential Assembly
- (5) Nut

Removal

1. Jack up and support the frame with stands.
2. Remove the wheel and tire. Refer to Wheel in Steering section.
3. Drain the differential oil.
4. Remove the propeller shaft. Refer to Rear Propeller Shaft in this section.
5. Remove the ABS speed sensor. Refer to 4–Wheel Anti–lock Brake System (ABS) in Brake section.
6. Remove the parking brake cable fastening clip and disconnect the equalizer section. Refer to Parking Brakes in Brake section.
7. Remove the bearing holder fixing nuts.
8. Remove axle shaft assembly, be sure not to damage the oil seal by axle shaft.
9. Remove differential carrier mounting bolts and nuts.
10. Remove differential assembly.

Installation

1. Clean the contact surfaces of the axle and differential carrier. As shown in the drawing, apply Three Bond TB1215 or equivalent then install differential assembly.



425RS006

2. Install bolt and nut. Tighten the differential carrier mounting bolts and nuts to the specified torque.

Torque:Nuts 44N·m (33lb ft)

Bolts 66N·m (48lb ft)

3. Install axle shaft assembly. Be sure not to damage the oil seal by axle shaft.
4. Install nut, refer to Axle Shaft in this section.
5. Install parking brake cable, refer to Parking Brakes in Brake section.

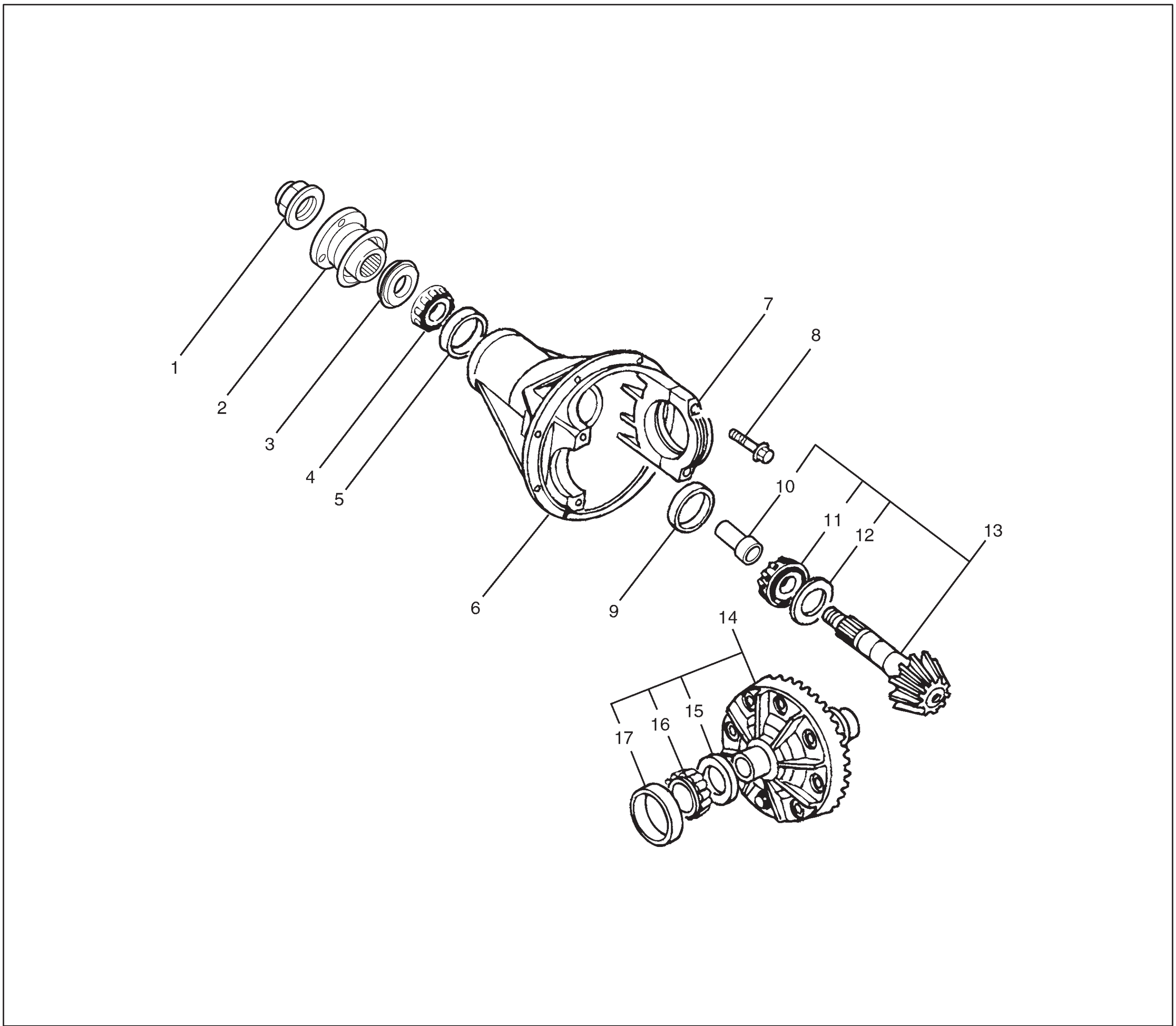
NOTE: After completing the assembling work, fill the prescribed gear oil to the filler hole.

Lubricant capacity: 3.0 liter (3.2 US qt)

6. Tighten the oil filler plug to the specified torque.

Torque: 78N·m (58lb ft)

Disassembled View

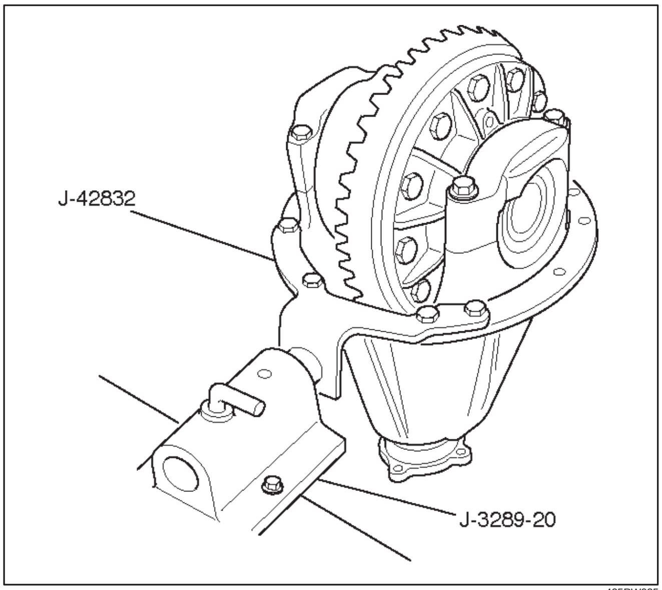


Legend

(1) Flange Nut and Washer
(2) Flange
(3) Oil Seal
(4) Oil Seal Slinger
(5) Outer Bearing
(6) Outer Bearing Outer Race
(7) Diff Carrier
(8) Bearing Cap
(9) Bolt
(10) Inner Bearing Outer Race
(11) Collapsible Spacer
(12) Inner Bearing
(13) Adjust Shim (Pinion Position)
(14) Drive Pinion Shaft
(15) Adjust Shim (Diff Cage Assembly)
(16) Diff Preload/Backlash
(17) Side Bearing
(18) Side Bearing Outer Race

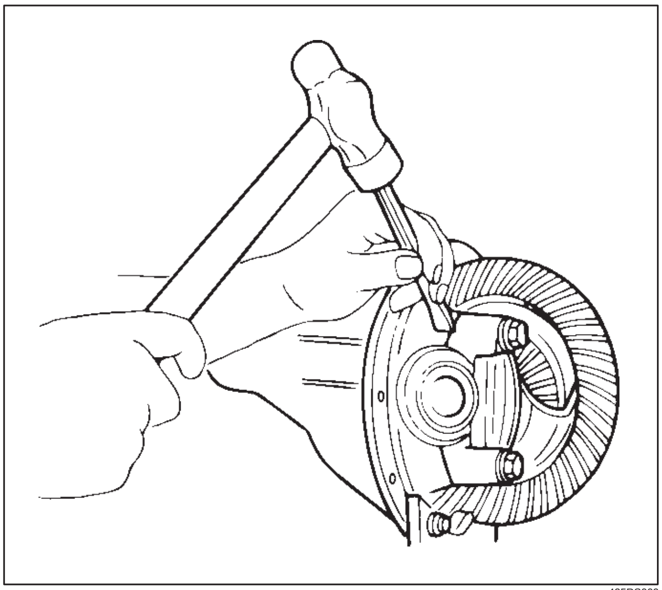
Disassembly

1. Using holding fixture J–42832 and holding fixture base J–3289–20, fix the differential assembly to the bench.



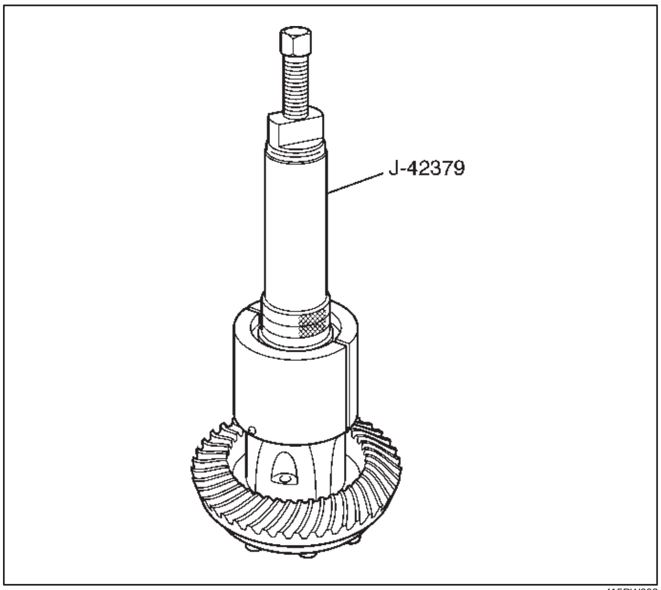
425RW035

2. Apply a setting mark to the side bearing cap and the differential carrier then remove bearing cap.



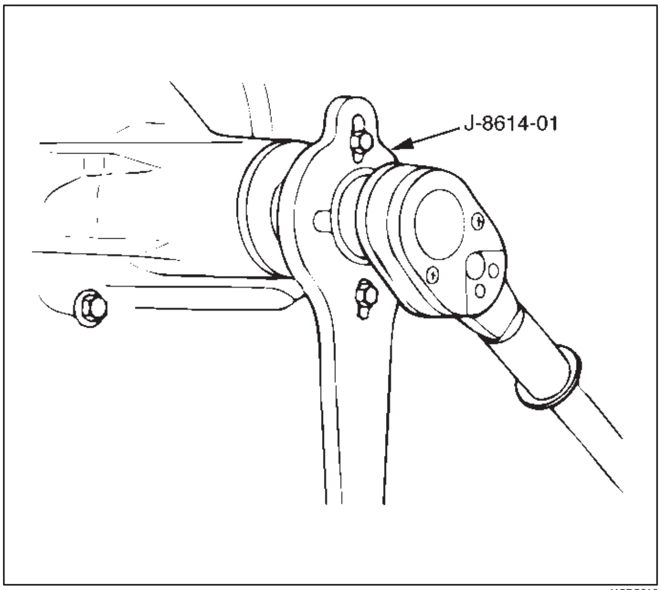
425RS009

3. Remove differential cage assembly.
4. Remove side bearing outer race. After removal, keep the right and left hand side bearing assemblies separate to maintain inner and outer race combinations.
5. Remove side bearing by using remover J–42379 and adapter J–8107–3. Select collet halves 44803 in remover kit J–42379 for side bearing removal and insert is not required for this operation.



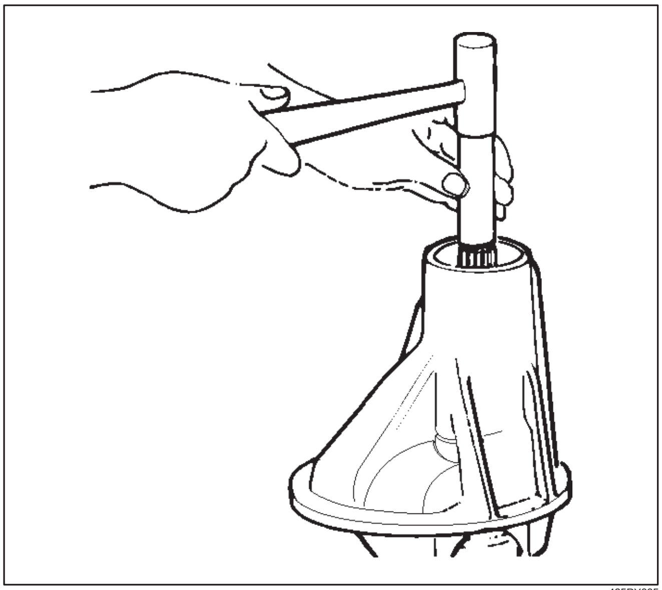
415RW003

6. Note the thickness and position of the shims then remove adjust shim.
7. Remove the flange nut and washer by using pinion flange holder J–8614–01 after raising up its staked parts completely.



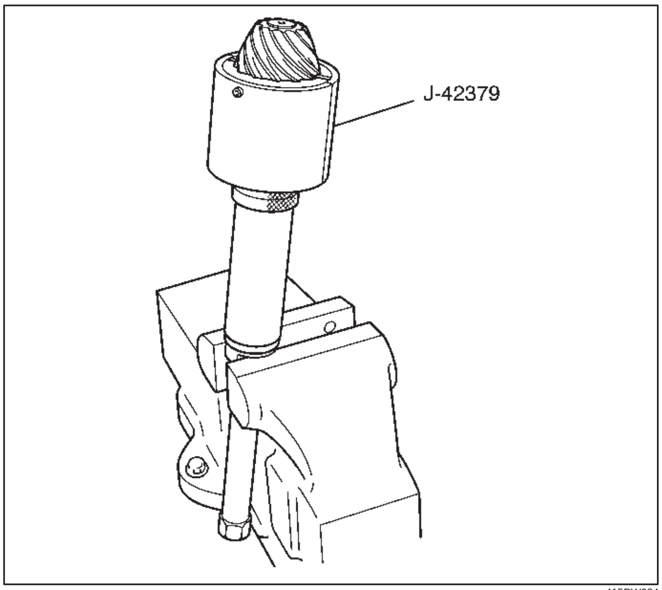
415RS018

8. Removed flange assembly.
9. Remove the drive pinion assembly using a soft metal rod and a hammer.



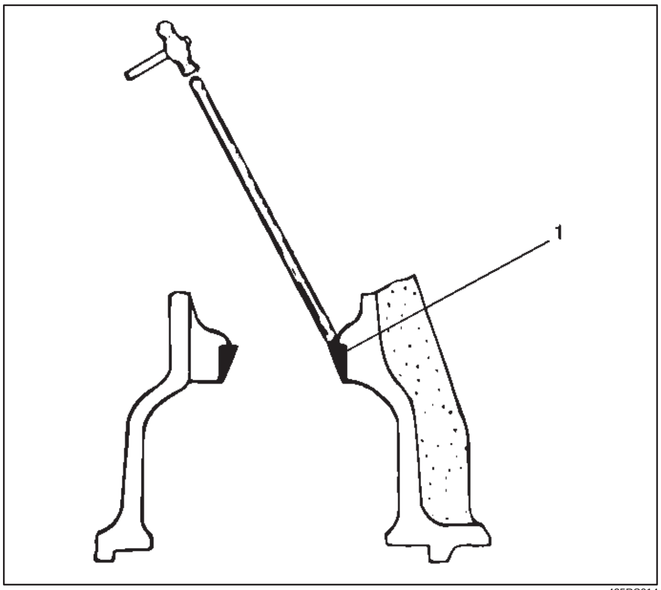
425RY005

10. Remove collapsible spacer.
11. Remove the inner bearing by using remover J–42379.Select insert 303174 and collet halves 44803 in remover kit J–42379 for inner bearing removal.

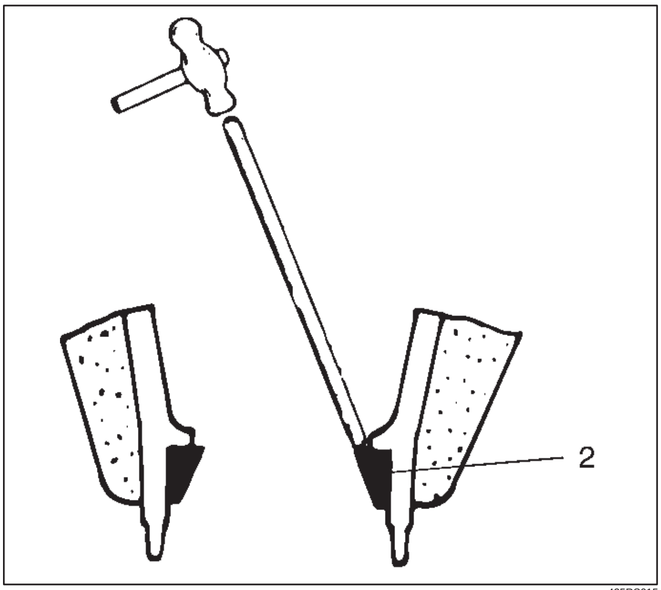


415RW004

12. Remove adjust shim.
13. Remove oil seal.
14. Remove oil seal slinger.
15. Remove outer bearing.
16. Remove the inner bearing outer race (1) and the outer bearing outer race (2) by using a brass bar and a hammer.



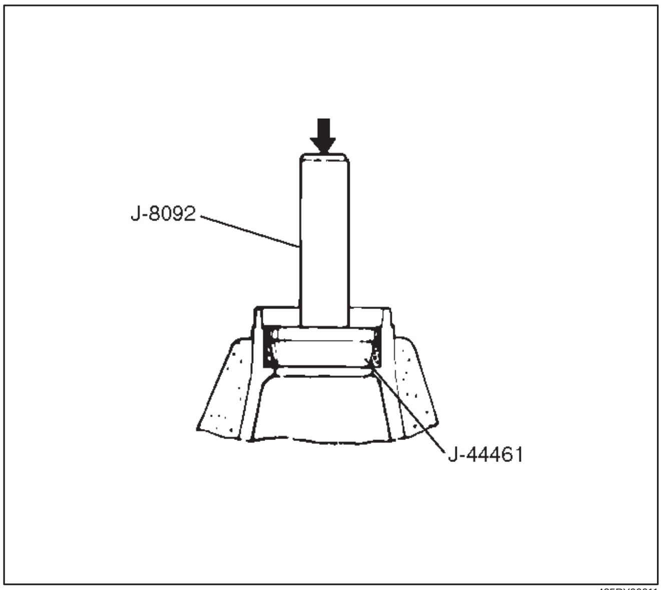
425RS014



425RS015

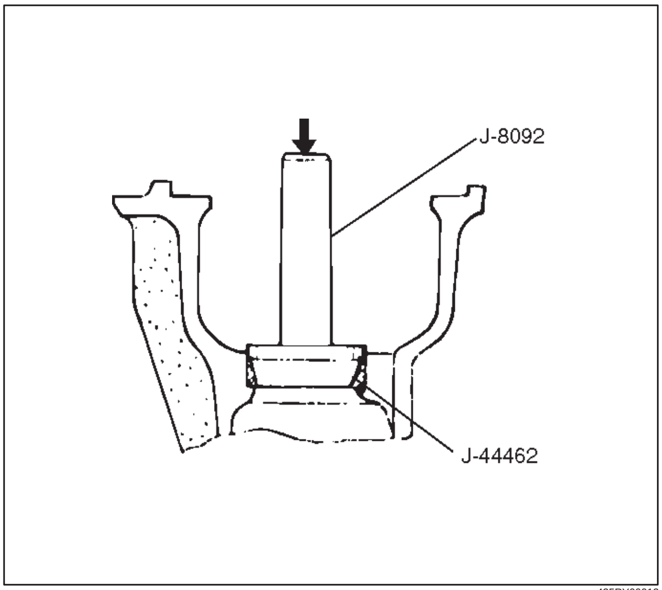
Reassembly

1. Install outer bearing outer race by using installer J–44461 and grip J–8092.



425RY00011

2. Install inner bearing outer race by using installer J–44462 and grip J–8092.



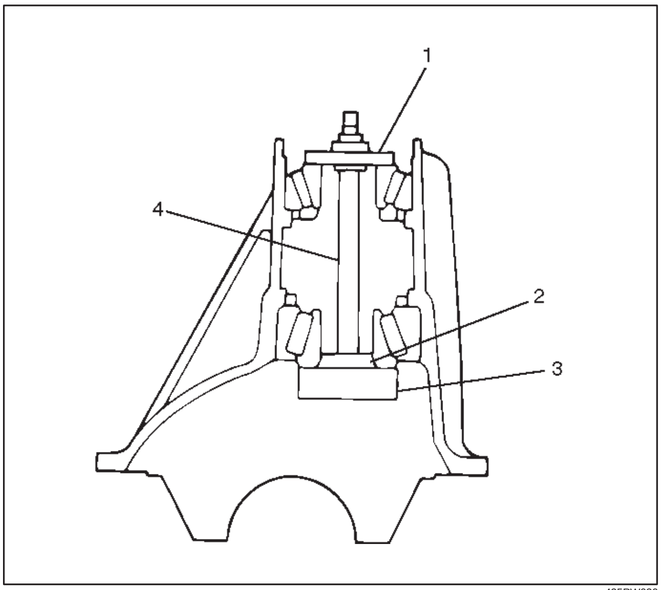
425RY00012

3. Adjust the drive pinion mounting distance as follows:
   1. Apply gear oil to the inner and outer drive pinion bearing. Clean the pinion setting gauge set. Then install the gauge set together with the inner and outer bearings.

   Install gauge plate J–42826 (3), inner pilot J–42827 (2) ,stud and nut J–21777–43 (4) and outer pilot J–42824 (1) through inner and outer bearings.

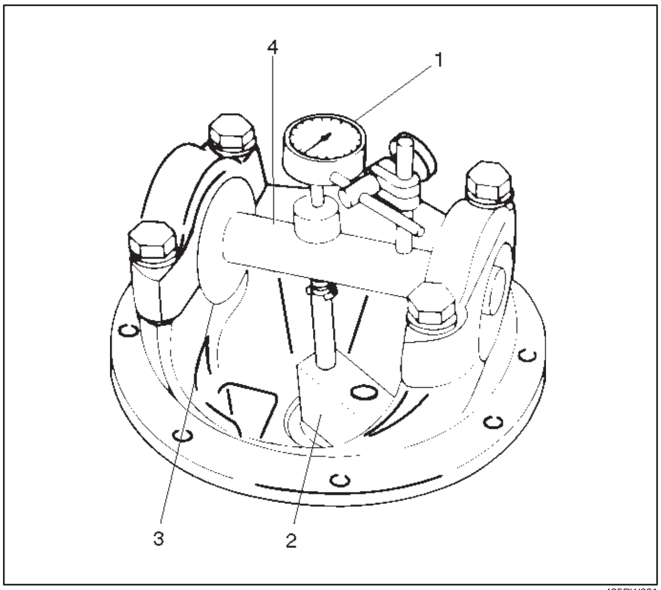
   2. Tighten the nut to the specified torque.

Torque: 2.3 N·m (20 lb in)



425RW030

   3. Clean the side bearing bores. Place discs and dial indicator on to arbor, and place tool into position in side bearing bores. Install and tighten the bearing caps to the specified torque.

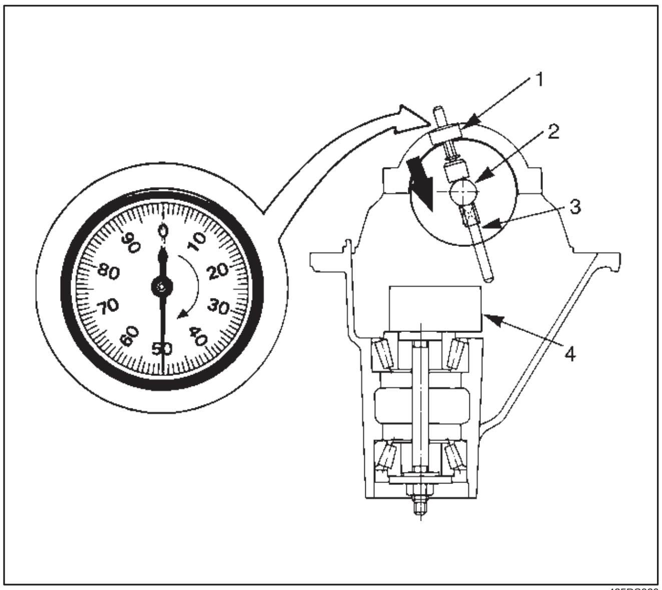


425RW031

Legend

(1) Dial Indicator: J–8001
(2) Gauge Plate: J–44451
(3) Disc (2 pcs.): J–44452
(4) Arbor: J–23597–1

4. Set the dial indicator J–8001 to “0”. Place it on the mounting post of the gauging arbor with the contact button touching the indicator pad. Force the dial indicator downward until the needle has made a half turn clockwise. Tighten down the dial indicator in this position.

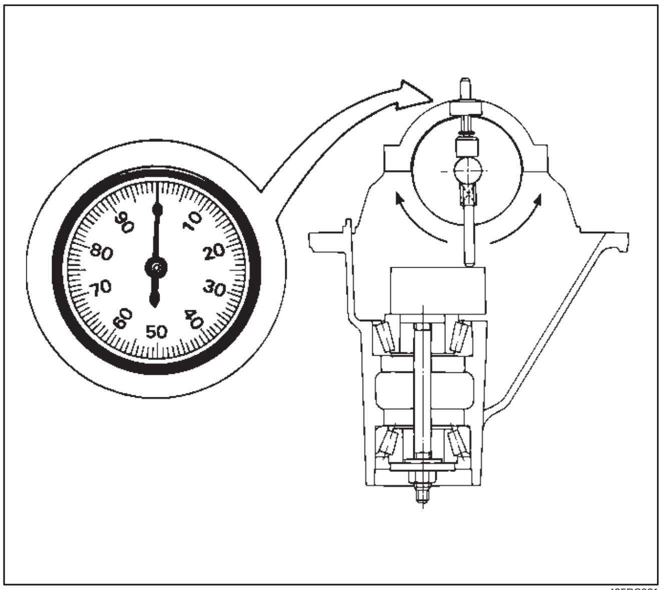


425RS020

Legend

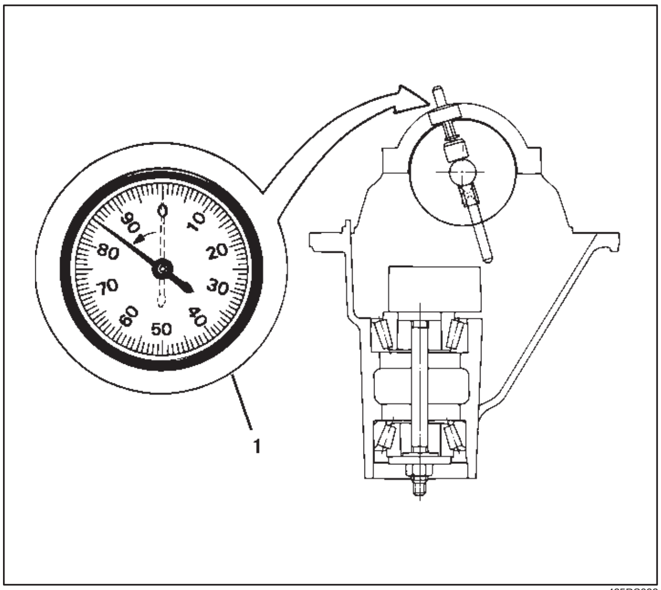
(1) Dial Indicator
(2) Ganging Arbor
(3) Plunger
(4) Gauge Plate

5. Position the plunger on the gauge plate. Move the gauging arbor slowly back and forth and locate the position at which the dial indicator shows the greatest defection. At this point, once again set the dial indicator to “0”. Repeat the procedure to verify the “0” setting.



425RS021

6. After the ZERO setting is obtained, rotate the gauging arbor until the dial indicator rod does not touch the gauging plate. Record the number the dial indicator needle points to.

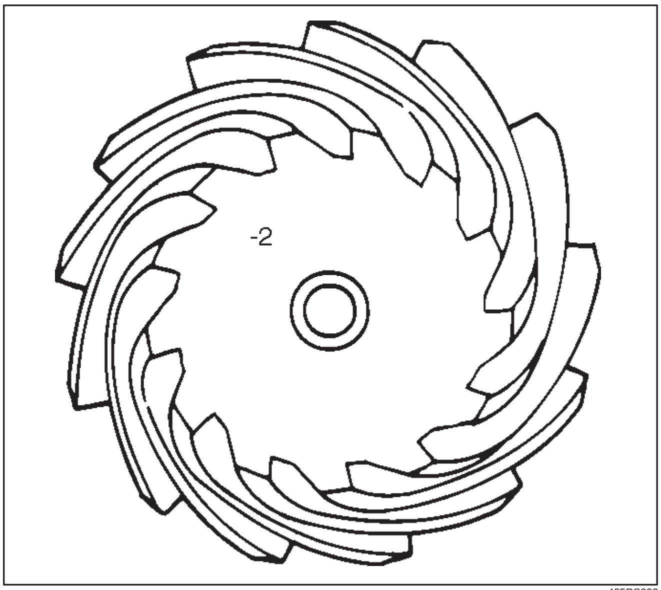


425RS022

Legend

(1) Example=Dial indicator reading od 0.085

7. Record the pinion depth code on the head of the drive pinion. The number indicates a necessary change in the pinion mounting distance. A plus number indicates the need for a greater mounting distance (which can be achieved by decreasing the shim thickness). A minus number indicates the need for a smaller mounting distance (which can be achieved by increasing the shim thickness). If examination reveals pinion depth code “0”, the pinion is “nominal”.



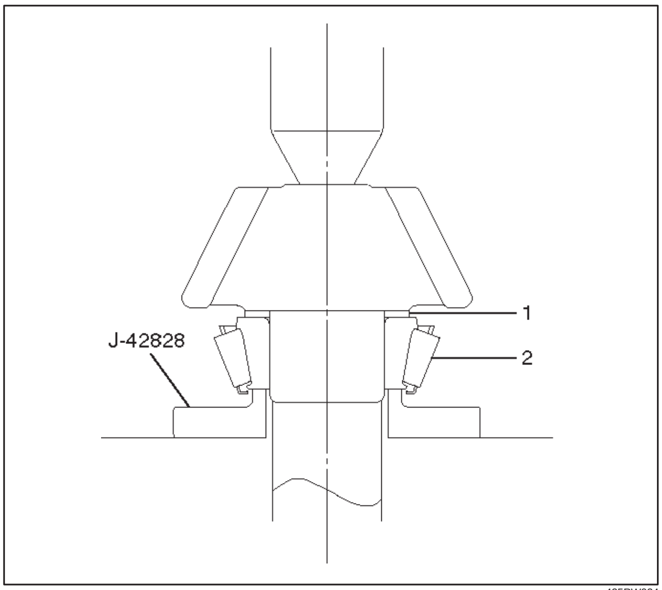
425RS023

8. Select the shim thickness using the chart;

Pinion marking Dial indicator reading (inches)	+10	+9	+8	+7	+6	+5	+4	+3	+2	+1	0	–1	–2	–3	–4	–5	–6	–7	–8	–9	–10
0.080																				2.12 (0.0835)	2.12 (0.0835)
0.081																	2.12 (0.0835)	2.12 (0.0835)	2.14 (0.0843)	2.14 (0.0843)	2.16 (0.0850)
0.082														2.12 (0.0835)	2.12 (0.0835)	2.14 (0.0843)	2.14 (0.0843)	2.16 (0.0850)	2.16 (0.0850)	2.18 (0.0858)	2.18 (0.0858)
0.083												2.12 (0.0835)	2.12 (0.0835)	2.14 (0.0843)	2.14 (0.0843)	2.16 (0.0850)	2.16 (0.0850)	2.18 (0.0858)	2.18 (0.0858)	2.20 (0.0866)	2.20 (0.0866)
0.084										2.12 (0.0835)	2.12 (0.0835)	2.14 (0.0843)	2.14 (0.0843)	2.16 (0.0850)	2.16 (0.0850)	2.18 (0.0858)	2.18 (0.0858)	2.20 (0.0866)	2.20 (0.0866)	2.22 (0.0874)	2.22 (0.0874)
0.085							2.12 (0.0835)	2.12 (0.0835)	2.14 (0.0843)	2.14 (0.0843)	2.16 (0.0850)	2.16 (0.0850)	2.18 (0.0858)	2.18 (0.0858)	2.20 (0.0866)	2.20 (0.0866)	2.22 (0.0874)	2.22 (0.0874)	2.24 (0.0822)	2.24 (0.0822)	2.26 (0.0890)
0.086				2.12 (0.0835)	2.12 (0.0835)	2.14 (0.0843)	2.14 (0.0843)	2.16 (0.0850)	2.16 (0.0850)	2.18 (0.0858)	2.18 (0.0858)	2.20 (0.0866)	2.20 (0.0866)	2.22 (0.0874)	2.22 (0.0874)	2.24 (0.0882)	2.24 (0.0882)	2.26 (0.0890)	2.26 (0.0890)	2.28 (0.0898)	2.28 (0.0898)
0.087		2.12 (0.0835)	2.12 (0.0835)	2.14 (0.0843)	2.14 (0.0843)	2.16 (0.0850)	2.16 (0.0850)	2.18 (0.0858)	2.18 (0.0858)	2.20 (0.0866)	2.20 (0.0866)	2.22 (0.0874)	2.22 (0.0874)	2.24 (0.0882)	2.24 (0.0882)	2.26 (0.0890)	2.26 (0.0890)	2.28 (0.0898)	2.28 (0.0898)	2.30 (0.0905)	2.30 (0.0905)
0.088	2.14 (0.0843)	2.14 (0.0843)	2.16 (0.0850)	2.16 (0.0850)	2.18 (0.0858)	2.18 (0.0858)	2.20 (0.0866)	2.20 (0.0866)	2.22 (0.0874)	2.22 (0.0874)	2.24 (0.0882)	2.24 (0.0882)	2.26 (0.0890)	2.26 (0.0890)	2.28 (0.0898)	2.28 (0.0898)	2.30 (0.0905)	2.30 (0.0905)	2.32 (0.0914)	2.32 (0.0914)	2.34 (0.0921)
0.089	2.16 (0.0850)	2.18 (0.0858)	2.18 (0.0858)	2.20 (0.0866)	2.20 (0.0866)	2.22 (0.0874)	2.22 (0.0874)	2.24 (0.0882)	2.24 (0.0882)	2.26 (0.0890)	2.26 (0.0890)	2.28 (0.0898)	2.28 (0.0898)	2.30 (0.0905)	2.30 (0.0905)	2.32 (0.0914)	2.32 (0.0914)	2.34 (0.0921)	2.34 (0.0921)	2.36 (0.0929)	2.36 (0.0929)
0.090	2.18 (0.0858)	2.20 (0.0866)	2.20 (0.0866)	2.22 (0.0874)	2.22 (0.0874)	2.24 (0.0882)	2.24 (0.0882)	2.26 (0.0890)	2.26 (0.0890)	2.28 (0.0898)	2.28 (0.0898)	2.30 (0.0905)	2.30 (0.0905)	2.32 (0.0914)	2.32 (0.0914)	2.34 (0.0921)	2.34 (0.0921)	2.36 (0.0929)	2.36 (0.0929)	2.38 (0.0937)	2.38 (0.0937)
0.091	2.20 (0.0866)	2.22 (0.0874)	2.22 (0.0874)	2.24 (0.0882)	2.24 (0.0882)	2.26 (0.0890)	2.26 (0.0890)	2.28 (0.0898)	2.28 (0.0898)	2.30 (0.0905)	2.30 (0.0905)	2.32 (0.0914)	2.32 (0.0914)	2.34 (0.0921)	2.34 (0.0921)	2.36 (0.0929)	2.36 (0.0929)	2.38 (0.0937)	2.38 (0.0937)	2.40 (0.0945)	2.40 (0.0945)
0.092	2.24 (0.0882)	2.24 (0.0882)	2.26 (0.0890)	2.26 (0.0890)	2.28 (0.0898)	2.28 (0.0898)	2.30 (0.0905)	2.30 (0.0905)	2.32 (0.0914)	2.32 (0.0914)	2.34 (0.0921)	2.34 (0.0921)	2.36 (0.0929)	2.36 (0.0929)	2.38 (0.0937)	2.38 (0.0937)	2.40 (0.0945)	2.40 (0.0945)	2.42 (0.0953)	2.42 (0.0953)	2.44 (0.0961)
0.093	2.26 (0.0890)	2.28 (0.0898)	2.28 (0.0898)	2.30 (0.0905)	2.30 (0.0905)	2.32 (0.0914)	2.32 (0.0914)	2.34 (0.0921)	2.34 (0.0921)	2.36 (0.0929)	2.36 (0.0929)	2.38 (0.0937)	2.38 (0.0937)	2.40 (0.0945)	2.40 (0.0945)	2.42 (0.0953)	2.42 (0.0953)	2.44 (0.0961)	2.44 (0.0961)	2.46 (0.0969)	2.46 (0.0969)
0.094	2.28 (0.0898)	2.30 (0.0905)	2.30 (0.0905)	2.32 (0.0914)	2.32 (0.0914)	2.34 (0.0921)	2.34 (0.0921)	2.36 (0.0929)	2.36 (0.0929)	2.38 (0.0937)	2.38 (0.0937)	2.40 (0.0945)	2.40 (0.0945)	2.42 (0.0953)	2.42 (0.0953)	2.44 (0.0961)	2.44 (0.0961)	2.46 (0.0969)	2.46 (0.0969)	2.48 (0.0977)	2.48 (0.0977)
0.095	2.30 (0.0905)	2.32 (0.0914)	2.32 (0.0914)	2.34 (0.0921)	2.34 (0.0921)	2.36 (0.0929)	2.36 (0.0929)	2.38 (0.0937)	2.38 (0.0937)	2.40 (0.0945)	2.40 (0.0945)	2.42 (0.0953)	2.42 (0.0953)	2.44 (0.0961)	2.44 (0.0961)	2.46 (0.0969)	2.46 (0.0969)	2.48 (0.0977)	2.48 (0.0977)	2.50 (0.0987)	2.50 (0.0987)
0.096	2.34 (0.0921)	2.34 (0.0921)	2.36 (0.0929)	2.36 (0.0929)	2.38 (0.0937)	2.38 (0.0937)	2.40 (0.0945)	2.40 (0.0945)	2.42 (0.0953)	2.42 (0.0953)	2.44 (0.0961)	2.44 (0.0961)	2.46 (0.0969)	2.46 (0.0969)	2.48 (0.0977)	2.48 (0.0977)	2.50 (0.0987)	2.50 (0.0987)	2.52 (0.0992)	2.52 (0.0992)	2.54 (0.1000)
0.097	2.36 (0.0929)	2.38 (0.0937)	2.38 (0.0937)	2.40 (0.0945)	2.40 (0.0945)	2.42 (0.0953)	2.42 (0.0953)	2.44 (0.0961)	2.44 (0.0961)	2.46 (0.0969)	2.46 (0.0969)	2.48 (0.0977)	2.48 (0.0977)	2.50 (0.0984)	2.50 (0.0984)	2.52 (0.0992)	2.52 (0.0922)	2.54 (0.1000)	2.54 (0.1000)	2.56 (0.1008)	2.56 (0.1008)
0.098	2.38 (0.0937)	2.40 (0.0945)	2.40 (0.0945)	2.42 (0.0953)	2.42 (0.0953)	2.44 (0.0961)	2.44 (0.0961)	2.46 (0.0969)	2.46 (0.0969)	2.48 (0.0977)	2.48 (0.0977)	2.50 (0.0984)	2.50 (0.0984)	2.52 (0.0992)	2.52 (0.0922)	2.54 (0.1000)	2.54 (0.1000)	2.56 (0.1008)	2.56 (0.1008)	2.58 (0.1016)	2.58 (0.1016)
0.099	2.42 (0.0953)	2.42 (0.0953)	2.44 (0.0961)	2.44 (0.0961)	2.46 (0.0969)	2.46 (0.0969)	2.48 (0.0977)	2.48 (0.0977)	2.50 (0.0984)	2.50 (0.0984)	2.52 (0.0992)	2.52 (0.0922)	2.54 (0.1000)	2.54 (0.1000)	2.56 (0.1008)	2.56 (0.1008)	2.58 (0.1016)	2.58 (0.1016)			
0.000	2.44 (0.0961)	2.46 (0.0969)	2.46 (0.0969)	2.48 (0.0977)	2.48 (0.0977)	2.50 (0.0984)	2.50 (0.0984)	2.52 (0.0992)	2.52 (0.0922)	2.54 (0.1000)	2.54 (0.1000)	2.56 (0.1008)	2.56 (0.1008)	2.58 (0.1016)	2.58 (0.1016)						
0.001	2.46 (0.0969)	2.48 (0.0977)	2.48 (0.0977)	2.50 (0.0984)	2.50 (0.0984)	2.52 (0.0992)	2.52 (0.0922)	2.54 (0.1000)	2.54 (0.1000)	2.56 (0.1008)	2.56 (0.1008)	2.58 (0.1016)	2.58 (0.1016)								
0.002	2.48 (0.0977)	2.50 (0.0984)	2.50 (0.0984)	2.52 (0.0992)	2.52 (0.0922)	2.54 (0.1000)	2.54 (0.1000)	2.56 (0.1008)	2.56 (0.1008)	2.58 (0.1016)	2.58 (0.1016)										
0.003	2.52 (0.0992)	2.52 (0.0922)	2.54 (0.1000)	2.54 (0.1000)	2.56 (0.1008)	2.56 (0.1008)	2.58 (0.1016)	2.58 (0.1016)													
0.004	2.54 (0.1000)	2.56 (0.1008)	2.56 (0.1008)	2.58 (0.1016)	2.58 (0.1016)																
0.005	2.56 (0.1008)	2.58 (0.1016)	2.58 (0.1016)																		
0.006	2.58 (0.1016)																				

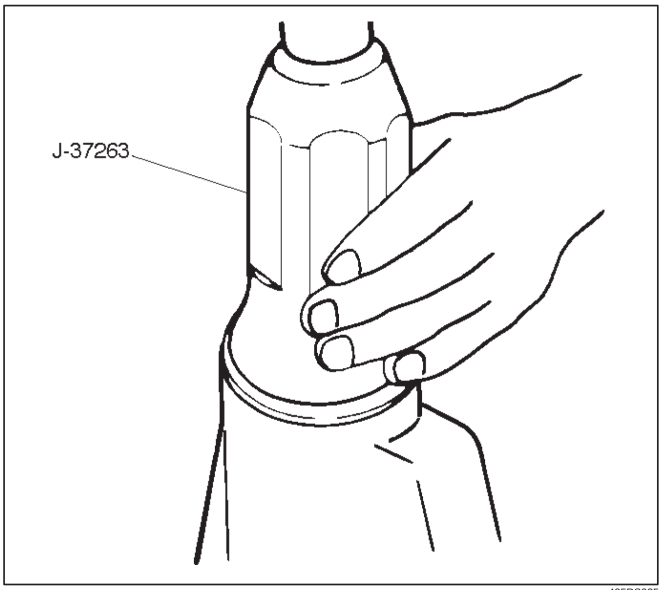
4. Place the shim (1) on the drive pinion, then install the inner bearing (2) onto the pinion by using installer J–42828 and a press .

NOTE: Do not apply pressure to the roller cage. Apply pressure only to the inner race.



425RW024

5. Install collapsible spacer. Discard the used collapsible spacer and install a new one.
6. Install drive pinion shaft assembly.
7. Install outer bearing and oil seal slinger.
8. Use oil seal installer J–37263 to install a new oil seal that has grease on seal lip.

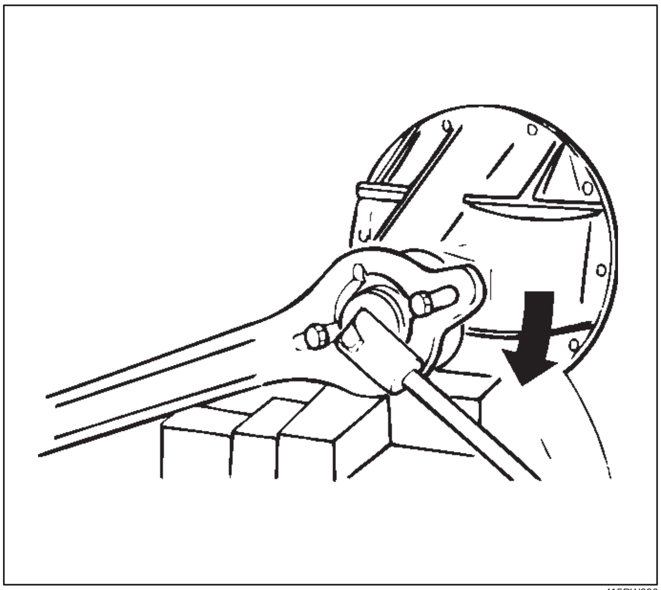


425RS025

9. Install flange assembly.

10. Install flange nut and washer.
    1. Apply lubricant to the pinion threads.
    2. Using the pinion flange holder J–8614–01, tighten the nut only enough to remove the shaft end play.

NOTE: Discard used flange nut and install new one.



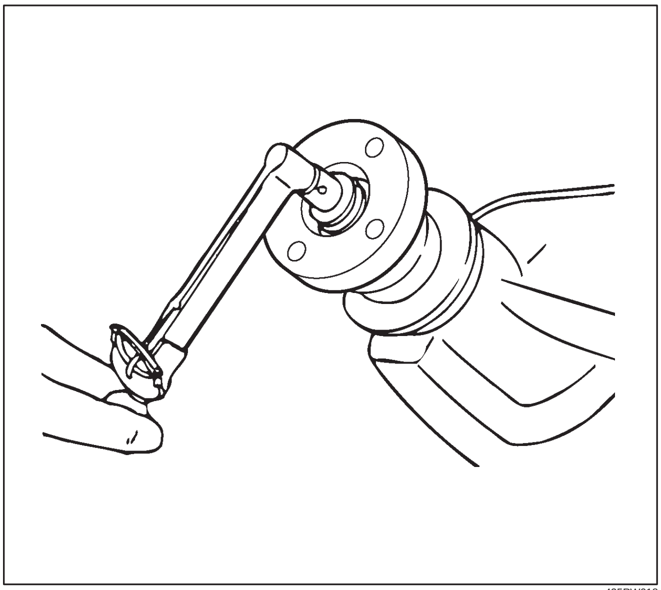
415RW006

3. Adjust pinion bearing preload.
   a. Measure the bearing preload by using a torque meter and note the scale reading required to rotate the flange.
   b. Continue tightening flange nut until the specified starting torque is obtained.

Starting torque: 1.1–1.6 N·m (10–14 lb in)

NOTE:

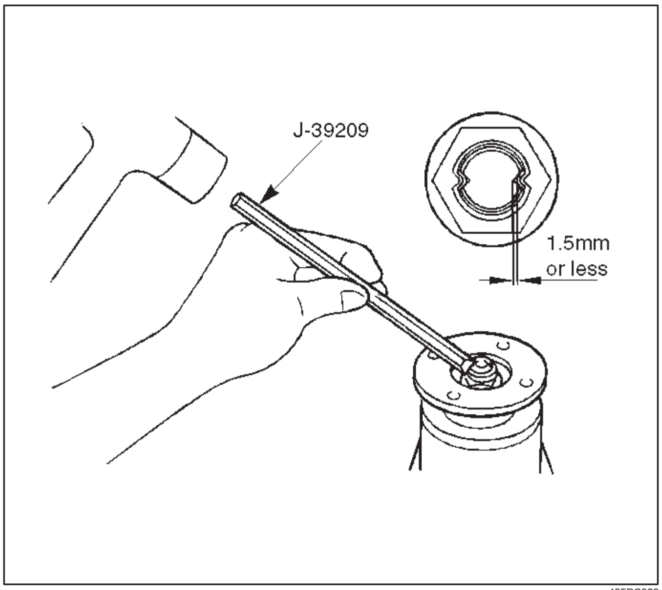
a. Do not overtighten or loosen and then retighten the nut.
b. Pinion nut torque should be in the range of 298–380 N·m (220–281 lb ft).



425RW018

4. Using punch J–39209, stake the flange nut at two points.

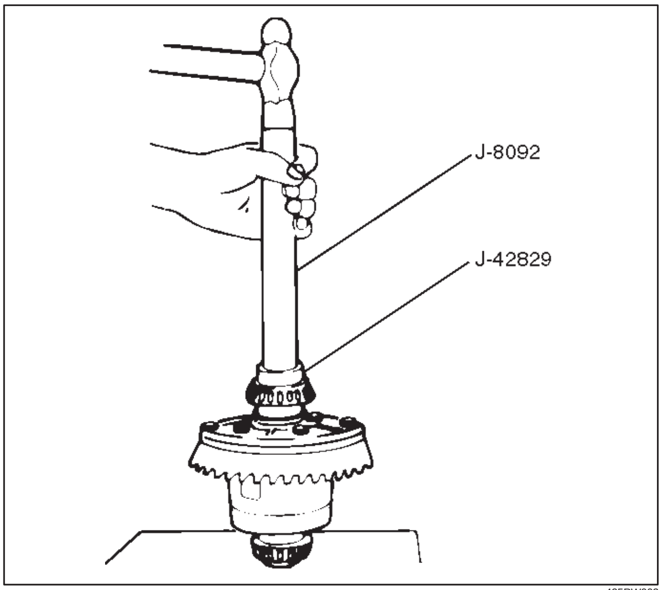
NOTE: When staking, be sure to turn the nut to ensure that there is no change in bearing preload. Make sure of preload again as instructed in 3).



425RS028

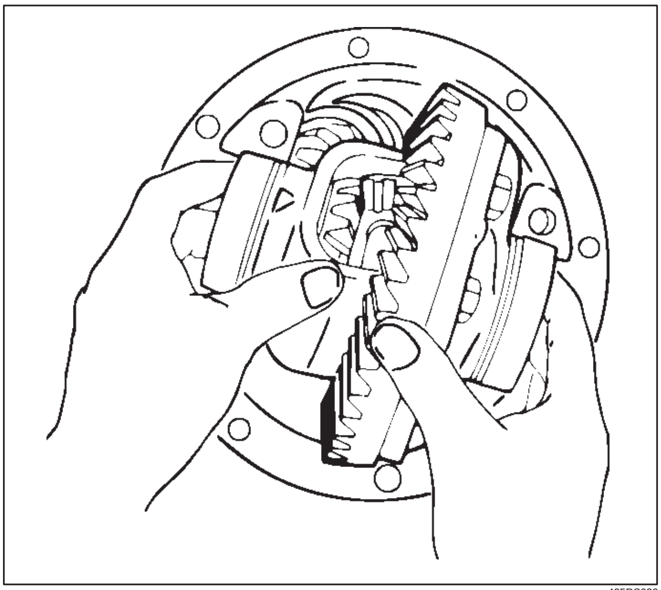
11. Adjust ring gear backlash.

1. Attach the side bearing to the differential assembly without shims by using installer J–42829 and grip J–8092.



425RW003

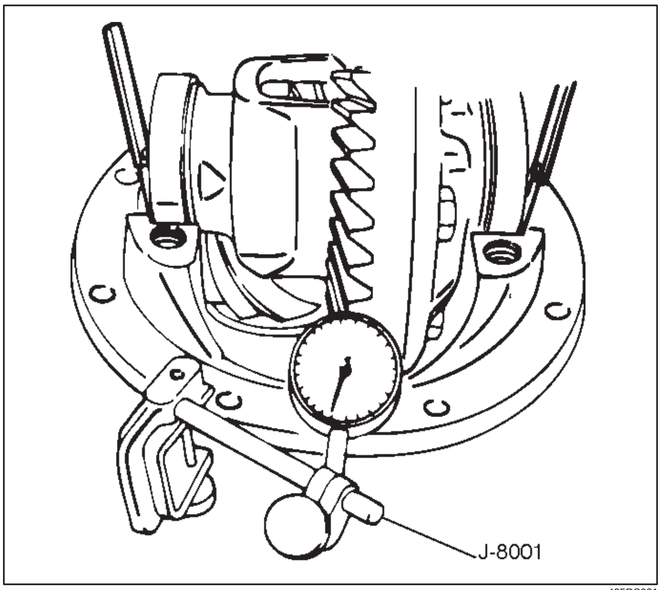
2. Insert the differential cage assembly with bearing outer races into the side bearing bores of the carrier.



425RS030

3. Using two sets of feeler gauges, insert a feeler stock of sufficient thickness between each bearing outer race and the carrier to remove all end play. Make certain the feeler stock is pushed to the bottom of the bearing bores.

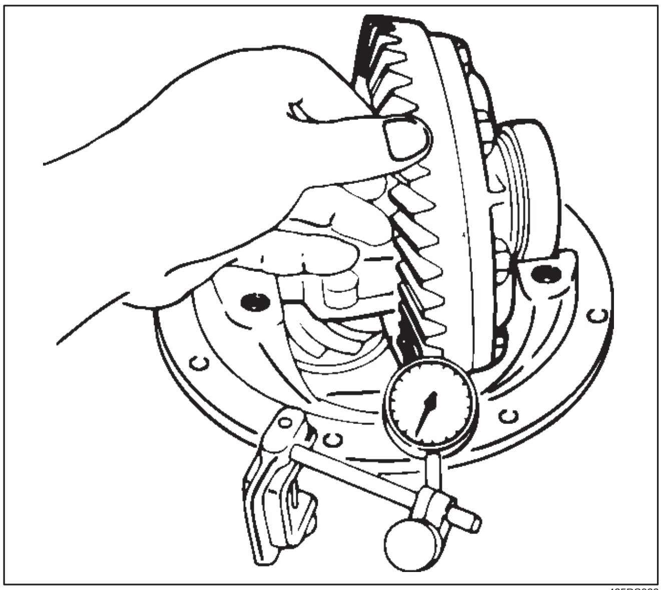
Mount the dial indicator J–8001 on the carrier so that the indicator stem is at right angles to a tooth on the ring gear.



425RS031

4. Adjust feeler gauge thickness from side to side until ring gear backlash is in the specified range.

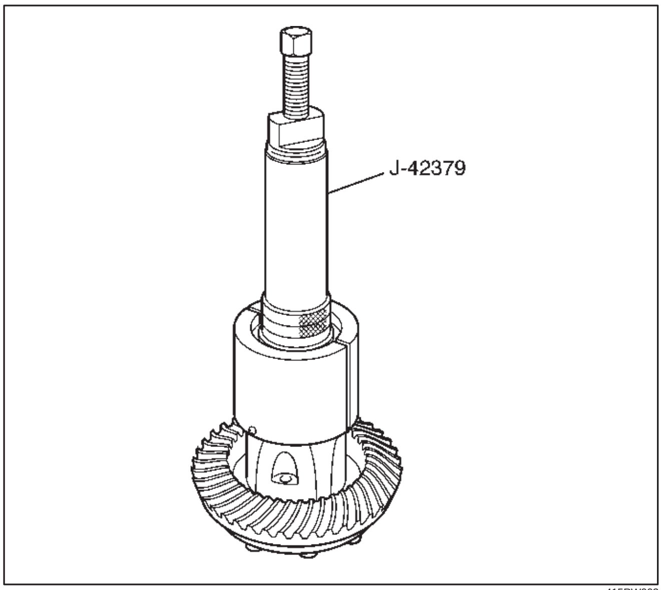
Backlash: 0.13– 0.2mm (0.005– 0.008in)



425RS032

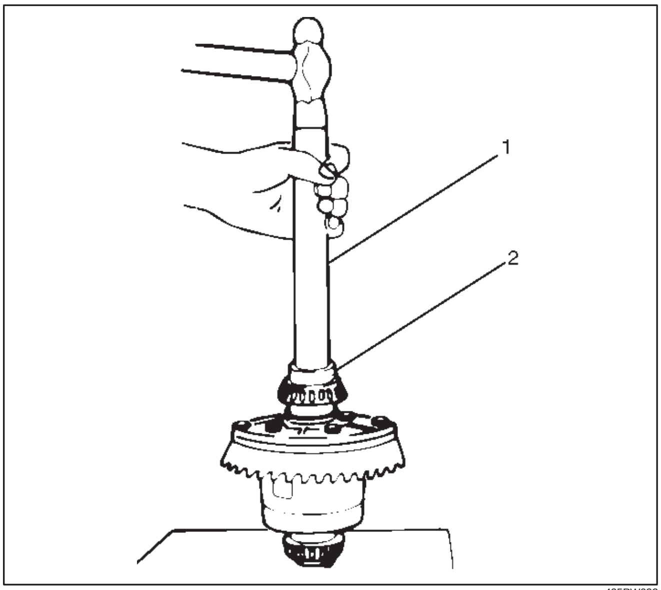
With zero end play and correct backlash established, remove the feeler gauge packs, determine the thickness of the shims required and add 0.05 mm (0.002 in) to each shim pack to provide side bearing preload. Always use new shims.

5. Remove side bearing by using remover J–42379 and adapter J–8107–3.



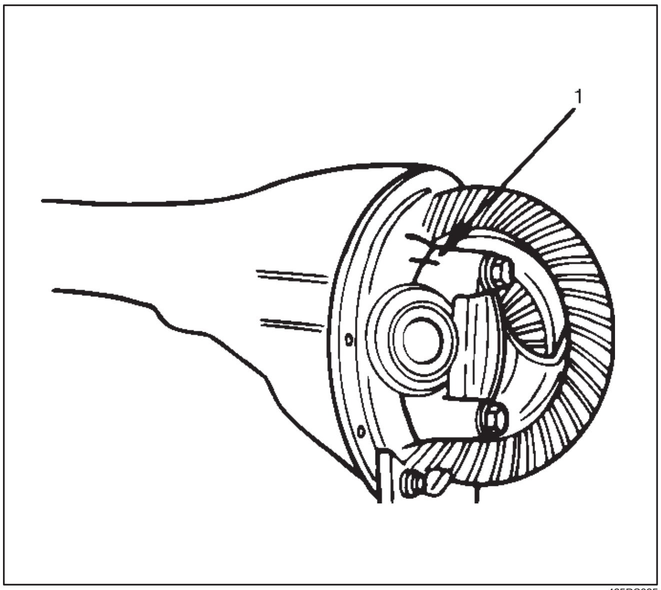
415RW003

12. Install the side bearings together with the selected shims by using installer J–42829 (2) and grip J–8092 (1).



425RW032

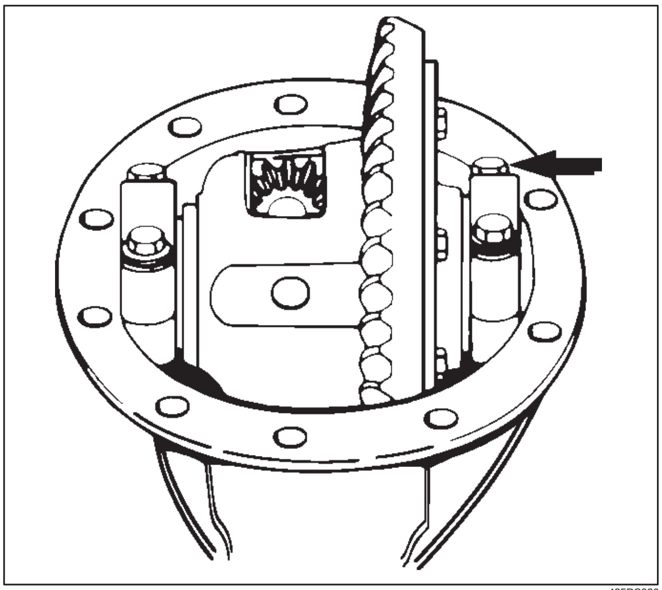
13. Install side bearing outer race.
14. Install differential cage assembly.
15. Align the setting marks (1) applied at disassembly then install the bearing cap.



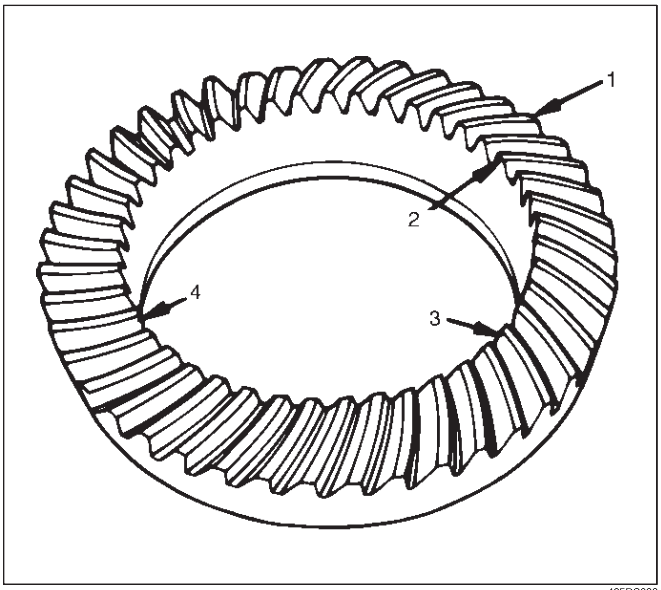
425RS035

16. Tighten the bolt to the specified torque.

Torque:108N·m (80lb ft)



425RS036



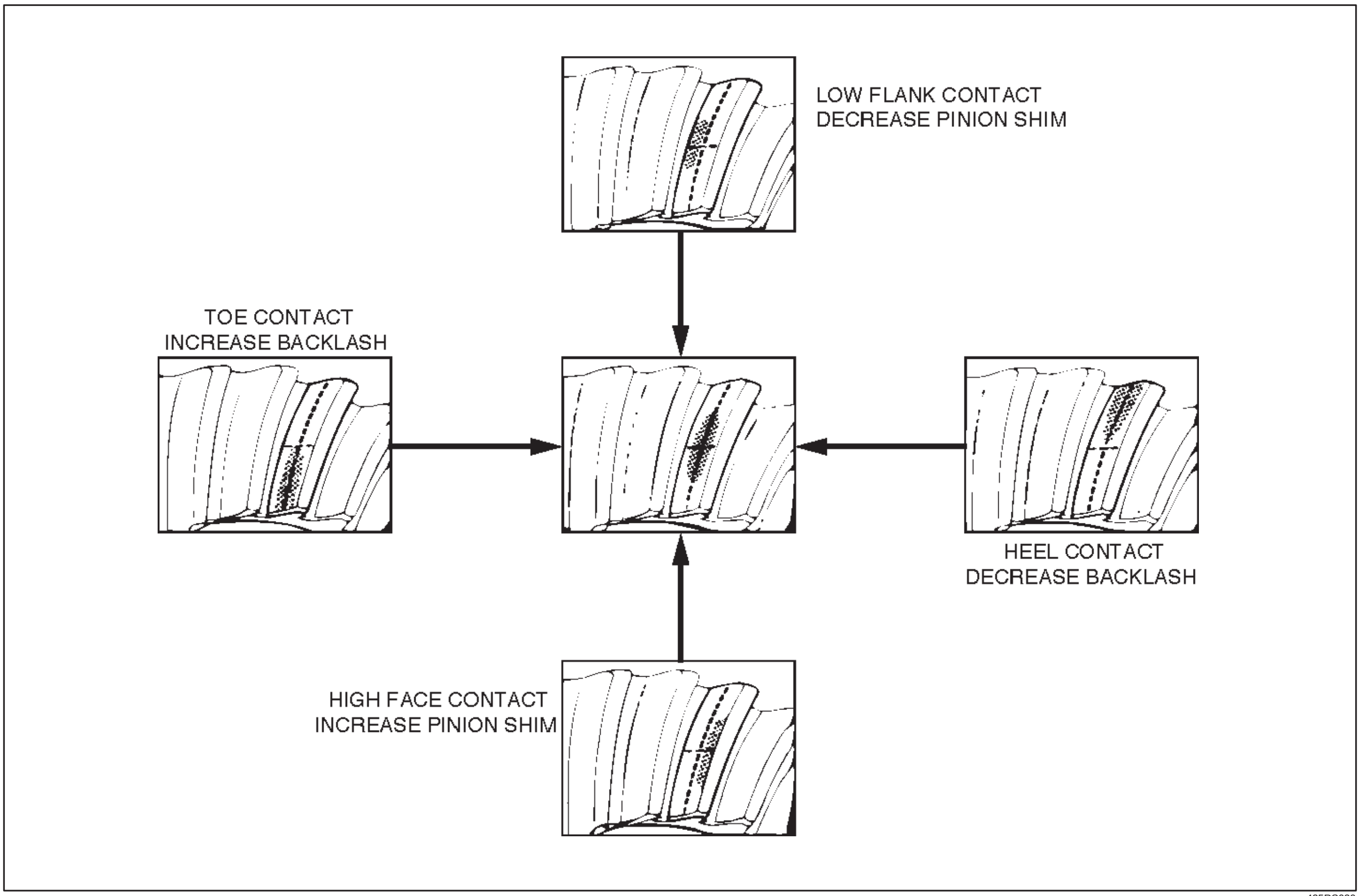
425RS038

Legend

(1) Heel
(2) Toe
(3) Concave Side(Coast)
(4) Convex Side(Drive)

Gear Tooth Contact Pattern Check and Adjustment

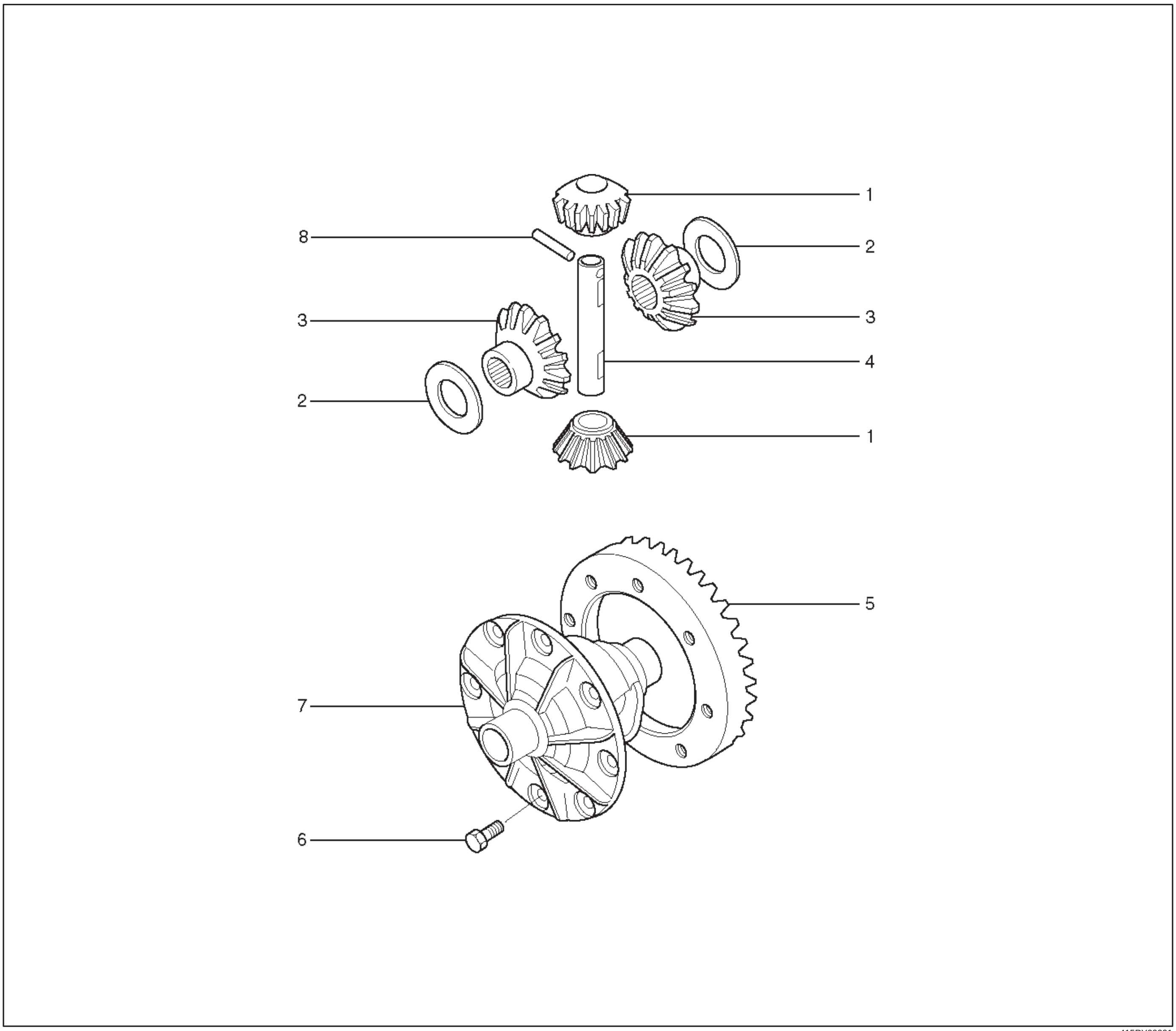
1. Apply a thin coat of Prussian blue or equivalent to the faces of the 7–8 teeth of the ring gear. Check the impression of contact on the ring gear teeth and make necessary adjustment as described in illustration if the contact is abnormal.



425RS039

Differential Cage Assembly

Disassembled View

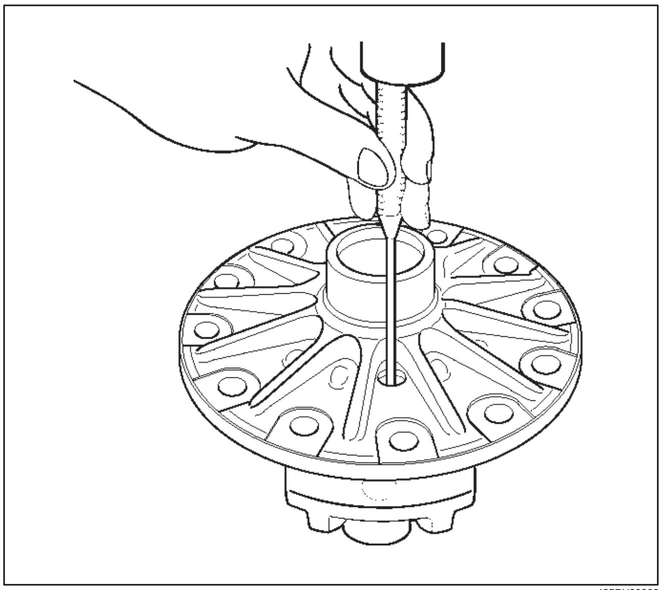


Legend

(1) Pinion Mate Gear
(2) Thrust Washer(for Side Gear)
(3) Side Gear
(4) Differential Shaft
(5) Ring Gear
(6) Bolt
(7) Differention Cage
(8) Lock Pin

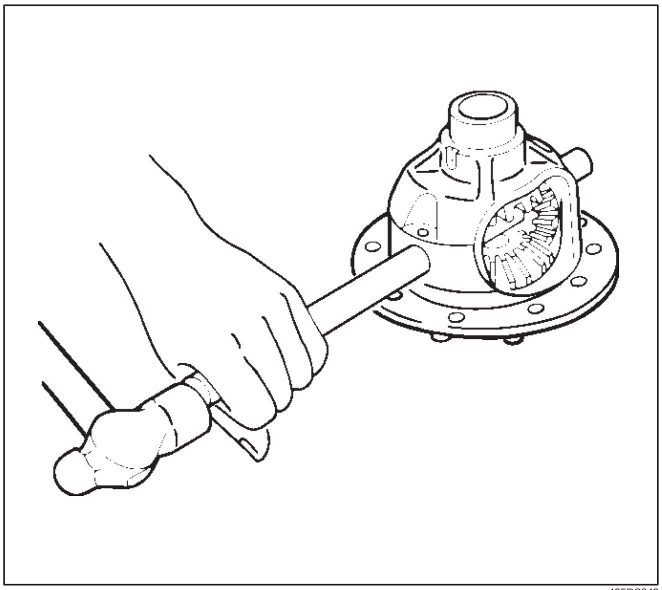
Disassembly

1. Remove bolt.
2. Remove ring gear.
3. Remove lock pin using a small drift.



425RY00002

4. Remove the differential shaft by using a hard metal rod and a hammer.



425RS043

5. Remove pinion mate gear and thrust washer.
6. Remove side gear and thrust washer.

Inspection and Repair

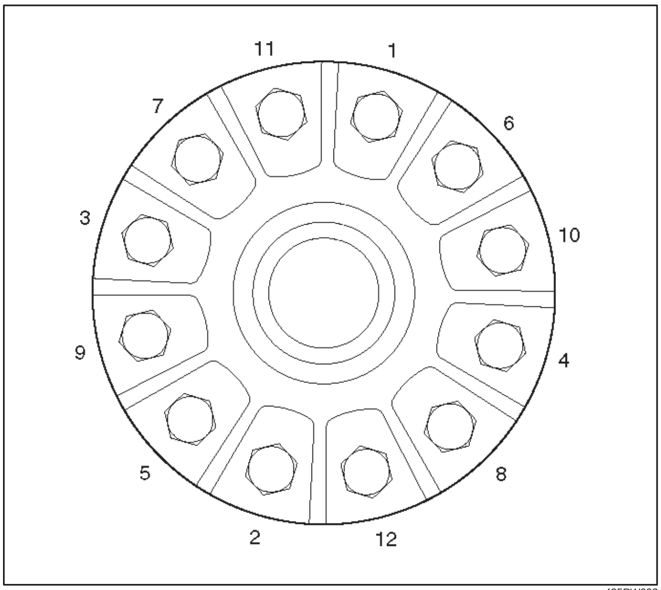
Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- Ring gear, pinion gear
- Bearing
- Side gear, pinion mate gear, differential shaft
- Differential cage, carrier
- Thrust washer
- Oil seal

Ring gear replacement:

1. The ring gear should always be replaced with the drive pinion as a set.
2. Clean the ring gear threaded holes to remove the locking agent.
3. Discard used bolts and install new ones.
4. When installing the ring gear, apply LOCTITE 271 or equivalent to all the threaded area and half of the unthreaded area of the bolt.

Torque: 127N·m (94 lb ft)

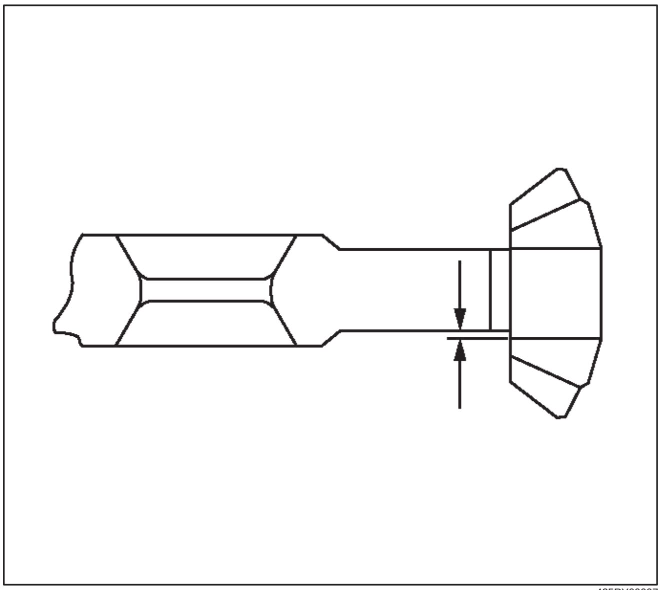


425RW033

Clearance between the differential pinion and the pinion shaft measurement.

Standard: 0.07 – 0.13 mm (0.003 – 0.005 in)

Limit: 0.2 mm (0.008 in)

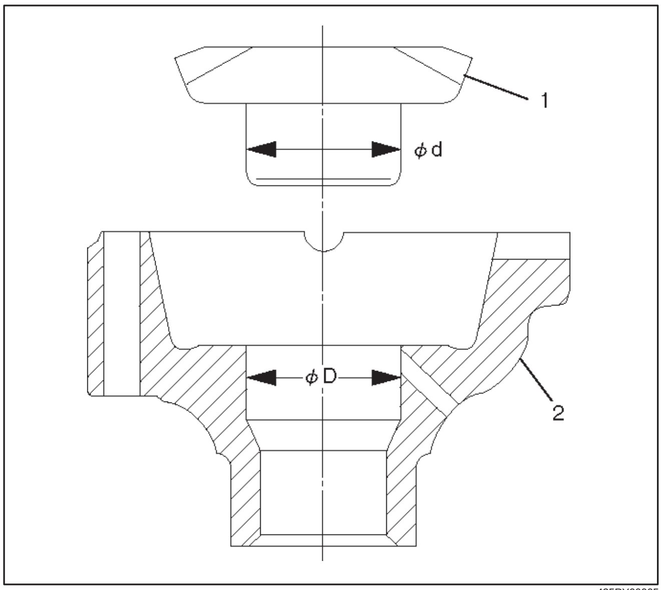


425RY00007

Clearance between the side gear and the differential box.

Standard: 0.032 – 0.105 mm (0.001 – 0.004 in)

Limit: 0.105 mm (0.004 in)



425RY00005

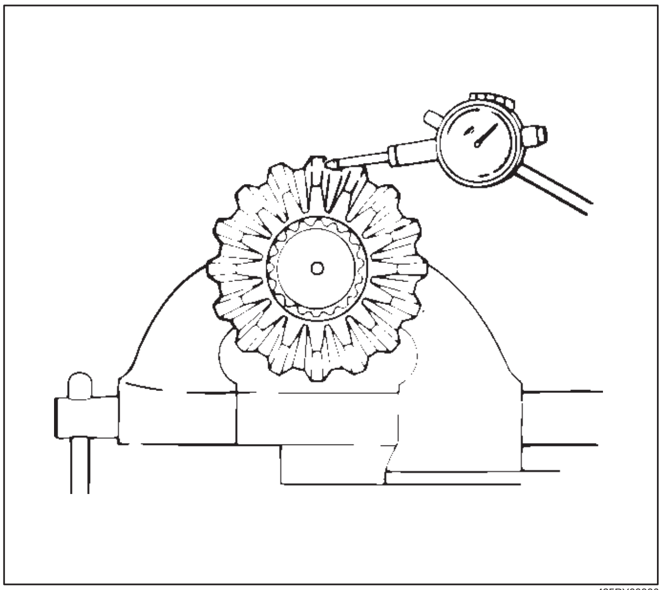
Legend

(1) Side gear
(2) Differential box

Play in splines between the side gear and the axle shaft.

Standard: 0.07 – 0.38 mm (0.003 – 0.014 in)

Limit: 0.5 mm (0.02 in)

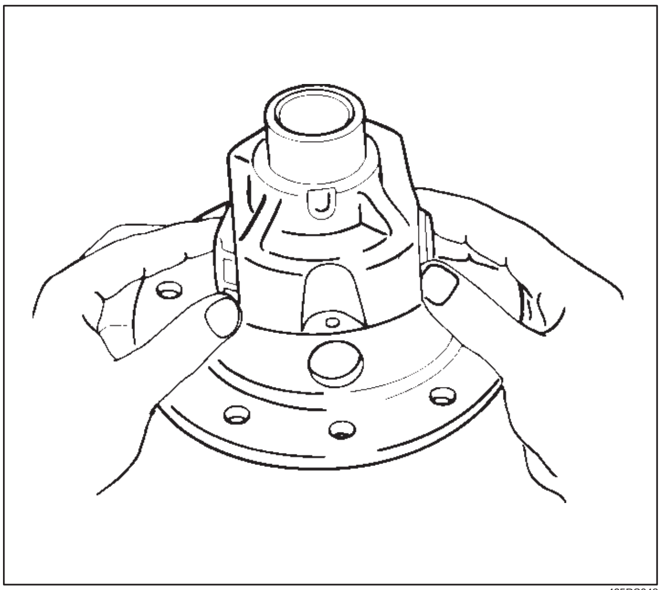


425RY00006

Reassembly

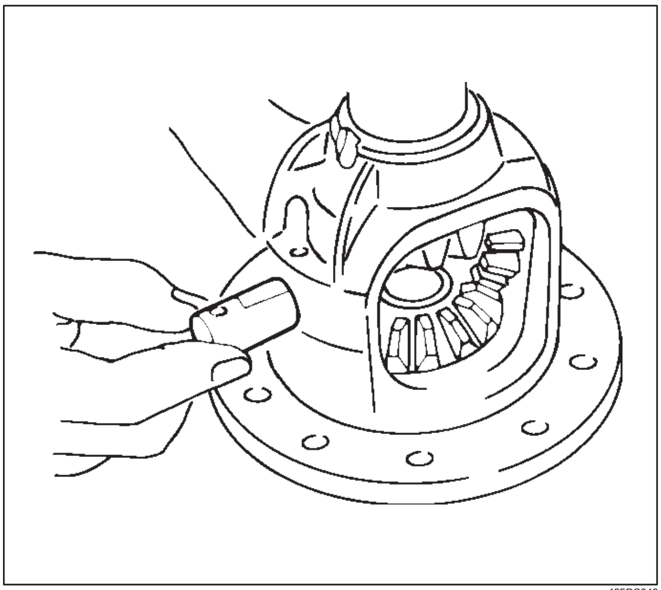
Differential cage
Thrust washer
Side gear
Pinion gear

1. Install the pinion gear by engaging it with the side gears while turning both pinion gears simultaneously in the same direction.
2. Install the pinion mate gear with thrust washer by engaging it with the side gears while turning both pinion mate gears simultaneously in the same direction.



425RS048

3. Install differential shaft.
    1. Be sure to install the differential shaft so that it is in alignment with the lock pin hole in the differential cage.



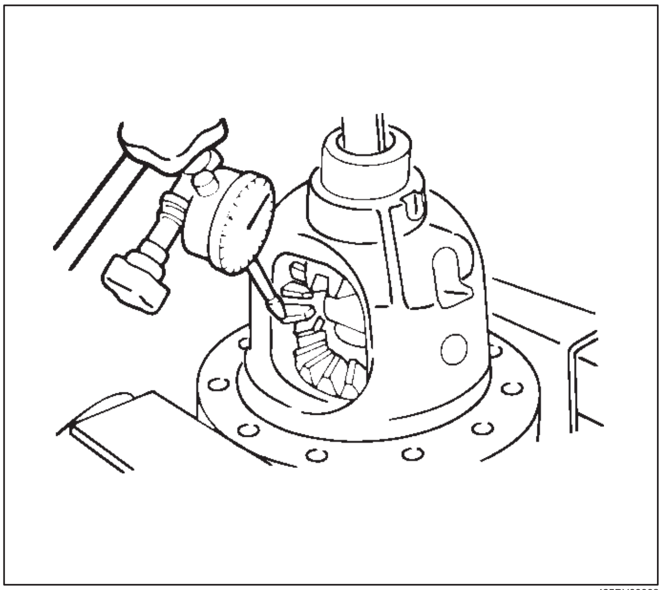
425RS049

2. Adjust the backlash between the side gear and the pinion gear.

Backlash: 0.15 – 0.20 mm (0.006 – 0.008 in)

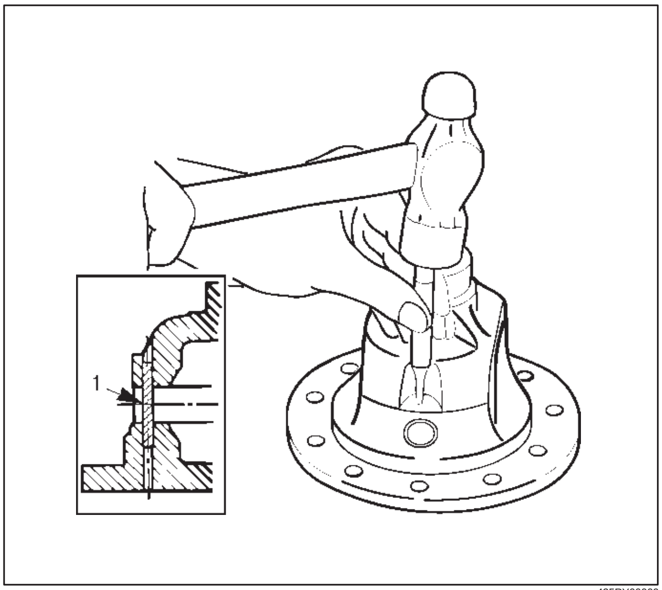
Thickness of thrust washers available

mm	0.80	0.90	1.00	1.10	1.20	1.30
in	0.031	0.035	0.039	0.043	0.047	0.051



425RY00008

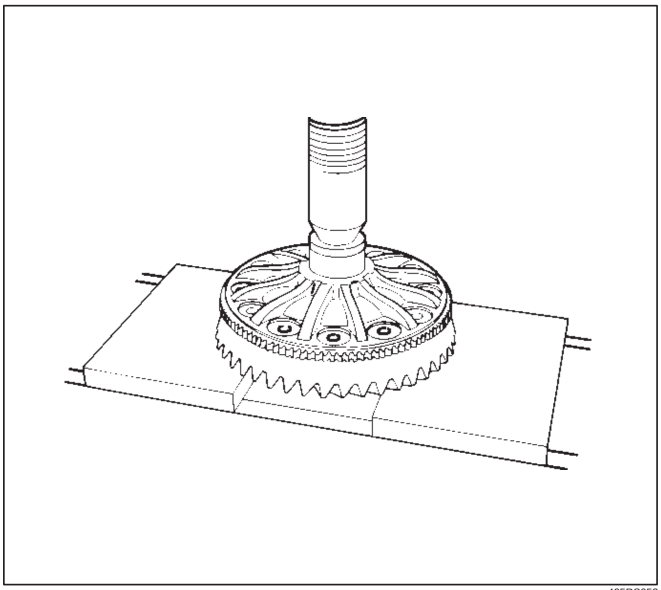
4. Install lock pin.
   - Install the lock pin using small drift.



425RY00009

5. Install exciter ring (If equipped with rear wheel antilock).
   - Press the exciter ring on the differential cage using the ring gear as a pilot.

NOTE: Discard used exciter ring and install new one.

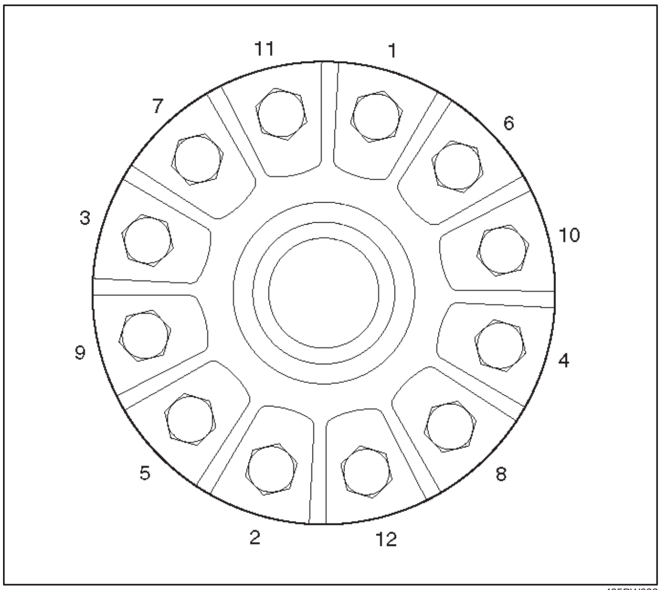


425RS052

6. Tighten the bolts in diagonal sequence as illustrated.

   Torque: 127N·m (94 lb ft)

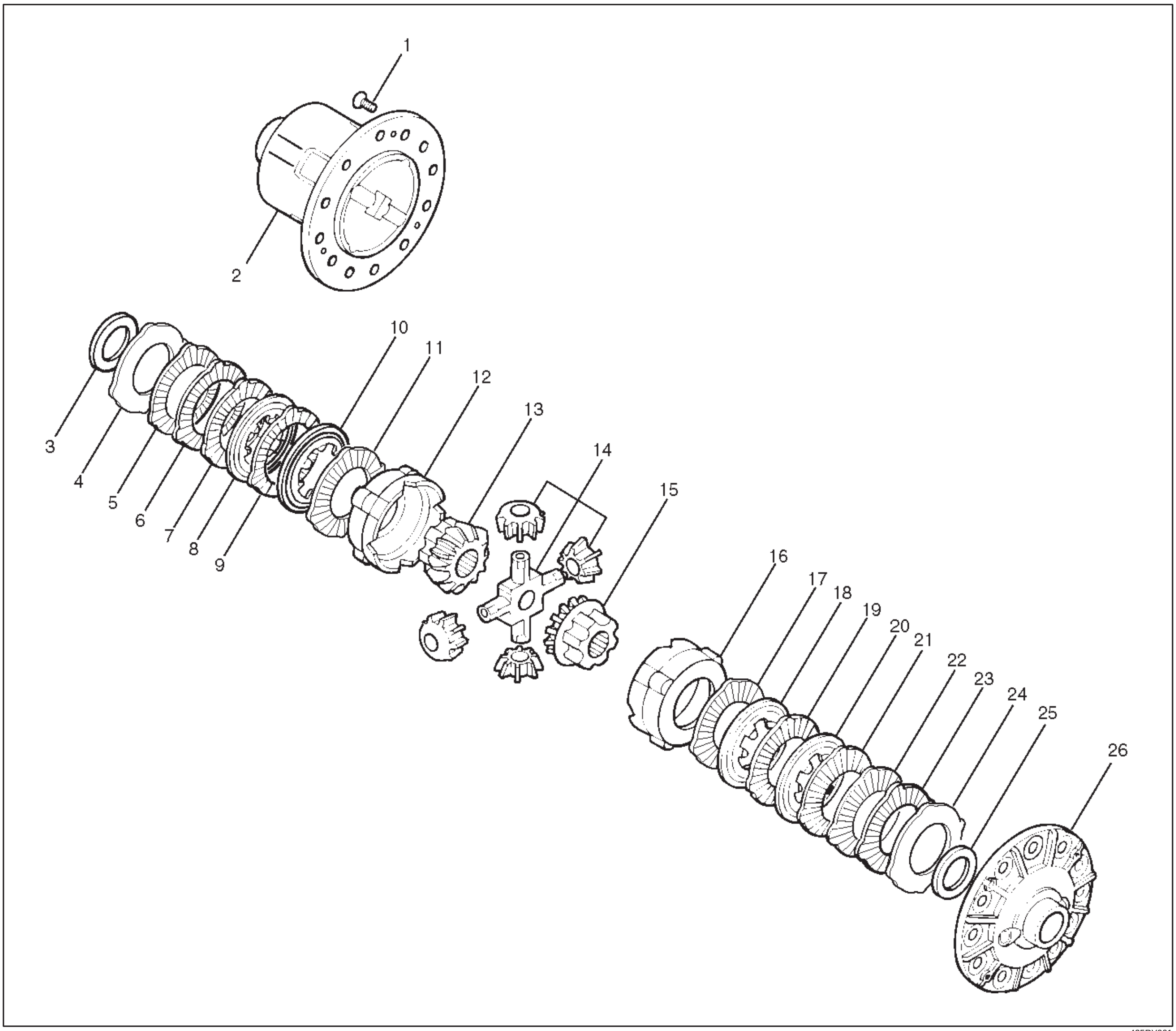
NOTE: Discard used bolts and install new ones.



425RW033

Limited Slip Differential

Disassembled View



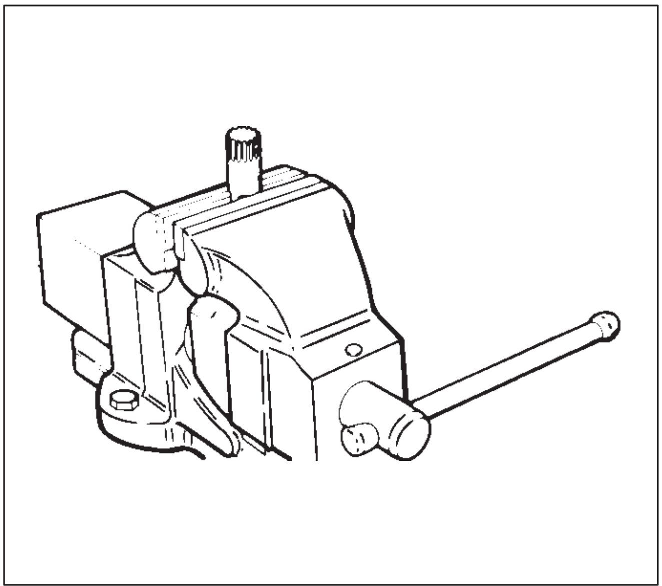
Legend

(1) Screw
(2) Differential cage A
(3) Thrust washer
(4) Spring disc
(5) Friction Plate
(6) Friction plate
(7) Friction Plate
(8) Friction disc
(9) Friction Plate
(10) Friction disc
(11) Friction Plate
(12) Pressure ring
(13) Side gear
(14) Pinion and Pinion shaft
(15) Side gear
(16) Pressure ring
(17) Friction Plate
(18) Friction disc
(19) Friction Plate
(20) Friction disc
(21) Friction Plate
(22) Friction Plate
(23) Friction Plate
(24) Spring disc
(25) Thrust washer
(26) Differential cage B

Disassembly

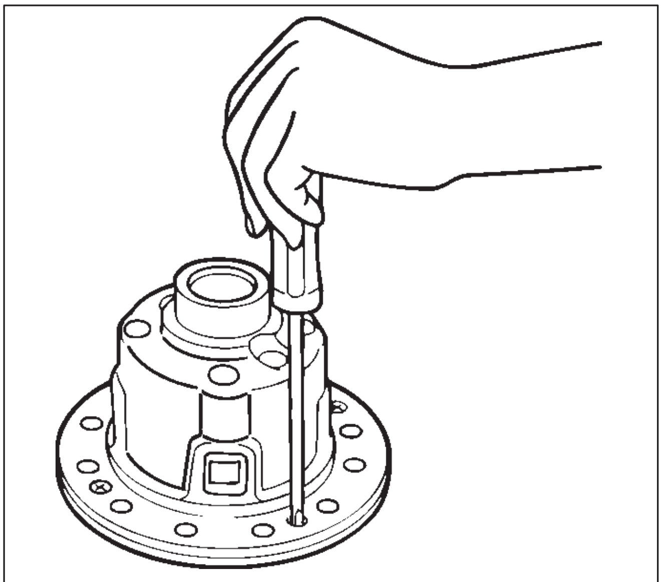
Differential Cages A and B

1. To ensure installation of the parts in original position apply a setting mark before removing the differential cages A and B.
2. Using special tool, J–44450, grip it with a vice, and set the differential.



425RS054

3. Gradually and evenly loosen the 3 fixing screws of the differential cages A and B.



425RS055

4. Remove Differential cage A.
5. Remove Thrust washer.
6. Remove Spring disc.

NOTE: When removing the spring disc, friction disc, and friction plate, place them in order for clear distinction of left and right use.

7. Remove Spring disc.
8. Remove Friction plate.
9. Remove Friction plate.
10. Remove Friction disc.
11. Remove Friction plate.
12. Remove Friction disc.
13. Remove Friction plate.
14. Remove Pressure ring.
15. Remove Side gear.
16. Remove Pinion and pinion shaft.
17. Remove Side gear.
18. Remove Pressure ring.
19. Remove Friction plate.
20. Remove Friction disc.
21. Remove Friction plate.
22. Remove Friction disc.
23. Remove Friction plate.
24. Remove Friction plate.
25. Remove Friction plate.
26. Remove Friction disc.
27. Remove Thrust washer.
28. Remove Differential cage B.

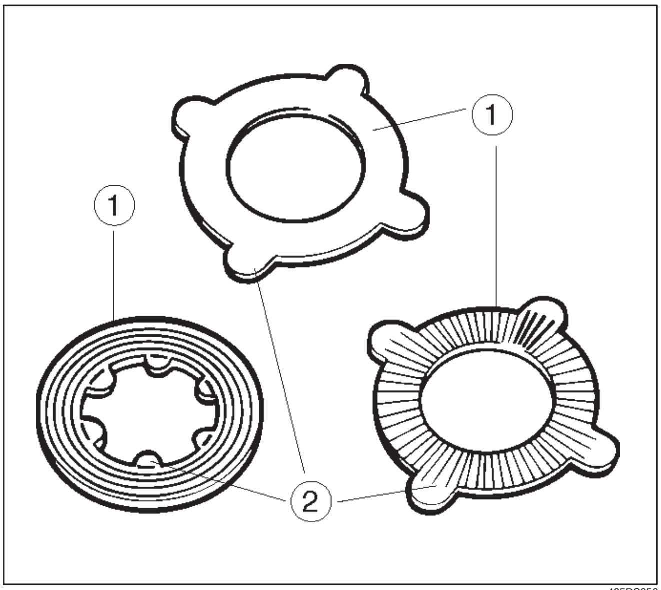
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition is found through inspection.

Visual check

Check the following parts for wear, damage, noise or any other abnormal conditions.

- **Friction disc, friction plate and spring disc**

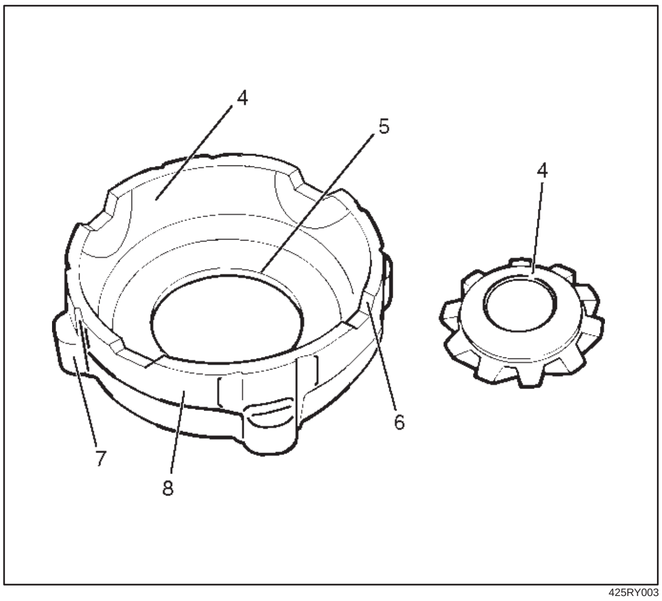


425RS056

Legend

(1) Sliding surfaces
(2) Projections

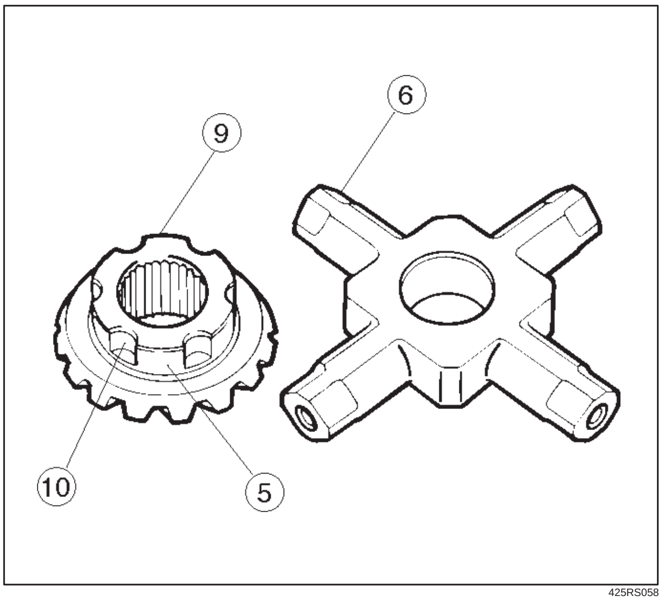
- **Pressure ring**



Legend

(3) Sliding surface with the friction disc. When nicks or scratches are found, polish with an oil stone and repair on a level block using a compound.
(4) Sliding spherical surface with the pinion gear.
(5) Sliding surface with the side gear.
(6) V–shaped groove of the pressure ring and V –shaped section of the pinion shaft.
(7) Fitting section with the case.
(8) Face contacting the inner surface of the differential case. Repair burrs and nicks using an oil stone.

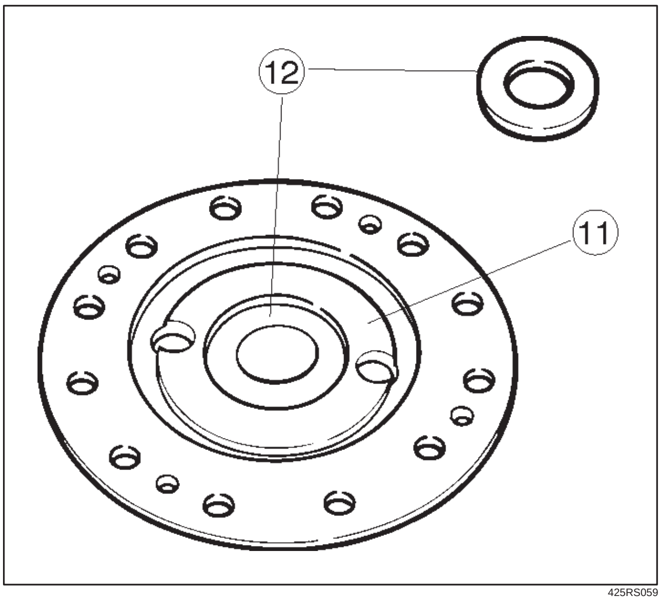
- **Thrust washer**



Legend

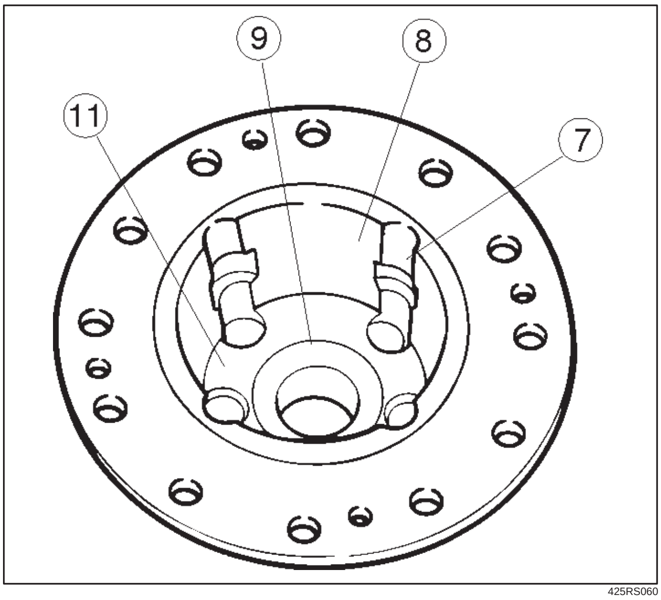
(9) Sliding surface with the side gear or case.
(10) Peripheral groove of the side gear.
Repair light nicks and burrs using an oil stone.

- **Case**



Legend

(11) Contact surface with the spring disc.
(12) Inner groove of the differential cage B.
Repair light nicks and burrs using an oil stone.

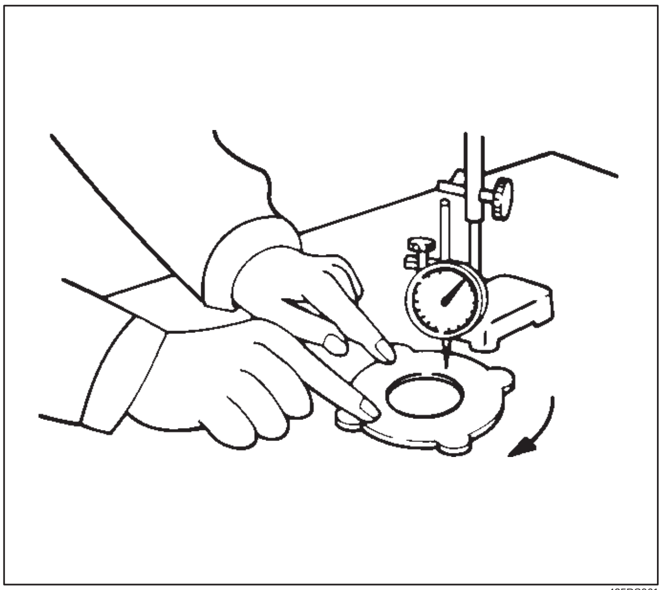


Legend

(7) Fitting section with the case.
(8) Face contacting the inner surface of the differential case.
Repair burrs and nicks using an oil stone.
(9) Sliding surface with the side gear or case.
(11) Contact surface with spring disc.

Measure the Deformation of the friction disc & plate.

Limit: 0.1 mm (0.004 in)



425RS061

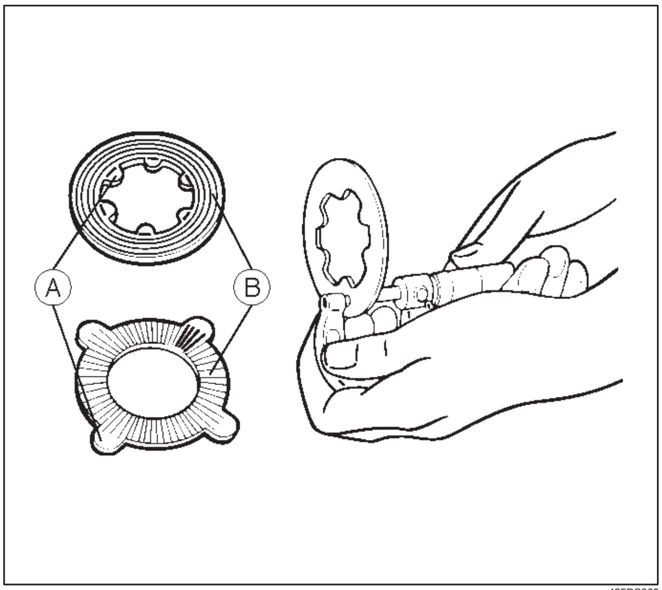
Measure the wear of the friction plate & disc

Limit(A–B): 0.1 mm (0.004 in)

Remarks:

A=Inner or outer projections

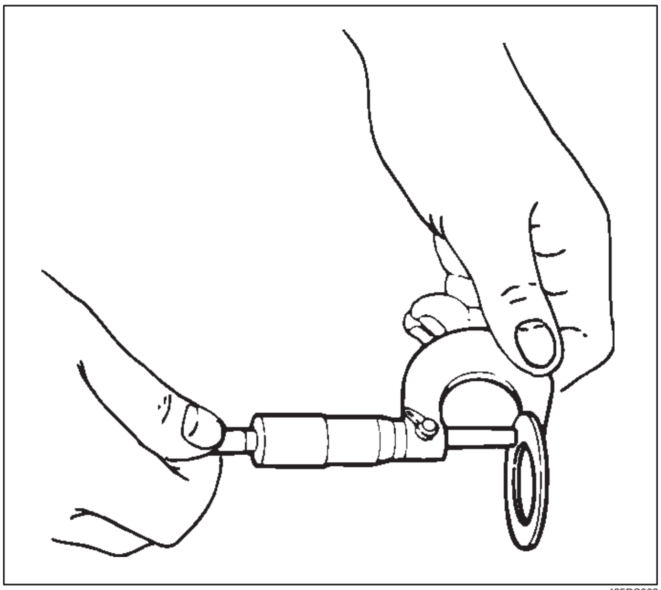
B=Sliding surface subjected to abrasion



425RS062

Measure the wear of the thrust washer

Limit: 1.3 mm (0.05 in)



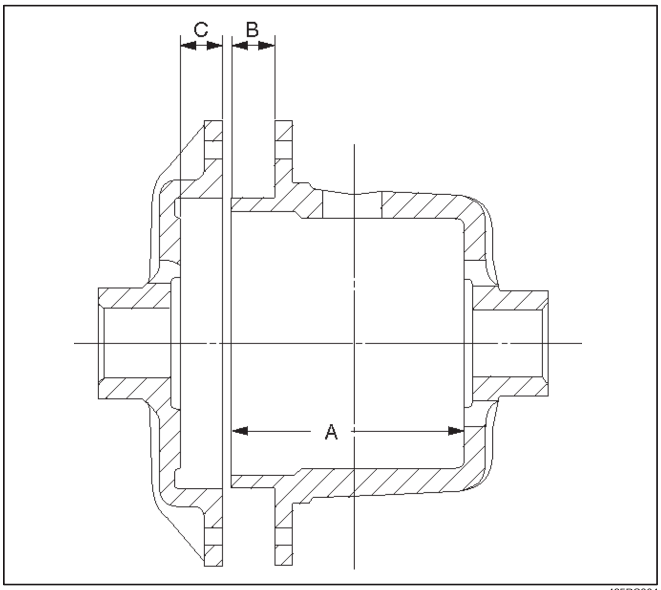
425RS063

Reassembly

Adjust the clearance between the friction disc and plate.

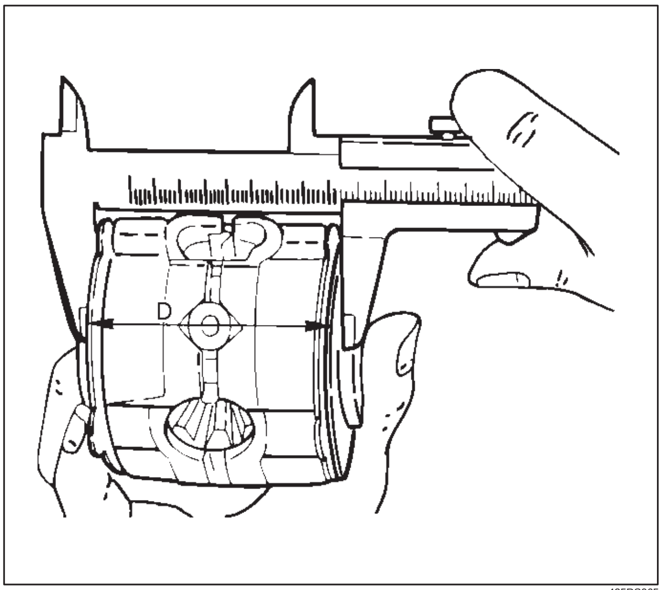
1. Measuring the depth of the differential cage.

Standard (A–B):	**89.13 mm (3.51 in)**
(C):	**9.13 mm (0.36 in)**



425RS064

2. Measuring the overall length of the pressurering, friction disc and friction plate.
   - Mount the pinion shaft in the pressurering and then install the friction disc & plate.
   - Measure the length between the plates over the V–groove. (D)



425RS065

3. After measuring dimensions A,B,C and D, make adjustment in the following manner:
   - Measure the thickness (E) of the spring disc.
     1.75mm (0.069in) ×2 discs
4. Select the friction disc & plate so as to satisfy the following equation:
   {(A-B)+C}-(D+E)=0.06-0.20mm (0.002-0.008in)
   Also, the total size difference of the friction disc & plate and spring disc should be 0.05mm (0.02in) or less.

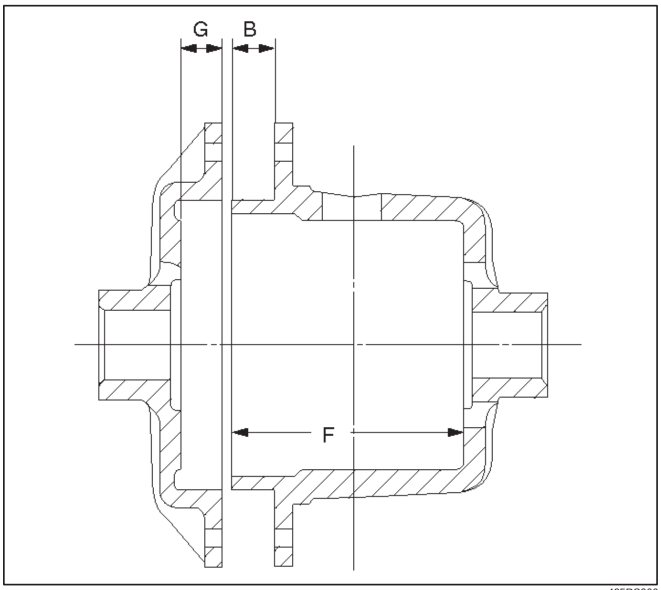
Thickness
:1.65–1.75–1.85mm(0.065–0.069–0.073 in)

Backlash adjustment of the side gear in the direction of the shaft

1. Measuring the depth of the differential cage.

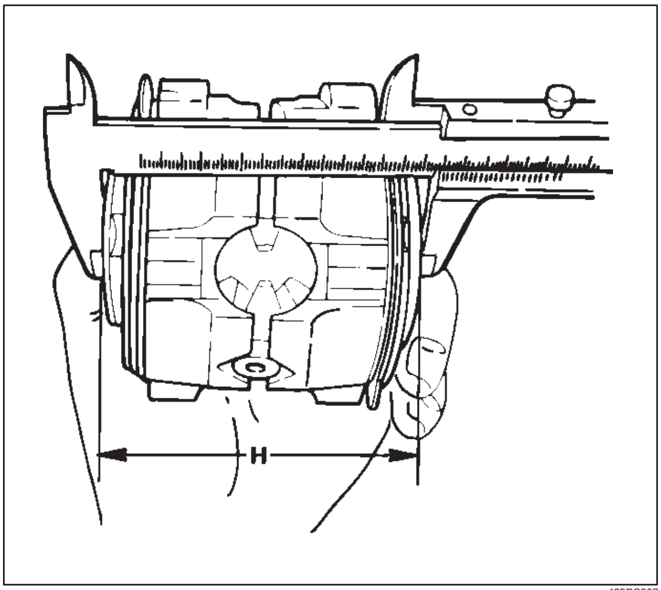
(F–B): 95.63 mm (3.76 in)

(G): 15.63 mm (0.62 in)



425RS066

2. Measuring the dimension between the thrust washers at both ends.
   - Assemble the side gear, pinion, pinion shaft, pressure ring and thrust washer, and pressing the pressure ring to–the pinion shaft in the direction of the shaft to make the clearance 0.
   - Have the side gear contact to the pinion to make the backlash 0.
   - Measure the dimension (H) between thrust washers at both ends.



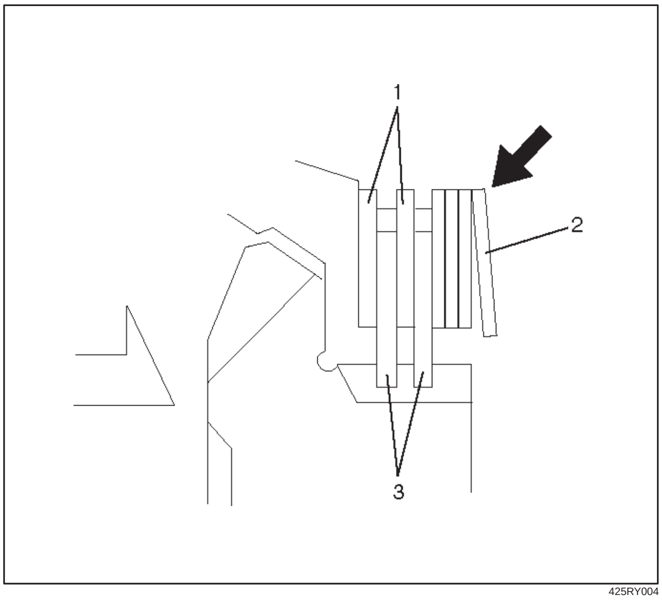
425RS067

3. After measuring dimensions of each of the above sections, proceed with the adjustment in the following manner:
   Adjust the clearance to satisfy the equation below.
   {(F – B) + G – H}=0.05 – 0.20 mm
   Also, select the thrust washers so that the dimensional difference between the back surfaces of the left and right pressure rings to the thrust washers is 0.05mm or less.

   Thickness : 1.5mm (0.059 in)
   1.6 mm(0.063 in)
   1.7 mm(0.067 in)

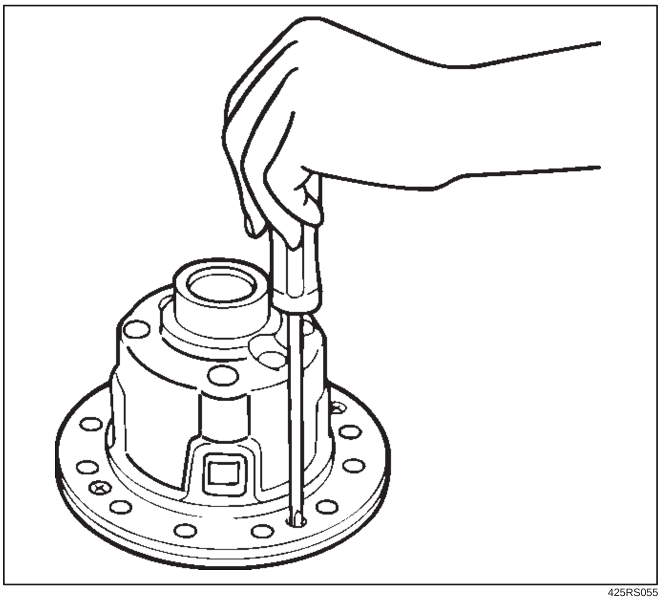
NOTE: When assembling the parts, apply recommended gear oil sufficiently to each of the parts, especially, to the contact surfaces and sliding surfaces.

1. Install Differential cage B.
2. Install Thrust washer.
3. Install Spring disc.
   - When assembling the spring disc, make sure the mounting direction is correct as shown in figure.



Legend
(1) Friction Plate
(2) Spring Disc
(3) Friction Disc

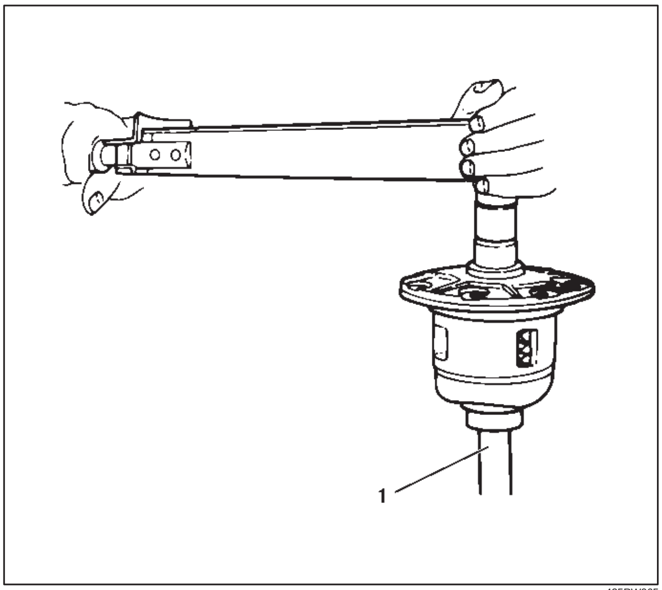
4. Install Friction disc.
5. Install Friction plate.
6. Install Friction plate.
7. Install Friction disc.
8. Install Friction plate.
9. Install Friction disc.
10. Install Friction plate.
11. Install Pressure ring.
12. Install Side gear.
13. Install Pinion and pinion shaft.
14. Install Side gear.
15. Install Pressure ring.
16. Install Friction plate.
17. Install Friction disc.
18. Install Friction plate.
19. Install Friction disc.
20. Install Friction plate.
21. Install Friction plate.
22. Install Friction plate.
23. Install Spring disc.
    - When assembling the spring disc, make sure the mounting direction is correct.
24. Install Spring disc.
25. Install Thrust washer.
26. Install Differential cage A.
27. Install Screw.
    - Matching the guide marks of the differential cages A and B, tighten the screws evenly in the diagonal order.



28. Check the operation.
  - Measure the starting torque using the side gear holder.

Starting torque:

29 – 45 N·m (3.0 – 4.6 kg·m/ 22 – 33lb ft)



425RW065

Legend

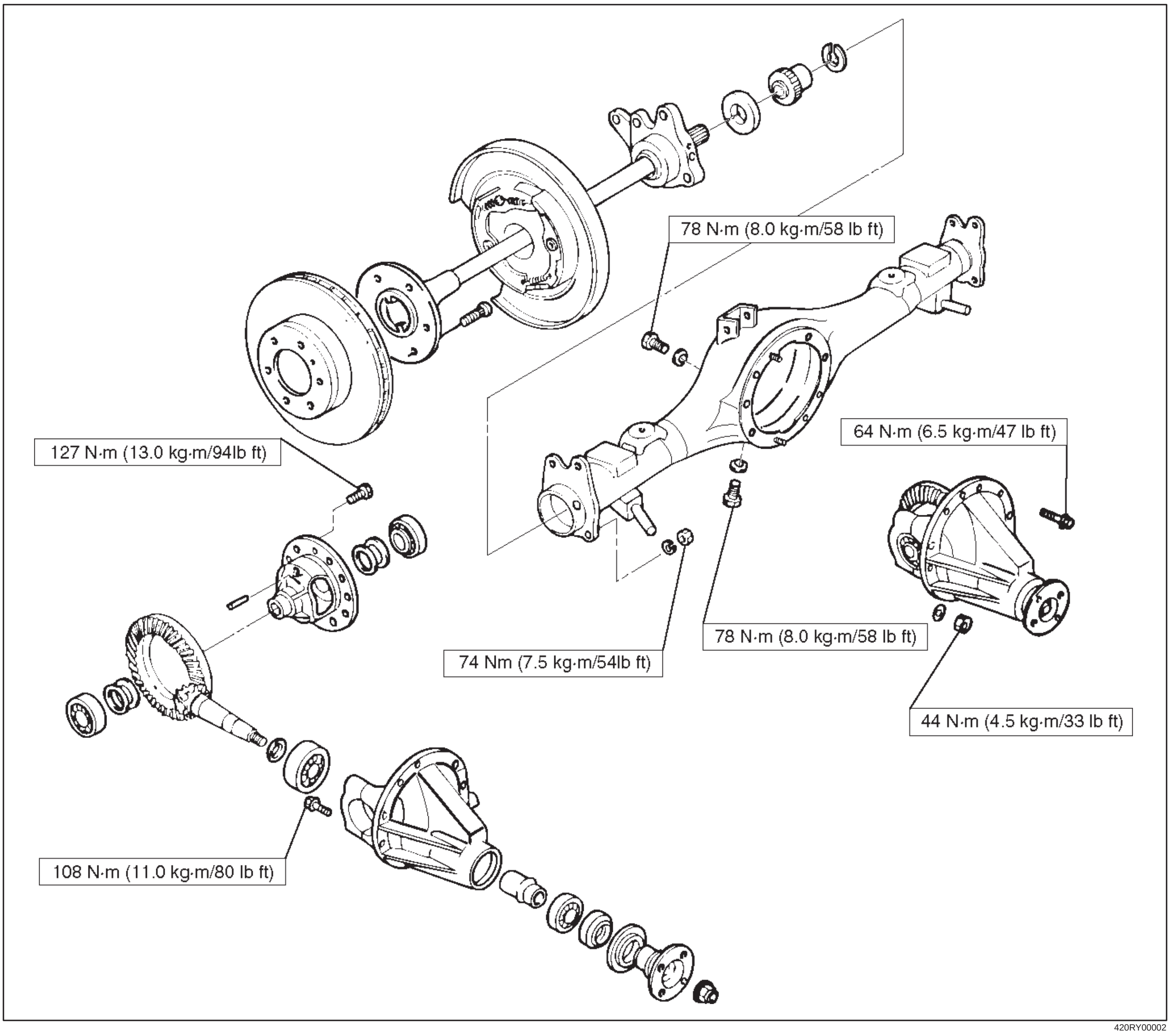
(1) Side Gear Holder : J–44450

Main Data and Specifications

General Specifications

Rear axle	
Type	Banjo, Semi–floating
Rear axle Size	244 mm (9.61 in)
Gear type	Hypoid
Gear ratio (to 1)	4.300
Differential type	Two pinion
Lubricant Grade	GL–5: (Standard differential)
	GL–5, LSD: (Limited slip differential)
Locking Differential Lubricant	80W90 GL–5 (USE Limited Slip Differential Gear Lubricant or Friction Modifier Organic Additive)
Capacity	3.0 liter (3.2 US qt)

Torque Specifications



Special Tools

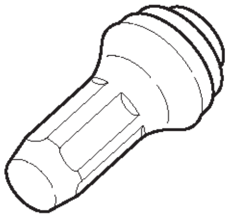
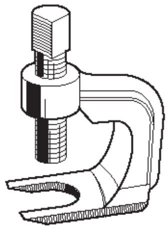
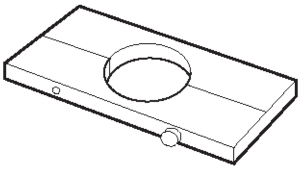
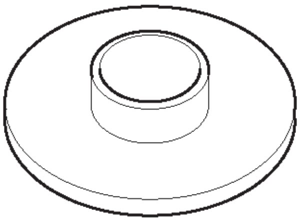
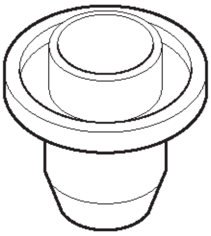
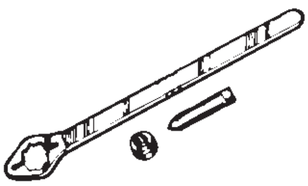
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–39210** Installer; Axle shaft inner seal
	**J–6627–A** Wheel pin remover
	**J–39211** Remover; Axle shaft bearing
	**J–39212** Installer; Axle shaft bearing
	**J–39379** Installer; Outer axle seal
	**J–8614–01** Pinion flange holder

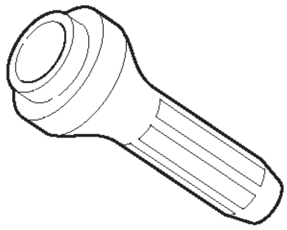
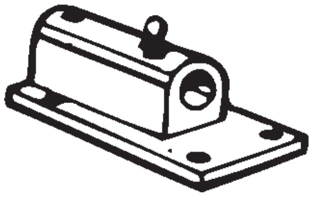
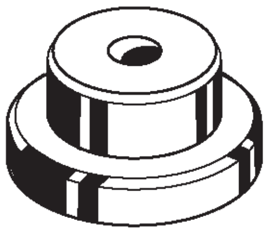
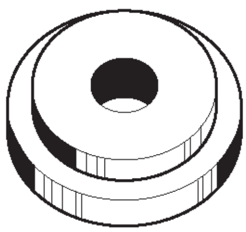
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–37263** Installer; Pinion oil seal
	**J–42832** Holding fixture
	**J–3289–20** Holding fixture base
	**J–42379** Remover; Bearing
	**J–8107–3** Adapter; Side bearing plug
	**J–44461** Installer; Outer bearing outer race

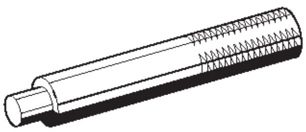
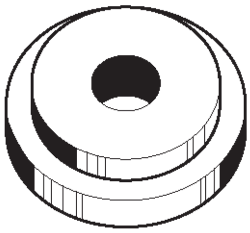
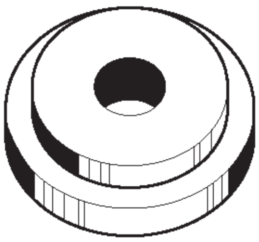
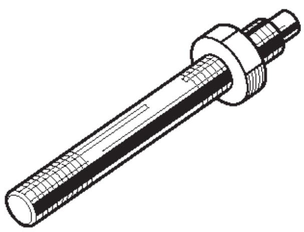
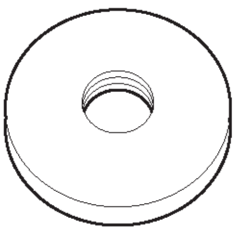
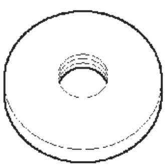
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS218	**J–8092** Grip
 901RS219	**J–44462** Installer; Inner bearing outer race
 901RS220	**J–42824** Pilot;Outer
 901RS221	**J–21777–43** Nut & Stud
 901RS222	**J–44453** Pilot;Inner
	**J–44449** Pilot;Outer bearing

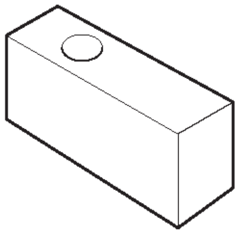
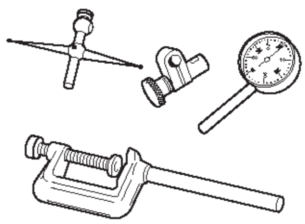
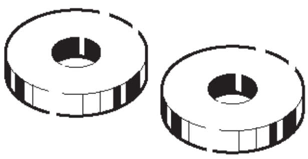
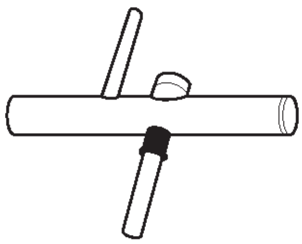
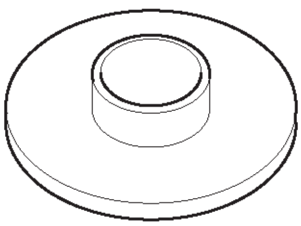
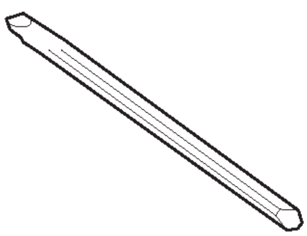
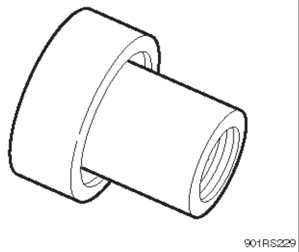
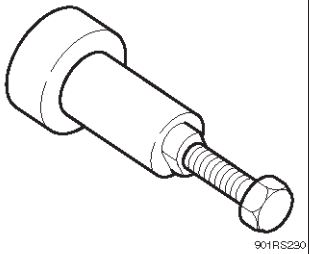
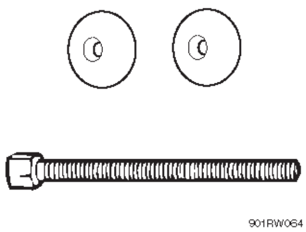
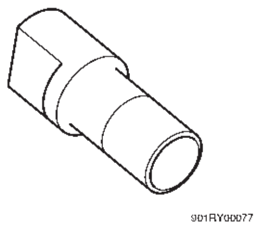
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS223	**J–44451** Gage plate
 901RS224	**J–8001** Dial indicator
 901RS225	**J–44452** Disc (2 required)
 901RS226	**J–23597–1** Arbor
 901RS208	**J–42828** Installer; Pinion bearing
 901RS228	**J–39209** Punch; End nut lock

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–42829** Installer; Side bearing
	**J–39602** Remover; Outer bearing
	**J–39858** Clutch pack unloading tool kit Includes **J–34174–1/J–34174–2** Screw cap and Cap **J–22342–15** Forcing screw
	**J–44450** Side gear holder

TROOPER

DRIVELINE/AXLE

DRIVELINE CONTROL SYSTEM (SHIFT ON THE FLY)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

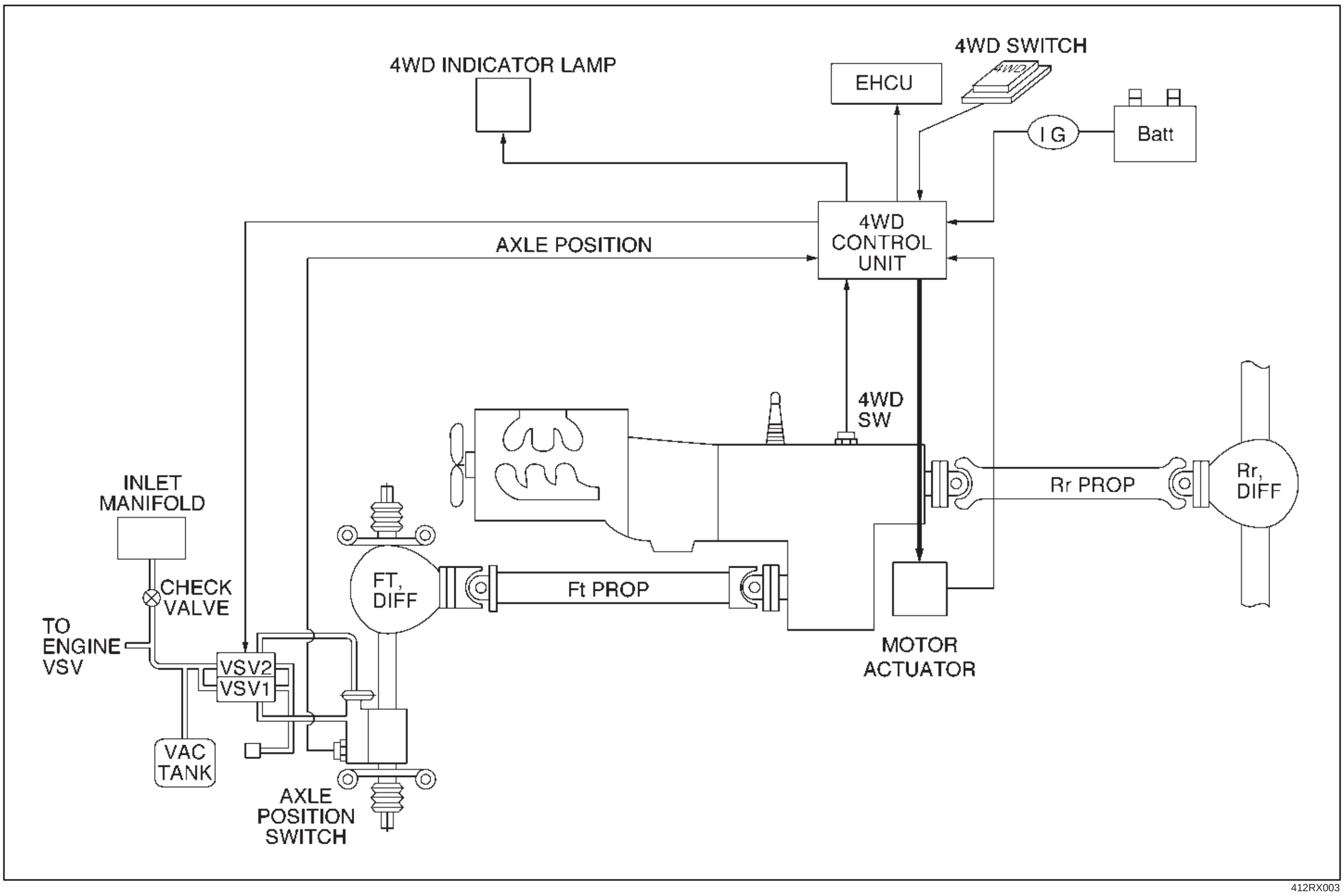
Shift On The Fly System

Outline of Shift on The Fly System

The shift on the fly system switches between 2 wheel drive (2WD) and 4 wheel drive (4WD) electrically by driver's pressing the 4WD switch (push button type) on instrument panel.
This system controls below operations. (Shifting between "4H" and "4L" must be performed by transfer control lever on the floor.)

1. Shifting the transfer front output gear (Connecting to, and disconnecting from, front propeller shaft by motor actuator).
2. Retrial of shifting the transfer front output gear.
3. Connecting front wheels to, and disconnecting them from, the front axles by vacuum actuator.
4. Indicator on instrument panel.
5. 4WD out signal to other Electronic Hydraulic Control Unit.

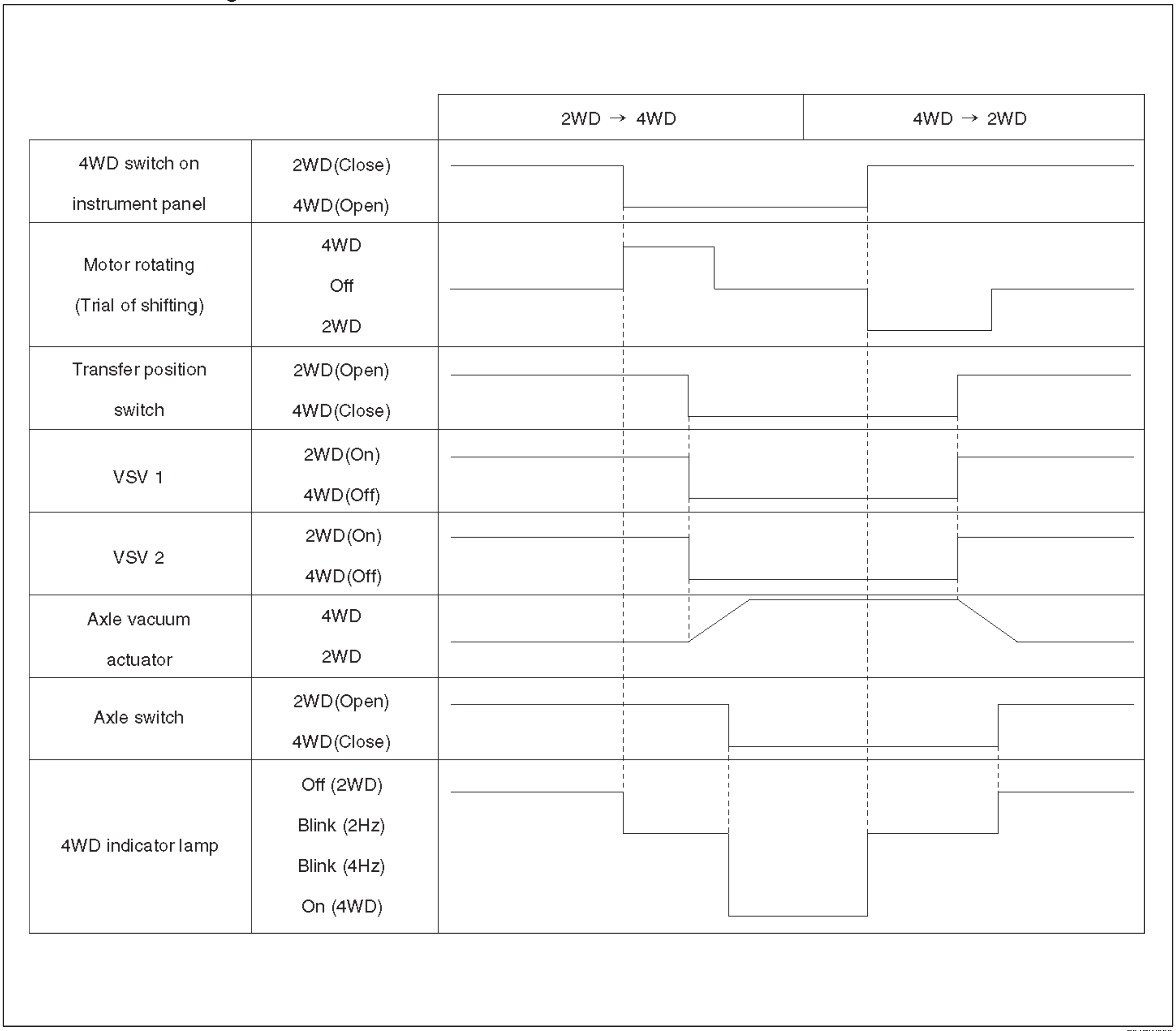
System Diagrams



Normal Operation

The motor actuator mounted on transfer rear case is driven by signal from 4WD switch on instrument panel. After complete the connecting transfer front output gear to, or disconnecting it from, front propeller shaft, condition of the transfer position switch changes. The vacuum solenoid valve (VSV) is driven by the signal from transfer position switch and the vacuum actuator connects front wheels to, or disconnect them from, front axles.

Time Chart of Shifting Under Normal Condition

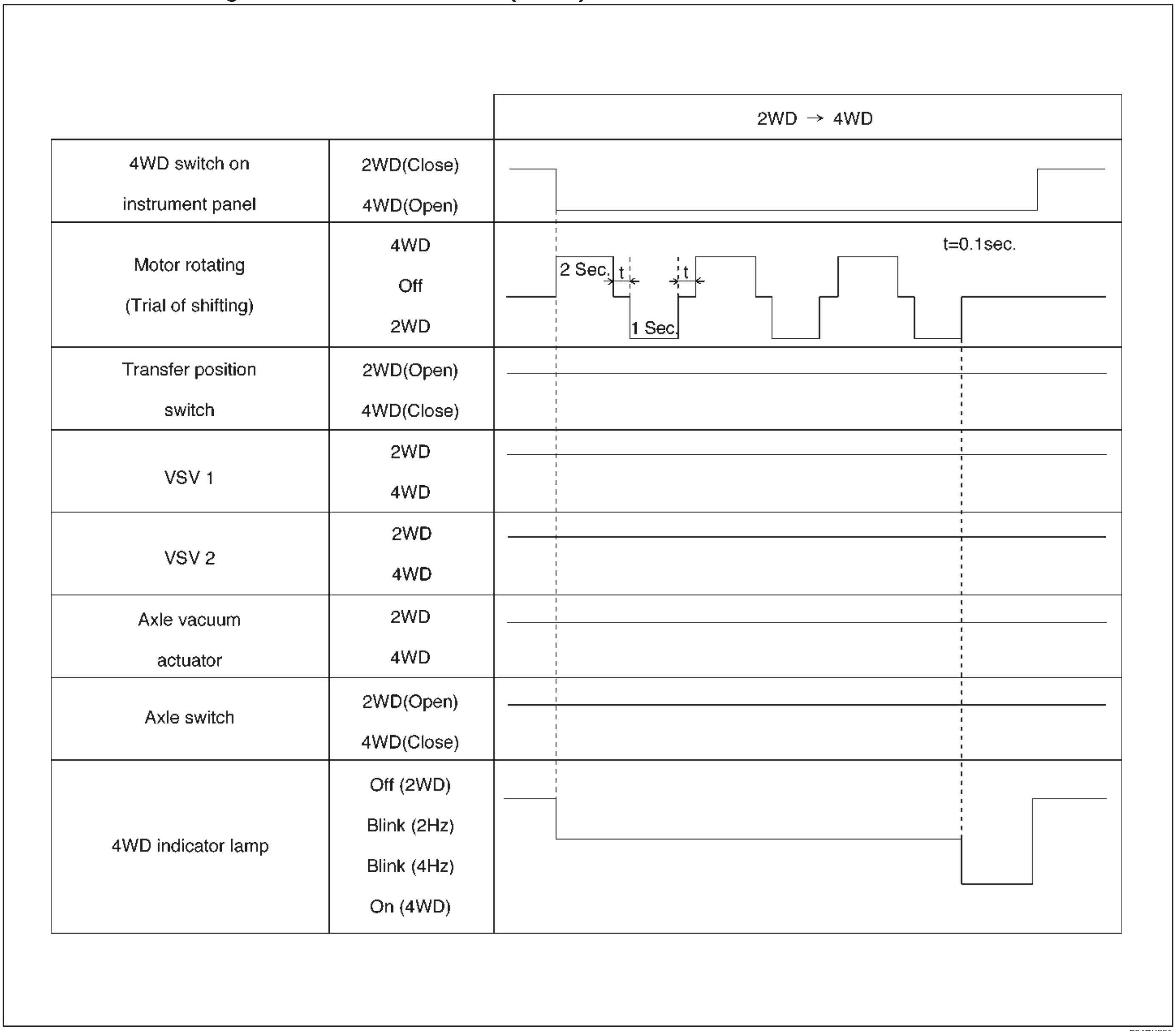


F04RW002

Retrial

The motor actuator starts transfer gear shifting after signal from 4WD switch on instrument panel has been received. But the shifting may be impossible in cold weather or under high speed condition. When 2 seconds have passed since transfer gear shifting started and the transfer position switch dose not turn on (the gear engagement is not completed), the motor reverses its rotation for 1.2 seconds and tries again to shift transfer gear. This procedure is repeated 3 times in maximum. While this procedure, 4WD indicator lamp blinks by 2 Hz. If the transfer position switch does not turn on after aforementioned procedure has been repeated 3 times, the gear shifting is stopped and 4WD indicator lamp's blinking changes from 2Hz to 4Hz to notify driver that the gear shifting is stopped. This blinking of indicator lamp continues until 4WD switch is returned from 4WD to 2WD.

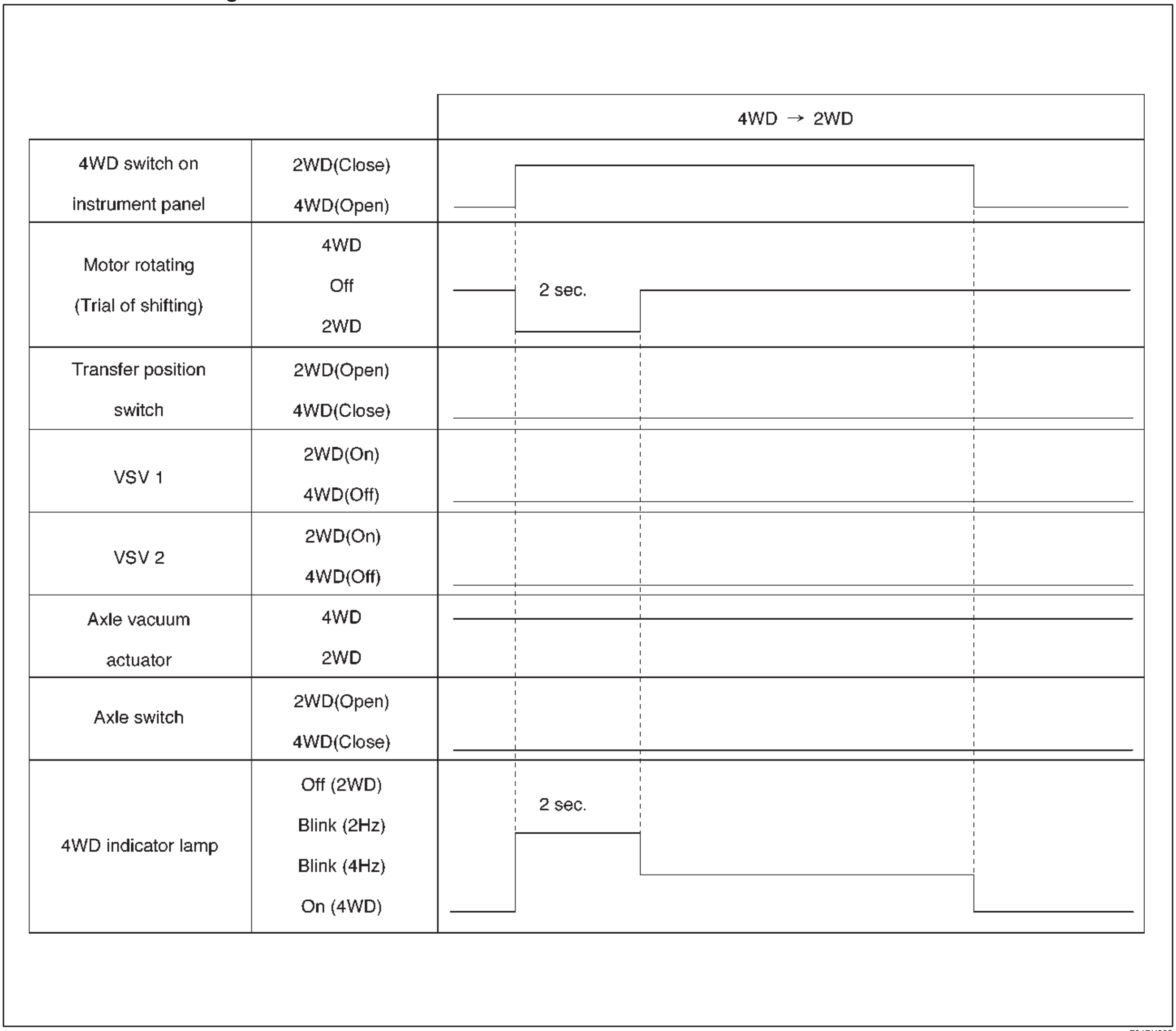
Time Chart of Shifting Under Severe Condition (retrial)



F04RX001

Warning at “4L” position : In view of the shifting mechanism of transfer, the gear shifting from 4WD to 2WD at “4L” condition is impossible. Therefore, the transfer position switch can not be turned off by 4WD switch when vehicle is in “4L” condition. In the case this condition continues for 2 seconds, the shifting to 2WD is stopped and the indicator lamp’s blinking changes from 2Hz to 4Hz to notify driver of wrong operation.

Time Chart of Shifting from 4WD to 2WD at “4L” Condition



F04RX002

4WD out signal to other Electronic Hydraulic Control Unit : 4WDcontrol unit sends 4WD out signal to other Electronic Hydraulic Control Unit as below.

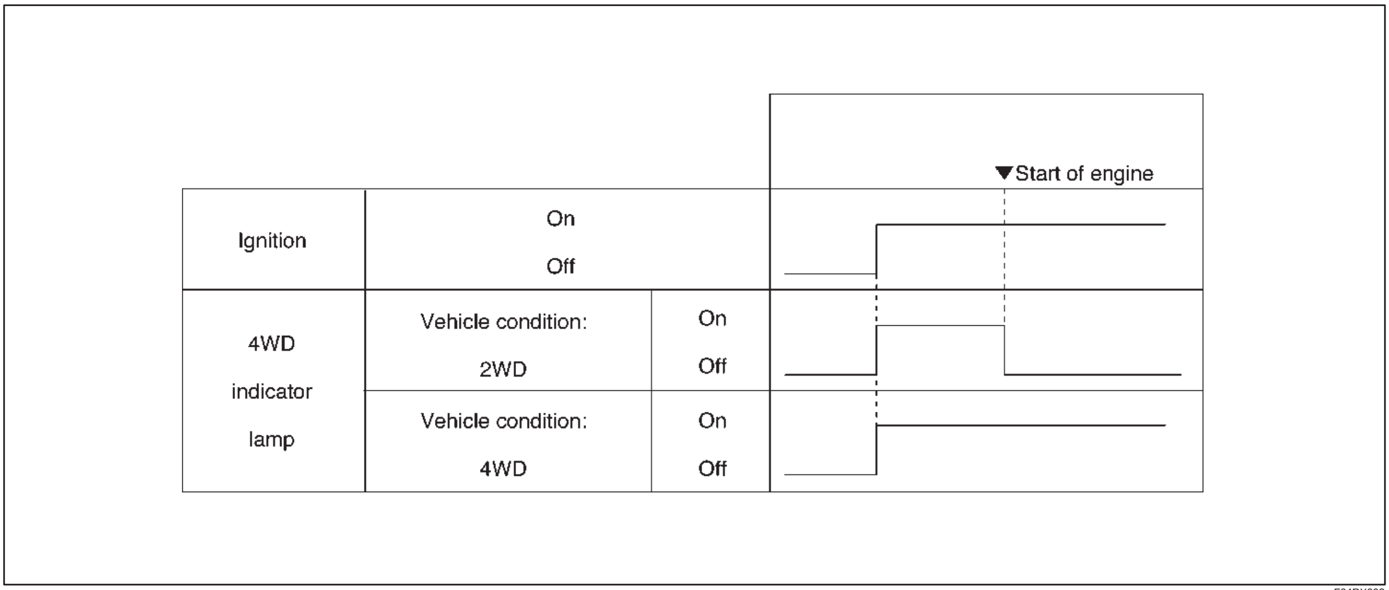
4WD out signal (Period)	Vehicle Condition	Transfer position switch	Front axle switch
120 ms	2WD	2WD (Open)	2WD (Open)
240 ms	4WD	4WD (Close)	4WD (Close)

Functions of Indicator Lamp

Indication of vehicle condition : Indicator lamp is controlled by 4WD control unit and shows vehicle conditions as below.

Indicator	Vehicle condition	4WD switch	Transfer position switch	Front axle switch
Off	2WD	Off (Close)	2WD (Open)	2WD (Open)
On	4WD	On (Open)	4WD (Close)	4WD (Close)
Blink (2Hz)	Operating	On (Open)	4WD (Close)	2WD (Open)
		Off (Close)	2WD (Open)	4WD (Close)
Blink (4Hz)	Stop operating	On (Open)	2WD (Open)	2WD (Open)
		Off (Close)	4WD (Close)	4WD (Close)

Bulb check :



F04RX003

Retrials from 2WD to 4WD : In cold weather or under high speed condition, the gear shifting (engagement) sometimes does not complete by 3 trials. In such case, the indicator lamp inform driver of this incident as aforementioned chart (shown at Retrial in Outline of shift on the fly system).

Diagnosis

Before Judging That Troubles Occur (Unfaulty mode)

When Switching from 2WD to 4WD

1. **In case that blinking frequency of the 4WD indicator changes from 2Hz to 4Hz.**

   When heavy synchronization load is needed, the motor actuator tries the shifting transfer gear three times including the activation shifting. While the motor actuator tries shifting, the indicator blinks by 2Hz. If the third shifting fails, the indicator's blinking changes from 2Hz to 4Hz at the same time that the motor actuator shifted back to 2WD.

   Heavy synchronization load occurs by:

   - extremely lower temperature.
   - higher speed, rotation difference of wheels during cornering.

   Solution 1: Operate again after stop the vehicle or slow down.

2. **In case that the 4WD indicator continues blinking by 2Hz for more than 11.5 seconds.**

   When there is rotation difference of wheels or there is phase difference between front wheels and axles, it is difficult to connect front wheels to front axles. The blinking by 2Hz shows that shifting the transfer gear or connecting the front wheels is in the middle of operating. In above case, the indicator's blinking by 2Hz shows that connecting the front wheels is not completed (because the indicator's blinking changes to 4Hz when the shifting transfer gear is impossible.). And removal of rotation or phase difference make connecting the front wheels possible.

   Solution 2: When vehicle is running, drive straight ahead while accelerating and decelerating. When vehicle is at a stop, move the vehicle forward and backward from 2 to 3 meters.

When switching from 4WD to 2WD

1. **In case that the 4WD indicator continues blinking by 2Hz .**

   The 4WD indicator continues blinking by 2Hz until both shifting the transfer gear and disconnecting the front wheels are completed when switching 4WD to 2WD. When driveline is loaded with torsional torque, the shifting transfer gear and disconnecting front wheels are impossible. In this case, removal of torsional torque on driveline make the shifting transfer gear and disconnecting front wheels possible.

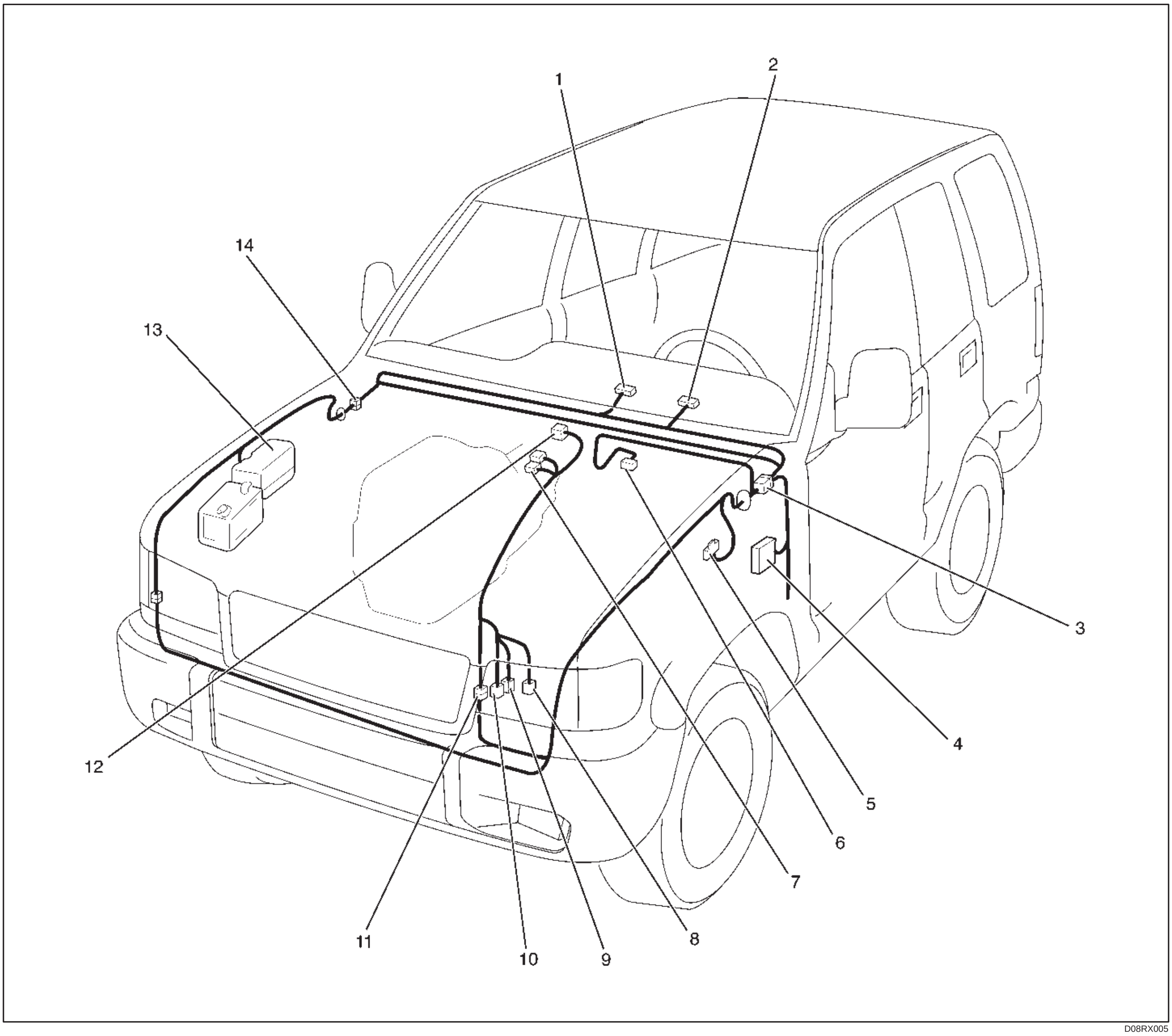
   Solution 3: When vehicle is running, drive straight ahead while accelerating and decelerating. When vehicle is at a stop, move the vehicle forward and backward from 2 to 3 meters.

2. **In case that the 4WD indicator's blinking changes from 2Hz to 4Hz.**

   Check the position of transfer lever. Is it at "4L" position? In view of the shifting mechanism of transfer, the gear shifting from 4WD to 2WD at "4L" condition is impossible.

   Solution 4: Push the 4WD switch to 4WD, shift the transfer lever to "High" position and re–operate the 4WD switch to 2WD.

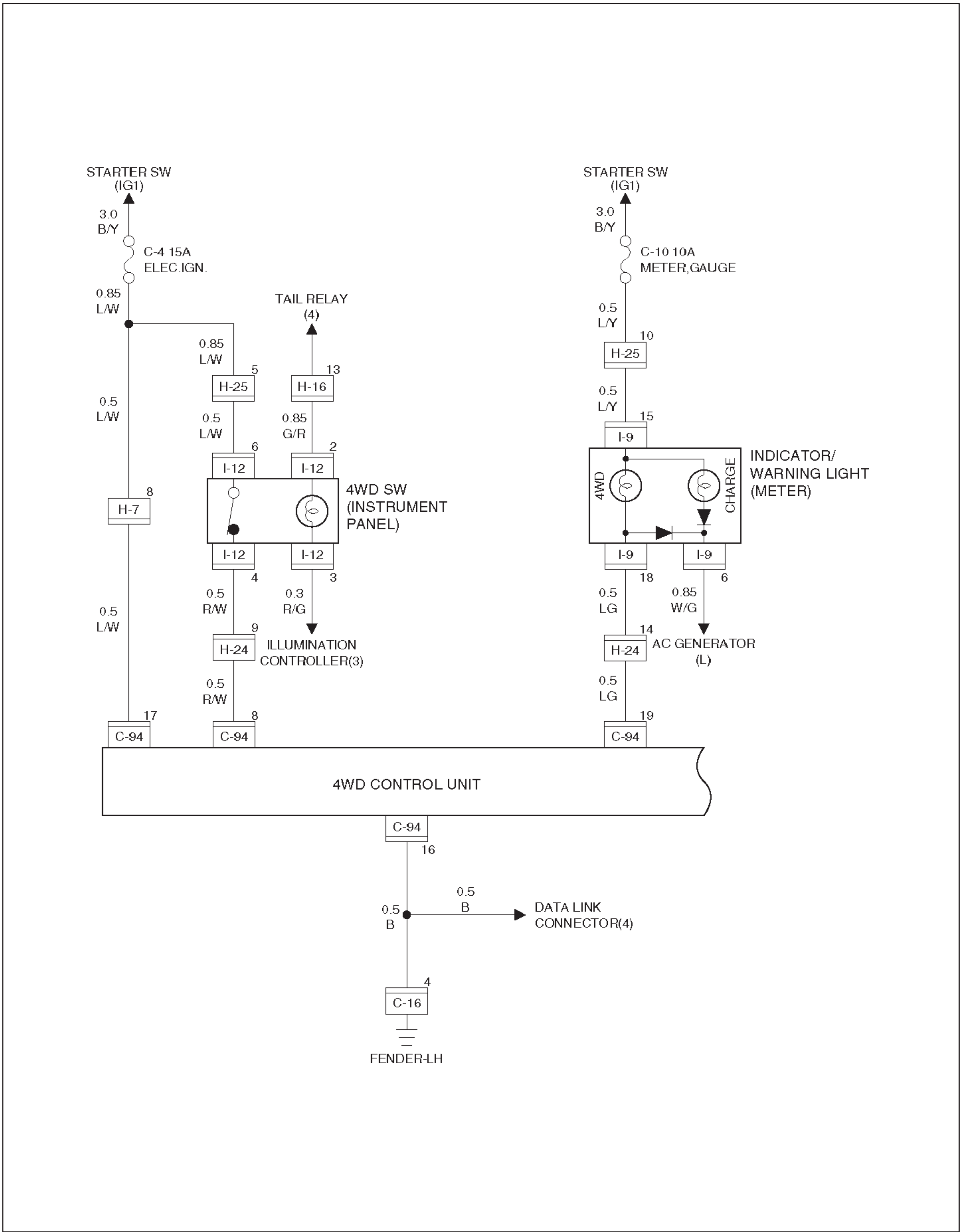
Parts Location



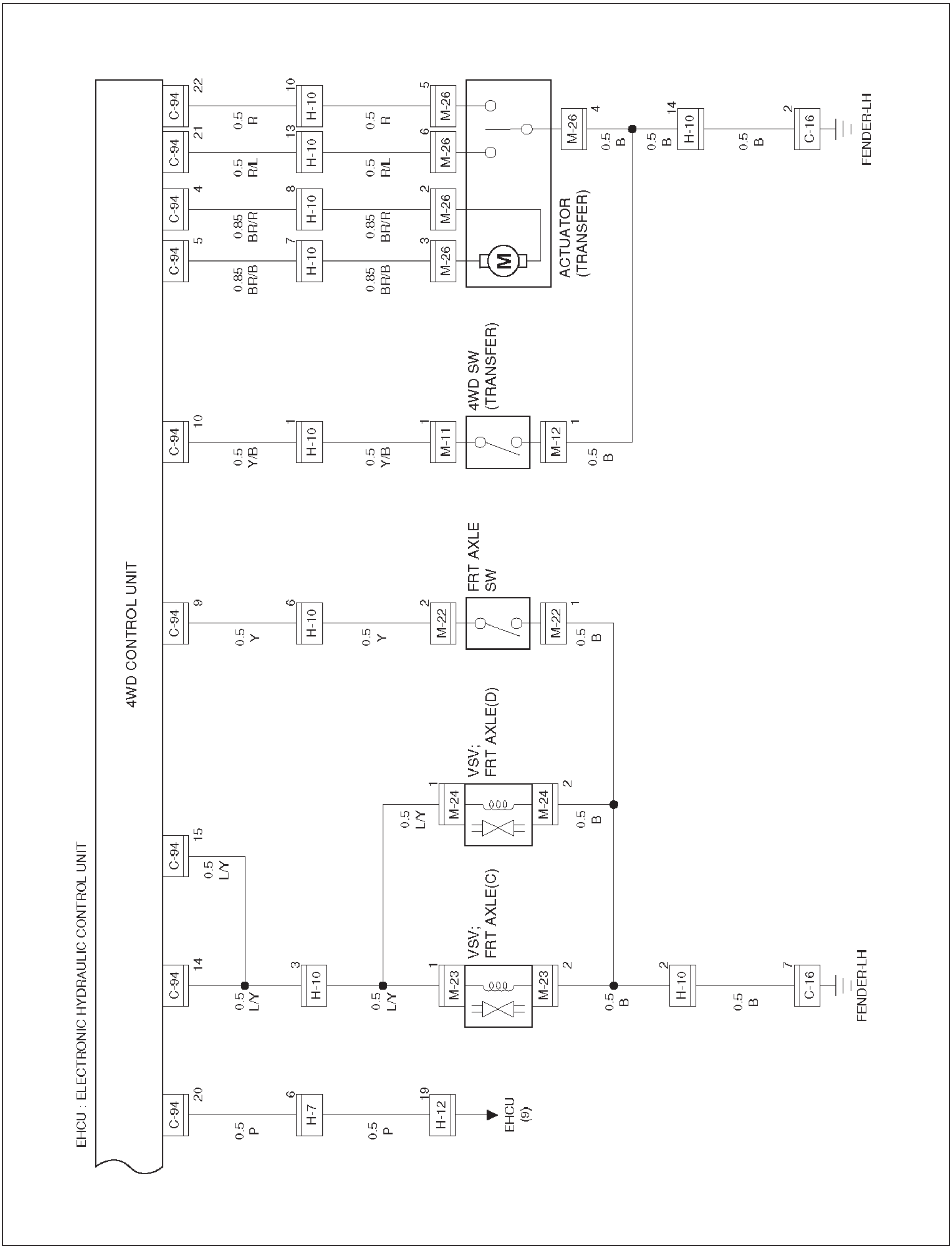
Legend

(1) I–12
(2) I–9
(3) H–7, H–24, H–25
(4) Fuse Box
(5) C–16
(6) C–94
(7) M–11, M–12
(8) M–22
(9) M–23
(10) M–24
(11) H–10
(12) M–26
(13) Relay & Fuse Box
(14) H–12, H–16

Wiring Diagram

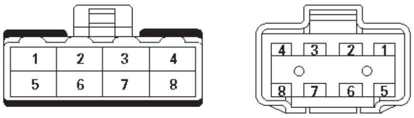
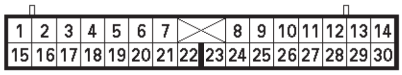
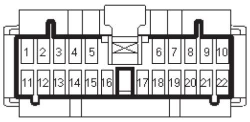
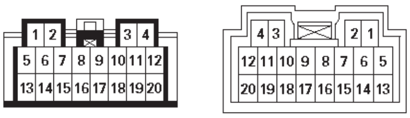
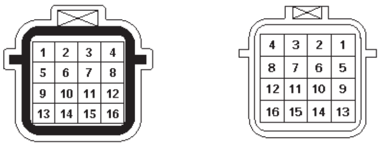
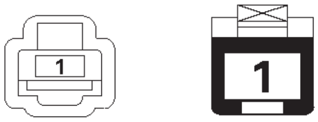
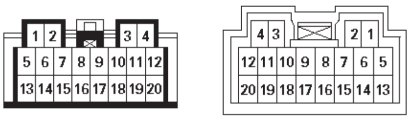
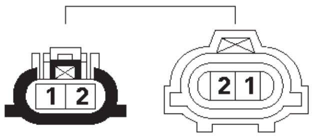
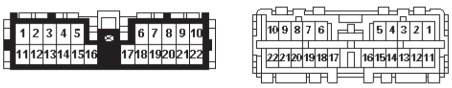
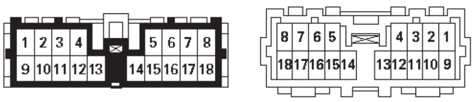
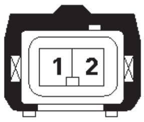
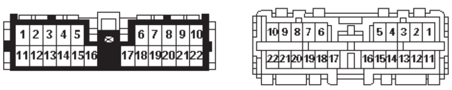


D08RW028


4WD CONTROL UNIT
EHCU : ELECTRONIC HYDRAULIC CONTROL UNIT
C-94
H-10
H-7
H-12
M-26
M-11
M-12
M-22
M-23
M-24
C-16
ACTUATOR (TRANSFER)
4WD SW (TRANSFER)
FRT AXLE SW
VSV; FRT AXLE(D)
VSV; FRT AXLE(C)
EHCU (9)
FENDER-LH
FENDER-LH
0.5 R
0.5 R/L
0.85 BR/R
0.85 BR/B
0.5 Y/B
0.5 Y
0.5 L/Y
0.5 P
0.5 B
M

D08RW029

Connector List

No.	Connector face	No.	Connector face
C-16		I-9	
C-94		I-12	
H-7		M-11	
H-10		M-12	
H-12		M-22	
H-16		M-23	
H-24		M-24	
H-25		M-26	

D04RW030

Diagnosis of The Faults Based on the Status of 4WD Indicator Lamp, 4WD Switch and T/F Change Lever

Diagnosis charts are shown on below. If troubles can not be solved after every chart was traced, troubles may occur in the 4WD control unit. In this case, replace the 4WD control unit and trace every chart again.

Fault on switching from 2WD to 4WD

1. **In case that 4WD indicator's blinking changes from 2Hz to 4Hz after Solution 1 is carried out.**
   Faults occur in the motor actuator or the transfer case assembly. Remove the motor actuator and check function. If problem was found and it was repaired, try **Solution 1** again. After that, disassemble the transfer case assembly for check and repair or replace. If incident is not improved after above mentioned actions were taken, replace the 4WD control unit.
2. **In case that 4WD indicator does not blink nor light, when switching from 2WD to 4WD.**

Step	Action	Yes	No
1	Is ignition turned on?	Go to Step 2	Turn on the ignition and trace this chart from start.
2	Does the indicator light comes on when the engine is not started?	Go to Step 3	Burning out of indicator lamp or disconnection of harness wire. Trace this chart from the start after repair or replace.
3	Start the engine. Is the 4WD switch turned from 2WD to 4WD?	Short-circuit (body short) on harness of the 4WD switch. Fault of the 4WD switch (holding the closed condition). Trace this chart from the start after repair or replace.	Push the 4WD switch to 4WD.

3. **Case that the indicator keeps blinking by 2Hz after aforementioned Solution 2 is carried out.**

Step	Action	Yes	No
1	Check the air pressure and wear of all tires. Were problems found?	Try **Solution 2** after adjust the air pressure and replace worn tires.	Go to Step 2
2	Can the transfer lever be operated from High to 4L or vice versa?	Go to Step 3	Disconnection of the motor actuator harness wiring. Trace this chart from the start after repair or replace. Faults on the motor actuator. Trace this chart from the start after replace. Internal faults of transfer case. Disassemble the transfer case for check. Trace this chart from the start after repair or replace.
3	Pull out the hoses from vacuum actuator and operate 4WD switch. Is there negative pressure on either of hoses?	Go to Step 4	Faults on the transfer position switch or its harness. Trace this chart from the start after repair or replace. Faults on the VSV main body, its harness or vacuuming system. Trace the front axle diagnosis chart in this section. After that, trace this chart from the start.
4	Check the axle switch. Were problems found?	Internal faults on axle switch. Trace this chart from the start after replace.	Disconnection on the axle harness. Trace this chart from the start after repair or replace. Faults on Front Axle ASM. Trace the front axle diagnosis chart in this section. After that, trace this chart from the start.

Fault on switching from 4WD to 2WD

1. **Case that indicator does not blink nor turn out.**

Step	Action	Yes	No
1	Does the indicator turn out by ignition off?	Go to Step 2	Short circuit of the indicator harness.
2	Is the 4WD switch on 2WD position?	Disconnection on the 4WD switch harness or breakdown of the 4WD switch in open state. Trace this chart from the start after repair or replace.	Turn the 4WD switch to 2WD position. Trace this chart from the start.

2. **Case that indicator keeps 2Hz blinking after aforementioned Solution 3 is carried out.**

Step	Action	Yes	No
1	Check the air pressure and wear of all tires. Were problems found?	Try **Solution 3** after adjust the air pressure and replace worn tires.	Go to Step 2
2	Can the transfer lever be operated from High to 4L or vice versa?	Faults on the harness wiring of motor actuator. Trace this chart from the start after repair or replace. Internal faults on transfer case. Disassemble the transfer case for check. Trace this chart from the start after repair or replace. Faults on the motor actuator. Trace this chart from the start after or replace.	Go to Step 3
3	Pull out the hoses from vacuum actuator and operate 4WD switch. Is there negative pressure on either of hoses?	Go to Step 4	Faults on the transfer position switch or its harness. Trace this chart from the start after repair or replace. Faults on the VSV main body, its harness or vacuuming system. Trace the front axle diagnosis chart in this section. After that, trace this chart from the start.
4	Check the axle switch. Were problems found?	Internal faults on axle switch. Trace this chart from the start after replace. Faults on Front Axle ASM. Trace the front axle diagnosis chart in this section. After that, trace this chart from the start.	Short circuit (body short) or disconnection of the axle harness. Trace this chart from the start after repair or replace.

3. **Case that indicator's blinking changes to 4Hz after aforementioned Solution 4 is carried out.**

Step	Action	Yes	No
1	Can the transfer lever be operated from High to 4L or vice versa?	Faults on the harness wiring of motor actuator. Trace this chart from the start after repair or replace. Faults on the motor actuator. Trace this chart from the start after replace. Internal faults on transfer case. Disassemble the transfer case for check. Trace this chart from the start after repair or replace.	Faults on the 4WD control unit. Trace this chart from the start after replace.

Front Axle Diagnosis

- When the 4WD switch is operated from 4WD to 2WD, indicator light does not go out.

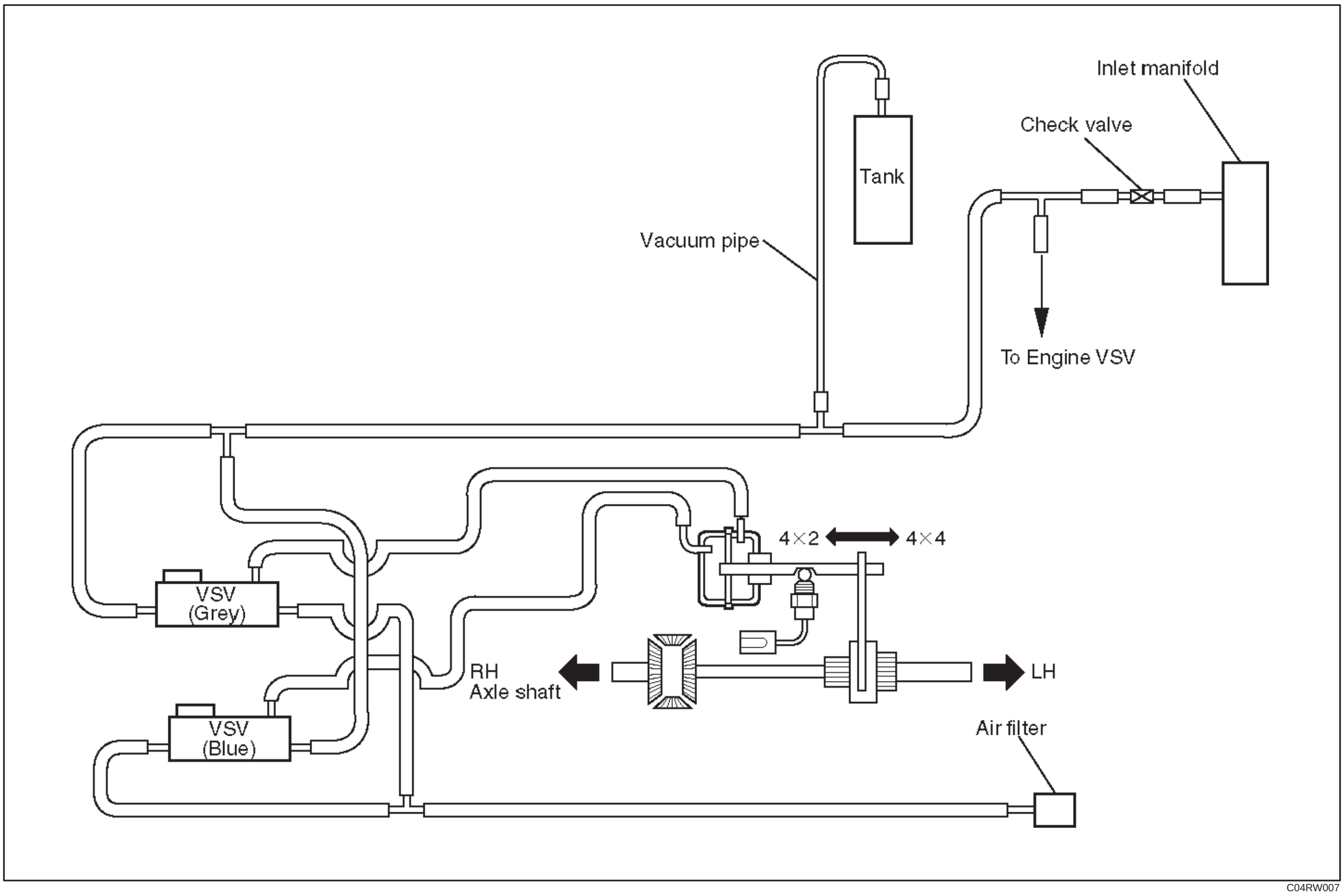
Step	Action	Yes	No
1	Drive slow 100 — 200m after a few minutes" idling. Has indicator light gone out?	All right.	Go to Step 2
2	Jack up front tires. Does the right side of front wheel rotate when the left side of front wheel is rotated?	Go to Step 4	Go to Step 3
3	1. Check the actuator switch. 2. Check the circuit to indicator. Was a problem found?	Trace this chart from the start after repair or replace.	Disassemble axle ASM for check. Trace this chart from the start after repair or replace.
4	1. Check the VSV valve. 2. Check the circuit to VSV valve. Was a problem found?	Trace this chart from the start after repair or replace.	Go to Step 5
5	Is vacuum piping all right? (tank, hose, & pipe damage or trouble)	Go to Step 6	Trace this chart from the start after repair or replace.
6	Does actuator work all right?	Trace this chart from the start.	Disassemble axle ASM for check. Trace this chart from the start after repair or replace.

- When the 4WD switch is operated from 2WD to 4WD, indicator light is not actuated.

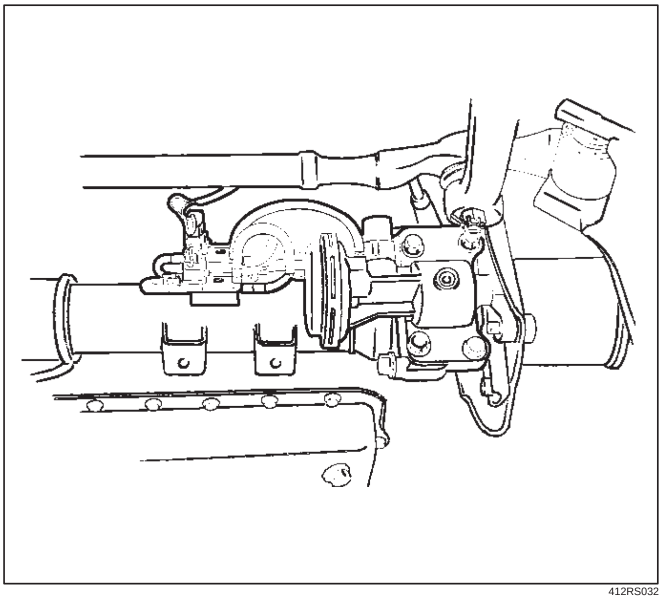
Step	Action	Yes	No
1	Drive slow 100 — 200m after a few minutes” idling. Has indicator light actuated?	All right.	Go to Step 2
2	Jack up front tires. Does not the right side of front wheel rotate when the left side of front wheel is rotated?	Go to Step 4	Go to Step 3
3	1. Check the actuator switch. 2. Check the circuit to indicator. Was a problem found?	Trace this chart from the start after repair or replace.	Disassemble axle ASM for check. Trace this chart from the start after repair or replace.
4	1. Check the VSV valve. 2. Check the circuit to VSV valve. Was a problem found?	Trace this chart from the start after repair or replace.	Go to Step 5
5	Is vacuum piping all right? (tank, hose, & pipe damage or trouble)	Go to Step 6	Trace this chart from the start after repair or replace.
6	Does actuator work all right?	Trace this chart from the start.	Disassemble axle ASM for check. Trace this chart from the start after repair or replace.

Shift On The Fly Vacuum Piping And Electric Equipment

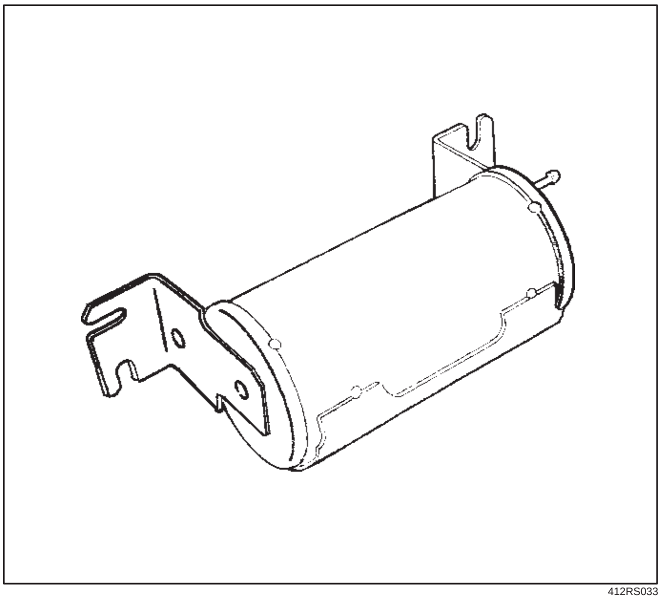
Vacuum piping diagram



VSV Assembly, Actuator Assembly

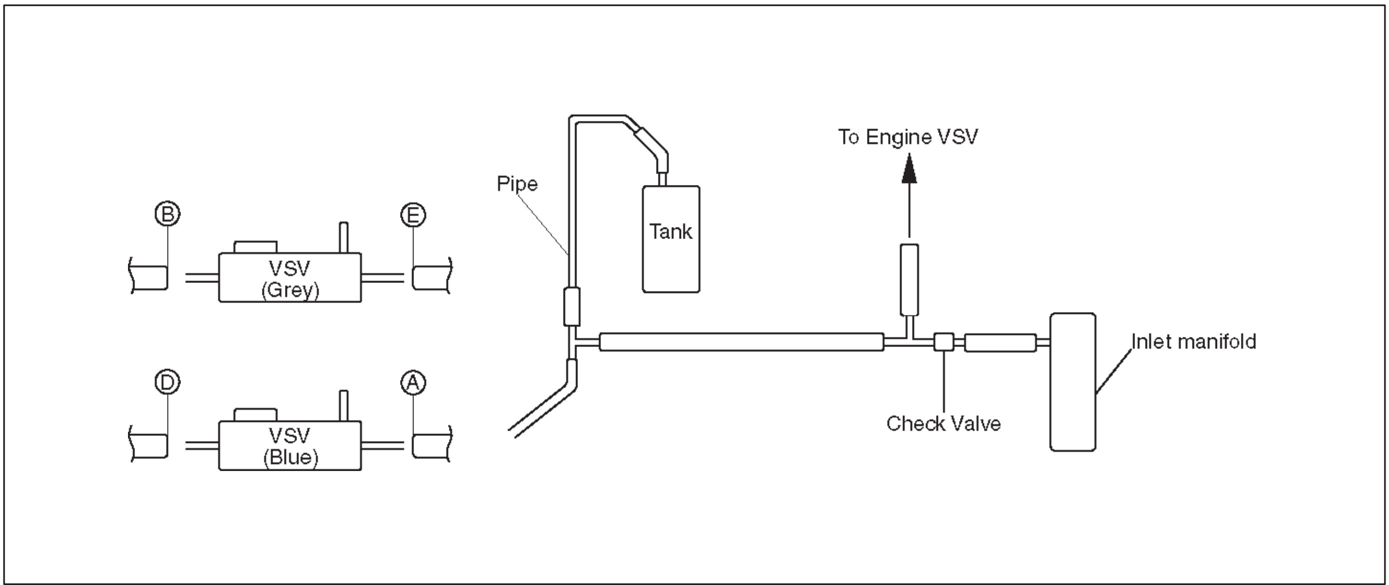


Vacuum Tank



Inspection And Repair

Vacuum Piping



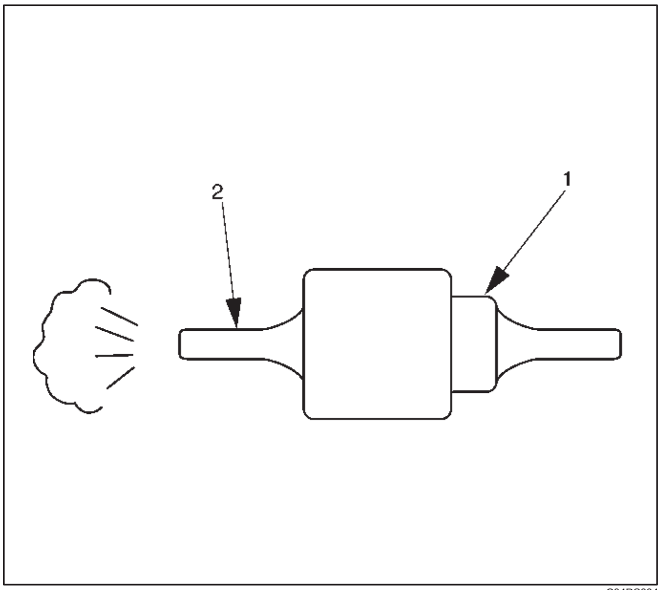
C04RW008

1. Pull out the Hose A in figure and install a vacuum gauge.
2. Plug up Hose B in figure to prevent the leak of vacuum.
3. Start the engine and measure vacuum 2 or 3 minutes afterward.
4. Repeat 1) and 2) but with Hose A plugged and Hose B pulled out.
5. If vacuum measures –400mmHg, or if it shows a sudden drop immediately after engine stop, inspect the hose, tank, and pipe for damage.

NOTE: Be careful not to permit the entry of dust and water during inspection.

6. Pull out Hose D in above illustration.
7. Plug Hose E in above illustration.
8. Make sure that Hose D in above illustration is under atmospheric pressure.
9. Pull out Hose E and plug Hose D, and make sure that Hose E is under atmospheric pressure.
10. If Check 8) or 9) has revealed stoppage, check and see that there is no bend, foreign matter in the hose or in the filter. If there is trouble, repair or replace.

Check Valve



C04RS004

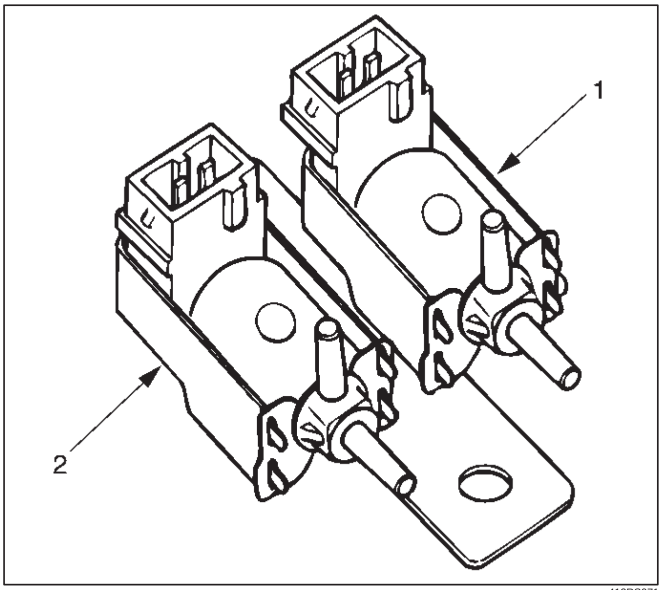
1. Apply vacuum from the orange colored side(1).

Vacuum:–400mmHg

2. Check leakage of vacuum.
3. Make sure that vacuum cannot be applied from the black colored side(2).
4. If vacuum is not applicable as much as –400mmHg, and if there is resistance on the intake side, replace with a new check valve.

VSV Assembly

Inspect the vehicle side harness as follows:



412RS071

Legend

(1) Grey

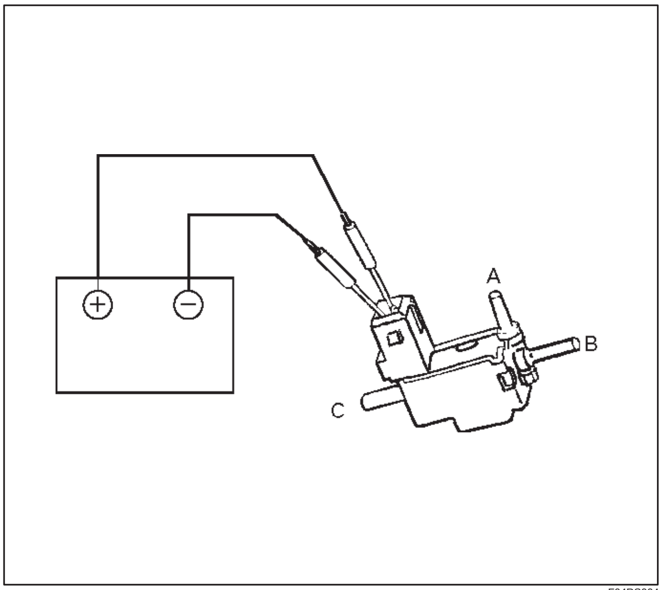
(2) Blue

1. Remove connector.
2. Shift transfer lever to 2H and start the engine.

NOTE: Do not move the vehicle while inspection.

3. Make sure that there is continuity in the vehicle side of harness. If there is no continuity, check transfer shift switch and wiring.

Inspect both VSVs as follows:



F04RS004

1. With battery not connected (Usual).

A–C:There is continuity

B:Closed

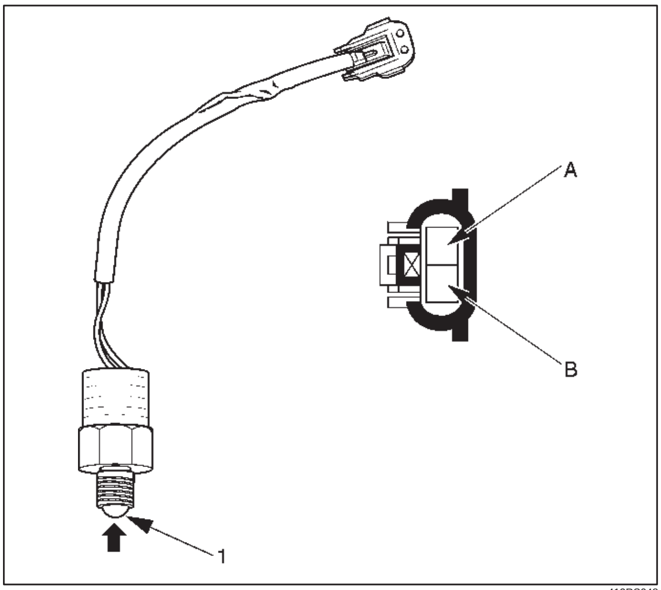
2. With battery connected

A – B:There is continuity

C:Closed

3. If 1) and 2) fail, replace with a new VSV.

Axle Position Switch



412RS048

1. With ball (1) being free

A – B:There is continuity

2. With ball forced into the switch

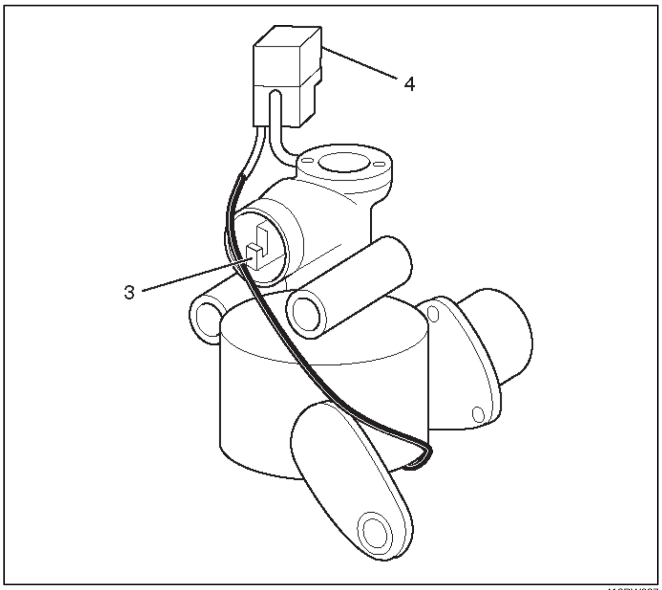
A – B:No continuity

3. If 1) and 2) fail, replace with a new switch.

Motor Actuator Assembly

Inspect the function of the motor actuator assembly as follows:

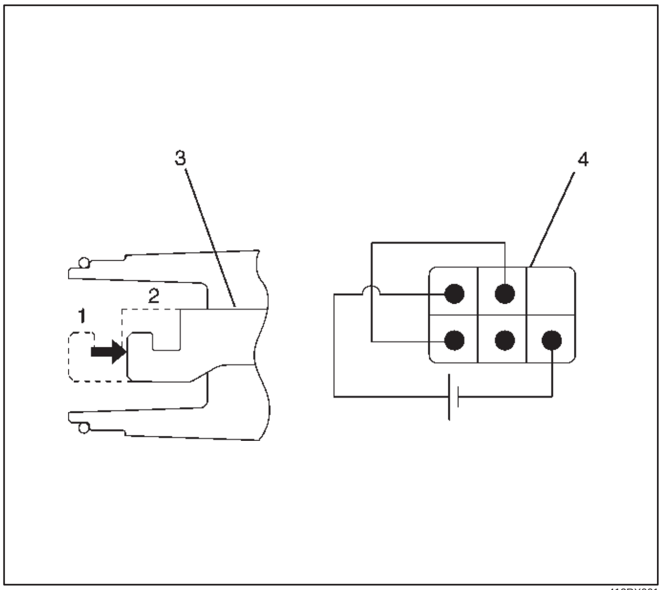
1. Disassemble the motor actuator from transfer rear case.



412RW037

Legend
(3) Shift Rod
(4) Connector

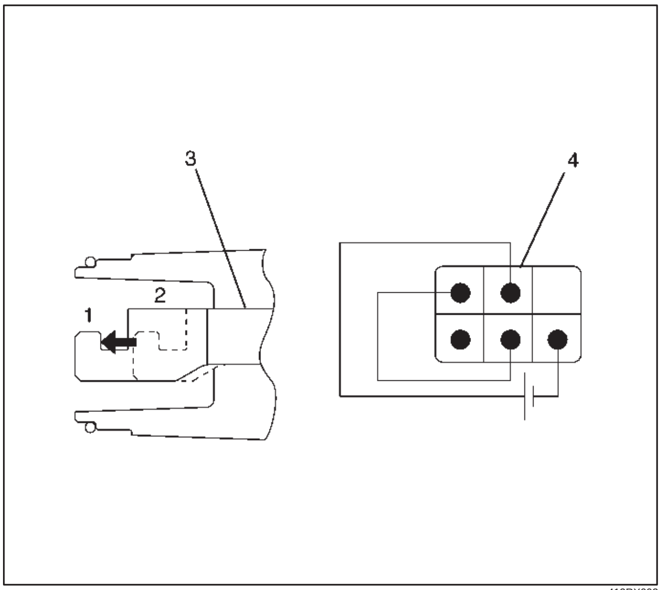
2. Connect the terminals as shown in figure.
Shift rod of the motor actuator moves and stops at 4WD position.



412RX001

Legend
(1) 2WD
(2) 4WD
(3) Shift Rod
(4) Connector

3. Connect the terminals as shown in figure.
Shift rod of the motor actuator moves and stops at 2WD position.

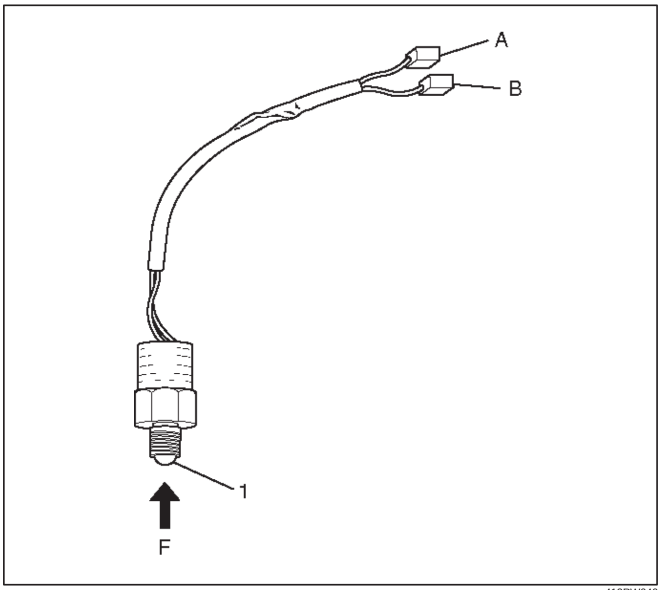


412RX002

Legend
(1) 2WD
(2) 4WD
(3) Shift Rod
(4) Connector

4. If 2) and 3) fail, replace with a new motor actuator.

Transfer Position Switch



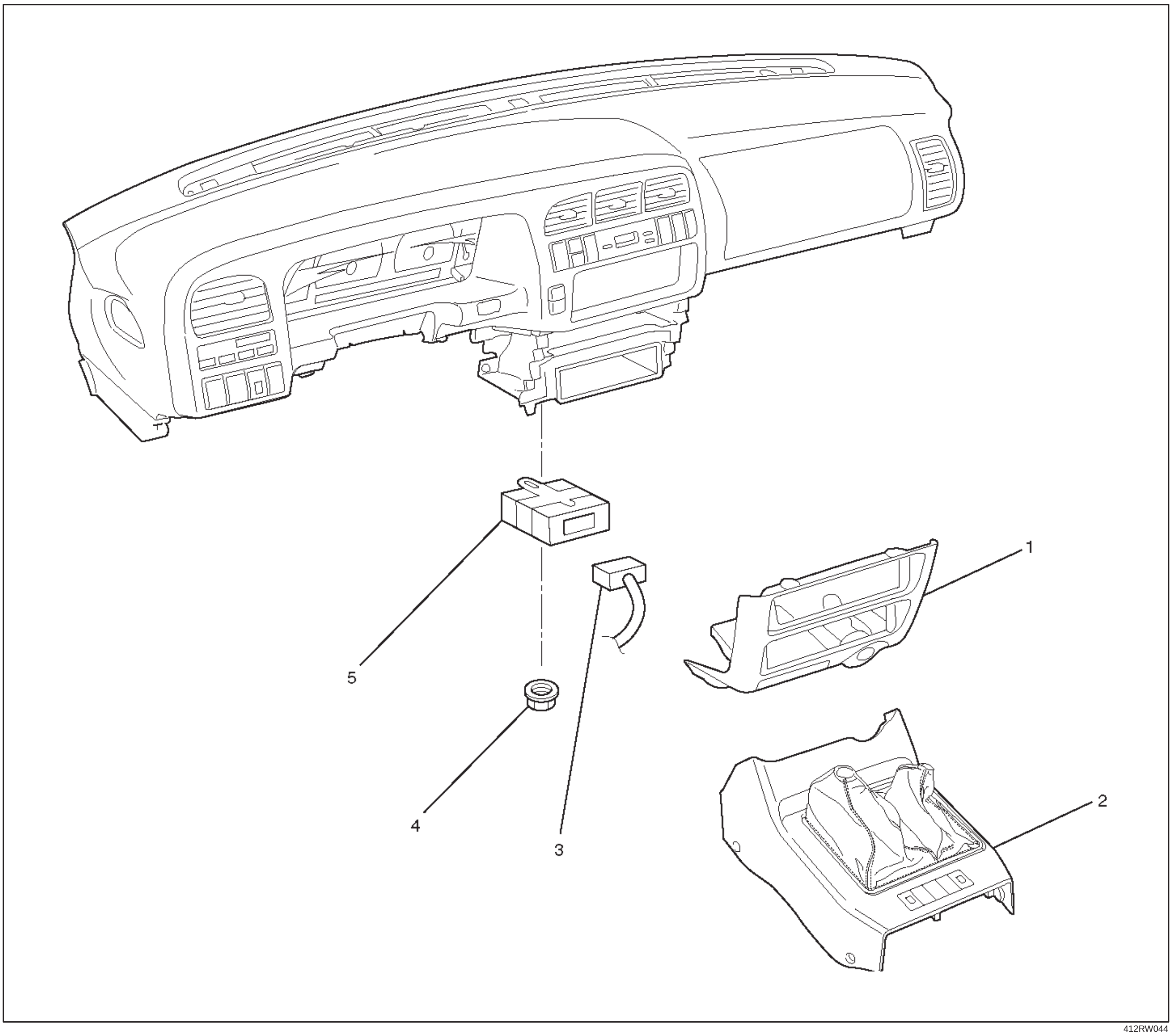
412RW040

Legend
(1) Ball

1. With ball being free.
A–B : There is continuity.
2. With ball forced into the switch.
A–B : No continuity.
3. If 1) and 2) fail, replace with a new switch.

4WD Control Unit

4WD Control Unit Associated Parts

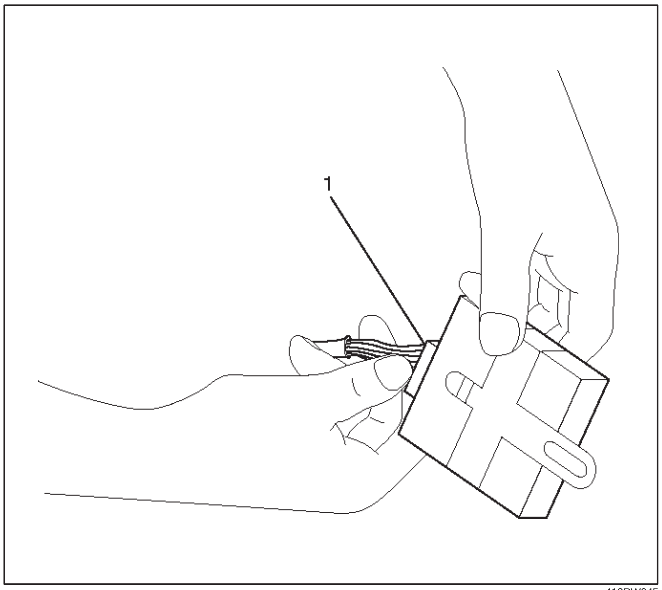


Legend

(1) Lower Cluster Assembly
(2) Front Console Assembly
(3) Harness Connector
(4) Nut
(5) 4WD Control Unit

Removal

1. Remove lower cluster assembly and front console assembly.
   Refer to Interior Trim in Body and Accessories section.
2. Remove nut.
3. Remove 4WD control unit.
4. Disconnect harness connector (1).



412RW045

Legend

(1) Harness Connector

Installation

1. Connect harness connector, then install 4WD control unit.
2. Install lower cluster assembly and front console assembly.

TROOPER

DRIVELINE/AXLE

DRIVELINE CONTROL SYSTEM (TOD)

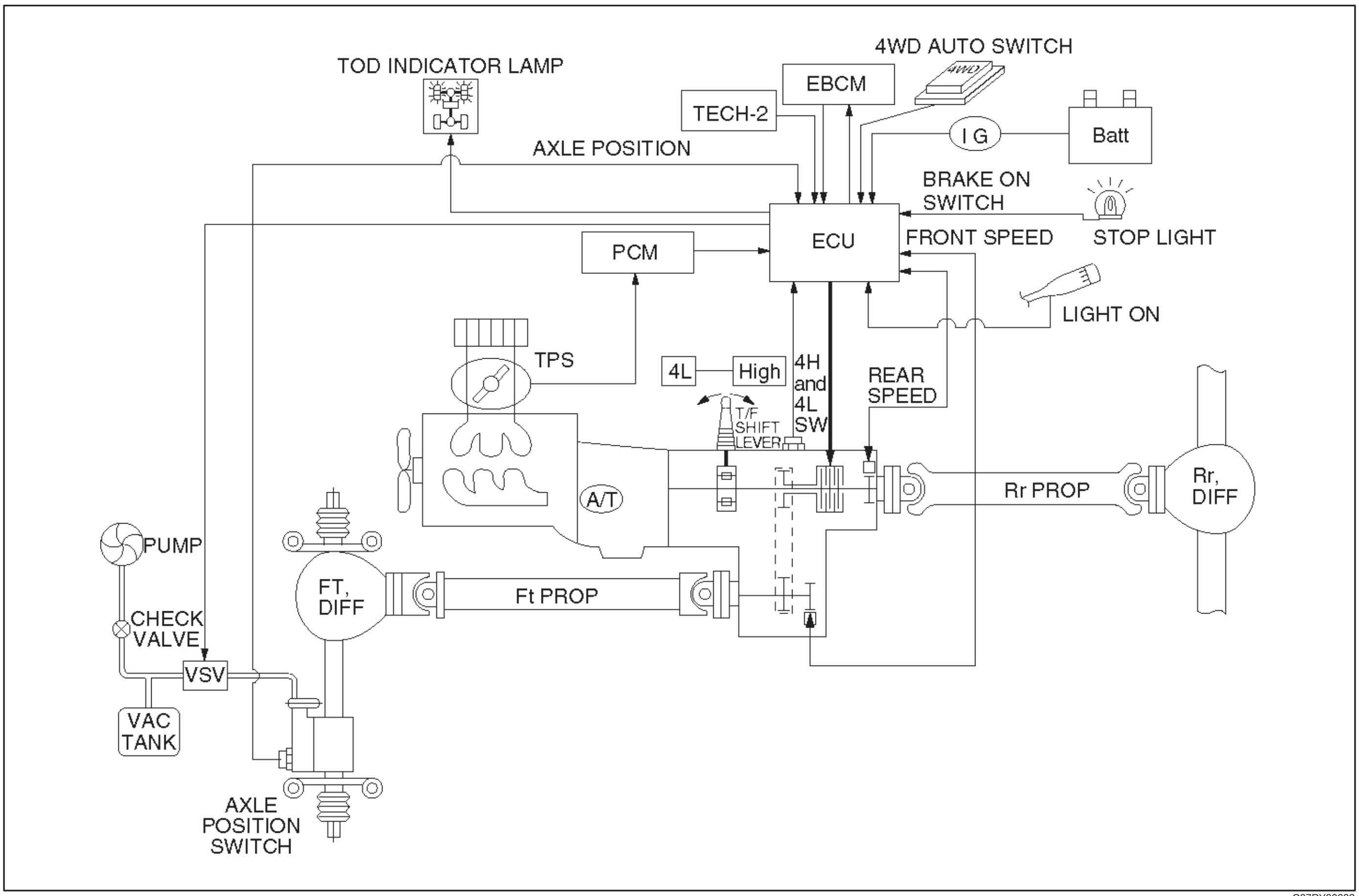
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



TOD (Torque on Demand) system is traction state control system to vehicle.

Transfer Position and Drive Mode

Three drive modes can be selected through operation of 4WD switch and transfer lever.

Transfer Position	4WD AUTO SWITCH	Mode	Drive mode
HIGH	ON	2H	Rear wheel drive
	OFF	TOD	Electronically controlled torque split four wheel drive
4L	ON/OFF	4L	Low-speed mechanical lock-up four wheel drive

The electronic control unit (ECU) judges the signals from the transfer lever and controls the transfer drive mode and shift-on-the-fly system status.

TOD Control

The TOD position usually drives the rear wheels, and transmits the torque to the front wheels with the help of electronically controlled torque split mechanism according to running conditions encountered. The driving force is directly transmitted to the rear wheels. This force is split by the transfer and delivered to the front wheels. The magnitude of the torque transmitted to the front wheels is controlled by changing the pressing force of the electromagnetic multi plate disk clutch built in the transfer unit. The pressing force of the clutch is controlled by changing the voltage to the electromagnetic coil mounted to the rear of the clutch. When the clutch is completely disengaged, the rear wheels are driven. When the clutch is completely engaged, a rigid four wheel drive mode is obtained. The torque split status is controlled continuously between the rear wheel and four wheel drive modes. This system includes front and rear speed sensors, and receives throttle position sensor information from the PCM.

The control unit receives signals sent from these sensors and changes the pressing force of the electromagnetic multi plate disk clutch to determine the torque distribution on the front and rear wheels. Therefore, when the slip of the rear wheels is increased against the current torque level in the normal rear wheel drive mode, the control unit detects the slip condition, determines the optimum torque based on the feedback control logic, and increases the torque to the front wheels.

The control unit uses the signal from the throttle position sensor to predict the future vehicle condition and the intention of the driver with respect to acceleration and deceleration, and determines the initial torque distribution using these data and the information from the speed sensors.

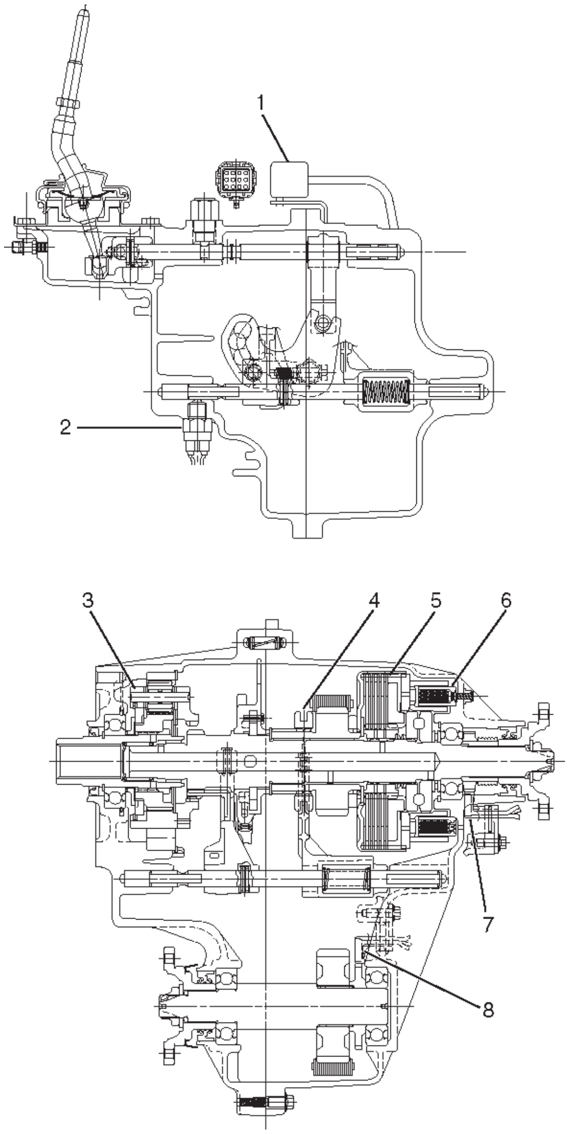
In case of small circle turning in the parking lot, for example, the control unit minimizes the clutch pressing force to restrict a braking phenomenon. When the ABS becomes active, the control unit optimizes the clutch pressing force to ensure stable braking.

TOD Indicator Control

The TOD indicator on the instrument panel informs the driver of the current working status of the transfer unit. The information consists of two items: the drive mode (2H, TOD, 4L, transition) and the torque split status of the TOD (torque distribution level). The indicator can display occasional errors and corresponding error codes.

System Components

Parts Location



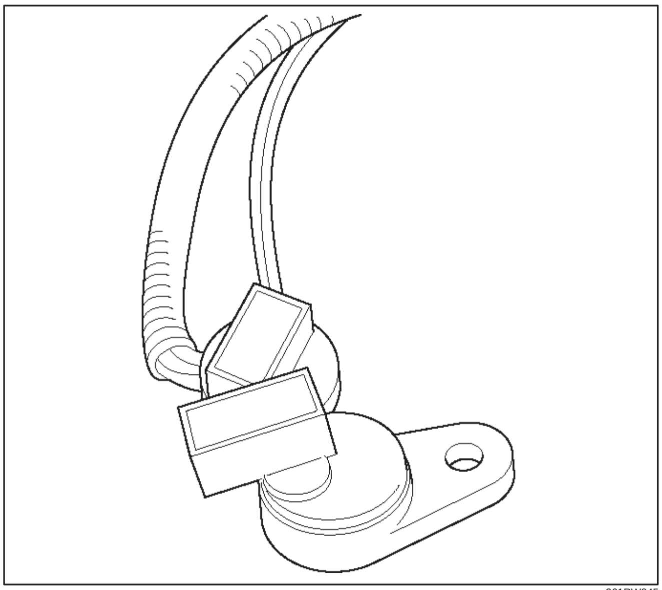
A07RY00002

Legend

- (1) T/F Connector
- (2) 4H Switch and 4L Switch
- (3) High-Low Planetary Gear Set
- (4) Mechanical Lock
- (5) Multi Plate Disk Clutch Pack
- (6) Electromagnetic Coil
- (7) Rear Speed Sensor
- (8) Front Speed Sensor

Front and Rear Speed Sensors

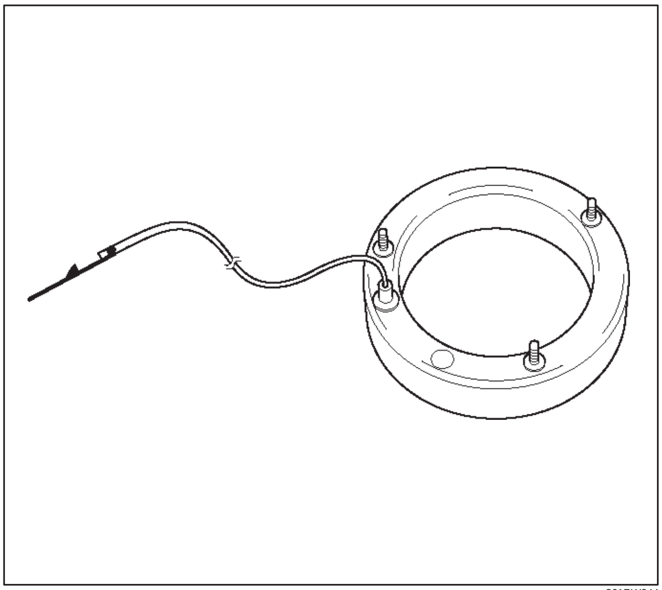
The sensors are built in the transfer case, and detect the rotation of rotors directly coupled to the propeller shafts. Thirty rectangular pulses are output per one rotation of the propeller shaft.



261RW045

Electromagnetic Coil

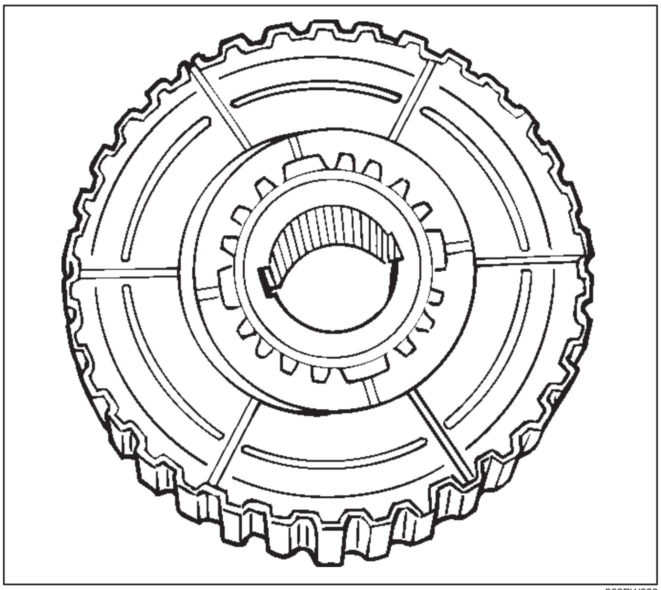
Receives the duty signals from the TOD control unit and controls the pressing force of the clutch pressure cam.



261RW044

Multi Plate Disk Clutch Pack

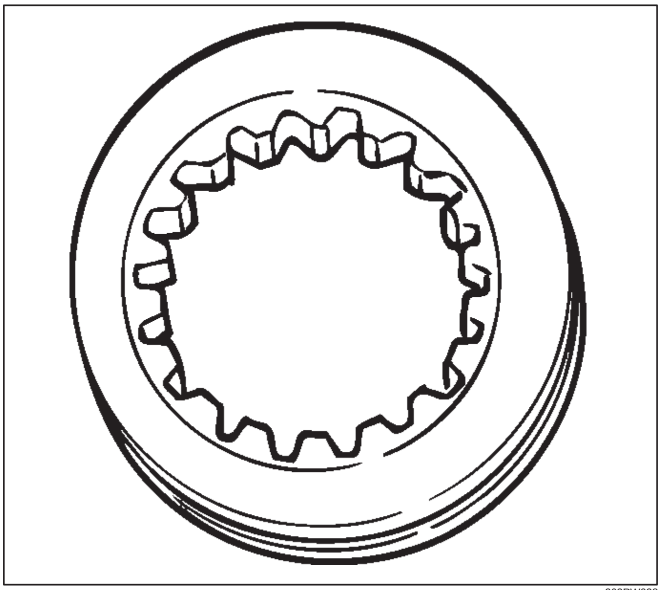
Transmits the torque determined by the clutch pressing force to the front propeller shaft via the front drive chain.



262RW029

Mechanical Lock Sleeve

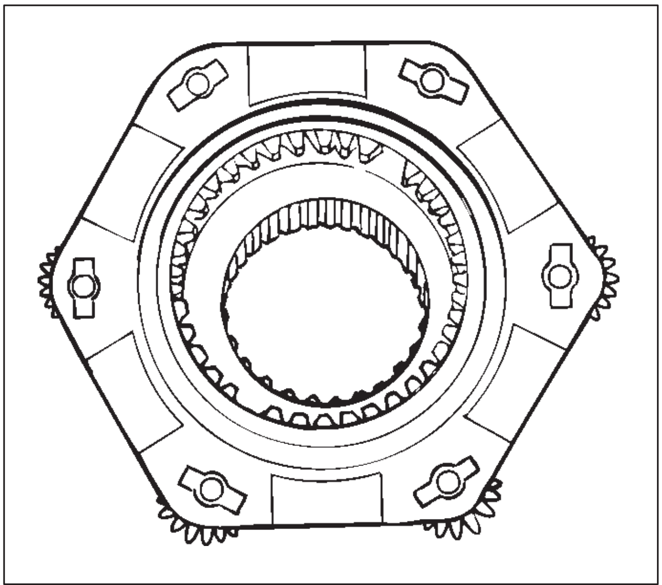
Couples the front and rear propeller shaft mechanically when the transfer shaft is in the 4L position.



262RW028

High-Low Planetary Gear Set

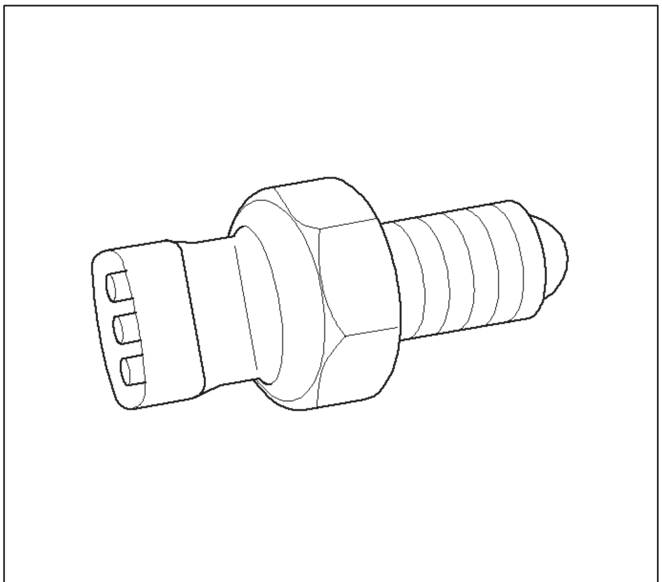
Establishes an auxiliary transmission mechanism. When the transfer shift lever is set to the 2H or TOD position, the reduction gear ratio is 1.000 and the corresponding driving force is generated. When the transfer shift lever is set to the 4L position, the reduction gear ratio is 2.480 and the corresponding driving force is generated.



262RW030

4H and 4L Switch

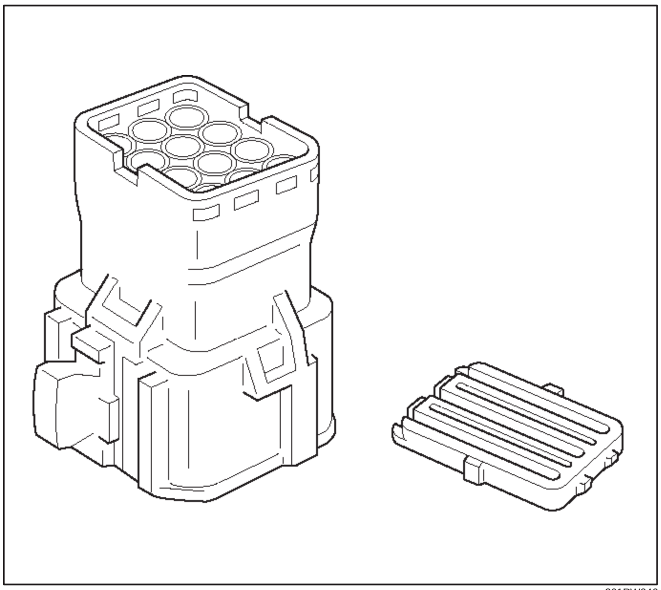
Detects the shift position of the transfer from the movement of the transfer lever and outputs signals to the TOD control unit.



261RW002

Transfer Connector

Transmits the input and output signals of the speed sensors, electromagnetic coil, and 4H and 4L switche to the vehicle harness. A waterproof 12-pin type is used.

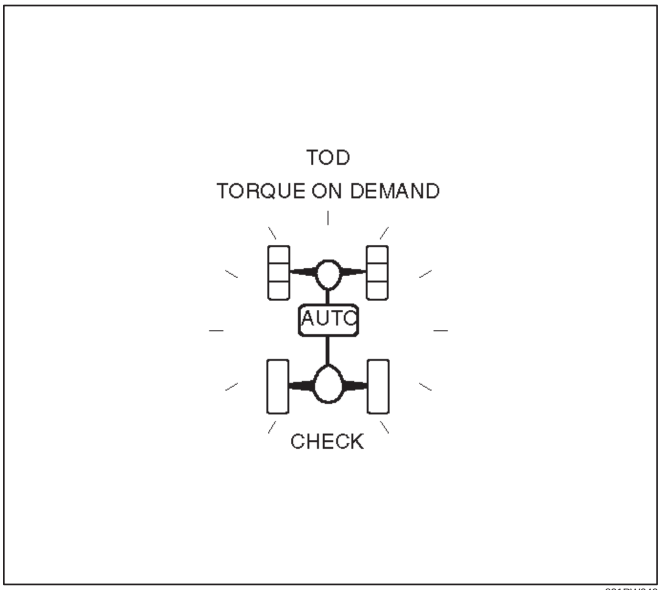


261RW046

TOD Indicator Lamps (on the instrument panel)

Inform the following items.

- Bulb check
- Drive mode
- ABS IN status
- BRAKE ON status

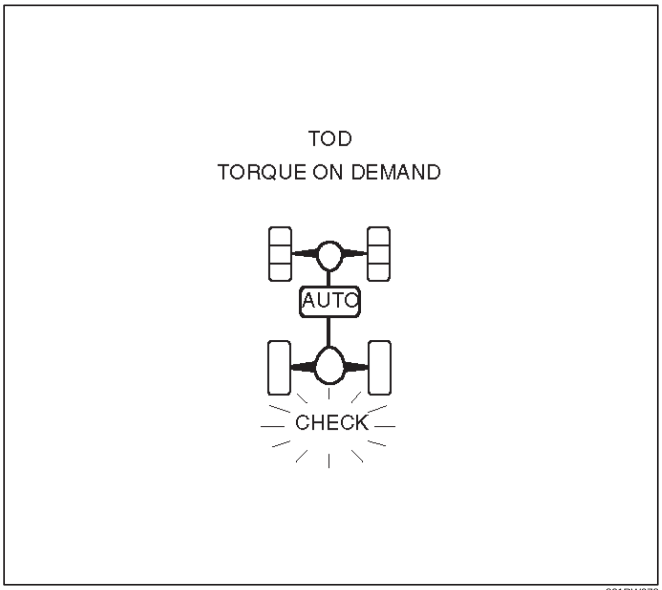


821RW049

Check Lamp

Inform the following items.

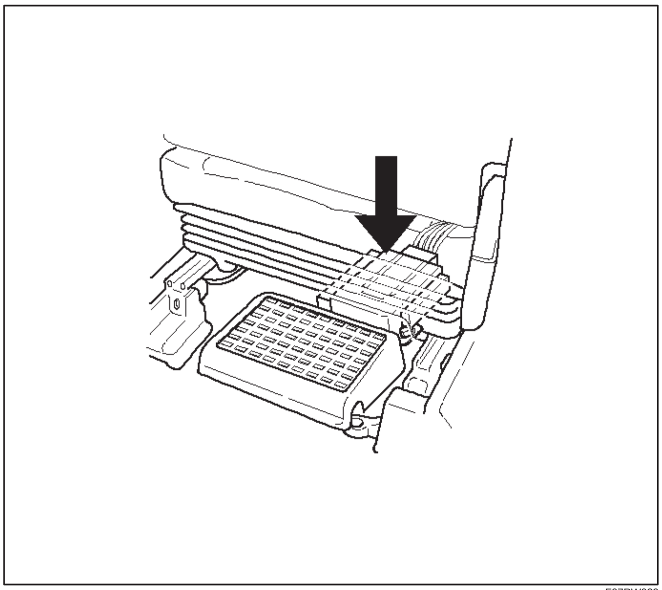
- Bulb check
- Fail (fail alarm)
- Trouble code



821RW078

TOD ECU

This control unit is mounted to the front right hand seat via a special bracket.



F07RW029

Functions of Indicator Lamp

TOD Indicator Lamps

<table>
<tr><th colspan="5">Output condition</th><th rowspan="3" colspan="2">Indicator indicate state</th><th rowspan="3">Remark</th><th rowspan="3">4WD Auto switch state</th><th colspan="4">Each sw state</th></tr>
<tr><th colspan="5">ECU Terminal No.</th><th rowspan="2">4WD Auto switch point of contact</th><th rowspan="2">4H SW</th><th rowspan="2">4L SW</th><th rowspan="2">AXLE SW</th></tr>
<tr><th>17</th><th>6</th><th>18</th><th>19</th><th>8</th></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>0</td><td>AUTO</td><td>2H Mode</td><td></td><td></td><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>1</td><td>0</td><td>AUTO</td><td>4L Mode</td><td></td><td></td><td>ON / OFF</td><td>OFF</td><td>ON</td><td>ON</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>1</td><td>1</td><td>AUTO</td><td>N Mode</td><td></td><td></td><td>ON / OFF</td><td>ON</td><td>ON</td><td>OFF</td></tr>
<tr><td>1</td><td>1</td><td>1</td><td>0</td><td>0</td><td>AUTO</td><td>TOD Mode1</td><td>Traction distribution about 0:100</td><td rowspan="4"></td><td rowspan="4">OFF</td><td rowspan="4">OFF</td><td rowspan="4">OFF</td><td rowspan="4">ON</td></tr>
<tr><td>1</td><td>1</td><td>0</td><td>0</td><td>0</td><td>AUTO</td><td>TOD Mode2</td><td>Traction distribution about 15:85</td></tr>
<tr><td>1</td><td>0</td><td>0</td><td>0</td><td>0</td><td>AUTO</td><td>TOD Mode3</td><td>Traction distribution about 30:70</td></tr>
<tr><td>0</td><td>0</td><td>0</td><td>0</td><td>0</td><td>AUTO</td><td>TOD Mode4</td><td>Traction distribution about 50:50</td></tr>
</table>

1=12V 0=GND

C07RY00017

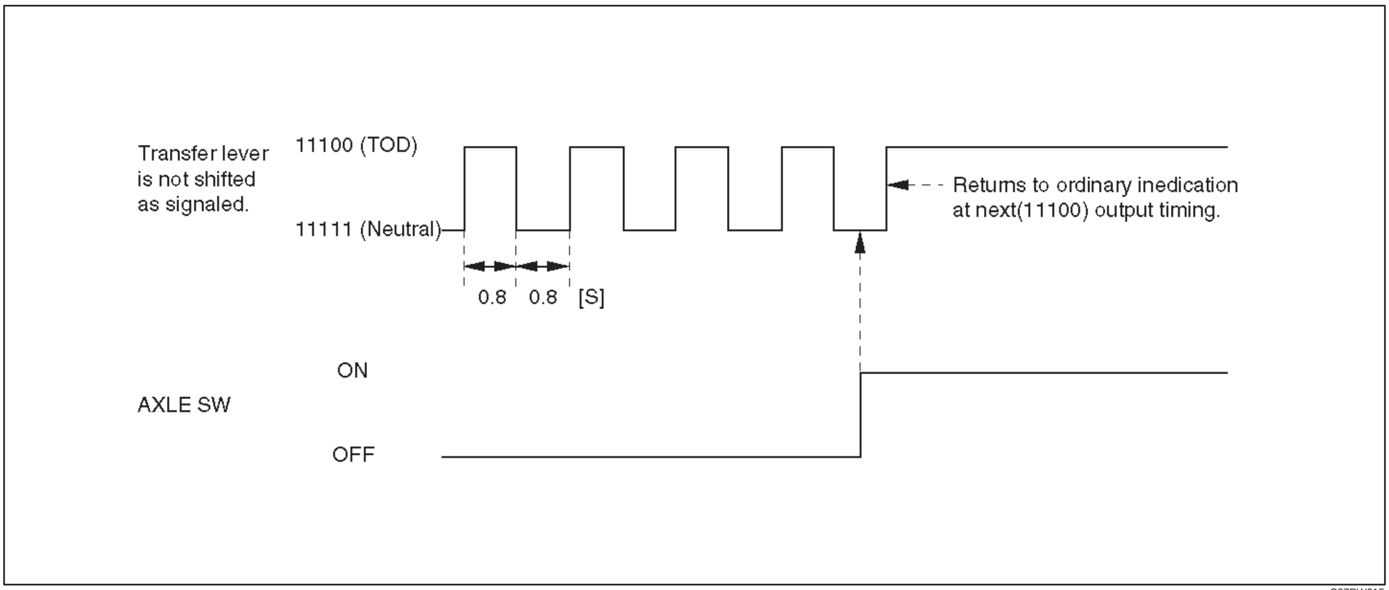
Indication of Drive Mode

The transfer lever position signals are transmitted to the TOD indicator lamp control unit according to the conditions listed below.

Indication During Transition of Transfer Lever

When the transfer lever is shifted, and the signals from the AXLE switch do not comply with the signal conditions of the 4H and 4L switch, the transfer lever position signals generated by the 4H and 4L switch and the N position signals are repeatedly output at an interval of 0.8 second.

NOTE: After the transfer lever is set to the specified position and the AXLE switch generates compliant signals, the normal output status is returned.

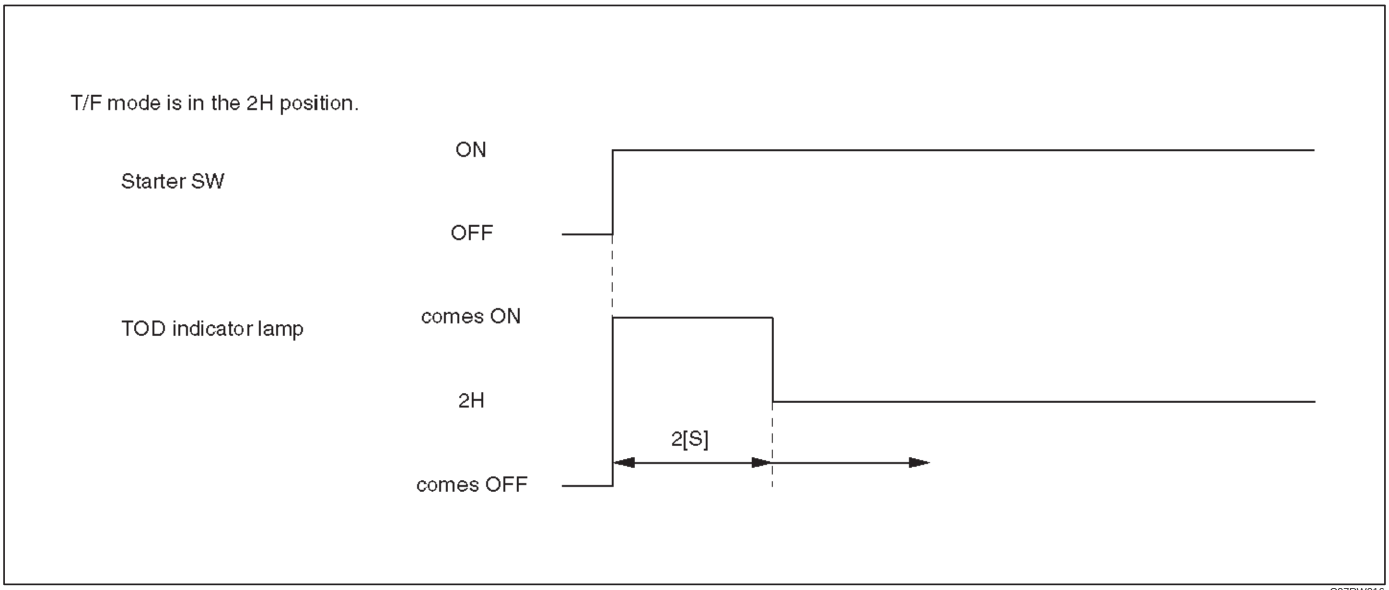


C07RW015

Bulb Check

When the starter switch is turned on, the TOD indicator lamps go on as shown below.

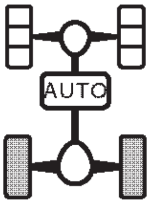
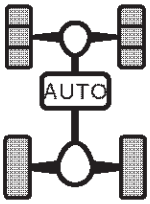
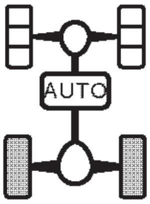
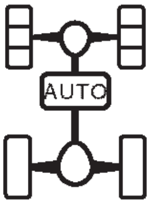
NOTE: Once the starter switch is turned on, all the TOD indicator lamps are lit for two seconds even if the transfer lever is in any position.



C07RW016

Simplified checking method of ABS IN and BRAKE ON signals:

In the event that any of the signal inputs listed below are observed while the self-diagnostic code is being displayed (the self-diagnostic connector is short-circuited to GND), you can simply check the ABS IN and BRAKE ON signals as shown in the figures below.

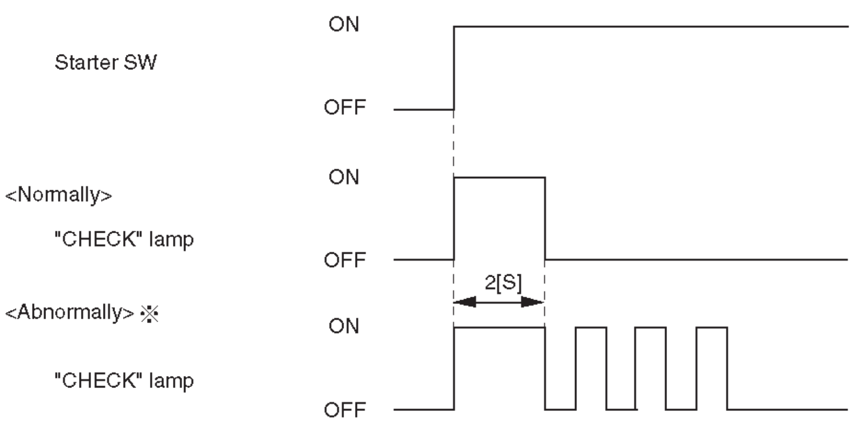
1		• In case of ABS signal being inputted, TOD indicator will light as illustrated.
2		• In case of BRAKE ON signal being inputted, TOD indicator will light as illustrated.
3		• When both the ABS and BRAKE ON signals are inputted simultaneously, ABS signal is indicated.
4		• In cases other than “1, 2, 3”, the indication is always as illustrated. (This is light-off mode) • TOD indicator light returns to usual control (mode) at 12 km/h or more.

C07RW017–1

Check Lamp

Check Lamp Bulb Check

When the starter switch is turned on in the normal state, the control unit turns on the CHECK lamp to check the bulb.



C07RW019

Diagnosis

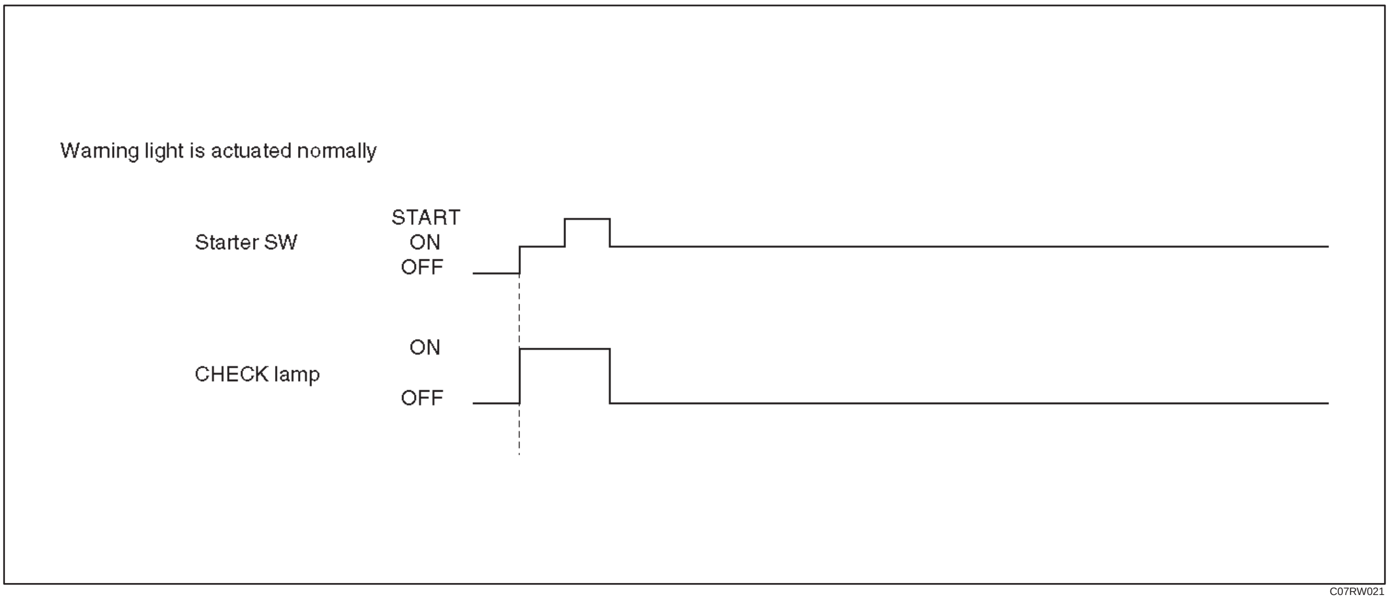
General Information Diagnosis

The troubles on TOD are classified into the group that can be identified by the lighting status of the TOD indicator lamps and those that can be recognized as abnormal phenomena of the vehicle by the driver.

The troubles that can be identified by the lighting status of the TOD indicator lamps are examined by the procedures “Diagnosis from Trouble Codes” and “Trouble Diagnosis Depending on The Status of TOD Indicator”. The troubles that can be recognized as abnormal phenomena of the vehicle by the driver are examined by the procedure “Diagnosis from symptom”.

Self-diagnosis

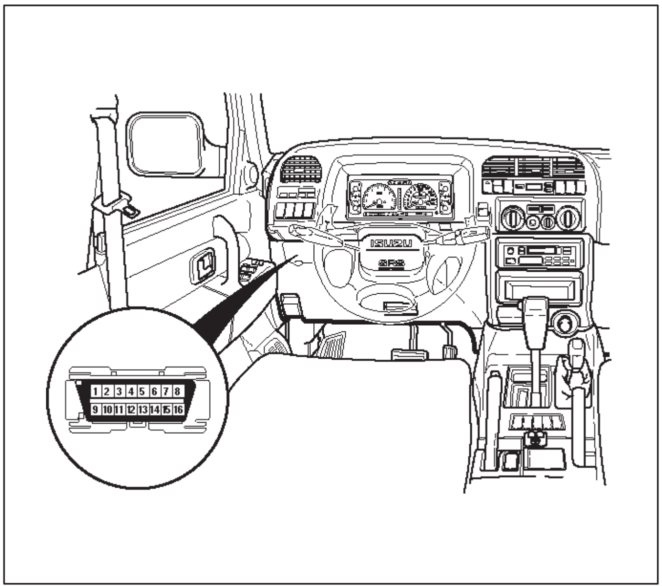
The control unit has a function of self-diagnosis. If a trouble occurs in the course of system startup, the control unit blinks the CHECK lamp and saves the trouble code.



NOTE: If an intermittent fault occurs, the control unit stops blinking upon removal of the fault. The trouble code is saved to the control unit.

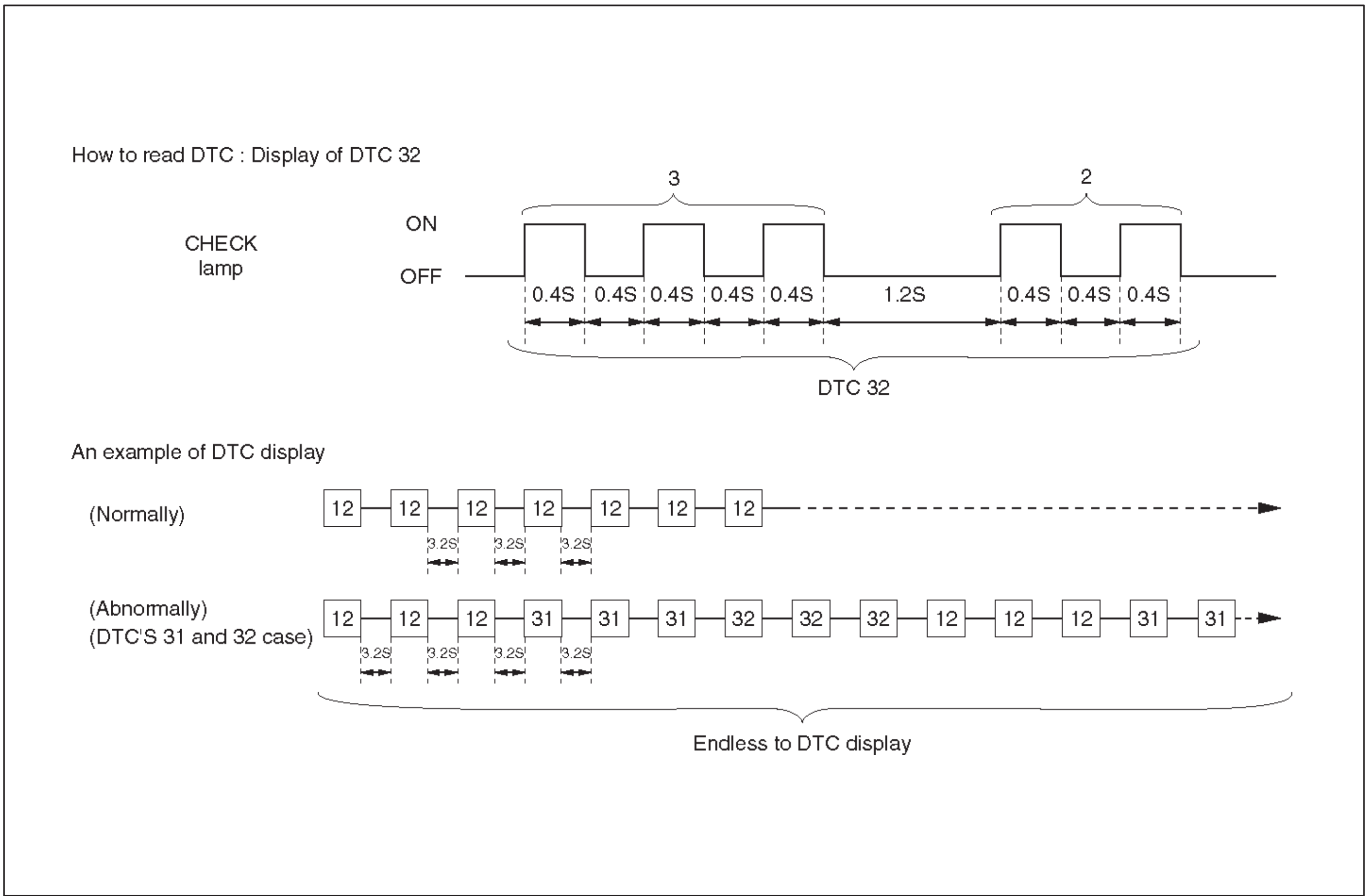
Indication Method of Trouble Code

- Short-circuit terminal 8 of the self-diagnostic connector to GND to display the trouble code on the CHECK lamp.



821RW021

- If no trouble codes exist, code “12” is displayed continuously.
- If trouble codes exist, code “12” is displayed three times, and the trouble codes, starting from the smaller code number, are displayed three times respectively.



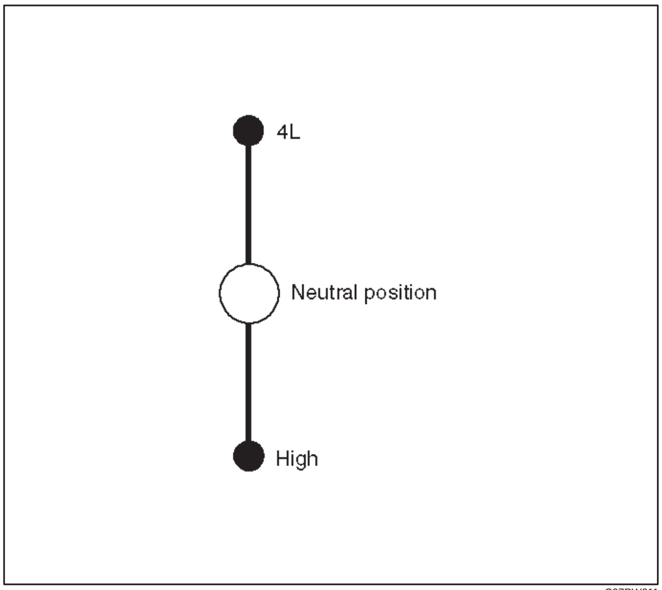
C07RY00018

How to Clear The Trouble Code

The trouble codes saved to the control unit can be deleted by the following procedure if the starter switch is being in the OFF position.

1. Shift the transfer lever to the neutral position between HIGH and 4L, and short-circuit the self-diagnostic connector.

NOTE: The neutral position between HIGH and 4L refers to the point that turns off the TOD indicator lamps. (However, be sure to check the position before short-circuiting the self-diagnostic connector.)



C07RW011

2. Turn on the starter switch while maintaining the state of step 1, and step on the brake pedal five times within five seconds from the first step on. (Note that "five times" includes the first step on). (The TOD indicator lamps display the 4L mode whenever the brake pedal is stepped on.)
3. If the conditions shown in steps 1 and 2 are met, clear the trouble codes saved to the control unit. (After the codes are completely deleted, the code 12 that indicates the normal condition is continuously displayed.)

Precautions on Diagnosis

Replacement of Control Unit

The control unit itself rarely fails. In most cases, the harnesses have failed (i.e. short-circuit) to cause secondary troubles. Other cases include that the cause has been unknown due to intermittent occurrence of troubles and the troubles are removed accidentally along with replacement of control unit, resulting in misjudgment of cause. Therefore, before replacing the control unit, check the connector joints and whether the unspecified current flows in the control unit due to short-circuit between harnesses.

Trouble Intermittently Observed

Troubles intermittently observed are mostly attributable to temporary imperfect connection of harnesses and connectors.
When such troubles are found, check the associated circuit according to the following procedure.

1. Check whether improper connectors are plugged in or connector terminals are completely engaged.
2. Check whether the terminals are deformed or damaged. If yes, remove the deformation or damage and connect the terminals securely.
3. It is likely that wires in the harness are falsely broken. Therefore, in examination of failed harness circuit, shake the harness for check to such extent that the harness will not be damaged.

Test Run of Failed TOD Vehicle

If the TOD indicator lamps experienced faulty operation even once in the past, the failed portion can be identified by use of the procedure "Diagnosis from Trouble Codes" or "Diagnosis from Lighting Status of TOD Indicator Lamps". If the troubles that are only recognized as abnormal phenomena of the vehicle by the driver are observed, conduct the test run in the following procedure to reproduce the faulty phenomena and diagnose the fault for each phenomenon.

1. Start the engine, and check that the TOD indicator lamps are turned on for about two seconds for initial check; the CHECK lamp goes off; and the TOD indicator lamps display the specified drive mode. (If the CHECK lamp starts blinking, read the trouble codes and identify the failed portion.)
2. While keeping the vehicle standstill, operate the 4WD switch and shift the transfer lever to change the modes: 2H mode→TOD mode→4L mode→TOD mode→2H mode. Check that the TOD indicator lamps correctly display the status whenever the mode is changed. If the transition status is displayed during the shift operation, run the vehicle a little to complete shifting.
3. Slowly start the vehicle in the TOD mode, and add the power to accelerate to at least 40 km/h and maintain the speed for about two minutes. Apply the brake to completely stop the vehicle. Repeat this test pattern at least three times.
4. Turn the steering to the right end (or left end) in the TOD mode, and slowly start the vehicle and make a circle five times. Next, conduct the same test in the 2H mode.
5. Slowly start the vehicle in the TOD mode, and accelerate to at least 40 km/h. Keep the established speed, carefully change the mode in the sequence "TOD mode→2H mode →TOD mode" while checking that the shift is complete in each mode change. After the test, apply the brake to completely stop the vehicle.
6. Slowly start the vehicle in the TOD mode, and accelerate to at least 40 km/h. Apply the brake strongly so that the ABS works, and completely stop the vehicle.

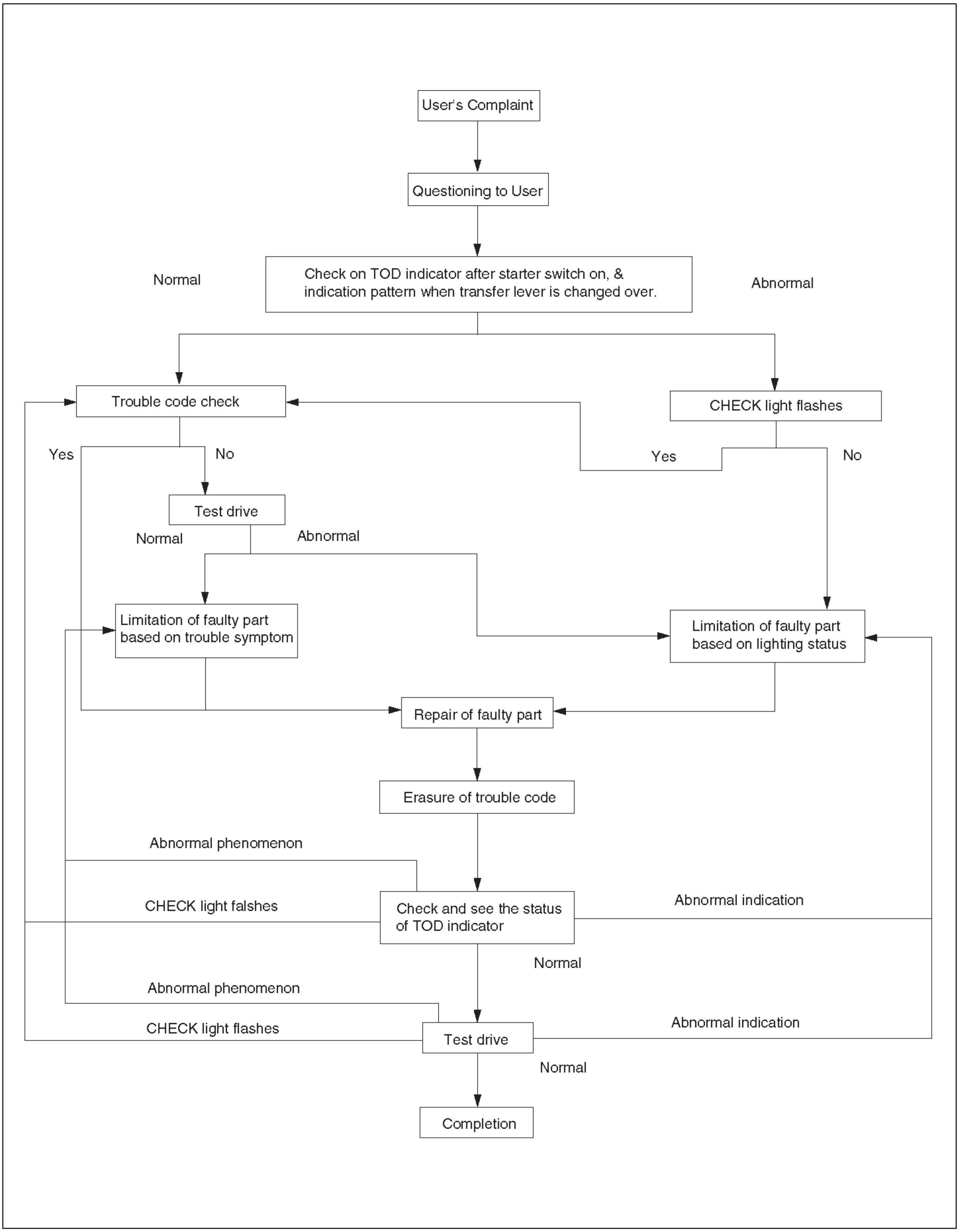
7. Slowly start the vehicle in the 4L mode, and accelerate to at least 20 km/h. Apply the brake to completely stop the vehicle.

If the CHECK lamp starts blinking during the test run, read the trouble codes and give appropriate maintenance according to the diagnostic procedure. If the TOD indicator lamps are lit abnormally during the run, check the lighting condition and give appropriate maintenance according to the diagnostic procedure. Even if the phenomena are not observed, try to reproduce the abnormal state reported by the customer to the possible extent.

Post-Repair Check

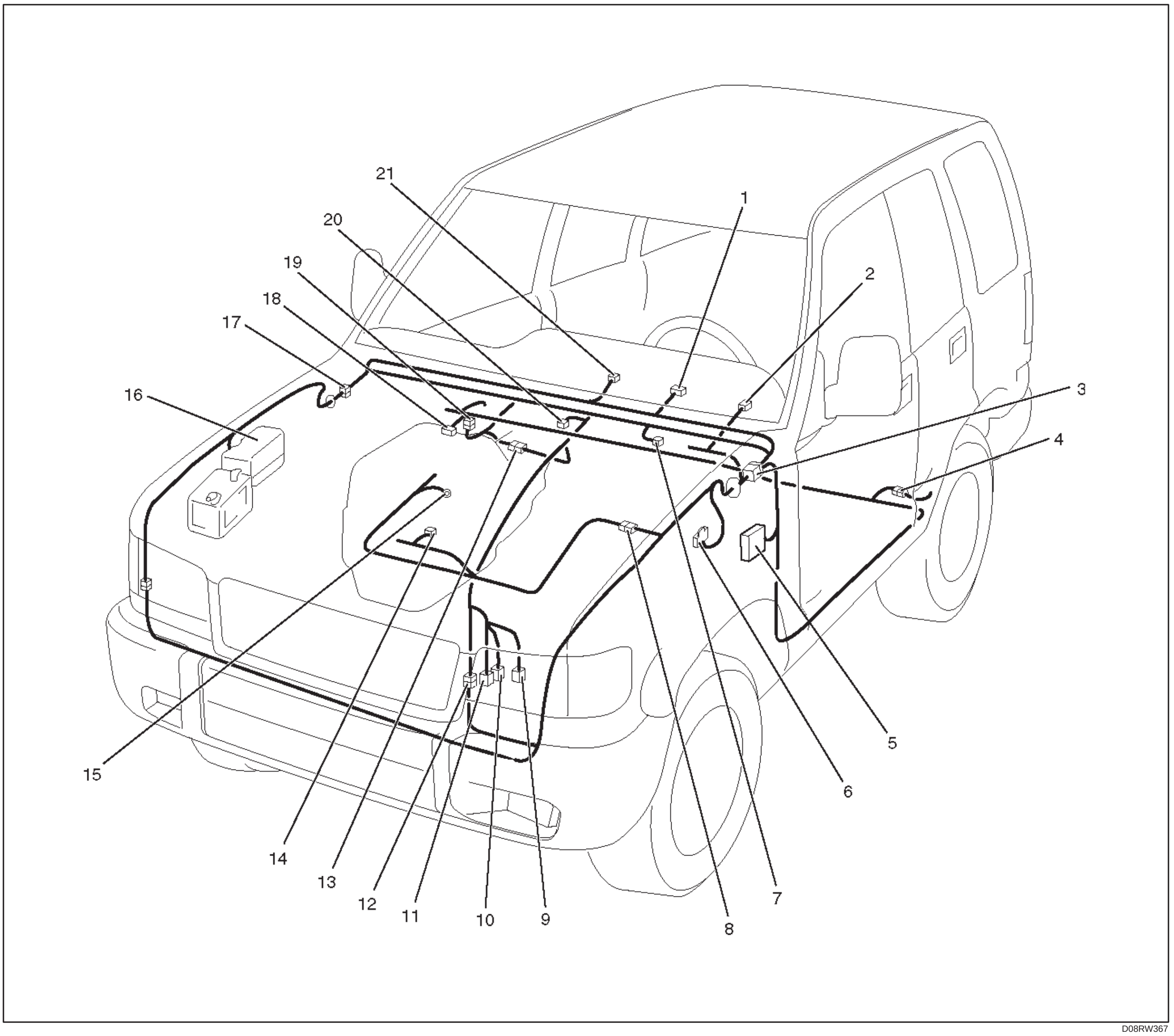
As long as the starter is not turned off, the TOD indicator lamps continue blinking even after the failed control unit is repaired. Therefore, upon completion of repair, be sure to turn off the starter switch once and then turn on it to conduct the test run sequence specified in steps 1 through 6 above and check that the TOD indicator lamps no longer show any faulty status.

Basic Diagnostic Flow Chart



C07RW023–1

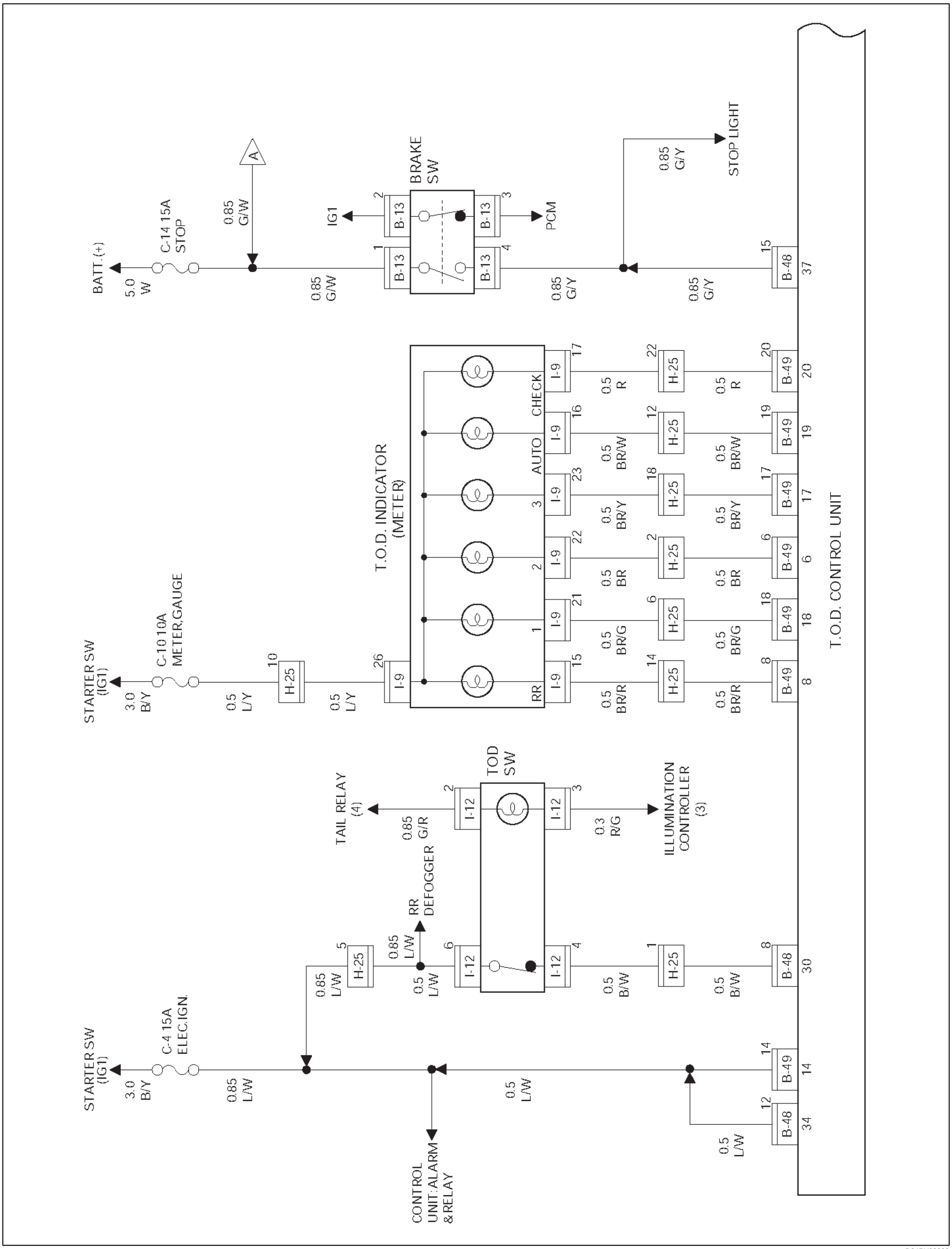
Parts Location



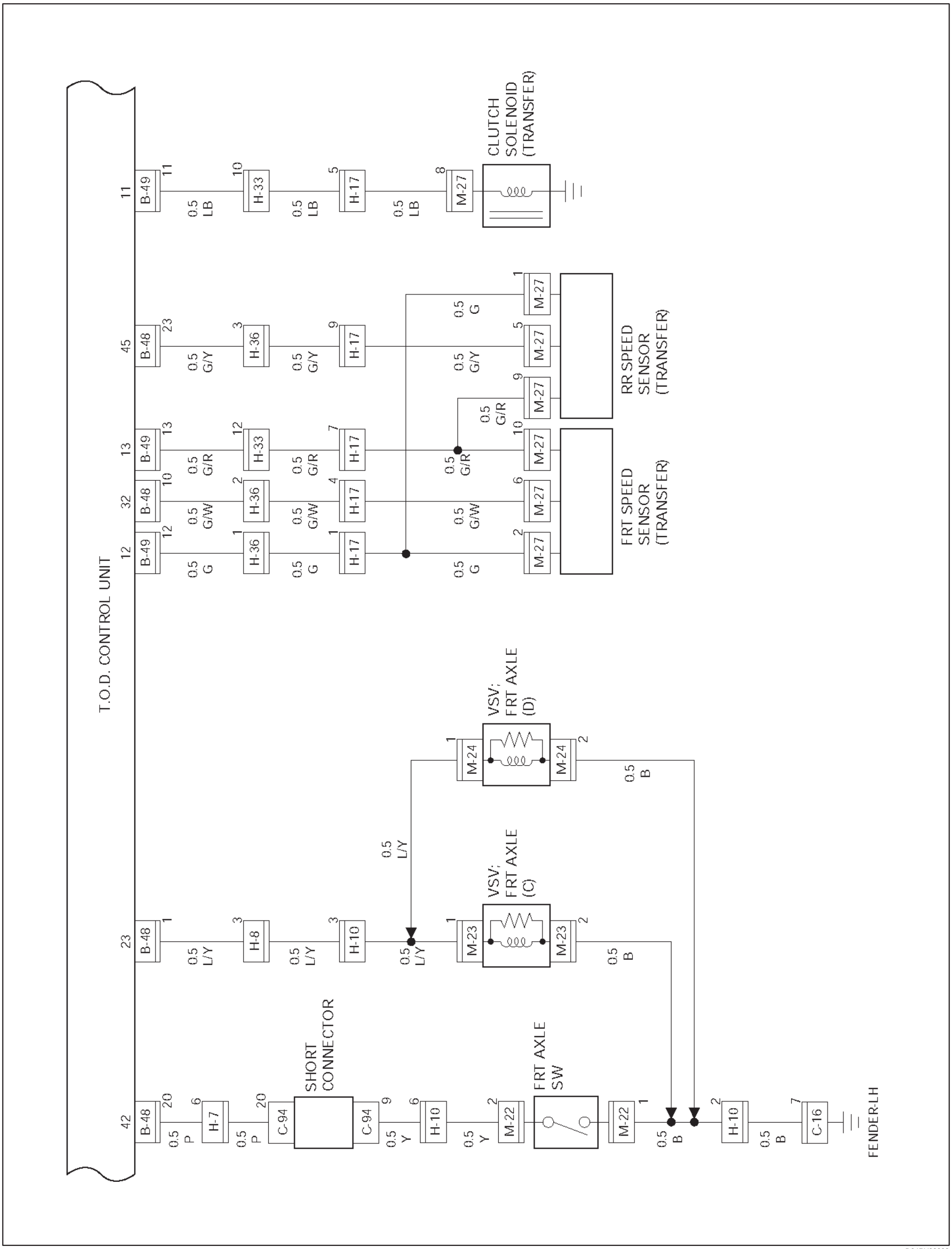
Legend

(1) I–9
(2) C–63
(3) H–7, H–8, H–25
(4) H–33
(5) Fuse Box
(6) C–16
(7) B–13
(8) H–55, H–57
(9) M–22
(10) M–23
(11) M–24
(12) H–10
(13) H–17
(14) E–54
(15) E–29
(16) Relay & Fuse Box
(17) H–12
(18) B–48, B–49
(19) H–33, H–36
(20) M–27
(21) I–12

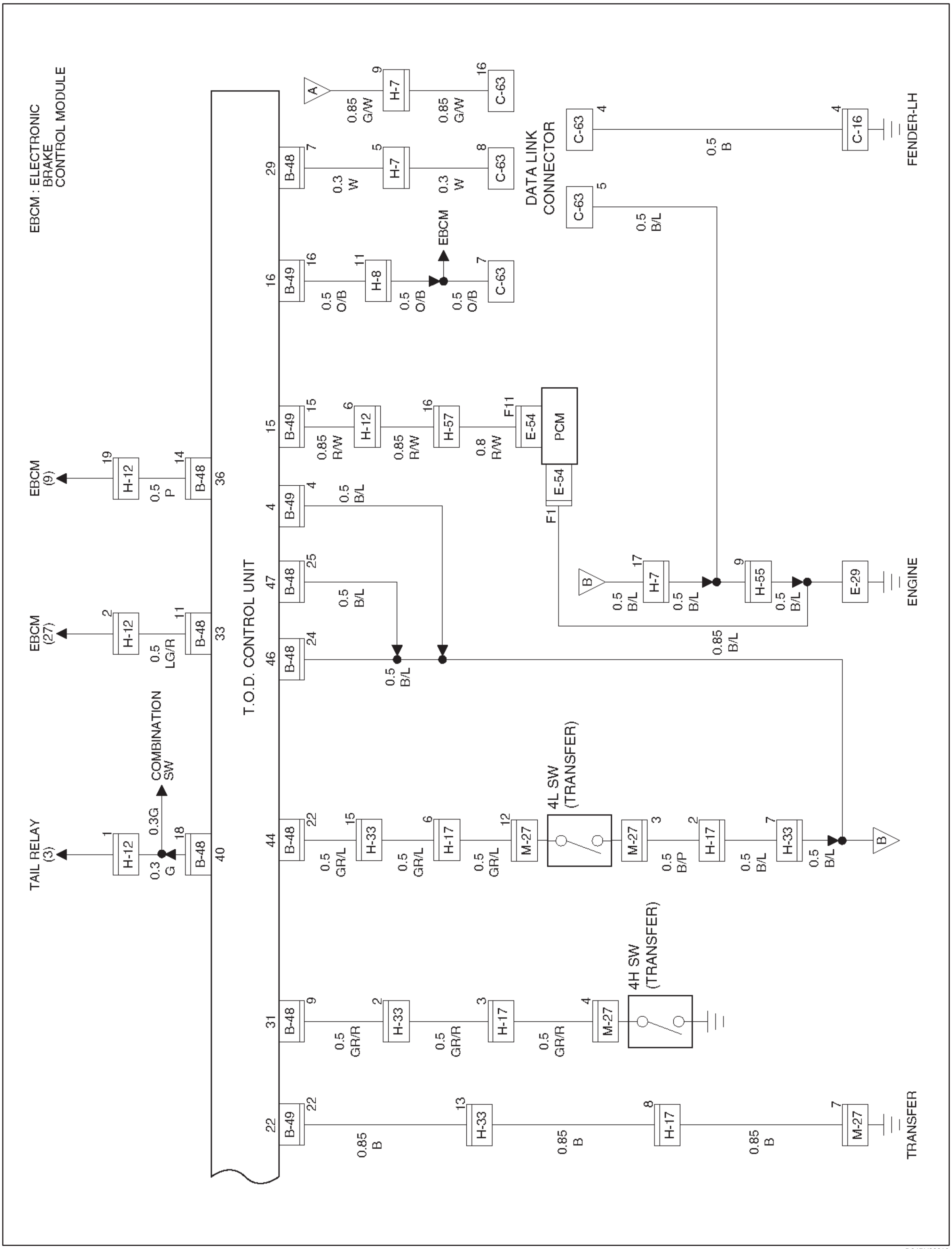
Circuit Diagram



D04RY00003

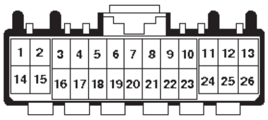
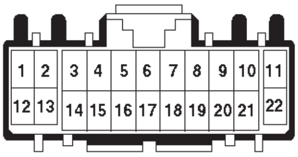
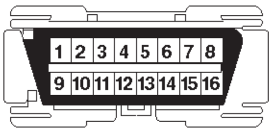

T.O.D. CONTROL UNIT
CLUTCH SOLENOID (TRANSFER)
RR SPEED SENSOR (TRANSFER)
FRT SPEED SENSOR (TRANSFER)
VSV; FRT AXLE (D)
VSV; FRT AXLE (C)
SHORT CONNECTOR
FRT AXLE SW
FENDER-LH
B-49
B-48
H-33
H-36
H-17
M-27
M-24
M-23
H-8
H-10
H-7
C-94
M-22
C-16
0.5 LB
0.5 G/Y
0.5 G/R
0.5 G/W
0.5 G
0.5 L/Y
0.5 B
0.5 P
0.5 Y

D04RY00002


EBCM : ELECTRONIC BRAKE CONTROL MODULE
T.O.D. CONTROL UNIT
DATA LINK CONNECTOR
PCM
4L SW (TRANSFER)
4H SW (TRANSFER)
TAIL RELAY (3)
COMBINATION SW
EBCM (27)
EBCM (9)
EBCM
FENDER-LH
ENGINE
TRANSFER

D04RY00010

Connector List

No.	Connector face
B-13	
B-48	
B-49	
C-16	
C-63	
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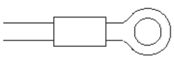
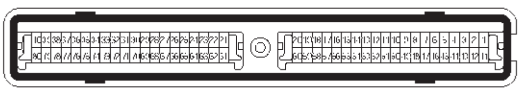
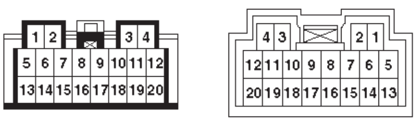
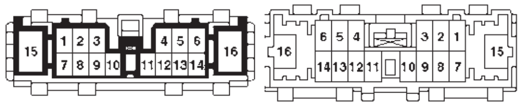
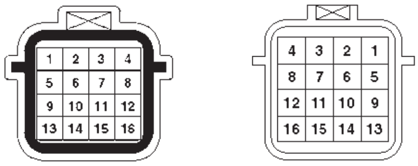
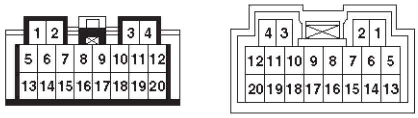
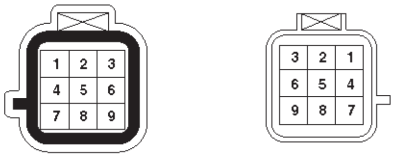
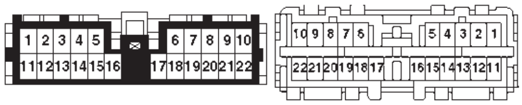
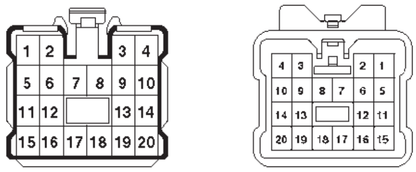
E-29	
E-54	
H-7	

No.	Connector face
H-8	
H-10	
H-12	
H-17	
H-25	
H-33	
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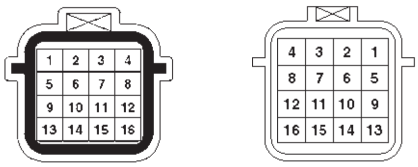
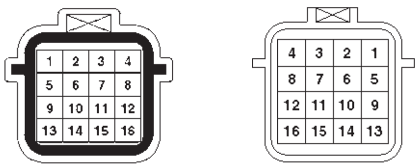
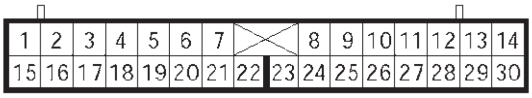
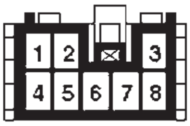
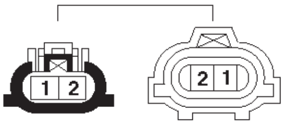
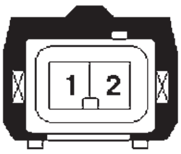
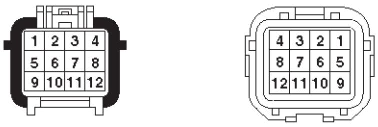
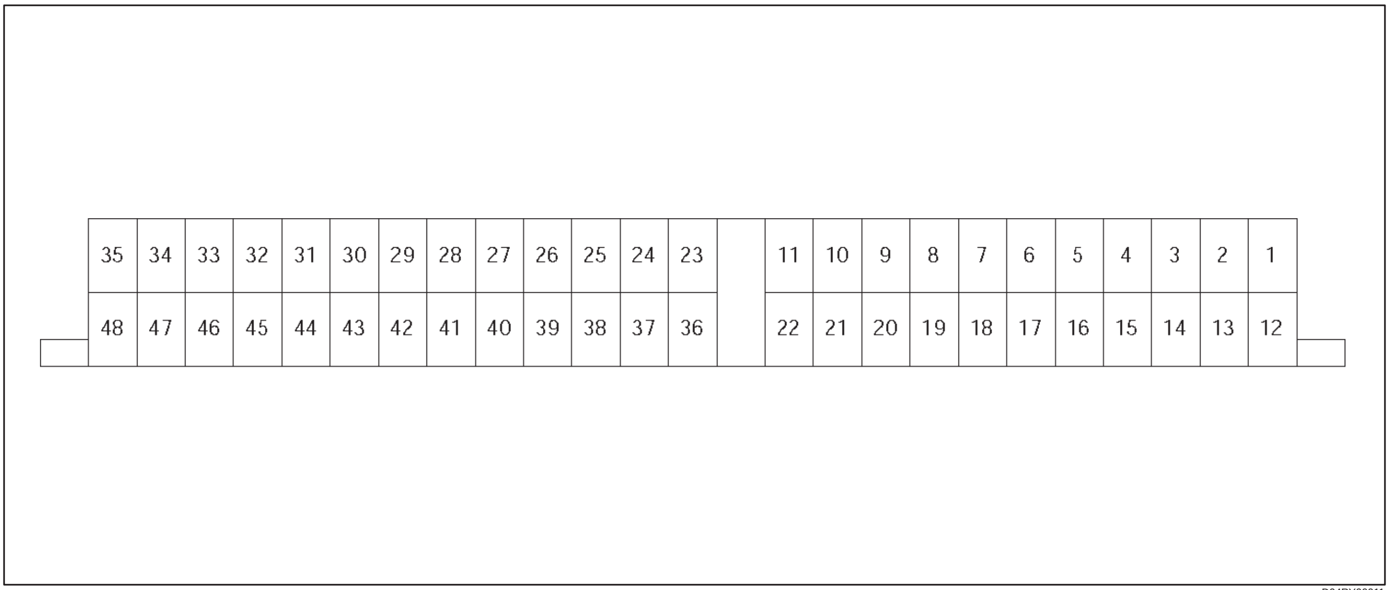
H-55	
H-57	

No.	Connector face
I-9	
I-12	
M-22	
M-23	
M-24	
M-27	

Checking Failed Pin

Connector Pin Assignment

- ECU pin assignment



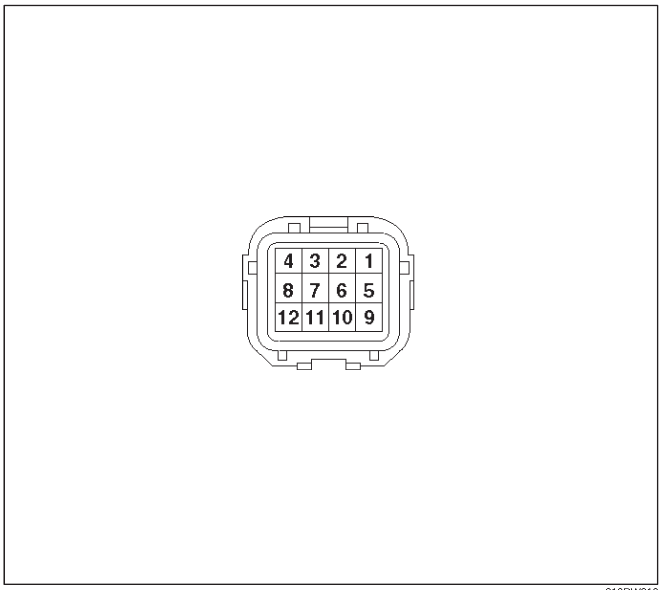
D04RY00011

No.	NAME	CONTENTS
1	N.C	Not used
2	N.C	Not used
3	N.C	Not used
4	D–G MAP	Gas/Diesel
5	N.C	Not used
6	IND. b	Display Front–B
7	N.C	Not used
8	IND. Rr	Display Rear–E
9	N.C	Not used
10	N.C	Not used
11	SOL (+)	EMC
12	Ref	Speed Reference
13	COM (–)	Speed Return
14	VIG	Ignition
15	TPS	TPS (PWM)
16	TECH 2	TECH–2
17	IND. a	Display Front–A
18	IND. c	Display Front–C
19	IND. AUTO	Display Auto–D
20	CHECK	Check T/F
21	N.C	Not used
22	P–GND	Power Ground
23	ADC (+)	Axle Disconnect Output
24	N.C	Not used
25	N.C	Not used

No.	NAME	CONTENTS
26	N.C	Not used
27	N.C	Not used
28	N.C	Not used
29	DIAG	Diagnostic Input
30	TOD SW	TOD Switch
31	4H SW	4H Switch Input
32	Frt. Sig	Front Speed Signal
33	ABS IN	ABS In
34	VIG	Ignition
35	N.C	Not used
36	4WD OUT	4WD Signal Output
37	BRAKE	Brake Switch Input
38	N.C	Not used
39	N.C	Not used
40	LIGHTING SW	Lighting Switch Input
41	N.C	Not used
42	AXLE SW	Axle Switch Input
43	N.C	Not used
44	4L SW	4L Switch Input
45	Rr. Sig	Rear Speed Signal
46	GND	ECU Ground 1
47	GND. 2	ECU Ground 2
48	N.C	Not used

Reference

- Transfer connector pin assignment (connector on the transfer case)
  for inspection of transfer pins.



810RW310

No.	NAME	CONTENTS
1	Ref. (Rer.)	Rear speed sensor reference output
2	Ref. (Frt.)	Front speed sensor reference output
3	SW GND	SW GND
4	4H SW (+)	4H SW plus terminal
5	Rer. (+)	Rear speed sensor plus
6	Frt. (+)	Front speed sensor plus
7	POWER GND	Power GND
8	SOL (+)	Electromagnetic solenoid
9	COM (–) (Rer.)	Rear speed sensor GND
10	COM (–) (Frt.)	Front speed sensor GND
11	NC	Not used
12	4L SW (+)	4L SW plus terminal

Checking Failed TOD Control Unit Pin

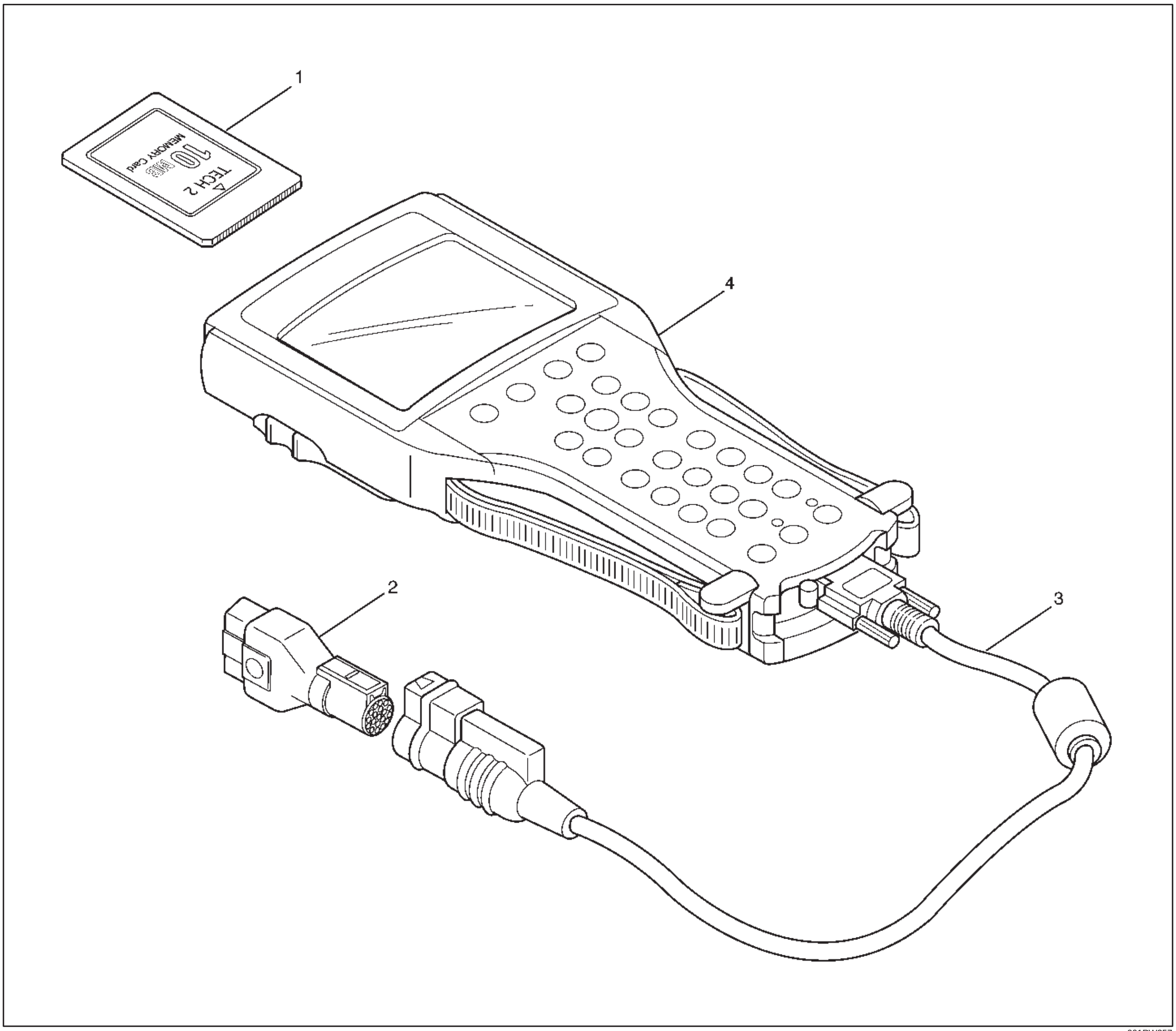
NOTE:

1. Unplug the ECU connector and the pins, unless otherwise specified.
2. Before removing the ECU, turn off the ignition switch.
3. If the standard values are not observed, check the pins with other testers.

Check Pin No.	Circuit to be tested	Ignition Switch Position	Engine State	Multimeter Scale/ Range	Measure between Pin Number	Standard Valve	Note
4	D-G MAP	OFF	STOP	Ω	4, 46	Continuity : OK	
22	P-GND	OFF	STOP	Ω	22, 46	Continuity : OK	
46	GND	OFF	STOP	Ω	46, GND	Continuity : OK	
31	4H SW	OFF	STOP	Ω	31, 46	No continuity (high, 4L) and continuity (N) : OK	
44	4L SW	OFF	STOP	Ω	44, 46	No continuity (high) and continuity (4L, N) : OK	
42	AXLE SW	ON	RUN	Ω	42, 46	Continuity : OK	Remove ECU and start the engine. Move the vehicle forth and back to connect axle surely.
29	DIAG	OFF	STOP	Ω	29 (TOD), 8 (DLC Connector)	Continuity : OK	DLC connector terminal 8
17	IND.a	ON	STOP	DCV	17 (+), 46 (–)	8.0 ~14.5 V	
6	IND.b	ON	STOP	DCV	6 (+), 46 (–)	8.0 ~14.5 V	
18	IND.c	ON	STOP	DCV	18 (+), 46 (–)	8.0 ~14.5 V	
20	CHECK LAMP	ON	STOP	DCV	20 (+), 46 (–)	8.0 ~14.5 V	
33	ABS IN	ON	STOP	DCV	33 (+), 46 (–)	11.5 ~14.5 V	
12	Ref.	ON	STOP	DCV	12 (+), 46 (–)	5 ~9 V	Connect ECU
32	Ft.(+)	ON	STOP	DCV	32 (+), 46 (–)	0.7 ~6 V	Connect ECU and move the vehicle (off one tooth of speed sensor ring) making sure of voltage change.
45	Rr.(+)	ON	STOP	DCV	45 (+), 46 (–)	0.7 ~6 V	Connect ECU and move the vehicle (off one tooth of speed sensor ring) making sure of voltage change.
13	COM(-)	ON	STOP	DCV	13 (+), 46 (–)	0V	Connect ECU
14	Vig	ON	STOP	DCV	14 (+), 46 (–)	8 ~14.5 V	
37	BRAKE	OFF	STOP	DCV	37 (+), 46 (–)	8 ~14.5 V	Press brake pedal
15	TPS	ON	STOP	DCV	15 (+), 46 (–)	PWM duty cycle 10% – 90%	Step on the accelerator pedal and make sure that duty cycle changes.
36	4WD OUT	OFF	STOP	Ω	36, 46	7 ~12 kΩ	Disconnect battery GND terminal
23	ADC(+)	OFF	STOP	Ω	23, 46	10 ~30 Ω	Disconnect battery GND terminal
11	SOL(+)	OFF	STOP	Ω	11, 46	1.0 ~5.0 Ω	Disconnect battery GND terminal
30	TOD SW	ON	STOP	DCV	30 (+), 46 (–)	SW OFF : 8.0 ~14.5 V SW ON : 0 V	SW OFF : Contact point open SW ON : Contact point close
40	LIGHTING	ON	STOP	DCV	40 (+), 46 (–)	SW OFF : 8.0 ~14.5 V SW ON : 0 V	
19	AUTO INDI	ON	STOP	DCV	19 (+), 46 (–)	TOD : 0 V 2H : 8.0 ~14.5 V	
8	RR INDI	ON	STOP	DCV	8 (+), 46 (–)	0 V	
34	VIG	ON	STOP	DCV	34 (+), 46 (–)	8 ~14.5 V	

Tech 2 Scan Tool

From 98 MY, Isuzu dealer service departments are recommended to use Tech 2. Please refer to Tech 2 scan tool user guide.



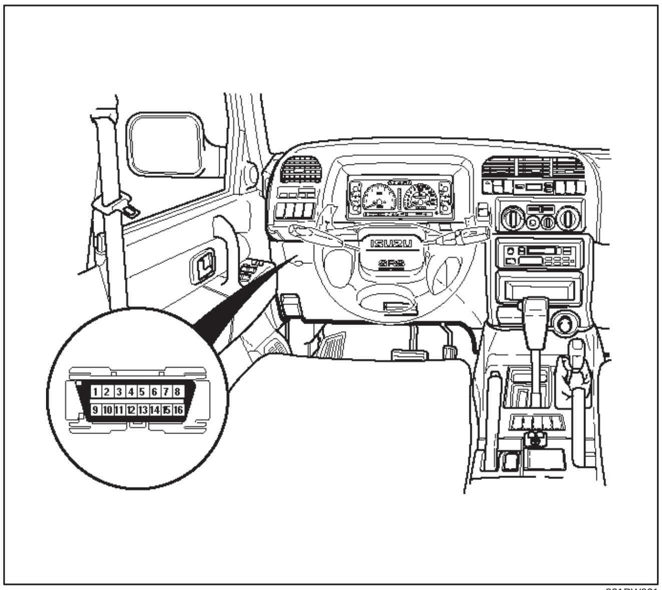
Legend

(1) PCMCIA Card
(2) SAE 16/19 Adaptor
(3) DLC Cable
(4) Tech 2

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 98 System PCMCIA card (1) inserts into the Tech 2 (4).
2. Connect the SAE 16/19 adapter (2) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (4)
4. Mark sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC connector.



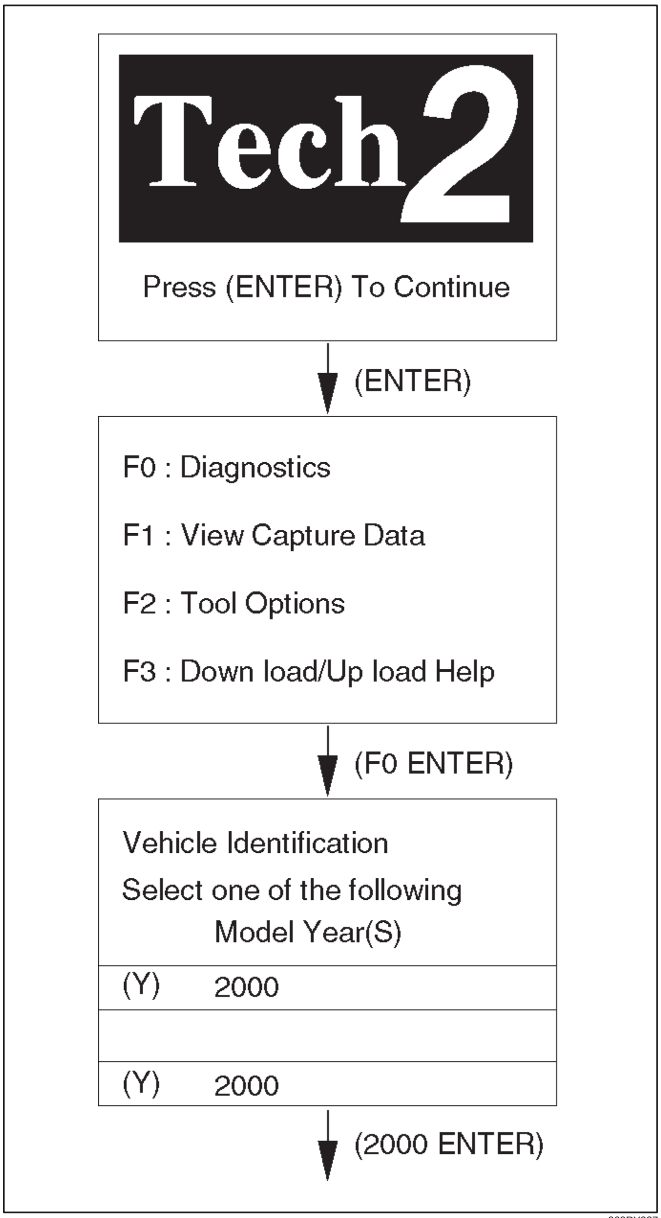
821RW021

6. The vehicle ignition turns on.
7. Power up the Tech 2.
8. Verify the Tech 2 power up display.

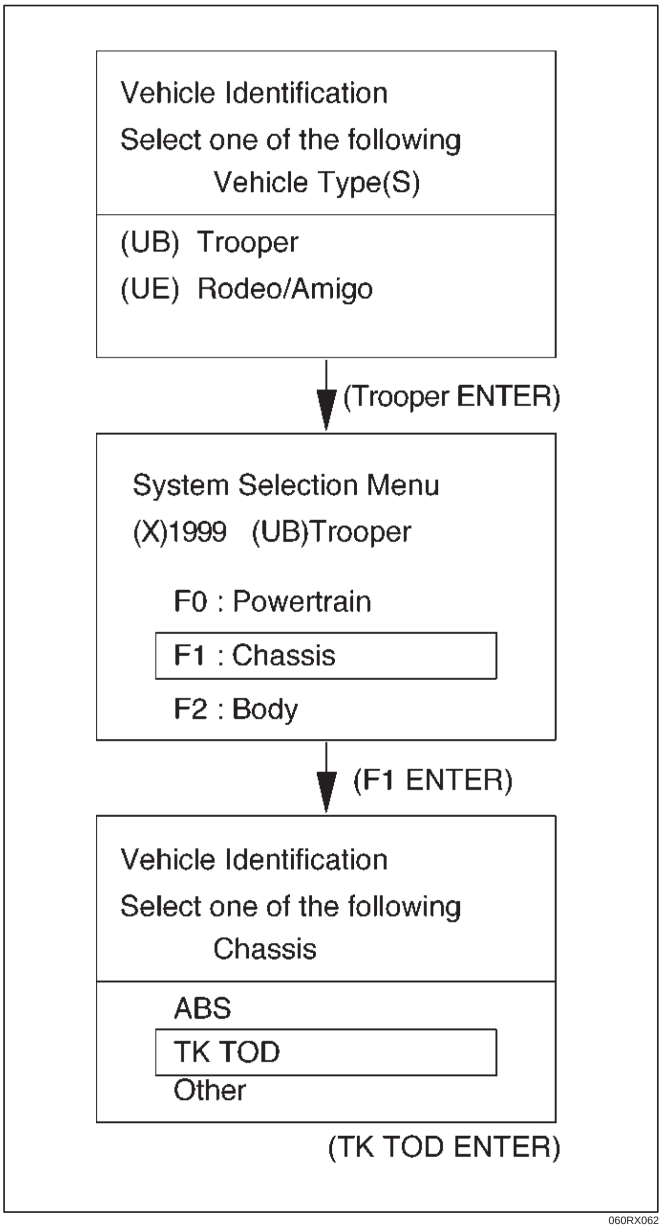
060RW009

Operating Procedure

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



060RY027


Vehicle Identification
Select one of the following
Vehicle Type(S)
(UB) Trooper
(UE) Rodeo/Amigo
(Trooper ENTER)
System Selection Menu
(X)1999 (UB)Trooper
F0 : Powertrain
F1 : Chassis
F2 : Body
(F1 ENTER)
Vehicle Identification
Select one of the following
Chassis
ABS
TK TOD
Other
(TK TOD ENTER)
060RX062

Diagnostic Trouble Codes

Code	Item	Diagnosis	Check flow No.
12	Start code	Normal	—
13	Ref	Shorted GND	6
14	Front speed sensor	Input abnormality (open, sig or com)	2
15	Ref	Shorted V_B	6
16	Front speed sensor	Input abnormality	3
21	TPS	Shorted or disconnected wiring, abnormality in input	7
23	ECU	CPU abnormality	1
24	Rear speed sensor	Input abnormality (open, sig or com)	5
26	EMC (+)	Shorted GND	10
27	Rear speed sensor	Input abnormality	4
28	ADC (+) & AXLE SW	Output abnormality	11
31	EMC (+)	Shorted or disconnected coil/wiring	9
32	ADC (+)	Shorted or disconnected coil/wiring	12
33	ADC (+)	Shorted GND	13
36	ECU	CPU abnormality	1
37	ECU	CPU abnormality	1
38	ECU	CPU abnormality	1

TPS : Throttle Position Sensor
EMC : Electromagnetic coil
ADC : Shift on the fly (Axle Dis Connect)

Diagnosis from Trouble Codes

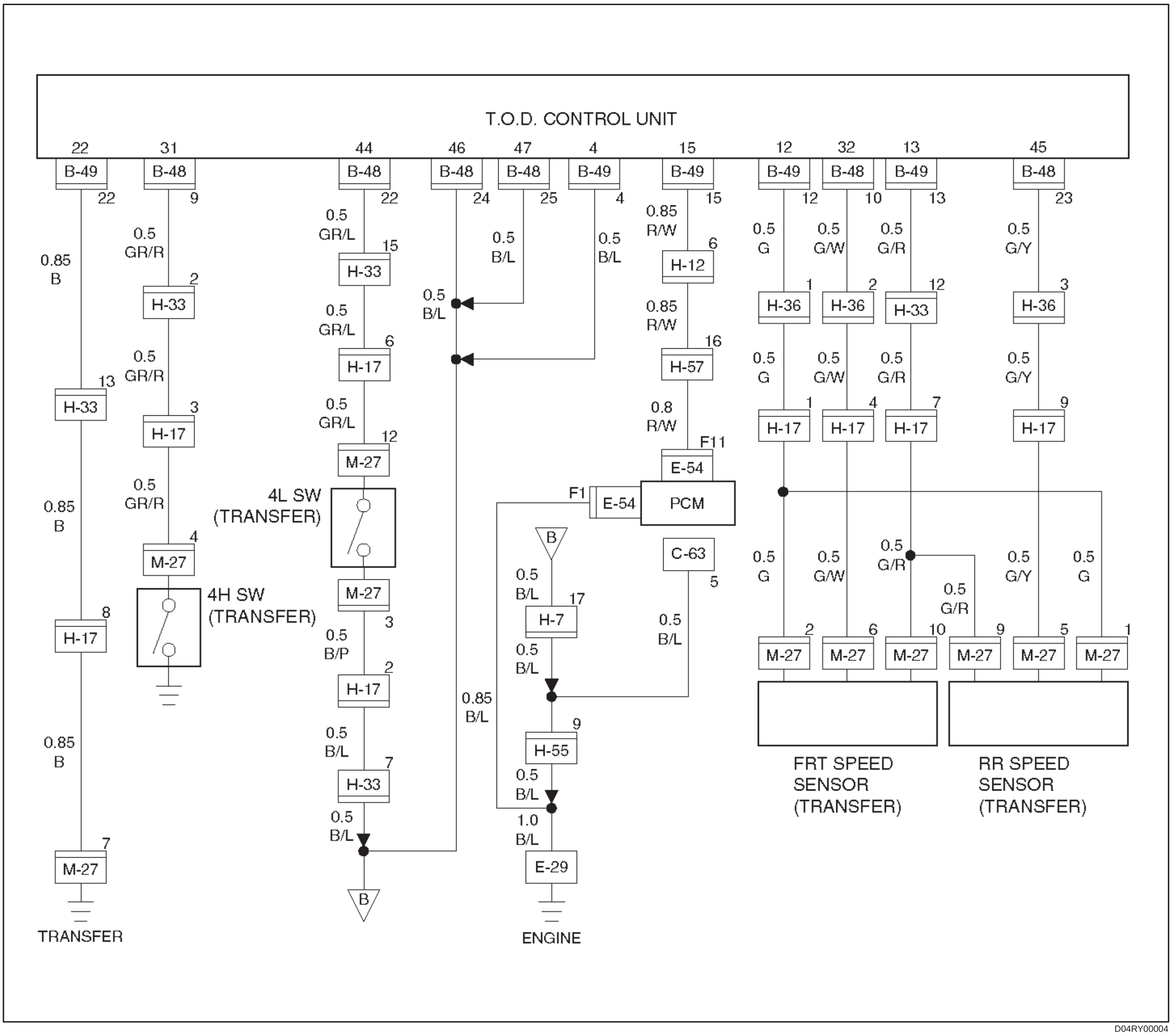
- Diagnose the based on the fault that have been saved to the control unit according to the system self-diagnostic function.

Check flow	Trouble code	Phenomenon	Standard
1	23, 36, 37, 38	The ECU is failed.	—

Step	Action	Yes	No
1	Turn on the starter switch. Is the trouble reproduced?	Replace the ECU and conduct the test run. Go to Step 3	Go to Step 2
2	1. Clear the trouble codes. 2. Conduct the test run. Is the trouble reproduced during the test run?	Replace the ECU and conduct the test run. Go to Step 3	The trouble is not reproduced. Refer to “Troubles intermittently observed”. Go to Step 3
3	1. Check that all the parts are mounted. 2. Clear the trouble codes. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 3

Check flow	Trouble code	Phenomenon	Standard
2	14	Front speed sensor signal open or GND short, speed sensor com open.	0.3 < sensor voltage

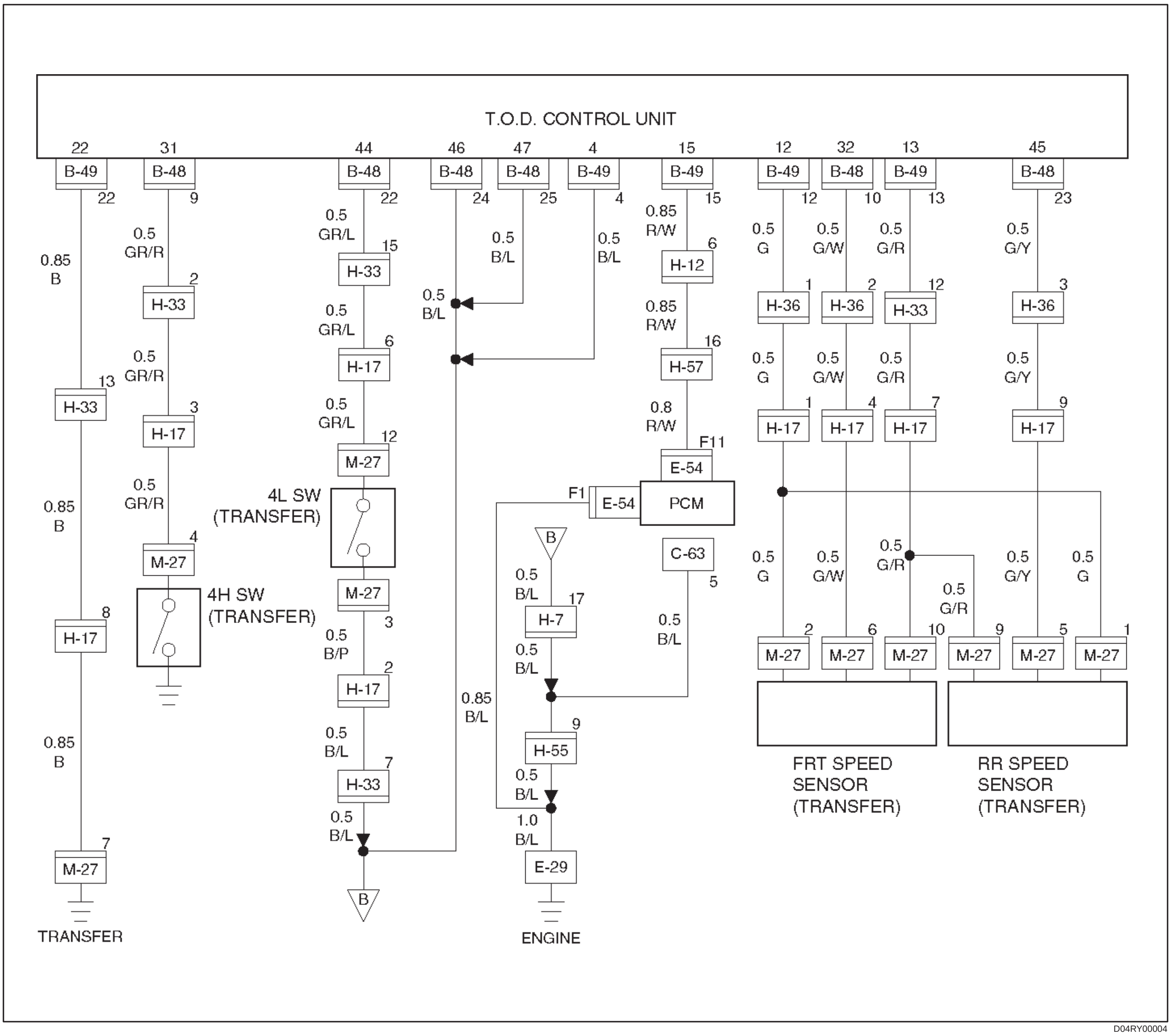
NOTE: The following procedure shows the case that the front or rear sensor common grounding line is broken.



Step	Action	Yes	No
1	1. Start the engine. 2. Select 4H (TOD) mode. Is the memory except DTC 14?	Go to Step 3	Go to Step 2
2	Is the continuity between harness of terminal 32 and ground (vehicle side terminal of the front speed sensor)?	Replace speed sensor. Go to Step 6	Repair the circuit. Go to Step 6
3	Is the memory DTC 24?	Go to Step 4	Refer to other trouble check flow. Go to Step 2
4	Is the continuity between harness of terminal 32 and 45 (vehicle side terminal of the front and rear speed sensor)?	Go to Step 5	Repair the circuit. Go to Step 6
5	Is the continuity between harness of terminal 12 and 13 (vehicle side terminal of the speed sensor COM and ref)?	Replace front and rear speed sensor. Go to Step 6	Repair the circuit. Go to Step 6
6	1. Check that all the parts are mounted. 2. Clear the trouble code. Is the step complete?	Repeat the “Diagnosis Flow”.	The trouble is not reproduced. Refer to “Troubles intermittently observed”. Return to Step 6

Check flow	Trouble code	Phenomenon	Standard
3	16	The front speed sensor no pulse.	Hi level : 4.5 ~ 6.0 V Lo level : 0.7 ~ 2.0 V Frequency (F) = 766 Hz (at 30 mile/h)

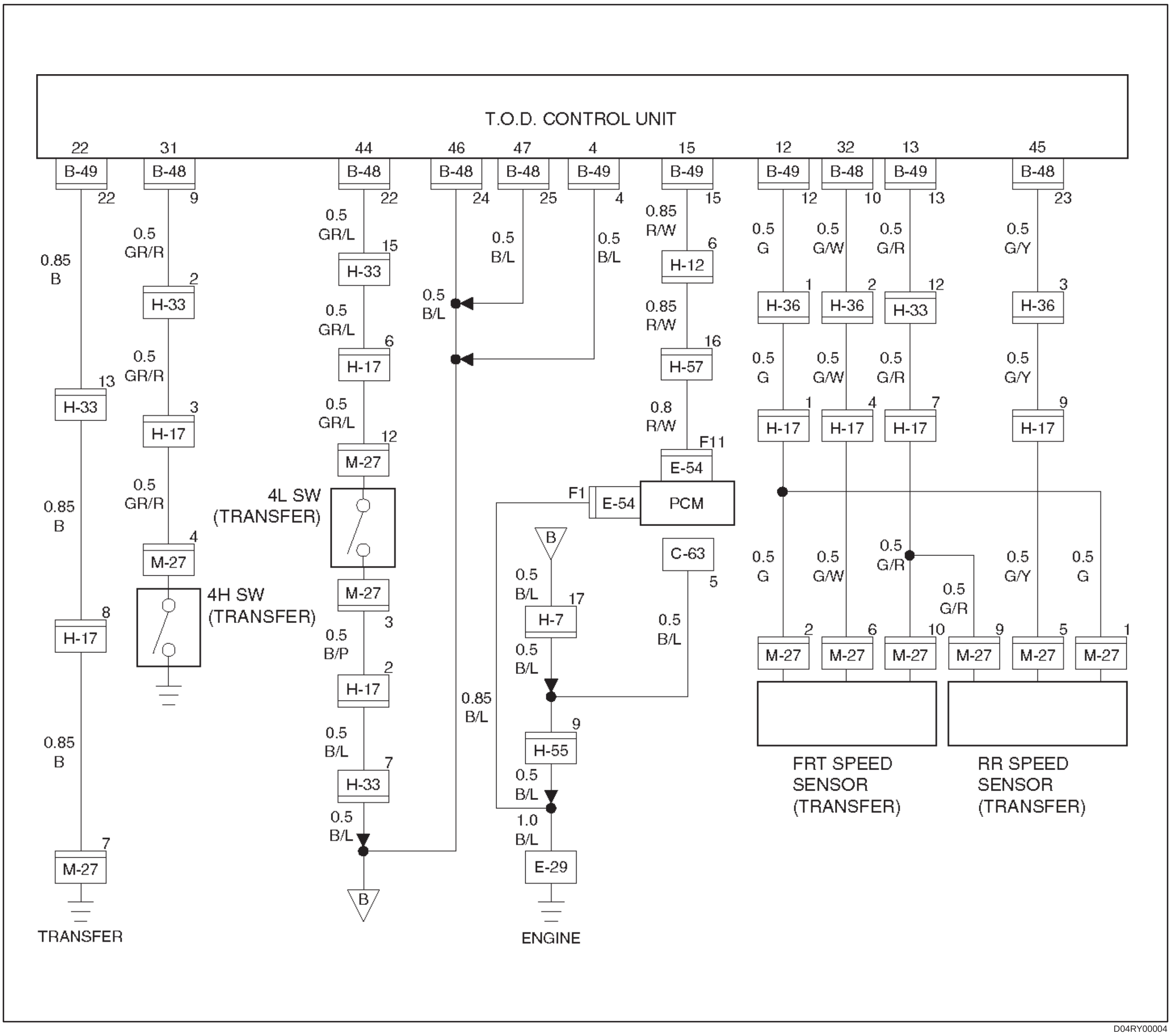
NOTE: Find the trouble in which the pulse corresponding to the running speed is not input.



Step	Action	Yes	No
1	1. Connect TECH 2. While running in TOD mode, does TECH–2's front speed sensor indication change with vehicle speed?	Go to Step 2	Repair and inspection front speed sensor tone wheel. Go to Step 4
2	Is the continuity between harness of terminal 32 and ground (vehicle side terminal of the front speed sensor)?	Replace speed sensor. Go to Step 3	Repair the circuit. Go to Step 3
3	1. Clear the trouble code. While running at 30 mph in TOD mode for 30 consecutive sec, is trouble code reissued?	Replace ECU. Go to Step 4	Go to Step 4
4	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	The trouble is not reproduced. Refer to "Troubles intermittently observed". Return to Step 4

Check flow	Trouble code	Phenomenon	Standard
4	27	The front speed sensor no pulse.	Hi level : 4.5 ~ 6.0 V Lo level : 0.7 ~ 2.0 V Frequency (F) = 766 Hz (at 30 mile/h)

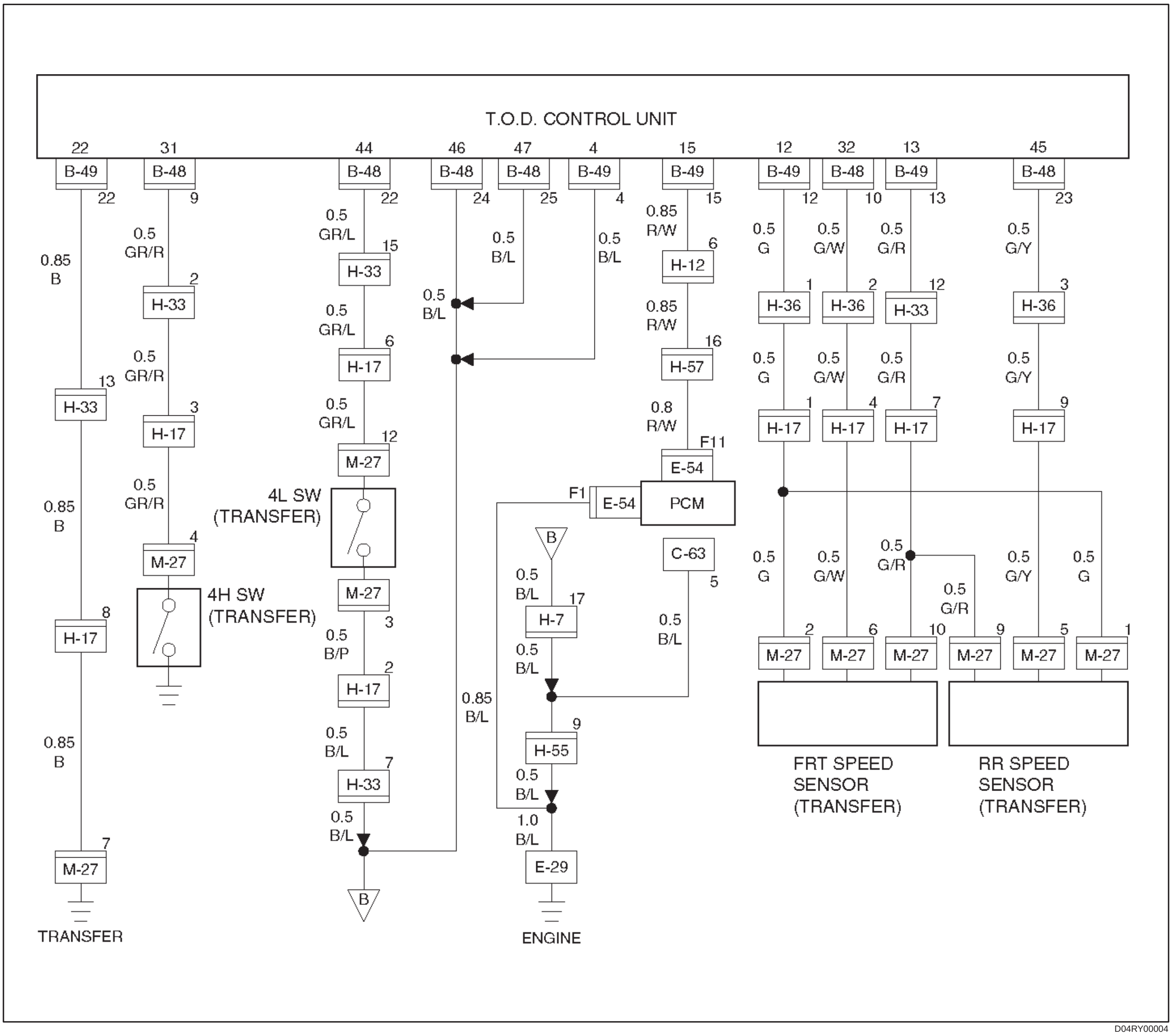
NOTE: Find the trouble in which the pulse corresponding to the running speed is not input.



Step	Action	Yes	No
1	1. Connect TECH 2. While running in TOD mode, does TECH–2's front speed sensor indication change with vehicle speed?	Go to Step 2	Repair and inspection front speed sensor tone wheel. Go to Step 4
2	Is the continuity between harness of terminal 45 and ground (vehicle side terminal of the rear speed sensor)?	Replace speed sensor. Go to Step 3	Repair the circuit. Go to Step 3
3	1. Clear the trouble code. While running at 30 mph in TOD mode for 30 consecutive sec, is trouble code reissued?	Replace EUC. Go to Step 4	Go to Step 4
4	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	The trouble is not reproduced. Refer to "Troubles intermittently observed". Return to Step 4

Check flow	Trouble code	Phenomenon	Standard
5	24	Rear speed sensor signal open or GND short, speed sensor COM open.	0.3 V < sensor voltage

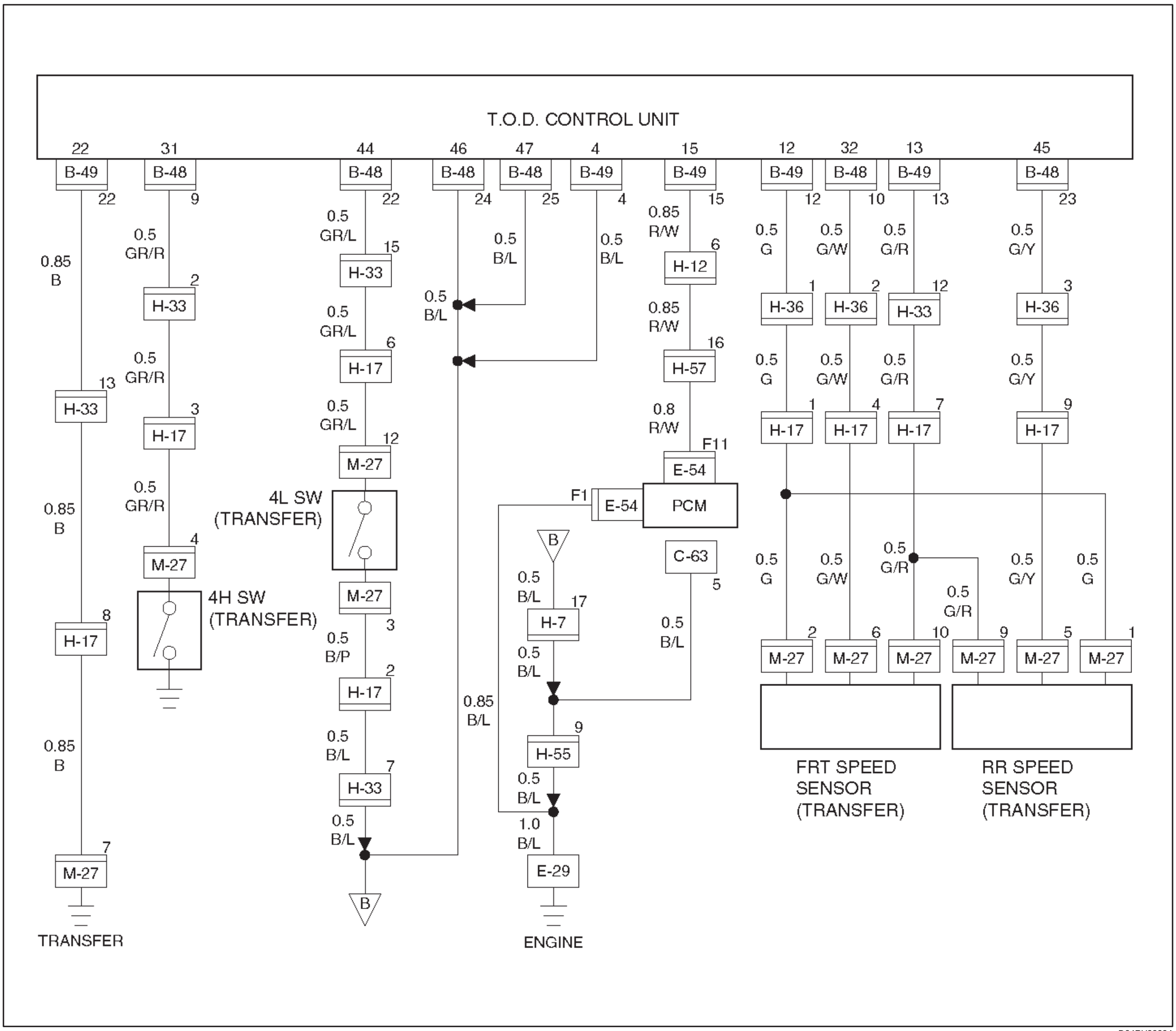
NOTE: The following procedure shows the case that the front or rear sensor common grounding line is broken.



Step	Action	Yes	No
1	1. Start the engine. 2. Select 4H (TOD) mode. Is the memory except DTC 24?	Go to Step 3	Go to Step 2
2	Is the continuity between harness of terminal 45 and ground (vehicle side terminal of the rear speed sensor)?	Replace speed sensor. Go to Step 6	Repair the circuit. Go to Step 6
3	Is the memory DTC 14?	Go to Step 4	Refer to other trouble cheek flow. Go to Step 2
4	Is the continuity between harness of terminal 32 and 45 (vehicle side terminal of the front and rear speed sensor)?	Go to Step 5	Repair the circuit Go to Step 6
5	Is the continuity between harness of terminal 12 and 13 (vehicle side terminal of the speed sensor COM and ref)?	Replace front and rear speed sensor. Go to Step 6	Repair the circuit. Go to Step 6
6	1. Check that all the parts are mounted. 2. Clear the trouble code. Is the step complete?	Repeat the “Diagnosis Flow”.	The trouble is not reproduced. Refer to “Troubles intermittently observed”. Return to Step 6

Check flow	Trouble code	Phenomenon	Standard
6	13	The reference is short-circuited to GND.	Reference ≃ 5 V
	15	The reference Vb is short-circuited.	

If the reference wire (15) is short-circuited to GND, the speed signal is not generated. If the wire is short-circuited to the battery voltage, the signal level becomes faulty.

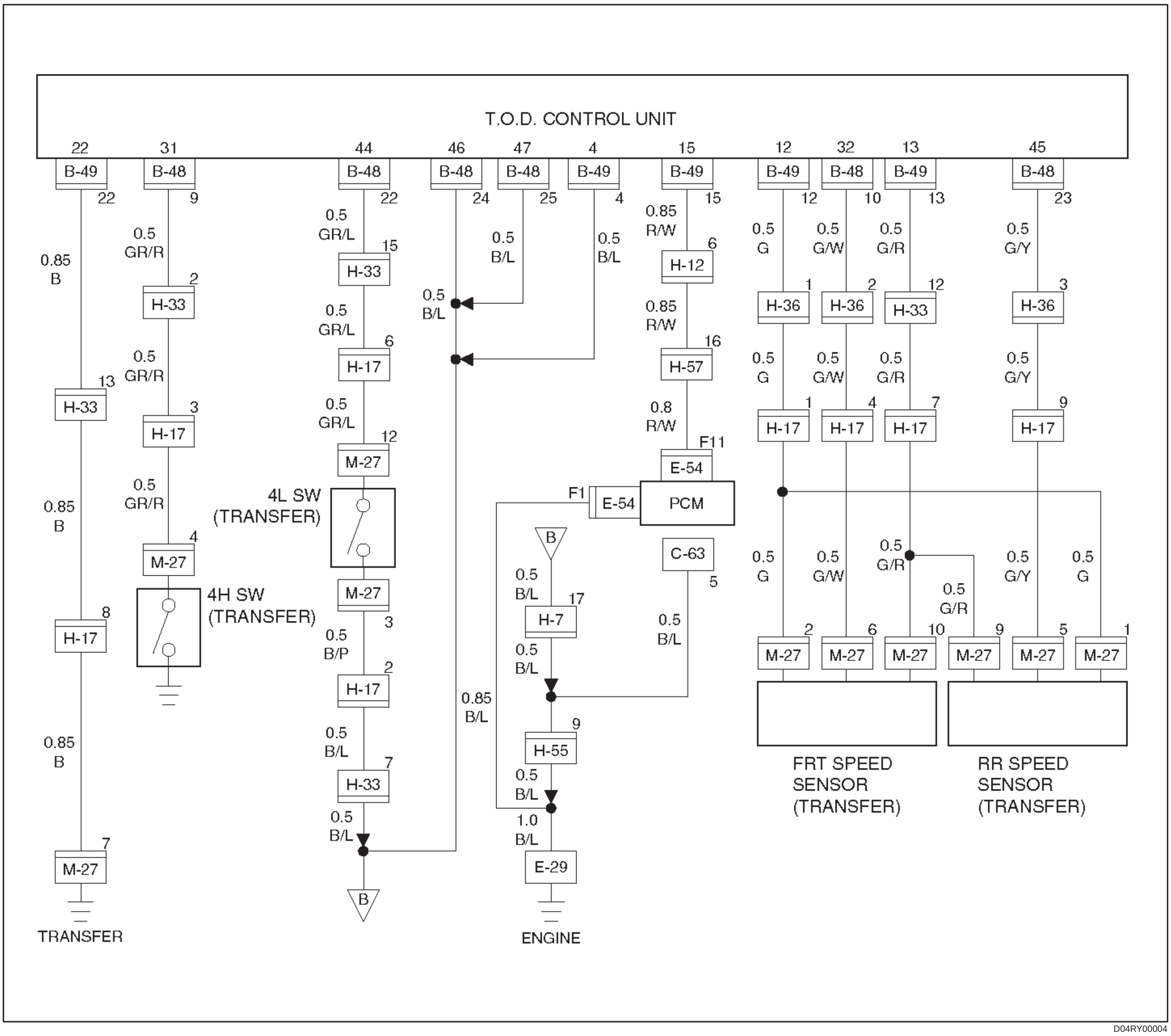


D04RY00004

Step	Action	Yes	No
1	1. Start the engine. Does the voltage between terminals 12 and 13 meet the standard 5V?	Go to Step 8	Go to Step 2
2	Is the voltage below the standard?	Go to Step 3	Go to Step 7
3	1. Turn off the starter switch. 2. Disconnect the ECU connector. Is the continuity established between vehicle harness terminals (B–49)12 and (B–48)24?	Go to Step 4	The ECU is failed. Replace the ECU. Go to Step 8
4	1. Disconnect the H-17 connector. Is the continuity established between floor harness connector terminals (H-17)1 and (H-17)8?	Go to Step 5	Go to Step 6
5	1. Disconnect the M-27 connector. Is the continuity established between transfer harness connector terminals (M–27)2 and (M–27)7?	Replace the front speed sensor. Go to Step 8	The reference harness for the front speed sensor is short–circuited to GND. Repair the circuit. Go to Step 8
6	1. Disconnect the M-27 connector. Is the continuity established between transfer harness connector terminals (M–27)1 and (M–27)7?	Replace the rear speed sensor. Go to Step 8	The reference harness for the front speed sensor is short–circuited to GND. Repair the circuit. Go to Step 8
7	1. Turn off the starter switch. 2. Disconnect the ECU connector. 3. Turn on the starter switch. Is the battery voltage observed between harness connector terminals (B–49)12 and (B–48)24?	Repair the harness circuit. Go to Step 8	The ECU has failed. Replace the ECU. Go to Step 8
8	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the “Diagnosis Flow”	Go to Step 8

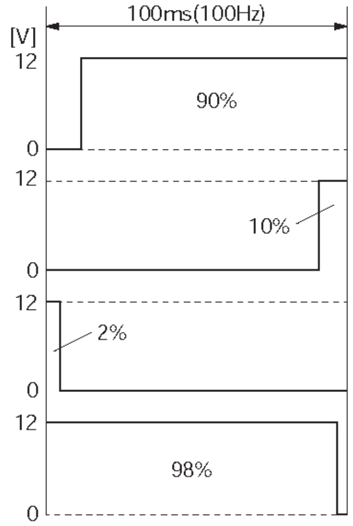
Check flow	Trouble code	Phenomenon	Standard
7	21	The voltage of the throttle position sensor (TPS) is faulty.	See below table.

NOTE: The signal voltage from the TPS deviates from the standard range.



Oscilloscope Waveform

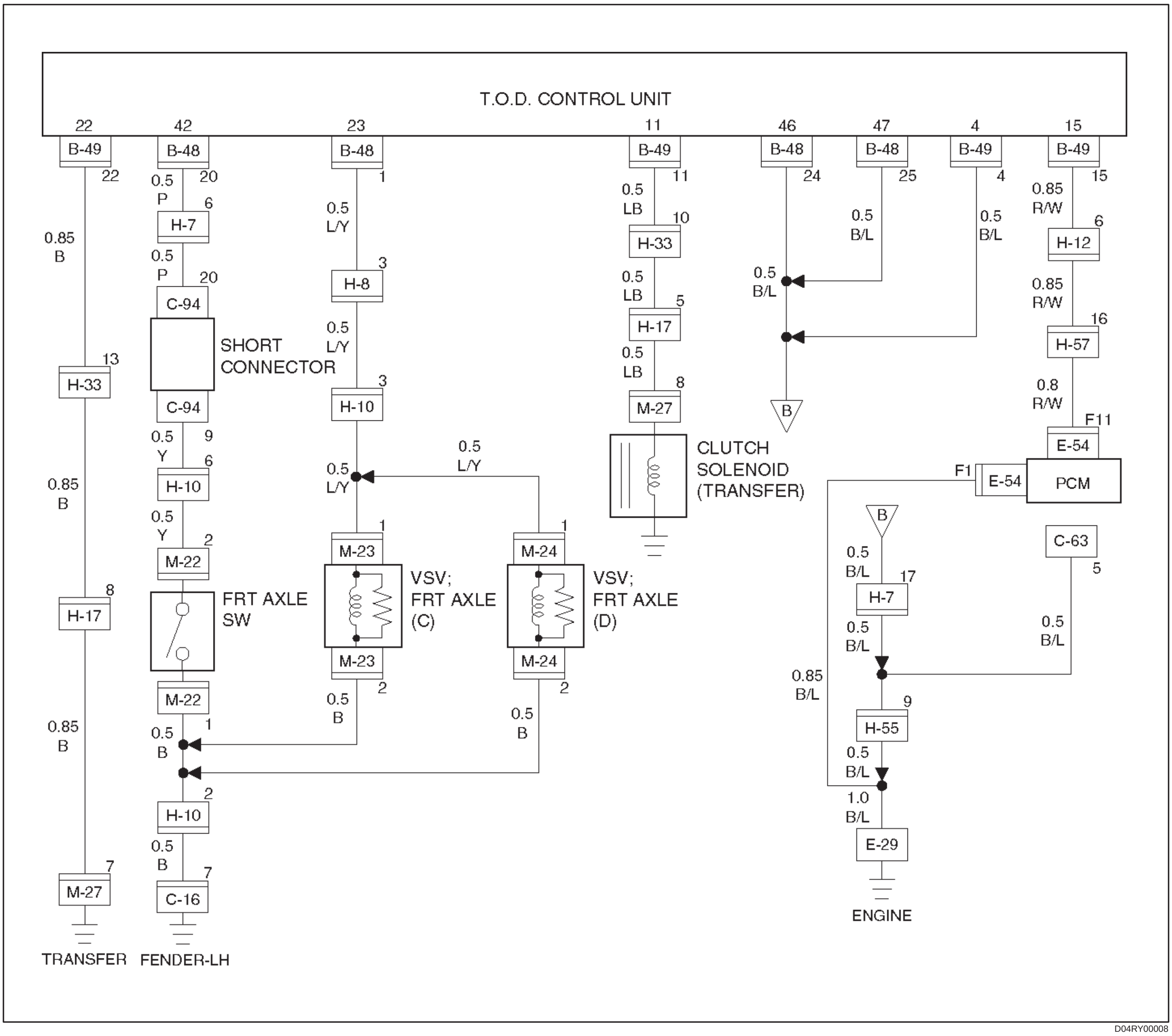
PWM 0-12V	Duty Cycle
1. Minimum Throttle	90%
2. Maximum Throttle	10%
3. TPS PWM FAULT	Less than 2% More than 98%



D04RY00012

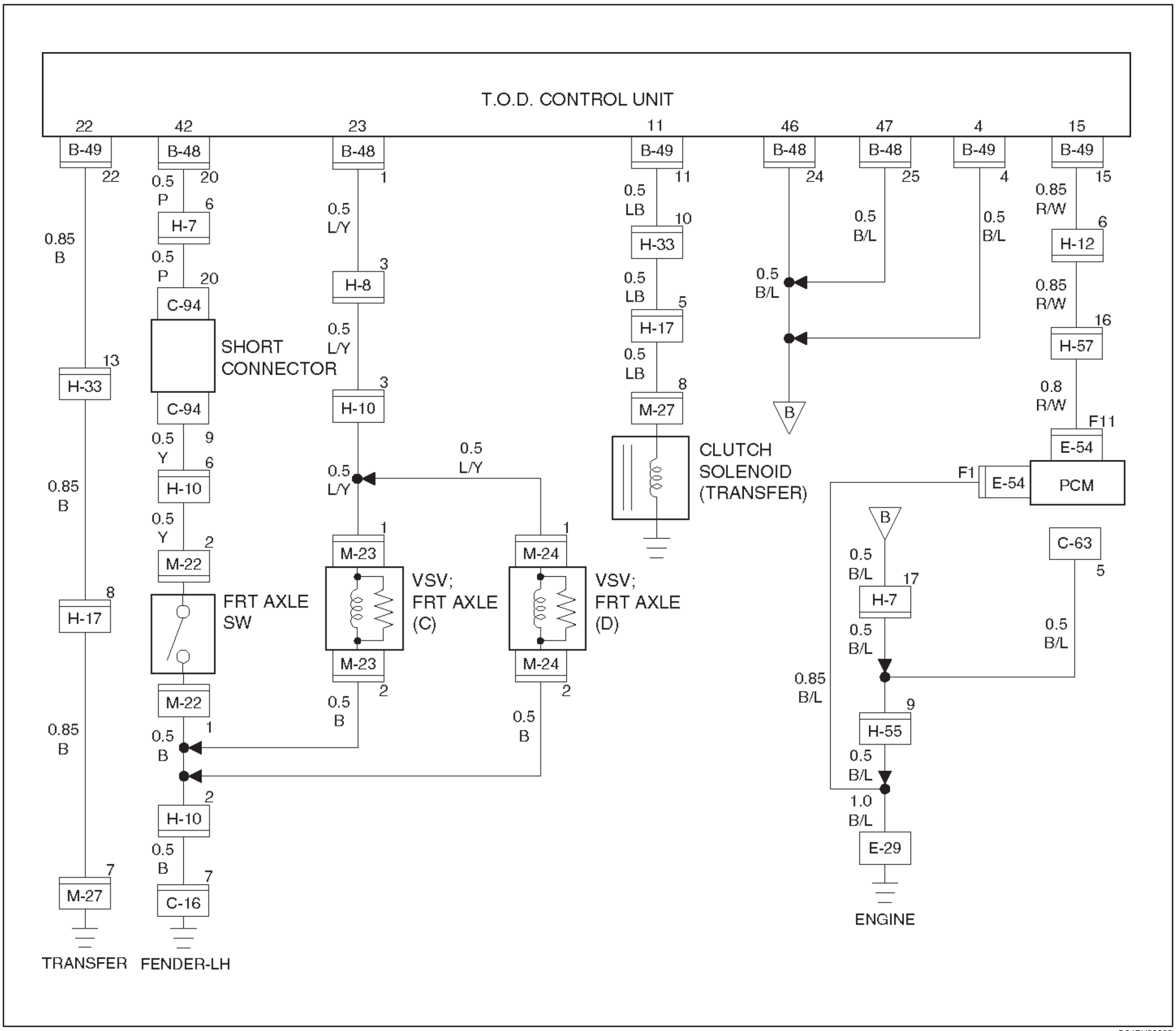
Step	Action	Yes	No
1	1. Turn off the starter switch. Is the battery voltage normal?	Go to Step 2	Charge or replace the battery. Go to Step 6
2	1. Turn on the starter switch. Does the voltage between terminals 15 and 46 fall within the standard range above?	Go to Step 6	Go to Step 3
3	1. Turn off the starter switch. 2. Disconnect the ECU connector. 3. Turn on the starter switch. Does the voltage between terminals (B–49)15 and (B–48)24 fall within the standard range above?	The ECU has failed. Replace the ECU. Go to Step 6	Go to Step 4
4	Is the harness healthy?	Go to Step 5	Repair the harness. Go to Step 6
5	Is the TPS healthy?	Go to Step 6	Replace the TPS. Go to Step 6
6	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the “Diagnosis Flow”.	Go to Step 6

Check flow	Trouble code	Phenomenon	Standard
9	31	The electromagnetic coil is broken.	—



Step	Action	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the ECU connector from ECU. Is the continuity established between terminals (B–49)11 and (B–49)22?	Go to Step 2	Go to Step 4
2	1. Connect the ECU connector. 2. Start the engine. 3. Set the TOD mode. Does the voltage between terminals 11 and 22 indicate at least 0.4V?	Go to Step 3	The ECU has failed. Replace the ECU. Go to Step 5
3	Is the battery voltage always observed between terminals 11 and 22?	The harness is short–circuited on the battery. Repair the circuit. Go to Step 5	The phenomenon is not reproduced. Refer to “Troubles intermittently observed”. Go to Step 4
4	1. Disconnect the M–27 connector. Is the continuity established between transfer connector terminals (M–27)8 and (M–27)7?	The harness is broken. Repair the circuit. Go to Step 5	Replace the transfer electromagnetic coil (solenoid clutch). Go to Step 5
5	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 5

Check flow	Trouble code	Phenomenon	Standard
10	26	The electromagnetic coil GND is short-circuited.	Resistance: 1.0 to 5.0 ohm (at ordinary temperature)



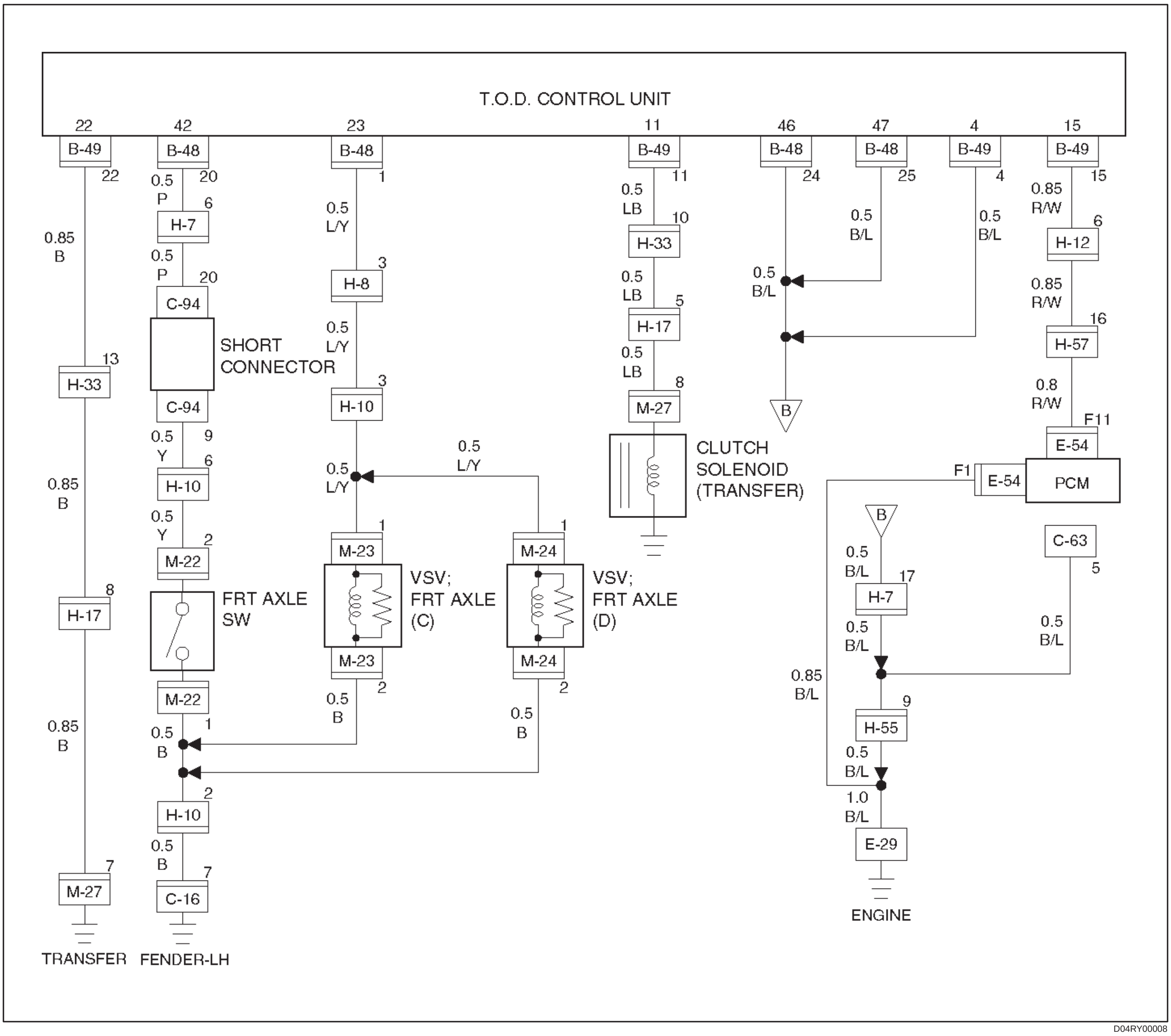
D04RY00008

Step	Action	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the ECU connector from ECU. Does the resistance between terminals (B–49)11 and (B–49)22 indicate 1.0 to 5.0 ohm?	Go to Step 2	Go to Step 3
2	1. Connect the ECU connector. 2. Start the engine. 3. Set the TOD mode. When the throttle is operated between full close and full open positions, does the voltage between terminals 11 and 22 indicate at least 0.1 to 1.0 V?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 4	The ECU has failed. Replace the ECU. Go to Step 4
3	Does the resistance between transfer connector terminals (M–27)8 and (M–27)7 indicate 1.0 to 5.0ohm?	The harness is broken. Repair the circuit. Go to Step 4	Replace the transfer electromagnetic coil. Go to Step 4
4	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 4

Check flow	Trouble code	Phenomenon	Standard
11	28	The shift on the fly system (front hub) works incorrectly.	—

NOTE: The shift on the fly system is not changed between 2WD and 4WD modes normally.

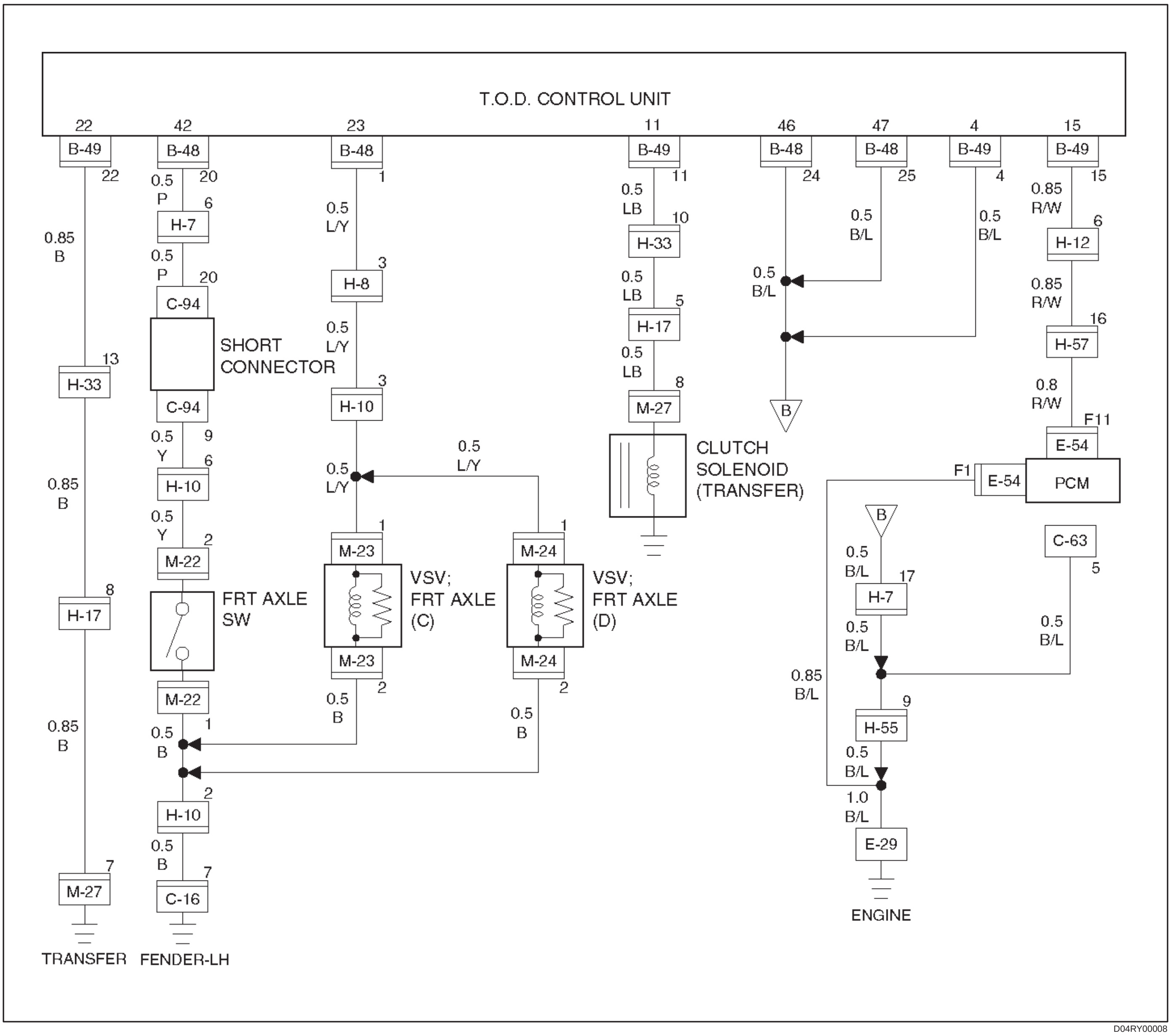
CAUTION: If code 32 or 33 is also observed, remove the trouble associated with code 32 or 33 first.



Step	Action	Yes	No
1	1. Turn on the starter switch. 2. Set the transfer to the 2H mode. Is the battery voltage observed between terminals 23 and 46?	Go to Step 2	Go to Step 5
2	Is the battery voltage observed between terminals 42 and 46?	Go to Step 3	Go to Step 6
3	1. Set the transfer to the high (TOD) mode. Does the voltage between terminals 23 and 46 indicate 0V?	Go to Step 4	The ECU has failed. Replace the ECU. Go to Step 7
4	Does the voltage between terminals 42 and 46 indicate 0V?	The phenomenon is not reproduced. Refer to “Troubles intermittently observed”. Go to Step 7	The shift on the fly system is failed (refer to Section 4C “Front Axle”). Go to Step 7
5	Does the TOD indicator show the 2H mode?	The ECU has failed. Replace the ECU. Go to Step 7	See “Trouble Diagnosis Depending on The Status of TOD Indicator”. Go to Step 7
6	Set the transfer to the high (TOD) mode. Does the voltage between terminals 23 and 46 indicate 0V?	The shift on the fly system has failed (refer to Section 4B1 “Driveline Control System”). Go to Step 7	The ECU has failed. Replace the ECU. Go to Step 7
7	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 7

Check flow	Trouble code	Phenomenon	Standard
12	32	The on/off signal (ADC) line of the shift on the fly system (front hub) is broken, or the line is short-circuited to the battery.	—

NOTE: The on/off signal line of the shift on the fly system is broken, or the line is short–circuited to the battery.



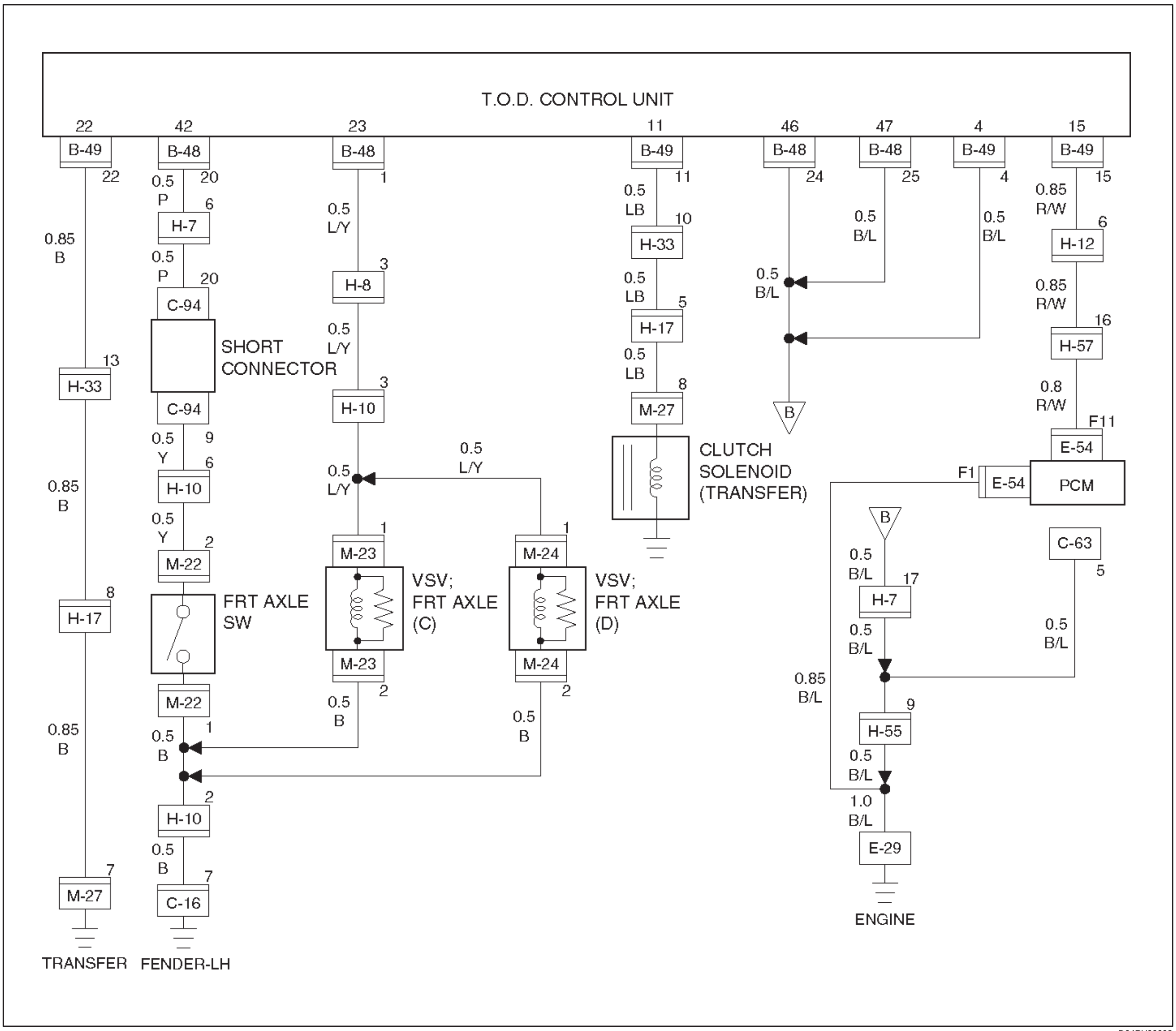
Step	Action	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the ECU connector from ECU. Is the continuity established between terminals (B–48)1 and (B–48)24?	Go to Step 2	The harness is broken. Repair the circuit. Go to Step 3
2	Does the voltage between terminals (B–48)1 and (B–48)24 indicate 0V?	Go to Step 3	The battery is short-circuited. Repair the circuit. Go to Step 4
3	1. Turn off the starter switch. 2. Connect ECU connector. 3. Turn on the starter switch. 4. Set the transfer to the 2H mode. Is the battery voltage observed between terminals 23 and 46?	The phenomenon is not reproduced Refer to “Troubles intermittently observed”. Go to Step 4	The ECU has failed. Replace the ECU. Go to Step 4
4	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 4

Check flow	Trouble code	Phenomenon	Standard
13	33	The ADC line is short-circuited to GND.	—

NOTE:

- The on/off signal line of the shift on the fly system is short–circuited to GND.
- The system enters into the fail-safe mode because of fusing or system protection.

  (If a short–circuit is observed on GND, the output to the on/off signal line becomes 0V.)



D04RY00008

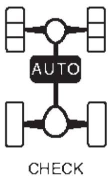
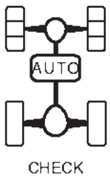
Step	Action	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the ECU connector from ECU. Does the resistance between terminals (B–48)1 and (B–48)24 meet the standard, R = 21 ± 4 ohms?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 4	Go to Step 2
2	Is the resistance between terminals (B–48)1 and (B–48)24 R<2 ohms?	The signal line circuit of the shift on the fly system is short-circuited to GND. Repair the circuit. Go to Step 4	Go to Step 3
3	Is the resistance between terminals (B–48)1 and (B–48)24 R= 9±7ohms?	The signal line circuit of the shift on the fly system is layer short-circuited*. Replace the valve (VSV). Go to Step 4	Go to Step 4
4	1. Check that all the parts are mounted. 2. Clear the trouble code. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 4

*Layer short-circuit : The coil is damaged by overcurrent.

Trouble Diagnosis Depending on The Status of TOD Indicator

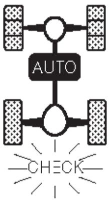
Functional check with TOD indicator light is conducted prior to check on Charts A–H.

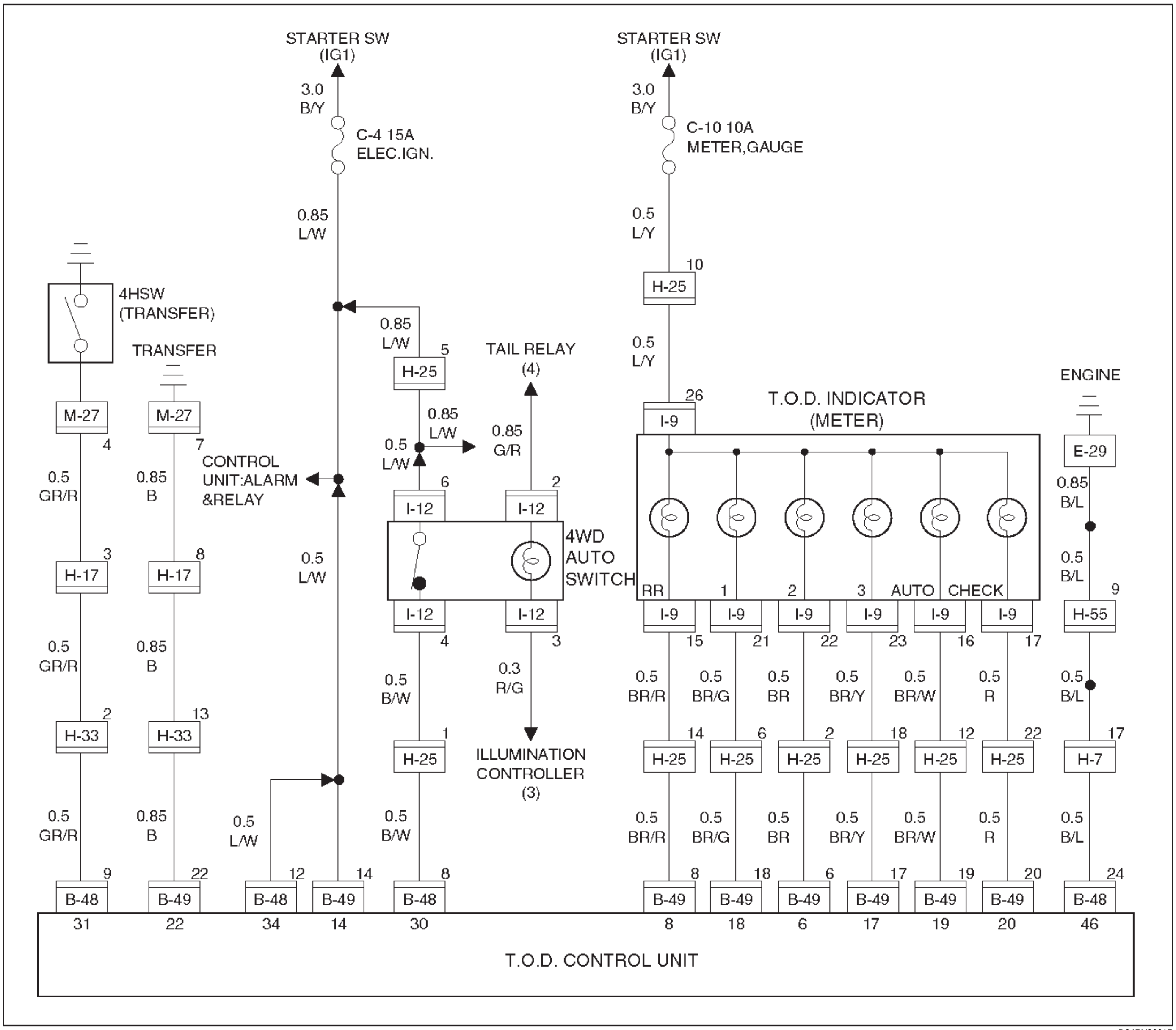
- After the starter is switched on, check and see if the status has become as tabulated below.

Is the continuity established between ECU terminal :					TOD Indicator indicate state
6 and 46	8 and 46	17 and 46	18 and 46	19 and 46	
Yes	Yes	Yes	Yes	Yes	
No	No	No	No	No	

C07RY00019

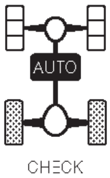
- If the status is as tabulated above, there is no problem. If not as tabulated above, inspect the harness.

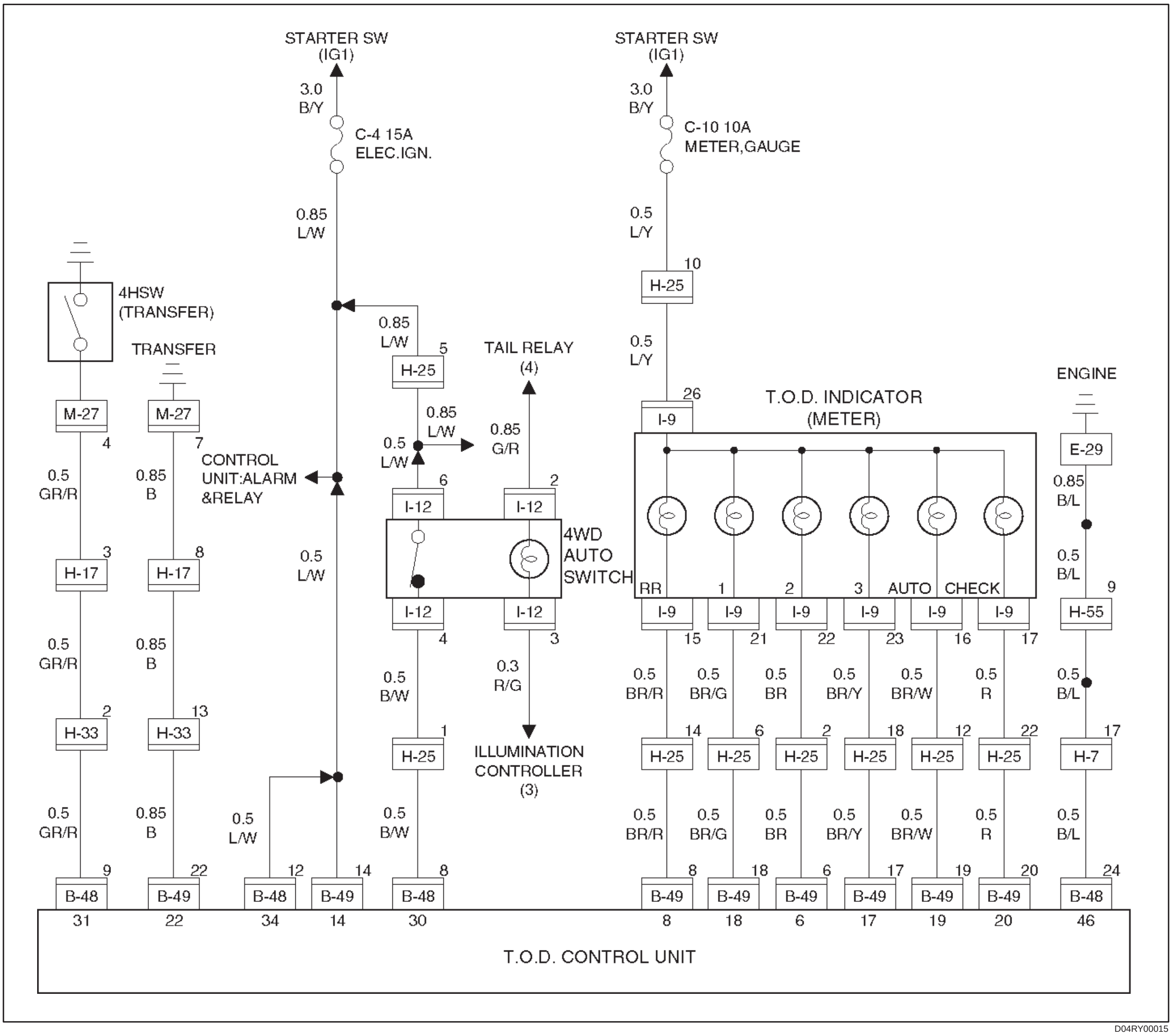
Chart A	Indicator drive circuit	
Function of circuit	The circuit informs the indicator of the working condition of the ECU.	
Fail condition	All the TOD indicator lamps and CHECK lamp are lit, and go off momentarily at an interval of about two seconds.	
Indicator lamp status		—
Transfer position	2H, TOD, 4L	—



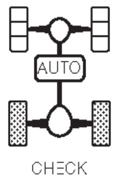
D04RY00015

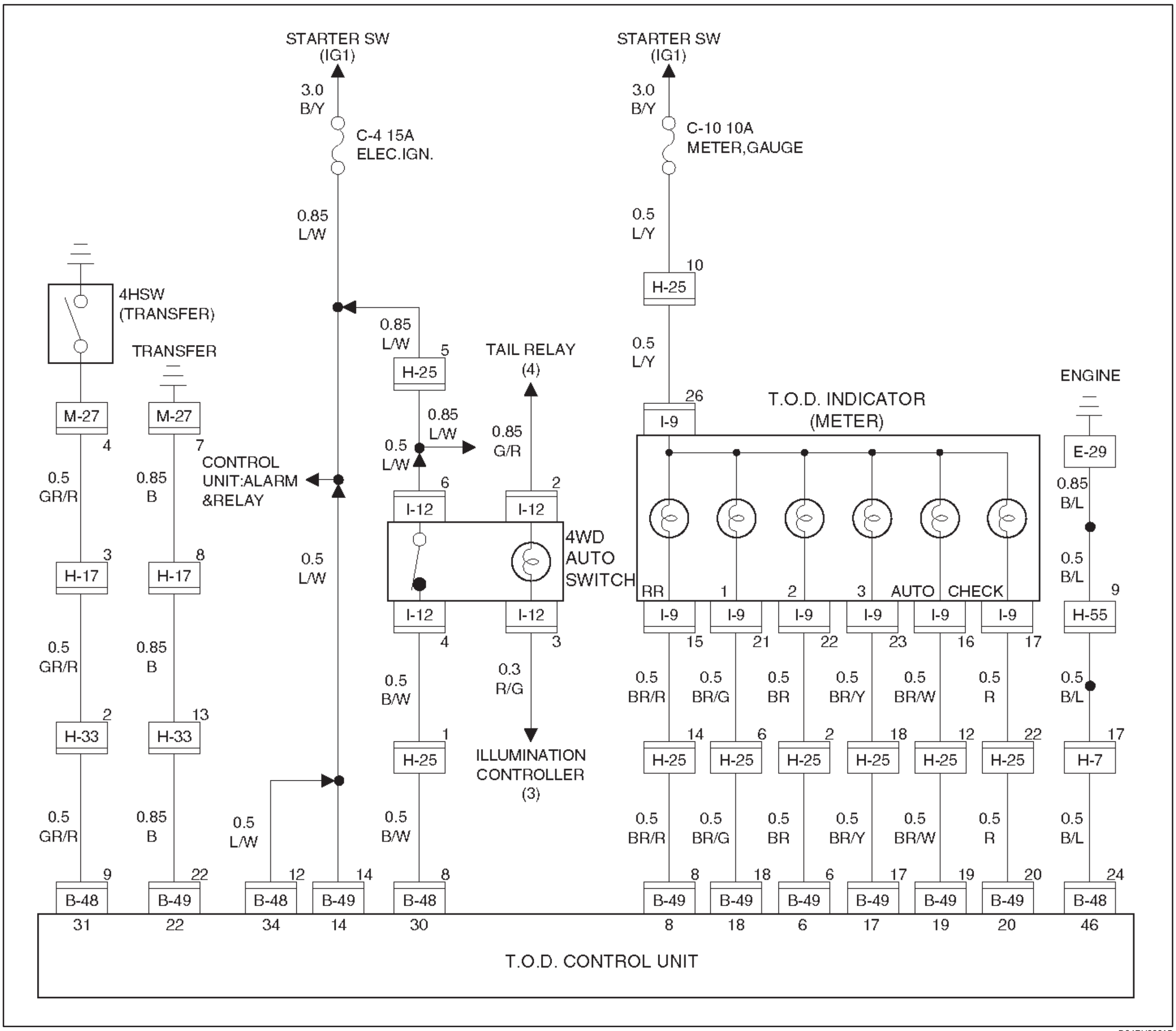
Step	Action	Yes	No
1	Turn on the starter switch. Is the battery voltage observed between terminals 14 and 46 or 34 and 46?	The ECU has failed. Replace the ECU. Go to Step 2	Check the battery circuit. Go to Step 2
2	Check that all the parts are mounted. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 2

Chart B–1	The 4WD switch circuit wires are broken or short-circuited to the GND	
Function of circuit	—	
Fail condition	Even after the transfer position is select from TOD to 2H, the indicator lamp status is not changed.	
Indicator lamp status		—
Transfer position	2H	—



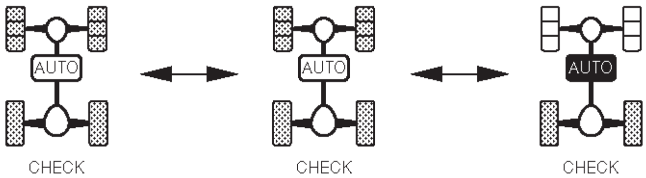
Step	Action	Yes	No
1	1. Turn on the starter switch. When the 4WD Auto Switch is select to the 4WD position, is 0 V observed between terminal 30 and 46?	Go to Step 2	Repair the 4WD Auto Switch circuit. Go to Step 4
2	When the 4WD Auto Switch is select to the 2WD position, is 12 V observed between terminals 30 and 46?	Go to Step 3	Repair the 4WD Auto Switch circuit. Go to Step 4
3	When the transfer lever is shifted to the 4L position, is battery boltage observed between terminals 19 and 46?	The phenomenon is not reproduced. Refer to “Troubles intermittently observed”. Go to Step 4	Replace the ECU. Go to Step 4
4	Check that all the parts are mounted. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 4

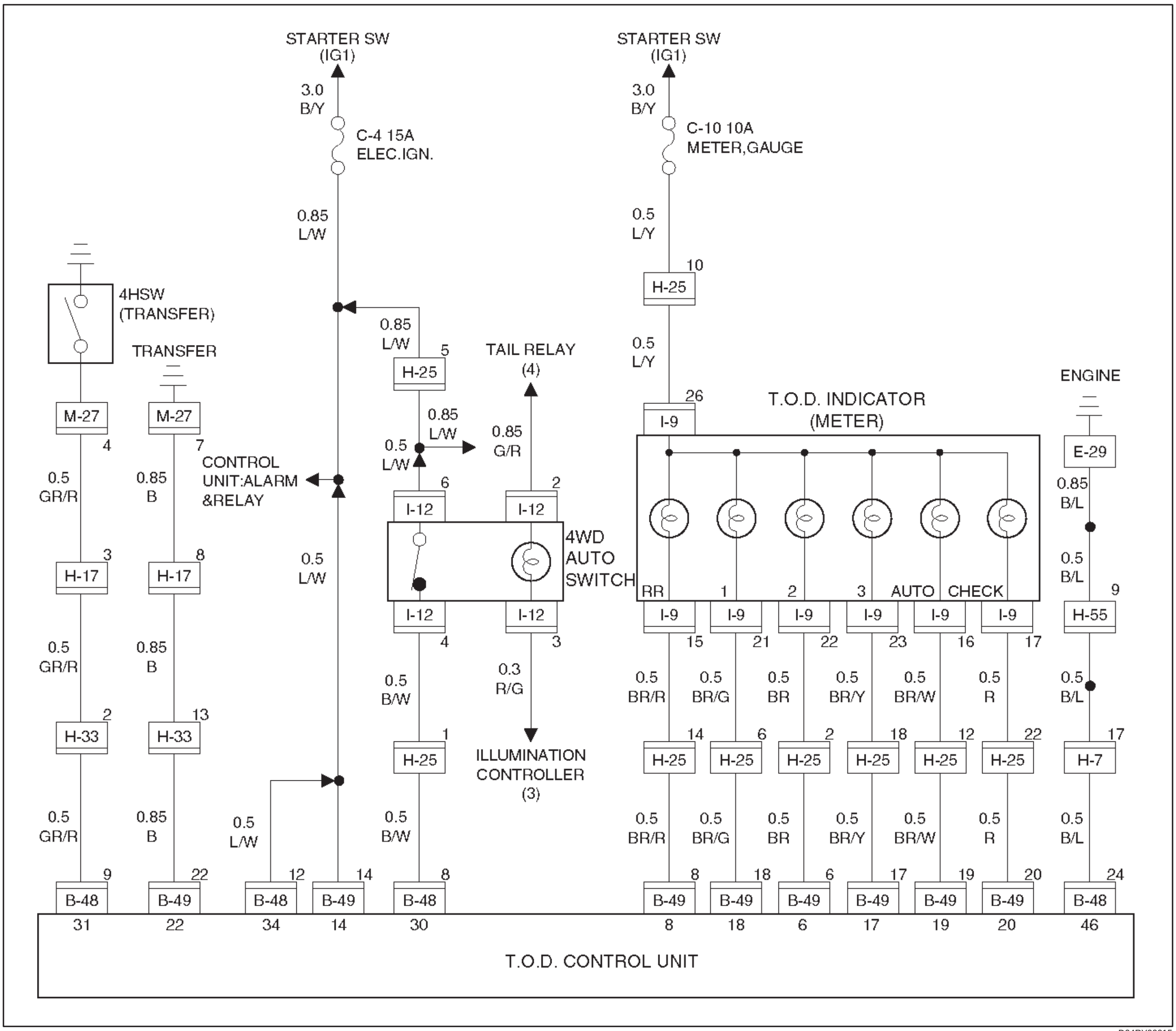
Chart B–2	The 4WD AUTO SWITCH circuit is short to battery.
Function of circuit	—
Fail condition	Even after the transfer mode is select from 2H to TOD.
Indicator lamp status	
Transfer position	TOD



D04RY00015

Step	Action	Yes	No
1	When the 4WD Auto Switch is select to the 4WD position, is 0 V observed between terminal 30 and 46 (4H switch)?	Go to Step 2	Repair the 4WD Auto Switch circuit. Go to Step 7
2	When the 4WD Auto Switch is select to the 2WD position, is 12 V observed between terminals 30 and 46 (4H switch)?	Go to Step 3	Repair the 4WD Auto Switch circuit. Go to Step 7
3	1. Disconnect the ECU connector. Is the continuity established between terminals (B–49)14 and (B–49)17?	Go to Step 4	Replace TOD indicator lamp bulb. Go to Step 7
4	Is the continuity established between terminals (B–49)14 and (B–49)6?	Go to Step 5	Replace TOD indicator lamp bulb. Go to Step 7
5	Is the continuity established between terminals (B–49)14 and (B–49)18?	Go to Step 6	Replace TOD indicator lamp bulb. Go to Step 7
6	Is the continuity established between terminals (B–49)14 and (B–49)19?	Replace ECU. Go to Step 7	Replace TOD indicator lamp bulb. Go to Step 7
7	Check that all the parts are mounted. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 7

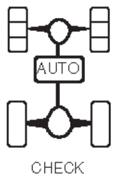
Chart C–1	4H switch circuit wires are broken or the battery is short-circuited.
Function of circuit	—
Fail condition	When the 4WD Auto Switch is 4WD mode. When the lever is shifted from 4L to TOD, the 4L mode remains on the indicator and the TOD mode is displayed without turning off the previous mode.
Indicator lamp status	
Transfer position	4L <——> Neutral <——> TOD

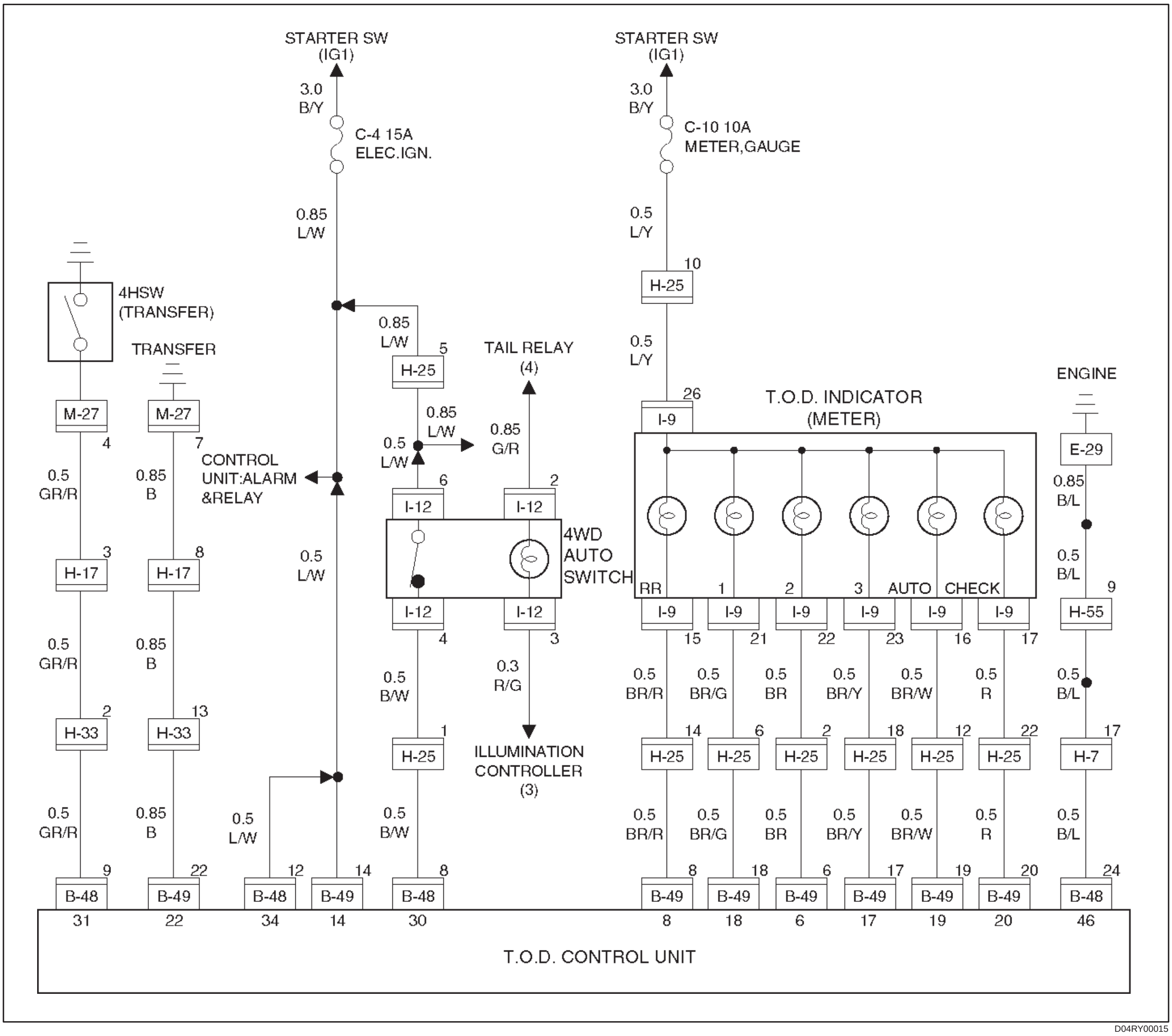


D04RY00015

Step	Action	Yes	No
1	1. Turn on the starter switch. When the transfer lever is shifted to the high position, is 5V observed between terminals 31 and 46 (4H switch)?	Go to Step 2	Go to Step 4
2	When the transfer lever is shifted to the 4L position, is 5V observed between terminals 31 and 46 (4H switch)?	Go to Step 3	Go to Step 4
3	When the transfer lever is shifted to the neutral position, is 0V observed between terminals 31 and 46 (4H switch)?	Replace the ECU. Go to Step 4	Go to Step 4
4	1. Turn off the starter switch. 2. Disconnect the ECU connector. 3. Turn on the starter switch. When the transfer lever is shifted to the high position, is 12V observed between terminals (B–48)9 and (B–48)24 (4H switch)?	Go to Step 5	Go to Step 7
5	When the transfer lever is shifted to the neutral position, is 0V observed between terminals (B–48)9 and (B–48)24 (4H switch)?	Go to Step 6	Go to Step 7
6	When the transfer lever is shifted to the 4L position, is 12V observed between terminals (B–48)9 and (B–48)24 (4H switch)?	The 4H switch circuit battery is short-circuited between ECU and transfer. Repair the circuit. Go to Step 14	Go to Step 7
7	Turn off the starter switch. When the transfer lever is shifted to the neutral position, is the continuity established between terminals (B–48)9 and (B–48)24 (4H switch)?	Go to Step 8	Go to Step 10
8	When the transfer lever is shifted to the high position, is the continuity established between terminals (B–48)9 and (B–48)24?	Go to Step 10	Go to Step 9
9	When the transfer lever is shifted to the 4L position, is the continuity established between terminals (B–48)9 and (B–48)24?	Go to Step 14	The phenomenon is not reproduced. Refer to “Troubles intermittently observed”. Go to Step 10
10	When the transfer lever is shifted to the neutral position, is the continuity established between terminals (M–27)4 and (M–27)7?	Go to Step 11	Repair the transfer assembly. Go to Step 14
11	When the transfer lever is shifted to the high position, is the continuity established between transfer connector terminals (M–27)4 and (M–27)7?	Repair the transfer assembly. Go to Step 14	Go to Step 12
12	When the transfer lever is shifted to the 4L position, is the continuity established between transfer connector terminals (B–48)9 and (M–27)4?	Repair the transfer assembly. Go to Step 14	Go to Step 13

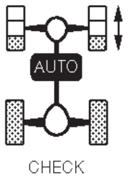
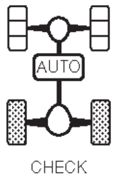
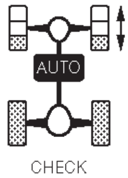
Step	Action	Yes	No
13	Is the continuity established between transfer terminals (M–27)4 and body?	The ECU has failed. Replace the ECU. Go to Step 14	The harness is broken between terminal (M-27)4 and GND. Repair the circuit. Go to Step 14
14	Check that all the parts are mounted. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 14

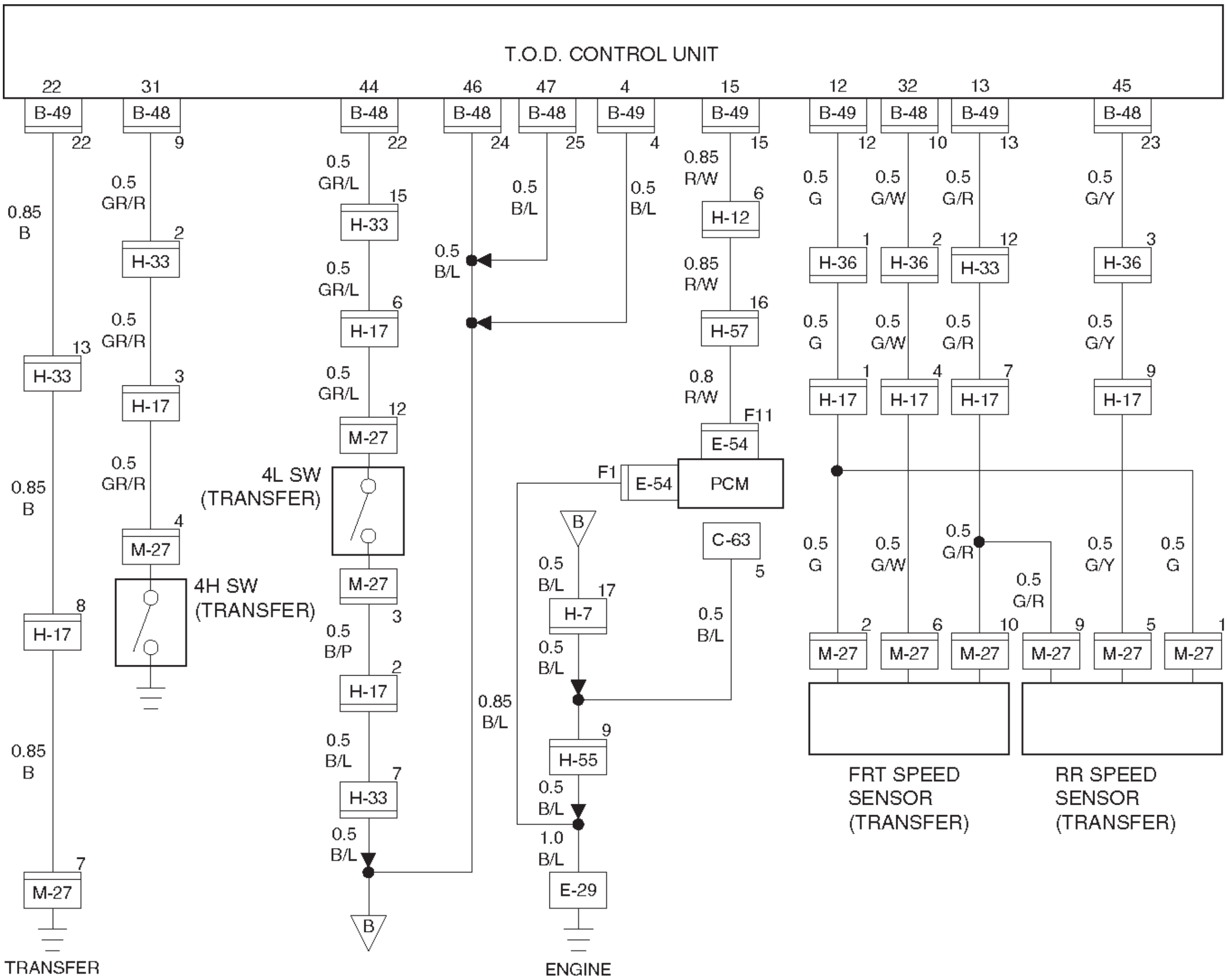
Chart C–2	The 4H switch circuit is short-circuited to GND.
Function of circuit	—
Fail condition	When the transfer lever is shifted to 4L, the indicator lamp status is not changed.
Indicator lamp status	
Transfer position	4L



Step	Action	Yes	No
1	When the transfer lever is shifted to the High position, is 5V observed between terminals 31 and 46 (4H switch)?	Go to Step 2	Go to Step 14
2	When the transfer lever is shifted to the neutral position, is 0V observed between terminals 31 and 46 (4H switch)?	Go to Step 3	Go to Step 14
3	When the transfer lever is shifted to the 4L position, is 5V observed between terminals 31 and 46 (4H switch)?	Go to Step 4	Go to Step 14
4	1. Turn off the starter switch. Is the continuity established between terminals 14 and 17?	Go to Step 5	Replace TOD indcator lamp bulb. Go to Step 23
5	Is the continuity established between terminals 14 and 6?	Go to Step 6	Replace TOD indicator lamp bulb. Go to Step 23
6	Is the continuity established between terminals 14 and 18?	Go to Step 7	Replace TOD indicator lamp bulb. Go to Step 23
7	Is the continuity established between terminals 14 and 19?	Go to Step 8	Replace TOD indicator lamp bulb. Go to Step 23
8	Is the continuity established between terminals 14 and 8?	Go to Step 9	Replace TOD indicator lamp bulb. Go to Step 23
9	1. Turn on the starter switch. 2. Shift the transfer lever is shifted to the 4L position. Is 0 V observed between terminals 17 and 22?	Go to Step 10	The ECU has failed. Replace the ECU. Go to Step 23
10	Is 0 V observed between terminals 6 and 22?	Go to Step 11	The ECU has failed. Replace the ECU. Go to Step 23
11	Is 0 V observed between terminals 18 and 22?	Go to Step 12	The ECU has failed. Replace the ECU. Go to Step 23
12	Is 0 V observed between terminals 19 and 22?	Go to Step 13	The ECU has failed. Replace the ECU. Go to Step 23
13	Is 0 V observed between terminals 8 and 22?	The phenomenon is not reproduced. Refer to “Troubles intermittently observed”. Go to Step 23	The ECU has failed. Replace the ECU. Go to Step 23

Step	Action	Yes	No
14	1. Turn off the starter switch. 2. Disconnect the ECU connector. When the transfer lever is shifted to the neutral position, is the continuity established between terminals (B–48)9 and (B–48)24 (4H switch)?	Go to Step 15	Go to Step 17
15	When the transfer lever is shifted to the high position, is the continuity established between terminals (B–48)9 and (B–48)24?	Go to Step 17	Go to Step 16
16	When the transfer lever is shifted to the 4L position, is the continuity established between terminals (B–48)9 and (B–48)24?	Go to Step 17	The ECU has failed. Replace the ECU. Go to Step 23
17	1. Disconnect the H–17 connector. When the transfer lever is shifted to the neutral position between high and 4L, is the continuity established between terminals (H-17)3 and (B-48)9?	Go to Step 18	Go to Step 20
18	When the transfer lever is shifted to the high position, is the continuity established between transfer connector terminals (H-17)3 and (B-48)9?	Go to Step 20	Go to Step 19
19	When the transfer lever is shifted to the 4L position, is the continuity established between transfer connector terminals (H-17)3 and (B-48)9?	Go to Step 20	GND is short-circuited between terminals (B-48)9 and (H-17)3. Repair the circuit. Go to Step 23
20	1. Disconnect the M–27 connector. When the transfer lever is shifted to the neutral position between high and 4L, is the continuity established between terminals (M-27)4 and (B-48)9?	Go to Step 21	Repair the transfer assembly. Go to Step 23
21	When the transfer lever is shifted to the high position, is the continuity established between terminals (M-27)4 and (B-48)9?	Repair the transfer assembly. Go to Step 23	Go to Step 22
22	When the transfer lever is shifted to the 4L position, is the continuity established between terminals (M-27)4 and (B-48)9?	Repair the transfer assembly. Go to Step 23	GND is short-circuited between terminals (B-48)9 and (M–27)4. Repair the circuit. Go to Step 23
23	Check that all the parts are mounted. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 23

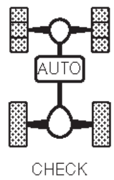
Chart D–1	4L switch circuit wires are broken or the battery is short-circuited.	
Function of circuit	—	
Fail condition	The TOD mode is displayed in the neutral position between high and 4L. When the lever is shifted to the 4L position, the TOD mode is displayed.	
Indicator lamp status	 or 	
Transfer position	4L	Neutral

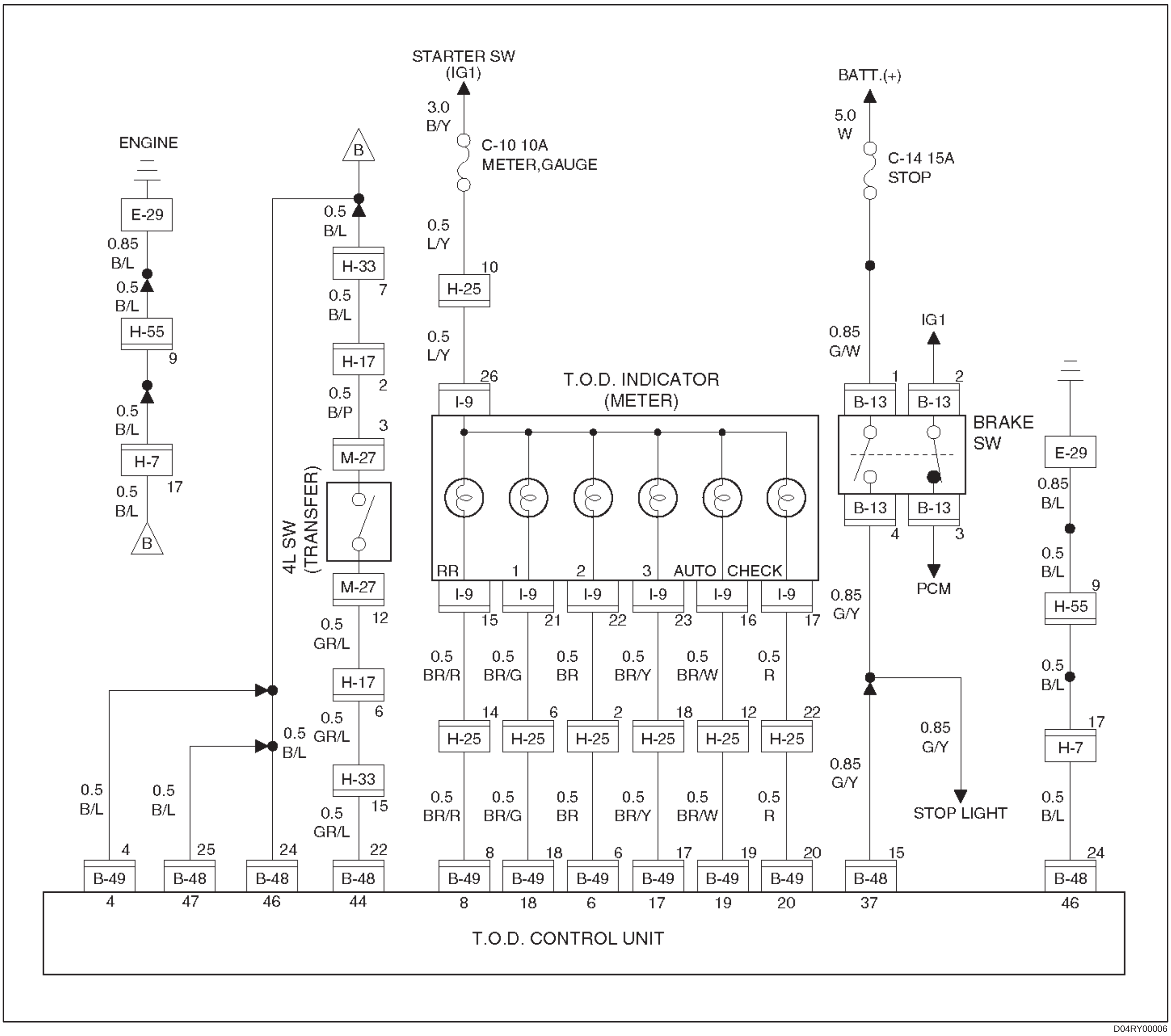


D04RY00004

Step	Action	Yes	No
1	Turn on the starter switch. When the transfer lever is shifted to the high position, is 5V observed between terminals 44 and 46 (4L switch)?	Go to Step 2	Go to Step 4
2	When the transfer lever is shifted to the neutral position, is 0V observed between terminals 44 and 46 (4L switch)?	Go to Step 3	Go to Step 4
3	When the transfer lever is shifted to the 4L position, is 0V observed between terminals 44 and 46 (4L switch)?	The ECU has failed. Replace the ECU. Go to Step 4	Go to Step 4
4	1. Turn off the starter switch. 2. Disconnect the ECU connector. 3. Turn on the starter switch. When the transfer lever is shifted to the high position, is 12V observed between terminals (B–48)22 and (B–48)24 (4L switch)?	Go to Step 5	Go to Step 7
5	When the transfer lever is shifted to the neutral position, is 0V observed between terminals (B–48)22 and (B–48)24 (4L switch)?	Go to Step 6	Go to Step 7
6	When the transfer lever is shifted to the 4L position, is 0V observed between terminals (B–48)22 and (B–48)24 (4L switch)?	The 4L switch circuit battery is short-circuited between ECU and transfer. Repair the circuit Go to Step 13	Go to Step 7
7	Turn off the starter switch. When the transfer lever is shifted to the high position, is the continuity established between terminals (B–48)22 and (B–48)24 (4L switch)?	Go to Step 10	Go to Step 8
8	When the transfer lever is shifted to the neutral position between high and 4L, is the continuity established between terminals (B–48)22 and (B–48)24 (4L switch)?	Go to Step 9	Go to Step 10
9	When the transfer lever is shifted to the 4L position, is the continuity established between terminals (B–48)22 and (B–48)24 (4L switch)?	The phenomenon is not reproduced. Refer to “Troubles intermittently observed”. Go to Step 13	Go to Step 10
10	1. Disconnect the M–27 connector. When the transfer lever is shifted to the neutral position between high and 4L, is the continuity established between transfer connector terminals (M-27)12 and GND?	Wires are broken between transfer connector (M-27) and floor connector (H-17). Repair the circuit. Go to Step 11	Repair the transfer assembly. Go to Step 13
11	When the transfer lever is shifted to the 4L position, is the continuity established between transfer connector terminals (M-27)12 and GND?	Go to Step 12	Repair the transfer assembly. Go to Step 13

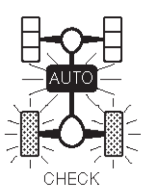
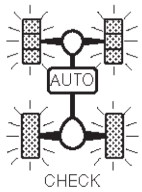
Step	Action	Yes	No
12	When the transfer lever is shifted to the high position, is the continuity established between transfer connector terminals (M-27)12 and GND?	Repair the transfer assembly. Go to Step 13	Go to Step 13
13	Check that all the parts are mounted. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 13

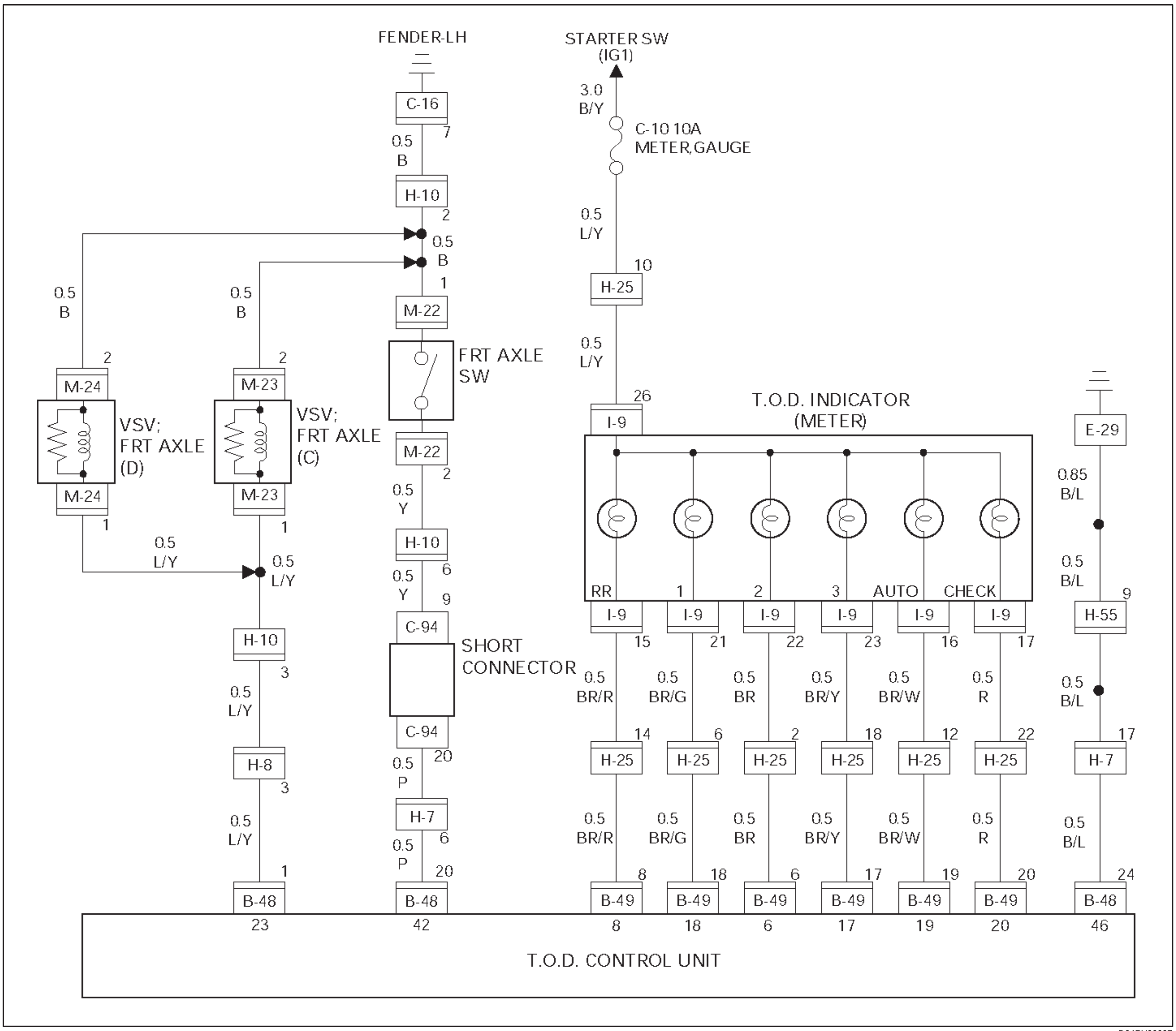
Chart D–2	The 4L switch circuit is short-circuited to GND.
Function of circuit	—
Fail condition	The 4L mode is displayed even in the 2H or TOD.
Indicator lamp status	
Transfer position	2H or TOD



Step	Action	Yes	No
1	When the transfer lever is shifted to the high position, is 5V observed between terminals 44 and 46 (4L switch)?	Go to Step 2	Go to Step 7
2	When the transfer lever is shifted to the neutral position, is 0V observed between terminals 44 and 46 (4L switch)?	Go to Step 3	Go to Step 7
3	When the transfer lever is shifted to the 4L position, is 0V observed between terminals 44 and 46 (4L switch)?	Go to Step 4	Go to Step 7
4	1. Select the 4WD Auto Switch to the 2H position. Is 12V observed between terminals 17 and 46?	Go to Step 5	The ECU has failed. Replace the ECU. Go to Step 16
5	Is 12V observed between terminals 6 and 46?	Go to Step 6	The ECU has failed. Replace the ECU. Go to Step 16
6	Is 12V observed between terminals 18 and 46?	The phenomenon is not reproduced. Refer to “Troubles intermittently observed”. Go to Step 16	The ECU has failed. Replace the ECU. Go to Step 16
7	1. Turn off the starter switch. 2. Disconnect the ECU connector. When the transfer lever is shifted to the neutral position between High and 4L, is the continuity established between terminals (B–48)22 and (B–48)24?	Go to Step 8	Go to Step 10
8	When the transfer lever is shifted to the 4L position, is the continuity established between terminals (B–48)22 and (B–48)24?	Go to Step 9	Go to Step 10
9	When the transfer lever is shifted to the high position, is the continuity established between terminals (B–48)22 and (B–48)24?	Go to Step 10	The ECU has failed. Replace the ECU. Go to Step 16
10	1. Disconnect the M-17 connector. When the transfer lever is shifted to the neutral position between high and 4L, is the continuity established between terminals (H-17)6 and (B-48)24?	Go to Step 11	Go to Step 13
11	When the transfer lever is shifted to the 4L position, is the continuity established between transfer connector terminals (H-17)6 and (B-48)24?	Go to Step 12	Go to Step 13
12	When the transfer lever is shifted to the high position, is the continuity established between terminals (H-17)6 and (B-48)24?	Go to Step 13	GND is short-circuited between terminals (B–48)22 and (H-17)6. Repair the circuit. Go to Step 16
13	1. Disconnect the M-27 connector. When the transfer lever is shifted to the neutral position between high and 4L, is the continuity established between terminals (M-27)12 and GND?	Go to Step 14	Repair the transfer assembly. Go to Step 16

Step	Action	Yes	No
14	When the transfer lever is shifted to the 4L position, is the continuity established between terminals (M-27)12 and GND?	Go to Step 15	Repair the transfer assembly. Go to Step 16
15	When the transfer lever is shifted to the high position, is the continuity established between terminals (M-27)12 and GND?	Repair the transfer assembly. Go to Step 16	GND is short-circuited between terminals (H–17)6 and (M-27)12. Repair the circuit. Go to Step 16
16	Check that all the parts are mounted. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 16

Chart E–1	AXLE switch circuit wires are broken.	
Function of circuit	—	
Fail condition	Both the TOD and 4L modes are disabled. (The transition status is not removed.)	
Indicator lamp status	 Blinking	 Blinking
Transfer position	TOD	4L



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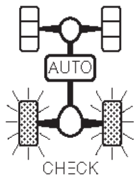
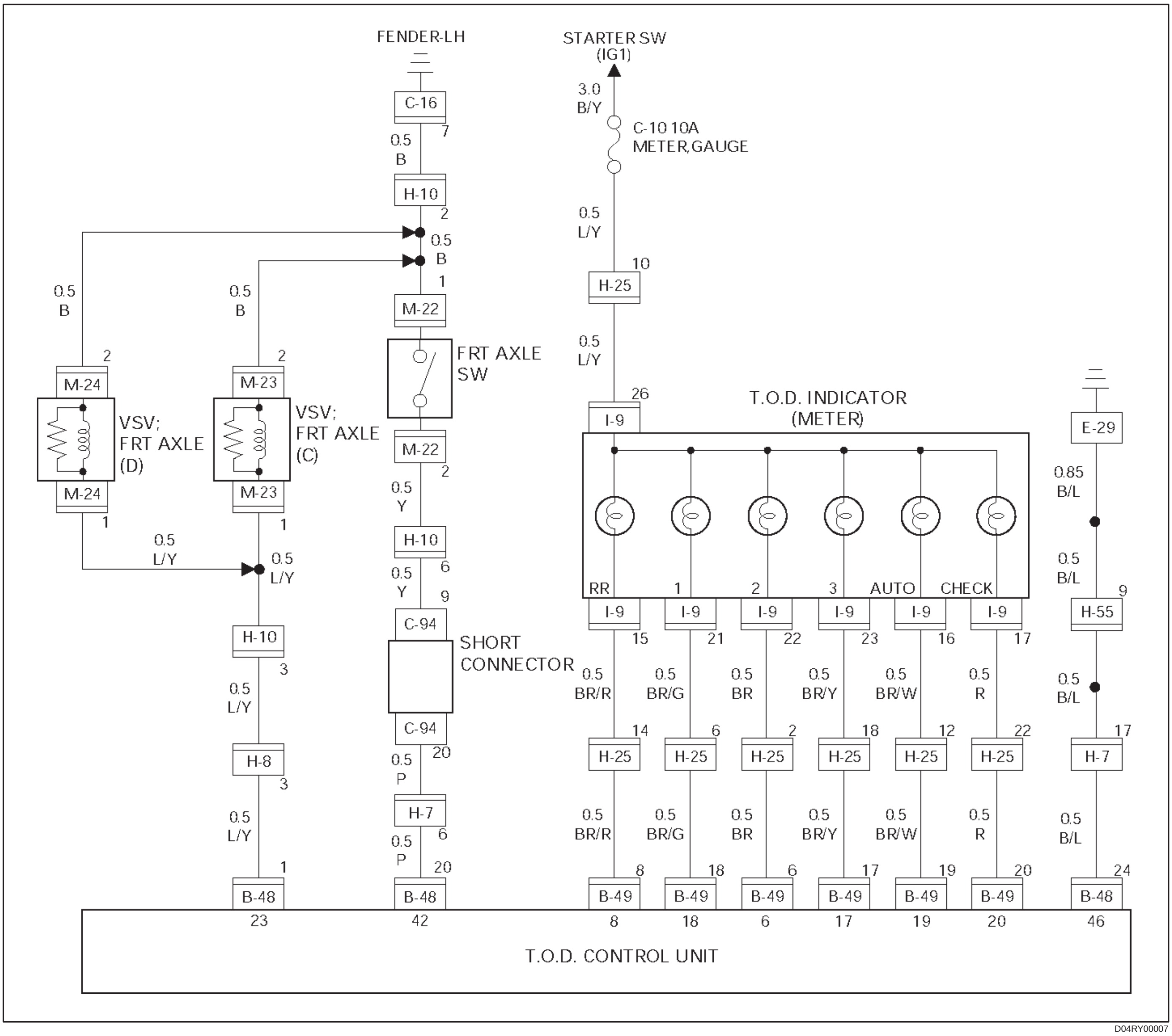
Step	Action	Yes	No
1	Start the engine. When the transfer lever is shifted to the neutral position between high and 4L, is the battery voltage observed between terminals 42 and 46?	Go to Step 2	Go to Step 7
2	When the transfer lever is shifted to the high position and 4WD Auto switch selected to 4WD position, is 0V observed between terminals 42 and 46?	Go to Step 3	Go to Step 7
3	When the transfer lever is shifted to the 4L position, is 0V observed between terminals 42 and 46?	Go to Step 4	Go to Step 7
4	Shift the transfer lever to the 4L position. Is 0V observed between terminals 17 and 46?	Go to Step 5	The ECU has failed. Replace the ECU. Go to Step 19
5	Is 0V observed between terminals 6 and 46?	Go to Step 6	The ECU has failed. Replace the ECU. Go to Step 19
6	Is 0V observed between terminals 18 and 46?	The phenomenon is not reproduced. Refer to “Troubles intermittently observed”. Go to Step 19	The ECU has failed. Replace the ECU. Go to Step 19
7	When the transfer lever is shifted to the high position and 4WD Auto Switch selected to the 2WD position, is the battery voltage observed between terminals 23 and 46?	Go to Step 8	Go to Step 11
8	When the transfer lever is shifted to the neutral position between high and 4L, is the battery voltage observed between terminals 23 and 46?	Go to Step 9	Go to Step 11
9	When the transfer lever is shifted to the high position (TOD mode), is 0V observed between terminals 23 and 46?	Go to Step 10	Go to Step 11
10	When the transfer lever is shifted to the 4L position, is 0V observed between terminals 23 and 46?	Go to Step 12	Go to Step 11
11	Is any of the trouble codes 28, 32 and 33 recorded?	Examine the trouble based on “Diagnosis from Trouble Codes”. Go to Step 19	The ECU has failed. Replace the ECU. Go to Step 19
12	1. Turn off the starter switch. 2. Disconnect the ECU connector. Does the resistance between terminals (B–48)1 and (B–48)24 meet the standard, 17< R < 25 ohm?	Go to Step 13	Repair the circuit of replace the VSV. Go to Step 19
13	1. Turn on the starter switch. When the 4WD Auto Switch is select to the 2WD position, is the battery voltage supplied to each VSV?	Go to Step 14	Repair the circuit of replace the VSV. Go to Step 19
14	When the transfer lever is shifted to the neutral position between high and 4L, is the battery voltage supplied to each VSV?	Go to Step 15	Repair the circuit of replace the VSV. Go to Step 19

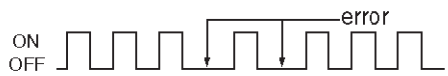
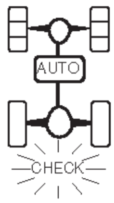
Step	Action	Yes	No
15	When the transfer lever is shifted to the high position and 4WD Auto Switch selected to 4WD position, is 0V observed on each VSV?	Go to Step 16	Repair the circuit of replace the VSV. Go to Step 19
16	When the transfer lever is shifted to the 4L position, is 0V observed on each VSV?	Go to Step 17	Repair the circuit of replace the VSV. Go to Step 19
17	Is the vacuum pressure supplied to the VSV?	Go to Step 18	Repair the vacuum system. Go to Step 19
18	Can the single AXLE switch enable and disable the continuity?	Repair the shift on the fly system (refer to Section 4B1 “Driveline Control System”). Go to Step 19	Replace the AXLE switch (refer to Section 4B1 “Driveline Control System”). Go to Step 19
19	Check that all the parts are mounted. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 19

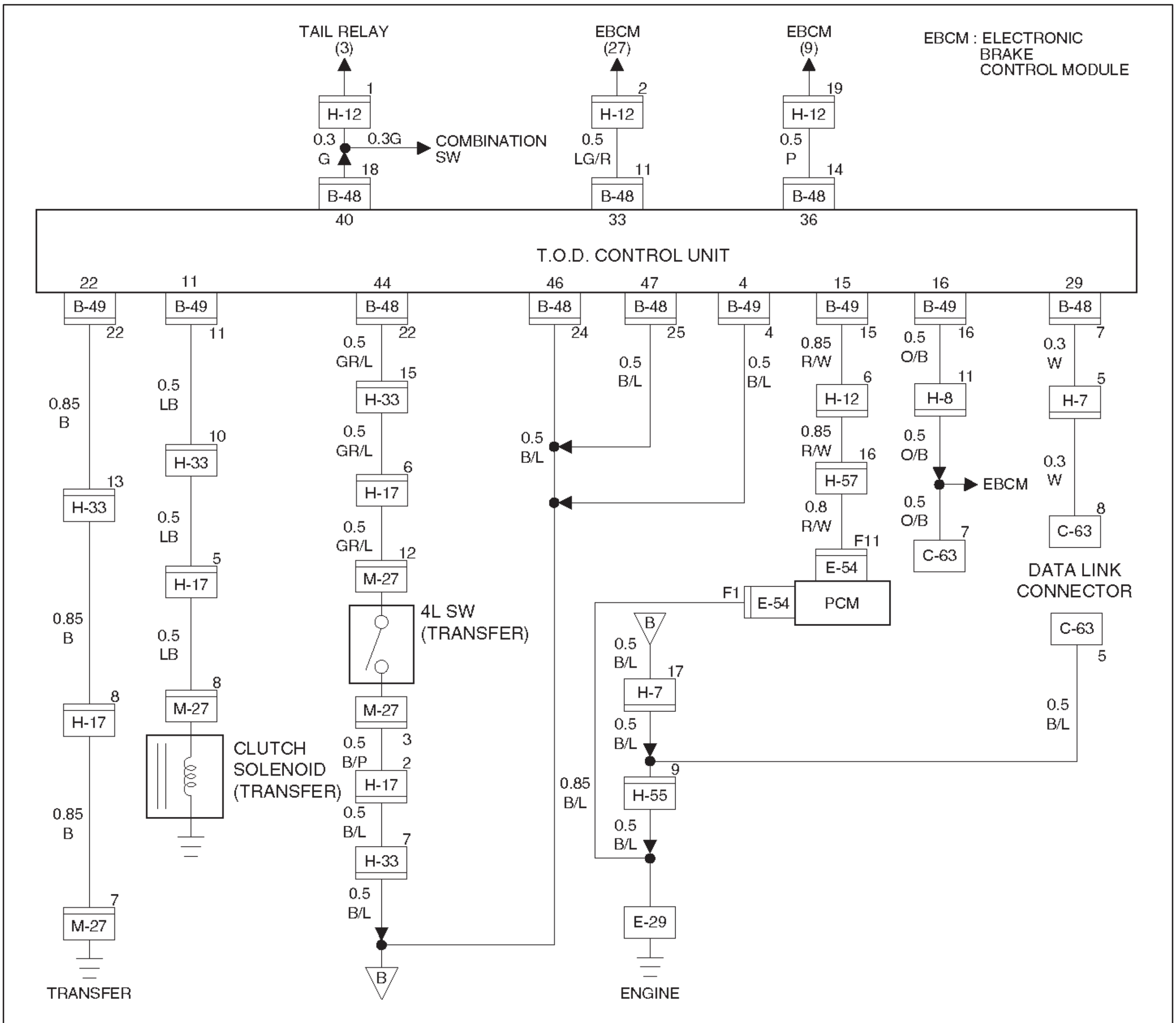
Chart E–2	The AXLE switch circuit is short-circuited to GND.
Function of circuit	—
Fail condition	Even after the 4WD Auto Switch is select to the 2WD position, the 2WD mode is not enabled. (The transition status is not removed.)
Indicator lamp status	
Transfer position	2H



Step	Action	Yes	No
1	Start the engine. When the transfer lever is shifted to the neutral position between high and 4L, is the battery voltage observed between terminals 42 and 46?	Go to Step 2	Go to Step 7
2	When the transfer lever is shifted to the high position and 4WD Auto Switch selected to 4WD position, is 0V observed between terminals 42 and 46?	Go to Step 3	Go to Step 7
3	When the transfer lever is shifted to the 4L position, is 0V observed between terminals 10 and 19?	Go to Step 4	Go to Step 7
4	Select the 4WD Auto Switch to the 2WD position. Is 12V observed between terminals 17 and 46?	Go to Step 5	Go to Step 19
5	Is 12V observed between terminals 6 and 46?	Go to Step 6	Go to Step 19
6	Is 12V observed between terminals 18 and 46?	The phenomenon is not reproduced. Refer to “Troubles intermittently observed”. Go to Step 19	The ECU has failed. Replace the ECU. Go to Step 17
7	When the 4WD Auto Switch is select to the 2WD position, is the battery voltage observed between terminals 23 and 46?	Go to Step 8	Go to Step 11
8	When the transfer lever is shifted to the neutral position between high and 4L, is the battery voltage observed between terminals 23 and 46?	Go to Step 9	Go to Step 11
9	When the transfer lever is shifted to the high position and 4WD Auto Switch selected to 4WD position, is 0V observed between terminals 23 and 46?	Go to Step 10	Go to Step 11
10	When the transfer lever is shifted to the 4L position, is 0V observed between terminals 23 and 46?	Go to Step 12	Go to Step 11
11	Is any of the trouble codes 28, 32 and 33 recorded?	Examine the trouble based on “Diagnosis from Trouble Codes”. Go to Step 19	The ECU has failed. Replace the ECU. Go to Step 19
12	1. Turn off the starter switch. 2. Disconnect the ECU connector. Does the resistance between terminals (B–48)1 and (B–48)24 meet the standard, 17< R < 25 ohm?	Go to Step 13	Repair the circuit of replace the VSV. Go to Step 19
13	1. Connect the ECU connector. 2. Turn on the starter switch. When the 4WD Auto Switch is select to the 2WD position, is the battery voltage supplied to each VSV?	Go to Step 14	Repair the circuit of replace the VSV. Go to Step 19
14	When the transfer lever is shifted to the neutral position between high and 4L, is the battery voltage supplied to each VSV?	Go to Step 15	Repair the circuit of replace the VSV. Go to Step 19
15	When the transfer lever is shifted to the high position and 4WD Auto Switch selected to 4WD position, is 0V observed on each VSV?	Go to Step 16	Repair the circuit of replace the VSV. Go to Step 19

Step	Action	Yes	No
16	When the transfer lever is shifted to the 4L position, is 0V observed on each VSV?	Go to Step 17	Repair the circuit of replace the VSV. Go to Step 19
17	Is the vacuum pressure supplied to the VSV?	Go to Step 18	Repair the vacuum system. Go to Step 19
18	Can the single AXLE switch enable and disable the continuity?	Repair the shift on the fly system (refer to Section 4B1 “Driveline Control System”). Go to Step 19	Replace the AXLE switch (refer to Section 4B1 “Driveline Control System”). Go to Step 19
19	Check that all the parts are mounted. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 19

Chart G	The trouble codes are displayed.
Function of circuit	—
Fail condition	The CHECK lamp continues blinking irregularly. 
Indicator lamp status	
Transfer position	—



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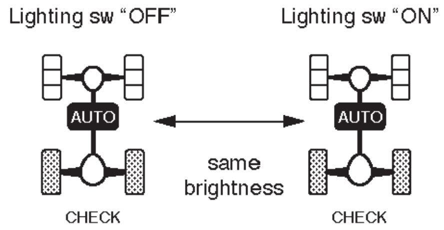
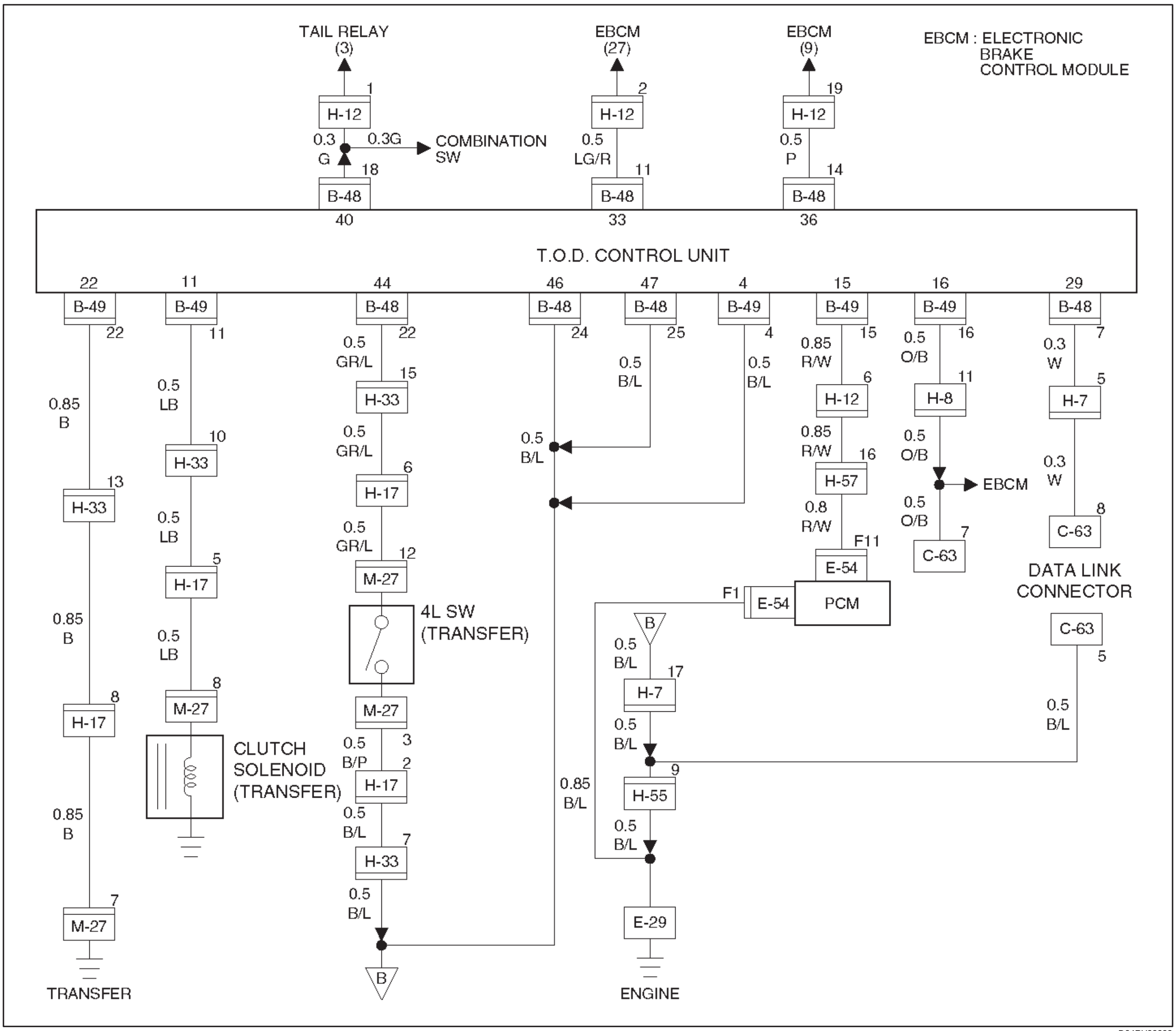
Step	Action	Yes	No
1	Disconnect the ECU connector from ECU. Is the continuity established between terminals (B–48)7 and (B–48)24?	Go to Step 2	The ECU has failed. Replace the ECU. Go to Step 3
2	Is the self-diagnostic connector short-circuited?	Go to Step 3	Open the self-diagnostic connector. Go to Step 3
3	1. Check that all the parts are mounted. 2. Clear the trouble codes. Is this step complete?	Repeat the “Diagnosis Flow”.	Repeat to Step 3

Chart H	lighting switch circuit
Function of circuit	Reads in the status of lighting switch, reducing the indicator at night.
Fail condition	Even if the lighting switch is pressed on and off, brightness does not change.
Indicator lamp status	
Transfer position	All position (exsample TOD mode)



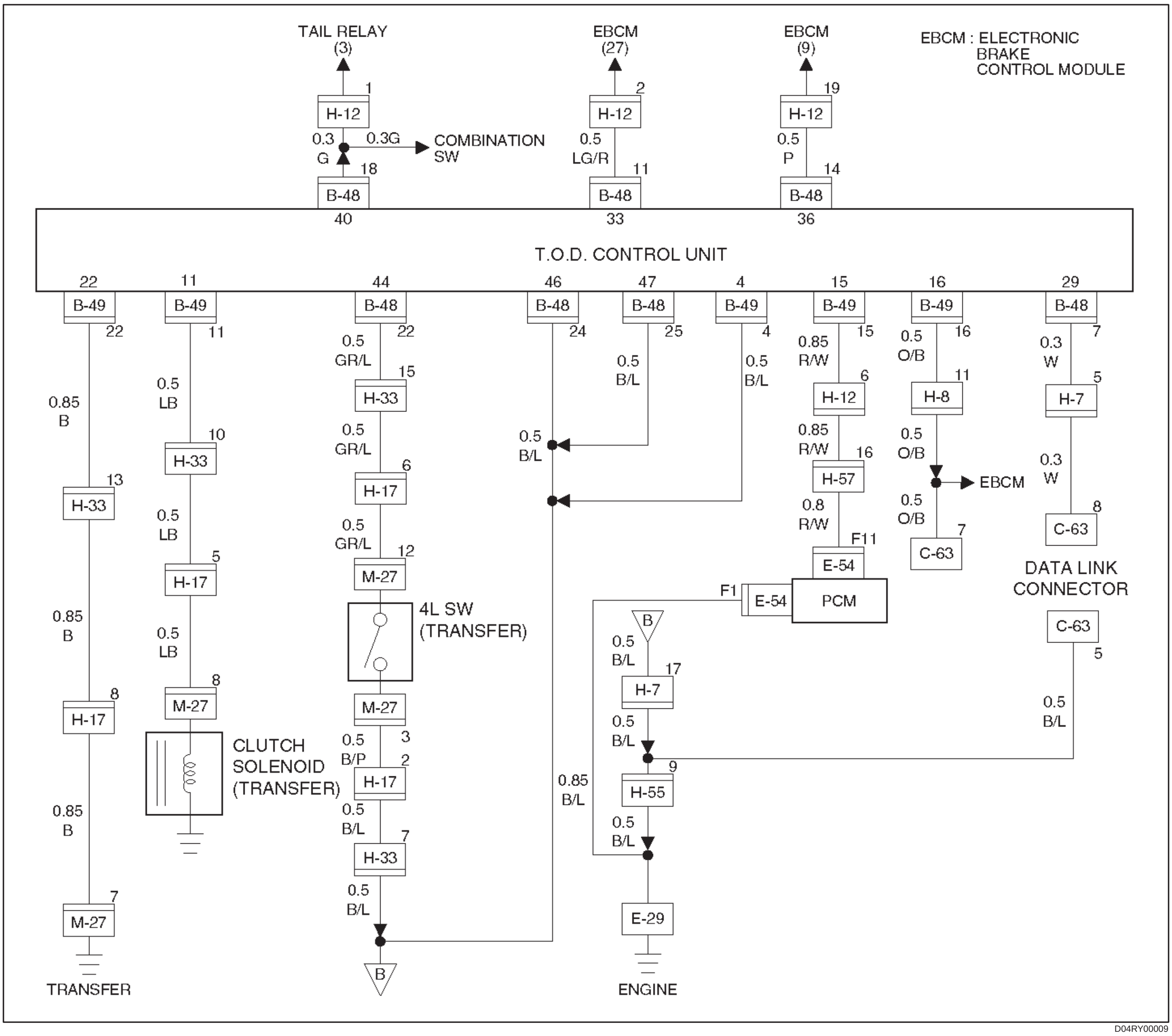
Step	Action	Yes	No
1	1. Disconnect ECU terminal. 2. Turn on the starter switch. Is battery voltage observed between ECU terminals (B–48)18 and (B–48)24?	Go to Step 2	Wires are broken lighting SW circuit. Repair the circuit. Go to Step 4
2	Turn lighting SW "ON". Is 0 V observed between ECU terminal (B–48)18 and (B–48)24?	Go to Step 3	Lighting SW circuit battery short. Repair the circuit. Go to Step 4
3	Connect ECU terminal. While the lighting switch is pressed on and off, does the brightness of the indicator change?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed" Go to Step 4	The ECU has failed. Replace the ECU. Go to Step 4
4	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 4

Diagnosis from Symptom

Troubles that are not indicated by the warning lamp are listed in the table below. These troubles are caused by the faults that cannot be detected by the self-diagnostic function of the control unit.
If this type of trouble is observed, interview the customer and conduct test runs to reproduce the trouble, cross-check the reported trouble with the listed phenomena, and diagnose and analyze the trouble on the item by item basis.

	Phenomena	Major cause	Corrective action
1	The tight corner braking is observed when the vehicle is subject to full steering.	● The standard tires are not used. ● The tire pressure is incorrect. ● The tires are worn inuniformity. ● The transfer or wiring is imperfect. ● The limited slip differential is failed.	Check and recondition the vehicle according to Chart 1.
2	Even if the 4WD Auto Switch is select to the 4WD position, the 4WD mode is not active, resulting in remarkable rear wheel spin.	● The transfer or wiring is imperfect. ● The shift on the fly system is failed.	Check and recondition the vehicle according to Chart 2.
3	● When the 4WD Auto Switch is select to the 4WD position, the drive resistance of the 4WD system is too large to get sufficient running speed. ● Noised drive line.	● The standard tires are not used. ● The tire pressure is incorrect. ● The tires are worn inuniformity. ● The transfer or wiring is imperfect. ● The limited slip differential is failed.	Check and recondition the vehicle according to Chart 1.
4	The shift on the fly system (front axle) generates gear noises.	● The wiring is imperfect. ● The shift on the fly system is failed.	Check and recondition the vehicle according to Chart 3.
5	The braking distance gets long even when the ABS is active.	● The wiring is imperfect. ● The ABS is failed.	Check and recondition the vehicle according to Chart 4.

Chart 1	The tight corner braking is observed.
Function of circuit	—
Fail condition	When the vehicle is subject to full steering in the TOD mode, the drive resistance gets large or the judder occurs. Otherwise, the above phenomenon is observed only when the brake is applied.

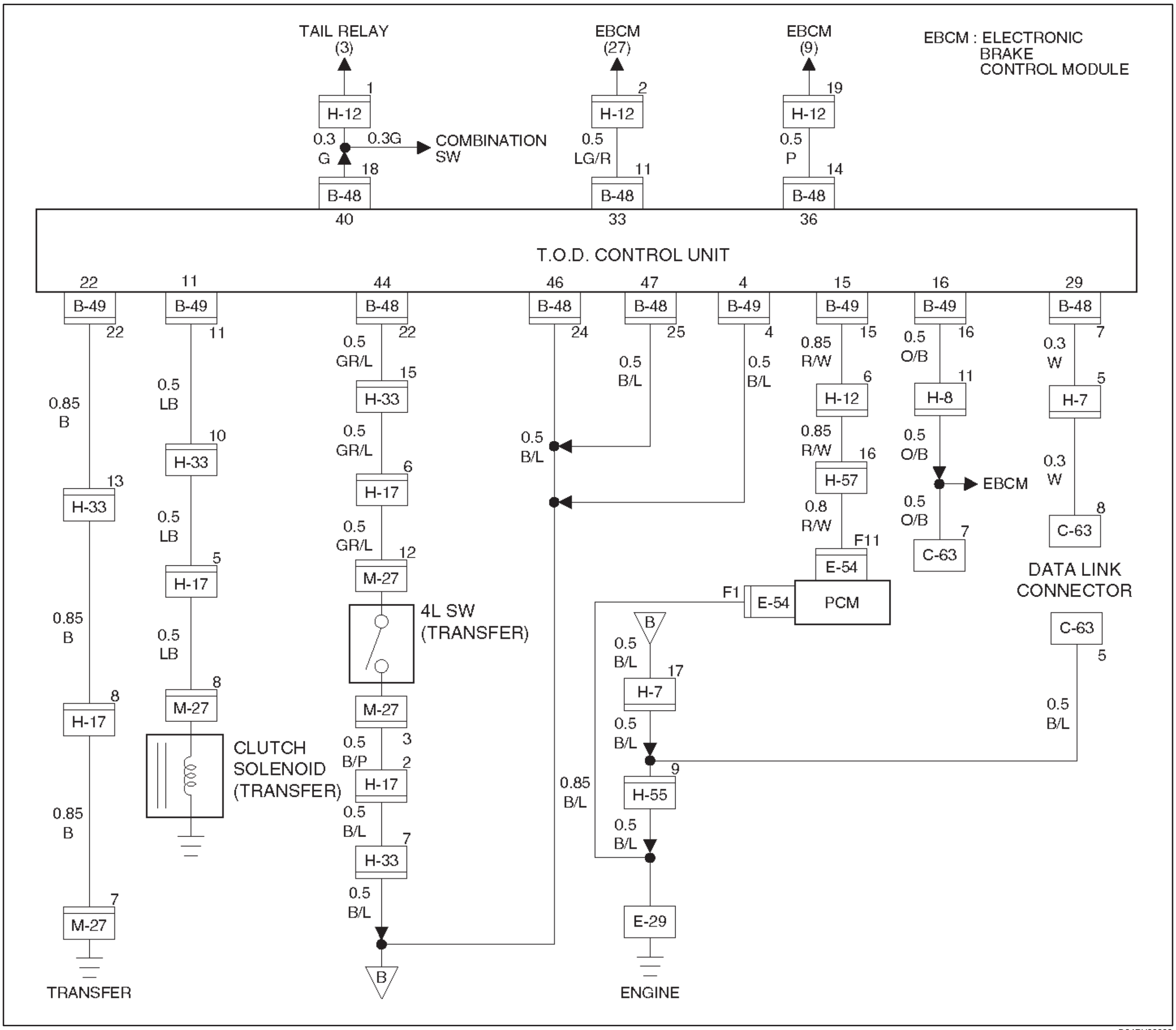


Step	Action	Yes	No
1	Are the front and rear tires in specified size?	Go to Step 2	Replace the tires with specified ones, and service the new tires. Go to Step 16
2	Is the tire pressure correct?	Go to Step 3	Replace the tires with specified ones, and service the new tires. Go to Step 16
3	Are the tires free from abnormal wear?	Go to Step 4	Replace the tires with specified ones, and service the new tires. Go to Step 16
4	Are different types of tires used?	Go to Step 5	Replace the tires with specified ones, and service the new tires. Go to Step 16
5	1. Start the engine. 2. Shift the transfer lever to the high (TOD) position. 3. Fully turn the steering to the left (or right) end, and select the D range and start the creep run. Does the tight corner braking occur? Is the judder with chug-chug sound observed? * Use caution on the operation.	Go to Step 6	Go to Step 11
6	1. Shift the transfer lever to the 2H position. 2. Fully turn the steering to the left (or right) end, and select the D range and start the creep run. Does the tight corner braking occur? Is the judder with chug-chug sound observed? * Use caution on the operation.	Go to Step 7	Go to Step 14
7	Is an LSD mounted to the rear differential?	Go to Step 8	Go to Step 9
8	Is the genuine LSD oil used in the rear differential?	Go to Step 9	Replace the differential oil. Go to Step 16
9	Does the engine output the power correctly?	Go to Step 10	Check the engine. Go to Step 16
10	Do the speed sensors work correctly? (Check trouble codes.)	The ECU has failed. Replace the ECU. Go to Step 16	Replace the speed sensors. Go to Step 16
11	Is the tight corner braking observed only when the brake is applied?	Go to Step 12	Conduct full steering under WOT. Go to Step 5
12	1. Turn off the starter switch. 2. Disconnect the ECU connector. Is the battery voltage observed between terminals (B–48)11 and (B–48)24?	Go to Step 13	Repair the circuit of terminal 6 (ABS IN). Go to Step 16

Step	Action	Yes	No
13	1. Apply the brake and fully turn the steering to the left (or right) end, and start the creep run. Does the voltage between terminals (B–49)11 and (B–49)22 range between 0.1 and 1.0V?	Repair the transfer assembly. Go to Step 16	The ECU has failed. Replace the ECU. Go to Step 16
14	1. Shift the transfer lever to the high (TOD) position. 2. Fully turn the steering to the left (or right) end, and select the D range and start the creep run. Does the voltage between terminals 11 and 22 range between 0.1 and 1.0V?	Go to Step 15	Go to Step 13
15	1. Select the 4WD Auto Switch to the 2WD position. 2. Jack up the right front wheel. Does the front tire rotate smoothly?	Repair the transfer assembly. Go to Step 16	The phenomenon is not reproduced. Refer to “Troubles intermittently observed”. Go to Step 16
16	Check that all the parts are mounted. Is this step complete?	Repeat the “Diagnosis Flow”.	Return to Step 16

*NOTE: Before checking this item, run the vehicle more than 10 meters with the steering wheel in straight position so that the 4L mechanical lock sleeve can be released certainly.

Chart 2	The 4WD mode is not active.
Function of circuit	—
Fail condition	The rear wheels spin in the TOD mode, so the driving torque is not transmitted to the front wheels. The indicator lamps will not show the 4L and TOD status.



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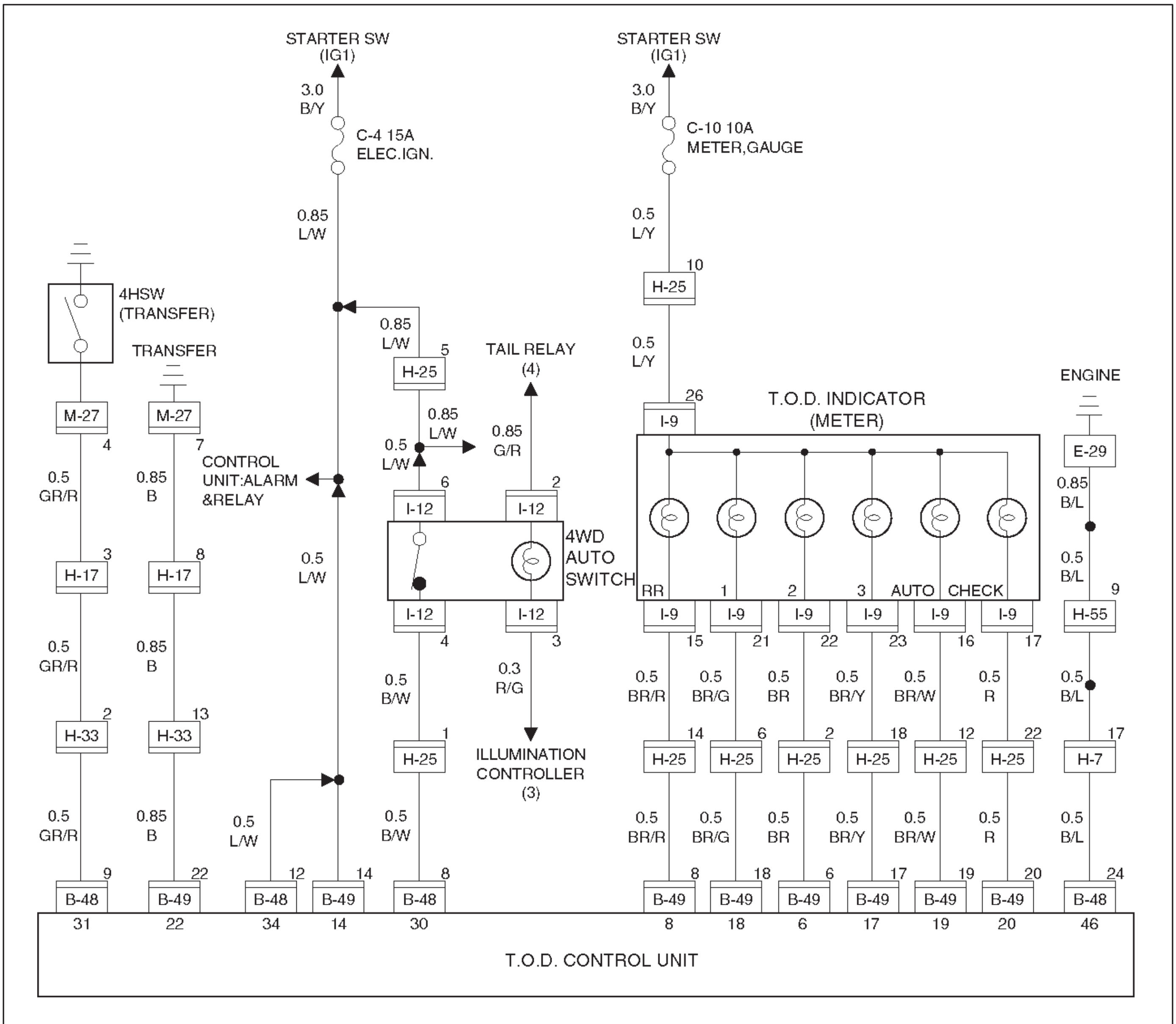
Step	Action	Yes	No
1	Is the trouble code 31 or 26 recorded?	Examine the trouble based on "Diagnosis from Trouble Codes". Go to Step 7	Go to Step 2
2	Is any of the trouble codes 28, 32 and 33 recorded?	Examine the trouble based on "Diagnosis from Trouble Codes". Go to Step 7	Go to Step 3
3	When the transfer lever is in the specified position, do the TOD indicator lamps show the correct status?	Go to Step 4	Examine the trouble based on "Trouble Diagnosis Depending on The Status of TOD Indicator". Go to Step 7
4	Shift the transfer lever to the 4L position, fully turn the steering to the left (or right) end, and start the creep run. Does the tight corner braking occur?	Go to Step 5	Repair the transfer assembly. Go to Step 7
5	1. Shift the transfer lever to the high (TOD) position. 2. Turn on the starter switch. Does the voltage between terminals 11 and 22 indicate at least 0.1V while the throttle is completely open?	Go to Step 6	The ECU has failed. Replace the ECU. Go to Step 7
6	Does the voltage between terminals 11 and 22 indicate at least 3V while the throttle is completely closed?	The TOD clutch is worn. Repair the transfer assembly. Go to Step 7	The ECU has failed. Replace the ECU. Go to Step 7
7	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 7

Chart 3	The shift on the fly system generates gear noises. (The fuel economy is bad in the 2H mode.)
Function of circuit	—
Fail condition	When the vehicle is run in the 2H mode, the shift on the fly system generates gear noises or the front wheel gears are engaged to generate a shock.



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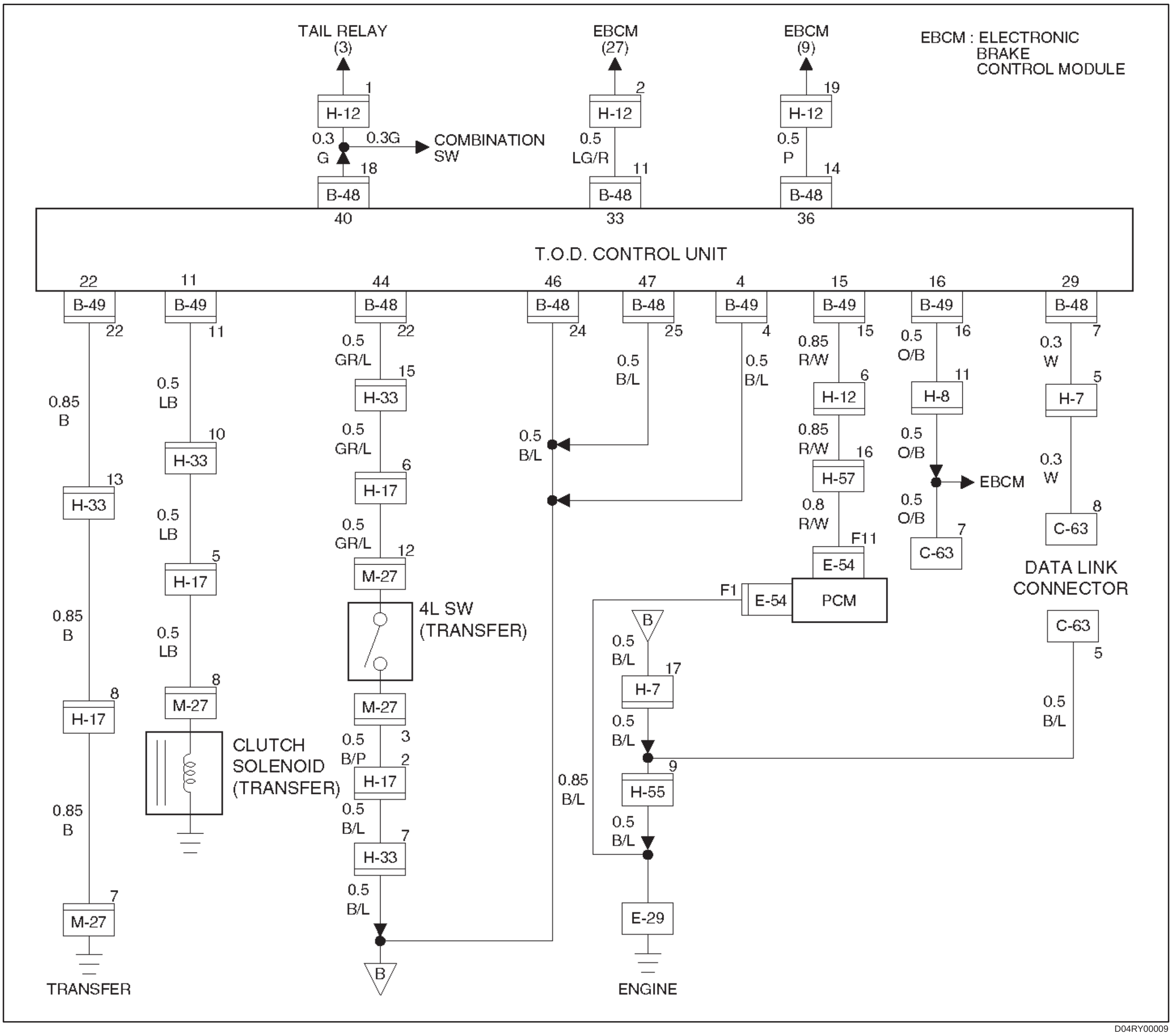
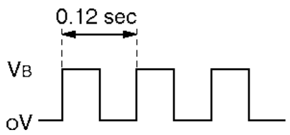
Step	Action	Yes	No
1	Do the indicator lamps show the correct status?	Go to Step 2	Examine the trouble based on "Diagnosis from Trouble Codes". Go to Step 2
2	Is any of the trouble codes 28, 32 and 33 recorded?	Examine the trouble based on "Diagnosis from Trouble Codes". Go to Step 6	Go to Step 3
3	Turn on the starter switch. Is the battery voltage observed between terminals 14 and 22?	Go to Step 4	Go to Step 5
4	When the 4WD Auto Switch is select to the 2WD position, are the front axle gears correctly disengaged (and when the left front tire is jacked up and turned, is the front propeller shaft standstill)?	The phenomenon is not reproduced. Refer to "Troubles intermittently observed". Go to Step 6	The shift on the fly system is failed (refer to Section 4B1 "Driveline Control System"). Go to Step 6
5	Does the battery voltage maintain the correct level?	Repair the battery circuit. Go to Step 6	Repair the battery and charging system. Go to Step 6
6	Check that all the parts are mounted. Is this step complete?	Repeat the "Diagnosis Flow".	Return to Step 6

Chart 4	The braking distance gets long even when the ABS is active.
Function of circuit	—
Fail condition	Enough deceleration is not obtained and the braking distance gets long even when the ABS is active in the 2H mode.



Step	Action	Yes	No
1	Are the brake and ABS systems healthy?	Go to Step 2	Repair the brake and ABS. Go to Step 4
2	Turn on the starter switch. Is the battery voltage observed between terminals 14 and 22?	Go to Step 3	Repair the battery system. Go to Step 4
3	1. Select the 4WD SW to the 2WD position. 2. The voltage between terminals 36 and 46 range between 7.5 and 16V (0.12 seconds make a cycle)  Does the voltage within the range specified?	Examine the trouble based on “Diagnosis from Trouble Codes". Go to Step 4	The ECU has failed. Replace the ECU. Go to Step 4
4	Check that all the parts are mounted. Is this step complete?	Repeat the “Diagnosis Flow".	Return to Step 4

TROOPER

DRIVELINE/AXLE

DRIVE SHAFT SYSTEM

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM(SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED , do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

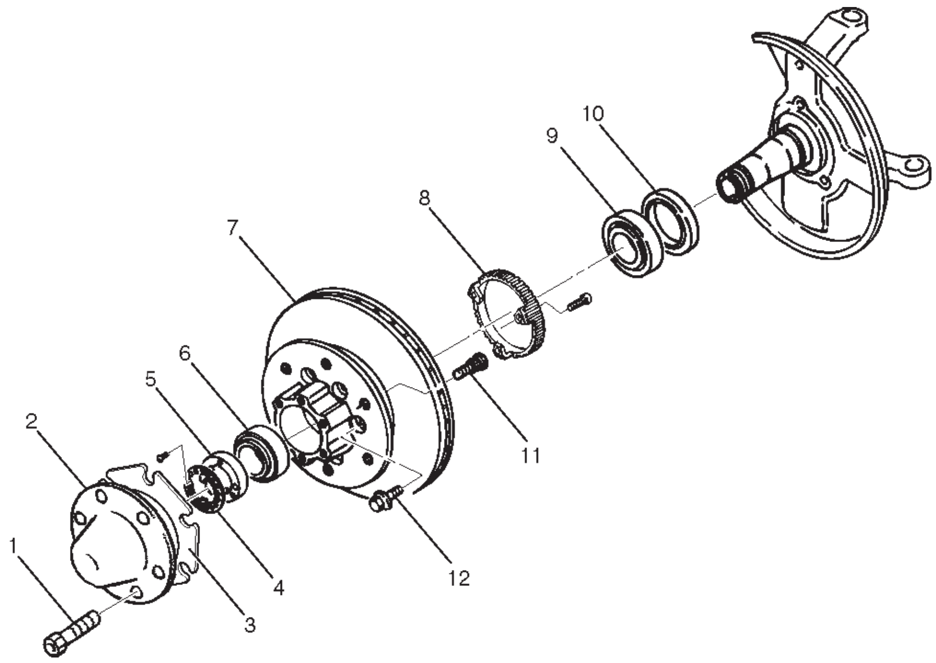
This publication contains essential removal, installation, adjustment and maintenance procedures.
The front axle utilizes a central disconnect type front axle/transfer case system.
The drive axles are completely flexible assemblies, consisting of inner and outer constant velocity (CV) drive shaft joints connected by an axle shaft.
For description of front propeller shaft and universal joint, refer to Front Propeller Shaft in this section.

Diagnosis

Condition	Possible cause	Correction
Oil Leak At Front Axle	Worn or defective oil seal.	Replace the oil seal.
	Front axle housing cracked.	Repair or replace.
Oil Leak At Pinion Shaft	Too much gear oil.	Correct the oil level.
	Oil seal worn or defective.	Replace the oil seal.
	Pinion flange loose or damaged.	Tighten or replace.
Noises In Front Axle Drive Shaft Joint	Broken or worn drive shaft joints and bellows (BJ and DOJ).	Replace the drive shaft joints and bellows.
“Clank” When Accelerating From “Coast”	Loose drive shaft joint to output shaft bolts.	Tighten.
	Damaged inner drive shaft joint.	Replace.
Shudder or Vibration During Acceleration	Excessive drive shaft joint angle.	Repair.
	Worn or damaged drive shaft joints.	Replace.
	Sticking spider assembly (inner drive shaft joint).	Lubricate or replace.
	Sticking joint assembly (outer drive shaft joint).	Lubricate or replace.
Vibration At Highway Speeds	Out of balance or out of round tires.	Balance or replace.
	Front end out of alignment.	Align.
Noises in Front Axle	Insufficient gear oil.	Replenish the gear oil.
	Wrong or poor grade gear oil.	Replace the gear oil.
	Drive pinion to ring gear backlash incorrect.	Adjust the backlash.
	Worn or chipped ring gear, pinion gear or side gear.	Replace the ring gear, pinion gear or side gear.
	Pinion shaft bearing worn.	Replace the pinion shaft bearing.
	Wheel bearing worn.	Replace the wheel bearing.
	Differential bearing loose or worn.	Tighten or replace.
Wanders and Pulls	Wheel bearing preload too tight.	Adjust the wheel bearing preload.
	Incorrect front alignment.	Adjust the front alignment.
	Steering linkage loose or worn.	Tighten or replace.
	Steering gear out of adjustment.	Adjust or replace the steering gear.
	Tire worn or improperly inflated.	Adjust the inflation or replace.
	Front or rear suspension parts loose or broken.	Tighten or replace.
Front Wheel Shimmy	Wheel bearing worn or improperly adjusted.	Adjust or replace.
	Incorrect front alignment.	Adjust the front alignment.
	Worn ball joint or bush.	Replace the ball joint or bush.
	Steering linkage loose or worn.	Tighten or replace.
	Steering gear out of adjustment.	Tighten or replace.
	Tire worn or improperly inflated.	Replace or adjust the inflation.
	Shock absorber worn.	Replace the shock absorber.

Front Hub and Disc (2WD Model)

Disassembled View



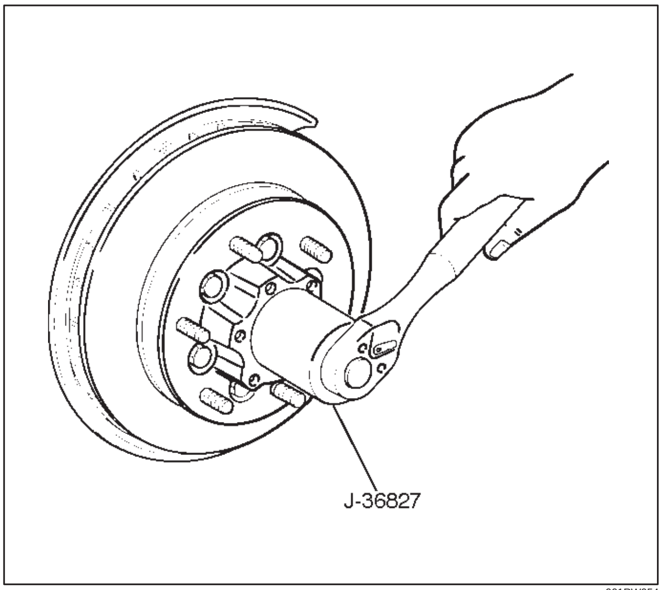
Legend

(1) Bolt
(2) Cover and Gasket
(3) Packing
(4) Lock Washer
(5) Hub Nut
(6) Outer Bearing
(7) Hub and Disc Assembly
(8) ABS Sensor Ring
(9) Inner Bearing
(10) Oil Seal
(11) Bolt
(12) Wheel Pin

Disassembly

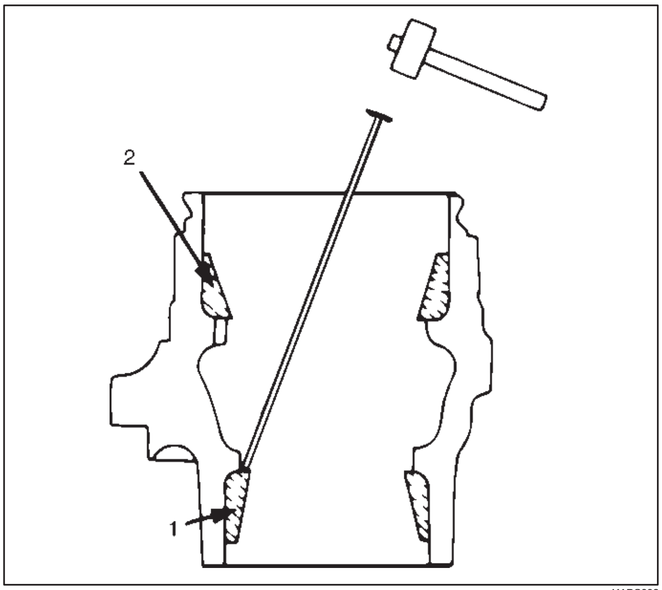
1. Before disassembly, jack up the front of vehicle and support frame with jack stands.
2. Remove the two bolts from the rear side of the knuckle arm, then remove the brake caliper, with the brake hose attached.
   Use a wire to attach the brake caliper to the upper link.
   Refer to Disk Brakes in Brake section.

3. Remove cover bolt.
4. Remove cover and gasket.
5. Remove lock washer.
6. Remove hub nut, using front hub nut wrench J–36827.



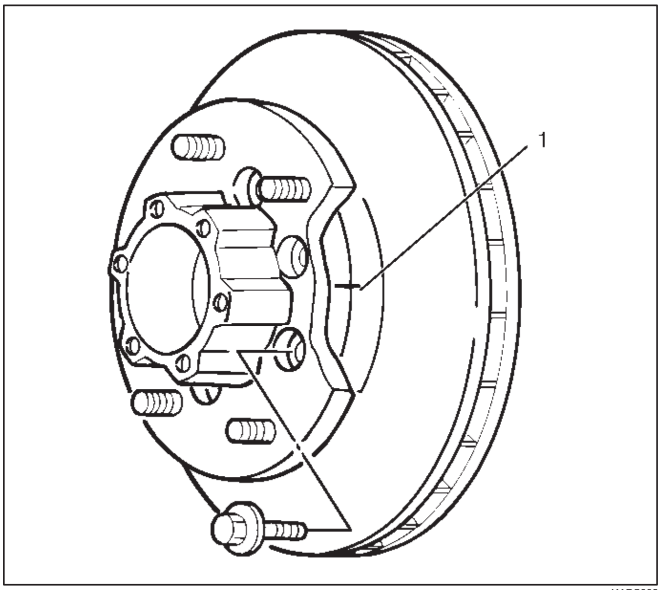
901RW054

7. Remove outer bearing.
8. Remove oil seal.
9. Remove inner bearing.
10. Use a brass bar to remove the outer bearing outer race(1), oil seal, inner bearing and inner bearing outer race(2) from the hub.



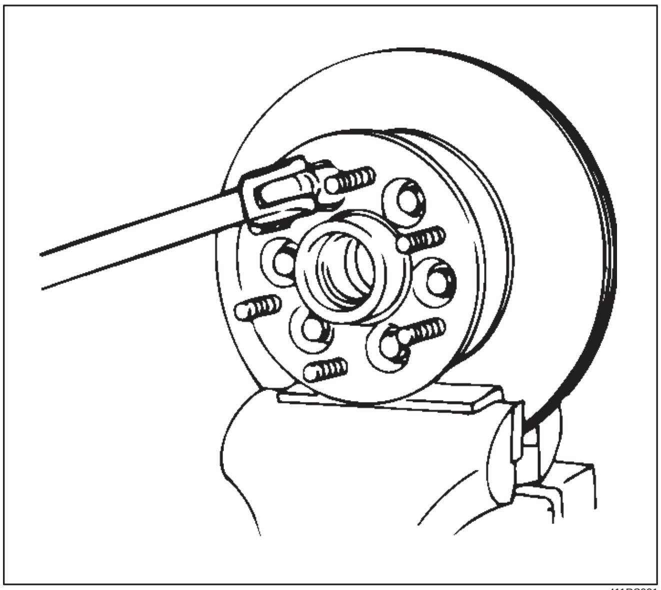
411RS002

11. Remove bolt.
12. If necessary, replace the wheel pin in the following manner.
    - Scribe mark(1) on hub to disc before disassembly to insure proper assembly.



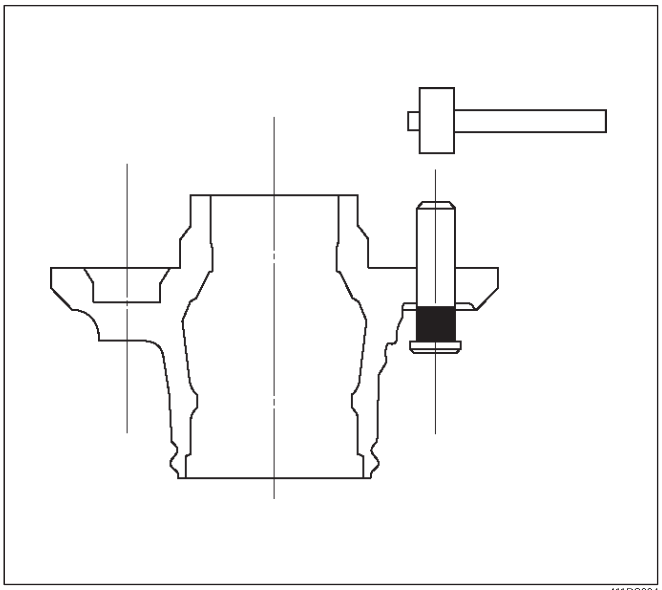
411RS003

- Clamp hub and disc assembly in vise, using protective pads. Remove six(6) disc-to-hub retaining bolts.



411RS021

- Place hub on a suitable work surface and remove wheel studs, as required, using a hammer.



411RS004

Inspection and Repair

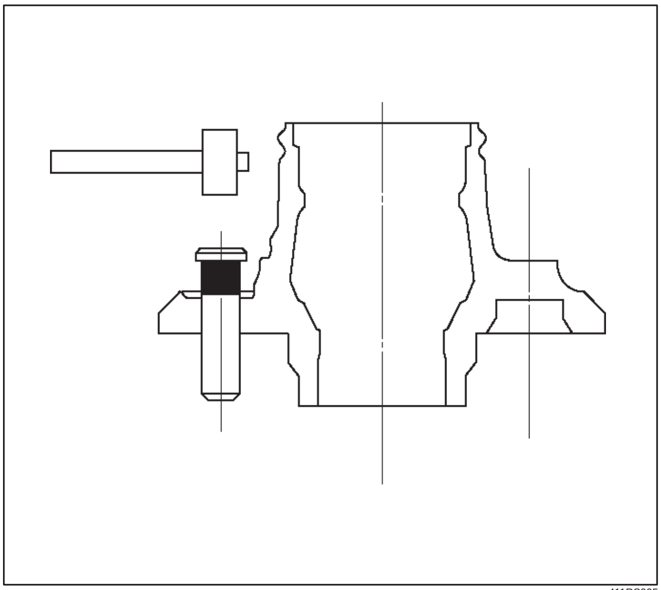
Check the following parts for wear, damage or other abnormal conditions.

- Hub
- Hub bearing
- Bearing outer race
- Disc
- Oil seal

Reassembly

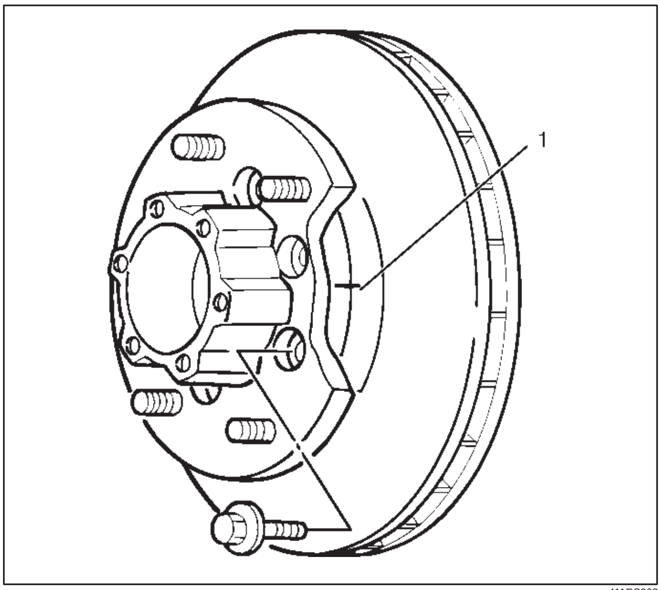
1. Install wheel pin.
   - Place hub on a wood workbench or a block of wood approx. 6” by 6” to protect the wheel stud ends and threads.
   - Install wheel stud, using a hammer.

NOTE: Be sure wheel stud is started squarely and seats completely.



411RS005

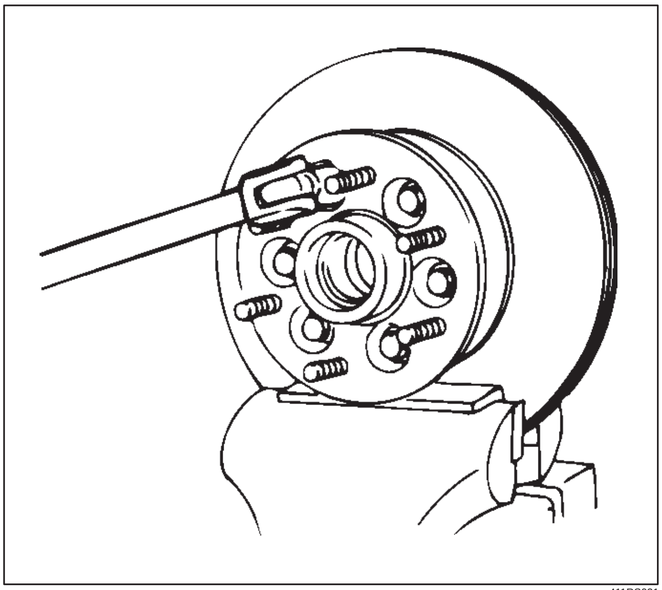
2. Align index marks(1) and install hub to disc.



411RS003

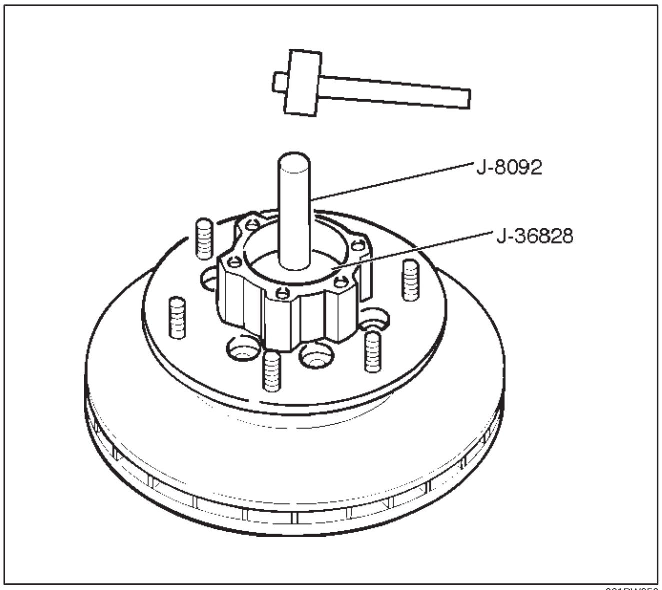
3. Install bolt.
   Tighten the bolts to the specified torque.

Torque: 103 N·m (76 lb ft)



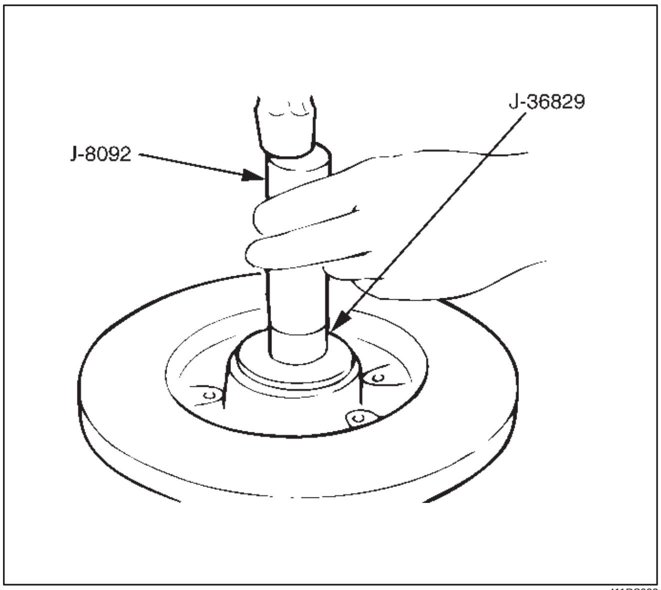
411RS021

4. Install outer bearing.
   Install the outer race by driving it into the hub by using installer J–36828 and grip J-8092.



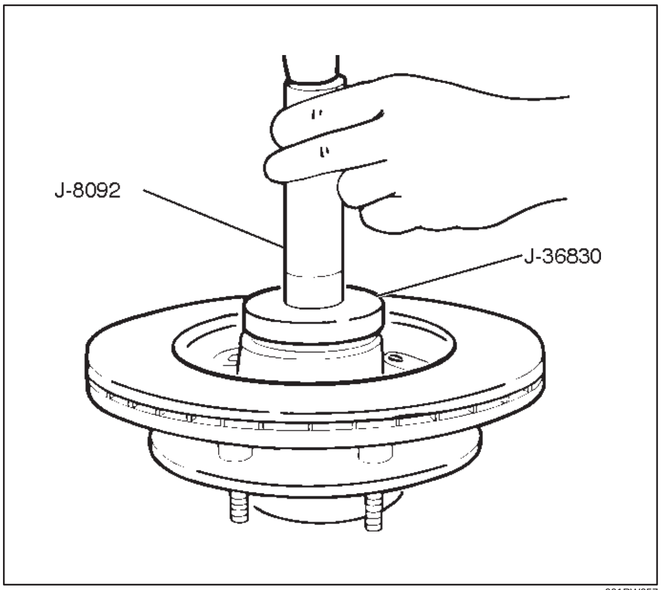
901RW056

5. Install inner bearing.
   Install the outer race by driving it into the hub by using installer J–36829 and grip J–8092.



411RS023

6. Install oil seal by using installer J–36830 and grip J–8092.
   Apply Multipurpose grease NLGI No. 2 or equivalent to the lip portion.

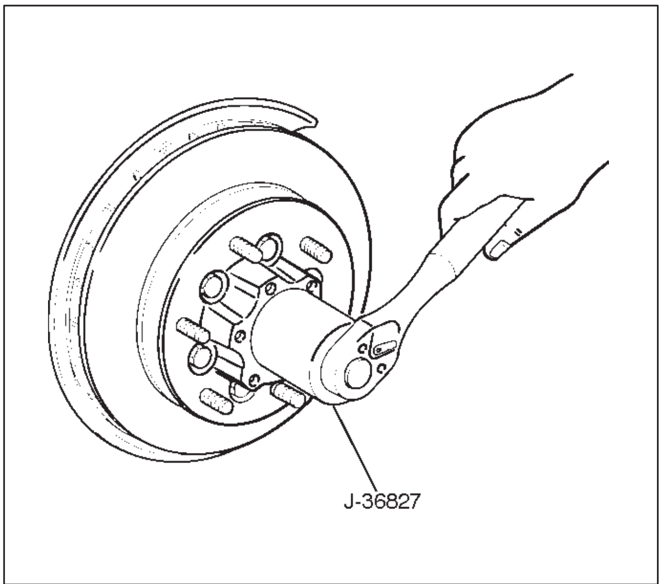


901RW057

7. Apply Multipurpose grease NLGI No.2 in the hub and bearing.

Hub	35 g (1.23 oz)
Outer bearing	10 g (0.35 oz)
Inner bearing	15 g (0.53 oz)

8. Install hub nut by using wrench J–36827.
   Turn the place where there is a chamfer in the tapped hole to the outer side, and attach the nut.



901RW054

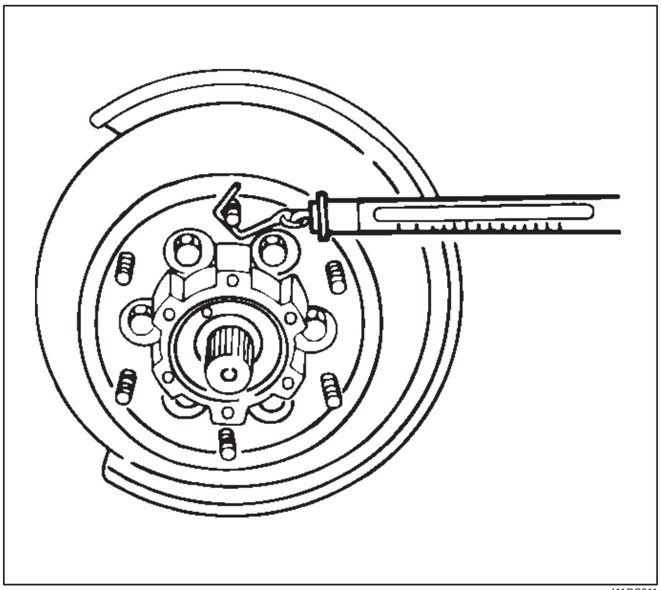
Preload Adjustment

1. Tighten the hub nut to 29.4 N·m (21.7 lb ft), then loosen the nut to the full.
2. Tighten the hub nut to the value given below, using a spring scale on the wheel pin.

Bearing Preload

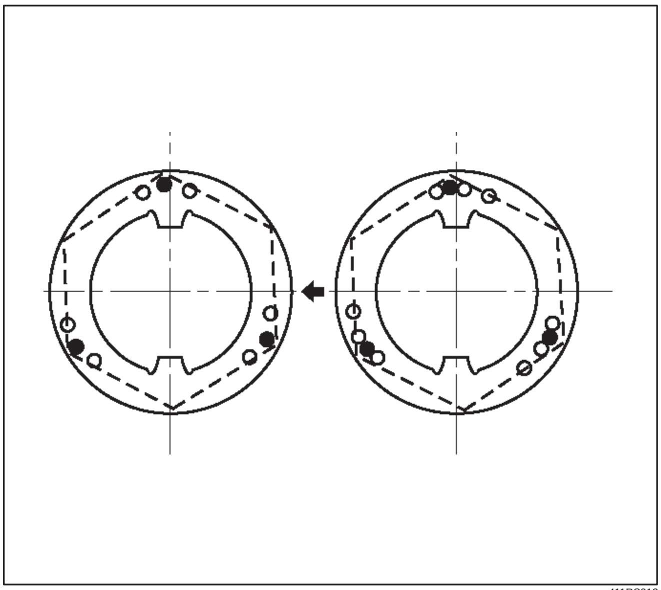
New bearing and New oil seal	19.6 – 24.5 N (4.4 – 5.5 lb)
Used bearing and New oil seal	11.8 – 17.7 N (2.6 – 4.0 lb)

If the measured bearing preload is outside the specifications, adjust it by loosening or tightening the bearing nut.



411RS011

9. Install lock washer.
   - Turn the side with larger diameter of the tapered bore to the vehicle outer side, then attach the washer.
     If the bolt holes in the lock plate are not aligned with the corresponding holes in the nut, reverse the lock plate. If the bolt holes are still out of alignment, turn in the nut just enough to obtain alignment. Screw is to be fastened tightly so its head may come lower than the surface of the washer.

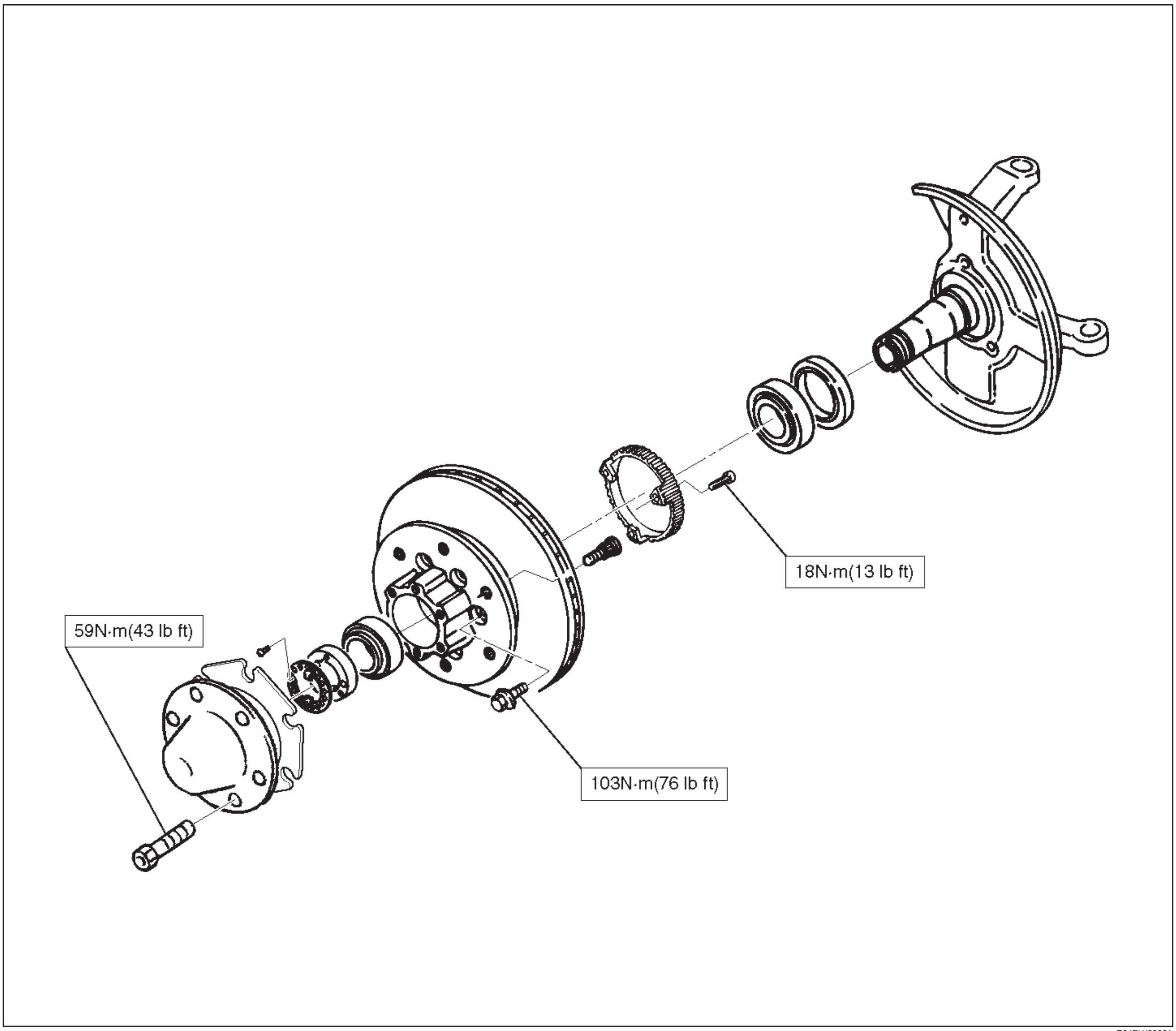


411RS012

10. Install the paking.
11. Install cover and tighten the cover bolt.
12. Install brake caliper and tighten fixing bolt.

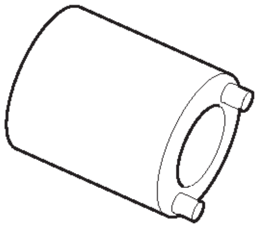
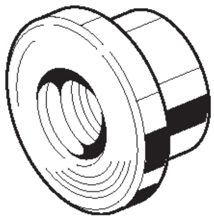
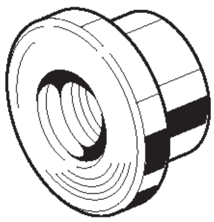
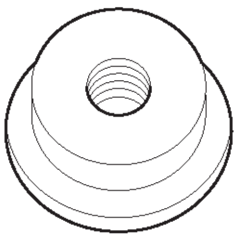
Main Data and Specifications

Torque Specifications



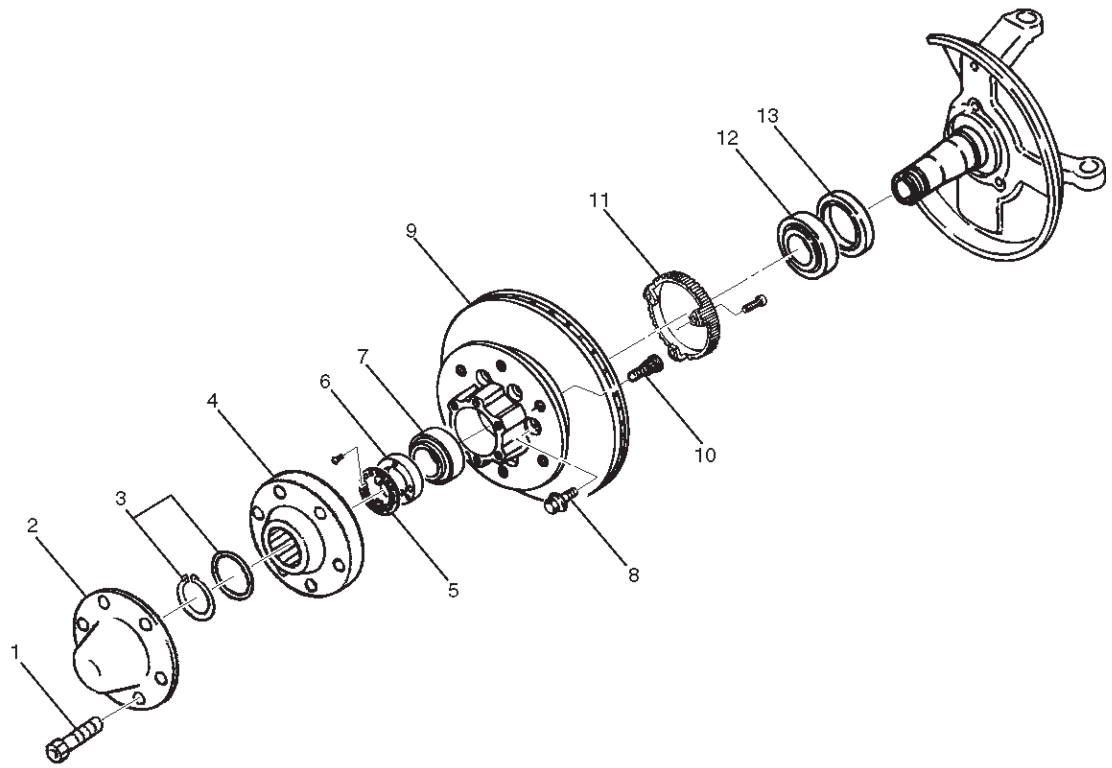
E04RW00001

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–36827** Wrench; Hub nut
	**J–36829** Installer; Inner bearing
	**J–36828** Installer; Outer bearing
	**J–36830** Installer; Oil seal

Front Hub and Disc (4WD Model)

Disassembled View



411RW001

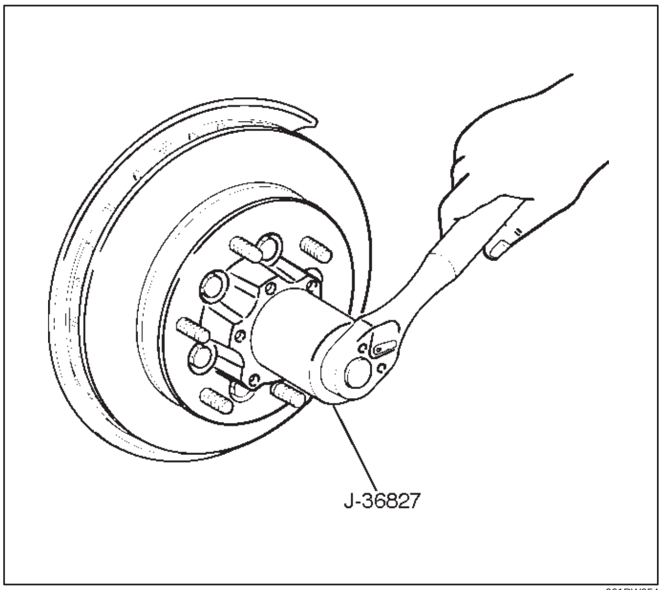
Legend

(1) Bolt
(2) Cap
(3) Snap Ring and Shim
(4) Hub Flange
(5) Lock Washer and Lock Screw
(6) Hub Nut
(7) Outer Bearing
(8) Bolt
(9) Hub and Disc Assembly
(10) Wheel Pin
(11) ABS Sensor Ring
(12) Inner Bearing
(13) Oil Seal

Disassembly

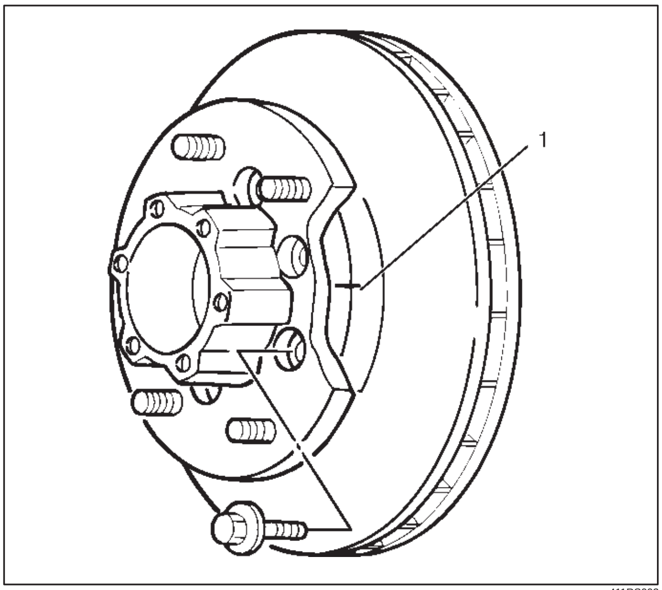
1. Before disassembly, select the 2WD position with the 4WD switch.
2. Jack up the front of vehicle and support frame with jack stands.
3. Remove the disc brake caliper assembly and hang it on the frame with wires. Refer to Disk Brakes in Brake section.
4. Remove Bolt.
5. Remove cap.
6. Remove snap ring and shim.
7. Remove hub flange.

8. Remove lock washer and lock screw.
9. Use wrench J–36827, remove hub nut.



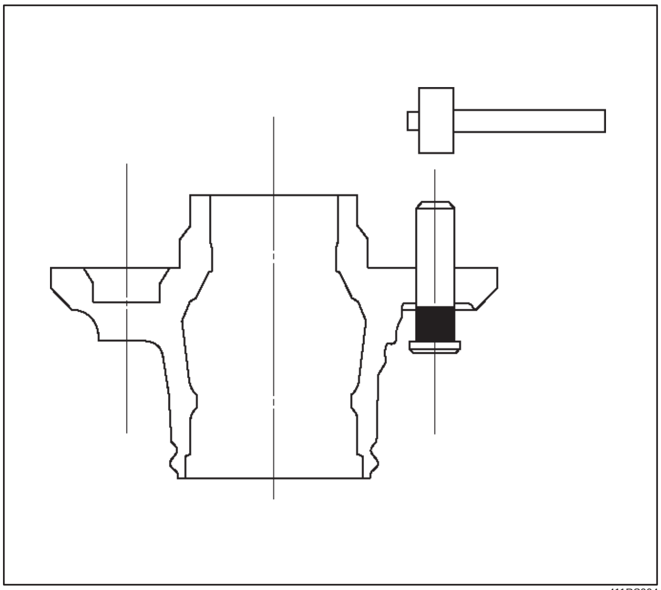
901RW054

10. Remove hub and disc assembly.
11. Remove ABS sensor ring.
12. Remove outer bearing.
13. Remove oil seal.
14. Remove inner bearing.
15. Remove bolt , if necessary, replace the wheel pin in the following manner.
    - Apply a scribe mark(1) to disc to hub.
    - Clamp the hub and disc assembly in a vise, using protective pads. Remove the 6 disc–to–hub retaining bolts.



411RS003

    - Place hub on a suitable work surface and remove the studs by using a hammer.



411RS004

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

- Hub
- Hub bearing oil seal
- Knuckle spindle
- Disc
- Caliper
- Shift on the fly system parts (Cap, Hub flange, Shim, Snap ring)
- ABS sensor ring

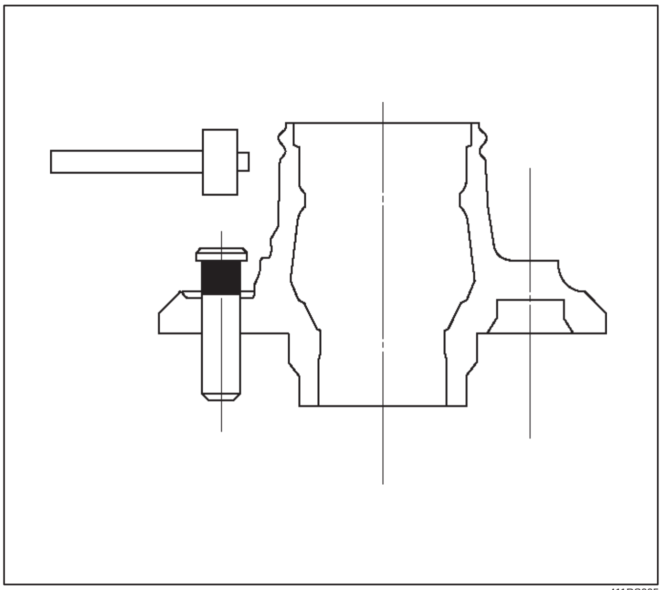
For inspection and servicing of disc caliper and related parts, refer to Disc Brakes in Brake section.

Reassembly

1. Install wheel pin.
    - Place the hub on a wood workbench or a block of wood approx. 6” by 6” to protect the wheel stud ends and threads.

- Insert a wheel stud using a hammer.

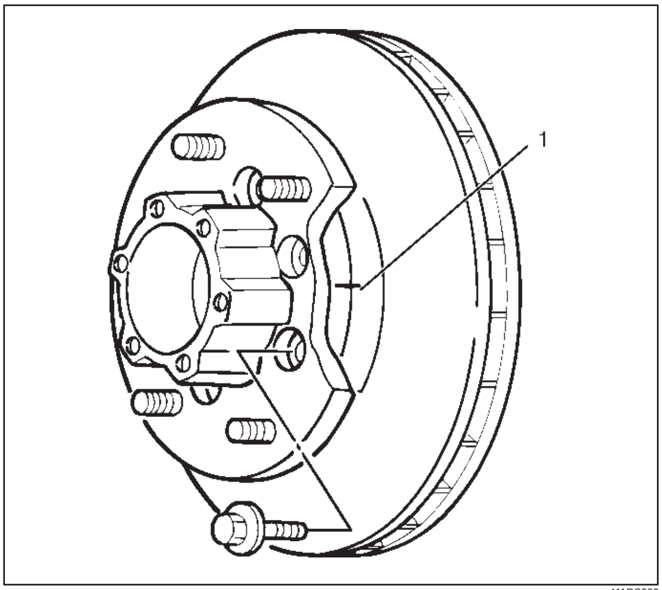
  Be sure the wheel stud is started squarely and seats completely.



411RS005

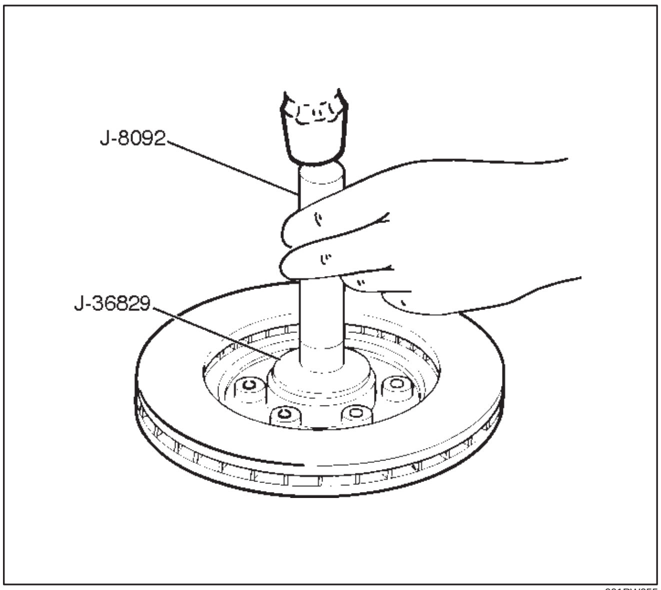
2. Align scribe marks(1) and attach the hub to the disc, then tighten the bolts to the specified torque.

Torque: 103 N·m (76 lb ft)



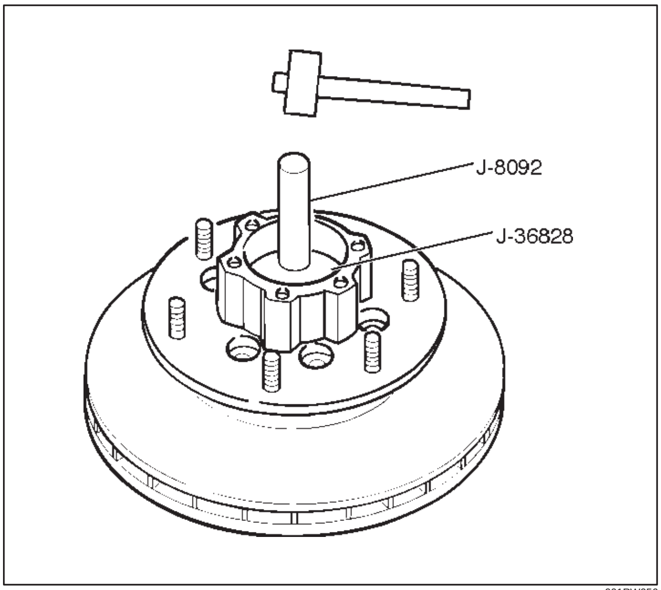
411RS003

3. Use installer J–36829 and grip J–8092, then install the inner bearing by driving it into the hub.



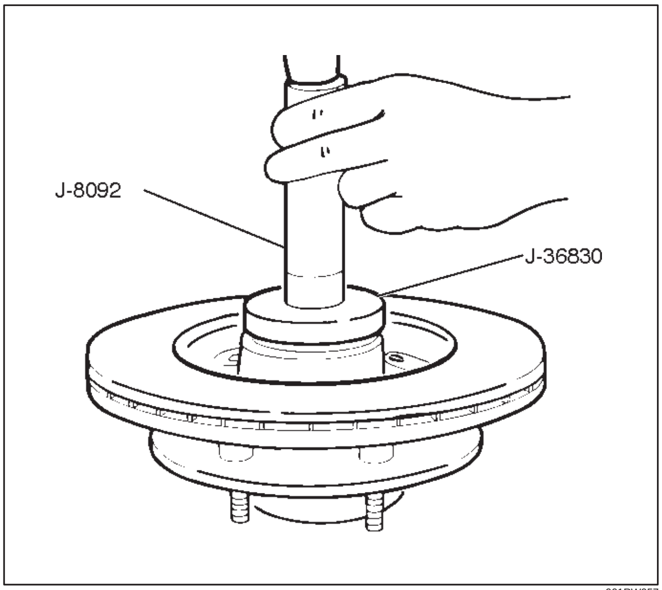
901RW055

4. Use installer J–36828 and grip J–8092 then install the outer bearing by driving it into the hub.



901RW056

5. Apply grease (NLGI No.2 or equivalent) to the lip portion, then install oil seal by using installer J–36830 and grip J–8092.



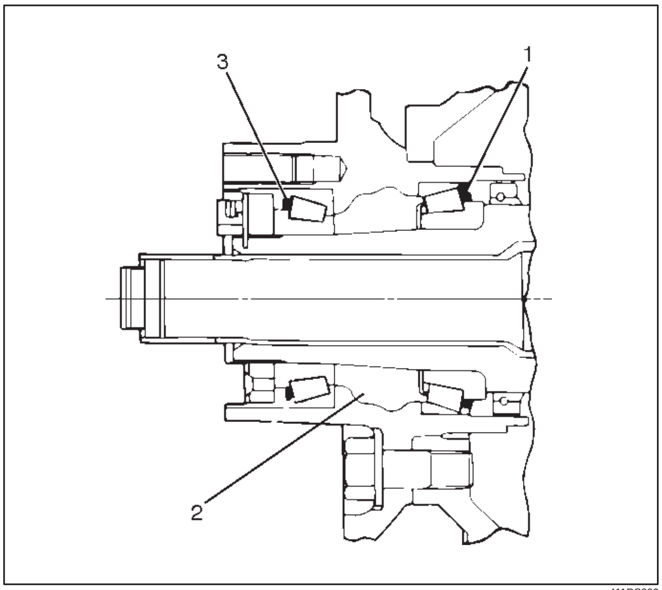
901RW057

6. Install ABS sensor ring, then tighten the bolts to the specified torque.

Torque: 18 N·m (13 lb ft)

7. Install hub and disc assembly.
   - Apply grease in the hub.
   - Apply wheel bearing type grease NLGI No. 2 or equivalent to the outer and inner bearing.

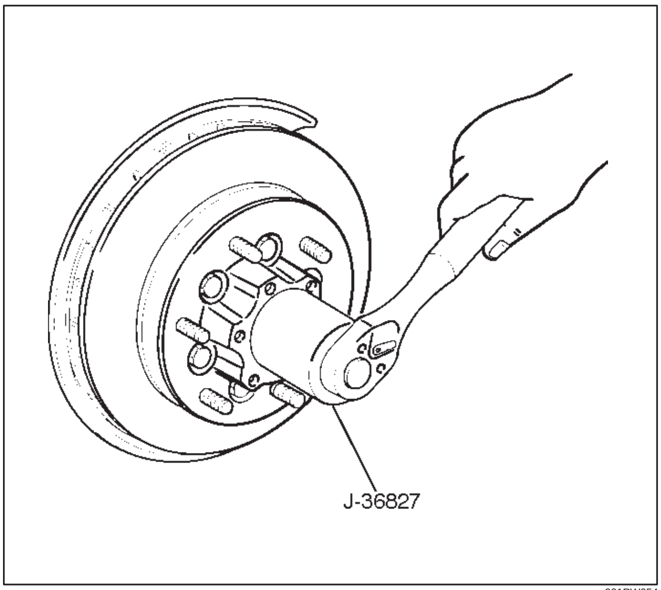
Grease Amount
- **Hub: 35 g (1.23 oz)**
- **Outer bearing: 10 g (0.35 oz)**
- **Inner bearing: 15 g (0.53 oz)**



411RS009

Legend
(1) Inner Bearing
(2) Hub
(3) Outer Bearing

8. Install hub nut.
   Turn to the place where there is a chamfer in the tapped hole to the outer side, then attach the nut by using front hub nut wrench J–36827.



901RW054

Preload Adjustment

1. Tighten the hub nut to 29 N·m (22 lb ft), then fully loosen the nut.
2. Tighten the hub nut to the value given below, using a spring scale on the wheel pin.

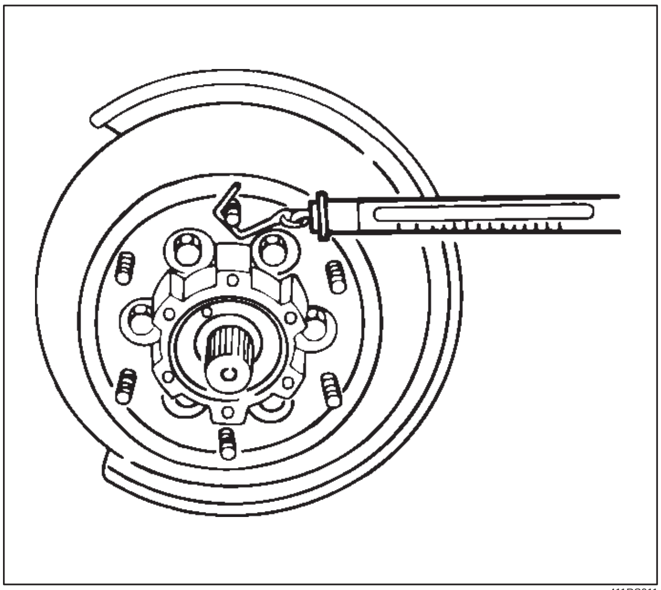
New bearing and New oil seal

Bearing Preload: 20 N – 25 N (4.4 lb – 5.5 lb)

Used bearing and New oil seal

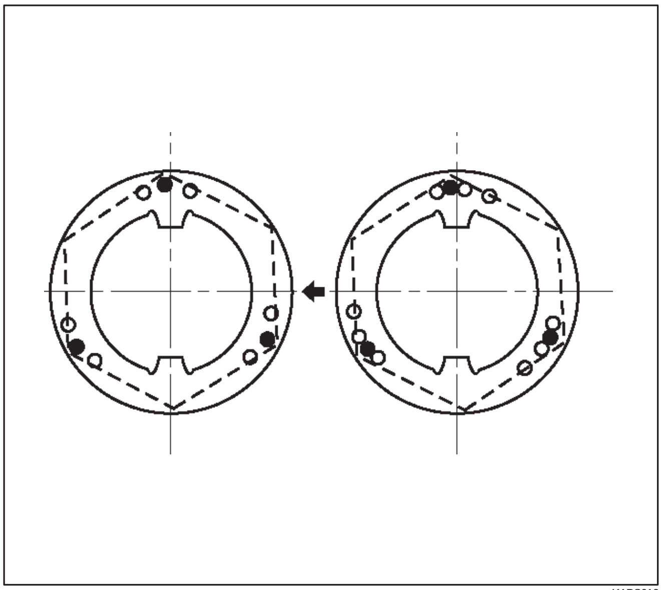
Bearing Preload: 12 N – 18 N (2.6 lb – 4.0 lb)

If the measured bearing preload is outside the specifications, adjust it by loosening or tightening the bearing nut.



411RS011

9. Install lock washer and lock screw in the following manner.
   - Turn the side with larger diameter of the tapered bore to the vehicle outer side, then attach the washer.
   - If the bolt holes in the lock plate are not aligned with the corresponding holes in the nut, reverse the lock plate.
   - If the bolt holes are still out of alignment, turn in the nut just enough to obtain alignment.
   - Screw is to be fastened tightly so its head may come lower than the surface of the washer.

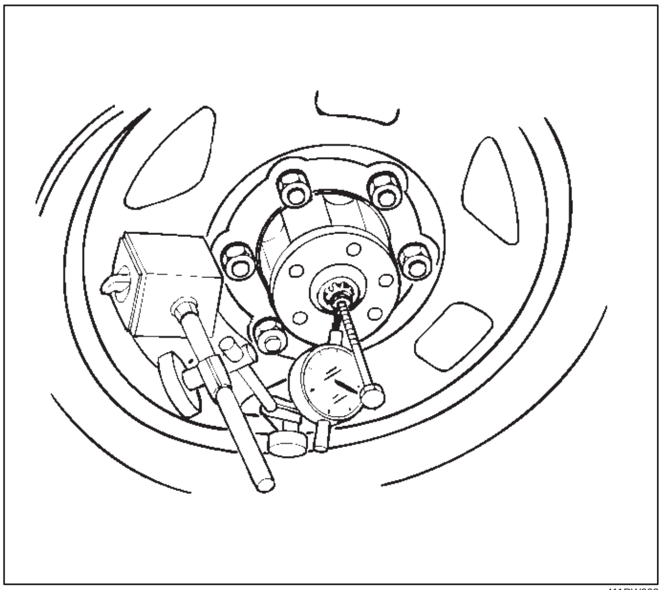


411RS012

10. Apply adhesive (LOCTITE 515 or equivalent) to both joining flange faces then install hub flange.
11. Install snap ring and shim.
   - Adjust the clearance between the free wheeling hub body and the snap ring.

Clearance: 0 mm–0.3 mm (0 in–0.012 in)

Shims Available: 0.2 mm, 0.3 mm, 0.5 mm, 1.0 mm (0.008 in, 0.012 in, 0.020 in, 0.039 in)



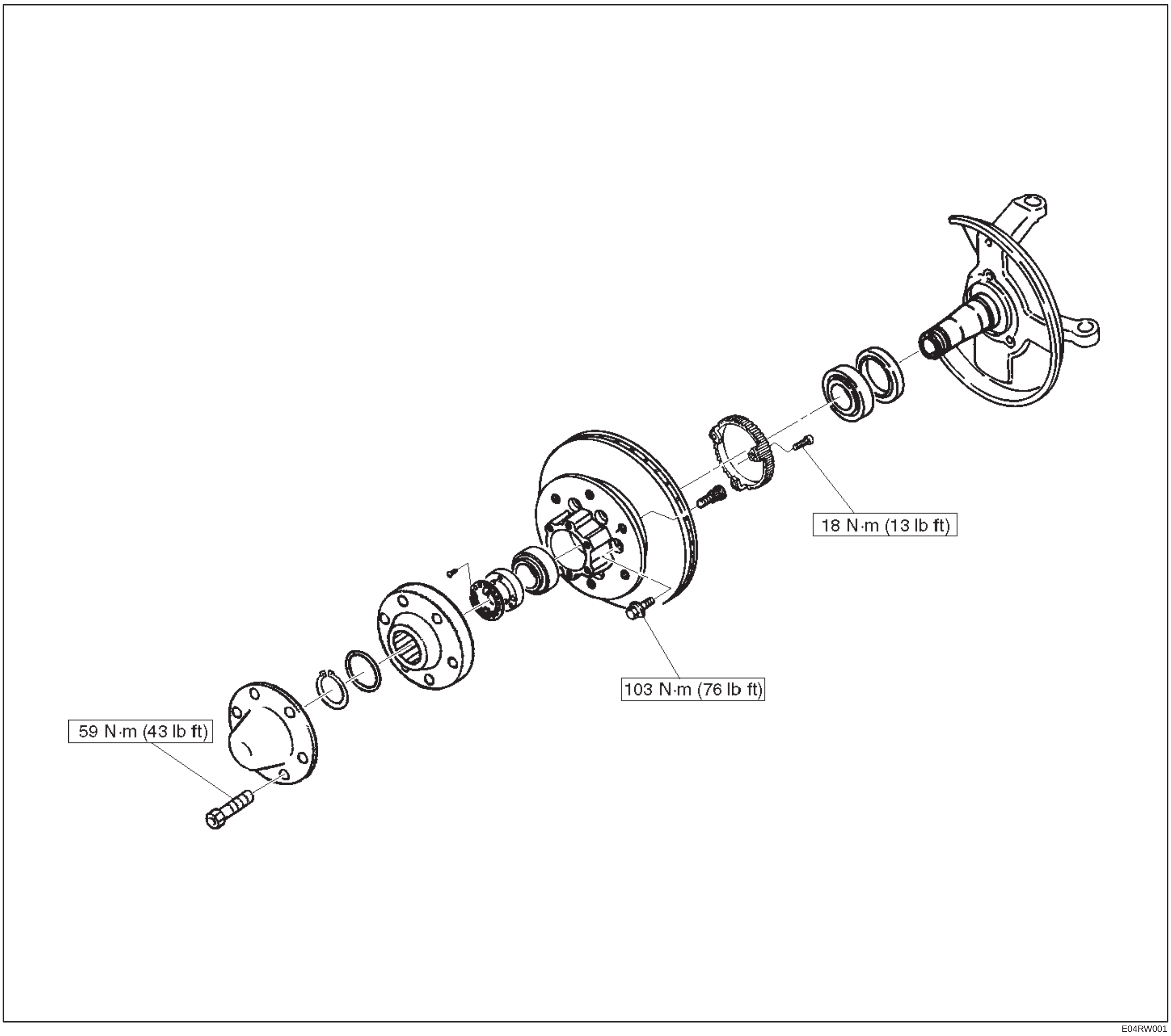
411RW002

12. Install hub cap.
13. Tighten the bolts to the specified torque.

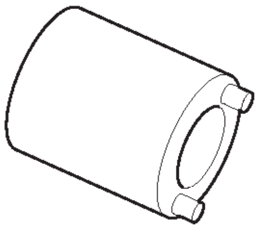
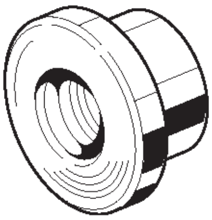
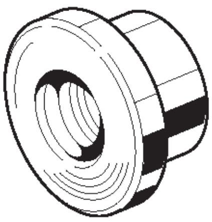
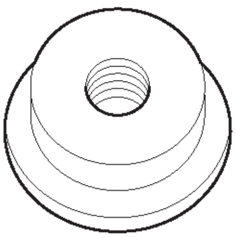
Torque: 59 N·m (43 lb ft)

Main Data and Specifications

Torque Specifications



Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS246	**J–36827** Wrench; Hub nut
 901RS247	**J–36829** Installer; Inner bearing
 901RS248	**J–36828** Installer; Outer bearing
 901RS249	**J–36830** Installer; Oil seal

Front Drive Shaft Joint

Front Drive Shaft Joints Replacement

- Refer to Front Drive Axle Assembly Replacement in this section, and refer to Front Hub and Disc in Suspension section.

Front Hub Bearing Preload Check

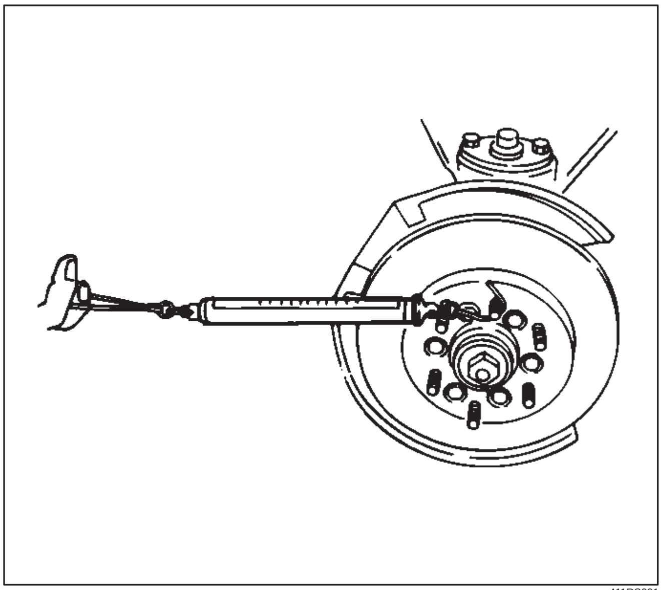
Check the hub bearing preload at the wheel pin.

New bearing and new oil seal:

19.6 – 24.5 N (4.4 – 5.5 lb)

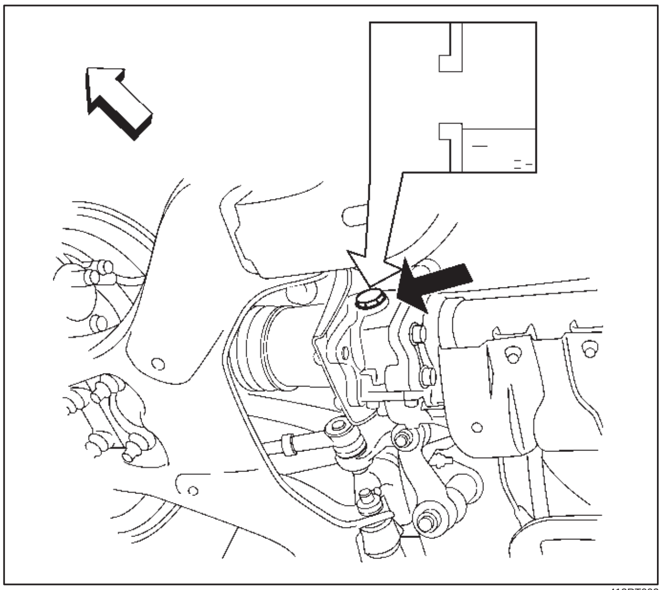
Used bearing and new oil seal:

11.8– 17.7 N (2.6 – 4.0 lb)



411RS001

Inspection Of Shift On The Fly System Gear Oil



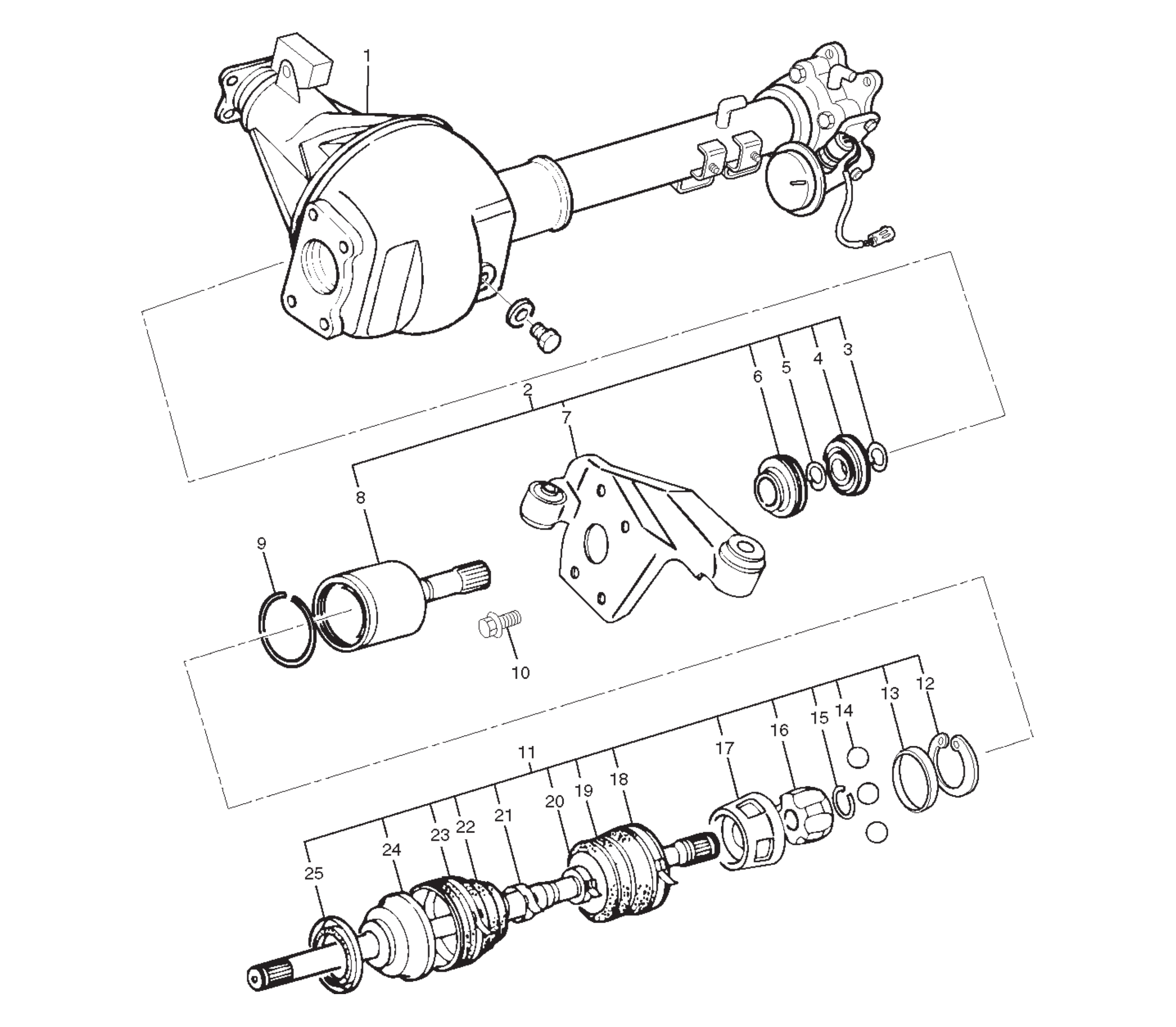
412RT002

1. Open filler plug and make sure that the oil is up to the plug port.
   If the level oil is low, replenish with gear oil GL–5 grade.
2. Tighten the filler plug to specified torque.

Torque: 78 N·m (58 lb in)

Front Axle Drive Shaft

Front Axle Drive Shaft and Associated Parts



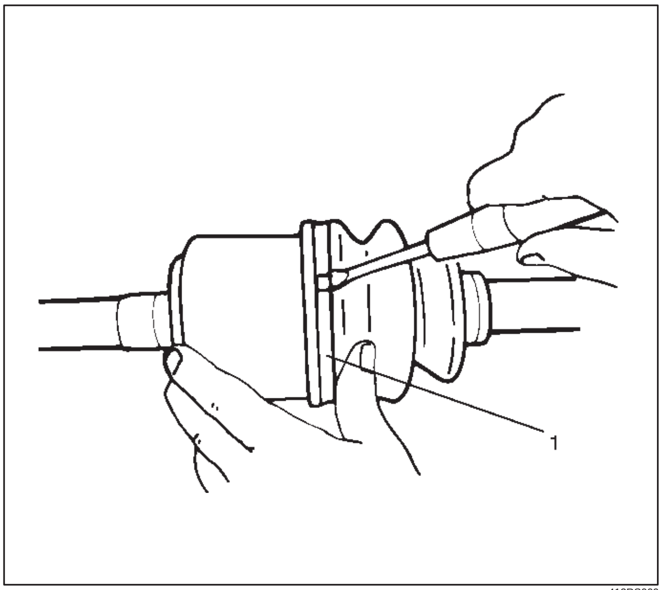
Legend

(1) Axle Case and Differential
(2) DOJ Case Assembly
(3) Snap Ring
(4) Bearing
(5) Snap Ring
(6) Oil Seal
(7) Bracket
(8) DOJ Case
(9) Circlip
(10) Bolt
(11) Drive Shaft Joint Assembly
(12) Snap Ring
(13) Spacer
(14) Ball
(15) Snap Ring
(16) Ball Retainer
(17) Ball Guide
(18) Band
(19) Bellows
(20) Band
(21) Band
(22) Bellows
(23) Band
(24) BJ Shaft
(25) Dust Seal

Disassembly

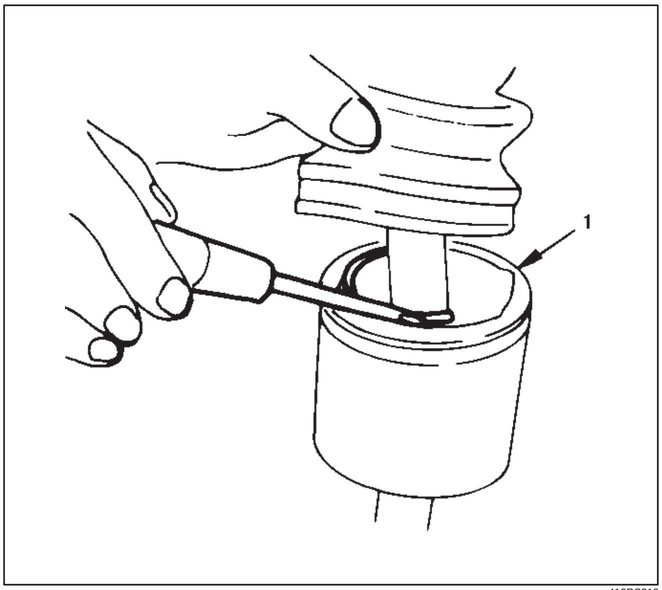
NOTE: For the left side, follow the same steps as right side.

1. Raise the hooked end of the band (1) with a screwdriver or equivalent.



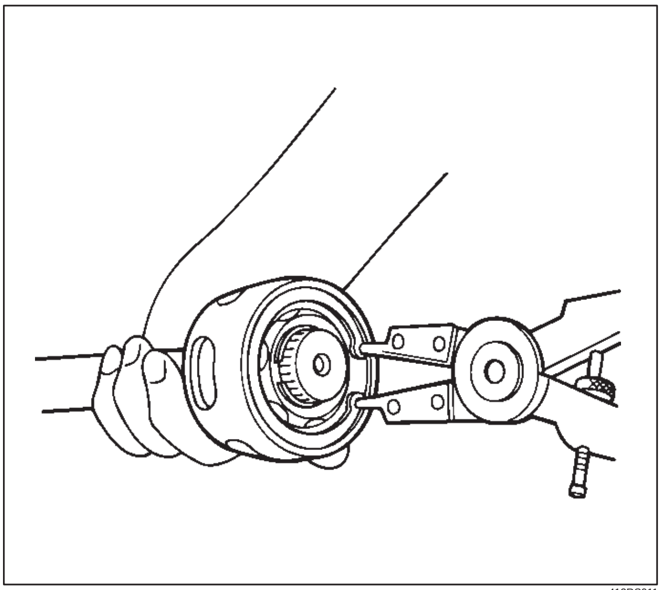
412RS009

2. Remove band.
3. Pry off circlip (1) with a screwdriver or equivalent.

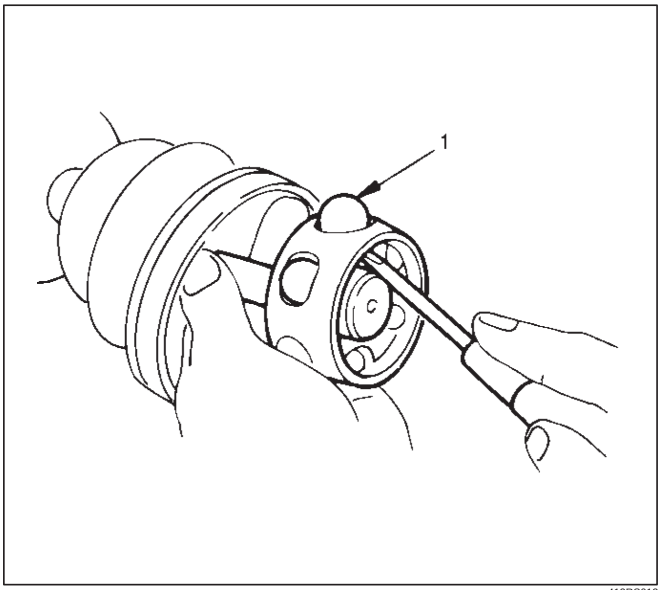


412RS010

4. Remove drive shaft joint assembly.
5. Using snap ring pliers, remove the snap ring.

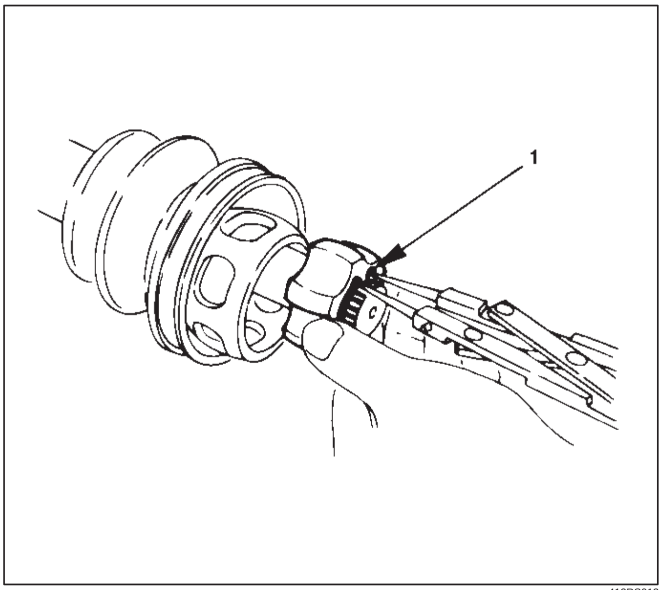

412RS011

6. Remove spacer.
7. Remove the six balls (1) with a screwdriver or equivalent.



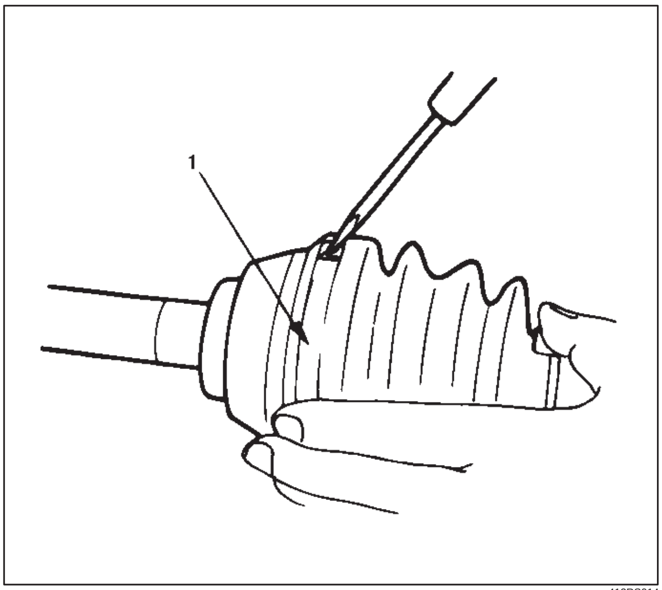
412RS012

8. Using snap ring pliers, remove the snap ring (1) fastening the ball retainer to the center shaft.



412RS013

9. Remove ball retainer, ball guide and bellows.
10. Raise the hooked end of the band (1) with a screwdriver or equivalent.



412RS014

11. Remove band.
12. Remove bellows.
13. Remove dust seal.
14. Remove BJ shaft assembly.
15. Remove the mounting bracket fixing bolts, and then remove DOJ case assembly from the axle case.
16. Remove snap ring and bearing.
17. Remove snap ring and oil seal.
18. Remove bracket.

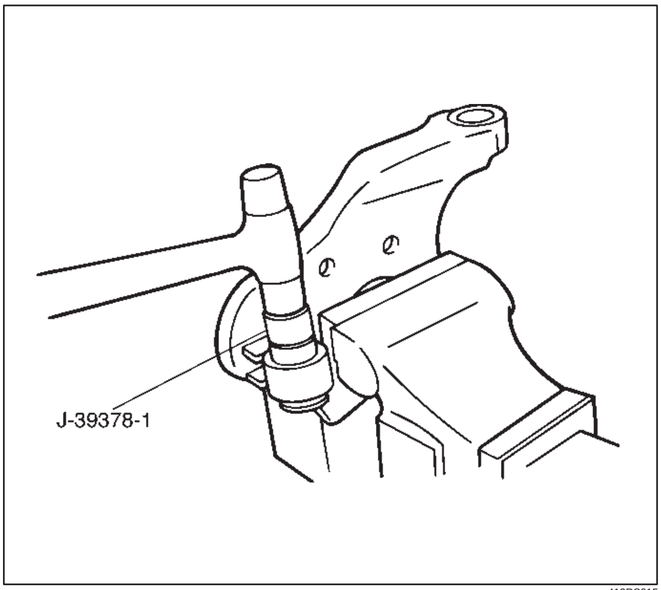
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

1. Drive shaft joint assembly
2. DOJ case, ball, ball guide, ball retainer
3. Bellows
4. Bearing
5. Dust seal, oil seal

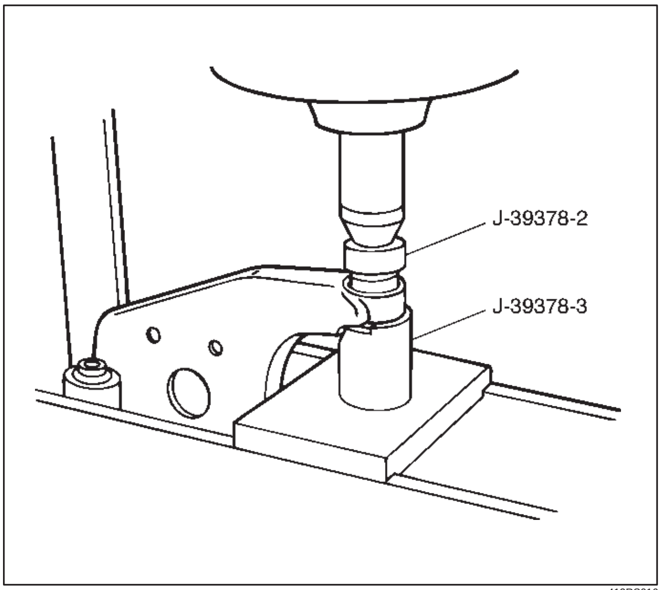
Bushing Replacement

- Remove the bushings using a remover J–39378–1 and hammer.



412RS015

- By using installer J–39378–2 and base J–39378–3, press fit the bushings into the bracket.



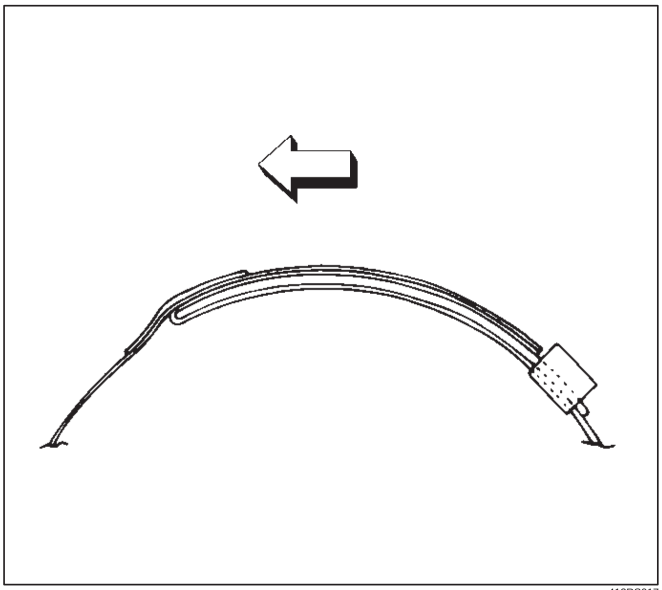
412RS016

Reassembly

1. Install DOJ case to bracket.
2. Install oil seal and fix snap ring.
3. Install bearing and fix snap ring.
4. Install bracket to axle case. Tighten the bracket bolt to the specified torque.

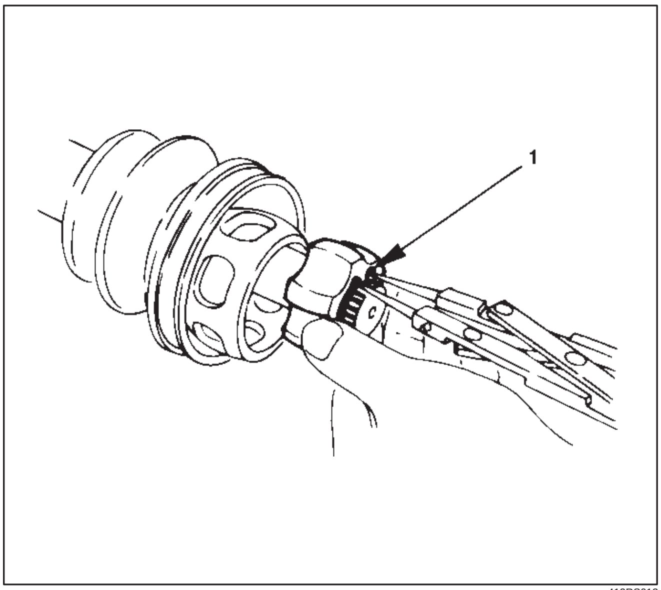
Torque: 116 N·m (85 lb ft)

5. Apply 150g of the specified grease in BJ .
6. Install dust seal .
7. Apply a thin coat of grease to the shaft for smooth installation then install bellows.
8. Install band. Note the setting direction. After installation, check that the bellows is free from distortion.



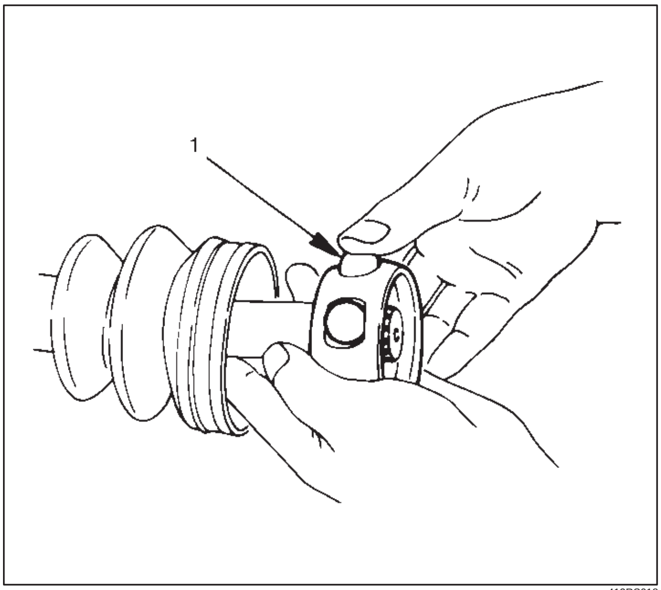
412RS017

9. Install another bellows and fix band.
10. Install the ball guide with the smaller diameter side ahead onto the shaft.
11. Install ball retainer.
12. Using snap ring pliers, install the snap ring (1) securing the ball retainer to the shaft.



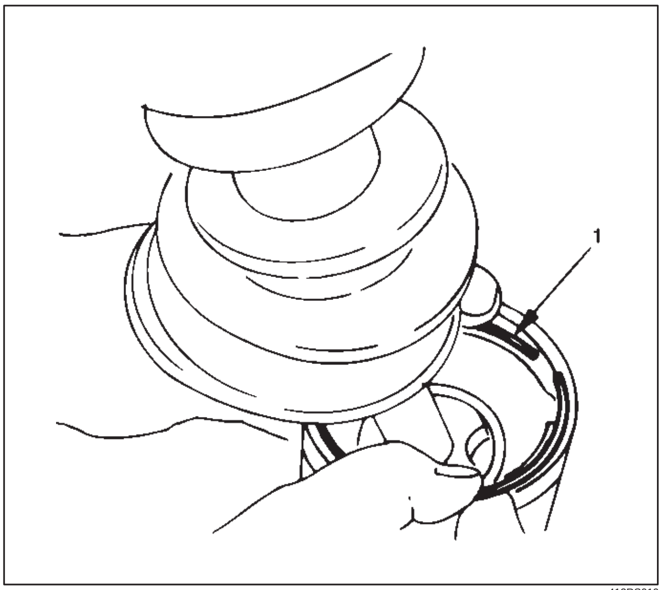
412RS013

13. Align the track on the ball (1) retainer with the window in the cage, and install the six balls into position.

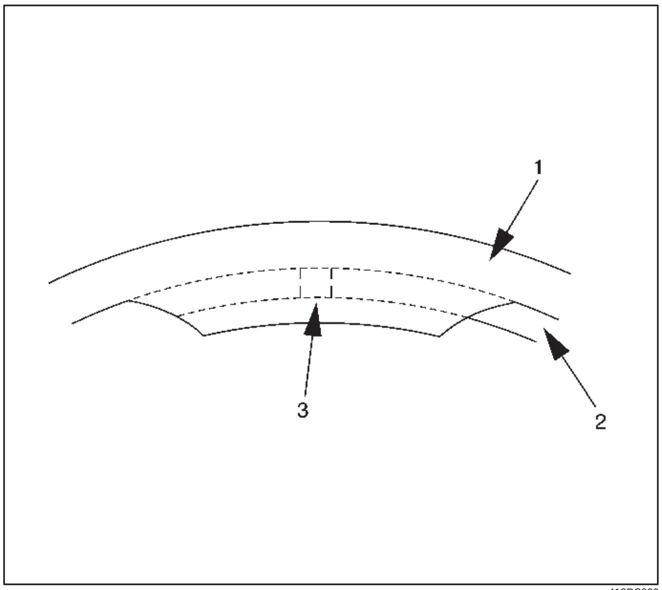


412RS018

14. Install spacer.
15. Install snap ring.
16. Enclose 150g of the specified grease in DOJ case, then install drive shaft joint assembly. After reassembly, move the DOJ longitudinally several times to get to fit.
17. Install the circlip (1) so that open ends are positioned away from the ball groove.



412RS019

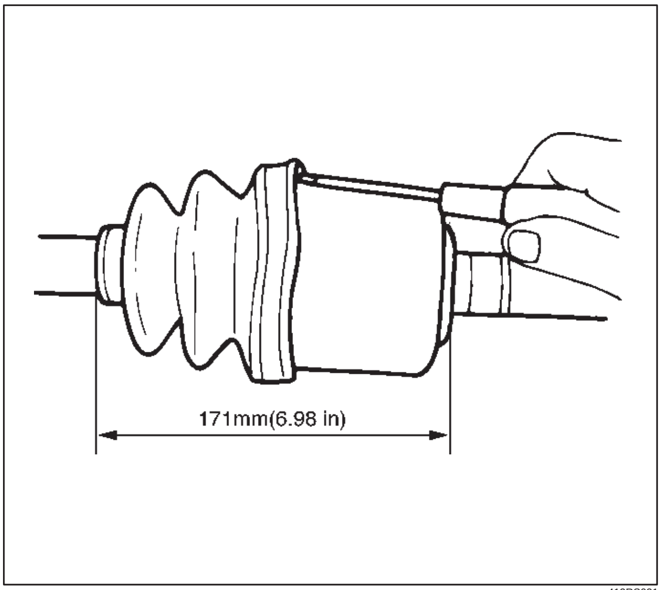


412RS020

Legend

(1) Outer Case
(2) Circlip
(3) Open Ends

18. Install bellows. Adjust the air pressure within the bellows by inserting a screwdriver or equivalent, so that it equals atmospheric pressure.

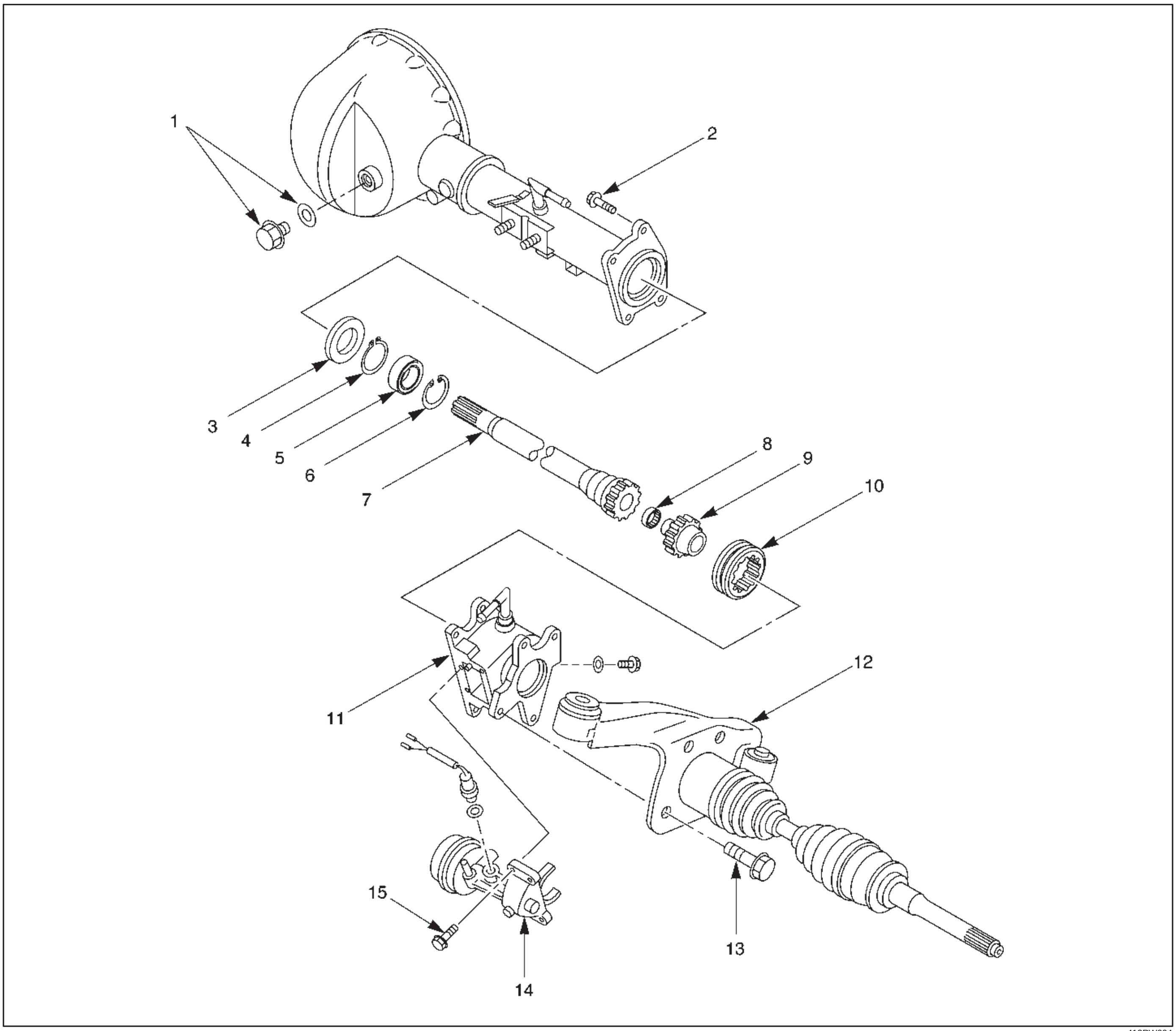


412RS021

19. Install Band. After installation, check that the bellows is free from distortion.

Shift On The Fly System

Shift On The Fly System and Associated Parts

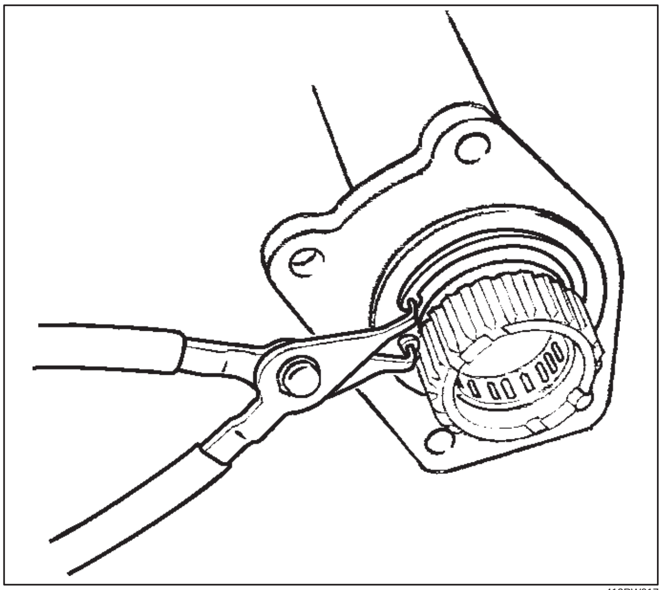


Legend
- (1) Filler Plug
- (2) Bolt
- (3) Oil Seal
- (4) Snap Ring(External)
- (5) Inner Shaft Bearing
- (6) Snap Ring(Internal)
- (7) Inner Shaft
- (8) Needle Bearing
- (9) Clutch Gear
- (10) Sleeve
- (11) Housing
- (12) Front Axle Drive Shaft (LH side)with Bracket
- (13) Bolt
- (14) Actuator Assembly
- (15) Bolt

Disassembly

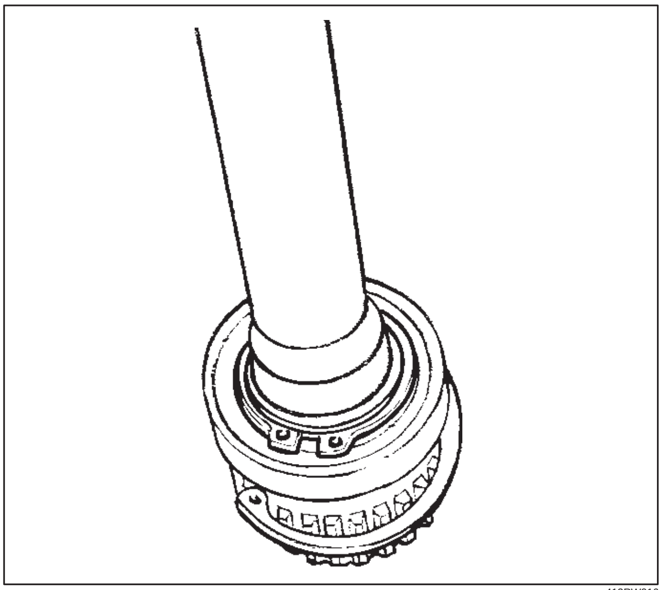
1. Remove filler plug and gasket, drain oil.
2. Loosen mounting bracket fitting bolts and remove front axle drive shaft from front axle case.
3. Remove Actuator Assembly and draw out actuator ASM.
4. Remove housing.
5. Remove sleeve.

6. Remove clutch gear.
7. Remove snap ring from front axle case by using snap ring pliers.



412RW017

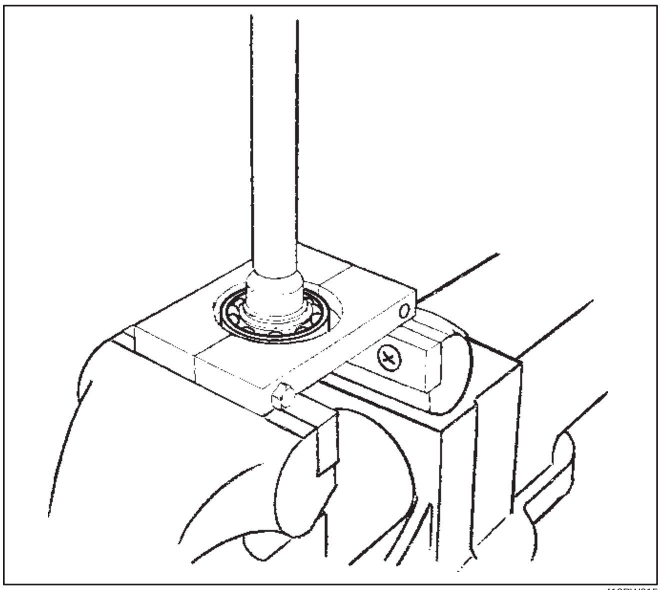
8. Take out inner shaft from front axle case.
9. Remove snap ring from inner shaft by using snap ring pliers.



412RW016

10. Remove inner shaft bearing by using a remover J–37452 and press.

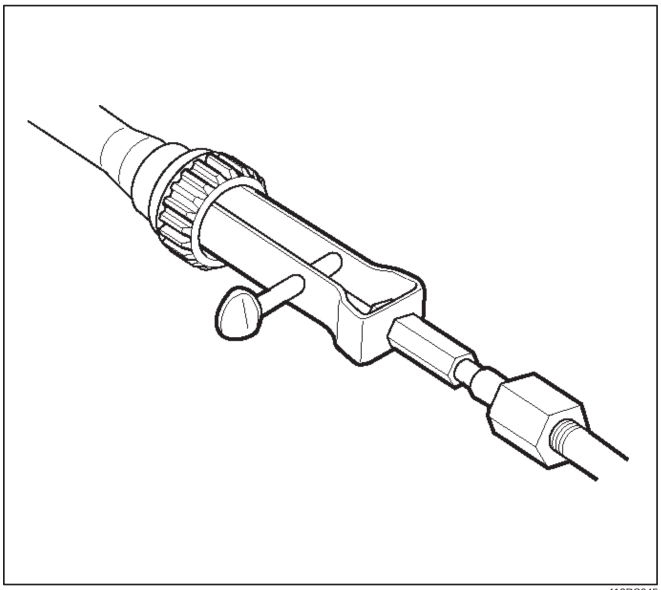
NOTE: Be careful not to damage the shaft.



412RW015

11. Remove needle bearing from inner shaft by using a remover J–26941 and sliding hammer J–2619–01.

NOTE: Be careful not to damage the shaft.



412RS045

12. Remove oil seal from front axle case.

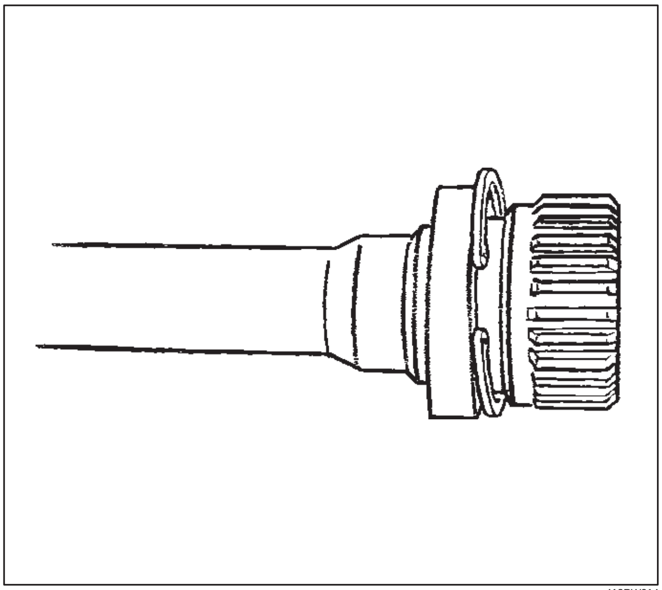
NOTE: Be careful not to damage the front axle case.

Inspection and Repair

Inspect the removed parts. If there are abnormalities such as wear and damage, take corrective action or replace.

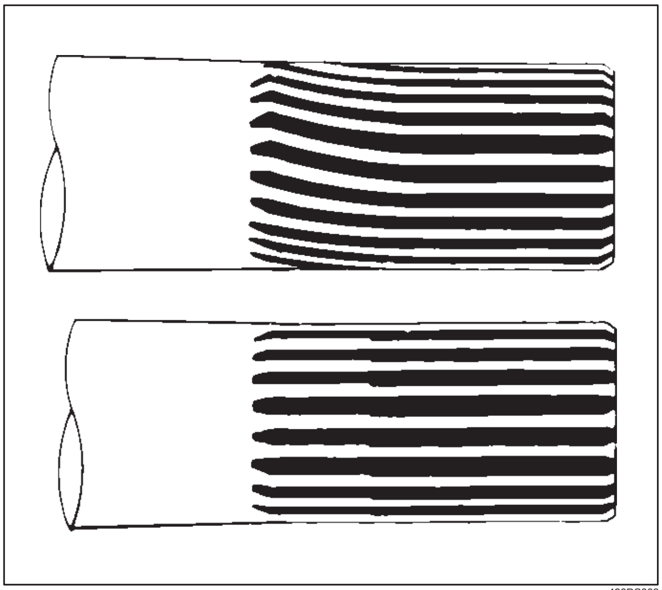
Visual Check

1. Check and see if the inner shaft has any abnormalities such as wear and damage.



412RW014

2. When inspecting the inner shaft, be sure to check and see if its splined part is twisted, worn, or cracked. If so, replace with a new shaft. In case of an abnormality in its gear part (a slide with sleeve), replace the shaft.



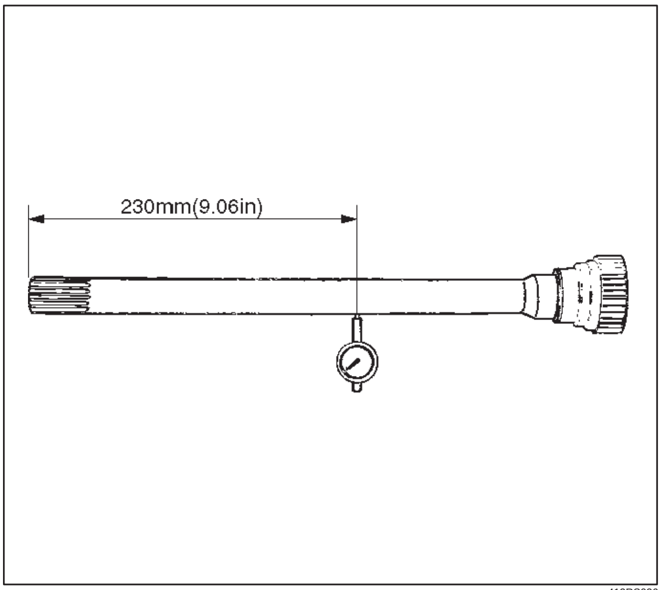
420RS008

Inner Shaft Run–Out

With both end centers supported, rotate the shaft slowly and measure deflection with a dial gauge.

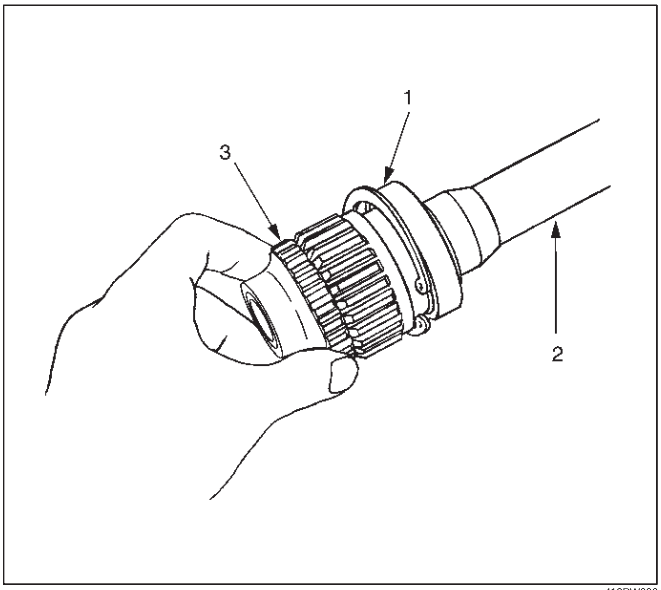
Limit: 0.5 mm (0.02 in)

NOTE: Do not heat the shaft to correct its bend.



412RS026

Inner Shaft Bearing



412RW006

Legend

(1) Inner Shaft Bearing
(2) Inner Shaft
(3) Clutch Gear

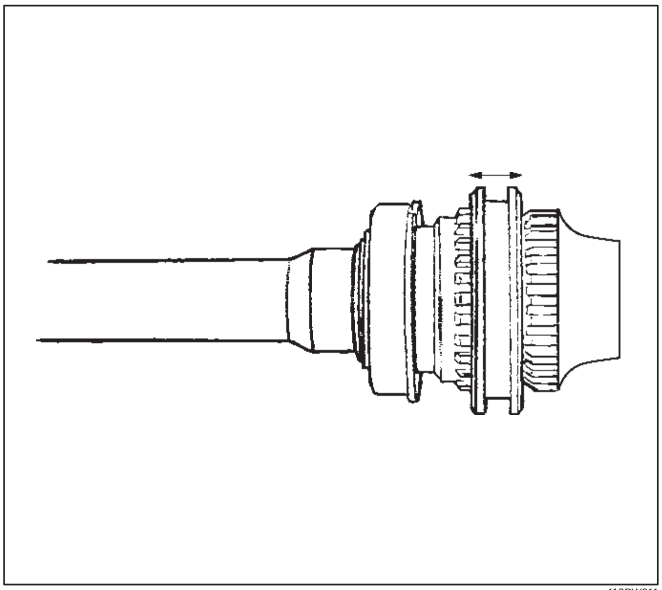
1. Inspect the state of inner shaft bearing. If any abnormality such as roughness is found, replace with a new inner shaft bearing.
2. Insert a clutch gear and check the state of needle bearing.
3. If there is an abnormality such as roughness, replace the needle bearing.

Sleeve Condition

Check and see that there is no wear, damage, or cracking in the sleeve.

NOTE: Close inspection of the groove and inner gear are required because those are important parts.

Sleeve Function



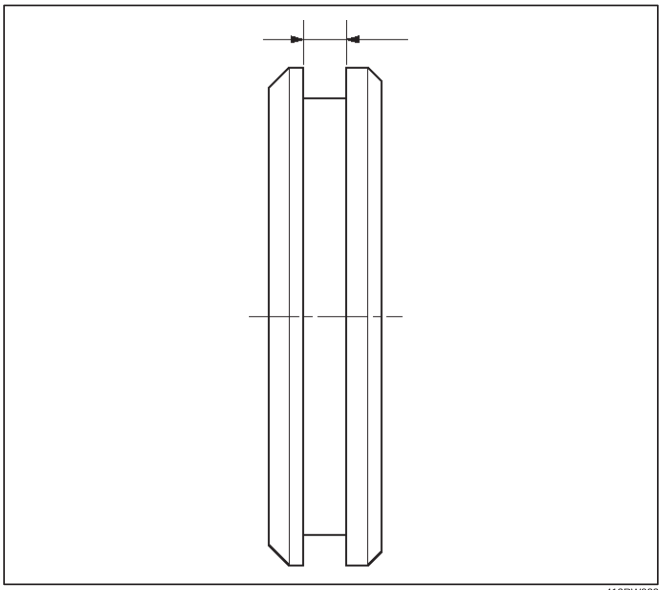
412RW011

Operate the sleeve with the inner shaft combined with the clutch gear. If roughness is felt, replace the sleeve.

NOTE: Gear oil should be applied to the contact surface of gear.

Check the width of sleeve center groove.

Limit: 7.1 mm (1.28 in)

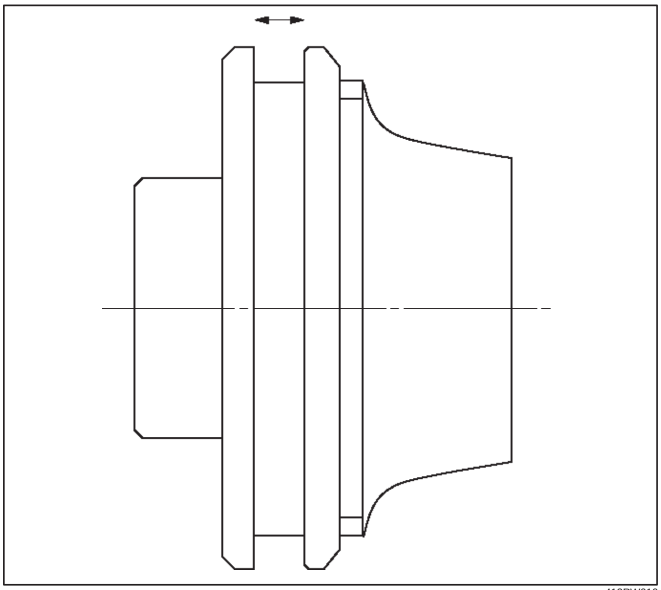


412RW022

Clutch Gear Condition

Check and see that there is no wear, damage, cracking, or any other abnormality in the clutch gear.

Clutch Gear Function



412RW010

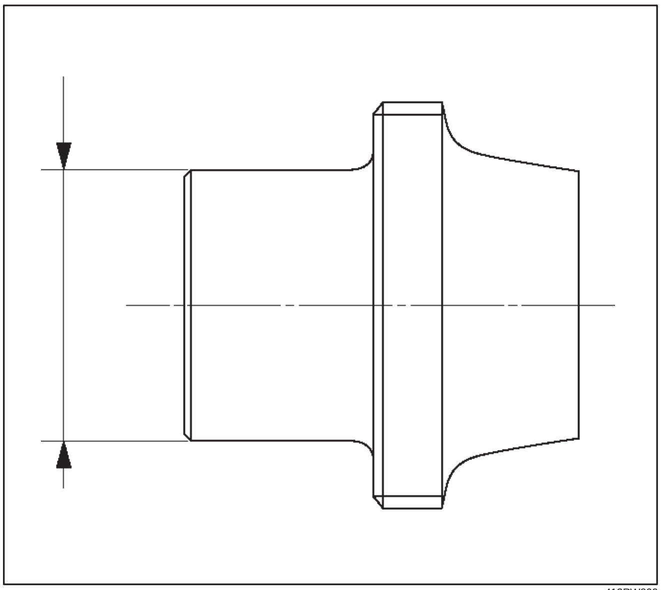
If there is an abnormality such as roughness when operated in combination with sleeve, replace the clutch gear.

NOTE: When inspecting, gear oil should be applied to the contact surface of gear.

Clutch Gear Journal Diameter

Make sure of the size illustrated.

Limit: 36.98 mm (1.456 in)

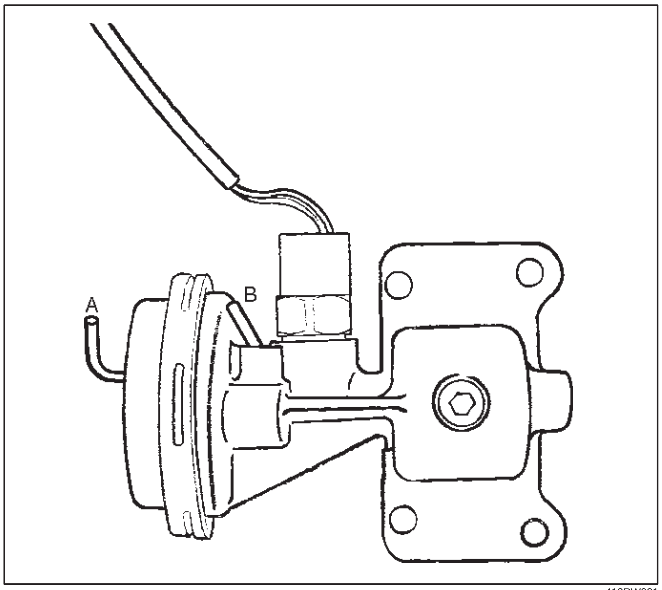


412RW009

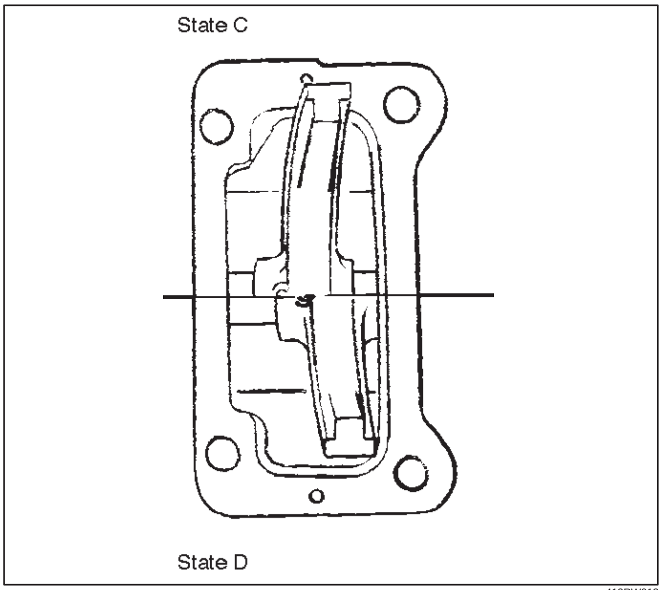
Actuator

Check and see that there is no damage, cracking, or other abnormality.

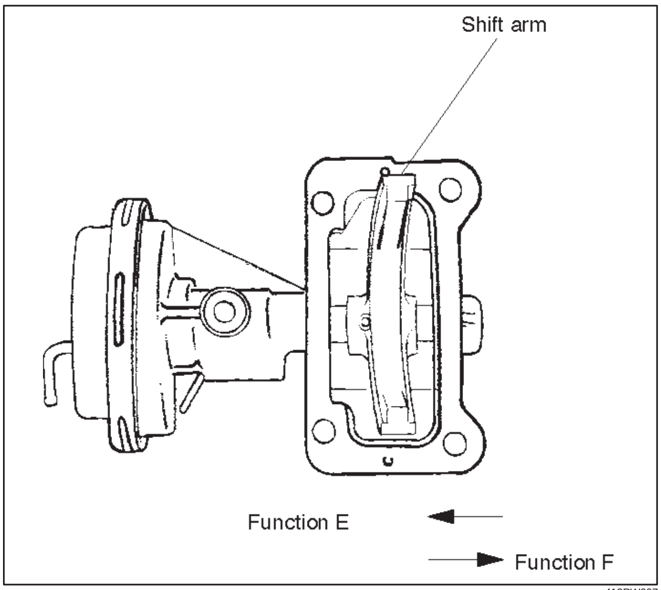
Functional Check



412RW021



412RW013



412RW007

Disconnect the shift position switch and make sure of function with a vacuum of –400 mmHg applied to Ports A and B, in accordance with the table below.

State	Port A	Port B	Function
C	–400 mmHg	A/P	E
D	A/P	–400 mmHg	F

If there is an abnormality, replace the actuator as an assembly.

NOTE:

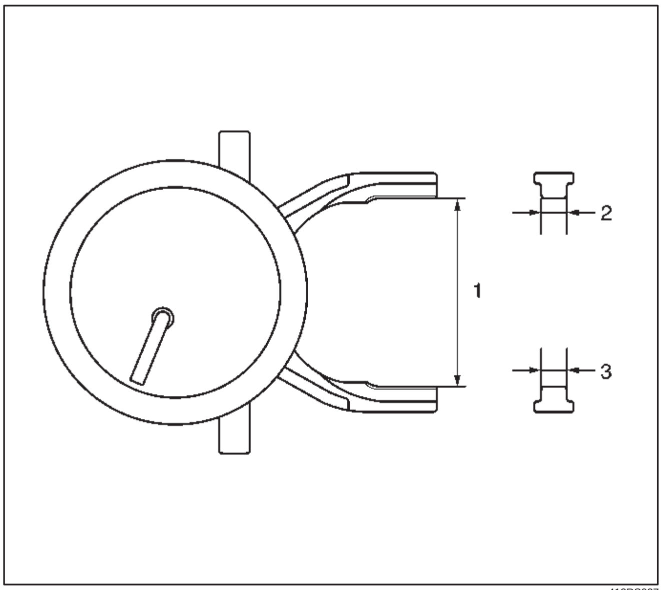
1. If the actuator works under –400mmHg or less, there is no functional problem.

2. Be careful not to permit the entry of water or dust into the ports of the actuator.

Dimensional Check

Measure illustrated sizes 1, 2, and 3.

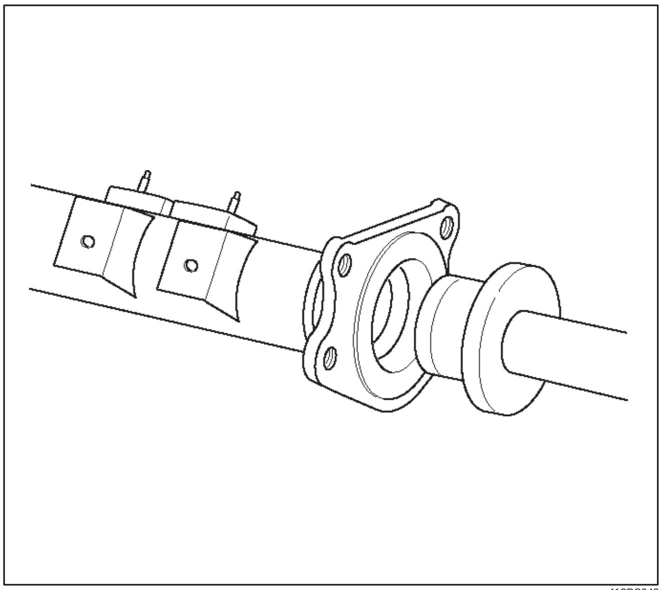
Limit
1=64.1 mm (2.52 in)
2=6.7 mm (0.26 in)
3=6.7 mm (0.26 in)



412RS037

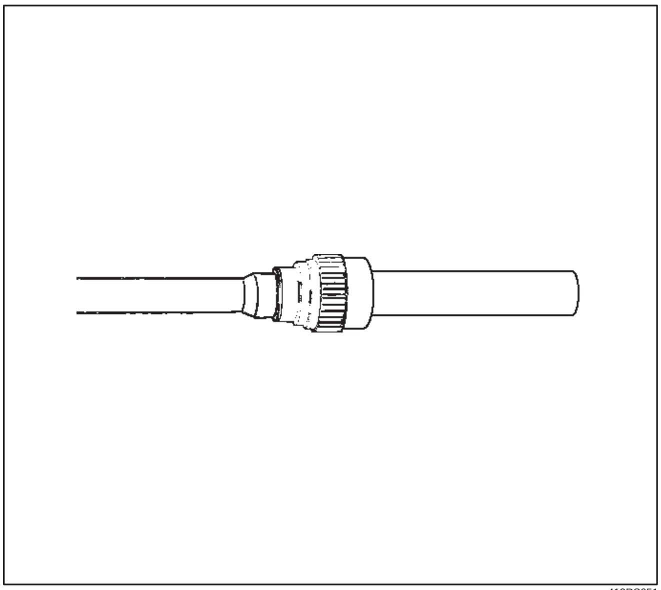
Reassembly

1. Install the new oil seal which has been immersed in differential gear oil, by using an oil seal installer J–41693 and grip J–8092.



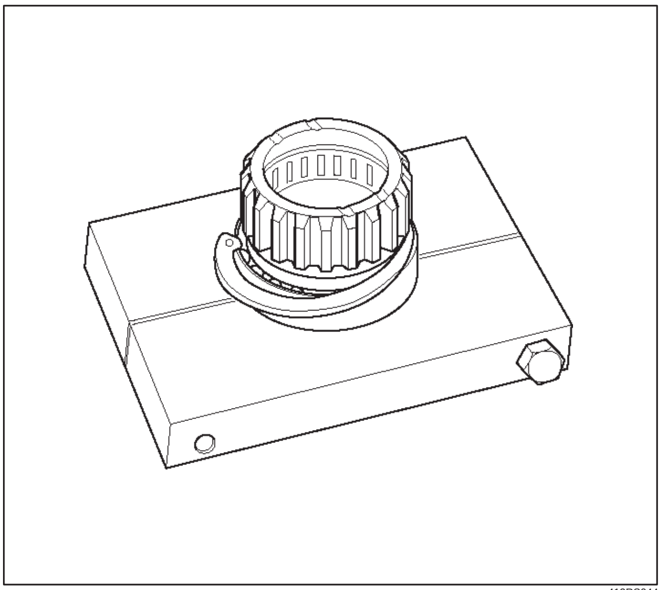
412RS043

2. Force a new needle bearing into inner shaft by using a installer J–41694 and grip J–8092.



412RS051

3. Place a new snap ring(internal) in inner shaft.
   Force a new inner shaft bearing into the inner shaft by using a installer J–37452 and press.



412RS044

4. Install snap ring(external).

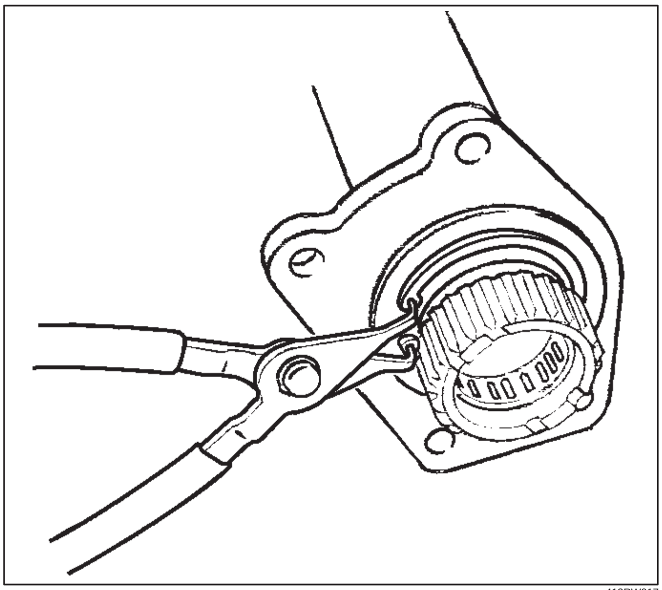
NOTE: Be careful not to damage the inner shaft.

5. Clean the housing contact surface of the front axle case and insert inner shaft assembly into the front axle case.

NOTE: Be careful not to damage seal.

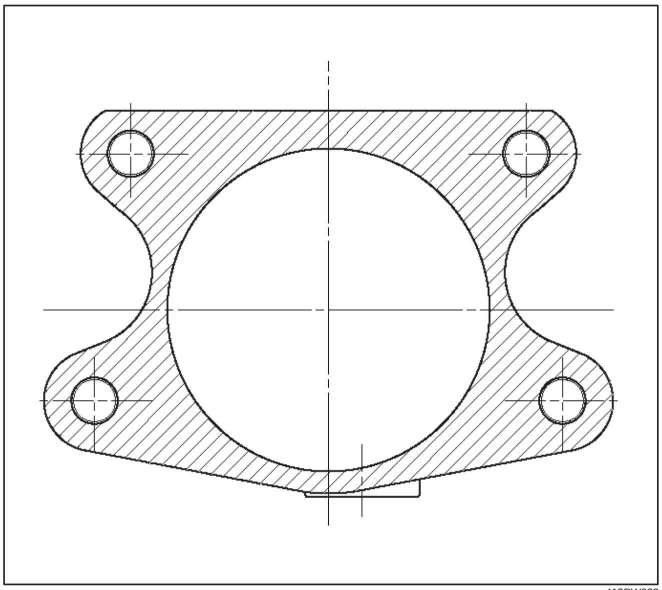
6. Install snap ring (internal) in the groove of front axle case.

NOTE: Be sure to install the snap ring properly.



412RW017

7. Apply differential gear oil to clutch gear, then install clutch gear.
8. Apply differential gear oil to sleeve, then install sleeve.
9. Clean contact surface with the front axle and actuator mounting surface. Apply liquid gasket to the contact surface on the front axle case, then install in the housing.



412RW023

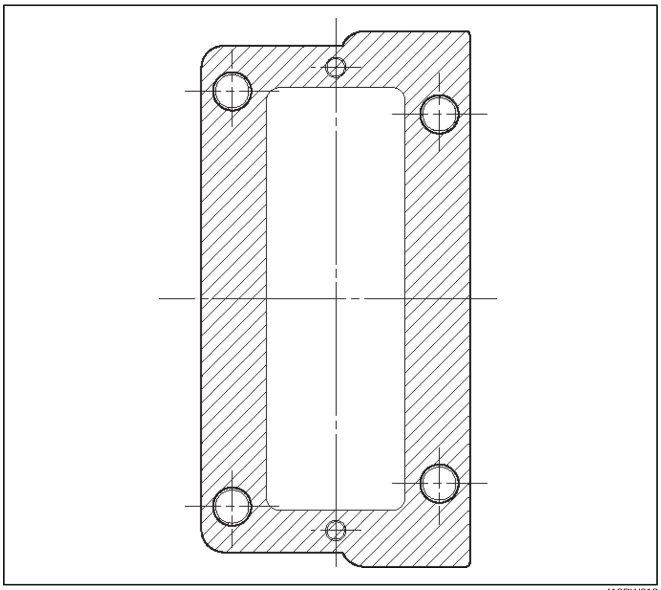
10. Tighten bolts to specified torque.

Torque: 116N·m(85 lb ft)

11. Clean the actuator contact surface with the housing then Install and tighten shift position switch to specified torque.

Torque: 39N·m (29 lb ft)

12. Apply liquid gasket to the contact surface on the actuator side.



412RW012

13. Align shift arm with the groove of sleeve and install the actuator.
14. Tighten bolts to specified torque.

Torque: 13N·m(113 lb ft)

15. Install front axle drive shaft and mounting bracket. Tighten fitting bolts to specified torque.

Torque: 116N·m (85 lb ft)

16. Pour specified amount of differential gear oil to filler plug.

Front Differential

Oil Capacity: 1.4lit (1.48US qt)

Actuator Housing

Oil Capacity: 0.12lit(0.13US qt)

17. Install filler plug through gasket and tighten to specified torque.

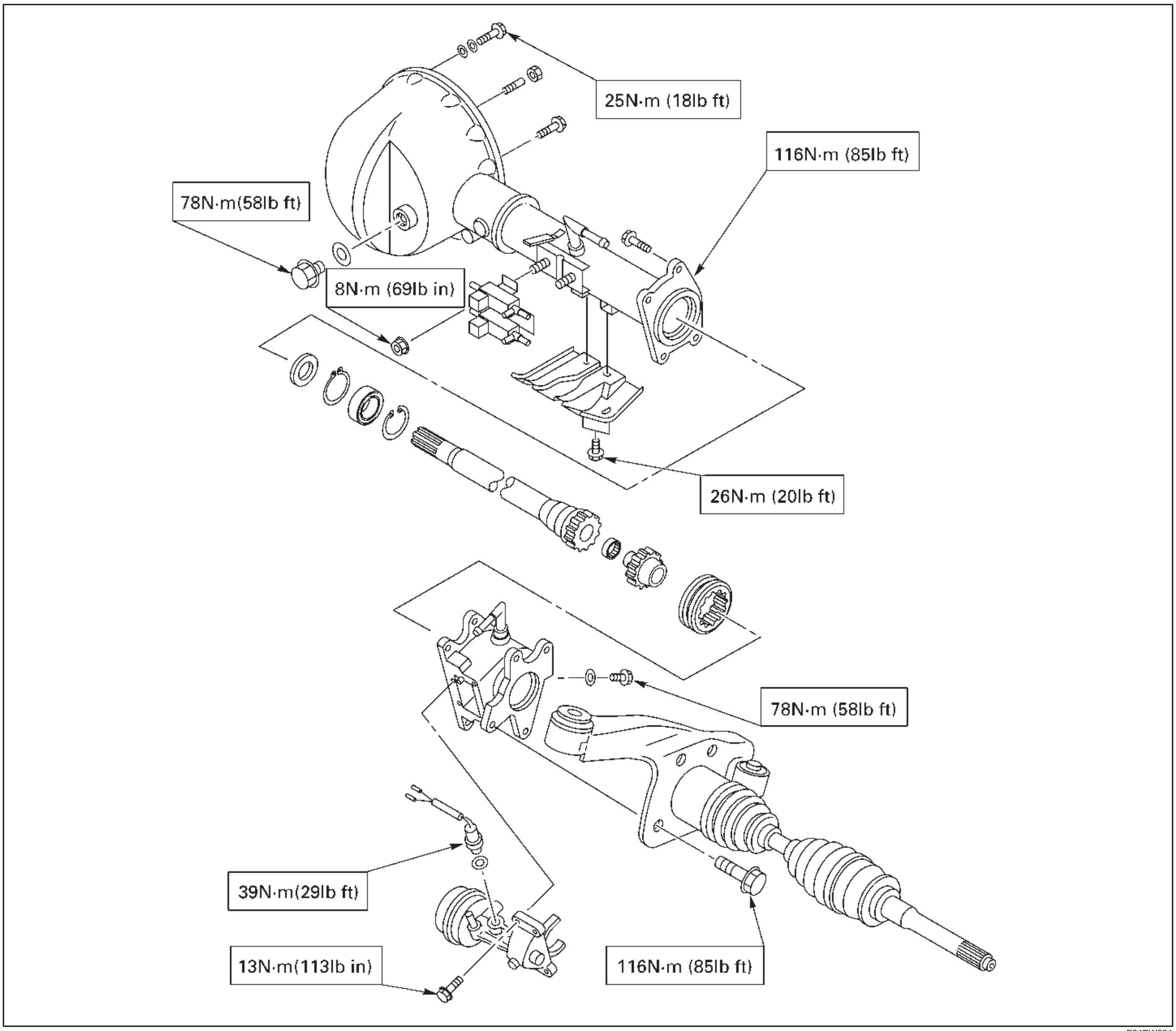
Torque: 7.8N·m (58lb ft)

Main Data and Specifications

General Specifications

Front drive axle oil capacity	1.4 liter (1.48 US qt)(Differential)
	0.12 liter (0.13 US qt)(Actuator Housing:Shift on the fly)
Type of lubricant	GL–5 (Multi grade type) Refer to chart in General Information
Axle shaft type	Constant velocity joint(Birfield joint type and double offset joint)

Torque Specifications



E04RW004

Special Tools

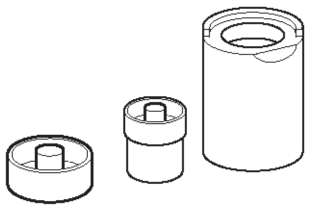
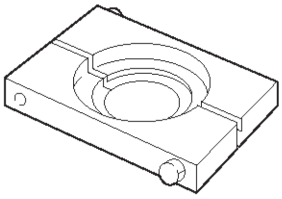
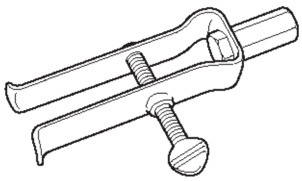
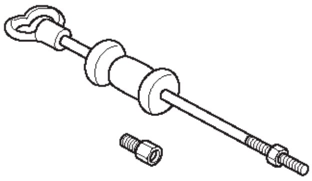
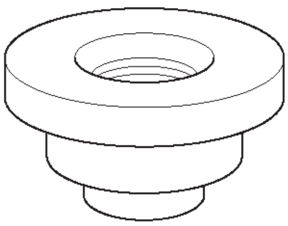
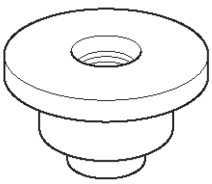
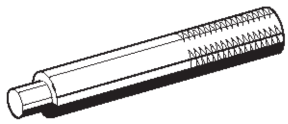
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–39378** Remover and Installer; Front Axle mount bushing
	**J–37452** Remover and Installer; Inner shaft bearing
	**J– 26941** Remover;Bearing needle
	**J–2619–01** Hammer; Sliding
	**J–41693** Installer; Oil seal
	**J–41694** Installer; Bearing needle

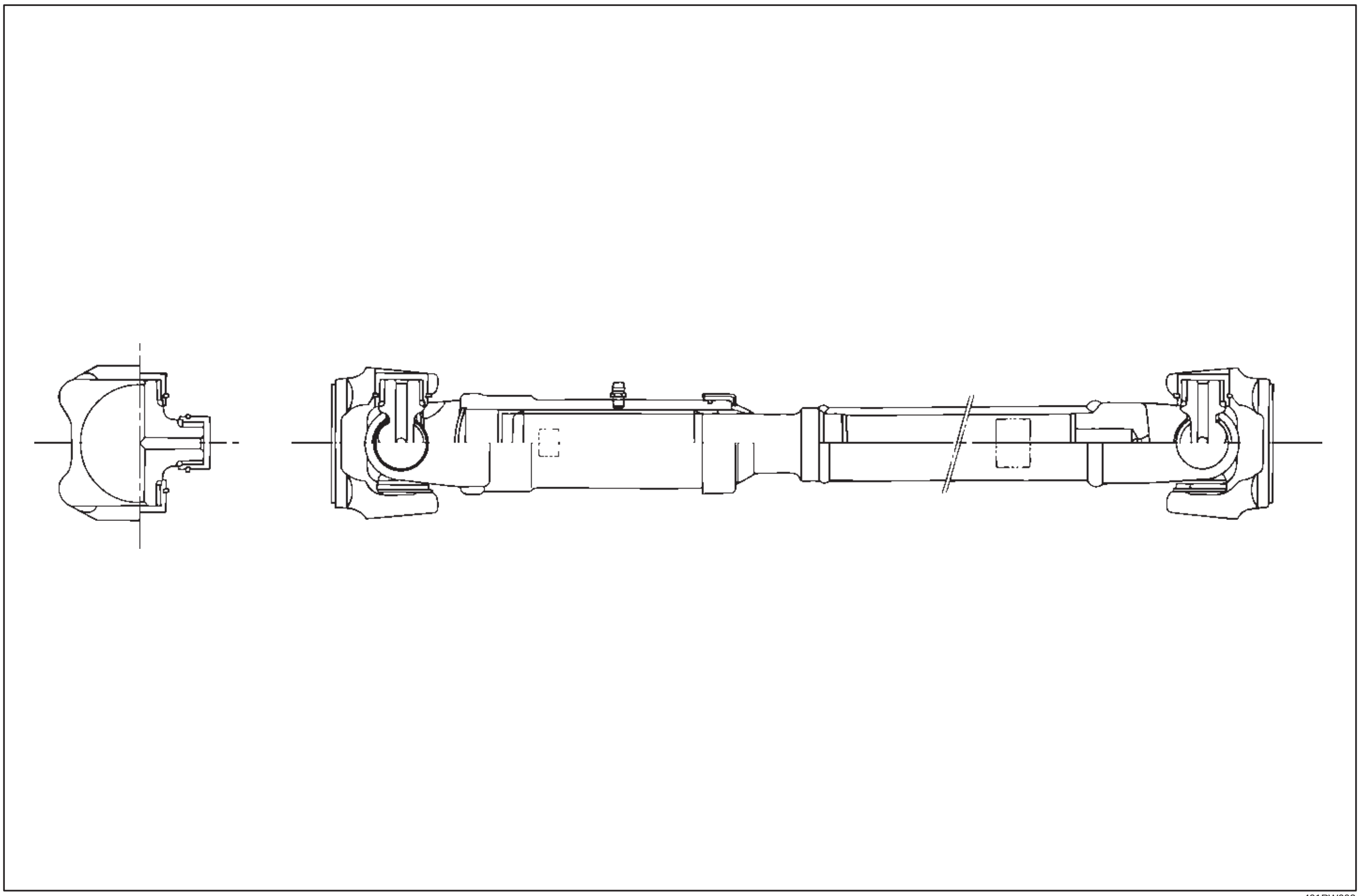
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–8092** Grip

Front Propeller Shaft

General Description

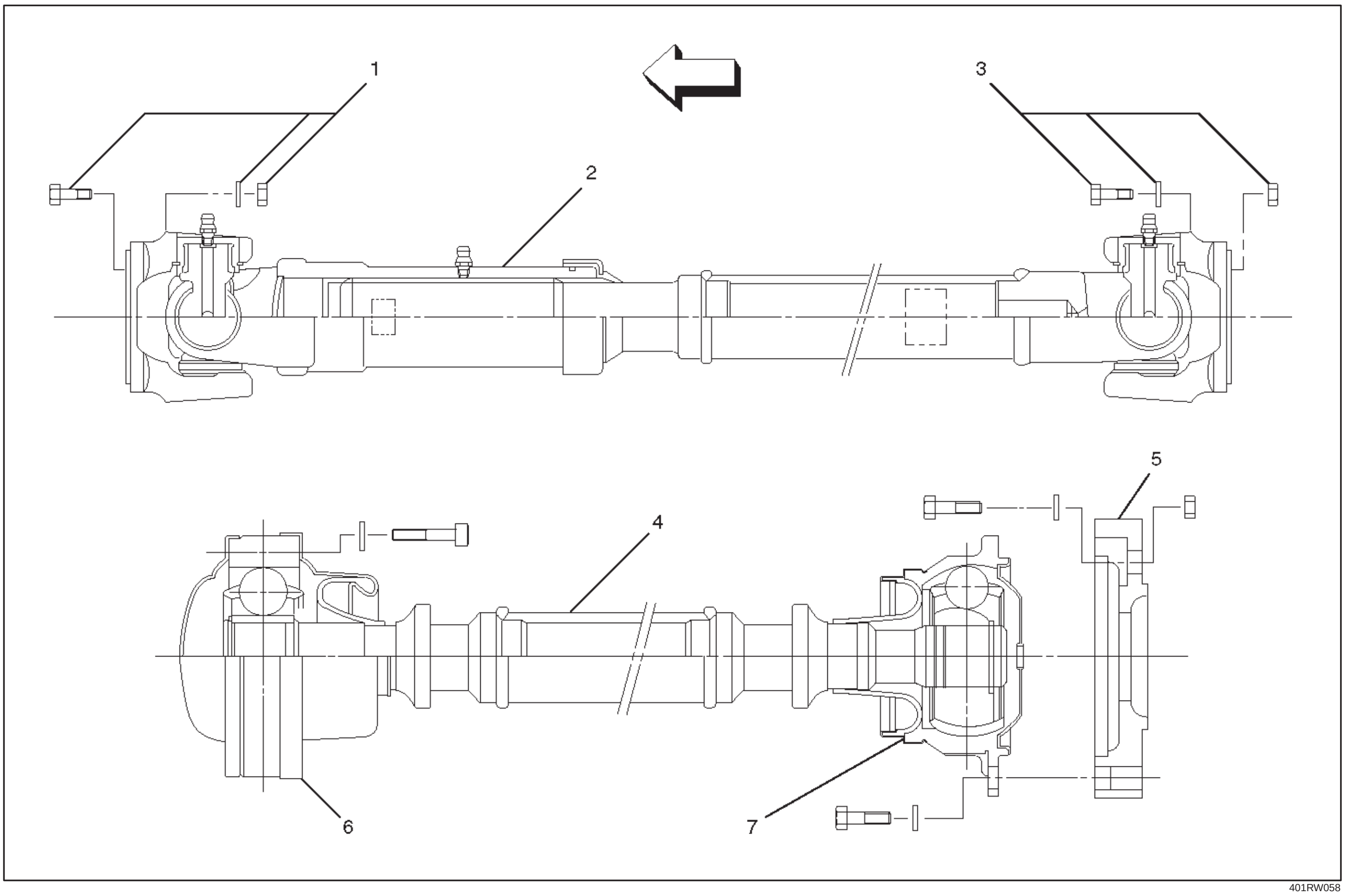
Since the propeller shaft is balanced carefully, welding or any other modifications are not permitted.

Alignment marks should be applied to each propeller shaft before removal.



401RW002

Front Propeller Shaft and Associated Parts



401RW058

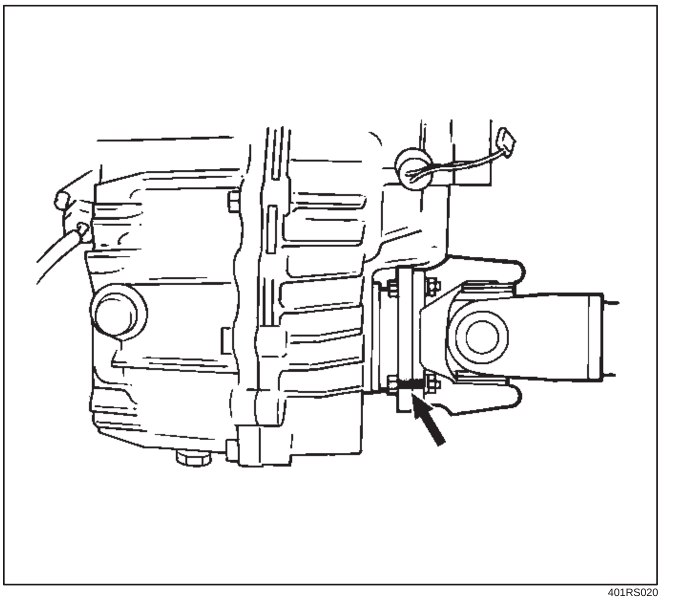
Legend

(1) Bolt, Nut and Washer (Front Axle Side)
(2) Front Propeller Shaft
(3) Bolt, Nut and Washer (Transfer Side)
(4) Front Propeller Shaft (with TOD)
(5) Coupling
(6) LJ Constant Velocity Joint
(7) BJ Constant Velocity Joint

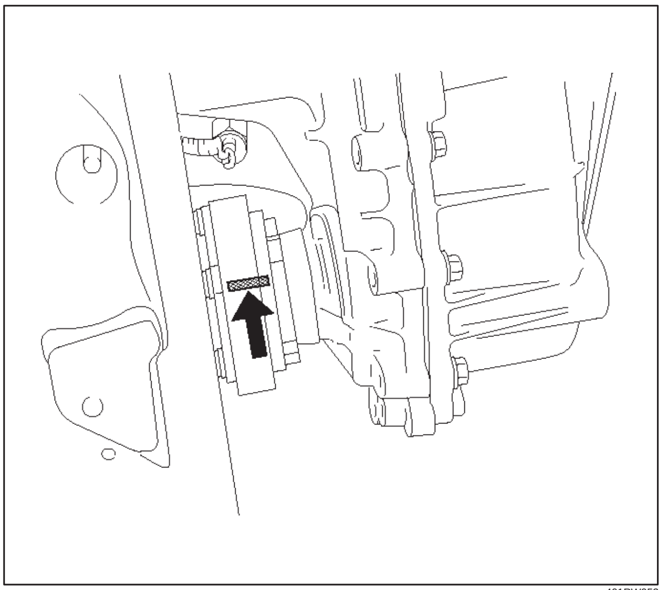
Removal

1. Jack up the vehicle and support it on the chassis stands.
2. Gear shift lever should be placed in neutral position and parking brake released.
3. Remove the exhaust and transfer protectors.

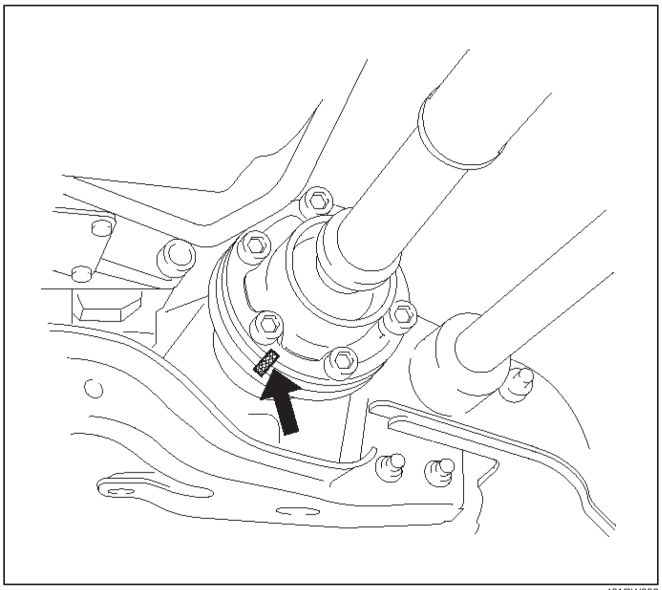
NOTE: Apply alignment marks on the flange at the front propeller shaft both front and rear side.



401RS020



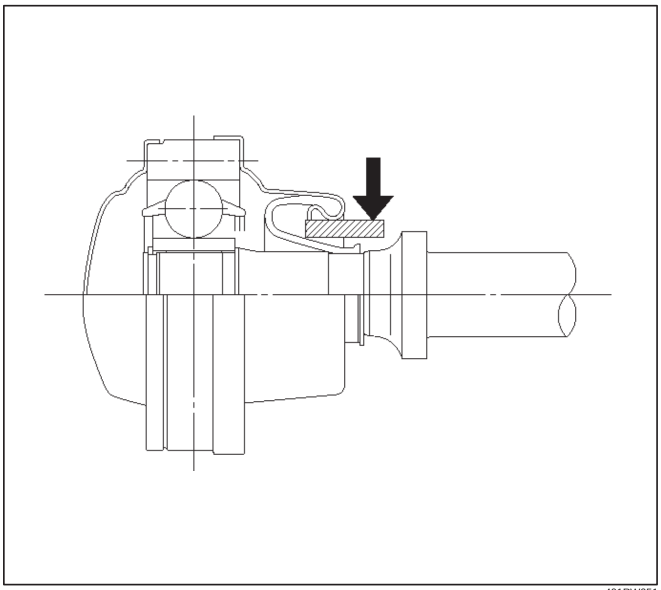
401RW053



401RW052

4. Remove bolt, nut and washer (Front axle side).
5. Remove bolt, nut and washer (Transfer side).
6. Remove front propeller shaft.

NOTE: If equipped with torque on demand (TOD), when removing, installing or carring for front propeller shaft, be sure to wind a piece of cloth round the part of the boot with which fittings may interfere so that the boot can be protected. The boot may be damaged if bending force is applied to the constant velocity joint of the shaft.



401RW051

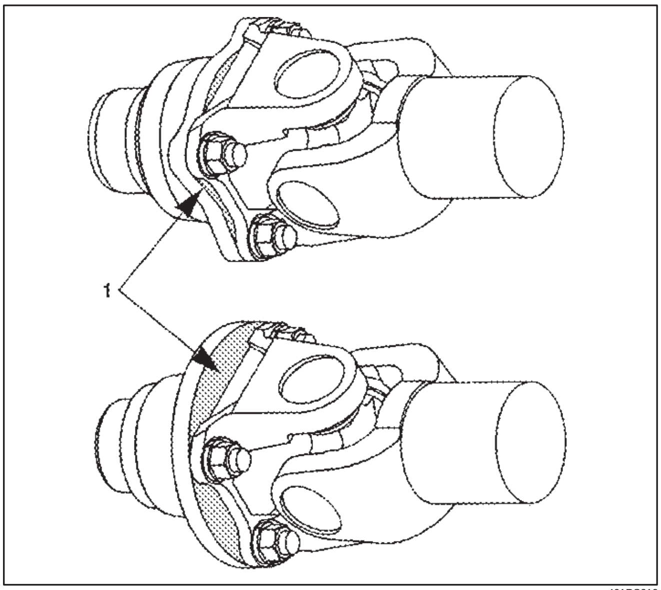
Installation

NOTE: Never install the shaft assembly backwards. Completely remove the black paint from the connecting surface of flange coupling on each end of propeller shaft. Clean so that no foreign matter will be caught in between.

1. Align the mark which was applied at removal. Install front propeller shaft and tighten the bolts to the specified torque.

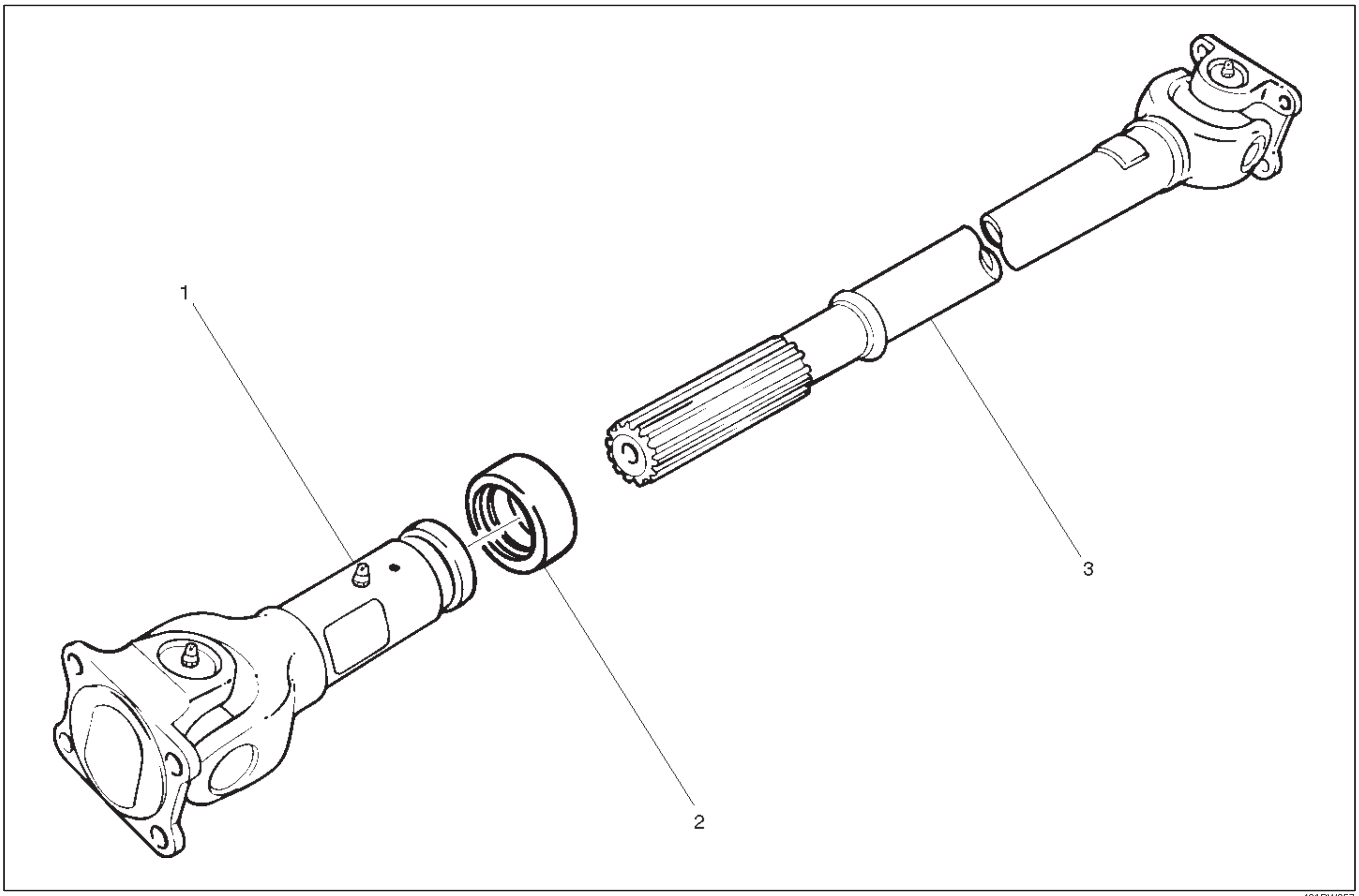
   Torque: 63 N·m (46 lb ft)

2. Install the exhaust and transfer protectors.
3. After installing the propeller shaft, be sure to apply black paint (1) to exposed area (other than connecting surface) of the entire surface of flange coupling .



401RS019

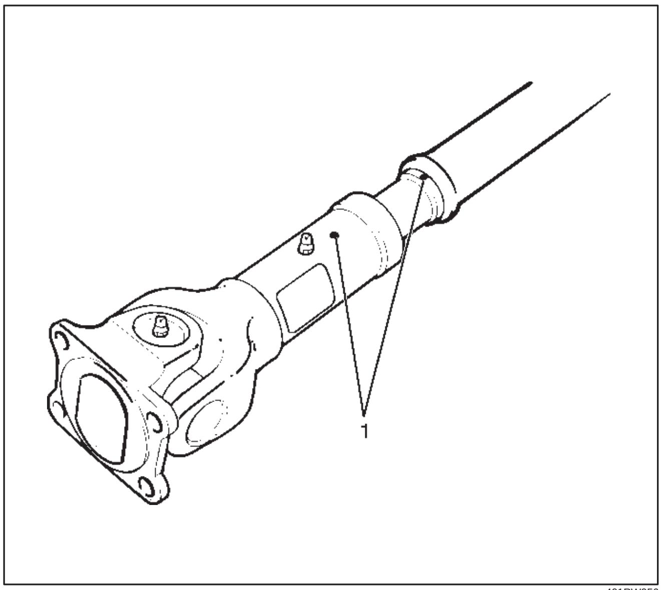
Disassembly (Except TOD 4×4)



Legend

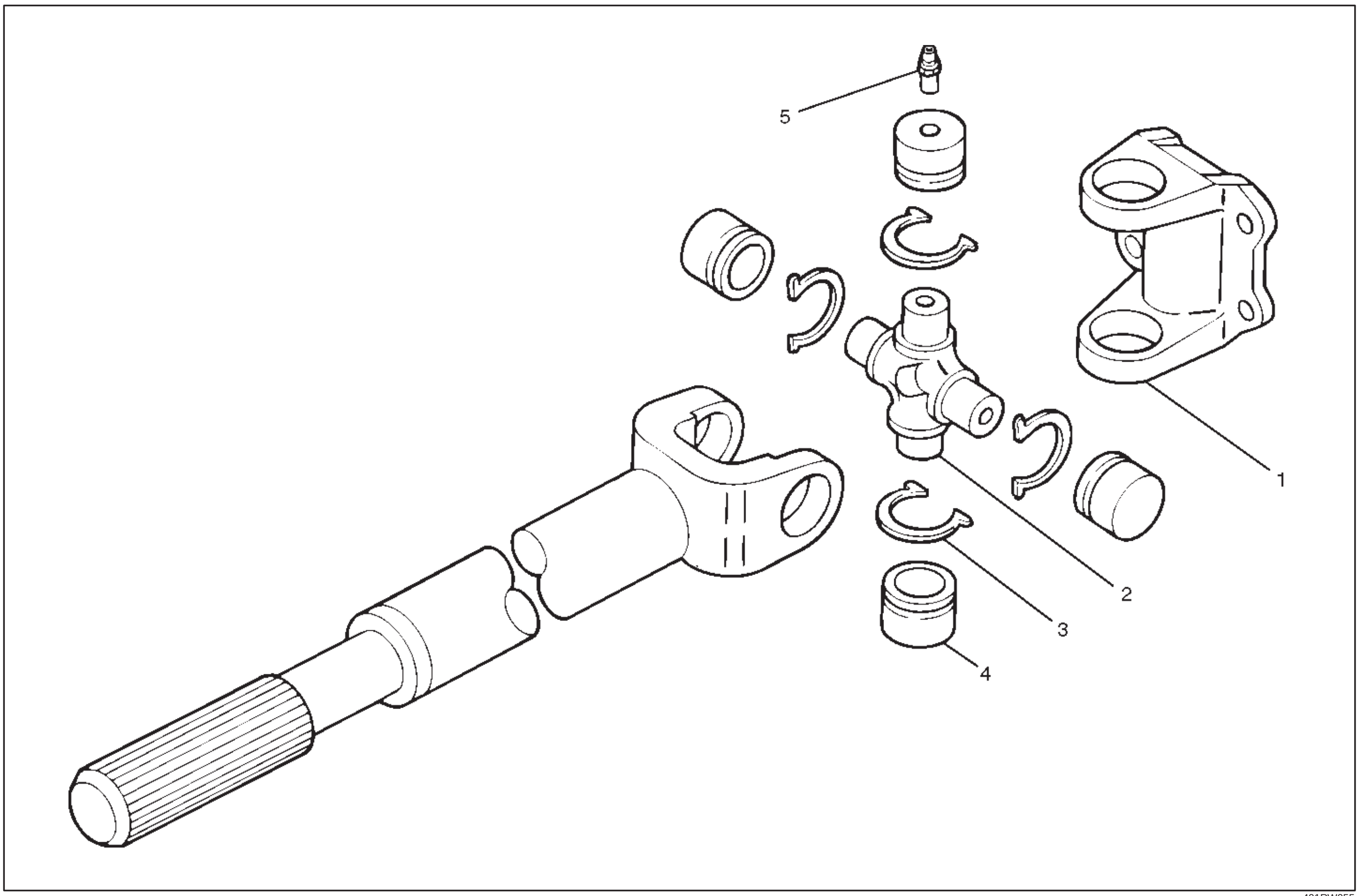
(1) Sleeve Yoke
(2) Seal
(3) Tube Assembly

1. Apply alignment marks (1) on the sleeve yoke and tube assembly then remove sleeve yoke.



2. Remove seal.
3. Remove tube assembly.

Universal Joint Disassembly

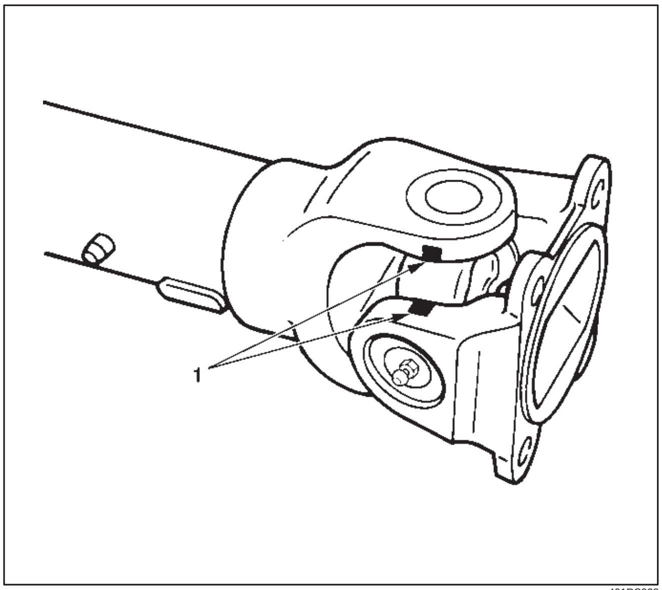


401RW055

Legend

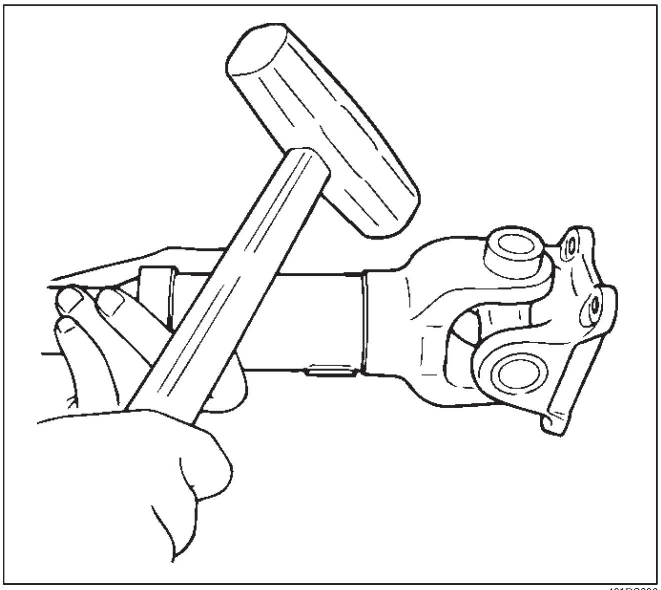
(1) Flange Yoke
(2) Spider
(3) Snap Ring
(4) Needle Roller Bearing
(5) Grease Fitting

1. Apply alignment marks (1) on the yokes of the universal joint, then remove snap ring.



401RS028

2. Tap out the needle roller bearing by gently striking the shoulder of the yoke, using a mallet or a copper hammer.



401RS006

3. Make sure of proper position for reinstallation by applying setting marks, then remove spider .

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition is found through inspection.

NOTE: When any part of the journal assembly (spider, needle roller bearing) requires replacement, be sure to replace the entire assembly.

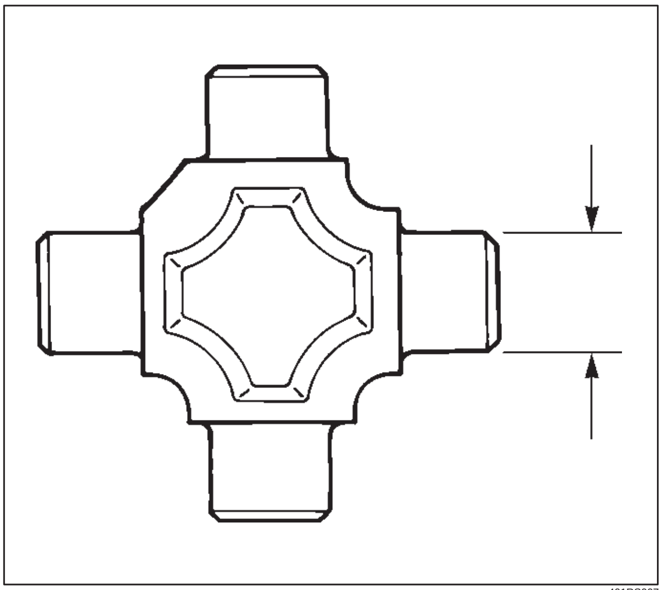
Check the following parts for wear, damage, noise or any other abnormal conditions:

1. Spider
2. Needle roller bearing
3. Yoke
4. Flange
5. Constant velocity joint

Outside Diameter of Spider Pin

Standard: 17.00 mm (0.669 in)

Limit: 16.90 mm (0.665 in)



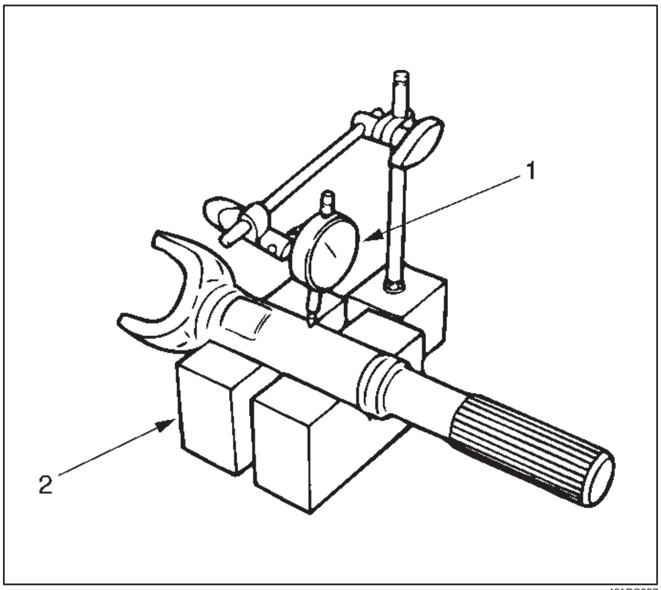
401RS007

Propeller Shaft Run–out

Support the ends of the propeller shaft on V-blocks (2) and check for run–out by holding the probe of a dial indicator (1) in contact with the center part of the shaft. If the amount of run–out is beyond the standard value for assembly, correct with a bench press or replace the shaft with a new propeller shaft assembly.

Standard: 0.3 mm (0.012 in)

Limit: 0.5 mm (0.02 in)



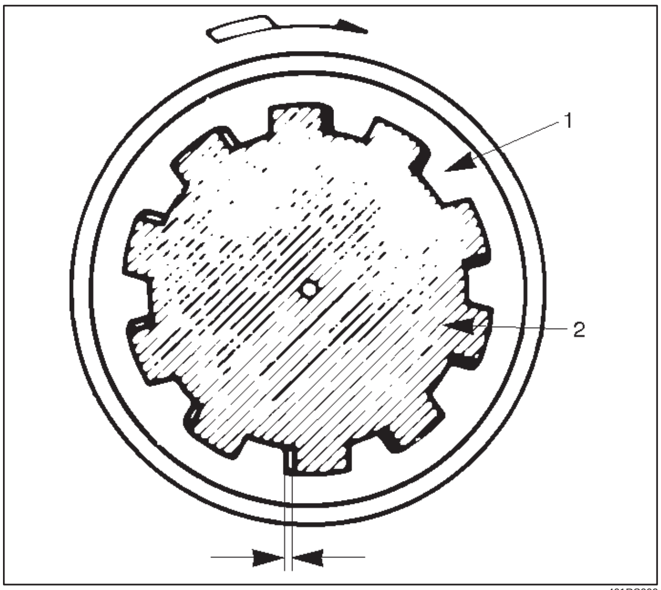
401RS027

Play in Splines in Normal Direction of Rotation

Check the amount of play between the sleeve yoke (1) and the propeller shaft spline (2) in the direction of rotation, using a pointed feeler gauge.

Standard: 0.073 – 0.156 mm (0.003 – 0.006 in)

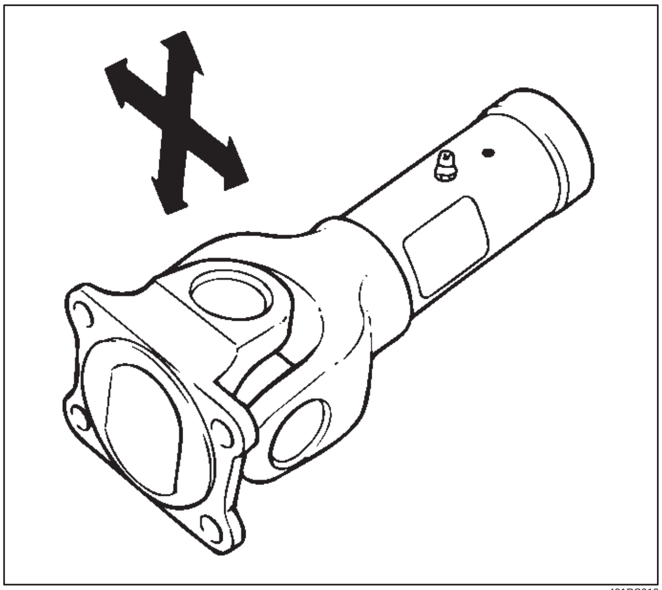
Limit: 0.3 mm (0.012 in)



401RS009

Play in Universal Joint

Limit: Less than 0.1 mm (0.004 in)



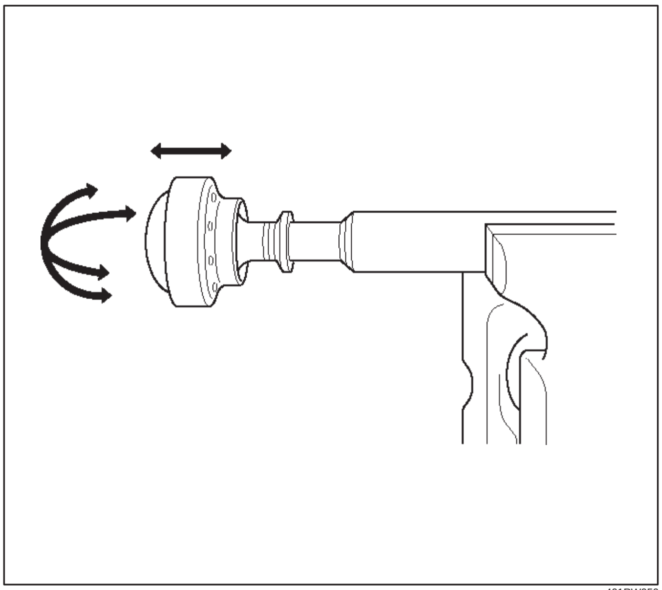
401RS010

Constant Velocity Joint

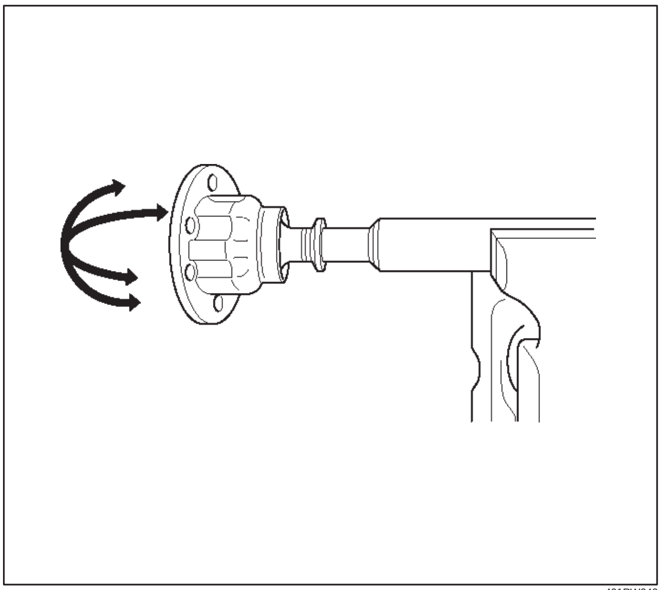
NOTE: LJ and BJ constant velocity joints are unremovable types. Check the joint for play and the boot for damage, wear, and leak of grease. If abnormality is found, replace propeller shaft as an assembly.

Play in Constant Velocity Joint

Fix the shaft in a vise throrgh pieces of wood, and try to move the joint vertically, right and left, and back and forth to make sure of smooth motions and no remarkable play.



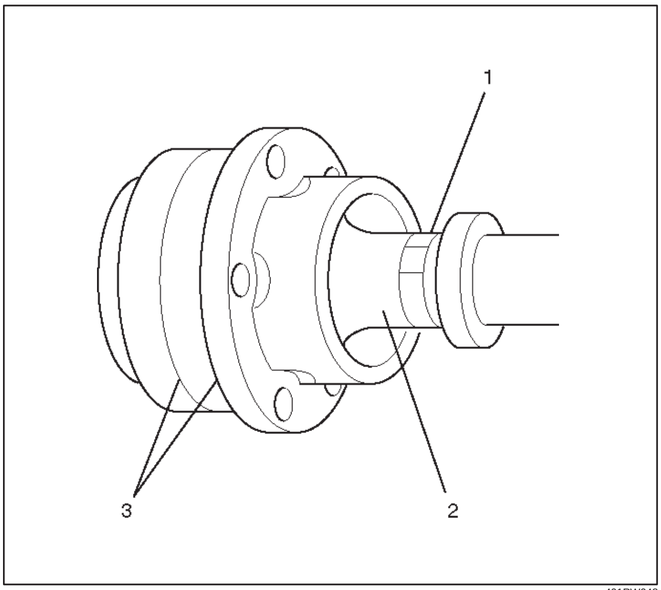
401RW050



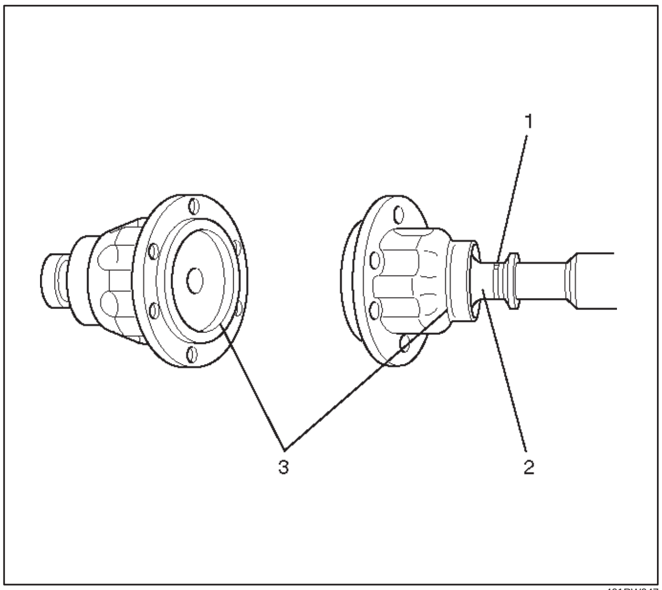
401RW049

Boot of Constant Velocity Joint

Check the boot (2) for crack, damage and grease leak, and the boot band (1) for loosening and damage. Check the both sides of the joint and make sure that there is no leak of grease from the cover press-in parts(3).



401RW048

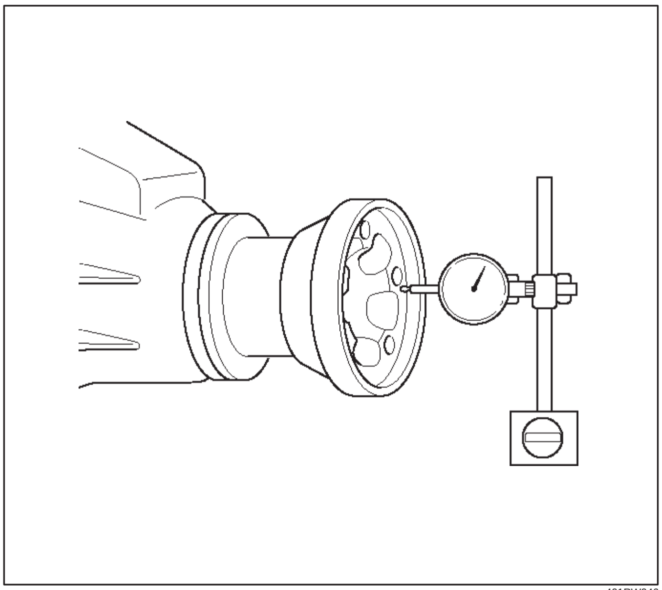


401RW047

Front Axle Flange Run-out

1. Set a dial gage at right angle near the outer circumference of the flange face and check the run-out of the flange face.

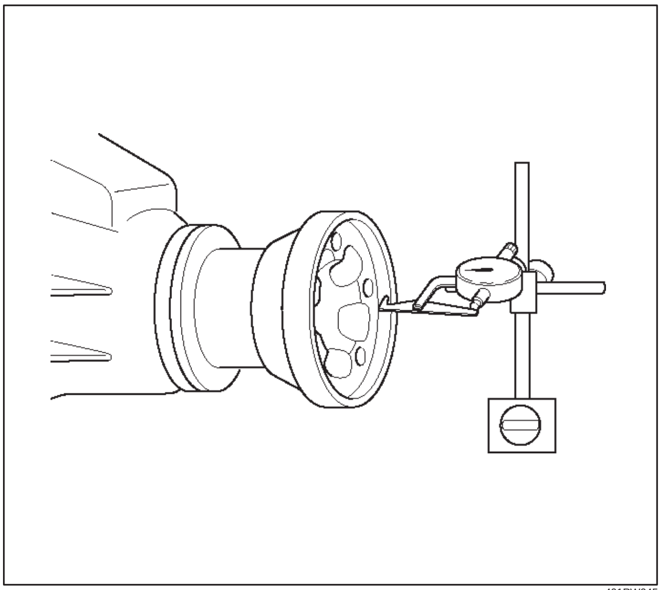
   Limit: 0.15 mm (0.006 in)



401RW046

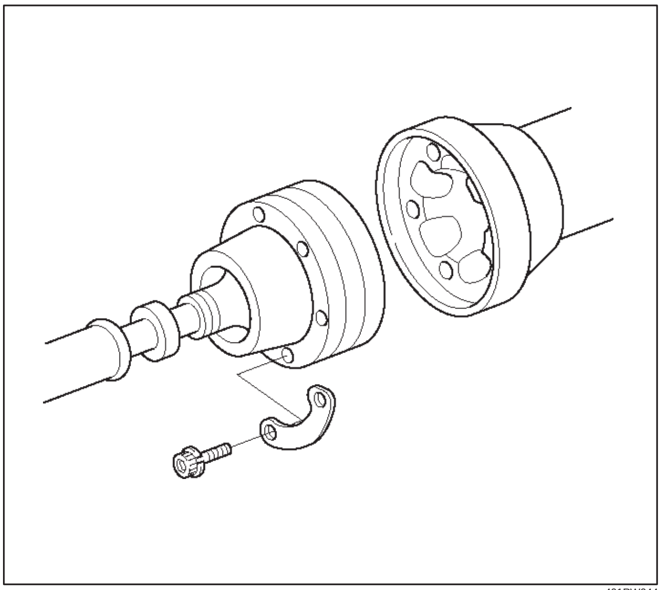
2. Set a dial gage at right angle near the inner circumference and check the run-out of the flange.

   Limit: 0.15 mm (0.006 in)



401RW045

3. If vibration is felt during the 4H AUTO drive, disconnct the propeller shaft at the front axle. Reinstall the propeller shaft at 60°, 120°, 180°, 240°, and 300° and conduct test drive in each position and check if there is vibration.

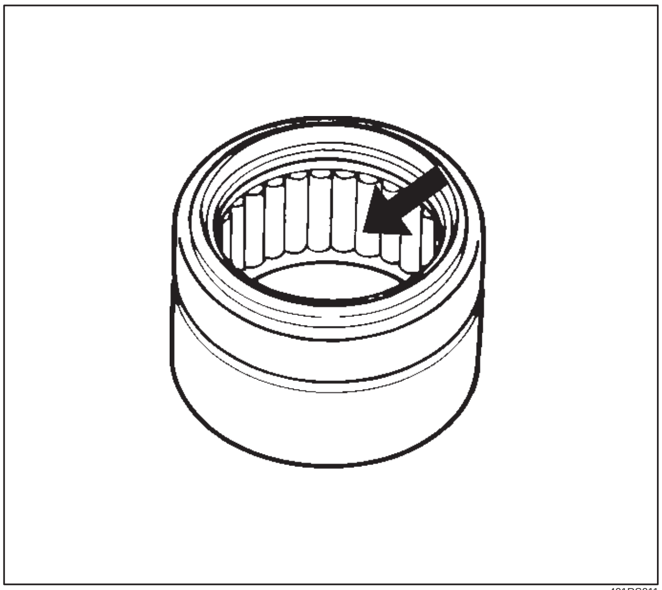


401RW044

Universal Joint Reassembly

1. Install spider to flange yoke. Be sure to install the spider by aligning the setting marks made during disassembly.
2. Apply a molybdenum–disulfide grease or a multi–purpose type grease NLGI No. 2 to inside of the bearing cap.

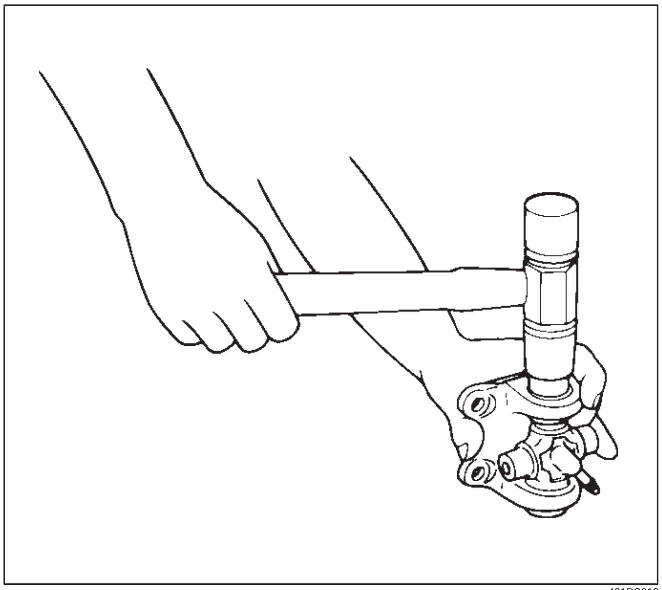
Grease Amount: Approx. 1.2 g (0.042 oz)



401RS011

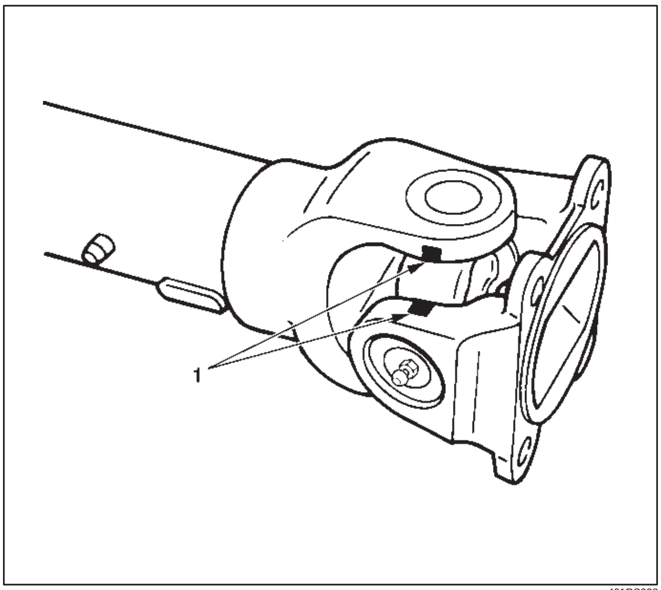
3. Using either a mallet (or copper hammer) or a press, install the needle roller bearing into the yoke so that the snap ring can be installed in its groove.

CAUTION: The needle roller bearing cannot be installed smoothly if it is set at an incorrect angle with the flange and excessive hammering will damage the needle roller bearing.



401RS012

4. Align setting marks (1) and join the yokes.



401RS028

5. Install snap ring.

NOTE: Discard used snap rings and install new ones.

When the bearing cap is in position, select and attach a snap ring of suitable thickness so that the end play of the spider pin is held within 0.1 mm (0.004 in).

Snap ring thickness and Identification color

1.5 mm (0.059 in); Blue

1.53 mm (0.060 in); White

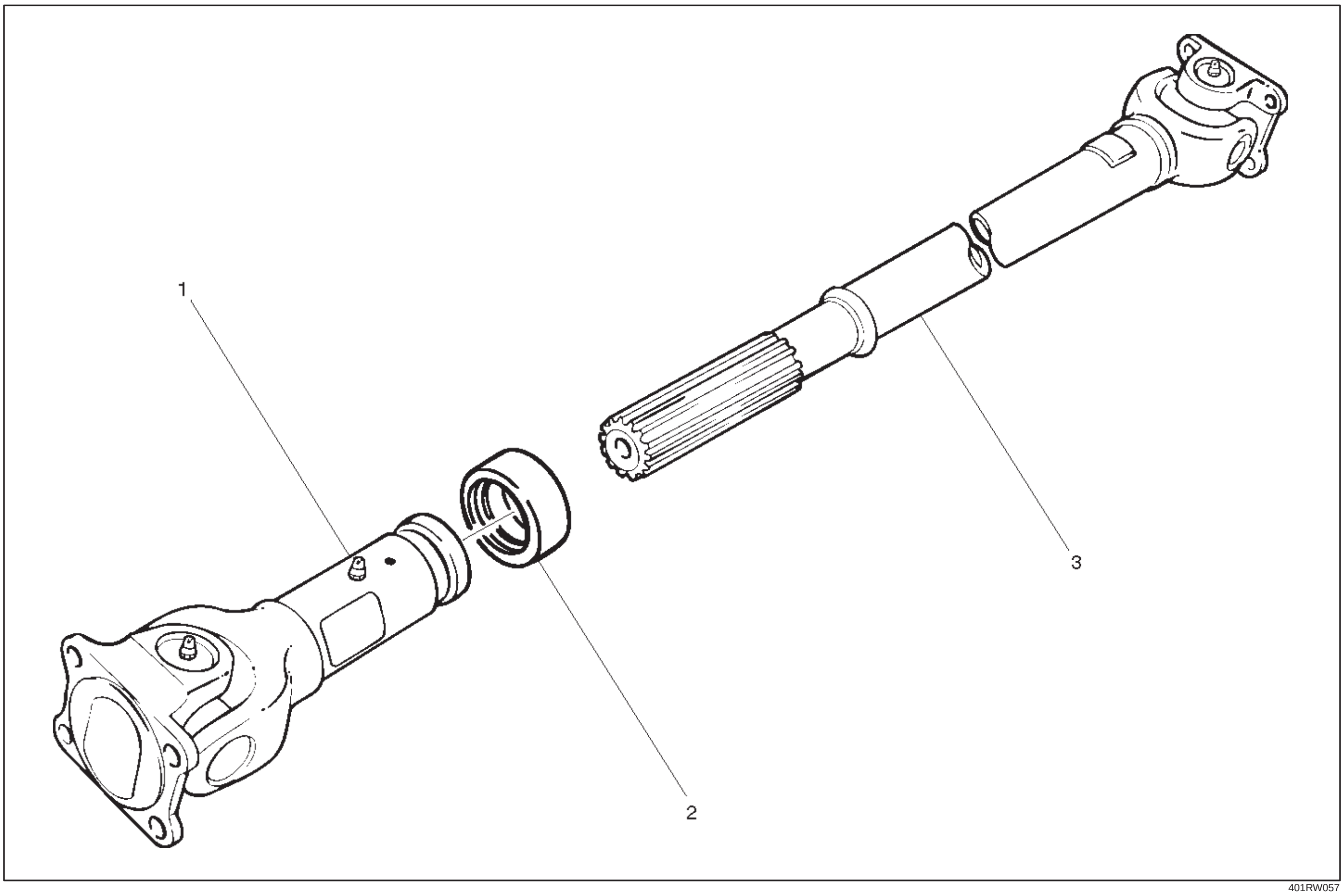
1.59 mm (0.063 in); Yellow

1.62 mm (0.064 in); Green

1.68 mm (0.066 in); Not colored

NOTE: Be sure to use snap rings of the same thickness on both sides.

Reassembly (Except TOD 4×4)



Legend

(1) Sleeve Yoke

(2) Seal

(3) Tube Assembly

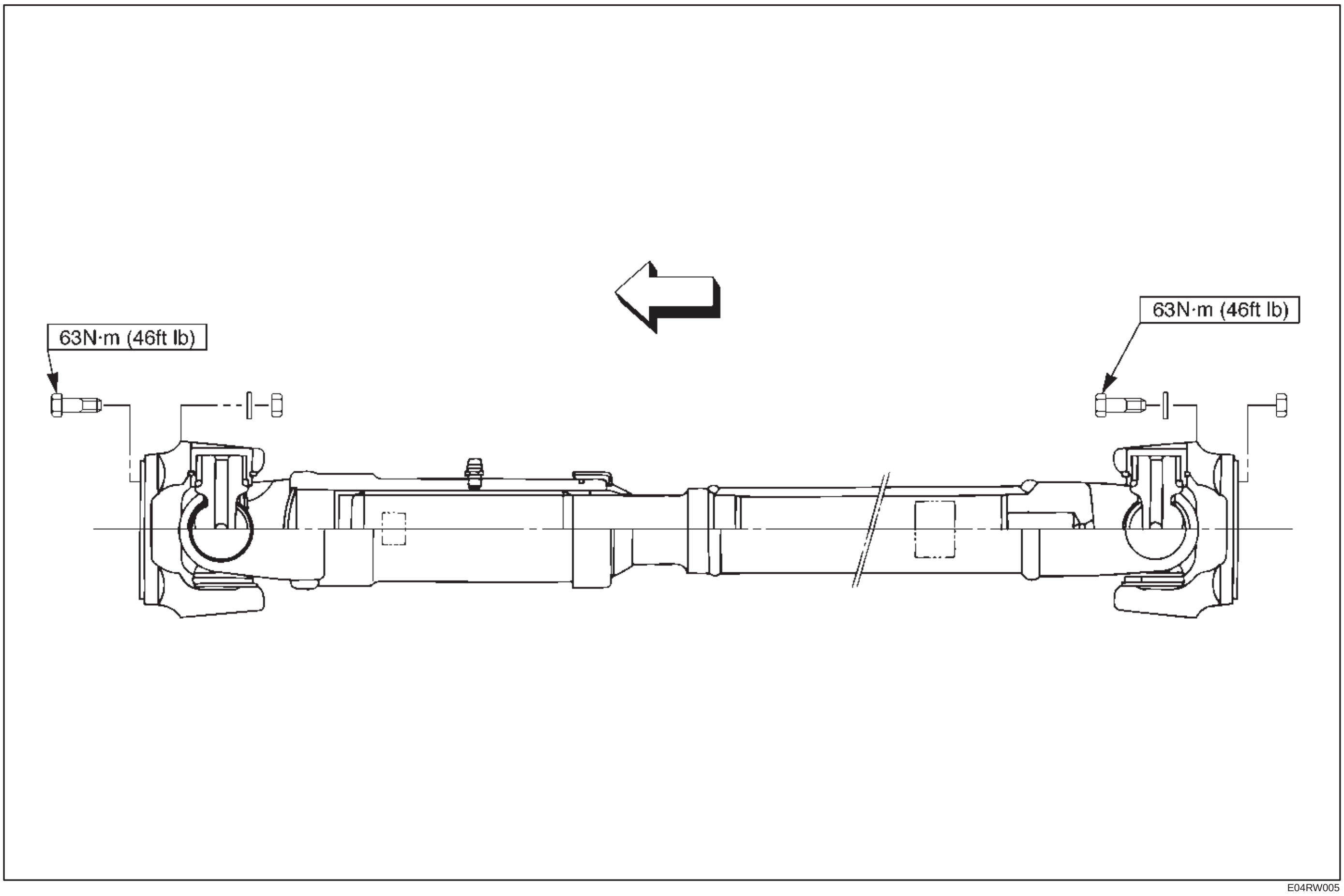
1. Discard used seal and install new one.
2. Align the alignment marks and install tube assembly to sleeve yoke.

Main Data and Specifications

General Specifications

Engine	6VE1(3.5 L)		
Transmission	M/T	A/T	A/T with TOD
Construction	Hollow steel tube with yoke and spider type universal joints.		Hollow steel tube with constant velocty joints.
Outside diameter	40.0 mm (1.57 in)	40.0 mm (1.57 in)	40.0 mm (1.57 in)
Length	559 mm (22.01 in)	559 mm (22.01 in)	577 mm (22.72 in)

Torque Specifications

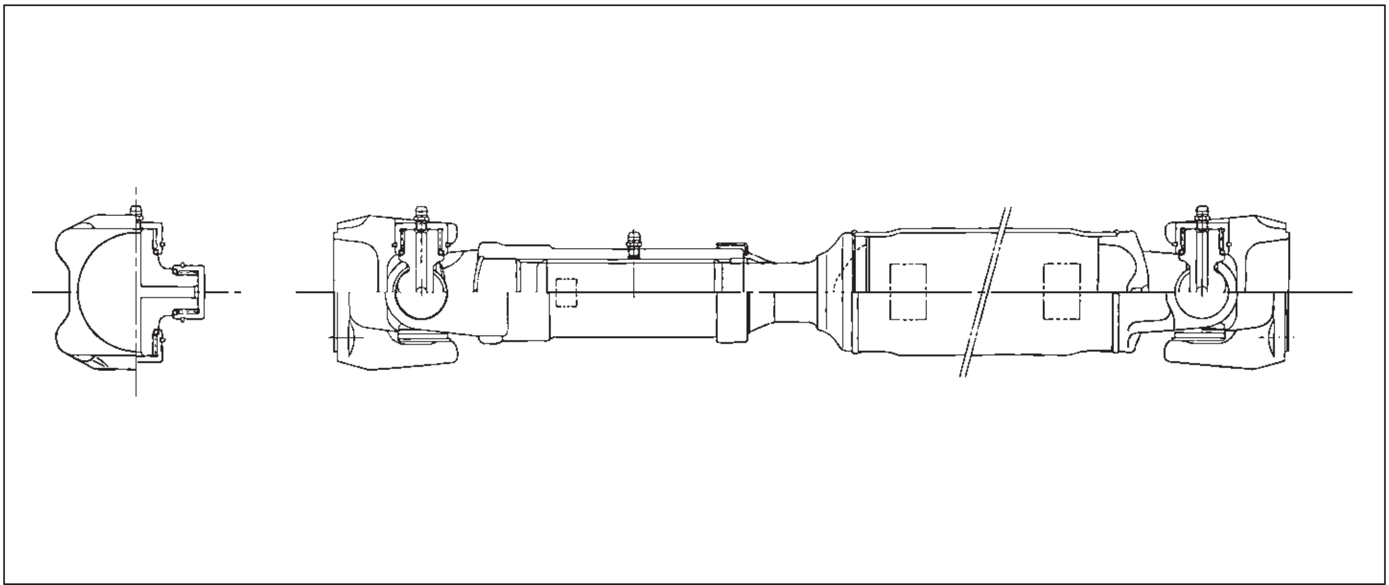


Rear Propeller Shaft

General Description

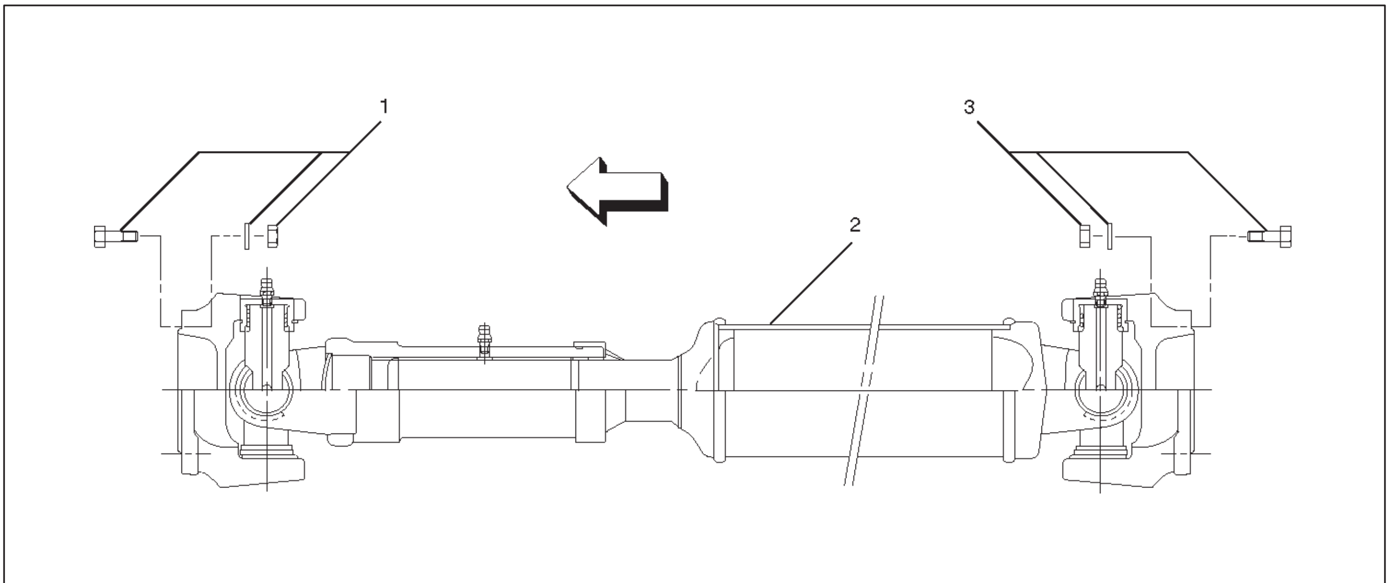
Since the propeller shaft is balanced carefully, welding or any other modifications are not permitted.

Alignment marks should be applied to each propeller shaft before removal.



401RW003

Rear Propeller Shaft and Associated Parts



401RW059

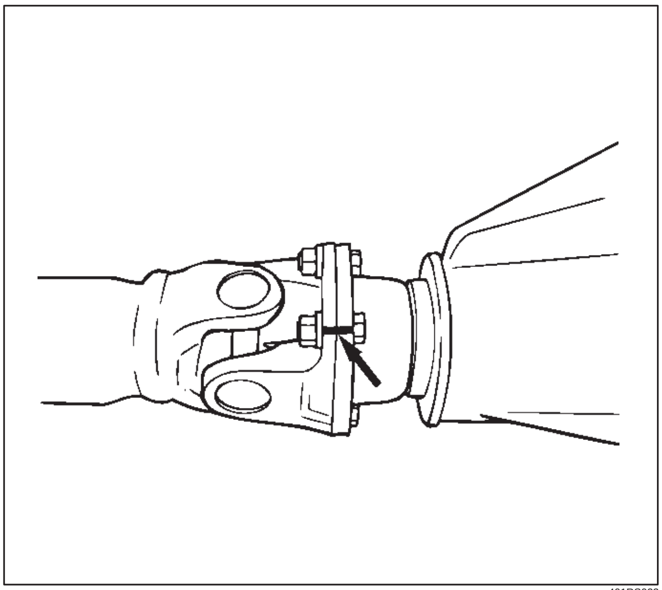
Legend

(1) Bolt, Nut and Washer
(2) Rear Propeller Shaft
(3) Bolt, Nut and Washer

Removal

1. Jack up the vehicle and support it on the chassis stands.
2. Gear shift lever should be placed in neutral position and parking brake released.

NOTE: Apply alignment marks on the flange at the rear propeller shaft both front and rear side.



401RS023

3. Remove bolt, nut and washer (Rear axle side).
4. Remove bolt, nut and washer (Transfer side).
5. Remove rear propeller shaft.

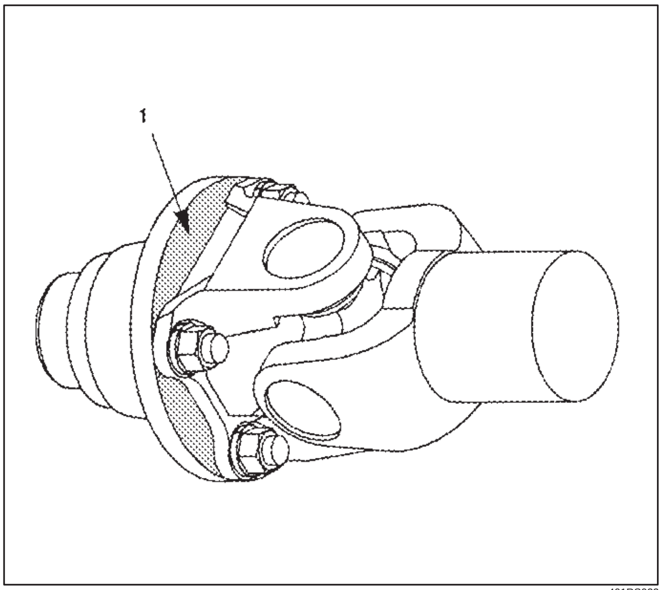
Installation

NOTE: Never install the shaft assembly backwards.

1. Completely remove the black paint from the connecting surface of flange coupling on each end of propeller shaft. Clean so that no foreign matter will be caught in between.
2. Align the mark which is applied at removal .
   Install rear propeller shaft and tighten the bolts to the specified torque.

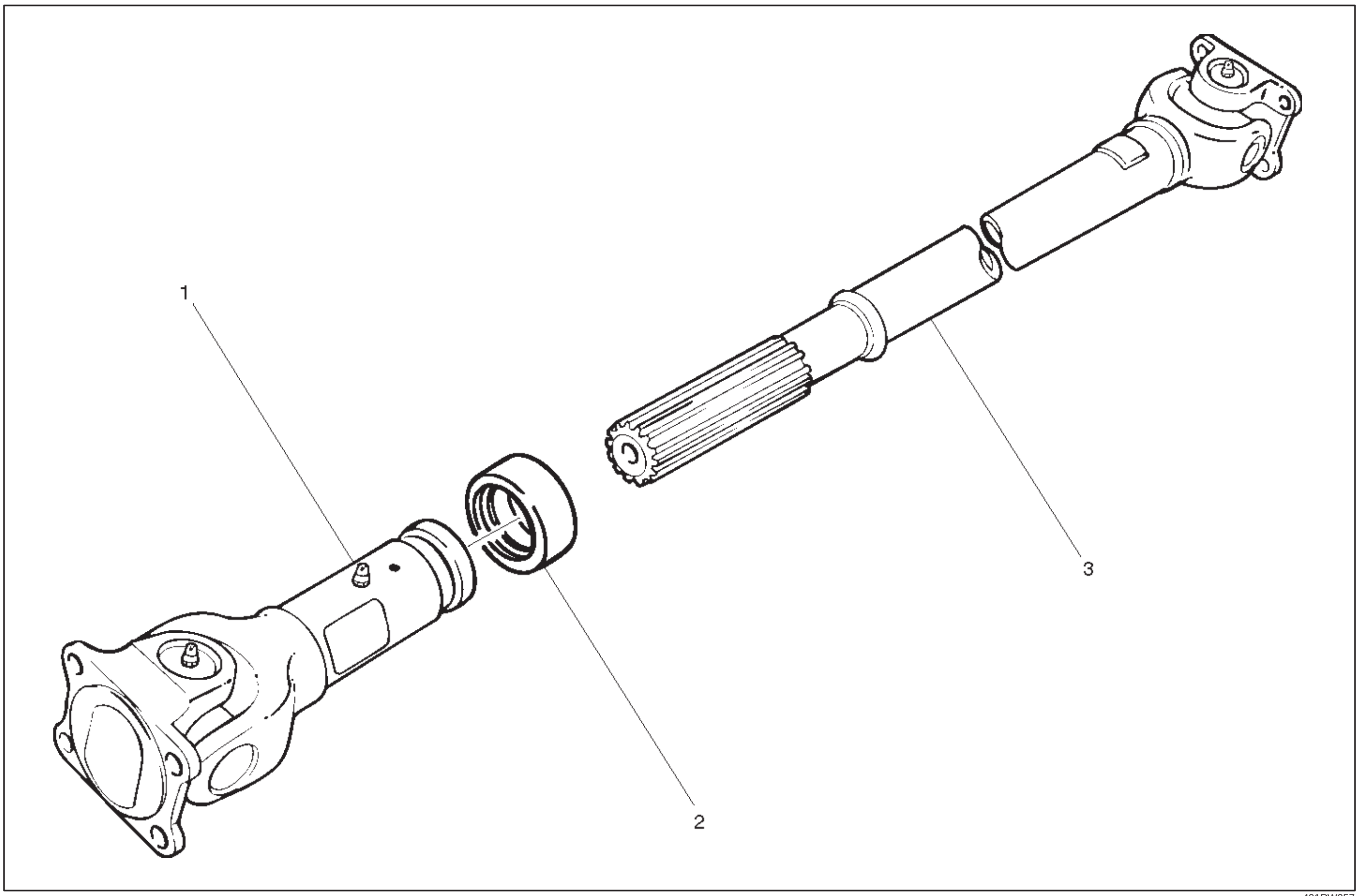
Torque: 63 N·m (46 lb ft)

3. After installing the propeller shaft, be sure to apply black paint (1) to exposed area (other than connecting surface) of the entire surface of flange coupling .



401RS022

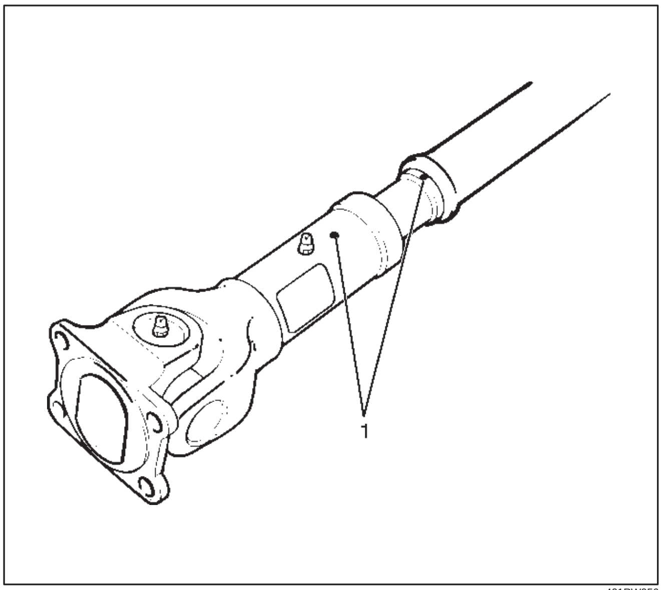
Disassembly



401RW057

Legend
(1) Sleeve Yoke
(2) Seal
(3) Tube Assembly

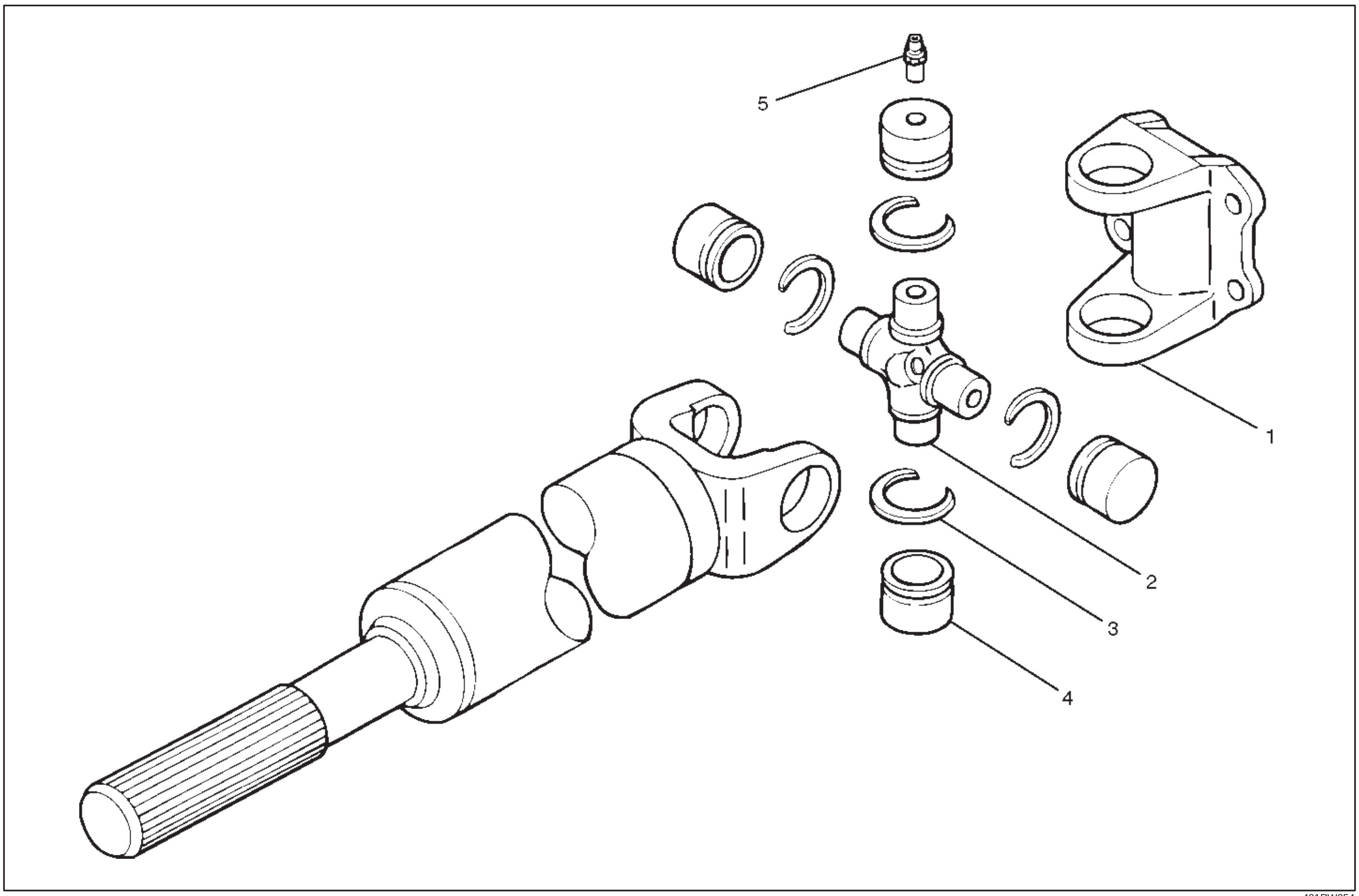
1. Apply alignment marks (1) on the sleeve yoke and tube assembly then remove sleeve yoke.



401RW056

2. Remove seal.
3. Remove tube assembly.

Universal Joint Disassembly

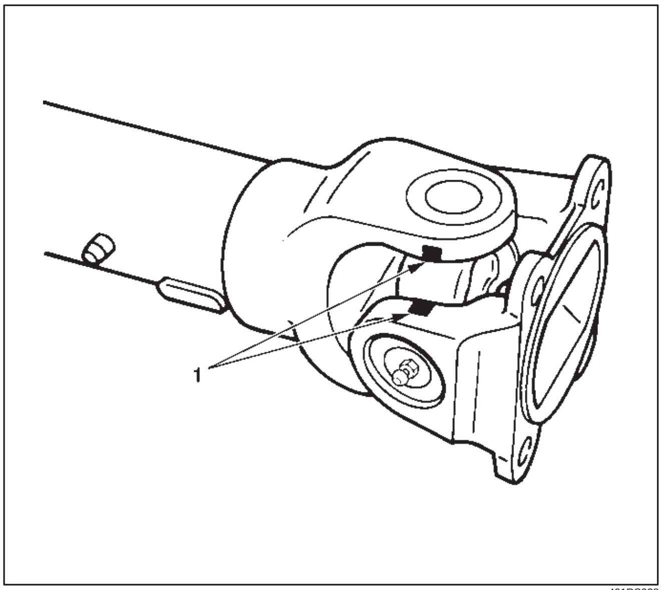


401RW054

Legend

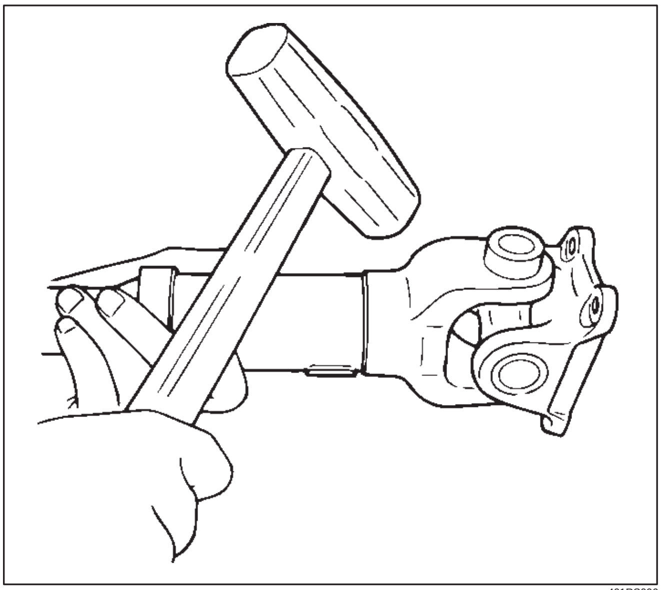
(1) Flange Yoke
(2) Spider with Grease Fitting
(3) Snap Ring
(4) Needle Roller Bearing
(5) Grease Fitting

1. Apply alignment marks (1) on the yokes of the universal joint, then remove snap ring.



401RS028

2. Tap out the needle roller bearing by gently striking the shoulder of the yoke, using a mallet or a copper hammer.



401RS006

3. Make sure of proper position for reinstallation by applying setting marks, then remove spider with grease fitting.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition is found through inspection.

NOTE: When any part of the journal assembly (spider, needle roller bearing, grease fitting) requires replacement, be sure to replace the entire assembly.

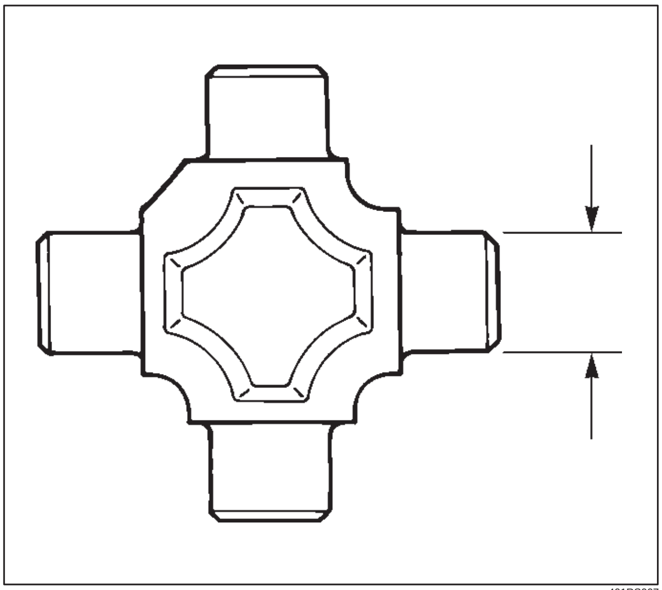
Check the following parts for wear, damage, noise or any other abnormal conditions:

1. Spider
2. Needle roller bearing
3. Yoke
4. Flange

Outside Diameter of Spider Pin

Standard: 17.00 mm (0.669 in)

Limit: 16.90 mm (0.665 in)



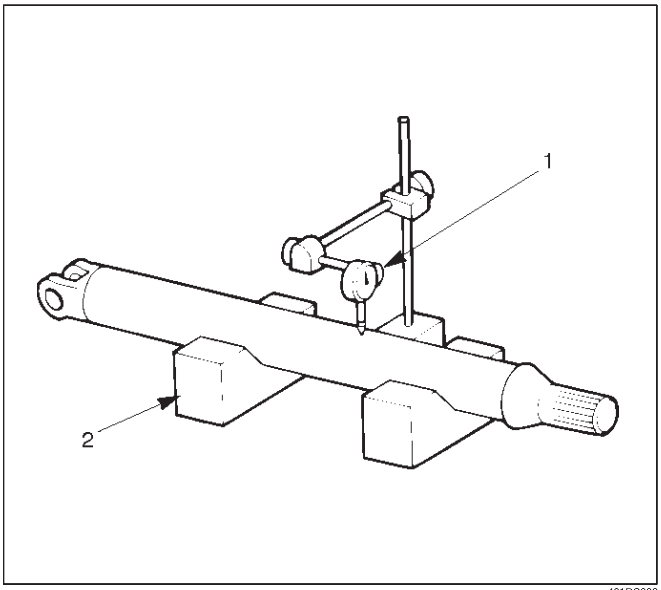
401RS007

Propeller Shaft Run-out

Support the ends of the propeller shaft on V-blocks (2) and check for run-out by holding the probe of a dial indicator (1) in contact with the center part of the shaft. If the amount of run-out is beyond the standard value for assembly, correct with a bench press or replace the shaft with a new propeller shaft assembly .

Standard: 0.3 mm (0.012 in)

Limit: 0.5 mm (0.02 in)



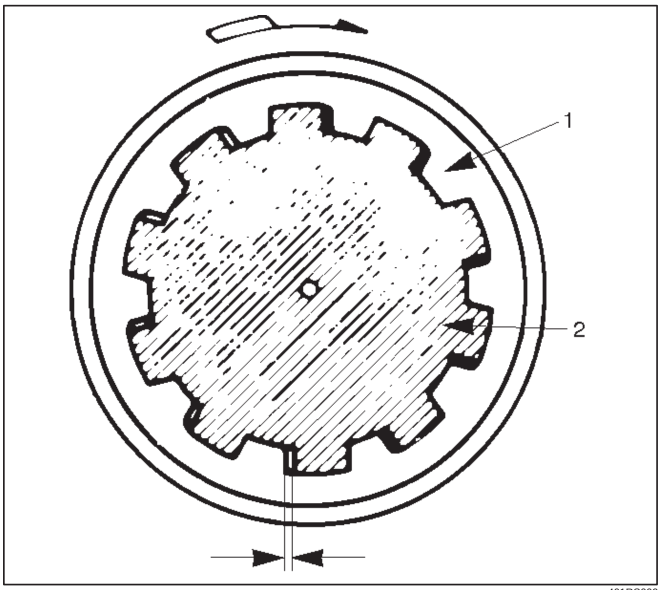
401RS008

Play in Splines in Normal Direction of Rotation

Check the amount of play between the sleeve yoke (1) and the propeller shaft spline (2) in the direction of rotation, using a pointed feeler gauge.

Standard: 0.073 – 0.156 mm (0.003 – 0.006 in)

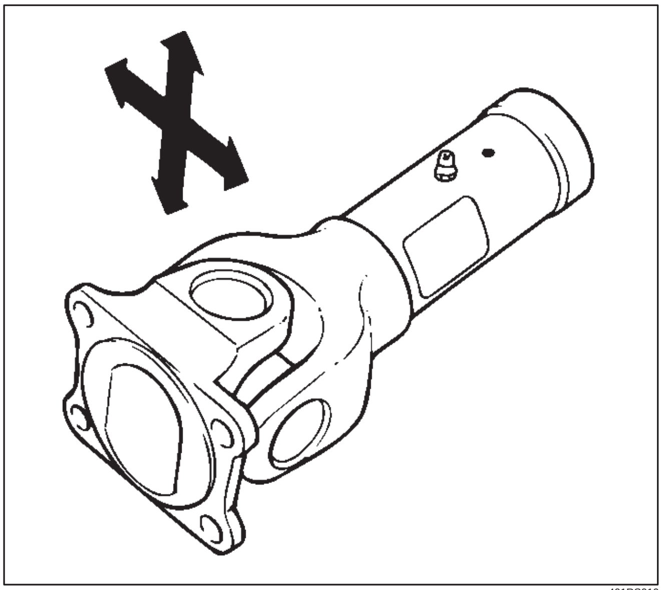
Limit: 0.3 mm (0.012 in)



401RS009

Play in Universal Joint

Limit: Less than 0.1 mm (0.004 in)

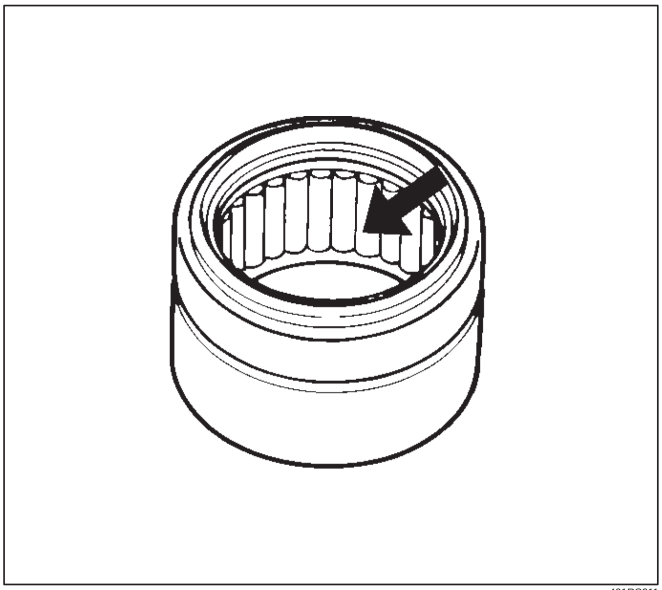


401RS010

Universal Joint Reassembly

1. Install spider to flange yoke. Be sure to install the spider by aligning the setting marks made during disassembly.
2. Before installing needle roller bearing, apply a molybdenum–disulfide grease or a multi–purpose type grease NLGI No. 2 to inside of the bearing cap.

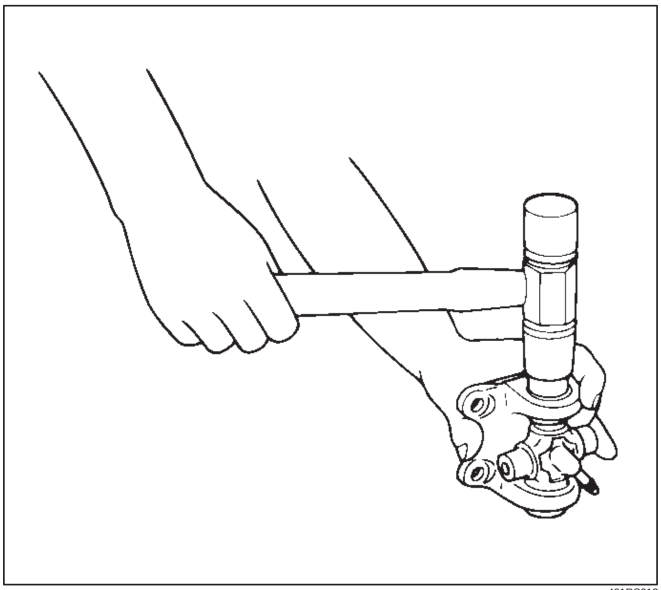
Grease Amount: Approx. 1.2 g (0.042 oz)



401RS011

3. Using either a mallet (or copper hammer) or a press, install the needle roller bearing into the yoke so that the snap ring can be installed in its groove.

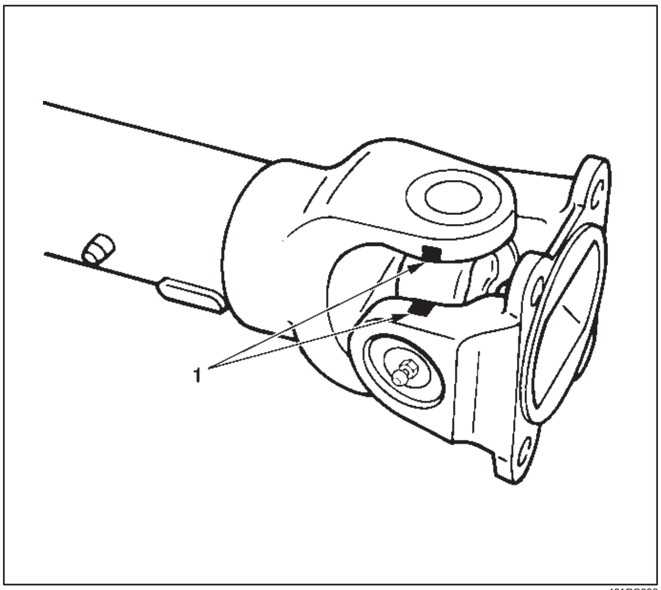
CAUTION: The needle roller bearing cannot be installed smoothly if it is set at an incorrect angle with the flange and excessive hammering will damage the needle roller bearing.



401RS012

4. Align setting marks (1) and join the yokes.

NOTE: Assemble the spider and spline yoke so that their grease fittings are arranged on the same side.



401RS028

5. Install snap ring.

NOTE: Discard used snap rings and install new ones.

When the bearing cap is in position, select and attach a snap ring of suitable thickness so that the end play of the spider pin is held within 0.1 mm (0.004 in).

Snap ring thickness and identification color

1.5 mm (0.059 in): Blue

1.545 mm (0.061 in): White

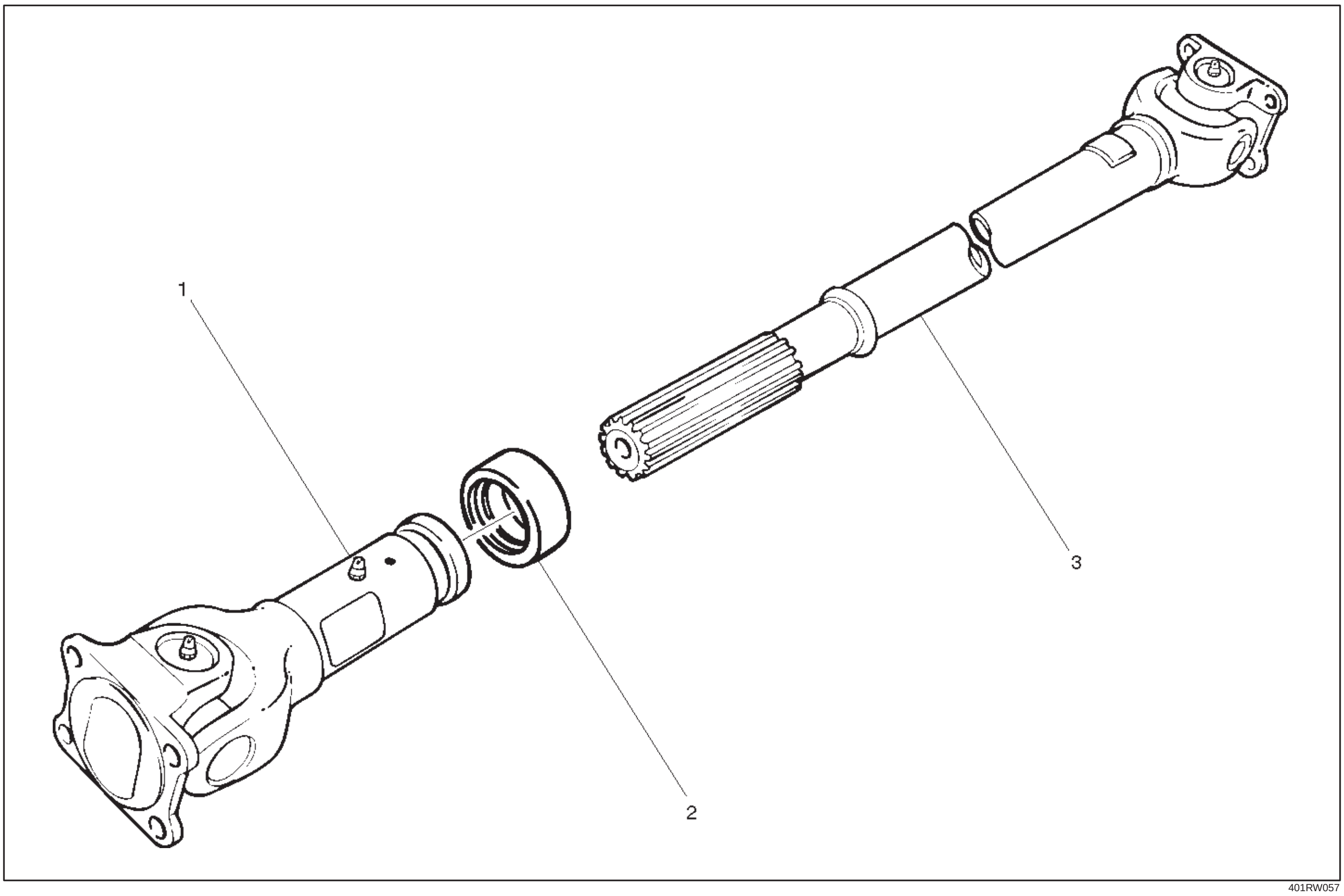
1.59 mm (0.063 in): Yellow

1.635 mm (0.064 in): Green

1.68 mm (0.066 in): Not colored

NOTE: Be sure to use snap rings of the same thickness on both sides.

Reassembly



Legend

(1) Sleeve Yoke
(2) Seal
(3) Tube Assembly

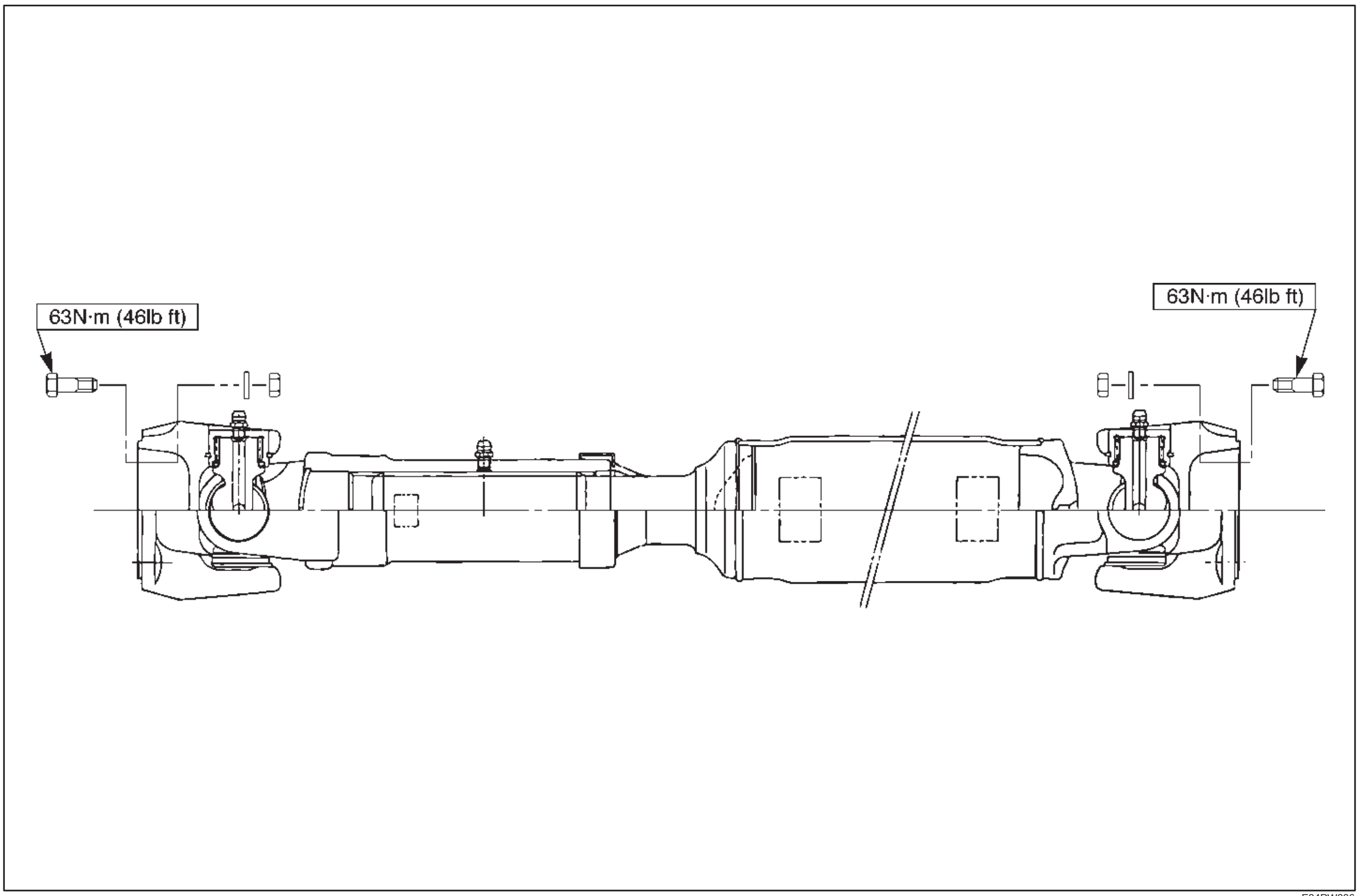
1. Discard used seal and install new one.
2. Align the alignment marks and install tube assembly to sleeve yoke.

Main Data and Specifications

General Specifications

Engine	6VE1(3.5 L)		
Transmission	M/T	A/T	A/T with TOD
Construction	Hollow steel tube with yoke and spider type universal joints.		
Outside diameter	68.9 mm (2.71 in)	68.9 mm (2.71 in)	68.9 mm (2.71 in)
Length	1093 mm (43.03 in)	1093 mm (43.03 in)	1075 mm (42.32 in)

Torque Specifications



E04RW006

TROOPER

DRIVELINE/AXLE

TRANSFER CASE (STANDARD TYPE)

CONTENTS

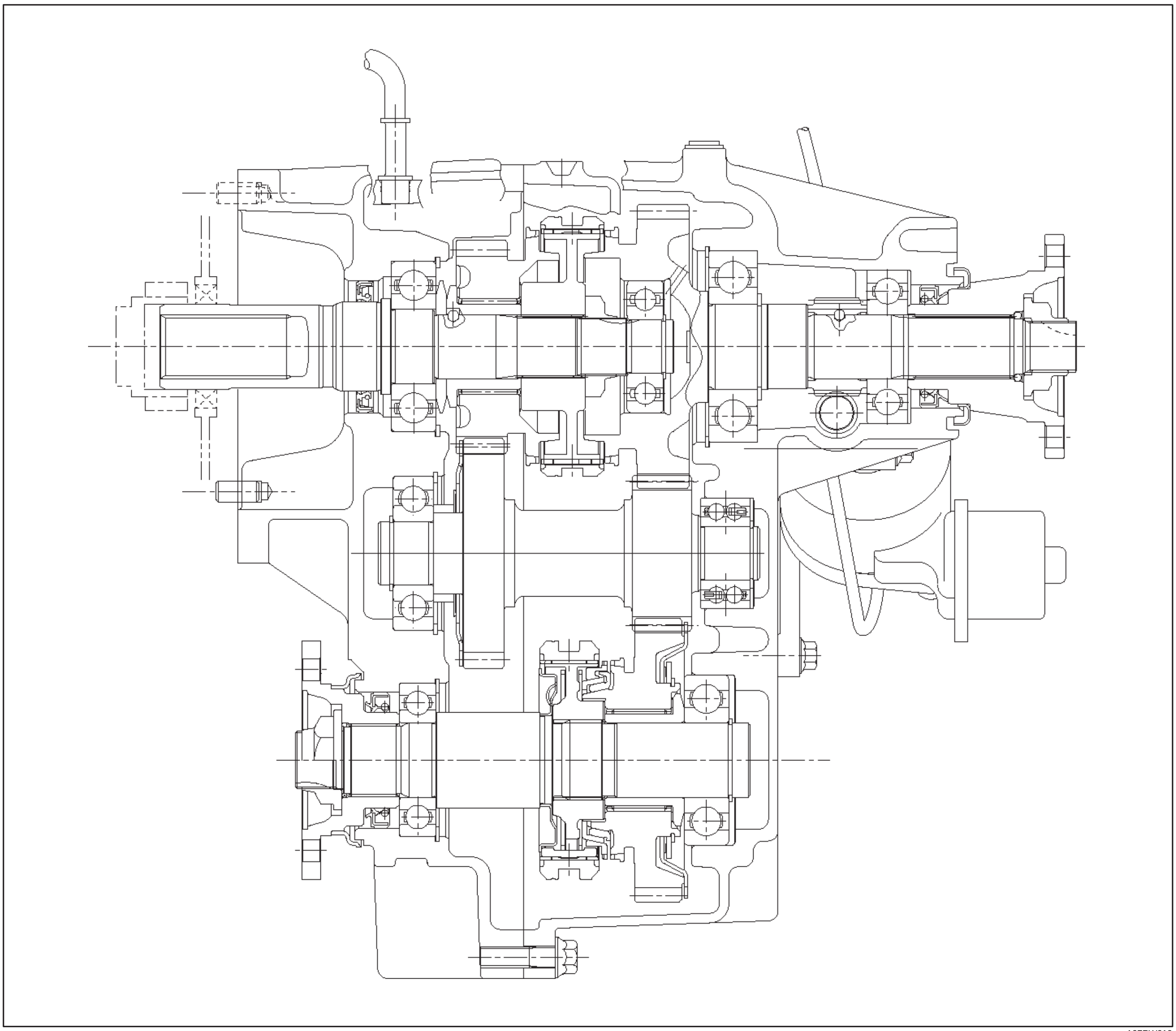
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

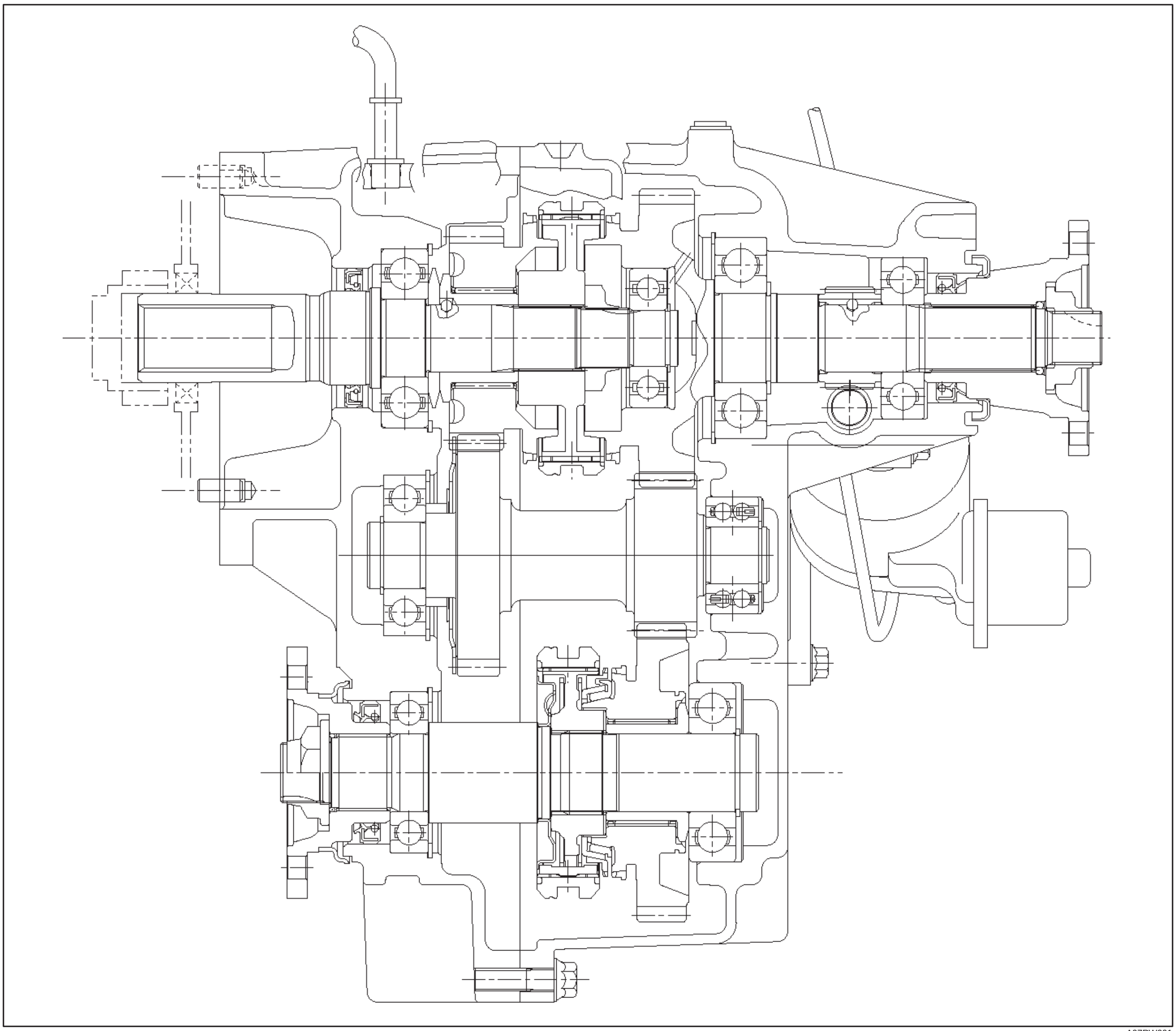
General Description

M/T model



A07RW019

A/T model



A07RW001

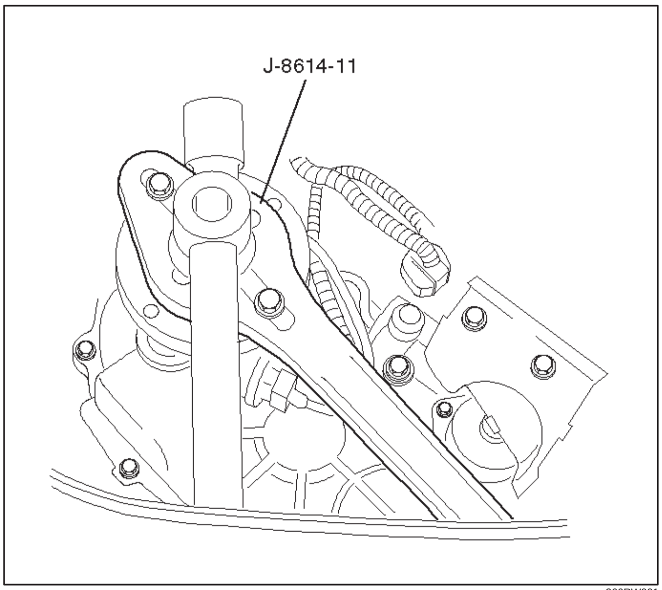
The transfer case is used to provide a means of providing power flow to the front axle. The transfer case also provides a means of disconnecting the front axle, providing better fuel economy and quieter operation when the vehicle is driven on improved roads where four wheel drive is not required. In addition, the transfer case provides an additional gear reduction when placed in low range, which is useful when difficult off–road conditions are encountered.

A floor mounted shift lever is used to select the operating range. When four wheel drive has been selected, the four wheel drive indicator light is designed to come on when the front axle has been engaged.

Transfer Rear Oil Seal

Removal

1. Disconnect the rear propeller shaft from the transfer case side.
2. Remove end nut and rear companion flange, use the companion flange holder J–8614–11 to remove the end nut.



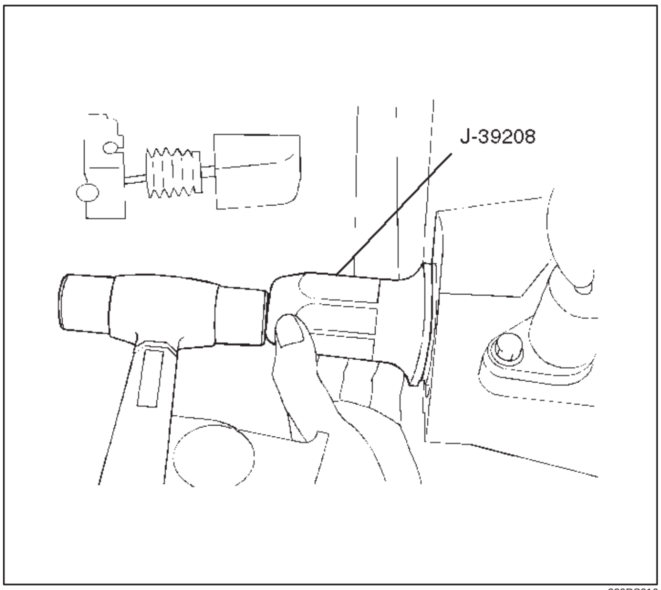
266RW001

3. Use the universal puller to remove the rear companion flange and O–ring.
4. Remove the oil seal from the transfer case.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Install oil seal and apply engine oil to the oil seal outer surfaces.
2. Apply the recommended grease (BESCO L2) or equivalent to the oil seal lip.
3. Use the oil seal installer J–39208 to install the rear seal to the transfer rear case.



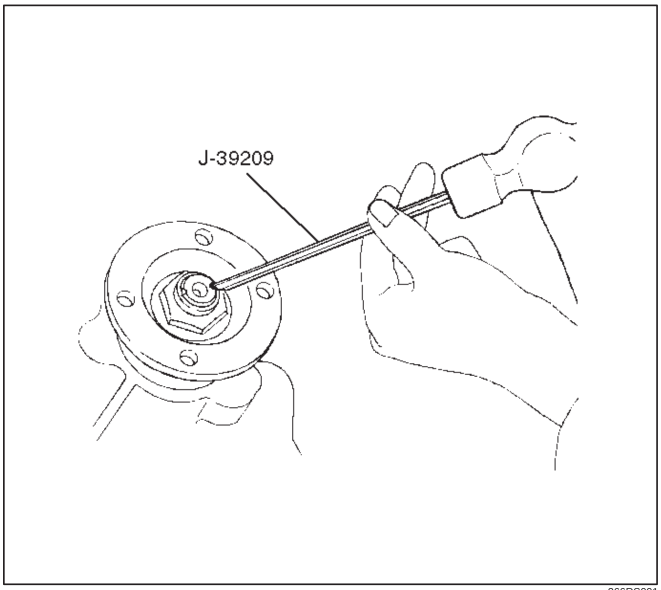
220RS016

4. Rear companion flange and end nut.
5. Install the rear companion flange and O–ring.
6. Use the companion flange holder J–37221 to install a new end nut and tighten to the specified torque.

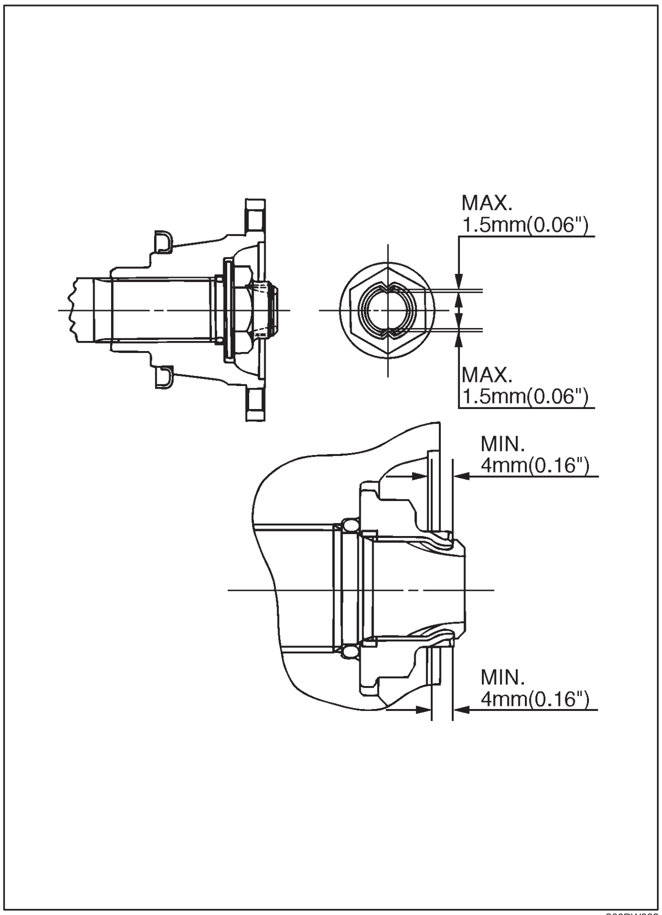
Torque: 167 N·m (123 lb ft)

7. Use the punch J–39209 to stake the end nut at two spots.

NOTE: Be sure to confirm that there is no crack at the staked portion of the end nut after staking.



266RS001



8. Connect the rear propeller shaft to the transfer case and tighten to the specified torque.

Torque: 63 N·m 46 (lb ft)

Transfer Case Assembly

Removal

NOTE: Before removing transmission & transfer assembly from vehicle, change the transfer mode to 2WD by pushing button switch on dash panel.

1. Disconnect the battery ground cable.
2. Drain the transfer case fluid.
3. Remove transfer protector.
4. Remove rear propeller shaft.
5. Remove the rear and front propeller shaft from the transfer case side.
6. Disconnect the four oxygen sensor connectors from the transmission harness.
7. Remove the right and left catalytic converter assemblies and exhaust pipe.
8. Remove the transfer control lever knob.
9. Remove the selector lever assembly. Refer to Selector Lever in the Section 7A.
10. Remove transfer control lever.
11. Disconnect the 4WD switch and speed sensor harness connector and 2WD–4WD actuator harness connector from the transmission harness.
12. Remove transmission–transfer bolt and support the transfer case with a transmission jack.
13. Remove four transmission–transfer bolts and the three nuts.
14. Remove the transfer case assembly from the vehicle.

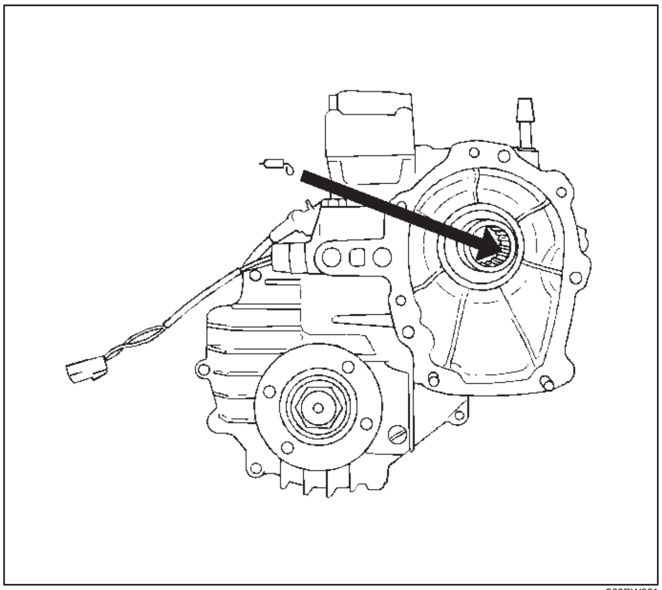
Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Install transfer case assembly and apply a thin coat of molybdenum disulfide grease to the input shaft spline.

2. Tighten the transmission–transfer bolt to the specified torque.

Torque: 46 N·m (34 lb ft)



260RW001

3. Tighten the exhaust pipe to exhaust manifold bolt to the specified torque.

Torque: 67 N·m (49 lb ft)

4. Tighten the exhaust pipe flange bolt to the specified torque.

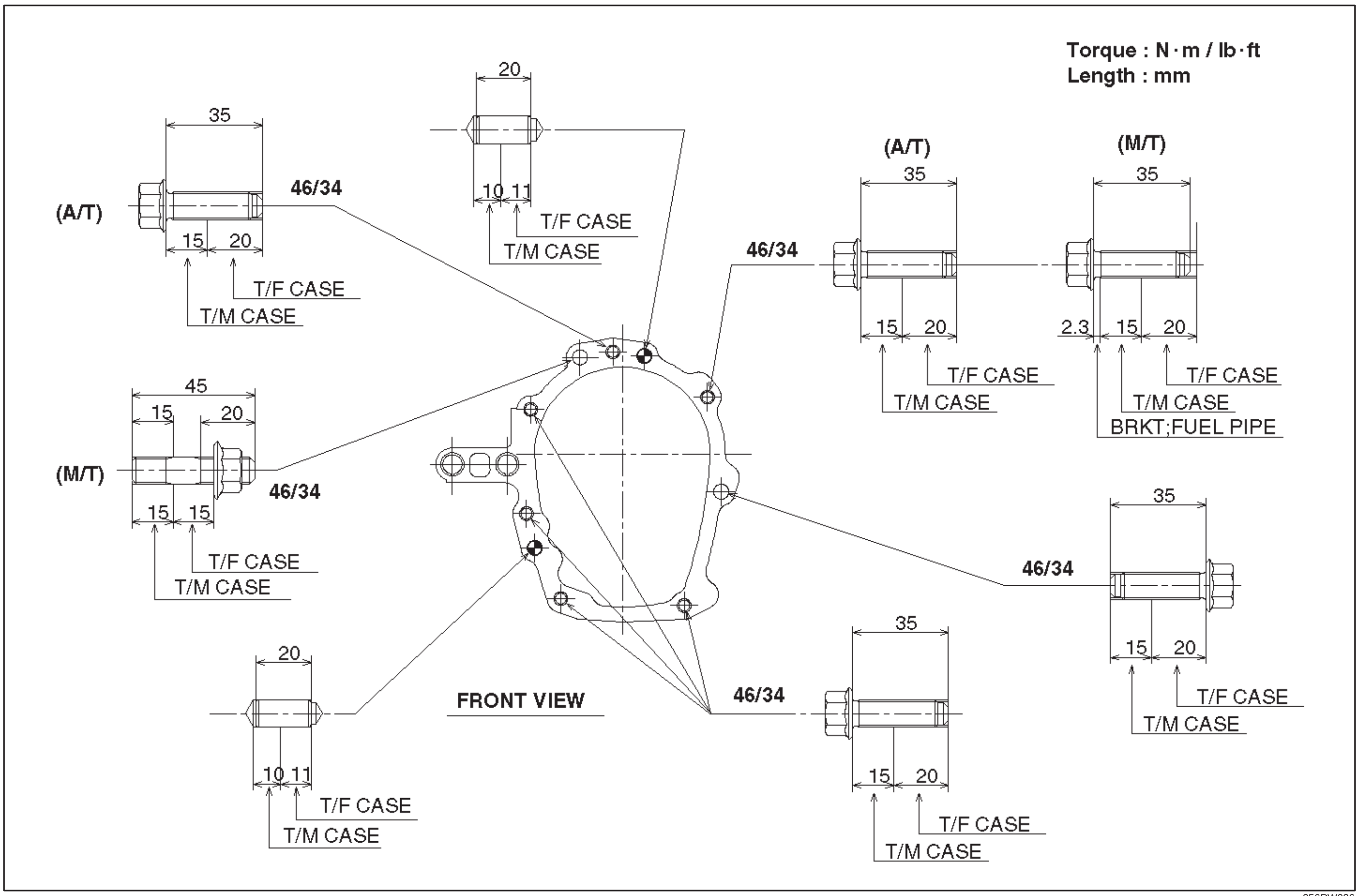
Torque: 43 N·m (32 lb ft)

5. Tighten the propeller shaft bolt to the specified torque.

Torque: 63 N·m (46 lb ft)

6. Tighten the transfer protector bolt to the specified torque.

Torque: 37 N·m (27 lb ft)



256RW026

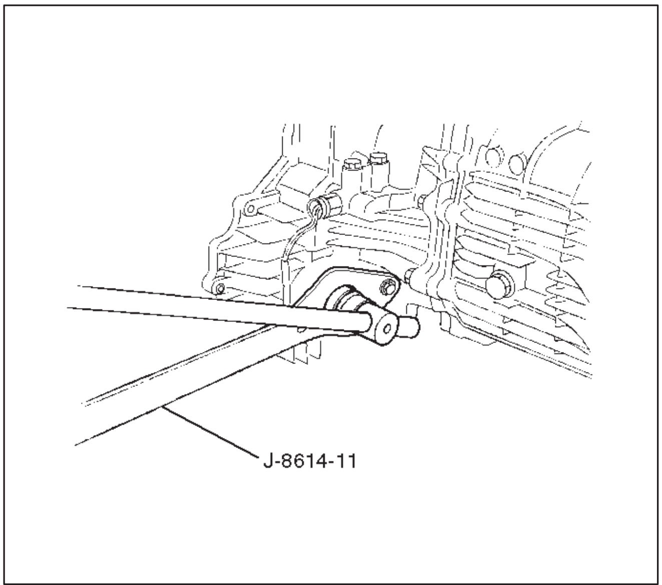
Transfer Rear Case Assembly

Removal

1. Remove the speedometer sensor.
2. Remove the plate.
3. Remove the speedometer driven gear bushing and driven gear.

NOTE: Apply a reference mark to the driven gear bushing before removal.

4. Remove front companion flange.
5. Remove rear companion flange, use the flange companion holder J–8614–11 to remove the end nut.

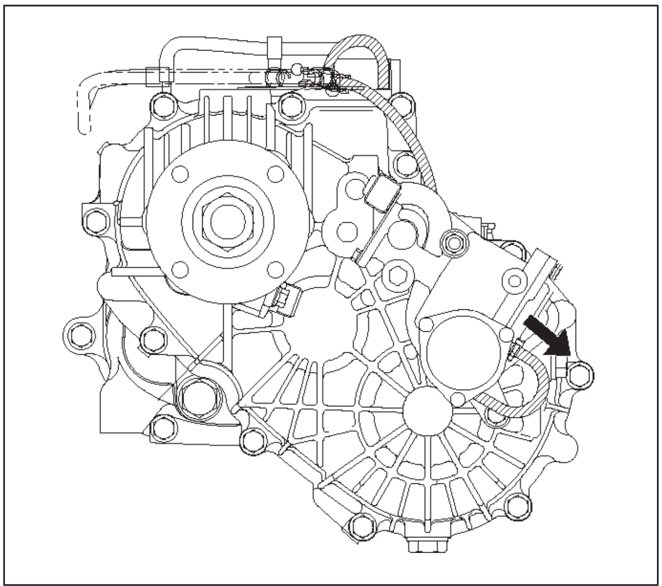


262RW009

6. Remove the front and rear companion flange.

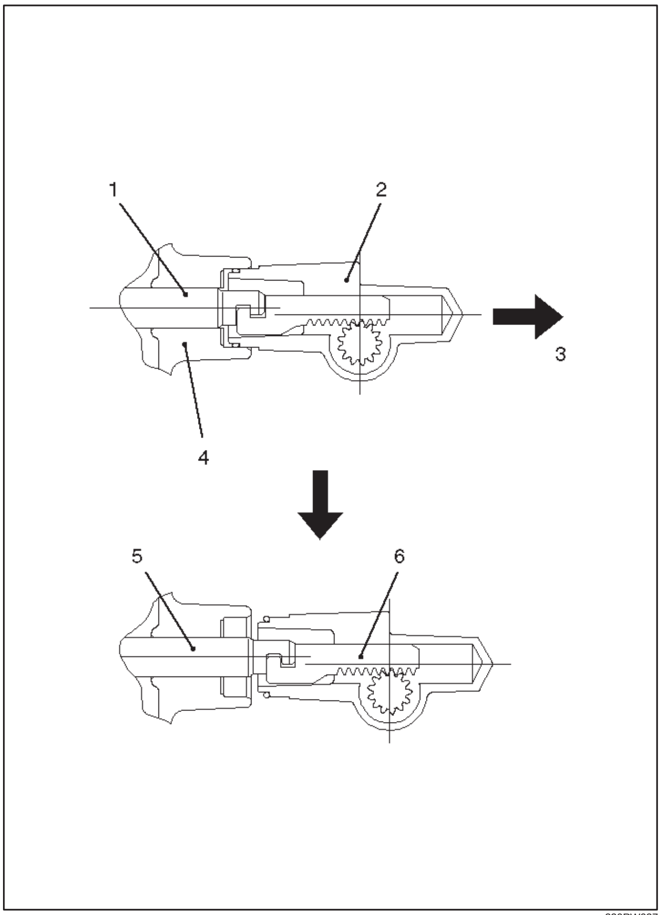
NOTE: Use the universal puller to remove the rear companion flange.

7. Remove control box assembly.
8. Disconnect the actuator breather hose from the 2WD–4WD actuator assembly.



220RW085

9. Remove the 2WD–4WD actuator assembly bolts.
10. Pull the 2WD–4WD actuator assembly with 2WD–4WD shift rod.

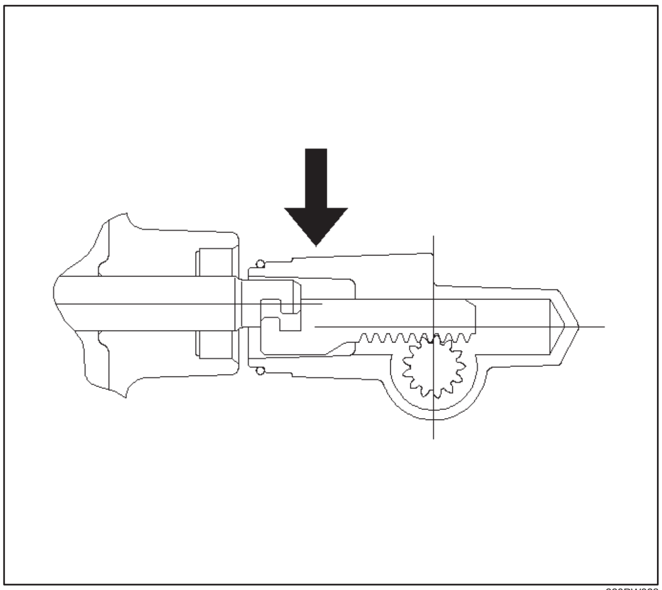


220RW027

Legend

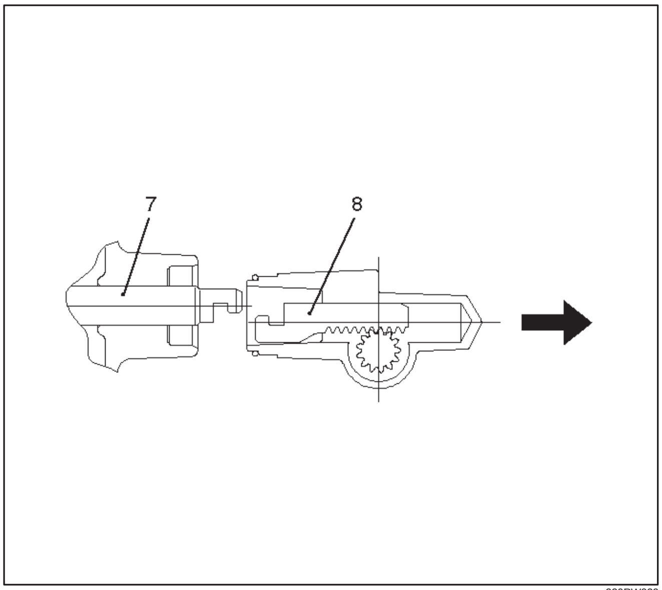
(1) Shift Rod: 2WD–4WD (Position: 2WD)
(2) 2WD–4WD Actuator Assembly
(3) Pull
(4) Rear Case Assembly
(5) Position: 4WD
(6) Mode: 2WD

11. Off set the actuator assembly.



220RW028

12. Remove the actuator assembly.



220RW029

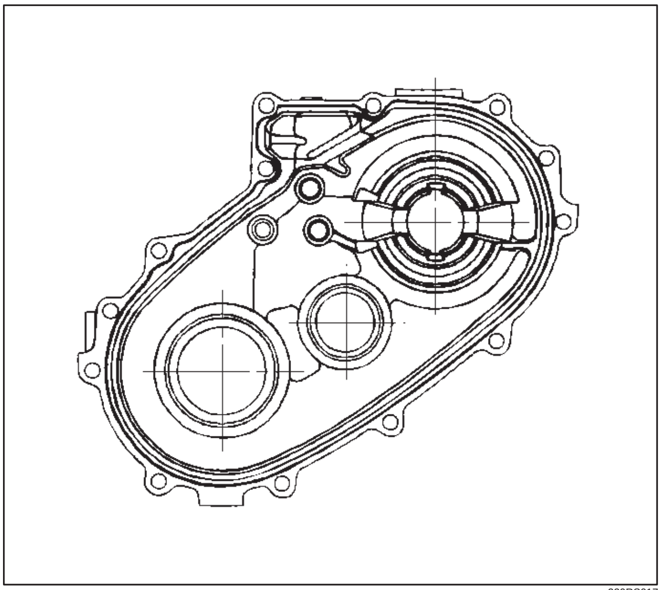
Legend

(7) Position: 4WD
(8) Mode: 2WD

13. Remove transfer case assembly.
14. Remove transfer rear case assembly.

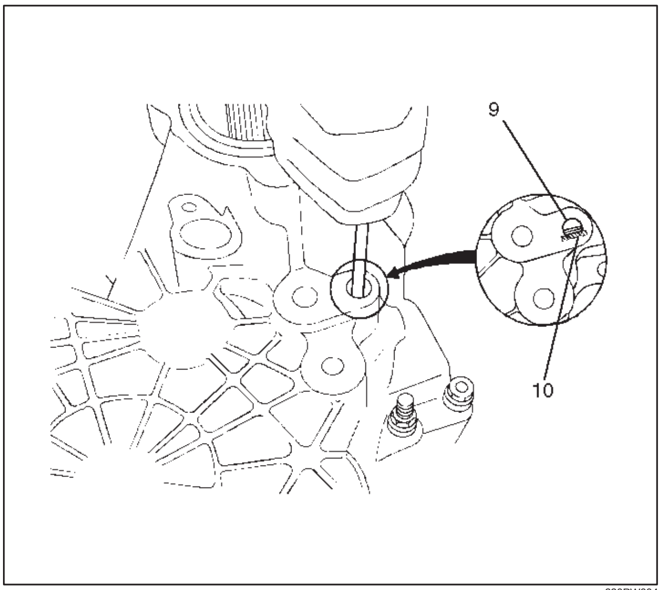
Installation

1. Install transfer rear case assembly.
2. Install transfer case assembly and apply the recommended liquid gasket (LOCTITE 17430) or its equivalent to the transfer rear case fitting faces.



220RS017

3. Perform the following steps before fitting the transfer rear case:
   1. Shift the high–low shift to the 4H side.
   2. Turn the select rod counterclockwise so that the select block projection A may enter into the 2WD–4WD shift block.
   3. The cut–away portion of the select rod head (9) should align with that of the rear case hole's stopper (10).



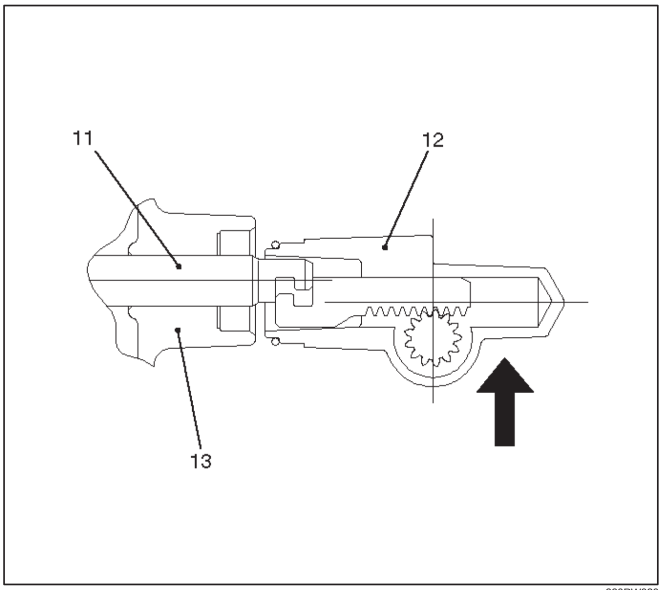
230RW004

4. Tighten the transfer rear case bolts to the specified torque.

Torque: 37 N·m (27 lb ft)

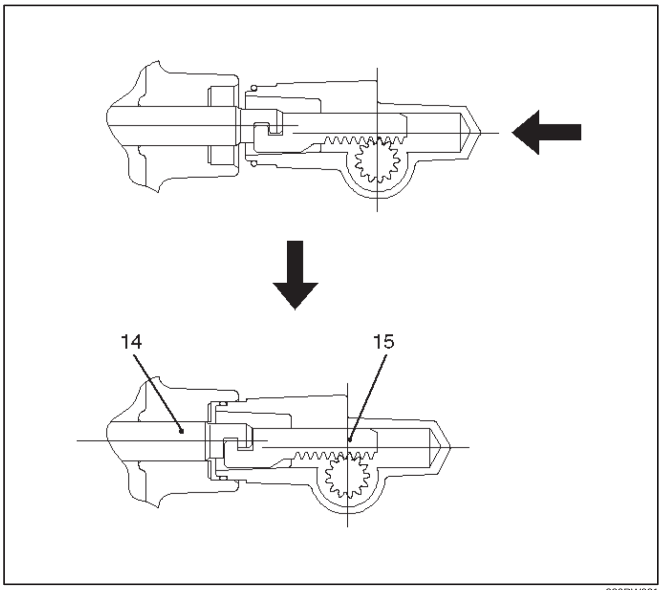
5. Shift the 2WD–4WD shift rod (11) to the 4WD side.

6. Join the rod grooves of 2WD–4WD actuator assembly (12) and shift rod (11).



Legend
- (11) Shift Rod: 2WD–4WD (Position: 4WD)
- (12) 2WD–4WD Actuator Assembly (Mode: 2WD)
- (13) Rear Case Assembly

7. Push the 2WD–4WD actuator assembly (12) with 2WD–4WD shift rod (11) till the shift rod (11) reaches the 2WD position.



Legend
- (14) Position: 2WD
- (15) Mode: 2WD

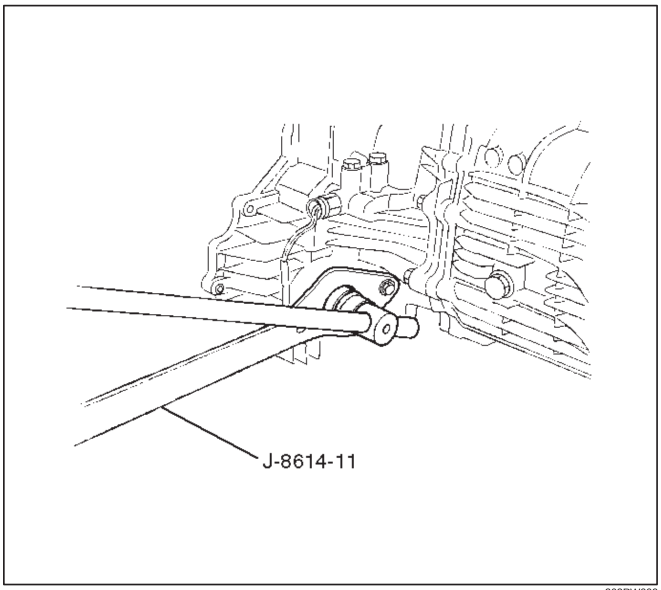
8. Tighten the 2WD–4WD actuator bolts to the specified torque.

Torque: 19 N·m (14 lb ft)

9. Connect the actuator breather hose to actuator.
10. Install control box assembly.

Torque: 19 N·m (14 lb ft)

11. Install rear companion flange.
12. Install front companion flange, use the companion flange holder J–8614–11 to tighten the flange nuts to the transfer case.



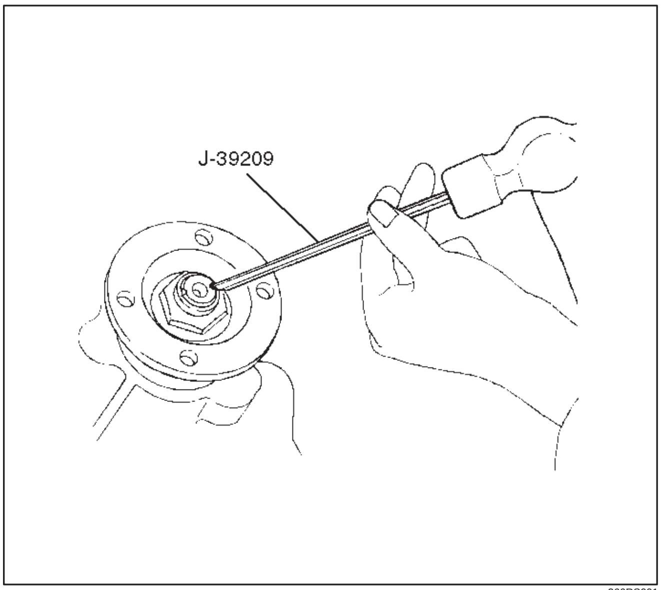
13. Tighten the new transfer flange nuts to the specified torque.

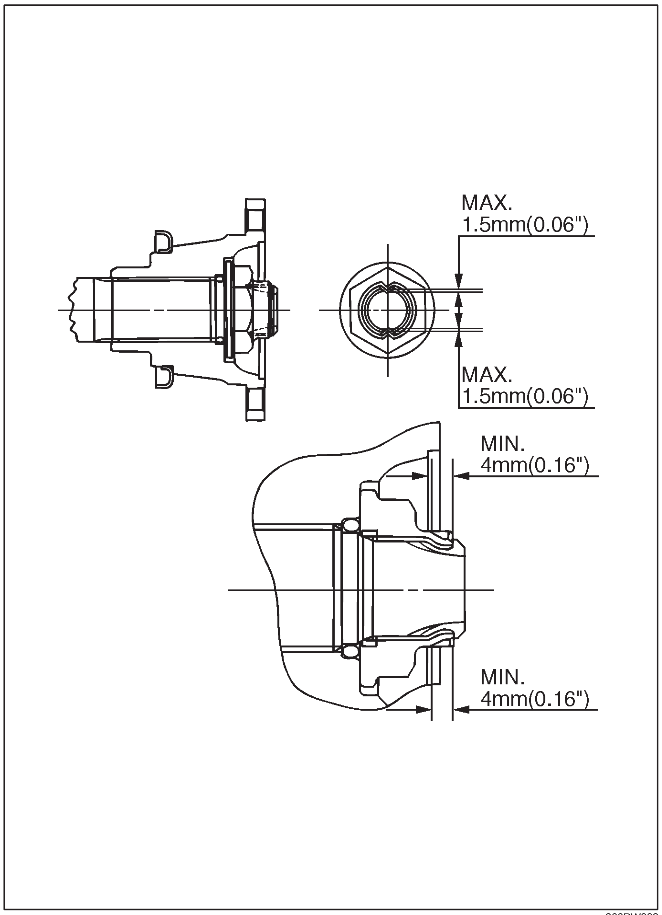
Torque

Rear companion flange: 167 N·m (123 lb ft)

Front companion flange: 137 N·m (101 lb ft)

14. Use the punch J–39209 to stake the rear companion flange nut at two spots.





266RW002

15. Stake the front companion flange nut at one spot.

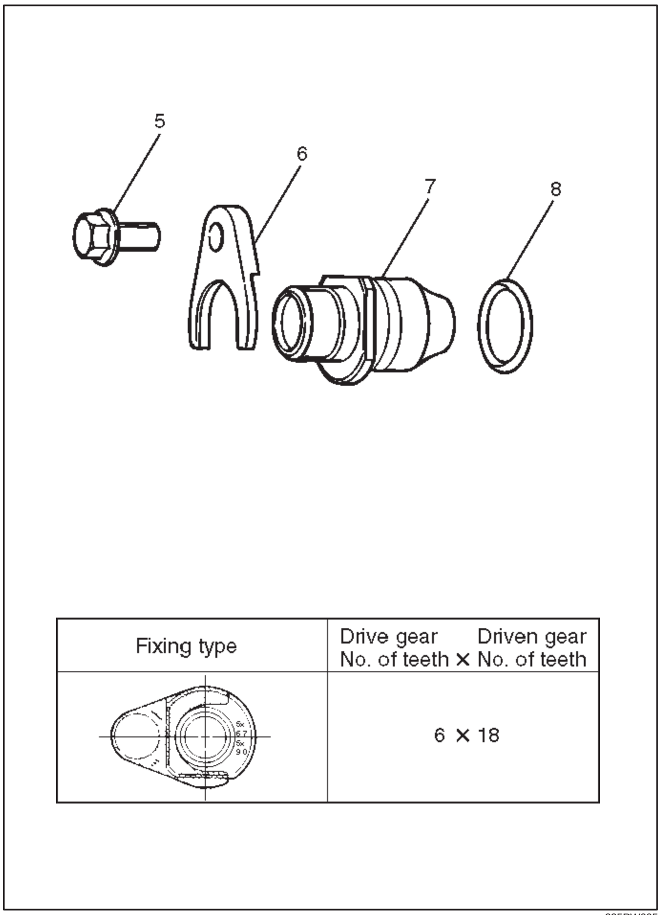
NOTE: Be sure to confirm that there is no crack at the staked portion of the flange nut after staking.

16. Install the O–ring (8) to the speedometer driven gear bushing (7).
17. Install the driven gear to the speedometer driven gear bushing (7).
18. Install the speedometer driven gear assembly to the transfer rear cover.
19. Install the plate (6) to the transfer rear case and tighten to the specified torque.

Torque: 15 N·m (11 lb ft)

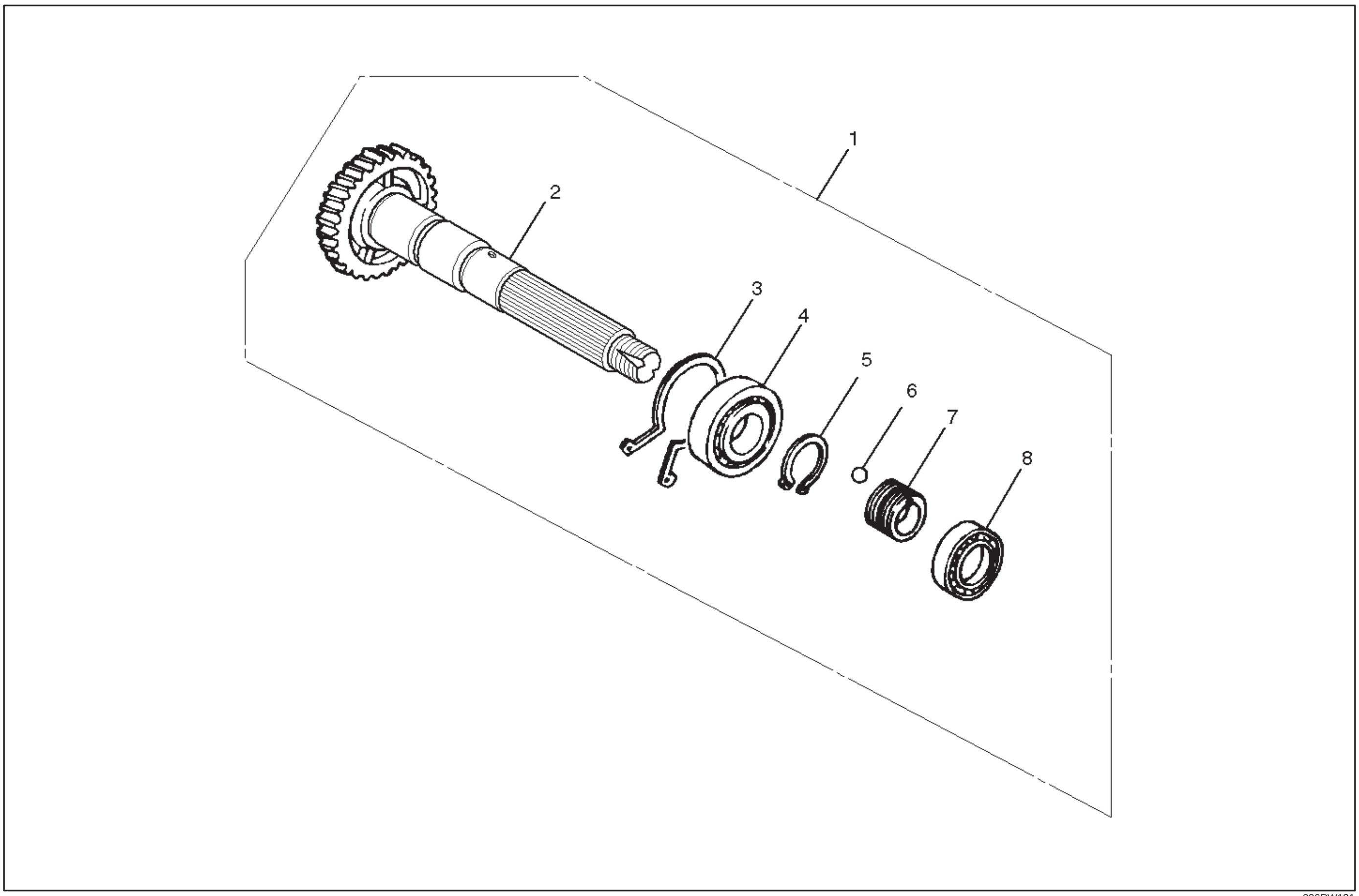
20. Install the speedometer sensor and tighten to the specified torque.

Torque: 27 N·m (20 lb ft)



225RW005

Disassembly

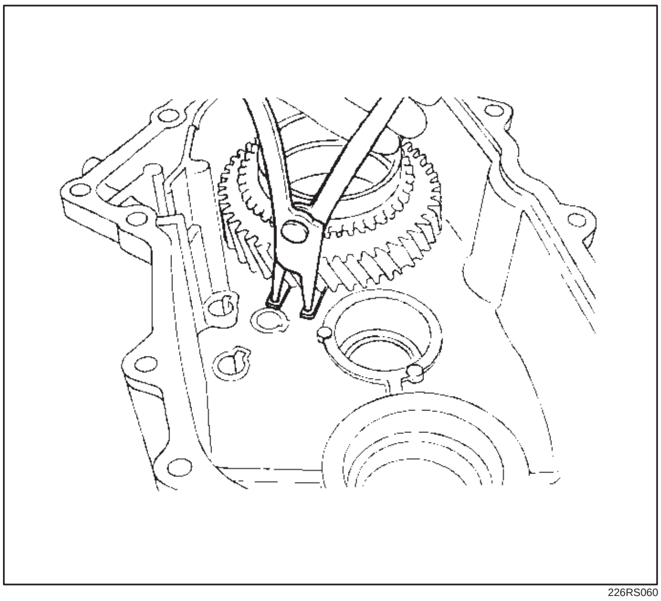


226RW131

Legend

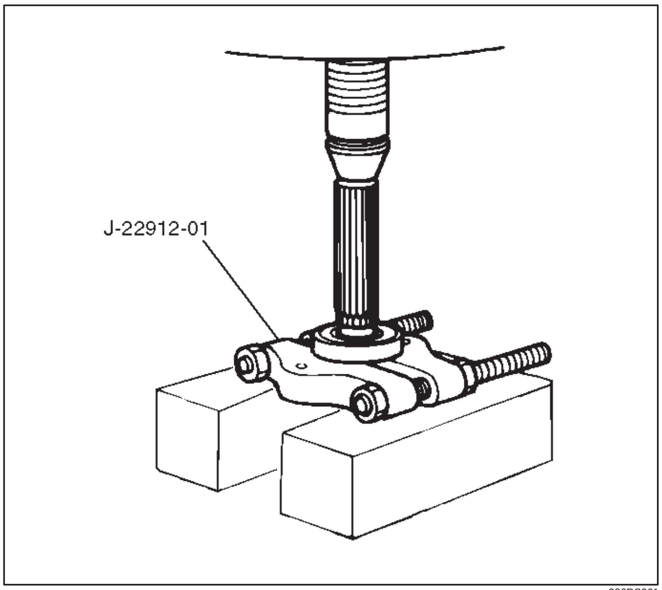
(1) Rear Output Shaft Assembly
(2) Rear Output Shaft
(3) Bearing Snap Ring
(4) Ball Bearing
(5) Bearing Snap Ring
(6) Ball
(7) Speedometer Drive Gear
(8) Ball Bearing
(9) Transfer Rear Case (with oil seal)

1. Remove bearing snap ring, use a pair of snap ring pliers to remove the snap ring.



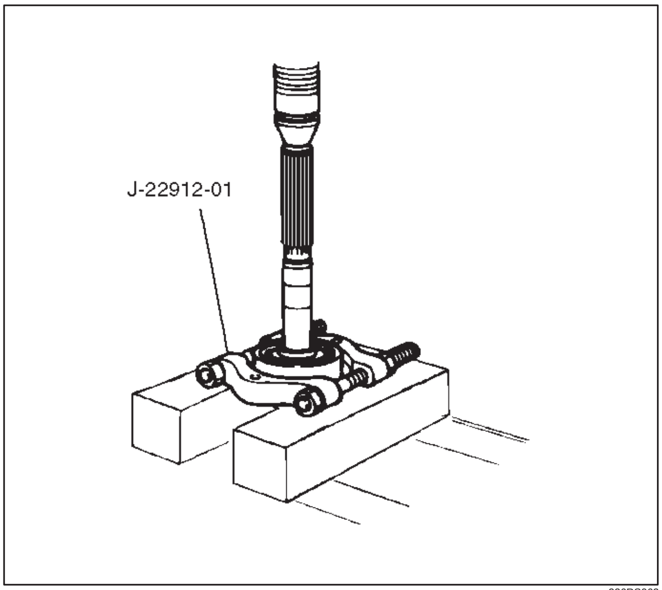
226RS060

2. Remove the rear output shaft assembly from the transfer rear case.
3. Remove ball bearing, use a bench press and the bearing remover J–22912–01 to remove the ball bearing.



226RS061

4. Remove speedometer drive gear.
5. Remove ball.
6. Remove bearing snap ring, use a pair of snap ring pliers to remove the snap ring.
7. Remove ball bearing.
8. Remove rear output shaft, use a bench press and the bearing remover J–22912–01 to remove the ball bearing.



226RS062

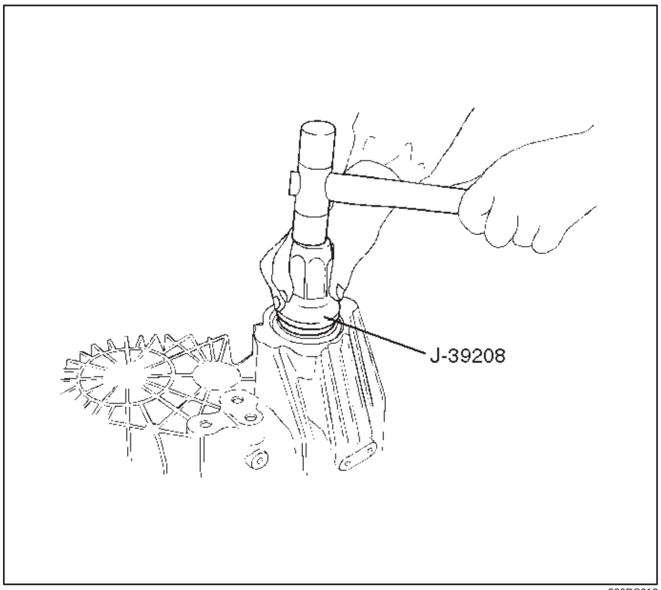
9. Remove transfer rear case (with oil seal).

Inspection and Repair

Refer to “TRANSFER CASE ASSEMBLY” in this section for inspection and repair.

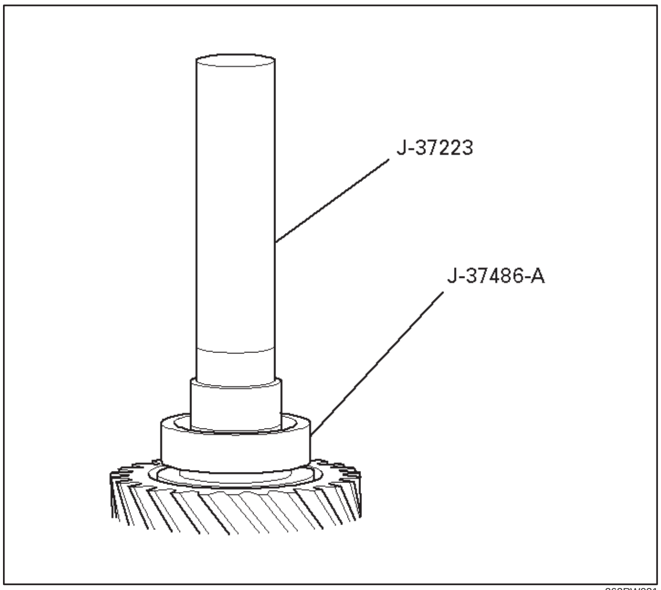
Reassembly

1. Install transfer rear case (with oil seal).
   Oil seal replacement
   - Remove the oil seal from the transfer rear case.
   - Apply engine oil to the oil seal outer surfaces.
   - Fill in recommended grease (BESCO L2) or equivalent in the oil seal lip.
   - Use the oil seal installer to install J–39208 to the rear oil seal to the transfer rear case.



220RS019

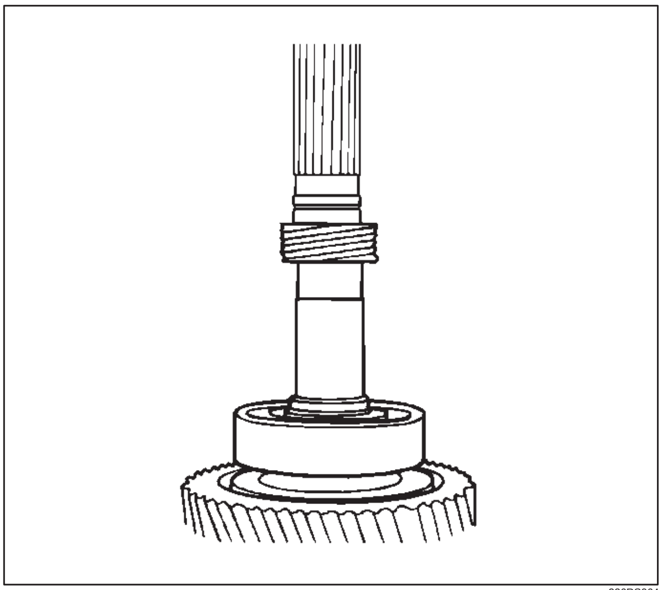
2. Install rear output shaft.
3. Install ball bearing, use the ball bearing installer J–37223 and the adapter J–37486–A to install the ball bearing.



262RW021

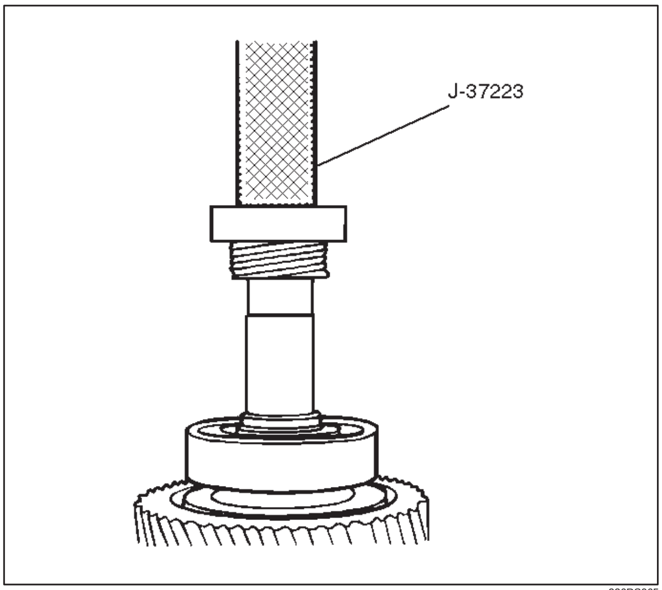
4. Install bearing snap ring.
5. Install ball.

6. Install speedometer drive gear.



226RS064

7. Install ball bearing, use the ball bearing installer J–37223 to install the ball bearing.



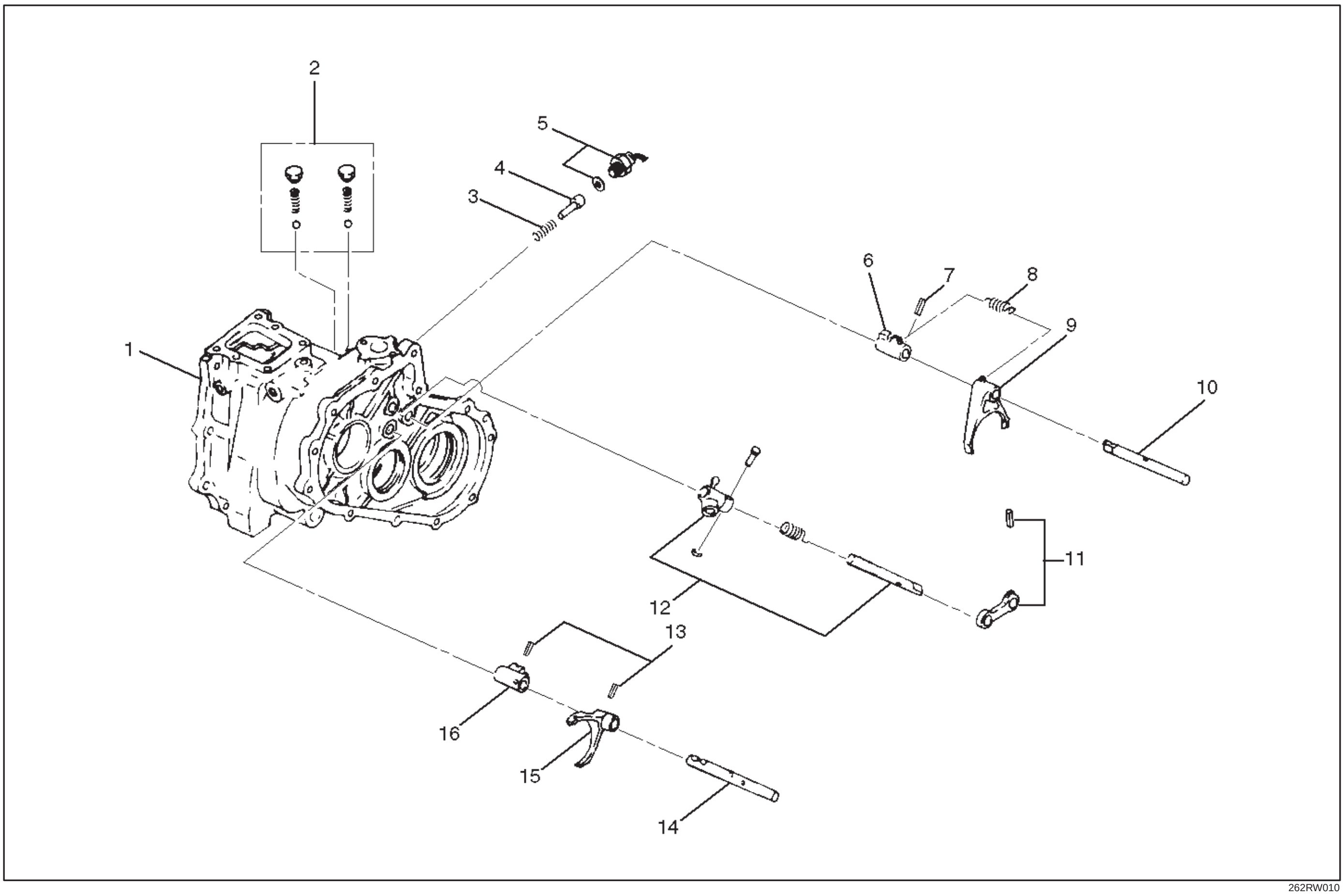
226RS065

8. Install the rear output shaft assembly to the transfer rear case.
9. Install bearing snap ring.

NOTE: The snap ring must be fully inserted into the transfer rear case snap ring groove.

Detent, Shift Arm, and Interlock Pin (Transfer Case Assembly)

Disassembled View



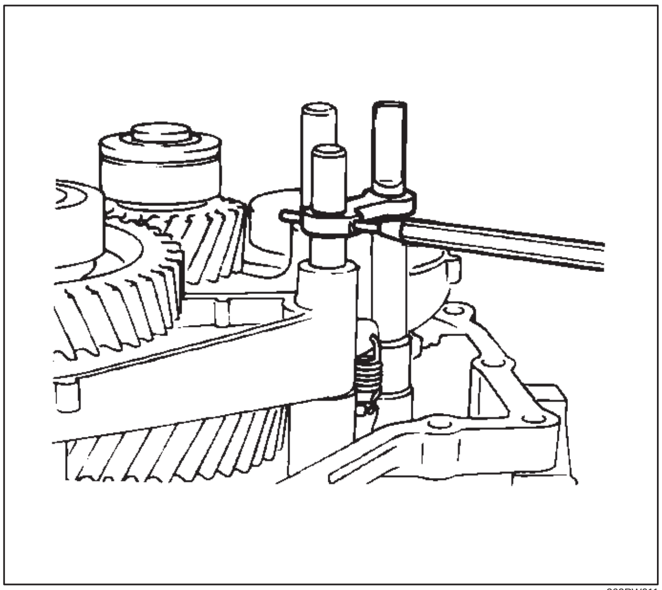
Legend

(1) Transfer Case
(2) Detent Ball, Spring and Plug
(3) Spring
(4) Interlock Pin
(5) 4WD Indicator Switch
(6) Shift Block
(7) Spring Pin
(8) Spring
(9) Shift Arm
(10) 2WD–4WD Shift Rod
(11) Spring Pin and Bridge
(12) Select Rod Assembly
(13) Spring Pin
(14) High–Low Shift Rod
(15) Shift Arm
(16) Shift Block

Disassembly

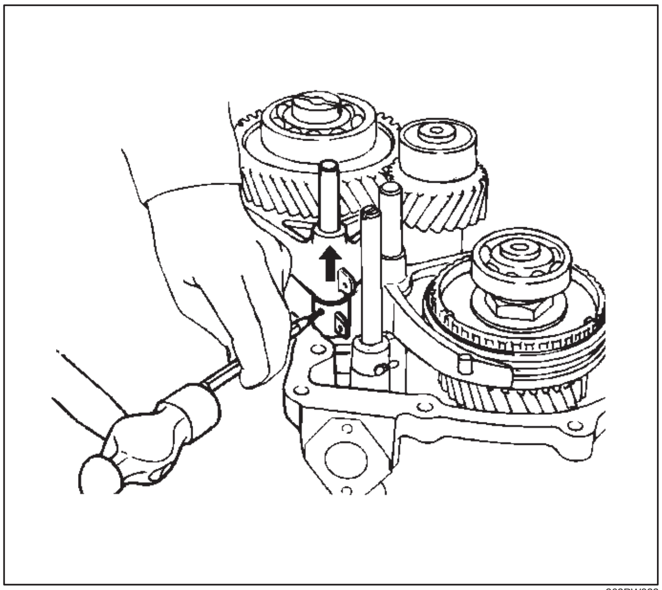
1. Remove detent ball, spring and plug.

2. Remove spring pin and bridge, use a spring pin remover to remove the spring pin from the bridge.



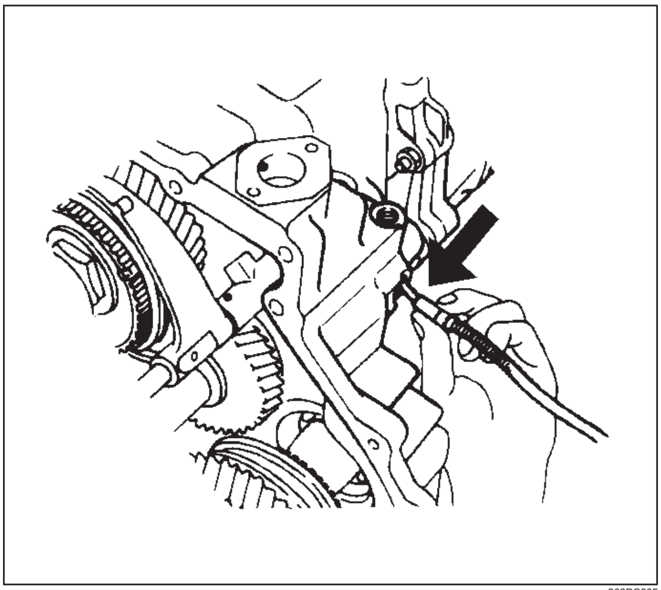
262RW011

3. Remove spring pin.
4. Remove spring.
5. Engage the 2WD–4WD sleeve with front output gear. Remove the spring pin from the block. Remove the shift rod.



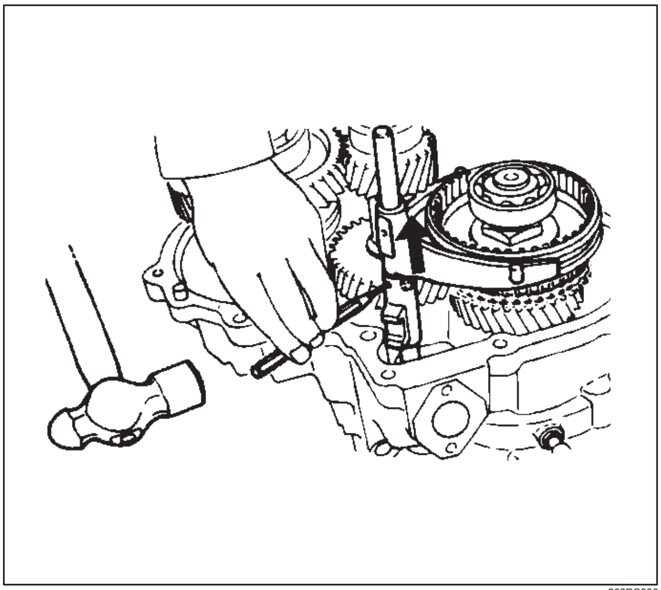
262RW022

6. Remove shift arm.
7. Remove shift block.
8. Remove 4WD indicator switch.
9. Remove interlock pin.
10. Remove spring, use a magnetic tool to remove the interlock pin from the transfer case.



262RS005

11. Remove select rod assembly.
12. Remove spring pin.
13. Remove high–low shift rod, use a spring pin remover to remove the shift arm spring pin from the shift arm and shift block. Remove the high–low shift rod.



262RS006

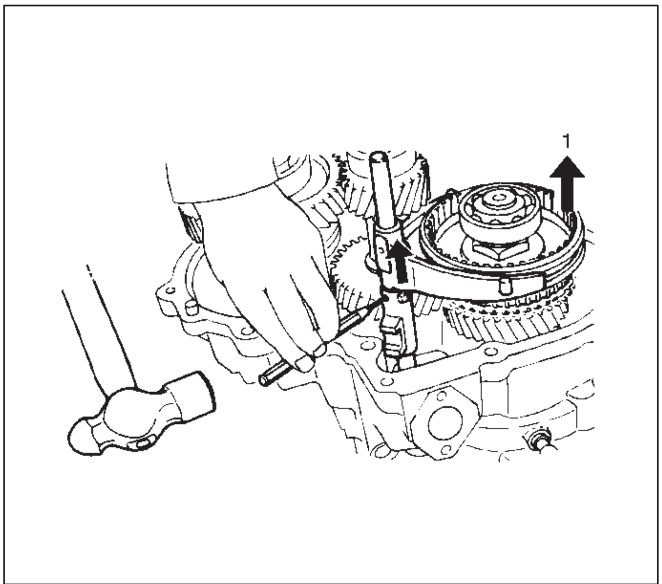
14. Remove shift arm.
15. Remove shift block.
16. Remove transfer case.

Inspection and Repair

Refer to “TRANSFER CASE ASSEMBLY” in this section for inspection and repair.

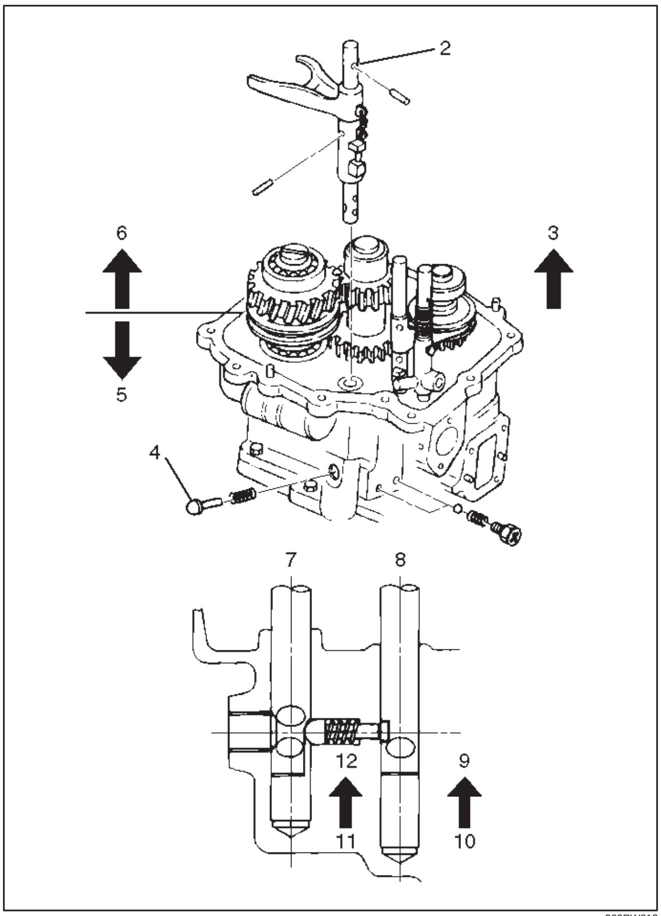
Reassembly

1. Install transfer case.
2. Install shift block.
3. Install shift arm.
4. Install high–low shift rod.
5. Engage the High–Low sleeve with the 4H (1) side.
6. Install the spring pin to the shift block and shift arm.



262RW012

7. Install select rod assembly.
8. Install spring.
9. Engage the High–Low sleeve with the 4H side and install the interlock pin (4) in the proper direction.
10. Install the shift rod: 2WD–4WD (2) with interlock pin pushed in.



262RW013

Legend

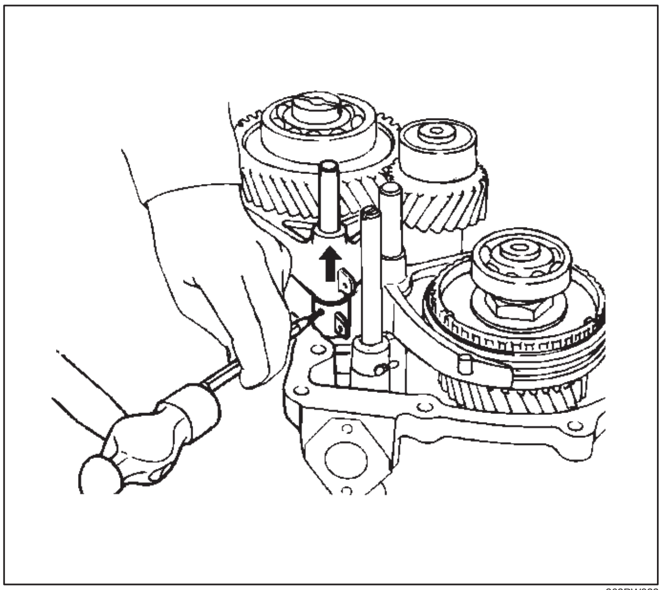
(2) 2WD–4WD
(3) 4H Side
(4) Interlock pin
(5) 2WD
(6) 4WD
(7) Rod: 2–4
(8) Rod: H–L
(9) 4H
(10) 4L
(11) 4×2
(12) 4×4

11. Install 4WD indicator switch and tighten to the specified torque.

    Torque: 39 N·m (29 lb ft)

12. Install shift block.
13. Install shift arm.
14. Install 2WD–4WD shift rod.
15. Install spring.

16. Engage the 2WD–4WD sleeve with the 4WD side and install the spring pin.



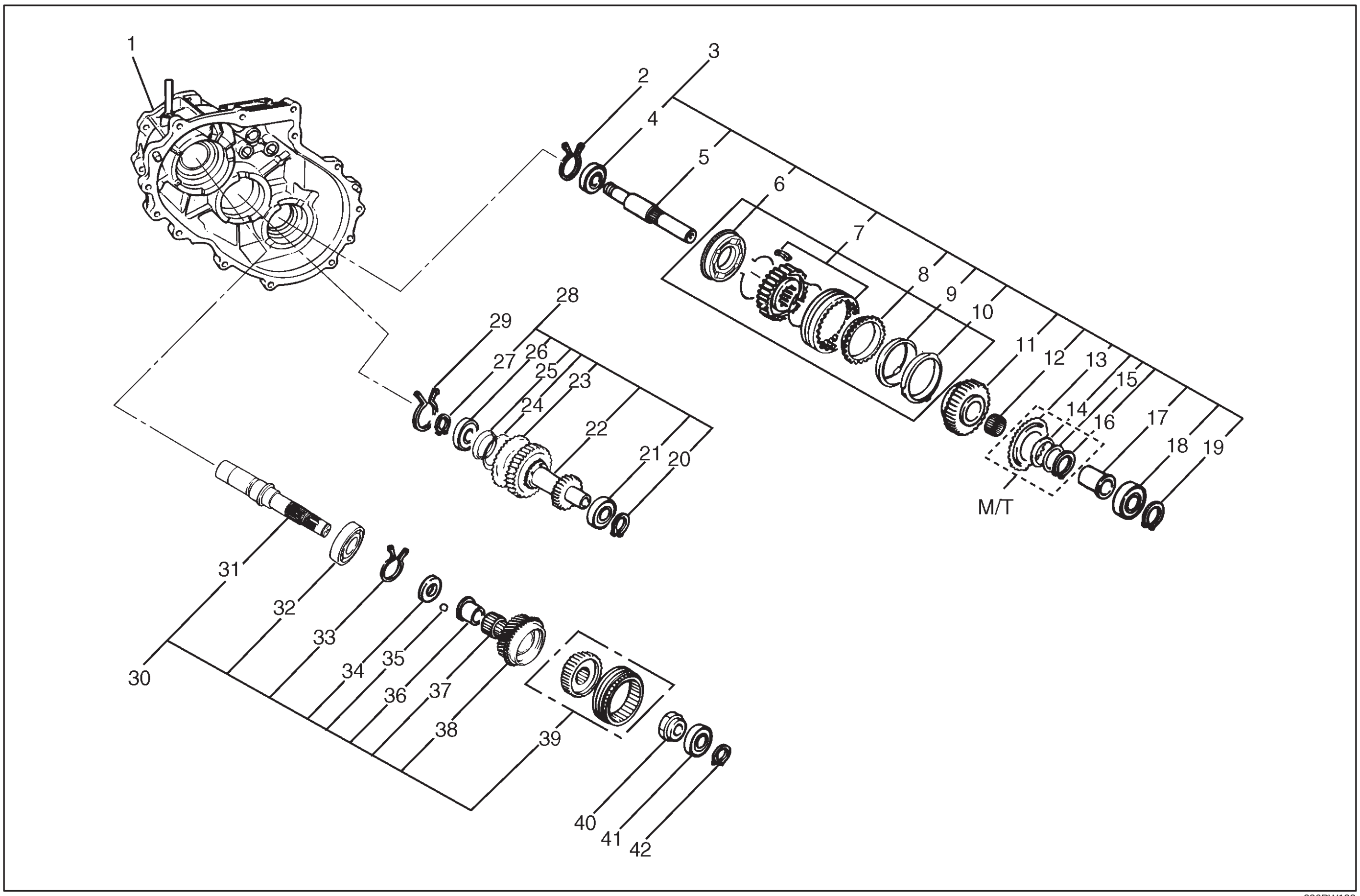
262RW022

17. Install spring pin and bridge.
18. Install detent ball, spring and plug and tighten the plug to the specified torque.

Torque: 25 N·m (18 lb ft)

Transfer Case Assembly

Disassembled View

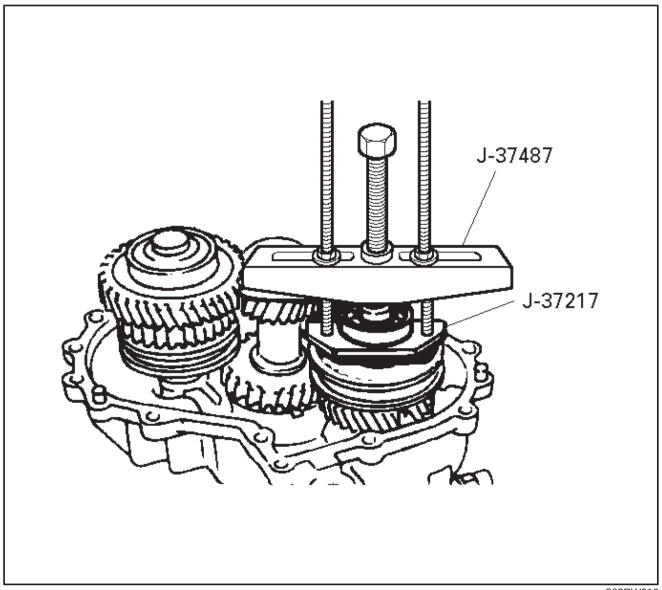


Legend

(1) Transfer Case (with oil seal)
(2) Bearing Snap Ring
(3) Front Output Gear Assembly
(4) Ball Bearing
(5) Front Output Shaft
(6) Stopper Plate
(7) 2WD–4WD Clutch Hub and Assembly
(8) Block Ring
(9) Outside Ring
(10) Inside Ring
(11) Front Output Gear
(12) Needle Bearing
(13) Sub–Gear (anti–lash plate) (M/T)
(14) Belleville Spring (M/T)
(15) Spacer (M/T)
(16) Sub–Gear Snap Ring (M/T)
(17) Bearing Collar
(18) Ball Bearing
(19) Bearing Snap Ring
(20) Snap Ring
(21) Ball Bearing
(22) Counter Gear
(23) Sub–Gear (anti–lash plate)
(24) Belleville Spring
(25) Spacer
(26) Ball Bearing
(27) Snap Ring
(28) Counter Gear Assembly
(29) Bearing Snap Ring
(30) Input Shaft Assembly
(31) Input Shaft
(32) Ball Bearing
(33) Snap Ring
(34) Plate
(35) Ball
(36) Bearing Collar
(37) Needle Bearing
(38) Transfer Input Gear
(39) High–Low Clutch Hub and Sleeve Assembly
(40) Lock Nut
(41) Ball Bearing
(42) Bearing Snap Ring

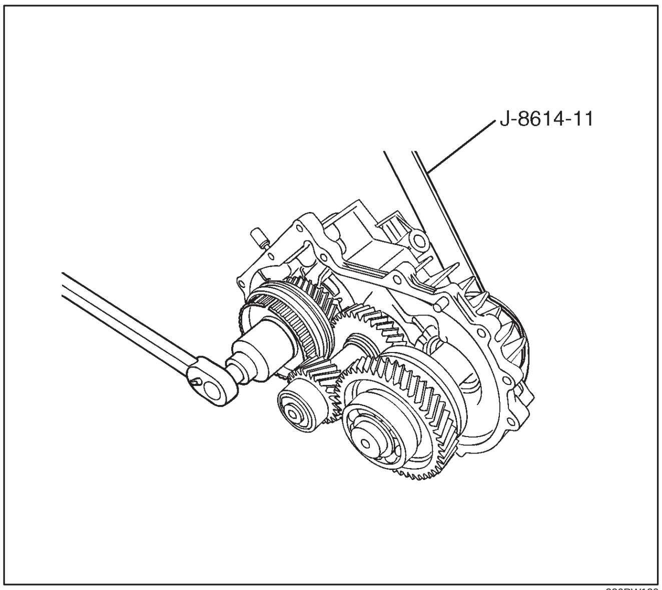
Disassembly

1. Remove bearing snap ring, use a pair of snap ring pliers to remove the snap ring.
2. Remove ball bearing, use a bearing remover J–37217 and puller J–37487 to remove the ball bearing.



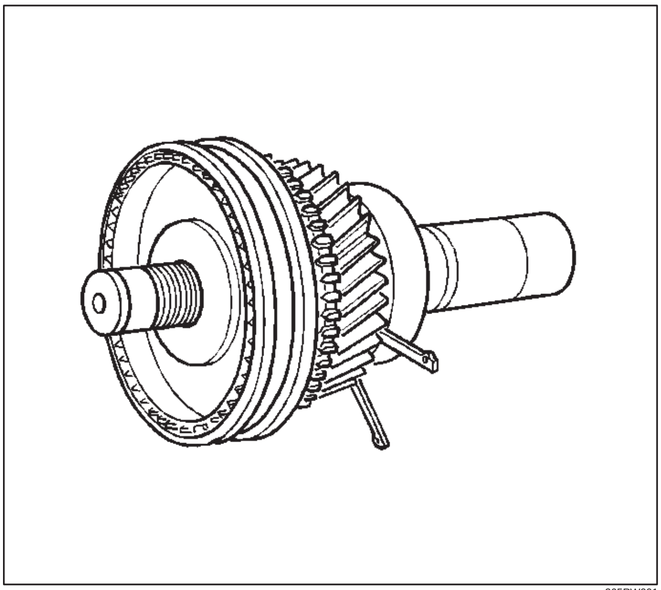
262RW016

3. Install the front companion flange temporarily.
4. Use the Companion flange holder J–8614–11 and lock nut wrench J–37219 to remove the lock nut.



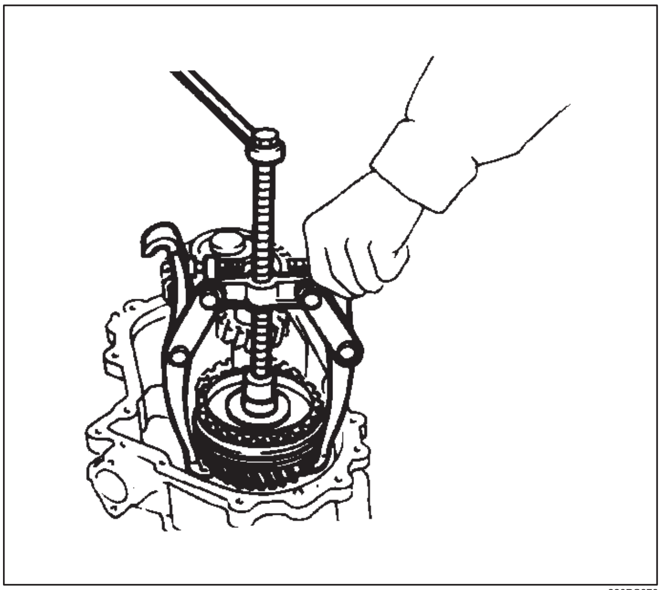
226RW130

5. Remove the front companion flange.
6. Remove snap ring.
7. Remove the input shaft assembly from the transfer case.



265RW001

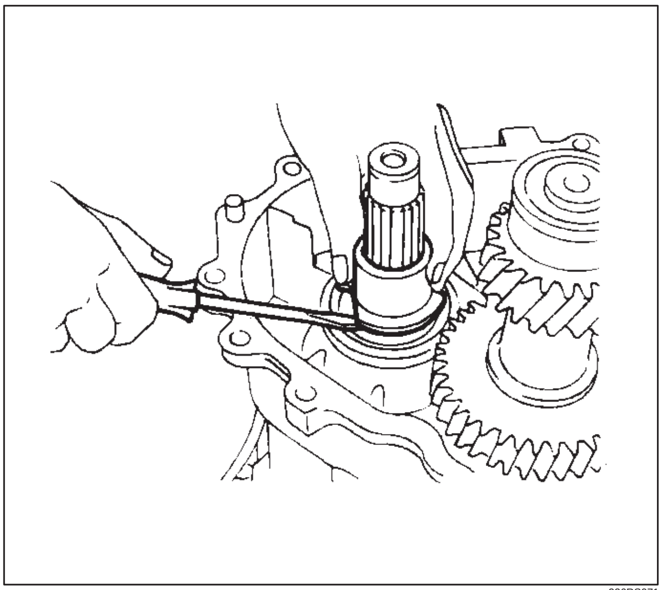
8. Remove high–low clutch hub and sleeve.
9. Remove transfer input gear, use the universal puller to remove the high–low clutch hub and sleeve, and transfer input gear.



226RS070

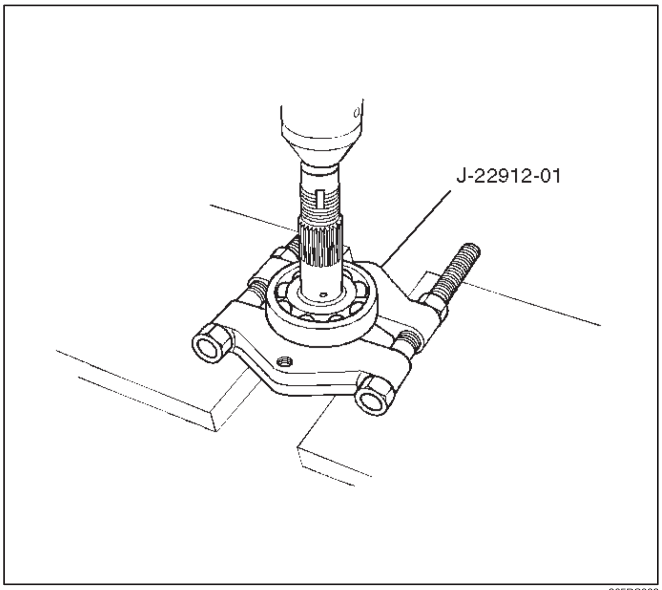
10. Remove needle bearing.

11. Remove bearing collar.



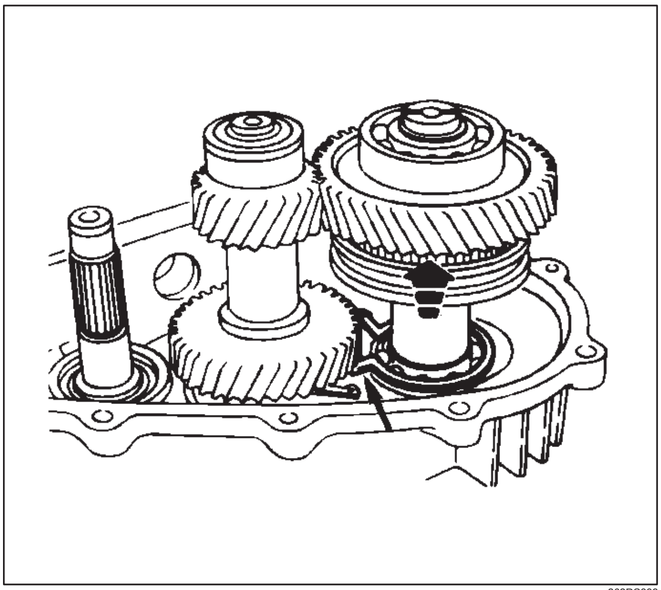
226RS071

12. Remove ball.
13. Remove plate.
14. Remove ball bearing, use a bench press and the ball bearing remover J–22912–01 to remove the ball bearing.



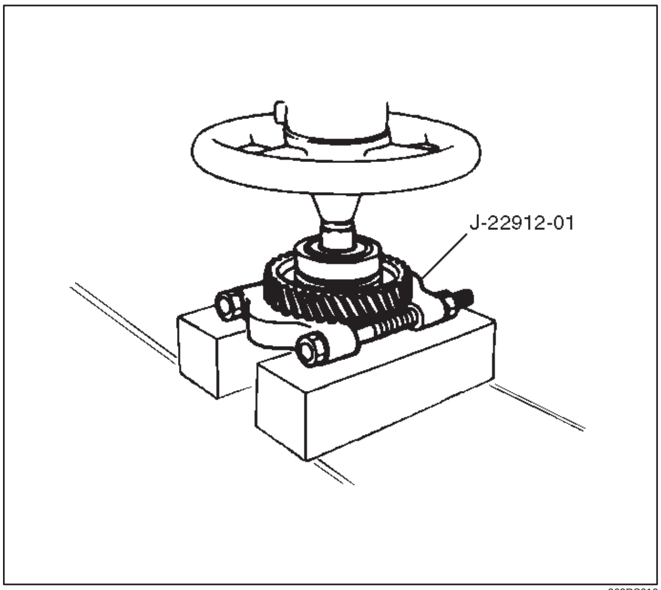
265RS002

15. Remove input shaft.
16. Remove bearing snap ring.
17. Remove front output gear assembly, use a pair of snap ring pliers to expand the bearing snap ring and use a plastic hammer to tap the front output gear assembly free.



262RS009

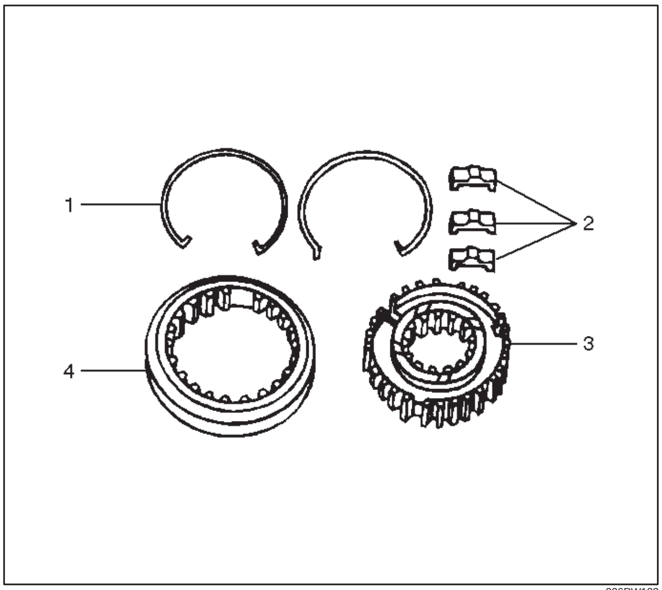
18. Remove bearing snap ring.
19. Remove ball bearing.
20. Remove bearing collar.
21. Remove sub–gear snap ring. (M/T)
22. Remove spacer. (M/T)
23. Remove belleville spring. (M/T)
24. Remove sub–gear (anti–lash plate). (M/T)
25. Remove front output gear.
26. Remove needle bearing, use a bench press and the bearing remover J–22912–01 to remove the parts above.



262RS010

27. Remove inside ring.
28. Remove outside ring.
29. Remove block ring.

30. Disassemble the 2WD–4WD clutch hub and sleeve assembly.
    - Springs (1)
    - Inserts (2)
    - Clutch Hub (3)
    - Sleeve (4)

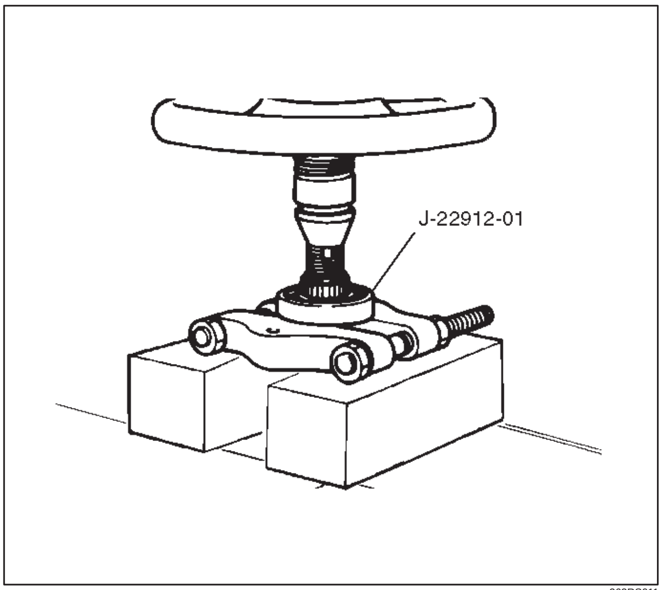


226RW133

31. Remove stopper plate.

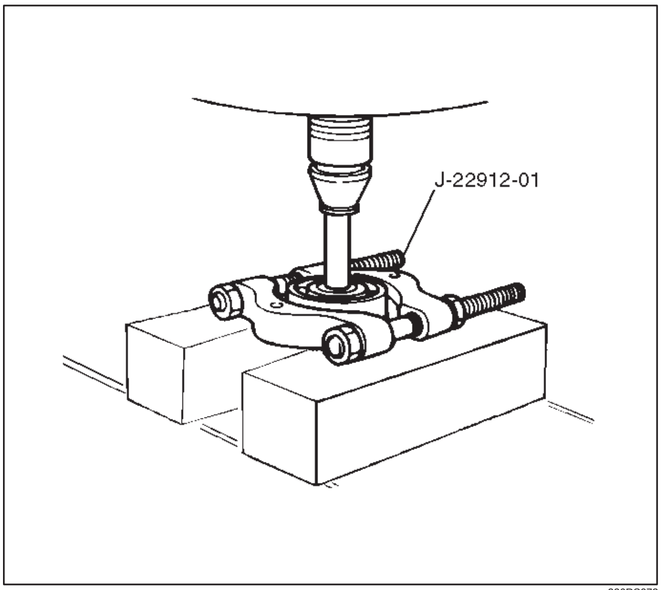
NOTE: Do not reuse the stopper plate.

32. Remove ball bearing, use the ball bearing remover J–22912–01 to remove the ball bearing.



262RS011

33. Remove front output shaft.
34. Remove bearing snap ring.
35. Remove the counter gear assembly from the transfer case.
36. Remove snap ring, use a pair of snap ring pliers to remove the snap ring.
37. Remove ball bearing, use a bench press and the bearing remover J–22912–01 to remove the ball bearing.
38. Remove snap ring, use a pair of snap ring pliers to remove the snap ring.
39. Remove ball bearing, use a bench press and the bearing remover J–22912–01 to remove the ball bearing.



226RS073

40. Remove spacer.
41. Remove belleville spring.
42. Remove sub–gear (anti–lash plate).
43. Remove counter gear.

Inspection and Repair

1. Make the necessary repair or parts replacement if wear, damage or any other abnormal conditions are found during inspection.
2. Wash all parts thoroughly in clean solvent. Be sure all old lubricant, metallic particles, dirt, or foreign material are removed from the surfaces of every part. Apply compressed air to each oil feed port and channel in each case half to remove any obstructions or cleaning solvent residue.

Gears

1. Inspect all the gear teeth for signs of excessive wear or damage and check all the gear splines for burrs, nicks, wear or damage. Remove the minor nicks or scratches on an oil stone. Replace any part exhibiting excessive wear or damage.

Gear Inside Diameter

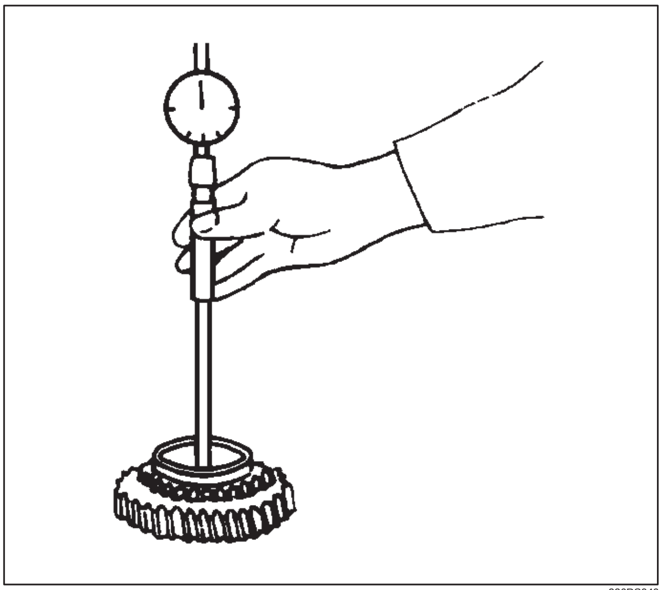
1. Use an inside dial indicator to measure the gear inside diameter.

2. If the measured value exceeds the specified limit, the gear must be replaced.

Gear inside diameter

Standard : 48.000–48.013 mm (1.8898–1.8903 in)

Limit : 48.10 mm (1.894 in)



226RS040

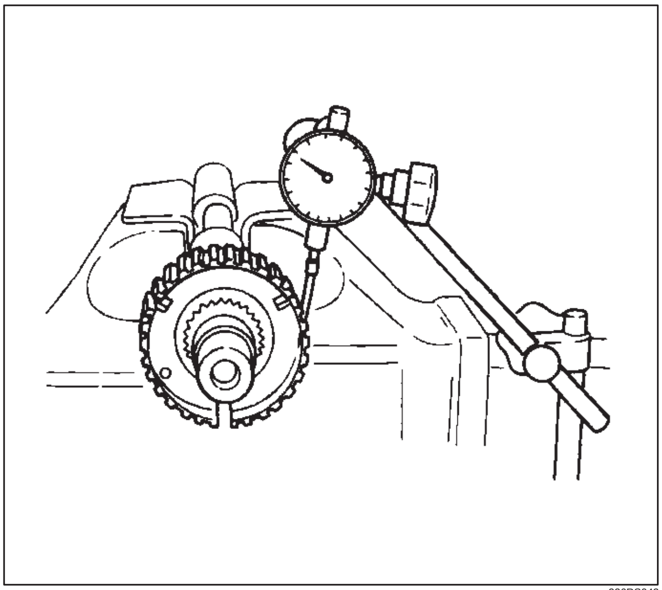
Clutch Hub Spline Play

1. Set a dial indicator to the clutch hub to measured.
2. Move the clutch hub as far as possible to both the right and the left.
   Note the dial indicator reading.
3. If the measured value exceeds the specified limit, the clutch hub must be replaced.

Clutch hub spline play

Standard : 0–0.1 mm (0–0.004 in)

Limit : 0.2 mm (0.008 in)



226RS042

Bearings

1. Inspect the condition of all the needles and ball bearings. Wash bearings thoroughly in a cleaning solvent. Apply compressed air to the bearings.

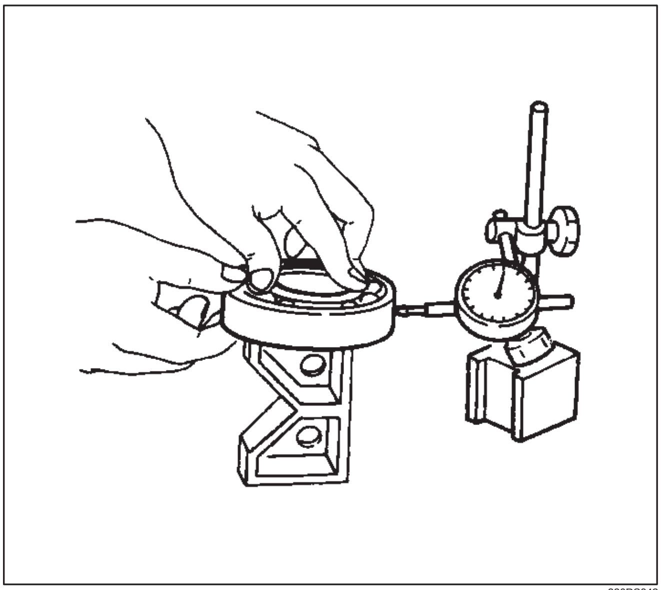
NOTE: Do not allow the bearings to spin. Turn them slowly by hand. Spinning bearings may damage the rollers.

2. Lubricate the bearings with a light oil and check them for roughness by slowly turning the race by hand.

Ball Bearing Play

1. Use a dial indicator to measure the ball bearing play.
2. If the measured value exceeds the specified limit, the ball bearing must be replaced.

Limit : 0.2 mm (0.008 in)



226RS043

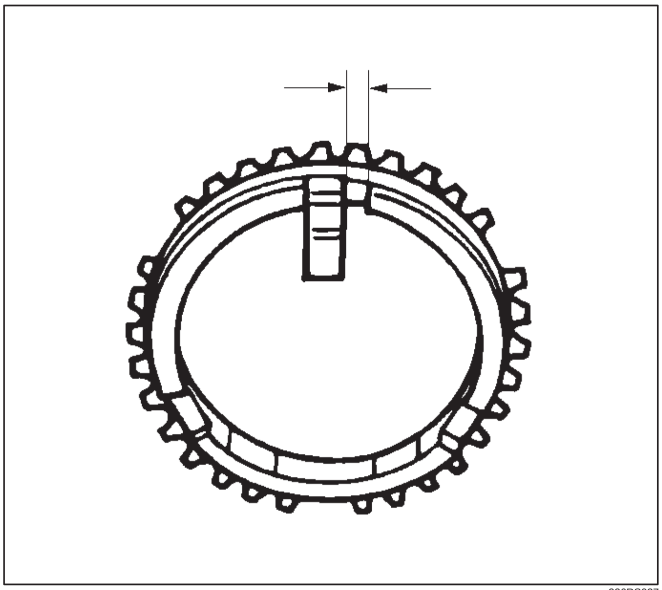
Block Ring and Insert Clearance

1. Use a vernier caliper to measure the clearance between the block ring and the insert.
2. If the measured value exceeds the specified limit, the block ring and the insert must be replaced.

Block ring and insert clearance

Standard : 3.46–3.74 mm (0.136–0.147 in)

Limit : 4.0 mm (0.158 in)



226RS037

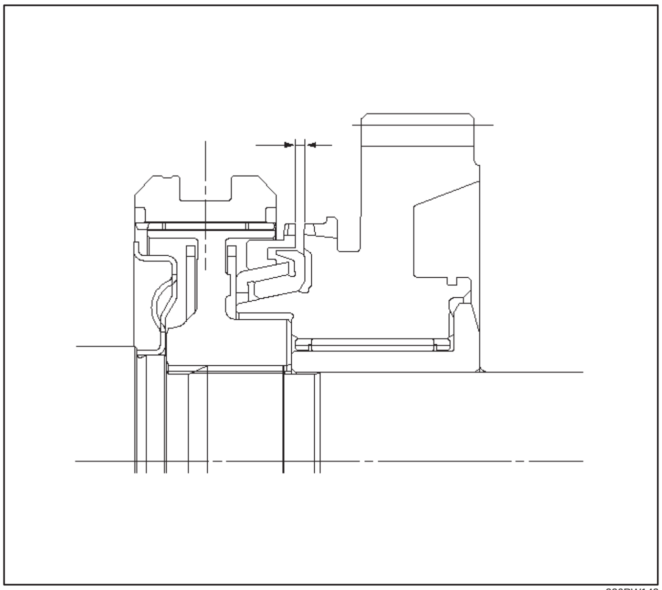
2WD–4WD Synchronizer (3–Cone)

1. Use a thickness gauge to measure the clearance between the block ring and the dog teeth.
2. If the measured value exceeds the specified limit, the 2WD–4WD synchronizer assembly must be replaced.

Block ring and insert clearance

Standard : 1.5 mm (0.059 in)

Limit : 0.8 in (0.031 in)



226RW142

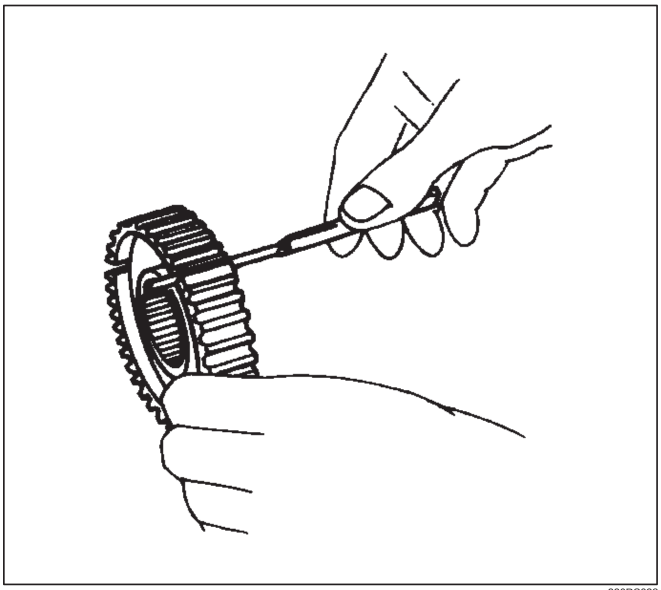
Clutch Hub and Insert Clearance

1. Use a thickness gauge to measure the clearance between the clutch hub and the insert.
2. If the measured value exceeds the specified limit, the clutch hub and the insert must be replaced.

Clutch hub and insert clearance

Standard : 0.01–0.19 mm (0.0004–0.0075 in)

Limit : 0.3 mm (0.012 in)



226RS038

Detent Springs

1. Inspect the springs for distortion, cracks or wear. Replace if these conditions are present.

Detent Spring Free Length

1. Use a vernier caliper to measure the detent spring free length.

2. If the measured value is less than the specified limit, the detent spring must be replaced.

Detent spring free length

Detent ball

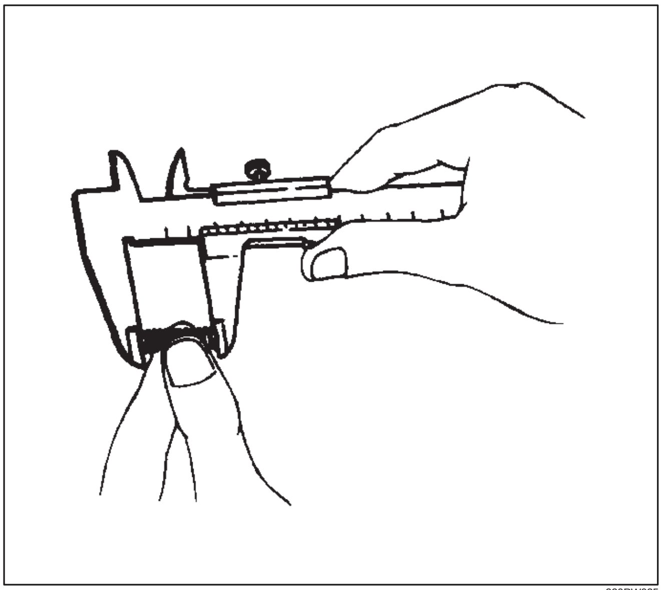
Standard : 23.4 mm (0.921 in)

Limit : 22.8 mm (0.898 in)

Interlock pin

Standard : 1.59 mm (0.063 in)

Limit : 1.53 mm (0.060 in)



220RW035

Detent Spring Tension

1. Use a spring tester to measure the detent spring tension.
2. If the measured value is less than the specified limit, the detent spring must be replaced.

Detent spring free length

Detent ball

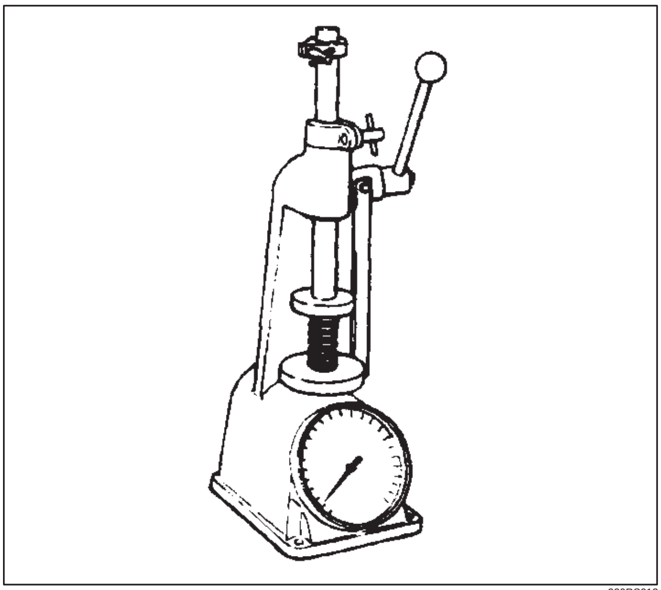
Compressed height : 18.7 mm (0.736 in)

Standard : 68.6–88.2 N (15.4–19.8 lb)

Interlock pin

Compressed height : 11.5 mm (0.453 in)

Standard : 9.8 N (2.2 lb)



220RS013

Shift Arm

1. Inspect the shift arms for wear, distortion or scoring. Replace if these conditions are present.

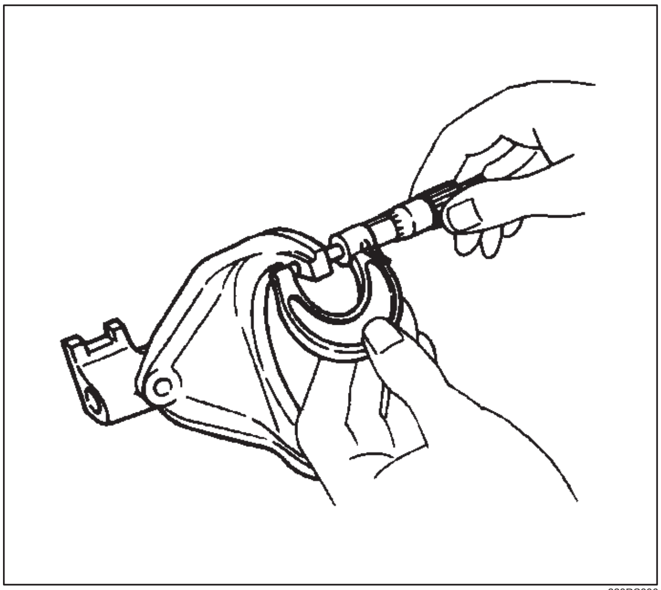
Shift Arm Thickness

1. Use a micrometer to measure the shift arm thickness.
2. If the measured value is less than the specified limit, the shift arm must be replaced.

Shift arm thickness

Standard : 9.60–9.85 mm (0.378–0.388 in)

Limit : 9.0 mm (0.354 in)



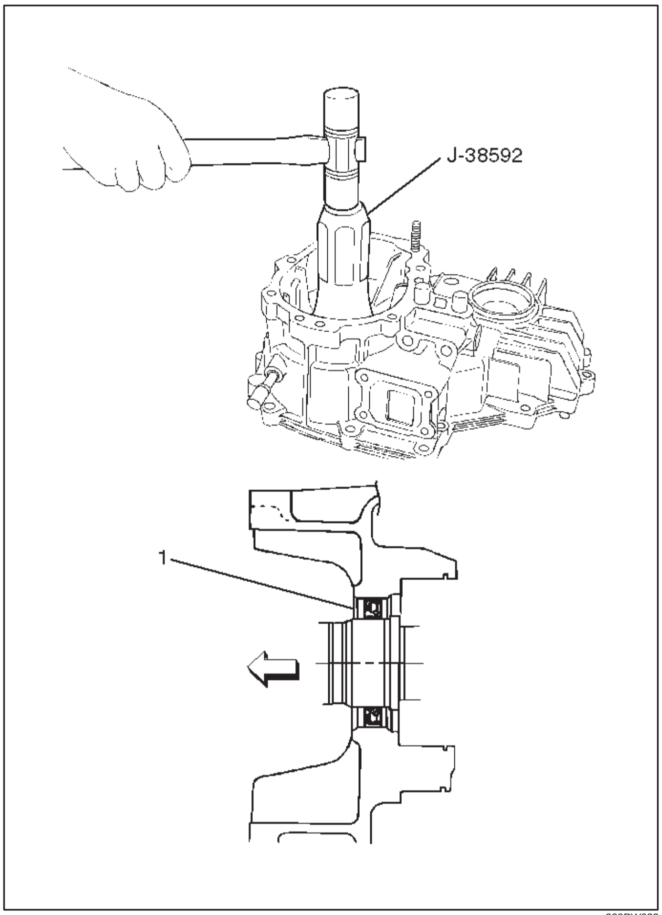
230RS006

Reassembly

1. Install transfer case (with oil seal).

Input shaft oil seal (1) replacement

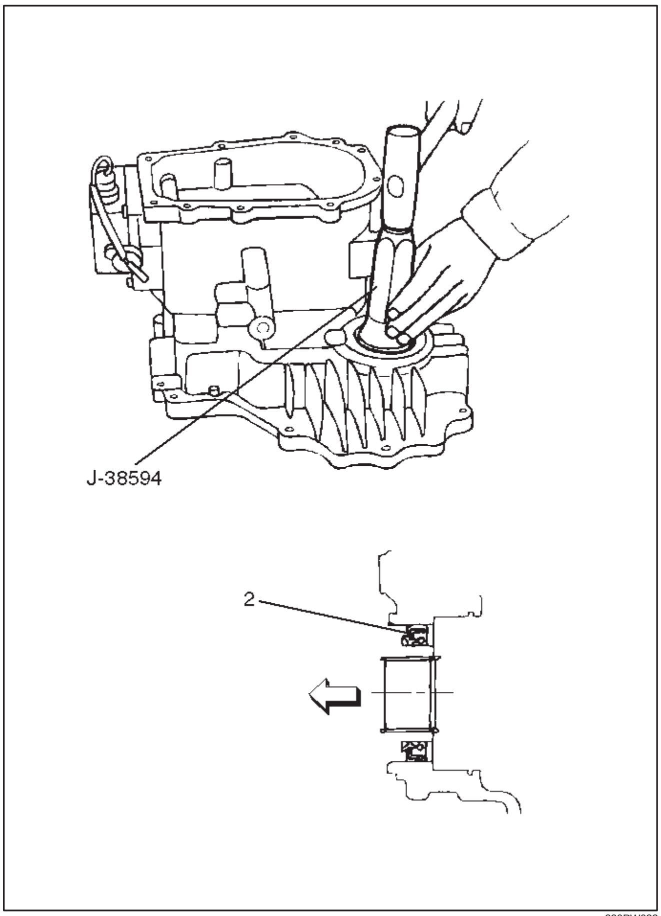
1. Remove the oil seal from the transfer case.
2. Apply engine oil to the oil seal outer surfaces.
3. Apply recommended grease (BESCO L2) or equivalent to the oil seal lip.
4. Use the oil seal installer J–38592 to install the oil seal to the transfer case.



220RW032

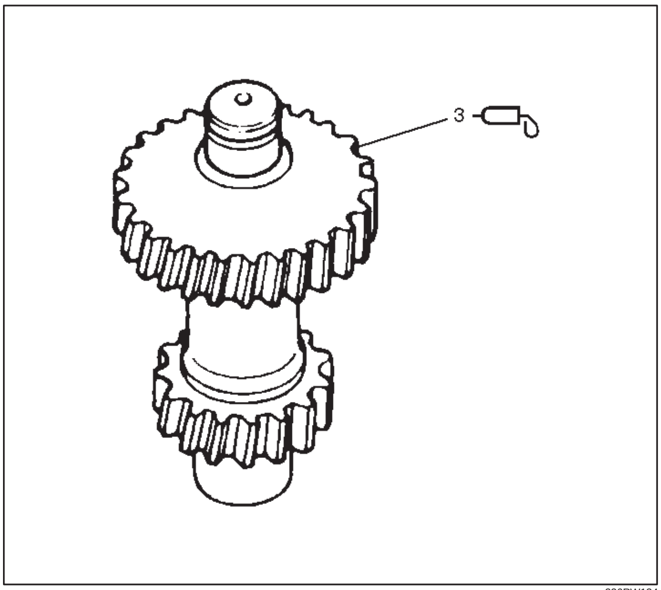
Front output shaft oil seal (2) replacement

1. Remove the oil seal from the transfer case.
2. Apply engine oil to the oil seal outer surfaces.
3. Apply recommended grease (BESCO L2) or equivalent to the oil seal lip.
4. Use the oil seal installer J–38594 to install the oil seal to the transfer case.



220RW033

2. Install counter gear.
3. Install sub–gear and apply chassis grease (3) to the sub–gear and the counter gear thrust surfaces.



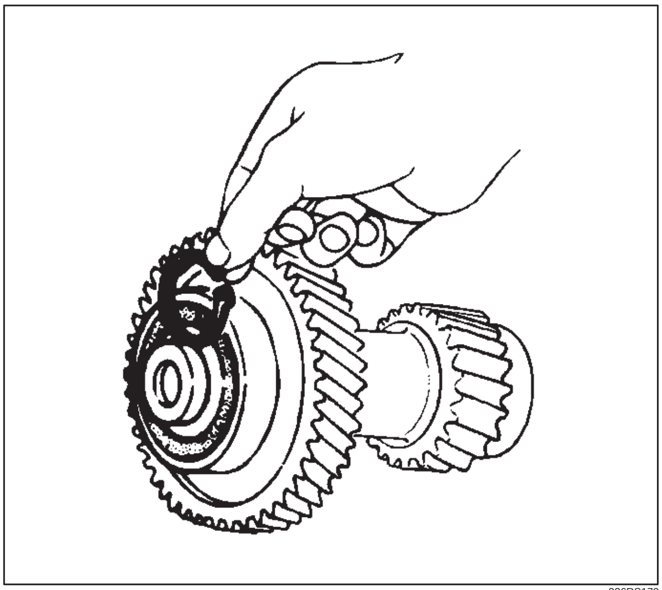
226RW134

4. Install belleville spring.
5. Install spacer.
6. Install ball bearing.
7. Select a snap ring that will allow the minimum axial play.

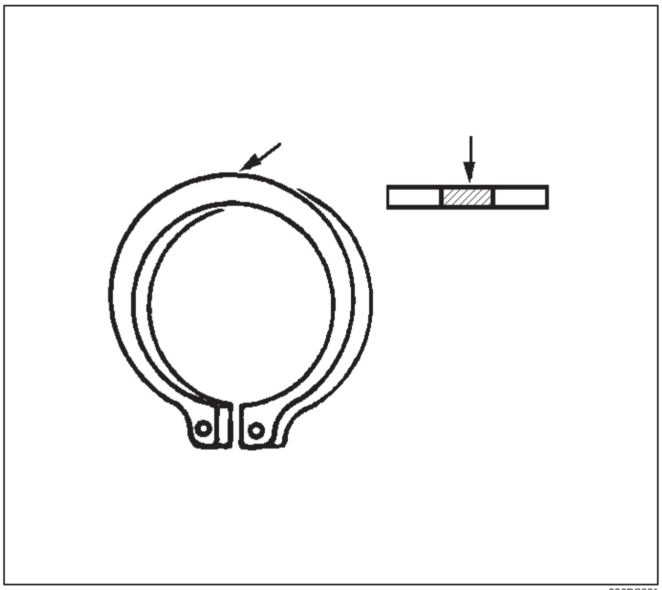
Clearance : 0–0.1 mm (0–0.004 in)

Snap ring availability:	
Thickness	Color–coding
1.50 mm (0.059 in)	White
1.55 mm (0.061 in)	Yellow
1.60 mm (0.063 in)	Blue

8. Use a pair of snap ring pliers to install the snap ring to the counter gear.



226RS170

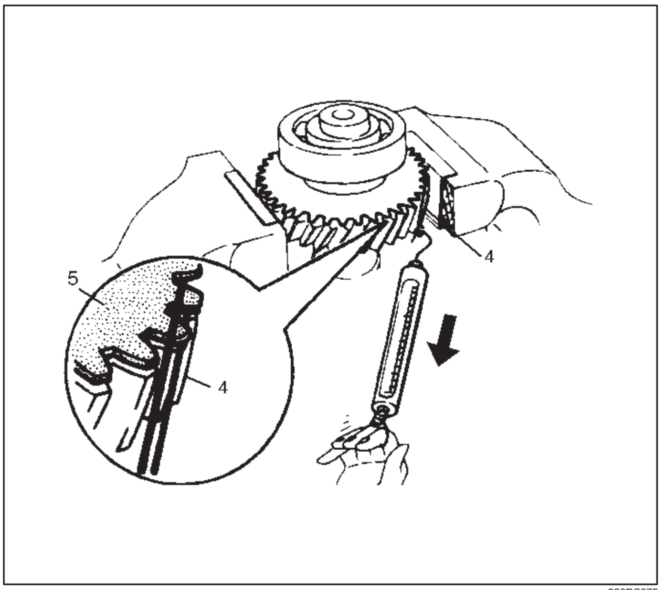


226RS021

Sub–Gear (anti–lash plate) Preload

1. Hook a length of piano wire (4) over one of the sub–gear (5) teeth.
2. Attach the other end of the piano wire (4) to a spring balancer.
3. Measure the sub–gear preload.

Preload : 59–98 N (13–22 lb)

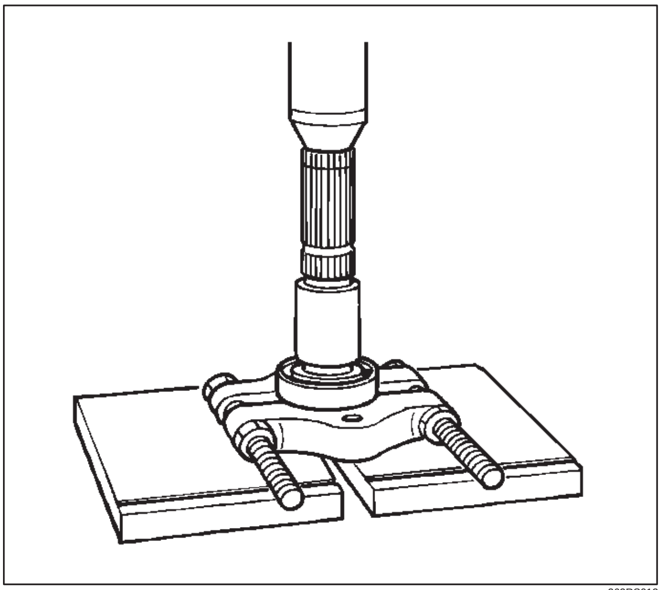


226RS075

9. Install ball bearing.
10. Install snap ring.
11. Install the counter gear assembly to the transfer case.
12. Install bearing snap ring, use a pair of snap ring pliers to install the snap ring to the transfer case.

NOTE: The snap ring must be fully inserted into the transfer case snap ring groove.

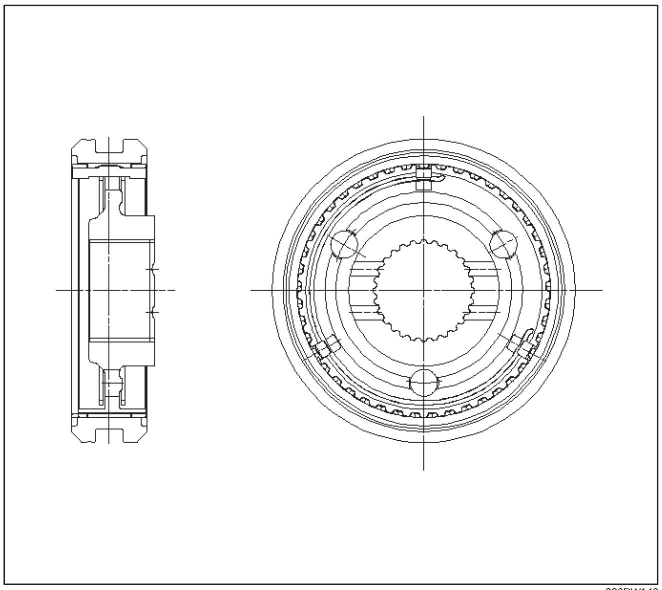
13. Install front output shaft.
14. Install ball bearing, use a bench press to install the ball bearing to the front output shaft.



262RS012

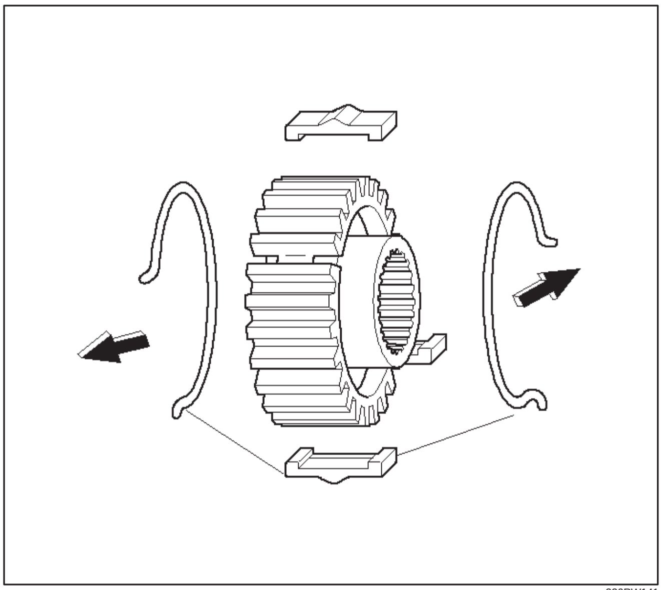
15. Install stopper plate.

16. Assemble the clutch sleeve and hub assembly.



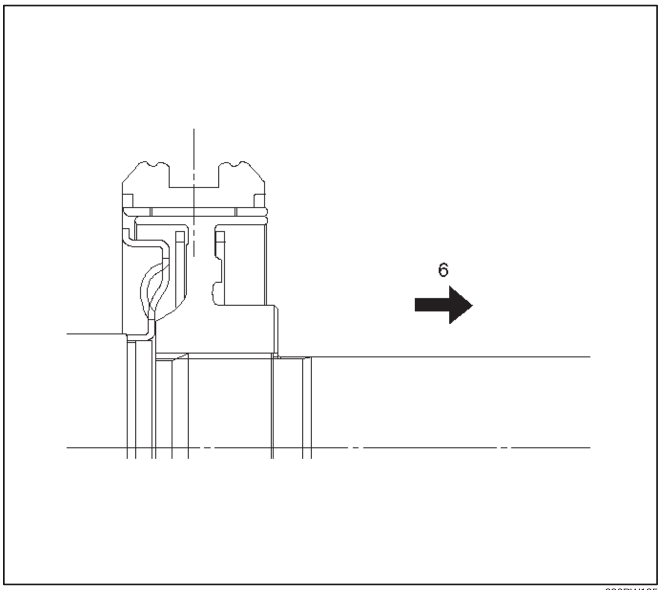
226RW140

17. Engage the springs in the same insert with the open ends away from each other.



226RW141

18. Install a new stopper plate and the clutch sleeve and hub assembly to the front output shaft.



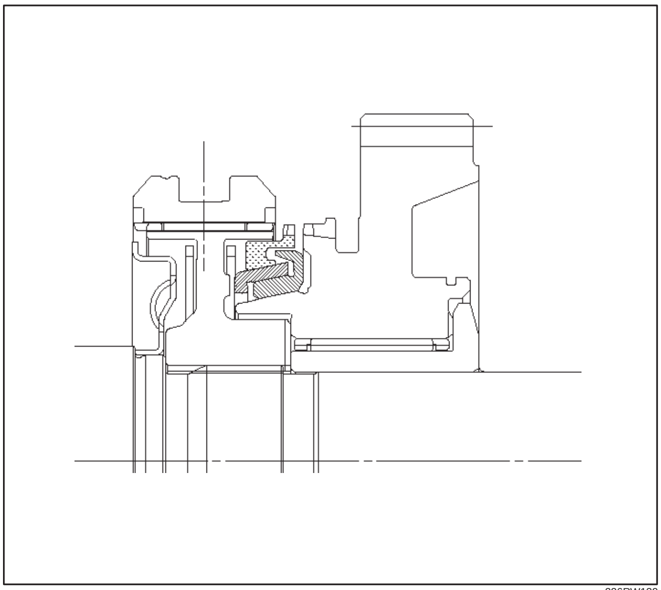
226RW135

Legend

(6) Front Output Gear

19. The clutch hub face (with the heavy boss) must be facing the front output gear side.
20. Use a bench press to slowly force the clutch sleeve and hub assembly together with the stopper plate into place.
21. Align the inserts with the block ring insert grooves. Install the block ring to the clutch sleeve and hub assembly.
22. Install outside ring.
23. Install the outside ring, inside ring and needle bearing to the front output gear and bearing collar.

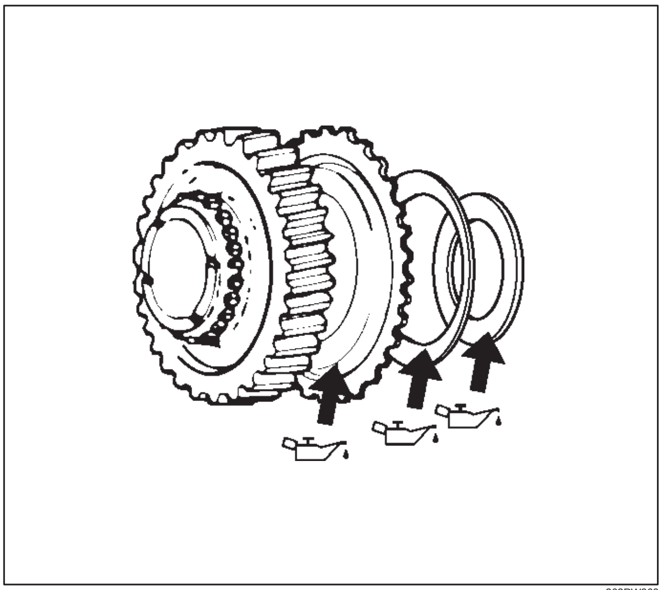
NOTE: Coat all parts with transmission oil before installing them.



226RW139

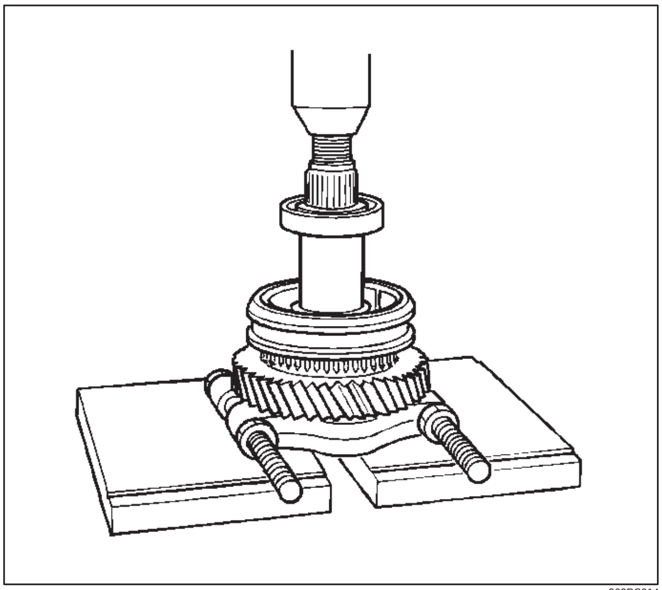
24. Install needle bearing.
25. Install front output gear.
26. Install sub–gear (anti–lash plate). (M/T)

27. Install belleville spring. (M/T)
28. Install spacer and apply engine oil to the thrust surfaces of the sub–gear, the belleville spring, and the spacer. (M/T)



262RW060

29. Install sub–gear snap ring. (M/T)
30. Install bearing collar, use a bench press to install the needle bearing collar together with the front output gear.

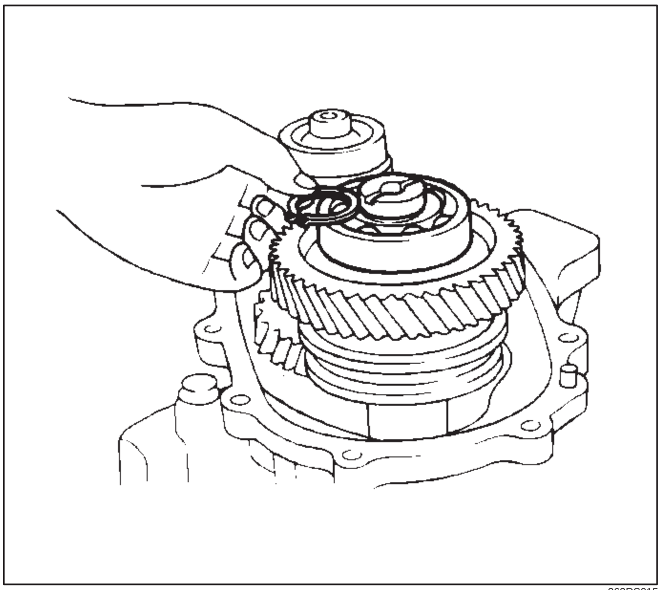


262RS014

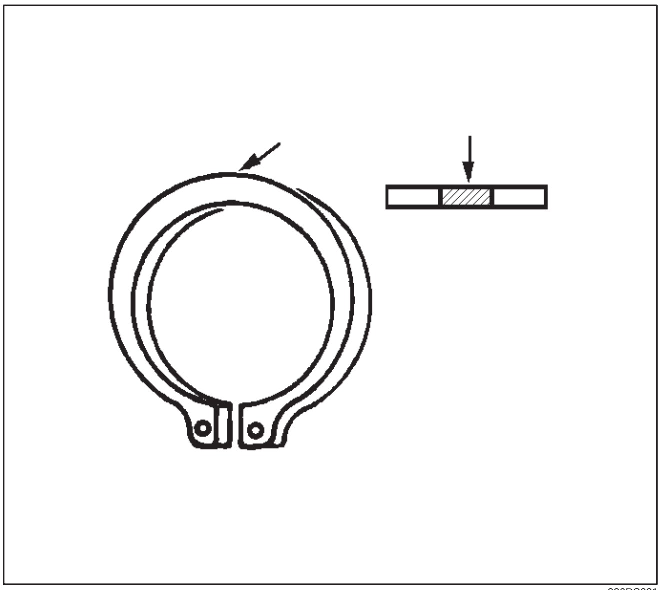
31. Install ball bearing.
32. Install bearing snap ring and select a snap ring that will allow the minimum axial play.

Clearance : 0–0.1 mm (0–0.004 in)

Snap ring availability:	
Snap ring thickness	Color coding
1.55 mm (0.061 in)	White
1.60 mm (0.063 in)	Yellow
1.65 mm (0.065 in)	Blue
1.70 mm (0.067 in)	Pink
1.75 mm (0.069 in)	Green
1.80 mm (0.071 in)	Brown
1.85 mm (0.073 in)	Red
1.90 mm (0.075 in)	Orange



262RS015



226RS021

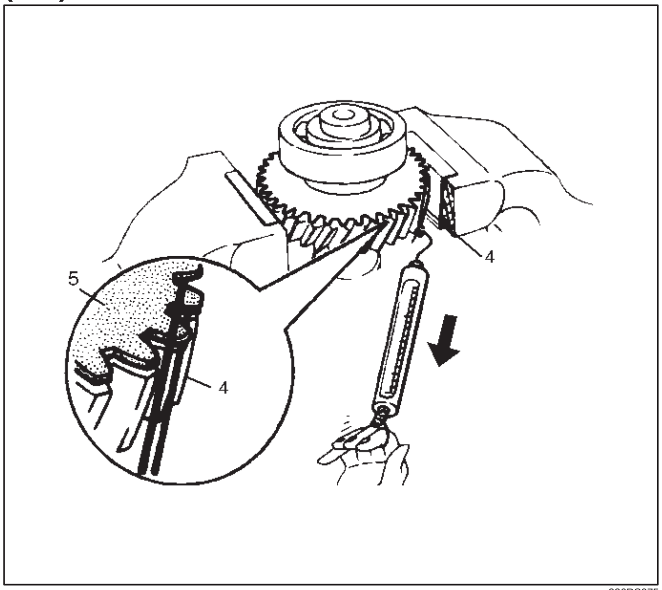
33. Use a pair of snap ring pliers to install the snap ring to the output shaft.

Sub gear (anti lash plate) preload (M/T)

1. Hook a length of piano wire (4) over one of the sub–gear (5) teeth.
2. Attach the other end of the piano wire to (4) a spring balancer.
3. Measure the sub–gear preload.

Preload: 59–98 N (13–22 lb)

(M/T)

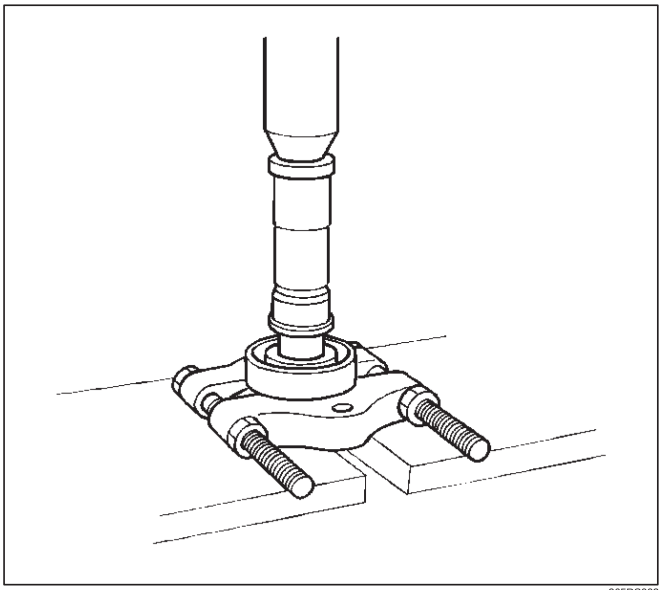


226RS075

34. Install front output gear assembly.
35. Install bearing snap ring, use a pair of snap ring pliers to install the snap ring to the transfer case.

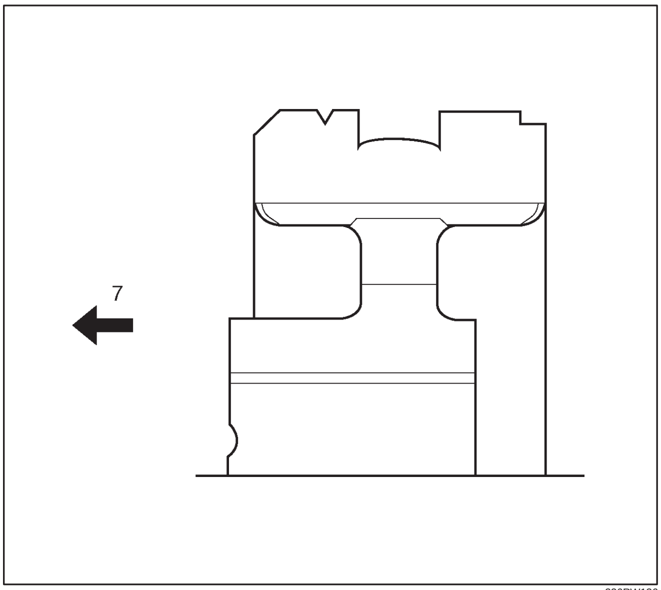
NOTE: The snap ring must be fully inserted into the transfer case snap ring groove.

36. Input shaft.
37. Install ball bearing, use a bench press to install the ball bearing to the input shaft.



265RS003

38. Install plate.
39. Install ball.
40. Install bearing collar.
41. Install needle bearing.
42. Install transfer input gear.
43. Install high–low clutch hub and sleeve and the clutch hub face (with the heavy boss) must be facing the transfer input gear side (7).



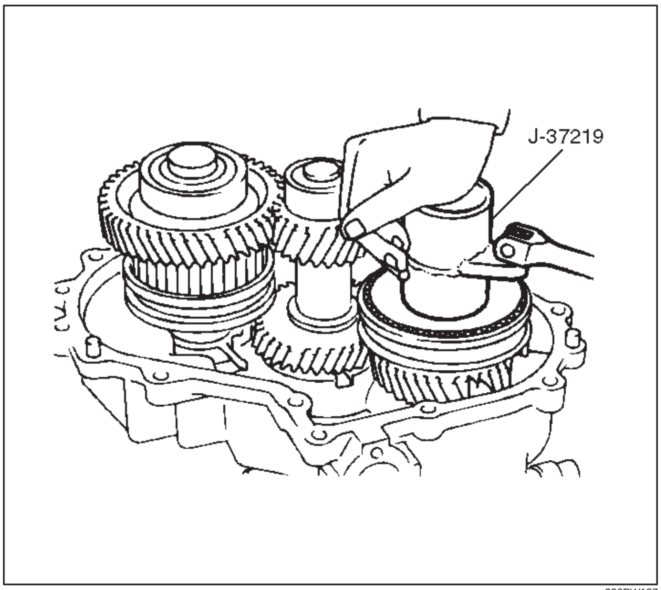
226RW136

44. Install input shaft assembly.
45. Install the snap ring to the input shaft.
46. Install the input shaft assembly to the transfer case.
47. Install the snap ring to the transfer case.

NOTE: The snap ring must be fully inserted into the transfer case snap ring groove.

48. Install the front companion flange temporarily and use the flange holder J–8614–11 and lock nut wrench J–37219 to install the lock nut.

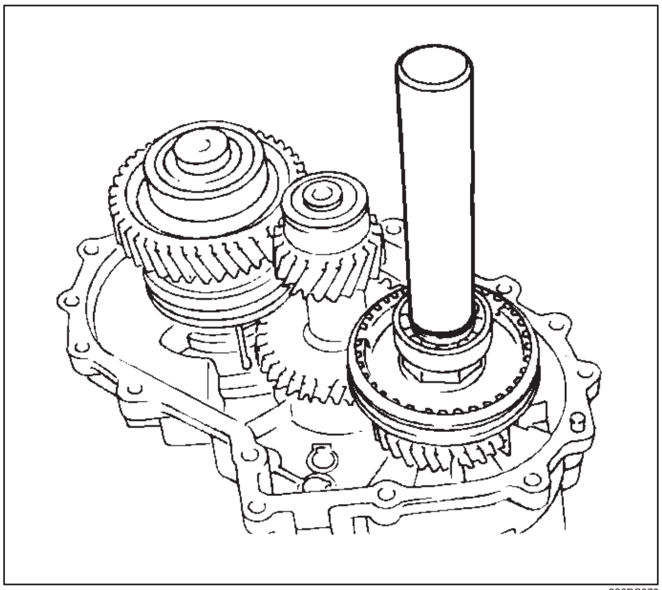
Torque: 137 N·m (101 lb ft)



226RW137

49. Use the punch to stake the lock nut at one spot.

50. Install ball bearing, use a suitable drift and hammer to install the ball bearing.



226RS079

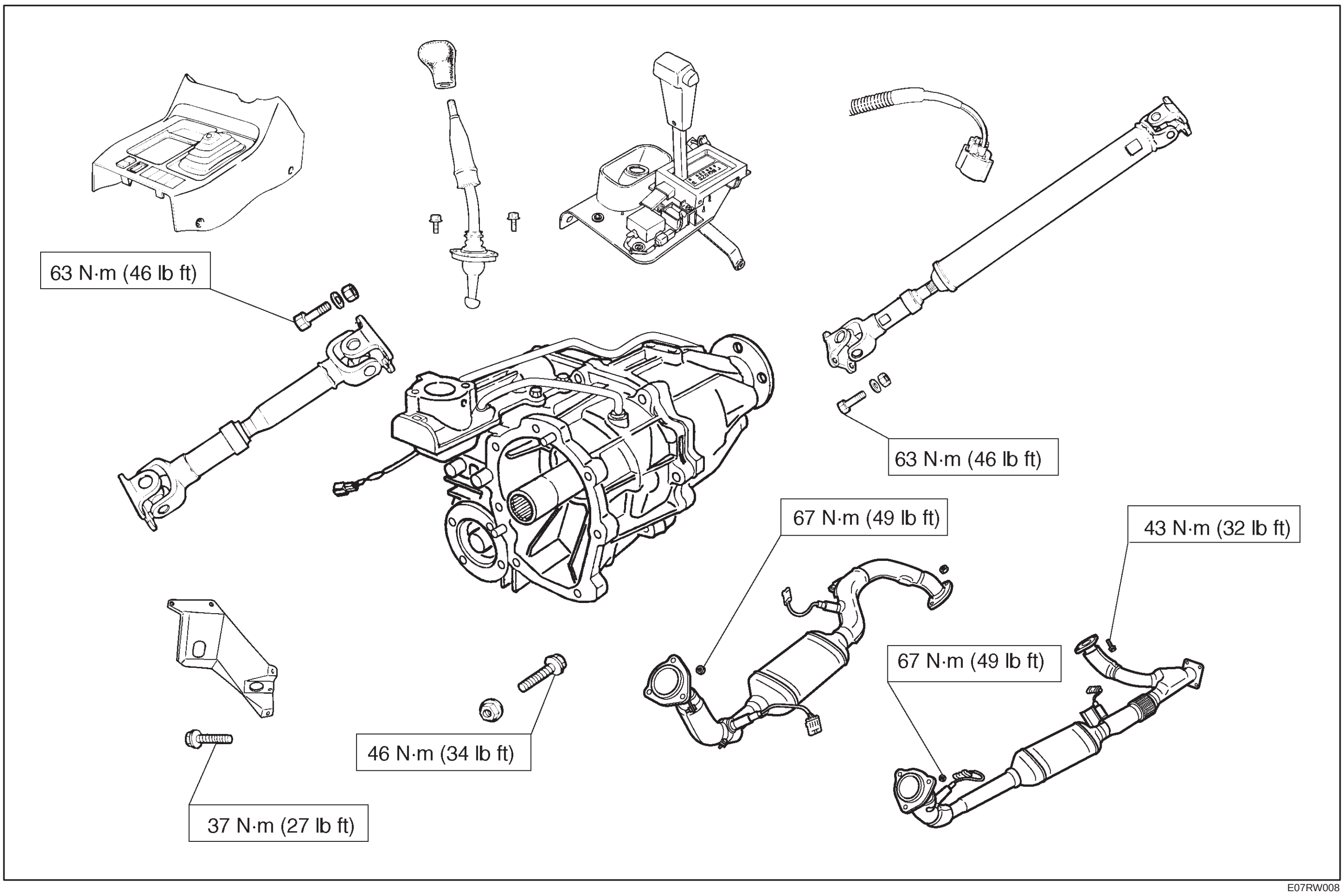
51. Install bearing snap ring.

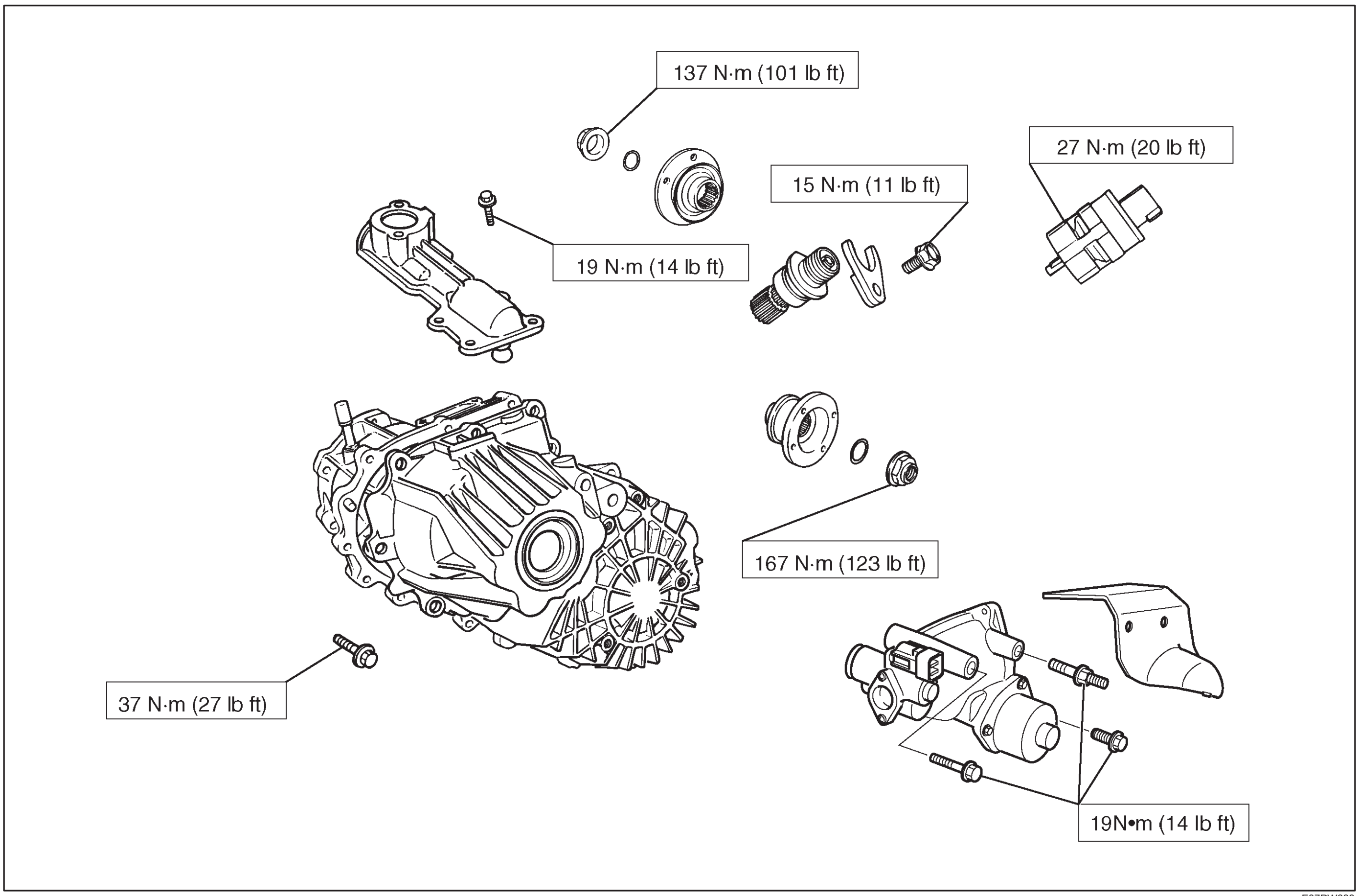
Main Data and Specifications

General Specifications

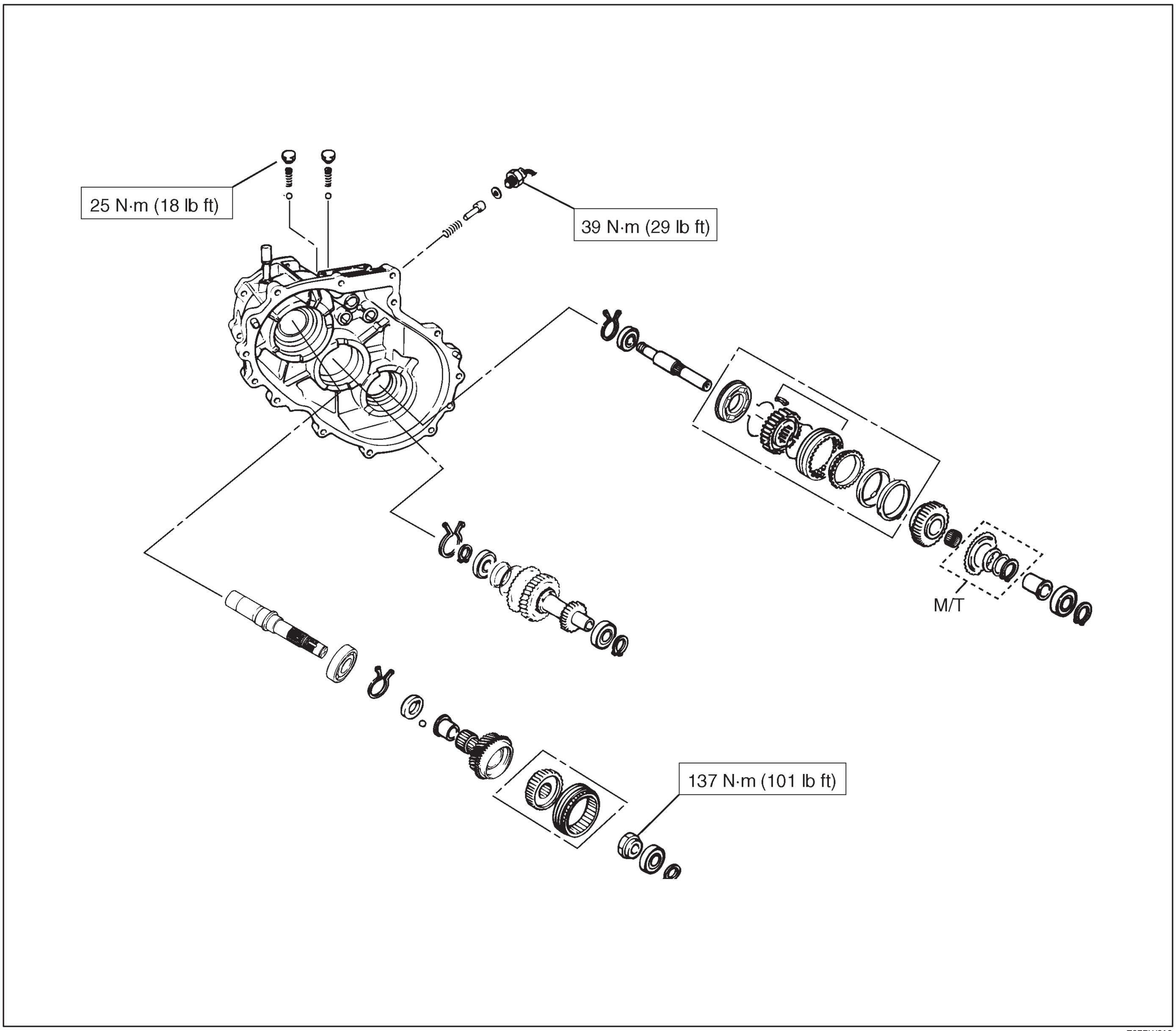
Type	Synchronized type gears shifting between the 2 and 4 wheel drive mode. Constant mesh type gears shifting between “low” and “high”.
Control method	Remote control with the gear shift lever on the floor for gear shifting between “low and high” . Electric control with the button switch on the instrument panel for gear shifting between the 2 and 4 wheel drive mode.
Gear ratio	High; 1.000 Low; 2.050
Oil capacity	1.45 lit. (1.53 U.S. quart)
Type of lubricant	Engine oil Refer to chart in Section 0

Torque Specifications




137 N·m (101 lb ft)
27 N·m (20 lb ft)
15 N·m (11 lb ft)
19 N·m (14 lb ft)
167 N·m (123 lb ft)
37 N·m (27 lb ft)
19N•m (14 lb ft)

E07RW009


25 N·m (18 lb ft)
39 N·m (29 lb ft)
M/T
137 N·m (101 lb ft)
E07RW010

Special Tools

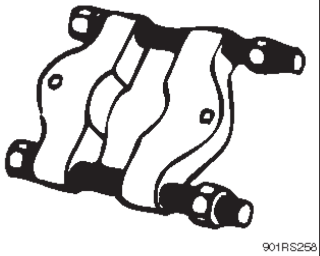
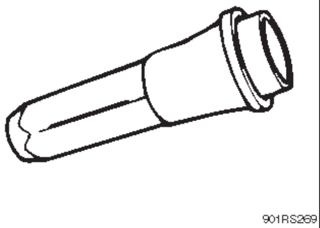
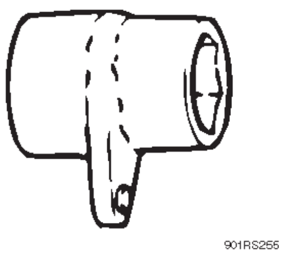
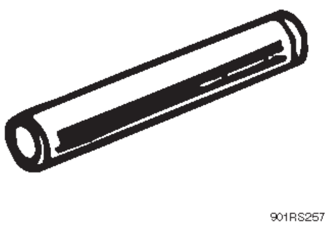
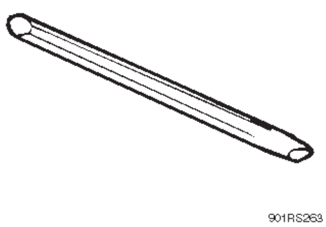
ILLUSTRATION	PART NO. PART NAME
	**J–22912–01** Bearing remover/installer
	**J–38592** Transfer case oil seal installer
	**J–37219** Mainshaft nut wrench
	**J–37223** Rear output shaft and bearing installer
	**J–39209** Punch, end nut

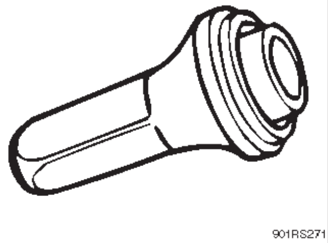
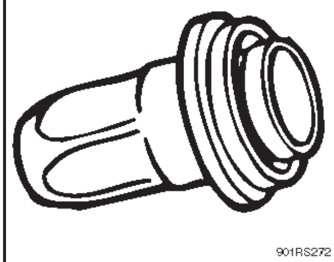
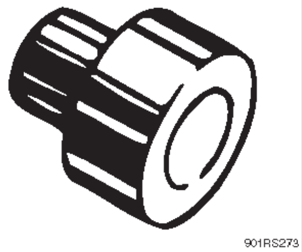
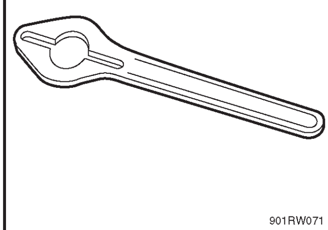
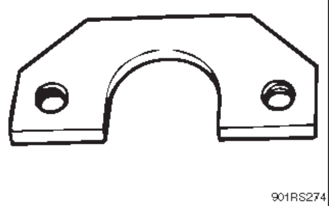
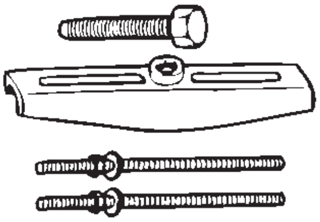
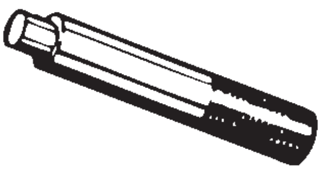
ILLUSTRATION	PART NO. PART NAME
	**J–38594** Front output shaft oil seal installer
	**J–39208** Rear oil seal installer
	**J–37486–A** Bearing installer adapter
	**J–8614–11** Flange holder
	**J–37217** Mainshaft end bearing remover

ILLUSTRATION	**PART NO.** PART NAME
	**J–37487** Puller
	**J–8092** Driver handle

TROOPER

DRIVELINE/AXLE

TRANSFER CASE (TOD)

CONTENTS

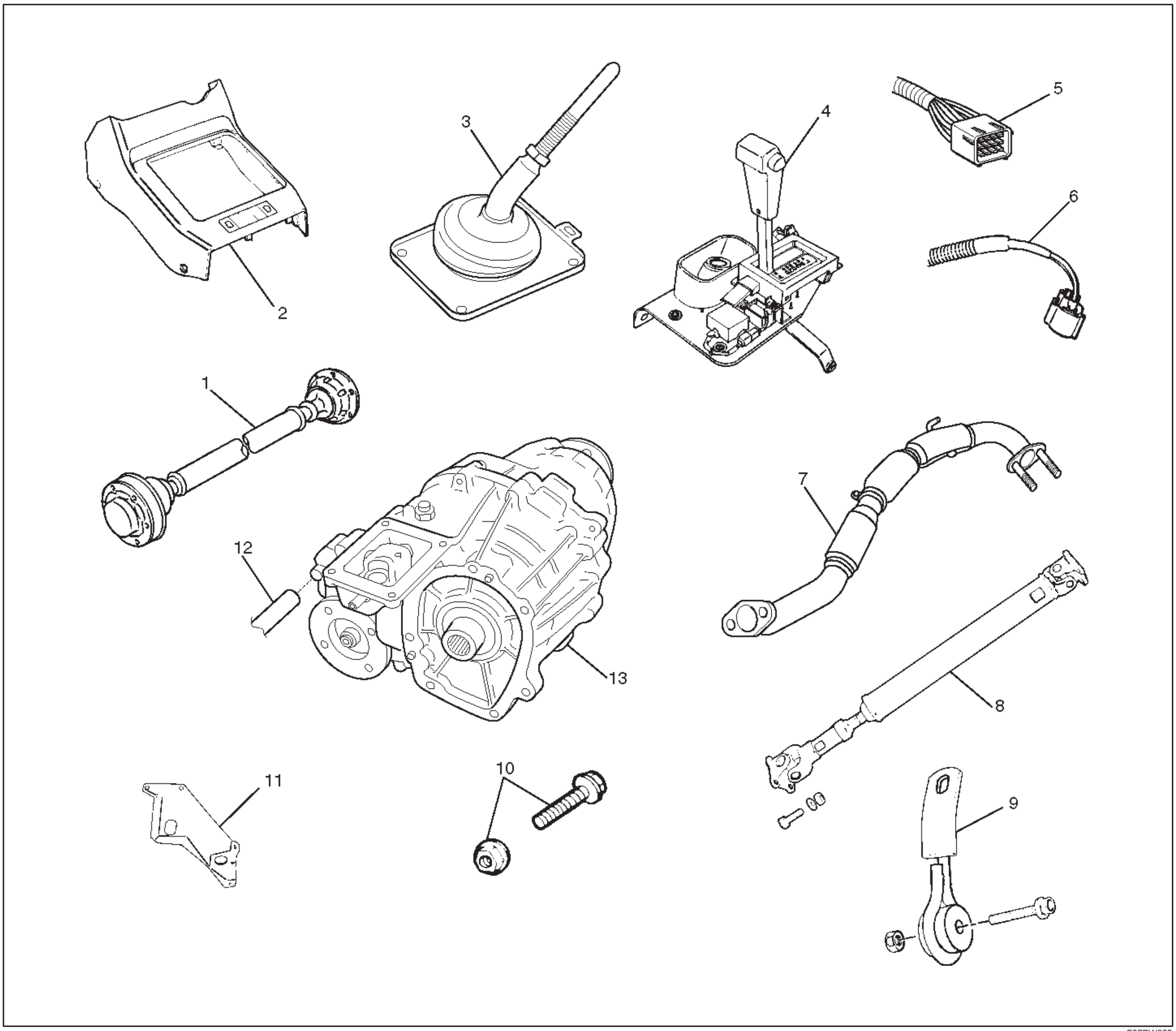
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

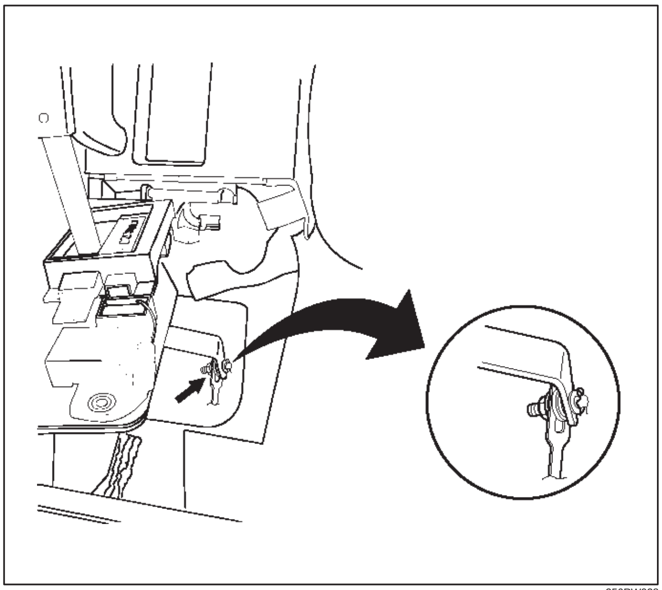
Transfer Case Assembly

Removal



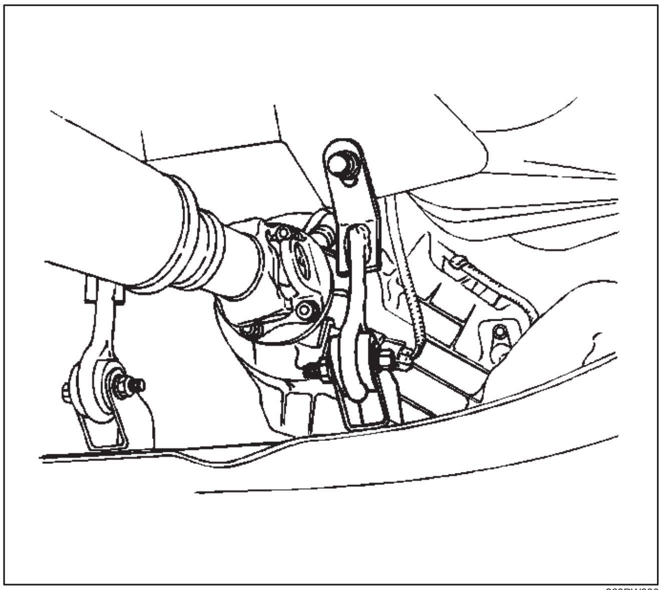
1. Disconnect the battery cable (-).
2. Remove transfer protector.
3. Remove rear propeller shaft.
4. Remove front propeller shaft.
5. Remove center console.

6. Uncouple the shift control rod from the select lever assembly.



256RW028

7. Place the select lever assembly near the end.
8. Remove transfer control lever.
9. Remove breather hose.
10. Remove the exhaust pipe set bolts and nuts, and shift the pipe to the end.
11. Remove the right cross member hanger and shift the proper shaft to the end.



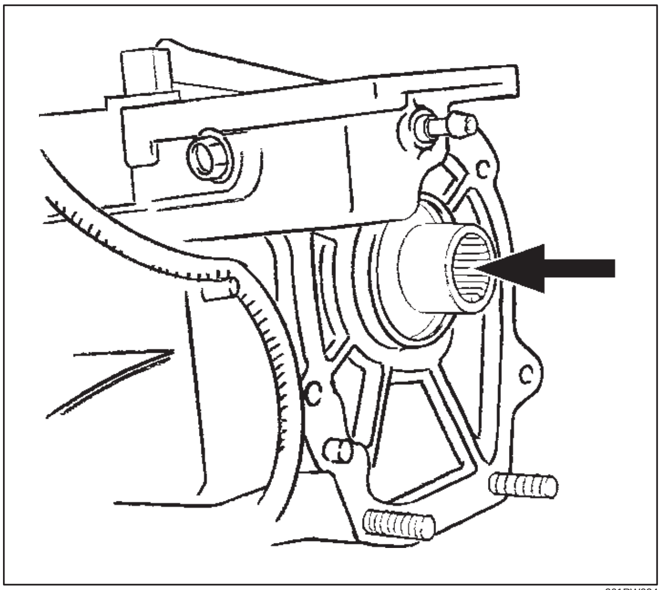
260RW006

12. Unplug the 4WD switch connector from the transmission harness.
13. Unplug the transfer connector from the top of the transfer case.
14. Support the transfer case with a jack.
15. Remove the four bolts and three nuts from the transfer case.
16. Remove transfer case assembly.

Installation

Pay attention to the following points.

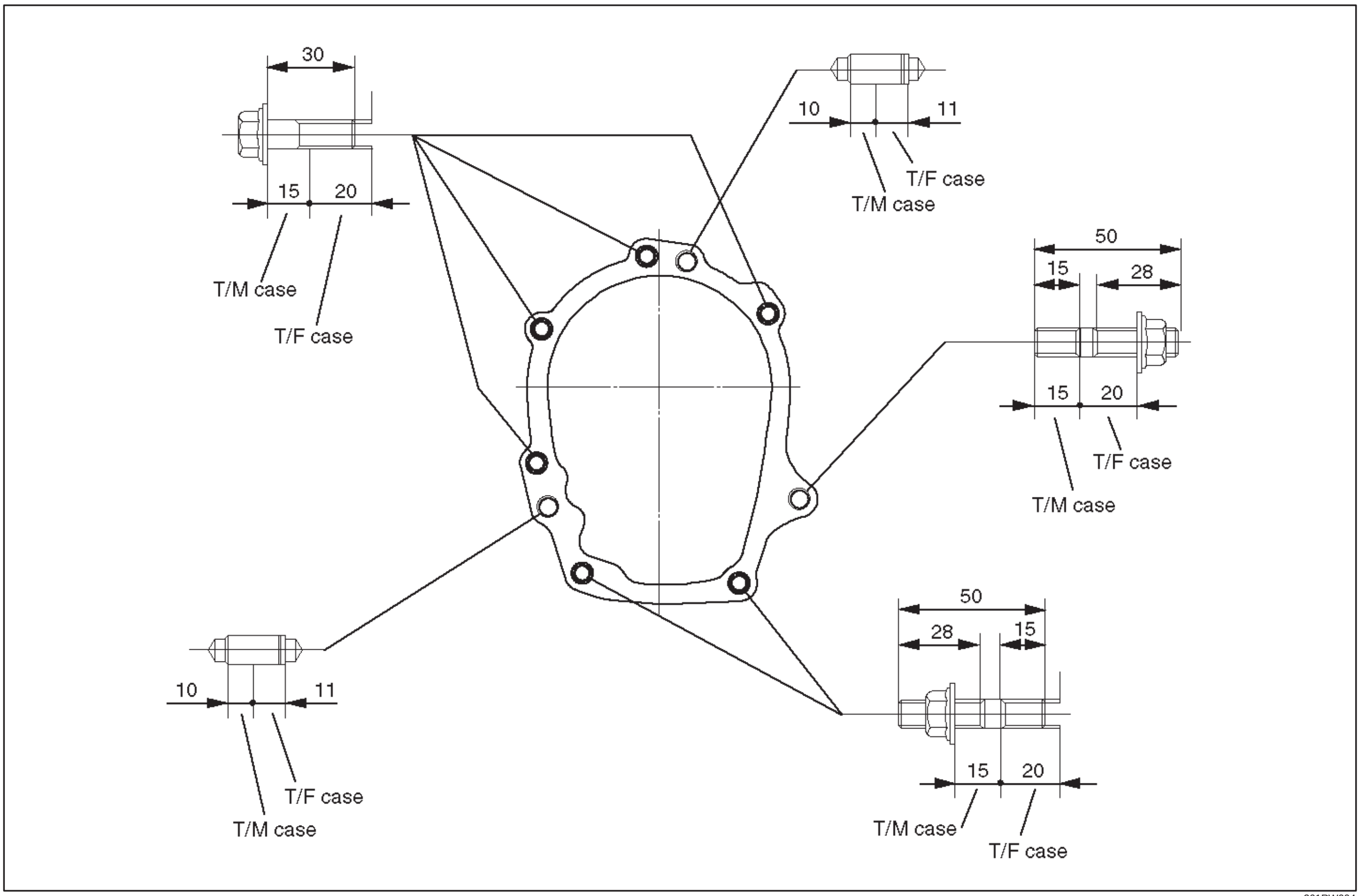
1. Apply grease (Besco L2) or equivalent to the input shaft spline.



261RW024

2. Mount the transfer case.

3. Tighten the transfer case bolts (see the figure below).



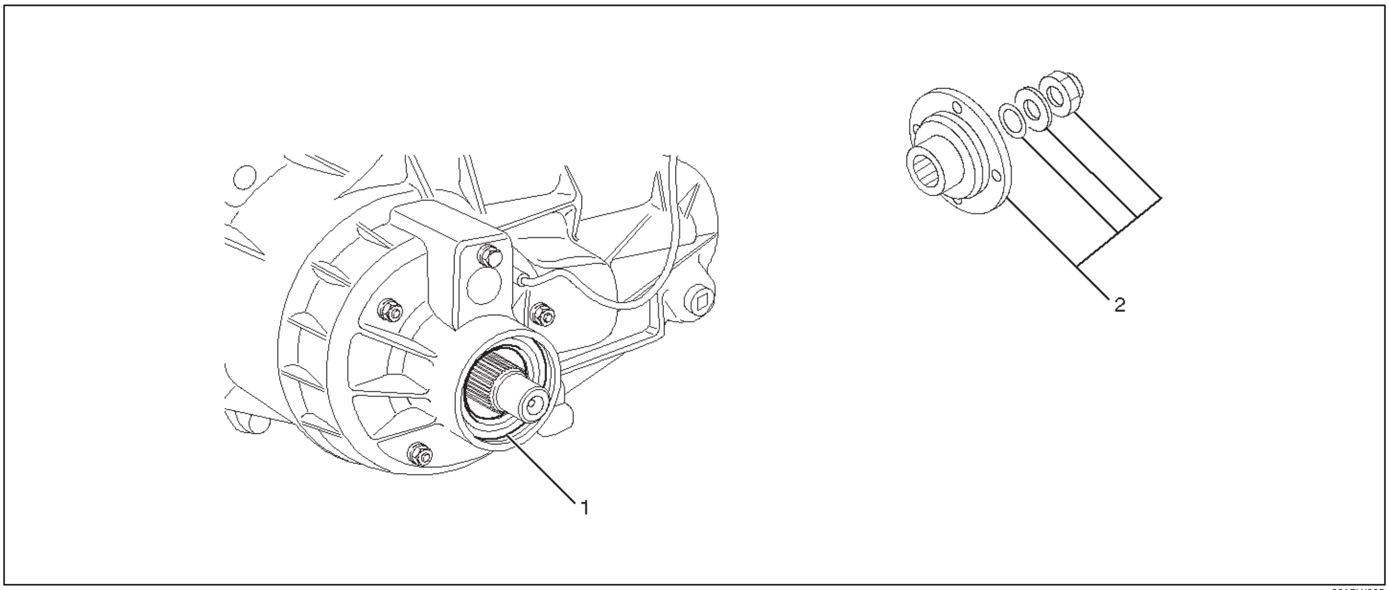
261RW004

4. Tighten propeller shaft bolt.

Torque : 63 N·m (46 lb ft)

Transfer Rear Oil Seal

Transfer Rear Oil Seal and Associated Parts



261RW005

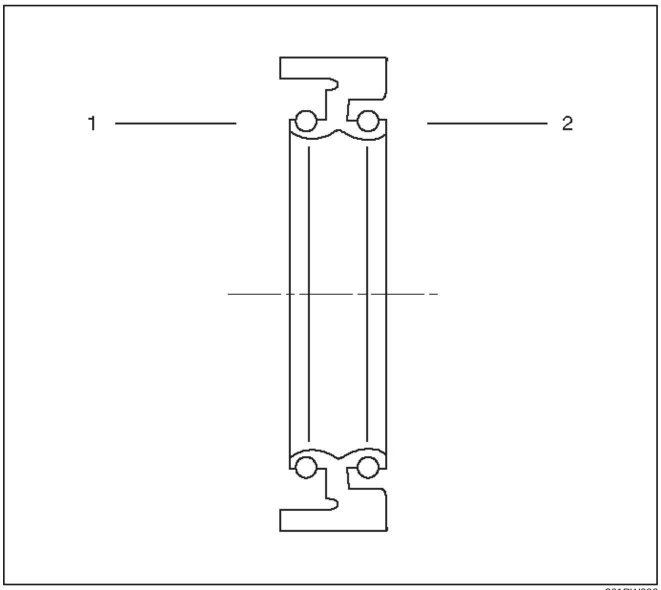
Legend
(1) Oil Seal
(2) End Nut and Rear Companion Flange

Removal

1. Uncouple the rear propeller shaft from the transfer case.
2. Using the flange holder J-8614-11, remove the end nut.
3. Using the universal puller, remove the rear companion flange and O-ring.
4. Remove the oil seal from the transfer rear case.

Installation

1. Apply oil to the circumference of the oil seal. Fill the oil seal lip with grease (Besco L2).

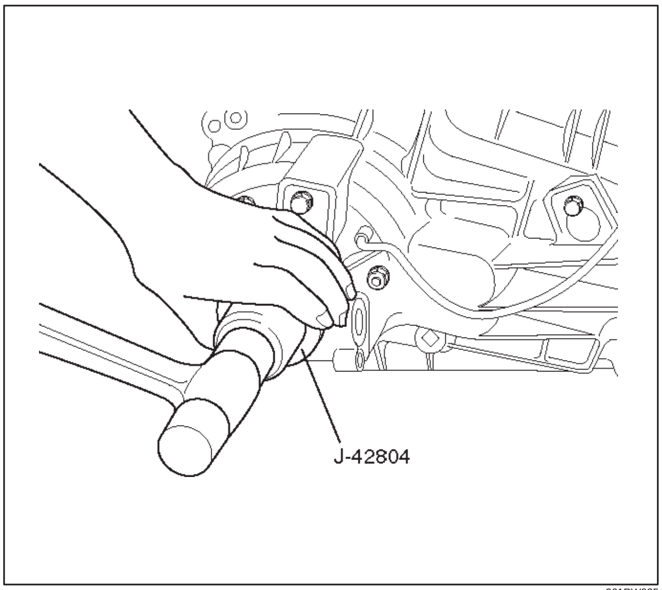


261RW006

Legend
(1) Inside
(2) Outside

2. Using the oil seal installer J-42804, attach the oil seal.

NOTE: When attaching the oil seal, pay attention to the direction.



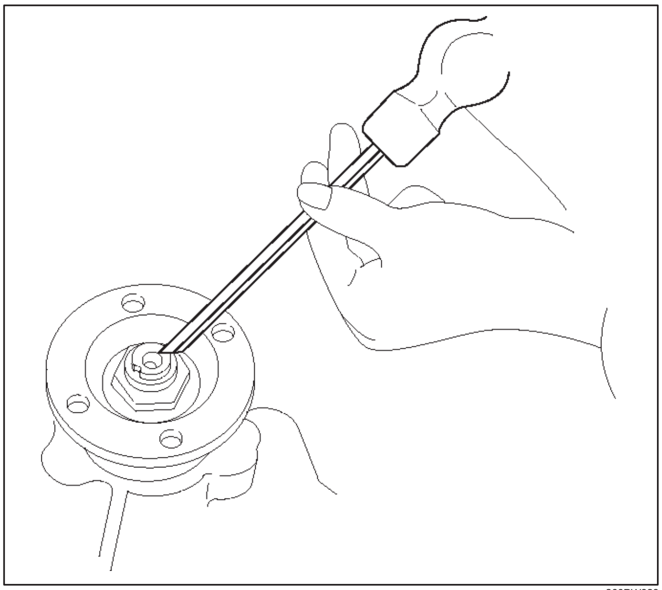
261RW035

3. Mount the rear companion flange, O-ring , washer, and nuts to the transfer in this order.
4. Using the flange holder J-8614-11, set the end nut.

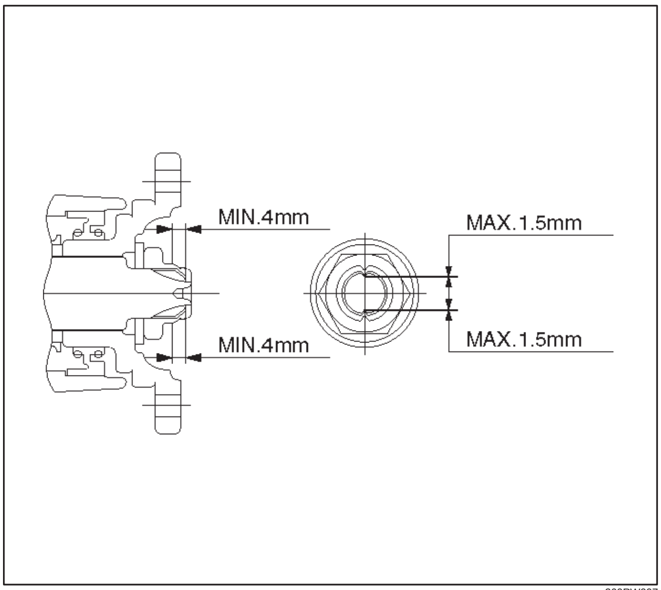
Torque : 167 N·m (123 lb ft)

5. Using the punch J-39209, stake the end nut at two places.

NOTE: Check the staked end nut is free from cracks.



266RW020



260RW007

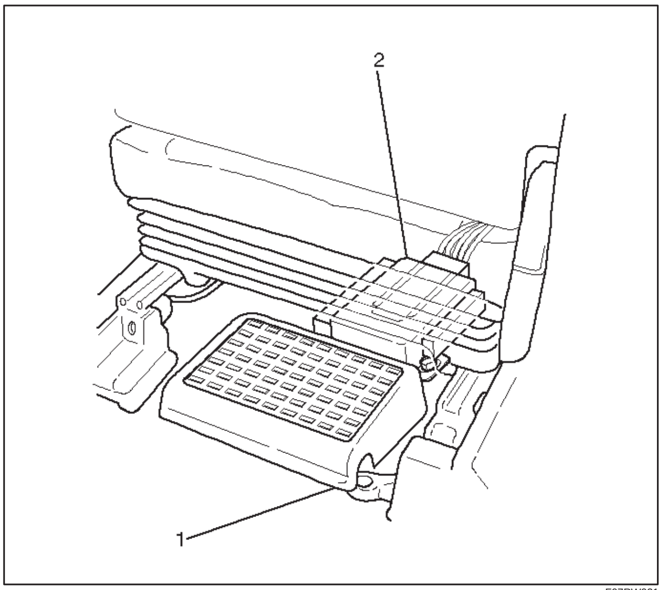
6. Connect the rear propeller shaft to the transfer case and tighten to the specified torque.

Torque : 63 N·m 46 (lb ft)

TOD ECU

Removal

1. Disconnect the battery cable (-).
2. Move the passenger seat forward and remove the second seat foot rest (1).
3. Unplug the connector from the ECU (2).
4. Remove the set bolts and detach the ECU (2) from the bracket.



F07RW021

Installation

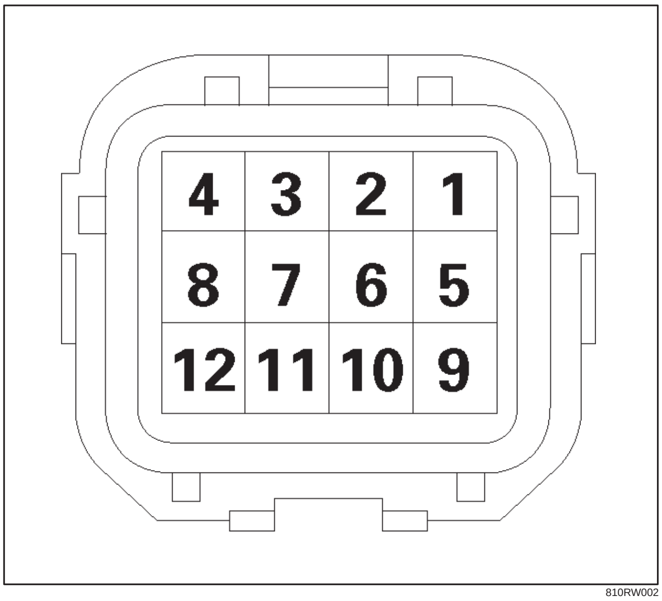
1. Perform the removal step in reverse order.

Unit Repair

Inspection

Before disassembling and after assembling, check the following items on the transfer connector terminals.

No.	NAME	CONTENTS
1	Ref . (Ref .)	Rear speed sensor reference output
2	Ref . (Frt .)	Front speed sensor reference output
3	SW GND	SW GND
4	4H SW (+)	4H SW plus terminal
5	Rer . (+)	Rear speed sensor plus
6	Frt . (+)	Front speed sensor plus
7	POWER GND	Power GND
8	SOL (+)	Electromagnetic solenoid
9	COM (–) (Ref .)	Rear speed sensor GND
10	COM (–) (Frt .)	Front speed sensor GND
11	NC	
12	4L SW (+)	4L SW plus terminal



810RW002

4H and 4L switches

Check whether the 4H switch (terminals 4 and 7) and 4L switch (terminals 12 and 3) work as specified in the table below. If yes, the continuity is established on these switches. If not, check the switches, shift rails, transfer case, and rear cover, and replace the failed parts.

Position	High	Neutral	4L
4H SW	OFF	ON	OFF
4L SW	OFF	ON	ON

Power GND

Check that there is a continuity between the power GND pin (terminal 7) and transfer case. If not, replace the grounding wire.

Resistance of electromagnetic coil

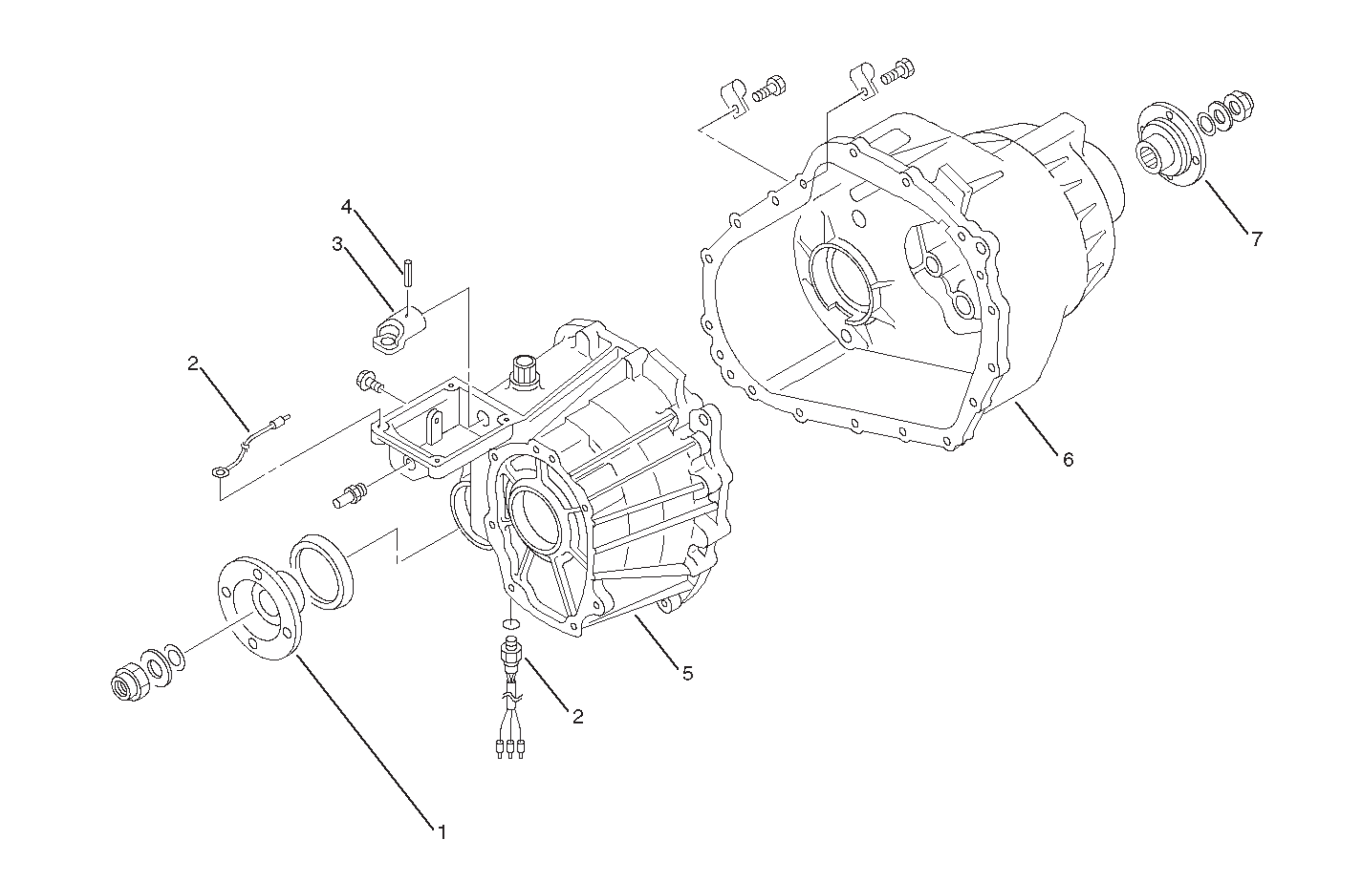
Check the resistance between electromagnetic clutch solenoid (terminal 8) and power GND (terminal 7). If not, replace the electromagnetic coil.

Standard : 1.4 ~ 2.0Ω

Allowable : 1.0 ~ 5.0Ω

Transfer Case

Disassembled View



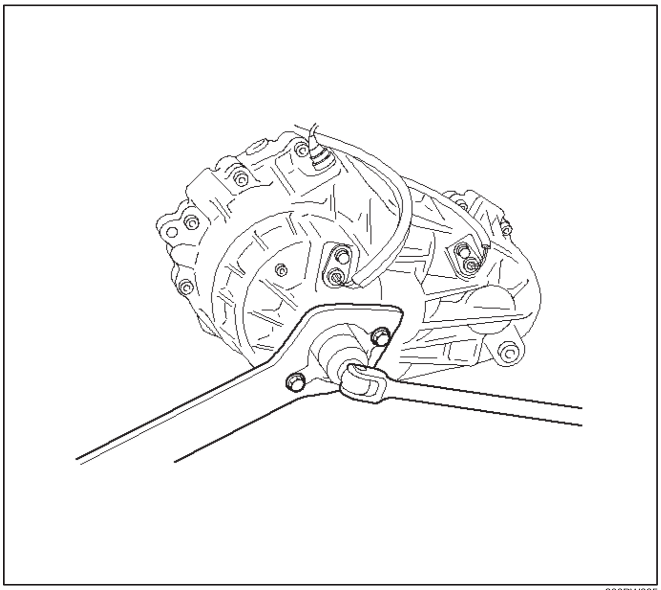
266RW004

Legend

(1) Front Companion Flange
(2) 4H and 4L Switch, Grounding Cable, and Center Connector
(3) Offset Lever
(4) Spring Pin
(5) Transfer Case Assembly
(6) Transfer Cover Assembly
(7) Rear Companion Flange

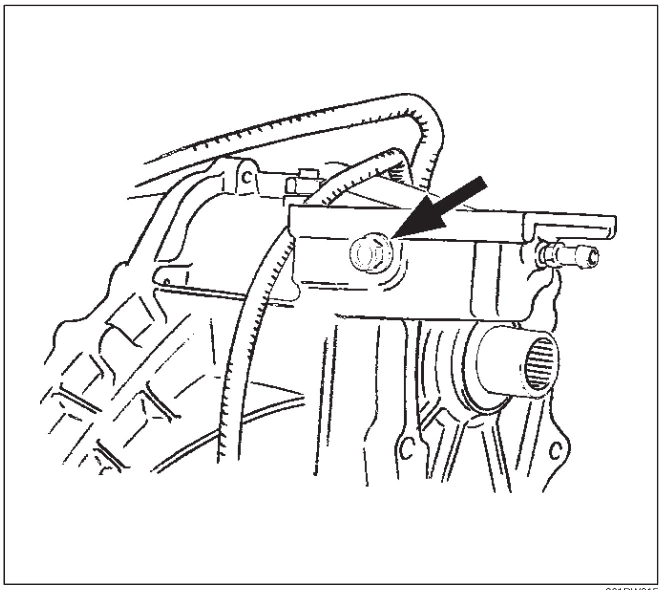
Disassembly

1. Remove the drain plug from the transfer case and drain the oil.
2. Disconnect the 4H and 4L switch and grounding cable.
3. Remove the clip fixing the harness.
4. Remove front companion flange and using the flange holder J-8614-11, remove the flange nut.
5. Remove rear companion flange and using the flange holder J-8614-11, remove the flange nut.



266RW005

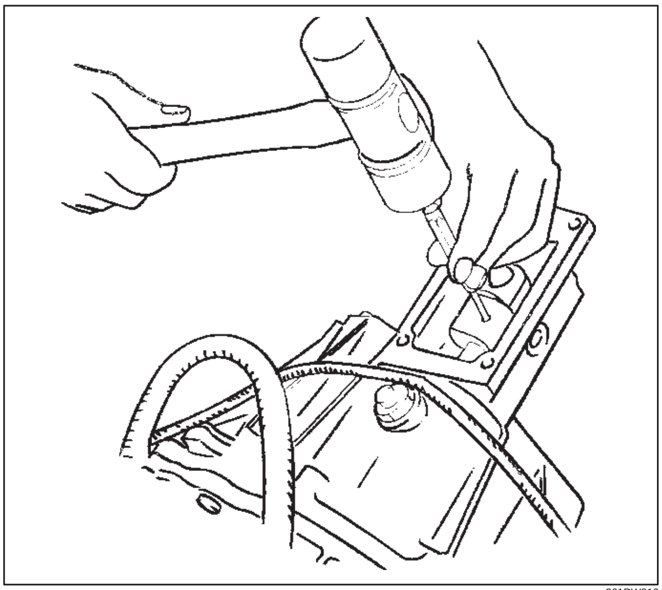
6. Remove the offset lever set bolt on the right side.



261RW015

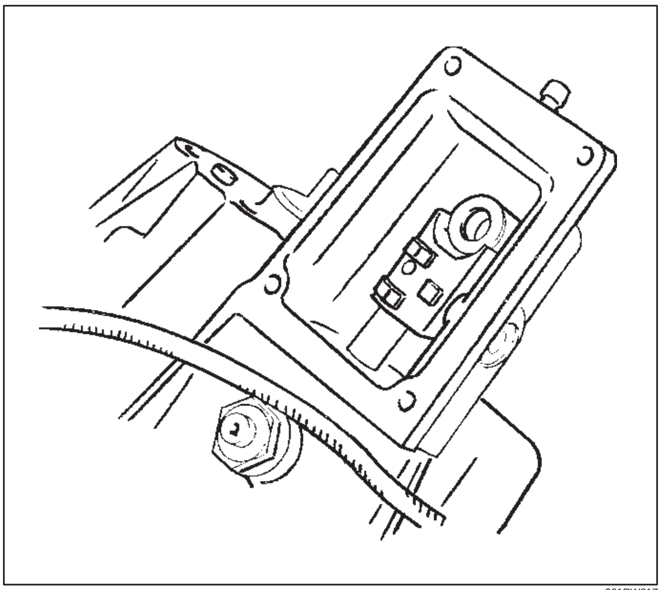
7. Remove the offset lever lock spring pin.

NOTE: When removing the spring pin, pay attention to the recess position of the pin.



261RW016

8. Remove the offset lever.



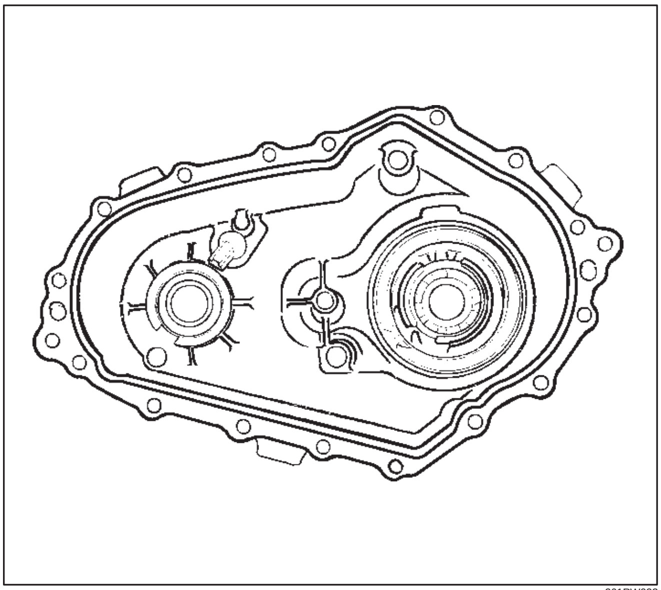
261RW017

9. Remove the sixteen bolts and detach the transfer cover assembly from the transfer cable assembly.

NOTE: When removing the transfer cover assembly, pay attention not to damage the oil seal.

Reassembly

1. Apply liquid gasket (Loctite 598 or equivalent) uniformly to the mating face that contacts the transfer case.



261RW023

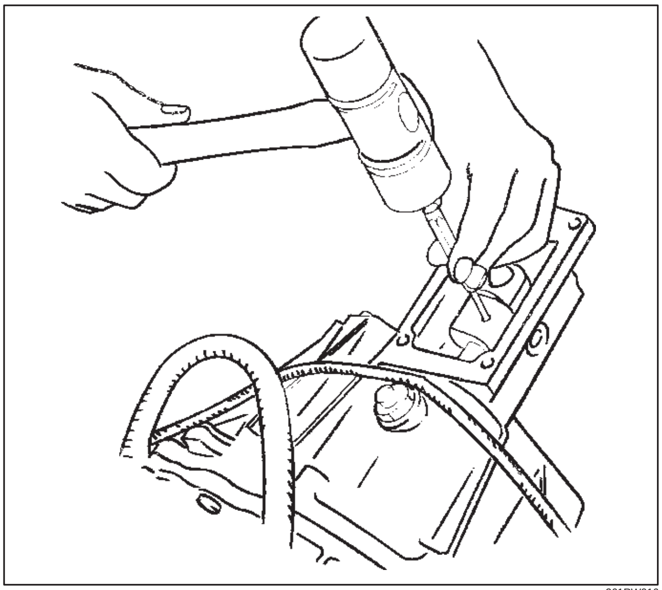
2. Tighten the sixteen bolts with the specified torque.

Torque : 31 N·m (23 lb ft)

3. Wind the sealing tape around the drain plug thread and tighten the plug with the specified torque.

Torque : 25 N·m (18 lb ft)

4. Install offset lever.
5. Mount the offset lever to the transfer shift and attach the spring pin.



261RW016

6. Install rear and front companion flange.
7. Attach the O-ring and washer to the companion flange.

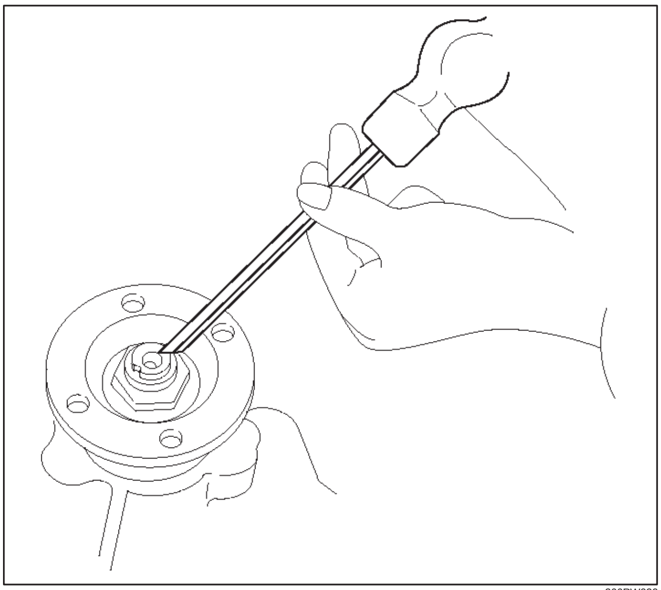
NOTE: Securely push the O-ring to the dent of the companion flange, and then attach the washer.

8. Use the flange holder J-8614-11 to tighten the flange nuts to transfer case.
9. Tighten the flange nut with the specified torque.

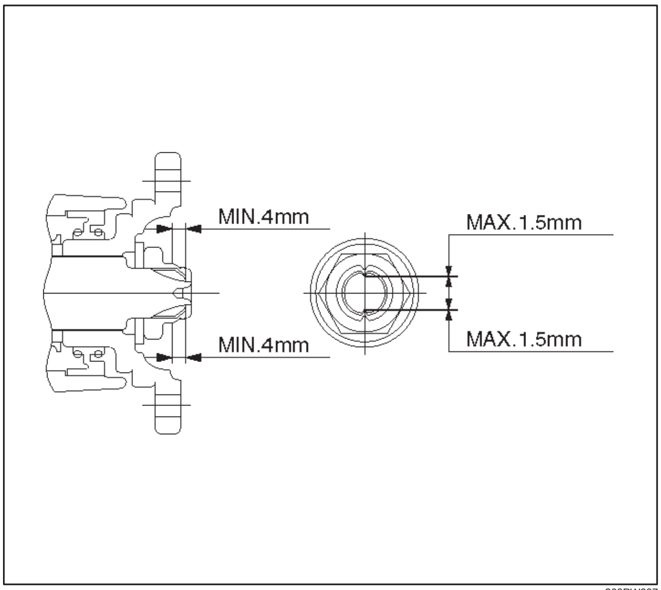
Torque : 167 N·m (123 lb ft)

10. Using the punch J-39209, securely stake the flange nut at two places

NOTE: Check the staked flange nut is free from cracks.



266RW020



260RW007

11. Fix the harness with the clip.
12. Tighten the 4L and 4H switch to the specified torque.

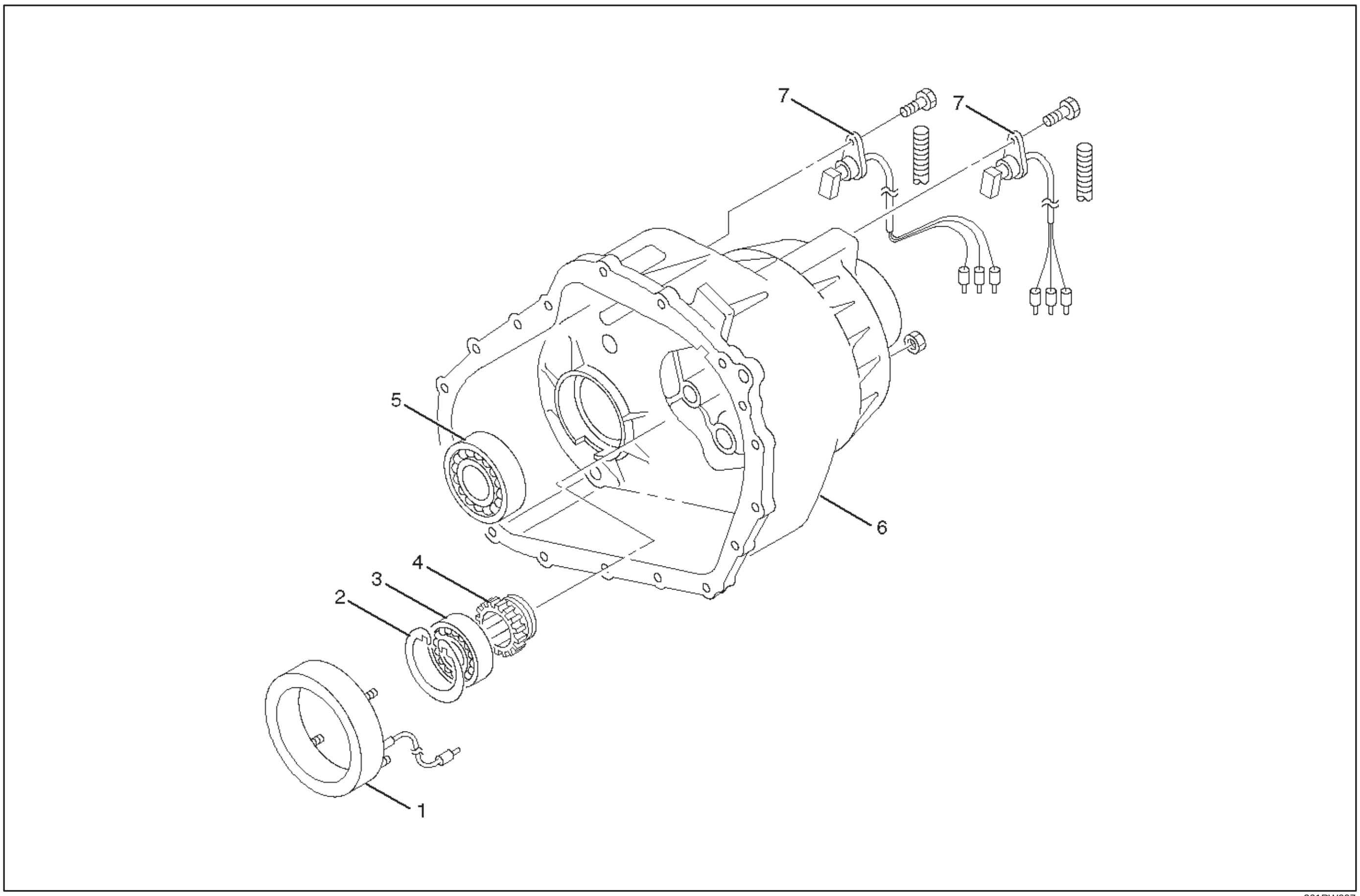
Torque : 16 N·m (12 lb ft)

13. Fill the transfer case with ATF II or III (1.9 liters).
14. Wind the sealing tape around the filler plug thread and tighten the plug with the specified torque.

Torque : 25 N·m (18 lb ft)

Transfer Cover Assembly

Disassembled View

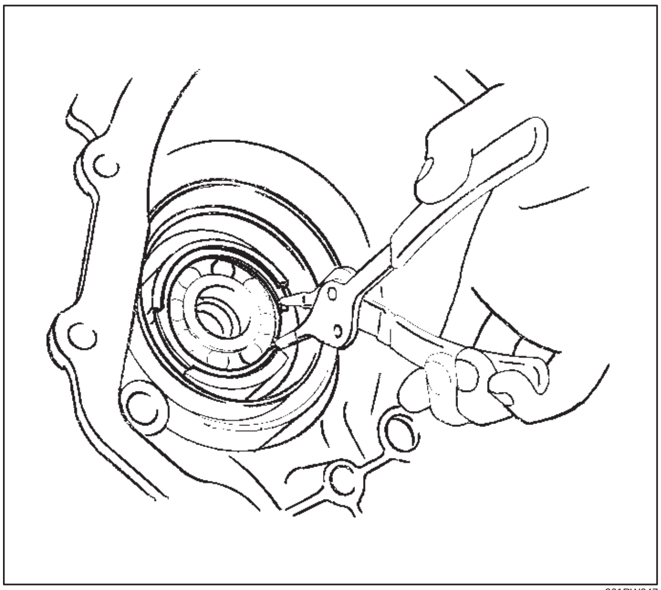


261RW007

Legend
(1) Coil Assembly
(2) Snap Ring
(3) Ball Bearing
(4) Speed Gear and Tone Wheel
(5) Ball Bearing
(6) Transfer Cover Assembly
(7) Front and Rear Speed Sensors

Disassembly

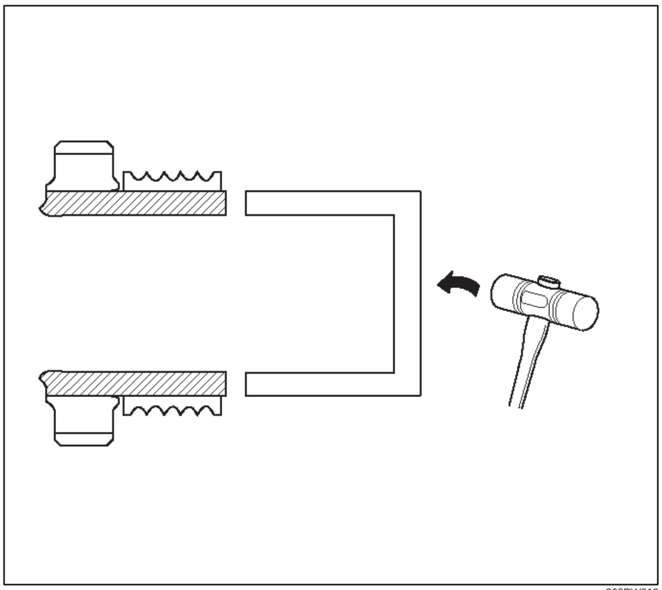
1. Using snap ring pliers, remove the snap ring.



261RW047

2. Remove ball bearing.
3. Strike the speed gear and tone wheel with a rod or other appropriate tool from the outside of the transfer cover assembly, and remove the ball bearing and speed gear and tone wheel.

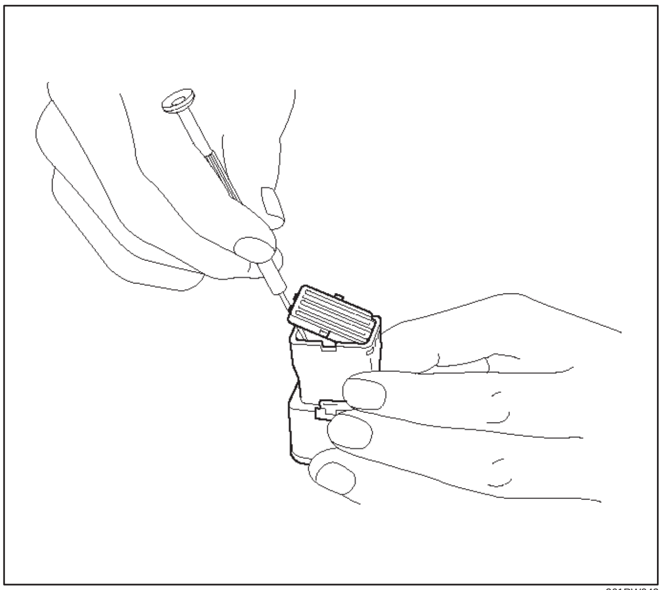
NOTE: Pay attention not to damage the speed gear teeth.



266RW018

4. Remove the stopper plate on the back with a precision screwdriver or other appropriate tool starting from the small lock of the plate.

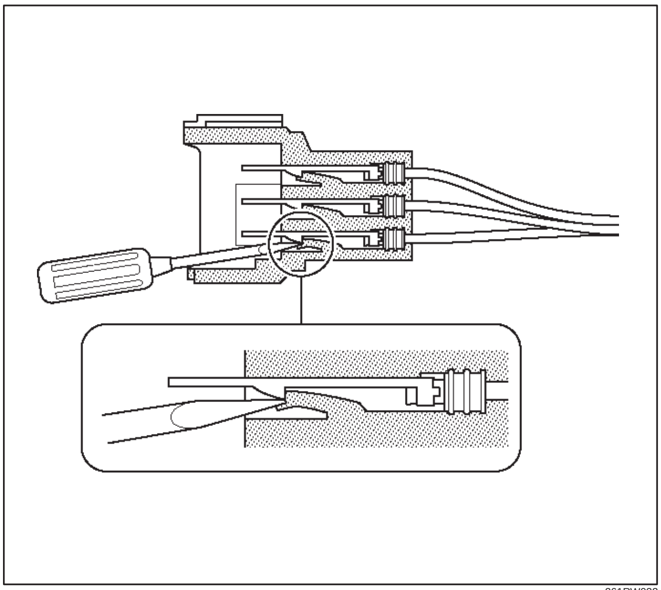
NOTE: Pay attention not to damage the stopper plate during the work.



261RW042

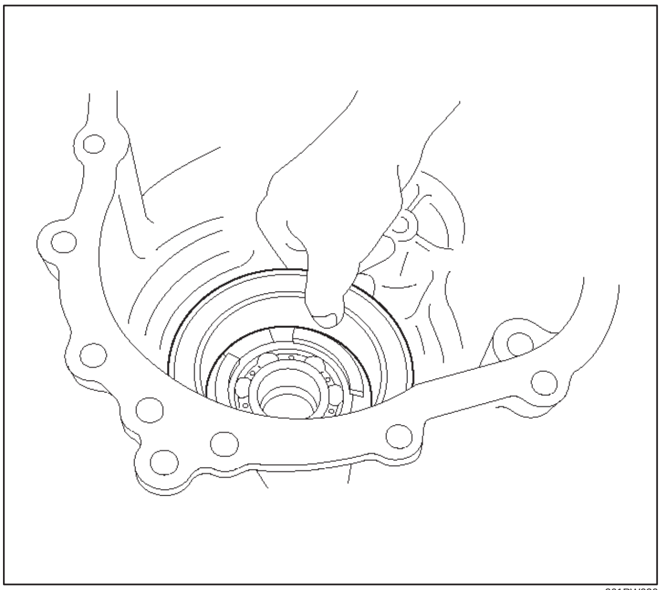
5. Using a terminal pull-out tool or an equivalent tool, push down the lock to unlatch the terminal for the coil assembly, and pull the terminal out.

NOTE: Pay attention not to damage other terminals.



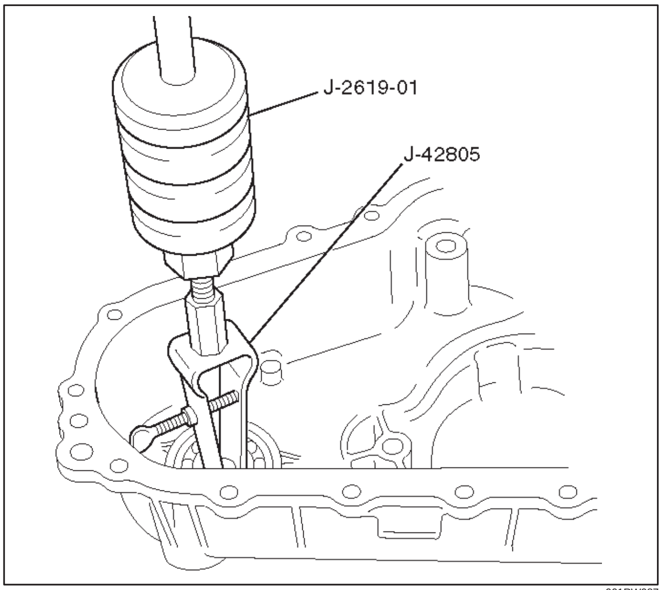
261RW032

6. Remove the set bolts of the cam&coil housing from the outside of the transfer cover assembly. Remove the housing from the transfer cover.



261RW030

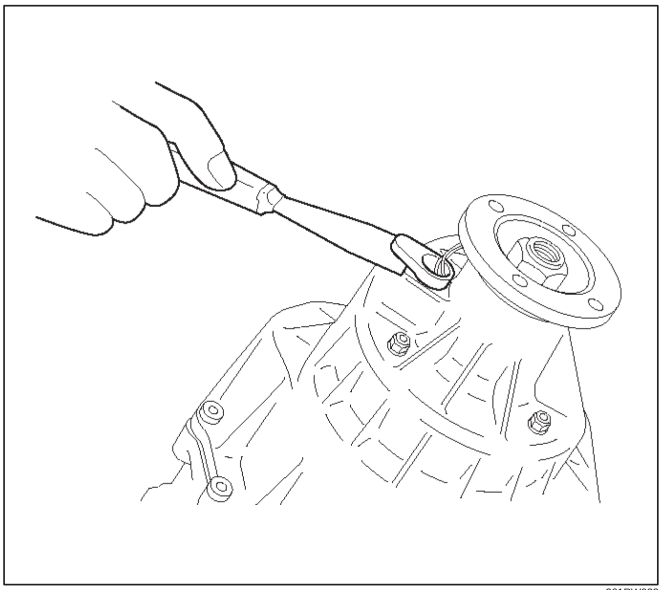
7. Using the bearing remover J-42805 and slide hammer J-2619-01, remove the ball bearing for the front output shaft.



901RW087

8. Remove the bolts and front and rear speed sensors.

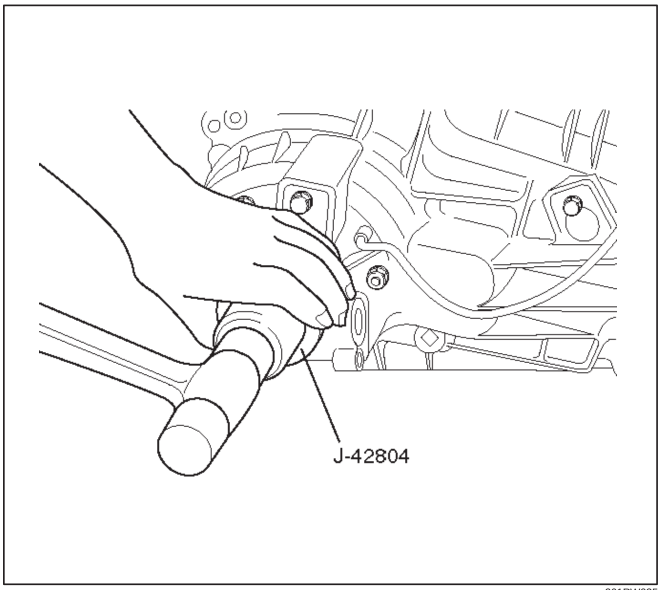
NOTE: Pay attention not to damage the speed sensors during the work.



261RW033

Reassembly

1. Remove the oil seal from the transfer cover assembly.
2. Apply oil to the circumference of the new oil seal and fill the lip with grease (Besco L2 or equivalent).
3. Using the oil seal installer J-42804, attach the oil seal to the transfer cover assembly.



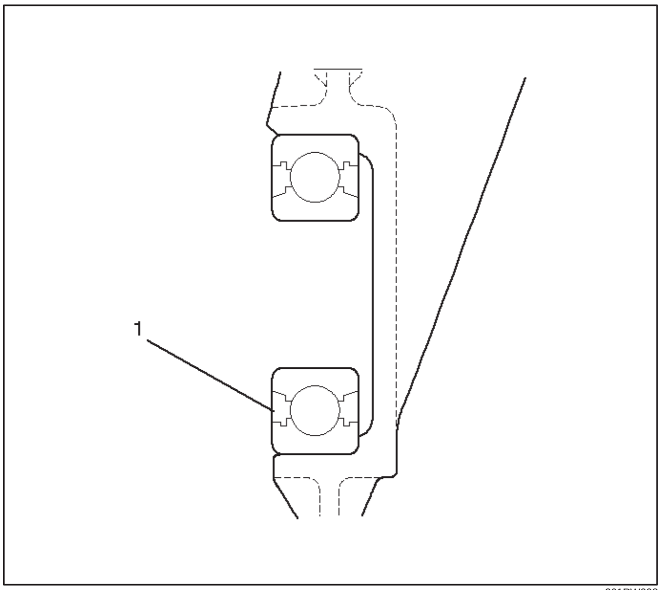
261RW035

4. Apply grease to the seal ring of each front and rear speed sensor, and mount the sensor carefully.
5. Tighten the bolt with the specified torque.

Torque : 5 N·m (43 lb in)

NOTE: Pay attention not to mount the front (or rear) sensor to the rear (or front) sensor position.

6. Mount the ball bearing (1) for the front output shaft flat as shown in the figure.



261RW008

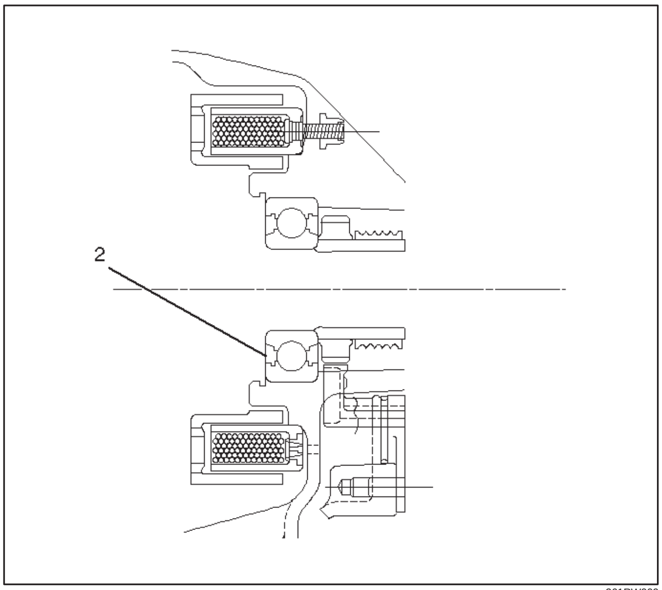
7. Mount the coil assembly and tighten the set nuts with the specified torque.

Torque : 10 N·m (87 lb in)

8. Plug the terminal in the central connector.

NOTE: Pay attention not to damage other terminals.

9. Install speed gear and tone wheel.
10. Mount the ball bearing (2) flat as shown in the figure.



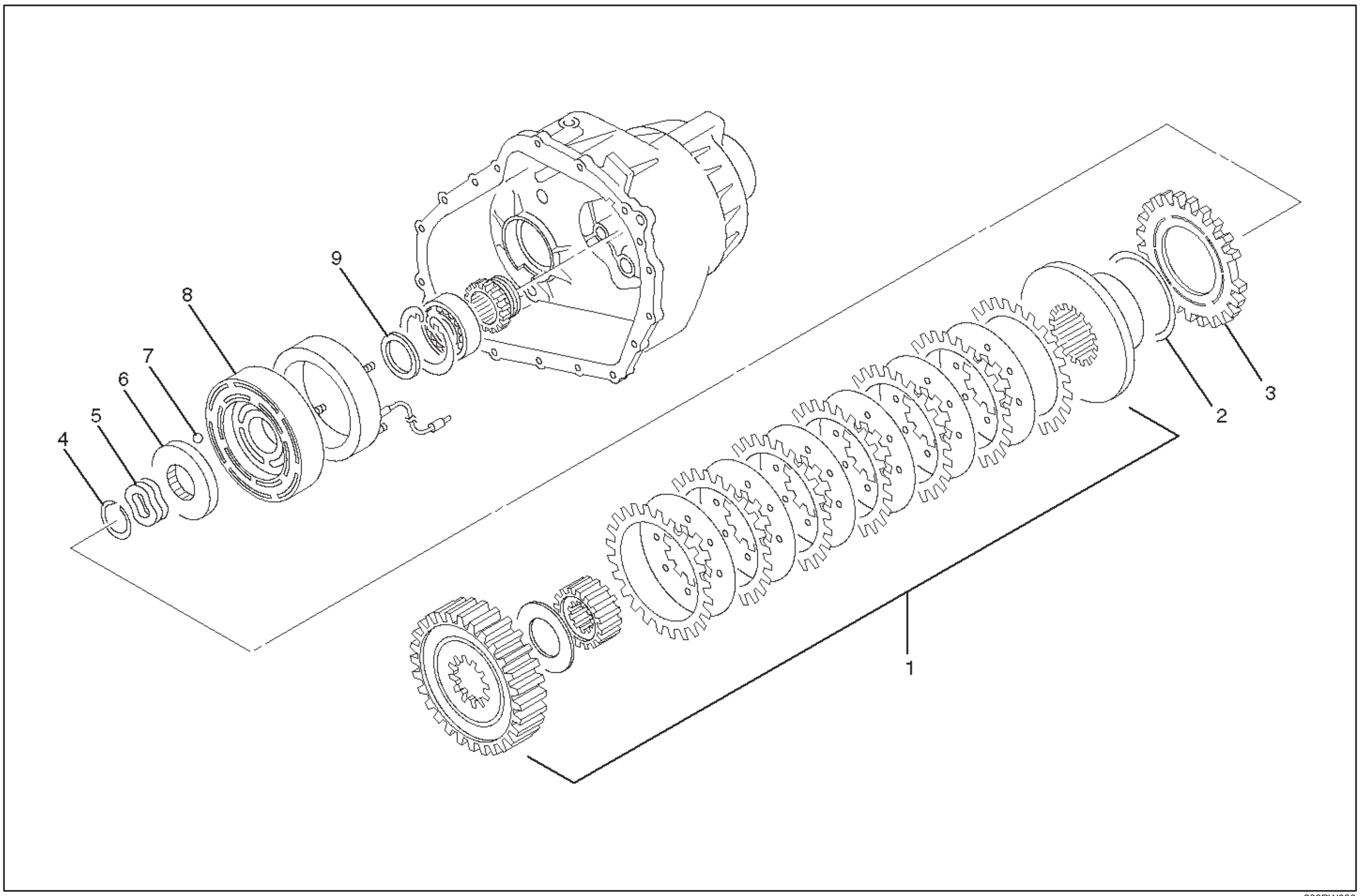
261RW009

11. Using snap ring pliers, attach the snap ring to the transfer cover assembly.

NOTE: Securely mount the snap ring to the groove of the transfer cover assembly.

Transfer Case Assembly Clutch Pack and Clutch Cam

Disassembled View



266RW006

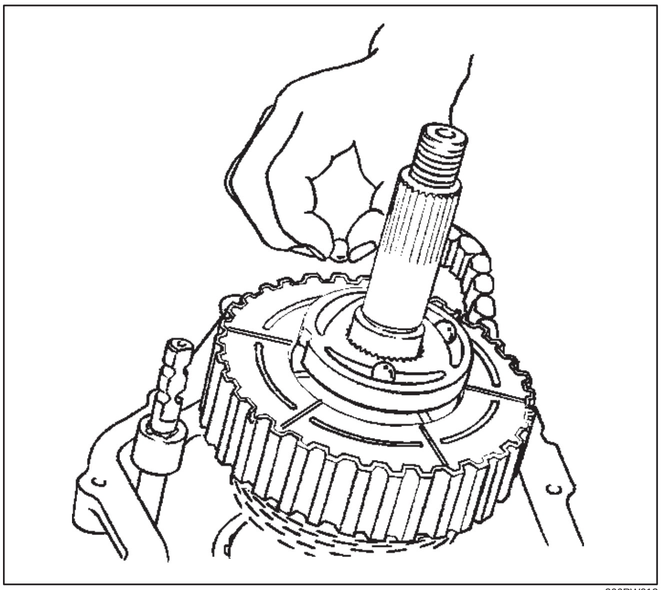
Legend
- (1) Clutch Pack Assembly
- (2) Insulator Washer
- (3) Armature Plate
- (4) Snap Ring
- (5) Wave Spring
- (6) Cam Pulley
- (7) Cam Ball
- (8) Cam and Coil Housing
- (9) Thrust Bearing

Disassembly

1. Remove thrust bearing.
2. Remove cam and coil housing.

NOTE: When the cam and coil housing is removed, the cam balls may be detached together with the housing. Pay attention not to lose the ball.

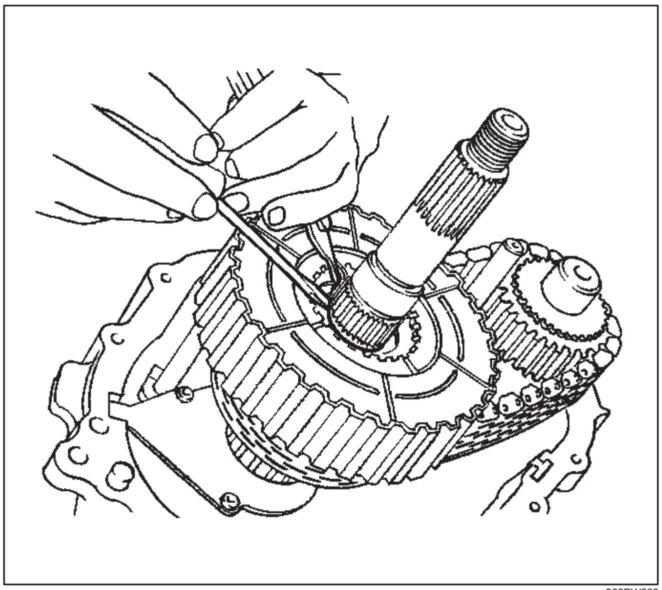
3. Remove cam ball.



266RW013

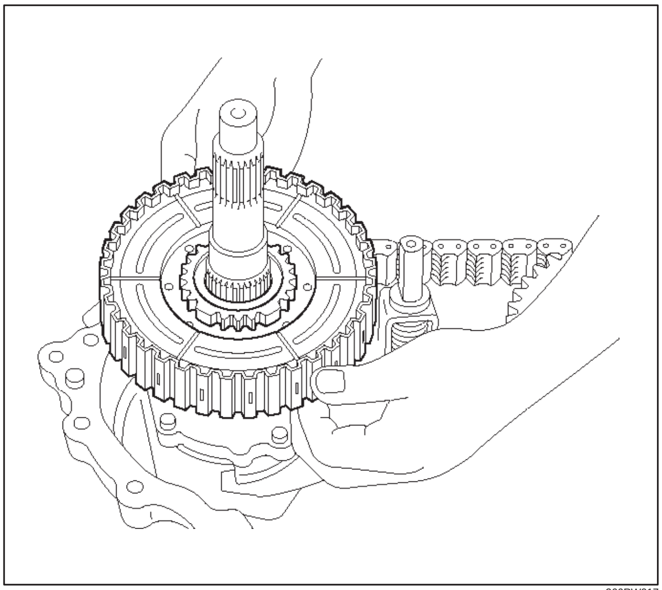
4. Remove cam pulley.
5. Remove wave spring.
6. Using snap ring pliers, remove the snap ring.

NOTE: Pay attention not to damage the snap ring.



266RW009

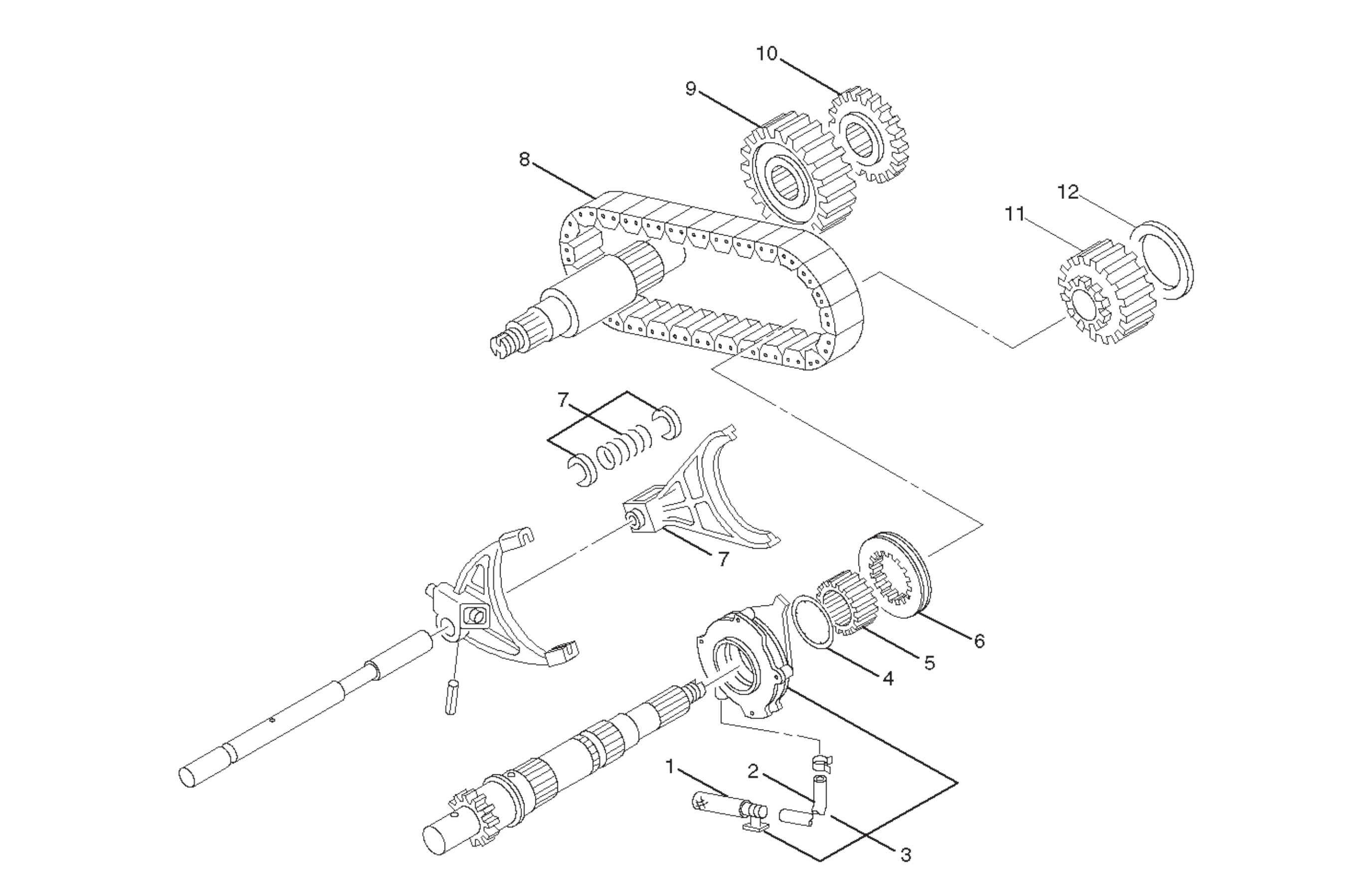
7. Remove the armature plate.
8. Remove the insulator washer.
9. Remove the clutch pack assembly as a package.



266RW017

Sprocket and Mechanical Lock

Disassembled View



266RW008

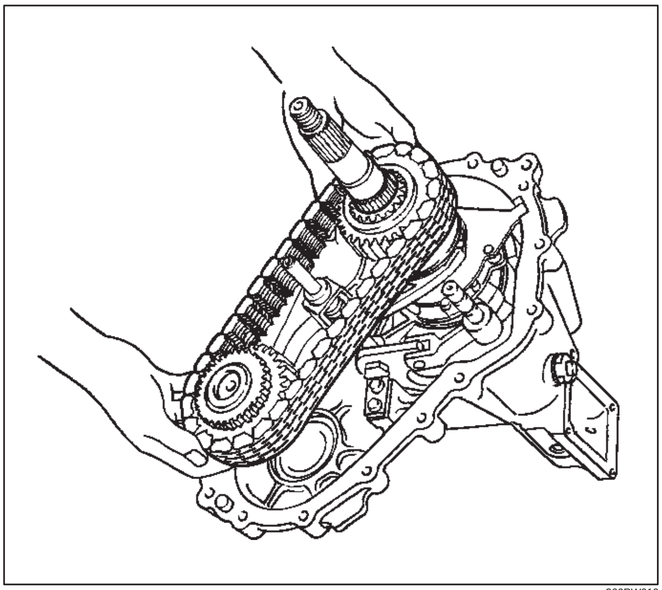
Legend

(1) Strainer
(2) Hose
(3) Oil Pump Assembly
(4) Thrust Washer
(5) Mechanical Lock Hub
(6) Lock-up Sleeve
(7) Lock-up Fork
(8) Chain
(9) Lower Drive Sprocket
(10) Front Tone Wheel
(11) Drive Sprocket
(12) Sprocket Spacer

Disassembly

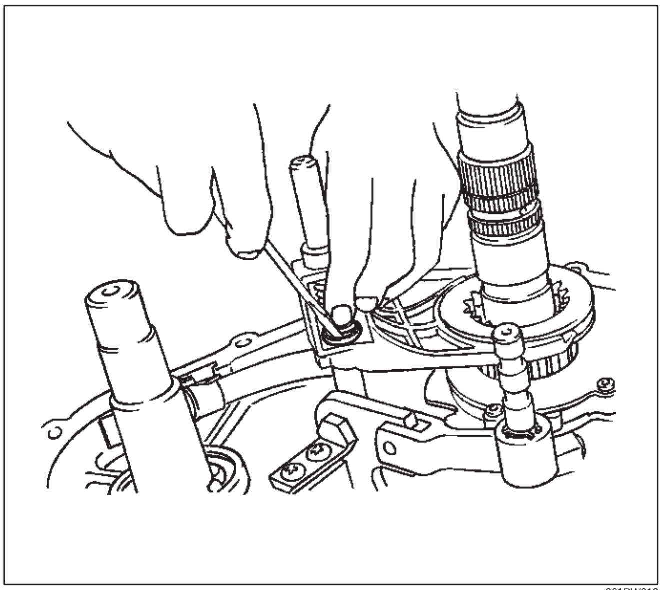
1. Remove sprocket spacer.
2. Remove front tone wheel.
3. Remove drive sprocket.
4. Remove lower drive sprocket.

5. Remove the drive sprocket, lower drive sprocket, and chain together from the front and rear output shafts.



266RW010

6. Remove mechanical lock hub.
7. Remove lock-up fork.
8. Remove the spring retainer from the connection between rail shaft and lock-up fork.
9. Remove lock-up sleeve.

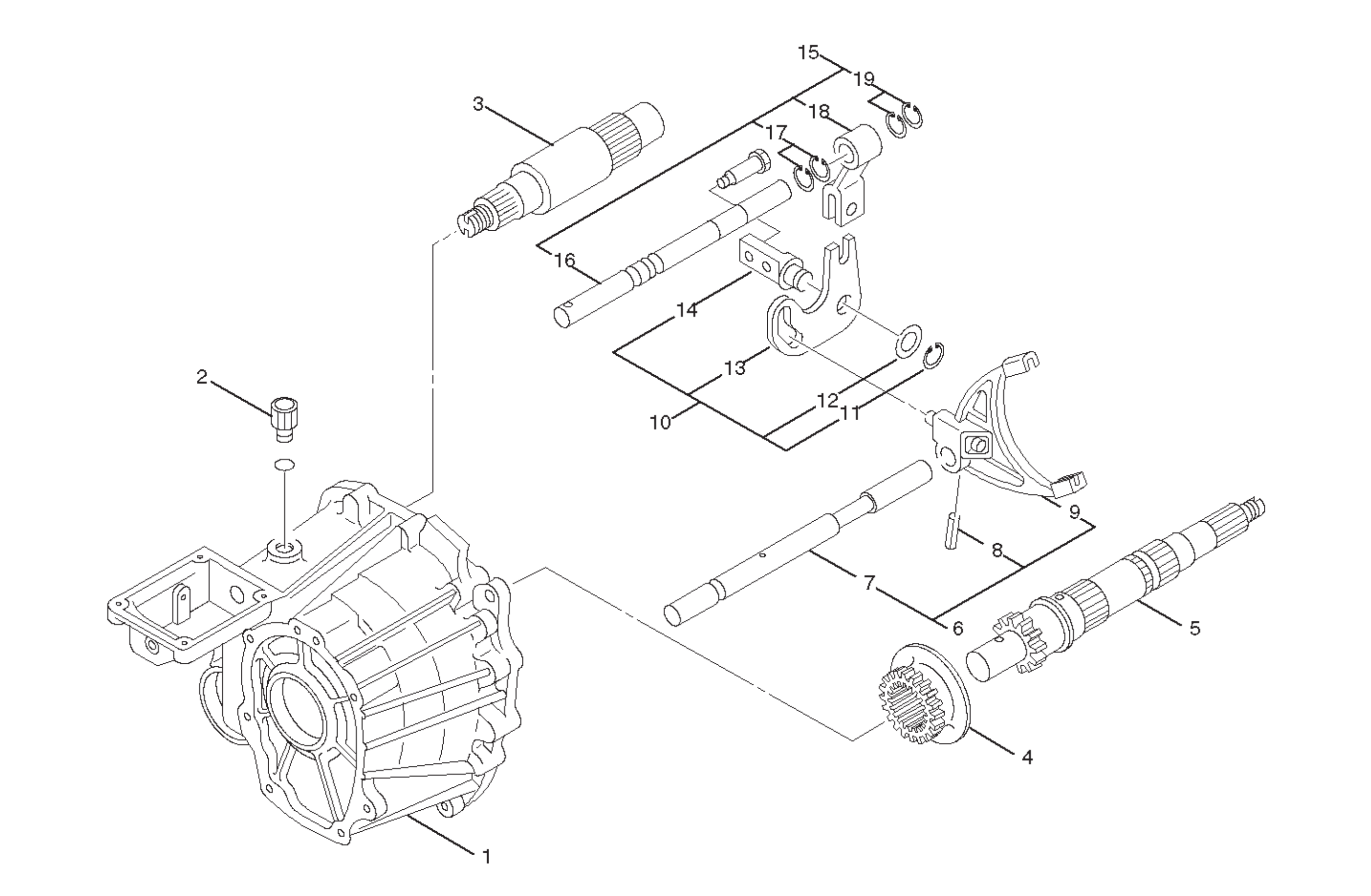


261RW018

10. Remove thrust washer.
11. Remove the magnet from the strainer set position together with the oil pump assembly.
12. Remove the strainer from the oil pump assembly.
13. Remove the hose from the oil pump assembly.

Output Shafts and Shift Control Shaft

Disassembled View

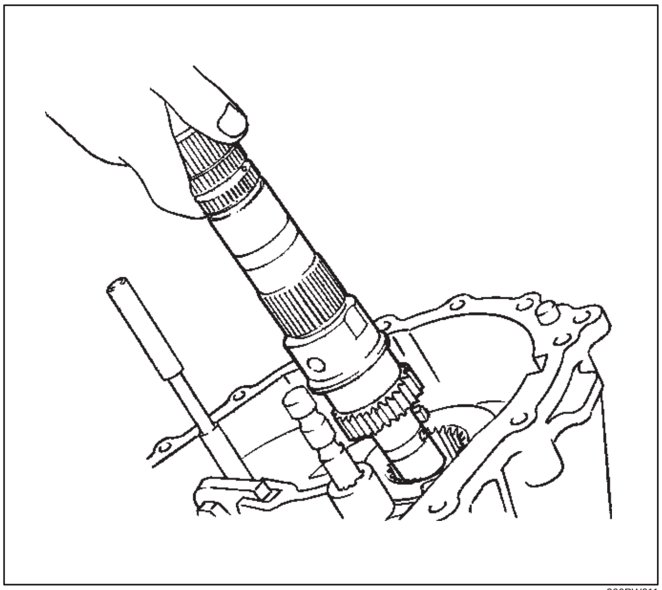


Legend

(1) Transfer Case Assembly
(2) Detent Spring
(3) Front Output Shaft
(4) Reduction Hub
(5) Output Shaft
(6) Lock-up Roll Assembly
(7) Spring Pin
(8) Spring Pin
(9) Reduction Fork
(10) Cam Assembly
(11) Snap Ring
(12) Washer
(13) Cam
(14) Cam Pilot Block
(15) Shifter Shaft Assembly
(16) Shifter Lever Shaft
(17) Snap Ring
(18) Reduction Lever Assembly
(19) Snap Ring

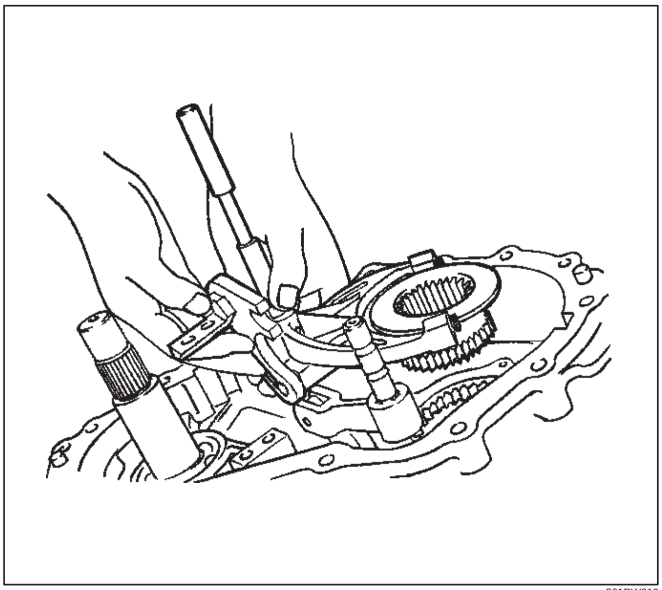
Disassembly

1. Remove output shaft.



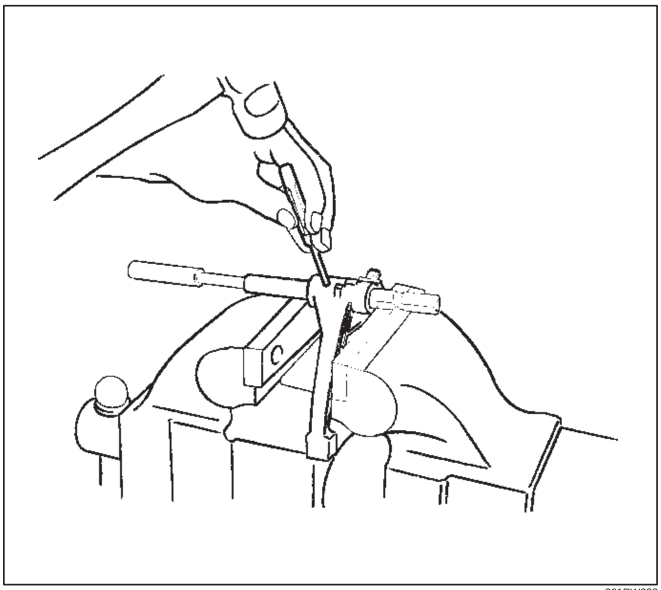
266RW011

2. Remove detent spring.
3. Remove the cam pilot block set bolts.
4. Remove the cam pilot block assembly and cam assembly.
5. Remove the spring pin that fixes the reduction hub together.



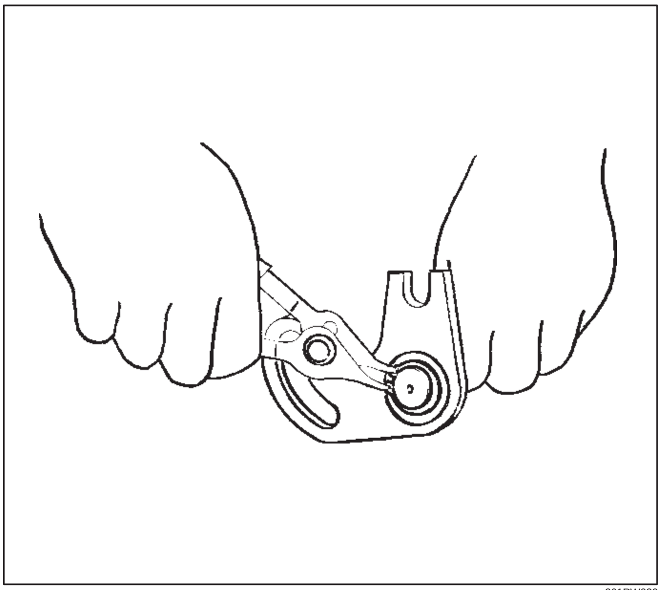
261RW019

6. Remove the spring pin that fixes the reduction fork.



261RW020

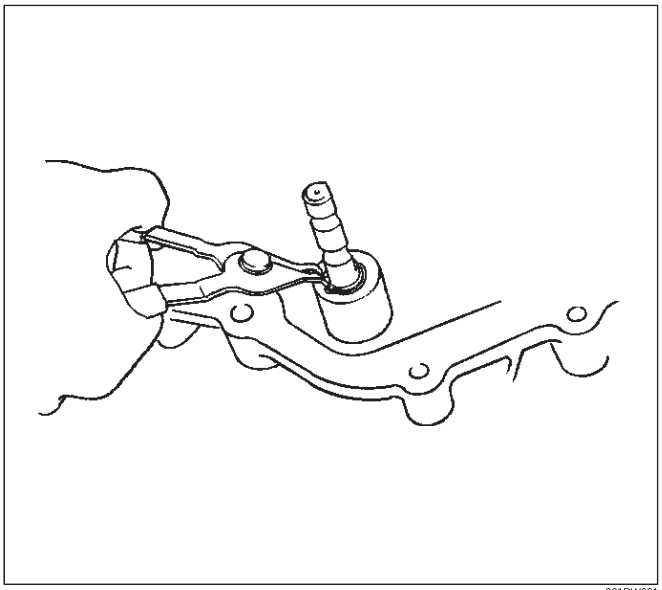
7. Remove the reduction fork.
8. Remove the lock-up roll.
9. Using snap ring pliers, remove the snap ring.



261RW029

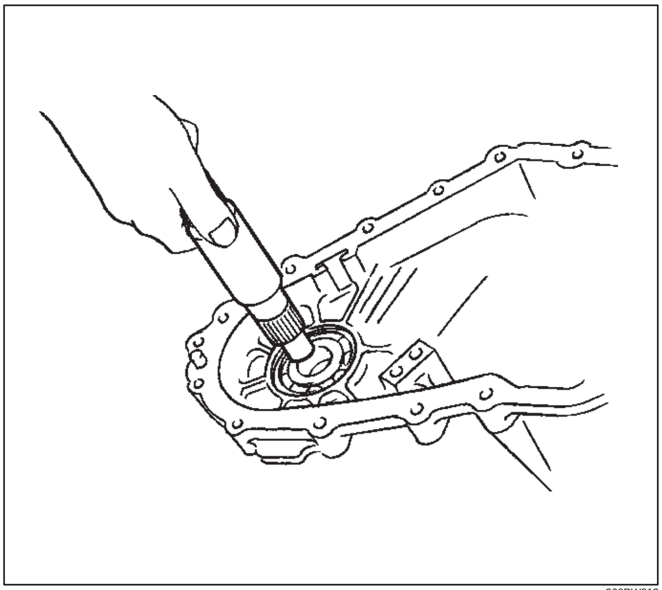
10. Remove the washer.
11. Remove the cam.
12. Remove the cam pilot block.

13. Using snap ring pliers, attach the snap ring.



261RW021

14. Remove the reduction lever assembly.
15. Remove the snap ring.
16. Remove the shifter lever shaft.
17. Remove the front output shaft.

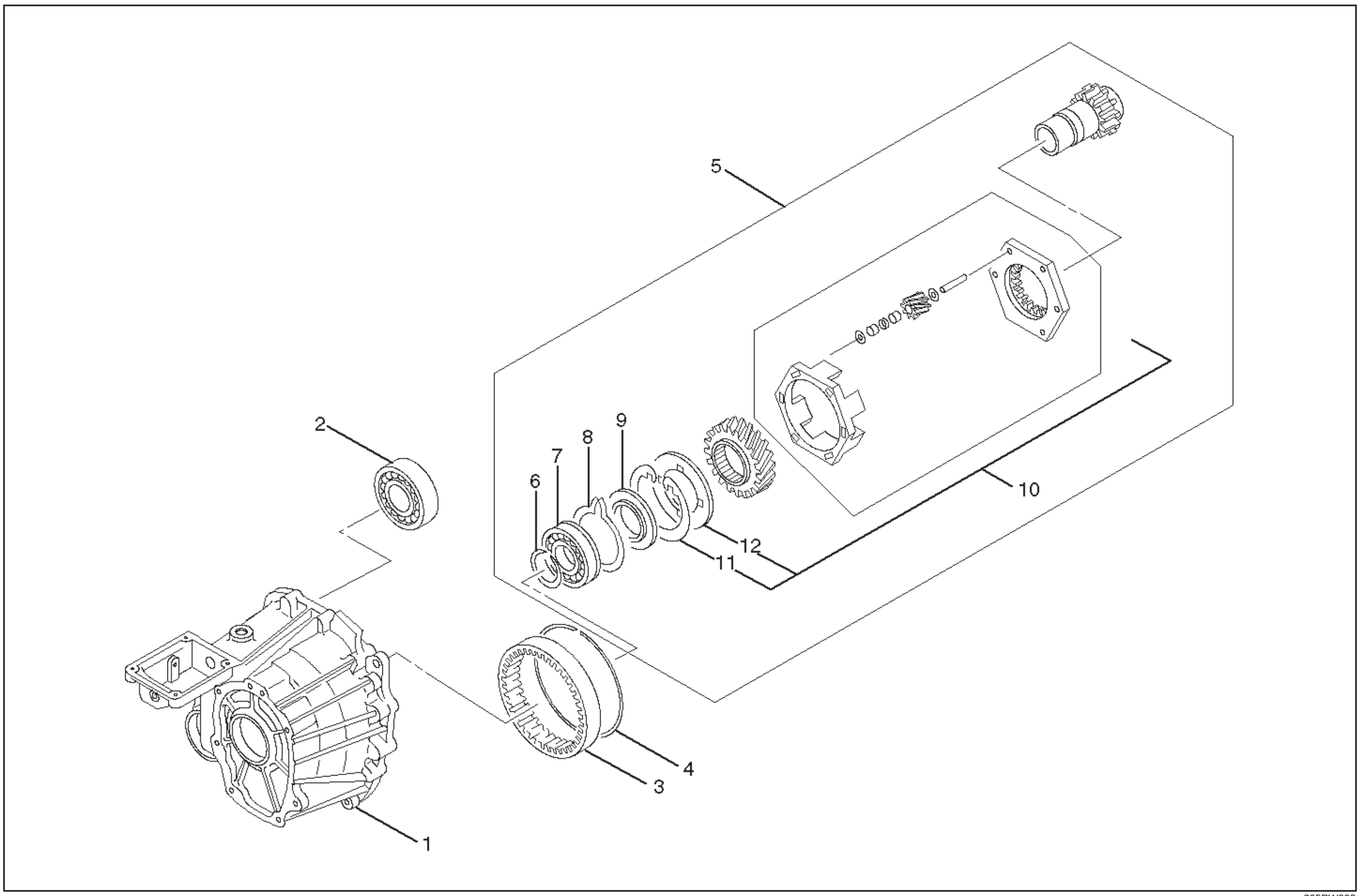


266RW012

18. Remove transfer case assembly.

Transfer Case

Disassembled View



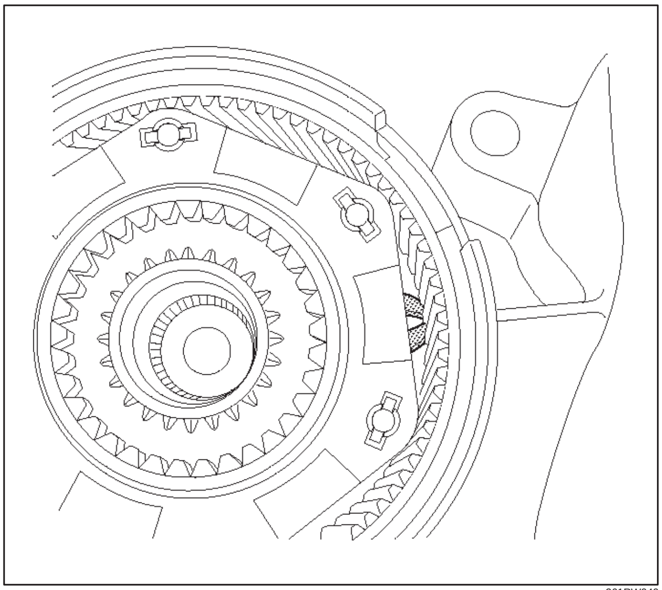
265RW002

Legend

(1) Transfer Case
(2) Ball Bearing
(3) Ring Gear
(4) Snap Ring
(5) Input Shaft and Carrier Assembly
(6) Snap Ring
(7) Ball Bearing
(8) Spring Ring
(9) Thrust Plate
(10) Carrier Assembly
(11) Snap Ring
(12) Circular Hub

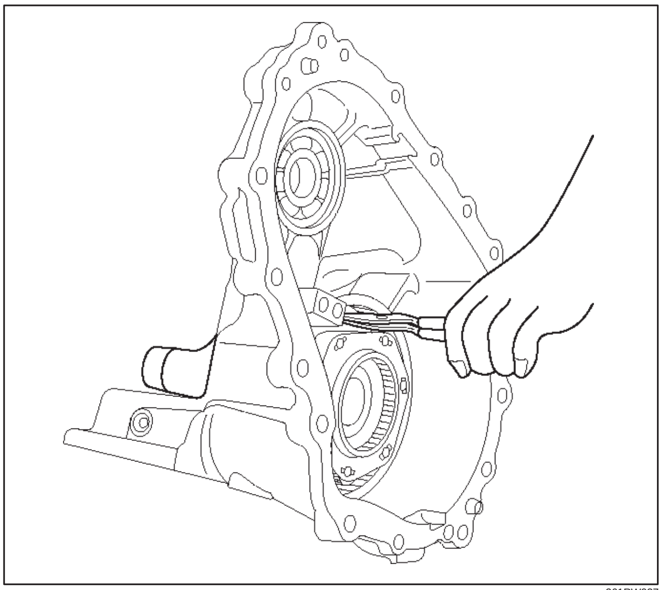
Disassembly

1. Remove ball bearing (for front output shaft).
2. Open the snap ring from the gap on the carrier assembly.



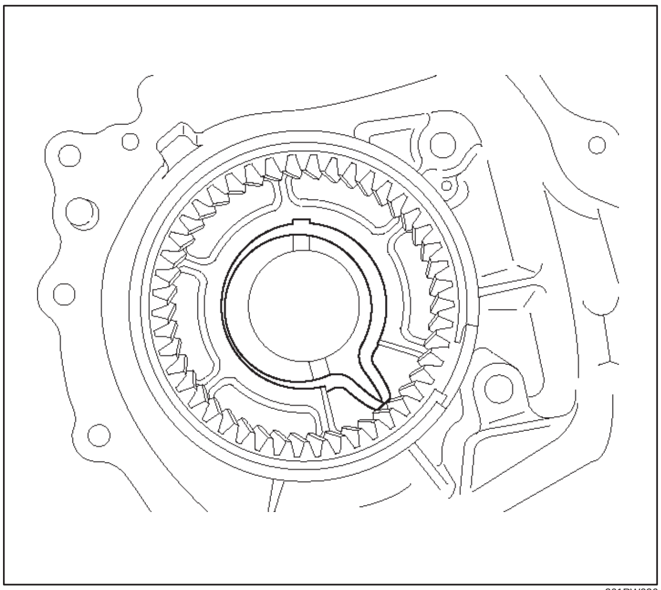
261RW040

3. While opening the snap ring, remove the input shaft, ball bearing, carrier assembly, and thrust plate from the transfer case.



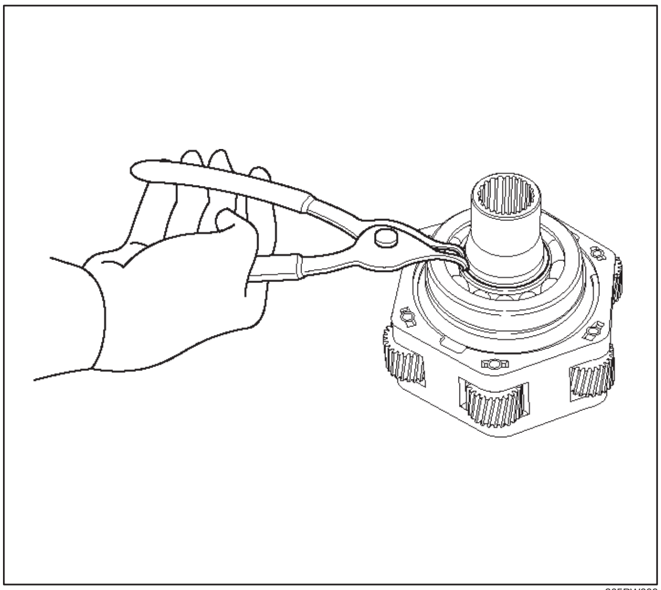
261RW037

4. Remove the snap ring from the transfer case.



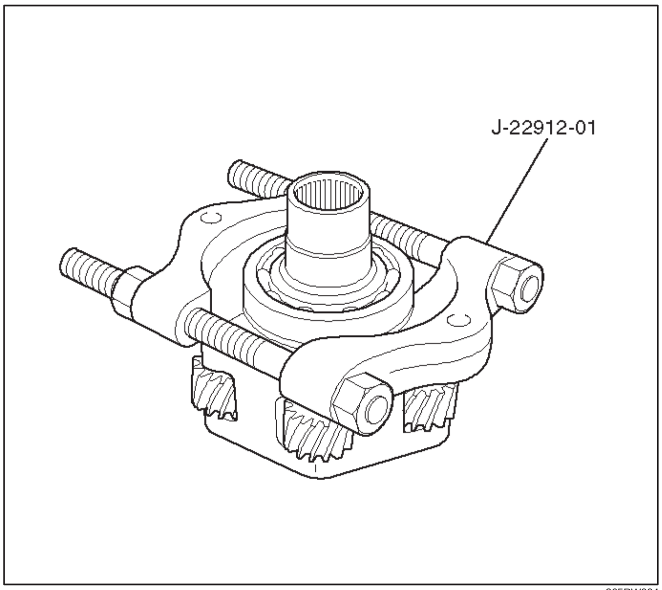
261RW036

5. Using snap ring pliers, remove the snap ring before the ball bearing.



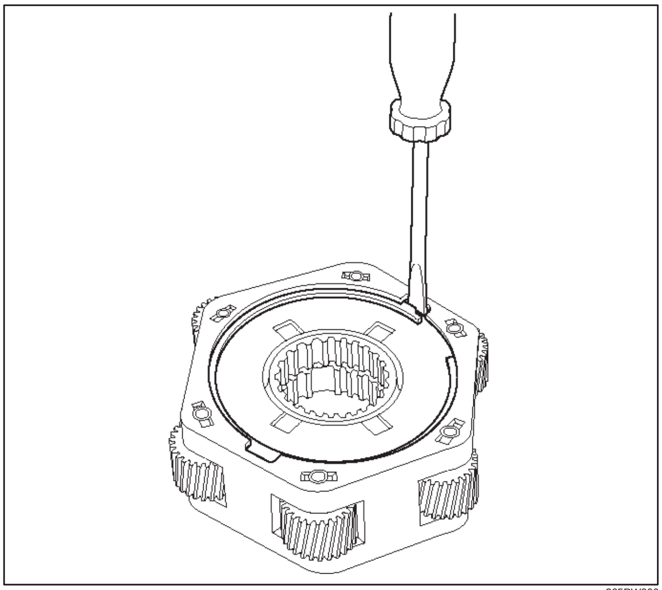
265RW009

6. Using the bearing remover J-22912-01, remove the ball bearing from the input shaft.

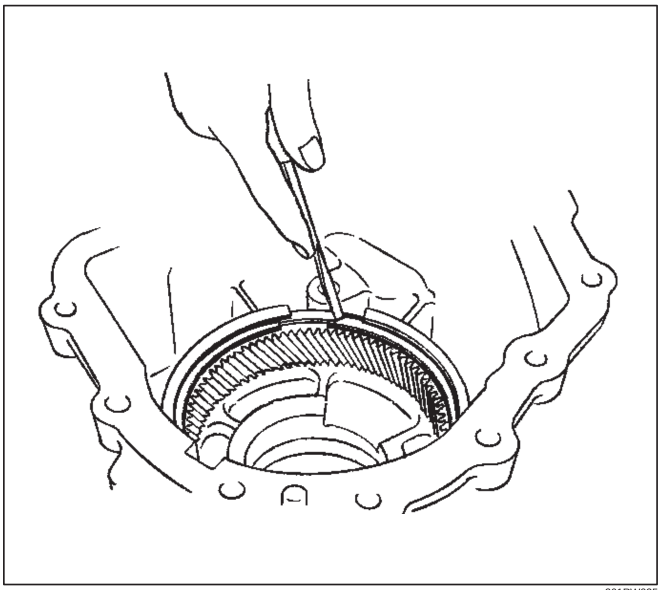


265RW004

7. Remove the thrust plate.
8. Remove the carrier assembly.
9. Remove the snap ring from the carrier assembly.

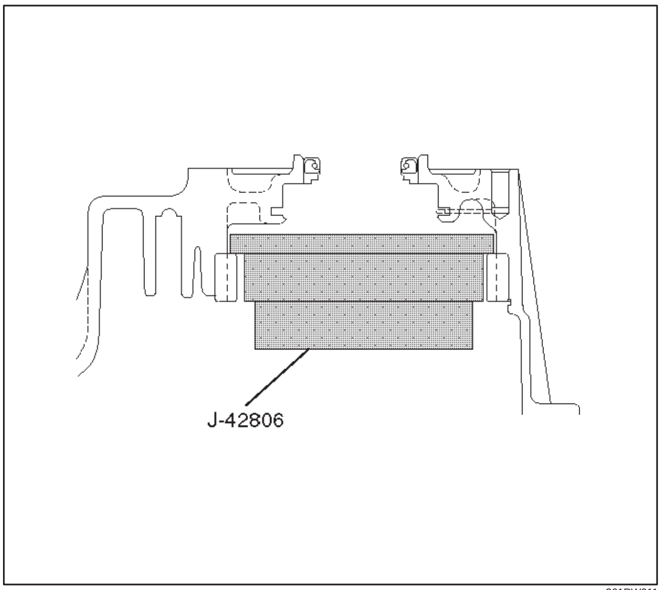

265RW006

10. Remove the circular hub.
11. Remove the snap ring before the ring gear.

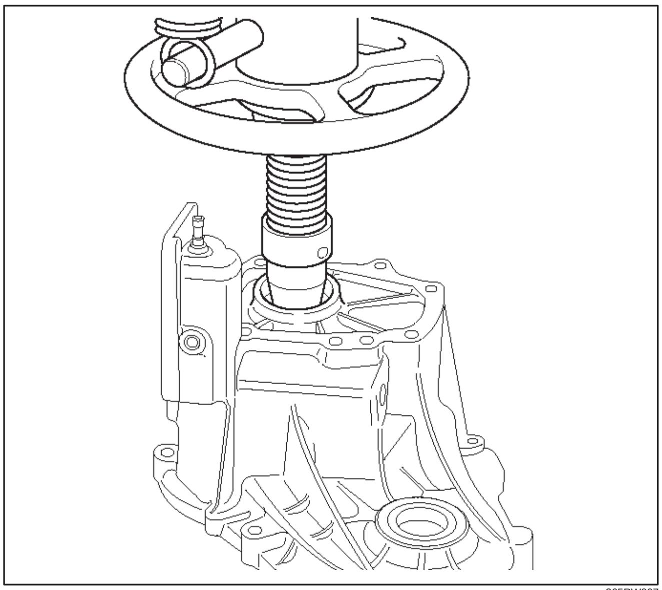

261RW025

12. Using the special tool J-42806, remove the ring gear.

NOTE: Removing the ring gear needs a high-load press. This means the transfer case may be damaged. To remove and replace the ring gear, it is recommended that the transfer case assembly should be replaced.



261RW011



265RW007

Inspection and Repair

When wear, damage, or any other defects are observed during the inspection, the part or parts must be repaired or replaced. Wash all the parts with clean detergent, and check that old oil, metallic particles, dirt, or foreign materials are completely removed. Blow the air into oil holes and grooves to remove foreign materials or residual detergent.

Chain

- Check whether the face that contacts the sprocket is free from excessive wear or damage. If defects are observed, replace the part.
- If the chain interference mark is found on the inside wall of the transfer cover or the chain is so slack that a skipped engagement occurs between the chain and sprocket, replace the chain.

Sprocket

- Check whether the sprocket tooth surface is excessively worn or damaged, and there is evidence of burrs, chipping, wear, or damage on the gear spline. Remove minor flaws or scratches with oil stone. If excessive wear or damage is observed, replace the part.
- If excessive wear or damage is observed on the sprocket inside sliding surface, replace the part.

Gear

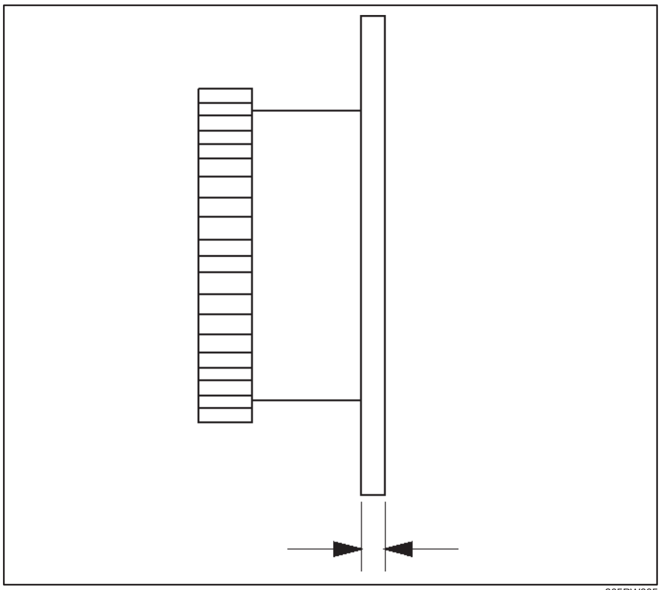
Check whether the gear tooth surface is excessively worn or damaged, and there is evidence of burrs, chipping, wear, or damage on the gear spline. Remove minor flaws or scratches with oil stone. If excessive wear or damage is observed, replace the part.

Thickness of Reduction Hub

- Measure the thickness with a micrometer.
- If the measurement exceeds the limit, replace the reduction hub.

Standard : 3.05-3.30 mm (0.120-0.130 in)

Allowable limit : 2.5 mm (0.098 in)



265RW005

Lock-up Sleeve

Mount the lock-up hub, drive sprocket assembly, and lock-up sleeve to the output shaft.

If the lock-up sleeve does not move smoothly, replace the sleeve.

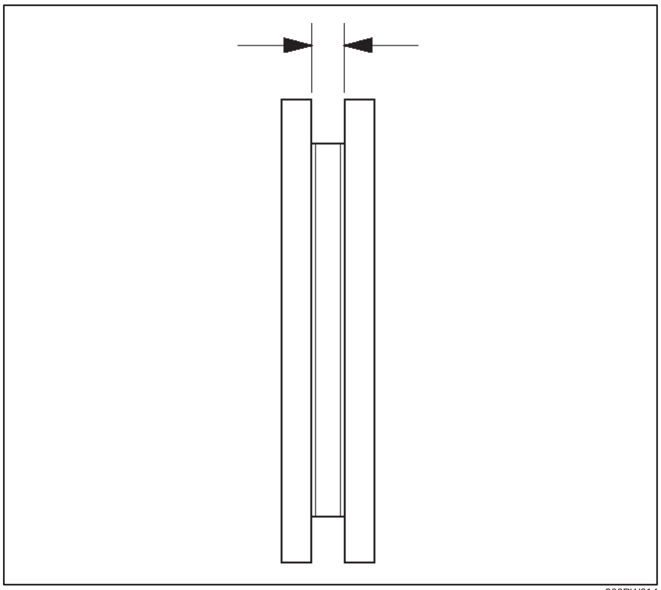
NOTE: Apply ATF to the area engaging the gear.

Thickness of Lock-up Sleeve

- If the measurement exceeds the limit, replace the lock-up sleeve.

Standard : 7.16-7.32 mm (0.282-0.288 in)

Allowable limit : 7.9 mm (0.311 in)



266RW014

Reduction Fork

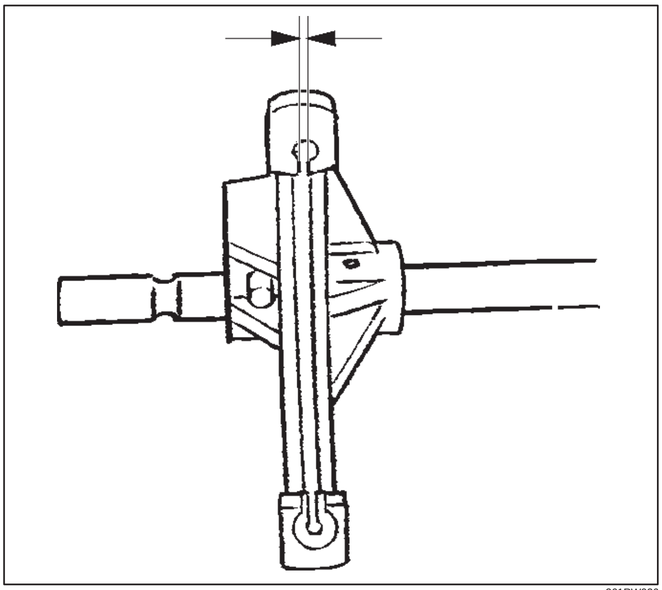
Check the reduction fork and shaft for wear, distortion, and scratches. If defects are observed, replace the parts.

Thickness of Reduction Fork

- If the measurement exceeds the limit, replace the reduction fork.

Standard : 3.41-3.79 mm (0.134-0.149 in)

Allowable limit : 4.4 mm (0.173 in)



261RW026

Lock-up Fork

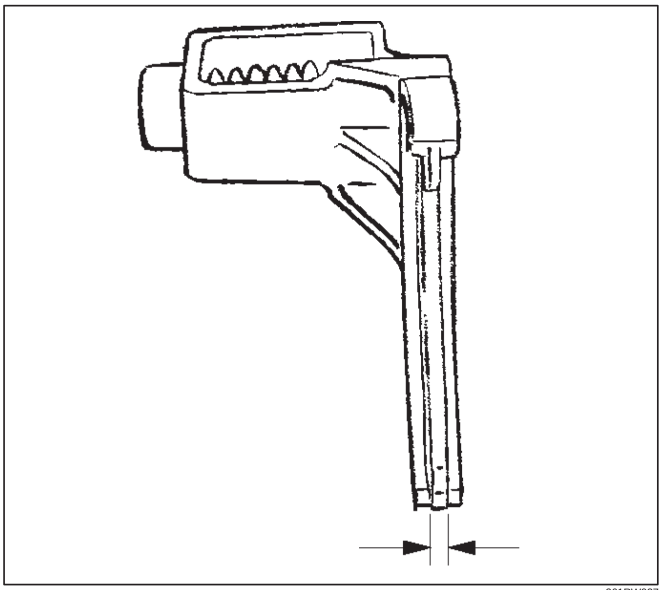
- Check the lock-up fork and shaft for wear, distortion, and scratches. If defects are observed, replace the parts.

Thickness Lock-up Fork

If the measurement exceeds the limit, replace the lock-up fork.

Standard : 6.99-7.09 mm (0.275-0.279 in)

Allowable limit : 6.3 mm (0.248 in)



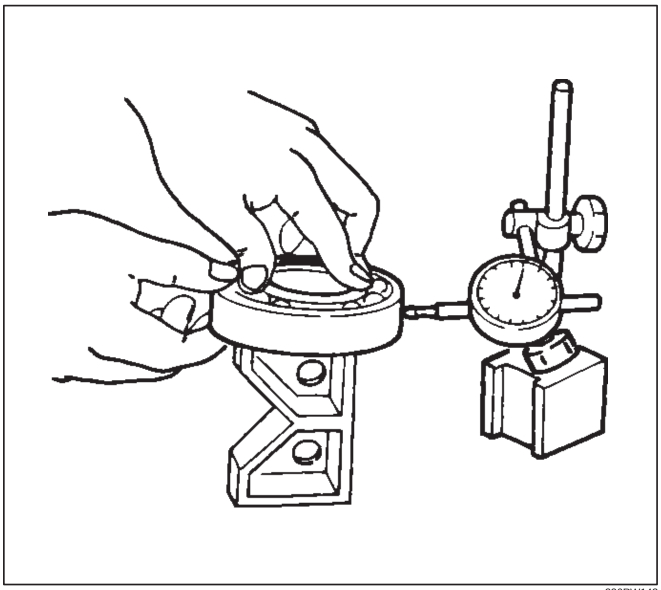
261RW027

Bearing

Check the profile of the needle, roller, ball, and thrust bearings. Wash the bearings with clean detergent completely, and dry with air.

NOTE: If the bearing is rotated excessively, the rollers may be damaged. So, rotate the bearing slowly with your hand. Apply grease to the bearing, and check the smoothness of the bearing while slowly rotating the race with your hand.

Allowable limit : 0.23 mm (0.009 in)



226RW143

Lock-up Fork Spring

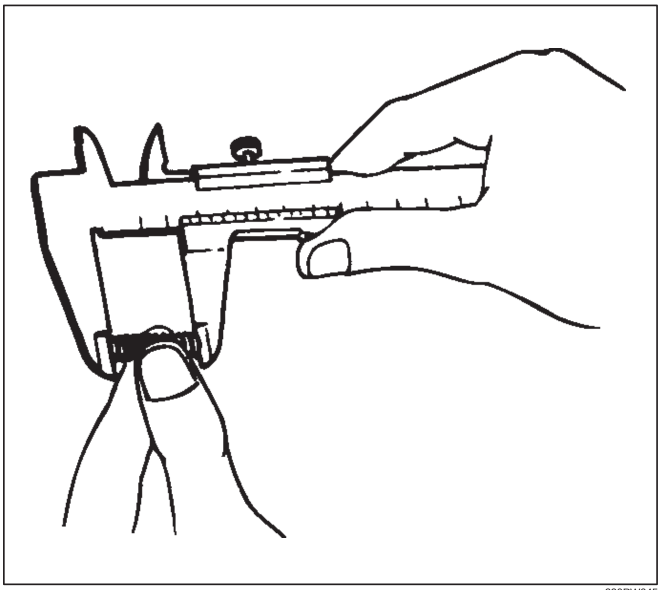
Check the lock-up fork spring for distortion, cracking, and wear. If defects are observed, replace the part.

Free Length of the Lock-up Fork Spring

- If the measurement exceeds the limit, replace the spring.

Standard : 60.96 mm (2.40 in)

Allowable limit : 55.0 mm (2.17 in)



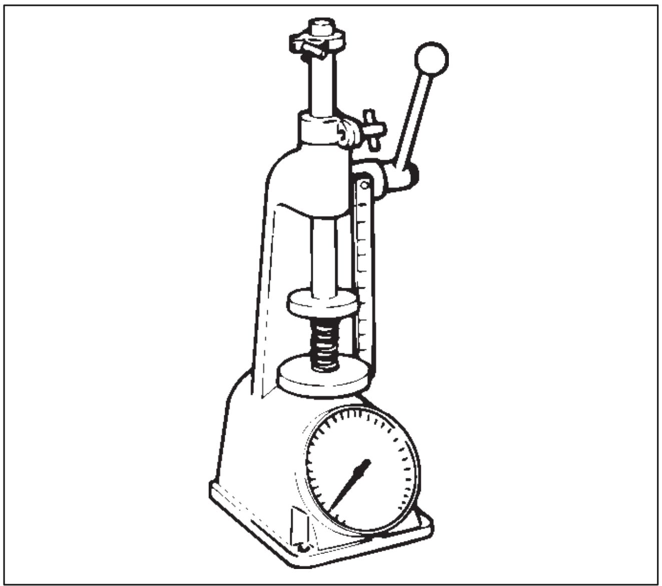
220RW045

Tension of Lock-up Fork Spring

- If the measurement exceeds the limit, replace the spring. (When compressed to 41.4 mm)

Standard : 27.1-33.8 N {2.76-3.45 kg}

Allowable limit : 24.5 N {2.5 kg}



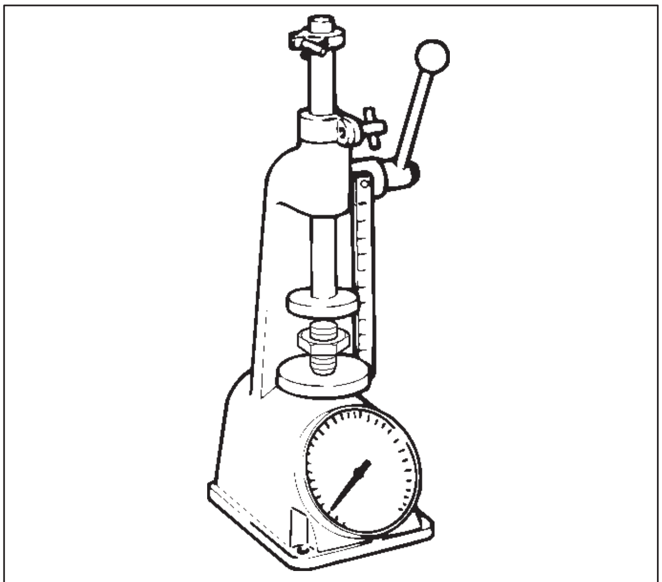
014RW048

Tension of Detent Spring Assembly

- If the measurement exceeds the limit, replace the spring. N {kg} (When compressed by 3 mm from the free length)

Standard : 139 N -203 {14.2-20.7 kg}

Allowable limit : 130 N {13.3 kg}



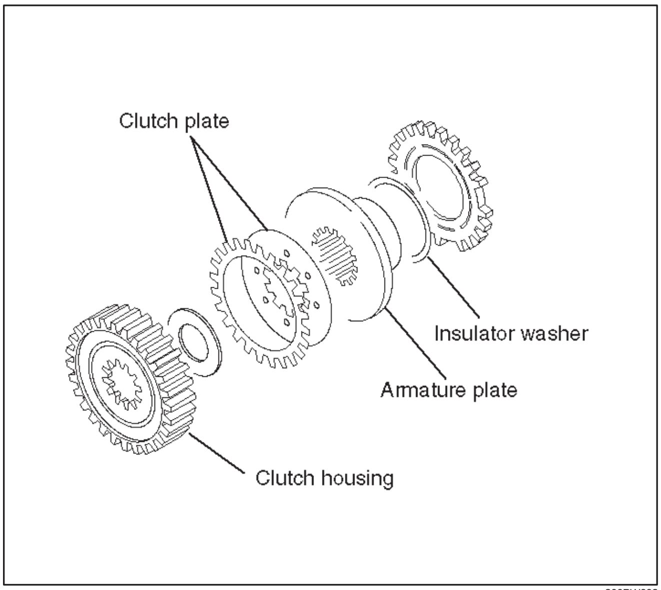
261RW041

Oil Pump

- Remove foreign materials from the strainer. If the strainer is damaged, replace it.
- If the area into which the shaft is inserted is excessively worn or damaged, replace the pump.

Multi Plate Disk Clutch

- If the burned, mirror-surfaced clutch facing, or scraping is observed on the clutch plates, clutch housing, armature plate, and insulator washer, replace the part or parts.



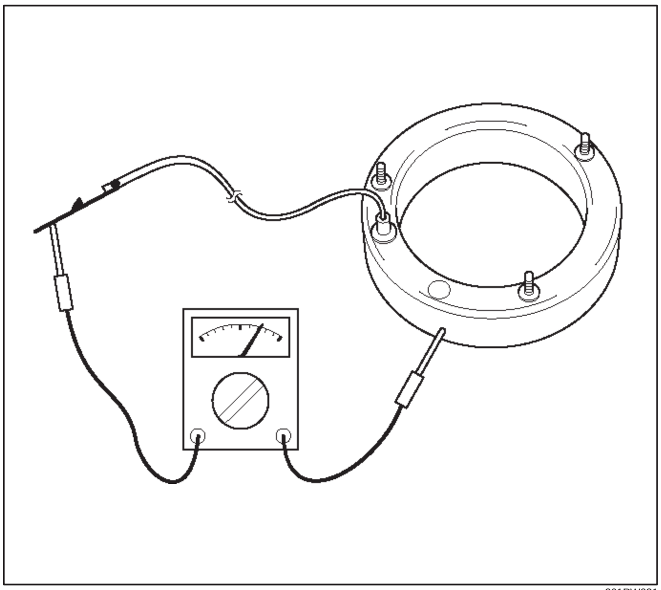
266RW003

Coil Assembly

- Check the resistance of the coil with a tester. If defects are observed, replace the assembly.
  * (ordinary temperature)

Standard : 1.4~2.0 Ω

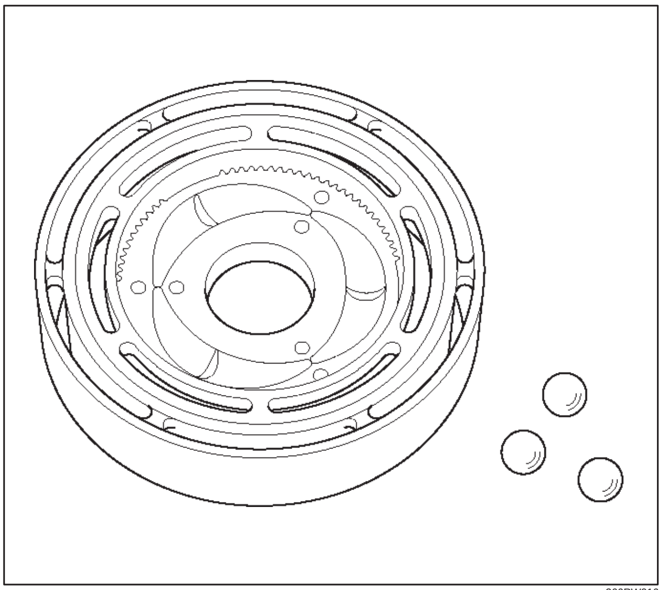
Allowable limit : 1.0~5.0 Ω



261RW031

Cam Pulley, Cam Ball, and Cam&Coil Housing

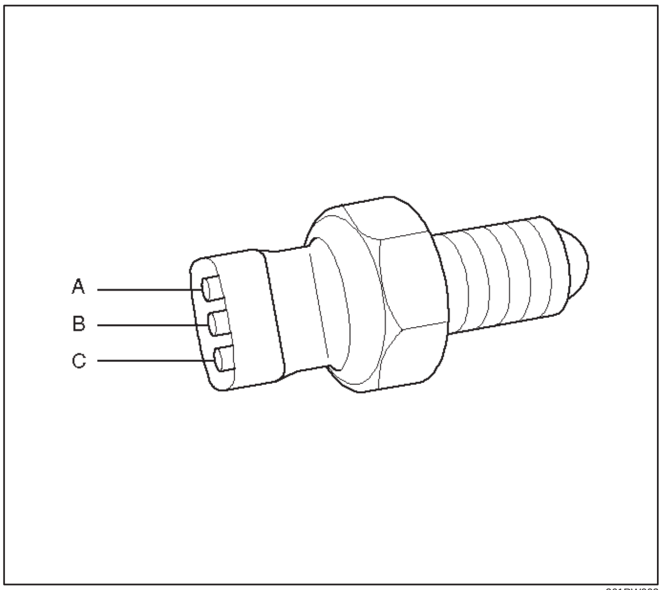
- Check the cam balls and cam for excessive wear or damage. If defective, replace the parts. 4H and 4L switches.



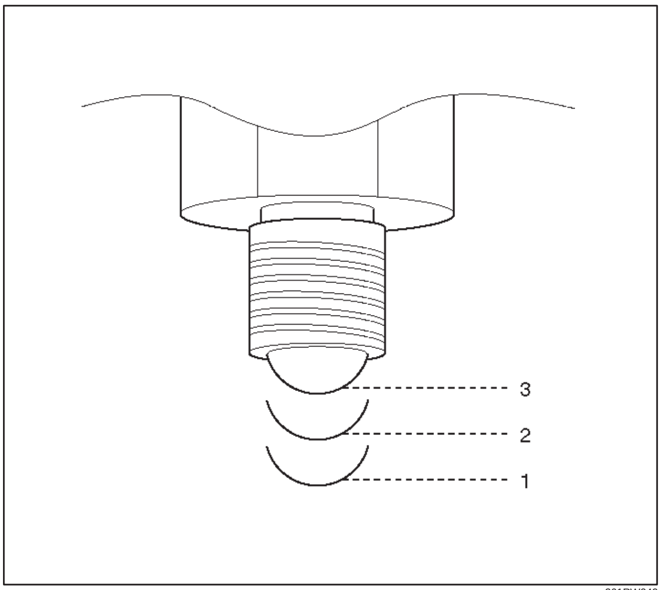
266RW016

The Parts 4H and 4L Switch

- Check the continuity of 4H and 4L switch.



261RW003

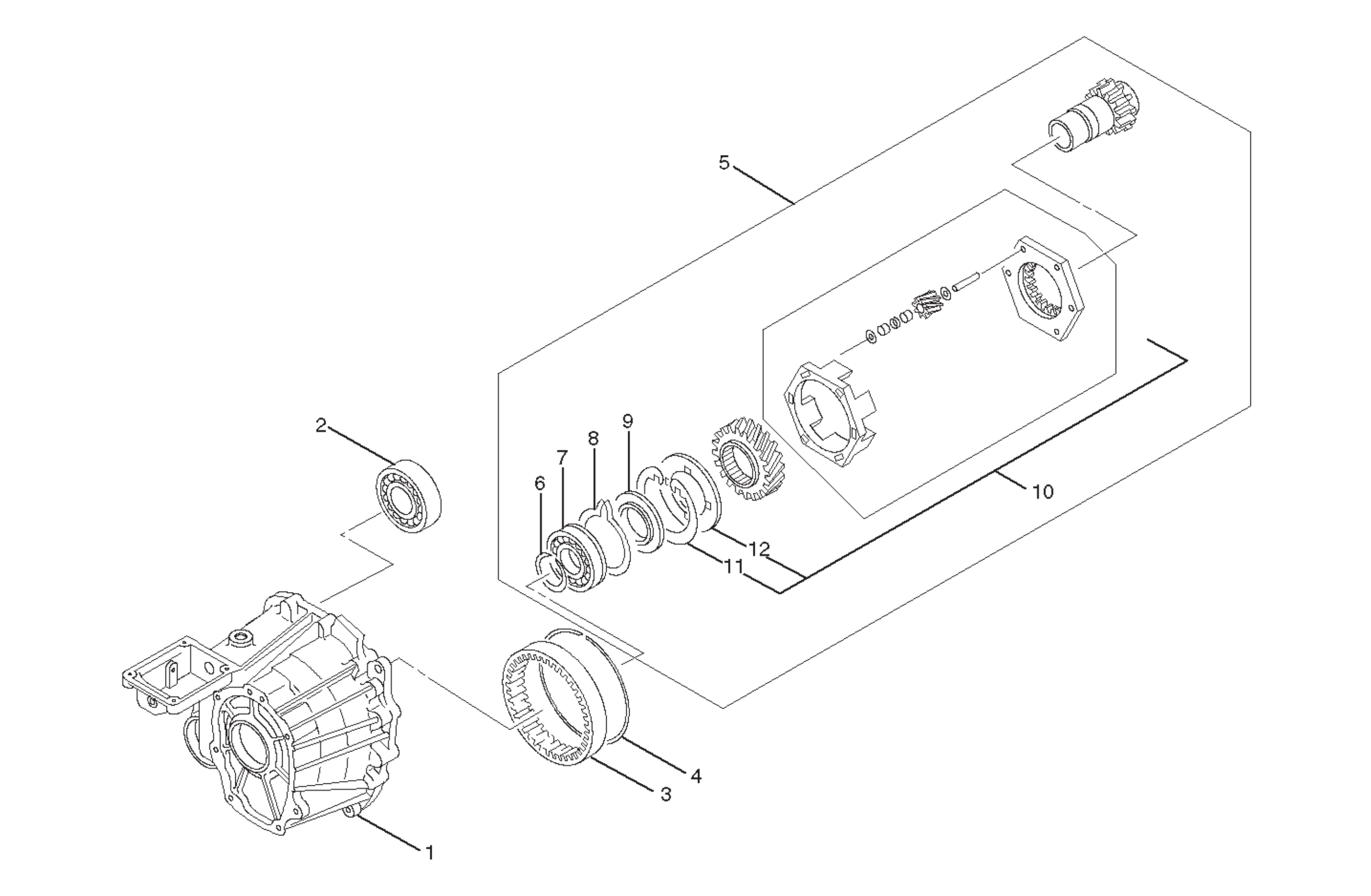


261RW049

Switch Stroke	4H Switch Signal	4L Switch Signal	The correspon ding position of transfer lever
	B to Switch Body	A to C	
1	Open	Open	High
2	Open	Close	4L
3	Close	Close	Neutral

Transfer Case

Disassembled View



265RW002

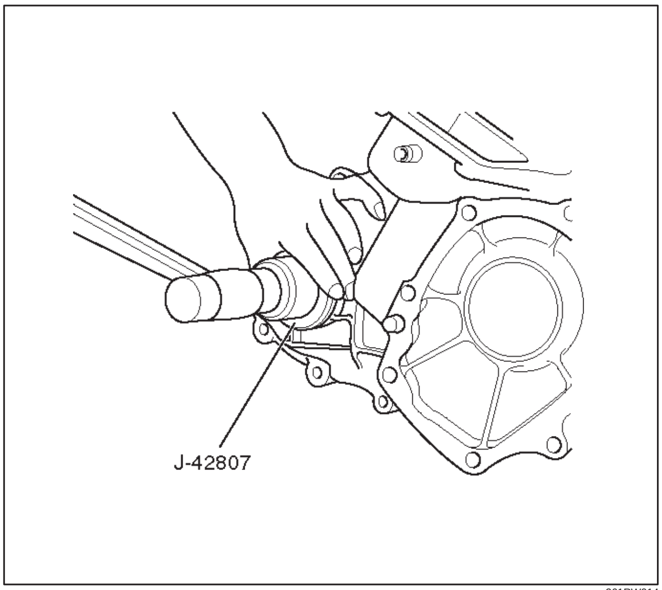
Legend

(1) Transfer Case
(2) Ball Bearing
(3) Ring Gear
(4) Snap Ring
(5) Input Shaft and Carrier Assembly
(6) Snap Ring
(7) Ball Bearing
(8) Spring Ring
(9) Thrust Plate
(10) Carrier Assembly
(11) Snap Ring
(12) Circular Hub

Reassembly

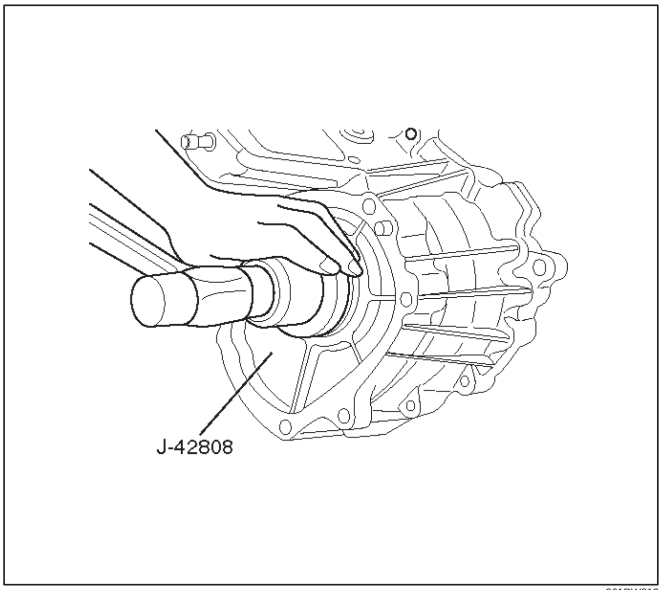
1. Remove the oil seal from the transfer case.
2. Apply the circumference of the new oil seal and fill the lip with grease (Besco L2 or equivalent).

3. Using the front output shaft oil seal installer J-42807, attach the oil seal to the transfer case.



261RW014

4. Using the input shaft (main) J-42808 oil seal installer, attach the oil seal to the transfer case.

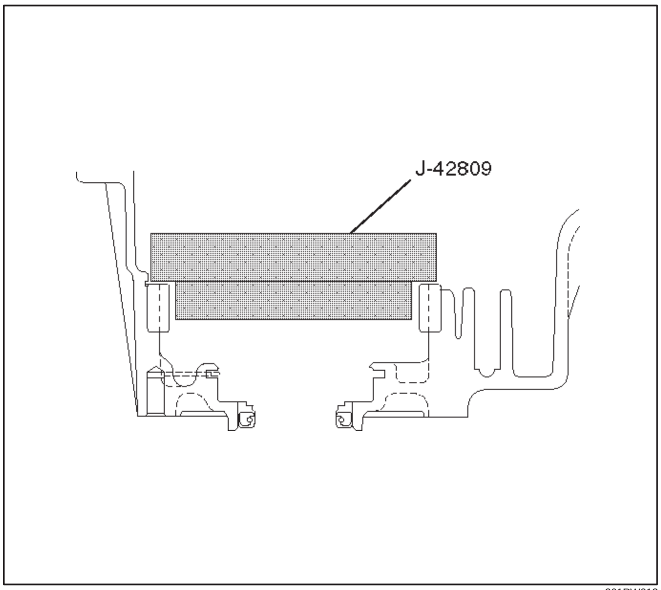


261RW012

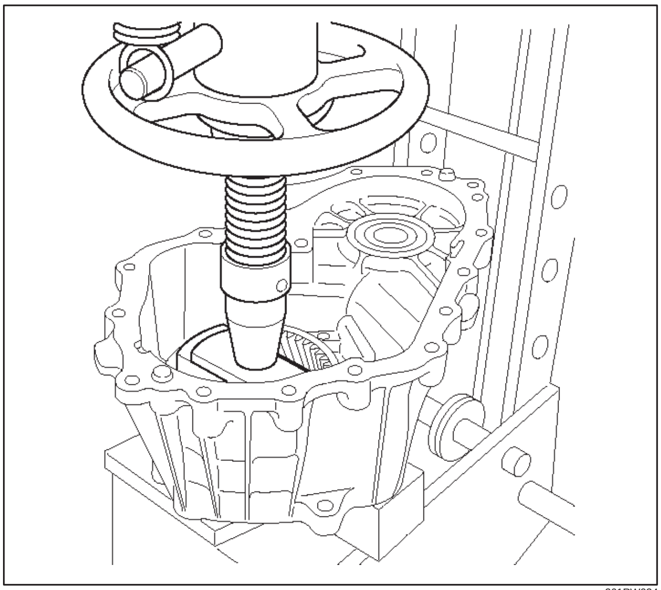
5. Using the special tool J-42809, press-fit the ring gear.

Pay attention to the following points.

- Identify the correct direction of gear.
- Do not damage the gear.
- Do not press-fit the ring gear slantingly.
- Press-fit the ring gear to the innermost.
- Remove burrs generated by press-fitting.
- If the transfer case has serrations, match them with those of the gear and press-fit the gear.



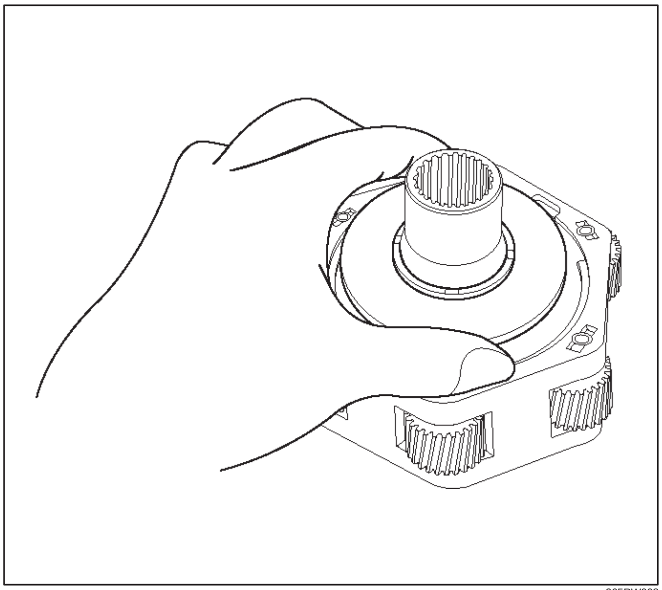
261RW013



261RW034

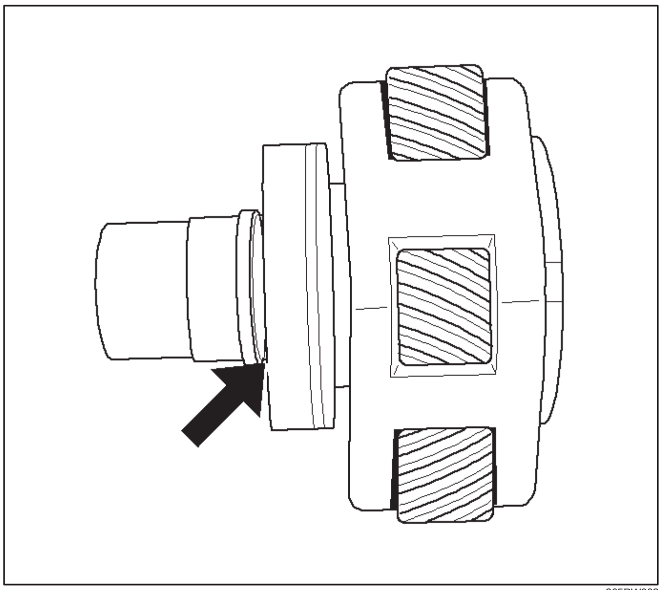
6. Install snap ring.
7. Install circular hub.
8. Attach the snap ring to the carrier.

9. Mount the carrier assembly to the transfer case.
10. Check the direction of thrust plate and mount it to the input shaft.



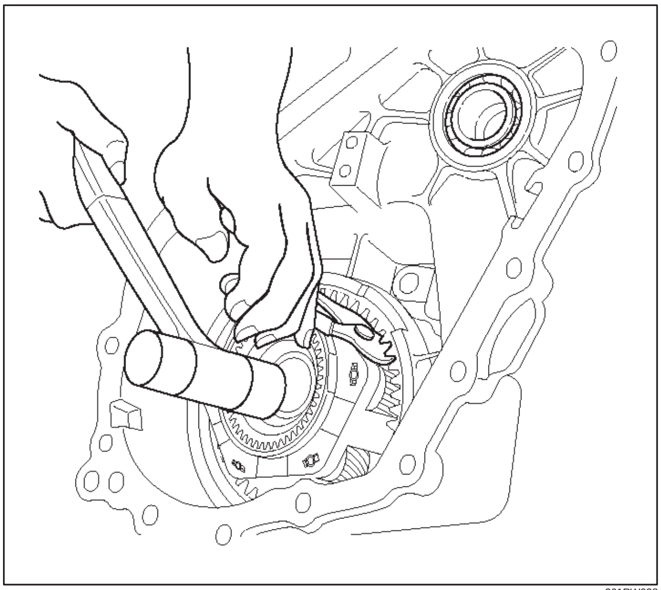
265RW008

11. Mount the ball bearing to the input shaft so that the snap ring will be attached to the input shaft.



265RW003

12. Attach the snap ring to the input shaft.
13. Attach the snap ring to the transfer case.
14. Using the snap ring pliers, open the snap ring from the gap on the input shaft and carrier assembly and securely attach the part.

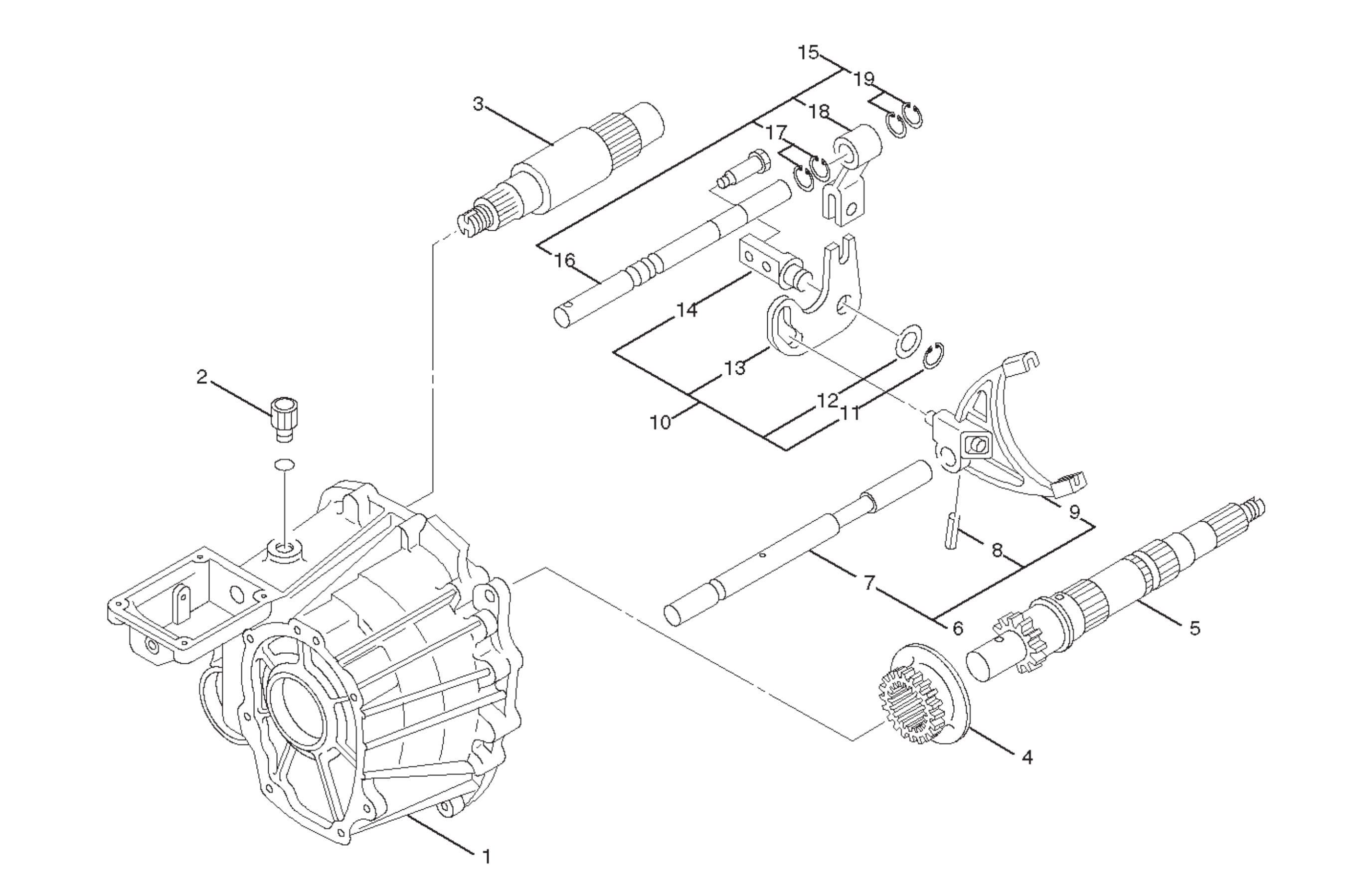


261RW038

15. Install ball bearing (for front output shaft)

Output Shafts and Shift Control Shaft

Disassembled View



261RW010

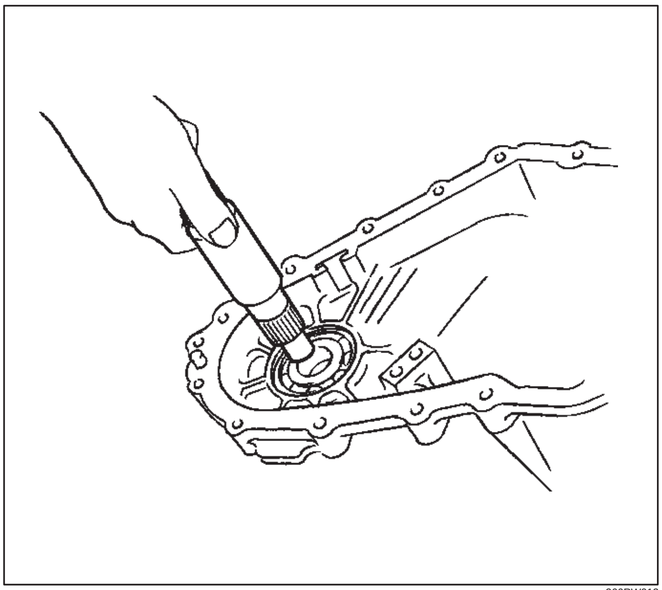
Legend

(1) Transfer Case Assembly
(2) Detent Spring
(3) Front Output Shaft
(4) Reduction Hub
(5) Output Shaft
(6) Lock-up Roll Assembly
(7) Spring Pin
(8) Spring Pin
(9) Reduction Fork
(10) Cam Assembly
(11) Snap Ring
(12) Washer
(13) Cam
(14) Cam Pilot Block
(15) Shifter Shaft Assembly
(16) Shifter Lever Shaft
(17) Snap Ring
(18) Reduction Lever Assembly
(19) Snap Ring

Reassembly

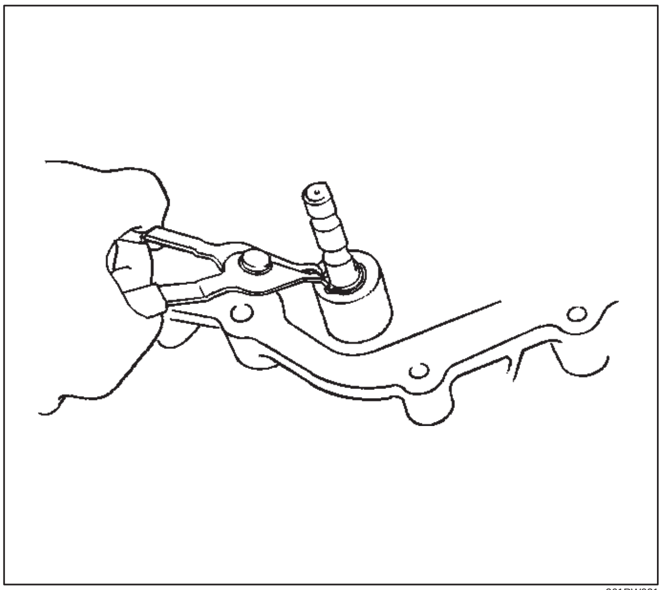
1. Apply ATF to the inside of the ball bearing.

2. Mount the front output shaft to the transfer case.



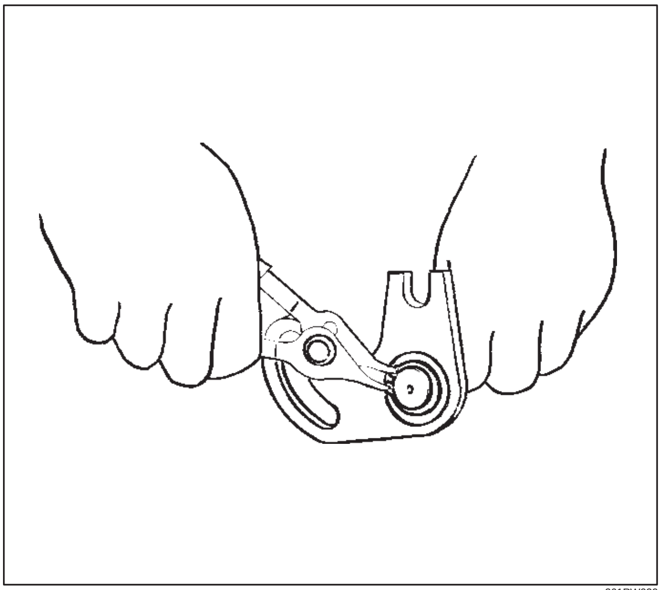
266RW012

3. Mount the reduction lever assembly to the shifter lever shaft and fix the assembly with the snap ring.



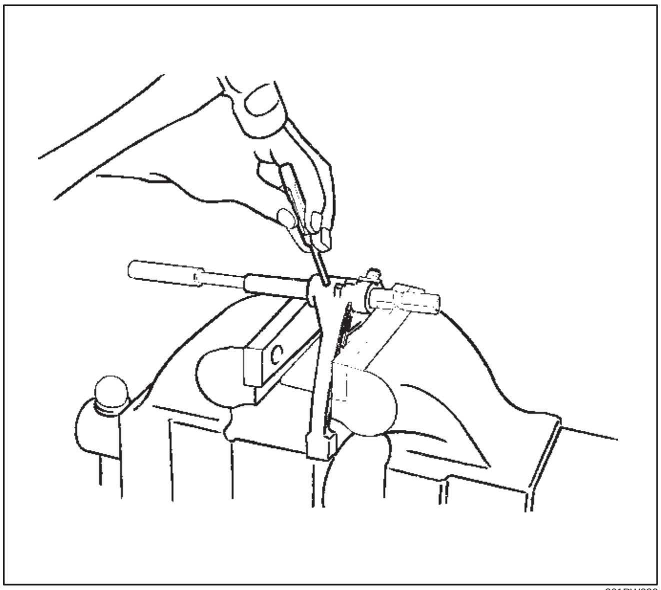
261RW021

4. Mount the cam to the cam pilot.
5. Attach the washer to the cam pilot block and fix the washer with the snap ring.



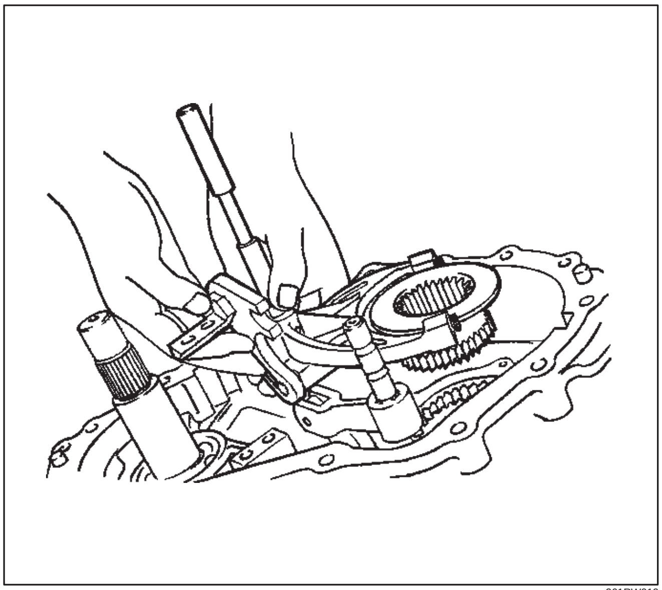
261RW029

6. Mount the reduction fork to the lock-up roll.
7. Attach the spring pin to fix to the reduction fork.



261RW020

8. Mount the lock-up assembly and reduction hub to together to transfer case assembly.
9. Mount the shifter shaft assembly.



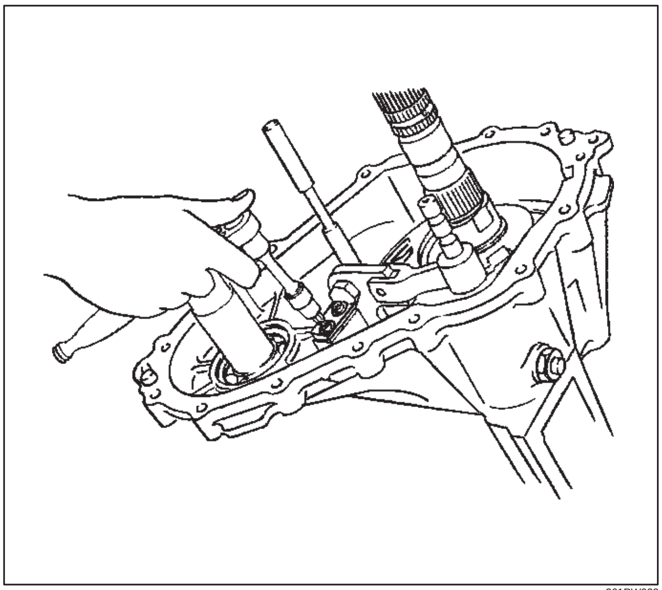
261RW019

10. Tighten the cam pilot block set bolts to the specified torque.

Torque : 12 N·m (104 lb in)

11. Tighten the detent spring to the specified torque.

Torque : 16 N·m (12 lb ft)

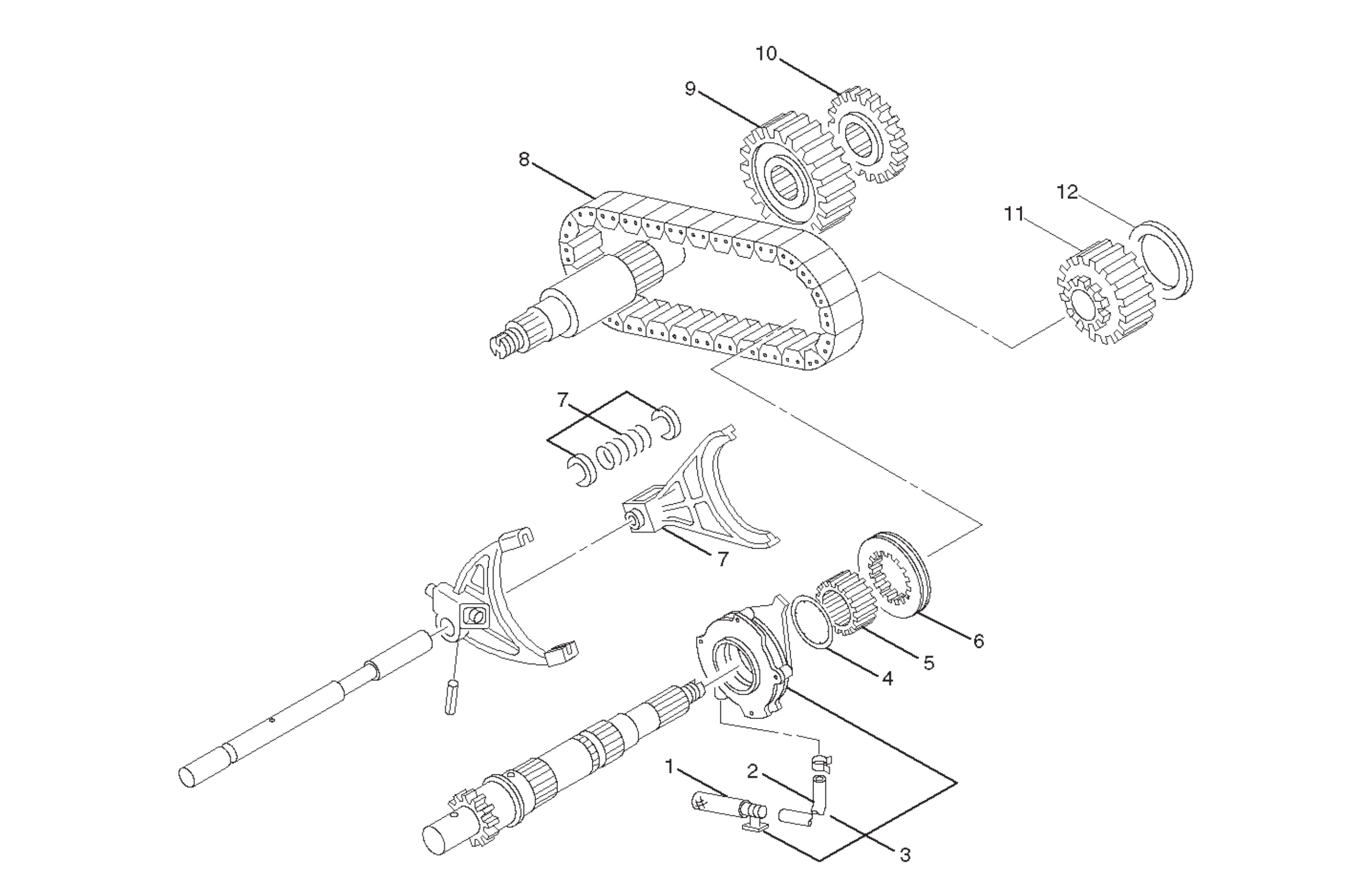


261RW022

12. Apply ATF to the needle bearing inside the output shaft assembly.
13. Mount the output shaft to the transfer case.

Sprocket and Mechanical Lock

Disassembled View



266RW008

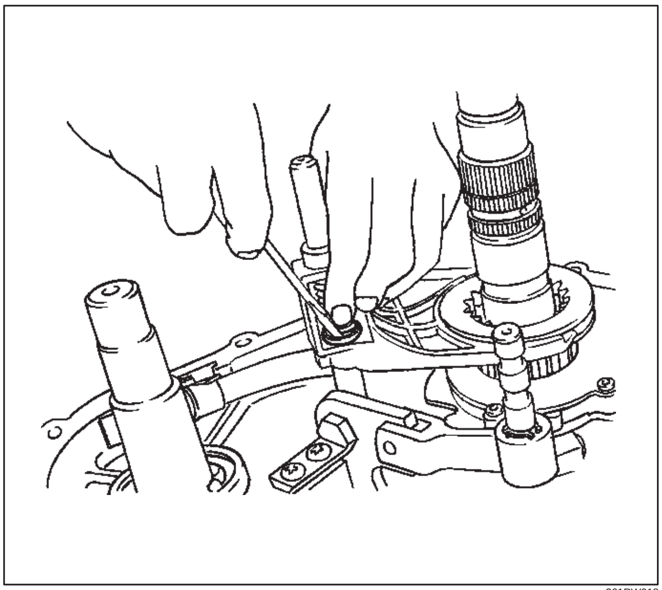
Legend

(1) Strainer
(2) Hose
(3) Oil Pump Assembly
(4) Thrust Washer
(5) Mechanical Lock Hub
(6) Lock-up Sleeve
(7) Lock-up Pork
(8) Chain
(9) Lower Drive Sprocket
(10) Front Tone Wheel
(11) Drive Sprocket
(12) Sprocket Spacer

Reassembly

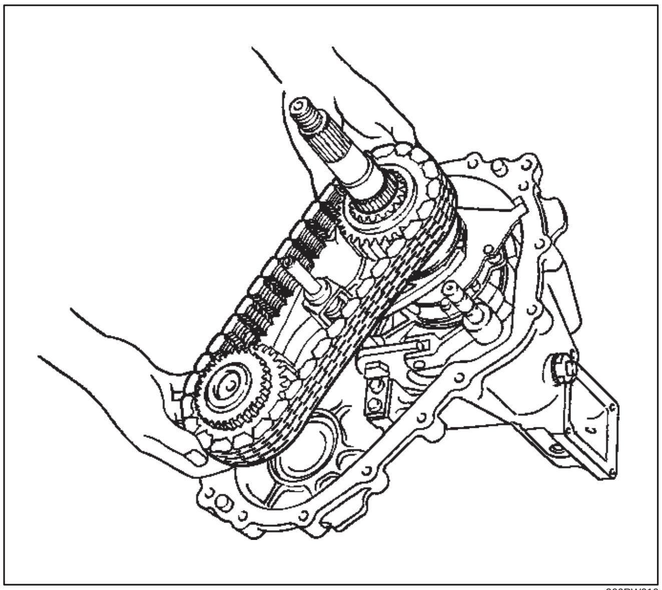
1. Install oil pump.
2. Attach the hose and strainer to the oil pump.
3. Mount the oil pump to the output shaft and attach the magnet to the strainer set position.
4. Install thrust washer.

5. Attach the spring to the lock-up fork.
6. Mount the lock-up sleeve and fork together to the output shaft and shifter roll assembly.
7. Mount the spring retainer to the lock-up fork.



261RW018

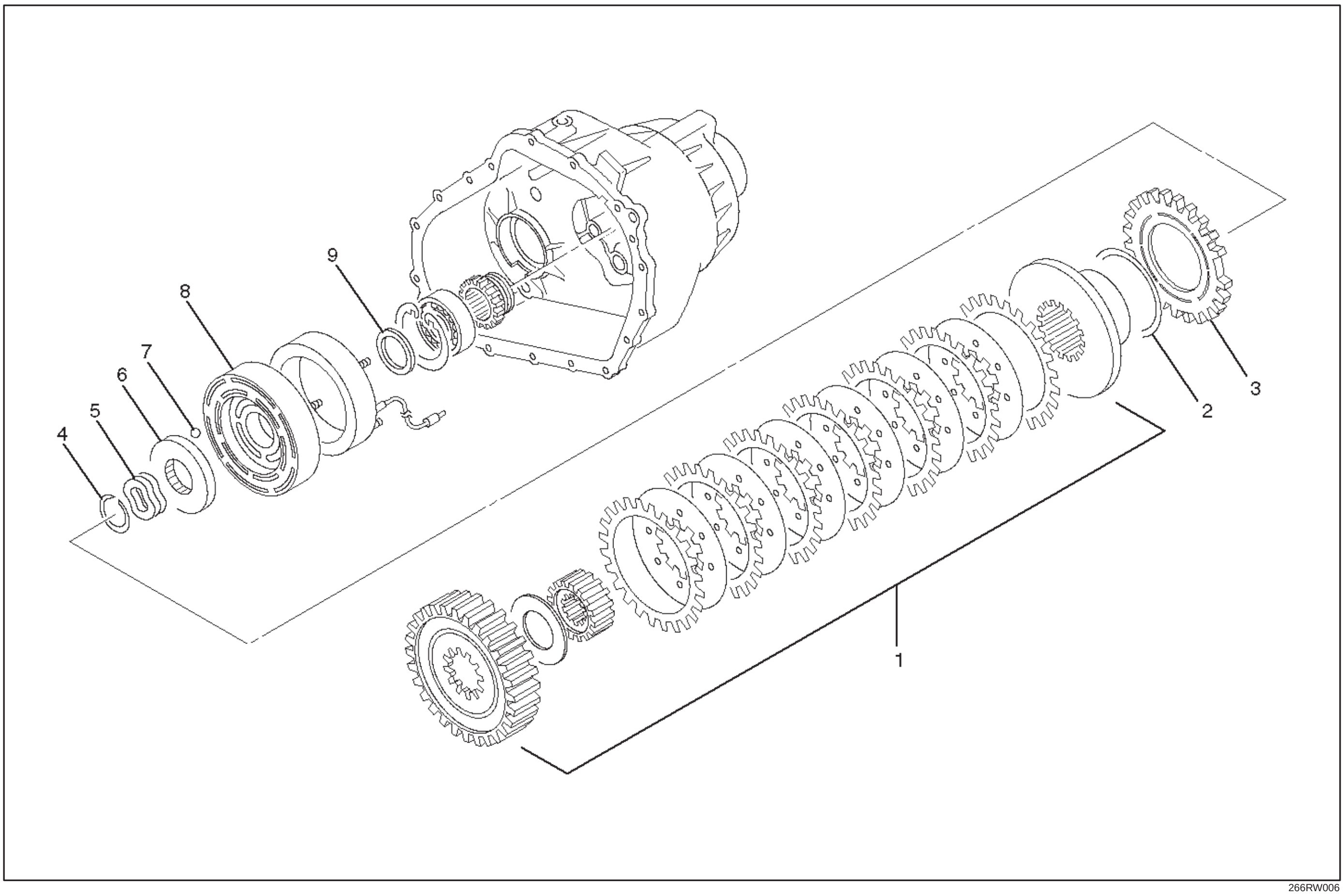
8. Install mechanical lock hub.
9. Apply ATF to the chain.
10. Engage the chain to both sprockets.
11. Mount the chain and sprocket assembly to both the output shafts.



266RW010

Clutch Pack and Clutch Cam

Disassembled View



Legend

(1) Clutch Pack Assembly
(2) Insulator Washer
(3) Armature Plate
(4) Snap Ring
(5) Wave Spring
(6) Cam Pulley
(7) Cam Ball
(8) Cam and Coil Housing
(9) Thrust Bearing

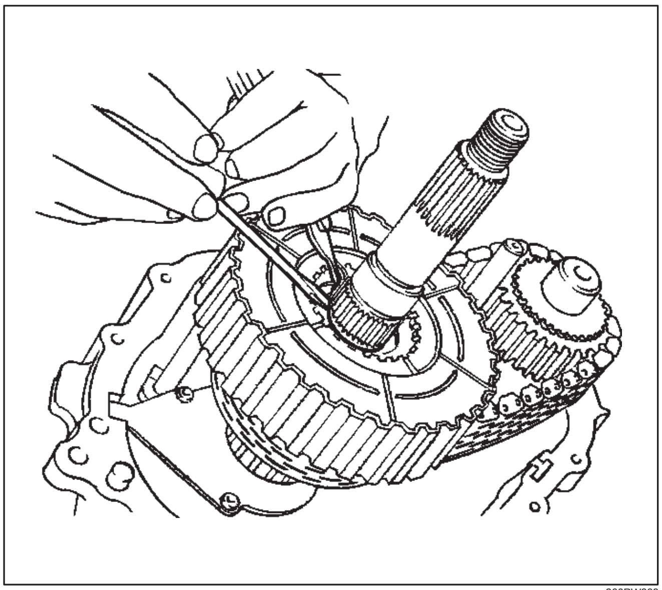
Reassembly

1. Mount the clutch pack assembly to which the multi plate disk clutch is already installed to the output shaft.

NOTE: Mount the clutch pack assembly while adjusting the phase of both the clutch housing and drive sprocket.

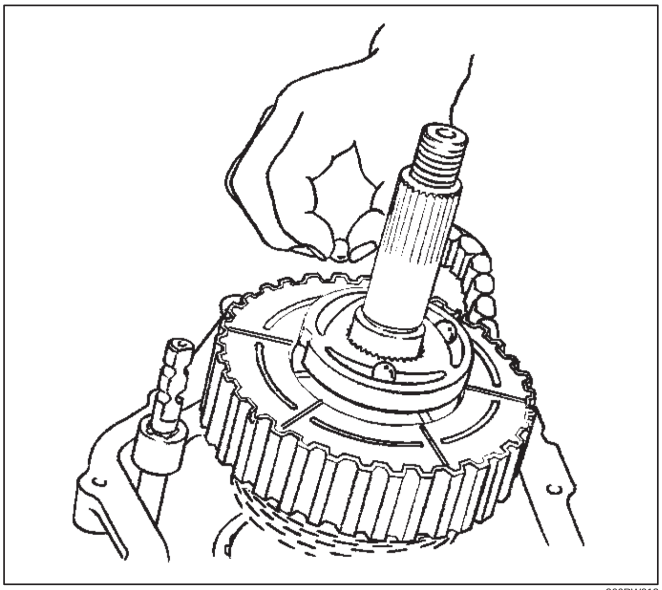
2. Install the insulator washer.
3. Install the armature plate.

4. Using snap ring pliers, attach the snap ring.



266RW009

5. Install the wave spring.
6. Install the cam pulley.
7. Place a ball on each groove of the cam pulley.



266RW013

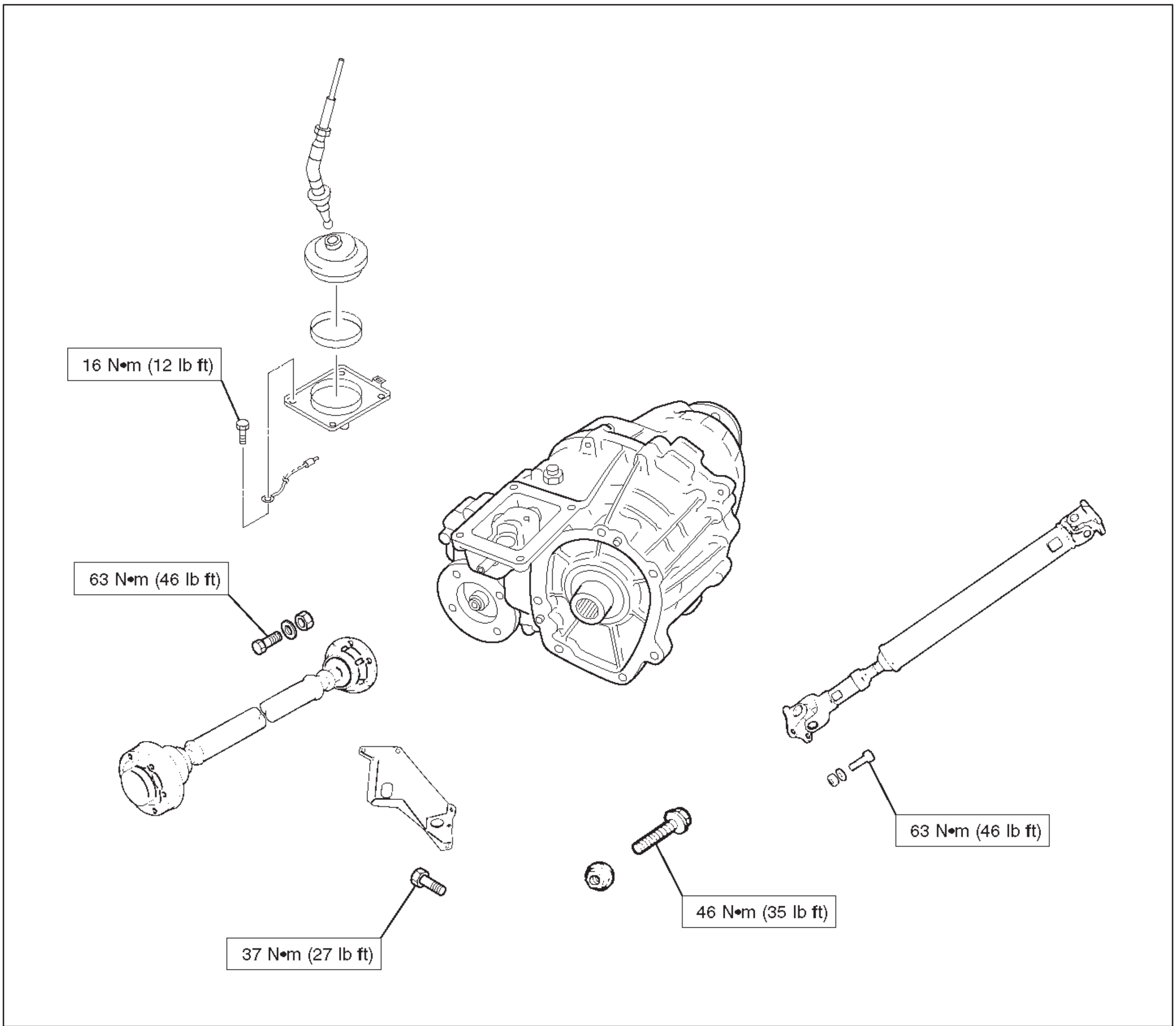
8. Install the cam and coil housing.
9. Thrust bearing.

Main Data and Specifications

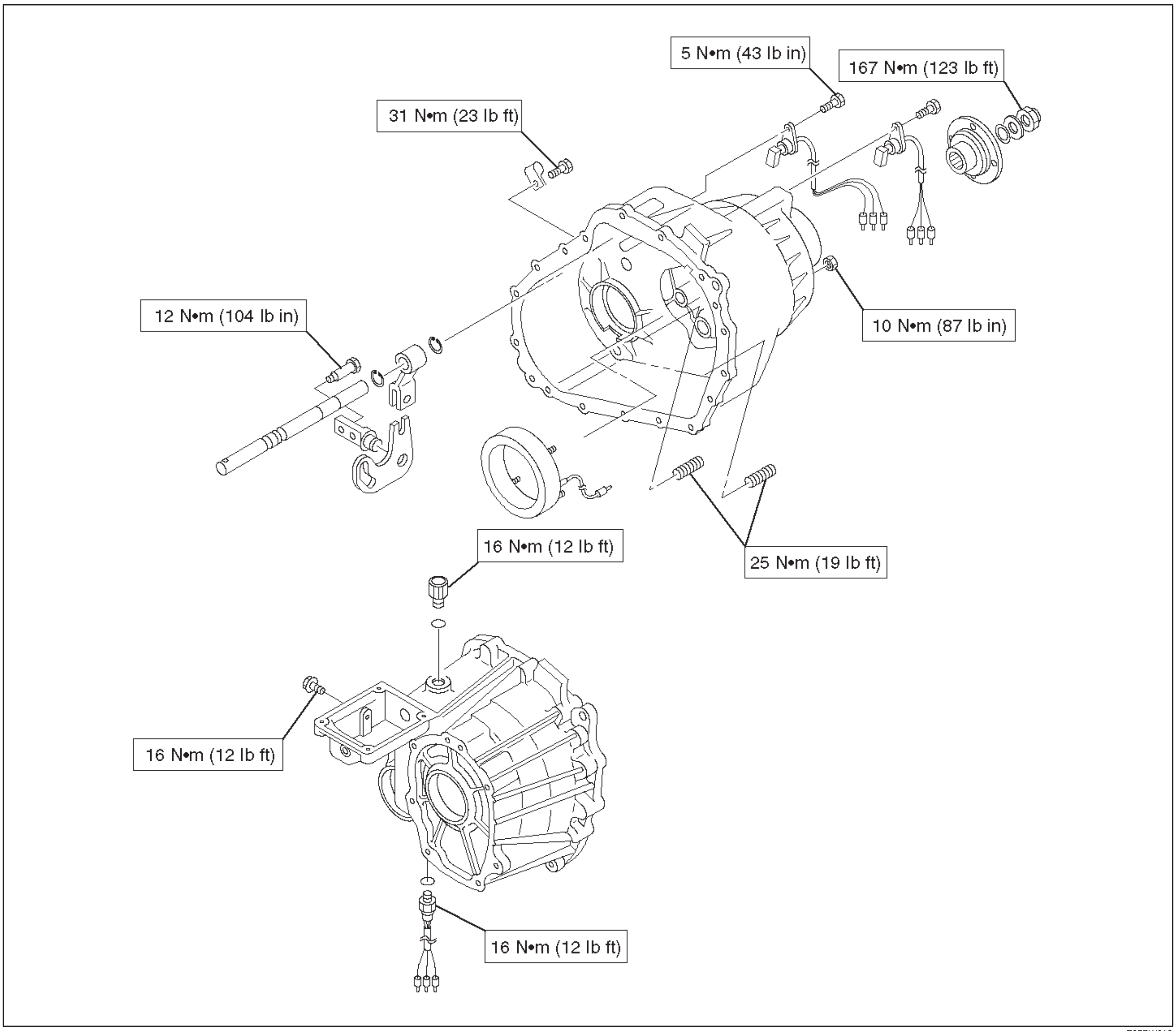
Leading Particulars

Type		Transfer case with low range reduction mechanisn
	2H	Rear wheel drive
	TOD	Electronically controlled torque split four wheel drive
	4L	Low-speed mechanical lock-up four wheel drive
Control system		Floor direct control
Gear ratio	H	1.000
	L	2.480
Oil quantity, Lit		1.9
Oil		ATF DEXRON®-IIE or ATF DEXRON®-III

Torque Specifications



E07RW011


5 N•m (43 lb in)
167 N•m (123 lb ft)
31 N•m (23 lb ft)
12 N•m (104 lb in)
10 N•m (87 lb in)
16 N•m (12 lb ft)
25 N•m (19 lb ft)
16 N•m (12 lb ft)
16 N•m (12 lb ft)

E07RW012

Special Tools

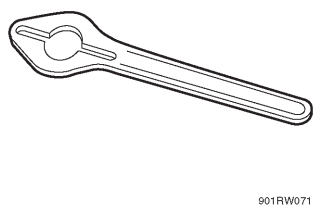
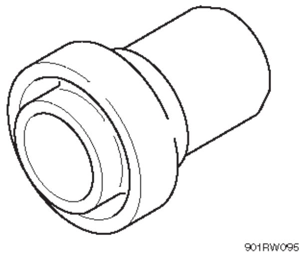
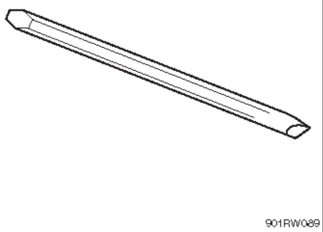
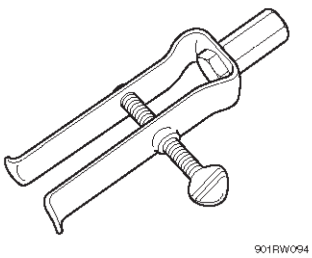
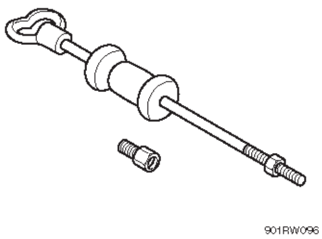
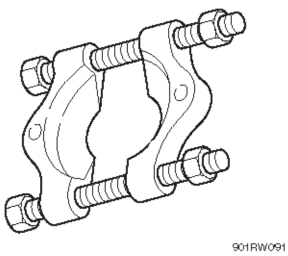
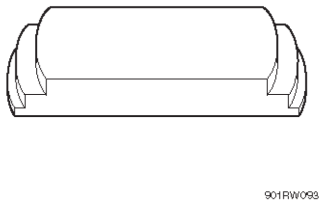
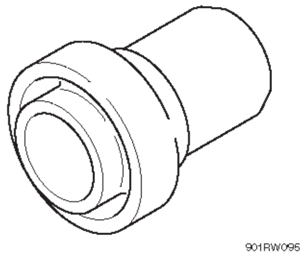
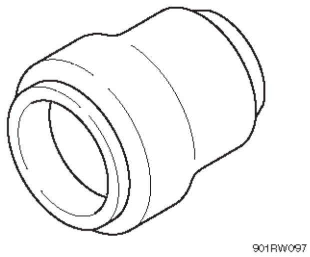
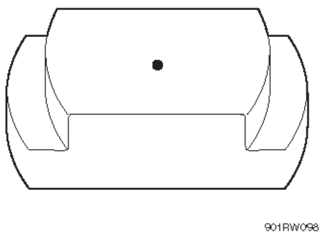
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–8614–11** Flange Holder
	**J–42804** Rear Oil Seal Installer
	**J–39209** Punch
	**J–42805** Bearing Remover
	**J–2619–01** Slide Hammer
	**J–22912–01** Bearing Remover

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–42806** Ring Gear Replacer
	**J–42807** Front Out Oil Seal Installer
	**J–42808** Input Shaft Oil Seal Installer
	**J–42809** Ring Gear Installer

TROOPER

BRAKES

CONTENTS

BRAKE CONTROL SYSTEM

CONTENTS

Service Precaution

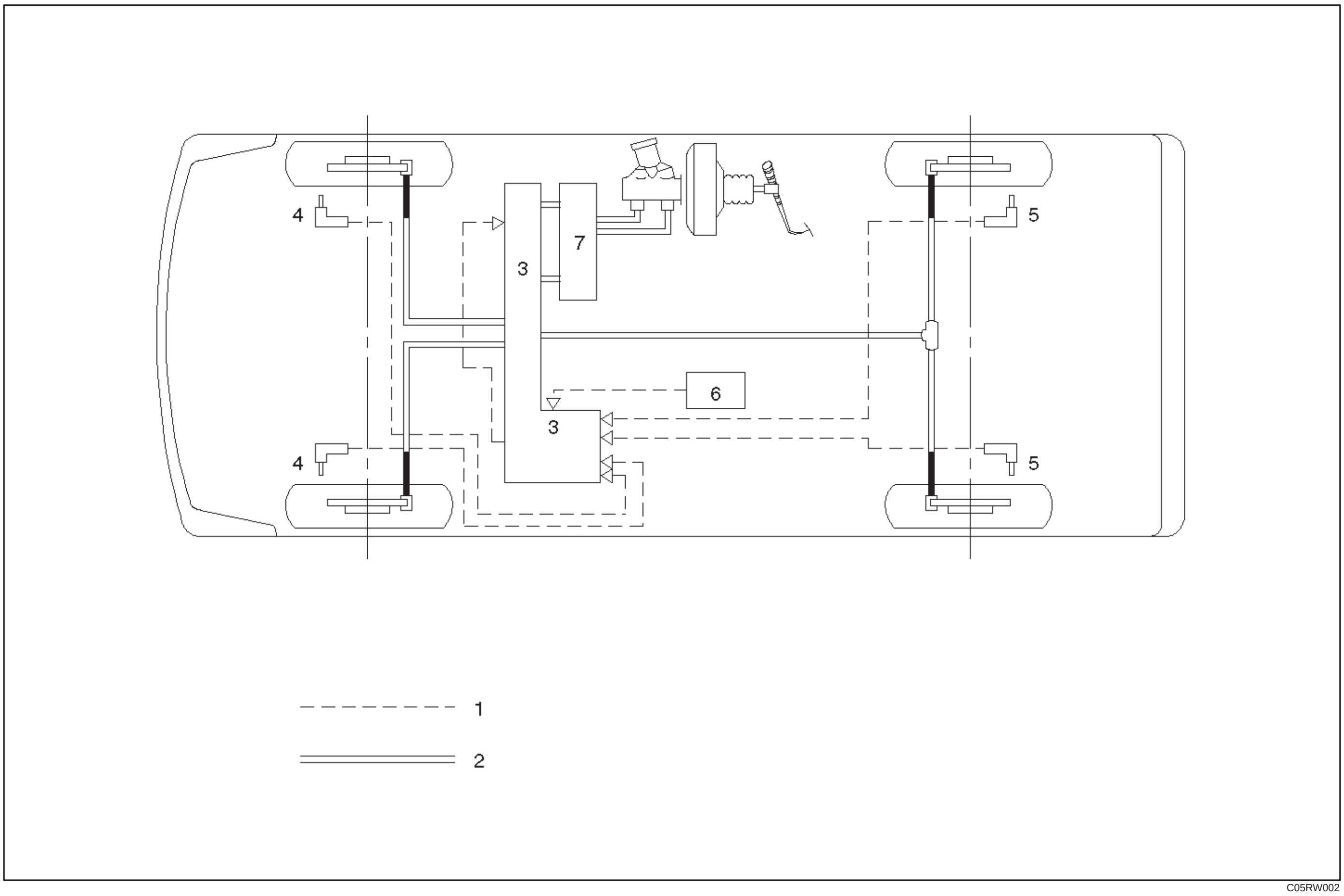
WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The Anti-lock Brake System (ABS) works on all four wheels. A combination of wheel speed sensor and Electronic Hydraulic Control Unit (EHCU) can determine when a wheel is about to stop turning and adjust brake pressure to maintain best braking.

This system helps the driver maintain greater control of the vehicle under heavy braking conditions.



Legend

(1) Electronic
(2) Hydraulic
(3) Electronic Hydraulic Control Unit (EHCU)
(4) Front Wheel Speed Sensor
(5) Rear Wheel Speed Sensor
(6) G-Sensor
(7) Proportioning and Bypass (P&B) Valve

System Components

Electronic Hydraulic Control Unit (EHCU), four Wheel Speed Sensors, Warning Light, and G-sensor.

Electronic Hydraulic Control Unit (EHCU)

The EHCU consists of ABS control circuits, fault detector, and a fail-safe. It drives the hydraulic unit according to the signal from each sensor, cancelling ABS to return to normal braking when a malfunction has occurred in the ABS.

The EHCU has a self-diagnosing function which can indicate faulty circuits during diagnosis.

The EHCU is mounted on the engine compartment front right side. It consists of a Motor, Plunger Pump, Solenoid Valves and Check Valve.

On the outside, the relay box containing a motor relay and a valve relay is installed.

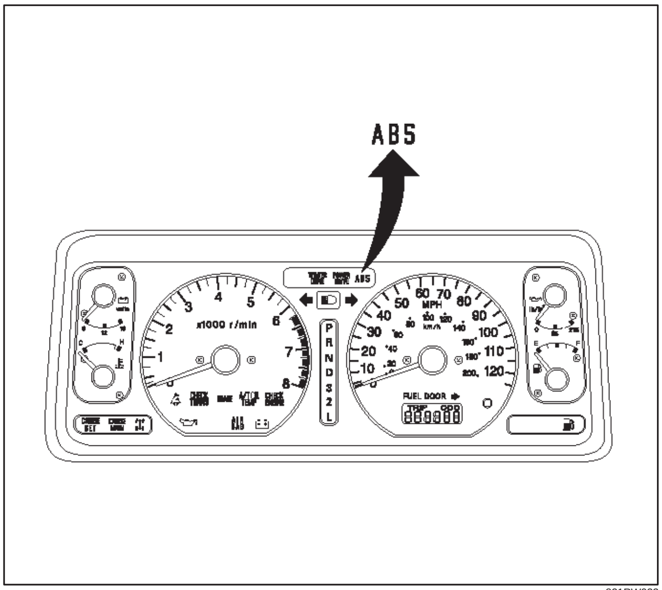
Solenoid Valves: Reduces or holds the caliper fluid pressure for each front disc brake or both rear disc brakes according to the signal sent from the EHCU.

Reservoir: Temporarily holds the brake fluid that returns from the front and rear disc brake caliper so that pressure of front disc brake caliper can be reduced smoothly.

Plunger Pump: Feeds the brake fluid held in the reservoir to the master cylinder.

Motor: Drives the pump according to the signal from EHCU.
Check Valve: Controls the brake fluid flow.

ABS Warning Light



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Vehicles equipped with the Anti-lock Brake System have an amber “ABS” warning light in the instrument panel. The “ABS” warning light will illuminate if a malfunction in the Anti-lock Brake System is detected by the Electronic Hydraulic Control Unit (EHCU). In case of an electronic malfunction, the EHCU will turn “ON” the “ABS” warning light and disable the Anti-lock braking function.
The “ABS” light will turn “ON” for approximately three seconds after the ignition switch is to the “ON” position.
If the “ABS” light stays “ON” after the ignition switch is the “ON” position, or comes “ON” and stays “ON” while driving, the Anti-lock Brake System should be inspected for a malfunction according to the diagnosis procedure.

Wheel Speed Sensor

It consists of a sensor and a rotor. The sensor is attached to the knuckle on the front wheels and to the axle shaft bearing holder on the rear wheels.
The rotor is press-fit in the axle shaft.
The flux generated from electrodes magnetized by a magnet in the sensor varies due to rotation of the rotor, and the electromagnetic induction generates alternating voltage in the coil. This voltage draws a “sine curve” with the frequency proportional to rotor speed and it allows detection of wheel speed.

G-Sensor

The G-sensor installed inside the center console detects the vehicle deceleration speed and sends a signal to the EHCU. In 4WD operation, all four wheels may be decelerated in almost the same phase, since all wheels are connected mechanically.
This tendency is noticeable particularly on roads with low friction coefficient, and the ABS control is adversely affected.
The G-sensor judges whether the friction coefficient of road surface is low or high, and changes the EHCU’s operating system to ensure ABS control.

Normal and Anti-lock Braking

Under normal driving conditions, the Anti-lock Brake System functions the same as a standard power assisted brake system. However, with the detection of wheel lock-up, a slight bump or kick-back will be felt in the brake pedal. This pedal “bump” will be followed by a series of short pedal pulsations which occurs in rapid succession. The brake pedal pulsation will continue until there is no longer a need for the anti-lock function or until the vehicle is stopped. A slight ticking or popping noise may be heard during brake applications when the Anti-lock features is being used.
When the Anti-lock feature is being used, the brake pedal may rise even as the brakes are being applied. This is also normal. Maintaining a constant force on the pedal will provide the shortest stopping distance.

Brake Pedal Travel

Vehicles equipped with the Anti-lock Brake System may be stopped by applying normal force to the brake pedal. Although there is no need to push the pedal beyond the point where it stops or holds the vehicle, by applying more force the pedal will continue to travel toward the floor. This extra brake pedal travel is normal.

Acronyms and Abbreviations

Several acronyms and abbreviations are commonly used throughout this section:

ABS
Anti-lock Brake System

CKT
Circuit

DLC
Data Link Connector

EHCU
Electronic Hydraulic Control Unit

FL
Front Left

FR
Front Right

GEN
Generator

MV
Millivolts

RL
Rear Left

RR
Rear Right

RPS
Revolution per Second

VDC
Volts DC

VAC
Volts AC

W/L
Warning Light

WSS
Wheel Speed Sensor

General Diagnosis

General Information

ABS malfunction can be classified into two types, those which can be detected by the ABS warning light and those which can be detected as a vehicle abnormality by the driver.
In either case, locate the fault in accordance with the "BASIC DIAGNOSTIC FLOWCHART" and repair.
Please refer to Section 5C for the diagnosis of mechanical troubles such as brake noise, brake judder (brake pedal or vehicle vibration felt when braking), uneven braking, and parking brake trouble.

ABS Service Precautions

Required Tools and Items:

- Box Wrench
- Brake Fluid
- Special Tool

Some diagnosis procedures in this section require the installation of a special tool.

J-39200 High Impedance Multimeter

When circuit measurements are requested, use a circuit tester with high impedance.

Computer System Service Precautions

The Anti-lock Brake System interfaces directly with the Electronic Hydraulic Control Unit (EHCU) which is a control computer that is similar in some regards to the Powertrain Control Module. These modules are designed to withstand normal current draws associated with vehicle operation. However, care must be taken to avoid overloading any of the EHCU circuits. In testing for opens or shorts, do not ground or apply voltage to any of the circuits unless instructed to do so by the appropriate diagnostic procedure. These circuits should only be tested with a high impedance multimeter (J-39200) or special tools as described in this section. Power should never be removed or applied to any control module with the ignition in the "ON" position.
Before removing or connecting battery cables, fuses or connectors, always turn the ignition switch to the "OFF" position.

General Service Precautions

The following are general precautions which should be observed when servicing and diagnosing the Anti-lock Brake System and/or other vehicle systems. Failure to observe these precautions may result in Anti-lock Brake System damage.

- If welding work is to be performed on the vehicle using an electric arc welder, the EHCU and valve block connectors should be disconnected before the welding operation begins.
- The EHCU and valve block connectors should never be connected or disconnected with the ignition "ON" .
- EHCU of the Anti-lock Brake System are not separately serviceable and must be replaced as assemblies. Do not disassemble any component which is designated as non-serviceable in this Section.
- If only rear wheels are rotated using jacks or drum tester, the system will diagnose a speed sensor malfunction and the "ABS" warning light will illuminate. But actually no trouble exists. After inspection stop the engine once and re-start it, then make sure that the "ABS" warning light does not illuminate.

If the battery has been discharged

The engine may stall if the battery has been completely discharged and the engine is started via jumper cables. This is because the Anti-lock Brake System (ABS) requires a large quantity of electricity. In this case, wait until the battery is recharged, or set the ABS to a non-operative state by removing the fuse for the ABS (40A). After the battery has been recharged, stop the engine and install the ABS fuse. Start the engine again, and confirm that the ABS warning light does not light.

Note on Intermittents

As with virtually any electronic system, it is difficult to identify an intermittent failure. In such a case duplicating the system malfunction during a test drive or a good description of vehicle behavior from the customer may be helpful in locating a "most likely" failed component or circuit. The symptom diagnosis chart may also be useful in isolating the failure. Most intermittent problems are caused by faulty electrical connections or wiring. When an intermittent failure is encountered, check suspect circuits for:

- Suspected harness damage.
- Poor mating of connector halves or terminals not fully seated in the connector body (backed out).
- Improperly formed or damaged terminals.

Test Driving ABS Complaint Vehicles

In case that there has been an malfunction in the lighting pattern of "ABS" warning light, the fault can be located in accordance with the "DIAGNOSIS BY "ABS" WARNING LIGHT ILLUMINATION PATTERN" . In case of such trouble as can be detected by the driver as a vehicle symptom, however, it is necessary to give a test drive following the test procedure mentioned below, thereby reproducing the symptom for trouble diagnosis on a symptom basis:

1. Start the engine and make sure that the "ABS" W/L goes OFF. If the W/L remains ON, it means that the Diagnostic Trouble Code (DTC) is stored. Therefore, read the code and locate the fault.
2. Start the vehicle and accelerate to about 30 km/h (19 mph) or more.

3. Slowly brake and stop the vehicle completely.
4. Then restart the vehicle and accelerate to about 40 km/h (25 mph) or more.
5. Brake at a time so as to actuate the ABS and stop the vehicle.
6. Be cautious of abnormality during the test. If the W/L is actuated while driving, read the DTC and locate the fault.
7. If the abnormality is not reproduced by the test, make best efforts to reproduce the situation reported by the customer.
8. If the abnormality has been detected, repair in accordance with the “SYMPTOM DIAGNOSIS” .

NOTE:

- Be sure to give a test drive on a wide, even road with little traffic.
- If an abnormality is detected, be sure to suspend the test and start trouble diagnosis at once.

“ABS” Warning Light

When ABS trouble occurs and actuates when possible the “ABS” warning light, the trouble code corresponding to the trouble is stored in the EHCU. Only the ordinary brake system is available when the ABS is turned off. When the “ABS” warning light is actuated, if the starter switch is set ON after setting it OFF once, the EHCU checks up on the entire system and, if there is no abnormality, judges ABS to work currently and the warning light works normally even though the trouble code is stored.

NOTE: Illumination of the “ABS” warning light indicates that anti-lock braking is no longer available. Power assisted braking without anti-lock control is still available.

Normal Operation

“ABS” Warning Light

When the ignition is first moved from “OFF” to “ON” , the amber “ABS” warning light will turn “ON” . The “ABS” warning light will turn “ON” during engine starting and will usually stay “ON” for approximately three seconds after the ignition switch is returned to the “ON” position. The warning light should remain “OFF” at all other times.

Basic Diagnostic Flow Chart

Step	Action	Yes	No
1	1. Customer complaint. 2. Questioning to customer. 3. Basic inspection (Refer to “Basic inspection procedure”) Using TECH 2?	Go to Step 2	Go to Step 4
2	Make sure of DTC by mode “F0 : Diagnostic Trouble Codes”. Is EHCU including DTC?	Go to Step 3	Go to Step 5
3	1. Repair of faulty part. 2. Elimination of DTC. 3. Inspection of “ABS” W/L Illumination pattern with ignition SW “ON”. 4. Test drive. Dose repeat trouble?	Repeat the diagnosis it the symptom or DTC appears again Go to Step 1	Go to Step 5
4	Check if the DTC is stored. Is EHCU including DTC?	Go to Step 3	Trouble diagnosis based on symptom (Refer to “SYMPTOM DIAGNOSIS”) Go to Step 3
5	1. Reconnect all components and ensure all component are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Finished	Go to Step 5

Basic Inspection Procedure

1. Basic Inspection of System Brake

Step	Action	Yes	No
1	Is the fluid level normal?	Go to Step 2	Replenish with fluid. Go to Step 2
2	Does fluid leak?	Repair. Go to Step 3	Go to Step 3
3	Is the booster functioning normal?	Go to Step 4	Repair. Go to Step 4
4	Is the pad and rotor normal?	Go to Step 5	Repair. Go to Step 5
5	Reconnect all components and ensure all component are properly mounted. Was this step finished?	Finished	Go to Step 5

2. Inspection of Front Axle Switch

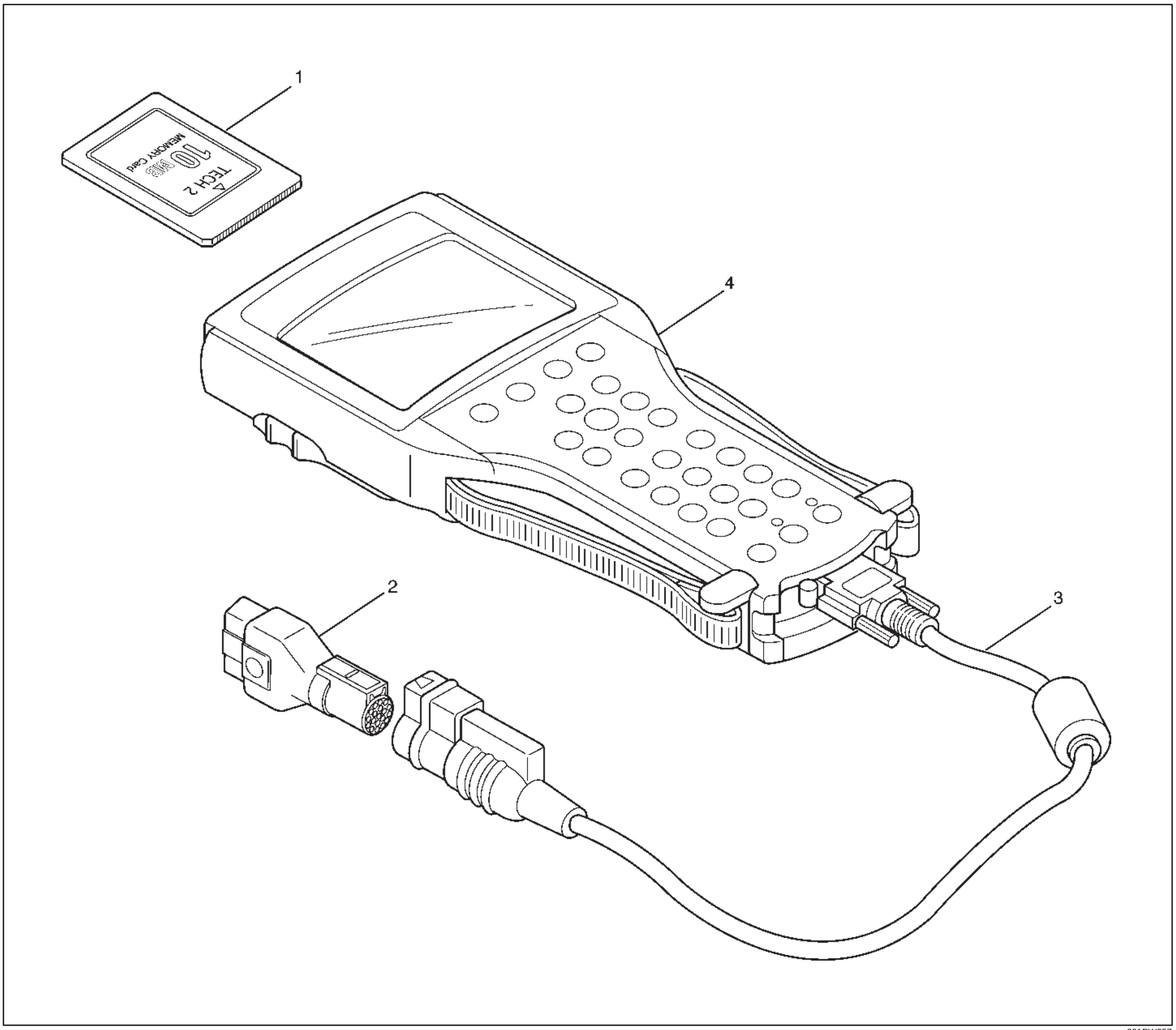
Step	Action	Yes	No
1	Turn the key switch on and shift to 4WD position by pressing the 4WD switch. Does the 4WD light come on?	Go to Step 2	Repair. Go to Step 2
2	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Finished	Go to Step 2

3. Ground Inspection

Step	Action	Yes	No
1	Are ABS—related ground points ok?	Go to Step 2	Repair. Go to Step 2
2	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Finished	Go to Step 2

Tech 2 Scan Tool

From 98 MY, Isuzu dealer service departments are recommended to use Tech 2. Please refer to Tech 2 scan tool user guide.



901RW257

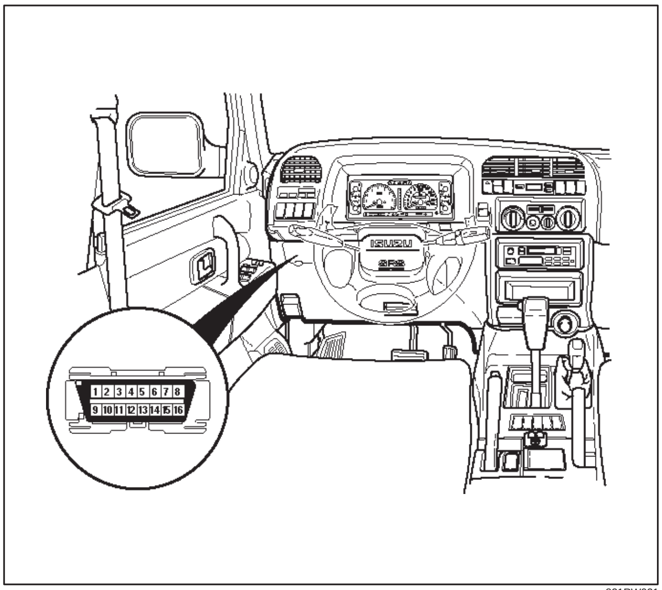
Legend

(1) PCMCIA Card
(2) SAE 16/19 Adaptor
(3) DLC Cable
(4) Tech–2

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 98 System PCMCIA card (1) inserts into the Tech 2 (4).
2. Connect the SAE 16/19 adapter (2) to the DLC cable (3).
3. Connect the DLC cable to the Tech 2 (4).
4. Make sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC connector.



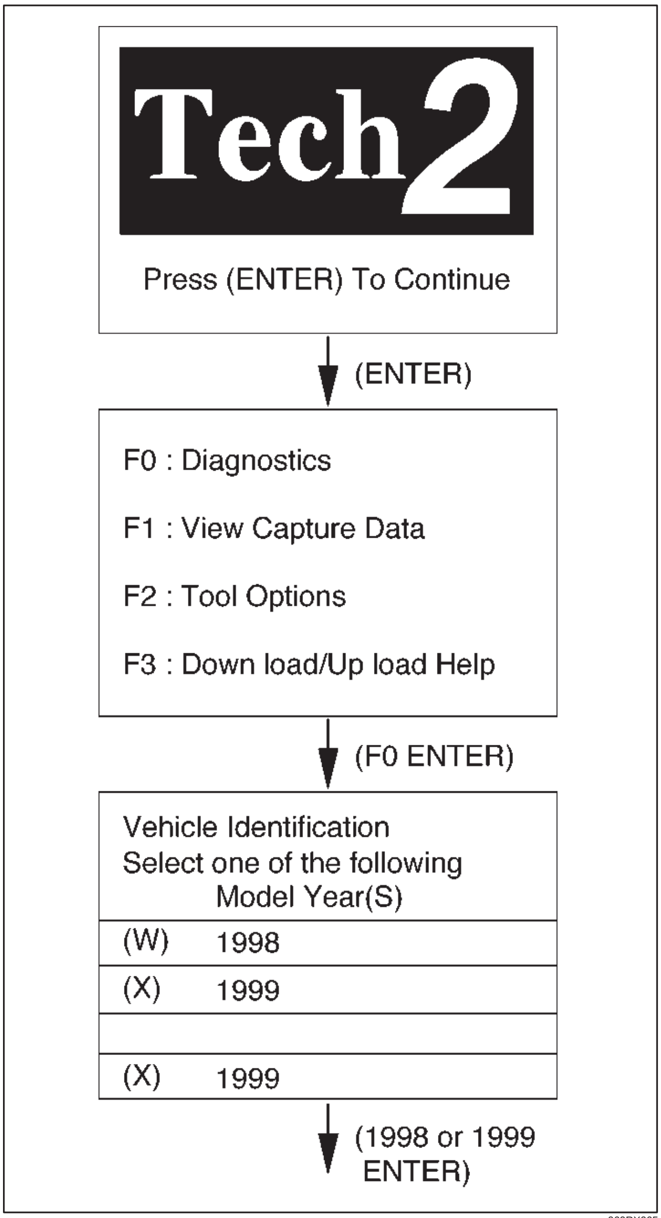
821RW021

6. The vehicle ignition turns on.
7. Power up the Tech 2.
8. Verify the Tech 2 power up display.

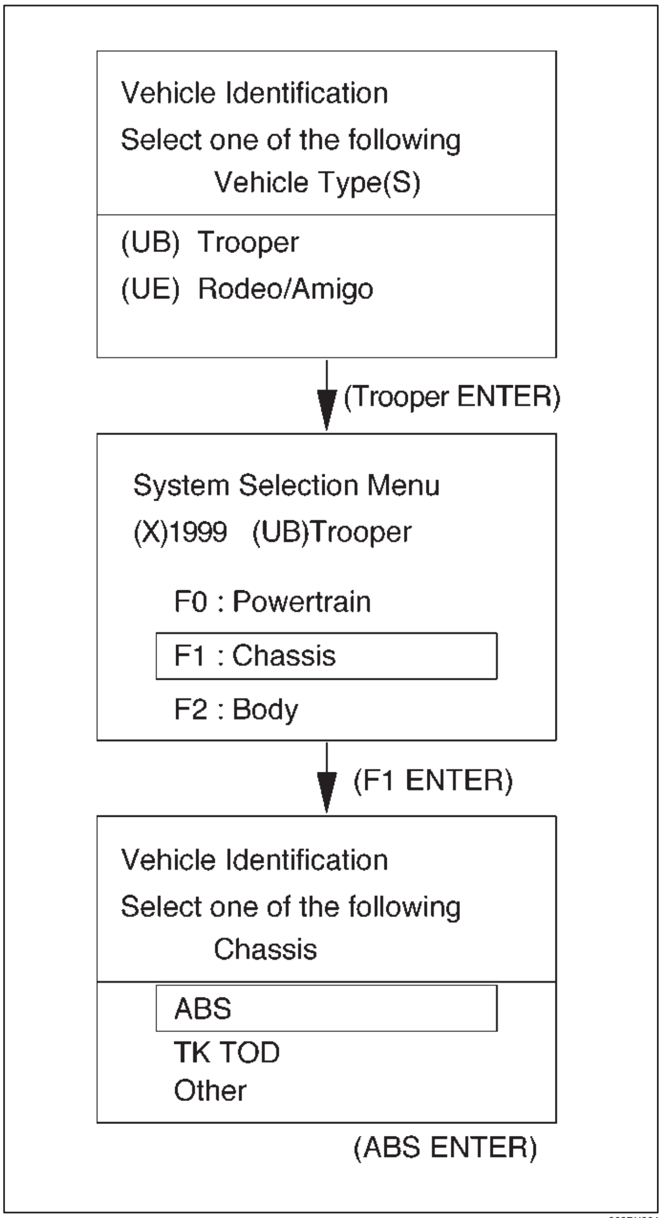
060RW009

Operating Procedure

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



060RX065


Vehicle Identification
Select one of the following
Vehicle Type(S)
(UB) Trooper
(UE) Rodeo/Amigo
(Trooper ENTER)
System Selection Menu
(X)1999 (UB)Trooper
F0 : Powertrain
F1 : Chassis
F2 : Body
(F1 ENTER)
Vehicle Identification
Select one of the following
Chassis
ABS
TK TOD
Other
(ABS ENTER)

060RX064

Data List

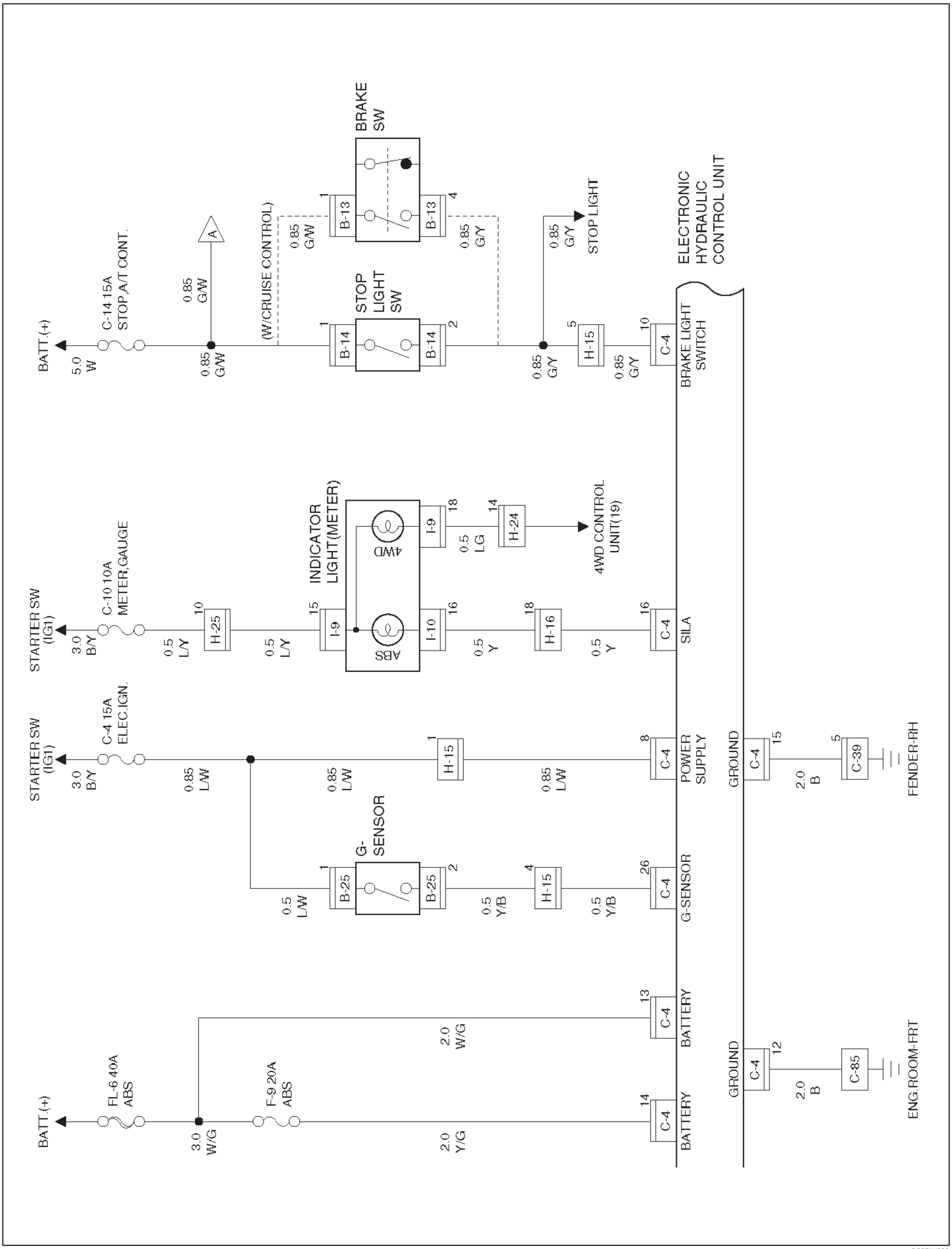
Display	Content	OK/NG Criteria for Data
Battery Voltage	Voltage	Between 10–16.9V
Brake Light Switch	Open/Close	Open(0V) when pedal is released
		Closed(12V) when pedal is depressed.
Front Left Wheel Speed Front Right Wheel Speed Rear Left Wheel Speed Rear Left Wheel Speed	MPH(km/h)	Start the vehicle and make sure of linear change in each wheel speed.
		Turn each wheel by hand and make sure that each speed data change.
Wheel Sensor Status	OK/NG	To be OK usually
G–sensor	Low/High	To be Low usually
Transfer Monitor(TOD)	2 Wheel Drive 4 Wheel Drive	When 2WD: 2 Wheel Drive When 4WD: 4 Wheel Drive
Off–Road Switch (Transmission Input)	Active/Inactive	When shift lever position is 1, 2 and R : Active (M/T)
		When shift lever position is L and R : Active (A/T)
Valve Relay	Active/Inactive	To be Active usually
ABS State	ON/OFF	To be OFF usually
ABS Relay	Active/Inactive	To be Active usually
Return Pump Relay	Active/Inactive	To be Inactive usually
Front Left Isolation Valve	Active/Inactive	To be Inactive usually
Front Left Dump Valve		
Front Right Isolation Valve		
Front Right Dump Valve		
Rear Isolation Valve		
Rear Dump Valve		
ABS Warning Lamp	ON/OFF	To be ON usually (while engine stopped)

EHCU Connector Pin-out Checks

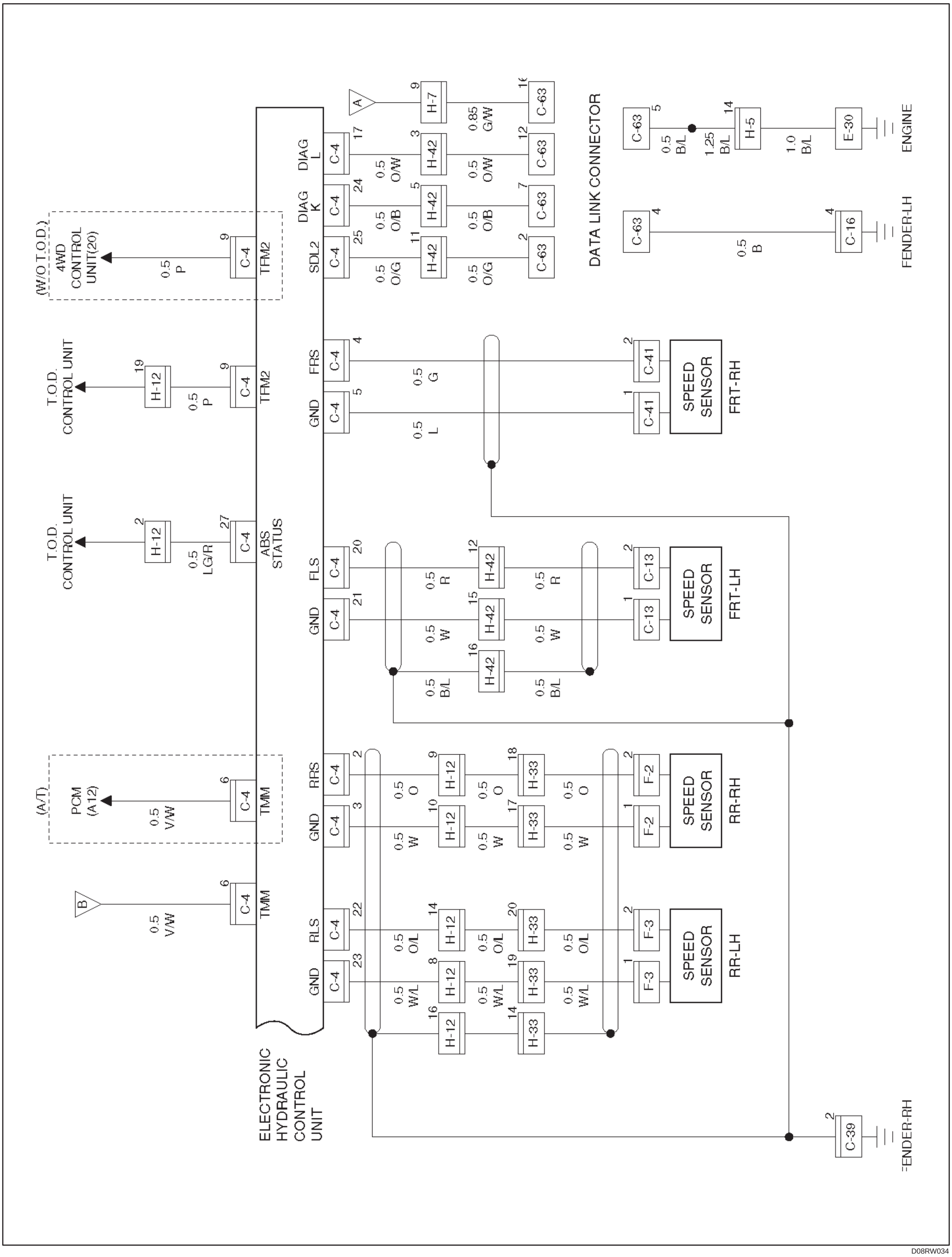
- Disconnect Electronic Brake Control Module.
- Perform checks with high impedance digital multimeter J-39200 or equivalent.

No.	Circuit to be Tested	Ignition Switch Position	Multimeter Scale/Range	Measure between Pin Number	Nominal Value	Note
1	Ignition enable	OFF	20DCV	8 (+), 15 (–)	0V to 0.1V	
		ON	20DCV	8 (+), 15 (–)	11.5V to 14.5V	
2	Stop light switch	OFF	20DCV	10, 15	10.5V to 14.5V	Press brake pedal
3	Ground connection	OFF	200Ω	12, Ground 15, Ground	Less than 2Ω	
4	FL speed sensor	OFF	2kΩ	20, 21	1.3k to 1.9kΩ	Internal Resistance
		OFF	200kΩ	20, 15	more than 100kΩ	Insulation Resistance
		OFF	200mACV	20, 21	more than 200mV	Turn wheel at 1RPS
5	FR speed sensor	OFF	2kΩ	4, 5	1.3k to 1.9kΩ	Internal Resistance
		OFF	200kΩ	4, 15	more than 100kΩ	Insulation Resistance
		OFF	200mACV	4, 5	more than 200mV	Turn wheel at 1RPS
6	RL speed sensor	OFF	2kΩ	22, 23	1.3k to 1.9kΩ	Insulation Resistance
		OFF	200kΩ	22, 15	more than 100kΩ	Internal Resistance
		OFF	200mACV	22, 23	more than 200mV	Turn wheel at 1RPS
7	RR speed sensor	OFF	2kΩ	2, 3	1.3k to 1.9kΩ	Internal Resistance
		OFF	200kΩ	2, 15	more than 100kΩ	Insulation Resistance
		OFF	200mACV	2, 3	more than 200mV	Turn wheel at 1RPS
8	G-sensor	ON		26, 8	1k to 2kΩ	Horizontal vehicle
9	Transmission Input	ON	20DCV	6 (+), 15 (–)	Less than 6V (shift lever position – L, R) 6.6 to 9.0V (other shift position)	A/T Battery voltage 12V
					More than 9.6V (shift lever position – 1, 2, R) 6.6 to 9.0V (other shift position)	M/T Battery voltage 12V

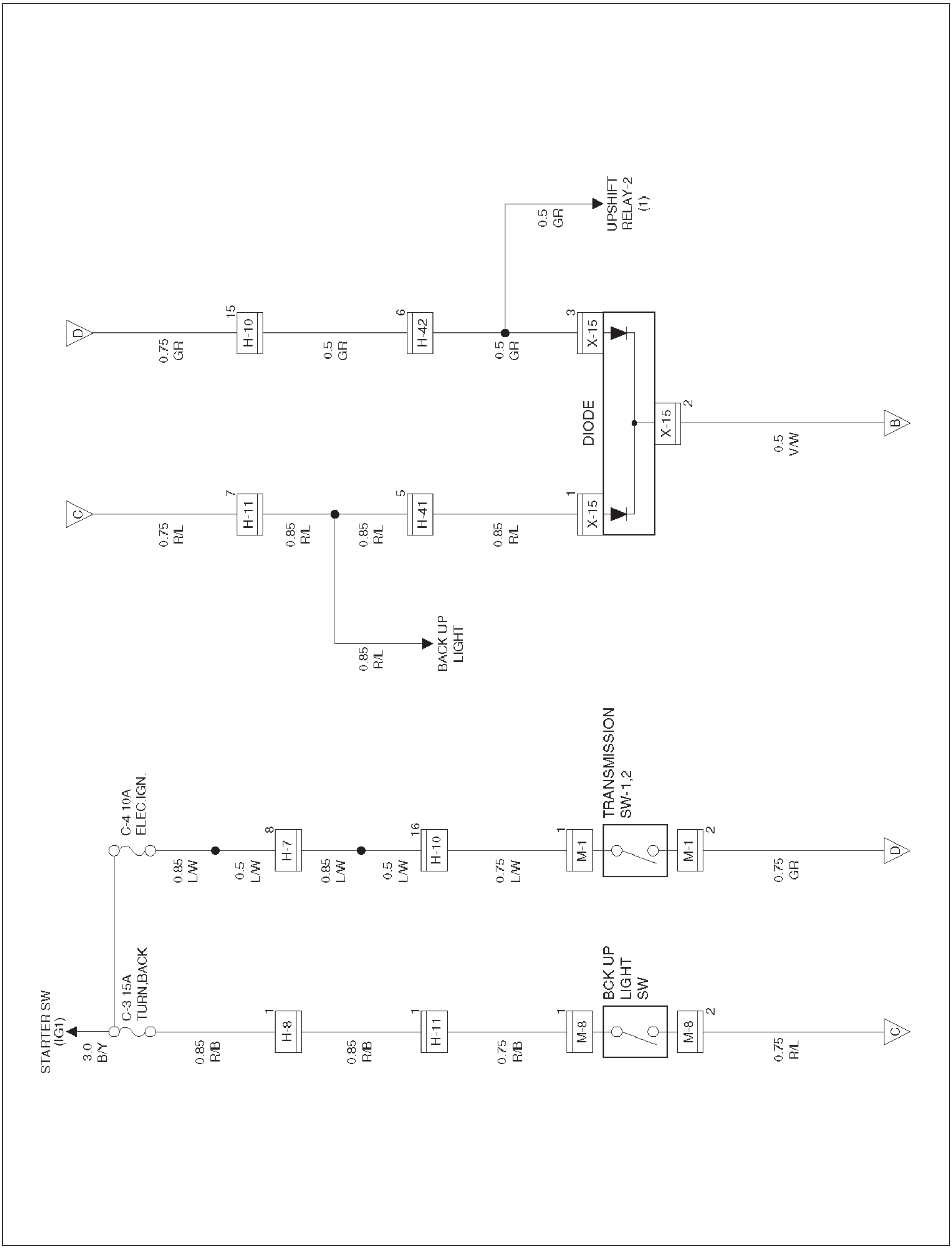
Circuit Diagram



D08RW033



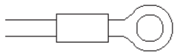
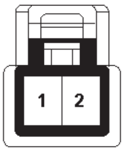
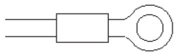
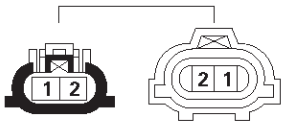
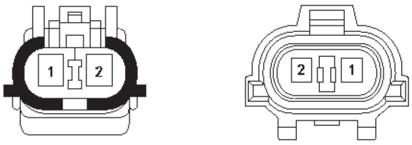
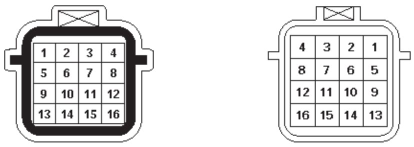
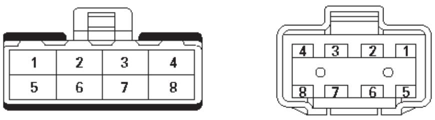
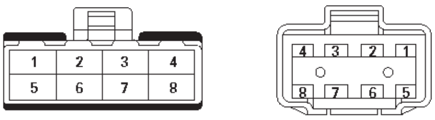
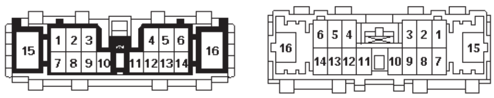
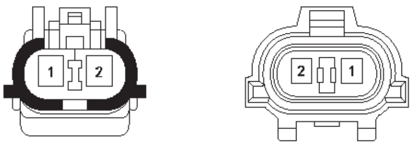
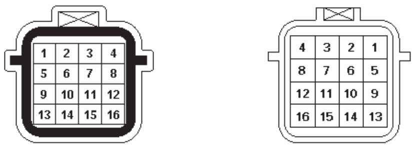
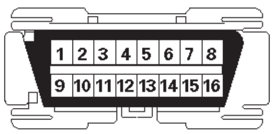
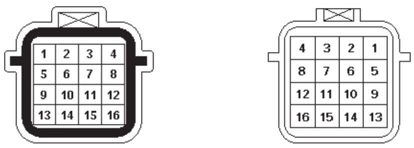
ELECTRONIC HYDRAULIC CONTROL UNIT
DATA LINK CONNECTOR
SPEED SENSOR
FRT-RH
SPEED SENSOR
FRT-LH
SPEED SENSOR
RR-RH
SPEED SENSOR
RR-LH
T.O.D. CONTROL UNIT
(W/O T.O.D.) 4WD CONTROL UNIT(20)
(A/T) PCM (A12)
ENGINE
FENDER-LH
FENDER-RH
DIAG L
DIAG K
SDL2
FRS
GND
FLS
RRS
RLS
TFM2
ABS STATUS
TMM
D08RW034



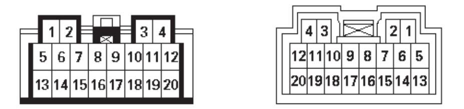
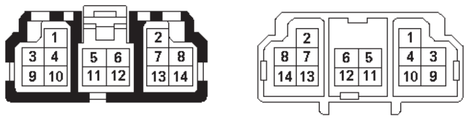
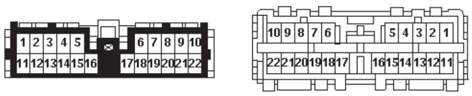
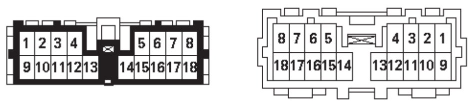
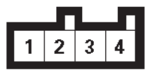
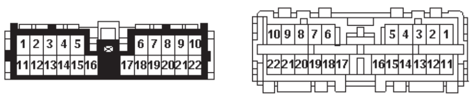
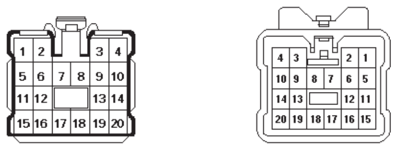
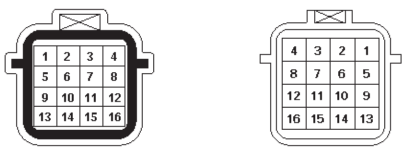
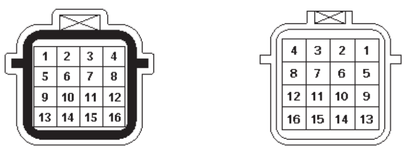
UPSHIFT RELAY-2 (1)
0.5 GR
D
0.75 GR
H-10
15
0.5 GR
H-42
6
0.5 GR
X-15
3
DIODE
X-15
2
0.5 V/W
B
C
0.75 R/L
H-11
7
0.85 R/L
0.85 R/L
H-41
5
0.85 R/L
X-15
1
0.85 R/L
BACK UP LIGHT
STARTER SW (IG1)
3.0 B/Y
C-3 15A TURN,BACK
C-4 10A ELEC.IGN.
0.85 L/W
0.5 L/W
H-7
8
0.85 L/W
0.5 L/W
H-10
16
0.75 L/W
M-1
1
TRANSMISSION SW-1,2
M-1
2
0.75 GR
D
0.85 R/B
H-8
1
0.85 R/B
H-11
1
0.75 R/B
M-8
1
BCK UP LIGHT SW
M-8
2
0.75 R/L
C

D08RW035

Connector List

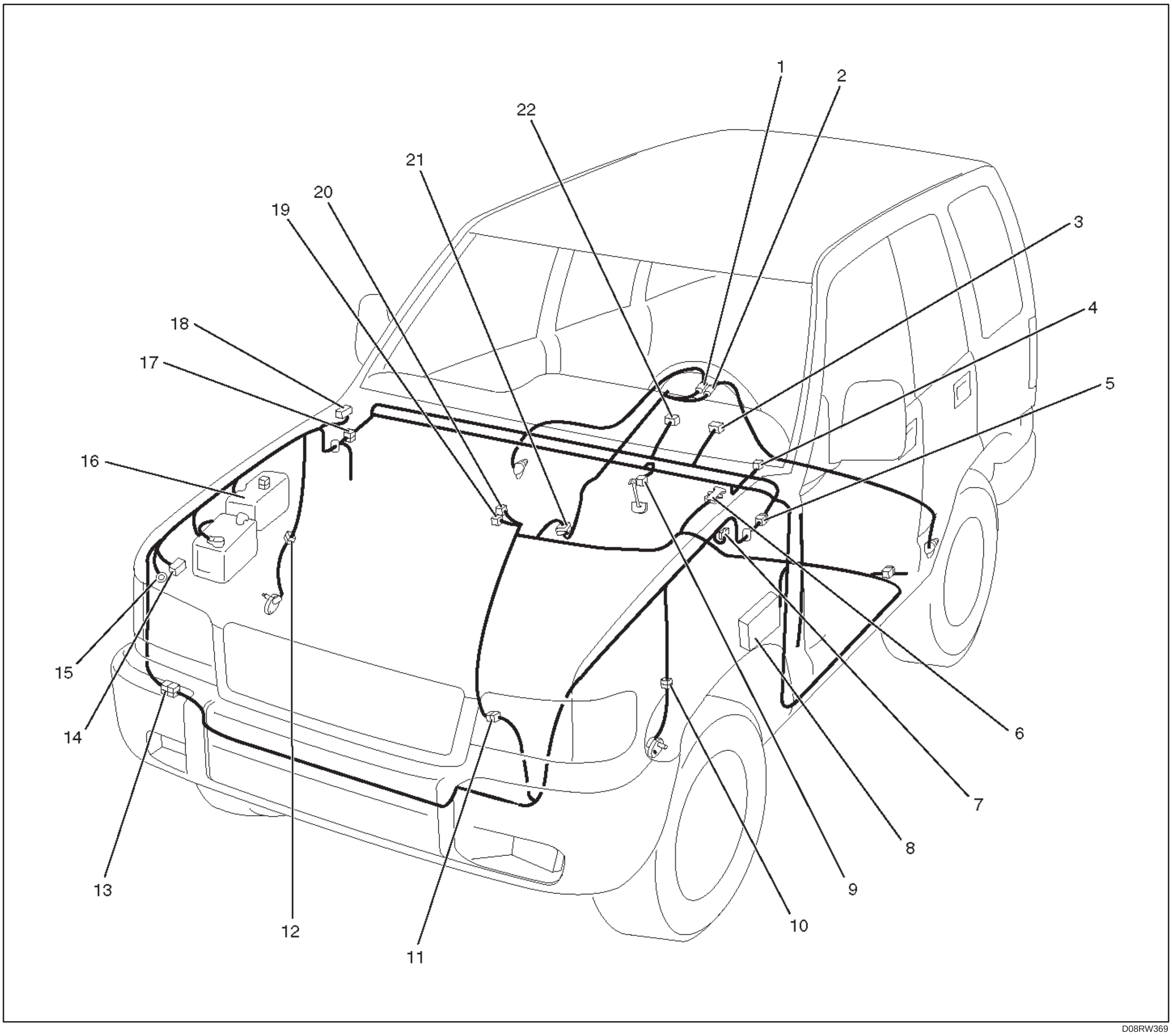
No.	Connector face	No.	Connector face
B-13		C-85	
B-14		E-30	
B-25		F-2	
C-4		F-3	
C-13		H-5	
C-16		H-7	
C-39		H-8	
C-41		H-10	
C-63		H-11	

D05RW002

No.	Connector face	No.	Connector face
H-12		I-10	
H-15		M-1	
H-16		M-8	
H-24		X-15	
H-25			
H-33			
H-41			
H-42			
I-9			

D05RW003

Part Location



Legend

(1) F–2
(2) F–3
(3) I–9
(4) C–63
(5) H–7, H–8, H–24, H–25
(6) B–25
(7) C–16
(8) Fuse Box
(9) B–13 or B–14
(10) C–13
(11) H–10, H–11
(12) C–41
(13) H–41, H–42
(14) C–4
(15) C–85
(16) Relay & Fuse Box (X–15)
(17) H–12, H–15, H–16
(18) C–39
(19) M–1
(20) M–8
(21) H–33
(22) I–10

Symptom Diagnosis

The symptoms that cannot be indicated by the warning light can be divided in the following five categories:

1. ABS works frequently but vehicle does not decelerate.
2. Uneven braking occurs while ABS works.
3. The wheels lock during braking.
4. Brake pedal feel is abnormal.
5. Braking sound (from EHCU) is heard while not braking.

These are all attributable to problems which cannot be detected by EHCU self-diagnosis. Use the customer complaint and a test to determine which symptom is present. Then follow the appropriate flow chart listed below.

No.	Symptom	Diagnostic Flow Charts	
		Without TECH 2	With TECH 2
1	ABS works frequently but vehicle does not decelerate.	Chart A–1	Chart TA–1
2	Uneven braking occurs while ABS works.	Chart A–2	—
3	The wheels are locked.	Chart A–3	Chart TA–3
4	Brake pedal feel is abnormal.	Chart A–4	—
5	Braking sound (from EHCU) is heard while not braking.	Chart A–5	Chart TA–5

Chart A–1 ABS Works Frequently But Vehicle Does Not Decelerate

Step	Action	Yes	No
1	1. Turn key off. 2. G Sensor connector and EHCU connector disconnected. Is there continuity between EHCU terminals 26 and 8?	Go to Step 2	Go to Step 3
2	Connect EHCU connector. Is there continuity between the G sensor and the EHCU?	Go to Step 3	Repair circuit. Go to Step 1
3	Is the G sensor normal? (Refer to chart B-5)	Go to Step 4	Replace G sensor. Go to Step 11
4	Is braking force distribution normal between the front and rear of the vehicle?	Go to Step 5	Repair brake parts. Go to Step 11
5	Are axle parts installed normally?	Go to Step 6	Repair axle parts. Go to Step 11
6	Is there play in each wheel speed sensor?	Repair wheel speed sensor. Go to Step 11	Go to Step 7
7	Is there damage, or powered iron sticking to each wheel speed sensor/sensor ring?	Replace sensor or sensor ring. Go to Step 11	Go to Step 8
8	Is the output of each wheel speed sensor normal? (Refer to chart C-1 or TC-1)	Go to Step 9	Replace wheel speed sensor or repair harness. Go to Step 11
9	Is the input of transmission normal? (Refer to chart C-2 or TC-2)	Go to Step 10	Replace switch or repair harness. Go to Step 11

Step	Action	Yes	No
10	Is the input of 4WD controller normal?	Go to Step 11	Replace controller or repair harness. Go to Step 11
11	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 11

Chart TA-1 ABS Works Frequently But Vehicle Does Not Decelerate (Use TECH 2)

Step	Action	Yes	No
1	1. Connect TECH 2. 2. Make sure of the output conditions of each wheel speed sensor by mode "F1: Data Display". Is the output of each sensor normal?	Go to Step 2	Replace wheel speed sensor. Go to Step 3
2	Return to Chart A-1. Was the Chart A-1 finished?	Go to Step 3	Go to Step 2
3	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 3

Chart A-2 Uneven Braking Occurs While ABS Works

Step	Action	Yes	No
1	Is there play in each sensor?	Repair. Go to Step 5	Go to Step 2
2	Is there damage or powdered iron sticking to each sensor/sensor ring?	Repair. Go to Step 5	Go to Step 3
3	Is the output of each sensor normal? (Refer to chart C-1 or TC-1)	Go to Step 4	Replace sensor or repair harness. Go to Step 5
4	Is brake pipe connecting order correct?	Replace EHCU. Go to Step 5	Reconnect brake pipe correctly. Go to Step 5
5	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 5

Chart A-3, TA-3 The Wheels Are Locked

Step	Action	Yes	No
1	Is ABS working?	Go to Step 2	Go to Step 6
2	Is vehicle speed under 10 km/h (6mph)?	Normal.	Go to Step 3
3	Is sensor output normal? (Chart C-1 or TC-1)	Go to Step 4	Replace sensor or repair harness. Go to Step 9
4	Is transmission input normal? (Chart C-2 or TC-2)	Go to Step 5	Replace SW or repair harness. Go to Step 9
5	Is front 4WD controller normal?	Replace EHCU. Go to Step 9	Replace 4WD controller or repair harness. Go to Step 9
6	Is transmission input normal? (Chart C-2 or TC-2)	Go to Step 7	Replace SW or repair harness Go to Step 9
7	Is front 4WD controller normal?	Go to Step 8	Replace 4WD controller or repair harness. Go to Step 9
8	Is hydraulic unit grounded properly?	Replace EHCU. Go to Step 9	Correct. Go to Step 9
9	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 9

Chart A-4 Brake Pedal Feed Is Abnormal

Step	Action	Yes	No
1	Is the stop light actuated when the brake pedal is depressed?	Go to Step 2	Go to Step 3
2	1. Turn the ignition switch off. 2. Disconnected EHCU connector. 3. Measure voltage between the EHCU connector terminal 10 and 15 when brake pedal is depressed. Is the voltage equal to the battery voltage?	Go to Step 4	Harness NG between brake SW and EHCU. Go to Step 7
3	Is stop light fuse C-14 normal?	Go to Step 5	Replace fuse C-14. Go to Step 7
4	Is there continuity between EHCU connector terminals, 12 and 15 to body ground?	Go to Step 6	Repair body grounded harness. Go to Step 7
5	Is the brake SW normal?	Repair stop light harness. Go to Step 7	Replace brake SW. Go to Step 7

Step	Action	Yes	No
6	Is the check harness/connector for suspended disconnection?	Hydraulic system leakage or air entry (Refer to servicing "Leakage or brake fluid") Go to Step 7	Repair harness. Go to Step 7
7	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 7

Chart A-5,TA-5 Braking Sound (From EHCU) Is Heard While Not Braking

Step	Action	Yes	No
1	Is this the first time the vehicle is being driven after starting the engine?	It is self checking sound. Normal.	Go to Step 2
2	Is vehicle speed under 10 km/h (6 mph)?	It is self checking sound. Normal.	Go to Step 3
3	Check for the following condition: ● At the time of shift down or clutch operation. ● At the time of low μ drive (ice or snow road) or rough road drive. ● At the time of high-speed turn. ● At the time of passing curb. ● At the time of operating electrical equipment switches. ● At the time of racing the engine (over 5000 rpm). Did it occur under any one condition above?	ABS may sometime be actuated even when brake pedal is not applied.	Go to Step 4
4	Is there play in each sensor/wheel speed sensor rings?	Go to Step 5	Repair. Go to Step 7
5	Damage or powdered iron sticking to each sensor/wheel speed sensor ring?	Go to Step 6	Repair. Go to Step 7
6	Is each sensor output normal?(Refer to chart C-1 or TC-1).	Check harness/ connector for suspected disconnection. If no disconnection is found, replace EHCU. Go to Step 7	Repair. Go to Step 7
7	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart."	Go to Step 7

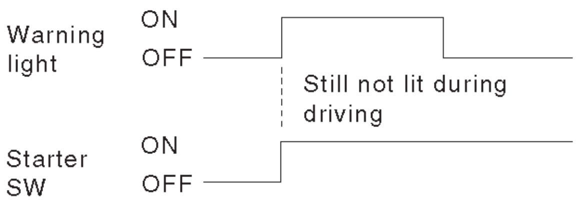
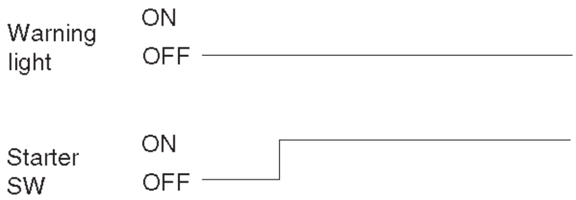
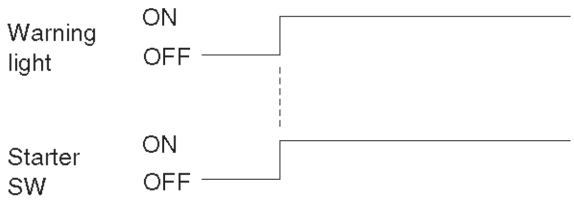
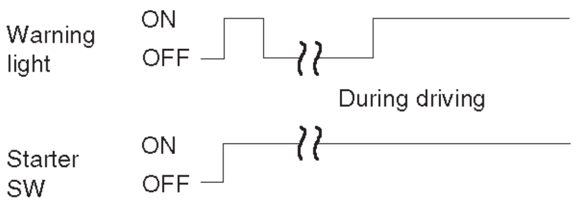
Diagnostic Trouble Codes

Choose and trace an appropriate flowchart by the numbers listed below to find fault and repair.

Code	Item	Diagnosis	Chart No.
12	Start Code	Normal	—
14	EHCU Function	Abnormality in input/output, operational and control circuits	B-2
15	Power Voltage Drop		B-3
16	CLASS–2 Communication Line Abnormality		B-4
21	G-sensor	Wiring disconnection	B-5
23	Transmission Input	Input abnormality	B-6
24	Transfer Monitor		B-7
32	Motor & Motor Relay	Shorted or disconnected coil	B-8
35	Valve Relay	Shorted or disconnected coil/wiring	B-9
41	FL Holding Solenoid Valve	Shorted or disconnected coil/wiring	B-10
42	FL Decompression Solenoid Valve	Shorted or disconnected coil/wiring	B-11
43	FR Holding Solenoid Valve	Shorted or disconnected coil/wiring	B-12
44	FR Decompression Solenoid Valve	Shorted or disconnected coil/wiring	B-13
45	Rear Holding Solenoid Valve	Shorted or disconnected coil/wiring	B-14
46	Rear Decompression Solenoid Valve	Shorted or disconnected coil/wiring	B-15
51	FL Wheel Speed Sensor	Disconnected coil/wiring	B-16
52	FR Wheel Speed Sensor	Disconnected coil/wiring	B-17
53	RL Wheel Speed Sensor	Disconnected coil/wiring	B-18
54	RR Wheel Speed Sensor	Disconnected coil/wiring	B-19
61	FL Wheel Speed Sensor	Shorted coil/wiring	B-20
62	FR Wheel Speed Sensor	Shorted coil/wiring	B-21
63	RL Wheel Speed Sensor	Shorted coil/wiring	B-22
64	RR Wheel Speed Sensor	Shorted coil/wiring	B-23
65	Sensor Signal Input	Wrong number of teeth	B-24

Diagnosis By “ABS” Warning Light Illumination Pattern

In the event that there is abnormality in the “ABS” warning light illumination pattern while the key is in the ON position or if the warning light is actuated during driving, trouble should be diagnosed on a illumination pattern basis as follows:

No.	Condition	“ABS” Warning Light Illumination Pattern	Diagnostic
1	Warning light is actuated normally		Normal
2	Warning light is not lit		Warning light lighting circuit trouble→Go to Chart B-1
3	Warning light remains ON		Diagnostic trouble codes are stored. Display diagnostic trouble codes and diagnose on a code basis according to the flow charts.
4	Warning light is actuated while driving		Diagnostic trouble codes are stored. Display diagnostic trouble codes and diagnose on a code basis according to the flow charts.

Diagnostic Trouble Codes (DTCs)

When the warning light in the meter remains ON, the EHCU stores the fault identification and disables the ABS.

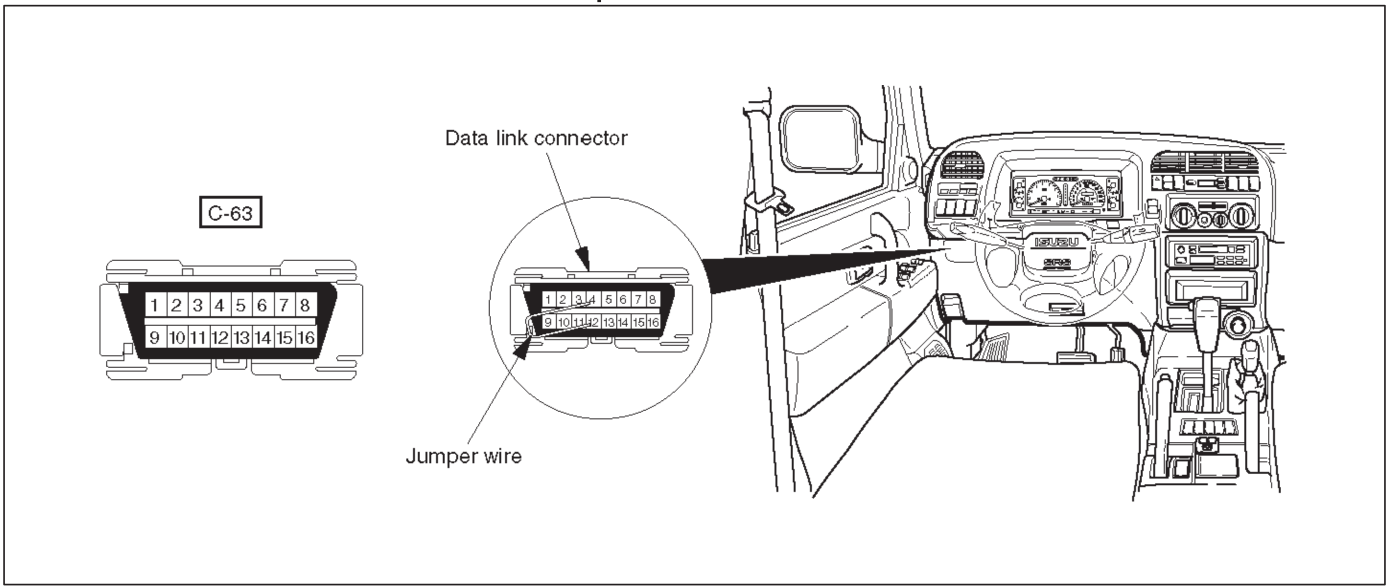
1. How to display and erase DTCs:

NOTE:

- If DTCs are not displayed, harness C-4 connector terminal 30 and I-10 connector terminal 2 may be disconnected. Repair the harness and try DTC display again.
- DTCs can be displayed also by TECH 2. Select mode “F0: Diagnostic Trouble Codes” from Application Menu.

1. How to start DTC display:
   - Confirm that the vehicle has come to a complete stop (with the wheels standing still) and that the brake pedal is not depressed. (Unless these two conditions are satisfied, DTC display cannot be started.)
   - With IGN OFF, connect #12 terminal with #4 terminal or # 5 terminal (GND) . Then turn IGN ON.

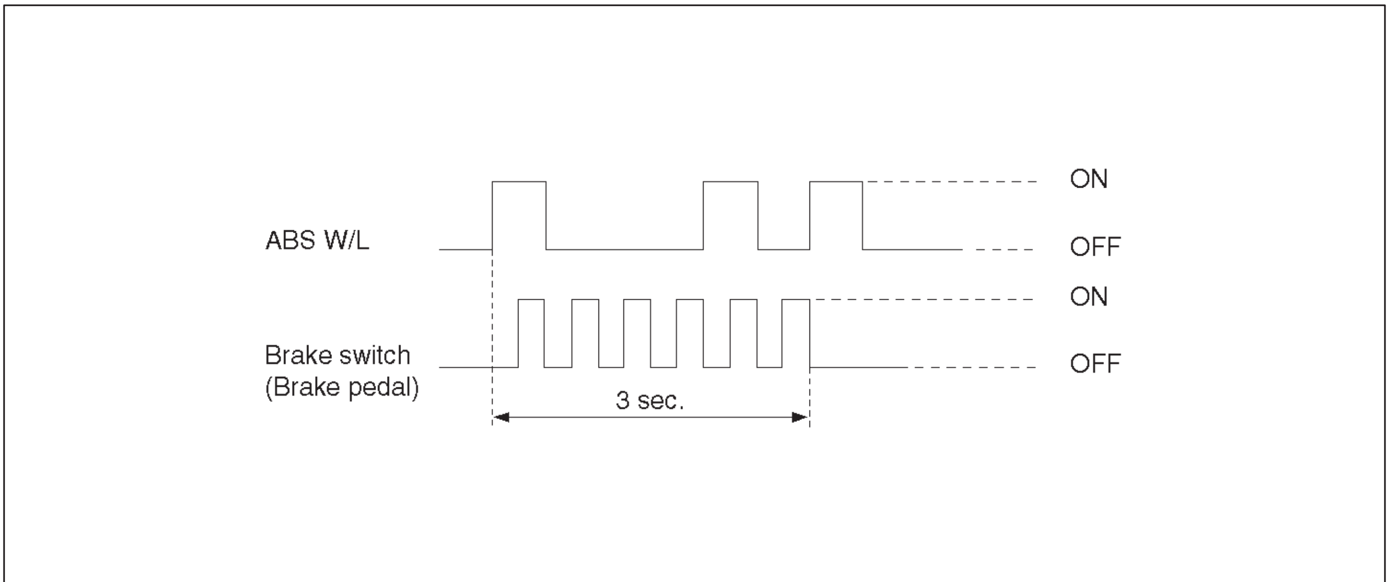
The DLC is located behind the driver side kick panel



350RT001

- Keep #12 terminal connected with #4 terminal or # 5 terminal (GND) during DTC display. (If #12 terminal is separated from #4 terminal or # 5 terminal (GND) during display, display will stop.)

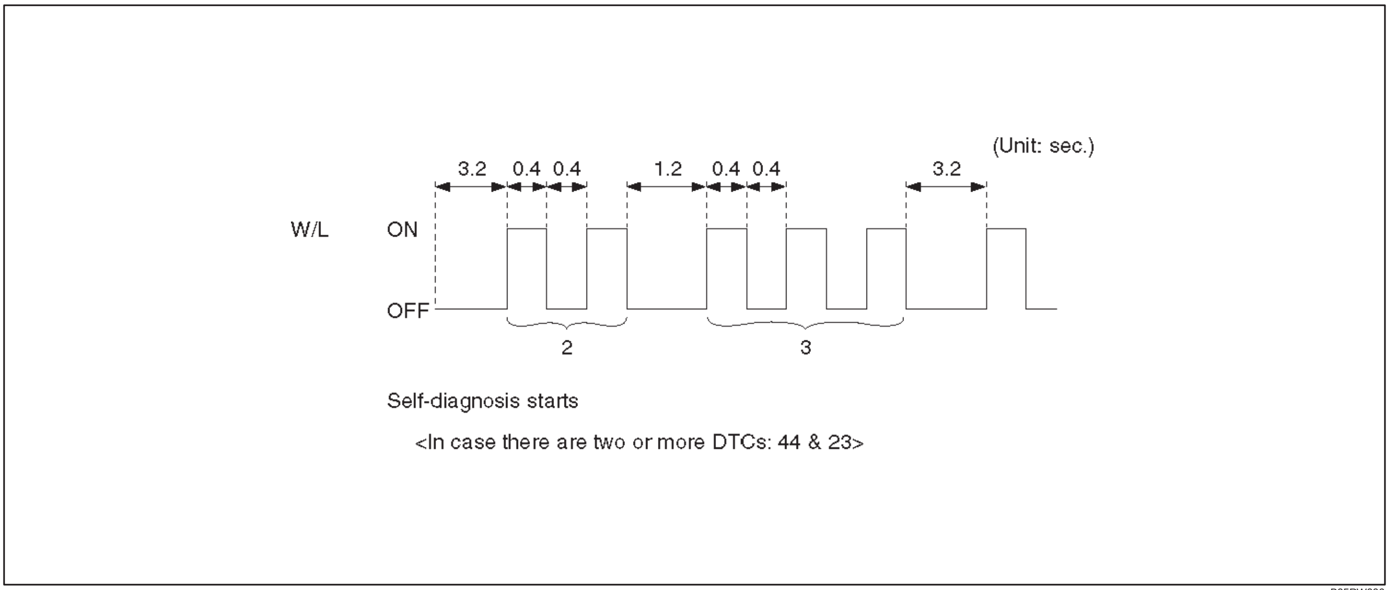
2. DTC display:
   - DTC is displayed by blinking warning light.
   - Double-digit display.
   - First, normal DTC 12 is displayed three times and then any other DTCs are displayed three times. (If no other DTCs have been stored, the display of DTC 12 will be repeated.)
3. How to erase code:
   - Conduct brake switch ON/OFF operation 6 or more times within 3 seconds of self-diagnosis startup.
   - The code cannot be erased if more than 3 seconds have passed since self-diagnosis startup, or if self-diagnosis has started with brake switched on (brake pedal depressed).



B05RW005

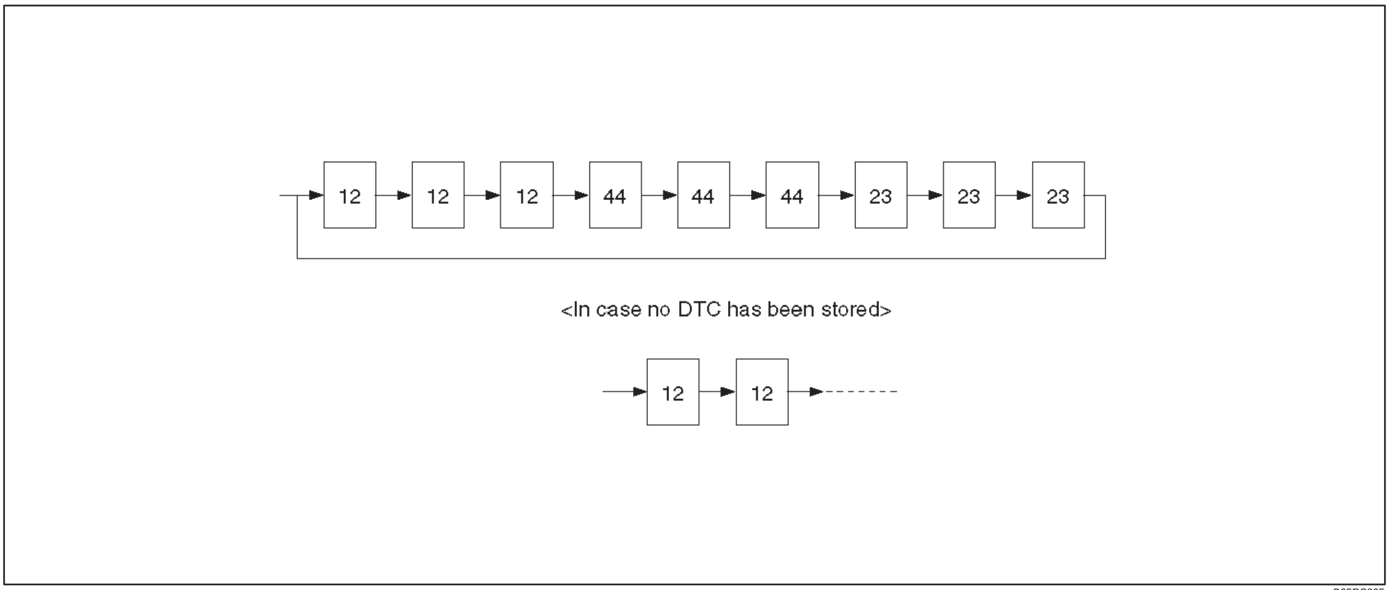
4. Notes
   - If the following should occurs during Diagnostic Trouble Code (DTC) display the display will be discontinued. After initial check, the status that is under the control of ABS will be returned :
     – The vehicle starts (The wheels turn) or the brake pedal is depressed.
   - Up to 3 different codes can be stored.
   - If the ABS should turn OFF due to an intermittent defect, the system will be restored at the next key cycle, if the initial check finds no abnormality (when IGN is switched from OFF to ON).
5. An example of DTC display

   Display of DTC 23



B05RW006

After displaying DTC 12 three times, one DTC after another is displayed, starting with the most recent one. (However, display is discontinued after about 5 minutes.)



B05RS005

The DTC 12 is displayed repeatedly. (display is discontinued after about 5 minutes)

Chart B-1 With the key in the ON position (Before starting the engine). Warning light (W/L) is not activated.

Step	Action	Yes	No
1	Is W/L fuse C-10 disconnected?	Replace fuse. Go to Step 5	Go to Step 2
2	Is W/L burnt out?	Replace W/L bulb. Go to Step 5	Go to Step 3
3	1. Turn the key off. 2. Disconnect EHCU connector. 3. Turn the key ON. 4. Measure the voltage between EHCU connector terminal 16 and 15. Is the voltage equal to the battery voltage?	Go to Step 4	Repair harness and connector. Go to Step 5
4	Is there continuity between EHCU connector terminals, 12 and 15 and body ground.	Check harness for suspected disconnection. No fault found: Replace EHCU. Go to Step 5	Repair harness and connector. Go to Step 5
5	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 5

Chart B-2 EHCU Abnormality (DTC 14)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect the EHCU connector. 3. Inspect EHCU ground. Is there resistance between the EHCU connector terminals, 12 and 15 and body ground?	Go to Step 2	Repair the body ground harness. Go to Step 3
2	1. Turn the key off, connect the EHCU. 2. Erase the trouble code. 3. Turn Ignition off, then on, to perform system self-check. 4. If warning light remains on, display trouble codes once again. Is the check trouble code 14?	Replace EHCU. Go to Step 3	Inspect in accordance with the DTC displayed.
3	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 3

Chart B-3 Power Voltage Drop (DTC 15)

Step	Action	Yes	No
1	Is the battery voltage normal? (Battery capacity check)	Go to Step 2	Charge or replace battery. Go to Step 2
2	1. Turn the key off. 2. Disconnect EHCU connector. 3. Turn the key on. Is the voltage between EHCU connector terminals 8 and 15, higher than 10V?	Check harness connector for suspected disconnection. Fault found: Repair, and perform system self-check. No fault found: replace EHCU. Go to Step 3	Repair harness or connector. Go to Step 3
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 3

Chart B-4 CLASS-2 Communication Line Abnormality (DTC 16)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU and PCM connector. Is there continuity between EHCU connector terminals 25 and ground?	Go to Step 2	Repair harness or connector. Go to Step 3
2	1. Connect EHCU connector. 2. Clear diagnostic trouble code. 3. Turn the key on. Is the diagnostic trouble code 16 shown on the displayed?	Check the PCM harness. Refer to 6E section. Go to Step 3	Replace EHCU. Go to Step 3
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 3

Chart B-5 G-Sensor Circuit (DTC 21)

Step	Action	Yes	No
1	Vehicle placed horizontal. Is the resistance between the G sensor connector terminals 1 and 2 within 4.0-6.0 kΩ?	Check harness connector for short. Fault found : Repair , and perform system self-check. No fault found : replace EHCU. Go to Step 3	Go to Step 2
2	Is the bracket installed horizontally?	Go to Step 4	Repair or replace bracket. Go to Step 4

Step	Action	Yes	No
3	Remove G sensor. Is the resistance between the G sensor connector terminals 1 and 2 within 1.0-2.0 kΩ when G sensor is horizontal?	Go to Step 4	Replace G sensor. Go to Step 5
4	Measure resistance between G sensor connector terminals 1 and 2 within 4.0-6.0 kΩ when G sensor tilted to 30° or more?	Harness between EHCU and G sensor is faulty and short. Repair the harness Go to Step 5	Replace G sensor. Go to Step 5
5	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 5

Chart B-6 Abnormal Transmission Input (DTC 23)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. Is there continuity between EHCU connector terminal 6 to 15 (Gear position-P(A/T), N(M/T))?	Shorted switch harness. Repair switch or harness. Go to Step 6	Go to Step 2
2	Is the vehicle an A/T model?	Go to Step 3	Go to Step 4
3	Turn the key on and measure the voltage between EHCU connector terminal 6 and 15. Is the 6V under when the gear position is L, and R(Battery voltage 12V)?	Go to Step 5	Transmission SW trouble. Disconnected harness. Repair SW and harness. Go to Step 6
4	Turn the key on and measure the voltage between EHCU connector terminal 6 and 15. Is the 9.6V over when the gear position is 1, 2, R(Battery voltage 12V)?	Go to Step 5	Transmission SW trouble. Disconnected harness. Repair SW and harness. Go to Step 6

Step	Action	Yes	No
5	Is there 6.6 to 9.0V when the gear position is 3, 4, 5 and N(M/T) or 2,3,D,N and P(A/T)(Battery voltage 12V)?	Suspected harness/ connector short power source/GND. Suspected shorted transmission SW. Fault found: repair, and perform system self-check. No fault found: replace EHCU. Go to Step 6	Transmission SW trouble. Disconnected harness. Repair SW and harness. Go to Step 6
6	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 6

Chart B-7 Transfer Monitor (DTC 24)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. Is the EHCU connector terminal 9 line normally?	Go to Step 2	Repair Go to Step 3
2	Is the TOD ECU or 4WD controler normal?	Replace EHCU. Go to Step 3	Repair or replace TOD ECU or 4WD contrder. Go to Step 3
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 3

Chart B-8 EHCU Pump Motor And Motor Relay Circuit (DTC 32)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Measure voltage between EHCU connector terminal 13 and body ground. Is the voltage equal to battery voltage?	Go to Step 2	Repair fuse/harness between battery and EHCU connector terminal 13. Go to Step 3
2	Is there continuity between EHCU connector terminal 12 and ground?	Go to Step 3	Repair between EHCU connector terminal 12 and ground. Go to Step 3
3	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 3

Chart B-9 EHCU Pump Valve And Valve Relay Circuit (DTC 35)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Measure voltage between EHCU connector terminal 14 and body ground. Is the voltage equal to battery voltage?	Replace EHCU. Go to Step 2	Repair fuse and harness EHCU connector terminal 14 and battery. Go to Step 2
2	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 2

Chart B-10 FL Isolation Solenoid Valve Abnormality (DTC 41)

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” perfomed?	Go to Step 2	Go to “EHCU Connector Pin-out Checks”.
2	Is the EHCU connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the “Basic Diagnostic Flow Chart”.
3	1. Replace the EHCU. 2. Reconnect all component, ensure all component are properly mounted. Was this step finished?	Repeat the “Basic Diagnostic Flow Chart”.	Go to Step 3

Chart B-11 FL Dump Solenoid Valve Abnormality (DTC 42)

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” perfomed?	Go to Step 2	Go to “EHCU Connector Pin-out Checks”.
2	Is the EHCU connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the “Basic Diagnostic Flow Chart”.
3	1. Replace the EHCU. 2. Reconnect all component, ensure all component are properly mounted. Was this step finished?	Repeat the “Basic Diagnostic Flow Chart”.	Go to Step 3

Chart B-12 FR Isolation Solenoid Valve Abnormality (DTC 43)

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” perfomed?	Go to Step 2	Go to “EHCU Connector Pin-out Checks”.
2	Is the EHCU connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the “Basic Diagnostic Flow Chart”.
3	1. Replace the EHCU. 2. Reconnect all component, ensure all component are properly mounted. Was this step finished?	Repeat the “Basic Diagnostic Flow Chart”.	Go to Step 3

Chart B-13 FR Dump Solenoid Valve Abnormality (DTC 44)

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” perfomed?	Go to Step 2	Go to “EHCU Connector Pin-out Checks”.
2	Is the EHCU connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the “Basic Diagnostic Flow Chart”.
3	1. Replace the EHCU. 2. Reconnect all component, ensure all component are properly mounted. Was this step finished?	Repeat the “Basic Diagnostic Flow Chart”.	Go to Step 3

Chart B-14 Rear Isolation Solenoid Valve Abnormality (DTC 45)

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” perfomed?	Go to Step 2	Go to “EHCU Connector Pin-out Checks”.
2	Is the EHCU connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the “Basic Diagnostic Flow Chart”.
3	1. Replace the EHCU. 2. Reconnect all component, ensure all component are properly mounted. Was this step finished?	Repeat the “Basic Diagnostic Flow Chart”.	Go to Step 3

Chart B-15 Rear Dump Solenoid Valve Abnormality (DTC 46)

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” perfomed?	Go to Step 2	Go to “EHCU Connector Pin-out Checks”.
2	Is the EHCU connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the “Basic Diagnostic Flow Chart”.
3	1. Replace the EHCU. 2. Reconnect all component, ensure all component are properly mounted. Was this step finished?	Repeat the “Basic Diagnostic Flow Chart”.	Go to Step 3

Chart B-16 FL Speed Sensor Disconnection (DTC 51)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Measure the resistance between EHCU connector terminals 20 and 21. Is the resistance between 1.3k and 1.9k ohms?	Check for faults in harness between speed sensor and EHCU. Fault found: Repair, and perform system self-check. No fault found: Replace EHCU. Go to Step 3	Go to Step 2
2	Measure the FL speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCU. Go to Step 3	Replace sensor. Go to Step 3
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 3

Chart B-17 FR Speed Sensor Disconnection (DTC 52)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Measure the resistance between EHCU connector terminals 4 and 5. Is the resistance between 1.3k and 1.9k ohms?	Check for faults in harness between speed sensor and EHCU. Fault found: Repair, and perform system self-check. No fault found: Replace EHCU. Go to Step 3	Go to Step 2
2	Measure the FR speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCU. Go to Step 3	Replace sensor. Go to Step 3
3	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 3

Chart B-18 RL Speed Sensor Disconnection (DTC 53)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Measure the resistance between EHCU connector terminals 22 and 23. Is the resistance between 1.3k and 1.9k ohms?	Check for faults in harness between speed sensor and EHCU. Fault found: Repair, and perform system self-check. No fault found: Replace EHCU. Go to Step 3	Go to Step 2
2	Measure the RL speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCU. Go to Step 3	Replace sensor. Go to Step 3
3	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 3

Chart B-19 RR Speed Sensor Disconnection (DTC 54)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Measure the resistance between EHCU connector terminals 2 and 3. Is the resistance between 1.3K and 1.9k ohms?	Check for faults in harness between speed sensor and EHCU. Fault found: Repair, and perform system self-check. No fault found: Replace EHCU. Go to Step 3.	Go to Step 2
2	Measure the RR speed sensor resistance at the sensor connector. Is the sensor resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHUC. Go to Step 3	Replace sensor. Go to Step 3
3	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 3

Chart B-20 FL Speed Sensor Short Circuit (DTC 61)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector 3. Measure the FL speed sensor resistance between EHCU connector terminals 20 and 21. Is the resistance between 1.3k and 1.9k ohms?	Go to Step 2	Go to Step 3
2	Is there play in the sensor/sensor rotor?	Go to Step 4	Repair. Go to Step 6
3	Measure the FL speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCU. Go to Step 6	Replace sensor. Go to Step 6
4	Damage and powdered iron sticking to sensor/sensor ring?	Go to Step 5	Repair. Go to Step 6
5	Is sensor output normal? (Chart C-2 or TC-2)	Check for faults in harness between speed sensor and EHCU. Fault found: repair, and perform system self-check. No fault found: replace EHCU. Go to Step 6	Replace sensor. Go to Step 6
6	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 6

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h or higher to make sure that the warning light goes out.

Chart B-21 FR Speed Sensor Short Circuit (DTC 62)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Measure the FR speed sensor resistance between EHCU connector terminals 4 and 5. Is the resistance between 1.3k and 1.9k ohms?	Go to Step 2	Go to Step 3
2	Is there play in the sensor/sensor rotor?	Go to Step 4	Repair. Go to Step 6
3	Measure the FR speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCU. Go to Step 6	Replace sensor. Go to Step 6
4	Damage and powdered iron sticking to sensor/sensor ring?	Go to Step 5	Repair. Go to Step 6
5	Is sensor output normal? (Chart C-2 or TC-2)	Check for faults in harness between speed sensor and EHCU. Fault found: repair, and perform system self-check. No fault found: replace EHCU. Go to Step 6	Replace sensor. Go to Step 6
6	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat “Basic diagnostic flow chart.”	Go to Step 6

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h or higher to make sure that the warning light goes out.

Chart B-22 RL Speed Sensor Short Circuit (DTC 63)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector 3. Measure the RL speed sensor resistance between EHCU connector terminals 22 and 23. Is the resistance between 1.3k and 1.9k ohms?	Go to Step 2	Go to Step 3
2	Is there play in the sensor/sensor rotor?	Go to Step 4	Repair. Go to Step 6
3	Measure the RL speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCU. Go to Step 6	Replace sensor. Go to Step 6
4	Damage and powdered iron sticking to sensor/sensor ring?	Go to Step 5	Repair. Go to Step 6
5	Is sensor output normal? (Chart C-2 or TC-2)?	Check for faults in harness between speed sensor and EHCU. Fault found: repair, and perform system self-check. No fault found: replace EHCU. Go to Step 6	Replace sensor. Go to Step 6
6	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 6

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h or higher to make sure that the warning light goes out.

Chart B-23 RR Speed Sensor Short Circuit (DTC 64)

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Measure the RR speed sensor resistance between EHCU connector terminals 2 and 3. Is the resistance between 1.3k and 1.9k ohms?	Go to Step 2	Go to Step 3
2	Is there play in the sensor/sensor rotor?	Go to Step 4	Repair. Go to Step 6
3	Measure the RR speed sensor resistance at the sensor connector. Is the resistance between 1.3k and 1.9k ohms?	Repair harness abnormality between sensors and EHCU. Go to Step 6	Replace sensor. Go to Step 6
4	Damage and powdered iron sticking to sensor/sensor ring?	Go to Step 5	Repair. Go to Step 6
5	Is sensor output normal? (Chart C-2 or TC-2)	Check for faults in harness between speed sensor and EHCU. Fault found: repair, and perform system self-check. No fault found: replace EHCU. Go to Step 6	Replace sensor. Go to Step 6
6	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat “Basic diagnostic flow chart.”	Go to Step 6

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h or higher to make sure that the warning light goes out.

Chart B-24 Sensor Signal Input Abnormality (DTC 65)

Step	Action	Yes	No
1	Using TECH 2?	Go to Step 2	Go to Step 3
2	1. Connect TECH 2. 2. Select Snap shot manual trigger. 3. With wheel speed data displayed, run the vehicle when speed has arrived at 30 km/h (18 mph). 4. Check speed data on each wheel (refer to the criterion given below). *1 Is the abnormal sensor condition found?	Replace. Go to Step 8	Go to Step 3 All the sensors should follow the following flowchart (without using TECH 2).
3	Is there play in sensor/sensor ring?	Repair. Go to Step 8	Go to Step 4
4	Is there powdered iron sticking to sensor/sensor ring?	Repair. Go to Step 8	Go to Step 5
5	Is there a broken tooth or indentation in sensor ring?	Replace sensor ring. Go to Step 8	Go to Step 6
6	Is there play in wheel bearing?	Adjust or repair. Go to Step 8	Go to Step 7
7	Is the check wiring between sensor and EHCU normal?	Replace EHCU. Go to Step 8	Repair, and perform system self-check. Go to Step 8
8	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat “Basic diagnostic flow chart.”	Go to Step 8

Sensor Signal Abnormality Criteria using TECH 2

1. While driving, the speed of one or two wheels 25% or more higher than that of the other wheels.
2. The speed of one or two wheels is 10 km/h (6 mph) or more higher than that of the other wheels.
3. During steady driving, wheel speed changes abruptly.

*1 The vehicle must run on a level paved road.

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop.

Turn the ignition switch to the ON position and drive the vehicle at 12 km/h or higher to make sure that the warning light goes out.

It is important to verify that the correct tires are installed on vehicle.

Unit Inspection Procedure

This section describes the following inspection procedures referred to during “SYMPTOM DIAGNOSIS” and “DIAGNOSIS BY ‘ABS’ WARNING LIGHT ILLUMINATION PATTERN” :

	without TECH 2	with TECH 2
Wheel Speed Sensor Output Inspection	Chart C-1-1 to C-1-4	Chart TC-1
Transmission SW Inspection	Chart C-2	Chart TC-2

Chart C-1-1 FL Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Jack up the vehicle, With all four wheels off the ground. Measure the AC voltage between EHCU connector terminals while turning FL wheel at a speed of 1 RPS: Is voltage between EHCU connector terminals 20 and 21 under 200 mV?	Go to Step 2	Ok. Go to Step 3
2	1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2. Is resistance between connector (C-13) terminals 1 and 2 within 1.3k - 1.9k ohms?	Connector is faulty, or open or short circuit in harness between wheel speed sensor connector and EHCU. Inspect and correct the connector or harness Go to Step 3	Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to Step 3
3	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 3

Chart C-1-2 FR Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Jack up the vehicle with all four wheels off the ground. Measure the AC voltage between EHCU connector terminals while turning FR wheel at a speed of 1 RPS: Is voltage between EHCU connector terminals 4 and 5 under 200 mV?	Go to Step 2	Ok. Go to Step 3
2	1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2. Is resistance between connector (C-41) terminals 1 and 2 within 1.3k - 1.9k ohms?	Connector is faulty, or open or short circuit of harness between wheel speed sensor connector and EHCU. Inspect and correct the connector or harness Go to Step 3	Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to Step 3
3	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 3

Chart C-1-3 RL Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Jack up the vehicle with all four wheels off the ground. Measure the AC voltage between EHCU connector terminals while turning RL wheel at a speed of 1 RPS: Is voltage between EHCU connector terminals 22 and 23 under 200 mV?	Go to Step 2	Ok. Go to Step 3
2	1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2. Is resistance between connector (F-3) terminals 1 and 2 within 1.3k - 1.9k ohms?	Connector is faulty, or open or short circuit of harness between wheel speed sensor connector and EHCU. Inspect and correct the connector or harness Go to Step 3	Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to Step 3
3	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 3

Chart C-1-4 RR Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. 3. Jack up the vehicle with all four wheels off the ground. Measure the AC voltage between EHCU connector terminals while turning RR wheel at a speed of 1 RPS: Is voltage between EHCU connector terminals 2 and 3 under 200 mV?	Go to Step 2	Ok. Go to Step 3
2	1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2. Is resistance between connector (F-2) terminals 1 and 2 within 1.3k - 1.9k ohms?	Connector is faulty, or open or short circuit of harness between wheel speed sensor connector and EHCU. Inspect and correct the connector or harness Go to Step 3	Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to Step 3
3	Reconnect all components and ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 3

Chart TC-1 Sensor Output Inspection Procedure (Use TECH 2)

Step	Action	Yes	No
1	1. Connect TECH 2. 2. While driving the vehicle, check the wheel speed of each sensor by Data List. Is the vehicle speed value is normal?	Go to Step 6	Go to Step 2
2	Check the sensor harness for suspected disconnection (Check while shaking harness/connector). Is the sensor harness connection normal?	Replace speed sensor. Go to Step 3	Repair. Go to Step 6
3	While driving the vehicle, check the wheel speed of each sensor by Data List. Is the vehicle speed value is normal?	Go to Step 6	Go to Step 4
4	Check sensor roter. Is the sensor roter normal?	Go to Step 6	Replace sensor roter. Go to Step 5
5	While driving the vehicle, check the wheel speed of each sensor by Data List. Is the vehicle speed value is normal?	Go to Step 6	Repair harness or connector between EHCU and speed sensor. Go to Step 6
6	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 6

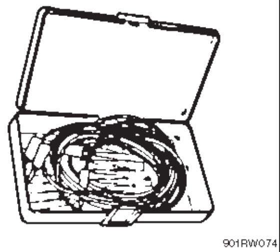
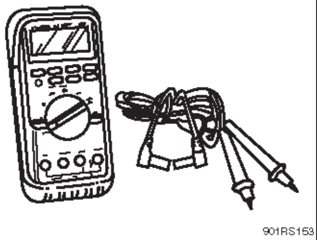
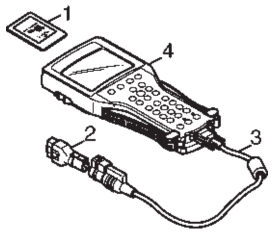
Chart C-2 Transmission Input Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect EHCU connector. Is there continuity between EHCU connector terminals 6 and 15 (Gear position-P(A/T), N(M/T))?	Shorted switch harness. Repair switch or harness. Go to Step 6	Go to Step 2
2	Is the vehicle an A/T model?	Go to Step 3	Go to Step 4
3	Turn the key on and measure voltage between EHCU connector terminals 6 and 15. Is there less than 6V when the gear position is L, and R(Battery voltage 12V)?	Go to Step 5	Transmission SW trouble. Disconnected harness. Repair SW and harness. Go to Step 6
4	Turn the key on and measure the voltage between EHCU connector terminal 6 and 15. Is there more than 9.6V when the gear position is 1, 2, R(Battery voltage 12V)?	Go to Step 5	Transmission SW trouble. Disconnected harness. Repair SW and harness. Go to Step 6
5	Measure the voltage between EHCU connector terminals 6 and 15. Is there 6.6 to 9.0V when the gear position is 3, 4, 5 and N(M/T) or 2,3,D,N and P(A/T)(Battery voltage 12V)?	Go to Step 6	Transmission SW trouble. Disconnected harness. Repair SW and harness. Go to Step 6
6	1. Reconnect all components and ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 6

Chart TC-2 Transmission Input Inspection Procedure (Use TECH 2)

Step	Action	Yes	No
1	1. Connect TECH 2. 2. Select Data List. Is this vehicle an A/T model ?	Go to Step 2	Go to Step 4
2	Is “Off–Road Switch(Transmission Input): Active” when the shift lever is the L and R?	Go to Step 3	Go to Step 6
3	Is “Off–Road Switch(Transmission Input): Inactive” when the shift lever is other than the L and R?	Go to Step 7	Go to Step 6
4	Is “Off–Road Switch(Transmission Input): Active” when the shift lever is in 1, 2 and R?	Go to Step 5	Go to Step 6
5	Is “Off–Road Switch(Transmission Input): Inactive” when the shift lever is other than the 1, 2 and R?	Go to Step 7	Go to Step 6
6	1. Abnormal T/M SW, inhibitor SW, or harness. 2. Repair T/M SW, inhibitor SW, or harness. Is the T/M SW, inhibitor SW, or harness repaired?	Go to Step 7	Go to Step 6
7	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart.”	Go to Step 7

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–35616** Connector test adapter kit
	**J–39200** High impedance multimeter
	**7000086–ISU** Tech 2 Set (1) PCMCIA Card (2) SAE 16/19 Adapter (3) DLC Cable (4) Tech 2

TROOPER

BRAKES

ANTI-LOCK BRAKE SYSTEM

CONTENTS

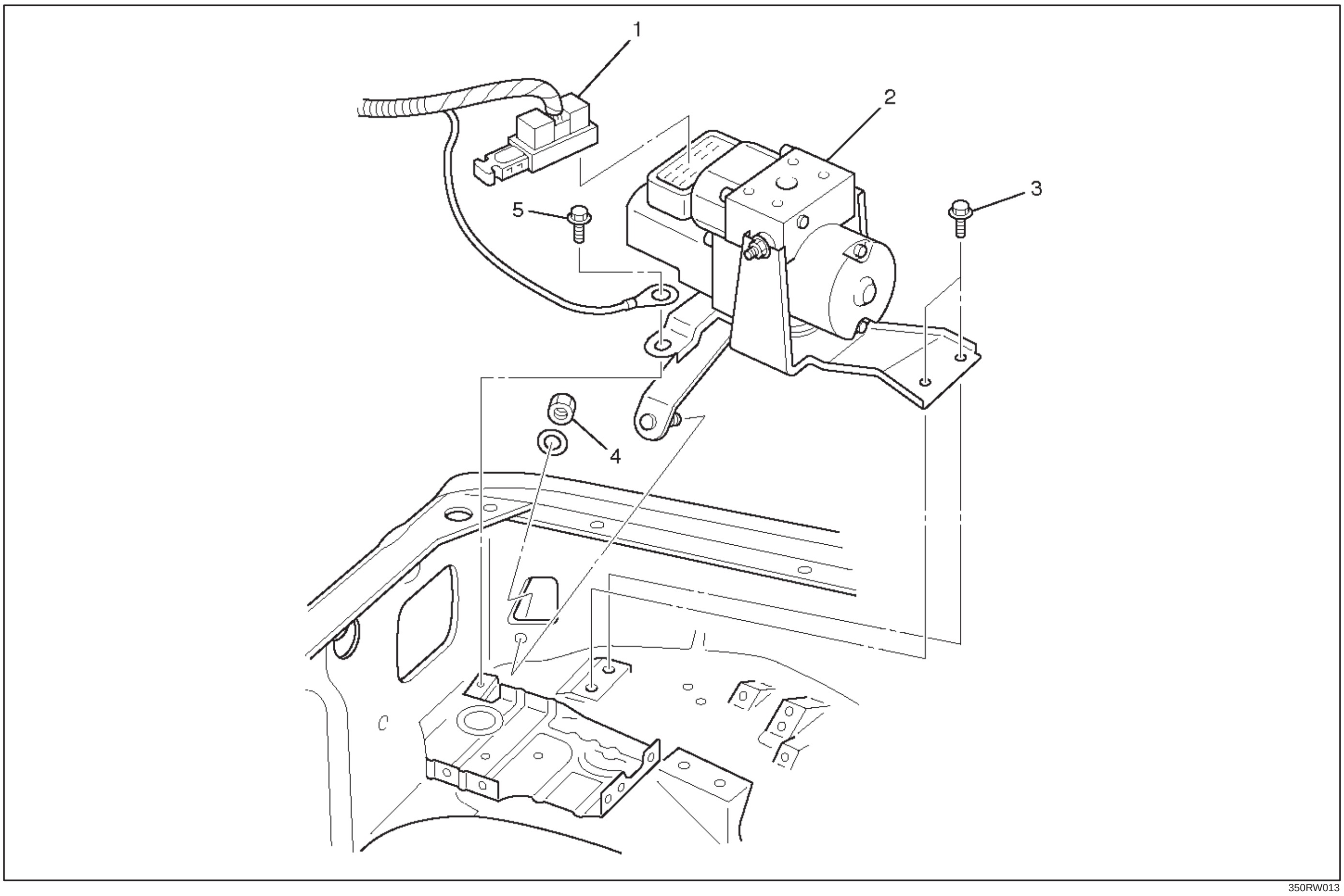
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Electronic Hydraulic Control Unit

Electronic Hydraulic Control Unit and Associated Parts



Legend

(1) Connector
(2) Hydraulic Unit ASM
(3) Bolts
(4) Nut
(5) Bolt

Removal

1. Remove battery ASM.
2. Remove harness connector.
3. Remove EHCU fixing nuts.
4. Remove brake pipes.
   - After disconnecting brake pipe, cap or tape the openings of the brake pipe to prevent the entry of foreign matter.
5. Remove hydraulic unit fixing nuts.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

Torque

Hydraulic unit fixing nuts : 22 N·m (16 lb ft)

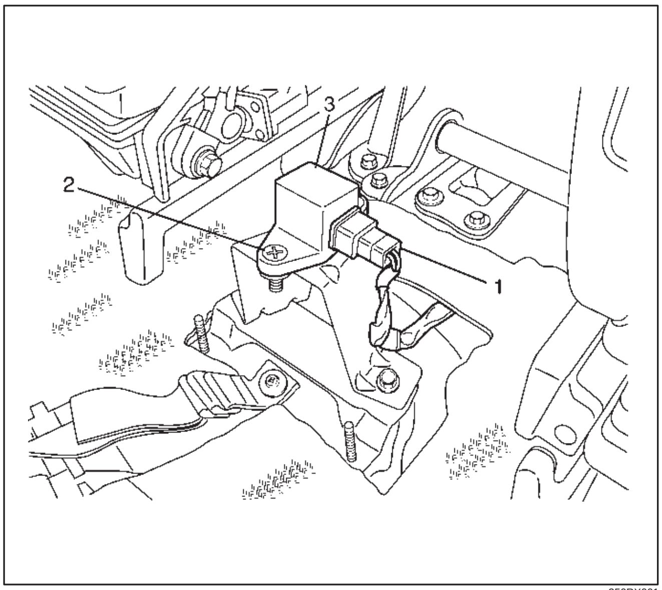
Ground cable : 14 N·m (10 lb ft)

Brake pipe (joint bolts) : 16 N·m (12 lb ft)

- After installing the hydraulic unit, bleed brakes completely. See Section 5A “Hydraulic Brakes”.

G-Sensor

Removal



350RX001

1. Remove center console.
   - Refer to Consoles in Body and Accessories section.
2. Remove clip from G-sensor connector, then disconnect connector.
3. Remove G-sensor assembly fixing bolt (2).
4. Remove G-sensor assembly (3).

Inspection and Repair

Refer to “Chart B-5” in this Section.

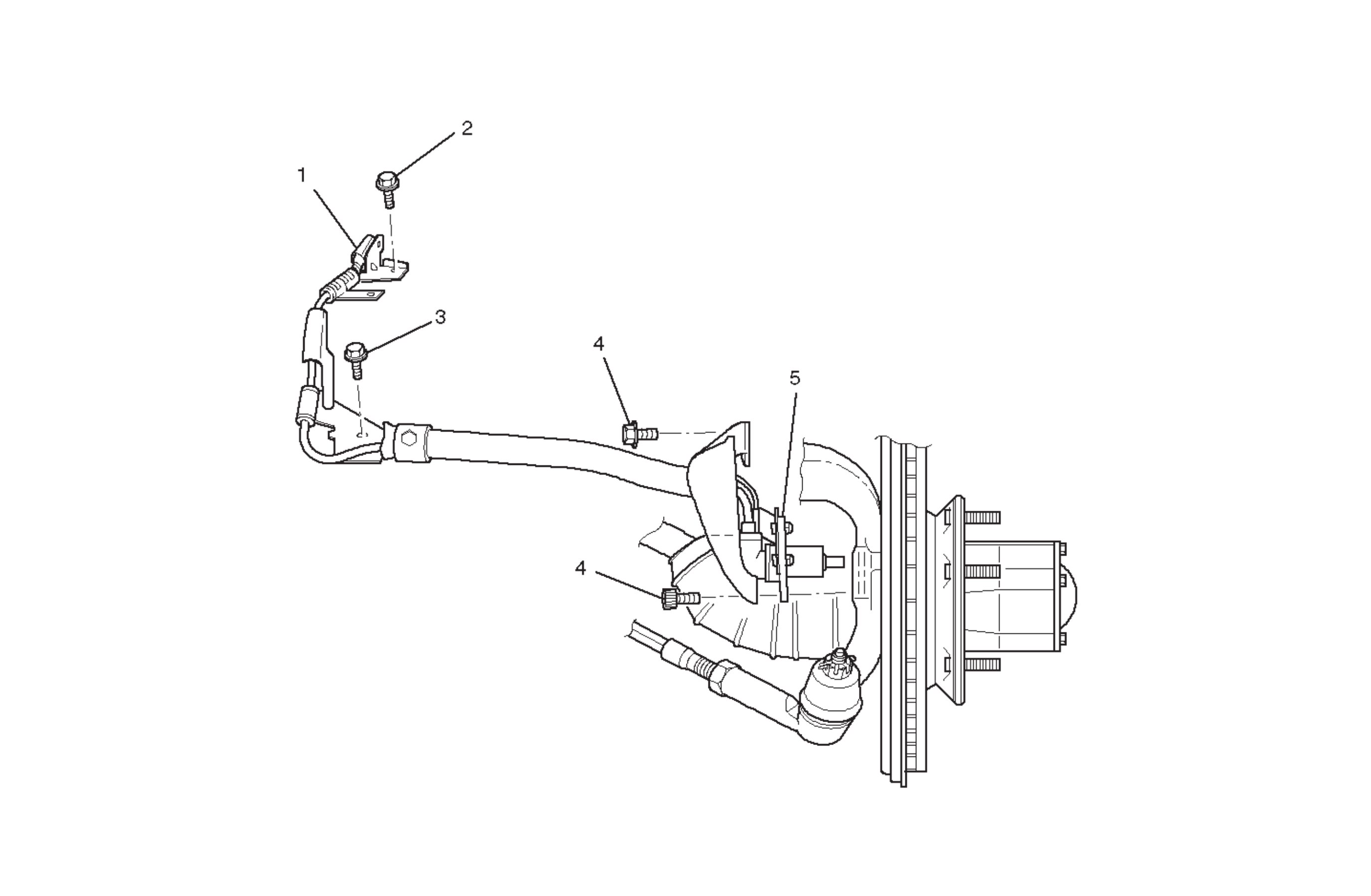
Installation

1. Install G-sensor assembly (3).
   - Care should be taken so that the G-sensor is not installed in the wrong direction.
2. Install G-sensor assembly fixing bolt (2).
   - Tighten the fixing bolt to the specified torque.

   Torque : 10 N·m (87 lb in)
3. Install G-sensor wiring connector (1).
4. Install center console.
   - Refer to Consoles in Body and Accessories section.

Front Wheel Speed Sensor

Front Wheel Speed Sensor and Associated Parts



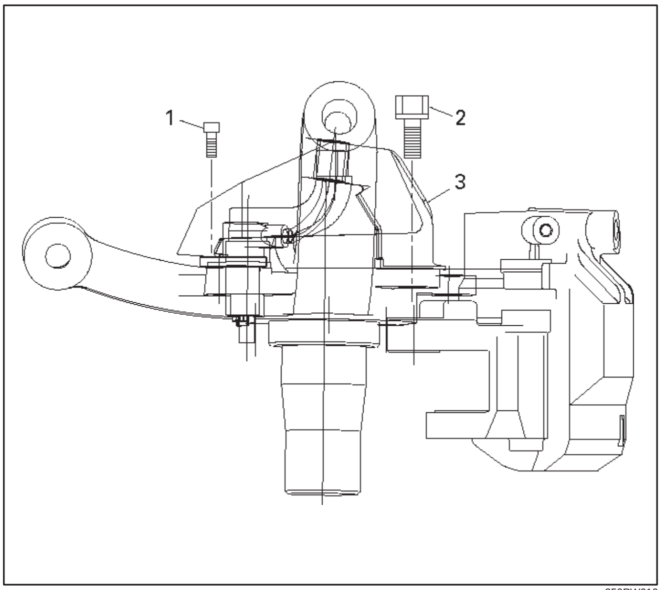
350RW012

Legend

(1) Speed Sensor Connector
(2) Sensor Cable Fixing Bolt (Upper side)
(3) Sensor Cable Fixing Bolt (Lower side)
(4) Sensor Cable Fixing Bolt (Sensor side)
(5) Speed Sensor

Removal

1. Remove speed sensor connector.
2. Remove sensor cable fixing bolt (Upper side).
3. Remove sensor cable fixing bolt (Lower side).
4. Remove the speed sensor cable fixing bolts (1) and caliper fixing bolt (2) from caliper side speed sensor cable bracket (3).



350RW010

5. Remove speed sensor.

Inspection and Repair

1. Check the speed sensor pole piece for presence of foreign materials; remove any dirt, etc.
2. Check the pole piece for damage; replace speed sensor if necessary.
3. Check the speed sensor cable for short or open circuit, and replace with a new one if necessary.
   To check for cable short or open, bend or stretch the cable while checking for continuity.
4. Check the sensor ring for damage including tooth chipping, and if damaged, replace the sensor ring assembly. Refer to removal of the sensor ring in Section 4C "Front hub and disc".

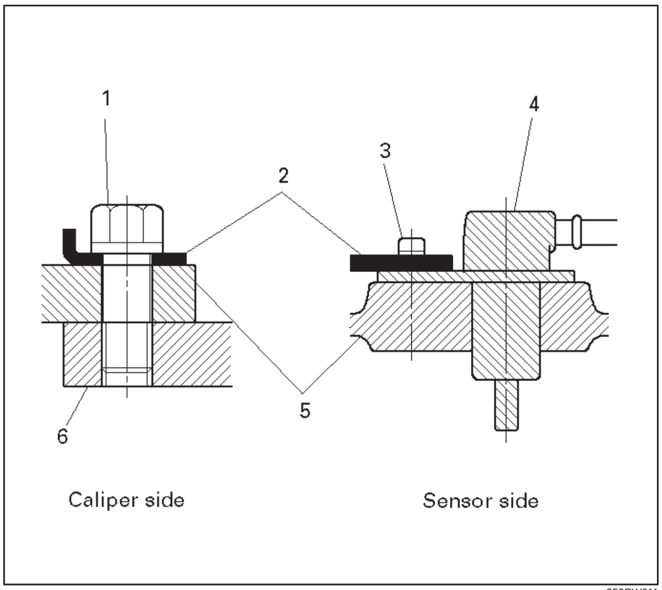
Installation

1. Install speed sensor and take care not to hit the speed sensor pole piece during installation.
2. Install speed sensor fixing bolt and tighten the fixing bolt to the specified torque.

Torque

Sensor side : 8 N·m (69 lb in)

Caliper side : 155 N·m (115 lb ft)



350RW011

Legend

(1) Caliper Fixing Bolt
(2) Bracket
(3) Sensor Fixing Bolt
(4) Sensor
(5) Knuckle
(6) Brake Caliper

3. Install speed sensor cable fixing bolt (Lower side) and tighten the fixing bolt to the specified torque.

Torque : 24 N·m (18 lb ft)

4. Install speed sensor cable fixing bolt (Upper side) and tighten the fixing bolt to the specified torque.

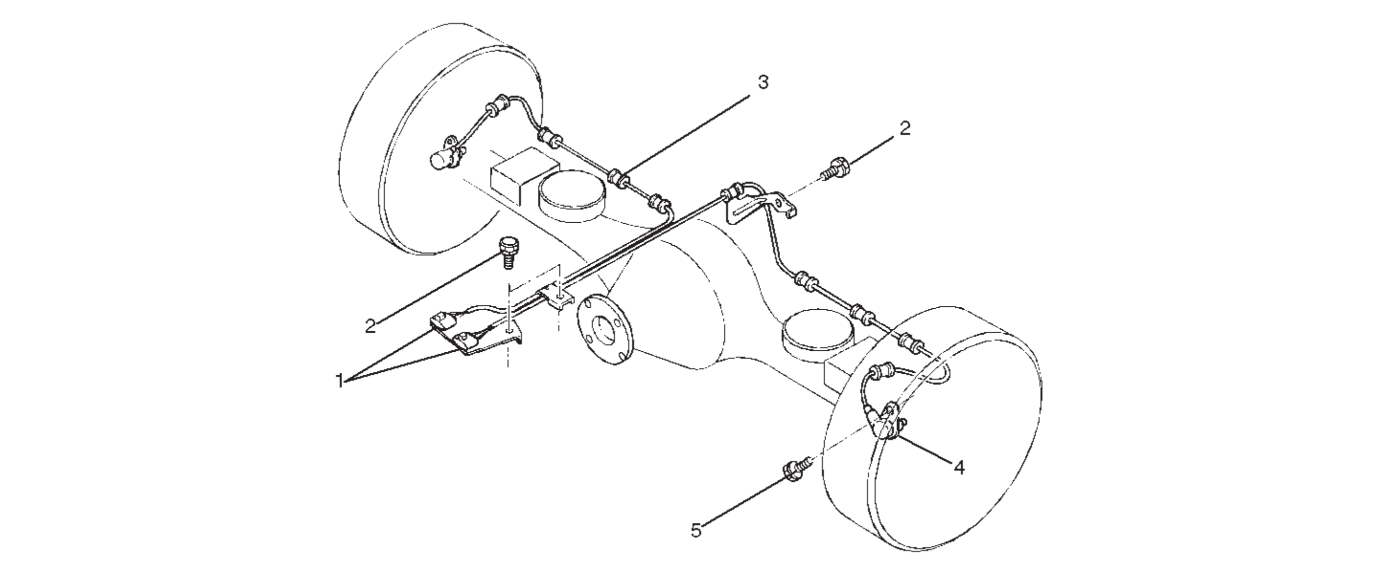
Torque : 6 N·m (52 lb ft)

NOTE: Confirm that a white line marked on the cable is not twisted when connecting the speed sensor cable.

5. Install speed sensor connector.

Rear Wheel Speed Sensor

Rear Wheel Speed Sensor and Associated Parts



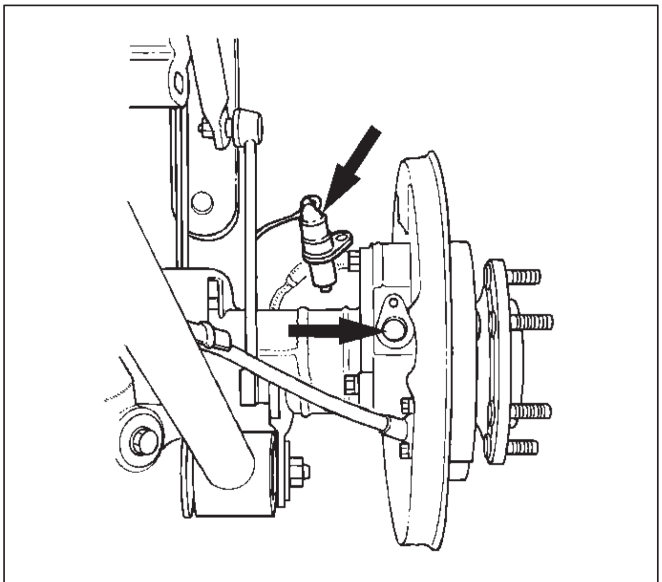
350RW008

Legend

(1) Speed Sensor Connector
(2) Sensor Cable Fixing Bolt
(3) Clip (11 pieces)
(4) Speed Sensor
(5) Sensor Fixing Bolt

Removal

1. Remove speed sensor connector.
2. Remove clip.
3. Remove sensor cable fixing bolt.
4. Remove sensor fixing bolt.
5. Remove speed sensor.



350RS035

Inspection and Repair

1. Check the speed sensor pole piece for presence of foreign materials; remove any dirt, etc.
2. Check the pole piece for damage, and replace the speed sensor if necessary.
3. Check the speed sensor cable for a short or an open, and replace with a new one if necessary. To check for cable short or open, bend or stretch the cable while checking for continuity.
4. Check the sensor ring for damage including tooth chipping. If damaged replace the axle shaft assembly. Refer to removal of the sensor ring in Section 4B "Rear Axle".

Installation

1. Install the speed sensor and take care not to hit the speed sensor pole piece during installation.
2. Install the sensor fixing bolt and tighten it to the specified torque.

   Torque : 18 N·m (13 lb ft)
3. Install the sensor cable fixing bolt and tighten it to the specified torque.

   Torque : 24 N·m (18 lb ft)

NOTE: Confirm that the cable is not twisted when connecting the speed sensor cable.

4. Install clip.
5. Install speed sensor connector.

TROOPER

BRAKES

POWER-ASSISTED BRAKE SYSTEM

CONTENTS

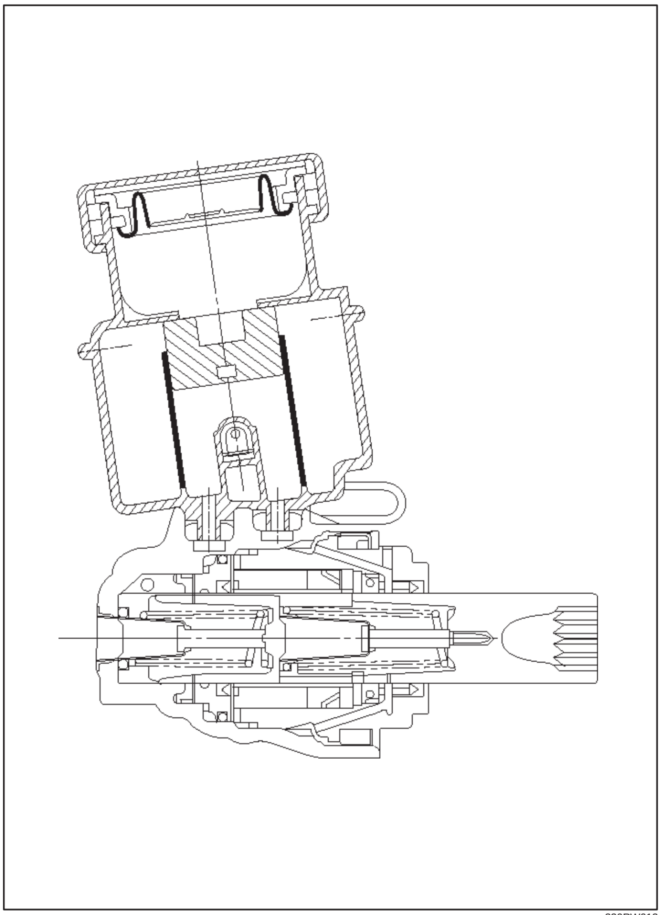
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Master Cylinder Assembly



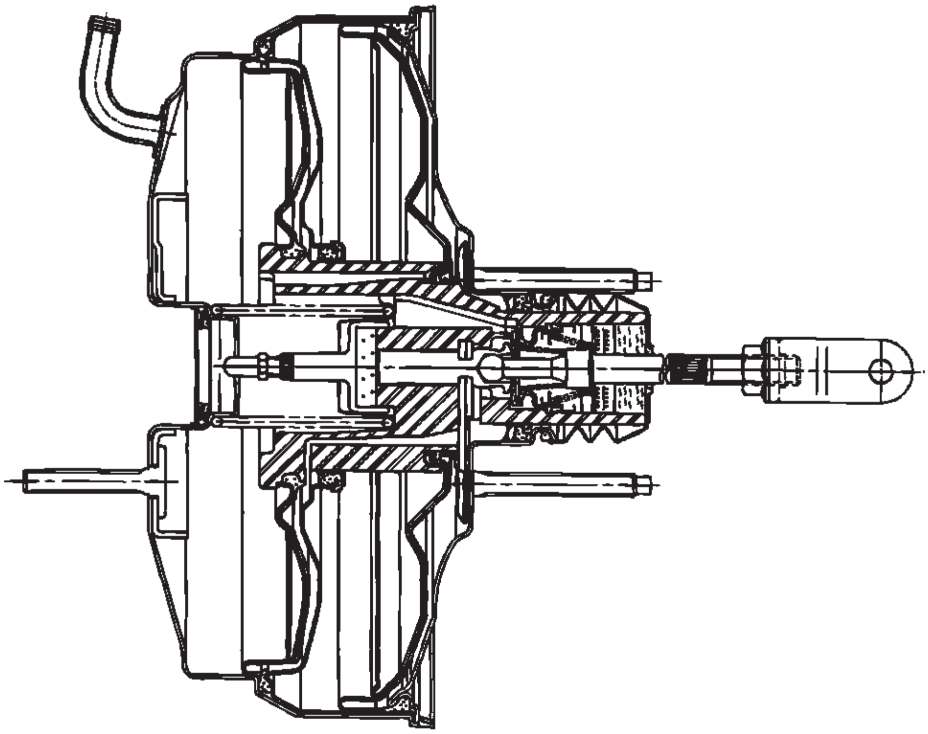
330RW013

The master cylinder contains two pistons that supply the hydraulic pressure for a dual–circuit braking system. The primary piston provides the fluid pressure to the front brakes, while the secondary piston provides the fluid pressure to the rear brakes. If the pressure is lost from either system, the remaining system will function to stop the vehicle.

CAUTION:

1. **The master cylinder is not repairable. If found defective, it must be replaced as a complete assembly.**
2. **If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system. (Refer to “On–Vehicle Service” in this section.)**
3. **The torque values specified are for dry, un-lubricated fasteners.**
4. **Perform service operations on a clean bench free from all mineral oil materials.**

Brake Booster



331RS001

This booster is a tandem vacuum unit with a diaphragm effective diameter 205mm + 230mm. In normal operating mode, with the service brakes in the released position, the tandem vacuum booster operates with vacuum on both sides of its diaphragms. When the brakes are applied, air at atmospheric pressure is admitted to one side of each diaphragm to provide the power assist. When the service brake is released, the atmospheric air is shut off from the one side of each diaphragm. The air is then drawn from the booster through the vacuum check valve to the vacuum source.

CAUTION:

1. **If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.**
2. **The torque values specified are for dry, unlubricated fasteners.**
3. **The vacuum booster is not repairable and must be replaced as a complete assembly.**

Disc Brake

The disc brake assembly consists of a caliper, piston, rotor, pad assembly and support bracket. The caliper assembly has a single bore and is mounted to the support bracket with two mounting bolts. The support bracket allows the caliper to move laterally against the rotor. The caliper is a one–piece casting with the inboard side containing the piston bore. A square cut rubber seal is located in a groove in the piston bore which provides the hydraulic seal between the piston and the cylinder wall.

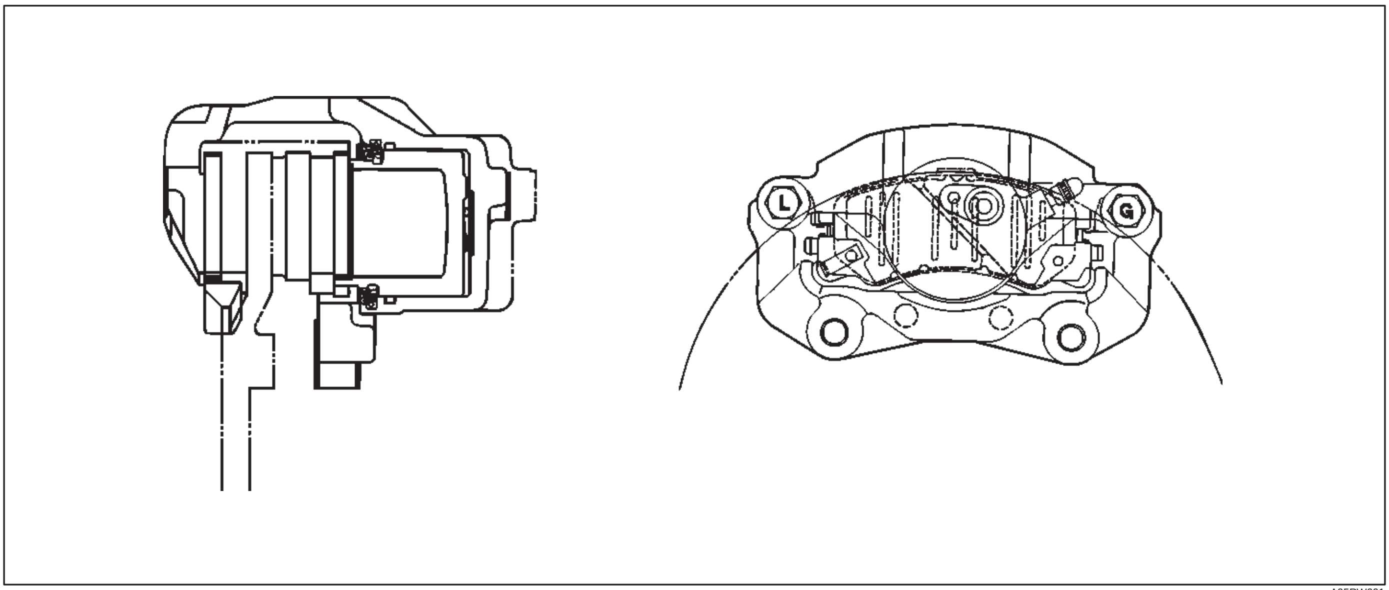
NOTE:

1. Replace all components included in repair kits used to service this caliper.
2. Lubricate rubber parts with clean brake fluid to ease assembly.
3. If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.
4. Replace pads in axle sets only.

5. The torque values specified are for dry, unlubricated fasteners.
6. Perform the service operation on a clean bench free from all mineral oil materials.

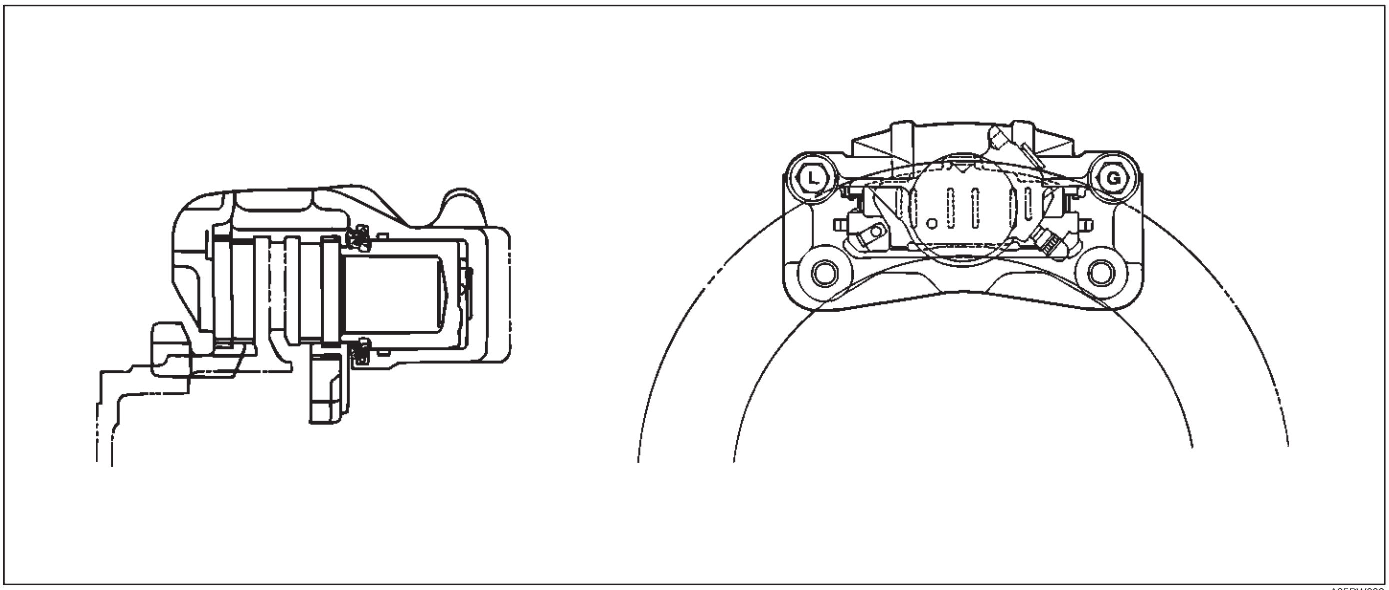
Operation

Front Disc Brake



A05RW001

Rear Disc Brake



A05RW002

Hydraulic pressure, created by applying the brake pedal, is converted by the caliper to a stopping force. This force acts equally against the piston and the bottom of the caliper bore to move the piston outward and to move (slide) the caliper inward resulting in a clamping action on the rotor. This clamping action forces the linings against the rotor, creating friction to stop the vehicle.

Diagnosis

Road Testing The Brakes

Brake Test

Brakes should be tested on a dry, clean, reasonably smooth and level roadway. A true test of brake performance cannot be made if the roadway is wet, greasy or covered with loose dirt so that all tires do not grip the road equally. Testing will also be adversely affected if the roadway is crowned so as to throw the weight of the vehicle toward wheels on one side or if the roadway is so rough that wheels tend to bounce. Test the brakes at different vehicle speeds with both light and heavy pedal pressure; however, avoid locking the wheels and sliding the tires. Locked wheels and sliding tires do not indicate brake efficiency, since heavily braked but turning wheels will stop the vehicle in less distance than locked wheels. More tire–to–road friction is present with a heavily braked turning tire then with a sliding tire.

The standard brake system is designed and balanced to avoid locking the wheels except at very high deceleration levels.

It is designed this way because the shortest stopping distance and best control is achieved without brake lock–up.

Because of high deceleration capability, a firmer pedal may be felt at higher deceleration levels.

External Conditions That Affect Brake Performance

1. Tires: Tires having unequal contact and grip on the road will cause unequal braking. Tires must be equally inflated, identical in size, and the thread pattern of right and left tires must be approximately equal.
2. Vehicle Loading: A heavily loaded vehicle requires more braking effort.
3. Wheel Alignment: Misalignment of the wheels, particularly in regard to excessive camber and caster, will cause the brakes to pull to one side.

Brake Fluid Leaks

With engine running at idle and the transmission in “Neutral”, depress the brake pedal and hold a constant foot pressure on the pedal. If pedal gradually falls away with the constant pressure, the hydraulic system may be leaking.

Check the master cylinder fluid level. While a slight drop in the reservoir level will result from normal lining wear, an abnormally low level in reservoir indicates a leak in the system. The hydraulic system may be leaking internally as well as externally. Refer to “Master Cylinder Inspection”. Also, the system may appear to pass this test but still have slight leakage. If fluid level is normal, check the vacuum booster push rod length. If an incorrect length push rod is found, adjust or replace the push rod. Check the brake pedal travel and the parking brake adjustment. When checking the fluid level, the master cylinder fluid level may be low from the “MAX” mark if the front and rear linings are worn. This is not abnormal.

Warning Light Operation

When the ignition switch is in the START position, the “BRAKE” warning light should turn on and go off when the ignition switch returns to the ON position.

The following conditions will turn on the “BRAKE” light:

1. Parking brake applied. The light should be on whenever the parking brake is applied and the ignition switch is on.
2. Low fluid level. A low fluid level in the master cylinder will turn the “BRAKE” light on.
3. During engine cranking the “BRAKE” light should remain on. This notifies the driver that the warning circuit is operating properly.

General Diagnosis

Condition	Possible cause	Correction
Brake Pull	Tire inflation pressure is unequal.	Adjust
	Front wheel alignment is incorrect.	Adjust
	Unmatched tires on same axle.	Tires with approx. the same amount of tread should be used on the same axle.
	Restricted brake pipes or hoses.	Check for soft hoses and damaged lines. Replace with new hoses and new double“walled steel brake piping.
	Water or oil on the brake pads.	Clean or replace.
	Brake pads hardened.	Replace
	Brake pads worn excessively.	Replace
	Brake rotor worn or scored.	Grind or replace.
	Disc brake caliper malfunctioning.	Clean or replace.
	Front hub bearing preload incorrect.	Adjust or replace.
	Loose suspension parts.	Check all suspension mountings.
	Loose calipers.	Check and tighten the bolts to specifications.
Brake Roughness or Chatter (Pulsates)	Excessive lateral runout.	Check per instructions. If not within specifications, replace or machine the rotor.
	Parallelism not within specifications.	Check per instructions. If not within specifications, replace or machine the rotor.
	Wheel bearings not adjusted.	Adjust wheel bearings to correct specifications
	Pad reversed (steel against iron).	Replace the brake pad and machine rotor to within specifications.
Excessive Pedal Effort	Malfunctioning vacuum booster.	Check the vacuum booster operation and repair, if necessary.
	Partial system failure.	Check the front and rear brake system for failure and repair. Also, check the brake warning light. If a failed system is found, the light should indicate failure.
	Excessively worn pad.	Check and replace pads in sets.
	Piston in caliper stuck or sluggish.	Remove caliper and rebuild.
	Fading brakes due to incorrect pad.	Remove and replace with original equipment pad or equivalent.
	Vacuum leak to vacuum booster.	Check for ruptured or loose hose.
	Check the direction of check valve within vacuum hose.	Correct vacuum hose direction.
	Grease on the brake pads.	Replace or clean.

Condition	Possible cause	Correction
Excessive Brake Pedal Travel	Air in hydraulic circuit.	Bleed the hydraulic circuit.
	Level of brake fluid in the reservoir too low.	Replenish brake fluid reservoir to specified level and bleed hydraulic circuit as necessary.
	Master cylinder push rod clearance excessive.	Adjust
	Leakage in hydraulic system.	Correct or replace defective parts.
Brake Drag	Master cylinder pistons not returning correctly.	Adjust the stop light switch and vacuum booster push rod. If necessary, rebuild.
	Restricted brake pipes or hoses.	Check for soft hoses or damaged pipes, and replace with new hoses and new double–walled steel brake piping.
	Parking brake misadjusted.	Adjust
	Parking brake lining clearance insufficient.	Adjust
	Brake pedal free play insufficient.	Adjust the brake pedal height or power cylinder operating rod.
	Piston in the master cylinder sticking.	Replace
	Piston in the disc brake caliper sticking.	Replace piston seals.
	Brake pads sticking in caliper.	Clean
	Return spring weakened.	Replace
	Parking brake binding.	Overhaul the parking brakes and correct.
	Front hub bearing preload incorrect.	Adjust or replace.
	Parking brake shoes not returning.	Correct or replace the brake back plate and brake shoe as necessary.
	Obstructions in hydraulic circuit.	Clean
	Brake disc warped excessively.	Grind or replace.
	Rear brake drum distorted.	Grind or replace.
	Parking cable sticking.	Grind or replace.
Grabbing or Uneven Braking Action (All conditions listed under "Pulls")	Malfunctioning vacuum booster.	Check operation and correct as necessary.
	Binding brake pedal mechanism.	Check and lubricate, if necessary.
	Corroded caliper assembly.	Clean and lubricate.
Brake Noisy	Brake pads are worn.	Replace
	Brake pads are hardened.	Replace
	Brake pads are in poor contact with rotor.	Correct
	Brake disc(s) warped, worn or damaged.	Grind or replace.
	Disc brake anti–squeak shims fatigued.	Replace
	Front hub bearings are loose or preload is incorrect.	Adjust or replace.
	Brake disc is rusted.	Grind or replace.

Condition	Possible cause	Correction
Poor Brake Action	Master cylinder faulty.	Correct or replace.
	Vacuum booster faulty.	Correct or replace.
	Level of brake fluid in reservoir too low.	Replenish and bleed.
	Air in hydraulic circuit.	Bleed
	Disc brake caliper faulty.	Clean or replace.
	Water or oil on brake pads.	Clean or replace.
	Brake pads in poor contact with the brake disc.	Correct
	Brake pads worn.	Replace
	Brake disc rusted.	Grind or replace.
	Check valve in vacuum hose faulty.	Correct or replace.

Hydraulic Brakes

Filling Master Cylinder Reservoir

CAUTION: Use only specified brake fluid. Do not use any fluid which contains a petroleum base. Do not use a container which has been used for petroleum based fluids or a container which is wet with water. Petroleum based fluid will cause swelling and distortion of rubber parts in the hydraulic brake system. Water mixed with brake fluid lowers the fluid boiling point. Keep all fluid containers capped to prevent contamination.

Always fill the master cylinder reservoir when the engine is cold.

Never allow the brake fluid to come in contact with the painted surfaces.

The master cylinder reservoir must be kept properly filled to ensure adequate reserve and to prevent air and moisture from entering the hydraulic system. However, because of expansion due to heat absorbed from the brakes and the engine, the reservoir must not be overfilled. The brake fluid reservoir is on the master cylinder, which is located under the hood on the left side of the cowl. Thoroughly clean reservoir cap before removal to avoid getting dirt into reservoir. Remove cup and diaphragm. Add fluid as required to bring level to the “MAX” mark on the reservoir tank. Use “DOT 3” Hydraulic Brake Fluid. If the fluid cap diaphragm is stretched, return it to the original position before installing.

Deterioration of Brake Fluid

Using any other brake fluid than specified or brake fluid with mineral oil or water mixed in will drop the boiling point of brake fluid. It may, in turn, result in vapor lock or deteriorated rubber parts of the hydraulic system. Be sure to change the brake fluid at specified intervals.

If the rubber parts are deteriorated, remove all the system parts and clean them with alcohol. Prior to reassembly, dry the cleaned parts with air to remove the alcohol. Replace all the hoses and rubber parts of the system.

Leakage of Brake Fluid

With engine idling, set shift lever in the neutral position and continue to depress brake pedal at a constant pedal application force.

Should the pedal stroke become deeper gradually, a leakage from the hydraulic pressure system is possible. Make sure by visual check that there is no leak.

Bleeding Brake Hydraulic System

A bleeding operation is necessary to remove air from the hydraulic brake system whenever air is introduced into the hydraulic system. It may be necessary to bleed the hydraulic system at all four brakes if air has been introduced through a low fluid level or by disconnecting brake pipes at the master cylinder. If a brake pipe is disconnected at one wheel, only that wheel cylinder/caliper needs to be bled. If the pipes are disconnected at any fitting located between the master cylinder and brakes, then the brake system served by the disconnected pipe must be bled.

1. For 4–Wheel Antilock Brake System (ABS) equipped vehicle, be sure to remove the ABS main fuse 40A located at the relay and fuse box before bleeding air. If you attempt to bleed air without removing the main fuse, air cannot be let out thoroughly, and this may cause damage to the hydraulic unit. After bleeding air, be sure to replace the ABS main fuse back to its original position.
2. Set the parking brake completely, then start the engine.

NOTE: The vacuum booster will be damaged if the bleeding operation is performed with the engine off.

3. Remove the master cylinder reservoir cap.
4. Fill the master cylinder reservoir with brake fluid. Keep the reservoir at least half full during the air bleeding operation
5. Always use new brake fluid for replenishment.
6. In replenishing brake fluid, take care that air bubbles do not enter the brake fluid.

   When the master cylinder is replaced or overhauled, first bleed the air from the master cylinder, then from each wheel cylinder and caliper following the procedures described below.

Bleeding the Master Cylinder

7. Disconnect the rear wheel brake pipe (1) from the master cylinder.

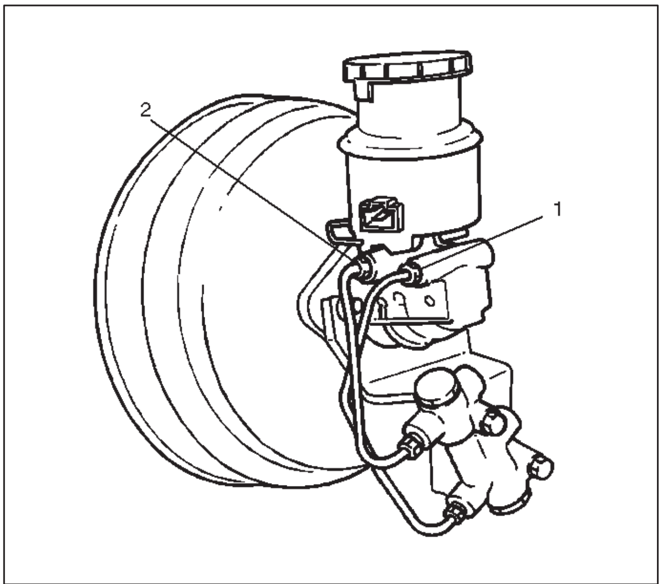
   Check the fluid level and replenish as necessary. If replenished, leave the system for at least one minute.
8. Depress the brake pedal slowly once and hold it depressed.
9. Completely seal the delivery port of the master cylinder with your finger, where the pipe was disconnected then release the brake pedal slowly.
10. Release your finger from the delivery port when the brake pedal returns completely.
11. Repeat steps 7 through 9 until the brake fluid comes out of the delivery port during step 7.

NOTE: Do not allow the fluid level in the reservoir to go below the half–way mark.

12. Reconnect the brake pipe (1) to the master cylinder and tighten the pipe.
13. Depress the brake pedal slowly once and hold it depressed.
14. Loosen the rear wheel brake pipe (1) at the master cylinder.
15. Retighten the brake pipe, then release the brake pedal slowly.

16. Repeat steps 13 through 15 until no air comes out of the port when the brake pipe is loosened

NOTE: Be very careful not to allow the brake fluid to come in contact with painted surfaces.



330RS023

17. Bleed the air from the front wheel brake pipe connection (2) by repeating steps 7 through 16.

Bleeding the Caliper

18. Bleed the air from each wheel in the order listed below:
    - Right rear caliper
    - Left rear caliper
    - Right front caliper
    - Left front caliper

    Conduct air bleeding from the wheels in the above order. If no brake fluid comes out, it suggests that air is mixed in the master cylinder. In this case, bleed air from the master cylinder in accordance with steps 7 through 17, and then bleed air from the caliper.
19. Place the proper size box end wrench over the bleeder screw.
20. Cover the bleeder screw with a transparent tube, and submerge the free end of the transparent tube in a transparent container containing brake fluid.
21. Pump the brake pedal slowly three (3) times (once/sec), then hold it depressed.
22. Loosen the bleeder screw until fluid flows through the tube.
23. Retighten the bleeder screw.
24. Release the brake pedal slowly.
25. Repeat steps 21 through 24 until the air is completely removed.

    It may be necessary to repeat the bleeding procedure 10 or more times for front wheels and 15 or more times for rear wheels.
26. Go to the next wheel in the sequence after each wheel is bled.

    Be sure to monitor reservoir fluid level.
27. Depress the brake pedal to check if you feel “sponginess” after the air has been removed from all wheel cylinders and calipers.

    If the pedal feels “spongy”, the entire bleeding procedure must be repeated.
28. After the bleeding operation is completed on the each individual wheel, check the level of the brake fluid in the reservoir and replenish up to the “MAX” level as necessary.
29. Attach the reservoir cap.

    If the diaphragm inside the cap is deformed, reform it and install.
30. Stop the engine.

Flushing Brake Hydraulic System

It is recommended that the entire hydraulic system be thoroughly flushed with clean brake fluid whenever new parts are installed in the hydraulic system. Approximately one quart of fluid is required to flush the hydraulic system. The system must be flushed if there is any doubt as to the grade of fluid in the system or if fluid has been used when it contains the slightest trace of mineral oil. All rubber parts that have been subjected to a contaminated fluid must be replaced.

Brake Pipes and Hoses

The hydraulic brake system components are interconnected by special steel piping and flexible hoses. Flexible hoses are used between the frame and the front calipers, the frame and rear axle case and the rear axle and the rear calipers.
When the hydraulic pipes have been disconnected for any reason, the brake system must be bled after reconnecting the pipe. Refer to “Bleeding the Brake Hydraulic System” in this section.

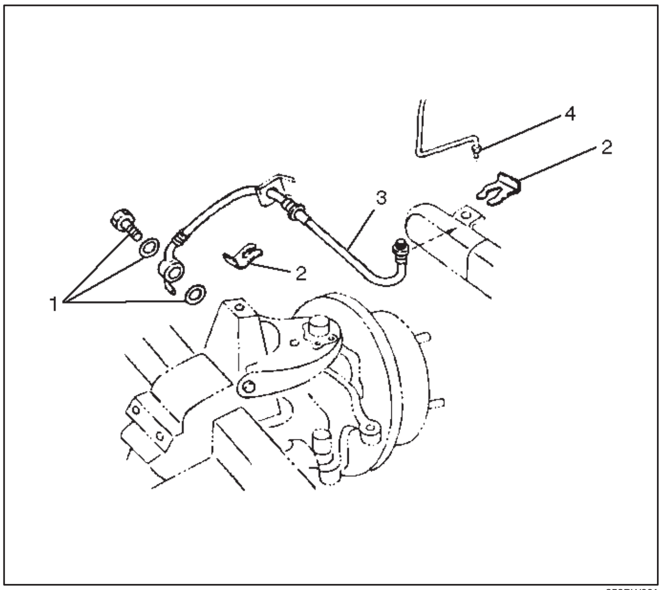
Brake Hose Inspection

The brake hose should be inspected at least twice a year. The brake hose assembly should be checked for road hazard, cracks and chafing of the outer cover, and for leaks and blisters. Inspect for proper routing and mounting of the hose. A brake hose that rubs on suspension components will wear and eventually fail. A light and mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, adjust or replace the hose as necessary.

CAUTION: Never allow brake components such as calipers to hang from the brake hoses, as damage to the hoses may occur.

Front / Rear Caliper Brake Hose

Front / Rear Caliper Brake Hose and Associated Parts



352RW001

Legend

(1) Bolt and Gasket
(2) Clip
(3) Hose
(4) Brake Pipe

Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove the wheel and tire assembly.
3. Clean dirt, grease, and other foreign material off the hose fittings at both ends.
4. Disconnect brake pipe.
5. Remove clip.
6. Remove bolt and gasket.
7. Remove hose.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the brake pipes to the specified torque

   Torque: 16 N·m (12 lb ft)

2. Tighten the bolt to the specified torque.

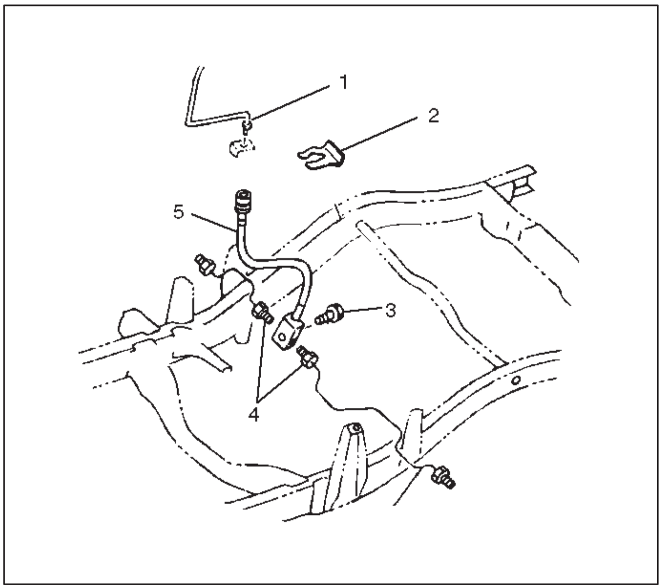
   Torque: 35 N·m (26 lb ft)

NOTE: Always use new gaskets and be sure to put the hooked edge of the flexible hose end into the anti–rotation cavity.

After installing the brake hoses, bleed the brakes as described in this section.

Rear Axle Brake Hose

Rear Axle Brake Hose and Associated Parts



352RW002

Legend

(1) Brake Pipe
(2) Clip
(3) Bolt
(4) Brake Pipe
(5) Hose

Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove wheel and tire assembly.
3. Clean dirt, grease, and other foreign material off the hose fittings at both ends.
4. Disconnect brake pipe.
5. Remove clip.
6. Remove brake pipe.
7. Remove bolt.
8. Remove hose.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the brake pipes to the specified torque

   Torque: 16 N·m (12 lb ft)

2. Tighten the bolt to the specified torque.

   Sems bolts

   Torque: 13 N·m (113 lb in)

   Flange bolts

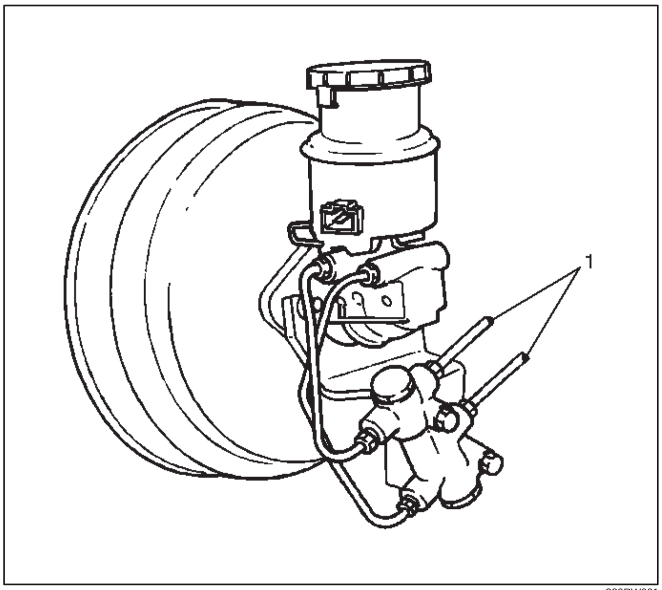
   Torque: 15 N·m (11 lb ft)

After installing the brake hoses, bleed the brakes as described in this section.

Brake Pipe

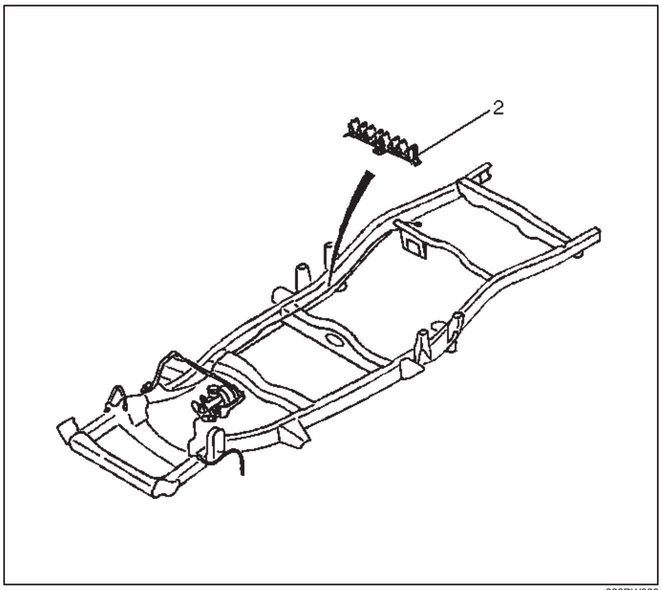
Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove wheel and tire assembly as necessary.
3. Clean dirt, grease, and other foreign material off the pipe fittings at both ends.
4. Remove brake pipe (1).



330RW001

5. Remove plastic clip (2).



330RW002

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the brake pipes to the specified torque.

   Master cylinder side

   Torque: 12 N·m (104 lb in)

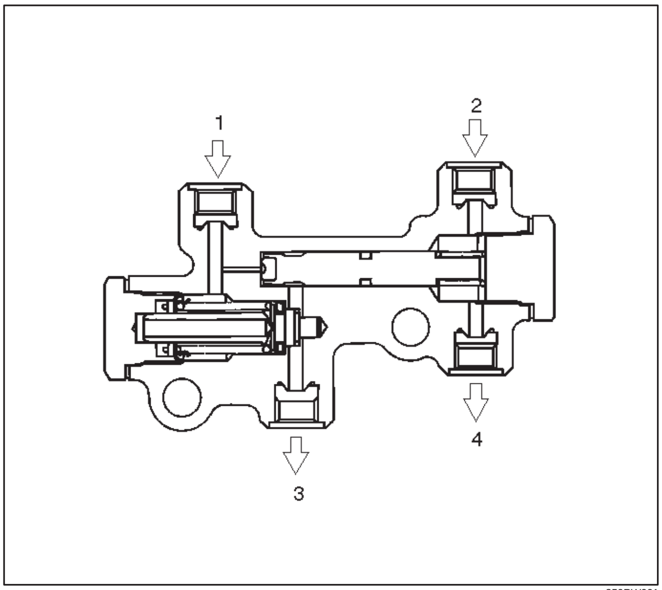
   Other

   Torque: 16 N·m (12 lb ft)

After installing the brake pipes, bleed the brakes as described in this section.

P & B (Proportioning and Bypass) Valve

P & B (Proportioning and Bypass) Valve Sectional View



350RW001

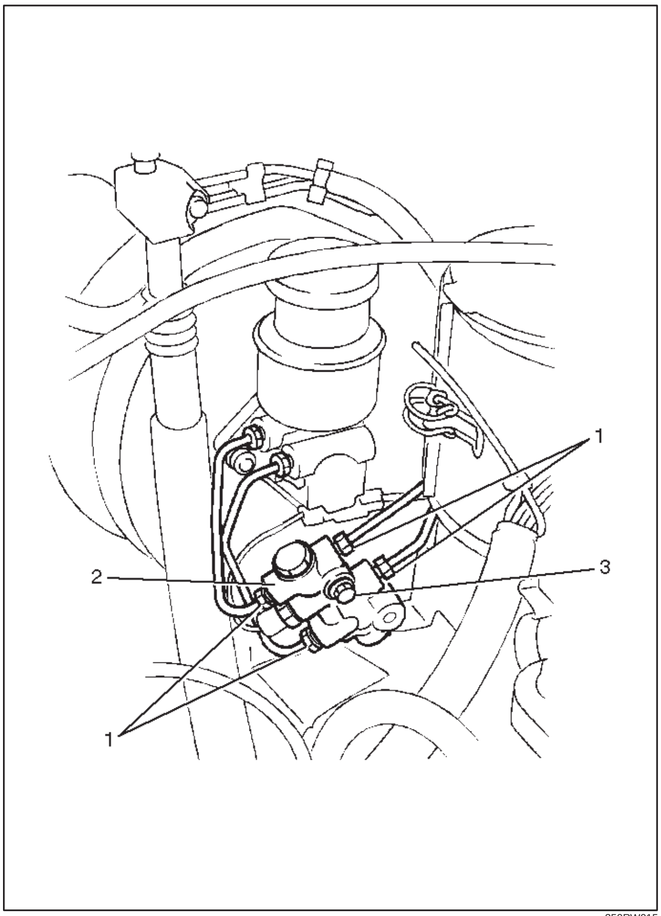
Legend

(1) Master Cylinder (Secondary)
(2) Master Cylinder (Primary)
(3) Rear Brake
(4) Front Brake

The P&B valve contains two sections, each serving a different function.
The proportioning section of the P&B valve proportions outlet pressure to the rear brakes after a predetermined rear input pressure has been reached. This is done to prevent rear wheel lock up on the vehicles with light rear wheel loads. The valve has a pass feature which assures full system pressure to the rear brakes in the event of front brake system malfunction. Also full front pressure is retained in the event of rear brake malfunction.
The combination valve has a pressure differential warning switch which is designed to constantly compare front and rear brake pressure from the master cylinder and turn on the brake system warning light on the instrument panel in the event of a front or rear system malfunction. The valve and switch are so designed that the switch will latch in the warning position once a malfunction has occured. The only way the light can be turned off is to repair the malfunction and apply a pedal forced required to developed line pressure. The P&B valve is not repairable and must be replaced as a complete assembly.

Removal

1. The P&B valve is not repairable and must be replaced as a complete assembly. Care must be taken to prevent brake fluid from contacting any painted surface.
2. Remove hydraulic pipes (1) and plug (1) the pipes to prevent the loss of fluid or the entrance of dirt.
3. Remove bolt (3).
4. Remove P&B valve (2).



350RW015

Installation

1. Install P&B valve (2).
2. Install bolt (3) and tighten the bolt to the specified torque.

   Torque: 13 N·m (113 lb in)

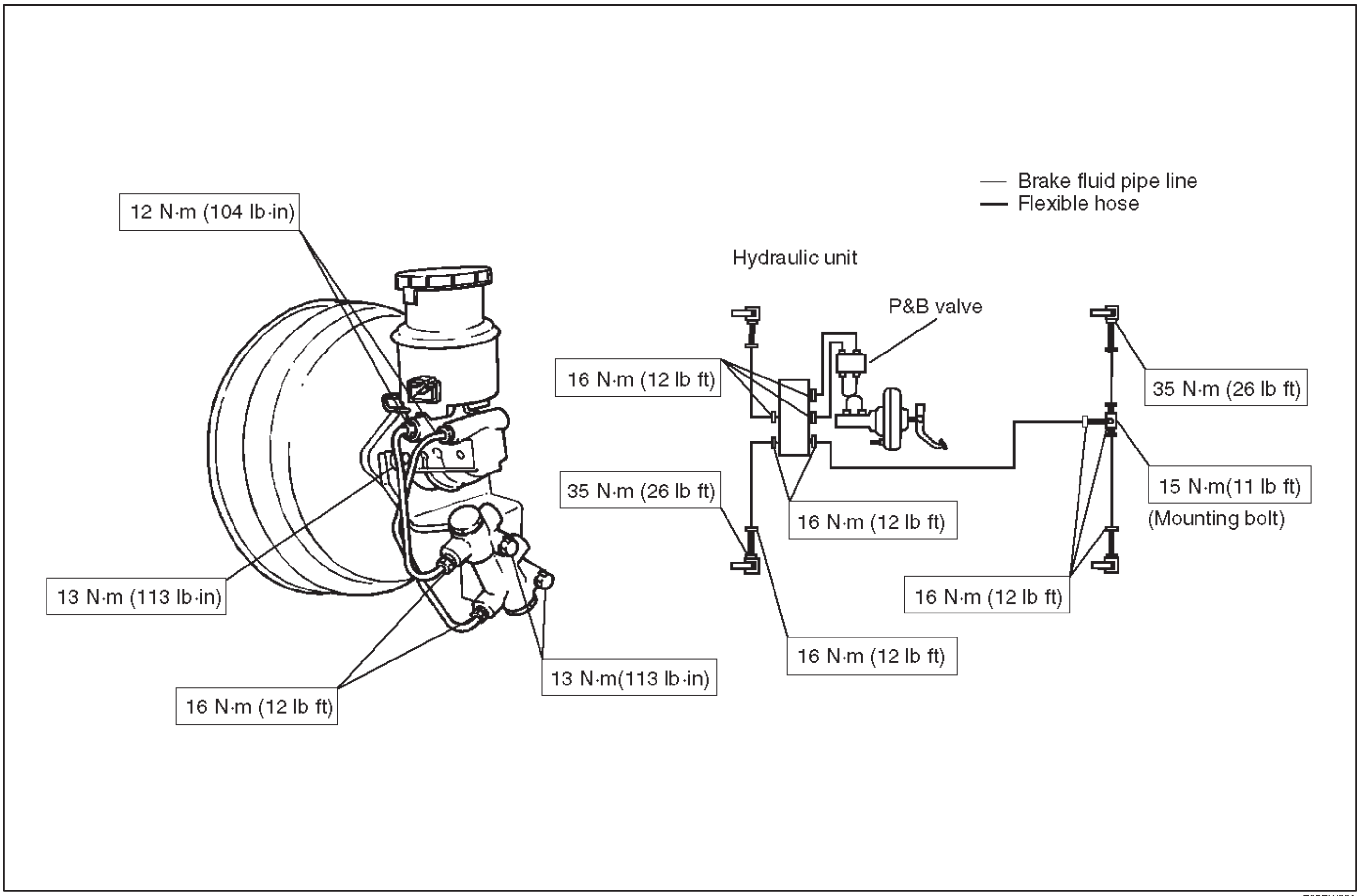
3. Install hydraulic pipes (1) and tighten the bolt to the specified torque.

   Torque: 16 N·m (12 lb ft)

4. After installing the brake pipes, bleed the brakes refering to “Bleeding Brake Hydraulic System” in this section.

Main Data and Specifications

Torque Specifications



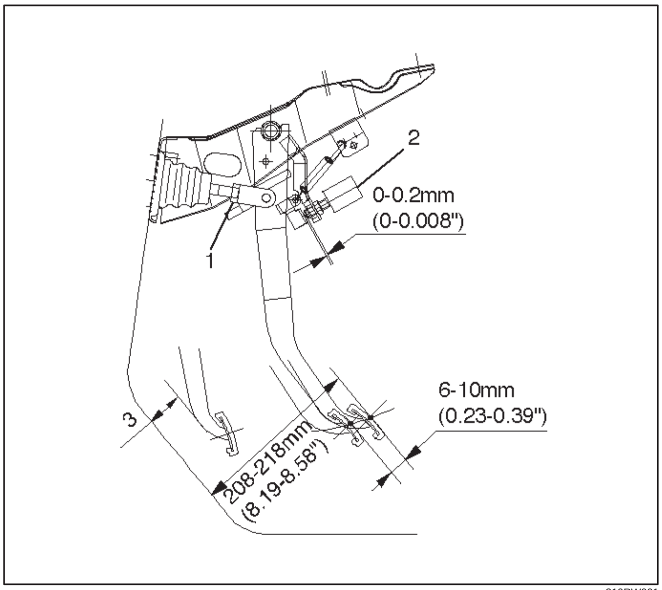
E05RW001

Brake Pedal

Checking Pedal Height

The push rod serves as the brake pedal stopper when the pedal is fully released. Brake pedal height adjustment should be performed as follows:

Adjust Brake Pedal



310RW001

1. Measure the brake pedal height after making sure the pedal is fully returned by the pedal return spring.
   Pedal height must be measured after starting the engine and receiving it several times.

   Pedal Free Play : 6-10 mm (0.23-0.39 in)

   Pedal Free Play : 208-218 mm (8.19-8.58 in)

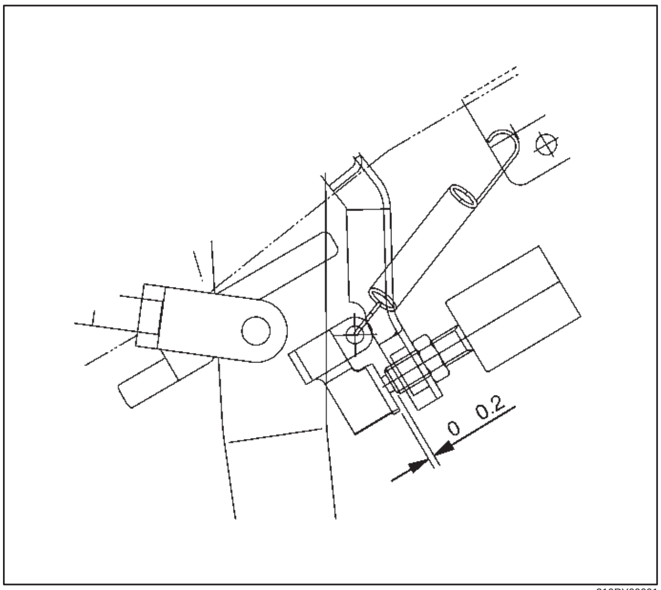
NOTE: Pedal free play must be measured after turning off the engine and stepping on the brake pedal firmly five times or more.

2. If the measured value is not within the above range, adjust the brake pedal as follows:
   a. Disconnect the stoplight switch connector.
   b. Loosen the stoplight switch lock nut (1).
   c. Rotate the stoplight switch so that is moves away from the brake pedal.
   d. Loosen the lock nut on the push rod.
   e. Adjust the brake pedal to the specified height by rotating the push rod in the appropriate direction.
   f. Tighten the lock nut to the specified torque.

   Torque: 20 N·m (15 lb ft)

   g. Adjust the stoplight switch to the specified clearance (between the switch housing and the brake pedal) by rotating the switch housing.

   Clearance : 0–0.2 mm (0–0.008 in)

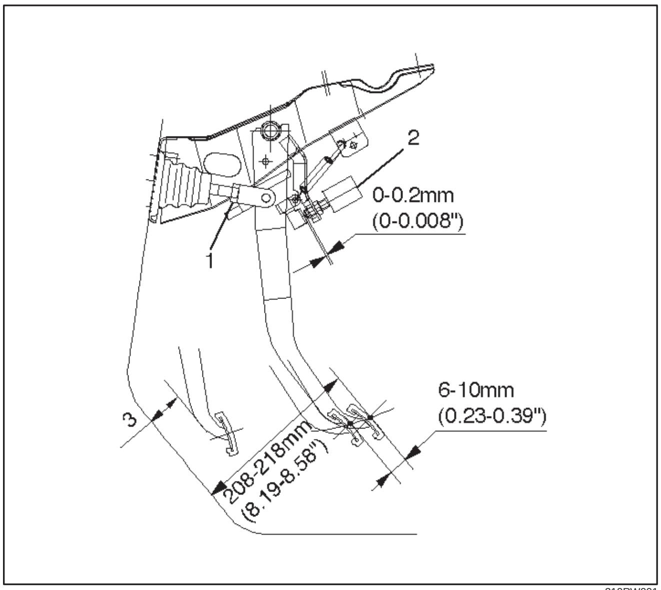


310RY00001

NOTE: While adjusting the stoplight switch, make sure that the threaded part of the stoplight switch does not push the brake pedal.

   h. Tighten the stoplight switch lock nut.
   i. Connect the stoplight switch connector.

Checking Pedal Travel



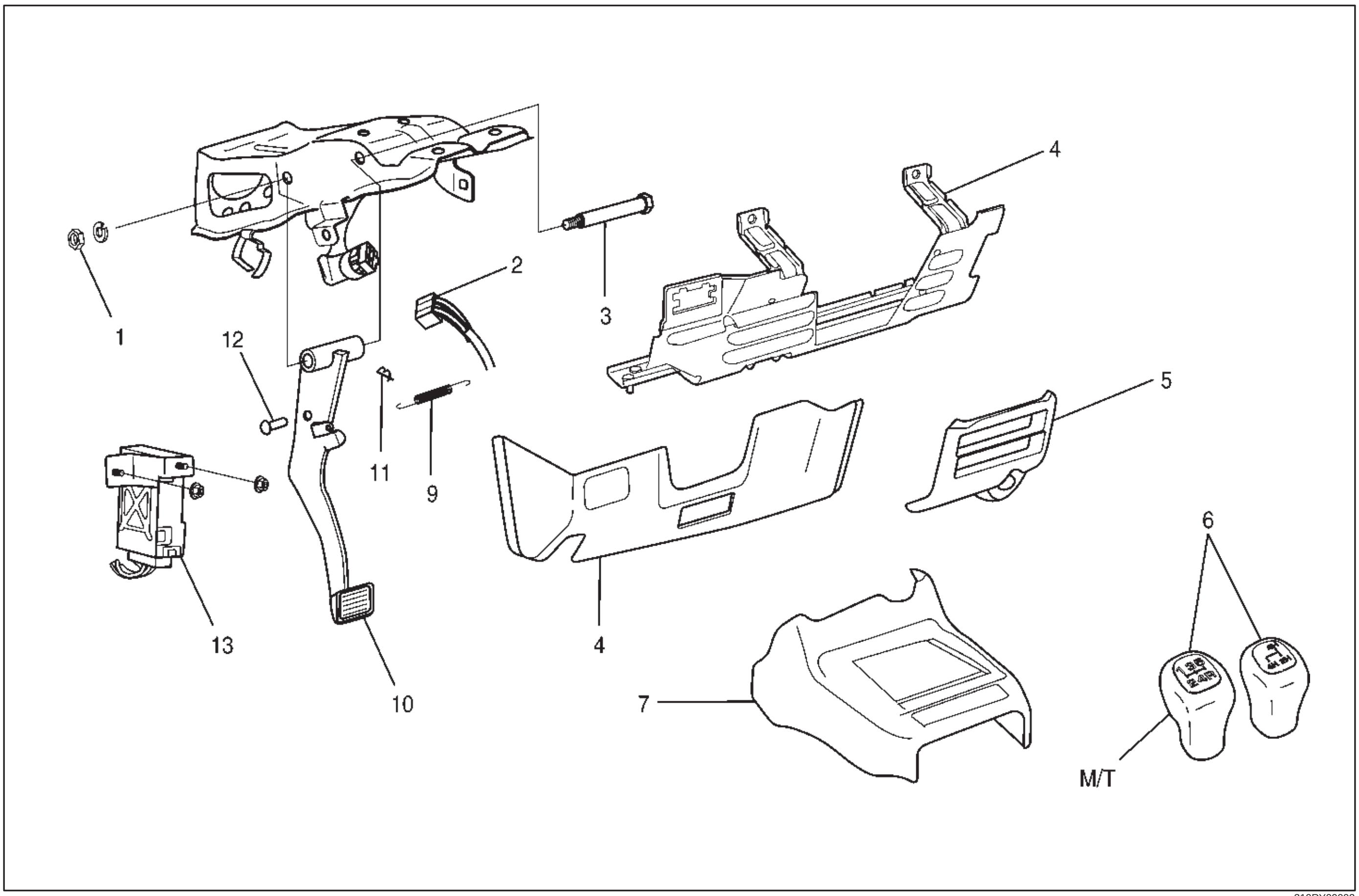
310RW001

1. Pedal height (3) must be measured after starting the engine and revving it several times to apply vacuum to the vacuum booster fully.

NOTE: Pedal height (3) must be 100 mm (3.9 in) or more when about 50 kg (110.25 lb) of stepping force is applied.

2. If the measured value is lower than the above range, air existing in the hydraulic system is suspected. Perform the bleeding procedure.

Brake Pedal and Associated Parts



Legend

(1) Nut
(2) Stoplight Switch Connector
(3) Fulcrum Pin
(4) Driver Knee Bolster Assembly
(5) Lower Cluster Assembly
(6) Shift Knob
(7) Front Console Assembly
(8) Instrument Panel Driver Lower Cover
(9) Return Spring
(10) Brake Pedal
(11) Snap Pin
(12) Pin
(13) Anti–theft Controller

Removal

1. Remove shift knob.
2. Remove front console assembly.
3. Remove lower cluster assembly.
4. Remove instrument panel driver lower cover.
5. Remove driver knee bolster assembly.
6. Remove anti–theft controller.
7. Remove stoplight switch connector.
8. Remove return spring.
9. Remove snap pin.
10. Remove pin.
11. Remove nut.
12. Remove fulcrum pin.
13. Remove brake pedal.

Installation

1. Install brake pedal.
2. Install fulcrum pin and apply grease to the entire circumference of the fulcrum pin.

   Torque: 33 N·m (24 lb ft)
3. Install nut and tighten the nut to the specified torque.

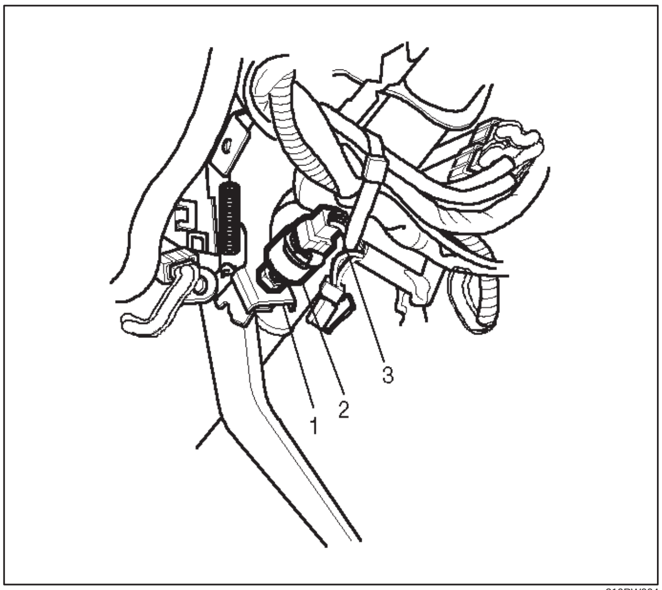
   Torque: 33 N·m (24 lb ft)
4. Install pin and apply grease to the entire circumference of the push rod pin.
5. Install snap pin and adjust the pedal free travel
   Refer to “Brake Pedal Adjustment” previously in this section.
6. Install return spring.
7. Connect stoplight switch connector.
8. Connect anti–theft connector.
9. Install driver knee bolster assembly.
10. Install instrument panel driver lower cover.

11. Install lower cluster assembly.
12. Install front console assembly.
13. Install shift knob.

Stoplight Switch

Removal

1. Remove shift knob.
2. Remove front console assembly.
3. Remove lower cluster assembly.
4. Remove instrument panel driver lower cover.
5. Remove driver knee bolster assembly.
6. Remove stoplight switch connector (3).
7. Remove lock nut (1).
8. Remove switch (2).



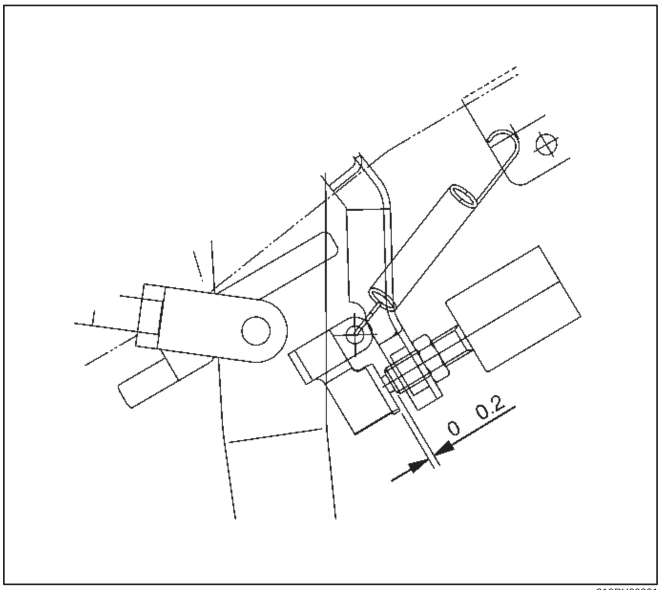
310RW004

Installation

1. Install switch and adjust the stoplight switch to the specified clearance (between the switch housing and the brake pedal) by rotating the switch housing.

   Clearance (1): 0-0.2 mm (0-0.009 in)

NOTE: While adjusting the installation of the stoplight switch, make sure that the threaded part of the stoplight switch does not push the brake pedal.



310RY00001

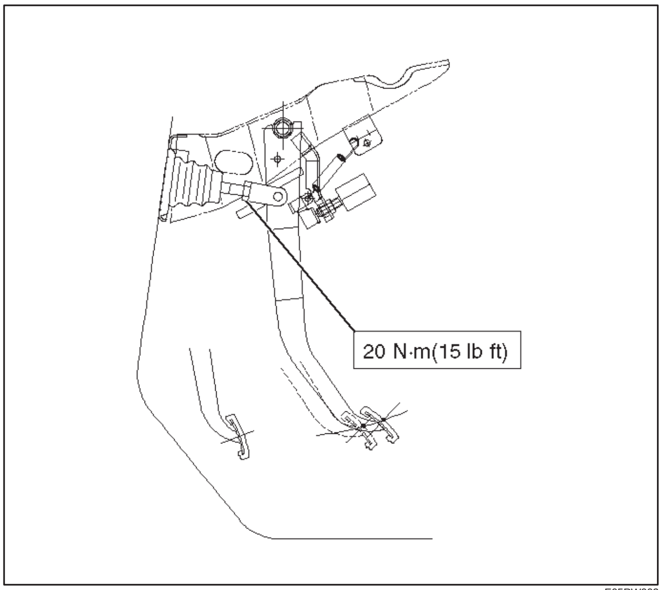
2. Install lock nut.
3. Connect stoplight switch connector.
4. Install driver knee bolster assembly.
5. Install instrument panel driver lower cover.
6. Install lower cluster assembly.
7. Install front console assembly.
8. Install shift knob.

Main Data and Specifications

General Specifications

Pedal free play	6–10 mm (0.23 –0.39 in)
Pedal Height	208–218 mm (819–8.58 in)

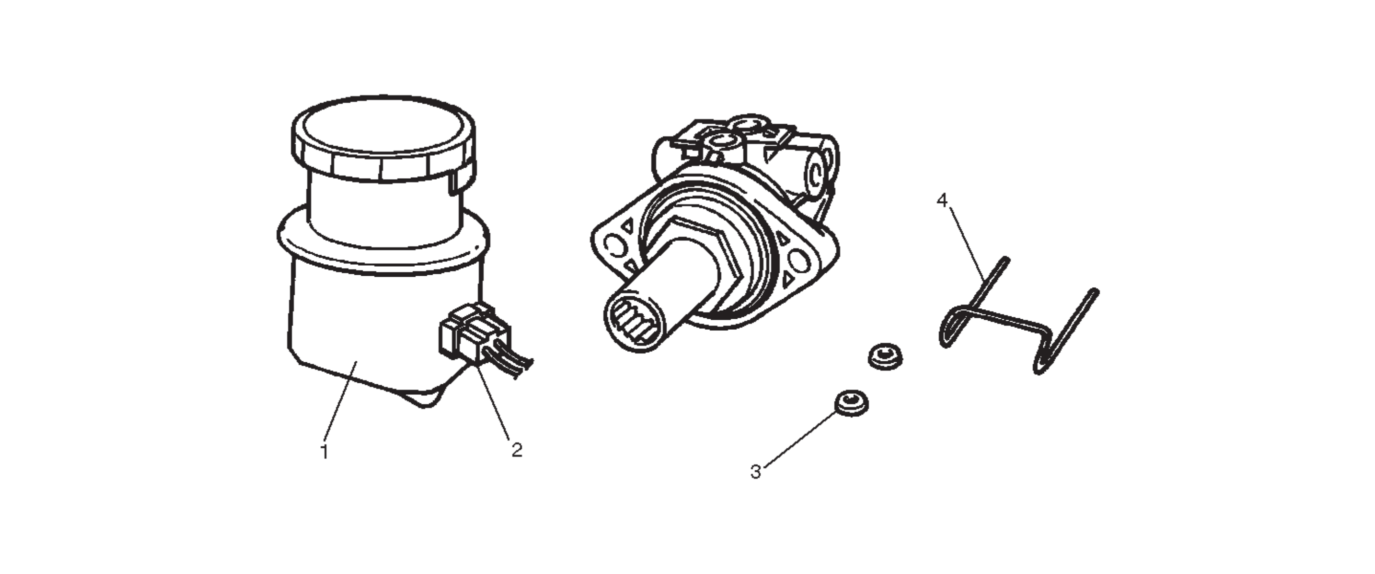
Torque Specifications



E05RW002

Fluid Reservoir Tank

Fluid Reservoir Tank and Associated Parts



330RW003

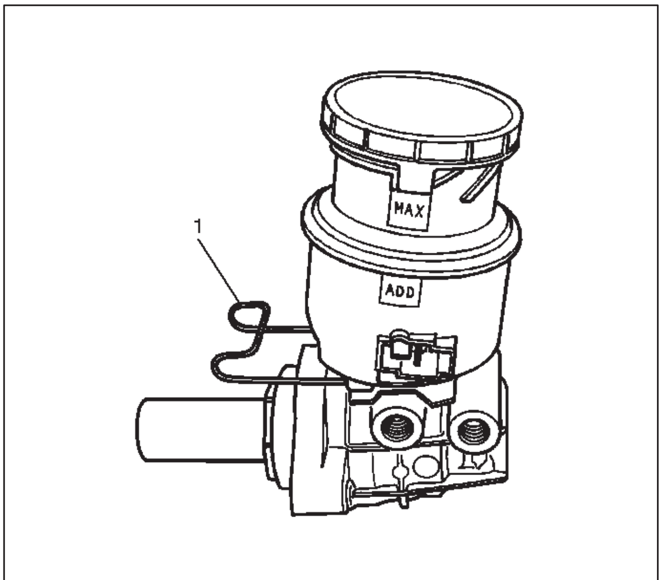
Legend

(1) Fluid Reservoir
(2) Electrical Connector
(3) O–ring
(4) Retainer

Removal

NOTE: Before removing the fluid reservoir, remove the brake fluid from the fluid reservoir.

1. Disconnect electrical connector.
2. Remove retainer (1).



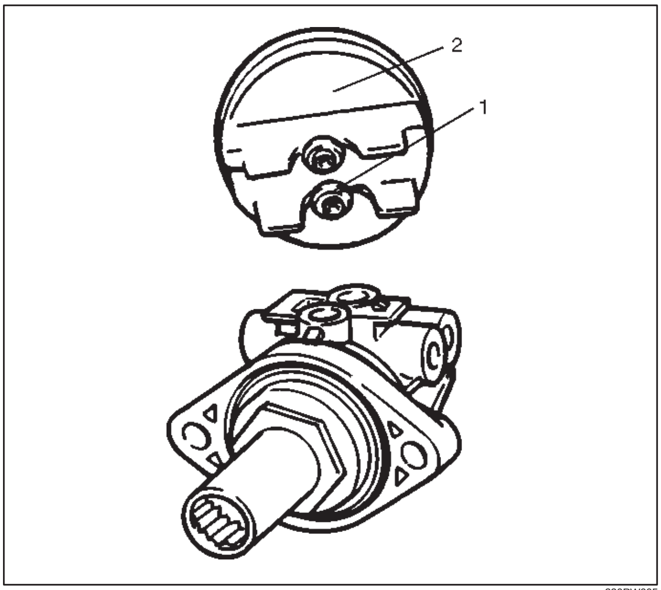
330RW004

3. Remove fluid reservoir and the fluid lever sensor built into the fluid reservoir . The fluid level sensor cannot be removed for servicing.
4. Remove O–ring.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

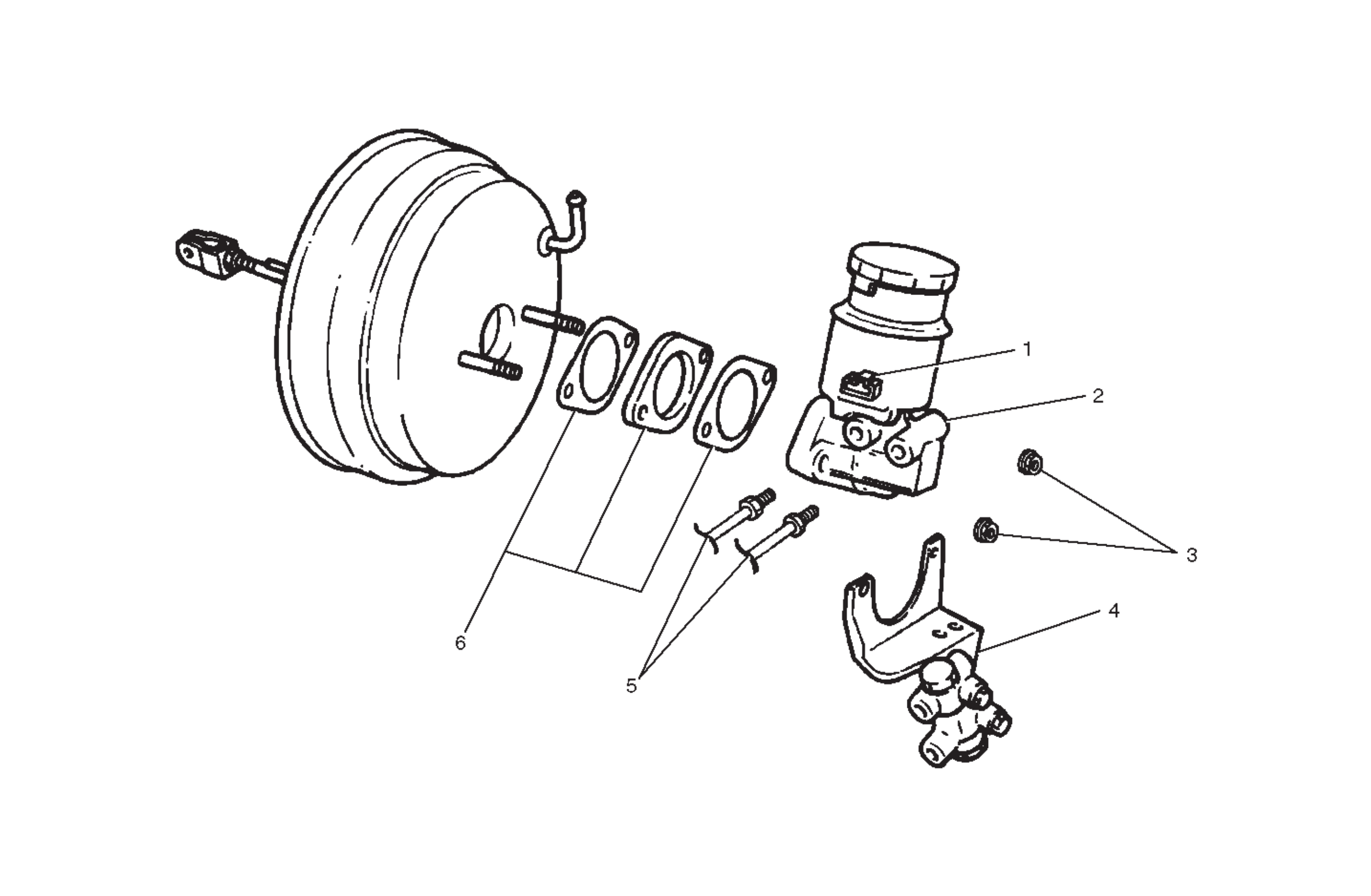
1. O–ring (1) must be set onto the fluid reservoir (2), before installing fluid reservoir.



330RW005

Master Cylinder Assembly

Master Cylinder Assembly and Associated Parts



Legend
(1) Electrical Connector
(2) Master Cylinder
(3) 2 attaching Nuts
(4) P&B Valve and Bracket
(5) Brake Pipes
(6) Spacer and 2 gaskets

Removal

CAUTION: When removing the master cylinder from the vacuum booster, be sure to get rid of the internal negative pressure of the vacuum booster (by, for instance, disconnecting the vacuum hose) in advance.

If any negative pressure remains in the vacuum booster, the piston may possibly come out when the master cylinder is being removed, letting the brake fluid run out.

While removing the master cylinder, further, do not hold the piston as it can be easily pulled out.

Outside surface of the piston is the surface on which seals are to slide. Care should be taken to keep the surface free of cuts and dents.

1. Disconnect electrical connector.
2. Remove brake pipes after disconnecting the brake pipe, cap or tape the openings of the brake pipe to prevent the entry of foreign matter.
3. Remove 2 attaching nuts.
4. Remove P&B valve and bracket.
5. Remove master cylinder.
6. Remove spacer and the 2 gaskets.

Inspection and Repair

Master Cylinder

The master cylinder is not repairable and must be replaced as a complete assembly if found defective.

Inspection

Excessive brake pedal travel, malfunction or dragging brake suggests that the master cylinder is defective. In such cases perform the following visual check.

Visual Check

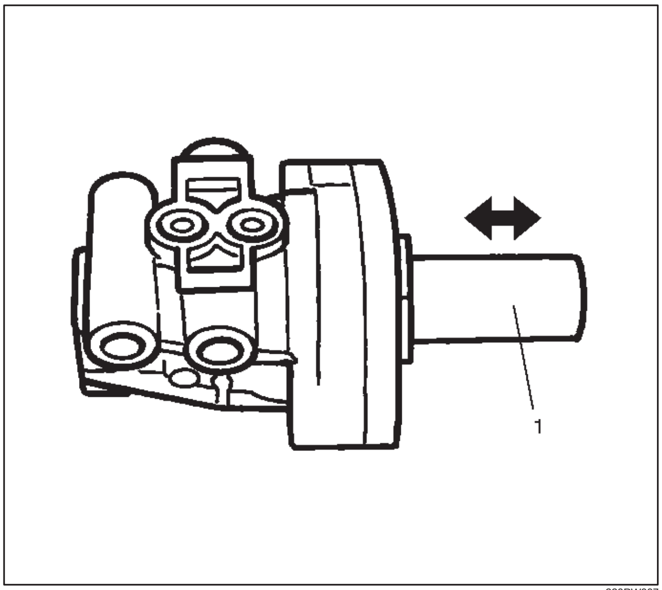
Make parts replacement as required if wear, distortion, nicks, cuts, corrosion, or other abnormal conditions are found through the following parts inspection:

- Master cylinder body
- Fluid reservoir

- O–ring

Functional Inspection of Master Cylinder Piston

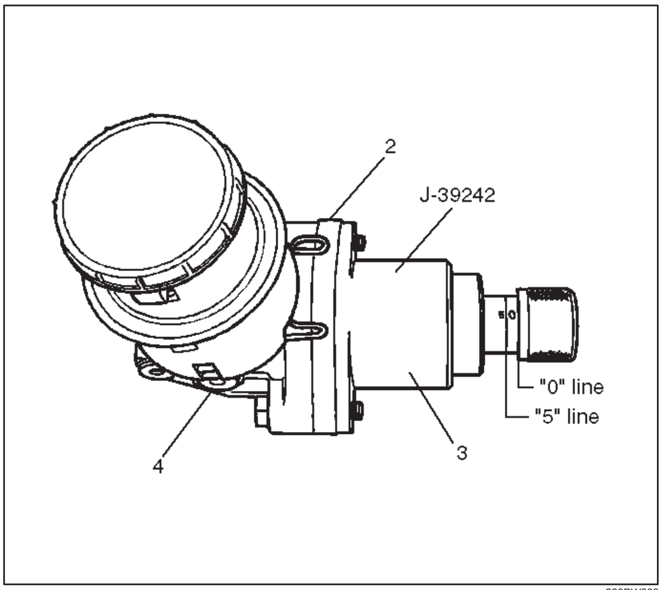
Push the primary piston (1) with your fingers to check that it travels smoothly. If the motion is questionable, replace the master cylinder as a complete assembly.



330RW007

Functional Inspection of Master Cylinder

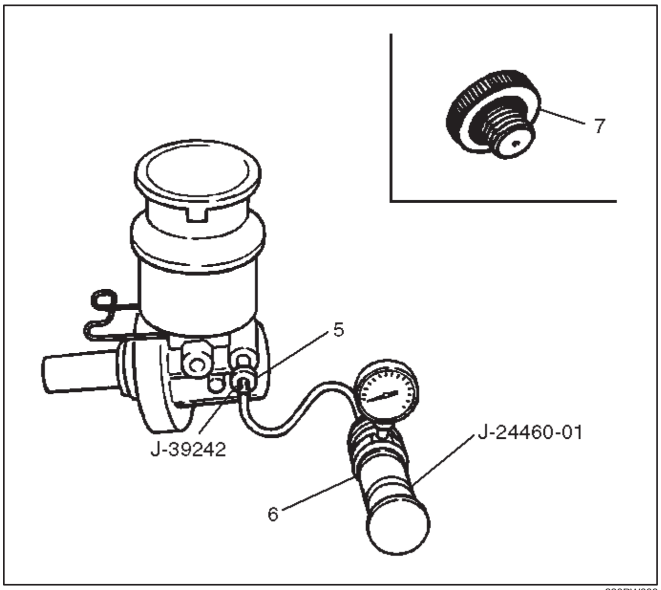
Inspect the master cylinder for function as follows. If any abnormal function is found, replace with a new one.
(including the master cylinder attachment and master cylinder plug (7))
Install the primary piston holder (3) J–39242 onto the master cylinder (4). Make sure the spacer (2) (2 bolts) with its adjusting bolt is screwed in up to the “0” line



330RW008

Connect the master cylinder attachment (5) J–39242 with the end of the radiator cap tester (6) J–24460–01, and apply air pressure with the cap tester. Make sure there is no rise in pressure and that with the adjusting bolt further screwed in 5 mm (align the adjusting bolt to the “5” line).

There should be a pressure increase of 0.5 kg/cm^2 or more.



330RW009

NOTE: When checking the front (or primary) side, be sure to mount the master cylinder plug in the rear (or secondary) port.

	“0” Line	“5” Line
Apply air pressure to the front and rear ports	No pressure rise.	Pressure increase of 0.5 kg/cm^2 or more
Remarks	Checks port into the atmospheric pressure chamber	Checks air tightness of the pressure chamber

NOTE:

1. Do not use an air compressor, as the air from the compressor is mixed with compressor oil.
2. When installing the master cylinder onto the vacuum booster, always adjust the vacuum booster push rod. (Refer to “Vacuum Booster” in this section).
3. After the master cylinder is installed onto the vehicle, check for leakage, pedal travel and pedal free play.

Installation

1. Install spacer and the 2 gaskets.
2. Install master cylinder, when replacing the master cylinder or vacuum booster or both, always measure the vacuum booster push rod protrusion and adjust it as necessary (Refer to “Vacuum Booster” in section).
3. Install P&B valve and bracket.
4. Install 2 attaching nuts and tighten the attaching nuts to the specified torque.

Torque: 13 N·m (113 lb in)

5. Install brake pipes and tighten the brake pipe to the specified torque.

   Master cylinder side

   Torque: 12 N·m (104 lb in)

   Others

   Torque: 16 N·m (12 lb ft)

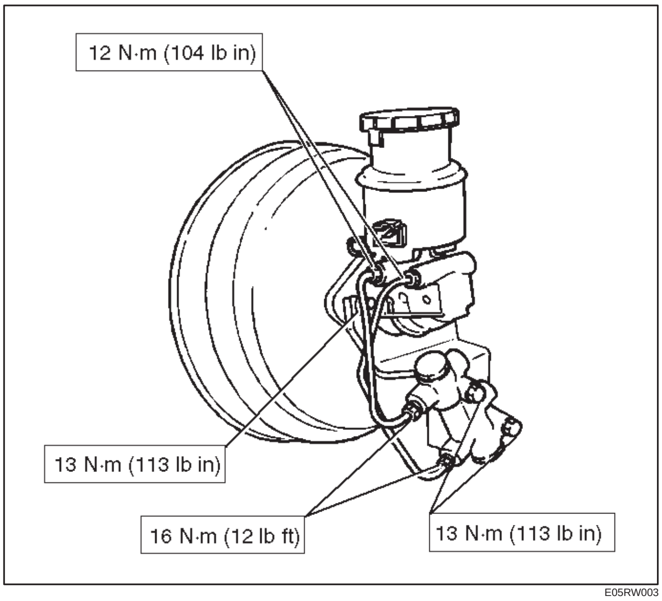
6. Connect electrical connector.

Main Data and Specifications

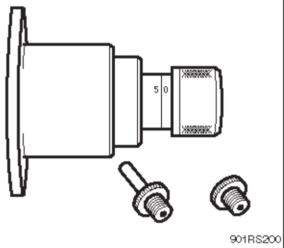
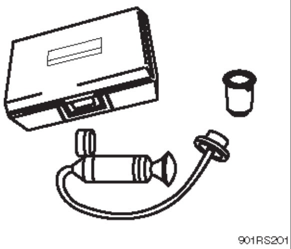
General Specifications

Type	Dual–circuit
Piston bore diameter	25.4 mm (1.000 in)

Torque Specifications

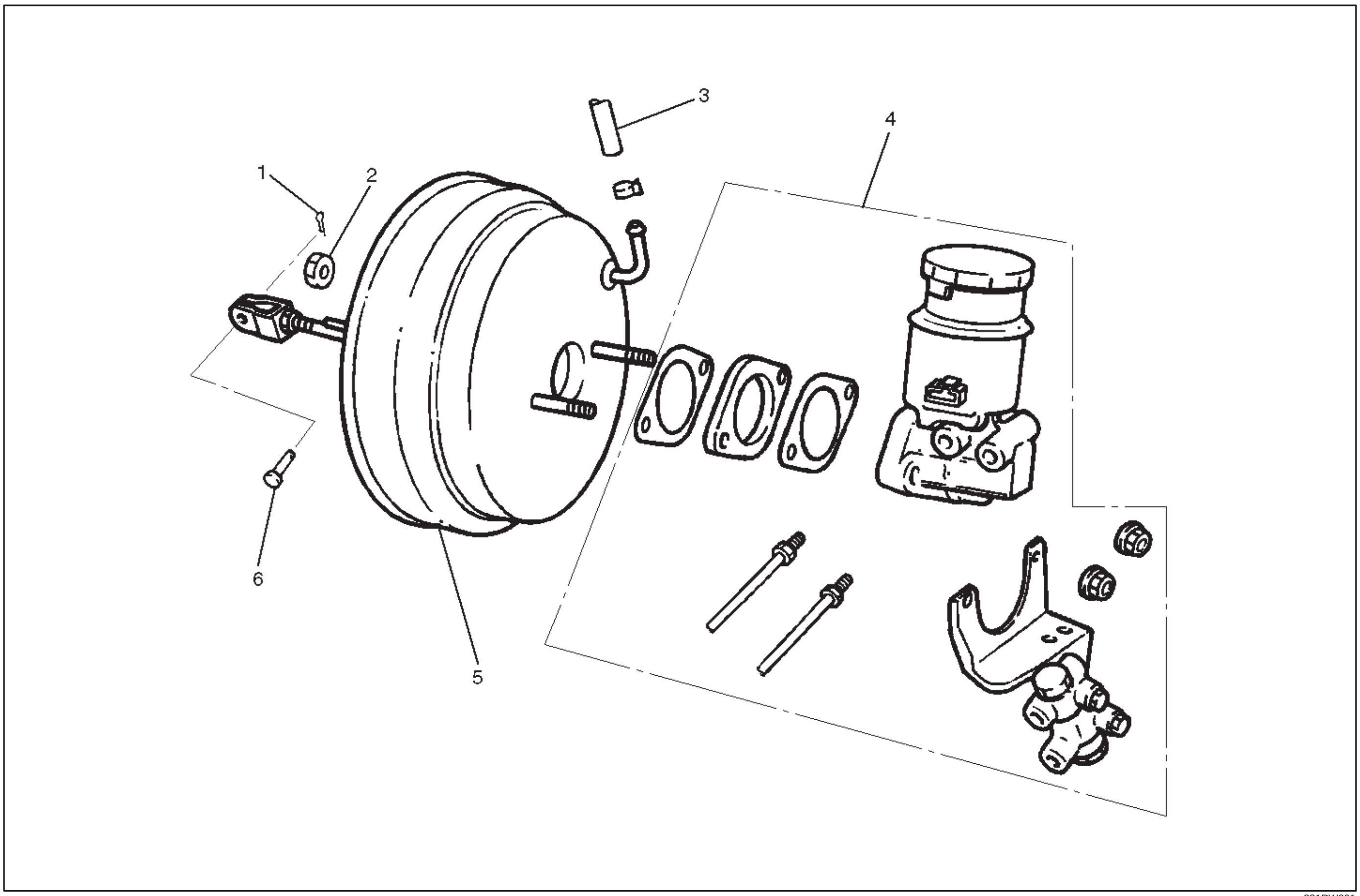


Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	J-39242 Primary Piston Holder (including master cylinder attachment and master cylinder plug
	J-24460-01 Radiator Cap Tester

Vacuum Booster Assembly

Vacuum Booster Assembly and Associated Parts



Legend
- (1) Pin
- (2) Vacuum Booster Fixing Nut
- (3) Vacuum Hose
- (4) Master Cylinder
- (5) Vacuum Booster
- (6) Snap Pin

Removal

1. Before removing the vacuum booster assembly, disconnect and remove the brake pipes.
2. Remove master cylinder, refer to "Master Cylinder Removal" in this section.

CAUTION: When removing the master cylinder from the vacuum booster, be sure to get rid of the internal negative pressure of the vacuum booster (by, for instance, disconnecting the vacuum hose) in advance.

If any negative pressure remains in the vacuum booster, the piston may possibly come out when the master cylinder is being removed, letting the brake fluid run out.

While removing the master cylinder, further, do not hold the piston as it can be easily pulled out.

Outside surface of the piston is the surface on which seals are to slide. Care should be taken to keep the surface free of cuts and dents.

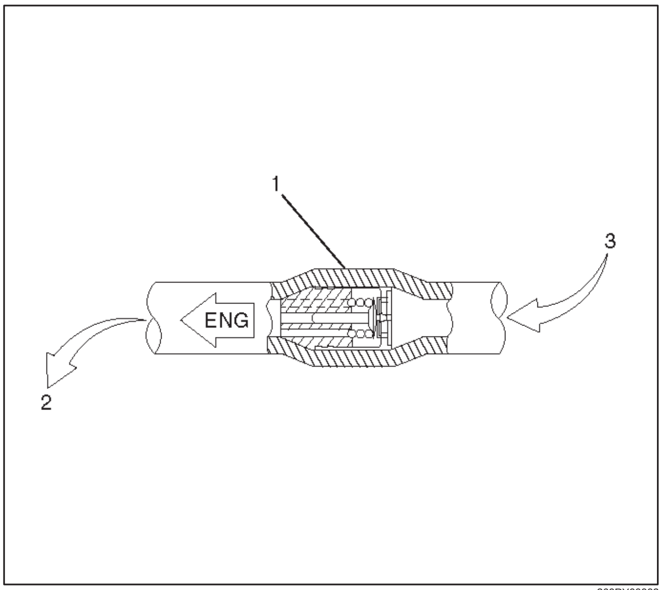
3. Remove vacuum hose.
4. Disconnect the yoke clevis from the brake pedal.
5. Remove vacuum booster fixing nut.
6. Remove vacuum booster.

Inspection and Repair

Vacuum Hose

1. Inspect the check valve (2), which is installed inside the vacuum hose.
2. Air should pass freely from the vacuum booster (3) to the engine (1).

3. Air should not pass from the engine (1) to the vacuum booster (3). If it does, the check valve is inoperative and the vacuum hose built check valve must be replaced.



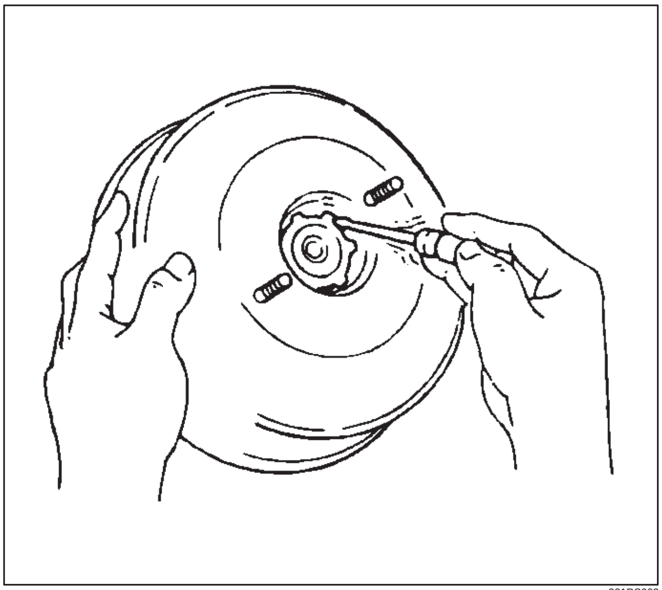
360RY00002

Installation

1. Install vacuum booster and vacuum booster push rod adjustment.

NOTE: When replacing either the master cylinder or vacuum booster, be sure to measure push rod, and adjust if required.

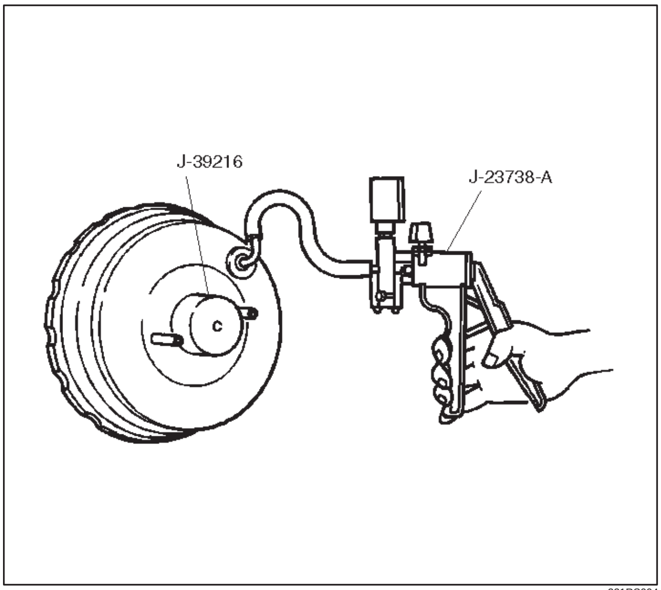
2. Remove retainer from vacuum booster front shell using a small screwdriver. Then gently draw plate and seal assembly out of the shell inside.



331RS003

3. Set push rod gauge J–39216 on vacuum booster, and apply negative pressure by means of vacuum pump J–23738–A so that the pressure in the vacuum booster becomes 500 mm Hg.

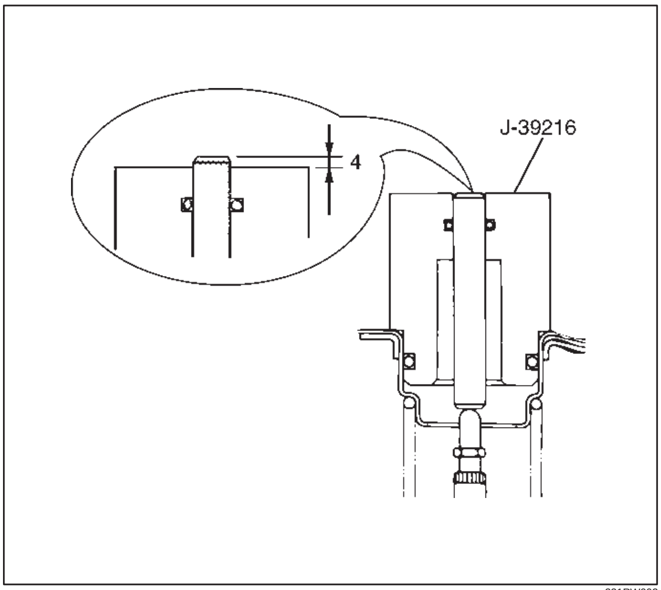
NOTE: Be sure to apply NEGATIVE pressure after installing a push rod gauge on the vacuum booster.



331RS004

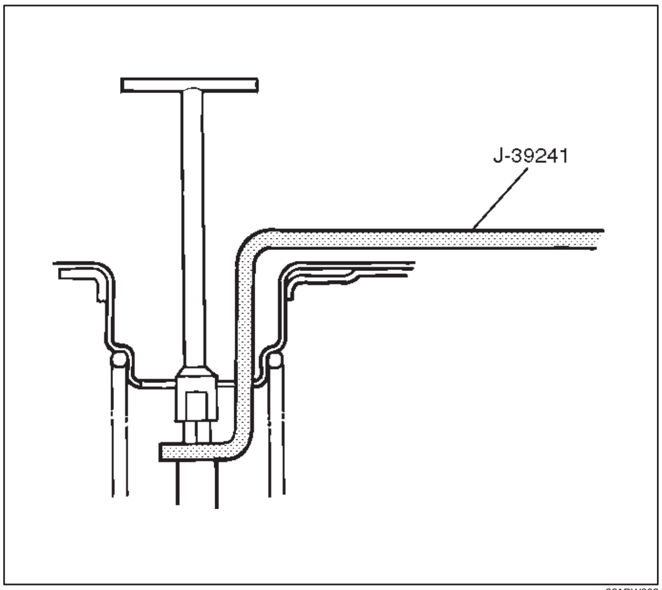
4. Measure dimension (4).

Dimension (4) (Standard): –0.1–0.1 mm (–0.0039–0.0039 in)



331RW002

5. If dimension (4) is out of the standard range, adjust push rod using the Push Rod Support J–39241.



331RW003

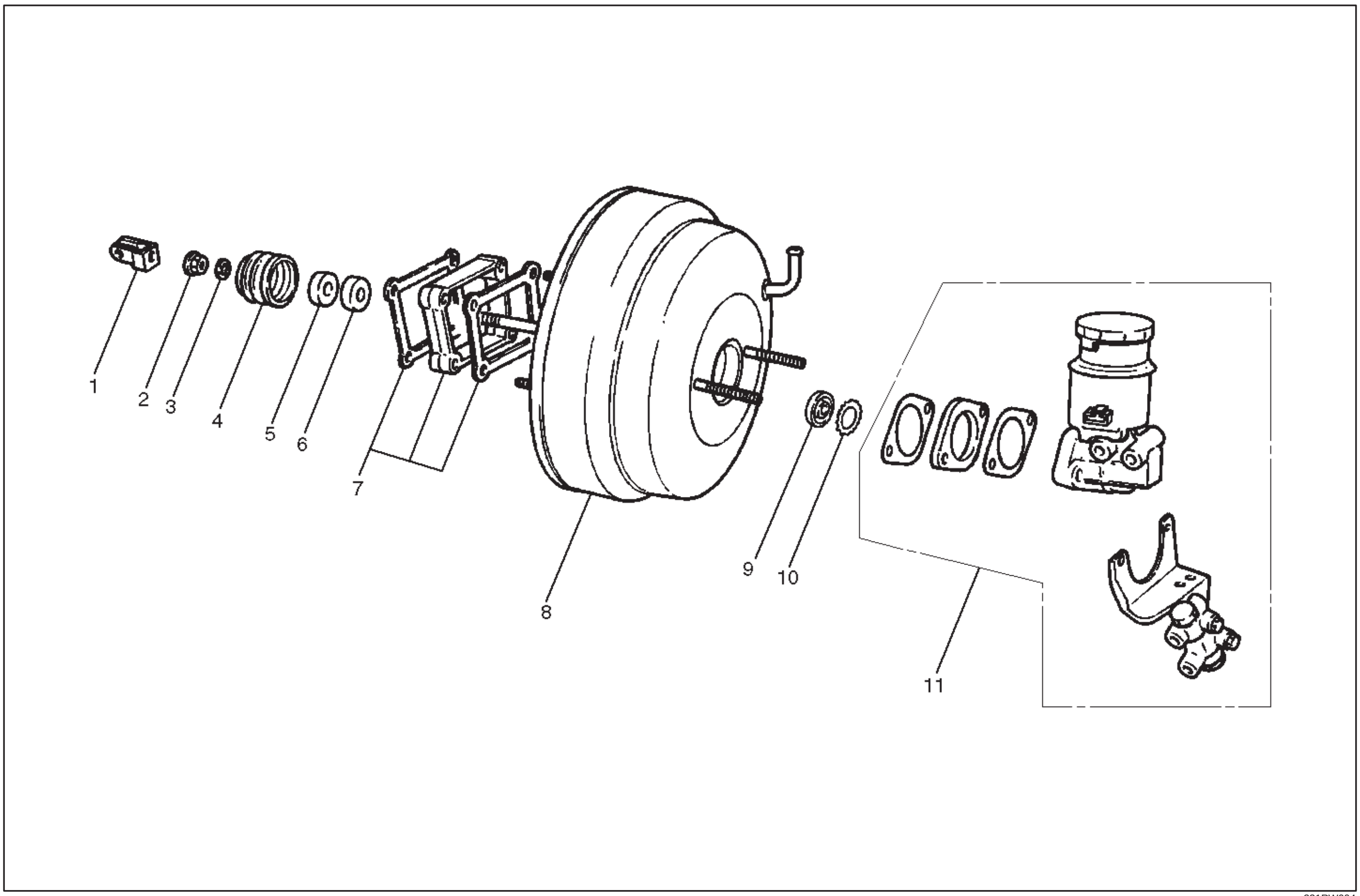
6. Mount plate and seal assembly in vacuum booster front shell. Then install the retainer.
7. Install vacuum booster fixing nut and tighten the specified torque.

   Torque: 21 N·m (16 lb ft)

8. Install yoke clevis.
9. Connect vacuum hose and make sure that the arrow on the hose points in the direction of the engine.
10. Install master cylinder, refer to “Master Cylinder Installation” in this section.

Exterior Components

Exterior Components and Associated Parts

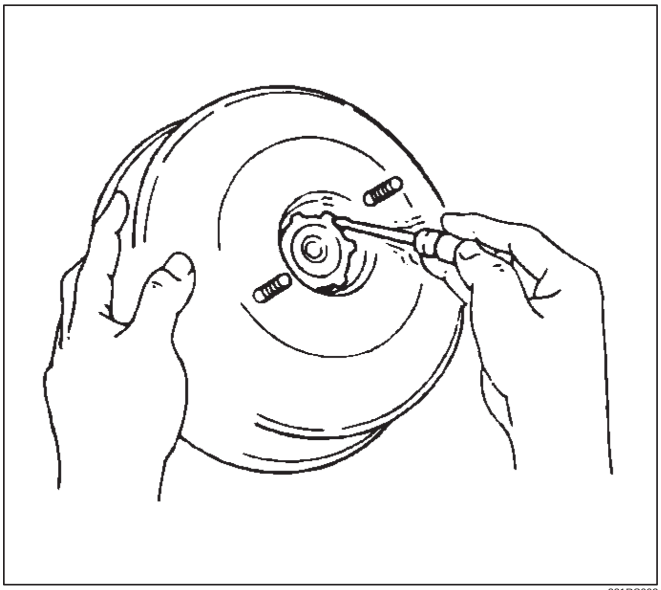


Legend

(1) Yoke Clevis
(2) Lock Nut
(3) Retaining Clip
(4) Valve Body Guard
(5) Silencer
(6) Filter
(7) 2 Gaskets and Spacer
(8) Vacuum Booster
(9) Retainer
(10) Plate and Seal Assembly
(11) Master Cylinder

Removal

1. Remove master cylinder, refer to “Master Cylinder” in this section.
2. Remove vacuum booster, refer to “Vacuum Booster” in this section.
3. Remove yoke clevis.
4. Remove lock nut.
5. Remove retaining clip.
6. Remove valve body guard.
7. Remove silencer.
8. Remove filter.
9. Remove 2 gaskets and spacer.
10. Remove retainer, use a small screwdriver to pry out the retainer. Gently pull out the plate and seal assembly from the shell.



11. Remove plate and seal assembly.

Inspection and Repair

Visual Check

Make necessary parts replacement if cuts, nicks, excessive wear, or other abnormal conditions are found through inspection. Check the following parts:

- Yoke clevis
- Valve body guard
- Silencer
- Filter plate and seal assembly

Installation

1. Install plate and seal assembly.
2. Install retainer.
3. Install 2 gaskets and spacer.
4. Install filter.
5. Install silencer.
6. Install valve body guard.
7. Install retainer.
8. Install lock nut and tighten to the specified torque.

   Torque: 20 N·m (15 lb ft)

9. Install yoke clevis.
10. Install vacuum booster, refer to “Vacuum Booster” in this section.
11. Install master cylinder, refer to “Master Cylinder” in this section and after installation, perform brake pedal check and adjustment. Refer to “Brake Pedal” in this section.

Vacuum Booster Overhaul

Vacuum Booster

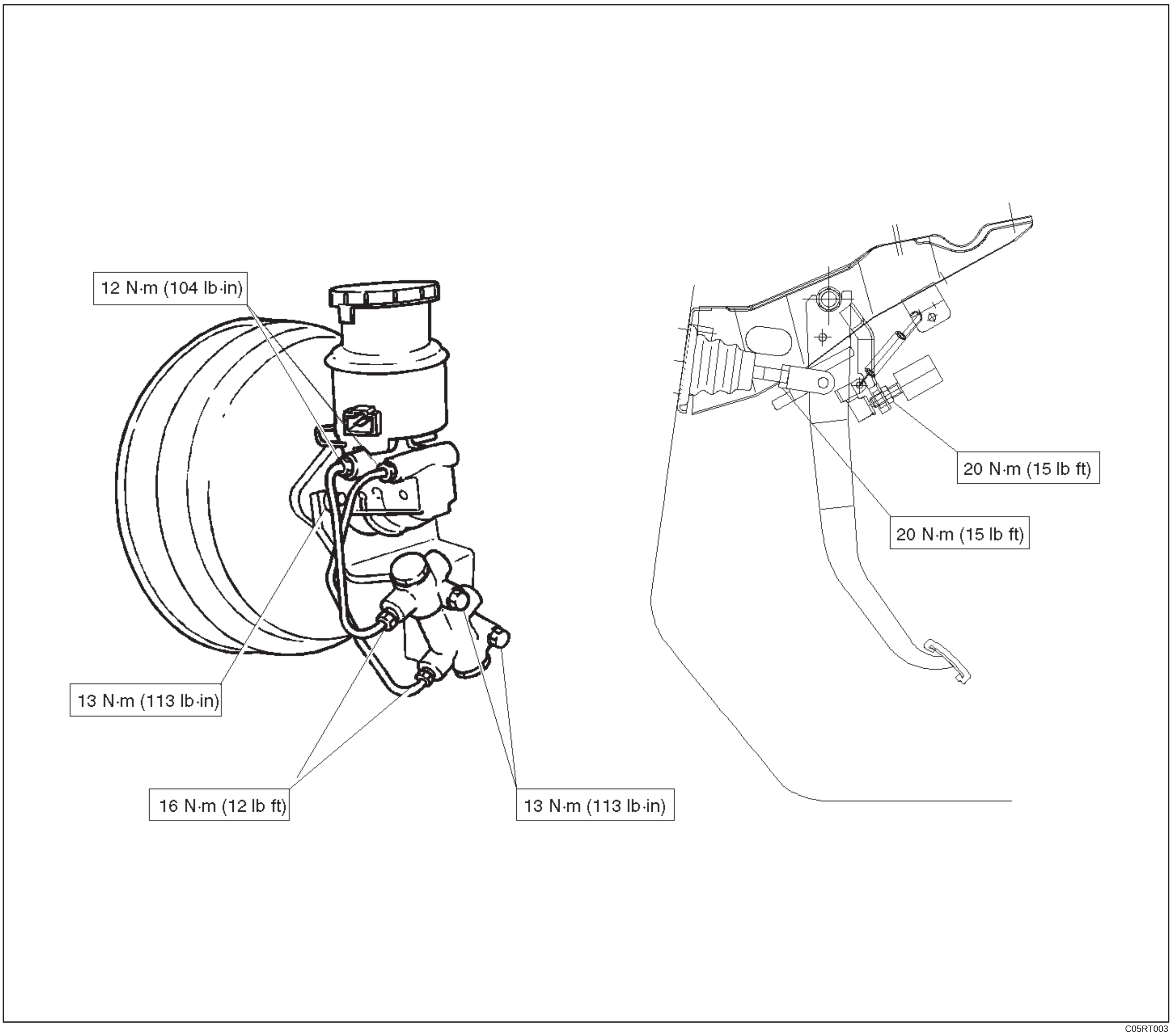
The vacuum booster cannot be disassembled for repair.
Replace a defective vacuum booster with a new one.

Main Data and Specifications

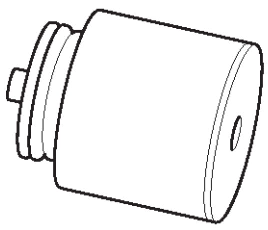
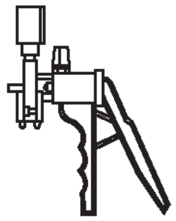
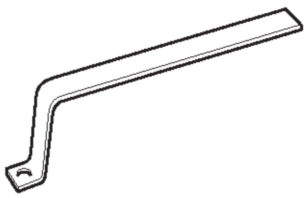
General Specifications

Vacuum booster diaphragm diameter (Front)	205 mm (8.07 in)
Vacuum booster diaphragm diameter (Rear)	230 mm (9.06 in)
Push rod stroke	More than 32.0 mm (1.26 in)
Plunger diameter	10.25 mm (0.40 in)
Push rod diameter	27.4 mm (1.08 in)

Torque Specifications



Special Tools

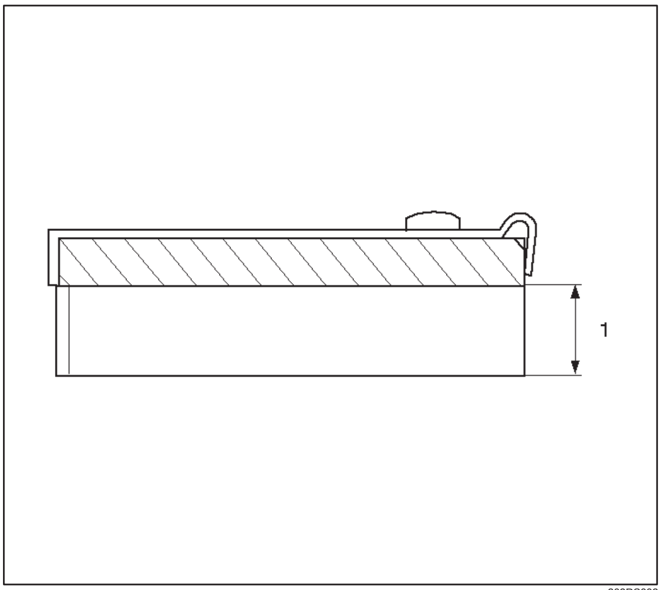
ILLUSTRATION	TOOL NO. TOOL NAME
 901RS202	J-39216 Push Rod Gauge
 901RS203	J-23738-A Vacuum Pump
 901RS204	J-39241 Push Rod Support

Front Disc Brake Pads

Front Disc Brake Pads Inspection

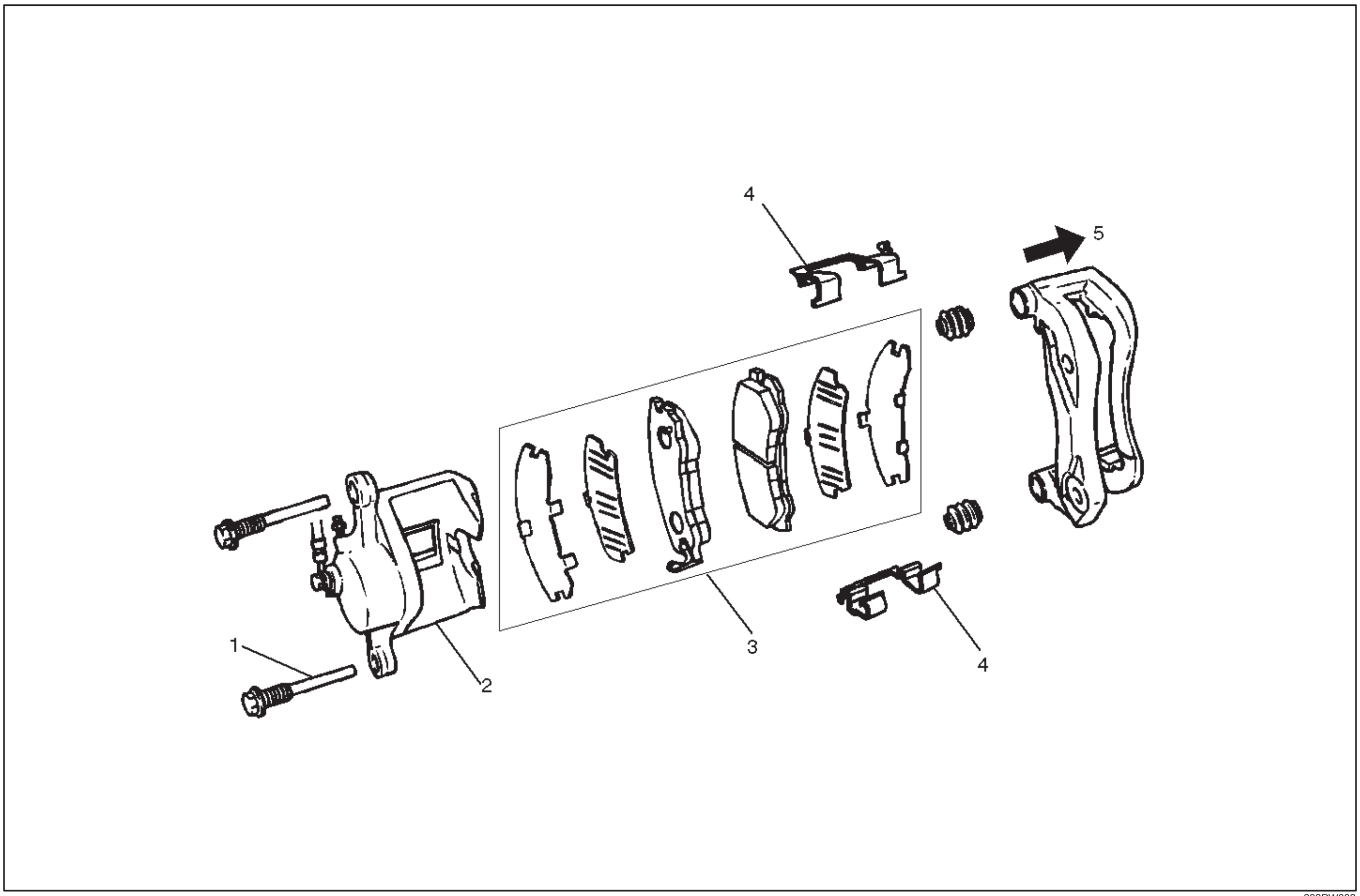
Check the outer pad by looking at each caliper from above. Check the thickness on the inner pad by looking down through the inspection hole in the top of the caliper. Whenever the pad is worn to about the thickness of the pad base, the pad should be removed for further measurements. The pad should be replaced anytime the pad thickness (1) is worn to within 1.00 mm (0.039 in) of the pad itself.
The disc pads have a wear indicator that makes a noise when the pad wears to where replacement is required.

Minimum limit (1): 1.0 mm (0.039 in)



302RS002

Front Disc Brake Pads and Associated Parts



302RW003

Legend

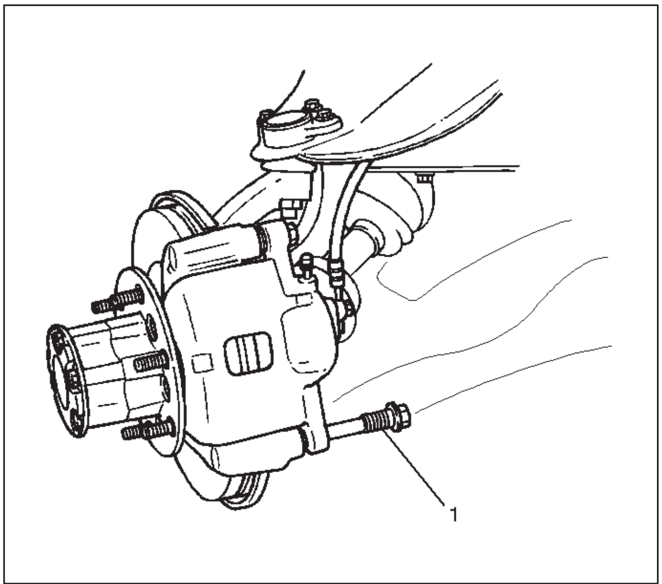
(1) Lock Bolt
(2) Caliper Assembly
(3) Pad Assembly
(4) Clip
(5) Outer Side

Removal

NOTE: If a squealing noise occurs from the front brake while driving, check the pad wear indicator plate. If the indicator plate contacts the rotor, the disc pad assembly should be replaced.

- Draw out two–thirds of the brake fluid from the reservoir.
- Raise the vehicle and support it with suitable safety stands.

1. Remove wheel and tire assembly, refer to “Wheels and Tires System” in Section 3E.
2. Remove lock bolt (1).

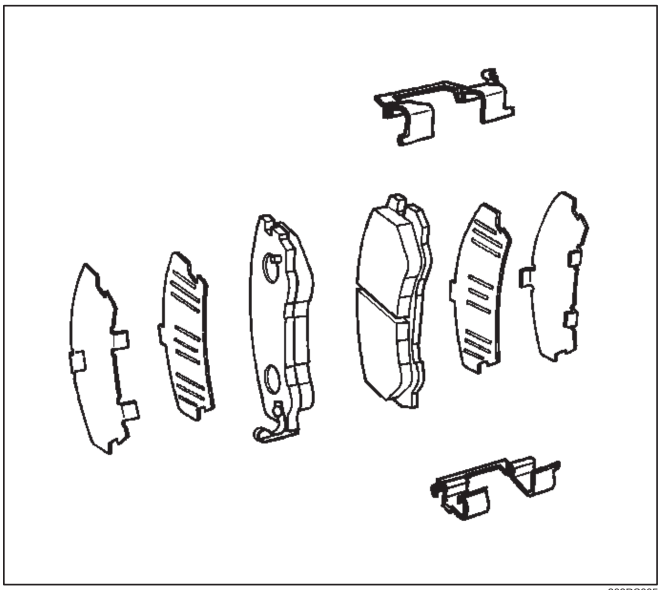


302RW004

3. Remove caliper assembly and support the caliper assembly so that the brake hose is not stretched or damaged.
4. Remove pad assembly with shim.
5. Remove Clip.

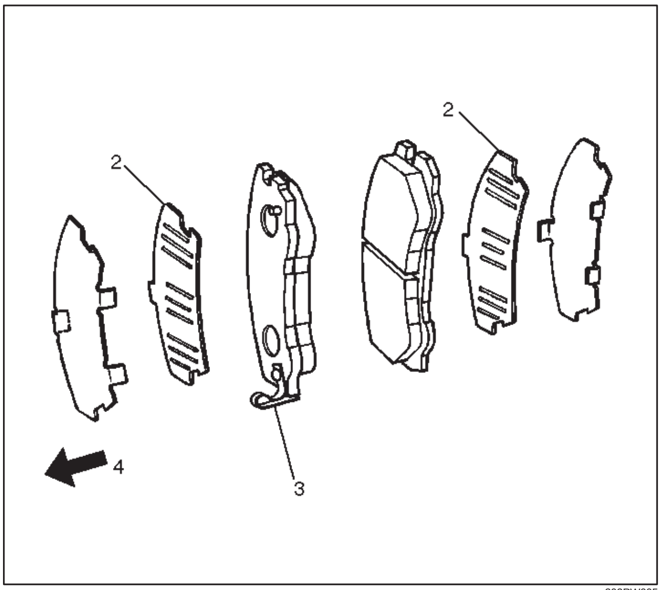
Installation

1. Install clip.



302RS005

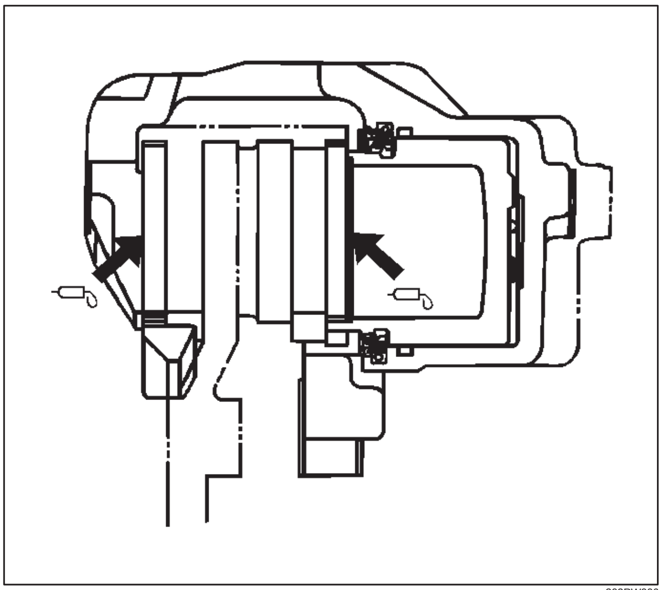
2. Install pad assembly with shim and apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims (2). Wipe off extruded grease after installing.



302RW005

Legend

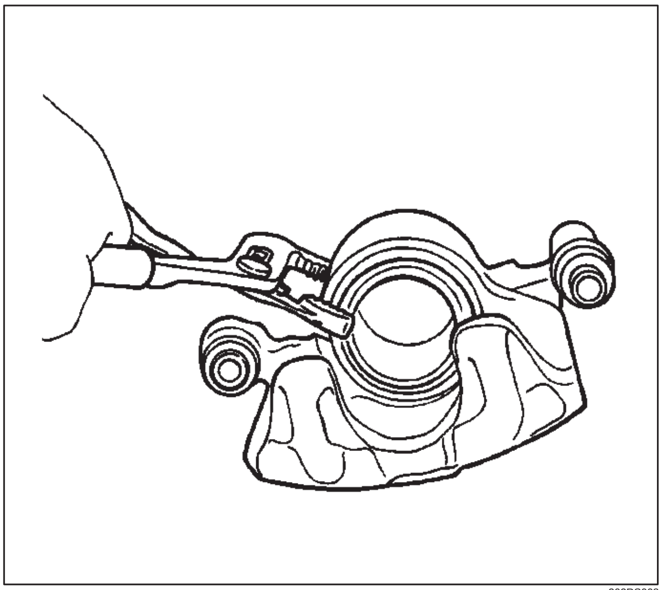
(2) Inner Shim
(3) Wear Indicator
(4) Inner Side



302RW006

3. Install caliper assembly, use adjustable pliers to bottom the piston into the caliper bore.

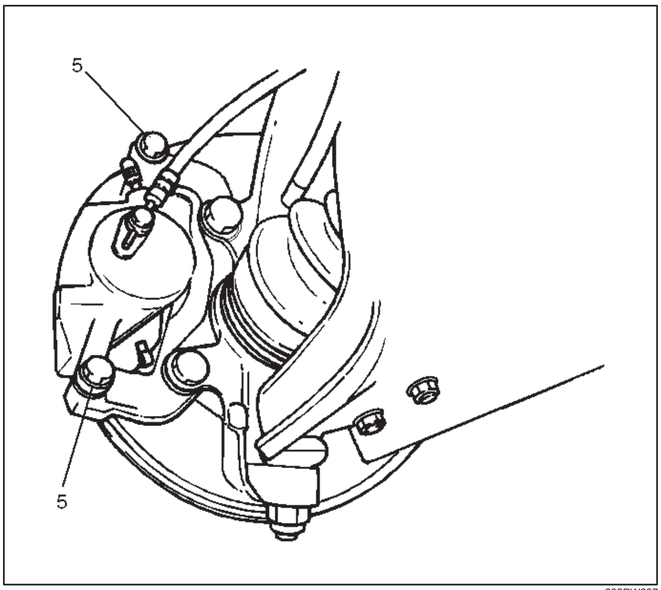
   Be careful do not damage the piston boot and do not damage the flexible hose by twisting or pulling it.



302RS008

4. Install lock bolt (5) and tighten the bolt to the specified torque.

Torque: 74 N·m (54 lb ft)



302RW007

5. Install wheel and tire assembly, refer to “Wheels and Tires System” in Section 3E.
6. Pump the brake pedal several times to make sure that the pedal is firm. Check the brake fluid level in the reservoir after pumping the brakes.

Front Disc Brake Rotor

Inspection

In the manufacturing of the brake rotor, all the tolerances regarding surface finish, parallelism and lateral runout are held very closely. Maintaining these tolerances provides the surface necessary to assure smooth brake operation.

Lateral Runout

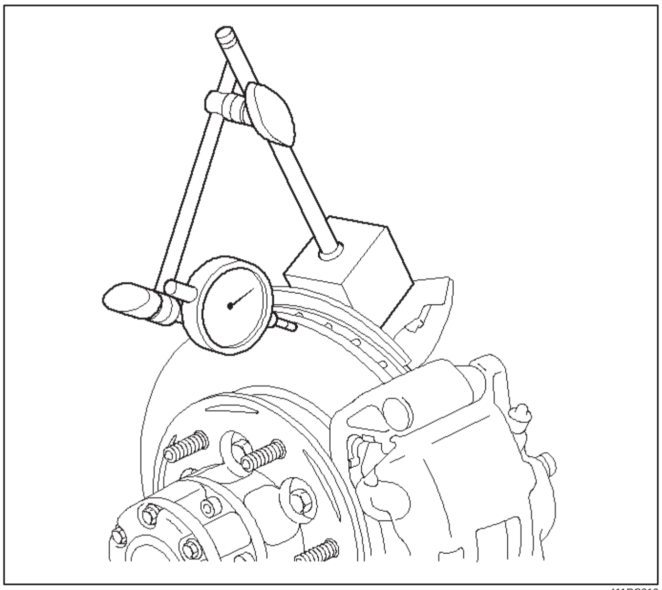
Lateral runout is the movement of the rotor from side to side as it rotates on the spindle. This could also be referred to as “rotor wobble”.

This movement causes the piston to be knocked back into its bore. This results in additional pedal travel and a vibration during braking.

Checking Lateral Runout

1. Adjust the wheel bearing correctly, refer to “Differential” in Section 4A.
2. Attach a dial indicator to some portion of the suspension so that the stem contacts the rotor face about 29 mm (1.14 in) from the rotor edge.
3. Move the rotor one complete rotation and the lateral runout should not exceed 0.13 mm (0.005 in).

Maximum runout: 0.13 mm (0.005 in)



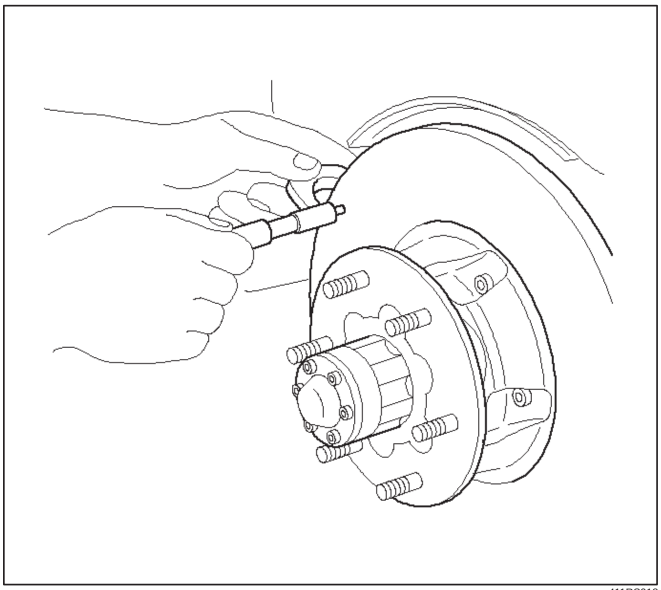
411RS019

Parallelism

Parallelism is the measurement of thickness of the rotor at four or more points around the circumference of the rotor. All measurements must be made 29 mm (1.14 in) from the edge of the rotor.

The rotor thickness must not vary more than 0.010 mm (0.0004 in) from point to point.

Maximum runout: 0.010 mm (0.0004 in)



411RS018

Replacing Brake Rotors

When installing new brake rotors, do not refinish the surfaces. These parts are at the correct level of surface finish.

Refinishing Brake Rotors

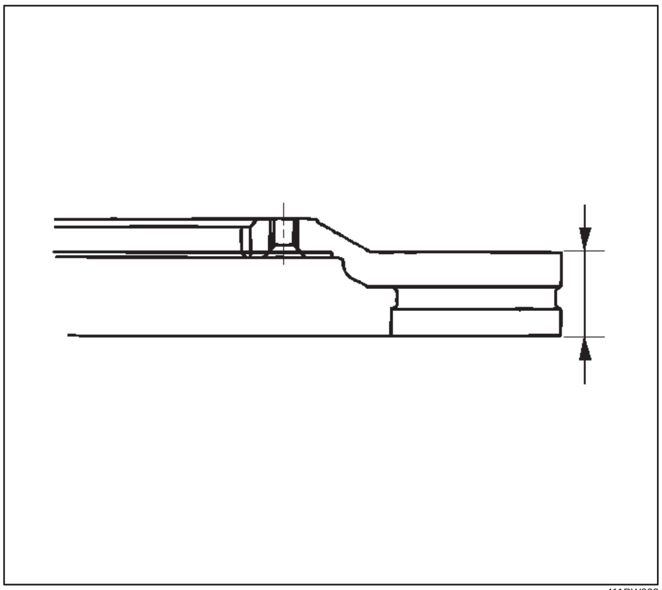
Accurate control of the rotor tolerances is necessary for proper performance of the disc brakes. Machining of the rotor should be done only with precision equipment. All brake rotors have a minimum thickness dimension cast into them. This dimension is the minimum wear dimension and not a refinish dimension. The minimum wear dimension is 24.60 mm (0.969 in). The minimum refinish dimension is 24.97 mm (0.983 in).

When refinishing rotors, always use sharp cutting tools or bits. Dull or worn tools leave a poor surface finish which will affect initial braking performance. Vibration dampening attachments should always be used when refinishing braking surfaces. These attachments eliminate tool chatter and will result in better surface finish.

After refinishing, replace any rotor that does not meet the minimum thickness of 24.97 mm (0.983 in). Do not use a brake rotor that will not meet the specification.

Minimum wear dimension: 24.60 mm (0.969 in)

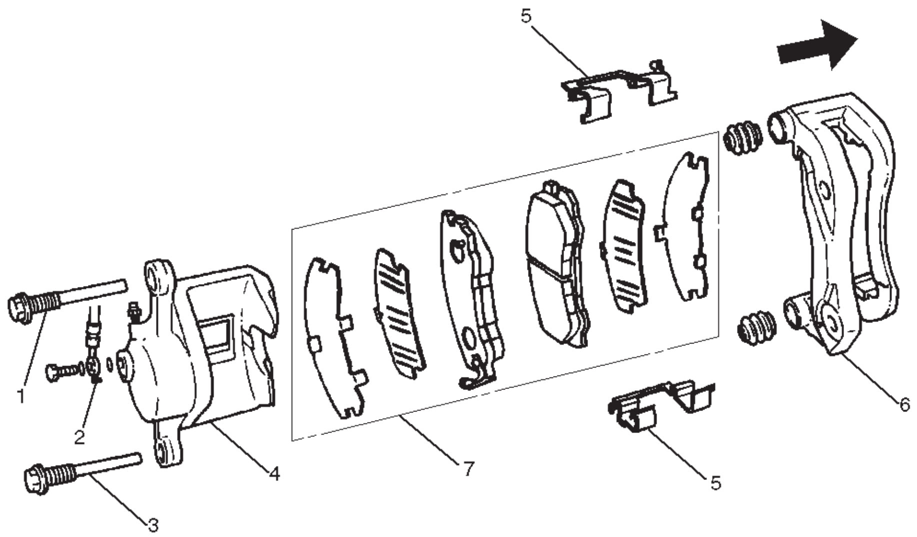
Refinish dimension: 24.97 mm (0.983 in)



411RW003

Front Disc Brake Caliper Assembly

Front Disc Brake Caliper Assembly and Associated Parts



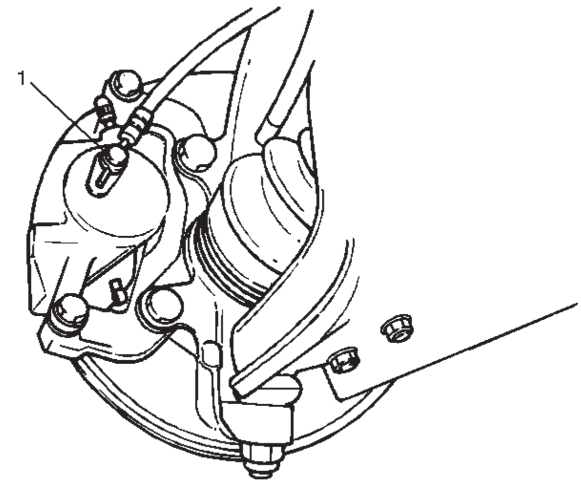
302RW008

Legend

(1) Guide Bolt
(2) Brake Flexible Hose
(3) Lock Bolt
(4) Caliper Assembly
(5) Clip
(6) Support Bracket with Pad Assembly
(7) Pad Assembly

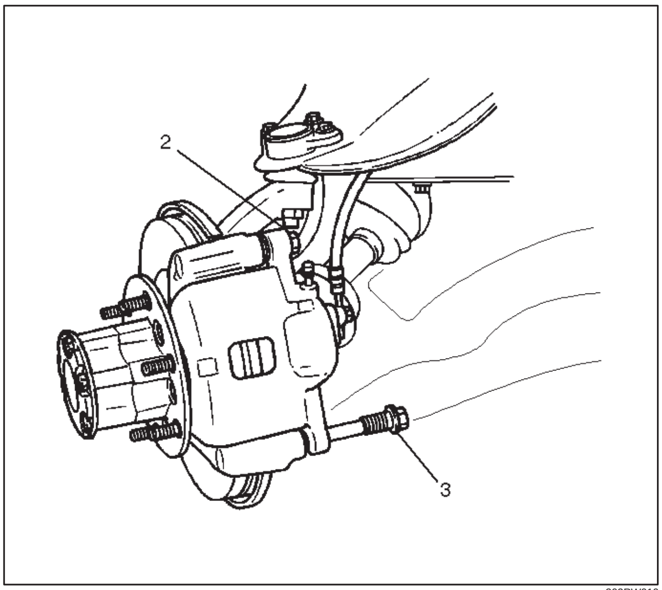
Removal

1. Raise the vehicle and support with suitable safety stands.
2. Wheel and tire assembly, refer to “Wheels and Tires System” in Section 3E.
3. Remove the bolt and gaskets, then disconnect the flexible hose from the caliper and after disconnecting the flexible hose (1), cap or tape the openings to prevent entry of foreign material.



302RW009

4. Since the brake fluid flows out from the connecting coupler, place a drain pan under the vehicle.
5. Remove guide bolt (2).
6. Remove lock bolt (3).

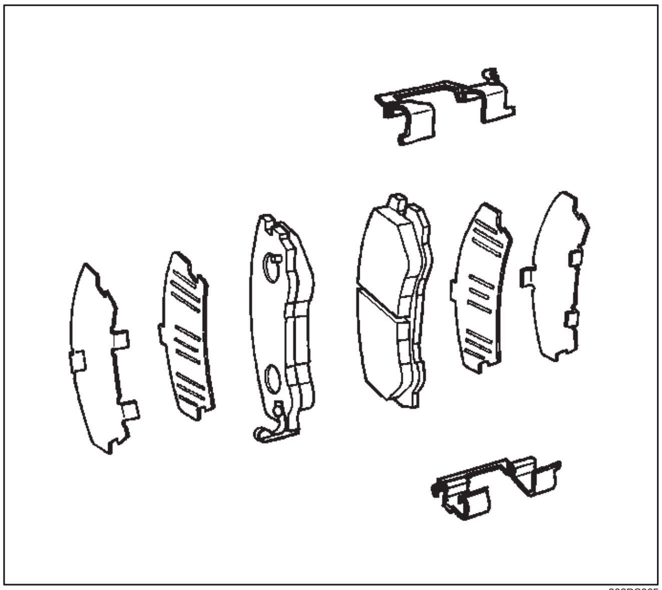


302RW010

7. Remove caliper assembly.
8. Remove support bracket with pad assembly and take care not to damage the flexible brake hose when removing the support bracket.
9. Remove pad assembly with shim and mark the lining locations if they are to be reinstalled.
10. Remove clip.

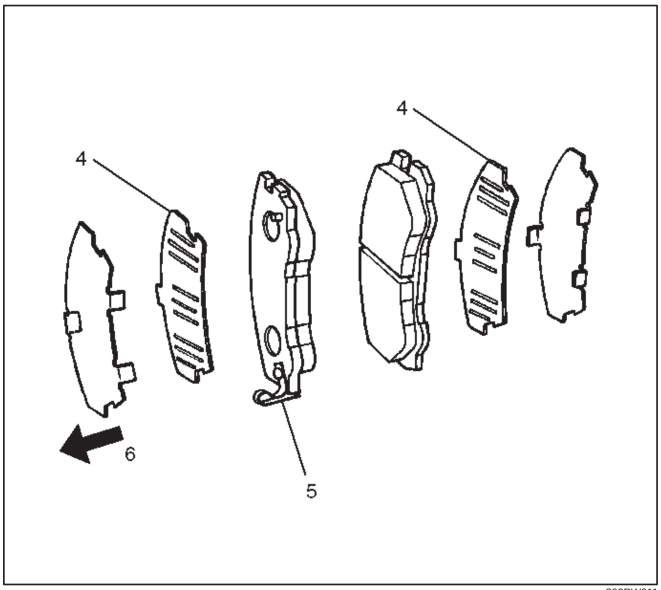
Installation

1. Install clip.



302RS005

2. Install pad assembly with shim and apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims (6). Wipe off extruded grease after installing.



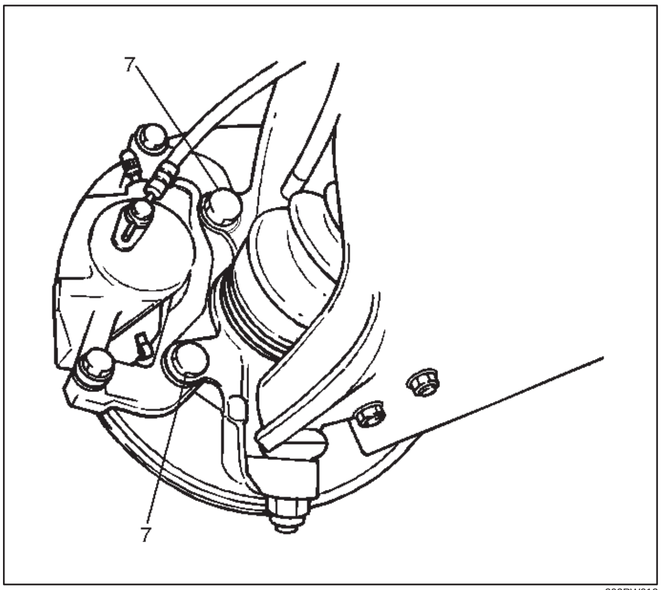
302RW011

Legend

(4) Inner Shim
(5) Wear Indicator
(6) Inner Side

3. Install support bracket and tighten the bolt (7) to the specified torque.

Torque: 155 N·m (115 lb ft)

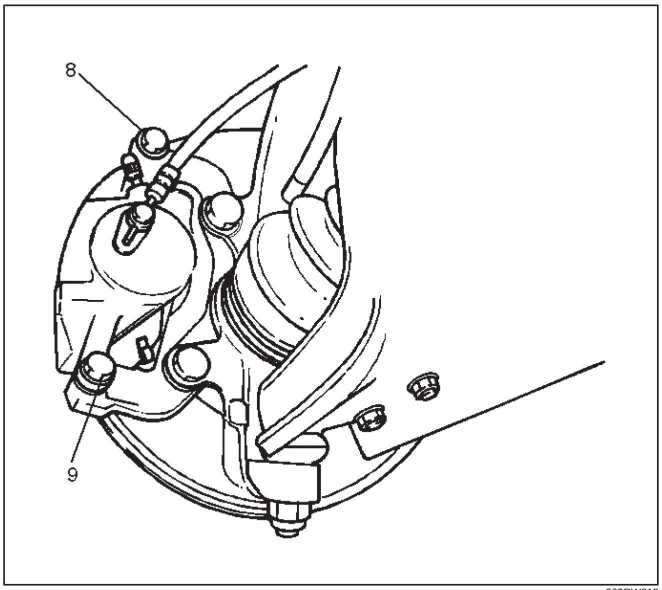


302RW012

4. Install caliper assembly.

5. Install lock bolt (9) and guide bolt (8) and tighten the bolt to the specified torque.

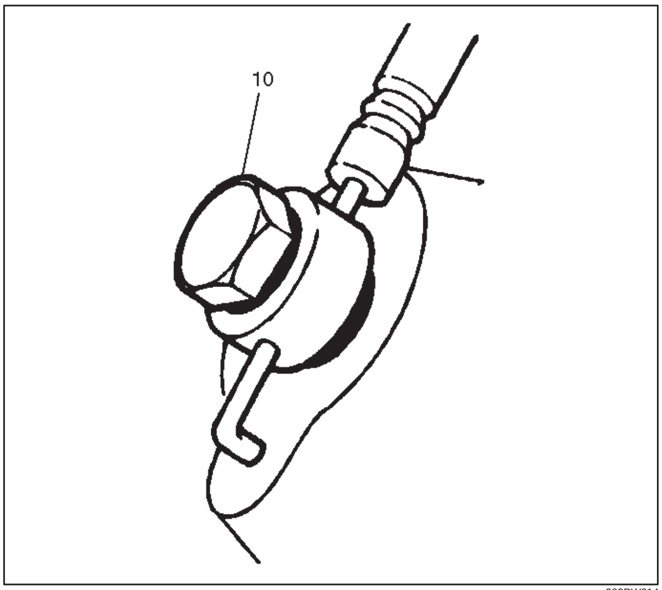
Torque: 74 N·m (54 lb ft)



302RW013

6. Install brake flexible hose, always use new gaskets and be sure to put the hooked edge of the flexible hose end into the anti–rotation cavity then tighten the I–bolt (10) to the specified torque.

Torque: 35 N·m (26 lb ft)

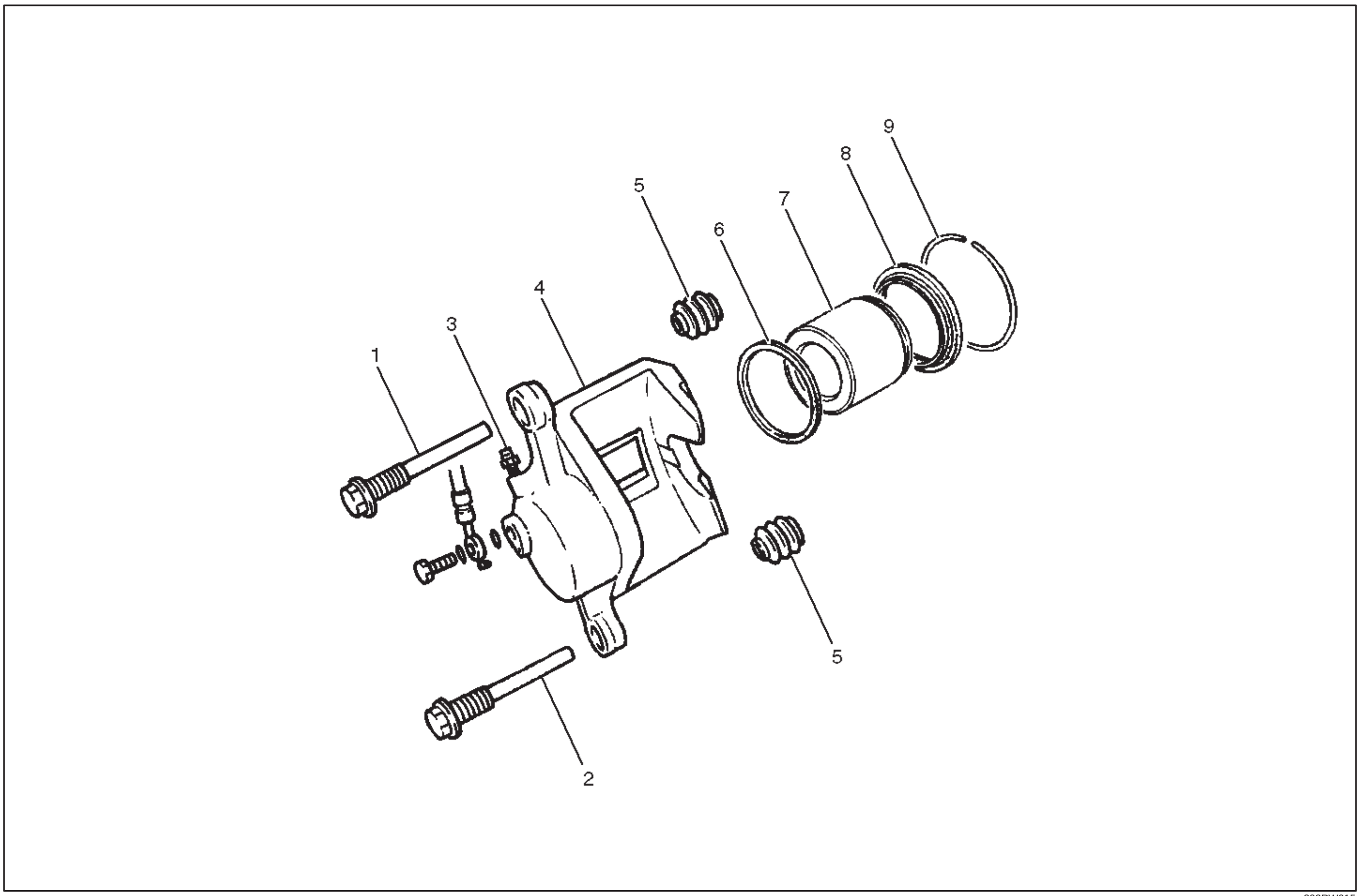


302RW014

7. Install wheel and tire assembly, refer to “Wheels and Tires System” in Section 3E.
8. Bleed brakes. Refer to “Hydraulic Brakes” in this section.

Front Disc Brake Caliper

Front Disc Brake Caliper Disassembled View



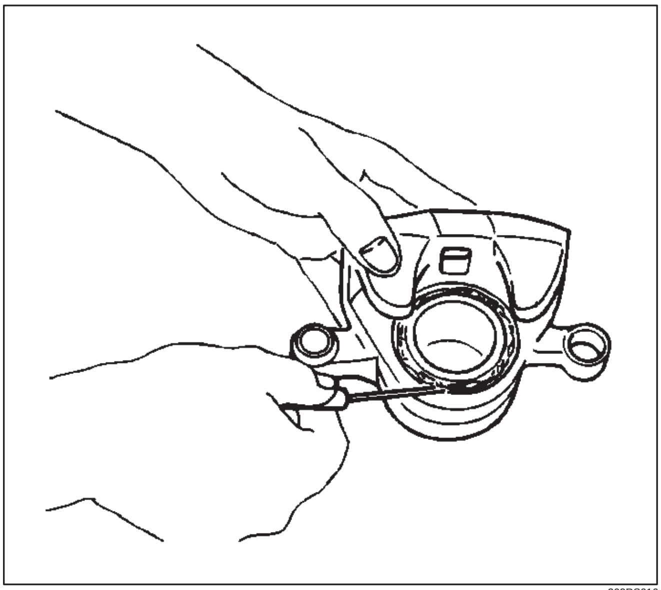
302RW015

Legend

(1) Guide Bolt
(2) Lock Bolt
(3) Bleeder with Cap
(4) Caliper Body
(5) Dust Boot: Guide Bolt and Lock Bolt
(6) Piston Seal
(7) Piston
(8) Dust Boot: Piston
(9) Dust Boot Ring

Disassembly

1. Remove guide bolt.
2. Remove lock bolt.
3. Remove dust boot: guide bolt and lock bolt.
4. Remove dust boot ring, using a small screwdriver, remove the dust boot ring.

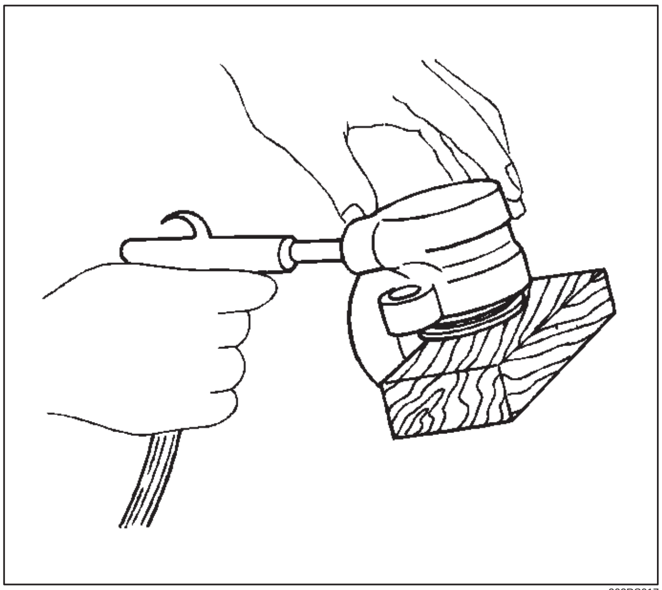


302RS016

5. Insert a block of wood into the caliper and force out the piston by blowing compressed air into the caliper at the flexible hose attachment. This procedure must be done prior to removal of the dust boot.

WARNING: DO NOT PLACE YOUR FINGERS IN FRONT OF THE PISTON IN AN ATTEMPT TO CATCH OR PROTECT IT WHEN APPLYING COMPRESSED AIR. THIS COULD RESULT IN PERSONAL INJURY.

CAUTION: Use just enough air to ease the piston out of the bore. If the piston is blown out, it may be damaged.



302RS017

6. Remove dust boot: piston.
7. Remove piston seal.
8. Remove bleeder with cap.
9. Remove caliper body.

Inspection and Repair

Make necessary parts replacement, if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- Rotor
- Cylinder body
- Cylinder bore
- Piston
- Guide bolt, lock bolt
- Support bracket

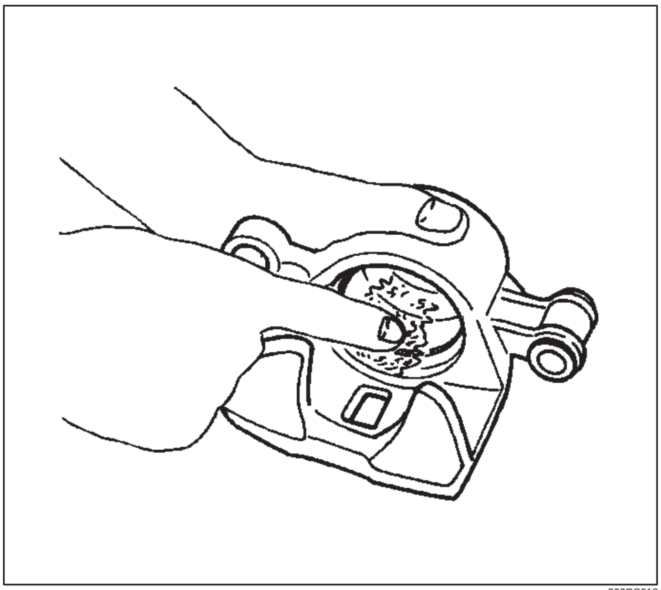
NOTE: The piston seal, boot ring and dust boot are to be replaced each time the caliper is overhauled. Discard these used rubber parts and replace them with new ones.

Reassembly

1. Install caliper body.
2. Install bleeder with cap and tighten the cap to the specified torque.

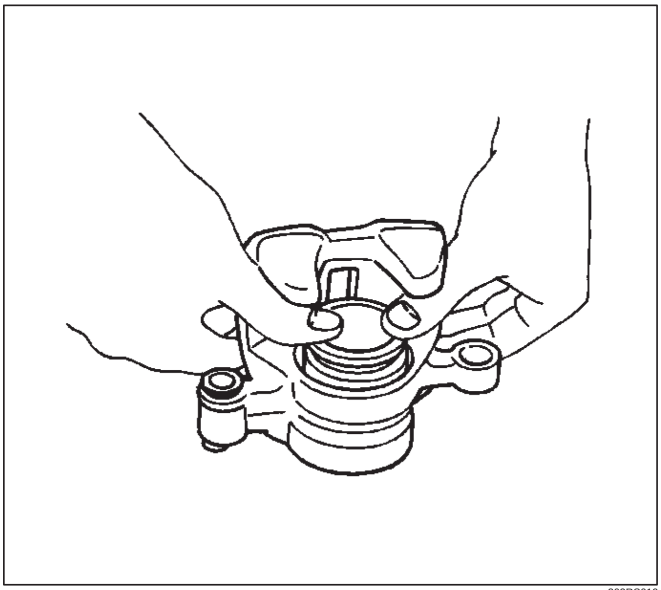
Torque: 8 N·m (69 lb in)

3. Install piston seal and apply special rubber grease to the piston seal and cylinder wall, then insert the piston seal into the cylinder. The special rubber grease is included in the repair kit.



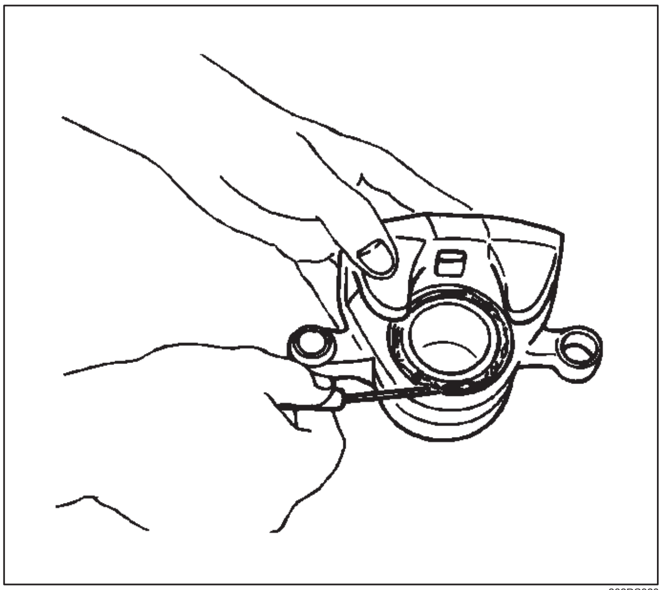
302RS018

4. Install piston.
5. Install piston dust boot; when inserting the piston into the cylinder, use finger pressure only and do not use a mallet or other impact tool, since damage to the cylinder wall or piston seal can result.



302RS019

6. Install dust boot ring and apply special grease (approximately 1 g) to the piston and attach the dust boot to the piston and caliper. Insert the dust boot ring into the dust boot.

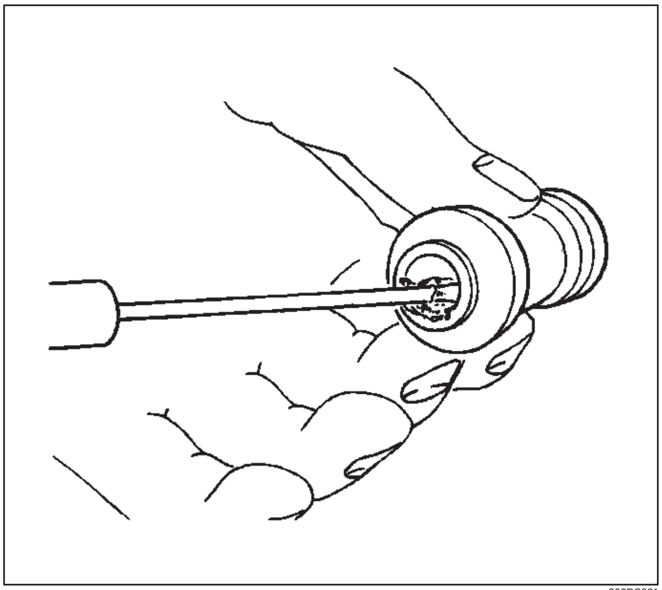


302RS020

7. Install guide bolt and lock bolt dust boot.
8. Install lock bolt and guide bolt and tighten the bolt to the specified torque.

Torque: 74 N·m (54 lb ft)

9. Install the dust boot on the support bracket after applying special grease (approximately 1 g) onto the dust boot inner surface. Apply special grease onto the lock bolt and guide bolt setting hole of the support bracket.



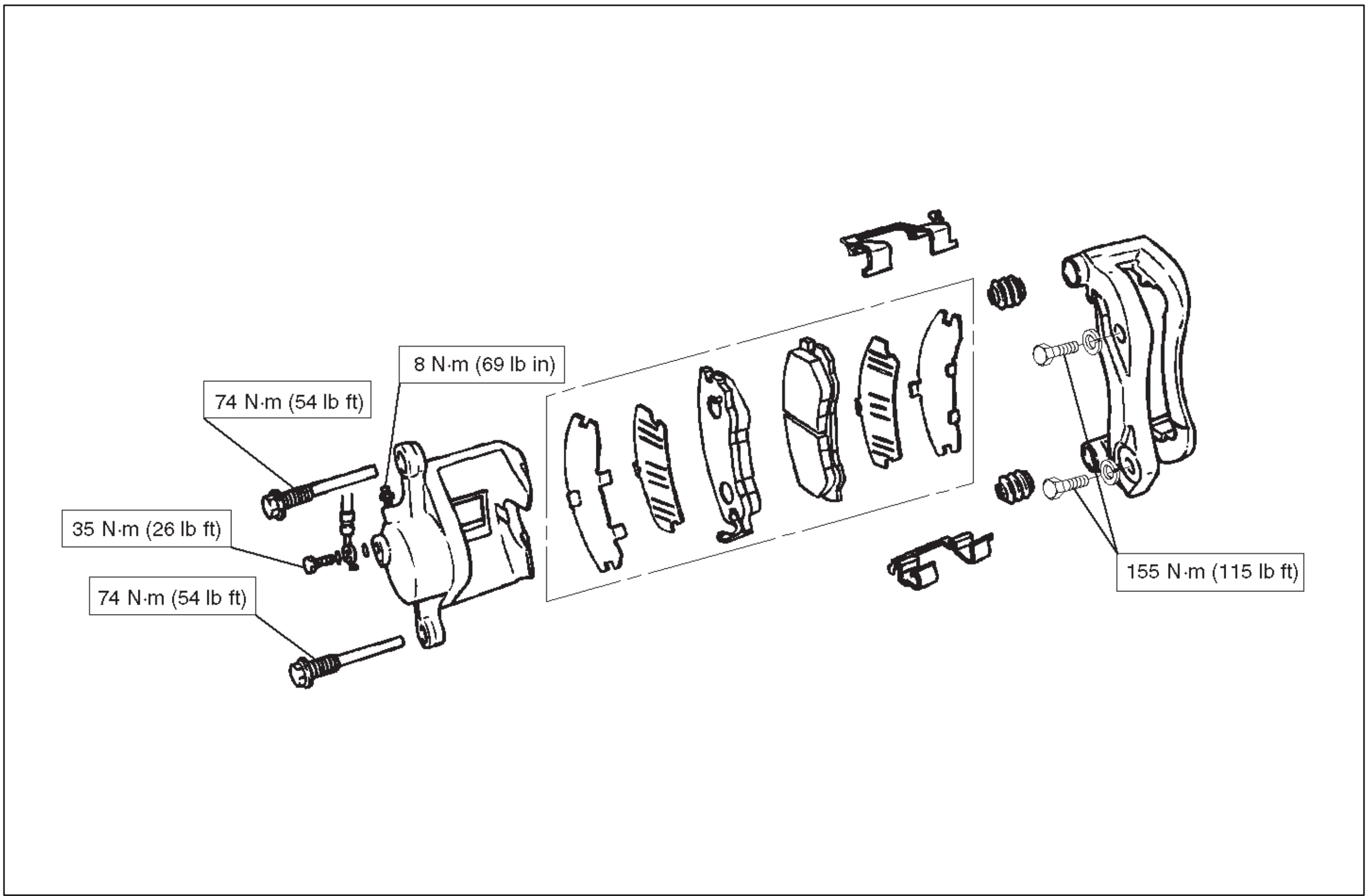
302RS021

Main Data and Specifications

General Specifications

Type	Floating, pin slide
Pad dimension	55 cm^2 (8.52 in^2)
Adjusting method	Self–adjusting
Piston diameter	60.33 mm (2.38 in)
Disc type	Ventilated
Disc thickness	26 mm (1.02 in)
Disc effective diameter	222 mm (8.74 in)

Torque Specifications



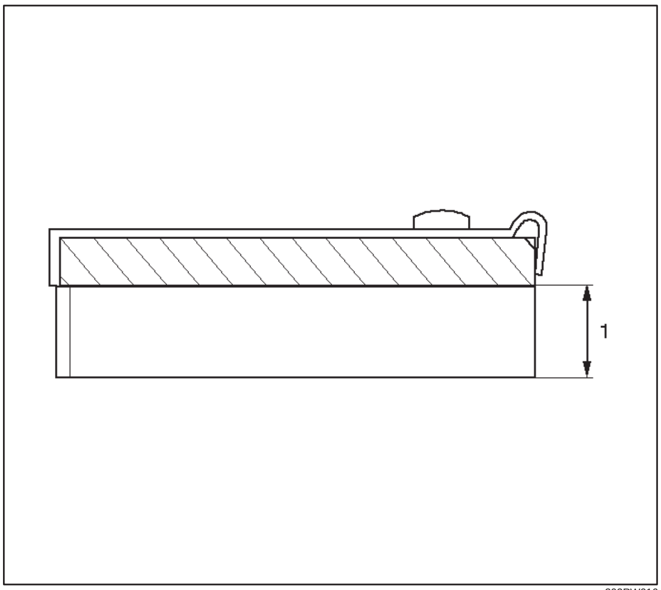
E05RW004

Rear Disc Brake Pads

Brake Pads Inspection

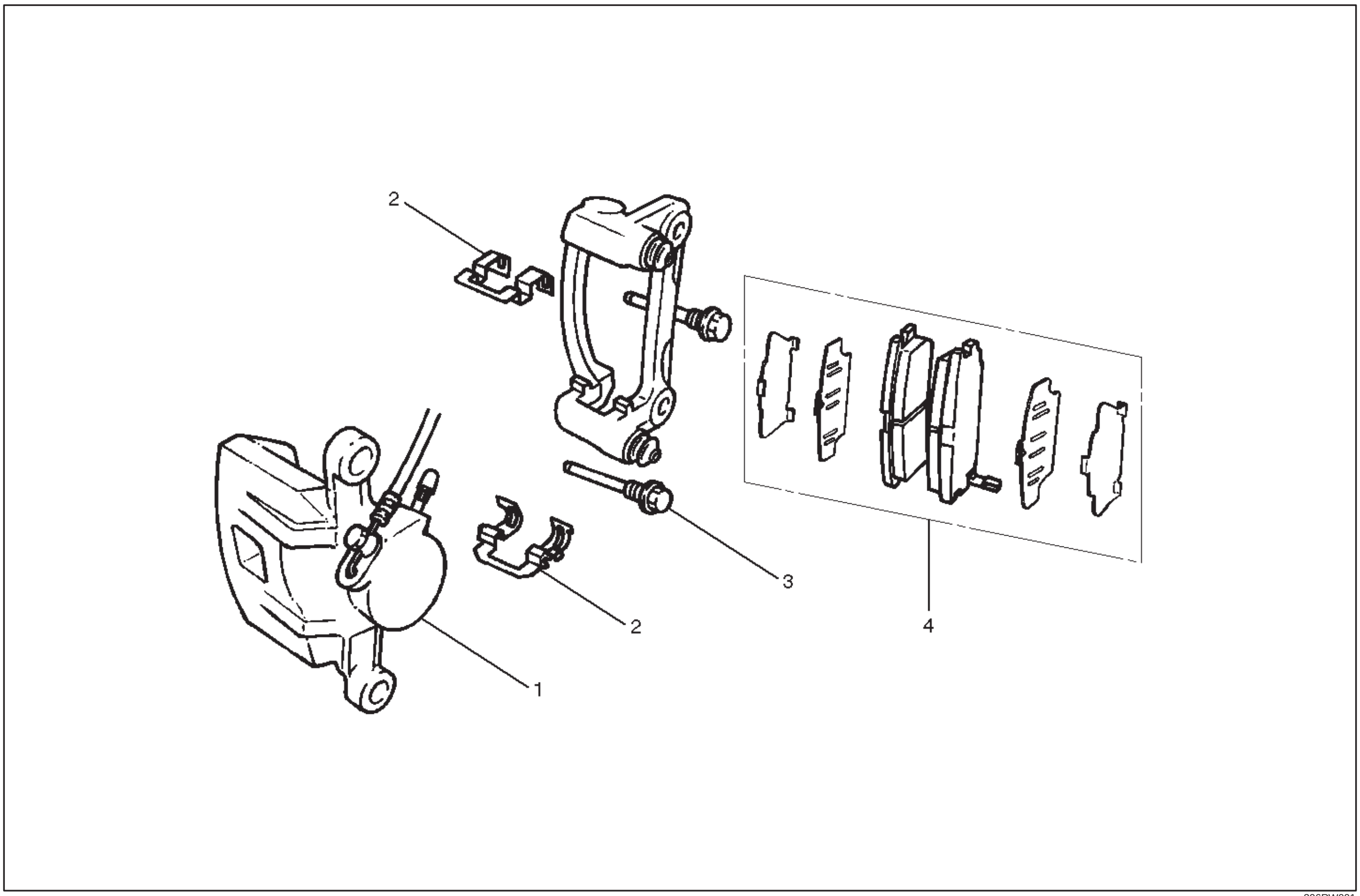
Check the outer pads by looking at each caliper from above. Check the thickness on the inner pad by looking down through the inspection hole in the top of the caliper. Whenever the pad is worn to about the thickness of the pad base, the pad should be removed for further measurements. The pad should be replaced anytime the pad thickness (1) is worn to within 1.0 mm (0.039 in) of the pad itself.
The disc pads have a wear indicator that makes a noise when the pad wears to where replacement is required.

Minimum limit (1): 1.0 mm (0.039 in)



302RW016

Brake Pads and Associated Parts



306RW001

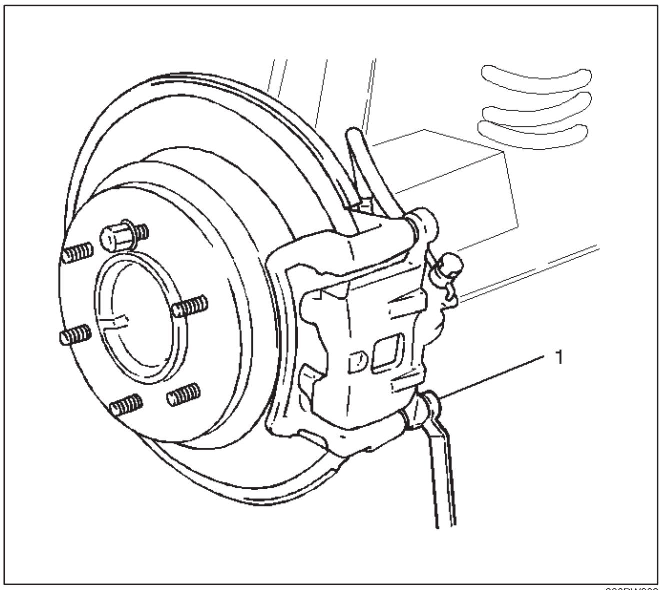
Legend
(1) Caliper Assembly
(2) Clip
(3) Lock Bolt
(4) Pad Assembly

Removal

NOTE: If a squealing noise occurs from the rear brake while driving, check the pad wear indicator plate. If the indicator plate contacts the rotor, the disc pad assembly should be replaced.

- Draw out two–thirds of the brake fluid from the reservoir.
- Raise the vehicle and support it with suitable safety stands.

1. Remove wheel and tire assembly, refer to “Wheels and Tires System” in Section 3E.
2. Remove lock bolt (1)

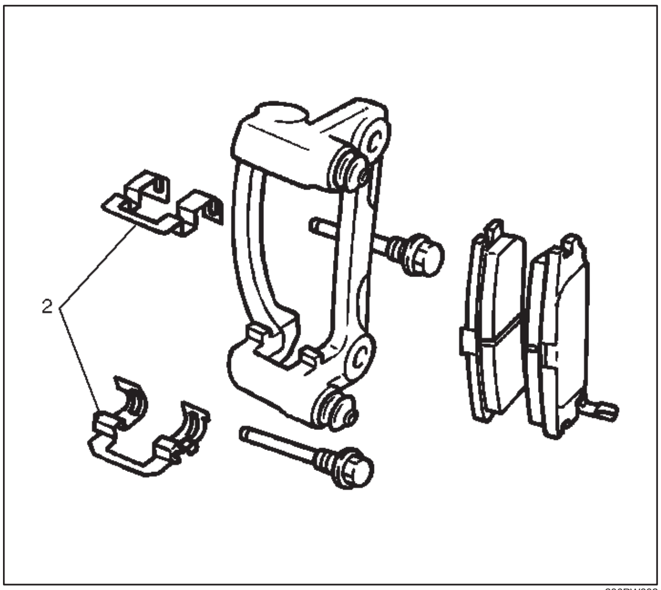


306RW002

3. Remove caliper assembly and support the caliper assembly so that the brake hose is not stretched or damaged.
4. Remove pad assembly with shim.
5. Remove clip.

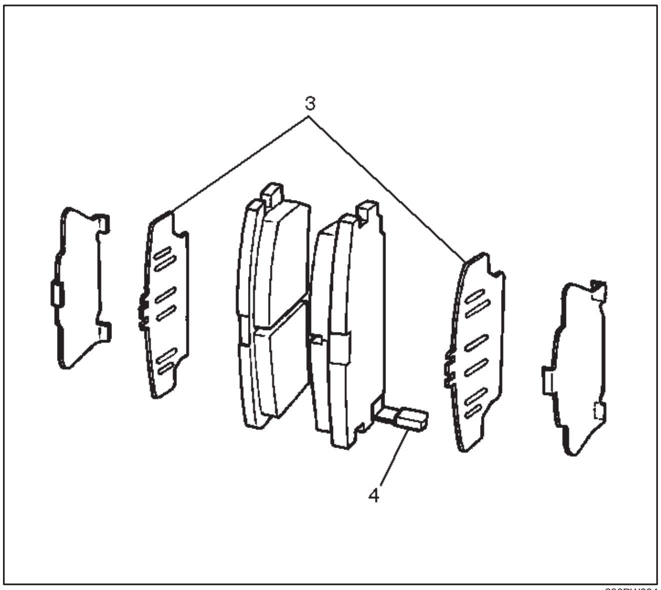
Installation

1. Install clip (2).



306RW003

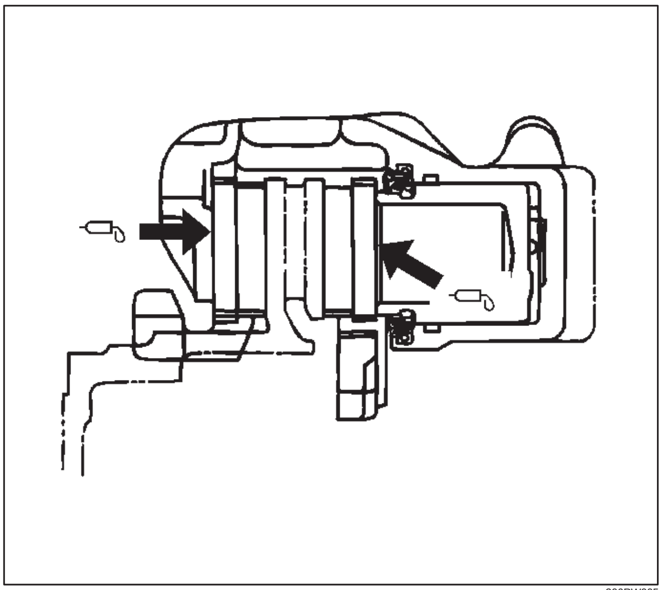
2. Install pad assembly with shim and apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims. Wipe off extruded grease after installing.



306RW004

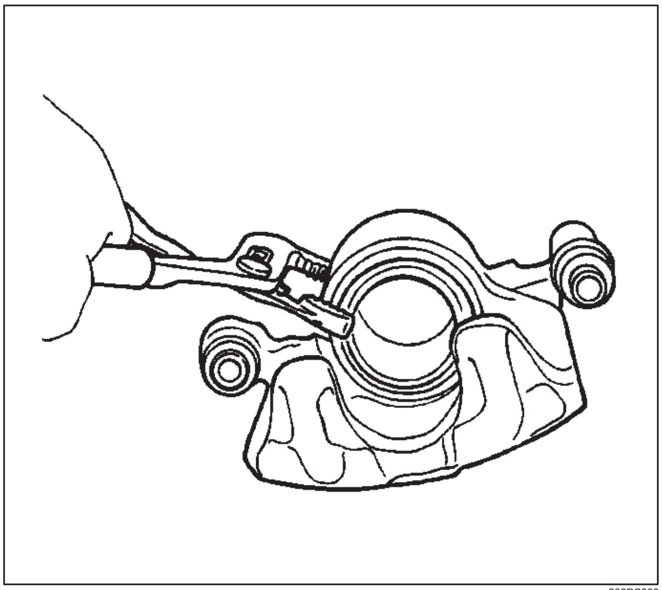
Legend

(3) Inner Shim
(4) Wear Indicator



306RW005

3. Install caliper assembly, use adjustable pliers to bottom the piston into the caliper bore. Be careful not to damage the piston dust boot and do not damage the flexible hose by twisting or pulling it.

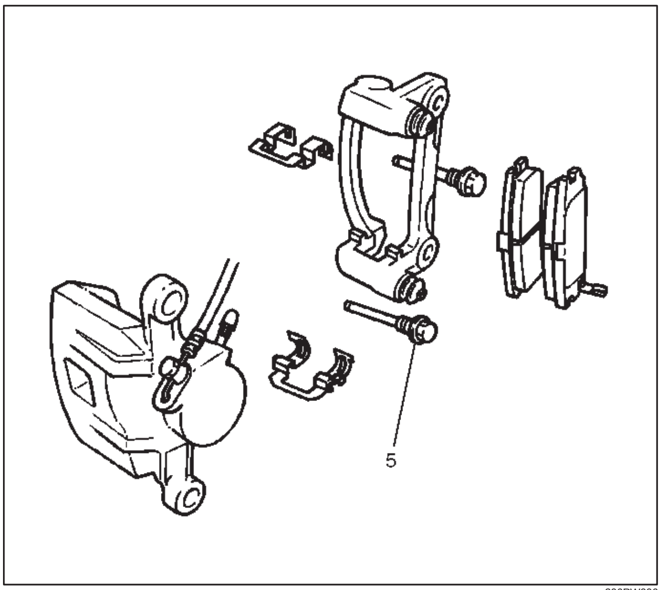


302RS008

4. Install lock bolt (5) and tighten the bolt to the specified torque.

Torque: 44 N·m (32 lb ft)

5. Install wheel and tire assembly, refer to “Wheels and Tires System” in Section 3E.
6. Pump the brake pedal several times to make sure that the pedal is firm. Check the brake fluid level in the reservoir after pumping the brakes.



306RW006

Rear Disc Brake Rotor

Inspection

In the manufacturing of the brake rotor, all the tolerances regarding surface finish, parallelism and lateral runout are held very closely. Maintaining these tolerances provides the surface necessary to assure smooth brake operation.

Lateral Runout

Lateral runout is the movement of the rotor from side to side as it rotates on the spindle. This could also be referred to as "rotor wobble".

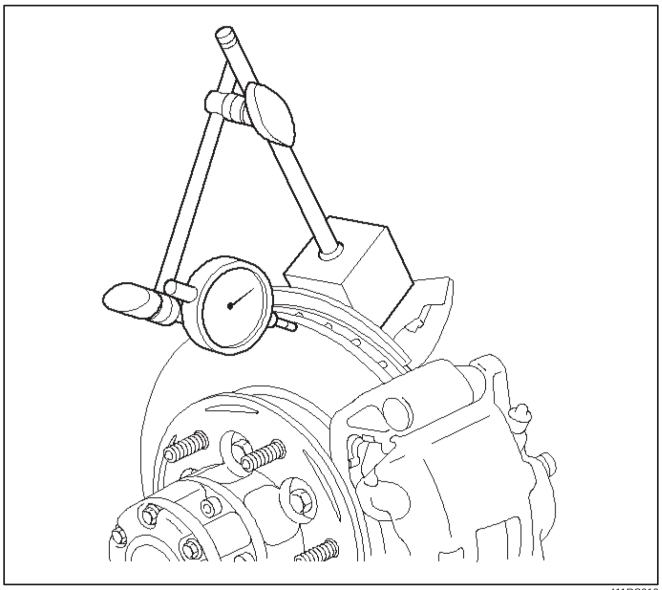
This movement causes the piston to be knocked back into its bore. This results in additional pedal travel and a vibration during braking.

Checking Lateral Runout

1. Adjust the wheel bearing correctly, refer to "Differential" in Section 4A.
2. Attach a dial indicator to some portion of the suspension so that the stem contacts the rotor face about 29 mm (1.14 in) from the rotor edge.
3. Move the rotor one complete rotation.

1. The lateral runout should not exceed 0.13 mm (0.005 in)

Maximum runout: 0.13 mm (0.005 in)



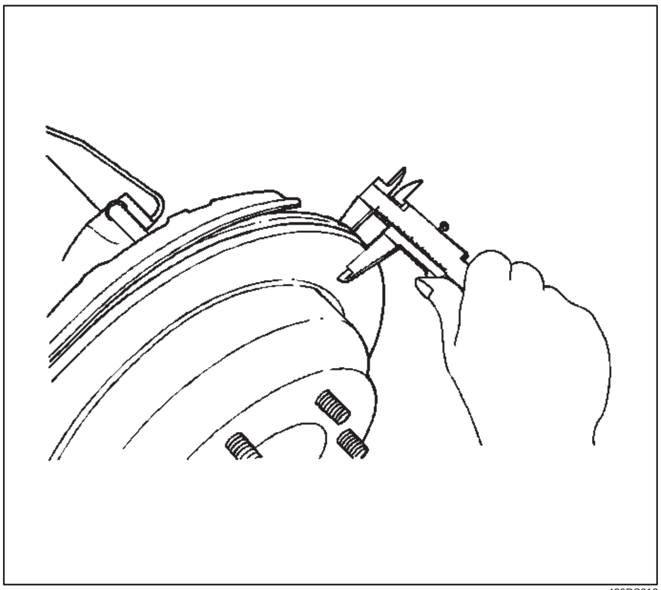
411RS019

Parallelism

Parallelism is the measurement of thickness of the rotor at four or more points around the circumference of the rotor. All measurements must be made 22 mm (0.87 in) from the edge of the rotor.

The rotor thickness must not vary more than 0.010 mm (0.0004 in) from point to point.

Maximum parallelism: 0.001 mm (0.0004 in)



420RS013

Replacing Brake Rotors

When installing new brake rotors, do not refinish the surfaces. These parts are at the correct level of surface finish.

Refinishing Brake Rotors

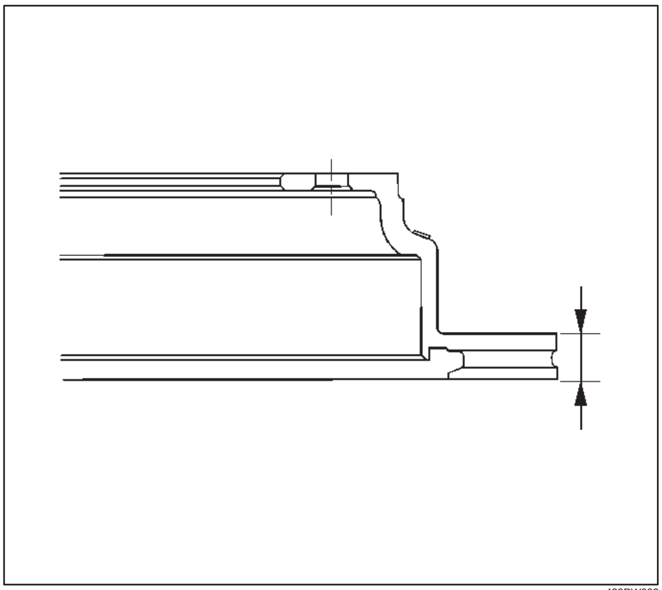
Accurate control of the rotor tolerances is necessary for proper performance of the disc brakes. Machining of the rotor should be done only with precision equipment. All brake rotors have a minimum thickness dimension cast into them. This dimension is the minimum wear dimension and not a refinish dimension. The minimum wear dimension is 16.6 mm (0.654 in). The minimum refinish dimension is 16.97 mm (0.668 in).

When refinishing rotors, always use sharp cutting tools or bits. Dull or worn tools leave a poor surface finish which will affect initial braking performance. Vibration dampening attachments should always be used when refinishing braking surfaces. These attachments eliminate tool chatter and will result in better surface finish.

After refinishing, replace any rotor that does not meet the minimum thickness of 16.97 mm (0.668 in). Do not use a brake rotor that will not meet the specification.

Minimum wear dimension: 16.6 mm (0.654 in)

Refinish dimension: 16.97 mm (0.668 in)



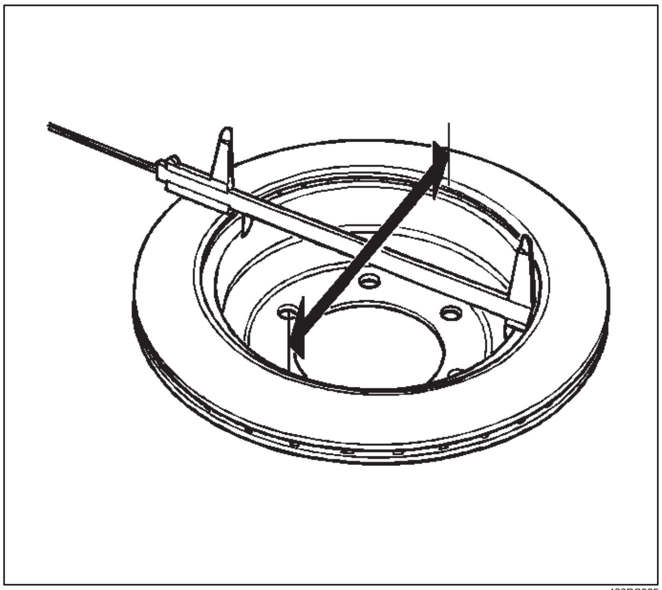
420RW002

Rear Drum (In Disc) Inside Diameter Check

Check the rear drum inside diameter by measuring at more than two portions as shown in the illustration.
If the inside diameter is greater than the limit, replace the rear rotor.

Standard: 210.0 mm (8.27 in)

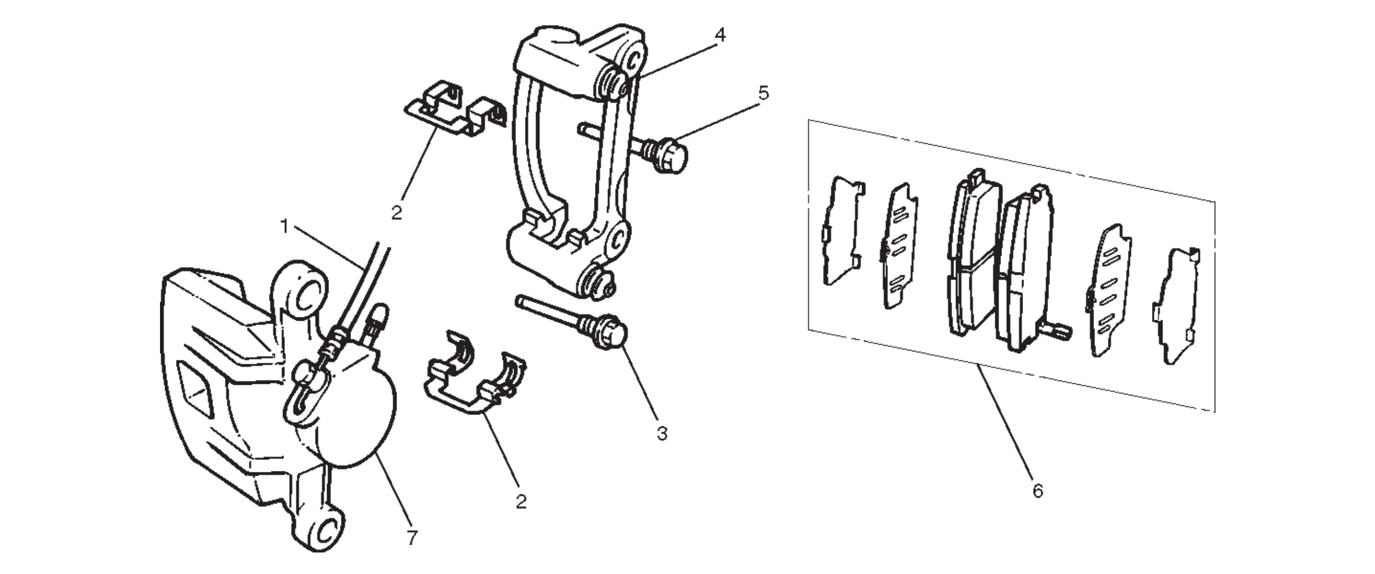
Limit: 211.4 mm (8.32 in)



420RS035

Rear Disc Brake Caliper Assembly

Rear Disc Brake Caliper Assembly and Associated Parts



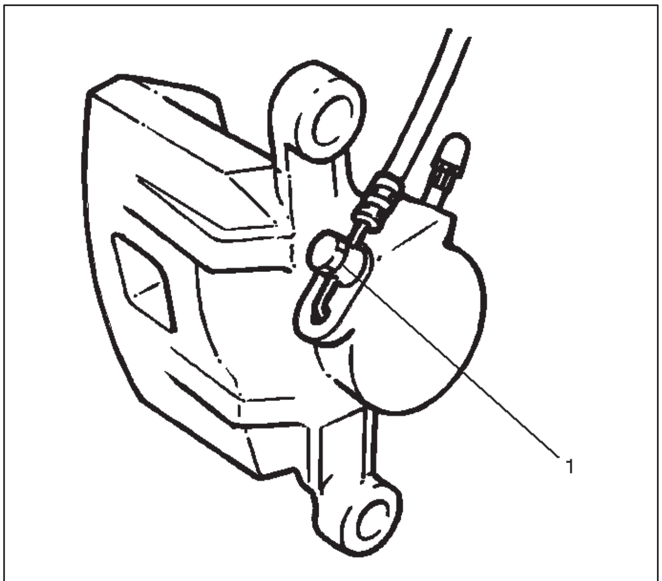
306RW007

Legend

(1) Brake Flexible Hose
(2) Clip
(3) Lock Bolt
(4) Support Bracket
(5) Guide Bolt
(6) Pad Assembly with Shim
(7) Caliper Assembly

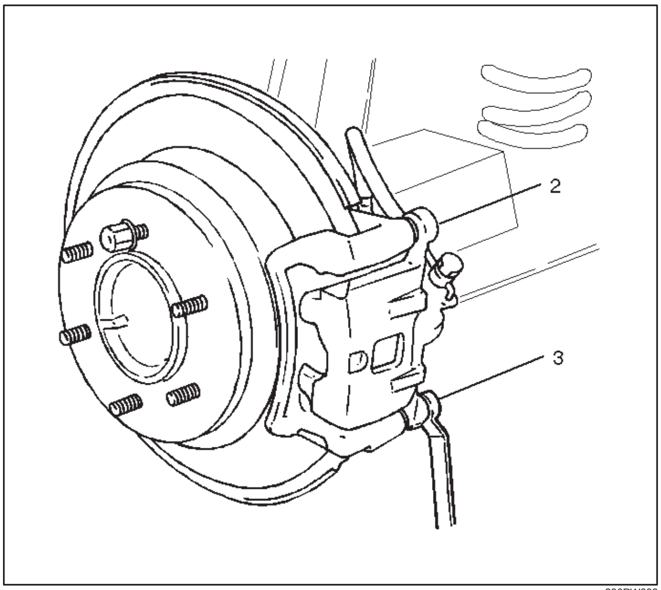
Removal

1. Raise the vehicle and support with suitable safety stands.
2. Remove wheel and tire assembly, refer to "Wheels and Tires System" in Section 3E.
3. Remove the bolt and gaskets, then disconnect the flexible hose from the caliper and after disconnecting the flexible hose (1), cap or tape the openings to prevent entry of foreign material.



306RW008

4. Since the brake fluid flows out from the connecting coupler, place a drain pan under the vehicle.
5. Remove lock bolt (2).
6. Remove guide bolt (3).



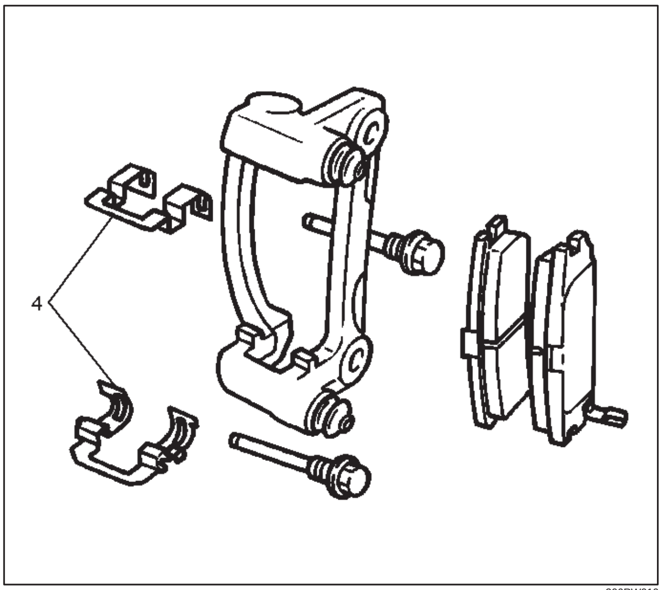
306RW009

7. Remove caliper assembly.
8. Remove support bracket with pad assembly and take care not to damage the flexible brake hose when removing the support bracket.
9. Remove pad assembly (with shim) and mark the lining locations if they are to be reinstalled.

10. Remove clip.

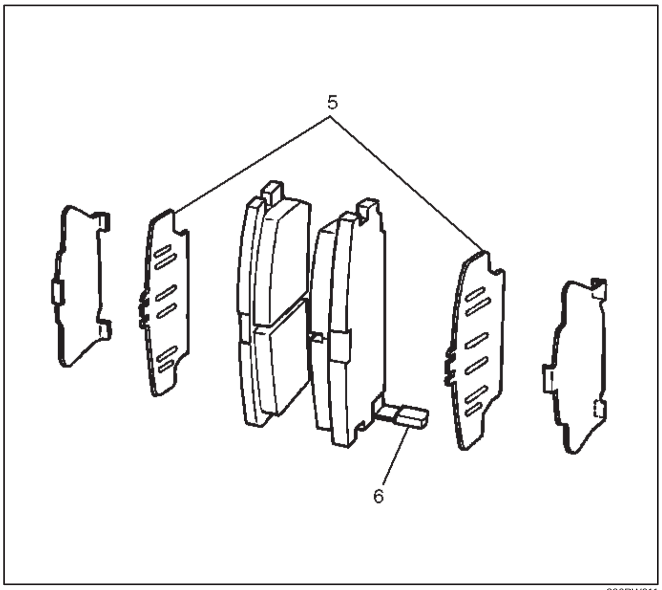
Installation

1. Install clip (4).



306RW010

2. Install pad assembly (with shim) and apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims (5). Wipe off extruded grease after installing.



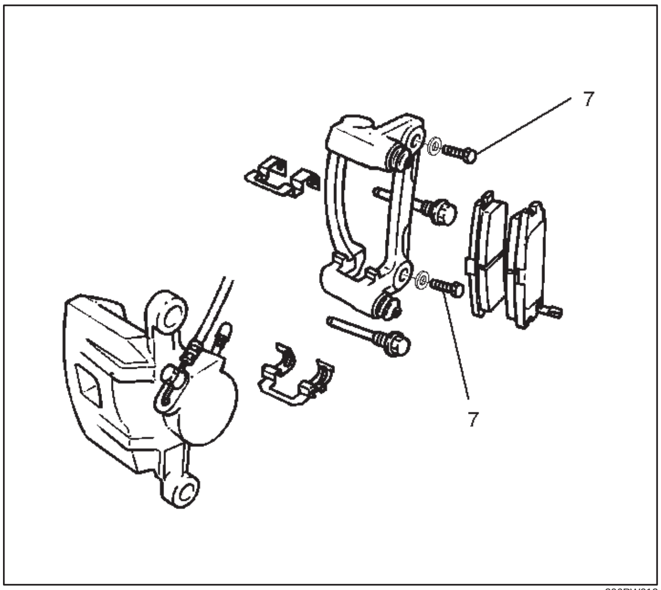
306RW011

Legend

(5) Inner Shim
(6) Wear indicator

3. Install support bracket and tighten the bolt (7) to the specified torque.

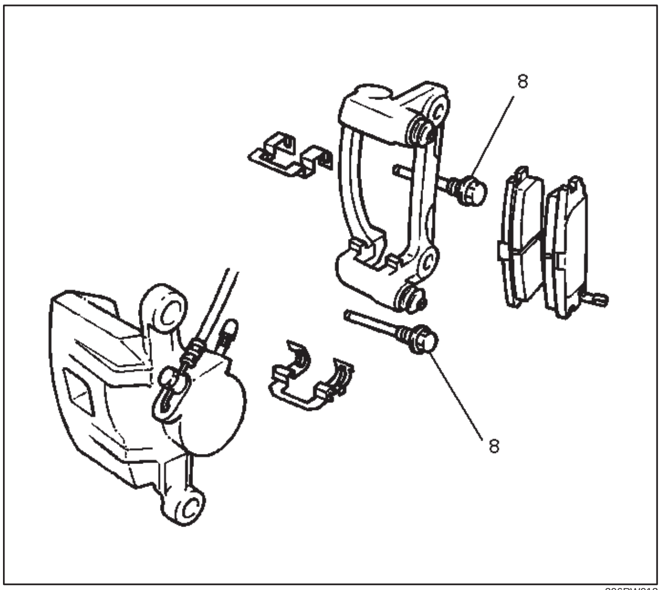
Torque: 103 N·m (76 lb ft)



306RW012

4. Install caliper assembly.
5. Install lock bolt and guide bolt (8) and tighten the bolt to the specified torque.

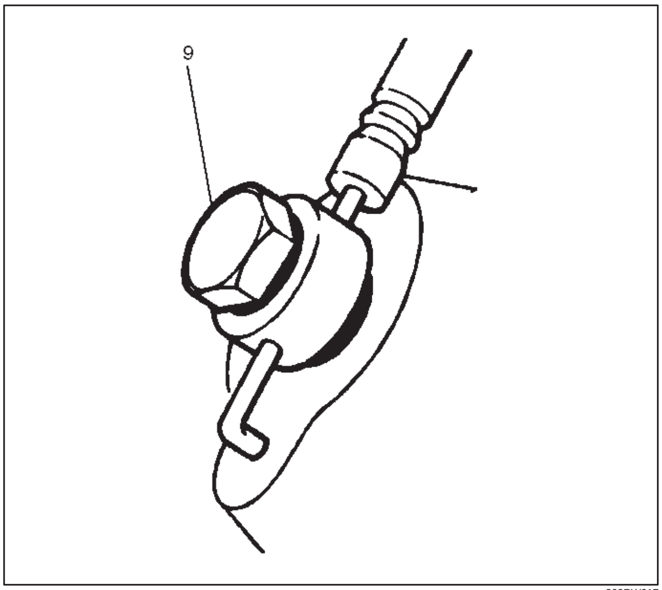
Torque: 44 N·m (32 lb ft)



306RW013

6. Install brake flexible hose, always use new gaskets and be sure to put the hooked edge of the flexible hose end into the anti–rotation cavity then tighten the I–bolt (9) to the specified torque.

Torque: 35 N·m (26 lb ft)

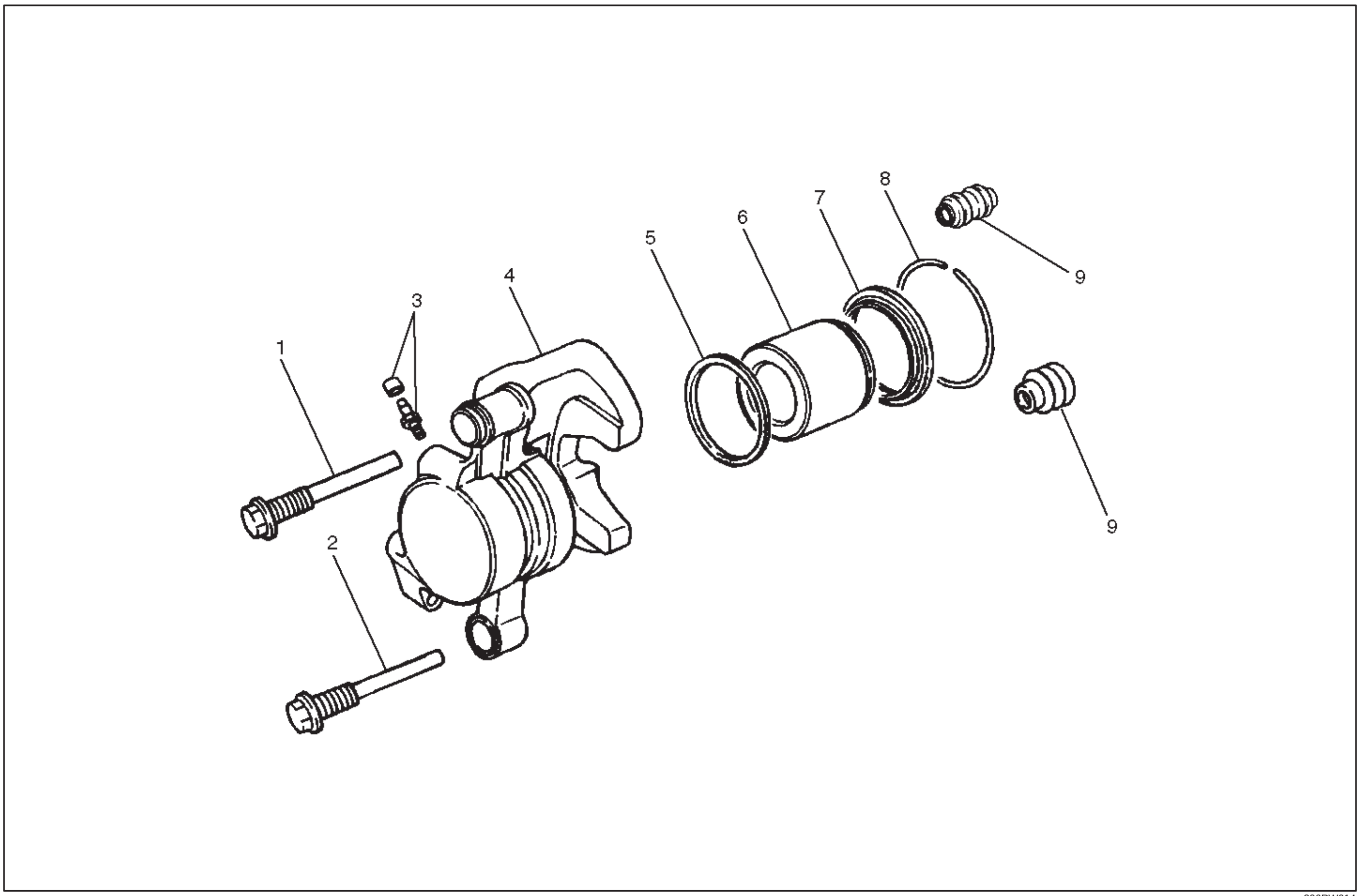


302RW017

7. Install the wheel and tire assembly, refer to “Wheels and Tires System” in Section 3E.
8. Bleed brakes. Refer to “Hydraulic Brakes” in this section.

Rear Disc Brake Caliper

Rear Disc Brake Caliper Disassembled View



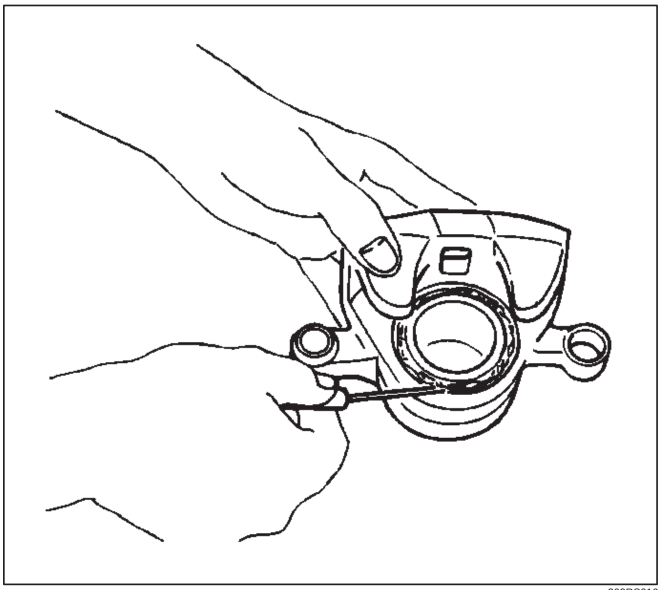
306RW014

Legend

(1) Guide Bolt
(2) Lock Bolt
(3) Bleeder with Cap
(4) Caliper Body
(5) Piston Seal
(6) Piston
(7) Dust Boot: Piston
(8) Dust Boot Ring
(9) Dust Boot: Guide Bolt and Lock Bolt

Disassembly

1. Remove guide bolt.
2. Remove lock bolt.
3. Remove dust boot; guide bolt and lock bolt.
4. Remove the dust boot ring using a small screwdriver.

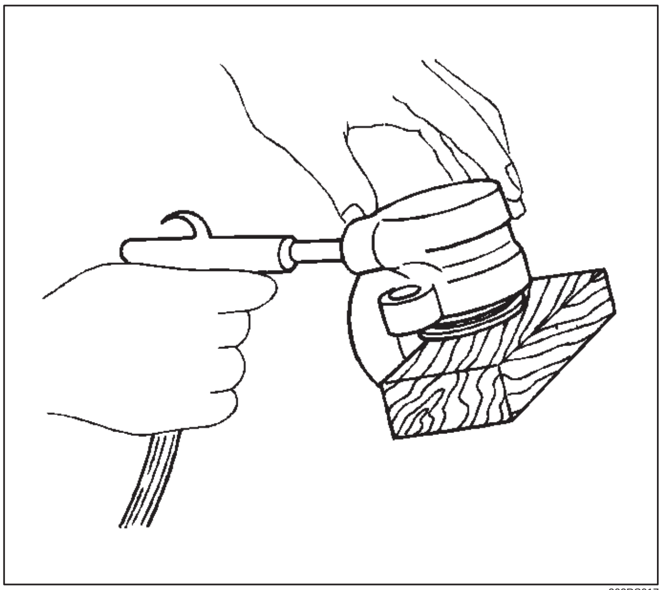


302RS016

5. Insert a block of wood into the caliper and force out the piston by blowing compressed air into the caliper at the flexible hose attachment. This procedure must be done prior to removal of the dust boot.

WARNING: DO NOT PLACE YOUR FINGERS IN FRONT OF THE PISTON IN AN ATTEMPT TO CATCH OR PROTECT IT WHEN APPLYING COMPRESSED AIR. THIS COULD RESULT IN PERSONAL INJURY.

CAUTION: Use just enough air to ease the piston out of the bore. If the piston is blown out, it may be damaged.



302RS017

6. Remove dust boot: piston.
7. Remove piston seal.
8. Remove bleeder with cap.
9. Remove caliper body.

Inspection and Repair

Make necessary parts replacement, if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- Rotor
- Cylinder body
- Cylinder bore
- Piston
- Guide bolt, lock bolt
- Support bracket

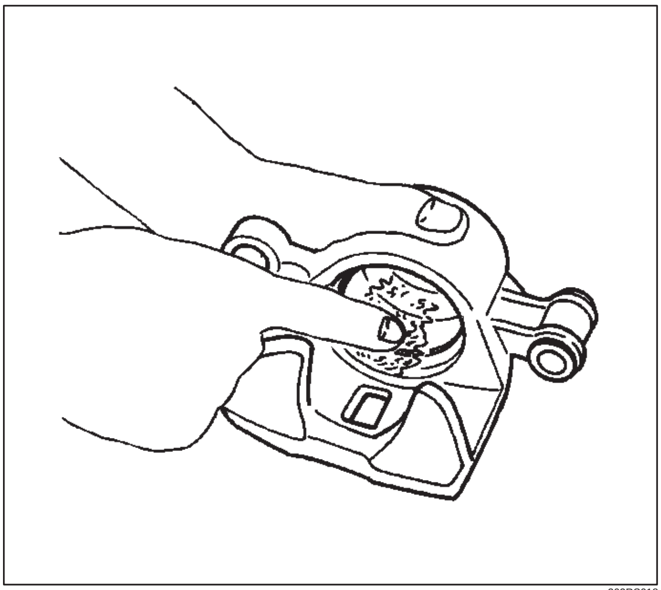
NOTE: The piston dust seal and dust boot are to be replaced each time the caliper is overhauled. Discard these used rubber parts and replace with new ones.

Reassembly

1. Install caliper body.
2. Install bleeder with cap and tighten the cap to the specified torque.

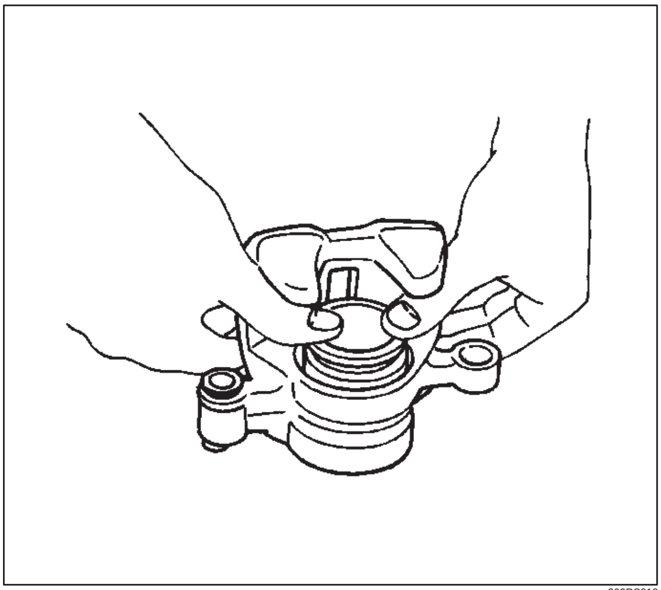
Torque: 8 N·m (69 lb ft)

3. Install piston seal and apply special rubber grease to the piston seal and cylinder wall, then insert the piston seal into the cylinder. The special rubber grease is included in the repair kit.



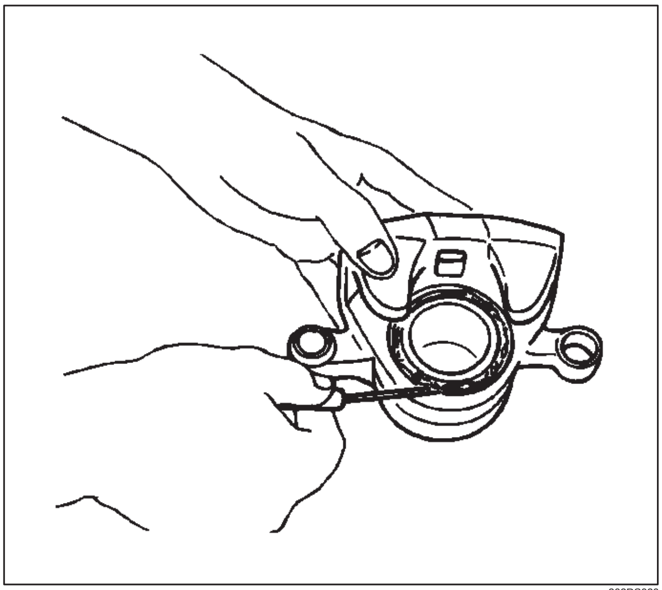
302RS018

4. Install piston.
5. Install piston dust boot; when inserting the piston into the cylinder, use finger pressure only and do not use a mallet or other impact tool, since damage to the cylinder wall or piston seal can result.



302RS019

6. Install dust boot ring and apply special grease (approximately 1g) to the piston and attach the dust boot to the piston and caliper. Insert the dust boot ring into the dust boot.

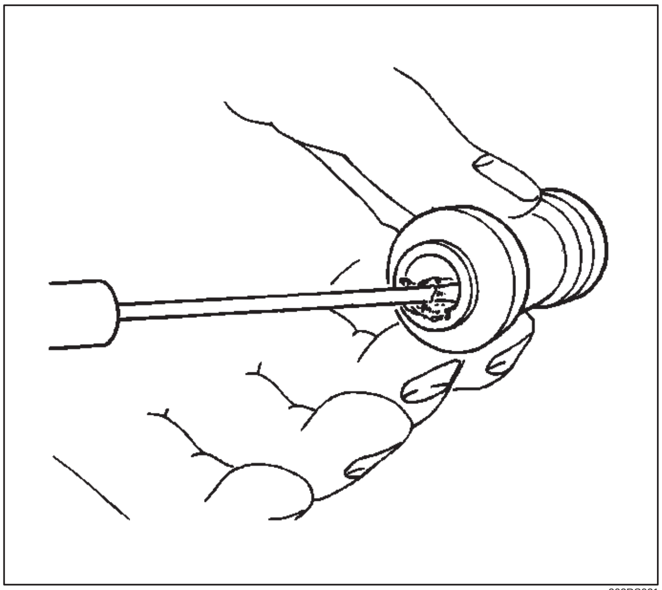


302RS020

7. Install guide bolt and lock bolt dust boot.
8. Install lock bolt and guide bolt and tighten the bolt to the specified torque.

Torque: 74 N·m (54 lb ft)

9. Install the dust boot on the support bracket after applying special grease (Approx. 1g) onto the dust boot inner surface. Also apply special grease onto the lock bolt and guide bolt setting hole of the support bracket.



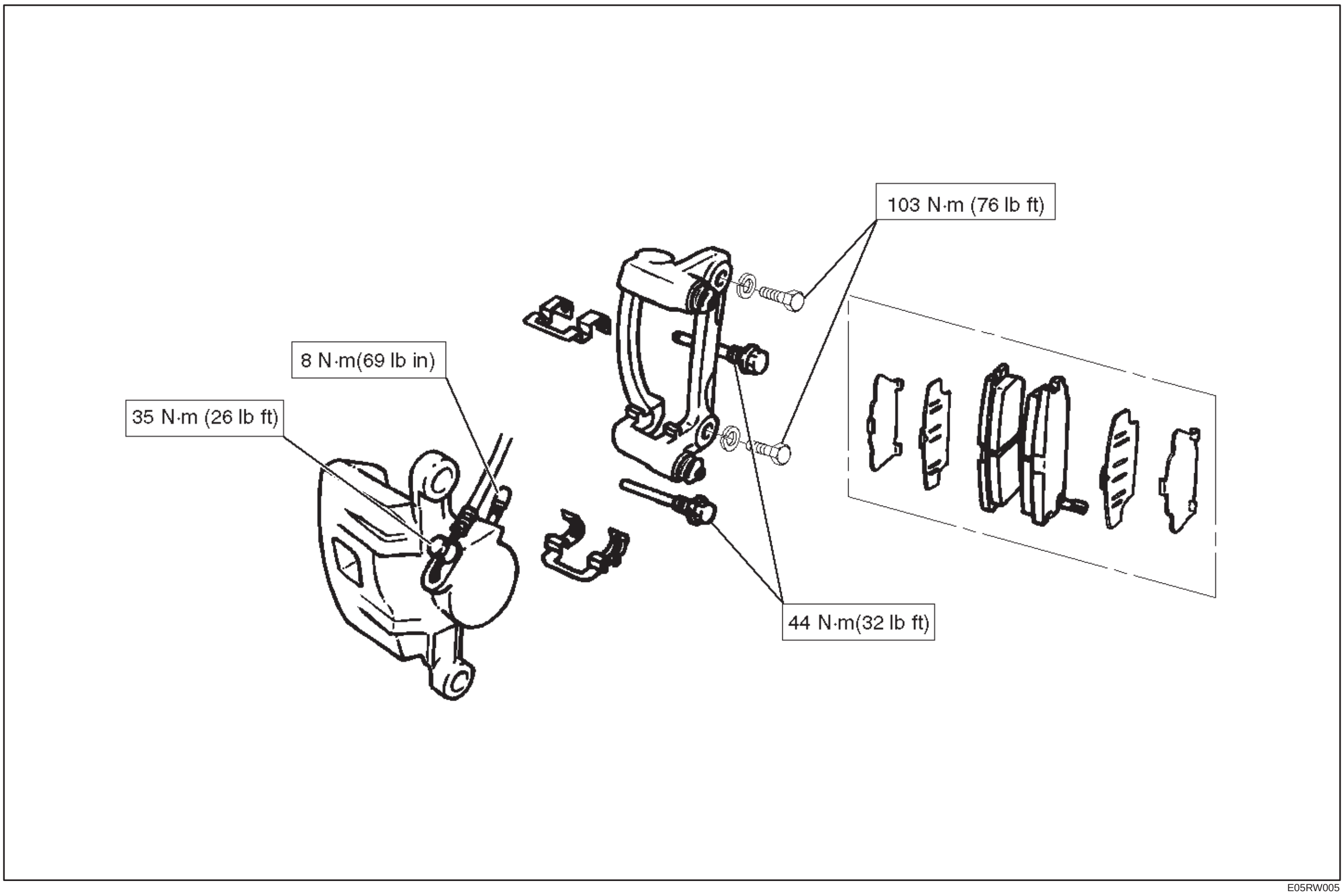
302RS021

Main Data and Specifications

General Specifications

Type	Floating, pin slide
Pad dimension	33 cm^2 (5.11 in^2)
Adjusting method	Self–adjusting
Piston diameter	41.3 mm (1.63 in)
Disc type	Ventilated
Disc thickness	18 mm (0.71 in)
Disc effective diameter	269.2 mm (10.60 in)

Torque Specifications



TROOPER

BRAKES

PARKING BRAKE SYSTEM

CONTENTS

Service Precaution

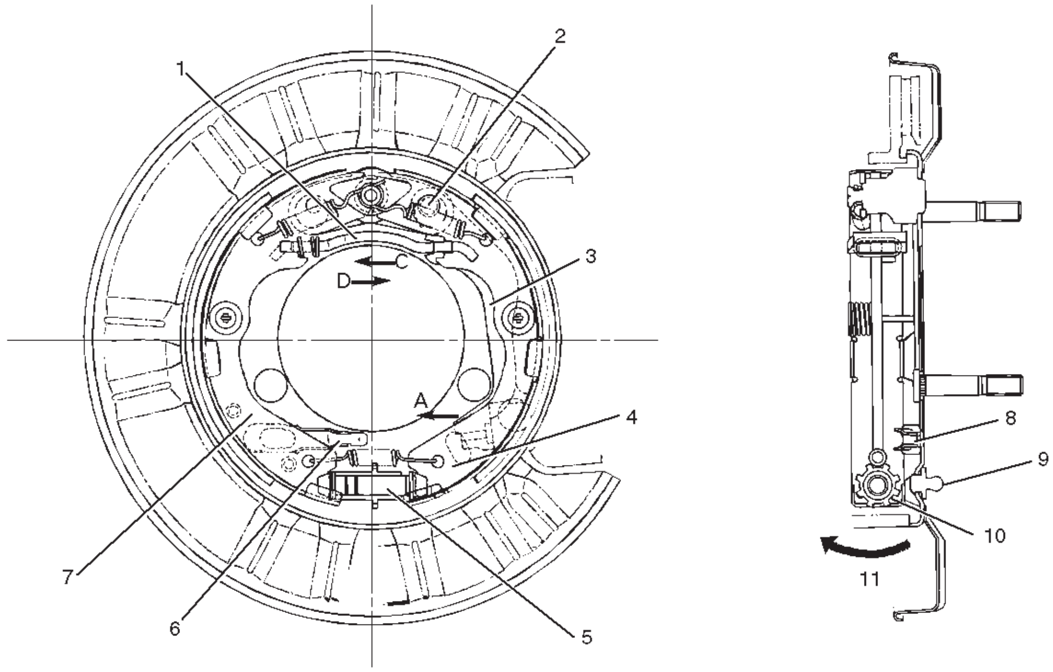
WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Pulling up the parking brake lever by hand will set the parking brake. Once pulled up, the lever is held by a ratchet–type lock until it is released. The position of the lever is transmitted through cable/lever systems to the rear wheels. These parts are designed in order to obtain sufficient braking force when parking on slopes. When the parking brake is set, or when the ignition switch is in the “ON” position, the brake warning light illuminates.
The rear wheel parking brake is a duo–servo brake (mechanical inside expansion type) built into the rear disc brake. Parking brake adjustment is made through the adjusting hole bored through the back plate. Adjust the parking brake lever stroke to six or seven notches. Refer to “Parking Brake Adjustment” in this Section.

Operation



C05RW003

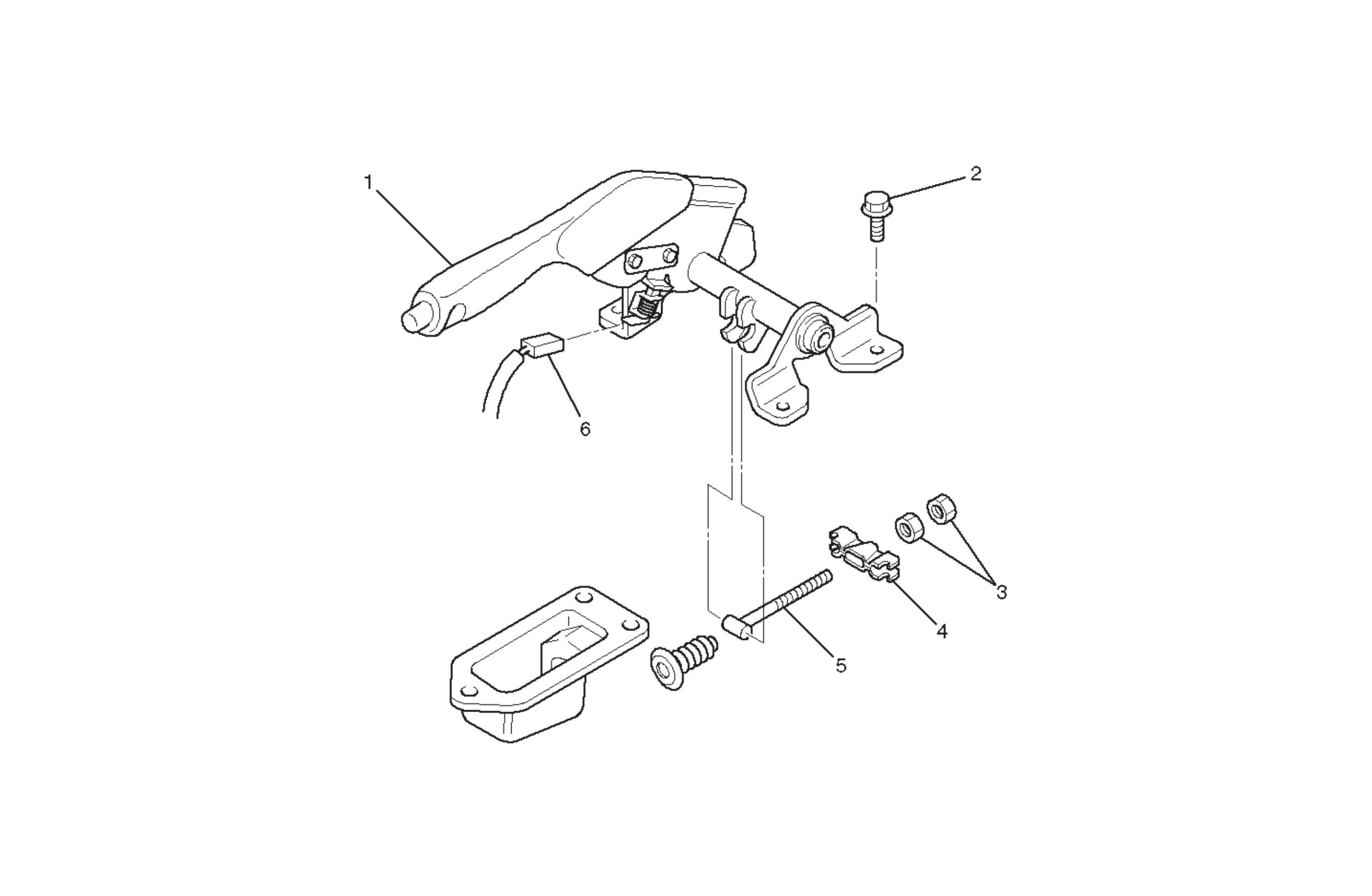
Legend

(1) Strut
(2) Fulcrum B
(3) Parking Lever
(4) Secondary Shoe
(5) Adjusting Screw Notch
(6) Parking Cable Guide
(7) Primary Shoe
(8) Parking Brake Cable Guide
(9) Adjusting Hole Plug
(10) Adjusting Screw Notch
(11) Shoe Expanding Direction

When pulled in the direction “A”, the parking lever presses the secondary shoe against the brake drum using the lever/shoe joint “B” as a fulcrum and pushes the strut in the direction “C”. The strut ,in turn, presses the primary shoe against the brake drum. Counter force “D” to the primary shoe is transmitted again to the secondary shoe through the fulcrum “B”. The secondary shoe contacts the drum thereby producing braking effect. Clearance which may result from worn parking brake shoe lining can be adjusted by turning the adjusting screw. Refer to “Parking Brake Adjustment” in this Section.

Parking Brake Lever and Front Cable

Parking Brake Lever, Front Cable and Associated Parts



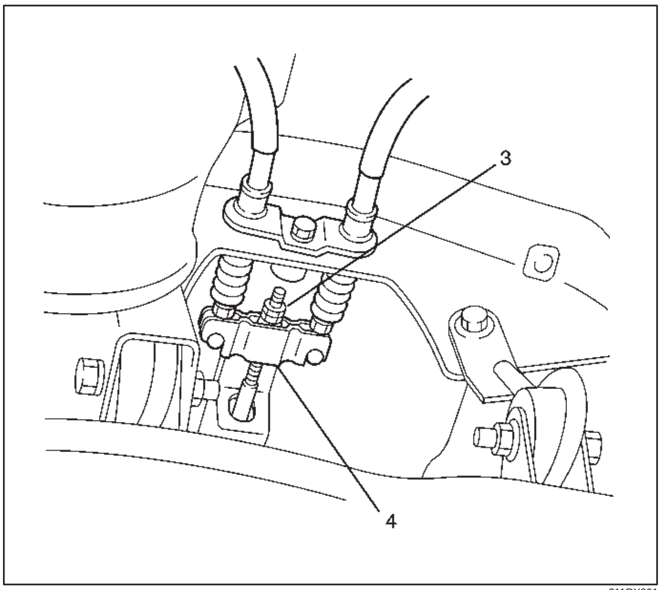
311RW001

Legend

(1) Parking Brake Lever
(2) Bolt
(3) Adjusting Nut
(4) Equalizer
(5) Parking Brake Front Cable
(6) Switch Connector

Removal

1. Remove adjusting nut (3).
2. Remove equalizer (4).



311RX001

3. Remove center console.
   (Refer to Section 10 “Body”.)
4. Remove bolts.
5. Disconnect switch connector.
6. Remove parking brake lever.
7. Remove parking brake front cable.

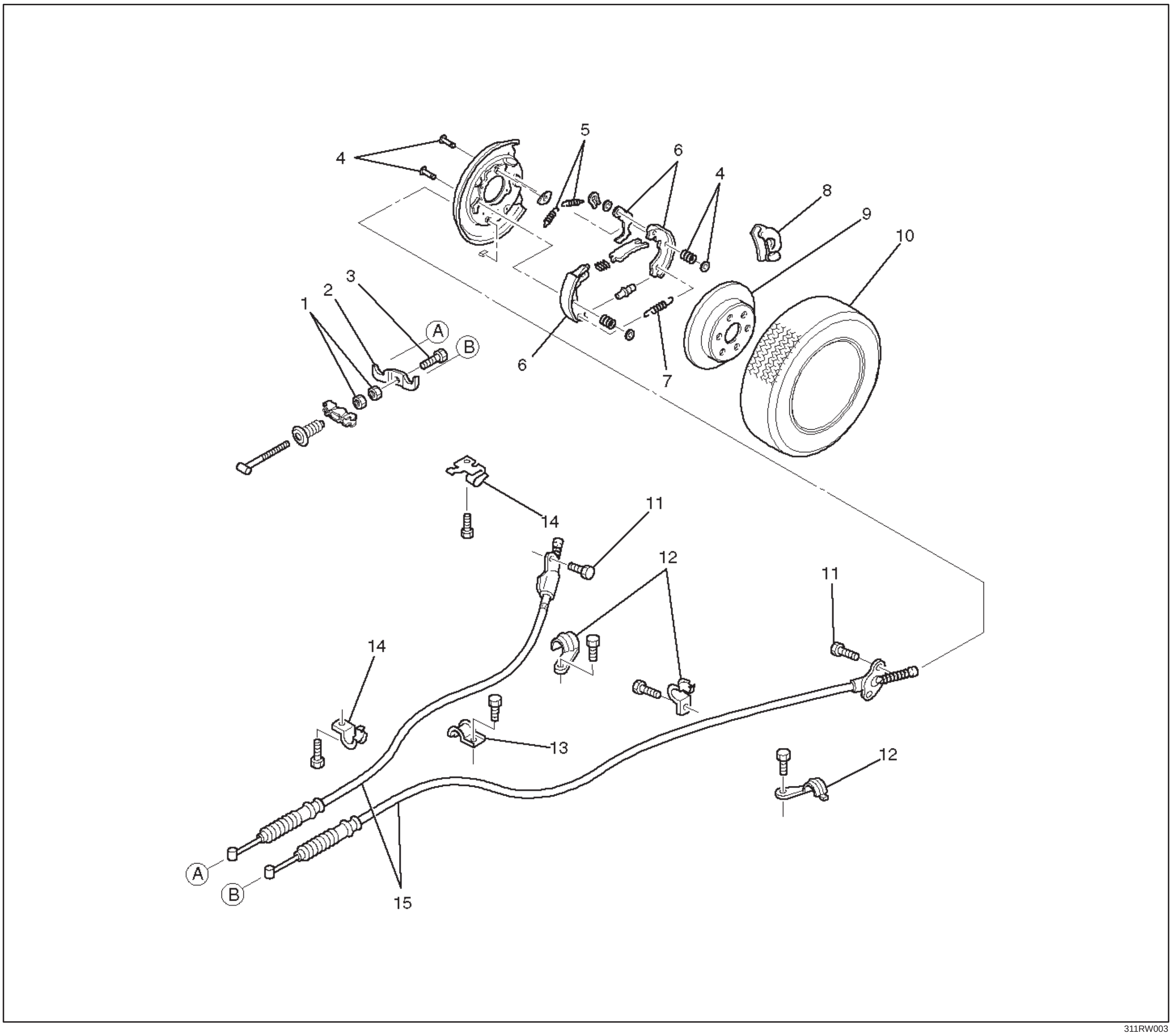
Installation

1. Install parking brake front cable.
2. Install parking brake lever and apply grease (BESCO L–2 or equivalent) to front cable contact point.
3. Reconnect switch connector.
4. Install bolts and tighten the parking brake lever fixing bolt to the specified torque.

   Torque : 15 N·m (11 lb ft)
5. Install center console.
   (Refer to Section 10 “Body”.)
6. Install equalizer.
7. Install adjusting nut and adjust the parking brake lever. (See “Parking Brake Adjustment” in this section.)

Parking Brake Rear Cable

Parking Brake Rear Cable and Associated Parts



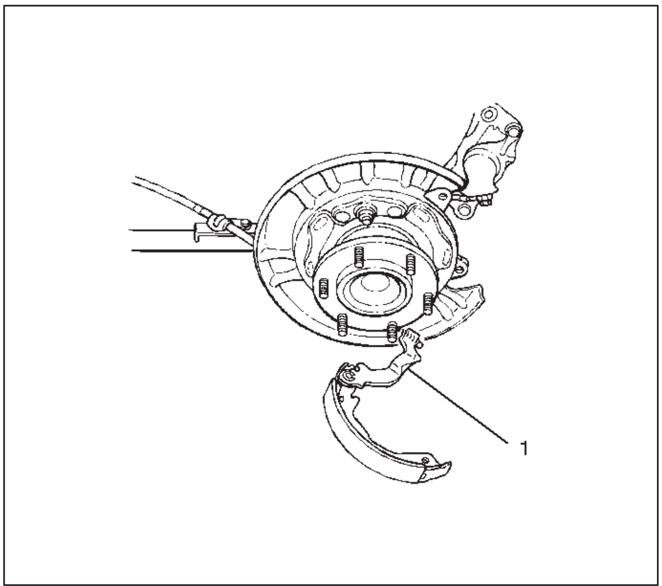
Legend

(1) Adjust Nut
(2) Back Plate
(3) Bolt
(4) Holding Spring
(5) Return Spring; Upper
(6) Shoe Assembly
(7) Return Spring; Lower
(8) Caliper Assembly
(9) Rotor (Drum)
(10) Rear Wheels
(11) Cable Fixing Bolt
(12) Clip
(13) Clip
(14) Clip
(15) Rear Cable

Removal

1. Remove adjusting nut.
2. Remove rear wheels.
3. Remove caliper assembly, remove two bolts to remove the caliper assembly from the support bracket. (Refer to “Rear Disc Brakes in Disc Brakes” in Section 5C). Temporarily hang the caliper with a wire in order to avoid stretching the brake hose.
4. Remove rotor (drum).
5. Remove clip (floor side).

6. Remove bolt.
7. Remove back plate.
8. Remove clip (frame side).
9. Remove clip (suspension side).
10. Remove holding spring.
11. Remove return spring; upper.
12. Remove return spring; lower.
13. Remove the brake shoe assembly. Then remove the parking brake cable from the parking brake lever (1).



308RW001

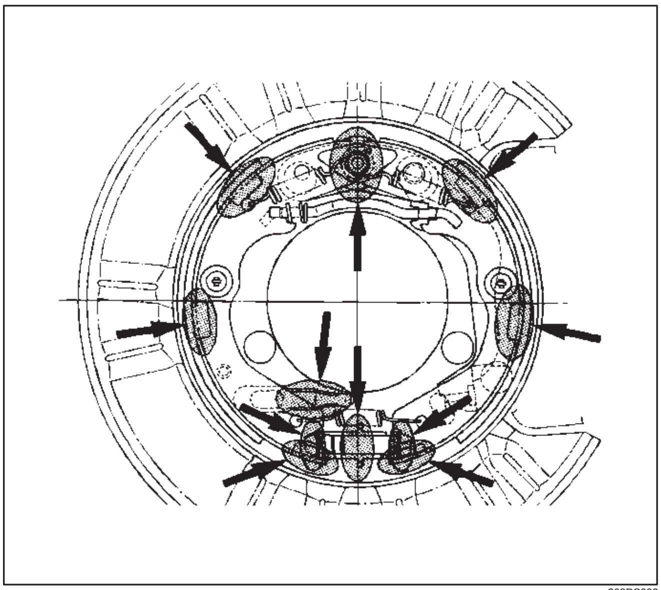
14. Remove cable fixing bolt.
15. Remove rear cable.

Installation

1. Install rear cable and apply grease (BESCO L–2 or equivalent) to the connecting portion of the rear cable and the equalizer.
2. Install cable fixing bolt and tighten the cable fixing bolt to the specified torque.

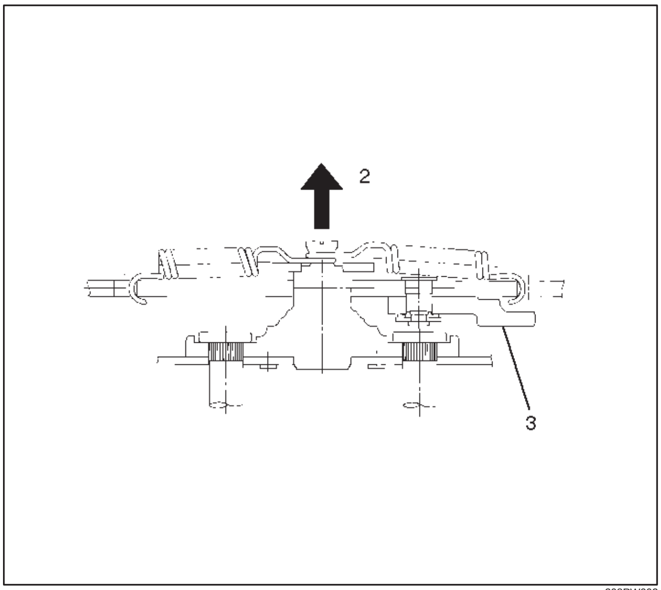
Torque: 6 N·m (52 lb in)

3. Install shoe assembly and after installation of the shoe and cable assembly, apply the special grease included in the repair kit to the portions indicated in the illustration.



308RS002

4. Install return spring; lower.
5. Install return spring; upper and the parking brake lever (3) side (secondary side) return spring must be installed on the outer side (2) of the primary side return spring.



308RW002

6. Install holding spring.
7. Install clip (suspension side) and tighten the bolt to the specified torque.

Torque: 7.8 N·m (68 lb in)

8. Install clip (frame side) and tighten the bolt to the specified torque.

Torque: 15 N·m (11 lb in)

9. Install back plate.
10. Install bolt and tighten the bolt to the specified torque.

Torque: 6 N·m (52 lb in)

11. Install clip (floor side) and tighten the bolt to the specified torque.

Torque: 15 N·m (11 lb in)

12. Install rotor.

13. Install caliper assembly.
14. Install rear wheels.
15. Install adjusting nut and apply grease (BESCO L–2 or equivalent) to front cable contact point.
16. Tighten the adjusting nut to the specified torque and to adjust the parking brake, refer to “Parking Brake Adjustment” in this section.

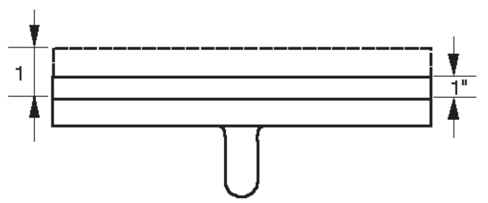
Torque: 6 N·m (52 lb in)

Inspection and Repair

Parking Brake Lining Inspection

Check the shoe assemblies for wear by removing the brake drum rotor.
Replace the shoe assemblies if the lining thickness is less than 1.0 mm (0.039 in).

Minimum limit: 1.0 m (0.039 in)



308RW003

Parking Brake Rotor (Drum) Inspection

Refer to “Rear Disc Brakes” in Section 5A2 for the inspection procedure of the rotor (drum).

Parking Brake Adjustment

1. Adjustment of parking brake assembly
   - Prior to lever stroke adjustment, adjust the rear brake shoe/rotor (drum) gap. Perform this procedure by loosening the adjusting nut of the equalizer.

   a. Remove the adjusting hole plug (rubber) and turn the shoe adjusting screw downward using a small screwdriver so that the shoes will expand until they get into close contact with the rotor. (Turn down the adjusting screw notch by notch until the rotor does not turn.)

   b. Turn the adjusting screw in the opposite direction (upward) until the rotor can be turned lightly. Standard number of notches to turn upward: 7 or 8.

   Turn the rotor in order to ensure that there is no brake dragging.

2. Adjustment of parking brake cable

   a. Turn the equalizer nut so that the parking brake lever travels 6 or 7 notches when pulled up with a force of 30 kg (66 lb).

   b. Make sure that there is no brake dragging and tighten the cable lock nut.

Torque : 6 N·m (52 lb in)

3. Break–in of parking brake shoe
   - When poor braking is felt, or just after replacement of parking brake shoes, be sure to conduct the break–in procedure by driving the vehicle as follows:

   a. Forward 50 km/h (30 mph) × 400 m (about 30 seconds) with a lever pull force of 15 kg (33 lb).

   b. Backward 10 km/h (6 mph) × 50 m (about 18 seconds) with a lever pull force of 15 kg (33 lb).

NOTE: Break–in procedures must be performed under safe conditions and traffic rules.

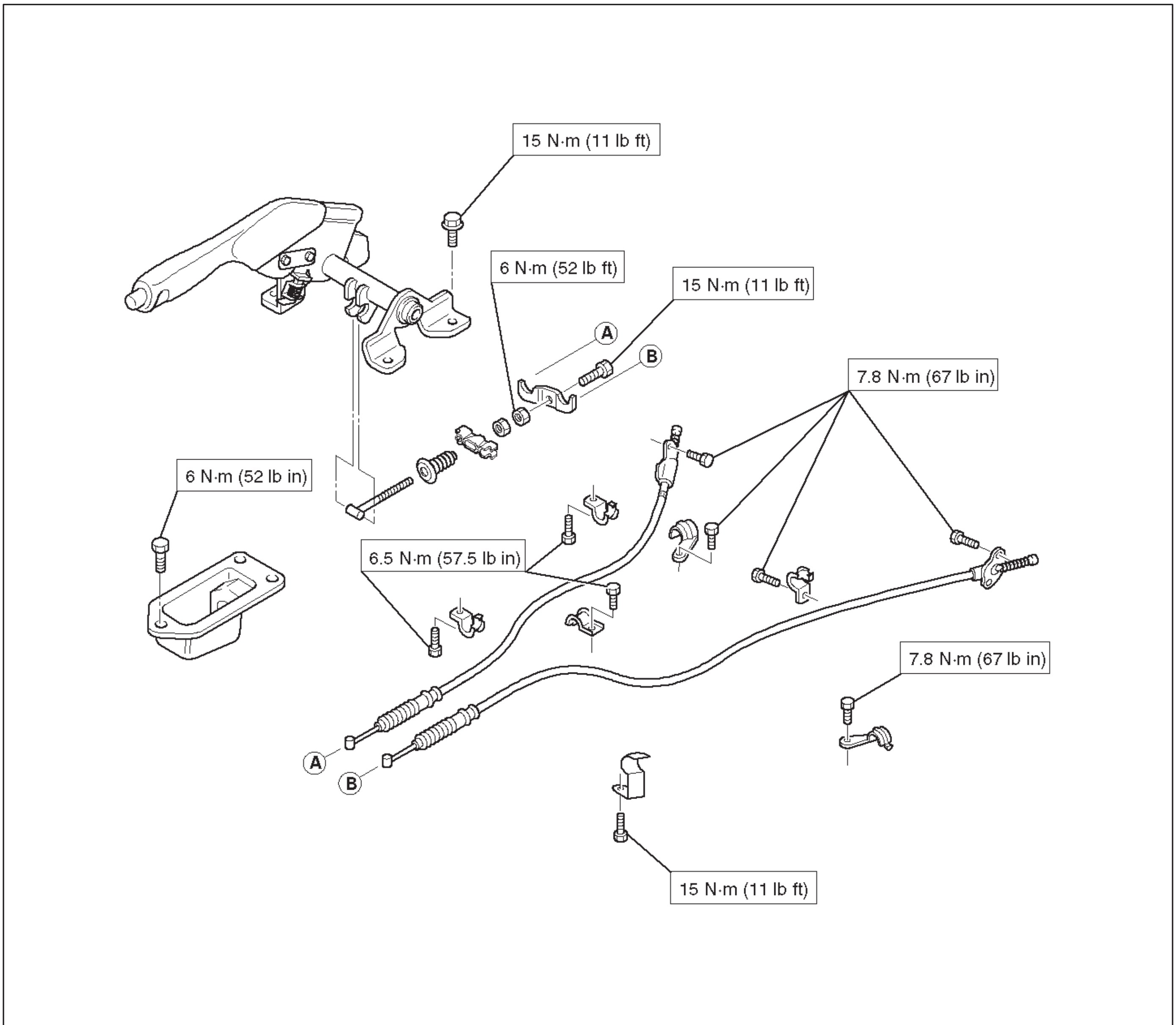
- If the braking effect remains poor after the break–in, wait for some time until parking brake shoe cools down and repeat procedures a. and b. noted above.
- On completion of break–in, inspect the parking brake lever stroke, and if the lever does not come within the specified number of notches when pulled up, readjust.
- Excessive break–in may cause premature wear of the parking brake lining.

Main Data and Specifications

General Specifications

Rear parking brake	
Type	Duo–servo
Lining Dimension	121.2 cm^2 (18.79 in^2)
Adjusting Method	Manual adjusting
Rotor (Drum) Inside Diameter	210 mm (8.27 in)
Parking Brake Lever Stroke	6–7 notches When pulled with a force of 30 kg (66 lb)

Torque Specifications



E05RW006

TROOPER

ENGINE

CONTENTS

ENGINE MECHANICAL

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Engine Cleanliness And Care

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousandths of a millimeter (ten thousandths of an inch). Accordingly, when any internal engine parts are serviced, care and cleanliness are important. Throughout this section, it should be understood that proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to all friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order.
- At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables may result in damage to wire harness or other electrical parts.
- The six cylinders of this engine are identified by numbers; Right side cylinders 1, 3 and 5, Left side cylinders 2, 4 and 6, as counted from crankshaft pulley side to flywheel side.

General Information on Engine Service

The following information on engine service should be noted carefully, as it is important in preventing damage and contributing to reliable engine performance:

- When raising or supporting the engine for any reason, do not use a jack under the oil pan. Due to the small clearance between the oil pan and the oil pump strainer, jacking against the oil pan may cause damage to the oil pick–up unit.
- The 12–volt electrical system is capable of damaging circuits. When performing any work where electrical terminals could possibly be grounded, the ground cable of the battery should be disconnected at the battery.
- Any time the intake air duct or air cleaner is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material into the cylinder which could cause extensive damage when the engine is started.

Cylinder Block

The cylinder block is made of aluminum die–cast casting for 75˚V–type six cylinders. It has a rear plate integrated structure and employs a deep skint. The cylinder liner is cast and the liner inner diameter and crankshaft journal diameter are classified into grades. The crankshaft is supported by four bearings of which width of No.3 bearing on the body side is different in order to support the thrust bearing. The bearing cap is made of nodular cast iron and each bearing cap uses four bolts and two side bolts.

Cylinder Head

The cylinder head, made of aluminum alloy casting employs a pent–roof type combustion chamber with a spark plug in the center. The intake and exhaust valves are placed in V–type design. The ports are cross–flow type.

Valve Train

Intake and exhaust camshaft on the both side of banks are driven through an camshaft drive gear by timing belt. The valves are operated by the camshaft and the valve clearance is adjusted to select suitable thickness shim.

Intake Manifold

The intake manifold system is composed of the aluminum cast common chamber and intake manifold attached with six fuel injectors.

Exhaust Manifold

The exhaust manifold is made of nodular cast iron.

Pistons and Connecting Rods

Aluminum pistons are used after selecting the grade that meets the cylinder bore diameter. Each piston has two compression rings and one oil ring. The piston pin is made of chromium steel is offset 1mm toward the thrust side, and the thrust pressure of piston to the cylinder wall varies gradually as the piston travels. The connecting rods are made of forged steel. The connecting rod bearings are graded for correct seze selection.

Crankshaft and Bearings

The crankshaft is made of Ductile cast–iron. Pins and journals are graded for correct size selection for their bearing.

Engine Lubrication

The oil discharged by a trochoid–type oil pump driven by the crankshaft is fed through full–flow oil filter and to the oil gallery provided under the crankshaft bearing cap. The oil is then led to the crankshaft journals and cylinder head. The crank pins are lubricated with oil from crankshaft journals through oil holes. Also, an oil jet is fed to each cylinder from crankshaft juornals on the connecting rod for piston cleaning. The oil pan flange is dealed with liquid packing only; do not deform or damage the flange surface during removal or installation.

Engine Diagnosis

Hard Starting

1. Starting Motor Does Not Turn Over

Troubleshooting Procedure

Turn on headlights and starter switch.

Condition	Possible cause	Correction
Headlights go out or dim considerably	Battery run down or under charged	Recharge or replace battery
	Terminals poorly connected	Clean battery posts and terminals and connect properly
	Starting motor coil circuit shorted	Overhaul or replace
	Starting motor defective	Overhaul or replace

2. Ignition Trouble — Starting Motor Turns Over But Engine Does Not Start

Spark Test

Disconnect an igniton coil from any spark plug. Connect the spark plug tester J–26792 (ST–125), start the engine, and check if a spark is generated in the spark plug tester. Before starting the engine, make sure that the spark plug tester is properly grounded. To avoid electrical shock, do not touch the part where insulation of the igniton coil is broken while the engine is running.

Condition	Possible cause	Correction
Spark jumps across gap	Spark plug defective	Clean, adjust spark gap or replace
	Ignition timing incorrect	Refer to Ignition System
	Fuel not reaching fuel injector(s) or engine	Refer to item 3 (Trouble in fuel system)
	Valve timing incorrect	Adjust
	Engine lacks compression	Refer to item 4 (Engine lacks compression)
No sparking takes place	Ignition coil disconnected or broken	Connect properly or replace
	Electronic Ignition System with module	Replace
	Poor connections in engine harness	Correct
	Powertrain Control Module cable disconnected or defective	Correct or replace

3. Trouble In Fuel System

Condition	Possible cause	Correction
Starting motor turns over and spark occurs but engine does not start.	Fuel tank empty	Fill
	Water in fuel system	Clean
	Fuel filter clogged	Replace filter
	Fuel pipe clogged	Clean or replace
	Fuel pump defective	Replace
	Fuel pump circuit open	Correct or replace
	Evaporative Emission Control System circuit clogged	Correct or replace
	Multiport Fuel Injection System faulty	Refer to “Electronic Fuel Injection” section

4. Engine Lacks Compression

Condition	Possible cause	Correction
Engine lacks compression	Spark plug loosely fitted or spark plug gasket defective	Tighten to specified torque or replace gasket
	Valve timing incorrect	Adjust
	Cylinder head gasket defective	Replace gasket
	Valve incorrectly seated	Lap valve
	Valve stem seized	Replace valve and valve guide
	Valve spring weakened or broken	Replace
	Cylinder or piston rings worn	Overhaul engine
	Piston ring seized	Overhaul engine.

Engine Compression Test Procedure

1. Start and run the engine until the engine reaches normal operating temperature.
2. Turn the engine off.
3. Remove all the spark plugs.
4. Remove ignition coil fuse (15A) and disable the ignition system.
5. Remove the fuel pump relay from the relay and fuse box.
6. Engage the starter and check that the cranking speed is approximately 300 rpm.
7. Install cylinder compression gauge into spark plug hole.
8. With the throttle valve opened fully, keep the starter engaged until the compression gage needle reaches the maximum level. Note the reading.
9. Repeat the test with each cylinder.

   If the compression pressure obtained falls below the limit, engine overhaul is necessary.

Limit; 1000 kPa (145 psi)

Rough Engine Idling or Engine Stalling

Condition	Possible cause	Correction
Trouble in fuel injection system	Throttle shutting off incomplete	Correct or replace
	Throttle position sensor circuit open or shorted	Correct or replace
	Fuel injector circuits open or shorted	Correct or replace
	Fuel injectors damaged	Replace
	Fuel pump relay defective	Replace
	Mass Airflow Sensor circuit open or poor connections	Correct or replace
	Mass Airflow Sensor defective	Replace
	Manifold Absolute Pressure Sensor circuit open or poor connections	Correct or replace
	Manifold Absolute Pressure Sensor defective	Replace
	Engine Coolant Temperature Sensor circuit open or poor connections	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	Intake Air Temperature sensor circuit open or poor connections	Correct or replace
	Intake Air Temperature sensor defective	Replace
	Ion sensing module cable broken or poor connections	Correct or replace
	Ion sensing module defective	Replace
	Vehicle Speed Sensor circuit open or shorted	Correct or replace
	Vehicle Speed Sensor defective	Replace
Trouble in emission control system	Powertrain Control Module defective	Replace
	Exhaust Gas Recirculation Valve circuit open or poor connections	Correct or replace
	Exhaust Gas Recirculation Valve faulty	Replace
	Canister purge valve circuit open or poor connections	Correct or replace
	Canister purge valve defective	Replace
	Evaporative Emission Canister Purge control valve defective	Replace
	Trouble in ignition system	Refer to “Hard Start”
Others	Engine lacks compression	Refer to “Hard Start”
	Valve incorrectly seated	Lap valve
	Air Cleaner Filter clogged	Replace filter element
	Valve timing incorrect	Readjust
	Idle air control valve broken	Replace
	Fast idle solenoid defective	Replace
	Positive Crankcase Ventilation valve defective or clogged	Replace

Rough Engine Running

Condition	Possible cause	Correction
Engine misfires periodically	Ignition coil layer shorted	Replace
	Spark plugs fouling	Clean or install hotter type plug
	Spark plug(s) insulator nose leaking	Replace
	Fuel injector(s) defective	Replace
	Powertrain control module faulty	Replace
Engine knocks periodically	Spark plugs running too hot	Install colder type spark plugs
	Powertrain control module faulty	Replace
	Ion sensing module faulty	Refer or replace
Engine lacks power	Spark plugs fouled	Clean
	Fuel injectors defective	Replace
	Mass Airflow Sensor or Intake Airflow Sensor circuit defective	Correct or replace
	Manifold Absolute Pressure (MAP) Sensor or Manifold Absolute Pressure Sensor circuit defective	Correct or replace
	Engine Coolant Temperature Sensor or Engine Coolant Temperature Sensor circuit defective	Correct or replace
	Powertrain Control Module faulty	Replace
	Intake Air Temperature Sensor or Intake Air Temperature Sensor circuit defective	Correct or replace
	Throttle Position Sensor or Throttle Position Sensor circuit defective	Correct or replace
	Ion sensing module or ION sensing module circuits defective	Correct or replace

Hesitation

Condition	Possible cause	Correction
Hesitation on acceleration	Throttle Position Sensor adjustment incorrect	Replace throttle valve assembly
	Throttle Position Sensor circuit open or shorted	Correct or replace
	Mass Airflow Sensor circuit open or poor connections	Correct or replace
	Mass Airflow Sensor defective	Replace
	Manifold Absolute Pressure (MAP) Sensor circuit open or shorted	Correct or replace
	MAP Sensor defective	Replace
	Intake Air Temperature (IAT) Sensor circuit open or shorted	Correct or replace
	Ion sensing module Circuit open or poor connections	Correct or replace
	Ion sensing module defective	Replace
	IAT Sensor defective	Replace
Hesitation at high speeds (Fuel pressure too low)	Fuel tank strainer clogged	Clean or replace
	Fuel pipe clogged	Clean or replace
	Fuel filter clogged	Replace
	Defective fuel pump system	Check and replace
	Fuel Pressure Control Valve leaking	Replace
Hesitation at high speeds (Fuel injector not working normally)	Power supply or ground circuit for Multiport Fuel Injection System shorted or open	Check and correct or replace
	Fuel Injector defective	Replace
	Cable of Multiport Fuel Injection System circuit open or poor connections	Correct or replace

Condition	Possible cause	Correction
Hesitation at high speeds	Powertrain Control Module defective	Replace
	Throttle Position Sensor cable broken or poor connections	Correct or replace
	Throttle Position Sensor defective	Replace
	Engine Coolant Temperature Sensor circuit open or shorted	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	Mass Airflow Sensor circuit open or poor connections	Correct or replace
	Mass Airflow Sensor defective	Replace
	MAP Sensor cable broken or poor connections	Correct or replace
	MAP Sensor defective	Replace
	IAT Sensor circuit open or poor connections	Correct or replace
	IAT Sensor defective	Replace
	Ion sensing module circuit open or poor connections	Correct or replace
	Ion sensing module defective	Replace
	Throttle valve not fully opened	Check and correct or replace
	Air Cleaner Filter clogged	Replace filter element
	Power supply voltage too low	Check and correct or replace

Engine Lacks Power

Condition	Possible cause	Correction
Trouble in fuel system	Fuel Pressure Control Valve not working normally	Replace
	Fuel injector clogged	Clean or replace
	Fuel pipe clogged	Clean
	Fuel filter clogged or fouled	Replace
	Fuel pump drive circuit not working normally	Correct or replace
	Fuel tank not sufficiently breathing due to clogged Evaporative Emission Control System circuit	Clean or replace
	Water in fuel system	Clean
	Inferior quality fuel in fuel system	Use fuel of specified octane rating
	Powertrain Control Module supplied poor voltage	Correct circuit
	Throttle Position Sensor cable broken or poor connections	Correct or replace
	Throttle Position Sensor defective	Replace
	Mass Airflow Sensor not working normally	Replace
	Manifold Absolute Pressure Sensor not working normally	Replace
	Intake Air Temperature Sensor not working normally	Replace
	Engine Coolant Temperature Sensor circuit open or shorted	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	Powertrain Control Module defective	Replace
Trouble in intake or exhaust system	Air Cleaner Filter clogged	Replace filter element
	Air duct kinked or flattened	Correct or replace
	TWC defective	Repair
Ignition failure	————	Refer to Hard Start Troubleshooting Guide
	Heat range of spark plug inadequate	Install spark plugs of adequate heat range
	Ignition coil defective	Replace

Condition	Possible cause	Correction
Engine overheating	Level of Engine Coolant too low	Replenish
	Fan clutch defective	Replace
	Incorrect fan installed	Replace
	Thermostat defective	Replace
	Engine Coolant pump defective	Correct or replace
	Radiator clogged	Clean or replace
	Radiator filler cap defective	Replace
	Level of oil in engine crankcase too low or wrong engine oil	Change or replenish
	Resistance in exhaust system increased	Clean exhaust system or replace defective parts
	Throttle Position Sensor adjustment incorrect	Replace with Throttle Valve ASM
	Throttle Position Sensor circuit open or shorted	Correct or replace
	Cylinder head gasket damaged	Replace
Engine overcooling	Thermostat defective	Replace (Use a thermostat set to open at 82˚C (180˚F))
Engine lacks compression	————	Refer to Hard Start
Others	Tire inflation pressure abnormal	Adjust to recommended pressures
	Brake drag	Adjust
	Clutch slipping	Adjust or replace
	Level of oil in engine crankcase too high	Correct level of engine oil
	Exhaust Gas Recirculation Valve defective	Replace

Engine Noisy

Abnormal engine noise often consists of various noises originating in rotating parts, sliding parts and other moving parts of the engine. It is, therefore, advisable to locate the source of noise systematically.

Condition	Possible cause	Correction
Noise from crank journals or from crank bearings (Faulty crank journals and crank bearings usually make dull noise that becomes more evident when accelerating)	Oil clearance increased due to worn crank journals or crank bearings	Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing
	Crankshaft out of round	Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing
	Crank bearing seized	Crank bearing seized. Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing

Troubleshooting Procedure

Short out each spark plug in sequence using insulated spark plug wire removers. Locate cylinder with defective bearing by listening for abnormal noise that stops when spark plug is shorted out.

Condition	Possible cause	Correction
Noise from connecting rods or from connecting rod bearings (Faulty connecting rods or connecting rod bearings usually make an abnormal noise slightly higher than the crank bearing noise, which becomes more evident when engine is accelerated)	Bearing or crankshaft pin worn	Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing
	Crankpin out of round	Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing
	Connecting rod bent	Correct or replace
	Connecting rod bearing seized	Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing

Troubleshooting Procedure

Abnormal noise stops when the spark plug on the cylinder with defective part is shorted out.

Condition	Possible cause	Correction
Piston and cylinder noise (Faulty piston or cylinder usually makes a combined mechanical thumping noise which increases when engine is suddenly accelerated but diminishes gradually as the engine warms up)	Piston clearance increased due to cylinder wear	Replace piston and cylinder body
	Piston seized	Replace piston and cylinder body
	Piston ring broken	Replace piston and cylinder body
	Piston defective	Replace pistons and others

Troubleshooting Procedure

Short out each spark plug and listen for change in engine noise.

Condition	Possible cause	Correction
Piston pin noise (Piston makes noise each time it goes up and down)	Piston pin or piston pin hole worn	Replace piston, piston pin and connecting rod assy

Troubleshooting Procedure

The slapping sound stops when spark plug on bad cylinder is shorted out.

Condition	Possible cause	Correction
Timing belt noise	Timing belt tension is incorrect	Replace pusher or adjust the tension pulley or replace timing belt
	Tensioner bearing defective	Replace
	Timing belt defective	Replace
	Timing pulley defective	Replace
	Timing belt comes in contact with timing cover	Replace timing belt and timing cover
Valve noise	Valve clearance incorrect	Replace adjusting shim
	Valve and valve guide seized	Replace valve and valve guide
	Valve spring broken or weakened	Replace
	Valve seat off–positioned	Correct
	Camshaft worn out	Replace
Crankshaft noise	Crankshaft end play excessive (noise occurs when clutch is engaged)	Replace thrust bearing
Engine knocking	Preignition due to use of spark plugs of inadequate heat range	Install Spark Plugs of adequate heat range
	Carbon deposits in combustion chambers	Clean
	Fuel too low in octane rating	Replace fuel
	Wide Open Throttle enrichment system failure	Refer to Section 6E
	Selection of transmission gear incorrect	Caution operator of incorrect gear selection
	Engine overheating	Refer to “Engine Lacks Power”
Others	Water pump defective	Replace
	Drive belt slipping	Replace auto tentioner or drive belt

Abnormal Combustion

Condition	Possible cause	Correction
Trouble in fuel system	Fuel pressure control valve defective	Replace
	Fuel filter clogged	Replace
	Fuel pump clogged	Clean or replace
	Fuel tank or fuel pipe clogged	Clean or replace
	Fuel injector clogged	Clean or replace
	Fuel pump relay defective	Replace
	Power supply cable for fuel pump broken or poor connections	Reconnect, correct or replace
	Mass Airflow (MAF) sensor circuit open or defective	Correct or replace
	MAF Sensor defective	Replace
	Manifold Absolute Pressure Sensor circuit open or shorted	Correct or replace
	Manifold Absolute Pressure Sensor defective	Replace
	Engine Coolant Temperature (ECT) Sensor circuit open or shorted	Correct or replace
	ECT Sensor defective	Replace
	Throttle Position Sensor adjustment incorrect	Readjust
	Throttle Position Sensor defective	Replace
	Throttle Position Sensor connector poor connections	Reconnect
	Vehicle Speed Sensor cable poor connections or defective	Correct or replace
	Vehicle Speed Sensor loosely fixed	Fix tightly
	Vehicle Speed Sensor in wrong contact or defective	Replace
	Powertrain Control Module cable poor connections or defective	Correct or replace
Trouble in emission control system	Heated Oxygen Sensor circuit open	Correct or replace
	Heated Oxygen Sensor defective	Replace
	Signal vacuum hose loosely fitted or defective	Correct or replace
	EGR Valve circuit open or shorted	Correct or replace
	Exhaust Gas Recirculation Valve defective	Replace
	ECT Sensor circuit open or shorted	Correct or replace
	Canister Purge Valve circuit open or shorted	Correct or replace
	Canister Purge Valve defective	Replace
	ECT Sensor defective	Replace
	Positive Crankcase Ventilation (PCV) valve and hose clogged	Correct or replace
	Evaporator system	Refer to Section 6E
Trouble in ignition system	————	Refer to “Engine Lacks Power”

Condition	Possible cause	Correction
Trouble in cylinder head parts	Carbon deposits in combustion chamber	Remove carbon
	Carbon deposit on valve, valve seat and valve guide	Remove carbon

Engine Oil Consumption Excessive

Condition	Possible cause	Correction
Oil leaking	Oil pan drain plug loose	Retighten or replace gasket
	Crankcase fixing bolts loosened	Retighten
	Oil pan setting bolts loosened	Retighten
	Oil pan gasket broken	Replace gasket
	Front cover retaining bolts loose or gasket broken	Retighten or replace gasket
	Head cover fixing bolts loose or gasket broken	Retighten or replace gasket
	Oil filter adapter cracked	Replace
	Oil filter attaching bolt loose or rubber gasket broken	Retighten or replace oil filter
	Crankshaft front or rear oil seal defective	Replace oil seal
	Oil pressure unit loose or broken	Retighten or replace
	Blow–by gas hose broken	Replace hose
	Positive Crankcase Ventilation Valve clogged	Clean
	Engine/Transmission coupling failed	Replace oil seal
Oil leaking into combustion chambers due to poor seal in valve system	Valve stem oil seal defective	Replace
	Valve stem or valve guide worn	Replace valve and valve guide
Oil leaking into combustion chambers due to poor seal in cylinder parts	Cylinders and pistons worn excessively	Replace cylinder body assembly and pistons
	Piston ring gaps incorrectly positioned	Correct
	Piston rings set with wrong side up	Correct
	Piston ring sticking	Replace cylinder body assembly and pistons
	Piston ring and ring groove worn	Replace pistons and others
	Return ports in oil rings clogged	Clean piston and replace rings
Positive Crankcase Ventilation System malfunctioning	Positive Crankcase Ventilation Valve clogged	Clean
Others	Improper oil viscosity	Use oil of recommended S.A.E. viscosity
	Continuous high speed driving and/or severe usage such as trailer towing	Continuous high speed operation and/or severe usage will normally cause increased oil consumption

Fuel Consumption Excessive

Condition	Possible cause	Correction
Trouble in fuel system	Mixture too rich or too lean due to trouble in fuel injection system	Refer to “Abnormal Combustion”
	Fuel cut function does not work	Refer to “Abnormal Combustion”
Trouble in ignition system	Misfiring or abnormal combustion due to trouble in ignition system	Refer to “Hard Start” or “Abnormal Combustion”
Others	Engine idle speed too high	Reset Idle Air Control Valve
	Fuel system leakage	Correct or replace
	Clutch slipping	Correct
	Brake drag	Correct
	Selection of transmission gear incorrect	Caution operator of incorrect gear selection
	Excessive Exhaust Gas Recirculation flow due to trouble in Exhaust Gas Recirculation system	Refer to “Abnormal Combustion”

Lubrication Problems

Condition	Possible cause	Correction
Oil pressure too low	Wrong oil in use	Replace with correct engine oil
	Relief valve sticking	Replace
	Oil pump not operating properly	Correct or replace
	Oil pump strainer clogged	Clean or replace strainer
	Oil pump worn	Replace
	Oil pressure gauge defective	Correct or replace
	Crankshaft bearing or connecting rod bearing worn	Replace
Oil contamination	Wrong oil in use	Replace with correct engine oil
	Oil filter clogged	Replace oil filter
	Cylinder head gasket damage	Replace gasket
	Burned gases leaking	Replace piston and piston rings or cylinder body assembly
Oil not reaching valve system	Oil passage in cylinder head or cylinder body clogged	Clean or correct

Engine Oil Pressure Check

1. Check for dirt, gasoline or water in the engine oil.
   a. Check the viscosity of the oil.
   b. Change the oil if the viscosity is outside the specified standard.
   c. Refer to the “Maintenance and Lubrication” section of this manual.
2. Check the engine oil level.
   The level should fall somewhere between the “ADD” and the “FULL” marks on the oil level dipstick.
   If the oil level does not reach the “ADD” mark on the oil level dipstick, engine oil must be added.
3. Remove the oil pressure unit.
4. Install an oil pressure gauge.
5. Start the engine and allow the engine to reach normal operating temperature (About 80°C).
6. Measure the oil pressure.

   Oil pressure should be:

   392–550 kPa (56.9–80.4 psi) at 3000 rpm.
7. Stop the engine.
8. Remove the oil pressure gauge.
9. Install the oil pressure unit.
10. Start the engine and check for leaks.

Malfunction Indicator Lamp

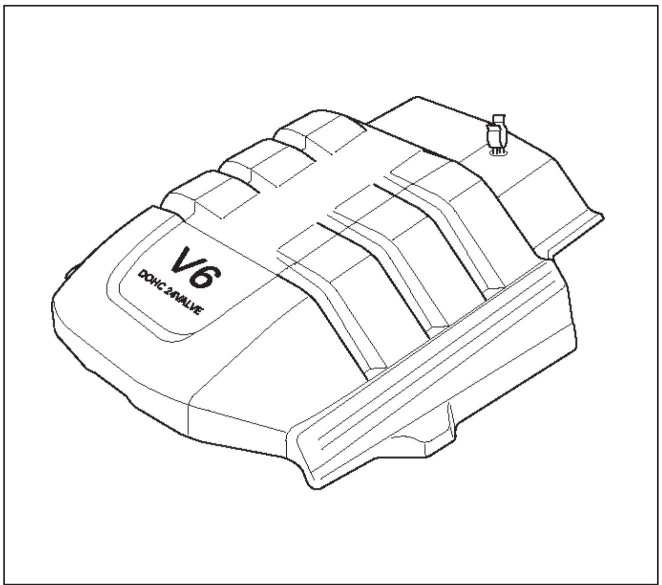
The instrument panel “CHECK ENGINE” Malfunction Indicator Lamp (MIL) illuminates by self diagnostic system when the system checks the starting of engine, or senses malfunctions.

Condition	Possible cause	Correction
“CHECK ENGINE” MIL does not illuminate at the starting of engine	Bulb defective	Replace
	MIL circuit open	Correct or replace
	Command signal circuit to operate self diagnostic system shorted	Correct or replace
	Engine Control Module (PCM) cable loosely connected, disconnected or defective	Correct or replace
	PCM defective	Replace
“CHECK ENGINE” MIL illuminates, and stays on	Deterioration of heated oxygen sensor internal element	Replace
	Heated oxygen sensor connector terminal improper contact	Reconnect properly
	Heated oxygen sensor lead wire shorted	Correct
	Heated oxygen sensor circuit open	Correct or replace
	Deterioration of engine coolant temperature sensor internal element	Replace
	Engine coolant temperature sensor connector terminal improper contact	Reconnect properly
	Engine coolant temperature sensor lead wire shorted	Correct
	Engine coolant temperature sensor circuit open	Correct or replace
	Throttle position sensor open or shorted circuits	Correct or replace
	Deterioration of crankshaft position sensor	Replace
	Crankshaft position sensor circuit open or shorted	Correct or replace
	Vehicle speed sensor circuit open	Correct or replace
	Manifold absolute pressure sensor circuit open or shorted	Correct or replace
	Intake air temperature sensor circuit open or shorted	Correct or replace
	Fuel injector circuit open or shorted	Correct or replace
	PCM driver transistor defective	Replace PCM
	Malfunctioning of PCM RAM (Random Access Memory) or ROM (Read Only Memory)	Replace PCM

Cylinder Head Cover LH

Removal

1. Disconnect battery ground cable.
2. Remove engine cover from the dowels on the common chamber.



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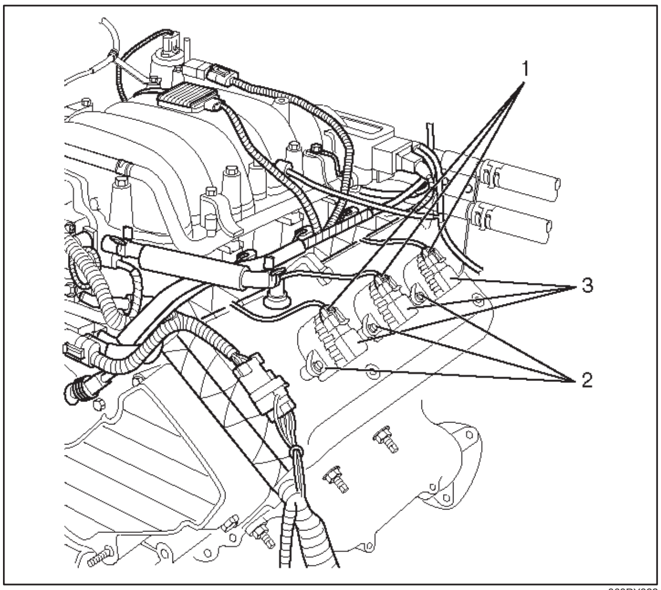
3. Disconnect positive crankcase ventilation hose.
4. Remove ground cable fixing bolt on cylinder head cover.
5. Ignition coil connector and ignition coil.
   - Disconnect the three connectors from the ignition coils.
   - Remove harness bracket bolt on cylinder head cover.
   - Remove fixing bolts on ignition coils.



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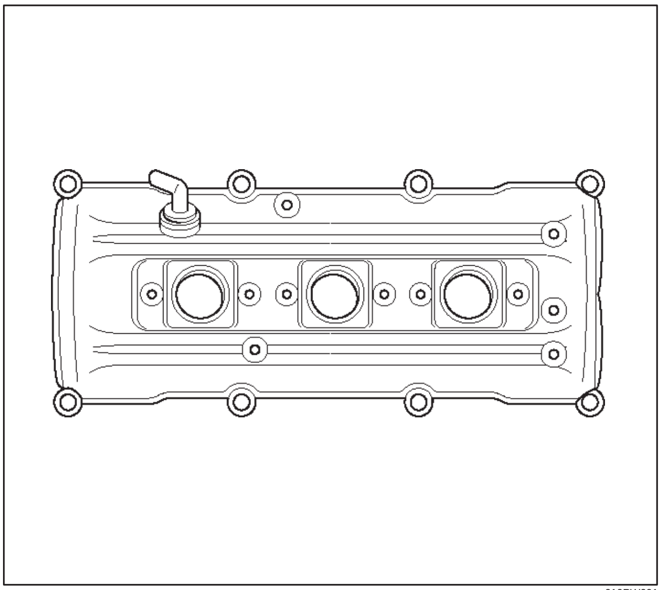
Legend

(1) Ignition Coil Connector
(2) Bolt
(3) Ignition Coil Assemblies

6. Disconnect fuel injector harness connector then remove fuel injector harness bracket bolt.
7. Remove eight fixing bolts, then the cylinder head cover.



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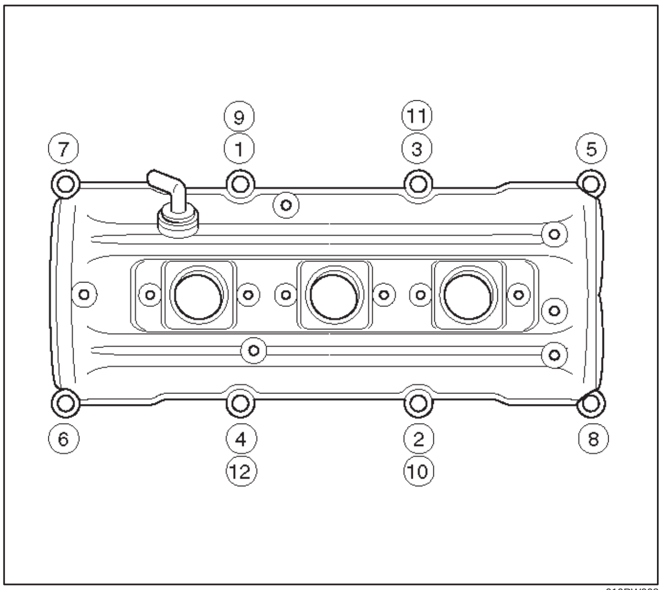
Installation

1. Install cylinder head cover.
   - Clean the sealing surface of cylinder head and cylinder head cover to remove oil and sealing materials completely.
   - Apply sealant (TB-1207B or equivalent) of bead diameter 2-3 mm at eight place of arched area of camshaft bearing cap on front and rear sides.
   - The cylinder head cover must be installed with in 5 minutes after sealant application to prevent hardning of sealant.
   - Tighten bolts to the specified torque.

   Torque : 9 N·m (80 lb in)



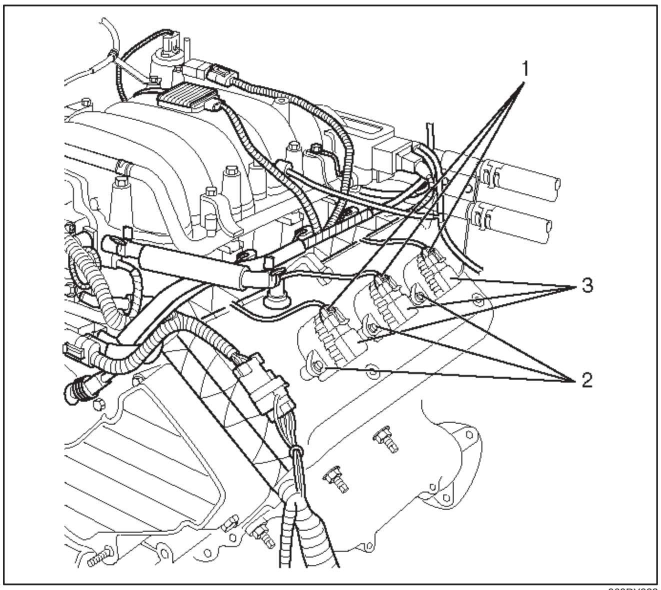
010RW008

2. Install fuel injection harness bracket and tighten bolt to the specified torque.

   Torque : 9 N·m (80 lb in)

3. Connect ignition coil connector and ignition coil, then tighten bolt to the specified torque.

   Torque : 4 N·m (35 lb in)

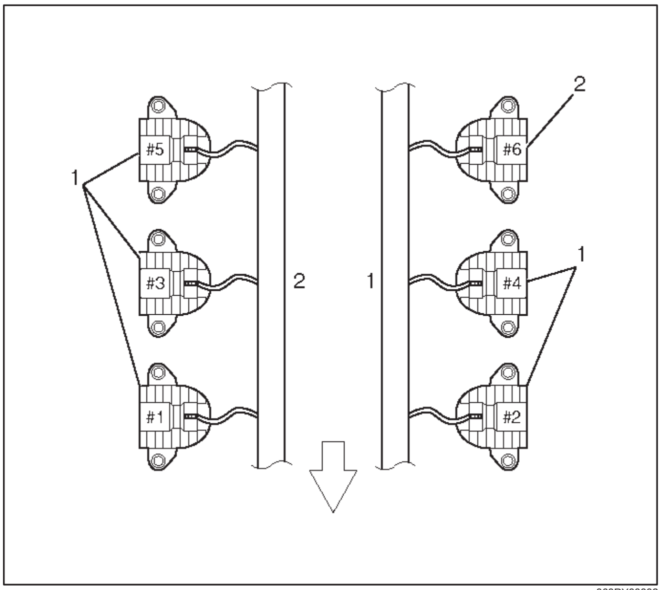


060RY022

Legend

(1) Ignition Coil Connector
(2) Bolt
(3) Ignition Coil Assembly

CAUTION: Ignition coil assembly #6 is different from ignition coil assembly from #1 to #5. Ignition coil assembly #6 is short type. So, note it when installing ignition coil assembly of #6.



060RY00002

Legend

(1) Long Type Ignition Coil Assemblies (# 1 ~ # 5)
(2) Short Type Ignition Coil Assembly (# 6)

4. Connect ground cable and tighten bolts to the specified torque.

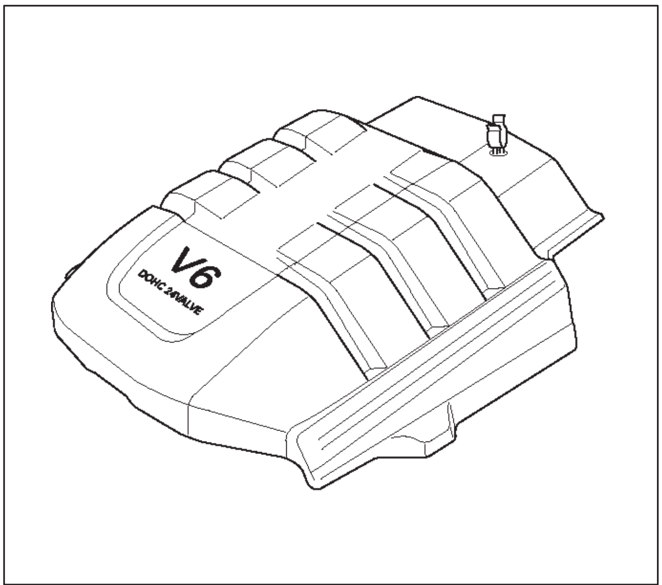
   Torque : 9 N·m (80 lb in)

5. Install positive crankcase ventilation hose.
6. Install engine cover mating with the dowels.

Cylinder Head Cover RH

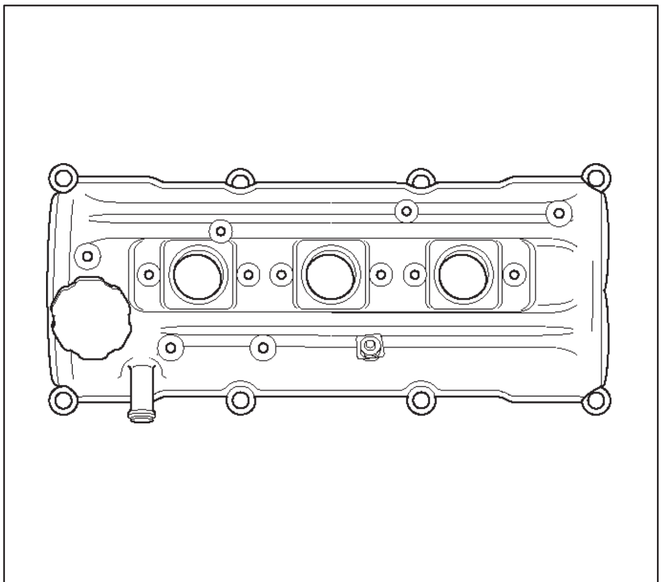
Removal

1. Disconnect battery ground cable.
2. Remove engine cover from the dowele on the common chamber.



F06RY001

3. Disconnect ventilation hose from cylinder head cover.
4. Disconnect three ignition coil connectors from ignition coils and remove harness bracket bolts on cylinder head cover then remove ignition coil fixing bolts on ignition coils and remove ignition coils.
5. Disconnect fuel injector harness connector then remove fuel injector harness bracket bolt.
6. Remove eight fixing bolts then the cylinder head cover.

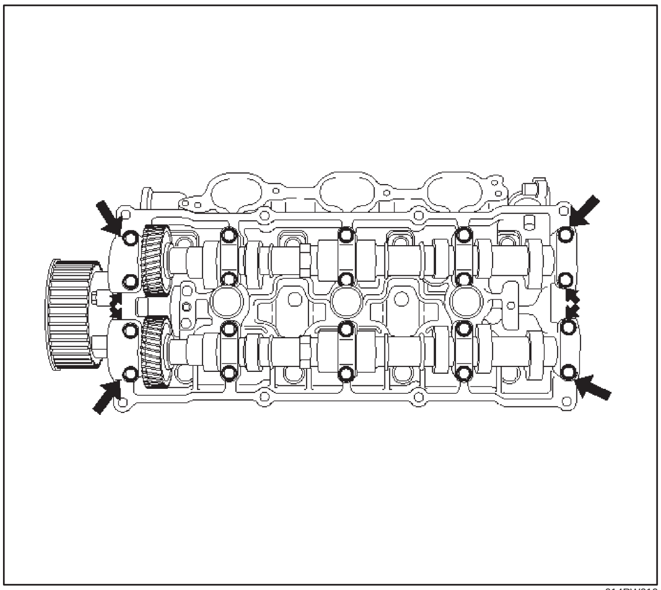


010RW002

Installation

1. Install cylinder head cover.
   - Clean the sealing surface of cylinder head and cylinder head cover to remove oil and sealing materials completely.
     Apply sealant (TB-1207B or equivalent) bead (diameter 2-3 mm) at eight places of arched areas of camshaft bracket on front and rear sides.
   - The cylinder head cover must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.
   - Tighten bolts to the specified torque.

   Torque : 9 N·m (80 lb in)



014RW019

2. Tighten fuel injector harness bracket bolts to specified torque then reconnect fuel injector harness connector.

   Torque : 7.8 N·m (5.7 lb ft)

3. Connect ignition coil connector and tighten ignition coil fixing bolts to specified torque.

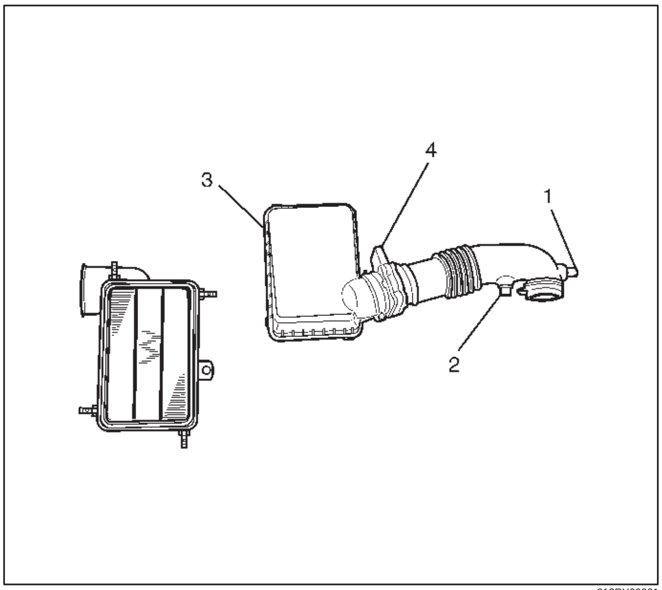
   Torque : 4 N·m (35 lb in)

4. Connect ventilation hose to cylinder head.
5. Install engine cover mating with the dowels.

Common Chamber

Removal

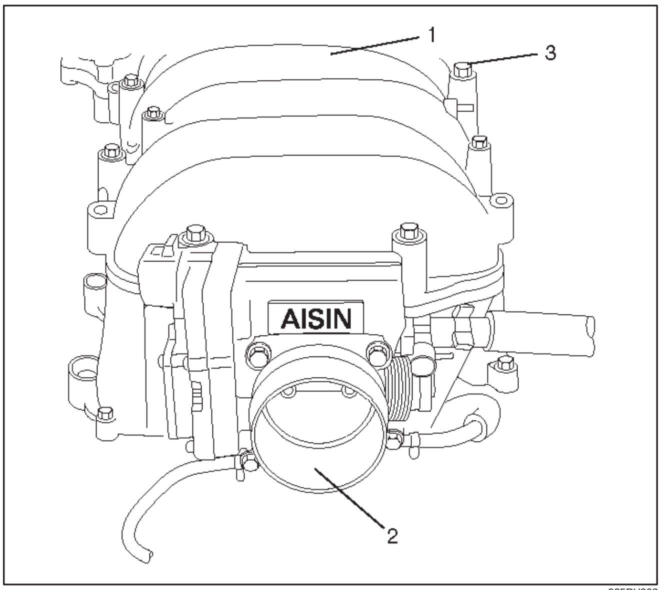
1. Disconnect battery ground cable.
2. Remove air cleaner duct assembly.



Legend

(1) Positive Crankcase Ventilation Hose Connector
(2) Intake Air Temperature Sensor
(3) Air Cleaner Duct Assembly
(4) Air Flow Sensor

3. Disconnect vacuum booster hose from common chamber.
4. Disconnect connector from manifold absolute pressure sensor, ion sensing module, throttle position sensor, solenoid valve, electric vacuum sensing valve, and EGR valve.
5. Disconnect vacuum hose on canister VSV and positive crankcase ventilation hose, fuel rail assembly with pressure control valve bracket.
6. Remove ventilation hose from throttle valve and intake duct and remove water hose.
7. Remove the four throttle body fixing bolts.
8. Remove exhaust gas recirculation valve assembly fixing bolt and nut on common chamber and remove EGR valve assembly.
9. Remove two bolts from common chamber rear side for remove fuel hose bracket.
10. Remove common chamber four bolts and four nuts then remove the common chamber.



Legend

(1) Common Chamber
(2) Throttle Valve Assembly
(3) Bolt

Installation

1. Install common chamber and tighten bolts and nuts to the specified torque.

   Torque :

   Bolt : 25 N·m (18 lb ft)

   Nut : 25 N·m (18 lb ft)
2. Install fuel hose bracket and tighten bolts to specified torque.

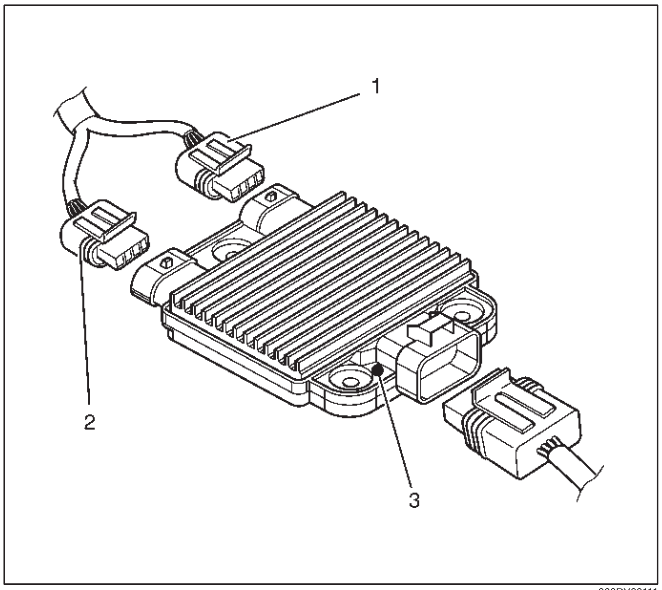
   Torque : 10 N·m (89 lb in)
3. Install exhaust gas recirculation valve assembly and tighten bolt and nut to the specified torque.

   Torque : 25 N·m (18 lb ft)
4. Install throttle body and tighten bolts to the specified torque.

   Torque : 25 N·m (18 lb ft)
5. Install ventilating hose to throttle valve and intake duct.
6. Connect vacuum hoses on canister VSV and positive crankcase ventilation hose. Tighten bolts for fuel rail assembly with pressure control valve bracket.

   Torque : 25 N·m (18 lb ft)
7. Connect each connector without fail.
8. Connect vacuum booster hose.

9. Connect the ion sensing module connectors as shown in the illustration.

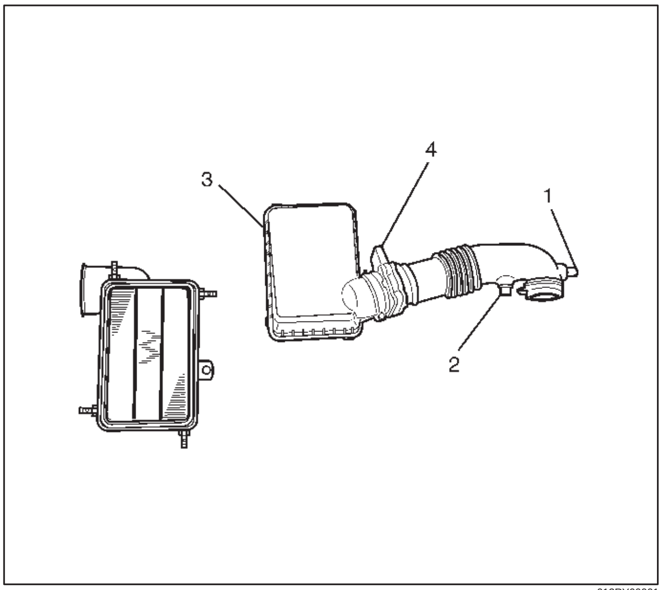


060RY00111

Legend

(1) Green Connector
(2) Blue Connector
(3) Identification Mark (6VE1 Engine Only)

10. Install air cleaner duct assembly.



013RY00001

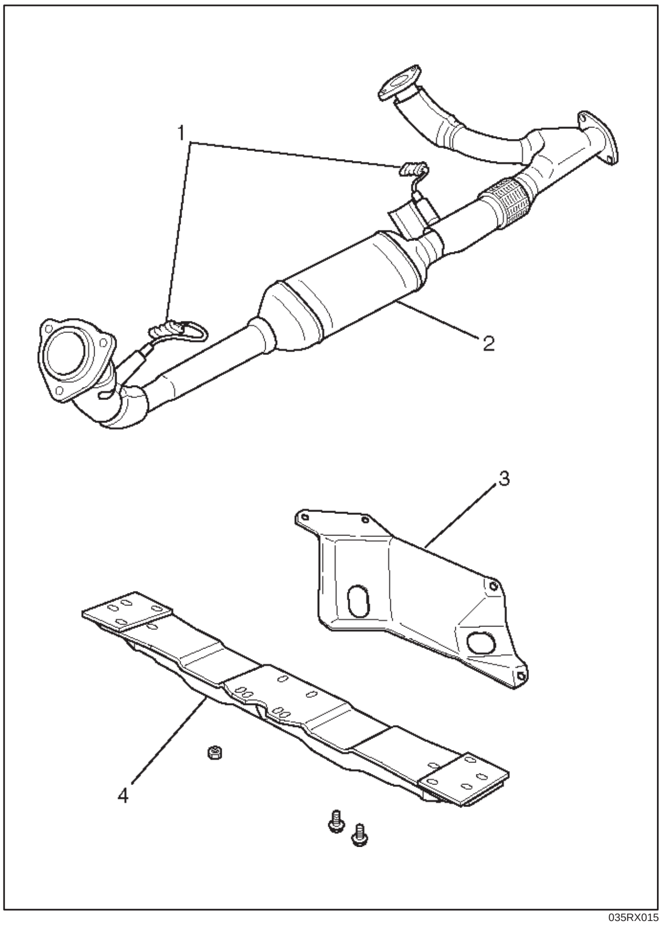
Legend

(1) Positive Crankcase Ventilation Hose Connector
(2) Intake Air Temperature Sensor
(3) Air Cleaner Duct Assembly
(4) Mass Air Flow Sensor

Exhaust Manifold LH

Removal

1. Disconnect battery ground cable.
2. Remove transfer case skid plate.
3. Remove 3rd crossmember.
4. Disconnect Heated oxygen (O_2) sensor connector.
5. Remove the three stud nuts from the front exhaust pipe flange and two nuts from the rear exhaust pipe flange.



Legend

(1) O_2 Sensors
(2) Exhaust Front Pipe LH
(3) Transfer Case Skid Plate
(4) 3rd Crossmember

6. Remove heat protector two fixing bolts and remove unit.
7. Remove a bolt on engine LH side for air conditioner (A/C) compressor bracket and loosen two bolts for A/C compressor then move A/C compressor to front side.
8. Remove exhaust manifold eight fixing nuts and remove exhaust manifold from the engine.

Installation

1. Install exhaust manifold and gasket and tighten exhaust manifold fixing nuts to the specified torque with new nuts.

Torque: 52 N·m (38 lb ft)

2. Install heat protector.
3. Install exhaust front pipe's three stud nuts and rear pipe's two nuts to the specified torque.

Torque :
Stud nuts: 67 N·m (49 lb ft)
Nuts: 43 N·m (32 lb ft)

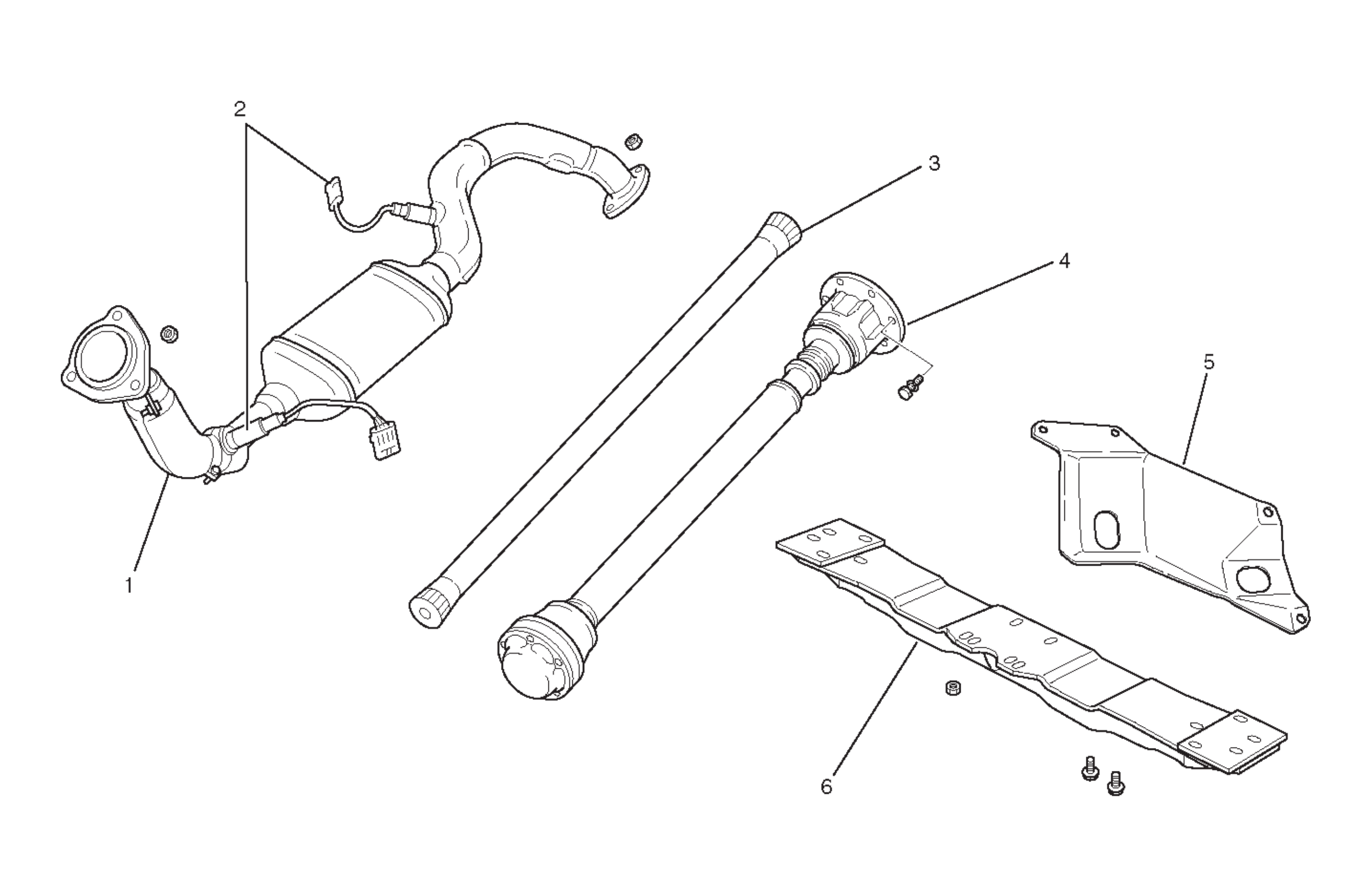
4. Set A/C compressor to normal position and tighten two bolts to the specified torque.

Torque : 40 N·m (30 lb ft)

5. Reconnect O_2 sensor connectors.
6. Install 3rd crossmember.
7. Install transfer case skid plate.

Exhaust Manifold RH

Removal



Legend

(1) Exhaust Front Pipe RH
(2) O_2 Sensors
(3) Torsion Bar
(4) Front Propeller Shaft
(5) Transfer Case Skid Plate
(6) 3rd Crossmember

1. Disconnect battery ground cable.
2. Remove transfer case skid plate.
3. Remove 3rd crossmember.
4. Remove torsion bar and front propeller shaft. Refer to removal procedure in Front Suspension section.
5. Disconnect front Heated oxygen (O_2) sensor connectors.
6. Remove front exhaust flange pipe three stud nuts and two rear flange nuts then disconnect exhaust pipe.
7. Remove heat protector two fixing bolts and remove unit.
8. Remove exhaust manifolds eight fixing nuts and the exhaust manifold.

Installation

1. Install exhaust manifold and tighten bolts to the specified torque.

   Torque : 52 N·m (38 lb ft)

   Torque : 44 N·m (33 lb ft)

   Tighten the bolt for EGR pipe bracket to specified torque.

   Torque : 25 N·m (18 lb ft)
2. Install heat protector
3. Install front exhaust flange pipe and tighten three stud nuts and rear two nuts to the specified torque.

   Torque:

   Stud nuts: 67 N·m (49 lb ft)

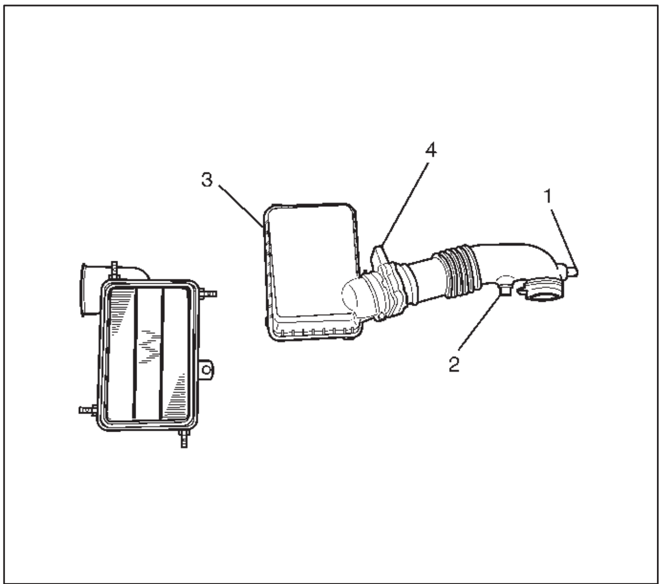
   Nuts: 43 N·m (32 lb ft)
4. Reconnect O_2 Sensor harness connector.
5. Install the torsion bar and readjust the vehicle height. Refer to installation and vehicle height adjustment procedure for Front Suspension.
6. Install front propeller shaft.

   Refer to installation procedue in Front suspension section.
7. Install 3rd crossmember.
8. Install transfer case skid plate.

Crankshaft Pulley

Removal

1. Disconnect battery ground cable.
2. Remove air cleaner assembly.

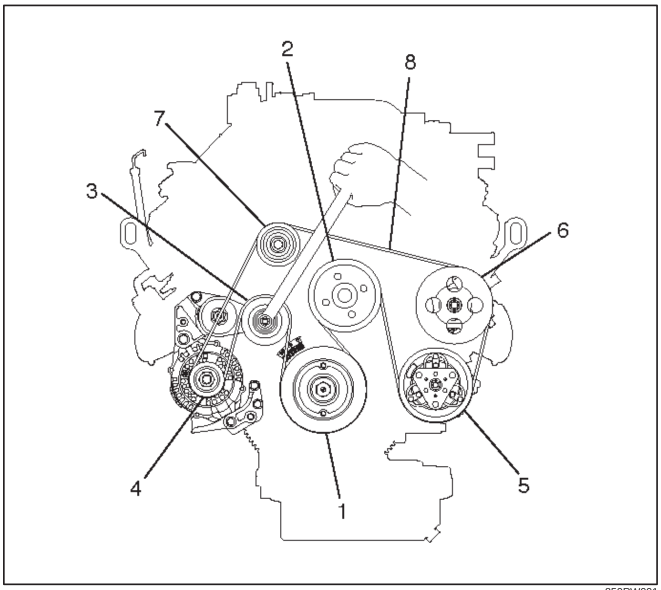


013RY00001

Legend

(1) Positive Crankcase Ventilation Hose Connector
(2) Intake Air Temperature Sensor
(3) Air Cleaner Duct Assembly
(4) Mass Air Flow Sensor

3. Remove radiator upper fan shroud from radiator.
4. Move serpentine belt tensioner to loose side using wrench then remove serpentine belt.



850RW001

Legend

(1) Crankshaft Pulley
(2) Cooling Fan Pulley
(3) Tensioner
(4) Generator
(5) Air Conditioner Compressor
(6) Power Steering Oil Pump
(7) Idle Pulley
(8) Driver Belt

5. Remove cooling fan assembly four fixing nuts, then the cooling fan assembly.
6. Remove crankshaft pulley assembly using J-8614-01 crankshaft holder, hold crankshaft pulley then remove center bolt and pulley.

Installation

1. Install crankshaft pulley using J-8614-01 crankshaft holder, hold the crankshaft pulley and tighten center bolt to the specified torque.

   Torque : 167 N·m (123 lb ft)

2. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

   Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.

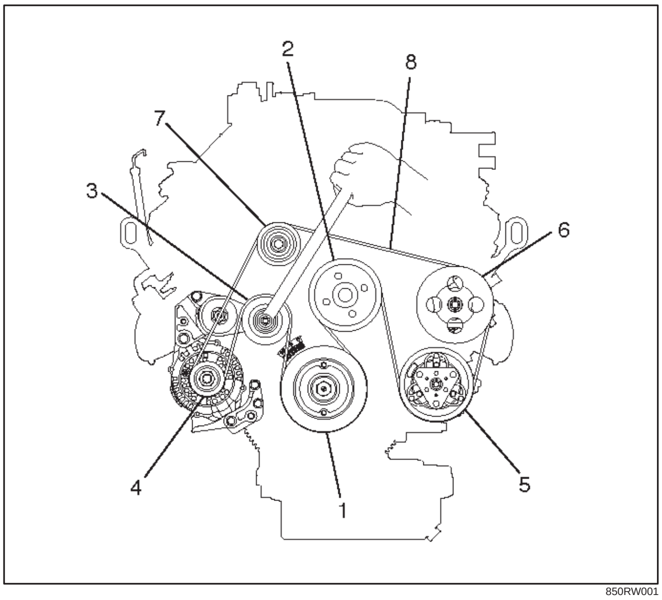
   Torque : 10 N·m (88.5 lb in) for fan and clutch assembly.

3. Move serpentine belt tensioner to loose side using wrench, then install serpentine belt to normal position.
4. Install radiator upper fan shroud.
5. Install air cleaner assembly.

Timing Belt

Removal

1. Disconnect battery ground cable.
2. Remove air cleaner assembly.
3. Remove radiator upper fan shroud from radiator.
4. Move drive belt tensioner to loose side using wrench then remove drive belt.

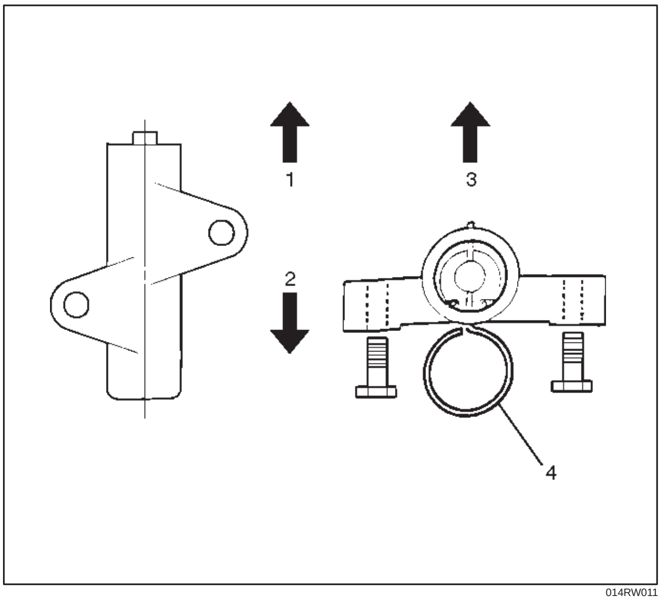


Legend

(1) Crankshaft Pulley
(2) Cooling Fan Pulley
(3) Tensioner
(4) Generator
(5) Air Conditioner Compressor
(6) Power Steering Oil Pump
(7) Idle Pulley
(8) Drive Belt

5. Remove cooling fan assembly four nuts, then the cooling fan assembly.
6. Remove cooling fan drive pulley assembly.
7. Remove idle pulley assembly.
8. Remove serpentine belt tensioner assembly.
9. Remove power steering pump assembly.
10. Remove crankshaft pulley assembly using J-8614-01 crankshaft holder, hold crankshaft pulley remove center bolt, then the pulley.
11. Remove right side timing belt cover then left side timing belt cover.
12. Remove lower timing belt cover
13. Remove pusher.

CAUTION: The pusher prevents air from entering the oil chamber. Its rod must always be facing upward.



Legend

(1) Up Side
(2) Down Side
(3) Direction For Installation
(4) Locking Pin

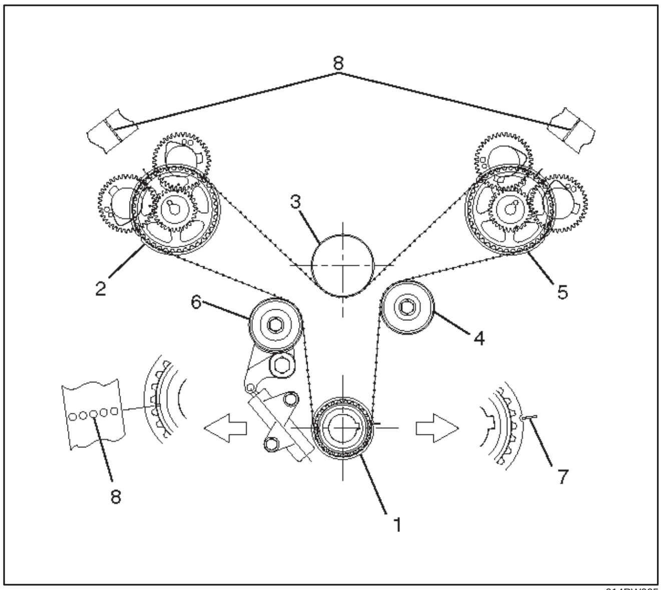
14. Remove timing belt.

CAUTION:

1. **Do not bend or twist the belt, otherwise its core could be damaged. The belt should not be bent at a radius less than 30 mm.**
2. **Do not allow oil or other chemical substances to come in contact with the belt. They will shorten the life.**
3. **Do not attempt to pry or stretch the belt with a screw driver or any other tool during installation.**
4. **Store timing belt in a cool and dark place. Never expose the belt direct sunlight or heat.**

Installation

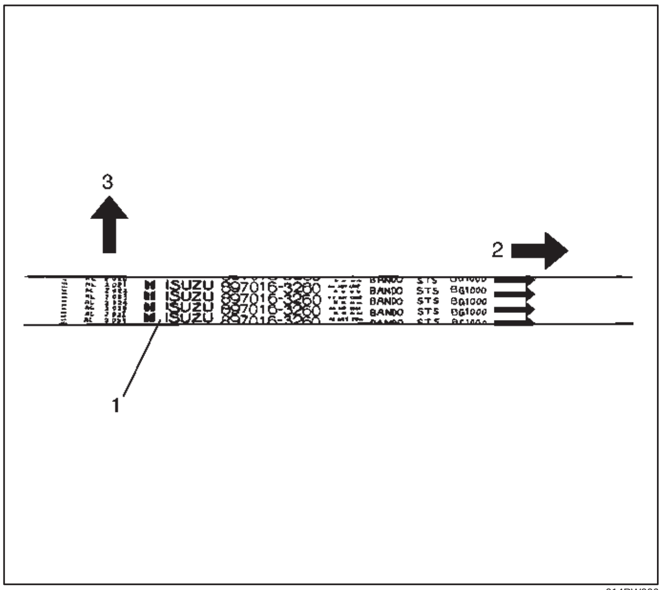
NOTE: For correct belt installation, the letter on the belt must be able to be read as viewed from the front of the vehicle.



014RW005

Legend

(1) Crankshaft Timing Pulley
(2) RH Bank Camshaft Drive Gear Pulley
(3) Water Pump Pulley
(4) Idle Pulley
(5) LH Bank Camshaft Drive Gear Pulley
(6) Tension Pulley
(7) Alignment Mark on Oil Pump.
(8) Alignment Mark on Timing Belt



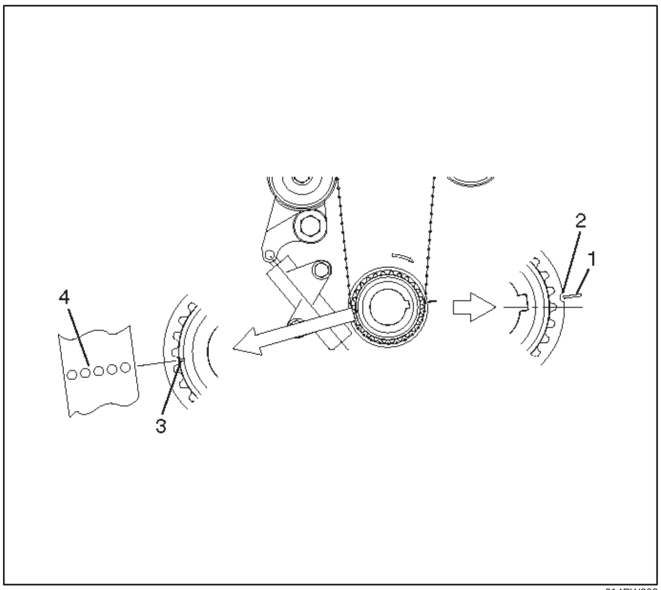
014RW006

Legend

(1) Timing Belt
(2) Engine Rotation Direction
(3) Cylinder Head Side

1. Install timing belt.
   1. Align groove of crankshaft timing pulley with mark on oil pump.
      Align the mark on the crankshaft timing pulley with alignment mark (white dotted line) on the timing belt.
      Secure the belt with a double clip.

NOTE: When timing marks are aligned, No.2 piston will be on Top Dead Center.

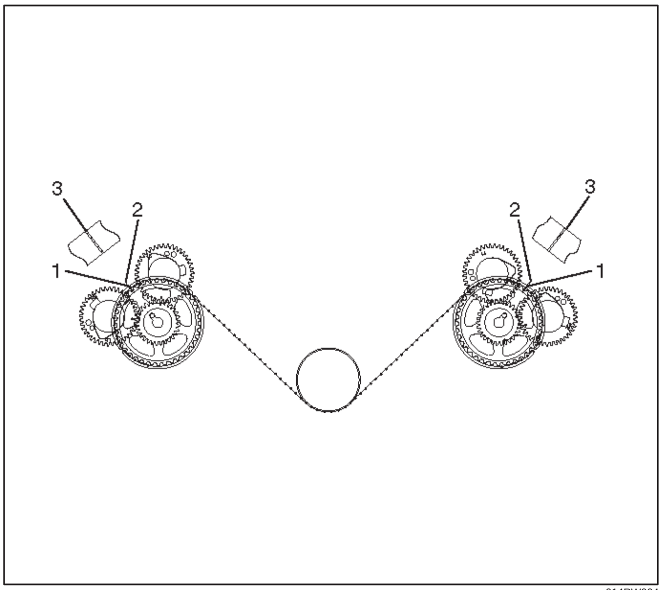


014RW003

Legend

(1) Alignment Mark on Oil Pump
(2) Groove on Crankshaft Timing Pulley
(3) Alignment Mark on Crankshaft Timing Pulley
(4) Alignment Mark on Timing Belt

2. Align the marks on the camshaft drive gear pulleys with the corresponding alignment marks on the cylinder head covers.



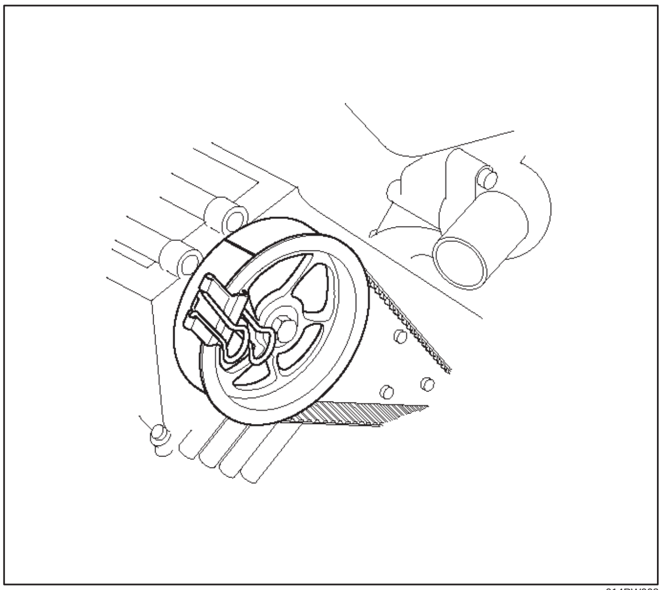
014RW004

Legend

(1) Alignment Mark on Camshaft Drive Gear Pulley
(2) Alignment Mark on Cylinder Head Cover.
(3) Alignment Mark on Timing Belt (White Line)

3. Align the alignment mark (white line) on the timing belt with alignment mark on the RH bank camshaft drive gear pulley (on the left side as viewed from the front of the vehicle).

   Secure the belt with a double clip.

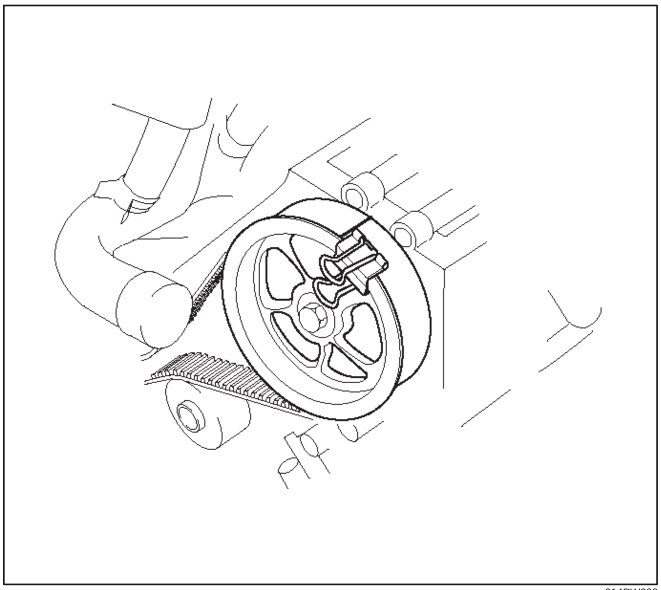


014RW008

4. Align the alignment mark (white line) on the timing belt with the alignment mark on the LH bank camshaft drive gear pulley.

   When aligning the timing marks, use a wrench to turn the camshaft drive gear pulley, then set the timing mark between timing belt and camshaft drive gear pulley.
   Secure the belt with a double clip.

NOTE: It is recommended for easy installation that the belt be secured with a double clip after it is installed to each pulley.



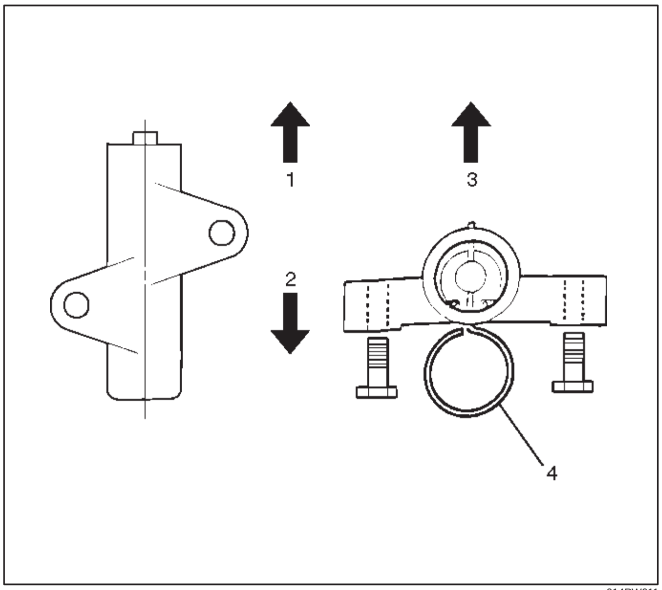
014RW009

5. Install crankshaft pulley temporarily and tighten center bolt by hand (do not use a wrench).

   Turn the crankshaft pulley clockwise to give some belt slack between the crankshaft timing pulley and the RH bank camshaft drive gear pulley.

2. Install pusher and tighten bolt to the specified torque.
   1. Install the pusher while pushing the tension pulley to the belt.
   2. Pull out pin from the pusher.

NOTE: When reusing the pusher, press the pusher with approximately 100Kg to retract the rod, and insert a pin (1.4 mm piano wire).



014RW011

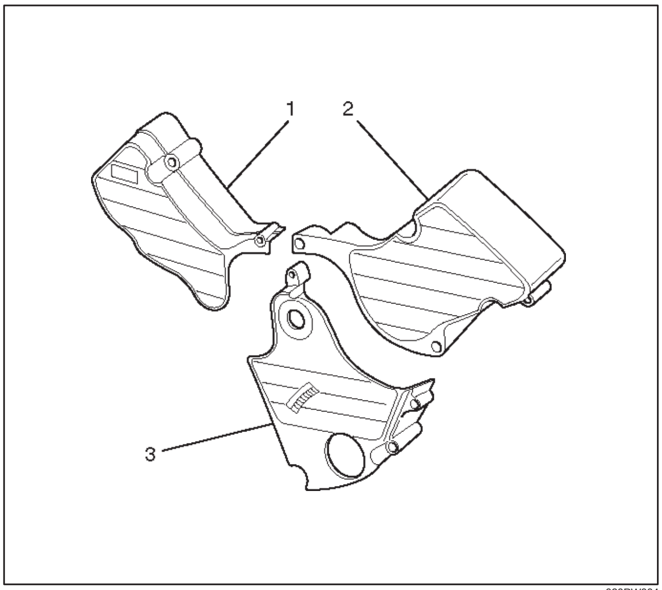
Legend
- (1) Up Side
- (2) Down Side
- (3) Direction for Installation
- (4) Locking Pin

3. Remove double clips from timing belt pulleys.
   Turn the crankshaft pulley clockwise by two turns.

Torque : 25 N·m (18 lb ft)

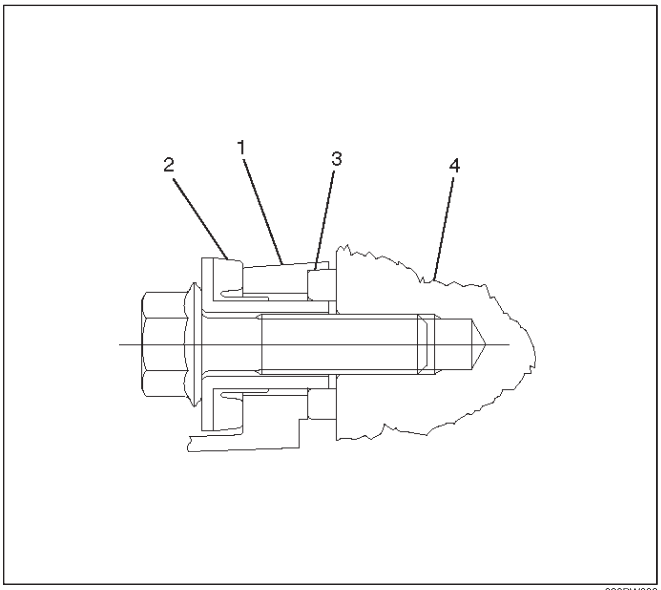
3. Install timing belt cover.
   Remove crankshaft pulley that was installed in step 1 item 5.
   Tighten bolts to the specified torque.

Torque: 19 N·m (14 lb ft)



020RW004

Legend
- (1) Timing Belt Cover RH
- (2) Timing Belt Cover LH
- (3) Timing Belt Cover Lower



020RW003

Legend
- (1) Timing Belt Cover
- (2) Rubber Bushing
- (3) Sealing Rubber
- (4) Cylinder Body

4. Install crankshaft pulley using J-8614-01, hold the crankshaft pulley and tighten center bolt to the specified torque.

Torque : 167 N·m (123 lb ft)

5. Install fan pulley bracket and tighten fixing bolts to the specified torque.

Torque : 22 N·m (16 lb ft)

6. Install power steering pump assembly and tighten to the specified torque.

Torque :

M8 bolt : 22 N·m (16 lb ft)

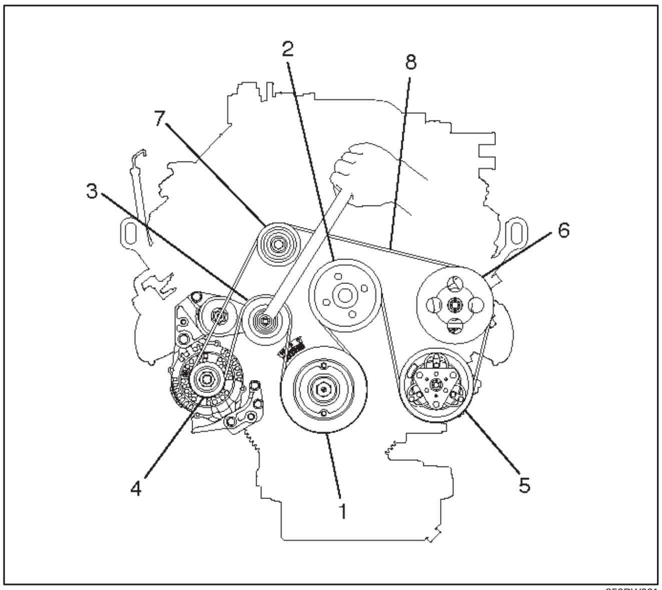
M10 bolt : 46 N·m (34 lb ft)

7. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.

Torque : 10 N·m (88.5 lb in) for fan and clutch assembly.

8. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.



850RW001

Legend

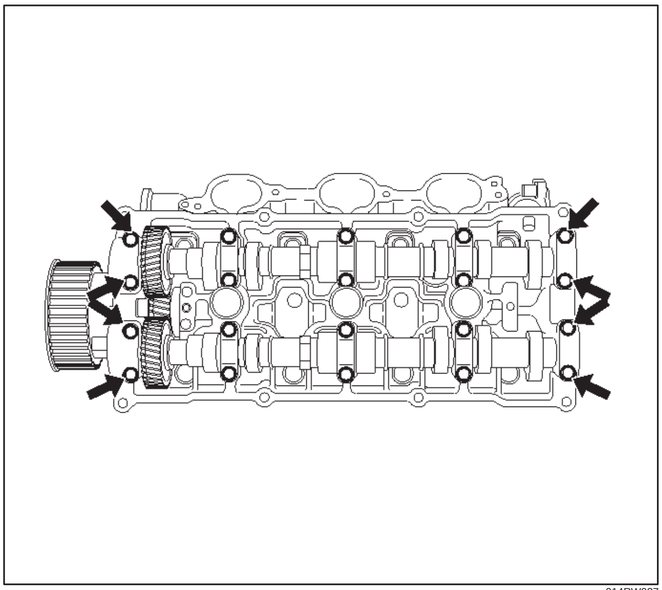
(1) Crankshaft Pulley
(2) Cooling Fan Pulley
(3) Auto Tensioner
(4) Generator
(5) Air Conditioner Compressor
(6) Power Steering Oil Pump
(7) Idle Pulley
(8) Drive Belt

9. Install radiator upper fan shroud.
10. Install air cleaner assembly.

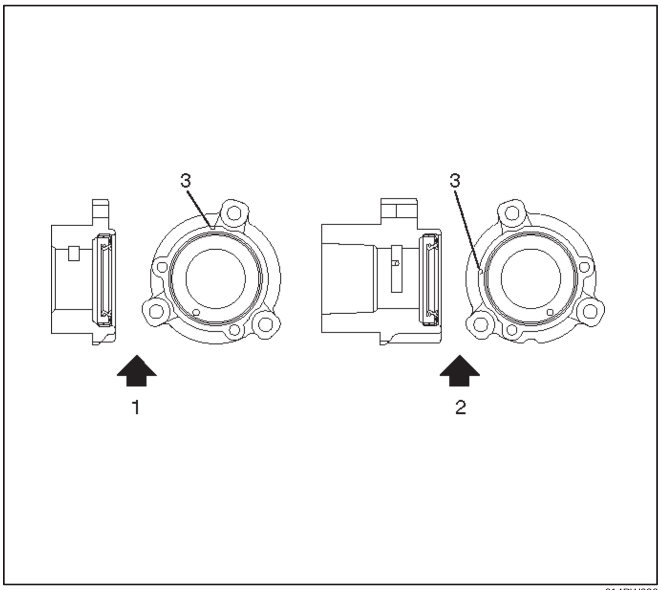
Camshaft

Removal

1. Disconnect battery ground cable.
2. Remove crankshaft pulley.
   - Refer to removal procedure for Crankshaft Pulley in this manual.
3. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
4. Remove cylinder head cover LH.
   - Refer to removal procedure for Cylinder Head Cover LH in this manual.
5. Remove cylinder head cover RH.
   - Refer to removal procedure for Cylinder Head Cover RH in this manual.
6. Remove twenty fixing bolts from inlet and exhaust camshaft bearing cap on one side bank, then camshaft bearing caps.



7. Remove camshaft assembly.
8. Remove fixing bolt for camshaft drive gear pulley.
9. Remove three fixing bolts from camshaft drive gear retainer, then camshaft drive gear assembly.



Legend

(1) Right Bank
(2) Left Bank
(3) Timing Mark on Retainer

Installation

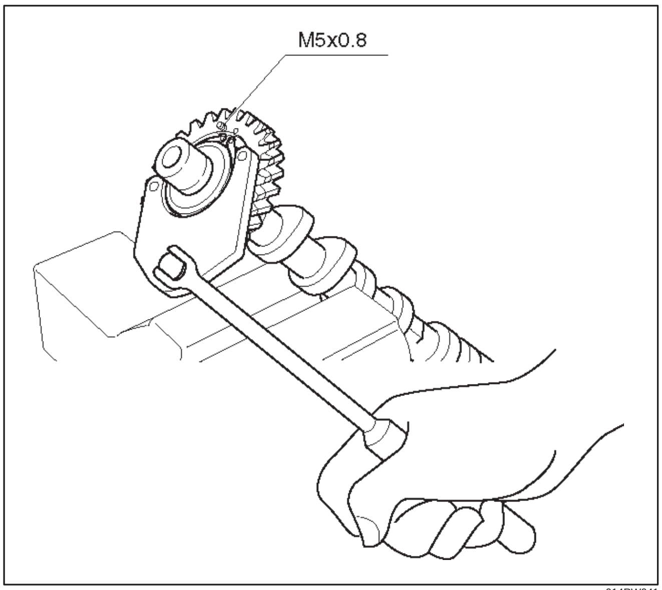
1. Install camshaft drive gear assembly and tighten three bolts to the specified torque.

   Torque : 10 N·m (89 lb in)

2. Tighten bolt for camshaft drive gear assembly pulley to the specified torque.

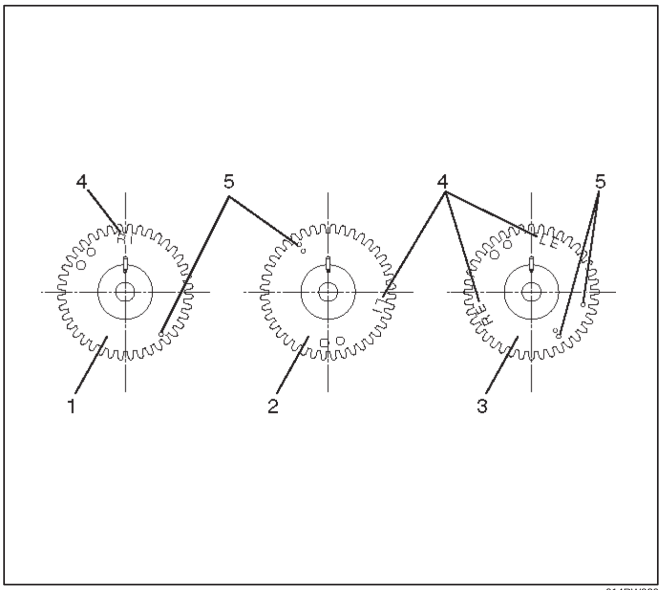
   Torque : 98 N·m (72 lb ft)

3. Tighten sub gear setting bolt.
   1. Use the J–42686 gear spring lever to turn sub gear to right direction until it aligns with the M5 bolt hole between camshaft driven gear and sub gear.
   2. Tighten the M5 bolt to a suitable torque to prevent the sub gear from moving.



014RW041

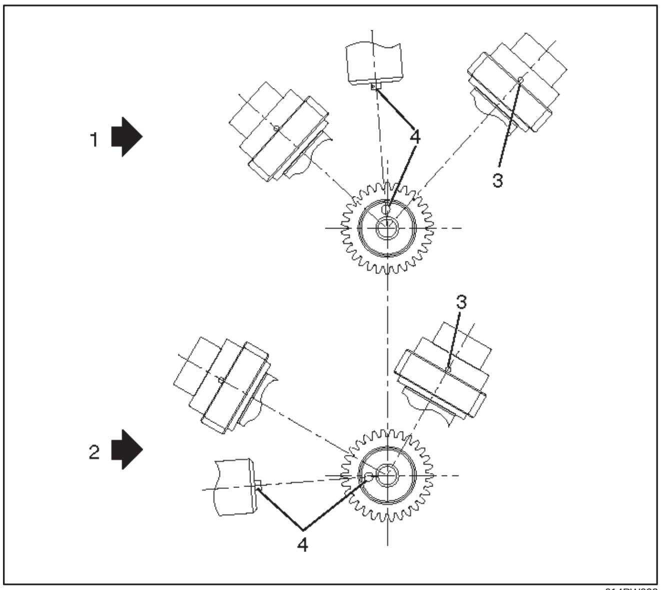
4. Install camshaft assembly and camshaft bearing caps, tighten twenty bolts on one side bank to the specified torque.
   1. Apply engine oil to camshaft journal and bearing surface of camshaft bearing cap.
   2. Align timing mark on intake camshaft (one dot for right bank, two dots for left bank) and exhaust camshaft (one dot for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



014RW020

Legend

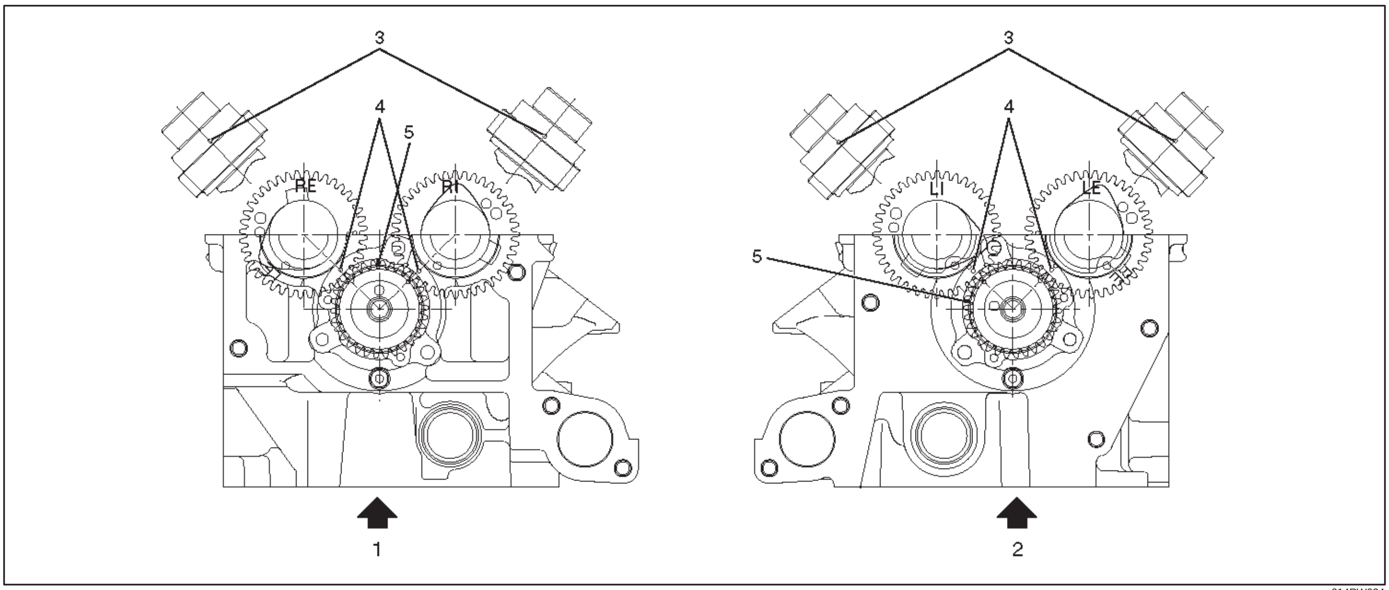
(1) Intake Camshaft Timing Gear for Right Bank
(2) Intake Camshaft Timing Gear for Left Bank
(3) Exhaust Camshaft Timing Gear
(4) Discrimination Mark
(LI: Left bank intake, RI: Right bank intake)
(LE: Left bank exhaust, RE: Right bank exhaust)



014RW023

Legend

(1) Right Bank Camshaft Drive Gear
(2) Left Bank Camshaft Drive Gear
(3) Timing Mark on Drive Gear
(4) Dowel Pin

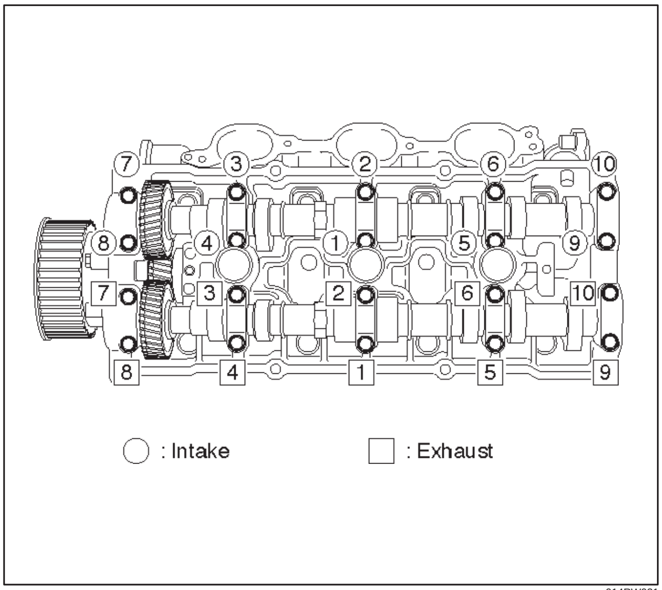


Legend

(1) Right Bank
(2) Left Bank
(3) Alignment Mark on Camshaft Drive Gear
(4) Alignment Mark on Camshaft
(5) Alignment Mark on Retainer

3. Tighten twenty bolts on numerical order an one side bank as shown in the illustration.

Torque : 10 N·m (89 lb in)

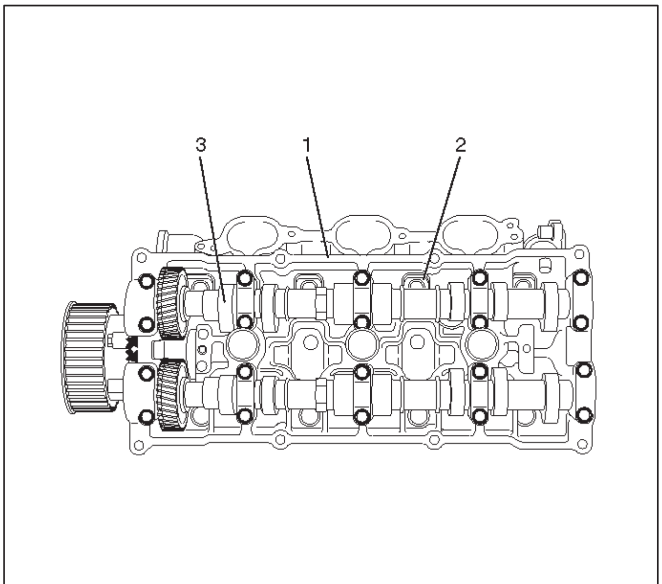


5. Install cylinder head cover RH.
   - Refer to installation procedure for CYLINDER HEAD COVER RH in this manual.
6. Install cylinder head cover LH.
   - Refer to installation procedure for CYLINDER HEAD COVER LH in this manual.
7. Install timing belt.
   - Refer to installation procedure for TIMING BELT in this manual.
8. Install crankshaft pulley.
   - Refer to installation procedure for CRANKSHAFT PULLEY in this manual.

Cylinder Head

Removal

1. Remove engine hood.
2. Disconnect battery ground cable.
3. Drain radiator coolant.
4. Drain engine oil.
5. Remove crankshaft pulley.
   - Refer to removal procedure for Crankshaft Pulley in this manual.
6. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
7. Remove cylinder head cover LH.
   - Refer to removal procedure for Cylinder Head Cover LH in this manual.
8. Remove cylinder head cover RH.
   - Refer to removal procedure for Cylinder Head Cover RH in this manual.
9. Remove common chamber.
   - Refer to removal procedure for Common Chamber in this manual.
10. Remove cylinder head assembly.
    A. Loosen head bolts in reverse of tightening sequence.
    B. Remove cylinder head assembly.



014RW028

Legend

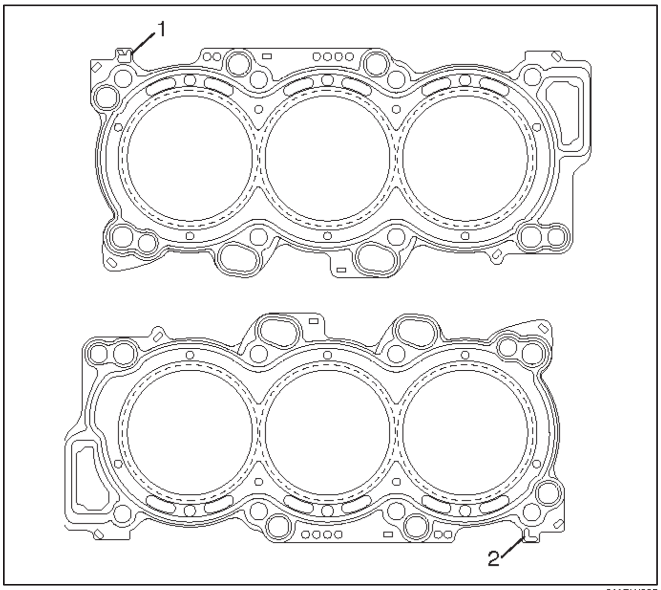
(1) Cylinder Head
(2) Cylinder Head Bolt
(3) Camshaft

Installation

1. Install cylinder head assembly to cylinder block.
   A. Put cylinder head gasket on the cylinder block.

NOTE: There is discrimination mark “R” for right bank and “L” for left bank on the cylinder head gasket as shown in the illustration.

Do not reuse cylinder head gasket.



011RW005

B. Align dowel pin hole to dowel pin on the cylinder block.
C. Position cylinder head on the cylinder block.
D. Tighten two bolts temporarily by hand to prevent the cylinder head assembly from moving.
E. Using J-24239-01 cylinder head bolt wrench, tighten bolts in numerical order as shown in the illustration to the specified torque.

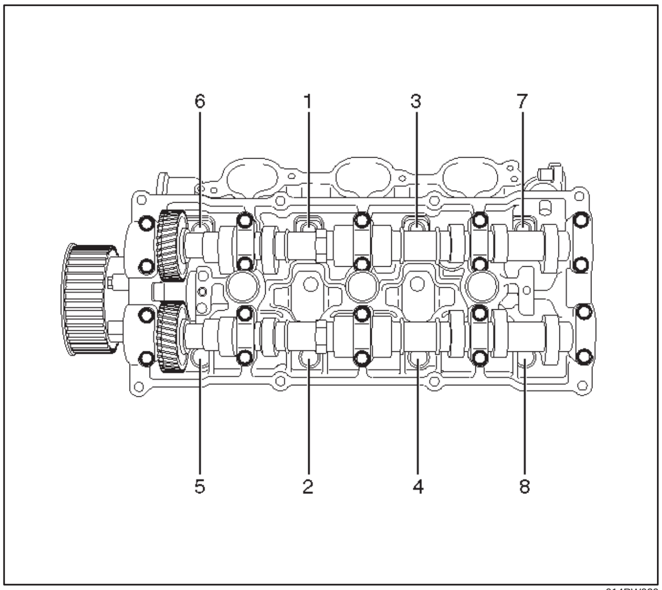
NOTE: Do not reuse cylinder head bolts.

Do not apply any lubricant to the cylinder head bolts.

Torque :

Temporary : 29 N·m (21 lb ft)

Final : 64 N·m (47 lb ft)



014RW029

2. Install common chamber.
   - Refer to installation procedure for Common Chamber in this manual.
3. Install cylinder head cover RH.
   - Refer to installation procedure for Cylinder Head Cover RH in this manual.
4. Install cylinder head cover LH.
   - Refer to installation procedure for Cylinder Head Cover LH in this manual.
5. Install timing belt.
   - Refer to installation procedure for Timing Belt in this manual.
6. Install crankshaft pulley.
   - Refer to installation procedure for Crankshaft Pulley in this manual.

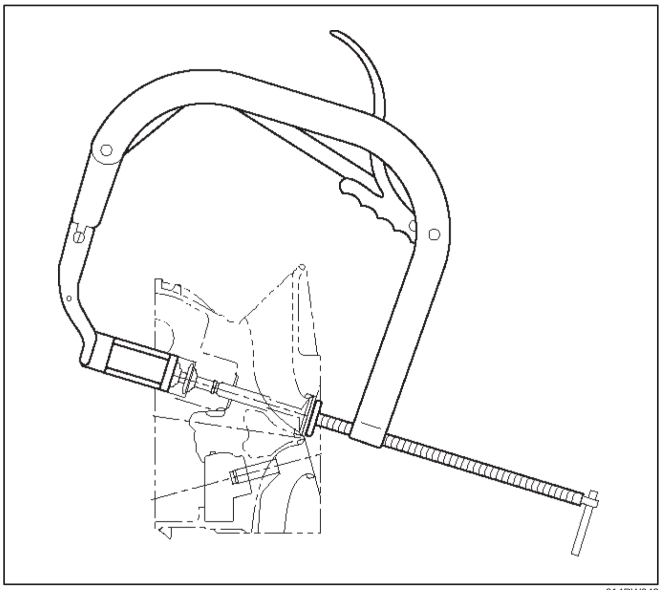
Valve Stem Oil Controller , Valve Spring and Valve Guide

Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
   - Drain engine coolant.
3. Remove cylinder head assembly.
   - Refer to removal procedure for Cylinder Head in this manual.
4. Remove camshaft.
   - Refer to removal procedure for Camshaft in this manual.
5. Remove tappets with shim.

NOTE: Do not damage shim surface.

6. Remove valve springs using J–8062 valve spring compressor and J–42898 valve spring compressor adapter then remove upper valve spring seat and lower seat.

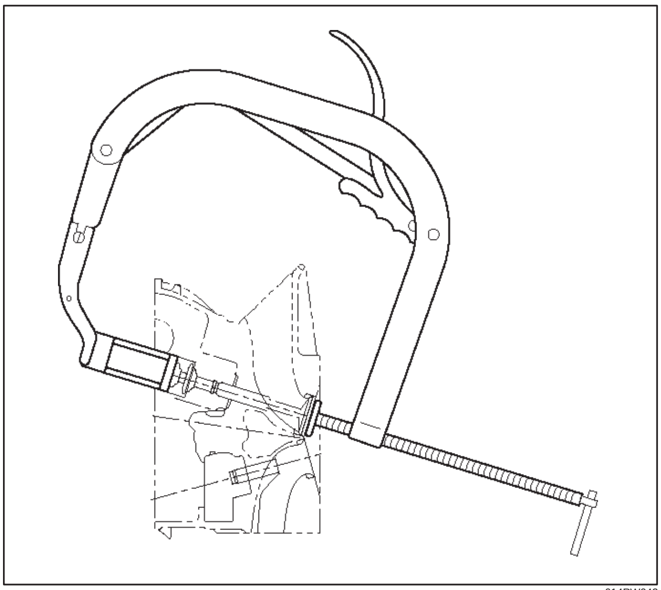


014RW042

7. Remove oil controller using J–37281 oil controller remover, remove each valve stem oil controller.
8. Remove valve guide using J–37985 valve guide replacer.

Installation

1. Install valve guide using J–42899 valve guide installer.
2. Install oil controller using J–38537 oil controller installer.
3. Install lower valve spring seat, valve spring and upper valve spring seat then put split collars on the upper spring seat, using J–8062 valve spring compressor and J–42898 valve spring compressor adapter to install the split collars.

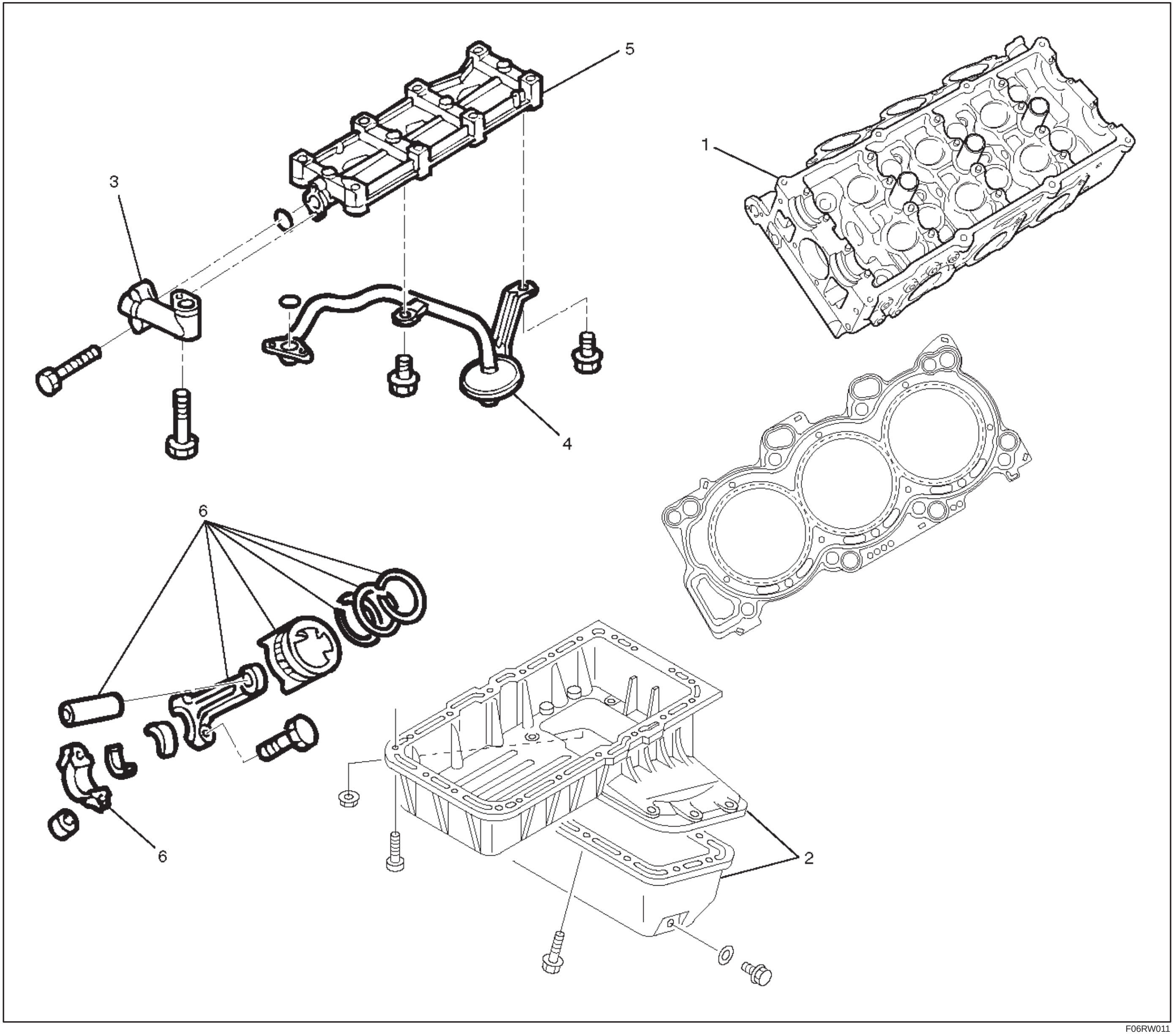


014RW042

4. Install tappet with shim.
5. Install camshaft assembly.
   - Refer to installation procedure for Camshaft in this manual.
6. Install cylinder head assembly.
   - Refer to installation procedure for Cylinder Head in this manual.
7. Fill engine oil until full level.
8. Fill engine coolant.

Piston, Piston Ring and Connecting Rod

Removal

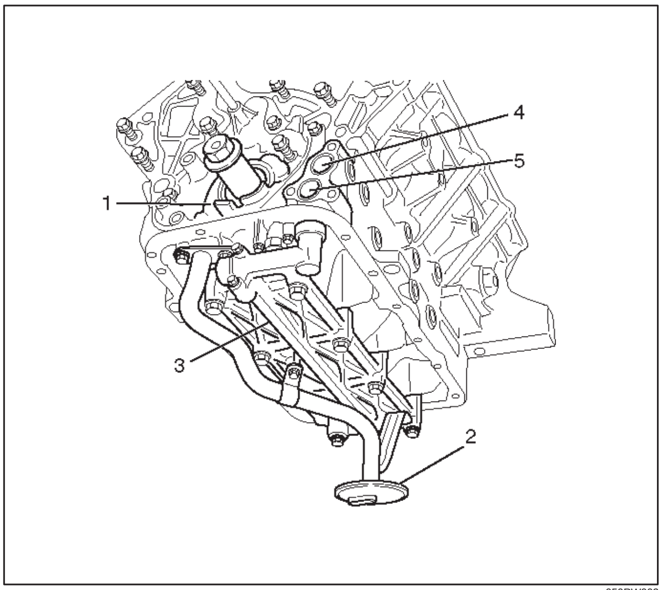


Legend

(1) Cylinder Head
(2) Crankcase with Oil Pan
(3) Oil Pipe
(4) Oil Strainer
(5) Oil Gallery
(6) Piston with Connecting Rod Assembly

1. Remove cylinder head assembly.
   - Refer to removal procedure for Cylinder Head in this manual.
2. Remove crankcase with Oil Pan.
   - Refer to removal procedure for Oil Pan and Crankcase in this manual.

3. Remove oil strainer fixing bolts, remove oil strainer assembly with O-ring.



050RW002

Legend
(1) Oil Pump
(2) Oil Strainer
(3) Oil Gallery
(4) From Oil Filter
(5) To Oil Filter

4. Remove three fixing bolts, oil pipe with O-ring.
5. Remove eight fixing bolts, oil gallery.
6. Remove piston with connecting rod assembly. (before removing the bearing cap, remove carbon on the top of cylinder bore and push piston with connecting rod out from the top of cylinder bore.)

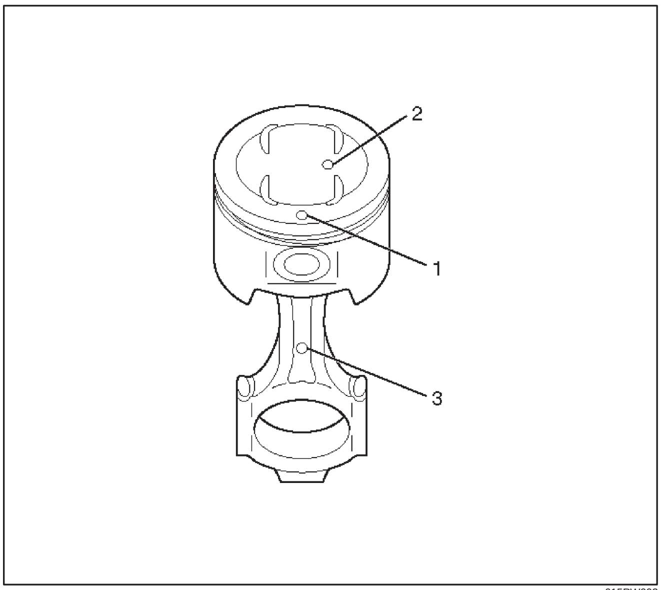
Installation

1. Install piston with connecting rod assembly.
   - Apply engine oil to cylinder bore, connecting rod bearing and crank pin.
     When installing the piston, its front mark must face the engine front side.
   - The bearing cap number must be the same as connecting rod number.
   - Apply engine oil to the thread and seating surface of each nut.
   - Tighten nuts to the specified torque.

   Torque : 54 N·m (40 lb ft)

   - After tightening the nuts, make sure that the crankshaft rotates smoothly.

NOTE: Do not apply engine oil to the bearing back faces and connecting rod bearing fitting surfaces.

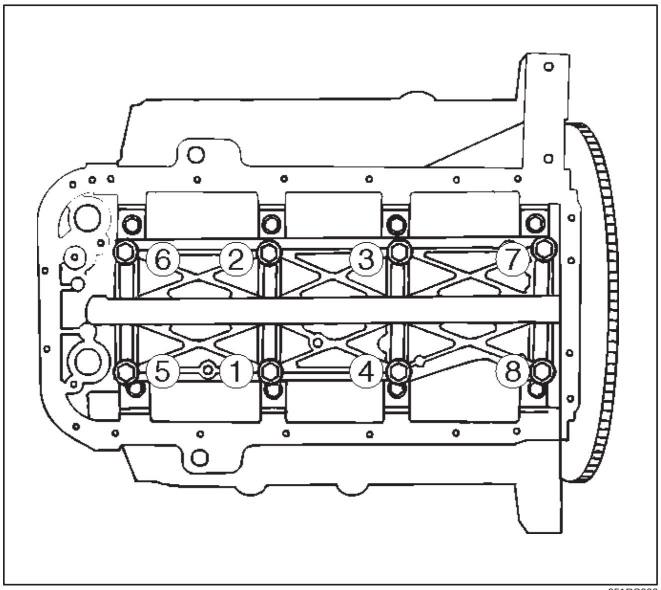


015RW003

Legend
(1) Piston Front Mark
(2) Piston Grade
(3) Connecting Rod Front Mark

2. Install oil gallery and tighten the bolts in two steps, in the order shown in illustration.

   Torque :
   1st step : 29 N·m (21 lb ft)
   2nd step : 55°–65°



051RS009

3. Install oil pipe with O-ring.

   Torque : 10 N·m (89 lb in)

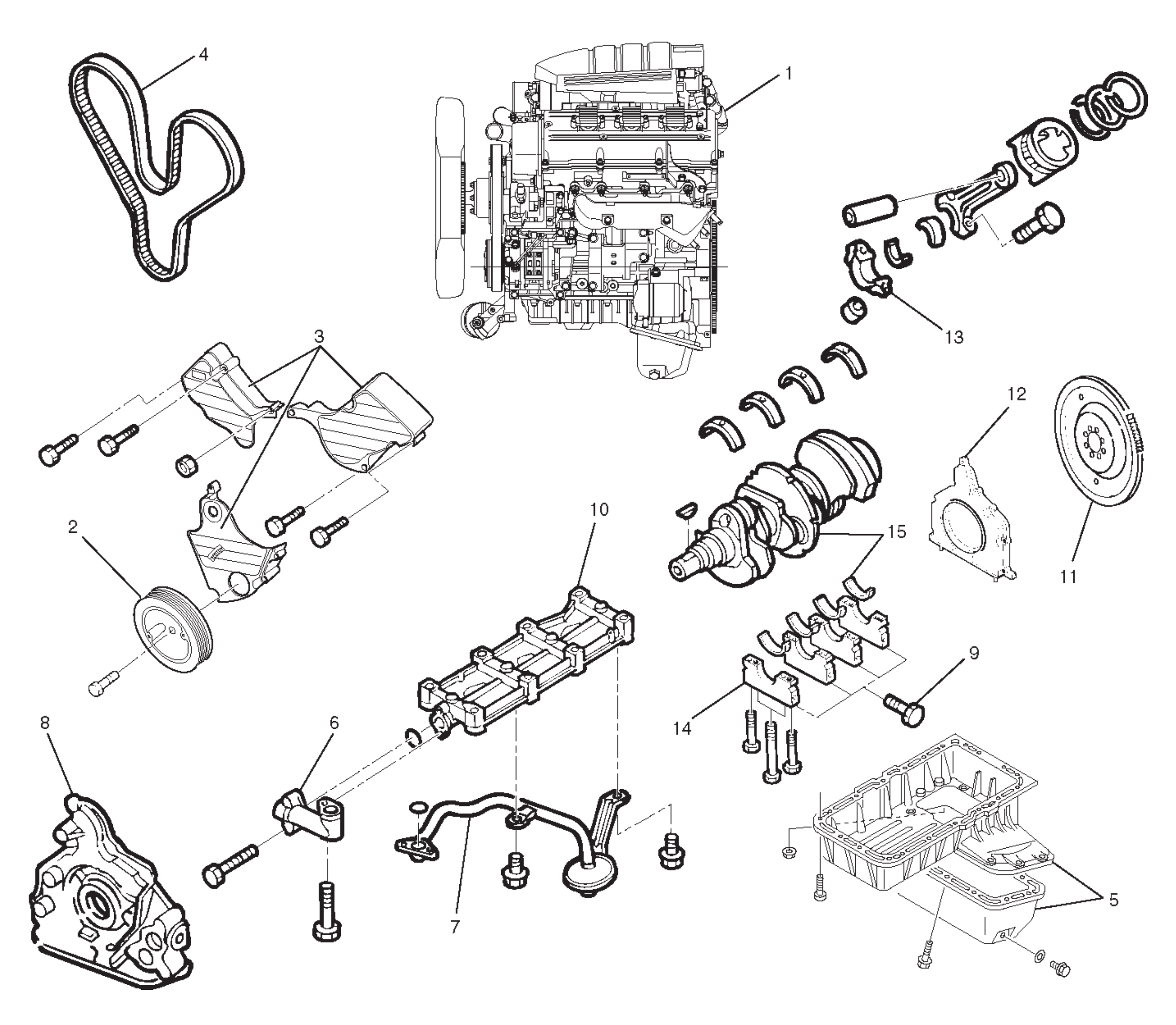
4. Install oil strainer assembly with O-ring.

   Torque : 25 N·m (18 lb ft)

5. Install crankcase with Oil Pan.
   - Refer to installation procedure for Oil Pan and Crankcase in this manual.
6. Install cylinder head assembly.
   - Refer to installation procedure for Cylinder Head in this manual.

Crankshaft and Main Bearings

Removal



F06RY002

Legend

(1) Engine Assembly
(2) Crankshaft Pulley
(3) Timing Belt Cover
(4) Timing Belt
(5) Crankcase with Oil Pan
(6) Oil Pipe
(7) Oil Strainer
(8) Oil Pump Assembly
(9) Cylinder Body Side Bolt
(10) Oil Gallery
(11) Flywheel
(12) Rear Oil Seal Retainer
(13) Connecting Rod Cap
(14) Crankshaft Main Bearing Cap
(15) Crankshaft and Main Bearing

1. Remove engine assembly.
   - Refer to removal procedure for Engine Assembly in this manual.
2. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
3. Remove oil pan and crankcase.
   - Refer to removal procedure for Oil Pan and Crankcase in this manual.
4. Remove oil pipe with O-ring.
5. Remove oil strainer assembly with O-ring.

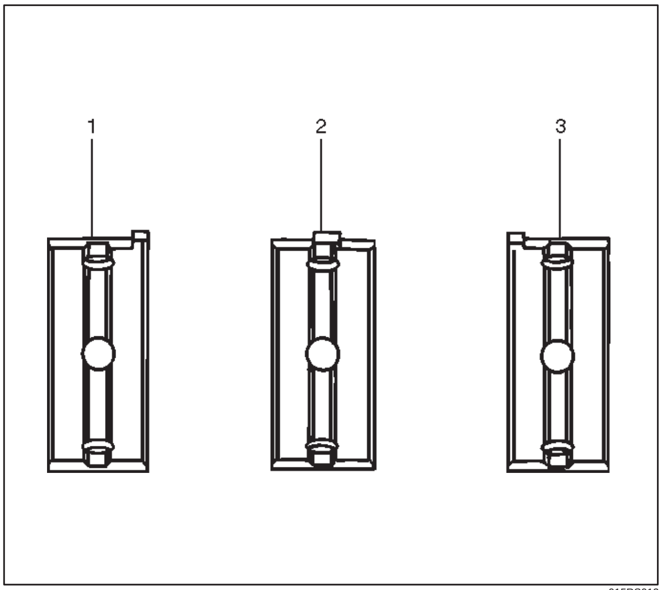
6. Remove oil pump assembly.
   - Refer to removal procedure for Oil Pump in this manual.
7. Remove cylinder body side bolts.
8. Remove oil gallery.
9. Remove flywheel.
10. Remove rear oil seal retainer.
    - Refer to removal procedure for Rear Oil Seal in this manual.
11. Remove connecting rod caps.
12. Remove crankshaft main bearing caps.
13. Remove crankshaft and main bearings.

Installation

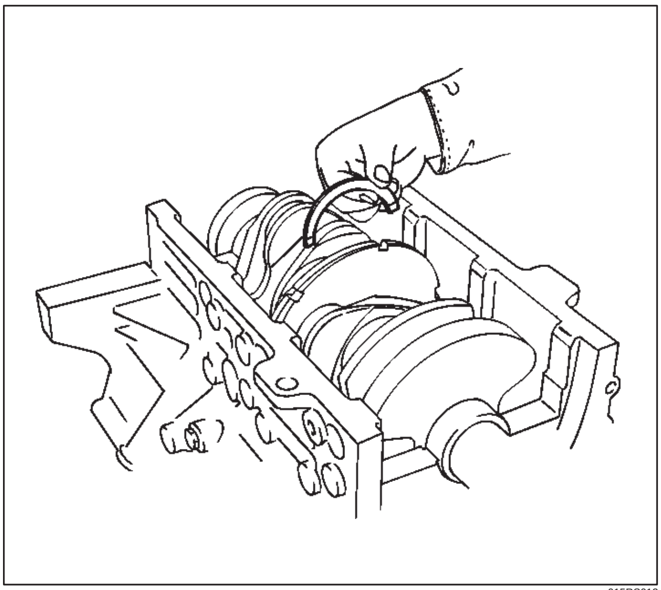
1. Install crankshaft and main bearings.
   - Install main bearing in the cylinder block and main bearing cap respectively.
     Apply new engine oil to upper and lower main bearings.

NOTE:

- Do not apply engine oil to the bearing back faces.
- Make sure that main bearings are in correct position.
- Install crankshaft with care.
- Apply engine oil to the thrust washer.
- Install thrust washer on No.3 journal.
- Oil grooves in thrust washer must face the crankshaft.



015RS012



015RS013

2. Install crankshaft main bearing caps.
   - Apply engine oil to the thread and seating surface of each bearing cap fixing bolt.

NOTE:

- Do not apply engine oil to the bearing back faces.
- Install bearing caps, starting with cylinder block front side.
- Tighten main bearing fixing bolts to the specified torque.

Torque : 39 N·m (29 lb ft)

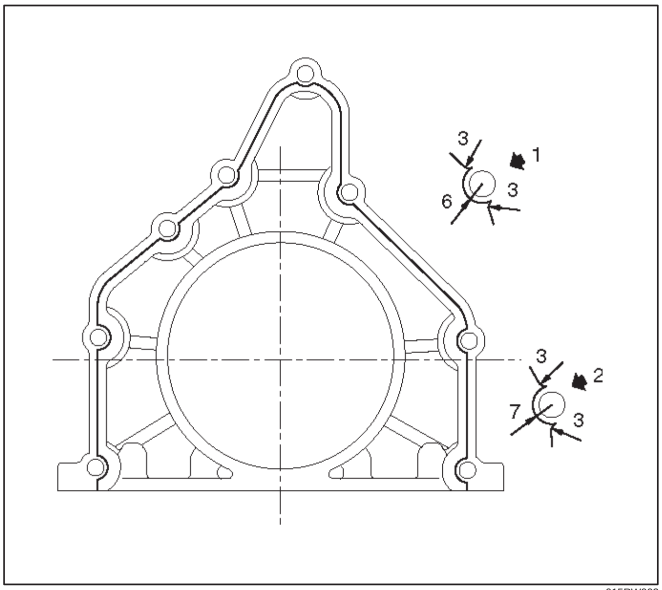
- After tightening the bolts, make sure that the crankshaft rotates smoothly.

3. Install connecting rod caps.
   - The cap number must be same as connecting rod number.
   - Apply engine oil to the thread and seating surface of each nut.
   - Tighten nuts to the specified torque.

Torque : 54 N·m (40 lb ft)

   - After tightening the nuts, make sure that the crankshaft rotates smoothly.
4. Install rear oil seal retainer.
   - Remove oil on cylinder block and retainer fitting surface.
   - Apply sealant (TB1207B or equivalent) to retainer fitting surface as shown in illustration.

- The oil seal retainer must be installed within 5 minutes after sealant application before the sealant hardens.



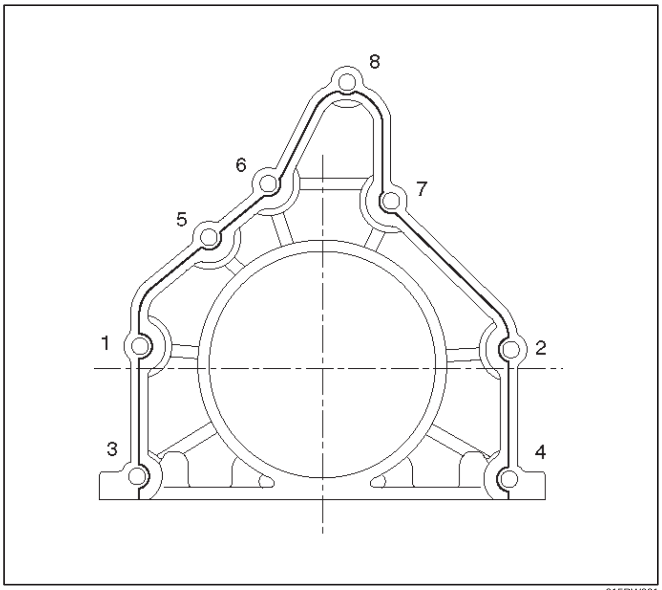
015RW002

Legend

(1) Around Bolt Holes
(2) Around Dowel Pin

- Apply engine oil to oil seal lip and align a dowel pin hole in the cylinder block with that in the retainer.
- Tighten retainer fixing bolts to the specified torque.

Torque : 18 N·m (13 lb ft)



015RW001

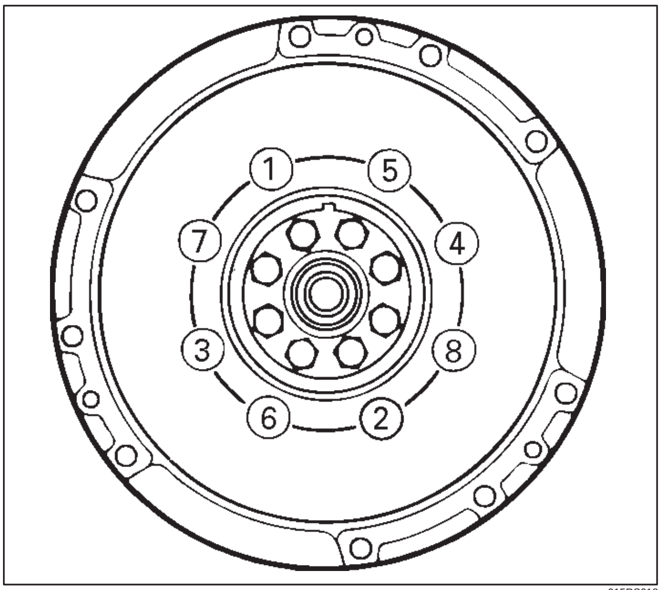
5. Install flywheel.
   - Clean tapped holes in the crankshaft.
   - Remove oil on crankshaft and flywheel fitting surface.

NOTE:

- Do not reuse the bolts.
- Do not apply oil or thread lock to the bolts.

- Tighten fixing bolts to the specified torque.

Torque : 54 N·m (40 lb ft)



015RS018

6. Install oil gallery.
   - Clean contact surface of oil gallery and main bearing cap.
     Apply engine oil to oil gallery fixing bolts and tighten the bolts in two steps, in the order shown in illustration.

Torque :

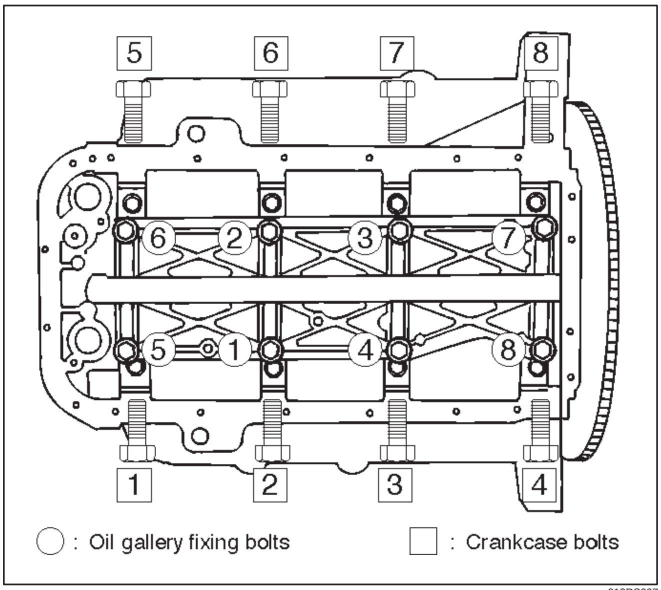
1st step : 29 N·m (21 lb ft)

2nd step : 55°–65°

7. Install cylinder body side bolts and tighten bolts in order to the specified torque.

Torque : 39 N·m (29 lb ft)

NOTE: Do not apply the oil to the bolts.

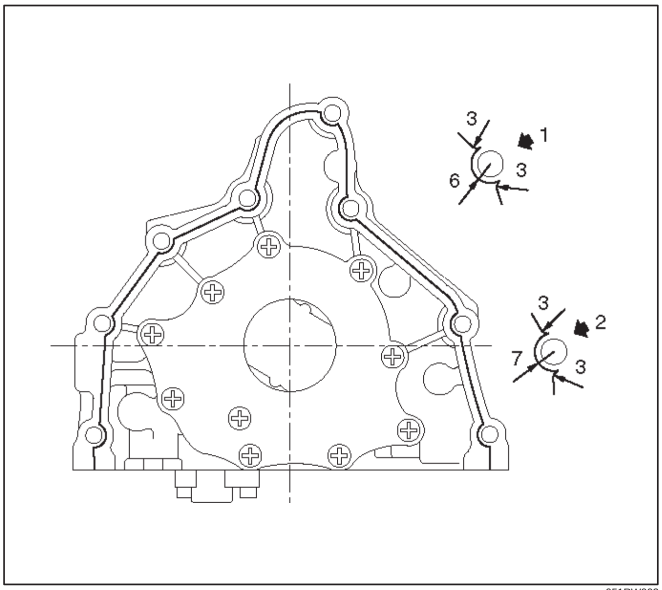


012RS007

8. Install oil pump assembly.
   - Remove oil on cylinder block and oil pump mounting surface.

- Apply sealant (TB1207B or equivalent) to the oil pump mounting surface.
- The oil pump assembly must be installed within 5 minutes after sealant application before the sealant hardens.
- Apply engine oil to oil seal lip.
- Install oil pump in the cylinder block and tighten fixing bolts to the specified torque.

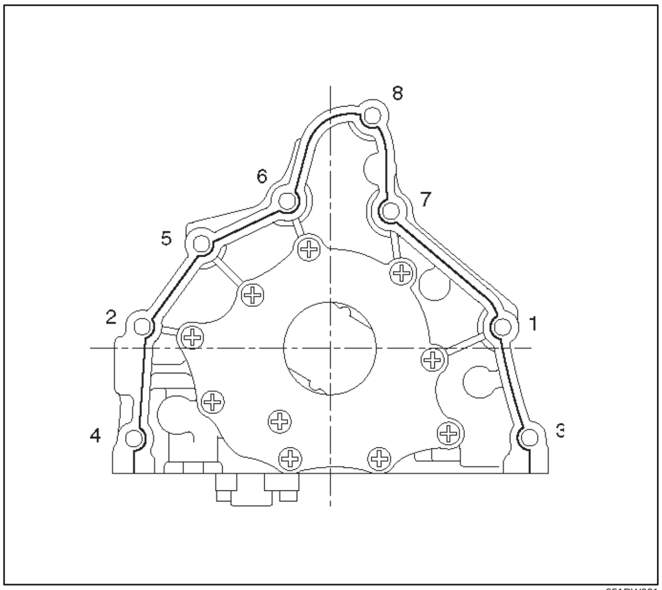
Torque : 25 N·m (18 lb ft)



051RW002

Legend

(1) Around Bolt Holes
(2) Around Dowel Pin



051RW001

9. Install oil strainer with O-ring, tighten to the specified torque.

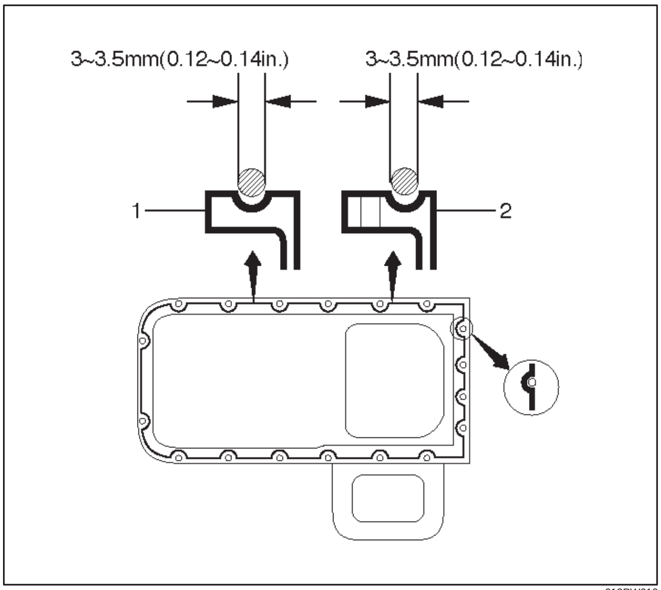
Torque : 25 N·m (18 lb ft)

10. Install oil pipe with O-ring, tighten fixing bolts to the specified torque.

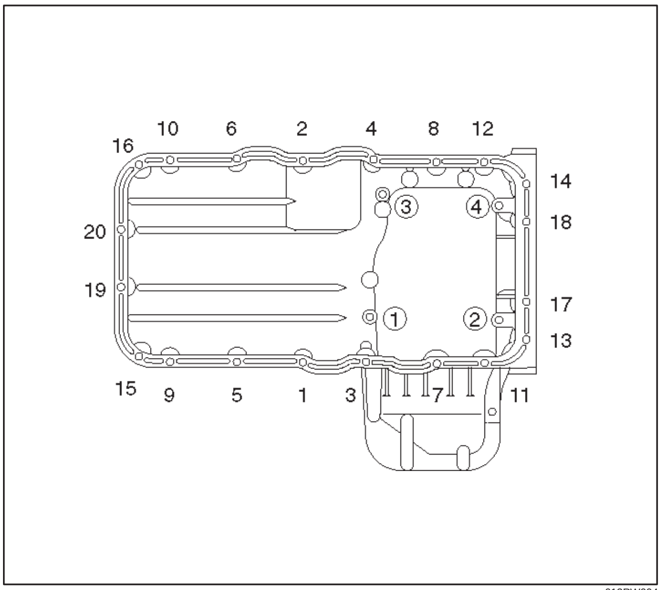
Torque : 25 N·m (18 lb ft)

11. Install crankcase.
    - Remove oil on crankcase mounting surface and dry the surface.
    - Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the crankcase mounting surface. The bead must be continuous.
    - The crankcase must be installed within 5 minutes after sealant application before the sealant hardens.
    - Tighten fixing bolts to the specified torque.

Torque : 10 N·m (89 lb in)



013RW010

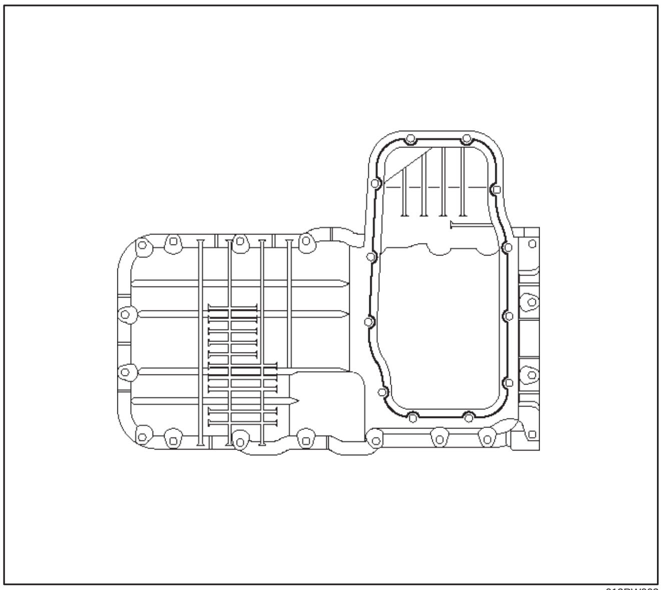


013RW004

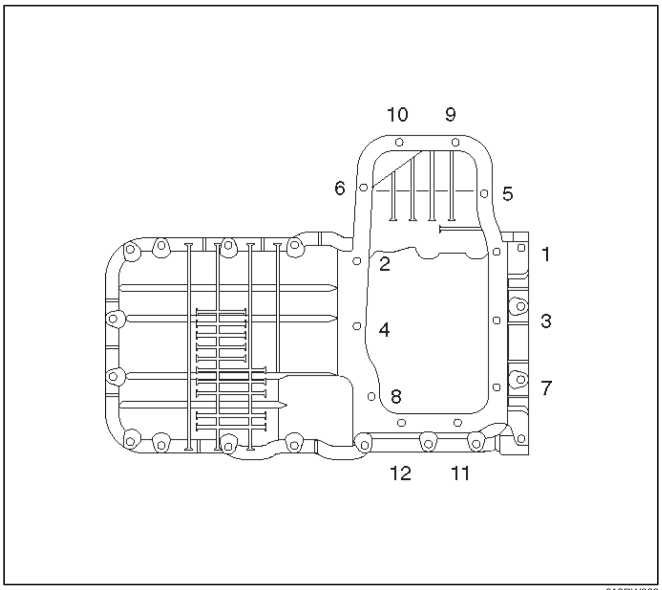
12. Install oil pan
    - Remove oil on oil pan mounting surface and dry the surface.
    - Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the oil pan mounting surface. The bead must be continuous.
    - The oil pan must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

- Tighten fixing bolts to the specified torque.

Torque : 25 N·m (18 lb ft)



013RW003



013RW002

13. Install timing belt.
    - Refer to installation procedure for Timing Belt in this manual.
14. Install engine assembly.
    - Refer to installation procedure for Engine in this manual.

Rear Oil Seal

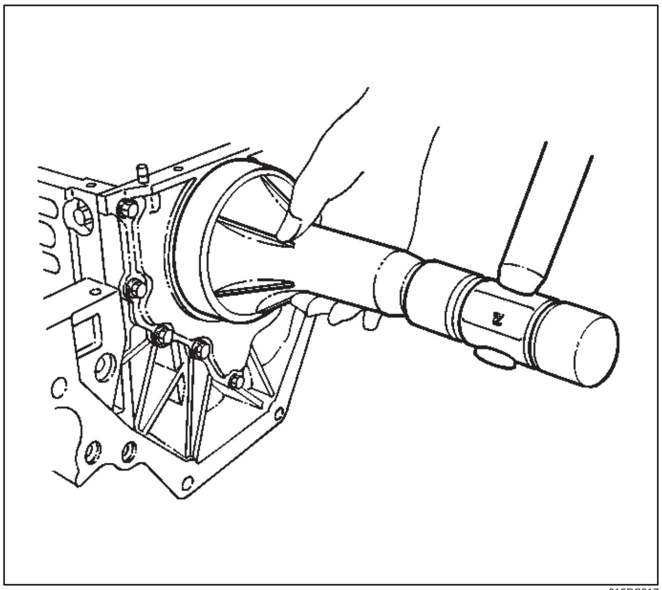
Removal

1. Remove transmission assembly.
   - Refer to removal procedure for Transmission section in this manual.
2. Remove flywheel.
3. Remove rear oil seal using a seal remover.

NOTE: Take care not to damage the crankshaft or oil seal retainer when removing oil seal.

Installation

1. Apply engine oil to oil seal lip and install oil seal using J-39201.

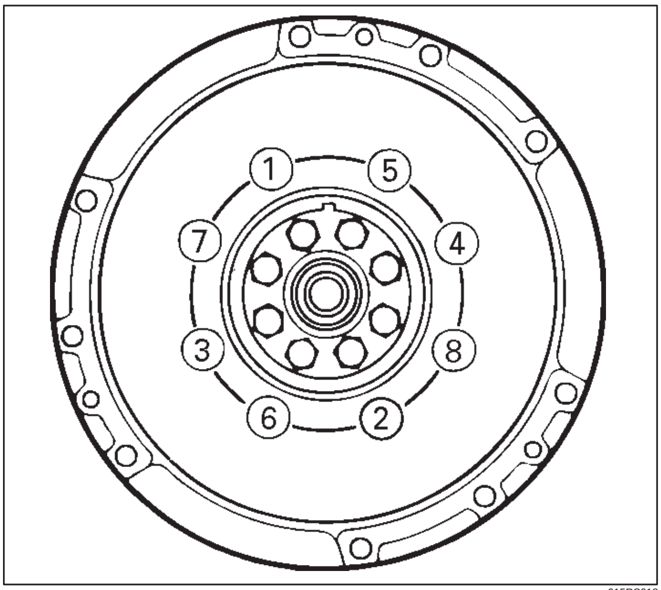


015RS017

2. Install flywheel.
   - Clean tapped holes in the crankshaft.
   - Remove oil on the crankshaft and flywheel mounting surface.
   - Tighten fixing bolts to the specified torque.

NOTE: Do not reuse the bolts and do not apply oil or thread lock to the bolts.

Torque : 54 N·m (40 lb ft)



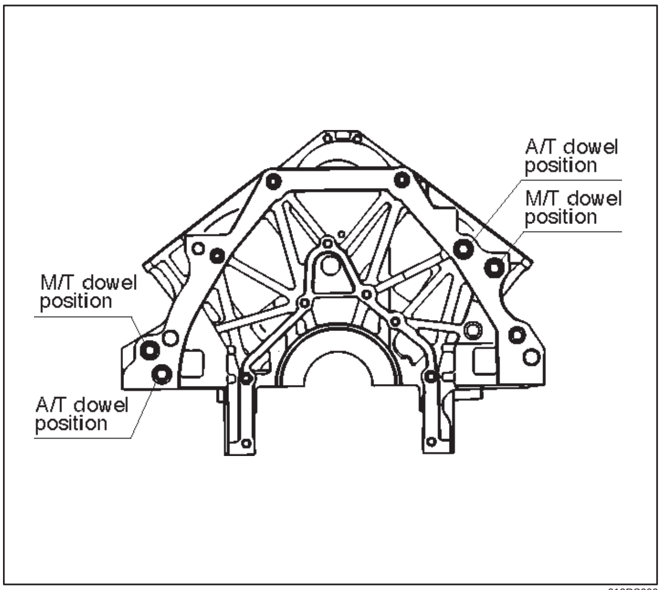
015RS018

3. Install transmission.
   - See Transmission section in this manual.

CAUTION: When assembling the engine and transmission, confirm that dowels have been mounted in the specified positions at the engine side.

NOTE: Take care that dowel positions are different between the manual transmission and the automatic transmission.

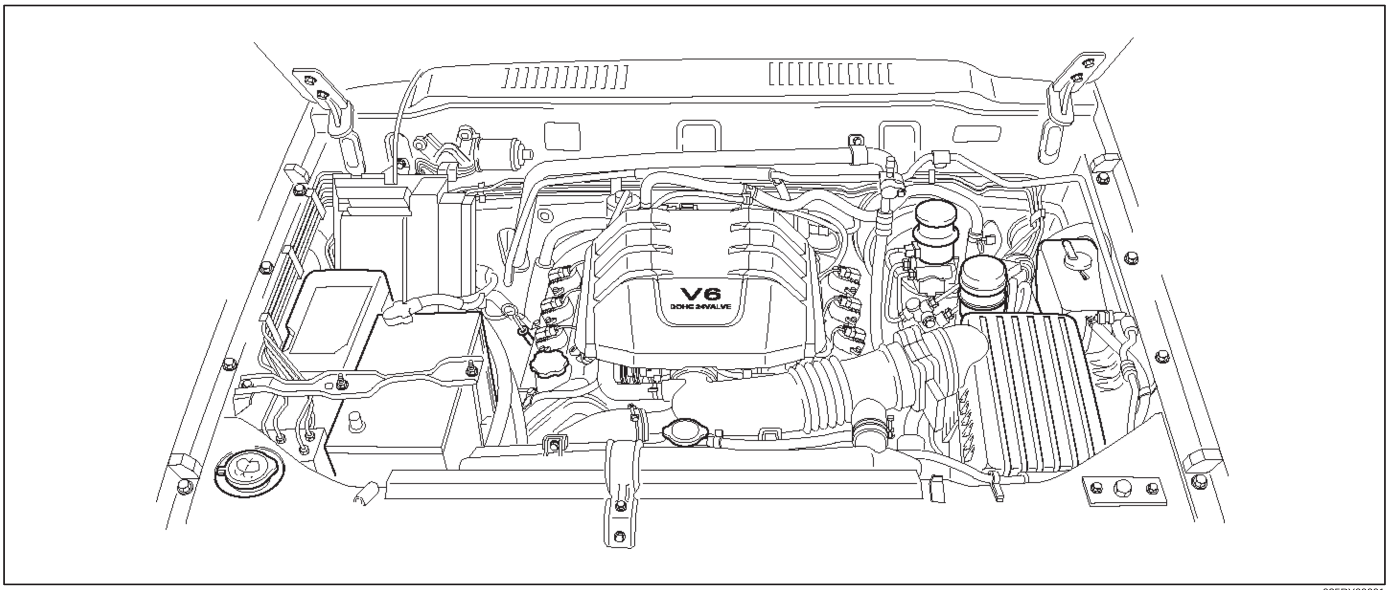
Otherwise, the transmission may be damaged.



012RS009

Engine Assembly

Removal



035RY00001

1. Disconnect battery ground and positive cable.
2. Remove battery.
3. Make alignment mark on the engine hood and hinges before removal in order to return the hood to original position exactly.
4. Remove engine hood.
5. Drain radiator coolant.
6. Disconnect ion sensing module harness connectors, and manifold absolute pressure sensor harness connectors from sensors on common chamber.
7. Disconnect throttle position sensor harness connectors from throttle body.
8. Disconnect air duct with air cleaner cover.
9. Remove air cleaner assembly.
10. Disconnect canister vacuum hose.
11. Disconnect vacuum booster hose.
12. Disconnect three engine harness connectors.
13. Disconnect harness connector to transmission (left front side of engine compartment), disconnect shift on the fly harness connector from front side of front axle and remove transmission harness bracket from engine left side.
14. Disconnect ground cable between engine and frame.
15. Disconnect bonding cable connector on the back of right dash panel.
16. Disconnect bonding cable terminal on the left bank.
17. Disconnect starter harness connector from starter.
18. Disconnect generator harness connector from generator.
19. Disconnect coolant reserve tank hose from radiator.
20. Remove radiator upper and lower hoses.
21. Remove upper fan shroud.
22. Remove cooling fan assembly four fixing nuts, then the cooling fan assembly.
23. Move drive belt tensioner to loose side using wrench then remove drive belt.
24. Remove power steering pump fixing bolts, then power steering pump. Place the power steering pump along with piping on the body side.
25. Remove air conditioning compressor fixing bolts from bracket and place the compressor along with piping on the body side.
26. Remove four O_2 sensor harness connectors (two each bank) from exhaust front pipe.
27. Remove three exhaust pipe fixing nuts from each bank.
28. Remove two exhaust pipe fixing nuts from each exhaust pipe, then move exhaust pipe to rear side of vehicle.
29. Remove flywheel dust covers.
30. Disconnect two heater hoses from engine.
31. Disconnect fuel hoses from right side of transmission.

CAUTION: Plug fuel pipes on engine side and fuel hoses from fuel tank.

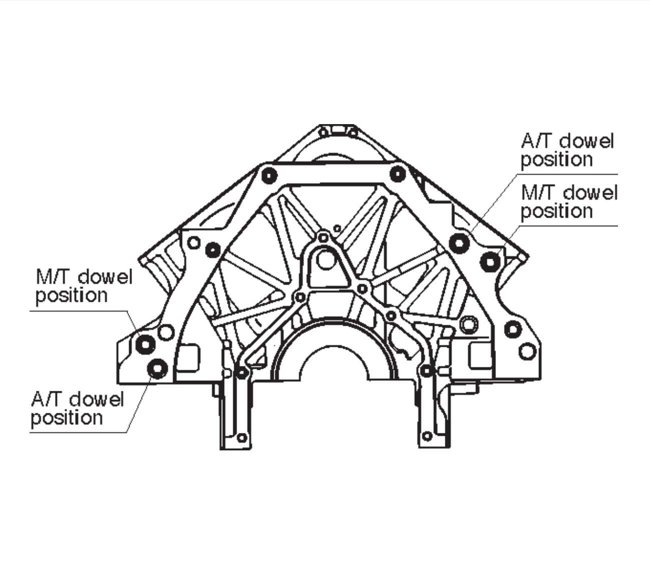
32. Remove transmission assembly. Refer to Transmission section in this manual.
33. Support the engine by engine hoist.
34. Remove two left side engine mount fixing bolts from engine mount on chassis side.
35. Remove two right side engine mount fixing bolts from engine mount on chassis side.
36. Remove engine assembly.

Installation

CAUTION: When assembling the engine and transmission, confirm that dowels have been mounted in the specified positions at the engine side.

NOTE: Take care that dowel positions are different between the manual transmission and the automatic transmission.

If the engine is assembled in the condition that the dowels have not been mounted in the specified positions, the transmission may be damaged the transmission.



012RS009

1. Install engine assembly. Tighten engine mount fixing bolts to frame to the specified torque.

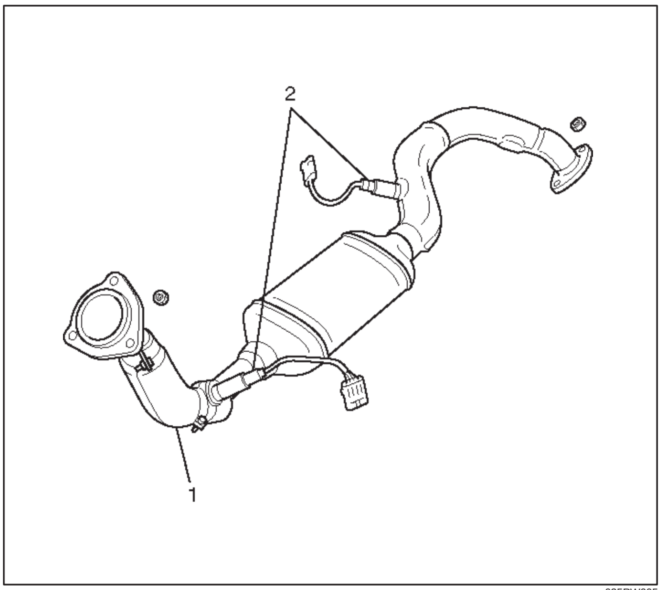
   Torque: 41 N·m (30 lb ft)

2. Reconnect fuel hose to fuel pipe on engine.
3. Install transmission assembly. Refer to Transmission section in this manual.
4. Reconnect two heater hoses to engine.
5. Install flywheel dust covers.
6. Install exhaust pipe and temporally tighten two (each bank) rear exhaust flange nuts then tighten three stud nuts (each bank) between exhaust manifold and exhaust pipe, finally tighten rear side nuts to the specified torque.

   Torque:

   Nuts: 43 N·m (32 lb ft)

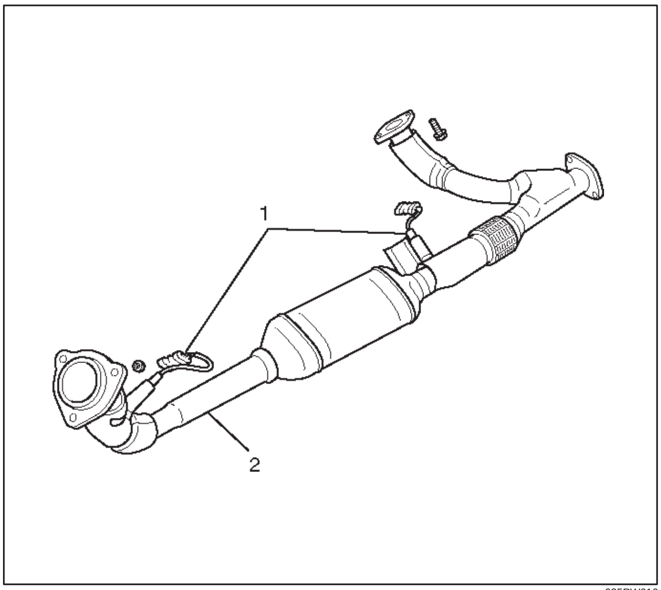
   Stud nuts: 67 N·m (49 lb ft)



035RW005

Legend

(1) Exhaust Front Pipe RH
(2) O_2 Sensor



035RW016

Legend

(1) O_2 Sensor
(2) Exhaust Front Pipe LH

7. Reconnect O_2 sensor connector.
8. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

   Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.

   Torque : 10 N·m (88.5 lb in) for fan and clutch assembly.

9. Install air conditioner compressor to engine and tighten to the specified torque.

   6VE1

   Torque :

M8 bolts : 22 N·m (16 lb ft)

M10 bolts : 43 N·m (32 lb ft)

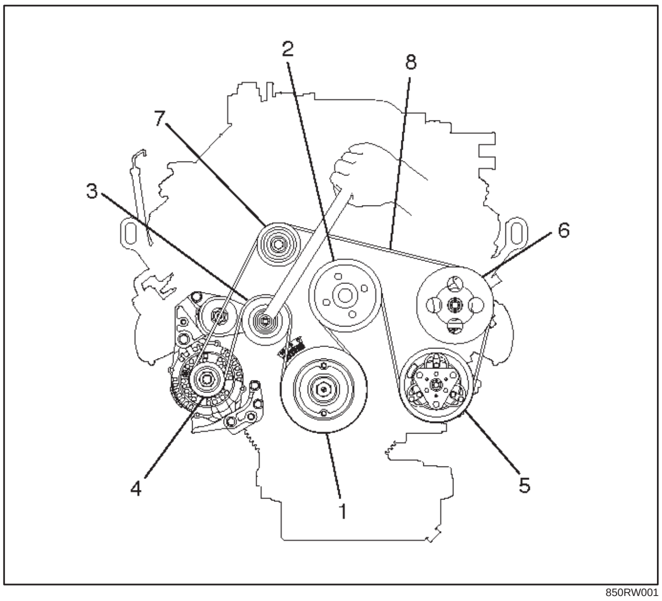
10. Install power steering pump, tighten fixing bolt to the specified torque.

Torque :

M8 bolts : 22N·m (16 lb ft)

M10 bolts : 46 N·m (34 lb ft)

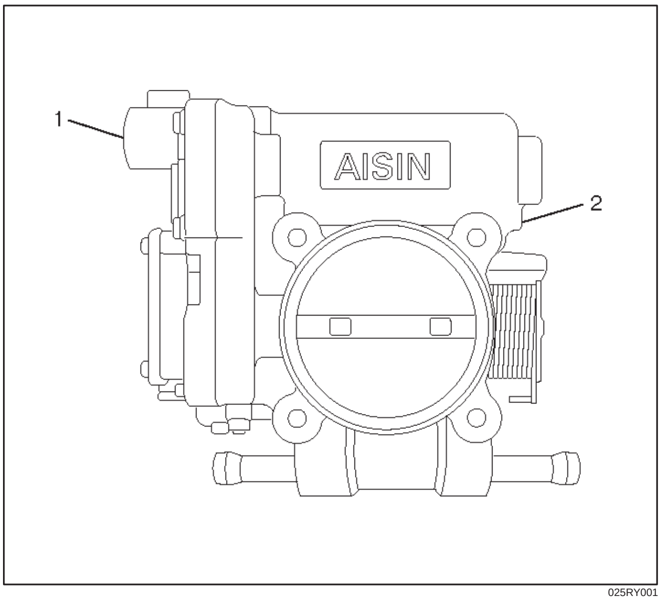
11. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.



Legend

- (1) Crankshaft Pulley
- (2) Cooling Fan Pulley
- (3) Tensioner
- (4) Generator
- (5) Air Conditioner Compressor
- (6) Power Steering Oil Pump
- (7) Idle Pulley
- (8) Drive Belt

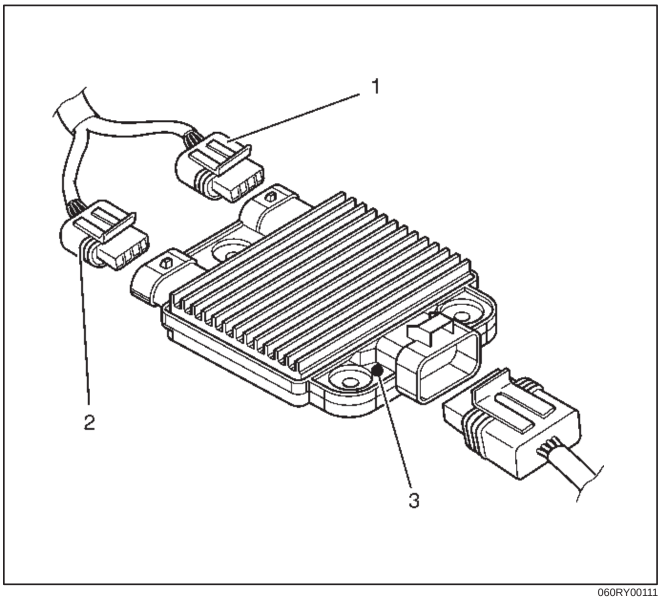
12. Install upper fan shroud.
13. Reconnect radiator upper and lower hoses.
14. Reconnect coolant reserve tank hose to radiator.
15. Reconnect generator harness connector.
16. Reconnect starter harness connector.
17. Reconnect bonding cable terminal on left bank
18. Reconnect bonding cable terminal on the back of right dash panel.
19. Reconnect ground cable between engine and chassis.
20. Reconnect harness connector to transmission and install transmission harness bracket on engine left side.
21. Reconnect three engine harness connectors.
22. Reconnect vacuum booster hose.
23. Reconnect canister vacuum hose.
24. Install air cleaner assembly.
25. Reconnect air duct.
26. Reconnect throttle position sensor harness connector.



Legend

- (1) Throttle Position Sensor Connector
- (2) Throttle Valve Assembly

27. Reconnect manifold absolute pressure sensor harness connectors.
28. Reconnect ion sensing module connectors as shown in the illustration.



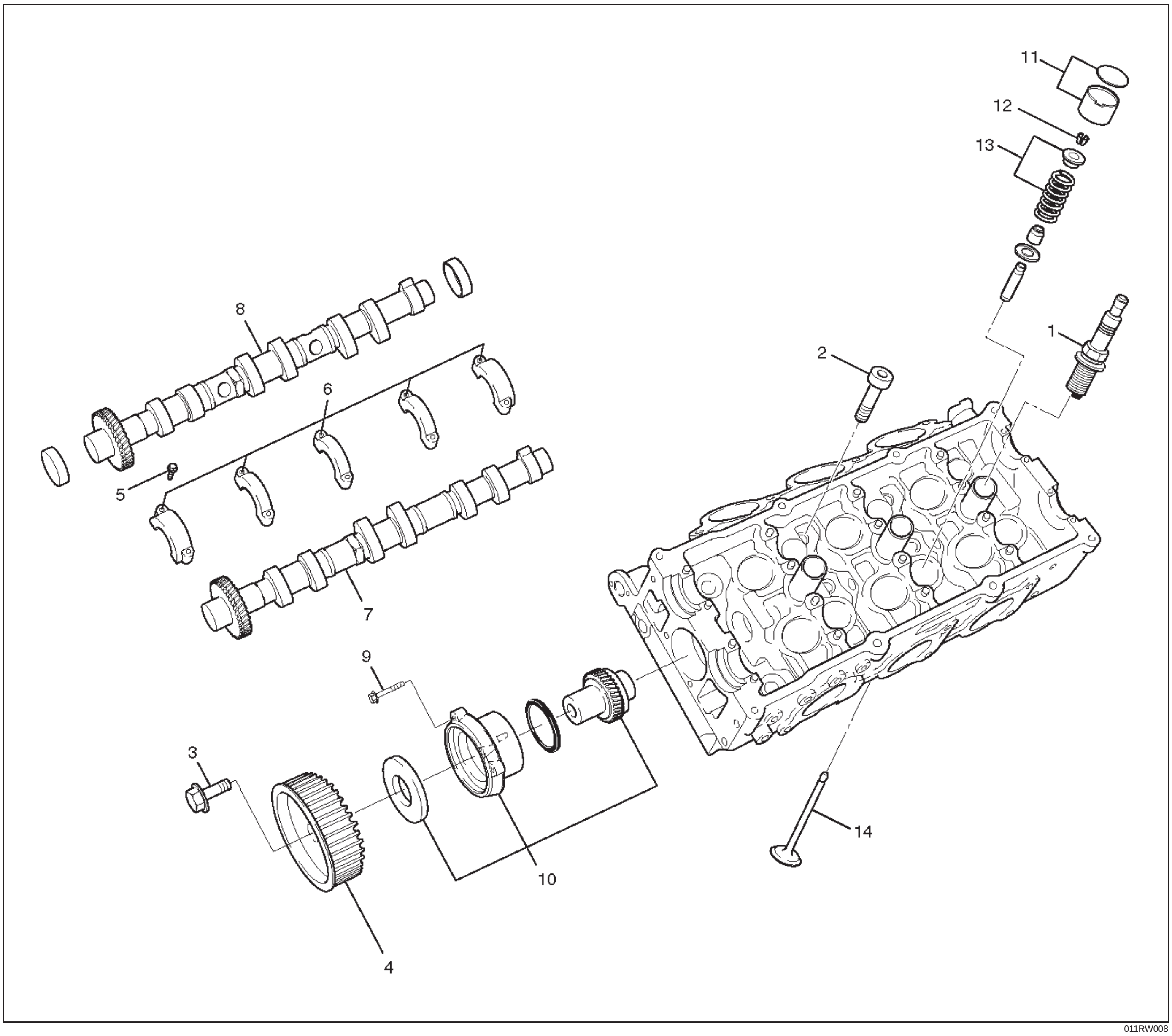
Legend

- (1) Green Connector
- (2) Blue Connector
- (3) Identification Mark (6VE1 Engine Only)

29. Install engine hood to the original position.
    - Refer to installation procedure for Body section in this manual.

Cylinder Head

Cylinder Head and Associated Parts



Legend

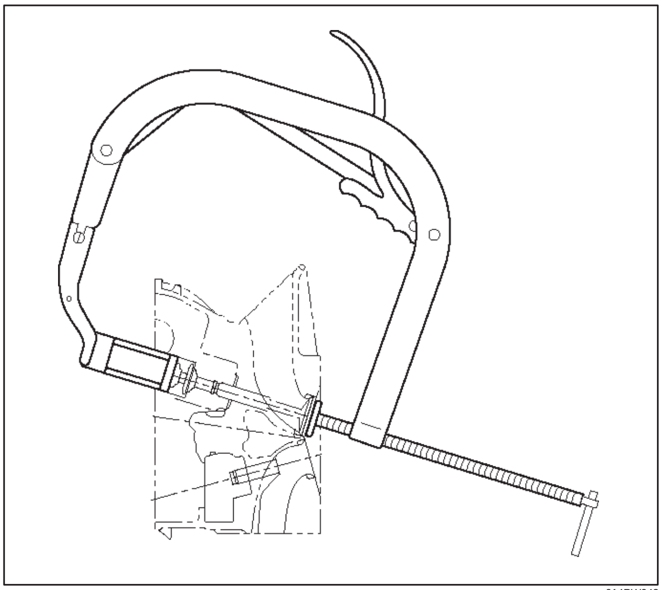
(1) Spark Plug
(2) Cylinder Head Bolt
(3) Camshaft Drive Gear Pulley Fixing Bolt
(4) Camshaft Drive Gear Pulley
(5) Camshaft Bearing Cap Fixing Bolt
(6) Camshaft Bearing Cap
(7) Camshaft Exhaust
(8) Camshaft Intake
(9) Retainer Fixing Bolt
(10) Retainer Assembly
(11) Tappet with Shim
(12) Split Collar
(13) Valve Spring and Spring Upper Seat
(14) Valve

Disassembly

NOTE:

- During disassembly, be sure that the valve train components are kept together and identified so that they can be reinstalled in their original locations.
- Before removing the cylinder head from the engine and before disassembling the valve mechanism, perform a compression test and note the results.

1. Remove camshaft drive gear pulley fixing bolt (3), then pulley (4).
2. Remove camshaft bearing cap fixing bolt (5), camshaft bearing cap (6), then camshaft exhaust (7), and intake side (8).
3. Remove tappet with shim (11).
4. Use the J–8062 valve spring compressor and J–42898 valve spring compressor adapter to remove the split collar (12), valve spring with upper seat (13) and valve (14).



014RW042

5. Remove spark plug (1).

CAUTION: Do not remove the spark plugs when the head and plugs are hot. Clean dirt and debris from spark plug recess areas before removal.

Clean

Cylinder head

Carefully remove all varnish, soot and carbon from the bare metal. Do not use a motorized wire brush on any gasket sealing surface.

Inspection and Repair

1. Cylinder head gasket and mating surfaces for leaks, corrosion and blow–by. If the gasket has failed, determine the cause.
   – Insufficient torque on head bolts.
   – Improper installation
   – Loose or warped cylinder head
   – Missing dowel pins
   – Warped case surface
2. Cylinder head for cracks, especially between valve seats and in the exhaust ports.
3. Cylinder head deck for corrosion, sand particles in head and porosity.

CAUTION:

- **Do not attempt to weld the cylinder head. Replace it.**
- **Do not reuse cylinder head bolts.**

4. Cylinder head deck, common chamber and exhaust manifold mating surfaces for flatness. These surfaces may be reconditioned by milling. If the surfaces are "out of flat" by more than specification, the surface should be ground to within specifications. Replace the head if it requires machining beyond the repairable limit.

Head surface and manifold surface

Standard: 0.05 mm (0.002 in) or less

Warpage limit: 0.2 mm (0.0079 in)

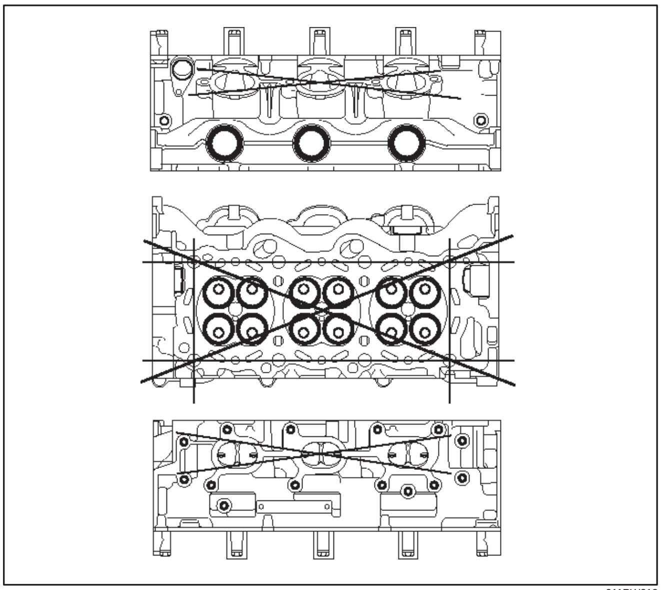
Maximum Repairable limit: 0.2 mm (0.0079 in)

Head height

Standard height : 133.2 mm (5.2441 in)

Warpage limit : 0.2 mm (0.0079 in)

Maximum Repairable limit : 133.0 mm (5.2362 in)



011RW019

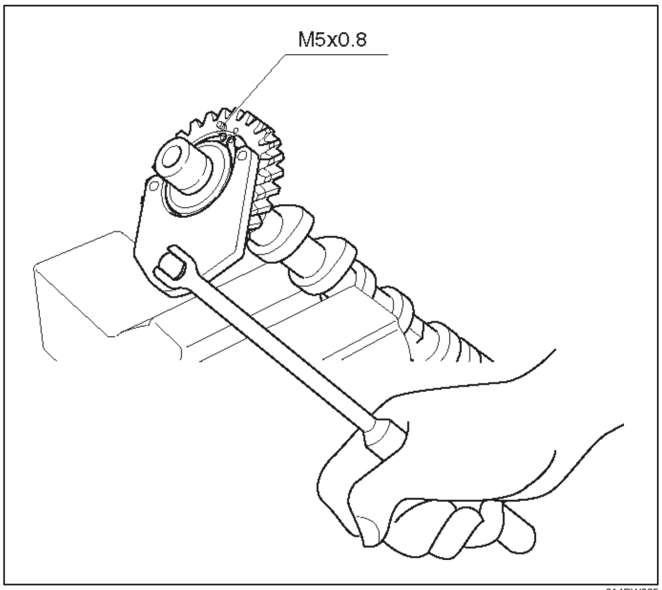
5. Water jacket sealing plugs seating surfaces.

Reassembly

1. Install Spark plug and tighten all the spark plugs to specified torque.

Torque: 18 N·m (13 lb ft)

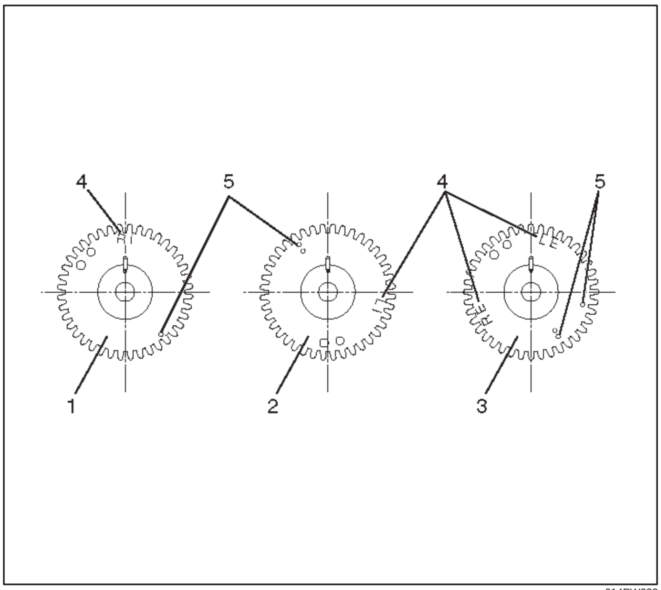
2. Tighten sub gear setting bolt.
   1. Use J–(42686 gear spring lever) to turn sub gear to right direction until the M5 bolt aligns with the hole between camshaft driven gear and sub gear.
   2. Tighten the M5 bolt to a suitable torque to prevent the sub gear from moving .



3. Install camshaft drive gear assembly and tighten three bolts to the specified torque.

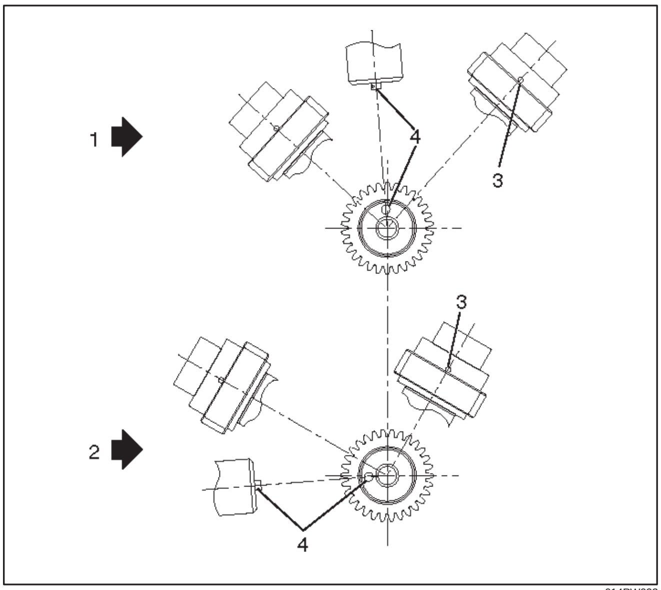
Torque: 10 N·m (7.4 lb ft)

4. Install camshaft assembly and camshaft bearing cap, tighten twenty bolts on one side bank to the specified torque.
   1. Apply engine oil to camshaft journal and bearing surface of camshaft bearing cap.
   2. Align timing mark on intake camshaft (one dot for right bank, two dots for left bank) and exhaust camshaft (one dot for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



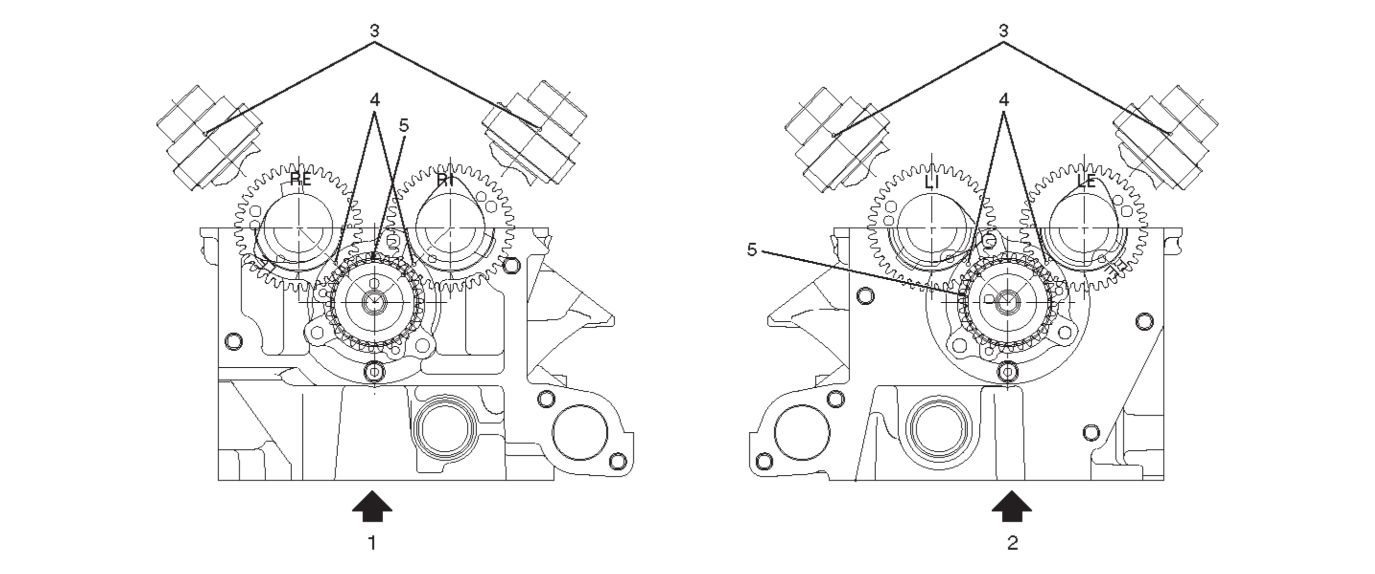
Legend

- (1) Intake Camshaft Timing Gear for Right Bank
- (2) Intake Camshaft Timing Gear for Left Bank
- (3) Exhaust Camshaft Timing Gear
- (4) Discrimination Mark
- LI: Left Bank Intake
- RI: Right Bank Intake
- LE: Left Bank Exhaust
- RE: Right Bank Exhaust



Legend

- (1) Right Bank Camshaft Drive Gear
- (2) Left Bank Camshaft Drive Gear
- (3) Timing Mark on Drive Gear
- (4) Dowel Pin

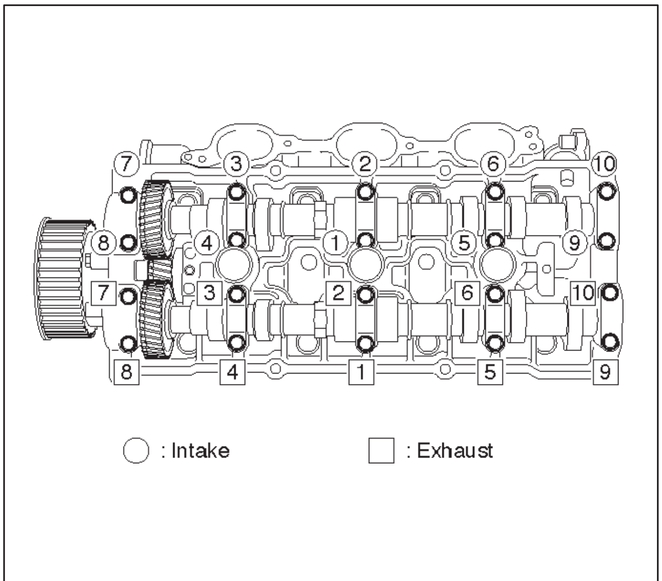


014RW024

Legend
(1) Right Bank
(2) Left Bank
(3) Alignment Mark on Camshaft Drive Gear
(4) Alignment Mark on Camshaft
(5) Alignment Mark on Retainer

3. Tighten twenty bolts in numerical order on one side bank as shown in the illustration.

Torque: 10 N·m (89 lb in)



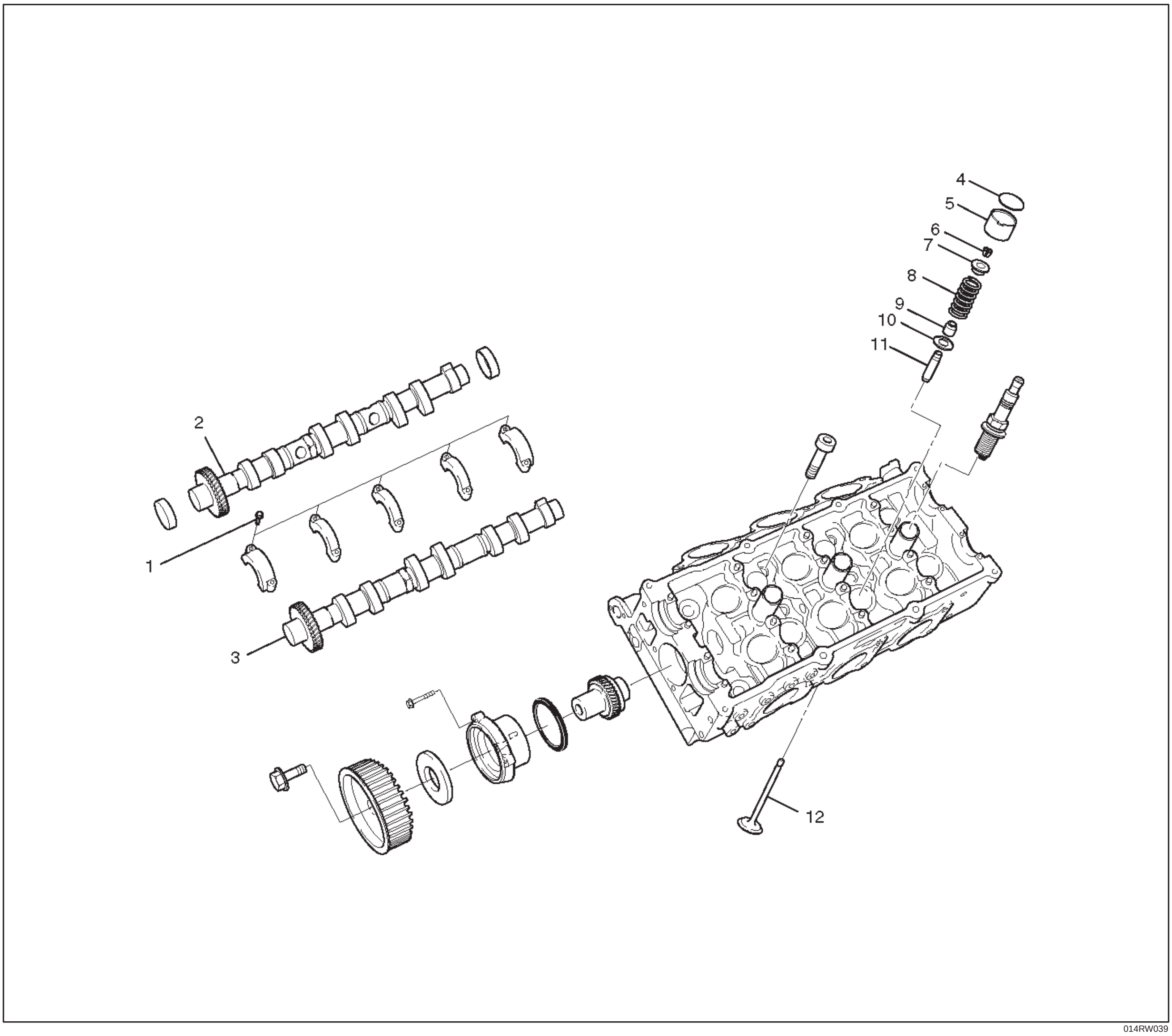
014RW031

5. Tighten bolt for camshaft drive gear assembly pulley to the specified torque.

Torque: 98 N·m (72 lb ft)

Valve Spring, Oil Controller, Valve, Valve Guide

Valve Spring, Oil Controller, Valve, Valve Guide and Associated Parts



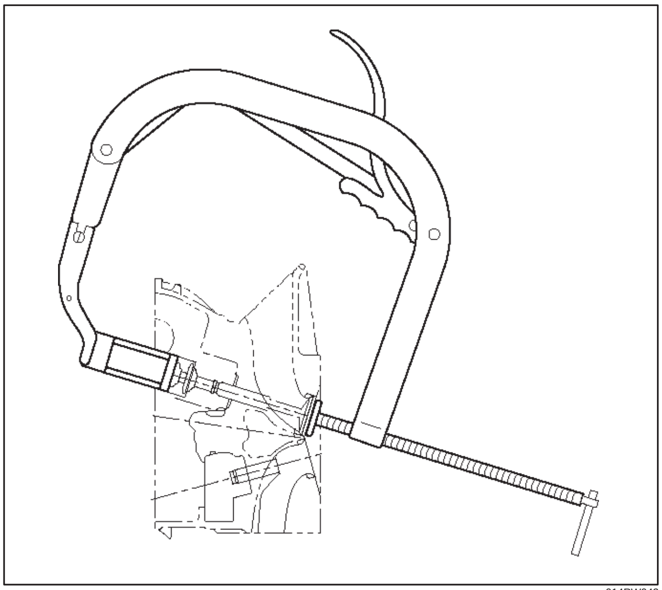
Legend

(1) Camshaft Bearing Cap Fixing Bolts
(2) Camshaft Assembly Inlet
(3) Camshaft Assembly Exhaust
(4) Shim
(5) Tappet
(6) Split Collar
(7) Spring Upper Seat
(8) Valve Spring
(9) Oil Controller
(10) Spring Lower Seat
(11) Valve Guide
(12) Valve

Disassembly

1. Remove camshaft bearing cap fixing bolts (1).
2. Remove camshaft assembly (intake).
3. Remove camshaft assembly (Exhaust side).
4. Remove shim (4) and tappet (5).

5. Use J–8062 valve spring compressor and J–42898 valve spring compressor adapter to remove split collar.



014RW042

6. Remove valve spring.
7. Remove valve.
8. Remove oil controller and spring lower seat.
9. Remove the valve guide using the J–42899 valve guide replacer.

Inspection and Repair

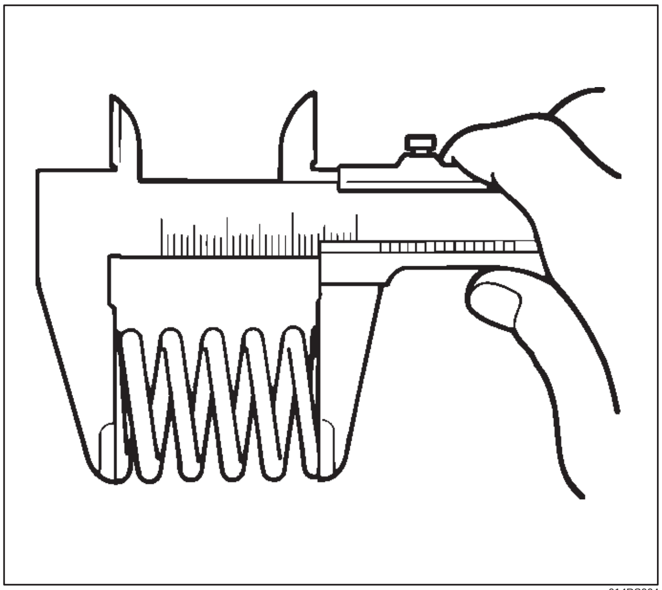
Valve Spring

CAUTION: Visually inspect the valve springs and replace them if damage or abnormal wear is evident.

1. Measure the free height of the springs. The springs must be replaced if the free height is below the specified limit.

Standard : 44.6 mm (1.7559 in)

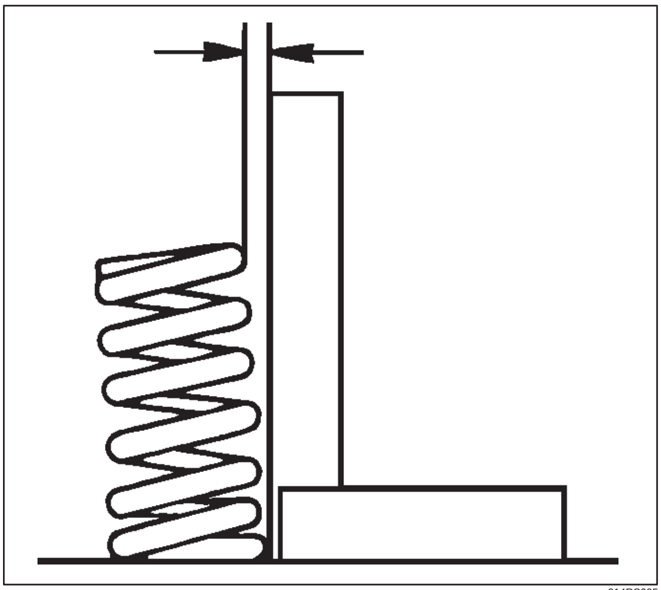
Limit : 43.6 mm (1.7165 in)



014RS004

2. Measure the valve spring squareness with a steel square and replace the valve springs if the measured value exceeds the specified limit.

Limit : 2 mm (0.0787 in)



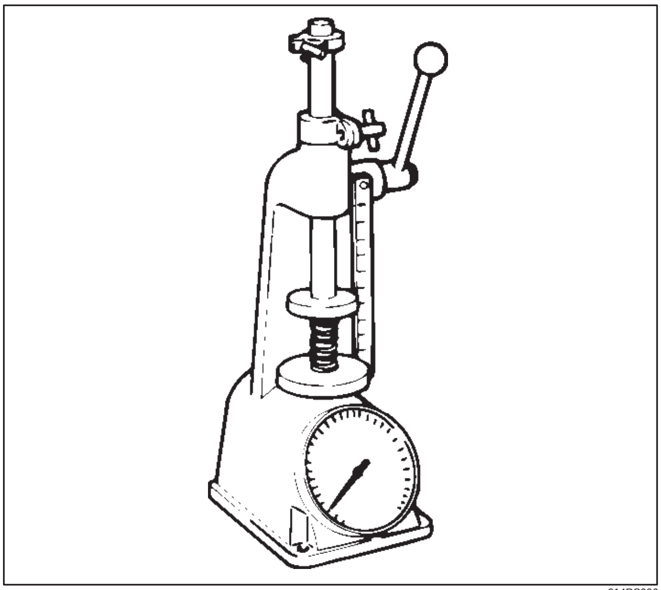
014RS005

3. Using a spring tester to compress the springs to the installed height, measure the compressed spring tension, and replace the springs if the measured tension is below the specified limit.

At installed height: 35.0 mm (1.38 in)

Standard: 196 N (44 lb)

Limit: Less than 181 N (41 lb)



014RS006

Valve Guide

CAUTION: Take care not to damage the valve seat contact surface, when removing carbon adhering to the valve head. Carefully inspect the valve stem for scratchs or abnormal wear. If these conditions are present, the valve and the valve guide must be replaced as a set.

1. Measure the valve stem diameter with a micrometer. If the valve stem diameter is less than the specified limit, the valve and the valve guide must be replaced as a set.

Diameter of Valve Stem

Intake

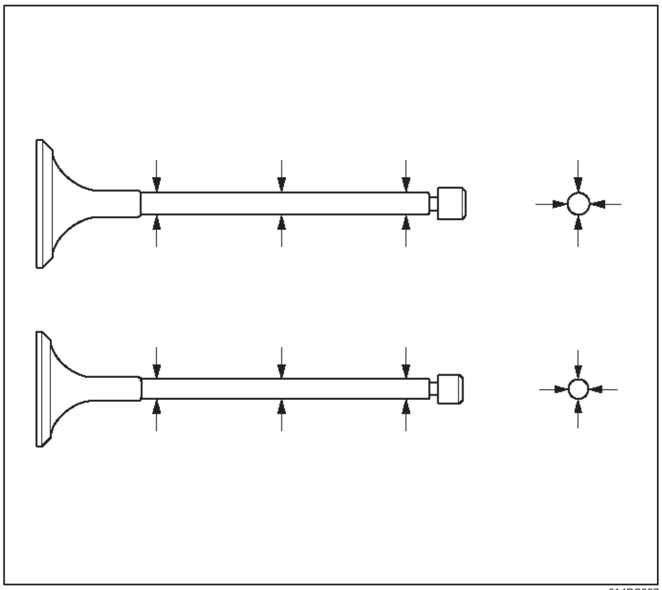
Standard : 5.977 mm–5.959 mm (0.2353 in–0.2346 in)

Limit : 5.90 mm (0.2323 in)

Exhaust

Standard : 5.952 mm–5.970 mm (0.2343 in–0.2350 in)

Limit : 5.90 mm (0.2323 in)



014RS007

2. Measure the inside diameter of the valve guide with a micrometer. Subtract the measured outer diameter of the valve stem from the measured inner diameter of the valve guide. If the value exceeds the specified limit, the valve and the valve guide must be replaced as a set.

Inside Diameter of the Vale Guide

Inlet clearance

Standard : 0.023 mm–0.056 mm (0.0009 in–0.0002 in)

Limit : 0.20 mm (0.00787 in)

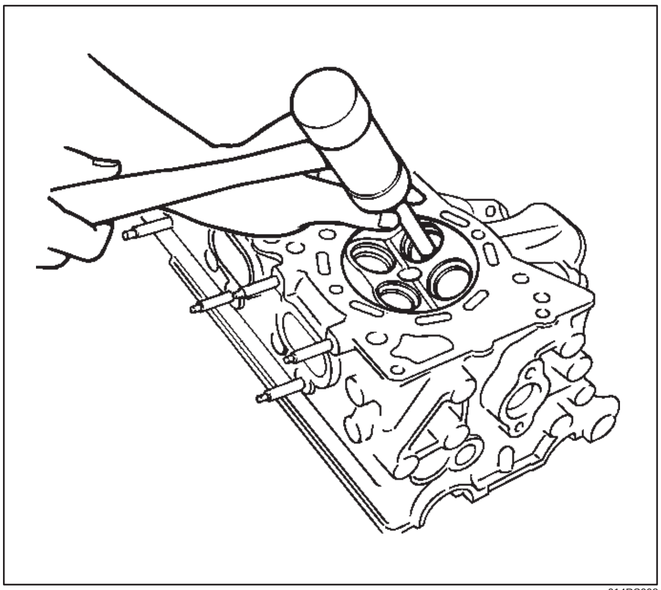
Exhaust clearance

Standard : 0.030 mm–0.063 mm (0.0012 in–0.0025 in)

Limit : 0.20 mm (0.00787 in)

Valve Guide Replacement

1. Using Valve guide replacer: J–42899, drive out the valve guide from the combustion chamber side.

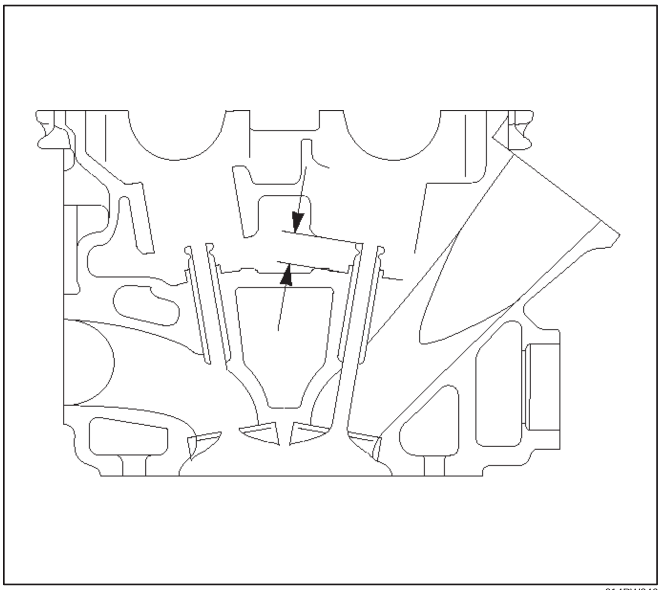


014RS008

2. Apply engine oil to the outside of the valve guide. Using valve guide replacer J–42899, drive in a new valve guide from the camshaft side, and check the valve guide height.

Valve guide upper end height: 13.0 mm (0.5118 in)

(Measured from the cylinder head upper face)



014RW046

3. Check the clearance. If the clearance is less than the specified value, ream the inside diameter of valve guide. Using a sharp 6 mm reamer, ream the valve guide to obtain the specified clearance.

Valve Seat

1. Measure the protrusion of the valve stem when a new valve is installed in the cylinder head. If the protrusion of the valve stem exceeds the limit, replace the valve seat insert or the cylinder head assembly.

Protrusion of valve stem

Intake

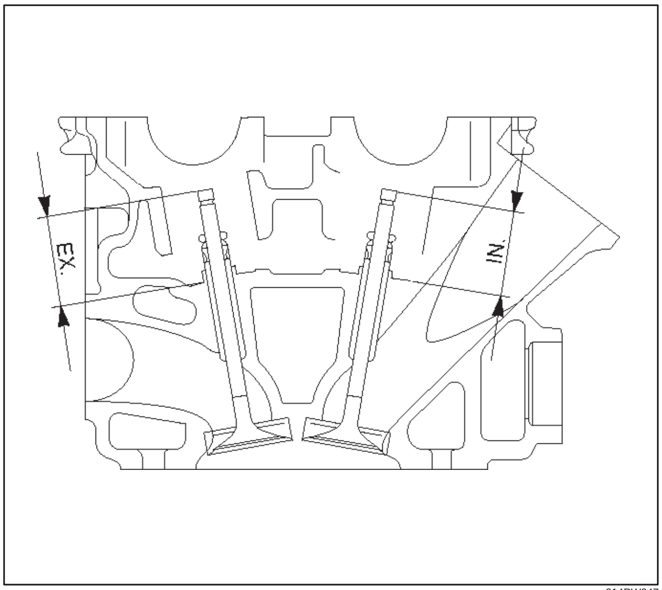
Standard: 39.32 mm (1.5480 in)

Limit: 39.47 mm (1.5539 in)

Exhaust

Standard: 39.30 mm (1.5472 in)

Limit: 39.45 mm (1.5531 in)



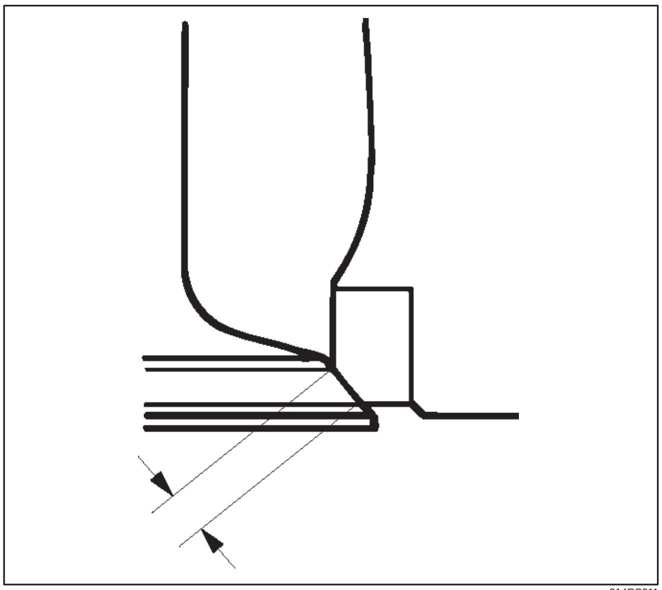
014RW047

2. Measure the valve seat contact width. Make the necessary corrections if the seat contact surface is damaged or rough or if the contact width wear exceeds the limit.

Valve seat contact width

Standard: 1.1 mm (0.0433 in)

Limit: 1.7 mm (0.0669 in)

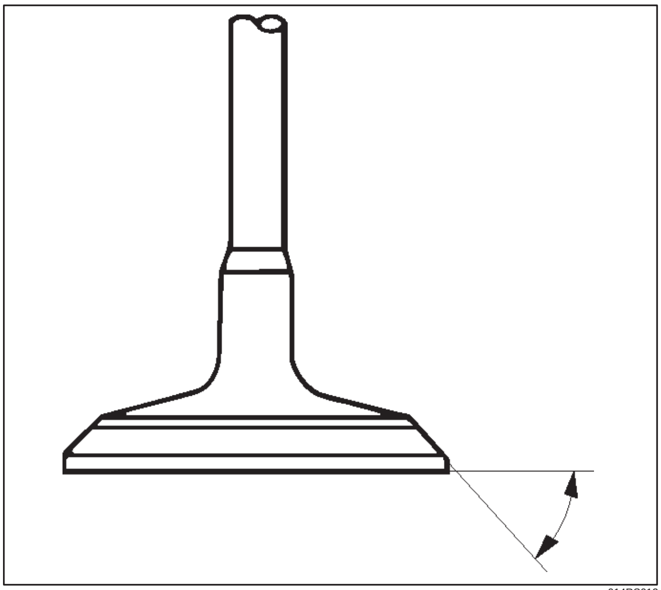


014RS011

Contact Surface Angle on Valve Seat on Valve

1. Measure contact surface angle on valve seat.
2. If the measured value exceeds the limit, replace valve, valve guide and valve seat as a set.

Valve contact surface angle: 45°

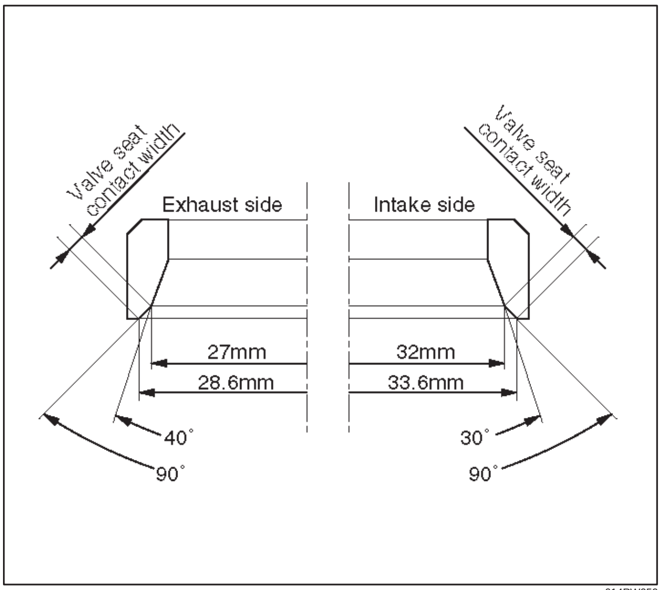


014RS012

Valve Seat Insert Correction

1. Remove the carbon from the valve seat insert surface.
2. Use a valve cutter to minimize scratches and other rough areas. This will bring the contact width back to the standard value. Remove only the scratches and rough areas. Do not cut away too much. Take care not to cut away unblemished areas of the valve seat surface.

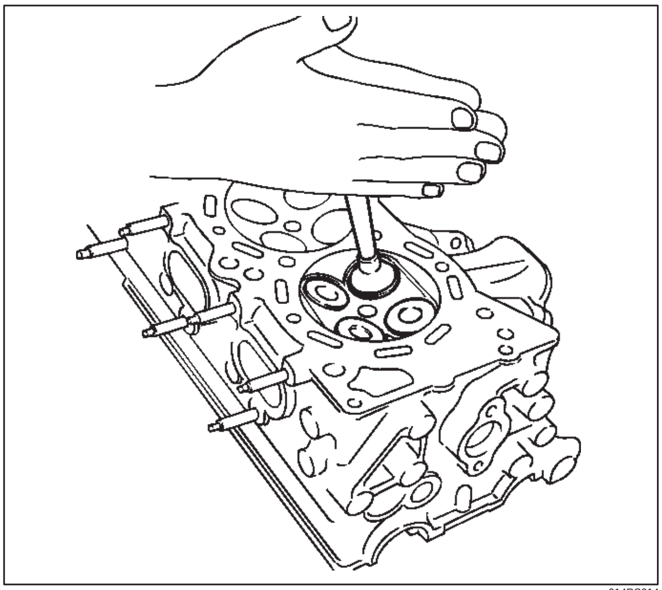
Valve seat angle degree: 90°



014RW059

3. Apply abrasive compound to the valve seat insert surface.
4. Insert the valve into the valve guide.
5. Turn the valve while lapping it to fit the valve seat insert.
6. Check that the valve contact width is correct.

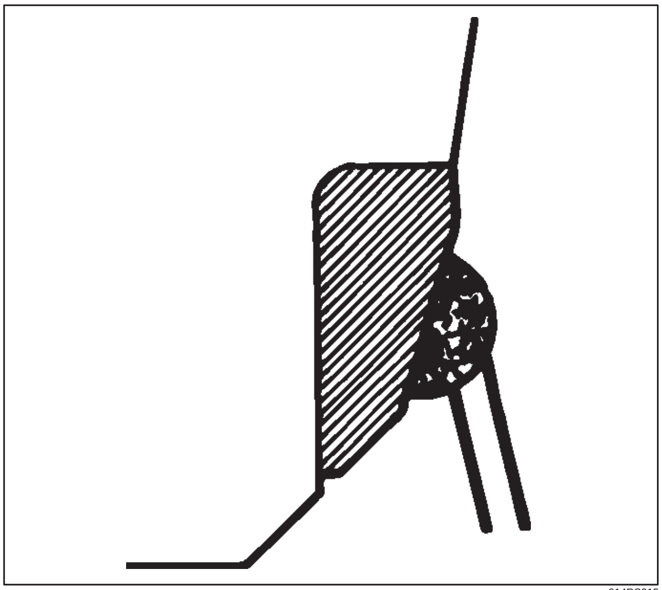
7. Check that the valve seat insert surface is in contact with the entire circumference of the valve.



014RS014

Valve Seat Insert Replacement

1. Arc weld the rod at several points. Be careful not to damage the aluminum section.
2. Allow the rod to cool for a few minutes. This will cause the valve seat to shrink.
3. Strike the rod and pull it out.



014RS015

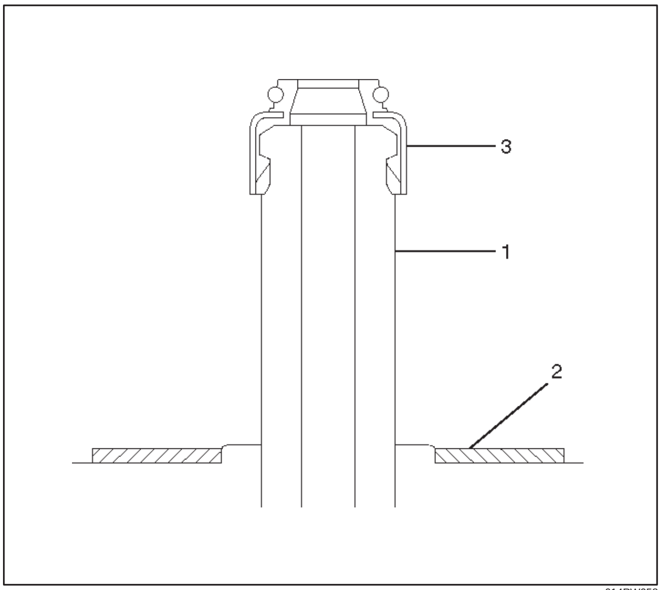
4. Carefully clean the valve seat press–fit section on the cylinder head side.
5. Heat the press–fit section with steam or some other means to cause expansion. Cool the valve seat with dry ice or some other means.
6. Insert the press–fit section into the valve seat horizontally.

Standard fitting interference: 0.14 mm–0.09 mm (0.0055 in–0.0035 in)

7. After insertion, use a seat grinder to grind finish the seating face. Carefully note the seating angle, the contact width, and the depression.
8. Lap the valve and the seat.

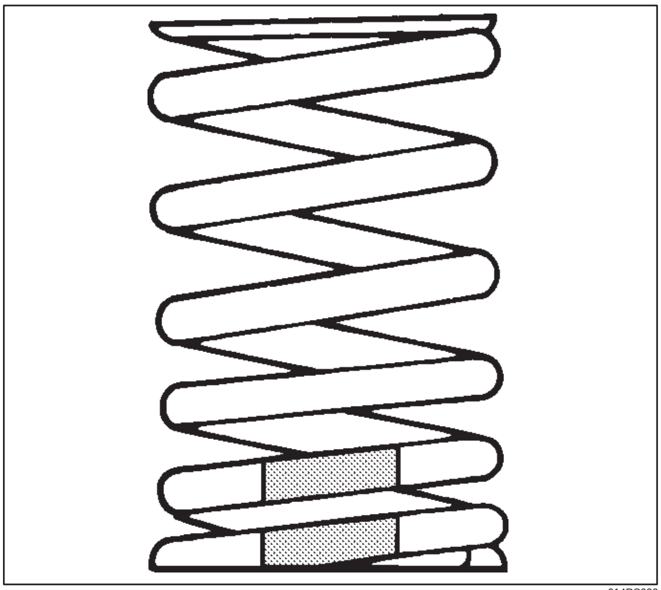
Reassembly

1. Install valve guide (1) to cylinder head. Apply engine oil to the outside of the valve guide. Using valve guide replacer J–42899, drive in a new valve guide from the camshaft side.
2. Install oil controller (3) and spring lower seat (2). Using oil controller replacer J–37281, drive in a new oil controller.



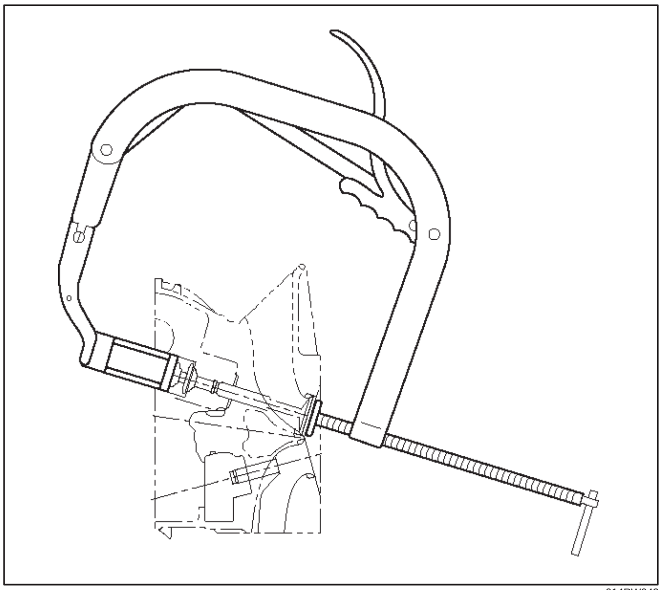
014RW058

3. Install valve to valve guide. Before install valve guide apply engine oil to the outside of the valve stem.
4. Install valve spring to cylinder head. Attach the valve spring to the lower spring seat. The painted area of the valve spring should be facing downward.



014RS020

5. Install lower valve spring seat, valve spring and upper valve spring seat then put split collars on the upper spring seat, using the J–8062 valve spring compressor and J–42898 valve spring compressor adapter to install the split collars.

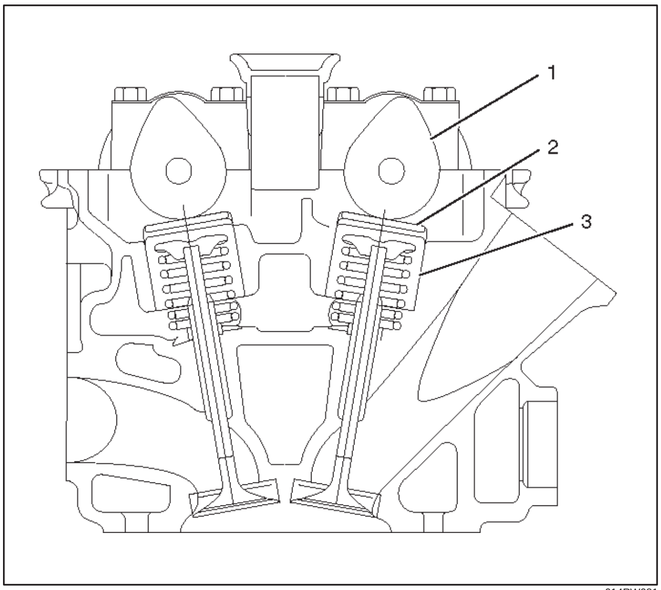


014RW042

6. Install tappet with shim.
7. Install camshaft assembly.
   - Refer to installation procedure for Camshaft in this manual.

Valve Clearance Adjustments

NOTE: To adjust valve clearance, apply engine oil to the cam as well as to the adjusting shim (2) with the cylinder head built on the cylinder block, give a few turns to the camshaft by means of timing pulley tightening bolt, and measure valve clearance when the nose of cam is just opposite to maximum cam lift (1) as shown in illistration below.



014RW081

Legend

(1) Cam
(2) Shim
(3) Tappet

Valve Clearance Standard Value (cold)

Intake: 0.23 mm–0.33 mm (0.0091 in–0.0130 in)

Exhaust: 0.25 mm–0.35 mm (0.0098 in–0.0138 in)

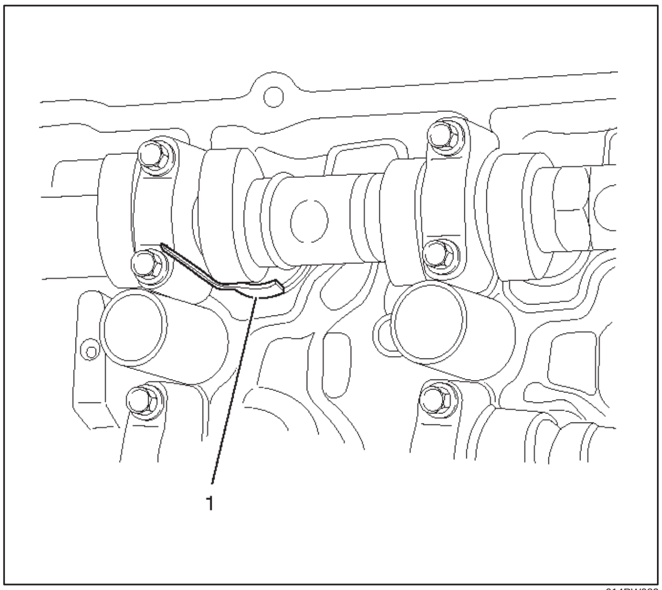
Selection of Adjusting Shim

Shim to be selected = (Thickness of removed shim) + (Valve clearance measurement – Standard valve)

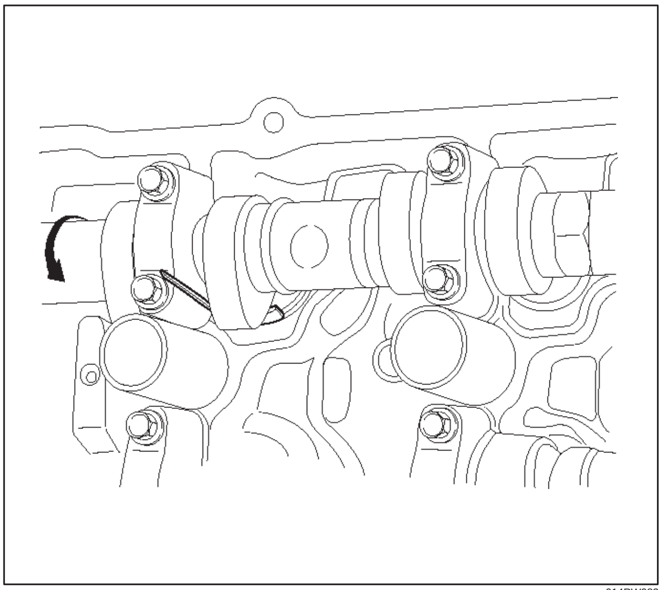
Based on the above formula, the best suited shim should be selected from 41 sorts of shim (differently thick at 0.02mm (0.0008 in) intervals from 2.40mm (0.0945 in) through 3.2mm (0.1260 in) thick). Install the shim and check valve clearance.

Replacement of Shim

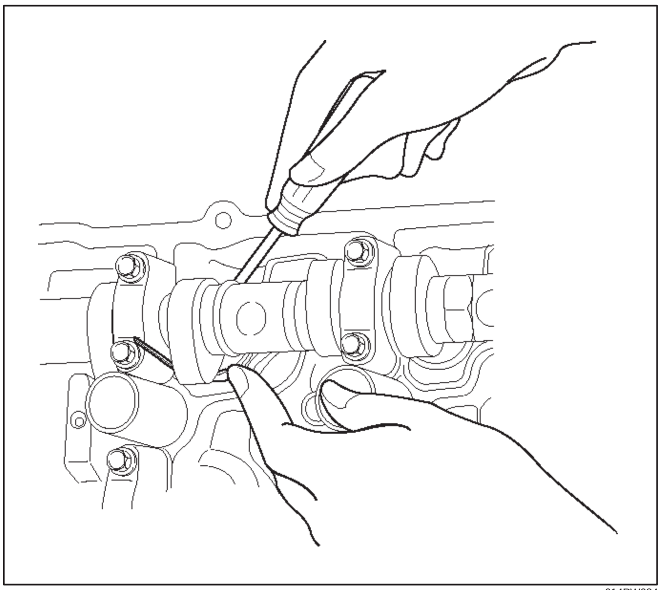
Let the cam push down the edge of tappet by using J–42689 valve clearance adjusting tool and push out the shim with a flat blade screw driver as shown in illustrations below.



014RW082



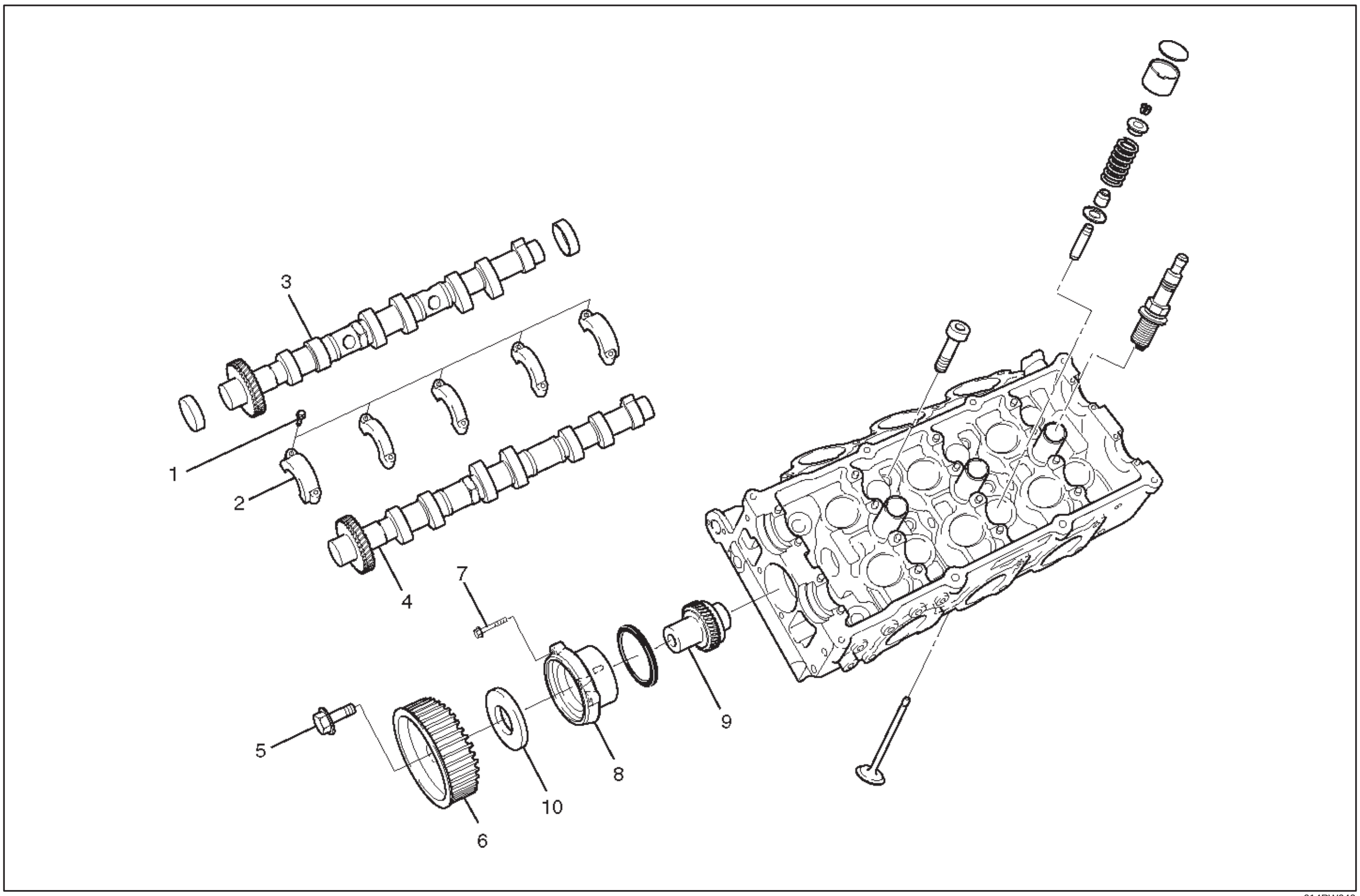
014RW083



014RW084

Camshaft

Camshaft and Associated Parts

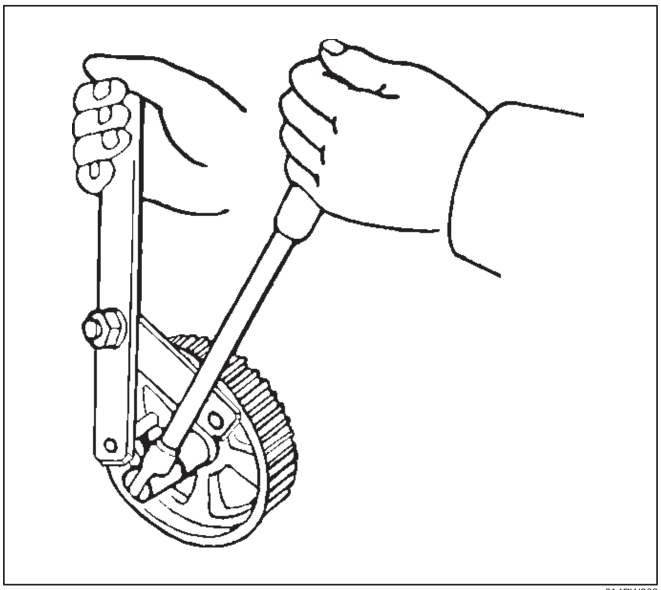


014RW040

Legend
- (1) Camshaft Bearing Cap Fixing Bolt
- (2) Camshaft Bearing Cap
- (3) Camshaft Assembly Intake
- (4) Camshaft Assembly Exhaust
- (5) Pulley Fixing Bolt
- (6) Camshaft Drive Gear Pulley
- (7) Retainer Fixing Bolt
- (8) Retainer
- (9) Camshaft Drive Gear
- (10) Oil Seal

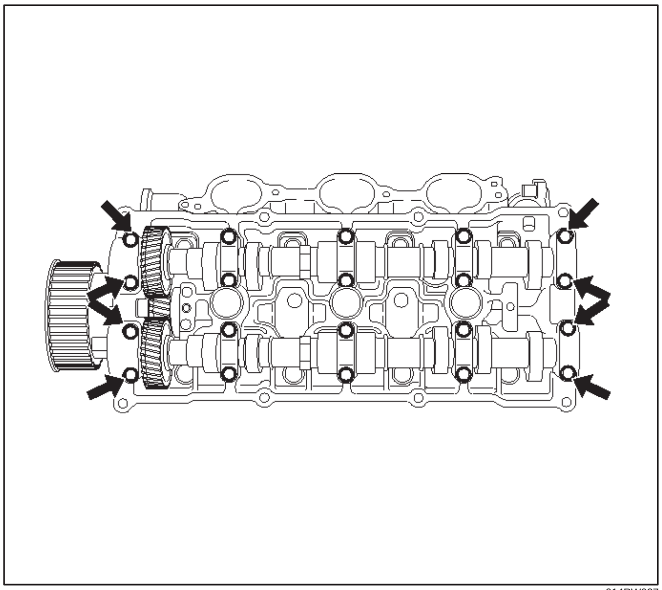
Disassembly

1. Remove fixing bolt (5) for camshaft drive gear pulley using the J–43041 universal holder.



014RW060

2. Remove twenty fixing bolts from inlet and exhaust camshaft bearing cap on one side bank, then camshaft bearing cap (2).



014RW027

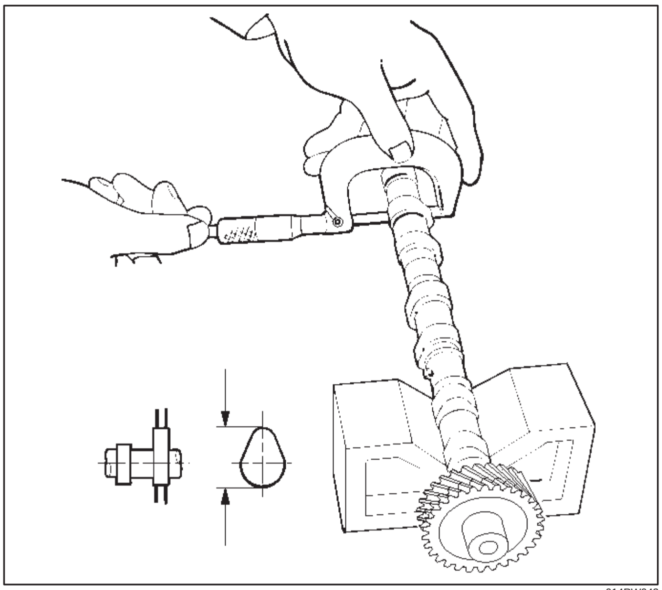
3. Remove camshaft assembly (3), (4).
4. Remove three fixing bolts (7) from camshaft drive gear retainer (8), then camshaft drive gear assembly.

Inspection and Repair

1. Use a micrometer to measure the cam lobe height and uneven wear. Replace the camshaft if either the lobe height or the uneven wear exceeds the specified limit.

Lobe height : 44.709 mm (1.7602 in)

Uneven wear : 0.05 mm (0.0020 in)



014RW043

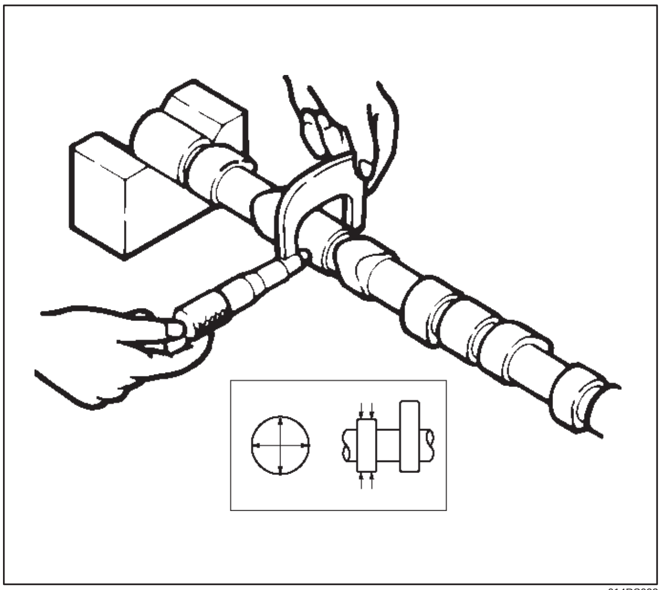
2. Use a micrometer to measure the diameter and the uneven wear of the camshaft journals.
   Replace the camshaft if the diameter or the uneven wear exceeds the specified limit.

Journal Diameter

Standard : 25.972 mm–25.993 mm (1.0225 in–1.0233 in)

Limit : 25.8 mm (1.0157 in)

Uneven wear : 0.05 mm (0.0020 in)

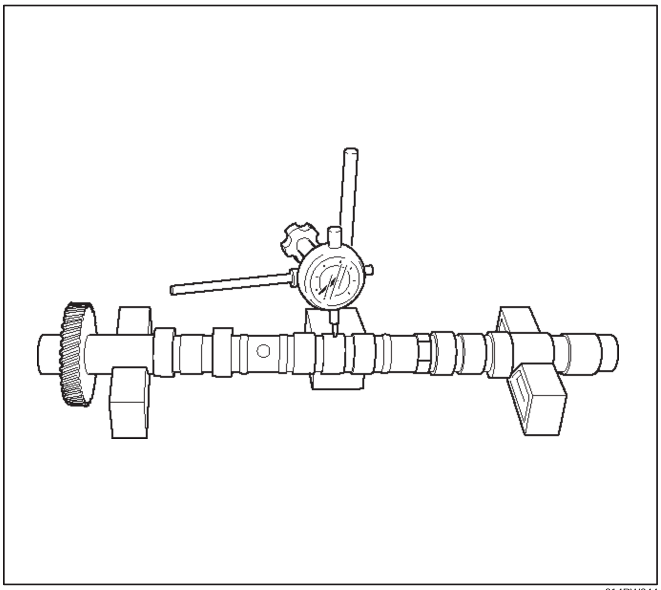


014RS023

3. Place the camshaft on V–blocks.
   Slowly rotate the camshaft and measure the runout with a dial indicator.
   Replace the camshaft if the runout exceeds the specified limit.

Runout

Limit : 0.1 mm (0.0039 in)

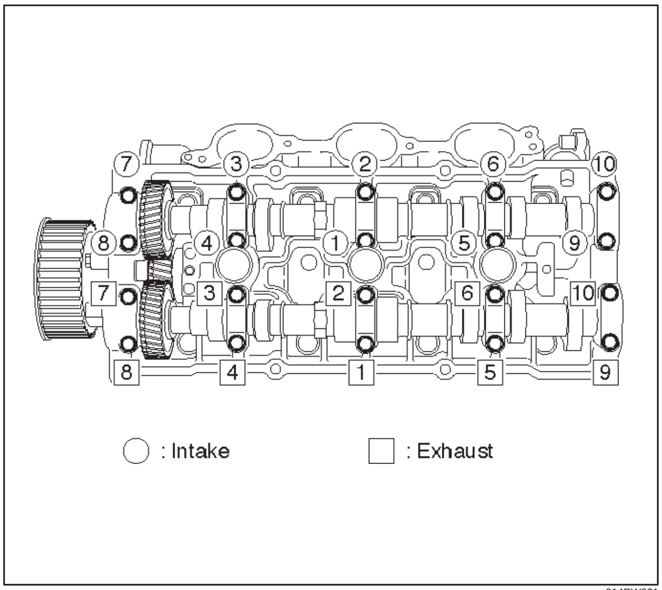


014RW044

4. Measure the camshaft journal oil clearance.
   1. Measure the camshaft bearing cap housing inside diameter.

NOTE: Tighten camshaft bearing cap (2) to specified torque before measuring the camshaft bearing cap inside diameter.

Torque : 10 N·m (89 lb in)



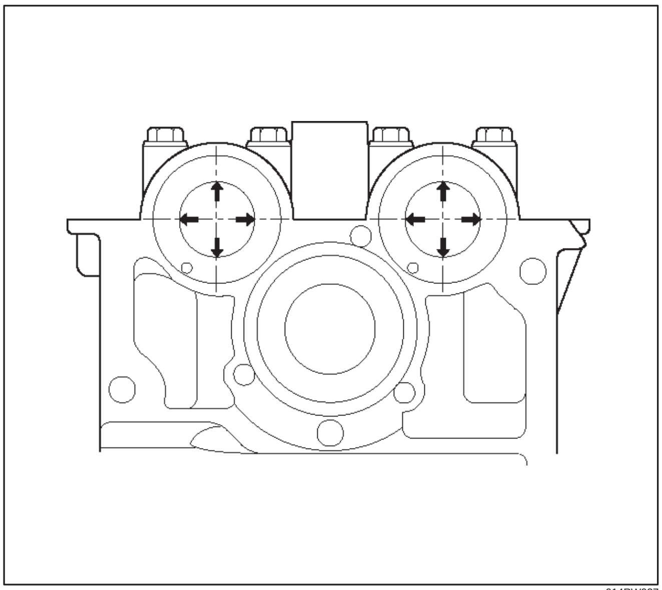
014RW031

2. Subtract the camshaft outside diameter from the camshaft bearing cap housing inside diameter.

Oil Clearance

Standard : 0.027 mm–0.078 mm (0.0011 in–0.0031 in)

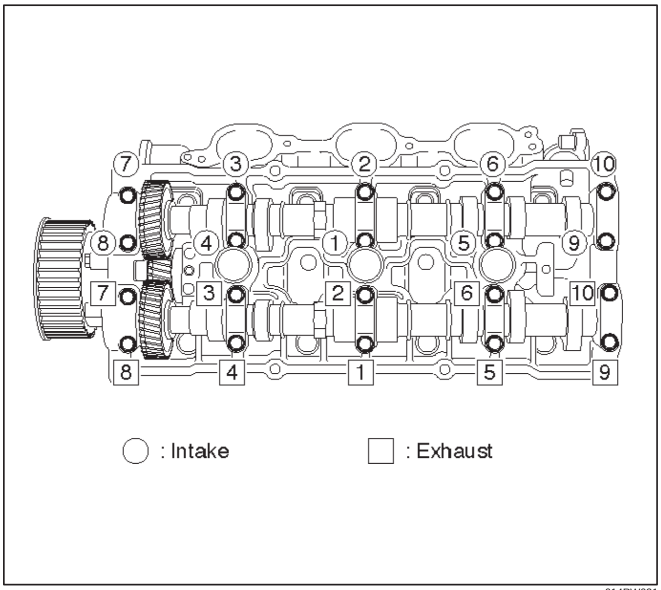
Limit : 0.11 mm (0.0043 in)



014RW037

5. Replace the cylinder head and/or camshaft if the measured oil clearance exceeds the specified limit.
   1. Carefully clean the camshaft journal, the camshaft bracket, and the cylinder head.
   2. Install camshaft assembly and camshaft bearing cap (2), tighten twenty bolts (1) on one side bank to the specified torque.

Torque: 10 N·m (89 lb in)



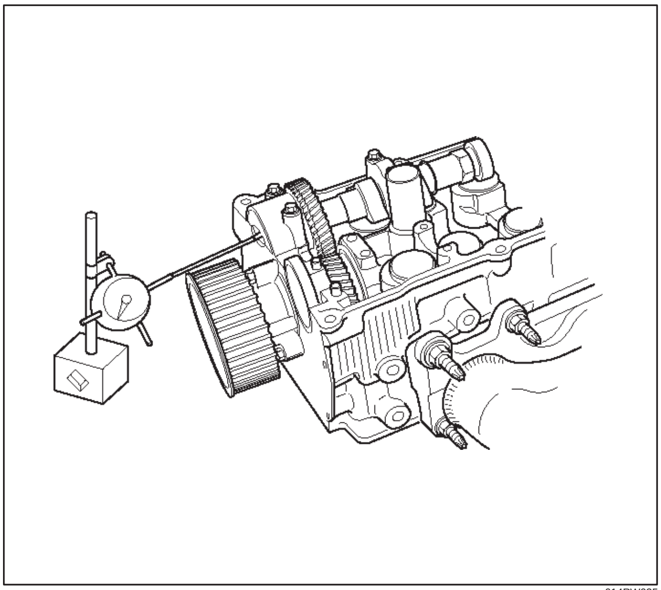
014RW031

3. Measure the camshaft thrust clearance with a dial indicator. Replace the camshaft and/or the cylinder head if the camshaft thrust clearance exceeds the specified limit.

Camshaft thrust Clearance

Standard : 0.03 mm–0.08 mm (0.0012 in.–0.0031 in.)

Limit : 0.12 mm (0.0047 mm)



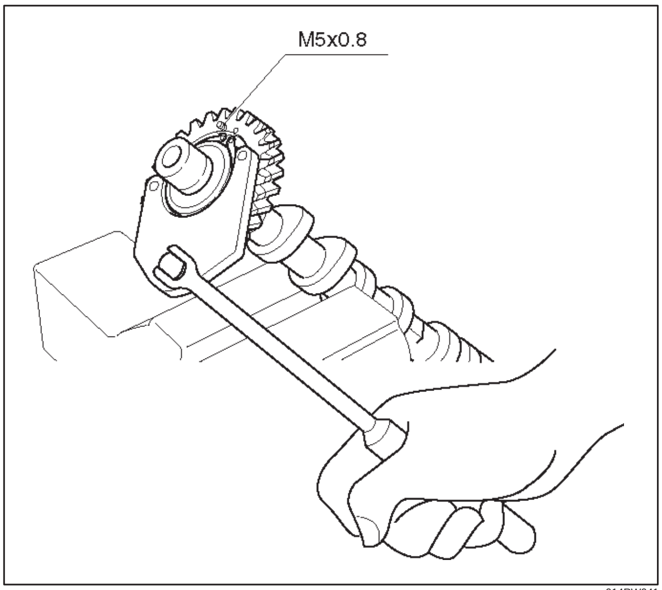
014RW035

Reassembly

1. Install camshaft drive gear assembly and tighten three bolts to specified torque.

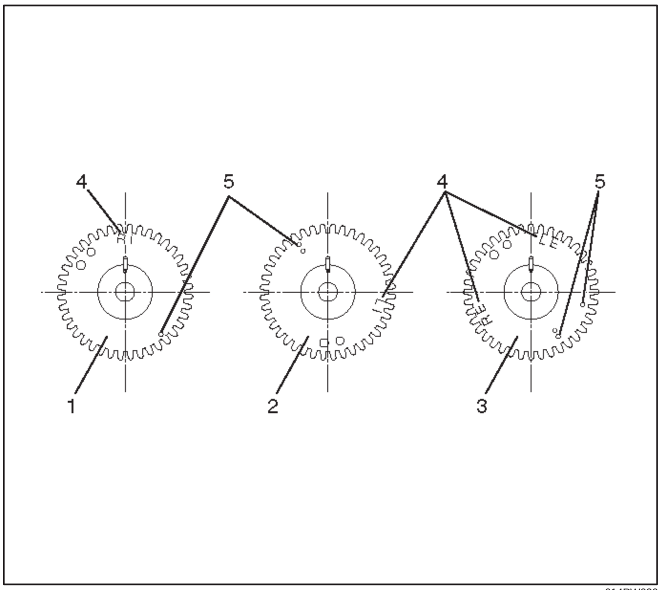
   Torque: 10 N·m (89 lb in)

2. Tighten sub gear setting bolt.
   1. Use J–42686 to turn sub gear to right direction until the M5 bolt hole aligns between camshaft driven gear and sub gear.
   2. Tighten M5 bolt suitable torque for prevent moving the sub gear.



014RW041

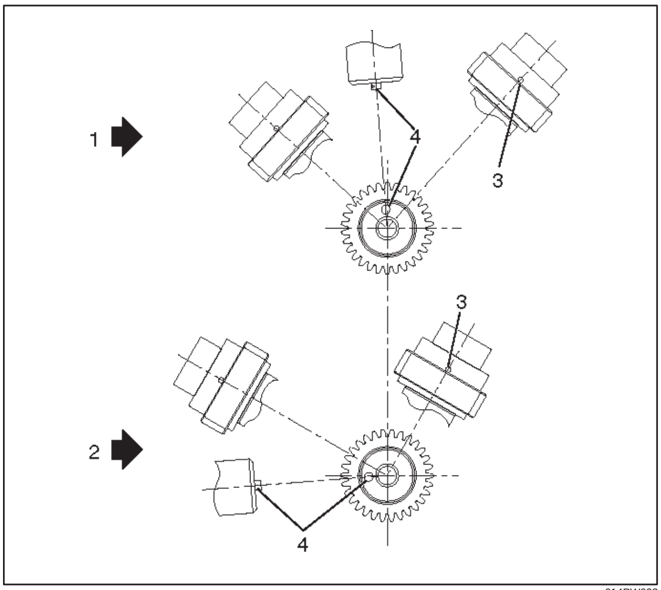
3. Install camshaft assembly and camshaft bearing caps, tighten twenty bolts on one side bank to the specified torque.
   1. Apply engine oil to camshaft journal and bearing surface of camshaft bearing cap.
   2. Align timing mark on intake camshaft (one dot for right bank, two dots for left bank) and exhaust camshaft (one dot for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



014RW020

Legend

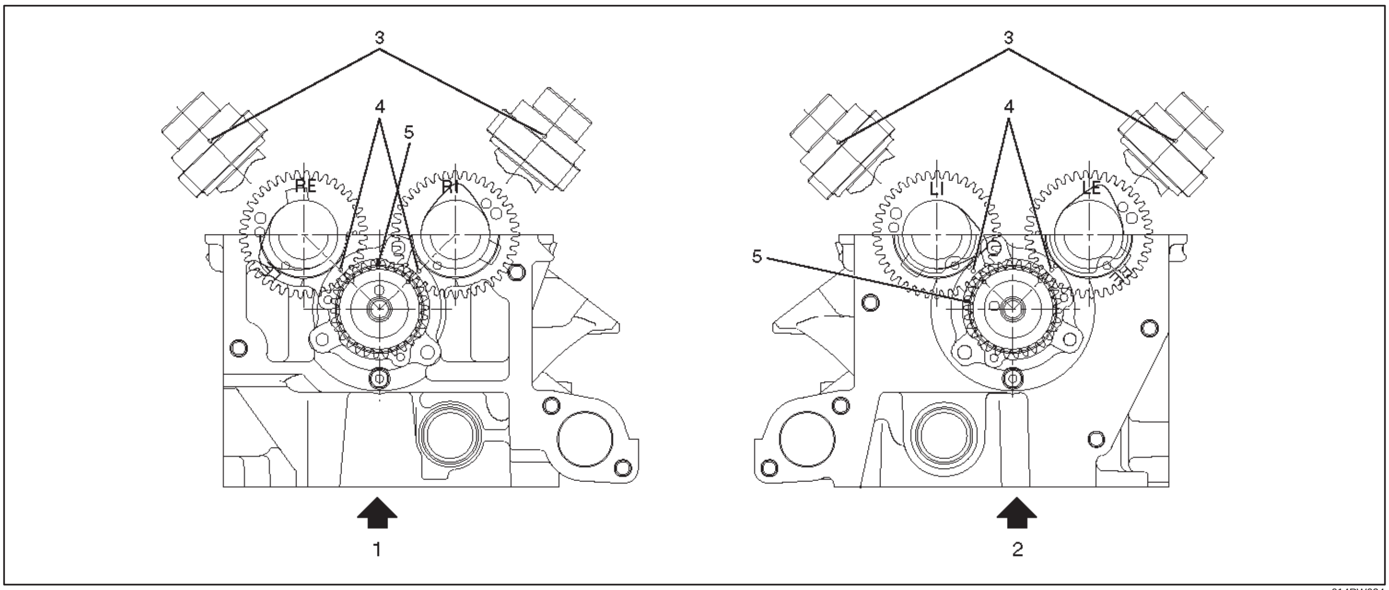
- (1) Intake Camshaft Timing Gear for Right Bank
- (2) Intake Camshaft Timing Gear for Left Bank
- (3) Exhaust Camshaft Timing Gear
- (4) Discerning Mark
- LI: Left Bank Intake
- RI: Right Bank Intake
- LE: Left Bank Exhaust
- RE: Right Bank Exhaust



014RW023

Legend

- (1) Right Bank Camshaft Drive Gear
- (2) Left Bank Camshaft Drive Gear
- (3) Timing Mark on Drive Gear
- (4) Dowel Pin

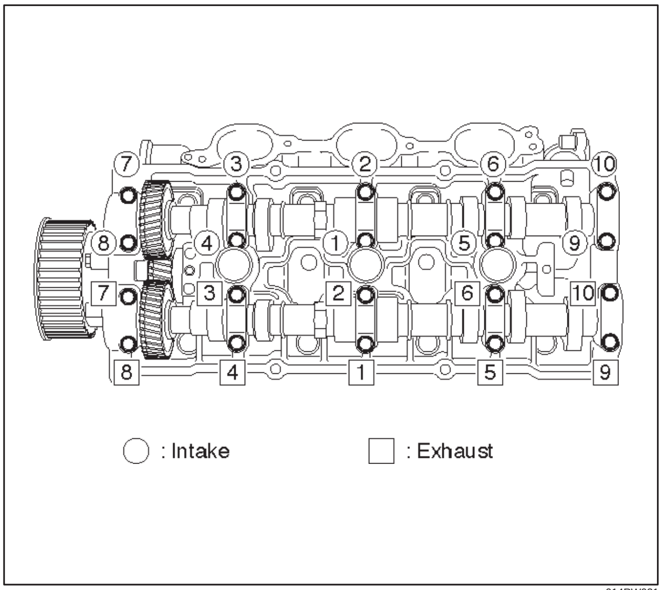


014RW024

Legend
(1) Right Bank
(2) Left Bank
(3) Alignment Mark on Camshaft Drive Gear
(4) Alignment Mark on Camshaft
(5) Alignment Mark on Retainer

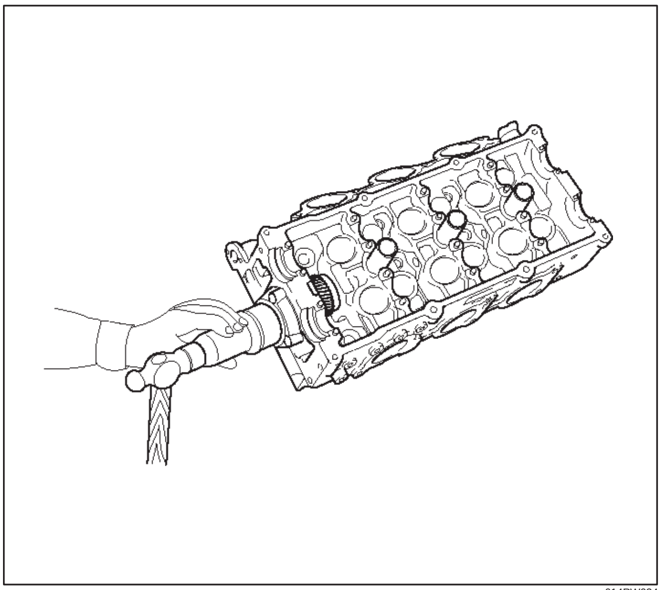
3. Tighten twenty bolts in numerical order on one side bank as shown in the illustration.

Torque: 10 N·m (89 lb in)



014RW031

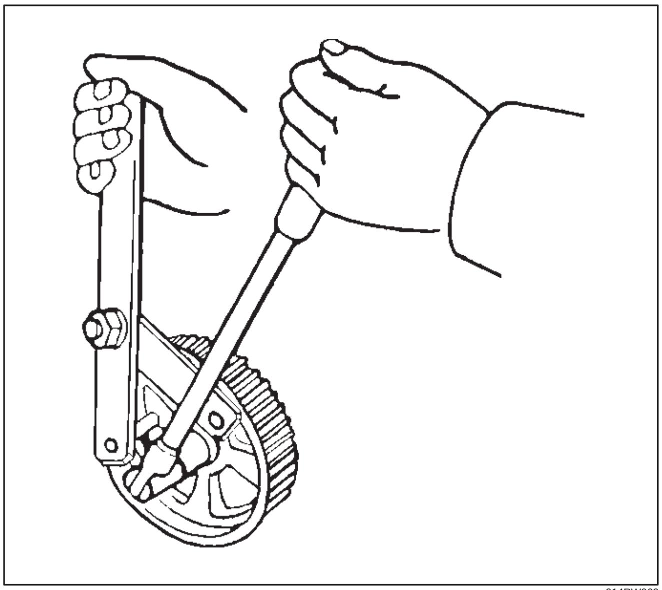
4. If the oil seal requires replacement, use the J–42985 to install the oil seal.



014RW034

5. Tighten bolt for camshaft drive gear pulley to the specified torque using the J–43041 universal holder.

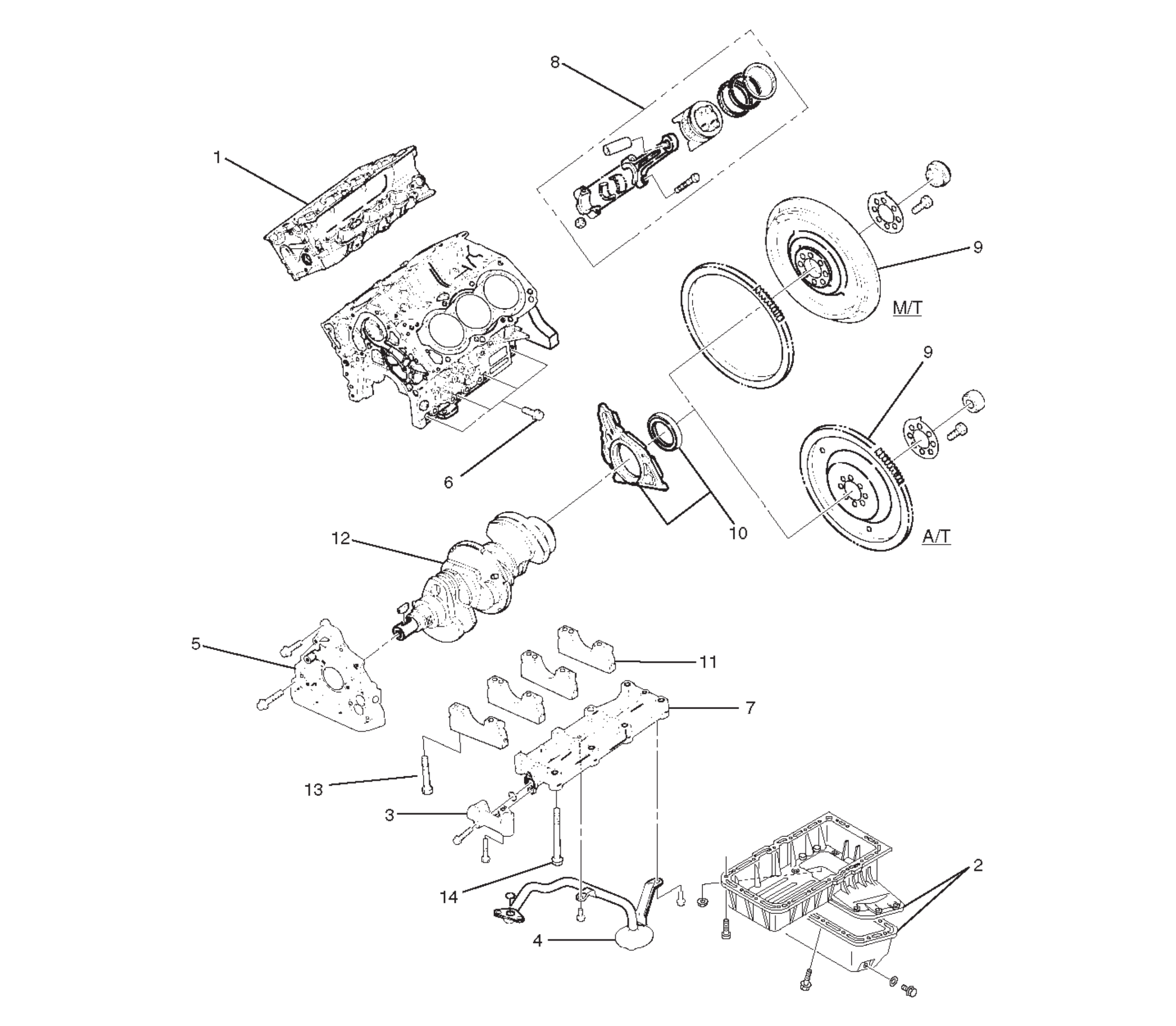
Torque: 98 N·m (72 lb ft)



014RW060

Crankshaft

Crankshaft and Associated Parts



013RW009

Legend

(1) Cylinder Head Assembly
(2) Crankcase with Oil Pan
(3) Oil Pipe and O-Ring
(4) Oil Strainer and O-Ring
(5) Oil Pump Assembly
(6) Cylinder Block Side Bolts
(7) Oil Gallery
(8) Piston and Connecting Rod Assembly
(9) Flywheel
(10) Rear Oil Seal Retainer and Oil Seal
(11) Main Bearing Cap
(12) Crankshaft
(13) Main Bearing Cap Fixing Bolts
(14) Oil Gallery Fixing Bolts

Disassembly

1. Remove cylinder head assembly (1). Refer to “Cylinder Head” in this manual.
2. Remove crankcase with oil pan (2). Refer to “Oil Pan and Crankcase” in this manual.

CAUTION: Take care not to damage or deform the sealing flange surface of crankcase.

3. Remove oil pipe and O-ring (3).
4. Remove oil strainer and O-ring (4).
5. Remove oil pump assembly (5).
6. Remove crankcase side bolts (6).
7. Remove oil gallery (7).
8. Remove piston and connecting rod assembly (8). Refer to “Piston, Piston Ring and Connecting Rod” in this manual.
9. Remove flywheel (9).
10. Remove rear oil seal retainer (10).
11. Remove main bearing cap (11).
12. Remove crankshaft (12).

Inspection and Repair

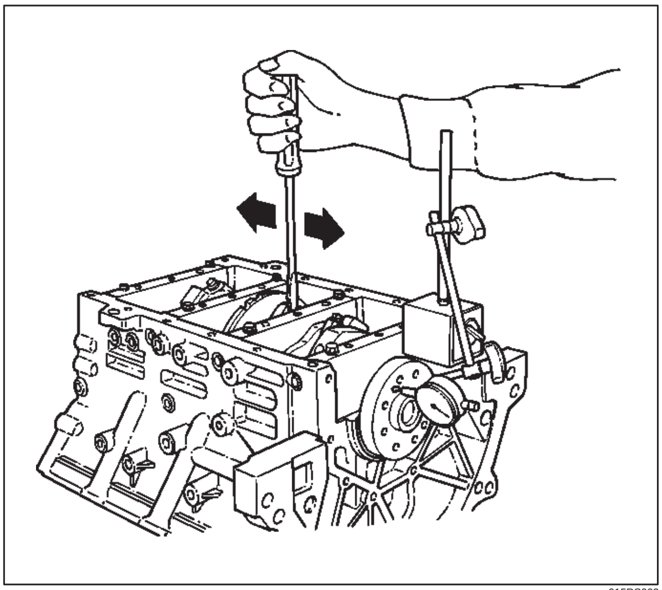
1. Crankshaft

   Set the dial indicator as shown in the illustration and measure the crankshaft thrust clearance. If the thrust clearance exceeds the specified limit, replace the thrust bearings as a set.

   Thrust Clearance

   Standard : 0.06 mm–0.24 mm (0.0024 in–0.0094 in)

   Limit : 0.30 mm (0.0118 in)



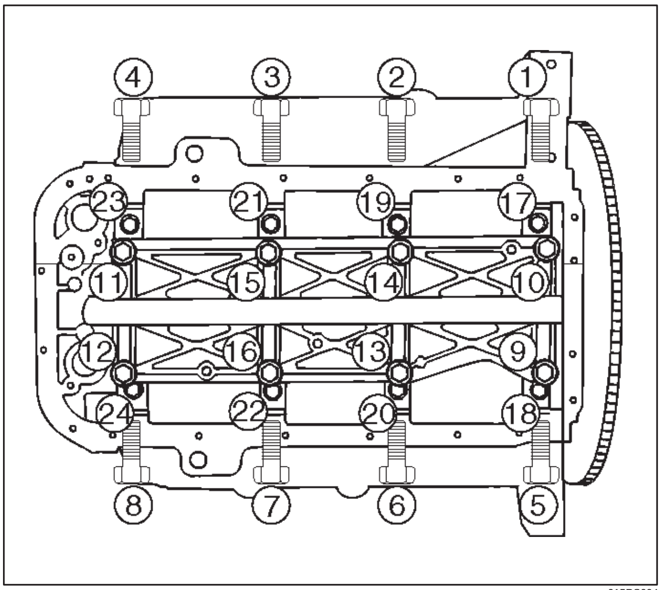
015RS003

Main Bearing Clearance

1. Remove the bearing caps and measure the oil clearance.
2. Remove the main bearing cap fixing bolts in the sequence shown in the illustration.

   Arrange the removed main bearing caps in the cylinder number order.

   Remove the main bearings.



015RS004

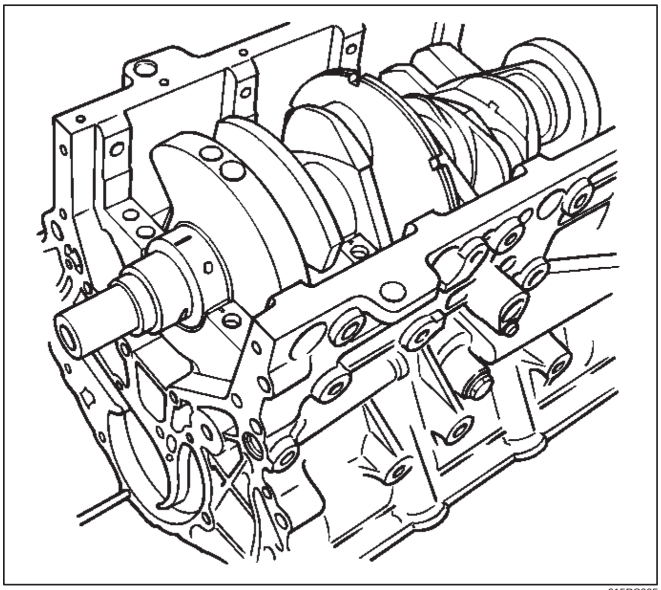
3. Remove the crankshaft.

   Remove the main bearings.
4. Clean the upper and lower bearings as well as the crankshaft main journal.
5. Check the bearings for damage or excessive wear.

   The bearings must be replaced as a set if damage or excessive wear is discovered during inspection.
6. Set the upper bearings and the thrust washers to their original positions.

   Carefully install the crankshaft.
7. Set the lower bearings to the bearing cap original position.
8. Apply plastigage to the crankshaft journal unit as shown in the illustration.

NOTE: Do not set the plastigage on the oil hole.



015RS005

9. Install main bearing caps, oil gallery and crank case bolts in the order shown, and tighten each bolt to the specified torque.

NOTE: Do not apply engine oil to the crank case side bolts.

Main bearing cap bolts.

Torque: 39 N·m (29lb ft)

Oil gallery fixing bolts.

Torque:

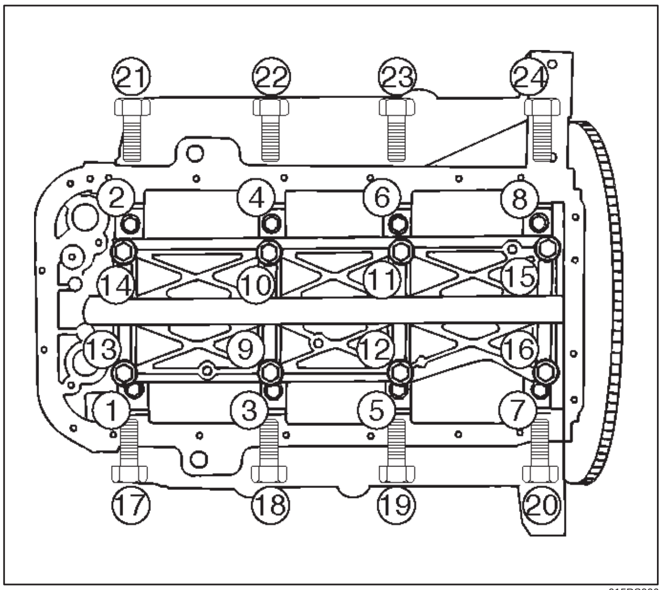
1st step: 29 N·m (21 lb ft)

2nd step 55°～65°

Crank case side bolts

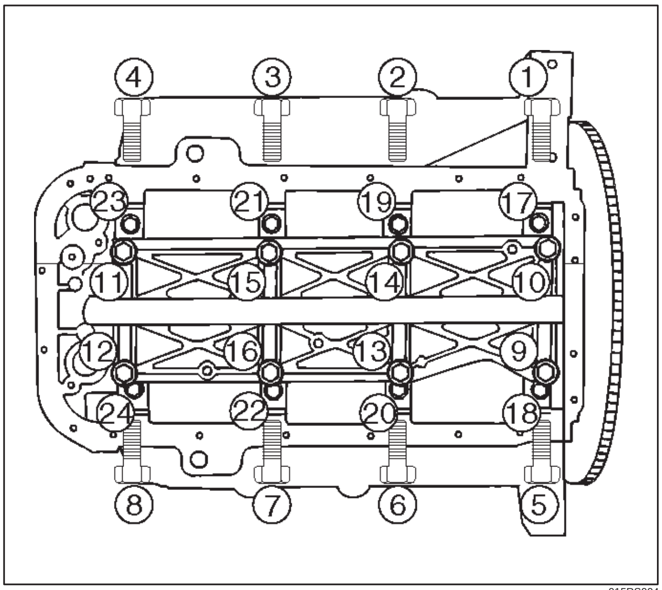
Torque : 39 N·m (29lb ft)

NOTE: Do not allow the crankshaft to rotate.



015RS006

10. Remove the main bearing caps in the sequence shown in the illustration.

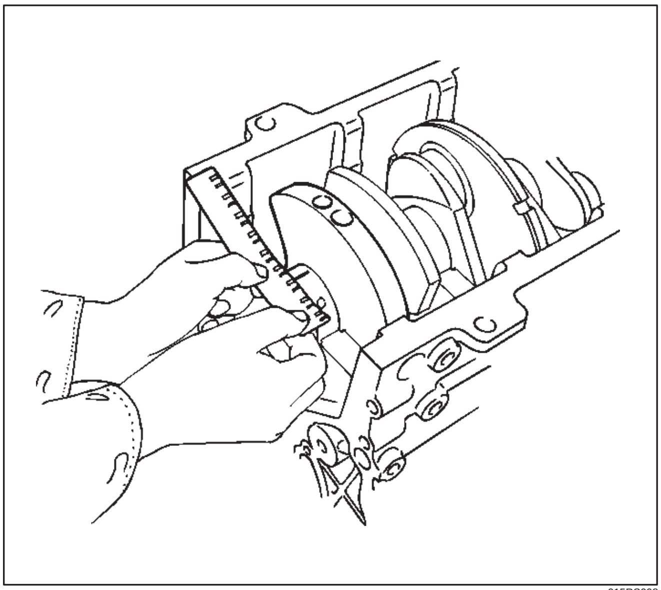


015RS004

11. Measure the plastigage width and determine the oil clearance. If the oil clearance exceeds the specified limit, replace the main bearings as a set and/or replace the crankshaft.

Standard : 0.019 mm–0.043 mm (0.0007 in–0.0017 in)

Limit : 0.08 mm (0.0031 in)



015RS008

12. Clean the plastigage from the bearings and the crankshaft.
 Remove the crankshaft and the bearings.

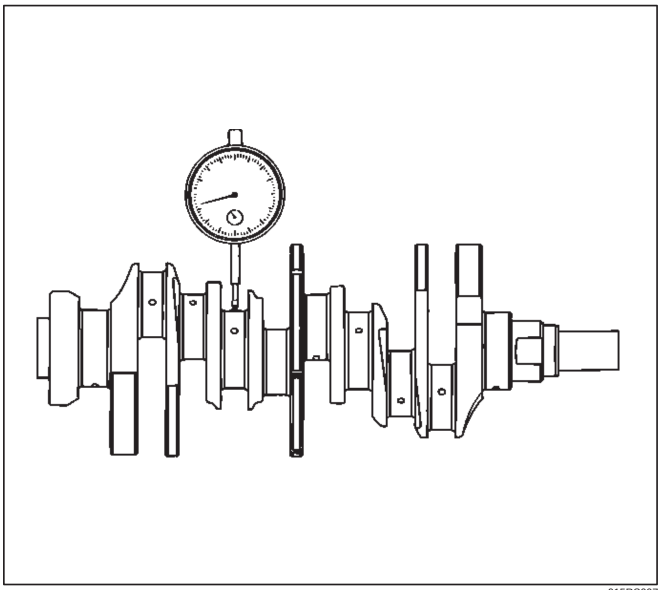
Crankshaft (12) Inspection

Inspect the surface of the crankshaft journal and crank pins for excessive wear and damage. Inspect the oil seal fitting surfaces for excessive wear and damage. Inspect the oil ports for obstructions.

Inspection and Repair

1. Carefully set the crankshaft on the V–blocks. Slowly rotate the crankshaft and measure the runout. If the crankshaft runout exceeds the specified limit, the crankshaft must be replaced.

Runout : 0.04 mm (0.0016 in)



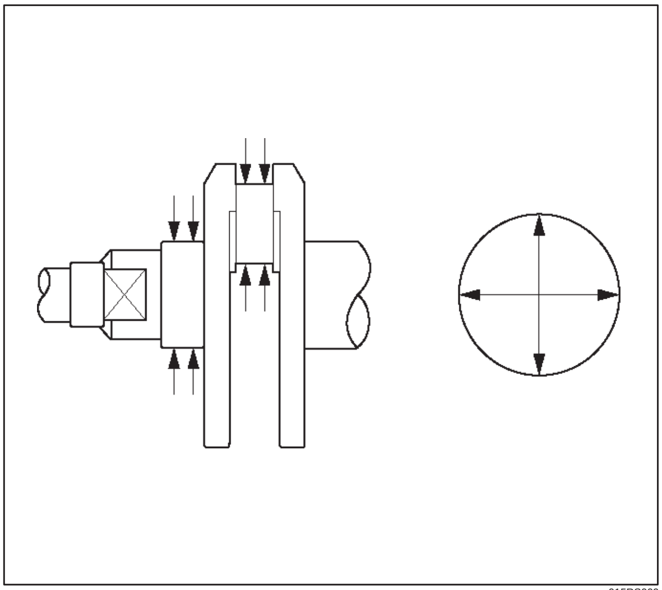
015RS007

2. Measure the diameter and the uneven wear of main journal and crank pin. If the crankshaft wear exceeds the specified limit, crankshaft must be replaced.

Main journal diameter : 63.918 mm–63.933 mm (2.5165 in–2.5170 in)

Crank pin diameter : 53.922 mm–53.937 mm (2.1229 in.–2.1235 in.)

Uneven wear limit : 0.005 mm (0.0002 in)

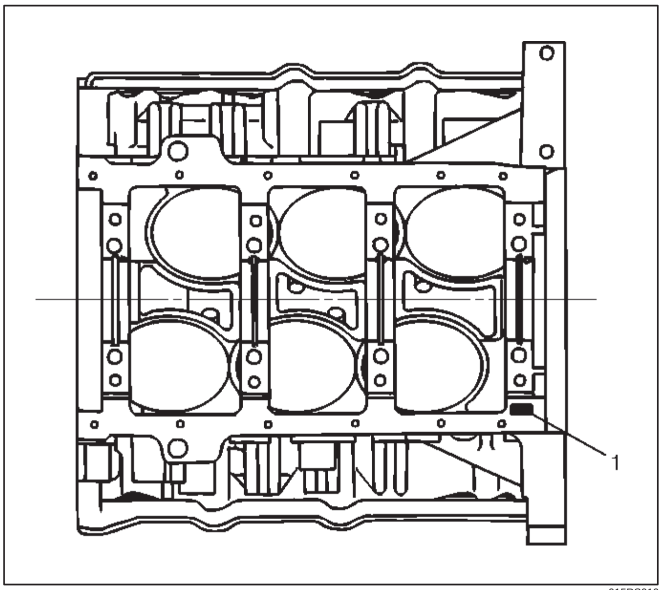


015RS009

Crankshaft Bearing Selection

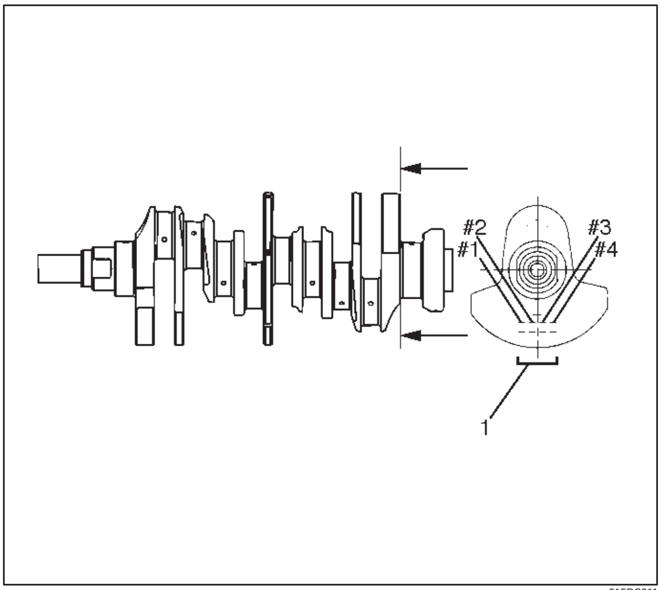
When installing new crankshaft bearings or replacing bearings, refer to the selection table below. Select and install the new crankshaft bearings, paying close attention to the cylinder block journal hole.

1. Diameter size mark (1) and the crankshaft journal.



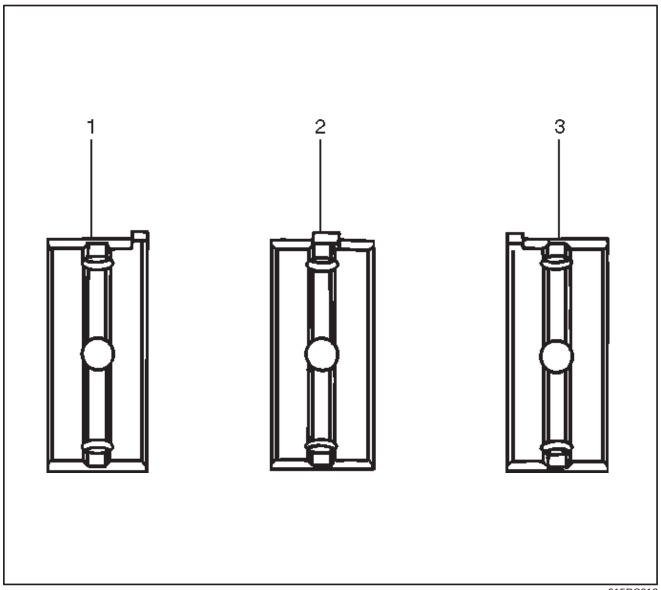
015RS010

2. Diameter size mark (1).
   The diameter size marks are stamped on the No.1 crankshaft balancer as shown in the illustration.



015RS011

NOTE: Take care to ensure the bearings are positioned correctly.



015RS012

Legend

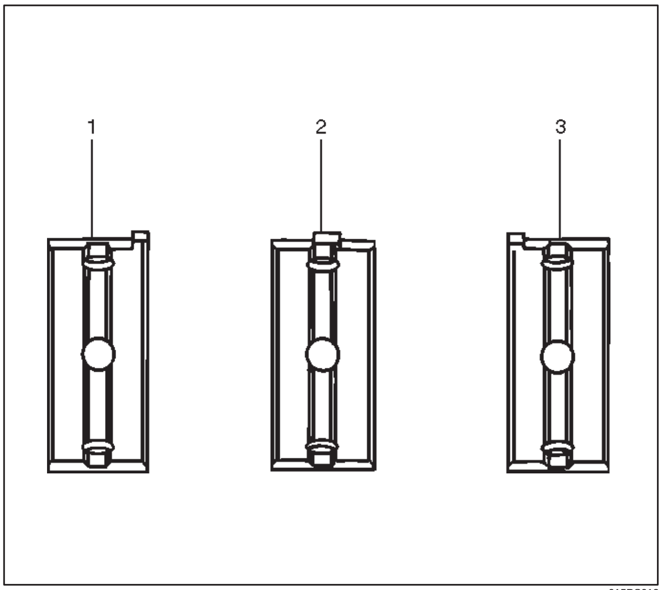
(1) Number 1 and 4 main bearing upper and lower
(2) Number 2 and 3 main bearing upper
(3) Number 2 and 3 main bearing lower

1 Size Mark	Main Bearing Bore Diameter	Crank Shaft Main Journal Diameter	2 Size Mark	Crank Shaft Bearing Size Mark (Upper Side)	Crank Shaft Bearing Size Mark (Lower Side)	Oil Clearance (Reference)
1	68.994-69.000 (2.7163-2.7165)	63.918-63.925 (2.5165-2.5167)	2	Blue	Blue	0.030-0.049 (0.0012-0.0019)
		63.926-63.933 (2.5168-2.5170)	1	Brown	Brown	0.028-0.047 (0.0011-0.0019)
2	68.987-68.993 (2.7160-2.7163)	63.918-63.925 (2.5165-2.5167)	2			0.029-0.048 (0.0011-0.0019)
		63.926-63.933 (2.5168-2.5170)	1	Green	Green	0.027-0.046 (0.0011-0.0018)
3	68.980-68.986 (2.7157-2.7160)	63.918-63.925 (2.5165-2.5167)	2			0.028-0.047 (0.0011-0.0019)
		63.926-63.933 (2.5168-2.5170)	1	Yellow	Yellow	0.026-0.045 (0.0010-0.0018)

Reassembly

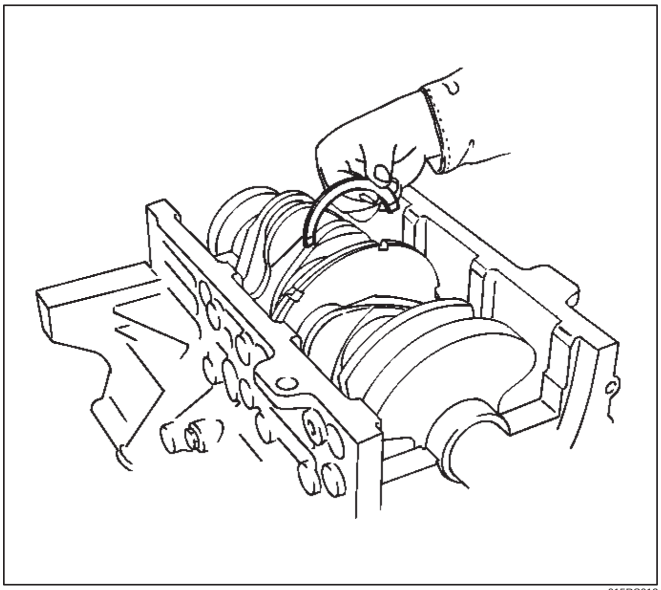
1. Crankshaft (12)
   - Install the main bearings to the cylinder block and the main bearing caps.
   - Be sure that they are positioned correctly.
   - Apply new engine oil to the upper and lower main bearing faces.

NOTE: Do not apply engine oil to the main bearing back faces.



015RS012

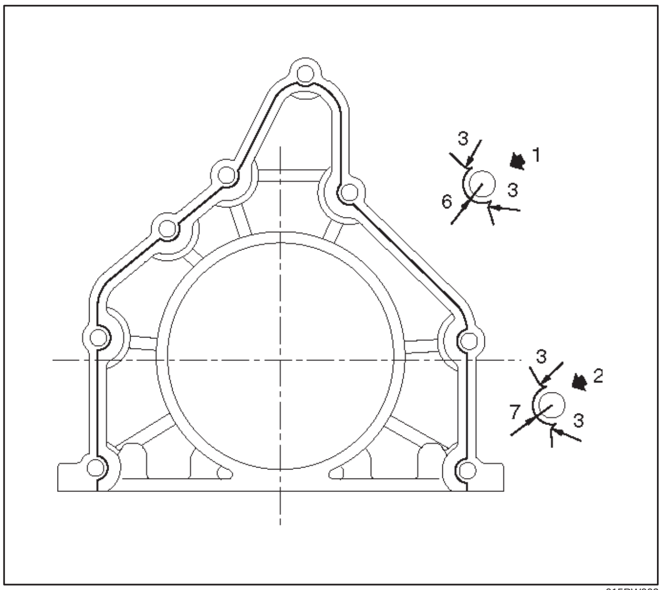
- Carefully mount the crankshaft.
- Apply engine oil to the thrust washer.
- Assemble the thrust washer to the No.3 bearing journal. The oil grooves must face the crankshaft.



015RS013

2. Rear oil seal (10)
   - Remove the oil from the cylinder block and the retainer mounting surface.
   - Apply sealant (TB–1207B or equivalent) to the retainer mounting surface, following the pattern shown in the illustration.

     The retainer must be installed within 5 minutes after sealant application befor the sealant hardens.



015RW002

Legend

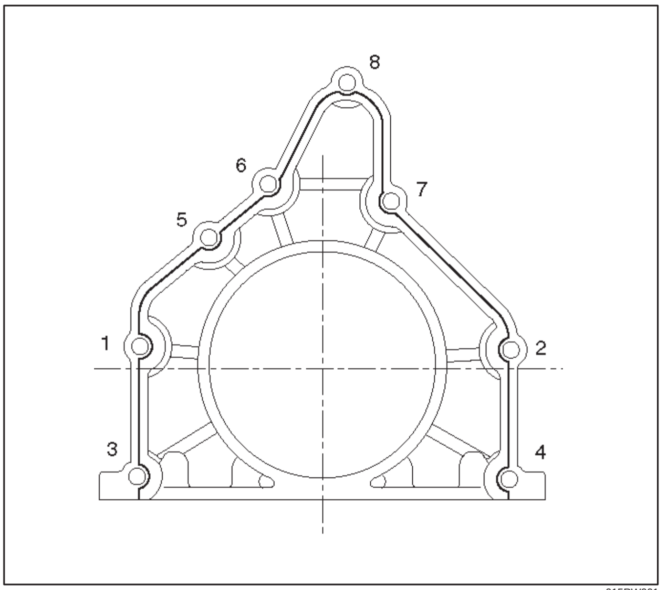
(1) Around Bolt Holes
(2) Around Dowel Pin

- Apply engine oil to the oil seal lip.
- Align the cylinder block dowel pin holes with the rear retainer dowel pins.
- Tighten the rear retainer fixing bolts. New bolts should be used when installing rear retainer.

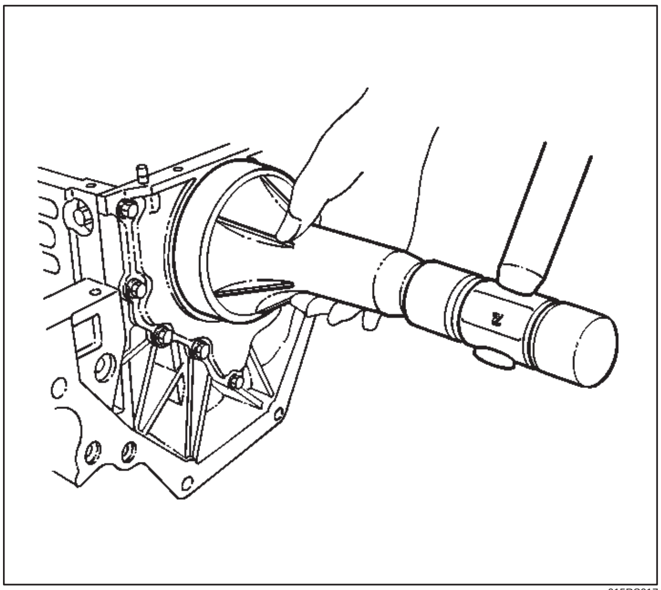
Torque: 18 N·m (13 lb ft)

NOTE: Be very careful not to disengage the oil seal garter spring during installation of the rear retainer.

If the seal was removed from retainer for replacement, apply engine oil to the oil seal lip and install the oil seal using J–39201 oil seal installer.



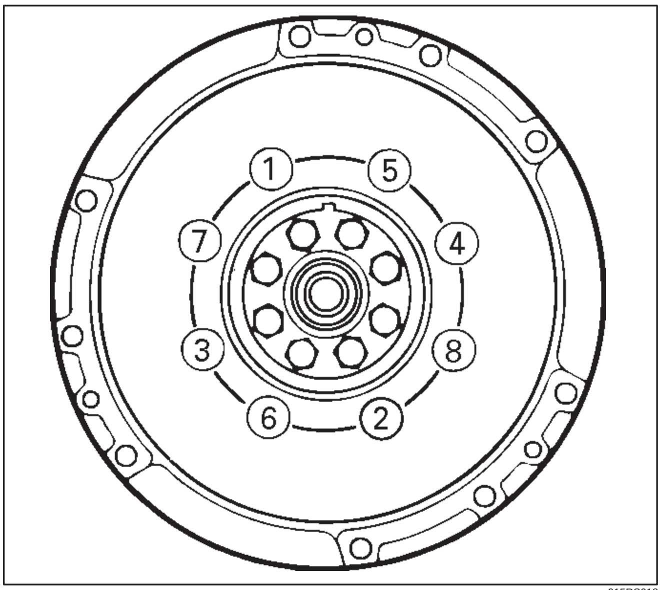
015RW001


015RS017

3. Flywheel (9)
   1. Thoroughly clean and remove the oil from the threads of crankshaft.
   2. Remove the oil from the crankshaft and flywheel mounting faces.
   3. Mount the flywheel on the crankshaft and then install the washer.
   4. Hold the crankshaft to prevent from rotating then install the bolts in the order shown to the specified torque.

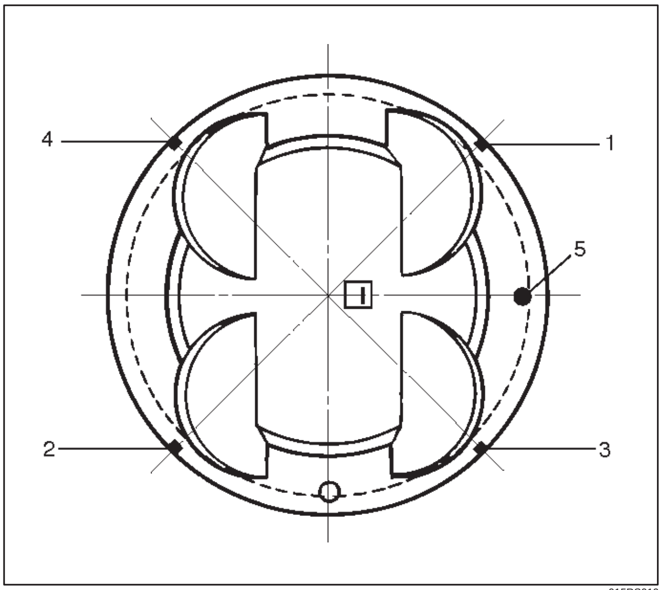
Torque: 54 N·m (40 lb ft)

NOTE: Do not reuse the bolt and do not apply oil or thread lock to the bolt.



015RS018

4. Piston and connecting rod assembly (8)
   - Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins. Check to see that the piston ring end gaps are correctly positioned.



015RS019

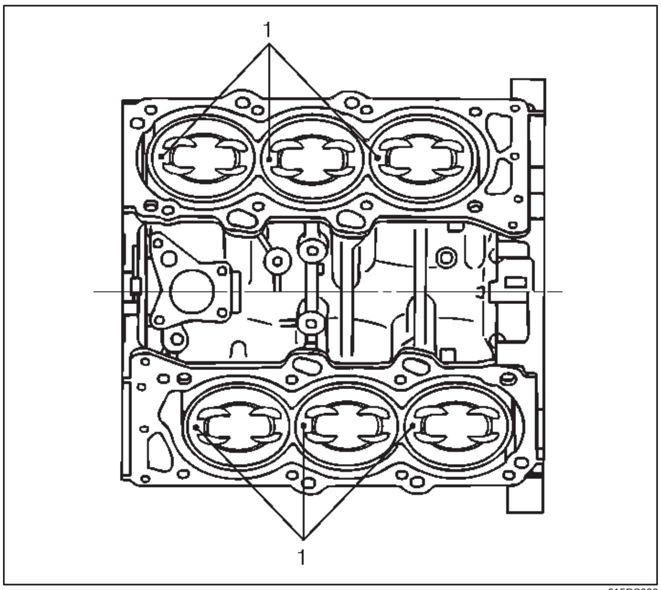
Legend
(1) No.1 Compression Ring
(2) No.2 Compression Ring
(3) Oil Ring Side Rail Upper
(4) Oil Ring Side Rail Lower
(5) Piston Front Mark

- Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor. The front marks must be facing the front of the engine.
- Match the numbered caps with the numbers on the connecting rods. Align the punched marks on the connecting rods and caps.
- Apply engine oil to the threads and seating faces of the nuts.
- Tighten the nuts.

Torque: 54 N·m (40 lb ft)

After tightening the cap nuts, check to see that the crankshaft rotates smoothly.

NOTE: Do not apply engine oil to the bearing back faces.

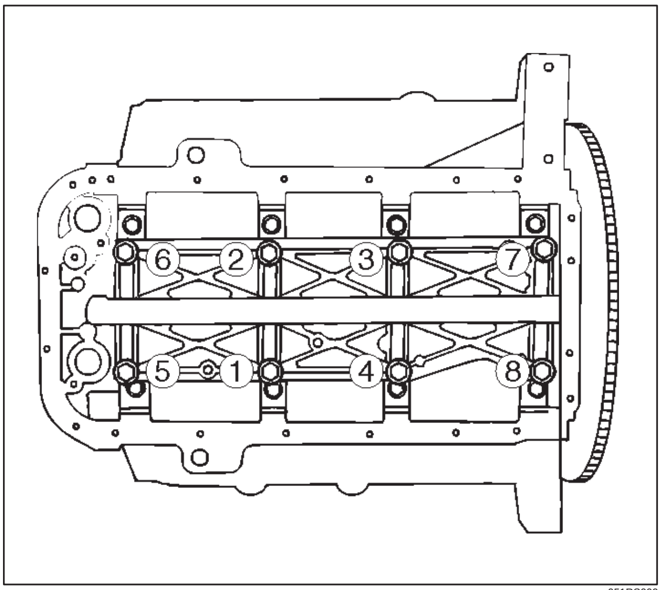


015RS020

5. Install oil gallery (7) and tighten the bolts in 2 steps, in the order shown.

1st step: 29 N·m (22 lb ft)

2nd step: 55° ~ 65°

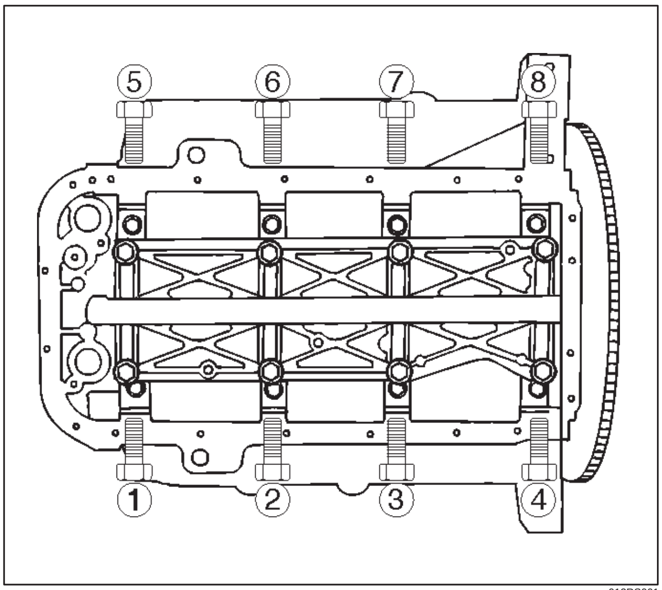


051RS009

6. Cylinder block side bolts (6)
   - Tighten all the bolts to the specified torque in the order shown.

NOTE: Do not apply engine oil to the crank case side bolts.

Torque: 39 N·m (29 lb ft)



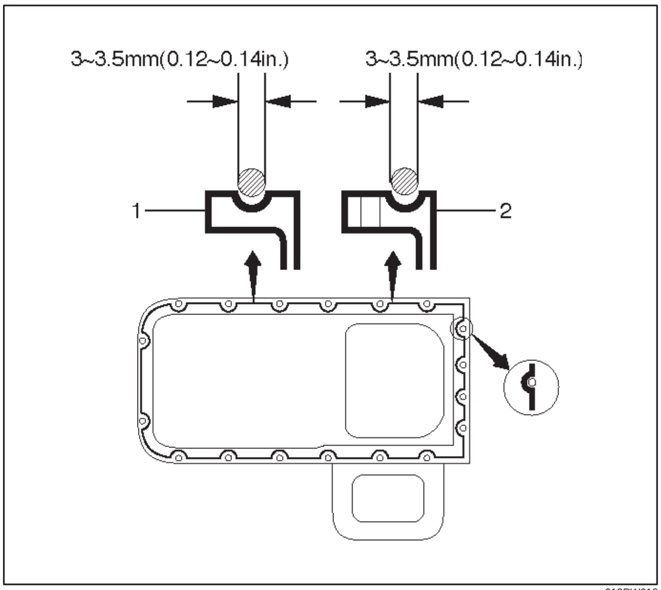
012RS001

7. Install oil pump assembly (5), refer to “Oil pump” in this manual.
8. Install oil strainer and O-ring (4).
9. Install oil pipe and O-ring (3) and tighten the bolts.

Torque: 25 N·m (18 lb ft)

10. Install crankcase with oil pan (2).
    1. Completely remove all residual sealant, lubricant and moisture from the sealing surfaces. The surfaces must be perfectly dry.
    2. Apply a correct width bead of sealant (TB—1207C or its equivalent) to the contact surfaces of the oil pan. There must be no gaps in the bead.
    3. The crankcase assembly must be installed within 5 minutes after sealant application to prevent premature hardening of the sealant.
    4. Tighten the bolts and nuts to the specified torque.

Torque : 10 N·m (89 lb in)



013RW010

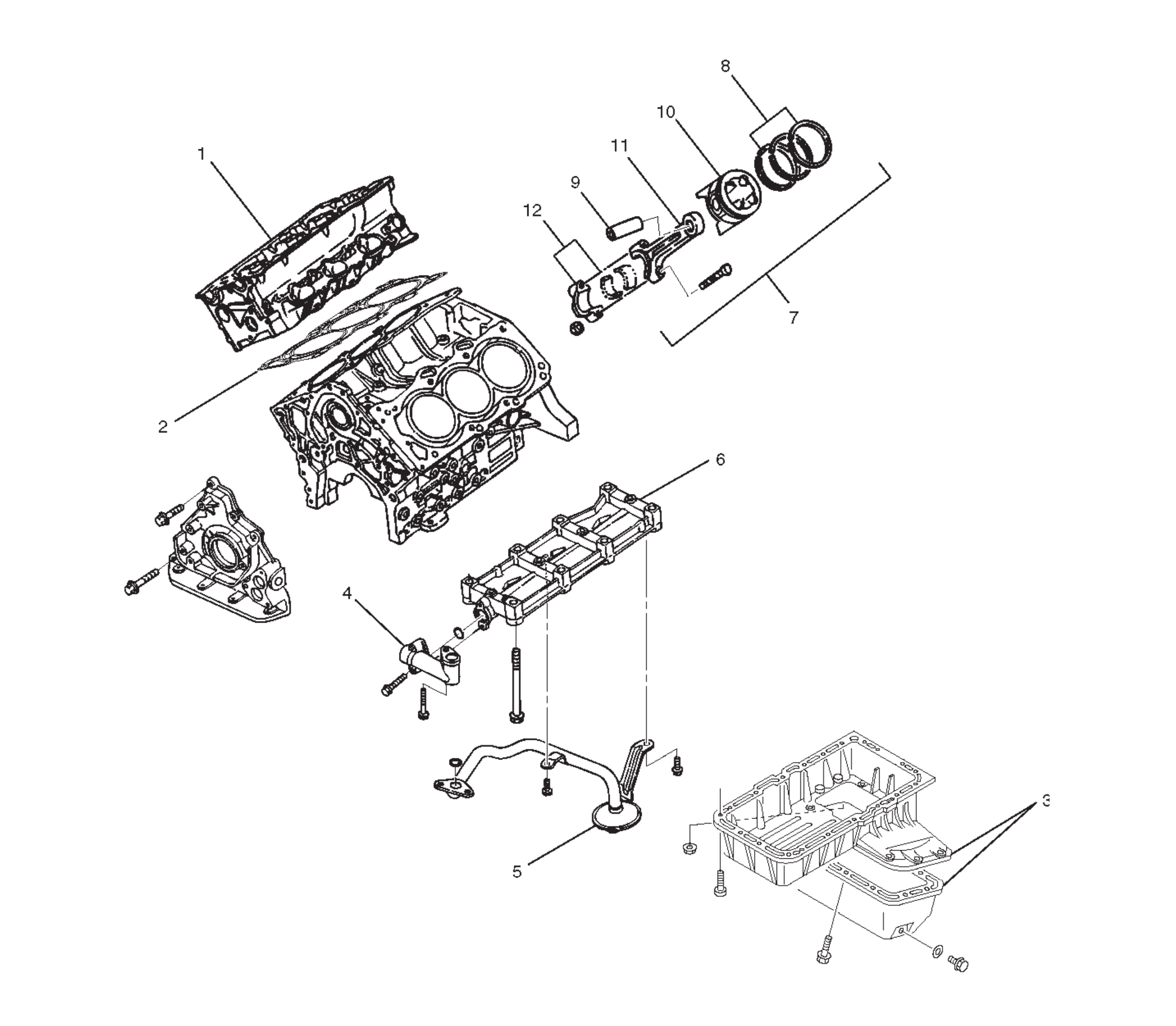
Legend

(1) Portion Between Bolt Holes
(2) Bolt Hole Portion

11. Install cylinder head assembly, refer to “Cylinder head” in this manual.

Piston and Connecting Rod

Piston, Connecting Rod and Associate Parts



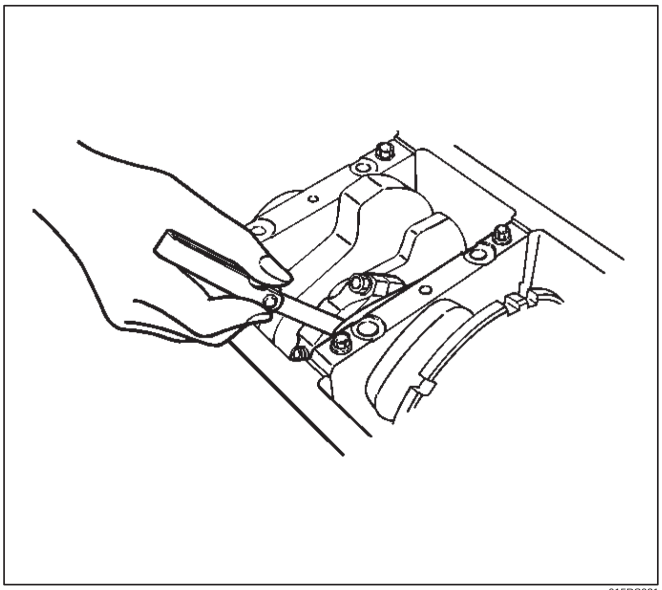
Legend

(1) Cylinder Head Assembly
(2) Cylinder Head Gasket
(3) Crankcase with Oil Pan
(4) Oil Pipe and O-Ring
(5) Oil Strainer and O-Ring
(6) Oil Gallery
(7) Piston and Connecting Rod Assembly
(8) Piston Ring
(9) Piston Pin
(10) Piston
(11) Connecting Rod
(12) Connecting Rod Cap

Disassembly

1. Remove cylinder head assembly (1). Refer to “Cylinder Head Removal” in this manual.
2. Remove cylinder head gasket (2).
3. Remove crankcase with oil pan (3). Refer to“Oil Pan and Crankcase” in this manual.
4. Remove oil pipe and O-ring (4).
5. Remove oil strainer and O-ring (5).
6. Remove oil gallery (6).
7. Remove connecting rod cap with connecting rod lower bearing (12).
8. Remove piston and connecting rod assembly (7).

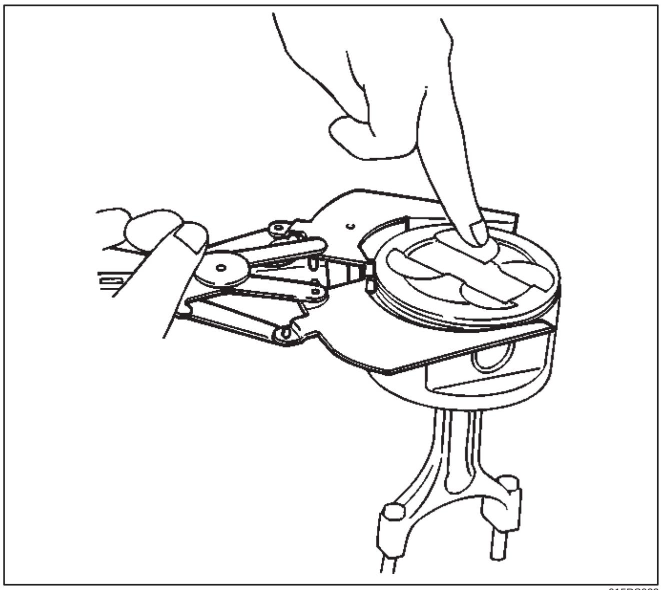
NOTE: Before removing piston and connecting rod assembly, measure thrust clearance.



015RS031

- Remove any ridge or carbon build up from the top end of the cylinder.

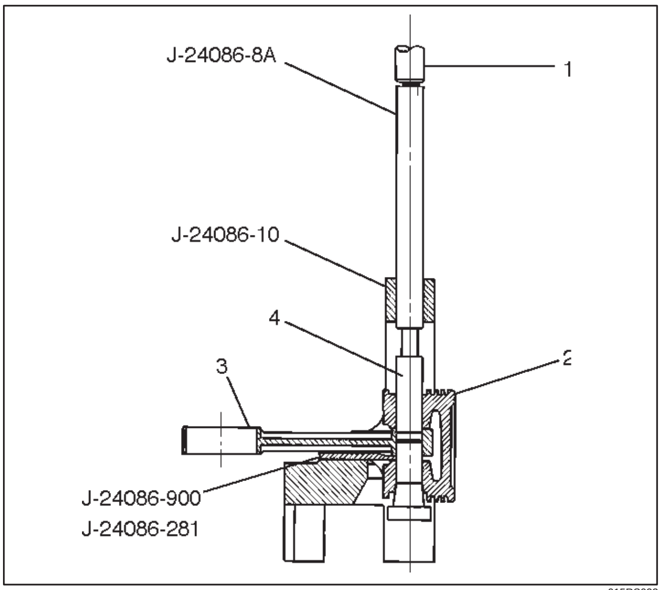
9. Remove the piston rings (8) with a piston ring expander. Arrange the removed piston rings in the cylinder number order.



015RS022

10. Remove the piston pin (9) using J–24086–C piston pin service set and piston support with a press.

NOTE: Keep the parts removed from each cylinder separate. All parts must be reinstalled in their original positions. Heating the connecting rod will permit easy removal of the piston pin.



015RS023

Legend

(1) Press Ram
(2) Piston
(3) Connecting Rod
(4) Piston Pin

11. Piston (10)
12. Connecting rod (11)

Inspection and Repair

Pistons (10)

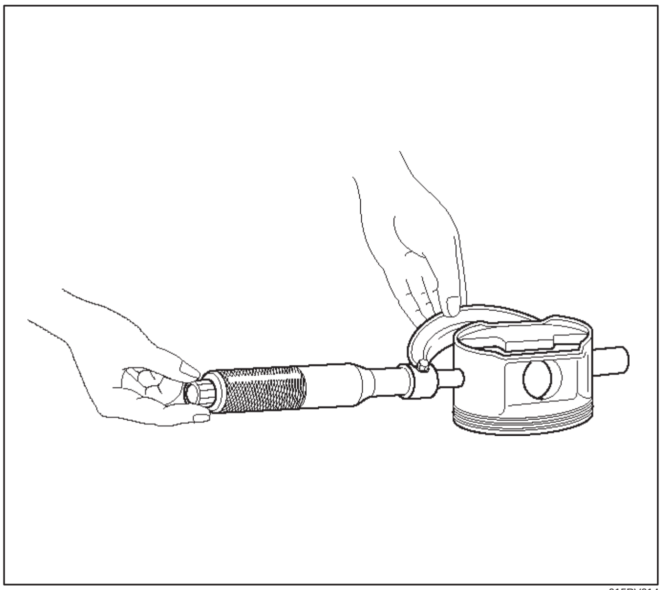
Carefully clean away all the carbon adhering to the piston head and the piston ring grooves.

NOTE: Never use a wire brush to clean the pistons. Damage will result. Visually check each piston for cracking, scoring, and other signs of excessive wear. If any of the above conditions are found, the piston must be replaced.

Piston Diameter

1. Measure the piston outside diameter with micrometer at the piston grading position and a right angle to the piston pin.
   Piston grading position (from piston head)

Piston grading position : 43.0 mm (1.6929 in)



015RV014

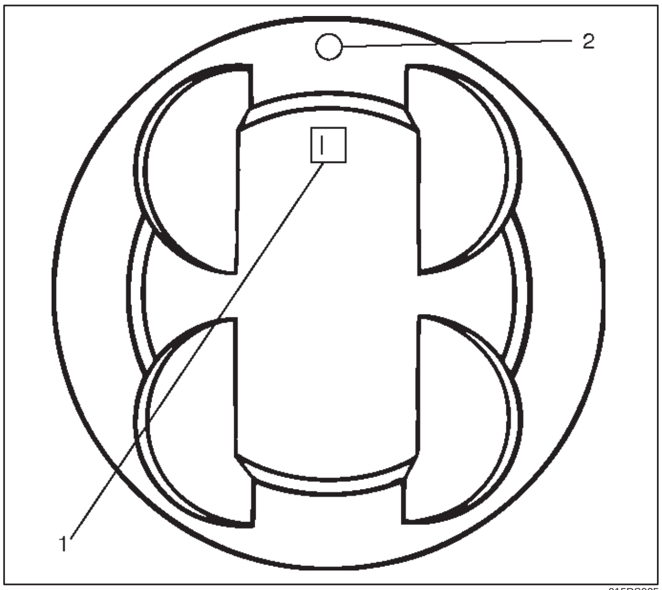
The size mark (1) for piston outside diameter is represented as shown in illustration below.

Outside Diameter

Size Mark A : 93.360 mm–93.370 mm (3.6756 in–3.6760 in)

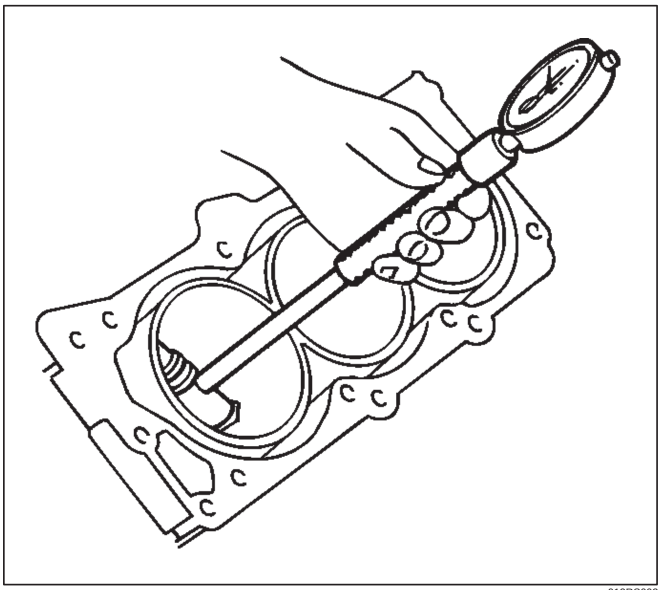
Size Mark B : 93.371 mm–93.380 mm (3.6760 in–3.6764 in)

Size Mark C : 93.381 mm–93.390 mm (3.6764 in–3.6768 in)



015RS025

Measure the cylinder bore inside diameter (refer to “Cylinder Block” in this manual).



012RS002

Piston Rings (8)

Any worn or damaged part discovered during engine overhaul must be replaced with a new one.

1. Ring end gap measurement
   - Insert the piston ring into the bore.
   - Push the ring by the piston, at a right angle to the wall, into the point at which the cylinder bore diameter is the smallest.
   - Measure the ring end gap.

Compression Ring

1st ring

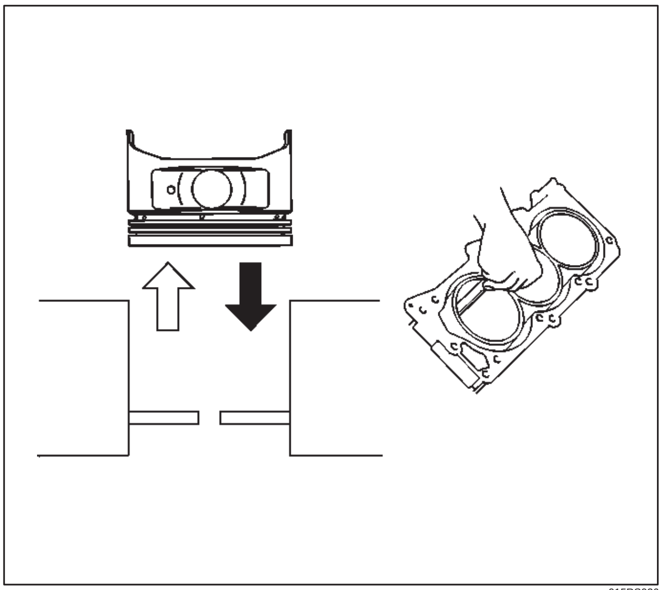
Standard:	**0.300 mm–0.400 mm (0.0118 in–0.0157 in)**
Limit:	**1.0 mm (0.0394 in)**

2nd ring

Standard:	**0.450 mm–0.600 mm (0.0177 in–0.0236 in)**
Limit:	**1.2 mm (0.0472 in)**

Oil ring

Standard:	**0.150 mm–0.450 mm (0.0059 in–0.0177 in)**
Limit:	**1.05 mm (0.0413 in)**

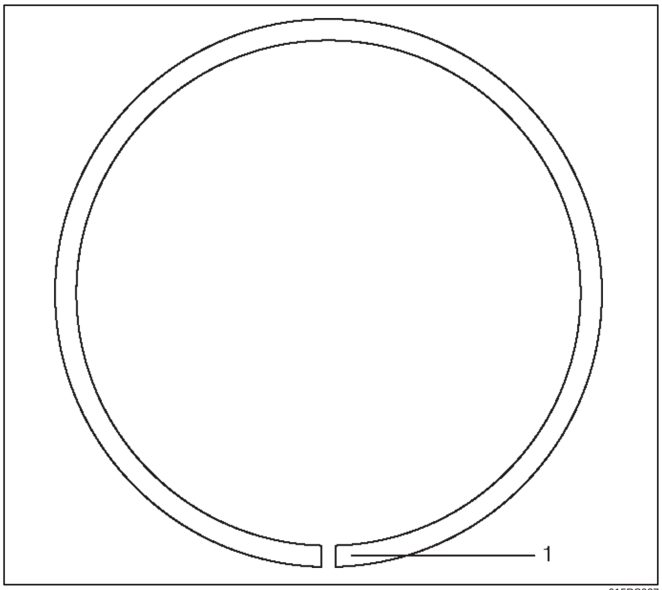


015RS026

- Positioning mark (1) is painted as shown in the illustration.

Marked T : No.1 Compression ring

Marked T2 : No.2 Compression ring



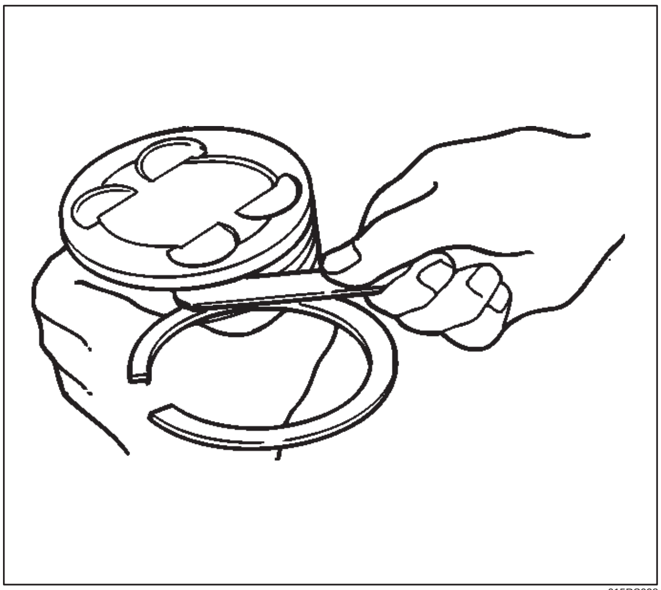
015RS027

2. Measure the clearance between the piston ring groove and the piston ring with a feeler gauge. If the piston ring groove / piston ring clearance exceeds the specified limit, the piston must be replaced.

Compression Ring Clearance

Standard : 0.016 mm–0.038 mm (0.0006 in.–0.0015 in)

Limit : 0.15mm (0.0059 in)



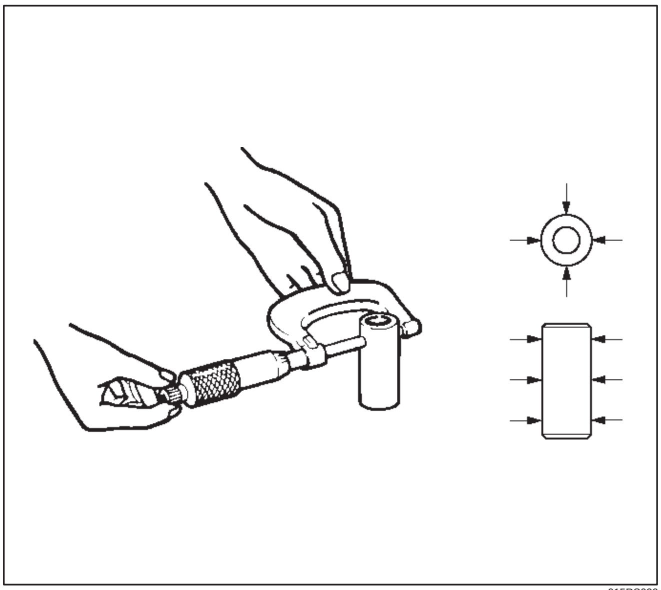
015RS028

Piston Pin (9)

NOTE: Do not reuse the old piston pin.

1. Use a micrometer to measure the new piston pin outside diameter in both directions at three different positions.
2. Measure the inside diameter of the connecting rod small end. If the fitting interference between the small end and pin does not conform to the specified value, the connecting rod must be replaced.

Standard : 0.023 mm–0.038 mm (0.0009 in–0.0015 in)



015RS029

3. Insert the new pin into the piston and rotate it. If the pin rotates smoothly with no backlash, the clearance is normal. If there is backlash or roughness, measure the clearance. If the clearance exceeds the specified limit, the piston must be replaced.

Clearance

Standard : 0.010 mm–0.017 mm (0.0004 in.–0.0007 in)

Limit : 0.040 mm (0.0016 in)

Connecting Rods (11)

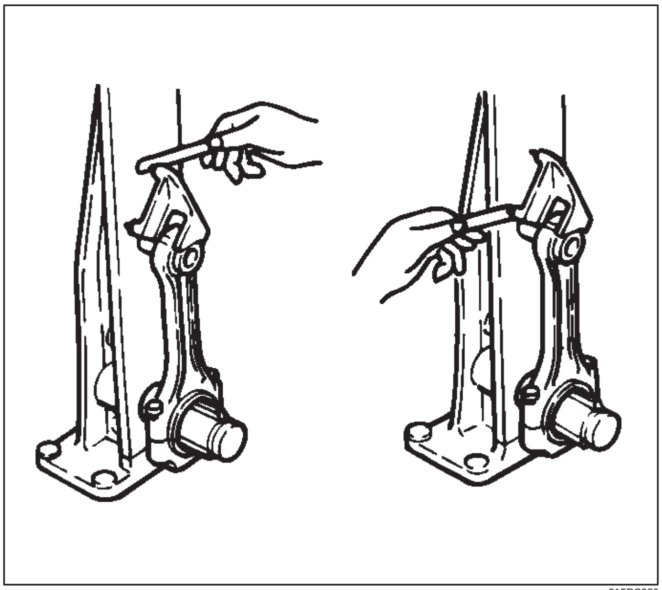
1. Check the connecting rod alignment If either the bend or the twist exceeds the specified limit, the connecting rod must be replaced.

Bend per 100 mm (3.937 in)

Limit: 0.15 (0.0059)

Twist per 100 mm (3.937 in)

Limit: 0.20 (0.0078)

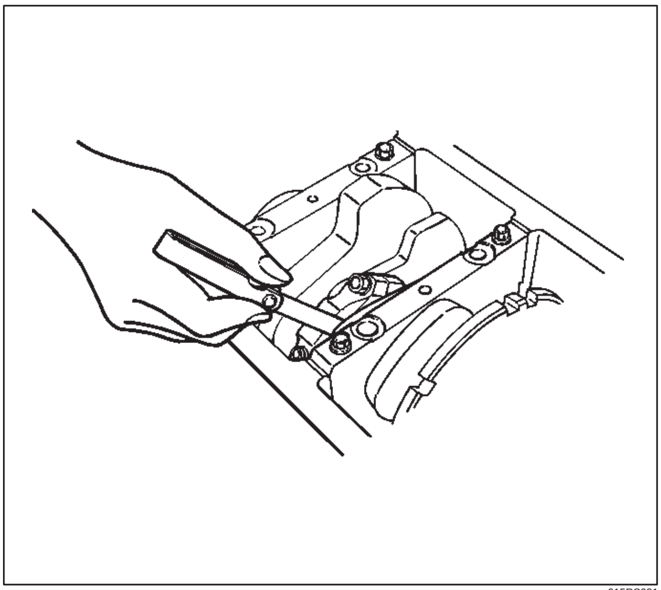


015RS030

2. Measure the connecting rod thrust clearance. Use a feeler gauge to measure the thrust clearance at the large end of the connecting rod If the clearance exceeds the specified limit, the connecting rod must be replaced.

Standard : 0.16 mm–0.35 mm (0.0063 in.–0.0138 in)

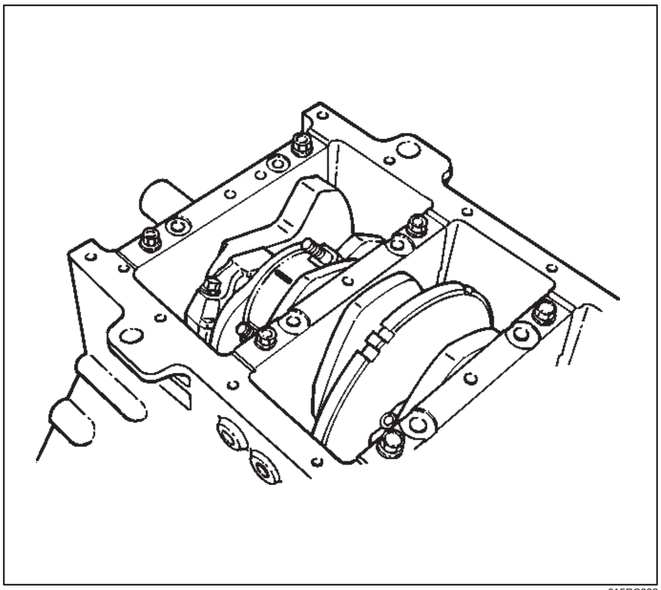
Limit : 0.40 mm (0.0157 in)



015RS031

3. Measure the oil clearance between the connecting rod and the crankshaft.
   1. Remove the connecting rod cap nuts and the rod caps (12).

      Arrange the removed rod caps in the cylinder number order.
   2. Clean the rod bearings and the crankshaft pins.
   3. Carefully check the rod bearings. If even one bearing is found to be damaged or badly worn, the entire bearing assembly must be replaced as a set. Reinstall the bearings in their original positions. Apply plastigage to the crank pin.



015RS032

   4. Reinstall the rod caps (12) to their original positions.

      Tighten the rod cap nuts.

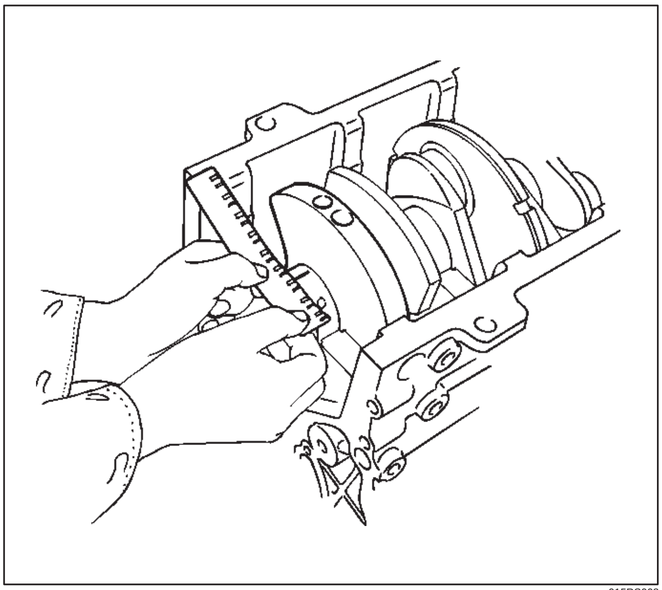
Torque: 54 N·m (40 lb ft)

NOTE: Do not allow the crankshaft to rotate.

5. Remove the rod caps.
6. Measure the width of the plastigage and determine the oil clearance. If the oil clearance exceeds the limit, replace the rod bearing as a set.

Standard : 0.019 mm–0.043 mm (0.0007 in–0.0017 in)

Limit : 0.08 mm (0.003 in)



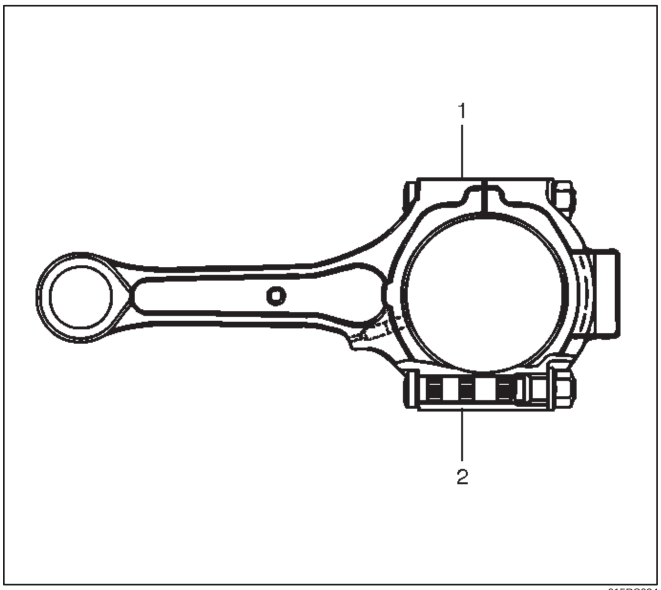
015RS008

7. Clean the plastigage from the bearings and the crankshaft pins.

Con–rod Bearing Selection

Select and install the new connecting rod bearings, paying close attention to the connecting rod big end diameter size mark (1).

NOTE: Take care not to confuse the alignment mark (2) and the size mark (1) during the installation procedure.



015RS034

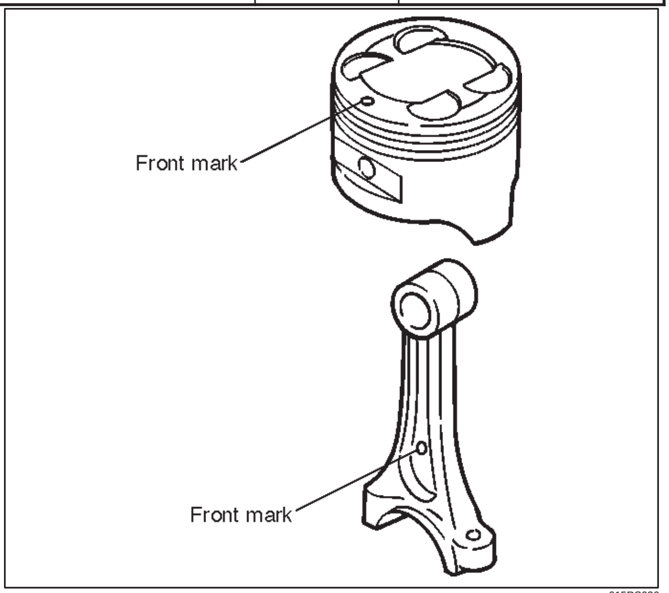
1 Size Mark	Big end Bore Diameter	Crankshaft Pin Diameter	Connecting Rod Bearing Thickness (Reference)	Color of Size Mark	Oil Clearance (Reference)
A	56.994-57.000 (2.2439-2.2441)	53.922-53.937 (2.1229-2.1235)	1.512-1.516 (0.0595-0.0597)	Yellow	0.025-0.054 (0.0010-0.0021)
B	56.988-56.994 (2.2436-2.2439)		1.508-1.512 (0.0594-0.0595)	Green	0.027-0.056 (0.0011-0.0022)
C	56.982-56.988 (2.2434-2.2436)		1.504-1.508 (0.0592-0.0594)	Pink	0.029-0.058 (0.0011-0.0023)

Reassembly

1. Install connecting rod
2. Install piston
3. Install piston pin
   - Apply a thin coat of engine oil to the piston pin. Try to insert the piston pin into the piston pin hole with normal finger pressure.

NOTE: When changing piston / connecting rod combinations, do not change the piston / piston pin combination and do not reuse the old piston pin.

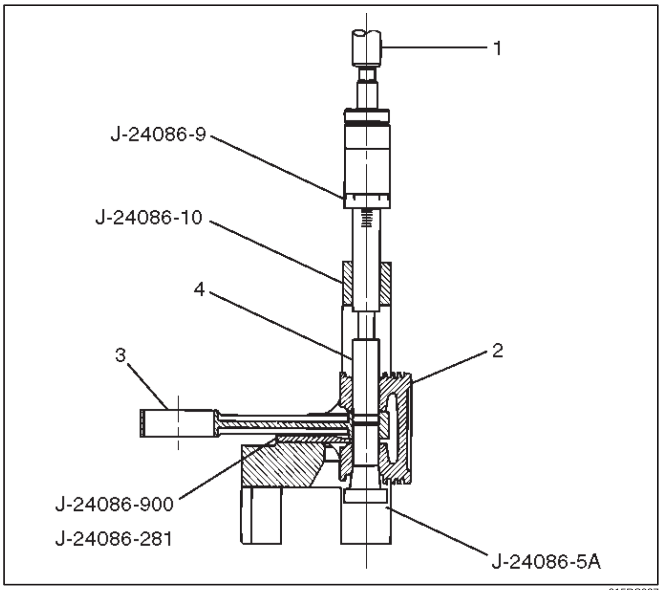
- Attach the piston to the connecting rod with the piston front mark and the connecting rod front mark on the same side.



015RS036

- With J–24086–C Piston pin service set and a press, press fit the piston pin.

NOTE: Heat the connecting rod small end to a suitable temperature to ensure smooth installation.



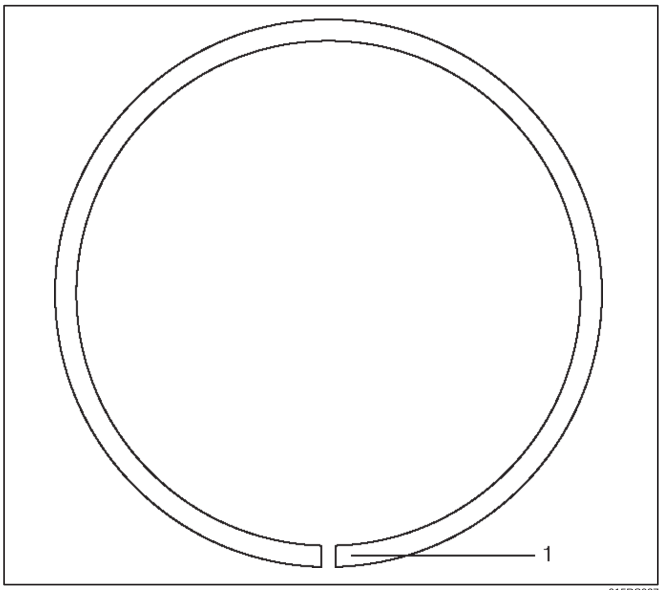
015RS037

Legend
(1) Press Ram
(2) Piston
(3) Connecting Rod
(4) Piston Pin

4. Install piston ring with the piston ring expander.
   The compression ring must be set with the T mark (1) facing up.

   Marked T : No.1 Compression ring

   Marked T2 : No.2 Compression ring



015RS027

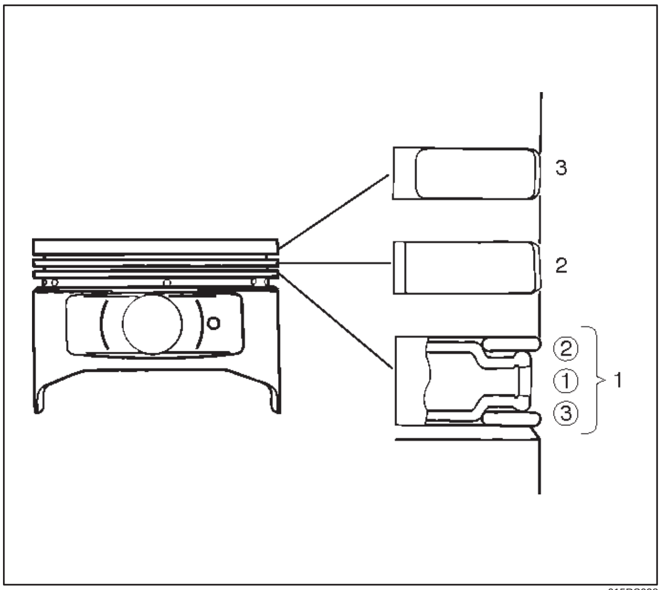
- Install piston rings in the following sequence.
1. Oil ring
   1. Expander ring
   2. Upper side rail
   3. Lower side rail
2. 2nd compression ring
3. 1st compression ring

- The compression rings must be set with the T or T2 mark facing up.

Marked T : No.1 Compression ring

Marked T2 : No.2 Compression ring

- After installation, apply engine oil to the entire circumference of the piston rings. Check to see that all the rings rotate smoothly.



015RS038

5. Install piston and connecting rod assembly.
   - Insert the bearings into the connecting rods and caps. Apply new engine oil to the bearing faces and nuts.
   - Tighten the connecting rod cap nuts

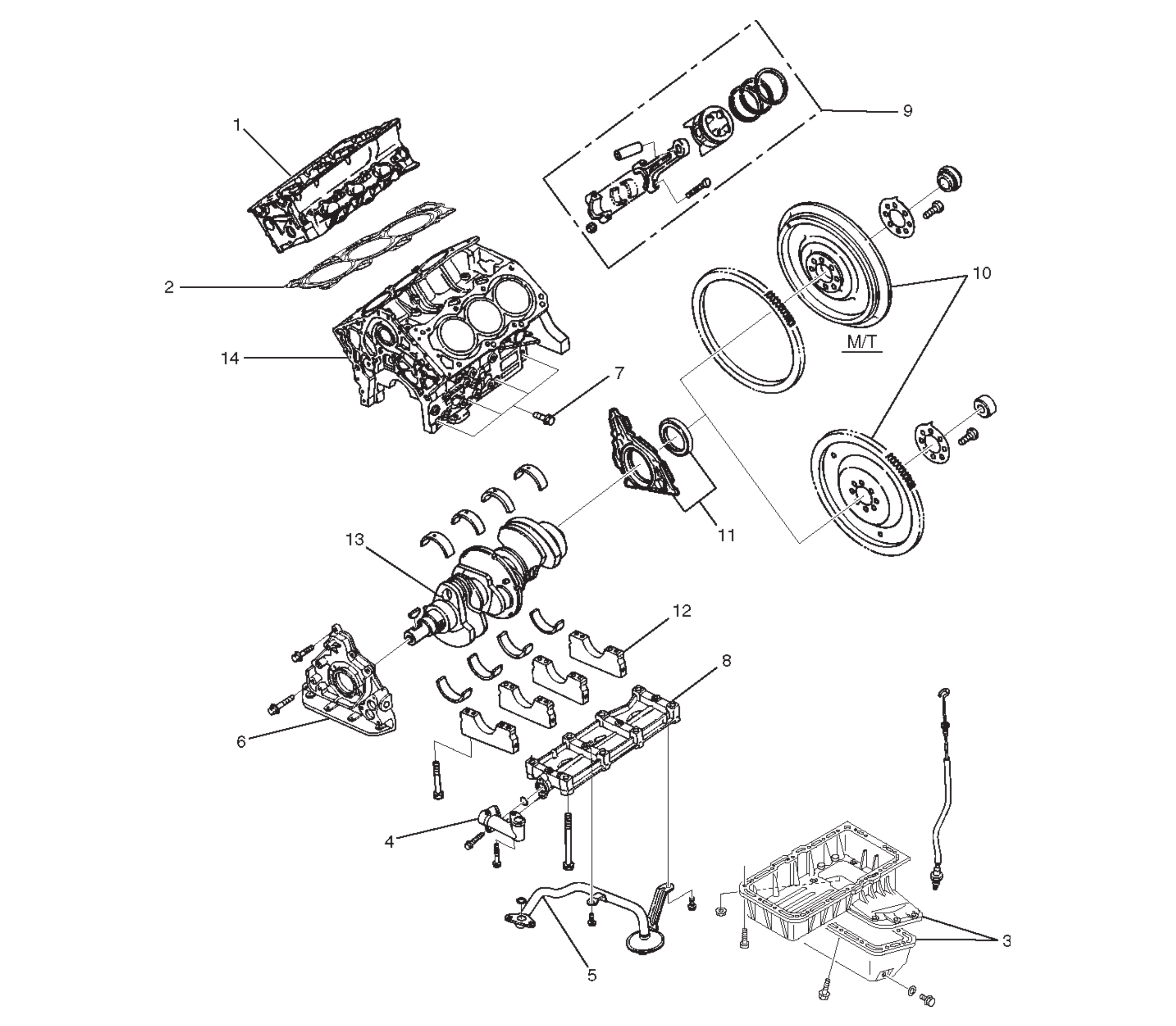
   Torque : 54 N·m (40 lb ft)

NOTE: Do not apply engine oil to the bearing back faces.

6. Oil gallery, refer to “Crankshaft and main bearing” in this manual.
7. Oil strainer and O-ring.
8. Oil pipe and O-ring.
9. Install crankcase with oil pan, refer to “Oil pan and Crankcase” in this manual.
10. Install cylinder head gasket.
11. Install Cylinder head assembly.
    - Refer to “Cylinder head” in this manual.

Cylinder Block

Cylinder Block and Associated Parts



Legend

(1) Cylinder Head Assembly
(2) Cylinder Head Gasket
(3) Crankcase with Oil Pan
(4) Oil Pipe and O-Ring
(5) Oil Strainer and O-Ring
(6) Oil Pump Assembly
(7) Cylinder Block Side Bolts
(8) Oil Gallery
(9) Piston and Connecting Rod Assembly
(10) Flywheel
(11) Rear Oil Seal Retainer Assembly
(12) Main Bearing Cap
(13) Crankshaft
(14) Cylinder Block

Disassembly

1. Remove cylinder head assembly.
2. Remove cylinder head gasket.
3. Remove crankcase with oil pan.
4. Remove oil pipe and O-ring.
5. Remove oil strainer and O-ring.
6. Remove oil pump assembly.
7. Remove crankcase side bolts.
8. Remove oil gallery.
9. Remove piston and connecting rod assembly.
10. Remove flywheel.

11. Remove rear oil seal retainer assembly.
12. Remove main bearing cap.
13. Remove crankshaft.
14. Remove cylinder block.

Inspection and Repair

1. Remove the cylinder head gasket and any other material adhering to the upper surface of the cylinder block. Be very careful not to allow any material to accidentally drop into the cylinder block. Be very careful not to scratch the cylinder block.
2. Carefully remove the oil pump, rear oil seal retainer, and crankcase assembly installation surface seal.
3. Wipe the cylinder block clean.
4. Visually inspect the cylinder block. If necessary, use a flaw detector to perform a dye penetrate and hydraulic (or air pressure) test. If cracking or other damage is discovered, the cylinder block must either be repaired or replaced.

Flatness

1. Using a straight–edge and feeler gauge, check that the upper surface of the cylinder block is not warped.

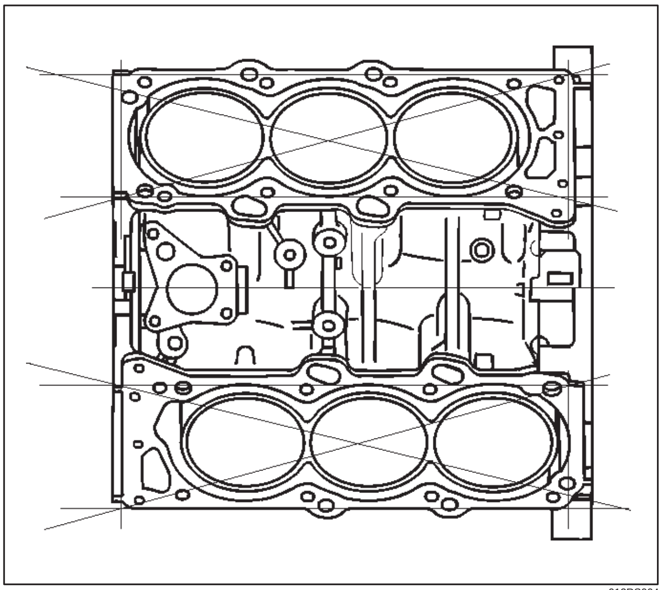
CAUTION: Be very careful not to allow any material to accidentally drop into the upper surface of the cylinder block. Be very careful not to scratch the upper surface of the cylinder block.

2. The cylinder block must be reground or replaced if the warpage exceeds the limit.

Warpage

Limit : 0.15 mm (0.0059 in)

Maximum repairable limit: 0.15 mm (0.0059 in)



012RS004

Cylinder Bore

Use a cylinder gauge to measure the cylinder bore diameter in both the axial and thrust directions. Each measurement should be made at six points.

CAUTION: Be very careful not to allow any material to accidentally drop into the upper surface of the cylinder block. Be very careful not to scratch the upper surface of the cylinder block.

Cylinder Bore Inside Diameter

Limit : 93.530 (3.6823)

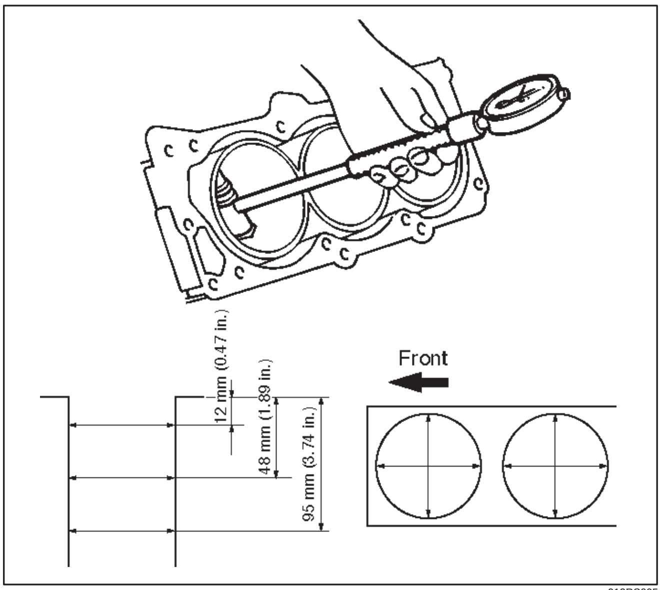
If the measurement exceed the specified limit, the cylinder block must be replaced.

Diameter

Grade A : 93.400 mm–93.410 mm (3.6772 in–3.6776 in)

Grade B : 93.411 mm–93.420 mm (3.6776 in–3.6779 in)

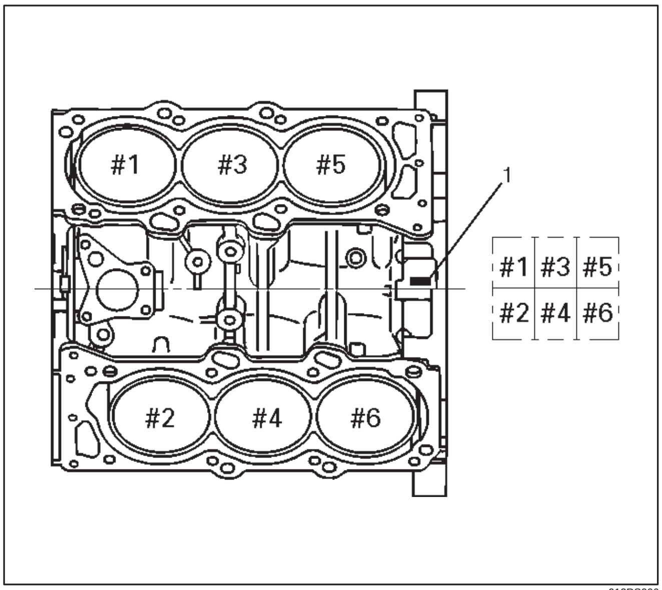
Grade C : 93.421 mm–93.430 mm (3.6780 in–3.6783 in)



012RS005

NOTE: For information on piston diameter, please refer to the section ”Inspection of the Piston and Connecting Rod Assembly” in this manual.

- The ”Grade” mark (1) is stamped at the position illustrated.

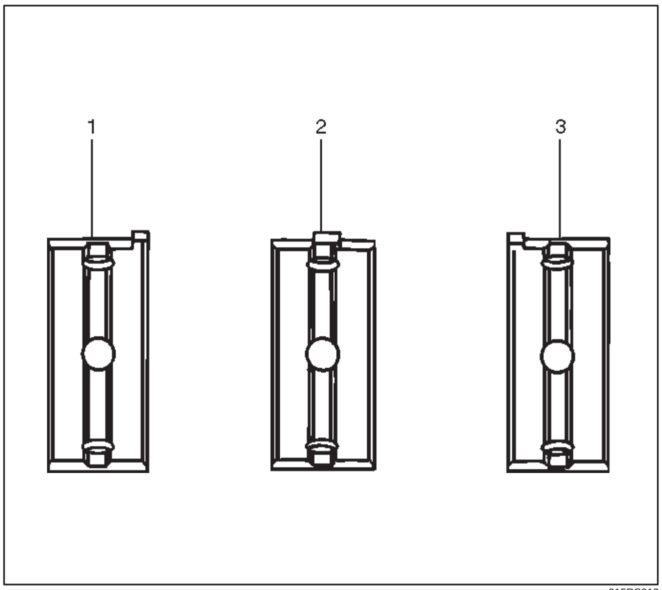


012RS006

Reassembly

1. Install cylinder block.
2. Install crankshaft.
   - Install the main bearings to the cylinder block and the main bearing caps.
   - Be sure that they are positioned correctly.
   - Apply new engine oil to the upper and lower main bearing faces.

NOTE: Do not apply engine oil to the bearing back faces.

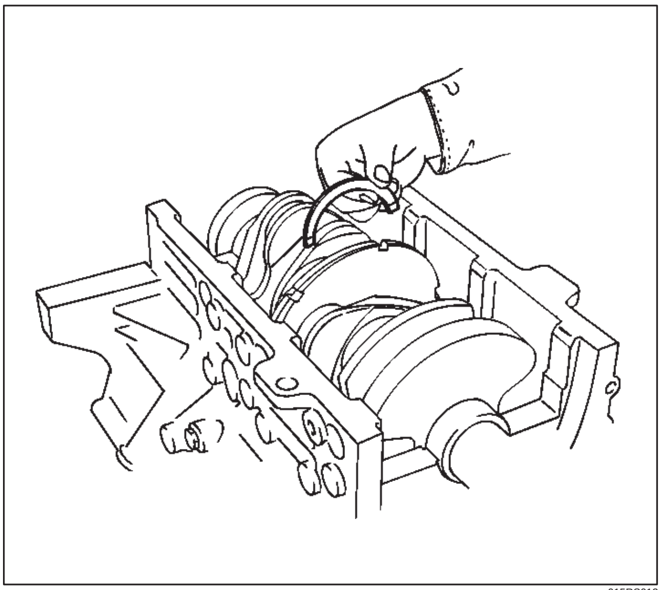


015RS012

Legend

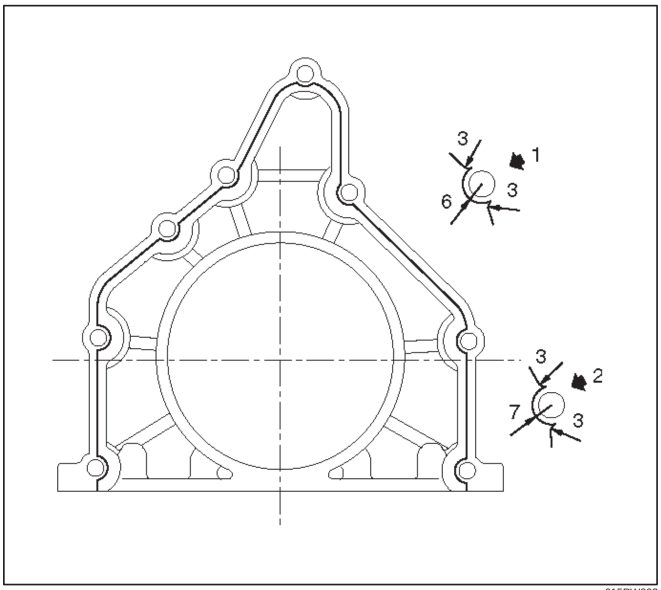
(1) Number 1 and 4 main bearing upper and lower.
(2) Number 2 and 3 main bearing upper.
(3) Number 2 and 3 main bearing lower.

- Carefully mount the crankshaft.
- Apply engine oil to the thrust washer.
- Assemble the thrust washer to the No. 3 bearing journal. The oil grooves must face the crankshaft.



015RS013

3. Install rear oil seal retainer.
   - Remove oil on cylinder block and retainer fitting surface.
   - Apply sealant (TB1207B or equivalent) to retainer fitting surface as shown in illustration.
   - The oil seal retainer must be installed within 5 minutes after sealant application before the sealant hardens.



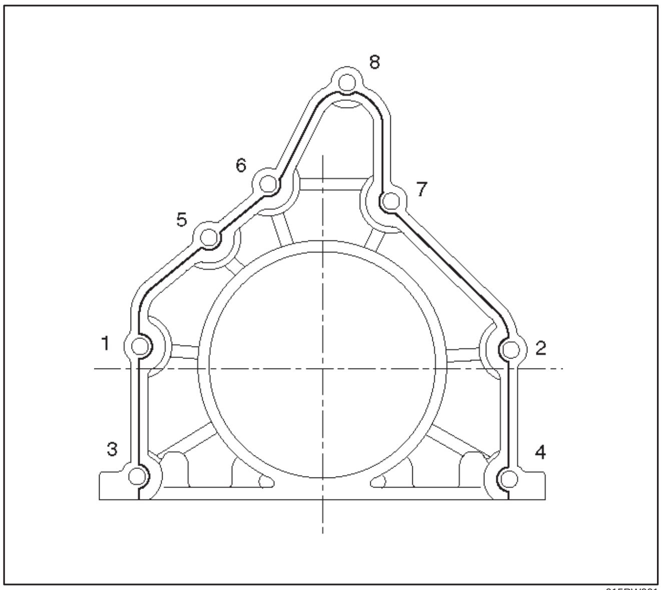
015RW002

Legend

(1) Around Bolt Holes
(2) Around Dowel Pin

- Apply engine oil to oil seal lip and align a dowel pin hole in the cylinder block with that in the retainer.
- Tighten retainer fixing bolts to the specified torque.

Torque: 25 N·m (18.4 lb ft)

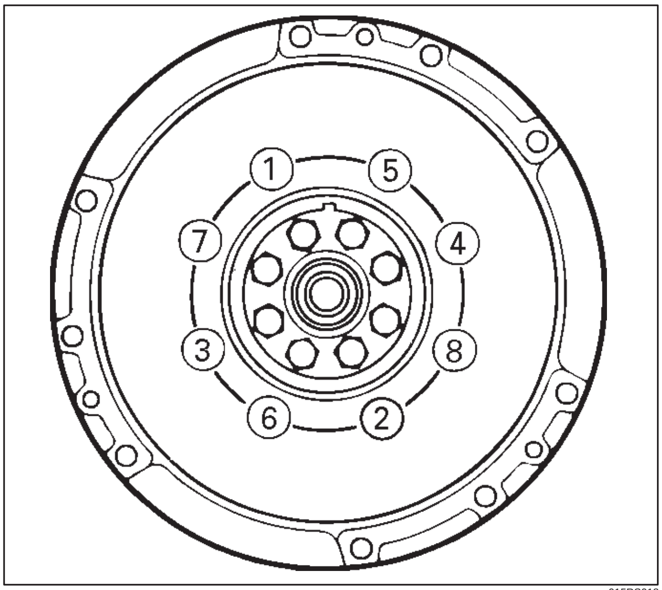


015RW001

4. Install flywheel
   1. Thoroughly clean and remove the oil from the threads of crankshaft.
   2. Remove the oil from the crankshaft and flywheel mounting faces.
   3. Mount the flywheel on the crankshaft and then install the washer.
   4. Holding the crankshaft stationary, tighten the flywheel bolts in the order shown.

Torque: 54 N·m (40 lb ft)

NOTE: Do not reuse the bolts and do not apply oil or thread lock to the bolts.

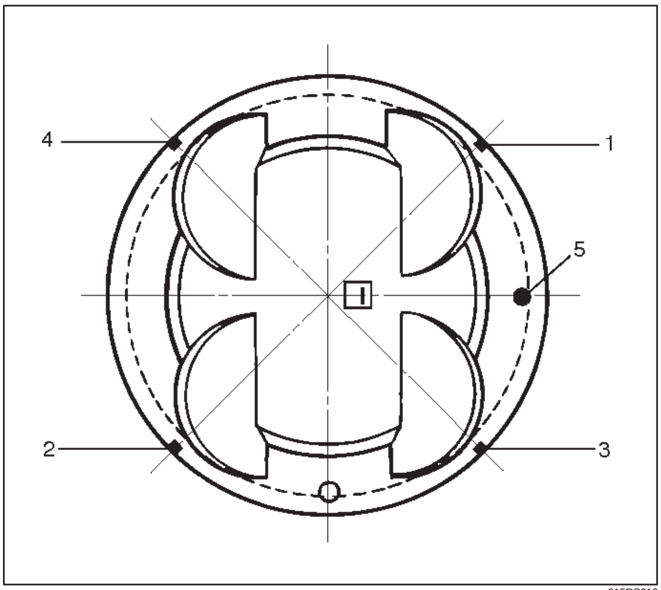


015RS018

5. Install piston and connecting rod assembly.
   - Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins.

NOTE: Do not apply engine oil to the bearing back faces.

- Check to see that the piston ring end gaps are correctly positioned.

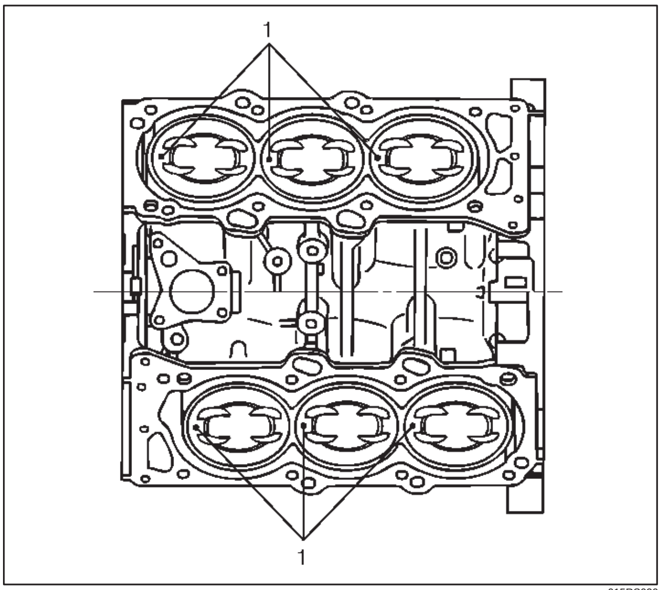


015RS019

Legend

(1) No.1 Compression Ring
(2) No.2 Compression Ring
(3) Oil Ring Side Rail Upper
(4) Oil Ring Side Rail Lower
(5) Piston Front Mark

- Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor.
- The front marks (1) must be facing the front of the engine.

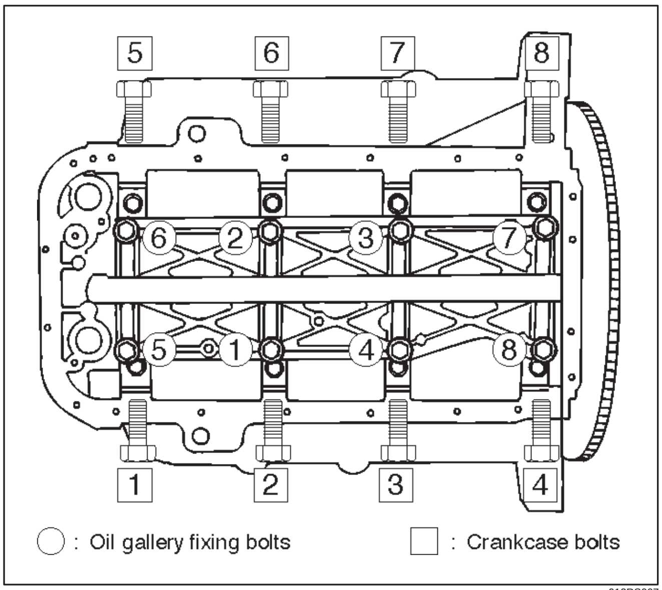


015RS020

6. Install oil gallery and tighten the bolts in 2 steps in the order shown.

1st step : 29 N·m (22 lb ft)

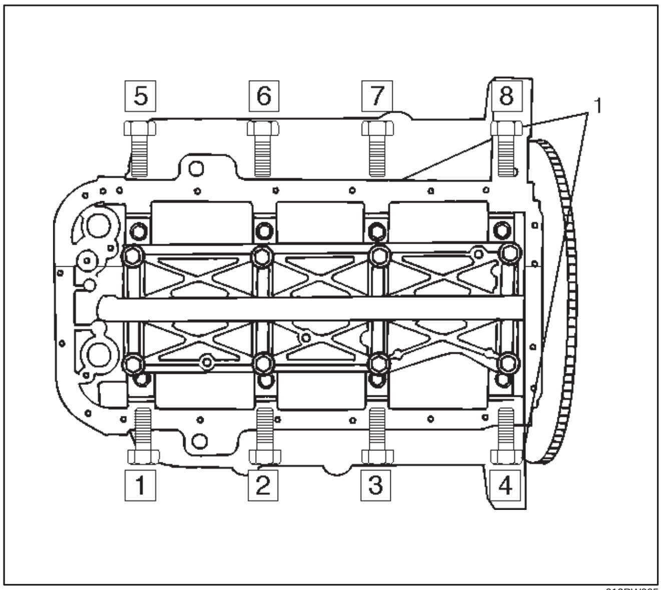
2nd step : 55° ~ 65°



012RS007

7. Install cylinder block side bolts (1) and tighten crankcase bolts in sequence shown in the illustration.

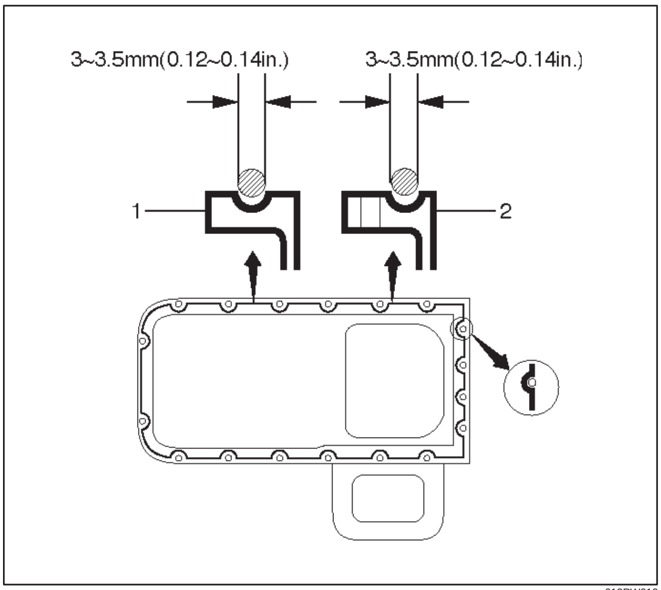
Torque : 39 N·m (29 lb ft)



012RW005

8. Install oil pump assembly. Refer to “Oil Pump” in this manual.
9. Install oil strainer and O-ring.
10. Install oil pipe and O-ring.
11. Install crankcase with oil pan.
    1. Completely remove all residual sealant, lubricant and moisture from the sealing surfaces. The surfaces must be perfectly dry.
    2. Apply a correct width bead of sealant (TB– 1207C or its equivalent) to the contact surfaces of the crankcase. There must be no gaps in the bead.
    3. The oil pan must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.
    4. Tighten the bolts and nuts to the specified torque.

Torque : 10 N·m (89 lb in)



013RW010

Legend

(1) Portion Between Both Holes
(2) Bolt Hole Portions

12. Install cylinder head gasket.
13. Install cylinder head assembly. Refer to “Cylinder Head” in this manual.

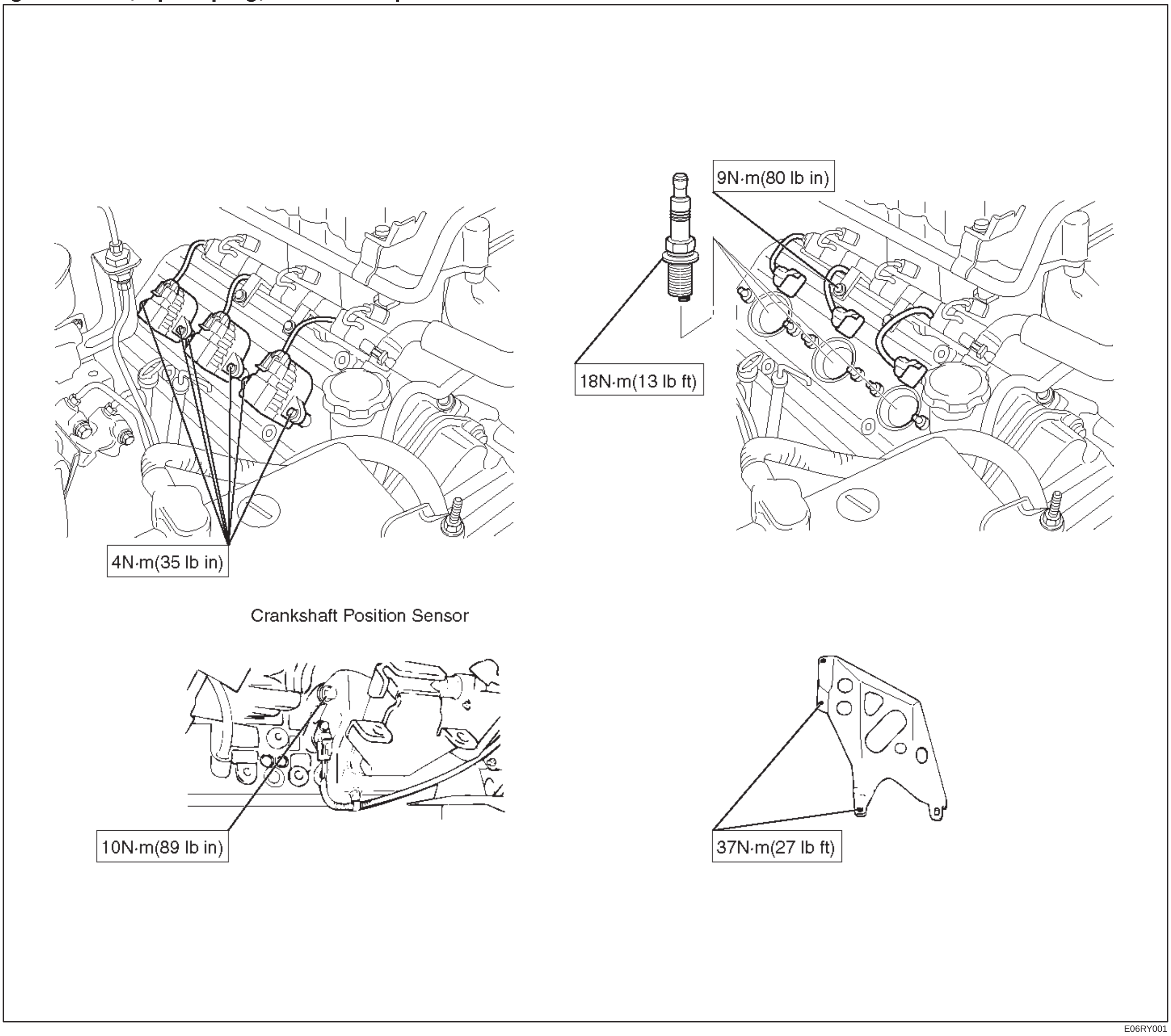
Main Data and Specification

General Specification

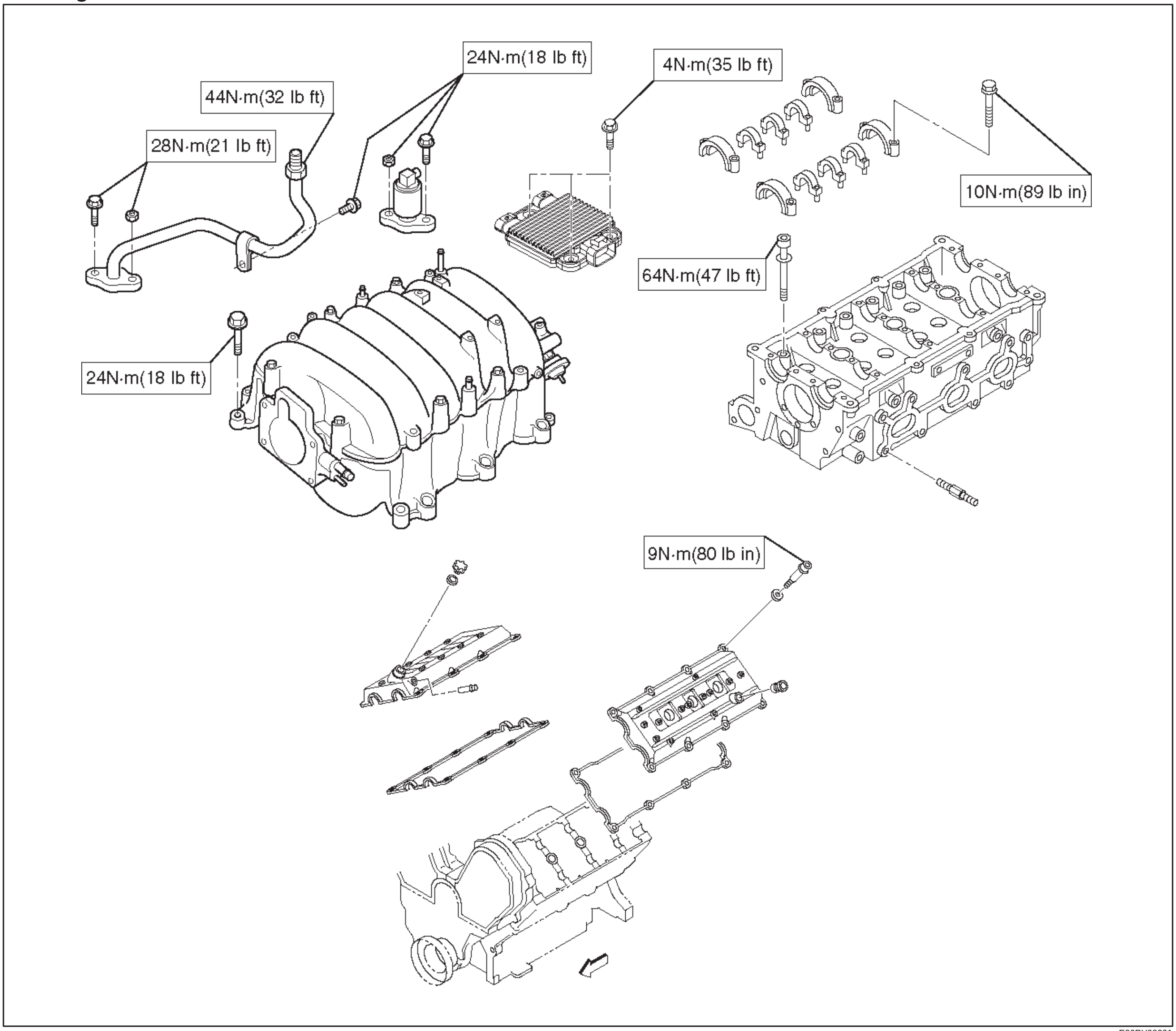
Item	Specifications
	6VE1
Engine type, number of cylinders and arrangement	Water cooled, four cycle V6
Form of combustion chamber	Pent roof type
Valve mechanism	4-Cams, 4-Valves, DOHC Gear & Belt Drive
Cylinder liner type	Casted in cylinder drive
Total piston displacement	3494 cc
Cylinder bore x stroke	93.4mm x 85.0mm (3.677 in x 3.346 in)
Compression ratio	9.1 : 1
Compression pressure at 300rpm	14.0 Kg/cm^2
Engine idling speed rpm	Non adjustable (750)
Valve clearance	Intake: 0.28 mm (0.11 in)
	Exhaust: 0.30mm (0.12in)
Oil capacity	5.3 liters
Ignition timing	Non adjustable (20° BTDC at idle rpm)
Spark plug	K16PR–P11, PK16PR11, RC10PYP4
Plug gap	1.0 mm–1.1 mm(0.0394 in – 0.0433 in)

Torque Specifications

Ignition coil, Spark plug, Crankshaft position sensor and Under cover



Cylinder head cover, Cylinder head, Camshaft bearing cap, Common chamber, EGR valve and EGR pipe, Ion sensing module



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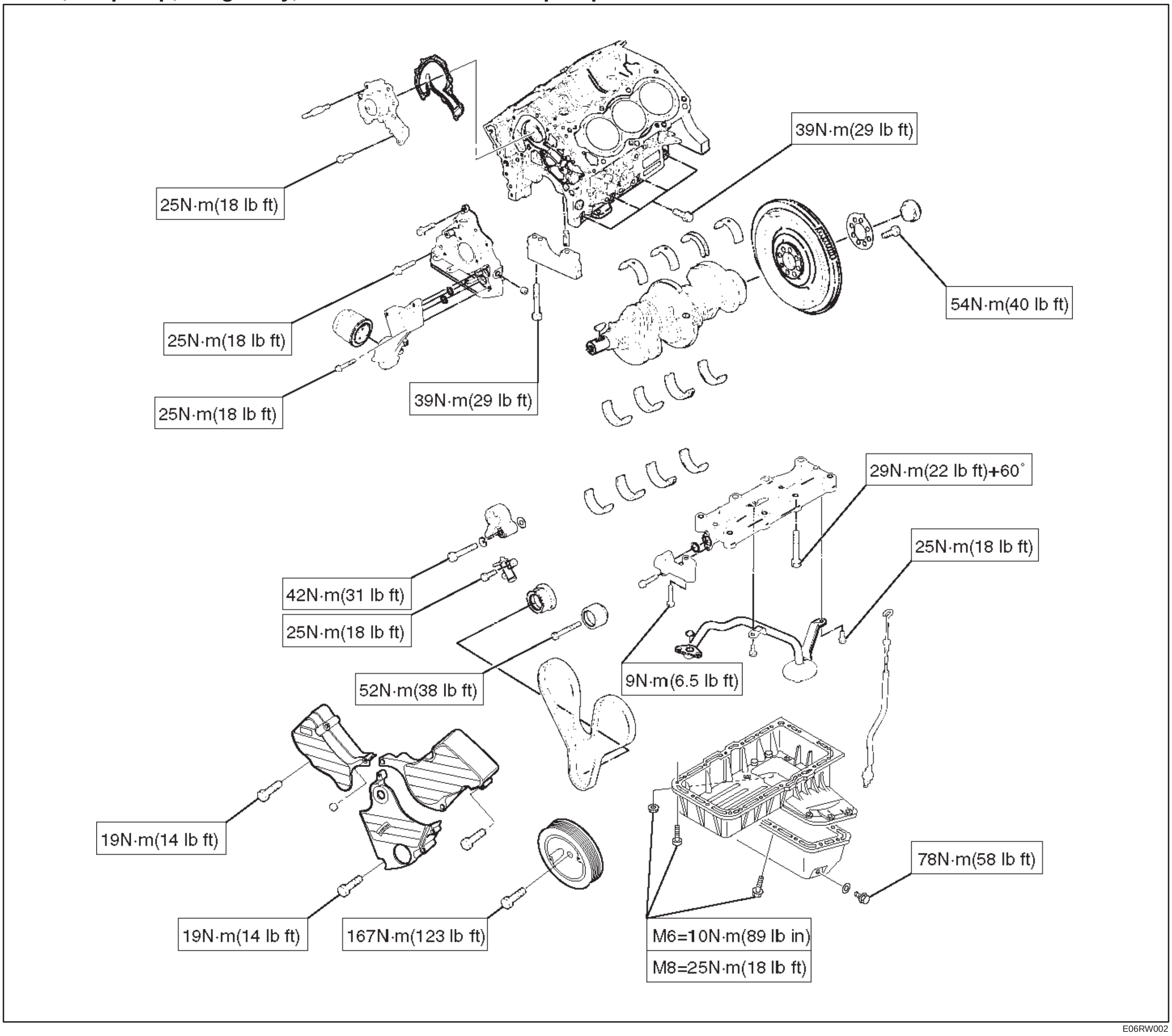
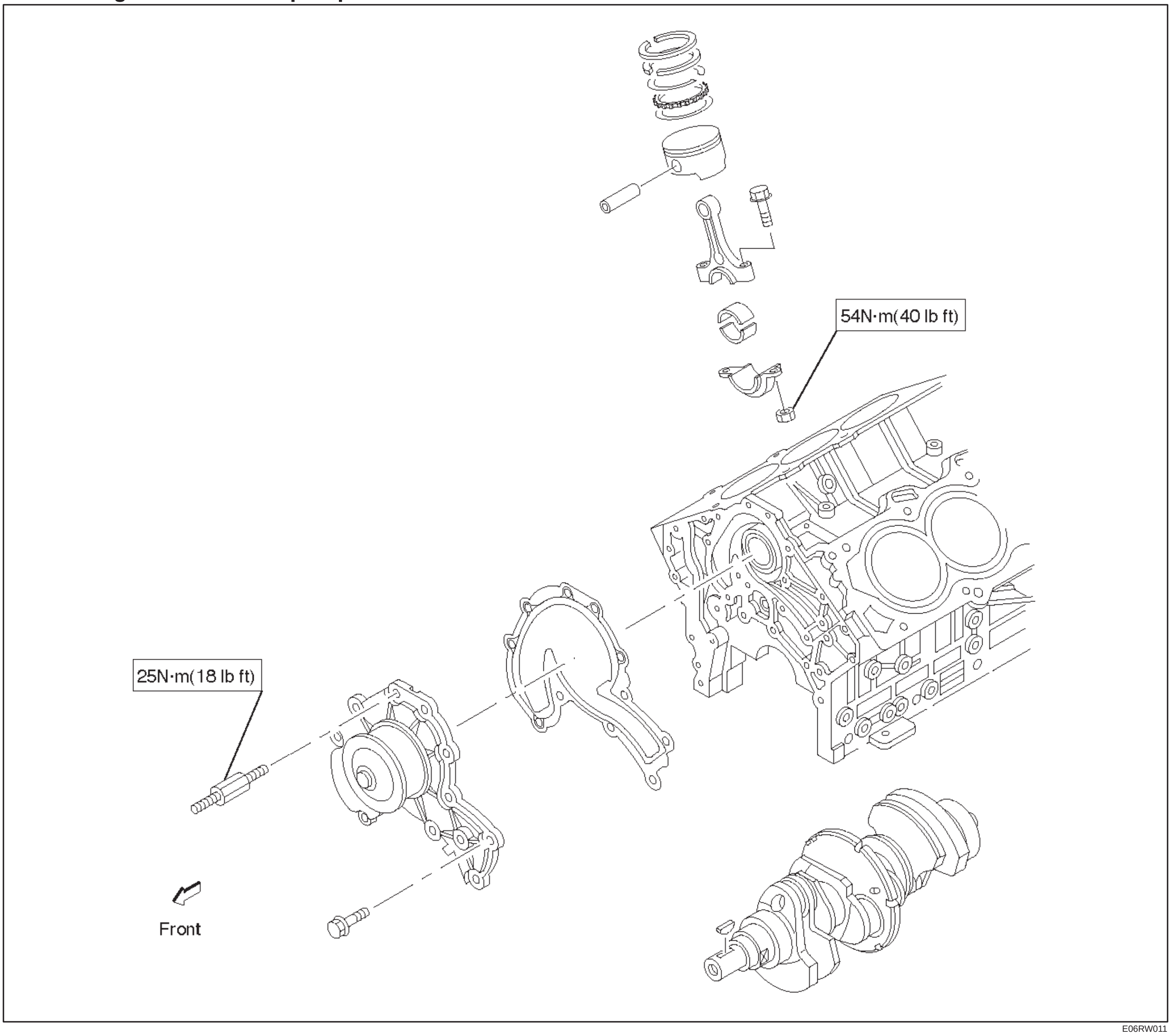
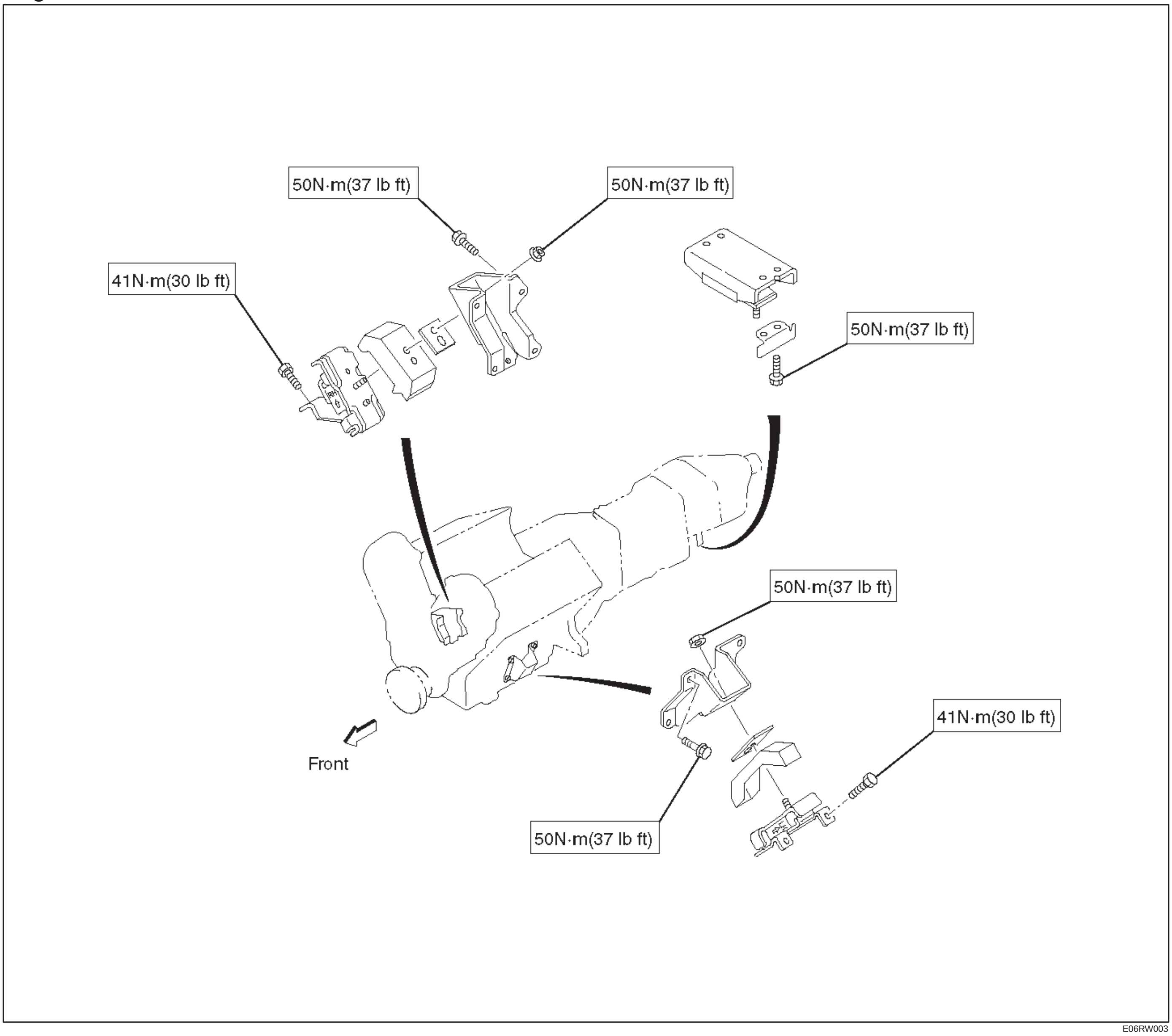
Crankshaft main bearing, Flywheel, Crankcase, Oil pan, Timing belt tensioner, Timing pulley, Timing belt cover, Oil pump, Oil gallery, Oil strainer and Water pump



Connecting rod and Water pump



Engine mount



Special Tool

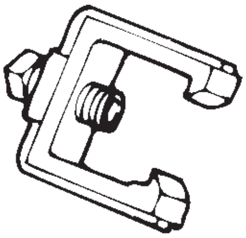
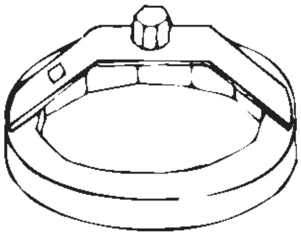
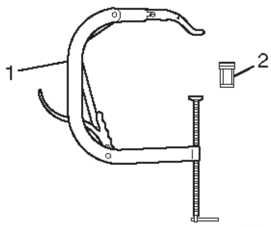
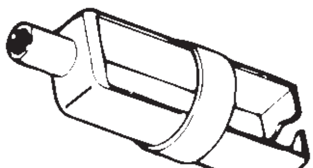
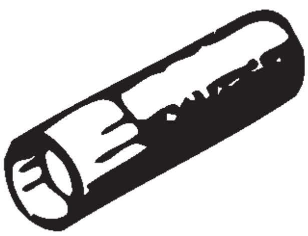
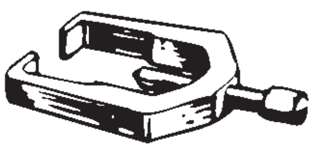
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–21687–02** Remover; tie rod end
	**J–36390** Wrench; Oil filter
	**J–8062** Compressor; Valve spring (1) **J–42898** Adapter; Compressor, Valve spring (2)
	**J–37281** Remover; Oil controller
	**J–38537** Installer; Oil controller
	**J–29107** Universal pitman arm puller

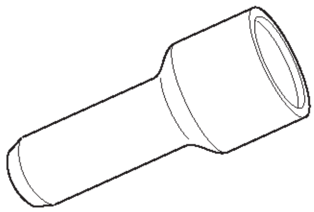
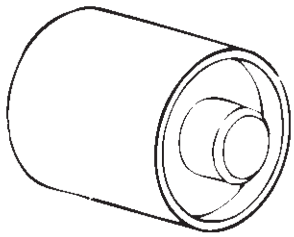
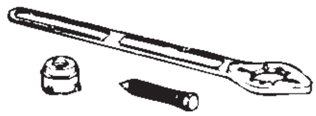
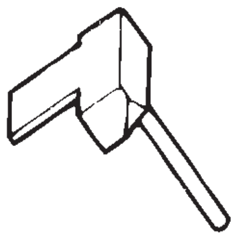
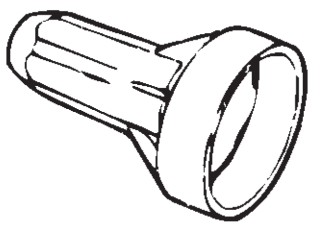
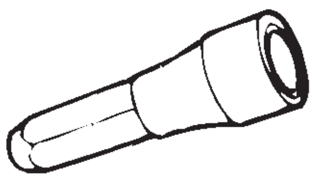
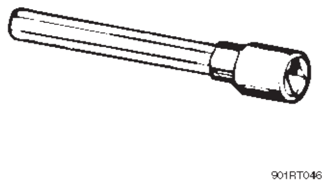
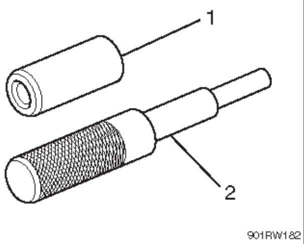
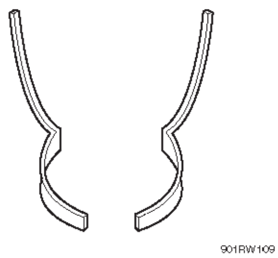
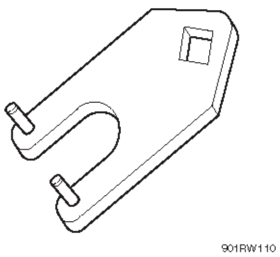
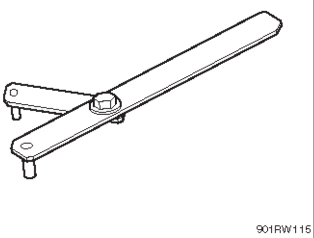
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–42985** Installer; Camshaft oil seal
	**J–39206** Installer; Pilot bearing
	**J–8614–01** Holder; Crankshaft
	**J–37228** Seal cutter
	**J–39201** Installer; Real oil seal
	**J–39202** Installer; Oil pump oil seal

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–24239–1** Cylinder head bolt wrench
	**J–42899** Replacer; Valve guide (1, 2) **J–42687** Installer; Valve guide (1) **J–37985–1** Remover; Valve guide (2)
	**J–42689** Adjusting Tool: Valve clearance
	**J–42686** Lever; Gear spring
	**J–43041** Holder; Universal

TROOPER

ENGINE

ENGINE COOLING

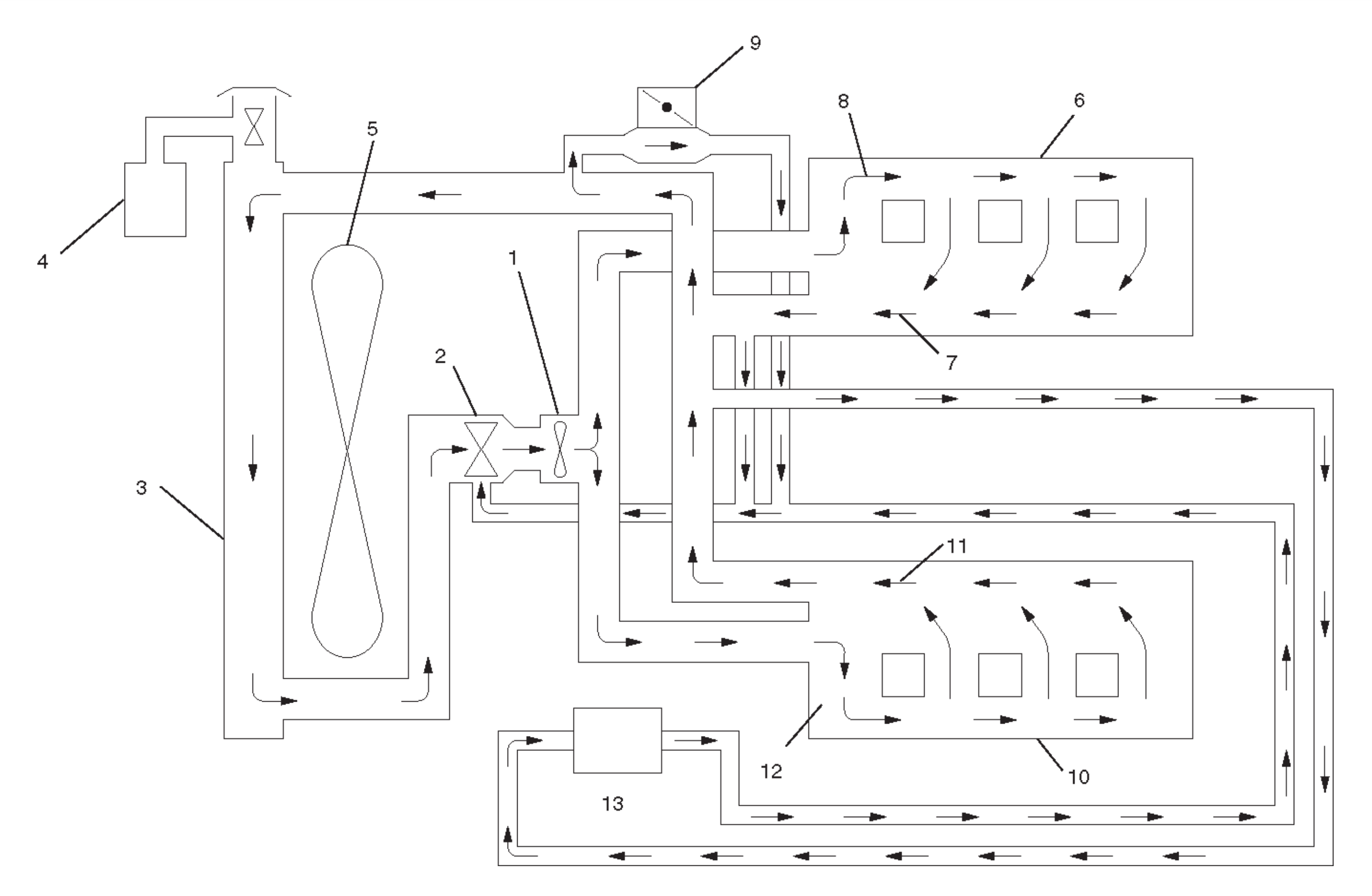
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



030RW001

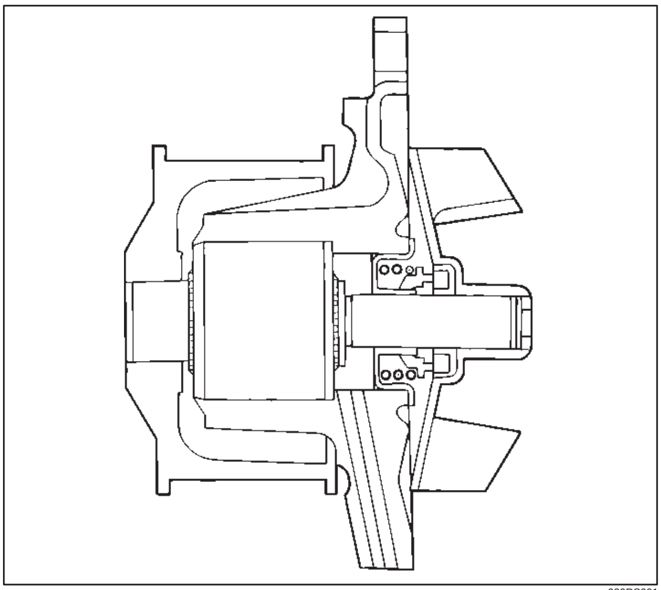
Legend

(1) Water Pump
(2) Thermostat
(3) Radiator
(4) Reserve Tank
(5) Cooling Fan
(6) Cylinder Block
(7) Cylinder Head
(8) Right Bank
(9) Throttle Body
(10) Cylinder Block
(11) Cylinder Head
(12) Left Bank
(13) Heater

The cooling system is a pressurized Engine Coolant (EC) forced circulation type which consists of a water pump, thermostat cooling fan, radiator and other components. The automatic transmission fluid is cooled by the EC in radiator.

Water Pump

The EC pump is a centrifugal impeller type and is driven by a timing belt.



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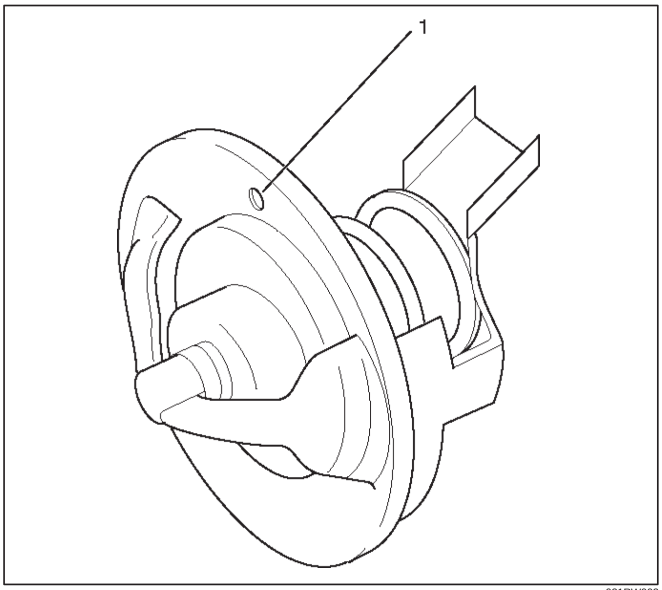
Thermostat

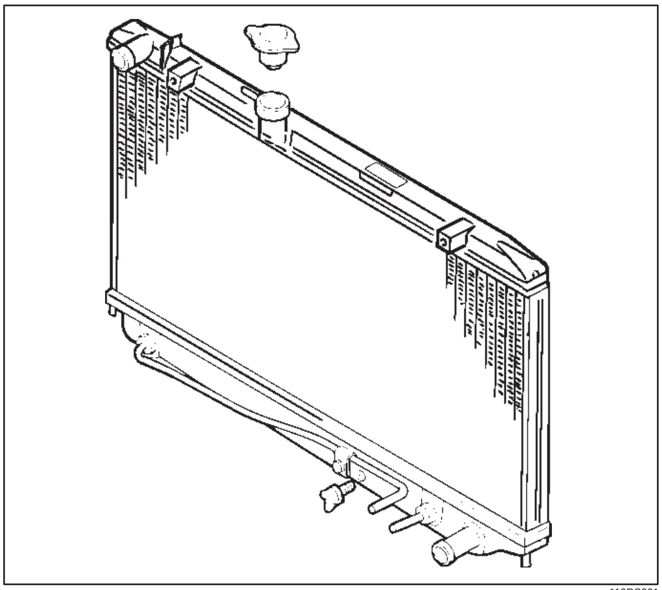
The thermostat is a wax pellet type with a air hole(1) and is installed in the thermostat housing.



031RW002

Radiator

The radiator is a tube type with corrugated fins. In order to raise the boiling point of the coolant, the radiator is fitted with a cap in which the valve is operated at 88.2 ~ 117.6 kPa (12.8 ~ 17.0 psi) pressure. (No oil cooler provided for M/T)



110RS001

Anti Freeze Solution

- Relation between the mixing ratio and freezing temperature of the EC varies with the ratio of anti–freeze solution in water. Proper mixing ratio can be determined by referring to the chart. Supplemental inhibitors or additives claiming to increase cooling capability that have not been specifically approved by Isuzu are not recommended for addition to the cooling system.
- Calculating mixing ratio

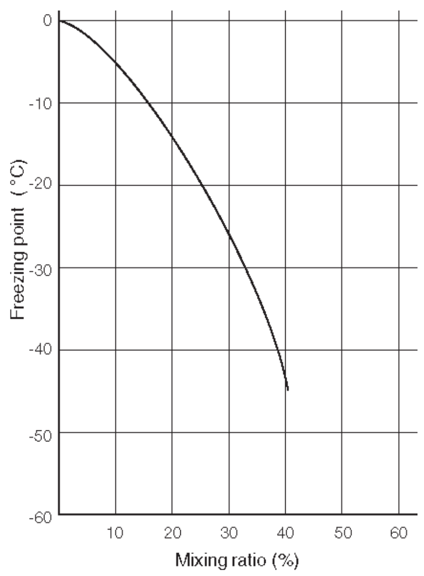
Mixing ratio

$$= \frac{\text{Antifreeze solution (Lit/gal.)}}{\text{Antifreeze solution (Lit/gal.)} + \text{Water (Lit/gal.)}}$$

F06RW005

NOTE: Antifreeze solution + Water = Total cooling system capacity.

- **Total Cooling System Capacity**
- **M/T 8.8Lit (2.32Us gal)**
- **A/T 8.4Lit (2.22Us gal)**



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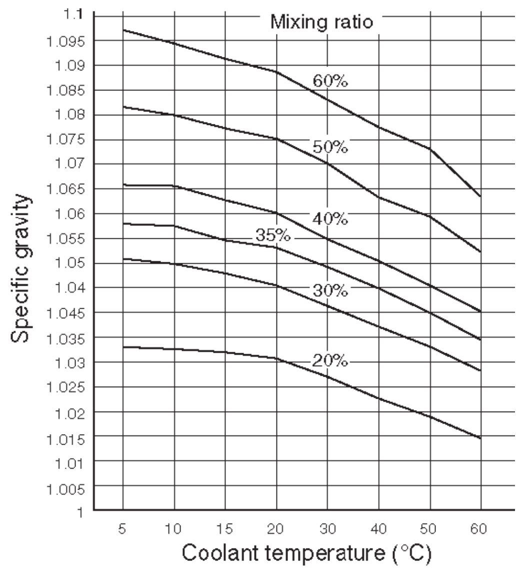


B06RW003

- Mixing ratio

  Check the specific gravity of engine coolant in the cooling system temperature ranges from 0°C to 50°C using a suction type hydrometer, then determine the density of the engine coolant by referring to the table.

NOTE:

1. Even in the areas where the atmospheric temperature is higher than 0°C, be sure not to use antifreeze solution at a mixing ratio lower than 20% so that the inside of the engine may not be corroded.
2. If antifreeze solution is used at a mixing ratio higher than 60%, the specific heat of the coolant falls and the engine may be overheated. Moreover, antifreeze performance drop and the coolant may be frozen. The density of the solution must be adjusted as occasion calls.

Antifreeze solution lower than 20% may not have sufficient anticorrosive performance, and therefore, please never fail to adjust as occasion demands within the range of 20% to 60%.

Diagnosis

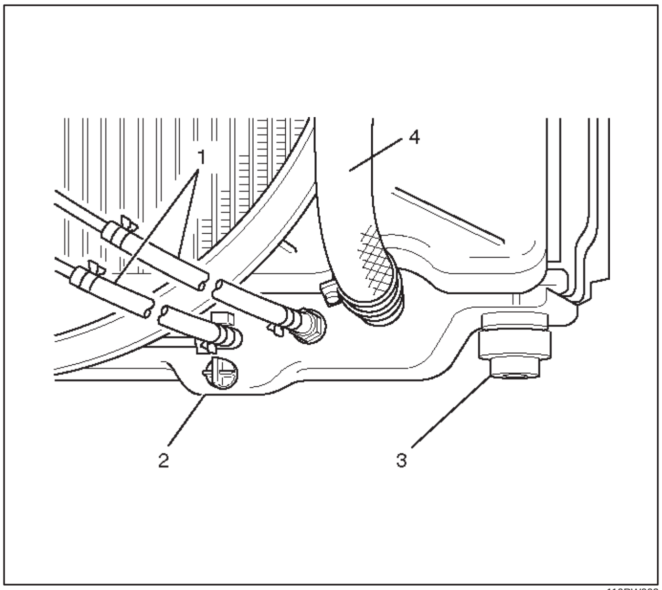
Engine Cooling Trouble

Condition	Possible cause	Correction
Engine overheating	Low Engine Coolant level	Replenish
	Incorrect fan installed	Replace
	Thermo meter unit faulty	Replace
	Faulty thermostat	Replace
	Faulty Engine Coolant temperature sensor	Repair or replace
	Clogged radiator	Clean or replace
	Faulty radiator cap	Replace
	Low engine oil level or use of improper engine oil	Replenish or change oil
	Clogged exhaust system	Clean exhaust system or replace faulty parts
	Faulty Throttle Position sensor	Replace throttle valve assembly
	Open or shorted Throttle Position sensor circuit	Repair or replace
	Damaged cylinder head gasket	Replace
Engine overcooling	Faulty thermostat	Replace
Engine slow to warm–up	Faulty thermostat	Replace
	Thermo unit faulty	Replace

Draining and Refilling Cooling System

Before draining the cooling system, inspect the system and perform any necessary service to ensure that it is clean, does not leak and is in proper working order. The engine coolant (EC) level should be between the “MIN” and “MAX” lines of reserve tank when the engine is cold. If low, check for leakage and add EC up to the “MAX” line. There should not be any excessive deposit of rust or scales around the radiator cap or radiator filler hole, and the EC should also be free from oil.
Replace the EC if excessively dirty.

1. Completely drain the cooling system by opening the drain plug (2) at the bottom of the radiator.



110RW002

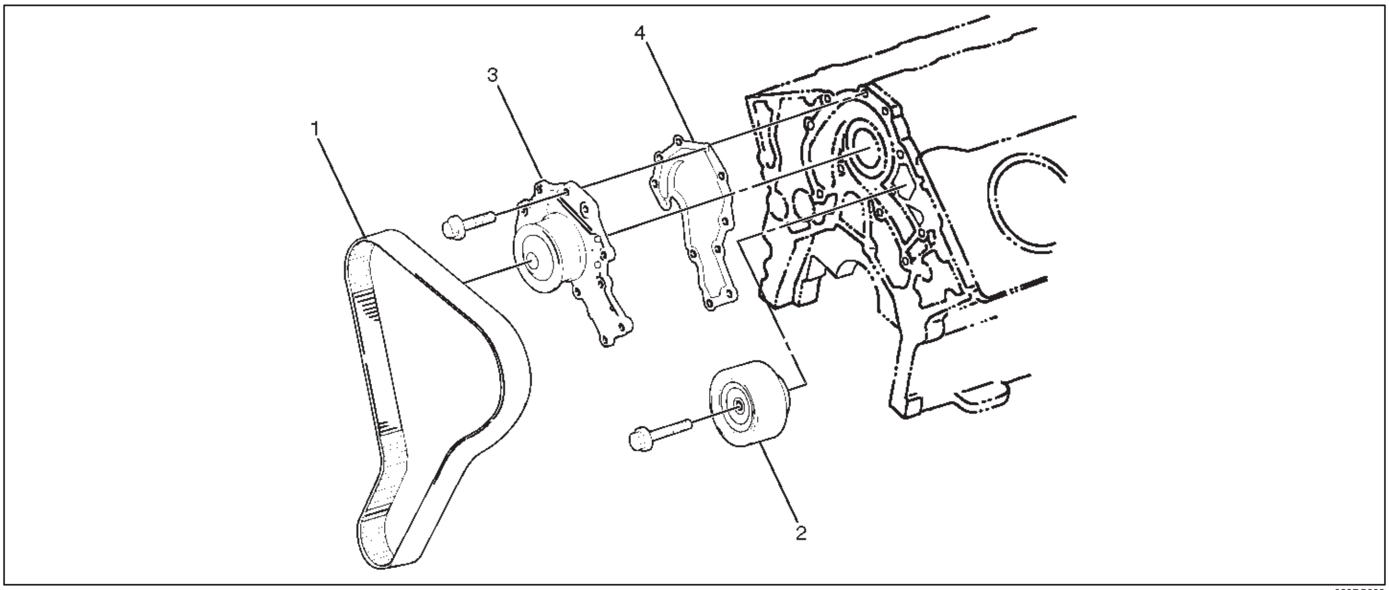
2. Remove the radiator cap.

WARNING: TO AVOID THE DANGER OF BEING BURNED, DO NOT REMOVE THE CAP WHILE THE ENGINE AND RADIATOR ARE STILL HOT. SCALDING FLUID AND STEAM CAN BE BLOWN OUT UNDER PRESSURE.

3. Disconnect all hoses from the EC reserve tank.
   Scrub and clean the inside of the reserve tank with soap and water. Flush it well with clean water, then drain it. Install the reserve tank and hoses.
4. Refill the cooling system with the EC using a solution that is at least 50 percent antifreeze but no more than 70 percent antifreeze.
5. Fill the radiator to the base of the filler neck.
   Fill the EC reserve tank to “MAX” line when the engine is cold.
6. Block the drive wheels and firmly apply the parking brake. Shift an automatic transmission to “P” (Park) or a manual transmission to neutral.
7. Remove the radiator cap. Start the engine and warm it up at 2,500 ~ 3,000 rpm for about 30 minutes.
8. When the air comes out from the radiator filler neck and the EC level has gone down, replenish with the EC. Repeat this procedure until the EC level does not go down. Then stop the engine and install the radiator cap. Let the engine cool down.
9. After the engine has cooled, replenish with EC up to the “MAX” line of the reserve tank.
10. Start the engine. With the engine running at 3,000 rpm, make sure there is no running water sound from the heater core (behind the center console).
11. If the running water sound is heard, repeat steps 8 to 10.

Water Pump

Water Pump and Associated Parts



Legend
(1) Timing Belt
(2) Idle Pulley
(3) Water Pump Assembly
(4) Gasket

Removal

1. Disconnect battery ground cable.
2. Drain coolant.
3. Radiator hose (on inlet pipe side).
4. Remove timing belt. Refer to “Timing Belt” in this manual.
5. Remove Idle pulley.
6. Remove water pump assembly.
7. Remove gasket.

Inspection

Make necessary repair and parts replacement if extreme wear or damage is found during inspection. Should any of the following problems occur, the entire water pump assembly must be replaced:

- Crack in the water pump body
- EC leakage from the seal unit
- Play or abnormal noise in the bearing
- Cracks or corrosion in the impeller.

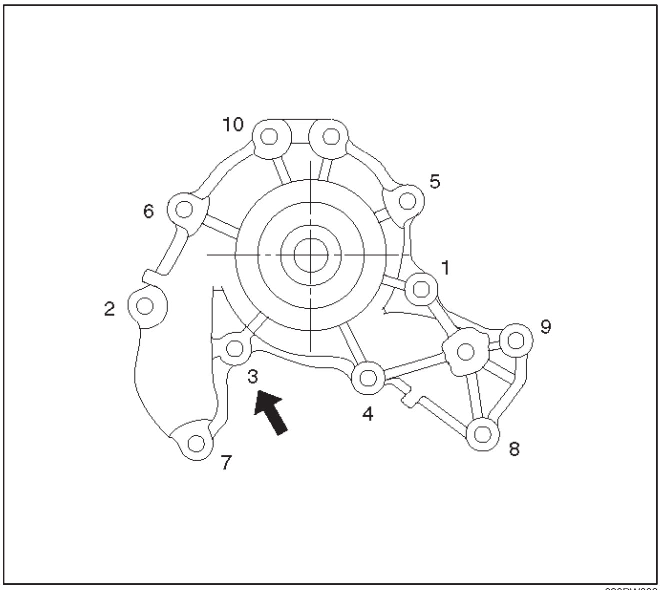
Installation

1. Install gasket, clean the mating surface of gasket before installation.
2. Install water pump assembly and tighten bolts to the specified torque.

   Torque: 25 N·m (18 lb ft)

   - Tightening order
     The tightening order are in the illustrate.

NOTE: To prevent the oil leakage, apply the LOCTITE 262 or an equivalent, to the arrow marked fixing bolt thread.

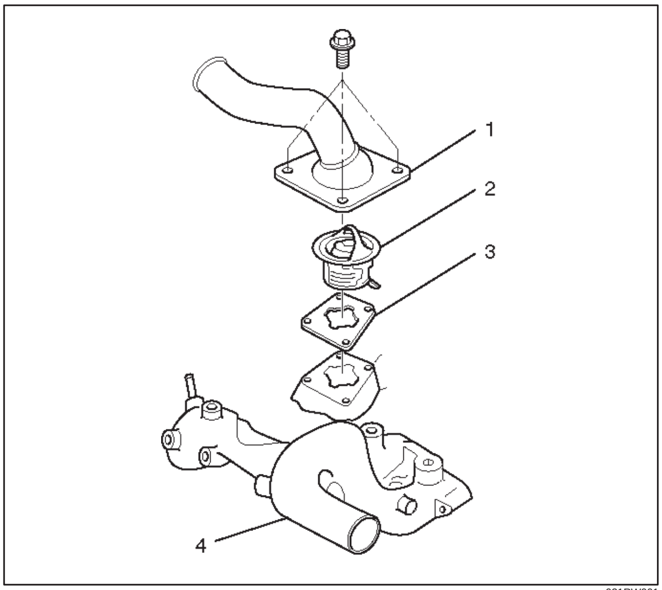


3. Idle pulley
   - Install idle pulley and tighten bolt to the specified torque.

   Torque: 52 N·m (38 lb ft)
4. Timing belt
   - Install timing belt. Refer to timing belt installation step in “Timing Belt” in this manual.
5. Connect radiator inlet hose and replenish EC.
6. Connect battery ground cable.

Thermostat

Thermostat and Associated Parts



Legend

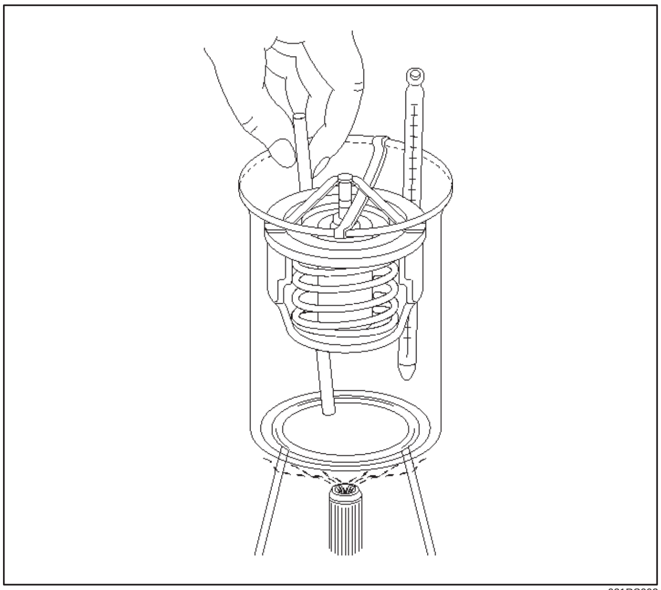
(1) Thermostat Housing
(2) Thermostat
(3) Outlet Pipe

Removal

1. Disconnect battery ground cable.
2. Drain engine coolant from the radiator and engine.
3. Disconnect radiator hose from the inlet pipe.
4. Remove thermostat housing.
5. Remove thermostat(2).

Inspection

Suspend the thermostat in a water–filled container using thin wire. Place a thermometer next to the thermostat. Do not directly heat the thermostat.
Gradually increase the water temperature. Stir the water so that the entire water is same temperature.



Confirm the temperature when the valve first begins to open.

Valve opening temperature 74.5C ~ 78.5˚C (166.1˚F ~ 173.3˚F)

Confirm the temperature when the valve is fully opened.

Valve full open temperature and lift More than 8.5mm (0.33 in) at 90˚C (194˚F)

Make necessary repair and parts replacement if extreme wear or damage is found during inspection.

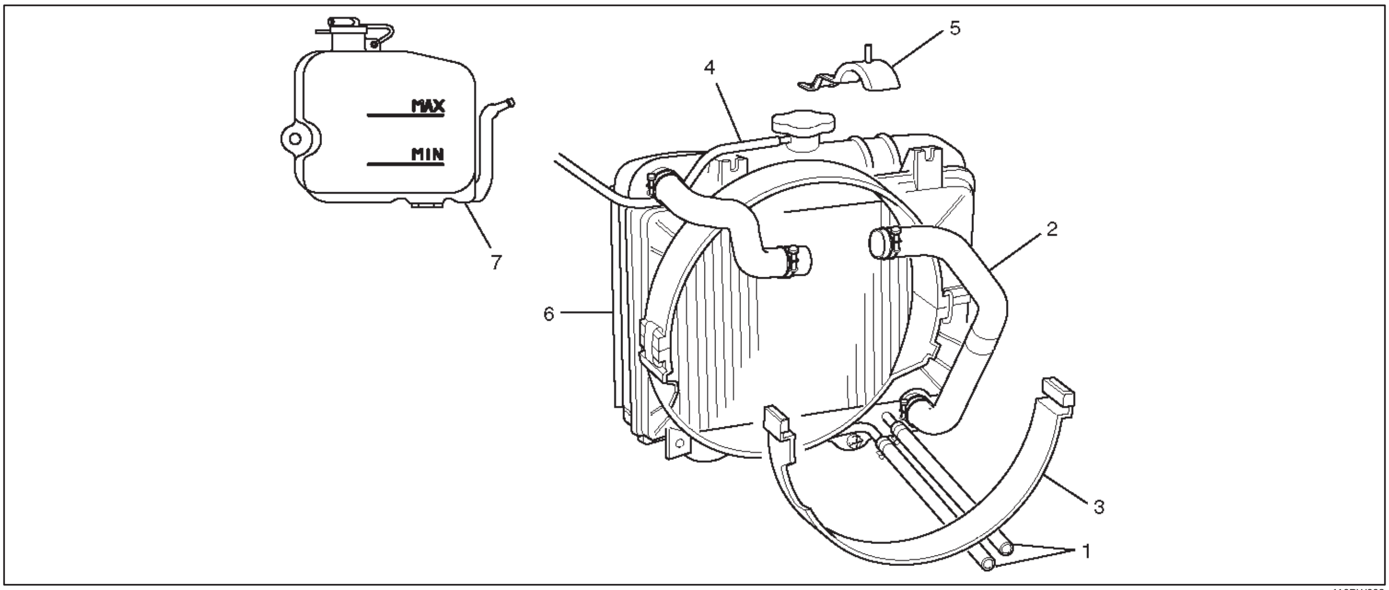
Installation

1. Install thermostat into the outlet pipe(4) making sure that the air hole is in the up position.
2. Install thermostat housing and tighten bolts to the specified torque.

   Torque: 25 N·m (18 lb ft)
3. Installation rubber hose.
4. Replenish engine coolant (EC).
5. Start engine and check for EC leakage.

Radiator

Radiator and Associated Parts



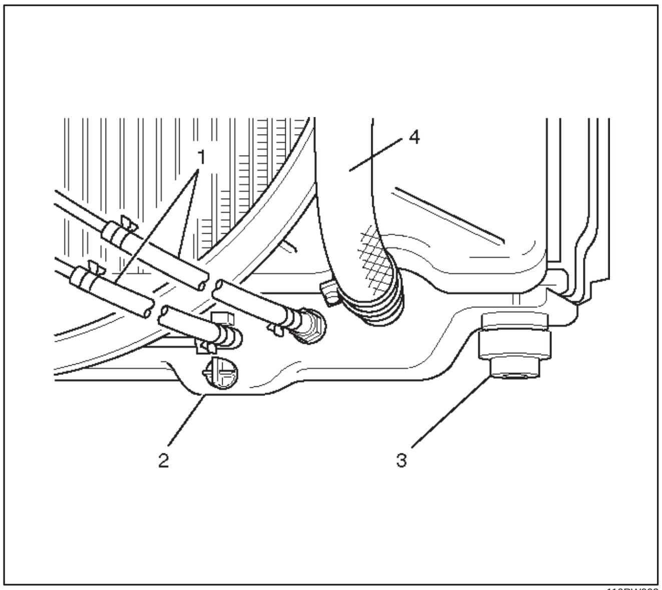
110RW003

Legend

(1) Oil Cooler Hose For Automatic Transmission
(2) Radiator Hose
(3) Fan Guide, Lower
(4) Reserve Tank Hose
(5) Bracket
(6) Radiator Assembly
(7) Reserve Tank

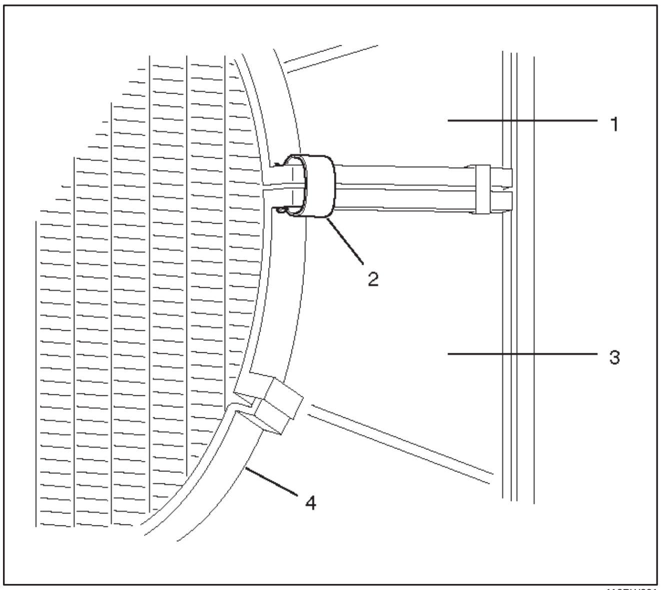
Removal

1. Disconnect battery ground cable.
2. Loosen a drain plug(2) to drain EC.
3. Disconnect oil cooler hose(1) on automatic transmission (A/T).
4. Disconnect radiator inlet hose and outlet hose from the engine.



110RW002

5. Remove fan guide(1), clips(3) on both sides and the bottom lock, then remove lower fan guide(3) with fan shroud(4).



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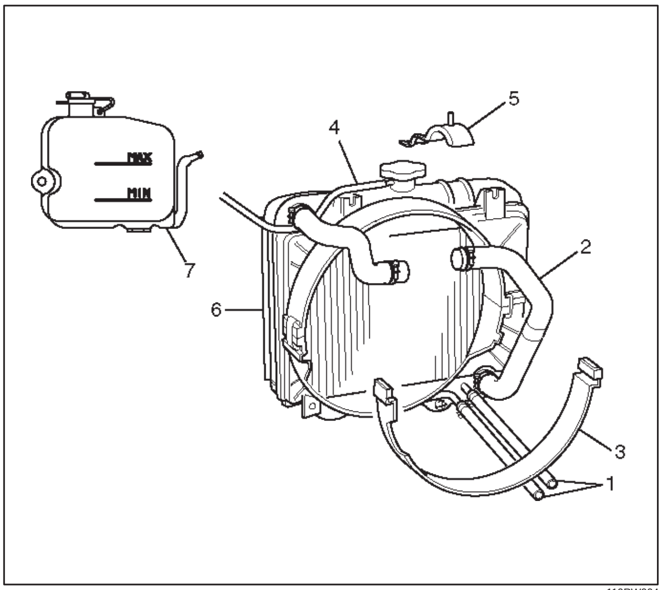
6. Disconnect the reserve tank hose(4) from radiator.
7. Remove bracket(5).



110RW004

8. Lift up and remove the radiator assembly with hose, taking care not to damage the radiator core with a fan blade.
9. Remove rubber cushions on both sides at the bottom.

Inspection

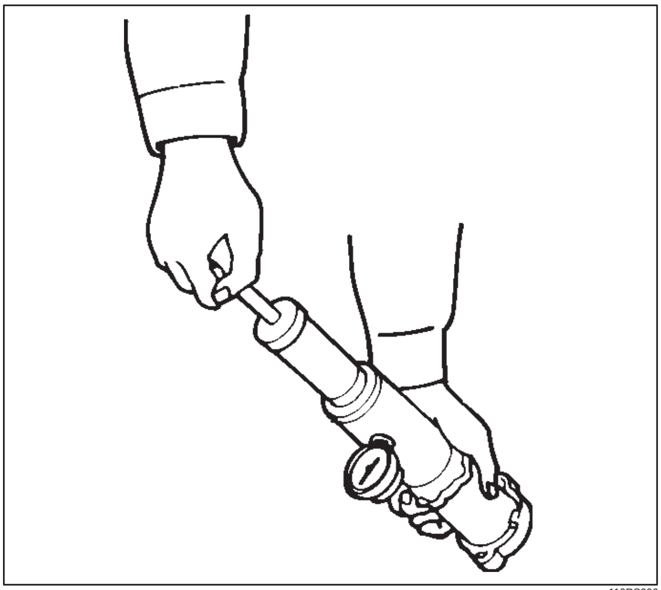
Radiator Cap

Measure the valve opening pressure of the pressurizing valve with a radiator filler cap tester.
Replace the cap if the valve opening pressure is outside the standard range.

Valve opening pressure kPa (psi) 88.3 ~ 117.7 (12.8 ~17.1)

Cap tester: J–24460–01
Adapter: J–33984–A
Check the condition of the vacuum valve in the center of the valve seat side of the cap. If considerable rust or dirt is found, or if the valve seat cannot be moved by hand, clean or replace the cap.

Valve opening vacuum kPa (psi) 1.96 ~ 4.91 (0.28 ~ 0.71)



110RS006

Radiator Core

1. A bent fin may result in reduced ventilation and overheating may occur. All bent fins must be straightened. Pay close attention to the base of the fin when it is being straightened.
2. Remove all dust, bugs and other foreign material.

Flushing the Radiator

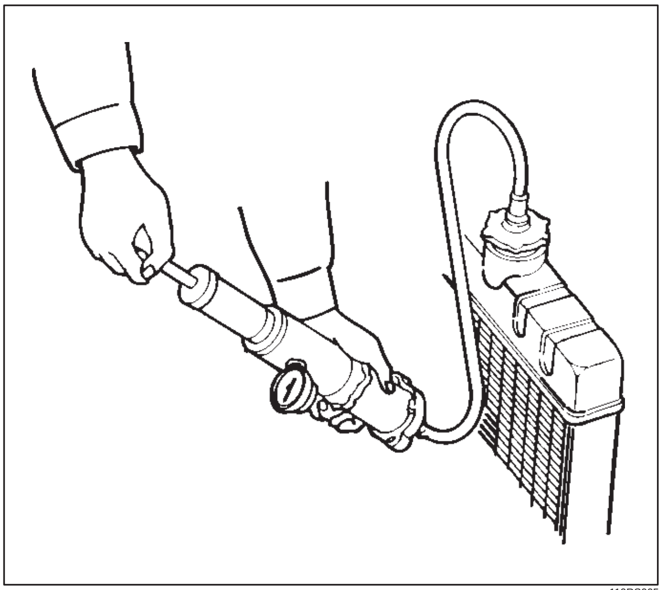
Thoroughly wash the inside of the radiator and the engine coolant passages with cold water and mild detergent. Remove all signs of scale and rust.

Cooling System Leakage Check

Use a radiator cap tester to force air into the radiator through the filler neck at the specified pressure of 196 kPa (28.5 psi) with a cap tester:

- Leakage from the radiator
- Leakage from the coolant pump
- Leakage from the water hoses
- Check the rubber hoses for swelling.

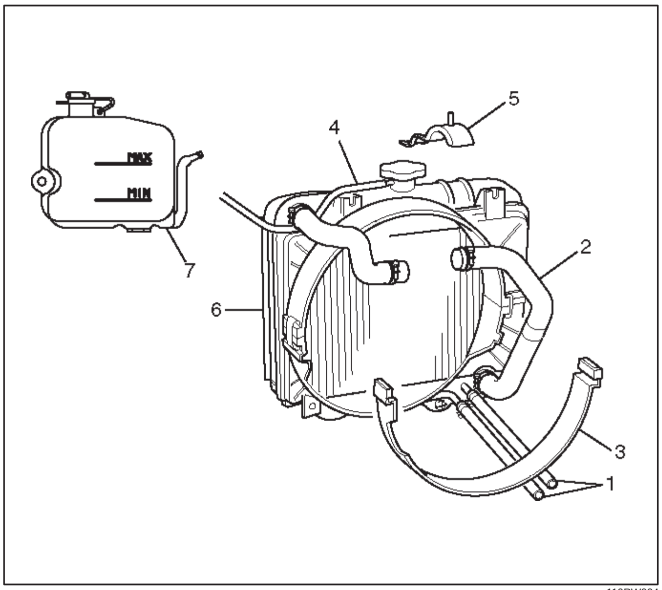
Cap tester: J–24460–01
Adapter: J–33984–A



110RS005

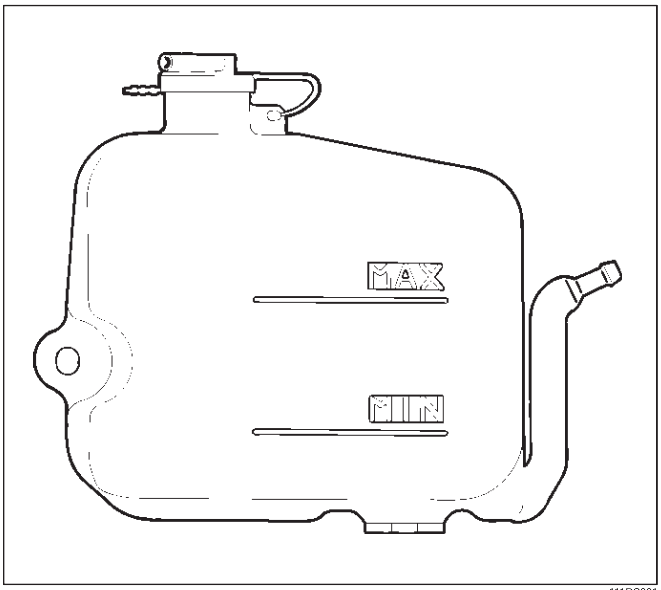
Installation

1. Install rubber cushions on both sides of radiator bottom.
2. Install radiator assembly with hose, taking care not to damage the radiator core with a fan blade.
3. Install bracket (6) and support the radiator upper tank with the bracket (5) and secure the radiator.
4. Connect reserve tank hose (4).
5. Install lower fan guide (3).
6. Connect radiator inlet hose and outlet hose to the engine.
7. Connect oil cooler hose (1) to automatic transmission.



110RW004

8. Connect battery ground cable.
9. Pour engine coolant up to filler neck of radiator, and up to MAX mark of reserve tank.



111RS001

Important operation (in case of 100% engine coolant change) procedure for filling with engine coolant.

Engine Coolant Filling Up Procedure

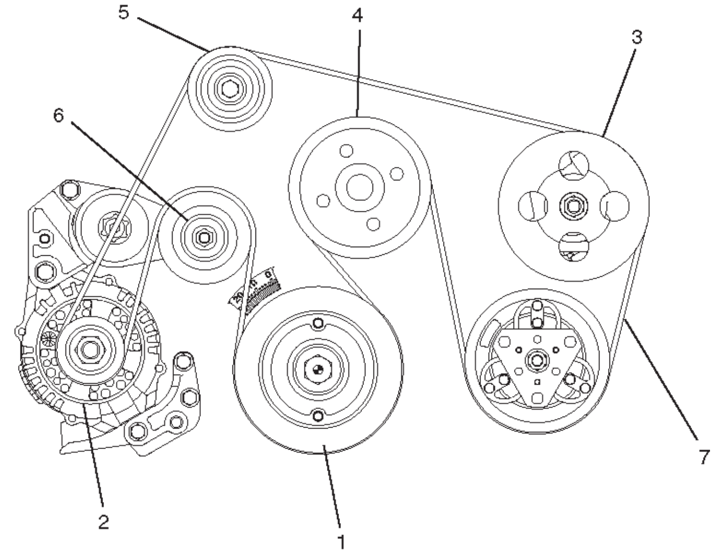
1. Make sure that the engine is cool.

WARNING: WHEN THE COOLANT IS HEATED TO A HIGH TEMPERATURE, BE SURE NOT TO LOOSEN OR REMOVE THE RADIATOR CAP. OTHERWISE YOU MIGHT GET SCALDED BY HOT VAPOR OR BOILING WATER. TO OPEN THE RADIATOR CAP, PUT A PIECE OF THICK CLOTH ON THE CAP AND LOOSEN THE CAP SLOWLY TO REDUCE THE PRESSURE WHEN THE COOLANT HAS BECOME COOLER.

2. Open radiator cap pour coolant up to filler neck.
3. Pour coolant into reservoir tank up to “MAX” line.
4. Tighten radiator cap and start the engine. After idling for 2 to 3 minutes, stop the engine and reopen radiator cap. If the water level is lower, replenish.
5. After replenish the coolant tighten radiator cap, warm up the engine at about 2000 rpm. Set heater adjustment to the highest temperature position, and let the coolant circulate also into heater water system.
6. Check to see the thermometer, continuously idling 5 minutes and stop the engine.
7. When the engine has been cooled, check filler neck for water level and replenish if required. Should extreme shortage of coolant is found, check the coolant system and reservoir tank hose for leakage.
8. Pour coolant into the reservoir tank up to “MAX” line.

Drive Belt and Cooling Fan

Drive Belt and Associated Parts



015RW005

Legend

(1) Crankshaft Pulley
(2) Generator
(3) Power Steering Pump
(4) Water Pump and Cooling Fan Pulley
(5) Idle Pulley
(6) Tension Pulley
(7) Drive Belt

The drive belt adjustment is not required as automatic drive belt tensioner is equipped.

Inspection

Check drive belt for wear or damage, and replace with a new one as necessary.

Installation

Install cooling fan assembly and tighten bolts/nuts to the specified torque.

Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.

Torque : 10 N·m (88.5 lb in) for fan and clutch assembly.

NOTE: Fan belts for 6VE1 Gasoline Engine mounted on 98MY Trooper (UX) have been brought into one. As a result, the rotating direction of a fan belt is opposite to the direction of cooling fan for 92 to 97MY 6VD1 with no interchangeability.

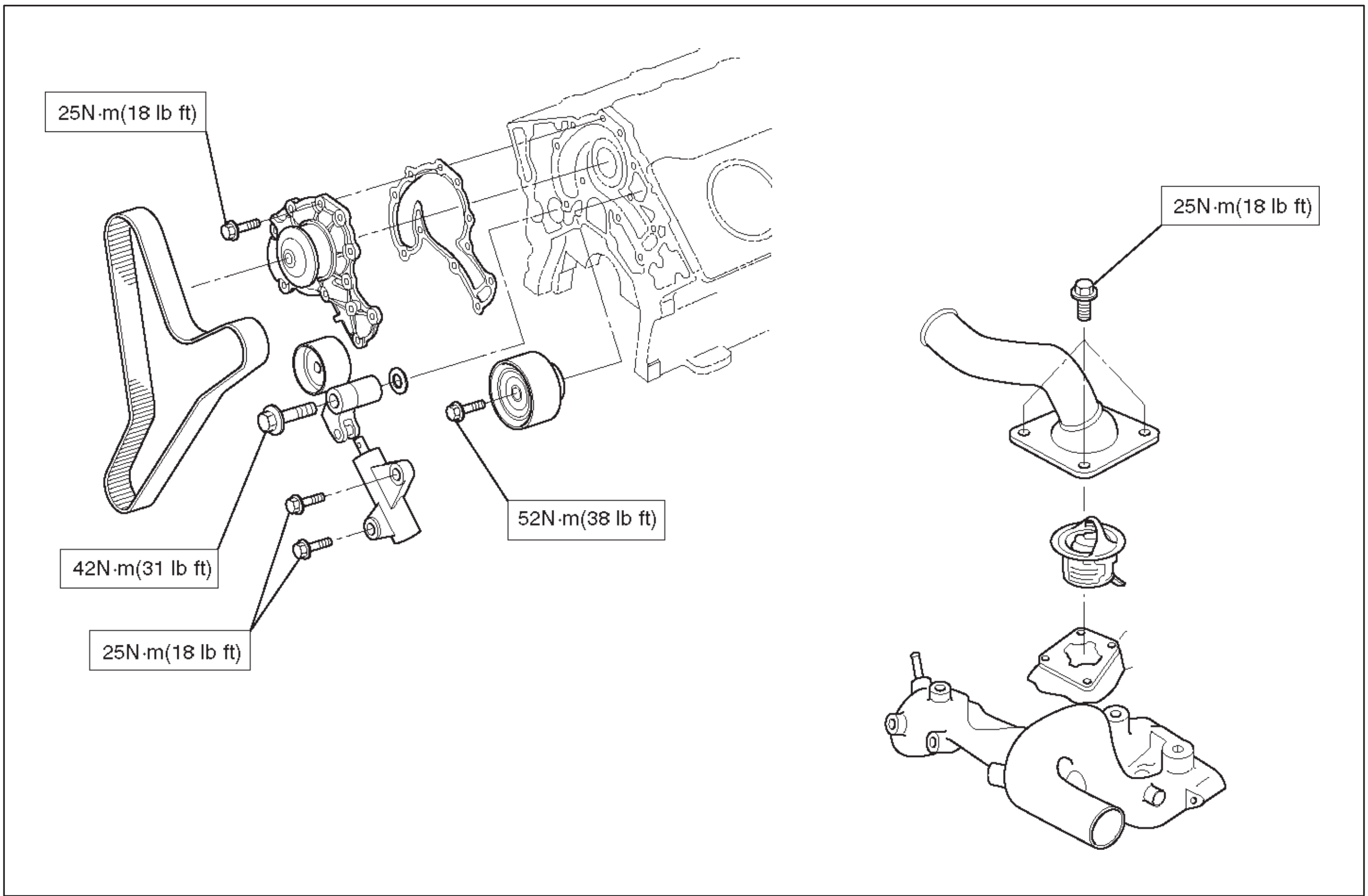
Therefore, incorrect installation of a fan may cause the air for cooling to flow in the opposite direction, this resulting in the poor performance of the air-conditioner and a rise temperature in engine cooling water.

Main Data and Specifications

General Specifications

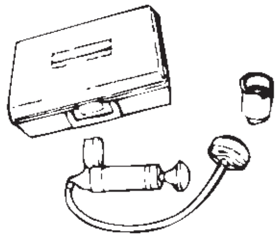
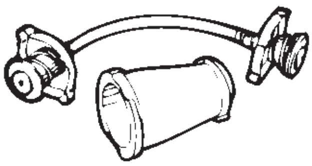
	M/T	A/T
Cooling system	Engine coolant forced circulation	
Radiator	(1 tube in row) Tube type corrugated (2 tube in row)	
Heat radiation capacity	68,000 kcal/h	77,000 kcal/h
Heat radiation area	9.445m2 (0.878ft2)	11.21m2 (1.04ft2)
Radiator front area	0.302m2 (0.028ft2)	
Radiator dry weight	39N (8.8lb)	44N (9.9lb)
Radiator cap valve opening pressure	93.3 ~ 122.7kpa (13.5 ~ 17.8psi)	
Engine coolant capacity	2.5lit (2.6U.S q.t.)	2.4lit (16.3U.S q.t.)
Engine coolant pump	Centrifugal impeller type	
Delivery	300 (317) or more	
Pump speed	5000 ± 50 rpm	
Thermostat	Wax pellet type with air hole	
Valve opening temperature	74.5 ~ 78.5˚C (166.1 ~ 173.3˚F)	
Engine coolant total capacity	10.4lit (11.0U.S qt)	10.5lit (11.1U.S qt)

Torque Specifications



E06RW004

Special Tool

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–24460–01** Tester; radiator cap
	**J–33984–A** Adapter; radiator cap

TROOPER

ENGINE

ENGINE FUEL

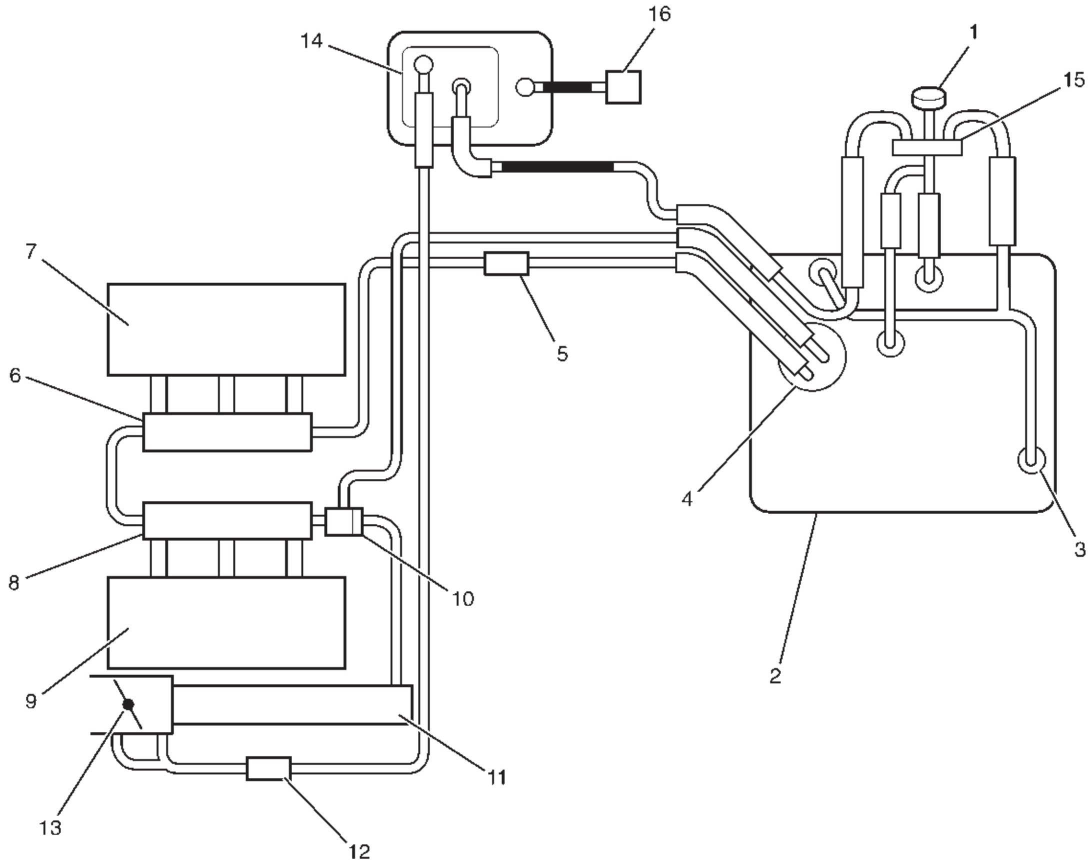
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



140RY00002

Legend

(1) Fuel Filler Cap
(2) Fuel Tank
(3) Rollover Valve
(4) Fuel Pump (Fuel Level Sending Unit/Fuel Tank Pressure Sensor)
(5) Fuel Filter
(6) Fuel Rail Right
(7) Right Bank
(8) Fuel Rail Left
(9) Left Bank
(10) Fuel Pressure Control Valve
(11) Common Chamber
(12) Duty Solenoid Valve
(13) Throttle Valve
(14) Canister
(15) Evaporation Shut Off Valve
(16) Vent Solenoid Cut Valve

When working on the fuel system, there are several things to keep in mind:

- Any time the fuel system is being worked on, disconnect the negative battery cable except for those tests where battery voltage is required.
- Always keep a dry chemical (Class B) fire extinguisher near the work area.
- Replace all pipes with the same pipe and fittings that were removed.
- Clean and inspect “O” rings. Replace if required.
- Always relieve the line pressure before servicing any fuel system components.
- Do not attempt repairs on the fuel system until you have read the instructions and checked the pictures relating to that repair.

- Adhere to all Notices and Cautions.

All gasoline engines are designed to use only unleaded gasoline. Unleaded gasoline must be used for proper emission control system operation.

Its use will also minimize spark plug fouling and extend engine oil life. Using leaded gasoline can damage the emission control system and could result in loss of emission warranty coverage.

All cars are equipped with an Evaporative Emission Control System. The purpose of the system is to minimize the escape of fuel vapors to the atmosphere.

Fuel Metering

The Engine Control Module (ECM) is in complete control of this fuel delivery system during normal driving conditions.

The intake manifold function, like that of a diesel, is used only to let air into the engine. The fuel is injected by separate injectors that are mounted over the intake manifold.

The Manifold Absolute Pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load and speed changes, which the MAP sensor converts to a voltage output.

This sensor generates the voltage to change corresponding to the flow of the air drawn into the engine. The changing voltage is transformed into an electric signal and provided to the ECM.

With receipt of the signals sent from the MAP sensor, Intake Air Temperature sensor and others, the ECM determines an appropriate fuel injection pulse width feeding such information to the fuel injector valves to effect an appropriate air/fuel ratio.

The Multiport Fuel Injection system utilizes an injection system where the injectors turn on at every crankshaft revolution. The ECM controls the injector on time so that the correct amount of fuel is metered depending on driving conditions.

Two interchangeable “O” rings are used on the injector that must be replaced when the injectors are removed.

The fuel rail is attached to the top of the intake manifold and supplies fuel to all the injectors.

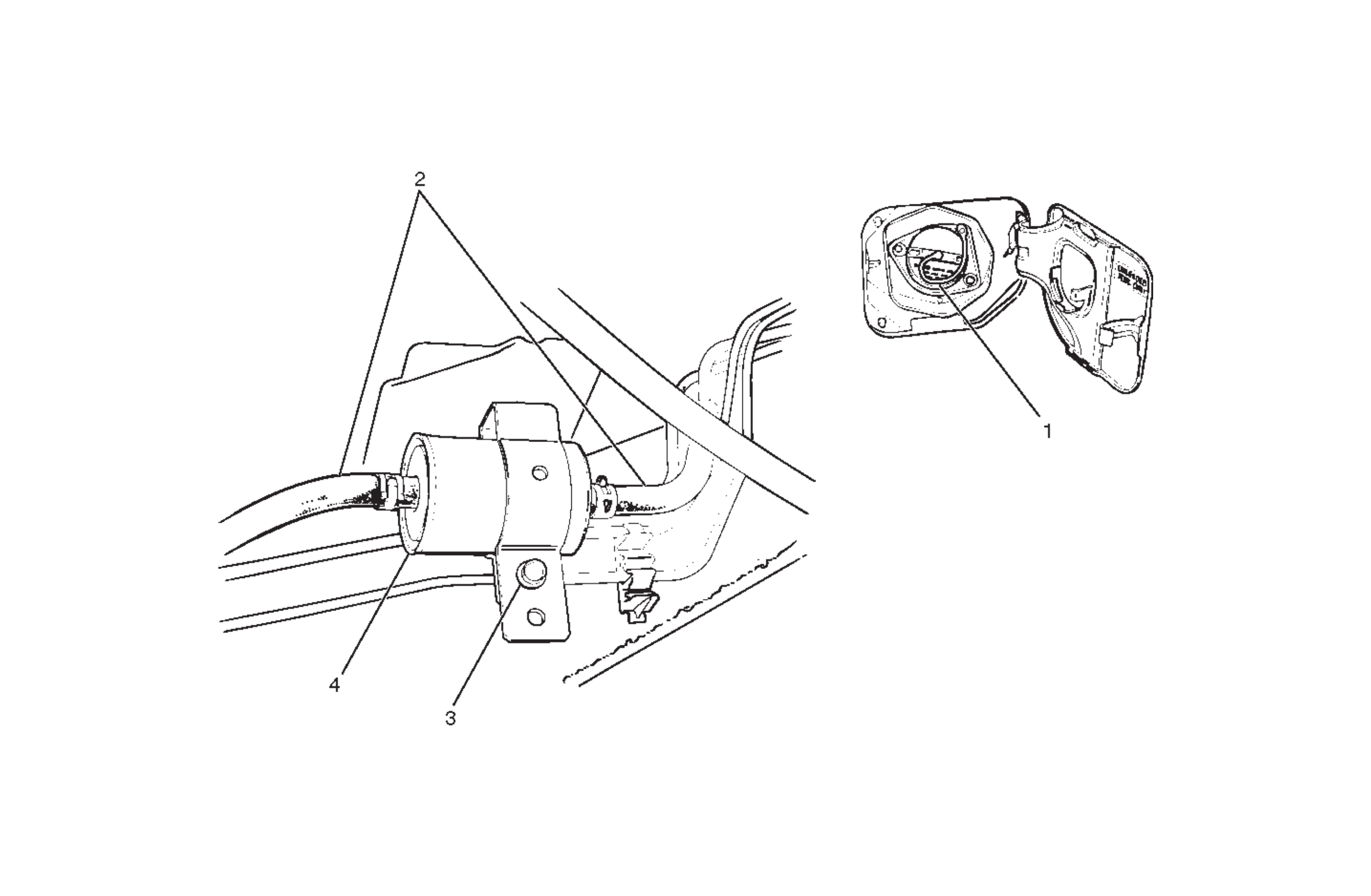
Fuel is recirculated through the rail continually while the engine is running. This removes air and vapors from the fuel as well as keeping the fuel cool during hot weather operation.

The fuel pressure control valve that is mounted on the fuel rail maintains a pressure differential across the injectors under all operating conditions. It is accomplished by controlling the amount of fuel that is recirculated back to the fuel tank based on engine demand.

See Section “Driveability and Emission” for more information and diagnosis.

Fuel Filter

Fuel Filter and Associated Parts



041RW014

Legend
(1) Fuel Filler Cap
(2) Fuel Hose
(3) Fuel Filter Fixing Bolt
(4) Fuel Filter

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".

1. Disconnect battery ground cable.
2. Remove Fuel filler cap(1).
3. Disconnect fuel hoses(2) from fuel filter on both engine side and fuel tank side.
4. Fuel filter fixing bolt(3).
   - Remove the fuel filter fixing bolt(3) on fuel filter holder.
5. Remove fuel filter(4).

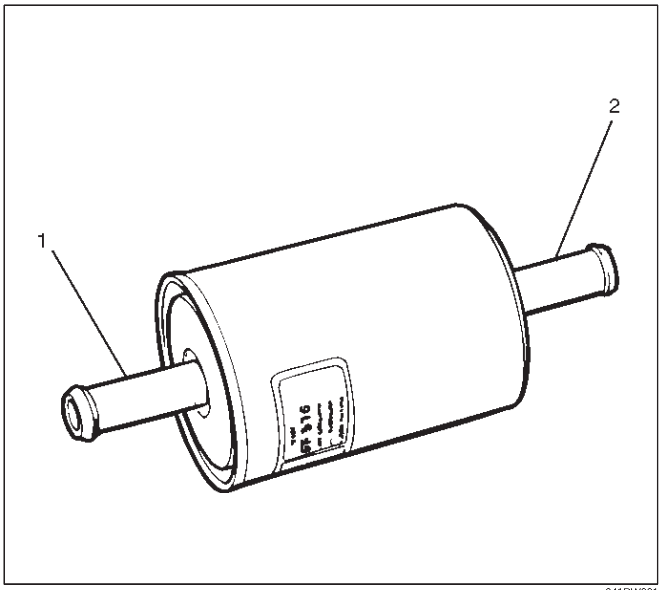
Inspection

1. Replace the fuel filter if the fuel leaks from fuel filter body or if the fuel filter body itself is damaged.
2. Replace the filter if it is clogged with dirt or sediment.
3. Check the drain of receive rubber and if it is clogged with dust, clean it up with air.

Installation

1. Install the fuel filter in the proper direction.
2. Install fuel filter holder fixing bolt.

3. Connect fuel hoses on engine side(1) and fuel tank side(2).



041RW001

4. Install fuel filler cap
5. Connect the battery ground cable.

Inspection

After installation, start engine and check for fuel leakage.

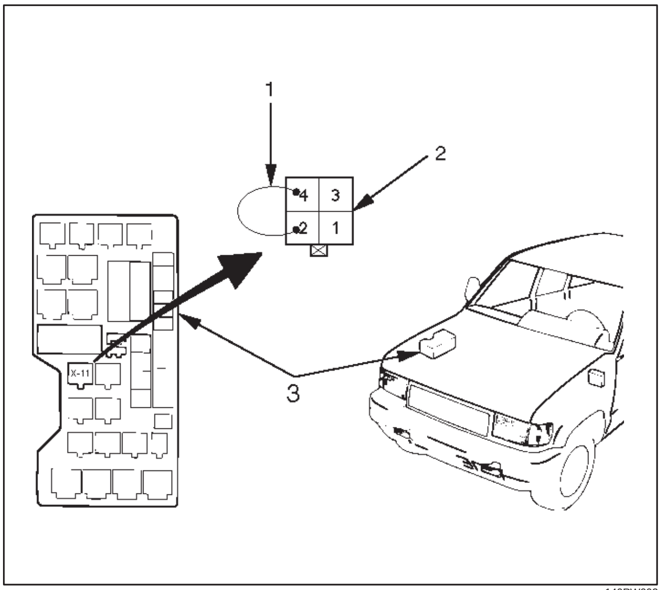
In–Tank Fuel Filter

The filter is located on the lower end of fuel pickup tube in the fuel tank. It prevents dirt from entering the fuel pipe and also stops water unless the filter is completely submerged in the water. It is a self cleaning type, not requiring scheduled maintenance. Excess water and sediment in the tank restricts fuel supply to the engine, resulting in engine stoppage. In such a case, the tank must be cleaned thoroughly.

Fuel Pump Flow Test

If reduction of fuel supply is suspected, perform the following checks:

1. Make sure that there is fuel in the tank.
2. With the engine running, check the fuel feed pipe and hose from fuel tank to injector for evidence of leakage. Retighten, if pipe or hose connection is loose. Also, check pipes and hoses for squashing or clogging.
3. Insert the hose from fuel feed pipe into a clean container, and check for fuel pump flow rate.
4. Connect the pump relay terminals with a jumper wire(1) as shown and start the fuel pump to measure delivery.



140RW002

CAUTION: Never generate sparks when connecting a jumper wire.

Delivery	Delivery
15 seconds	0.38 liters minimum

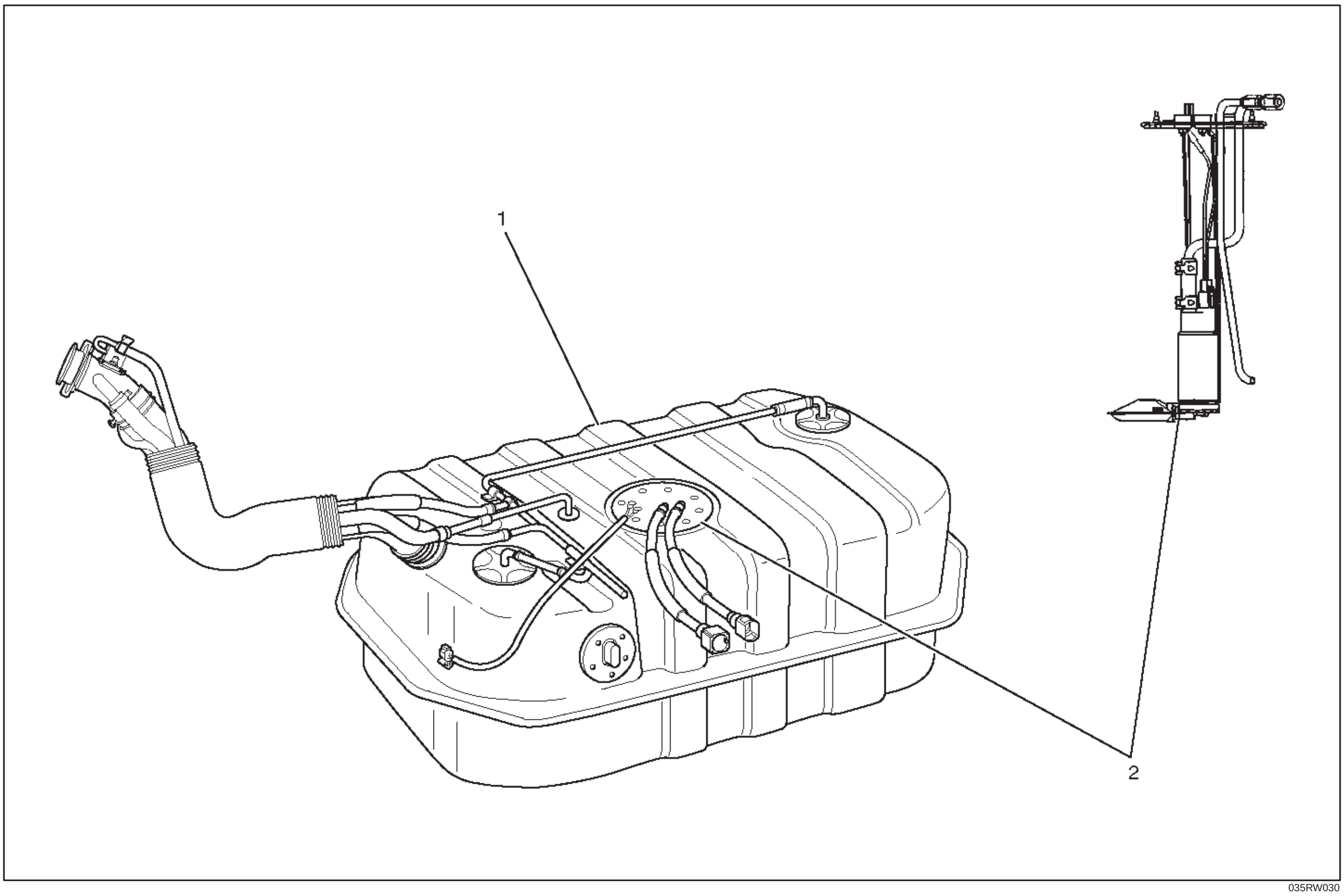
If the measure value is out of standard, conduct the pressure test.

Pressure test

For the pressure test to the fuel system, see Section 6E “Fuel Control System”.

Fuel Pump

Fuel Pump and Associated Parts



Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".

1. Disconnect battery ground cable.
2. Loosen fuel filler cap.
3. Drain fuel.
   Tighten drain plug to the specified torque after draining fuel.

   Torque: 20 N·m (14 lb ft) — M8
4. Remove fuel tank assembly(1). Refer to "Fuel Tank Removal" in this section.
5. Remove fuel pump (FP) assembly(2) fixing screws and remove the FP assembly.

NOTE: After removing FP, cover fuel tank to prevent any dust entering.

Installation

1. Install FP assembly(2).
2. Install fuel tank assembly(1). Refer to "Fuel Tank Installation".
3. Fill the tank with fuel and tighten fuel filler cap.
4. Connect battery ground cable.

Fuel Pump Relay

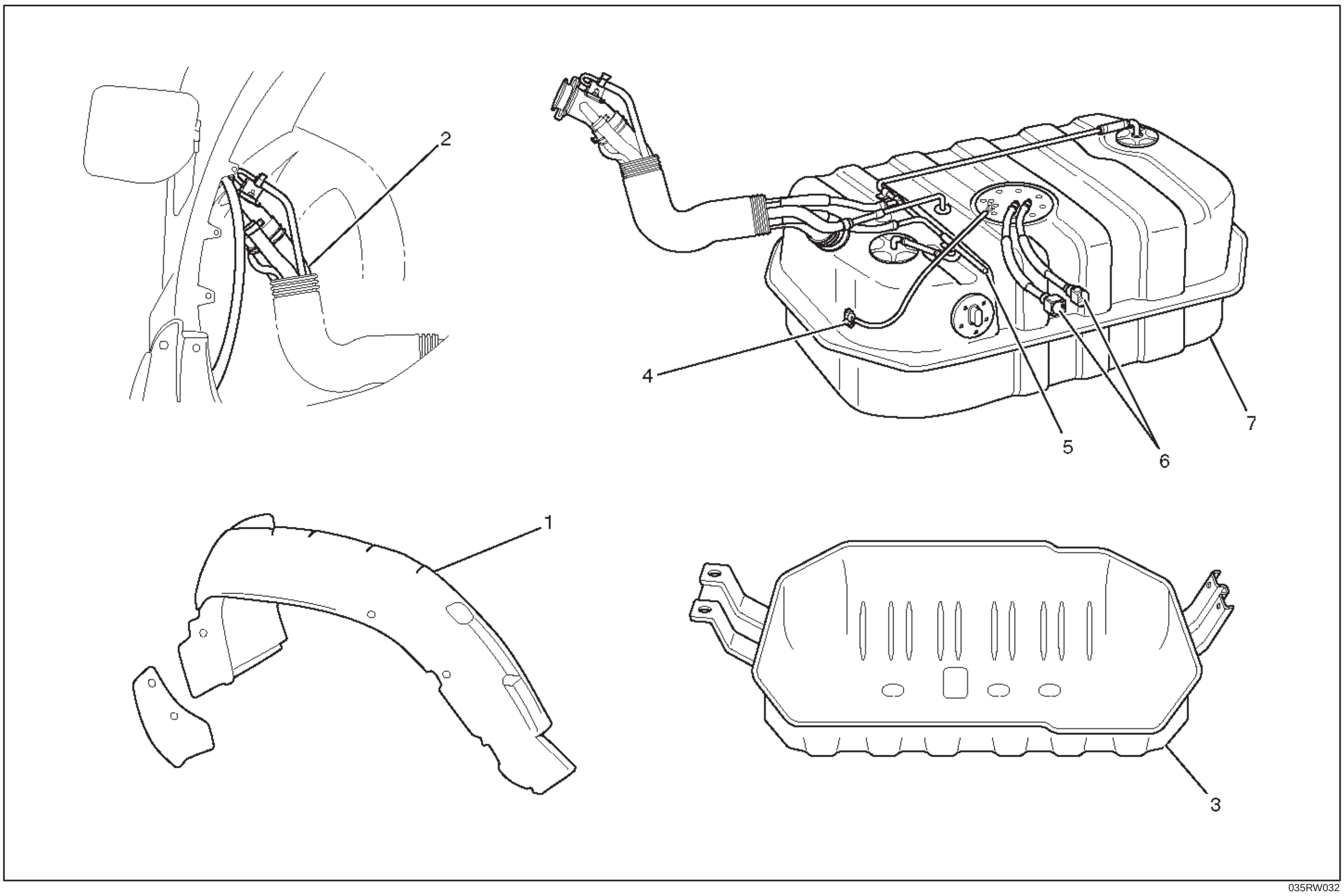
General Description

In order to control the FP operation, the FP relay is provided. When the starter switch is turned to “ON” position, the FP relay operates the FP for 2 seconds.

When it is turned to “START” position, the Power Train Control Module (PCM) receives the reference pulse from the Ignition Control Module and it operates the relay, again causing the FP to feed fuel.

Fuel Tank

Fuel Tank and Associated Parts



Legend

(1) Fender Liner
(2) Fuel Filler Hose and Air Breather Hose and Evapo Hose
(3) Undercover
(4) Fuel Tank Wiring Connector
(5) Evapo Fuel Hose
(6) Fuel Feed Tube and Fuel Return Tube/Quick–Connect Fittings
(7) Fuel Tank

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section “Driveability and Emission”.

1. Disconnect battery ground cable.
2. Loosen fuel filler cap.
3. Drain fuel.
   Tighten drain plug to the specified torque after draining fuel.

   Torque: 20 N·m (14 lb ft) — M8
4. Remove fender liner (1) of wheel well on rear right side.
5. Fuel filler hose, air breather hose and evapo hose (2).
6. Remove undercover fixing bolts on both sides and remove under cover(3).

7. Disconnect two fuel tank wiring connectors(4) on front right side of tank.
8. Disconnect evapo fuel hose(5).
9. Disconnect fuel feed tube and fuel return tube(6).

NOTE: Handling of the fuel tube, be sure to refer “Fuel Tube/Quick–Connect Fittings” in this section.

10. Remove fuel tank fixing bolts on both sides and remove fuel tank(7).

Installation

1. Install fuel tank(7).
   - Place a flange on right side of tank on the bracket.
   - Install a flange on left side on the bracket from the bottom, and tighten bolts to the specified torque.

Torque: 36 N·m (27 lb ft)

2. Connect fuel feed tube and fuel return tube(6).
3. Connect evapo fuel hose(5).
4. Connect fuel tank wiring connector(4).
5. Install undercover(3).
6. Connect fuel filler hose, air breather hose and evapo hose(2).
7. Install fender liner(1).
   - Mount fender liner to the wheel well.
   - Fill the tank with fuel and tighten fuel filler cap.
   - Connect battery ground cable.

Fuel Tube / Quick – Connect Fittings

Precautions

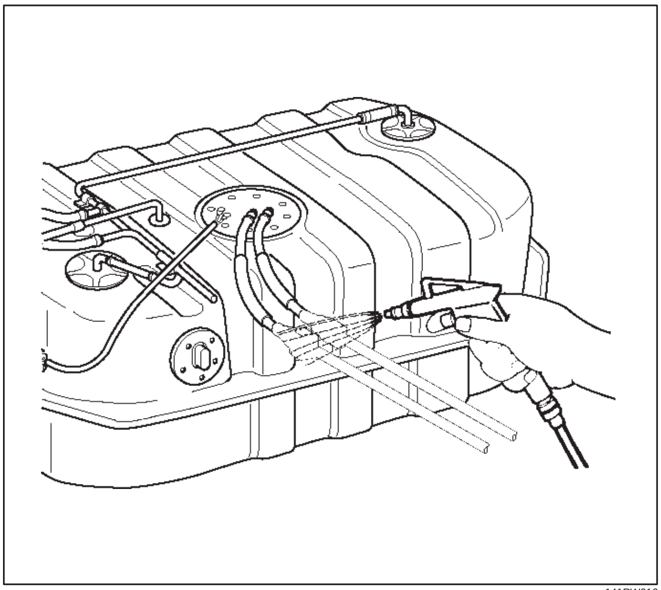
- Lighting of Fires Prohibited.
- Keep flames away from your work area to prevent the inflammable from catching fire.
- Disconnect the battery negative cable to prevent shorting during work.
- When welding or conducting other heat-generating work on other parts, be sure to provide pretreatment to protect the piping system from thermal damage or spattering.

Cautions During Work

Do not expose the assembly to battery electrolyte or do not wipe the assembly with a cloth used to wipe off spilt battery electorolyte.
The piping wet with battery electrolyte cannot be used.
Be careful not to give a bending or twisting force to the piping during the work. If deformed, replace with a new piping.

Removal

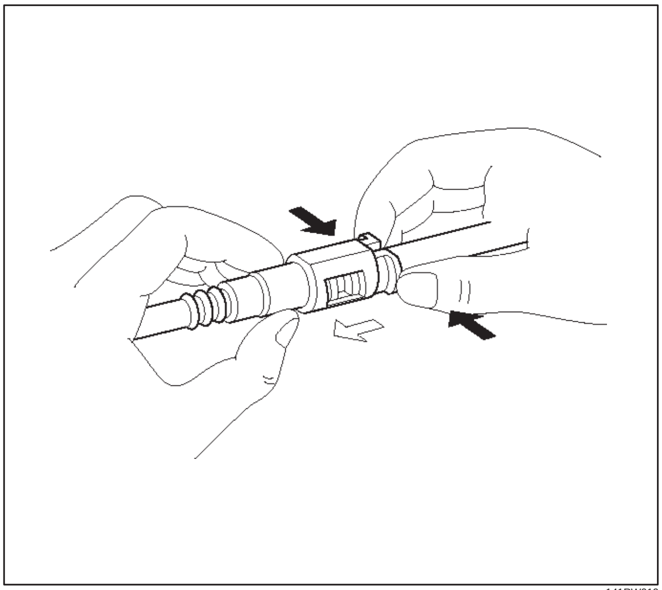
1. Open the fuel cap to relieve the fuel pressure in the tank.
   If the fuel quick-connect fittings are dusty, clean with an air blower, etc. and then remove it.



141RW016

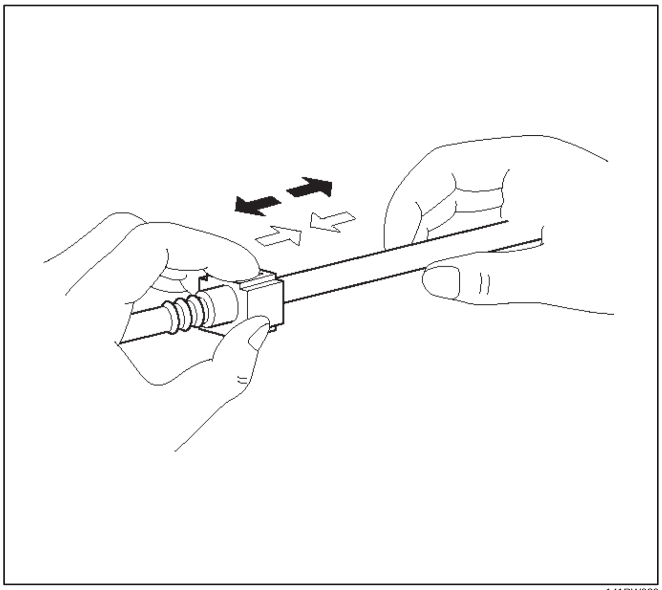
As some pressure may remain in the piping, cover the connector with a cloth, etc. to prevent the splashing of fuel in the first disconnection of the piping.

2. For removal of the delivery pipe (feeding fuel to the engine), hold the connector in one hand, and hold the retainer tab with the other hand and pull out the connector, as illustrated. The pipe can be removed with the retainer attached.



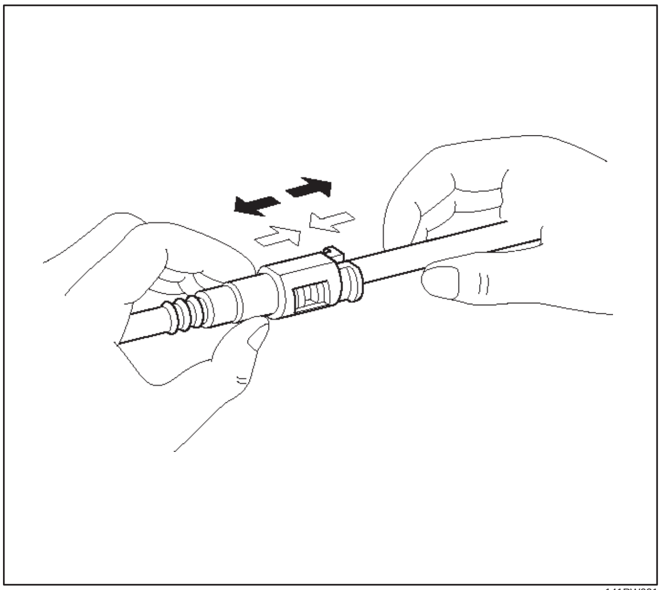
141RW019

3. For removal of the return pipe (returnig fuel to the tank), hold the pipe in one hand, and pull out the connentor with the other hand while pressing the square relieve button of the retainer, as illustrated.



141RW020

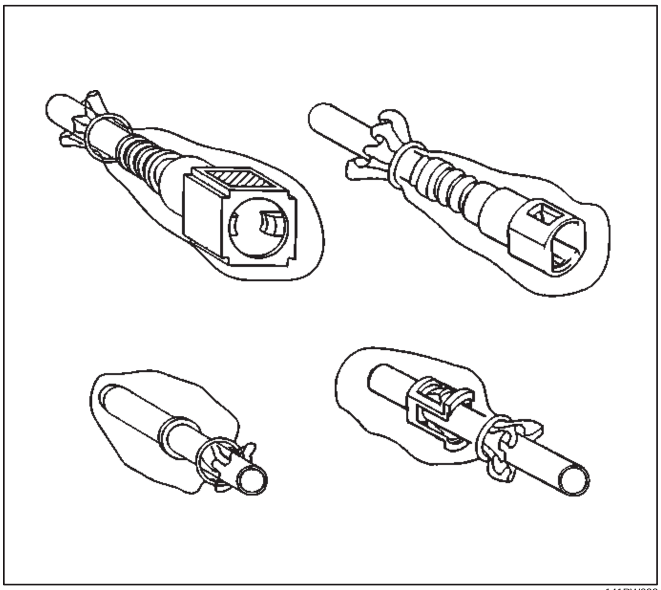
NOTE: This work should be done by hands. Do not use any tools. Should the pipe can hardly be removed from the connector, use a lubricant (light oil) and/or push and pull the connector longitudinally until the pipe is removed.



141RW021

When reusing the delivery pipe retainer, reuse without removing the retainer from the pipe. If the retainer is damaged or deformed, however, replace with a new retainer.

Cover the connectors removed with a plastic bag, etc. to prevent the entry of dust or rain water.



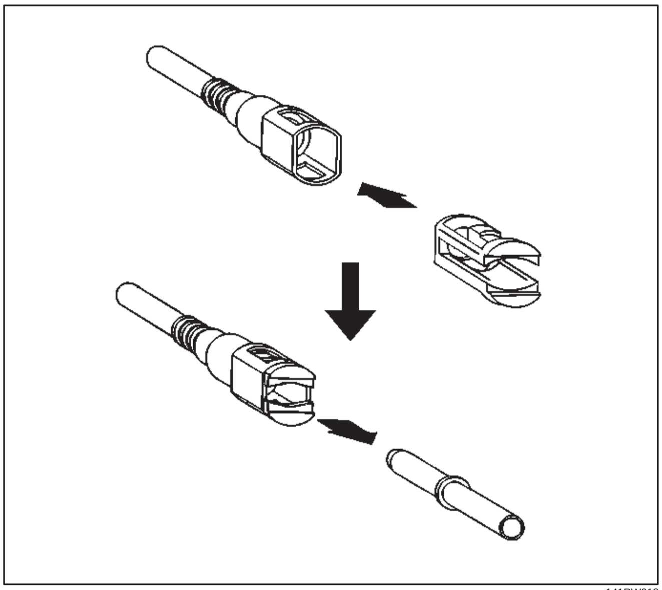
141RW022

Reuse of Quick–Connector

(Delivery Pipe)

- Replace the pipe and connector if scratch, dent or crack is found.
- Remove mud and dust from the pipe and make sure that the end including spool is free of defects, such as scratch, rust, and dent, which may cause poor sealability. If defective, replace with a new pipe.
- If the retainer removed according to the removal step above is attached to the pipe, clean and insert it straight into the quick-connector till it clicks. After it clicks, try pulling it out to make sure that it is not drawn and is securely locked.

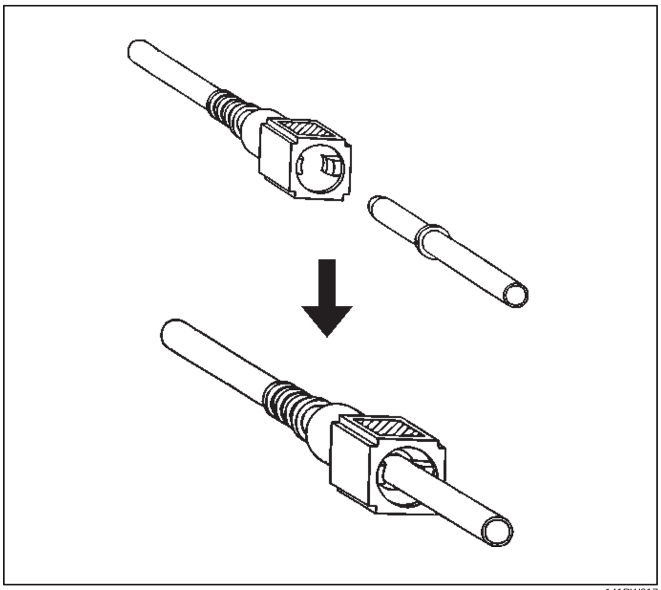
NOTE: The retainer, once removed from the pipe, cannot be reused. Just replace with a new retainer. Insert the new retainer into the connector side until it clicks, and connect the pipe as inserting it into the retainer until it clicks.



141RW018

(Return Pipe)

- Replace the pipe and connector if scratch, dent or crack is found.
- Remove mud or dust from the pipe and make sure that the end including spool is free from defects, such as scratch, rust, and dent, which may cause poor sealability. If defective, replace with a new pipe.
- After cleaning the pipe, insert it straight into the connector until it clicks. After it clicks, try pulling it out to make sure that it is not drawn and is securely locked.



141RW017

Assembling Advice

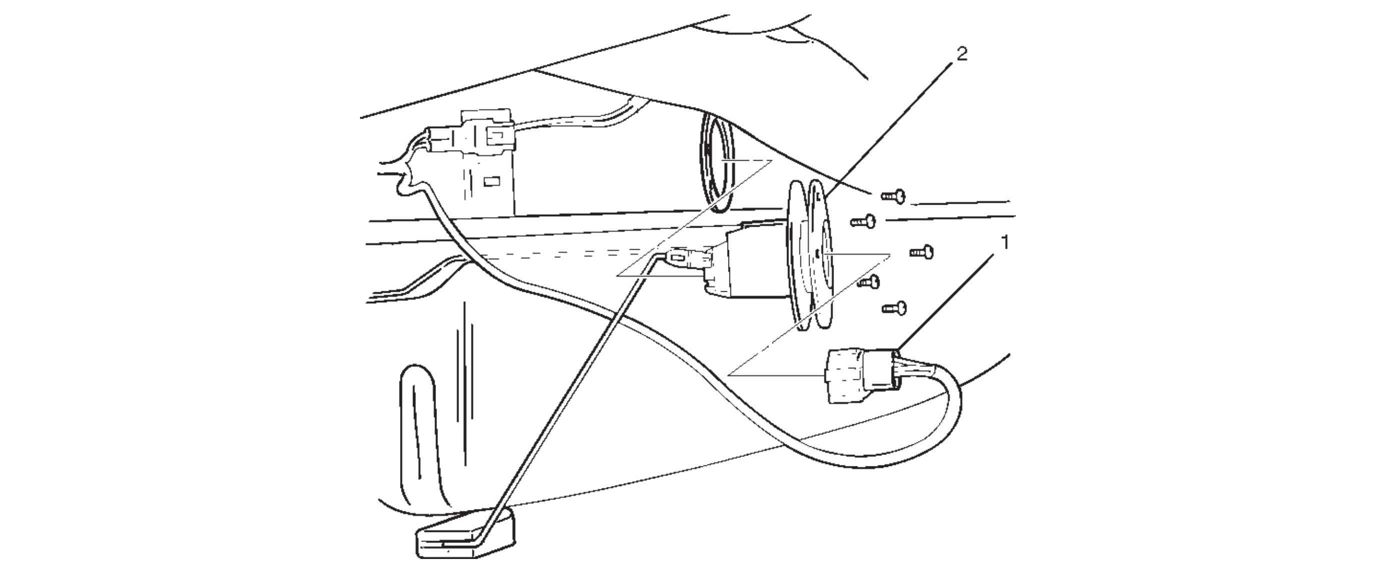
Application of engine oil or light oil to the pipe facilitates connecting work. The work should be started immediately after lubrication, since dust may stick to the pipe surface to cause poor sealability if a long time passes after lubrication.

Test/Inspection After Assembling

1. Reconnect the battery negative cable.
2. Turn the ignition key to the “ON” position and check pump startup sound. As the pump is actuated to raise fuel pressure, check and see fuel leak from the piping system.
3. Make sure of no fuel leakage by conducting the above fuel leak check a few times.
4. Start the engine and make sure of stable idling speed and normal vehicle run.The entry of dust during the work may sometimes affect the fuel injection system.

Fuel Gauge Unit

Fuel Gauge Unit and Associated Parts



140RS004

Legend

(1) Wiring Connector
(2) Fuel Gauge Unit

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".

1. Disconnect battery ground cable.
2. Loosen fuel filler cap.
3. Drain fuel.
   Tighten drain plug to the specified torque after draining fuel.

   Torque: 20 N·m (14 lb ft) — M8
4. Wiring connector
   - Disconnect wiring connector(1) from the unit.
5. Fuel gauge unit
   - Remove the fixing screws, then the fuel gauge unit(2).

NOTE: After removing fuel gauge unit, cover fuel tank to prevent any dust entering

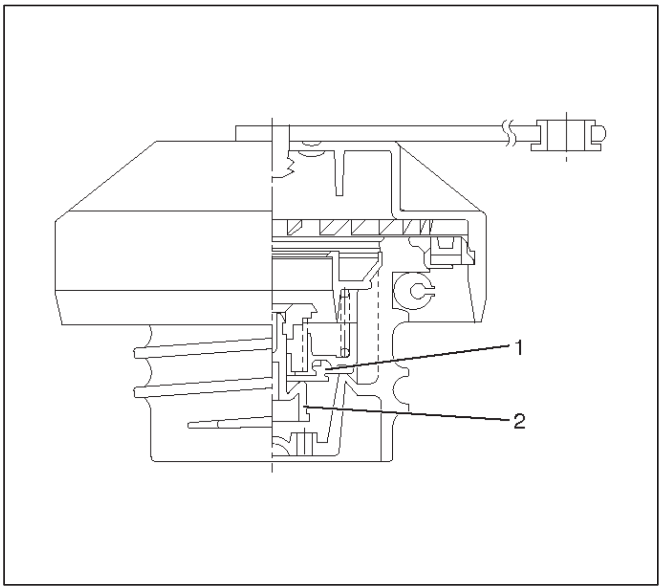
Installation

1. Fuel gauge unit(2).
2. Wiring connector(1).
   - Connect the wiring connector to the fuel gauge unit.
   - Fill the tank with fuel and tighten fuel filler cap.
   - Connect battery ground cable.

Fuel Filler Cap

General Description

Fuel filler cap includes vacuum valve and pressure valve. In case any high vacuum and any high pressure happen in tank, each valve works to adjust the pressure to prevent the tank from being damaged.



140RW021

Legend

(1) Vacuum Valve
(2) Pressure Valve

Inspection

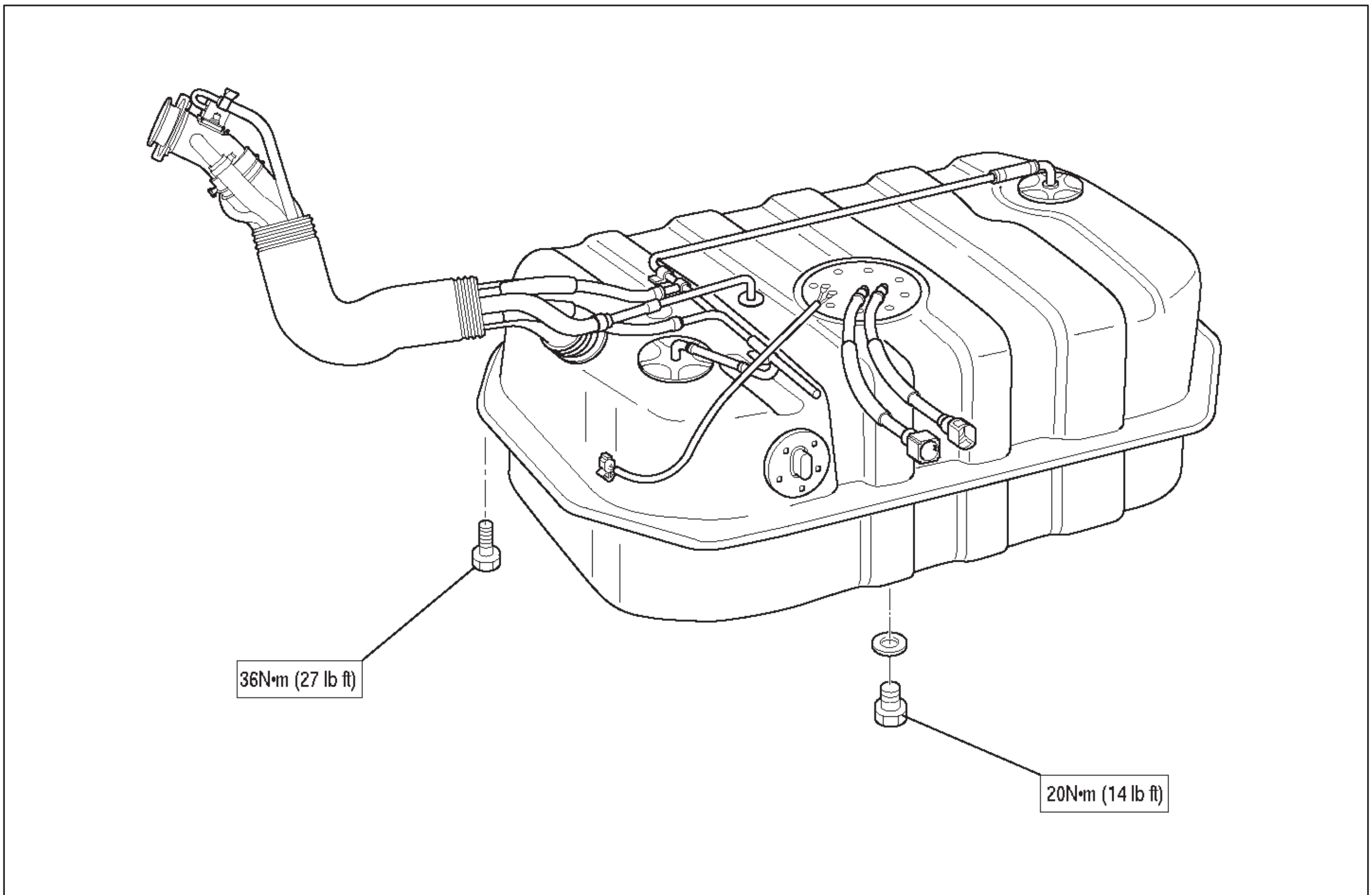
Check the seal ring in the filler cap for presence of any abnormality and for seal condition.
Replace the filler cap, if abnormal.

CAUTION: The fuel filler cap valves have characteristics.

A defective valve, no valve at all or a valve with the wrong characteristics will do a lot of harm to engine operating characteristics; be sure to use the same fuel filler cap as installed in this vehicle.

Main Data and Specifications

Torque Specification



035RW031

TROOPER

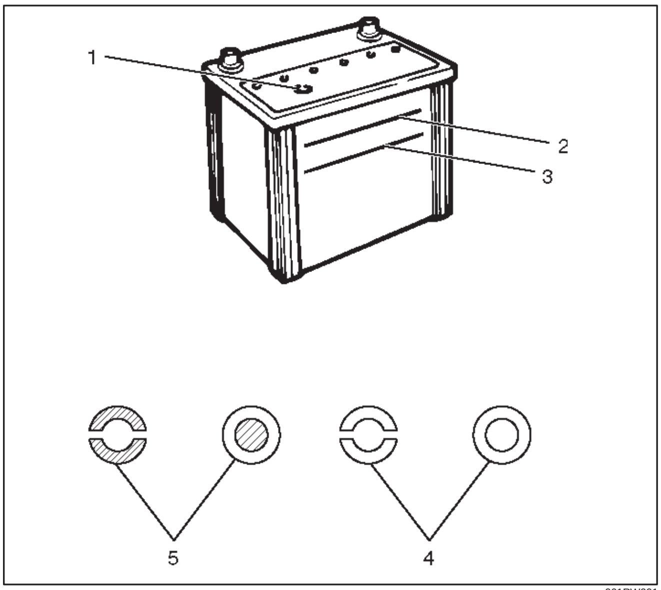
ENGINE

ENGINE ELECTRICAL

CONTENTS

Battery

General Description



061RW001

There are six battery fluid caps on top of the battery. These are covered by a paper label.
The battery is completely sealed except for the six small vent holes on the side. These vent holes permit the escape of small amounts of gas generated by the battery.
This type of battery has the following advantages over conventional batteries:

1. There is no need to add water during the entire service life of the battery.
2. The battery protects itself against overcharging. The battery will refuse to accept an extensive charge. (A conventional battery will accept an excessive charge, resulting in gassing and loss of battery fluid.)
3. The battery is much less vulnerable to self discharge than a conventional type battery.

Diagnosis

1. Visual Inspection

Inspect the battery for obvious physical damage, such as a cracked or broken case, which would permit electrolyte loss.
Replace the battery if obvious physical damage is discovered during inspection.
Check for any other physical damage and correct it as necessary.

2. Hydrometer Check

There is a built–in hydrometer (Charge test indicator(1)) at the top of the battery. It is designed to be used during diagnostic procedures.
Before trying to read the hydrometer, carefully clean the upper battery surface.
If your work area is poorly lit, additional light may be necessary to read the hydrometer.

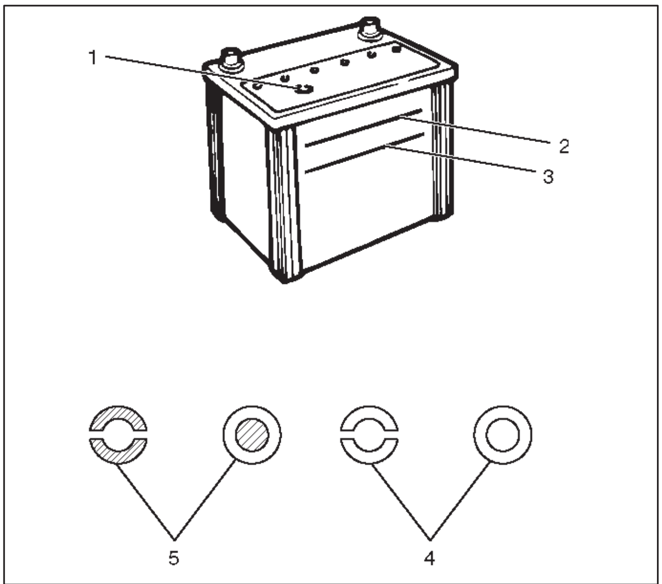
a. BLUE RING OR DOT VISIBLE(5) – Go to Step 4.
b. BLUE RING OR DOT NOT VISIBLE(4) – Go to Step 3.

3. Fluid Level Check

The fluid level should be between the upper level line(2) and lower level line(3) on side of battery.

a. CORRECT FLUID LEVEL – Charge the battery.

b. BELOW LOWER LEVEL – Replace battery.



061RW001

4. Voltage Check

1. Put voltmeter test leads to battery terminals.
   a. VOLTAGE IS 12.4V OR ABOVE – Go to Step 5.
   b. VOLTAGE IS UNDER 12.4V – Go to procedure (2) below.
2. Determine fast charge amperage from specification. (See Main Data and Specifications in this section).
   Fast charge battery for 30 minutes at amperage rate no higher than specified value.
   Take voltage and amperage readings after charge.
   a. VOLTAGE IS ABOVE 16V AT BELOW 1/3 OF AMPERAGE RATE – Replace battery.
   b. VOLTAGE IS ABOVE 16V AT ABOVE 1/3 OF AMPERAGE RATE – Drop charging voltage to 15V and charge for 10 – 15 hours. Then go to Step 5.
   c. VOLTAGE IS BETWEEN 12V AND 16V – Continue charging at the same rate for an additional 3–1/2 hours. Then go to Step 5.
   d. VOLTAGE BELOW 12V – Replace Battery.

5. Load Test

1. Connect a voltmeter and a battery load tester across the battery terminals.
2. Apply 300 ampere load for 15 seconds to remove surface charge from the battery. Remove load.
3. Wait 15 seconds to let battery recover. Then apply specified load from specifications (See Main Data and Specifications in this section).
   Read voltage after 15 seconds, then remove load.
   a. VOLTAGE DOES NOT DROP BELOW THE MINIMUM LISTED IN THE TABLE – The battery is good and should be returned to service.
   b. VOLTAGE IS LESS THAN MINIMUM LISTED – Replace battery.

ESTIMATED TEMPERATURE		MINIMUM VOLTAGE
˚F	˚C	V
70	21	9.6
60	16	9.5
50	10	9.4
40	4	9.3
30	–1	9.1
20	–7	8.9
10	–12	8.7
0	–18	8.5
The battery temperature must be estimated by feel and by the temperature the battery has been exposed to for the preceding few hours.		

Battery Charging

Observe the following safety precautions when charging the battery:

1. Never attempt to charge the battery when the fluid level is below the lower level line on the side of the battery. In this case, the battery must be replaced.
2. Pay close attention to the battery during charging procedure.
   Battery charging should be discontinued or the rate of charge reduced if the battery feels hot to the touch.
   Battery charging should be discontinued or the rate of charge reduced if the battery begins to gas or spew electrolyte from the vent holes.
3. In order to more easily view the hydrometer blue dot or ring, it may be necessary to jiggle or tilt the battery.
4. Battery temperature can have a great effect on battery charging capacity.
5. The sealed battery used on this vehicle may be either quick charged or slow charged in the same manner as other batteries.
   Whichever method you decide to use, be sure that you completely charge the battery. Never partially charge the battery.

Jump Starting

Jump Starting with an Auxiliary (Booster) Battery

CAUTION: Never push or tow the vehicle in an attempt to start it. Serious damage to the emission system as well as other vehicle parts will result.

Treat both the discharged battery and the booster battery with great care when using jumper cables. Carefully follow the jump starting procedure, being careful at all times to avoid sparking.

WARNING: FAILURE TO CAREFULLY FOLLOW THE JUMP STARTING PROCEDURE COULD RESULT IN THE FOLLOWING:

1. Serous personal injury, particularly to your eyes.
2. Property damage from a battery explosion, battery acid, or an electrical fire.
3. Damage to the electronic components of one or both vehicles particularly.

Never expose the battery to an open flame or electrical spark. Gas generated by the battery may catch fire or explode.

Remove any rings, watches, or other jewelry before working around the battery. Protect your eyes by wearing an approved set of goggles.

Never allow battery fluid to come in contact with your eyes or skin.

Never allow battery fluid to come in contact with fabrics or painted surfaces.

Battery fluid is a highly corrosive acid.

Should battery fluid come in contact with your eyes, skin, fabric, or a painted surface, immediately and thoroughly rinse the affected area with clean tap water.

Never allow metal tools or jumper cables to come in contact with the positive battery terminal, or any other metal surface of the vehicle. This will protect against a short circuit.

Always keep batteries out of reach of young children.

Jump Starting Procedure

1. Set the vehicle parking brake.

   If the vehicle is equipped with an automatic transmission, place the selector level in the “PARK” position.

   If the vehicle is equipped with a manual transmission, place the shift lever in the “NEUTRAL” position.

   Turn “OFF” the ignition.

   Turn “OFF” all lights and any other accessory requiring electrical power.
2. Look at the built–in hydrometer.

   If the indication area of the built–in hydrometer is completely clear, do not try to jump start.
3. Attach the end of one jumper cable to the positive terminal of the booster battery.

   Attach the other end of the same cable to the positive terminal of the discharged battery.

   Do not allow the vehicles to touch each other. This will cause a ground connection, effectively neutralizing the charging procedure.

   Be sure that the booster battery has a 12 volt rating.
4. Attach one end of the remaining cable to the negative terminal of the booster battery.

   Attach the other end of the same cable to a solid engine ground (such as the air conditioning compressor bracket or the generator mounting bracket) of the vehicle with the discharged battery.

   The ground connection must be at least 450 mm (18 in.) from the battery of the vehicle whose battery is being charged.

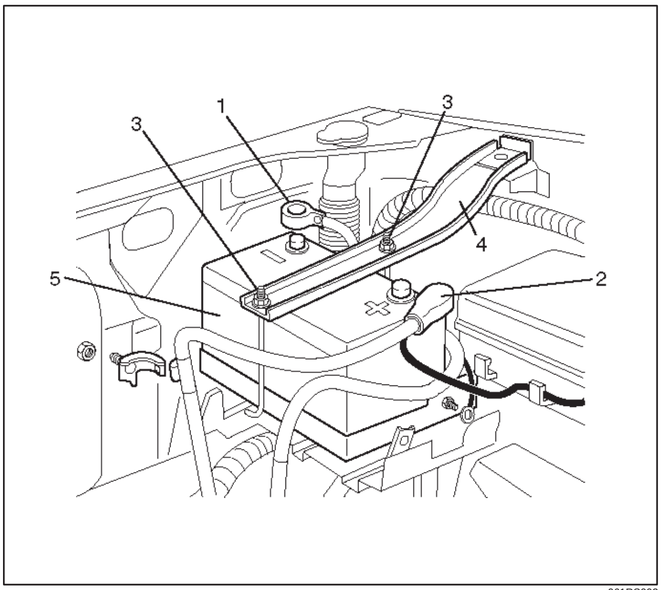
WARNING: NEVER ATTACH THE END OF THE JUMPER CABLE DIRECTLY TO THE NEGATIVE TERMINAL OF THE DEAD BATTERY.

5. Start the engine of the vehicle with the good battery.

   Make sure that all unnecessary electrical accessories have been turned “OFF”.
6. Start the engine of the vehicle with the dead battery.
7. To remove the jumper cables, follow the above directions in reverse order.

   Be sure to first disconnect the negative cable from the vehicle with the discharged battery.

Battery Removal



061RS002

1. Remove negative cable (1).
2. Remove positive cable (2).
3. Remove retainer screw and rods (3).
4. Remove retainer (4).
5. Remove battery (5).

Battery Installation

1. Install battery (5).
2. Install retainer (4).
3. Instal retainer screw and rods (3).

NOTE: Make sure that the rod is hooked on the body side.

4. Install positive cable (2).
5. Install negative cable (1).

Main Data and Specifications

General Specifications

Model (JIS)	95D31R–MF	80D26R–MF	75D26R–MF
Voltage (V)	12	12	12
Cold Cranking Performance (Amp)	622	582	490
Reserve Capacity (Min)	159	133	123
Load Test (Amp)	310	290	245
Fast Charge Maximum Amperage (Amp)	20	20	20
BCI Group No.	27	24	24

TROOPER

ENGINE

IGNITION SYSTEM

CONTENTS

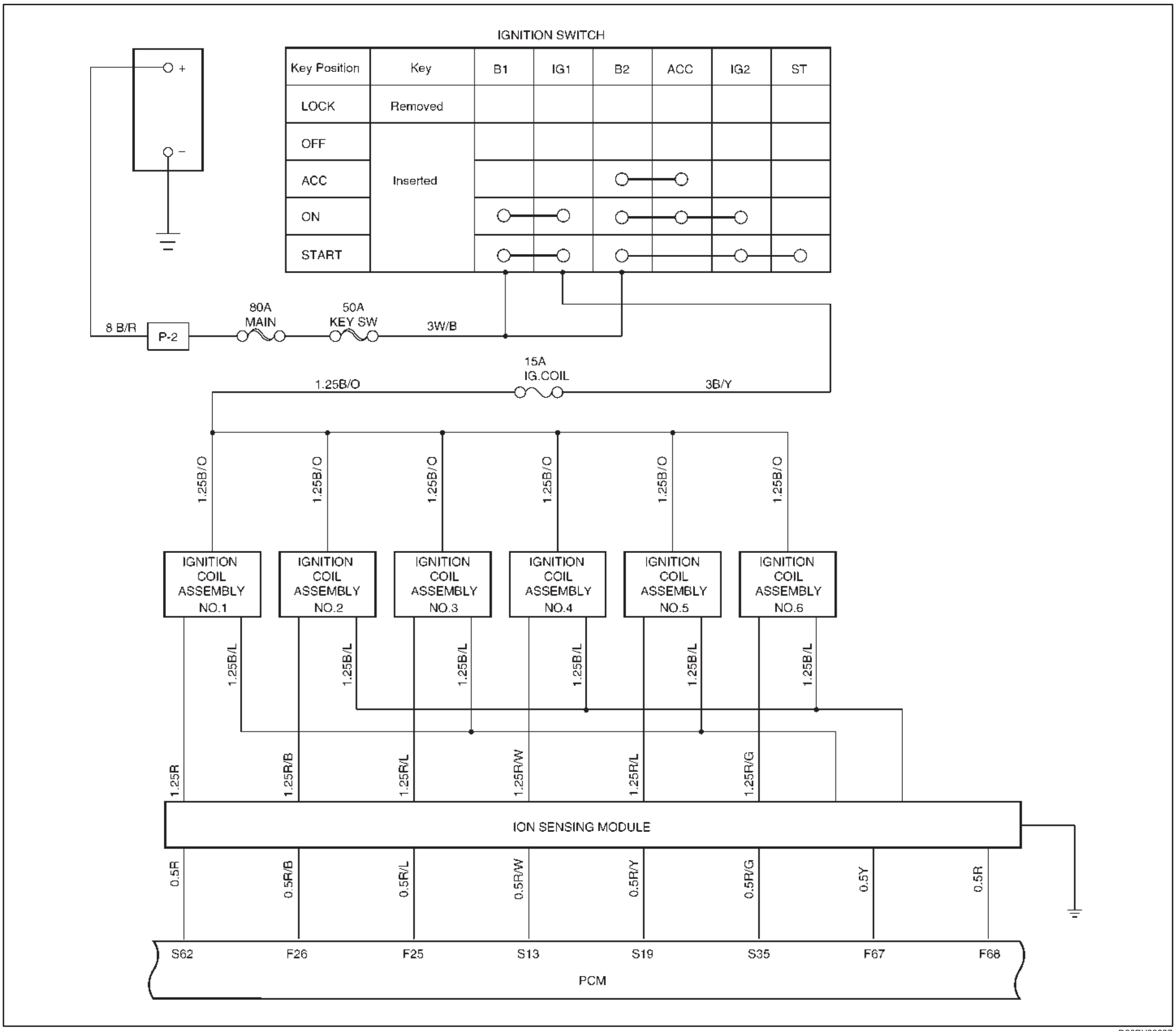
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Ignition is done by the electronic ignition (EI) that directly fires the spark plugs from ignition coils through spark plug wires without using a distributor. A pair of ignition coils for the cylinders having different phases by 360° (No.1 and No.4,No.2 and No.5,No.3 and No.6) are fired simultaneously.
Since the cylinder on exhaust stroke requires less energy to fire its ignition plug, energy from the ignition coils can be utilized to fire the mating cylinder on compression stroke. After additional 360° rotation, respective cylinder strokes are reversed.
The EI consists of six ignition coils,ignition control module, position angle sensor, powertrain control module (PCM) and other components.
The ignition coils are connected with the PCM by means of a 80 pin connector.
The ignition control module turns on/off the primary circuit of ignition coils, and also it controls the ignition timing at the engine speed below 538 rpm.
A notch in the timing disc on the crankshaft activates the crank position sensor which then sends information such as firing order and starting timing of each ignition coil to the PCM.
Further, the EI employs ignition control (IC) to control similar to a distributor system.
By receiving signals such as crank position,engine speed, water temperature and Manifold Absolute Pressure (MAP), the PCM controls the ignition timing.



D06RY00037

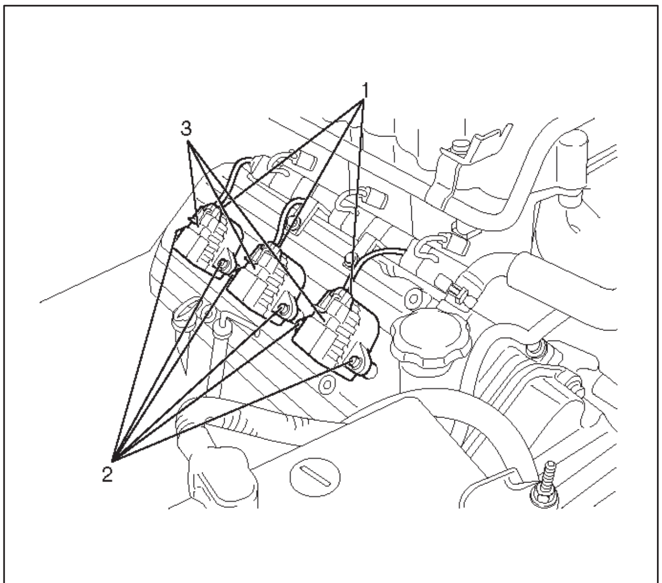
Diagnosis

Refer to Section Drivability and Emissions for the diagnosis to electronic ignition system (EI system).

Ignition Coil

Removal

1. Disconnect battery ground cable.
2. Ignition coil connector and ignition coil.
   - Disconnect three connector from ignition coil.
   - Remove harness bracket bolt on cylinder head cover.
   - Remove fixing bolts on ignition coil.



060RY023

Legend

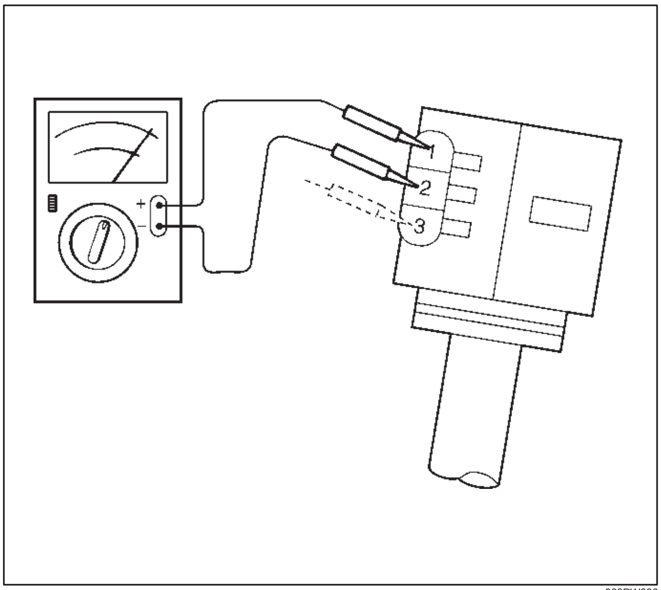
(1) Ignition Coil Connector
(2) Bolt
(3) Ignition Coil Assembly

Inspection and Repair

Check the ignition coil assembly for insulation. Check terminals for corrosion or damage, and replace as necessary.
Measuring resistance of ignition coil assembly.

Terminal No.	Limit
1 to 2	Resistance cannot be 0 ohm (short) or infinity (open circuit).
1 to 3	Same as above
2 to 3	Same as above

Measure resistance of ignition coil assembly, and replace the ignition coil assembly if its value exceeds the standard.

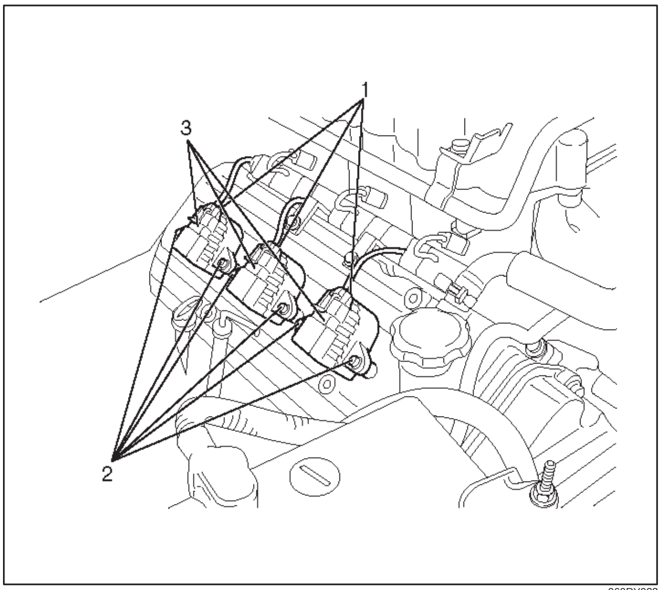


060RW006

Installation

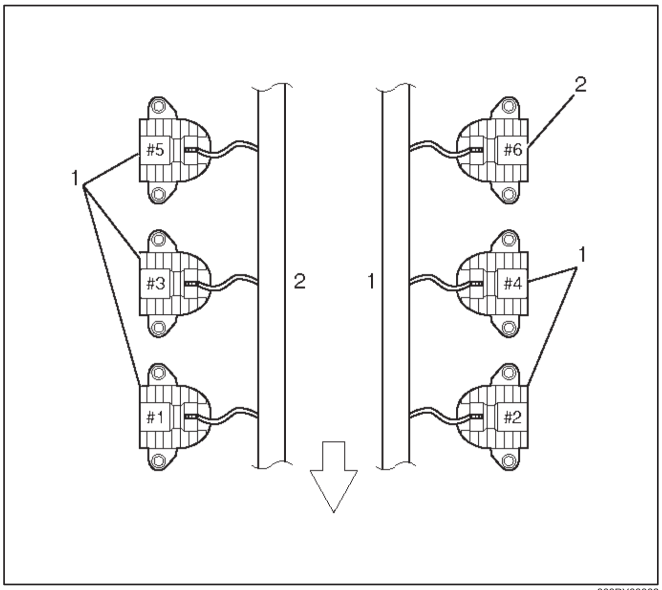
1. Install the ignition coil assembly (3).
   Connect ignition coil connector (1) and ignition coil (3), then tighten bolt (2) to the specified torque.

Torque: 4 N·m (35.4 lb in)



060RY023

CAUTION: Ignition coil assembly # 6 is different from ignition coil assembly from # 1 to # 5. Ignition coil assembly # 6 is short type. So, note it when installing ignition coil assembly of # 6.



060RY00002

Legend

(1) Long Type Ignition Coil Assemblies (# 1 ~ # 5)
(2) Short Type Ignition Coil Assembly (# 6)

2. Connect battery ground cable.

Spark Plug

Removal

1. Remove spark plugs.

Inspection and Repair

The spark plug affects entire engine performance and therefore its inspection is very important.

- Check electrode and insulator for presence of cracks, and replace if any.
- Check electrode for wear, and replace if necessary.
- Check gasket for damage, and replace if necessary.
- Measure insulation resistance with an ohmmeter, and replace if faulty.
- Adjust spark plug gap to 1.0 mm (0.04 in) ~ 1.1 mm (0.043 in).
- Check fuel and electrical systems if spark plug is extremely dirty.
- Use spark plugs having low heat value (hot type plug) if fuel and electrical systems are normal.
- Use spark plugs having high heat value (cold type plug) if insulator and electrode are extremely burned.

Sooty Spark Plugs

Much deposit of carbon or oil on the electrode and insulator of spark plug reduces the engine performance.

Possible causes:

- Too rich mixture
- Presence of oil in combustion chamber
- Incorrectly adjusted spark plug gap

Burning Electrodes

This fault is characterized by scorched or heavily oxidized electrode or blistered insulator nose.

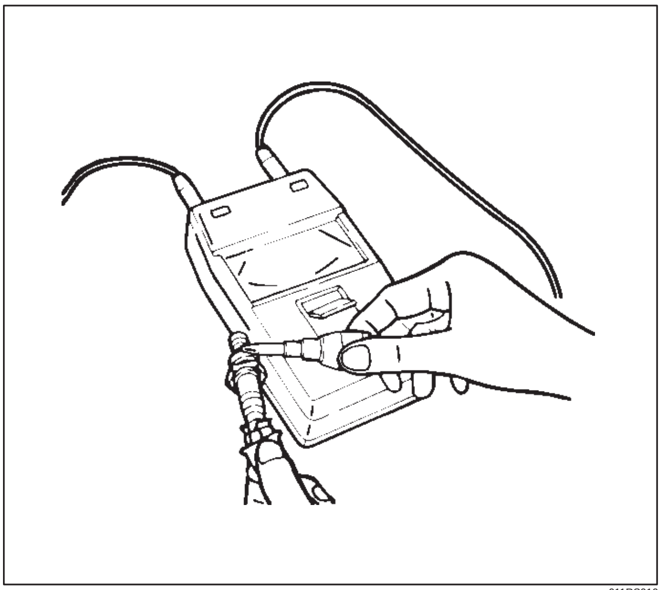
Possible causes:

- Too lean mixture
- Improper heat value

Measuring Insulation Resistance

- Measure insulation resistance using a 500 volt megaohm meter.
- Replace spark plugs if measured value is out of standard.

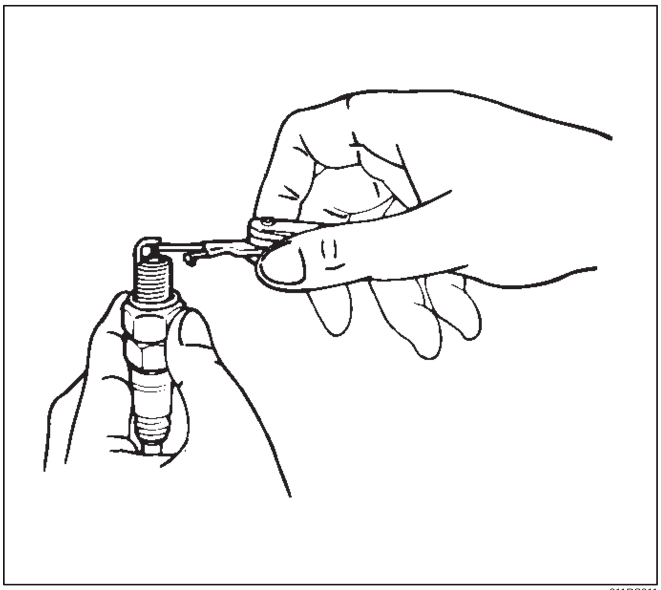
Insulation resistance: 50 MΩ or more



011RS010

Cleaning Spark Plugs

- Clean spark plugs with a spark plug cleaner.
- Raise the ground electrode to an angle of 45 to 60 degrees. If electrode is wet, dry it before cleaning.
- After spark plug is thoroughly cleaned, check insulator for presence of cracks.
- Clean threads and metal body with a wire brush.
- File the electrode tip if electrode is extremely worn.
- Bend the ground electrode to adjust the spark plug gap.



011RS011

Installation

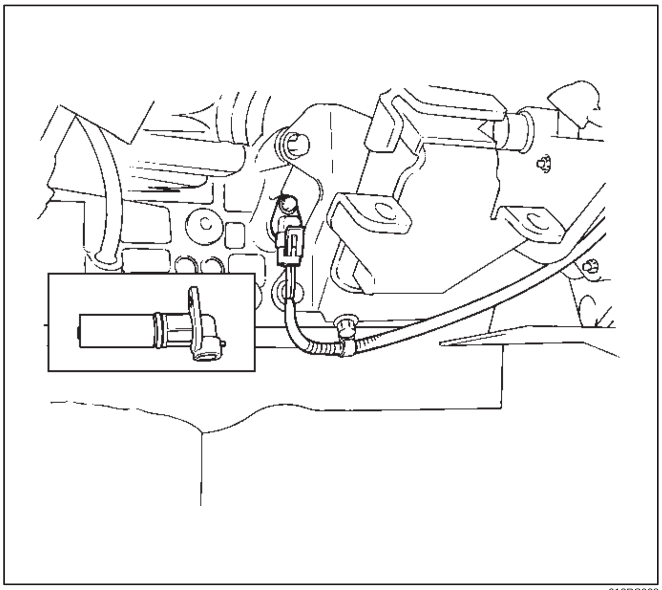
1. Spark plugs
   - Tighten spark plugs to the specified torque.

Torque: 18 N·m (13 lb ft)

Crankshaft Position Sensor

Removal

1. Disconnect battery ground cable
2. Wiring connector from crankshaft position sensor.
3. Remove crankshaft position sensor from cylinder block.



012RS008

Installation

1. Install crankshaft position sensor into the cylinder block.

   Before installation,apply small amount of engine oil to the O–ring.

   Torque: 10 N·m (89 lb in)

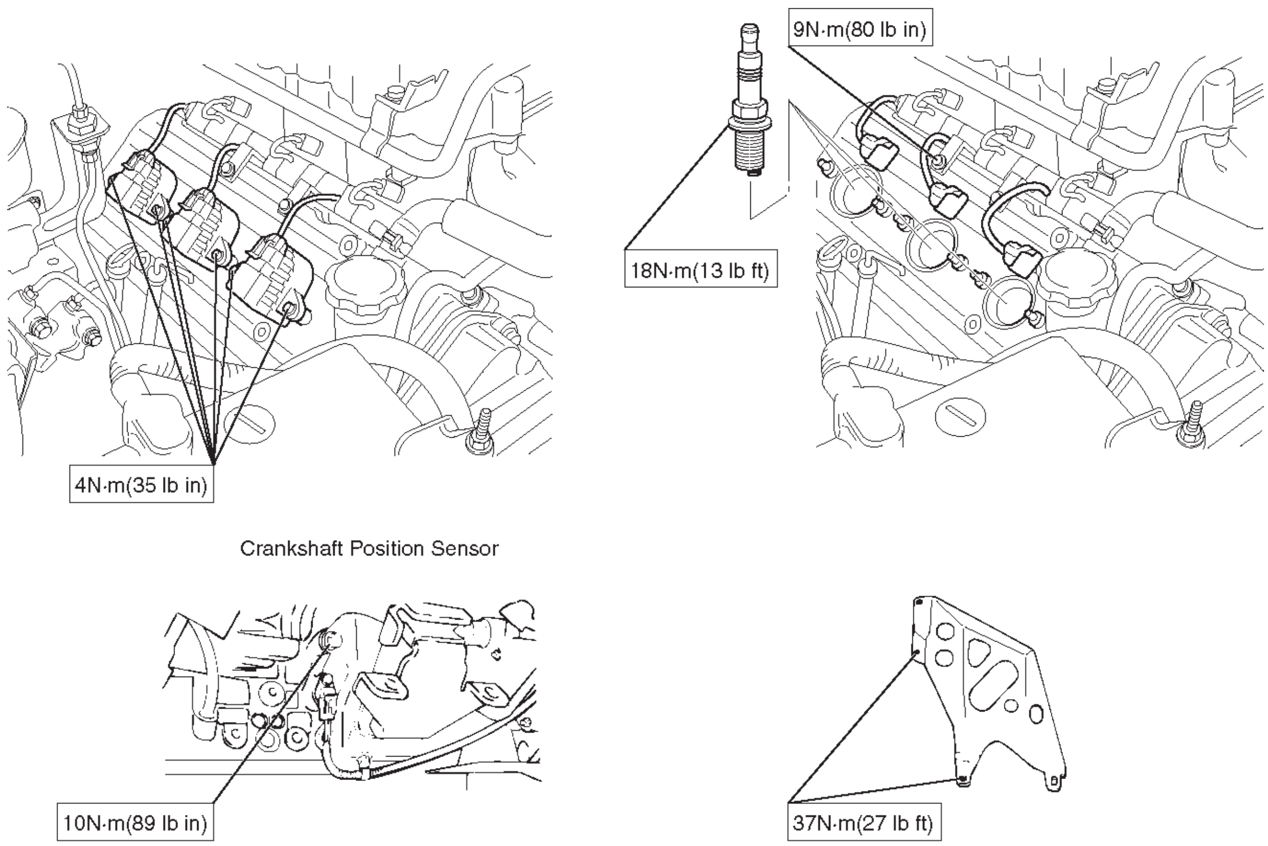
2. Reconnect wiring connector to crankshaft position sensor.

Main Data and Specifications

General Specifications

Ignition System	
Ignition Form	Electronic Ignition System (El system) with Crankshaft position Sensor
Spark Plug	
Type	K16PR–P11 RC10PYP4 PK16PR11
Plug gap	1.0 mm (0.04 in) – 1.1 mm (0.043 in)
Torque	18 N·m (13 lb ft)

Torque Specifications



E06RY001

TROOPER

ENGINE

STARTING AND CHARGING SYSTEM

CONTENTS

Service Precaution

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Starting System

General Description

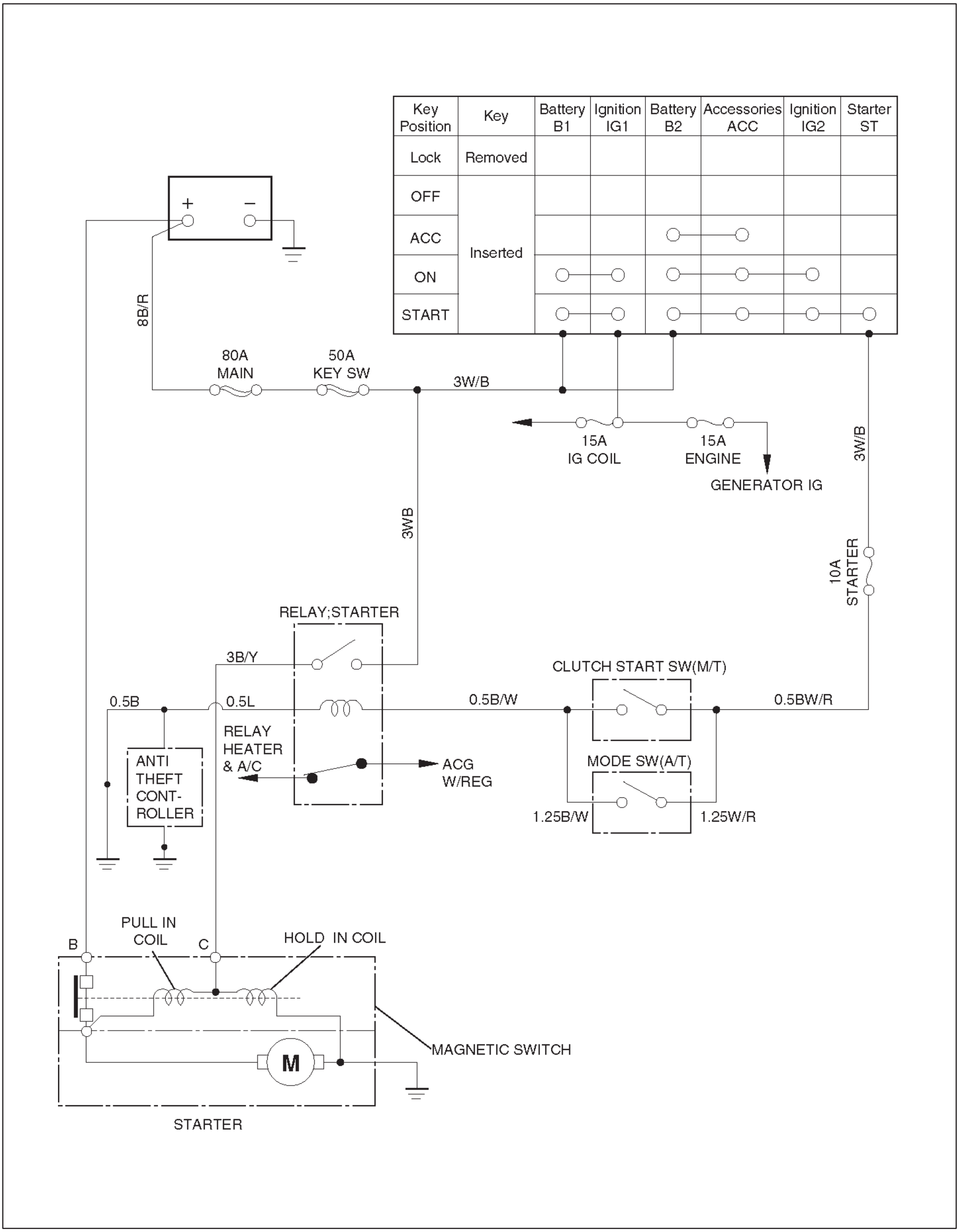
Cranking Circuit

The cranking system consists of a battery, starter, starter switch, starter relay, etc. These main components are connected.

Starter

The cranking system employs a magnetic type reduction starter in which the motor shaft is also used as a pinion shaft. When the starter switch is turned on, the contacts of magnetic switch are closed, and the armature rotates. At the same time, the plunger is attracted, and the pinion is pushed forward by the shift lever to mesh with the ring gear.

Then, the ring gear runs to start the engine. When the engine starts and the starter switch is turned off, the plunger returns, the pinion is disengaged from the ring gear, and the armature stops rotation. When the engine speed is higher than the pinion, the pinion idles, so that the armature is not driven.


Key Position
Key
Battery B1
Ignition IG1
Battery B2
Accessories ACC
Ignition IG2
Starter ST
Lock
Removed
OFF
ACC
Inserted
ON
START
+
–
8B/R
80A MAIN
50A KEY SW
3W/B
15A IG COIL
15A ENGINE
GENERATOR IG
3W/B
3WB
10A STARTER
RELAY;STARTER
3B/Y
0.5B
0.5L
0.5B/W
0.5BW/R
CLUTCH START SW(M/T)
MODE SW(A/T)
1.25B/W
1.25W/R
RELAY HEATER & A/C
ACG W/REG
ANTI THEFT CONT-ROLLER
PULL IN COIL
B
C
HOLD IN COIL
M
MAGNETIC SWITCH
STARTER

C06RY00002

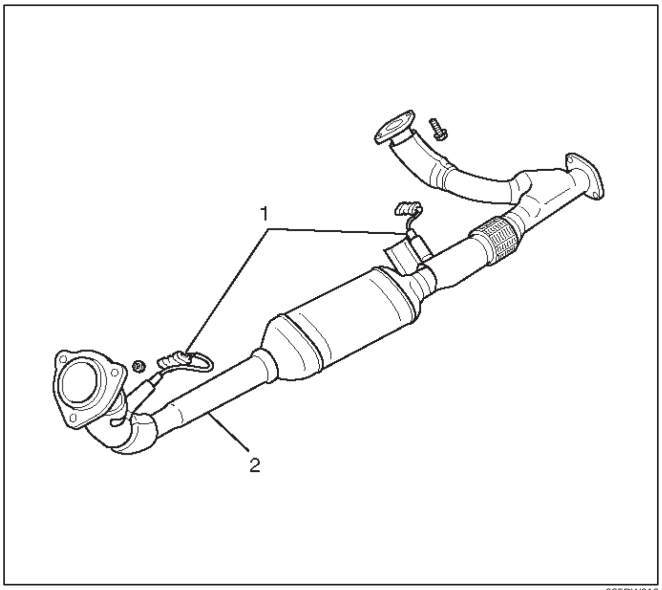
Diagnosis

Condition	Possible cause	Correction
Starter does not run	Charging failure	Repair charging system
	Battery Failure	Replace Battery
	Terminal connection failure	Repair or replace terminal connector and/or wiring harness
	Starter switch failure	Repair or replace starter switch
	Starter failure	Repair or replace starter

Starter

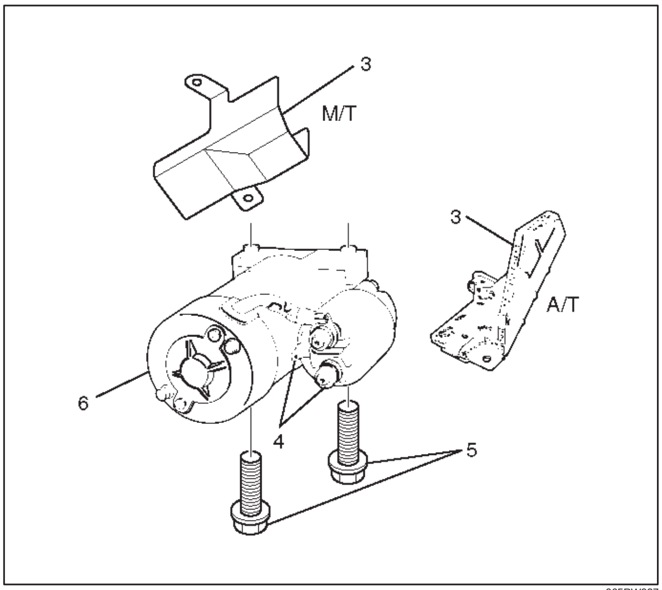
Removal

1. Battery ground cable.
2. Disconnect Heated O2 Sensor connector (1).
3. Remove exhaust front left pipe(2).



035RW016

4. Remove heat protector(3).
5. Disconnect starter wiring connector from terminals “B” and “S”(4).
6. Remove starter assembly mounting bolts on inside and outside(5).
7. Remove starter assembly toward the bottom of engine(6).



065RW027

Installation

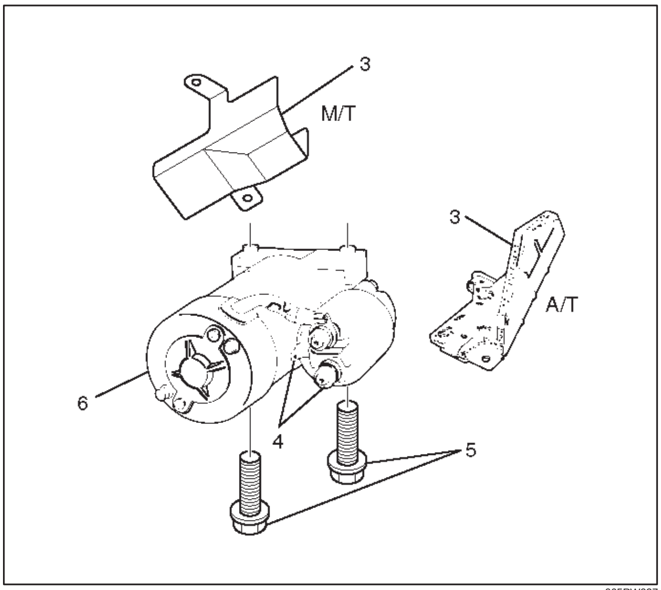
1. Install starter assembly(6).
2. Install mounting bolts and tighten bolts to specified torque(5).

Torque: 40 N·m (30 lb ft)

3. Reconnect the connectors to terminals “B” and “S” and tighten Terminals “B” to specified torque.

Torque: 9 N·m (80 lb in)

4. Install heat protector(3).



065RW027

5. Install exhaust front left pipe and tighten bolts and nuts to specified torque(2).

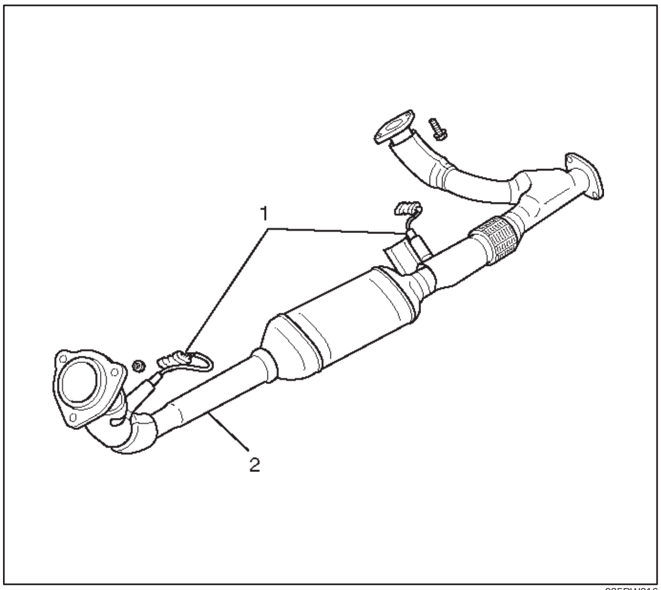
Stud Nuts

Torque: 67 N·m (49 lb ft)

Nuts

Torque: 43 N·m (32 lb ft)

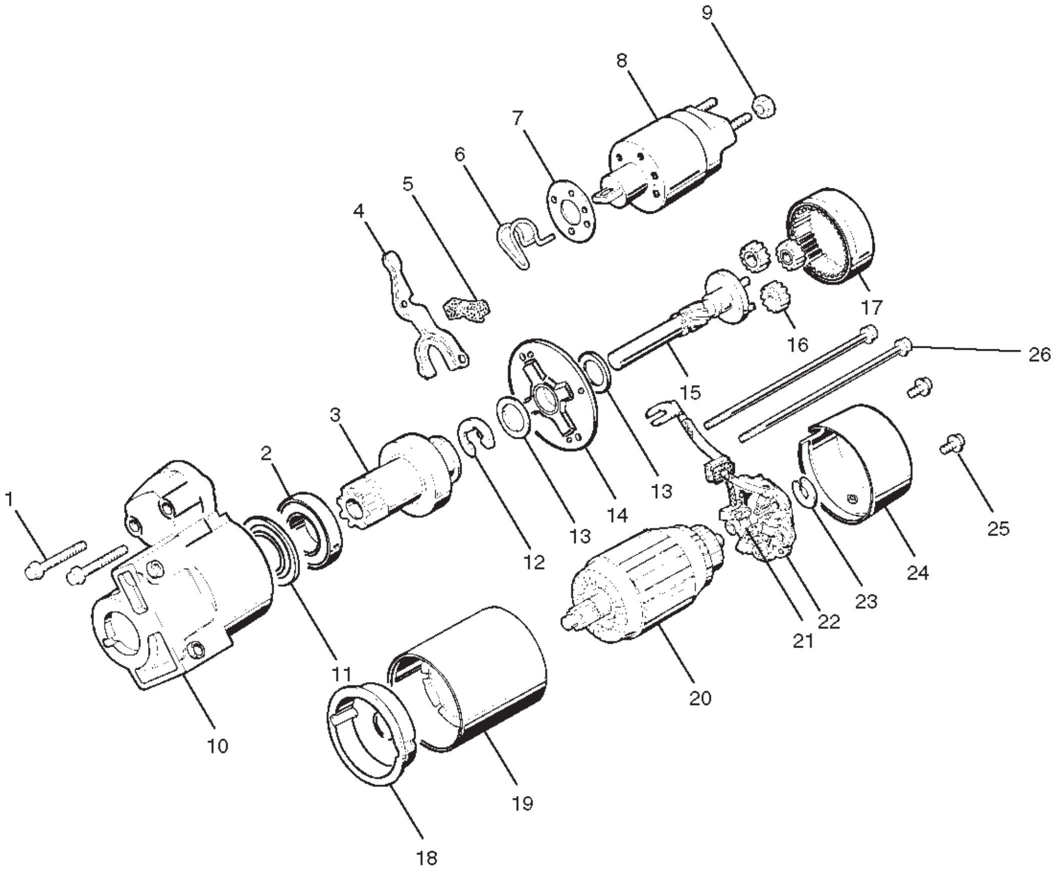
6. Connect Heated O2 Sensor connector (1).



035RW016

7. Reconnect the battery ground cable.

Disassembled View

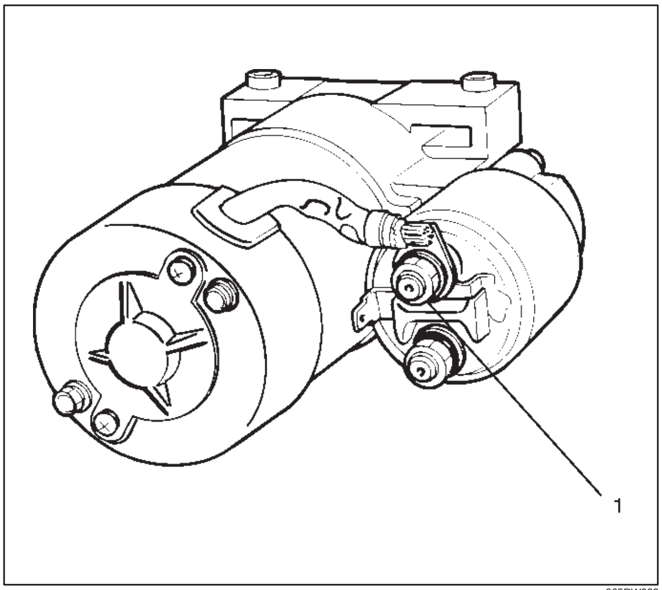


Legend

(1) Bolt (2 pcs)
(2) Ball Bearing
(3) Pinion
(4) Shift Lever
(5) Dust Cover
(6) Torsion Spring
(7) Dust Cover
(8) Magnetic Switch
(9) Nut
(10) Gear Case
(11) Bearing Cover
(12) E–Ring
(13) Thrust Washer (2)
(14) Center Bracket
(15) Pinion Shaft
(16) Planet Gear (3)
(17) Internal Gear
(18) Center Bracket (A)
(19) Yoke Assembly
(20) Armature
(21) Brush
(22) Brush Holder
(23) Thrust Washer
(24) Rear Cover
(25) Screw (2 pcs)
(26) Through Bolt (2 pcs)

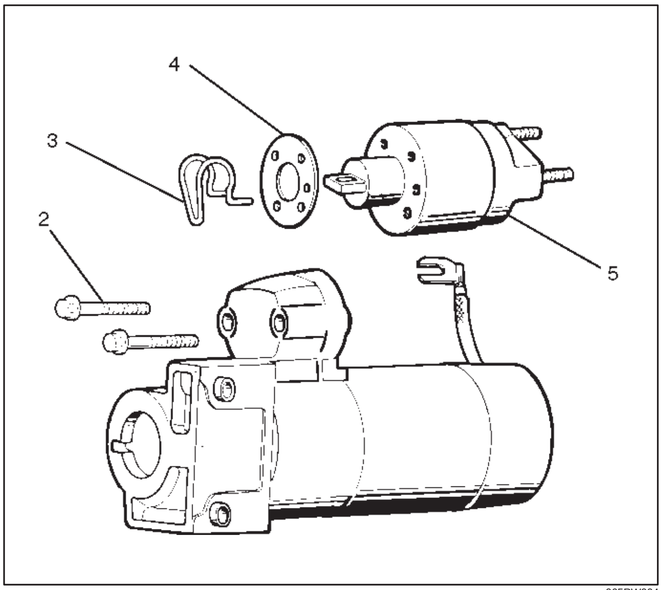
Disassembly

1. Loosen the nut(1) on terminal "M" of magnetic switch and disconnect the connector cable.
2. Remove bolt (2 pcs) (2).



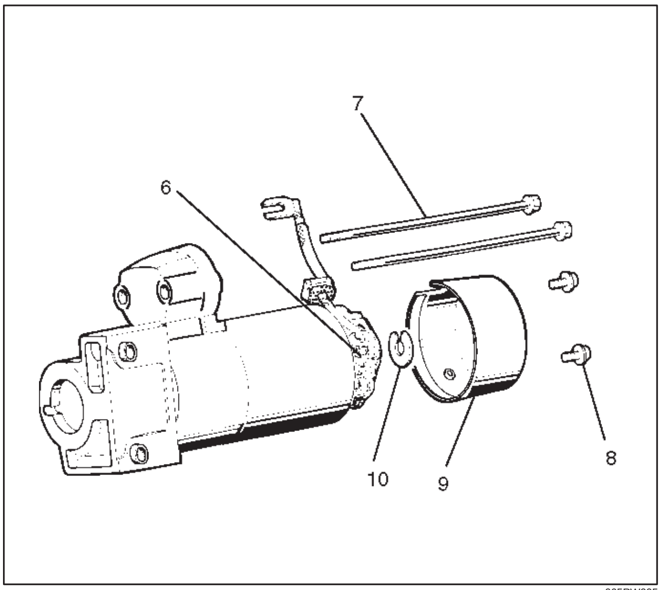
065RW003

3. Remove magnetic switch(5).
4. Remove dust cover(4).
5. Remove torsion spring bolts, then the magnetic switch assembly.
6. Remove torsion spring(3) from magnetic switch assembly(5).



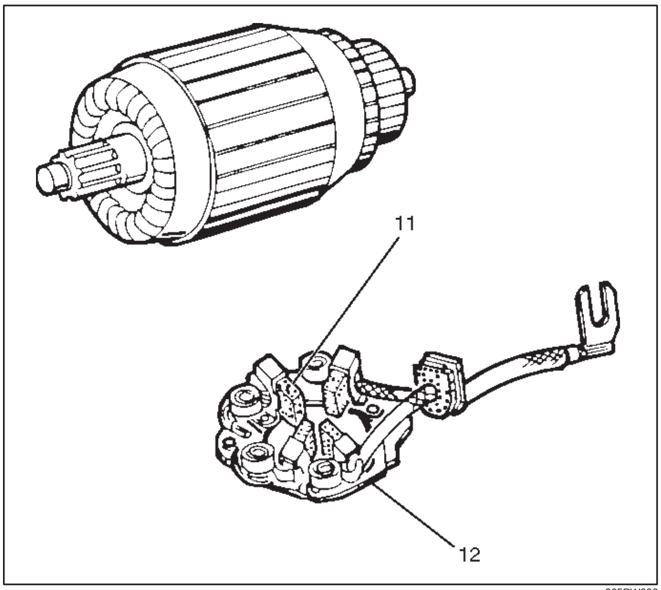
065RW004

7. Remove screw (2 pcs) (8).
8. Remove through bolt (2 pcs) (7).
9. Remove screws and through bolts, then the rear cover(9) then remove thrust washer(10).
10. Remove brush holder(6).



065RW005

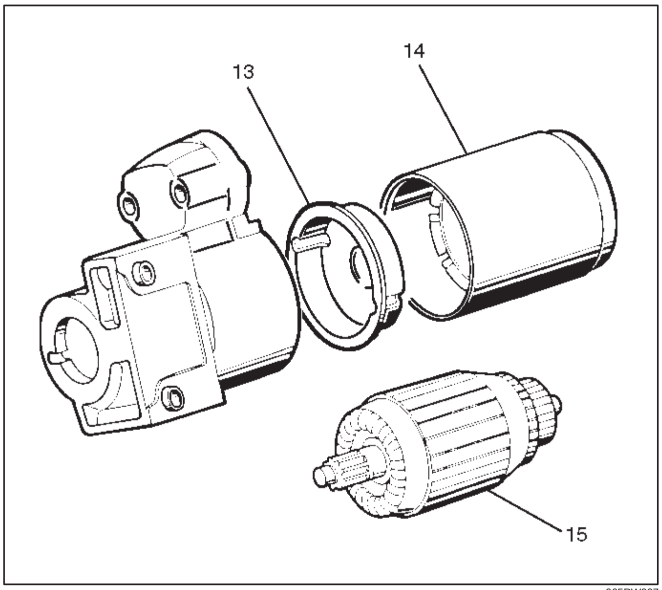
11. Raise a brush spring to detach brushes (4 pcs) from the commutator face and pull off the brush holder(12) and brush(11).



065RW006

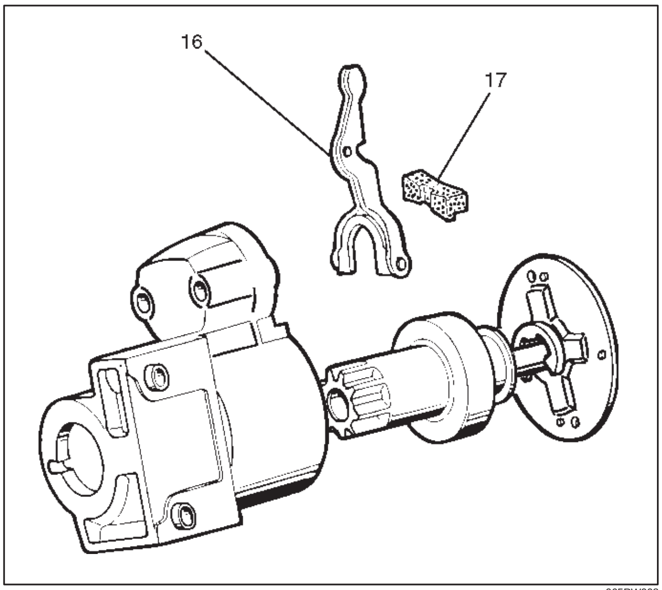
12. Remove yoke assembly(14).
13. Remove armature(15).
14. Pull off the yoke assembly, then remove armature, washer and center bracket.(A) (13).

NOTE: In disassembling the yoke assembly, hold the armature and pull off slowly the yoke assembly. Because of strong magnetic force, avoid placing a metallic part near armature.



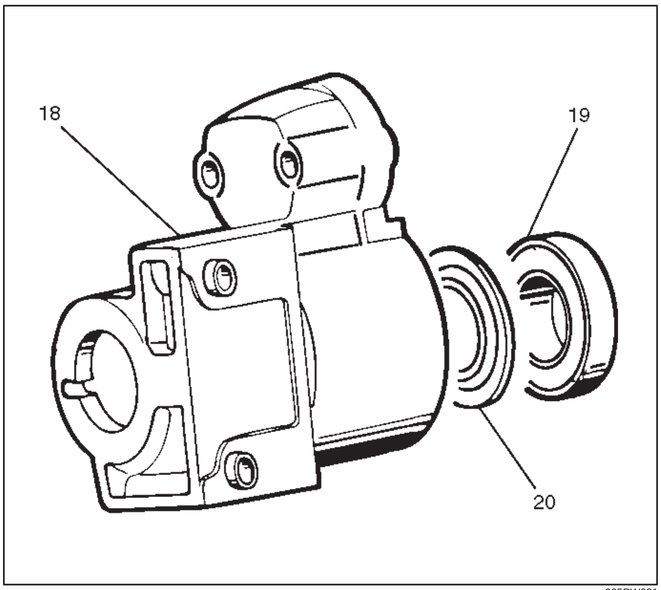
065RW007

15. Remove dust cover(17).
16. Remove a dust cover and shift lever(16) from the gear case.



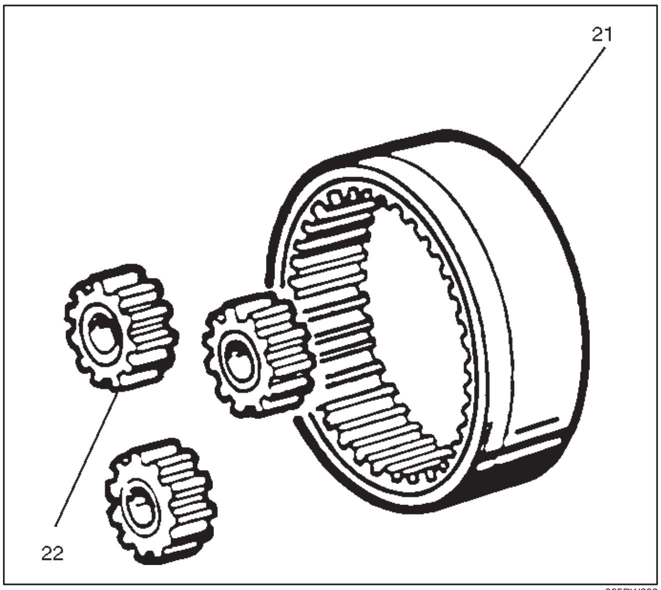
065RW008

17. Remove ball bearing(19).
18. Remove bearing cover(20).
19. Remove a ball bearing and bearing cover from the gear case(18).



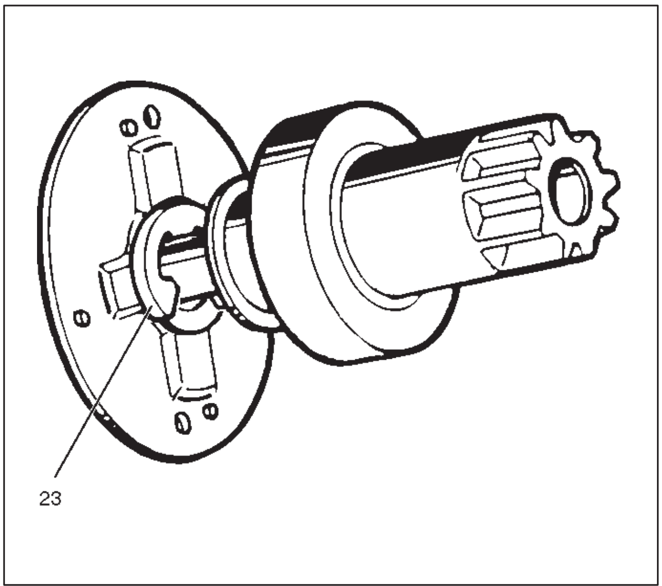
065RW021

20. Internal gear(21).
21. Remove internal gear and planet gear(3) (22).



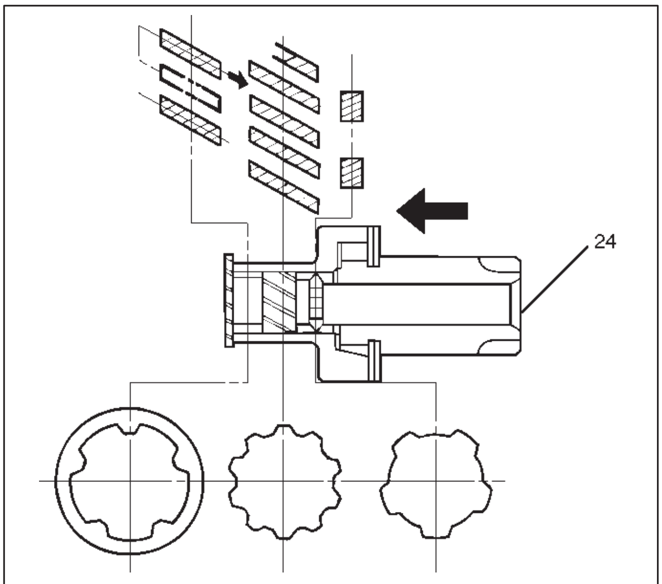
065RW009

22. Remove an E–ring(23) from the pinion shaft using a flat blade screwdriver.



065RW010

23. Holding the pinion shaft, push pinion toward the center bracket. and turn the pinion clockwise or counterclockwise by one tooth of spline, then pull off the pinion.
24. Remove thrust washer(24).
25. Remove center bracket
26. Remove pinion shaft.



065RW011

Inspection and Repair

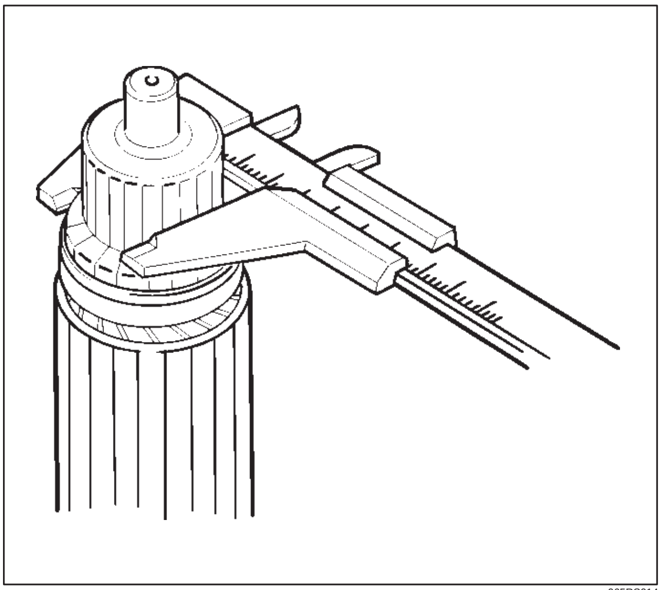
Repair or replace necessary parts if extreme wear or damage is found during inspection.

Armature

Measure the outer diameter of commutator, and replace with a new one if it is out of the limit.

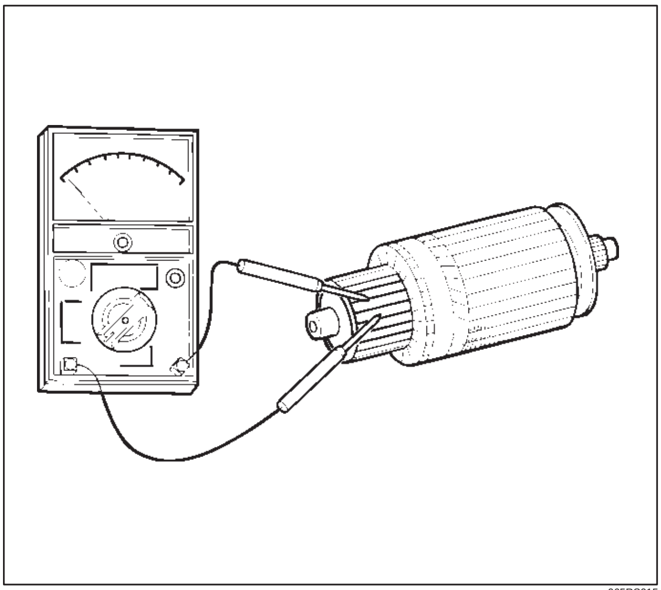
Standard: 33.0 mm (1.30 in)

Limit: 32.0 mm (1.26 in)



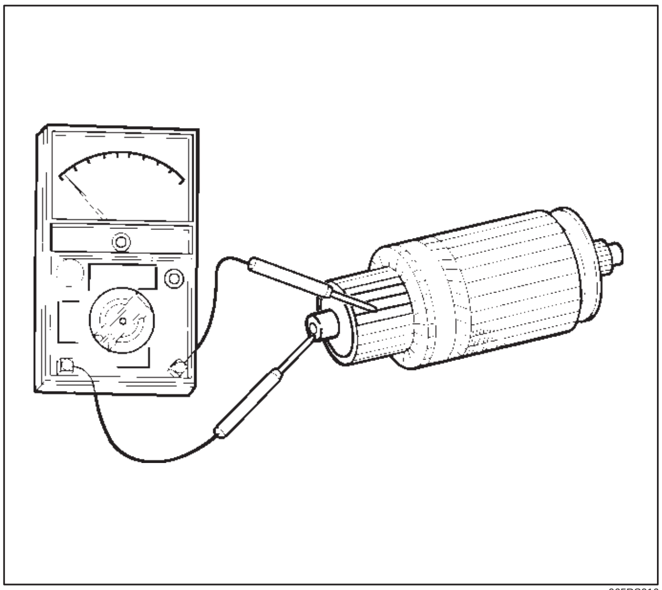
065RS014

Check for continuity between commutator and segment. Replace commutator if there is no continuity (i.e., disconnected).



065RS015

Check for continuity between commutator and shaft. Also, check for continuity between commutator and armature core,armature core and shaft. Replace commutator if there is continuity (i.e., internally grounded).



065RS016

Measure runout of armature core and commutator with a dial gauge. Repair or replace, if it exceeds the limit.

Armature

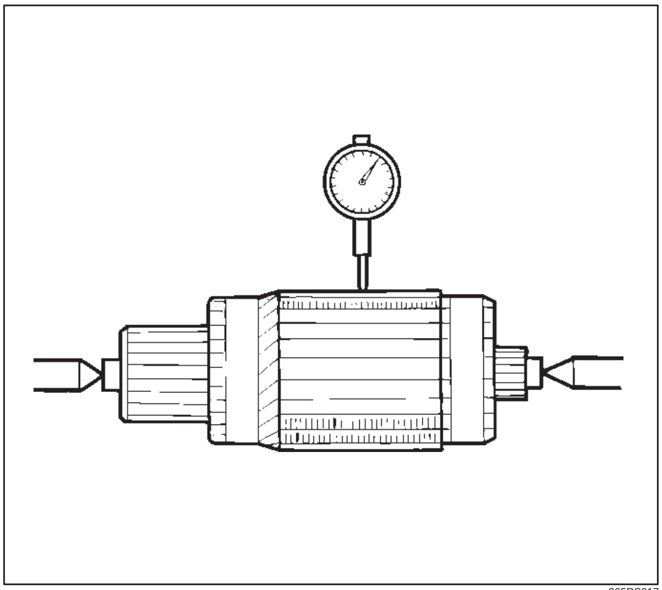
Standard: 0.05 mm (0.002 in) Max.

Limit: 0.10 mm (0.004 in)

Commutator

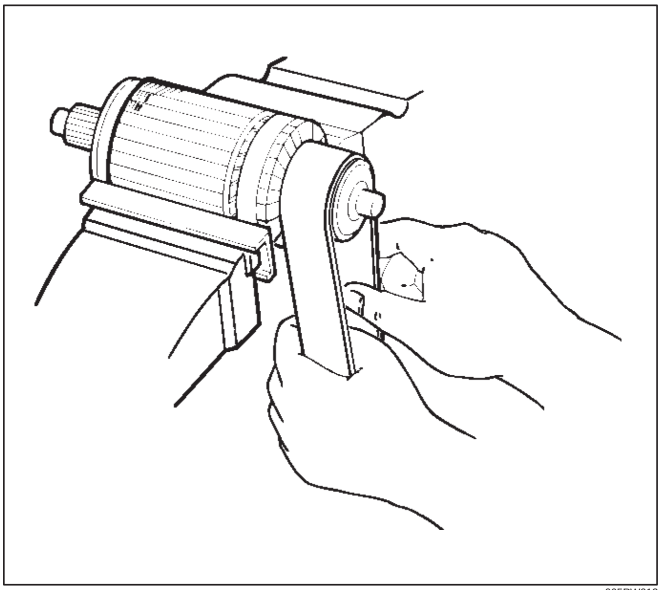
Standard: 0.05 mm (0.002 in) Max.

Limit: 0.10 mm (0.004 in)



065RS017

Polish the commutator surface with sandpaper #500 to #600 if it is rough.

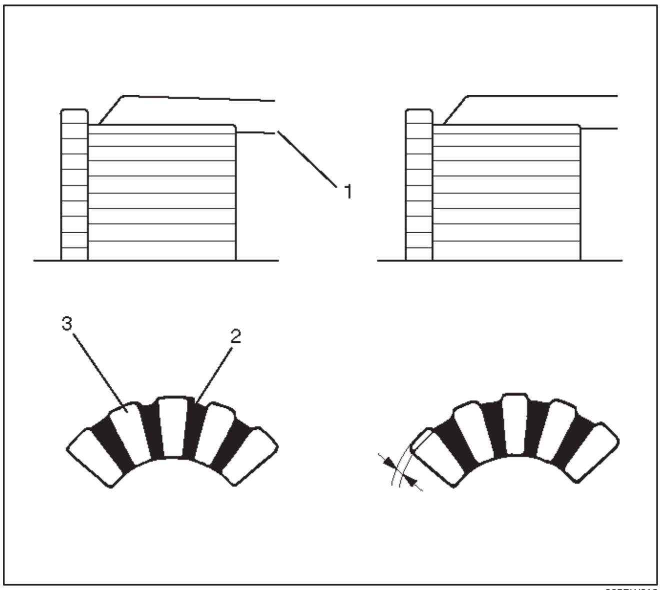


065RW012

Measure the depth of insulator in commutator. Repair, if it is below the limit.

Standard: 0.5 mm to 0.8 mm (0.02 in to 0.03 in)

Limit: 0.2 mm (0.008 in)



065RW013

Legend

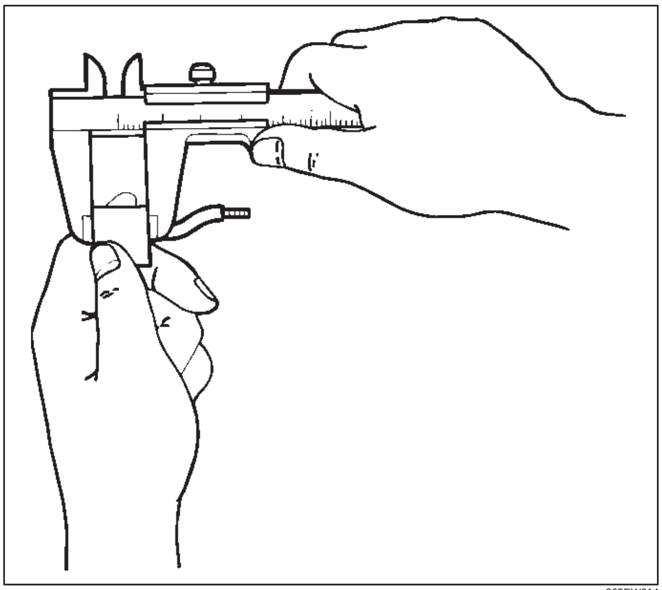
(1) Steel Saw
(2) Insulator
(3) Commutator Segments

Brush

Measure the length of brush.
Replace with a new one, if it is below the limit.

Standard: 16 mm (0.63 in)

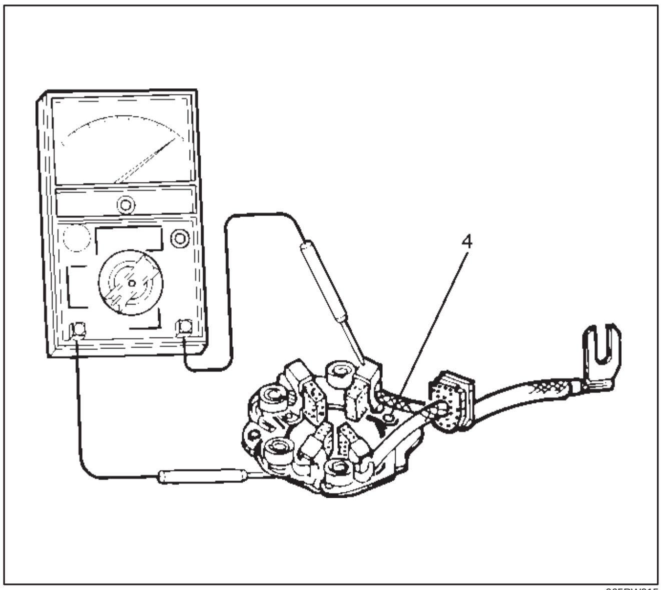
Limit: 11 mm (0.43 in)



065RW014

Brush Holder

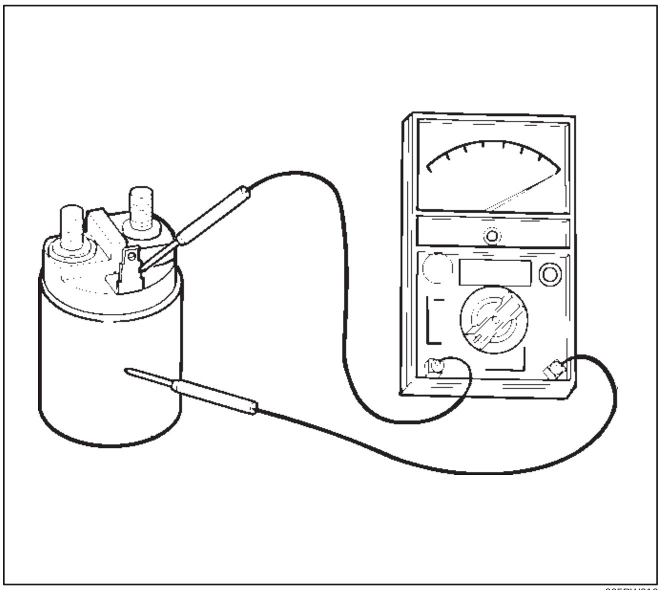
Check for continuity between brush holder (+) (4) and base (–). Replace, if there is continuity (i.e., insulation is broken).



065RW015

Magnetic Switch

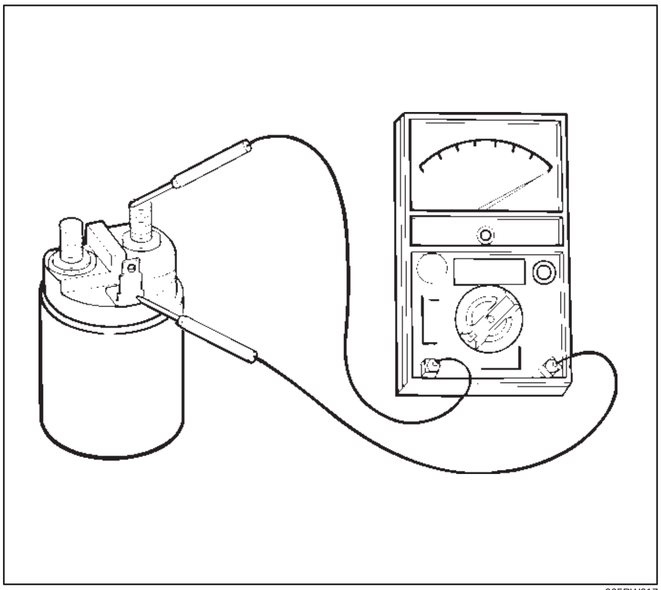
Check for continuity of shunt coil between terminals S and M.
Replace, if there is no continuity (i.e., coil is disconnected).



065RW016

Continuity of Series Coil

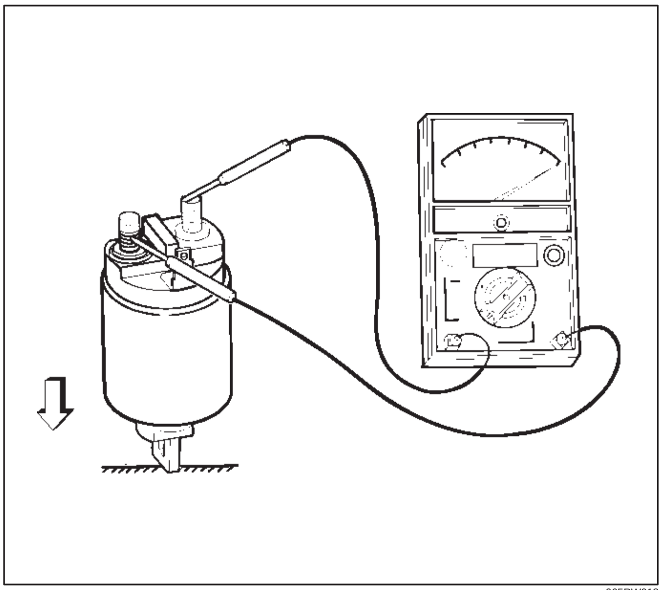
Check for continuity between terminals S and M.
Replace, if there is no continuity (i.e., coil is disconnected).



065RW017

Continuity of Contacts

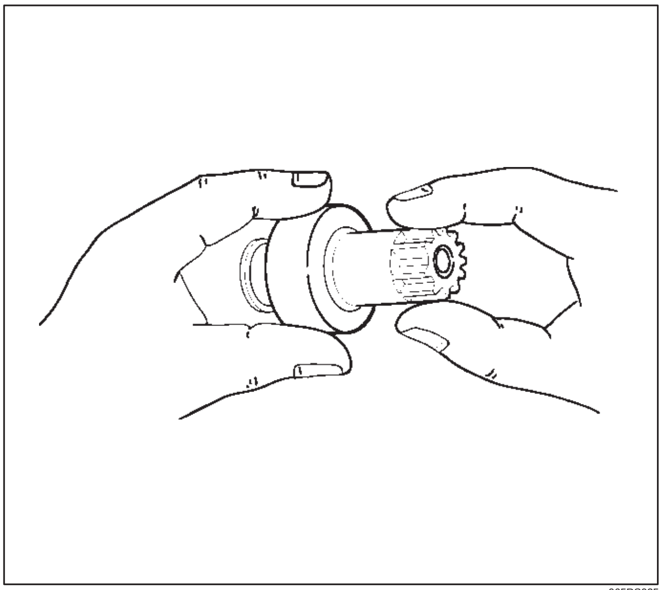
With the plunger faced downward, push down the magnetic switch. In this state, check for continuity between terminals B and M. Replace, if there is no continuity (i.e., contacts are faulty).



065RW018

Pinion

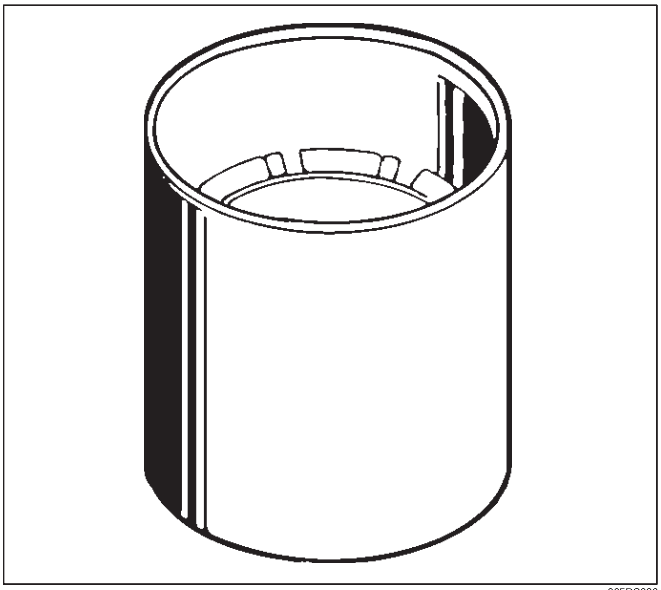
Check if the pinion rotates smoothly in drive direction by hand, or if it is locked when it is rotated in reverse. If not, replace the pinion.



065RS025

Yoke Assembly

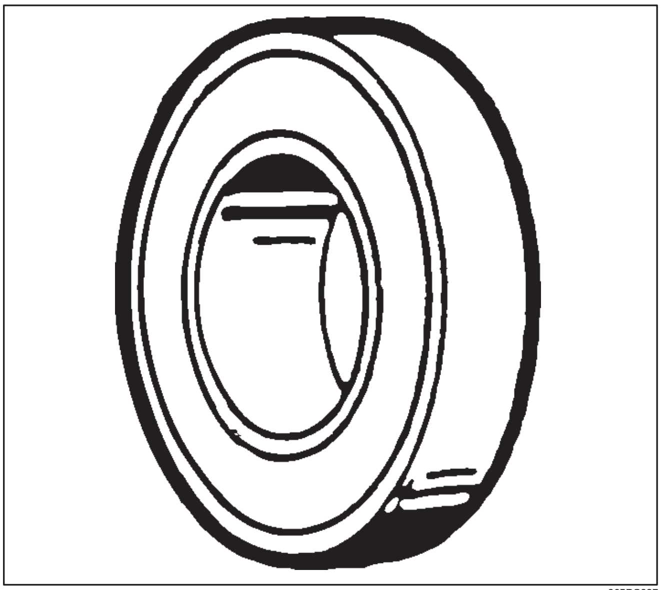
Check a magnet inside the yoke.
Replace the yoke assembly if it is broken.



065RS026

Ball Bearing

Clamp the inner race of the ball bearing with your finger, and check for sticking or play when rotating the outer race.
Replace, if abnormality is found.

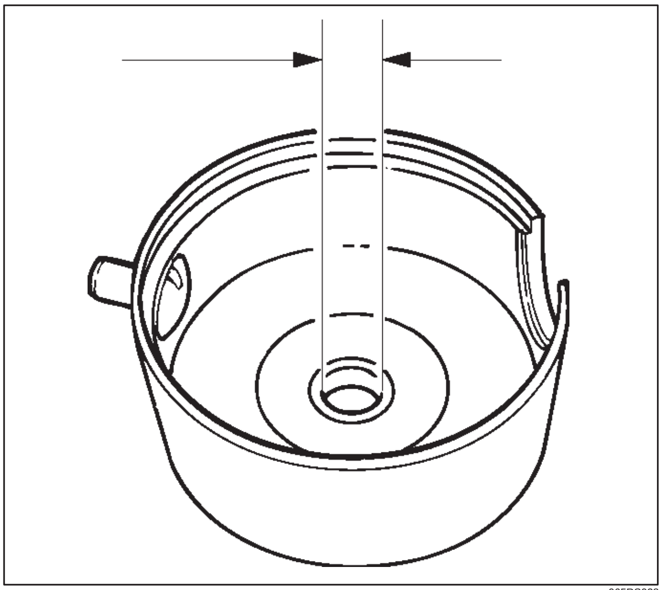


065RS027

Measure inner diameter of bushing in the rear cover, and replace if it exceeds the limit.

Standard: 12.50 mm to 12.527 mm (0.492 in to 0.4932 in)

Limit: 12.60 mm (0.4961 in)

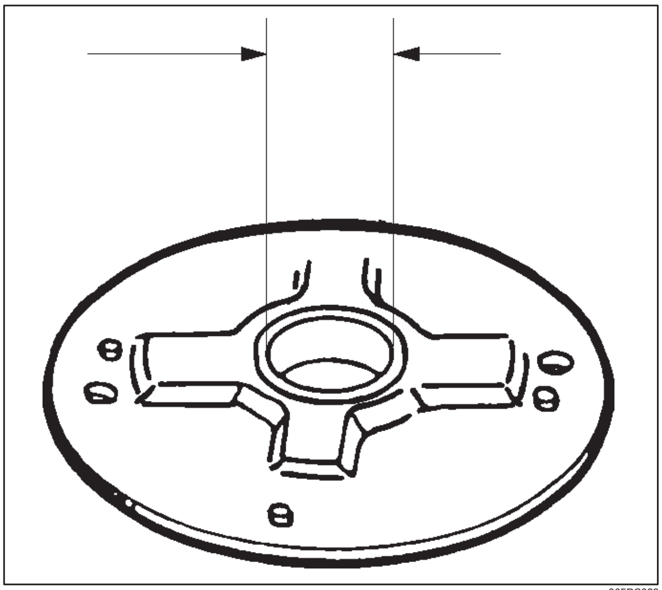


065RS028

Measure inner diameter of bushing in the center bracket (P), and replace if it exceeds the limit.

Standard: 18.01 mm to 18.127 mm (0.7091 in to 0.7137 in)

Limit: 18.15 mm (0.7146 in)



065RS029

Reassembly

To install, follow the removal steps in the reverse order, noting the following points:

Grease application places

- Bushing in rear cover and center bracket
- Gears in reduction gear
- Shift lever operating portion
- Sliding portion of pinion
- Plunger sliding portion of magnetic switch

Reassembling Yoke Assembly

Before reassembly, make sure that no metallic parts attach to the yoke assembly. Because of strong magnetic force, hold the yoke assembly and insert it slowly into the armature.

Torque

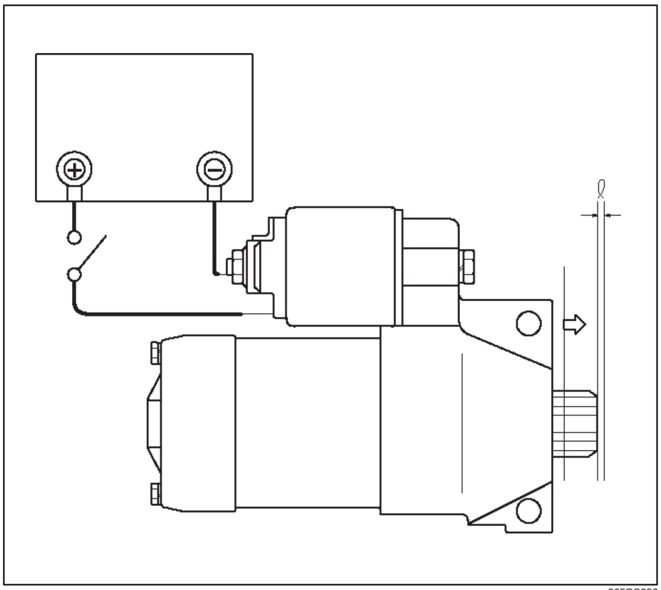
Torque for each part (See Torque Specifications in this section)

Pinion Jump–out Dimension

Connect the "+" cable of battery to terminal S and the "–" cable to terminal M. Turn the switch on, and measure pinion travel dimension in thrust direction from the jump–out position.

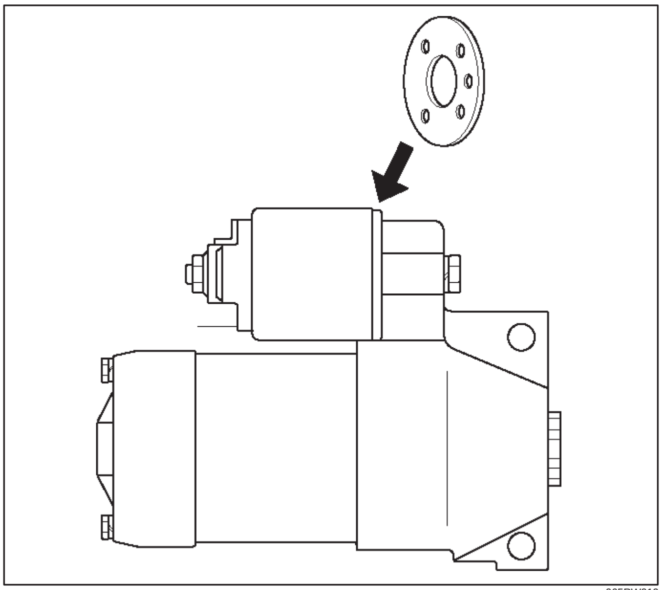
In measuring the dimension, pull the pinion out a little in the arrow direction.

Dimension(L): 0.05 mm to 1.5 mm (0.002 in to 0.06 in)



065RS030

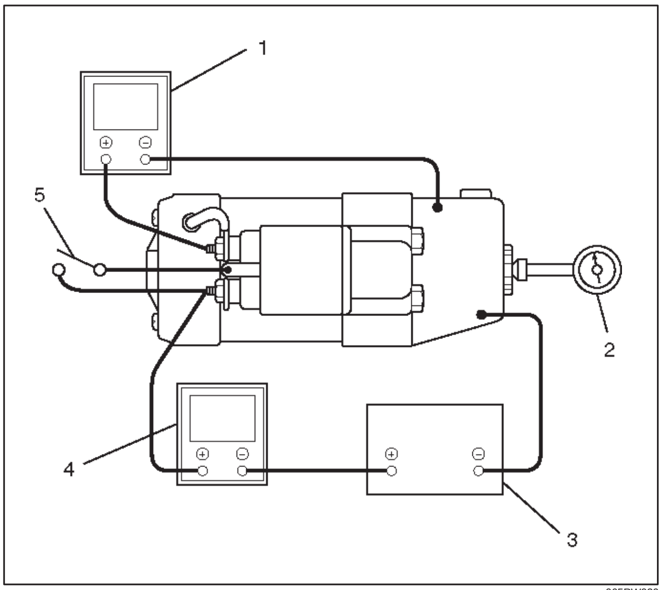
If the measured value is out of standard, insert dust cover, or disassemble and adjust.



065RW019

Characteristic Test

For easily confirming the characteristics, conduct the no load test as follows:
Rating as short as 30 seconds requires rapid testing.
Fix the starter on the test bench, and wire as shown in illustration. When the switch is closed, the current flows and the starter runs under no load. At this time, measure current, voltage and speed to check if they satisfy the standard.



065RW020

Legend

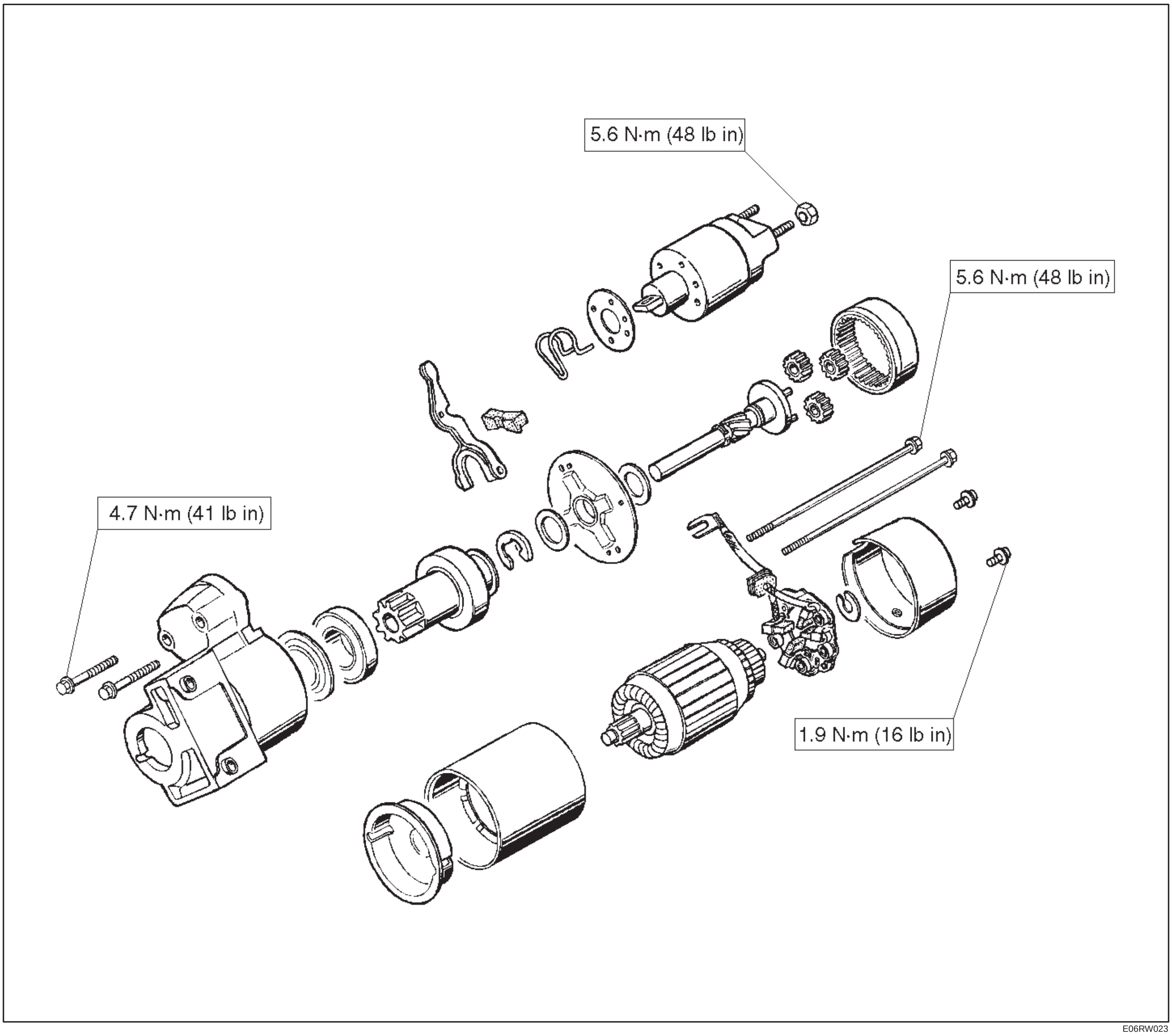
(1) Volt Meter
(2) Tachometer
(3) Battery
(4) Ammeter
(5) Switch

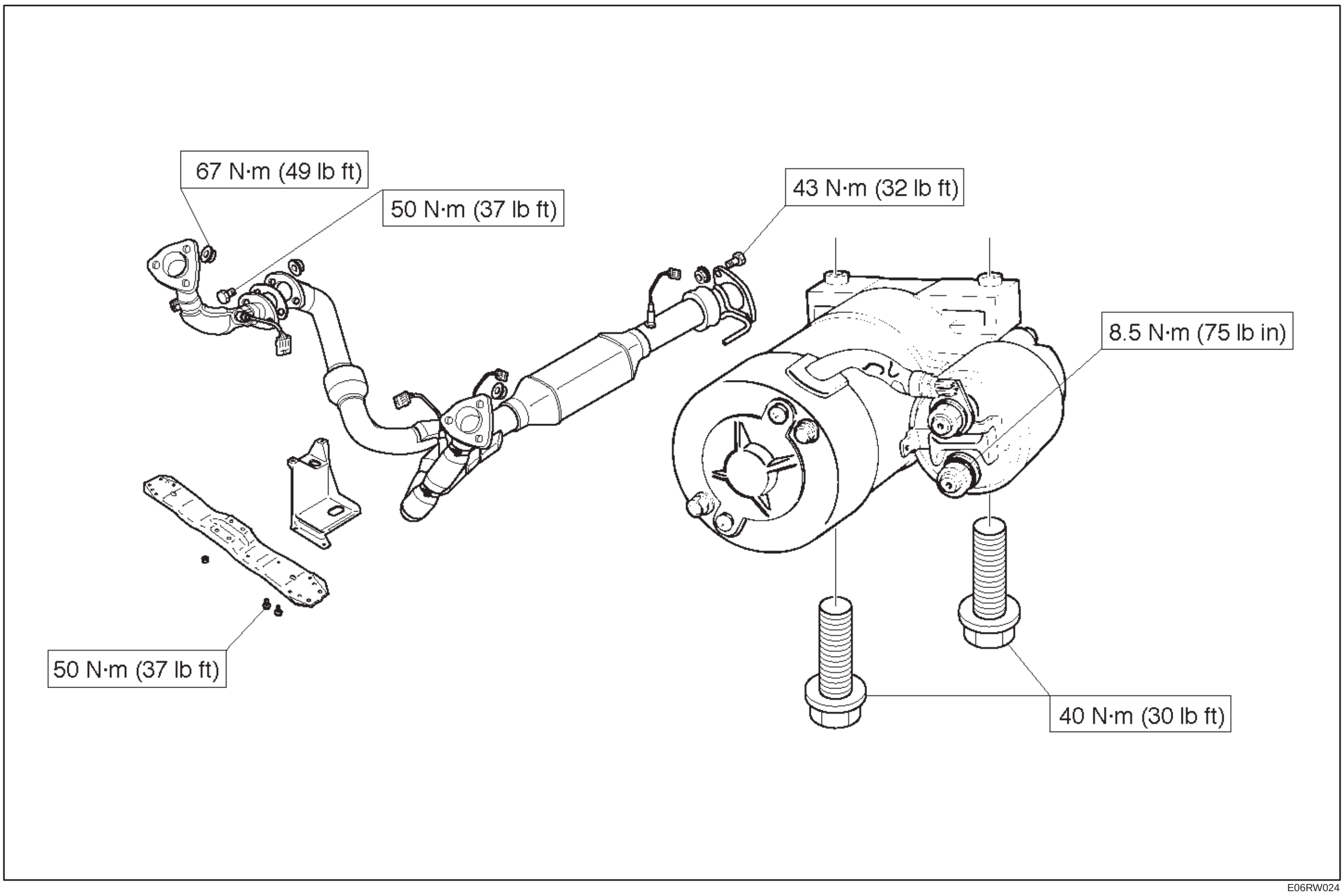
Main Data and Specifications

General Specifications

Model	HITACHI GD003138
Rating	
Voltage	12 V
Output	1.4 Kw
Time	30 sec
Number of teeth of pinion	9
Rotating direction(as viewed from pinion)	Clockwise
Weight(approx.)	34 N
No load characteristics	
Voltage /Current	11V/90A or less
Speed	2700rpm or more
Load characteristics	
Voltage/current	8.4V/250A
Torque	7.3N·m(64lb·in.) or more
Speed	1200rpm or more
Locking characteristics	
Voltage/current	3V/750A or less
Torque	19N·m(14lb·in) or more

Torque Specifications




67 N·m (49 lb ft)
50 N·m (37 lb ft)
43 N·m (32 lb ft)
8.5 N·m (75 lb in)
50 N·m (37 lb ft)
40 N·m (30 lb ft)
E06RW024

Charging System

General Description

The IC integral regulator charging system and its main components are connected as shown in the illustration.
The regulator is a solid state type and it is mounted along with the brush holder assembly inside the generator installed on the rear end cover.
The generator does not require particular maintenance such as voltage adjustment.
The rectifier connected to the stator coil has eight diodes to transform AC voltage into DC voltage.
This DC voltage is connected to the output terminal of generator.

General On–Vehicle Inspection

The operating condition of charging system is indicated by the charge warning lamp. The warning lamp comes on when the starter switch is turned to "ON" position. The charging system operates normally if the lamp goes off when the engine starts.
If the warning lamp shows abnormality or if undercharged or overcharged battery condition is suspected, perform diagnosis by checking the charging system as follows:

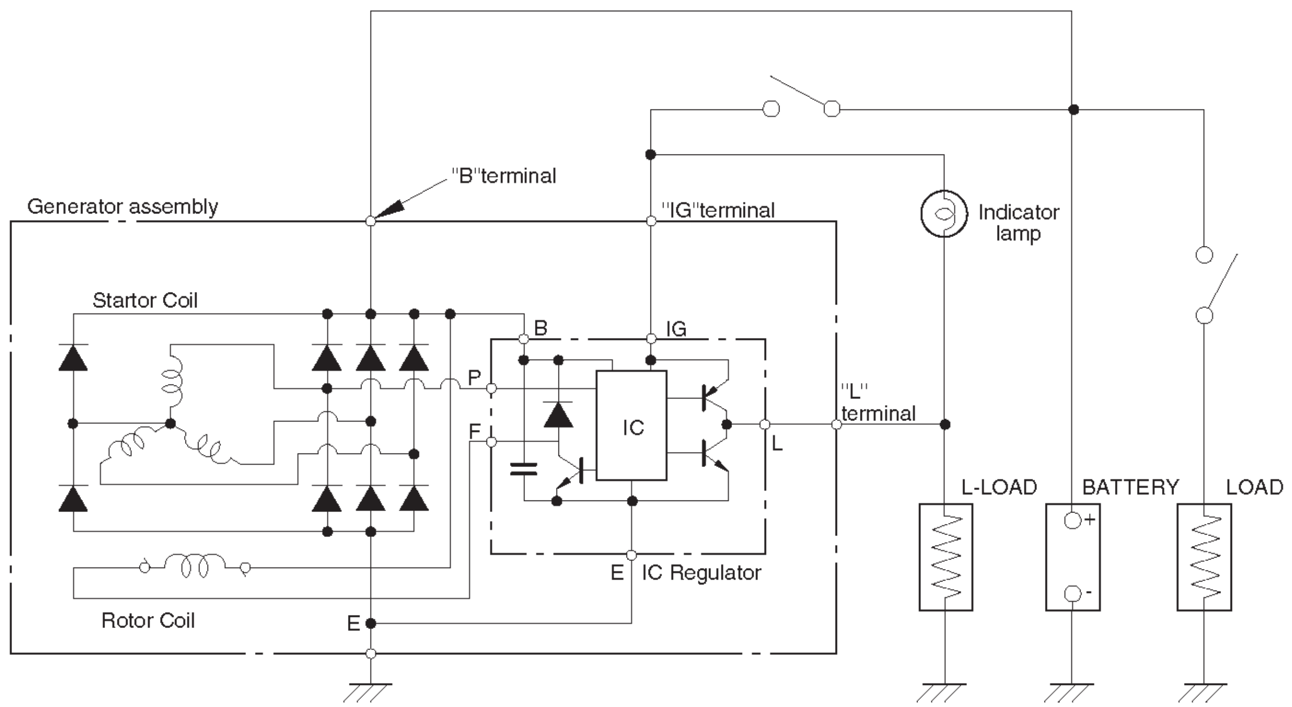
1. Check visually the belt and wiring connector.
2. With the engine stopped, turn the stator switch to "ON" position and observe the warning lamp.

   If lamp does not come on:

   Disconnect wiring connector from generator, and ground the terminal "L" on connector side.

   If lamp comes on:

   Repair or replace the generator.

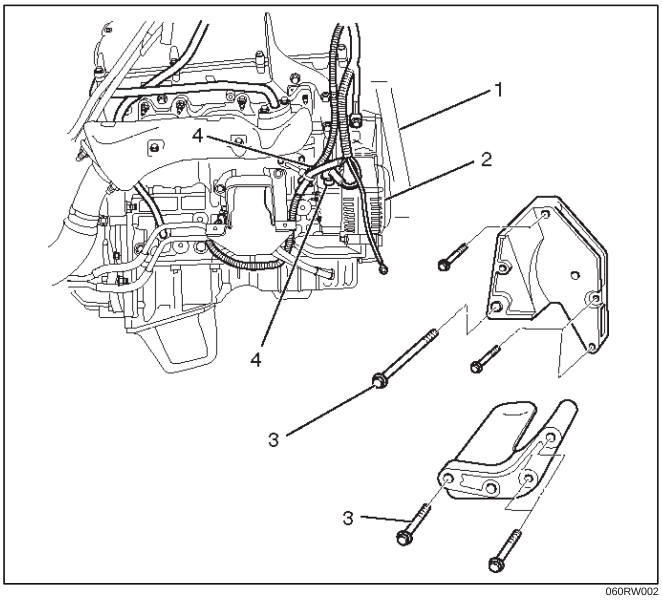


F06RY00002

Generator

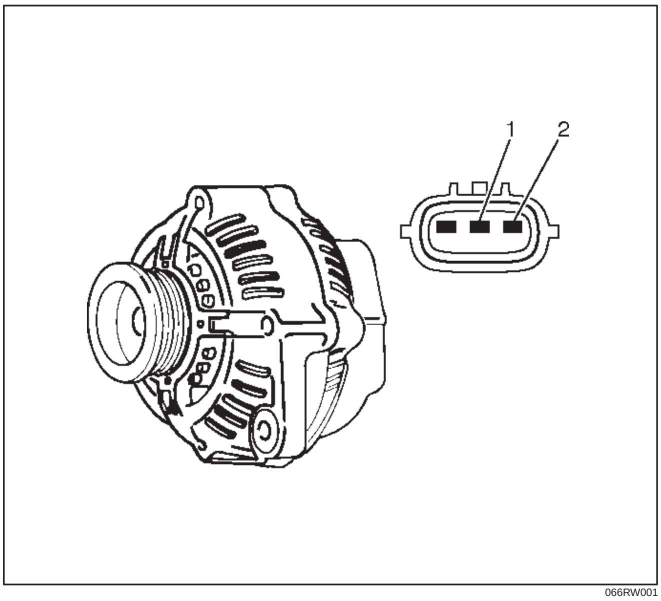
Removal

1. Disconnect battery ground cable.
2. Move drive belt tensioner to loose side using wrench then remove drive belt (1).
3. Disconnect the wire from terminal "B" and disconnect the connector (4).
4. Remove generator fixing bolt (3).
5. Remove generator assembly (2).



Inspection

1. Disconnect the wiring connector from generator.
2. With the engine stopped, turn starter switch to "ON" and connect a voltmeter between connector terminal L (2) and ground or between terminal IG (1) and ground.



If voltage is not present, the line between battery and connector is disconnected and so requires repair.

3. Reconnect the wiring connector to the generator, run the engine at middle speed, and turn off all electrical devices other than engine.
4. Measure battery voltage. If it exceeds 16V, repair or replace the generator.
5. Connect an ammeter to output terminal of generator, and measure output current under load by turning on the other electrical devices (eg., head lights). At this time, the voltage must not be less than 13V.

Installation

1. Install generator assembly to the position to be installed.
2. Install generator assembly and tighten the fixing bolts to the specified torque.

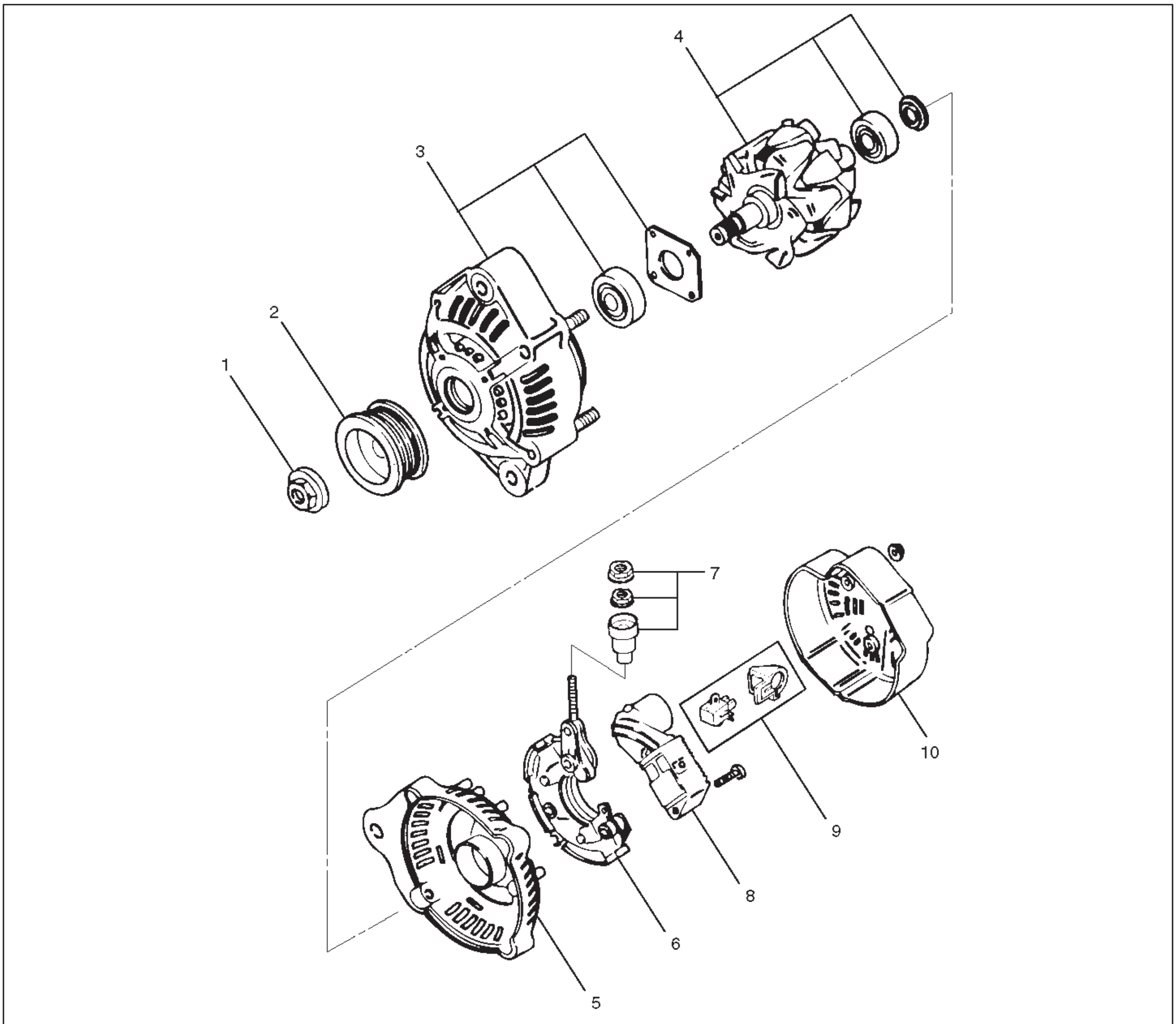
Torque:

M10 bolt: 41 N·m (30 lb ft)

M8 bolt: 21 N·m (15 lb ft)

3. Connect wiring harness connector and direct terminal "B".
4. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.
5. Reconnect battery ground cable.

Disassembled View

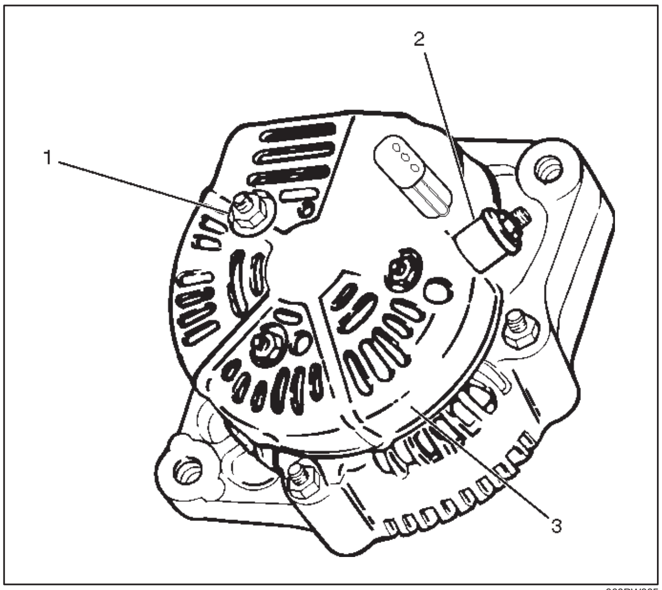


Legend

(1) Pulley Nut
(2) Pulley
(3) Front Cover Assembly
(4) Rotor Assembly
(5) Rear End Cover
(6) Rectifier
(7) Terminal Insulator and Nut
(8) Regulator Assembly
(9) Brush Holder Assembly
(10) Rear Cover

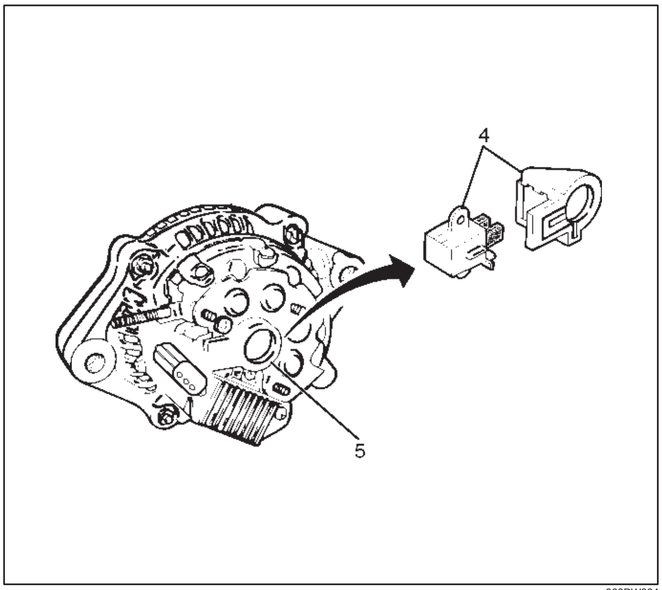
Disassembly

1. Terminal insulator and nut(2).
2. Remove three nuts(1) on the rear cover and a nut on terminal B and insulator, then remove the rear cover(3).



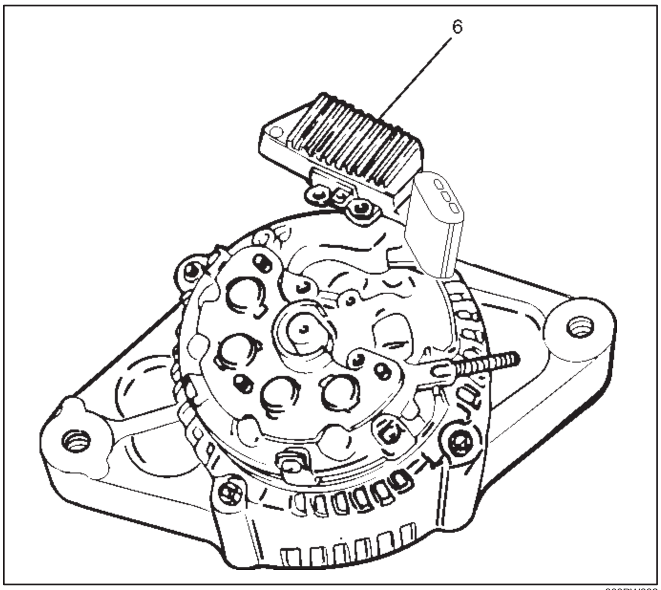
060RW005

3. Remove two screws that fix the brush holder(5) and rectifier, then remove the brush holder assembly(4).



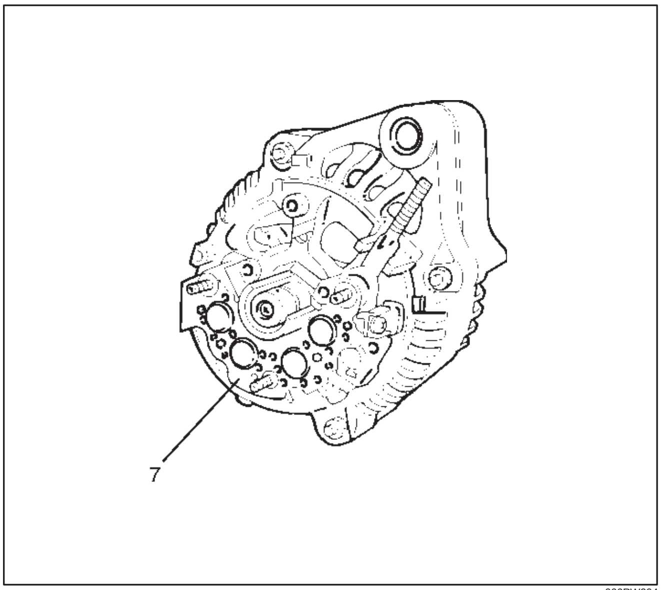
060RW004

4. Remove three screws on the IC regulator, then the IC regulator assembly(6).



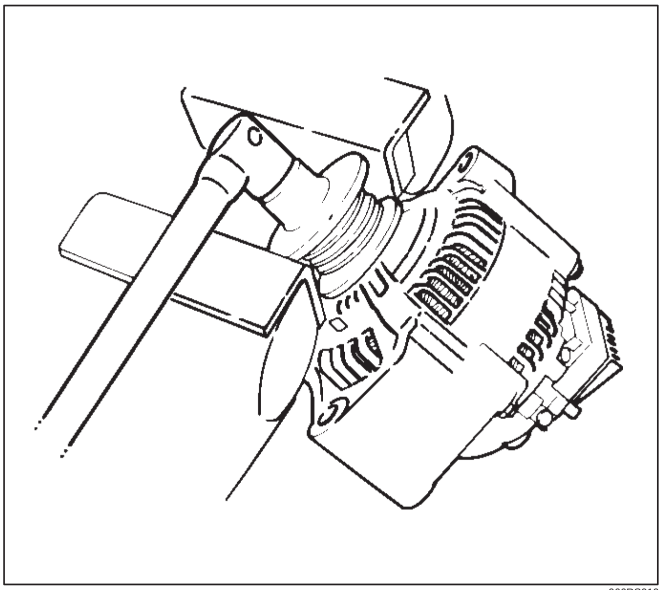
060RW003

5. Remove four screws that fix rectifier(7) and stator lead wires.



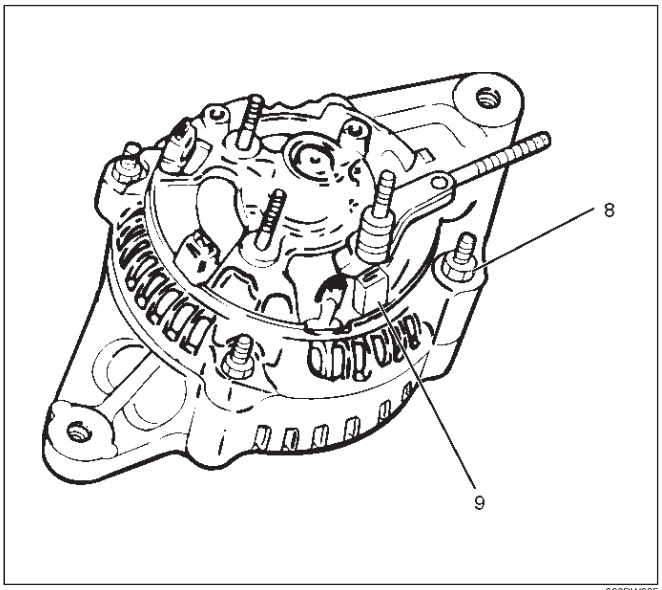
066RW004

6. Secure the pulley directly in the vise between two copper plates, and remove the nut and pulley.



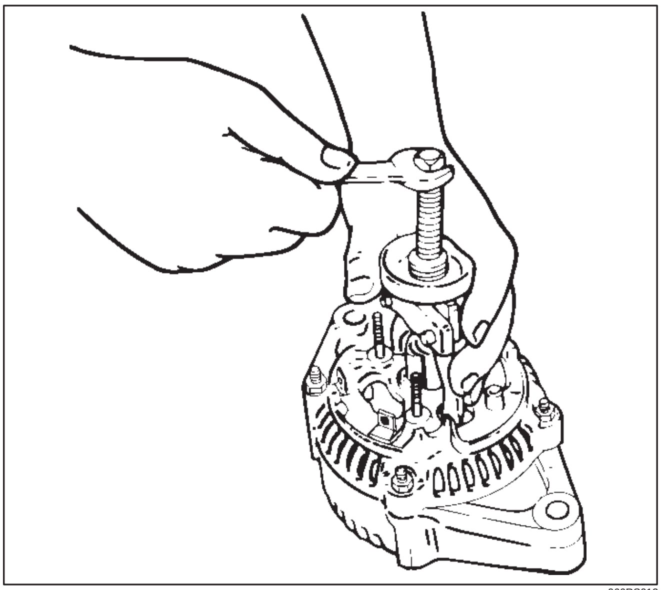
066RS010

7. Remove four nuts(8) that secure the front cover assembly and rear end cover, and an insulator(9).



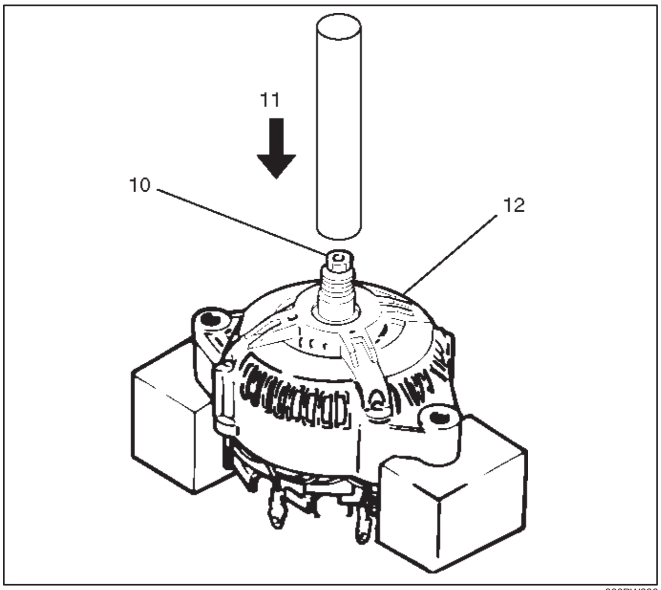
066RW005

8. Use the puller to remove the rear end cover.
9. Rotor assembly



066RS012

10. Pull the rotor assembly(10) off the front cover assembly(12) using a bench press(11).



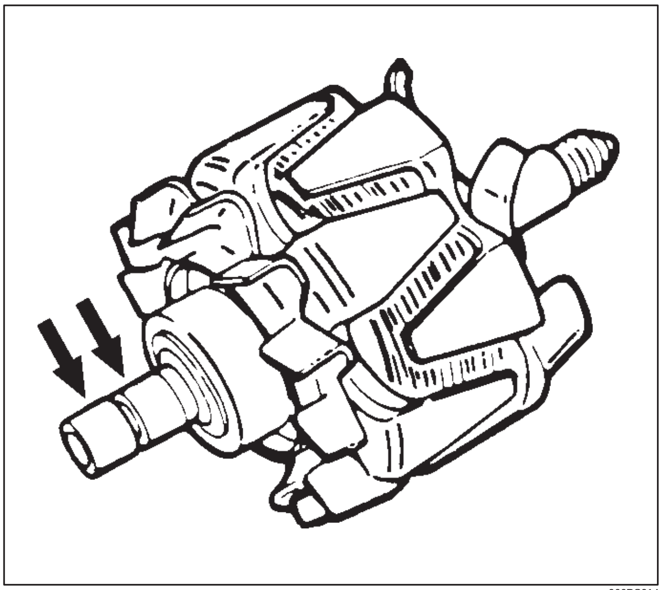
066RW006

Inspection and Repair

Repair or replace necessary parts if extreme wear or damage is found during inspection.

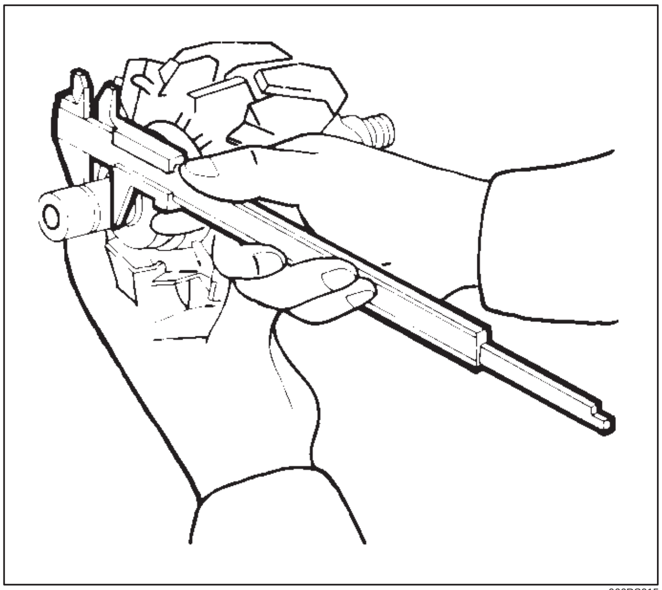
Rotor Assembly

1. Check the rotor slip ring surfaces for contamination and roughness. If rough, polish with #500—600 sandpaper.



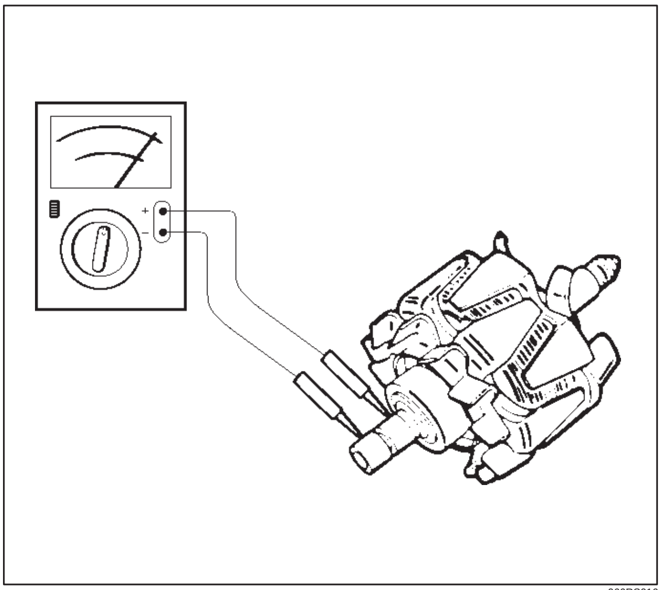
066RS014

2. Measure the slip ring diameter, and replace if it exceeds the limit.



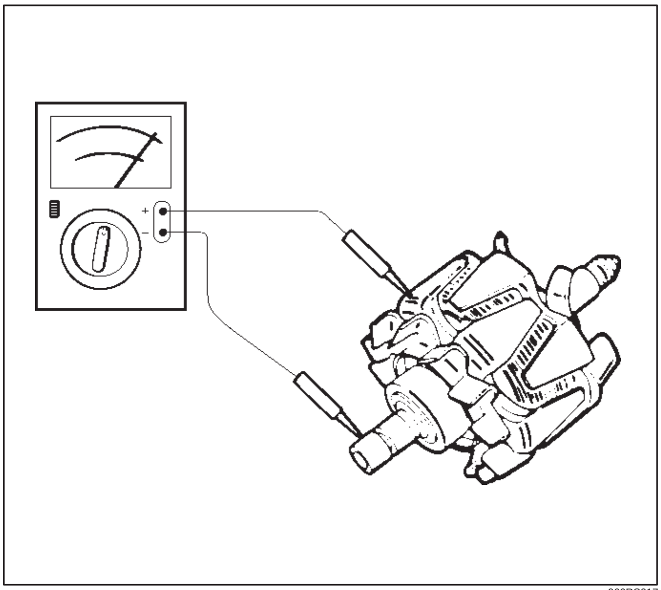
066RS015

3. Check resistance between slip rings, and replace if there is no continuity.



066RS016

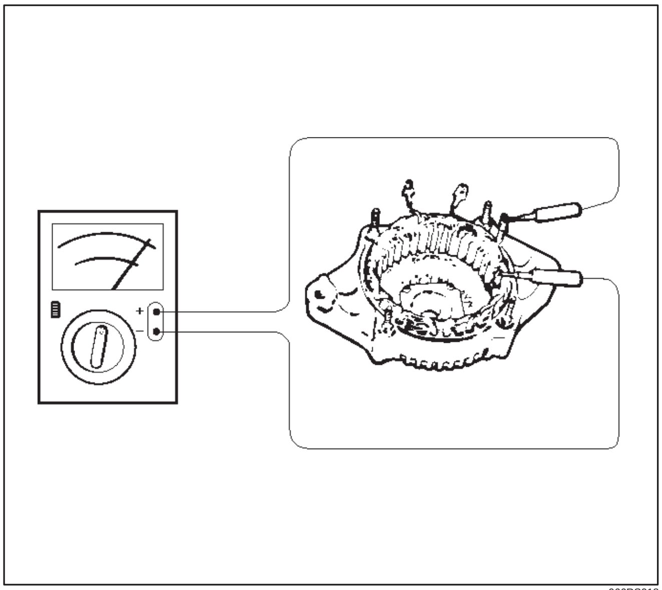
4. Check for continuity between slip ring and rotor core. In case of continuity, replace the rotor assembly.



066RS017

Stator Coil

1. Measure resistance between respective phases.
2. Measure insulation resistance between stator coil and core with a mega–ohmmeter.
   If less than standard, replace the coil.



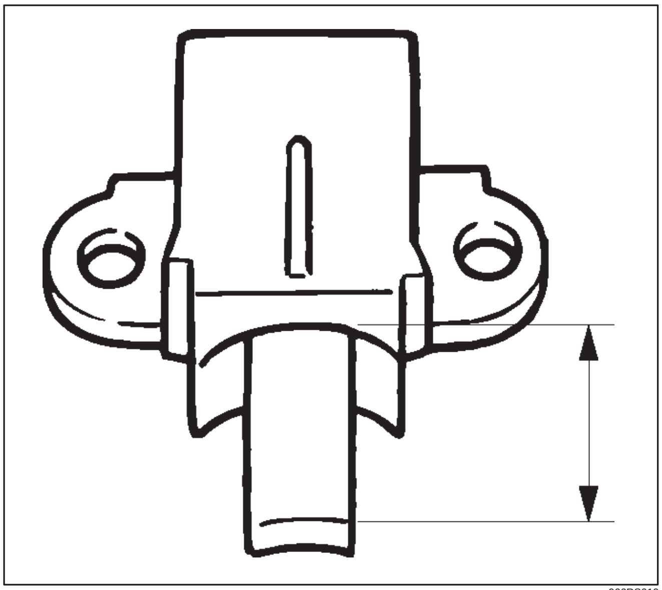
066RS018

Brush

Measure the brush length.
If more than limit, replace the brush.

Standard: 10.mm (0.4134 in)

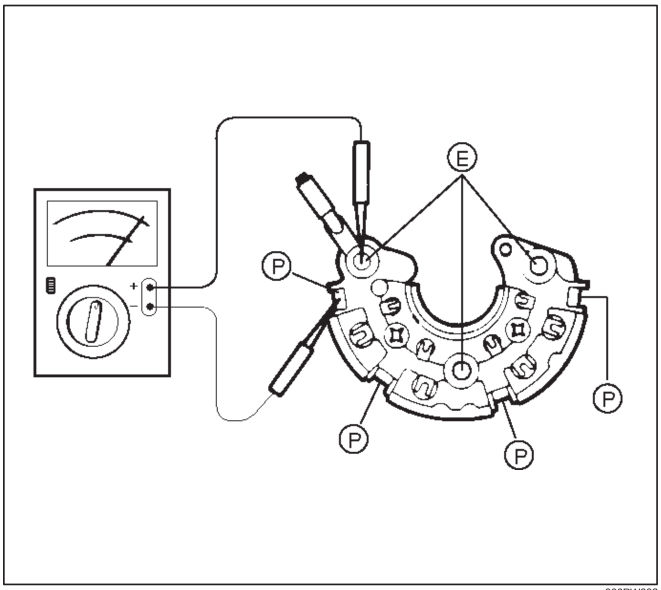
Limit: 8.4.mm (0.3307 in)



066RS019

Rectifier Assembly

Check for continuity across “P” and “E” in the × 100W range of multimeter.

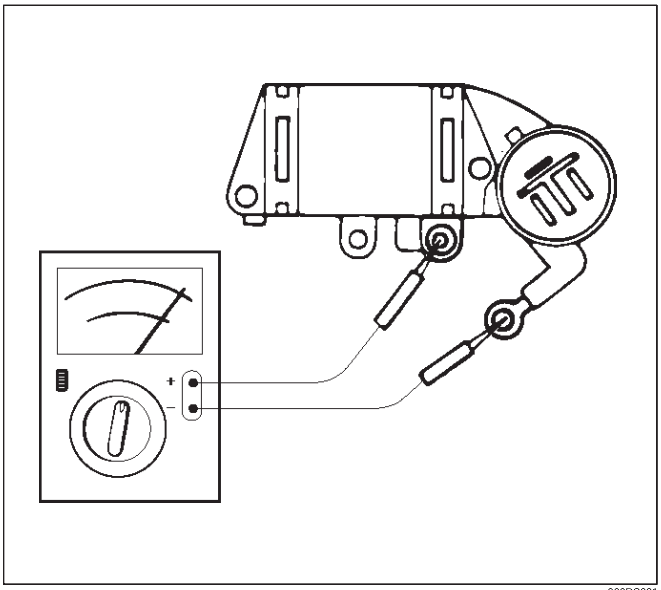


066RW002

Change polarity, and make sure that there is continuity in one direction, and not in the reverse direction. In case of continuity in both directions, replace the rectifier assembly.

IC Regulator Assembly

Check for continuity across “B” and “F” in the × 100W range of multimeter.



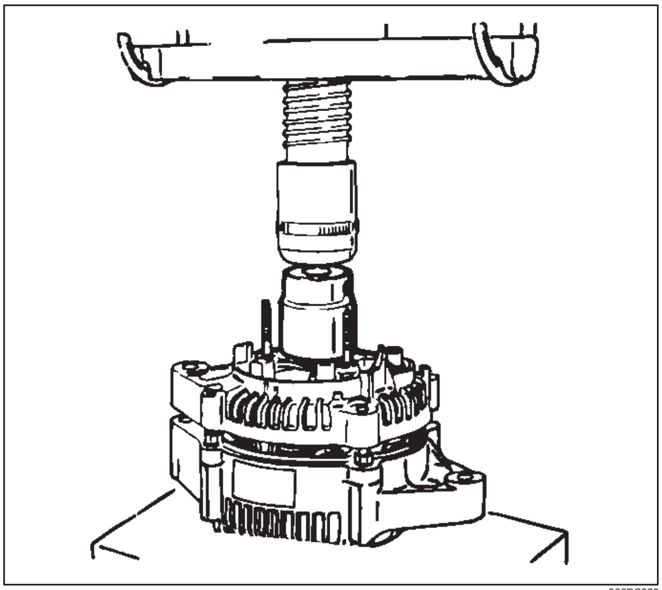
066RS021

Change polarity, and make sure that there is continuity in one direction, and not in the reverse direction. In case of continuity in both directions, replace the IC regulator assembly.

Reassembly

To reassemble, follow the disassembly steps in the reverse order, noting the following points:

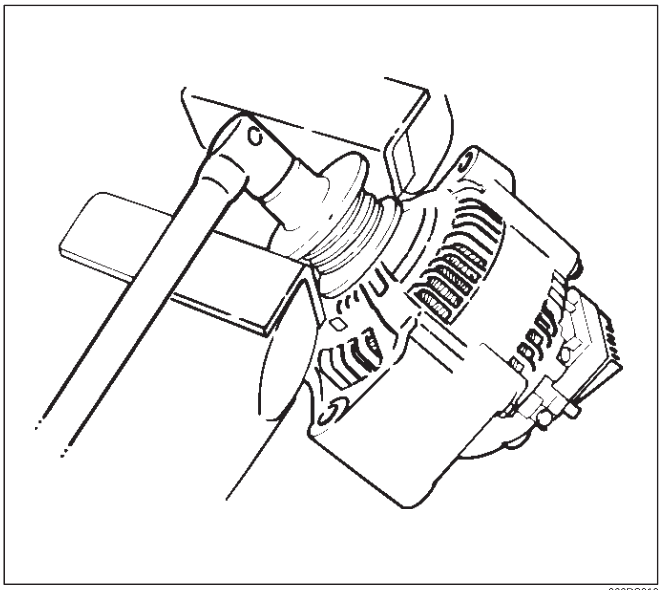
1. Using a press with a socket wrench attached, reassemble rotor and rear end cover assembly in the front cover.



066RS022

2. Install pulley on the rotor.
   Secure the pulley directly in the vise between two copper plates, and tighten nut to the specified torque.

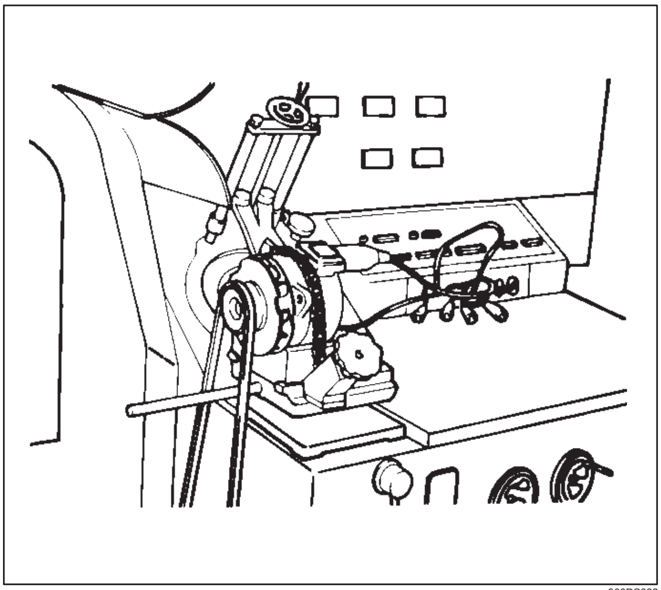
Torque: 111 N·m (82 lb ft)



066RS010

Bench Test

Conduct a bench test of the generator.

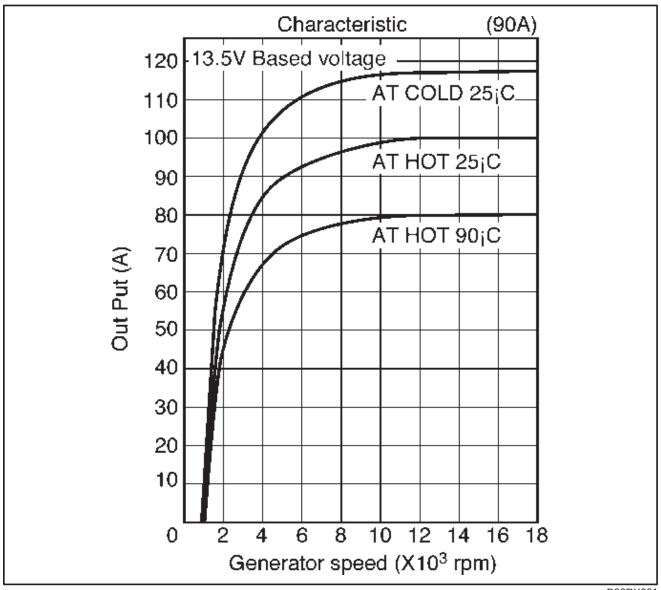


066RS023

Preparation

Remove generator from the vehicle (see “Generator removal”).

1. Secure generator to the bench test equipment and connect wires.
   Terminal “IG” for energization
   Terminal “L” for neutral (warning lamp)
   Terminal “B” for output
2. Conduct the generator characteristic test.
   Characteristics of generator are shown in illustration.
   Repair or replace the generator if its outputs are abnormal.



B06RX001

Main Data and Specifications

General Specifications

Parts Number (Nippon denso)	102211—1740
Model	ACJV74
Rated voltage	12 V
Rated output	90 A
Rotating direction (As viewed from pulled)	Clockwise
Pulley effective diameter	57.5 mm (2.26 in)
Weight	49.7 N (11.2 lb)

TROOPER

ENGINE

TROOPER 3.5L ENGINE DRIVEABILITY AND EMISSIONS

CONTENTS

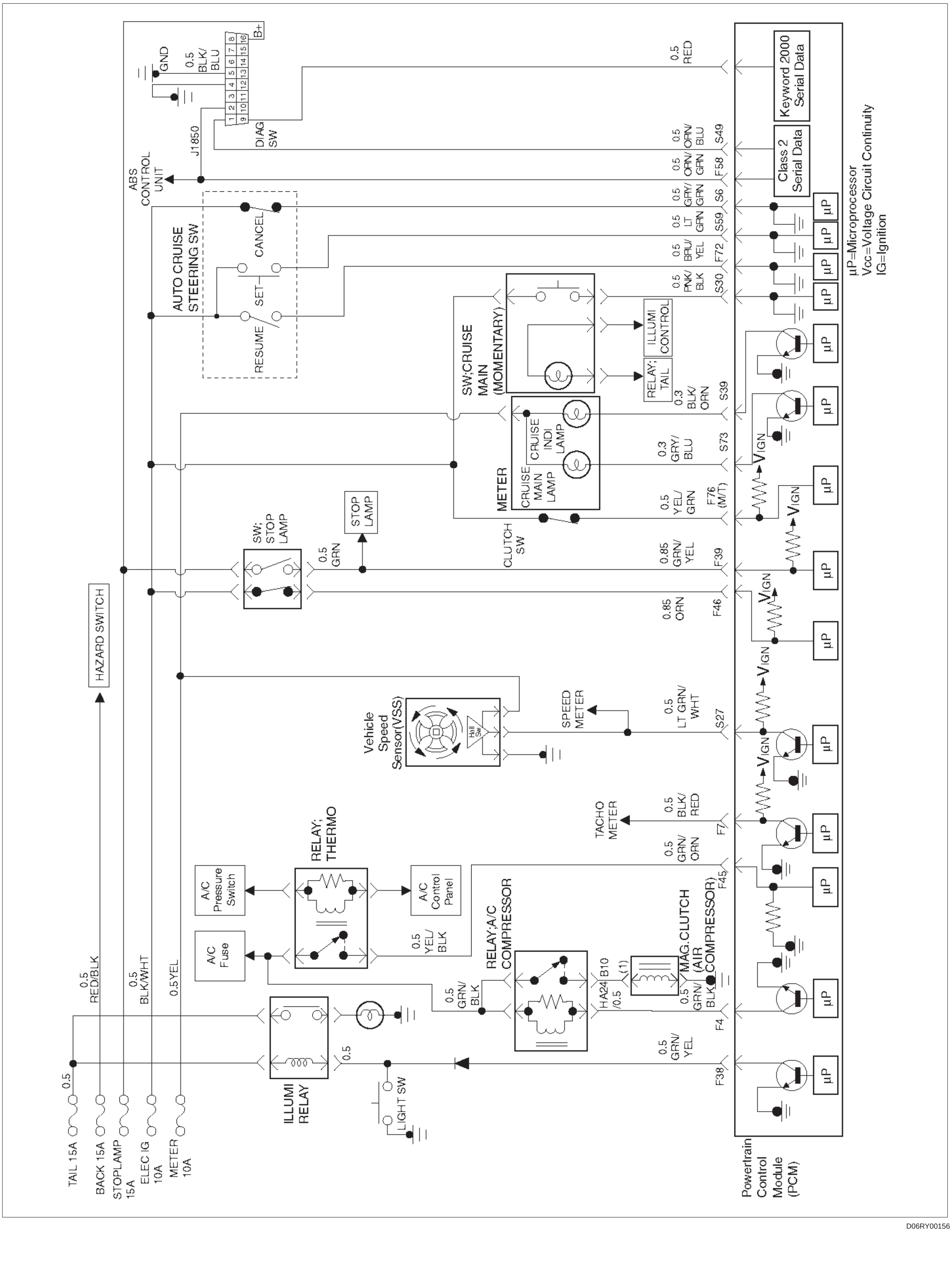
Specifications

Tightening Specifications

Application	N·m	Lb Ft.	Lb In.
Camshaft Position Sensor Retaining Screw	9	—	78
Crankshaft Position Sensor Mounting Bolt	9	—	78
EGR Bolt	25	18	—
Engine Coolant Temperature Sensor	30	22	—
Fuel Drain Plug	20	14	—
Fuel Pressure Regulator Attaching Screw	3	—	26
Fuel Rail Bolts	25	18	—
Fuel Tank Undercover Retaining Bolts	36	27	—
Heated Oxygen Sensor	55	40	—
Lower Intake Manifold to Engine Block Bolts	25	18	—
Lower Intake Manifold to Engine Block Nuts	25	18	—
Spark Plugs	18	13	—
Throttle Body Mounting Bolts	10	—	87
Common Chamber to Lower Intake Manifold Bolts	25	18	—
VSS Retaining Bolt	16	12	—

Diagrams and Schematics

PCM Wiring Diagram (1 of 7)



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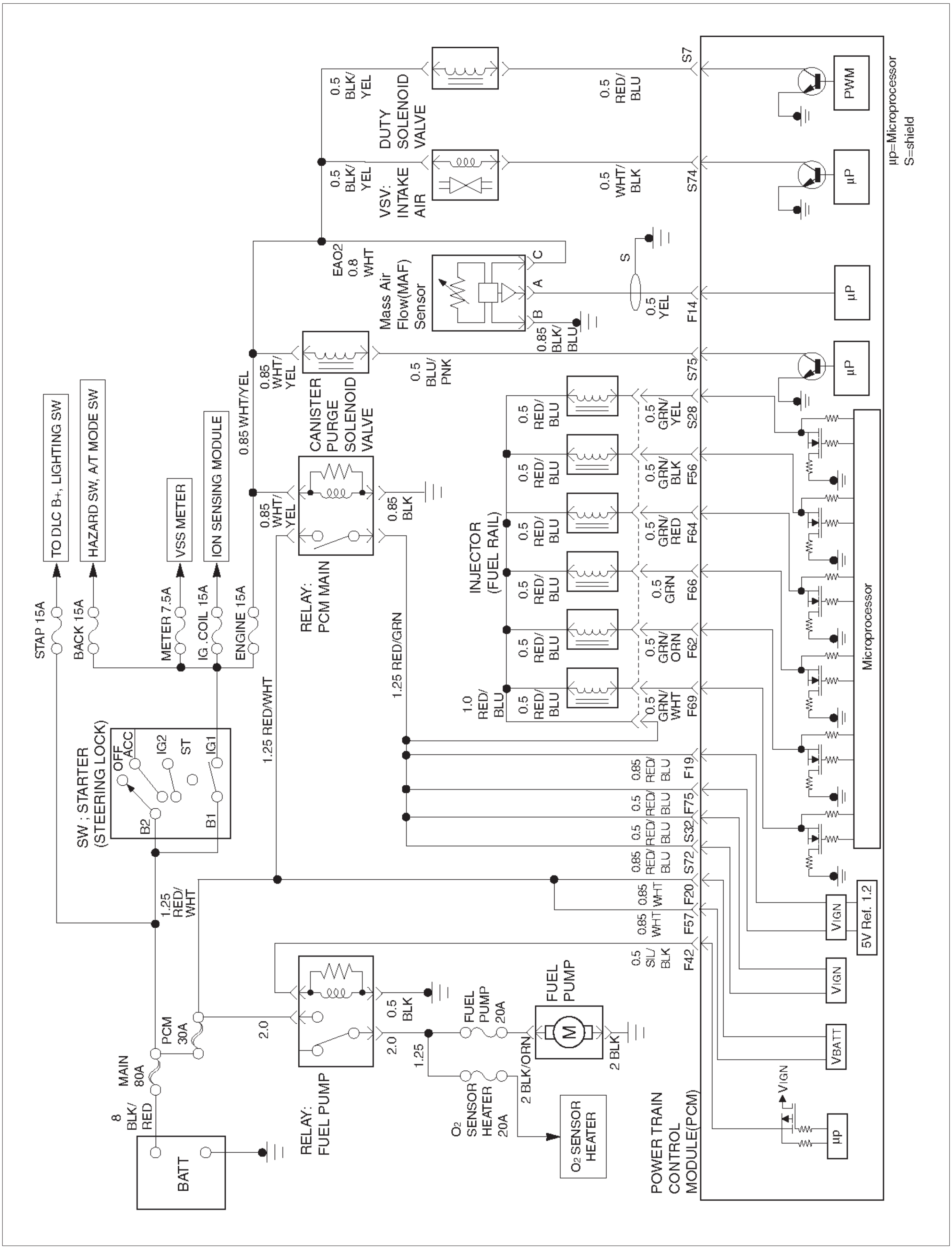
PCM Wiring Diagram (2 of 7)



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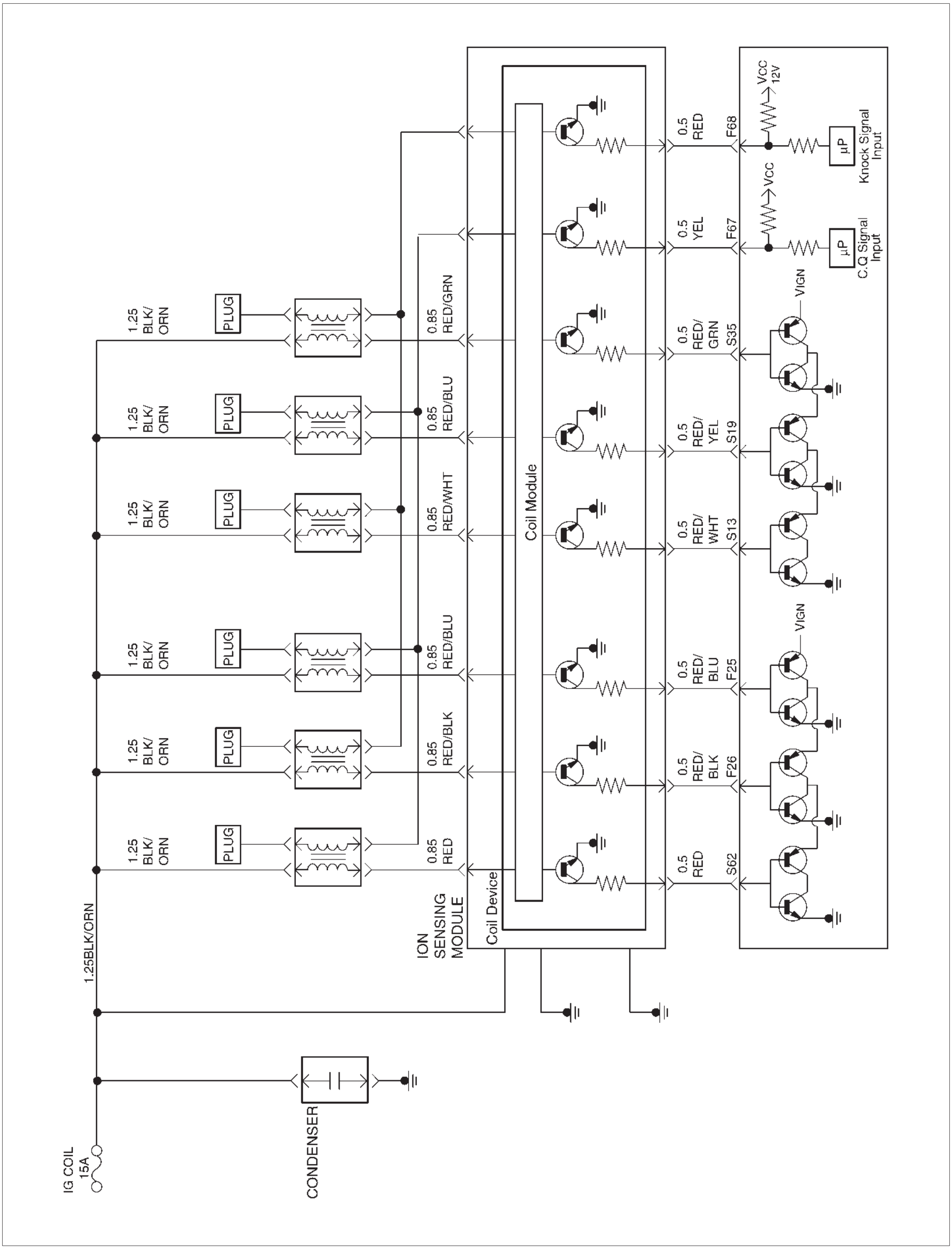
PCM Wiring Diagram (3 of 7)



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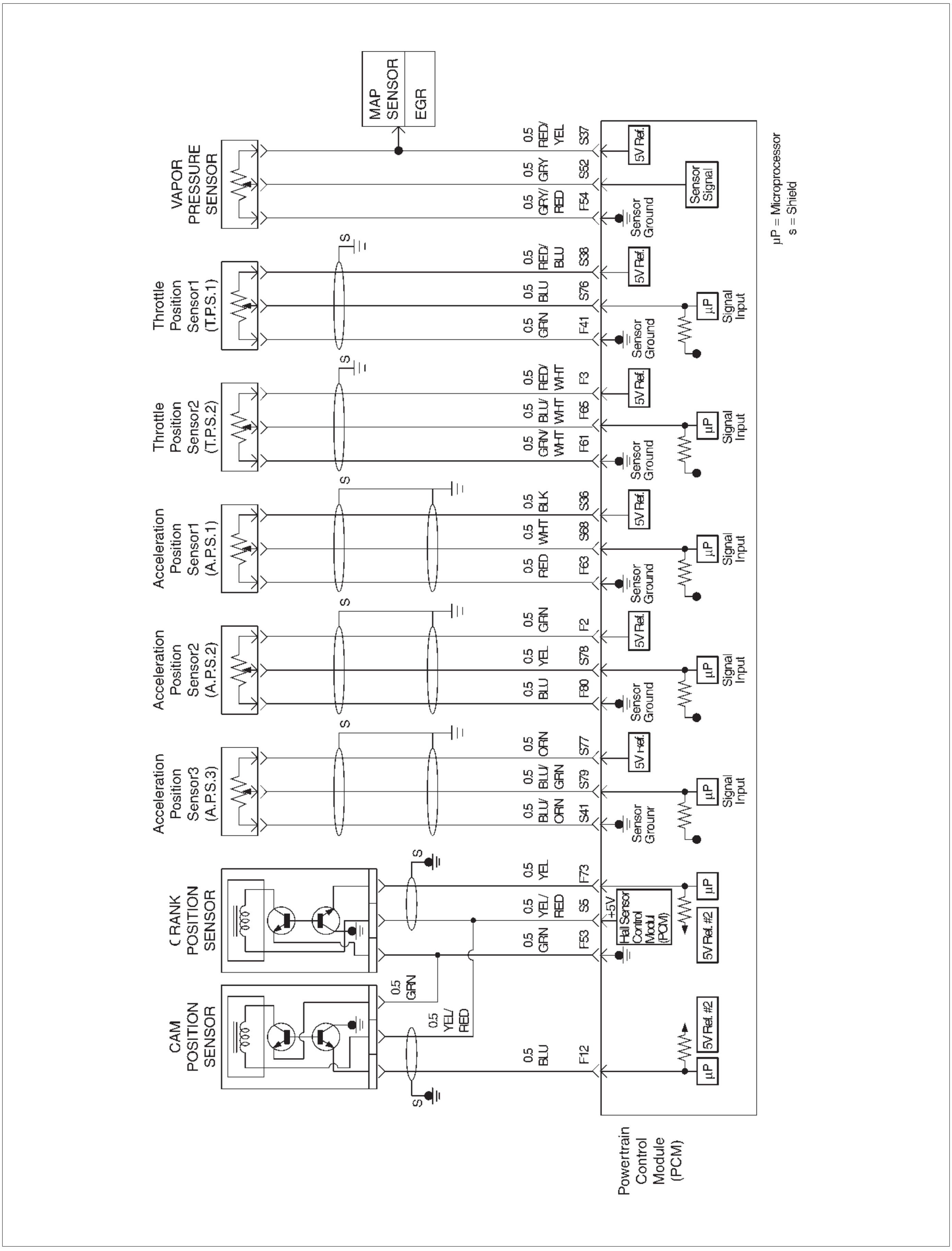
PCM Wiring Diagram (4 of 7)



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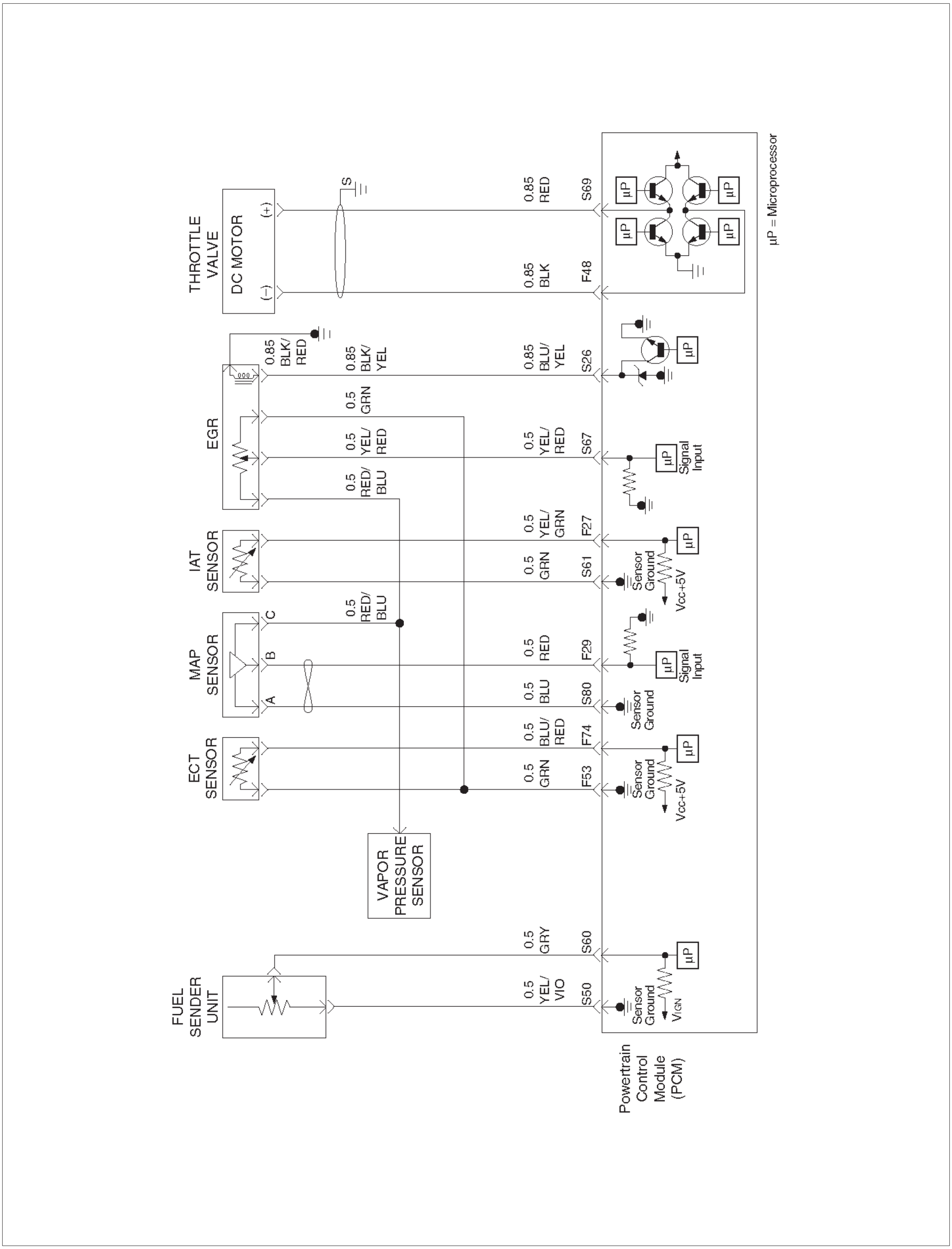
PCM Wiring Diagram (5 of 7)



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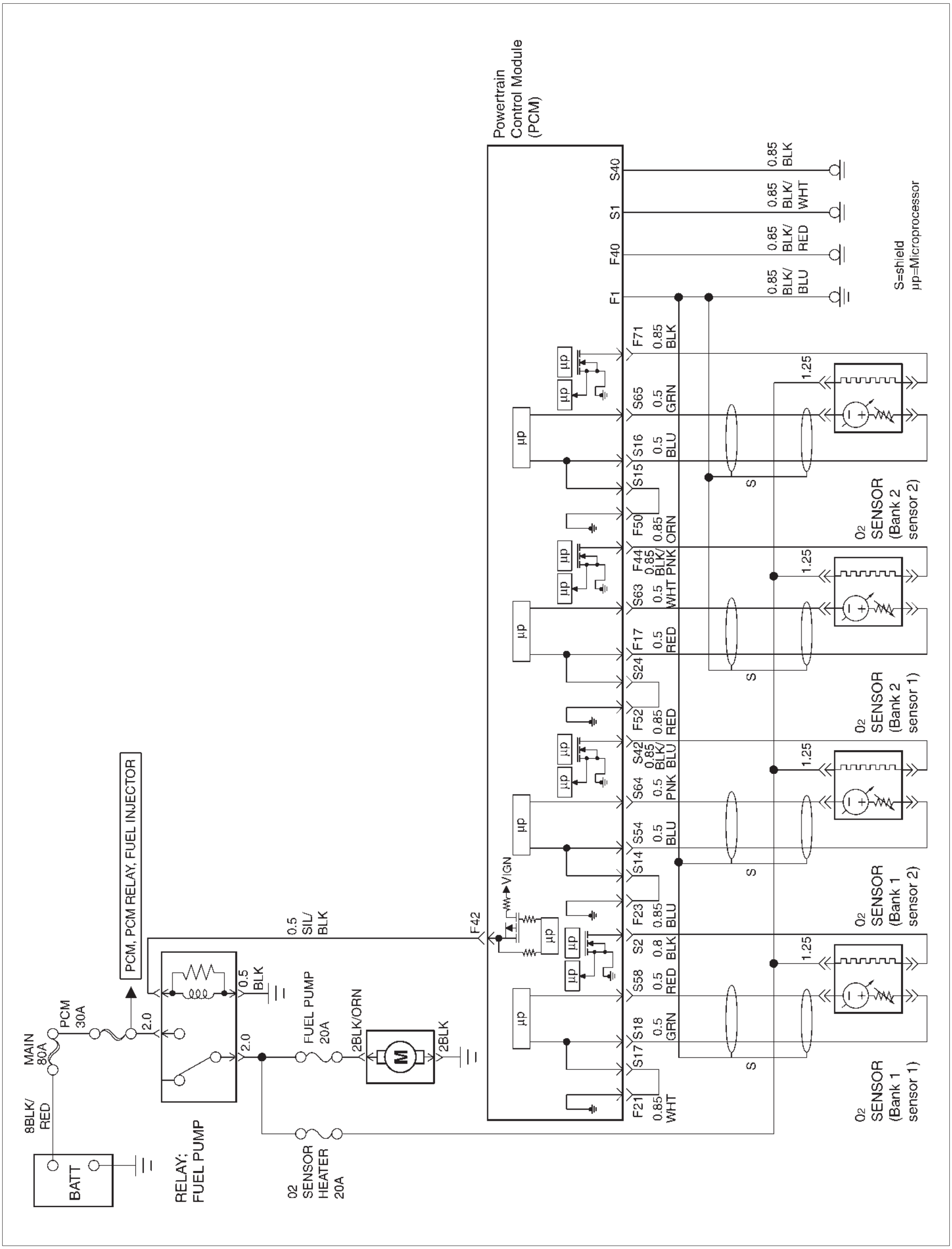
PCM Wiring Diagram (6 of 7)



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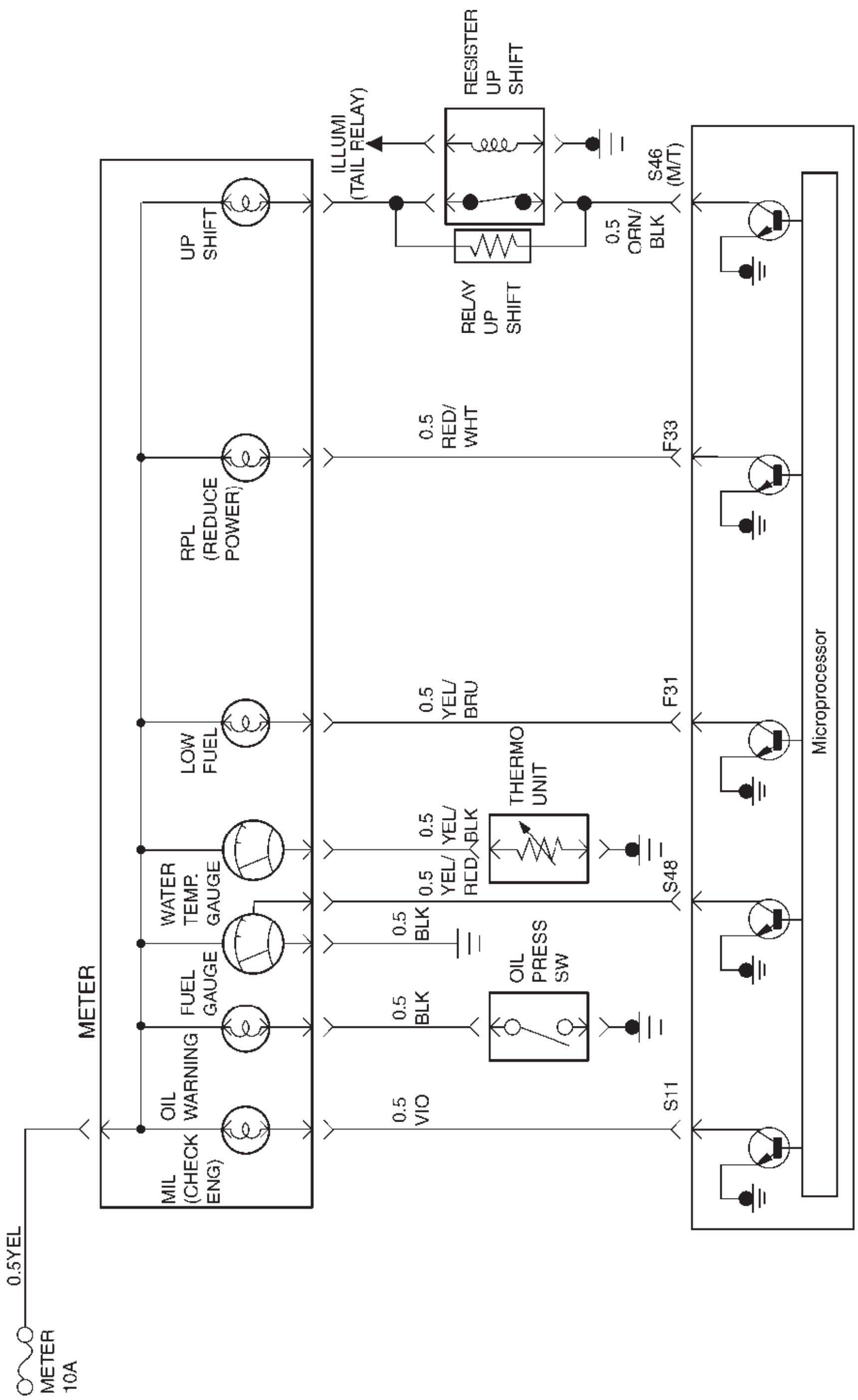
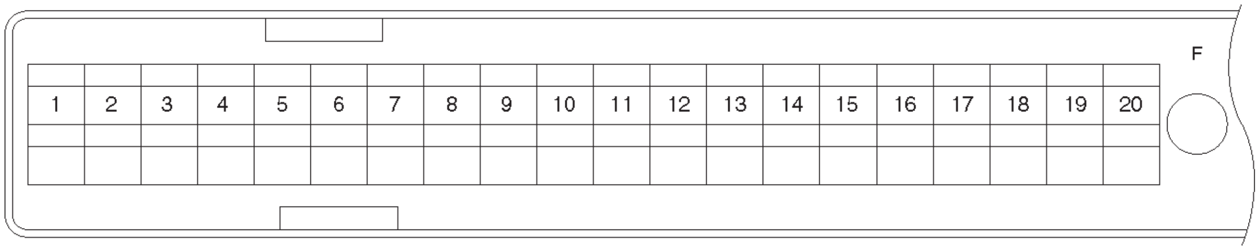
PCM Wiring Diagram (7 of 7)



D06RY00127

PCM Pinouts

PCM Pinout Table, 80-Way Blue Connector – Row “F1 ~ 20”



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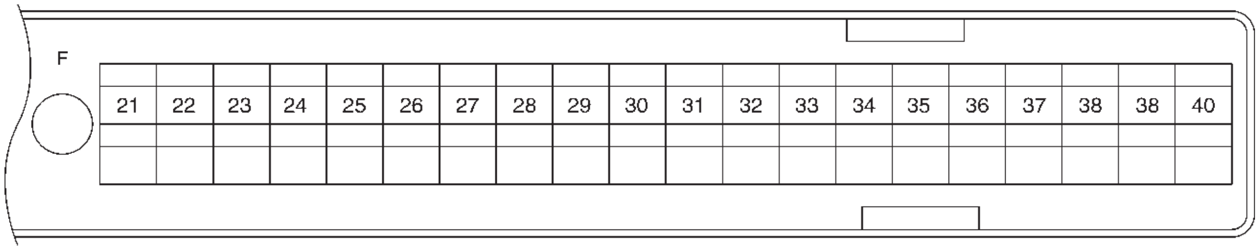
PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F1	PCM Ground	BLK/BLU	0.0V	0.0V	Chassis Electrical
F2	5Volt Referrence“2” (AP Sensor 2)	GRN	5.0V	5.0V	AP Sensor
F3	5Volt Referrence“2” (TP Sensor 2)	RED/WHT	5.0V	5.0V	AP Sensor
F4	A/C Clutch	GRN/BLK	B+(A/C off)	B+(A/C off)	General Description and Operation,A/C Cluch Circuit Opreation
F5	Mission Main Case	GRN/RED	0.0V	0.0V	4L30E T/Mission
F6	Not Used	—	—	—	—
F7	Tachometer	BLK/RED	8.8V	10.0V(at idle)	Chassis Electrical
F8	Not Used	—	—	—	—
F9	Not Used	—	—	—	—
F10	Not Used	—	—	—	—
F11	Not Used	—	—	—	—
F12	Camshaft Position Sensor	WHT/RED	5.0V or less than 1.0V	4.6V	General Description and Operation,Camshaft Position Sensor
F13	Not Used	—	—	—	—
F14	Mass Air Flow(MAF)	BLK/BLU	4.9V	4.2V	General Description, Mass Air Flow Sensor
F15	Not Used	—	—	—	—
F16	Not Used	—	—	—	—
F17	Bank 1 HO2S Low	RED	0.0V	0.1V	General Description and Operation, Catalyst Monitor HO2S 2
F18	Not Used	—	—	—	—

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F19	Ignition Feed	RED/GRN	B+	B+	6D Section
F20	Ignition Feed	RED/WHT	B+	B+	6D Section

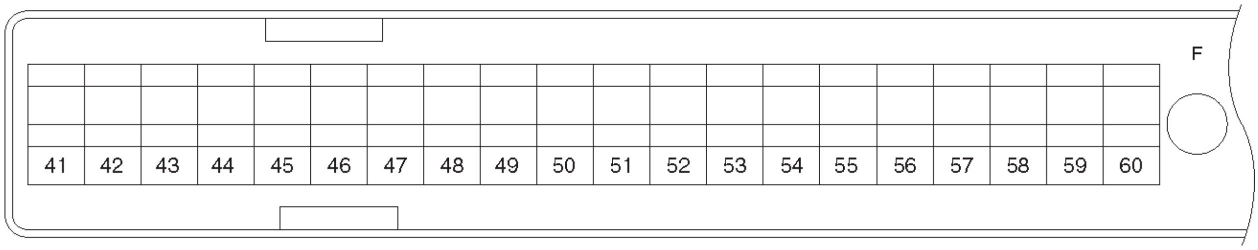
PCM Pinout Table, 80-Way Blue Connector – Row “F20 ~ 40”



PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F21	Bank 1 HO2S 1 Ground	WHT	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 1
F22	Not Used	—	—	—	—
F23	Bank 2 HO2S 1 Ground	BLU	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 1
F24	Not Used	—	—	—	—
F25	ION Sensing Module	RED/BLU	1.555V	1.555V	General Description and Operation,ION Sensing Module
F26	ION Sensing Module	RED/BLK	1.555V	1.555V	General Description and Operation,ION Sensing Module
F27	Intake Air Temperature (IAT)Sensor	YEL/GRN	0.5–4.9V	0.5–4.9V	General Description and Operation, IAT
F28	Not Used	—	—	—	—
F29	Manifold Absolute Pressure(MAP)	RED	3.5V–4.9V (depends on altitude and barometric pressure)	0.6-1.3V	General Description and Operation, Manifold Absolute Pressure
F30	Not Used	—	—	—	—
F31	Low Fuel Lamp	YEL/BRN	B+	B+	Chassis Electrical
F32	Power Lamp	GRN/WHT	B+	B+	4L30E T/Mission
F33	Reduse Power Lamp	RED/WHT	B+	B+	Chassis Electrical
F34	Not Used	—	—	—	—
F35	Not Used	—	—	—	—
F36	Not Used	—	—	—	—
F37	Power Steering Pressure (PSP)	GRN/YEL	B+	B+	Power Steering
F38	Illuminated Switch	GRN/YEL	B+	B+	Chassis Electrical

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F39	Brake Swich	GRN/YEL	0.0V	0.0V	4L30E T/Mission
F40	PCM Ground	BLK/RED	0.0V	0.0V	Chassis Electrical

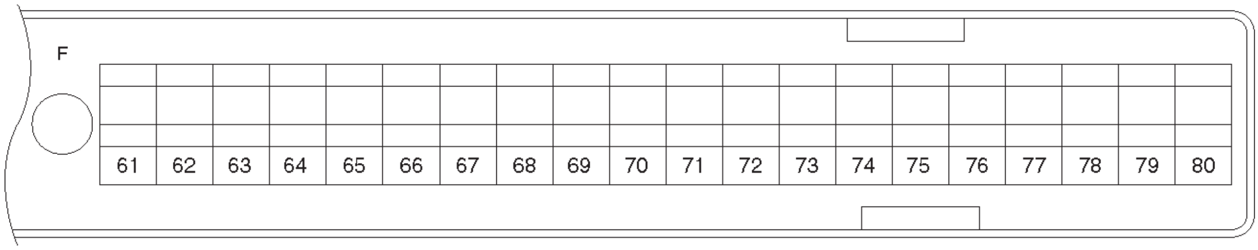
PCM Pinout Table, 80-Way Blue Connector – Row “F41 ~ 60”



PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F41	Throttle Position(TP) 1 Sensor Ground	GRN	0.0V	0.0V	General Description and Operation,TPS
F42	Fuel Pump Relay	SIL/BLK	0.0V	B+	On Vehicle Service, Fuel Pump Relay
F43	Adaptor Case	RED/WHT	0.0V	0.0V	4L30E T/Mission
F44	Bank 1 HO2S 2 Heater Ground	BLK/PNK	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 2
F45	A/C Request	GRN/ORN	0.0V	0.0V	Chassis Electrical
F46	Auto Cruise Brake Switch	ORN	0.0V	0.0V	Chassis Electrical
F47	Adaptor Case	VIO/RED	B+	B+	4L30E T/Mission
F48	Throttle Valve DC Motor(–)	BLK	Duty Cycle	Duty Cycle	General Description and Operation, ETC
F49	Shielded Wire (ION Sensing Module)	SIL	0.0V	0.0V	Chassis Electrical
F50	Bank 2 HO2S 2 Ground	ORN	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 2
F51	DLC Serial Data	ORN	5.0V	5.0V	Chassis Electrical
F52	Bank 1 HO2S 2 Ground	RED	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 2
F53	ECT Ground	GRN	0.0V	0.0V	General Description and Operation,ECT Sensor
F54	Vapor Pressure Sensor Ground	GRY/RED	0.0V	0.0V	General Description and Operation,VP Sensor
F55	Not Used	—	—	—	—
F56	Injector Cylinder #5	GRN/BLK	B+	B+	General Description and Operation,Fuel Injector
F57	Ignition Feed	WHT	B+	B+	Chassis Electrical
F58	Class 2 Data	ORN/GRN	0.0V	0.0V	General Description

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F59	Not Used	—	—	—	—
F60	Shielded Wire	SIL	0.0V	0.0V	Chassis Electrical

PCM Pinout Table, 80-Way Blue Connector – Row “F61 ~ 80”



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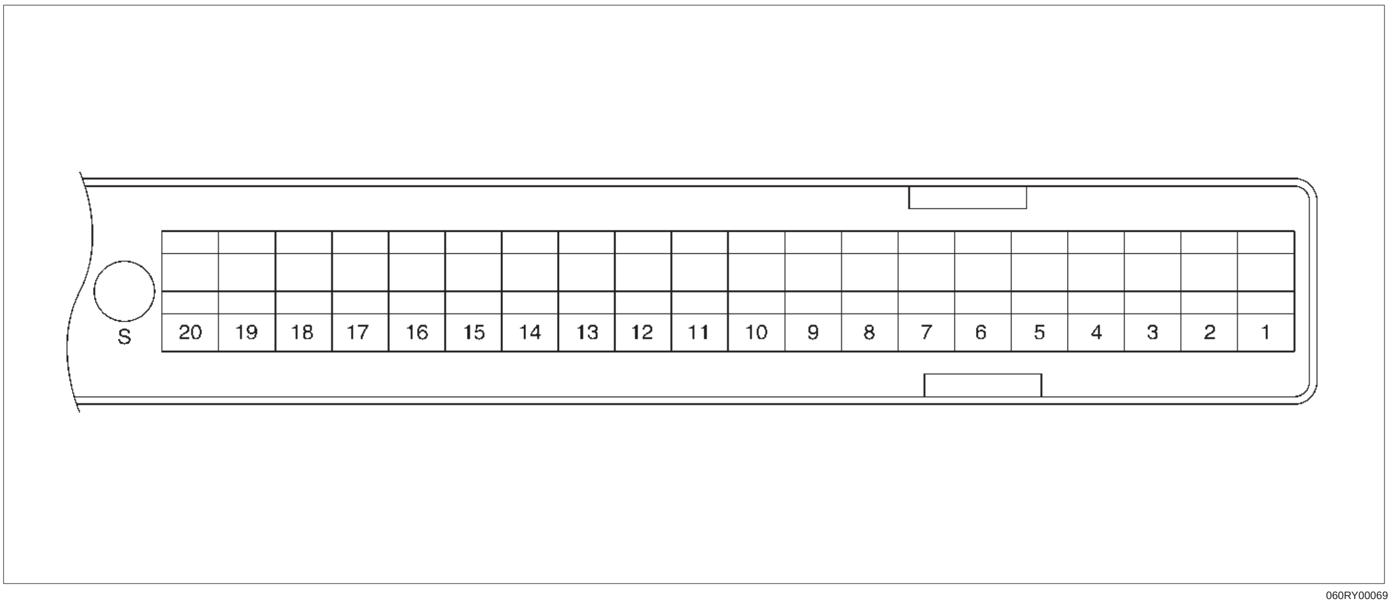
PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F61	Throttle Position(TP) 2 Sensor Ground	GRN/WHT	0.0V	0.0V	General Description and Operation,TPS
F62	Injector Cylinder #2	GRN/ORN	B+	B+	General Description and Operation,Fuel Injector
F63	AP Sensor 1 Sensor Ground	RED	0.0V	0.0V	General Description and Operation,APS
F64	Injector Cylinder #4	GRN/RED	B+	B+	General Description and Operation,Fuel Injector
F65	Throttle Psition(TP) 2 Sensor Signal	BLU/WHT	0.5–0.8V	0.8–0.8V (at idle)	General Description and Operation,TPS
F66	Injector Cylinder #3	GRN	B+	B+	General Description and Operation,Fuel Injector
F67	ION Sensing Module	YEL	1.555V	1.555V	General Description and Operation, ION Sensing Module
F68	ION Sensing Module	RED	1.555V	1.555V	General Description and Operation, ION Sensing Module
F69	Injector Cylinder #1	GRN/WHT	B+	B+	General Description and Operation,Fuel Injector
F70	Not Used	—	—	—	—
F71	Bank 2 HO2S 2 Heater Ground	BLK	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 2
F72	Auto Cruise Switch Resume	BRN/YEL	0.0V	0.0V	Chassis Electrical
F73	Cranshaft Position Sensor	YEL	0.3V	2.2V	General Description and Operation, CKP sensor
F74	ECT Sensor	BLU/RED	0.5–4.9V	0.5–4.9V	General Description and Operation, ECT Sensor
F75	Ignition Feed	RED/BLU	B+	B+	Chassis Electrical
F76	Clutch Switch(M/T only)	YEL/GRN	B+	B+	Manual T/Mission
	Mode Switch(A/T only)	YEL/GRN	B+	B+	4L30E T/Mission

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F77	Mode Switch	BLU/WHT	B+	B+	4L30E T/Mission
F78	Mode Switch	BLU/BLK	B+	B+	4L30E T/Mission
F79	Mode Switch	BLU/YEL	B+	B+	4L30E T/Mission
F80	AP Sensor 2 Sensor Ground	BLU	0.0V	0.0V	General Description and Operation, APS

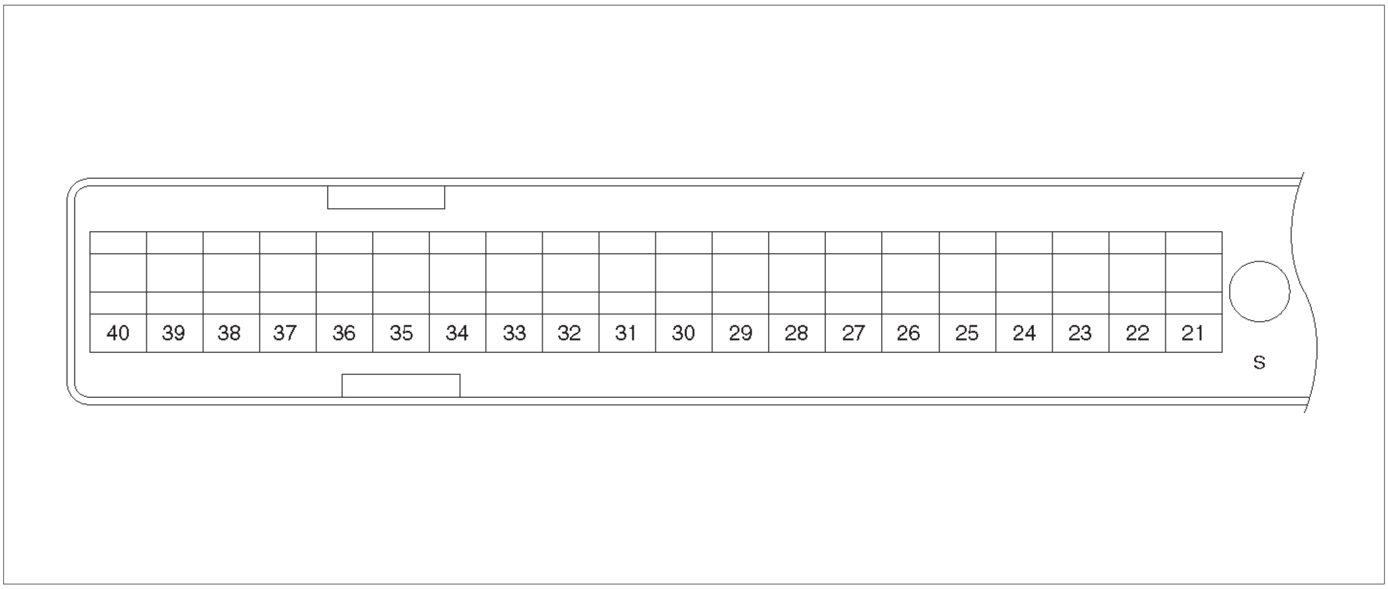
PCM Pinout Table, 80-Way Red Connector – Row “S1 ~ 20”



PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S1	PCM Ground	BLK/WHT	0.0V	0.0V	Chassis Electrical
S2	Bank 1 HO2S 1 Heater Ground	BLK	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S
S3	Not Used	—	—	—	—
S4	ATF Warning Lamp	ORN/BLU	B+	B+	4L30E T/Mission
S5	5Volt Referrence“2” (CKP Sensor/CMP Sensor)	YEL/RED	5.0V	5.0V	Appropriate Sensor (CKP Sensor, CMP Sensor ,AP2 Sensor)
S6	Auto Cruise Switch Cancel	GRY/GRN	0.0V	0.0V	Chassis Electrical
S7	Fuel Gauge	YEL/RED	B+	B+	Chassis Electrical
S8	Not Used	—	—	—	—
S9	Not Used	—	—	—	—
S10	Shift High(Band Apply)	BRN/YEL	B+	B+	4L30E T/Mission
S11	Malfunction Indicator (Check Engine) Lamp	VIO	0.0V	B+	Chassis Electrical
S12	Not Used	—	—	—	—
S13	ION Sensing Module	RED/WHT	1.555V	1.555V	General Description and Operation, ION Sensing Module
S14	Bank 2 HO2S 1 Ground Jump	BLU	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 1
S15	Bank 2 HO2S 2 Ground Jump	ORN	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 2
S16	Bank 2 HO2S 2 Low	BLU	0.0V	0.1V	General Description and Operation, Catalyst Monitor HO2S
S17	Bank 1 HO2S 1 Ground Jump	WHT	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 1

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S18	Bank 1 HO2S 1 Low	GRN	0.0V	0.1V	General Description and Operation, Catalyst Monitor HO2S
S19	ION Sensing Module	RED/YEL	1.555V	1.555V	General Description and Operation, ION Sensing Module
S20	Transmission Fluid Temperature Sensor Ground		0.0V	0.0V	4L30E T/Mission

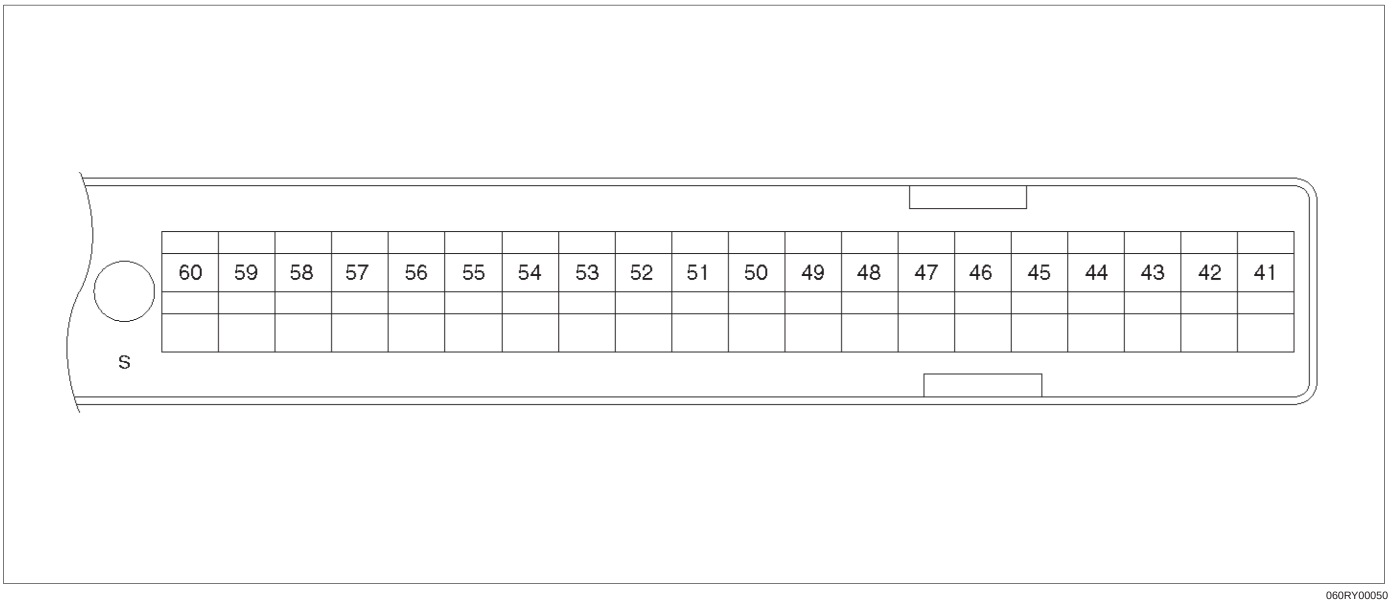
PCM Pinout Table, 80-Way Red Connector – Row "S21 ~ 40"



PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S21	Not Used	—	—	—	—
S22	Transmissin Output Speed Sensor	RED	0.0V	0.0V	4L30E T/Mission
S23	PCM Ground	BLK/RED	0.0V	0.0V	Chassis Electrical
S24	Bank 1 HO2S 2 Ground Jump	RED	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 2
S25	Not Used	—	—	—	—
S26	EGR Control Low	BLK/YEL	B+	B+	General Description and Operation, EGR Control
S27	VSS Input	Light GRN/WHT	0.0V	0.1V (at rest)	Chassis Electrical
S28	Injector Cylinder #6	GRN/YEL	B+	B+	General Description and Operation, Fuel Injector
S29	Winter Switch	VIO/GRN	B+	B+	4L30E T/Mission
S30	Auto Cruise Main Switch	PNK/BLK	0.0V	0.0V	Chassis Electrical
S31	Transmissin Range Signal"2–3"	GRN	0.0V	0.0V	4L30E T/Mission
S32	Ignition Feed	RED/BLU	B+	B+	Chassis Electrical
S33	TCC Solenoid	RED/BRN	0.0V	0.0V	T/Mission
S34	Not Used	—	—	—	—
S35	ION Sensing Module	RED/GRN	1.555V	1.555V	General Description and Operation, ION Sensing Module
S36	5Volt Referrence (AP Sensor 1)	BLK	5.0V	5.0V	AP Sensor
S37	5Volt Referrence (Fuel Tank Pressure Sensor/MAP Sensor/EGR Posistion Sensor)	RED/YEL	5.0V	5.0V	(Fuel Tank Pressure Sensor/MAP Sensor/EGR Posistion Sensor) Sensor
S38	5Volt Referrence (TP Sensor 1)	RED/YEL	5.0V	5.0V	TP Sensor

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S39	Auto Cruise Lamp	BLK/ORN	0.0V	0.0V	Chassis Electrical
S40	PCM Ground	BLK	0.0V	0.0V	Chassis Electrical

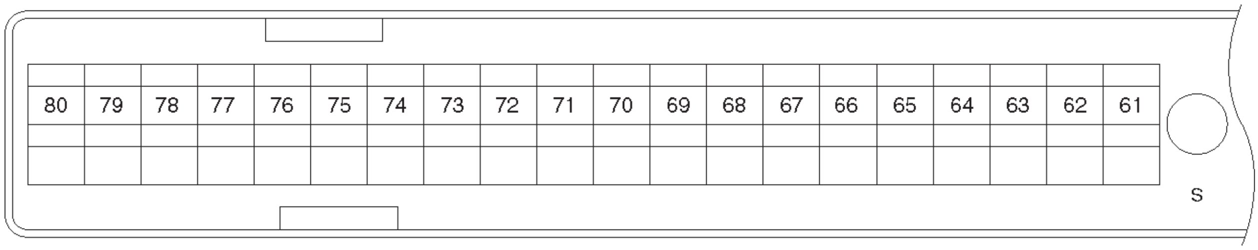
PCM Pinout Table, 80-Way Red Connector – Row “S41 ~ 60”



PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S41	AP Sensor 3 Sensor Ground	BLU/ORN	0.0V	0.0V	General Description and Operation, APS
S42	Bank 2 HO2S 1 Heater Ground	BLK	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S
S43	Transmissin Range Signal“1–2” “3–4”	GRY/WHT	0.0V	0.0V	4L30E T/Mission
S44	Not Used	—	—	—	—
S45	Antilock Brake System (ABS) Off Switch	VIO/WHT	B+	B+	Antilock Brake System
S46	A/T Check Transmission Lamp	ORN/BLK	B+	B+	Chassis Electrical
	M/T Up Shift Lamp	ORN/BLK	B+	B+	Chassis Electrical
S47	Winter Lamp	PNK/GRN	B+	B+	4L30E T/Mission
S48	EVAP Duty Solenoid Valve	RED/BLU	B+	5.7V	General Description and Operation, EVAP Emission Control System
S49	DLC	ORN/BLU	B+	B+	General Description
S50	Fuel Sender Unit	YEL/VIO	0.0V	0.0V	—
S51	TCC Solenoid	BRN/BLU	B+	B+	T/Mission
S52	Vapor Pressure Sensor Signal	GRY	0.2–4.8V	0.2–4.8V	General Description and Operation,VP Sensor
S53	Power Switch	VIO/RED	B+	B+	4L30E T/Mission
S54	Bank 2 HO2S 1 Low	BLU	0.0V	0.1V	General Description and Operation, Catalyst Monitor HO2S
S55	Transmissin Output Speed Sensor	WHT	0.0V	0.0V	4L30E T/Mission
S56	Not Used	—	—	—	—
S57	Not Used	—	—	—	—

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S58	Bank 2 HO2S 1 High	RED	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S
S59	Auto Cruise Steering Set Switch	Light GRN	0.0V	0.0V	Chassis Electrical
S60	Fuel Sender Unit	GRY	0.5–4.9V	0.5–4.9V	ON-Vehicle Service PCM and Sensors

PCM Pinout Table, 80-Way Red Connector – Row “S61 ~ 80”



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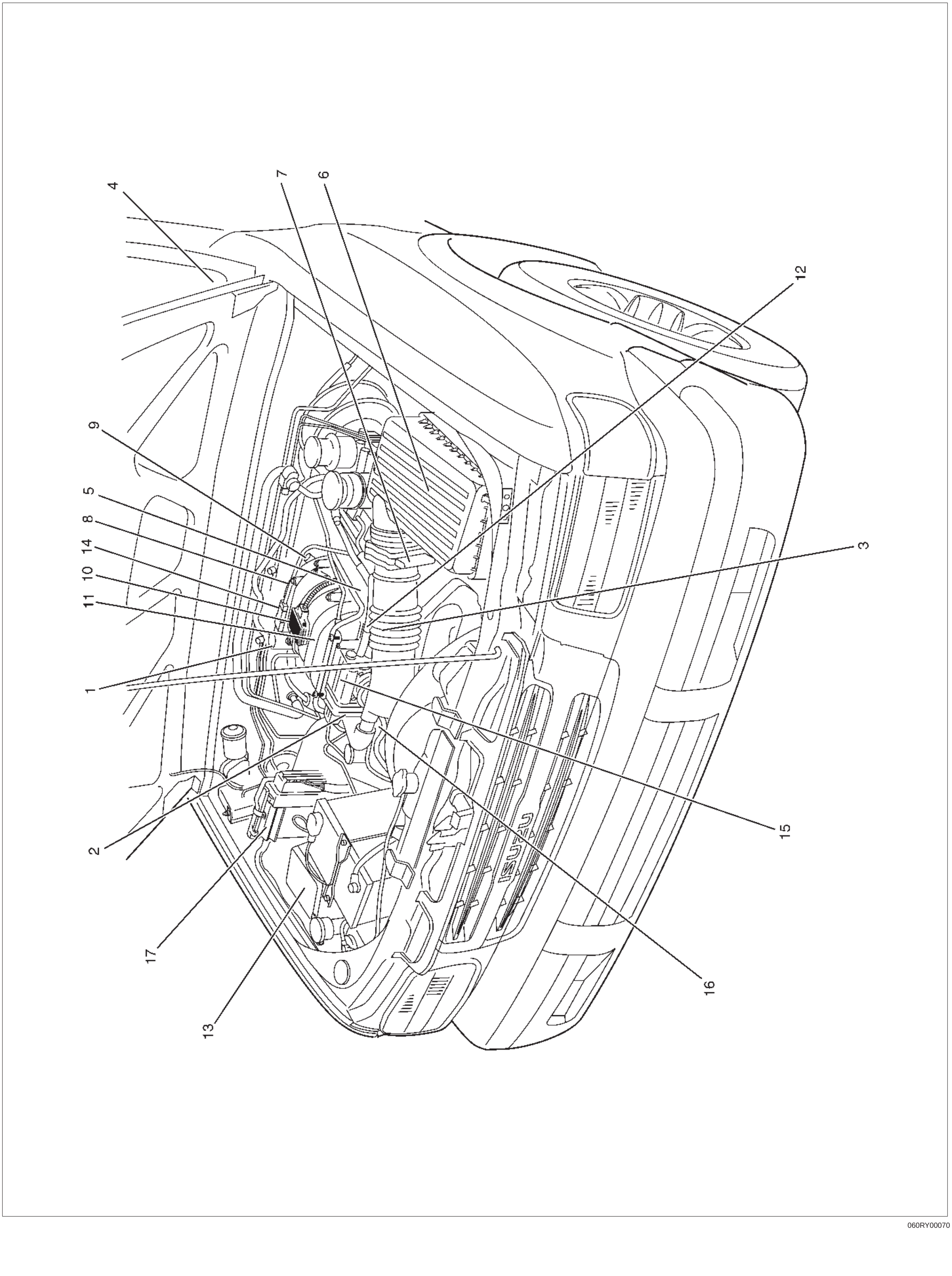
PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S61	Intake Air Temperature (IAT)Sensor Ground	GRN	0.0V	0.0V	General Description and Operation, IAT
S62	ION Sensing Module	RED	1.555V	1.555V	General Description and Operation, ION Sensing Module
S63	Bank 1 HO2S 2 High	WHT	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S
S64	Bank 2 HO2S 1 High	PNK	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S
S65	Bank 2 HO2S 2 High	GRN	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S
S66	Transmission Fluid Temperature Sensor	RED/WHT	0.5–4.9V (depends on temperature)	0.5–4.9V (depends on temperature)	4L30E T/Mission
S67	Exhaust Gas Recirculation (EGR)	YEL/RED	0.6V	0.6V	General Description and Operation,EGR Control
S68	Accelerator Position(AP) Sensor 1	WHT	0.41–0.45V	0.41–0.45V	General Description and Operation,AP Sensor
S69	Throttle Valve DC Motor(+)	BLK	Duty Cycle	Duty Cycle	General Description and Operation,ETC
S70	Not Used	—	—	—	—
S71	Not Used	—	—	—	—
S72	Ignition Feed for ETC	RED/BLU	B+	B+	Chassis Electrical
S73	Auto Cruise Main Lamp	GRY/BLU	B+	B+	Chassis Electrical
S74	Variable Intake Manifold	WHT/BLU	0.0V	B+(rpm 3600 over)	General Description
S75	Canister Vent Valve	BLU/PNK	6.0V Tank empty	5.7V Tank empty	General Description and Operation, EVAP
S76	Throttle Position(TP) 1 Sensor Signal	BLU/PNK	0.5–0.8V	0.5–0.8V (at idle)	General Description and Operation,TPS

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S77	5Volt Referrence (AP Sensor 3)	ORN	5.0V	5.0V	Appropriate Sensor
S78	Accelerate Position(AP) Sensor 2	YEL	0.41–0.45V	0.41–0.45V	General Description and Operation,AP Sensor
S79	Accelerate Position(AP) Sensor 3	BLU/GRN	4.55–4.99V	0.41–0.45V	General Description and Operation,AP Sensor
S80	Manifold Absolute Pressure(MAP)	BLU	0V	0V	General Description and Operation, Manifold Absolute Pressure

Component Locators

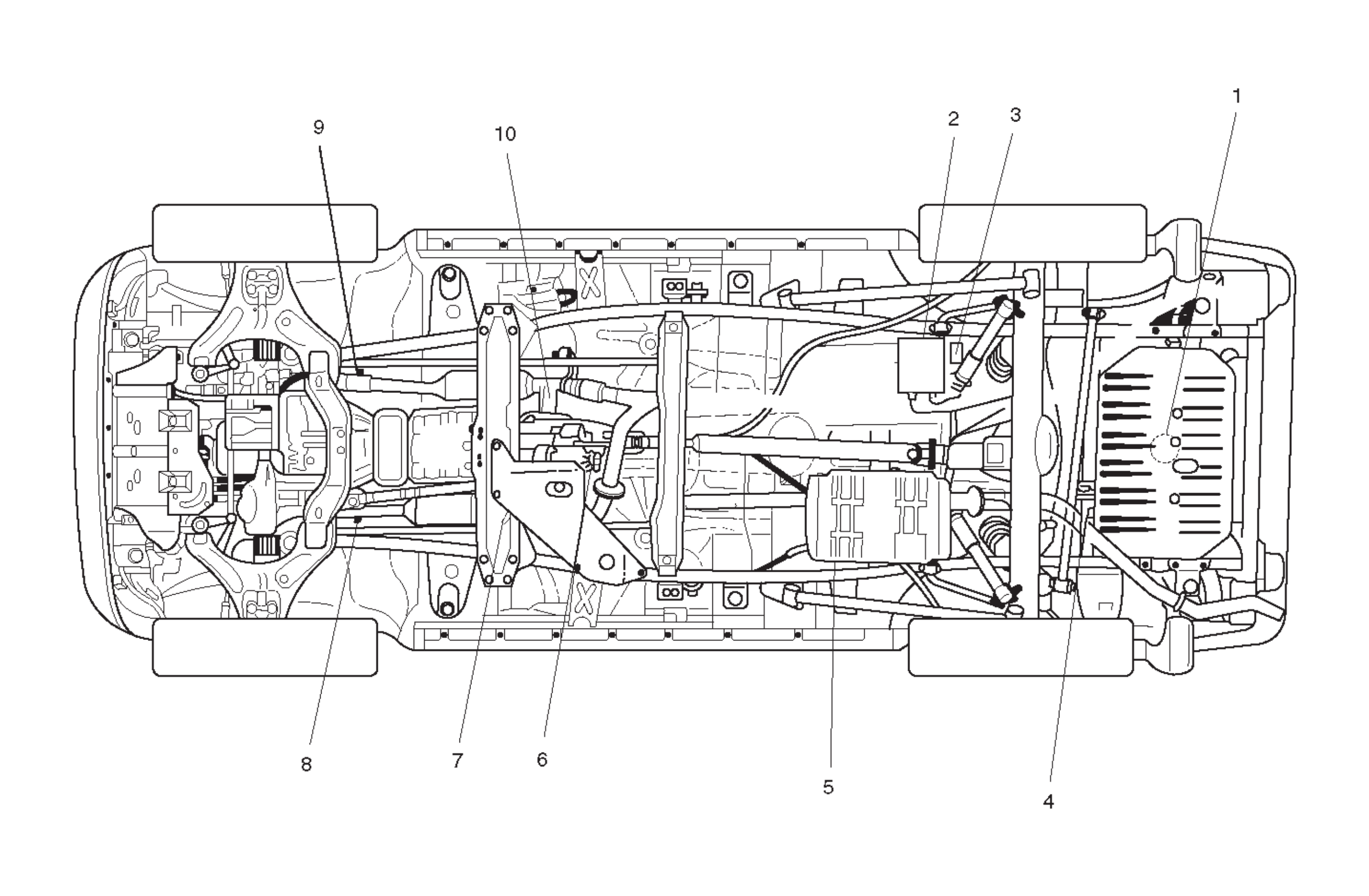
Engine Component Locator



Engine Component Locator Table

Number	Name	Location
1	Linear Exhaust Gas Recirculation (EGR) Valve	Rear right side of the engine
2	Throttle Position (TP) Sensor	On the throttle body
3	Intake Air Temperature (IAT) Sensor	On the intake air duct near the throttle body
4	Check Engine (MIL) Light	On the instrument panel beneath the tachometer
5	Positive Crankcase Ventilation (PCV) Valve	On the left of the cylinder head cover
6	Air Cleaner	Left front of the engine bay
7	Mass Air Flow (MAF) Sensor	Attached to the air filter box
8	Camshaft Position (CMP) Sensor	On the rear right side of the left cylinder head
9	Fuel Pressure Regulator	Rear side of the engine
10	ION Sensing module	Bolted to the top of the Common Chamber
11	Common Chamber	Top of the engine
12	EVAP Canister Purge Valve	Bolted to the front of the coolant pipe
13	Fuse/Relay Box	Along the inside of the right fender
14	Manifold Absolute Pressure (MAP) Sensor	Bolted to the top of the Common Chamber
15	Throttle Body	Between the intake air duct and the Common Chamber
16	Engine Coolant Temperature Sensor	On the coolant crossover pipe at the front of the engine, near the throttle body
17	Power Train Control Module (PCM)	Along the inside of the right fender

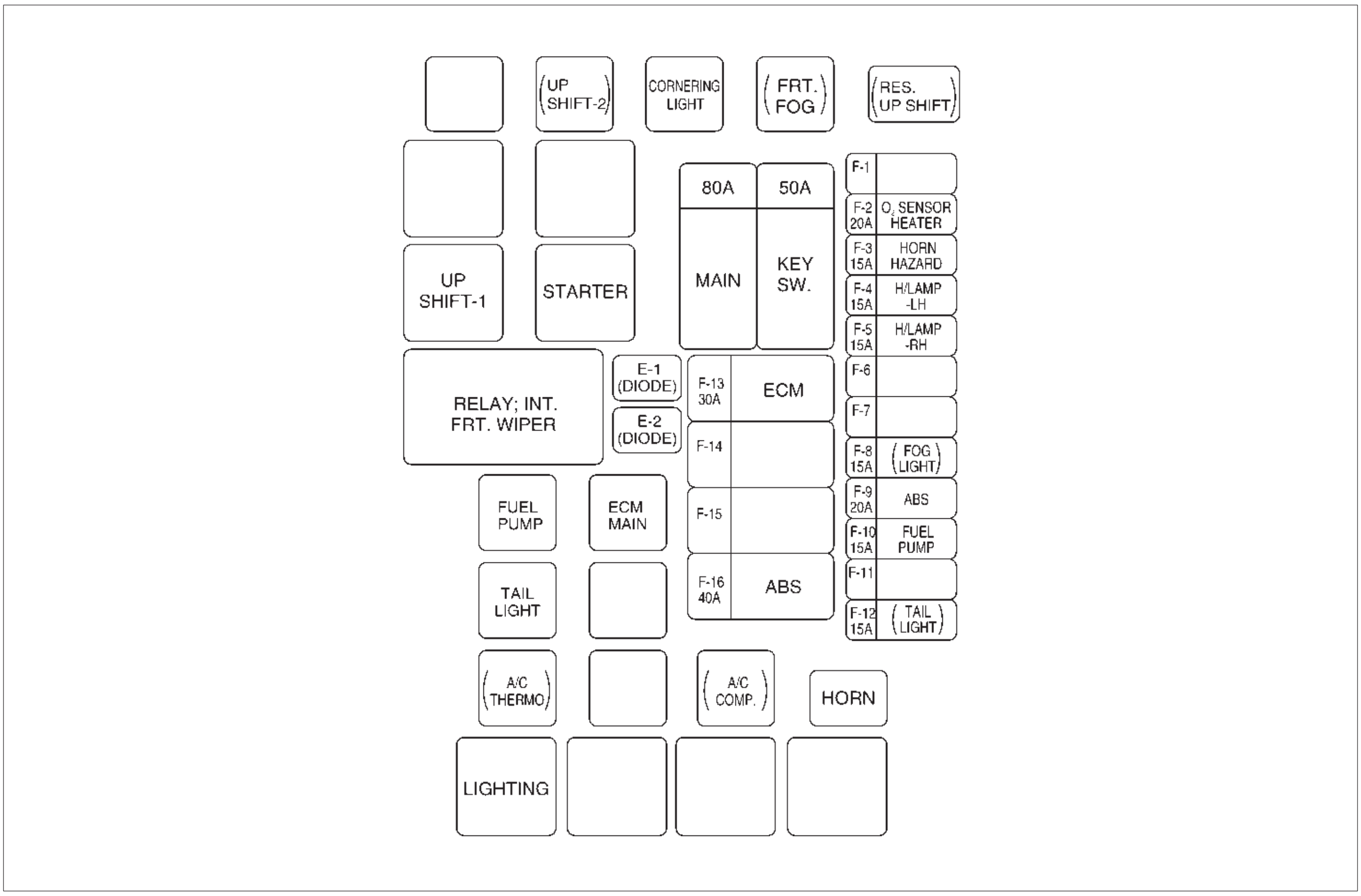
Undercarriage Component Locator



Undercarriage Component Locator Table

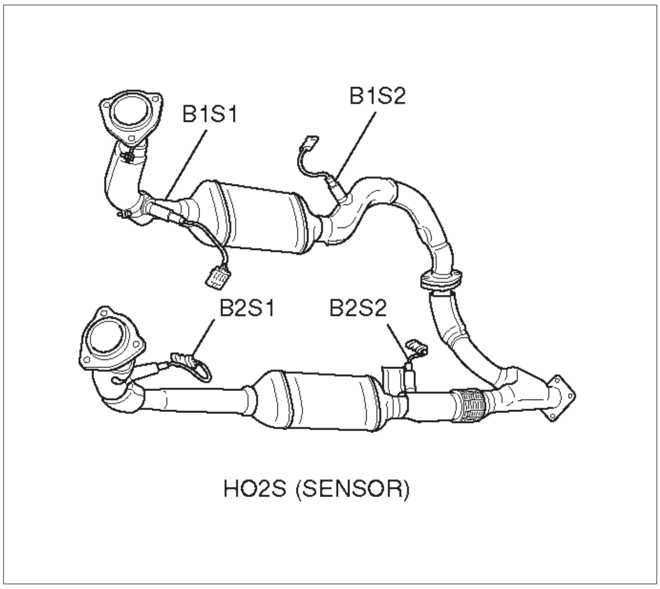
Number	Name	Location
1	Fuel Pump Assembly	Installed in the top of the fuel tank
2	EVAP Canister	On the top of the bracket that is located behind of the cross member
3	EVAP Canister Cut Valve	On the top of the bracket that is located behind of the cross member
4	Fuel Gauge Unit	Installed in the front edge of the fuel tank, on the right side
5	Fuel Filter	Located along the inside of the right frame rail, ahead of the rear axle
6	Vehicle Speed Sensor (VSS)	2WD: Protrudes from the transmission housing, just ahead of the propeller shaft. 4WD: Protrudes from the rear output shaft housing of the transfer case.
7	Heated Oxygen Sensor (Bank 1, HO2S 1)	Threaded into the exhaust pipe behind the right-hand catalytic converter
8	Heated Oxygen Sensor (Bank 1, HO2S 2)	Threaded into the exhaust pipe ahead of the right-hand catalytic converter
9	Heated Oxygen Sensor (Bank 2, HO2S 1)	Threaded into the exhaust pipe ahead the left-hand catalytic converter
10	Heated Oxygen Sensor (Bank 2, HO2S 2)	Threaded into the exhaust pipe behind the left-hand catalytic converter

Fuse and Relay Panel (Underhood Electrical Center)



065RY00003

Sensors and Miscellaneous Component Locators



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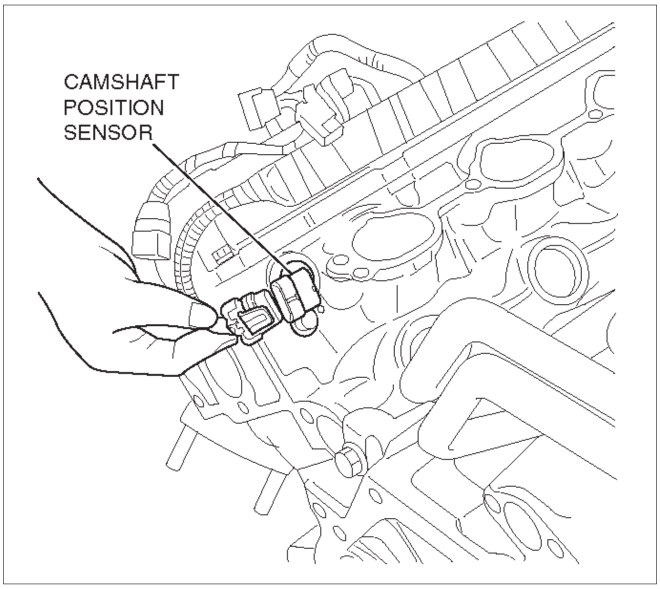

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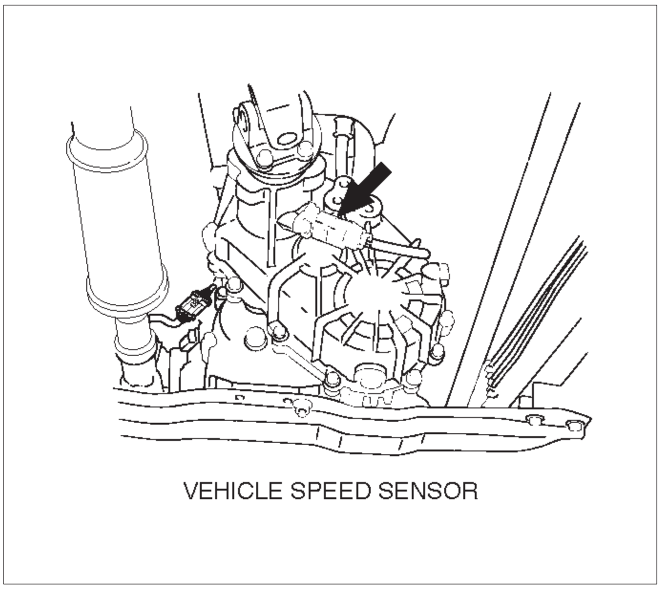

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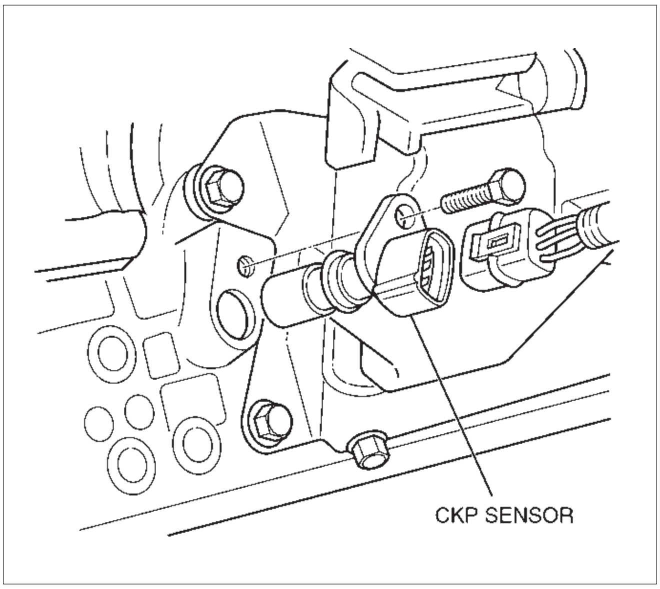

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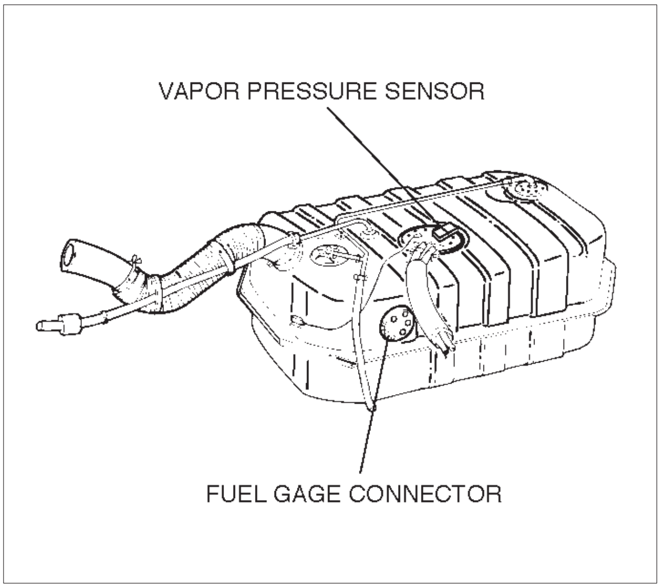

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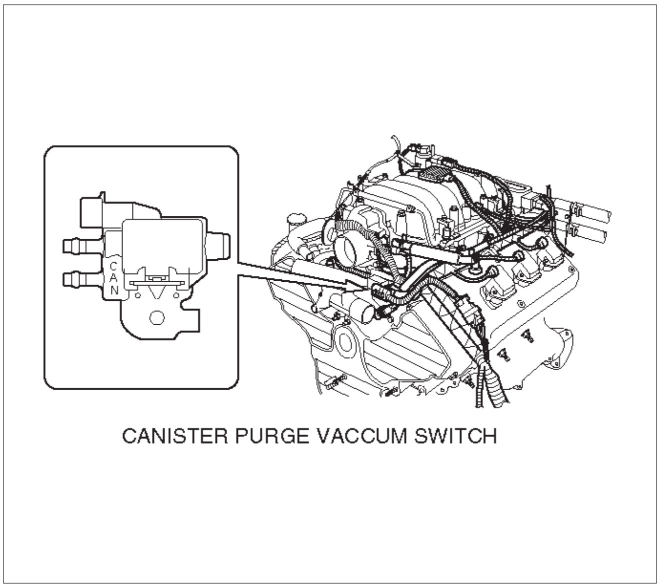

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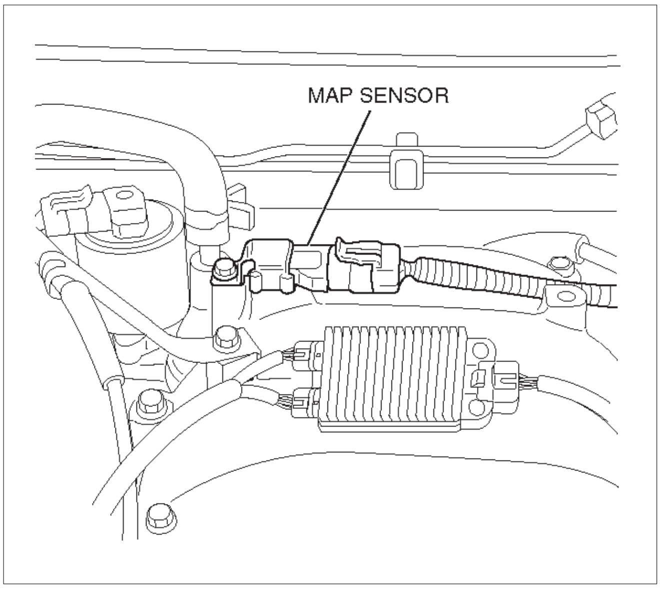

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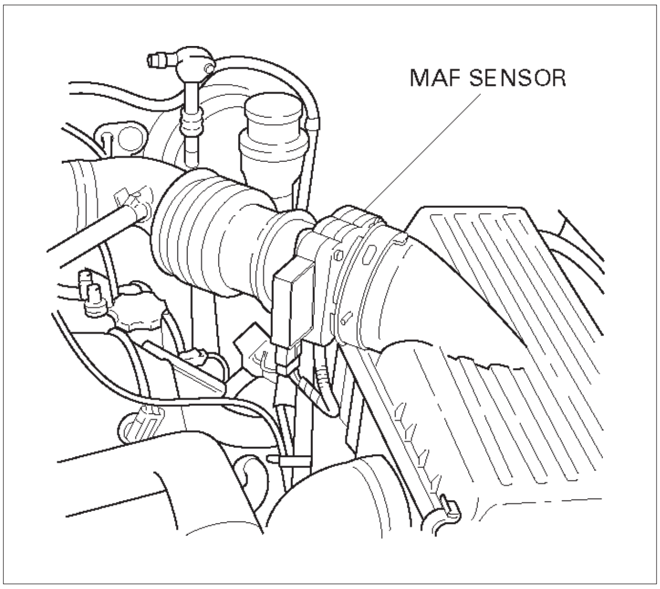

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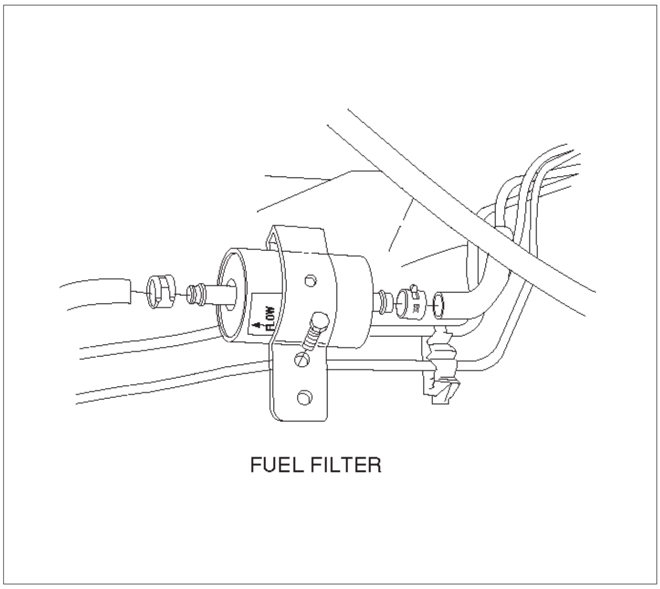

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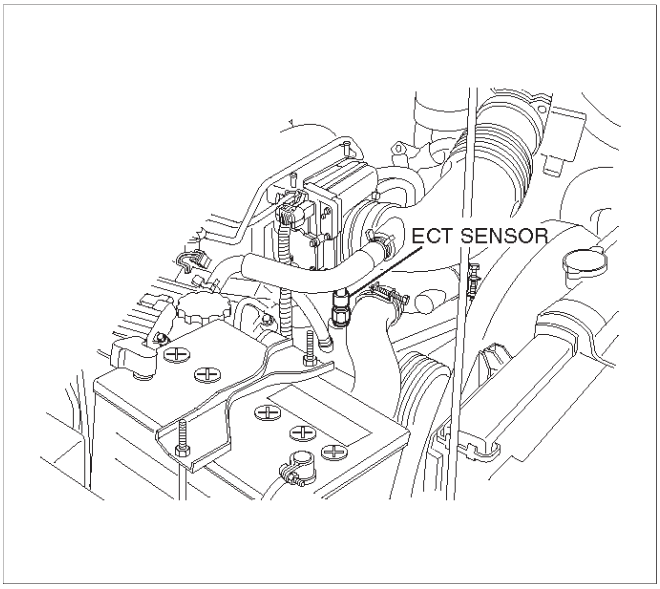

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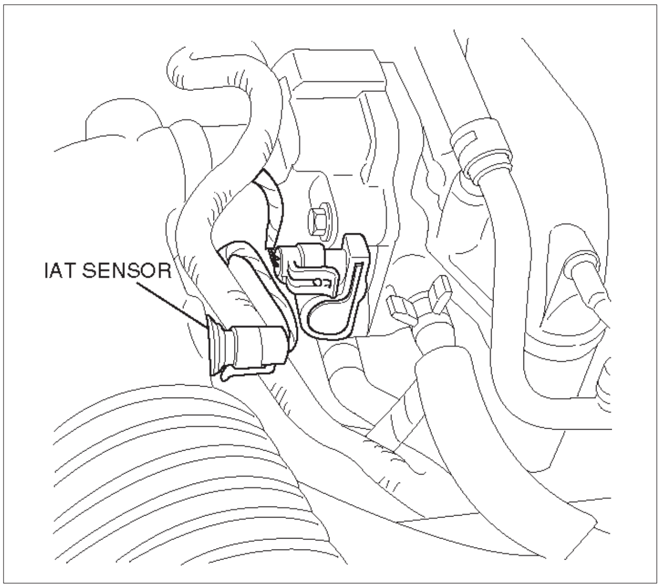

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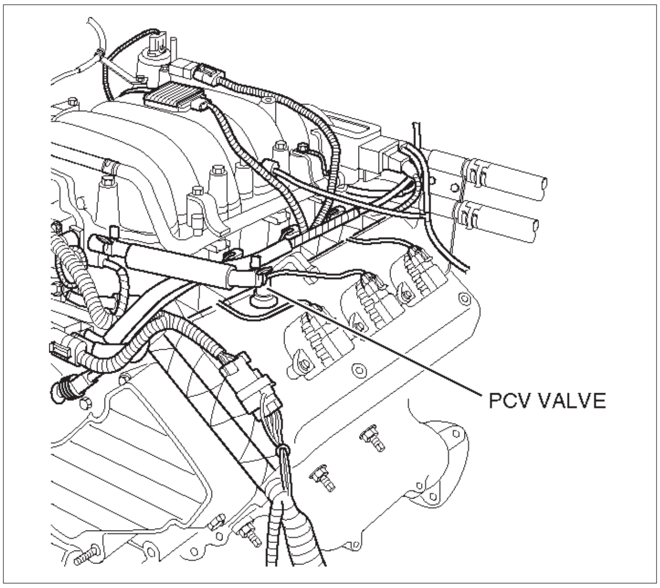

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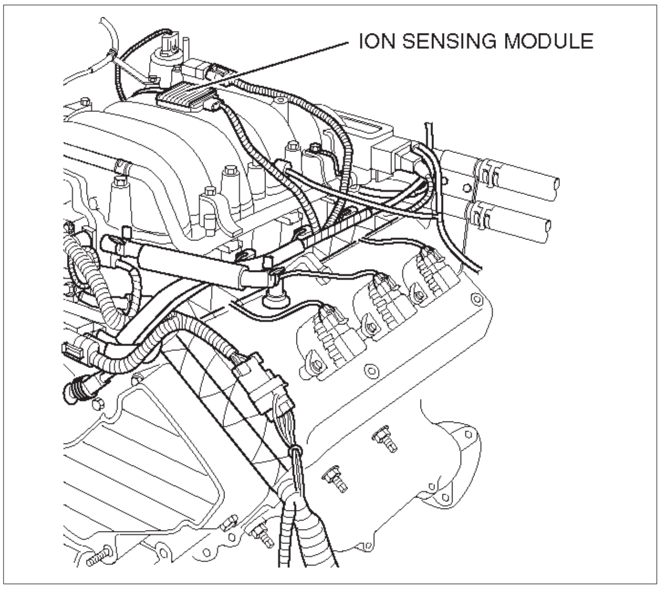

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Diagnosis

Strategy-Based Diagnostics

Strategy-Based Diagnostics

The strategy-based diagnostic is a uniform approach to repair all Electrical/Electronic (E/E) systems. The diagnostic flow can always be used to resolve an E/E system problem and is a starting point when repairs are necessary. The following steps will instruct the technician how to proceed with a diagnosis:

1. Verify the customer complaint.
   - To verify the customer complaint, the technician should know the normal operation of the system.
2. Perform preliminary checks.
   - Conduct a thorough visual inspection.
   - Review the service history.
   - Detect unusual sounds or odors.
   - Gather diagnostic trouble code information to achieve an effective repair.
3. Check bulletins and other service information.
   - This includes videos, newsletters, etc.
4. Refer to service information (manual) system check(s).
   - “System checks” contain information on a system that may not be supported by one or more DTCs. System checks verify proper operation of the system. This will lead the technician in an organized approach to diagnostics.
5. Refer to service diagnostics.

DTC Stored

Follow the designated DTC chart exactly to make an effective repair.

No DTC

Select the symptom from the symptom tables. Follow the diagnostic paths or suggestions to complete the repair. You may refer to the applicable component/system check in the system checks.

No Matching Symptom

1. Analyze the complaint.
2. Develop a plan for diagnostics.
3. Utilize the wiring diagrams and the theory of operation.

Combine technician knowledge with efficient use of the available service information.

Intermittents

Conditions that are not always present are called intermittents. To resolve intermittents, perform the following steps:

1. Observe history DTCs, DTC modes, and freeze frame data.
2. Evaluate the symptoms and the conditions described by the customer.
3. Use a check sheet or other method to identify the circuit or electrical system component.
4. Follow the suggestions for intermittent diagnosis found in the service documentation.

Most Scan Tools, such as the Tech 2, have data-capturing capabilities that can assist in detecting intermittents.

No Trouble Found

This condition exists when the vehicle is found to operate normally. The condition described by the customer may be normal. Verify the customer complaint against another vehicle that is operating normally. The condition may be intermittent. Verify the complaint under the conditions described by the customer before releasing the vehicle.

1. Re-examine the complaint.

   When the Complaint cannot be successfully found or isolated, a re-evaluation is necessary. The complaint should be re-verified and could be intermittent as defined in *Intermittents* section, or could be normal.
2. Repair and verify.

   After isolating the cause, the repairs should be made. Validate for proper operation and verify that the symptom has been corrected. This may involve road testing or other methods to verify that the complaint has been resolved under the following conditions:
   - Conditions noted by the customer.
   - If a DTC was diagnosed, verify a repair by duplicating conditions present when the DTC was set as noted in the Failure Records or Freeze Frame data.

Verifying Vehicle Repair

Verification of the vehicle repair will be more comprehensive for vehicles with OBD II system diagnostics. Following a repair, the technician should perform the following steps:

IMPORTANT: Follow the steps below when you verify repairs on OBD II systems. Failure to follow these steps could result in unnecessary repairs.

1. Review and record the Failure Records and the Freeze Frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for an A or B type diagnostic and only if the MIL(”Check Engine” lamp) has been requested).
2. Clear the DTC(S).
3. Operate the vehicle within conditions noted in the Failure Records and Freeze Frame data.
4. Monitor the DTC status information for the DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

General Service Information

OBD II Serviceablity Issues

With the introduction of OBD II diagnostics across the entire passenger car and light-duty truck market in 1996, illumination of the MIL (“Check Engine” lamp) due to a non-vehicle fault could lead to misdiagnosis of the vehicle, increased warranty expense and customer dissatisfaction. The following list of non-vehicle faults does not include every possible fault and may not apply equally to all product lines.

Fuel Quality

Fuel quality is not a new issue for the automotive industry, but its potential for turning on the MIL (“Check Engine” lamp) with OBD II systems is new.

Fuel additives such as “dry gas” and “octane enhancers” may affect the performance of the fuel. If this results in an incomplete combustion or a partial burn, it will show up as a Misfire DTC P0300. The Reid Vapor Pressure of the fuel can also create problems in the fuel system, especially during the spring and fall months when severe ambient temperature swings occur. A high Reid Vapor Pressure could show up as a Fuel Trim DTC due to excessive canister loading. High vapor pressures generated in the fuel tank can also affect the Evaporative Emission diagnostic as well.

Using fuel with the wrong octane rating for the vehicle may cause driveability problems. Many of the major fuel companies advertise that using “premium” gasoline will improve the performance of the vehicle. Most premium fuels use alcohol to increase the octane rating of the fuel. Although alcohol-enhanced fuels may raise the octane rating, the fuel’s ability to turn into vapor in cold temperatures deteriorates. This may affect the starting ability and cold driveability of the engine.

Low fuel levels can lead to fuel starvation, lean engine operation, and eventually engine misfire.

Non-OEM Parts

All of the OBD II diagnostics have been calibrated to run with OEM parts. Something as simple as a high-performance exhaust system that affects exhaust system back pressure could potentially interfere with the operation of the EGR valve and thereby turn on the MIL (“Check Engine” lamp). Small leaks in the exhaust system near the post catalyst oxygen sensor can also cause the MIL (“Check Engine” lamp) to turn on.

Aftermarket electronics, such as transceivers, stereos, and anti-theft devices, may radiate EMI into the control system if they are improperly installed. This may cause a false sensor reading and turn on the MIL (“Check Engine” lamp).

Environment

Temporary environmental conditions, such as localized flooding, will have an effect on the vehicle ignition system. If the ignition system is rain-soaked, it can temporarily cause engine misfire and turn on the MIL (“Check Engine” lamp).

Refueling

A new OBD II diagnostic was introduced in 1996 on some vehicles. This diagnostic checks the integrity of the entire evaporative emission system. If the vehicle is restarted after refueling and the fuel cap is not secured correctly, the on-board diagnostic system will sense this as a system fault and turn on the MIL (“Check Engine” lamp) with a DTC P0440.

Vehicle Marshaling

The transportation of new vehicles from the assembly plant to the dealership can involve as many as 60 key cycles within 2 to 3 miles of driving. This type of operation contributes to the fuel fouling of the spark plugs and will turn on the MIL (“Check Engine” lamp) with a P0300 Misfire DTC.

Poor Vehicle Maintenance

The sensitivity of OBD II diagnostics will cause the MIL (“Check Engine” lamp) to turn on if the vehicle is not maintained properly. Restricted air filters, fuel filters, and crankcase deposits due to lack of oil changes or improper oil viscosity can trigger actual vehicle faults that were not previously monitored prior to OBD II. Poor vehicle maintenance can’t be classified as a “non-vehicle fault”, but with the sensitivity of OBD II diagnostics, vehicle maintenance schedules must be more closely followed.

Related System Faults

Many of the OBD II system diagnostics will not run if the PCM detects a fault on a related system or component. One example would be that if the PCM detected a Misfire fault, the diagnostics on the catalytic converter would be suspended until Misfire fault was repaired. If the Misfire fault was severe enough, the catalytic converter could be damaged due to overheating and would never set a Catalyst DTC until the Misfire fault was repaired and the Catalyst diagnostic was allowed to run to completion. If this happens, the customer may have to make two trips to the dealership in order to repair the vehicle.

Emissions Control Information Label

The engine compartment “Vehicle Emissions Control Information Label” contains important emission specifications and setting procedures. In the upper left corner is exhaust emission information. This identifies the emission standard (Federal, California, or Canada) of the engine, the displacement of the engine in liters, the class of the vehicle, and the type of fuel metering system. There is also an illustrated emission components and vacuum hose schematic.

This label is located in the engine compartment of every vehicle. If the label has been removed it should be replaced. It can be ordered from Isuzu Dealership.

Visual / Physical Engine Compartment Inspection

Perform a careful visual and physical engine compartment inspection when performing any diagnostic procedure or diagnosing the cause of an emission test failure. This can often lead to repairing a problem without further steps. Use the following guidelines when performing a visual/physical inspection:

- Inspect all vacuum hoses for pinches, cuts, disconnections, and proper routing.
- Inspect hoses that are difficult to see behind other components.
- Inspect all wires in the engine compartment for proper connections, burned or chafed spots, pinched wires, contact with sharp edges or contact with hot exhaust manifolds or pipes.

Basic Knowledge of Tools Required

NOTE: Lack of basic knowledge of this powertrain when performing diagnostic procedures could result in an incorrect diagnosis or damage to powertrain components. Do not attempt to diagnose a powertrain problem without this basic knowledge.

A basic understanding of hand tools is necessary to effectively use this section of the Service Manual.

Serial Data Communications

Class II Serial Data Communications

Government regulations require that all vehicle manufacturers establish a common communication system. This vehicle utilizes the “Class II” communication system. Each bit of information can have one of two lengths: long or short. This allows vehicle wiring to be reduced by transmitting and receiving multiple signals over a single wire. The messages carried on Class II data streams are also prioritized. If two messages attempt to establish communications on the data line at the same time, only the message with higher priority will continue. The device with the lower priority message must wait. The most significant result of this regulation is that it provides Scan tool manufacturers with the capability to access data from any make or model vehicle that is sold.

The data displayed on other Scan tools will appear the same, with some exceptions. Some Scan tools will only be able to display certain vehicle parameters as values that are a coded representation of the true or actual value. On this vehicle the Scan tool displays the actual values for vehicle parameters. It will not be necessary to perform any conversions from coded values to actual values.

On-Board Diagnostic (OBD II)

On-Board Diagnostic Tests

A diagnostic test is a series of steps, the result of which is a pass or fail reported to the diagnostic executive. When a diagnostic test reports a pass result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The diagnostic test has passed during the current ignition cycle.
- The fault identified by the diagnostic test is not currently active.

When a diagnostic test reports a fail result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The fault identified by the diagnostic test is currently active.
- The fault has been active during this ignition cycle.
- The operating conditions at the time of the failure.

Remember, a fuel trim DTC may be triggered by a list of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Comprehensive Component Monitor Diagnostic Operation

Comprehensive component monitoring diagnostics are required to monitor emissions-related input and output powertrain components. The *CARB OBD II Comprehensive Component Monitoring List Of Components Intended To illuminate MIL* is a list of components, features or functions that could fall under this requirement.

Input Components:

Input components are monitored for circuit continuity and out-of-range values. This includes rationality checking. Rationality checking refers to indicating a fault when the signal from a sensor does not seem reasonable, i.e. Throttle Position (TP) sensor that indicates high throttle position at low engine loads or MAP voltage. Input components may include, but are not limited to the following sensors:

- Vehicle Speed Sensor (VSS)
- Crankshaft Position (CKP) sensor
- Throttle Position (TP) sensor
- Engine Coolant Temperature (ECT) sensor
- Camshaft Position (CMP) sensor
- Manifold Absolute Pressure (MAP) sensor
- Mass Air Flow (MAF) sensor

In addition to the circuit continuity and rationality check, the ECT sensor is monitored for its ability to achieve a steady state temperature to enable closed loop fuel control.

Output Components:

Output components are diagnosed for proper response to control module commands. Components where functional monitoring is not feasible will be monitored for circuit continuity and out-of-range values if applicable.

Output components to be monitored include, but are not limited to, the following circuits:

- Control module controlled EVAP Canister Purge Valve
- Electronic Transmission controls
- A/C relays
- Cooling fan relay
- VSS output
- MIL control

- Cruise control inhibit

Refer to PCM and Sensors in General Descriptions.

Passive and Active Diagnostic Tests

A passive test is a diagnostic test which simply monitors a vehicle system or component. Conversely, an active test, actually takes some sort of action when performing diagnostic functions, often in response to a failed passive test. For example, the EGR diagnostic active test will force the EGR valve open during closed throttle decel and/or force the EGR valve closed during a steady state. Either action should result in a change in manifold pressure.

Intrusive Diagnostic Tests

This is any on-board test run by the Diagnostic Management System which may have an effect on vehicle performance or emission levels.

Warm-Up Cycle

A warm-up cycle means that engine at temperature must reach a minimum of 70˚C (160˚F) *and* rise at least 22˚C (40˚F) over the course of a trip.

Freeze Frame

Freeze Frame is an element of the Diagnostic Management System which stores various vehicle information at the moment an emissions-related fault is stored in memory and when the MIL is commanded on. These data can help to identify the cause of a fault. Refer to *Storing And Erasing Freeze Fame Data* in this section for more detailed information.

Failure Records

Failure Records data is an enhancement of the OBD II Freeze Frame feature. Failure Records store the same vehicle information as does Freeze Frame, but it will store that information for any fault which is stored in on-board memory, while Freeze Frame stores information only for emission-related faults that command the MIL on.

System Status and Drive Cycle for Satisfying Federal Inspection/Maintenance (I/M 240) Regulations

I/M Ready Status means a signal or flag for each emission system test that had been set in the PCM. I/M Ready Status indicates that the vehicle on-board emissions diagnostics have been run. I/M Ready Status is not concerned whether the emission system passed or failed the test, only that on-board diagnosis is complete. Not all vehicles use all possible I/M flags.

Common OBD II Terms

Diagnostic

When used as a noun, the word diagnostic refers to any on-board test run by the vehicle's Diagnostic Management System. A diagnostic is simply a test run on a system or component to determine if the system or component is operating according to specification. There are many diagnostics, shown in the following list:

- Misfire
- Oxygen sensors
- Oxygen sensor heaters
- EGR
- Catalyst monitoring

Enable Criteria

The term "enable criteria" is engineering language for the conditions necessary for a given diagnostic test to run. Each diagnostic has a specific list of conditions which must be met before the diagnostic will run. "Enable criteria" is another way of saying "conditions required".

The enable criteria for each diagnostic is listed on the first page of the DTC description in Section 6E under the heading "Conditions for Setting the DTC". Enable criteria varies with each diagnostic, and typically includes, but is not limited to the following items:

- engine speed
- vehicle speed
- ECT
- MAF/MAP
- barometric pressure
- IAT
- TP
- high canister purge
- fuel trim
- TCC enabled
- A/C on

Trip

Technically, a trip is a key on-run-key off cycle in which all the enable criteria for a given diagnostic are met, allowing the diagnostic to run. Unfortunately, this concept is not quite that simple. A trip is official when all the enable criteria for a given diagnostic are met. But because the enable criteria vary from one diagnostic to another, the definition of trip varies as well. Some diagnostics are run when the vehicle is at operating temperature, some when the vehicle first starts up; some require that the vehicle be cruising at a steady highway speed, some run only when the vehicle is idle; some diagnostics function with the TCC disable. Some run only immediately following a cold engine start-up.

A trip then, is defined as a key on-run-key off cycle in which the vehicle was operated in such a way as to satisfy the enabling criteria for a given diagnostic, and this diagnostic will consider this cycle to be one trip. However, another diagnostic with a different set of enable criteria (which were not met) during this driving event, would not consider it a trip. No trip will occur for that particular diagnostic until the vehicle is driven in such a way as to meet all the enable criteria.

The Diagnostic Executive

The Diagnostic Executive is a unique segment of software which is designed to coordinate and prioritize the diagnostic procedures as well as define the protocol for recording and displaying their results. The main responsibilities of the Diagnostic Executive are listed as the following:

- Commanding the MIL ("Check Engine" lamp) on and off
- DTC logging and clearing

- Freeze Frame data for the first emission related DTC recorded
- Non-emission related Service Lamp
- Operating conditions Failure Records buffer, (the number of records will vary)
- Current status information on each diagnostic
- System Status (I/M ready)

The Diagnostic Executive records DTCs and turns on the MIL when emission-related faults occur. It can also turn off the MIL if the conditions cease which caused the DTC to set.

Diagnostic Information

The diagnostic charts and functional checks are designed to locate a faulty circuit or component through a process of logical decisions. The charts are prepared with the requirement that the vehicle functioned correctly at the time of assembly and that there are no multiple faults present.

There is a continuous self-diagnosis on certain control functions. This diagnostic capability is complemented by the diagnostic procedures contained in this manual. The language of communicating the source of the malfunction is a system of diagnostic trouble codes. When a malfunction is detected by the control module, a diagnostic trouble code is set and the Malfunction Indicator Lamp (MIL) ("Check Engine" lamp) is illuminated.

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) looks the same as the MIL you are already familiar with ("Check Engine" lamp). However, OBD II requires that it illuminate under a strict set of guide lines.

Basically, the MIL is turned on when the PCM detects a DTC that will impact vehicle emissions.

The MIL is under the control of the Diagnostic Executive. The MIL will be turned on if an emissions-related diagnostic test indicates a malfunction has occurred. It will stay on until the system or component passes the same test, for three consecutive trips, with no emissions related faults.

If the vehicle is experiencing a misfire malfunction which may cause damage to the Three-Way Catalytic Converter (TWC), the MIL will flash once per second. This will continue until the vehicle is outside of speed and load conditions which could cause possible catalyst damage, and the MIL will stop flashing and remain on steady.

Extinguishing the MIL

When the MIL is on, the Diagnostic Executive will turn off the MIL after *three(3) consecutive* trips that a "test passed" has been reported for the diagnostic test that originally caused the MIL to illuminate.

Although the MIL has been turned off, the DTC will remain in the PCM memory (both Freeze Frame and Failure Records) until *forty(40) warm-up cycles after no faults* have been completed.

If the MIL was set by either a fuel trim or misfire-related DTC, additional requirements must be met. In addition to the requirements stated in the previous paragraph, these requirements are as follows:

- The diagnostic tests that are passed must occur within 375 RPM of the RPM data stored at the time the last test failed.
- Plus or minus ten (10) percent of the engine load that was stored at the time the last failed.
- Similar engine temperature conditions (warmed up or warming up) as those stored at the time the last test failed.

Meeting these requirements ensures that the fault which turned on the MIL has been corrected.

The MIL ("Check Engine" lamp) is on the instrument panel and has the following function:

- It informs the driver that a fault affects vehicle emission levels has occurred and that the vehicle should be taken for service as soon as possible.
- As a bulb and system check, the MIL will come "ON" with the key "ON" and the engine not running. When the engine is started, the MIL will turn "OFF."
- When the MIL remains "ON" while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, a Powertrain On-Board Diagnostic (OBD ll) System Check must be performed. The procedures for these checks are given in On-Board Diagnostic (OBD) System Check. These checks will expose faults which may not be detected if other diagnostics are performed first.

DTC Types

Each DTC is directly related to a diagnostic test. The Diagnostic Management System sets DTC based on the failure of the tests during a trip or trips. Certain tests must fail two (2) consecutive trips before the DTC is set. The following are the four (4) types of DTCs and the characteristics of those codes:

- Type A
  - Emissions related
  - Requests illumination of the MIL of the first trip with a fail
  - Stores a History DTC on the first trip with a fail
  - Stores a Freeze Frame (if empty)
  - Stores a Fail Record
  - Updates the Fail Record each time the diagnostic test fails
- Type B
  - Emissions related
  - "Armed" after one (1) trip with a fail
  - "Disarmed" after one (1) trip with a pass
  - Requests illumination of the MIL on the *second consecutive trip* with a fail
  - Stores a History DTC on the second consecutive trip with a fail (The DTC will be armed after the first fail)
  - Stores a Freeze Frame on the second consecutive trip with a fail (if empty)
  - Stores a Fail Record when the first test fails (not dependent on *consecutive trip* fails)
  - Updates the Fail Record each time the diagnostic test fails

(Some special conditions apply to misfire and fuel trim DTCs)

- Type C (if the vehicle is so equipped)
  - Non-Emissions related
  - Requests illumination of the Service Lamp or the service message on the Drive Information Center (DIC) on the *first trip* with a fail
  - Stores a History DTC on the *first trip* with a fail
  - *Does not* store a Freeze Frame
  - Stores Fail Record when test fails
  - Updates the Fail Record each time the diagnostic test fails
- Type D
  - Non-Emissions related
  - Not request illumination of any lamp
  - Stores a History DTC on the *first trip* with a fail
  - *Does not* store a Freeze Frame
  - Stores Fail Record when test fails
  - Updates the Fail Record each time the diagnostic test fails

IMPORTANT: Only four Fail Records can be stored. Each Fail Record is for a different DTC. It is possible that there will not be Fail Records for every DTC if multiple DTCs are set.

Special Cases of Type B Diagnostic Tests

Unique to the misfire diagnostic, the Diagnostic Executive has the capability of alerting the vehicle operator to potentially damaging levels of misfire. If a misfire condition exists that could potentially damage the catalytic converter as a result of high misfire levels, the Diagnostic Executive will command the MIL to “flash” at a rate of once per seconds during those the time that the catalyst damaging misfire condition is present.

Fuel trim and misfire are special cases of *Type B* diagnostics. Each time a fuel trim or misfire malfunction is detected, engine load, engine speed, and engine coolant temperature are recorded.

When the ignition is turned off, the last reported set of conditions remain stored. During subsequent ignition cycles, the stored conditions are used as reference for similar conditions. If a malfunction occurs during two consecutive trips, the Diagnostic Executive treats the failure as a normal *Type B* diagnostic, and not use the stored conditions. However, if a malfunction occurs on two non-consecutive trips, the stored conditions are compared with the current conditions. The MIL will then illuminate under the following conditions:

- When the engine load conditions are within 10% of the previous test that failed.
- Engine speed is within 375 rpm, of the previous test that failed.
- Engine coolant temperature is in the same range as the previous test that failed.

Storing and Erasing Freeze Frame Data and Failure Records

Government regulations require that engine operating conditions be captured whenever the MIL is illuminated. The data captured is called Freeze Frame data. The Freeze Frame data is very similar to a single record of operating conditions. Whenever the MIL is illuminated, the corresponding record of operating conditions is recorded to the Freeze Frame buffer.

Freeze Frame data can only be overwritten with data associated with a misfire or fuel trim malfunction. Data from these faults take precedence over data associated with any other fault. The Freeze Frame data will not be erased unless the associated history DTC is cleared.

Each time a diagnostic test reports a failure, the current engine operating conditions are recorded in the *Failure Records* buffer. A subsequent failure will update the recorded operating conditions. The following operating conditions for the diagnostic test which failed *typically* include the following parameters:

- Air Fuel Ratio
- Air Flow Rate
- Fuel Trim
- Engine Speed
- Engine Load
- Engine Coolant Temperature
- Vehicle Speed
- TP Angle
- MAP/BARO
- Injector Base Pulse Width
- Loop Status

Intermittent Malfunction Indicator Lamp

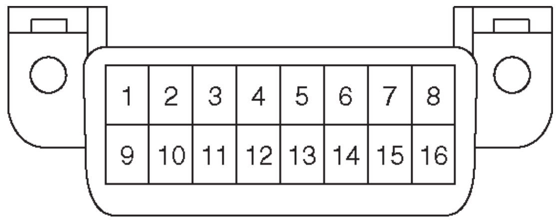
In the case of an “intermittent” fault, the MIL (“Check Engine” lamp) may illuminate and then (after three trips) go “OFF”. However, the corresponding diagnostic trouble code will be stored in the memory. When unexpected diagnostic trouble codes appear, check for an intermittent malfunction.

A diagnostic trouble code may reset. Consult the “Diagnostic Aids” associated with the diagnostic trouble code. A physical inspection of the applicable sub-system most often will resolve the problem.

Data Link Connector (DLC)

The provision for communication with the control module is the Data Link Connector (DLC). It is located at the lower left of the instrument panel behind a small square cover. The DLC is used to connect to the Tech 2 Scan Tool. Some common uses of the Tech 2 are listed below:

- Identifying stored Diagnostic Trouble Codes (DTCs).
- Clearing DTCs.
- Performing output control tests.
- Reading serial data.



TS24064

Decimal/Binary/Hexadecimal Conversions

Beginning in 1996, Federal Regulations require that all auto manufacturers selling vehicles in the United States provide Scan Tool manufacturers with software information to display vehicle operating parameters. All Scan Tool manufacturers will display a variety of vehicle information which will aid in repairing the vehicle. Some Scan Tools will display encoded messages which will aid in determining the nature of the concern. The method of encoding involves the use of a two additional numbering systems: Binary and Hexadecimal.

The binary number system has a base of two numbers. Each digit is either a 0 or a 1. A binary number is an eight digit number and is read from right to left. Each digit has a position number with the farthest right being the 0 position and the farthest left being the 7 position. The 0 position, when displayed by a 1, indicates 1 in decimal. Each position to the left is double the previous position and added to any other position values marked as a 1.

A hexadecimal system is composed of 16 different alpha numeric characters. The alpha numeric characters used are numbers 0 through 9 and letters A through F. The hexadecimal system is the most natural and common approach for Scan Tool manufacturers to display data represented by binary numbers and digital code.

Verifying Vehicle Repair

Verification of vehicle repair will be more comprehensive for vehicles with OBD II system diagnostic. Following a repair, the technician should perform the following steps:

1. Review and record the Fail Records and/or Freeze Frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for an A or B type diagnostic and only if the MIL has been requested).
2. Clear DTC(s).
3. Operate the vehicle within conditions noted in the Fail Records and/or Freeze Frame data.
4. Monitor the DTC status information for the DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

Following these steps are very important in verifying repairs on OBD ll systems. Failure to follow these steps could result in unnecessary repairs.

Reading Diagnostic Trouble Codes Using The Tech 2 Scan Tool

The procedure for reading diagnostic trouble code(s) is to use a diagnostic Scan Tool. When reading DTC(s), follow instructions supplied by tool manufacturer.

Clearing Diagnostic Trouble Codes

IMPORTANT: Do not clear DTCs unless directed to do so by the service information provided for each diagnostic procedure. When DTCs are cleared, the Freeze Frame and Failure Record data which may help diagnose an intermittent fault will also be erased from memory.

If the fault that caused the DTC to be stored into memory has been corrected, the Diagnostic Executive will begin to count the “warm-up” cycles with no further faults detected, the DTC will automatically be cleared from the PCM memory.

To clear Diagnostic Trouble Codes (DTCs), use the diagnostic Scan Tool “clear DTCs” or “clear information” function. When clearing DTCs follow instructions supplied by the tool manufacturer.

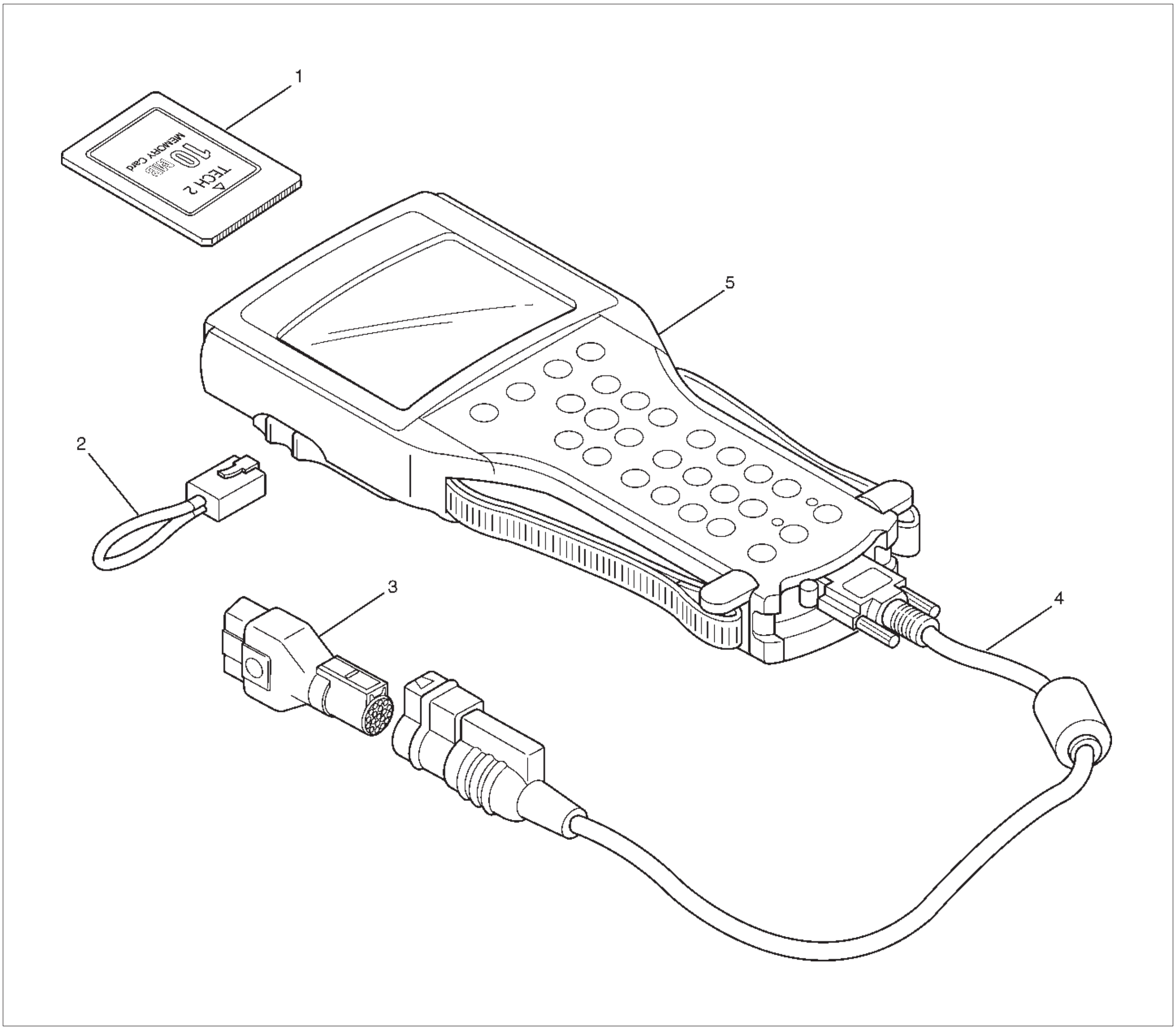
When a Scan Tool is not available, DTCs can also be cleared by disconnecting *one* of the following sources for at least thirty (30) seconds.

NOTE: To prevent system damage, the ignition key must be “OFF” when disconnecting or reconnecting battery power.

- The power source to the control module. Examples: fuse, pigtail at battery PCM connectors etc.
- The negative battery cable. (Disconnecting the negative battery cable will result in the loss of other on-board memory data, such as preset radio tuning).

Tech 2

From 98 MY, Isuzu dealer service departments are recommended to use the Tech 2 Scan Tool. Please refer to the Tech 2 user guide.



Legend

(1) PCMCIA Card
(2) RS 232 Loop Back Connector
(3) SAE 16/19 Adaptor
(4) DLC Cable
(5) Tech–2

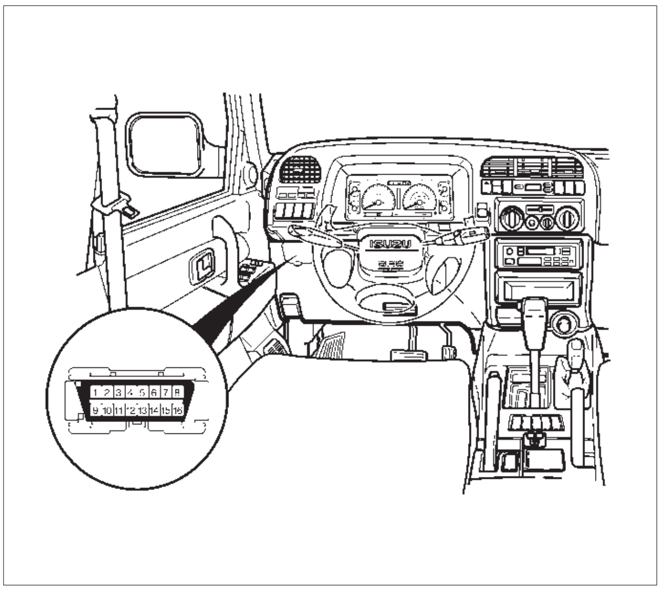
Tech 2 Features

1. Tech 2 is a 12 volt system. Do not apply 24 volts.
2. After connecting and/or installing the Vehicle Communications Interface (VCI) module, PCMCIA card and DLC connector to the Tech 2, connect the tool to the vehicle DLC.
3. Make sure the Tech 2 is powered OFF when removing or installing the PCMCIA card.
4. The PCMCIA card has a capacity of 10 Megabytes which is 10 times greater than the memory of the Tech 1 Mass Storage Cartridge.
5. The Tech 2 has the capability of two snapshots.
6. The PCMCIA card is sensitive to magnetism and static electricity, so care should be taken in the handling of the card.
7. The Tech 2 can plot a graph when replaying a snapshot.
8. Always return to the Main Menu by pressing the EXIT key several times before shutting down.
9. To clear Diagnostic Trouble Codes (DTCs), open Application Menu and press “F1: Clear DTC Info”.

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 2000 System PCMCIA card (1) inserts into the Tech 2 (5).
2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (5)
4. Make sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.



821RW021

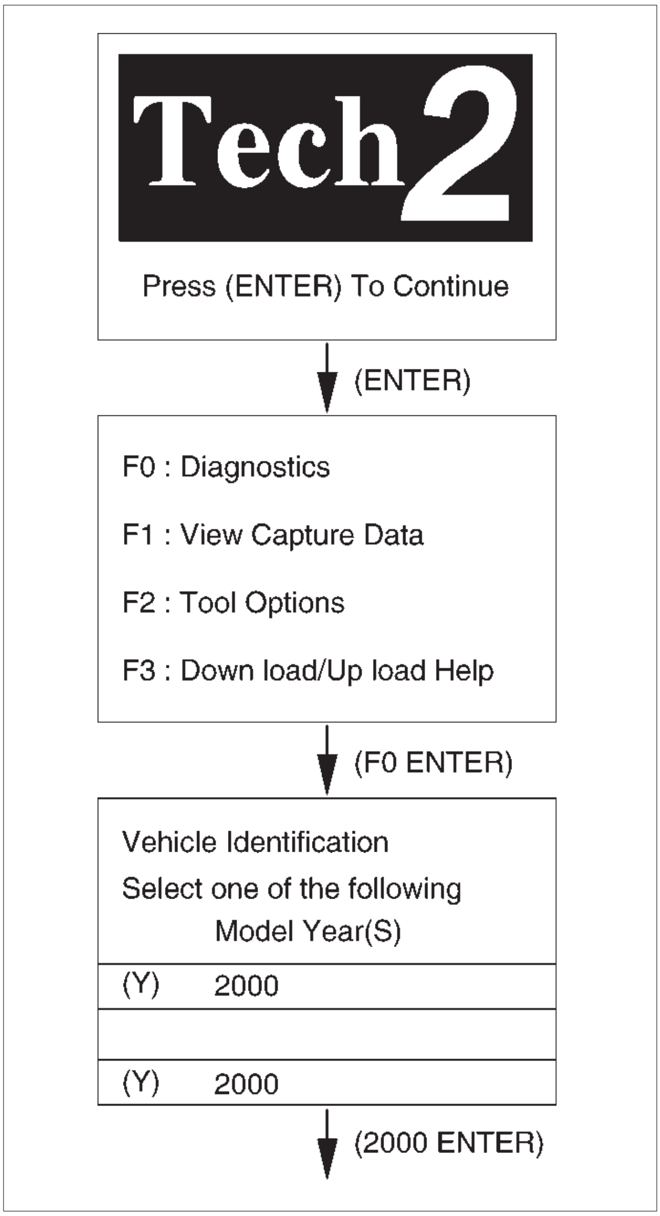
6. Turn on the vehicle ignition.
7. Power the Tech 2 ON and verify the Tech 2 power up display.

060RW009

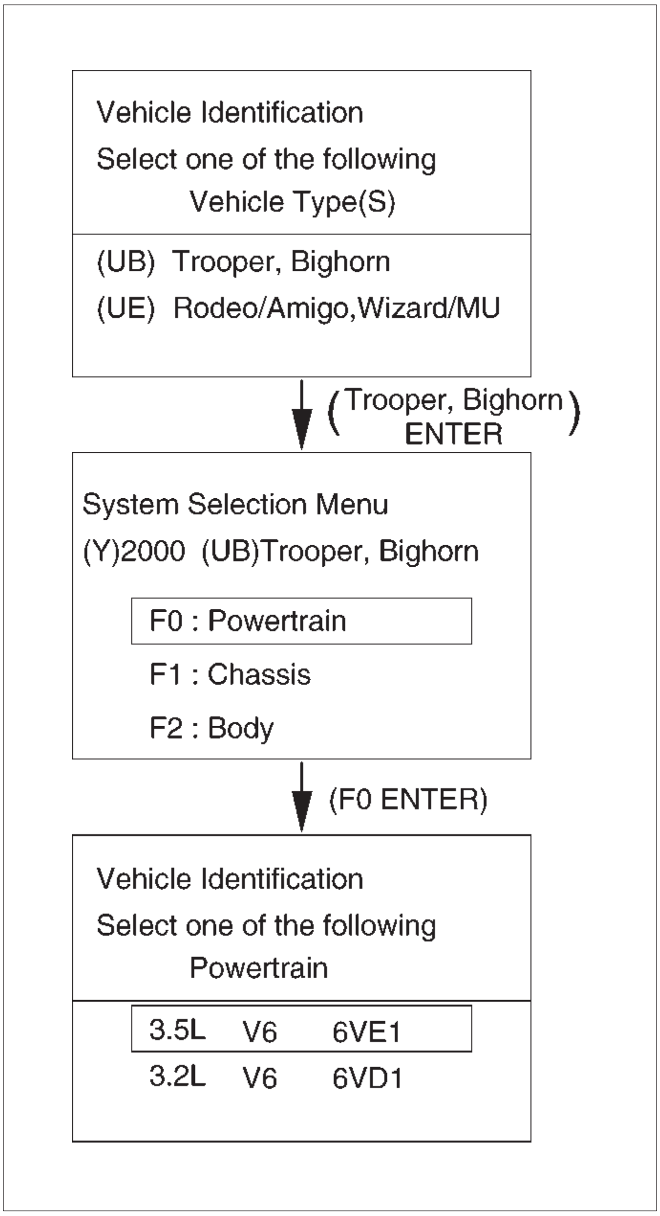
NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2. Refer to user guide of the Tech 2.

Operating Procedure (For Example)

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



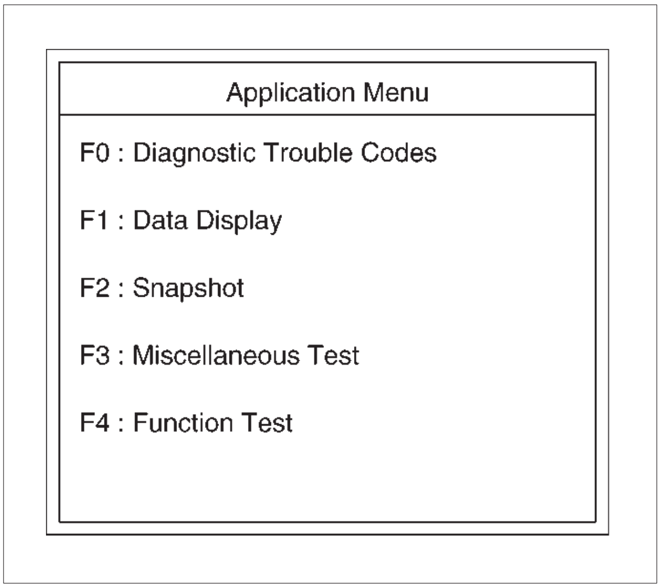
060RY027



060RY00072

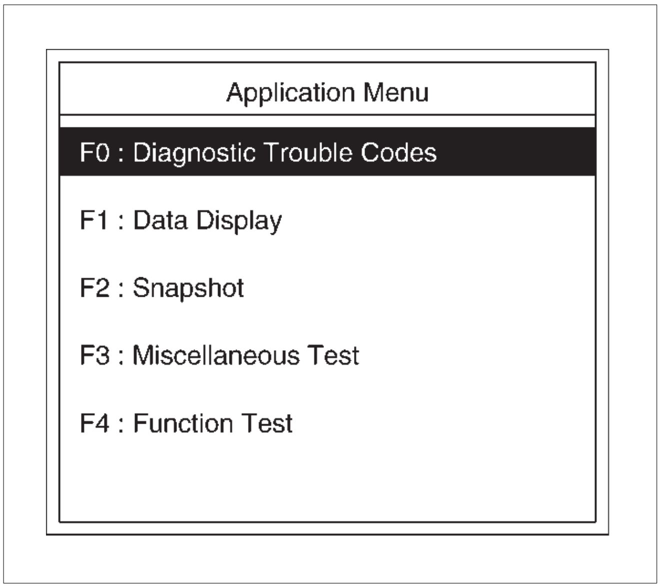
Menu

- The following table shows which functions are used for the available equipment versions.



060RY00073

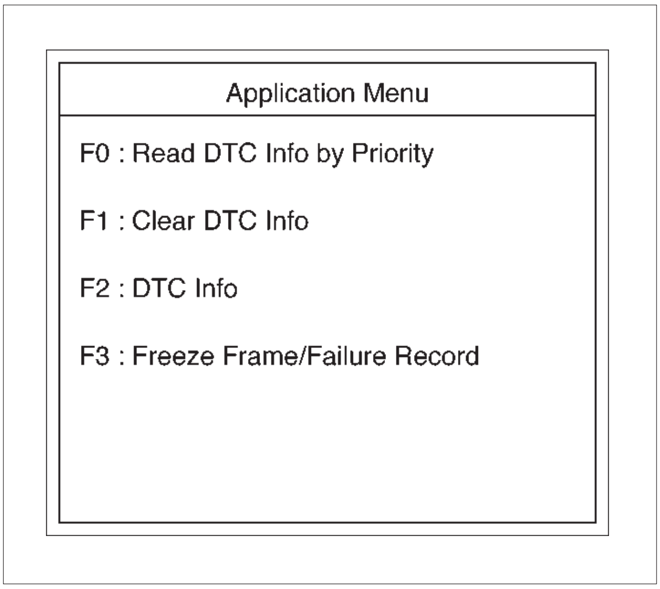
DTC Modes



060RY00074

On OBD II vehiles there are options available in Tech 2 DTC mode to display the enhanced information available. After selecting DTC, the following menu appears:

1. Read DTC Info by Priority
2. Freeze Frame
3. Fail Records (not all applications)
4. DTC Info
5. Clear Info



060RW223

The following is a brief description of each of the sub menus in DTC Info and DTC. The order in which they appear here is alphabetical and not necessarily the way they will appear on the Tech 2.

DTC Information Mode

Use the DTC info mode to search for a specific type of stored DTC information.

DTC Status

This selection will display any DTCs that have not run during the current ignition cycle or have reported a test failure during this ignition up to DTCs. DTC tests which run and pass will cause that DTC number to be removed from Tech 2 screen.

Fail This Ignition

This selection will display all DTCs that have failed during the present ignition cycle.

History

This selection will display only DTCs that are stored in the PCM's history memory. It will display all type A and B DTCs that have requested the MIL and have failed within the last 40 warm-up cycles. In addition, it will display all type C and type D DTCs that have failed within the last 40 warm-up cycles.

Last Test Failed

This selection will display only DTCs that have failed the last time the test run. The last test may have run during a previous ignition cycle if a type A or type B DTC is displayed. For type C and type D DTCs, the last failure must have occurred during the current ignition cycle to appear as Last Test Fail.

MILSVC or Message Request

This selection will display only DTCs that are requesting the MIL. Type C and type D DTCs cannot be displayed using this option. This selection will report type B DTCs only after the MIL has been requested.

Not Run Since Code Cleared

This option will display up to DTCs that have not run since the DTCs were last cleared. Since any displayed DTCs have not run, their condition (passing or failing) is unknown.

Test Failed Since Code Cleared

This selection will display all active and history DTCs that have reported a test failure since the last time DTCs were cleared. DTCs that last failed more than 40 warm-up cycles before this option is selected will not be displayed.

Miscellaneous Test

This test consists of eight menus-Lights, Relays, EVAP, Fuel System, Instruments, EGR Control, Variable Intake Manifold Solenoid, and Injector Balance Tests.

In these tests, Tech 2 sends operating signals to the systems to confirm their operations thereby to judge the normality of electric circuits.

To judge intermittent trouble,

1. Confirm DTC freeze frame data, and match the freeze frame data as test conditions with the data list displayed by Miscellaneous Test.
2. Confirm DTC setting conditions, and match the setting conditions as test conditions with the data list displayed by Miscellaneous Test.
3. Refer to the latest Service Bulletin.
   Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.

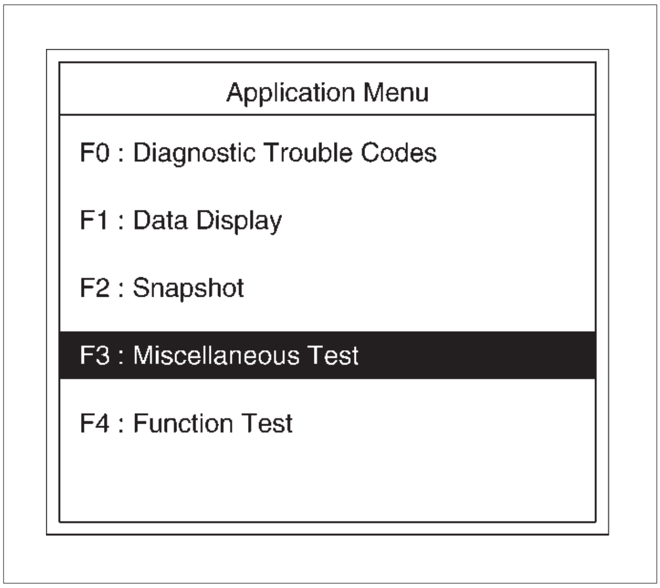
Lamps Test

This test is conducted check MIL, Up Shift Lamp, Low Fuel Lamp, Reduced Power Lamp and Cruise Control Lamp for its working.

Tech2 must be used for this test.

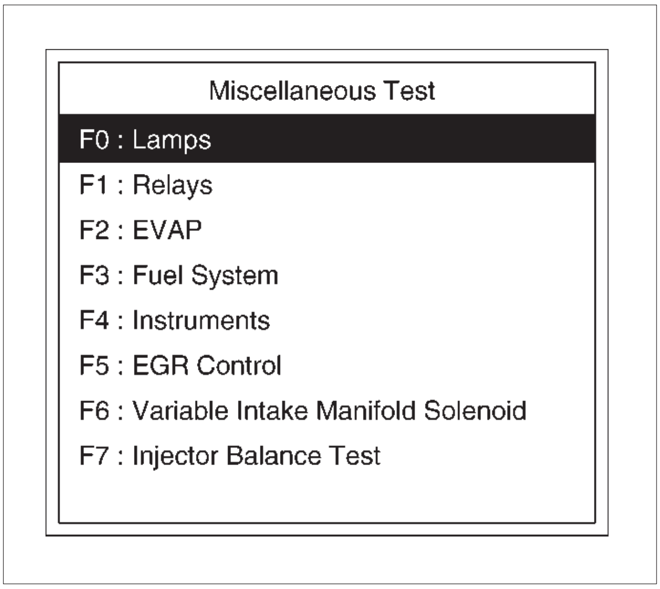
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



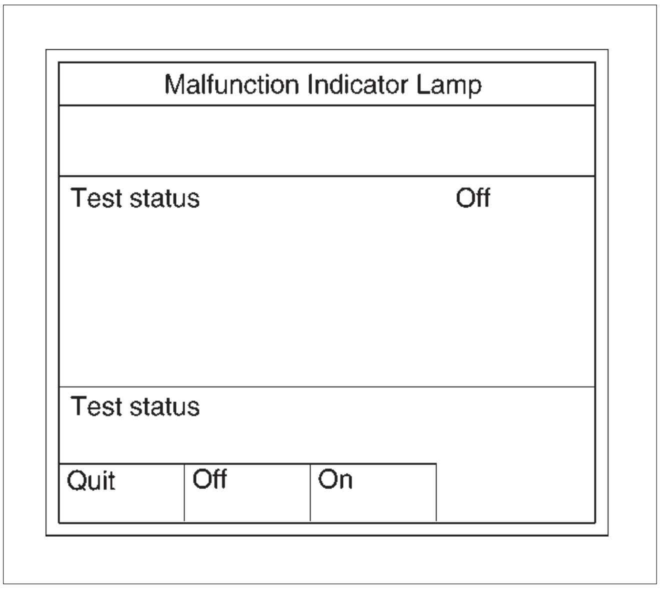
060RY00075

4. Select F0:Lamps Test in the Miscellaneous Test.



060RY00080

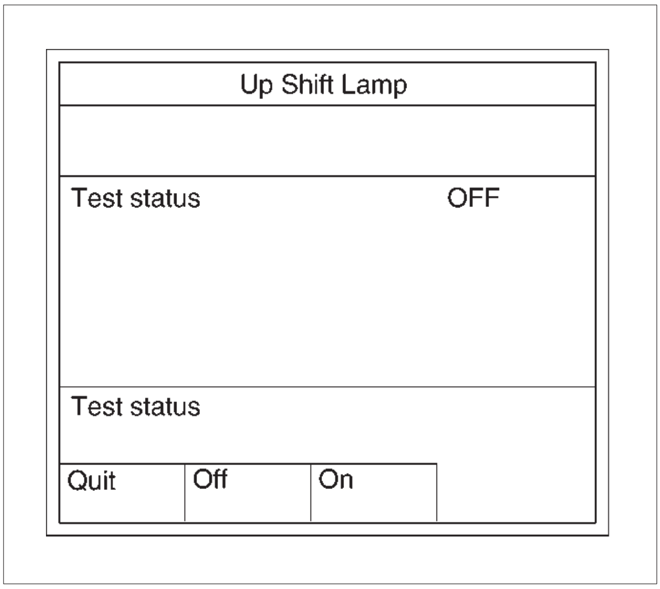
5. Select F0:Malfunction Indicator Lamp.



060RY00091

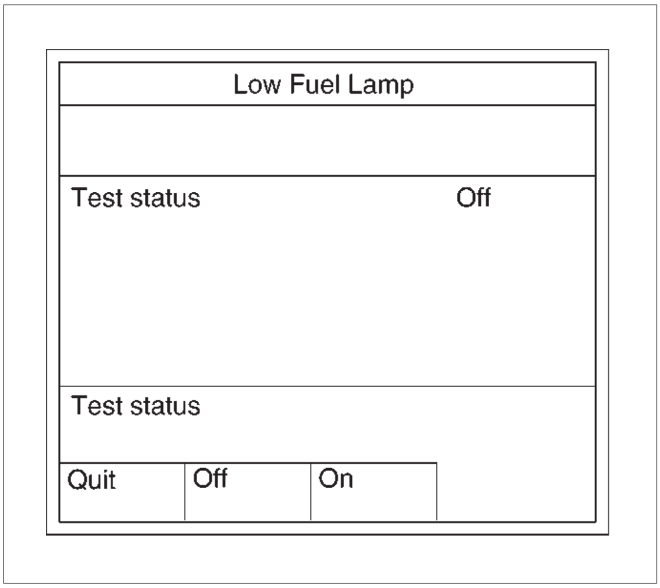
6. Push”On” soft key.
7. Make sure Lamp illuminates.
8. If lamp illuminates, the Lamp is operating correctly.

9. Select F2: Up Shift Lamp



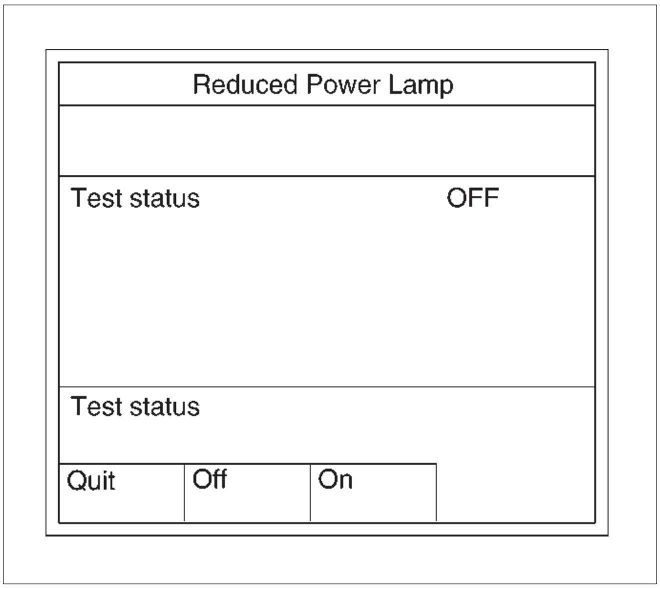
060RY00076

10. Push “On” of soft key.
11. Make sure Lamp illuminates.
12. If Lamp illuminates, the Lamp is operating correctly.
13. Select F2:Low Fuel Lamp



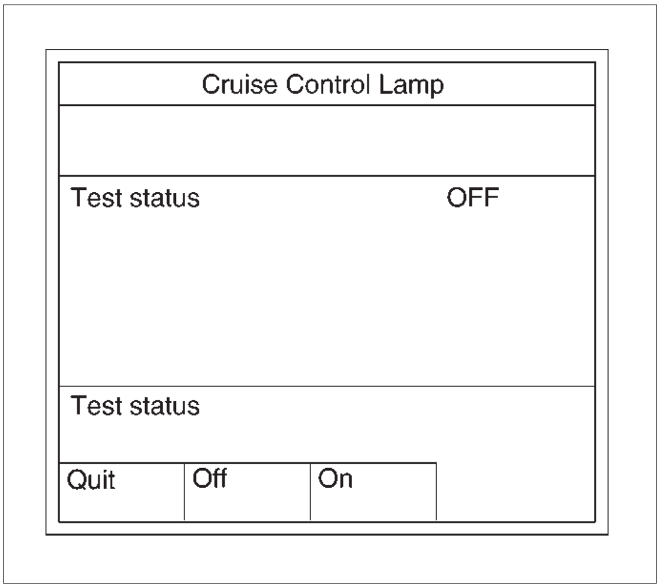
060RY00092

14. Push ”On” of soft key.
15. Make sure Lamp illuminates.
16. If Lamp illuminates, the Lamp is operating correctly.
17. Select F3:Reduced Power Lamp



060RY00077

18. Push ”On” of soft key.
19. Make sure Lamp illuminates.
20. If Lamp illuminates, the Lamp is operating correctly.
21. Select F5:Cruise Control Lamp



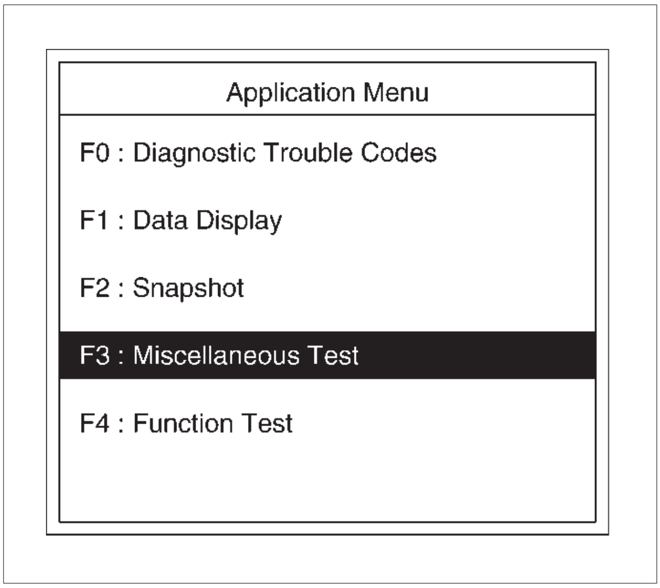
060RY00078

22. Push ”On” of soft key.
23. Make sure Lamp illuminates.
24. If Lamp illuminates, the Lamp is operating correctly.

Relays Test

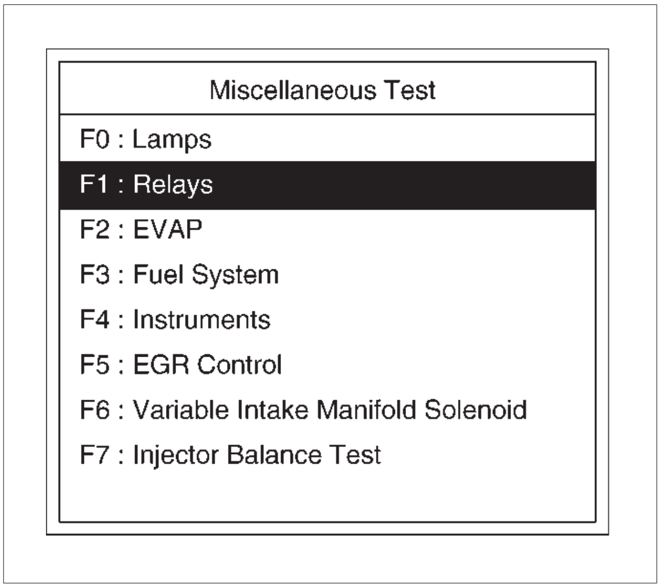
This test is conducted to check Fuel Pump Relay and A/C Clutch for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.



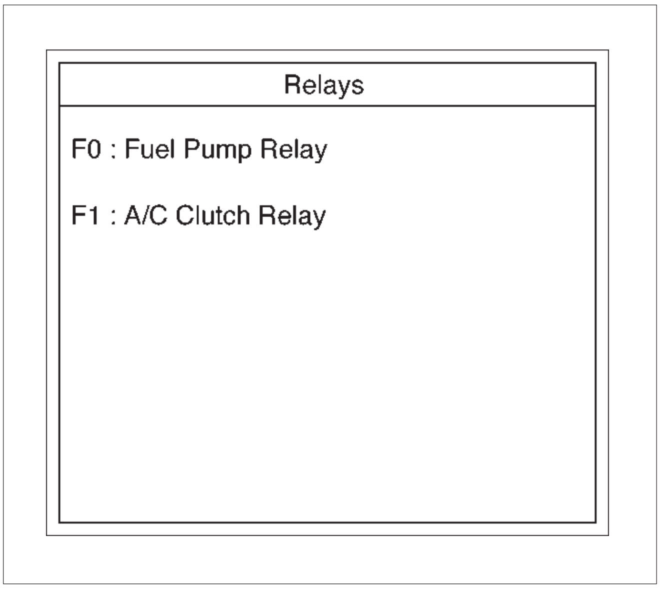
060RY00075

4. Select F1:Relay Test in the Miscellaneous Test.



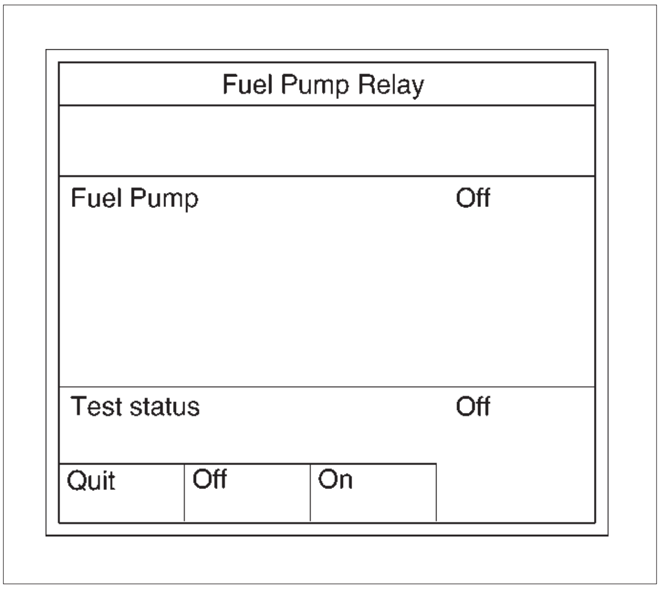
060RY00081

5. Select F0:Fuel Pump Relay.



060RX021

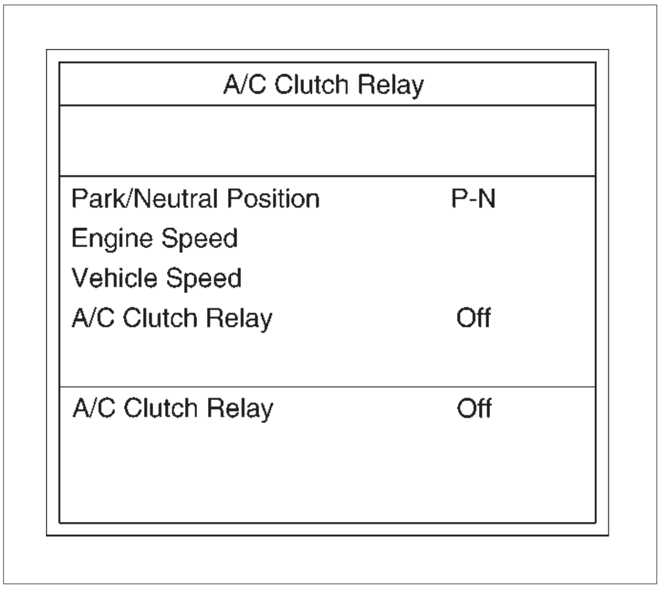
6. Push “On” soft key.



060RY00093

7. Control Fuel Pump Relay and check data list.
8. If the data list changes, the Fuel Pump Relay is normal.
9. Select F1:A/C Clutch Relay.
10. Run the Engine at idle.

11. Turn on Air Condtioning.



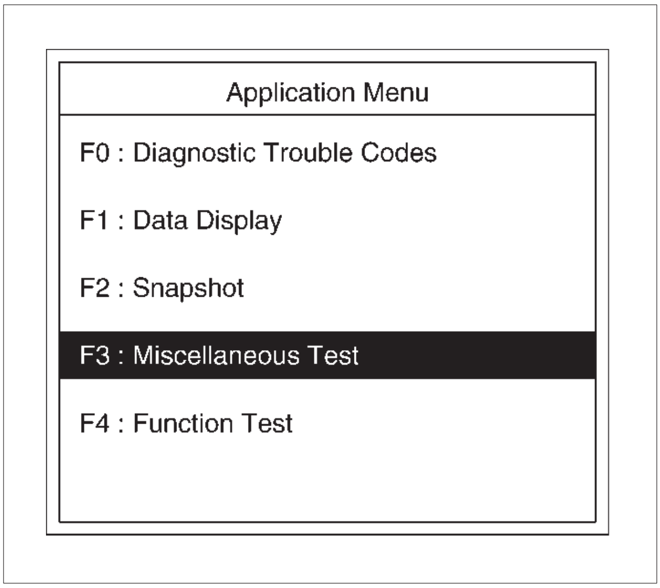
060RY00094

12. Turn “On” and “Off” A/C Switch.
13. Contol A/C Clutch Relay and check data list.
14. If the data list changes, the Fuel Pump Relay is normal.

EVAP Test

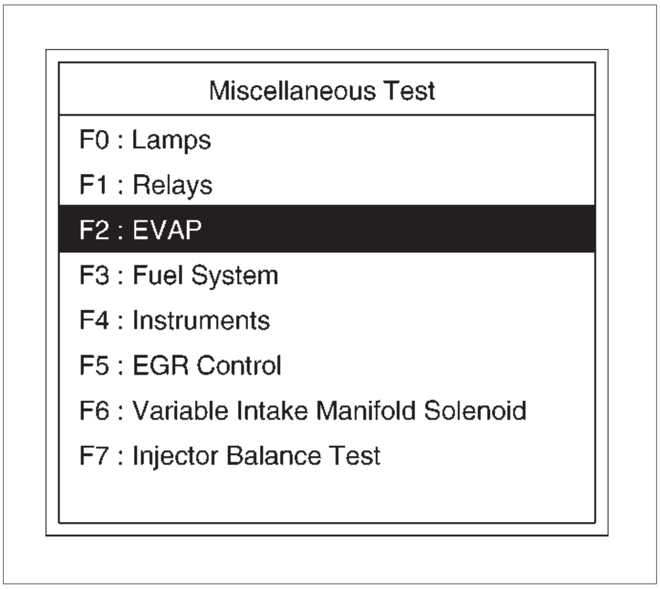
This test is conducted to check EVAP system for its power operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



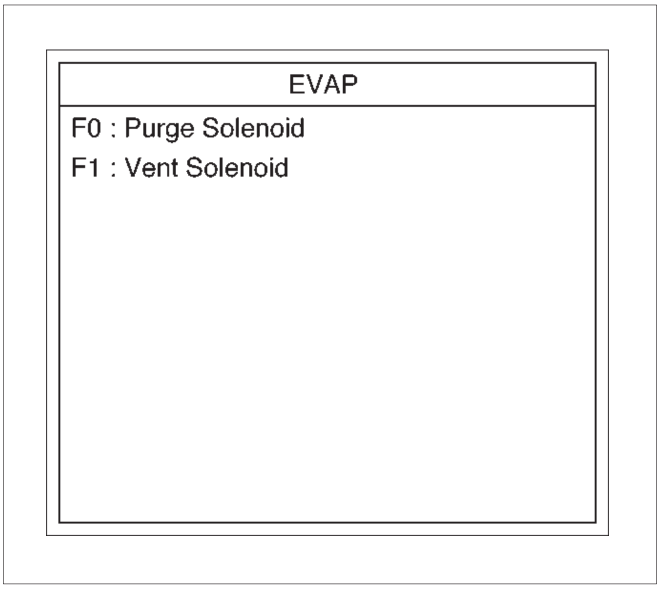
060RY00075

4. Select F2: EVAP Test in the Miscellaneous Test.



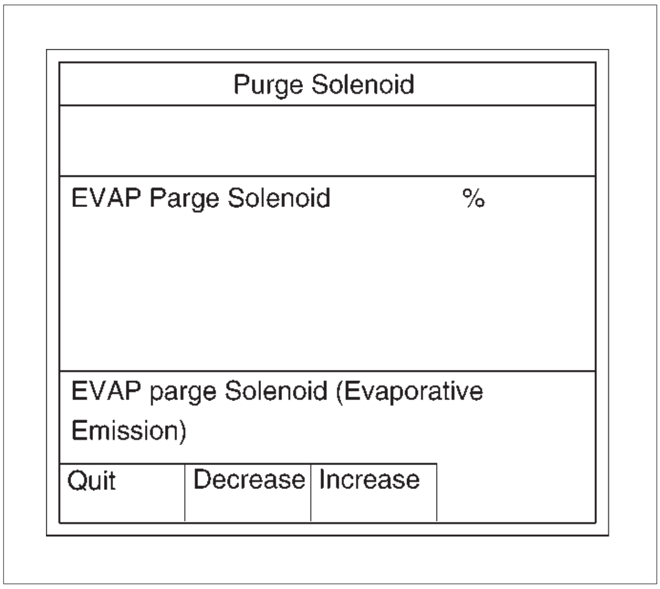
060RY00082

5. Select F0: Purge Solenoid.



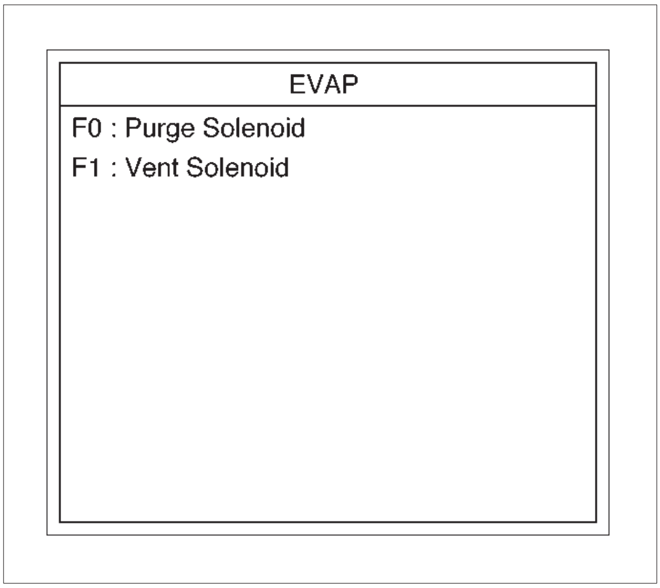
060RX025

6. Push “Decrease” or “Increase” soft key.



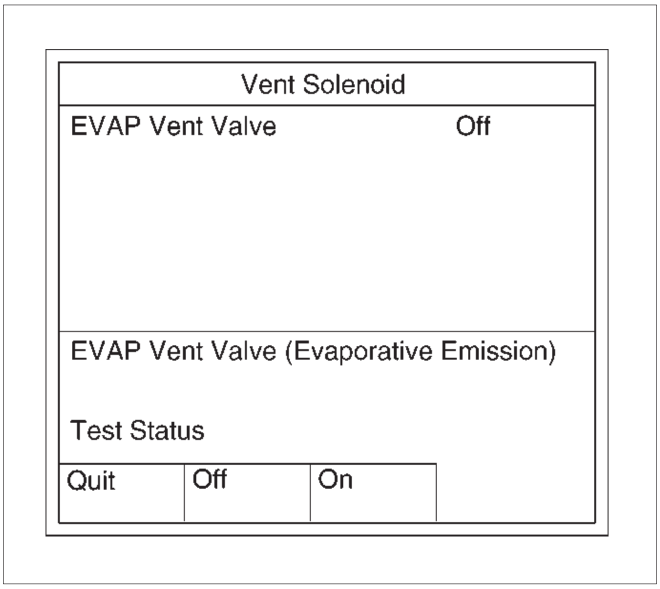
060RY00095

7. Control EVAP Purge Solenoid and check a data list.
8. If the data list changes, the Purge Solenoid is normal.
9. Turn engine off, turn ignition SW “On”.
10. Select F1:EVAP Vent Solenoid.



060RX025

11. Push “On” or “Off” soft key.



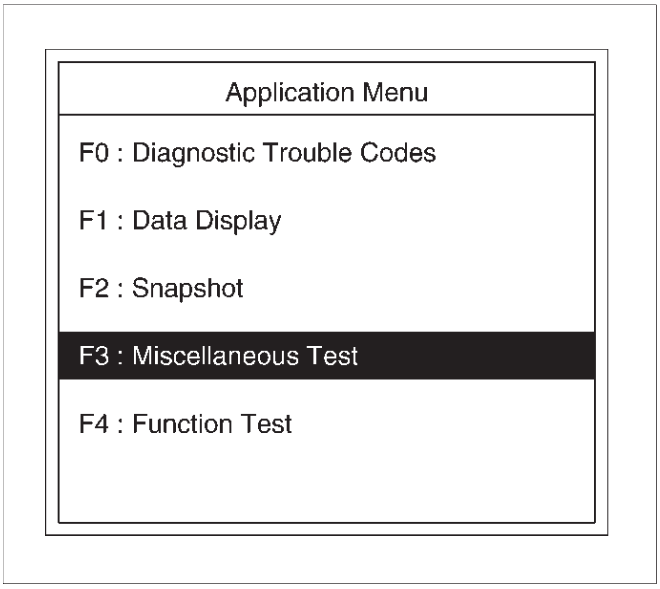
060RY00096

12. Control EVAP Vent Solenoid and check data list.
13. If the data list changes, the EVAP Vent Solenoid is normal.

Fuel System Test

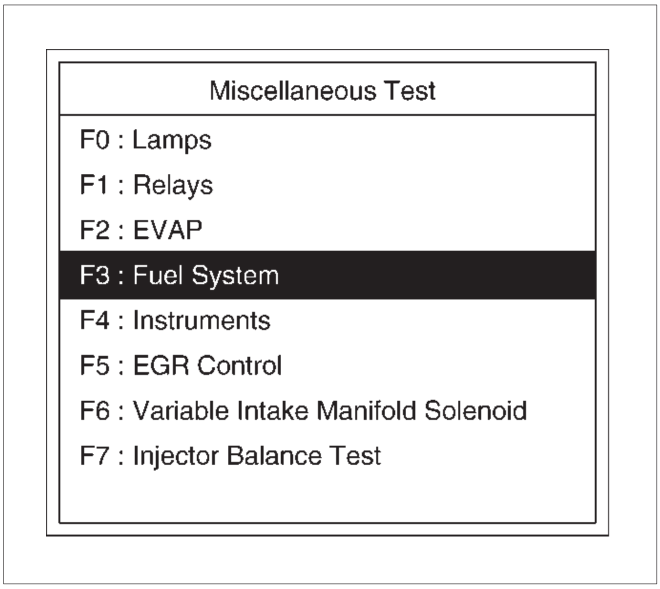
This test is conducted check Fuel system for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.



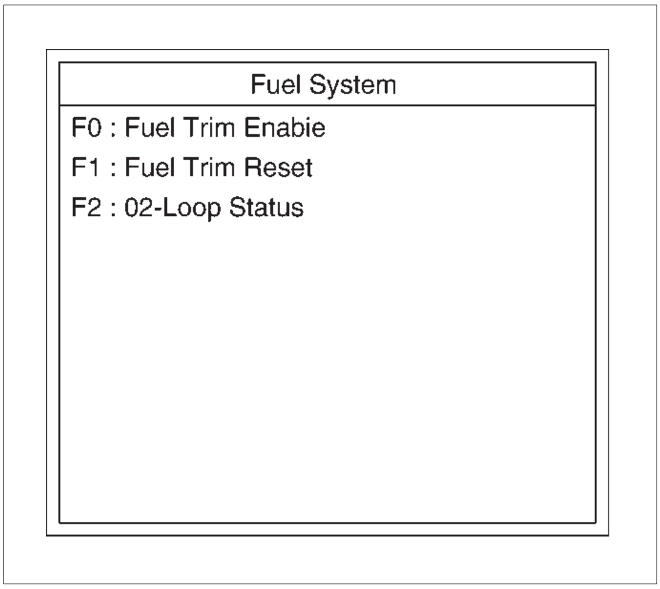
060RY00075

4. Select F3: Fuel System in the Miscellaneous Menu.



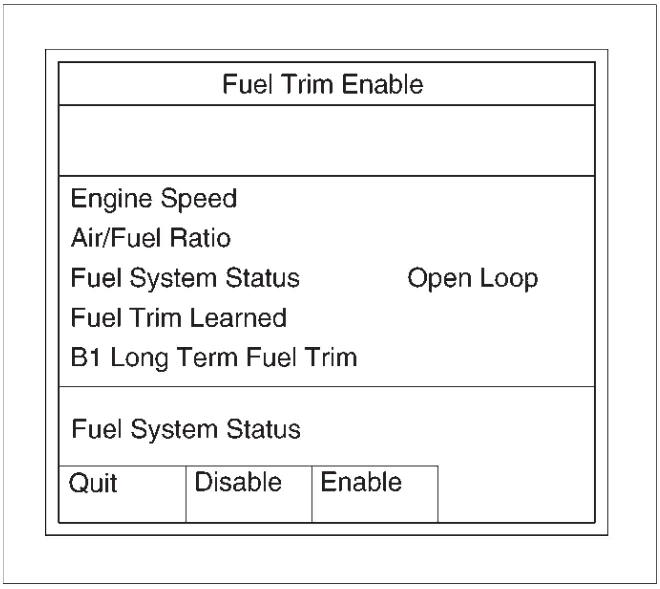
060RY00083

5. Select F0: Fuel Trim Enable.



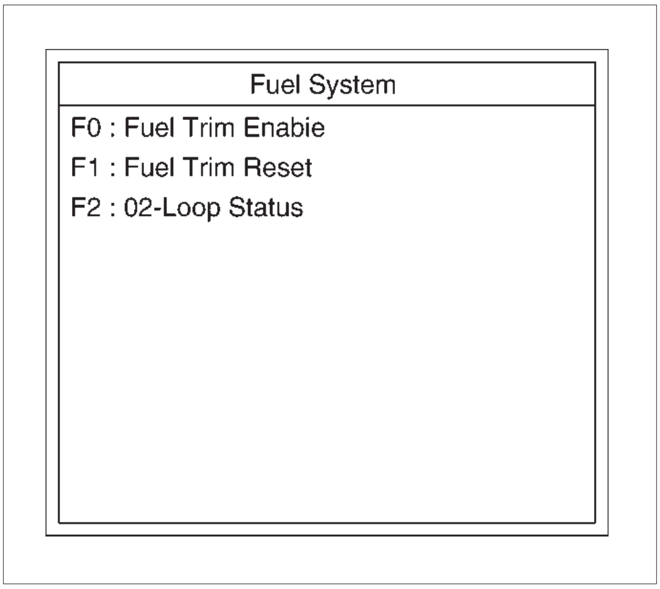
060RY00079

6. Push “Disable” or “Enable” soft key.



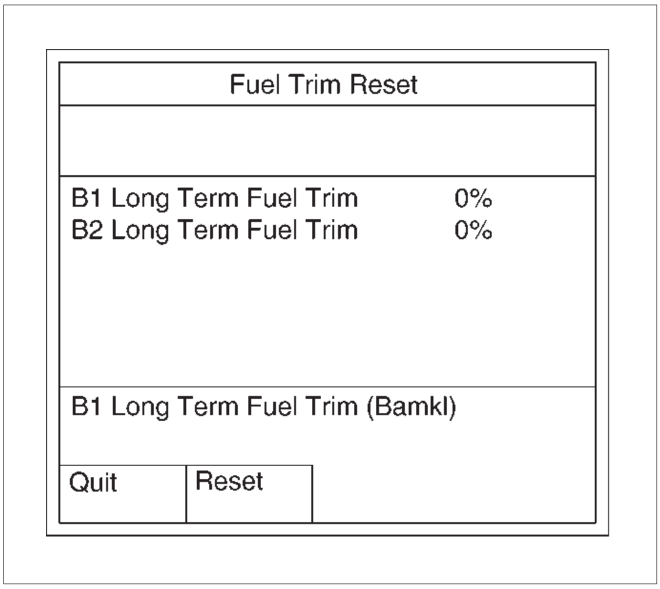
060RY00097

7. Control Fuel Trim and check data list.
8. If data list changes, the Fuel Trim is normal.
9. Select F1: Fuel Trim Reset.



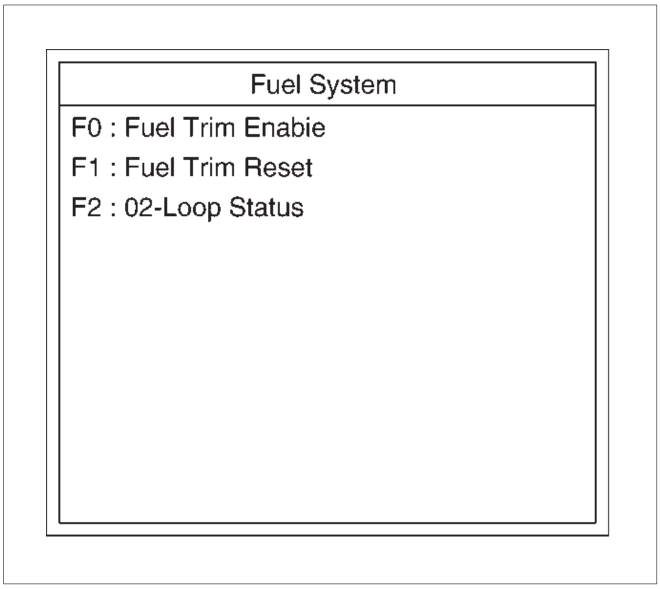
060RY00079

10. Push “Reset” of soft key.



060RY00098

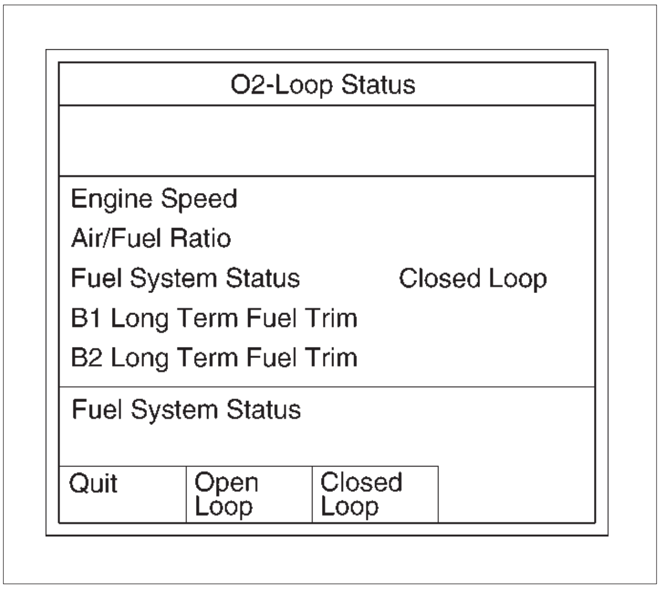
11. Select F2: O2-Loop status.



060RY00079

12. This test is check the “Closed Loop Status” performance.

13. Push “Open Loop” or “Closed Loop” soft key.



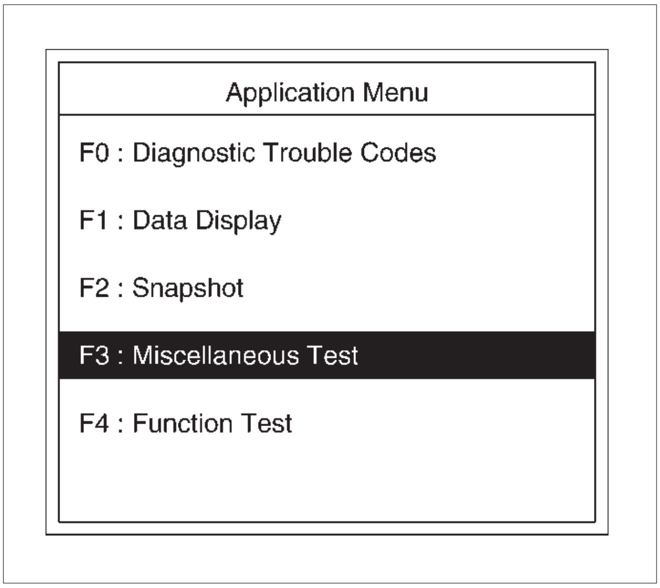
060RY00099

14. Control O2-Loop and check data list.
15. If data list changes, the O2-Loop is normal.

Instruments Test

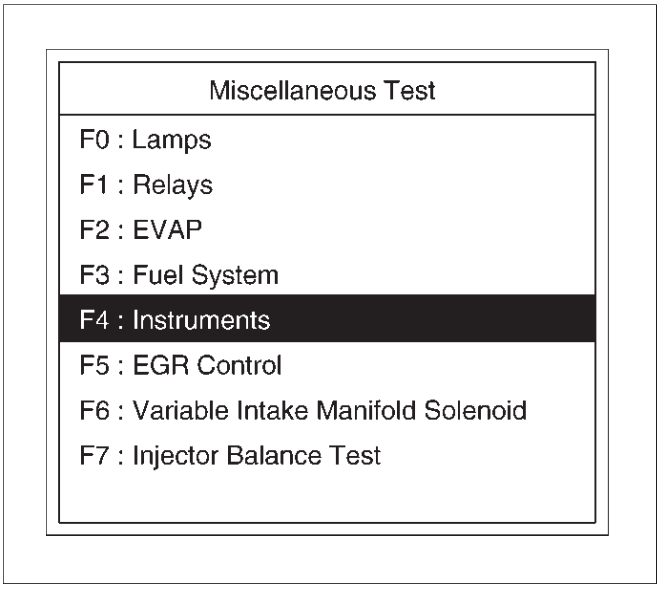
This test is conducted check Instruments for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.



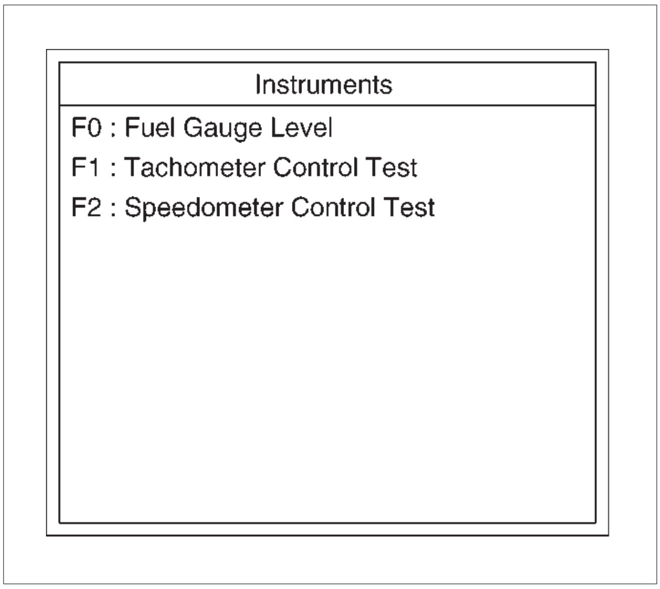
060RY00075

4. Select F4: Instruments in the Miscellaneous Menu.



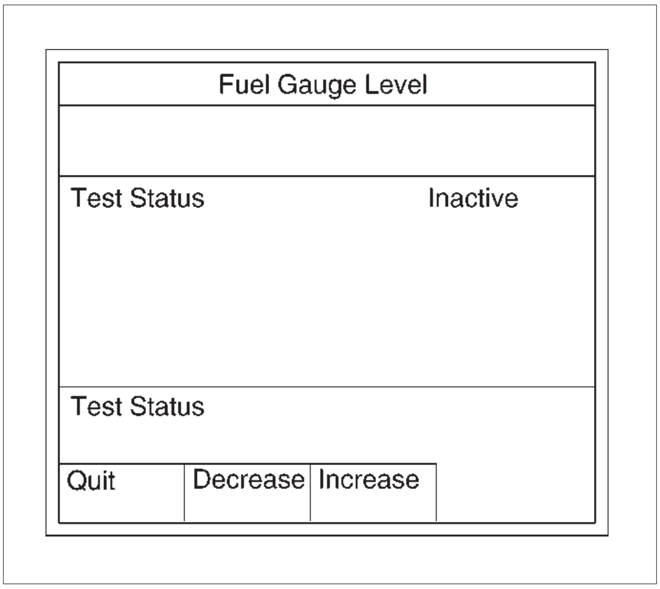
060RY00106

5. Select F0: Fuel Gauge level.



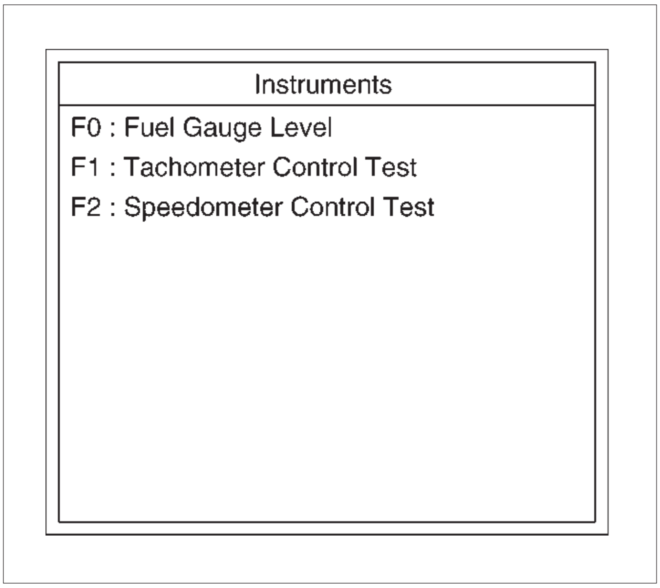
060RY00107

6. Push “Decrease” or “Increase” soft key.



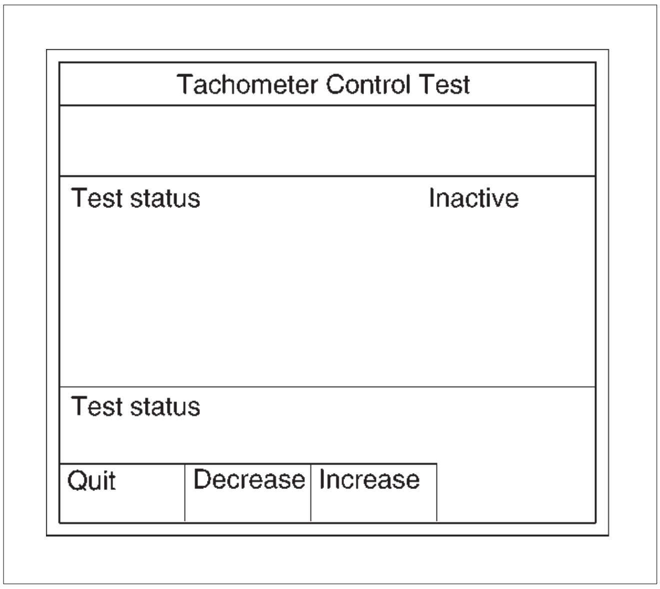
060RY00100

7. Control Fuel Level and check data list.
8. If data list and Fuel gauge meter changes, Fuel Gauge level is normal.
9. Select F1: Tachometer Control Test.



060RY00107

10. Push “Inactive” or “active” soft key.



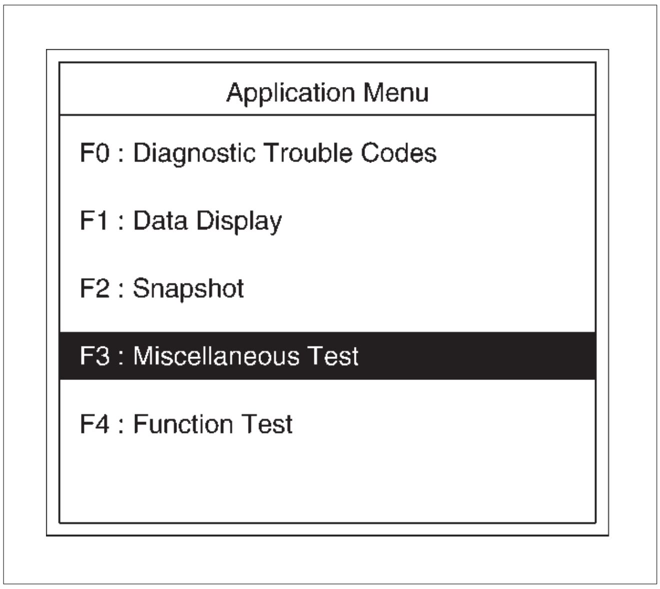
060RY00101

11. Control tachometer and data list.
12. If data list and meter changes, the tachometer control is normal.

EGR Control Test

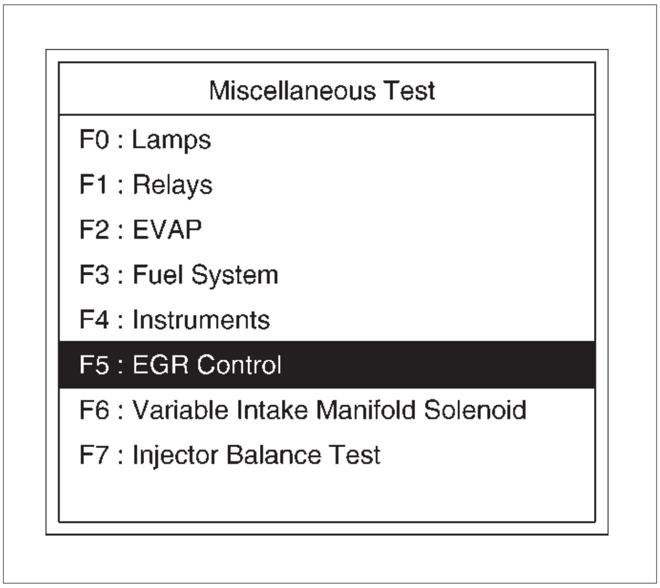
This test is conducted check EGR valve for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



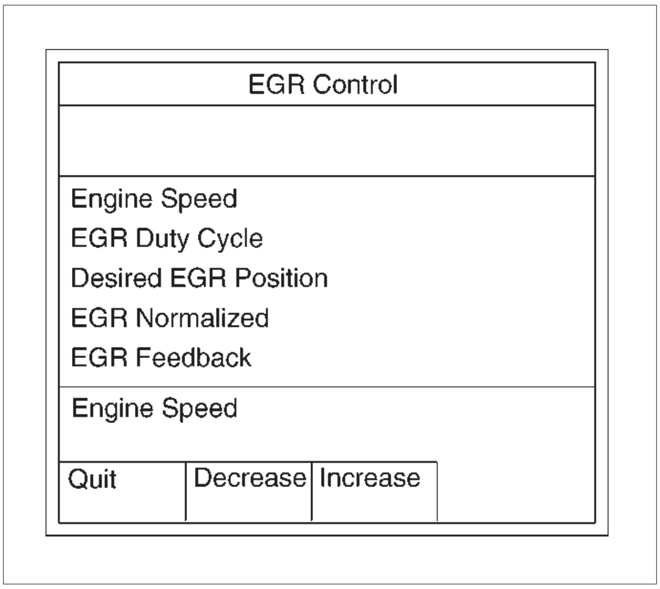
060RY00075

4. Select F5: EGR Control Test in the Miscellaneous Test.



060RY00084

5. Control EGR Valve and check data list.



060RY00103

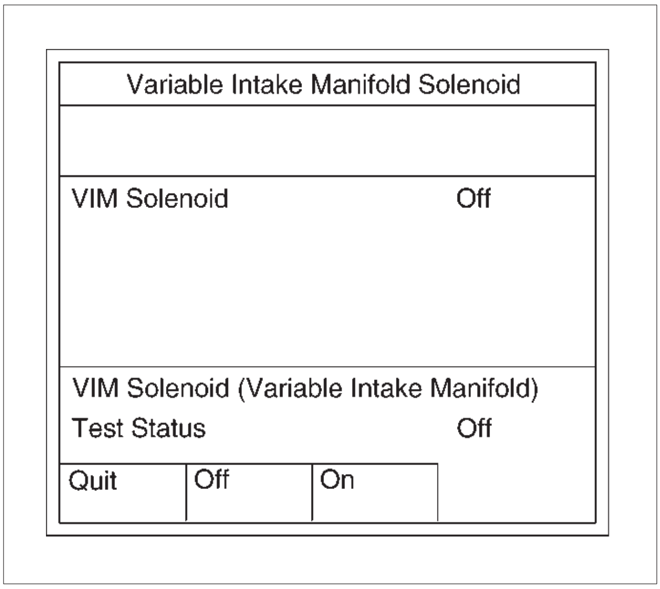
6. If data list changes, the EGR Contol is normal.

Variable Intake Manifold Solenoid Test

This test is conducted check VIM Solenoid for proper operation.
Tech 2 must be used for this test.
Test Procedure:

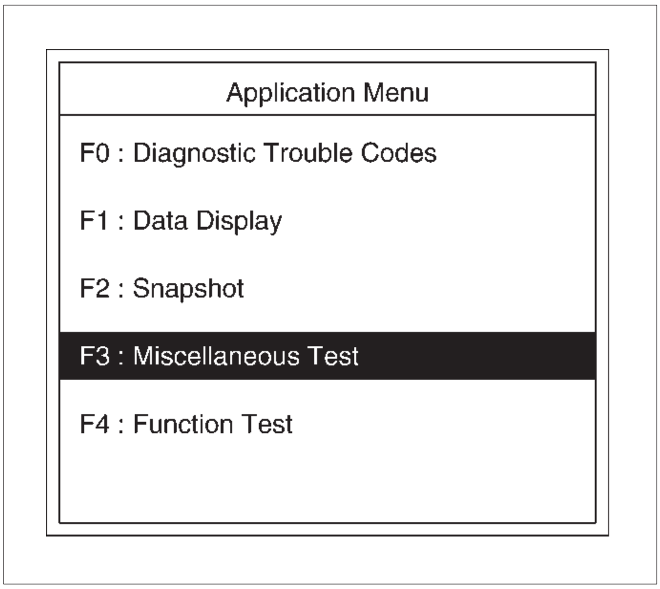
1. Connect Tech 2 to the vehicle DLC.

2. Ignition SW is “On”.



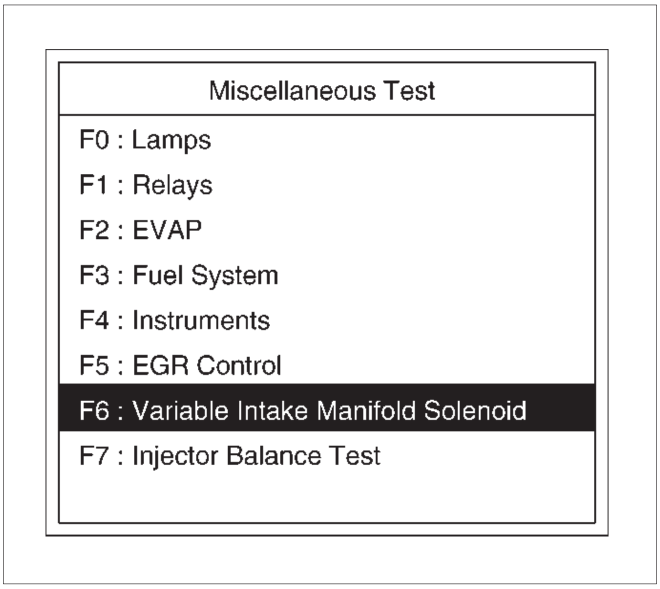
060RY00104

3. Select F3: Miscellaneous Test in the Application Menu.



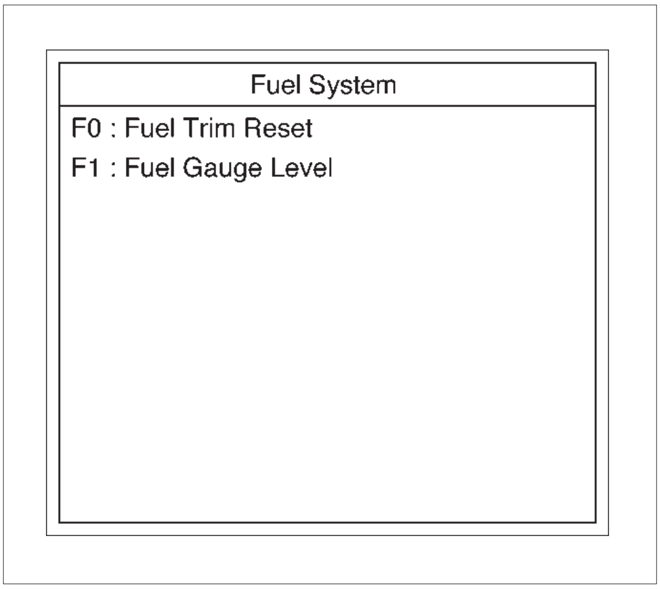
060RY00075

4. Select F6: Variable Intake Manifold Solenoid Test.



060RY00085

5. Push “On” or “Off” of soft key.



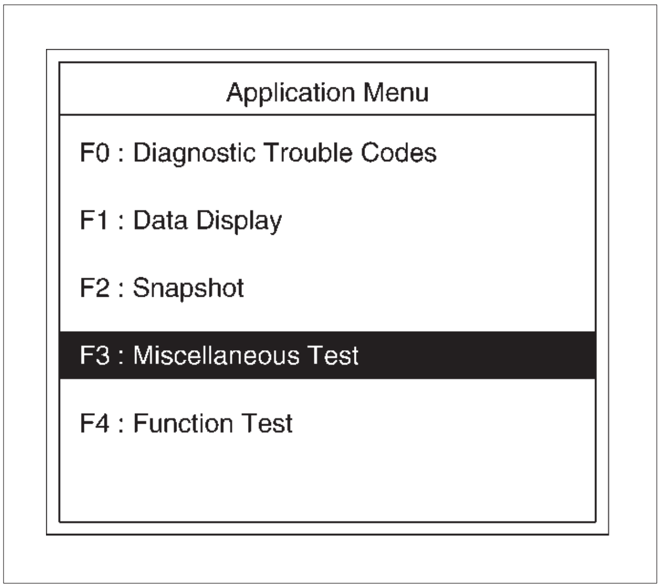
060RX028

6. Control VIM Solenoid check data list.
7. If data list changes, the VIM Solenoid is normal.

Injector Balance Test

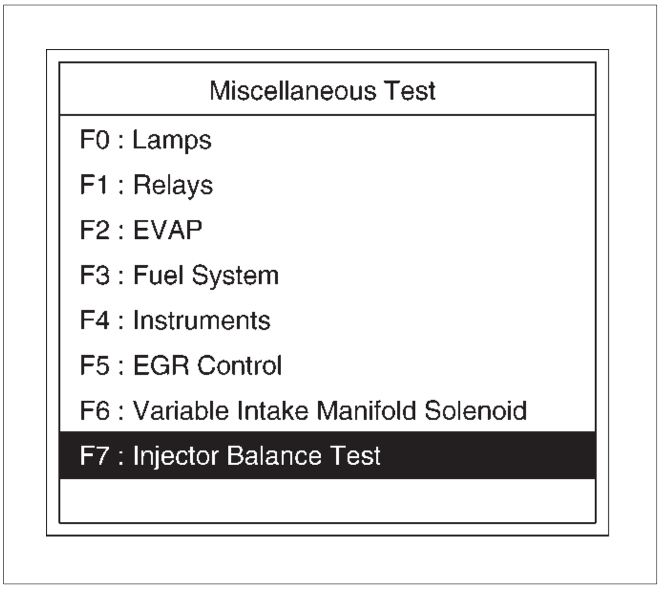
This test is conducted to make sure the appropriate electric signals are being sent to injectors Nos. 1–6.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



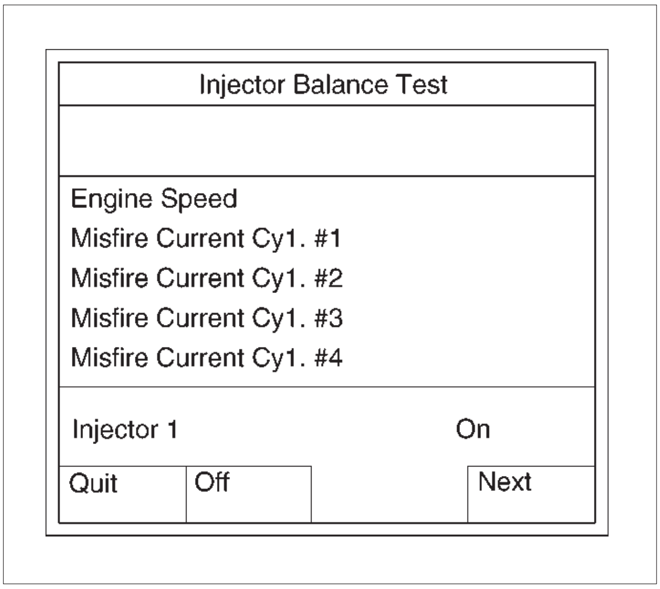
060RY00075

4. Select F7: Injector Balance Test in the Miscellaneous Test.



060RY00086

5. Select injector number and push “injector off” soft key.

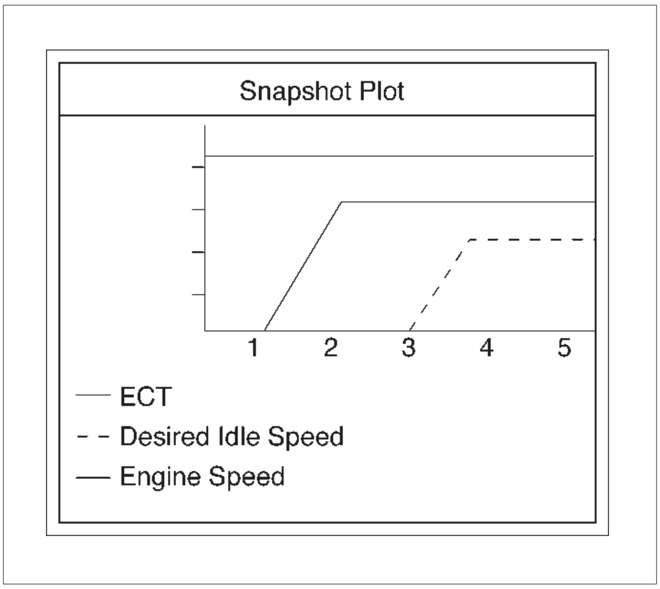


060RY00105

6. Make sure of engine speed change.
7. If engine speed changes, the injector electric circuit is normal.
   If engine speed does not change, the injector electric circuit or the injector itself is not normal.

Plotting Snapshot Graph

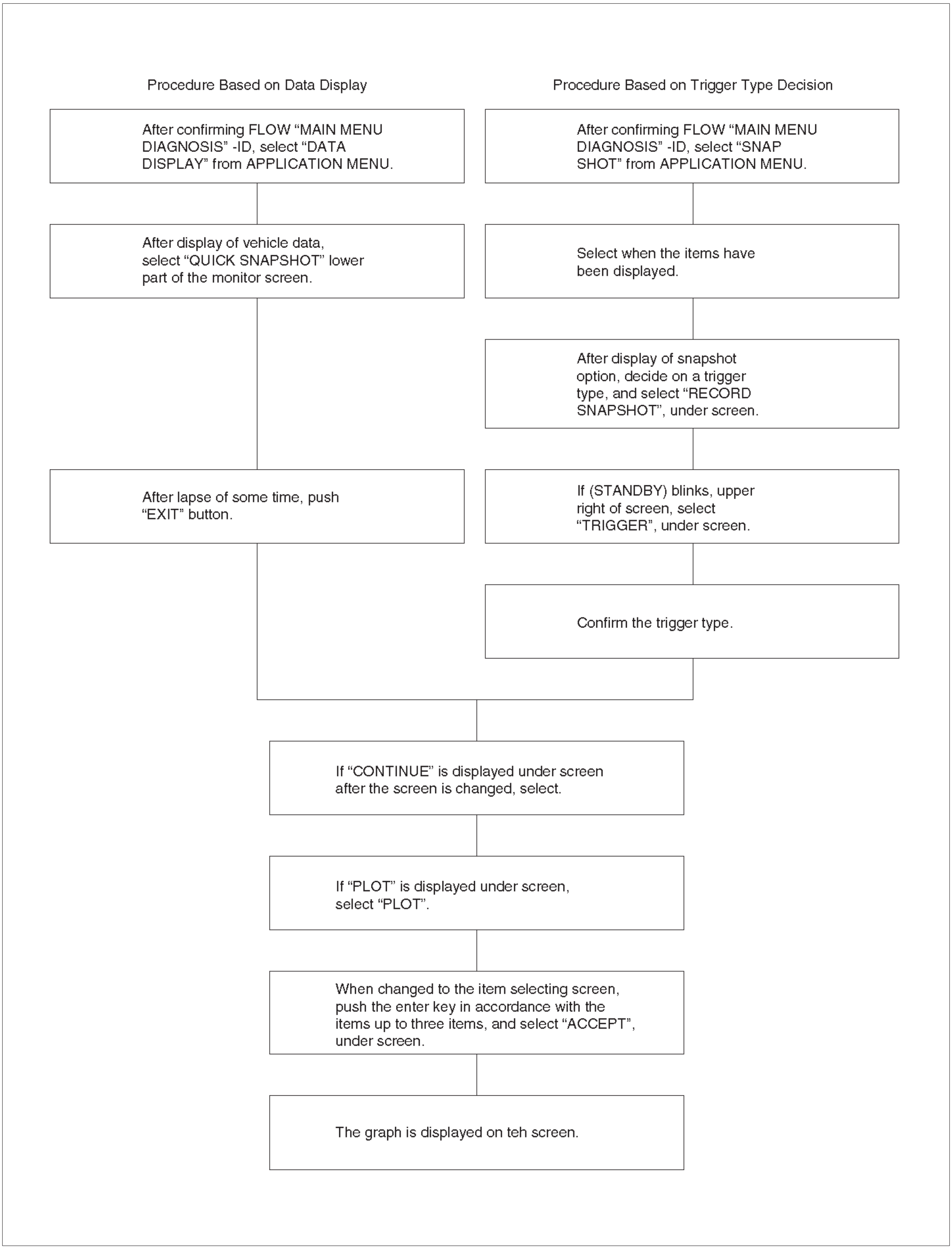
This test selects several necessary items from the data list to plot graphs and makes data comparison on a long term basis. It is an effective test particularly in emission related evaluations.



060RX037

For trouble diagnosis, you can collect graphic data (snap shot) directly from the vehicle.
You can replay the snapshot data as needed. Therefore, accurate diagnosis is possible, even though the vehicle is not available.

Plotting Graph Flow Chart (Plotting graph after obtaining vehicle information)



D06RY00167

Flow Chart for Snapshot Replay (Plotting Graph)

Press the enter-key in initial display.

Select "VIEW CAPTURE DATA"

If snapshot option is displayed, decide on a trigger type, and slect “REVIEW DATA” under screen.

When the data triggered by vehicle is displayed, select the data.
(Plural display of data depending on the number of times of triggering.)

data is displayed on the screen.
To see the graph, select “PLOT” under screen.

Changed to the item selection screen, push the enter key up to three times, and select “ACCEPT” under screen.

The graph is displayed on the screen.

060RX040

Primary System-Based Diagnostic

Primary System-Based Diagnostic

There are primary system-based diagnostics which evaluate system operation and its effect on vehicle emissions. The primary system-based diagnostics are listed below with a brief description of the diagnostic function:

Oxygen Sensor Diagnosis

The fuel control heated oxygen sensors (Bank 1 HO2S 1 and Bank 2 HO2S 1) are diagnosed for the following conditions:

- Heater performance (time to activity on cold start)
- Slow response
- Response time (time to switch R/L or L/R)
- Inactive signal (output steady at bias voltage – approx. 450 mV)
- Signal fixed high
- Signal fixed low

The catalyst monitor heated oxygen sensors (Bank 1 HO2S 2 and Bank 2 HO2S 2) are diagnosed for the following conditions:

- Heater performance (time to activity on cold start).
- Signal fixed low during steady state conditions or power enrichment (hard acceleration when a rich mixture should be indicated).
- Signal fixed high during steady state conditions or deceleration mode (deceleration when a lean mixture should be indicated).
- Inactive sensor (output steady at approx. 438 mV).

If the oxygen sensor pigtail wiring, connector or terminal are damaged, the entire oxygen sensor assembly must be replaced. DO NOT attempt to repair the wiring, connector or terminals. In order for the sensor to function properly, it must have clean reference air provided to it. This clean air reference is obtained by way of the oxygen sensor wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the reference air and degrade oxygen sensor performance. Refer to *On-Vehicle Service, Heated Oxygen Sensors* in this section.

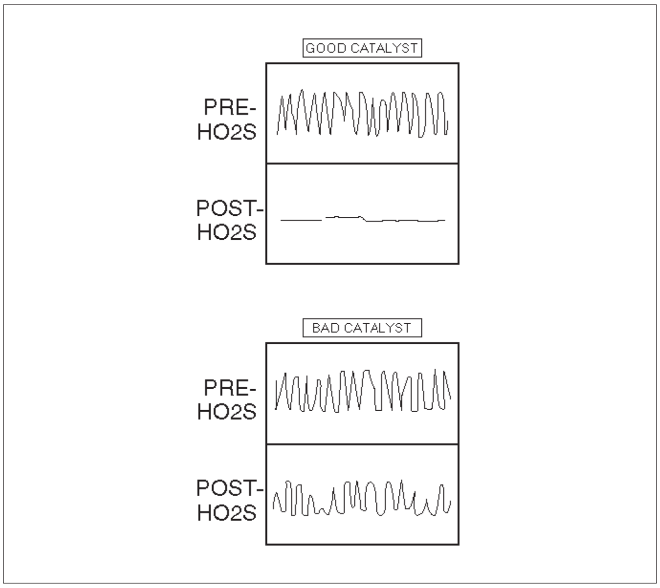
Fuel Control Heated Oxygen Sensor

The main function of the fuel control heated oxygen sensors is to provide the control module with exhaust stream oxygen content information to allow proper fueling and maintain emissions within mandated levels. After it reaches operating temperature, the sensor will generate a voltage, inversely proportional to the amount of oxygen present in the exhaust gases. The control module uses the signal voltage from the fuel control heated oxygen sensors while in closed loop to adjust fuel injector pulse width. While in closed loop, the PCM can adjust fuel delivery to maintain an air/fuel ratio which allows the best combination of emission control and driveability. The fuel control heated oxygen sensors are also used to determine catalyst efficiency.

HO2S Heater

Heated oxygen sensors are used to minimize the amount of time required for closed loop fuel control to begin operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors (Bank 1 HO2S 1 and Bank2 HO2S 1) to become active. Oxygen sensor heaters are required by catalyst monitor and sensor (Bank 1 HO2S 2 and Bank 2 HO2S 2) to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further away from the engine.

Catalyst Monitor Heated Oxygen Sensors and Diagnostic Operation



TS24067

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The PCM has the ability to monitor this process using the pre-catalyst and post-catalyst heated oxygen sensors. The pre-catalyst sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The post-catalyst sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the pre-catalyst signal will be far more active than that produced by the post-catalyst sensor.

In addition to catalyst monitoring, the heated oxygen sensors have a limited role in controlling fuel delivery. If the sensor signal indicates a high or low oxygen content for an extended period of time while in closed loop, the PCM will adjust the fuel delivery slightly to compensate.

- For the 3.5L w/automatic transmission, the pre-catalyst sensor are designated Bank 1 HO2S 1 and Bank 2 HO2S 1. The post-catalyst sensors are Bank 1 HO2S 2 and Bank 2 HO2S 2.

Catalyst Monitor Outputs

The catalyst monitor diagnostic is sensitive to the following conditions:

- Exhaust leaks
- HO2S contamination
- Alternate fuels

Exhaust system leaks may cause the following:

- Preventing a degraded catalyst from failing the diagnostic.
- Causing a false failure for a normally functioning catalyst.
- Preventing the diagnostic from running.

Some of the contaminants that may be encountered are phosphorus, lead, silica, and sulfur. The presence of these contaminants will prevent the TWC diagnostic from functioning properly.

Three-Way Catalyst Oxygen Storage Capacity

The Three-Way catalyst (TWC) must be monitored for efficiency. To accomplish this, the control module monitors the pre-catalyst HO2S and post-catalyst HO2S oxygen sensors. When the TWC is operating properly, the post-catalyst oxygen sensor will have significantly less activity than the pre-catalyst oxygen sensor. The TWC stores and releases oxygen as needed during its normal reduction and oxidation process. The control module will calculate the oxygen storage capacity using the difference between the pre-catalyst and post catalyst oxygen sensor's voltage levels. If the activity of the post-catalyst oxygen sensor approaches that of the pre-catalyst oxygen sensor, the catalyst's efficiency is degraded.

Stepped or staged testing level allow the control module to statistically filter test information. This prevents falsely passing or falsely failing the oxygen storage capacity test. The calculations performed by the on-board diagnostic system are very complex. For this reason, post catalyst oxygen sensor activity should not be used to determine oxygen storage capacity unless directed by the service manual.

Two stages are used to monitor catalyst efficiency. Failure of the first stage will indicate that the catalyst requires further testing to determine catalyst efficiency. The seconds stage then looks at the inputs for the pre and post catalyst HO2S sensors more closely before determining if the catalyst is indeed degraded. This further statistical processing is done to increase the accuracy of oxygen storage capacity type monitoring. Failing the first (stage 1) test DOES NOT indicate a failed catalyst. The catalyst may be marginal or the fuel sulfur content could be very high.

Aftermarket HO2S characteristics may be different from the original equipment manufacturer sensor. This may lead to a false pass or a false fail of the catalyst monitor diagnostic. Similarly, if an aftermarket catalyst does not contain the same amount of cerium as the original part, the correlation between oxygen storage and conversion efficiency may be altered enough to set a false DTC.

Evaporative Emission (EVAP) Purge System Vacuum Switch

The EVAP system uses a switch located in the purge line between the canister and the purge valve to detect when purge is occurring. This switch senses the flow from the engine through the purge valve. When no purge is present, the switch is closed, applying a 12 volt signal to the control module as a NO PURGE signal. When canister purging occurs, the switch opens, interrupting the 12 volt signal to the control module. A Tech 2 display will indicate that purge is occurring.

Clogging of the canister fresh air vent could allow the purge hose between the switch and canister to trap vacuum with the purge valve closed. This would result in a diagnostic indication of a purge valve stuck open or a vacuum switch failure. Similarly, leaks or blockages in the purge hoses may result in misdiagnosis of the purge valve or vacuum switch.

When servicing a purge valve diagnostic trouble code, check the canister fresh air vent, vacuum switch and the integrity of all purge hoses prior to servicing the valve. (Refer to EVAP Vacuum Switch in On-Vehicle Service Procedures in this section.)

Misfire Monitor Diagnostic Operation

Misfire Monitor Diagnostic Operation

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.

The misfire ratio is calculated once every 100 engine cycles. For example, on a 6-cylinder engine, 600 ignition plug sparks occur every 100 cycles and if a misfire occurs 12 times during that time, the misfire is $12/600 \times 100 = 2$ %.

Misfire Counters

Whenever a cylinder misfires, the misfire diagnostic counts the misfire and notes the crankshaft position at the time the misfire occurred. These "misfire counters" are basically a file on each engine cylinder. A current and a history misfire counter are maintained for each cylinder. The misfire current counters (Misfire Cur #1-6) indicate the number of firing events out of the last 100 cylinder firing events which were misfires. The misfire current counter will display real time data without a misfire DTC stored. The misfire history counters (Misfire Hist #1-6) indicate the total number of cylinder firing events which were misfires. The misfire history counters will display 0 until the misfire diagnostic has failed and a DTC P0300 is set. Once the misfire DTC P0300 is set, the misfire history counters will be updated every 100 cylinder firing events. A misfire counter is maintained for each cylinder. If the misfire diagnostic reports a failure, the diagnostic executive reviews all of the misfire counters before reporting DTC. This way, the diagnostic executive reports the most current information.

When crankshaft rotation is erratic, a misfire condition will be detected. Because of this erratic condition, the data that is collected by the diagnostic can sometimes incorrectly identify which cylinder is misfiring. Misfires are counted from more than one cylinder. Cylinder #1 has the majority of counted misfires. In this case, the Misfire Counters would identify cylinder #1 as the misfiring cylinder. The misfires in the other counters were just background noise caused by the erratic misfire rotation of the crankshaft. If the number of accumulated misfires is sufficient for the diagnostic to identify a true misfire, the diagnostic will set DTC P0300 – Misfire Detected.

Use diagnostic equipment to monitor misfire counter data on OBD II-compliant vehicles. Knowing which specific cylinder(s) misfired can lead to the root cause, even when dealing with a multiple cylinder misfire. Using the information in the misfire counters, identify which cylinders are misfiring. If the counter indicate cylinders numbers 1 and 4 misfired, look for a circuit or component common to both cylinders number 1 and 4.

Misfire counter information is located in the “Eng.” menu, “Misfire Data” sub-menu of the data list.

The misfire diagnostic may indicate a fault due to a temporary fault not necessarily caused by a vehicle emission system malfunction. Examples include the following items:

- Contaminated fuel
- Low fuel
- Fuel-fouled spark plugs
- Basic engine fault

Fuel Trim System Monitor Diagnostic Operation

Fuel Trim System Monitor Diagnostic Operation

This system monitors the averages of short-term and long-term fuel trim values. If these fuel trim values stay at their limits for a calibrated period of time, a malfunction is indicated. The fuel trim diagnostic compares the averages of short-term fuel trim values and long-term fuel trim values to rich and lean thresholds. If either value is within the thresholds, a pass is recorded. If both values are outside their thresholds, a rich or lean DTC will be recorded.

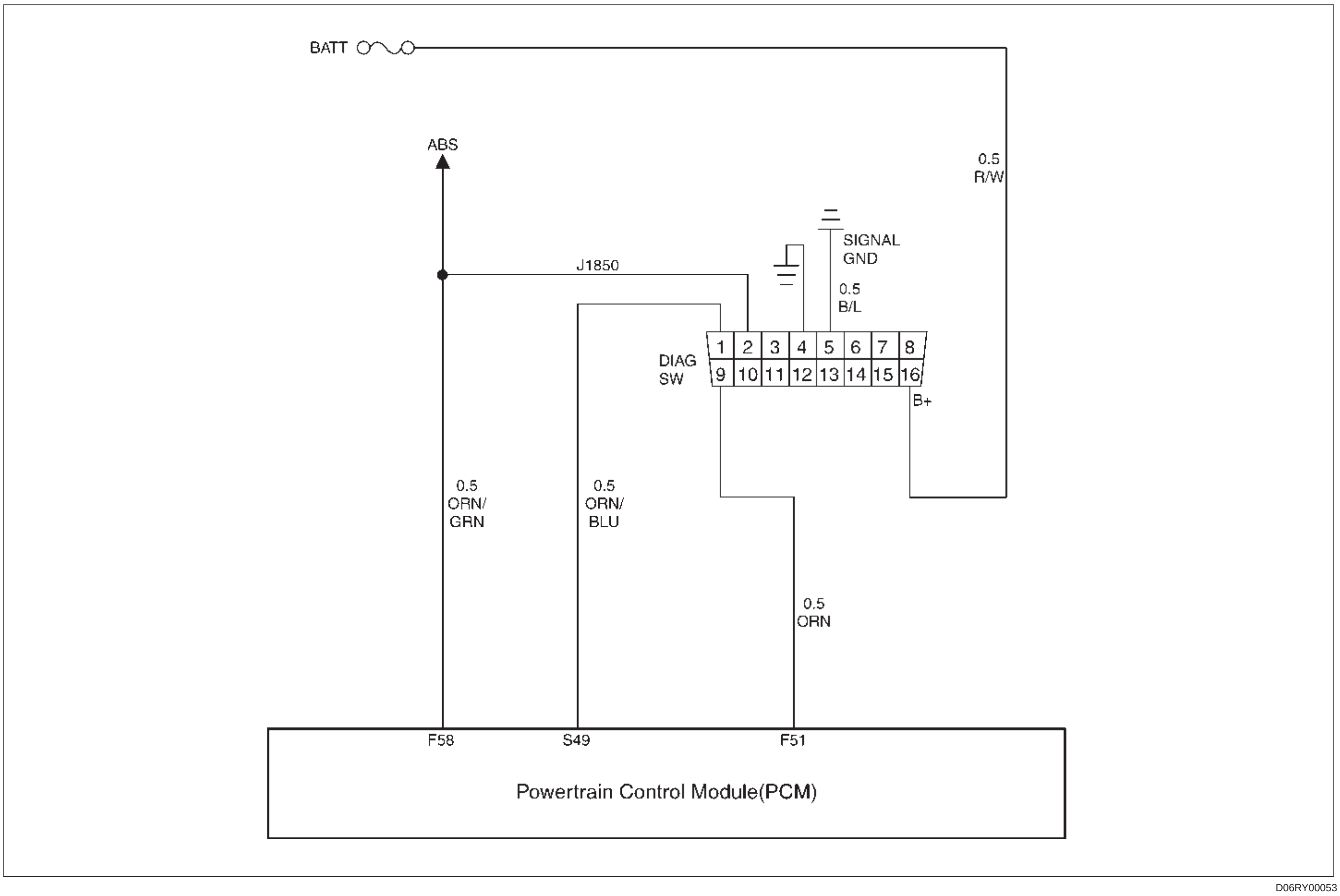
The fuel trim system diagnostic also conducts an intrusive test. This test determines if a rich condition is being caused by excessive fuel vapor from the EVAP canister. In order to meet OBD II requirements, the control module uses weighted fuel trim cells to determine the need to set a fuel trim DTC. A fuel trim DTC can only be set if fuel trim counts in the weighted fuel trim cells exceed specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e., engine idle high due to a small vacuum leak or rough idle due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use the Tech 2 to observe fuel trim counts while the problem is occurring.

A fuel trim DTC may be triggered by a number of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Fuel Trim Cell Diagnostic Weights

No fuel trim DTC will set regardless of the fuel trim counts in cell 0 unless the fuel trim counts in the weighted cells are also outside specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e. engine idle high due to a small vacuum leak or rough due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use the Tech 2 to observe fuel trim counts while the problem is occurring.

On-Board Diagnostic (OBD II) System Check



Circuit Description

The on-board diagnostic system check is the starting point for any driveability complaint diagnosis. Before using this procedure, perform a careful visual/physical check of the PCM and engine grounds for cleanliness and tightness.

The on-board diagnostic system check is an organized approach to identifying a problem created by an electronic engine control system malfunction.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the PCM harness and connector for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1.The MIL (“Check Engine lamp”) should be “ON” steady with the ignition “ON ”engine “OFF.”If not, the “No MIL”chart should be used to isolate the malfunction.

2.The RPL (“Reduced Power lamp”) should be “ON” steady with the ignition “ON ”engine “OFF.”If not, the “No RPL”chart should be used to isolate the malfunction.

3.Checks the Class 2 data circuit and ensures that the PCM is able to transmit serial data.

4.This test ensures that the PCM is capable of controlling the MIL (“Check Engine lamp”) and the MIL (“Check Engine lamp”) driver circuit is not shorted to ground.

5.This test ensures that the PCM is capable of controlling the RPL (“Reduced Powere lamp”) and the RPL (“Reduced Powere lamp”) driver circuit is not shorted to ground.

7.Check the DTCs (System ,Volts Supply circuit).

8.Check the DTCs (PCM{Software} detect Errors).

10.If the engine will not start, the Cranks But Will Not Run chart should be used to diagnose the condition.

13.A Tech 2 parameter which is not within the typical range may help to isolate the area which is causing the problem.

14.This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to *PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors* of this section.

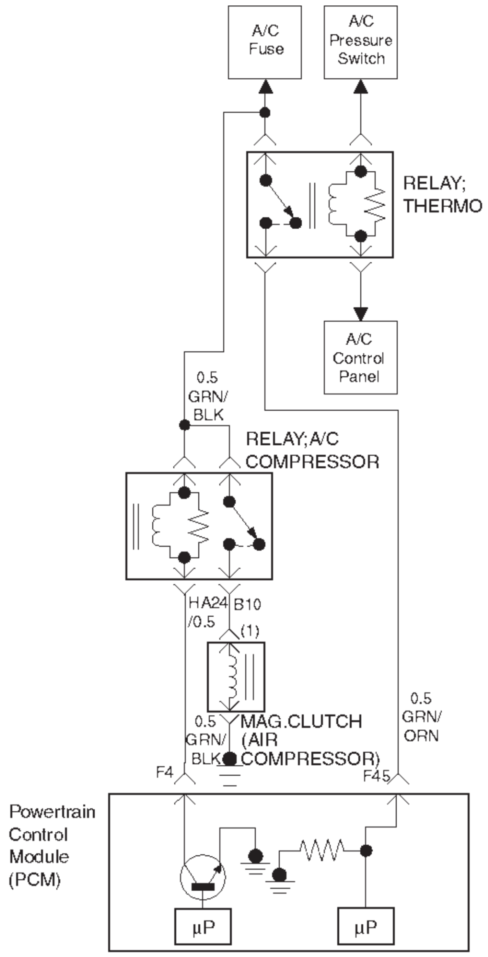
On-Board Diagnostic (OBD II) System Check

Step	Action	Value(s)	Yes	No
1	1. Ignition "ON,"engine "OFF." 2. Observe the malfunction indicator lamp (MIL or "Check Engine lamp"). Is the MIL ("Check Engine lamp")"ON?"	—	Go to *Step 2*	Go to *No MIL("Check Engine lamp")*
2	1. Ignition "ON,"engine "OFF." 2. Observe the malfunction indicator lamp ("Reduced Power lamp"). Is the MIL ("Reduced Power lamp") "ON?"	—	Go to *Step 3*	Go to *No RPL("Reduce d Power lamp")*
3	1. Ignition "OFF." 2. Install Tech 2. 3. Ignition "ON." 4. Attempt to display PCM engine data with the Tech 2. Does the Tech 2 display PCM data?	—	Go to *Step 4*	Go to *Step 12*
4	1. Using the Tech 2 output tests function, select MIL ("Check Engine lamp") control and command the MIL ("Check Enginelamp") "OFF." 2. Observe the MIL ("Check Engine lamp"). Did the MIL ("Check Engine lamp") turn "OFF?"	—	Go to *Step 5*	Go to *MIL("Check Engine lamp") On Steady*
5	1. Using the Tech 2 output tests function, select MIL ("Reduced Power lamp") control and command the MIL ("Reduced Power lamp") "OFF." 2. Observe the MIL ("Reduced Power lampp"). Did the MIL ("Reduced Power lamp") turn "OFF?"	—	Go to *Step 6*	Go to *RPL("Reduce d Power lamp")On Steady*
6	Select "Display DTCs" with the Tech 2. Are any DTCs stored?	—	Go to *Step 7*	Go to *Step 11*
7	Following below the DTCs stored: P0562,P0563,P0601,P0602,P0604,P0606,P1625,P1635,P1639,P1640, 1650	—	Go to *applicable DTC table*	Go to *Step 8*
8	Following below the DTCs stored: P1514, P1515, P1516, P1523, P1125, P1290, P1295, P1299	—	Go to *applicable DTC table*	Go to *Step 9*
9	Following below the DTCs stored: 1. P0425, P0106, P0107, P1107, P0401, P1404, P0405, P1120, P1221, P1515, P1516, P1275, P1635, P1271, P1273, P1285, P1272 2. P0336,P0337,P0341,P0342,P1220,P1515,P1221, P1516,P1280,P1639,P1271,P1272	—	Go to *"Multiple PCM Information sensor DTCs Set"*	Go to *Step 10*
10	Attempt to start the engine. Did the engine start and continue to run?	—	Go to *Step 6*	Go to *Cranks But Will Not Run*

On-Board Diagnostic (OBD II) System Check (Cont'd)

Step	Action	Value(s)	Yes	No
11	Compare PCM data values displayed on the Tech 2 to the typical engine scan data values. Are the displayed values normal or close to the typical values?	—	Go to *Symptom*	Refer to *indicated Component System Checks*
12	1. Ignition "OFF," disconnect the PCM. 2. Ignition "ON," engine "OFF." 3. Check the Class 2 data circuit for an open, short to ground, or short to voltage. Also, check the DLC ignition feed circuit for an open or short to ground and the DLC ground circuit for an open. 4. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 2*	Go to *Step 13*
13	1. Attempt to reprogram the PCM. Refer to *Powertrain Control Module (PCM) in On-Vehicle Service.* 2. Attempt to display PCM data with the Tech 2. Does the Tech 2 display PCM engine data?	—	Go to *Step 2*	Go to *Step 14*
14	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Go to *Step 2*	—

A/C Clutch Control Circuit Diagnosis



D06RY00159

Circuit Description

When air conditioning and blower fan are selected, and if the system has a sufficient refrigerant charge, a 12-volt signal is supplied to the A/C request input of the powertrain control module (PCM). The A/C request signal may be temporarily canceled during system operation by the electronic thermostat in the evaporator case. When the A/C request signal is received by the PCM, the PCM supplies a ground from the compressor clutch relay if the engine operating conditions are within acceptable ranges. With the A/C compressor relay energized, voltage is supplied to the compressor clutch coil.

The PCM will enable the compressor clutch to engage whenever A/C has been selected with the engine running, unless any of the following conditions are present:

- The throttle is greater than 90%.
- The ignition voltage is below 10.5 volts.
- The engine speed is greater than 4500 RPM for 5 seconds or 5400 RPM.
- The engine coolant temperature (ECT) is greater than 125 °C (257 °F).
- The intake air temperature (IAT) is less than 5°C (41°F).
- The power steering pressure switch signals a high pressure condition.

Diagnostic Aids

To diagnose an the intermittent fault, check for following conditions:

- Poor connection at the PCM–Inspect connections for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness–Inspect the wiring harness for damage. If the harness appears to OK, observe the A/C clutch while moving connectors and wiring harnesses related to the A/C. A sudden clutch malfunction will indicate the source of the intermittent fault.

A/C Clutch Diagnosis

This chart should be used for diagnosing the electrical portion of the A/C compressor clutch circuit. A Tech 2 will be used in diagnosing the system. The Tech 2 has the ability to read the A/C request input to the PCM. The Tech 2 can display when the PCM has commanded the A/C clutch “ON.” The Tech 2 should have the ability to override the A/C request signal and energize the A/C compressor relay.

Test Description

IMPORTANT: Do not engage the A/C compressor clutch with the engine running if an A/C mode is not selected at the A/C control switch.

The numbers below refer to the step numbers on the Diagnostic Chart:

3. This a test determine is the problem is with the refrigerant system. If the switch is open, A/C pressure gauges will be used to determine if the pressure switch is faulty or if the system is partially discharged or empty.
4. Although the normal complaint will be the A/C clutch failing to engage, it is possible for a short circuit to cause the clutch to run when A/C has not been selected. This step is a test for that condition.
7. There is an extremely low probability that both relays will fail at the same time, so the substitution process is one way to check the A/C Thermostat relay. Use a known good relay to do a substitution check.

A/C Clutch Control Circuit Diagnosis

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any other DTCs stored?	—	Go to the other DTC chart(s) first	Go to *Step 3*
3	1. Disconnect the electrical connector at the pressure switch located on the receiver/drier. 2. Use an ohmmeter to check continuity across the pressure switch. Is the pressure switch open?	—	Go to Air *Conditioning* to diagnose the cause of the open pressure switch	Go to *Step 4*
4	**IMPORTANT:** Before continuing with the diagnosis, the following conditions must be met: • The intake air temperature must be greater than 15°C. (60°F). • The engine coolant temperature must be less than 119°C (246°F). 1. A/C “OFF.” 2. Start the engine and idle for 1 minute. 3. Observe the A/C compressor. Is the A/C compressor clutch engaged even though A/C has not been requested?	—	Go to *Step 37*	Go to *Step 5*
5	1. Idle the engine. 2. A/C “ON”. 3. Blower “ON”. 4. Observe the A/C compressor. Is the A/C compressor magnetic clutch engaged?	—	Refer to *Diagnostic Aids*	Go to *Step 6*
6	1. Engine idling. 2. A/C “ON”. 3. Blower “ON”. 4. Observe the “A/C Request” display on the Tech 2. (Refer to the Miscellaneous test) Does the tool “A/C Request” display indicate “Yes?”	—	Go to *Step 26*	Go to *Step 7*

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
7	Temporarily substitute the A/C compressor relay in place of the A/C thermostat relay, then repeat Step 5. Did the "A/C Request" display indicate "Yes?"	—	Go to *Step 8*	Go to *Step 9*
8	Replace the original A/C thermostat relay. Is the action complete?	—	Verify repair	—
9	Dose the blower operate?	—	Go to *Step 10*	Go to *Step 11*
10	Repair the blower. Is the action complete?	—	Verify repair	—
11	Check for a faulty 10A A/C fuse in the underdash fuse panel. Was the 10A fuse OK?	—	Go to *Step 13*	Go to *Step 12*
12	Check for short circuit and make repairs if necessary. Replace the 10A A/C fuse. Is the action complete?	—	Verify repair	—
13	1. Remove the glove box to gain access to the A/C thermostat. 2. Disconnect the thermostat connector. 3. Attach a fused jumper between ground and the PNK/GRN wire at the thermostat. 4. A/C "ON." 5. Blower "ON." Dose A/C request indicate "YES" on the Tech 2?	—	Go to *Step 14*	Go to *Step 17*
14	1. Ignition "ON." 2. Use a DVM to check voltage at the electronic A/C thermostat. Was voltage equal to the specified value?	B+	Go to *Step 17*	Go to *Step 15*
15	Check for an open (LT GRN) between the thermostat and the A/C switch. Was the wire open?	—	Go to *Step 16*	Go to *Step 17*
16	Repair the open wire (LT GRN) between the thermostat and the A/C switch. Is the action complete?	—	Verify repair	—
17	Check for an open circuit between A/C thermostat relay and PCM A/C request terminal (F45). Was there an open circuit?	—	Go to *Step 18*	Go to *Step 19*
18	Repair the open circuit between the PCM and A/C thermostat relay. Is the action complete?	—	Verify repair	—
19	1. Ignition "ON." 2. Use a DVM to check voltage at the A/C pressure switch (BRN). Was voltage equal to the specified value?	B+	Go to *Step 21*	Go to *Step 20*
20	Repair the open circuit between the 10A A/C fuse and the pressure switch. Is the action complete?	—	Verify repair	—

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
21	Use an ohmmeter to check continuity between the pressure switch (GRN/WHT) and the A/C thermostat relay (GRN/WHT). Was the circuit open?	—	Go to *Step 22*	Go to *Step 23*
22	Repair the open circuit between the pressure switch and the A/C thermostat relay. Is the action complete?	—	Verify repair	—
23	Check for damaged pin or terminal at F45 of the PCM. Was a damaged pin or terminal found?	—	Go to *Step 24*	Go to *Step 25*
24	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
25	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
26	1. Remove the A/C compressor relay. 2. Ignition "ON." 3. Use a DVM to check voltage at both of the BRN wires at the A/C compressor relay socket. Is the voltage equal to the specified value?	B+	Go to *Step 28*	Go to *Step 27*
27	Repair the faulty BRN wire between the A/C fuse and the A/C compressor relay . Is the action complete?	—	Verify repair	—
28	1. A/C compressor relay removed. 2. Engine idling. 3. A/C "ON." 4. Blower "ON." 5. Use a DVM to measure voltage between the GRN/BLK wire at the A/C compressor relay socket and battery±. Did the DVM indicate the specified value?	B+	Go to *Step 32*	Go to *Step 29*
29	Check for an open GRN/BLK wire between PCM terminal F4 and the A/C compressor relay. Was the wire open?	—	Go to *Step 30*	Go to *Step 31*
30	Repair the open GRN/BLK wire between the PCM and the A/C compressor relay. Is the action complete?	—	Verify repair	—
31	Check for a damaged pin or terminal at F4 of the PCM. Was a damaged pin or a terminal found?	—	Go to *Step 24*	Go to *Step 25*

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
32	1. A/C compressor relay removed. 2. Connect a fused jumper at the A/C compressor relay socket between either BRN wire and the BRN/YEL wire. 3. Engine idling. 4. A/C "ON." 5. Blower "ON." Did the compressor magnetic clutch engage?	—	Go to *Step 33*	Go to *Step 34*
33	Repair the A/C compressor relay. Is the action complete?	—	Verify repair	—
34	Check for an open circuit between the A/C compressor relay and the A/C clutch. Was an open circuit found?	—	Go to *Step 35*	Go to *Step 36*
35	Repair the open circuit between the compressor Clutch and the A/C compressor relay. Is the action complete?	—	Verify repair	—
36	Service the compressor clutch or replace the compressor due to a faulty internal overheat switch. Is the action complete?	—	Verify repair	—
37	1. Remove the A/C compressor relay. 2. Idle the engine. Is the compressor clutch still engaged when A/C is not selected?	—	Go to *Step 38*	Go to *Step 39*
38	Repair the short to voltage between the A/C clutch and A/C compressor relay. Is the action complete?	—	Verify repair	—
39	1. Reinstall the A/C compressor relay. 2. Remove the A/C thermostat relay. 3. Engine idling. Is the compressor clutch still engaged when A/C is not selected?	—	Go to *Step 40*	Go to *Step 42*
40	Use a DVM to check for a short to ground between the A/C compressor relay and F4 of the PCM. Was a short detected?	—	Go to *Step 41*	Go to *Step 25*
41	Repair the short to ground between the PCM and A/C compressor relay. Is the action complete?	—	Verify repair	—
42	Repair the short to ground between the A/C thermostat relay and the electronic thermostat. Is the action complete?	—	Verify repair	—

Electronic Ignition System Diagnosis

If the engine cranks but will not run or immediately stalls, the Engine Cranks But Will Not Start chart must be used to determine if the failure is the ignition system or the fuel system. If DTC P0300 through P306, P0341, or P0336 is set, the appropriate diagnostic trouble code chart must be used for diagnosis.

If a misfire is being experienced with no DTC set, refer to the *Symptoms* section for diagnosis.

EVAP Canister Purge Solenoid and EVAP Vacuum Switch

A continuous purge condition with no purge commanded by the PCM will set a DTC P1441. Refer to the DTC charts for further information.

Visual Check of The Evaporative Emission Canister

- If the canister is cracked or damaged, replace the canister.
- If fuel is leaking from the canister, replace the canister and check hoses and hose routing.

Fuel Metering System Check

Some failures of the fuel metering system will result in an "Engine Cranks But Will Not Run" symptom. If this condition exists, refer to the *Cranks But Will Not Run* chart. This chart will determine if the problem is caused by the ignition system, the PCM, or the fuel pump electrical circuit.

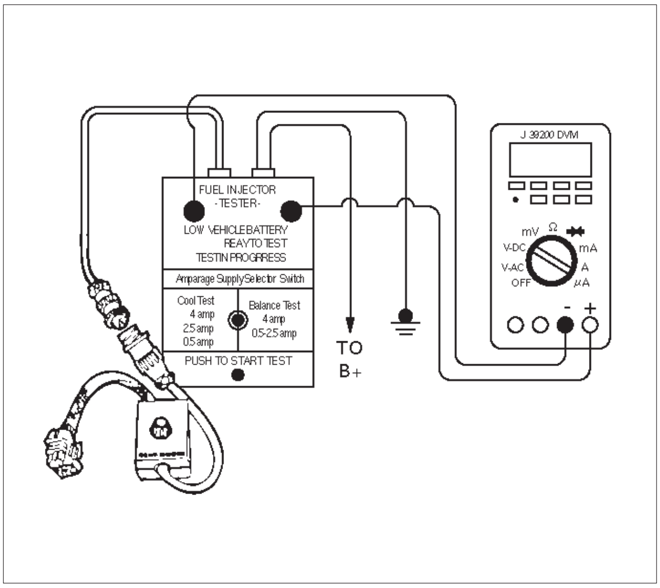
Refer to *Fuel System Electrical Test* for the fuel system wiring schematic.

If there is a fuel delivery problem, refer to *Fuel System Diagnosis*, which diagnoses the fuel injectors, the fuel pressure regulator, and the fuel pump. If a malfunction occurs in the fuel metering system, it usually results in either a rich HO2S signal or a lean HO2S signal. This condition is indicated by the HO2S voltage, which causes the PCM to change the fuel calculation (fuel injector pulse width) based on the HO2S reading. Changes made to the fuel calculation will be indicated by a change in the long term fuel trim values which can be monitored with a Tech 2. Ideal long term fuel trim values are around 0%; for a lean HO2S signal, the PCM will add fuel, resulting in a fuel trim value above 0%. Some variations in fuel trim values are normal because all engines are not exactly the same. If the evaporative emission canister purge is "ON," the fuel trim may be as low as –38%. If the fuel trim values are greater than +23%, refer to *DTC P0131, DTC P0151, DTC P0171, and DTC 1171* for items which can cause a lean HO2S signal.

Fuel System Pressure Test

A fuel system pressure test is part of several of the diagnostic charts and symptom checks. To perform this test, refer to *Fuel Systems Diagnosis.*

Fuel Injector Coil Test Procedure and Fuel Injector Balance Test Procedure



T32003

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Relieve the fuel pressure by connecting the J 34730-1 Fuel Pressure Gauge to the fuel pressure connection on the fuel rail.

CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.

Place the fuel pressure gauge bleed hose in an approved gasoline container.

With the ignition switch "OFF," open the valve on the fuel pressure gauge.

3. Record the lowest voltage displayed by the DVM after the first second of the test. (During the first second, voltage displayed by the DVM may be inaccurate due to the initial current surge.)

Injector Specifications:

Resistance Ohms	Voltage Specification at 10°C-35°C (50°F-95°F)
11.8 – 12.6	5.7 – 6.6

- The voltage displayed by the DVM should be within the specified range.
- The voltage displayed by the DVM may increase throughout the test as the fuel injector windings warm and the resistance of the fuel injector windings changes.

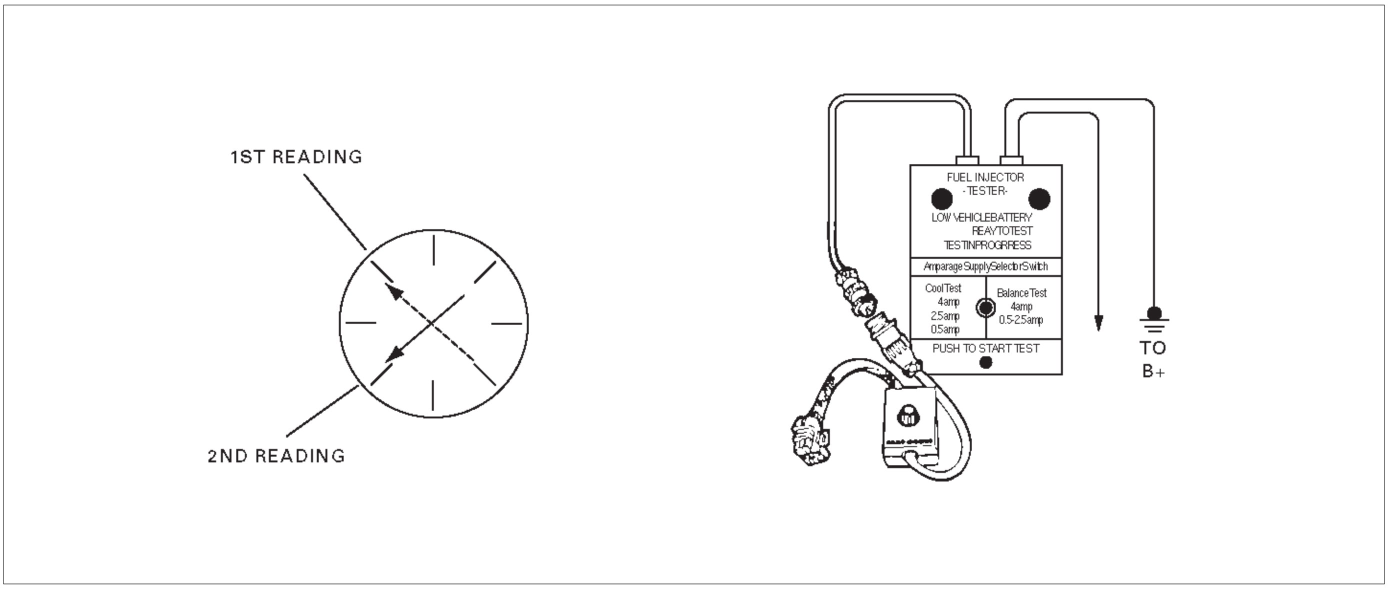
- An erratic voltage reading (large fluctuations in voltage that do not stabilize) indicates an intermittent connection within the fuel injector.

5. Injector Specifications:

Highest Acceptable Voltage Reading Above/Below 35˚C/10˚C (95˚F/50˚F)	Acceptable Subtracted Value
9.5 Volts	0.6 Volts

7. The Fuel Injector Balance Test portion of this chart (Step 7 through Step 11) checks the mechanical (fuel delivery) portion of the fuel injector. An engine cool-down period of 10 minutes is necessary in order to avoid irregular fuel pressure readings due to “Hot Soak” fuel boiling.

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11)



R262001

CYLINDER	1	2	3	4	5	6
1st Reading (1)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)
2nd Reading (2)	131 kPa (19 psi)	117 kPa (17 psi)	124 kPa (18 psi)	145 kPa (21 psi)	131 kPa (19 psi)	130 kPa (19 psi)
Amount of Drop (1st Reading–2nd Reading)	165 kPa (24 psi)	179 kPa (26 psi)	172 kPa (25 psi)	151 kPa (22 psi)	165 kPa (24 psi)	166 kPa (24 psi)
Av.drop = 166 kPa/24 psi ± 10 kPa/1.5 psi = 156 – 176 kPa or 22.5 – 25.5 psi	OK	Faulty, Rich (Too Much Fuel Drop)	OK	Faulty, Lean (Too Little Fuel Drop)	OK	OK

NOTE: These figures are examples only.

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11)

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to *OBD System Check*
2	1. Turn the engine "OFF." NOTE: In order to prevent flooding of a single cylinder and possible engine damage, relieve the fuel pressure before performing the fuel injector coil test procedure. 2. Relieve the fuel pressure. Refer to *Test Description Number 2.* 3. Connect the J 39021-5V Fuel Injector Tester to B+ and ground, and to the J 39021-90 Injector Switch Box. 4. Connect the injector switch box to the grey fuel injector harness connector located on the front of the EVAP canister bracket. 5. Set the amperage supply selector switch on the fuel injector tester to the "Coil Test" 0.5 amp position. 6. Connect the leads from the J 39200 Digital Voltmeter (DVM) to the injector tester. Refer to the illustrations associated with the test description. 7. Set the DVM to the tenths scale (0.0). 8. Observe the engine coolant temperature. Is the engine coolant temperature within the specified values?	10°C (50°F) to 35°C (95°F)	Go to *Step 3*	Go to *Step 5*
3	1. Set injector switch box injector #1. 2. Press the "Push to Start Test" button on the fuel injector tester. 3. Observe the voltage reading on the DVM. **IMPORTANT:** The voltage reading may rise during the test. 4. Record the lowest voltage observed after the first second of the test. 5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4. Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading outside of the specified values?	5.7-6.6 V	Go to *Step 4*	Go to *Step 7*
4	Replace the faulty fuel injector(s). Refer to *Fuel Injector.* Is the action complete?	—	Go to *Step 7*	—

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11) (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Set injector switch box injector #1. 2. Press the "Push to Start Test" button on the fuel injector tester. 3. Observe the voltage reading on the DVM. **IMPORTANT:** The voltage reading may rise during the test. 4. Record the lowest voltage observed after the first second of the test. 5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4. Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading above the specified value?	9.5 V	Go to *Step 4*	Go to *Step 6*
6	1. Identify the highest voltage reading recorded (other than those above 9.5 V). 2. Subtract the voltage reading of each injector from the highest voltage selected in step 1. Repeat until you have a subtracted value for each injector. For any injector, is the subtracted Value in step 2 greater than the specified value?	0.6 V	Go to *Step 4*	Go to *Step 7*
7	**CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.** 1. Connect the J 34730-1 Fuel Pressure Gauge to the fuel pressure test port. 2. Energize the fuel pump using the Tech 2. 3. Place the bleed hose of the fuel pressure gauge into an approved gasoline container. 4. Bleed the air out of the fuel pressure gauge. 5. With the fuel pump running, observe the reading on the fuel pressure gauge. Is the fuel pressure within the specified values?	296-376 kPa (43-55 psi)	Go to *Step 8*	Go to *Fuel System Diagnosis*
8	Turn the fuel pump "OFF." Does the fuel pressure remain constant?	—	Go to *Step 9*	Go to *Fuel System Diagnosis*

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11) (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Connect the J 39021-5V Fuel Injector Tester and J 39021-90 Injector Switch Box the fuel injector harness connector. 2. Set the amperage supply selector switch on the fuel injector tester to the "Balance Test" 0.5–2.5 amp position. 3. Using the Tech 2 turn the fuel pump "ON" then "OFF" in order to pressurize the fuel system. 4. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure stabilizes. This is the first pressure reading. 5. Energize the fuel injector by depressing the "Push to Start Test" button on the fuel injector tester. 6. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure gauge needle has stopped moving. This is the second pressure reading. 7. Repeat steps 1 through 6 for each fuel injector. 8. Subtract the second pressure reading from the first pressure reading for one fuel injector. The result is the pressure drop value. 9. Obtain a pressure drop value for each fuel injector. 10. Add all of the individual pressure drop values. This is the total pressure drop. 11. Divide the total pressure drop by the number of fuel injectors. This is the average pressure drop. Does any fuel injector have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value?	10 kPa (1.5 psi)	Go to *Step 10*	Go to *OBD System Check*
10	Re-test any fuel injector that does not meet the specification. Refer to the procedure in step 9. NOTE: Do not repeat any portion of this test before running the engine in order to prevent the engine from flooding. Does any fuel injector still have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value?	10 kPa (1.5 psi)	Go to *Step 11*	Go to *Symptoms*
11	Replace the faulty fuel injector(s). Refer to *Fuel Injector.* Is the action complete?	—	Verify repair	—

Powertrain Control Module (PCM) Diagnosis

To read and clear diagnostic trouble codes, use a Tech 2.

IMPORTANT: Use of a Tech 2 is recommended to clear diagnostic trouble codes from the PCM memory. Diagnostic trouble codes can also be cleared by turning the ignition "OFF" and disconnecting the battery power from the PCM for 30 seconds. Turning off the ignition and disconnecting the battery power from the PCM will cause all diagnostic information in the PCM memory to be cleared. Therefore, all the diagnostic tests will have to be re-run.

Since the PCM can have a failure which may affect only one circuit, following the diagnostic procedures in this section will determine which circuit has a problem and where it is.

If a diagnostic chart indicates that the PCM connections or the PCM is the cause of a problem, and the PCM is replaced, but this does not correct the problem, one of the following may be the reason:

- There is a problem with the PCM terminal connections. The terminals may have to be removed from the connector in order to check them properly.
- EEPROM program is not correct for the application. Incorrect components or reprogramming the PCM with the wrong EEPROM program may cause a malfunction and may or may not set a DTC.
- The problem is intermittent. This means that the problem is not present at the time the system is being checked. In this case, refer to the *Symptoms* portion of the manual and make a careful physical inspection of all component and wiring associated with the affected system.
- There is a shorted solenoid, relay coil, or harness. Solenoids and relays are turned "ON" and "OFF" by the PCM using internal electronic switches called drivers. A shorted solenoid, relay coil, or harness will not damage the PCM but will cause the solenoid or relay to be inoperative.

Multiple PCM Information Sensor DTCs Set

Circuit Description

The powertrain control module (PCM) monitors various sensors to determine the engine operating conditions.

The PCM controls fuel delivery, spark advance, transmission operation, and emission control device operation based on the sensor inputs.

The PCM provides a sensor ground to all of the sensors. The PCM applies 5 volts through a pull–up resistor, and determines the status of the following sensors by monitoring the voltage present between the 5–volt supply and the resistor:

- The engine coolant temperature (ECT) sensor
- The intake air temperature (IAT) sensor
- The transmission fluid temperature (TFT) sensor

The PCM provides the following sensors with a 5–volt reference and a sensor ground signal:

1

- The exhaust gas recirculating (EGR) pintle position
- sensor
- The manifold absolute pressure (MAP) sensor
- The throttle position (TP) sensor 1
- The acceleration position (AP) sensor 1
- The acceleration position (AP) sensor 3
- The Vapor Pressure Sensor

2

- The Crank position (CKP) sensor
- The Camshaft Position (CMP) Sensor
- The throttle position (TP) sensor 2
- The acceleration position (AP) sensor 2

The PCM monitors the separate feedback signals from these sensors in order to determine their operating status.

Diagnostic Aids

IMPORTANT: Be sure to inspect PCM and engine grounds for being secure and clean.

A short to voltage in one of the sensor input circuits may cause one or more of the following DTCs to be set:

- P0425
- P0108, P1106
- P0406
- P1120, P1515, P1221, P1516, P1635
- P1275, P1639, P1271, P1273
- P1285, P1272, P1273
- P0336, P0337
- P0341, P0342
- P1220, P1515, P1221, P1515, P1516
- P1280, P1271, P1272

IMPORTANT: If a sensor input circuit has been shorted to voltage, ensure that the sensor is not damaged. A damaged sensor will continue to indicate a high or low voltage after the affected circuit has been repaired. If the sensor has been damaged, replace it.

An open in the sensor ground circuit between the PCM and the splice will cause one or more of the following DTCs to be set:

- P0425
- P0108,P1106
- P0406
- P1120, P1515, P1221, P1516, P1635
- P1275, P1639, P1271, P1273
- P1285, P1272, P1273
- P0336, P0337
- P0341, P0342
- P1220, P1515, P1221, P1515, P1516
- P1280, P1271, P1272

A short to ground in the 5–volt reference A or B circuit will cause one or more of the following DTCs to be set:

- P0453
- P0106, P0107, P1107
- P0401, P1404, P0405
- P1120, P1515, P1221, P1516, P1635
- P1275, P1639, P1271, P1273
- P1285, P1646, P1272, P1273
- P0336, P0337
- P0341, P0342
- P1220, P1515, P1221, P1515, P1516
- P1280, P1271, P1272

Check for the following conditions:

- **Poor connection at PCM.** Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damage terminals, and a poor terminal–to–wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness is not damaged, observe an affected sensor fs displayed value on the Tech 2 with the ignition "ON" and the engine "OFF" while you move the connectors and the wiring harnesses related to the following sensors:
  - Vapor Pressure Sensor
  - MAP Sensor
  - EGR
  - TPS1/TPS2
  - APS1/APS2/APS3
  - CKP/CMP

Multiple PCM Information Sensor DTCs Set

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Turn the ignition "OFF," disconnect the PCM. 2. Turn the ignition "ON," check the 5 volt reference 1 and 2 circuit for the following conditions: • A poor connection at the PCM. • An open between the PCM connector and the splice. • A short to ground. • A short to voltage. Is there an open or short?	—	Go to *Step 3*	Go to *Step 4*
3	Repair the open or short. Is the action complete?	—	Verify repair	—
4	Check the sensor ground circuit for the following conditions: • A poor connection at the PCM or the affected sensors. • An open between the PCM connector and the affected sensors. Is there an open or a poor connection?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the open or the poor connection. Is the action complete?	—	Verify repair	—
6	Following below the DTCs stored: P1635, P1639, P1646	—	Go to *applicable DTC table*	Go to *Step 7*
7	Measure the resistance below the items: • Between EGR sensor supply circuit and Vapor Pressure Sensor supply circuit. • Between MAP sensor supply circuit and Vapor Pressure Sensor supply circuit. • Between Vapor Pressure Sensor supply circuit and PCM harness connector. (5Volt supply circuit) Does the resistance measure near the specified value?	—	Go to *Step 9*	Go to *Step 8*
8	Locate and repair the open circuit in the MAP or EGR or Vapor Pressure sensor suppy circuit. Is the action complete?	—	Verify repair	—
9	1. Disconnect the MAP , Vapor pressure sensor and EGR connecter. 2. Ignition "ON." 3. Measure the resistance below the items: • MAP sensor GND circuit. • EGR GND circuit. • Vapor pressure sensor GND circuit. Does the voltage resistance near the specified value?	—	Go to *Step 11*	Go to *Step 10*

Multiple PCM Information Sensor DTCs Set (Cont'd)

Step	Action	Value(s)	Yes	No
10	Locate and repair the short circuit in the MAP or EGR or Vapor Pressure sensor signal or GND circuit. Is the action complete?	—	Verify repair	—
11	Measure the resistance below the items: ● Between CKP sensor supply circuit and CMP Sensor supply circuit. ● Between CKP Sensor supply circuit and PCM harness connector. (5Volt supply circuit) Does the voltage resistance near the specified value?	—	Go to *Step 13*	Go to *Step 12*
12	Locate and repair the open circuit in the CKP or CMP sensor supply circuit. Is the action complete?	—	Verify repair	—
13	1. Disconnect the CKP and CMP sensor connector. 2. Ignition "ON." 3. Measure the voltage below the items: ● CKP sensor GND circuit and shield circuit. ● CMP sensor GND circuit and shield circuit. Does the voltage resistance near the specified value?	—	Go to *Step 15*	Go to *Step 14*
14	Locate and repair the short circuit in the CKP or CMP sensor signal or GND circuit. Is the action complete?	—	Verify repair	—
15	Are more of the following items for DTCs stored? EGR, Vapor Pressure Sensor, MAP, CKP, CMP, TPS, APS	—	Go to *applicable DTC table*	Go to *Step 16*
16	Replace the PCM. The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to *OBD System Check*	—

Exhaust Gas Recirculation (EGR) Diagnosis

An EGR flow check diagnosis of the linear EGR system is covered by DTC P0401. Pintle position error diagnosis is covered by DTC P0402, P0404, P1404, P0405, P0406. If EGR diagnostic trouble codes P0401 and/or P0402, P0404, P1404, P0405, P0406 are encountered, refer to the DTC charts.

Engine Tech 2 Data Definitions and Ranges

A/C CLUTCH – Tech 2 Displays ON or OFF –
Indicates whether the PCM has commanded the A/C clutch ON. Used in A/C system diagnostic.

A/C REQUEST — Tech 2 Displays YES or NO —
Indicates the state of the A/C request input circuit from the HVAC controls. The PCM uses the A/C request signal to determine whether A/C compressor operation is being requested.

AIR/FUEL RATIO — Tech 2 Range 0.0-25.5 —
Air/fuel ratio indicates the PCM commanded value. In closed loop, the air/fuel ratio should normally be displayed around “14.2-14.7.” A lower air/fuel ratio indicates a richer commanded mixture, which may be seen during power enrichment or TWC protection modes. A higher air/fuel ratio indicates a leaner commanded mixture. This can be seen during deceleration fuel mode.

AP1 —Tech 2 Range 0%-100% —
AP (accelerator pedal) angle is computed by the PCM from the AP sensor voltage. AP angle should display “3%” at idle and “85-89%” at wide open throttle.

AP2 —Tech 2 Range 0%-100% —
AP (accelerator pedal) angle is computed by the PCM from the AP sensor voltage. AP angle should display “85-89%” at idle and “11-15%” at wide open throttle.

AP3 —Tech 2 Range 0%-100% —
AP (accelerator pedal) angle is computed by the PCM from the AP sensor voltage. AP angle should display “85-89%” at idle and “32-36%” at wide open throttle.

BAROMETRIC PRESSURE — Tech 2 Range 10-105 kPa/0.00-5.00 Volts —
The barometric pressure reading is determined from the MAP sensor signal monitored during key up and wide open throttle (WOT) conditions. The barometric pressure is used to compensate for altitude differences and is normally displayed around “61-104” depending on altitude and barometric pressure.

CHECK TRANS LAMP — AUTO TRANSMISSION —
Indicates the need to check for a DTC with the Tech 2 when the lamp is flashing 0.2 seconds ON and 0.2 seconds OFF.

DESIRED EGR POS. — Tech 2 Range 0%-100% —
Represents the EGR pintle position that the PCM is commanding.

DESIRED IDLE — Tech 2 Range 0-3187 RPM —
The idle speed that the PCM is commanding. The PCM will compensate for various engine loads based on engine coolant temperature, to keep the engine at the desired speed.

ECT — (Engine Coolant Temperature) Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F) —
The engine coolant temperature (ECT) is mounted in the coolant stream and sends engine temperature information to the PCM. The PCM applies 5 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (high resistance), the PCM monitors a high signal voltage and interprets that as a cold engine. As the sensor warms (decreasing resistance), the voltage signal will decrease and the PCM will interpret the lower voltage as a warm engine.

EGR DUTY CYCLE — Tech 2 Range 0%-100% —
Represents the EGR valve driver PWM signal from the PCM. A duty cycle of 0% indicates that no EGR flow is being commanded; a 100% duty cycle indicates maximum EGR flow commanded.

EGR FEEDBACK — Tech 2 Range 0.00-5.00 Volts —
Indicates the EGR pintle position sensor signal voltage being monitored by the PCM. A low voltage indicates a fully extended pintle (closed valve); a voltage near 5 volts indicates a retracted pintle (open valve).

ENGINE LOAD — Tech 2 Range 0%-100% —
Engine load is calculated by the PCM from engine speed and MAF sensor readings. Engine load should increase with an increase in RPM or air flow.

ENGINE RUN TIME — Tech 2 Range 00:00:00-99:99:99 Hrs:Min:Sec —
Indicates the time elapsed since the engine was started. If the engine is stopped, engine run time will be reset to 00:00:00.

ENGINE SPEED — Range 0-9999 RPM —
Engine speed is computed by the PCM from the 58X reference input. It should remain close to desired idle under various engine loads with engine idling.

EVAP PURGE PWM — Tech 2 Range 0%-100% —
Represents the PCM commanded PWM duty cycle of the EVAP purge solenoid valve. “0%” displayed indicates no purge; “100%” displayed indicates full purge.

EVAP VACUUM SWITCH (Vent Valve) — Tech 2 Displays ON or OFF —
The EVAP purge vacuum switch is a normally closed switch positioned in the purge line between the canister and the EVAP purge solenoid. The EVAP purge vacuum switch will open when vacuum increases to greater than 5 inches of water in the purge line. The EVAP purge vacuum switch is used by the PCM to monitor EVAP canister purge solenoid operation and purge system integrity. The EVAP purge vacuum switch should be closed to ground with no vacuum present (0% EVAP purge PWM). With EVAP purge PWM at 25% or greater, the EVAP purge vacuum switch should be open and “PURGE” should be indicated.

FUEL PUMP — Tech 2 Displays ON or OFF —
Indicates the PCM commanded state of the fuel pump relay driver circuit.

HO2S BANK 1, SEN. 1
— Tech 2 Range 0-1132 mV —
Represents the fuel control exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10 mV (lean exhaust) and 1000 mV (rich exhaust) while operating in closed loop.

HO2S BANK 1, SEN. 2
— Tech 2 Range 0-1000mV —
Monitors the exhaust oxygen sensor output voltage. The PCM monitors the operating efficiency of catalytic converter by comparing the output voltages of sensor 1 and sensor 2 in this bank. If the catalytic converter is operating efficiently, the output voltage of sensor 1 will give a greater fluctuation than that of sensor 2. If the PCM detects an abnormal level of voltage fluctuation from sensor 2, a DTC P0420 will be set, indicating that the catalytic converter for this bank is no longer operating efficiently.

HO2S BANK2, SEN. 1 —Tech 2 Range 0-1132 mV—
Represents the fuel control exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10mV (lean exhaust) and 1000 mV (rich exhaust) while operating in closed loop.

HO2S BANK 2, SEN. 2—Tech 2 Range 0-1000 mV—
Monitors the exhaust oxygen sensor output voltage. The PCM monitors the operating efficiency of catalytic converter by comparing the output voltages of sensor 1 and sensor 2 in this bank. If the catalytic converter is operating efficiently, the output voltage of sensor 1 will have a greater fluctuation than that of sensor 2. If the PCM detects an abnormal level of voltage fluctuation from sensor 2, a DTC P0430 will be set, indicating that the catalytic converter for this bank is no longer operating efficiently.

HO2S BANK 1, SEN. 1—Tech 2 Displays NOT READY or READY—
Indicates the status of the exhaust oxygen sensor. The Tech 2 will indicate that the exhaust oxygen sensor is ready when the PCM detects a fluctuating HO2S voltage sufficient to allow closed loop operation. This will not occur unless the exhaust oxygen sensor is warmed up.

HO2S BANK 2, SEN. 1 — Tech 2 Displays NOT READY or READY —
Indicates the status of the exhaust oxygen sensor. The Tech 2 will indicate that the exhaust oxygen sensor is ready when the PCM detects a fluctuating HO2S voltage sufficient to allow closed loop operation. This will not occur unless the exhaust oxygen sensor is warmed up.

HO2S WARM UP TIME BANK 1, SEN. 1/BANK 1, SEN 2/BANK 2 SEN. 1/BANK 2 SEN. 2 — Tech 2 Range 00:00:00-99:99:99 HRS:MIN:SEC —
Indicates warm-up time for each HO2S. The HO2S warm-up time is used for the HO2S heater test. The PCM will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that tool much time was required for the HO2S to become active, a DTC will set. If the engine was warm when started, HO2S warm-up will the display “00:00:00”.

IAT (INTAKE AIR TEMPERATURE) — Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F) —
The PCM converts the resistance of the intake air temperature sensor to degrees. Intake air temperature (IAT) is used by the PCM to adjust fuel delivery and spark timing according to incoming air density.

IGNITION 1 — Tech 2 Range 0-25.5 Volts —
This represents the system voltage measured by the PCM at its ignition feed.

INJ. PULSE BANK 1/INJ. PULSE BANK 2 — Tech 2 Range 0-1000 msec. —
Indicates the amount of time the PCM is commanding each injector “ON” during each engine cycle. A longer injector pulse width will cause more fuel to be delivered. Injector pulse width should increase with increased engine load.

LONG TERM FUEL TRIM BANK 1/BANK 2 —
The long term fuel trim is derived from the short term fuel trim values and represents a long term correction of fuel delivery for the bank in question. A value of 0% indicates that fuel delivery requires no compensation to maintain the PCM commanded air/fuel ratio. A negative value significantly below 0% indicates that the fuel system is rich and fuel delivery is being reduced (decreased injector pulse width). A positive value significantly greater than 0% indicates that a lean condition exists and the PCM is compensating by adding fuel (increased injector pulse width). Because long term fuel trim tends to follow short term fuel trim, a value in the negative range due to canister purge at idle should not be considered unusual. Fuel trim values at maximum authority may indicate an excessively rich or lean system.

Fuel System STATUS — Tech 2 Displays OPEN or CLOSED —
“CLOSED” indicates that the PCM is controlling fuel delivery according to oxygen sensor voltage. In “OPEN” the PCM ignores the oxygen sensor voltage and bases the amount of fuel to be delivered on TP sensor, engine coolant, and MAF sensor inputs only.

MAF — Tech 2 Range 0.0-512 gm/s —
MAF (mass air flow) is the MAF input frequency converted to grams of air per second. This indicates the amount of air entering the engine.

MAP
— Tech 2 Range 10-105 kPa (0.00-4.97 Volts) —
The manifold absolute pressure (MAP) sensor measures the change in the intake manifold pressure from engine load, EGR flow, and speed changes. As intake manifold pressure increases, intake vacuum decreases, resulting in a higher MAP sensor voltage and kPa reading. The MAP sensor signal is used to monitor intake manifold pressure changes during the EGR flow test, to update the BARO reading, and as an enabling factor for several of the diagnostics.

MIL — Tech 2 Displays ON or OFF —
Indicates the PCM commanded state of the malfunction indicator lamp.

MISFIRE CUR. CYL. #1 /#2 /#3 /#4 / #5 / #6 — Tech 2 Range 0-255 Counts —
The misfire current counters increase at a rate according to the number of the possible misfires being detected on each cylinder. The counters may normally display some activity, but the activity should be nearly equal for all the cylinders.

MISFIRE CUR. CYL. #1 /#2 /#3 /#4 / #5 / #6 — Tech 2 Range 0-65535 Counts —
The misfire history counters display the relative level of misfire that has been detected on each cylinder. The misfire history counters will not update or show any activity until a misfire DTC (P0300) has become active.

MISFIRE FAILURES SINCE FIRST FAIL — Tech 2 Range 0-65535 Counts —
Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently high to report a fail.

MISFIRE PASSES SINCE FIRST FAIL — Tech 2 Range 0-65535 Counts —
Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently low to report a pass.

POWER ENRICHMENT — Tech 2 Displays ACTIVE or INACTIVE —
“ACTIVE” displayed indicates that the PCM has detected conditions appropriate to operate in power enrichment mode. The PCM will command power enrichment mode when a large increase in throttle position and load is detected. While in power enrichment mode, the PCM will increase the amount of fuel delivered by entering open loop and increasing the injector pulse width. This is done to prevent a possible sag or hesitation from occurring during acceleration.

SPARK — Tech 2 Range –64° to 64° —
Displays the amount of spark advance being commanded by the PCM on the IC circuit.

START-UP ECT — Tech 2 Range –40°C to 151°C (–40°F to 304°F) —
Indicates the engine coolant temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start-up was a cold start.

START-UP IAT — Tech 2 Range –40°C to 151°C (–40°F to 304°F) —
Indicates the intake air temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start-up was a cold start.

TOTAL MISFIRE CURRENT COUNT — Tech 2 Range 0-255 —
Indicates the total number of cylinder firing events that were detected as being misfires during the last 200 crankshaft revolution sample period.

TP — Tech 2 Range 0%-100% —
TP (throttle position) angle is computed by the PCM from the TP sensor voltage. TP angle should display “8-13%” at idle and “87-97%” at wide open throttle.

CATALYST PROTECTION MODE — Tech 2 Displays YES or NO —
“YES” displayed indicates that the PCM has detected conditions appropriate to operate in TWC protection mode. The PCM will decrease the air/fuel ratio to a value that depends on mass air flow (higher mass air flow = lower air/fuel ratio).

UPSHIFT LAMP (MANUAL TRANSMISSION)
VEHICLE SPEED — Tech 2 Range 0-255 km/h (0-155 mph) —
The vehicle speed sensor signal is converted into km/h and mph for display.

WEAK CYLINDER — Tech 2 Displays Cylinder Number —
This indicates that the PCM has detected crankshaft speed variations that indicate 2% or more cylinder firing events are misfires.

Typical Scan Data Values

Use the Typical Scan Data Values Table only after the On-Board Diagnostic System Check has been completed, no DTC(s) were noted, and you have determined that the on-board diagnostics are functioning properly. Tech 2 values from a properly-running engine may be used for comparison with the engine you are diagnosing. The typical scan data values represent values that would be seen on a normally-running engine.

NOTE: A Tech 2 that displays faulty data should not be used, and the problem should be reported to the Tech 2 manufacturer. Use of a faulty Tech 2 can result in misdiagnosis and unnecessary replacement of parts.

Only the parameters listed below are referred to in this service manual for use in diagnosis. For further information on using the Tech 2 to diagnose the PCM and related sensors, refer to the applicable reference section listed below. If all values are within the typical range described below, refer to the *Symptoms* section for diagnosis.

Test Conditions

Engine running, lower radiator hose hot, transmission in park or neutral, closed loop, accessaries off, brake not applied and air conditioning off.

3.5L V-6 Engine (Automatic and Manual Transmission)

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
A/C Clutch Relay	Engine	On/Off	Off	Off	General Description and Operation, A/C Clutch Circuit Operation
A/C Request	Engine	Yes/No	No	No	General Description and Operation, A/C Request Signal
Air/Fuel Ratio	Engine	Ratio: _ to 1	14.7	14.7	General Description and Operation, Fuel System Metering Purpose
APP Sensor1	Engine	Percent	11–13	35–40	General Description and Operation
APP Sensor2	Engine	Percent	87–88	60–65	General Description and Operation
APP Sensor3	Engine	Percent	87–88	50–57	General Description and Operation
Barometric Pressure	Engine	kPa	61-104 (depends on altitude and barometric)	61-104 (depends on altitude and barometric)	General Description and Operation
Brake Light Switch	Engine	Open 0V/Closed 12V	Open 0V	Open 0V	Refer to Section 5
Check Trans Lamp (**Auto Trans**)	Engine	On/Off	Off	Off	4L30-E Automatic Transmission Diagnosis
Cruise Main Switch	Engine	Active/Inactive	Inactive	Inactive	Refer to Section 10
Cruise Set Switch	Engine	Active/Inactive	Inactive	Inactive	Refer to Section 10
Cruise Cancel Switch	Engine	Active/Inactive	Inactive	Inactive	Refer to Section 10
Cruise Resume Switch	Engine	Active/Inactive	Inactive	Inactive	Refer to Section 10
Decel Fuel Cutoff	Engine	Active/Inactive	Inactive	Inactive	General Description and Operation, Deceleration Mode
Desired EGR Position	Engine	Percent	0%	0%	General Description and Operation, EGR Pintle Position Sensor
Desired Idle Speed	Engine	RPM	750	800	General Description and Operation
ECT (Engine Coolant Temp)	Engine	Degrees C, Degrees F	80-100°C (176-212°F)	80-100°C (176-212°F)	General Description and Operation, Engine Coolant Temperature (ECT) Sensor
EGR Closed Pintle Position	Engine	Steps	20-40	20-40	General Description and Operation, EGR Pintle Position Sensor
EGR Duty Cycle	Engine	Percent	0%	0%	General Description and Operation, Linear EGR Operation and Results of Incorrect Operation

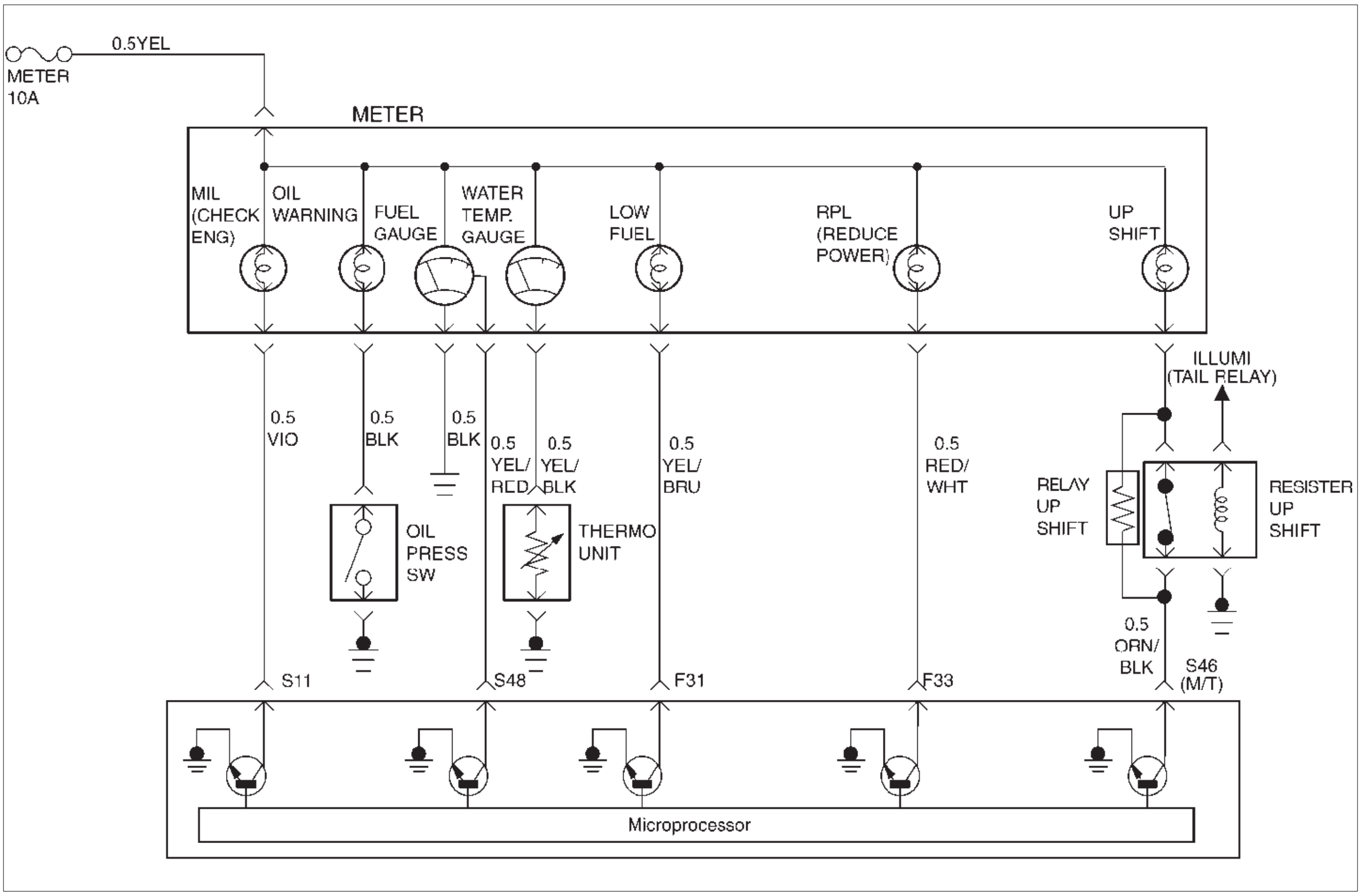
Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
EGR Feedback	Engine	Volts	0.45-0.80	0.45-0.80	—
EGR Normalized	Engine	Percent	0%	0%	—
Engine Load	Engine	Percent	2.0% - 5.5%	8.0% - 16.0%	General Description and Operation, Mass Air Flow (MAF) Sensor
Time From Start	Engine	Sec	Varies. Resets at each engine start.	Varies. Resets at each engine start.	—
Engine Speed	Engine	RPM	Within –50 to +100 of “Desired Idle”	Actual engine speed	—
EVAP Purge Solenoid	Engine	Percent	0%	0%	Diagnosis, EVAP Emission Canister Purge Valve Check
EVAP Vent Valve	Engine	On/Off	Off	Off	Diagnosis, EVAP Canister Purge Solenoid and EVAP Vacuum Switch and Visual Check; DTCs: P1441, P1442
Fuel System Status	Engine	Open Loop/Closed Loop	Closed Loop	Closed Loop	General Description
Fuel Level	Engine	Percent	—	—	Engine Fuel
Fuel Level Sensor	Engine	Volts	—	—	Engine Fuel
Fuel Tank Pressure Sensor	Engine	Volts	1.02 – 1.86	1.02 – 2.57	General Description and Operation
		in. H2O	—	—	
Fuel Pump	Engine	On/Off	On	On	Engine Fuel
HO2S Bank 1 Sen.1 (millivolts)	O2 Sensor Data	Millivolts	50-950 changing quickly	50-950, always changing quickly	General Description and Operation, Fuel control HO2S
HO2S Bank 1 Sen.2 (millivolts) (**Auto Trans**)	O2 Sensor Data	Millivolts	200-700 changing slowly	250-650 changing slowly	General Description and Operation, Fuel Metering System
HO2S Bank 1 Sen.2 (millivolts) (**Manual Trans**)	O2 Sensor Data	Millivolts	50-950 changing quickly	50-950 changing quickly	General Description and Operation, Fuel Metering System
HO2S Bank 1 Sen.3 (millivolts) (**Manual Trans**)	O2 Sensor Data	Millivolts	200-700 changing slowly	250-650 changing slowly	General Description and Operation, Catalyst Monitor Heated Oxygen Sensor (Manual Trans)
HO2S Bank 2 Sen.1 (millivolts)	O2 Sensor Data	Millivolts	50-950 changing quickly	50-950 changing quickly	General Description and Operation, Fuel Control HO2S
HO2S Bank 2 Sen.2 (millivolts) (**Auto trans**)	O2 Sensor Data	Millivolts	200-700 changing slowly	250-650 changing slowly	General Description and Operation, Fuel Metering System

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
HO2S Bank 1 Sen.1 (ready/not ready)	O2 Sensor Data	Ready Yes/No	Ready Yes	Ready Yes	General Description and Operation, Fuel Control HO2S; DTC: P0135
HO2S Bank 2 Sen.1 (ready/not ready)	O2 Sensor Data	Ready Yes/No	Ready Yes	Ready Yes	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 1 Sen.1	O2 Sensor Data	Seconds	25-45	25-45	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 1 Sen.2	O2 Sensor Data	Seconds	60-100	60-100	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 2 Sen.1	O2 Sensor Data	Seconds	25-45	25-45	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 2 Sen.2	O2 Sensor Data	Seconds	60-100	60-100	General Description and Operation, Catalyst Monitor Heated Oxygen Sensor (Auto Trans)
IAT (Intake Air Temp)	Engine	Degrees C, Degrees F	0-100˚C, depends on underhood	0-80˚C, depends on underhood	General Description and Operation, Intake Air Temperature (IAT) Sensor
Illumination Switch	Engine	Closed 0V/Open 12V	Closed 0V	Closed 0V	Refer to Section 8
Ignition Voltage	Engine	Volts	12.8-14.1	12.8-14.1	General Description and Operation, Electronic Ignition System
Inj. Pulse Bank 1	Engine	Millisecond s	2.0-4.0	2.5-4.0	General Description, Fuel Metering, Fuel Injector
Inj. Pulse Bank 2	Engine	Millisecond s	2.0-4.0	2.5-4.0	General Description, Fuel Metering, Fuel Injector
Knock Present	Engine	No/Yes	No	No	General Description and ION Sensing Module
Knock Signal	Engine	Percent	1~4	1~4	General Description and ION Sensing Module
Knock Sensor Retard	Engine	˚CA	0	0	General Description and ION Sensing Module
Knock Counter	Engine	Counts	—	—	General Description
Long Term FT Bank 1 (Long Term Fuel Trim)	Misfire	Counts and Percent	100 to 150 counts, –22% to +17%	100 to 150 counts, –22% to +17%	Diagnosis, Fuel Trim System Monitor; DTCs: P0171, P0172
Long Term FT Bank 2 (Long Term Fuel Trim)	Misfire	Counts and Percent	100 to 150 counts, –22% to +17%	100 to 150 counts, –22% to +17%	Diagnosis, Fuel Trim System Monitor; DTCs: P0171
MAF (Mass Air Flow)	Engine	Grams per second	2.85-6.65	9.5-16.5	General Description and Operation, MAF; DTCs: P101, P0102, P0103

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
MAP kPa (Manifold Absolute Pressure)	Engine	Kilopascals	23-40	19-32	General Description and Operation, Manifold Absolute Pressure (MAP) Sensor; DTCs: P0106, P0107, P0108
		Volts	0.65-1.32	0.46-1.10	
MIL	Engine	On/Off	Off	Off	On-Board Diagnostic System Check
Misfire Cur. Cyl #1	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #2	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #3	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #4	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #5	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #6	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Hist. Cyl #1	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #2	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #3	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #4	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #5	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #6	Misfire	Counts	0	0	DTC P0300
Misfire Failures Since First Fail	Misfire	Counts	0	0	DTC P0300
Misfire Passes Since First Fail	Misfire	Counts	0	0	DTC P0300
PNP (Park/Neutral Position)	Engine	P-N / R-D-3-2-L	P-N	P-N	4L30-E Automatic Transmission Diagnosis
Power Enrichment	Engine	NO/YES	NO	NO	General Description and Operation, Acceleration Mode
PSP Switch (Power Steering Pressure)	Engine	Normal/Hi	Normal Pressure	Normal Pressure	Refer to 2A Section
Spark (Advance)	Engine	Degrees Before Top Dead Center	15-22	34-44	General Description and Operation, Electronic Ignition System
Start-Up ECT (Engine Coolant Temp)	Engine	Degrees C, Degrees F	Depends on engine coolant temperature at time of start-up	Depends on engine coolant temperature at time of start-up	General Description and Operation, Engine Coolant Temperature (ECT) Sensor

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
Start-Up IAT (Intake Air Temp)	Engine	Degrees C, Degrees F	Depends on intake air temperature at time of start-up	Depends on intake air temperature at time of start-up	General Description and Operation, Intake Air Temperature (IAT) Sensor
TCC Cruise Brake Switch	Engine	Active/Inactive	Active	Active	Refer to Section 10
Total Misfire Current Count	Misfire	Counts	0-5	0-5	DTC P0300
TP Sensor 1 (Throttle Position Sensor 1)	Engine	Percent	3–13	12–21	General Description and Operation, Throttle Position (TP) Sensor
TP Sensor 2 (Throttle Position Sensor 2)	Engine	Percent	87–97	79–88	General Description and Operation, Throttle Position (TP) Sensor
Throttle at Idle	Engine	No/Yes	Yes	No	General Description and Operation, Throttle Position (TP) Sensor
Upshift Lamp (manual trans)	Engine	On/Off	Off	Off	Manual Transmission
Vehicle Speed	Engine	MPH / km/h	0	0	4L30-E Automatic Transmission Diagnosis
Weak Cylinder	Misfire	Cylinder #	—	—	DTC P0300

No Malfunction Indicator Lamp (MIL)



D06RY00127

Circuit Description

The “Check Engine” lamp (MIL) should always be illuminated and steady with the ignition “ON” and the engine stopped. Ignition feed voltage is supplied to the MIL bulb through the meter fuse. The powertrain control module (PCM) turns the MIL “ON” by grounding the MIL driver circuit.

Diagnostic Aids

An intermittent MIL may be cased by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Inspect the PCM harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- If the engine runs OK, check for a faulty light bulb, an open in the MIL driver circuit, or an open in the instrument cluster ignition feed.
- If the engine cranks but will not run, check for an open PCM ignition or battery feed, or a poor PCM to engine ground.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. A “No MIL” condition accompanied by a no-start condition suggests a faulty PCM ignition feed or battery feed circuit.
9. Using a test light connected to B+, probe each of the PCM ground terminals to ensure that a good ground is present. Refer to *PCM Terminal End View* for terminal locations of the PCM ground circuits.
12. In this step, temporarily substitute a known good relay for the PCM relay. The horn relay is nearby, and it can be verified as “good” simply by honking the horn. Replace the horn relay after completing this step.
17. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to *PCM Replacement and Programming Procedures Powertrain Control Module (PCM) and Sensors.*

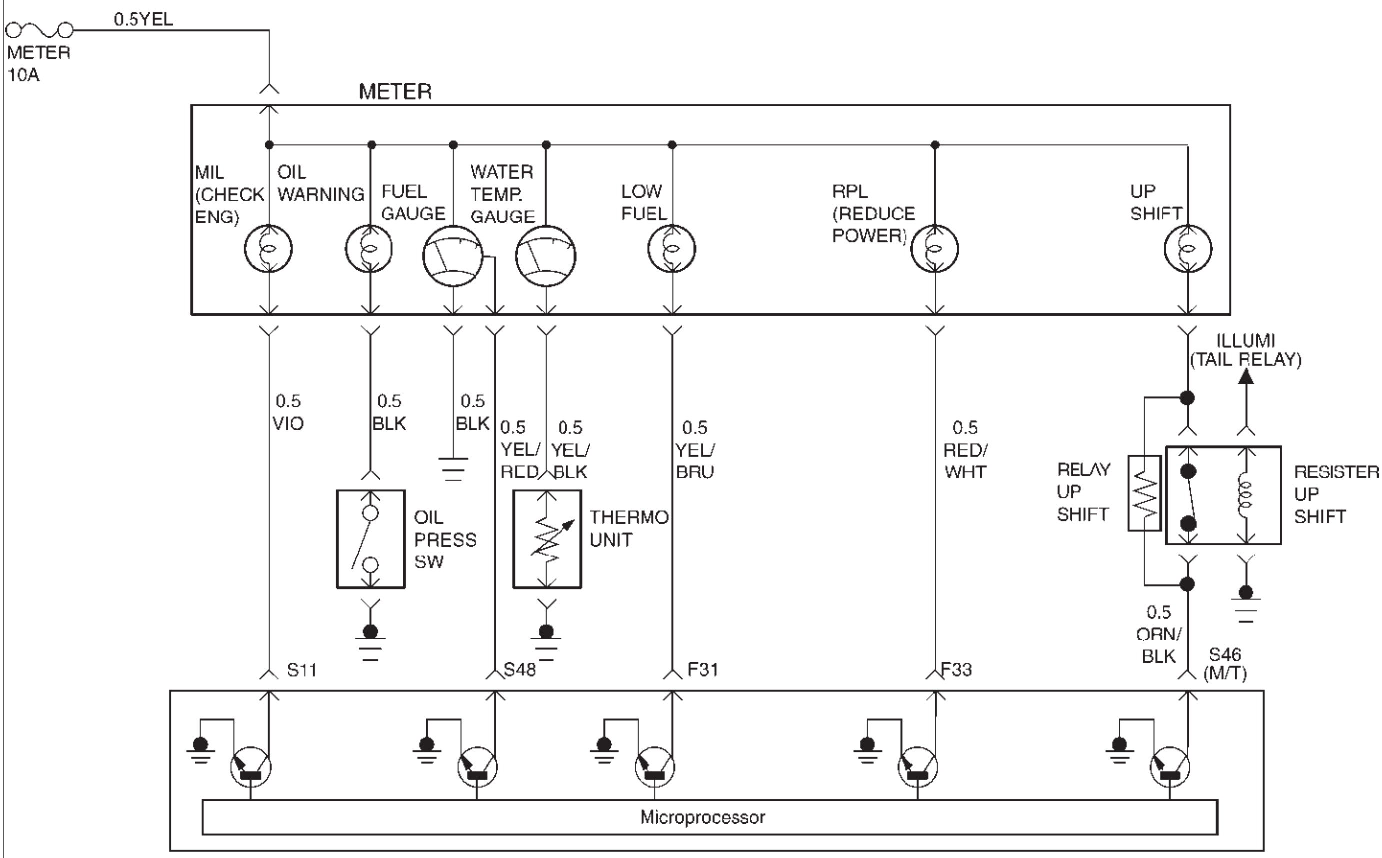
No Malfunction Indicator Lamp (MIL)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Attempt to start the engine. Does the engine start?	—	Go to *Step 3*	Go to *Step 6*
3	Check the meter fuse for the instrument cluster ignition feed circuit. Is the fuse OK?	—	Go to *Step 4*	Go to *Step 16*
4	Ignition “ON,” probe the ignition feed circuit at the cluster connector with a test light to ground. Is the test light “ON?”	—	Go to *Step 5*	Go to *Step 13*
5	1. Ignition “OFF.” 2. Disconnect the PCM. 3. Jumper the MIL driver circuit at the PCM connector to ground. 4. Ignition “ON.” Is the MIL “ON?”	—	Go to *Step 10*	Go to *Step 11*
6	Check the PCM ignition feed and battery feed fuses (15 A engine fuse and 15 A PCM fuse). Are both fuses OK?	—	Go to *Step 7*	Go to *Step 15*
7	1. Ignition “OFF.” 2. Disconnect the PCM. 3. Ignition “ON.” 4. Probe the ignition feed circuit at the PCM harness connector with a test light to ground. Is the test light “ON?”	—	Go to *Step 8*	Go to *Step 12*
8	Probe the battery feed circuit at the PCM harness connector with a test light to ground. Is the test light “ON?”	—	Go to *Step 9*	Go to *Step 14*
9	Check for a faulty PCM ground connection. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check for damaged terminals at the PCM. Was a problem found?	—	Verify repair	Go to *Step 17*
11	Check for an open MIL driver circuit between the PCM and the MIL. Was a problem found?	—	Verify repair	Go to *Step 18*
12	Substitute a known “good” relay for the PCM main relay. Was the malfunction fixed?	—	Verify repair	Go to *Step 13*
13	Repair the open in the ignition feed circuit. Is the action complete?	—	Verify repair	—
14	Locate and repair the open PCM battery feed circuit. Is the action complete?	—	Verify repair	—

No Malfunction Indicator Lamp (MIL) (Cont'd)

Step	Action	Value(s)	Yes	No
15	Locate and repair the short to ground in the PCM ignition feed circuit or PCM battery feed circuit. Is the action complete?	—	Verify repair	—
16	Locate and repair the short to ground in the ignition feed circuit to the instrument cluster, and replace the fuse. Is the action complete?	—	Verify repair	—
17	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *PCM* in *ON-Vehicle Service* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
18	Check the MIL driver circuit for a poor connection at the instrument panel connector. Was a problem found?	—	Verify repair	Go to *Instrument Panel* in *Electrical Diagnosis*

Malfunction Indicator Lamp (MIL) "ON" Steady



D06RY00127

Circuit description

The malfunction indicator lamp (MIL) should always be illuminated and steady with ignition "ON" and the engine stopped. Ignition feed voltage is supplied directly to the MIL indicator. The powertrain control module (PCM) turns the MIL "ON" by grounding the MIL driver circuit. The MIL should not remain "ON" with the engine running and no DTC(s) set. A steady MIL with the engine running and no DTC(s) suggests a short to ground in the MIL driver circuit.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

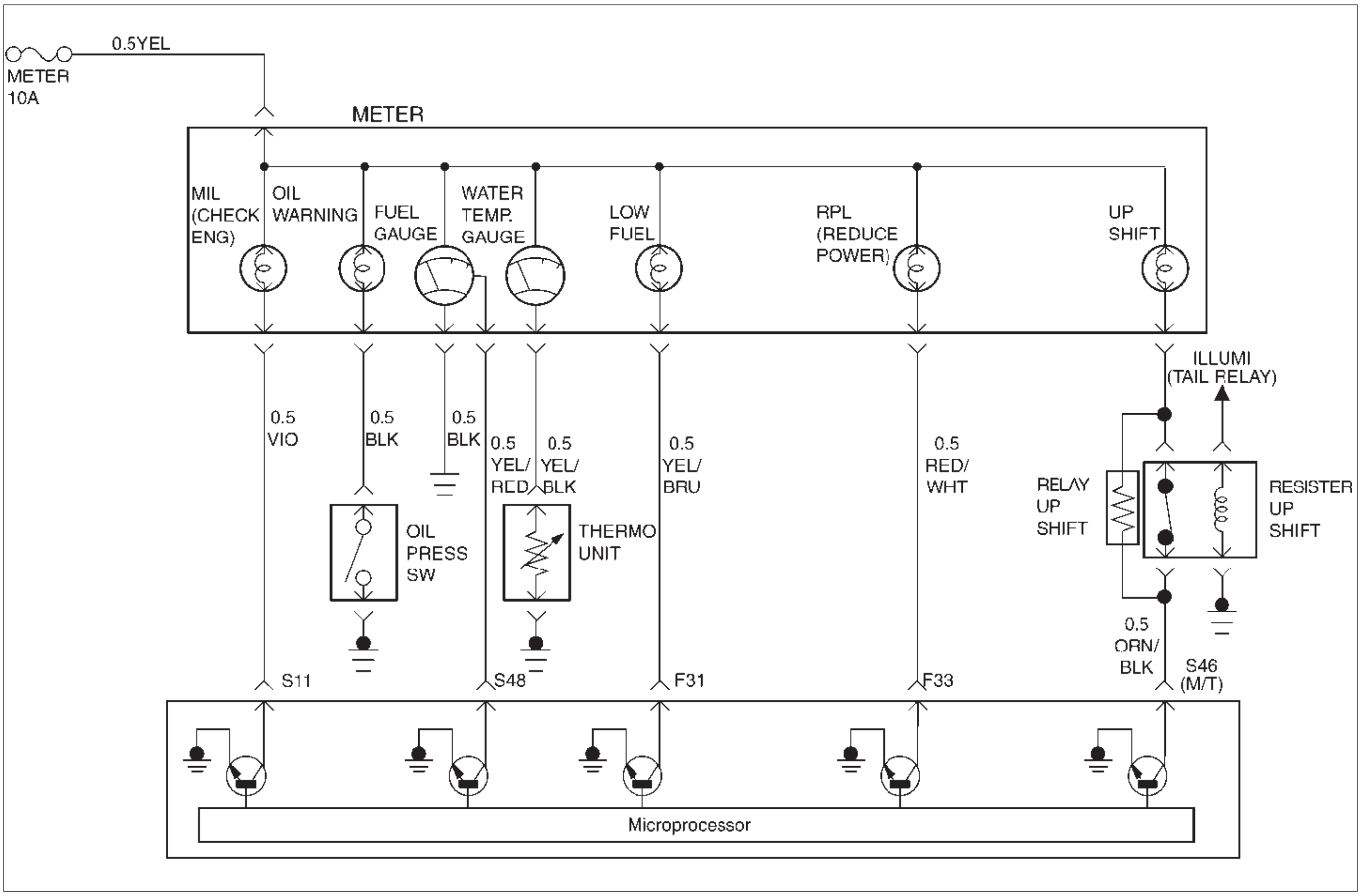
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If the MIL does not remain "ON" when the PCM is disconnected, the MIL driver wiring is not faulty.
3. If the MIL driver circuit is OK, the instrument panel cluster is faulty.
6. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to *PCM Replacement and Programming Procedures* in *Powertrain Control Module (PCM) and Sensors.*

Malfunction Indicator Lamp (MIL) “ON” Steady

Step	Action	Value(s)	Yes	No
1	Was the “On-Board diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “OFF,” disconnect PCM. 2. Ignition “ON,” observe the MIL (Service Engine Soon lamp). Is the MIL “ON?”	—	Go to *Step 3*	Go to *Step 5*
3	1. Ignition “OFF,” disconnect the instrument panel cluster. 2. Check the MIL driver circuit between the PCM and the instrument panel cluster for a short to ground. 3. If a problem is found, repair as necessary. Was the MIL driver circuit shorted to ground?	—	Go to *OBD System Check*	Go to *Step 4*
4	Replace the instrument panel cluster. Is the action complete?	—	Go to *OBD System Check*	—
5	1. Ignition “OFF,” reconnect the PCM. 2. Ignition “ON,” reprogram the EEPROM. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. 3. Using the Tech 2 output controls function, select MIL dash lamp control and command the MIL “OFF.” (Refer to the Miscellaneous test) Did the MIL turn “OFF?”	—	Go to *OBD System Check*	Go to *Step 6*
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to *OBD System Check*	—

No Reduced Power Lamp (RPL)



D06RY00127

Circuit Description

The Reduced Power lamp (RPL) should always be illuminated and steady with the ignition "ON" and the engine stopped. Ignition feed voltage is supplied to the RPL bulb through the meter fuse. The powertrain control module (PCM) turns the RPL "ON" by grounding the RPL driver circuit.

Diagnostic Aids

An intermittent RPL may be cased by a poor connection, rubbed - through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Inspect the PCM harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- If the engine runs OK, check for a faulty light bulb, an open in the MIL driver circuit, or an open in the instrument cluster ignition feed.
- If the engine cranks but will not run, check for an open PCM ignition or battery feed, or a poor PCM to engine ground.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. A " No RPL"condition accompanied by a no - start condition suggests a faulty PCM ignition feed or battery feed circuit.
9. Using a test light connected to B + , probe each of the PCM ground terminals to ensure that a good ground is present. Refer toPCM Terminal End View for terminal locations of the PCM ground circuits.
12. In this step, temporarily substitute a known good relay for the PCM relay. The horn relay is nearby, and it can be verified as "good" simply by honking the horn. Replace the horn relay after completing this step.
17. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.

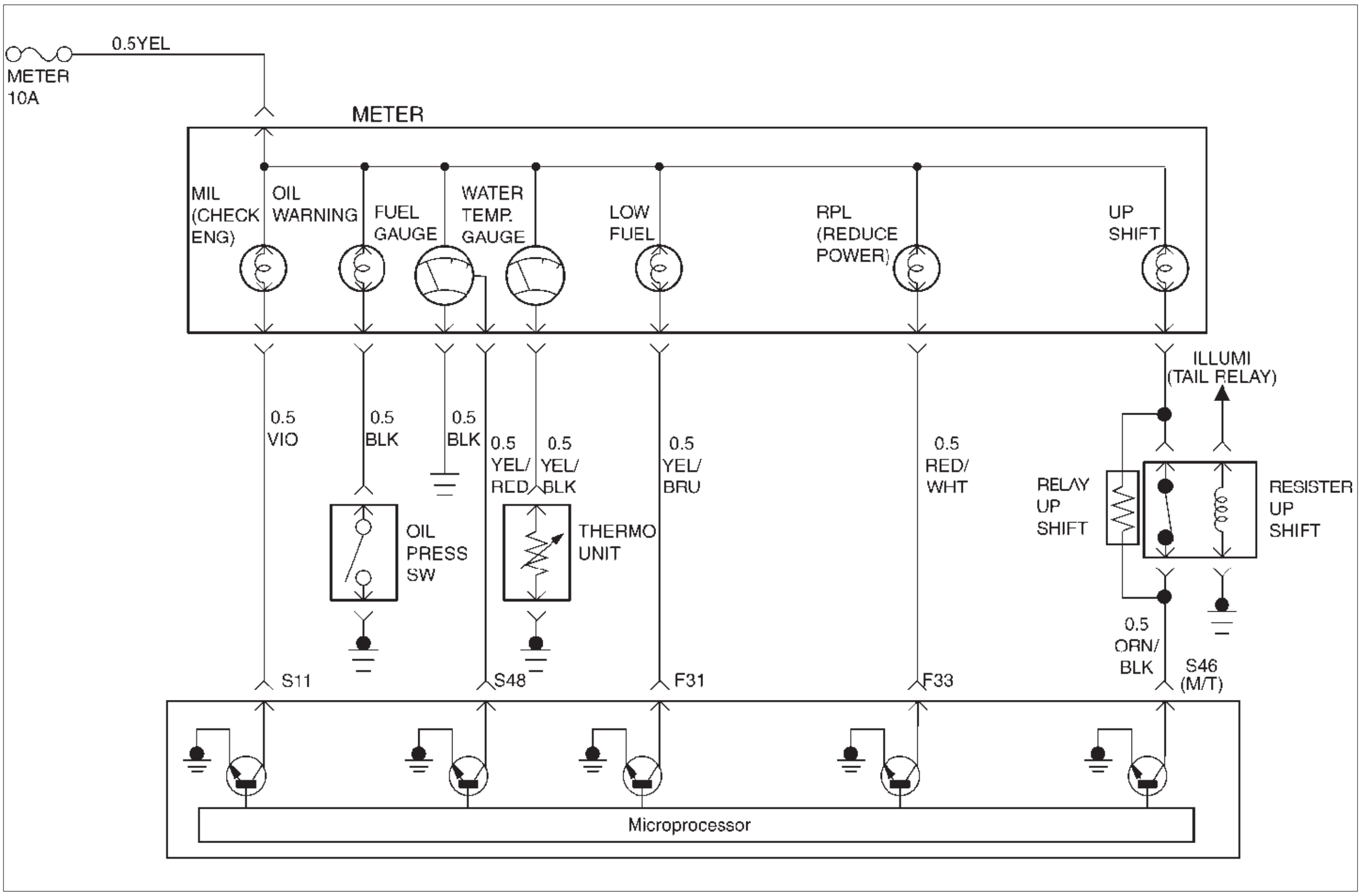
No Reduced Power Lamp (RPL)

Step	Action	Value(s)	Yes	No
1	Was the "On - Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Attempt to start the engine. Does the engine start?	—	Go to *Step 3*	Go to *Step 6*
3	Check the meter fuse for the instrument cluster ignitionfeed circuit. Is the fuse OK?	—	Go to *Step 4*	Go to *Step 16*
4	Ignition "ON," probe the ignition feed circuit at thecluster connector with a test light to ground. Is the test light "ON?"	—	Go to *Step 5*	Go to *Step 13*
5	1. Ignition "OFF." 2. Disconnect the PCM. 3. Jumper the RPL driver circuit at the PCM connector to ground. 4. Ignition "ON." Is the RPL "ON?"	—	Go to *Step 10*	Go to *Step 11*
6	Check the PCM ignition feed and battery feed fuses (15A engine fuse and 15 A PCM fuse). Are both fuses OK?	—	Go to *Step 7*	Go to *Step 15*
7	1. Ignition "OFF." 2. Disconnect the PCM. 3. Ignition "ON." 4. Probe the ignition feed circuit at the PCM harness connector with a test light to ground. Is the test light "ON?"	—	Go to *Step 8*	Go to *Step 12*
8	Probe the battery feed circuit at the PCM harness connector with a test light to ground. Is the test light "ON?"	—	Go to *Step 9*	Go to *Step 14*
9	Check for a faulty PCM ground connection. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check for damaged terminals at the PCM. Was a problem found?	—	Verify repair	Go to *Step 17*
11	Check for an open RPL driver circuit between the PCM and the RPL. Was a problem found?	—	Verify repair	Go to*Step 18*
12	Substitute a known "good" relay for the PCM mainrelay. Was the malfunction fixed?	—	Verify repair	Go to *Step 13*
13	Repair the open in the ignition feed circuit. Is the action complete?	—	Verify repair	—
14	Locate and repair the open PCM battery feed circuit. Is the action complete?	—	Verify repair	—

No Reduced Power Lamp (RPL) (Cont'd)

Step	Action	Value(s)	Yes	No
15	Locate and repair the short to ground in the PCM ignition feed circuit or PCM battery feed circuit. Is the action complete?	—	Verify repair	—
16	Locate and repair the short to ground in the ignition feed circuit to the instrument cluster, and replace thefuse. Is the action complete?	—	Verify repair	—
17	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to ON-Vehicle Service in Power Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
18	Check the RPL driver circuit for a poor connection at the instrument panel connector. Was a problem found?	—	Verify repair	Go to *Instrument Panel in Electrical Diagnosis*

Reduced Power Lamp (RPL) "ON" Steady



D06RY00127

Circuit Description

The Reduced Power lamp (RPL) should always be illuminated and steady with ignition "ON" and the engine stopped. Ignition feed voltage is supplied directly to the RPL indicator. The powertrain control module (PCM) turns the RPL "ON" by grounding the RPL driver circuit. The RPL should not remain "ON" with the engine running and no DTC(s) set. A steady RPL with the engine running and no DTC(s) suggests a short to ground in the RPL driver circuit.

Diagnostic Aids

An intermittent RPL may be cased by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness-Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

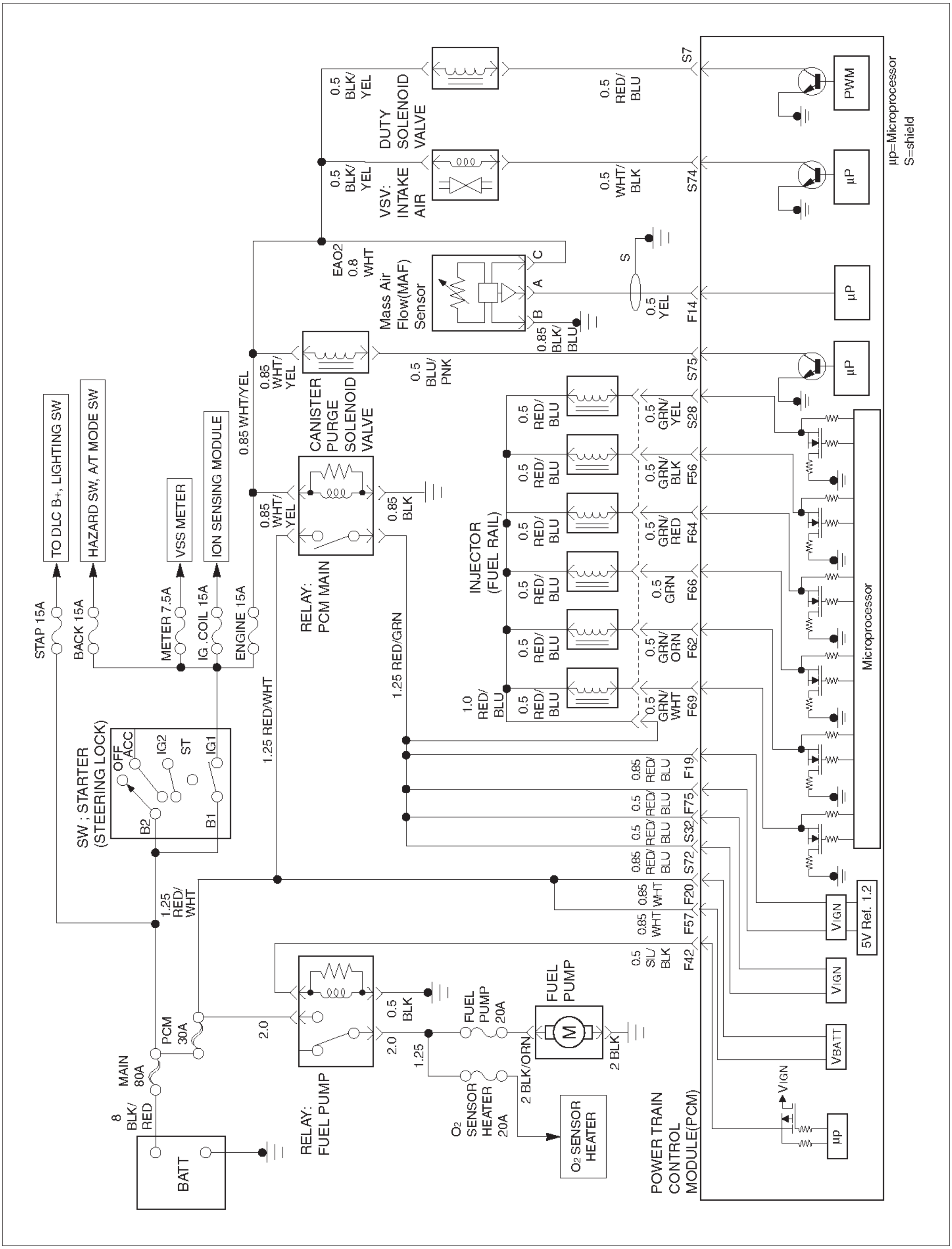
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If the RPL does not remain "ON" when the PCM is disconnected, the RPL driver wiring is not faulty.
3. If the RPL driver circuit is OK, the instrument panel cluster is faulty.
6. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to *PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.*

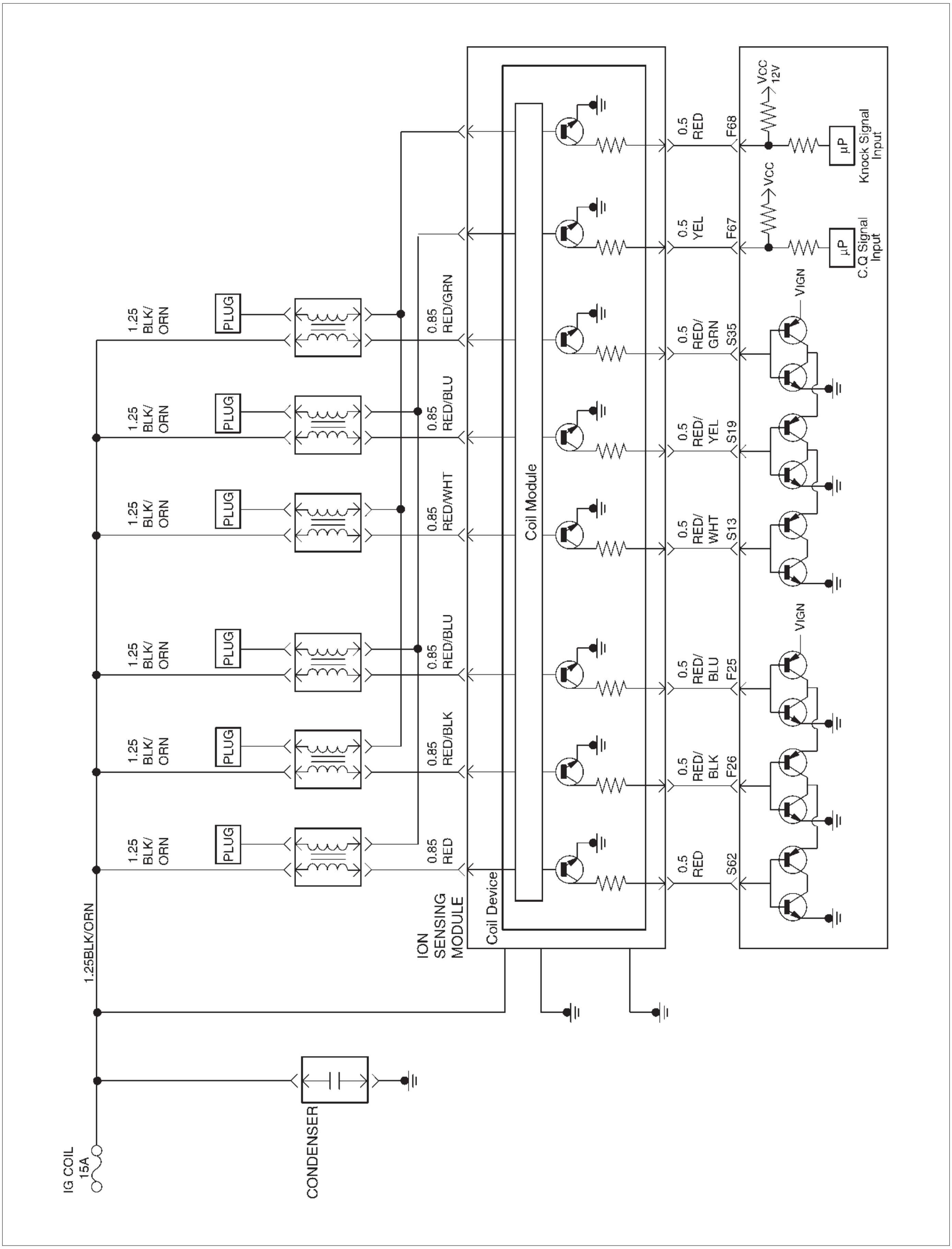
Reduced Power Lamp (RPL) “ON” Steady

Step	Action	Value(s)	Yes	No
1	Was the “ On - Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “OFF,” disconnect PCM. 2. Ignition “ON,” observe the RPL (Reduced Power Lamp). Is the RPL “ ON?”	—	Go to *Step 3*	Go to *Step 5*
3	1. Ignition “OFF,” disconnect the instrument panel cluster. 2. Check the RPL driver circuit between the PCM and the instrument panel cluster for a short to ground. 3. If a problem is found, repair as necessary. Was the RPL driver circuit shorted to ground?	—	Go to *OBD System Check*	Go to *Step 4*
4	Replace the instrument panel cluster. Is the action complete?	—	Go to *OBD System Check*	—
5	1. Ignition “OFF,” reconnect the PCM. 2. Ignition “ON,” reprogram the EEPROM. Refer to *On - Vehicle Service in Powertrain Control Module and Sensors for procedures.* 3. Using the Tech 2 output controls function, select RPL dash lamp control and command the RPL “OFF.” (Refer to*the Miscellaneous test*) Did the MIL turn “OFF”?	—	Go to *OBD System Check*	Go to *Step 6*
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Go to *OBD System Check*	—

Engine Cranks But Will Not Run



D06RY00150


IG COIL
15A
CONDENSER
1.25BLK/ORN
1.25
BLK/
ORN
PLUG
0.85
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RED/BLK
RED/BLU
RED/WHT
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ION
SENSING
MODULE
Coil Device
Coil Module
0.5
RED
RED/
BLK
BLU
WHT
YEL
GRN
S62
F26
F25
S13
S19
S35
F67
F68
VIGN
VCC
12V
μP
C.Q Signal
Input
Knock Signal
Input

D06RY00042

Circuit Description

The electronic Ignition system uses a coil -at-plug method of spark distribution. In this type of ignition system, the powertrain control module (PCM) triggers the correct driver outside the Ignition Current Sense System (ICSS), which then triggers the correct ignition coil based on the 58X signal received from the crankshaft position sensor (CKP). The spark plug connected to the coil fires when the ICSS opens the ground circuit for the coil's primary circuit.

During crank, the PCM monitors the CKP 58X signal. The CKP signal is used to determine which cylinder will fire first. After the CKP 58X signal has been processed by the PCM, it will command all six injectors to allow a priming shot of fuel for all the cylinders. After the priming, the injectors are left “OFF” during the next six 58X reference pulses from the CKP. This allows each cylinder a chance to use the fuel from the priming shot. During this waiting been received by the PCM. The CMP signal allows the PCM to operate the injectors sequentially based on camshaft position. If the camshaft position signal is not present at start - up, the PCM will begin sequential fuel delivery with a 1 -in-6 chance that fuel delivery is correct. The engine will run without a CMP signal, but will set a DTC code.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed - through wire insulation or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness-Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty engine coolant temperature sensor-Using a Tech 2, compare engine coolant temperature with intake air temperature on a completely cool engine. Engine coolant temperature should be within 10 ° C of intake air temperature. If not, replace the ECT sensor.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

5. An obvious cause of low fuel pressure would be an empty fuel tank.
6. The engine will easily start and run if a few injectors are disabled. It is not necessary to test all injectors at this time since this step is only a test to verify that all of the injectors have not been disabled by fuel contamination.
7. A blinking test light verifies that the PCM monitoring the 58X crankshaft reference signal and is capable of activating the injectors. If there is an open or shorted driver circuit, DTCs 201 – 206 and a misfire DTC 300 – 306 should be set.
19. By using a spark tester, each ignition coil's ability to produce 25,000 volts is verified.
25. If there is an open or shorted driver circuit, DTCs 201 – 206 and a misfire DTC 301 – 306 should be set. All six injector driver circuits can be checked at one time without removing the intake manifold if a J 39021 – 95 test light is available. This is the alternative procedure:
    - With the ignition “OFF”, disconnect the gray connector located at the rear of the air filter, attached to a bracket on the purge canister.
    - Connect test light J 39021 – 95 to the connector. Do any of the light constantly illuminate or fail to blink when the engine is cranked? If so, repair the short or open circuit, or replace the PCM if indicated.

This procedure only tests the driver circuit as far as the test connection, so step 31 is added to test the circuit all the way to the injector.

Engine Cranks But Will Not Run

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check”performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Check the ignition coil fuse, the engine fuse, and the PCM fuse. Was a fuse blown?	—	Go to *Step 3*	Go to *Step 4*
3	Check for a short to ground and replace the fuse. Is the action complete?	—	Verify repair	—

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
4	1. Ignition "OFF", install a fuel pressure gauge at the test fitting on the fuel supply line in the engine compartment. (Use a shop cloth to absorb any fuel leakage while making the connection.) 2. Ignition "ON," observe the fuel pressure. Is the fuel pressure within the specified values, and does it hold steady?	285 - 375 kPa (43 – 55 psi)	Go to *Step 6*	Go to *Step 5*
5	Is any fuel pressure indicated?	—	Go to *Fuel System Electrical Test*	Go to *Fuel System Diagnosis*
6	Install the switch box J 39021–2 at the injector test connector and activate an injector. Did the fuel pressure drop when the injector was activated?	—	Go to *Step 7*	Go to *Step 18*
7	Install an injector test light at the #2 cylinder injector harness connector. Does the light blink when the engine is cranked?	—	Go to *Step 8*	Go to *Step 24*
8	1. Ignition " OFF." 2. Disconnect the 11-pin connector at the ION sensing module. 3. With a test light to B + , probe each of the 6 exposed ION sensing module pins, one at a time, while the engine is cranked. (Use the gray narrow Metri - Pak © flexible female connector from the J - 35616 kit to make the pin accessible.) Does the light flash at each pin when the engine is cranked?	—	Go to *Step 12*	Go to *Step 9*
9	1. Remove the 4-pin connector at the ION sensing module. 2. Ignition " ON." 3. Use a test light at the harness connector to verify that the module is being supplied with B + and ground. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*
10	Repair the open ignition feed circuit or ground circuit to the ION sensing module. Is the action complete?	—	Verify repair	—
11	Repair the ION sensing module. Is the action complete?	—	Verify repair	—
12	1. Reconnect the ION sensing module 11-pin connector. 2. Remove the electrical connector from each coil. 3. With a test light to B+, probe each of the coil connectors at the wire which runs to the ION sensing module. Does the light flash at each coil connector when the engine is cranked?	—	Go to *Step 14*	Go to *Step 13*
13	Check for an open circuit between the coil and ION sensing module. Is the action complete?	—	Verify repair	—

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Ignition "ON." 2. While the coil connectors are disconnected, touch each coil connector's ignition feed terminal with a grounded test light (the ignition feed wire is black with orange tracer). Did the test light illuminate?	—	Go to *Step 16*	Go to *Step 15*
15	Repair the open ignition feed circuit. Is the action complete?	—	Verify repair	—
16	While the coil connectors are disconnected, touch each connector's secondary ground terminal with a test light to B +. (The ground wires are black.) Did the test light illuminate at each coil connector?	—	Go to *Step 18*	Go to *Step 17*
17	Repair the open secondary ground circuit. Is the action complete?	—	Verify repair	—
18	1. Test the fuel for contamination. 2. If a problem is found, clean the fuel system and correct the contaminated fuel condition as necessary. Replace the fuel filter and replace any injectors that are not delivering fuel (see Injector Balance Test). Was a problem found?	—	Verify repair	Go to *Step 19*
19	1. Remove any ignition coil and install a spark tester at the spark plug end of the coil. 2. Observe the tester while the engine is cranking. Was a crisp, blue spark observed? Only one or two sparks followed by no result is considered the same as "No Spark."	—	Go to *Step 21*	Go to *Step 20*
20	Replace the ignition coil, and return to Step 19 to test the remaining coils. Is the action complete?	—	Verify repair	—
21	Repeat Step 19 for each coil. Remove only one coil at a time, and reinstall each coil on its spark plug after testing, but do not refasten coils with screws at this time. After all coils have passed the spark test, does the engine start?	—	Refasten all coils with their screws	Go to *Step 22*
22	1. Remove the spark plugs from all cylinders. 2. Visually inspect the spark plug electrodes. 3. Replace any spark plugs with loose or missing electrodes or cracked insulators. Did your inspection reveal any spark plugs exhibiting excessive fouling?	—	Correct the fouling condition	Go to *Step 23*

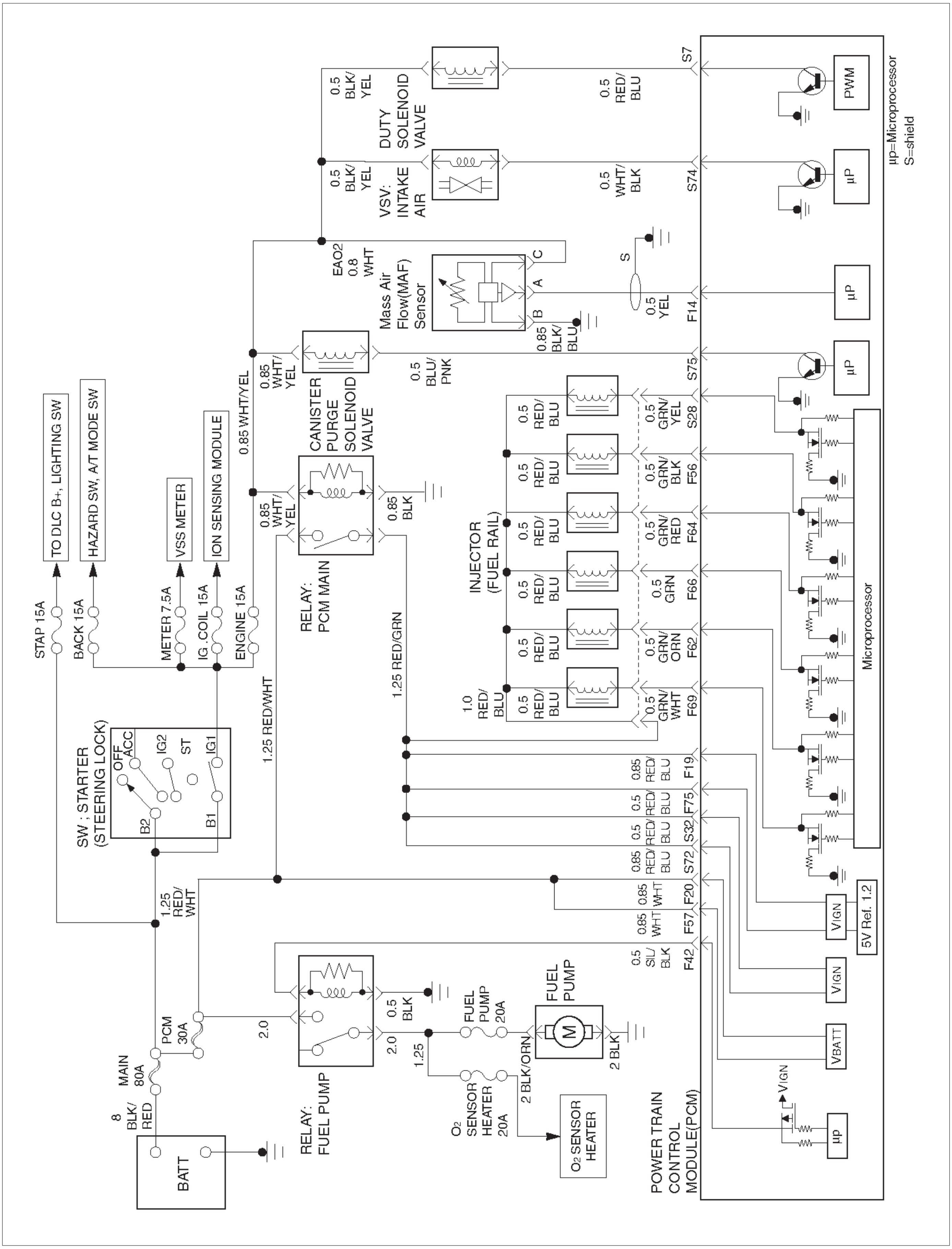
Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
23	Refer to *Engine Mechanical Diagnosis* to diagnose the following conditions: • Faulty or incorrect camshaft drive belts • Leaking or sticky valves or rings • Excessive valve deposits • Loose or worn rocker arms • Weak valve springs • Incorrect valve timing • Leaking head gasket Is the action complete?	—	Verify repair	Go to *Step 25*
24	Observe the "Engine Speed" data display on the Tech 2 while cranking the engine. Is the engine RPM indicated?	—	Go to *Step 25*	Go to *Step 34*
25	1. Disconnect the 7-pin gray connector at the rear of the air filter beneath the point where the air duct attaches to the MAF sensor. 2. Ignition "ON." 3. Using a test light connected to ground, probe the ignition terminal at the PCM (female) side of the 7-pin connector. Is the test light "ON?"	—	Go to *Step 26*	Go to *Step 32*
26	1. At the PCM (female) side of the connector, connect a test light between the ignition + terminal and one of the injector driver circuits at the same connector. 2. Ignition "ON." 3. Observe the test light, and repeat the test for each injector driver circuit. Did the test light stay on when checking any of the 6 injector driver circuits?	—	Go to *Step 27*	Go to *Step 29*
27	1. Ignition "OFF," disconnect the PCM. 2. Ignition "ON," observe the test light. Is the test light "ON?"	—	Go to *Step 28*	Go to *Step 33*
28	Locate and repair the short to ground in the injectordriver circuit. Is the action complete?	—	Verify repair	—
29	1. Using the same test location as in step 26, connect a test light between the ignition terminal and one of the driver circuits. 2. Crank the engine and observe the test light. 3. Repeat for each injector driver circuit. Did the light blink during the test for each circuit?	—	Go to *Step 31*	Go to *Step 30*
30	Check for an open injector driver circuit. Was a problem found?	—	Verify repair	Go to *Step 33*

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
31	1. At the injector (male) side of the gray connector mentioned in step 25, connect an ohmmeter between the ignition pin and one of the driver circuit pins. 2. Check for continuity in the circuit. 3. Repeat for each injector circuit. The readings should be approximately equal to the specified value for injector resistance. Was a problem found?	12.5 Ω	Verify repair	Go to *Step 8*
32	Repair the ignition feed circuit. Is the action complete?	—	Verify repair	—
33	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
34	1. Raise the vehicle and disconnect the CKP sensor harness. 2. Ignition "ON." 3. With a test light to ground, probe the harness ignition feed terminal. Did the light illuminate?	—	Go to *Step 36*	Go to *Step 35*
35	Check the ignition feed wire between the sensor andthe PCM for a short to ground or open circuit. Is the action complete?	—	Verify repair	—
36	1. Ignition "ON." 2. At the CKP harness connector, connect a test light between the ignition and ground terminals. Did the light illuminate?	—	Go to *Step 38*	Go to *Step 37*
37	Check the sensor ground circuit for an open or short to voltage. Is the action complete?	—	Verify repair	—
38	Check the signal circuit between the sensor and the PCM for a short to ground, short to voltage, or an open. Was a problem found?	—	Verify repair	Go to *Step 39*
39	Replace the CKP position sensor. Is the action complete?	—	Verify repair	Go to *Step 33*

Fuel System Electrical Test



D06RY00150

Circuit Description

When the ignition switch is first turned “ON,” the powertrain control module (PCM) energizes the fuel pump relay which applies power to the in-tank fuel pump. The fuel pump relay will remain “ON” as long as the engine is running or cranking and the PCM is receiving 58X crankshaft position pulses. If no 58X crankshaft position pulses are present, the PCM de-energizes the fuel pump relay within 2 seconds after the ignition is turned “ON” or the engine is stopped.

The fuel pump delivers fuel to the fuel rail and injectors, then to the fuel pressure regulator. The fuel pressure regulator controls fuel pressure by allowing excess fuel to be returned to the fuel tank. With the engine stopped and ignition “ON,” the fuel pump can be turned “ON” by using a command by the Tech 2.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If the fuel pump is operating but incorrect pressure is noted, the fuel pump wiring is OK and the “Fuel System Pressure Test” chart should be used for diagnosis.

CAUTION: To reduce the risk of fire and personal injury:

- **It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.**
- **A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the procedure is completed.**

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge J 34730-1 to the fuel feed line located in front of and above the right side valve train cover .
3. Reinstall the fuel pump relay.

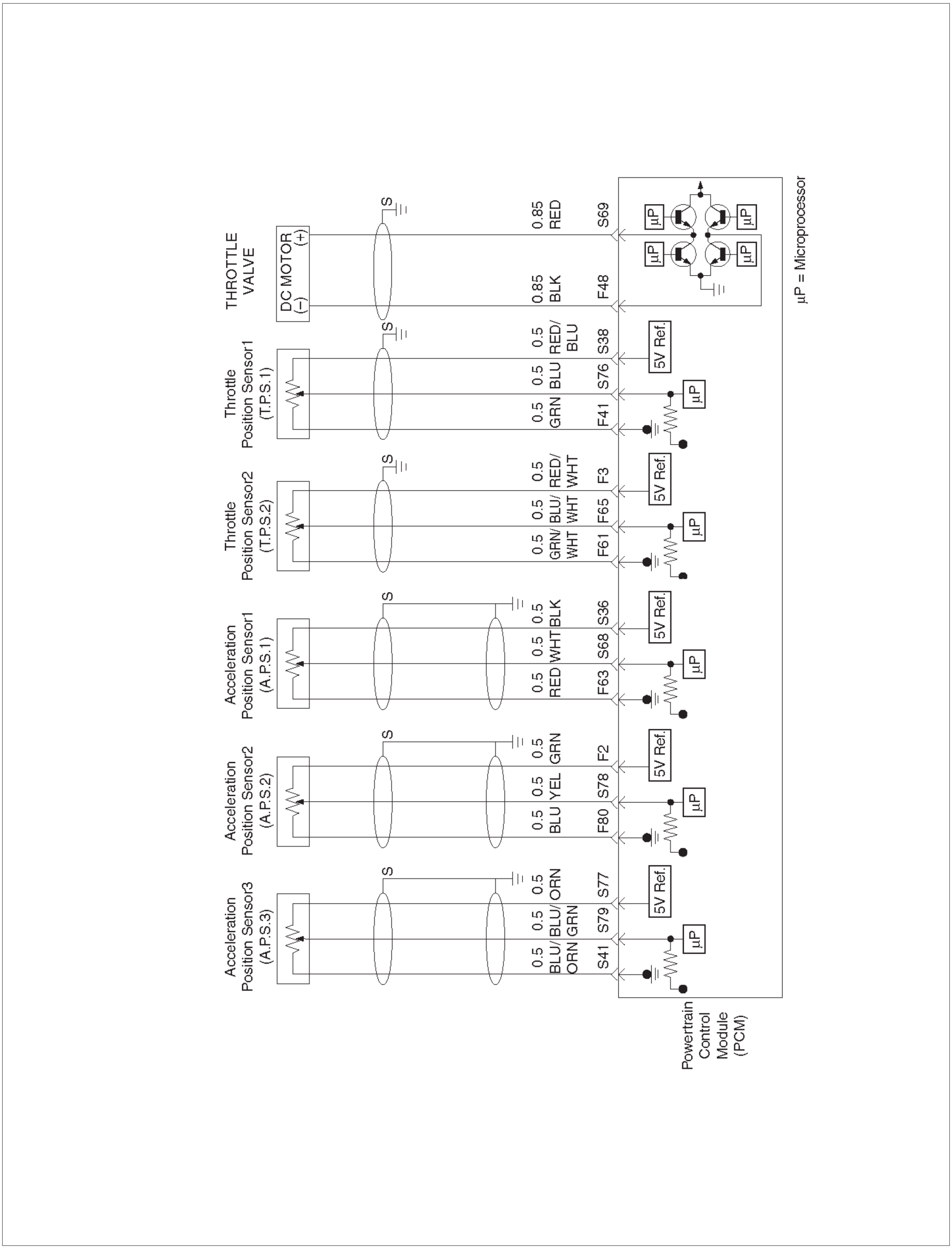
Fuel System Electrical Test

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Read the "Caution" above. 2. Relieve the fuel system pressure and install the fuel pump pressure gauge to the test fitting. 3. Ignition ON, Engine is Off. 4. Use a Tech 2 to command the fuel pump "ON." (Refer to the Miscellaneous Test.) Is there an immediate pressure build-up which indicates the pump is running?	—	Go to *Step 3*	Go to *Step 4*
3	1. Verify that the pump is not running by removing the fuel filler cap and listening. 2. Command the pump "ON" with the Tech 2. Did the pump turn "OFF" after 2 seconds?	—	Test completed	Go to *Step 12*
4	1. Ignition "OFF." 2. Remove the fuel pump relay. 3. Using a test light connected to ground, probe the battery feed to the relay. Did the light illuminate?	—	Go to *Step 6*	Go to *Step 5*
5	Repair short or open battery feed to fuel pump relay. Is the action complete?	—	Verify repair	—
6	1. Connect a test light between the two wires that connect to the fuel pump relay pull-in coil. 2. Ignition "ON." Did the test light illuminate for 2 seconds and then turn off?	—	Go to *Step 12*	Go to *Step 7*
7	1. With a test light connected to battery (–), probe the fuel pump relay connector at the wire which runs from the relay pull-in coil to the PCM. 2. Ignition "ON." Did the test light illuminate for 2 seconds and then turn off?	—	Go to *Step 8*	Go to *Step 9*
8	Locate and repair open in the fuel pump relay ground circuit. Is the action complete?	—	Verify repair	—
9	Check for short or open between the PCM and the fuel pump relay. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check the fuel pump relay circuit for a poor terminal connection at the PCM. 2. If a problem is found, replace terminal as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*

Fuel System Electrical Test (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
12	1. Reconnect the fuel pump relay. 2. Disconnect the fuel pump electrical connector at the fuel tank. 3. Using a test light connected to ground, probe the fuel pump feed wire (harness side). 4. Command the fuel pump "ON" with a Tech 2. Did the light illuminate for 2 seconds?	—	Go to *Step 15*	Go to *Step 13*
13	1. Honk the horn to verify that the horn relay is functioning. 2. Substitute the horn relay for the fuel pump relay. 3. Leave the test light connected as in step 12. 4. Command the fuel pump "ON" with the Tech 2. Did the test light illuminate for 2 seconds when the fuel pump was commanded "ON?"	—	Go to *Step 17*	Go to *Step 14*
14	1. Re-connect the horn relay in its proper location. 2. Check for a short circuit, blown fuse or open circuit between the relay and the fuel tank. Is the action complete?	—	Verify repair	—
15	1. With the fuel pump electrical connector at the fuel tank disconnected, connect a test light between the feed wire and the ground wire (harness side). 2. Command the fuel pump "ON" with a Tech 2. Did the test light illuminate for 2 seconds?	—	Go to *Step 18*	Go to *Step 16*
16	Repair the open circuit in the fuel pump ground wire. Is the action complete?	—	Verify repair	—
17	1. Re-connect the horn relay in its proper location. 2. Replace the fuel pump relay. Is the action complete?	—	Verify repair	—
18	Replace the fuel pump. Is the action complete?	—	Verify repair	—

Electric Throttle Control (ETC) System Check



D06RY00179

Circuit Description

- The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to the DC motor coil in PWM (%) to adjust the throttle valve into a passage in the throttle body to allow air flow. This method allows highly accurate control of engine speed and quick response to changes in engine load.
- The acceleration position (AP1) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle will vary about 13% at idle position to about 87% at wide open throttle(WOT).

  APS signal is used to determine which DC motor will adjust throttle position.

  After the APS signal has been processed by the PCM, it will command DC motor to allow movement of throttle position.

Diagnostic Aids

- An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the PCM harness and connector for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Throttle body – Check for objects blocking the DC motor or throttle bore, excessive deposits in the ETC passage and on the valve spring, and excessive deposits in the throttle bore and on the throttle valve plate.
- Acceleration pedal – Check for objects blocking the AP sensor or pedal arm with spring, and excessive deposits in the acceleration pedal arm and on the acceleration pedal.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Visually/physically inspect for the following throttle valve conditions.
3. Visually/physically inspect for the following acceleration pedal conditions.
5. Check the following circuits for throttle valve and DC moter. Check the following TP sensor resistance and DC motor.
7. Check the following circuits for acceleration pedal. Check the following AP sensor resistance.
10. Following DTC: Software detect Error for ETC system.
11. Following DTC: Software detect Error for ETC system.

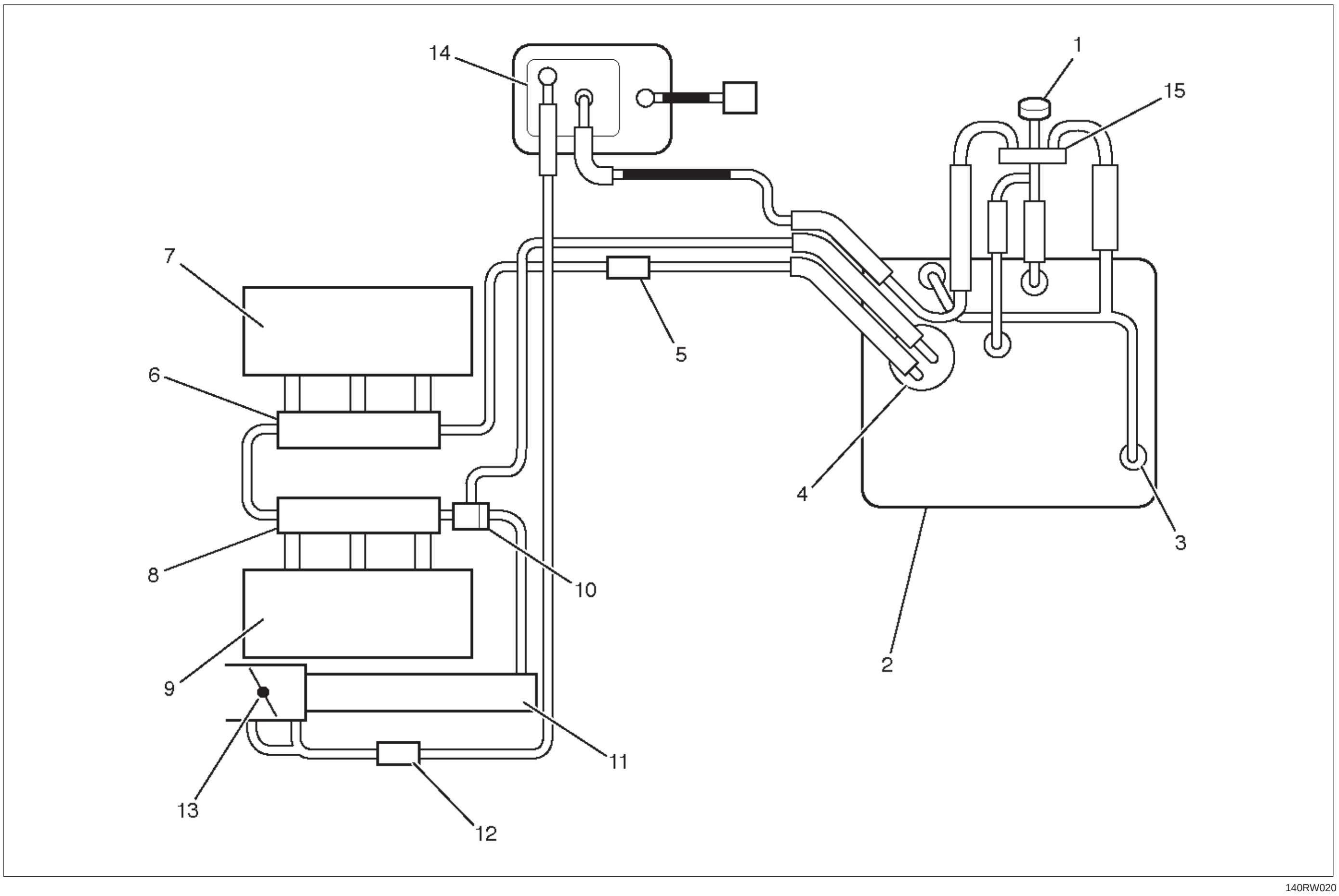
Electric Throttle Control (ETC) System Check

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Visually/physically inspect for the following conditions: ● Throttle body tampering. ● Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ● Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate. ● Throttle body with lever: When check for objects to send round the throttle spring lever that lever is smooth movement by less than 9 l·bm{1.0 N·m}, and spring lever has not excessive play. ● Throttle function: Check for the throttle function. When ignition switch “ON” that throttle lever is smooth operated by step on the acceleration pedal. Did any of the above require a repair?	—	Refer to *appropriate section for on-vehicle service*	Go to *Step 3*
3	Visually/physically inspect for the following conditions: ● Acceleration pedal tampering. ● Acceleration pedal : Check for objects blocking the spring or pedal arm. ● Acceleration pedal : For check for objects to move the acceleration pedal that pedal is smooth movement, and acceleration pedal arm has not excessive play. Did any of the above require a repair?	—	Refer to *appropriate section for on-vehicle service*	Go to *Step 4*
4	1. Check for a poor connection at the throttle body harness connector. 2. Check for a poor connection at the acceleration position sensor harness connector. 3. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: ● Throttle position sensor 1 circuit. ● Throttle position sensor 2 circuit. ● Throttle DC motor circuit. ● Throttle position sensor resistance. ● Throttle DC motor resistance. If a problem is found, repair as necessary. Was a problem found?	Vcc–GND 1–7kΩ SIG–GND change resistance 0.3–100Ω	Verify repair	Go to *Step 6*

Electric Throttle Control (ETC) System Check (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Install the Tech 2 2. Ignition "ON" but not engine run. 3. Chech the valve for APS and TPS. Was the prblem found?	Idle AP1 = 11–13% AP2 = 87–88% AP3 = 87–88% TP1 = 3–13% TP2 = 87–97% WOT AP1 = 85–89% AP2 = 11–15% AP3 = 32–36% TP1 = 87–97% TP2 = 3–13%	Go to *Step 10*	Go to *Step 7*
7	Replace the throttle valve. Is the action complete?	—	Go to *Step 3*	—
8	Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: • Acceleration position sensor 1 circuit. • Acceleration position sensor 2 circuit. • Acceleration position sensor 3 circuit. • Acceleration position sensor resistance. If a problem is found, repair as necessary. Was a problem found?	Vcc–GND 4–6kΩ SIG–GND change resistance	Verify repair	Go to *Step 9*
9	Replace the acceleration position sensor. Is the action complete?	—	Go to *Step 10*	–
10	Following below the DTCs stored: P1125, P1290, P1295, P1299	—	Go to *applicable DTC table*	Go to *Step 11*
11	Following below the DTCs stored: P1514, P1515, P1516, P1523, P1271, P1272, P1273	—	Go to *applicable DTC table*	Go to *Step 12*
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Fuel System Diagnosis



Legend

(1) Fuel Filler Cap
(2) Fuel Tank
(3) Rollover Valve
(4) Fuel Pump and Sender Assembly
(5) Fuel Filter
(6) Fuel Rail Right
(7) Right Bank
(8) Fuel Rail Left
(9) Left Bank
(10) Fuel Pressure Control Valve
(11) Common Chamber
(12) Duty Solenoid Valve
(13) Throttle Valve
(14) Canister
(15) Evap Shut Off Valve

Circuit Description

When the ignition switch is turned "ON," the powertrain control module (PCM) will turn "ON" the in-tank fuel pump. The in-tank fuel pump will remain "ON" as long as the engine is cranking or running and the PCM is receiving 58X crankshaft position pulses. If there are no 58X crankshaft position pulses, the PCM will turn the in-tank fuel pump "OFF" 2 seconds after the ignition switch is turned "ON" or 2 seconds after the engine stops running. The in-tank fuel pump is an electric pump within an integral reservoir. The in-tank fuel pump supplies fuel through an in-line fuel filter to the fuel rail assembly. The fuel pump is designed to provide fuel at a pressure above the pressure needed by the fuel injectors. A fuel pressure regulator, attached to the fuel rail, keeps the fuel available to the fuel injectors at a regulated pressure. Unused fuel is returned to the fuel tank by a separate fuel return line.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Connect the fuel pressure gauge to the fuel feed line as shown in the fuel system illustration. Wrap a shop towel around the fuel pressure connection in order to absorb any fuel leakage that may occur when installing the fuel pressure gauge. With the ignition switch "ON" and the fuel pump running, the fuel pressure indicated by the fuel pressure gauge should be 333-376 kPa (48-55 psi). This pressure is controlled by the amount of pressure the spring inside the fuel pressure regulator can provide.
3. A fuel system that cannot maintain a constant fuel pressure has a leak in one or more of the following areas:
   - The fuel pump check valve.
   - The fuel pump flex line.

- The valve or valve seat within the fuel pressure regulator.
- The fuel injector(s).

4. Fuel pressure that drops off during acceleration, cruise, or hard cornering may case a lean condition. A lean condition can cause a loss of power, surging, or misfire. A lean condition can be diagnosed using a Tech 2. If an extremely lean condition occurs, the oxygen sensor(s) will stop toggling. The oxygen sensor output voltage(s) will drop below 500 mV. Also, the fuel injector pulse width will increase.

IMPORTANT: Make sure the fuel system is not operating in the "Fuel Cut-Off Mode."

When the engine is at idle, the manifold pressure is low (high vacuum). This low pressure (high vacuum) is applied to the fuel pressure regulator diaphragm. The low pressure (high vacuum) will offset the pressure being applied to the fuel pressure regulator diaphragm by the spring inside the fuel pressure regulator. When this happens, the result is lower fuel pressure. The fuel pressure at idle will vary slightly as the barometric pressure changes, but the fuel pressure at idle should always be less than the fuel pressure noted in step 2 with the engine "OFF."

16. Check the spark plug associated with a particular fuel injector for fouling or saturation in order to determine if that particular fuel injector is leaking. If checking the spark plug associated with a particular fuel injector for fouling or saturation does not determine that a particular fuel injector is leaking, use the following procedure:
    - Remove the fuel rail, but leave the fuel lines and injectors connected to the fuel rail. Refer to *Fuel Rail Assembly* in *On-Vehicle Service.*
    - Lift the fuel rail just enough to leave the fuel injector nozzles in the fuel injector ports.

CAUTION: In order to reduce the risk of fire and personal injury that may result from fuel spraying on the engine, verify that the fuel rail is positioned over the fuel injector ports and verify that the fuel injector retaining clips are intact.

- **Pressurize the fuel system by connecting a 10 amp fused jumper between B+ and the fuel pump relay connector.**
- **Visually and physically inspect the fuel injector nozzles for leaks.**

17. A rich condition may result from the fuel pressure being above 376 kPa (55 psi). A rich condition may cause a DTC P0132 or a DTC P0172 to set. Driveability conditions associated with rich conditions can include hard starting (followed by black smoke) and a strong sulfur smell in the exhaust.

20. This test determines if the high fuel pressure is due to a restricted fuel return line or if the high fuel pressure is due to a faulty fuel pressure regulator.

21. A lean condition may result from fuel pressure below 333 kPa (48 psi). A lean condition may cause a DTC P0131 or a DTC P0171 to set. Driveability conditions associated with lean conditions can include hard starting (when the engine is cold), hesitation, poor driveability, lack of power, surging , and misfiring.

22. Restricting the fuel return line causes the fuel pressure to rise above the regulated fuel pressure. Command the fuel pump "ON" with the Tech 2. The fuel pressure should rise above 376 kPa (55 psi) as the fuel return line becomes partially closed.

NOTE: Do not allow the fuel pressure to exceed 414 kPa (60 psi). Fuel pressure in excess of 414 kPa (60 psi) may damage the fuel pressure regulator.

CAUTION: To reduce the risk of fire and personal injury:

- **It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.**
- **A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the procedure is completed.**

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge J 34730-1 to the fuel feed line located in front of and above the right side valve train cover.
3. Reinstall the fuel pump relay.

Fuel System Diagnosis

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Turn the ignition “OFF.” 2. Turn the air conditioning system “OFF.” 3. Relieve fuel system pressure and install the fuel pressure gauge. 4. Turn the ignition “ON.” NOTE: The fuel pump will run for approximately 2 seconds. Use the Tech 2 to command the fuel pump “ON”. (Refer to the Miscellaneous Test.) 5. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running. Is the fuel pressure within the specified limits?	290-376 kPa (42-55 psi)	Go to *Step 3*	Go to *Step 17*
3	NOTE: The fuel pressure will drop when the fuel pump stops running, then it should stabilize and remain constant. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to *Step 4*	Go to *Step 12*
4	1. When the vehicle is at normal operation temperature, turn the ignition “ON” to build fuel pressure and observe the measurement on the gauge. 2. Start the engine and observe the fuel pressure gauge. Did the reading drop by the amount specified after the engine was started?	21-105 kPa (3-15 psi)	Go to *Step 5*	Go to *Step 9*
5	Is fuel pressure dropping off during acceleration, cruise, or hard cornering?	—	Go to *Step 6*	Check for improper fuel
6	Visually and physically inspect the following items for a restriction: • The in-pipe fuel filter. • The fuel feed line. Was a restriction found?	—	Verify repair	Go to *Step 7*
7	Remove the fuel tank and visually and physically inspect the following items: • The fuel pump strainer for a restriction. • The fuel line for a leak. • Verify that the correct fuel pump is in the vehicle. Was a problem found in any of these areas?	—	Verify repair	Go to *Step 8*
8	Replace the fuel pump. Is the action complete?	—	Verify repair	—
9	1. Disconnect the vacuum hose from the fuel pressure regulator. 2. With the engine idling, apply 12-14 inches of vacuum to the fuel pressure regulator. Does the fuel pressure indicated by the fuel pressure gauge drop by the amount specified?	21-105 kPa (3-15 psi)	Go to *Step 10*	Go to *Step 11*

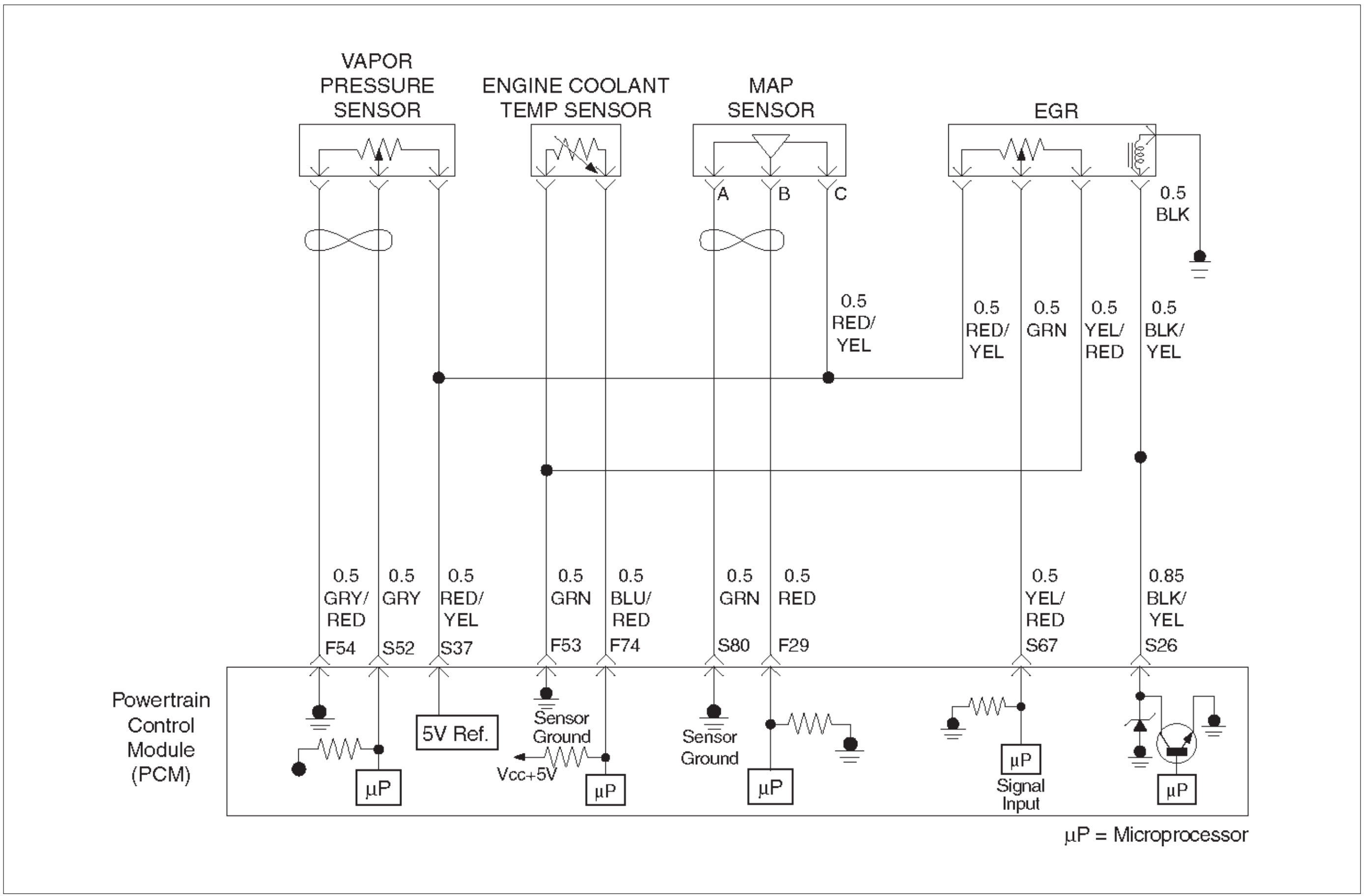
Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
10	Locate and repair the loss of vacuum to the fuel pressure regulator. Is the action complete?	—	Verify repair	—
11	Replace the fuel pressure regulator. Is the action complete?	—	Verify repair	—
12	1. Run the fuel pump with the Tech 2. 2. After pressure has built up, turn off the pump and clamp the supply hose shut with suitable locking pliers which will not damage the hose. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to *Step 13*	Go to *Step 15*
13	Visually inspect the fuel supply line and repair any leaks. Was a problem found?	—	Verify repair	Go to *Step 14*
14	Remove the fuel tank and inspect for leaky hose or in-tank fuel line. Was a problem found?	—	Verify repair	Go to *Step 8*
15	1. If the pliers are still clamped to the fuel supply hose, remove the locking pliers. 2. With suitable locking pliers, which will not damage the hose, clamp the fuel return line to prevent fuel from returning to the fuel tank. 3. Run the fuel pump with the Tech 2. 4. After pressure has built up, remove power to the pump. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to *Step 11*	Go to *Step 16*
16	Locate and replace any leaking fuel injector(s). Is the action complete?	—	Verify repair	—
17	Is the fuel pressure indicated by the fuel pressure gauge above the specified limit?	376 kPa (55 psi)	Go to *Step 18*	Go to *Step 21*
18	1. Relieve the fuel pressure. Refer to the *Fuel Pressure Relief.* 2. Disconnect the fuel return line from the fuel rail. 3. Attach a length of flexible hose to the fuel rail return outlet passage. 4. Place the open end of the flexible hose into an approved gasoline container. 5. Run the fuel pump with the Tech 2. 6. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running. Is the fuel pressure within the specified limits?	290-376 kPa (42-55 psi)	Go to *Step 19*	Go to *Step 20*
19	Locate and correct the restriction in the fuel return line. Is the action complete?	—	Verify repair	—
20	Visually and physically inspect the fuel rail outlet passages for a restriction. Was a restriction found?	—	Verify repair	Go to *Step 11*

Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
21	Is the fuel pressure indicated by the fuel pressure gauge above the specified value?	0 kPa (0 psi)	Go to *Step 22*	Go to *Step 23*
22	1. Command the fuel pump "ON" with the Tech 2. 2. Using suitable pliers which will not damage the fuel hose, gradually apply pressure with the pliers to pinch the flexible fuel return hose closed. **CAUTION: Do not let the fuel pressure exceed the second specified value.** Does the fuel pressure indicated by the fuel pressure gauge rise above the first specified value?	376 kPa (55 psi) 414 kPa (60 psi)	Go to *Step 11*	Go to *Step 7*
23	1. Command the fuel pump "ON" with the Tech 2. 2. Remove the fuel filler cap and listen for the sound of the fuel pump running. 3. Turn the pump off. Was the fuel pump running?	—	Go to *Step 7*	Go to *Fuel System Electrical Test Chart*

Exhaust Gas Recirculation (EGR) System Check



060RY00167

Circuit Description

A properly operation exhaust gas recirculation (EGR) system will directly affect the air/fuel requirements of the engine. Since the exhaust gas introduced into the air/fuel mixture is an inert gas (contains very little or no oxygen), less fuel is required to maintain a correct air/fuel ratio. Introducing exhaust gas into the combustion chamber lowers combustion temperatures and reduces the formation of oxides of nitrogen (NOx) in the exhaust gas. Lower combustion temperatures also prevent detonation. If the EGR pintle were to stay closed, the inert exhaust gas would be replaced with air and the air/fuel mixture would be leaner. The powertrain control module (PCM) would compensate for the lean condition by adding fuel, resulting in higher long term fuel trim values.

Diagnostic Aids

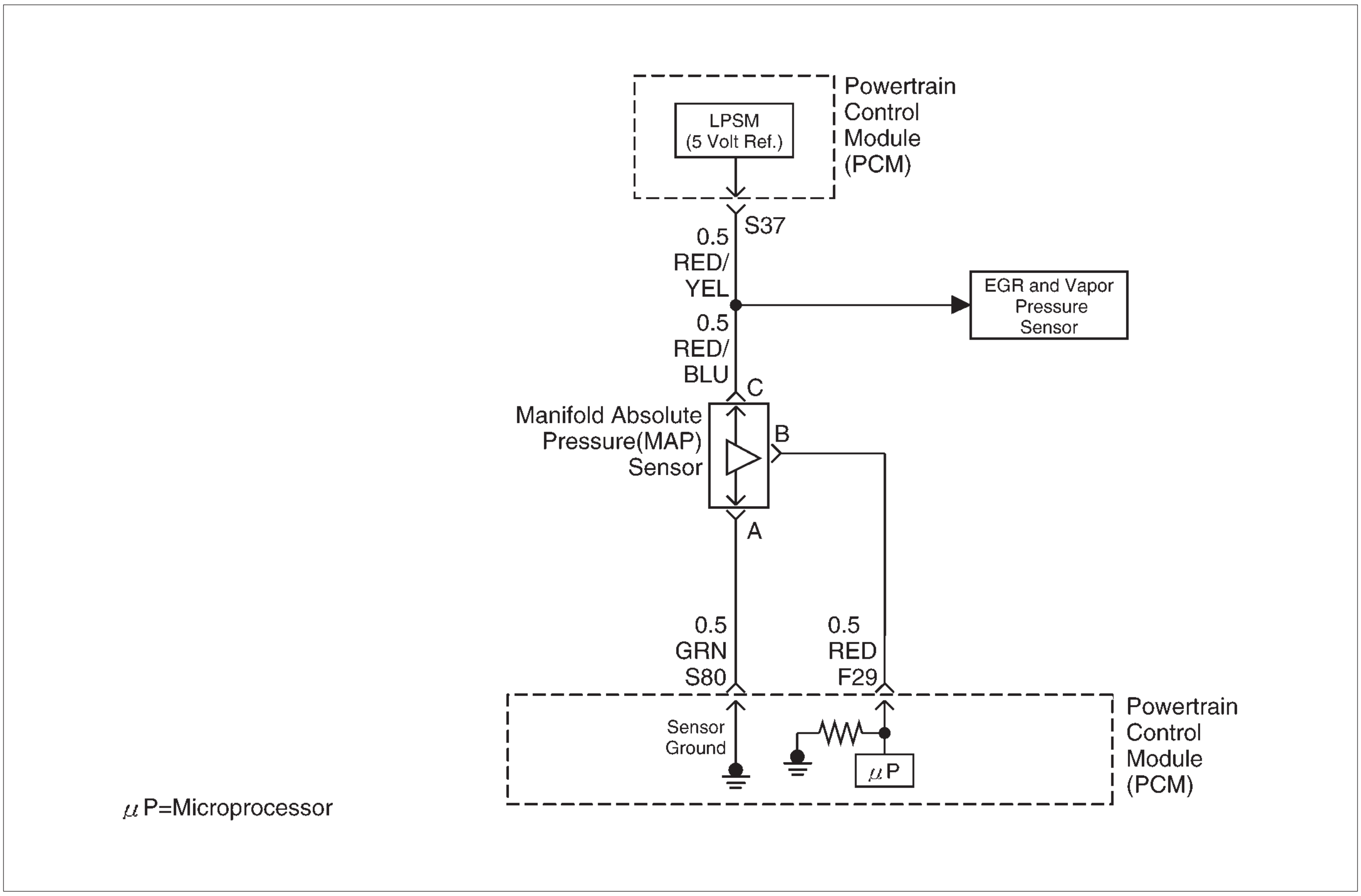
The EGR valve chart is a check of the EGR system. An EGR pintle constantly in the closed position could cause detonation and high emissions of NOx. It could also result in high long term fuel trim values in the open throttle cell, but not in the closed throttle cell. An EGR pintle constantly in the open position would cause a rough idle. Also, an EGR mounted incorrectly (rotated 180°) could cause rough idle. Check for the following items:

- EGR passages – Check for restricted or blocked EGR passages.
- Manifold absolute pressure sensor – A manifold absolute pressure sensor may shift in calibration enough to affect fuel delivery. Refer to *Manifold Absolute Pressure Output Check.*

Exhaust Gas Recirculation (EGR) System Check

Step	Action	Value(s)	Yes	No
1	Check the EGR valve for looseness. Is the EGR valve Loose?	—	Go to *Step 2*	Go to *Step 3*
2	Tighten the EGR valve. Is the action complete?	—	Verify repair	—
3	1. Place the transmission selector in Park or Neutral. 2. Start the engine and idle until warm. 3. Using a Tech 2, command EGR “50% ON.” (Refer to the Miscellaneous Test.) Does the engine idle rough and lose RPMs?	—	EGR system working properly. No problem found.	Go to *Step 4*
4	1. Engine “OFF.” 2. Ignition “ON.” 3. Using a test light to ground, check the EGR harness between the EGR valve and the ignition feed. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 5*
5	Repair the EGR harness ignition feed. Was the problem corrected?	—	Verify repair	Go to *Step 6*
6	1. Remove the EGR valve. 2. Visually and physically inspect the EGR valve pintle, valve passages and adapter for excessive deposits, obstructions or any restrictions. Does the EGR valve have excessive deposits, obstructions or any restrictions?	—	Go to *Step 7*	Go to *Step 8*
7	Clean or replace EGR system components as necessary. Was the problem corrected?	—	Verify repair	Go to *Step 8*
8	1. Ground the EGR valve metal case to battery (–). 2. Using a Tech 2, command EGR “ON” and observe the EGR valve pintle for movement. Does the EGR valve pintle move according to command?	—	Go to *Step 9*	Go to *DTC P1406 chart*
9	1. Remove the EGR inlet and outlet pipes from the intake and exhaust manifolds. 2. Visually and physically inspect manifold EGR ports and EGR inlet and outlet pipes for blockage or restriction caused by excessive deposits or other damage. Do the manifold EGR ports or inlet and outlet pipes have excessive deposits, obstructions, or any restrictions?	—	Go to *Step 10*	EGR system working properly. No problem found.
10	Clean or replace EGR system components as necessary. Is the action complete?	—	Verify repair	—

Manifold Absolute Pressure (MAP) Output Check



D06RY00165

Circuit Description

The manifold absolute pressure (MAP) sensor measures the changes in the intake MAP which result from engine load (intake manifold vacuum) and engine speed changes; and converts these into a voltage output. The powertrain control module (PCM) sends a 5-volt reference voltage to the MAP sensor. As the MAP changes, the output voltage of the sensor also changes. By monitoring the the sensor output voltage, the PCM knows the MAP. A lower pressure (low voltage) output voltage will be about 1-2 volts at idle. Higher pressure (high voltage) output voltage will be about 4-4.8 volts at wide open throttle. The MAP sensor is also used, under certain conditions, to measure barometric pressure, allowing the PCM to make adjustments for different altitudes. The PCM uses the MAP sensor to diagnose proper operation of the EGR system, in addition to other functions.

Test Description

IMPORTANT: Be sure to used the same diagnostic test equipment for all measurements.

The number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Applying 34 kPa (10 Hg) vacuum to the MAP sensor should cause the voltage to be 1.5-2.1 volts less than the voltage at step 1. Upon applying vacuum to the sensor, the change in voltage should be instantaneous. A slow voltage change indicates a faulty sensor.
3. Check the vacuum hose to the sensor for leaking or restriction, Be sure that no other vacuum devices are connected to the MAP hose.

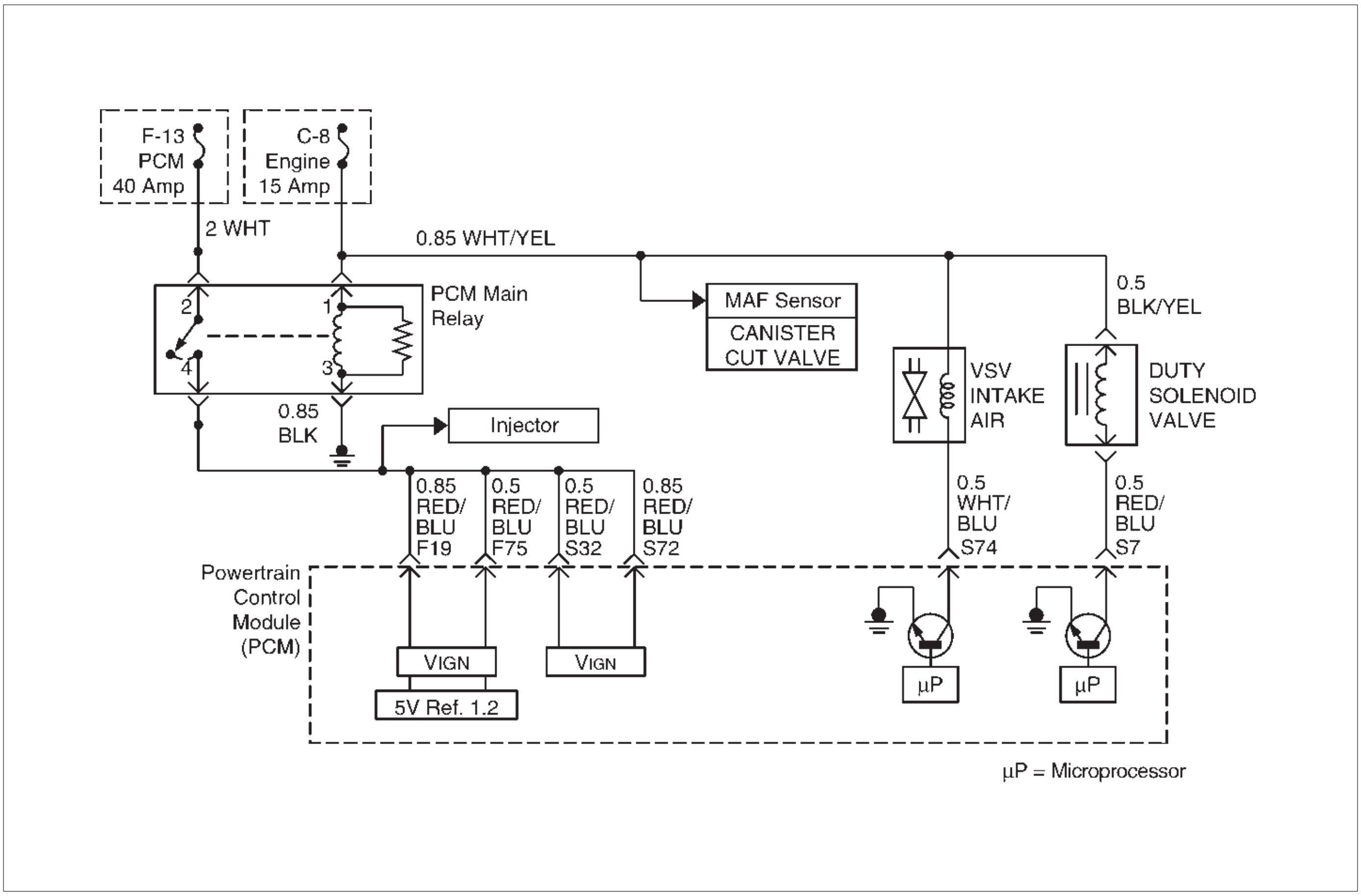
IMPORTANT: Make sure the electrical connector remains securely fastened.

4. Disconnect the sensor from the bracket. Twist the sensor with your hand to check for an intermittent connection. Output changes greater than 0.10 volt indicate a bad sensor.

Manifold Absolute Pressure (MAP) Output Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition “OFF”and leave it “OFF” for 15 seconds. 2. Ignition “ON.” Don’t crank engine. 3. The Tech 2 should indicate a manifold absolute pressure (MAP) sensor voltage. 4. Compare this scan reading to scan reading of a known good vehicle obtained using the exact same procedure as in Steps 1-4. Is the voltage reading the same +/–0.40 volt?	—	Go to *Step 2*	Go to *Step 5*
2	1. Disconnect the vacuum hose at the MAP sensor and plug the hose. 2. Connect a hand vacuum pump to the MAP sensor. 3. Start the engine. 4. Apply 34 kPa (10 Hg) of vacuum and note the voltage change. Is the voltage change 1.5-2.1 volts less than Step 1?	—	Go to *Step 3*	Go to *Step 4*
3	Check the sensor cover for leakage or restriction. Does the hose supply vacuum to the MAP sensor only?	—	Go to *Step 5*	Go to *Step 4*
4	Repair the hose to block. Is the action complete?	—	Verify repair	—
5	Check the sensor connection. Is the sensor connection good?	—	Go to *Step 6*	Go to *Step 7*
6	Refer to *On-Vehicle Service, MAP Sensor.* Is the action complete?	—	Verify repair	—
7	Repair the poor connection. Is the action complete?	—	Verify repair	—

Evaporative (EVAP) Emissions Canister Purge Valve Check



D06RY00128

Circuit Description

Canister purge is controlled by a solenoid valve that allows manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge “ON”). The EVAP purge solenoid control is turned “ON” and “OFF” several times a second. The duty cycle (pulse width or “ON” time) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the purge solenoid is enabled when the appropriate conditions have been met:

- The engine run time after start is more than 60 seconds.
- The engine coolant temperature is above 30°C (86°F).
- The fuel control system is operating in the closed-loop mode.

Diagnostic Aids

- Make a visual check of vacuum hoses.
- Check the throttle body for possible cracked.
- Check the malfunction indicator lamp for a possible mechanical problem.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

1. Check to see if the solenoid is open or closed. The solenoid is normally de-energized in this step, so it should be closed.
2. This step checks to determine if the solenoid was open due to an electrical circuit problem or a defective solenoid.
3. This should normally energize the solenoid, opening the valve and allowing the vacuum to drop (purge “ON”).

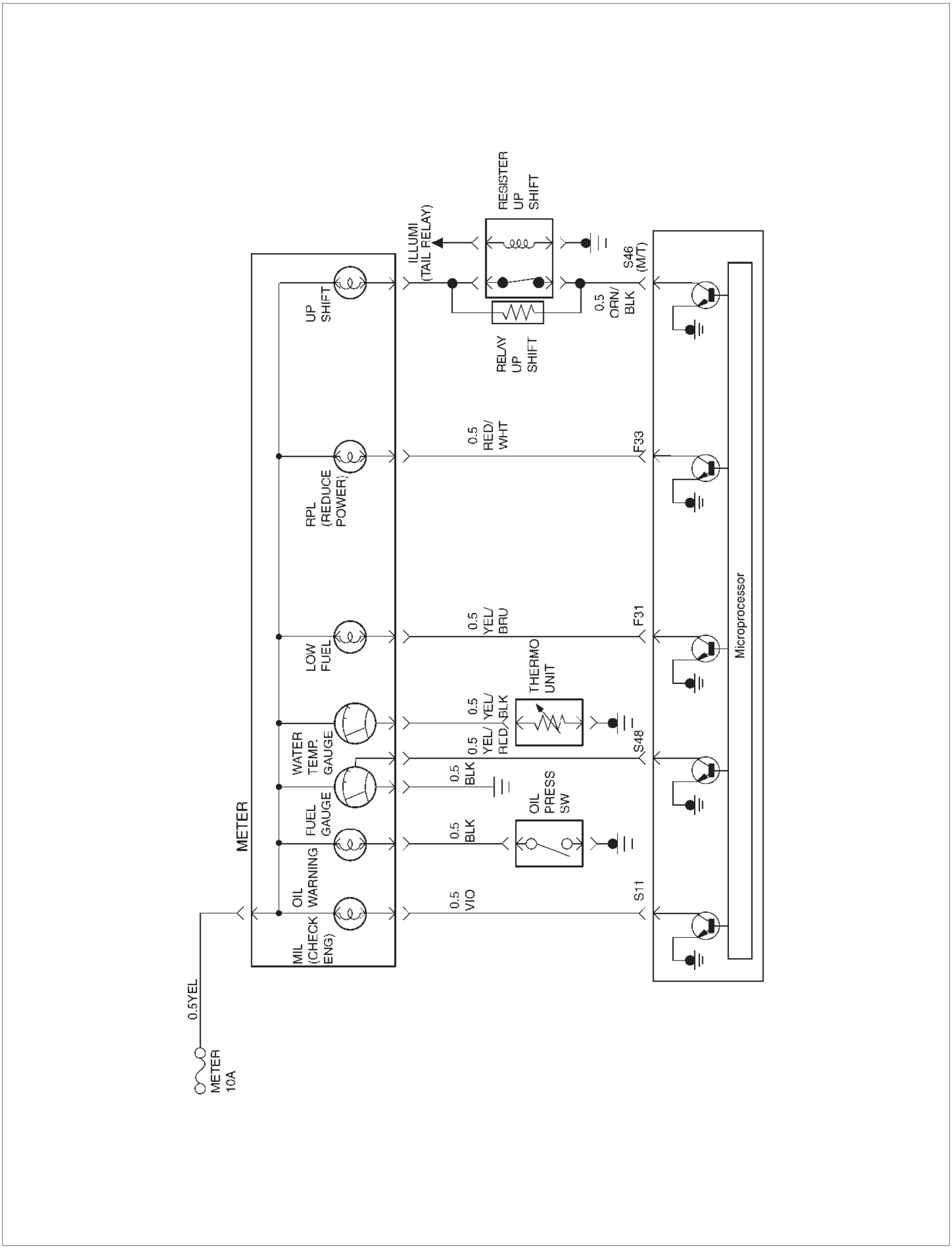
Evaporative (EVAP) Emissions Canister Purge Valve Check

Step	Action	Value(s)	Yes	No
1	1. Ignition "OFF." 2. Ignition "ON," engine "OFF." 3. At the throttle body, disconnect the hose that goes to the pump solenoid. 4. Using a hand vacuum pump with an attached vacuum gauge J 23738-A, apply vacuum (10" Hg or 34 kPa) to the solenoid. Does the solenoid hold the vacuum?	—	Go to *Step 3*	Go to *Step 2*
2	1. Disconnect the solenoid electrical connector. 2. As in Step 1, apply vacuum (10" Hg or 34 kPa) to the solenoid. Does the solenoid hold the vacuum?	—	Go to *Step 4*	Go to *Step 7*
3	1. At the throttle body, put a cap over the vacuum port where the hose was disconnected for testing. This is to prevent a vacuum leak when the engine is started. 2. Ignition "OFF." 3. Install the Tech 2. 4. Apply vacuum to the purge solenoid with the hand vacuum pump. 5. Start the engine, run at 2500 RPM. 6. Using the Tech 2, select Powertrain, 3.5–V6 6VE1, F3: Misc. Tests, F2: EVAP Purge, F0: EVAP Purge. (Refer to the Misellaneous Test.) 7. Turn the purge solenoid "ON." Did the vacuum drop when the purge was turned on?	—	Go to *Step 8*	Go to *Step 9*
4	Check for a short to ground in the RED/BLU wire. Is there a short?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the short to ground. Is the action complete?	—	Verify repair	—
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service*in *Powertrain Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
7	Replace the faulty purge solenoid. Refer to *On-Vehicle Service, EVAP Canister Purge Solenoid.* Is the action complete?	—	Verify repair	—

Evaporative (EVAP) Emissions Canister Purge Valve Check (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition "OFF." 2. At the throttle body, install a vacuum gauge where the hose from the purge solenoid was disconnected for testing. 3. Start the engine. 4. Stabilize the engine speed at about 2500 RPM. 5. Momentarily snap the throttle open and let it return to idle. Is there approximately 10" Hg (34 kPa) of vacuum available at the EVAP emission canister purge solenoid?	—	No problem found in the EVAP emission canister purge valve check	Refer to *Diagnostic Aids*
9	1. Disconnect the solenoid electrical connector. 2. Connect a test lamp between the harness terminals. Does the test lamp light?	—	Go to *Step 7*	Go to *Step 10*
10	Probe terminal A and terminal B with a test lamp to ground. Does the test lamp light on both terminals?	—	Go to *Step 11*	Go to *Step 12*
11	Repair the short to voltage in the RED/BLUE wire. Is the action complete?	—	Verify repair	—
12	Does on of the terminals light the test lamp?	—	Go to *Step 13*	Go to *Step 14*
13	Check for an open in the RED/BLU wire between the purge solenoid and the PCM. Was there an open circuit?	—	Go to *Step 15*	Go to *Step 6*
14	Repair the open in the BLK/YEL wire. Is the action complete?	—	Verify repair	—
15	Repair the open in the RED/BLU wire. Is the action complete?	—	Verify repair	—

Upshift Lamp System Check (Manual Transmission Only)



060RY00127

Circuit Description

The shift lamp indicates the best transmission shift point for maximum fuel economy.

The lamp is controlled by the Power Train Control Module (PCM) and is turned "ON" by grounding the BLK wire.

The PCM is used information from the following inputs to control the upshift lamp.

- Engine Coolant temperature (ECT) Sensor
- Throttle Position Sensor
- Vehicle Speed Sensor
- Engine Speed

The PCM uses the measured RPM and the vehicle speed to calculate what gear the vehicle is in.

It's this calculation that determines when the upshift lamp should be turned "ON".

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation. Check for poor connections or a damaged harness.

Inspect the PCM harness and connector for proper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.

Test Description

1. This should not turn "ON" the up-shift lamp. If the lamp is "ON", there is a short to ground in BLK or a fault PCM.
2. This checks the upshift lamp circuit up to the PCM connector.

   If the up-shift lamp illuminates, then the PCM connector is faulty or PCM does not have the ability to ground the circuit.

Up-Shift Lamp System Check

Step	Action	Value(s)	Yes	No
1	1. Verify the customer complaints in accordance with mentioned below: Go to the adequate Step Chart first. • At the 1st gear position, the lamp doesn't illuminate: Go to Step Chart • At the 3rd gear position, the lamp doesn't illuminate: Go to Step Chart • Upshift Lamp doesn't illuminate always. 2. Ignition "ON", engine "OFF". 3. Using the Tech 2, check to see if the upshift lamp turn "ON" or "OFF". Does the upshift lamp stay "OFF"?	—	Go to *Step 2*	Go to *Step 12*
2	Check for an open of 15A Turn Backup Fuse. Was a problem found?	—	Go to *Step 3*	Go to *Step 4* Refer to Section 8
3	Replace the fuse. Is the action complete?	Verify Repair	—	—
4	Check for an burned out the Upshift Lamp. Was a problem found?	—	Go to *Step 5*	Go to *Step 6*
5	Replace the Upshift Lamp. Is the action complete?	Verify Repair	—	—
6	1. Check for an Clutch Switch operation and the fixing condition. 2. Check for an open or short of clutch switch. 3. Check for an open or short of WHT/GRN wiring harness between Turn Backup Fuse and Clutch Switch. Was a problem found?	—	Go to *Step 7*	Go to *Step 8*

Up-Shift Lamp System Check (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Replace the Clutch Switch. Or, 2. Repair for an open or short of WHT/GRN wiring harness. Is the action complete?	Verify Repair	—	—
8	1. Check for an open or short of 1-2 Transmission Switch. 2. Check for an open or short of 3-4 Transmission Switch. 3. Check for an open or short of GRN wiring harness between Clutch Switch and Transmission Switches. Was a problem found?	—	Go to *Step 9*	Go to *Step 10*
9	1. Replace the applicable Transmission Switch. or, 2. Repair for an open or short of GRN wiring harness. Is the action complete?	Verify Repair	—	—
10	1. Check for an open or short in the Alarm and Relay Control Unit. 2. Check for an open of BLU/ORN wiring harness between Transmission Switches and Alarm Relay Control Unit. Was a problem found?	—	Go to *Step 11*	Go to *Step 12*
11	1. Replace the Alarm and Relay Control Unit. Or, 2. Repair for an open of BLU/ORN wiring harness between Alarm and Relay Control Unit and PCM connector. Is the action complete?	Verify Repair	—	Go to *Step 15*
12	1. Ignition "OFF". 2. Disconnect the PCM connectors. 3. Shift the gear to 1^{st} or 4^{th} gear position. 4. Turn ignition "ON", but *don't start the engine*. Does the Upshift Lamp Stay "ON"?	—	Go to *Step 13*	Go to *Step 15*
13	Check for an short to ground of YEL/GRN wiring harness between Alarm and PCM connector. Was a problem found?	—	Go to *Step 14*	Go to *Step 15*
14	Repair for an open YEL/GRN wiring harness. Is the action complete?	Verify Repair	—	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed refer to *ON-Vehicle Service in Power Train Control Module and Sensor* for procedure. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	—	—

PCM Diagnostic Trouble Codes

The following table lists the diagnostic trouble codes supported by this vehicle application. If any DTCs not listed here are displayed by a Tech 2, the Tech 2 data may be faulty; notify the Tech 2 manufacturer of any DTCs displayed that are not included in the following table.

PCM Diagnostic Trouble Codes

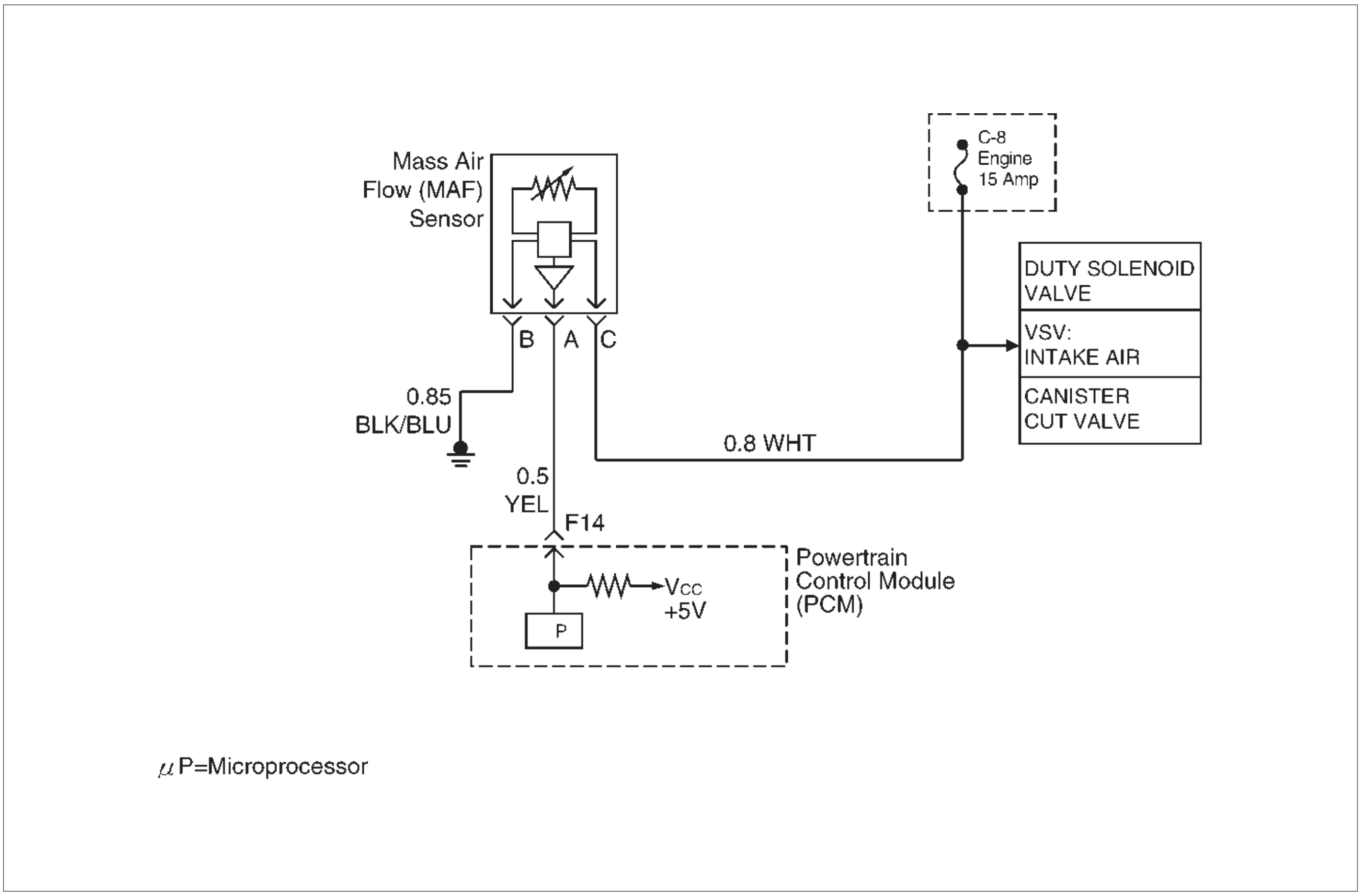
DTC	Description	Type	Illuminate MIL (Check Enigne Lamp)	Illuminate RPL (Reduced Power Lamp)
P0101	MAF System Performance	B	Yes	No
P0102	MAF Sensor Circuit Low Frequency	B	Yes	No
P0103	MAF Sensor Circuit High Frequency	B	Yes	No
P0106	MAP Rationality/Performance	B	Yes	No
P0107	MAP Circuit Low Input Voltage	B	Yes	No
P0108	MAP Circuit Hgh Input Voltage	B	Yes	No
P0112	IAT Circuit Low Input Voltage	B	Yes	No
P0113	IAT Circuit Hgh Input Voltage	B	Yes	No
P0117	ECT Circuit Low Input Voltage	B	Yes	No
P0118	ECT Circuit Hgh Input Voltage	B	Yes	No
P0125	ECT Insufficient for Closed Loop Fuel Control	B	Yes	No
P0128	ECT Below Thermostat Regulating Temperature	B	Yes	No
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	B	Yes	No
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	B	Yes	No
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	B	Yes	No
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	B	Yes	No
P0135	O2 Sensor Heater Circuit (Bank 1 Sensor 1)	B	Yes	No
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	B	Yes	No
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	B	Yes	No
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	B	Yes	No
P0141	O2 Sensor Heater Circuit (Bank 1 Sensor 2)	B	Yes	No
P0151	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)	B	Yes	No
P0152	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)	B	Yes	No
P0153	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)	B	Yes	No
P0154	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)	B	Yes	No
P0155	O2 Sensor Heater Circuit (Bank 2 Sensor 1)	B	Yes	No
P0157	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2)	B	Yes	No
P0158	O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)	B	Yes	No
P0160	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 2)	B	Yes	No
P0161	O2 Sensor Heater Circuit (Bank 2 Sensor 2)	B	Yes	No
P0171	O2 Sensor – System too Lean (Bank 1)	B	Yes	No
P0172	O2 Sensor – System too Rich (Bank 1)	B	Yes	No
P0174	O2 Sensor – System too Lean (Bank 2)	B	Yes	No

DTC	Description	Type	Illuminate MIL (Check Enigne Lamp)	Illuminate RPL (Reduced Power Lamp)
P0175	O2 Sensor – System too Rich (Bank 2)	B	Yes	No
P0201	Injector 1 Control Circuit	A	Yes	No
P0202	Injector 2 Control Circuit	A	Yes	No
P0203	Injector 3 Control Circuit	A	Yes	No
P0204	Injector 4 Control Circuit	A	Yes	No
P0205	Injector 5 Control Circuit	A	Yes	No
P0206	Injector 6 Control Circuit	A	Yes	No
P0300	Engine Misfire Detected	B	Yes	No
P0301	Engine Misfire Detected Cylinder #1	B	Yes	No
P0302	Engine Misfire Detected Cylinder #2	B	Yes	No
P0303	Engine Misfire Detected Cylinder #3	B	Yes	No
P0304	Engine Misfire Detected Cylinder #4	B	Yes	No
P0305	Engine Misfire Detected Cylinder #5	B	Yes	No
P0306	Engine Misfire Detected Cylinder #6	B	Yes	No
P0325	ION Sensing Module Knock Intensity Circuit	B	Yes	No
P0336	CKP Sensor Circuit Range/Performance (58X)	B	Yes	No
P0337	CKP Sensor Circuit No signal (58X)	B	Yes	No
P0341	CMP Sensor Circuit Range/Performance	C	No	No
P0342	CMP Sensor Circuit No signal	C	No	No
P0351	Injection 1 Control Circuit	A	Yes	No
P0352	Ignition 2 Control Circuit	A	Yes	No
P0353	Ignition 3 Control Circuit	A	Yes	No
P0354	Ignition 4 Control Circuit	A	Yes	No
P0355	Ignition 5 Control Circuit	A	Yes	No
P0356	Ignition 6 Control Circuit	A	Yes	No
P0401	EGR Flow Insufficient	B	Yes	No
P0402	EGR Flow Excessive	B	Yes	No
P0404	EGR Range/Performance (Open Valve)	B	Yes	No
P0405	EGR Sensor Circuit Low Voltge	B	Yes	No
P0406	EGR Sensor Circuit High Voltge	B	Yes	No
P0420	Catalyst System Low Efficiency (Bank 1)	A	Yes	No
P0430	Catalyst System Low Efficiency (Bank 2)	A	Yes	No
P0440	EVAP Control System	B	Yes	No
P0442	EVAP Control System Small Leak Deteced	B	Yes	No
P0446	EVAP Control System Vent Valve Blocked	B	Yes	No
P0452	EVAP Control System Tank Pressure Sensor Low Input	B	Yes	No
P0453	EVAP Control System Tank Pressure Sensor High Input	B	Yes	No
P0456	EVAP Control System Very Small Leak Deteced	C	No	No
P0461	Fuel Level Sensor Circuit Range/Performance	B	Yes	No
P0462	Fuel Level Sensor Circuit Low Input Voltage	B	Yes	No

DTC	Description	Type	Illuminate MIL (Check Enigne Lamp)	Illuminate RPL (Reduced Power Lamp)
P0463	Fuel Level Sensor Circuit High Input Voltage	B	Yes	No
P0502	No VSS Signal	B	Yes	No
P0506	Idle Speed Control RPM too Low	B	Yes	No
P0507	Idle Speed Control RPM too High	B	Yes	No
P0562	System Voltge is Low	D	No	No
P0563	System Voltge is High	B	Yes	No
P0565	Cruise Main Circuit (Refer to Chassis Electrical)	D	No	No
P0566	Cruise Cancel Circuit (Refer to Chassis Electrical)	D	No	No
P0567	Cruise Resume Circuit (Refer to Chassis Electrical)	D	No	No
P0568	Cruise Set Circuit (Refer to Chassis Electrical)	D	No	No
P0575	Cruise Analog Input Circuit (Refer to Chassis Electrical)	C	No	No
P0601	PCM/ECM Memory Checksum	A	Yes	No
P0602	PCM/ECM Programming error	D	No	No
P0604	PCM/ECM RAM error	D	No	No
P0606	PCM/ECM Internal Preformance	D	No	No
P1106	MAP Circuit Intermittent High Voltage)	D	No	No
P1107	MAP Circuit Intermittent Low Input Voltage	D	No	No
P1111	IAT Circuit Intermittent High Voltage	D	No	No
P1112	IAT Circuit Intermittent Low Input Voltage	D	No	No
P1114	ECT Circuit Intermittent Low Voltage	D	No	No
P1115	ECT Circuit Intermittent High Voltage	D	No	No
P1120	TPS1 Circuit	D	No	No
P1125	ETC Limit Performance Mode	A	Yes	Yes
P1133	O2 Sensor – Too Few Rich/Lean and Lean/Rich Switches (Bank 1 Sensor 1)	B	Yes	No
P1134	O2 Sensor – Transition Switch Time ratio (Bank 1 Sensor 1)	B	Yes	No
P1153	O2 Sensor – Too Few Rich/Lean and Lean/Rich Switches (Bank 2 Sensor 1)	B	Yes	No
P1154	O2 Sensor – Transition Switch Time ratio (Bank 2 Sensor 1)	B	Yes	No
P1167	Fuel supply System RICH During Decel Fuel Cut Off	D	No	No
P1169	Fuel supply System RICH During Decel Fuel Cut Off	D	No	No
P1171	Fuel supply System Lean During Power Enrichment	D	No	No
P1220	TPS2 Circuit	D	No	No
P1221	TPS1–TPS2 Correlation (Circuit Performance)	D	No	No
P1271	APS1–APS2 Correlation (Circuit Performance)	D	No	No
P1272	APS2–APS3 Correlation (Circuit Performance)	D	No	No
P1273	APS1–APS3 Correlation (Circuit Performance)	D	No	No
P1275	APS1 Circuit	D	No	No
P1280	APS2 Circuit	D	No	No
P1285	APS3 Circuit	D	No	No
P1290	ETC Forced Idle Mode	A	Yes	Yes

DTC	Description	Type	Illuminate MIL (Check Enigne Lamp)	Illuminate RPL (Reduced Power Lamp)
P1295	ETC Power Management Mode	A	Yes	Yes
P1299	ETC Forced Engine Shotdown Mode	A	Yes	Yes
P1310	ION Sensing Module Diagnostic	A	Yes	No
P1311	ION Sensing Module SEC 1 Line Circuit Fault	A	Yes	No
P1312	ION Sensing Module SEC 2 Line Circuit Fault	A	Yes	No
P1326	ION Sensing Module Combustion Quality circuit	A	Yes	No
P1340	ION Sensing Module – Cylinder Synchronization	B	Yes	No
P1404	EGR Range/Performance (Closed Valve)	B	Yes	No
P1441	EVAP Control System Comtinuous Open Puege Flow	B	Yes	No
P1514	TPS–MAF Correlation	A	Yes	No
P1515	Command–Acrual TPS Correlation	A	Yes	No
P1516	Command–Acrual TPS Correlation Error	A	Yes	No
P1523	Throttle Actuator Control Return Performance	D	No	No
P1625	PCM/ECM System Reset	C	No	No
P1635	Reference Voltage #1 Ciecuit	D	No	No
P1639	Reference Voltage #2 Ciecuit	D	No	No
P1640	ODM Output circuit Fault	D	No	No
P1650	QDM Output Circuit Fault	D	No	No

Diagnostic Trouble Code (DTC) P0101 MAF System Performance



D06RY00164

Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity or air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load. DTC P0101 will be set if the signal from the MAF sensor does not match a predicted value based on throttle position and engine RPM.

Conditions for setting the DTC

- The engine is running.
- No TP sensor and MAP sensor DTCs are set.
- No MAF frequency DTCs are set.
- System voltage is between 11.5 volts and 16 volts.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P0101 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P0101 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.
- he duct work at the MAF sensor for leaks.
- An engine vacuum leak.
- The PCV system for vacuum leaks.
- An incorrect PCV valve.
- The engine oil dip stick not fully seated.
- The engine oil fill cap loose or missing.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness- Inspect the wiring harness for damage. If the harness appears to be OK, observe the Mass Air Flow (MAF) display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.
- Plugged intake air duct or filter element
- A wide–open throttle acceleration from a stop should cause the mass air flow displayed on a Tech 2 to increase from about 3–6 g/s at idle to 100 g/s or greater at the time of the 1–2 shift. If not, check for a restriction.

A change in the display will indicate the location of the fault.

If DTC P0101 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P001 Diagnostic Chart may isolate the cause of the fault.

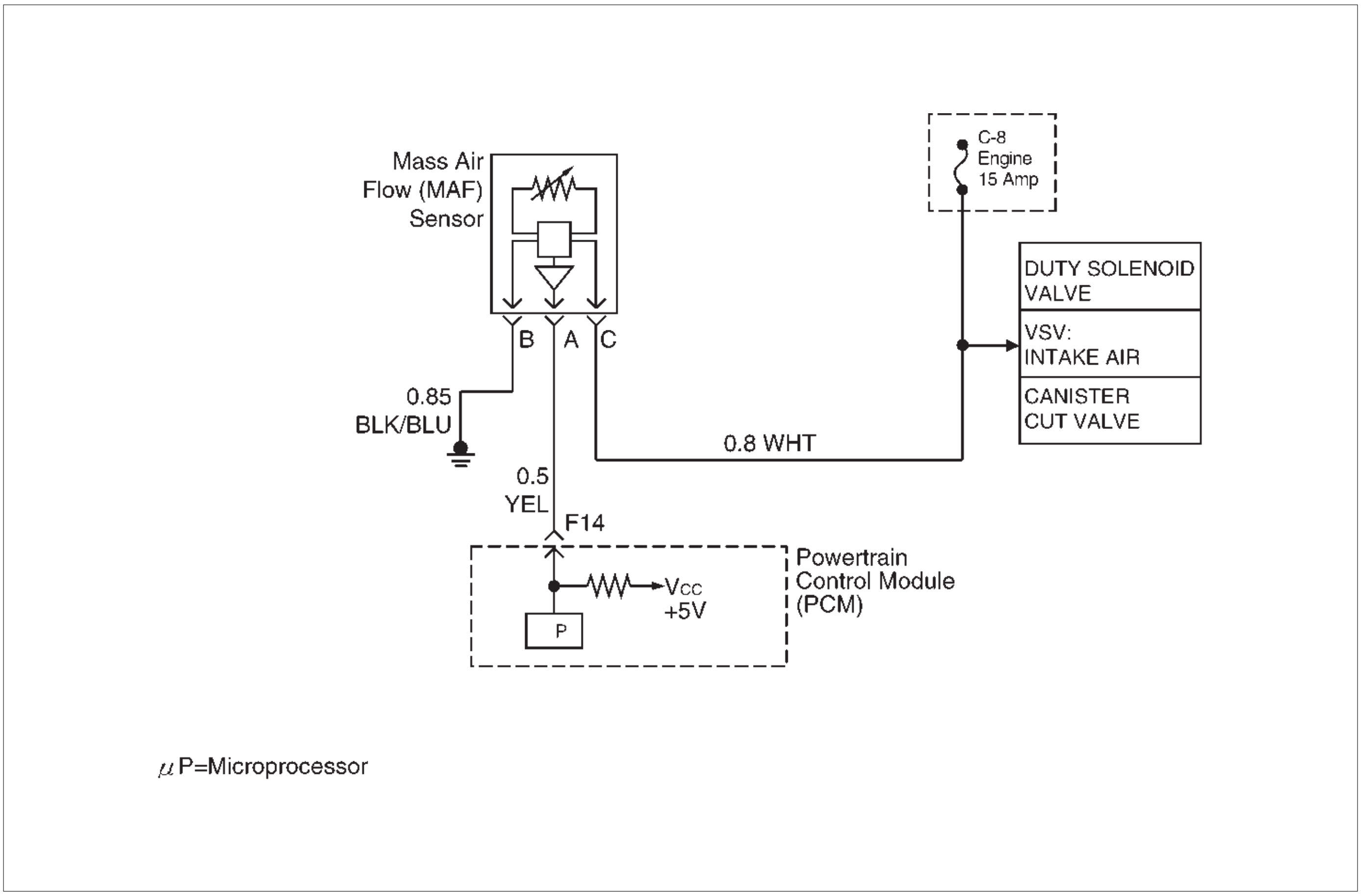
DTC P0101 – MAF System Performance

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "OFF." 2. Disconnect the Mass Air Flow (MAF) Sensor harness connector from the MAF Sensor. 3. Place an unpowered test lamp between the 12 volt signal circuit and the ground circuit, both at the MAF Sensor connector. 4. Ignition "ON," Engine"OFF." Did the test lamp illuminate?	—	Go to *Step 6*	Go to*Step 3*
3	1. Ignition "ON," Engine "OFF." 2. Using a Digital Voltmeter (DVM), check the 12 volt signal circuit for the correct voltage. Did the DVM indicate a value within the following range?	11.5 to 12.5 Volt	Go to *Step 5*	Go to *Step 4*
4	1. Ignition "OFF." 2. Check the 12 volt signal circuit for the following conditions: • An open circuit • A short to ground Was the problem found?	—	Verify repair	—
5	Check the MAF ground circuit for the following conditions: • An open circuit • A short to voltage Was a problem found?	—	Verify repair	—
6	1. Ignition "OFF." 2. Check the MAF Sensor signal circuit between the PCM and the MAF Sensor for the following conditions: • An open circuit • A short to ground • A short to battery voltage Was a problem found?	—	Verify repair	Go to *Step 7*

DTC P0101 – MAF System Performance (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Connect the MAF Sensor wiring harness connector to the MAF Sensor. 2. Connect the Tech 2 to the vehicle. 3. Place the Transmission in Park/Neutral, and fully apply the Parking Brake. 4. Start the engine. 5. Select the Mass Air Flow (MAF) parameter on the Tech 2. With the engine idling, does the Tech 2 display the following value(s)?	4 to 7 g/s	Go to *Step 8*	Go to *Step 9*
8	Observe the Tech 2 value while increasing the engine RPM to its upper limit. Does the Tech 2 display the following value(s)?	25 to 40 g/s	Go to *Step 10*	Go to *Step 9*
9	Replace the MAF Sensor. Is the action complete?	—	Verify repair	—
10	Replace the PCM. **IMPORTANT:** The PCM must be reprogrammed. Refer to PCM reprogramming. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0102 MAF Sensor Circuit Low Frequency



D06RY00164

Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40 g/s at maximum engine load. DTC P0102 will be set if the signal from the MAF sensor is below the possible range of a normally operating MAF sensor.

Conditions for Setting the DTC

- The engine is running above 500 RPM for greater than 10 seconds.
- System voltage is above 11.5 volts.
- MAF signal frequency is below 1.6g/s for a total of 50-percent of the last 1000 samples monitored. A sample is taken every cylinder event.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0102 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0102 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Misrouted harness – Inspect the MAF sensor harness to ensure that it is not routed too close to high voltage wires.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 while moving connectors and wiring harnesses related to the MAF sensor. A change in the display will indicate the location of the fault.
- Plugged intake air duct or filter element – A wide-open throttle acceleration from a stop should cause the mass air flow displayed on a Tech 2 to increase from

about 3-6 g/second at idle to 100 g/second or greater at the time of the 1-2 shift. If not, check for a restriction.

If DTC P0102 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. This step verifies that the problem is present at idle.
4. A voltage reading of less than 4 or over 5 volts at the MAF sensor signal circuit indicates a fault in the wiring or a poor connection.
5. This verifies that ignition feed voltage and a good ground are available at the MAF sensor.

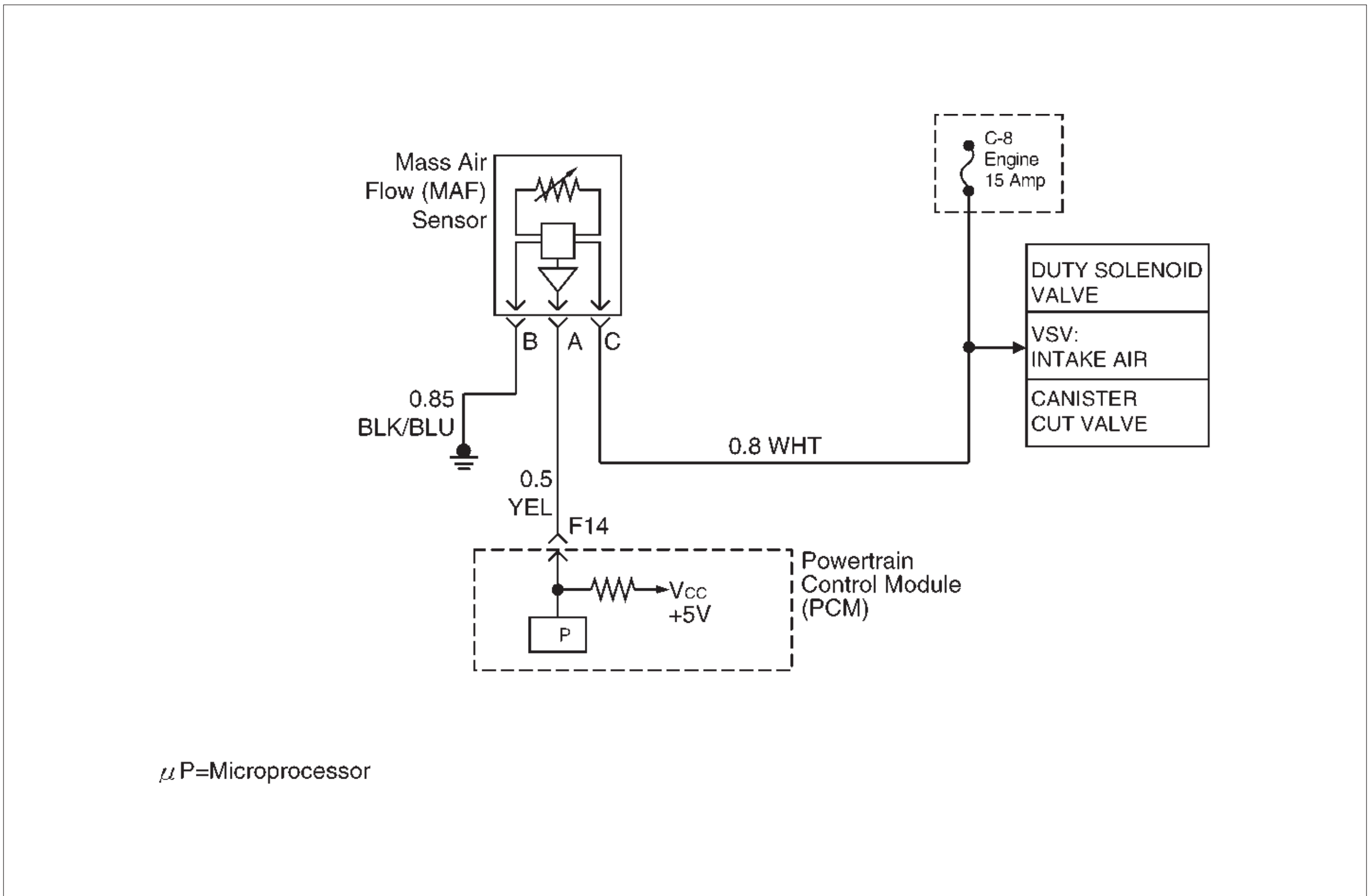
DTC P0102 – MAF Sensor Circuit Low Frequency

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. 2. With the engine idling, monitor "MAF Frequency" display on the Tech 2. Is the "MAF Frequency" below the specified value?	1.6 g/s	Go to *Step 4*	Go to *Step 5*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0102. Does the Tech 2 indicate DTC P0102 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF." 2. Disconnect the MAF sensor connector. 3. Ignition "ON," engine "OFF." 4. Using a DVM, measure voltage between the MAF sensor signal circuit and battery ground. Is the voltage near the specified value?	5 V	Go to *Step 5*	Go to *Step 8*
5	Connect a test light between the MAF sensor ignition feed and ground circuits at the MAF sensor harness connector. Is the test light "ON?"	—	Go to *Step 13*	Go to *Step 6*
6	Connect a test light between the MAF sensor ignition feed circuit and battery ground. Is the test light "ON?"	—	Go to *Step 12*	Go to *Step 7*
7	1. Check for a poor connection at the MAF sensor. 2. If a poor connection is found, replace the faulty terminal(s). Was a poor connection found?	—	Verify repair	Go to *Step 11*
8	1. Ignition "OFF." 2. Disconnect the MAF sensor. 3. Disconnect the PCM connector for the MAF signal circuit. 4. Ignition "ON," engine "OFF." 5. With the DVM, measure the voltage between the MAF signal terminal at the PCM and battery ground. Is the voltage under the specified value?	4 V	Go to *Step 9*	Go to *Step 10*

DTC P0102 – MAF Sensor Circuit Low Frequency (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Ignition "OFF." 2. Disconnect the PCM connector. 3. Ignition "ON." 4. Check the MAF sensor signal circuit for a short to 5 volts. Is the action complete?	—	Verify repair	—
10	1. Ignition "OFF." 2. Disconnect the PCM connector. 3. Ignition "ON." 4. Check the MAF sensor signal circuit between the PCM and the MAF sensor for an open, short to ground, or short to the MAF ground circuit. Is the action complete?	—	Verify repair	Go to *Step 13*
11	Locate and repair the open in the ground circuit to the MAF sensor. Is the action complete?	—	Verify repair	—
12	Locate and repair the open in the ignition feed circuit to the MAF sensor. Is the action complete?	—	Verify repair	—
13	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 14*
14	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0103 MAF Sensor Circuit High Frequency



D06RY00164

Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40 g/s at maximum engine load. DTC P0103 will be set if the signal from the MAF sensor is above the possible range of a normally operating MAF sensor.

Conditions for Setting the DTC

- The engine is running above 500 RPM for more than 10 seconds.
- System voltage is above 11.5 volts.
- MAF signal frequency is above 40g/s for a total of 50 percent of the last 200 samples monitored. A sample is taken every cylinder event.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an airflow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0103 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0103 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

If DTC P0103 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

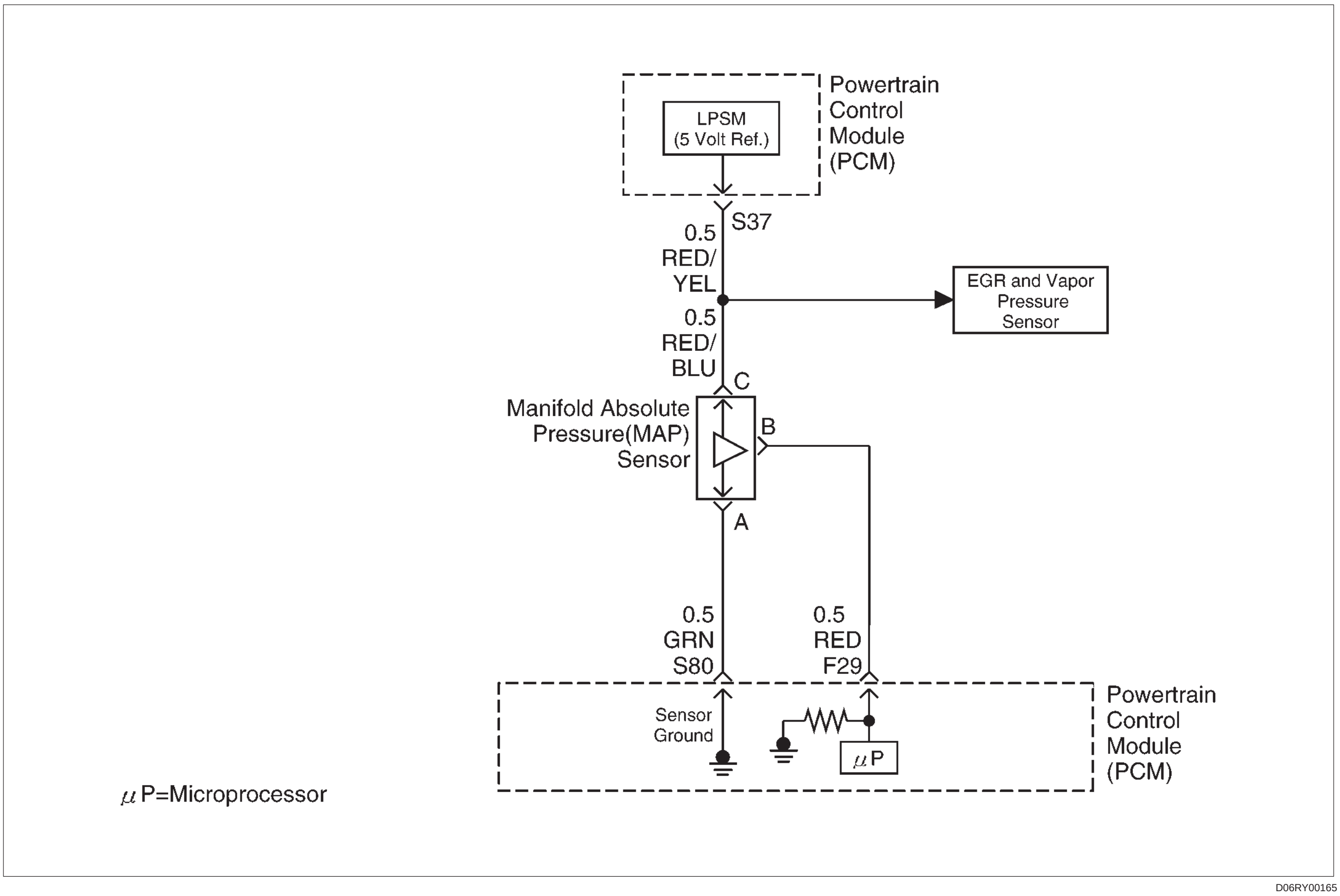
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. This step verifies that the problem is present at idle.
4. A frequency reading with the MAF sensor connector disconnected indicates an electromagnetic interfernce (EMI) related fault.
8. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed. Refer to *PCM Replacement and Programming Procedures* in *Powertrain Control Module (PCM) and Sensor*.

DTC P0103 – MAF Sensor Circuit High Frequency

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0103. Does the Tech 2 indicate DTC P0103 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Start the engine. 2. With the engine idling, monitor “MAF Frequency” display on the Tech 2. Is “MAF Frequency” above the specified value?	40g/s	Go to *Step 4*	Go to *Step 7*
4	1. Ignition “OFF.” 2. Disconnect the MAF sensor connector. 3. Ignition “ON,” engine idling. 4. Using a Tech 2, monitor “MAF Frequency.” Does the Tech 2 indicate a “MAF Frequency” at the specified value?	0g/s	Go to *Step 5*	Go to *Step 6*
5	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 8*
6	1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors). 2. If incorrect routing is found, correct the harness routing. Was a problem found?	—	Verify repair	Go to *Step 6*
7	1. With the engine idling, monitor “MAF Frequency” display on the Tech 2. 2. Quickly snap open throttle to wide open throttle while under a road load and record value. Does the Tech 2 indicate “MAF Frequency” above the specified value?	40g/s	Go to *Step 5*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0106 MAP System Performance



Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts at wide-open throttle (low vacuum) at sea level.

The MAP sensor is used to determine: manifold pressure changes while the linear exhaust gas recirculation (EGR) flow test diagnostic is being run (refer to DTC P0401), engine vacuum level for some other diagnostics, and barometric pressure (BARO). The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factor. If the PCM detects a MAP signal that varies excessively above or below the calculated value, DTC P0106 will set.

Conditions for Setting the DTC

- No TP sensor DTCs are present.
- Engine speed is steady, changing less then 100 RPM.
- Throttle position is steady, throttle angle changes less than 1%.
- EGR flow rate is steady, changing less than 4%.
- No change in brake switch, A/C clutch, TCC or power steering pressure switch status.
- Above conditions are met for longer than 1 second.
- Actual MAP value varies more than 10 kPa.
- The MAP value must vary for a total of 10 seconds over a 20-second period of time that the samples were monitored.
- The failure must occur for 2 consecutive trips.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0106 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0106 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0106 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1107 Diagnostic Chart may isolate the cause of the fault.

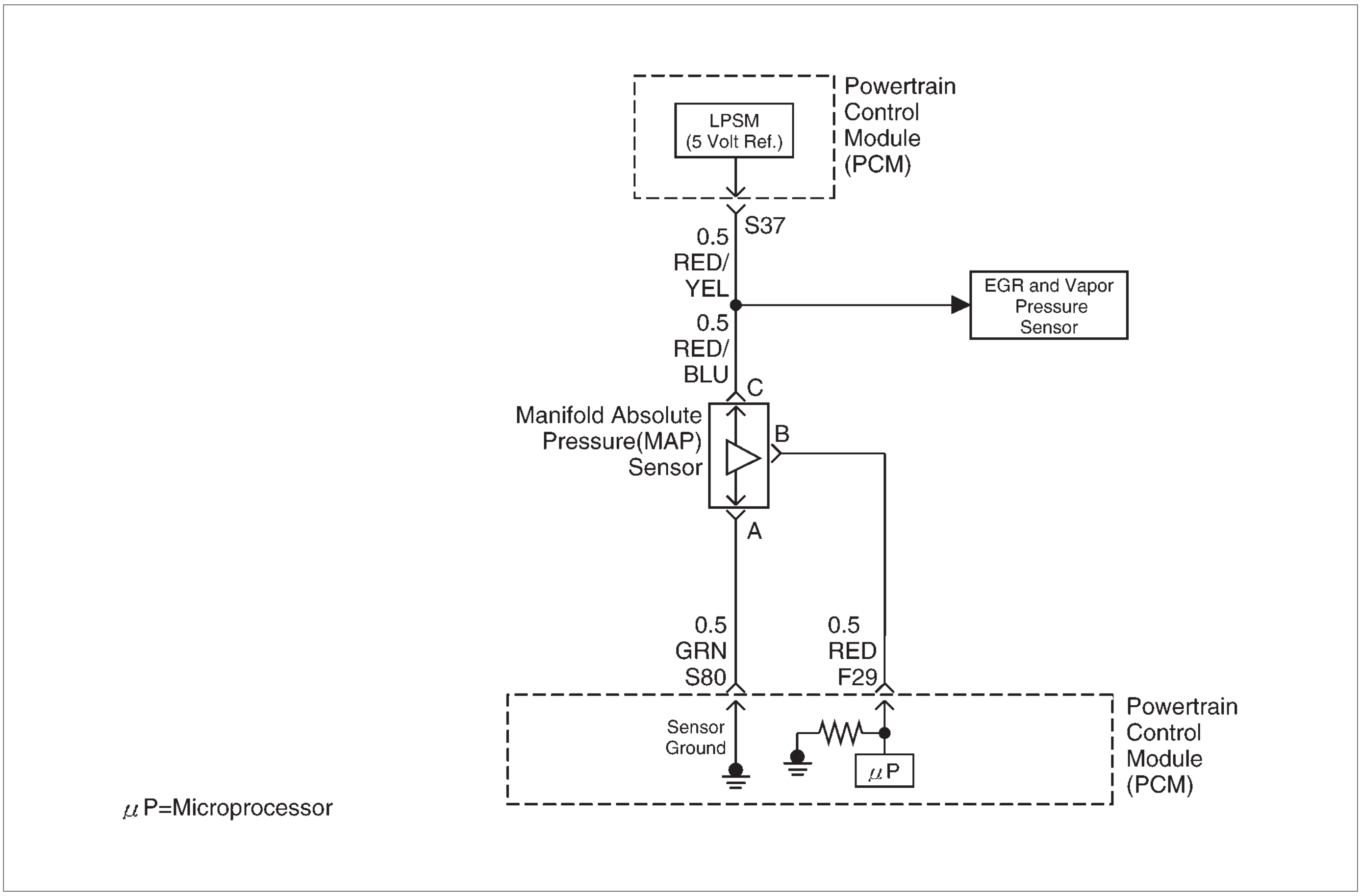
DTC P0106 – MAP System Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0106. Does the Tech 2 indicate DTC P0106 failed?	—	Go to *Step 4*	Go to *Step 3*
3	1. Check for the following conditions: • Vacuum hoses disconnected, damaged, or incorrectly routed; • Intake manifold vacuum leaks; • Vacuum leaks at throttle body; • Vacuum leaks at EGR valve flange and pipes; • Crankcase ventilation valve faulty, missing or incorrectly installed. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*
4	1. Disconnect the MAP sensor electrical connector. 2. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	11 kPa	Go to *Step 5*	Go to *Step 13*
5	1. Connect a test light between B+ and the MAP sensor signal circuit at the MAP sensor harness connector. 2. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	105 kPa	Go to *Step 6*	Go to *Step 9*
6	1. Jumper the 5 volt reference circuit and the MAP signal circuit together at the MAP sensor harness connector. 2. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	104 kPa	Go to *Step 7*	Go to *Step 8*
7	1. Ignition “OFF.” 2. Disconnect the PCM and check the sensor ground circuit for high resistance, an open between the PCM and the MAP sensor, or for a poor connection at the PCM. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*

DTC P0106 – MAP System Performance (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Check the 5 volt reference circuit for high resistance, an open between the PCM and the MAP sensor, or a poor connection at the PCM. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
9	1. Ignition "OFF." 2. Disconnect the PCM, and check the MAP sensor signal circuit for high resistance, an open, a short to ground, or a short to the sensor ground circuit. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check the MAP sensor signal circuit for a poor connection at the PCM. 2. If a problem is found, repair as necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
11	1. Check for a poor connection at the MAP sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
13	1. Ignition "OFF," disconnected the PCM. 2. Ignition "ON," check the MAP signal circuit for a short to voltage or a short to the 5 volt reference circuit. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0107 MAP Sensor Circuit Low Voltage



D06RY00165

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition “ON,” engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the exhaust gas recirculation (EGR) flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively low, DTC P0107 will be set.

Conditions for Setting the DTC

- No TP sensor DTCs present.
- Engine is running.
- Throttle angle is above 1% if engine speed is less than 1000 RPM.
- Throttle angle is above 2% if engine speed is above 1000 RPM.
- The MAP sensor indicates manifold absolute pressure at or below 11 kPa for a total of approximately 10 seconds over a 16-second period.
- Ignition voltage more than 11 volts.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0107 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0107 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Check for intermittent codes.
- The MAP sensor shares a 5 Volt reference with the Fuel Tank Pressure Sensor. If these codes are also set, it could indicate a problem with the 5 Volt reference circuit .
- The MAP sensor shares a ground with the Fuel Tank Pressure Sensor, the ECT sensor, and the Transmission Fluid Temperature sensor.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0107 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P0107 Diagnostic Chart may isolate the cause of the fault.

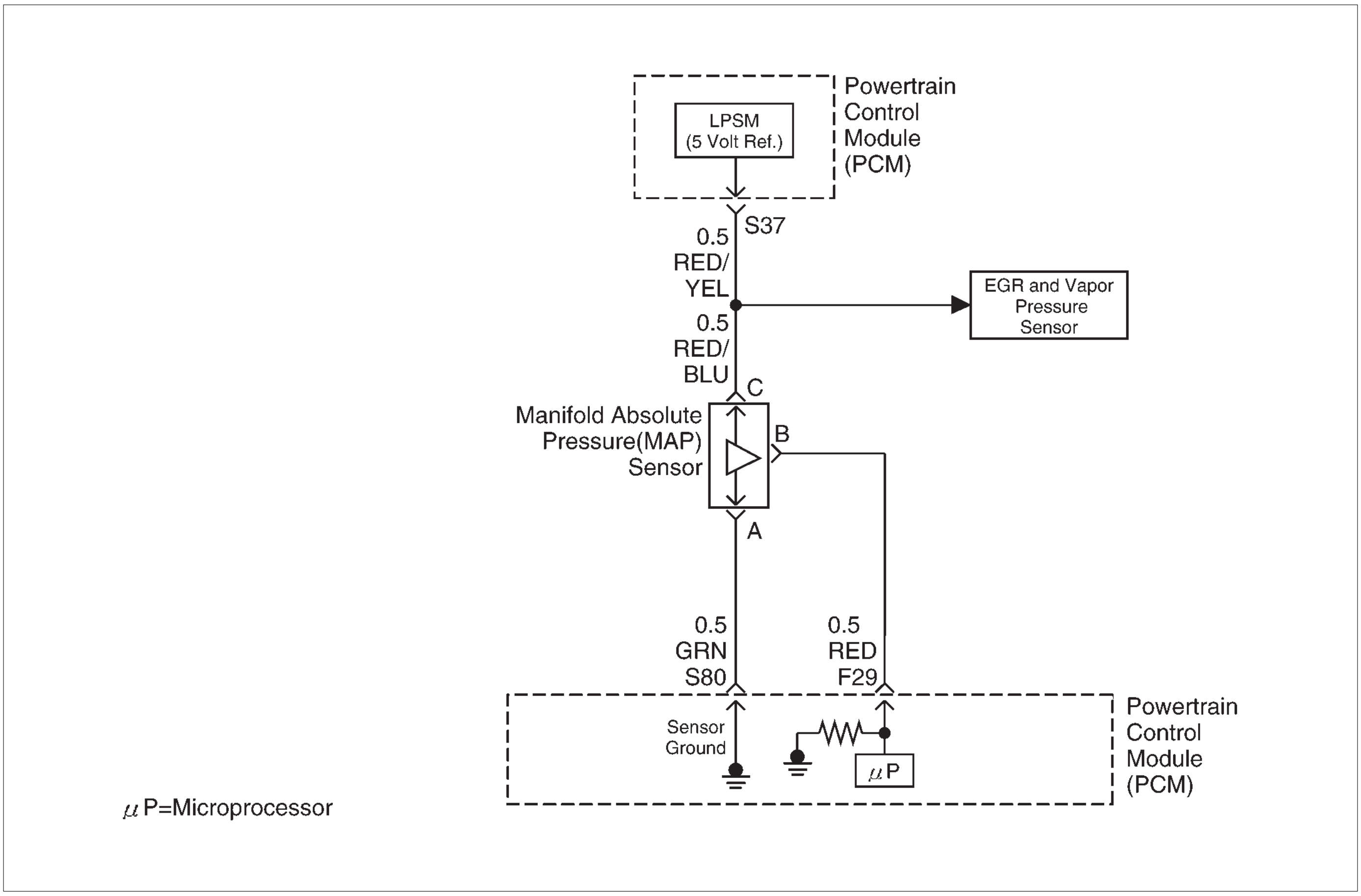
DTC P0107 – MAP Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. With the throttle closed, observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	0 V 11 kPa at sea level	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0107. Does the Tech 2 indicate DTC P0107 failed?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF." 2. Disconnect the MAP sensor electrical connector. 3. Jumper the 5 volt reference circuit and the MAP signal together at the MAP sensor harness connector. 4. Ignition "ON." 5. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.)	5 V 104 kPa	Go to *Step 10*	Go to *Step 5*
5	1. Disconnect the jumper. 2. Connect a test light between B+ and the MAP sensor signal circuit at the MAP sensor harness connector. 3. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value.	5 V 104 kPa	Go to *Step 6*	Go to *Step 8*
6	1. Ignition "OFF." 2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground. 3. If the 5 volt reference circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference circuit open or shorted to ground?	—	Verify repair	Go to *Step 7*
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 11*

DTC P0107 – MAP Sensor Circuit Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF." 2. Disconnect the PCM, and check the MAP signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. If the MAP sensor signal circuit is open or shorted to ground, repair it as necessary. Was the MAP signal circuit open or shorted to ground?	—	Verify repair	Go to *Step 9*
9	Check the MAP sensor signal circuit for a poor connection at the PCM and the MAP sensor; replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 11*
10	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0108 MAP Sensor Circuit High Voltage



D06RY00165

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the key "ON," engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively high, DTC P0108 will be set.

Conditions for Setting the DTC

- No TP sensor DTCs present.
- Engine is running for more than 10 seconds.
- Throttle position is below 3% if engine speed is below 1000 RPM.
- Throttle position is below 10% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure above 80 kPa for a total of approximately 10 seconds over a 16-second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0108 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0108 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- The MAP sensor shares a 5 Volt reference with the Fuel Tank Pressure Sensor. If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the Fuel Tank Pressure Sensor (Vapor Pressure Sensor), the ECT sensor, and the Transmission Fluid Temperature sensor.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0108 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1108 Diagnostic Chart may isolate the cause of the fault.

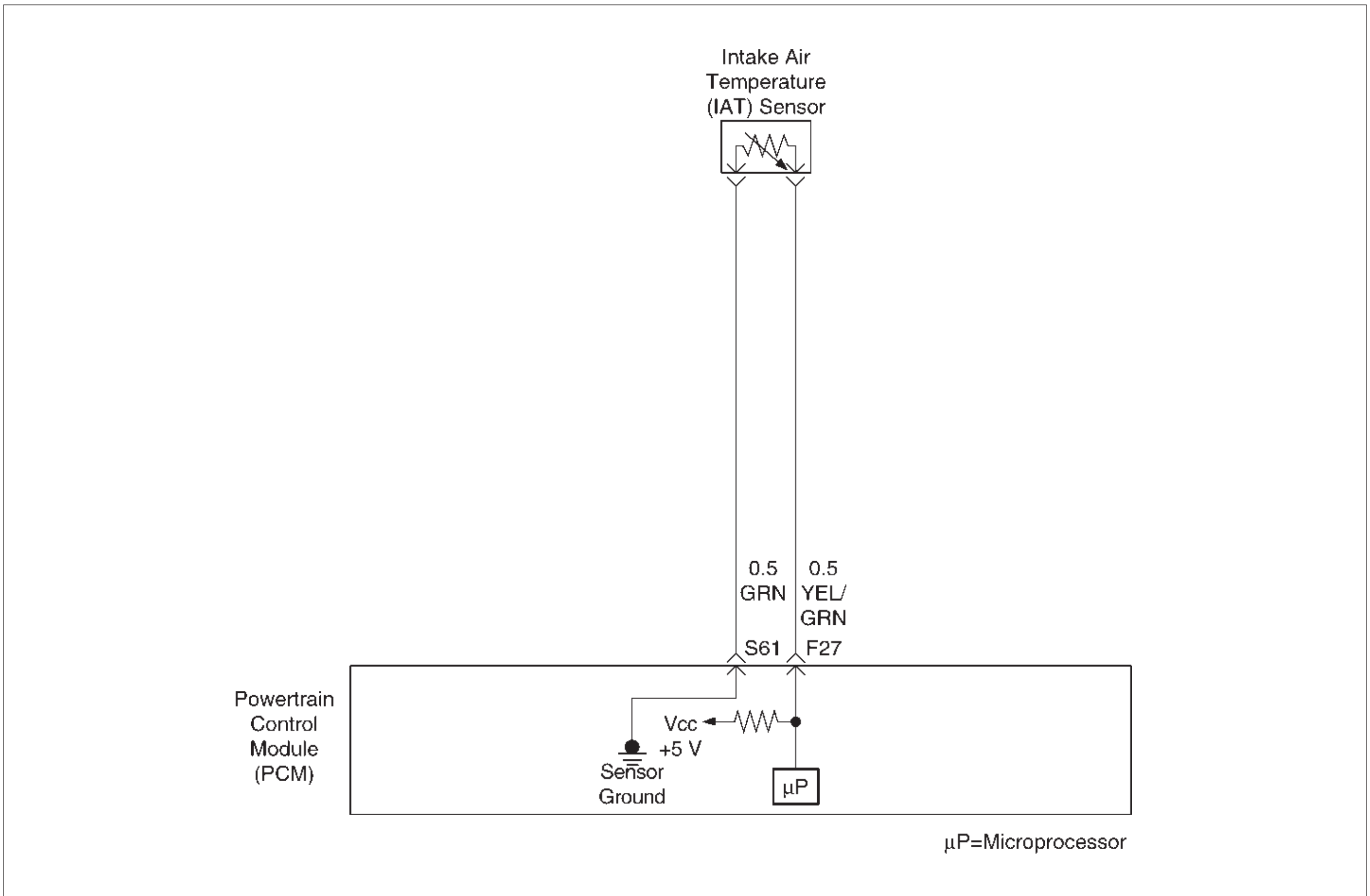
DTC P0108 – MAP Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. If the engine idle is rough, unstable or incorrect, repair the idle problem before using this chart. Refer to *Symptoms* section. 2. With the engine idling, note the MAP value on the Tech 2. Is the MAP reading above the specified value?	90 kPa	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0108. Does the Tech 2 indicate DTC P0108 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF." 2. Disconnect the MAP sensor electrical connector. 3. Ignition "ON." 4. Note the MAP sensor voltage displayed on the Tech 2. (If no, start with diagnostic chart for other sensors in the circuit and see if 5V returns.) Is the MAP sensor voltage at the specified value?	11 kPa 0.0 V	Go to *Step 5*	Go to *Step 6*
5	Probe the sensor ground circuit with a test light to B+. Is the test light "ON?"	—	Go to *Step 7*	Go to *Step 9*
6	1. Check the MAP signal circuit for a short to voltage or a short to the 5 volt reference circuit. 2. If the MAP sensor signal circuit is shorted, repair circuit as necessary. Was the MAP sensor signal circuit shorted?	—	Verify repair	Go to *Step 11*
7	1. Check for a poor sensor ground terminal connection at the MAP sensor electrical connector. 2. If a problem if found, replace the faulty terminal. Did the terminal require replacement?	—	Verify repair	Go to *Step 8*
8	Check for a plugged or leaking vacuum supply to the MAP sensor. Is the vacuum supply plugged or leaking?	—	Verify repair	Go to *Step 12*
9	1. Check for a poor sensor ground terminal connection at the PCM. 2. If a problem is found, replace the faulty terminal. Did the terminal require replacement?	—	Verify repair	Go to *Step 10*

DTC P0108 – MAP Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check the continuity of the MAP sensor ground circuit. 2. If the MAP sensor ground circuit measures over 5 ohms, repair open or poor connection. Was a condition found and corrected?	—	Verify repair	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify Repair	—
12	Replace the MAP sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0112 IAT Sensor Circuit Low Voltage



D06RY00168

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower, causing the PCM to monitor a lower voltage. DTC P0112 will set when the PCM detects an excessively low signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 2 minutes.
- Vehicle speed is greater than 30 mph (48 km/h) .
- IAT signal voltage indicates and intake air temperature greater than 148°C (298°F) (about 5 volts) for a total of 12.5 seconds over a 25-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0112 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0112 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-bout terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

If DTC P0112 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.
3. If DTC P0112 can be repeated only by duplicating the Failure Records condition, refer to the *Temperature vs. Resistance Value* table. The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be stored above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

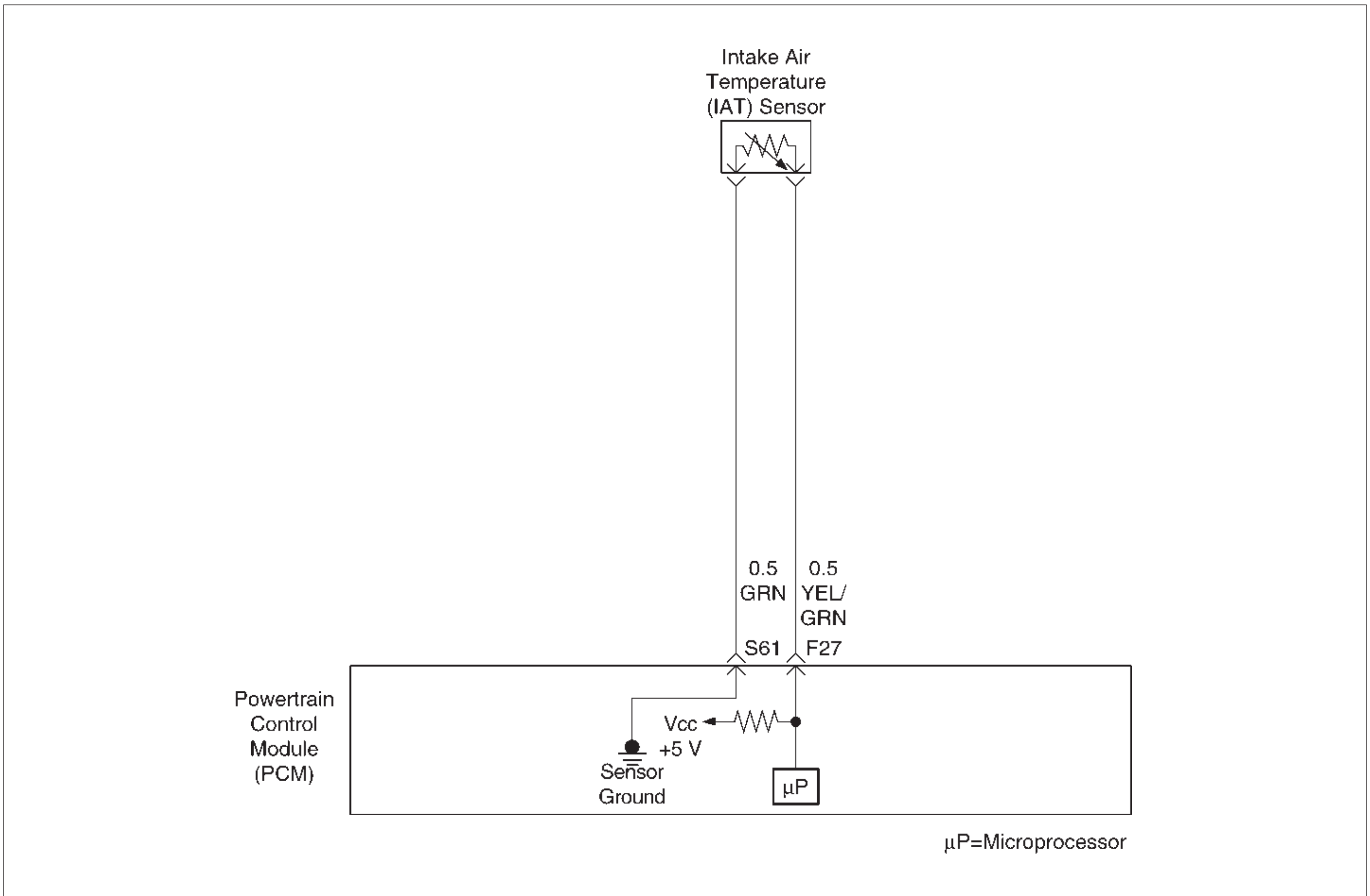
Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P0112–IAT Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. Using a Tech 2, monitor the intake air temperature (IAT). Is the intake air temperature greater than the specified value?	148°C (283°F)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF." Review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor the "DTC" info for DTC P0112. Does the Tech 2 indicate DTC P0112 failed this ignition?	—	Refer to *Test Description*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF." 2. Disconnect the IAT sensor electrical connector. 3. Ignition "ON." 4. Observe the intake air temperature on the Tech 2. Is the intake air temperature below the specified value?	–38°C (–36°F)	Go to *Step 6*	Go to *Step 5*
5	1. Ignition "OFF." 2. Disconnect the PCM electrical connectors. 3. Check the IAT sensor signal circuit for a short to ground. Is the IAT sensor signal circuit shorted to ground?	—	Verify repair	Go to *Step 7*
6	Replace the IAT sensor. Is the action complete?	—	Verify repair	—
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0113 IAT Sensor Circuit High Voltage



D06RY00168

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. DTC P0113 will set when the PCM detects an excessively high signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 4 minutes.
- Vehicle speed is less than 20 mph (32 km/h).
- ECT signal temperature is above 60°C (140°F).
- Mass air flow is less then 20 g/second.
- IAT signal voltage indicates an intake air temperature less than –39°C (–38°F) for total of 12.5 seconds over a 25-second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0113 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0113 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- The IAT sensor shares a ground with the EGR position sensor and the TP sensor. Check the ground if these DTC's are set.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

If DTC P0113 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.
3. If DTC P0113 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Values" table. The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be open above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

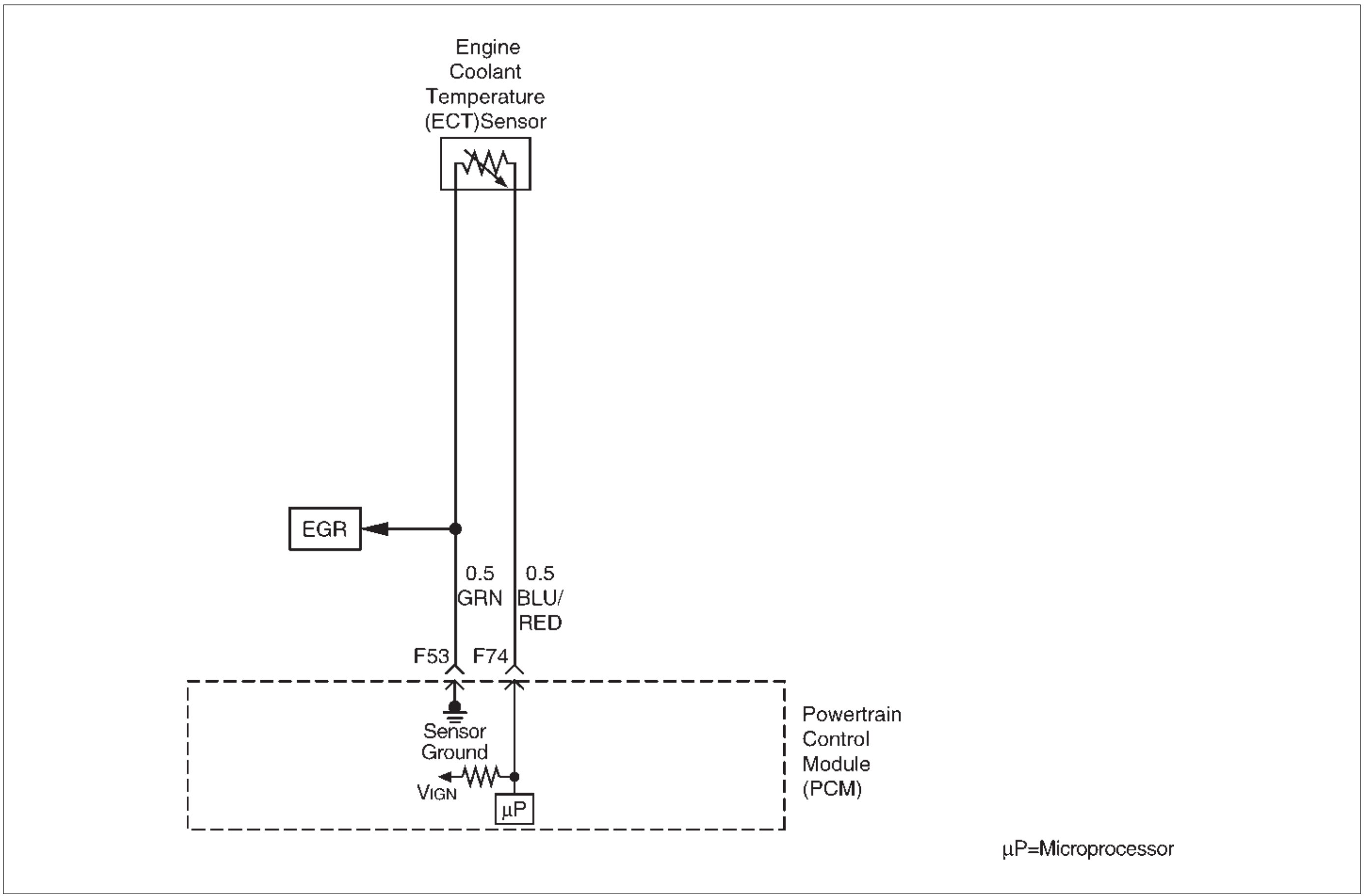
DTC P0113 –IAT Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Ignition "ON," engine "OFF." Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" below the specified value?	–38˚C (–36˚F)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data parameters. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0113. Does the Tech 2 indicate DTC P0113 failed?	—	Refer to *Test Description*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF." 2. Disconnect the IAT sensor electrical connector. 3. Jumper the IAT signal circuit and the sensor ground circuit together at the IAT sensor harness connector. 4. Ignition "ON." 5. Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" at the specified value?	140˚C (284˚F)	Go to *Step 6*	Go to *Step 5*
5	1. Jumper the IAT signal circuit at the IAT sensor harness connector to chassis ground. 2. Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" at the specified value?	140˚C (284˚F)	Go to *Step 7*	Go to *Step 8*

DTC P0113 –IAT Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
6	Check for poor connections at the IAT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 10*
7	1. Ignition "OFF." 2. Disconnect the PCM, and check the IAT sensor ground circuit for an open. 3. If the IAT sensor ground circuit is open, repair it as necessary. Was the IAT sensor ground circuit open?	—	Verify repair	Go to *Step 9*
8	1. Ignition "OFF." 2. Disconnect the PCM, and check the IAT signal circuit for an open. 3. If the IAT sensor signal circuit is open, repair it as necessary. Was the IAT signal circuit open?	—	Verify repair	Go to *Step 9*
9	Check for a poor sensor ground or IAT signal circuit terminal connection at the PCM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to *Step 11*
10	Replace the IAT sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0117 ECT Sensor Circuit Low Voltage



D06RY00169

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted on a coolant crossover pipe at the front of the engine. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes lower, and the ECT signal voltage measured at the PCM drops. With a fully warmed-up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts.

Conditions for Setting the DTC

- Engine running time is longer than one minute.
- The ECT sensor signal indicates an engine coolant temperature greater than 150˚C (302˚F) (about 0.10 V) for a total of 50 seconds over a 100–second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start-up intake air temperature and running time.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0117 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0117 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If DTC P0117 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1114 Diagnostic Chart may isolate the cause of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.
3. If DTC P0117 can be repeated only by duplicating the Failure Records conditions, refer to the “Temperature vs. Resistance Values” table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a “shifted” sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

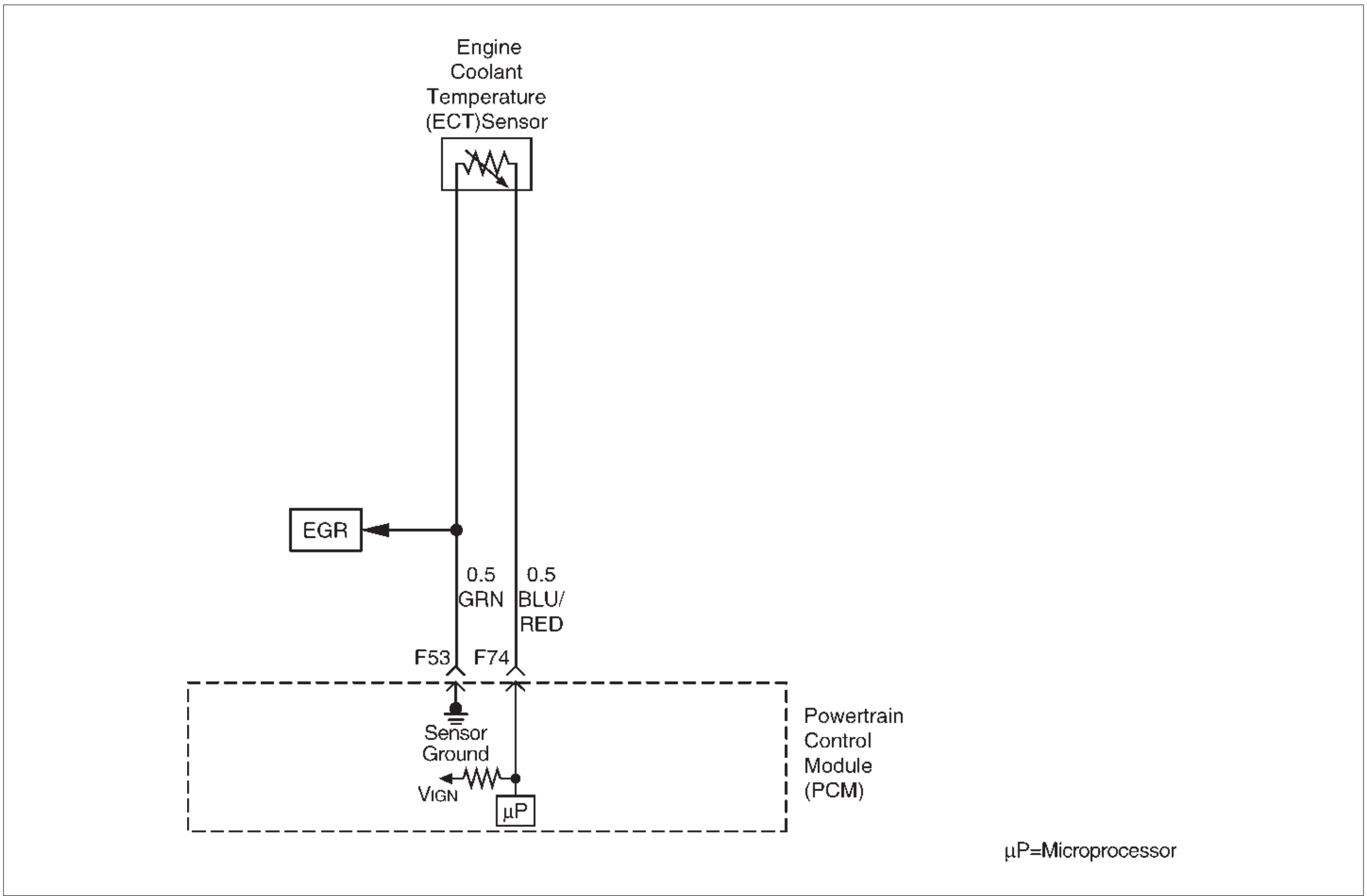
Engine Coolant Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P0117 – ECT Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Observe the “Eng Cool Temp” display on the Tech 2. Is the “Eng Cool Temp” below the specified value?	139°C (282°F)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0117. Does the Tech 2 indicate DTC P0117 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Disconnect the ECT sensor electrical connector. 2. Observe the “Eng Cool Temp” display on the Tech 2. Is the “Eng Cool Temp” at the specified value?	–39°C (–38°F)	Go to *Step 6*	Go to *Step 5*
5	1. Ignition “OFF.” 2. Disconnect the PCM and check the ECT signal circuit for a short to ground or a short to the sensor ground circuit. 3. If the ECT signal circuit is shorted. repair it as necessary. Was the ECT signal circuit shorted to ground?	—	Verify repair	Go to *Step 7*
6	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0118 ECT Sensor Circuit High Voltage



D06RY00169

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in on a coolant crossover pipe at the front of the engine. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed-up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts.

Conditions for Setting the DTC

- Engine running time is longer than 1.5 minutes.
- The ECT sensor signal indicates an engine coolant temperature of –39˚C (–38˚F) or less (about 5 volts) for a total of 50 seconds over a 100-second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start-up intake air temperature and running time.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0118 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0118 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

The ECT shares a ground with the Transmission Fluid Temperature sensor, the Fuel Tank Pressure sensor, and the MAP sensor.

Check the ground if these DTCs are also set.

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If DTC P0118 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1115 Diagnostic Chart may isolate the cause of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.
3. If DTC P0118 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Value" table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

Engine Coolant Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

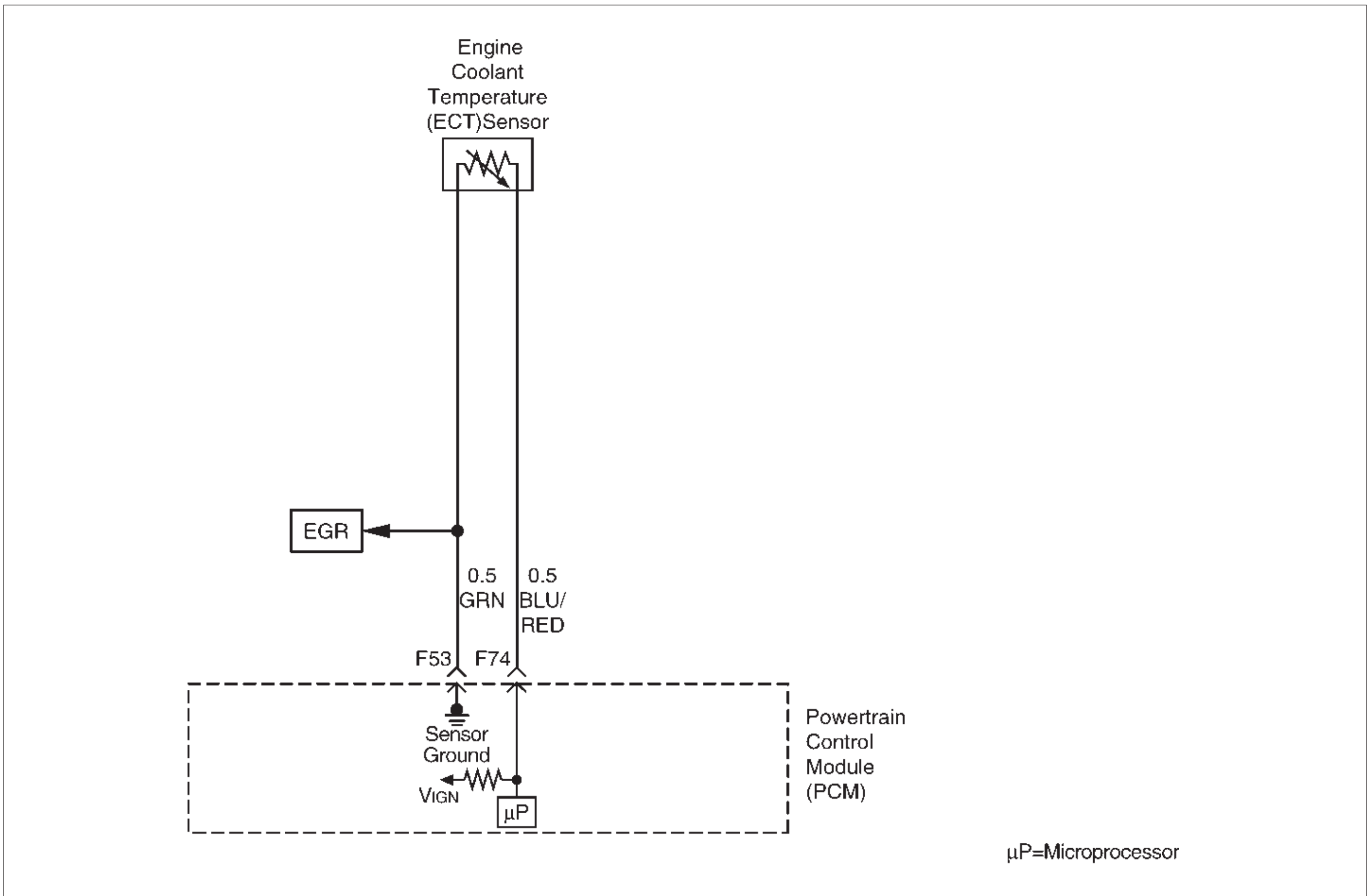
DTC P0118 – ECT Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" below the specified value?	–39˚C (–38˚F)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P0118. Does the Tech 2 indicate DTC P0118 failed?	—	Refer to *Test Description*	Refer to *Diagnostic Aids*
4	1. Disconnect the ECT sensor electrical connector. 2. Jumper the ECT signal circuit and the sensor ground circuit together at the ECT sensor harness connector. 3. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" at the specified value?	140˚C (284˚F)	Go to *Step 6*	Go to *Step 5*
5	1. Jumper the ECT signal circuit at the ECT sensor harness connector to chassis ground. 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" at the specified value?	140˚C (284˚F)	Go to *Step 7*	Go to *Step 8*
6	Check for poor connections at the ECT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 10*

DTC P0118 – ECT Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition "OFF." 2. Disconnect the PCM, and check the ECT sensor ground circuit for an open. 3. If the ECT sensor ground circuit is open, repair it as necessary. Was the ECT sensor ground circuit open?	—	Verify repair	Go to *Step 9*
8	1. Ignition "OFF." 2. Disconnect the PCM, and check the ECT signal circuit for an open. 3. If the ECT sensor signal circuit is open, repair it as necessary. Was the ECT signal circuit open?	—	Verify repair	Go to *Step 9*
9	Check for a poor sensor ground or ECT signal circuit terminal connection at the PCM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to *Step 11*
10	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0125 ECT Excessive Time to Closed Loop Fuel Control



D06RY00169

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a "closed loop" air/fuel metering system is used. When the vehicle is first started, the powertrain control module (PCM) controls fuel delivery in "open loop," ignoring the heated oxygen sensor (HO2S) signals and calculating air/fuel ratio based on inputs from the engine coolant temperature, throttle position, and mass air flow sensors. The PCM will begin using the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals for controlling fuel delivery under "closed loop" conditions when the following conditions have been met:

- The HO2S output signals are varying, indicating that the sensors are hot enough to operate properly.
- The engine coolant temperature sensor indicates coolant temperature above 50˚C (122˚F).
- Time since start-up is at least 16 seconds for a warm engine or 23 seconds for a cold engine.

Conditions for Setting the DTC

- No active IAT or ECT DTC(s) are present.
- Engine is running.
- Vehicle speed is greater than 5 mph (8 km/h) .
- Intake air temperature is greater than –10˚C (14˚F) 0˚C (32˚F).
- Start–up engine coolant temperature is between –10˚C (–14˚F) and 28˚C (82˚F).
- For a warm engine (intake air temperature is greater than 10˚C/50˚F), engine coolant temperature sufficient to allow "closed loop" operation (50˚C/122˚F) is not achieved within 2 minutes of start-up. For a cold engine (intake air temperature between (–7˚C and 10˚C), engine coolant temperature sufficient to allow "closed loop" operation (50˚C/122˚F) is not achieved within 10 minutes of start-up.
- The above condition fails 20 consecutive times.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0125 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0125 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

DTC P0125 set indicates a faulty ECT sensor. Comparing the engine coolant temperature displayed on a Tech 2 with actual coolant temperature measured with a thermometer may isolate this condition. If the displayed engine coolant temperature is not close to the actual coolant temperature, replace the ECT sensor.

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0125 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage wince the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Comparing the engine coolant temperature displayed on a Tech 2 with actual coolant temperature measured with a thermometer may isolate this condition. If the displayed engine coolant temperature is not close to the actual coolant temperature, replace the ECT sensor. If the temperatures are close, the fault is intermittent; refer to *Diagnostic Aids*.

Engine Coolant Temperature

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

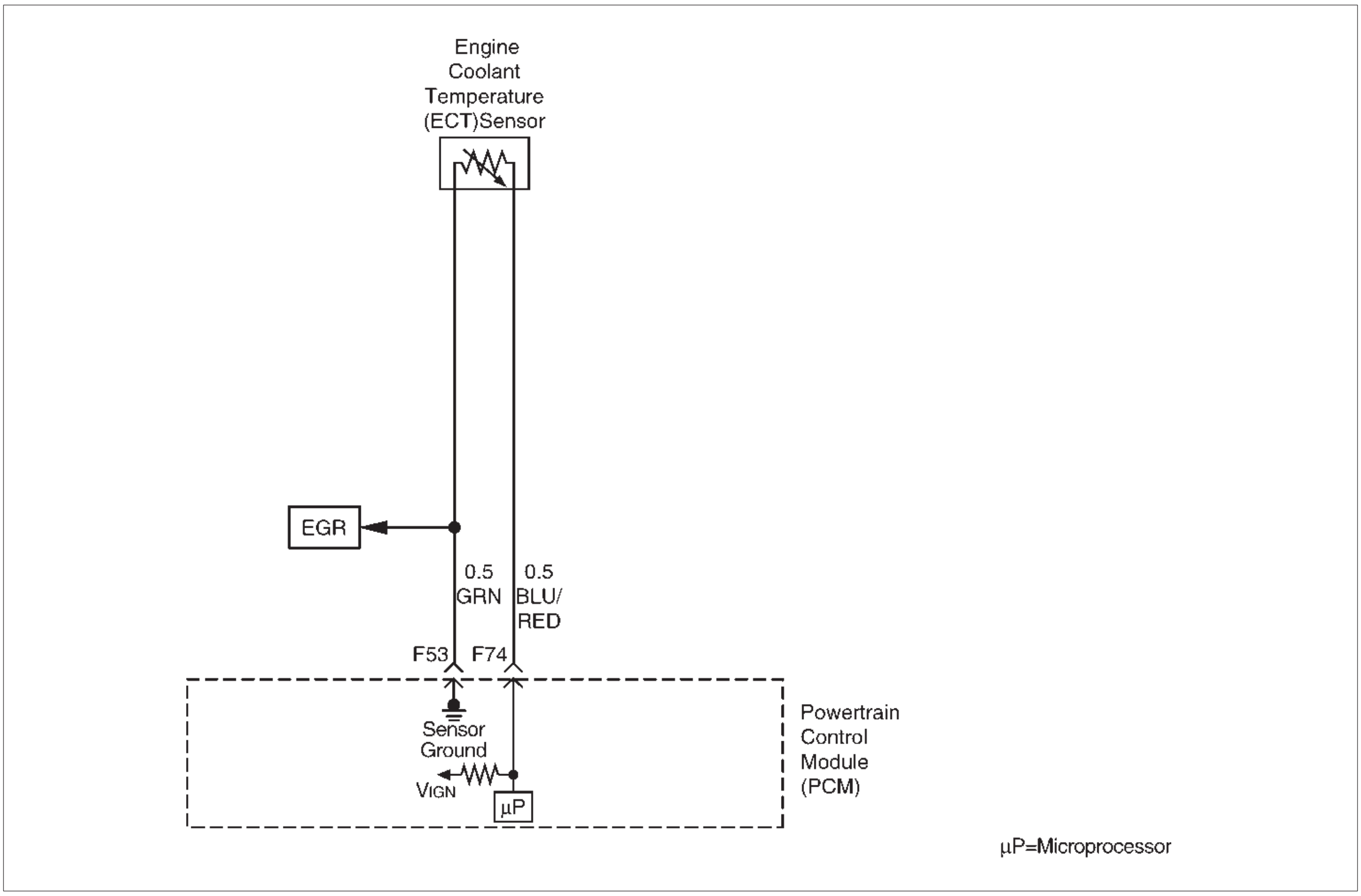
DTC P0125 –ECT Excessive Time to Closed Loop Fuel Control

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any ECT sensor DTCs set?	—	Go to applicable ECT sensor DTC chart	Go to *Step 3*
3	1. Allow the engine to cool completely. 2. Check the cooling system coolant level (refer to *Cooling and Radiator*). Is the coolant level OK?	—	Go to *Step 4*	Go to *Step 9*
4	1. Start the engine. 2. With the engine idling, monitor “ENG COOL TEMP” display on the Tech 2. Does “ENG COOL TEMP” increase to above the specified value within 2 minutes?	21°C (70°F)	Refer to *Diagnostic Aids*	Go to *Step 5*
5	Check for proper operation of the thermostat (refer to *Cooling and Radiator*). Is the thermostat operating correctly?	—	Go to *Step 6*	Go to *Step 9*

DTC P0125 –ECT Excessive Time to Closed Loop Fuel Control (Cont'd)

Step	Action	Value(s)	Yes	No
6	Compare engine coolant temperature displayed on the Tech 2 to the actual coolant temperature measured with a thermometer. (Observe normal precautions when opening the cooling system.) Is the Tech 2 engine coolant temperature indication close to the measured temperature?	—	Go to *Step 9*	Go to *Step 7*
7	1. Ignition "OFF." 2. Disconnect the PCM. 3. Using a DVM, measure the resistance of the ECT at the PCM connector. 4. Compare the DVM reading with the chart in "Test Description." Is the chart value approximately equal to the thermometer reading?	—	Go to *Step 12*	Go to *Step 8*
8	Check for high resistance in wiring related to the ECT sensor. Also, check for poor connections at the ECT sensor and the PCM. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*
9	Refer to *Cooling and Radiator* for cooling system diagnosis and repair condition as necessary. Is the action complete?	—	Verify repair	—
10	Replace the faulty terminal(s) or repair faulty wiring as necessary. Is the action complete?	—	Verify repair	—
11	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code(DTC)
P0128 Thermostat Insufficient temperrature for Stable Opreation



D06RY00169

Circuit Description

- The engine coolant temperature (ECT) sensor thermistor mounted on a coolant crossover pipe at the front of the engine.

  This code determines if system has insufficient coolant temperatures for stable operation.

Conditions for setting the DTC

- Engine running.
- No IAT, ECT and MAF DTCs set.
- No VSS DTC set.

Warm case(Ambient temperature is between 50˚F and 128˚F.):

Time for coolant to reach stabillzed closed loop value is less than 239 sec.

Cold case(Ambient temperature is between 20˚F and 50˚F.):

Time for coolant to reach stabillzed thermostat regulation temperature is more than 263 sec.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp(MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P0128 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P0128 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

  Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM–Inspect harness connectors for backed out terminals,improper mating,broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.

- Damaged harness–Inspect the wiring harness for damage.

  If the harness appears to be OK,observe the ECT display on the Tech2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault.

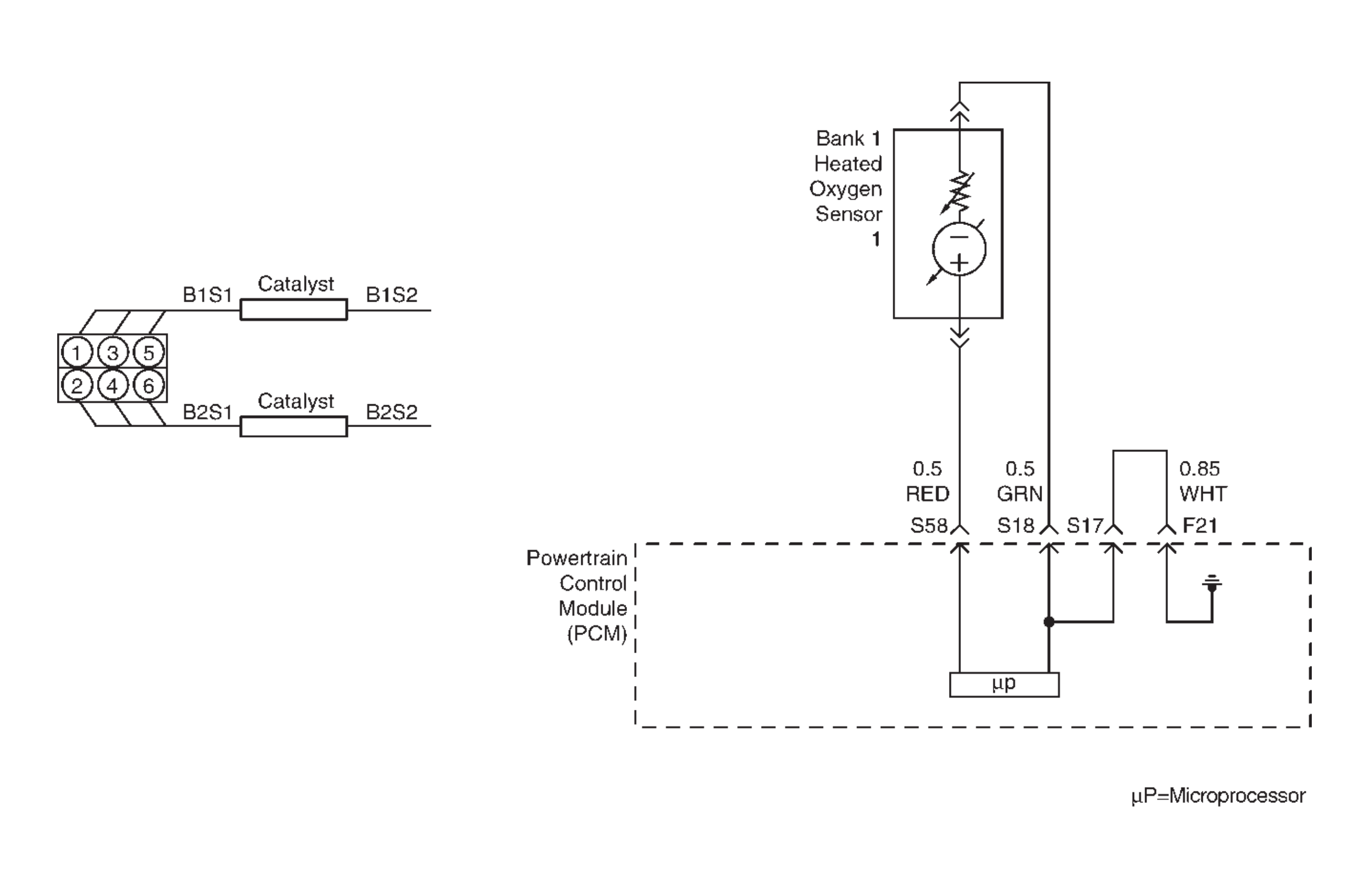
  If DTC P0128 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P0128 Diagnostic Chart may isolate the cause of the fault.

Diagnostic Trouble Code (DTC)
P0128 Thermostat Insufficient temperrature for stable opreation

Step	Action	Value(s)	Yes	No
1	Was the “On-Board(OBD)System Check”performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Visually/physically check air duct and water pipe for splits, kinks,and proper conections and routing. 2. If a problem is found,repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 3*
3	1. Remove and check the filter element for dirt or restrictions. 2. Replace the air filter element if necessary. Was a problem found?	—	Verify repair	Go to *Step 4*
4	1. Remove and check the Thermostat for stable opreation. Refer to *6B section.* 2. Replace the thermostat if necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition “ON”,engine “OFF”. 2. Review and record Tech 2 Failure Records. 3. Opreate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0128. Does the Tech 2 indicate DTC P0128 failed this ignition?	—	Go to *Step 6*	Refer to *DiagnosticAids*
6	1. Ignition “ON”, engine “OFF”. 2. Oberve the “Eng Cool Temp”display on the Tech 2. Is the “Eng Cool Temp” below the specified value?	139˚C (282˚F)	Verify repair	Go to *Step 7*
7	1. Ignition “OFF”. 2. Disconnect the PCM and check the ECT signal circuit for a short to ground or a short to the sensor ground circuit. 3. If the ECT signal circuit is shorted,repair it as necessary. Was a problem found?	—	Verify repair	Refer to *Diag-nostic* Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1



D06RY00170

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 350 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively low for an extended period of time, DTC P0131 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Vehicle is operating in "closed loop."
- Engine coolant temperature is above 60˚C (140˚F).
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 1 signal voltage remains below 22 mV during normal "closed loop" operation for a total of 77 seconds over a 90-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0131 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0131 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be routed incorrectly and contacting the exhaust system.
- Poor PCM to engine block grounds.
- Fuel pressure – The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, If fuel pressure is too low, a DTC P0131 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform "Injector Balance Test."

- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Check for exhaust leaks that may cause a false lean condition to be indicated.
- MAF sensor – The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to step numbers on the diagnostic chart.

3. DTC P0131 failing during operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0131 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

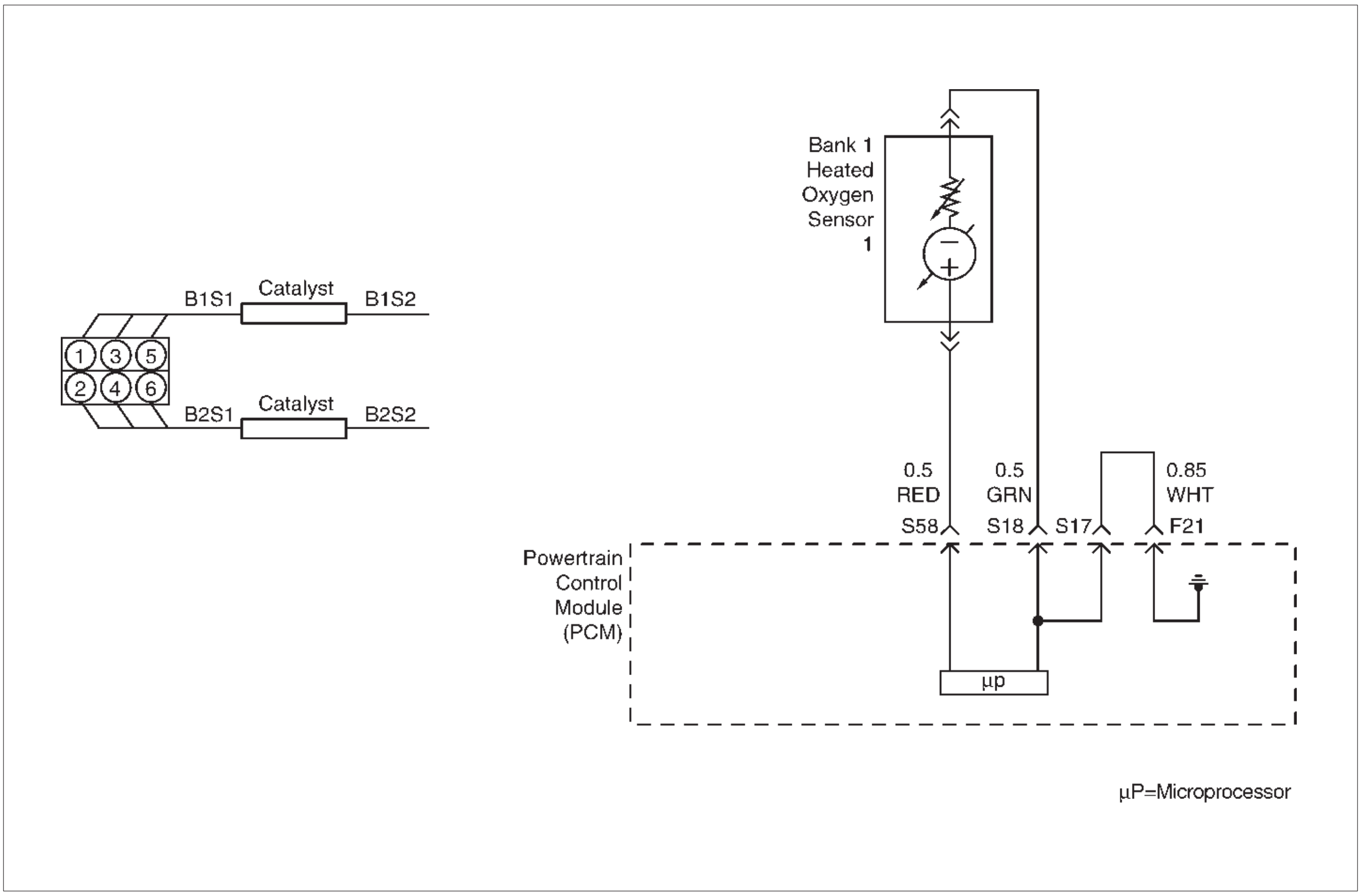
DTC P0131 –HO2S Circuit Low Voltage Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 1 voltage remain below the specified value?	22 mV	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON,” engine “OFF,” review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0131 until the DTC P0131 test runs. Note test result. Does Tech 2 indicate DTC P0131 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Turn the ignition “OFF.” 2. Disconnect the PCM. 3. Check the Bank 1 HO2S 1 high and low circuits for a short to ground or a short to the heater ground circuit. Are the Bank 1 HO2S 1 signal circuits shorted to ground?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the Bank 1 HO2S 1 signal circuit. Is the action complete?	—	Verify repair	—
6	1. Turn the ignition “OFF,” HO2S 1 and PCM disconnected. 2. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to *Step 7*	Go to *Step 8*

DTC P0131 –HO2S Circuit Low Voltage Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition "OFF." 2. Reconnect the PCM, leave the sensor disconnected. 3. Ignition "ON." Does the Tech 2 indicate Bank 1 HO2S 1 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0132 HO2S Circuit High Voltage Bank 1 Sensor 1



D06RY00170

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively high for an extended period of time, DTC P0132 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature is above 60˚C (140˚F)
- “Closed loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 1 signal voltage remains above 952 mV during normal “closed loop” operation for a total of 77 seconds over a 90-second period.

OR

- Bank 1 HO2S 1 signal voltage remains above 500 mV during “deceleration fuel cutoff mode” operation for 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0132 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0132 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check the following items:

- Fuel pressure – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a DTC P0132 may be set. Refer to *Fuel System Diagnosis*.
- Perform “Injector Balance Test” – Refer to *Fuel System Diagnosis*.
- Check the EVAP canister for fuel saturation – If full of fuel, check canister control and hoses. Refer to *Evaporative (EVAP) Emission Control System*.

- MAF sensor –The system can go rich if MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see it the rich condition is corrected. If so, replace the MAF sensor.
- Check for a leak in the fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel. There should be no fuel in the vacuum line.
- An intermittent TP sensor output will cause the system to go rich due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S) –If the HO2S is internally shorted, the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key “ON,” engine “OFF.” If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit or Faulty HO2S–A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle by monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal circuit wiring and associated terminal conditions.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0132 failing during “deceleration fuel cutoff mode” operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0132 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

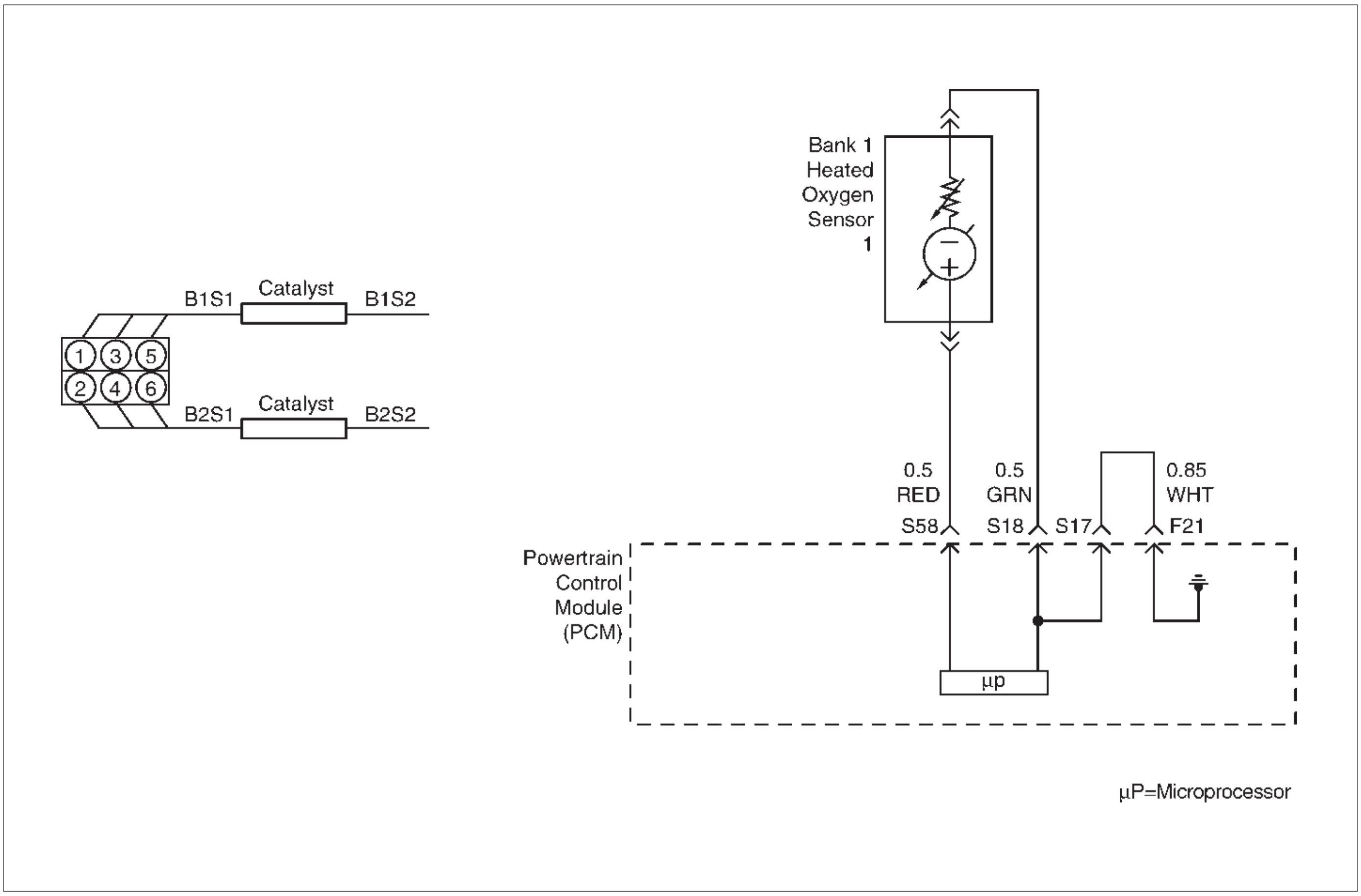
DTC P0132 – HO2S Circuit High Voltage Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 1 voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cutoff mode)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON,” review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0132 until the DTC P0132 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0132 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition “OFF.” 2. Disconnect Bank 1 HO2S 1. 3. Ignition “ON.” 4. At HO2S Bank 1 Sensor 1 connector (PCM side) use a DVM to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	3-4 V	Go to *Step 5*	Go to *Step 6*
5	Repair short to voltage in signal circuit. Is the action complete?	—	Verify repair	—

DTC P0132 – HO2S Circuit High Voltage Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition "ON," engine"OFF." 2. At Bank 1 HO2S 1 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage below the specified value?	10 mV	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the jumpers to ground from Bank 1 HO2S 1 PCM-side connector. 2. With the HO2S 1 connector disconnected, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0133 HO2S Slow Response Bank 1 Sensor 1



D06RY00170

Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after "closed loop" has been enabled. During the monitoring period the PCM counts the number of times that a rich-to-lean and lean-to-rich response is indicated and adds the amount of time it took to complete all rich-to-lean transitions and lean-to-rich transitions. With this information, an average time for rich-to-lean and lean-to-rich transitions can be determined. If the average response time of either transition is too slow, a DTC P0133 will be set.

A lean-to-rich transition is indicated when the HO2S voltage changes from less than 300 mV to greater than 600 mV. A rich-to-lean transition is indicated when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is likely to be faulty and should be replaced.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ETC) is above 50˚C (122˚F) for automatic transmission; 75˚C (167˚F) for manual transmission.
- Engine is operating in "closed loop."
- Engine has been running for at least 1 minute.
- Engine speed is between 1500 RPM and 3000 RPM.
- Canister purge duty cycle is greater than 2%.
- Mass air flow is between 9 g/second and 42 g/second.
- All above conditions are met for 3 seconds.
- 90 seconds after "closed loop" has been enabled, Bank1 HO2S 1 average transition time between 300 mV and 600 mV is too slow. The lean-to-rich average transition response time was longer than 94 milliseconds or rich-to-lean average transition response time was longer than 105 milliseconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator Lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0133 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0133 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0133 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is currently present.
3. HO2S transition time, ratio mean volts and switching DTCs set for multiple sensors indicate probable contamination. Before replacing the sensors, isolate and correct the source of the contamination to avoid damaging the replacement sensors.

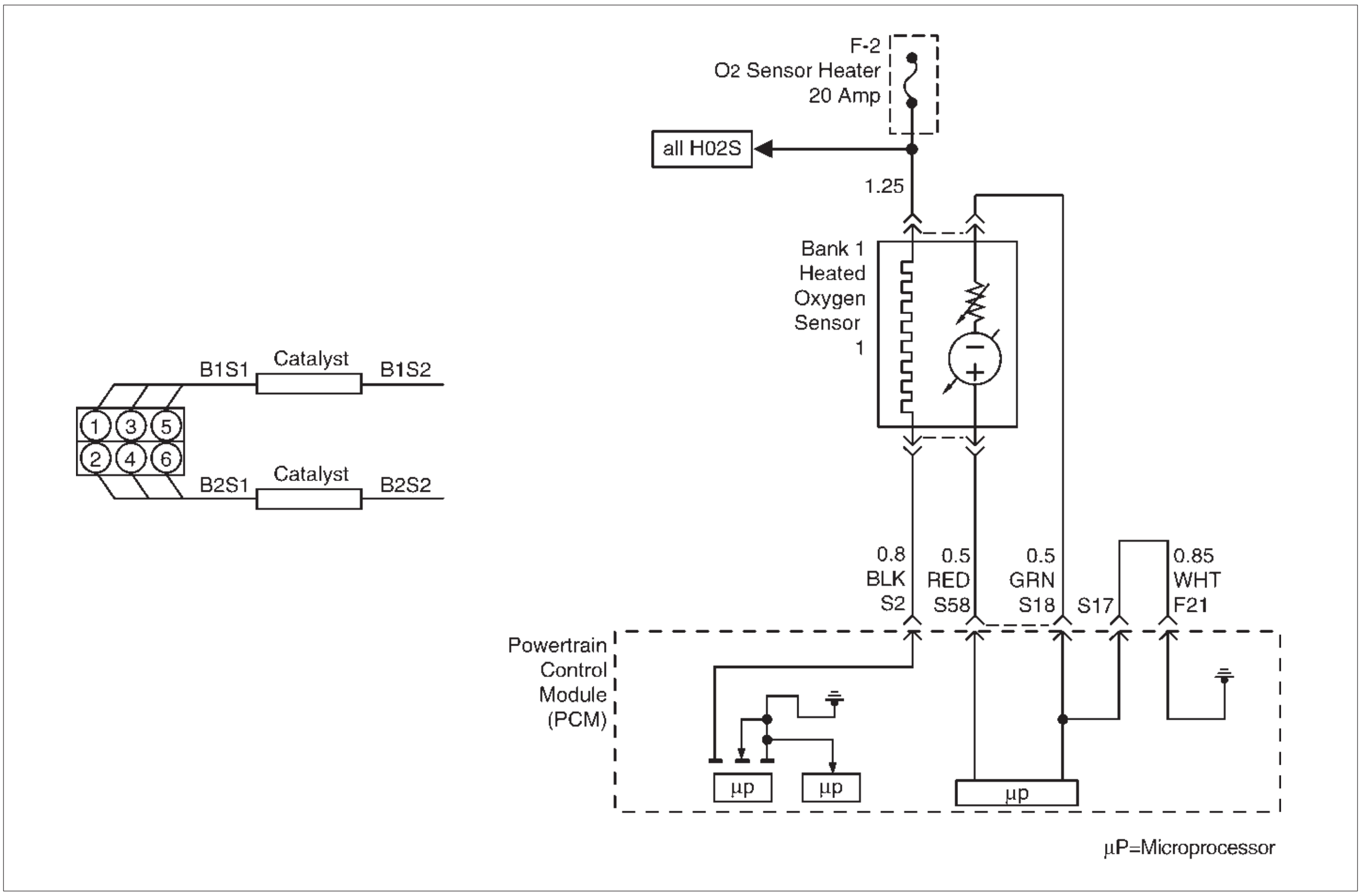
DTC P0133 – HO2S Slow Response Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If any DTCs are set (expect P0153, P1133, P1134, P1153, and/or P1154), refer to those DTCs before proceeding with this diagnostic chart. 1. Install the Tech 2. 2. Idle the engine at operating temperature. 3. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" included in Diagnostic Support. 4. Using a Tech 2, monitor "DTC" info for DTC P0133 until the DTC P0133 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0133 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate DTC P0153, P1133, P1134, P1153, and/or P1154 failed this ignition?	—	Go to *Step 17*	Go to *Step 4*
4	Check for leaks at the pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U–bolt nuts at the leaking joints. Is the action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is the action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 2*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is the action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*
11	Replace the exhaust pipes, as required. Is the action complete?	—	Go to *Step 2*	—
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications to replace the manifold if necessary. Is the action complete?	—	Go to *Step 2*	—

DTC P0133 – HO2S Slow Response Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
14	Visually/physically inspect the following items: • Ensure that the Bank 1 HO2S 1 is securely installed. • Check for corrosion on terminals. • Check terminal tension (at Bank 1 HO2S 1 and at the PCM). • Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to *Step 18*	Go to *Step 15*
15	1. Disconnect Bank 1 HO2S 1. 2. Ignition "ON." 3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. Also measure the voltage between the low signal circuit and ground. Are both voltages in the specified range?	3-4 V	Go to *Step 16*	Go to *Step 19*
16	1. With Bank 1 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition "ON." 3. Using a Tech 2, monitor the Bank 1 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to *Step 21*	Go to *Step 22*
17	Replace the affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. • Fuel contamination. • Use of improper RTV sealant. • Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
18	Repair condition as necessary. Is the action complete?	—	Verify repair	—
19	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to *Step 20*
20	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	—
21	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1



D06RY00171

Circuit Description

- The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) high and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains at or near the 450 mV bias for an extended period of time, DTC P0134 will be set, indicating an open sensor signal or sensor low circuit.
- Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active.
- Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- No related DTCs.
- Battery voltage is above 10 volts.
- Engine run time is longer than 40 seconds.
- Oxygen sensor heater has been determined to be functioning properly.
- Bank 1 HO2S 1 signal voltage remains between 400 mV and 500 mV for a total of 77 seconds over a 90-second period of time.

Action Take When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0134 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0134 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

- Faulty HO2S heater or heater circuit – With the ignition "ON," engine "OFF," after a cool down period, the HO2S 1 voltage displayed on the Tech 2 is normally 455-460 mV. A reading over 1000 mV indicates a signal line shorted to voltage. A reading under 5 mV indicates a signal line shorted to ground or signal lines shorted together. Disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light for 2 seconds when the ignition is turned on, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test – With the Ignition "ON," monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. If the DTC P0134 test passes while the Failure Records conditions are being duplicated, an intermittent conditions is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

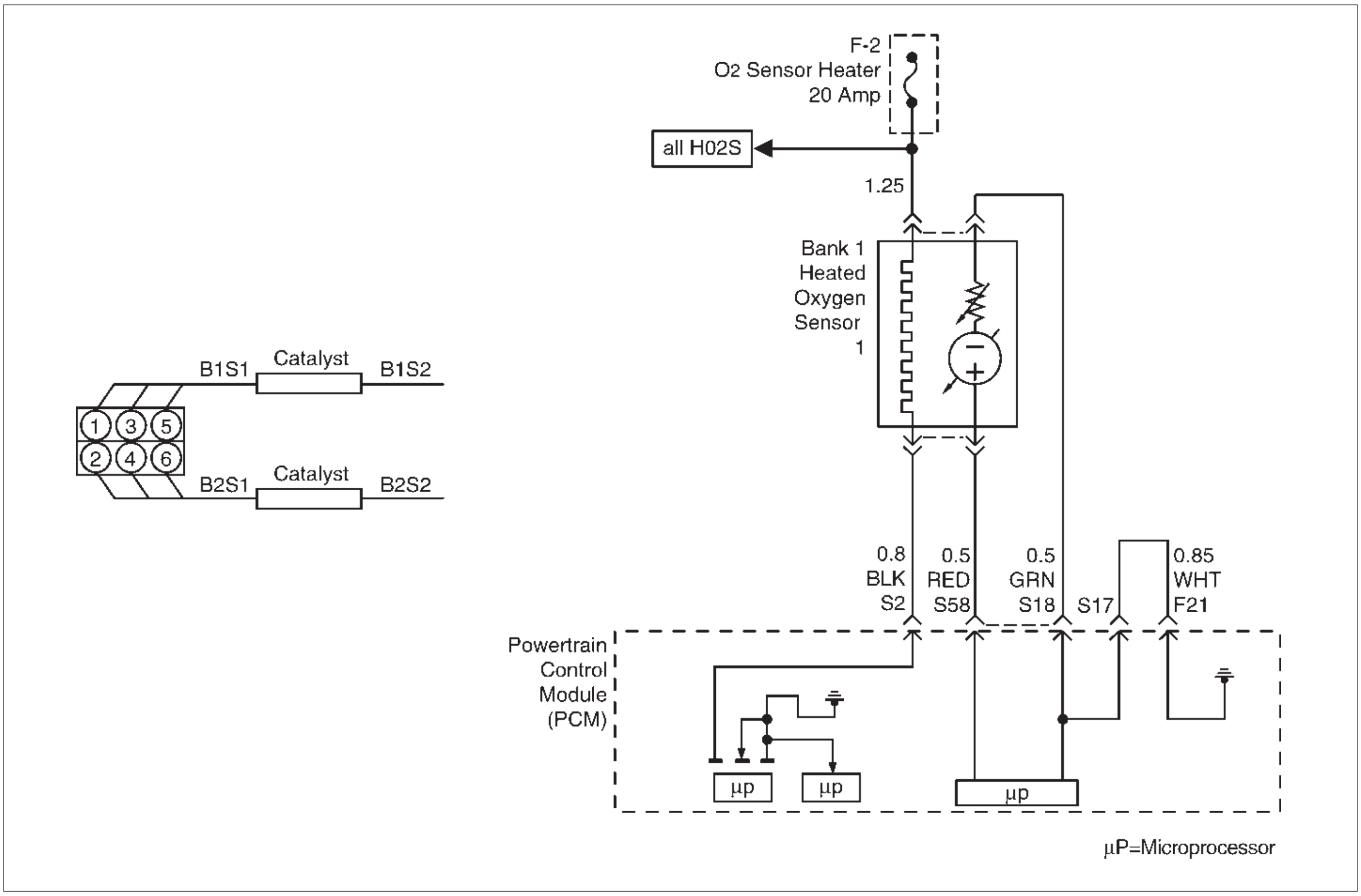
DTC P0134 –HO2S Circuit Insufficient Activity Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 1 HO2S 1 voltage varying outside the specified values?	400-500 mV	Go to *Step 3*	Go to *Step 4*
3	1. Ignition "ON," engine "OFF," review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0134 until the DTC P0134 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0134 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Check for a damaged harness. Was a problem found?	—	Verify repair	Go to *Step 5*
5	Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the Bank 1 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 6*
6	Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the PCM and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 7*
7	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 high circuit. 3. If the Bank 1 HO2S 1 high circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 1 high circuit problem found and corrected?	—	Verify repair	Go to *Step 8*

DTC P0134 –HO2S Circuit Insufficient Activity Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 low circuit measures over 5 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 1 low circuit problem found and corrected?	—	Verify repair	Go to *Step 9*
9	1. Ignition "ON," engine "OFF." 2. Disconnect Bank 1 HO2S 1 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage in the specified range?	0-10 mV	Go to *Step 10*	Go to *Step 11*
10	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0135 HO2S Heater Circuit Bank 1 Sensor 1



D06RY00171

Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine. The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 1 HO2S 1 to become active, a DTC P0135 will set. The time it should take the HO2S to reach operating temperature is based on the accumulated amount of air that has passed through the MAF sensor and into the engine (more accumulated air flow = shorter time to HO2S activity).

Conditions for Setting the DTC

- No related DTCs.
- Intake air temperature (IAT) is less than 32°C (90°F) at start-up.
- Engine coolant temperature (ECT) is less than 32°C (90°F) at start-up.
- IAT and ECT are within 6°C (11°F) of each other at start-up.
- Ignition voltage is between 11 and 18 V.
- Average mass air flow is less than 21 g/second during sample period.
- Bank 1 HO2S 1 voltage does not change more than 150 mV from the bias voltage (between 400 mV and 500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 150 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulate air flow since start-up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0135 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0135 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. Ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. Checks the HO2S heater ground circuit.
6. Checks or an open or shorted HO2S heater element.
10. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

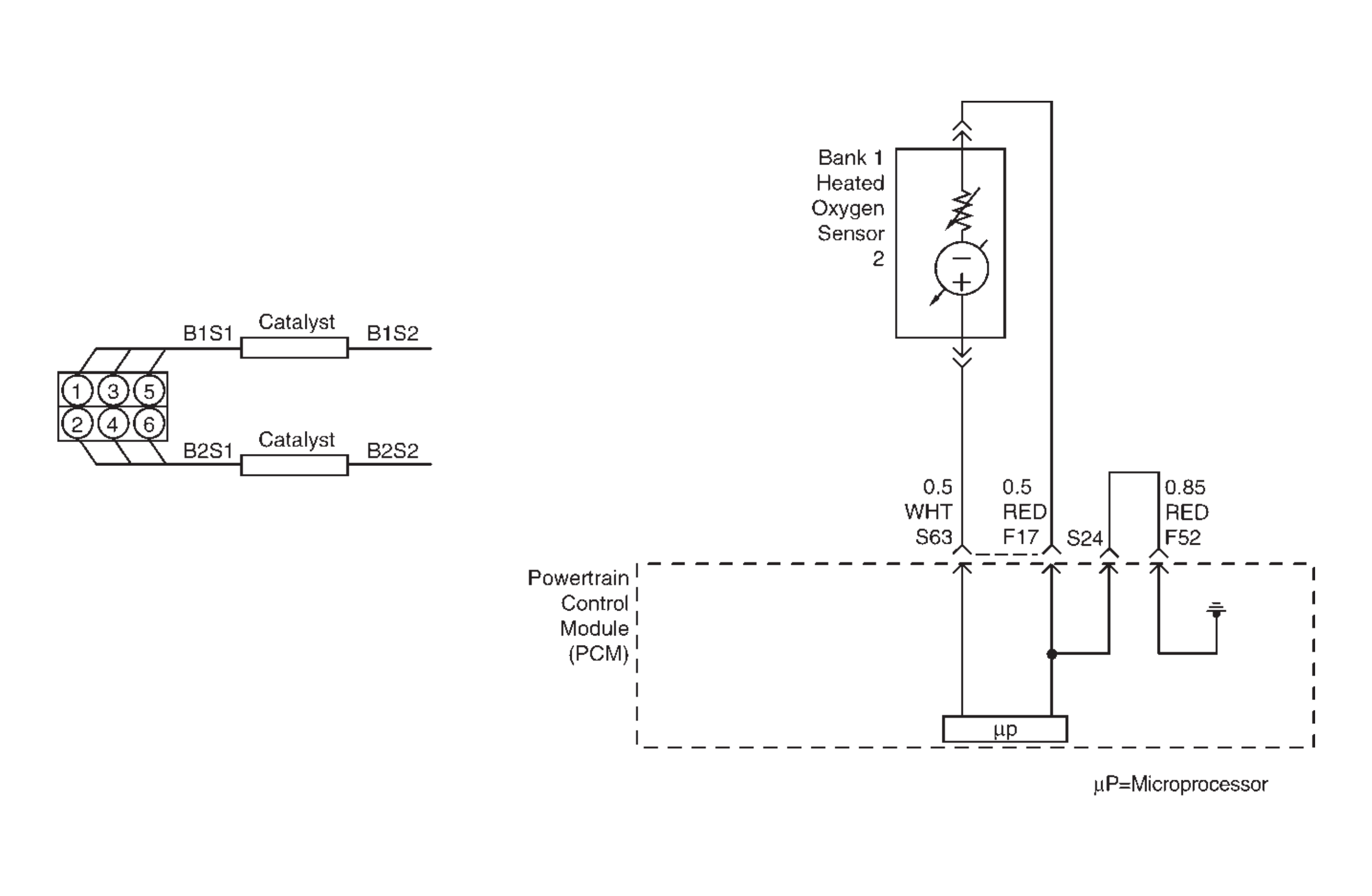
DTC P0135 – HO2S Heater Circuit Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If the engine has just been operating ,allow the engine to cool for at least 15 minutes before proceeding. 1. Remove the fuel pump relay. 2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses. 3. Ignition “OFF.” 4. Install a Tech 2. 5. Ignition “ON,” engine “OFF.” 6. Monitor the Bank 1 HO2S 1 voltage for several minutes. Did the HO2S voltage go from bias voltage to above or below the specified values?	Above 650 mV or below 250 mV	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Inspect the fuse for the Bank 1 HO2S 1 ignition feed. Is the fuse open?	—	Go to *Step 15*	Go to *Step 4*
4	1. Ignition “OFF.” 2. Raise the vehicle. 3. Disconnect the Bank 1 HO2S 1 electrical connector. 4. Using a test light connected to a good ground (do not use Bank 1 HO2S 1 heater ground or Bank 1 HO2S 1 low), probe the ignition feed circuit at the Bank 1 HO2S 1 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to *Step 5*	Go to *Step 7*
5	Connect the test light between the Bank 1 HO2S 1 ignition feed and the Bank 1 HO2S 1 heater ground. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 8*

DTC P0135 – HO2S Heater Circuit Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Allow the HO2S to cool for at least 15 minutes. 2. Using a DVM, measure the resistance between the Bank 1 HO2S 1 ignition feed and the Bank 1 HO2S 1 heater ground at the Bank 1 HO2S 1 pigtail. Is the HO2S heater resistance within the specified values?	3-6 ohms	Go to *Step 9*	Go to *Step 10*
7	Repair the open Bank 1 HO2S 1 ignition feed circuit to Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 1 HO2S 1 heater ground circuit to Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 1 HO2S 1 harness terminals. 2. If a poor connection is found, replace terminals. Was a poor connection found?	—	Verify repair	Go to *Step 10*
10	Check for a poor Bank 1 HO2S 1 high or low circuit terminal connection at the Bank 1 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF." 2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 1 signal circuit and the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 high circuit or HO2S low circuit measures over 5 ohms, repair open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check for a poor Bank 1 HO2S 1 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 13*
13	Check for a poor Bank 1 HO2S 1 high circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
14	Replace the Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in Bank 1 HO2S 1 ignition feed circuit and replace the fault fuse. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2



D06RY00172

Circuit Description

The powertrain control module (PCM) supplies bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm impedance digital voltmeter, this may display as low as 350 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when the exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 2 signal voltage remains excessively low for an extended period of time, DTC P0137 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in “closed loop.”
- Engine coolant temperature is above 60˚C (140˚F).
- “Closed loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 2 signal voltage remains below 22 mV during normal “closed loop” operation for a total of 106 seconds over a 125-second period of time.

OR

- Bank 1 HO2S 2 signal voltage remains below 400 mV during power enrichment mode fuel control operation for up to 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0137 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0137 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and contacting the exhaust system.
- Poor PCM to engine grounds.
- Fuel pressure – A condition which causes a lean exhaust can cause DTC P0137 to set. The system will go lean if pressure is too low. The PCM can

compensate for some decrease. However, if fuel pressure is too low, a DTC P0137 may be set. Refer to *Fuel System Diagnosis*.

- Lean injector(s) – Perform “Injector Balance Test.”
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the DTC P0137 to set. Check for exhaust leaks near the Bank 1 HO2S 2 sensor.
- MAF sensor – The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0137 failing during operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC0137 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

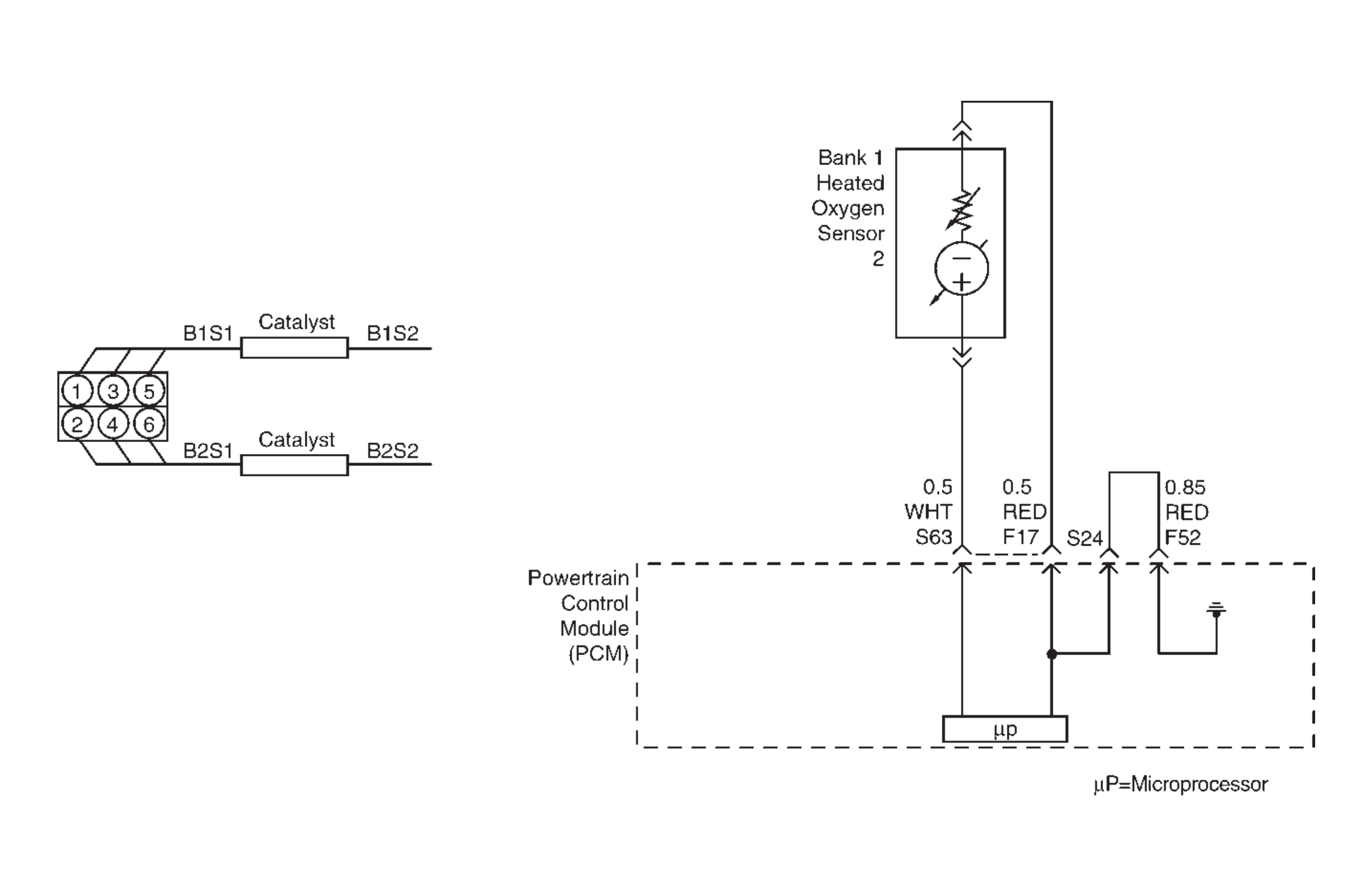
DTC P0137 –HO2S Circuit Low Voltage Bank 1 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Does the Bank 1 HO2S voltage remain below the specified value?	22 mV	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON,” engine “OFF,” review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0137 until the DTC P0137 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0137 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Turn ignition “OFF.” 2. Disconnect the PCM. 3. Check the Bank 1 HO2S 2 high and low signal circuits for a short to ground or a short to the heater ground circuit. Were Bank 1 HO2S 2 signal circuits shorted?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the Bank 1 HO2S 2 signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition “OFF.” 2. Leave the PCM and HO2S 2 disconnected. 3. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to *Step 7*	Go to *Step 8*

DTC P0137 –HO2S Circuit Low Voltage Bank 1 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition "OFF." 2. Reconnect the PCM, leave HO2S 2 disconnected. 3. Ignition "ON." Does the Tech 2 indicate Bank 1 HO2S 2 voltage near the specified value?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0138 HO2S Circuit High Voltage Bank 1 Sensor 2



D06RY00172

Circuit Description

The powertrain control module (PCM) supplies bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when the exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 2 voltage remains excessively high for an extended period of time, DTC P0138 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in "closed loop."
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Engine coolant temperature is above 60°C (140°F).
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 2 signal voltage remains above 952 mV during normal "closed loop" operation for a total of 106 seconds over a 125-second period of time.

OR

- Bank 1 HO2S 2 signal voltage remains above 500 mV during deceleration fuel cut–off mode operation for up to 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0138 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0138 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Fuel pressure – An excessively rich fuel mixture can cause a DTC P0138 to be set. Refer to *Fuel System Diagnosis*.
- Rich injector(s) – Perform "Injector Balance Test."
- Leaking injector – Refer to *Fuel System Diagnosis*.

- Evaporative emissions (EVAP) canister purge – Check for fuel saturation. If full of fuel, check the canister control and hoses. Refer to *Evaporative Emission (EVAP) Control System*.
- MAF sensor –The system can go rich if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the rich condition is corrected. If so, replace the MAF sensor.
- Check for a leak in fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel. There should be no fuel in the vacuum line.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S) – If the HO2S is internally shorted the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key “ON,” engine “OFF.” If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit of Faulty HO2S – A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal and wiring and associated terminal connections.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0138 being set during deceleration fuel mode operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0138 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

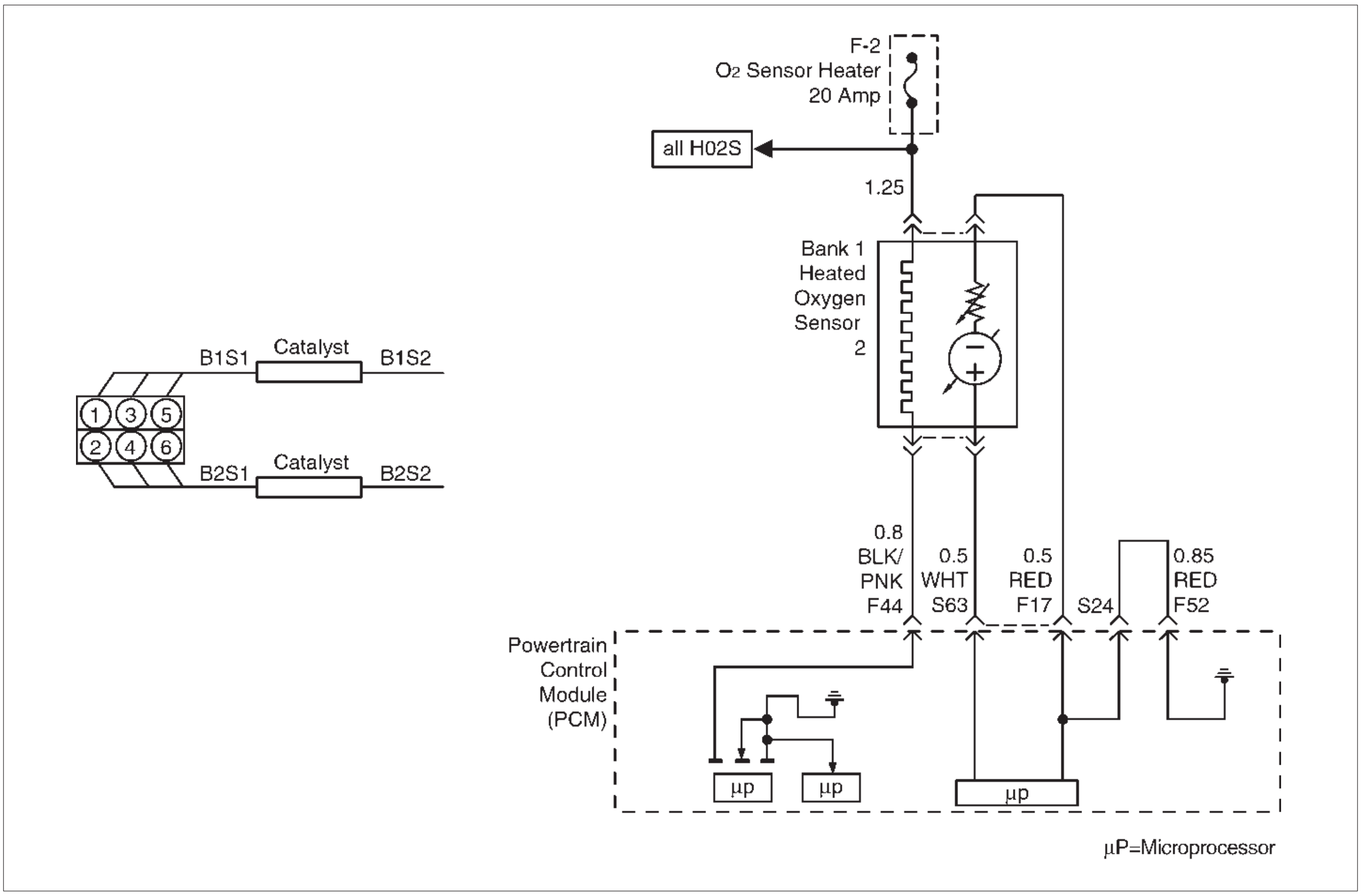
DTC P0138 – HO2S Circuit High Voltage Bank 1 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Does the Bank 1 HO2S voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cutoff mode)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON,” review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0138 until the DTC P0138 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0138 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition “OFF.” 2. Disconnect Bank 1 HO2S 1. 3. Ignition “ON.” 4. At the HO2S Bank 1 Sensor 2 connector (PCM side), use a DVM to measure voltages at the high and low signal terminals. Are the voltages above the specified range?	3-4 V	Go to *Step 5*	Go to *Step 6*

DTC P0138 – HO2S Circuit High Voltage Bank 1 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
5	Repair short to voltage in the signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition "ON," engine"OFF." 2. At Bank 1 HO2S 2 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Is Bank 1 HO2S 2 voltage below the specified value?	10 mV	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the jumpers to ground from Bank 1 HO2S 2 PCM–side connector. 2. With the HO2S 2 connector disconnected, monitor BANK 1 HO2S 2 voltage. Is the Bank 1 HO2S 2 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code(DTC)
P0140 HO2S Circuit Insufficient Activity Bank 1 Sensor 2



D06RY00173

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 2 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the Bank 1 HO2S 2 signal voltage remains between 400 mV and 500 mV for an extended period of time, DTC P0140 will be set. Heated oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- No related DTCs.
- Battery voltage is above 10 volts.
- Engine run time is longer than 40 seconds.
- Oxygen sensor heater is functioning properly.
- Engine is operating in "closed loop"
- Bank 1 HO2S 2 signal voltage remains between 426 mV and 474 mV for a total of 106 seconds over a 125-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Cleaning the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0140 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0140 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness– Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty HO2S heater or heater circuit–With the ignition“ON,” engine “OFF,” the HO2S voltage displayed on a Tech 2 should gradually drop to below 250 mV. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test–With the ignition “ON,” monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number (s) below refer to the step number (s) on the Diagnostic Chart.

3. If the DTC P0140 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

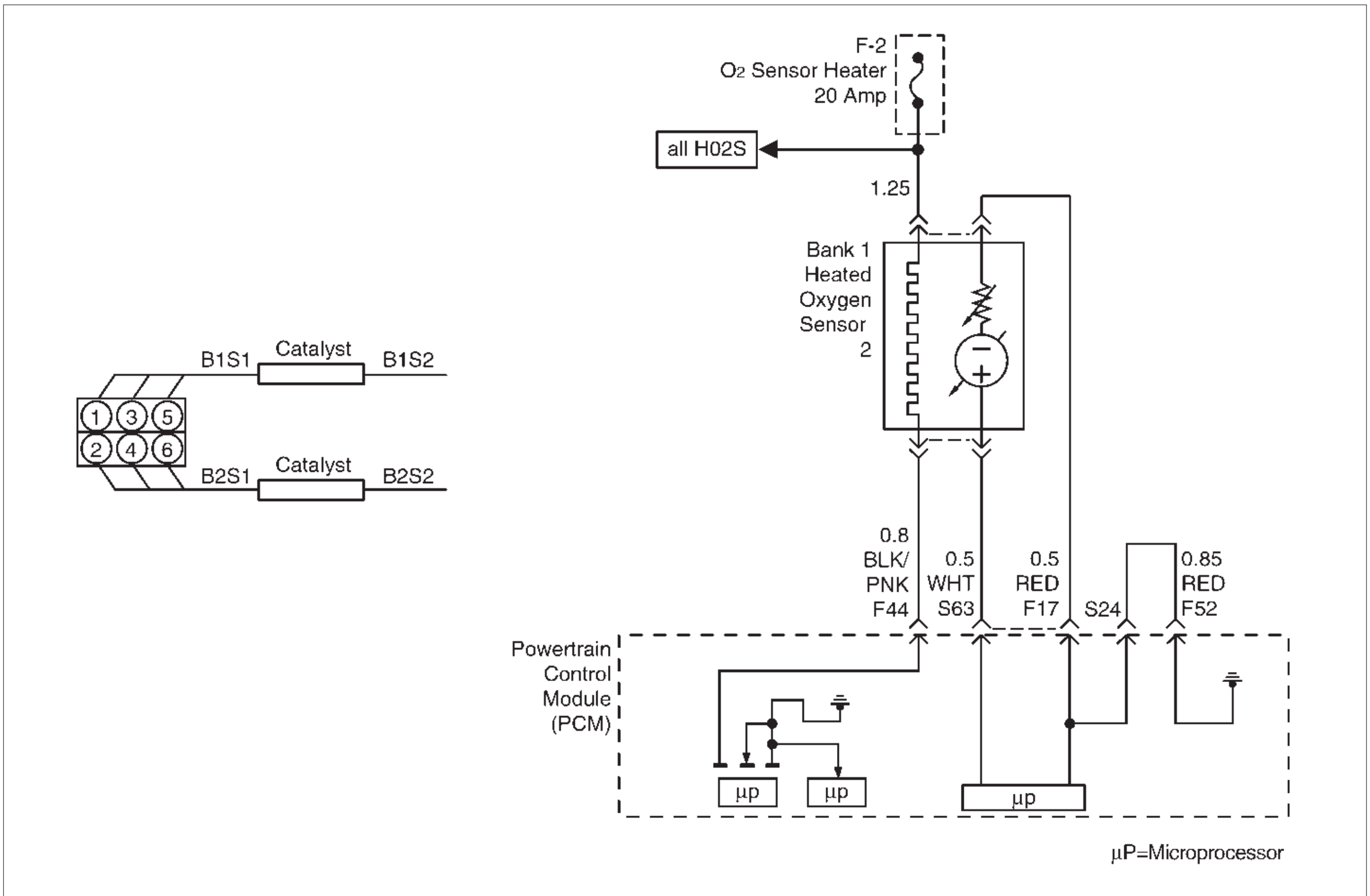
DTC P0140 – HO2S Circuit Insufficient Activity BANK 1 SENSOR 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 1 HO2S 2 voltage varying outside the specified values?	425-475 mV	Go to *Step 3*	Go to *Step 4*
3	1. Ignition “ON,” engine “OFF,” review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0140 until the DTC P0140 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0140 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Check for a damaged harness. Was a problem found?	—	Verify repair	Go to *Step 5*
5	Check for poor Bank 1 HO2S 2 high and low circuit terminal connections at the Bank 1 HO2S 2 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 6*
6	Check for poor Bank 1 HO2S 2 high and low circuit terminal connections at the PCM and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 7*
7	1. Ignition “OFF.” 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 2 high circuit. 3. If the Bank 1 HO2S 2 high circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 2 high circuit problem found and corrected?	—	Verify repair	Go to *Step 8*

DTC P0140 – HO2S Circuit Insufficient Activity BANK 1 SENSOR 2 (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 2 high circuit. 3. If the Bank 1 HO2S 2 low circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 2 low circuit problem found and corrected?	—	Verify repair	Go to *Step 9*
9	1. Ignition "ON," engine"OFF." 2. Disconnect Bank 1 HO2S 2 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Is Bank 1 HO2S 2 voltage in the specified range?	0-10 mV	Go to *Step 10*	Go to *Step 11*
10	Replace Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0141 HO2S Heater Circuit Bank 1 Sensor 2



D06RY00173

Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for closed loop fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine.

The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the Bank HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 1 HO2S 2 to become active, a DTC P0141 will set. The time it should take the HO2S to reach operating temperature is based on the total amount of air that has passed through the MAF sensor and into the engine (more total airflow = shorter time to HO2S activity).

Conditions for Setting the DTC

- No related DTCs.
- Intake air temperature (IAT) is less than 32°C (90°F) at start-up.
- Engine coolant temperature (ECT) is less than 32°C (90°F) at start-up.
- IAT and ECT are within 6°C (11°F) of each other at start-up.
- Ignition voltage is between 11 volts and 18 volts.
- Average mass airflow is less than 23 g/second during the sample period.
- Bank 1 HO2S 2 voltage does not change more than 150 mV from the bias voltage (between 400 mV–500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 120 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulated air flow since start-up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0141 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0141 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. This ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. This checks the HO2S heater ground circuit.
6. This checks for an open or shorted HO2S heater element.
11. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

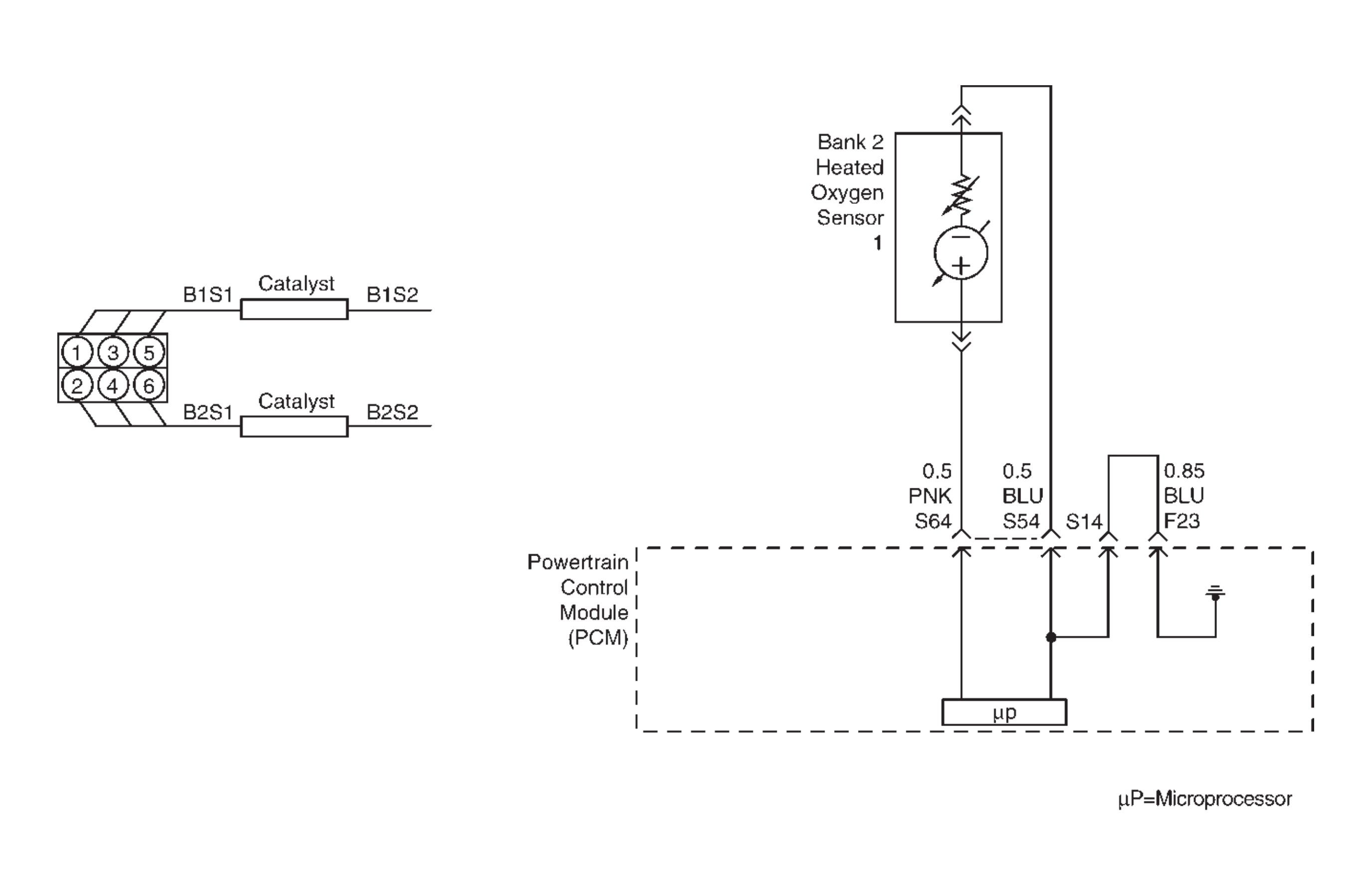
DTC P0141 – HO2S Heater Circuit Bank 1 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If the engine has just been operating, allow the engine to cool for at least 15 minutes before proceeding. 1. Remove the fuel pump relay. 2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses. 3. Ignition "OFF." 4. Install a Tech 2. 5. Ignition "ON," engine "OFF." 6. Monitor the Bank 1 HO2S 1 voltage for several minutes. Did the HO2S voltage go from bias voltage to above or below the specified values?	Above 650 mV or below 250 mV	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Inspect the fuse for Bank 1 HO2S 2 ignition feed. Is the fuse open?	—	Go to *Step 15*	Go to *Step 4*
4	1. Ignition "OFF." 2. Raise the vehicle. 3. Disconnect the Bank 1 HO2S 2 electrical connector. 4. Using a test light connected to a good ground (do not use Bank 1 HO2S 2 heater ground or Bank 1 HO2S 2 low), probe the ignition feed circuit at the Bank 1 HO2S 2 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to *Step 5*	Go to *Step 7*

DTC P0141 – HO2S Heater Circuit Bank 1 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
5	Connect the test light between the Bank 1 HO2S 2 ignition feed and the Bank 1 HO2S 2 heater ground. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 8*
6	1. Allow the HO2S to cool for at least 15 minutes. 2. Using a DVM, measure the resistance between the Bank 1 HO2S 2 ignition feed and the Bank 1 HO2S 2 heater ground at the Bank 1 HO2S 2 pigtail. Is the HO2S resistance within the specified values?	3-6 ohms	Go to *Step 9*	Go to *Step 10*
7	Repair the open Bank 1 HO2S 2 ignition feed circuit to Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 1 HO2S 2 heater ground circuit. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 1 HO2S 2 harness terminals. 2. If a poor connection is found, replace the terminals. Was a poor connection found?	—	Verify repair	Go to *Step 10*
10	1. Ignition "OFF." 2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 2 signal circuit and the Bank 1 HO2S 2 low circuit. 3. If the Bank 1 HO2S 2 signal circuit or the HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF." 2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 1 signal circuit and the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 high circuit or the HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check for a poor Bank 1 HO2S 2 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 13*
13	Check for a poor Bank 1 HO2S 2 high circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
14	Replace Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in Bank 1 HO2S 2 ignition feed circuit and replace the faulty fuse. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1



D06RY00174

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains excessively low for an extended period of time, DTC P0151 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop."
- Engine coolant temperature is above 60°C (140°F).
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.
- Bank 2 HO2S 1 signal voltage remains below 22 mV during normal "closed loop" operation for a total of 77 seconds over a 90-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0151 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0151 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and contacting the exhaust system.
- Poor PCM to engine block grounds.
- Fuel pressure – The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a DTC P0151 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform "Injector Balance Test."

- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Check for exhaust leaks that may cause a false lean condition to be indicated.
- MAF sensor –The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0151 failing during operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0151 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicate.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

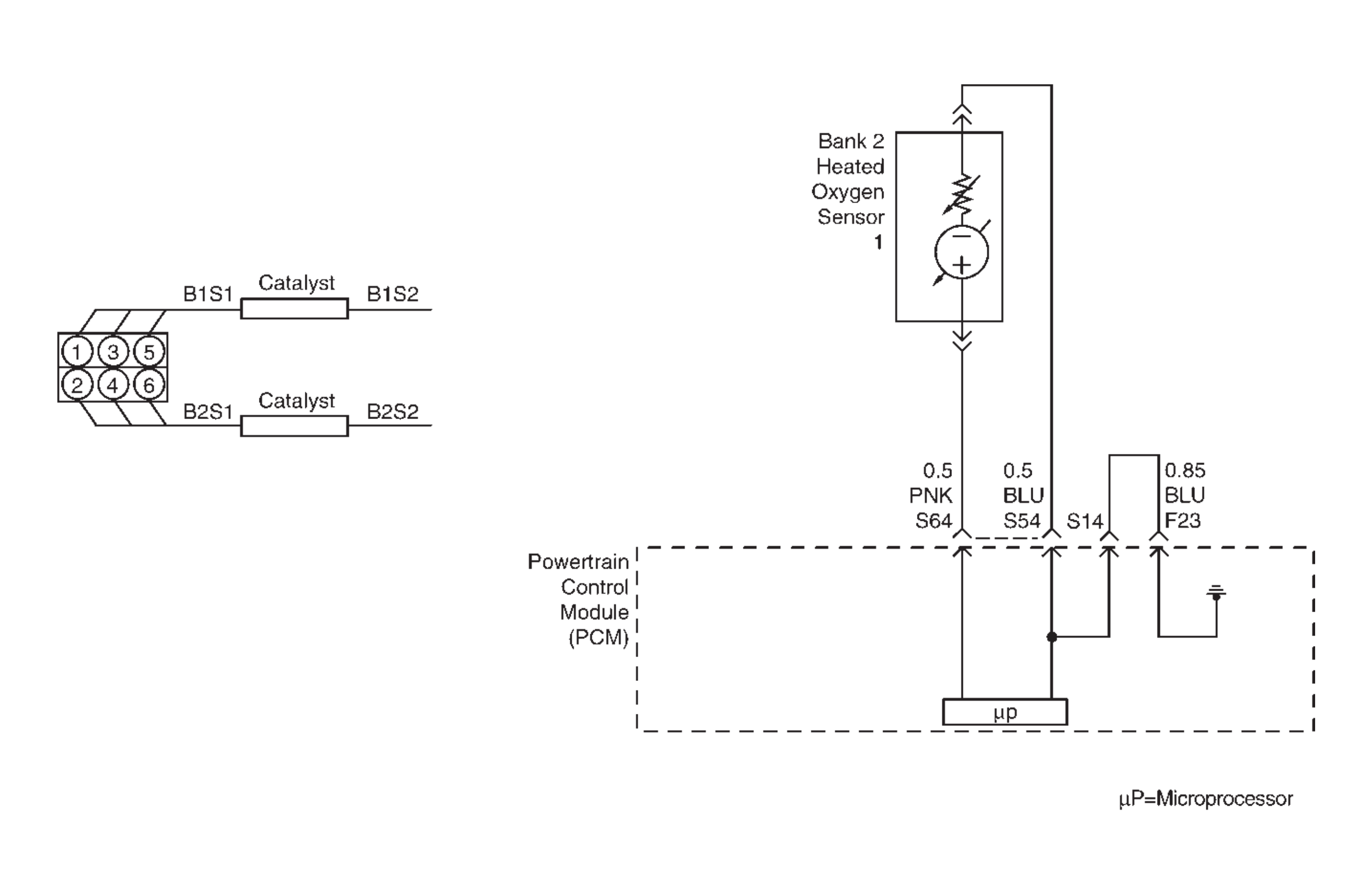
DTC P0151 – HO2S Circuit Low Voltage Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 2 HO2S 1 voltage. Does the Bank 2 HO2S 1 voltage remain below the specified value?	22 mV	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF," review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0151 until the DTC P0151 test runs. 4. Note test result. Does the Tech 2 indicate DTC P0151 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Turn ignition "OFF." 2. Disconnect the PCM. 3. Check the Bank 2 HO2S 1 high and low signal circuits for a short to ground or a short to the heater ground circuit. Were Bank 2 HO2S 1 signal circuits shorted?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the Bank 2 HO2S 1 signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition "OFF." 2. Leave the PCM and HO2S 1 disconnected. 3. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to *Step 7*	Go to *Step 8*

DTC P0151 – HO2S Circuit Low Voltage Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition "OFF." 2. Reconnect the PCM, leave HO2S disconnected. 3. Ignition "ON." Does the Tech 2 indicate Bank 2 HO2S 1 voltage near the specified value?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0152 HO2S Circuit HIGH Voltage Bank 2 Sensor 1



D06RY00174

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing the injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains excessively high for an extended period of time, DTC P0152 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop."
- The engine coolant temperature is above 60˚C (140˚F).
- "Closed loop" commanded air/fuel ratio between 14.5 and 14.8.
- Bank 2 HO2S 1 signal voltage remains above 952 mV during normal "closed loop" operation for a total of 77 seconds over a 90-second period.

OR

- Bank 2 HO2S 1 signal voltage remains above 500 mV during deceleration fuel cutoff mode operation for up to 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0152 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0152 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Fuel pressure – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a DTC P0152 may be set. Refer to *Fuel System Diagnosis*.
- Rich injector(s) – Perform "Injector Balance Test."
- Leaking injector – Refer to *Fuel System Diagnosis*.
- Evaporative emissions (EVAP) system – Check the canister for fuel saturation. If the canister is full of fuel, check EVAP control system components and hoses.

Refer to *Evaporative Emission (EVAP) Control System*.

- MAF sensor – The system can go rich if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if rich condition is corrected. If so, replace MAF sensor.
- Check for leaking fuel pressure regulator diaphragm by checking vacuum line to regulator for the presence of fuel. There should be no fuel in the vacuum line.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S)– If the HO2S is internally shorted, the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key “ON,” engine “OFF.” If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can cause a high HO2S voltage to be indicated. This condition is indicated by powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit of Faulty HO2S– A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage switch between the rich and lean thresholds can also cause the condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S is limited within a range between 300 mV to 600 mV, check the HO2S signal circuit wiring and associated terminal connections.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0152 failing during deceleration fuel cutoff mode operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0152 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

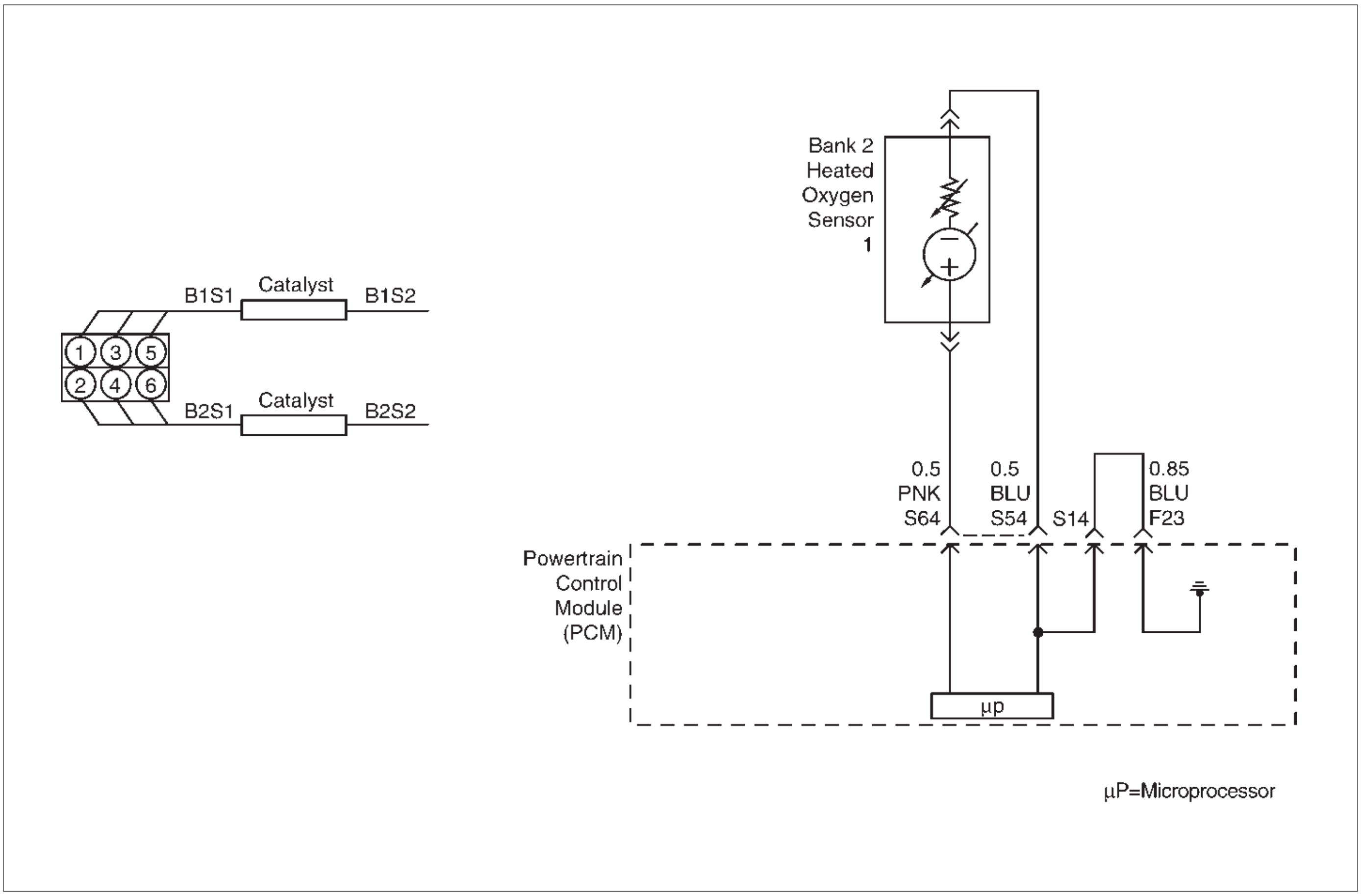
DTC P0152 – HO2S Circuit High Voltage Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Engine is at operating temperature. 3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 2 HO2S 1 voltage. Does the Bank 2 HO2S 1 voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cut-off mode)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0152 until the DTC P0152 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0152 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition “OFF.” 2. Disconnect Bank 2 HO2S 1. 3. Ignition “ON.” 4. At HO2S Bank 2 Sensor 1 connector (PCM side) use a DVM to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	3-4 V	Go to *Step 5*	Go to *Step 6*
5	Repair short to voltage in signal circuit. Is the action complete?	—	Verify repair	—

DTC P0152 – HO2S Circuit High Voltage Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition "ON," engine"OFF." 2. At Bank 2 HO2S 1 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 2 HO2S 1 voltage. Is Bank 2 HO2S 1 voltage below the specified value?	10 mV	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the jumpers to ground from Bank 2 HO2S 1 PCM-side connector. 2. With the HO2S 1 connector disconnected, monitor Bank 2 HO2S 1 voltage. Is the Bank 2 HO2S 1 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0153 HO2S Slow Response Bank 2 Sensor 1



D06RY00174

Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” has been enabled. During the monitoring period the PCM counts the number of times that a rich-to-lean and lean-to-rich response is indicated and adds the amount of time it took to complete all rich-to-lean transitions and lean-to-rich transitions. With this information, an average time for rich-to-lean and lean-to-rich transitions can be determined. If the average response time of either transition is too slow, a DTC P0153 will be set.

A lean-to-rich transition is indicated when the HO2S voltage changes from less than 300 mV to greater than 600 mV. A rich-to-lean transition is indicated when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is likely to be faulty and should be replaced.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ECT) is above 50°C (122°F) for automatic transmission; 75° (167°F) for manual transmission.
- The engine is operating in “closed loop.”
- Engine has been running for at least one minute.
- Canister purge duty cycle is above 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow is between 9 g/second and 42 g/second.
- All above conditions are met for 3 seconds.
- 90 seconds after “closed loop” has been enabled, Bank 2 HO2S 1 average transition time between 300 mV and 600 mV is too slow. The lean-to-rich average transition response time was longer than 94 milliseconds or the rich-to-lean average transition response time was longer than 105 milliseconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0153 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0153 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is currently present.
3. HO2S transition time, ratio mean volts and switching DTCs set for multiple sensors indicate probable contamination. Before replacing the sensors, isolate and correct the source of the contamination to avoid damaging the replacement sensors.

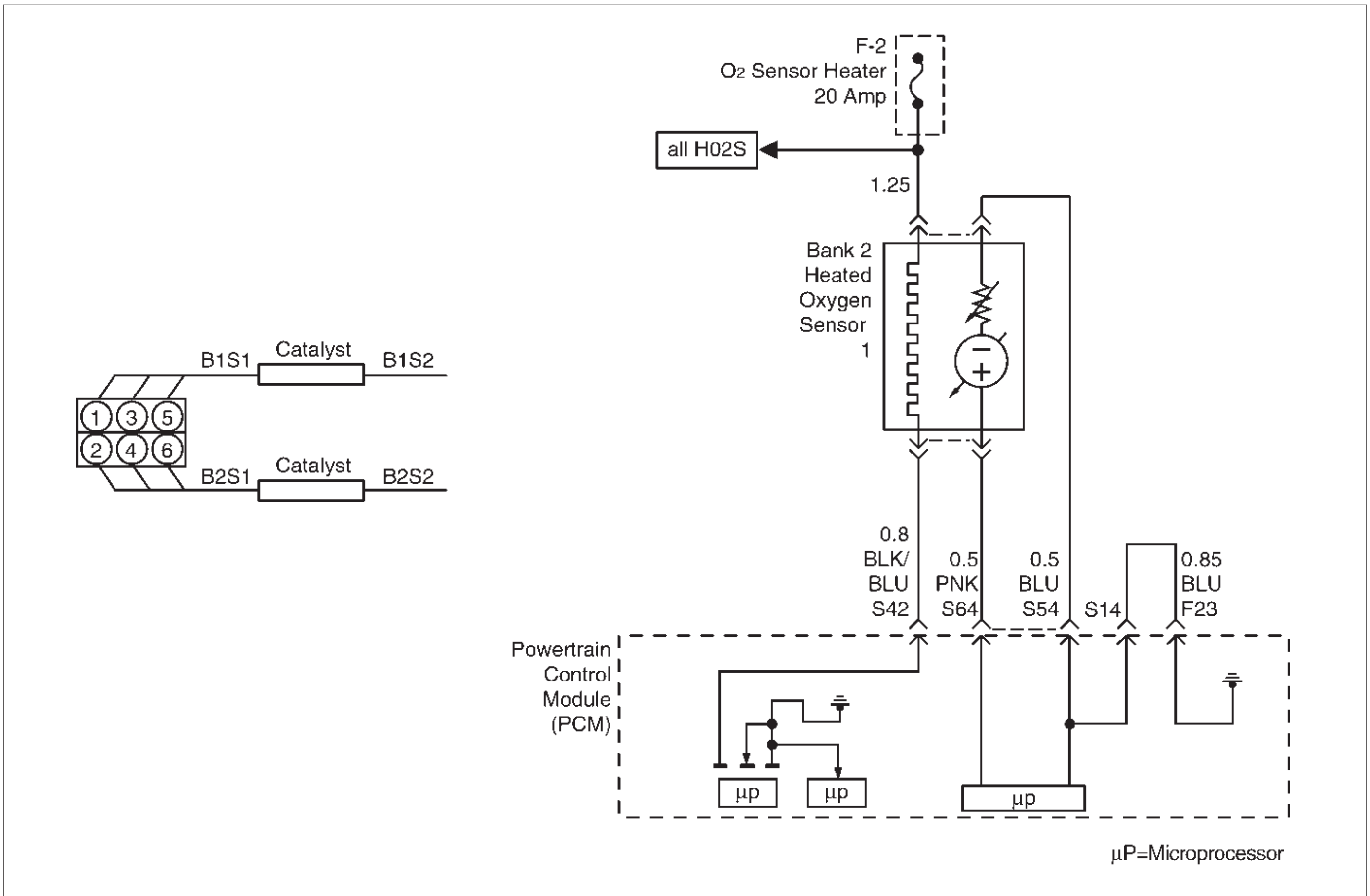
DTC P0153 – HO2S Slow Response Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If any DTCs are set, (except P0133, P1133, P1134, P1153, and/or P1154), refer to those DTCs before proceeding with this diagnostic chart. 1. Install the Tech 2. 2. Idle the engine at operating temperature. 3. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor “DTC” info for DTC P0153 until the DTC P0153 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0153 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate DTC P0153, P1133, P1134, P1153, and/or P1154 test failed this ignition?	—	Go to *Step 17*	Go to *Step 4*
4	Check for leaks at the pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U-bolt nuts at the leaking joint. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damage or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—

DTC P0153 – HO2S Slow Response Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Visually/physically inspect the following items: ● Ensure that the Bank 2 HO2S 1 is securely installed. ● Check for corrosion on terminals. ● Check terminal tension (at Bank 2 HO2S 1 and at the PCM). ● Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to *Step 18*	Go to *Step 15*
15	1. Disconnect Bank 2 HO2S 1. 2. Ignition "ON." 3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. Are both voltages in the specified range?	3-4 V	Go to *Step 16*	Go to *Step 19*
16	1. With Bank 2 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition "ON." 3. Using a Tech 2, monitor the Bank 2 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to *Step 21*	Go to *Step 22*
17	Replace the affected heated oxygen sensors. NOTE: Before replacing the sensors, the cause of the contamination must be determined and corrected. ● Fuel contamination. ● Use of improper RV sealant. ● Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
18	Repair condition as necessary. Is the action complete?	—	Verify repair	—
19	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to *Step 20*
20	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	—
21	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1



D06RY00175

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) high and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains at or near the 450 mV bias for an extended period of time, DTC P0154 will be set, indicating an open sensor signal or sensor low circuit.

Heated oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- No related DTCs.
- Battery voltage is above 10 volts.
- Engine running time is longer than 40 seconds.
- Oxygen sensor heater is functioning properly.
- Bank 2 HO2S 1 signal voltage remains between 400 mV and 500 mV for a total of 77 seconds over a 90-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0154 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0154 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire-connection, and damaged harness.

- Faulty HO2S heater or heater circuit – With the ignition “ON,” engine “OFF,” the HO2S 1 voltage displayed on the Tech 2 is normally 455-460 mV. A reading over 1000 mV indicates a signal line shorted to voltage. A reading under 5 mV indicates a signal line shorted to ground or signal lines shorted together. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light for 2 seconds when the ignition is turned on, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test – With the ignition “ON,” monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. If the DTC P0154 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

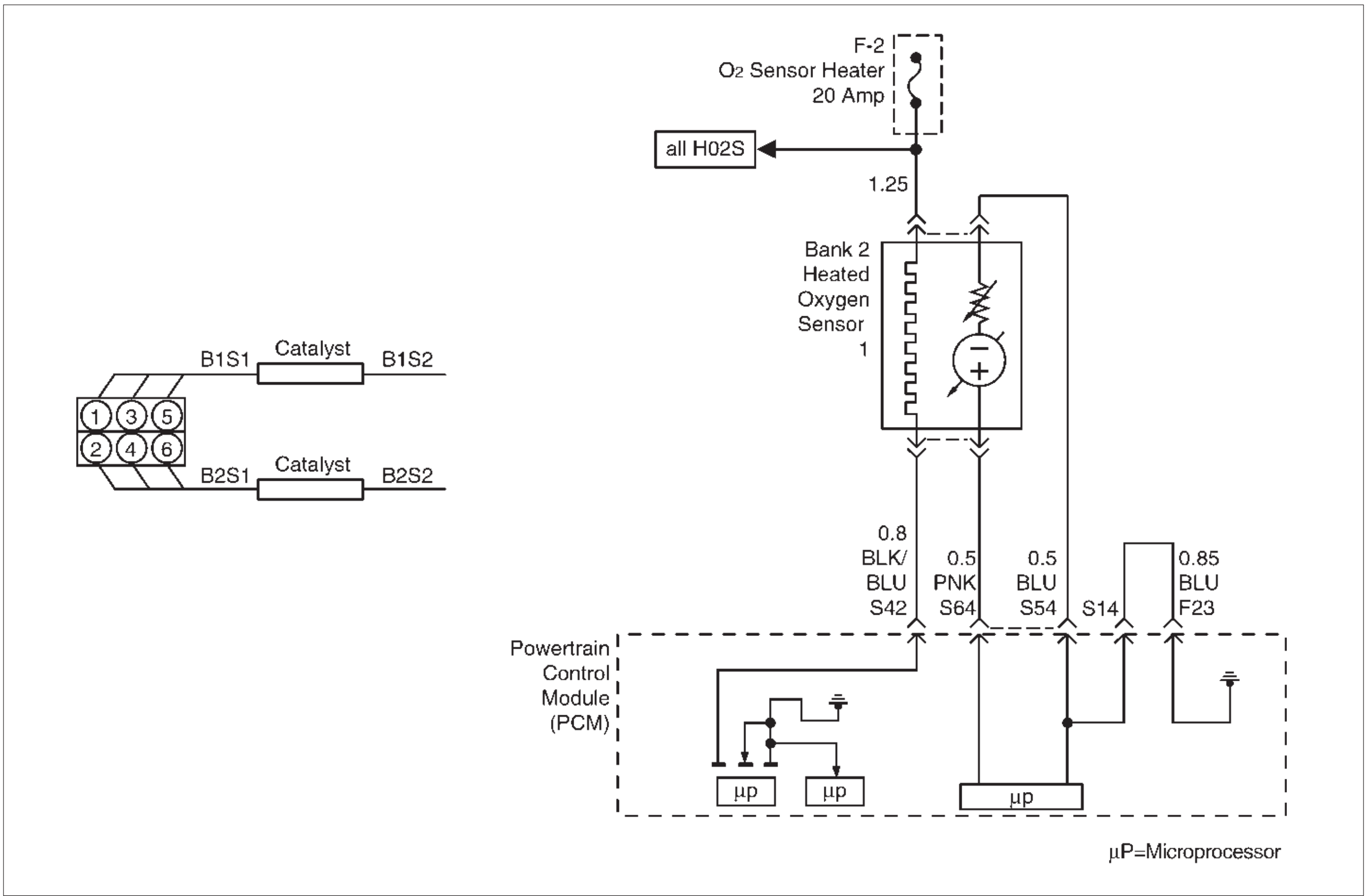
DTC P0154 –HO2S Circuit Insufficient Activity Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 2 HO2S 1 voltage varying outside the specified values?	400-500 mV	Go to *Step 3*	Go to *Step 4*
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data and note parameters. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0154 until the DTC P0154 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0154 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Check for a damaged harness. Was a problem found?	—	Verify repair	Go to *Step 5*
5	Check for a poor Bank 2 HO2S 1 high and low circuit terminal connections at the Bank 2 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 6*
6	Check for a poor Bank 2 HO2S 1 high and low circuit terminal connections at the PCM and replace terminal(s) if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 7*

DTC P0154 –HO2S Circuit Insufficient Activity Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 2 HO2S 1 high circuit. 3. If the Bank 2 HO2S 1 high circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 2 HO2S 1 high circuit problem found and corrected?	—	Verify repair	Go to *Step 8*
8	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 2 HO2S 1 low circuit. 3. If the Bank 2 HO2S 1 low circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 2 HO2S 1 low circuit problem found and corrected?	—	Verify repair	Go to *Step 9*
9	1. Ignition "ON," engine "OFF." 2. Disconnect Bank 2 HO2S 1 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 2 HO2S 1 voltage. Is the Bank 2 HO2S 1 voltage in the specified range?	0-10 mV	Go to *Step 10*	Go to *Step 11*
10	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0155 HO2S Heater Circuit Bank 2 Sensor 1



D06RY00175

Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for closed loop fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine.

The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the Bank HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 2 HO2S 1 to become active, a DTC P0155 will set. The time it should take the HO2S to reach operating temperature is based on the total amount of air that has passed through the mass air flow (MAF) sensor and into the engine (more total air flow = shorter time to HO2S activity).

Conditions for Setting the DTC

- No related DTCs.
- Intake air temperature (IAT) is less than 32°C (90°F) at start-up.
- Engine coolant temperature (ECT) is less than 32°C (90°F) at start-up.
- IAT and ECT are within 6°C (11°F) of each other at start-up.
- Ignition voltage is between 11 volts and 18 volts.
- Average mass air flow for the sample period is less than 21 g/second.
- Bank 1 HO2S 2 voltage does not change more than 150 mV from the bias voltage (between 400 mV-500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 120 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulated air flow since start-up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0155 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0155 can be cleared by using the Tech 2 "Clear info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. Ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. Checks the HO2S heater ground circuit.
6. Checks for an open or shorted HO2S heater element.
10. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

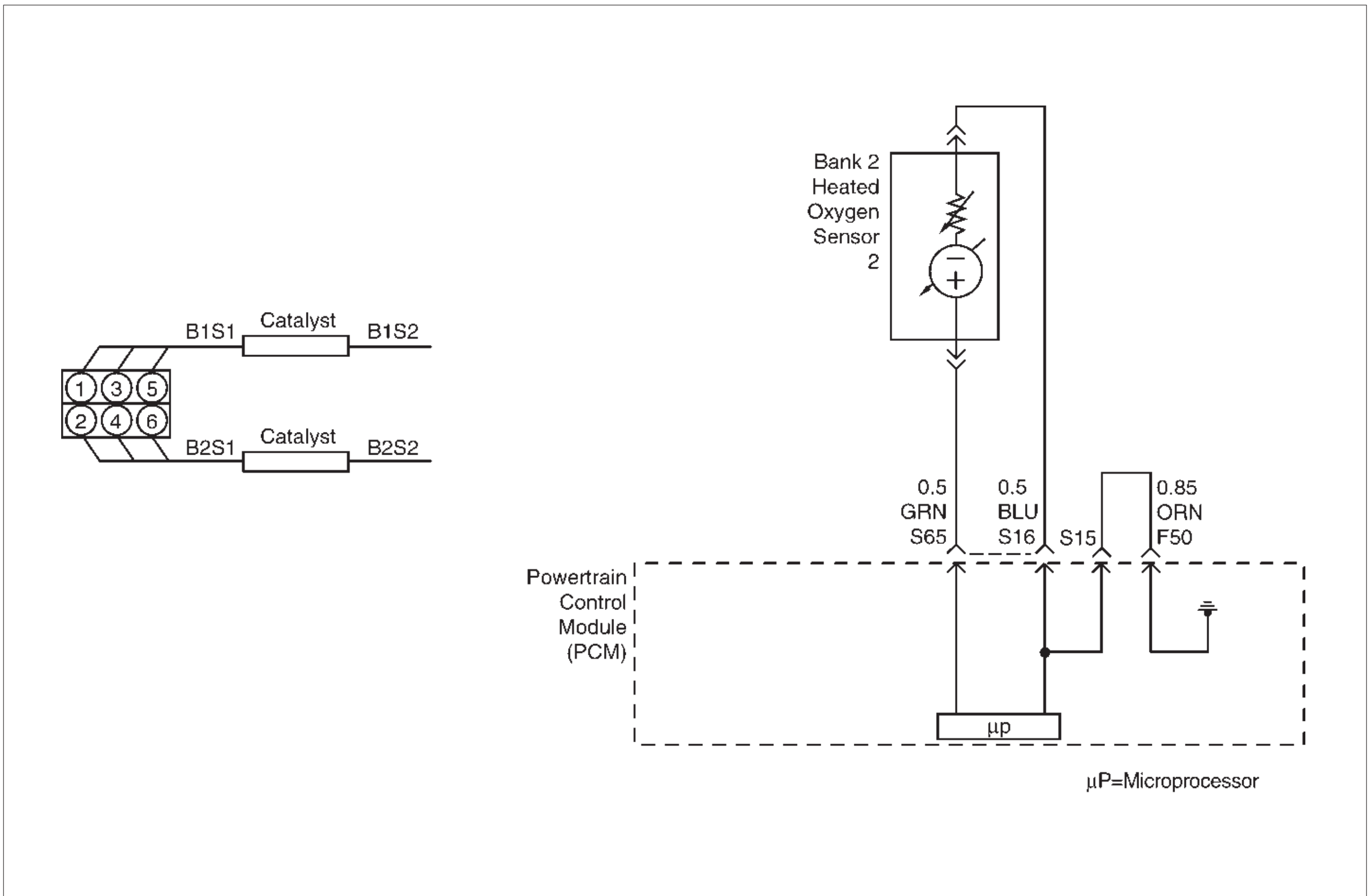
DTC P0155 – HO2S Heater Circuit Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If the engine has just been operating, allow the engine to cool for at least 15 minutes before proceeding. 1. Remove the fuel pump relay. 2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses. 3. Ignition "OFF." 4. Install a Tech 2. 5. Ignition "ON," engine "OFF." 6. Monitor the Bank 1 HO2S 1 voltage for several minutes. Did the HO2S voltage go from bias voltage to above or below the specified value?	Above 650 mV or below 250 mV	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Inspect the fuse for the Bank 2 HO2S 1 ignition feed. Is the fuse open?	—	Go to *Step 15*	Go to *Step 4*
4	1. Ignition "OFF." 2. Raise the vehicle. 3. Disconnect the Bank 2 HO2S 1 electrical connector. 4. Using a test light connected to a known good ground (do not use Bank 2 HO2S 1 heater ground or Bank 2 HO2S 1 low), probe the ignition feed circuit at the Bank 2 HO2S 1 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to *Step 5*	Go to *Step 7*

DTC P0155 – HO2S Heater Circuit Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
5	Connect the test light between Bank 2 HO2S 1 ignition feed and Bank 2 HO2S 1 heater ground. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 8*
6	1. Allow the HO2S to cool for at least 15 minutes. 2. Using a DVM, measure resistance between the Bank 2 HO2S 1 ignition feed and the Bank 2 HO2S 1 heater ground at the Bank 2 HO2S 1 pigtail. Is the HO2S resistance within the specified values?	3-6 ohms	Go to *Step 9*	Go to *Step 10*
7	Repair the open Bank 2 HO2S 1 ignition feed circuit to Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 2 HO2S 1 heater ground circuit. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 2 HO2S 1 harness terminals. 2. If a poor connection is found, replace terminals. Was a poor connection found?	—	Verify repair	Go to *Step 10*
10	Check for a poor Bank 2 HO2S 1 signal or low circuit terminal connection at the Bank 2 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF." 2. Disconnect the PCM and check the continuity of the Bank 2 HO2S 1 signal circuit and the Bank 2 HO2S 1 low circuit. 3. If the Bank 2 HO2S 1 signal circuit or HO2S low circuit measures over 5 ohms, repair open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check for a poor Bank 2 HO2S 1 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 13*
13	Check for a poor Bank 2 HO2S 1 signal circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
14	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
15	Locate and repair short to ground in Bank 2 HO2S 1 ignition feed circuit and replace the faulty fuse. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0157 HO2S Circuit Low Voltage Bank 2 Sensor 2



D06RY00176

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the Bank 2 HO2S 2 signal voltage remains excessively low for an extended period of time, DTC P0157 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop."
- Engine coolant temperature is above 60°C (140°F).
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8
- Bank 2 HO2S 2 signal voltage remains below 22 mV during normal "closed loop" operation for a total of 106 seconds over a 125-second period of time.

OR

- Bank 2 HO2S 2 signal voltage remains below 400 mV during "power enrichment" mode fuel control operation for up to 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0157 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0157 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and contacting the exhaust system.
- Poor PCM to engine grounds.
- Fuel pressure – A condition which causes a lean exhaust can cause DTC P0157 to set. The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a DTC P0157 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform “Injector Balance Test.”
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the DTC P0157 to set. Check for exhaust leaks near the Bank 1 HO2S 2 sensor.
- MAF sensor – The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of above conditions are present, replace the affected HO2S 2.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0157 failing during operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0157 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

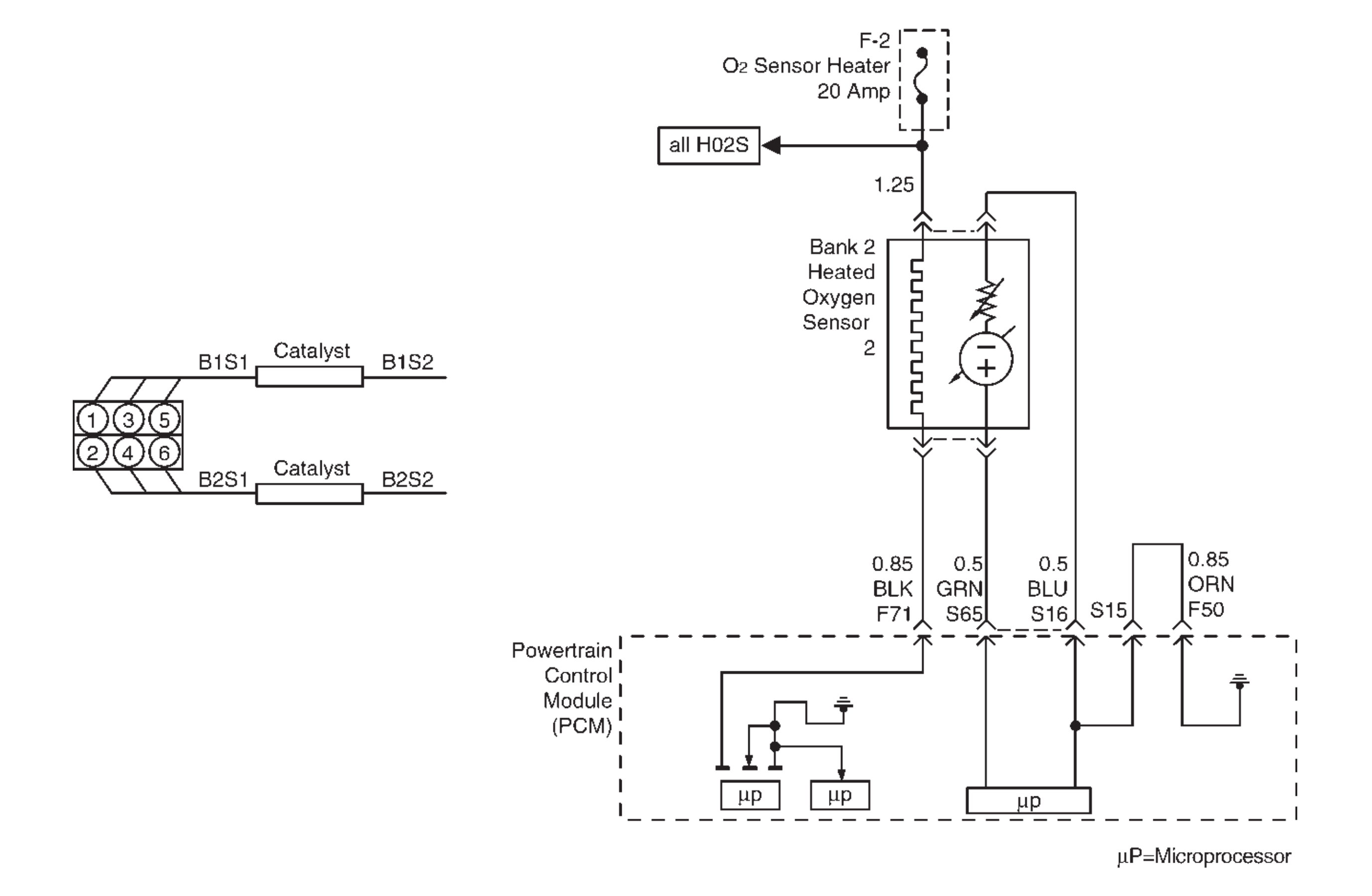
DTC P0157 – HO2S Circuit Low Voltage Bank 2 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 2 HO2S 2 voltage. Does the Bank 2 HO2S 2 voltage remain below the specified value?	22 mV	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data and note parameters. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0157 until the DTC P0157 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0157 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Turn the ignition “OFF.” 2. Disconnect the PCM. 3. Check the Bank 2 HO2S 2 high and low signal circuits for a short to ground or a short to the heater ground circuit. Were Bank 2 HO2S 2 signal circuits shorted?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the Bank 1 HO2S 2 signal circuit. Is the action complete?	—	Verify repair	—

DTC P0157 – HO2S Circuit Low Voltage Bank 2 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition "OFF." 2. Leave the PCM and HO2S 2 disconnected. 3. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to *Step 7*	Go to *Step 8*
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition "OFF." 2. Reconnect the PCM, leave HO2S 2 disconnected. 3. Ignition "ON." Does the Tech 2 indicate Bank 2 HO2S 2 voltage near the specified value?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0158 HO2S Circuit High Voltage Bank 2 Sensor 2



D06RY00177

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the Bank 2 HO2S 2 signal voltage remains excessively high for an extended period of time, DTC P0158 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in "closed loop."
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Engine coolant temperature is above 60˚C (140˚F).
- Bank 2 HO2S 2 signal voltage remains above 952 mV during normal "closed loop" operation for a total of 106 seconds over a 125-second period.

OR

- Bank 2 HO2S 2 signal voltage remains above 500 mV during deceleration fuel cutoff mode operation for up to 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0158 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0158 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Fuel pressure – An excessively rich fuel mixture can cause a DTC P0158 to be set. Refer to *Fuel System Diagnosis*.
- Rich injector(s) – Perform "Injector Balance Test."
- Leaking injector – Refer to *Fuel System Diagnosis*.
- Evaporative emissions (EVAP) canister purge – Check for fuel saturation. If full of fuel, check canister control and hoses. Refer to *Evaporative Emission (EVAP) Control System*.
- MAF sensor –The system can go rich if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if a rich condition is corrected. If so, replace the MAF sensor.
- Check for a leaking fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel. There should be no fuel in the vacuum line.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S) – If the HO2S is internally shorted, the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key "ON," engine "OFF." If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S signal or low circuit, or faulty HO2S – A poor connection or open in the HO2S signal or low circuit can cause the DTC to set during deceleration fuel cutoff mode operation. An HO2S which is faulty and does not allow full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal and low circuit wiring and associated terminal connections. If the wiring and connections are OK, replace the HO2S.
- If none of above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0158 being set during deceleration fuel cutoff mode operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0158 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

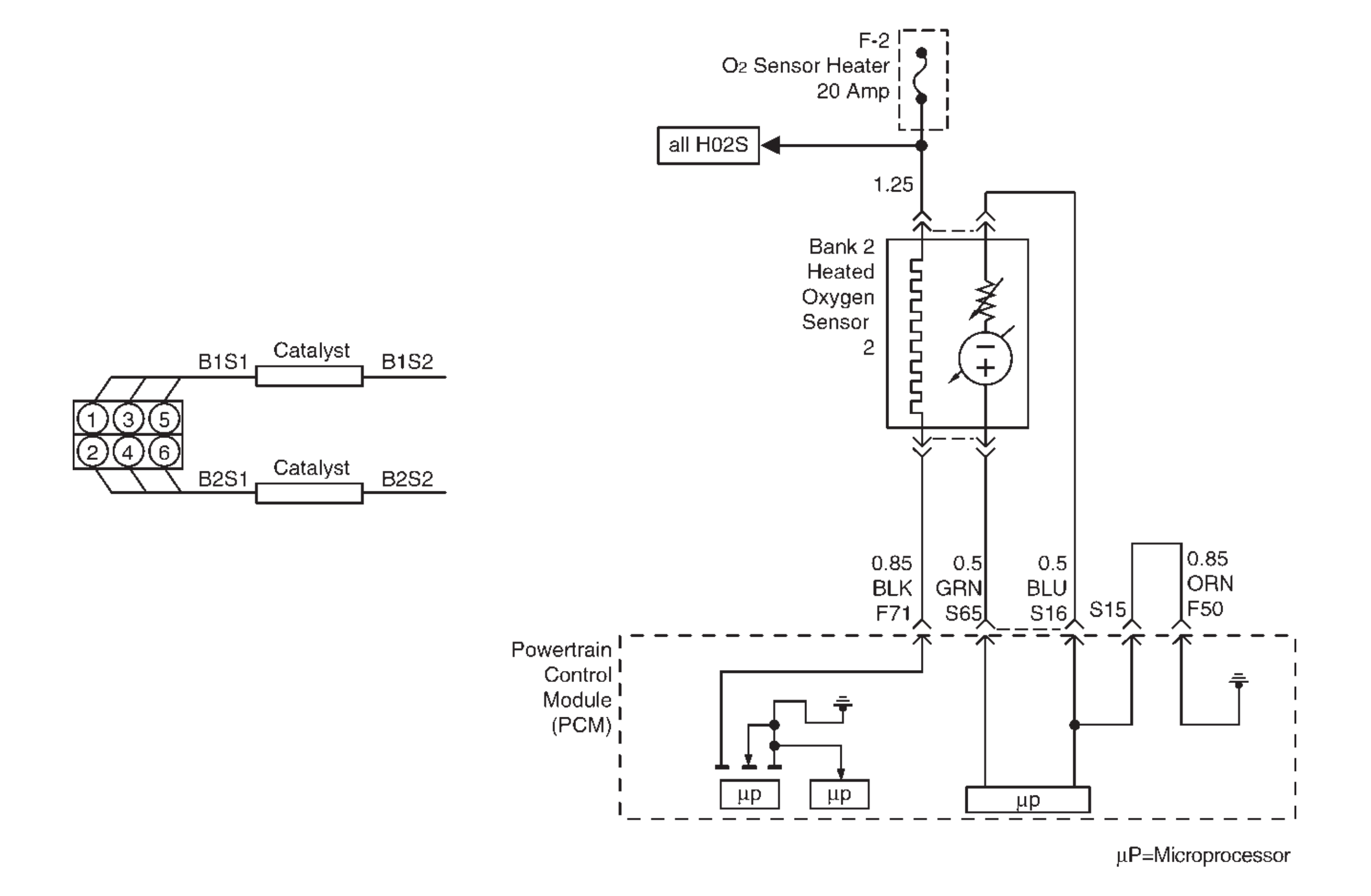
DTC P0158 – HO2S Circuit High Voltage Bank 2 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 2 HO2S 2 voltage. Does the Bank 2 HO2S 2 voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cut-out mode)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0158 until the DTC P0158 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0158 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*

DTC P0158 – HO2S Circuit High Voltage Bank 2 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
4	1. Ignition "OFF." 2. Disconnect Bank 2 HO2S 2. 3. Ignition "ON." 4. At the HO2S Bank 2 Sensor 2 connector (PCM side), use a DVM to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	3-4 V	Go to *Step 5*	Go to *Step 6*
5	Repair short to voltage in signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition "ON," engine "OFF." 2. At Bank 2 HO2S 2 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 2 HO2S 2 voltage. Is Bank 2 HO2S 2 voltage below the specified value?	10 mV	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the jumpers to ground from Bank 2 HO2S 2 PCM-side connector. 2. With the HO2S 2 connector disconnected, monitor Bank 2 HO2S 2 voltage. Is Bank 2 HO2S 2 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0160 HO2S Circuit Insufficient Activity Bank 2 Sensor 2



D06RY00177

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the Bank 2 HO2S 2 signal voltage remains between 400 mV and 500 mV for an extended period of time, DTC P0160 will be set.

Heated Oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- No related DTCs.
- Battery voltage is above 10 volts.
- Engine run time is longer than 40 seconds.
- Oxygen sensor heater is functioning properly.
- Engine is in "closed loop" operation.
- Bank 2 HO2S 2 signal voltage remains between 426 mV and 474 mV for a total of 106 seconds over a 125-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0160 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0160 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty HO2S heater or heater circuit – With the ignition "ON," engine "OFF," the HO2S voltage displayed on a Tech 2 should gradually drop to below 250 mV. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test – With the ignition "ON," monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. If the DTC P0160 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

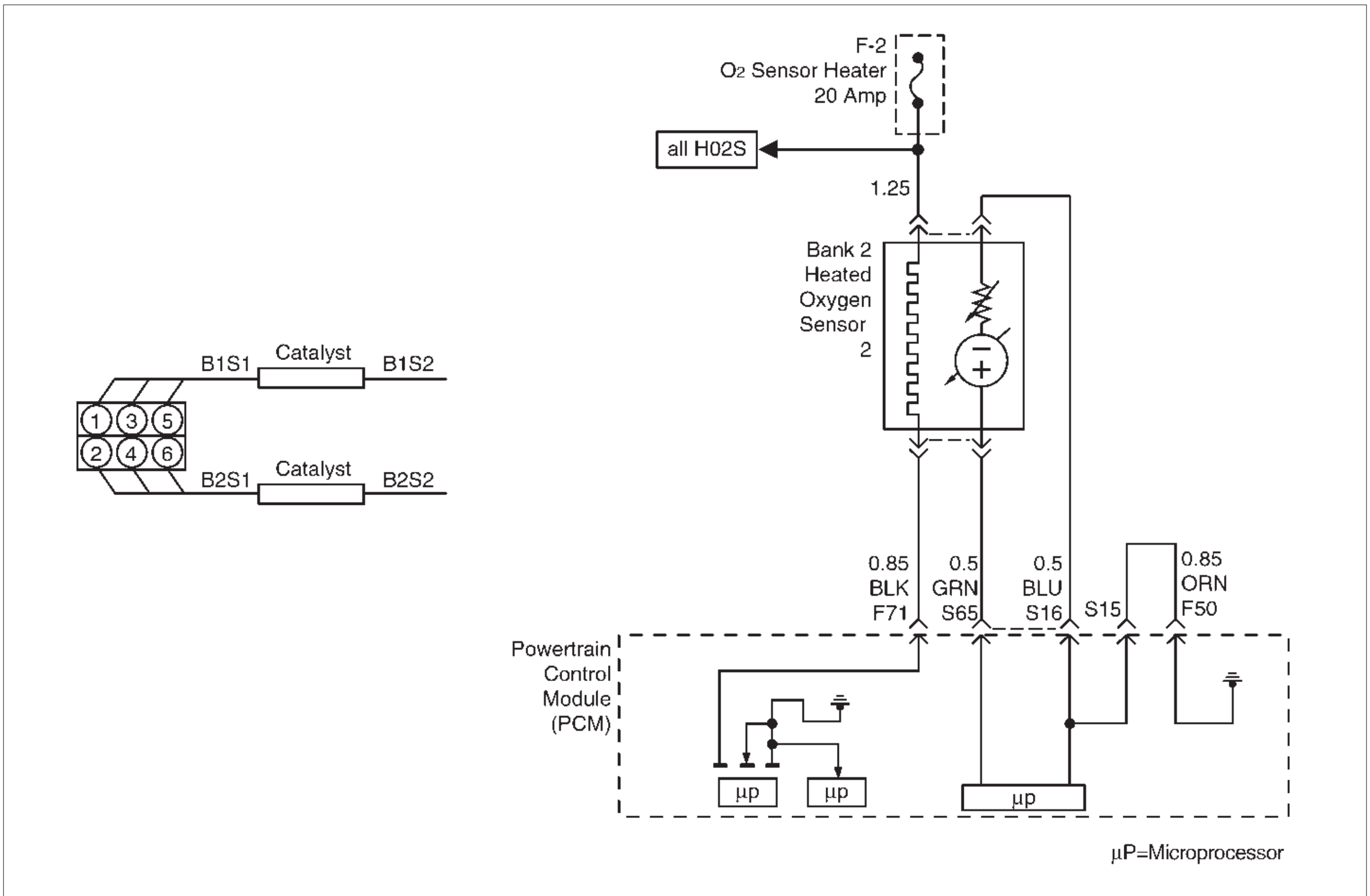
DTC P0160 – HO2S Circuit Insufficient Activity Bank 2 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 2 HO2S 2 voltage varying outside the specified values?	425-475 mV	Go to *Step 3*	Go to *Step 4*
3	1. Ignition "ON," engine "OFF," review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0160 until the DTC P0160 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0160 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Check for a damaged harness. Was problem found?	—	Verify repair	Go to *Step 5*
5	Check for poor Bank 2 HO2S 2 high and low circuit terminal connections at the Bank 2 HO2S 2 harness connector and replace terminal(s) if necessary. Did either terminal require replacement?	—	Verify repair	Go to *Step 6*
6	Check for poor Bank 2 HO2S 2 high and low circuit terminal connections at the PCM and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 7*

DTC P0160 – HO2S Circuit Insufficient Activity Bank 2 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 2 HO2S 2 high circuit. 3. If the Bank 2 HO2S 2 high circuit measures over 5.0 ohms, repair open or poor connections as necessary. Was a Bank 2 HO2S 2 high circuit problem found and corrected?	—	Verify repair	Go to *Step 8*
8	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 2 HO2S 2 low circuit. 3. If the Bank 2 HO2S 2 low circuit measures over 5 ohms, repair open or poor connections as necessary. Was a Bank 2 HO2S 2 low circuit problem found and corrected?	—	Verify repair	Go to *Step 9*
9	1. Ignition "ON," engine "OFF." 2. Disconnect Bank 2 HO2S 2 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 2 HO2S 2 voltage. Is Bank 2 HO2S 2 voltage in the specified range?	0-10 mV	Go to *Step 10*	Go to *Step 11*
10	Replace Bank 2 HO2S 2. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0161 HO2S Heater Circuit Bank 2 Sensor 2



D06RY00177

Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine. The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started, the PCM will monitor the HO2S voltage. When the Bank 2 HO2S 2 voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 2 HO2S 2 to become active, a DTC P0161 will set. The time it should take the HO2S to reach operating temperature is based on the total amount of air that has passed through the MAF sensor and into the engine (more total air flow = shorter time to HO2S activity).

Conditions for Setting the DTC

- No related DTCs.
- Intake air temperature (IAT) is less than 32°C (90°F) at start-up.
- Engine coolant temperature (ECT) is less than 32°C (90°F) at start-up.
- IAT and ECT are within 6°C (11°F) of each other at start-up.
- Ignition voltage is between 11 volts and 18 volts.
- Average mass air flow for the sample period is less than 23 g/second.
- Bank 2 HO2S 2 voltage does not change more than 150 mV from the bias voltage (between 400 mV-500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 120 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulated air flow since start-up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0161 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0161 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. This ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. This checks the HO2S heater ground circuit.
6. This checks for an open or shorted HO2S heater element.
11. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

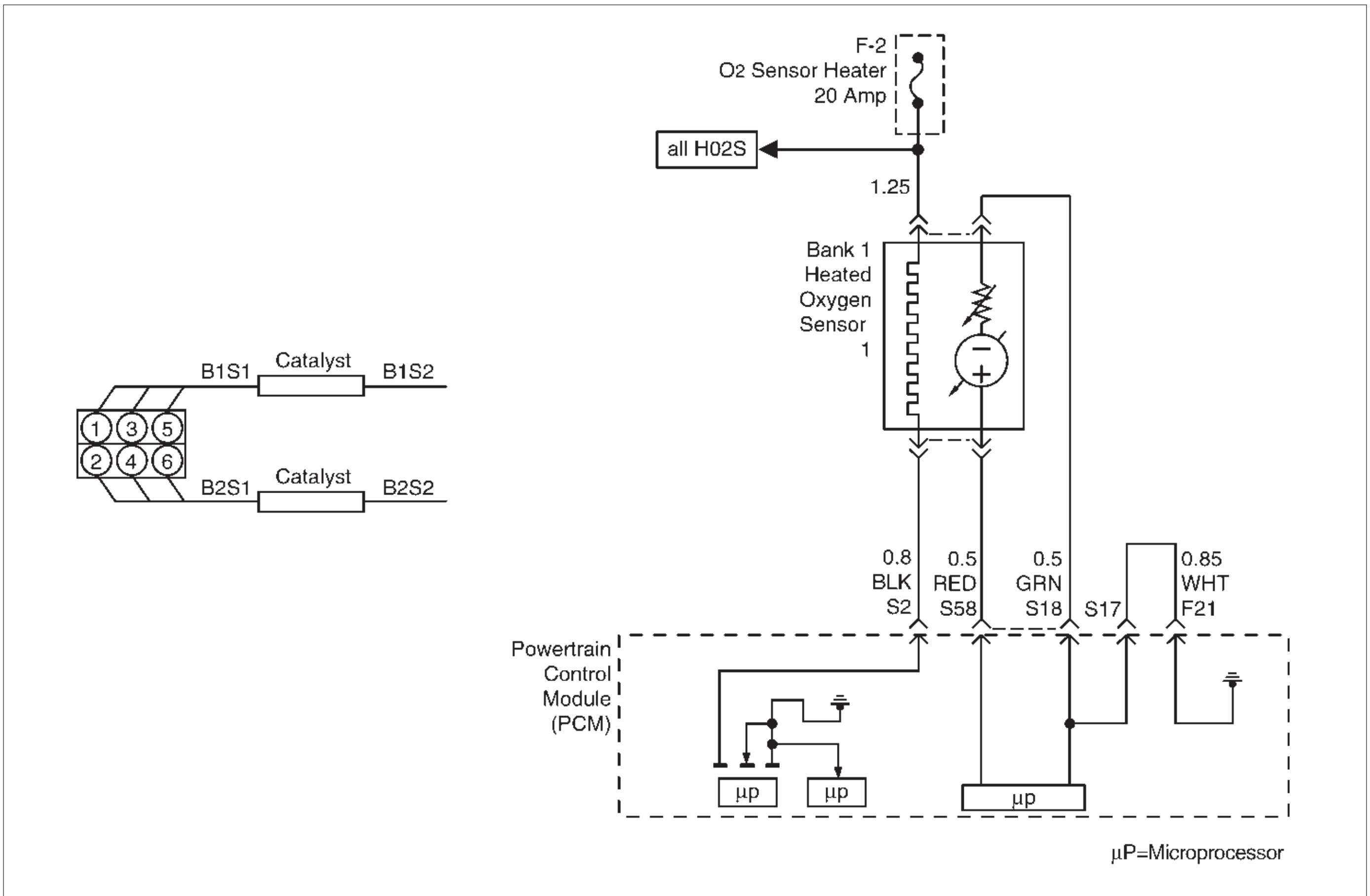
DTC P0161 – HO2S Heater Circuit Bank 2 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If the engine has just been operating, allow the engine to cool for at least 15 minutes before proceeding. 1. Remove the fuel pump relay. 2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses. 3. Ignition "OFF." 4. Install a Tech 2. 5. Ignition "ON," engine "OFF." 6. Monitor the Bank 2 HO2S 2 voltage for several minutes. Did the HO2S voltage go from bias voltage to above or below the specified values?	Above 650 mV or Below 250 mV	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Inspect the fuse for the Bank 2 HO2S 2 ignition feed. Is the fuse open?	—	Go to *Step 15*	Go to *Step 4*
4	1. Ignition "OFF." 2. Raise the vehicle. 3. Disconnect the Bank 2 HO2S 2 electrical connector. 4. Using a test light connected to a known good ground (do not use Bank 2 HO2S 2 heater ground or Bank 2 HO2S 2 low), probe the ignition feed circuit at the Bank 2 HO2S 2 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to *Step 5*	Go to *Step 7*
5	Connect the test light between the Bank 2 HO2S 2 ignition feed and the Bank 2 HO2S 2 heater ground. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 8*

DTC P0161 – HO2S Heater Circuit Bank 2 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Allow the HO2S to cool for at least 15 minutes. 2. Using a DVM, measure resistance between the Bank 2 HO2S 2 ignition feed and the Bank 2 HO2S 2 heater ground at the Bank 2 HO2S 2 pigtail. Is the HO2S resistance within the specified values?	3-6 ohms	Go to *Step 9*	Go to *Step 10*
7	Repair the open Bank 2 HO2S 2 ignition feed circuit to Bank 2 HO2S 2. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 2 HO2S 2 heater ground circuit. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 2 HO2S 2 harness terminals. 2. If a poor connection is found, replace the terminals. Was a poor connection found?	—	Verify repair	Go to *Step 10*
10	1. Ignition "OFF." 2. Disconnect the PCM and check the continuity of the Bank 2 HO2S 2 signal circuit and the Bank 2 HO2S 2 low circuit. 3. If the Bank 2 HO2S 2 signal circuit or HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF." 2. Disconnect the PCM and check the continuity of the Bank 2 HO2S 2 signal circuit and the Bank 2 HO2S 2 low circuit. 3. If the Bank 2 HO2S 2 signal circuit or HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check for a poor Bank 2 HO2S 2 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 13*
13	Check for a poor Bank 2 HO2S 2 high circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
14	Replace Bank 2 HO2S 2. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in the Bank 2 HO2S 2 ignition feed circuit and replace the faulty fuse. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0171 Fuel Trim System Lean Bank 1



D06RY00171

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a "closed loop" air/fuel metering system is used. While in "closed loop," the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected on Bank 1, the PCM will set DTC P0171.

The PCM's maximum authority to control long term fuel trim allows a range between –15% (automatic transmission) or –12% (manual transmission) and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following: EGR DTCs, HO2S DTCs, (response, transition, open, low volts, no activity), MAF DTCs, TP sensor DTCs, MAP DTCs, IAT DTCs, canister purge DTCs, EVAP DTCs, injector circuit DTCs, or misfire DTCs.
- Engine coolant temperature is between 25˚C (77˚F) and 100˚C (212˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady below 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in "closed loop."
- Canister purge duty cycle is greater than 0% if on.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0171 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0171 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0171 and P0174 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0171/P0174.

4. If the DTC P0171 test passes while the Failure Records conditions are being duplicated, the lean condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

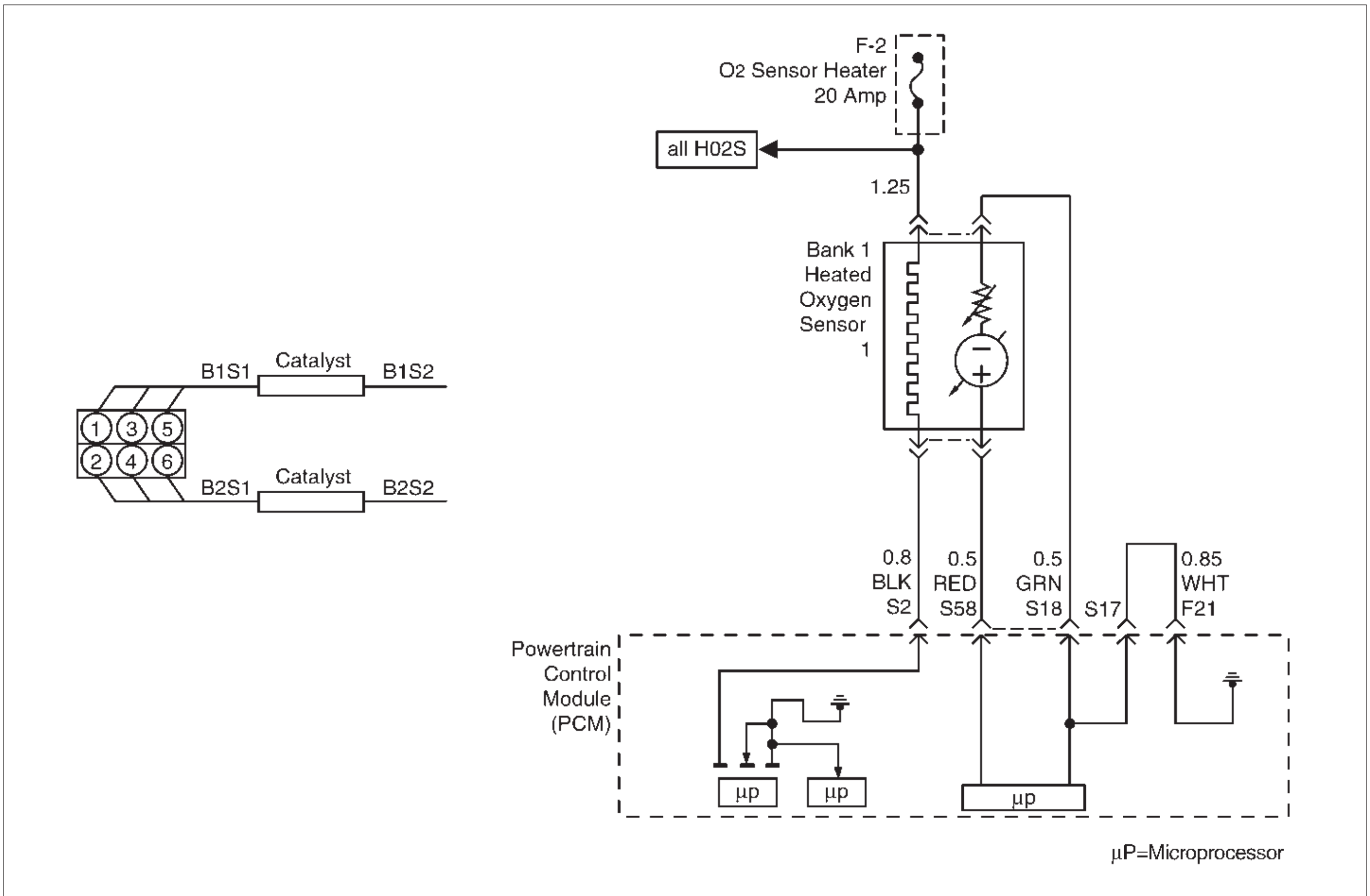
DTC P0171 – Fuel Trim System Lean Bank 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any DTCs set other than P0171 and P0174?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart	Go to *Step 3*
3	1. Start the engine and operate the vehicle in "closed loop." 2. Observe the "BANK 1 L.T. FUEL TRIM" display on the Tech 2. Is the displayed value greater than the specified value?	L.T. Fuel Trim: +20%	Go to *Step 5*	Go to *Step 4*
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the DTC P0171/P0174 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 "DTC" info for DTC P0171 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0171 test runs and note the test result. Does the Tech 2 indicate DTC P0171 failed this ignition?	—	Go to *Step 5*	The lean condition is not present. If a driveability symptom still exists, refer to *Symptoms* section.
5	Was DTC P0174 also set?	—	Go to *Step 6*	Go to *Step 15*
6	Visually and physically inspect the vacuum hoses for disconnections, splits, kinks, improper routing and improper connections and repair any problem found. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 7*
7	Visually and physically inspect the crankcase ventilation valve for proper installation and repair any problem found (refer to *Crankcase Ventilation System*). Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 8*
8	1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block the air flow sample through the MAF sensor. 2. Correct any problem that is found as necessary. Did your inspection of the MAF sensor reveal a condition requiring repair?	—	Verify repair	Go to *Step 9*
9	Start the engine and note the idle quality. Is a high or unsteady idle being experienced?	—	Go to *Step 10*	Go to *Step11*
10	1. Visually and physically inspect the throttle body, intake manifold, EGR valve and the EGR feed pipe for vacuum leaks. 2. Repair any vacuum leaks as necessary. Did your inspection reveal a vacuum leak?	—	Verify repair	Go to *Step 11*

DTC P0171 – Fuel Trim System Lean Bank 1 (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check the fuel for excessive water, alcohol, or other contaminants (see *Diagnosis* in *Engine Fuel* for the procedure) and correct the contaminated fuel condition if present (see *Engine Fuel*). Was the fuel contaminated?	—	Verify repair	Go to *Step 12*
12	1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight, and in their proper locations. 2. If a faulty ground condition is present, correct it as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 13*
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 1 S.T. FUEL TRIM" displayed on the Tech 2. Does "BANK 1 S.T. FUEL TRIM" value decrease to near the specified value?	0%	Go to *Step 19*	Go to *Step 14*
14	Perform the procedure in the "Fuel System Pressure Test" and repair fuel system problem if necessary. Did Fuel System Pressure Test isolate a condition requiring repair?	—	Verify repair	Go to *Step 15*
15	1. Visually and physically inspect the intake manifold, injector O-rings, EGR adapter, EGR valve and the EGR feed pipes for vacuum leaks. 2. Repair any problem that is found. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 16*
16	Visually and physically inspect the Bank 1 exhaust manifold for leaks and loose or missing hardware and correct any problem found. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 17*
17	Perform the "Injector Balance Test," and correct any problem found (refer to *Fuel Metering System*). Did Injector Balance Test isolate a problem?	—	Verify repair	Go to *Step 18*
18	1. Visually and physically inspect the Bank 1 HO2S 1 to ensure that it is installed securely and that the Bank 1 HO2S 1 pigtail and wiring harness are not contacting the exhaust or otherwise damaged. 2. If a problem is found, correct it as necessary. Did your inspection reveal a problem?	—	Verify repair	Refer to *Diagnostic Aids*
19	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0172 Fuel Trim System Rich Bank 1



D06RY00171

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a "closed loop" air/fuel metering system is used. While in "closed loop," the powertrain control module (PCM) monitors the Bank 1 heated oxygen sensors (HO2S) 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected on Bank 1, the PCM will set DTC P0172.

The PCM's maximum authority to control long term fuel trim allows a range between –15% (automatic transmission) or –12 (manual transmission) and +20%. The PCM's maximum authority to control short term fuel trim allows a range between –11% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following was set: EGR DTCs, HO2S DTCs, (response, transition, open, low volts, no activity), MAF DTCs, TPS DTCs, MAP DTCs, IAT DTCs, canister purge DTCs, EVAP DTCs, injector circuit DTCs, or misfire DTCs.
- Engine coolant temperature is between 25°C (77°F) and 100°C (212°F).
- Intake air temperature is between –40°C (–40°F) and 120°C (248°F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady below 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in "closed loop."
- Canister purge duty cycle is greater than 0%, if "ON."

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0172 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0172 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0172 and P0175 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0172/P0175.
4. If the DTC P0172 test passes while the Failure Records conditions are being duplicated, the rich condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

DTC P0172 – Fuel Trim System Rich Bank 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any DTCs set other than P0172 and P0175?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart	Go to *Step 3*
3	1. Start the engine and operate the vehicle in “closed loop.” 2. Observe “B1 Long Term Fuel Trim” display on the Tech 2. Is the displayed value more negative than the specified value?	L.T. Fuel Trim: –15% (auto. trans.) OR –12% (man. trans.)	Go to *Step 5*	Go to *Step 4*
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the DTC P0172/P0175 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 “DTC” info for DTC P0172 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0172 test runs and note test result. Does the Tech 2 indicate DTC P0172 failed this ignition?	—	Go to *Step 5*	The rich condition is not present. If a driveability symptom still exists, refer to *Symptoms*.
5	Is DTC P0175 also set?	—	Go to *Step 6*	Go to *Step 15*
6	Visually and physically inspect the air filter element and replace it if necessary. Did the air filter require replacement?	—	Verify repair	Go to *Step 7*

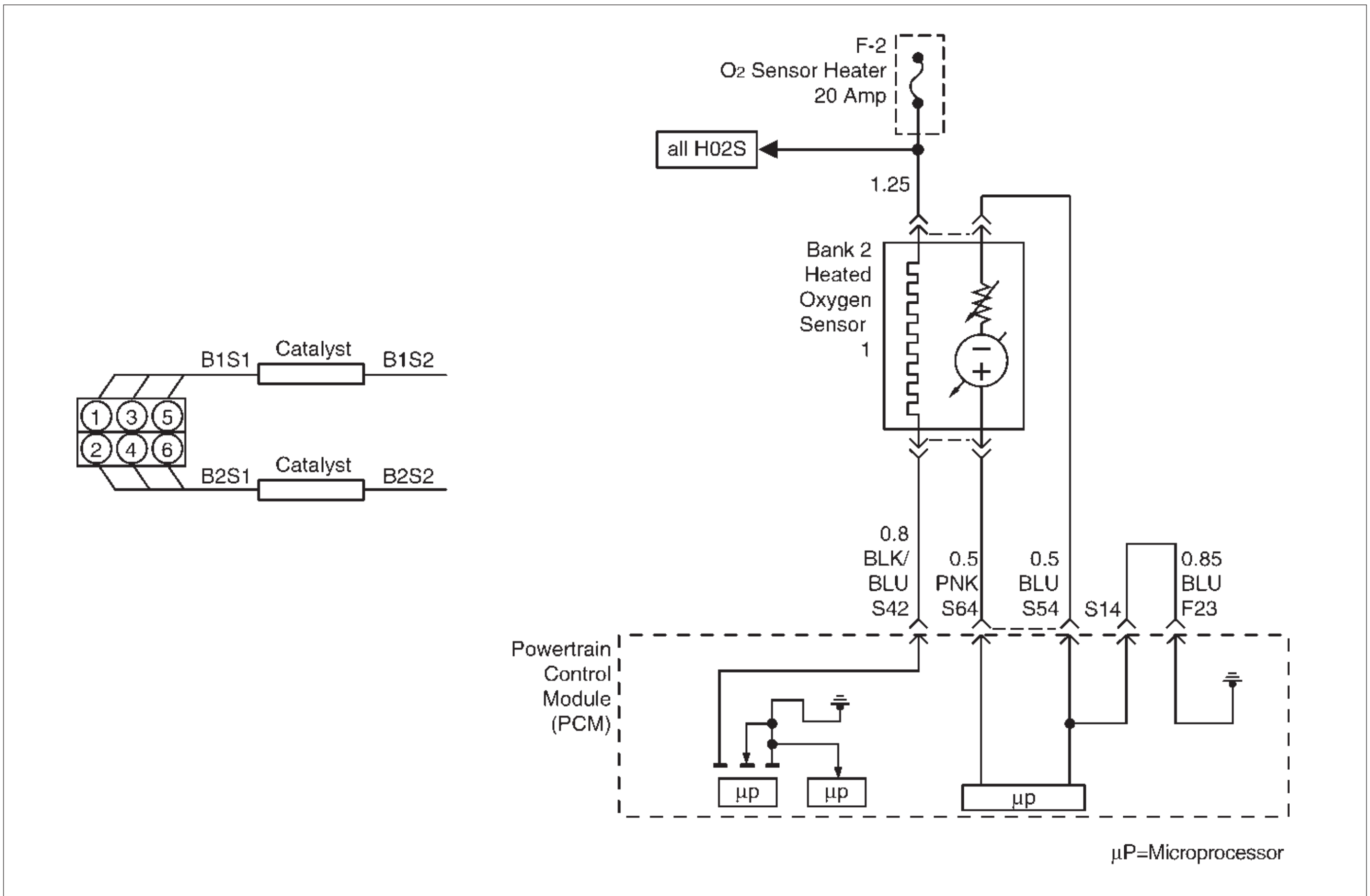
DTC P0172 – Fuel Trim System Rich Bank 1 (Cont'd)

Step	Action	Value(s)	Yes	No
7	Visually and physically inspect the air intake duct for collapse or restriction and repair if necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 8*
8	Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block air flow through the screen and correct any problem found. Did your inspection of the MAF sensor reveal a condition requiring repair or replacement?	—	Verify repair	Go to *Step 9*
9	Start the engine and note the idle quality. Is a low or unsteady idle being experienced?	—	Go to *Step 10*	Go to *Step 11*
10	1. Ignition "OFF." 2. Physically inspect the throttle body bore and throttle plate for coking and foreign objects. 3. If a problem was found, repair as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 11*
11	1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is present in the vacuum hose, replace the fuel pressure regulator (refer to *Fuel Metering System*). Did the fuel pressure regulator require replacement?	—	Verify repair	Go to *Step 12*
12	Ignition "ON," engine "OFF," monitor the TP1 Angle display on the Tech 2 while slowly depressing the accelerator pedal. Does the TP1 Angle display increase steadily and evenly from minimum value at closed throttle to maximum value at wide-open throttle?	Minimum 8% Maximum 92%	Go to *Step 13*	Go to *Step 21*
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 1 L.T. FUEL TRIM" and "BANK 1 S. T. FUEL TRIM" display on the Tech 2. Did both values change to near the specified value?	0%	Go to *Step 22*	Go to *Step 14*
14	1. Perform "Fuel System Pressure Test." 2. If Fuel System Pressure Test isolates a problem, repair as necessary (refer to *Engine Fuel* or *Fuel Metering System*). Did the Fuel System Pressure Test isolate a problem requiring repair?	—	Verify repair	Go to *Step 15*
15	1. Ignition "ON," engine "OFF." 2. Connect a test light between the harness connector terminals of canister purge solenoid. Is the test light on?	—	Go to *Step 16*	Go to *Step 19*
16	Check for short to ground in the wire (red/yel) between the canister purge solenoid and PCM terminal S7. Was there a short to ground?	—	Go to *Step 17*	Go to *Step 18*
17	Repair the short to ground. Is the action complete?	—	Verify repair	—

DTC P0172 – Fuel Trim System Rich Bank 1 (Cont'd)

Step	Action	Value(s)	Yes	No
18	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
19	1. Perform the "Injector Balance Test." 2. If Injector Balance Test isolates a problem, repair as necessary (refer to *Fuel Metering System*). Did the Injector Balance Test isolate a problem requiring repair?	—	Verify repair	Go to *Step 20*
20	1. Remove and visually/physically inspect the Bank 1 HO2S 1 for silicon contamination. This will be indicated by a powdery deposit on the portion of the HO2S that is exposed to the exhaust stream. 2. If contamination is evident on the Bank 1 HO2S 1, replace the contaminated sensors. Did the sensor require replacement?	—	Verify repair	Refer to *Diagnostic Aids*
21	1. Check the TP sensor mounting screws and tighten or replace them as necessary if they are loose or missing. 2. If the screws are OK, replace the TP sensor. Is the action complete?	—	Verify repair	—
22	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0174 Fuel Trim System Lean Bank 2



D06RY00175

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a "closed loop" air/fuel metering system is used. While in "closed loop," the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected on Bank 2, the PCM will set DTC P0174.

The PCM's maximum authority to control long term fuel trim allows a range between –15%(automatic transmission) or –12%(manual transmission) and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following DTCs are set: idle system, EGR, HO2S, (response, transition, open, low volts, no activity), MAF, TP sensor, MAP, IAT, canister purge, EVAP, injector circuit, or misfire.
- Engine coolant temperature is between 25˚C (77˚F) and 100˚C (212˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady between 3 and 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in "closed loop."
- Canister purge duty cycle is greater than 0%, if "ON."

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the failure is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0174 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0174 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0171 and P0174 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0171/P0174.

4. If the DTC P0174 test passes while the Failure Records conditions are being duplicated, the lean condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

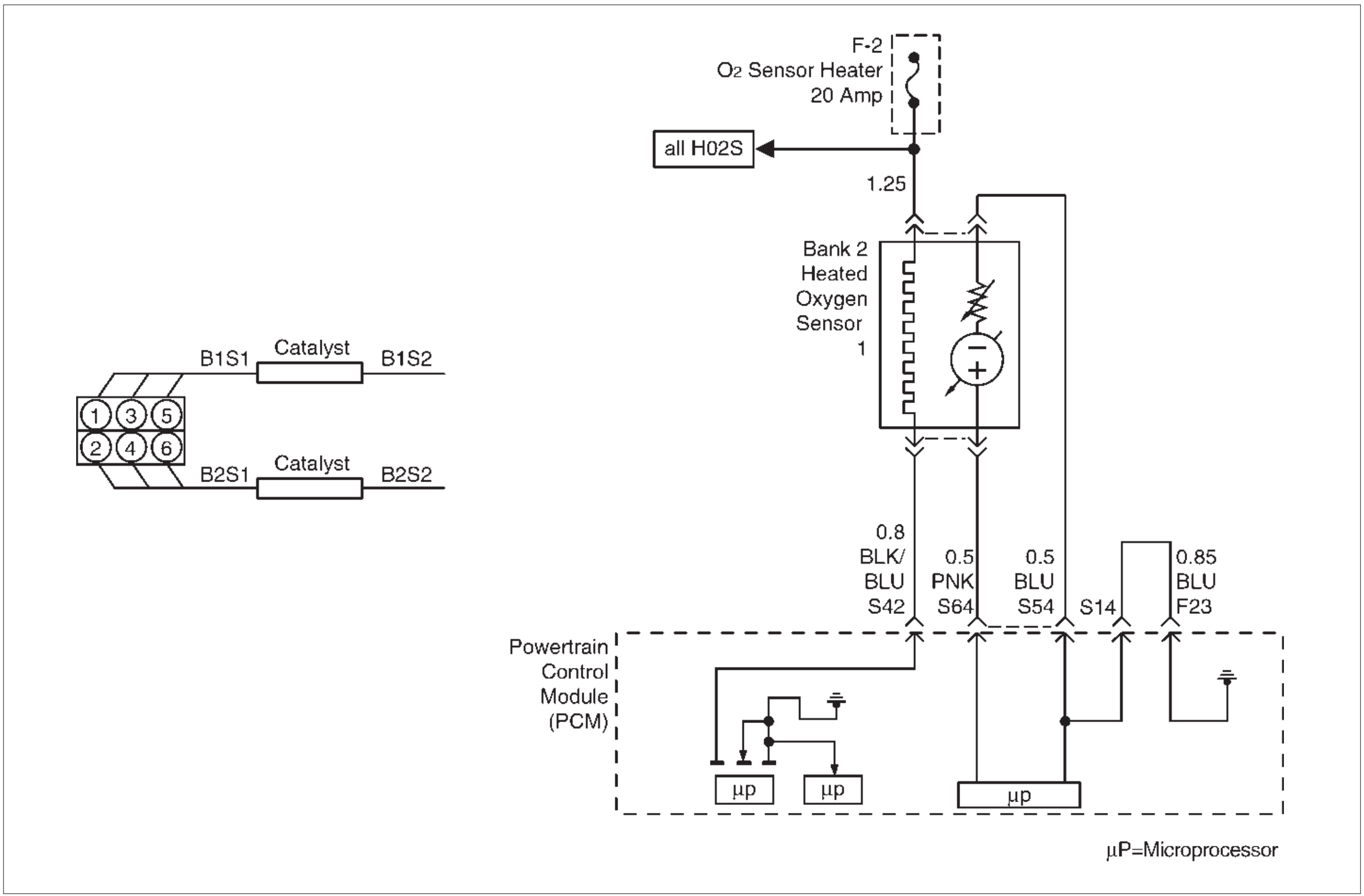
DTC P0174 – Fuel Trim System Lean Bank 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any DTCs set other than P0174 and P0171?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart.	Go to *Step 3*
3	1. Start the engine and operate the vehicle in "closed loop." 2. Observe the "BANK 2 L.T. FUEL TRIM" display on the Tech 2. Is the displayed values greater than the specified values?	L.T. Fuel Trim: +20%	Go to *Step 5*	Go to *Step 4*
4	1. Review and record Tech 2 Failure Records data. 2. Clear the DTC P0171/P0174 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 "DTC" info for DTC P0174 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0174 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0174 failed this ignition?	—	Go to *Step 5*	The lean condition is not present. If a driveability symptom still exists, refer to *Symptoms* section.
5	Was DTC P0171 also set?	—	Go to *Step 6*	Go to *Step 15*
6	Visually and physically inspect the vacuum hoses for disconnections, splits, kinks, improper routing and improper connections and repair any problem found. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 7*
7	Visually and physically inspect the crankcase ventilation valve for proper installation and repair any problem found (refer to *Crankcase Ventilation System*). Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 8*
8	1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block the air flow sample through the MAF sensor. 2. Correct any problem that is found as necessary. Did your inspection of the MAF sensor reveal a condition requiring repair?	—	Verify repair	Go to *Step 9*
9	Start the engine and note the idle quality. Is a high or unsteady idle being experienced?	—	Go to *Step 10*	Go to *Step 11*

DTC P0174 – Fuel Trim System Lean Bank 2 (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Visually and physically inspect the throttle body, intake manifold, EGR valve and the EGR feed pipe for vacuum leaks. 2. Repair any vacuum leaks as necessary. Did your inspection reveal a vacuum leak?	—	Verify repair	Go to *Step 11*
11	Check the fuel for excessive water, alcohol, or other contaminants (see *Diagnosis* in *Engine Fuel* for procedure) and correct the contaminated fuel condition is present (see *Engine Fuel*). Was the fuel contaminated?	—	Verify repair	Go to *Step 12*
12	1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight, and in their proper locations. 2. If a faulty ground condition is present, correct it as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 13*
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 2 S.T. FUEL TRIM" displayed on the Tech 2. Does the "BANK 2 S.T. FUEL TRIM" value decrease to near the specified value?	0%	Go to *Step 19*	Go to *Step 14*
14	Perform the procedure in the "Fuel System Pressure Test" and repair fuel system problem if necessary. Did the Fuel System Pressure Test isolate a condition requiring repair?	—	Verify repair	Go to *Step 15*
15	1. Visually and physically inspect the intake manifold, injector O-rings, EGR adapter, EGR valve and the EGR feed pipes for vacuum leaks. 2. Repair any problem that is found. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 16*
16	Visually and physically inspect the Bank 2 exhaust manifold for leaks and loose or missing hardware and correct any problem found. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 17*
17	Perform the "Injector Balance Test," and correct any problem found (refer to *Fuel Metering System*). Did the Injector Balance Test isolate a problem?	—	Verify repair	Go to *Step 18*
18	1. Visually and physically inspect the Bank 2 HO2S 1 to ensure that it is installed securely and that the Bank 2 HO2S 1 pigtail and wiring harness are not contacting the exhaust or otherwise damaged. 2. If a problem is found, correct it as necessary. Did your inspection reveal a problem?	—	Verify repair	Refer to *Diagnostic Aids*
19	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0175 Fuel Trim System Rich Bank 2



Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a "closed loop" air/fuel metering system is used. While in "closed loop," the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected on Bank 2, the PCM will set DTC P0175.

The PCM's maximum authority to control long term fuel trim allows a range between –15%(automatic transmission) or –12%(manual transmission) and +20%. The PCM's maximum authority to control short term fuel trim allows a range between –11% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following DTCs are set: idle system, EGR, HO2S, (response, transition, open, low volts, no activity), MAF, TPS, MAP, IAT, canister purge, EVAP, injector circuit, or misfire.
- Engine coolant temperature is between 25˚C (77˚F) and 100˚C (212˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady between 3 and 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in "closed loop."

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the failure is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0175 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0175 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed -out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records Vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0172 and P0175 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0172/P0175.
4. If the DTC P0175 test passes while the Failure Records conditions are being duplicated, the rich condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

DTC P0175 – Fuel Trim System Rich Bank 2

Step	Action	Value(s)	Yes	No
1	Was the ”On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to *OBD System Check*
2	Are any DTCs set other than P0172 and P0175?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart.	Go to *Step 3*
3	1. Start the engine and operate the vehicle in “closed loop.” 2. Observe the “BANK 2 L.T. FUEL TRIM” display on the Tech 2. Is the displayed value more negative than the specified value?	L.T. Fuel Trim: –15% (auto. trans.) OR –12% (man. trans.)	Go to *Step 5*	Go to *Step 4*
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the DTC P0172/P0175 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 “DTC” info for DTC P0175 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0175 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0175 failed this ignition?	—	Go to *Step 5*	The rich condition is not present. If a driveability symptom still exists, refer to *Symptoms*.
5	Was DTC P0172 also set?	—	Go to *Step 6*	Go to *Step 15*
6	Visually and physically inspect the air filter element and replace it if necessary. Did the air filter require replacement?	—	Verify repair	Go to *Step 7*
7	Visually and physically inspect the air intake duct for collapse or restriction and repair if necessary. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 8*

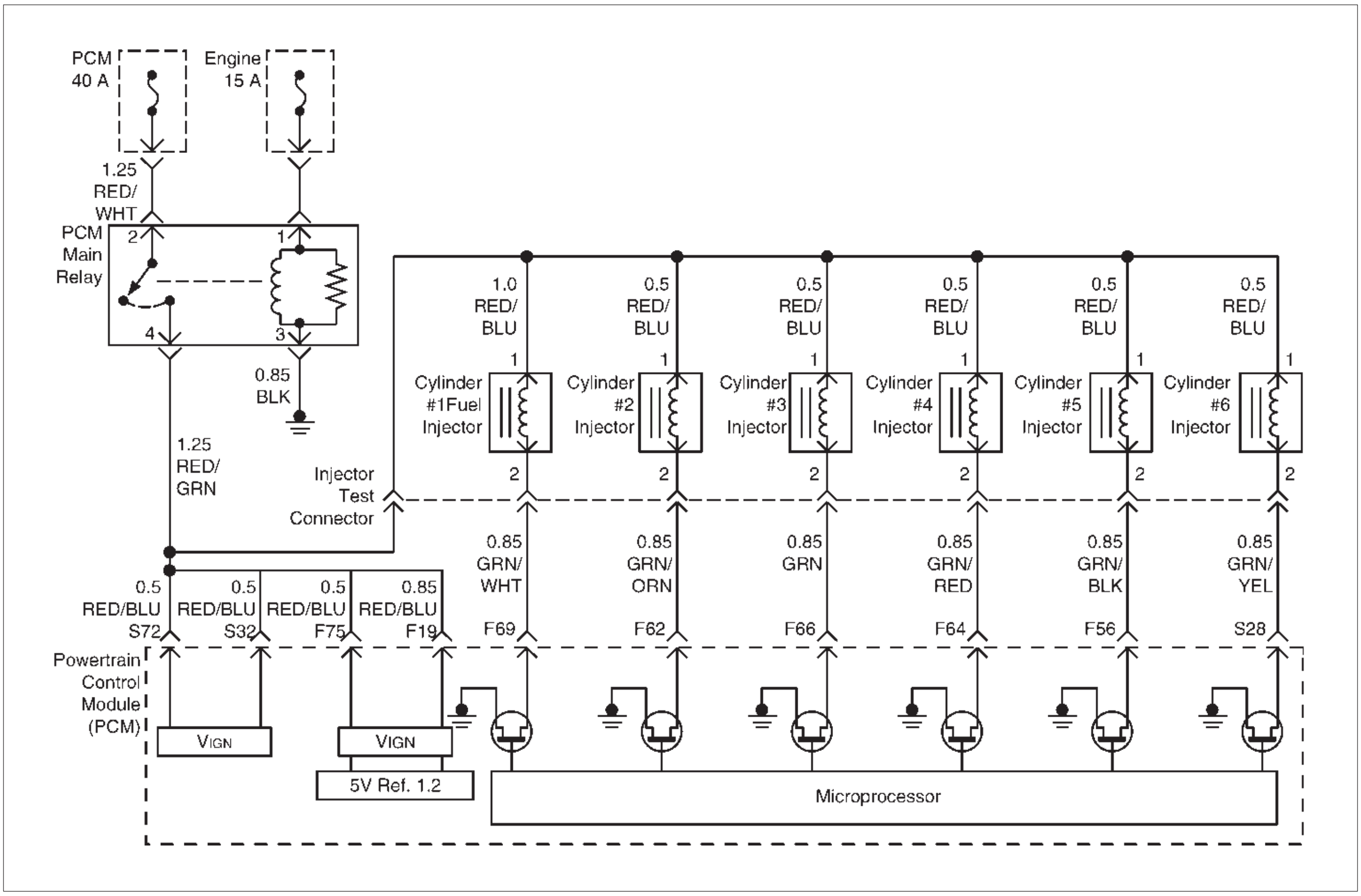
DTC P0175 – Fuel Trim System Rich Bank 2 (Cont'd)

Step	Action	Value(s)	Yes	No
8	Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block air flow through the screen and correct any problem found. Did your inspection of the MAF sensor reveal a condition requiring repair or replacement?	—	Verify repair	Go to *Step 9*
9	Start the engine and note the idle quality. Is a low or unsteady idle being experienced?	—	Go to *Step 10*	Go to *Step 11*
10	1. Turn the ignition off and physically inspect the throttle body bore, throttle plate, and IAC passages for coking and foreign objects. 2. If a problem was found, repair as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 11*
11	1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is present in the vacuum hose, replace the fuel pressure regulator (refer to *Fuel Metering System*). Did the fuel pressure regulator require replacement?	—	Verify repair	Go to *Step 12*
12	1. Ignition "ON," engine "OFF." 2. Monitor the TP Angle display on the Tech 2 while slowly depressing the accelerator pedal. Does the TP Angle display increase steadily and evenly from minimum value at closed throttle to maximum value at wide-open throttle?	Minimum 8% Maximum 92%	Go to *Step 13*	Go to *Step 21*
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 2 L.T. FUEL TRIM" and "BANK 2 S.T. FUEL TRIM" display on the Tech 2. Did both values change to near the specified value?	0%	Go to *Step 22*	Go to *Step 14*
14	1. Perform the "Fuel System Pressure Test." 2. If Fuel System Pressure Test isolates a problem, repair as necessary (refer to *Engine Fuel* or *Fuel Metering System*). Did the Fuel System Pressure Test isolate a condition requiring repair?	—	Verify repair	Go to *Step 15*
15	1. Ignition "ON," engine "OFF." 2. Connect a test light between the harness connector terminals of canister purge solenoid. Is the test light on?	—	Go to *Step 16*	Go to *Step 19*
16	Check for short to ground in the wire (red/yel) between the canister purge solenoid and PCM terminal S-7. Was there a short to ground?	—	Go to *Step 17*	Go to *Step 18*
17	Repair the short to ground. Is the action complete?	—	Verify repair	—

DTC P0175 – Fuel Trim System Rich Bank 2 (Cont'd)

Step	Action	Value(s)	Yes	No
18	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
19	1. Perform the "Injector Balance Test." 2. If the Injector Balance Test isolates a problem, repair as necessary (refer to *Fuel Metering System*). Did the Injector Balance Test isolate a problem requiring repair?	—	Verify repair	Go to *Step 20*
20	1. Remove and visually/physically inspect the Bank 2 HO2S 1 for silicon contamination. This will be indicated by a powdery deposit on the portion of the HO2S that is exposed to the exhaust stream. 2. If contamination is evident on the Bank 2 HO2S 1, replace the contaminated sensor. Did the sensor require replacement?	—	Verify repair	Refer to *Diagnostic Aids*
21	1. Check the TP sensor mounting screws and tighten or replace them as necessary if they are loose or missing. 2. If the screws are OK, replace the TP sensor. Is the action complete?	—	Verify repair	—
22	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0201 Injector 1 Control Circuit



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Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON.”
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0201 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0201 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0201 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

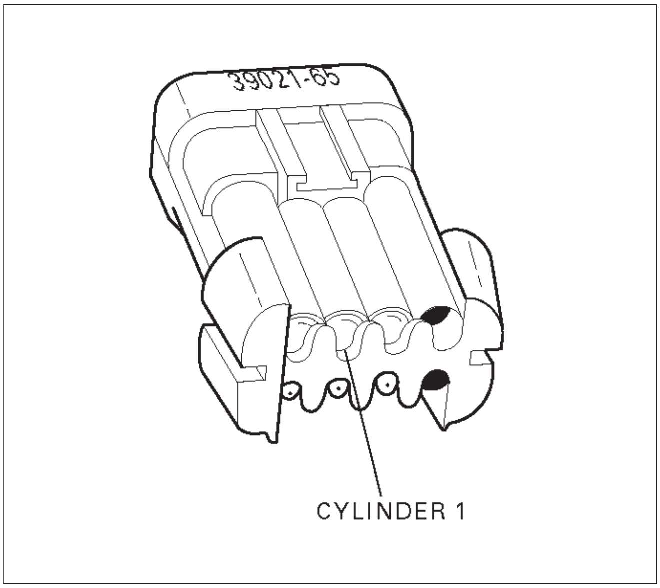
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0201 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 1 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



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7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.
9. The reading should be about 12-14Ω.
10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

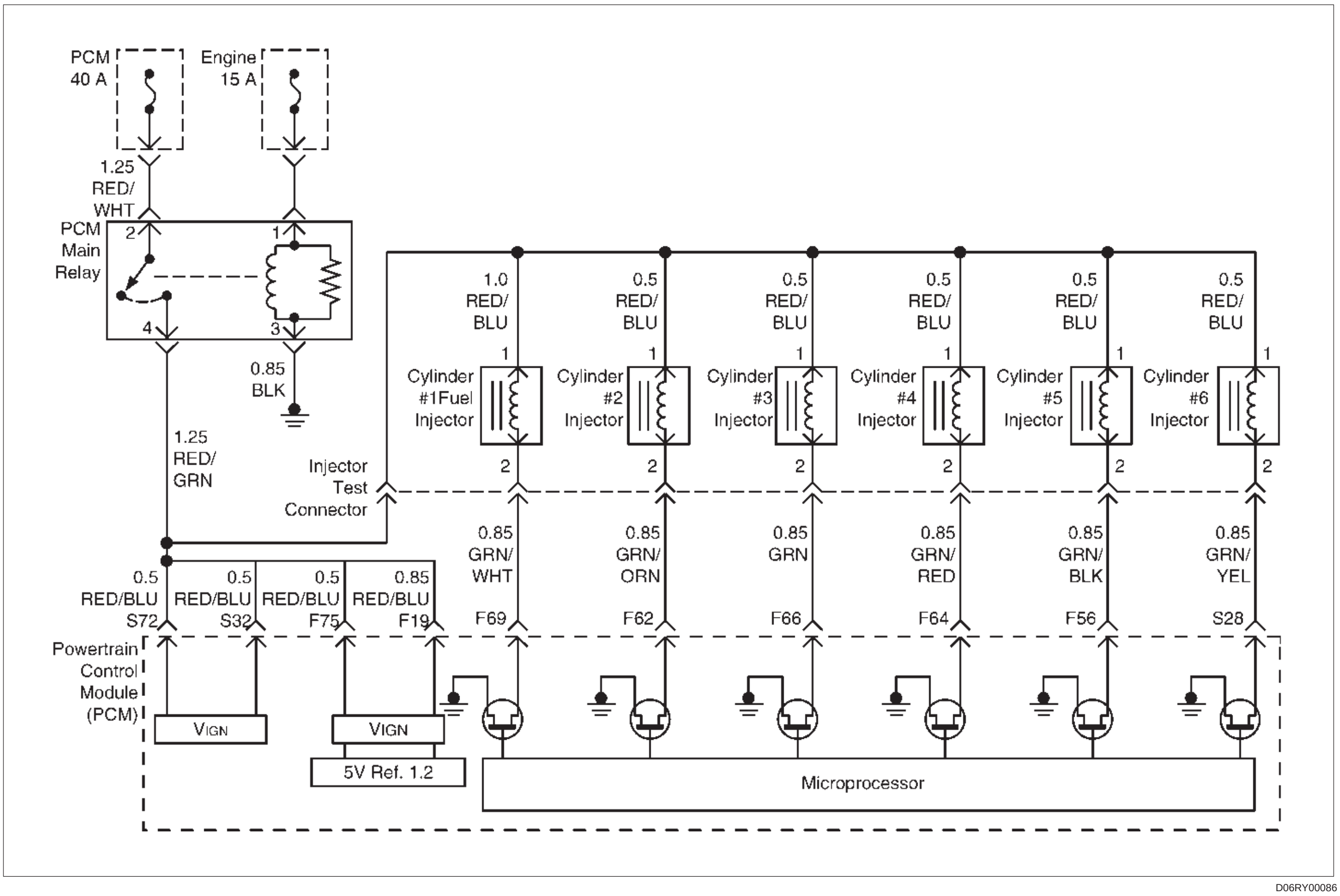
DTC P0201 – Injector 1 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0201 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0201 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*

DTC P0201 – Injector 1 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Engine "OFF." 2. Disconnect the injector connector. 3. Install an injector test light J-39021-65 on the injector test connector. 4. Crank the engine and note the light. Does the injector test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*
6	Note whether the injector test light for cylinder 1 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 1 (green with white tracer). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/white wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0202 Injector 2 Control Circuit



Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON.”
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0202 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0202 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0202 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

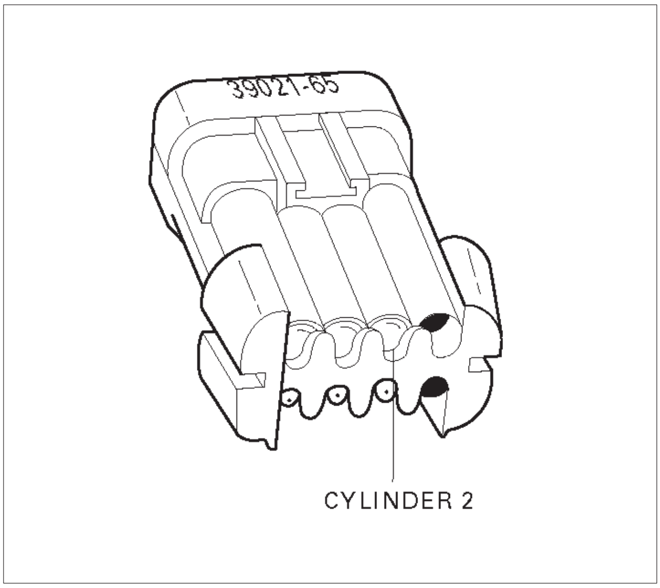
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0202 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 2 is "ON" steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



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7. Because the test light was "ON" steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

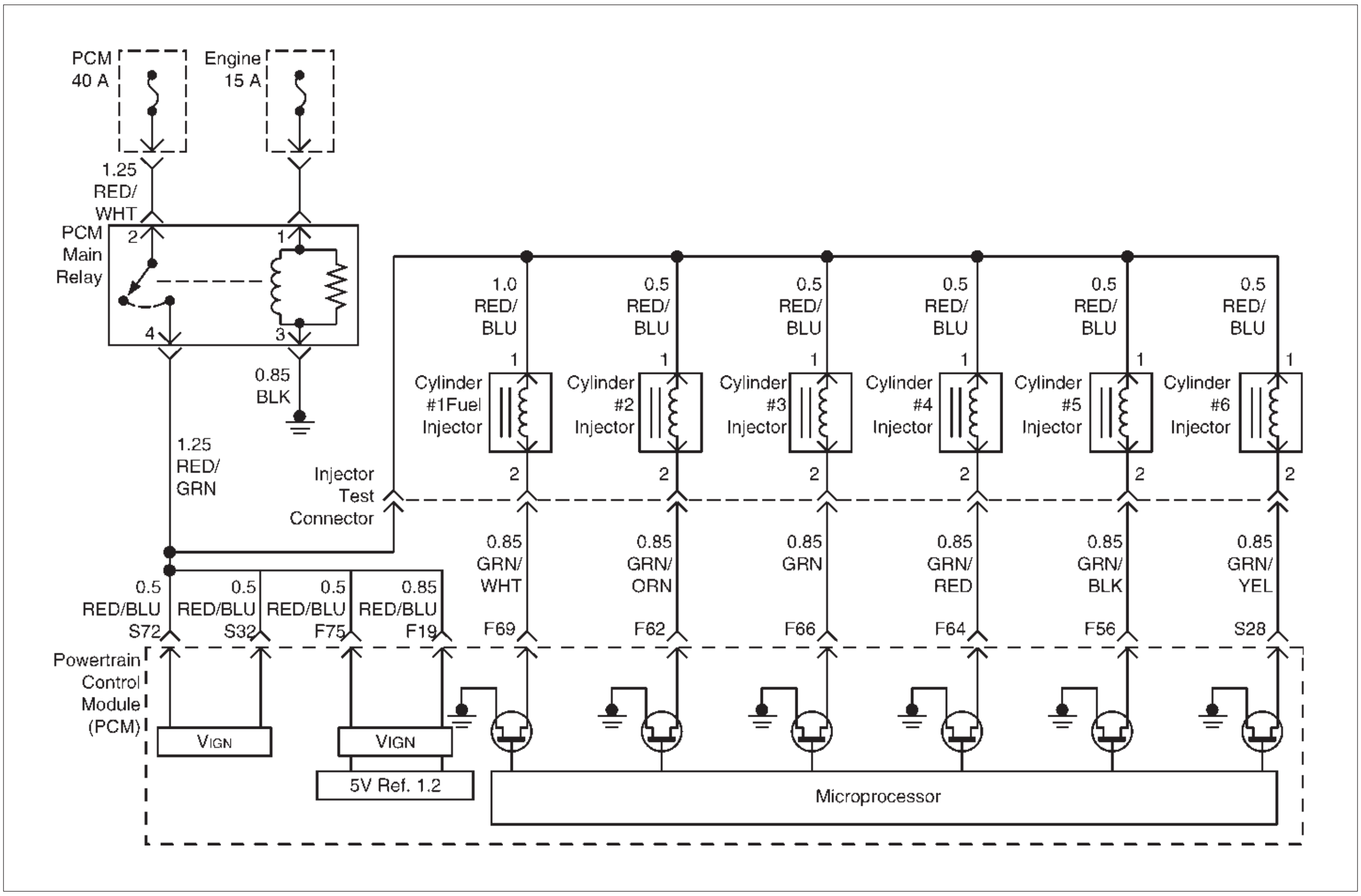
DTC P0202 – Injector 2 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0202 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0202 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*

DTC P0202 – Injector 2 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Engine "OFF." 2. Disconnect the injector test connector. 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 2 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*
6	Note whether the injector test light for cylinder 2 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 2 (green with orange tracer). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/orange wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0203 Injector 3 Control Circuit



D06RY00086

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON.”
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0203 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0203 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0203 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0203 is the result of a hard failure or an intermittent condition.

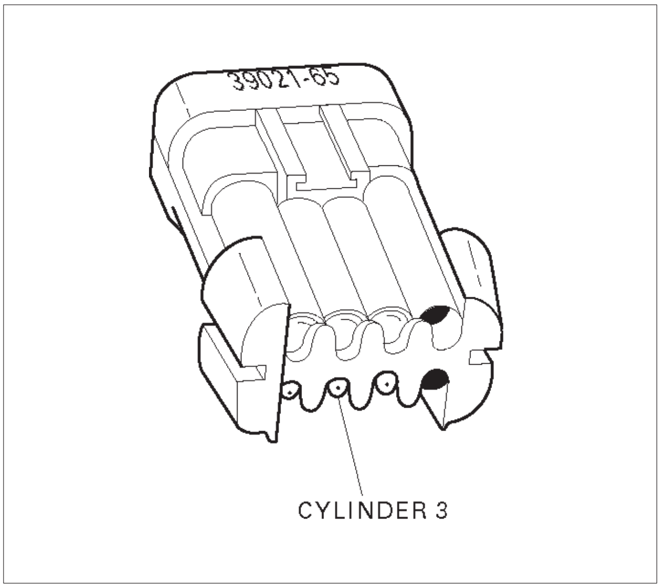
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 3 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.



R321056

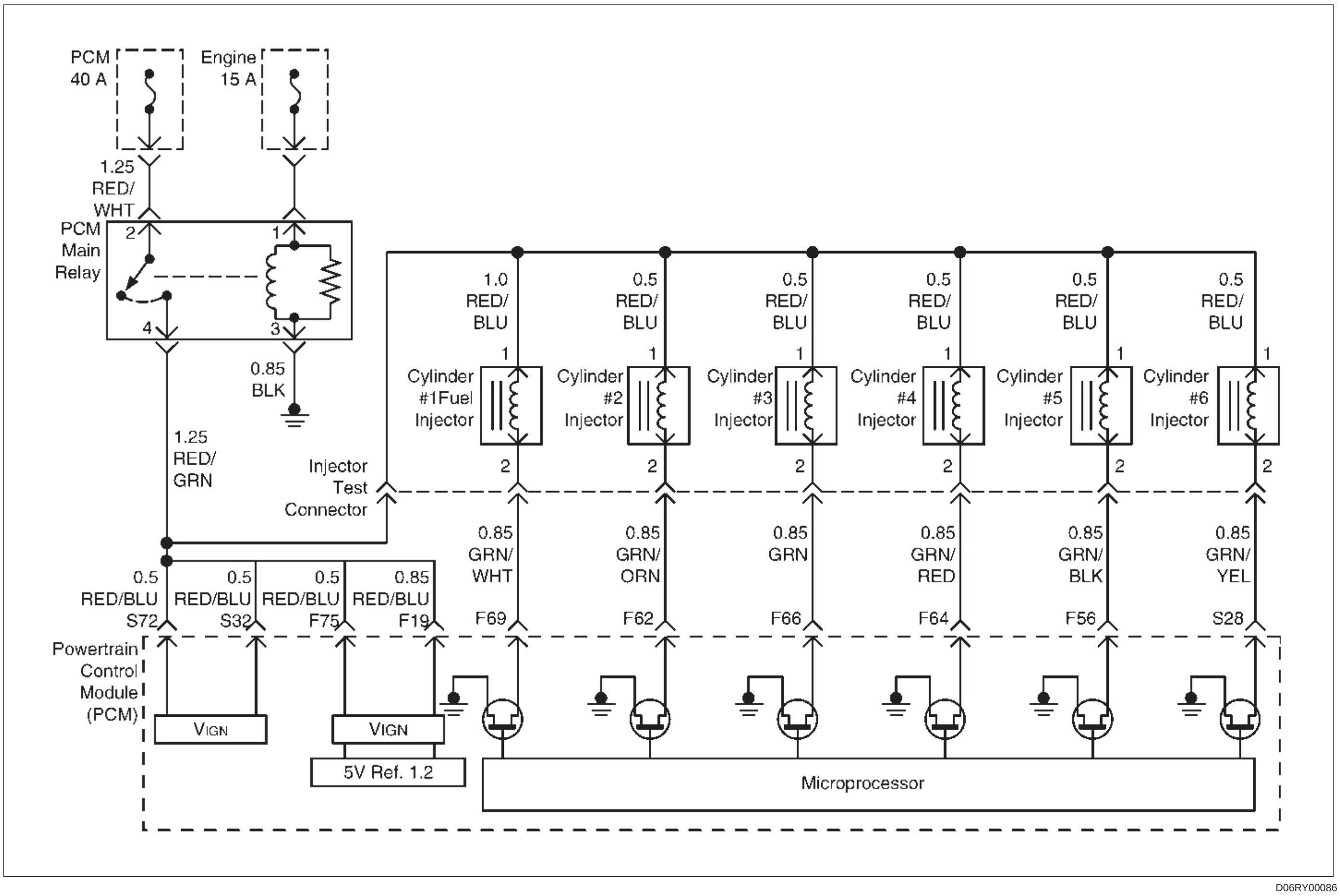
DTC P0203 – Injector 3 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0203 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0203 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*

DTC P0203 – Injector 3 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Engine "OFF." 2. Disconnect the injector test connector . 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 3 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*
6	Note whether the injector test light for cylinder 3 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 3 (green). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0204 Injector 4 Control Circuit



Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON.”
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0204 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0204 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0204 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0204 is the result of a hard failure or an intermittent condition.

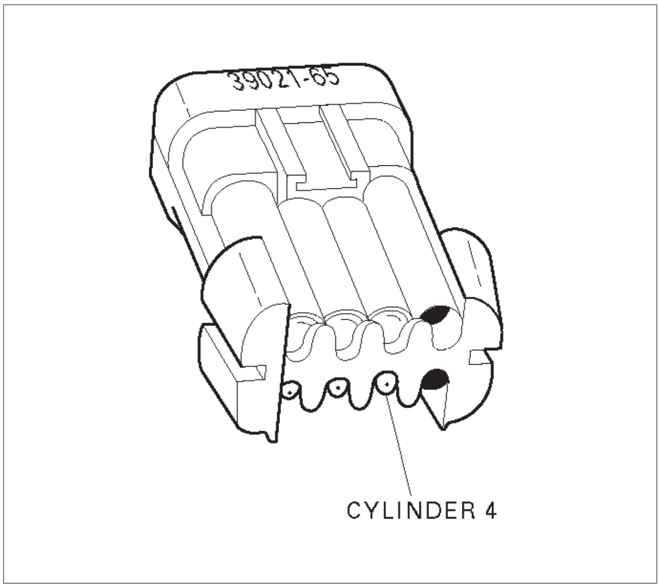
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 4 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.



R321057

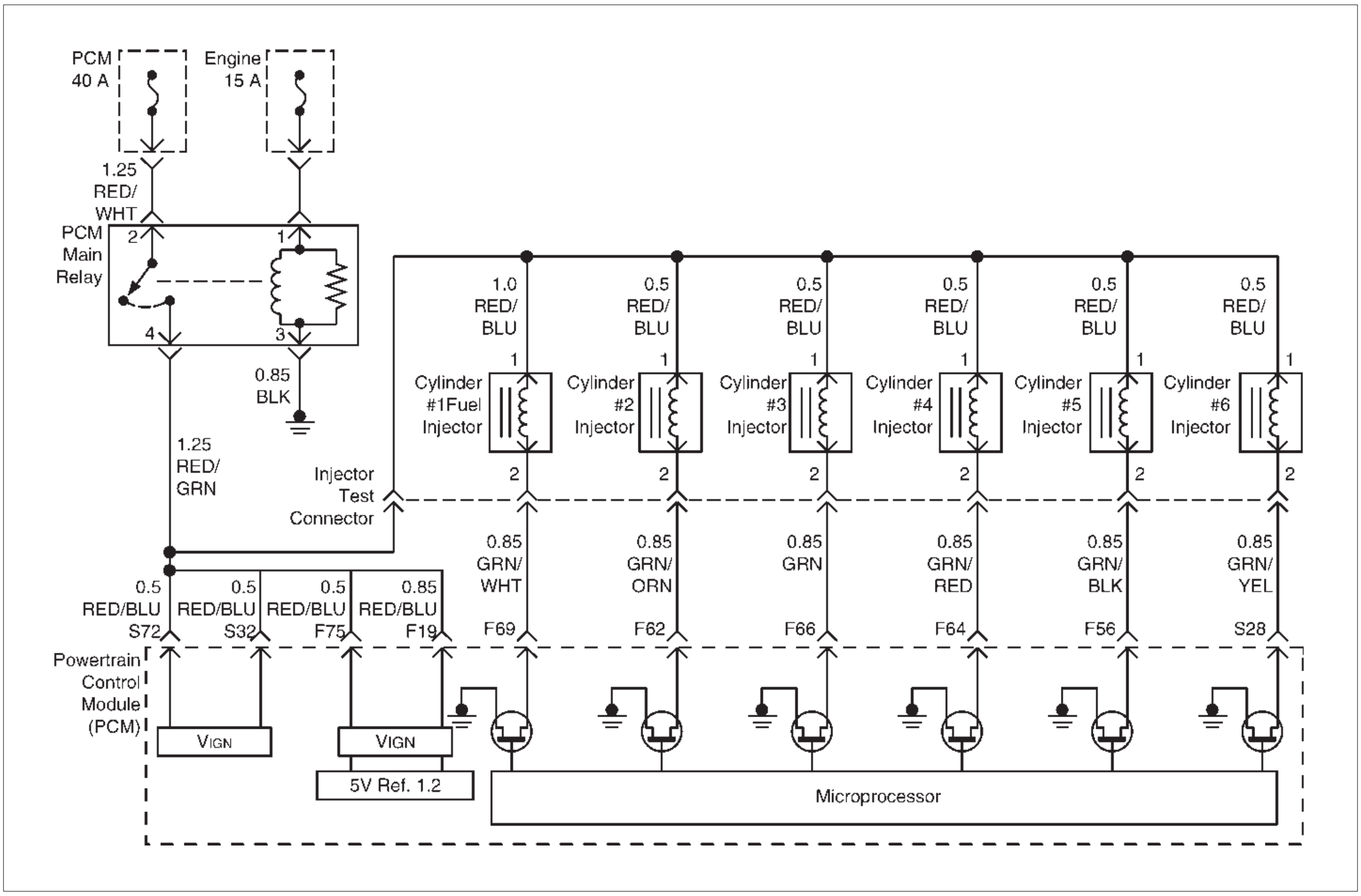
DTC P0204 – Injector 4 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0204 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0204 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*

DTC P0204 – Injector 4 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Engine "OFF." 2. Disconnect the injector test connector. 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 4 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to Step 6
6	Note whether the injector test light for cylinder 4 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 4 (green/red). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/red wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0205 Injector 5 Control Circuit



D06RY00086

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded "OFF" or the injector voltage does not equal 0 volts when the injector is commanded "ON."
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn "OFF" the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0205 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0205 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0205 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0205 is the result of a hard failure or an intermittent condition.

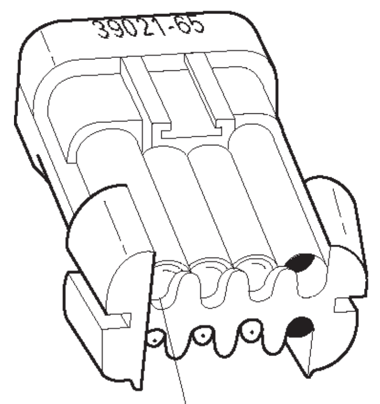
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold.The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 5 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.



R321058

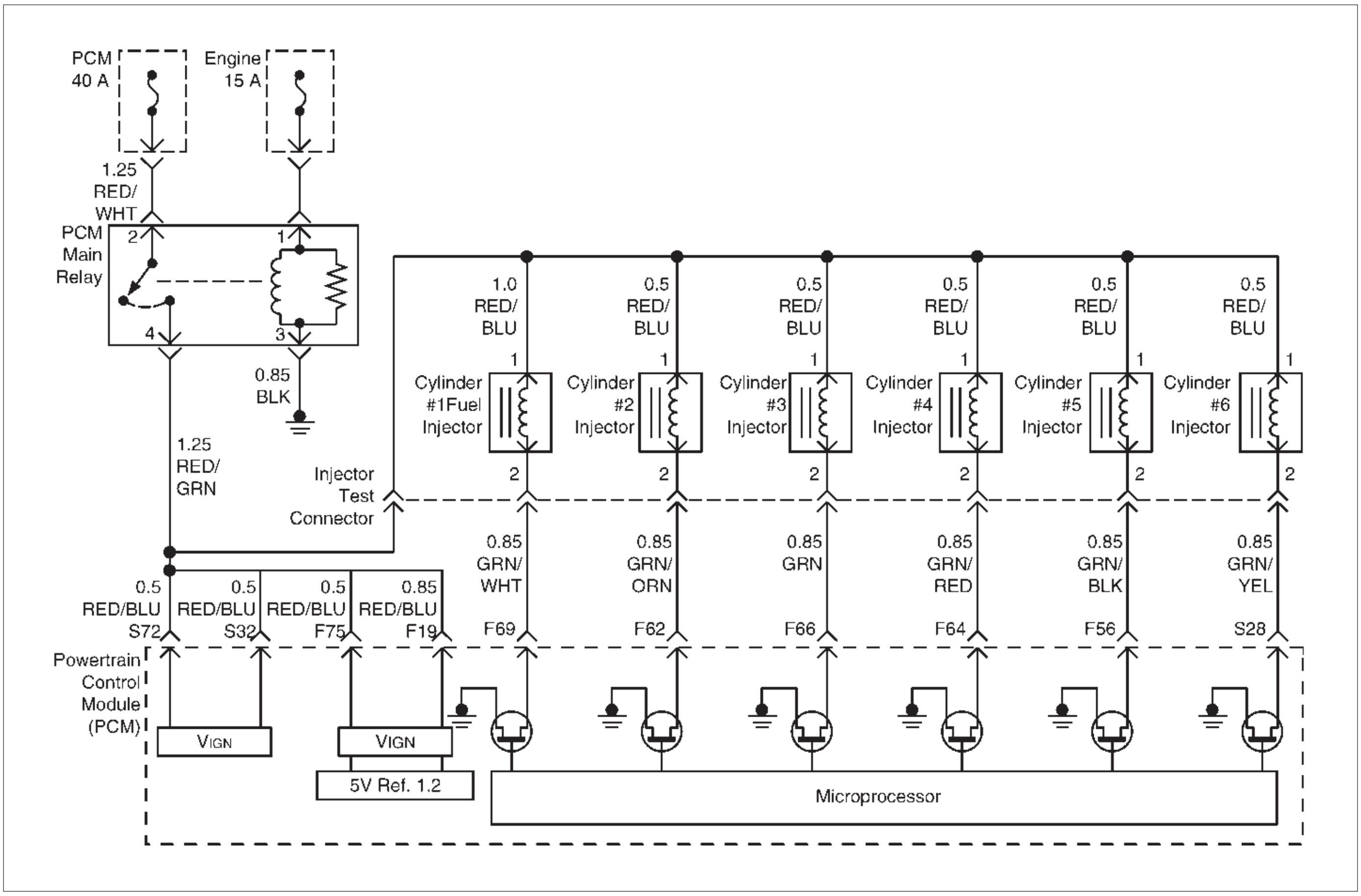
DTC P0205 – Injector 5 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0205 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0205 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*

DTC P0205 – Injector 5 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Engine "OFF." 2. Disconnect the injector test connector. 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 5 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*
6	Note whether the injector test light for cylinder 5 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 5 (green with black tracer). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/black wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0206 Injector 6 Control Circuit



D06RY00086

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON.”
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0206 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0206 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0206 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

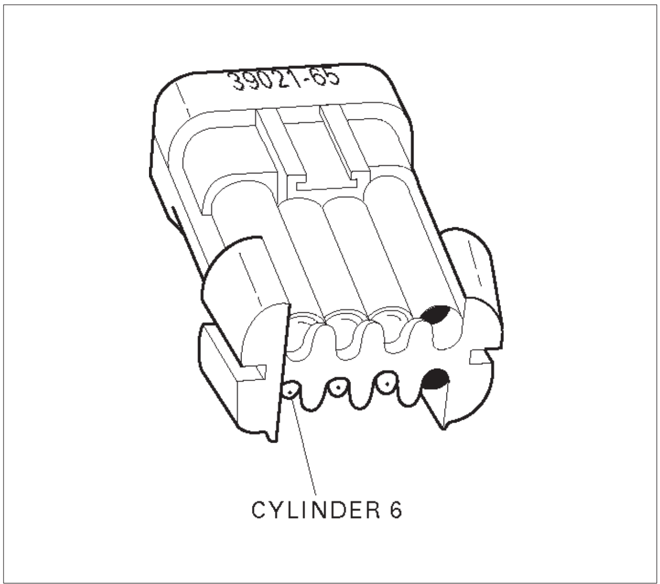
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0206 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold.The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 6 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



R321059

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.
9. The reading should be about 12-14Ω.
10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

DTC P0206 – Injector 6 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0206 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0206 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*

DTC P0206 – Injector 6 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Engine "OFF." 2. Disconnect the injector test connector. 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 6 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*
6	Note whether the injector test light for cylinder 6 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 6 (green with yellow tracer). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/yellow wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0300 Engine Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ION Sensing Module system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.

This DTC P0300 will determine if a multiple cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, VSS, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine temperature sensor (ECT) indicates an engine temperature between –7˚C (20˚F) and 120˚C (248˚F).
- Throttle angle is steady and throttle changes less than 15% per 125 milliseconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will disable the TCC operation.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0300 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0300 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

The Tech 2 display “Misfire Cur. #1 through #6” can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coil – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- MAF – A mass air flow (MAF) sensor output that causes the PCM to sense a lower than normal air flow will cause a lean condition.
- Air induction system – Air leaks into the induction system which bypass the MAF sensor will cause a lean condition. Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O-rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.
- Fuel quality – Using fuel with the wrong octane rating for the vehicle may cause driveability problems. Although alcohol-enhanced fuels may raise the octane rating, the fuel’s ability to turn into vapor in cold temperatures deteriorates. This may affect the cold driveability of the engine. The Reid Vapor Pressure of the fuel can also create problems in the fuel system, especially during the spring and fall when changes by the refineries may not coincide with changes in the weather.
- Vehicle marshalling – The transportation of new vehicles from the assembly plant to the dealership can involve as many as 60 key cycles within 2 to 3 miles of driving. This type of operation contributes to the fuel fouling of the spark plugs and will turn on the MIL with a P0300 Misfire DTC.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0300 – Engine Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record the Tech 2 Freeze Frame data. 3. Operate the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data). 4. Monitor the Tech 2 "Misfire Cur. #" display for each cylinder. Is "Misfire Cur. #" display increasing for any cylinder (indicating a misfire currently occurring)?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. 2. If a problem is found, repair or replace the vacuum hoses as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 4*
4	1. Visually and physically inspect the following areas for vacuum leaks: • The intake manifold • The injector O-rings • The EGR adapter • The EGR feed pipes • ION Sensing Module 2. If a problem is found, repair the vacuum leak as necessary. Did your inspection reveal a vacuum leak?	—	Verify repair	Go to *Step 5*
5	1. Visually and physically inspect the crankcase ventilation valve for improper installation or damaged grommet. 2. If a problem is found, repair as necessary (refer to *Crankcase Ventilation System*). Did your inspection reveal a problem?	—	Verify repair	Go to *Step 6*
6	1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects that may partially block the air flow sample through the MAF sensor. 2. If a problem is found, repair or replace the MAF sensor as necessary. Did your inspection of the MAF sensor reveal a condition requiring repair or replacement?	—	Verify repair	Go to *Step 7*
7	1. Remove the EGR valve and visually/physically inspect the valve to ensure that the pintle is not sticking partially open. Also, inspect the EGR valve pintle and seat for carbon deposits or burrs that may interfere with the pintle closing completely. 2. If a problem is found, clean the EGR valve pintle and seat or replace the EGR valve as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 8*

DTC P0300 – Engine Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Install a spark tester at the spark plug end of the ignition coil for a cylinder that indicated a misfire. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 14*	Go to *Step 9*
9	1. Remove and visually/physically inspect the ignition coil(s) associated with the cylinders that were indicated as misfiring. Ensure that the coil(s) are free of cracks. 2. If a problem is found, replace the damaged ignition coil(s) as necessary. Did any ignition coils require replacement?	—	Verify repair	Go to *Step 10*
10	1. Remove the spark plugs from the cylinders that were indicated as misfiring. 2. Visually inspect the spark plug electrodes. Does your inspection reveal any spark plugs exhibiting excessive fouling?	—	Go to *Engine Mechanical Diagnosis*	Go to *Step 11*
11	1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage. 2. If a problem is found, replace the faulty spark plug(s) as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in “closed loop” while monitoring the “BANK 1 L.T. FUEL TRIM” and “BANK 1 S.T. FUEL TRIM” display on the Tech 2. Do both values decrease below the specified values?	”BANK 1 L.T. FUEL TRIM” below +20%; “BANK 1 S.T. FUEL TRIM” below +50%	Go to *Step 13*	Replace the ignition coil of the affected cylinder
13	Replace the ignition coil control module. Is the action complete?	—	Verify repair	—
14	1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations. 2. If a problem is found, correct the faulty ground condition as necessary. Did your inspection reveal a poor ground?	—	Verify repair	Go to *Step 15*
15	1. Perform the “Fuel System Pressure Test” procedure. 2. If a problem is found, repair as necessary (refer to *Engine Fuel or Fuel Metering System*). Was a fuel system problem found?	—	Verify repair	Go to *Step 16*
16	1. Check the fuel for excessive water, alcohol, or other contaminants (refer to *Diagnosis* in *Engine Fuel* for procedure). 2. If a problem is found, correct the contaminated fuel condition as necessary. Was the fuel contaminated?	—	Verify repair	Go to *Step 17*

DTC P0300 – Engine Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
17	1. Perform the "Injector Coil/Balance Test." 2. If a problem is found, replace faulty injector(s) as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 18*
18	1. Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • Incorrect valve timing • A leaking head gasket • A loose or broken motor mount 2. If a problem is found, repair as necessary. Was a basic engine mechanical problem found and repaired?	—	Verify repair	Go to *Step 19*
19	1. Check for a transmission TCC problem. Refer to *4L30-E Automatic Transmission Diagnosis*. 2. If a problem is found, repair the transmission as necessary. Refer to *4L30-E Automatic Transmission Unit Repair*. Was a transmission problem found and repaired?	—	Verify repair	Go to *Step 20*
20	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0301 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.
This DTC P0301 will determine if the No.1 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 120˚C (248˚F).
- The throttle angle is steady.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0301 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0301 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0301 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor "Misfire Cur. #1" on the Tech 2. Is "Misfire Cur. #1" increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor "Misfire Hist. #1" while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is "Misfire Hist. #1" increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #1 ignition coil. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0301 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #1. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #1 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test." 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0302 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.

This DTC P0302 will determine if the No.2 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7°C (28°F) and 120°C (248°F).
- The throttle angle is steady.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0302 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0302 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0302 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor "Misfire Cur. #2" on the Tech 2. Is "Misfire Cur. #2" increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor "Misfire Hist. #2" while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is "Misfire Hist. #2" increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #2 ignition coil. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0302 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #2. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #2 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test." 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0303 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.
This DTC P0303 will determine if the No.3 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 120˚C (248˚F).
- The throttle angle is steady.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0303 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0303 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector — Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0303 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor "Misfire Cur. #3" on the Tech 2. Is "Misfire Cur. #3" increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor "Misfire Hist. #3" while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is "Misfire Hist. #3" increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #3 ignition coil. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0303 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #3. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #3 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test." 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0304 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.

This DTC P0304 will determine if the No.4 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7°C (28°F) and 120°C (248°F).
- The throttle angle is steady.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0304 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0304 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0304 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor "Misfire Cur. #4" on the Tech 2. Is "Misfire Cur. #4" increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor "Misfire Hist. #4" while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is "Misfire Hist. #4" increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #4 ignition wire. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0304 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #4. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #4 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test." 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0305 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.

This DTC P0305 will determine if the No.5 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 120˚C (248˚F).
- The throttle angle is steady.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0305 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0305 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0305 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #5” on the Tech 2. Is “Misfire Cur. #5” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #5” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #5” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #5 ignition wire. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0305 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #5. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #5 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test." 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0306 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.
This DTC P0306 will determine if the No.6 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 120˚C (248˚F).
- The throttle angle is steady.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0306 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0306 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

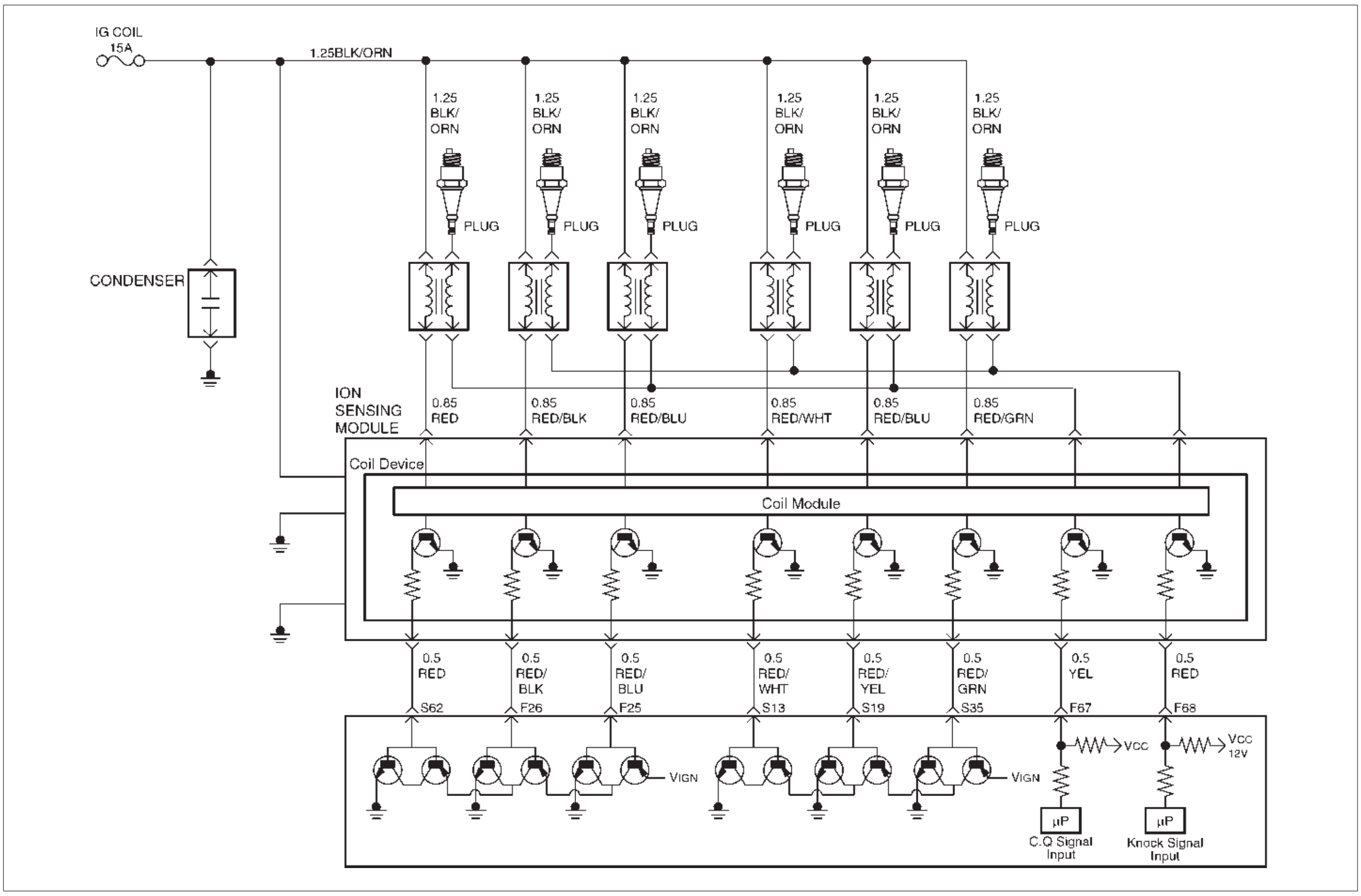
DTC P0306 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #6” on the Tech 2. Is “Misfire Cur. #6” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #6” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #6” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #6 ignition wire. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0306 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #6. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #6 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test." 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the intake manifold and the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0325 ION Sensing Module/ION Sensing Knock Intensity Circuit Fault



D06RY00067

Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine opreating conditions.

- The test is performed to evauate the Knock Intensity (KI) signal pulse width if it is within a predetermined renge. If the KI signal puls width is out of the predetermined range, the fail counter will be incremented. If the failure counter excceds the calibration, then test is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the test is complete and a pass will be reported. This test will detect an open/short in the KI line circuit, ION module faults and analog input faults in the PCM.

Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- No Crank DTCs set.
- No EST DTCs.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P0325 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P0325 can be cleared using the Tech2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM- Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage.

  If the harness appears to be OK, observe the Knock Present, Knock Sensor Noise Channel display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

If DTC P0325 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P0325 Diagnostic Chart may isolate the cause of the fault.

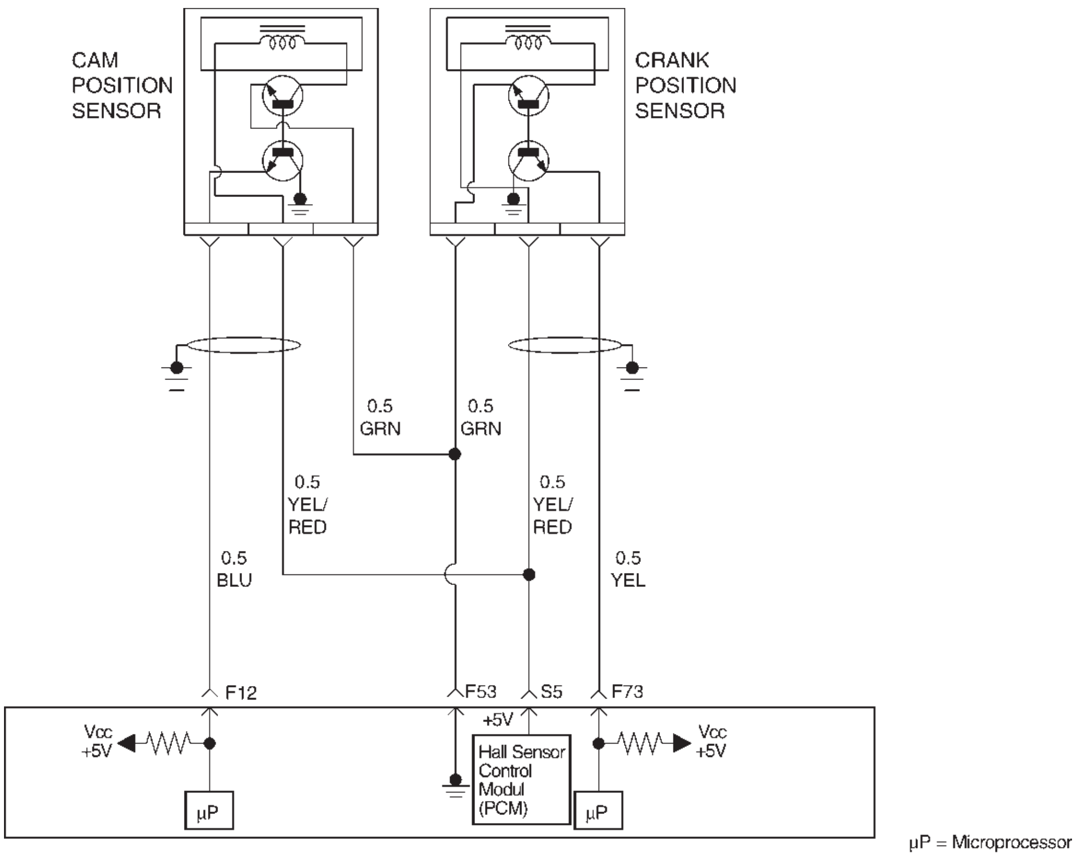
DTC P0325 - ION Sensing Module Knock Intensity Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0325. Does the Tech 2 indicate DTC P0325 failed thisignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition "OFF." 2. Disconnect the ION sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	—
4	Check the ION sensing harness between the PCM (F68) and ION sensing module circuit (RED Wire) at the KI line harness connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	—
6	Check the ION sensing harness between the ignition coil and ION sensing module circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION sensing module ground circuit for a poor connection. 2. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*

DTC P0325 - ION Sensing Module Knock Intensity Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 10*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not .And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0336 58X Reference Signal Circuit



D06RY00066

Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft pulses will be produced. The powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CMP) signal pulses being received. If the PCM receives an incorrect number of pulses on the 58X reference circuit, DTC P0336 will set.

Conditions for Setting the DTC

- Engine is running.
- Extra or missing pulse is detected between consecutive 58X reference pulses.
- Above condition is detected in 10 of 100 crankshaft rotations.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0336 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0336 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

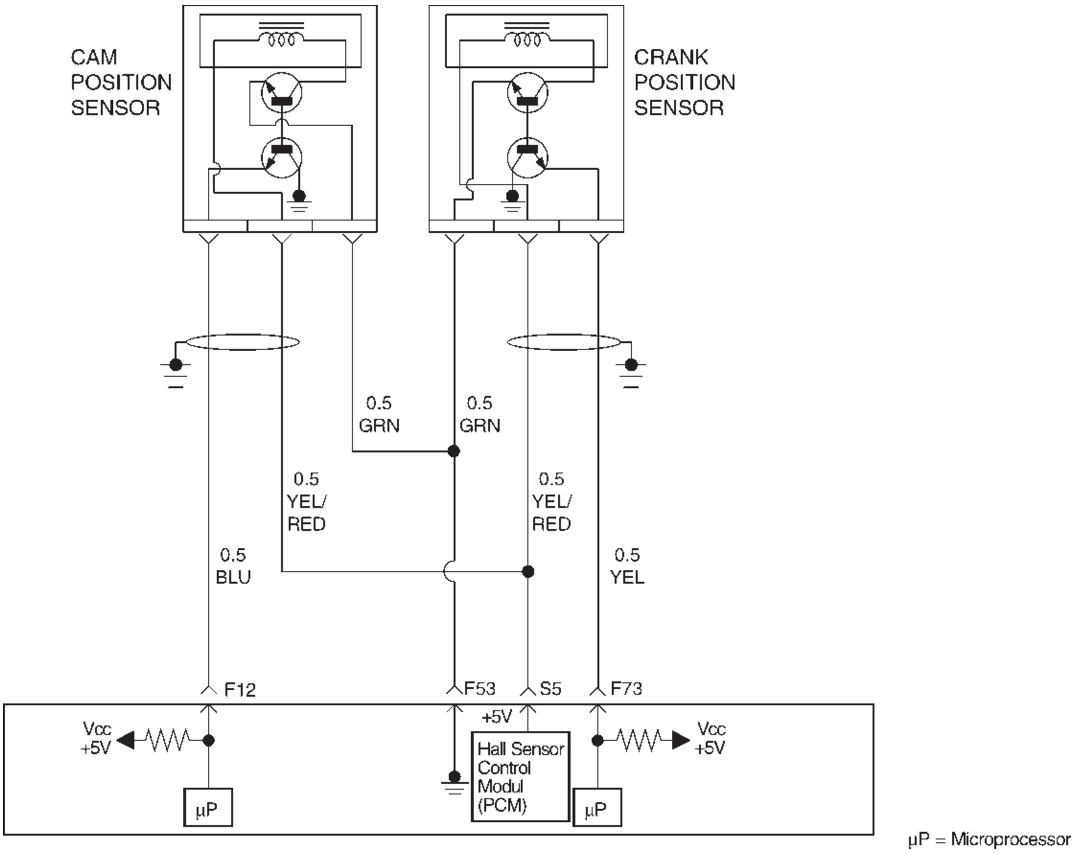
- Poor connection - Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0336 – 58X Reference Signal Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Attempt to start the engine. Does the engine start?	—	Go to *Step 3*	Go to *"Engine Cranks But Will Not Run"* chart
3	1. Review and record Failure Records information. 2. Clear DTC P0336. 3. Start the engine and idle for 1 minute. 4. Observe DTCs. Is DTC P0336 set?	—	Go to *Step 4*	Refer to Diagnostic Aids
4	1. Disconnect the PCM and CKP sensor. 2. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Reconnect the PCM and CKP sensor. 2. Connect a DVM to measure voltage on the 58X reference circuit at the PCM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to *Step 8*	Go to *Step 6*
6	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 7*
7	Replace the CKP sensor. Use caution to avoid any hot oil that may drip out. Is the action complete?	—	Verify repair	—
8	Check connections at the PCM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0337 CKP Sensor Circuit Low Frequency



D06RY00066

Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft reference pulses will be produced. The powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CMP) signal pulses being received. If the PCM does not receive pulses on the 58X reference circuit, DTC P0337 will set.

Conditions for Setting the DTC

- No camshaft position (CMP) sensor DTCs are set.
- Engine cranking.
- Crankshaft position (CKP) sensor signal is not present between two cam pulses.
- CKP reference pulse is not detected within 8 CMP pulses.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0337 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0337 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

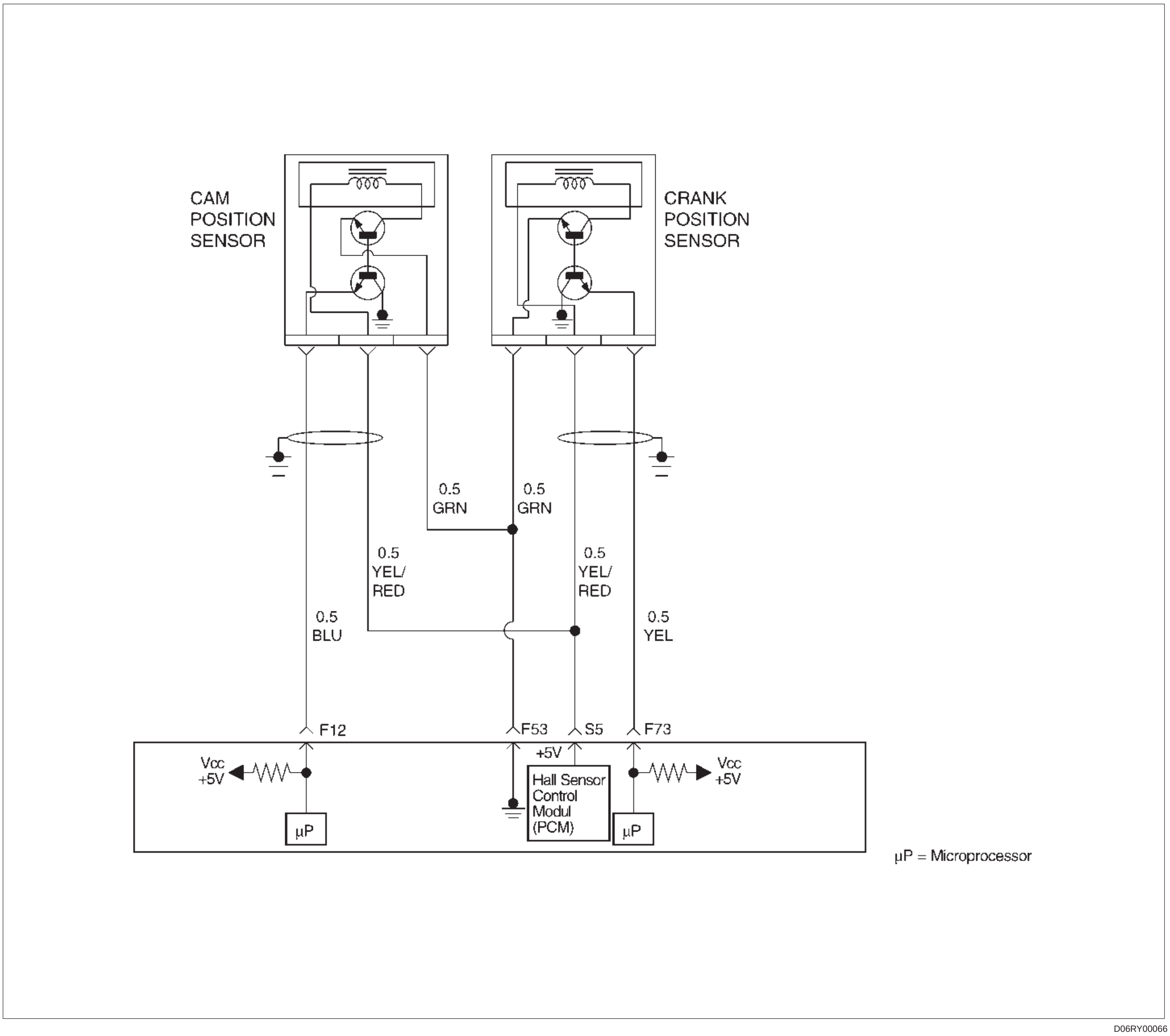
DTC P0337 – CKP Sensor Circuit Low Frequency

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Attempt to start the engine. Does the engine start?	—	Go to *Step 3*	Go to *Chart 3*
3	1. Review and record Failure Records information. 2. Clear DTC P0337. 3. Start the engine and idle for 1 minute. 4. Observe DTCs. Is DTC P0337 set?	—	Go to *Step 4*	Refer to *Diagnostic Aid*
4	1. Disconnect the CKP sensor. 2. Ignition "ON." 3. Using a DVM, verify that 5 V reference and ground are being supplied at the sensor connector (PCM side). Are 4-6 volts and ground available at the sensor?	—	Go to *Step 7*	Go to *Step 5*
5	1. Ignition "ON." 2. With a DVM, backprobe the PCM connector 5 V reference and ground connections. Are 5 V reference and ground available at the PCM?	—	Go to *Step 6*	Go to *Step 11*
6	Check 5 V reference or ground between the CKP sensor and PCM and repair the open circuit, short to ground or short to voltage. Is the action complete?	—	Verify repair	—
7	1. Ignition "OFF." 2. Disconnect the PCM and CKP sensor. 3. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector. 4. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Reconnect the PCM and CKP sensor. 2. Connect a DVM to measure voltage on the 58X reference circuit at the PCM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to *Step 11*	Go to *Step 9*

DTC P0337 – CKP Sensor Circuit Low Frequency (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 10*
10	Replace the CKP sensor. Use caution and avoid hot oil that may drip out. Is the action complete?	—	Verify repair	—
11	Check the connections at the PCM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 12*
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0341 CMP Sensor Circuit Performance



Circuit Description

The CMP signal is produced by the camshaft position (CMP) sensor pulses when the engine is running and crankshaft position (CKP) sync pulses are also being received. The powertrain control module (PCM) uses the CMP signal pulses to initiate sequential fuel injection. The PCM constantly monitors the number of pulses on the CMP signal circuit and compares the number of CMP pulses to the number of 58X reference pulses received. If the PCM receives an incorrect number of pulses on the CMP reference circuit, DTC P0341 will set and the PCM will initiate injector sequence without the CMP signal with a one in six chance that injector sequence is correct. The engine will continue to start and run normally, although the misfire diagnostic will be affected if a misfiring condition occurs.

Conditions for Setting the DTC

- The engine is running (1X CMP reference pulses are being received).
- The CMP sensor signal is not detected at the correct interval every 6 cylinders.
- Above condition fails for 100 occurrences within 200 test samples.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will initiate the injector sequence without the CMP signal with a one in six chance that the injector sequence is correct.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0341 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0341 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the CMP signal circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM and the CMP sensor. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Ensures that the fault is present.

12. Determines whether the fault is being caused by a missing camshaft magnet or a faulty sensor. The voltage measured in this step should read around 4 volts, toggling to near 0 volts when the CMP sensor interfaces with the camshaft magnet.

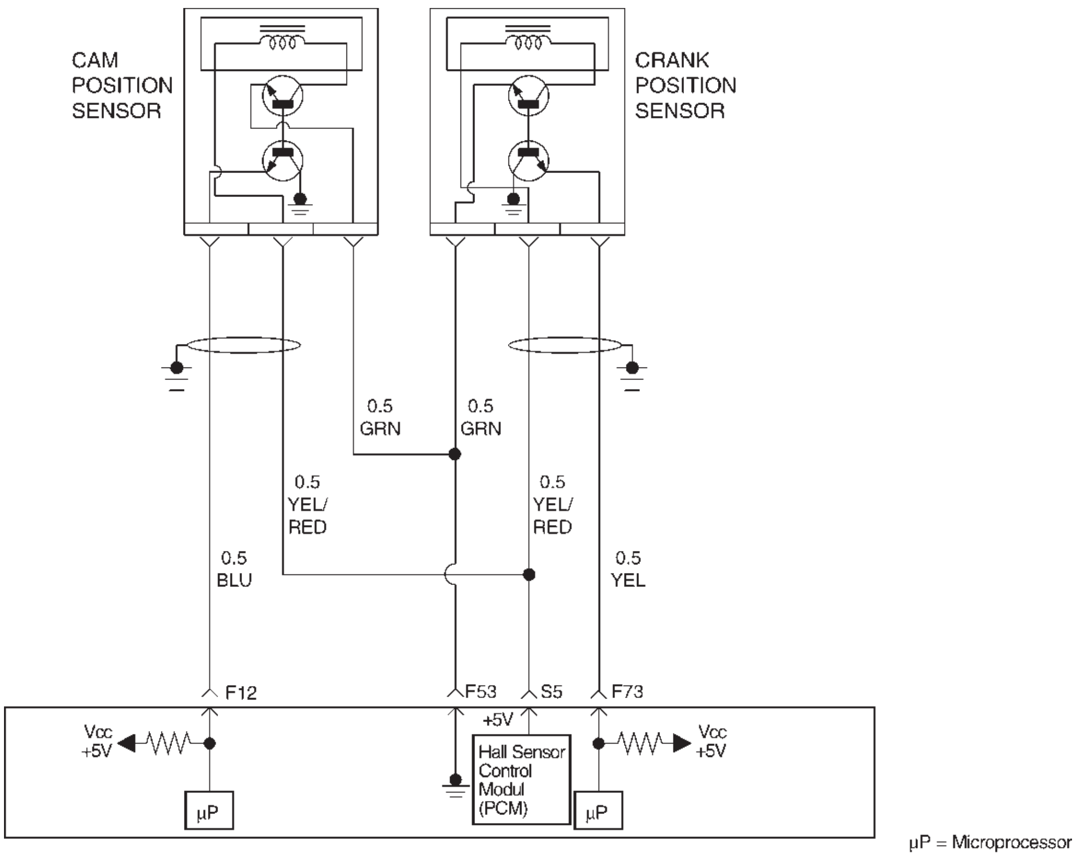
DTC P0341 – CMP Sensor Circuit Performance

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0341 until the DTC P0341 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0341 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the CMP sensor. 2. Measure the voltage between the sensor feed circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to *Step 4*	Go to *Step 5*
4	Measure the voltage between the CMP sensor signal circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to *Step 11*	Go to *Step 8*
5	If the voltage measured in step 3 was less than 4-6 volts, proceed directly to step 6 without completing this step. If the voltage in step 3 was greater than 4-6 V, repair the short to voltage in the CMP feed circuit. Is the action complete?	—	Verify repair	—
6	1. Check for poor connections at the camshaft position sensor. 2. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Ignition "OFF," disconnect the PCM and the CMP sensor. 2. Check the following circuits for an open between the ignition control module and the CMP sensor: • The sensor feed circuit. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	1. Ignition "OFF," disconnect the PCM (leave the CMP sensor disconnected). 2. Ignition "ON," check the following circuits: • The CMP sensor signal circuit for an open or a short to voltage. • The CMP sensor input signal circuit for a short to ground. 3. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	Check for a short or open in the sensor ground circuit. Was a problem found?	—	Verify repair	Go to *Step 10*

DTC P0341 – CMP Sensor Circuit Performance (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check for poor connections at the PCM. 2. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	Backprobe the PCM connector with a DVM to monitor voltage on the camshaft position input signal circuit while cranking the engine with the sensor connected. (Use rubber band, tape, or an assistant to keep the DVM lead in contact with the sensor terminal during this test.) Does the voltage toggle between the specified values?	4-0 V	Go to *Step 15*	Go to *Step 12*
12	1. Remove the CMP sensor. 2. Place a magnet on the CMP sensor. (If you use a magnet that is too small to cover the face of the sensor, test on every part of the sensor face because only a small area will respond to this test.) Does the DVM display a voltage near the specified value?	0 V	Go to *Step 13*	Go to *Step 14*
13	Replace the faulty or missing camshaft position sensor magnet. Is the action complete?	—	Verify repair	—
14	Replace the camshaft position sensor. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0342 CMP Sensor Circuit Low



D06RY00066

Circuit Description

The CMP signal produced by the camshaft position (CMP) sensor pulses when the engine is running and crankshaft position (CKP) sync pulses are also being received. The hall type CMP sensor and the CKP sensor share 5 V and ground connections at the powertrain control module (PCM). The third wire at the sensor is a signal circuit to the PCM. The PCM uses the CMP signal pulses to initiate sequential fuel injection. The PCM constantly monitors the number of pulses on the CMP signal circuit and compares the number of CMP pulses to the number of 58X reference pulses received. If the PCM does not receive pulses on the CMP reference circuit, DTC P0342 will set and the PCM will initiate injector sequence without the CMP signal with a one in six chance that injector sequence is correct. The engine will continue to start and run normally, although the misfire diagnostic will be affected if a misfiring condition occurs.

Conditions for Setting the DTC

- The engine is running.
- The CMP sensor signal is not received by the PCM once every 6 cylinders.
- The above condition occurs for 10 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will initiate injector sequence without the CMP signal with a one in six chance that the injector sequence is correct.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0342 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0342 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the CMP signal circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM and the CMP sensor. A change in voltage will indicate the location of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Ensures that the fault is present.

14. Determines whether the fault is being caused by a damaged camshaft or a faulty PCM. The voltage measured in this step should read around 4 volts, toggling to near 0 volts when the CMP sensor interfaces with the camshaft magnet.

DTC P0342 – CMP Sensor Circuit Low

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" information for DTC P0342 until the DTC P0342 test runs. 5. Note test result. Does the Tech 2 indicate DTC P0342 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition "ON." 2. Disconnect the CMP sensor. 3. Measure the voltage between the sensor feed circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to *Step 7*	Go to *Step 4*
4	1. Ignition "OFF," disconnect the PCM and the CMP sensor. 2. Check for poor connections at the camshaft position sensor. 3. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Check for poor connections at the PCM. 2. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*

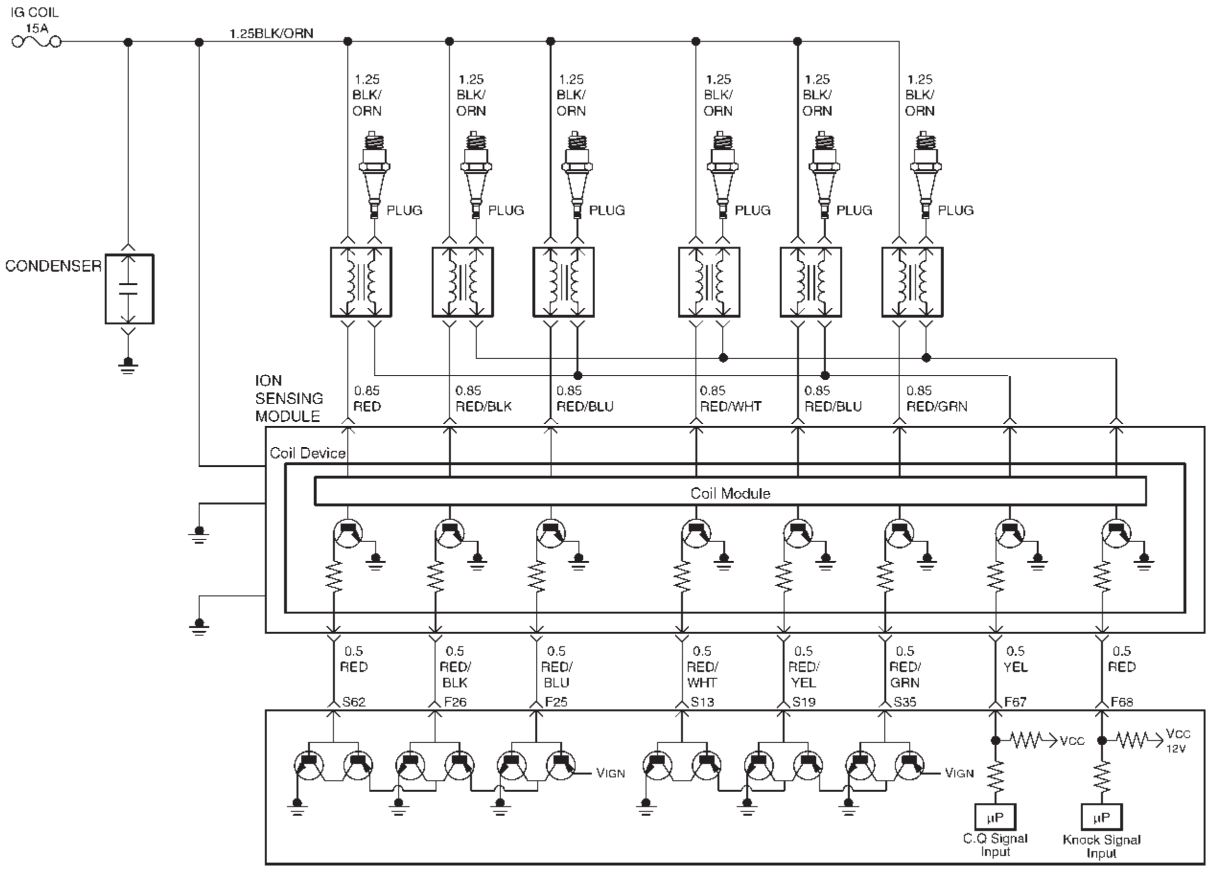
DTC P0342 – CMP Sensor Circuit Low (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Check the following circuits between the PCM and the CMP sensor: • The sensor feed circuit. Open or short to ground? • The sensor ground circuit. Open or short to voltage? 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	—
7	1. Ignition "ON," engine "OFF." 2. Measure the voltage between the CMP sensor signal circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to *Step 8*	Go to *Step 9*
8	1. Turn the ignition "OFF." 2. Disconnect the PCM and connect a DVM to monitor voltage on the camshaft position signal circuit at the PCM connector. 3. Ignition "ON." 4. Monitor the voltage display on the DVM while repeatedly touching the CMP sensor signal circuit at the CMP sensor connector with a test light to ground. Does the DVM voltage display switch between 0 and approximately 5 volts when the test light is touched to the CMP sensor signal circuit?	—	Go to *Step 12*	Go to *Step 9*
9	1. Ignition "OFF." 2. Leave the PCM disconnected. 3. Ignition "ON." 4. Probe the camshaft position signal circuit at the PCM connector with a test light to B+. 5. If the test light is "ON," locate and repair the short to ground in the camshaft position input signal circuit. Was either circuit shorted to ground?	—	Verify repair	Go to *Step 10*
10	1. Ignition "OFF." 2. Leave the PCM disconnected. 3. Ignition "ON." 4. Probe the camshaft position signal circuit with a test light to ground. 5. If the test light is "ON," locate and repair the short to voltage in the camshaft position input signal circuit. Was the test light "ON"?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF," disconnect the PCM (leave the CMP sensor disconnected). 2. Ignition "ON," check the following circuit: • The CMP sensor signal circuit for an open. 3. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	—

DTC P0342 – CMP Sensor Circuit Low (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Ignition "ON." 2. Remove the CMP sensor. 3. Place a magnet on the CMP sensor. If you use a magnet that is too small to cover the face of the sensor, test on every part of the sensor face because only a small area will respond to this test. Does the DVM display a voltage near the specified value?	0 V	Go to *Step 14*	Go to *Step 13*
13	Replace the camshaft position sensor. Is the action complete?	—	Verify repair	—
14	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0351 Ignition 1 Control Circuit



D06RY00067

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 1, it will set a DTC P0351.

Conditions for Setting the DTC

- The ignition is “ON.”
- The engine is turning, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON.”
- The output voltage is not equal to 0 volts when output is “OFF.”
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0351 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0351 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0351 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

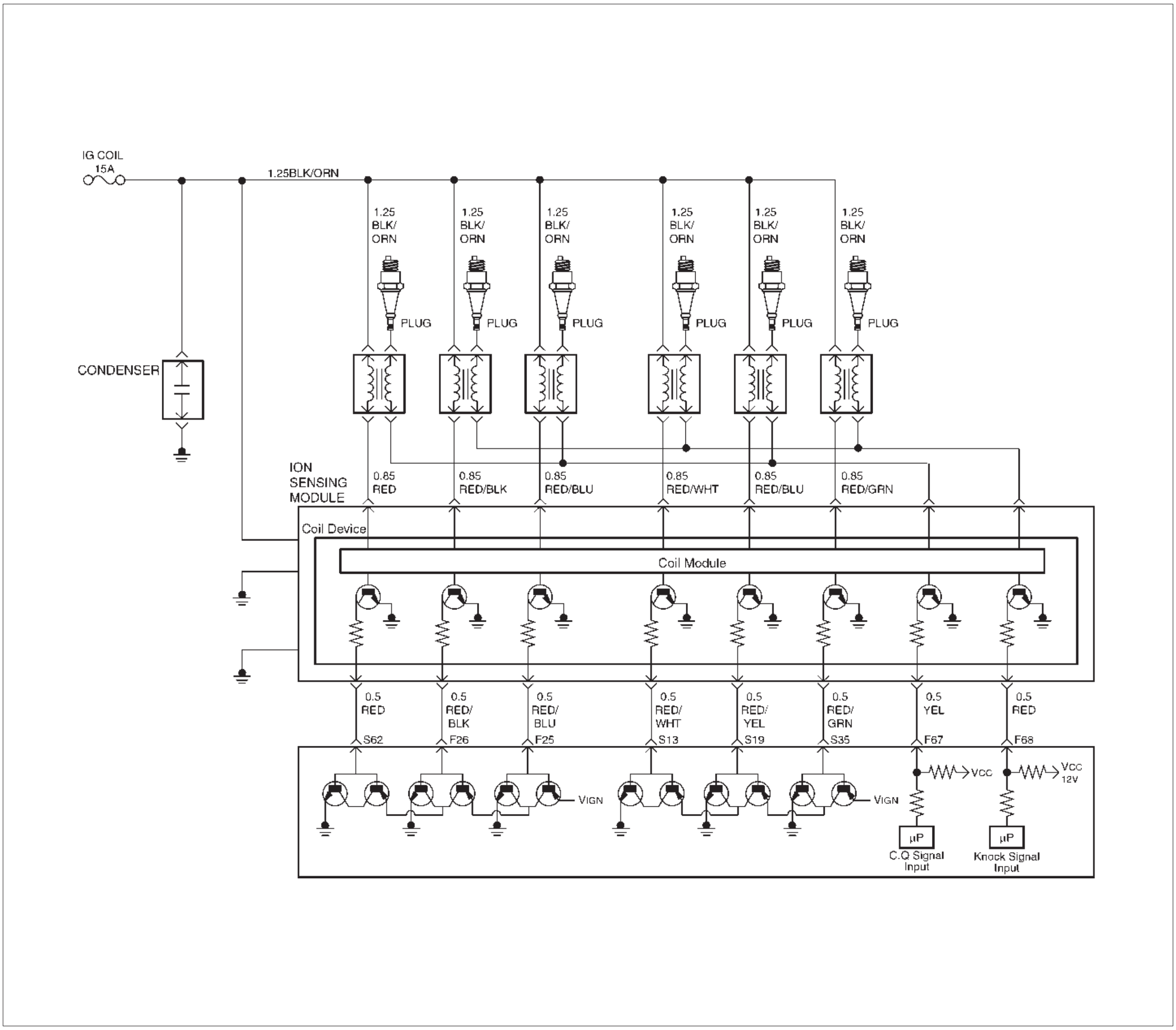
DTC P0351 – Ignition 1 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the "DTC" information for DTC P0351 until the DTC P0351 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0351 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition "ON," engine "OFF." 2. Back probe the ignition control circuit 1 at the ION Sensing Module with a DVM. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition "ON," engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition "OFF." 2. Disconnect the 3-pin and connector at the ignition coil. 3. Check ignition control circuit 1 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF." 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 1 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 1 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0351 – Ignition 1 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 1. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0352 Ignition 2 Control Circuit



D06RY00067

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 2, it will set a DTC P0352.

Conditions for Setting the DTC

- The ignition is “ON.”
- The engine is turning, determined by the 58 X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON.”
- The output voltage is not equal to 0 volts when output is “OFF.”
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0352 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0352 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0352 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

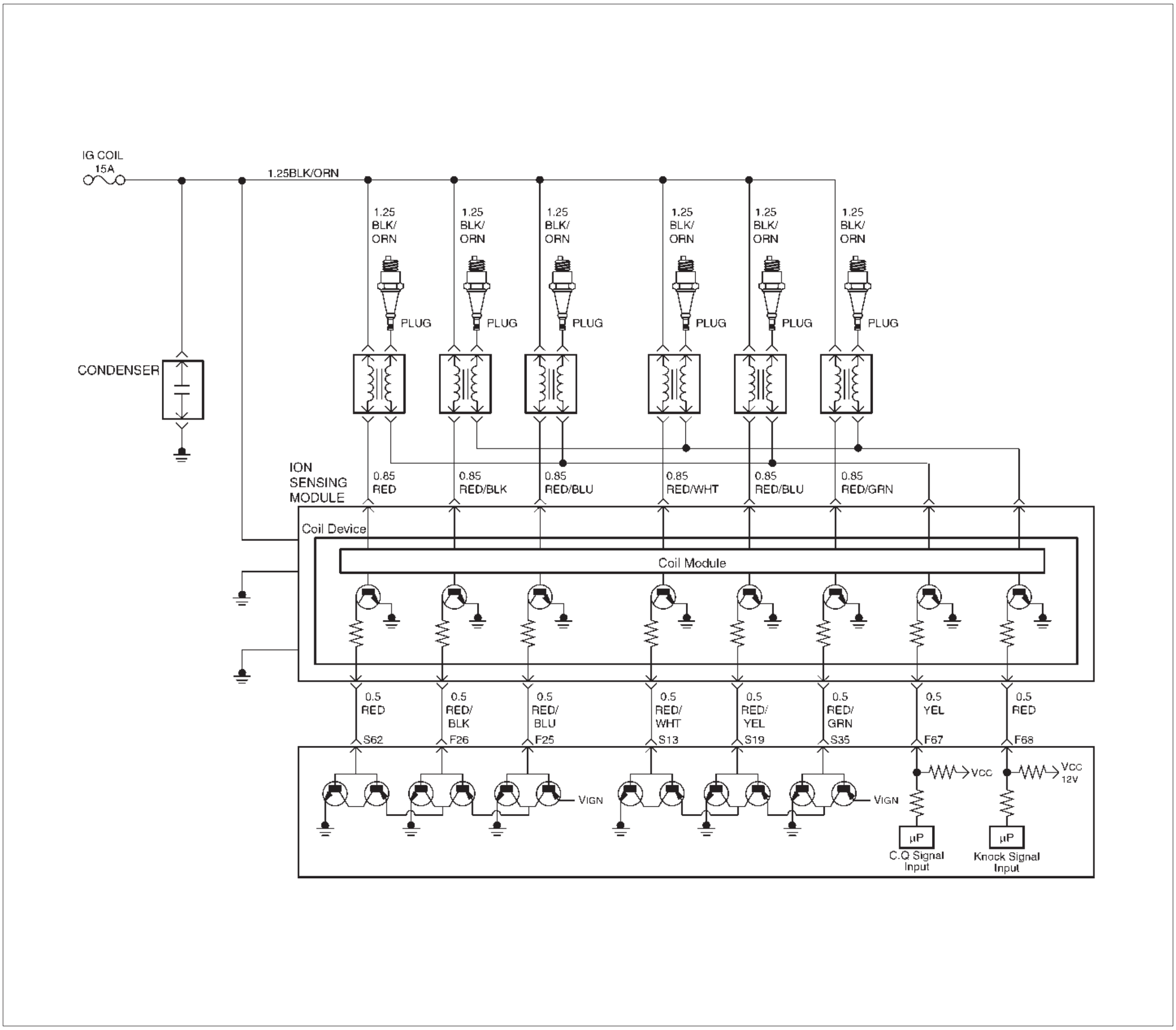
DTC P0352 – Ignition 2 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the “DTC” information for DTC P0352 until the DTC P0352 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0352 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition “ON,” engine “OFF.” 2. Back probe the ignition control circuit 2 at the ION Sensing Module with a DVM . Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition “ON,” engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition “OFF.” 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 2 voltage at the ignition coil connector while cranking the engine connector. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition “OFF.” 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 2 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 2 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0352 – Ignition 2 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 2. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0353 Ignition 3 Control Circuit



D06RY00067

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 3, it will set a DTC P0353.

Conditions for Setting the DTC

- The ignition is “ON.”
- The engine is turning, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON.”
- The output voltage is not equal to 0 volts when output is “OFF.”
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0353 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0353 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0353 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

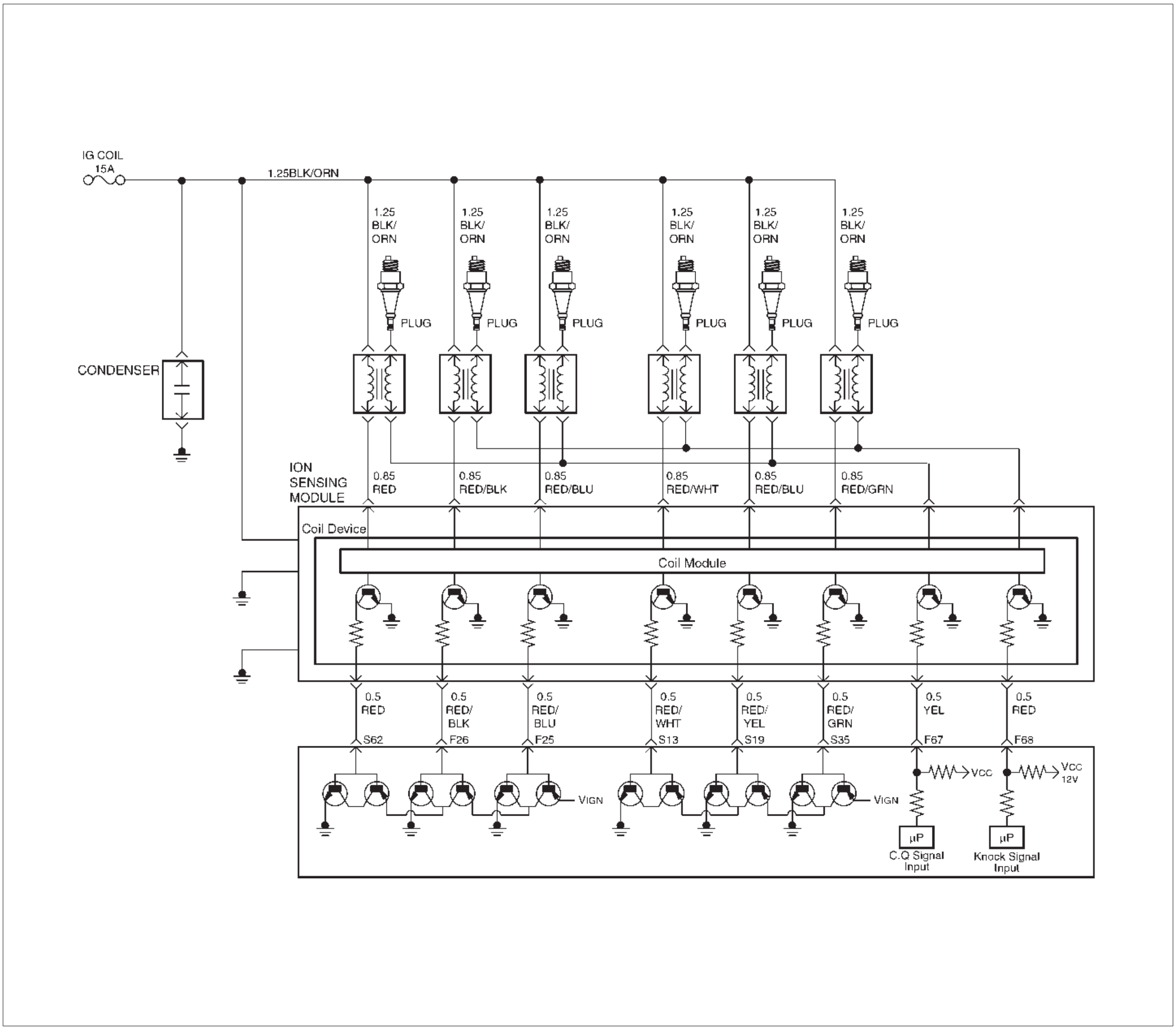
DTC P0353 – Ignition 3 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the “DTC” information for DTC P0353 until the DTC P0353 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0353 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition “ON,” engine “OFF.” 2. Back probe the ignition control circuit 3 at the ION Sensing Module with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition “ON,” engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition “OFF.” 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 3 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition “OFF.” 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 3 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 3 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0353 – Ignition 3 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 3. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0354 Ignition 4 Control Circuit



D06RY00067

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 4, it will set a DTC P0354.

Conditions for Setting the DTC

- The ignition is “ON.”
- The engine is turning, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON.”
- The output voltage is not equal to 0 volts when output is “OFF.”
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0354 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0354 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0354 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

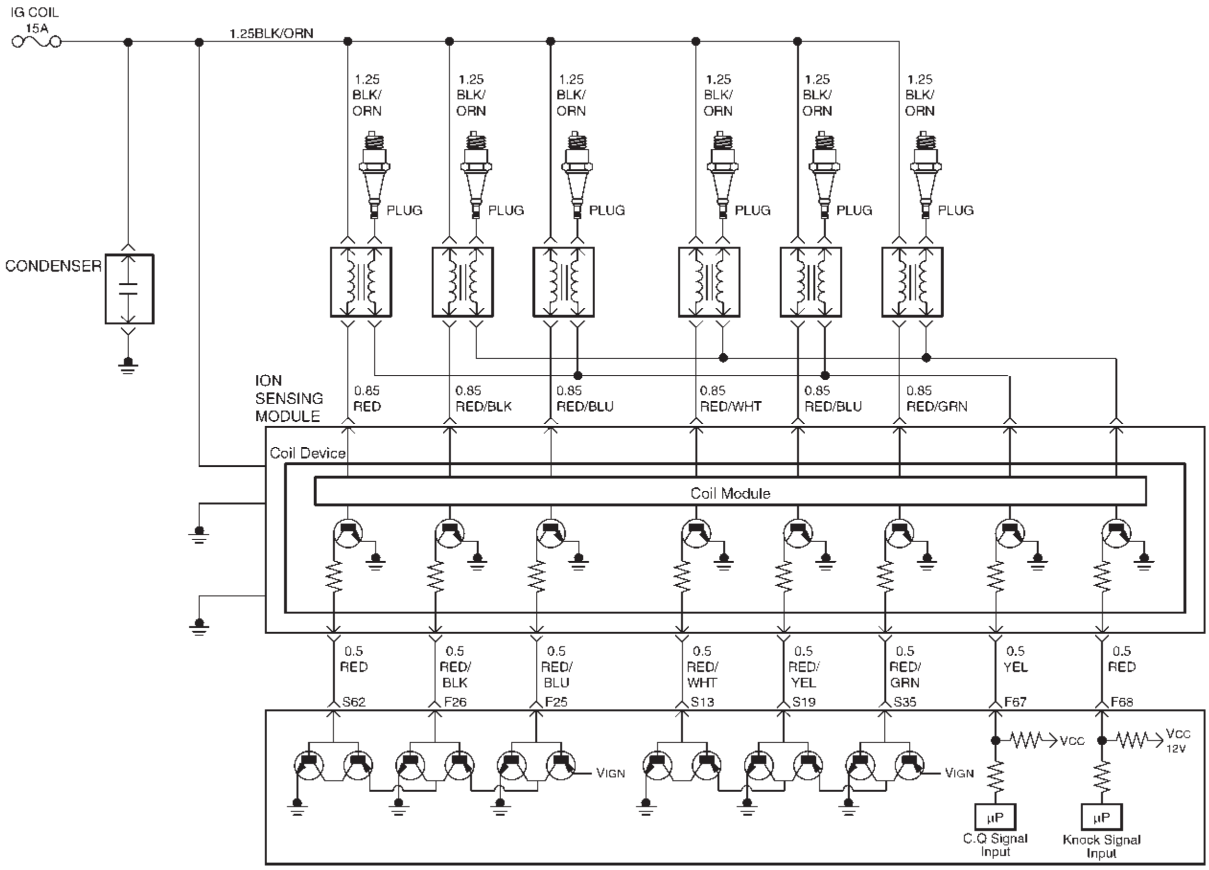
DTC P0354 – Ignition 4 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the "DTC" information for DTC P0354 until the DTC P0354 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0354 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition "ON," engine "OFF." 2. Back probe the ignition control circuit 4 at the ION Sensing Module with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition "ON," engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition "OFF." 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 4 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF." 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 4 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 4 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0354 – Ignition 4 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 4. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open in ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0355 Ignition 5 Control Circuit



D06RY00067

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST in control circuit 5, it will set a DTC P0355.

Conditions for Setting the DTC

- The ignition is “ON.”
- The engine is turning, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON.”
- The output voltage is not equal to 0 volts when output is “OFF.”
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0355 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0355 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0355 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

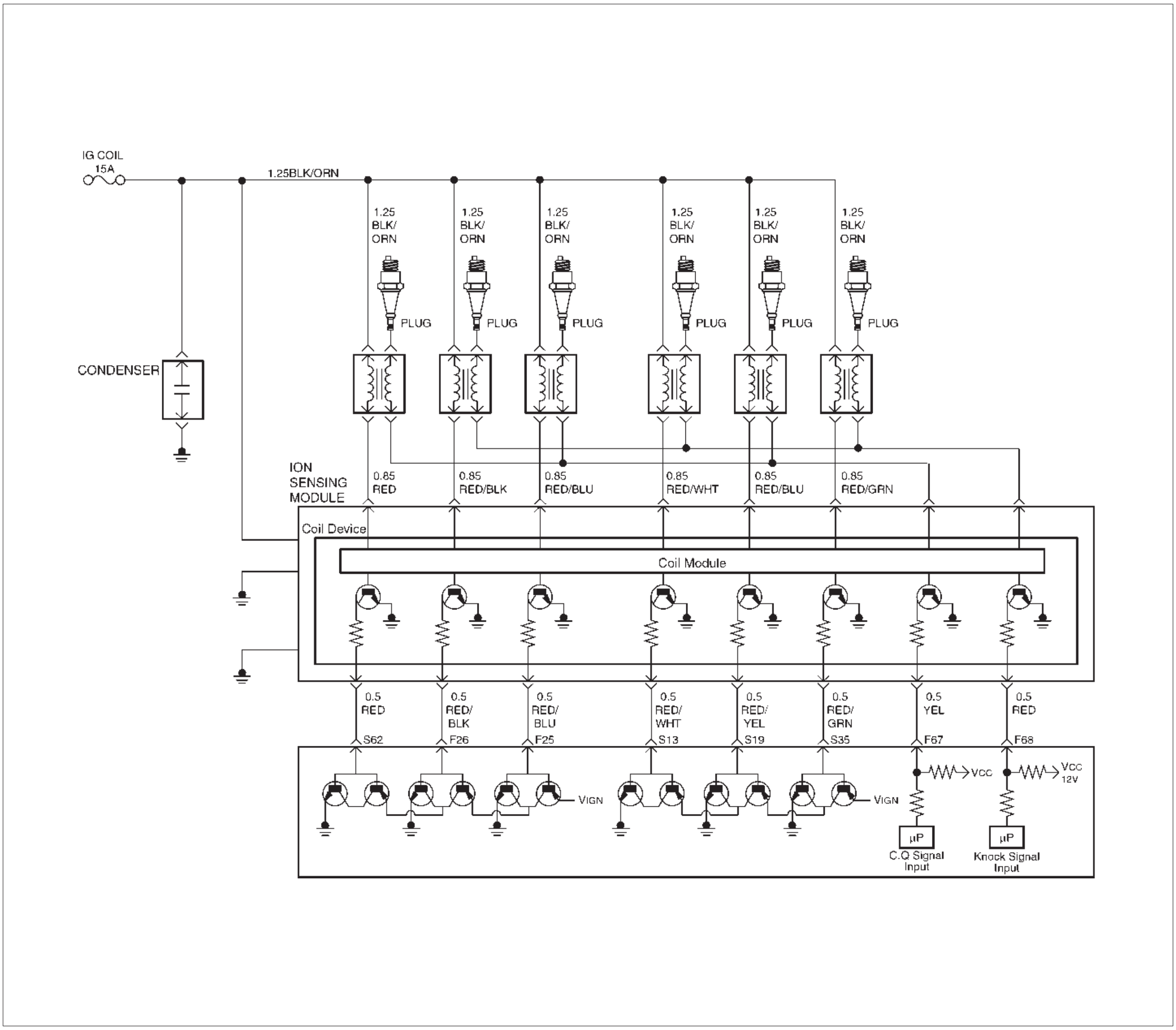
DTC P0355 – Ignition 5 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the “DTC” information for DTC P0355 until the DTC P0355 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0355 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition “ON,” engine “OFF.” 2. Back probe the ignition control circuit 5 at the ION Sensing Module with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition “ON,” engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition “OFF.” 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 5 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition “OFF.” 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 5 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 5 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0355 – Ignition 5 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 5. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0356 Ignition 6 Control Circuit



D06RY00067

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 6, it will set a DTC P0356.

Conditions for Setting the DTC

- The ignition is “ON.”
- The engine is turning, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON.”
- The output voltage is not equal to 0 volts when output is “OFF.”
- Ten test failures occur within 10 samples of continuous circuit monitoring.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0356 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0356 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0356 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

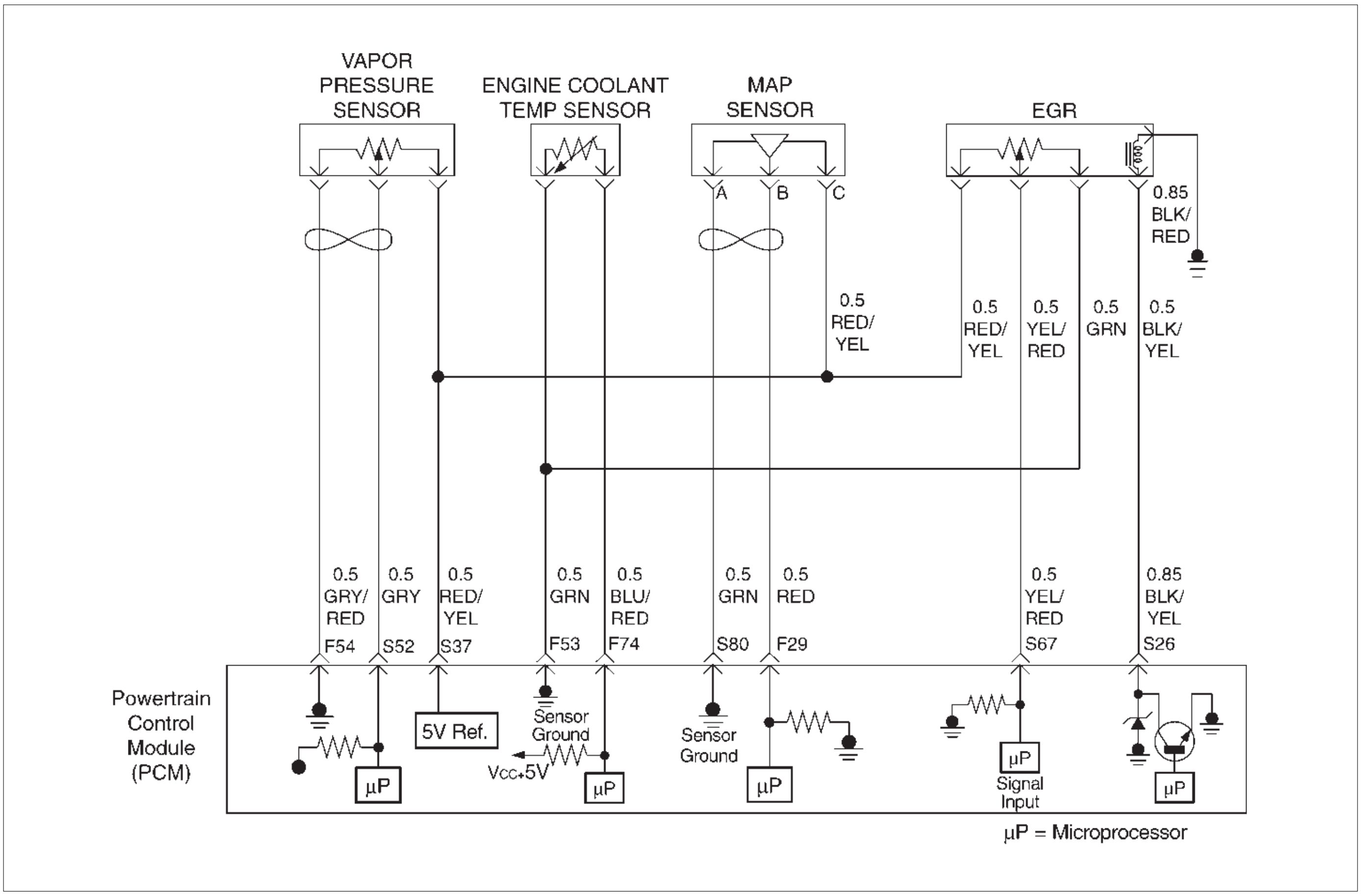
DTC P0356 – Ignition 6 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the "DTC" information for DTC P0356 until the DTC P0356 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0356 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition "ON," engine "OFF." 2. Back probe the ignition control circuit 6 at the ION Sensing Module with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition "ON," engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition "OFF." 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 6 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF." 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 6 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 6 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0356 – Ignition 6 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 6. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0401 EGR Flow Insufficient



D06RY00178

Circuit Description

The powertrain control module (PCM) tests the exhaust gas recirculation (EGR) system during deceleration by momentarily commanding the EGR valve to open while monitoring the manifold absolute pressure (MAP) sensor signal. When the EGR valve is opened, the PCM monitors the change in MAP input signal. The PCM compares the MAP change to a RPM vs. BARO table. When the PCM interprets the change in MAP to be out of limits, the PCM will set DTC P0401. The number of test samples required to accomplish this may vary according to the severity of the detected flow error.

Normally, the PCM will only allow one EGR flow test sample to be taken during an ignition cycle. To aid in verifying a repair, the PCM allows twelve test samples during the first ignition cycle following a Tech 2 “Clear Info” or a battery disconnect. Between nine and twelve samples should be sufficient for the PCM to determine adequate EGR flow and pass the EGR test.

Conditions for Setting the DTC

- No TP sensor, vehicle speed sensor (VSS), MAP sensor, EGR Pintle Position sensor, ECT sensor, misfire, or automatic transmission DTCs set.
- Engine coolant temperature is greater than 60°C (140°F).
- Ignition voltage between 11.5 and 16 volts.
- Vehicle speed is greater than 24 km/h (15 mph).
- A/C clutch status is unchanged.
- TCC status is unchanged.

Start Test

- TP angle is less than 1%.
- EGR duty cycle is less than 1%.
- MAP is steady, changing less than 2 kPa.
- Engine speed is between 1100 RPM and 2000 RPM.
- MAP between 10 kPa and 40 kPa.

The test will be aborted if the vehicle speed changes by more than 16 km/h (10 mph), engine speed changes by more than 100 RPM or the EGR is opened less than 95% of commanded position.

- The PCM will only run the EGR test during a closed throttle condition.
- The PCM will only run the EGR test at vehicle speeds above 24 km/h (15 mph).
- Several deceleration cycles will be necessary to run a sufficient number of EGR flow tests.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Actual EGR Position display on the Tech 2 while moving connectors and wiring harnesses related to the EGR valve. A change in the display will indicate the location of the fault.
- Ensure EGR valve is correctly mounted. See *On-Vehicle Service*.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

NOTE: If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possibly a plugged catalytic converter) using the “Restricted Exhaust System Check.”

Test Description

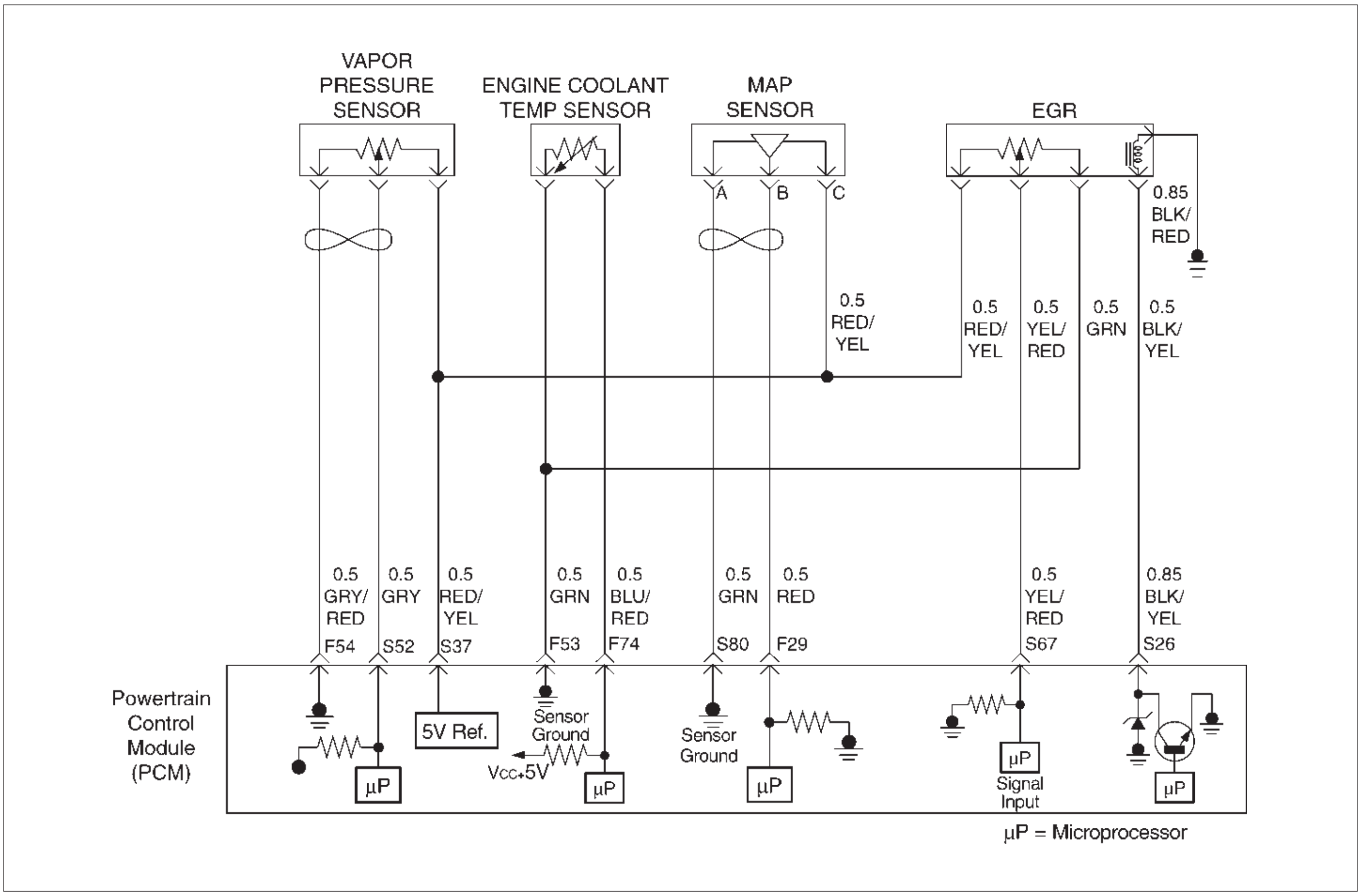
Number(s) below refer to the step number(s) on the Diagnostic Chart

3. A malfunctioning MAP sensor can set an EGR DTC. The MAP sensor could send a constant signal which is not low enough to set a low MAP DTC. The constant signal from the MAP sensor also may not be high enough to set a high MAP DTC. This step verifies that the MAP sensor is responding.

DTC P0401 – EGR Flow Insufficient

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P1404 also set?	—	Go to *DTC 1404*	Go to *Step 3*
3	1. Start the engine. 2. Monitor the MAP signal with a Tech 2 while idling. 3. While idling, jab the accelerator pedal about halfway down and immediately let the engine return to idle. Did the MAP value on the Tech 2 show an immediate large change?	—	Go to *Step 5*	Go to *Step 4*
4	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
5	1. Inspect the exhaust system for modification of original installed parts or leaks. 2. If a problem was found, repair exhaust system as necessary. Was a condition present that required repair?	—	Go to *Step 8*	Go to *Step 6*
6	1. Remove the EGR valve. 2. Visually and physically inspect the pintle, valve passages and the adapter for excessive deposits or any kind of a restriction. 3. If a problem is found, clean or replace EGR system components as necessary. Was a condition present that required repair?	—	Go to *Step 8*	Go to *Step 7*
7	1. Remove the EGR inlet and outlet pipes from the exhaust manifold and the intake manifold. 2. Inspect the manifold EGR ports and the EGR inlet and outlet pipes for a blockage caused by excessive deposits or other damage. 3. If a problem is found, correct the condition as necessary. Was a condition present that required repair?	—	Go to *Step 8*	Refer to *Diagnostic Aids*
8	1. Review and record the Tech 2 Failure Records data. 2. Clear DTC and monitor the Tech 2 System Info Screen while operating the vehicle as specified in “Diagnostic Aids.” 3. Using a Tech 2, monitor “DTC” info for DTC P0401 until the DTC P0401 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0401 failed this ignition?	—	—	Repair complete

Diagnostic Trouble Code (DTC) P0402 EGR Pintle Crank Error



D06RY00178

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if pintle position is stuck open. If the PCM detects a pintle position signal indicates more than 21.5% and more than for 625 msec during cranking, the PCM will set DTC P0402.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- Intake Air temp is more than 3°C
- At Engine revolution less than 600 RPM, EGR pintle position indicates more than 21.0% and more than for 625 msecs.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0402 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

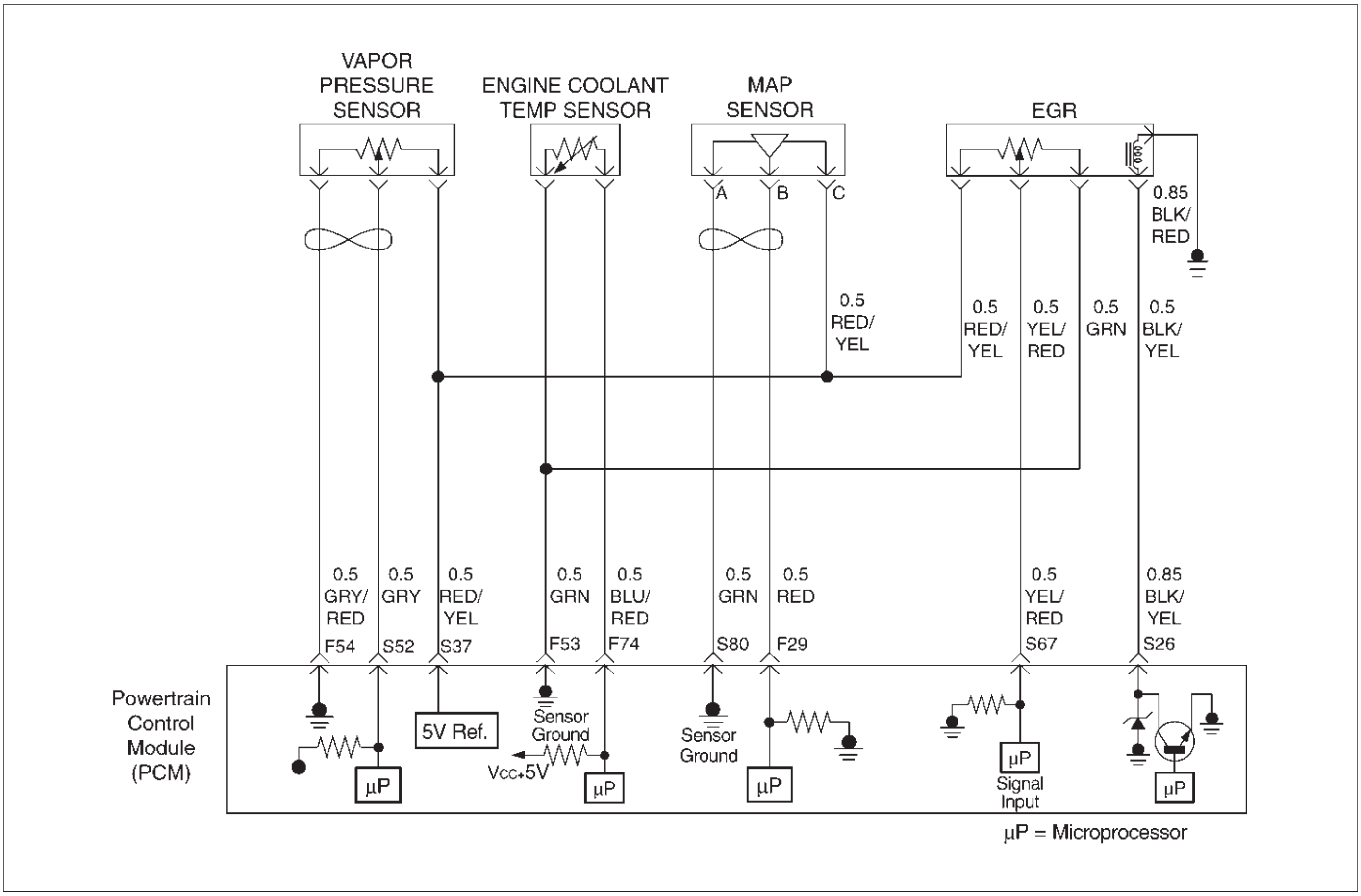
- Foreign material on EGR valve between pintle and seat may cause EGR stuck open. Inspect foreign material in EGR valve.
- Excessive carbon deposit may cause unsmooth operation of EGR valve shaft. Inspect carbon deposit and clean up inside of carbon deposit.
- Poor connection or damaged harness–inspect the wiring harness for damage If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

NOTE: If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possibly a plugged catalytic converter) using the “Restricted Exhaust System Check”.

DTC P0402 – EGR Pintle Crank Open Error

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine "OFF", review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0402 until the DTC P0402 test runs. Note the result. Does the Tech 2 indicates DTC P0402 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
5	1. Remove EGR valve from Engine. 2. Inspect EGR valve whether there is any foreign material between seat and pintle. Was any foreign material in EGR valve?	—	Go to *Step 6*	Go to *Step 7*
6	1. Remove EGR valve foreign material from EGR valve and clean up inside. 2. Visually inspect damage of pintle and seat, which leakage may occur. Was there any severe damage which affects function?	—	Go to *Step 7*	Verify repair Go to *Step 8*
7	1. Reconnect. 2. Ignition "OFF". 3. Install the Tech 2. 4. Run the engine at idle. 5. On Tech-II, select special function for EGR. 6. Use the "UP" arrow to increase the EGR from 0% to 40%. Did EGR work properly?	—	—	Go to *Step 8*
8	Replace the EGR valve. Does DTC P0402 still fail "DTC" test on the Tech 2?	—	Go to *Step 9*	Verify repair
9	Replace the EGR valve. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0404 EGR Open Stuck



D06RY00178

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if pintle position is different from commanded position. If the PCM detects a pintle position signal indicates more than 15 points different between current and commanded and more than 15 seconds, the PCM will set DTC P0404.

Conditions for Setting the DTC

- The engine is running.
- Ignition voltage is between 11 and 16 volts.
- Intake Air temp is more than 3°C.
- Desire EGR position is more than 0.
- The difference between desired EGR and current EGR is less than 3%.
- Difference EGR pintle position between current and commanded position becomes more than 15% and last more than 15 seconds, and this condition meets three times in a trip. Then it trigger, the PCM lights on.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected after consecutive 2nd trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0404 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

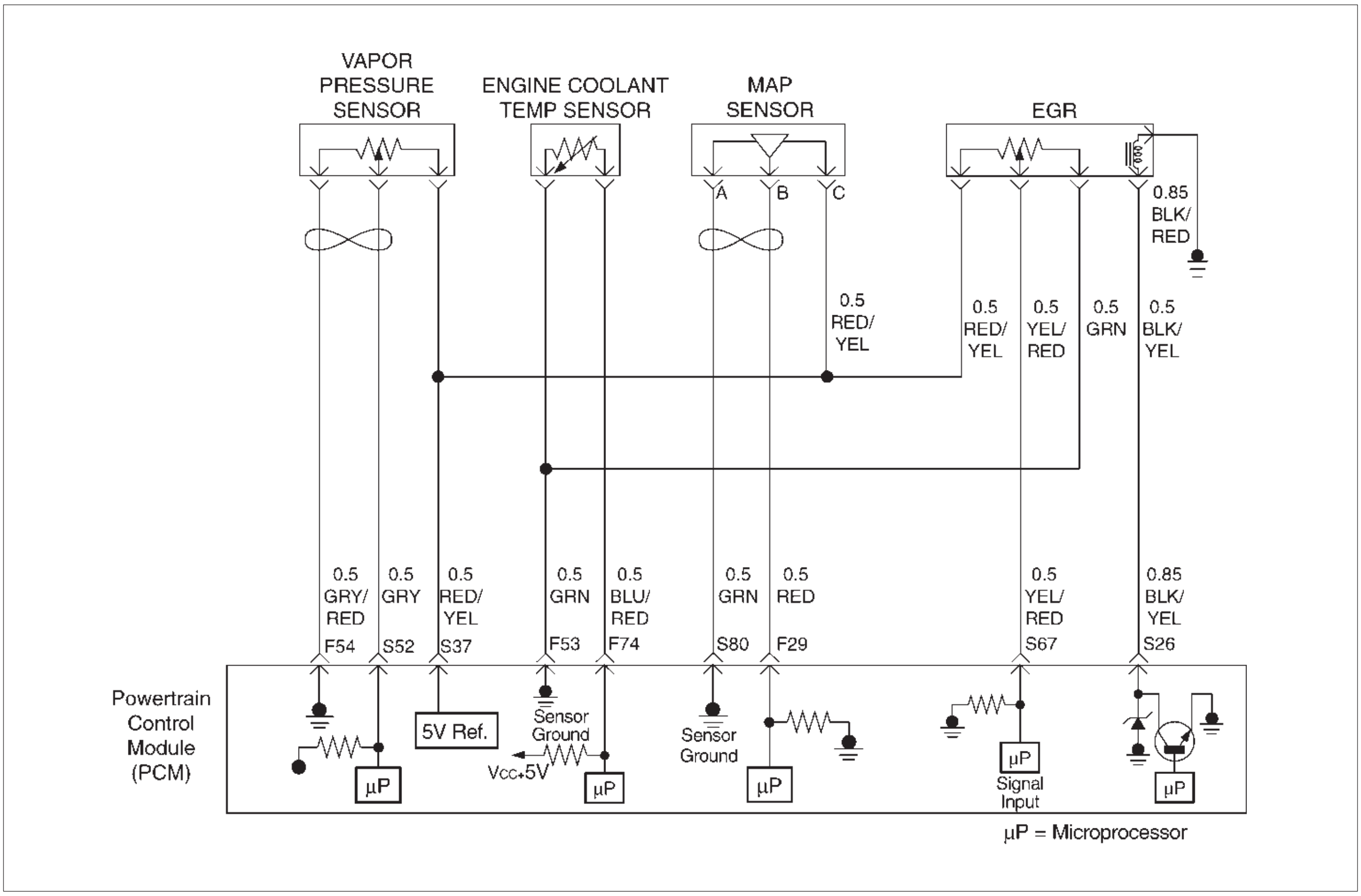
Check for the following conditions:

- Excessive carbon deposit on EGR valve shaft may cause EGR stuck open or unsmooth operation. Those carbon deposit may occur by unusual port operation. Clean up carbon may make smooth function of EGR valve.
- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

DTC P0404 – EGR Open Stuck

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0404 until the DTC P0404 test runs. Note the result. Does the Tech 2 indicates DTC P0404 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal.	—	Verify repair	Is the action complete?
5	1. Remove EGR valve from Engine. 2. Inspect EGR valve whether there is any excessive carbon deposit on EGR shaft. Was excessive carbon deposit on EGR valve shaft?	—	Go to *Step 6*	Go to *Step 7*
6	1. Clean up EGR valve shaft and inside of EGR valve. 2. Visually inspect damage of pintle and seat if is bent, leakage may occur. Was there any severe damage which affects function?	—	Go to *Step 8*	Verify repair Go to *Step 7*
7	1. Reconnect. 2. Ignition "OFF". 3. Install the Tech 2. 4. Run the engine at idle. 5. On the Tech 2, select EGR Control Test. 6. Use the "UP" arrow to increase the EGR from 0% to 40%. Did EGR work properly?	—	—	Go to *Step 8*
8	Replace the EGR valve. Does DTC P0404 still fail "DTC" test on the Tech 2?	—	Go to *Step 9*	Verify repair
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0405 EGR Low Voltage



D06RY00178

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to command from the PCM. If current pintle position voltage indicates less than 0.1 V and last more than 10 seconds, then the PCM will set DTC P0405.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- EGR pintle position is less than 2% and last more than 10 sec. Action taken when the DTC sets.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0405 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

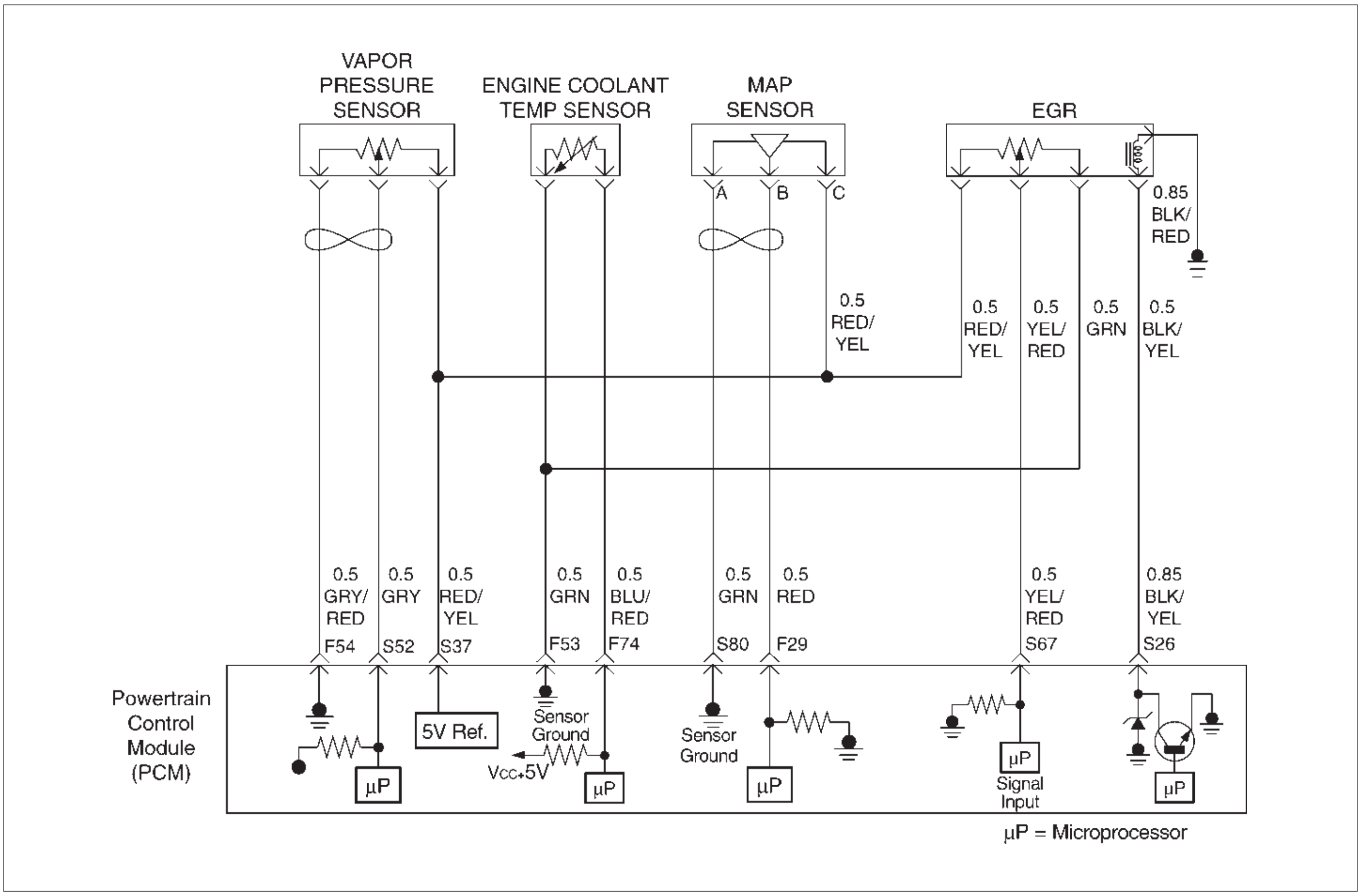
DTC P0405 – EGR Low Volt

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0405 until the DTC P0405 test runs. Note the result. Does the Tech 2 indicates DTC P0405 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
5	1. Disconnect the EGR harness connector. 2. Ignition "ON". 3. At the EGR valve, use a DVM to check the voltage at the 5 volt reference wire (RED/YEL) and ground. Did the DVM indicate the specified value?	4–6 V	Go to *Step 6*	Go to *Step 7*
6	1. Disconnect the EGR harness connector. 2. Measure resistance between terminal 5 Volt reference wire and ground. Was resistance in range?	5–5.5 KΩ	Go to *Step 10*	Go to *Step 17*
7	1. Ignition "ON". 2. At the PCM connector, back prove with a DVM at the 5 volt reference for the EGR valve. Did the DVM indicate the specified value?	4–6 V	Go to *Step 8*	Go to *Step 18*
8	Repair the open 5 volt reference circuit. Is the action complete?	—	Verify repair	—
9	Repair the damaged sensor ground wire. Is the action complete?	—	Verify repair	—
10	1. Disconnect the EGR harness 2. Use an ohmmeter to measure between the pintle position pin and the sensor ground pin on the EGR valve. NOTE: J-35616 Connector Test Adapter Kit may be useful for gaining access to the recessed pins on the valve. Was the ohmmeter reading approximately equal to the specified value?	1 to 1.25 KΩ	Go to *Step 13*	Go to *Step 17*
11	1. Ignition "ON". 2. Backprobe with a DVM to measure voltage at EGR valve pintle position pin and sensor ground pin. Was voltage in range?	Less than 0.1 V	Go to *Step 17*	Go to *Step 12*

DTC P0405 – EGR Low Volt (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Ignition "ON". 2. Backprobe with a DVM to measure voltage at PCM sensor ground pin and pintle position pin. Was voltage in range?	Less than 0.1 V	Go to *Step 13*	Go to *Step 18*
13	1. Ignition "OFF". 2. Disconnect the EGR harness. 3. Check short circuit between EGR pintle position circuit and EGR ground circuit. Was any short circuit?	—	Go to *Step 14*	Go to *Step 18*
14	Locate and repair the short to ground in the pintle position circuit Is the action complete?	—	Verify repair	—
15	1. Ignition "OFF". 2. Disconnect the PCM. 3. Ignition "ON". 4. Measure the voltage between the EGR pintle position circuit and ground. Is the measured voltage near the specified value?	Less than 0.1 V	Go to *Step 17*	Go to *Step 16*
16	Check for a short circuit between other wires and the pintle position circuit Is there any short circuit?	—	Repair short circuit Verify repair	Go to *Step 17*
17	Replace the EGR valve. Does DTC P1404 still fail "DTC test on the Tech 2?	—	Go to *Step 18*	Verify repair
18	Examine the PCM pin and terminal connection. Was there a damaged terminal?	—	Go to *Step 4*	Go to *Step 19*
19	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0406 EGR High Voltage



D06RY00178

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to command from the PCM. If current pintle position voltage indicates more than 4.8 V and last more than 10 seconds, then the PCM will set DTC P0406.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- EGR pintle position is more than 99% and last more than 10 sec.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

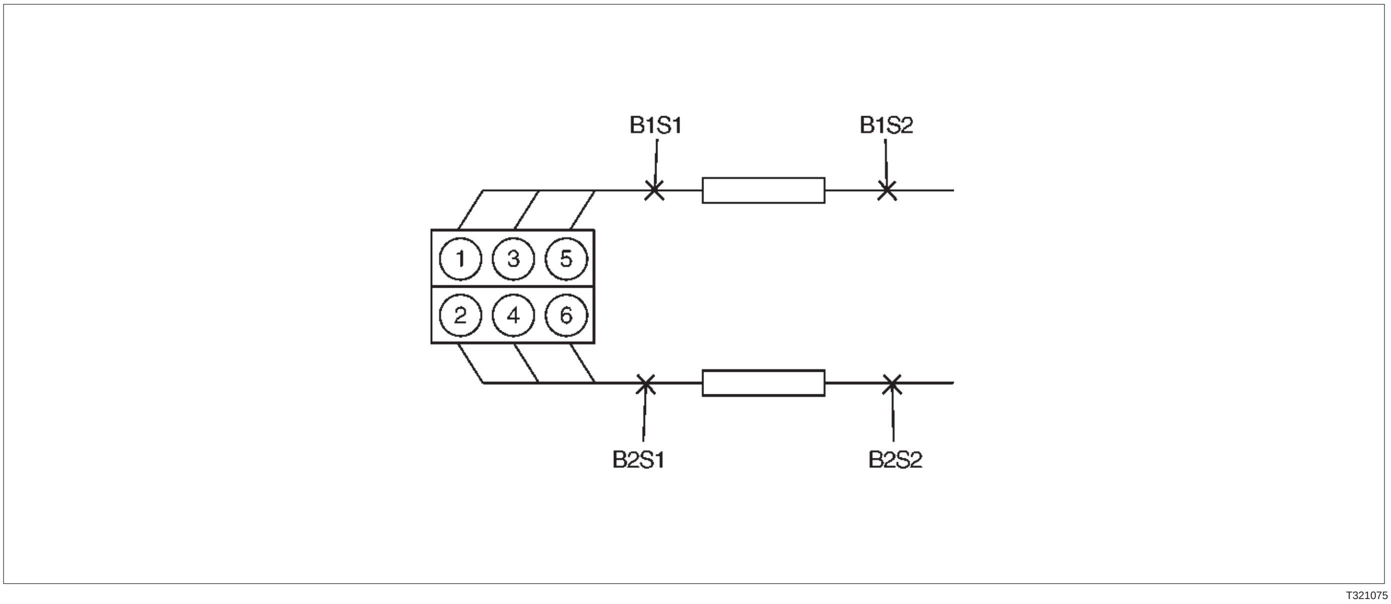
DTC P0406 – EGR High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0406 until the DTC P0406 test runs. Note the result. Does the Tech 2 indicates DTC P0406 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	Is the action complete?
5	1. Disconnect the EGR harness connector. 2. Ignition "ON". 3. At the EGR valve, use a DVM to check the voltage at the 5 volt reference wire (RED/YEL). Did the DVM indicate the specified value?	4–6 V	Go to *Step 8*	Go to *Step 6*
6	1. Ignition "ON". 2. At the PCM connector, backprove with a DVM at the 5 volt reference for the EGR valve. Did the DVM indicate the specified value?	4–6 V	Go to *Step 7*	Go to *Step 16*
7	Repair the open 5 volt reference circuit Is the action complete?	—	Verify repair	—
8	1. Ignition "OFF" 2. Disconnect the EGR harness. 3. Use a DVM to check for an resistance between 5 V reference and Sensor Ground at EGR sensor terminals. NOTE: J-35616 Connector Test Adapter Kit may be useful for gaining access to the recessed pins on the valve. Was the measured resistance in range?	5 to 5 KΩ	Go to *Step 9*	Go to *Step 15*
9	1. Ignition "OFF". 2. Disconnect the EGR harness. 3. Use a DVM to check for an resistance between Sensor Ground and Signal wire at EGR sensor terminal. Is there an open circuit?	—	Go to *Step 15*	Go to *Step 10*
10	1. Ignition "OFF". 2. Disconnect the EGR harness at PCM connector. 3. Use a DVM to check for shorted wire between S37 and F53. Is there a shorted wire?	—	Go to *Step 14*	Go to *Step 11*

DTC P0406 – EGR High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Ignition "ON". 2. Use a DVM to backprove at terminal Connector of EGR valve for voltage. Was measured voltage more than 4.8 V?	more than 4.8 V	Go to *Step 12*	Go to *Step 12*
12	1. Ignition "ON". 2. Stay the EGR harness connected. 3. Check voltage by backproving at PCM S37 terminal. Was voltage more than 4.8 V?	4.8 V	Go to *Step 16*	Go to *Step 13*
13	1. Locate short circuit at EGR harness between RED/YEL to RED/YEL or GRN, YEL/RED to BLK/YEL. 2. Replace EGR harness. Is the action complete?	—	Verify repair	—
14	Replace EGR harness. Is the action complete?	—	Verify repair	—
15	Replace the EGR valve. Does DTC P1404 still fail "DTC test on the Tech 2?	—	Go to *Step 16*	Verify repair
16	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0420 TWC System Low Efficiency Bank 1



Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalyst (TWC) is used. The catalyst promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the PCM detects a level of Bank 1 HO2S 2 activity that indicates the catalyst is no longer operating efficiently, DTC P0420 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop."
- Engine air load is below 99%.
- Engine coolant temperature is between 70°C (158°F) and 120°C (248°F).
- Mass air flow is between 2.5 g/second and 10 g/second.
- Engine speed is below 200 RPM.
- Catalyst temperature is above 35°C (662°F).
- The PCM determines that the catalyst's oxygen storage capacity is below the acceptable threshold.
- Intake Air temperature is between –10°C (14°F) and 70°C (158°F).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0420 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0420 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

The "TWC Monitor Test Counter" displayed on the Tech 2 may be used to monitor the progress of the TWC diagnostic. To complete the TWC diagnostic with a good catalyst, the counter must be allowed to increment to 49 samples and roll over to 0 at least twice. A failed catalyst will require three or more 50-sample tests to report a failure.

Test Description

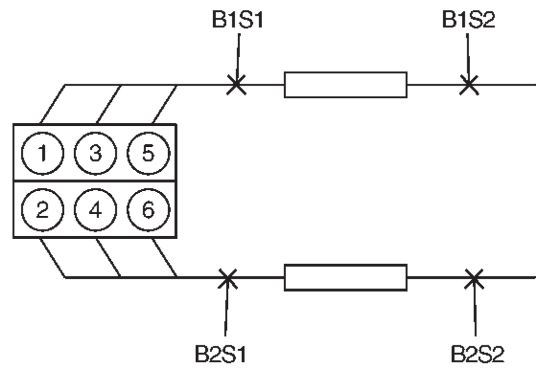
Number(s) below refer to the step number(s) on the Diagnostic Chart.

7. Difficulty completing the DTC P0420 “Status This Ign.” test may be encountered in areas where test conditions cannot be maintained easily, especially in urban areas. To minimize the amount of driving required to complete the DTC P0420 “Status This Ign.” test, use the following procedure:
   - Allow the engine to warm completely.
   - With the vehicle in “Park,” monitor mass air flow on the Tech 2 and hold part throttle to maintain a reading of over 12 g/second for at least 2 minutes. This will achieve the “warm catalyst” required for running the test.
   - Operate the vehicle in second or third gear to remain in the DTC P0420 test conditions described in “Conditions for Setting the DTC” as much as possible. If you must stop the vehicle, maintain the “warm catalyst” criteria as follows:
     - Place the vehicle in “Park” or “Neutral.”
     - Hold part throttle to maintain a mass air flow reading of over 15 g/second for the duration of the stop.

DTC P0420 – TWC System Low Efficiency Bank 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any other DTCs set (such as P0140)?	—	Diagnose other DTC(s) first	Go to *Step 3*
3	1. Visually and physically inspect the three-way catalytic converter for damage. Check for the following: • dents • severe discoloration caused by excessive temperatures • holes • internal rattle caused by damaged catalyst 2. Also, ensure that the three-way catalytic converter is a proper original equipment manufacturer part. Did your inspection reveal a problem?	—	Go to *Step 6*	Go to *Step 4*
4	1. Visually and physically inspect the exhaust system between the three-way catalytic converter and the rear converter flange for leaks, damage, and loose or missing hardware. 2. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to *Step 7* to verify repair	Go to *Step 5*
5	1. Visually and physically inspect the Bank 1 HO2S 2. 2. Ensure that the Bank 1 HO2S 2 is secure and that the pigtail and wiring harness is not contacting the exhaust pipe or is not otherwise damaged. 3. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to *Step 7* to verify repair	Go to *Step 6*
6	Replace the three-way catalytic converter. NOTE: Check for conditions which may cause catalyst damage (refer to *Diagnostic Aids*). Is the action complete?	—	Go to *Step 7* to verify repair	—
7	1. Review and record the Tech 2 Failure Records data. 2. Clear DTC P0420. 3. Start the engine and allow it to warm up until the engine coolant temperature monitored on the Tech 2 is above the specified value. 4. Run the engine to maintain the specified mass air flow range for at least 2 minutes. 5. Operate the vehicle to maintain DTC P0420 test conditions (refer to *DTC Test Description* in *Diagnostic Support* for detailed instructions). 6. Using a Tech 2, monitor "DTC" info for DTC P0420 until the DTC P0420 test runs. 7. Note the test result. Does the Tech 2 indicate DTC P0420 passed this ignition?	Engine coolant temp: greater than 60°C (140°F). Mass air flow: between 8 g/second and 50 g/second	Repair complete. If a driveability symptom still exists, refer to *Symptoms*.	Go to the *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0430 TWC System Low Efficiency Bank 2



T321075

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalyst (TWC) is used. The catalyst promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the PCM detects a level of Bank 2 HO2S 2 activity that indicates the catalyst is no longer operating efficiently, DTC P0430 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop."
- Engine air load is below 99%.
- Engine coolant temperature is between 70˚C (158˚F) and 115˚C (239˚F).
- Mass air flow is between 2.5 g/second and 10 g/second.
- Change in engine load is below 8%.
- Engine speed is below 200 RPM.
- Catalyst temperature is above 350˚C (662˚F).
- The PCM determines that the catalyst's oxygen storage capacity is below the acceptable threshold.
- Intake Air temperature is between –20˚C (4˚F) and 70˚C (158˚F).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0430 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0430 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

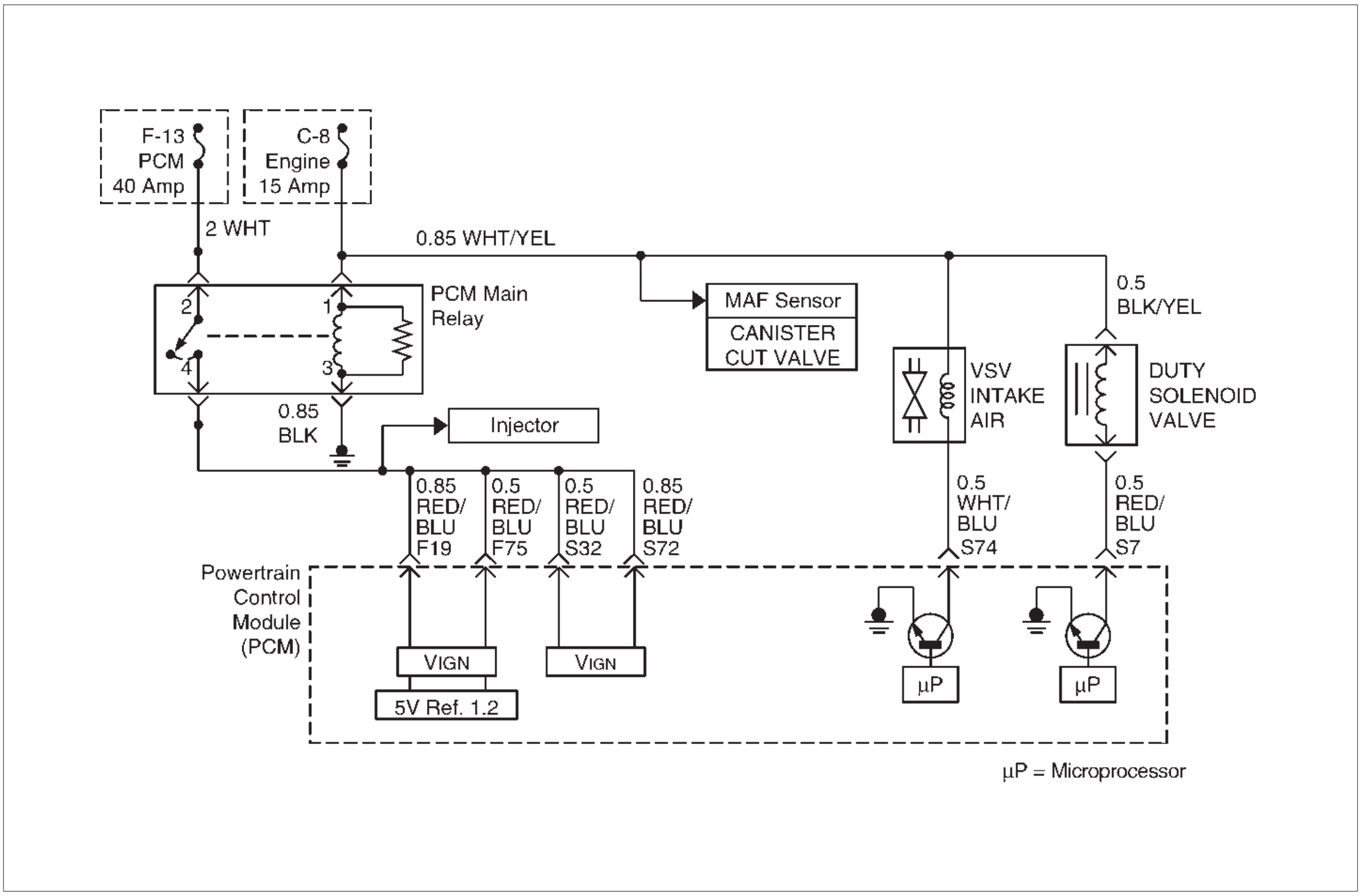
7. Difficulty completing the DTC P0430 “Status This Ign.” test may be encountered in areas where test conditions cannot be maintained easily, especially in urban areas. To minimize the amount of driving required to complete the DTC P0430 “Status This Ign.” test, use the following procedure:
   - Allow the engine to warm completely.
   - With the vehicle in “Park,” monitor mass air flow on the Tech 2 and hold part throttle to maintain a reading of over 12 g/second for at least 2 minutes. This will achieve the “warm catalyst” required for running the test.
   - Operate the vehicle in second or third gear to remain in the DTC P0430 test conditions described in “Conditions for Setting the DTC” as much as possible. If you must stop the vehicle, maintain the “warm catalyst” criteria as follows:
     – Place the vehicle in “Park” or “Neutral.”
     – Hold part throttle to maintain a mass air flow reading of over 15 g/second for the duration of the stop.

The “TWC Monitor Test Counter” displayed on the Tech 2 may be used to monitor the progress of the TWC diagnostic. To complete the TWC diagnostic with a good catalyst, the counter must be allowed to increment to 49 samples and roll over to 0 at least twice.

DTC P0430 – TWC System Low Efficiency Bank 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any other DTCs set (such as P0160)?	—	Diagnose other DTC(s) first	Go to *Step 3*
3	1. Visually and physically inspect the three-way catalytic converter for damage. Check for the following: • dents • severe discoloration caused by excessive temperatures • holes • internal rattle caused by damaged catalyst 2. Also, ensure that the three-way catalytic converter is a proper original equipment manufacturer part. Did your inspection reveal a problem?	—	Go to *Step 6*	Go to *Step 4*
4	1. Visually and physically inspect the exhaust system between the three-way catalytic converter and the rear converter flange for leaks, damage, and loose or missing hardware. 2. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to *Step 7* to verify repair	Go to *Step 5*
5	1. Visually and physically inspect the Bank 2 HO2S 2. 2. Ensure that the Bank 2 HO2S 2 is secure and that the pigtail and wiring harness is not contacting the exhaust pipe or is not otherwise damaged. 3. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to *Step 7* to verify repair	Go to *Step 6*
6	Replace the three-way catalytic converter. NOTE: Check for conditions which may cause catalyst damage (refer to *Diagnostic Aids*). Is the action complete?	—	Go to *Step 7* to verify repair	—
7	1. Review and record the Tech 2 Failure Records data. 2. Clear DTC P0430. 3. Start the engine and allow it to warm up until the engine coolant temperature monitored on the Tech 2 is above the specified value. 4. Run the engine to maintain the specified mass air flow range for at least 6 minutes. 5. Operate the vehicle to maintain DTC P0430 test conditions (refer to *DTC Test Description* in *Diagnostic Support* for detailed instructions). 6. Using a Tech 2, monitor "DTC" info for DTC P0430 until the DTC P0430 test runs. 7. Note the test result. Does the Tech 2 indicate DTC P0430 passed this ignition?	Engine coolant temp: greater than 70°C (158°F). Mass air flow: between 2.5 g/second and 10 g/second	Repair complete. If a driveability symptom still exists, refer to *Symptoms*.	Go to the *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0440 EVAP System



Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister duty solenoid valve
- Fuel tank pressure sensor
- Fuel pipes and hoses
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister cut valve (purge solenoid)

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The powertrain control module (PCM) monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid and the EVAP canister vent solenoid are turned “ON,” allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system. If a sufficient vacuum level cannot be achieved, a large leak or a faulty EVAP canister purge solenoid is indicated. This can be caused by the following conditions:

- Disconnected or faulty fuel tank pressure sensor
- Missing or faulty fuel cap
- Disconnected, damaged, pinched, or blocked EVAP purge line
- Disconnected or damaged EVAP vent hose
- Disconnected, damaged, pinched, or blocked fuel tank vapor line
- Disconnected or faulty EVAP canister cut valve
- Disconnected or faulty EVAP canister duty solenoid valve
- Open ignition feed circuit to the EVAP canister vent solenoid or the EVAP canister cut valve
- Damaged EVAP canister
- Leaking fuel sender assembly O-ring
- Leaking fuel tank or fuel filler neck

Any of the above conditions can set DTC P0440.

Conditions for Setting the DTC

- No TP sensor, IAT sensor, or MAP sensor DTCs set.
- Start-up engine coolant temperature is less than 32°C (90°F).
- Start-up engine coolant temperature is not more than 7°C (13°F) greater than start-up intake air temperature.
- Start-up intake air temperature is greater than 4°C (39°F) .
- Start-up intake air temperature is not more than 2°C (4°F) greater than start-up engine coolant temperature.
- Vehicle speed is less than 5 mph (8 km/h).
- Throttle position is greater than 3%.
- Minimal fuel slosh.
- BARO is greater than 70 kPa.

- The EVAP system is unable to achieve or maintain vacuum during the diagnostic test.
- Above conditions are present for 60 to 180 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the second key cycle in which the DTC sets.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" when the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0440 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0440 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Cracked or punctured EVAP canister.
- Damaged or disconnected source vacuum line, EVAP purge line, vent hose or fuel tank vapor line.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness to the EVAP canister vent solenoid, EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.
- Kinked, pinched, or plugged vacuum source, EVAP purge, or fuel tank vapor line–Verify that the lines are not restricted.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If an EVAP canister vent solenoid or an EVAP canister purge solenoid electrical fault is present, the purge system will not operate correctly. Repairing the electrical fault will very likely correct the condition that set DTC P0440.
3. Checks the fuel tank pressure sensor at ambient pressure.
4. Determines whether or not the EVAP system can be sealed sufficiently to be pressurized. If not, the large leak must be located and corrected before continuing with diagnosis.
5. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.
8. Checks for a blocked EVAP canister purge solenoid. The PCM commands the EVAP canister purge solenoid "OFF" (open) and the vent solenoid "ON" (closed) with the Tech 2 "System Perf." EVAP output control function activated. Any pressure in the system should be released through the EVAP canister purge solenoid within a few seconds when "System Perf." is activated.
9. Ensures that sufficient source vacuum is present at the EVAP canister purge solenoid.

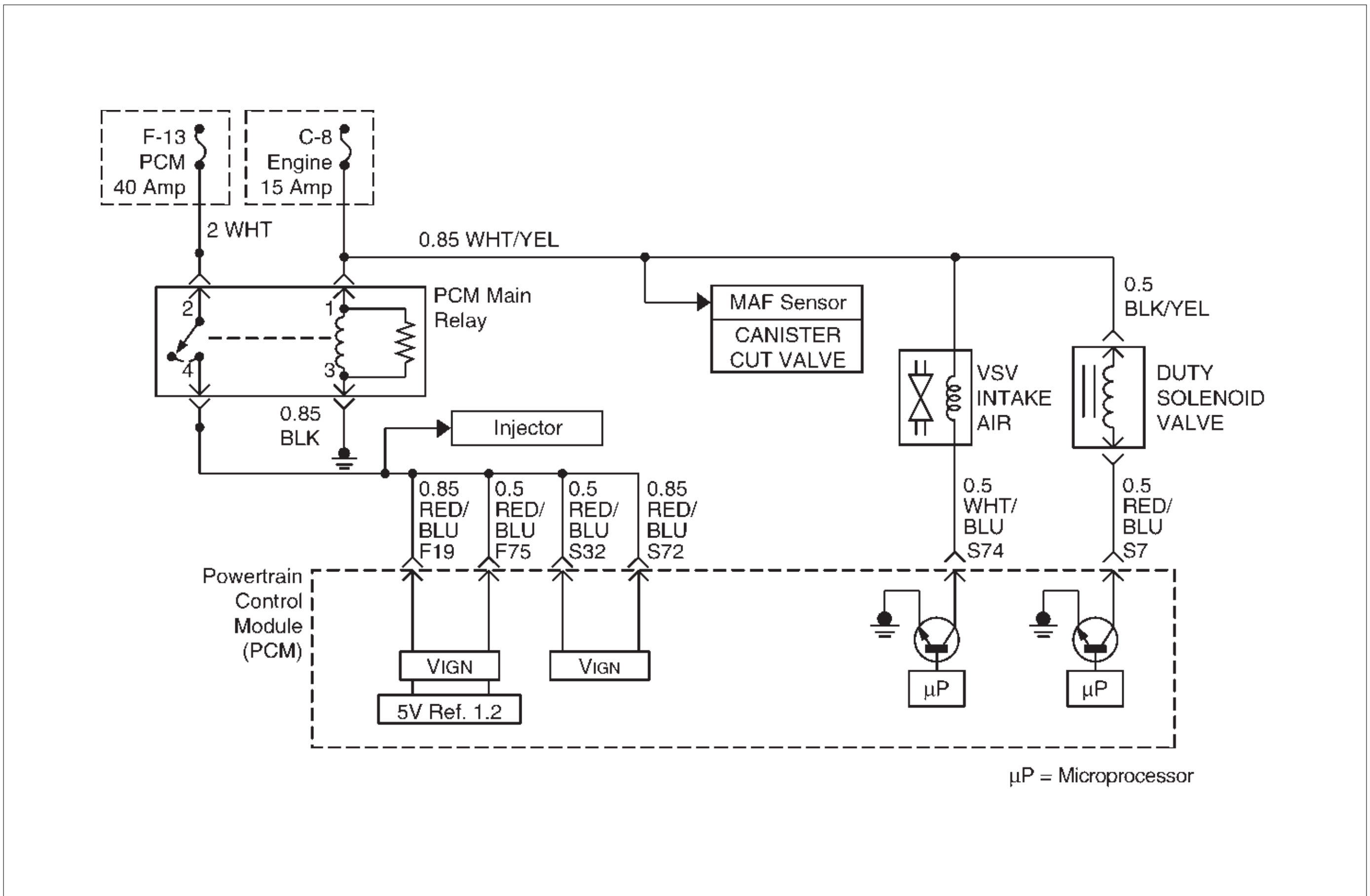
DTC P0440 – EVAP System

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0452 or P0453 also set?	—	Go to *other DTC first*	Go to *Step 3*
3	1. Ignition "OFF." 2. Remove the fuel cap. 3. Ignition "ON." 4. Observe "Fuel Tank Pressure" on the Tech 2. Does the Tech 2 indicate "Fuel Tank Pressure" at the specified value?	1.51 V	Go to *Step 4*	Go to *DTC P0452* or *DTC P0453*
4	1. Replace the fuel cap. 2. Engine is running. 3. Observe "Fuel Tank Vacuum" on the Tech 2. Does Tech 2 indicate "Fuel Tank Vacuum" at the specified value?	1.47–1.51 V	Go to *Step 7*	Go to *Step 6*

DTC P0440 – EVAP System (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Ignition "OFF". 2. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister. 3. Block the canister fitting for the fuel tank vapor line. 4. Connect a hand vacuum pump to the canister fitting for the EVAP purge line. 5. Ensure that the EVAP canister vent solenoid is still commanded "ON" (closed). 6. Attempt to apply vacuum to the EVAP canister. Observe "Fuel tank pressure" on the Tech 2. Does the Tech 2 indicate "Fuel tank pressure" at the specified value?	1.47–1.51 V	Go to *Step 8*	Go to *Step 7*
6	1. Visually/physically check for the following conditions: • Restricted fuel tank vapor line. • Restricted EVAP purge line. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *DTC P0452* or *DTC P0453*
7	1. Visually/physically check for the following conditions: • Vent hose disconnected or the damaged. • EVAP canister damaged. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
8	1. Visually/physically check for the following conditions: • Missing or faulty fuel cap. • Disconnected or leaking fuel tank vapor line. • Disconnected or damaged EVAP purge line. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	Replace the EVAP canister purge solenoid. Is the action complete?	—	Verify repair	—
10	Locate and repair cause of no source vacuum to the EVAP canister purge solenoid. Is the action complete?	—	Verify repair	—
11	Replace the EVAP canister vent solenoid. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0442 EVAP System Small Leak Detected



D06RY00128

Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister vent solenoid
- Fuel tank pressure sensor
- Fuel pipes and hoses
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister purge solenoid

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The powertrain control module (PCM) monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid and the EVAP canister vent solenoid are turned “ON,” allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system. After the desired vacuum level has been achieved, the EVAP canister purge solenoid is turned “OFF,” sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant. A small leak in the system will cause DTC P0442 to be set.

Conditions for Setting the DTC

- No TP sensor, ECT sensor, Tank pressure sensor, IAT sensor, or MAP sensor DTCs set.
- The DTC P0440 diagnostic test has passed.
- A vacuum decay condition, indicating a small leak, is detected during the diagnostic test.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second key cycle in which the DTC sets.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0442 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0442 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Cracked or punctured EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel tank vapor line.

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness to the EVAP canister vent solenoid, EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If an EVAP canister vent solenoid or an EVAP canister purge solenoid electrical fault is present, the purge system will not operate correctly. Repairing the electrical fault will very likely correct the condition that set DTC P0442.
3. Checks the fuel tank pressure sensor at ambient pressure.
4. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.

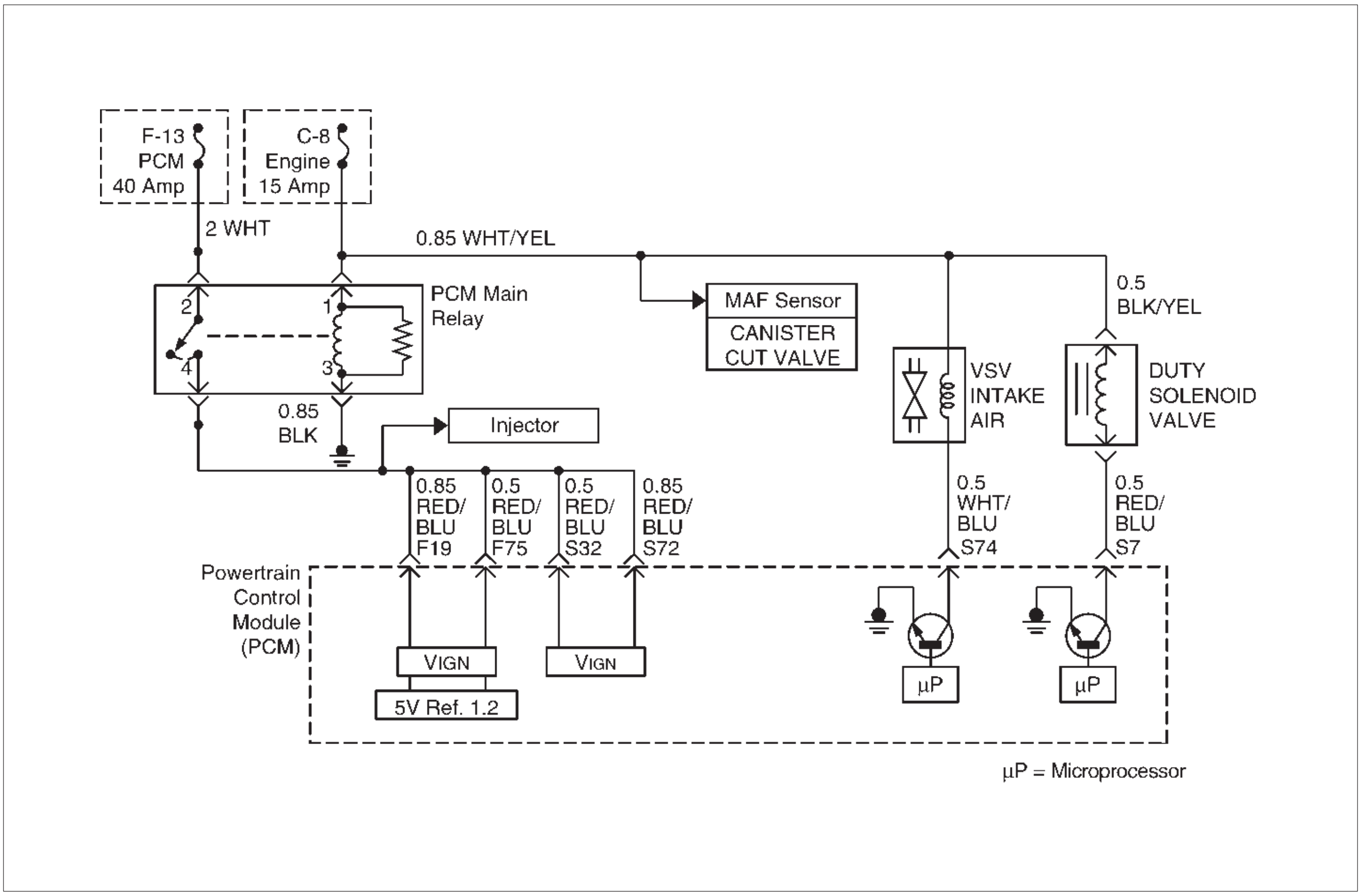
DTC P0442 – EVAP System Leak Detected

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "OFF." 2. Remove the fuel cap. 3. Ignition "ON." 4. Observe "Fuel Tank Pressure" on the Tech 2. Does the Tech 2 indicate "Fuel Tank Pressure" at the specified value?	1.51V	Go to *Step 3*	Go to *Fuel Tank Pressure System*
3	**IMPORTANT:** Before continuing with diagnosis, zero the EVAP pressure and vacuum gauges on EVAP pressure/purge cart J 41413 (refer to tool operating instructions). 1. Replace the fuel cap. 2. Capture Failure Records data for DTC P0442 and clear DTCs. 3. Connect the EVAP pressure/purge cart J 41413 to the EVAP service port. 4. Using the Tech 2, command the EVAP canister vent solenoid "ON" (closed). 5. Using the EVAP pressure/purge cart J 41413, pressurize the EVAP system to the specified value. 6. Observe "Fuel Tank Pressure" on the Tech 2. Does the Tech 2 indicate "Fuel Tank Pressure" at the specified value?	1.47V	Go to *Step 4*	Go to *Fuel Tank Pressure System*
4	1. Ignition "ON," engine idling. 2. Using the Tech 2, command the EVAP canister vent solenoid "ON" (closed). 3. Using the EVAP pressure/purge cart J 41413, pressurize the EVAP system to 15 in. H2O. 4. Switch the rotary switch on the cart to "HOLD" and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	1.47 – 1.51V	Go to *Step 5*	Refer to *Diagnostic Aids*

DTC P0442 – EVAP System Leak Detected (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister. 2. Block the canister fitting for the fuel tank vapor line. 3. Connect a hand vacuum pump to the canister fitting for the EVAP purge line. 4. Ensure that the EVAP canister vent solenoid is still commanded "ON" (closed). 5. Attempt to apply vacuum to the EVAP canister. Can the vacuum be maintained at the specific value?	1.46V	Go to *Step 8*	Go to *Step 6*
6	1. Visually/physically check for the following conditions: • Vent hose disconnected or damaged. • EVAP canister damaged. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 7*
7	Replace the EVAP canister vent solenoid. Is the action complete?	—	Go to *Step 10*	—
8	1. Visually/physically check for the following conditions: • Missing or faulty fuel cap. • Disconnected or leaking fuel tank vapor line. • Disconnected or damaged EVAP purge line. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 9*
9	1. Using Tech 2, command the EVAP canister vent solenoid "ON" (closed). 2. With the cart connected to the EVAP service port, continuously attempt to pressurize the EVAP system by leaving the cart control knob in the pressurize position. 3. Using ultrasonic leak detector J 41416, locate and repair leak in EVAP system. (It may be necessary to partially lower the fuel tank to examine the connections on top of the tank.) Is the action complete?	—	Go to *Step 10*	—
10	1. Ignition "ON," engine not running. 2. Using the Tech 2, command the EVAP canister vent solenoid "ON" (closed). 3. Using the EVAP pressure/purge cart J 41413, pressurize and monitor the EVAP system to 15 in. H2O. 4. Switch the rotary switch on the cart to "HOLD" and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	2.14V	Go to *Step 2*	Verify repair

Diagnostic Trouble Code (DTC) P0446 EVAP Canister Vent Blocked



D06RY00128

Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister vent solenoid
- Fuel tank pressure sensor
- Fuel pipes and hoses
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister purge solenoid

An incorrect fuel tank pressure sensor signal is detected by monitoring fuel tank pressure when the key is first turned “ON” during a cold start. If the fuel tank pressure signal is out of range, DTC P0446 will set. A restricted or blocked EVAP vent path is detected by monitoring fuel tank pressure during normal operation (EVAP canister vent solenoid open, EVAP canister purge solenoid normal). With the EVAP canister vent solenoid open, vacuum level in the system should be very low unless the vent path is blocked. A blockage can be caused by the following condition:

- Faulty EVAP canister vent solenoid (stuck closed).
- Plugged, kinked or pinched vent hose.
- Shorted EVAP canister vent solenoid driver circuit.
- Plugged evaporative canister.

If any of these conditions are present, DTC P0446 will set.

Conditions for Setting the DTC

- No TP sensor, ECT sensor, Tank pressure sensor, IAT sensor, or MAP sensor DTCs set.
- Start-up engine coolant temperature is less than 32˚C (90˚F).
- Start-up engine coolant temperature is not more than 7˚C (13˚F) greater than start-up intake air temperature.
- Vehicle speed is less than 75 mph (120 km/h).
- Throttle position is greater than 7% but less than 30%.
- Minimal fuel slosh.
- Fuel tank level is between 10% and 90%.
- BARO is greater than 70 kPa.

Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the second key cycle in which the DTC sets.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0446 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0446 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness to the EVAP canister vent solenoid, EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.
- Kinked, pinched, or plugged vent hose–Verify that the vent hose between the EVAP canister and EVAP canister vent solenoid is not restricted.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If a vent solenoid electrical fault is present, the purge system will not operate correctly. Repairing the electrical fault will very likely correct the condition that set DTC P0446.
3. Checks the fuel tank pressure sensor at ambient pressure.
4. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.
6. Checks for a blocked EVAP canister.

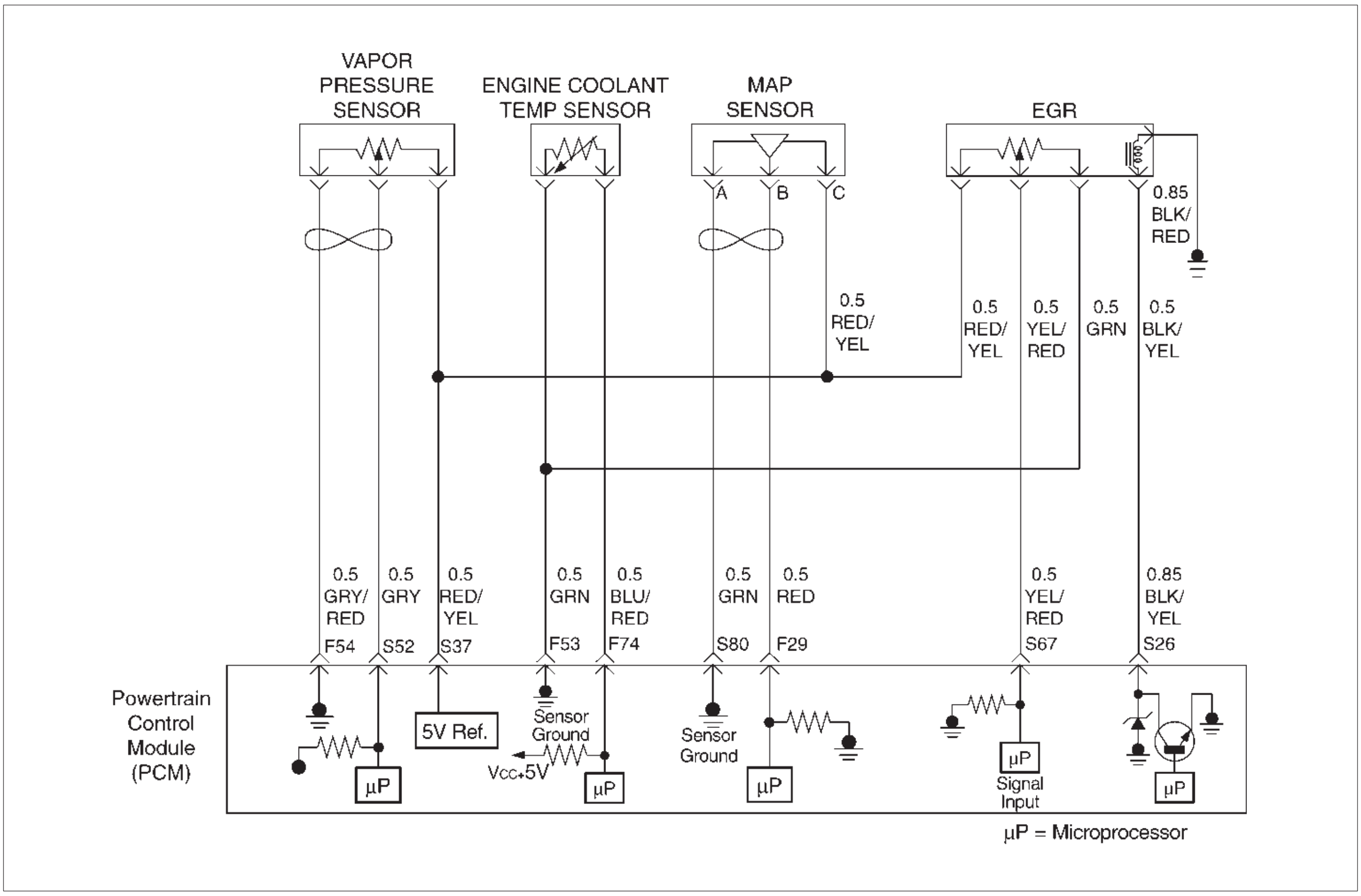
DTC P0446– EVAP Canister Vent Blocked

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON." 2. Capture Failure Records data for DTC P0446 and clear DTCs. 3. Ignition "OFF." 4. Remove the fuel cap. 5. Ignition "ON." 6. Observe "Fuel Tank Pressure" on the Tech 2. Does Tech 2 indicate "Fuel Tank Pressure" at the specified value?	1.51V	Go to *Step 3*	Go to *Fuel Tank Pressure System*
3	**IMPORTANT:** Before continuing with diagnosis, zero the EVAP pressure and vacuum gauges on the EVAP pressure/purge cart J 41413 (refer to tool operating instructions). 1. Replace the fuel cap. 2. Using the Tech 2, command the EVAP vent solenoid "ON" (closed). 3. Connect the EVAP pressure/purge cart J 41413 to the EVAP service port. 4. Using the EVAP pressure/purge cart J 41413, pressurize the EVAP system to the specified value. 5. Observe "Fuel Tank Pressure" on the Tech 2. Does Tech 2 indicate "Fuel Tank Pressure" at the specified value?	1.52 – 1.69V	Go to *Step 4*	Go to *Fuel Tank Pressure System*
4	1. Maintain the EVAP pressure at 5 in. at H2O. 2. Using Tech 2, command the EVAP vent solenoid "OFF" (open) while observing the EVAP pressure gauge on the cart J 41413. Does the EVAP pressure return to the specified value within 5 seconds?	0 in. H2O	Refer to *Diagnostic Aids*	Go to *Step 5*

DTC P0446– EVAP Canister Vent Blocked (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect the large vent hose (marked "AIR") from the EVAP canister. 2. Switch the rotary switch on the cart J 41413 to "PURGE." 3. Ignition "ON," engine idling at normal operating temperature. 4. Observe vacuum gauge for 5 seconds while holding the engine speed at 2500 RPM. Does the vacuum remain less than the specified value?	30 in. H2O	Go to *Step 6*	Go to *Step 8*
6	1. Inspect the vent hose between the EVAP canister and the EVAP canister vent solenoid for kinks, pinched areas, or any other form of blockage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 9*	Go to *Step 7*
7	Replace the EVAP canister vent solenoid. Is the action complete?	—	Go to *Step 9*	—
8	Replace the EVAP canister. Is the action complete?	—	Go to *Step 9*	—
9	1. Using Tech 2, command the EVAP canister vent solenoid "ON" (closed). 2. Using the EVAP pressure/purge cart J 41413, pressurize and monitor the EVAP system to 15 in. H2O. 3. Switch the rotary switch on cart J 41413 to "HOLD." 4. Using the Tech 2, command the EVAP canister vent solenoid "OFF" (open) while observing the EVAP pressure gauge on cart J 41413. Does the EVAP pressure return to the specified value within 5 seconds?	0 in. H^2O	Verify repair	Go to *Step 2*

Diagnostic Trouble Code (DTC)
P0452 Fuel Tank Pressure Sensor (Vapor Pressure Sensor) Low Voltage



D06RY00178

Circuit Description

The powertrain control module (PCM) monitors fuel tank pressure sensor (Vapor pressure sensor) of the Enhanced Evapo system. When the tank pressure output indicates low voltage, PCM will set DTC P0452.

Conditions for Setting the DTC

- Tank sensor output is less than 0.2 volts for 12.5 sec.
- 100 test failures within a 200 tests.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Open circuit of 5 volt reference line – Inspect wiring harness from PCM to the sensor. The PCM turns P0452, and P0107 at the same time.
- Open circuit or short circuit to ground line – Inspect wiring harness from PCM to the sensor. The PCM turns P0452 and P0107 at the same time.
- Tank fuel pressure sensor malfunction may cause P0452.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

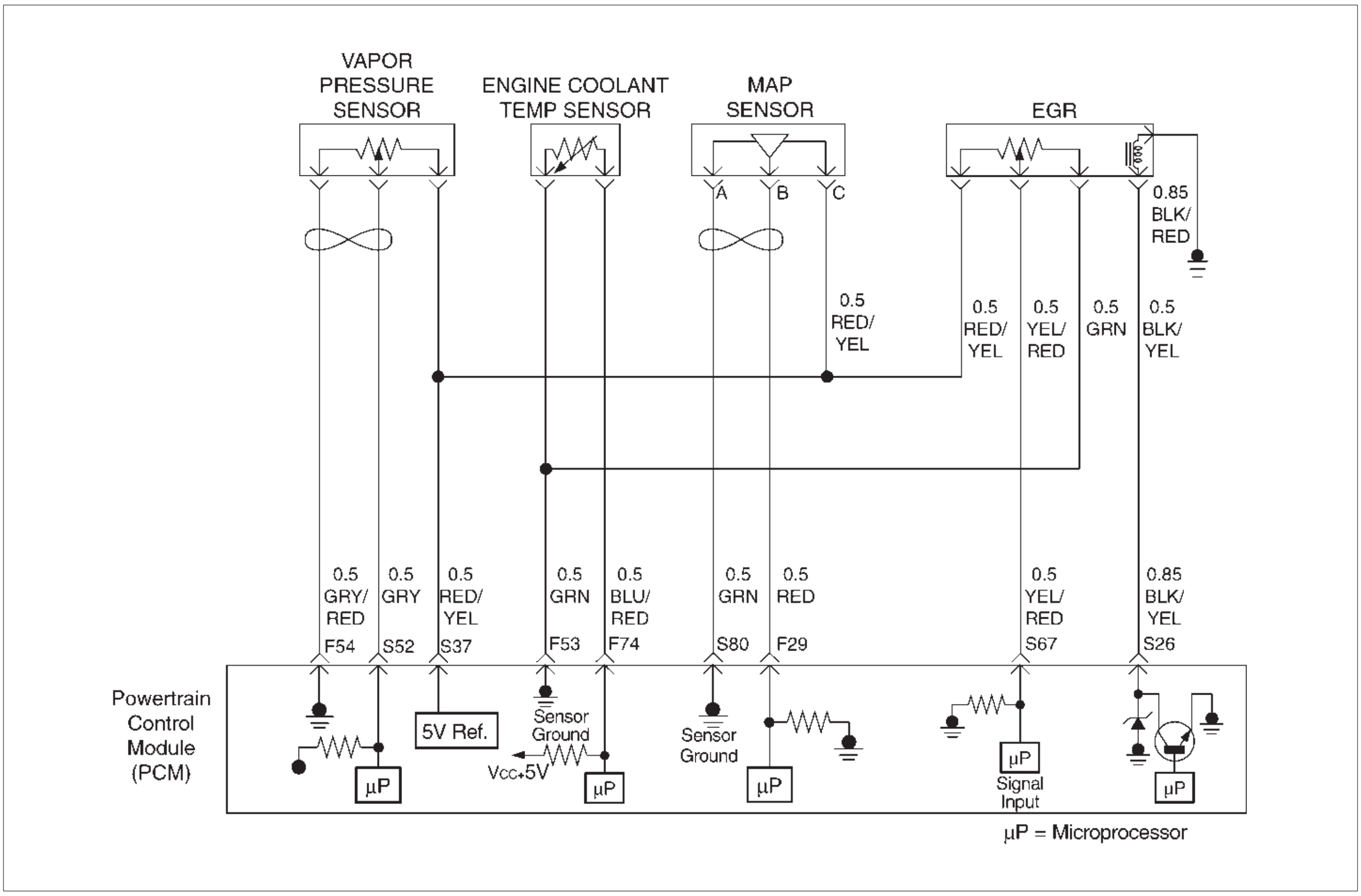
DTC P0452 – Tank Pressure Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0452 until the DTC P0452 test runs. Note the result. Does the Tech 2 indicates DTC P0452 or P0452/P0107 failed this ignition?	—	P0452/P0107 turn on Go to *Step 3* P0452 turns on Go to *Step 6*	Refer to *Diagnostic Aids*
3	1. Ignition "OFF". 2. Disconnect connector at the PCM. 3. Ignition "ON". 4. At the PCM connector, measure voltage with a DVM at F54 and S37 terminals. Was the voltage in range of voltage?	4–6 V	Go to *Step 4*	Go to *Step 10*
4	1. Ignition "OFF". 2. Connect the PCM connector to the PCM. 3. Backprobe with a DVM at fuel tank pressure sensor between 5 V reference terminal and sensor ground terminal. Was the voltage within range?	4–6 V	For P0452 go to *Step 5* and for P0107, go to diagnosis section.	Go to *Step 5*
5	1. Locate open wiring of 5 volt reference circuit from the PCM to fuel tank pressure sensor. 2. Repair wiring harness. Is the action complete?	—	Verify repair	—
6	1. Ignition "ON" 2. At the PCM connector, backprove with a DVM at the sensor output for the voltage. Was voltage within the range?	Less than 0.2 V	Go to *Step 7*	Go to *Step 10*
7	At the sensor output terminal, backprobe with a DVM at the sensor output Was voltage within the range?	Less than 0.2 V	Go to *Step 9*	Go to *Step 8*
8	1. Locate open circuit or short circuit to ground line. 2. Repair the harness. Is the action complete?	—	Verify repair	—
9	1. Locate open circuit or short circuit to ground line. 2. Repair the harness. Is the action complete?	—	Verify repair	—

DTC P0452 – Tank Pressure Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0453 Fuel Tank Pressure Sensor (Vapor Pressure Sensor) High Voltage



D06RY00178

Circuit Description

The powertrain control module (PCM) monitors fuel tank pressure sensor (Vapor pressure sensor) of the Enhanced Evapo system. When the tank pressure output indicates high voltage , PCM will set DTC P0453.

Conditions for Setting the DTC

- Tank sensor output is more than 4.9 volts for 12.5 sec.
- 100 test failures within a 200 tests.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0453 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- Info function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Open circuit of sensor ground line – Inspect wiring harness from PCM to the sensor. The PCM turns P0453, and P0108 at the same time.
- Open circuit or short circuit to 5 volt reference line – Inspect wiring harness from PCM to the sensor. The PCM turns P0453 and P0108 at the same time.
- Tank fuel pressure sensor malfunction may cause P0453.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

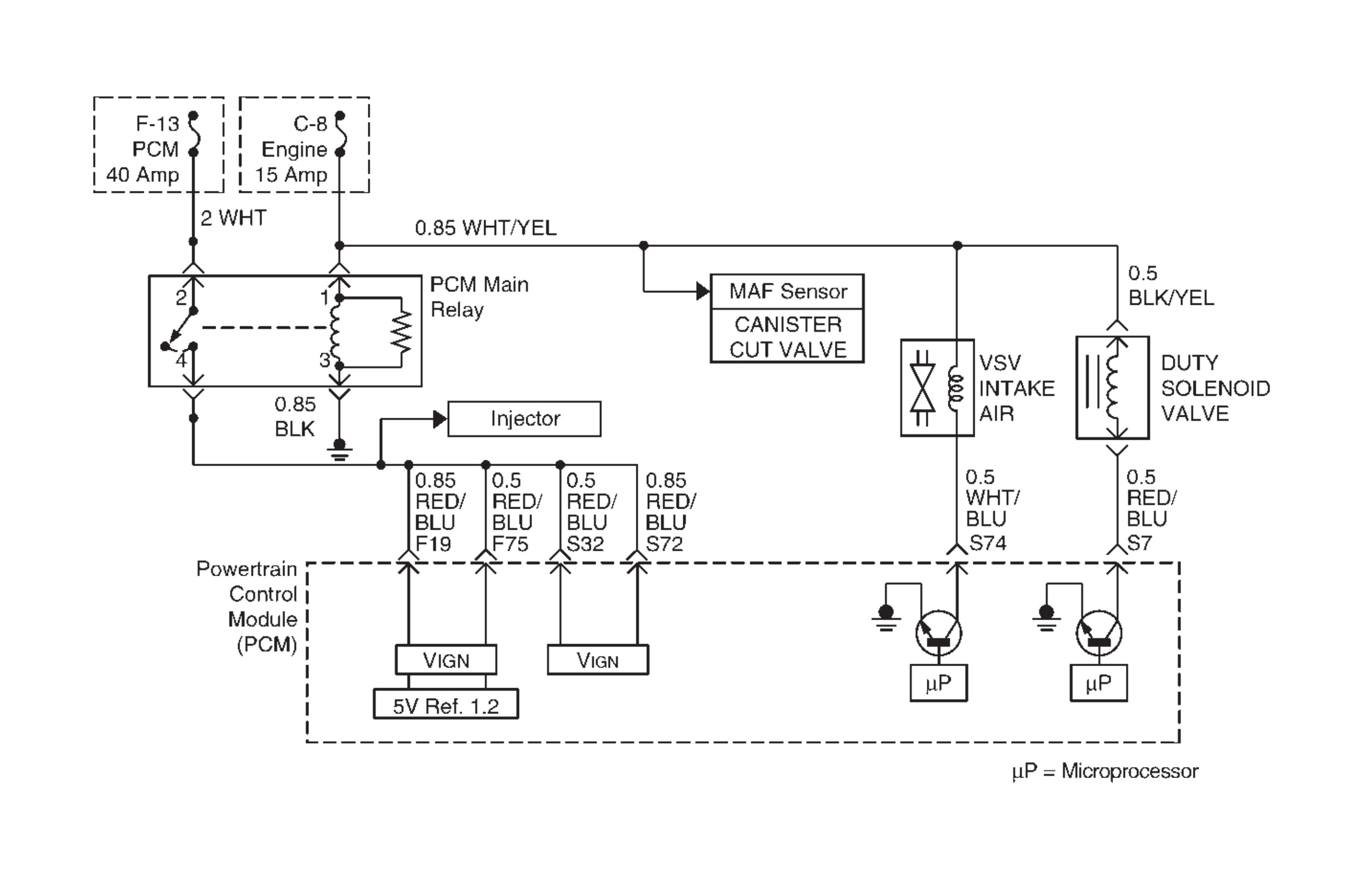
DTC P0453 – Fuel Tank Pressure Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF”, review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0453 until the DTC P0453 test runs. Note the result. Does the Tech 2 indicates DTC P0452 or P0452/P0107 failed this ignition?	—	P0453/P0108 turn on Go to *Step 3* P0452 turns on Go to *Step 6*	Refer to *Diagnostic Aids*
3	1. Ignition “OFF”. 2. Disconnect connector at the PCM. 3. Ignition “ON”. 4. At the PCM connector, measure voltage with a DVM at F54 and S37 terminals. Was the voltage in range of voltage?	4–6 V	Go to *Step 4*	Go to *Step 10*
4	1. Ignition “OFF”. 2. Connect the PCM connector to the PCM. 3. Disconnect sensor harness at fuel pressure sensor. Measure voltage with a DVM at the end of the tank pressure wiring between 5 V reference terminal and sensor ground terminal. Was the voltage within range?	4–6 V	For P0453 go to *Step 6* and for P0108, go to diagnosis section.	Go to *Step 5*
5	1. Locate open wiring of ground line from the PCM to fuel tank pressure sensor. 2. Repair wiring harness. Is the action complete?	—	Verify repair	—
6	1. Ignition “ON”. 2. At the PCM connector, backprove with a DVM at the sensor output for the voltage. Was voltage within the range?	More than 4.9 V	Go to *Step 7*	Go to *Step 10*
7	At the sensor output terminal, backprobe with a DVM at the sensor output. Was the voltage within range?	More than 4.9 V	Go to *Step 9*	Go to *Step 8*
8	1. Locate open circuit or short circuit to ground line. 2. Repair the harness. Is the action complete?	—	Verify repair	—
9	Replace the tank pressure sensor. Is the action complete?	—	Verify repair	—

DTC P0453 – Fuel Tank Pressure Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0456 EVAP Very Small Leak



D06RY00128

Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister vent solenoid
- Fuel tank pressure sensor
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister purge solenoid

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP systemand monitoring vacuum decay. The powertrain control module(PCM)monitors vacuum level via the fuel tank presuure sensor input .At an appropriate time, the EVAP canister purge solenoid and the EVAP canister vent solenoid are turned "ON," allowing engine vacuum to draw a very small on the entire evaporative emissions system. After the desired vacuum level has been achieved, the EVAP canister purge solenoid is turned "OFF", sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant.

A very small leak in the system will cause DTC P0456 to be set.

Conditions for setting the DTC

- No MAP DTC's set.
- No TPS DTC's set.
- No IAT DTC's set.
- No ECT DTC's set.
- No tank pressure sensor DTC's set.
- Baro is more than 70KPa.
- A vacuum decay condition, indicating a very small leak, is detected during the diagnostic test.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Warm up cycles have occurred without a fault.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0456 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P0456 can be cleared using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Cracked or punctured EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel tank vapor line. to wire connection.
- Poor connection at PCM–Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged hanrness-Inspect the wiring harness to the EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs.

This may assist in diagnosing the condition.

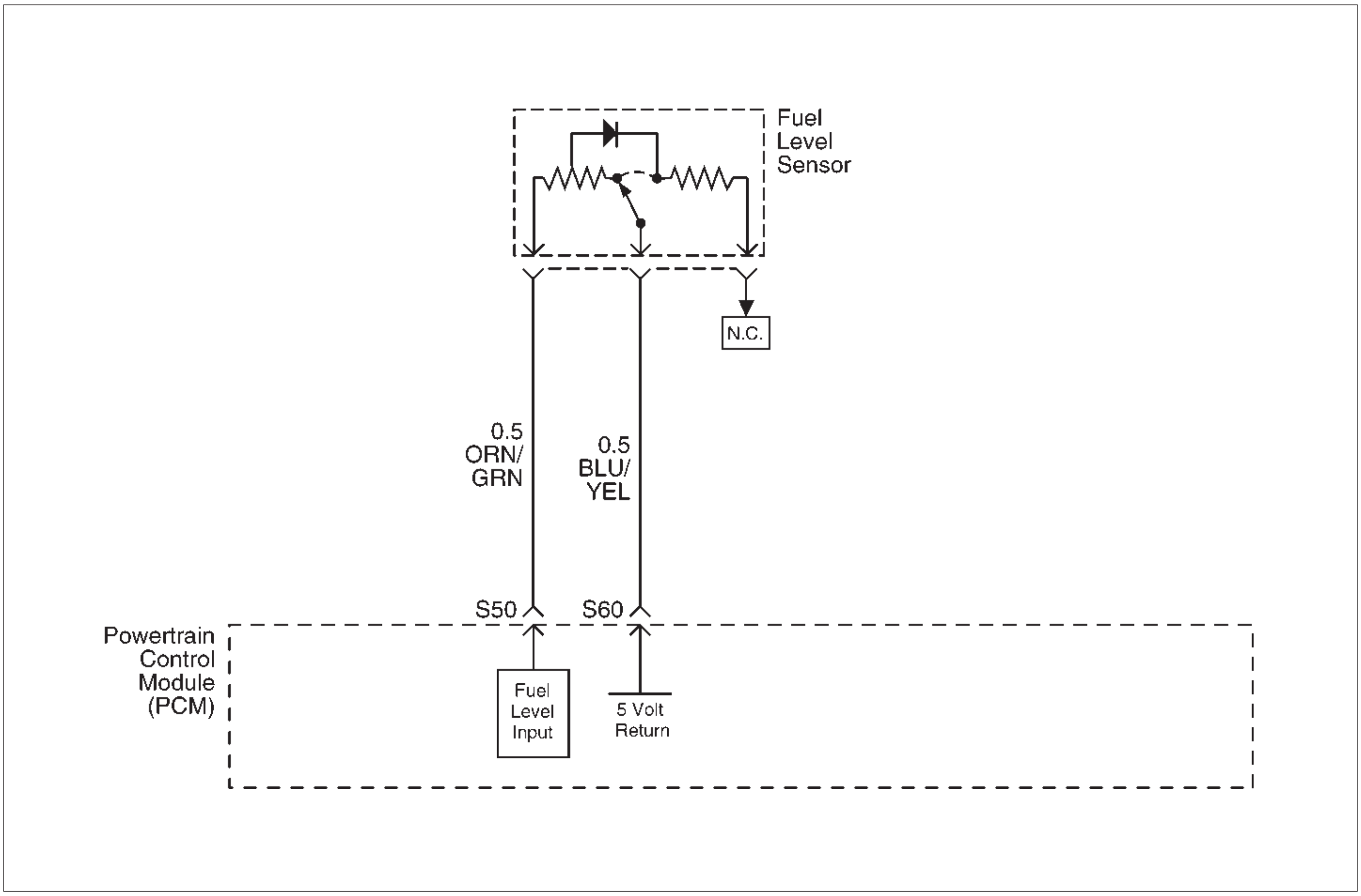
Diagnostic Trouble Code(DTC)P0456 EVAP Very Small Leak

Step	Action	Value(s)	Yes	No
1	Was the "On-Board(OBD)System Check"performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "OFF". 2. Remove the fuel cap. 3. Ignition "ON". 4. Observe "Fuel Tank Pressure" on the Tech 2. Does the Tech 2 indicate "Fuel Tank Pressure" at the specified value?	1.51V	Go to*Step 3*	Go to*Fuel Tank Pressure System*
3	1. Visually/physically check for the following conditions: • Vent hose disconnected or darmaged. • EVAP canister damaged. • Fuel cap damaged 2. If a problem is found,repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 4*
4	1. Ignition "ON", engine "OFF". 2. Install the fuel cap. 3. Review and record Tech 2 Failure Records data. 4. Operate the vehicle within Failure Records conditions as noted. 5. Using theTech 2,monitor the "DTC" info for DTC P0456. Does the Tech 2 indicate DTC P0456?	—	Go to *Step 5*	Refer to *Diagnostic Aids*
5	1. Ignition "ON", engine idling. 2. Observe "Fuel Tank Pressure" on the Tech 2. Does the Tech 2 indicate "Fuel Tank Pressure" at the specified value?	—	Refer to *Diagnostic Aids*	Go to *Step 5*
6	1. Ignition "ON", engine idling. 2. Using theTech 2, command the EVAP canister vent solenoid "ON" (closed) 3. Observe "EVAP canister vent solenoid operation". second value? 4. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*

Diagnostic Trouble Code(DTC)P0456 EVAP Very Small Leak (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Visually/physically check for the following conditions: • Disconnected or leaking fuel tank vapor line. • Disconnected or damage EVAP purge line. 2. If a problem is found,repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0462 Fuel Level Sensor Circuit–Low Voltage



060RY00163

Circuit Description

The fuel level sensor is an important input to powertrain control module (PCM) for the enhanced evaporative system diagnostic. Fuel level information is needed for the PCM to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the evaporative system. Several of the enhanced evaporative system diagnostic sub-tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is greater than 85%, or less than 15% full. Fuel level DTCs should be diagnosed before other evaporative system DTCs because they can cause other DTCs to be set.

The sending unit is a float in the fuel tank which moves a wiper arm across a variable resistor. Low fuel level causes high resistance in the sending unit, and this is recognized by the PCM because the circuit operates at a corresponding low voltage. When the circuit is continuously open or has a high resistance connection, DTC P0462 is set.

Conditions for Setting the DTC

- Fuel tank level “slosh test” is completed.
- Fuel tank level “main test” is completed.
- Fuel tank level data is valid.
- Fuel tank level signal is less than a specified value.
- There are 100 test failures within a 200-test sample.

Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON.”
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- The PCM will turn the MIL “OFF” after three consecutive trips without a fault condition present. A history DTC will be cleared if no fault conditions have been detected for 40 warm-up cycles (engine coolant temperature has risen 4°C (40°F) from the start-up ECT, and ECT exceeds 71°C (160°F) during that same ignition cycle).
- DTC P0462 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Test Description

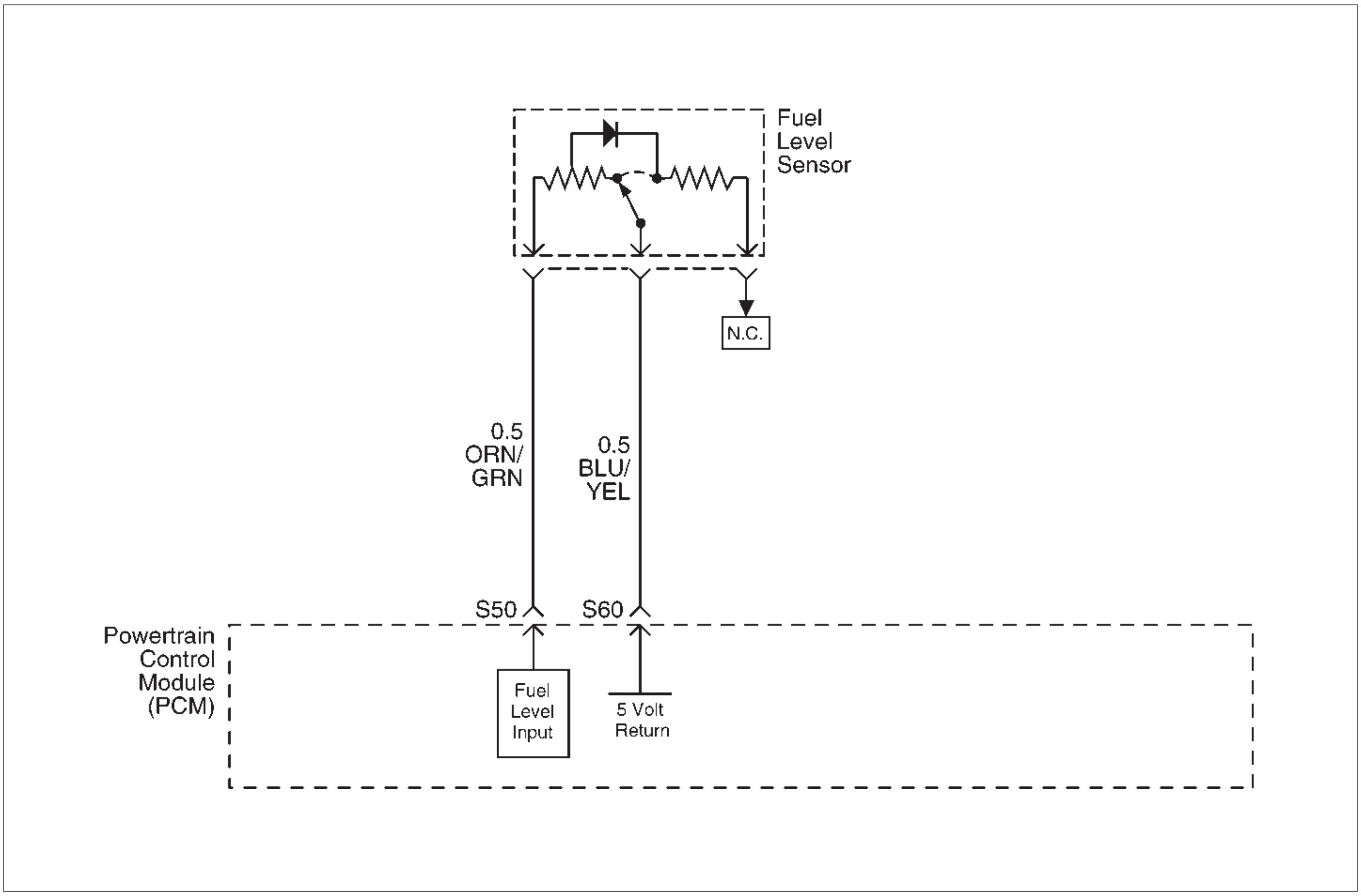
Number(s) below refer to the step number(s) on the Diagnostic Chart.

8. The following chart can be used to check the sending unit:

DTC P0462– Fuel Level Sensor Circuit –Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Disconnected the fuel level sensor harness from its connector at the fuel tank. 2. Ignition "ON," engine "OFF." 3. Using a DVM, measure the voltage between the sensor harness positive and ground wires. Is the voltage approximately equal to the specified value?	5 V	Go to *Step 6*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF." 2. With a DVM, backprobe the PCM connector at the terminal which supplies 5 volts to the fuel level sensor. Is the voltage approximately equal to the specified value?	5 V	Go to *Step 4*	Go to *Step 9*
4	1. Ignition "ON," engine "OFF." 2. Fuel level sensor disconnected from wiring harness. 3. With a DVM, probe the 5-volt supply wire at the sensor harness. Is the voltage approximately equal to the value measured in Step 4?	—	Go to *Step 5*	Go to *Step 9*
5	Check for open or high resistance connection in the ground wire between the PCM and the fuel level sensor. Is the action complete?	—	Verify repair	—
6	Remove the fuel level sensor and check the following: • Does the arm move freely? • Are the wires open or intermittently open when wiggled? • Do the resistance values match the specification chart? Was a problem found?	—	Go to *Step 7*	Go to *Step 9*
7	Replace the fuel level sensor. Is the action complete?	—	Verify repair	—
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
9	Short to ground between the PCM connector and the fuel level sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0463 Fuel Level Sensor Circuit–High Voktage



Circuit Description

The fuel level sensor is an important input to powertrain control module (PCM) for the enhanced evaporative system diagnostic. Fuel level information is needed for the PCM to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the evaporative system. Several of the enhanced evaporative system diagnostic sub-tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is greater than 85% or less than 15%, full. Fuel level DTCs should be diagnosed before other evaporative system DTCs because they can cause other DTCs to be set.

The sending unit is a float in the fuel tank which moves a wiper arm across a variable resistor. High fuel level causes low resistance in the sending unit. This is recognized by the PCM because the circuit operates at a corresponding high voltage. When the circuit is continuously shorted to a voltage source greater than a specified value, or when the 5 volt signal is shorted to ground, DTC P0463 is set.

Conditions for Setting the DTC

- Fuel tank level “slosh test” is completed.
- Fuel tank level “main test” is completed.
- Fuel tank level data is valid.
- Fuel tank level signal is greater than a specified value.
- There are 100 test failures within a 200-test sample.

Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON.”
- The PCM will store conditions which were present when the DTC set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- The PCM will turn the MIL “OFF” after three consecutive trips without a fault condition present. A history DTC will be cleared if no fault conditions have been detected for 40 warm-up cycles (engine coolant temperature has risen 4°C (40°F) from the start-up ECT, and ECT exceeds 71°C (160°F) during that same ignition cycle) or the scan tool clearing function has been used.
- DTC P0463 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Test Description

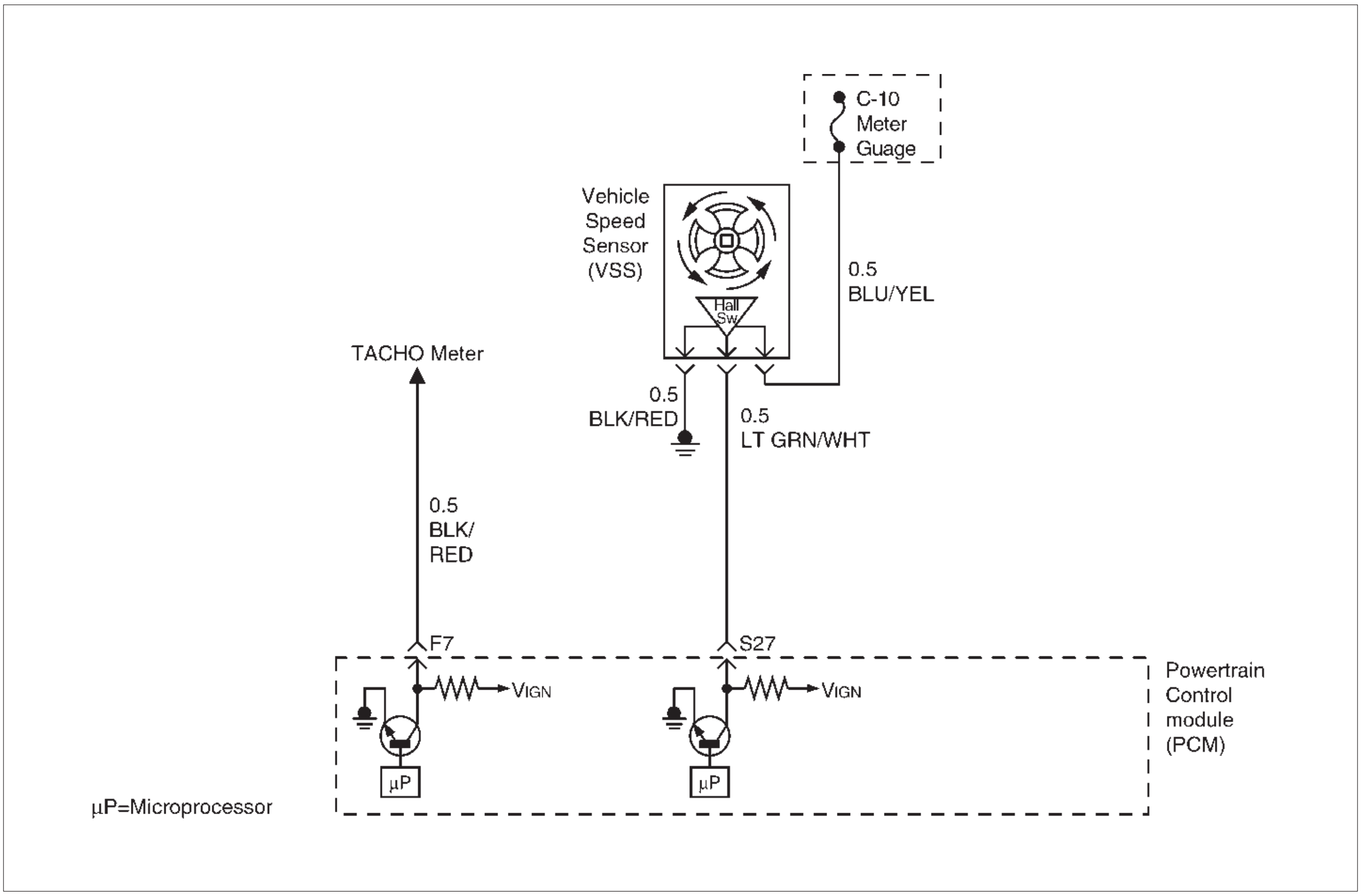
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The ETC and MAP sensors share a ground at PCM terminal D9.
9. Equates the resistance values at various float positions to the following fuel gauge readings:

DTC P0463– Fuel Level Sensor Circuit –High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Disconnected the fuel level sensor harness from its connector at the fuel tank. 2. Ignition “ON,” engine “OFF.” 3. Using a DVM, measure the voltage between the sensor harness positive and ground wires. Is the voltage approximately equal to the specified value?	5 V	Go to *Step 8*	Go to *Step 3*
3	With the negative DVM lead connected to ground, use the positive DVM lead to probe the sensor ground wire with the harness still disconnected. Does the DVM indicate a short to a voltage source?	—	Go to *Step 4*	Go to *Step 5*
4	Repair short to voltage between the sensor and the PCM. Is the repair complete?	—	Verify repair	—
5	With the negative DVM lead connected to ground, use the positive DVM lead to probe the sensor positive wire with the harness still disconnected. Does the DVM indicate a voltage greater than the specified value?	5 V	Go to *Step 4*	Go to *Step 6*
6	Open circuit between the PCM connector and the fuel level sensor?	—	Verify repair	Go to *Step 7*
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
8	Remove the fuel level sensor and check the following: • Does the arm move freely? • Are the wire leads shorted together? • Do the resistance values match the specification chart? Was a problem found?	—	Go to *Step 9*	Go to *Step 7*
9	Replace the fuel level sensor. Is the repair complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0502 VSS Circuit Low Input



D06RY00070

Circuit Description

The vehicle speed sensor has a magnet rotated by the transmission output shaft. Attached to the sensor is a hall effect circuit the interacts with the magnetic field treated by the rotating magnet. A 12-volt operating supply for the speed sensor hall circuit is supplied from the meter fuse. The VSS pulses to ground the 9-volt signal sent from the powertrain control module (PCM) on the reference circuit. The PCM interprets vehicle speed by the number of pulses to ground per second on the reference circuit.

Conditions for Setting the DTC

- Engine is running.
- Engine speed is between 1800 RPM and 2500 RPM.
- Throttle angle is between 10% and 40%.
- Engine load is greater than 50 kPa.
- PCM detects no VSS signal for 12.5 seconds over a period of 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0502 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0502 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

10. To avoid backprobing the VSS and possibly damaging a seal or terminal, the VSS output can be tested at the point where the transmission harness connects to the engine harness. Power and ground are applied by jumpers to the VSS through the connectors which are located to the rear of the air cleaner assembly. The VSS signal is monitored with a DVM as the rear driveshaft turns. The wheels can be turned to rotate the driveshaft, or in 2-wheels-drive vehicles the driveshaft can be turned directly.

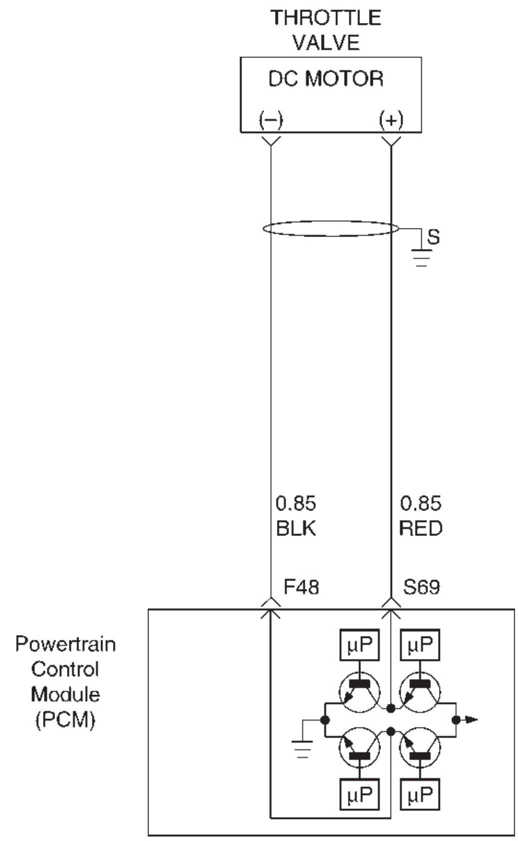
DTC P0502 – VSS Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Does the speedometer work?	—	Go to *Step 10*	Go to *Step 3*
3	1. Disconnect the VSS connector. 2. Ignition "ON." 3. Using a test light to battery +, probe the connector ground wire. Did the light illuminate?	—	Go to *Step 5*	Go to *Step 4*
4	Repair the sensor ground. Is the action complete?	—	Verify repair	—
5	1. Ignition "ON," sensor disconnected. 2. Using a DVM, measure at the VSS connector between ground and voltage supply. Was the measurement near the specified value?	Battery voltage	Go to *Step 7*	Go to *Step 6*
6	Repair the open or short to ground which may have blown the meter fuse. Is the action complete?	—	Verify repair	—
7	1. Ignition "ON," VSS disconnected. 2. Using a DVM, measure at the VSS connector between ground and the wire from the speedometer. Was the measurement near the specified value?	7.5-8 V	Go to *Step 9*	Go to *Step 8*
8	Check for an open or short circuit between the speedometer and the VSS. Was an open or short circuit located?	—	Verify repair	Go to *Step 9*
9	Replace the speedometer. Is the action complete?	—	Verify repair	—

DTC P0502 – VSS Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Ignition "OFF." 2. Disconnect the MAF sensor. The connector attaches the VSS wires from the transmission harness to the left-side engine harness. 3. Disconnect the black 16-way connector. 4. Select a terminal adapter from kit J 35616 that can be used with a jumper to supply B+ to the blue wire with a yellow tracer (transmission side of the connector). 5. Use another terminal adapter to attach a voltmeter to the light-green wire with a white tracer (next to the wire in the previous step.) 6. Disconnect the blue connector next to the black 16-way connector, and locate the black/red tracer wire at one corner of the blue connector. The black/red wire is the VSS ground. Use a terminal adapter to attach a jumper to ground to the black/red VSS ground wire at the transmission side of the blue connector. 7. Raise the rear wheels off the ground with transmission in neutral. Does the DVM toggle back and forth between 0.6 V and 10 V as the wheels (and driveshaft) are rotated?	—	Go to *Step 11*	Go to *Step 10*
11	Replace the VSS. Is the action complete?	—	Verify repair	—
12	Check for an open or short between the PCM and the speedometer. Was a problem found?	—	Verify repair	Go to *Step 13*
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0506 Idle Air Control System Low RPM



D06RY00158

Circuit Description

The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to the DC motor coil in position (%) to adjustment the throttle valve into a passage in the throttle body to air flow. This method allows highly accurate control of engine speed and quick response to changes in engine load.

If the PCM detects a condition where too low of an idle speed is present and the PCM is unable to adjust idle speed by increasing the throttle position, DTC P0506 will set, indicating a problem with the idle control system.

Conditions for Setting the DTC

- No TPS, VSS, ECT, EGR, MAF, low voltage, fuel system, canister purge, injector control, or ignition control DTCs are set.
- MAP is less than 60 kPa.
- Canister purge duty cycle is above 10%.
- Engine running time is more than 125 seconds.
- Vehicle speed is less than 1 mph.
- Engine coolant temperature (ECT) is above 50°C.
- Ignition voltage is between 9.5 volts and 16.7 volts.
- The throttle is closed.
- EVAP purge duty cycle more than 10%.
- All conditions are met for 10 seconds.
- Engine speed is more than 100-200 RPM lower than desired idle based upon coolant temperature.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0506 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or throttle DC motor – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.
- Restricted air intake system – Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system.
- Throttle body – Check for objects blocking the ETC passage or throttle bore, excessive deposits in the

ETC passage and on the ETC position, and excessive deposits in the throttle bore and on the throttle plate.

- Large vacuum leak – Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty PCV valve or brake booster hose disconnected.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

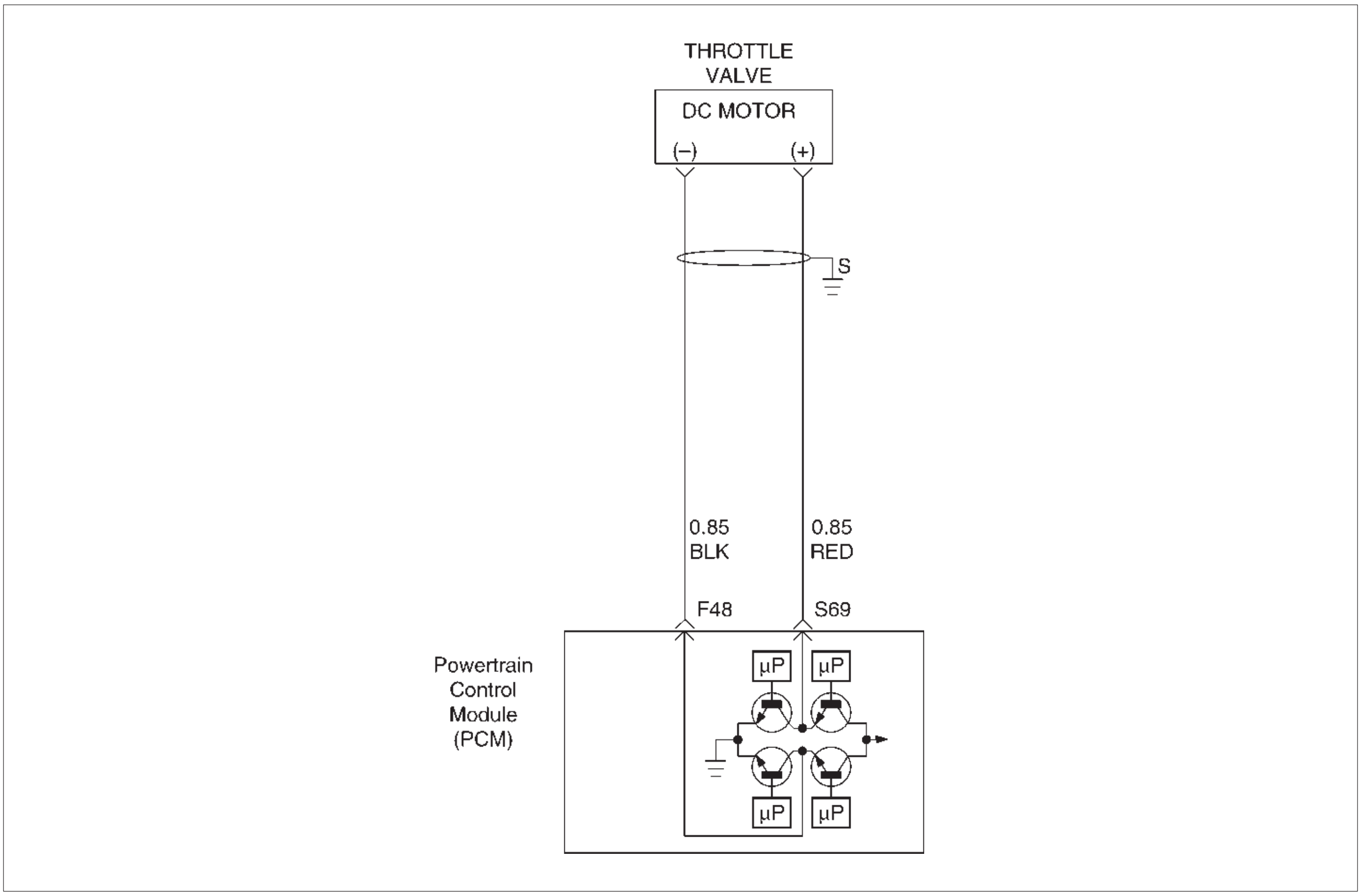
DTC P0506 – Idle Air Control System Low RPM

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Visually/physically inspect for the following conditions: ● Throttle body tampering. ● Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ● Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate. ● Throttle body with lever: Check for objects send round the throttle spring lever that lever is smooth movement, and spring lever has not excessive play Do any of the above require a repair?	—	Refer to *appropriate section foron–vehicle service*	Go to *Step 4*
3	Visually/physically inspect for the following conditions: ● Acceleration pedal tampering. ● Acceleration pedaL : Check for objects blocking the spring or pedal arm. ● Acceleration pedal : Check for objects move the acceleration pedal that pedal is smooth movement, and acceleration pedal arm has not excessive play. Do any of the above require a repair?	—	Refer to *appropriate section foron–vehicle service*	Go to *Step 4*
4	1. Check for a poor connection at the throttle body harness connector. 2. Check for a poor connection at the acceleration position sensor harness connector. 3. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
5	Check the following circuits for an open, short tovoltage, short to ground, or poor connection at thePCM: ● Throttle position sensor 1 circuit. ● Throttle position sensor 2 circuit. ● Throttle DC motor circuit. ● Throttle position sensor resistance. ● Throttle DC motor resistance. ● If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 1–7kΩ SIG-DND change resistance0.3 – 100Ω	Verify repair	Go to *Step 6*

DTC P0506 – Idle Air Control System Low RPM (Cont'd)

Step	Action	Value(s)	Yes	No
6	Replace the throttle valve. Is the action complete?	—	Go to *Step 3*	—
7	1. Check the following circuits for an open, short tovoltage, short to ground, or poor connection at the PCM: Acceleration position sensor 1 circuit. Acceleration position sensor 2 circuit. C position sensor 2 circuit. V position sensor resistance. 2. If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 4–6kΩ SIG-DND change resistance	Verify repair	Go to *Step 8*
8	Replace the acceleration position sensor. Is the action complete?	—	Go to *Step 9*	—
9	Following below the DTCs stored: P1125, P1290, P1295, P1299	—	Go to *applicableDTC table*	Go to *Step 10*
10	Following below the DTCs stored:P1514, P1515, P1516, P1523, P1271, P1272, P1273	—	Go to *applicable DTC table*	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0507 Idle Air Control System High RPM



D06RY00158

Circuit Description

The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to the DC motor coil in position (%) to adjustment the throttle valve into a passage in the throttle body to air flow. This method allows highly accurate control of engine speed and quick response to changes in engine load.

If the PCM detects a condition where too high of an idle speed is present and the PCM is unable to adjust idle speed by increasing the throttle position, DTC P0507 will set, indicating a problem with the idle control system.

Conditions for Setting the DTC

- No TPS, VSS, ECT, EGR, MAF, low voltage, fuel system, canister purge, injector control or ignition control DTCs are set.
- Barometric pressure is above 75 kPa.
- Canister purge duty cycle is above 10%.
- Engine running time is more than 125 seconds.
- Vehicle speed is less than 1 mph.
- Engine coolant temperature (ECT) is above 50°C.
- Ignition voltage is between 9.5 volts and 16.7 volts.
- The throttle is closed.
- EVAP purge duty cycle is more than 10%.
- All conditions are met for 10 seconds.
- Engine speed is more than 100-200 RPM higher than desired idle based upon coolant temperature.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0507 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0507 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or throttle DC motor – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.
- Vacuum leak – Check for a condition that causes a vacuum leak, such as disconnected or damaged hoses, leaks at EGR valve and EGR pipe to intake

manifold, leak at the throttle body, a faulty or incorrectly installed PCV valve, leaks at the intake manifold, etc.

- Throttle body – Check for sticking throttle plate. Also inspect the air passage for deposits or objects which will not allow the ETC position to fully extend or properly seat.

If DTC P0507 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

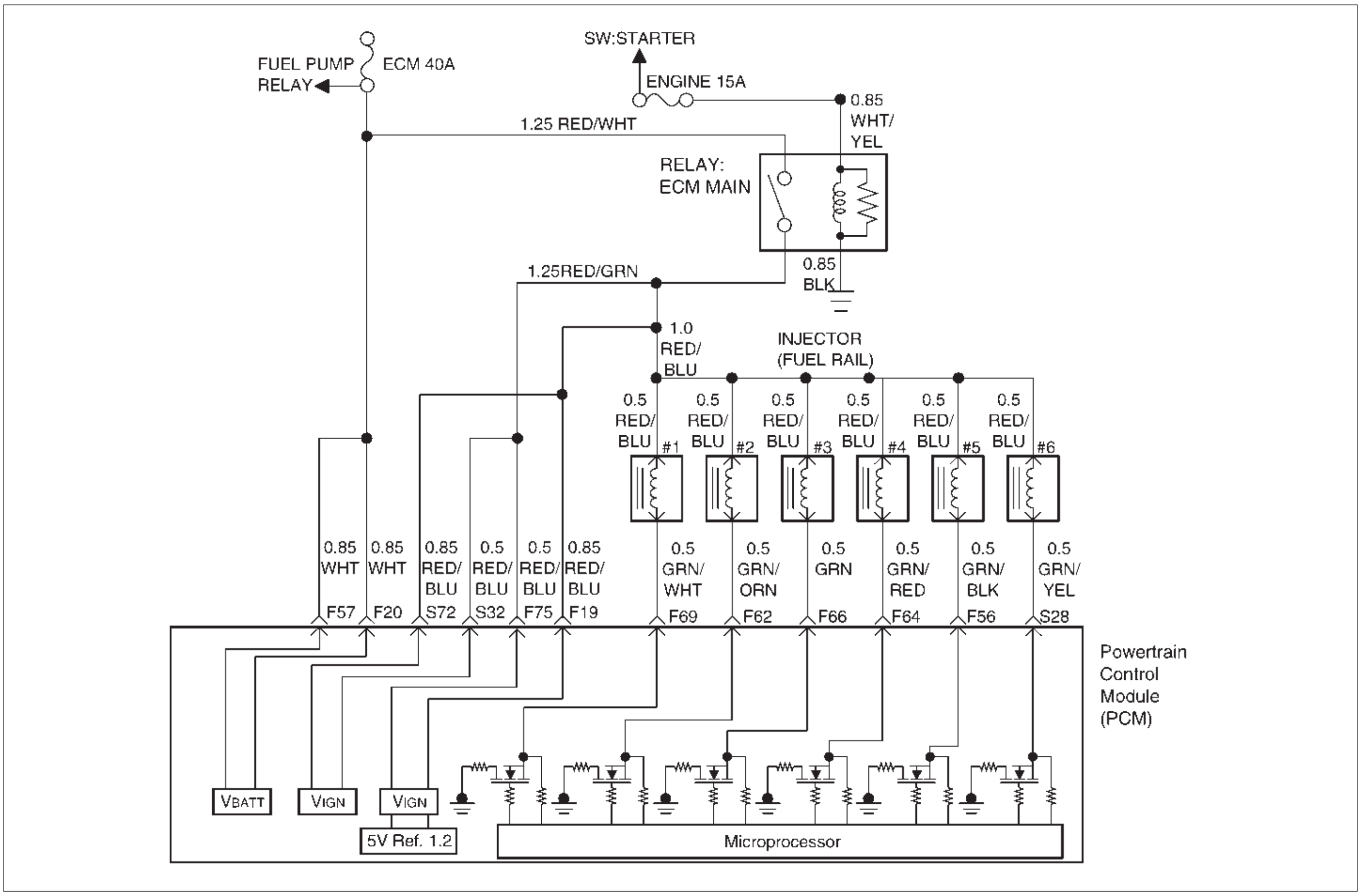
DTC P0507 – Idle Air Control System High RPM

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Visually/physically inspect for the following conditions: • Throttle body tampering. • Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. • Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate. • Throttle body with lever: Check for objects send round the throttle spring lever that lever is smooth movement, and spring lever has not excessive play Do any of the above require a repair?	—	Refer to *appropriate section for on-vehicle service*	Go to *Step 4*
3	Visually/physically inspect for the following conditions: • Acceleration pedal tampering. • Acceleration pedaL : Check for objects blocking the spring or pedal arm. • Acceleration pedal : Check for objects move the acceleration pedal that pedal is smooth movement, and acceleration pedal arm has not excessive play. Do any of the above require a repair?	—	Refer to *appropriate section for on-vehicle service*	Go to *Step 4*
4	1. Check for a poor connection at the throttle body harness connector. 2. Check for a poor connection at the acceleration position sensor harness connector. 3. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
5	Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: • Throttle position sensor 1 circuit. • Throttle position sensor 2 circuit. • Throttle DC motor circuit. • Throttle position sensor resistance. • Throttle DC motor resistance. • If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 1–7kΩ SIG-DND change resistance 0.3 – 100Ω	Verify repair	Go to *Step 6*

DTC P0507 – Idle Air Control System High RPM (Cont'd)

Step	Action	Value(s)	Yes	No
6	Replace the throttle valve. Is the action complete?	—	Go to *Step 3*	—
7	1. Check the following circuits for an open, short tovoltage, short to ground, or poor connection at the PCM: • Acceleration position sensor 1 circuit. • Acceleration position sensor 2 circuit. • C position sensor 3 circuit. • V position sensor resistance. 2. If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 4–6kΩ SIG-DND change resistance	Verify repair	Go to *Step 8*
8	Replace the acceleration position sensor. Is the action complete?	—	Go to *Step 9*	—
9	Following below the DTCs stored: P1125, P1290, P1295, P1299	—	Go to *applicable DTC table*	Go to *Step 10*
10	Following below the DTCs stored:P1514, P1515, P1516, P1523, P1271, P1272, P1273	—	Go to *applicable DTC table*	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0562 System Voltage Low



D06RY00073

Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminal to the PCM. A system voltage DTC will set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- Ignition "ON."
- System voltage is below 11.5 volts for 15 minutes.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store as Failure Records conditions which were present when the DTC was set. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P0562 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0562 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

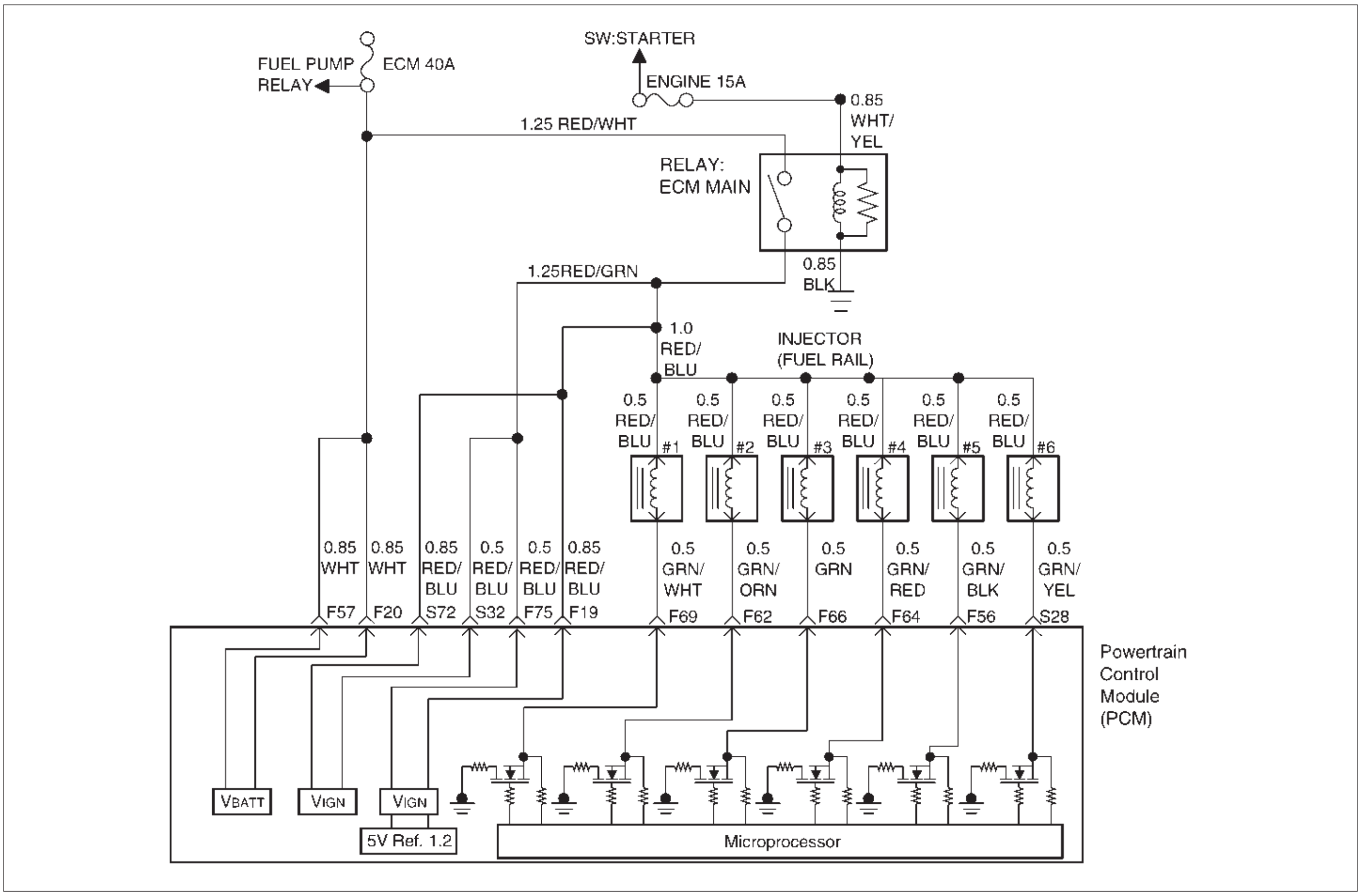
Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

DTC P0562 – System Voltage Low

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Using a DVM, measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	11.5 V	Go to *Step 3*	Charge battery, then go to *Step 3*
3	1. Install a Tech 2. 2. Select “Ignition Volts” on the Tech 2. 3. Start the engine and raise the engine speed to the specified value. 4. Load the electrical system by turning on the headlights, high blower, etc. Is the ignition voltage approximately equal to the specified value?	2000 RPM 12.8-14.1 V	Go to *Step 4*	Go to *Starting/Charging*
4	1. Ignition “OFF.” 2. Disconnect the PCM connector at the PCM. 3. Using a DVM, measure the battery voltage at the PCM connector F-20 and F-57. Is it approximately equal to battery voltage?	—	Check for excessive current draw with ignition “OFF,” engine “OFF.”	Go to *Step 5*
5	1. Check for faulty connections at the PCM harness terminals. 2. Repair as necessary. Was a repair necessary?	—	Verify repair	Go to *Step 6*
6	Check for an open battery feed circuit to the PCM. Is the action complete?	—	Verify repair	Go to *Step 7*
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0563 System Voltage High



D06RY00073

Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminals to the PCM. A system voltage DTC will set whenever the voltage is above a calibrated value.

Conditions for Setting the DTC

- Ignition “ON.”
- System voltage is above 16 volts for 15 minutes.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store as Failure Records only conditions which were present when the DTC was set. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P0563 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0563 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

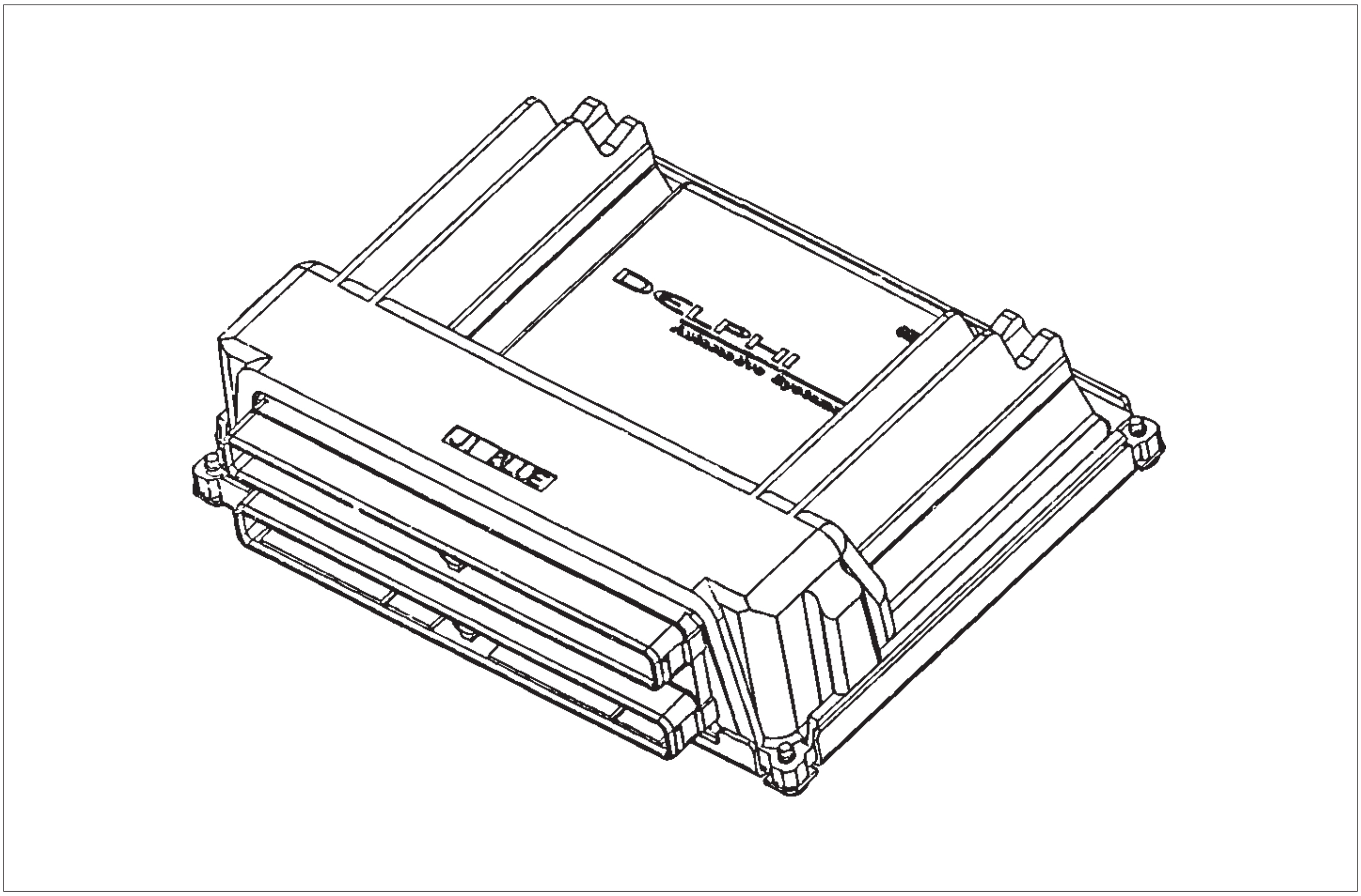
Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

DTC P0563 – System Voltage High

Step	Action	Value(s)	Yes	No
1	Was the "ON-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Using a DVM, measure the battery voltage at the battery. Is the battery voltage less than the specified value?	11.5 V	Go to *Step 3*	Go to *Step 4*
3	1. Charge the battery and clean the battery terminals. 2. Clean the battery ground cable connection if corrosion is indicated. Is the battery voltage less than the specified value?	11.5 V	Replace battery	Go to *Step 4*
4	1. Turn "OFF" all the accessories. 2. Install a Tech 2. 3. Select the ignition voltage parameter on the Tech 2. 4. Start the engine and raise the engine RPM to the specified value. Is the voltage more than 2.5 volts greater than the measurement taken in step 2 or 3?	2000 RPM	Go to *Starting/Charging*	Go to *Step 5*
5	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0601 PCM Memory



060RY014

Circuit Description

The powertrain control module (PCM) used in this vehicle utilizes an electrically erasable programmable read-only memory (EEPROM). The EEPROM contains program information and the calibrations required for engine, transmission, and powertrain diagnostics operation.

Unlike the PROM used in past applications, the EEPROM is not replaceable. When the PCM is replaced or a calibration update is required, the PCM must be programmed using a Tech 2. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for the EEPROM programming procedure.

Conditions for Setting the DTC

- The PCM detects an internal program fault (check sum error).

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0601 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0601 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

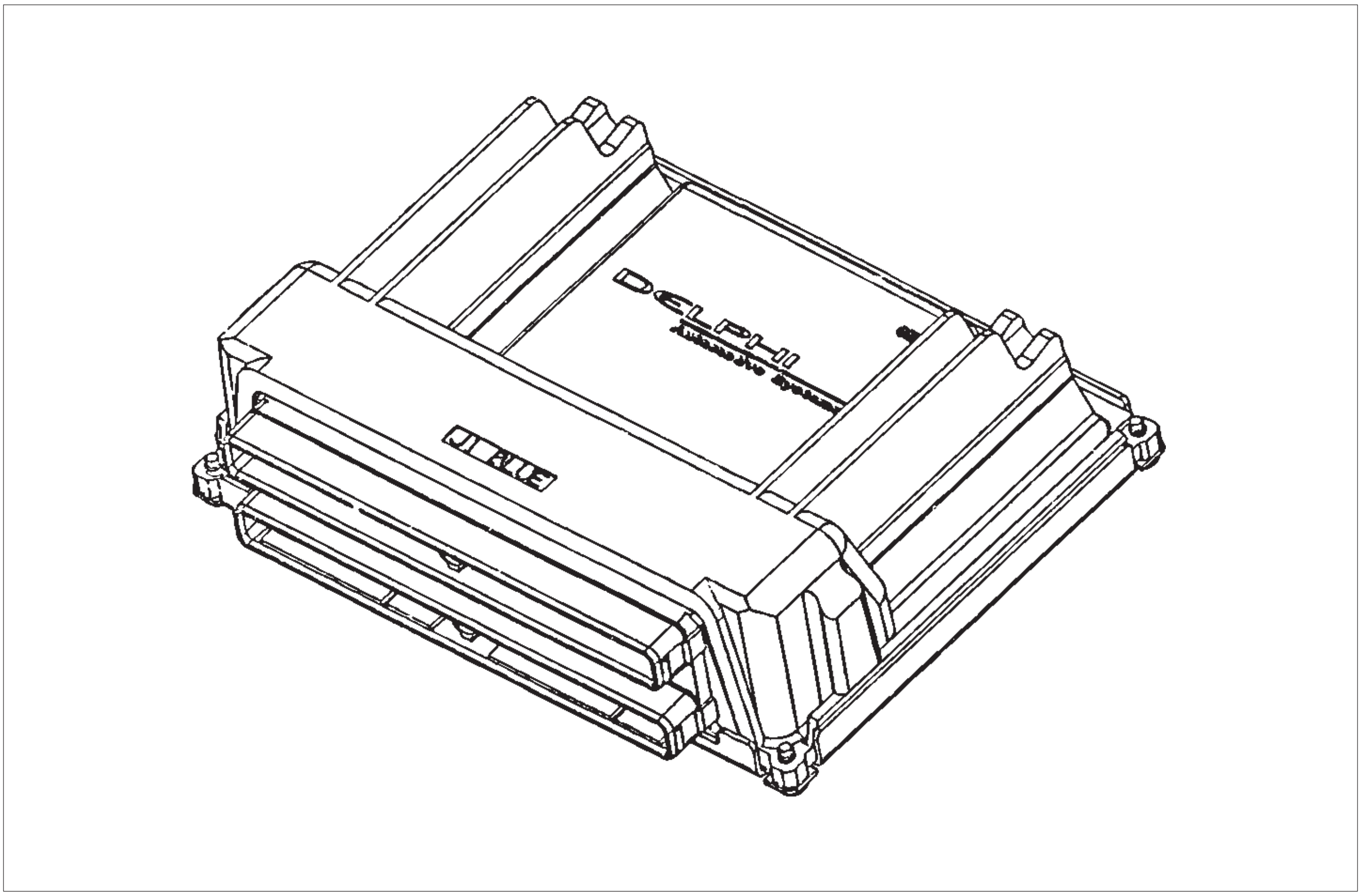
Diagnostic Aids

- DTC P0601 indicates that the contents of the EEPROM have changed since the PCM was programmed. The only possible repair is PCM replacement. Remember to program the replacement PCM with the correct software and calibration for the vehicle.

DTC P0601 – PCM Memory

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0602 PCM Programming Error



060RY014

Circuit Description

The powertrain control module (PCM) used Main CPU and Watchdog CPU software/calibration.

Conditions for Setting the DTC

- This code detects inconsistencies between Main CPU and Watchdog CPU software/calibration.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

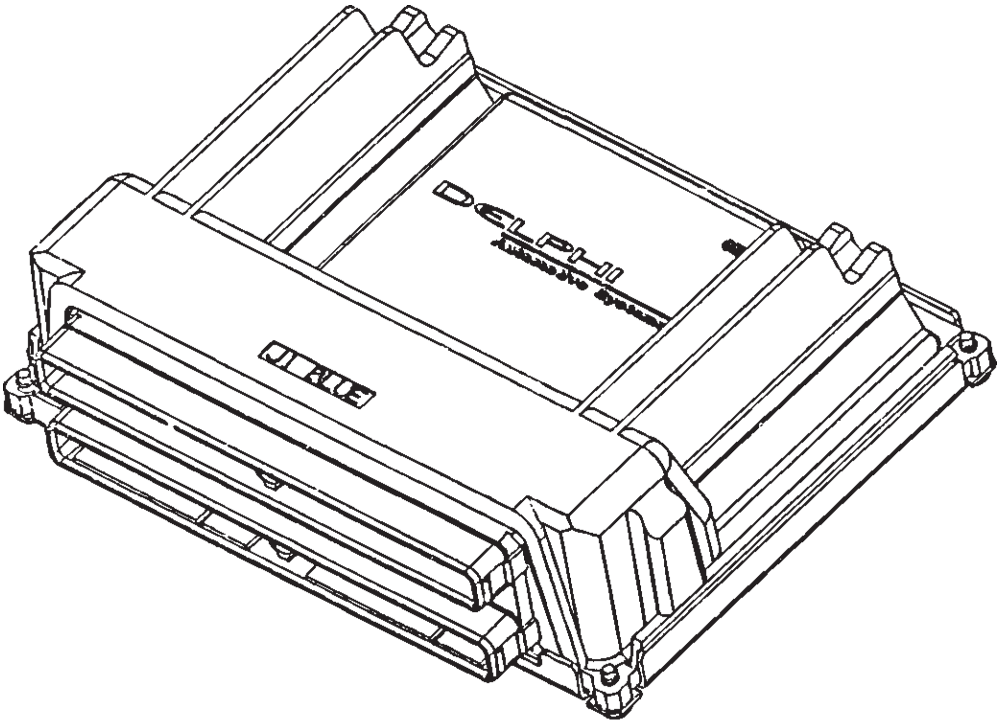
Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0602 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0602 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

DTC P0602 – PCM Programming Error

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0604 PCM RAM Error



060RY014

Circuit Description

The powertrain control module (PCM) used Main CPU RAM and Watchdog CPU RAM.

Conditions for Setting the DTC

- This code detects inconsistencies between Main CPU RAM and Watchdog CPU RAM.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

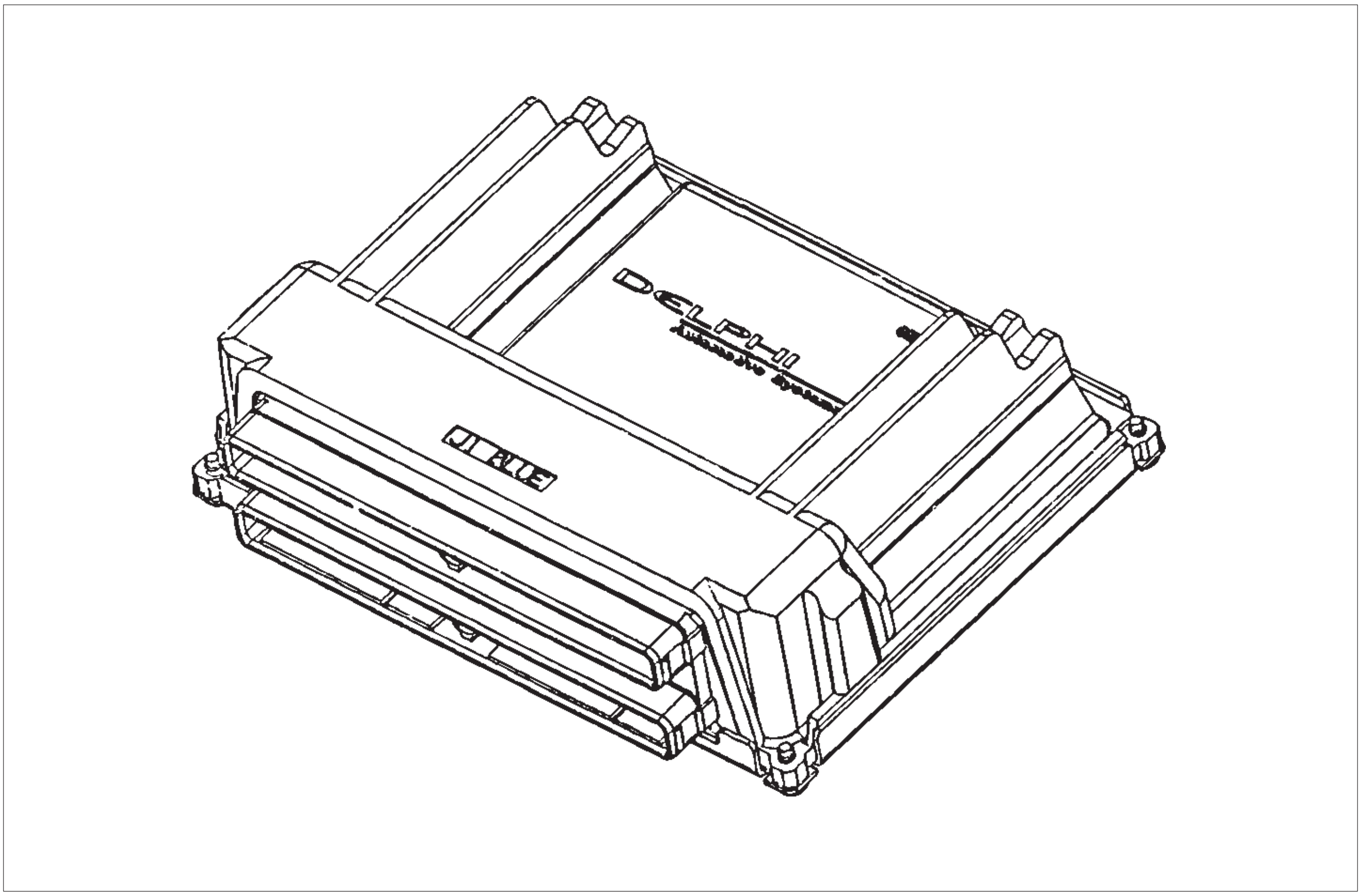
Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0604 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0604 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

DTC P0604 – PCM RAM Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0606 PCM Internal Performance



060RY014

Circuit Description

The input/output devices in the PCM include analog-to-digital converters, signal buffers, counters, and special drivers. The PCM controls most components with electronic switches which complete a ground circuit when turned “ON”. These switches are arranged in groups of 4 and 7, called either a surface-mounted quad driver module (QDM), which can independently control up to 4 output terminals, or QDMs which can independently control up to 7 outputs.

Conditions for Setting the DTC

- This code detects inconsistencies between Main CPU A/D converters and Watchdog CPU A/D converters.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

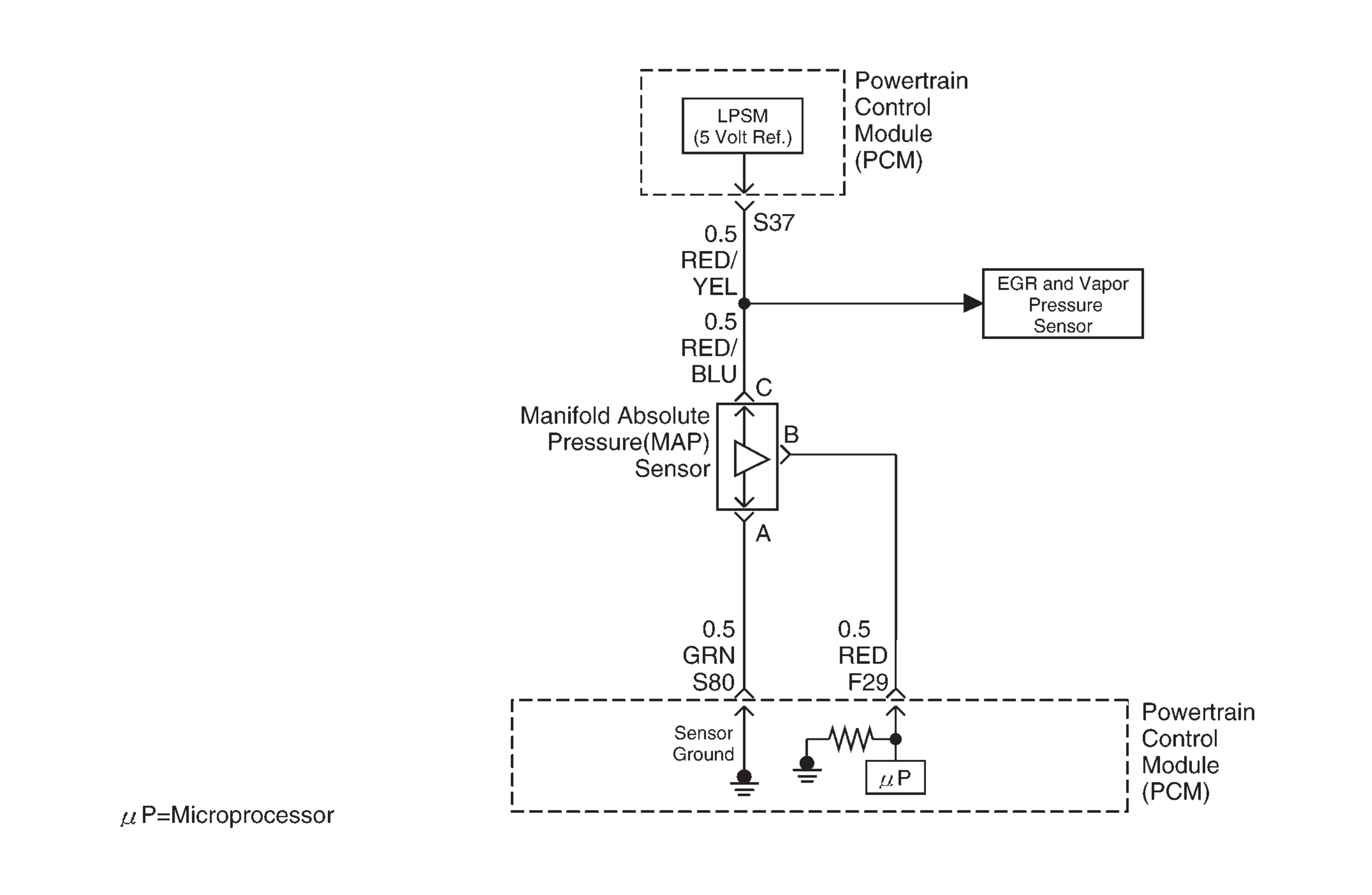
Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0606 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0606 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

DTC P0606 – PCM Internal Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1106 MAP Sensor Circuit Intermittent High Voltage



D06RY00165

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition "ON," engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the liner EGR flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that is intermittently above the calculated value, DTC P1106 will set.

Conditions for Setting the DTC

- No TP sensor DTCs are present.
- Engine is running for at least 10 seconds.
- Throttle angle is below 3% if engine speed is below 1000 RPM.
- Throttle angle is below 10% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure above 80 kPa for a total of approximately 5 seconds over a 16-second period of time.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1106 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1106 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Leaking or plugged vacuum supply line to the MAP sensor.
- Inspect PCM harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

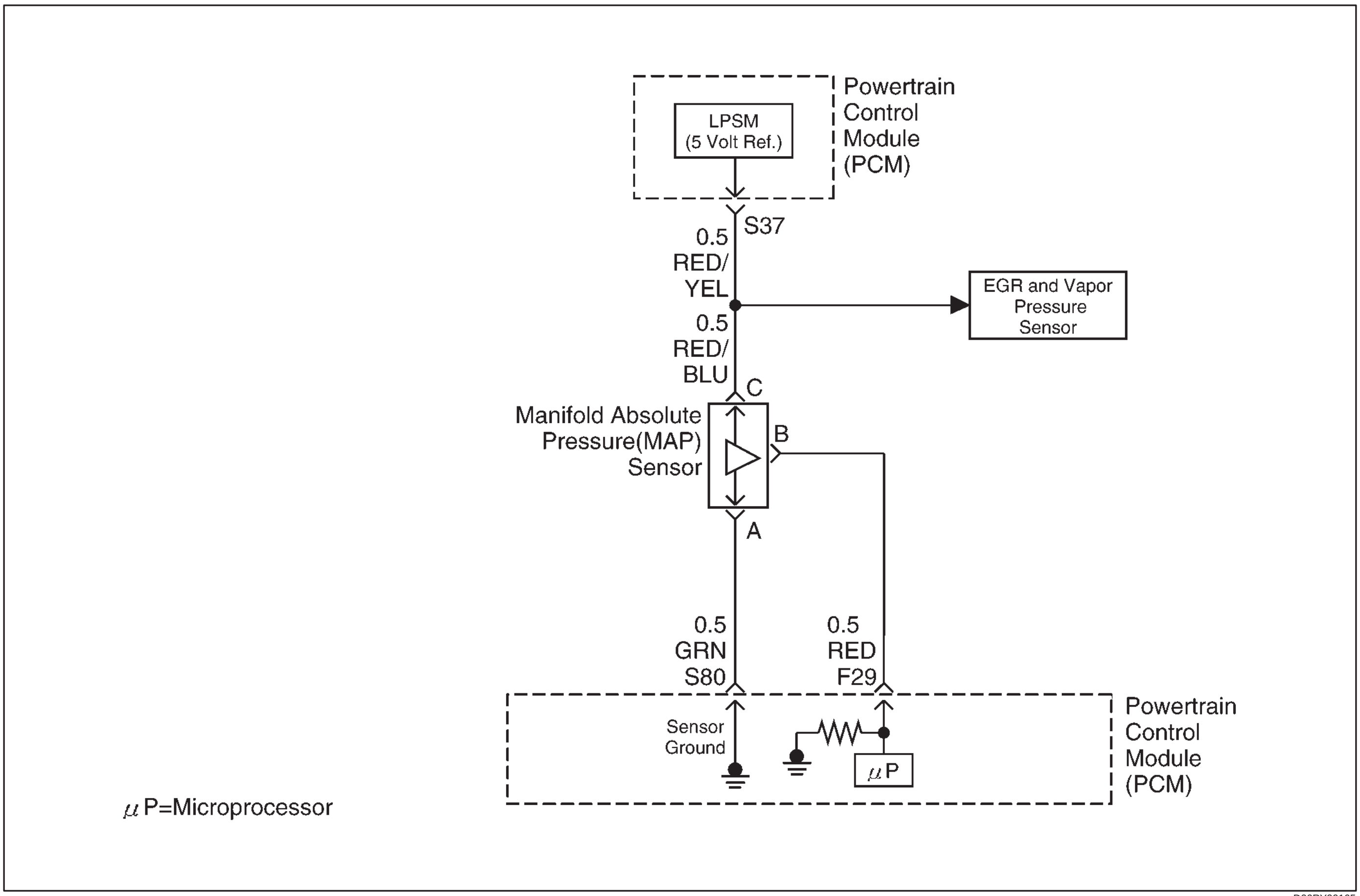
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

- The MAP sensor shares a 5 Volt Reference with the Fuel Tank Pressure sensor. Check the 5 Volt reference if this DTC is also set.
- The MAP sensor shares a ground with the Fuel Tank Pressure sensor and the ECT Sensor. Check the ground if these other DTCs are also set.

DTC P1106 – MAP Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0108 also set?	—	Go to *DTC P0108* chart first	Go to *Step 3*
3	Are DTC P1111, P1115, and/or P1120 also set?	—	Go to *Step 6*	Go to *Step 4*
4	Check for a poor sensor ground circuit terminal connection at the MAP sensor. Was a problem found?	—	Go to *Step 9*	Go to *Step 5*
5	Check the MAP signal circuit between the MAP sensor connector and the PCM for an intermittent short to voltage. Was a problem found?	—	Go to *Step 10*	Go to *Step 8*
6	Check for an intermittent short to voltage on the 5 volt reference circuit between the PCM and the following components: • MAP sensor • EGR valve • TP sensor Was a problem found?	—	Go to *Step 10*	Go to *Step 7*
7	Check for a poor sensor ground circuit terminal connection at the PCM. Was a problem found?	—	Go to *Step 9*	Go to *Step 8*
8	Check for an intermittent open or a faulty splice in the sensor ground circuit. Was a problem found?	—	Go to *Step 10*	Refer to *Diagnostic Aids*
9	Replace the faulty harness connector terminal for the sensor ground circuit. Is the action complete?	—	Verify repair	—
10	Locate and repair the intermittent open/short circuit in the wiring harness as necessary. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1107 MAP Circuit Intermittent Low Voltage



D06RY00165

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition "ON," engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that is intermittently below the calculated value, DTC P1107 will be set.

Conditions for Setting the DTC

- No TP sensor DTCs are present.
- Engine is running.
- Ignition voltage is more than 11 volts.
- Throttle angle is above 1% if engine speed is less than 1000 RPM.
- Throttle angle is above 2% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure below 11 kPa for a total of approximately 5 seconds over a 16-second period of time.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1107 will Clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1107 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- The MAP Sensor shares a 5 Volt reference with the EGR Valve. If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The MAP Sensor share a ground with the EGR Valve and the IAT Sensor.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors

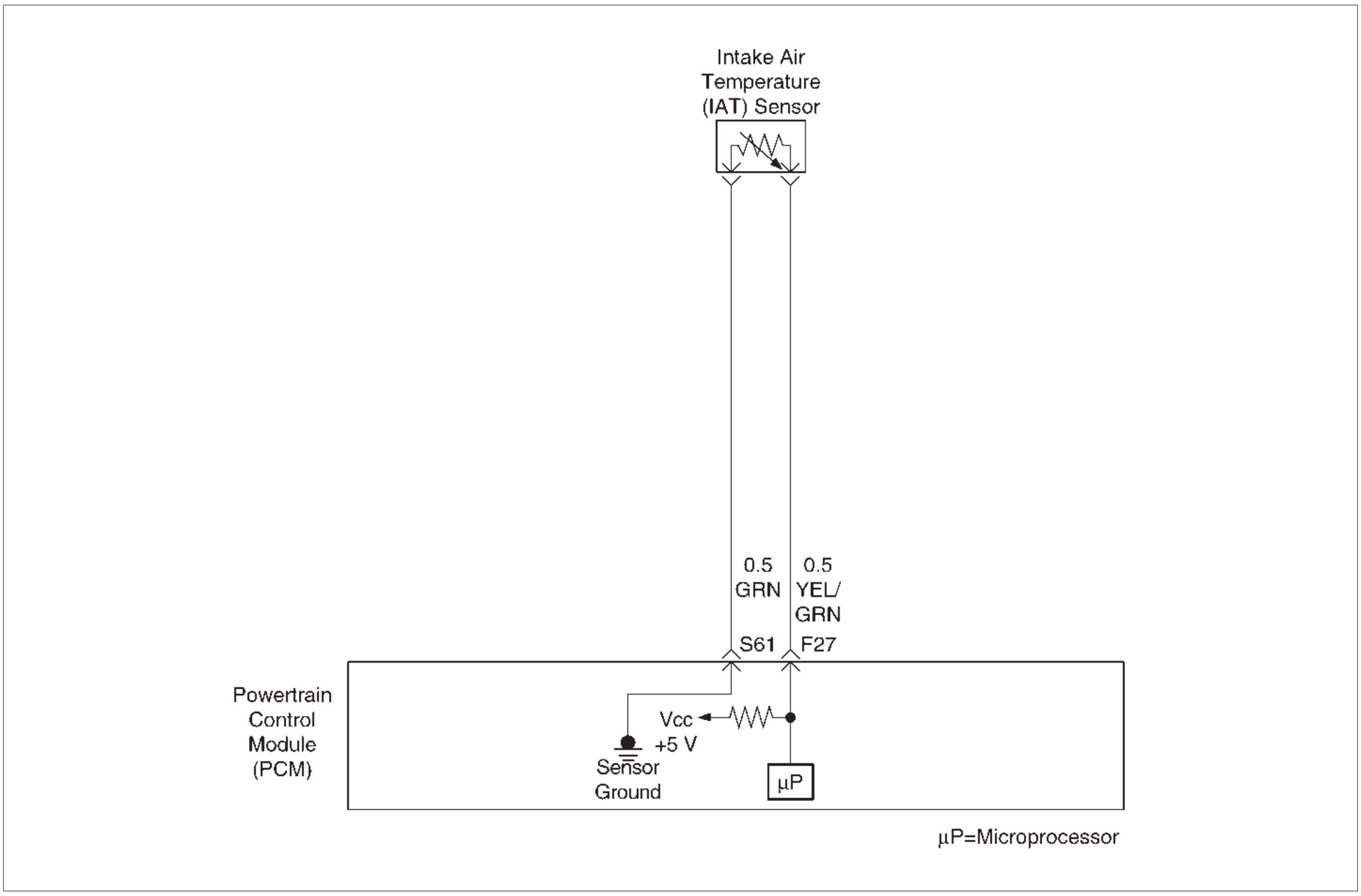
and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1107 – MAP Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0107 also set?	—	Go to *DTC P0107* chart first	Go to *Step 3*
3	Check for a poor 5 volt reference circuit or MAP signal circuit terminal connection at the MAP sensor. Was a problem found?	—	Go to *Step 8*	Go to *Step 4*
4	Check the MAP signal circuit between the MAP sensor connector and the PCM for an intermittent open or short to ground. Was a problem found?	—	Go to *Step 9*	Go to *Step 7*
5	Check for an intermittent short to ground on the 5 volt reference circuit between the PCM and the following components: ● MAP sensor ● EGR valve ● TP sensor Was a problem found?	—	Go to *Step 9*	Go to *Step 6*
6	Check for a poor 5 volt reference terminal connection at the PCM. Was a problem found?	—	Go to *Step 8*	Go to *Step 7*
7	Check for an intermittent open or a faulty splice in the 5 volt reference circuit. Was a problem found? (If no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to *Step 9*	Refer to *Diagnostic Aids*
8	Replace the faulty harness connector terminal(s) for the 5 volt reference circuit and/or the MAP signal circuit as necessary. Is the action complete?	—	Verify repair	—
9	Repair intermittent open/short circuit in the wiring harness as necessary. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1111 IAT Sensor Circuit Intermittent High Voltage



D06RY00168

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. DTC P1111 will set when the PCM intermittently detects an excessively high signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 4 minutes.
- Vehicle speed is less than 32 km/h (20 mph).
- Engine coolant temperature is above 60˚C (140˚F).
- Mass air flow is less than 20g/second.
- IAT signal voltage indicates and intake air temperature intermittently less than –39˚C (–38˚F) (about 5 volts) for approximately 2.5 seconds over a 25-second period of time.

Action Taken When the DTC Sets

- The PCM will substitute a default value for intake air temperature.
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.
- DTC P1111 does not illuminate the MIL.

Conditions for Clearing the MIL/DTC

- A history DTC P1111 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1111 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM –Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

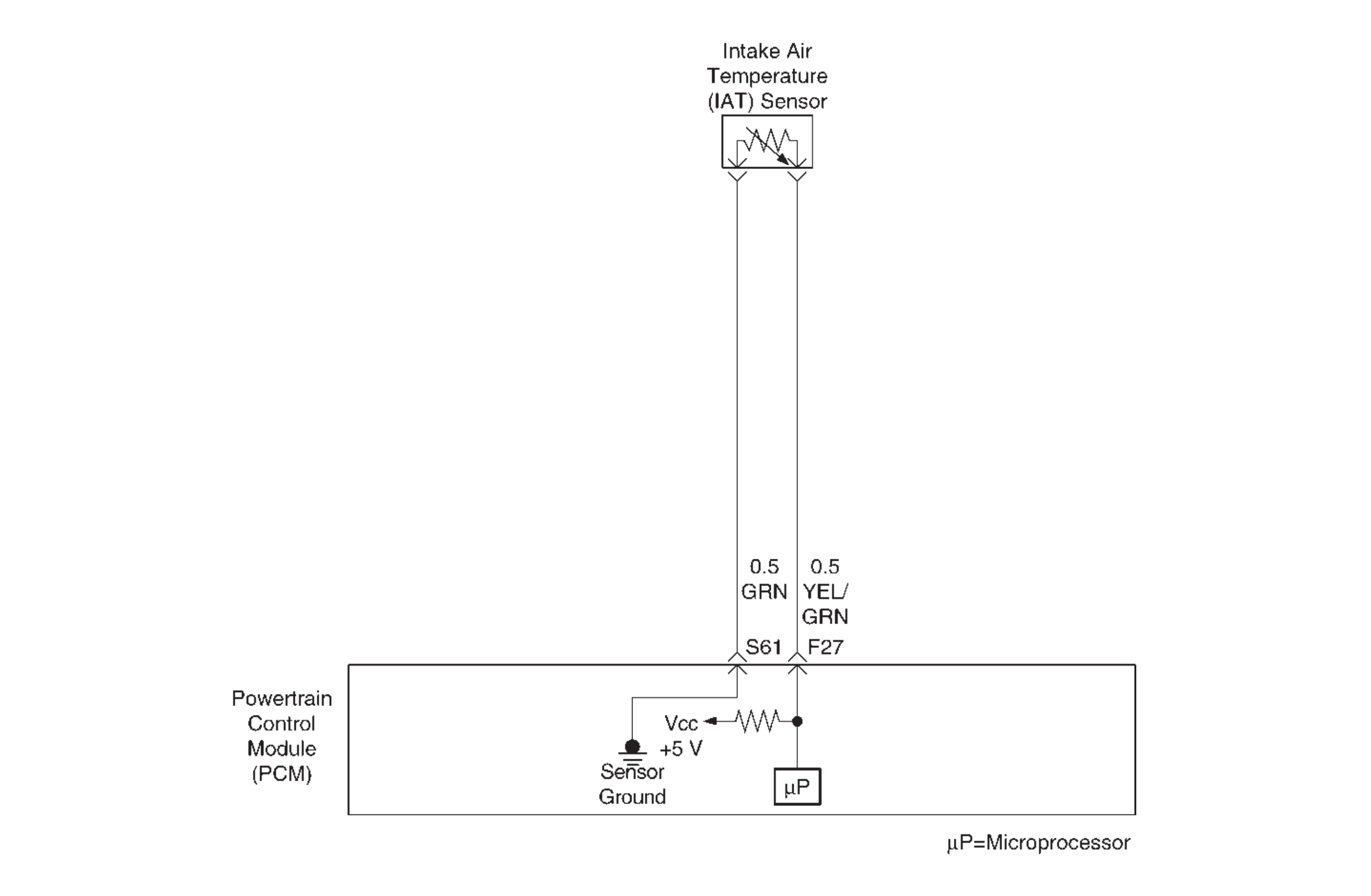
Intake Air Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1111 –IAT Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0113 also set?	—	Go to *DTC P0113* chart first	Go to *Step 3*
3	Is DTC P1115, also set?	—	Go to *Step 6*	Go to *Step 4*
4	1. Check for a poor sensor ground circuit terminal connection at the IAT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Check for a poor IAT signal circuit terminal connection at the IAT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent open. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent short to voltage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Check for a poor sensor ground circuit terminal connection at the PCM. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	1. Check for an intermittent open or a faulty splice in the sensor ground circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC)
P1112 IAT Sensor Circuit Intermittent Low Voltage



D06RY00168

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance becomes lower, causing the PCM to monitor a lower voltage. DTC P1112 will set when the PCM intermittently detects an excessively low signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 2 minutes.
- Vehicle speed is greater than 48 km/h (30 mph).
- IAT signal voltage is greater than 148°C (298°F) (about 0.10 volt) for a total of 2.5 seconds over a 25-second period of time.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.
- The PCM will substitute a default value for intake air temperature.

Conditions for Clearing the MIL/DTC

- A history DTC P1112 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1112 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.
3. If DTC P1112 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Value Chart." The chart may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the IAT sensor.

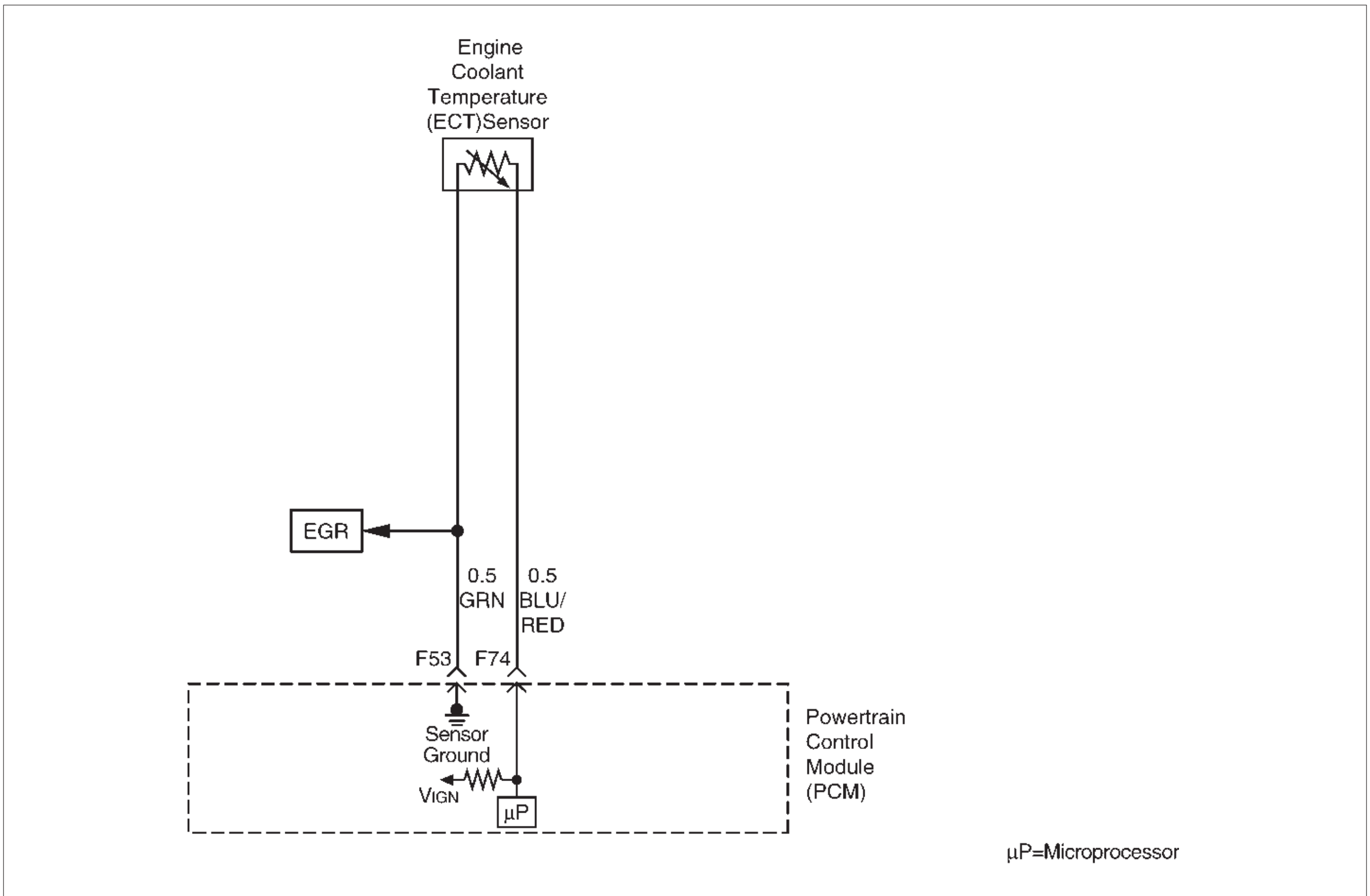
Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1112 – IAT Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0112 also set?	—	Go to *DTC P0112* first	Go to *Step 3*
3	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent short to ground. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC)
P1114 ECT Sensor Circuit Intermittent Low Voltage



D06RY00169

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5.0 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently below the range of the ECT sensor, DTC P1114 will set.

Conditions for Setting the DTC

- Engine run time longer than 60 seconds.
- The ECT sensor signal is intermittently greater than 150°C (302°F) (about 0.10 volt) for a total of 10 seconds over a 100-second period.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1114 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1114 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often

the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

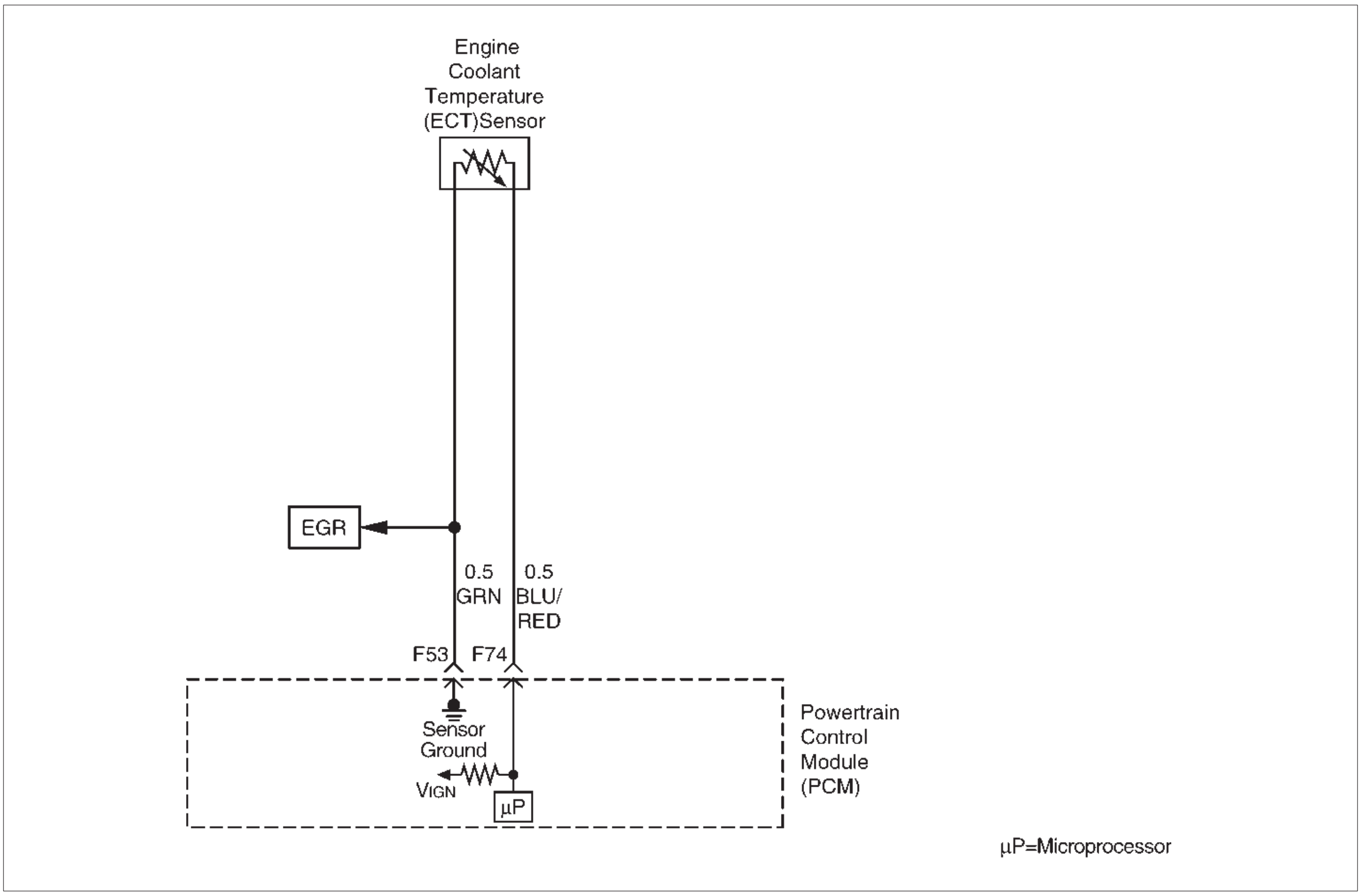
Engine Coolant Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1114 – ECT Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0117 also set?	—	Go to *DTC P0117* first	Go to *Step 3*
3	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent short to ground. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC)
P1115 ECT Sensor Circuit Intermittent High Voltage



D06RY00169

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5.0 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently above the range of the ECT sensor, DTC P1115 will set.

Conditions for Setting the DTC

- Engine running time longer than 90 seconds.
- The ECT sensor signal is intermittently greater than –39°C (–38°F) (about 5 volts) for a total of 10 seconds over a 100-second period.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1115 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1115 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often

the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

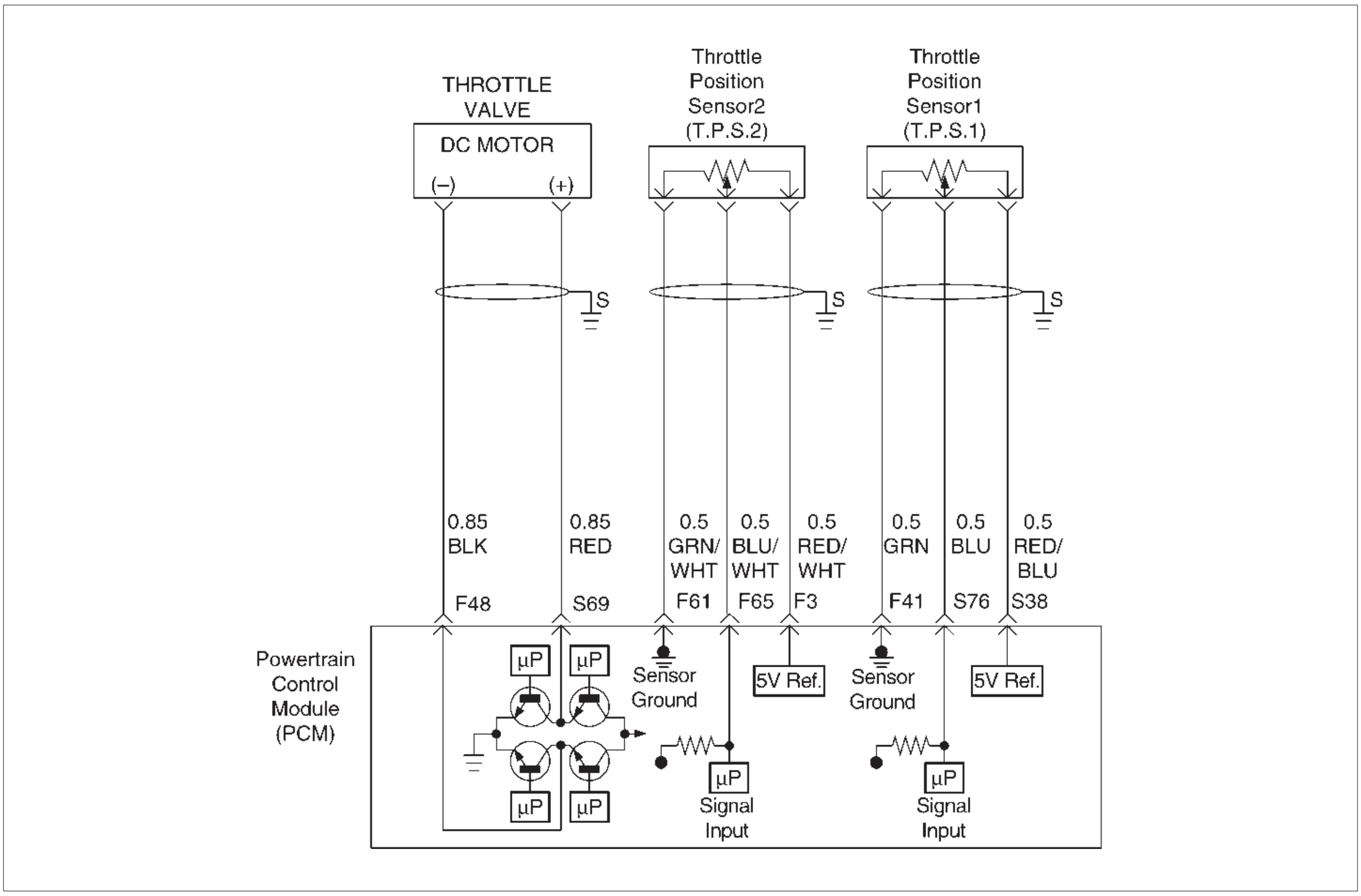
Engine Coolant Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1115 – ECT Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0118 also set?	—	Go to *DTC P0118* chart first	Go to *Step 3*
3	Is DTC P1111 also set?	—	Go to *Step 8*	Go to *Step 4*
4	1. Check for a poor sensor ground circuit terminal connection at the ECT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Check for a poor ECT signal circuit terminal connection at the ECT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent open. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent short to voltage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Check for a poor sensor ground circuit terminal connection at the PCM. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	1. Check for an intermittent open or a faulty splice in the sensor ground circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code(DTC)
P1120-TPS 1 Throttle Position Sensor (TPS1) Circuit Fault



D06RY00088

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle blade angle.

  The throttle blade angle will vary about 8 % at closed throttle to about 92 % at wide open throttle(WOT).

  This code detects a continuous short to ground or high in either the cicuit or the sensor.

Conditions for setting the DTC

- The Ignition is “ON”.
- The throttle blade angle is less than 2.5 % or more tnan 97.5 % for 18 failres within 500 test samples (15.6m sec)

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A histror DTC P1120 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1120 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK,observe the TPS 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault.

  If DTC P1120 cannot be duplicated,the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P1120 Diagnostic Chart may isolate the cause of the fault.

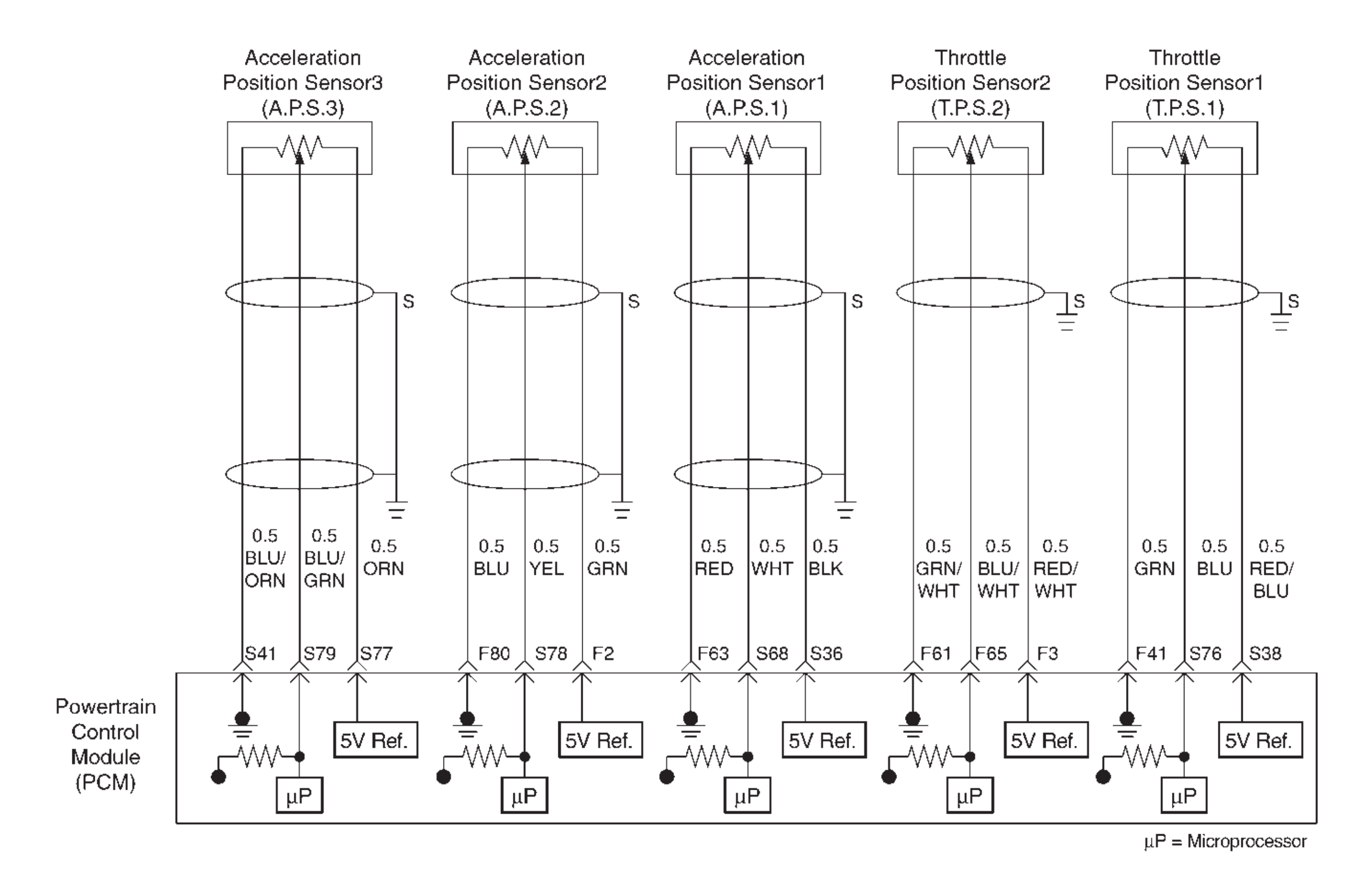
Diagnostic Trouble Code(DTC)P1120-TPS 1 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board(OBD)System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON", engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65kPa	Go to *Step 3*	Go to *Step 6*
3	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value? (If no, start with diagnosis chart forother sensors in the circuit and see if 5V returns.)	—	Go to *Step 5*	Go to *Step 4*
4	1. Check the MAP signal circuit between the PCM and MAP grund circuit. 2. If the MAP signal circuit is open or shoted, repair it as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 12*
5	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
6	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle =8 % Wide open throttle =92 %	Refer to *Diagnostic Aids*	Go to *Step 7*
7	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 8*	Go to *Step 9*
8	1. Connect a test light between the 5Volt reference circuit and the TP1 sensor signal circuit at the TP1 sensor harness connector. 2. Observe the TP1 sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 11*	Go to *Step 10*
9	Check the following items; 1. TP1 signal circuit for a short to voltage. 2. TP1 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1 sensor ground circuit for a poor connection. 4. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*

Diagnostic Trouble Code(DTC)P1120-TPS 1 Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP signal circuit or 5 volt reference circuit for a poor connection. 2. TP signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
11	Replace the TP sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1125 ETC (Electric Throttle Control) Limit Performance Mode



D06RY00157

Circuit Description

- The acceleration position (AP1) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle will vary about 13 % at idle position to about 87 % at wide open throttle (WOT).

  This code detects if the systm is in Limit Performance Mode. (Fail safe Mode)

Conditions for setting the DTC

- The Ignition is “ ON”.
- Limit Performance Mode is active. (Fail safe Mode)

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1125 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1125 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 1, APP sensor 2, APP sensor 3 display on the Tech 2 While moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault.

  If DTC P1125 cannot be duplicated,the information includedin the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently,performing the DTC P1125 Diagnostic Chart may isolate the cause of the fault.

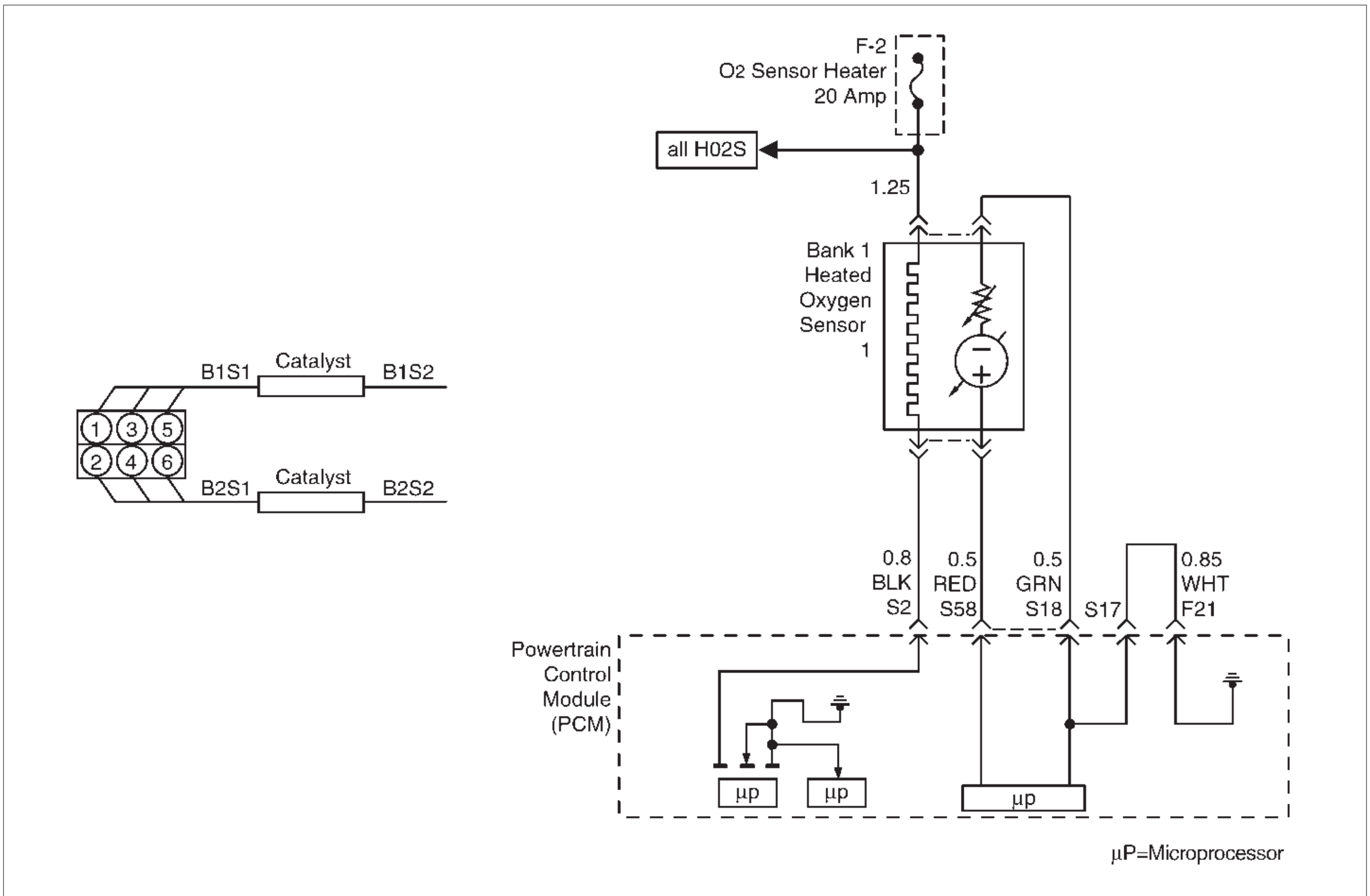
DTC P1125 – ETC Limit Performance Model

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Chcek” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position APP sensor 1 =13 % APP sensor 2, 3 =85 ~ 89 % open throttle APP sensor 1 =85 ~ 89 % APP sensor 2 =11 ~ 15 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP1, AP2 AND AP3 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP1, AP2 or AP3 signal circuit for a short to voltage. 2. AP1, AP2 or AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1, AP2 or AP3 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1, AP2 or AP3 signal circuit or 5 volge supply circuit for a poor connection. 2. AP1, AP2 or AP3 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP1, AP2 or AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*

DTC P1125 – ETC Limit Performance Model (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed.Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1133 HO2S Insufficient Switching Bank 1 Sensor 1



D06RY00171

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after "closed loop" and stoichiometric operation have been enabled. During this test period the PCM counts the number of times that the HO2S signal voltage crosses the rich-to-lean and lean-to-rich threshold. If the PCM determines that the HO2S did not switch enough times, DTC P1133 will be set.

A lean-to-rich switch is determined when the HO2S voltage changes above and below 450 mV.

Heated oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- Engine coolant temperature (ECT) is above 50˚C (122˚F) for automatic transmission; 75˚C (167˚F) for manual transmission.
- Engine is operating in "closed loop".
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow (MAF) is between 9 g/second and 42 g/second.
- Above conditions are present for 3 seconds.
- 90 seconds after "closed loop" and stoichiometric operation have been achieved, the PCM monitors the oxygen sensor as it switches above and below 450 mV. If fewer than 23 rich-to-lean and lean-to-rich switches are detected, DTC P1133 will be set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- "Open loop" fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1133 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1133 can be cleared by using Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1133 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1133 continues to set, replace the Bank 1 HO2S 1.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help to determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging the replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
11. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

DTC P1133 – HO2S Insufficient Switching Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	**IMPORTANT:** If any DTCs are set (except P1153 or P1154) refer to those DTCs before proceeding with this diagnostic chart. 1. Engine idling at operating temperature. 2. Operating the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 3. Using a Tech 2, monitor “DTC” info for DTC P1133 until the DTC P1133 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P1133 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate that the P1153 or P1154 tests failed?	—	Go to *Step 20*	Go to *Step 4*
4	Check for leaks at the exhaust pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the bolt/nuts at the leaking joints. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*

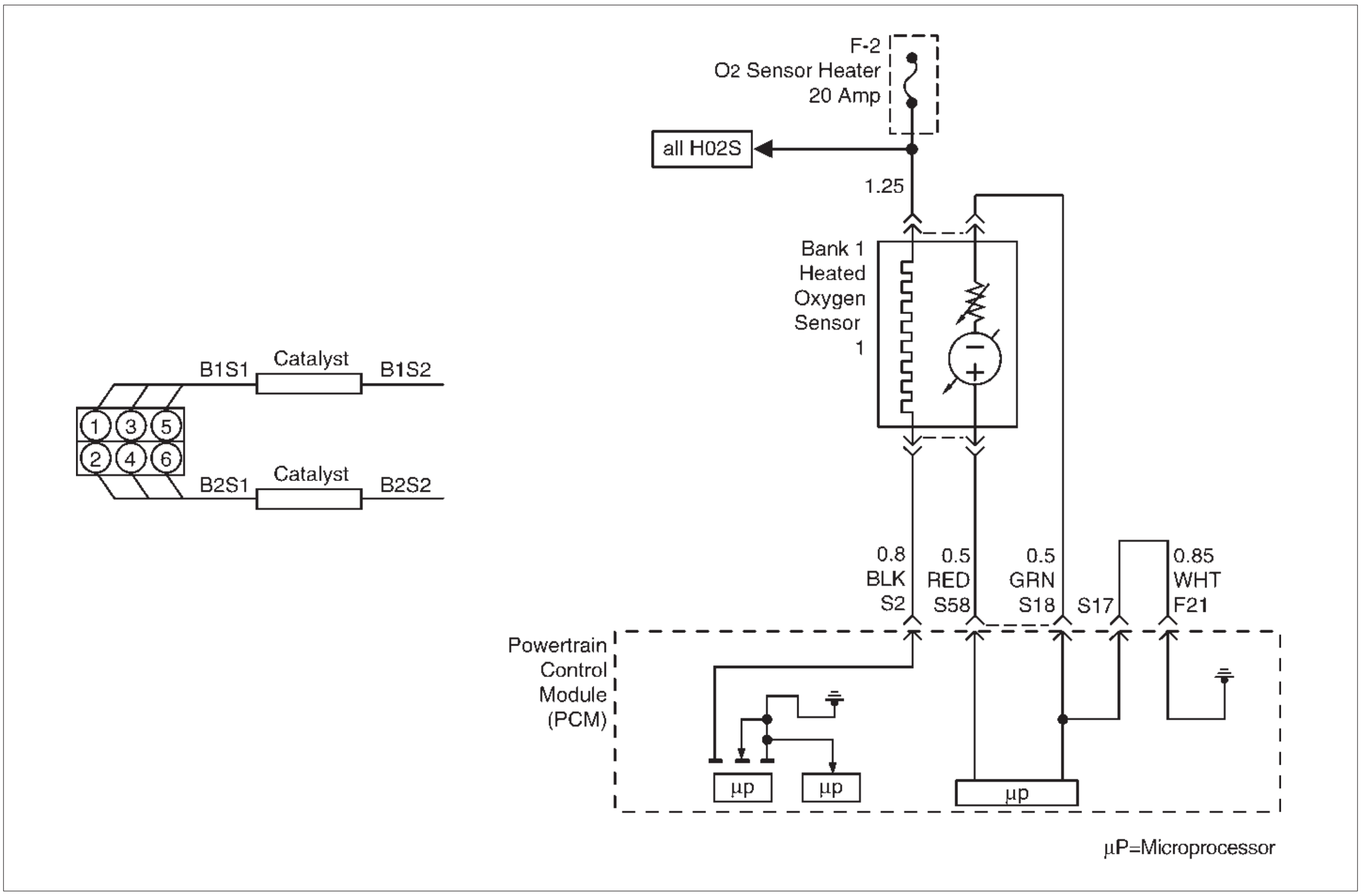
DTC P1133 – HO2S Insufficient Switching Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—
14	Visually/physically inspect the following items: ● Ensure that the Bank 1 HO2S 1 is securely installed. ● Check for corrosion on the terminals. ● Check the terminals at Bank 1 HO2S 1 and at the PCM. ● Check for damaged wiring. Was a problem found in any of the above areas?	—	Verify repair	Go to *Step 15*
15	1. Disconnect Bank 1 HO2S 1. 2. Ignition "ON." 3. Using a DVM at the PCM side of the connector, check the voltage between the high signal circuit and ground. Also measure between the low signal circuit and ground. Are both voltages in the specified range?	3-4 mV	Go to *Step 18*	Go to *Step 16*
16	1. Ignition "OFF." 2. Check for damage to PCM pins or terminals. Was a problem found.	—	Verify repair	Go to *Step 17*
17	Check for a short to voltage or ground or an open in the signal circuit. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Ignition "OFF." 2. Disconnect the PCM connector. 3. With the HO2S disconnected, check for high and low signal circuits shorted together between the PCM and HO2S. Was a problem found?	—	Verify repair	Go to *Step 19*
19	With the PCM connected and Bank 1 HO2S 1 disconnected from the harness, check Bank 1 HO2S 1 with a Tech 2. Is the voltage in the specified range?	425-475 mV	Go to *Step 21*	Go to *Step 22*
20	Replace the affected heated oxygen sensors. NOTE: Before replacing the sensors, the cause of the contamination must be determined and corrected. ● Fuel contamination ● Use of improper RTV sealant. ● Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—

DTC P1133 – HO2S Insufficient Switching Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action compete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1134 HO2S Transition Time Ratio Bank 1 Sensor 1



D06RY00171

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” and stoichiometric operation have been established. During the monitoring period the PCM counts the number of times that the HO2S responds from rich-to-lean and from lean-to-rich and adds the amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. The PCM then divides the rich-to-lean average by the lean-to-rich average to obtain a ratio. If the HO2S transition time ratio is not within this range, DTC P1134 will be set, indicating that the oxygen sensor is not responding as expected to changes in exhaust oxygen content.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ECT) is above 50°C (122°F) for automatic transmission; 75°C (167°F) for manual transmission.
- Engine is operating in “closed loop.”
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow (MAF) is between 9 g/second and 42 g/second.
- Above conditions are present for a 3-second monitoring period.
- 90 seconds after “closed loop” and stoichiometric operation have been enabled, Bank 1 HO2S 1 transition ratio between lean-to-rich and rich-to-lean is less than 0.44 or greater than 3.8.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after second consecutive trip in which the fault is detected.
- ”Open loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1134 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1134 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1134 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1134 continues to set, replace the Bank 1 HO2S 1.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
8. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

DTC P1134 – HO2S Transition Time Ratio Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	**IMPORTANT:** If any DTCs are set (except P1153 and/or P1154), refer to those DTCs before proceeding with this diagnostic chart. 1. Idle the engine at operating temperature. 2. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 3. Using a Tech 2, monitor "DTC" info for DTC P1134 until the DTC P1134 test runs. 4. Note the test result. Does Tech 2 indicate DTC 1134 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate P1153, and/or P1154 test failed?	—	Go to *Step 17*	Go to *Step 4*
4	Check for leaks at the exhaust pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U-bolt nuts at the leaking joints. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—

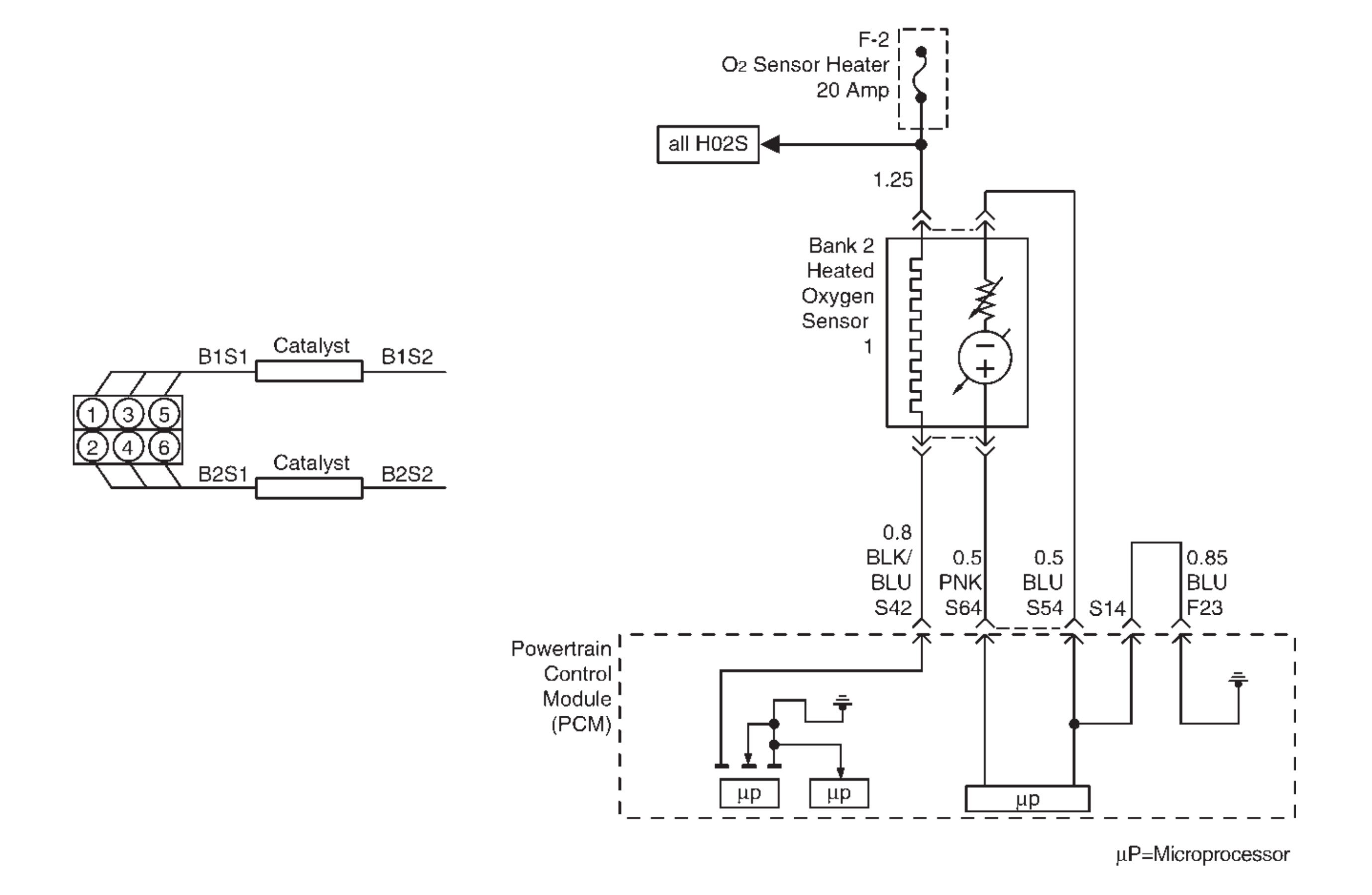
DTC P1134 – HO2S Transition Time Ratio Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—
14	Visually/physically inspect the following items: • Ensure that the Bank 1 HO2S 1 is securely installed. • Check for corrosion on terminals. • Check the terminal tension (at Bank 1 HO2S 1 and at the PCM). • Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to *Step 18*	Go to *Step 15*
15	1. Disconnect Bank 1 HO2S 1. 2. Ignition "ON." 3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. 4. Also measure the voltage between the low signal circuit and ground. Are both voltages in the specified range?	3-4V	Go to *Step 16*	Go to *Step 19*
16	1. With Bank 1 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition "ON." 3. Using a Tech 2, monitor the Bank 1 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to *Step 21*	Go to *Step 22*
17	Replace affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. • Fuel contamination. • Use of improper RTV sealant. • Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
18	Repair condition as necessary. Is the action complete?	—	Verify repair	—
19	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to *Step 20*
20	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	Go to *Step 7*

DTC P1134 – HO2S Transition Time Ratio Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1153 HO2S Insufficient Switching Bank 2 Sensor 1



D06RY00175

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after "closed loop" and stoichiometric operation have been enabled. During this test period the PCM counts the number of times that the HO2S signal voltage crosses the rich-to-lean and lean-to-rich thresholds. If the PCM determines that the HO2S did not switch enough times, DTC P1153 will be set.

A lean-to-rich switch is determined when the HO2S voltage changes above and below 450 mV.

Heated oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- The engine is operating in "closed loop."
- Engine coolant temperature (ECT) is above 50°C (122°F) for automatic transmission; 75°C (167°F) for manual transmission.
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow is between 9 g/second and 42 g/second.
- Above conditions are present for a 3 seconds.
- 90 seconds after "closed loop" and stoichiometric operation have been enabled, the PCM monitors the oxygen sensor switching above and below 450 mV. If fewer than 27 rich-to-lean and lean-to-rich switches for Bank 2 HO2S 1 are detected, DTC P1153 will set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- "Open loop" fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1153 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1153 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1153 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1153 continues to set, replace the Bank 2 HO2S 1.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
8. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

DTC P1153 – HO2S Insufficient Switching Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	**IMPORTANT:** If any DTCs are set, (except P1133 and/or P1134), refer to those DTCs before proceeding with this diagnostic chart. 1. Idle the engine at operating temperature. 2. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 3. Using a Tech 2, monitor “DTC” info for DTC P1153 until the DTC P1153 test runs. Note the test result. Does Tech 2 indicate DTC failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate P1133 and/or P1134 test failed?	—	Go to *Step 20*	Go to *Step 4*
4	Check for leaks at the exhaust pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U-bolt nuts at the leaking joints. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*

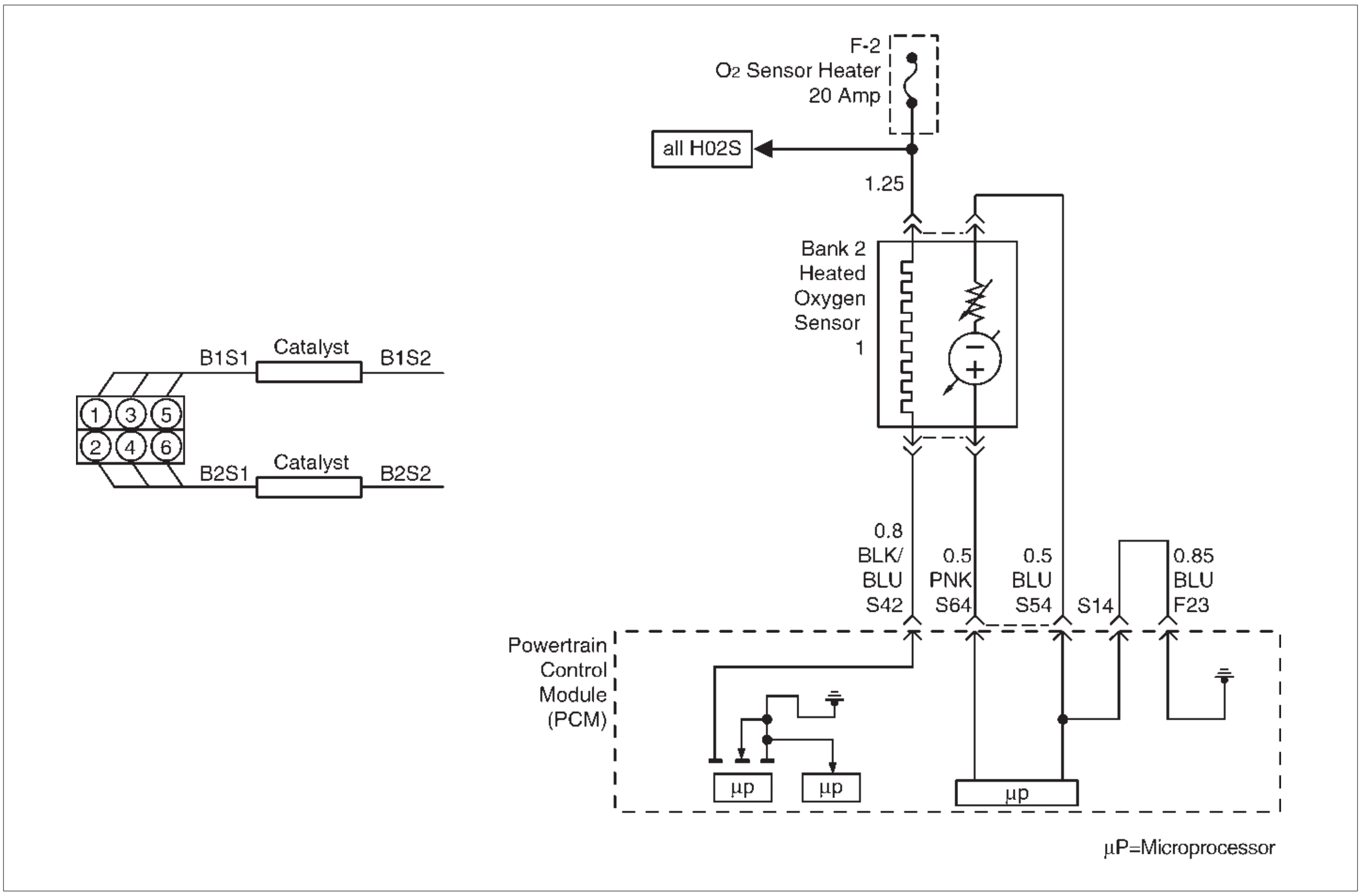
DTC P1153 – HO2S Insufficient Switching Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—
14	Visually/physically inspect the following items: ● Ensure that the Bank 2 HO2S 1 is securely installed. ● Check for corrosion on terminals. ● Check the terminal tension at Bank 2 HO2S 1 and at the PCM. ● Check for damaged wiring. Was a problem found in any of the above areas?	—	Verify repair	Go to *Step 15*
15	1. Disconnect Bank 2 HO2S 1. 2. Ignition "ON." 3. Using a DVM at the PCM side of the connector, check the voltage between the high signal circuit and ground. Also measure between the low signal circuit and ground. Are both voltages in the specified range?	3-4V	Go to *Step 18*	Go to *Step 16*
16	1. Ignition "ON." 2. Check for damage to PCM pins or terminals. Was a problem found?	—	Verify repair	Go to *Step 17*
17	Check for short to voltage or ground or an open in the signal circuit. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Ignition "OFF." 2. Disconnect the PCM connector. 3. With HO2S disconnected, check for high and low signal circuits shorted together between the PCM and HO2S. Was a problem found?	—	Verify repair	Go to *Step 19*
19	With the PCM connected and Bank 2 HO2S 1 disconnected from the harness, check Bank 2 HO2S 1 with a Tech 2. Is the voltage in the specified range?	425-475 mV	Go to *Step 21*	Go to *Step 22*
20	Replace affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. ● Fuel contamination. ● Use of improper RTV sealant. ● Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—

DTC P1153 – HO2S Insufficient Switching Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1154 HO2S Circuit Transition Time Ratio Bank 2 Sensor 1



D06RY00175

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” and stoichiometric operation have been enabled. During the monitor period the PCM counts the number of times that the HO2S responds from rich-to-lean and from lean-to-rich and adds the amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. The PCM then divides the rich-to-lean average by the lean-to-rich average to obtain a ratio. If the HO2S transition time ratio is not within this range, DTC P1154 will be set, indicating that the oxygen sensor is not responding as expected to changes in exhaust oxygen content.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ETC) is above 50˚C (122˚F) for automatic transmission; 75˚C (167˚F) for manual transmission.
- The engine is operating in “closed loop.”
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow is between 9 g/second and 42 g/second.
- Above conditions are present for a 3-second monitoring period.
- 90 seconds after “closed loop” and stoichiometric operation have been enabled, Bank 2 HO2S 1 transition ratio between lean to rich and rich to lean is less than 0.44 or greater than 3.8.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- ”Open loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1154 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1154 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

A multifunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1154 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1154 continues to set, replace the Bank 2 HO2S 1.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
8. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	**IMPORTANT:** If any other DTCs are set (except P1133 and/or P1134), refer to those DTCs before proceeding with this diagnostic chart. 1. Idle the engine at operating temperature. 2. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 3. Using a Tech 2, monitor “DTC” info for DTC P1154 until the DTC P1154 test runs. Note the test result. Does Tech 2 indicate DTC failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate P1133, and/or P1134 test failed?	—	Go to *Step 17*	Go to *Step 4*
4	Check for leaks at the exhaust pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U-bolt nuts at the leaking joints. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—

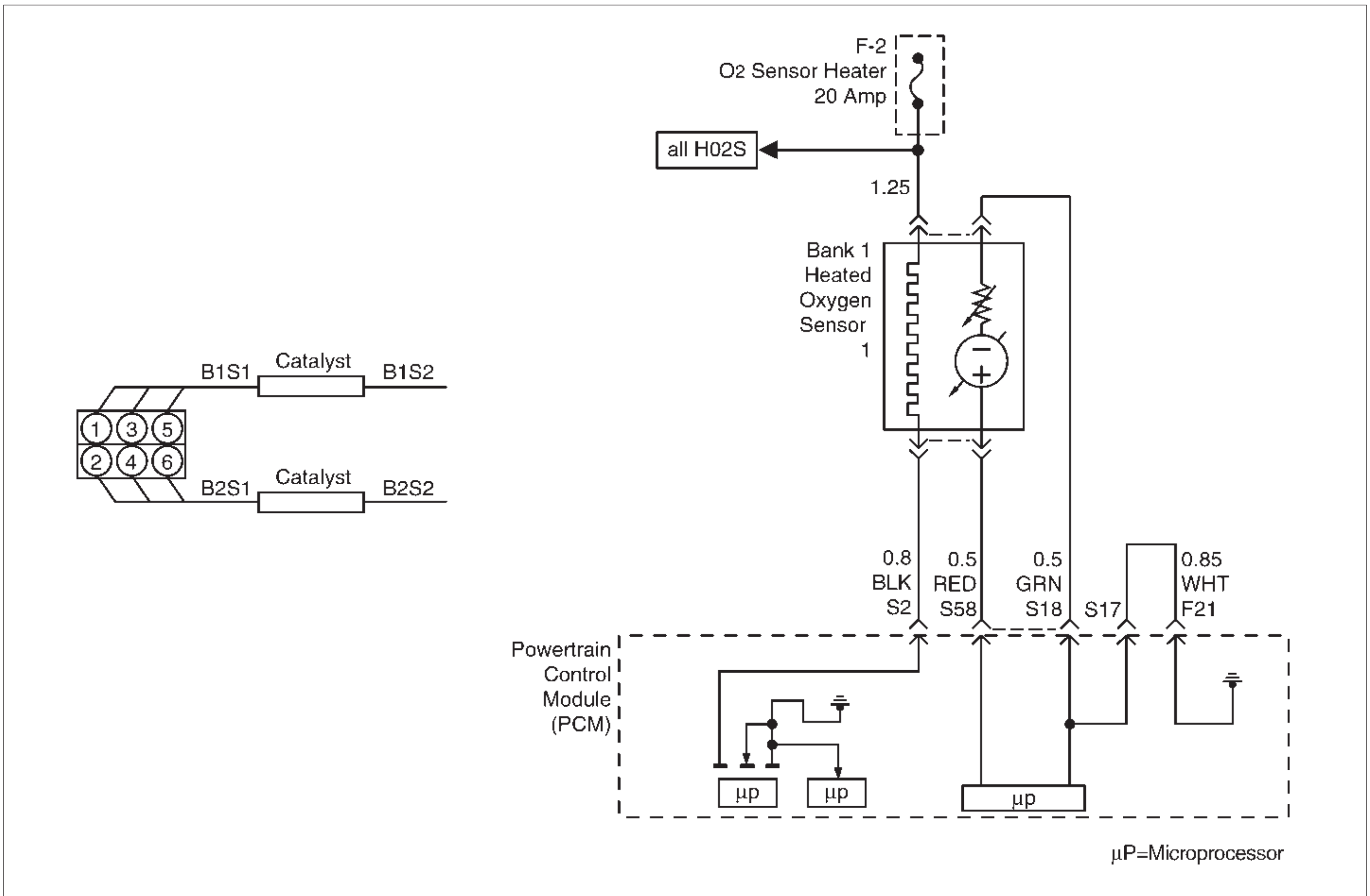
DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—
14	Visually/physically inspect the following items: • Ensure that the Bank 2 HO2S 1 is securely installed. • Check for corrosion on terminals. • Check terminal tension (at Bank 2 HO2S 1 and at the PCM). • Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to *Step 18*	Go to *Step 15*
15	1. Disconnect Bank 2 HO2S 1. 2. Ignition "ON." 3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. Also measure the voltage between the low signal circuit and ground. Are both voltages in the specified range?	3-4 V	Go to *Step 16*	Go to *Step 19*
16	1. With Bank 2 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition "ON." 3. Using a Tech 2, monitor the Bank 2 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to *Step 21*	Go to *Step 22*
17	Replace affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. • Fuel contamination. • Use of improper RTV sealant. • Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
18	Repair condition as necessary. Is the action complete?	—	Verify repair	—
19	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to *Step 20*
20	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	—

DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1167 Fuel System Rich During Decel Fuel Cut Off (Bank 1)



D06RY00171

Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after "closed loop" has been enabled. During the monitoring period the powertrain control module (PCM) counts the number of times a rich to lean and respones is indicated and adds the amountof time it look to complete all rich to lean transisitions and lean to rich transitions.

This code detects if Bank1 02 sensor indicated rich exhaust while in Decel Fuel Cut Off (DFCO) for fuel control sensors.

Conditions for setting the DTC

- No related DTCs.
- The engine coolant temperature is more than 60 °C (140 °F).
- Engine is operating in "closed loop" power enrichment mode for 3 secondes.
- While in "power enrichment" mode the oxygen sensor voltage remains more than 600mV in DFCO.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction malfunction indicator lamp (MIL).
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- A history DTC P1167 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1167 can be cleared using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

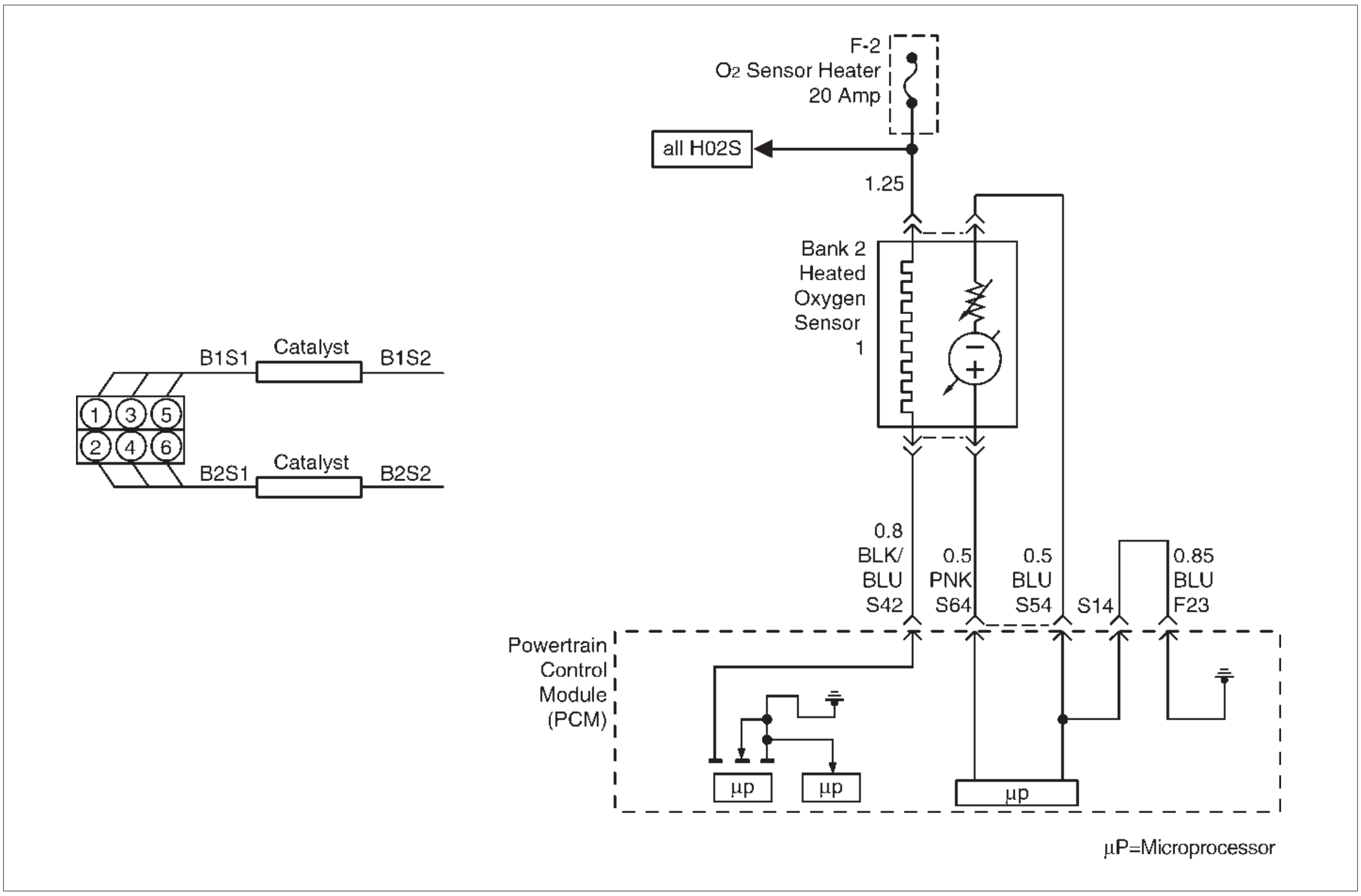
Diagnostic Aids

- Check for faulty fuel injectors and fuel pump.

Diagnostic Trouble Code (DTC)
P1167 Fuel System Rich During Decel Fuel Cut Off (Bank1)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any component related DTCs set?		Go to *component DTC charts*	Go to *Step 3*
3	1. Place the transmission in Park. 2. Using a Tech 2, HO2S 1 voltage while running warm engine 75 °C – 95 °C (167 °F – 203 °F) at 1200 RPM. 3. HO2S 1 votages should vary within the specified range. (100 – 900mV) 4. Quickly open the wide open the throtle for a few Did the voltage suddenly rise toward the low endof the specified range?	100 – 600 mV	Go to *OBD System Check*	Go to *Step 4*
4	1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure. 2. Install the fuel pressure gauge. 3. Start the engine and idle at normal operating temperatur. 4. Disconnect the vacuum line going to the fuel pressure regurlator. With the engine running, is the fuel pressure within the specified range?	280 – 325Kpa (41 – 46psi)	Go to *OBD System Check*	Go to *Step 5*
5	1. Ignition “OFF”. 2. Remove the fuel pump relay and replace it with a fused jumper which will connect the relay’s battery terminal to the terminal leading to the fuel pump fuse. 3. While the fuel pump is opreating, use pliers to slowly close the return line (do not exceed the first specified value). Using the pliers to restrict the return line, can the fuel pressure be manipulated to exceed the second value? Is the TP sensor reading near the specified value?	414KPa (60psi) 325KPa (46psi)	Refer to *Diagnostic Aids*	Go to *Step 6*
6	Check the following items; • Faulty fuel pump • Incorrect fuel pump • Incorrect fuel being used • Cold fuel If a problem is found, repair one as necessary. Was a problem found?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1169 Fuel System Rich During Decel Fuel Cut Off (Bank 2)



D06RY00175

Circuit Description

The powertrain control module(PCM)
continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” has been enabled. During the monitoring period the powertrain control module (PCM) counts the number of times a rich to lean and respones is indicated and adds the amountof time it look to complete all rich to lean transisitions and lean to rich transitions.
This code detects if Bank2 sensor indicated rich exhaust while in Decel Fuel Cut Off (DFCO) for fuel control sensors.

Conditions for setting the DTC

- No related DTCs.
- The engine coolant temperature is more than 60 ˚C (140 ˚F).
- Engine is operating in “closed loop” power enrichment mode for 3 secondes.
- While in “power enrichment” mode the oxygen sensor voltage remains more than 600mV in DFCO.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction malfunction indicator lamp(MIL).
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- A history DTC P1169 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1169 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

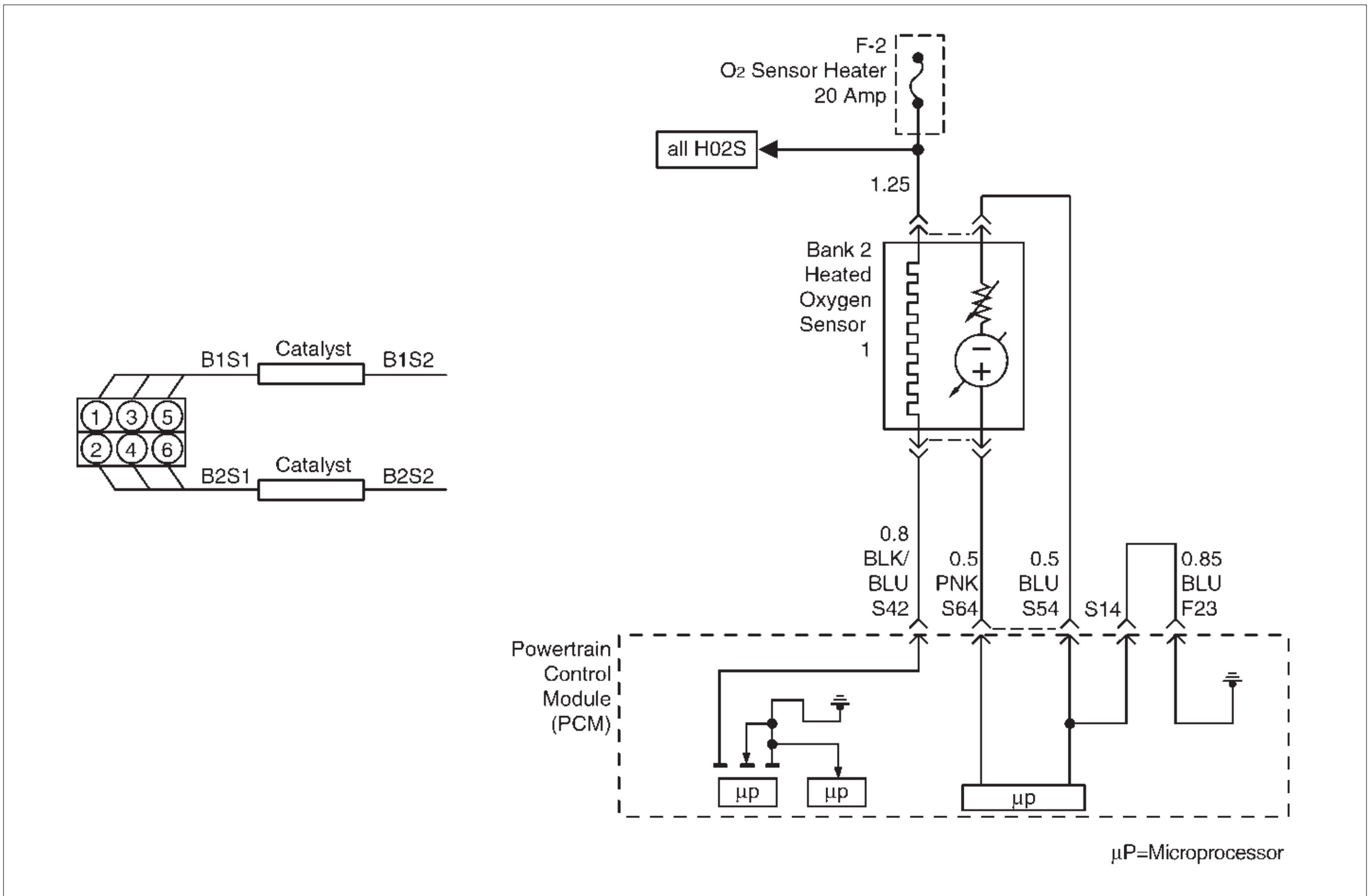
Diagnostic Aids

- Check for faulty fuel injectors and fuel pump.

Diagnostic Trouble Code (DTC) P1169 Fuel System Rich During Decel Fuel Cut Off (Bank2)

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any component related DTCs set?		Go to *component DTC charts*	Go to *Step 3*
3	1. Place the transmission in Park. 2. Using a Tech 2, HO2S 2 voltage while running warm engine75 C – 95 C (167 F – 203 F) at 1200 RPM. 3. HO2S 1 votages should vary within the specified range. (100 – 900mV) 4. Quickly open the wide open the throtle for a few Did the voltage suddenly rise toward the low end of the specified range?	100 – 600 mV	Go to *OBD System Check*	Go to *Step 4*
4	1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure. 2. Install the fuel pressure gauge. 3. Start the engine and idle at normal operating temperatur. 4. Disconnect the vacuum line going to the fuel pressure regurlator. With the engine running, is the fuel pressure within the specified range?	280 – 325Kpa (41 – 46psi)	Go to *OBD System Check*	Go to *Step 5*
5	1. Ignition "OFF". 2. Remove the fuel pump relay and replace it with a fused jumper which will connect the relay's battery terminal to the terminal leading to the fuel pump fuse. 3. While the fuel pump is opreating, use pliers to slowly close the return line (do not exceed the first specified value). Using the pliers to restrict the return line, can the fuel pressure be manipulated to exceed the second value? Is the TP sensor reading near the specified value?	414KPa (60psi) 325KPa (46psi)	Refer to *Diagnostic Aids*	Go to *Step 6*
6	Check the following items; ● Faulty fuel pump ● Incorrect fuel pump ● Incorrect fuel being used ● Cold fuel. If a problem is found, repair one as necessary. Was a problem found?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1171 Fuel System Lean During Acceleration



D06RY00175

Circuit Description

The powertrain control module (PCM) internal circuitry can identify if the vehicle fuel system is capable of supplying adequate amounts of fuel during heavy acceleration (power enrichment). The PCM monitors the voltage of the oxygen sensor during power enrichment. When a power enrichment mode of operation is requested during "closed loop" operation (by heavy acceleration), the PCM will provide more fuel to the engine. Under these conditions the PCM should detect a "rich" condition (high oxygen sensor voltage). If this "rich" exhaust is not detected at this time, a DTC P1171 will set. A plugged fuel filter, restricted fuel line, restricted in-tank filter or defective fuel pump can prevent adequate amounts of fuel from being supplied during power enrichment mode.

Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in "closed loop power enrichment" mode for 3 seconds.
- Engine coolant temperature is above 60°C (140°F).
- While in "power enrichment" mode the oxygen sensor voltage remains below 400 mV for 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1171 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1171 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

- A restricted fuel filter or fuel line, restricted in-tank filter, or a defective fuel pump may supply adequate amounts of fuel at idle, but may not be able to supply enough fuel during heavy acceleration.
- Water or alcohol in the fuel may cause low HO2S voltage during acceleration.
- Check for faulty or plugged fuel injector(s).
- Check for low fuel.

Test Description

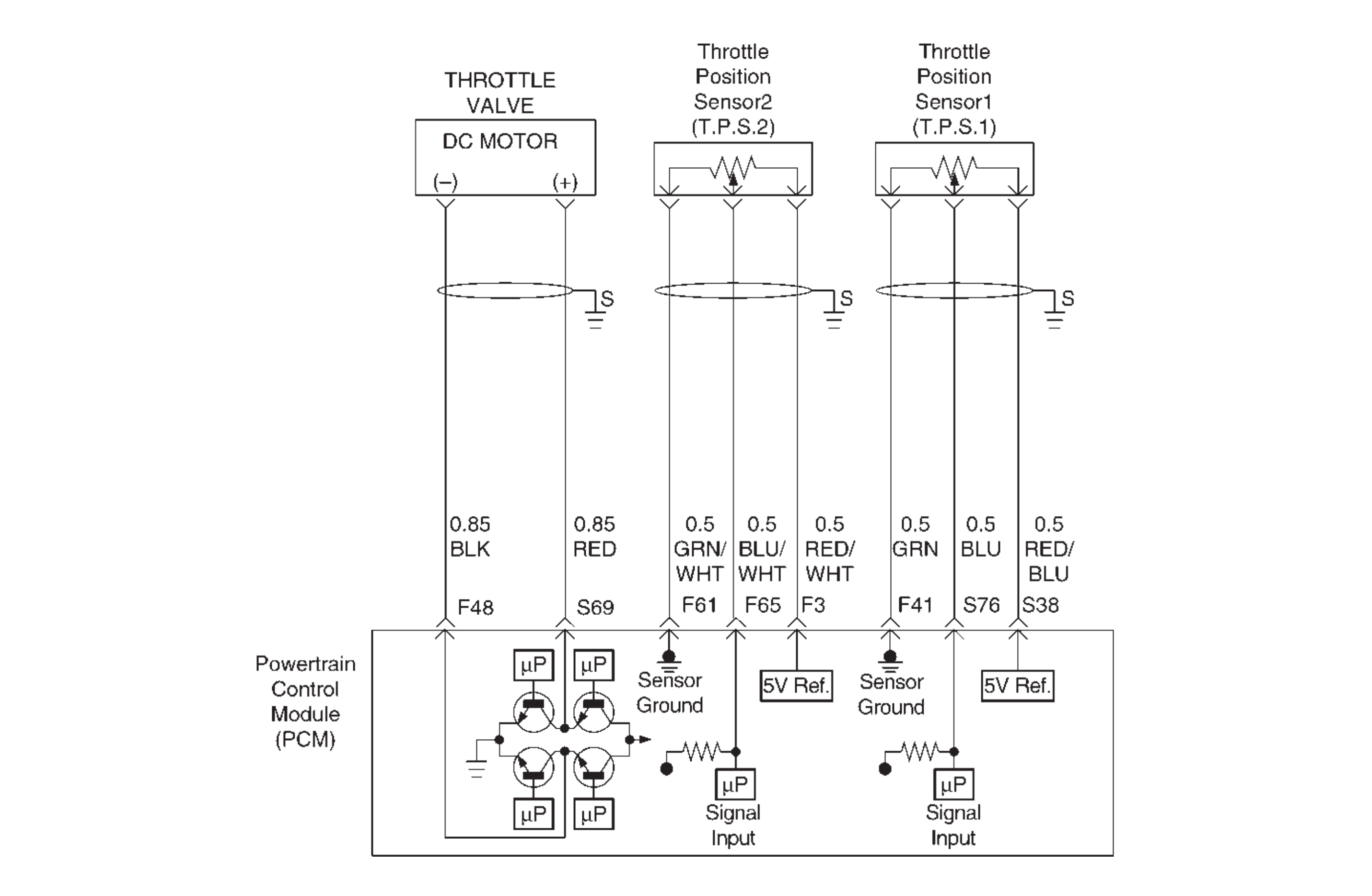
Number(s) below refer to the step number(s) on the Diagnostic Chart.

4. When the engine is idling or at steady cruise, the HO2S voltage should vary from between approximately 100 mV to 900 mV. It is possible to measure a satisfactory fuel pressure at idle even though the pressure may drop at high flow requirements. It may be necessary to watch fuel pressure at high engine load.
5. Wrap a shop towel around the fuel pressure connector to absorb any small amount of fuel leakage that may occur when installing gauge. Ignition “ON,” pump pressure should be 280-320 kPa.
7. Add Caution, Use correct pliers so damage to fuel lines will not occur.

DTC P1171 – Fuel System Lean During Acceleration

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any component-related DTCs set?	—	Go to component DTC charts	Go to *Step 3*
3	1. Check the vehicle’s fuel tank for an adequate amount of fuel. 2. Add fuel to the vehicle’s fuel tank if the tank is almost empty. Was fuel added to the vehicle’s fuel tank?	—	Go to *Step 4*	Go to *Step 5*
4	1. Place the transmission in park. 2. Using a Tech 2, observe HO2S 1 voltage while running warm engine 75°C-95°C (167°F-203°F) at 1200 RPM. 3. HO2S 1 voltage should vary within the specified range. 4. Quickly open the throttle halfway for a few seconds. Did the voltage suddenly rise toward the high end of the specified range?	100-900 mV	Go to *Fuel System Electrical Test*	Go to *Step 5*
5	1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure. 2. Install the fuel pressure gauge. 3. Start the engine and idle at normal operating temperature. 4. Disconnect the vacuum line going to the fuel pressure regulator. With the engine running, is the fuel pressure within the specified range?	280-325 kPa (41-46 psi)	Go to *OBD System Check*	Go to *Step 6*
6	Check for restricted fuel lines or restricted in-line filter. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Ignition “OFF.” 2. Remove the fuel pump relay and replace it with a fused jumper which will connect the relay’s battery terminal to the terminal leading to the fuel pump fuse. 3. While the fuel pump is operating, use pliers to slowly close the return line (do not exceed the first specified value). Using the pliers to restrict the return line, can the fuel pressure be manipulated to exceed the second specified value?	414 kPa (60 psi) 325 kPa (46 psi)	Go to *Diagnostic Aids*	Go to *Step 8*
8	Check for: • Faulty fuel pump • Restricted fuel pump strainer (sock) • Incorrect fuel pump • Incorrect fuel being used • Hot fuel Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1220 Throttle Position Senser2 (TPS2) Circuit Fault



D06RY00088

Circuit Description

- The throttle position (TP2) sensor circuit provides a voltage signal relative to throttle blade angle.

  The throttle blade angle will vary about 92 % at closed throttle to about 8 % at wide open throttle (WOT).

  This code detects a continuous short to ground or high in either the cicuit or the sensor.

Conditions for setting the DTC

- The Ignition is “ON”.
- The throttle blade angle is less than 2.5 % or more tnan 97.5 % for 18 failres within 500 test samples (15.6m sec).

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1120 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1120 can be cleared using the Tech2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- The MAP sensor shares a 5 Volt reference with the Fuel Tank Pressure.If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the Fuel Tank Pressure,the ECT sensor,and the Transmission Fluid
- Poor connection at PCM-Inspect harness connectors for backed out terminals,improper mating,broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK,observe the TP sensor display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1120 cannot be duplicated,the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently,performing the DTC P1120 Diagnostic Chart may isolate the cause of the fault.

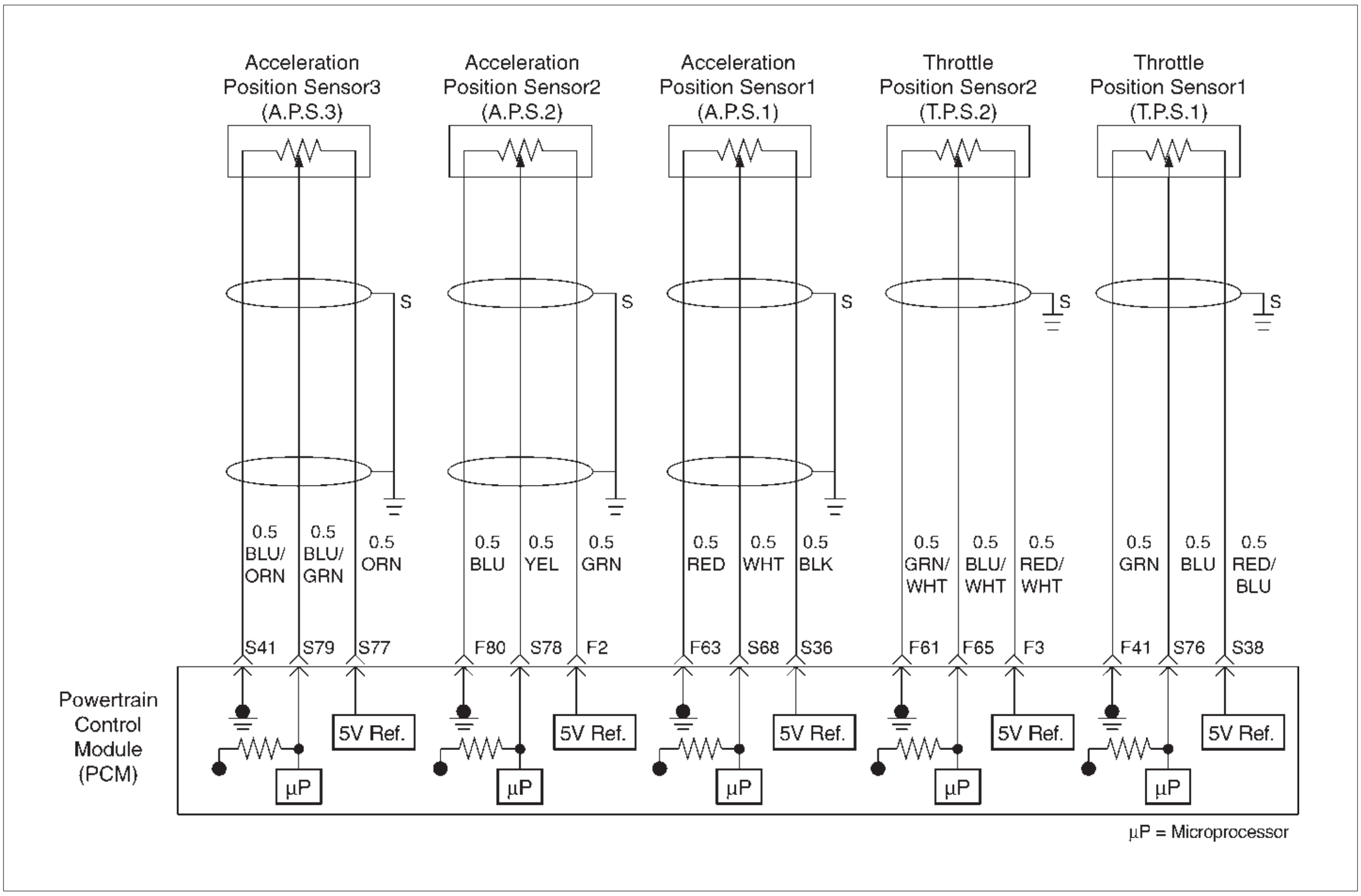
DTC P1220-TPS 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition “ON”, engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65 kPa	Go to *Step 4*	Go to *Step 7*
4	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to *Step 6*	Go to *Step 5*
5	1. Check the MAP signal circuit between the PCM and MAP ground circuit. 2. If the MAP signal circuit is open or shorted, repair as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 13*
6	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
7	Observe the TP angle reading on the Tech-2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 %	Refer to *Diagnostic Aids*	Go to *Step 8*
8	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	0V	Go to *Step 9*	Go to *Step 10*
9	1. Connect a test light between the 5Volt reference circuit and the TP2 sensor signal circuit at the TPsensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 12*	Go to *Step 11*

DTC P1220-TPS 2 Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP2 signal circuit for a short to voltage. 2. TP2 sensor ground circuit for high resistance between the PCM and the TP2 sensor. 3. TP2 sensor ground circuit for a poor connection. 4. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
11	Check the following items; 1. TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
12	Replace the TP sensor. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnosis Truble Code(DTC)
P1221 TPS1 – TPS2 correlation(Circuit Performance)



Circuit Description

- The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to DC motor coil in steps (%) to adjustment the valve into a passage in the throttle body to air flow.

  This method allows highly accurate control of engine speed and quick response to changes in engine load.
- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP1) will vary about 13% at idle position to about 87% at open throttle(WOT).

  APS signal is used to determine which DC will adjusting throttle position.

  After the APS signal has been processed by the PCM, it will command DC motor to allow a move of throttle position.
- Acceleration pedal – Check for objects blocking the AP sensor or pedal arm with spring, and excessive deposits in the acceleration pedal arm and on the acceleration pedal.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Visually/physically inspect for the following throttle valve conditions.

3.Visually/physically inspect for the following acceleration pedal conditions.

5.Check the following circuits for throttle valve and DC moter. Check the following TP sensor resistance and DC motor.

7.Check the following circuits for acceleration pedal. Check the following AP sensor resistance.

9.Following DTC: Software detect Error for ETC system.

10.Following DTC: Software detect Error for ETC system.

Diagnostic Aids

- An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the PCM harness and connector for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Throttle body – Check for objects blocking the DC motor or throttle bore, excessive deposits in the ETC passage and on the valve spring, and excessive deposits in the throttle bore and on the throttle valve plate.

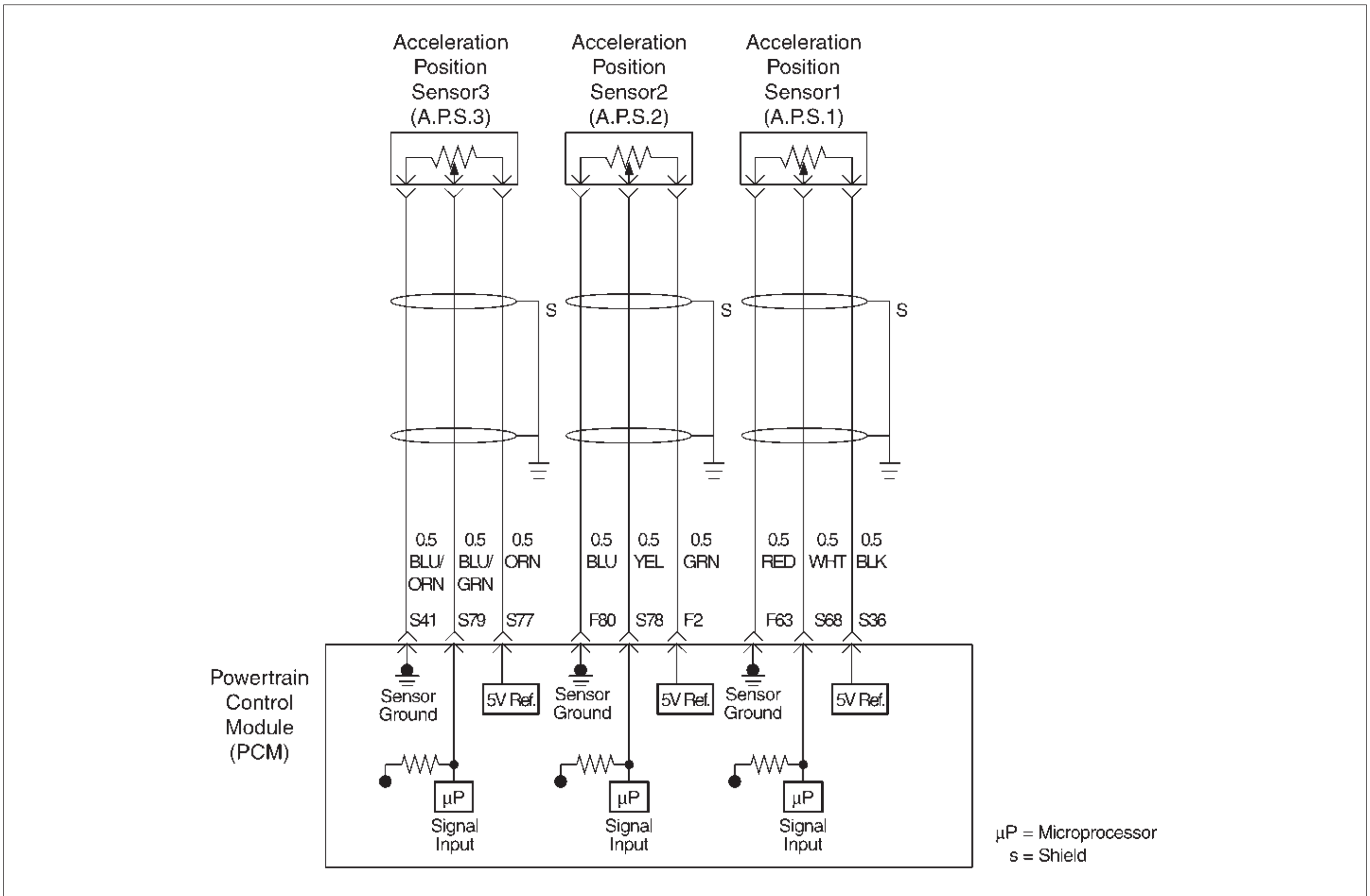
Diagnosis Truble Code(DTC)
P1221 TPS1 – TPS2 correlation(Circuit Perfoemance)

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check"performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Visually/physically inspect for the following conditions: ● Throttle body tampering. ● Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ● Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate. ● Throttle body with lever: Check for objects send round the throttle spring lever that lever is smooth movement, and spring lever has not excessive play Do any of the above require a repair?	—	Refer to *appropriate section for on–vehicle service*	Go to *Step 5*
4	Visually/physically inspect for the following conditions: ● Acceleration pedal tampering. ● Acceleration pedal : Check for objects blocking the spring or pedal arm. ● Acceleration pedal : Check for objects move the acceleration pedal that pedal is smooth movement, and acceleration pedal arm has not excessive play. Do any of the above require a repair?	—	Refer to *appropriate section for on–vehicle service*	Go to *Step 5*
5	1. Check for a poor connection at the throttle body harness connector. 2. Check for a poor connection at the acceleration position sensor harness connector. 3. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
6	1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: Throttle position sensor 1 circuit. Throttle position sensor 2 circuit. Throttle DC motor circuit. Throttle position sensor resistance. Throttle DC motor resistance. 2. If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 1–7kΩ SIG-DND change resistance 0.3 – 100Ω	Verify repair	Go to *Step 7*

Diagnosis Truble Code(DTC)
P1221 TPS1 – TPS2 correlation(Circuit Perfoemance) (Cont'd)

Step	Action	Value(s)	Yes	No
7	Replace the throttle valve. Is the action complete?	—	Go to *Step 4*	—
8	1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: ● Acceleration position sensor 1 circuit. ● Acceleration position sensor 2 circuit. ● C position sensor 3 circuit. ● V position sensor resistance. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	Replace the acceleration position sensor. Is the action complete?	—	Go to *Step 10*	—
10	Following below the DTCs stored: P1125, P1290, P1295, P1299	—	Go to *applicable DTC table*	Go to *Step 11*
11	Following below the DTCs stored: P1514, P1515, P1516, P1523, P1271, P1272, P1273	—	Go to *applicable DTC table*	Go to *Step 12*
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1271 APS 1– 2 Correlation Error



D06RY00075

Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP1) will vary about 13 % at idle position to about 87 % at wide open throttle(WOT).

  This code detects a correlation error between APS1 and APS2.

Conditions for setting the DTC

- The Ignition is “ON”.
- The acceleration pedal angle difference is less than 4.5 % between ASP1 and APS2 for 50 counts within 50 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1271 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1271 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 1, APP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1271 cannot be duplicated,the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTCP1271 Diagnostic Chart may isolate the cause of the fault.

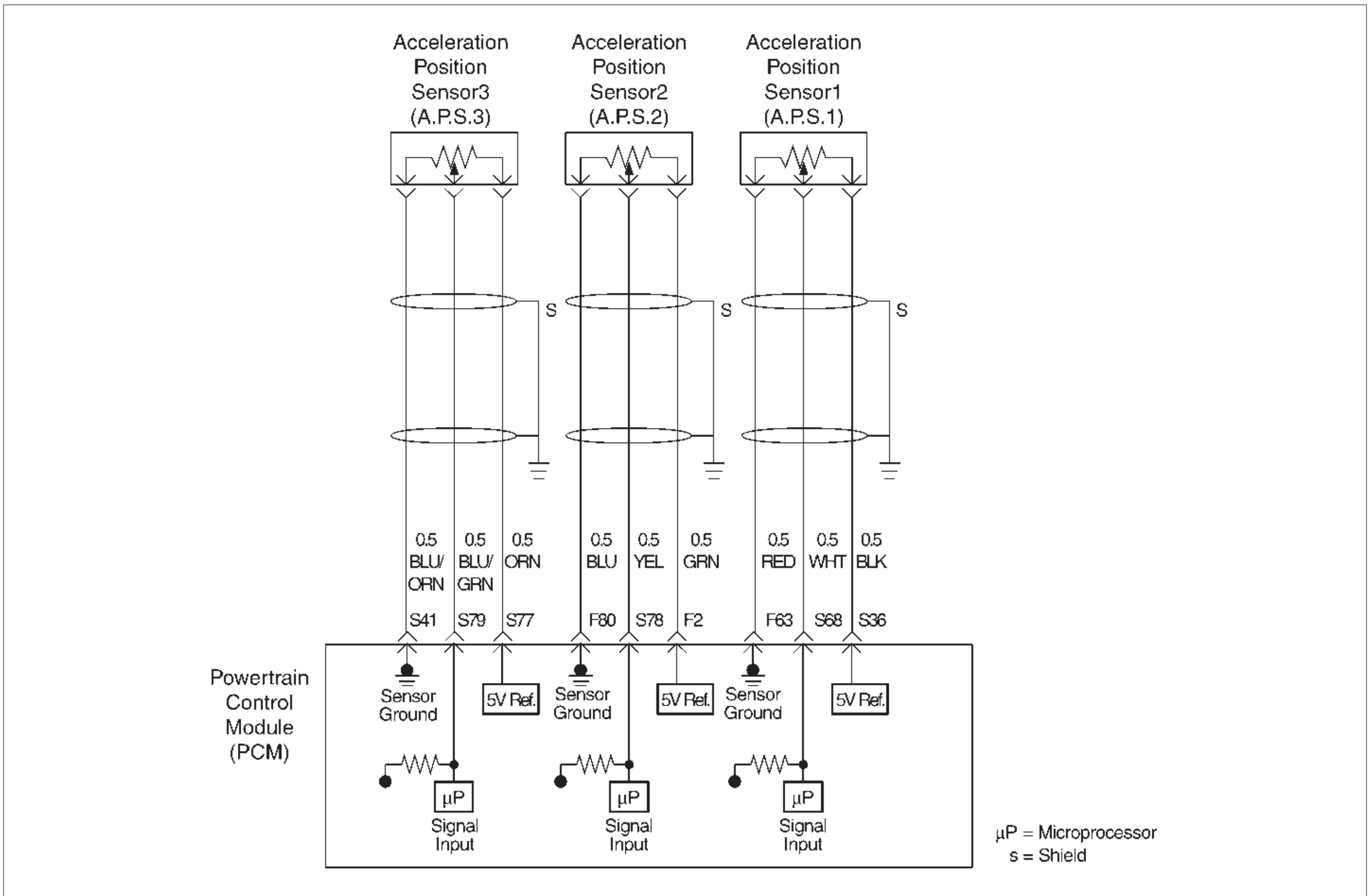
DTC P1271 – APS 1– 2 Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position APP sensor 1 =13 % APP sensor 2 =85 ~ 89 % Wide open throttle APP sensor 1 =85 ~ 89 % APP sensor 2 =11 ~ 15 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP sensor signal circuit at the AP1, AP2 sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP1and AP2 signal circuit for a short to voltage. 2. AP1and AP2 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1and AP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1and AP2 signal circuit or 5 volge supply circuit for a poor connection. 2. AP1and AP2 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP1 and AP2 sensor. 3. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—

DTC P1271 – APS 1– 2 Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released ornot. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1272 APS 2 – 3 Correlation Error



D06RY00075

Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP2) will vary about 87 % at idle position to about 13 % at wide open throttle (WOT).

  This code detects a correlation error betweenAPS2 and APS3.

Conditions for setting the DTC

- The Ignition is "ON".
- The acceleration pedal angle difference is less than 4.5 % between ASP2 and APS3 for 50 counts within 50 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1272 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1272 can be cleared using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals,improper mating,broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 2, APP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1272 cannot be duplicated, the information includedin the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC

P1272 Diagnostic Chart may isolate the cause of the fault.

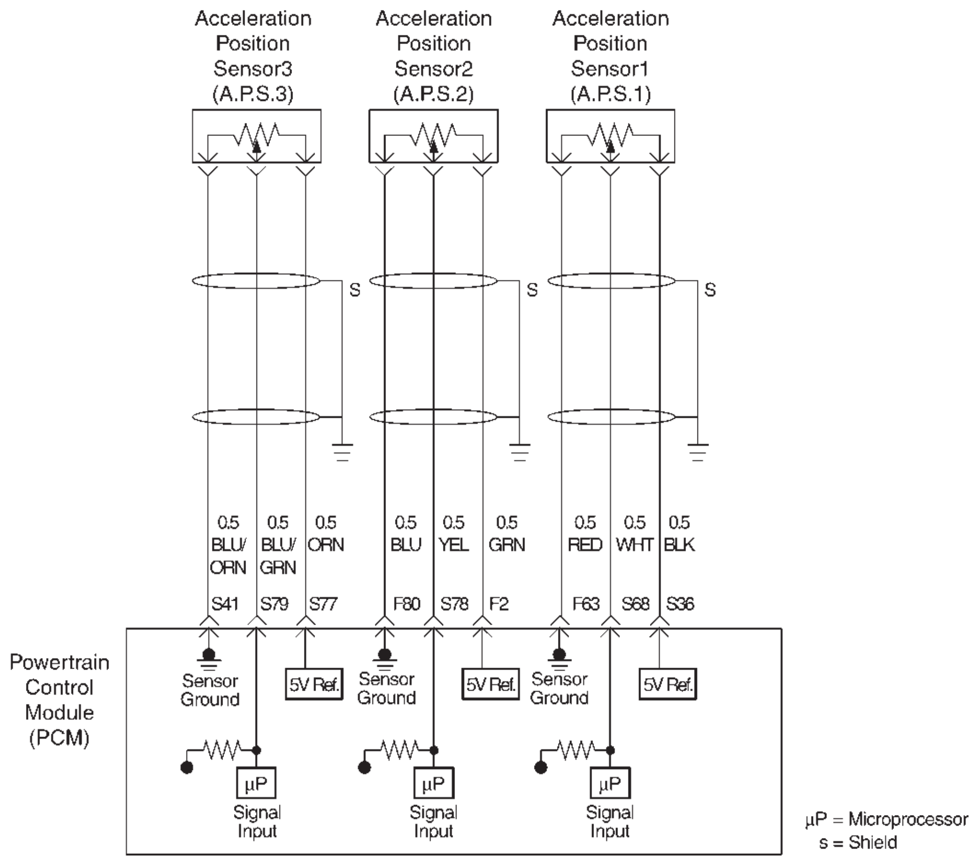
DTC P1272 – APS 2 – 3 Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idleposition APP sensor 2 =86 ~ 88 % APP sensor 3 =86 ~ 88 % Wide open throttle APP sensor 2 =12 ~ 14 % APP sensor 3 =32 ~ 36 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP sensor signal circuit at the AP2 and AP3 sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 6*	Go to *Step 8*
6	Check the following items; 1. AP2 and AP3 signal circuit for a short to voltage. 2. AP2 and AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP2 and AP3 sensor ground circuit for a poor connection. 4. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP2 and AP3 signal circuit or 5 volge supply circuit for a poor connection. 2. AP2 and AP3 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP2 and AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—

DTC P1272 – APS 2 – 3 Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1273 APS 1 – 3 Correlation Error



D06RY00075

Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP1) will vary about 13 % at idle position to about 87 % at wide open throttle (WOT).

  This code detects a correlation error between APS1 and APS3.

Conditions for setting the DTC

- The Ignition is “ON”.
- The acceleration pedal angle difference is less than 4.5 % between ASP1 and APS3 for 50 counts within 50 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1273 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1273 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK,observe the APP sensor 1, APP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1273 cannot be duplicated,the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently,performing the DTC

P1273 Diagnostic Chart may isolate the cause of the fault.

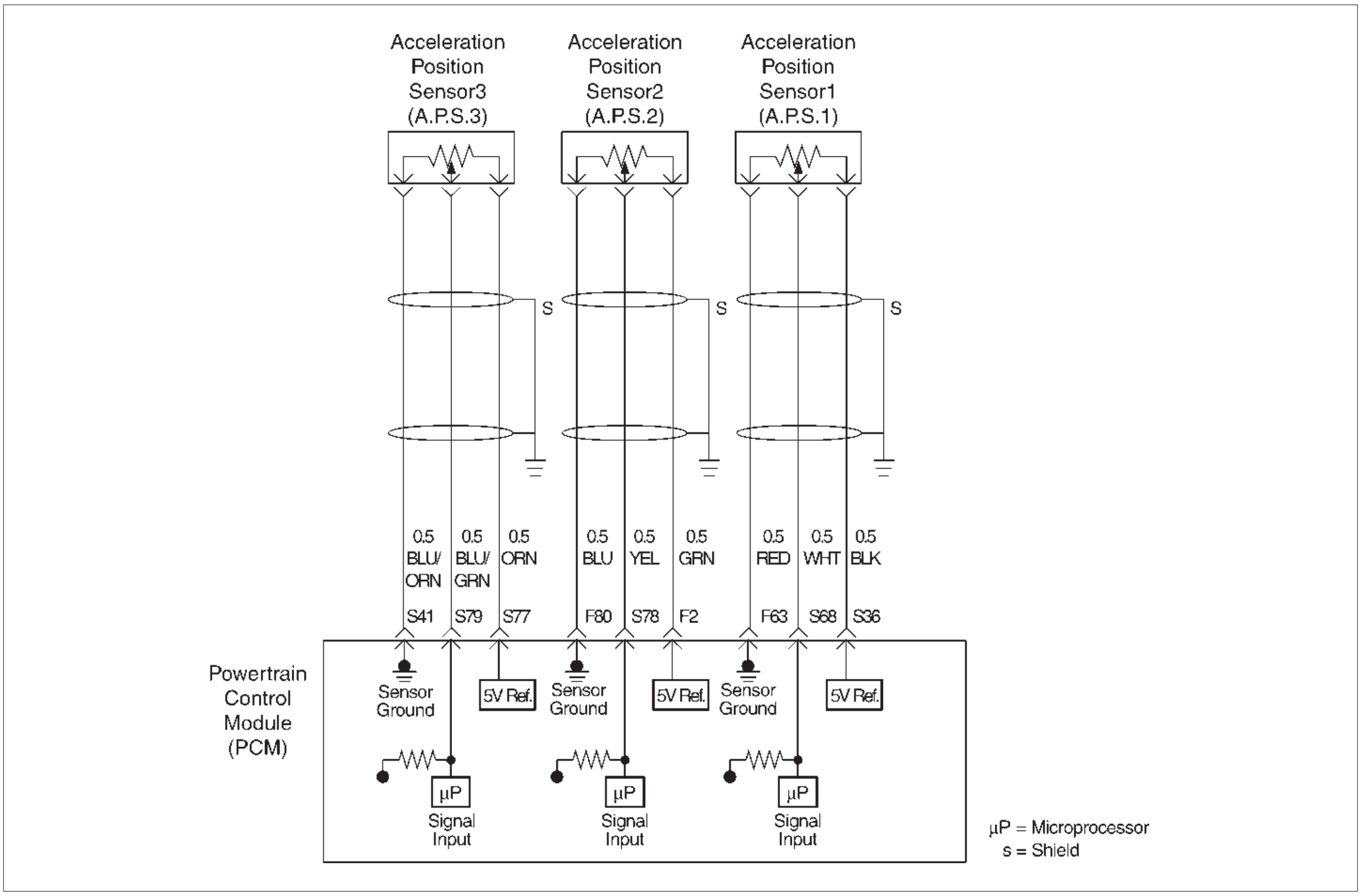
DTC P1273 – APS 1 – 3 Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idleposition APP sensor 1 =13 % APP sensor 3 =85 ~ 89 % Wide open throttle APP sensor 1 =85 ~ 89 % APP sensor 3 =32 ~ 36 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP sensor signal circuit at the AP1 and AP3 sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP1 and AP3 signal circuit for a short to voltage. 2. AP1 and AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1 and AP3 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1 and AP3 signal circuit or 5 volge supply circuit for a poor connection. 2. AP1 and AP3 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP1 and AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—

DTC P1273 – APS 1 – 3 Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released ornot. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1275 APS 1 Circuit Fault



D06RY00075

Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP1) will vary about 13 % at idle position to about 87 % at wide open throttle (WOT).

  This code detects a continuous short to ground or high in either the cicuit or the sensor.

Conditions for setting the DTC

- The Ignition is “ON”.
- The acceleration pedal angle is less than 2.5 % or more than 97 % for 12 counts within 500 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will store condition which werepresent when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1275 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1275 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK,observe the APP sensor 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1275 cannot be duplicated,the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

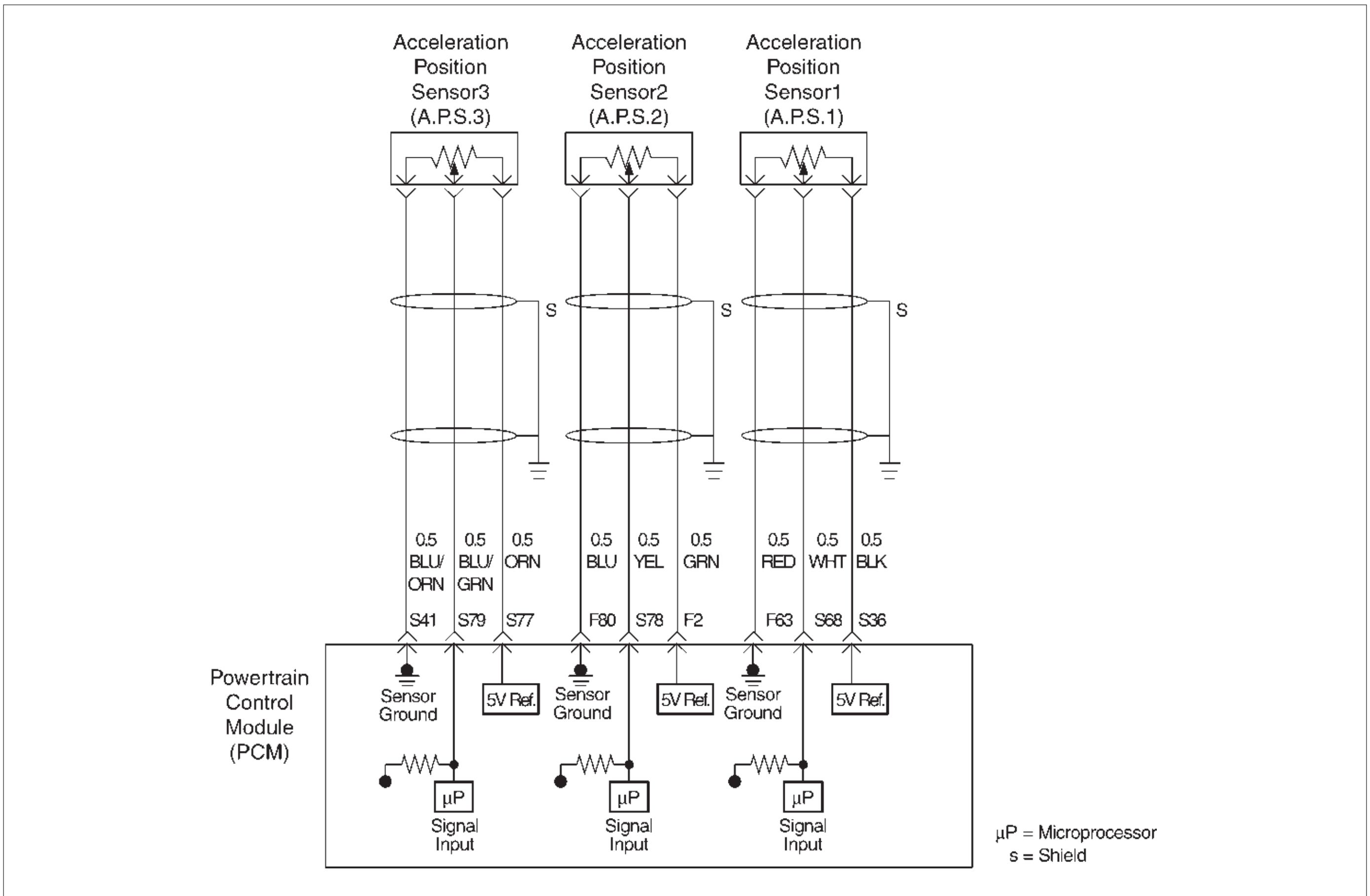
  If it is determined that the DTC occurs intermittently, performing the DTC

P1275 Diagnostic Chart may isolate the cause of the fault.

DTC P1275 – APS 1 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position =12 ~ 14 % Wide open throttle =86 ~ 88 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP1 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP1 signal circuit for a short to voltage. 2. AP1 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1 sensor ground circuit for a poor connection. 4. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1 signal circuit or 5 volge supply circuit for a poor connection. 2. AP1 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP1 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1280 APS 2 Circuit Fault



D06RY00075

Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP2) will vary about 87 % at idle position to about 13 % at wide open throttle(WOT).

  This code detects a continuous short to ground or high in either the cicuit or the sensor.

Conditions for setting the DTC

- The Ignition is “ON”.
- The acceleration pedal angle is less than 2.5 % or more than 97 % for 12 counts within 500 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1280 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1280 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1280 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

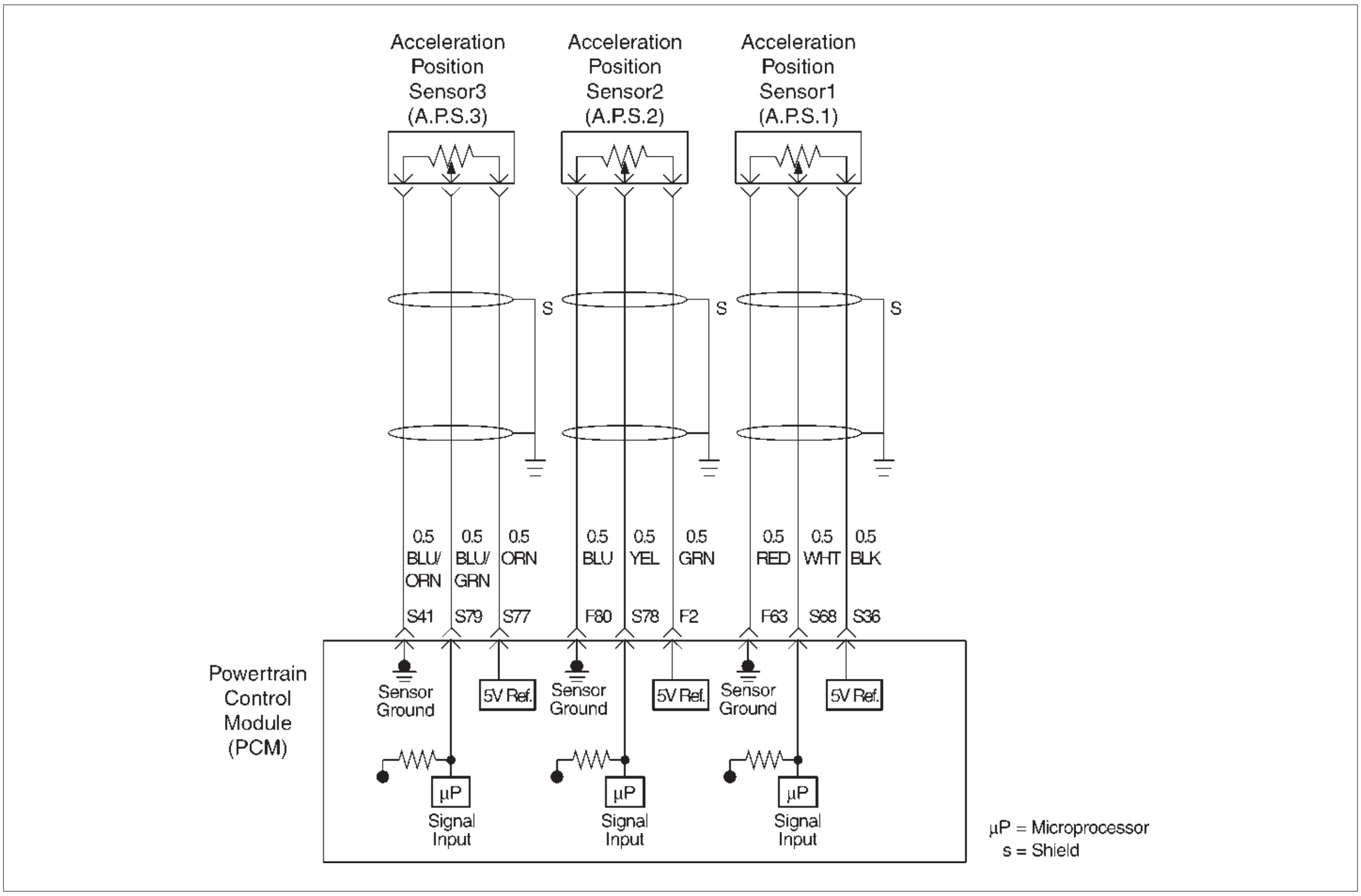
  If it is determined that the DTC occurs intermittently, performing the DTC

P1280 Diagnostic Chart may isolate the cause of the fault.

DTC P1280 - APS 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position =86 ~ 88 %Wide open throttle =12 ~ 14 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP2 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP2 signal circuit for a short to voltage. 2. AP2 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP2 signal circuit or 5 volge supply circuit for a poor connection. 2. AP2 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed.Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1285 APS 3 Circuit Fault



D06RY00075

Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP3) will vary about 87 % at idle position to about 34 % at wide open throttle(WOT).

  This code detects a continuous short to ground or high in either the circuit or the sensor.

Conditions for setting the DTC

- The Ignition is “ON”.
- The acceleration pedal angle is less than 2.5 % or more than 97 % for 12 counts within 500 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1285 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1285 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1285 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

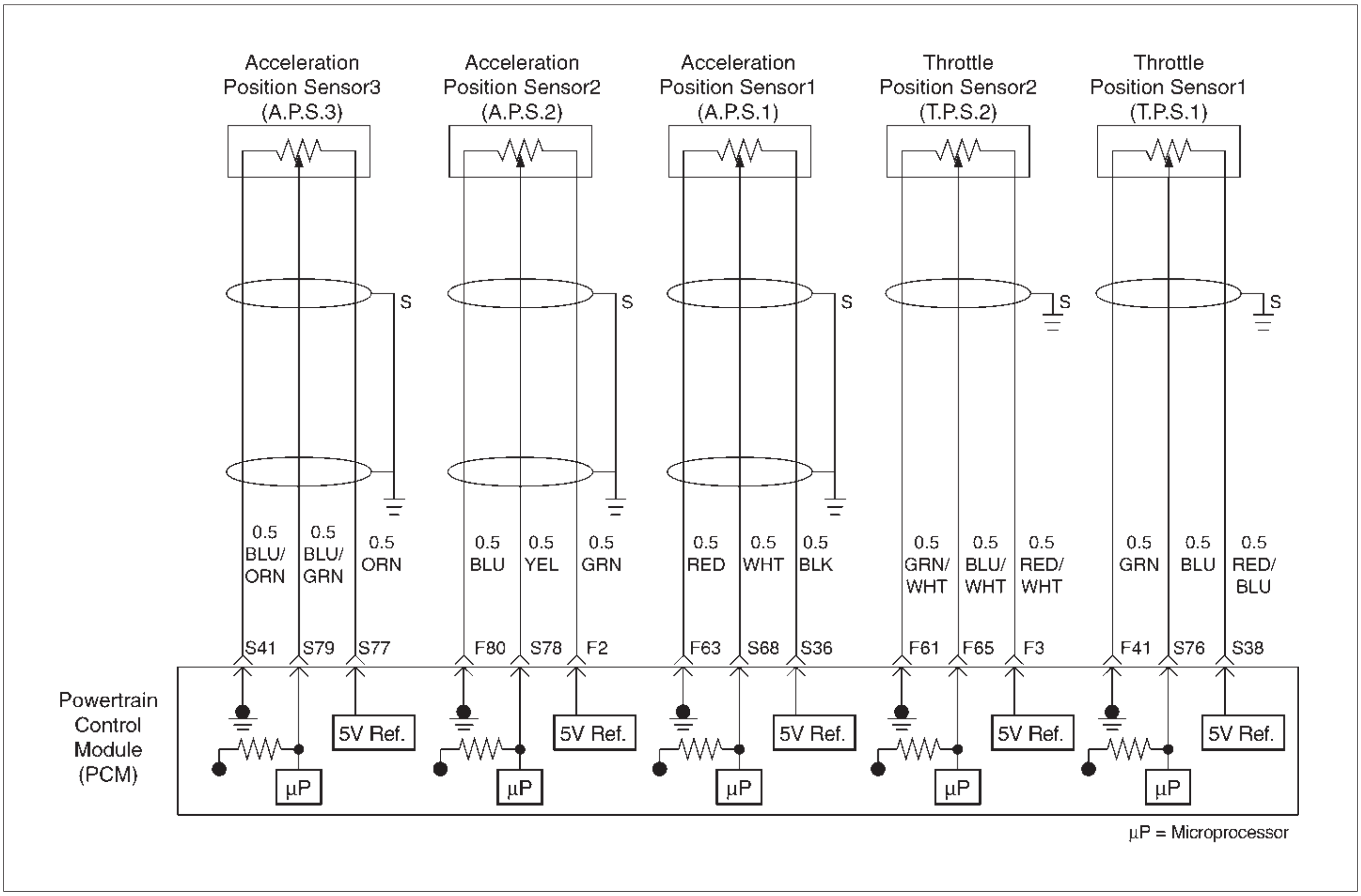
  If it is determined that the DTC occurs intermittently, performing the DTC

P1285 Diagnostic Chart may isolate the cause of the fault.

DTC P1285 – APS 3 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position =86 ~ 88 %Wide open throttle =32 ~ 36 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP3 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP3 signal circuit for a short to voltage. 2. AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP3 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP3 signal circuit or 5 volge supply circuit for a poor connection. 2. AP3 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released ornot. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1290 ETC Forced Idle Mode



D06RY00157

Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP1) will vary about 13 % at idle position to about 87 % at wide open throttle (WOT).

  This code detects that if the systm is in Forced Idle Mode. (Fail safe Mode)

Conditions for setting the DTC

- The Ignition is “ON”.
- Forced Idle Mode is active. (Fail safe Mode)

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1290 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1290 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 1, APP sensor 2, APP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1290 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC

P1290 Diagnostic Chart may isolate the cause of the fault.

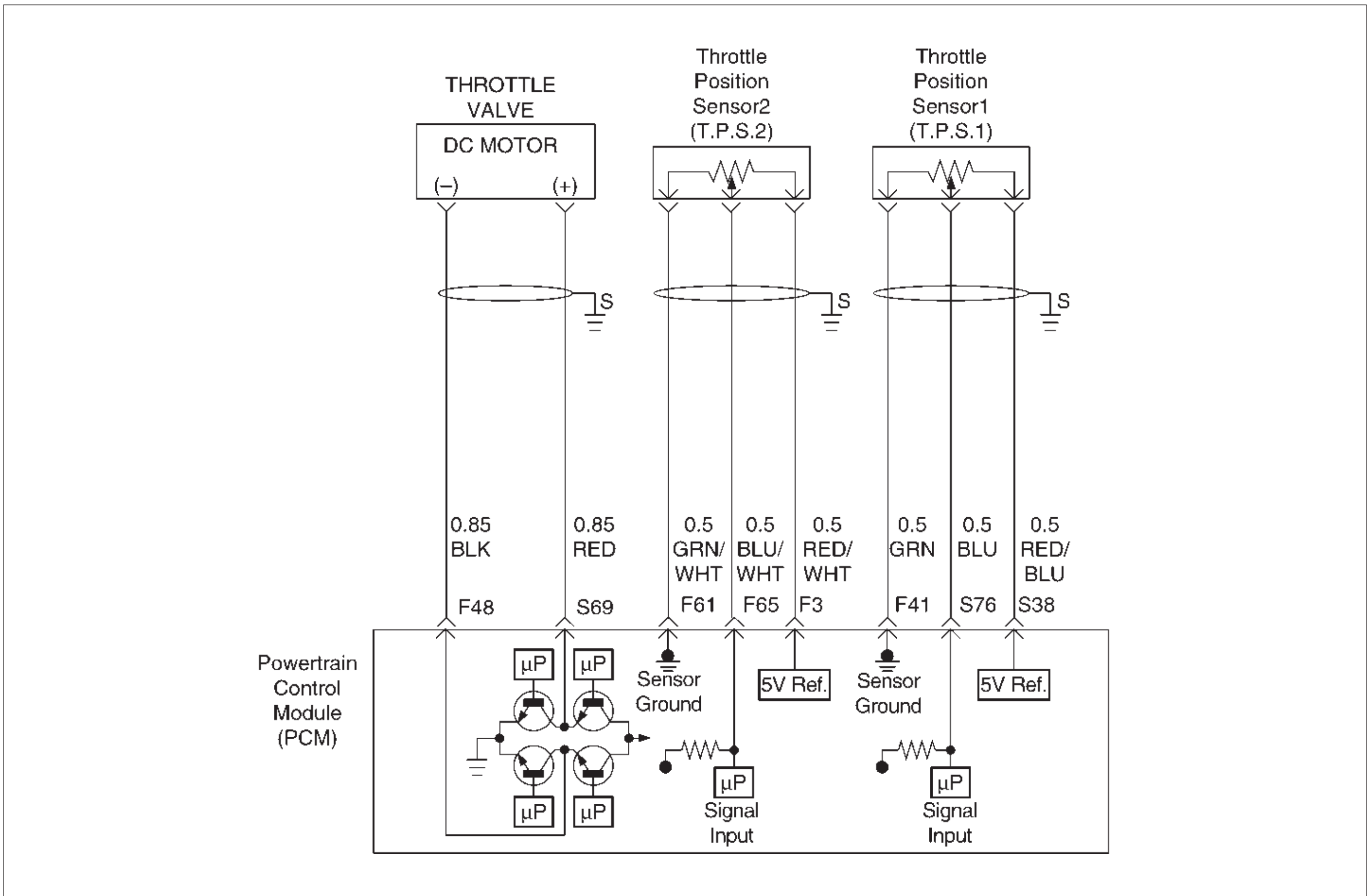
DTC P1290 - ETC Forced Idle Mode

Step	Action	Value(s)	Yes	No
1	Was the “On - Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position APP sensor 1 =12 ~ 14 % APP sensor 2, 3 =86 ~ 88 % Wide open throttle APP sensor 1 =86 ~ 88 % APP sensor 2 =12 ~ 14 % APP sensor 3 =32 ~ 36 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP1, AP2 and AP3 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP1,AP2 and AP3 signal circuit for a short to voltage. 2. AP1, AP2 and AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1, AP2 and AP3 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1, AP2 and AP3 signal circuit or 5 volge supply circuit for a poor connection. 2. AP1, AP2 and AP3 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP1, AP2 and AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*

DTC P1290 - ETC Forced Idle Mode (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1295 Power Management Mode



D06RY00088

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary about 8 % at closed throttle to about 92 % at wide open throttle (WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain Control Module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations.

  A large quantitiy of air entering the engine indicates an accleration or high load situation, while a small quantity or air indicates deceleration or idle.

  The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load.
- This DTC ditects that if the systm is in PowerManagement Mode.(Fail safe Mode)

Conditions for setting the DTC

- The ignition is “ON”.
- Power Management Mode is active. (Fail safe Mode)

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1295 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1295 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken

locks, improperly formed or damaged terminals,and poor terminal to wire connection.

- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault.If DTC P1295 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P1295 Diagnostic Chart may isolate the cause of the fault.

DTC P1295 - Power Management Mode

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P1295. Does the Tech 2 indicate DTC P1295 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 99 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 %	Go to *Step 9*	Go to *Step 5*
5	1. Ignition “OFF.” 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100 Ω	Go to *Step 6*	Go to *Step 8*
6	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the throttle valve assembly. Was a problem found?		Verify repair	Go to *Step 8*
8	Replace the DC motor. (Replace the Throttle valve assembly) Is the action complete?	—	Verify repair	Go to *Step 7*
9	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 10*	Go to *Step 11*

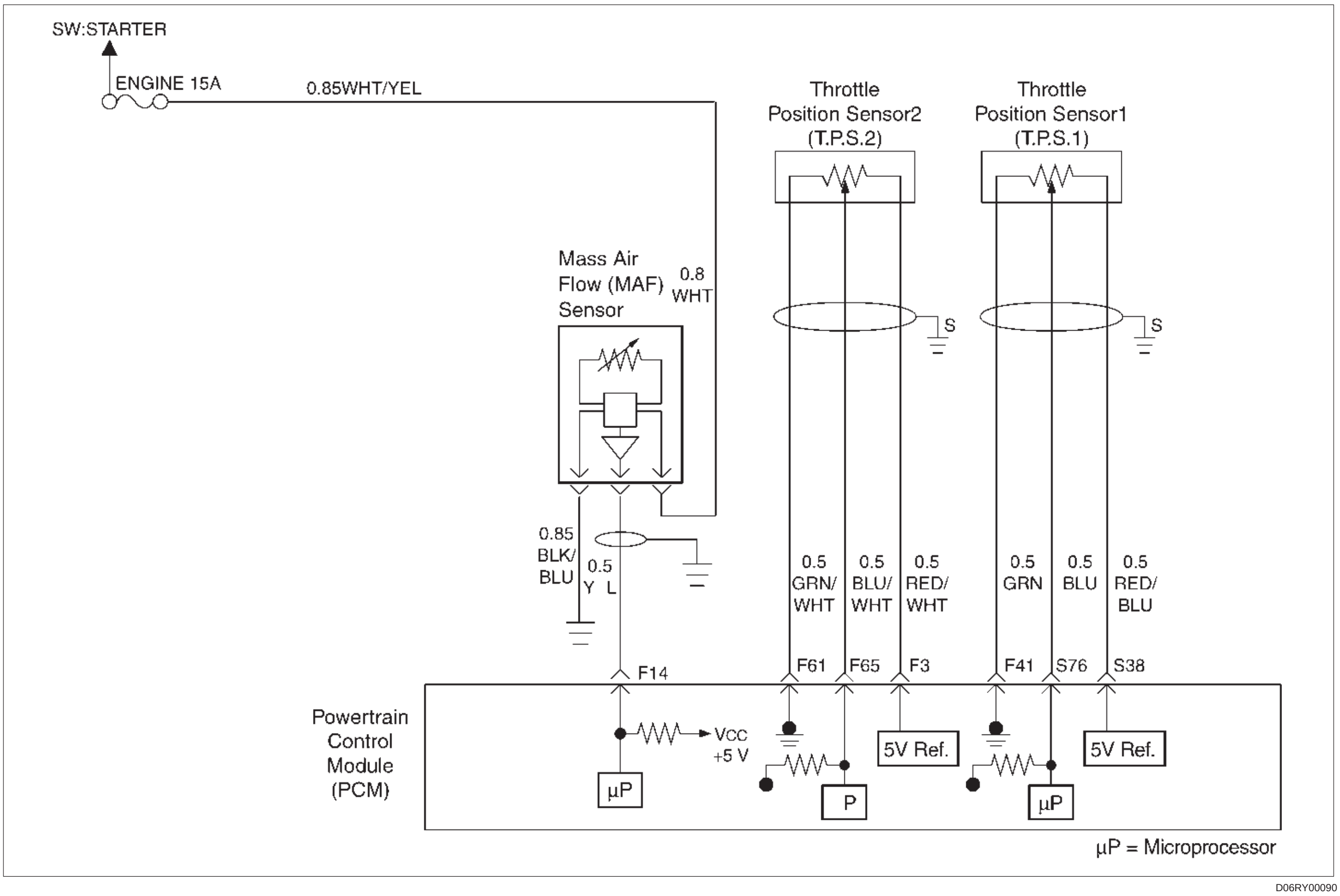
DTC P1295 - Power Management Mode (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Connect a test light between the 5Volt reference "A"circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 13*	Go to *Step 12*
11	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
12	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
13	Replace the TP sensor. Is the action complete?	—	Verify repair	—
14	1. Start the engine. 2. With the engine idling, monitor "MAF Frequency" display on the Tech 2. Is the "MAF Frequency" below the specified value?	6 ~ 10 g/s	Go to *Step 15*	Go to *Step 18*
15	1. Ignition "OFF." 2. Disconnect the MAF sensor connector. 3. Ignition "ON," engine idling. 4. Using a Tech 2, monitor "MAF Frequency." Does the Tech 2 indicate a "MAF Frequency" at the specified value?	0g/s	Go to *Step 16*	Go to *Step 17*
16	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 19*
17	1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors). 2. If incorrect routing is found, correct the harness routing. Was a problem found?	—	Verify repair	Go to *Step 17*
18	1. With the engine idling, monitor "MAF Frequency." display on the Tech 2. 2. Quickly snap open throttle to wide open throttle while under a road load and record value. Does the Tech 2 indicate a "MAF Frequency" at thespecified value?	6 ~ 10 g/s	Go to *Step 16*	Go to *Step 19*

DTC P1295 - Power Management Mode (Cont'd)

Step	Action	Value(s)	Yes	No
19	1. Ignition "ON",engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65kPa	Go to *Step 20*	Go to *Step 23*
20	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value? (If no, start with diagnosis chart forother sensors in the circuit and see if 5V returns.)	—	Go to *Step 22*	Go to *Step 21*
21	1. Check the MAP signal circuit between the PCM and MAP grund circuit. 2. If the MAP signal circuit is open or shoted, repair it as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 23*
22	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
23	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin.Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1299 ETC Forced Engine Shutdown Mode



Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary about 8% at closed throttle to about 92% at wide open throttle(WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain Control Module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A laege quantitiy of air entering the engine indicates an accleration or high load situation, while a small quantity or air indicates deceleration or idle.

  The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load.
- This DTC ditects if the system is in ECT Forced Engine Shutdown Mode.(Fail safe Mode)

Conditions for setting the DTC

- The ignition is “ON”.
- ECT Forced Engine Shutdown Mode is active. (Fail safe Mode)

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1299 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1299 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech 2 while

moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1299 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1299 Diagnostic Chart may isolate the cause of the fault.

DTC P1299 - ETC Forced Engine Shutdown Mode

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 %	Go to *Step 8*	Go to *Step 4*
4	1. Ignition “OFF.” 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100Ω	Go to *Step 5*	Go to *Step 7*
5	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
6	Check the throttle valve assembly. Was a problem found?		Verify repair	Go to *Step 7*
7	Replace the DC motor. (Replace the Throttle valve assembly) Is the action complete?	—	Verify repair	Go to *Step 8*
8	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 9*	Go to *Step 10*
9	1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. .Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 12*	Go to *Step 11*

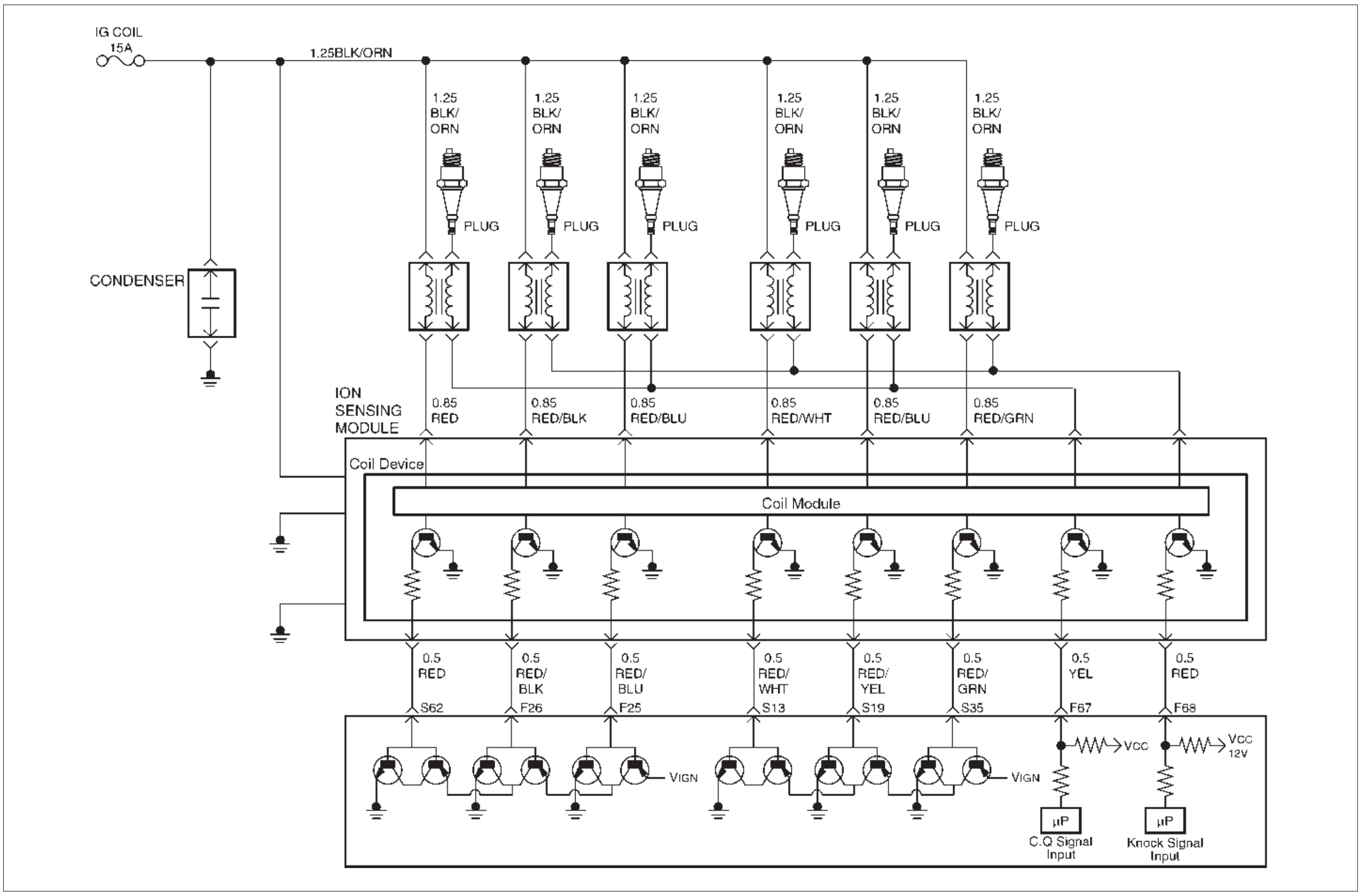
DTC P1299 - ETC Forced Engine Shutdown Mode (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
11	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
12	Replace the TP sensor. Is the action complete?	—	Verify repair	—
13	1. Start the engine. 2. With the engine idling, monitor "MAF Frequency" display on the Tech 2. Is the "MAF Frequency" below the specified value?	6 ~ 10 g/s	Go to *Step 16*	Go to *Step 17*
14	1. Ignition "OFF." 2. Disconnect the MAF sensor connector. 3. Ignition "ON," engine idling. 4. Using a Tech 2, monitor "MAF Frequency." Does the Tech 2 indicate a "MAF Frequency" at the specified value?	0g/s	Go to *Step 15*	Go to *Step 16*
15	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 18*
16	1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors). 2. If incorrect routing is found, correct the harness routing. Was a problem found?	—	Verify repair	Go to *Step 16*
17	1. With the engine idling, monitor "MAF Frequency." display on the Tech 2. 2. Quickly snap open throttle to wide open throttle while under a road load and record value. Does the Tech 2 indicate a "MAF Frequency" at the specified value?	6 ~ 10 g/s	Go to *Step 15*	Go to *Step 18*
18	1. Ignition "ON",engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65kPa	Go to *Step 19*	Go to *Step 22*

DTC P1299 - ETC Forced Engine Shutdown Mode (Cont'd)

Step	Action	Value(s)	Yes	No
19	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference "A" circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?(If no, start with diagnosis chart for other sensors in the circuit and see if 5Vreturns.)	—	Go to *Step 21*	Go to *Step 20*
20	1. Check the MAP signal circuit between the PCM and MAP ground circuit. 2. If the MAP signal circuit is open or shorted ,repair it as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 22*
21	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1310 ION Sensing Module Diagnosis



D06RY00067

Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine operating conditions.

- The Deceleration Fuel Cut Off (DFCO) test is performed to evaluate the Combustion Quality (CQ) signal pulse width if it is below a predetermined value, the value it is expected to be during DFCO conditions. If the CQ signal pilse width is above the predetermined threshold, the fail counter will be incremented. If the failure counter exceeds the calibration, then the test is conplete and a failure will be reported.
- The Power Enrichment (PE) test is performed to evaluate the Combustion Quality (CQ) signal pulse width if it is below a predetermined value, the value it is expected to be during PE conditions.

  If the CQ signal pulse width is above the predetermined threshold, the fail counter will be incremented. If the failure counter exceeds the calibration, then the test is complete and a failure will be reported.
- The Combustion Quality (CQ) test is performed to check if inappropriate (CQ) signal status were detected. If missing CQ pulses or multiple CQ pulses or CQ pulse width calculation errors were detected, the fail counter will be incremented. If the failure counter exceeds the calibration, then the test is complete and a failure will be reported.

Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- MAP sensor signal is between 26kPa and 100 kPa.
- Fuel level is more than 10%.
- Engine speed is between 650rpm and 6500rpm.
- No Crank DTCs set.
- No System voltage DTCs set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1310 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1310 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.

- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1310 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1310 Diagnostic Chart may isolate the cause of the fault.

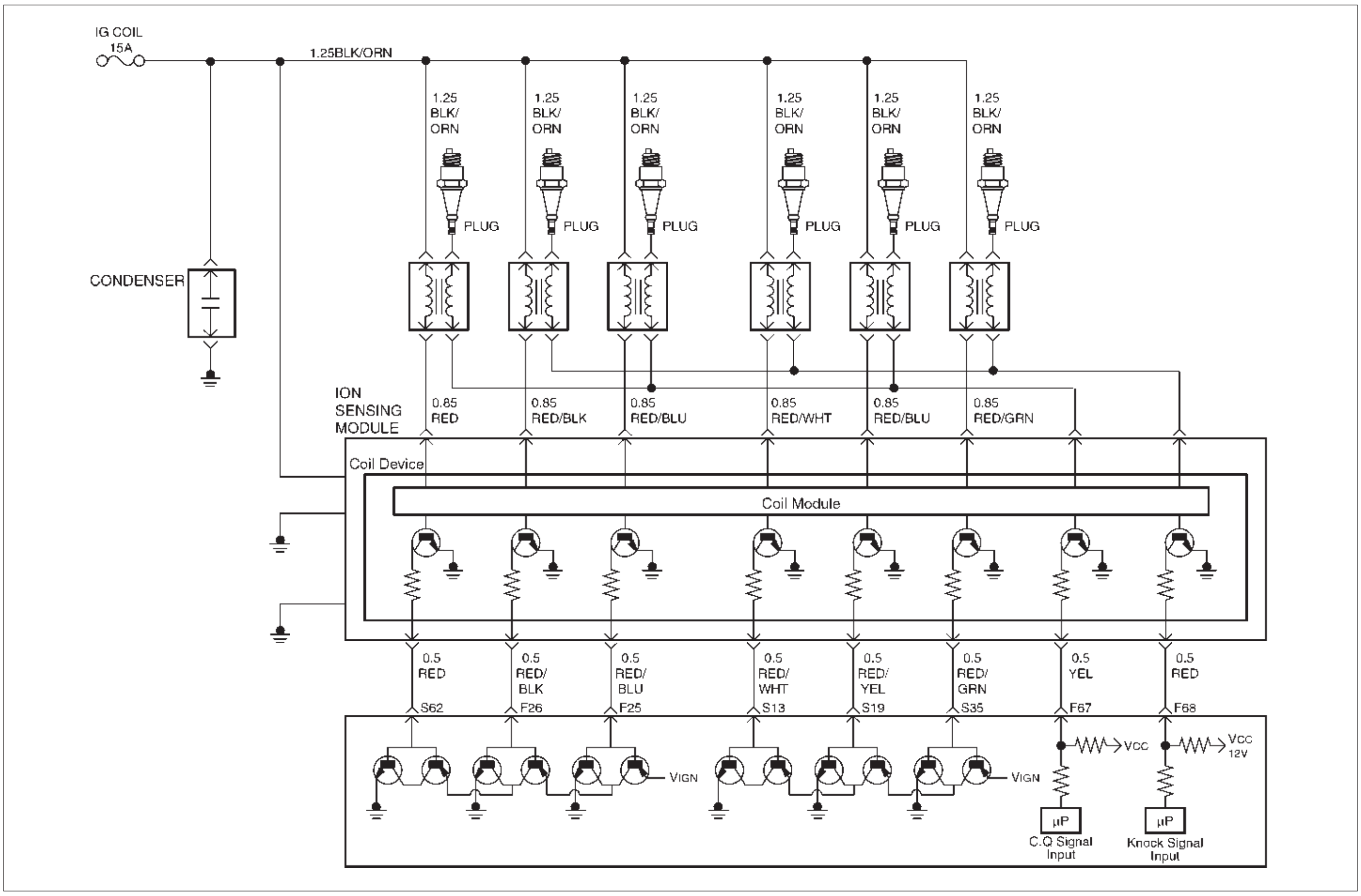
DTC P1310 - ION Sensing Module Diagnostic

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P1310. Does the Tech 2 indicate DTC P1310 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition “OFF.” 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing harness between the PCM and ION Sensing module circuit harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing harness between the ignition coil and ION Sensing module circuit at the ION Sensing Module harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 10*

DTC P1310 - ION Sensing Module Diagnostic (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1311 ION Sensing Module SEC line 1 Circuit Fault



D06RY00067

Circuit Description

- The Power Control Module (PCM) will compara the secondary current reading to a predetermined maximum and minimum thresholds.

  If the secondary current signal pulse width is out of the predetermined renge, the fail counter will be incremented. If the failure counter exceeds the calibration, then the PCM is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the PCM is complete and pass will be reported.

  This PCM will detect an open/short circuit in the secondary current sense input circuit, misfire on the entire bank for the secondary current sense input circuit, coil failure, and same internal Ignition Current Sense System (ICSS) module faults.

Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- MAP sensor signal is between 26kPa and 100 kPa.
- Fuel level is more than 10%.
- Engine speed is between 650rpm and 6500rpm.
- ION Sensing Module circuit is open or shorted signals on the SEC 1 line.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1311 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1311 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.
- A change in the display will indicate the location of the fault. If DTC P1311 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.
- If it is determined that the DTC occurs intermittently, performing the DTC P1311 Diagnostic Chart may isolate the cause of the fault.

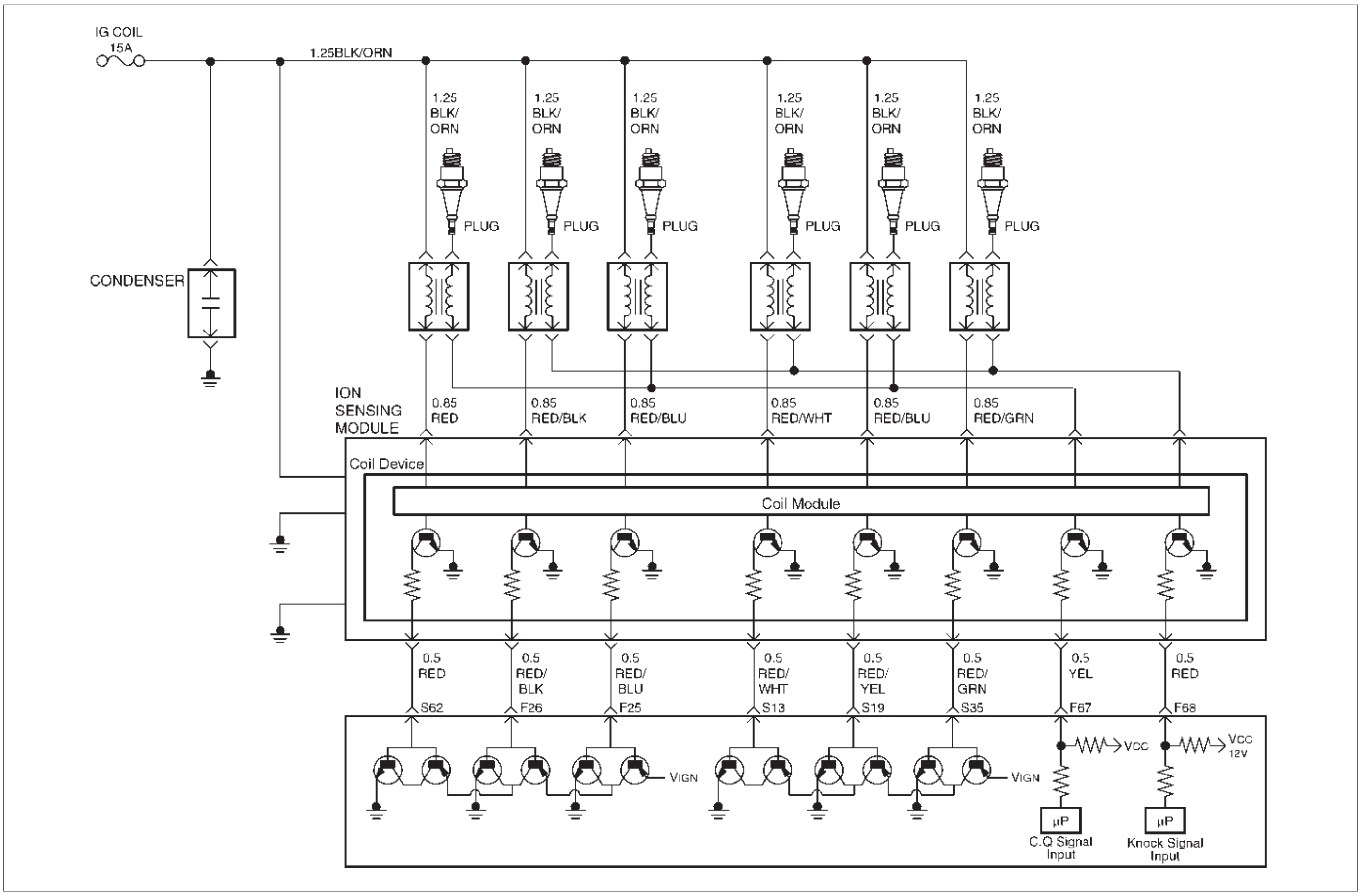
DTC P1311 - ION Sensing Module SEC line 1 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P1311. Does the Tech 2 indicate DTC P1311 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition “OFF.” 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing module harness between the PCM and ION Sensing module circuit at the ION Sensing module harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing module harness between the ignition coil and ION Sensing module circuit at the SEC line 1 harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*

DTC P1311 - ION Sensing Module SEC line 1 Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 10*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1312 ION Sensing Module SEC line 2 Circuit Fault



D06RY00067

Circuit Description

- The Power Control Module (PCM) will compara the secondary current reading to a predetermined maximum and minimum thresholds.

  If the secondary current signal pulse width is out of the predetermined renge, the fail counter will be incremented. If the failure counter exceeds the calibration, then the PCM is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the PCM is complete and pass will be reported.

  This PCM will detect an open/short circuit in the secondary current sense input circuit, misfire on the entire bank for the secondary current sense input circuit, coil failure, and same internal Ignition Current Sense System (ICSS) module faults.

Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- MAP sensor signal is between 26kPa and 100 kPa.
- Fuel level is more than 10%.
- Engine speed is between 650rpm and 6500rpm.
- ION Sensing Module circuit is open or shorted signals on the SEC 2 line.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1312 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1312 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1312 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1312 Diagnostic Chart may isolate the cause of the fault.

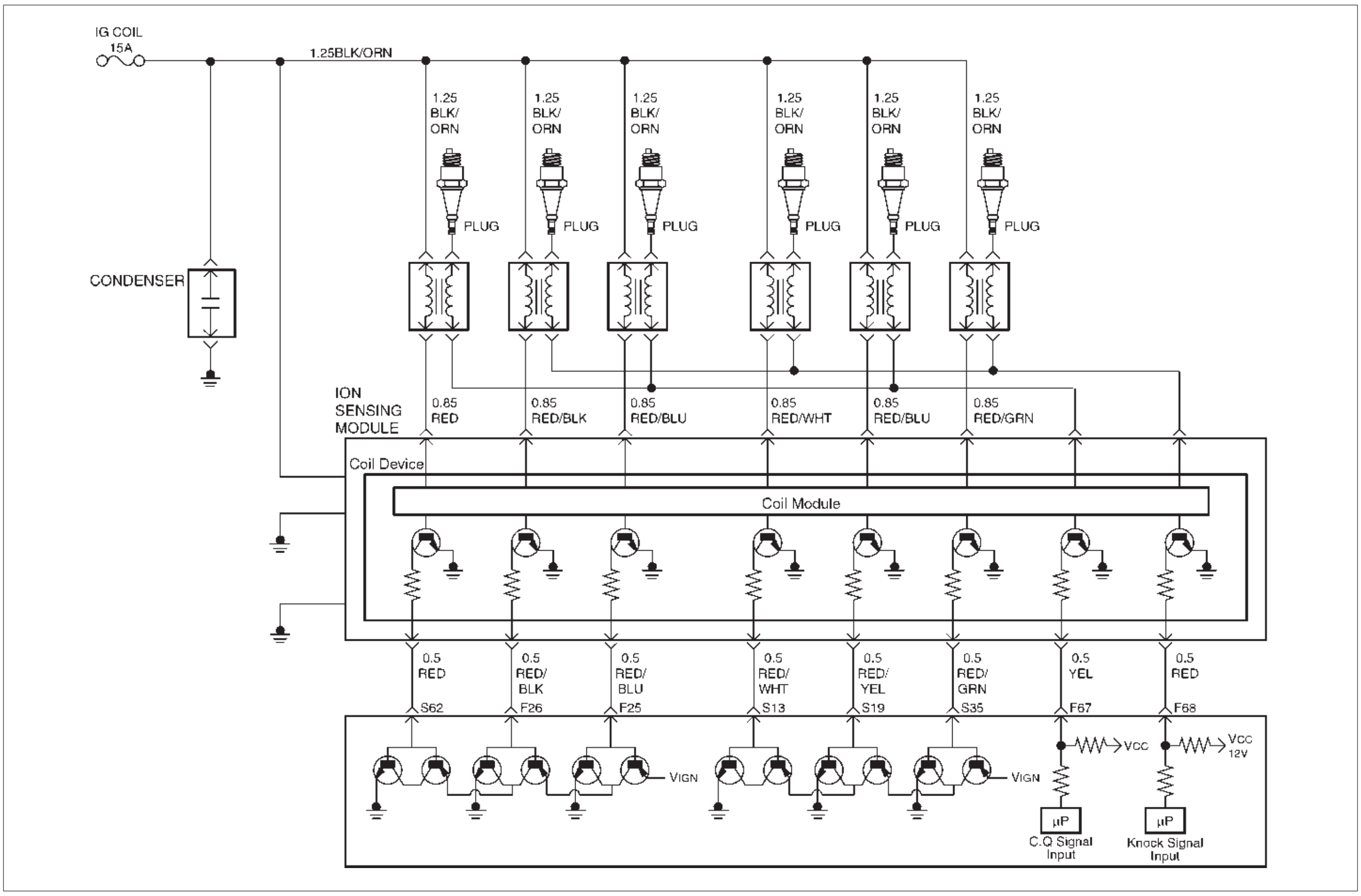
DTC P1312 - ION Sensing Module SEC line 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P1312. Does the Tech 2 indicate DTC P1312 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition "OFF." 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing module harness between the PCM and ICSS module circuit at the ION Sensing Module harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing module harness between the ignition coil and ION Sensing module circuit at the SEC line 2 harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*

DTC P1312 - ION Sensing Module SEC line 2 Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 10*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1326 ION Sensing Module Combustion Quality Input Circuit Fault



D06RY00067

Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine operating conditions.

- The test is performed to evauate the Combustion Quality (CQ) signal pulse width if it is within a predetermined range. If the CQ signal puls width is out of the predetermined range, the fail counter will be incremented. If the failure counter exceeds the calibration, then test is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the test is complete and a pass will be reported. This test will detect an open/short in the QC line circuit, ION Sensing module faults and analog input faults in the PCM.

Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- No Cramk DTCs set.
- No cylinder ID DTCs set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1326 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1326 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1326 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1326 Diagnostic Chart may isolate the cause of the fault.

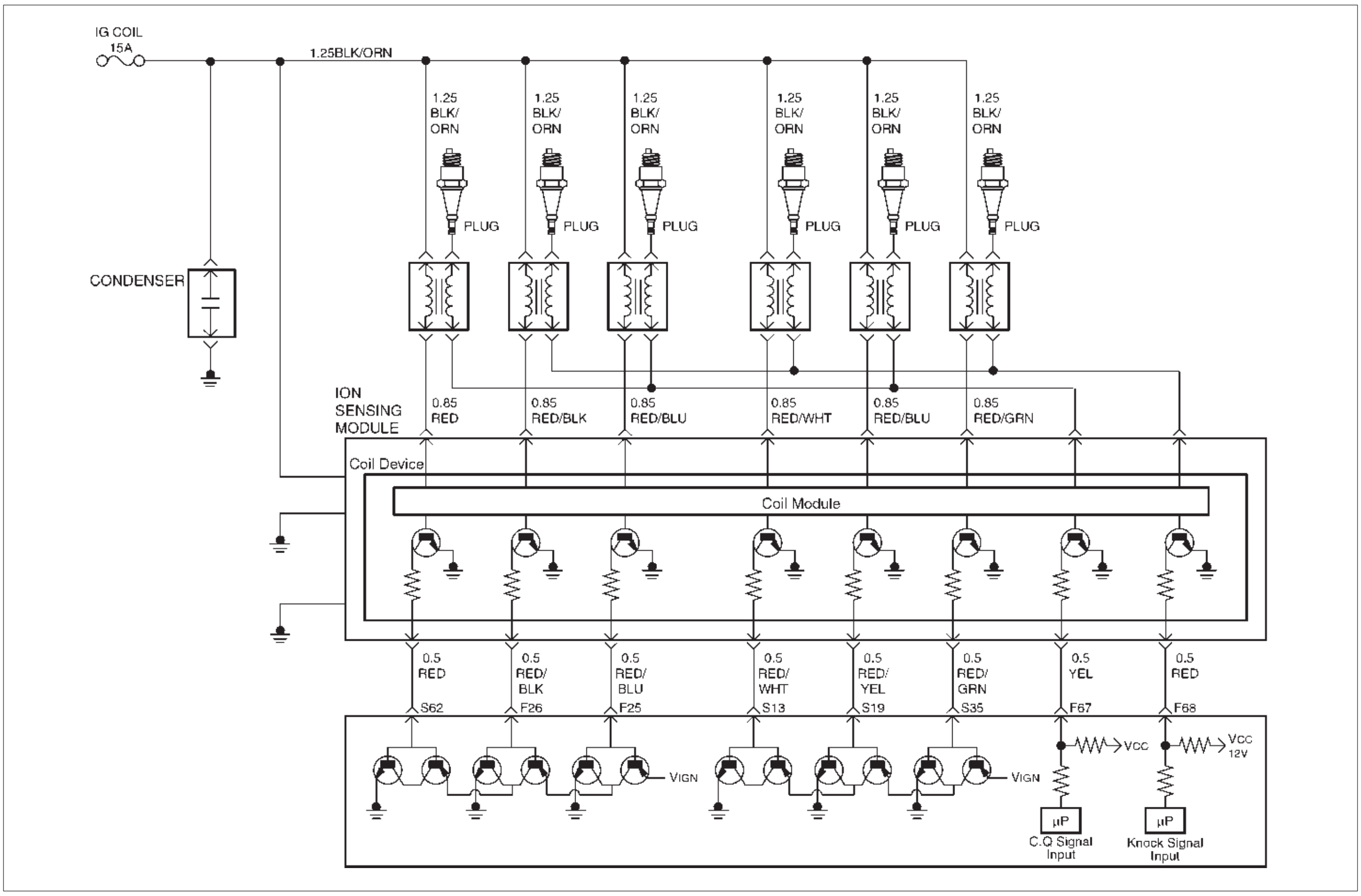
DTC P1326 - ION Sensing Module Combustion

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC”info for DTC P1326. Does the Tech 2 indicate DTC P1326 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition “OFF.” 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing module harness between the PCM and ION Sensing module circuit at the QC line harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing module harness between the ignition coil and ICSS module circuit at the ION Sensing Module harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*

DTC P1326 - ION Sensing Module Combustion (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 10*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin .Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1340 ION Sensing Module Cylinder ID Fault (Cylinder Synchronization Fail)



D06RY00067

Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine opreating conditions.

- This test will return a fault if the cylinder synchronization routine has not been completed after a predetermined number of events after crank. This test will detect fault that will prevent the PCM from synchronaization, such as Knock Signal (KI) - Combustion Quality (CQ) lines being swapped, shorted spark plugs, ION Sensing module faults, an PCM hardware faults.

Conditions for setting the DTC

- Ignition voltage is between 11volt and 16 volts.
- Engine speed is between 650rpm and 6500rpm.
- No ECT DTCs set.
- No injector DTCs set.
- No Fuel Trim DTCs set.
- No Misfire DTCs set.
- No system voltage DTCs set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1340 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1340 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1340 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1340 Diagnostic Chart may isolate the cause of the fault.

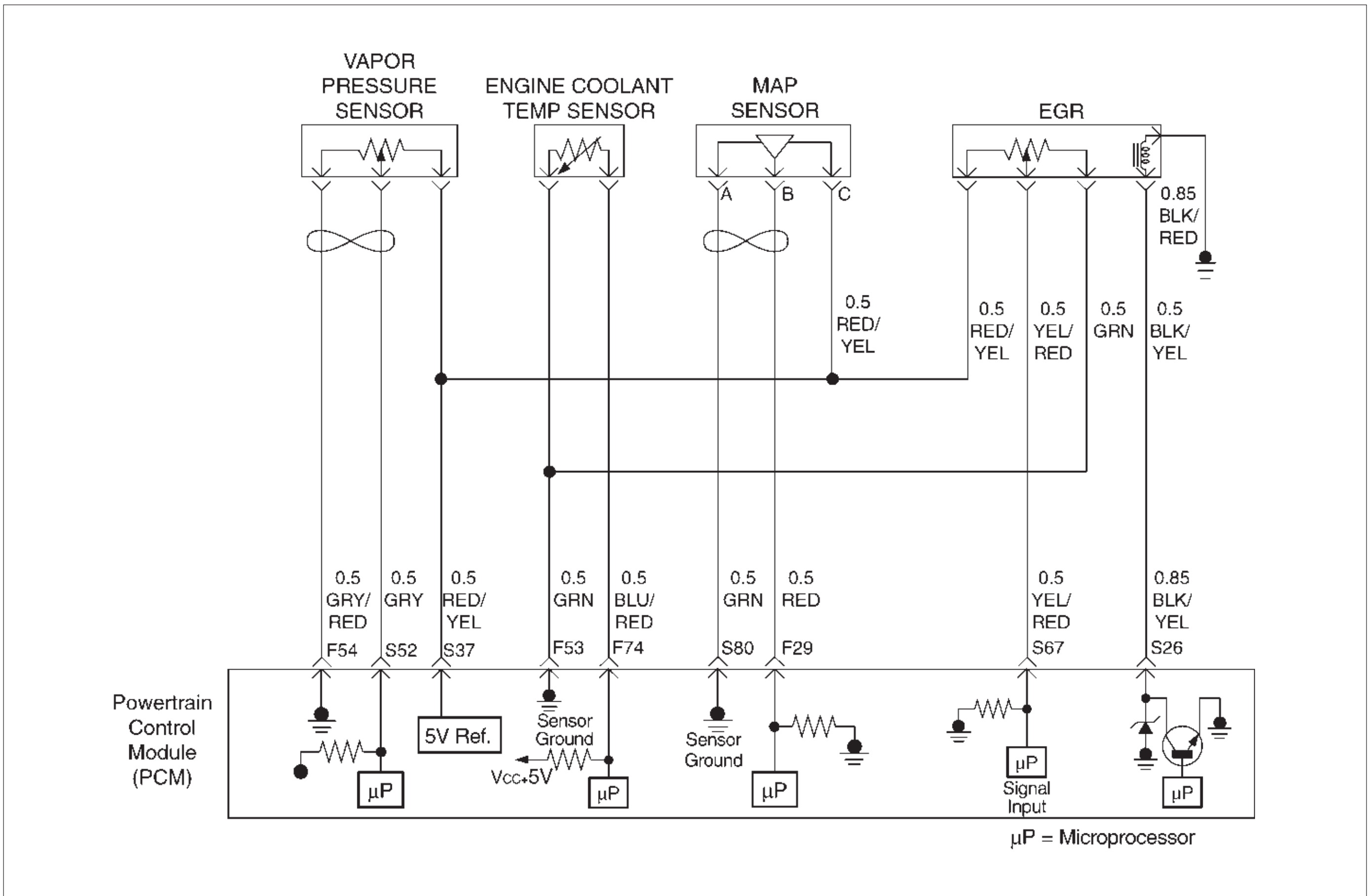
DTC P1340 - ION Sensing Module Cylinder ID Fault (Cylinder Synchronization Fail)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “ DTC” info for DTC P1340. Does the Tech 2 indicate DTC P1340 failed thisignition?	—	Go to *Step 3*	Refer to *DiagnosticAids*
3	1. Ignition “OFF.” 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing module harness between the PCM and ICSS module circuit at the QC line harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing module harness between the ignition coil and ION Sensing module circuit at the ION Sensing Module harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*

DTC P1340 - ION Sensing Module Cylinder ID Fault (Cylinder Synchronization Fail) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 10*
11	Replace the PCM. **IMPORTANT:** IMPORTANT; The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin.Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1404 EGR Stuck Closed



D06RY00178

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if current pintle zero position is different from the learned zero position. If the PCM detects a pintle position signal indicates more than 30 % different between current zero position and the learned zero position for more than 5 seconds, and this condition exists 3 times during trip, then the PCM will set DTC P1404.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- Intake Air temp is more than 3°C.
- Desired EGR position is 0.
- Difference of EGR pintle position between current and the learned zero is more than 30 % for more than 5 seconds, and exists three time to the above condition during a trip the PCM will set DTC 1404. Then it trigger the PCM lights on.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after consecutive 2nd trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1404 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Excessive carbon deposit on EGR valve shaft and/or foreign material may cause the EGR valve not to fully seated. The carbon deposit may occur by unusual port operation. Remove foreign material and/or excessive carbon deposit on EGR valve shaft and may allow the EGR valve to be fully seated.
- Poor connection or damaged harness – Inspect the wiring harness for damage.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

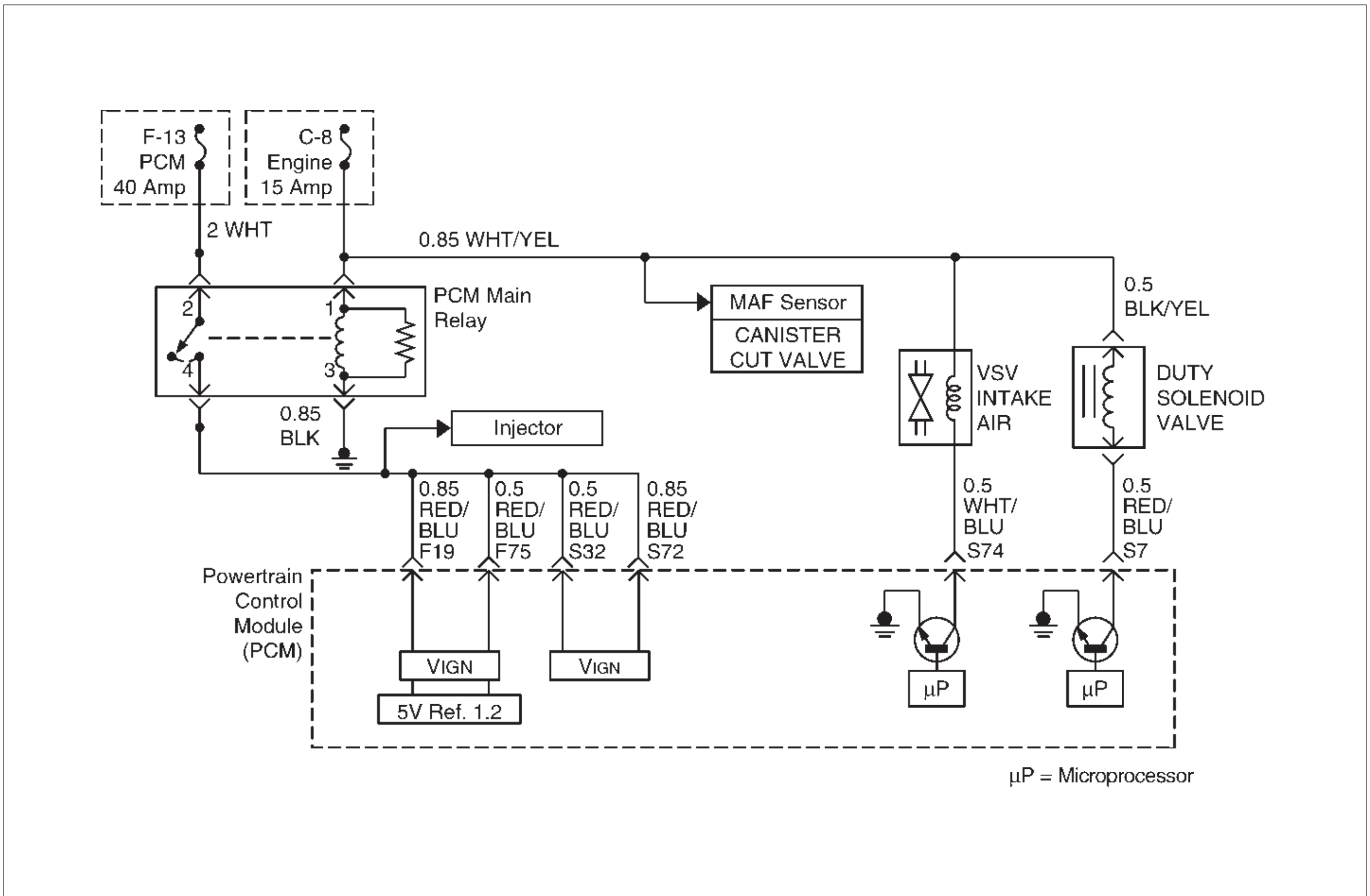
DTC P1404 – EGR Stuck Closed

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC inf. for DTC P1404 until the DTC P1404 test runs. Note the result. Does the Tech 2 indicates DTC P1404 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
5	1. Remove EGR valve from Engine. 2. Inspect EGR valve for any excessive carbon deposit on EGR shaft. 3. Inspect for any foreign material inside of EGR valve. Was excessive carbon deposit on EGR valve shaft and/or foreign material in EGR valve ?	—	Go to *Step 6*	Go to *Step 7*
6	1. Clean up EGR valve shaft and inside of EGR valve. 2. Remove foreign material from EGR valve. 3. Visually inspect damage of pintle and seat to see if it is bent. If damaged leakage may occur. Was there any severe damage which affects function?	—	Go to *Step 8*	Verify repair Go to *Step 7*
7	1. Install the EGR valve. 2. Ignition "OFF". 3. Install the Tech 2. 4. Run the engine at idle. 5. On the Tech 2, select EGR Control Test. 6. Use the "UP" arrow to increase the EGR from 0% to 40%. Did EGR work properly?	—	—	Go to *Step 8*
8	1. Reset the learned zero EGR valve position. 2. Repeat step 7. Did EGR work properly?	—	Verify repair	Go to *Step 9*

DTC P1404 – EGR Stuck Closed (Cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the EGR valve. Does DTC P1404 still fail "DTC" test on the Tech 2?	—	Go to *Step 10*	Verify repair
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1441 EVAP System Flow During Non-Purge



D06RY00128

Circuit Description

Canister purge is controlled by a solenoid valve that allows manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge “ON”). The EVAP purge solenoid control is pulse-width modulated (PWM) or turned “ON” and “OFF” several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met.

The EVAP purge vacuum switch is a normally closed switch positioned in the purge line between the canister and to EVAP purge solenoid. The EVAP purge vacuum switch will open when vacuum increases to greater than 5 inches of water in the purge line. The PCM monitors the EVAP purge vacuum switch signal to determine if the evaporative emission control system is working properly. If the switch is open (purge flow detected) when the PCM is not commanding the EVAP purge solenoid “ON,” DTC P1441 will be set.

Conditions for Setting the DTC

- No active ECT sensor, IAT sensor, MAP sensor, vacuum switch, or TP sensor DTCs set.
- BARO reading is above 85 kPa.
- Engine coolant temperature is below 70°C (158°F).
- Start-up intake air temperature (IAT) and start-up engine coolant temperature (ECT) are both above 5°C (41°F).
- The difference between start-up ECT and start-up IAT is less than 25°C (45°F).
- TP sensor indicates a throttle position above 12%.
- Battery voltage is between 11.5 volts and 16 volts.
- Engine speed is between 800 and 6,000 RPM.
- Canister purge duty cycle is below 3%.
- Canister purge vacuum switch is open, which results in the PCM signal voltage (from the vacuum switch input) being approximately 12 volts.
- All conditions are present for at least 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1441 will clear after 40 consecutive warm–up cycles have occurred without a fault.

- DTC P1441 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wring harness for damage. If the harness appears to be OK, observe the EVAP vacuum switch display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The canister purge vacuum switch is normally closed when no vacuum (purge) is present. With the ignition "ON" and the engine "OFF," there shouldn't be any vacuum (purge) present in the EVAP system.
3. Determines if the PCM is able to control the EVAP purge solenoid valve.
4. Determines if the DTC will set under the conditions present when the DTC was originally stored. If not, the fault is intermittent.
5. Checks for a grounded EVAP purge solenoid driver circuit, a faulty EVAP vacuum switch, or a leaking EVAP purge solenoid valve.

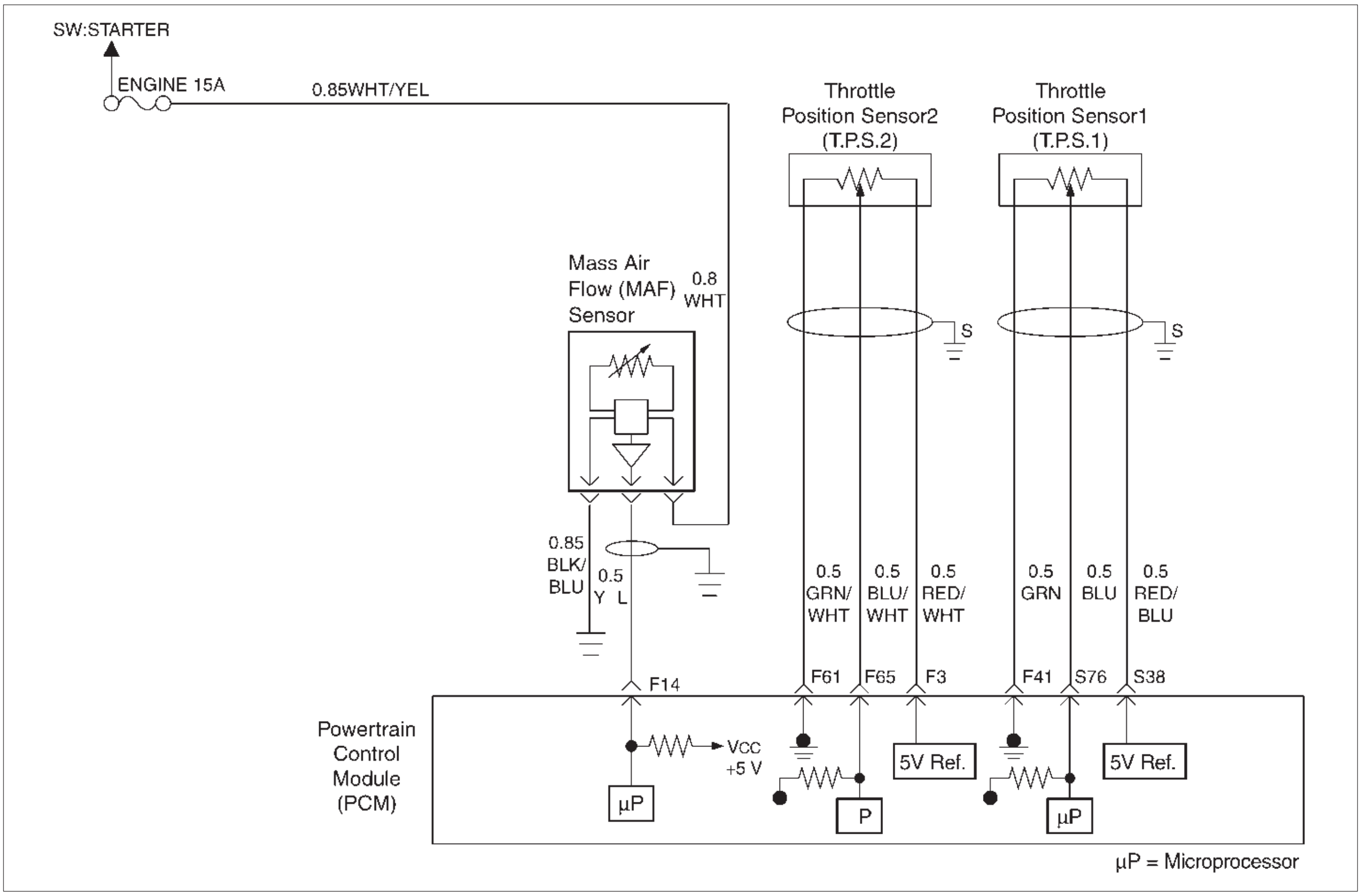
DTC P1441 – EVAP System Flow During Non-Purge

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "OFF." 2. Remove the fuel filler cap. 3. Ignition "ON." 4. Observe "Fuel Tank Pressure" on the Tech 2. Is "Fuel Tank Pressure" at the specified value?	1.51V	Go to *Step 3*	Go to *DTC P0452 or P0453*
3	1. Re-install the fuel filler cap. 2. Using the Tech 2, command the EVAP Vent Solenoid Valve "ON" (Closed). 3. Disconnect the canister side rubber hose end that hose is connected between the Purge Solenoid Valve and Canister. **IMPORTANT:** Before continuing with the diagnosis, zero the EVAP pressure/purge cart J41413 (refer to the tool operating instructions). And them monitor the fuel tank inner pressure using the Tech 2. Does the fuel tank pressure remain the specified value?	1.52 - 1.60V	Go to *Step 4*	Go to *Step 6*
4	1. Disconnect the EVAP pressure/purge cart J41413, and then plug the hose end. 2. Disconnect the rubber hose end of engine vacuum source side, (the hose connected between Purge Solenoid Valve and engine). 3. Connect the vacuum hand pump to this rubber hose end. 4. Then apply the -15 in H2O vacuum by the vacuum pump. 5. Monitor the fuel tank inner pressure using the Tech 2. Does the fuel tank inner pressure hold the specified value?	1.47 - 1.51V	Go to *Step 6*	Go to *Step 5*

DTC P1441 – EVAP System Flow During Non-Purge (Cont'd)

Step	Action	Value(s)	Yes	No
5	Replace the Purge Solenoid Valve.	—	Verify Repair	—
6	1. Check leaks, kinks or pinched hoses at the EVAP system rubber hose line, and also check if the rubber hoses are correctly connected or not. 2. Check for a leak from Vent Solenoid Valve and EVAP system rubber hoses, and also check for clogged Filter of air separator which is located near the vent solenoid valve. Was a problem found? Using the Vacuum Hose Routing Diagram, repair or re-connect the rubber hoses correctly.	—	Verify Repair	Go to *Step 7*
7	1. Start engine. 2. Remove the Fuel Filler cap. 3. Using the Tech 2, command the EVAP Vent Solenoid Valve "ON" (closed) and Purge Solenoid Valve "OFF" (0%). 4. Replace the Fuel Filler Cap. 5. Run the engine at 2500RPM constant while monitoring "Fuel Tank Vacuum" on the Tech 2. Does the fuel tank vacuum remain at the specified value while the EVAP Vent Solenoid Valve "ON" (closed) and Purge Solenoid Valve "OFF" (0%)?	30 - 40 %	Verify Repair	Go to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P1514 TPS - MAF Correlation Error



D06RY00090

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle blade angle.

  The throttle blade angle will vary about 8 % at closed throttle to about 92 % at wide open throttle (WOT).
- The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain Control Module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations.

  A large quantitiy of air entering the engine indicates an accleration or high load situation, while a small quantity or air indicates deceleration or idle.

  The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load.

Conditions for setting the DTC

- The engine is running.
- No MAF sensor DTCs are set.
- Throttle actuation mode is not off.
- MAF reading-ETC estimated air flow is less than 40g/s for 250 failres within test 1000 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1514 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1514 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM - Inspect harness connectors for backed out terminals, improper mating,broken

locks, improperly formed or damaged terminals,and poor terminal to wire connection.

- Damaged harness - Inspect the wiring harness for damage. If the harness appears to be OK, observe the Mass Air Flow, TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.
- Plugged intake air duct or filter element
- A wide - open throttle acceleration from a stop should cause the mass air flow displayed on a Tech 2 to increase from about 3 – 6 g/s at idle to 100 g/s or greater at the time of the 1 – 2 shift. If not, check for a restriction.

A change in the display will indicate the location of the fault. If DTC P1514 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1514 Diagnostic Chart may isolate the cause of the fault.

DTC P1514 - TPS-MAF Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P1514. Does the Tech 2 indicate DTC P1514 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Start the engine. 2. With the engine idling, monitor “MAF Frequency” display on the Tech 2. Is the “MAF Frequency” below the specified value?	6 ~ 10 g/s	Go to *Step 5*	Go to *Step 8*
5	1. Ignition “OFF.” 2. Disconnect the MAF sensor connector. 3. Ignition “ON,” engine idling. 4. Using a Tech 2, monitor “MAF Frequency.” Does the Tech 2 indicate a “MAF Frequency” at the specified value?	0g/s	Go to *Step 6*	Go to *Step 7*
6	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 9*
7	1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors). 2. If incorrect routing is found, correct the harness routing. Was a problem found?	—	Verify repair	Go to *Step 7*
8	1. With the engine idling, monitor “MAF Frequency.” display on the Tech 2. 2. Quickly snap open throttle to wide open throttle while under a road load and record value. Does the Tech 2 indicate a “MAF Frequency” at thespecified value?	6 ~ 10 g/s	Go to *Step 6*	Go to *Step 9*

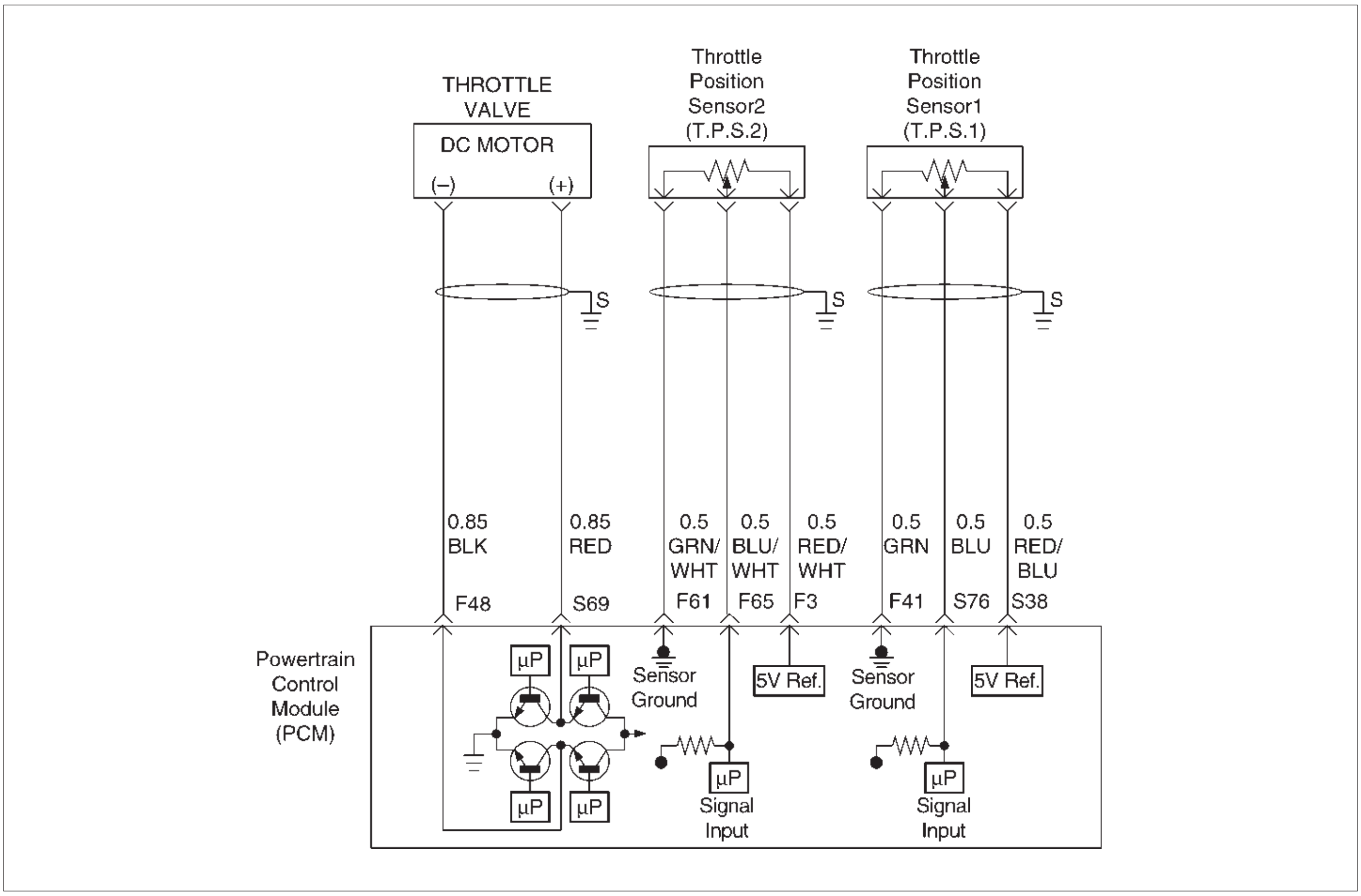
DTC P1514 - TPS-MAF Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Ignition"ON", engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65kPa	Go to *Step 10*	Go to *Step 13*
10	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5Vreturns.)	—	Go to *Step 12*	Go to *Step 11*
11	1. Check the MAP signal circuit between the PCM and MAP ground circuit. 2. If the MAP signal circuit is open or shoted, repair it as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 13*
12	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
13	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 %	Refer to *Diagnostic Aids*	Go to *Step 14*
14	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	0V	Go to *Step 15*	Go to *Step 16*
15	1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	5V	Go to *Step 18*	Go to *Step 17*
16	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1 and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 19*

DTC P1514 - TPS-MAF Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
17	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	Replace the TP sensor. Is the action complete?	—	Verify repair	—
19	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin.Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1515 Command - Actual TPS Correlation Error



D06RY00088

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary about 8 % at closed throttle to about 92 % at wide open throttle(WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- This DTC ditects the difference between actual throttle position and command throttle position.

Conditions for setting the DTC

- The ignition is “ON”.
- Throttle actuation mode is normal.
- Command Throttle position - Actual Throttle position is more than + 5 % for 100 counts within test 1000 test samples (15.6 m sec) else Actual Throttle position is less than + 40 % and Command Throttle position - Actual Throttle position is more than - 5 % or Command Throttle position - Actual Throttle position is more than - 20 % for 150 failres within test 1000 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1515 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1515 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, mproper mating, locks, improperly formed or damaged terminals, and poor terminal to wire connection.

- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1515 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P1515 Diagnostic Chart may isolate the cause of the fault.

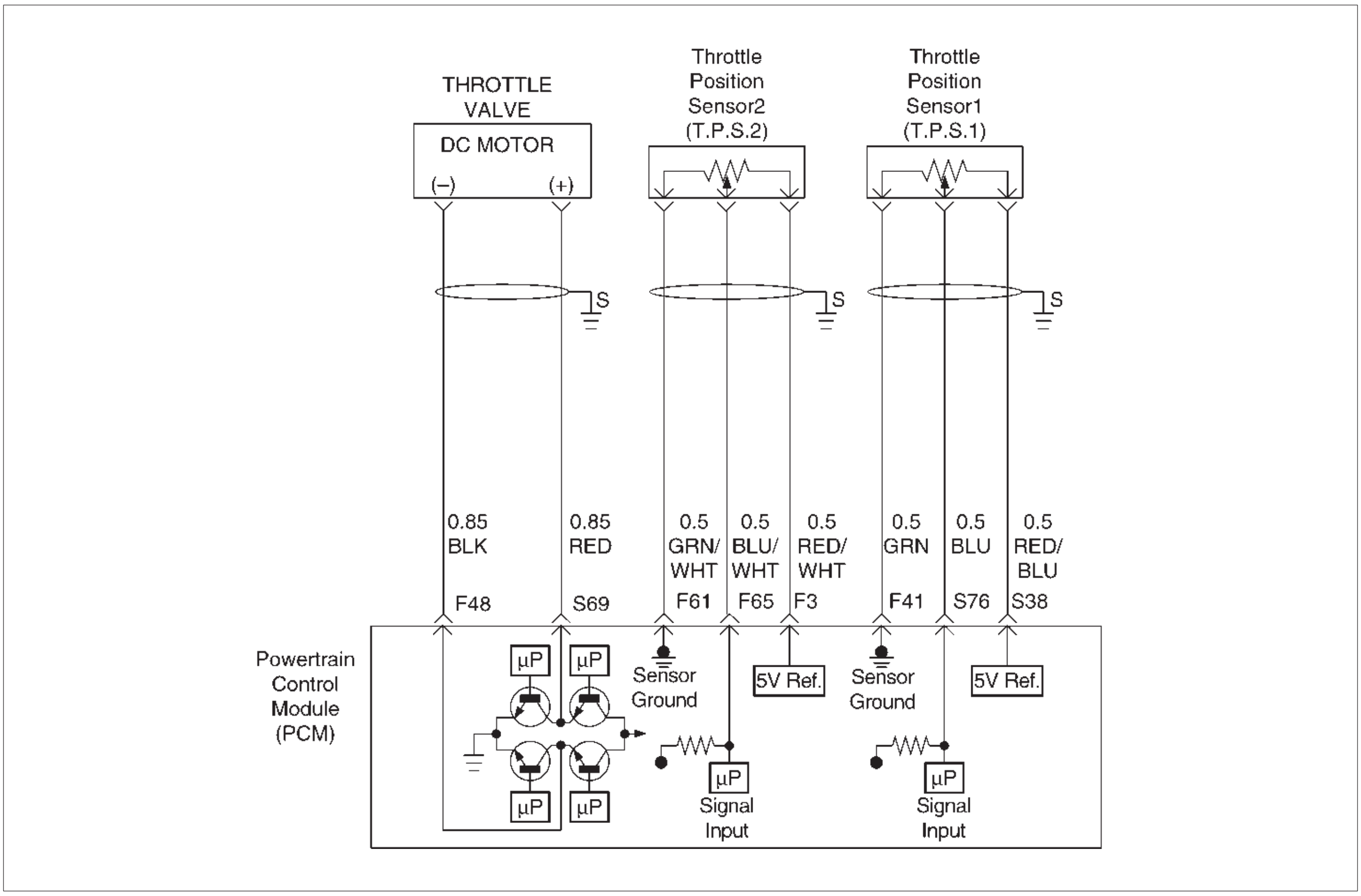
DTC P1515 - Command - Actual TPS Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “ DTC” info for DTC P1515. Does the Tech 2 indicate DTC P1515 failed thisignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 %	Go to *Step 8*	Go to *Step 5*
5	1. Ignition “OFF.” 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100 Ω	Go to *Step 6*	Go to *Step 7*
6	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 8*
7	Replace the DC motor. Is the action complete?	—	Verify repair	Go to *Step 6*
8	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 9*	Go to *Step 10*
9	1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	5V	Go to *Step 12*	Go to *Step 11*

DTC P1515 - Command - Actual TPS Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
11	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
12	Replace the TP sensor. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1516 Command - Actual TPS Correlation Error



D06RY00088

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle). The throttle blade angle will vary about 8 % at closed throttle to about 92 % at wide open throttle (WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- This DTC detects the dufference between actual throttle position and command throttle position in steady state.

Conditions for setting the DTC

- The ignition is “ON”.
- Throttle Actuation mode is normal.
- Command Throttle position-Actual Throttle positionis less than 8 % when desird TPS is sutudy wihtin 0.5 %for 30 second within test samples (30 second)

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1516 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1516 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness - Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1516 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1516 Diagnostic Chart may isolate the cause of the fault.

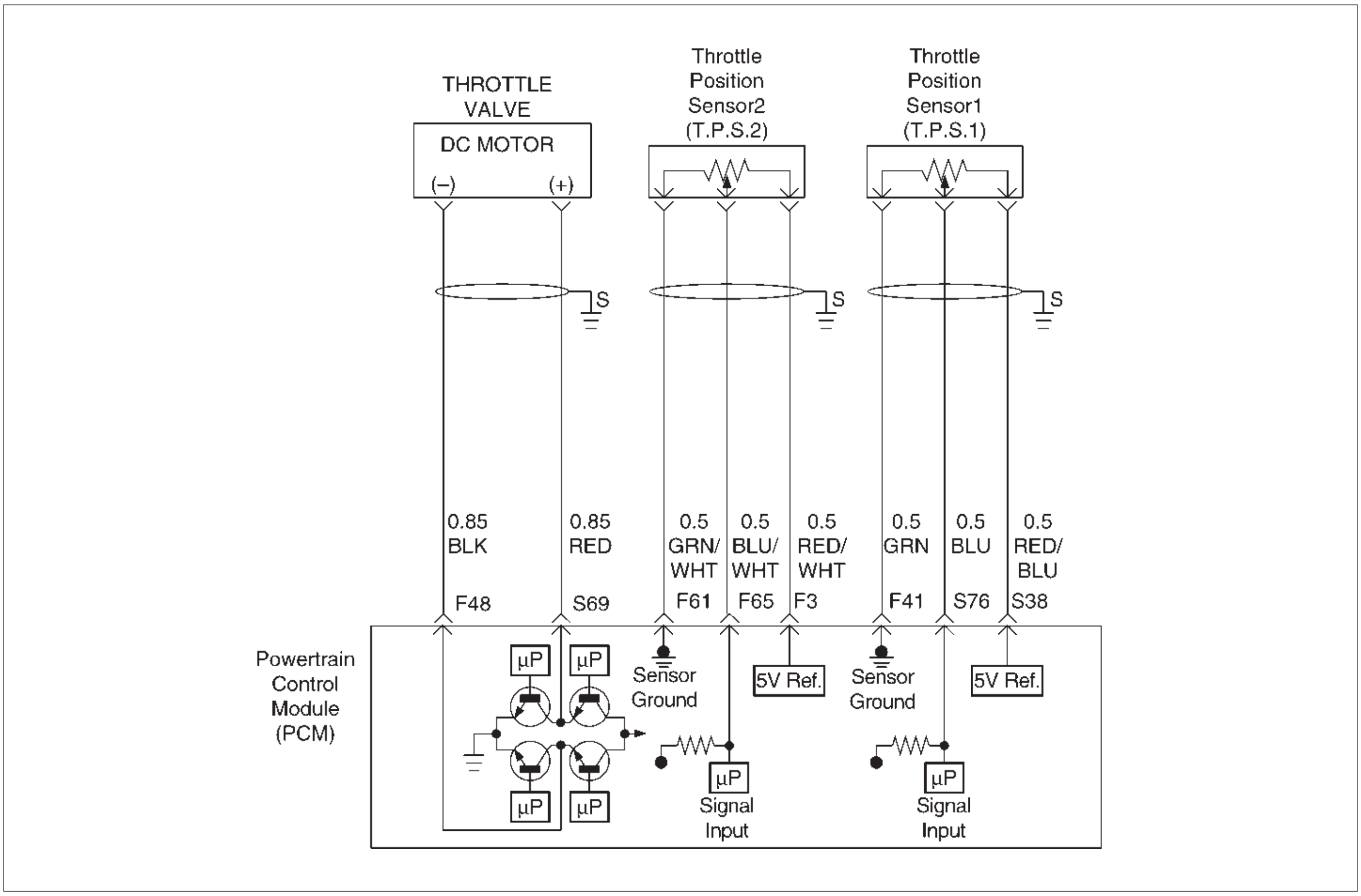
DTC P1516 - Command - Actual TPS Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P1516. Does the Tech 2 indicate DTC P1516 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 %	Go to *Step 8*	Go to *Step 5*
5	1. Ignition “OFF.” 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100 Ω	Go to *Step 6*	Go to *Step 7*
6	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 8*
7	Replace the DC motor. Is the action complete?	—	Verify repair	Go to *Step 6*
8	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	0V	Go to *Step 9*	Go to *Step 10*
9	1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 12*	Go to *Step 11*

DTC P1516 - Command - Actual TPS Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
11	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1 and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
12	Replace the TP sensor. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1523 Actuator Control Return Performance



D06RY00088

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary about 8 % at closed throttle to about 92 % at wide open throttle(WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- This DTC ditects if the throttle return to the default position at key on, steady state.

Conditions for setting the DTC

- The ignition is “ON”.
- Normalized TPS is less than 0 % but Normalized TPS is more than 25 %.

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1523 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1523 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1523 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P1523 Diagnostic Chart may isolate the cause of the fault.

DTC P1523 - Actuator Control Return Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =90 ~ 92 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =8 ~ 10 %	Go to *Step 7*	Go to *Step 4*
4	1. Ignition “OFF.” 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100 Ω	Go to *Step 5*	Go to *Step 6*
5	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
6	Replace the DC motor. Is the action complete?	—	Verify repair	Go to *Step 5*
7	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 8*	Go to *Step 9*
8	1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 11*	Go to *Step 10*
9	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*

DTC P1523 - Actuator Control Return Performance (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
11	Replace the TP sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1625 PCM Unexpected Reset

Circuit Description

The powertrain control module (PCM) monitors unexpected PCM reset. This will not turn on MIL light on, only records code DTC P1625.

Conditions for Setting the DTC

- Clock or COP (Computer Operating Properly) reset.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1625 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1625 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

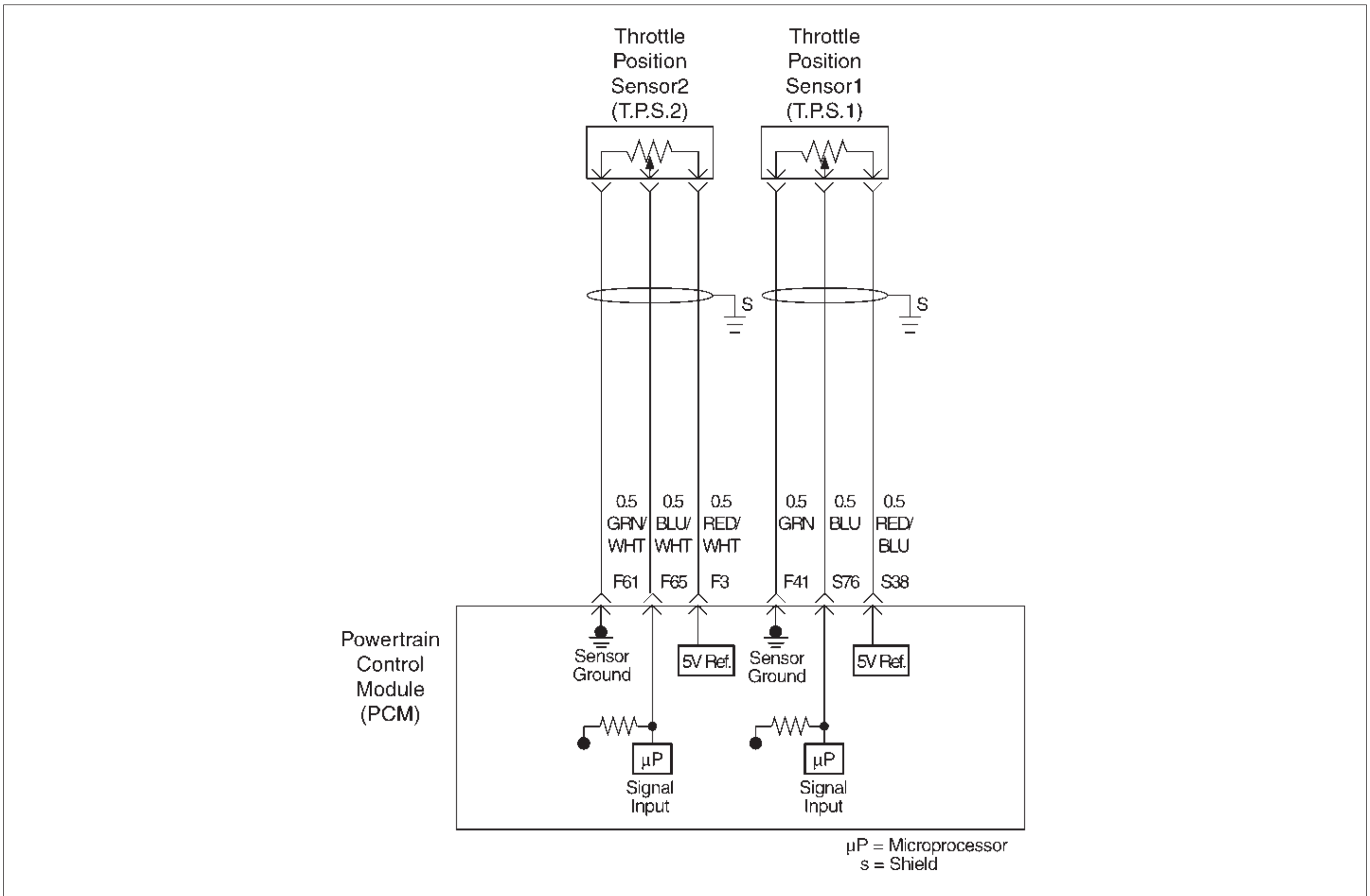
Check for the following conditions:

- P1625 alone stored does not need diagnosis. Clear DTC code.

DTC P1625 – PCM Unexpected Reset

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to *OBD System Check*
2	1. Ignition is “ON”. 2. Install the Tech 2. 3. Start the engine at let it Idle. 4. On the Tech 2, select “DTC info”. Does the Tech 2 indicate DTC P1625 failed?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	1. Ignition is “ON”. 2. Clear DTC P1625 by using the Tech 2 “Clear Info”. 3. Start the engine at let it Idle. 4. On the Tech 2, select “DTC info”. Does the Tech 2 indicate DTC P1625 failed?	—	Go to *Step 4*	Go to *Diagnostic Aids*
4	1. Check for aftermarket electronics, such as transceiver, stereos, and anti theft devices. They may radiate EMI into the control system if they are improperly installed. (This may cause a false sensor reading and turn on the MIL.) 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1635 Reference Voltage # 1 Circuit Fault



D06RY00077

Circuit Description

The TP sensor # 1 shares a 5 Volt reference with the PCM.

If the PCM detects the 5 Volt reference for the TP sensor # 1 is failure, DTCP1635 will be set.

Conditions for setting the DTC

- The ignition is “ON”.
- The 5 Volt reference voltage for the TP sensor # 1 is less than 4 volts.
- The 5 Volt reference voltage for the TP sensor # 1 is more than 5 volts.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL) .
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

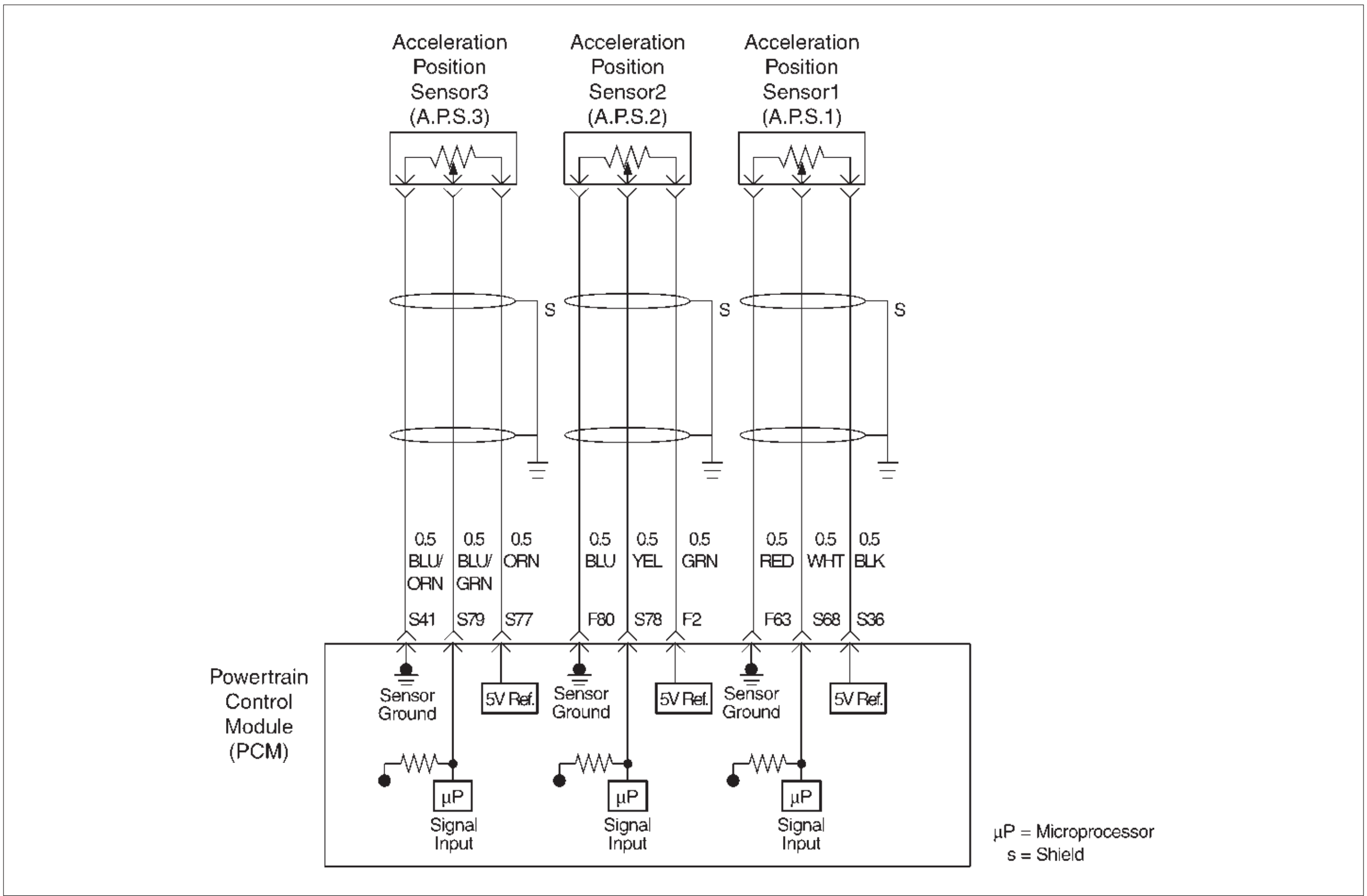
Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1635will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1635 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed. Tech2 “ Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Trouble Code (DTC) P1635 Reference Voltage # 1 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board(OBD)System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the votage at terminal S38 (RED/BLU) pin. Is the voltage in specified range?	4.95 – 5.0V	Go to *ETC System Check*	Go to *Step 3*
3	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the votage at terminal F20 (WHT) pin. Is the voltage in specified range?	11.6 – 12.7V	Go to *Step 4*	Go to *Step 5*
4	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the votage at terminal F57 (WHT) pin. Is the voltage in specified range?	11.6 – 12.7V	Go to *Step 6*	Go to *Step 5*
5	Observe the battery voltage and circuit. If the probrem found, repair it as necessary. Was the probrem found?	—	Verify repair	Go to *Step 6*
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1639 Reference Voltage # 2 Circuit Fault



D06RY00075

Circuit Description

The AP sensor # 1shares a 5Volt reference with the PCM. If the PCM detects the 5 Volt reference for the AP sensor # 1 is failure, DTC P1635 will be set.

Conditions for setting the DTC

- The ignition is “ON”.
- The 5 Volt reference voltage for the AP sensor # 1 is less than 4 volts.
- The 5 Volt reference voltage for the AP sensor # 1 is more than 5 volts.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1639 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1639 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed. Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Trouble Code (DTC) P1639 Reference Voltage # 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the votage at terminal S36 (BLK) pin. Is the voltage in specified range?	4.95 – 5.0V	Go to *ETC System Check*	Go to *Step 3*
3	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the votage at terminal F20(WHT) pin. Is the voltage in specified range?	11.6 – 12.7V	Go to *Step 4*	Go to *Step 5*
4	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the votage at terminal F57 (WHT) pin. Is the voltage in specified range?	11.6 – 12.7V	Go to *Step 6*	Go to *Step 5*
5	Observe the battery voltage and circuit. If the probrem found, repair it as necessary. Was the probrem found?	—	Verify repair	Go to *Step 6*
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin.Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1640 Driver-1-Output Circuit Fault (ODM)

Circuit Description

Output driver modules (ODMs) are used by the powertrain control module (PCM) to turn "ON" many of the current-driven devices that are needed to control various engine and transmission functions. Each ODM is capable of controlling up to 7 separate outputs by applying ground to the device which the PCM is commanding "ON."

Unlike the Quad Driver Modules (QDMs) used in prior model years, ODMs have the capability of diagnosing each output circuit individually. DTC P1640 set indicates an improper voltage level has been detected on an ODM output.

Since A/C is an option, No A/C will cause the air conditioning clutch relay output to always fail. If a fault is seen on the air conditioning clutch relay output, it will not be logged as a fault until the A/C request input interrupts a high voltage, indicating that A/C has been installed.

Conditions for Setting the DTC

- Ignition "ON."
- Engine running.
- No DTC 1618.
- Ignition voltage is above 13.2 volts for 4 seconds.
- Output voltage does not equal ignition voltage when output is "OFF" or output voltage is not less than 1 volt when output is "ON."
- Above conditions occur for at least 1 second.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1640 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P1640 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage, If the harness appears to be OK, disconnect the PCM, turn the ignition "ON" and observe a voltmeter connected to the suspect driver circuit at the PCM harness connector while moving connectors and wiring harnesses relates to the MIL. A change in voltage will indicate the location of the fault.
- Poor connection at component – Examine for damaged connectors, unplugged connector, or damaged terminals at the following locations: Instrument cluster harness, canister purge solenoid, A/C clutch relay. An open ignition feed circuit at any of these components will cause DTC P1640 to be set.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

4. The Tech 2 Driver Module Status indicates the PCM pin that is affected.

9. The Tech 2 may indicate "short circuit" even when the problem is an open circuit. The cause of an open circuit may be in the component itself-lamp, purge, solenoid, or A/C compressor relay.

11. A short to ground on the ignition side of the component will blow the fuse. Since the fuse was checked in Step 2, a short to ground would be between the affected component and the PCM.

DTC P1640 – Driver-1-Output Circuit Fault (ODM)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Check the fuse for the driver circuit that was shown as faulty. Was the fuse blown?	—	Go to *Step 3*	Go to *Step 4*
3	1. Check for a short to ground between the fuse and the affected component. 2. Replace the fuse after making any necessary repairs. Is the action complete?	—	Verify repair	—
4	Disconnect the PCM connector for the affected driver circuit. Is there any damage to the PCM pin or connector?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
6	Were either of the lamp circuits for “Check Engine” or “Check Trans.” indicated as faulty by the Tech 2?	—	Go to *Step 7*	Go to *Step 13*
7	1. Leave the PCM connector for the lamp driver circuit disconnected. 2. Ignition “ON.” 3. Using a DVM, check the voltage at the PCM connector for the affected lamp driver circuit. Was the voltage equal to the specified value?	B+	Go to *Step 15*	Go to *Step 8*
8	1. Ignition “ON.” 2. Check for battery voltage at the fuse for the affected lamp circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
9	Repair the open circuit between the ignition switch and the fuse. Is the action complete?	—	Verify repair	—
10	1. Ignition “OFF.” 2. Disconnect the PCM connector for the affected driver terminal. 3. Connect an ohmmeter between a good ground and the PCM connector for the affected driver. Did the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 12*
11	Repair the short to ground between the affected component and its PCM driver terminal. Is the action complete?	—	Verify repair	—
12	Repair the open circuit between the fuse and the PCM driver terminal for the affected circuit. Is the action complete?	—	Verify repair	—

DTC P1640 – Driver-1-Output Circuit Fault (ODM) (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Connect the PCM. 2. Start the engine and let it idle. 3. Backprobe the affected terminal at the PCM with a DVM. Was the voltage equal to the specified value?	+B	Go to *Step 15*	Go to *Step 14*
14	1. Run the engine at idle. 2. Check for battery voltage at the fuse for the affected circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1650 Quad Driver Module “A” Fault

Circuit Description

The Quad Driver Module (QDMs) are used by the powertrain control module (PCM) to turn “ON” current–driven devices that are needed to control two engine functions. The PCM monitors open or short circuit of either of Canister Control Purge (CCP) Vent solenoid or Variable Intake Manifold (VIM).

Conditions for Setting the DTC

- Ignition “ON”.
- Engine running.
- Ignition voltage.
- Output voltage does not equal voltage is not less than 1 volt when out put is “ON”.
- Above conditions occur for at least 0.5 second.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1650 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1650 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage, If the harness appears to be OK, disconnect the PCM, turn the ignition “ON” and observe a voltmeter connected to the suspect driver circuit at the PCM harness connector while moving connectors and wiring harnesses relates to the MIL. A change in voltage will indicate the location of the fault.
- Poor connection at component – Examine for damaged connectors, unplugged connector, or damaged terminals at the following locations: canister purge solenoid, fuel level sensor. An open ignition feed circuit at any of these components will cause DTC P1650 to be set.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

The following PCM pins are controlled by Quad driver modules (QDMs):

- S74 – VIM
- S7 – Canister control purge

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

4. The Tech 2 Driver Module Status indicates the PCM pin that is affected.

9.The Tech 2 may indicate “short circuit” even when the problem is an open circuit. The cause of an open circuit may be in the component itself.

11.A short to ground on the ignition side of the component will blow the fuse. Since the fuse was checked in Step 2, a short to ground would be between the affected component and the PCM.

DTC P1650 – Quad Driver Module (QDM) Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Check the fuse for the driver circuit that was shown as faulty. Was the fuse blown?	—	Go to *Step 5*	Go to *Step 6*
3	1. Check for a short to ground between the fuse and the affected component. 2. Replace the fuse after making any necessary repairs. Is the action complete?	—	Verify repair	—
4	Disconnect the PCM connector for the affected driver circuit. Is there any damage to the PCM pin or connector?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
6	Were either of the lamp circuits for “Check Engine” or “Check Trans.” indicated as faulty by the Tech 2?	—	Go to *Step 7*	Go to *Step 13*
7	1. Leave the PCM connector for the lamp driver circuit disconnected. 2. Ignition “ON.” 3. Using a DVM, check the voltage at the PCM connector for the affected lamp driver circuit. Was the voltage equal to the specified value?	B+	Go to *Step 15*	Go to *Step 8*
8	1. Ignition “ON.” 2. Check for battery voltage at the fuse for the affected lamp circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
9	Repair the open circuit between the ignition switch and the fuse. Is the action complete?	—	Verify repair	—
10	1. Ignition “OFF.” 2. Disconnect the PCM connector for the affected driver terminal. 3. Connect an ohmmeter between a good ground and the PCM connector for the affected driver. Did the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 12*
11	Repair the short to ground between the affected component and its PCM driver terminal. Is the action complete?	—	Verify repair	—
12	Repair the open circuit between the fuse and the PCM driver terminal for the affected circuit. Is the action complete?	—	Verify repair	—

DTC P1650 – Quad Driver Module (QDM) Fault (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Connect the PCM. 2. Start the engine and let it idle. 3. Backprobe the affected terminal at the PCM with a DVM. Was the voltage equal to the specified value?	+B	Go to *Step 15*	Go to *Step 14*
14	1. Run the engine at idle. 2. Check for battery voltage at the fuse for the affected circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Symptom Diagnosis

Preliminary Checks

Before using this section, perform the "On-Board Diagnostic (OBD) System Check" and verify all of the following items:

- The powertrain control module (PCM), and malfunction indicator lamp (MIL) (Check Engine lamp) and Reduced Power Lamp (RPL) are operating correctly.
- There are no DTC(s) stored.
- Tech 2 data is within normal operating range. Refer to *Typical Scan Data Values*.
- Verify the customer complaint and locate the correct symptom in the table of contents. Perform the procedure included in the symptom chart.

Visual/Physical Check

Several of the symptom procedures call for a careful visual/physical check. This can lead to correcting a problem without further checks and can save valuable time.

This check should include the following items:

- PCM grounds for cleanliness, tightness and proper location.
- Vacuum hoses for splits, kinks, and proper connections, as shown on the "Vehicle Emission Control Information" label. Check thoroughly for any type of leak or restriction.
- Air intake ducts for collapsed or damaged areas.
- Air leaks at throttle body mounting area, mass air flow (MAF) sensor and intake manifold sealing surfaces.
- Ignition components for cracking, hardness, and carbon tracking.
- Wiring for proper connections, pinches and cuts.

Intermittents

IMPORTANT: An intermittent problem may or may not turn on the malfunction indicator lamp (MIL) or store a DTC. DO NOT use the Diagnostic Trouble Code (DTC) charts for intermittent problems. The fault must be present to locate the problem.

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful visual/physical check for the following conditions:

- Poor mating of the connector halves or a terminal not fully seated in the connector (backed out).
- Improperly formed or damaged terminal.
- All connector terminals in the problem circuit should be carefully checked for proper contact tension.
- Poor terminal-to-wire connection. This requires removing the terminal from the connector body to check.

Road test the vehicle with a J 39200 Digital Multimeter connected to a suspected circuit. An abnormal voltage when the malfunction occurs is a good indication that there is a fault in the circuit being monitored.

Use a Tech 2 to help detect intermittent conditions. The scan tool has several features that can be used to locate an intermittent condition. Use the following feature to find intermittent faults:

- Using a Tech 2's "Freeze Frame" buffer or "Failure Records" buffer can aid in locating an intermittent condition. Review and record the information in the freeze frame or failure record associated with the intermittent DTC being diagnosed. The vehicle can be driven within the conditions that were present when the DTC originally set.

To check for loss of diagnostic code memory, disconnect the MAP sensor and idle the engine until the MIL (Check Engine lamp) comes on. DTC P0107 should be stored and kept in memory when the ignition is turned "OFF." If not, the PCM is faulty. When this test is completed, make sure that you clear the DTC P0107 from memory.

An intermittent MIL (Check Engine lamp) with no stored DTC may be caused by the following:

- Ignition coil shorted to ground and arcing.
- MIL (Check Engine lamp) wire to PCM shorted to ground.
- Poor PCM grounds. Refer to the PCM wiring diagrams.

Check for improper installation of electrical options such as lights, cellular phones, etc. Check all wires from the PCM to the ignition coils for poor connections.

Check for an open diode across the A/C compressor clutch and check for other open diodes (refer to wiring diagrams in *Electrical Diagnosis*).

If problem has not been found, refer to *PCM Connector Symptom* tables.

- Check the "Calibration ID" of the PCM, and compare it with the latest Isuzu service bulletins and/or Isuzu EEPROM reprogramming equipment to determine if an update to the PCM's reprogrammable memory has been released. To check the "Calibration ID", connect the Tech 2, then look for "Powertrain", then select "Calibration ID". This identifies the contents of the reprogrammable software and calibration contained in the PCM. If the "Calibration ID" is not the most current available, it is advisable to reprogram the PCM's EEPROM memory, which may either help identify a hard-to-find problem or may fix the problem.
- Calibration ID (example)

Part number	9377709
Broadcast Code	CYYD
Identifier	801

Hard Start Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine cranks, but does not start for a long time. Does eventually run, or may start but immediately stalls. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/Physical Check*
5	Check engine coolant temperature (ECT) sensor for shift in value. After 8 hours with the hood up and the engine not running, connect the Tech 2. With the ignition "ON" and the engine not running, compare engine coolant temperature to intake air temperature. Are ECT and IAT within the specified value of each other?	± 5°C (± 9°F)	Go to *Step 10*	Go to *Step 6*
6	1. Using a Tech 2, display the engine coolant temperature and note the value. 2. Check the resistance of the engine coolant temperature sensor. 3. Refer to *Engine Coolant Temperature Sensor Temperature vs. Resistance* chart on *DTC P0118 Diagnostic Support* for resistance specifications. Is the resistance value near the resistance for the temperature noted?	—	Go to *Step 8*	Go to *Step 7*
7	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
8	Locate and repair high resistance or poor connection in the ECT signal circuit or the ECT sensor ground. Is the action complete?	—	Verify repair	—
9	1. Check for a faulty, plugged, or incorrectly installed PCV valve. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check for water- or alcohol-contaminated fuel. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Perform the procedure in *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*

Hard Start Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electric Ignition System* for procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Check for a loose ignition coil ground and ION Sensing module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Remove the ignition coils and check the ignition coils for cracks or carbon tracking. 2. If a problem is found, replace affected coil(s) as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Check for the following engine mechanical problems (refer to *Engine Mechanical*): • Low compression • Leaking cylinder head gaskets • Worn or incorrect camshaft • Camshaft drive belt slipped or stripped 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Surges and/or Chuggles Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/Physical Check*
5	Be sure that the driver understands transmission torque converter clutch and A/C compressor operation as explained in the owner's manual. Inform the customer how the TCC and the A/C clutch operate. Is the customer experiencing a normal condition?	—	System OK	Go to *Step 6*
6	1. Check the the fuel control heated oxygen sensors (HO2S, B1S1 and B2S1). The fuel control heated oxygen sensors (HO2S) should respond quickly to different throttle positions. If they don't, check them for silicone or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating. Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication). The PCM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem. For more information, refer to *Powertrain Control Module (PCM) and Sensors*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check the fuel pressure. Refer to *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Monitor the long term fuel trim on the Tech 2. Is the long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 9*	Go to *Step 10*
9	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 11*	Verify repair

Surges and/or Chuggles Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 11*	Verify repair
11	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electric Ignition System* for procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	1. Check for a loose ignition coil ground and ION Sensing module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Check the ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
14	1. Remove the spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check the injector connections. 2. If any of the injector connectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Check PCM grounds for the cleanliness, tightness and proper locations. Refer to the PCM wiring diagrams in *Electrical Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Check MAF sensor connections. 2. If a problem is found, replace the faulty terminals as necessary. Refer to *Electrical Diagnosis* for wiring repair procedures. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Visually/physically check vacuum hoses for splits, kinks, and proper connections and routing as shown on the "Vehicle Emission Control Information" label. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 19*

Surges and/or Chuggles Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
19	1. Check the exhaust system for possible restriction: • Inspect the exhaust system for damaged or collapsed pipes. • Inspect the muffler for heat distress or possible internal failure. • Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to *Restricted Exhaust System Check*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 20*
20	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Lack of Power, Sluggish or Spongy Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine delivers less than expected power. Little or no increase in speed when accelerator pedal is pushed down part-way. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/Physical Check*
5	1. Remove and check the air filter element for dirt or restrictions. Refer to *Air Intake System* in *ON-Vehicle Service*. 2. Replace the air filter element if necessary. Was a repair required?	—	Verify repair	Go to *Step 6*
6	1. Check for low fuel pressure. Refer to *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check for water- or alcohol-contaminated fuel. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Install the Tech 2. 2. Run the engine at idle. 3. On the Tech 2, select F3: Miscellaneous Test, F6: Variable Intake Manifold. 4. Repeat Switch ON or OFF of VIM solenoid valve by using the Tech 2. 5. Check to see if the actuator works normally. 6. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*

Lack of Power, Sluggish or Spongy Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Remove the spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Check the ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	1. Check the PCM grounds for the cleanliness, tightness and proper locations. Refer to the PCM wiring diagrams in *Electrical Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Check the exhaust system for possible restriction: • Inspect the exhaust system for damaged or collapsed pipes. • Inspect the muffler for heat distress or possible internal failure. • Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to *Restricted Exhaust System Check*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Check the torque converter clutch (TCC) for proper operation. Refer to *4L30-E Transmission Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check for an engine mechanical problem. Check for low compression, incorrect or worn camshaft, loose timing belt, etc. Refer to *Engine Mechanical*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Detonation/Spark Knock Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/Physical Check*
4	If Tech 2 readings are normal (refer to *Typical Scan Values*) and there are no engine mechanical faults, fill the fuel tank with a known quality gasoline that has a minimum octane rating of 87 and re-evaluate the vehicle performance. Is detonation present?	—	Go to *Step 5*	Verify repair
5	1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive. 2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to *4L30-E Automatic Transmission Diagnosis*). Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Check TCC operation. Refer to *4L30-E Transmission Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check for obvious overheating problems: • Low engine coolant. • Restricted air flow to radiator, or restricted water flow through radiator. • Correct coolant solution should be a 50/50 mix of approved antifreeze/coolant and water. Refer to *Engine Cooling*. • EGR operation. Refer to *DTC P0401*. • ION sensing module fault. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Ignition "OFF." 2. Disconnect the ION sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 9*	—
9	Check the ION sensing harness between the PCM (F68) and ION sensing module circuit (RED Wire) at the Kl line harness connector. Was a problem found?	—	Verify repair	Go to *Step 10*

Detonation/Spark Knock Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 11*	—
11	Check the ION sensing harness between the ignition coil and ION sensing module circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 14*
14	Check the following items; 1. ION sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 16*
15	Replace the ION sensing module. Is the action complete?	—	Verify repair	Go to *Step 16*
16	1. Check fuel pressure. Refer to Chart Fuel System Pressure Test. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Check items that can cause an engine to run lean (long term fuel trim significantly in the positive range). For a lean condition, refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Spark plugs for proper heat range. Refer to *General Information*. 2. If incorrect spark plugs are installed, replace spark plugs as necessary. Did any spark plugs require replacement?	—	Verify repair	Go to *Step 19*
19	1. Remove excessive carbon buildup with a top engine cleaner. Refer to instructions on the top engine cleaner can. 2. Re-evaluate vehicle performance. Is detonation still present?	—	Go to *Step 20*	Verify repair

Detonation/Spark Knock Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
20	1. Check for an engine mechanical problem. Perform a cylinder compression check. Refer to *Engine Mechanical*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 21*
21	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Rough, Unstable, or Incorrect Idle, Stalling Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine runs unevenly at idle. If severe, the engine or vehicle may shake. Engine idle speed may vary in RPM. Either condition may be severe enough to stall the engine. Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Go to *Step 14*	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/Physical Check*
5	1. Check the PCM grounds for cleanliness, tightness and proper routing. Refer to the PCM wiring diagrams in *Electrical Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	Observe the long term fuel trim on the Tech 2. Is the long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 7*	Go to *Step 8*
7	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
8	Is the long term fuel trim significantly in the positive range (lean condition)?	—	Go to *Step 9*	Go to *Step 10*
9	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check for incorrect idle speed. Ensure that the following conditions are present: • The engine is fully warm. • The accessories are “OFF.” 2. Using a Tech 2, monitor the Engine Speed. Is the Engine Speed within the specified values?	Desired Idle Speed	Go to *Step 12*	Go to *Step 11*

Rough, Unstable, or Incorrect Idle, Stalling Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Visually/physically inspect for the following conditions: • Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. • Large vacuum leak. Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty crankcase ventilation valve or a disconnected brake booster hose. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
12	Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Perform the "Injector Coil/Balance Test" in *Fuel Metering System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Check for fuel in the pressure regulator vacuum hose. 2. If fuel is present, replace the fuel pressure regulator assembly. Refer to *Fuel Metering System*. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for the procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Check for a loose ignition coil ground and ION Sensing Module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Check ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 19*

Rough, Unstable, or Incorrect Idle, Stalling Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
19	Using a Tech 2, monitor the throttle position 1 and 2 angle with the engine idling. Is the TP angle at the specified value and steady?	8 ~ 10%	Go to *Step 20*	Refer to *DTC* for further diagnosis
20	1. Check the positive crankcase ventilation (PCV) valve for proper operation. Refer to *Crankcase Ventilation System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 21*
21	1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive. 2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to *4L30-E Automatic Transmission Diagnosis*). Was a problem found?	—	Verify repair	Go to *Step 22*
22	1. Check for the following engine mechanical items. Refer to *Engine Mechanical* for diagnosis procedures: • Low compression • Sticking or leaking valves • Worn camshaft lobe(s) • Camshaft drive belt slipped or stripped • Incorrect valve timing • Worn rocker arms • Broken valve springs 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 23*
23	1. Check for faulty motor mounts. Refer to *Engine Mechanical* for inspection of mounts. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 24*
24	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Poor Fuel Economy Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test. (Non-standard tires will cause odometer readings to be incorrect, and that may cause fuel economy to appear poor when it is actually normal.) Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/Physical Check*
4	Check owner's driving habits. • Is the A/C "ON" full time (defroster mode "ON")? • Are tires at the correct pressure? • Are excessively heavy loads being carried? • Is acceleration too much, too often? Was a problem found?	—	Go to *Step 5*	Go to *Step 6*
5	Review the items in Step 4 with the customer and advise as necessary. Is the action complete?	—	System OK	—
6	1. Visually/physically check: Vacuum hoses for splits, kinks, and improper connections and routing as shown on the "Vehicle Emission Control Information" label. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Remove and check the air filter element for dirt or for restrictions. Refer to *Air Intake System*. 2. Replace the air filter element if necessary. Was a repair required?	—	Verify repair	Go to *Step 8*
8	1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Spark Plug Replacement*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	1. Check for low engine coolant level. Refer to *Engine Cooling*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*

Poor Fuel Economy Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check for an incorrect or faulty engine thermostat. Refer to *Engine Cooling*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Check for low engine compression. Refer to *Engine Mechanical*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	1. Check the TCC operation. Refer to *4L30-E Transmission Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Check the exhaust system for possible restriction: • Inspect the exhaust system for damaged or collapsed pipes. • Inspect the muffler for heat distress or possible internal failure. • Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to *Restricted Exhaust System Check*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	Check for proper calibration of the speedometer. Does the speed indicated on the speedometer closely match the vehicle speed displayed on the Tech 2?	—	Go to *Step 16*	Go to *Step 15*
15	Diagnose and repair an inaccurate speedometer condition as necessary. Refer to *Vehicle Speed Sensor* in *Electrical Diagnosis*. Was a problem found?	—	Verify repair	—
16	1. Check the air intake system and the crankcase for air leaks. Refer to *Air Intake System* and *Crankcase Ventilation System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Review all diagnostic procedures within this table. 2. When all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	Perform the procedure in *Fuel System Pressure Test*. Was the fuel pressure normal?	—	Contact Technical Assistance	Verify repair

Excessive Exhaust Emissions or Odors Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Vehicle fails an emission test. Vehicle has excessive "rotten egg" smell. (Excessive odors do not necessarily indicate excessive emissions.) Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Go to *Step 13*	Go to *Step 3*
3	Was a thorough visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/Physical Check*
4	1. Check for vacuum leaks. Check vacuum lines, intake manifold, throttle body, etc. 2. If a problem is found, repair as necessary. Were any vacuum leaks located?	—	Go to *Step 13*	Go to *Step 5*
5	1. Check the fuel cap for proper installation. 2. Secure the fuel cap if necessary. Was the fuel cap installed properly?	—	Go to *Step 6*	Go to *Step 13*
6	1. Check the fuel pressure. Perform the procedure in *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 7*
7	1. Check for a faulty, plugged, or incorrectly installed crankcase ventilation valve; also check the crankcase ventilation system for plugging. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 8*
8	1. Check the injector connections. 2. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 9*
9	1. Perform the "Injector Coil/Balance Test" in *Fuel Metering System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 10*
10	1. Refer to *Engine Cooling* for cooling system diagnosis. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 11*
11	1. Check EVAP canister for fuel loading. Refer to *Evaporative Emission Control System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 12*

Excessive Exhaust Emissions or Odors Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Remove excessive carbon buildup with a top engine cleaner. Refer to the instructions on the top engine cleaner can. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to *Step 14*
13	Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to *Step 14*
14	Does the exhaust emission test indicate excessive CO and HC levels or is long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 15*	Go to *Step 16*
15	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. Make any necessary repairs. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to *Step 17*
16	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. Make any necessary repairs. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to *Step 17*
17	1. Check the EGR system (refer to *DTC P0401*). 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 18*
18	1. Check for an engine mechanical problem. Perform a cylinder compression check (refer to *Engine Mechanical*). 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 19*
19	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records butter • All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Dieseling, Run-On Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine continues to run after key is turned "OFF," but runs very rough. If engine runs smooth, check ignition switch and adjustment. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/Physical Check*
4	1. Check for a short between B+ and any of the ignition feed circuits. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records butter • All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Backfire Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Fuel ignites in the intake manifold, or in the exhaust system, making a loud popping noise. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/Physical Check*
4	1. Check for proper ignition voltage coil output with spark tester J 26792 (ST-125). Refer to *Electric Ignition System* for procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. Refer to *DTC P0172* to determine the cause of a rich condition or *Engine Mechanical* for an oil fouling condition. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Visually/physically inspect the ignition coils for cracks. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check for an intermittent ignition system malfunction: • Intermittent CKP 58X signal. • Intermittent ignition feed circuit or sensor ground circuit to the crankshaft position sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Check the fuel pressure. Refer to *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*

Backfire Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Check for the following engine mechanical conditions. Refer to *Engine Mechanical* for diagnosis procedures: • Low compression • Sticking or leaking valves • Worn camshaft lobe(s) • Camshaft drive belt slipped or stripped • Incorrect valve timing 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check the intake and exhaust manifold(s) for casting flash. Refer to *Engine Mechanical*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records butter • All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Cuts Out, Misses Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Steady pulsation or jerking that follows engine speed; usually more pronounced as engine load increases. Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Go to *Step 14*	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/Physical Check*
4	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 5*	Go to *ETC System Check*
5	1. Check the PCM grounds for clearness, tightness and proper routing. Refer to the PCM wiring diagrams in *Electrical Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	Observe the long term fuel trim on the Tech 2. Is the long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 7*	Go to *Step 8*
7	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
8	Is the long term fuel trim significantly in the positive range (lean condition)?	—	Go to *Step 9*	Go to *Step 10*
9	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check for incorrect idle speed. Ensure that the following conditions are present: • The engine is fully warm. • The accessories are “off.” 2. Using a Tech 2, monitor the Engine Speed. Is the Engine Speed within the specified values?	Desired Idle Speed	Go to *Step 12*	Go to *Step 11*

Cuts Out, Misses Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Visually/physically inspect for the following conditions: • Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. • Large vacuum leak. Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty PCV valve or brake booster hose disconnected . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
12	Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Perform the "Injector Coil/Balance Test" in *Fuel Metering System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Check for fuel in the pressure regulator vacuum hose. 2. If fuel is present, replace the fuel pressure regulator assembly. Refer to *Fuel Metering System*. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for the procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Check for a loose ignition coil ground and ION Sensing module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Check ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 19*
19	Using a Tech 2, monitor the TP 1, 2 angle with the engine idling. Is the TP angle at the specified value and steady?	8 ~ 10%	Go to *Step 20*	Refer to *DTC P0123* for further diagnosis

Cuts Out, Misses Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
20	1. Check the PCV valve for proper operation. Refer to *Crankcase Ventilation System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 21*
21	1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive. 2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to *4L30-E Automatic Transmission Diagnosis*). Was a problem found?	—	Verify repair	Go to *Step 22*
22	1. Check the following engine mechanical items. Refer to *Engine Mechanical* for diagnosis procedures: • Low compression • Sticking or leaking valves • Worn camshaft lobe(s) • Camshaft drive belt slipped or stripped • Incorrect valve timing • Worn rocker arms • Broken valve springs 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 23*
23	1. Check for faulty motor mounts. Refer to *Engine Mechanical* for inspection of mounts. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 24*
24	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records butter • All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Hesitation, Sag, Stumble Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Momentary lack of response as the accelerator is pushed down. Can occur at any vehicle speed. Usually most pronounced when first trying to make the vehicle move, as from a stop sign. May cause the engine to stall if severe enough. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/Physical Check*
5	1. Check the fuel control heated oxygen sensors (HO2S, B1S1 and B2S1). The fuel control heated oxygen sensors (HO2S) should respond quickly to different throttle positions. If they don't, check them for silicon or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating. Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication). The PCM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem. For more information, refer to *Powertrain Control Module (PCM) and Sensors*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Check the fuel pressure. Refer to *Fuel System Pressure Test.* 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Observe the TP 1, 2 angle display on the Tech 2 while slowly increasing throttle pedal. Does the TP angle display steadily increase from 8 ~ 10% at closed throttle to 90 ~ 92% at WOT?	—	Go to *Step 8*	Go to *Step 19*
8	Monitor the long term fuel trim on the Tech 2. Is the long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 9*	Go to *Step 10*
9	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*

Hesitation, Sag, Stumble Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for the procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	1. Check for a loose ignition coil ground and ION Sensing module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Check the ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check the PCM grounds for clearness, tightness and proper routing. Refer to the PCM wiring diagrams in Electrical Diagnosis. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Check the MAF sensor connections. 2. If a problem is found, replace the faulty terminals as necessary. Refer to *Electrical Diagnosis* for wiring repair procedures. Was a problem found?	—	Verify repair	Go to *Step 17*

Hesitation, Sag, Stumble Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
17	1. Visually/physically check vacuum hoses for splits, kinks, and proper connections and routing as shown on the "Vehicle Emission Control Information" label. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records butter • All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Bank 1 Restricted Exhaust System Check

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Remove the Bank 1 HO2S 2. 2. Install the Exhaust Backpressure Tester (BT-8515-V or equivalent) in place of the Bank 1 HO2S 2. 3. Run the engine at normal operating temperature. 4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build. 5. Observe the exhaust system backpressure reading on the gauge. Does the reading exceed the amount in the value column?	8.62 kPa (1.25 psi)	Go to *Step 3*	Go to *Step 4*
3	Repair the restriction in the exhaust system after the catalytic converter. Possible faults include: • Collapsed pipe • Heat distress • Internal muffler failure Is the action complete?	—	Verify repair	—
4	1. Install the Bank 1 HO2S 2. 2. Install the Exhaust Backpressure Tester in place of Bank 1 HO2S 1. 3. Run the engine at normal operating temperature. 4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build. 5. Observe the exhaust system backpressure reading on the gauge. Does the reading exceed the amount in the value column?	8.62 kPa (1.25 psi)	Go to *Step 5*	No trouble found. If a driveability symptom exists, refer to symptom charts
5	Repair the restriction in the catalytic converter. Is the action complete?	—	Verify repair	—

NOTE: DTCs will be set by running the vehicle to normal operating temperature after a cold start with the O2 sensor disconnected. After performing these tests, use the Tech 2 to erase the DTCs that were set by the lack of O2 sensor activity.

Bank 2 Restricted Exhaust System Check

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Remove the Bank 2 HO2S 2. 2. Install the Exhaust Backpressure Tester (BT-8515-V or equivalent) in place of the Bank 2 HO2S 2. 3. Run the engine at normal operating temperature. 4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build. 5. Observe the exhaust system backpressure reading on the gauge. Does the reading exceed the amount in the value column?	8.62 kPa (1.25 psi)	Go to *Step 3*	Go to *Step 4*
3	Repair the restriction in the exhaust system after the catalytic converter. Possible faults include: • Collapsed pipe • Heat distress • Internal muffler failure Is the action complete?	—	Verify repair	—
4	1. Install the Bank 2 HO2S 2. 2. Install the Exhaust Back pressure Tester in place of Bank 1 HO2S 1. 3. Run the engine at normal operating temperature. 4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build. 5. Observe the exhaust system backpressure reading on the gauge. Does the reading exceed the amount in the value column?	8.62 kPa (1.25 psi)	Go to *Step 5*	No trouble found. If a driveability symptom exists, refer to symptom charts
5	Repair the restriction in the catalytic converter. Is the action complete?	—	Verify repair	—

NOTE: DTCs will be set by running the vehicle to normal operating temperature after a cold start with the O2 sensor disconnected. After performing these tests, use the Tech 2 to erase the DTCs that were set by the lack of O2 sensor activity.

Default Matrix Table

Service Procedure Default Strategy

A referral strategy has been established to assist the technician with additional information when the cause of the failure cannot be determined. If no problem is found after performing diagnostics, then refer to the default matrix table for further diagnostic information.

Default Matrix Table

Strategy Based Diagnostic Charts	Initial Diagnosis	Default Section(s)
On-Board Diagnostic (OBD) System Check	Vehicle does not enter diagnostics.	Chassis Electrical
On-Board Diagnostic (OBD) System Check	Vehicle enters diagnostics and communicates with the Tech 2. MIL is "ON" in diagnostics. Engine does not start and run.	Ignition System Check
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of vibration.	—
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of harsh or soft shift, poor performance, delayed or no engagement into drive or reverse, transmission fluid leak, transmission noise or vibration, or improper TCC operation.	Automatic Transmission
PCM Power and Ground Check	On-Board Diagnostic (OBD) System Check.	Chassis Electrical
PCM Power and Ground Check	On-Board Diagnostic (OBD) System Check. PCM power and ground circuits OK. Data link voltage incorrect.	Chassis Electrical
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of harsh or soft shift, poor performance, delayed or no engagement into drive or reverse, transmission fluid leak, transmission noise or vibration, or improper TCC operation.	Automatic Transmission

Symptoms	Initial Diagnosis	Default Section(s)
Intermittents	1. On-board Diagnostic (OBD) system check. 2. Careful visual/physical inspections.	Chassis Electrical
Hard Starts	1. OBD system check. 2. ETC system check. 3. Sensors (ECT, MAP, MAF, TP) ; MAP output chart. 4. Fuel system electrical test, fuel system diagnosis. 5. Ignition system.	Engine Mechanical, Ignition System Check, Exhaust System Diagnosis

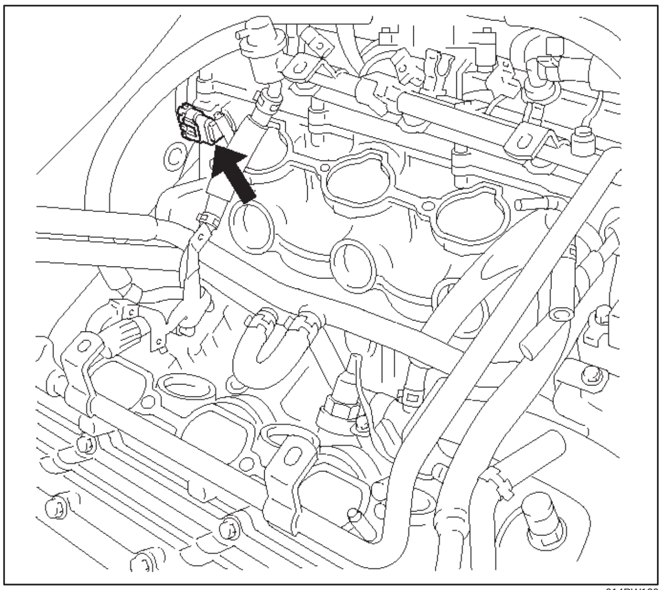
Symptoms	Initial Diagnosis	Default Section(s)
Surges and/or Chuggles	1. OBD system check. 2. ETC system check. 3. Heated oxygen sensors. 4. Fuel system diagnosis. 5. Ignition system.	Calibration ID/Service Bulletins, Ignition System Check, Generator Output, Exhaust System Diagnosis, 4L30-E System Test
Lack of Power, Sluggish or Spongy	1. OBD system check. 2. ETC system check. 3. Fuel system diagnosis. 4. Ignition system. 5. EGR operation. 6. EGR system check.	Refer to *Exhaust System* in *Engine Exhaust*, TCC Operation, Calibration ID/Service Bulletins
Detonation/Spark Knock	1. OBD system check. 2. Transmission range switch. 3. EGR operation. 4. EGR system check. 5. TCC operation. 6. Fuel system diagnosis. 7. Ignition system. 8. ION sensing module check.	TCC operation, Cooling System, Ignition System Check, Calibration ID/Service Bulletins
Rough, Unstable, or Incorrect Idle, Stalling	1. OBD system check. 2. ETC system check. 3. Fuel injector and fuel injector balance test. 4. EVAP emission canister purge valve check. 5. Ignition system. 6. EGR operation.	MAP Output Check, Throttle Linkage, EGR System Check, A/C Clutch Control Circuit Diagnosis, Crankcase Ventilation System, Calibration ID/Service Bulletins, Generator Output Voltage (refer to *Chassis Electrical*), Exhaust Diagnosis
Poor Fuel Economy	1. OBD system check. 2. Careful visual/physical inspection. 3. Ignition system. 4. Cooling system.	TCC Operation, Exhaust System (refer to *Engine Exhaust*)
Hesitation, Sag, Stumble	1. OBD system check. 2. ETC system check. 3. TP. 4. MAP output check. 5. Fuel system diagnosis. 6. Fuel injector and fuel injector balance test. 7. EVAP emission canister purge valve. 8. Ignition system.	EGR Operation, EGR System Check, Generator Output Voltage (refer to *Chassis Electrical*), Calibration ID/Service Bulletins, Ignition System Check
Cuts Out, Misses	1. OBD system check. 2. Cylinder balance test. 3. ETC system check.	Ignition System Check
Engine Cranks But Will Not Run	1. OBD system check.	Fuel System Electrical Diagnosis, Fuel System Diagnosis, Fuel Injector and Fuel Injector Balance Test.

Symptoms	Initial Diagnosis	Default Section(s)
Excessive Exhaust Emissions or Odors	1. OBD system check. 2. Emission test. 3. Cooling system. 4. Fuel system diagnosis. 5. Fuel injector and fuel injector balance test. 6. EVAP emission canister purge valve. 7. Crankcase ventilation system. 8. Ignition system. 9. MAP output check.	EGR System Check, Exhaust Diagnosis, Calibration ID/Service Bulletins
Dieseling, Run-On	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis.	—
Backfire	1. OBD system check. 2. Ignition system. 3. Fuel system diagnosis. 4. Fuel injector and fuel injector balance test. 5. EGR operation, EGR system check.	Exhaust System Diagnosis, Intake Casting Flash, Ignition System Check
Misfire	1. OBD system check. 2. Ignition system. 3. Fuel system diagnosis. 4. Fuel injector and fuel injector balance test.	Vibrations, Transmission, Driveshaft and Axle
Catalyst Monitor	1. OBD system check. 2. Careful visual/physical inspection. 3. Heated oxygen sensors.	Exhaust System
Fuel Trim	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis. 4. Heated oxygen sensors, MAF sensors.	Exhaust System Intake Air System
Evaporative Emissions	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis.	—
Heated Oxygen Sensors	1. OBD system check. 2. Careful visual/physical inspection.	Exhaust System

On-Vehicle ServiceCamshaft Position (CMP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Remove the common chamber assembly.
   Refer to Common Chamber in Engine Mechanical section.



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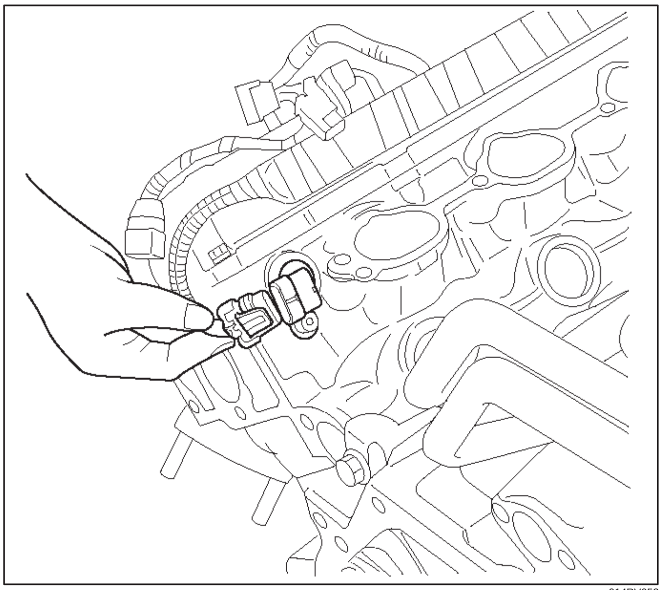
4. Disconnect the electrical connector to the CMP sensor.



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5. Remove the CMP retaining bolt from the side of left cylinder head.
6. Remove the CMP sensor from the cylinder head.

Inspection Procedure

1. Inspect the sensor O-ring for cracks or leaks.
2. Replace the O-ring if it is worn or damaged.
3. Lubricate the new O-ring with engine oil.
4. Install the lubricated O-ring.

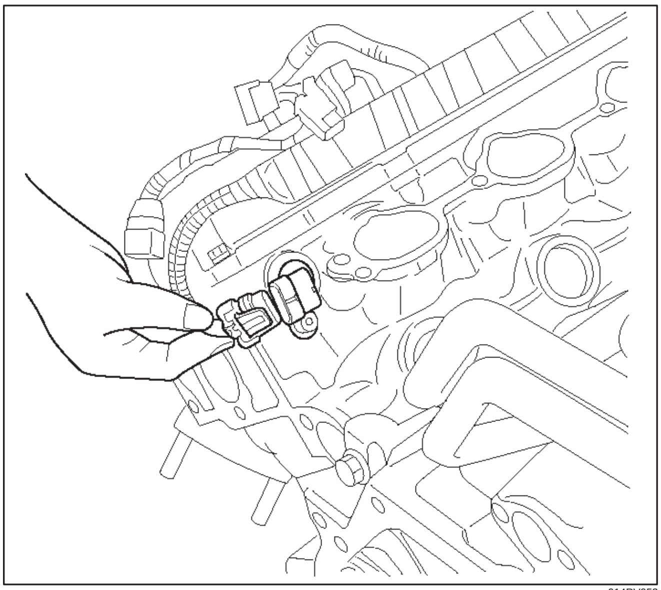
Installation Procedure

1. Install the CMP sensor in the cylinder head.
2. Install the CMP sensor retaining bolt.

Tighten

- **Tighten the retaining screw to 9 N·m (78 lb in.).**

3. Connect the electrical connector to the CMP sensor.



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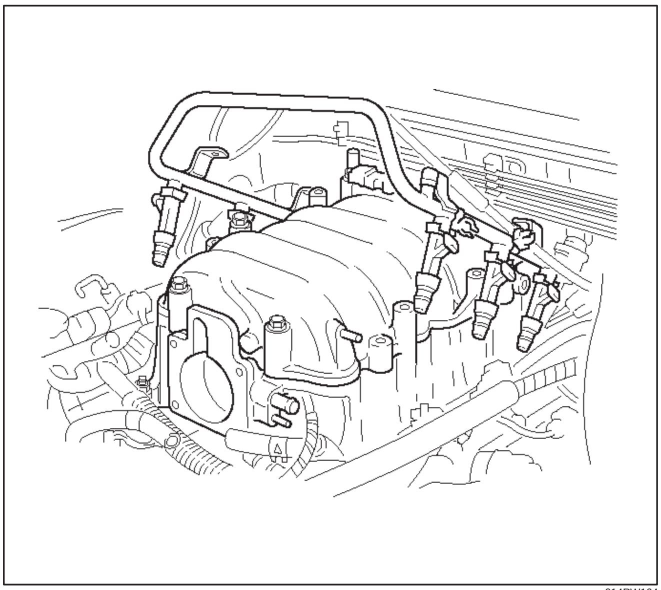
4. Install the common chamber assembly.
   Refer to Common Chamber in Engine Mechanical section.



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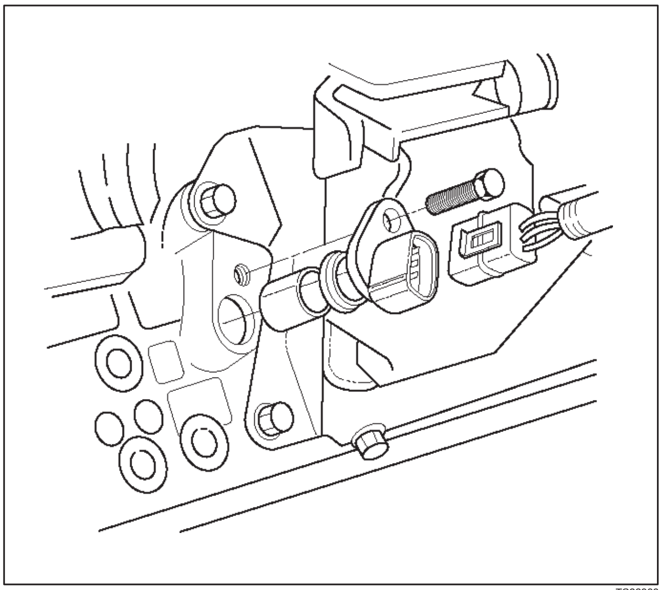
5. Install the engine cover.
6. Connect the negative battery cable.

Crankshaft Position (CKP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector to the CKP sensor.
3. Remove one bolt and the CKP sensor from the right side of the engine block, just behind the mount.

NOTE: Use caution to avoid any hot oil that might drip out.



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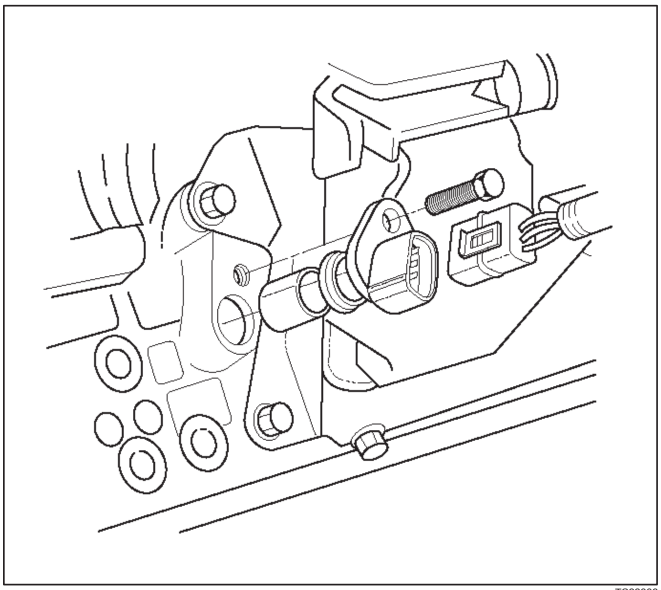
Inspection Procedure

1. Inspect the sensor O-ring for cracks or leaks.
2. Replace the O-ring if it is worn or damaged.
3. Lubricate the new O-ring with engine oil.
4. Install the lubricated O-ring.

Installation Procedure

1. Install the CKP sensor in the engine block.
2. Install the CKP sensor mounting bolt.

Tighten
- **Tighten the mounting bolt to 9 N·m (78 lb in.).**



TS22909

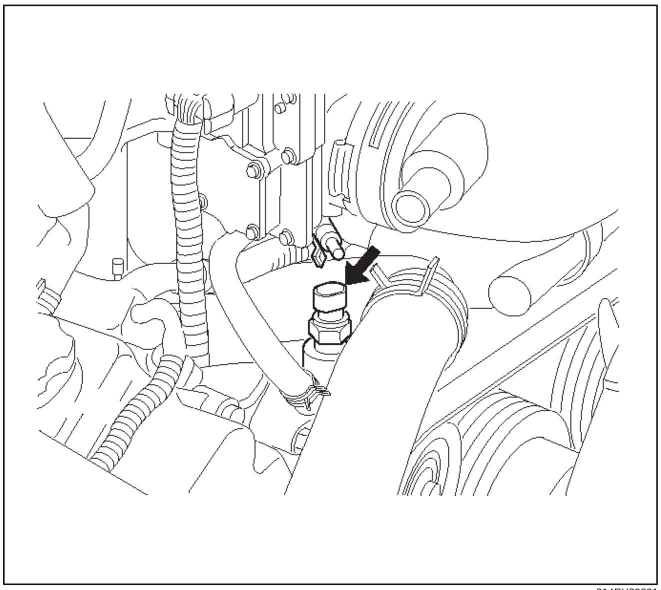
3. Connect the electrical connector to the CKP sensor.
4. Connect the negative battery cable.

Engine Coolant Temperature (ECT) Sensor

Removal Procedure

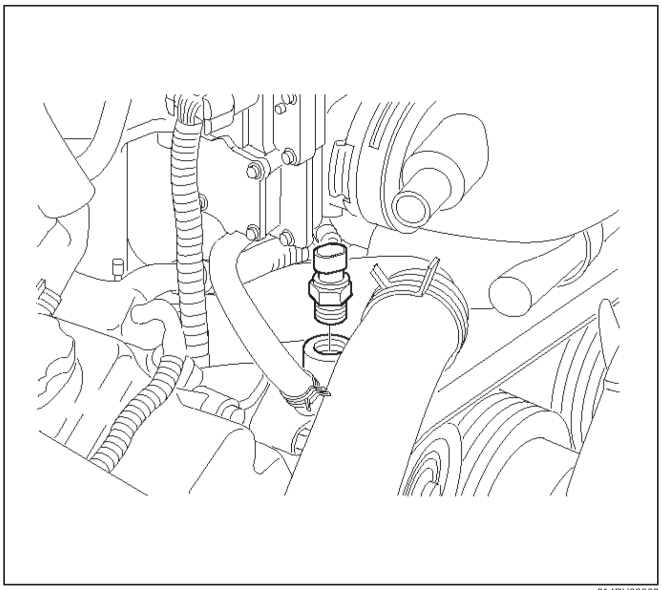
NOTE: Care must be taken when handling the engine coolant temperature (ECT) sensor. Damage to the ECT sensor will affect proper operation of the fuel injection system.

1. Disconnect the negative battery cable.
2. Drain the radiator coolant. Refer to *Draining and Refilling Cooling System* in *Engine Cooling* section.
3. Disconnect the electrical connector.



014RY00001

4. Remove the ECT sensor from the coolant crossover.



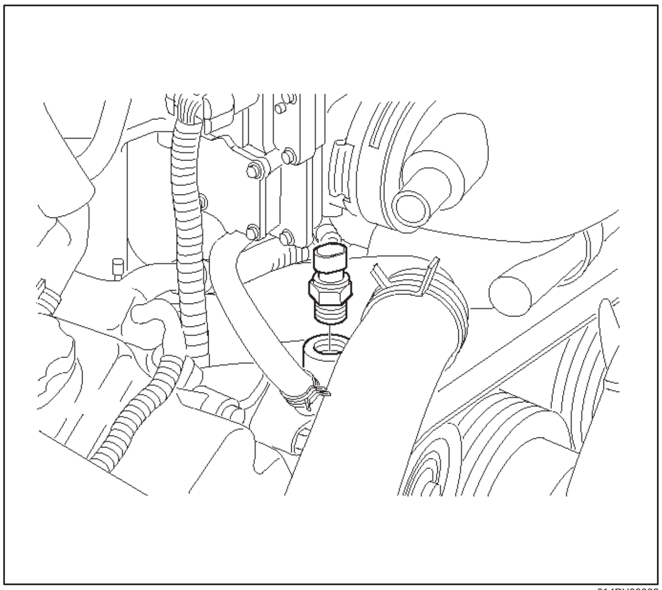
014RY00002

Installation Procedure

1. Apply sealer or the equivalent to the threads of the ECT sensor.
2. Install the ECT sensor in the coolant crossover.

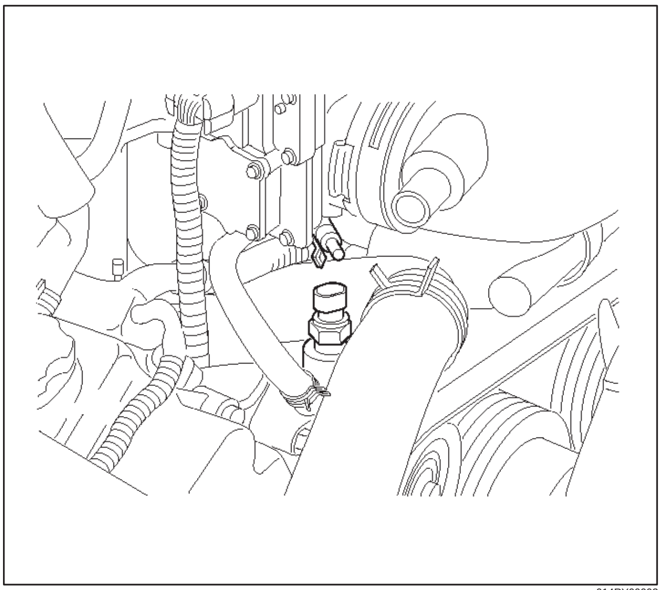
Tighten

- **Tighten the ECT sensor to 30 N·m (22 lb ft.).**



014RY00002

3. Connect the electrical connector.



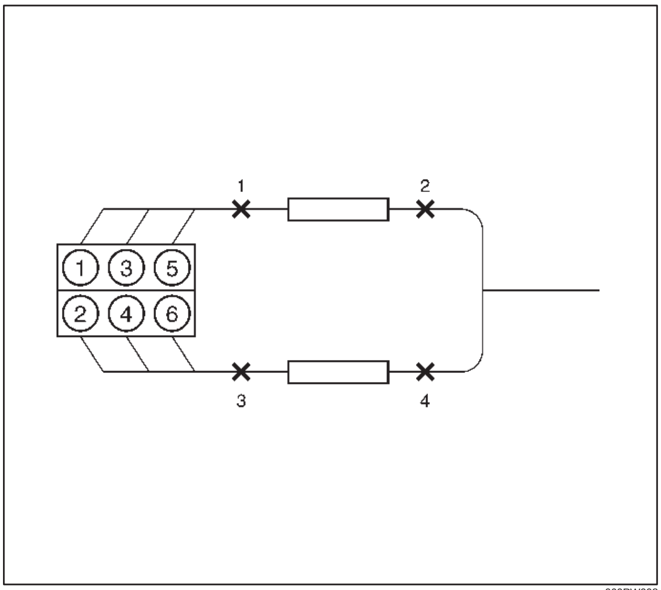
014RY00003

4. Fill the radiator with coolant. Refer to *Draining and Refilling Cooling System* in *Engine Cooling* section.
5. Connect the negative battery cable.

Heated Oxygen Sensor (HO2S)

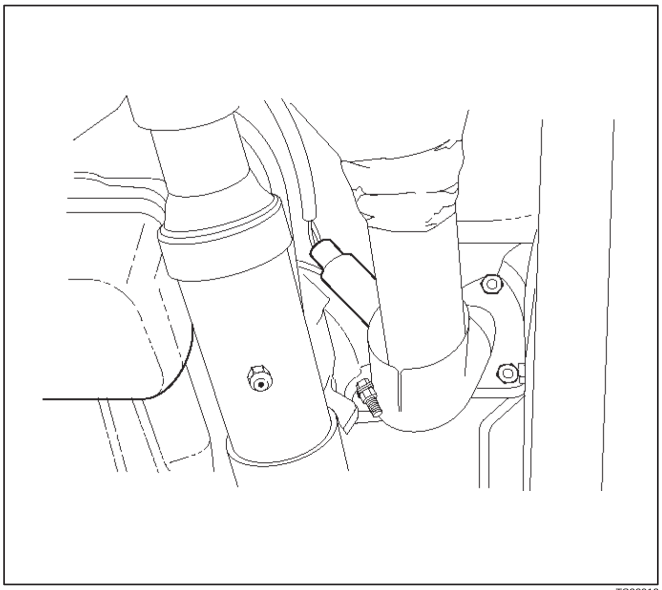
Removal Procedure

1. Disconnect the negative battery cable.
2. Locate the four oxygen sensors.



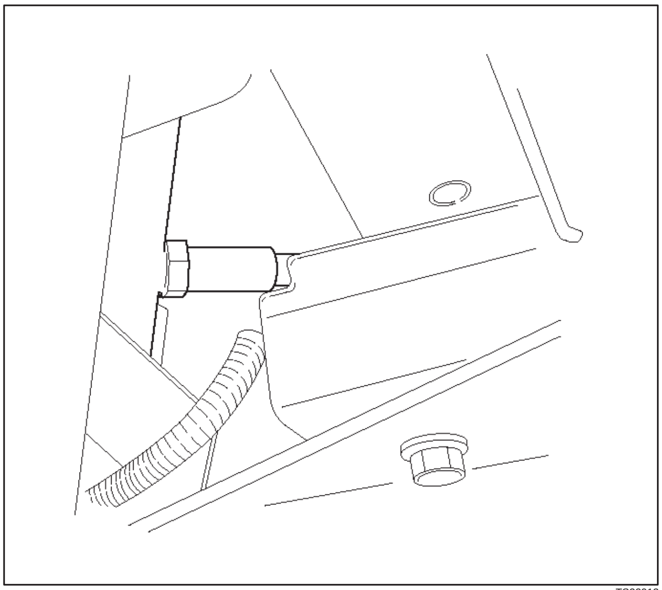
060RW008

- Bank 1 sensor 1 is mounted on the exhaust pipe ahead of the right-hand catalytic converter.



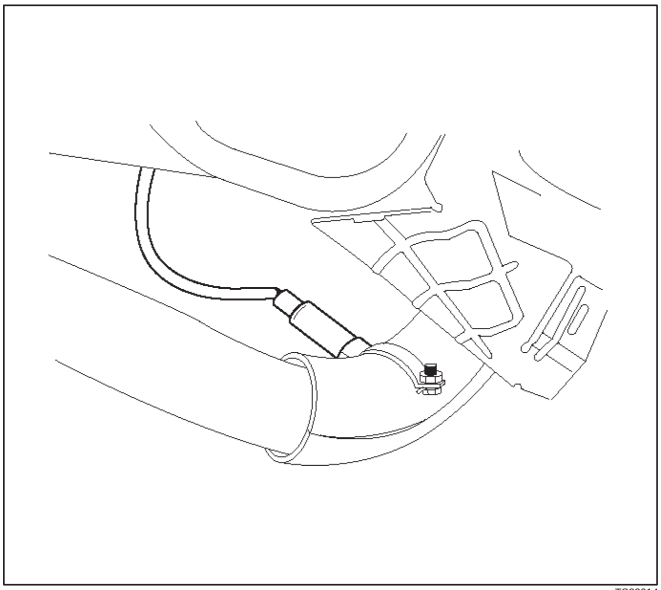
TS22912

- Bank 1 sensor 2 is mounted behind the right-hand catalytic converter.



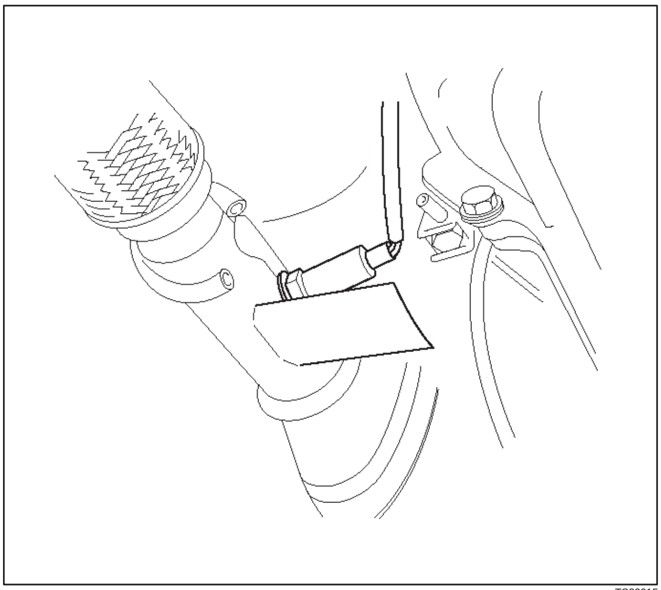
TS22913

- Bank 2 sensor 1 is mounted on the exhaust pipe ahead of the left-hand catalytic converter.



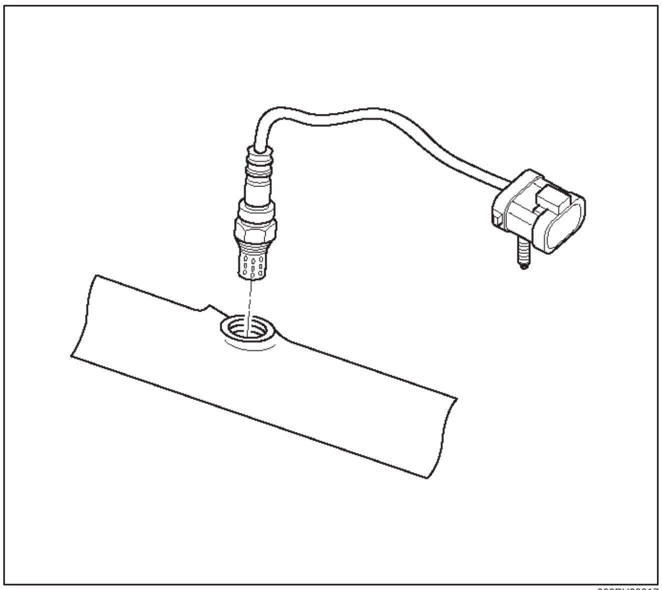
TS22914

- Bank 2 sensor 2 is mounted behind the left-hand catalytic converter.



TS22915

3. Disconnect the pigtail from the wiring harness.

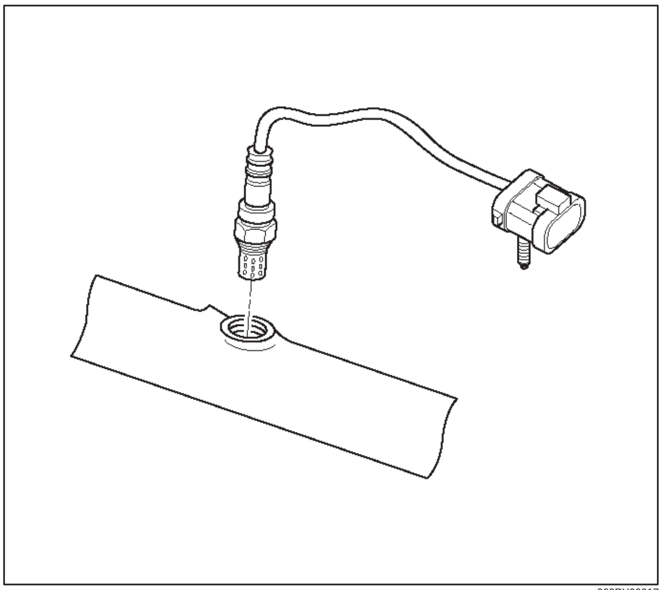


060RY00017

IMPORTANT: The pigtail is permanently attached to the sensor. Be careful not to pull the wires out.

NOTE: Do not use a torch to remove an HO2S unless the sensor is being replaced. Using a torch could damage the sensor.

4. Remove the sensor from the exhaust pipe.
   - Because of the expansion and contraction of the metal in the exhaust system over time, this may be difficult if the engine temperature is below 48°C (120°F).

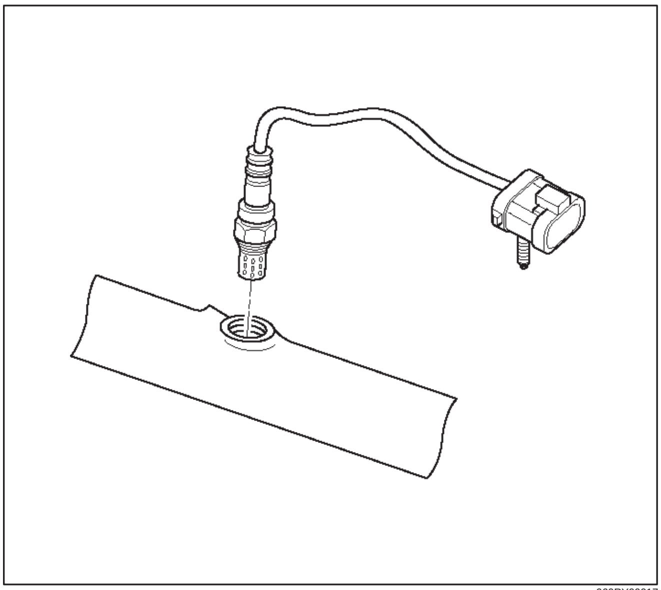


060RY00017

Inspection Procedure

All four sensors are identical. Inspect each in the same way.

1. Inspect the pigtail and the electrical connector for grease, dirt, corrosion, and bare wires or worn insulation.
2. Inspect the louvered end of the sensor for grease, dirt, or other contaminations.



060RY00017

Installation Procedure

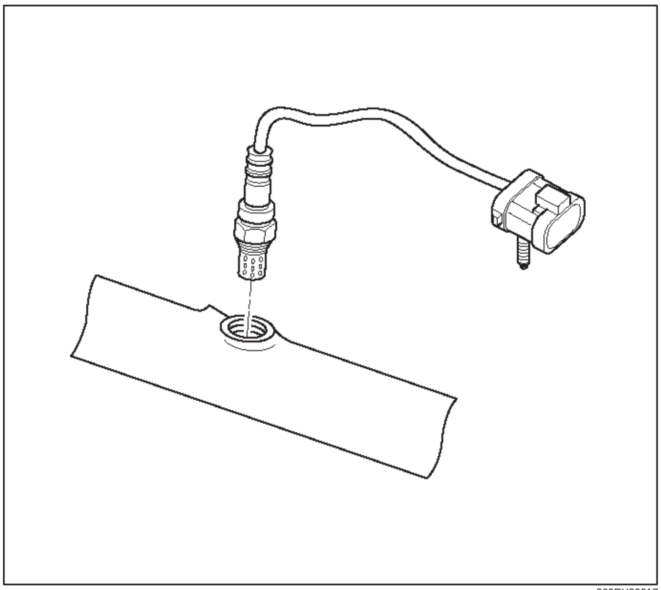
IMPORTANT:

- A special anti-seize compound on the HO2S threads. This compound consists of glass beads suspended in a liquid graphite solution. The graphite burns away with engine heat, but the glass beads will remain, making the sensor easier to remove.
- New or service sensors will already have the compound applied to the threads. If a sensor is removed and is to be reinstalled for any reason, the threads must have anti-seize compound applied.

1. Apply anti-seize compound or the equivalent to the threads of the oxygen sensor, if necessary.
2. Install the oxygen sensor on the exhaust pipe in its original position.

Tighten

- **Tighten the oxygen sensor to 55 N·m (40 lb ft.).**



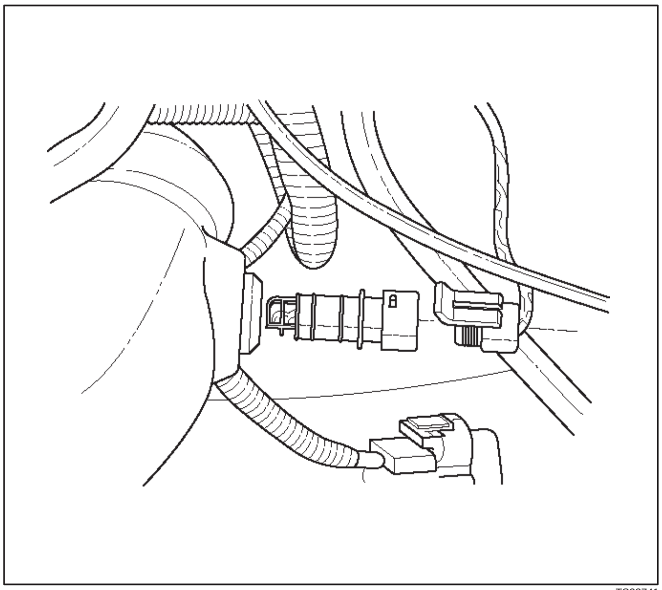
060RY00017

3. Connect the pigtail to the wiring harness.
4. Connect the negative battery cable.

Intake Air Temperature (IAT) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the engine cover
3. The IAT sensor is located in the intake air duct, behind the throttle body.
4. Disconnect the electrical connector from the IAT sensor.

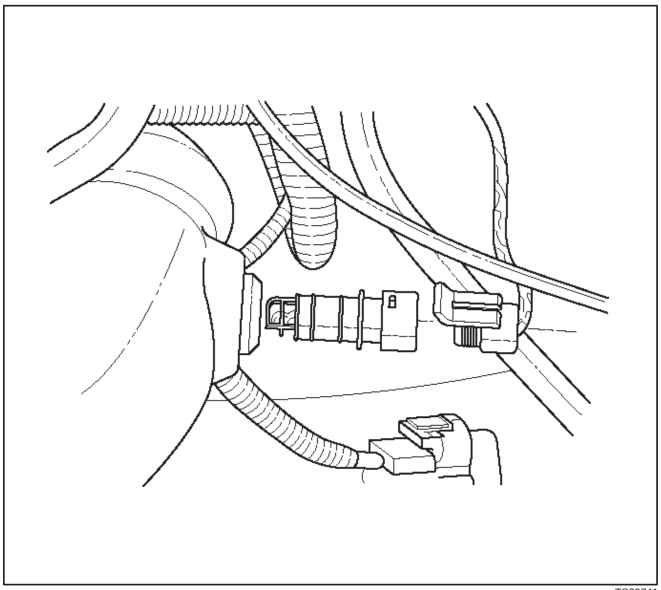


TS23741

5. Remove the IAT sensor from the intake air duct by using a rocking motion while pulling the sensor.

Installation Procedure

1. Install the IAT sensor into the grommet in the intake air duct.
2. Correct the IAT electrical connector.



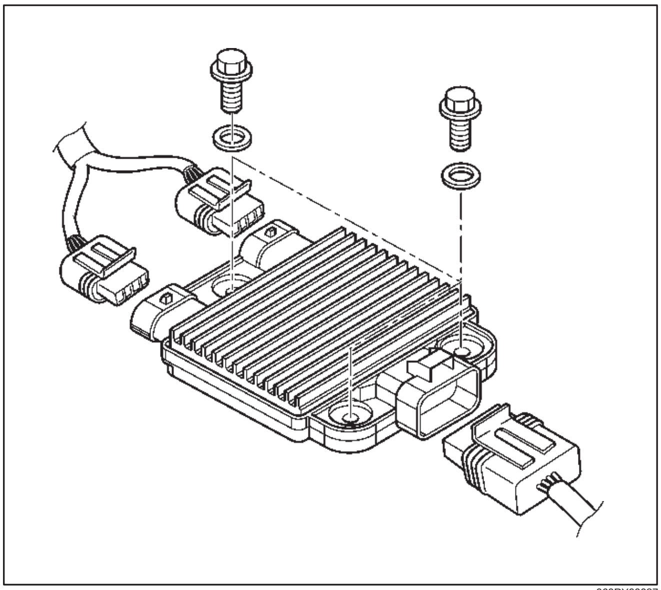
TS23741

3. Install the engine cover.
4. Connect the negative battery cable.

ION Sensing Module

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the ION sensing module connector.
3. Remove the bolts and the ION sensing module from the common chamber.



060RY00087

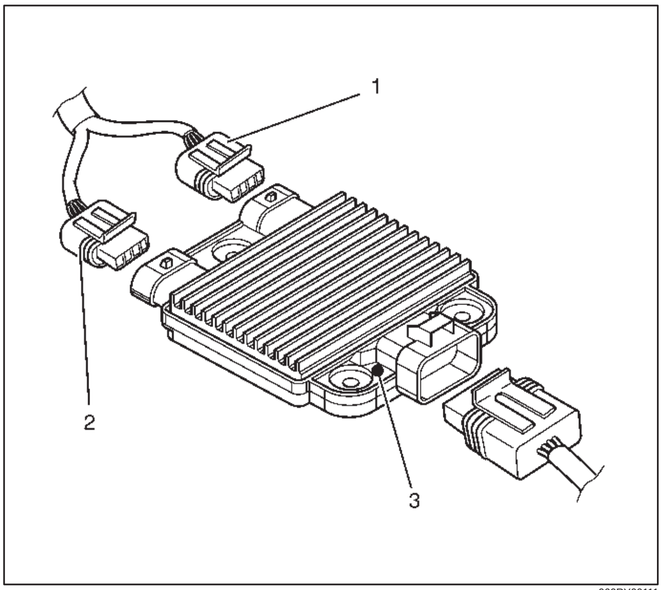
Installation Procedure

1. Install the ION sensing module on the common chamber with the bolts.

Tighten

- **Tighten the ION sensing module to 4 N·m (35 lb in.).**

2. Connect the ION sensing module connectors as shown in the illustration.



060RY00111

Legend

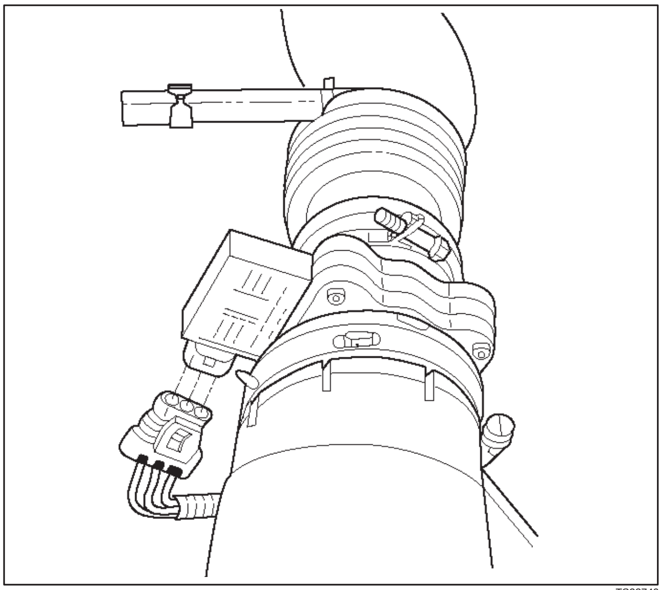
(1) Green Color Connector
(2) Blue Color Connector
(3) Identification Mark (6VE1 Engine Only)

3. Connect the negative battery cable.

Mass Air Flow (MAF) Sensor

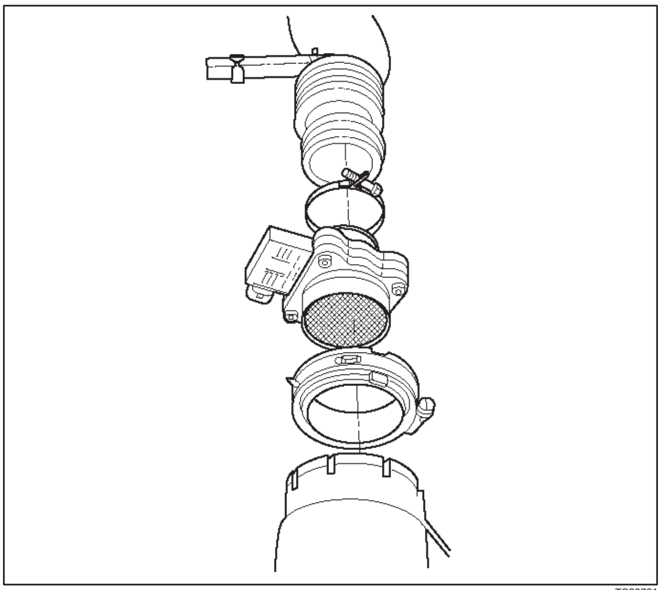
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the MAF sensor.



TS23740

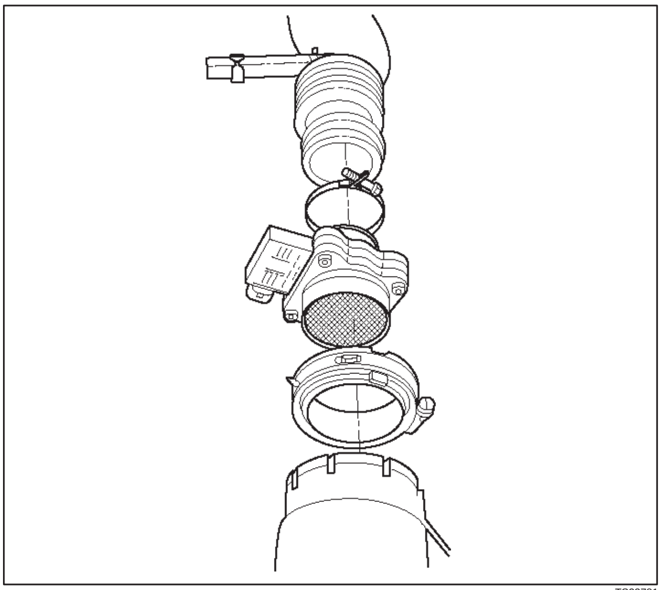
3. Loosen the clamps which secure the intake air duct and the air cleaner to the MAF sensor.
4. Remove the intake air duct from the MAF sensor.
5. Remove the MAF sensor from the air cleaner.



TS23781

Installation Procedure

1. Install the MAF sensor on the air cleaner with the clamp.
2. Install the intake air duct and the clamp on the MAF sensor.



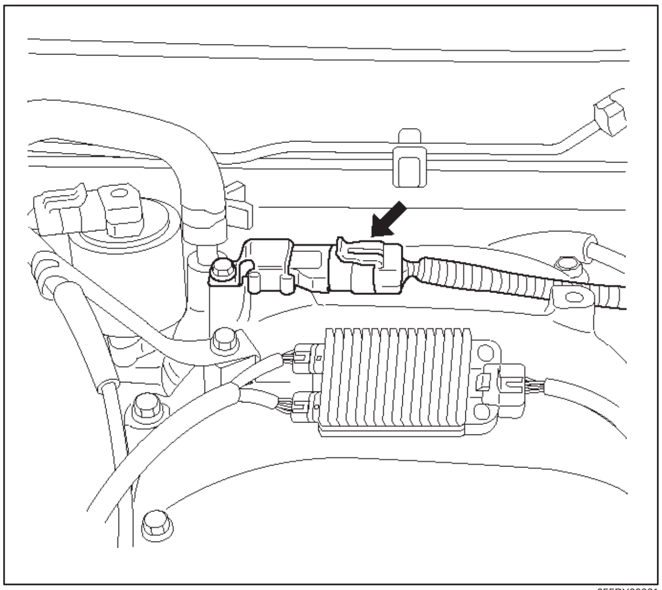
TS23781

3. Tighten the clamps to secure the MAF sensor to the intake air duct and the air cleaner.
4. Connect the MAF electrical connector.
5. Connect the negative battery cable.

Manifold Absolute Pressure (MAP) Sensor

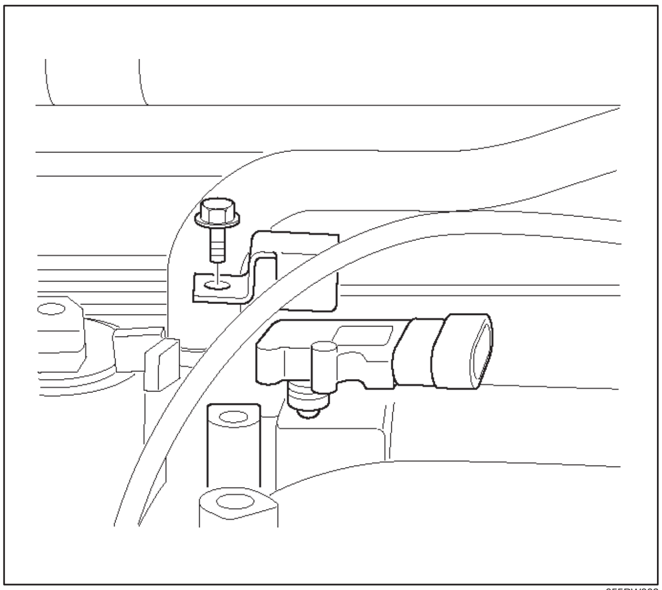
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the MAP sensor.



055RY00001

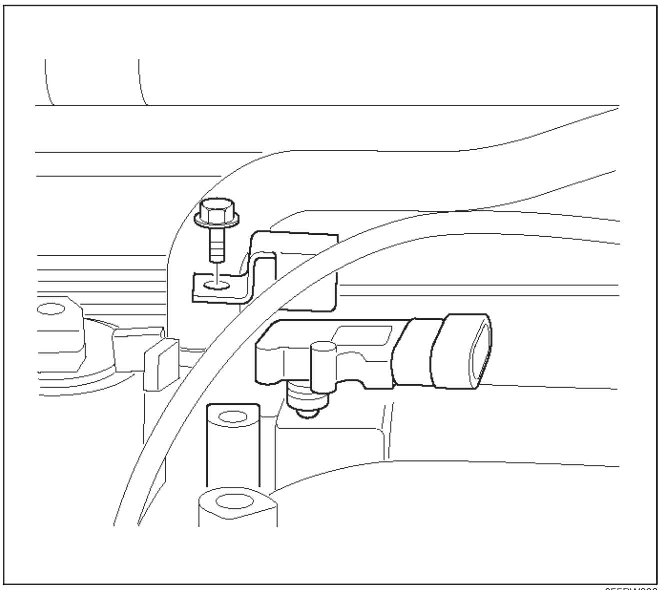
3. Remove the bolt securing the MAP sensor to the mounting bracket on the common chamber.
4. Remove the MAP sensor from the mounting bracket.



055RW002

Installation Procedure

1. Install the MAP sensor in the mounting bracket.



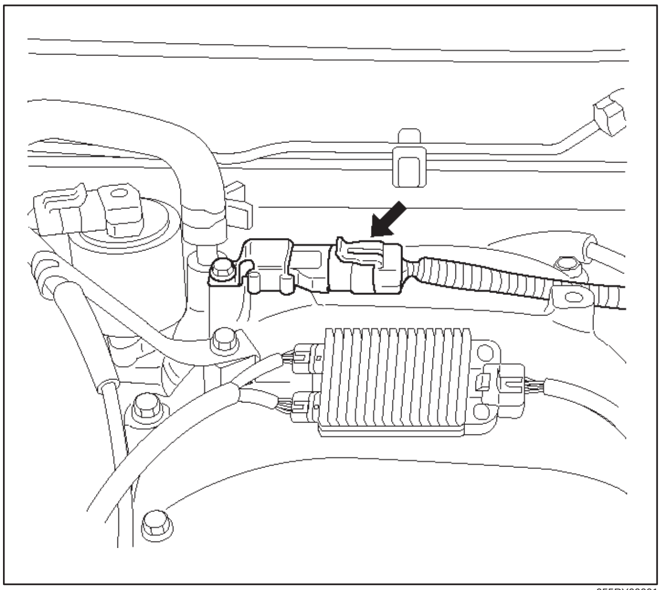
055RW002

2. Install the mounting bracket retaining bolt on the common chamber.

Tighten

- **Tighten the bolt to 20 N·m (12 lb ft.).**

3. Connect the MAP electrical connector.



055RY00001

4. Connect the negative battery cable.

Malfunction Indicator Lamp (MIL)

Removal and Installation Procedure

Refer to Warning light bulb, indicator light valve, illumination light bulb, A/T indicator light bulb in Meter and Gauge.

Reduced Power Lamp

The reduced power lamp (PPL) turns on when the ignition key is moved to the ON position. It should turn off in approximately 3 seconds or immediately after the engine starts.
If the RPL turns on during vehicle operation, a vehicle system failure resulting in reduced engine output is indicated.
If both the reduced RPL and the check engine light turn on, a serious problem affecting vehicle performance is indicated.
Refer to the *OBD system check NO and RPL "ON" steady* in this manual.

Powertrain Control Module (PCM)

Service Precaution

NOTE: To prevent possible electrostatic discharge damage to the PCM, do not touch the connector pins or soldered components on the circuit board.

Electrostatic Discharge (ESD) Damage

Electronic components used in the control systems are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.
There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat.
Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTE: To prevent possible Electrostatic Discharge damage, follow these guidelines:

- Do not touch the control module connector pins or soldered components on the control module circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, or while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

NOTE: To prevent internal PCM damage, the ignition must be in the "OFF" position in order to disconnect or reconnect power to the PCM (for example: battery cable, PCM pigtail, PCM fuse, jumper cables, etc.).

IMPORTANT: When replacing the production PCM with a service PCM, it is important to transfer the broadcast code and production PCM number to the service PCM label. This will allow positive identification of PCM parts throughout the service life of the vehicle. Do not record this information on the metal PCM cover.

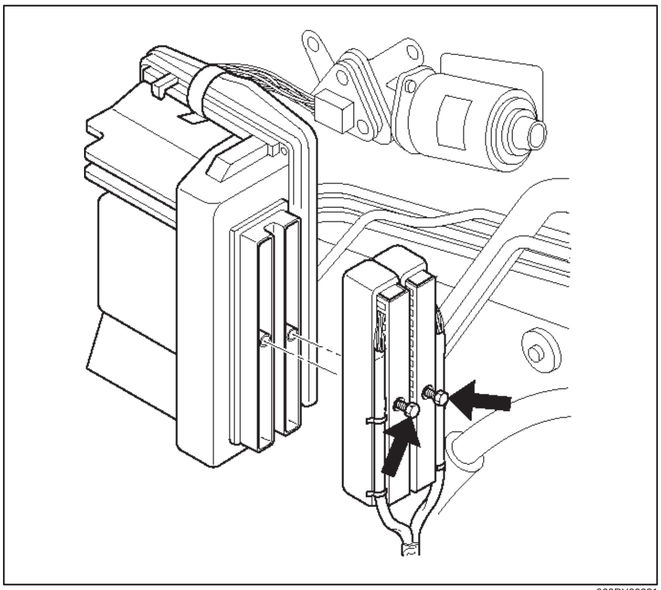
IMPORTANT: The ignition should always be in the "OFF" position in order to install or remove the PCM connectors.

Service of the PCM should normally consist of either replacement of the PCM or EEPROM programming. If the diagnostic procedures call for the PCM to be replaced, the PCM should be checked first to ensure it is the correct part. If it is, remove the faulty PCM and install the new service PCM.

The service PCM EEPROM will not be programmed. DTC P0601 indicates the check sum error.

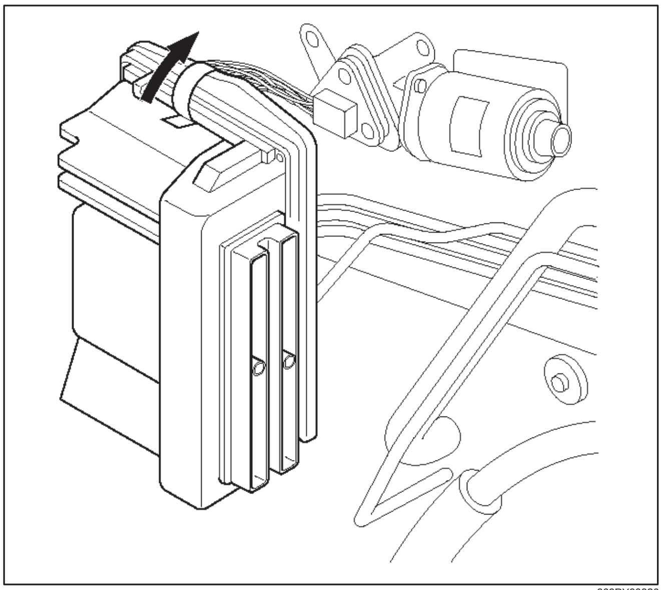
Removal Procedure

1. Disconnect the negative battery cable.
2. Block the wheels.
3. Remove the two screws from the PCM electrical connectors.
4. Disconnect the PCM electrical connectors.



060RY00031

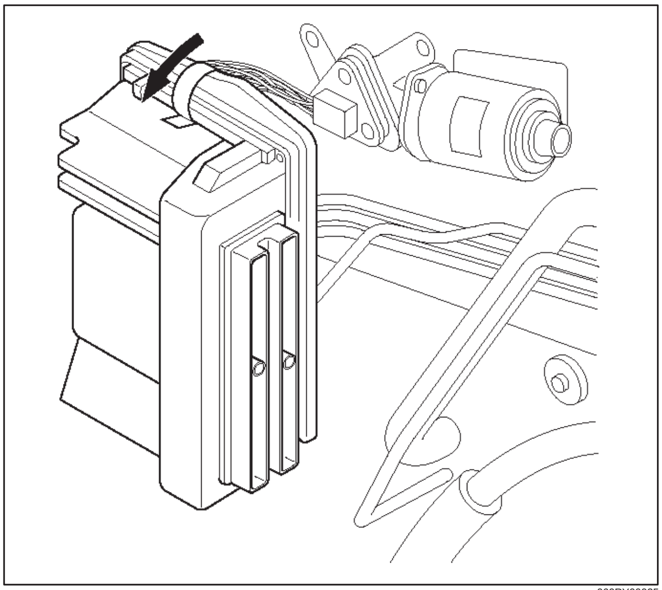
5. After removing the clip which fixes the PCM to the bracket, remove PCM.



060RY00026

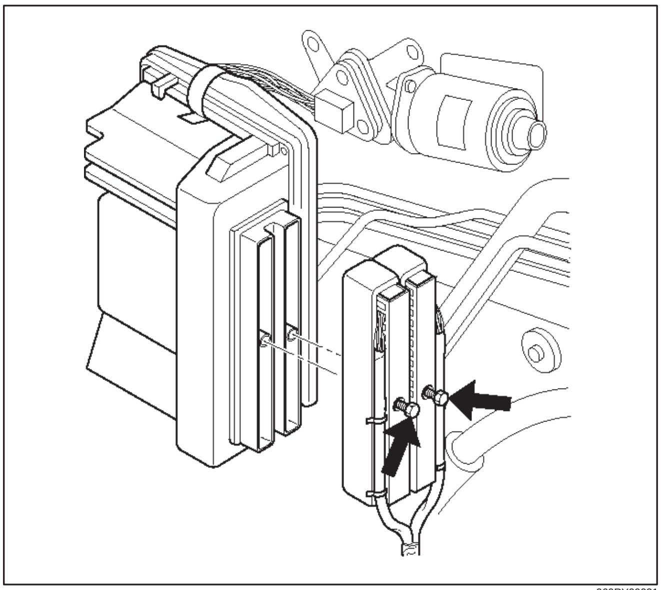
Installation Procedure

1. Install the PCM to bracket and fix with the clip.



060RY00025

2. Connect the PCM electrical connectors.
3. Install the two screws to PCM electrical connectors.



060RY00031

EEPROM

General Description

The Electronically Erasable Programmable Read Only Memory (EEPROM) is a permanent memory that is physically soldered within the PCM. The EEPROM contains program and calibration information that the PCM needs to control powertrain operation.

EEPROM Programming

1. Set-up – Ensure that the following conditions have been met:
   - The battery is fully charged.
   - The ignition is "ON."
   - The Vehicle Interface Module cable connection at the DLC is secure.
2. Program the PCM using the latest software matching the vehicle. Refer to up-to-date Techline equipment user's instructions.
3. If the PCM fails to program, proceed as follows:
   - Ensure that all PCM connections are OK.
   - Check the Techline equipment for the latest software version.
   - Attempt to program the PCM. If the PCM still cannot be programmed properly, replace the PCM. The replacement PCM must be programmed.

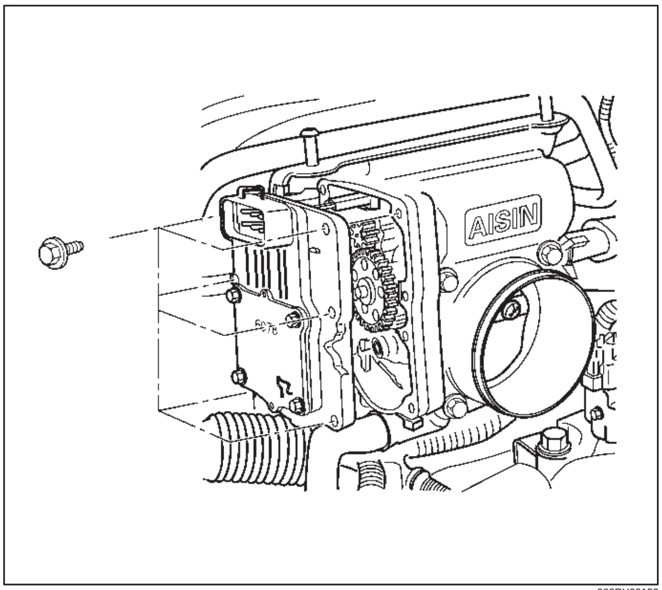
Functional Check

1. Perform the On-Board Diagnostic System Check.
2. Start the engine and run for one minute.
3. Scan for DTCs using the Tech 2.

Throttle Position (TP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the TPS electrical connector.
3. Remove the bolts and the TP sensor from the throttle body.



060RY00159

NOTE: Do not clean the TP sensor by soaking it in solvent. The sensor will be damaged as a result.

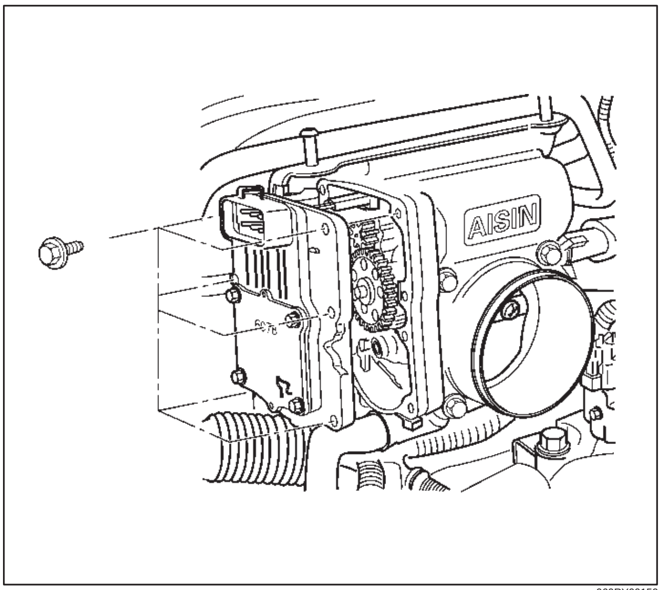
Function Check

Use a Tech 2 to check the TP sensor output voltage at closed throttle.

- The voltage should be under 0.85 volt.
- If the reading is greater than 0.85 volt, check the throttle shaft to see if it is binding.

Installation Procedure

1. Install the TP sensor on the throttle body with the bolts.



060RY00159

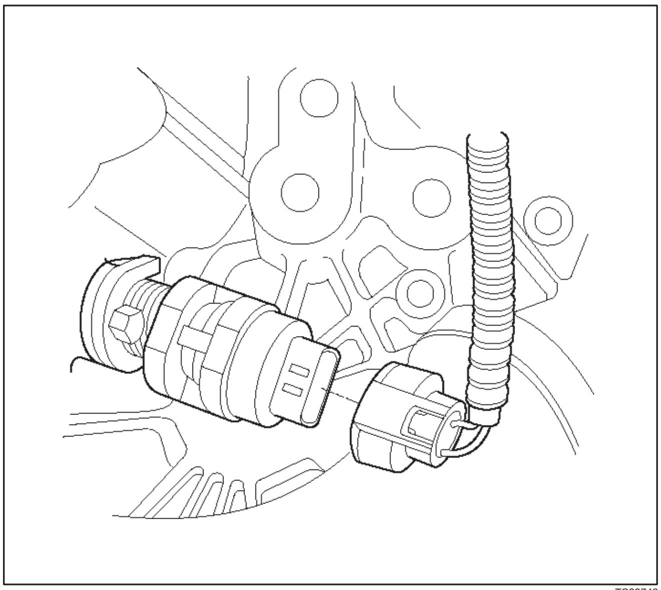
2. Connect the TP electrical connector.
3. Install the negative battery cable.

Vehicle Speed Sensor (VSS)

Removal Procedure

CAUTION: The VSS is located on the right side of the transfer case just ahead of the rear propeller shaft and very close to the exhaust pipes for 4WD and on the extension cover for 2WD. Be sure that the exhaust pipes are cool enough to touch before trying to remove the VSS. If the pipes are hot, you could be burned.

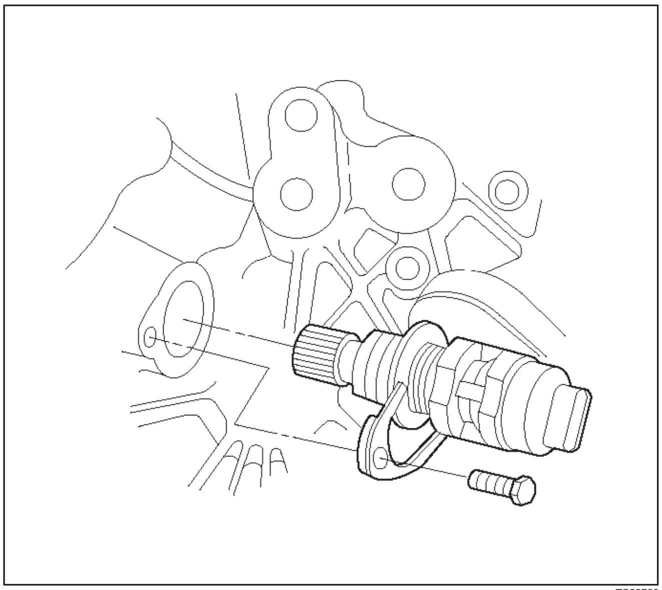
1. Disconnect the negative battery cable.
2. Disconnect the VSS electrical connector.



TS23748

3. Remove the bolt and the clamp securing the VSS in place.

IMPORTANT: Have a container ready to catch any fluid that leaks out when the VSS is removed from the transfer case for 4WD and on the extension cover for 2WD.



TS23780

4. Remove the VSS from the transfer case by wiggling it slightly and pulling it straight out.

Inspection Procedure

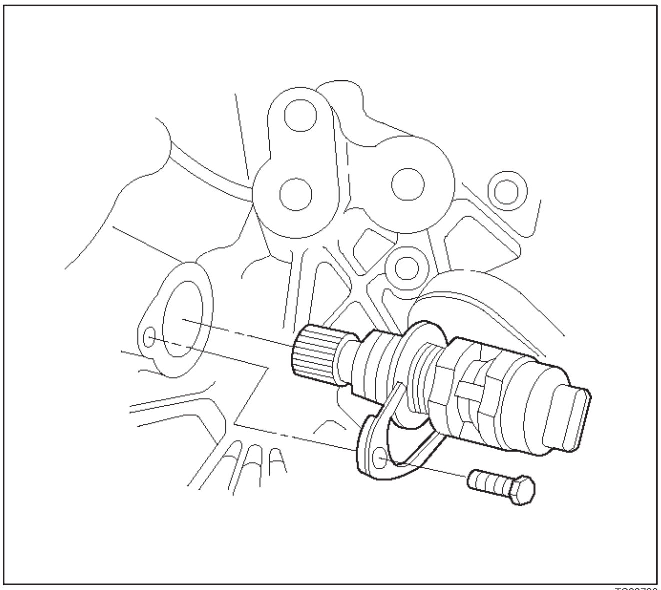
1. Inspect the electrical connector for signs of corrosion or warping. Replace the VSS if the electrical connector is corroded or warped.
2. Inspect the VSS driven gear for chips, breaks, or worn condition. Replace the VSS if the driven gear is chipped, broken or worn.
3. Inspect the O-ring for wear, nicks, tears, or looseness. Replace the O-ring if necessary.

Installation Procedure

1. Install the VSS in the transfer case with the notch for the connector facing the rear.
2. Secure the VSS in place with the clamp and the bolt.

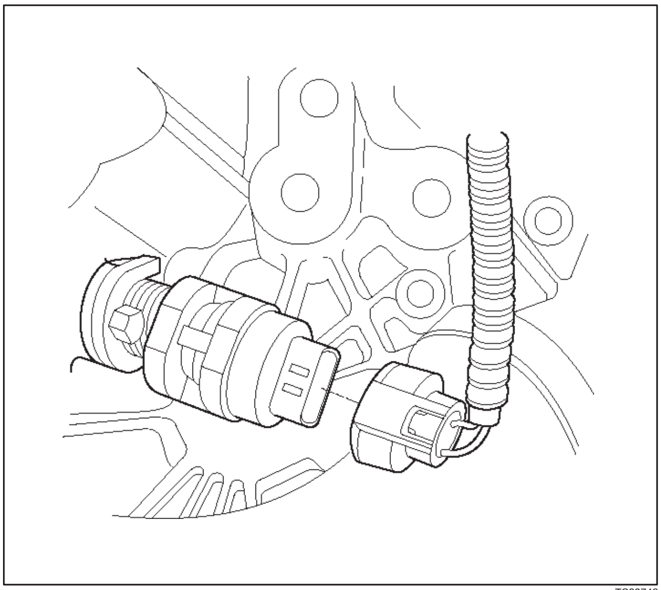
Tighten

- **Tighten the bolt to 16 N·m (12 lb ft.).**



TS23780

3. Connect the VSS electrical connector.



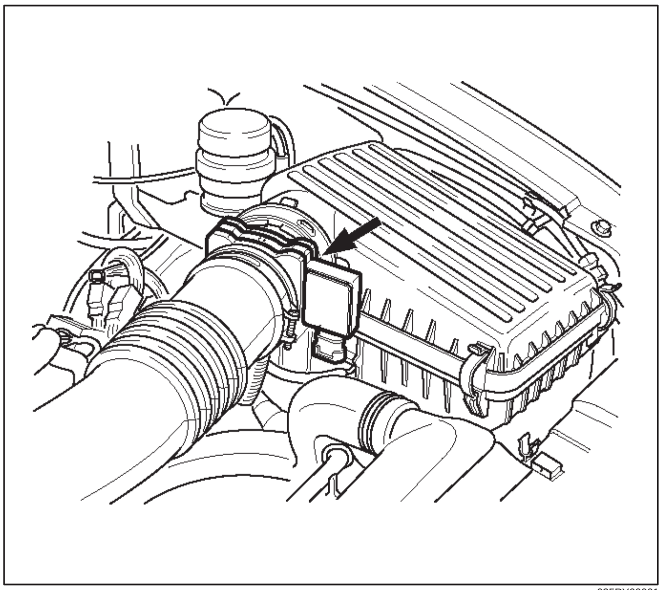
TS23748

4. Check the transfer case oil level. Add fluid if necessary.
5. Connect the negative battery cable.

Air Cleaner/Air Filter

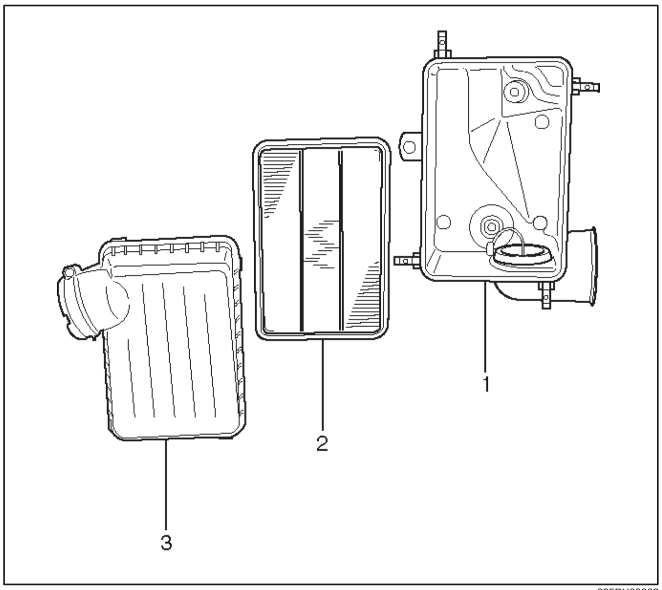
Removal Procedure

1. Loosen the clamp between the air cleaner lid and the mass air flow sensor.



025RY00001

2. Release the four latches securing the lid to the air cleaner housing.
3. Remove the air cleaner lid.
4. Remove the air filter element.
5. Remove the retaining bolts and the air cleaner housing from the vehicle.



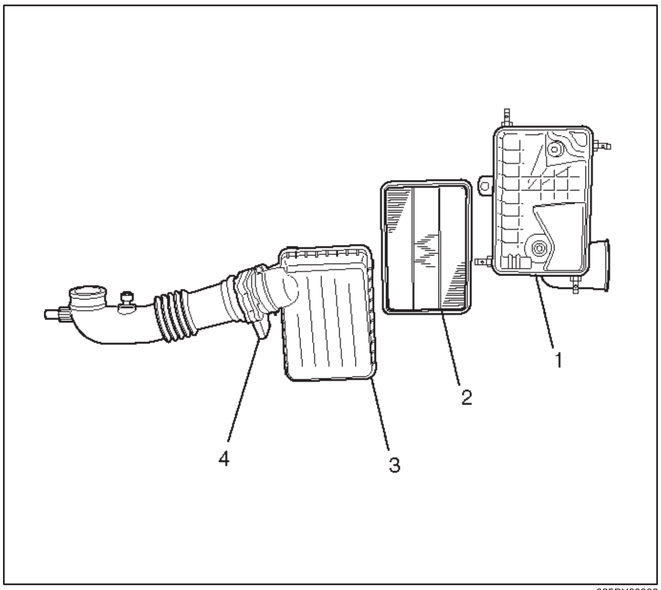
025RY00002

Legend

(1) Air Cleaner Housing
(2) Air Filter Element
(3) Air Cleaner Lid

Installation Procedure

1. Install the air cleaner housing in the vehicle with the retaining bolts.
2. Install the air filter element in the air cleaner housing.
3. Install the air cleaner lid on the MAF sensor and the air cleaner housing.



025RY00003

Legend

(1) Air Cleaner Housing
(2) Air Filter Element
(3) Air Cleaner Lid
(4) Mass Air Flow Sensor

4. Tighten the clamp and secure the four latches between the lid and the air cleaner housing.

Common Chamber

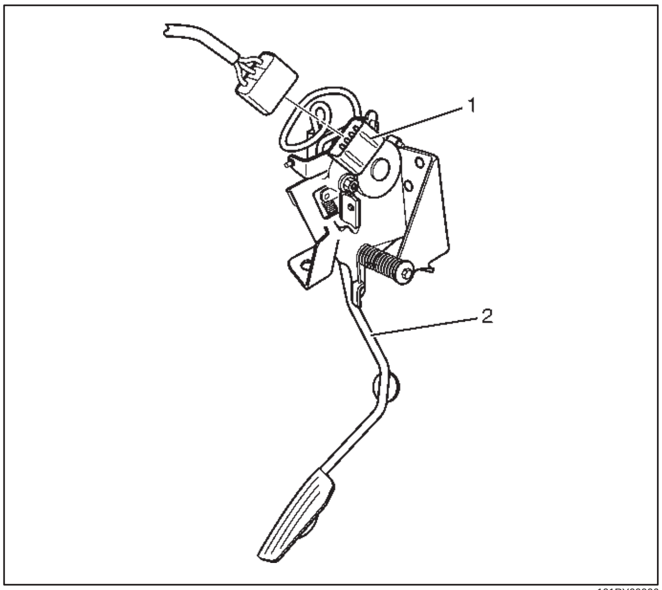
Removal and Installation Procedure

Refer to Common Chamber in Engine Mechanical section.

Accelerator Pedal Replacement

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical harness from the accelerator position sensor.

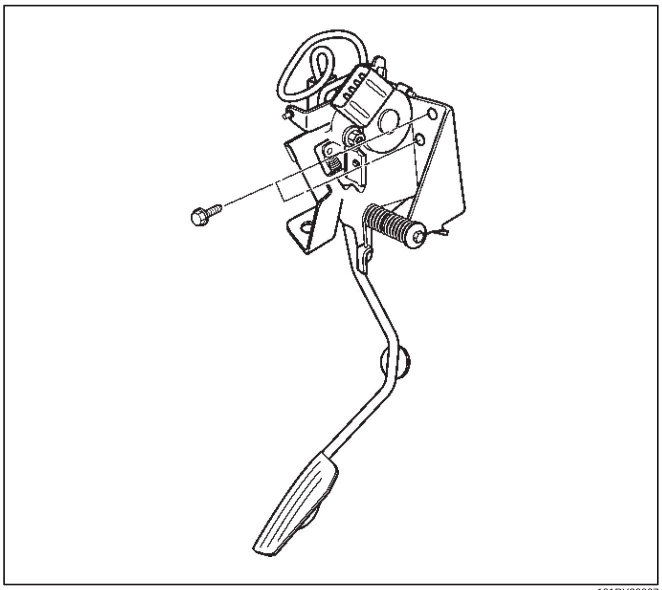


101RY00006

Legend

(1) Accelerator Position Sensor
(2) Accelerator Pedal Assembly

3. Remove the two screws from the accelerator pedal assembly.



101RY00007

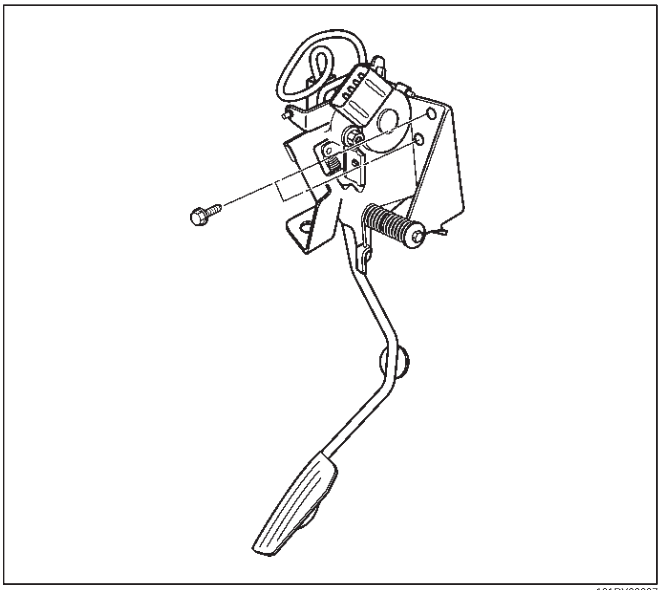
4. Remove the accelerator pedal assembly from the bulkhead.

Installation Procedure

1. Install the accelerator pedal assembly on the bulkhead.
2. Install the two screws to the accelerator pedal assembly.

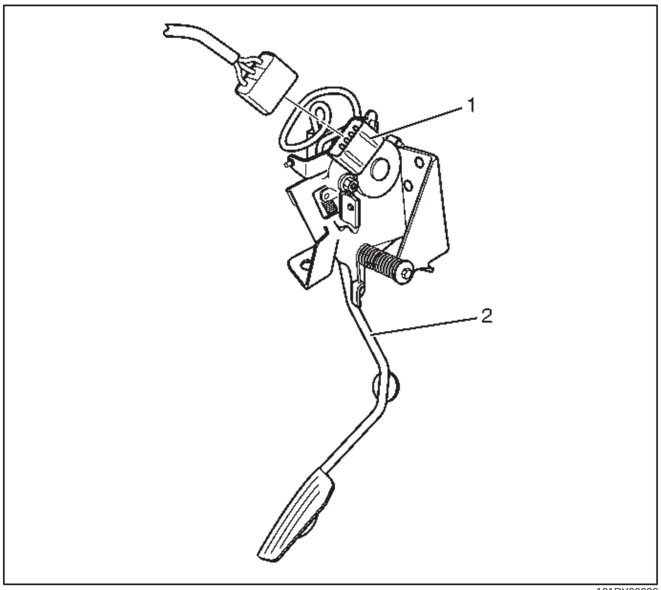
Tighten

- **Tighten the screws to 22 N·m (16 lb ft.).**



101RY00007

3. Connect the electrical harness to the accelerator position sensor.



101RY00006

Legend

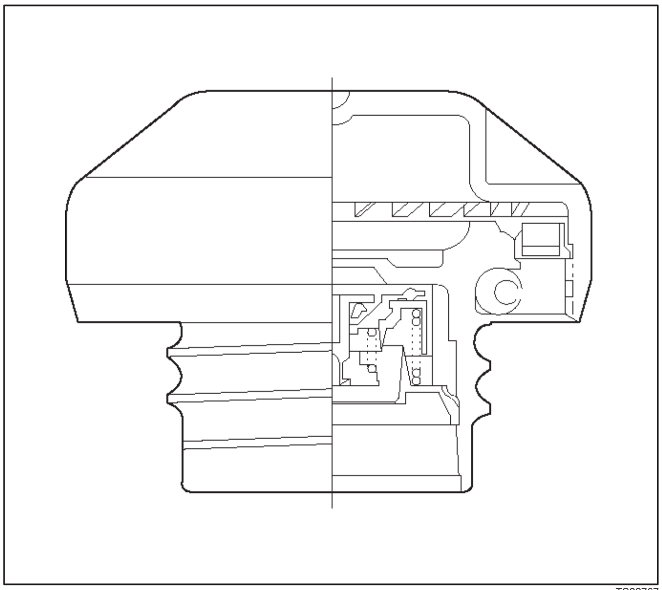
(1) Accelerator Position Sensor
(2) Accelerator Pedal Assembly

4. Install the negative battery cable.

Fuel Filler Cap

General Description

The fuel filler cap includes a vacuum valve and a pressure valve.
If high vacuum or high pressure occurs in the fuel tank, each valve works to adjust the pressure in order to prevent damage of the tank.



TS23767

Inspection Procedure

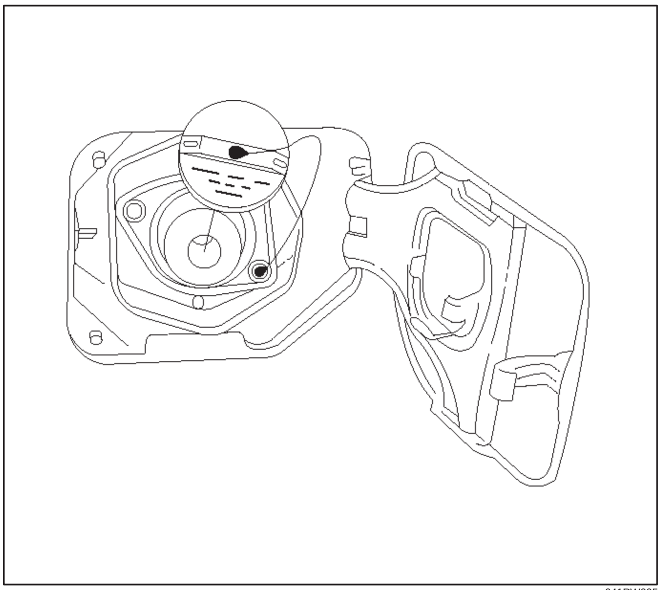
NOTE: Replace the fuel filler cap with the same type of filler cap that was originally installed on the vehicle.

- Check the seal ring in the filler cap for any abnormality and for seal condition.
- Replace the filler cap if any abnormality is found.

Fuel Filter

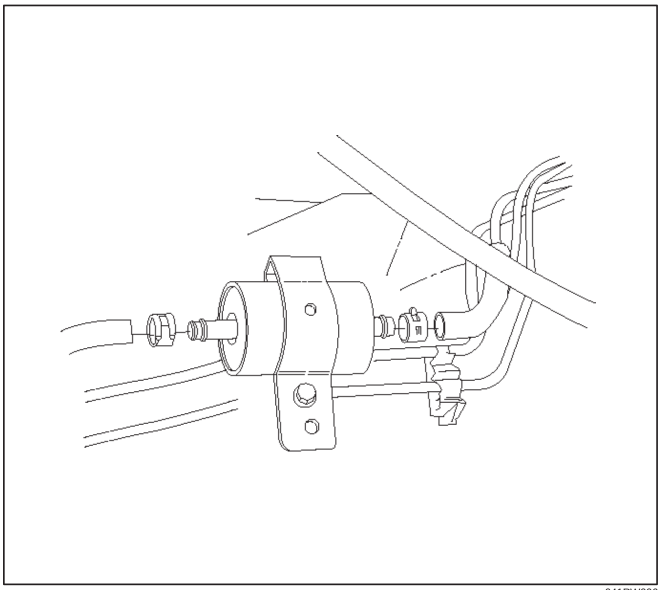
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the fuel filler cap.



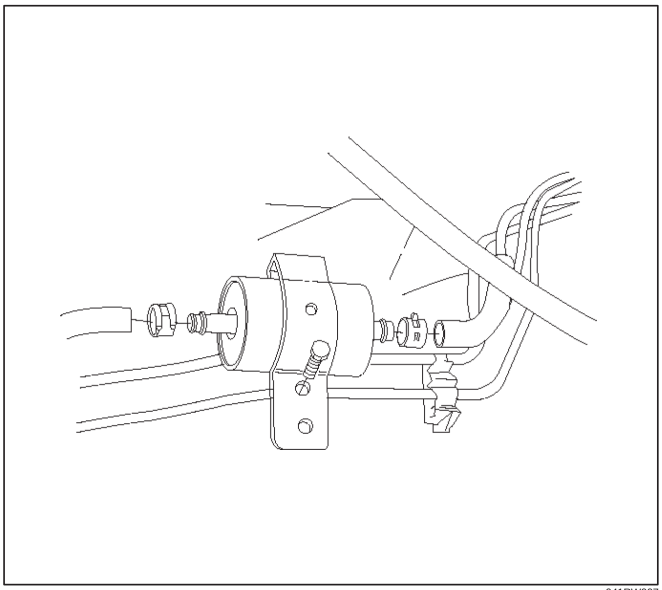
041RW005

3. Disconnect the fuel line from the fuel filter on the engine side.
4. Disconnect the fuel line from the fuel filter on the fuel tank side.



041RW006

5. Remove the bolt on the fuel filter holder.



041RW007

6. Remove the fuel filter.

Inspection Procedure

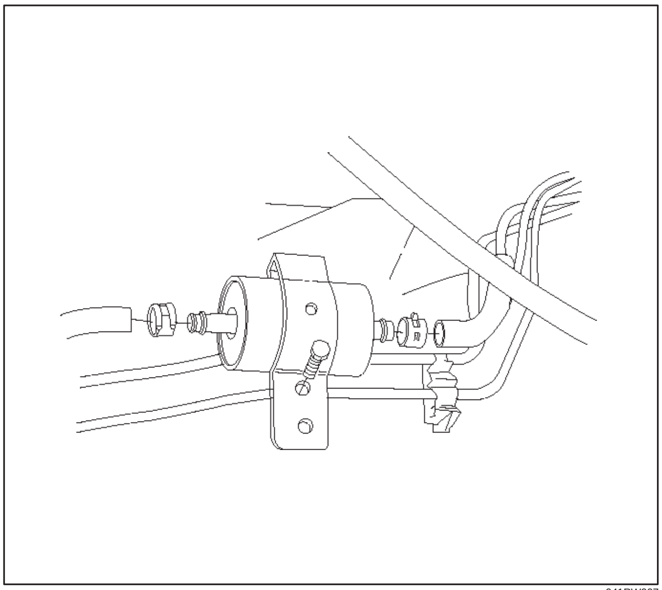
1. Replace the fuel filter when the following occur:
   - Fuel leaks from the fuel filter body.
   - The fuel filter body is damaged.
   - The fuel filter is clogged with dirt or sediment.

Installation Procedure

1. Install the fuel filter in the correct direction.
2. Install the bolt on the fuel filter holder.

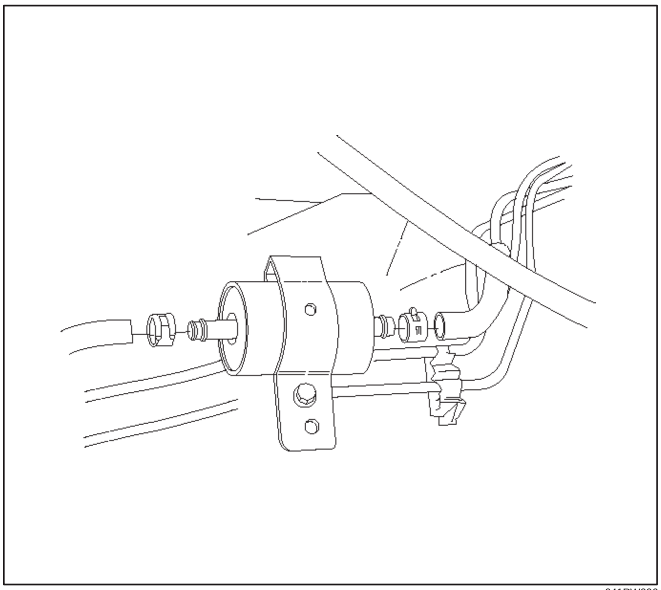
Tighten

- **Tighten the screws to 20 N·m (14 lb ft.).**



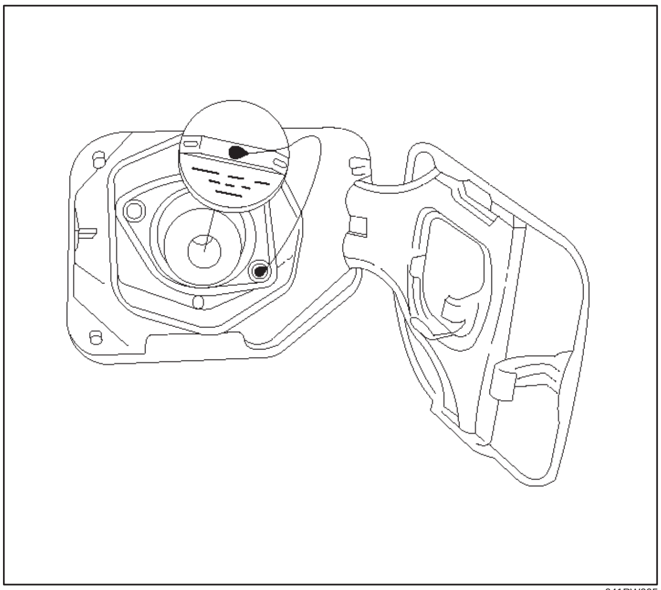
041RW007

3. Connect the fuel line on the engine side.
4. Connect the fuel line on the fuel tank side.



041RW006

5. Install the fuel filler cap.



041RW005

6. Connect the negative battery cable.

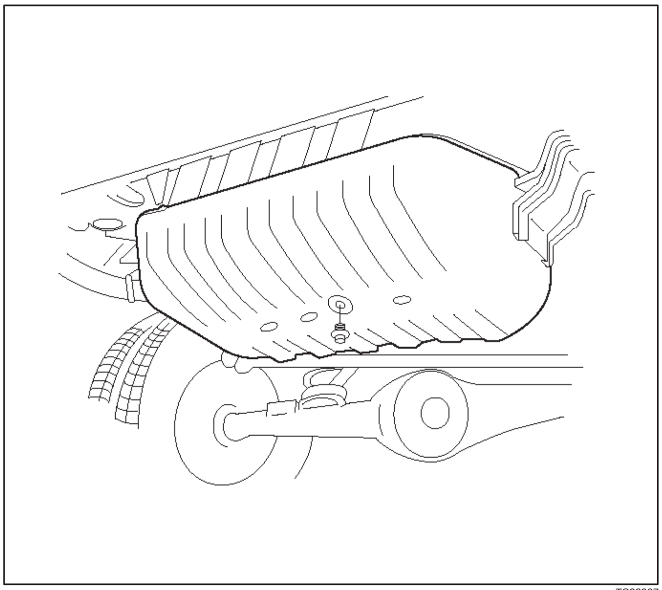
Fuel Gauge Unit

Removal Procedure

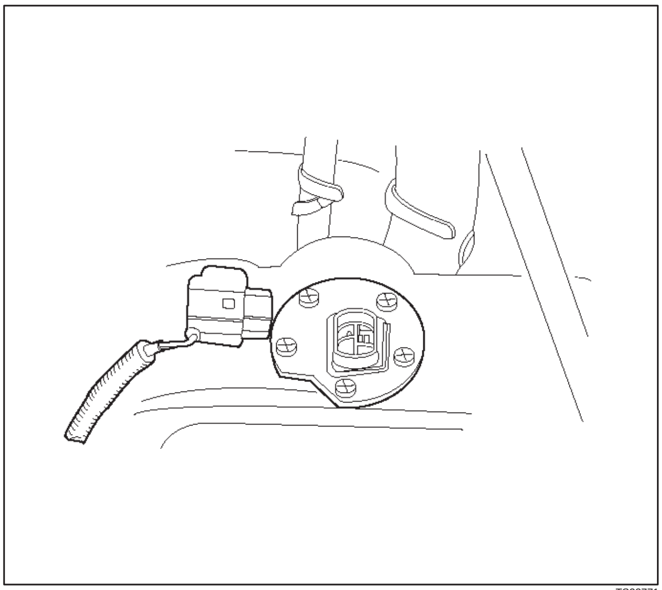
1. Disconnect the negative battery cable.
2. Loosen the fuel filler cap.
3. Drain the fuel from the tank.

Tighten

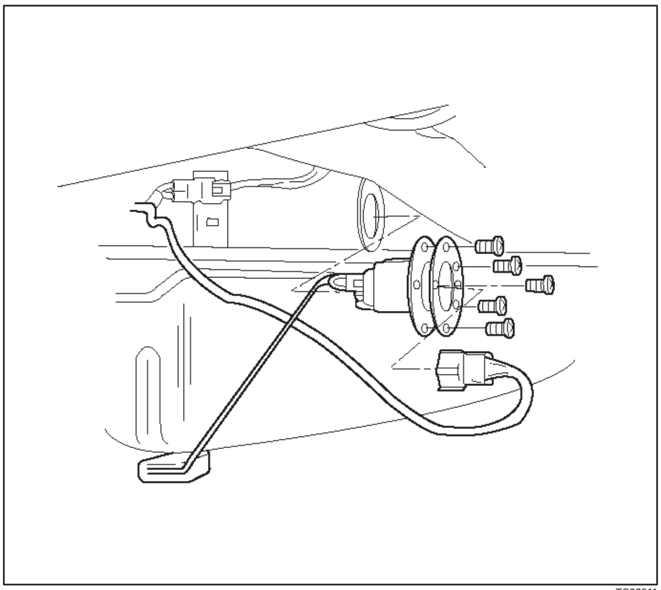
- **Tighten the drain plug to 20 N·m (14 lb ft.).**


TS22907

4. Disconnect the wiring connector from the fuel gauge unit.

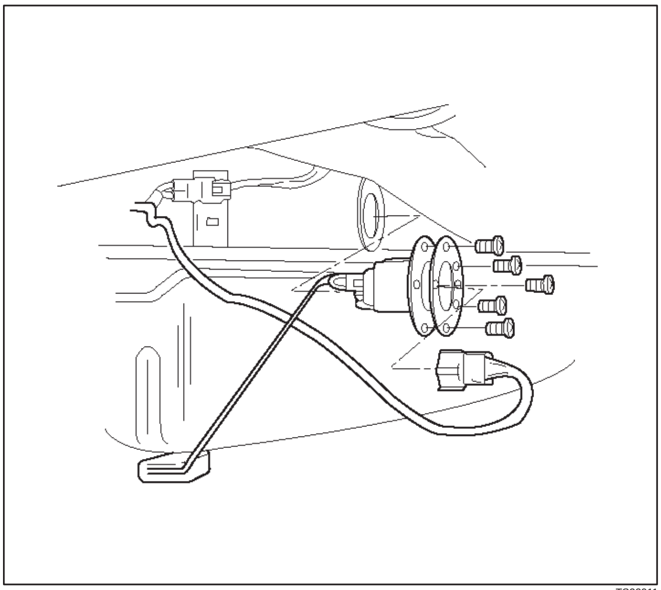

TS23771

5. Remove the fuel gauge unit retaining screws.
6. Remove the fuel gauge unit.
   - Cover or plug the fuel tank to prevent dust, dirt, or debris from entering the tank.

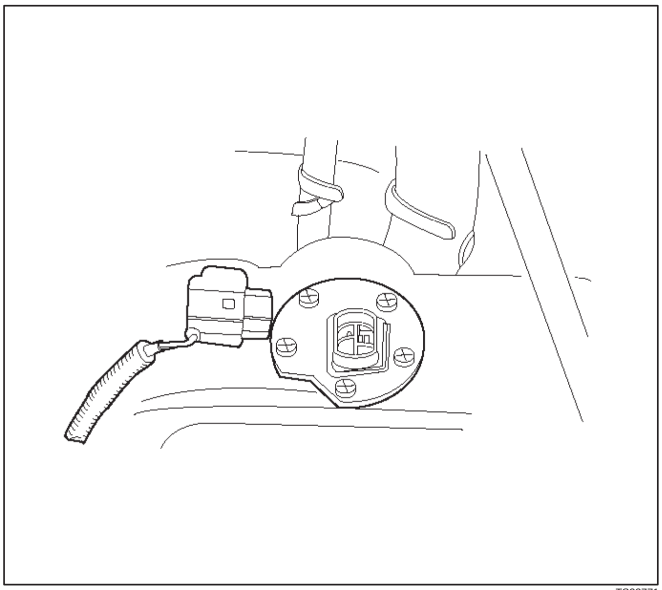

TS22911

Installation Procedure

1. Install the fuel gauge unit.
2. Install the fuel gauge unit retaining screws.


TS22911

3. Connect the wiring connector to the fuel gauge unit.



TS23771

4. Fill the fuel tank with fuel.
   - Tighten the fuel filler cap.
   - Check for leaks at the fuel gauge unit gasket.
5. Connect the negative battery cable.

Fuel Injectors

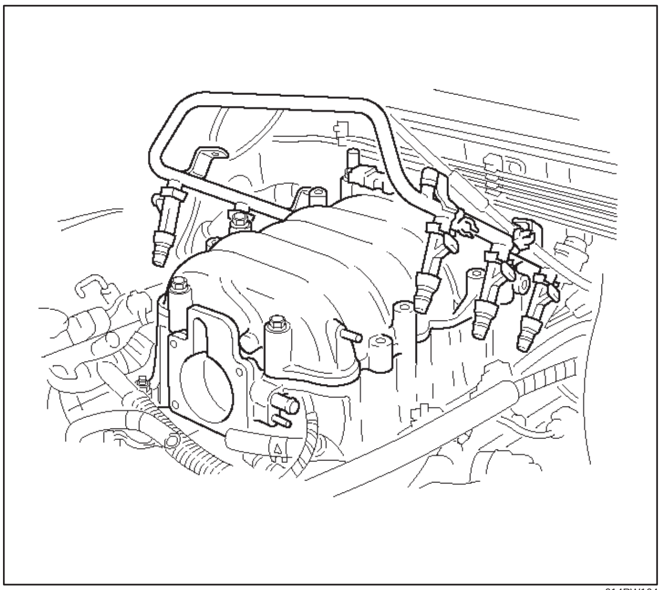
Removal Procedure

NOTE: If the fuel injectors are leaking, the engine oil may be contaminated with fuel. Check the oil for signs of contamination and change the oil and the filter if necessary.

NOTE: Use care in removing the fuel injectors in order to prevent damage to the fuel injector electrical connector pins or the fuel injector nozzles. The fuel injector is an electrical component and should not be immersed in any type of cleaner as this may damage the fuel injector.

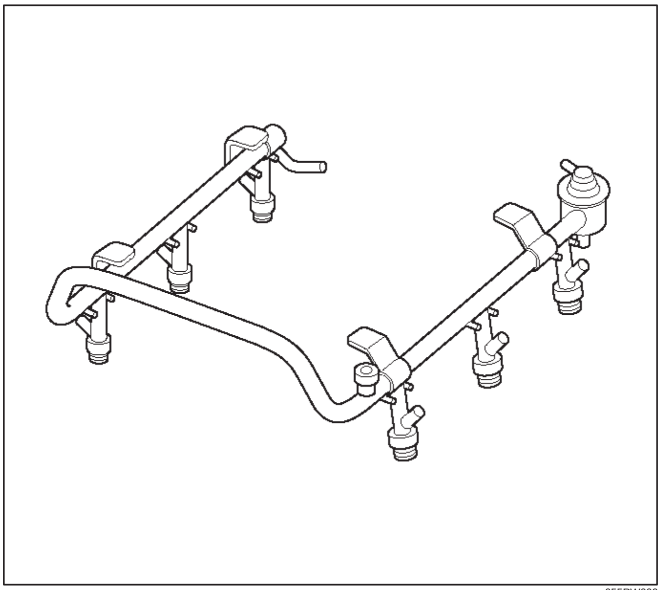
IMPORTANT: Fuel injectors are serviced as a complete assembly only.

1. Disconnect the negative battery cable.
2. Remove the common chamber. Refer to *Common Chamber in Engine Mechanical* section.
3. Remove the fuel rail. Refer to *Fuel Rail* section.



014RW164

4. Remove the injector retainer clip.



055RW009

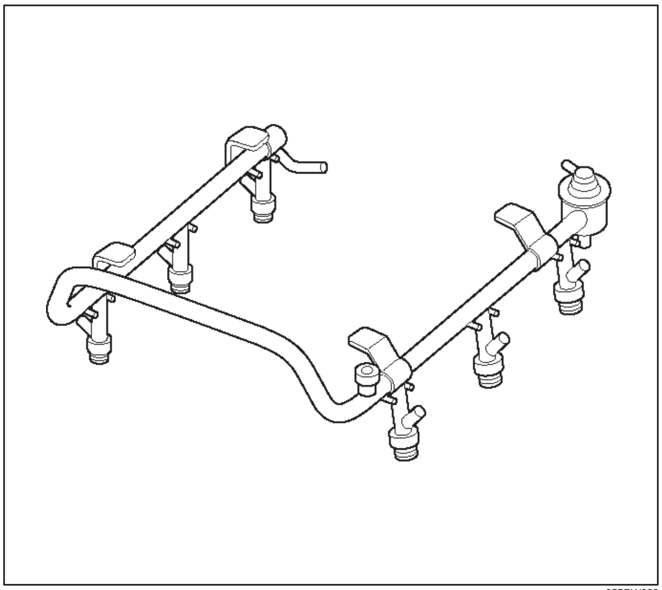
5. Remove the fuel injector assembly.
6. Remove the O-ring from the fuel injector.
7. Remove the O-ring backup from the fuel injector .

Inspection Procedure

1. Inspect the O-rings for cracks or leaks.
2. Replace worn or damaged O-rings.
3. Lubricate the new O-rings with engine oil before installation.

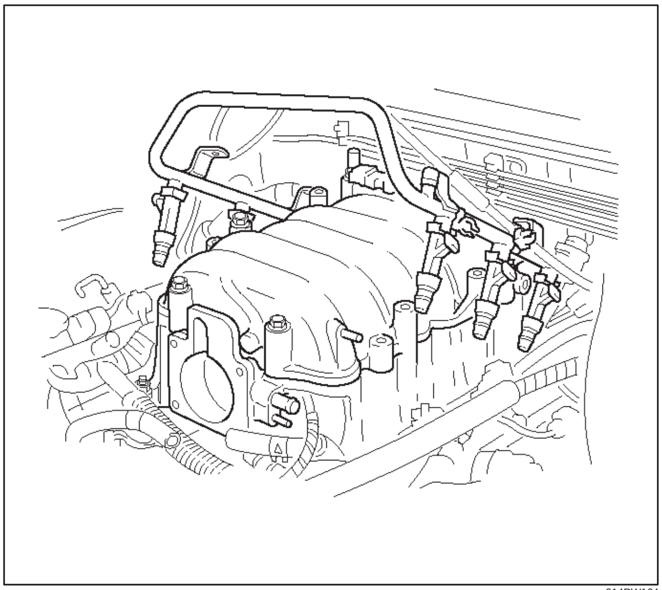
Installation Procedure

1. Install the O-ring backup on the fuel injector.
2. Install the new O-ring on the fuel injector.
3. Install the fuel injector on the fuel rail.



055RW009

4. Use new fuel injector retainer clips to retain the fuel injector to the fuel rail.
5. Coat the end of the fuel injector with gasoline.
6. Install the fuel rail. Refer to *Fuel Rail* section.



014RW164

7. Install the common chamber. Refer to *Common Chamber in Engine Mechanical* section.
8. Install the engine cover.
9. Connect the negative battery cable.

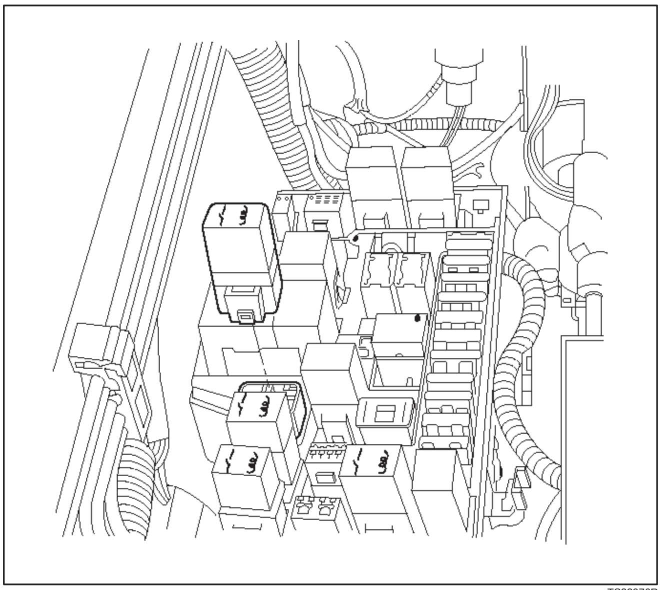
Fuel Metering System

Fuel Pressure Relief Procedure

CAUTION: To reduce the risk of fire and personal injury, there are necessary to relieve the fuel system pressure filler and gauge unit before servicing the fuel system components.

CAUTION: After relieving the system pressure, a small amount of fuel may be released when servicing fuel lines or connections. Reduce the chance of personal injury by covering the fuel line fittings with a shop towel before you disconnect the fittings. The towels will absorb any fuel that may leak out. When the disconnect is completed, place the towel in an approved container.

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay box. Refer to *Fuel Pump Relay* section.



TS23976R

3. Start the engine and allow it to stall.
4. Crank the engine for 30 seconds.
5. Disconnect the negative battery cable.

Fuel Pump Assembly

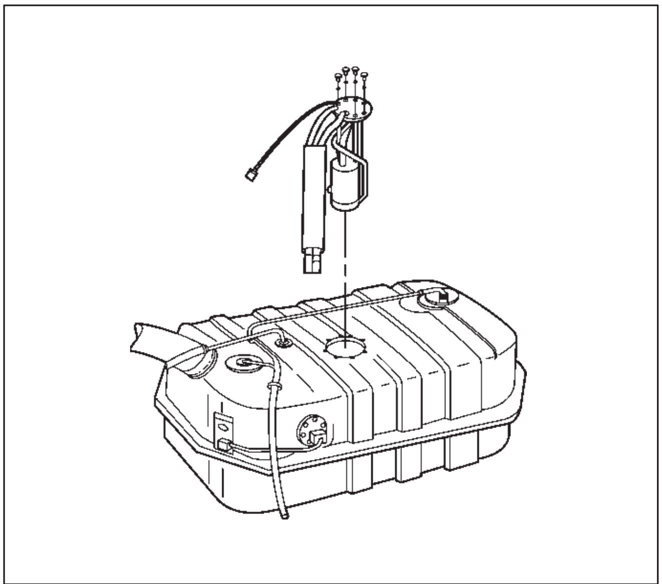
Removal Procedure

1. Disconnect the negative battery cable.
2. Drain all the fuel from the tank.
3. Install and tighten the drain plug.

Tighten

- **Tighten the drain plug to 20 N·m (14 lb ft.).**

4. Remove the fuel tank. Refer to *Fuel Tank* section.
5. Remove the retaining screws from the fuel tank.
6. Remove the fuel pump assembly from the fuel tank.
   - Cover the fuel pump opening in order to prevent dust, dirt, or debris from entering the fuel tank.



TS23795

Inspection Procedure

1. Inspect the fuel pump gasket for tears, cracks, stretching, or rotting. If any of these conditions are found, replace the fuel pump gasket.
2. Inspect the in-tank fuel filter for tears or evidence of dirt, debris, or water in the fuel. If any of these conditions are found, replace the in-tank fuel filter.

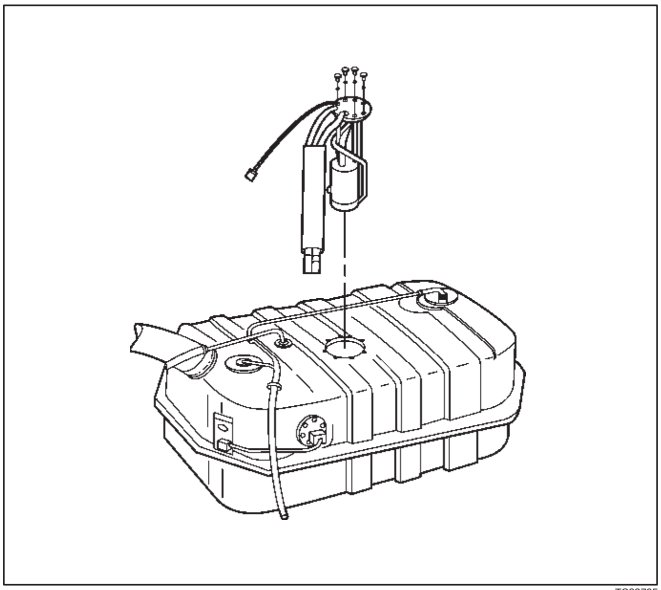
Installation Procedure

1. Install the fuel pump assembly.

Tighten

- **Tighten the fuel pump assembly mounting bolts to 3 N·m (27 lb ft.).**

2. Install the fuel pump assembly retaining screws.
3. Install the fuel tank assembly. Refer to *Fuel Tank* section.
4. Fill the tank with fuel.
5. Tighten the fuel filler cap.
6. Connect the negative battery cable.

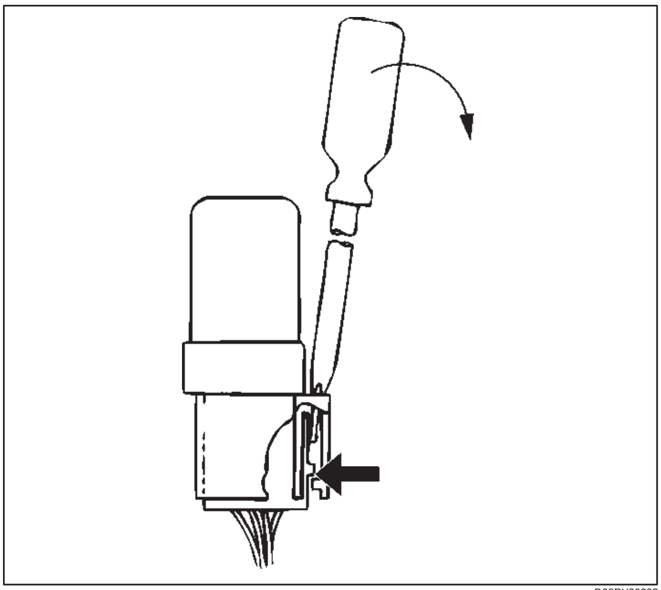


TS23795

Fuel Pump Relay

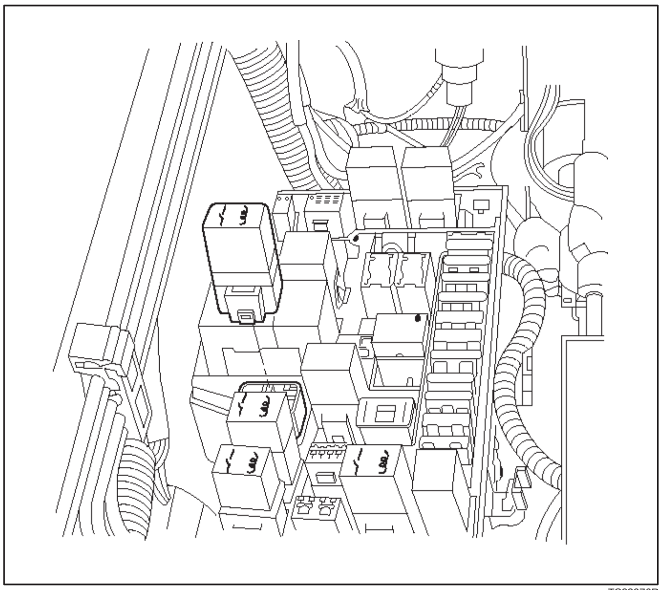
Removal Procedure

1. Remove the fuse and relay box cover from under the hood.
2. Consult the diagram on the cover to determine which is the correct relay.
3. Insert a small screwdriver into the catch slot on the forward side of the fuel pump relay.
   - The screwdriver blade will release the catch inside.



D08RY00292

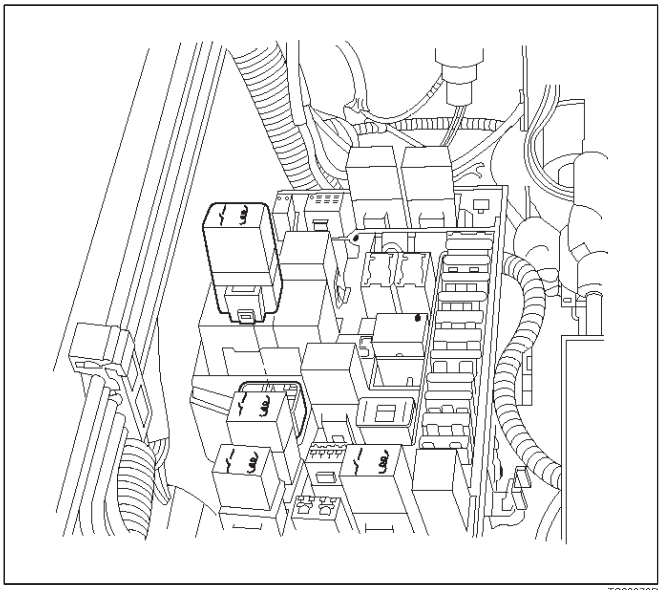
4. Pull the relay straight up and out of the fuse and relay box.



TS23976R

Installation Procedure

1. Insert the relay into the correct place in the fuse and relay box with the catch slot facing forward.
2. Press down until the catch engages.
   - An audible “click” will be heard.



TS23976R

3. Install the fuse and relay box cover.

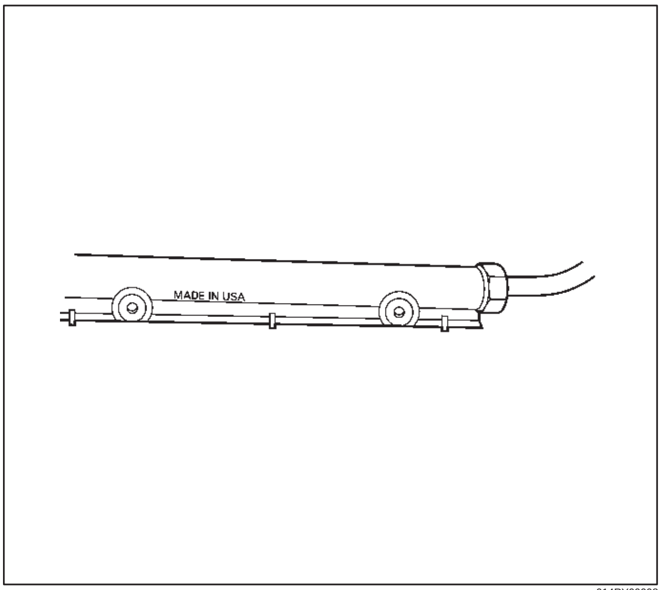
Fuel Rail Assembly

Removal Procedure

NOTE:

- Do not attempt to remove the fuel inlet fitting on the fuel rail. It is staked in place. Removing the fuel inlet fitting will result in damage to the fuel rail or the internal O-ring seal.
- Use care when removing the fuel rail assembly in order to prevent damage to the injector electrical connector terminals and the injector spray tips.
- Fittings should be capped and holes plugged during servicing to prevent dirt and other contaminants from entering open lines and passages.

IMPORTANT: An eight-digit identification number is stamped on the side of the fuel rail. Refer to this number when you service the fuel rail or when a replacement part is required.

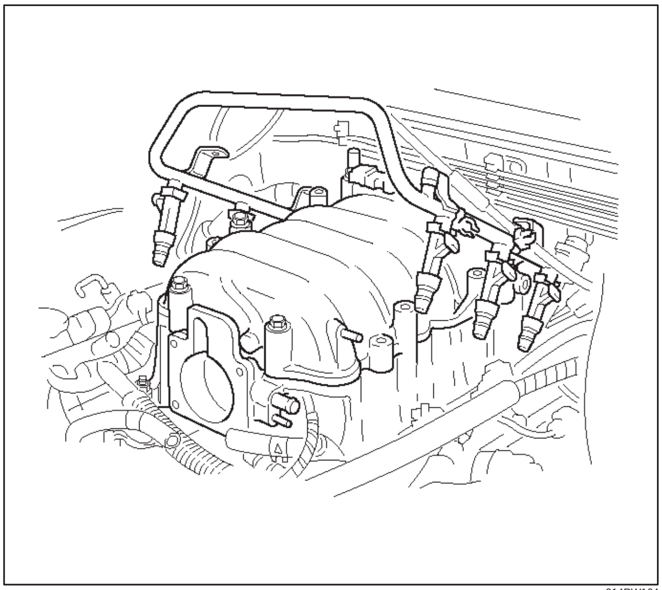


014RY00008

Before removal, the fuel rail assembly may be cleaned with a spray type engine cleaner. Follow the spray package instructions. Do not immerse the fuel rails in liquid cleaning solvent.

1. Depressurize the fuel system. Refer to Fuel Pressure Relief Procedure in this Section.
2. Disconnect the negative battery cable.
3. Remove the engine cover.
4. Disconnect the throttle position sensor electrical connector from throttle body.
5. Disconnect the connectors from manifold absolute pressure sensor, solenoid valve, electric vacuum sensing valve.
6. Disconnect the vacuum hose on canister VSV and positive crankcase ventilation hose.

7. Remove the common chamber. Refer to the common chamber in Engine Mechanical section.
   1. Lift up carefully on the fuel injectors. Do not separate the fuel injectors from the fuel rail.
   2. If an injector becomes separated from the fuel rail, the infector O-ring seals and the retainer clip must be replaced.
   3. Drain residual fuel into an approved container.

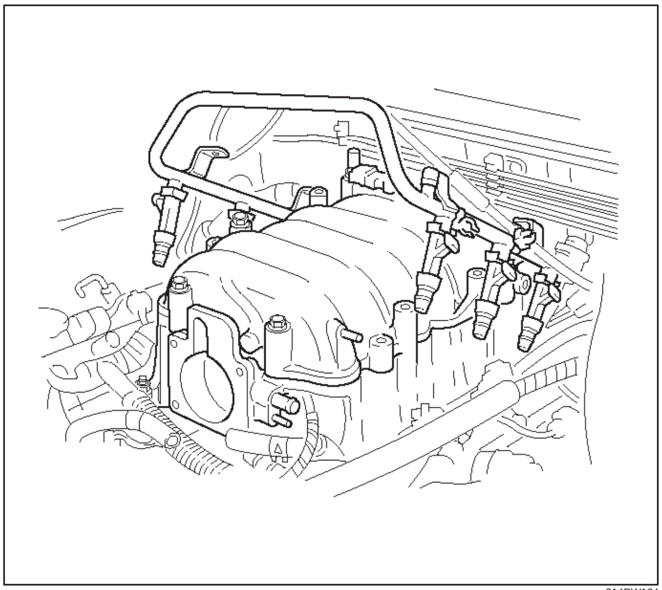


014RW164

8. If removal of the fuel pressure regulator is necessary, refer to *Fuel Pressure Regulator* section.
9. If removal of the fuel injectors is necessary, refer to *Fuel Injectors* section.

Installation Procedure

1. If the fuel injectors were removed, install them. Refer to *Fuel Injectors* section.
2. If the fuel pressure regulator was removed, install it. Refer to *Fuel Pressure Regulator* section.
3. Install the common chamber. Refer to common chamber in engine Mechanical section.



014RW164

4. Connect the vacuum hose on Canister VSV and positive crankcase ventilation hose.
5. Connect the connectors to manifold absolute pressure sensor, solenoid valve, electric vacuum sensing valve.
6. Connect the throttle position sensor electrical connector to throttle body.
7. Install the engine cover.
8. Connect the negative battery cable.
9. Crank the engine until it starts. Cranking the engine may take longer than usual due to trapped air in the fuel rail and in the injectors.

Fuel Tank

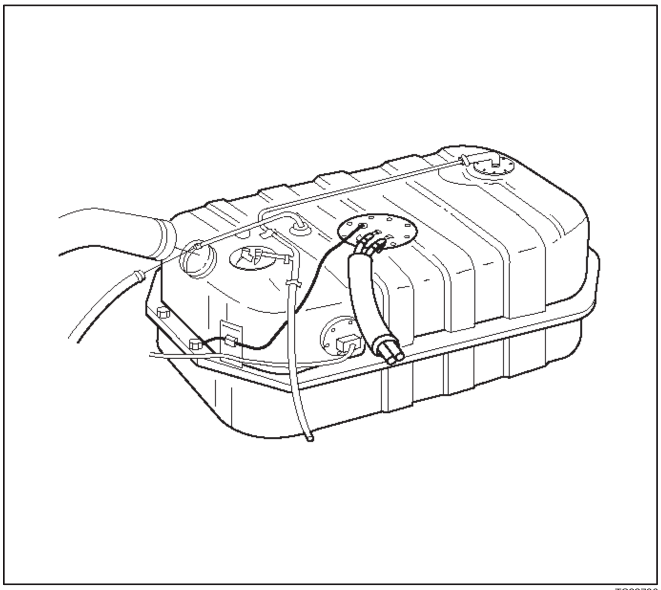
Removal Procedure

1. Disconnect the negative battery cable.
2. Loosen the fuel filler cap.
3. Drain the fuel from the tank into an approved container.
4. Install and tighten the drain plug.

Tighten

- **Tighten the drain plug to 20 N·m (14 lb ft.).**

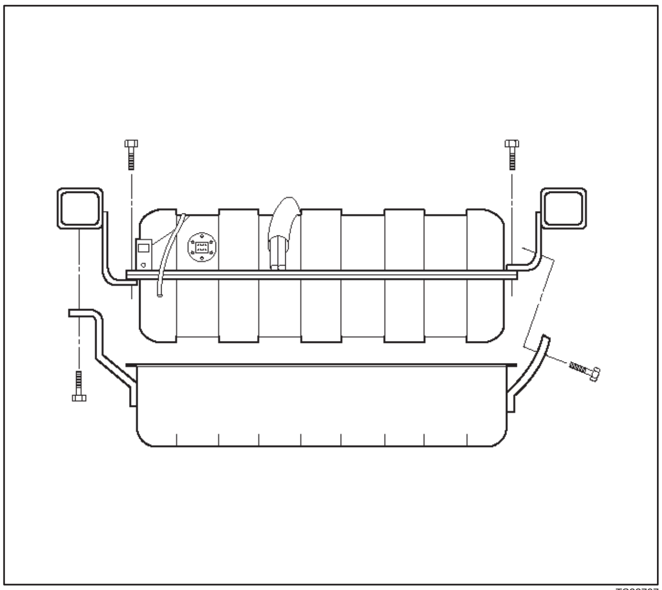
5. Disconnect the fuel filler hose at the fuel tank.
6. Disconnect the air breather hose at the fuel tank.



TS23796

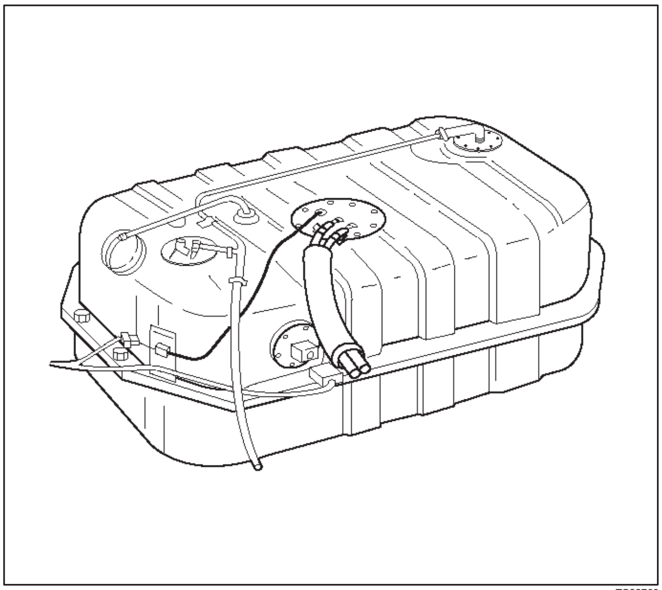
7. Remove the undercover retaining bolts.

8. Remove the undercover.



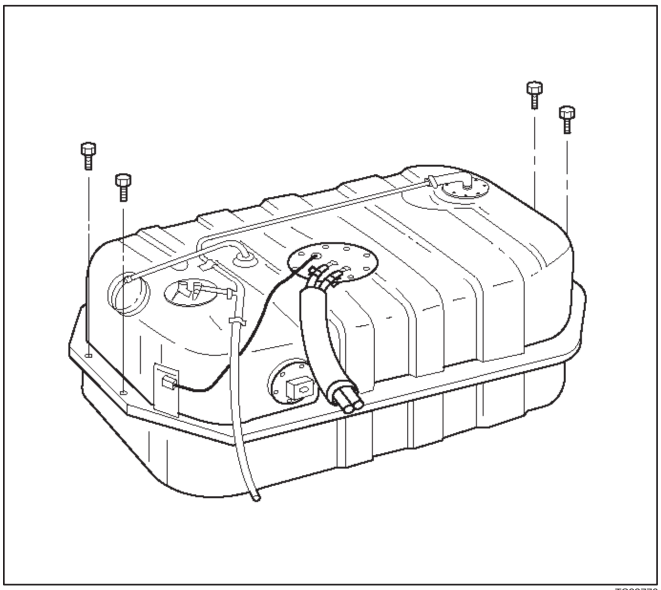
TS23797

9. Disconnect the wiring connector to the fuel pump.
10. Disconnect the wiring connector to the fuel gauge unit.
11. Remove the fuel gauge unit connector from the bracket.
12. Disconnect the EVAP vapor hose.
13. Disconnect the fuel supply hose.
14. Disconnect the fuel return hose.
    - Plug the hoses to prevent dust from entering the hoses.



TS23769

15. Remove the fuel tank retaining bolts on both sides.
16. Remove the fuel tank.



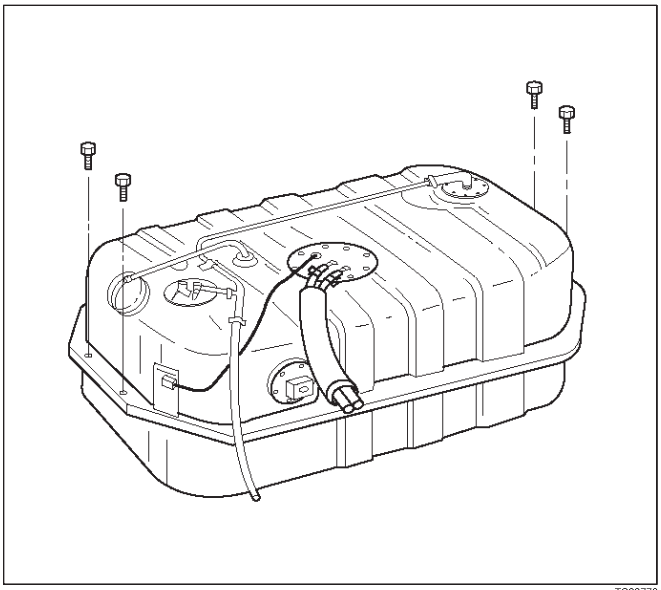
TS23770

Installation Procedure

1. Install the fuel tank.
    - Place the flanges on the left and right side of the tank on the bracket.
2. Install the fuel tank retaining bolts.

Tighten

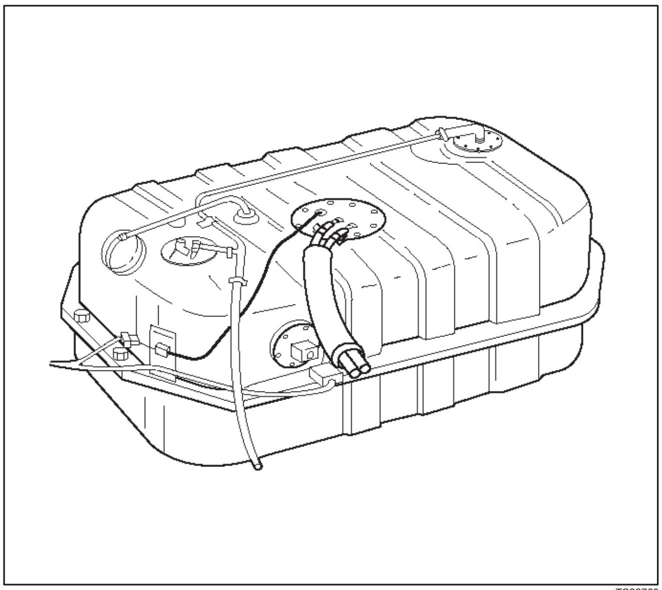
- **Tighten the fuel tank retaining bolts to 36 N·m (27 lb ft.).**



TS23770

3. Connect the fuel return hose.
4. Connect the fuel supply hose.
5. Connect the EVAP vapor hose.
6. Connect the wiring connector for the fuel gauge unit.
7. Connect the fuel gauge wiring connector to the bracket.

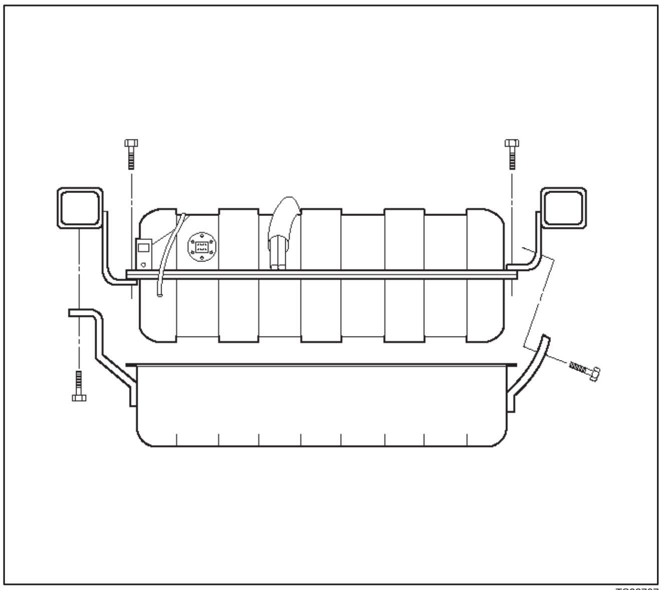
8. Connect the wiring connector for the fuel pump.



TS23769

9. Install the undercover.
10. Secure the undercover with the retaining bolts.

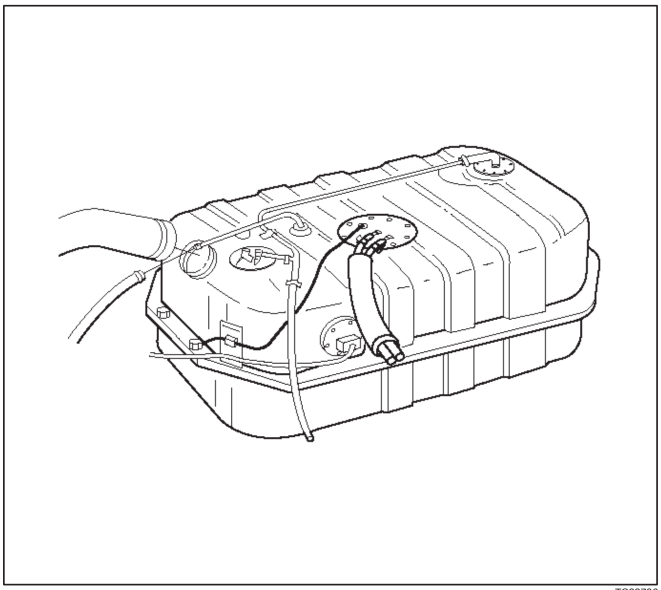
Torque: 36 N·m (26 Ib in)



TS23797

11. Connect the fuel filler fuse at the tank.

12. Connect the air breather hose at the tank.



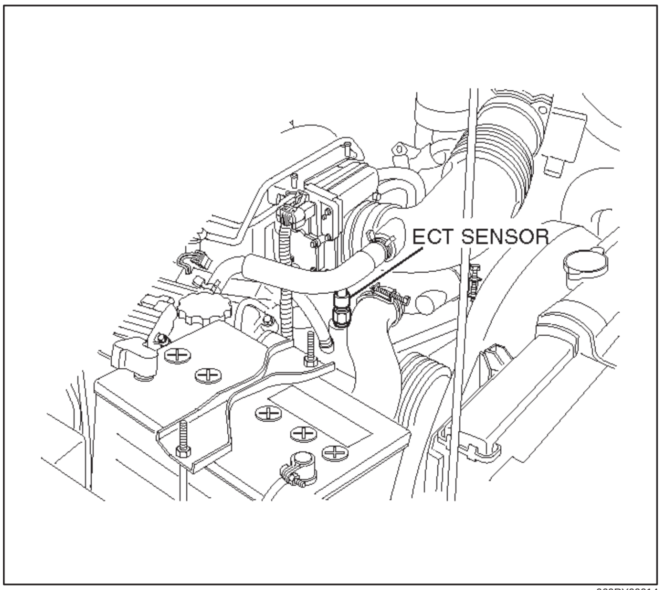
TS23796

13. Fill the fuel tank with fuel.
14. Tighten the fuel filler cap.
15. Connect the negative battery cable.

Throttle Body (TB)

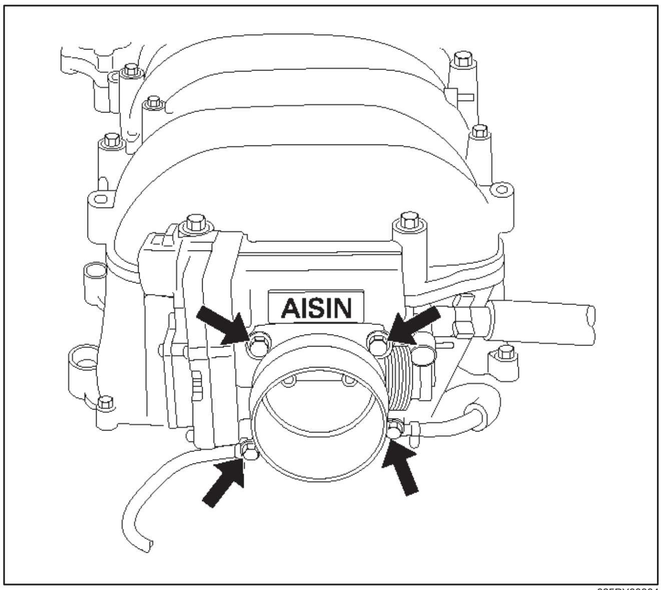
Removal Procedure

1. Disconnect the negative battery cable.
2. Drain the cooling system. Refer to *Cooling System* section.
3. Disconnect the electrical connectors:
   - Throttle position (TP) sensor.
   - Intake air temperature (IAT) sensor. Refer to *Intake Air Temperature Sensor* section.



060RY00014

4. Disconnect the vacuum hose below the air horn.
5. Remove the intake air duct clamp.
6. Disconnect the intake air duct.
7. Disconnect the coolant lines from the throttle body.
8. Remove the bolts from the common chamber.
9. Remove the throttle body from the common chamber.
10. Remove the gasket from the common chamber.



025RY00004

11. Remove the TP sensor. Refer to *Throttle Position (TP) Sensor* section.

Inspection Procedure

NOTE: Do not use solvent of any type when you clean the gasket surfaces on the intake manifold and the throttle body assembly. The gasket surfaces and the throttle body assembly may be damaged as a result.

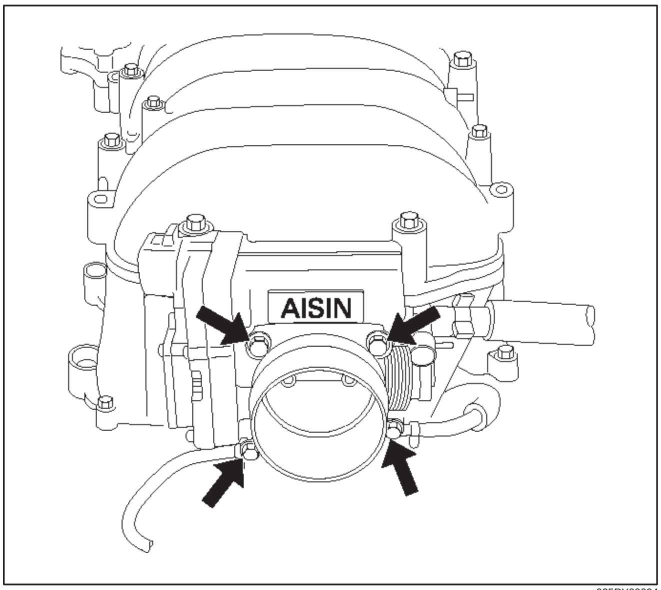
- If the throttle body gasket needs to be replaced, remove any gasket material that may be stuck to the mating surfaces of the manifold.
- Do not leave any scratches in the aluminum casting.

Installation Procedure

1. Install the TP sensor. Refer to *Throttle Position (TP) Sensor* section.
2. Install the gasket on the common chamber.
3. Install the throttle body on the common chamber.
4. Secure the gasket and the throttle body with the four bolts.
   - The vacuum lines must be properly routed under the throttle body before tightening the mounting bolts.

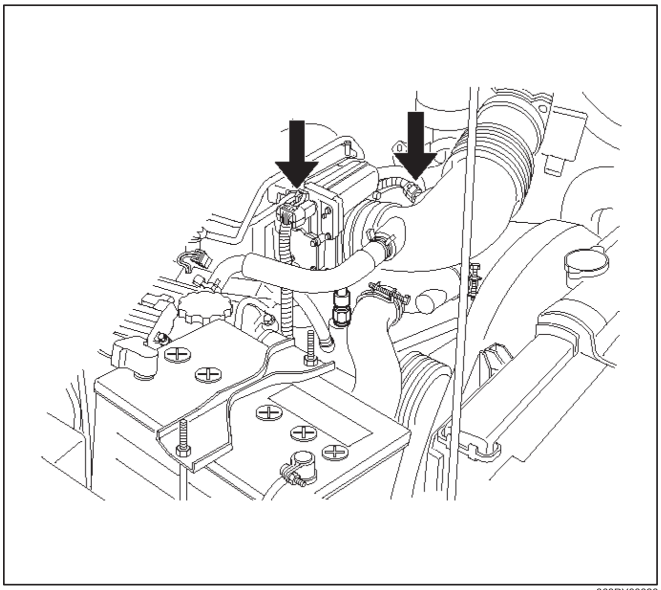
Tighten

- **Tighten the throttle body mounting bolts to 10 N·m (87 lb in).**



025RY00004

5. Install the coolant lines.
6. Connect all the vacuum lines.
7. Install the intake air duct.
8. Tighten the intake air duct clamp.
9. Connect all the electrical connectors:
   - Throttle position (TP) sensor.
   - Intake air temperature (IAT) sensor. Refer to *Intake Air Temperature Sensor* section.



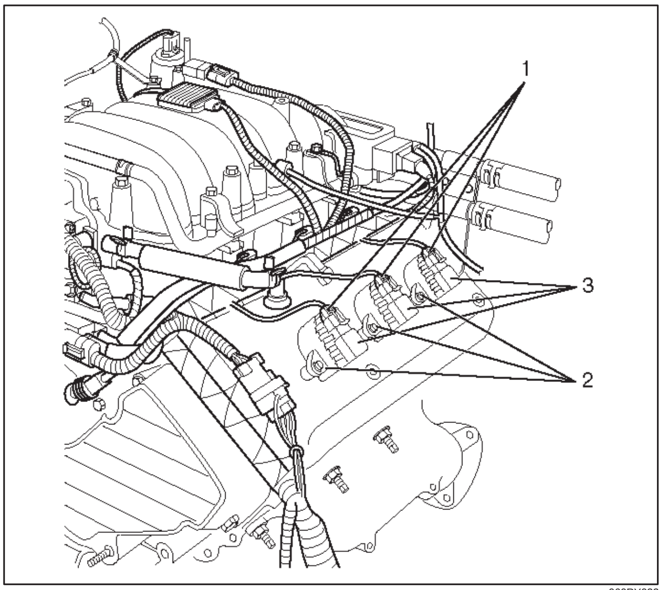
060RY00020

10. Install the accelerator cable assembly. Refer to *Accelerator Cable in Engine Speed Control System* section.
11. Fill the cooling system. Refer to *Cooling System* section.
12. Install the negative battery cable.

Electronic Ignition System

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the ignition coil connector at the ignition coil assemblies.
3. Remove the two screws that secure the ignition coil assemblies to the rocker cover.



060RY022

Legend

(1) Ignition Coil Connectors
(2) Bolts
(3) Ignition Coil Assemblies

4. Remove the ignition coil assemblies and the spark plug boot from the spark plug.
   - Twist the ignition coil assemblies while pulling it straight up.
5. Use the approhiate spark plug socket in order to remove the spark plug from the engine.

Installation Procedure

NOTE: The plug must thread smoothly into the cylinder head and be fully seated. Use a thread chaser if necessary to clean the threads in the cylinder head. Cross-threading or failure to fully seat the spark plug can cause plug overheating, exhaust blow-by gases, or thread damage. Do not overtighten the spark plugs. Over tightening can cause aluminum threads to strip.

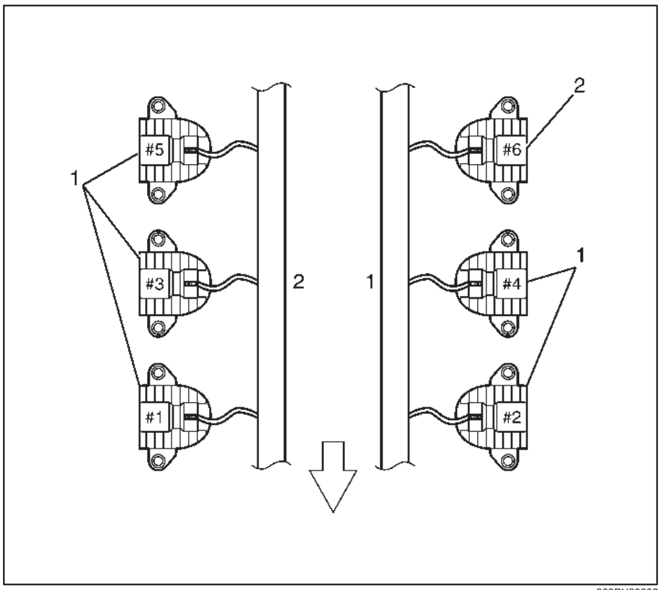
1. Install the spark plug in the engine. Use the appropriate spark plug socket.

Tighten

- **Tighten the spark plug to 18 N·m (13 lb ft.).**

2. Install the ignition coil assemblies and spark plug boot over the spark plug.

CAUTION: Ignition coil assembly #6 is different from ignition coil assembly from #1 to #5. Ignition coil assemblies #6 is short type. So, note it when installing ignition coil assembly of #6.



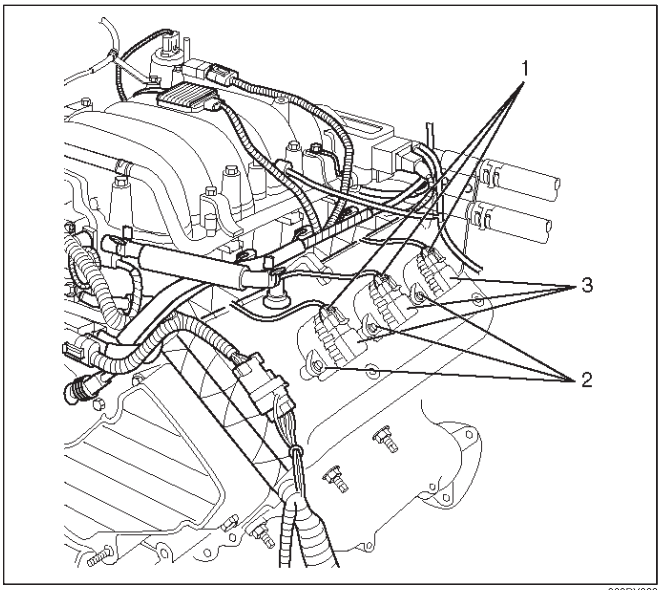
060RY00002

Legend

(1) Long Type Ignition Coil Assemblies (#1 ~ #5)
(2) Short Type Ignition Coil Assembly (#6)

3. Install ignition coil assemblies and tighten the fixing bolts to the specified torque.

Torque: 4 N·m (35.4 lb in)



060RY022

Legend

(1) Ignition Coil Connectors
(2) Bolts
(3) Ignition Coil Assemblies

4. Connect the ignition coil connector at the ignition coil assemblies.
5. Connect the negative battery cable.

Catalytic Converter

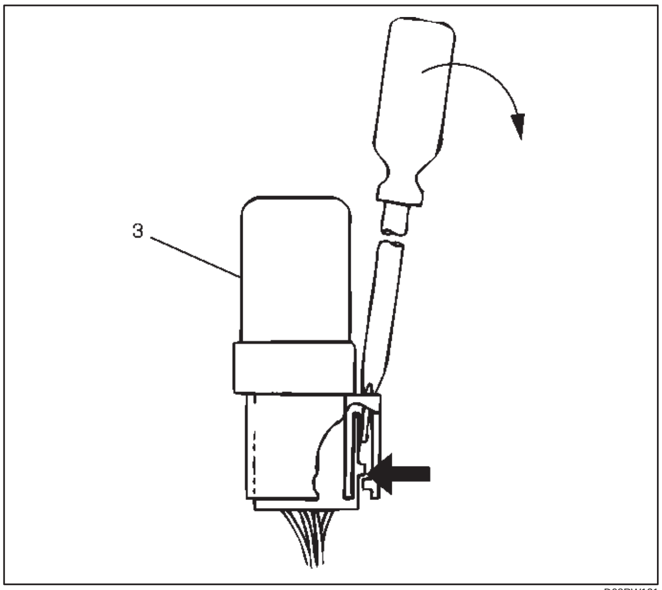
Removal and Installation Procedure

Refer to *Engine Exhaust in Engine* section.

Air Conditioning Thermo Relay

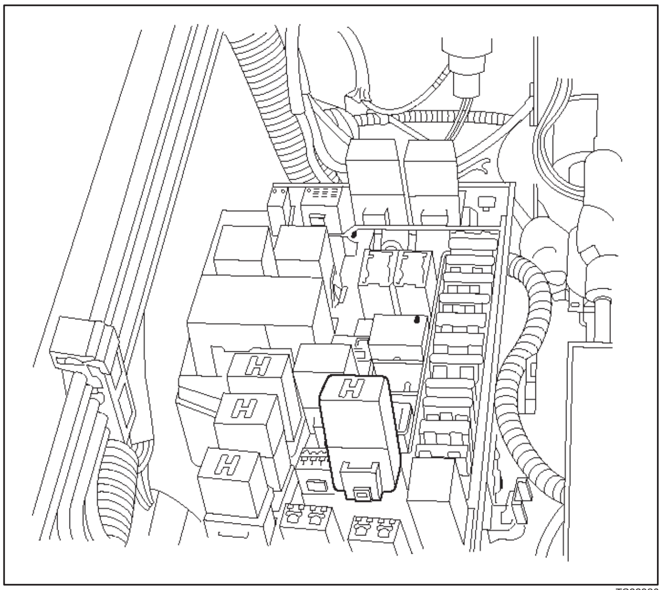
Removal Procedure

1. Remove the fuse and relay box cover from under the hood.
2. Consult the diagram on the cover to determine which is the correct relay.
3. Insert a small screwdriver into the catch slot on the forward side of the fuel pump relay.
   - The screwdriver blade will release the catch inside.



D08RW131

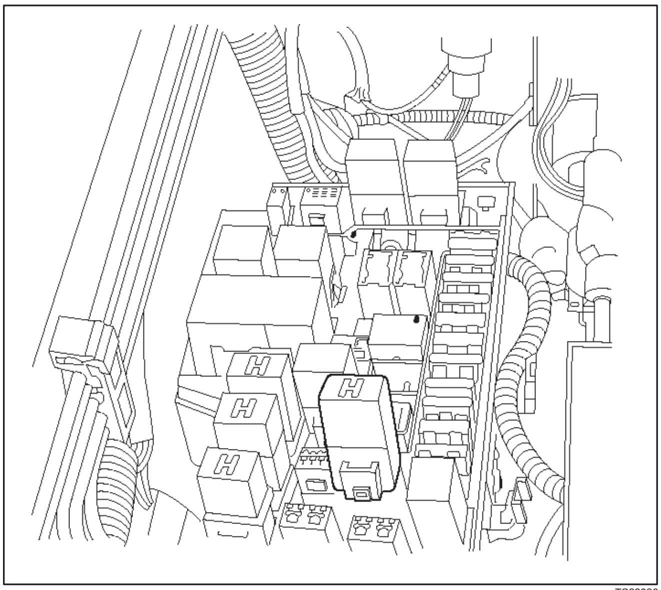
4. Pull the relay straight up and out of the fuse and relay box.



TS23986

Installation Procedure

1. Insert the relay into the correct place in the fuse and relay box with the catch slot facing forward.
2. Press down until the catch engages.
   - An audible “click” will be heard.
3. Install the fuse and relay box cover.



TS23986

EVAP Canister Hoses

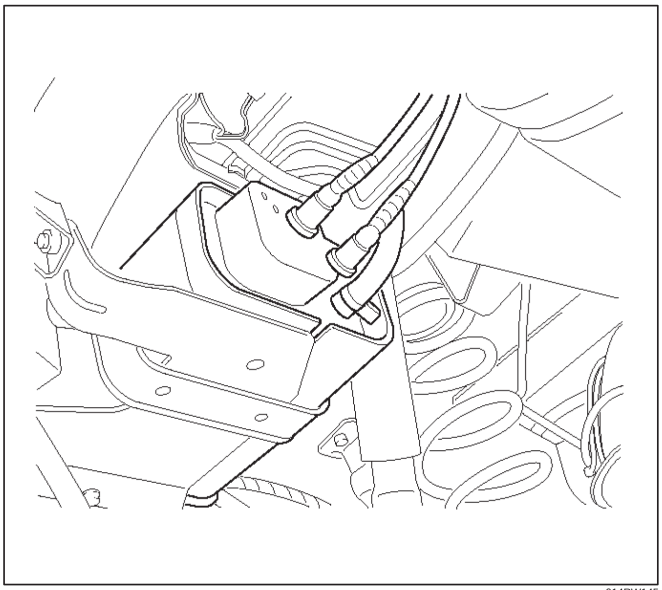
Service Information

To view the routing of the EVAP canister hoses, refer to *Vehicle Emission Control Information* in *Diagnosis* section.

EVAP Canister

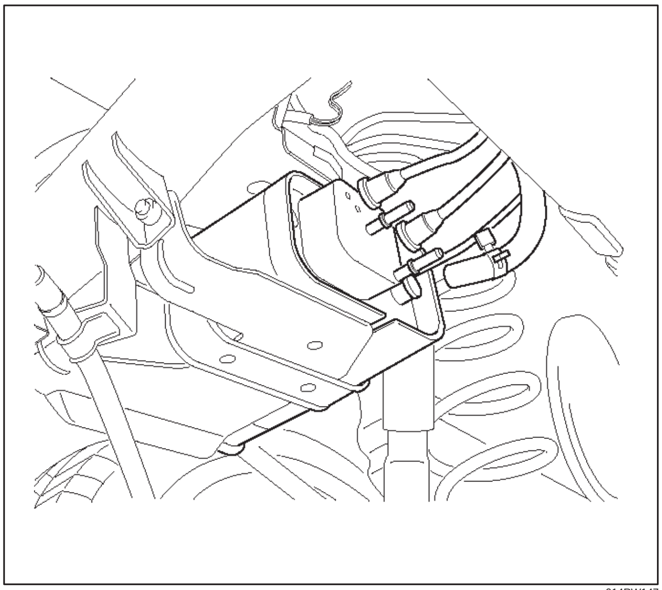
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the three hoses from the EVAP canister.



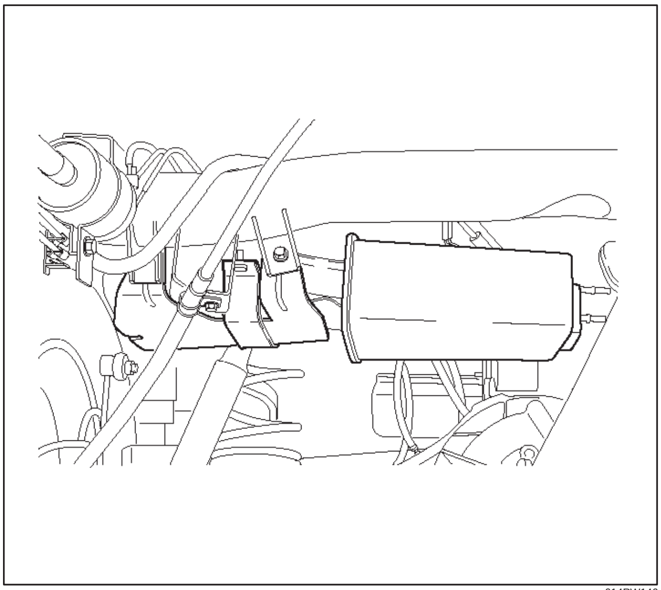
014RW145

3. Disconnect the fuel vapor connector and the purge hose from the EVAP canister vent solenoid.



014RW147

4. Remove the retaining two bolts on the mounting bracket and slide the canister out of mounting bracket.



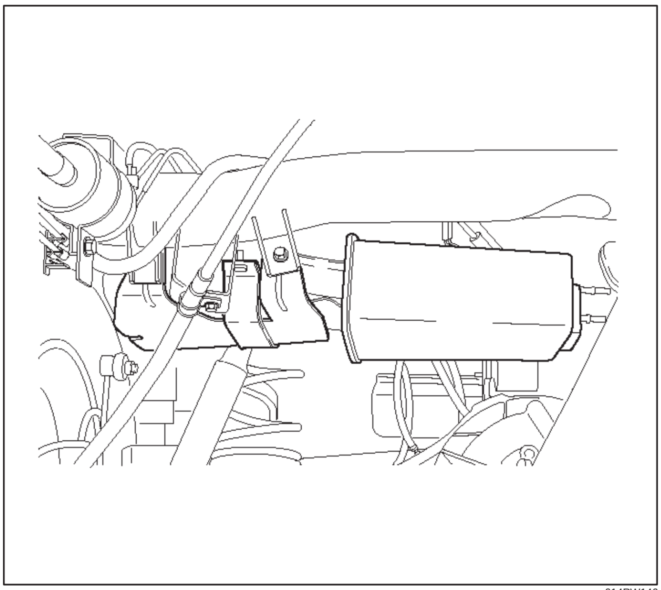
014RW146

Inspection Procedure

1. Inspect the hoses for cracks and leaks.
2. Inspect the canister for a damaged case.

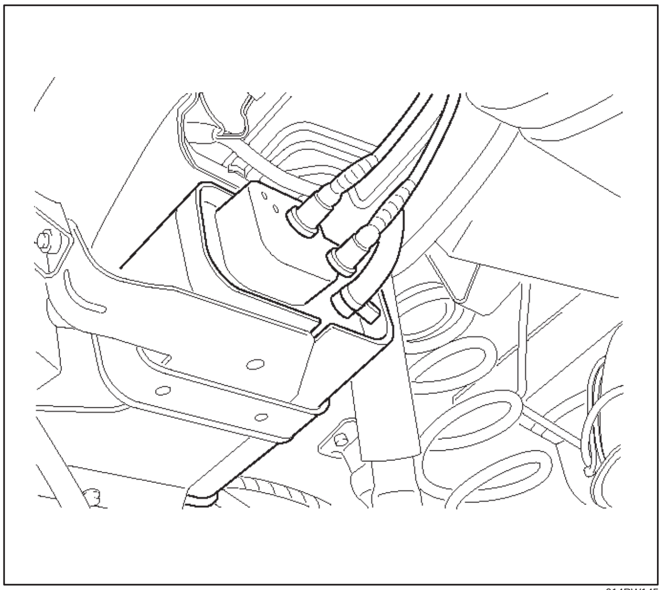
Installation Procedure

1. Slide the canister into mounting bracket and install the mounting bracket two bolts.



014RW146

2. Connect the fuel vapor connector to the EVAP canister vent solenoid.
3. Connect the three hoses to the EVAP canister.



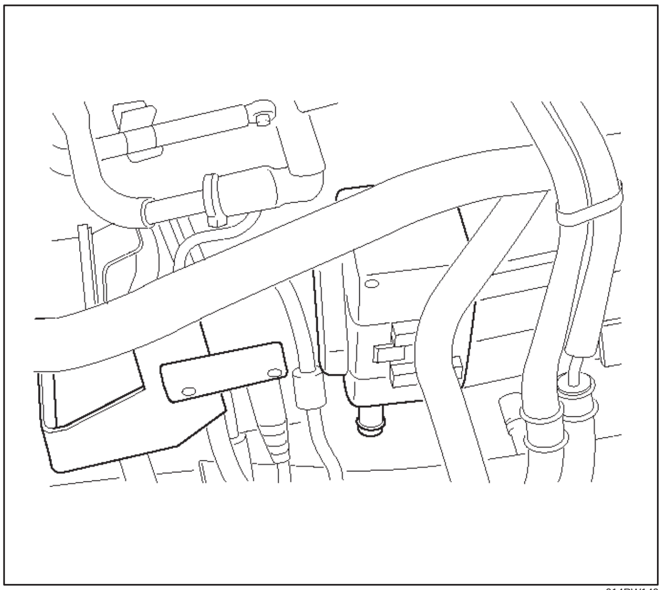
014RW145

4. Disconnect the negative battery cable.

EVAP Canister Vent Solenoid

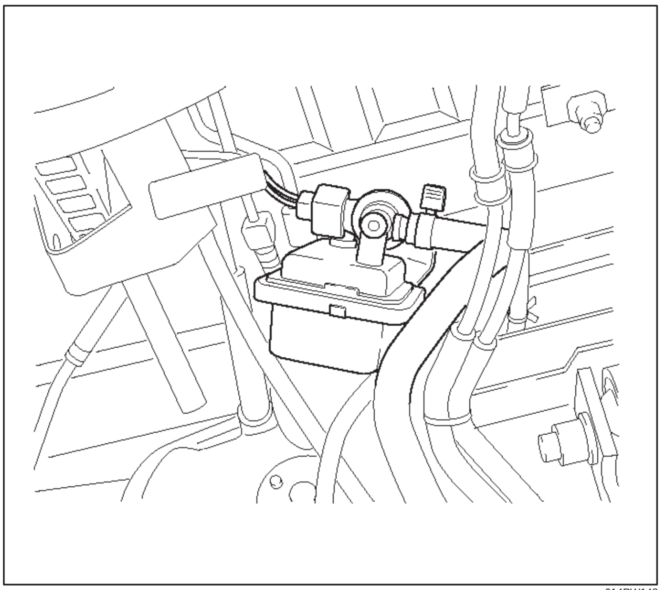
Removal Procedure

1. Disconnect the negative battery cable.
2. Slide out the EVAP canister vent solenoid from mounting bracket.



014RW149

3. Disconnect the connector and hose.



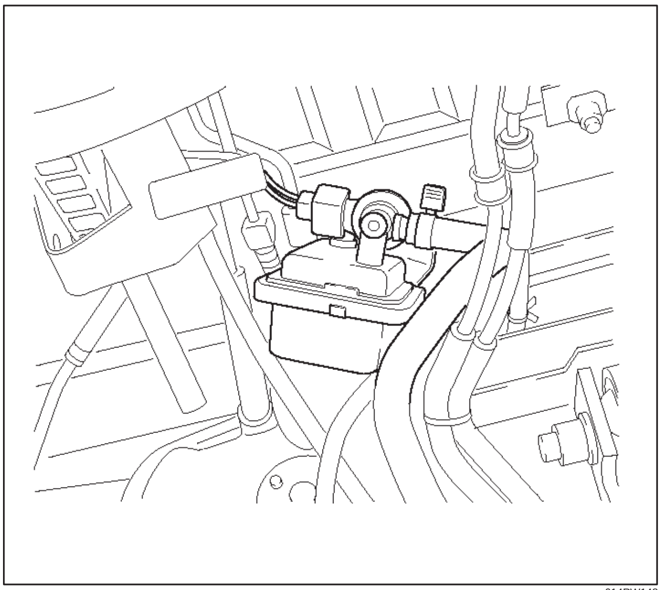
014RW148

Inspection Procedure

1. Check for cracks or leaks.
2. Energize the solenoid and try to blow through it. The solenoid should not allow passage of air when energized. (J 35616 Connector Test Kit can be used to easily attach jumper wires from the battery to the solenoid).

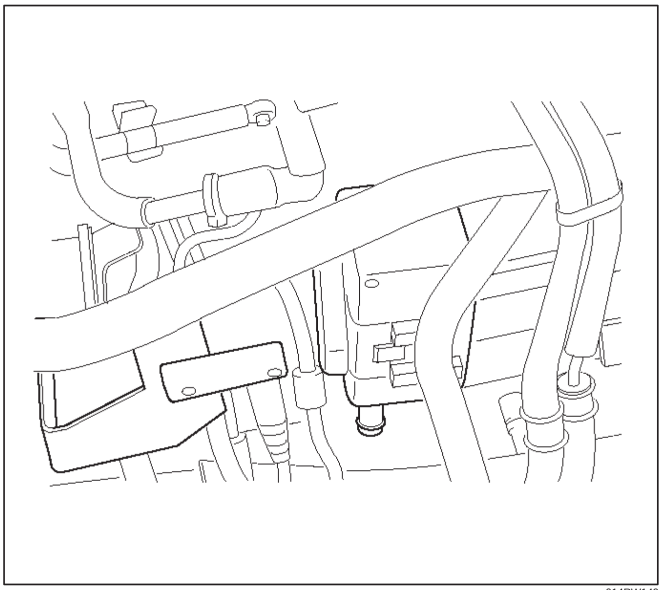
Installation Procedure

1. Connect the connector and hose.



014RW148

2. Slide the EVAP canister vent solenoid into mounting bracket.



014RW149

3. Connect the negative battery cable.

Fuel Tank Pressure Sensor

Removal Procedure

1. Remove the fuel pump assembly. Refer to *Fuel Tank In Fuel Pump* section.
2. Carefully pry the fuel tank pressure sensor out of the top of the fuel pump assembly.

Inspection Procedure

1. Inspect the vapor pressure sensor for cracks in the housing and corrosion on the electrical terminals.
2. Inspect the rubber grommet for tears and signs of rot.

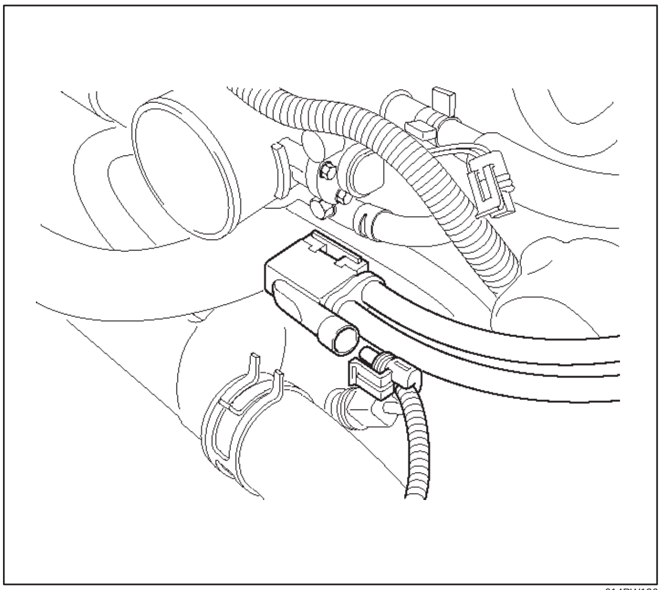
Installation Procedure

1. Install the rubber grommet on the fuel pump assembly.
2. Install the fuel tank vapor pressure sensor on the fuel pump assembly.
   - Insert the sensor nipple firmly into the grommet.
   - Keep twisting and pushing the sensor until the wide portion of the nipple shows on the other side of the grommet.
3. Install the fuel pump assembly on the fuel tank. Refer to *Fuel Tank In Fuel Pump* section.

EVAP Canister Purge Solenoid

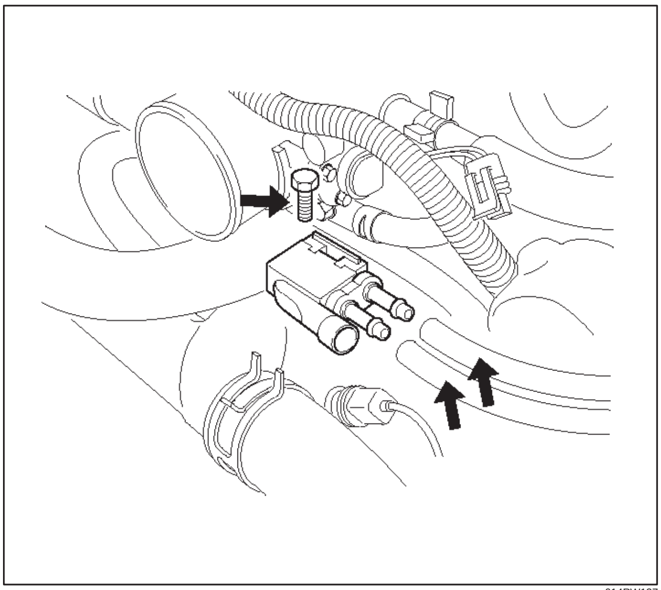
Removal Procedure

1. Disconnect the electrical connector from the EVAP canister purge solenoid.
2. Disconnect the vacuum hoses from the EVAP canister purge solenoid.



014RW136

3. Remove the EVAP canister purge solenoid retaining bolt from the common chamber.
4. Remove the EVAP canister purge solenoid.



014RW137

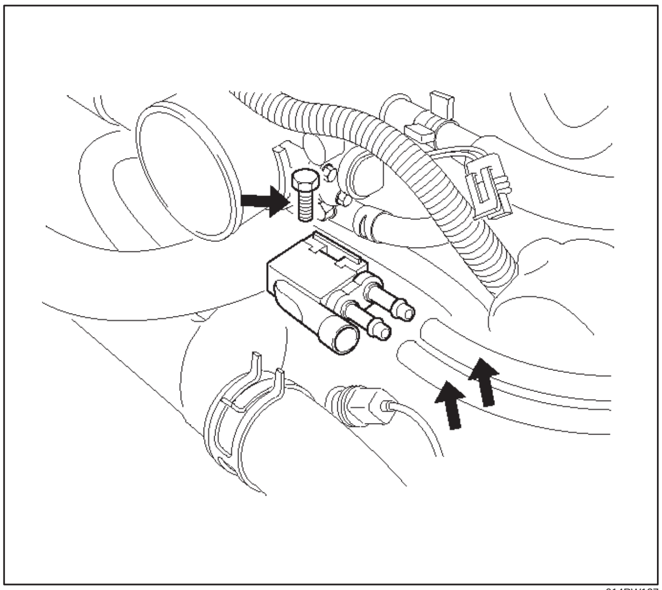
Installation Procedure

1. Install the EVAP canister purge solenoid on the upper intake manifold.
2. Install the EVAP canister purge solenoid retaining bolt.

Tighten

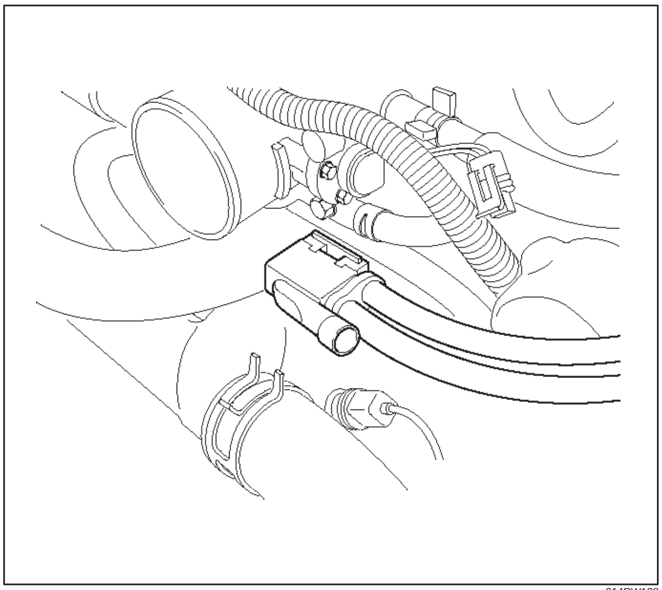
- **Tighten the bolts to 20 N·m (16 lb ft.).**

3. Connect the vacuum hoses to the EVAP canister purge solenoid.



014RW137

4. Connect the electrical connector to the EVAP canister purge solenoid.



014RW138

Fuel Tank Vent Valve

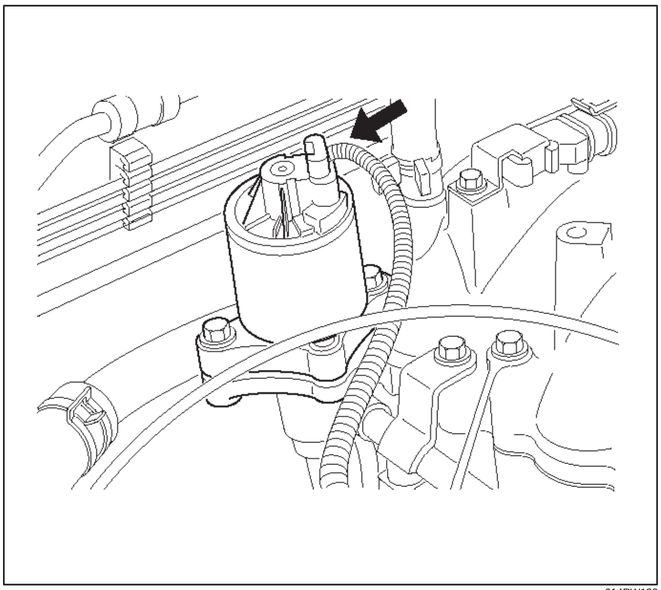
Removal and Installation Procedure

Refer to *Fuel Pump* section.

Linear Exhaust Gas Recirculation (EGR) Valve

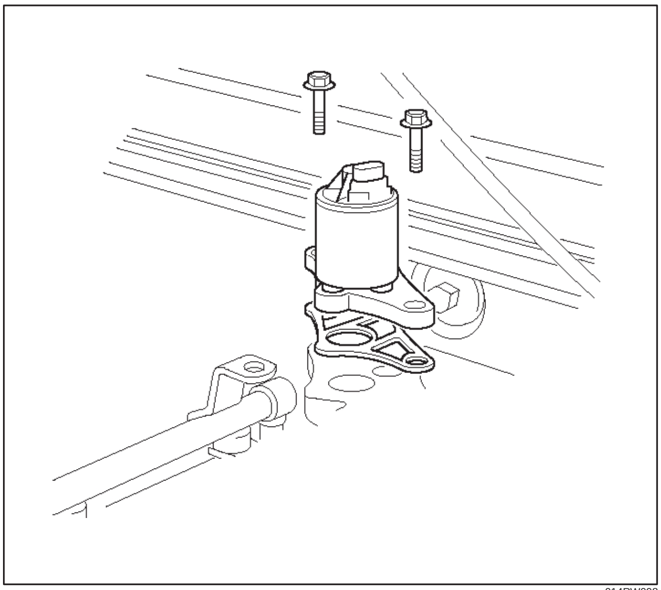
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector at the EGR valve.



014RW139

3. Remove the bolts from the common chamber.



014RW098

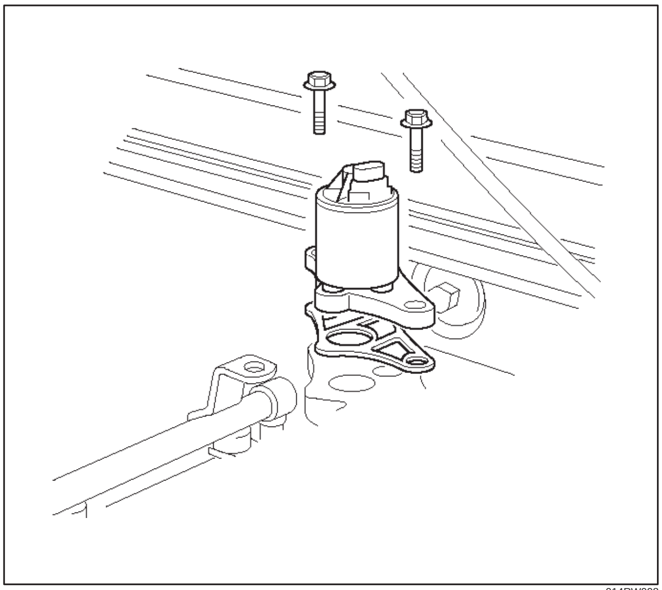
4. Remove the EGR valve from the common chamber manifold.
5. Remove the gasket from the common chamber manifold.

Installation Procedure

1. Install the gasket on the common chamber.
2. Install the EGR valve on the common chamber.
3. Secure the EGR valve and the gasket with the bolts.

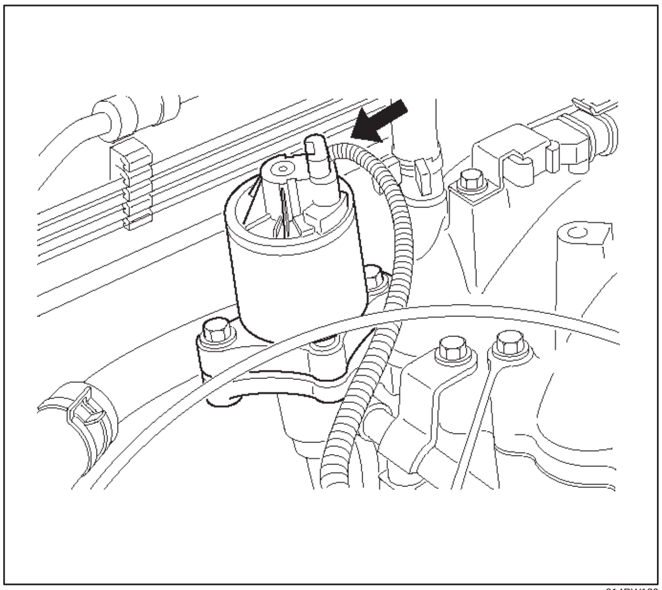
Torque: 25 N·m (18 lb ft)

NOTE: It is possible to install the EGR valve rotated 180° from the correct position. Make sure that the base of the valve is placed so that it aligns with the mounting flange.



014RW098

4. Connect the electrical connector at the EGR valve.



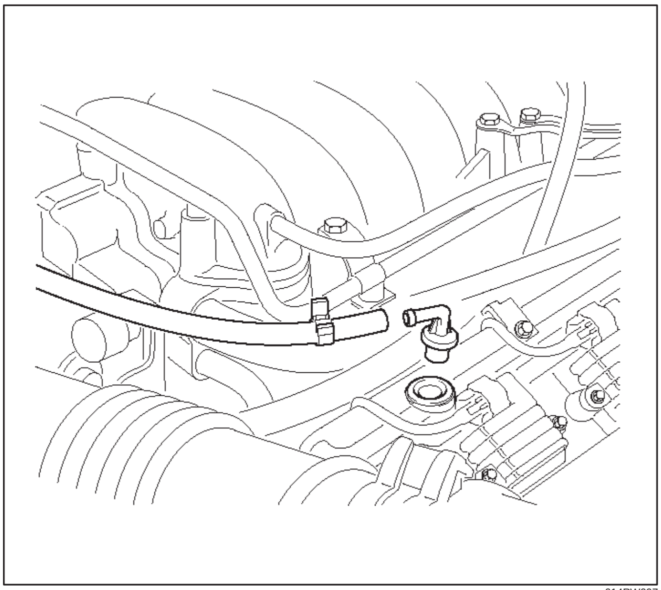
014RW139

5. Connect the negative battery cable.

Positive Crankcase Ventilation (PCV) Valve

Removal Procedure

1. Remove the vacuum hose at the PCV valve.
   - Slide the clamp back to release the hose.
2. Pull the PCV valve from the rubber grommet in the right valve cover.



014RW097

Inspection Procedure

Before inspecting the PCV valve, make sure that the hoses are connected properly and are in good condition. Also check that the oil pan and rocker cover gaskets are sealing properly.

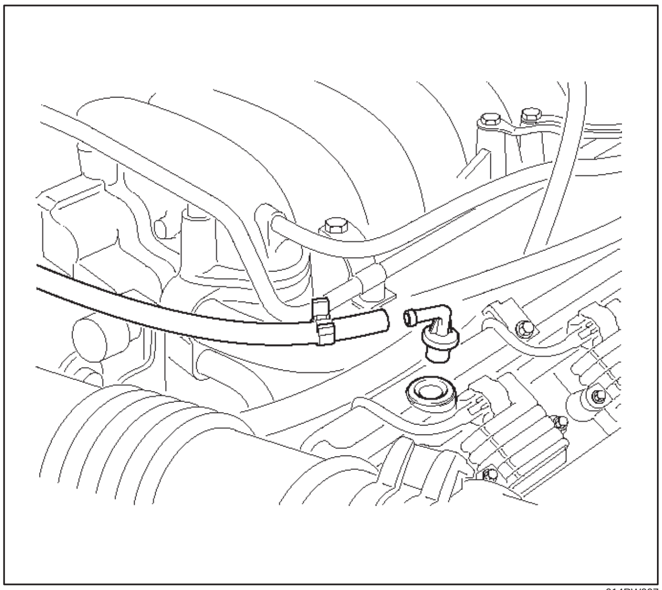
PCV Valve

1. Run the engine at normal operating temperature.
2. Disconnect the valve from the rocker cover.
   RESULT: A hissing noise should be heard from the valve. If no noise is heard, the PCV valve or hose is plugged.
3. Remove the PCV valve from the engine.
   a. Blow air into the rocker cover side of the valve.
   RESULT: Air should pass freely.
   b. Blow air into the air cleaner side of the valve.
   RESULT: Air should not pass through the valve.
4. Re-install the PCV valve and remove the oil filler cap.

RESULT: A small vacuum should be felt at the oil filler hole.

Installation Procedure

1. Push the PCV valve into the rubber grommet in the left valve cover.
2. Install the vacuum hose on the PCV valve and secure the vacuum hose with the clamp.



014RW097

Wiring and Connectors

Wiring Harness Service

The control module harness electrically connects the control module to the various solenoids, switches and sensors in the vehicle engine compartment and passenger compartment.

Replace wire harnesses with the proper part number replacement.

Because of the low amperage and voltage levels utilized in powertrain control systems, it is essential that all wiring in environmentally exposed areas be repaired with crimp and seal splice sleeves.

The following wire harness repair information is intended as a general guideline only. Refer to *Chassis Electrical* section for all wire harness repair procedures.

Connectors and Terminals

Use care when probing a connector and when replacing terminals. It is possible to short between opposite terminals. Damage to components could result. Always use jumper wires between connectors for circuit checking. NEVER probe through Weather-Pack seals.

Use an appropriate connector test adapter kit which contains an assortment of flexible connectors used to probe terminals during diagnosis. Use an appropriate fuse remover and test tool for removing a fuse and to adapt the fuse holder to a meter for diagnosis.

Open circuits are often difficult to locate by sight because oxidation or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor, or in the wiring harness, may temporarily correct the open circuit. Intermittent problems may also be caused by oxidized or loose connections.

Be certain of the type of connector/terminal before making any connector or terminal repair. Weather-Pack and Com-Pack III terminals look similar, but are serviced differently.

PCM Connectors and Terminals

Removal Procedure

1. Remove the connector terminal retainer.
2. Push the wire connected to the affected terminal through the connector face so that the terminal is exposed.
3. Service the terminal as necessary.

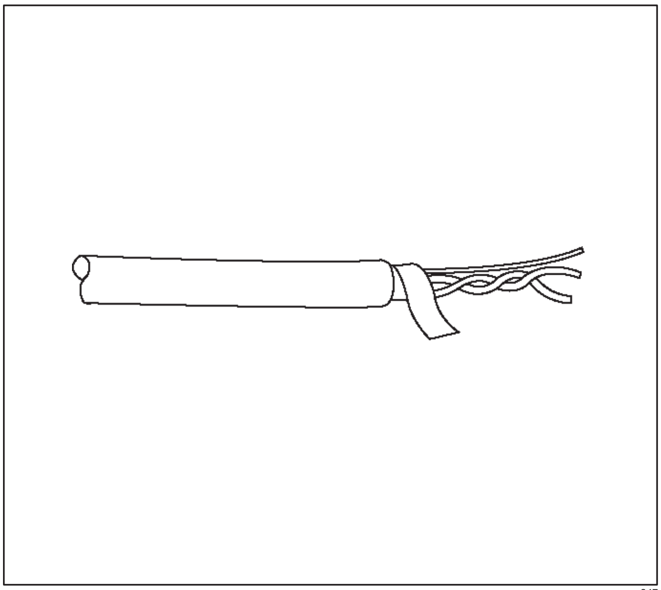
Installation Procedure

1. Bend the tab on the connector to allow the terminal to be pulled into position within the connector.
2. Pull carefully on the wire to install the connector terminal retainer.

Wire Harness Repair: Twisted Shielded Cable

Removal Procedure

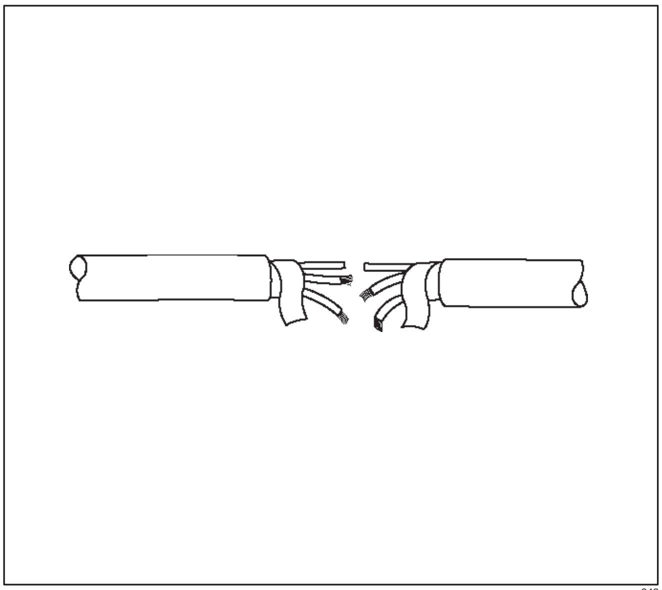
1. Remove the outer jacket.
2. Unwrap the aluminum/mylar tape. Do not remove the mylar.



047

3. Untwist the conductors.

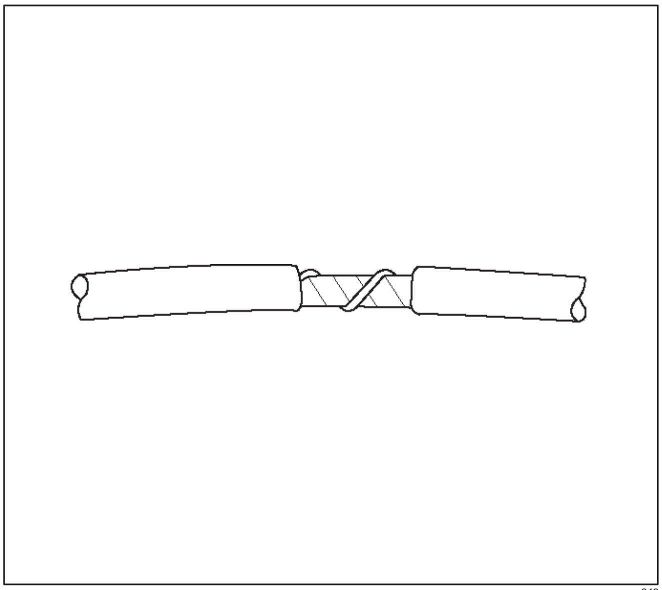
4. Strip the insulation as necessary.



048

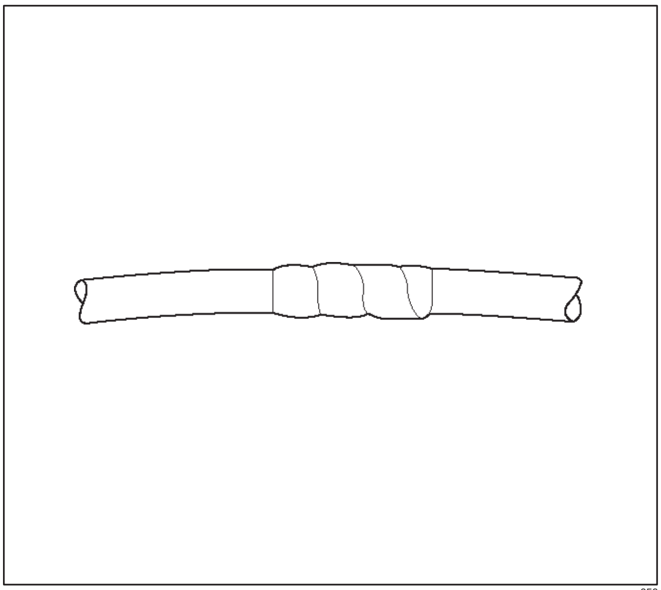
Installation Procedure

1. Splice the wires using splice clips and rosin core solder.
2. Wrap each splice to insulate.
3. Wrap the splice with mylar and with the drain (uninsulated) wire.



049

4. Tape over the whole bundle to secure.

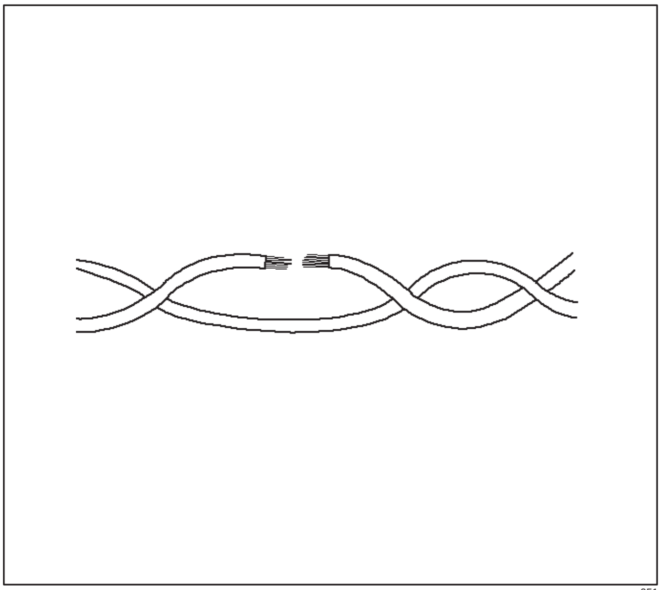


050

Twisted Leads

Removal Procedure

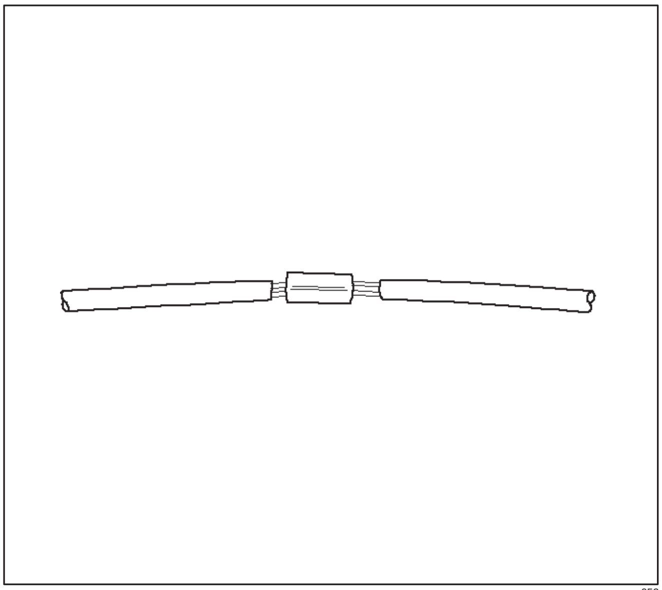
1. Locate the damaged wire.
2. Remove the insulation as required.



051

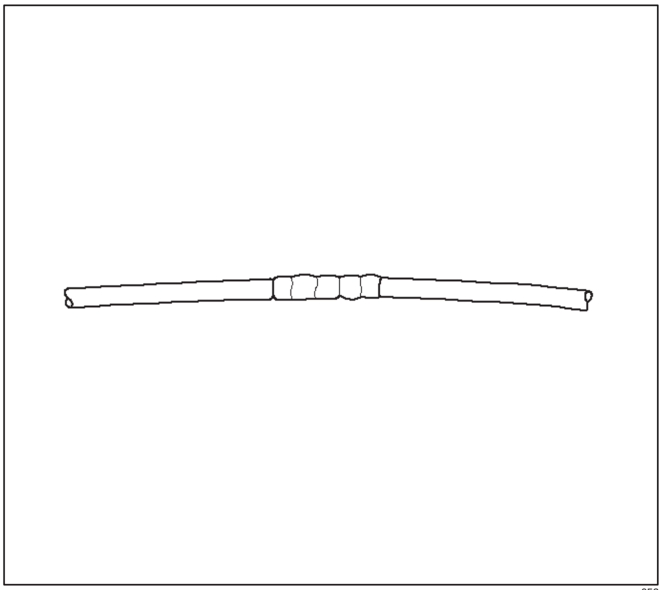
Installation Procedure

1. Use splice clips and rosin core solder in order to splice the two wires together.



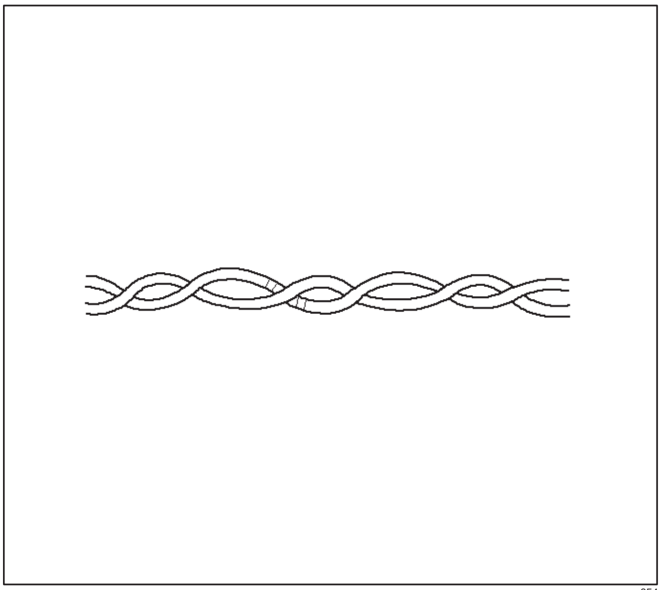
052

2. Cover the splice with tape in order to insulate it from the other wires.



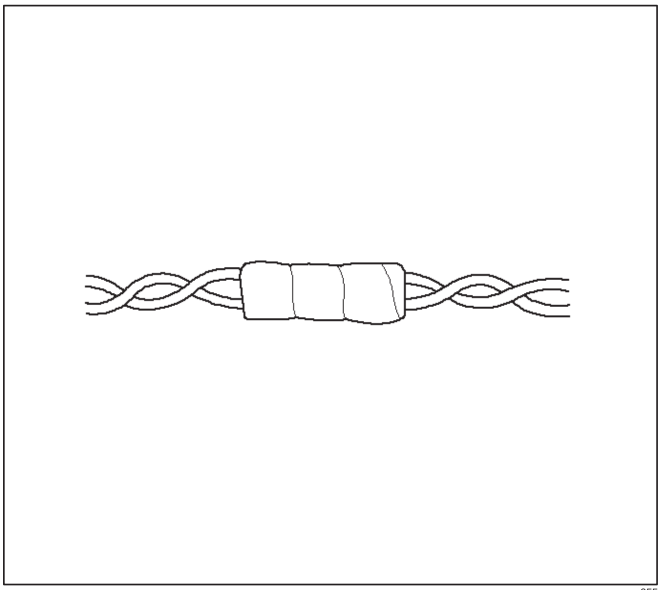
053

3. Twist the wires as they were before starting this procedure.



054

4. Tape the wires with electrical tape. Hold in place.



055

Weather-Pack Connector

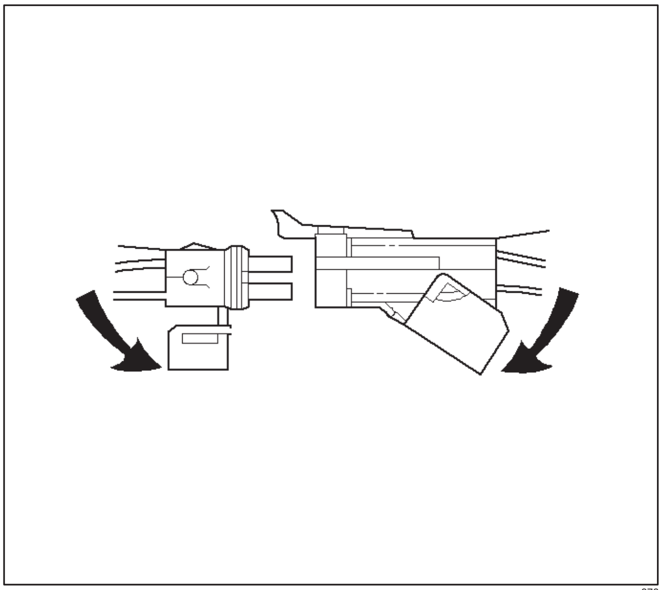
Tools Required

J 28742-A Weather-Pack II Terminal Remover

Removal Procedure

A Weather-Pack connector can be identified by a rubber seal at the rear of the connector. This engine room connector protects against moisture and dirt, which could from oxidation and deposits on the terminals. This protection is important, because of the low voltage and the low amperage found in the electronic systems.

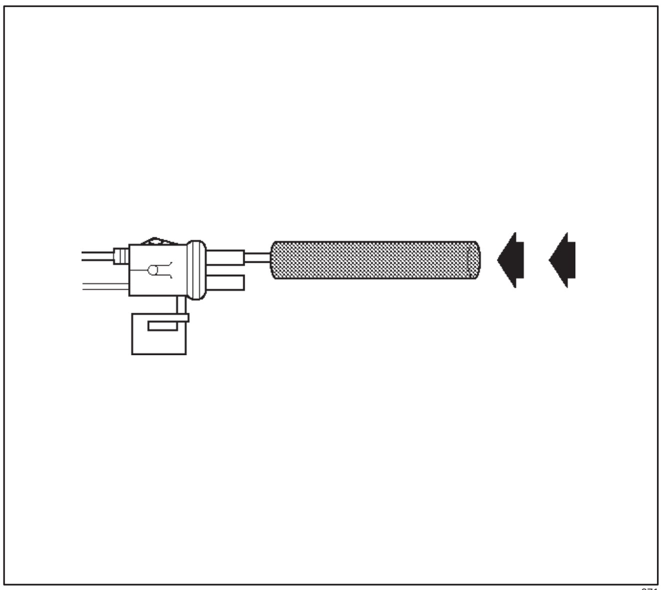
1. Open the secondary lock hinge on the connector.



070

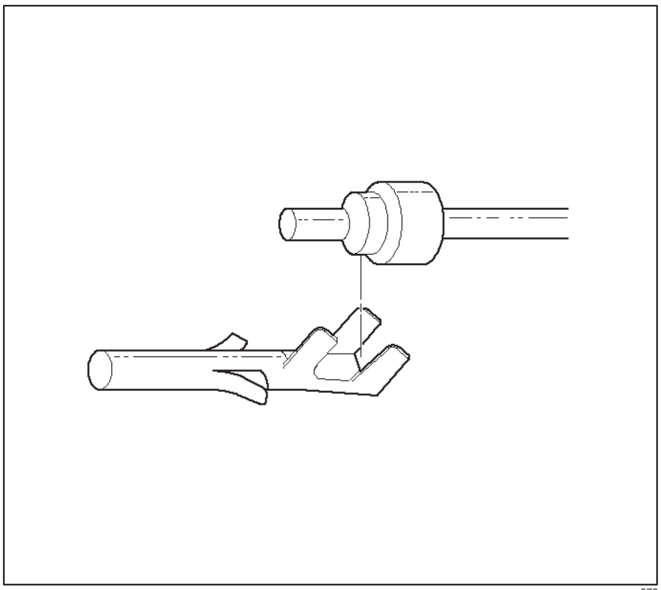
2. Use tool J 28742-A or the equivalent to remove the pin and the sleeve terminals. Push on J 28742-A to release.

NOTE: Do the use an ordinary pick or the terminal may be bent or deformed. Unlike standard blade terminals, these terminals cannot be straightened after they have been improperly bent.



071

3. Cut the wire immediately behind the cable seal.



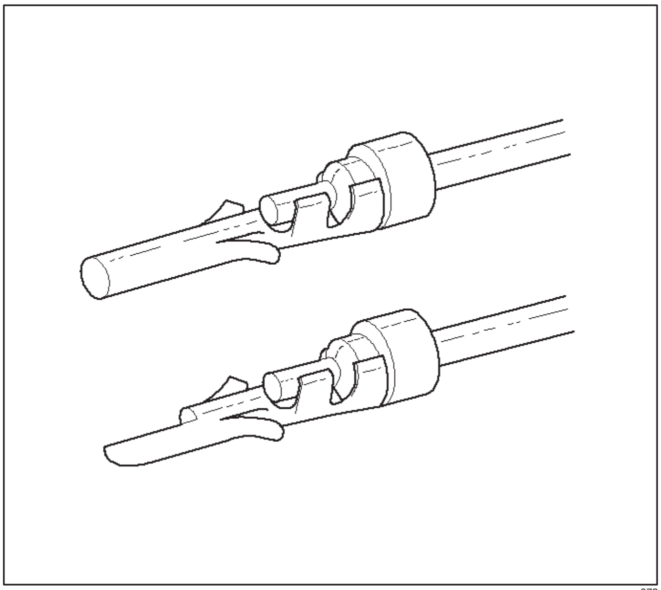
072

Installation Procedure

Make certain the connectors are properly seated and all of the sealing rings are in place when you reconnect the leads. The secondary lock hinge provides a backup locking feature for the connector. The secondary lock hinge is used for added reliability. This flap should retain the terminals even if the small terminal lock tangs are not positioned properly.

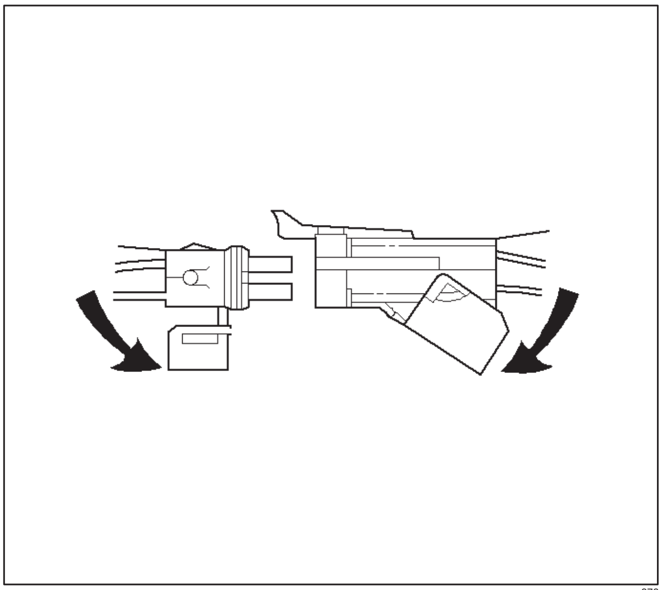
Do not replace the Weather-Pack connections with standard connections. Read the instructions provided with the Weather-Pack connector and terminal packages.

1. Replace the terminal.
2. Slip the new seal onto the wire.
3. Strip 5 mm (0.2”) of insulation from the wire.
4. Crimp the terminal over the wire and the seal.



073

5. Push the terminal and the connector to engage the locking tangs.



070

6. Close the secondary locking hinge.

Com-Pack III

General Information

The Com-Pack III terminal looks similar to some Weather-Pack terminals. This terminal is not sealed and is used where resistance to the environment is not required. Use the standard method when repairing a terminal. Do not use the Weather-Pack terminal tool J 28742-A or equivalent. These will damage the terminals.

Metri-Pack

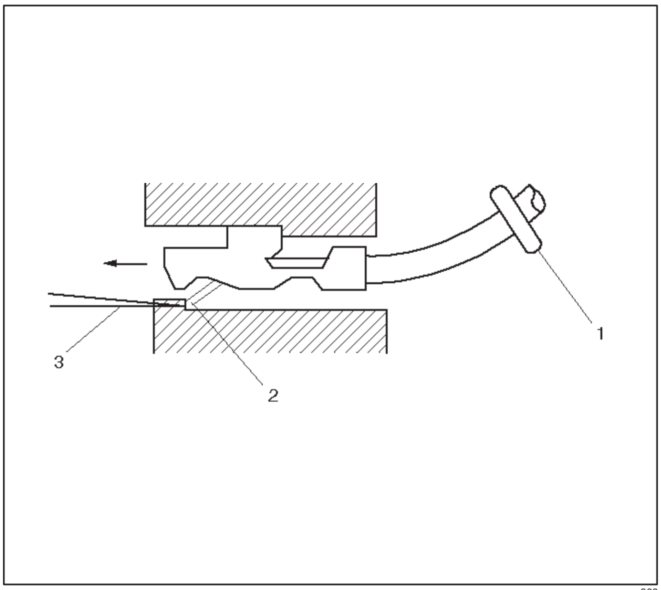
Tools Required

J 35689 Terminal Remover

Removal Procedure

Some connectors use terminals called Metri-Pack Series 150. These may be used at the engine coolant temperature (ECT) sensor.

1. Slide the seal (1) back on the wire.
2. Insert the J 35689 tool or equivalent (3) in order to release the terminal locking tang (2).



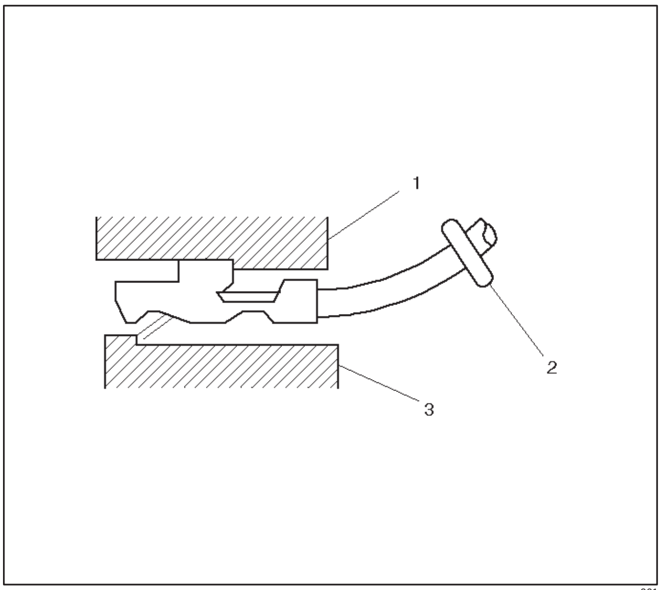
060

3. Push the wire and the terminal out through the connector. If you reuse the terminal, reshape the locking tang.

Installation Procedure

Metri-Pack terminals are also referred to as “pull-to-seat” terminals.

1. In order to install a terminal on a wire, the wire must be inserted through the seal (2) and through the connector (3).
2. The terminal (1) is then crimped onto the wire.



061

3. Then the terminal is pulled back into the connector to seat it in place.

General Description (PCM and Sensors)

58X Reference PCM Input

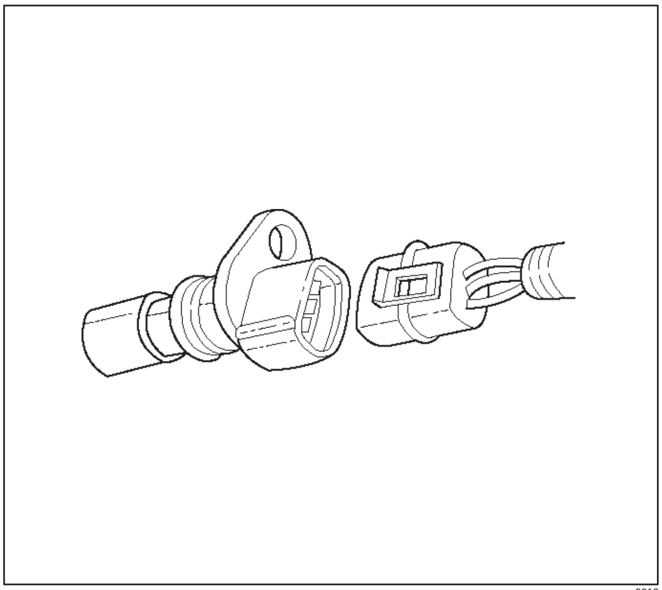
The powertrain control module (PCM) uses this signal from the crankshaft position (CKP) sensor to calculate engine RPM and crankshaft position at all engine speeds. The PCM also uses the pulses on this circuit to initiate injector pulses. If the PCM receives no pulses on this circuit, DTC P0337 will set. The engine will not start and run without using the 58X reference signal.

A/C Request Signal

This signal tells the PCM when the A/C mode is selected at the A/C control head. The PCM uses this to adjust the idle speed before turning "ON" the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.
Refer to *A/C Clutch Circuit Diagnosis* section for A/C wiring diagrams and diagnosis for the A/C electrical system.

Crankshaft Position (CKP) Sensor

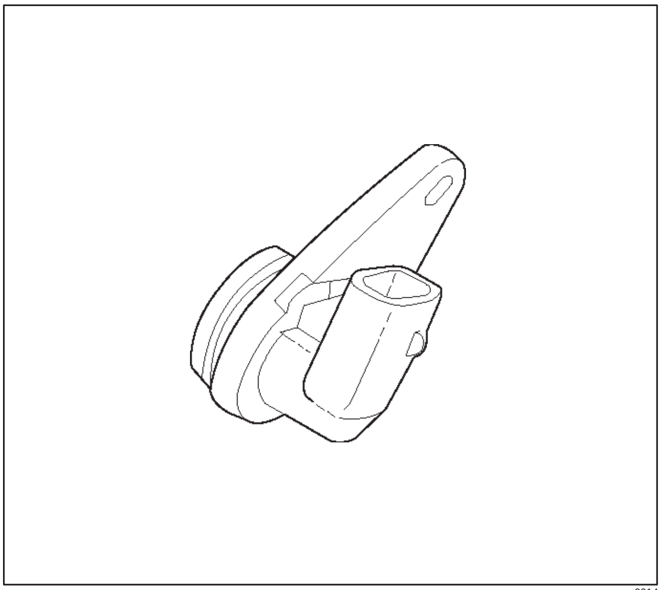
The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The CKP sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position.
Refer to *Electronic Ignition System* section for additional information.



0013

Camshaft Position (CMP) Sensor and Signal

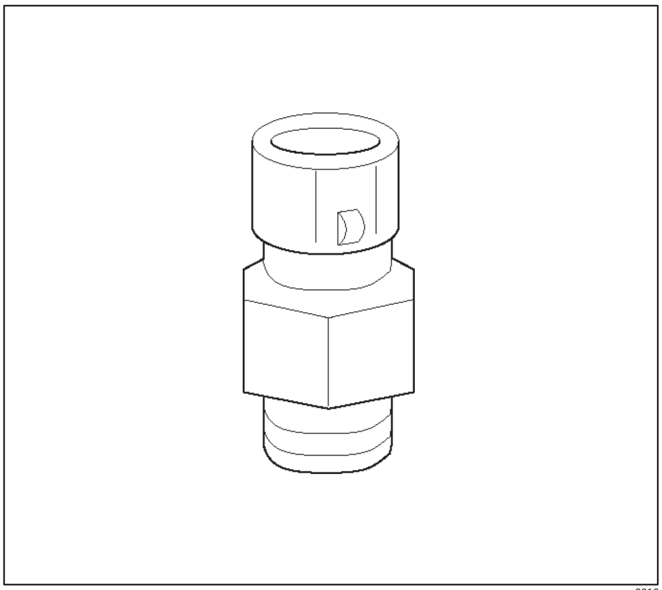
The camshaft position (CMP) sensor sends a CMP signal to the PCM. The PCM uses this signal as a "sync pulse" to trigger the injectors in the proper sequence. The PCM uses the CMP signal to indicate the position of the #1 piston during its power stroke. This allows the PCM to calculate true sequential fuel injection (SFI) mode of operation. If the PCM detects an incorrect CMP signal while the engine is running, DTC P0341 will set. If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection mode based on the last fuel injection pulse, and the engine will continue to run. As long as the fault is present, the engine can be restarted. It will run in the calculated sequential mode with a 1-in-6 chance of the injector sequence being correct.
Refer to *DTC P0341* for further information.



0014

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. Low coolant temperature produces a high resistance of 100,000 ohms at –40°C (–40°F). High temperature causes a low resistance of 70 ohms at 130°C (266°F). The PCM supplies a 5-volt signal to the ECT sensor through resistors in the PCM and measures the voltage. The signal voltage will be high when the engine is cold and low when the engine is hot. By measuring the voltage, the PCM calculates the engine coolant temperature. Engine coolant temperature affects most of the systems that the PCM controls.
The Tech 2 displays engine coolant temperature in degrees. After engine start-up, the temperature should rise steadily to about 85°C (185°F). It then stabilizes when the thermostat opens. If the engine has not been run for several hours (overnight), the engine coolant temperature and intake air temperature displays should be close to each other. A hard fault in the engine coolant sensor circuit will set DTC P0177 or DTC P0118. An intermittent fault will set a DTC P1114 or P1115.



0016

Electrically Erasable Programmable Read Only Memory (EEPROM)

The electrically erasable programmable read only memory (EEPROM) is a permanent memory chip that is physically soldered within the PCM. The EEPROM contains the program and the calibration information that the PCM needs to control powertrain operation.

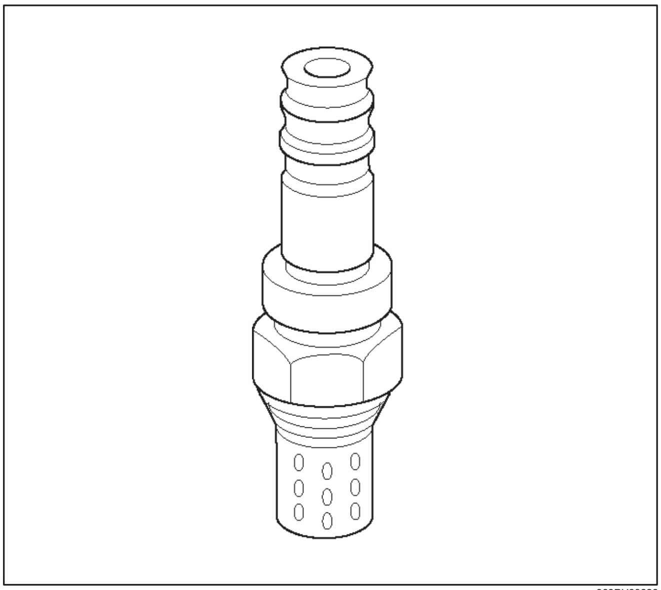
Unlike the PROM used in past applications, the EEPROM is not replaceable. If the PCM is replaced, the new PCM will need to be programmed. Equipment containing the correct program and calibration for the vehicle is required to program the PCM.

Fuel Control Heated Oxygen Sensors

The fuel control heated oxygen sensors (Bank 1 HO2S 1 and Bank 2 HO2S 1) are mounted in the exhaust stream where they can monitor the oxygen content of the exhaust gas. The oxygen present in the exhaust gas reacts with the sensor to produce a voltage output. This voltage should constantly fluctuate from approximately 100 mV to 900 mV. The heated oxygen sensor voltage can be monitored with a Tech 2. By monitoring the voltage output of the oxygen sensor, the PCM calculates the pulse width command for the injectors to produce the proper combustion chamber mixture.

- Low HO2S voltage is a lean mixture which will result in a rich command to compensate.
- High HO2S voltage is a rich mixture which will result in a lean command to compensate.

An open Bank 1 HO2S 1 signal circuit will set a DTC P0134 and the Tech 2 will display a constant voltage between 400-500 mV. A constant voltage below 300 mV in the sensor circuit (circuit grounded) will set DTC P0131. A constant voltage above 800 mV in the circuit will set DTC P0132. Faults in the Bank 2 HO2S 1 signal circuit will cause DTC 0154 (open circuit), DTC P0151 (grounded circuit), or DTC P0152 (signal voltage high) to set. A fault in the Bank 1 HO2S 1 heater circuit will cause DTC P0135 to set. A fault in the Bank 2 HO2S 1 heater circuit will cause DTC P0155 to set. The PCM can also detect HO2S response problems. If the response time of an HO2S is determined to be too slow, the PCM will store a DTC that indicates degraded HO2S performance.



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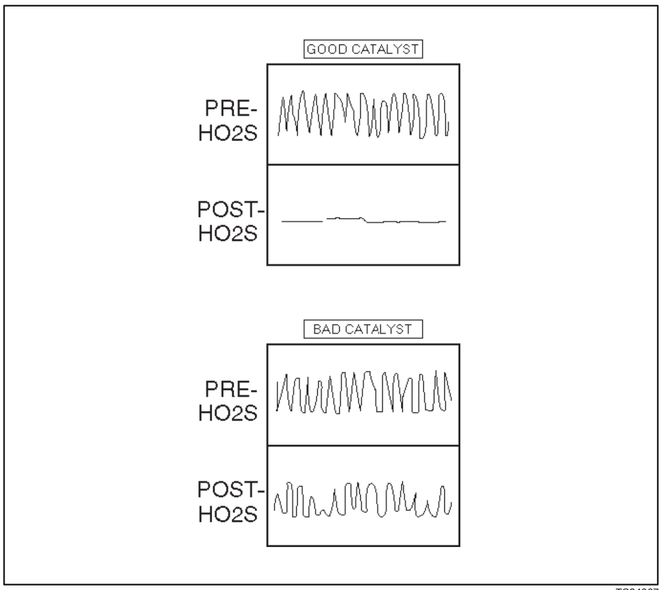
Catalyst Monitor Heated Oxygen Sensors

Three-way catalytic converters are used to control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx). The catalyst within the converters promotes a chemical reaction. This reaction oxidizes the HC and CO present in the exhaust gas and converts them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx by converting it to nitrogen. The PCM can monitor this process using the Bank 1 HO2S 2 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 and the Bank 2 HO2S 1 sensors produce an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 1 HO2S 2 and the Bank 2 HO2S 2 sensors produce an output signal which indicates the oxygen storage capacity of the catalyst. This indicates the catalyst's ability to efficiently convert exhaust gases. If the catalyst is operating efficiently, the Bank 1 HO2S 1 and the Bank 2 HO2S 1 signals will be more active than the signals produced by the Bank 1 HO2S 2 and the Bank 2 HO2S 2 sensors.

The catalyst monitor sensors operate the same as the fuel control sensors. The Bank 1 HO2S 2 and the Bank 2 HO2S 2 sensors' main function is catalyst monitoring, but they also have a limited role in fuel control. If a sensor output indicates a voltage either above or below the 450 mV bias voltage for an extended period of time, the PCM will make a slight adjustment to fuel trim to ensure that fuel delivery is correct for catalyst monitoring.

A problem with the Bank 1 HO2S 2 signal circuit will set DTC P0137, P0138, or P0140, depending on the specific condition. A problem with the Bank 2 HO2S 2 signal circuit will set DTC P0157, P0158, or P0160, depending on the specific condition. A fault in the heated oxygen sensor heater element or its ignition feed or ground will result in lower sensor response. This may cause incorrect catalyst monitor diagnostic results.



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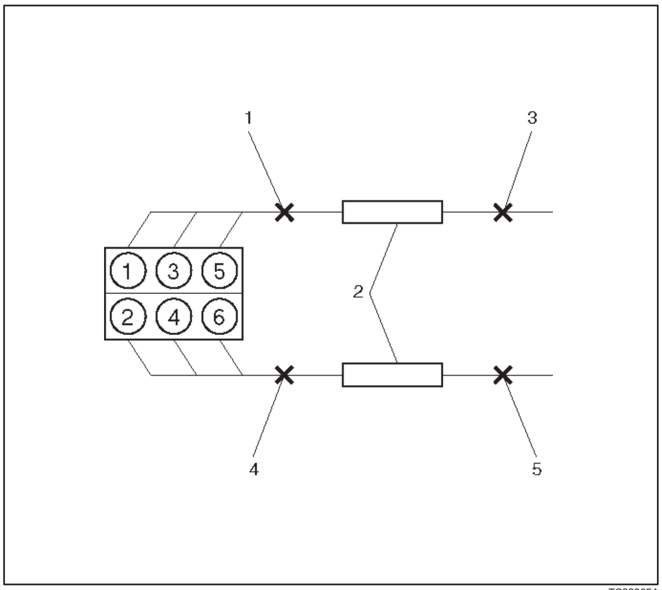

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Legend

(1) Bank 1 Sensor 1 (Fuel Control)
(2) Catalytic Converter
(3) Bank 1 Sensor 2 (Catalyst Monitor)
(4) Bank 2 Sensor 1 (Fuel Control)
(5) Bank 2 Sensor 2 (Catalyst Monitor)

Intake Air Temperature (IAT) Sensor

The intake air temperature (IAT) sensor is a thermistor which changes its resistance based on the temperature of air entering the engine. Low temperature produces a high resistance of 100,000 ohms at –40°C (–40°F). High temperature causes low resistance of 70 ohms at 130°C (266°F) . The PCM supplies a 5-volt signal to the sensor through a resistor in the PCM and monitors the signal voltage. The voltage will be high when the incoming air is cold. The voltage will be low when the incoming air is hot. By measuring the voltage, the PCM calculates the incoming air temperature. The IAT sensor signal is used to adjust spark timing according to the incoming air density.

The Tech 2 displays the temperature of the air entering the engine. The temperature should read close to the ambient air temperature when the engine is cold and rise as underhood temperature increases. If the engine has not been run for several hours (overnight), the IAT sensor temperature and engine coolant temperature should read close to each other. A fault in the IAT sensor circuit will set DTC P0112 or DTC P0113.

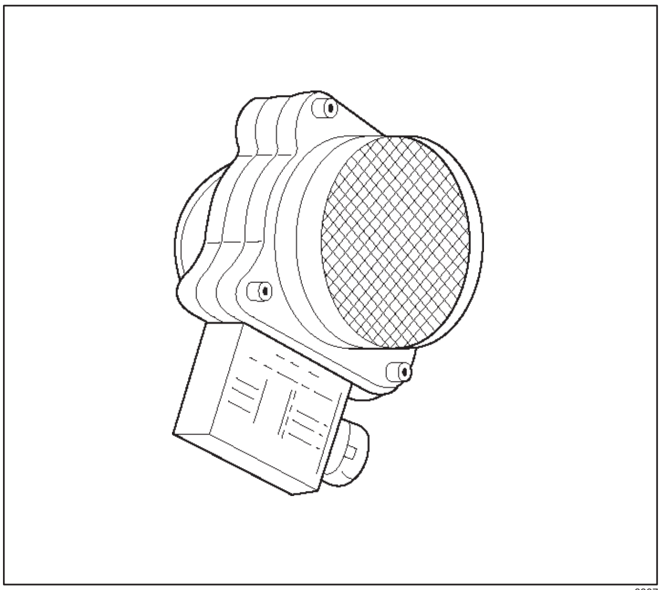
Linear Exhaust Gas Recirculation (EGR) Control

The PCM monitors the exhaust gas recirculation (EGR) actual position and adjusts the pintle position accordingly. The PCM uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Mass air flow (MAF) sensor.

Mass Air Flow (MAF) Sensor

The mass air flow (MAF) sensor measures the difference between the volume and the quantity of air that enters the engine. “Volume” means the size of the space to be filled. “Quantity” means the number of air molecules that will fit into the space. This information is important to the PCM because heavier, denser air will hold more fuel than lighter, thinner air. The PCM adjusts the air/fuel ratio as needed depending on the MAF value. The Tech 2 reads the MAF value and displays it in terms of grams per second (gm/s). At idle, the Tech 2 should read between 4-7 gm/s on a fully warmed up engine. Values should change quickly on acceleration. Values should remain stable at any given RPM. A failure in the MAF sensor or circuit will set DTC P0101, DTC P0102, or DTC P0103.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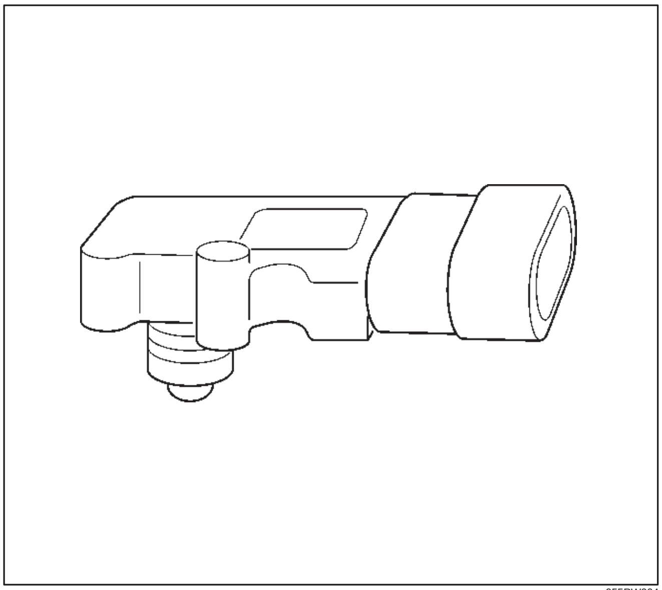
Manifold Absolute Pressure (MAP) Sensor

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition ON, engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine the following:

- Manifold pressure changes while the linear EGR flow test diagnostic is being run. Refer to *DTC P0401*.
- Engine vacuum level for other diagnostics.
- Barometric pressure (BARO).

If the PCM detects a voltage that is lower than the possible range of the MAP sensor, DTC P0107 will be set. A signal voltage higher than the possible range of the sensor will set DTC P0108. An intermittent low or high voltage will set DTC P1107, respectively. The PCM can detect a shifted MAP sensor. The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that varies excessively above or below the calculated value, DTC P0106 will set.



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Powertrain Control Module (PCM)

The powertrain control module (PCM) is located in the passenger compartment below the center console. The PCM controls the following:

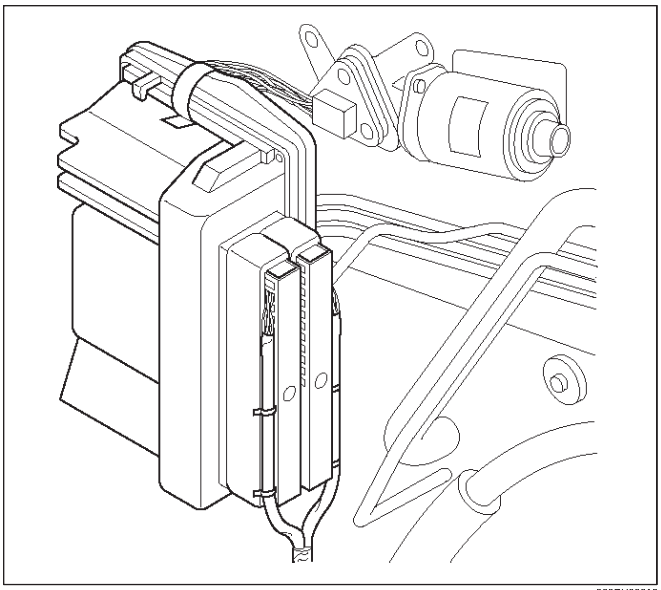
- Fuel metering system.
- Transmission shifting (automatic transmission only).
- Ignition timing.
- On-board diagnostics for powertrain functions.

The PCM constantly observes the information from various sensors. The PCM controls the systems that affect vehicle performance. The PCM performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the MIL (Check Engine lamp), and store diagnostic trouble codes (DTCs). DTCs identify the problem areas to aid the technician in making repairs.

PCM Function

The PCM supplies either 5 or 12 volts to power various sensors or switches. The power is supplied through resistances in the PCM which are so high in value that a test light will not light when connected to the circuit. In some cases, even an ordinary shop voltmeter will not give an accurate reading because its resistance is too low. Therefore, a digital voltmeter with at least 10 megohms input impedance is required to ensure accurate voltage readings. Tool J 39200 meets this requirement. The PCM controls output circuits such as the injectors, fan relays, etc., by controlling the ground or the power feed circuit through transistors or through either of the following two devices:

- Output Driver Module (ODM)
- Quad Driver Module (QDM)



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PCM Components

The PCM is designed to maintain exhaust emission levels to government mandated standards while providing excellent driveability and fuel efficiency. The PCM monitors numerous engine and vehicle functions via electronic sensors such as the throttle position (TP) sensor, heated oxygen sensor (HO2S), and vehicle speed sensor (VSS). The PCM also controls certain engine operations through the following:

- Fuel injector control
- Ignition control module
- ION sensing module
- Automatic transmission shift functions
- Cruise control
- Evaporative emission (EVAP) purge
- A/C clutch control

PCM Voltage Description

The PCM supplies a buffered voltage to various switches and sensors. It can do this because resistance in the PCM is so high in value that a test light may not illuminate when connected to the circuit. An ordinary shop voltmeter may not give an accurate reading because the voltmeter input impedance is too low. Use a 10-megohm input impedance digital voltmeter (such as J 39200) to assure accurate voltage readings.

The input/output devices in the PCM include analog-to-digital converters, signal buffers, counters, and special drivers. The PCM controls most components with electronic switches which complete a ground circuit when turned "ON." These switches are arranged in groups of 4 and 7, called either a surface-mounted quad driver module (QDM), which can independently control up to 4 output terminals, or QDMs which can independently control up to 7 outputs. Not all outputs are always used.

PCM Input/Outputs

Inputs – Operating Conditions Read

- Air Conditioning "ON" or "OFF"
- Engine Coolant Temperature
- Crankshaft Position
- Exhaust Oxygen Content
- Electronic Ignition
- Manifold Absolute Pressure
- Battery Voltage
- Throttle Position
- Vehicle Speed
- Fuel Pump Voltage
- Power Steering Pressure
- Intake Air Temperature
- Mass Air Flow
- Engine Knock
- Camshaft Position

Outputs – Systems Controlled

- EVAP Canister Purge
- Exhaust Gas Recirculation (EGR)
- Ignition Control
- Fuel Control
- ION Sensing Module
- Electric Fuel Pump
- Air Conditioning
- Diagnostics
  - Malfunction Indicator Lamp
  - Data Link Connector (DLC)
  - Data Output
- Transmission Control Module

PCM Service Precautions

The PCM is designed to withstand normal current draws associated with vehicle operation. Avoid overloading any circuit. When testing for opens and shorts, do not ground or apply voltage to any of the PCM's circuits unless instructed to do so. These circuits should only be tested using digital voltmeter J 39200. The PCM should remain connected to the PCM or to a recommended breakout box.

Reprogramming The PCM

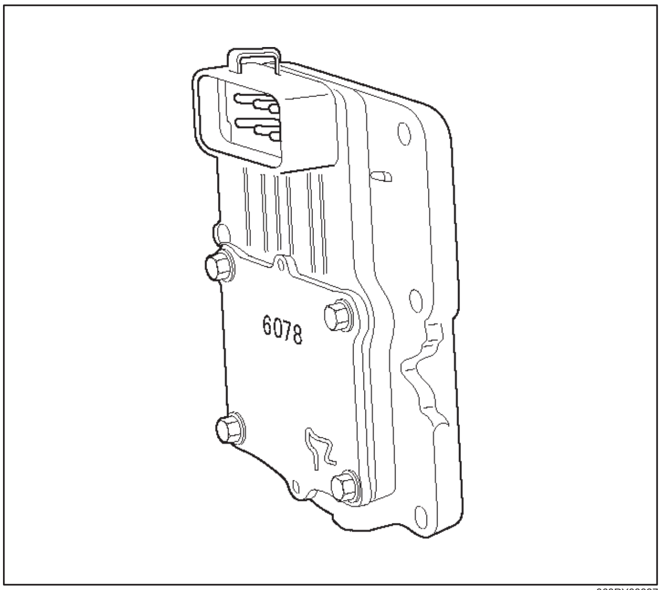
Reprogramming of the PCM is done without removing it from the vehicle . This provides a flexible and cost-effective method of making changes in software calibrations.

Refer to the latest Techline information on reprogramming or flashing procedures.

Throttle Position (TP) Sensor

The throttle position (TP) sensor is a potentiometer connected to the throttle shaft on the throttle body. The PCM monitors the voltage on the signal line and calculates throttle position. As the throttle valve angle is changed (accelerator pedal moved), the TP sensor signal also changes. At a closed throttle position, the output of the TP sensor is low. As the throttle valve opens, the output increases so that at wide open throttle (WOT), the output voltage should be above 4 volts.

The PCM calculates fuel delivery based on throttle valve angle (driver demand). A broken or loose TP sensor may cause intermittent bursts of fuel from an injector and unstable idle because the PCM thinks the throttle is moving.



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Transmission Fluid Temperature (TFT) Sensor

The transmission fluid temperature sensor is a thermistor which changes its resistance based on the temperature of the transmission fluid. For a complete description of the TFT sensor, refer to *4L30-E Automatic Transmission Diagnosis* section.

A failure in the TFT sensor or associated wiring will cause DTC P0712 or DTC P0713 to set. In this case, engine coolant temperature will be substituted for the TFT sensor value and the transmission will operate normally.

Transmission Range Switch

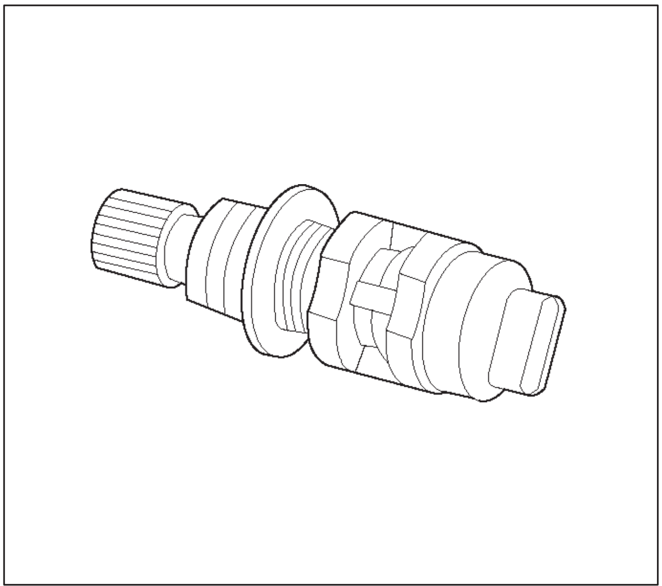
IMPORTANT: The vehicle should not be driven with the transmission range switch disconnected; idle quality will be affected.

The four inputs from the transmission range switch indicate to the PCM which position is selected by the transmission selector lever. This information is used for ignition timing, EVAP canister purge, EGR operation.

For more information on the transmission on the transmission range switch, refer to *4L30-E Automatic Transmission* section.

Vehicle Speed Sensor (VSS)

The PCM determines the speed of the vehicle by converting a plusing voltage signal from the vehicle speed sensor (VSS) into miles per hour. The PCM uses this signal to operate the cruise control, speedometer, and the TCC and shift solenoids in the transmission. For more information on the TCC and shift solenoids, refer to *4L30-E Automatic Transmission* section.



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Use of Circuit Testing Tools

Do not use a test light to diagnose the powertrain electrical systems unless specifically instructed by the diagnostic procedures. Use Connector Test Adapter Kit J 35616 whenever diagnostic procedures call for probing connectors.

Aftermarket Electrical and Vacuum Equipment

Aftermarket (add-on) electrical and vacuum equipment is defined as any equipment which connects to the vehicle's electrical or vacuum systems that is installed on a vehicle after it leaves the factory. No allowances have been made in the vehicle design for this type of equipment.

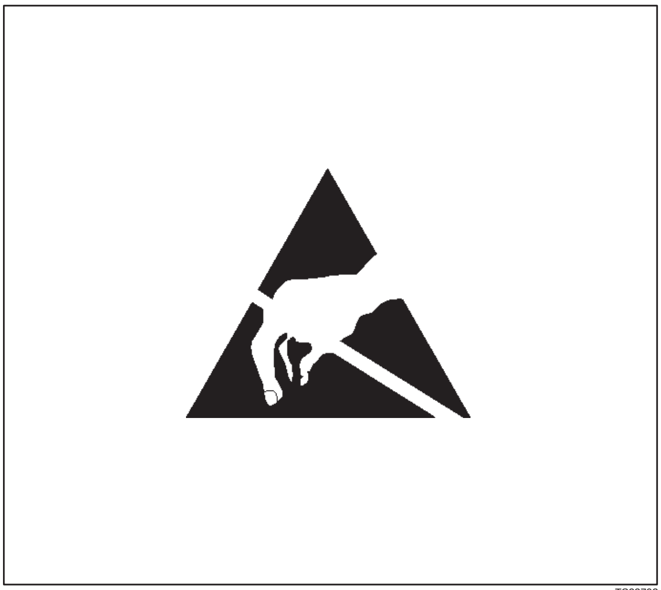
NOTE: No add-on vacuum equipment should be added to this vehicle.

NOTE: Add-on electrical equipment must only be connected to the vehicle's electrical system at the battery (power and ground).

Add-on electrical equipment, even when installed to these guidelines, may still cause the powertrain system to malfunction. This may also include equipment not connected to the vehicle electrical system such as portable telephones and radios. Therefore, the first step in diagnosing any powertrain problem is to eliminate all aftermarket electrical equipment from the vehicle. After this is done, if the problem still exists, it may be diagnosed in the normal manner.

Electrostatic Discharge Damage

Electronic components used in the PCM are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4000 volts for a person to feel even the zap of a static discharge.



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There are several ways for a person to become statically charged. The most common methods of charging are by friction and induction.

- An example of charging by friction is a person sliding across a vehicle seat.
- Charge by induction occurs when a person with well insulated shoes stands near a highly charged object and momentary touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore it is important to use care when handling and testing electronic components.

NOTE: To prevent possible electrostatic discharge damage, follow these guidelines:

- Do not touch the PCM connector pins or soldered components on the PCM circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

Upshift Lamp

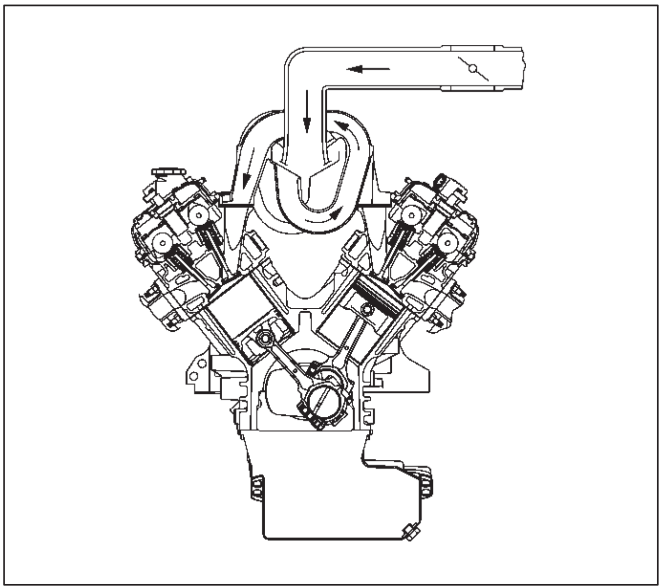
Refer to *Manual Transmission* section.

General Description (Air Induction)

Air Induction System

The air induction system filters contaminants from the outside air, and directs the progress of the air as it is drawn into the engine. A remote-mounted air cleaner prevents dirt and debris in the air from entering the engine. The air duct assembly routes filtered air to the throttle body. Air enters the engine by to following steps:

1. Through the throttle body.
2. Into the common chamber.
3. Through the cylinder head intake ports.
4. Into the cylinders.



055RV010

General Description (Fuel Metering)

Acceleration Mode

The PCM provides extra fuel when it detects a rapid increase in the throttle position and the air flow.

Battery Voltage Correction Mode

When battery voltage is low, the PCM will compensate for the weak spark by increasing the following:

- The amount of fuel delivered.
- The idle RPM.
- Ignition dwell time.

CMP Signal

The PCM uses this signal to determine the position of the number 1 piston during its power stroke, allowing the PCM to calculate true sequential multiport fuel injection (SFI). Loss of this signal will set a DTC P0341. If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection based on the last fuel injection pulse, and the engine will continue to run. The engine can be restarted and will run in the calculated sequential mode as long as the fault is present, with a 1-in-6 chance of being correct.

Clear Flood Mode

Clear a flooded engine by pushing the accelerator pedal down all the way. The PCM then de-energizes the fuel injectors. The PCM holds the fuel injectors de-energized as long as the throttle remains above 80% and the engine speed is below 800 RPM. If the throttle position becomes less than 80%, the PCM again begins to pulse the injectors "ON" and "OFF," allowing fuel into the cylinders.

Deceleration Mode

The PCM reduces the amount of fuel injected when it detects a decrease in the throttle position and the air flow. When deceleration is very fast, the PCM may cut off fuel completely for short periods.

Engine Speed/Vehicle Speed/Fuel Disable Mode

The PCM monitors engine speed. It turns off the fuel injectors when the engine speed increase above 6400 RPM. The fuel injectors are turned back on when engine speed decreases below 6150 RPM.

Fuel Cutoff Mode

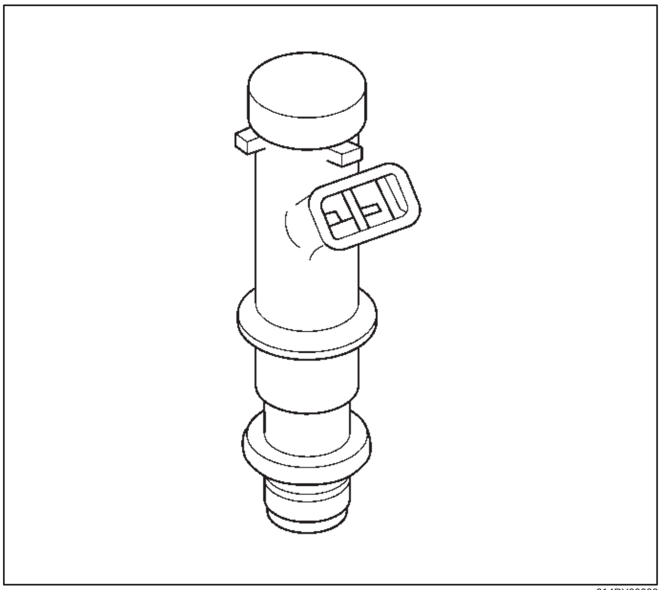
No fuel is delivered by the fuel injectors when the ignition is "OFF." This prevents engine run-on. In addition, the PCM suspends fuel delivery if no reference pulses are detected (engine not running) to prevent engine flooding.

Fuel Injector

The sequential multiport fuel injection (SFI) fuel injector is a solenoid-operated device controlled by the PCM. The PCM energizes the solenoid, which opens a valve to allow fuel delivery.

The fuel is injected under pressure in a conical spray pattern at the opening of the intake valve. Excess fuel not used by the injectors passes through the fuel pressure regulator before being returned to the fuel tank.

A fuel injector which is stuck partly open will cause a loss of fuel pressure after engine shut down, causing long crank times.



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Fuel Metering System Components

The fuel metering system is made up of the following parts:

- The fuel injectors.
- The throttle body.
- The fuel rail.

- The fuel pressure regulator.
- The PCM.
- The crankshaft position (CKP) sensor.
- The camshaft position (CMP) sensor.
- The ION sensing module.
- The fuel pump.
- The fuel pump relay.

Basic System Operation

The fuel metering system starts with the fuel in the fuel tank. An electric fuel pump, located in the fuel tank, pumps fuel to the fuel rail through an in-line fuel filter. The pump is designed to provide fuel at a pressure above the pressure needed by the injectors. A fuel pressure regulator in the fuel rail keeps fuel available to the fuel injectors at a constant pressure. A return line delivers unused fuel back to the fuel tank. Refer to *Section 6C* for further information on the fuel tank, line filter, and fuel pipes.

Fuel Metering System Purpose

The basic function of the air/fuel metering system is to control the air/fuel delivery to the engine. Fuel is delivered to the engine by individual fuel injectors mounted in the intake manifold near each intake valve.

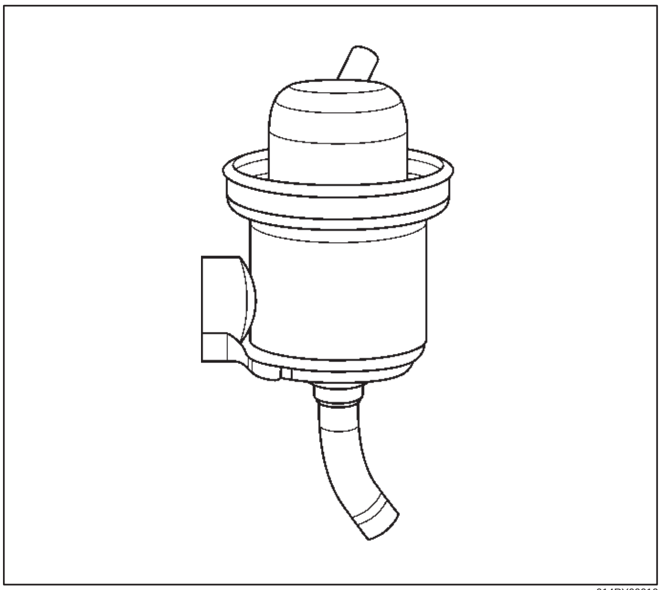
The main control sensor is the heated oxygen sensor (HO2S) located in the exhaust system. The HO2S tells the PCM how much oxygen is in the exhaust gas. The PCM changes the air/fuel ratio to the engine by controlling the amount of time that fuel injector is "ON." The best mixture to minimize exhaust emissions is 14.7 parts of air to 1 part of gasoline by weight, which allows the catalytic converter to operate most efficiently. Because of the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a "closed loop" system.

The PCM monitors signals from several sensors in order to determine the fuel needs of the engine. Fuel is delivered under one of several conditions called "modes." All modes are controlled by the PCM.

Fuel Pressure Regulator

The fuel pressure regulator is a diaphragm-operated relief valve mounted on the fuel rail with fuel pump pressure on one side and manifold pressure on the other side. The fuel pressure regulator maintains the fuel pressure available to the injector at three times barometric pressure adjusted for engine load. It may be serviced separate.

If the pressure is too low, poor performance and a DTC P0131, DTC P0151,DTC P0171 or DTC P1171 will be the result. If the pressure is too high, excessive odor and/or a DTC P0132, DTC P0152,DTC P0172 will be the result. Refer to *Fuel System Diagnosis* for information on diagnosing fuel pressure conditions.



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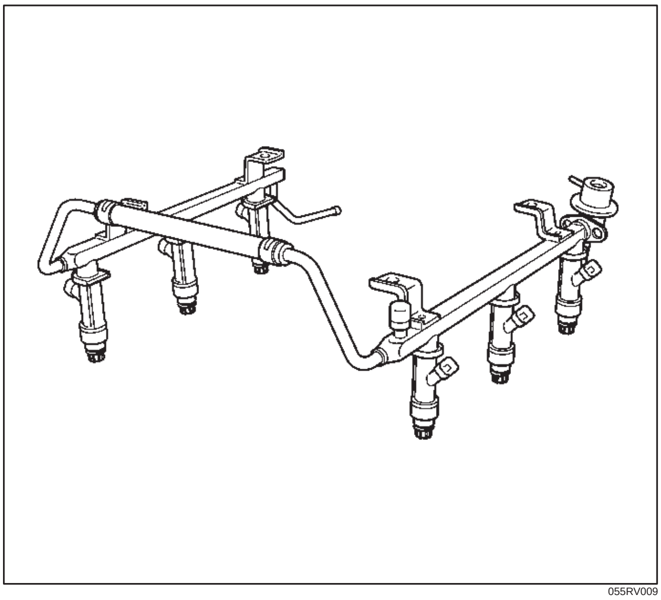
Fuel Pump Electrical Circuit

When the key is first turned "ON," the PCM energizes the fuel pump relay for two seconds to build up the fuel pressure quickly. If the engine is not started within two seconds, the PCM shuts the fuel pump off and waits until the engine is cranked. When the engine is cranked and the 58 X crankshaft position signal has been detected by the PCM, the PCM supplies 12 volts to the fuel pump relay to energize the electric in-tank fuel pump.

An inoperative fuel pump will cause a "no-start" condition. A fuel pump which does not provide enough pressure will result in poor performance.

Fuel Rail

The fuel rail is mounted to the top of the engine and distributes fuel to the individual injectors. Fuel is delivered to the fuel inlet tube of the fuel rail by the fuel lines. The fuel goes through the fuel rail to the fuel pressure regulator. The fuel pressure regulator maintains a constant fuel pressure at the injectors. Remaining fuel is then returned to the fuel tank.



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Run Mode

The run mode has the following two conditions:

- Open loop
- Closed loop

When the engine is first started the system is in “open loop” operation. In “open loop,” the PCM ignores the signal from the heated oxygen sensor (HO2S). It calculates the air/fuel ratio based on inputs from the TP, ECT, and MAF sensors.

The system remains in “open loop” until the following conditions are met:

- The HO2S has a varying voltage output showing that it is hot enough to operate properly (this depends on temperature).
- The ECT has reached a specified temperature.
- A specific amount of time has elapsed since starting the engine.
- Engine speed has been greater than a specified RPM since start-up.

The specific values for the above conditions vary with different engines and are stored in the programmable read only memory (PROM). When these conditions are met, the system enters “closed loop” operation. In “closed loop,” the PCM calculates the air/fuel ratio (injector on-time) based on the signal from the HO2S. This allows the air/fuel ratio to stay very close to 14.7:1.

Starting Mode

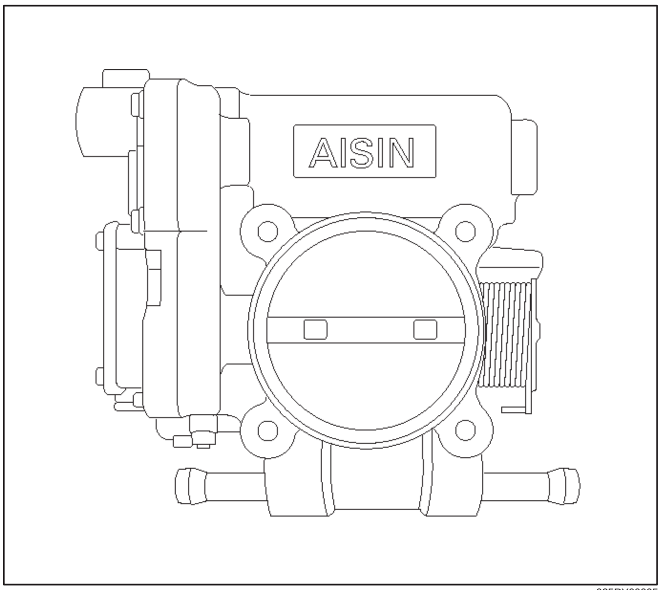
When the ignition is first turned “ON,” the PCM energizes the fuel pump relay for two seconds to allow the fuel pump to build up pressure. The PCM then checks the engine coolant temperature (ECT) sensor and the throttle position (TP) sensor to determine the proper air/fuel ratio for starting.

The PCM controls the amount of fuel delivered in the starting mode by adjusting how long the fuel injectors are energized by pulsing the injectors for very short times.

Throttle Body Unit

The throttle body has a throttle plate to control the amount of air delivered to the engine. The TP sensor are also mounted on the throttle body. Vacuum ports located behind the throttle plate provide the vacuum signals needed by various components.

Engine coolant is directed through a coolant cavity in the throttle body to warm the throttle valve and to prevent icing.



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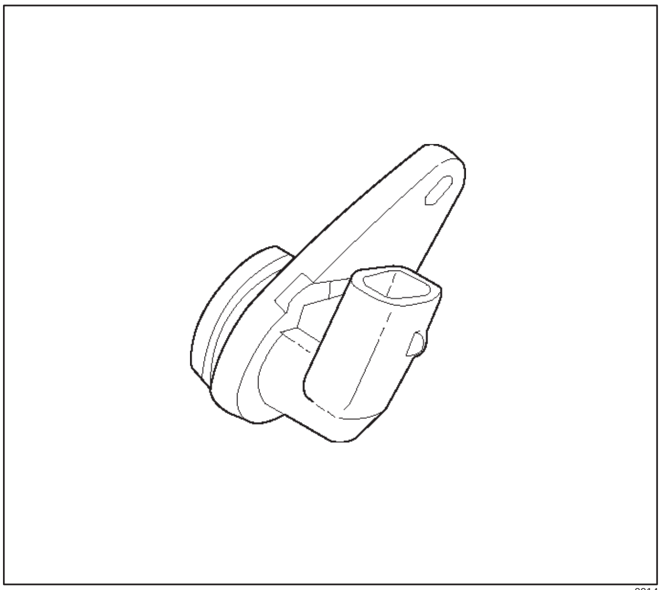
General Description (Electronic Ignition System)

Camshaft Position (CMP) Sensor

CMP is located Left Rear cylinder head. When the Hall-effect switch is activated, it grounds the signal line to the PCM, pulling the camshaft position sensor signal circuit’s applied voltage low. This is a CMP signal. The CMP signals is created as piston #1 is approximately 25° after top dead counter on the power stroke. If the correct CMP signal is not received by the PCM, DTC P0341 will be set.



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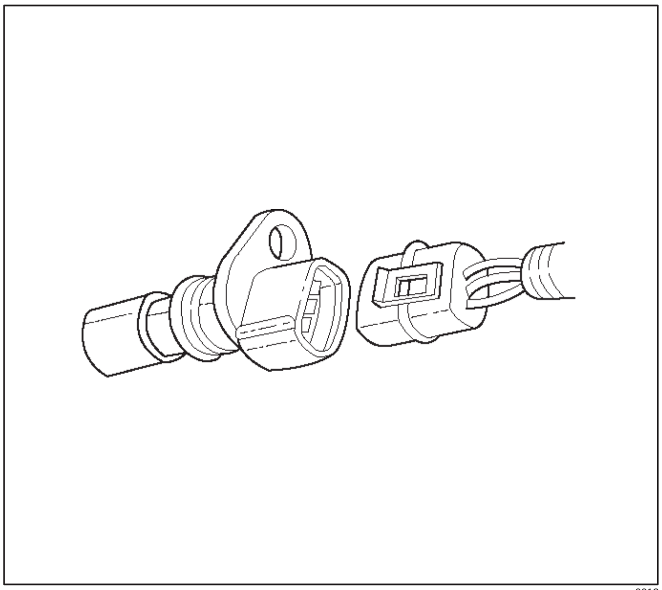
Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position. Refer to *Electronic Ignition System* section for additional information.

Electronic Ignition

The electronic ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide optimum engine performance, fuel economy, and control of exhaust emissions, the PCM controls the spark advance of the ignition system. Electronic ignition has the following advantages over a mechanical distributor system:

- No moving parts.
- Less maintenance.
- Remote mounting capability.
- No mechanical load on the engine.
- More coil cooldown time between firing events.
- Elimination of mechanical timing adjustments.
- Increased available ignition coil saturation time.



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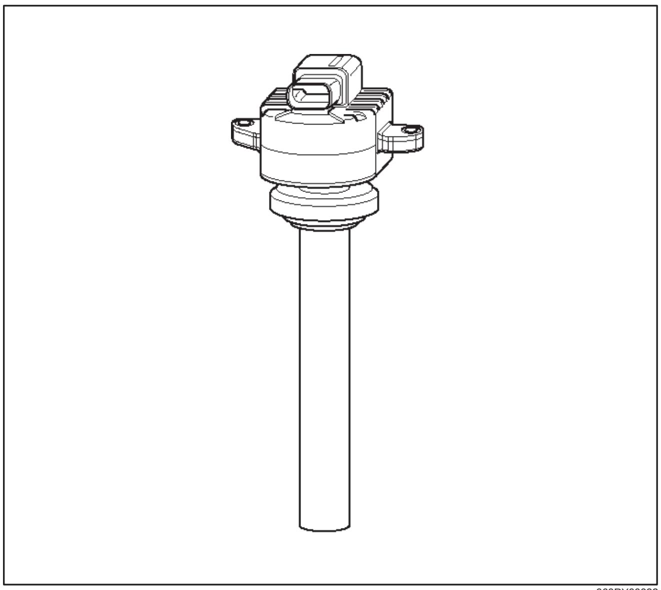
Ignition Coils

A separate coil-at-plug module is located at each spark plug. The coil-at-plug module is attached to the engine with two screws. It is installed directly to the spark plug by an electrical contact inside a rubber boot. A three-way connector provides 12-volt primary supply from the 15-amp ignition fuse, a ground-switching trigger line from the PCM, and a ground.

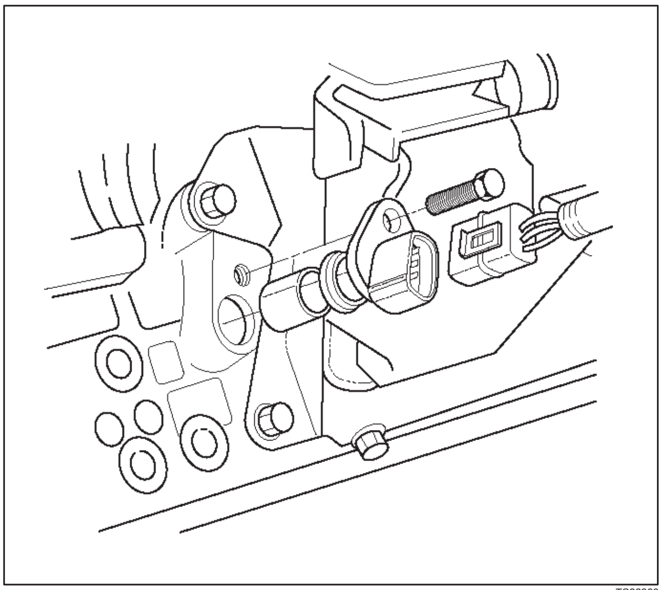


060RY00022

Ignition Control

The ignition control (IC) spark timing is the PCM's method of controlling the spark advance and the ignition dwell. The IC spark advance and the ignition dwell are calculated by the PCM using the following inputs:

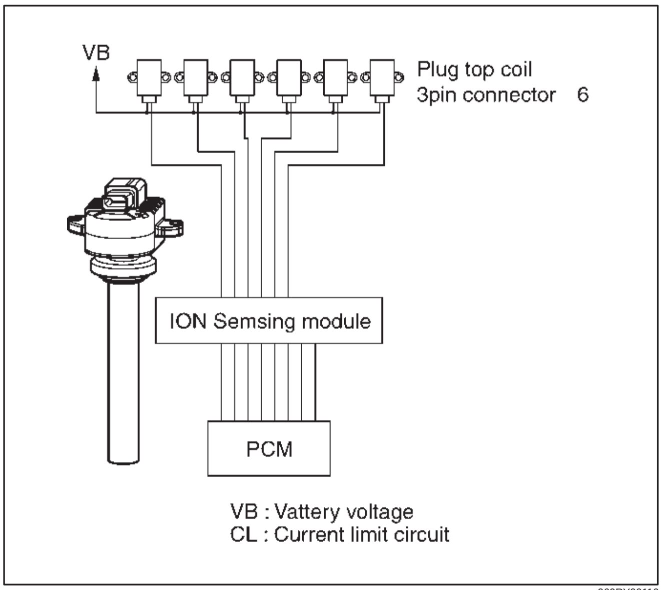
- Engine speed.
- Crankshaft position (58X reference).
- Camshaft position (CMP) sensor.
- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- ION sensing module.
- Park/Neutral position (PRNDL input).
- Vehicle speed (vehicle speed sensor).
- PCM and ignition system supply voltage.
- The crankshaft positron (CKP) sensor sends the PCM a 58X signal related to the exact position of the crankshaft.



TS22909

- The camshaft position (CMP) sensor sends a signal related to the position of the camshaft.

Based on these sensor signals and engine load information, the PCM sends 5V to each ignition coil.



060RY00116

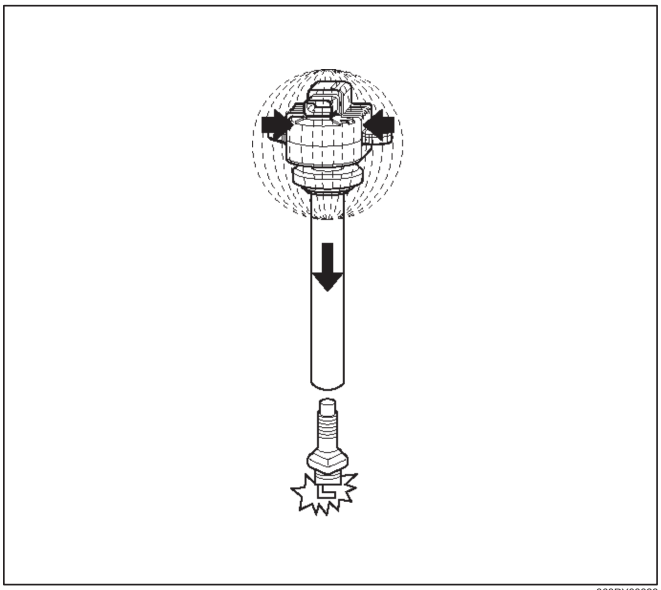
This module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The Throttle PCM controls ignition timing and dwell time.

Continuity and out-or-range value check:

This diagnosis detects open circuit or short-circuiting in the Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

Diagnosis enabling conditions are as follows:

- RPM is higher than the specified threshold.
- EST line is enabled.



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Ignition Control PCM Output

The PCM provides a zero volt (actually about 100 mV to 200 mV) or a 5-volt output signal to the ignition control (IC) module. Each spark plug has its own primary and secondary ignition coil assembly (”coil-at-plug”) located at the spark plug itself. When the ignition coil receives the 5-volt signal from the PCM, it provides a ground path for the B+ supply to the primary side of the coil-at -plug module. When the PCM shuts off the 5-volt signal to the ION sensing module, the ground path for the primary coil is broken. The magnetic field collapses and induces a high voltage secondary impulse which fires the spark plug and ignites the air/fuel mixture.

The circuit between the PCM and the ignition coil is monitored for open circuits, shorts to voltage, and shorts to ground. If the PCM detects one of these events, it will set one of the following DTCs:

- P0351: Ignition coil Fault on Cylinder #1
- P0352: Ignition coil Fault on Cylinder #2
- P0353: Ignition coil Fault on Cylinder #3
- P0354: Ignition coil Fault on Cylinder #4
- P0355: Ignition coil Fault on Cylinder #5
- P0356: Ignition coil Fault on Cylinder #6

Powertrain Control Module (PCM)

The PCM is responsible for maintaining proper spark and fuel injection timing for all driving conditions. To provide optimum driveability and emissions, the PCM monitors the input signals from the following components in order to calculate spark timing:

- Engine coolant temperature (ECT) sensor.
- Intake air temperature (IAT) sensor.
- Mass air flow (MAF) sensor.
- PRNDL input from transmission range switch.
- Throttle position (TP) sensor.
- Vehicle speed sensor (VSS) .
- Crankshaft position (CKP) sensor.

Spark Plug

Although worn or dirty spark plugs may give satisfactory operation at idling speed, they frequency fail at higher engine speeds. Faulty spark plugs may cause poor fuel economy, power loss, loss of speed, hard starting and generally poor engine performance. Follow the scheduled maintenance service recommendations to ensure satisfactory spark plug performance. Refer to *Maintenance and Lubrication* section.

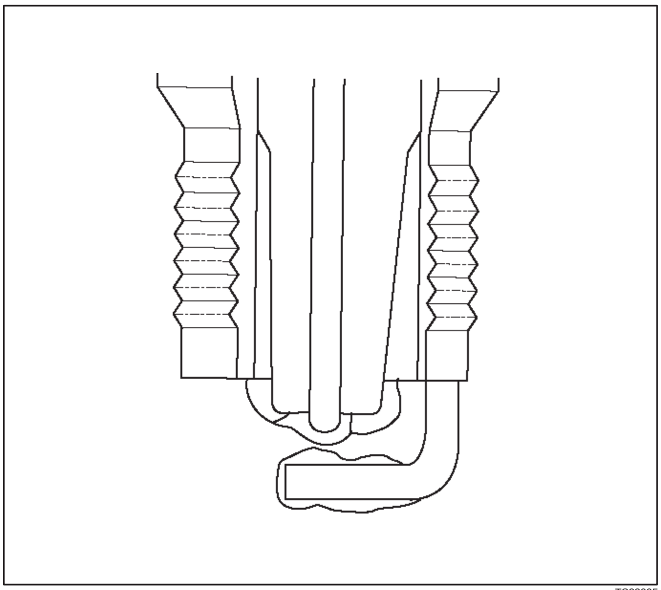
Normal spark plug operation will result in brown to grayish-tan deposits appearing on the insulator portion of the spark plug. A small amount of red-brown, yellow, and white powdery material may also be present on the insulator tip around the center electrode. These deposits are normal combustion by-products of fuels and lubricating oils with additives. Some electrode wear will also occur. Engines which are not running properly are often referred to as “misfiring.” This means the ignition spark is not igniting the air/fuel mixture at the proper time. While other ignition and fuel system causes must also be considered, possible causes include ignition system conditions which allow the spark voltage to reach ground in some other manner than by jumping across the air gap at the tip of the spark plug, leaving the air/fuel mixture unburned. Refer to *DTC P0300*. Misfiring may also occur when the tip of the spark plug becomes overheated and ignites the mixture before the spark jumps. This is referred to as “pre-ignition.”

Spark plugs may also misfire due to fouling, excessive gap, or a cracked or broken insulator. If misfiring occurs before the recommended replacement interval, locate and correct the cause.

Carbon fouling of the spark plug is indicated by dry, black carbon (soot) deposits on the portion of the spark plug in the cylinder. Excessive idling and slow speeds under light engine loads can keep the spark plug temperatures so low that these deposits are not burned off. Very rich fuel mixtures or poor ignition system output may also be the cause. Refer to DTC P0172.

Oil fouling of the spark plug is indicated by wet oily deposits on the portion of the spark plug in the cylinder, usually with little electrode wear. This may be caused by oil during break-in of new or newly overhauled engines.

Deposit fouling of the spark plug occurs when the normal red-brown, yellow or white deposits of combustion by products become sufficient to cause misfiring. In some cases, these deposits may melt and form a shiny glaze on the insulator around the center electrode. If the fouling is found in only one or two cylinders, valve stem clearances or intake valve seals may be allowing excess lubricating oil to enter the cylinder, particularly if the deposits are heavier on the side of the spark plug facing the intake valve.



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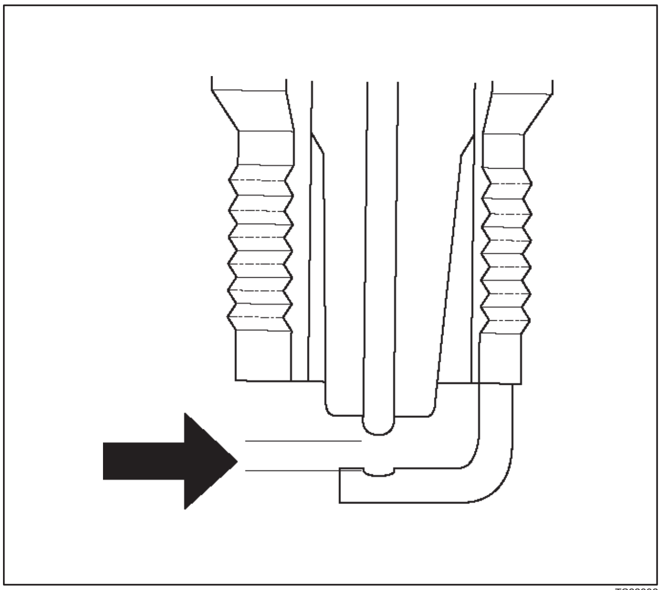
Excessive gap means that the air space between the center and the side electrodes at the bottom of the spark plug is too wide for consistent firing. This may be due to improper gap adjustment or to excessive wear of the electrode during use. A check of the gap size and comparison to the gap specified for the vehicle in *Maintenance and Lubrication* section will tell if the gap is too wide. A spark plug gap that is too small may cause an unstable idle condition. Excessive gap wear can be an indication of continuous operation at high speeds or with engine loads, causing the spark to run too hot. Another possible cause is an excessively lean fuel mixture.



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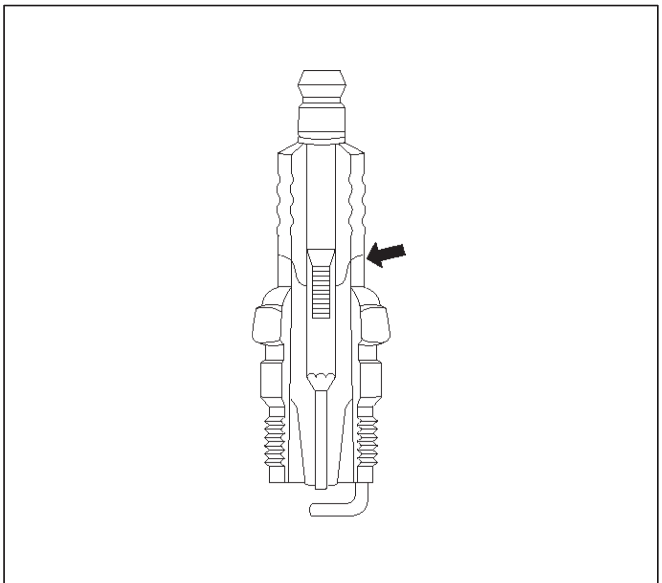
Low or high spark plug installation torque or improper seating can result in the spark plug running too hot and can cause excessive center electrode wear. The plug and the cylinder head seats must be in good contact for proper heat transfer and spark plug cooling. Dirty or damaged threads in the head or on the spark plug can keep it from seating even though the proper torque is applied. Once spark plugs are properly seated, tighten them to the torque shown in the Specifications Table. Low torque may result in poor contact of the seats due to a loose spark plug. Overtightening may cause the spark plug shell to be stretched and will result in poor contact between the seats. In extreme cases, exhaust blow-by and damage beyond simple gap wear may occur.

Cracked or broken insulators may be the result of improper installation, damage during spark plug re-gapping, or heat shock to the insulator material. Upper insulators can be broken when a poorly fitting tool is used during installation or removal, when the spark plug is hit from the outside, or is dropped on a hard surface. Cracks in the upper insulator may be inside the shell and not visible. Also, the breakage may not cause problems until oil or moisture penetrates the crack later.



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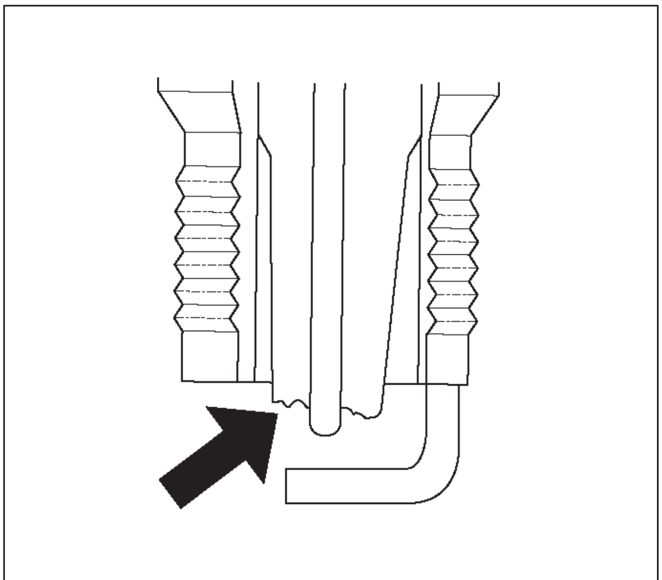
A broken or cracked lower insulator tip (around the center electrode) may result from damage during re-gapping or from “heat shock” (spark plug suddenly operating too hot).



TS23993

- Damage during re-gapping can happen if the gapping tool is pushed against the center electrode or the insulator around it, causing the insulator to crack. When re-gapping a spark plug, make the adjustment by bending only the ground side terminal, keeping the tool clear of other parts.
- ”Heat shock” breakage in the lower insulator tip generally occurs during several engine operating conditions (high speeds or heavy loading) and may be caused by over-advanced timing or low grade fuels. Heat shock refers to a rapid increase in the tip temperature that causes the insulator material to crack.

Spark plugs with less than the recommended amount of service can sometimes be cleaned and re-gapped , then returned to service. However, if there is any doubt about the serviceability of a spark plug, replace it. Spark plugs with cracked or broken insulators should always be replaced.

A/C Clutch Diagnosis

A/C Clutch Circuit Operation

A 12-volt signal is supplied to the A/C request input of the PCM when the A/C is selected through the A/C control switch.

The A/C compressor clutch relay is controlled through the PCM. This allows the PCM to modify the idle air control position prior to the A/C clutch engagement for better idle quality. If the engine operating conditions are within their specified calibrated acceptable ranges, the PCM will enable the A/C compressor relay. This is done by providing a ground path for the A/C relay coil within the PCM. When the A/C compressor relay is enabled, battery voltage is supplied to the compressor clutch coil. The PCM will enable the A/C compressor clutch whenever the engine is running and the A/C has been requested. The PCM will not enable the A/C compressor clutch if any of the following conditions are met:

- The throttle is greater than 90%.
- The engine speed is greater than 6315 RPM.
- The ECT is greater than 119°C (246°F).
- The IAT is less than 5°C (41°F).
- The throttle is more than 80% open.

A/C Clutch Circuit Purpose

The A/C compressor operation is controlled by the powertrain control module (PCM) for the following reasons:

- It improvises idle quality during compressor clutch engagement.
- It improvises wide open throttle (WOT) performance.
- It provides A/C compressor protection from operation with incorrect refrigerant pressures.

The A/C electrical system consists of the following components:

- The A/C control head.
- The A/C refrigerant pressure switches.
- The A/C compressor clutch.
- The A/C compressor clutch relay.
- The PCM.

A/C Request Signal

This signal tells the PCM when the A/C mode is selected at the A/C control head. The PCM uses this to adjust the idle speed before turning on the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.

Refer to *A/C Clutch Circuit Diagnosis* section for A/C wiring diagrams and diagnosis for A/C electrical system.

General Description (Evaporative (EVAP) Emission System)

EVAP Emission Control System Purpose

The basic evaporative emission (EVAP) control system used on all vehicles is the charcoal canister storage method. Gasoline vapors from the fuel tank flow into the canister through the inlet labeled “TANK.” These vapors are absorbed into the activated carbon (charcoal) storage device (canister) in order to hold the vapors when the vehicle is not operating. The canister is purged by PCM control when the engine coolant temperature is over 60˚C (140˚F), the IAT reading is over 10˚C (50˚F), and the engine has been running. Air is drawn into the canister through the air inlet grid. The air mixes with the vapor and the mixture is drawn into the intake manifold.

EVAP Emission Control System Operation

The EVAP canister purge is controlled by a solenoid valve that allows the manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge on). The EVAP purge solenoid control is pulse-width modulated (PWM) (turned on and off several times a second). The duty cycle (pulse width) is determined by engine operating conditions including load, throttle positron, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM. The output is commanded when the appropriate conditions have been met. These conditions are:

- The engine is fully warmed up.
- The engine has been running for a specified time.
- The IAT reading is above 10˚C (50˚F).

A continuous purge condition with no purge commanded by the PCM will set a DTC P1441.

Poor idle, stalling and poor driveability can be caused by:

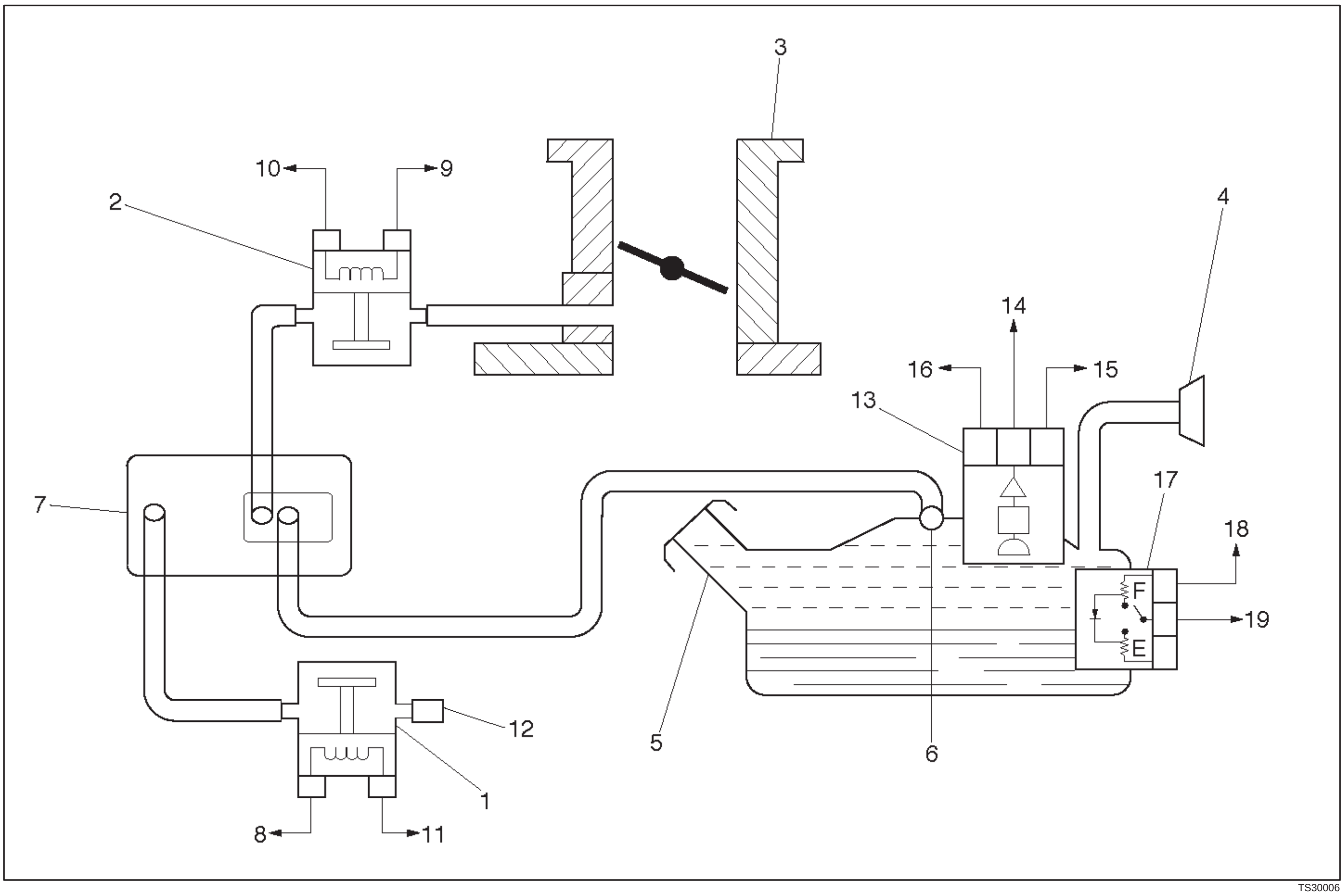
- A malfunctioning purge solenoid.
- A damaged canister.
- Hoses that are split, cracked, or not connected properly.

Enhanced Evaporative Emission Control System

The basic purpose of the Enhanced Evaporative Emissions control system is the same as other EVAP systems. A charcoal-filled canister captures and stores gasoline fumes. When the PCM determines that the time is right, it opens a purge valve which allows engine vacuum to draw the fumes into the intake manifold.

The difference between this and other systems is that the PCM monitors the vacuum and/or pressure in the system to determine if there is any leakage. If the PCM determines that the EVAP system is leaking or not functioning properly, it sets a Diagnostic Trouble Code (DTC) in the PCM memory.

The enhanced EVAP system is required to detect evaporative fuel system leaks as small as 0.040 in. (1.0 mm) between the fuel filler cap and purge solenoid. The system can test the evaporative system integrity by applying a vacuum signal (ported or manifold) to the fuel tank to create a small vacuum. The PCM then monitors the ability of the system to maintain the vacuum. If the vacuum remains for a specified period of time, there are no evaporative leaks and a PASS report is sent to the diagnostic executive. If there is a leak, the system either will not achieve a vacuum, or a vacuum cannot be maintained. Usually, a failure can only be detected after a cold start with a trip of sufficient length and driving conditions to run the needed tests. The enhanced EVAP system diagnostic will conduct up to eight specific sub-tests to detect fault conditions. If the diagnostic fails a sub-test, the PCM will store a Diagnostic Trouble Code (DTC) to indicate the type of detected.



Legend

(1) Vent Solenoid
(2) EVAP Purge Solenoid
(3) Throttle Body
(4) Fuel Filler Neck
(5) Fuel Tank
(6) Rollover Valve
(7) EVAP Canister
(8) Ignition Feed
(10) EVAP Purge Solenoid Driver Signal from PCM
(11) Vent Solenoid Driver Signal from PCM
(12) Vent Filter
(13) Fuel Tank Pressure Sensor
(14) Fuel Tank Pressure Signal to PCM
(15) 5 Volt Reference "A" Circuit from PCM
(16) Sensor Ground Circuit from PCM
(17) Fuel Level Sensor
(18) Fuel Level Signal to PCM
(19) 5 Volt Return

Electrical Components

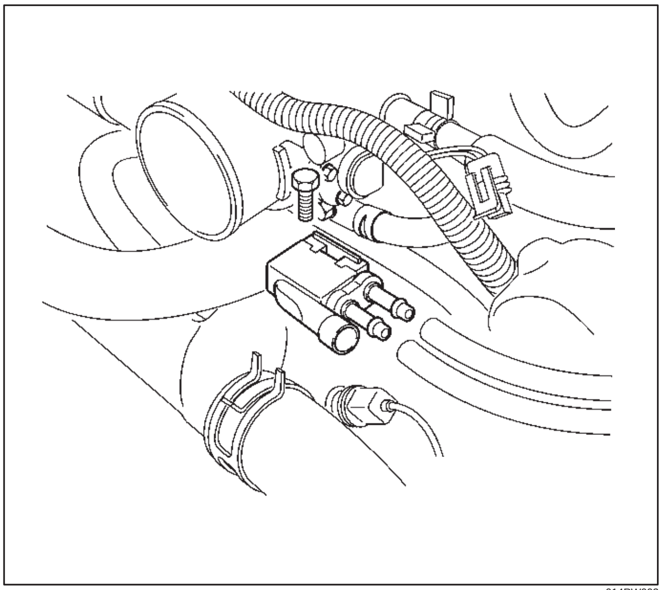
The electrical components that make up the enhanced EVAP system are:

- Fuel Tank Pressure Sensor. The fuel tank pressure sensor is a three-wire strain gauge sensor similar to a common MAP sensor. However, the fuel tank pressure sensor has very different electrical characteristics due to its pressure differential design. The sensor measures the difference between the air pressure (or vacuum) in the fuel tank and the outside air pressure.

The sensor mounts at the top of the fuel pump assembly. A three-wire electrical harness connects it to the PCM. The PCM supplies a five-volt reference voltage and a ground to the sensor. The sensor will return a voltage between 0.1 and 4.9 volts. When the air pressure in the fuel tank is equal to the outside air pressure, such as when the fuel cap is removed, the output voltage of the sensor will be 1.3 to 1.7 volts.

When the air pressure in the fuel tank is 4.5 in. H2O (1.25 kPa), the sensor output voltage will be 0.5 ± 0.2 V. When there is neither vacuum nor pressure in the fuel tank, the sensor voltage will be 1.5 V. At –14 in. H2O (–3.75 kPa), the sensor voltage will be 4.5 ± 0.2 V.

- EVAP Canister Purge Solenoid. Normally closed, the purge solenoid opens upon the PCM's signal to allow engine vacuum to purge gasoline fumes from the canister. Mounted on the water pipe to front of the engine assembly.



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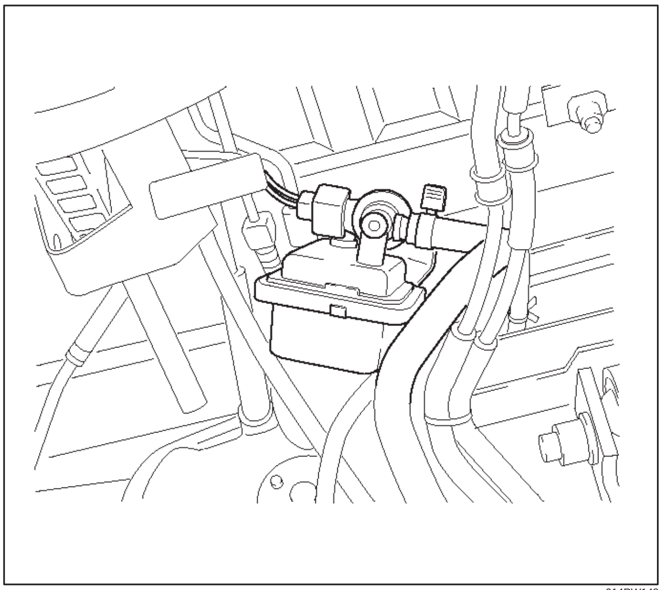
- EVAP Canister Vent Solenoid. Located next to the canister, the vent solenoid opens to allow air into the EVAP system. Fresh air is necessary to completely remove gasoline fumes from the canister during purge. The EVAP vent solenoid closes to seal off the evaporative emissions system for leak testing.



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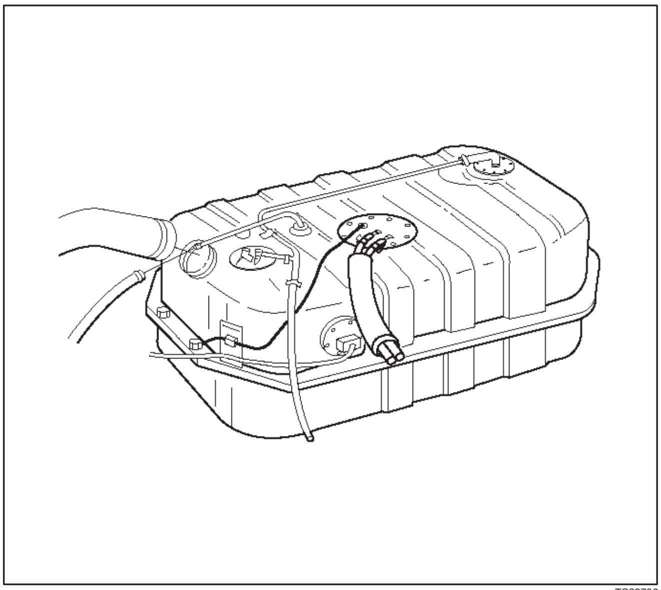
- Fuel Level Sensor. The fuel level sensor is an important input to the PCM for the enhanced EVAP system diagnostic. The PCM needs fuel level information to know the volume of fuel in the tank. The fuel level affects the rate of change of air pressure in the EVAP system. Several of the enhanced EVAP system diagnostic sub-tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is less than 15% or more than 85% full. Be sure to diagnose any Fuel Level Sensor DTCs first, as they can cause other DTCs to set.



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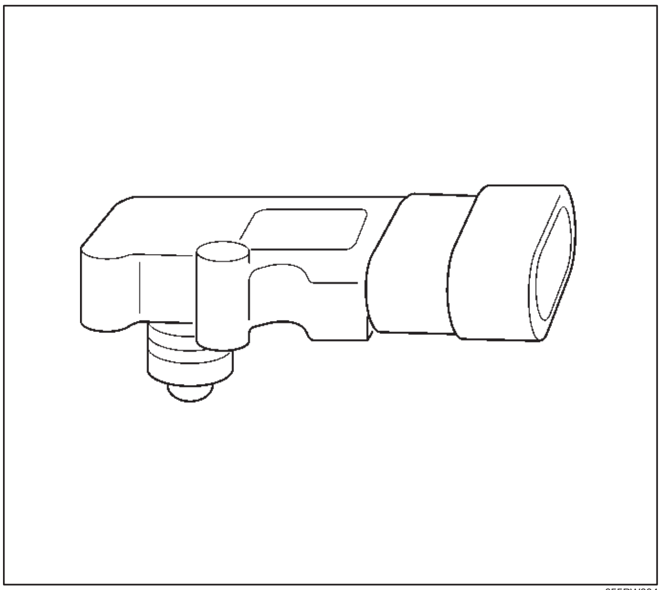
- Manifold Absolute Pressure (MAP) Sensor. The PCM compares the signals from the fuel tank pressure sensor and the MAP sensor to ensure that a relative vacuum is maintained the EVAP system.



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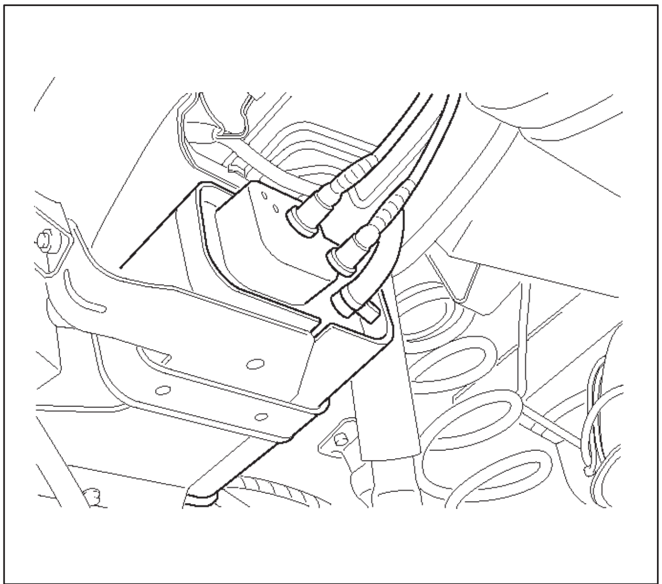
Non-Electrical Components

- Purge/Vacuum Hoses. Made of rubber compounds, these hoses route the gasoline fumes from their sources to the canister and from the canister to the intake air flow.
- EVAP Canister. Mounted on a bracket ahead of the fuel tank, the canister stores fuel vapors until the PCM determines that engine conditions are right for them to be remove and burned.
- Fuel Tank. The tank has a built-in air space designed for the collection of gasoline fumes.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- Vacuum Source. The vacuum source is split between two ports, one on either side of the throttle body.
- Fuel Cap. The fuel cap is designed to be an integral part of the EVAP system.

System Fault Detection

The EVAP leak detection strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The PCM monitors vacuum level via the fuel tank pressure sensor. At an appropriate time, the EVAP purge solenoid and the EVAP vent solenoid are turned “ON,” allowing the engine vacuum to draw a small vacuum on the entire evaporative emission system.

After the desired vacuum level has been achieved, the EVAP purge solenoid is turned “OFF,” sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant. A small leak in the system will cause DTC P0442 to be set.

If the desired vacuum level cannot be achieved in the test described above, a large leak or a faulty EVAP purge solenoid is indicated.

Leaks can be caused by the following conditions:

- Disconnected or faulty fuel tank pressure sensor
- Missing or faulty fuel cap
- Disconnected, damaged, pinched, or blocked EVAP purge line
- Disconnected or damaged EVAP vent hose
- Disconnected, damaged, pinched, or blocked fuel tank vapor line
- Disconnected or faulty EVAP purge solenoid
- Disconnected or faulty EVAP vent solenoid
- Open ignition feed circuit to the EVAP vent or purge solenoid
- Damaged EVAP canister
- Leaking fuel sender assembly O-ring
- Leaking fuel tank or fuel filler neck

A restricted or blocked EVAP vent path is detected by drawing vacuum into the EVAP system, turning “OFF” the EVAP vent solenoid and the EVAP purge solenoid (EVAP vent solenoid “OPEN,” EVAP purge Pulse Width Modulate (PWM) “0%”) and monitoring the fuel tank vacuum sensor input. With the EVAP vent solenoid open, any vacuum in the system should decrease quickly unless the vent path is blocked. A blockage like this will set DTC P0446 and can be caused by the following conditions:

- Faulty EVAP vent solenoid (stuck closed)
- Plugged, kinked or pinched vent hose
- Shorted EVAP vent solenoid driver circuit
- Plugged EVAP canister

The PCM supplies a ground to energize the purge solenoid (purge “ON”). The EVAP purge control is PWM, or turned “ON” and “OFF,” several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met.

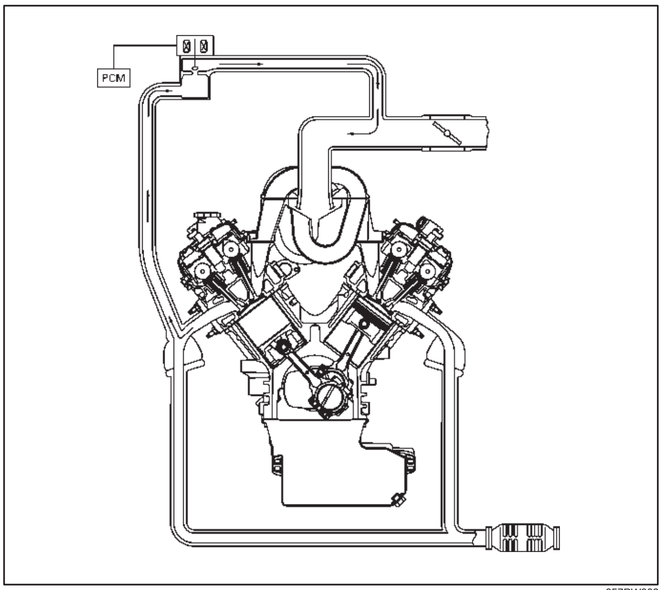
The system checks for conditions that cause the EVAP system to purge continuously by commanding the EVAP vent solenoid “ON” and the EVAP purge solenoid “OFF” (EVAP vent solenoid “CLOSED,” EVAP purge PWM “0%”). If fuel tank vacuum level increases during the test, a continuous purge flow condition is indicated, which will set a DTC P1441. This can be cause by the following conditions:

- EVAP purge solenoid leaking
- EVAP purge and engine vacuum lines switched at the EVAP purge solenoid
- EVAP purge solenoid driver circuit grounded

General Description (Exhaust Gas Recirculation (EGR) System)

EGR Purpose

The exhaust gas recirculation (EGR) system is use to reduce emission levels of oxides of nitrogen (NOx). NOx emission levels are caused by a high combustion temperature. The EGR system lowers the NOx emission levels by decreasing the combustion temperature.



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Linear EGR Valve

The main element of the system is the linear EGR valve. The EGR valve feeds small amounts of exhaust gas back into the combustion chamber. The fuel/air mixture will be diluted and combustion temperatures reduced.

Linear EGR Control

The PCM monitors the EGR actual positron and adjusts the pintle position accordingly. The uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Mass air flow (MAF) sensor.

Linear EGR Valve Operation and Results of Incorrect Operation

The linear EGR valve is designed to accurately supply EGR to the engine independent of intake manifold vacuum. The valve controls EGR flow from the exhaust to the intake manifold through an orifice with a PCM controlled pintle. During operation, the PCM controls pintle position by monitoring the pintle position feedback signal. The feedback signal can be monitored with a Tech 2 as "Actual EGR Pos." "Actual EGR Pos." should always be near the commanded EGR position ("Desired EGR Pos."). If a problem with the EGR system will not allow the PCM to control the pintle position properly, DTC P1406 will set. The PCM also tests for EGR flow. If incorrect flow is detected, DTC P0401 will set. If DTCs P0401 and/or P1406 are set, refer to the DTC charts.

The linear EGR valve is usually activated under the following conditions:

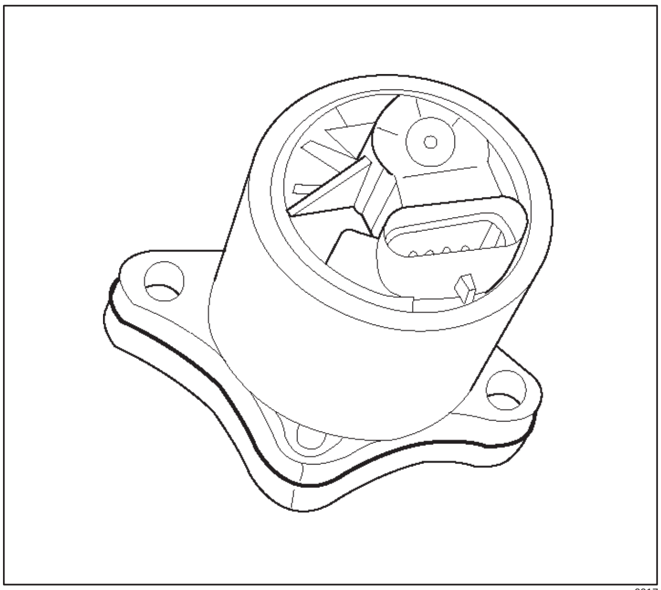
- Warm engine operation.
- Above-idle speed.

Too much EGR flow at idle, cruise or cold operation may cause any of the following conditions to occur:

- Engine stalls after a cold start.
- Engine stalls at idle after deceleration.
- Vehicle surges during cruise.
- Rough idle.
- DTC P0300 (misfire detected).

Too little or no EGR flow may allow combustion temperatures to get too high. This could cause:

- Spark knock (detonation).
- Engine overheating.
- Emission test failure.
- DTC P0401 (EGR flow test).
- Poor fuel economy.



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EGR Pintle Position Sensor

The PCM monitors the EGR valve pintle position input to endure that the valve responds properly to commands from the PCM and to detect a fault if the pintle position sensor and control circuits are open or shorted. If the PCM detects a pintle position signal voltage outside the normal range of the pintle position sensor, or a signal voltage that is not within a tolerance considered acceptable for proper EGR system operation, the PCM will set DTC P1406.

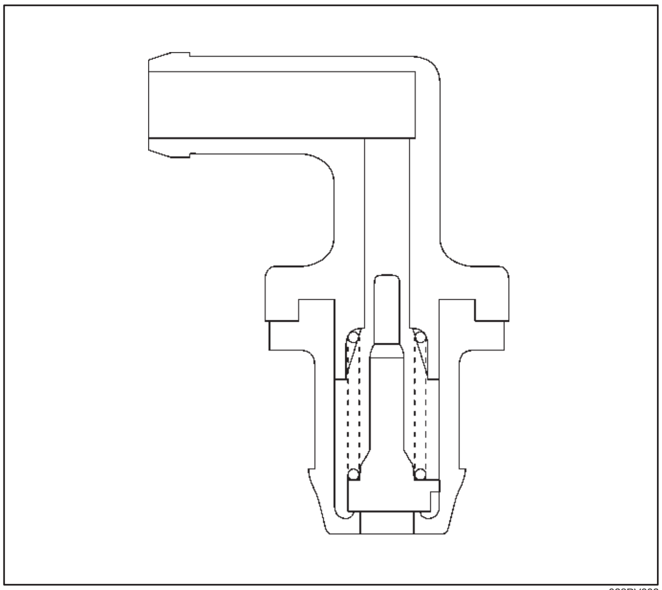
General Description (Positive Crankcase Ventilation (PCV) System)

Crankcase Ventilation System Purpose

The crankcase ventilation system is use to consume crankcase vapors in the combustion process instead of venting them to the atmosphere. Fresh air from the throttle body is supplied to the crankcase and mixed with blow-by gases. This mixture is then passed through the positive crankcase ventilation (PCV) valve into the common chamber.

Crankcase Ventilation System Operation

The primary control is through the positive crankcase ventilation (PCV) valve. The PCV valve meters the flow at a rate that depends on the intake vacuum. The PCV valve restricts the flow when the inlet vacuum is highest. In addition, the PCV valve can seal the common chamber off in case of sudden high pressure in the crankcase.



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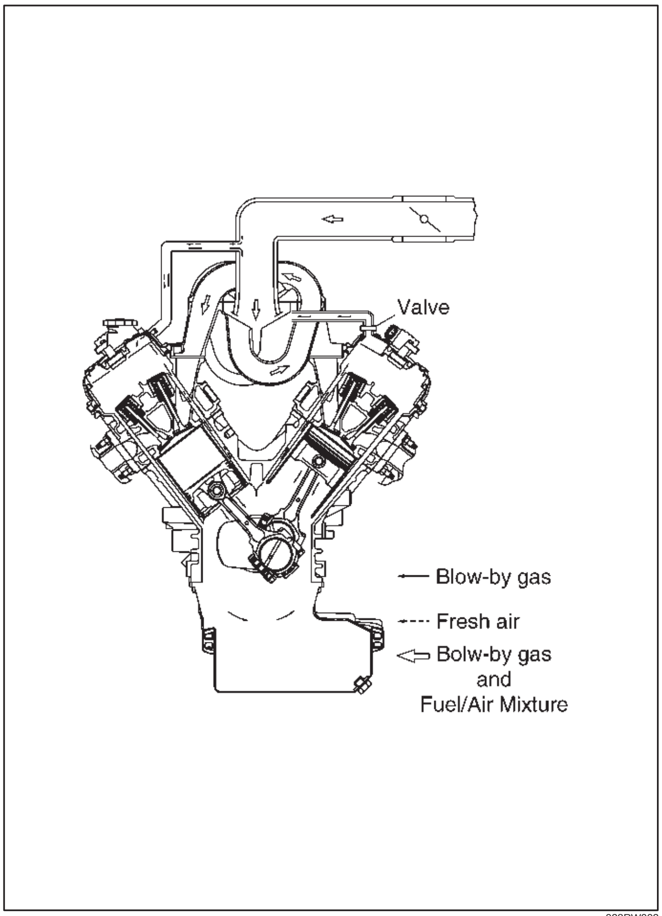
While the engine is running, exhaust fuses and small amounts of the fuel/air mixture escape past the piston rings and enter the crankcase. These gases are mixed with clean air entering through a tube from the air intake duct.



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During normal, part-throttle operation, the system is designed to allow crankcase gases to flow through the PCV valve into the throttle body to be consumed by normal combustion.

A plugged valve or PCV hose may cause the following conditions:

- Rough idle.
- Stalling of slow idle speed.
- Oil leaks.
- Sludge in the engine.

A leaking PCV hose would cause:

- Rough idle.
- Stalling.
- High idle speed.

Special Tools

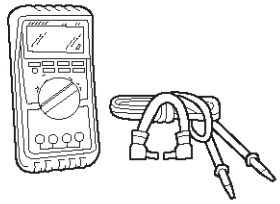
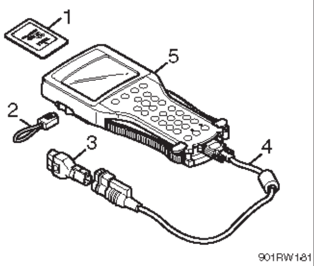
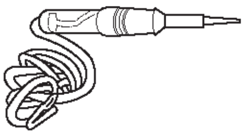
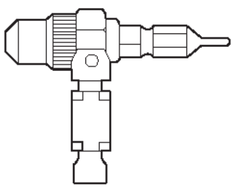
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 39200** High Impedance Multimeter (Digital Voltmeter – DVM)
	(1) PCMCIA Card (2) RS232 Loop Back Connector (3) SAE 16/19 Adapter (4) DLC Cable (5) TECH–2
	**J 34142-B** Unpowered Test Light
	Connector Test Adapter Kit J 35616-A/BT-8637
	**J 26792/BT-7220-1** Spark Tester
	**J 34730-E** Port Fuel Injection Diagnostic Kit

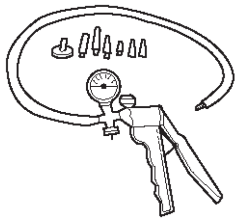
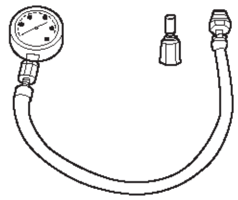
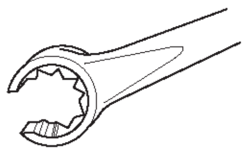
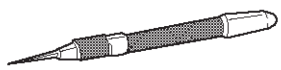
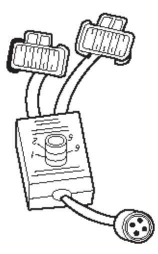
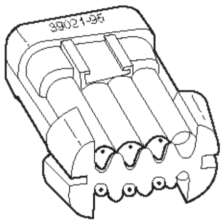
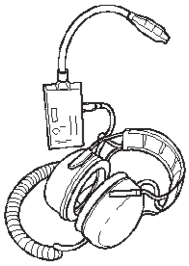
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 23738-A** Vacuum Pump with Gauge
	**BT-8515/8515V** Exhaust Back Pressure Tester
	**J 39194-B** Heated Oxygen Sensor Wrench
	**J 35689-A** Terminal Remover
	**J 28742-A** Weather Pack II Terminal Remover
	**J 39021-90** Injector Switch Box

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 39021-65** Injector Test Light
	**J 41416**[2] Ultrasonic Leak Detector

1. J 41416 Ultrasonic Leak Detector is a microprocessor-based device used to detect leaks in the enhanced evaporative emission control system. The evaporative system is pressurized to 30 inches of water using the J 41413 EVAP Pressure/Purge Diagnostic System. Small leaks in the EVAP system will emit sound at a high frequency undetectable by a human ear but detectable with the J 41416. The technician traces along the evaporative system and can pinpoint leaks due to corroded lines, cracked hoses, or a damaged EVAP component. The detector includes a high quality set of headphones to block out surrounding shop noise and the LED sensitivity meter allows a visual reference for locating leaks in conjunction with the audio output heard through the headphones. Powered by (1) nine volt battery.

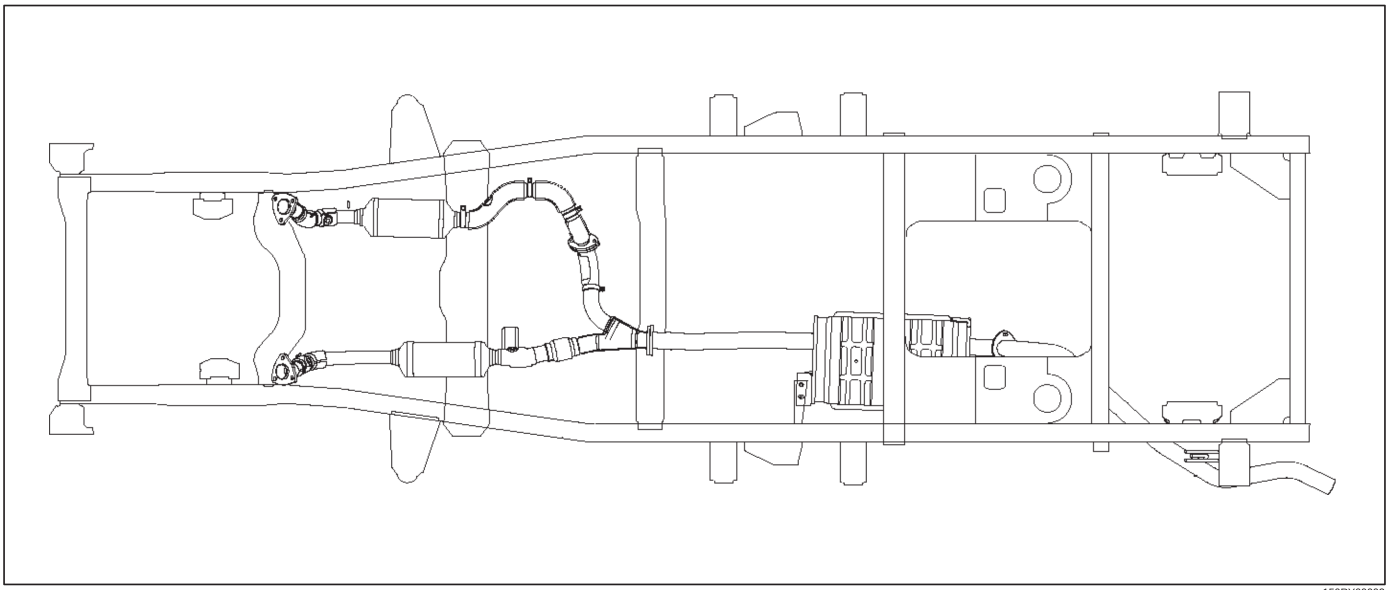
TROOPER

ENGINE

ENGINE EXHAUST

CONTENTS

General Description



150RY00002

When inspecting or replacing exhaust system components, make sure there is adequate clearance from all points on the underbody to prevent overheating the floor pan and possible damage to the passenger compartment insulation and trim materials.

Check complete exhaust system and nearby body areas and rear compartment lid for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections or other deterioration which could permit exhaust fumes to seep into the rear compartment or passenger compartment. Dust or water in the rear compartment may be an indication of a problem in one of these areas. Any faulty areas should be corrected immediately.

Hangers

Various types of hangers are used to support exhaust system(s). These include conventional rubber straps, rubber rings, and rubber blocks.

The installation of exhaust system supports is very important, as improperly installed supports can cause annoying vibrations which can be difficult to diagnose.

Three Way Catalytic Converter

The three way catalytic converter is an emission control device added to the exhaust system to reduce pollutants from the exhaust gas stream.

CAUTION: The catalytic converter requires the use of unleaded fuel only.

Periodic maintenance of the exhaust system is not required. If the vehicle is raised for other service, it is advisable to check the condition of the complete exhaust system.

A dual bed monolith catalytic converter is used in combination with three way catalytic converter.

Catalytic Types:

Three way (Reduction/Oxidation) catalyst

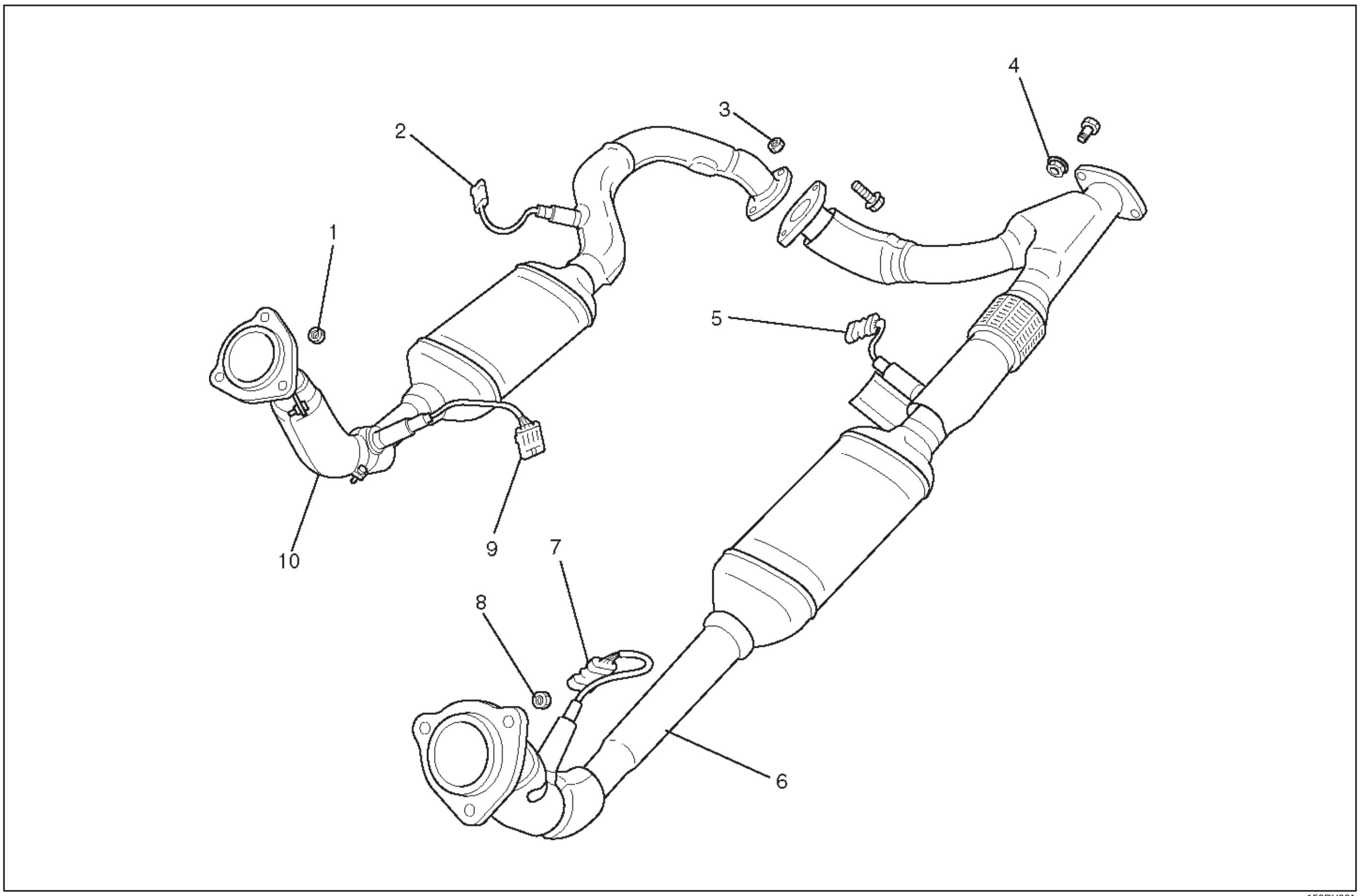
The catalyst coating on the three way (reduction) converter contains platinum and rhodium which lowers the levels of nitrous oxide (NOx) as well as hydrocarbons (HC) and carbon monoxide (Co).

Gasket

The gasket must be replaced whenever a new exhaust pipe, muffler or catalytic converter is installed.

Front Exhaust Pipe

Front Exhaust Pipe and Associated Parts



150RY001

Legend

(1) Front Exhaust Pipe RH Fixing Nuts
(2) O_2 Sensor Terminal Connector
(3) Front Exhaust Pipe RH Fixing Bolts and Nuts
(4) Front Exhaust Pipe Fixing Bolts and Nuts
(5) O_2 Sensor Terminal Connector
(6) Front Exhaust Pipe LH
(7) O_2 Sensor Terminal Connector
(8) Front Exhaust Pipe LH Fixing Nuts
(9) O_2 Sensor Terminal Connector
(10) Front Exhaust Pipe RH

Removal

1. Disconnect battery ground cable.
2. Raise the vehicle and support with suitable safety stands.
3. Disconnect O_2 sensor harness connector (2)(5)(7)(9).
4. Remove front exhaust pipe fixing nuts (3)(4).
5. Remove front exhaust pipe fixing three stud nuts from exhaust manifold (1)(8).
6. Remove front exhaust pipe (6)(10).

Installation

1. Install front exhaust pipe (10)(6) and tighten three stud nuts (1)(8) and two nuts (3)(4) to the specified torque.

   Torque

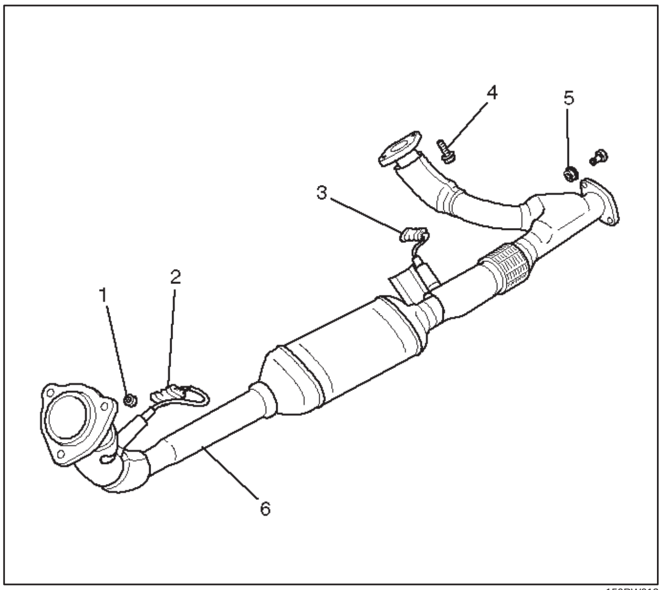
   Stud Nuts : 67 N·m (49 lb ft)

   Nuts : 43 N·m (32 lb ft)
2. Reconnect O_2 sensor harness connector (2)(5)(7)(9).

Three Way Catalytic Converter LH

Removal

1. Disconnect battery ground cable.
2. Raise the vehicle and support with suitable safety stands.
3. Disconnect front O_2 sensor harness connector and rear O_2 sensor harness connector (2)(3).
4. Remove exhaust front pipe fixing three stud nuts (1) from exhaust manifold side and two nuts (4)(5) from rear end of exhaust front pipe (6).



150RW013

Legend

(1) Front Exhaust Pipe Fixing Three Stud Nuts
(2) O_2 Sensor Harness Connector
(3) O_2 Sensor Harness Connector
(4) Front Exhaust Pipe RH Fixing Bolts and Nuts
(5) Front Exhaust Pipe Fixing Bolts and Nuts
(6) Front Exhaust Pipe LH

Installation

1. Install exhaust front pipe (6) and tighten three studs nuts (1) and two nuts (4)(5) to the specified torque.

Torque

Stud nuts : 67 N·m (49 lb ft)

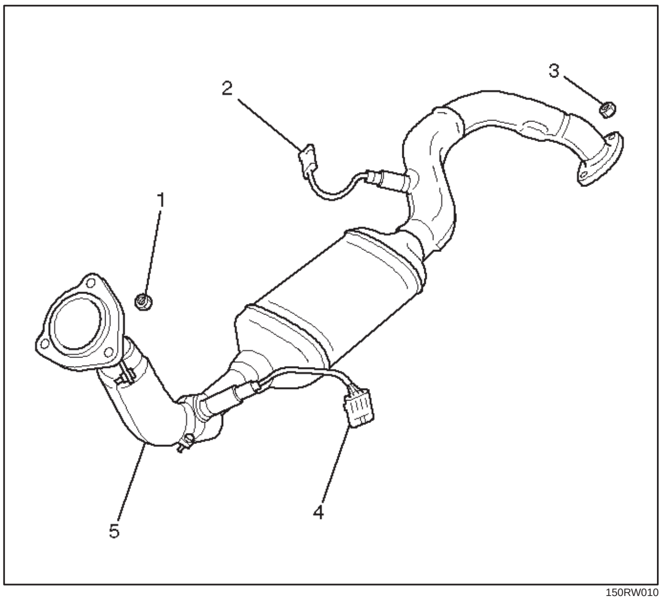
Nuts : 43 N·m (32 lb ft)

2. Reconnect O_2 sensor harness connector (2)(3).

Three Way Catalytic Converter RH

Removal

1. Disconnect battery ground cable.
2. Raise the vehicle and support with suitable safety stands.
3. Remove torsion bar. Refer to removal procedure in Front Suspension section.
4. Disconnect front O_2 sensor harness connector (4) and rear O_2 sensor harness connector (2).
5. Remove front exhaust pipe fixing nuts (3).
6. Remove three stud nuts (1) from exhaust manifold then remove the exhaust front pipe (5).



Legend

(1) Front Exhaust Pipe Fixing Three Stud Nuts
(2) O_2 Sensor Harness Connector
(3) Front Exhaust Pipe Fixing Bolts and Nuts
(4) O_2 Sensor Harness Connector
(5) Front Exhaust Pipe

Installation

1. Install front exhaust pipe (5) and tighten three stud nuts (1) and two nuts (3) to the specified torque.

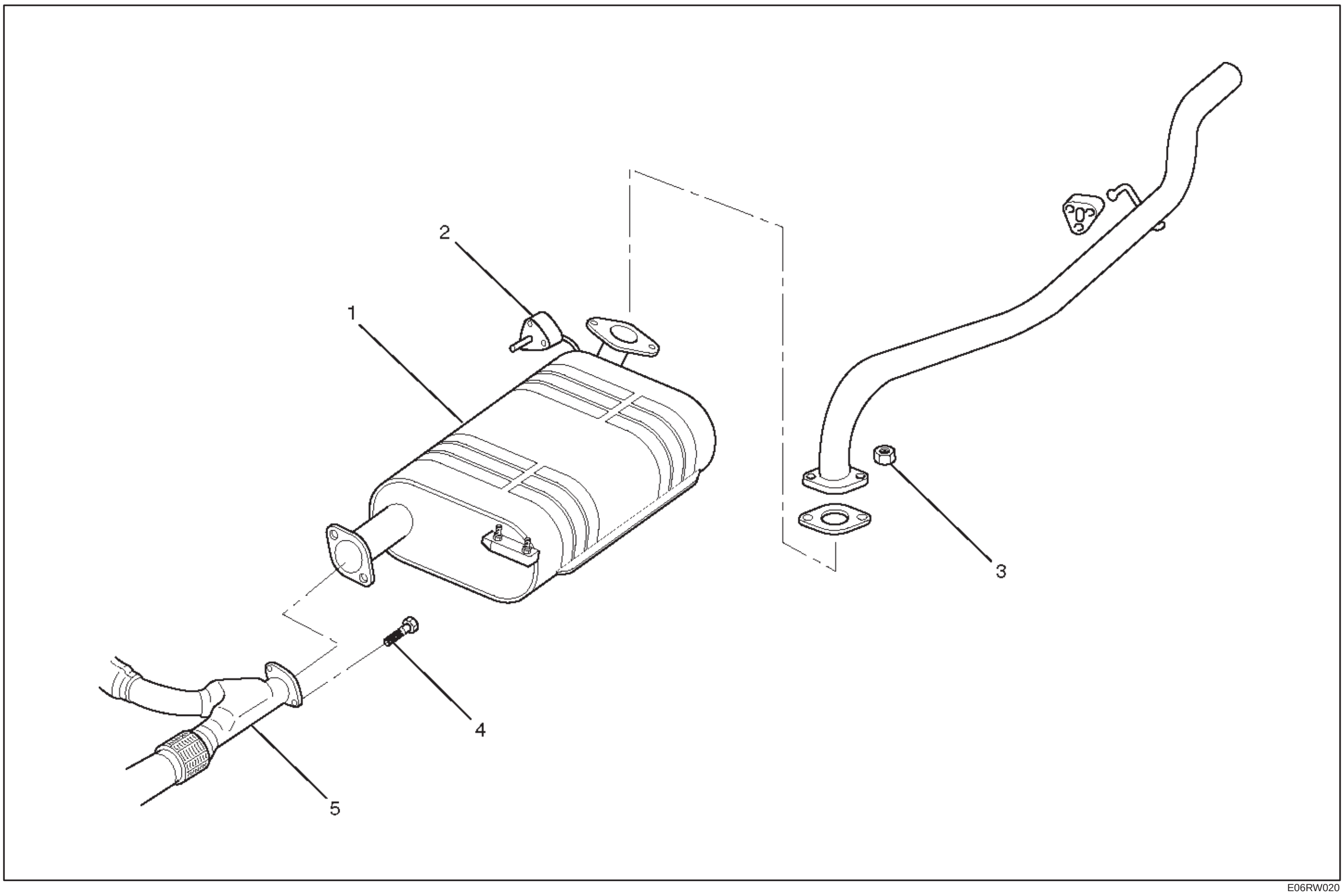
   Torque

   Stud nuts : 67 N·m (49 lb ft)

   Nuts : 43 N·m (32 lb ft)
2. Install the torsion bar and readjust the vehicle height. Refer to the installation and vehicle height adjustment instructions in the Front Suspension Section.

Exhaust Silencer

Exhaust Silencer and Associated Parts



Legend

(1) Exhaust Silencer
(2) Mounting Rubber
(3) Exhaust Silencer Fixing Nuts
(4) Exhaust Silencer Fixing Bolts
(5) Exhaust Front Pipe

Removal

1. Disconnect battery ground cable.
2. Raise the vehicle and support with suitable safety stands.
3. Remove exhaust silencer fixing nuts (3) then disconnect rear exhaust pipe from exhaust silencer.
4. Remove exhaust silencer fixing bolts (4) then disconnect exhaust silencer from front exhaust pipe (5).
5. Remove exhaust silencer mounting nuts from chassis side then remove exhaust silencer (1).

Installation

1. Install the exhaust silencer (1) chassis side and tighten four nuts to the specified torque.

   Nuts: 16 N·m (12 lb ft)

2. Install the exhaust silencer and tighten two bolts (4) on front exhaust pipe to specified torque.

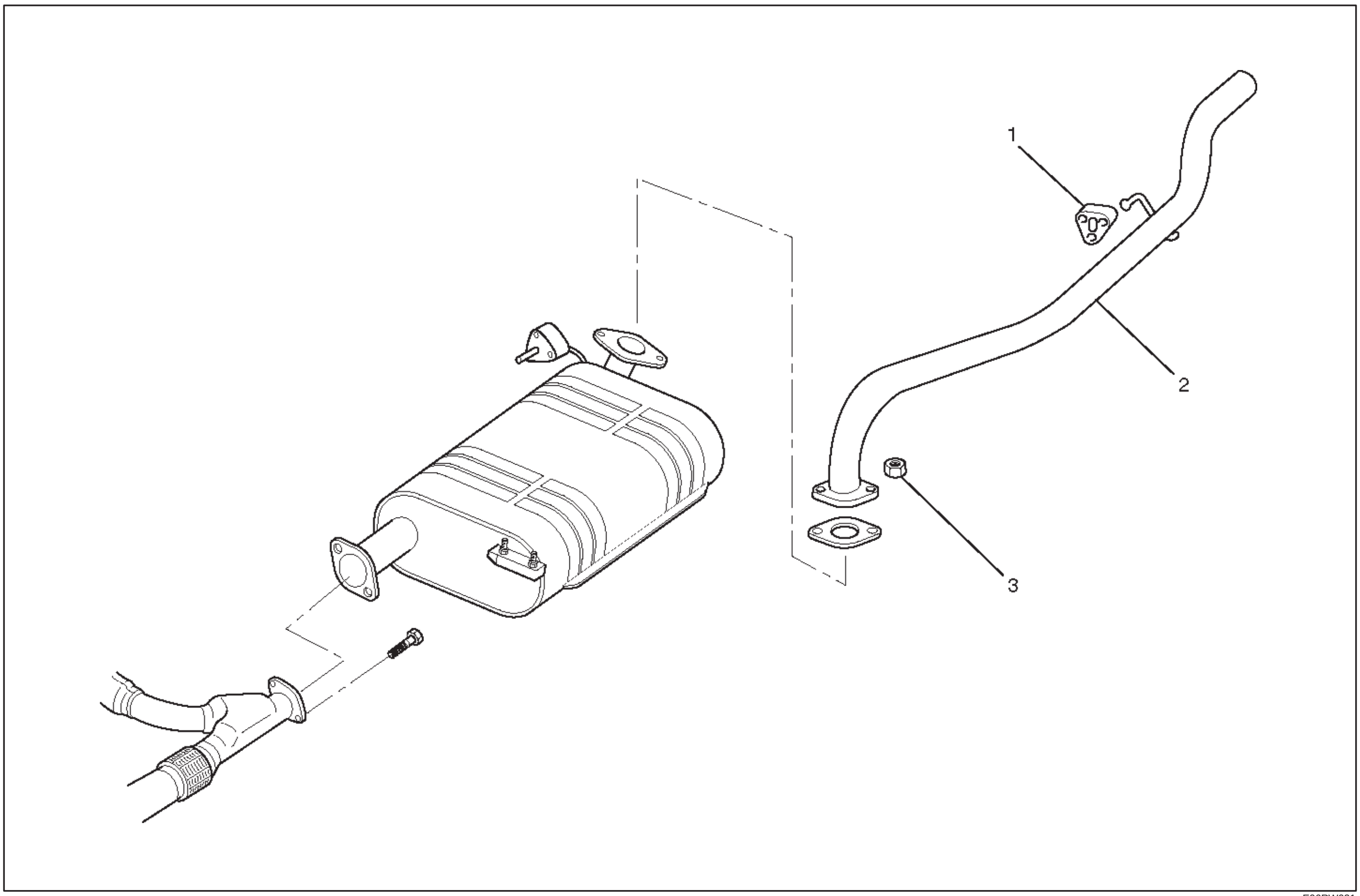
   Bolts: 43 N·m (32 lb ft)

3. Install the rear exhaust pipe and tighten on exhaust silencer to specified torque.

   Nuts: 43 N·m (32 lb ft)

Rear Exhaust pipe

Rear Exhaust pipe and Associated Parts



Legend
(1) Mounting Rubber
(2) Rear Exhaust Pipe
(3) Rear Exhaust Pipe Fixing Nuts

Removal

1. Disconnect battery ground cable.
2. Raise the vehicle and support with suitable safety stands.
3. Remove rear exhaust pipe fixing nuts (3), then disconnect rear exhaust pipe from exhaust silencer.
4. Remove mounting rubber (1).
5. Remove rear exhaust pipe (2).

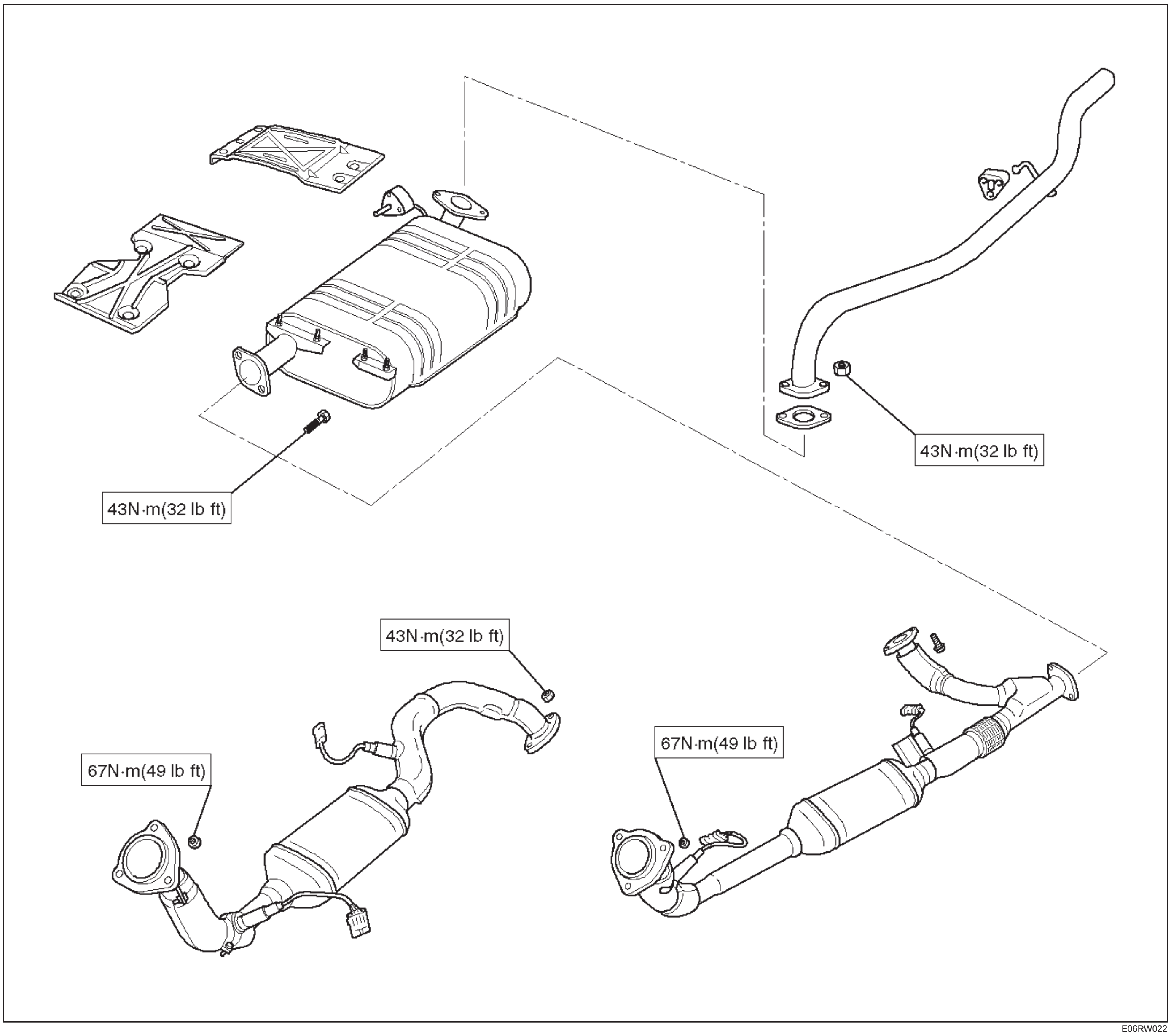
Installation

1. Install the mounting rubber (1).
2. Install the exhaust pipe (2) and tighten two nuts (3) on exhaust silencer to specified torque.

Nuts: 43 N·m (32 lb ft)

Main Data and Specifications

Torque Specifications



TROOPER

ENGINE

ENGINE LUBRICATION

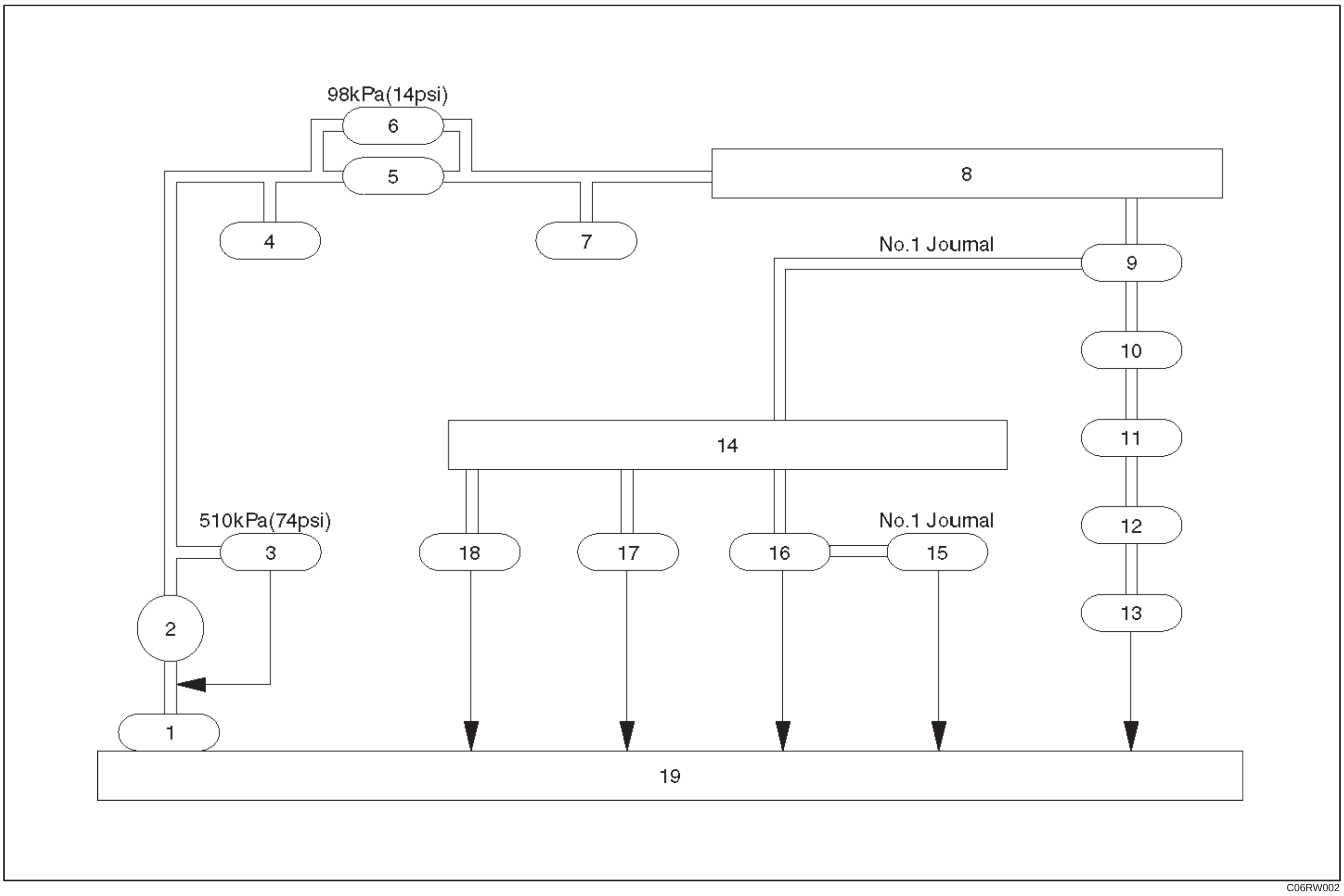
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

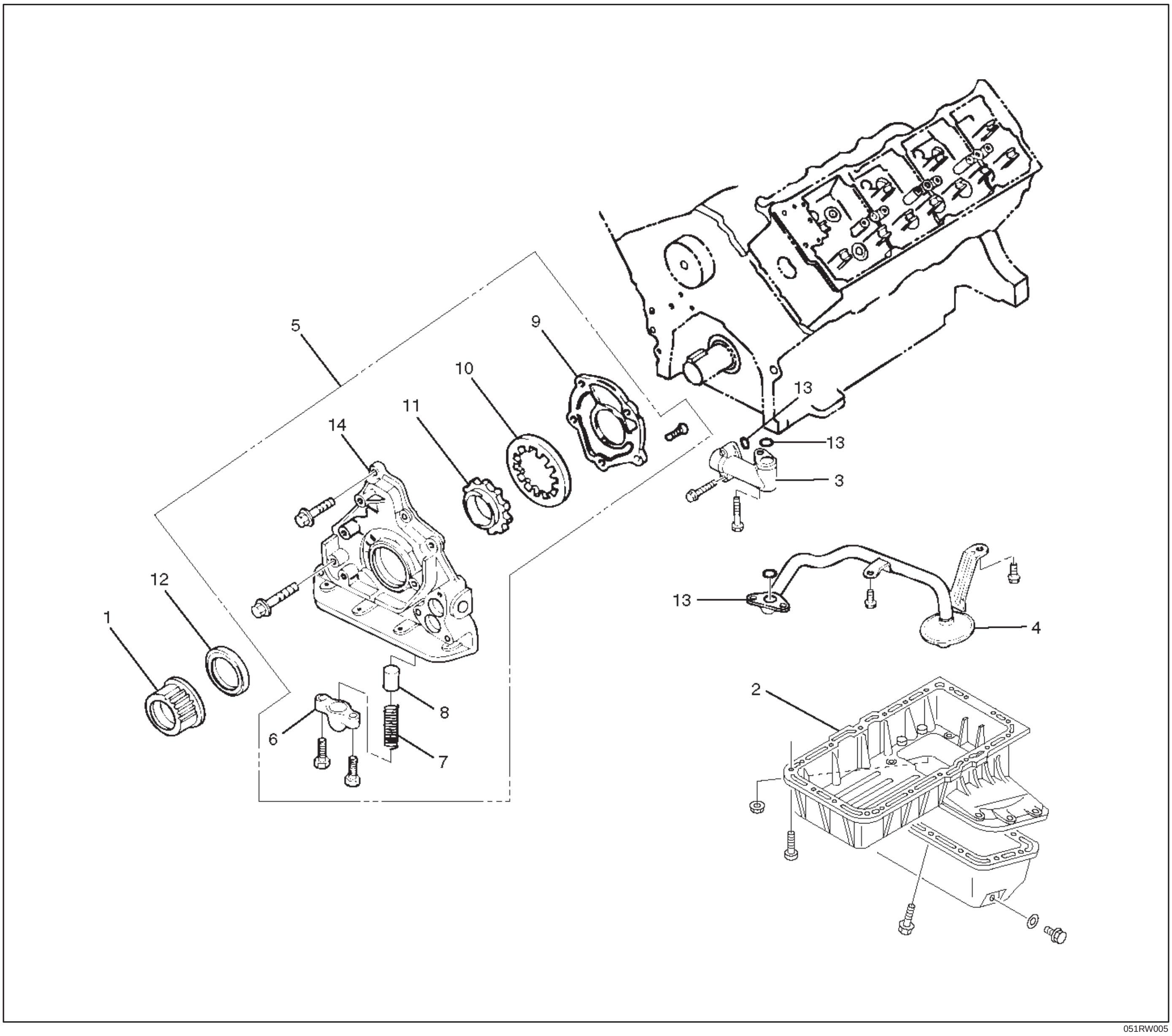


Legend

(1) Oil Strainer
(2) Oil Pump
(3) Relief Valve
(4) Oil Pressure Switch
(5) Oil Filter
(6) Safety Valve
(7) Oil Pressure Unit
(8) Oil Gallery
(9) Crankshaft Bearing
(10) Crankshaft
(11) Connecting Rod Bearing
(12) Connecting Rod
(13) Piston
(14) Oil Gallery; Cylinder Head
(15) Camshaft
(16) Camshaft Journal
(17) Front Journal; Camshaft Drive Gear
(18) Rear Journal; Camshaft Drive Gear
(19) Oil Pan

Oil Pump

Oil Pump and Associated Parts



Legend

(1) Crankshaft Timing Pulley
(2) Crankcase with Oil Pan
(3) Oil Pipe
(4) Oil Strainer
(5) Oil Pump Assembly
(6) Plug
(7) Spring
(8) Relief Valve
(9) Oil Pump Cover
(10) Driven Gear
(11) Drive Gear
(12) Oil Seal
(13) O-ring
(14) Oil Pump Body

Disassembly

1. Remove crankshaft timing pulley.
2. Remove crankcase with oil pan.
3. Remove oil pipe.
4. Remove oil strainer.
5. Remove oil pump assembly.
6. Remove plug.
7. Remove spring.
8. Remove relief valve.
9. Remove oil pump cover.
10. Remove driven gear.

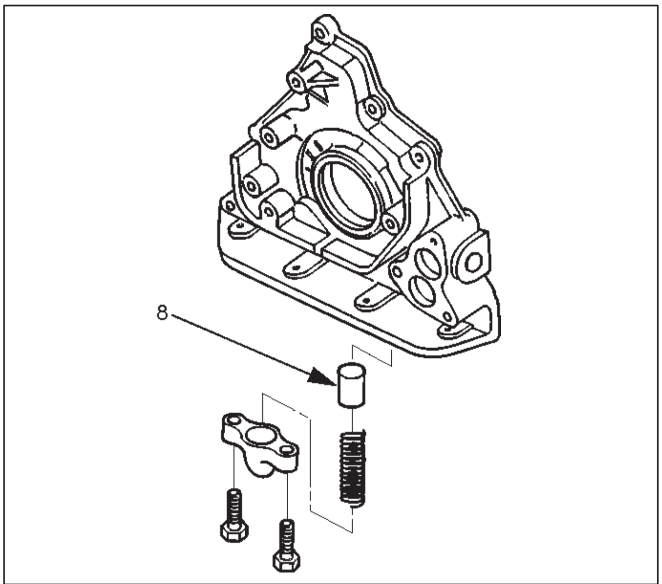
11. Remove drive gear.
12. Remove oil seal.
13. Remove O-ring.

Inspection and Repair

CAUTION: Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found during inspection.

Relief Valve (8)

- Check to see that the relief valve slides freely.
- The oil pump must be replaced if the relief valve does not slide freely.
- Replace the spring and/or the oil pump assembly (5) if the spring is damaged or badly worn.



051RS002

Body (14) and Gears (10, 11)

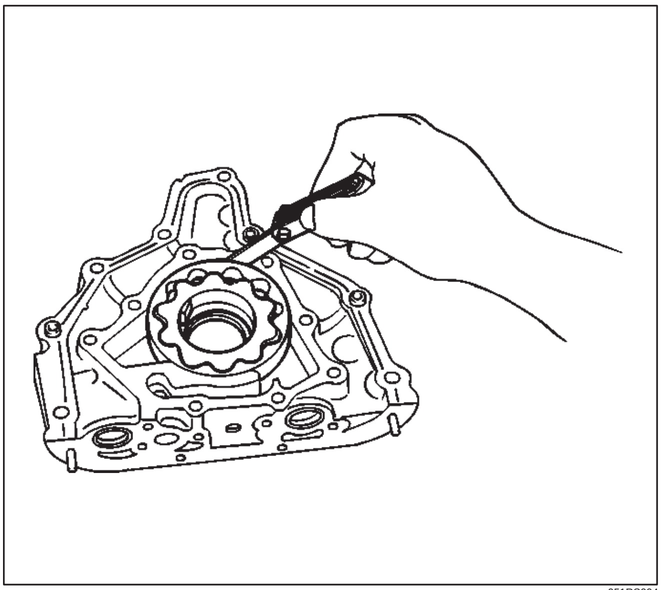
The pump assembly must be replaced if one or more of the conditions below is discovered during inspection.

- Badly worn or damaged driven gear (10).
- Badly worn drive gear (11) driving face.
- Badly scratched or scored body sliding face (14) or driven gear (10).
- Badly worn or damaged gear teeth.

Measure the clearance between the body and the driven gear with a feeler gauge.

Standard : 0.10 mm–0.18 mm (0.0039 in.–0.0070 in)

Limit : 0.20mm (0.0079 in)

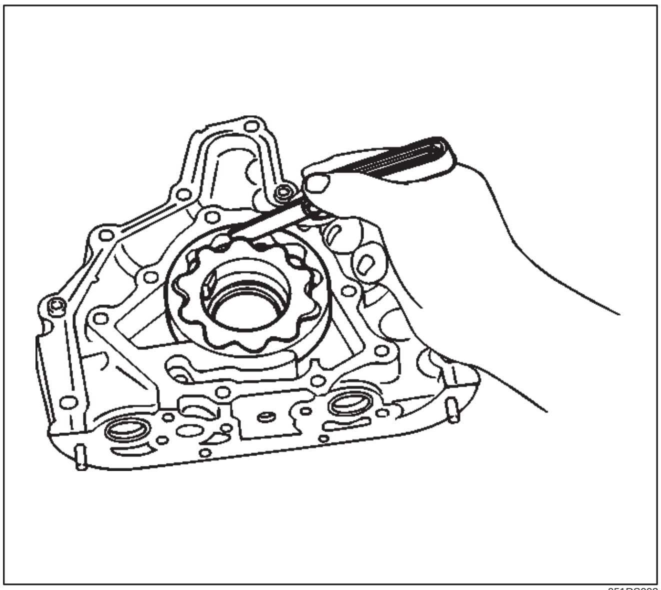


051RS004

- Measure the clearance between the drive gear and driven gear with a feeler gauge.

Standard : 0.11 mm–0.24 mm (0.0043 in–0.0094 in)

Limit : 0.35mm (0.0138 in)



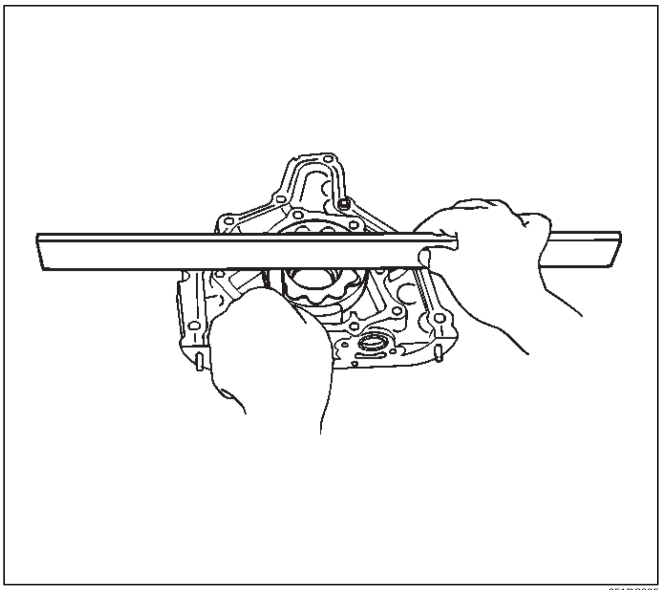
051RS003

- Measure the side clearance with a precision straight edge and a feeler gauge.

Clearance

Standard : 0.03 mm–0.09 mm (0.0011 in–0.0035 in)

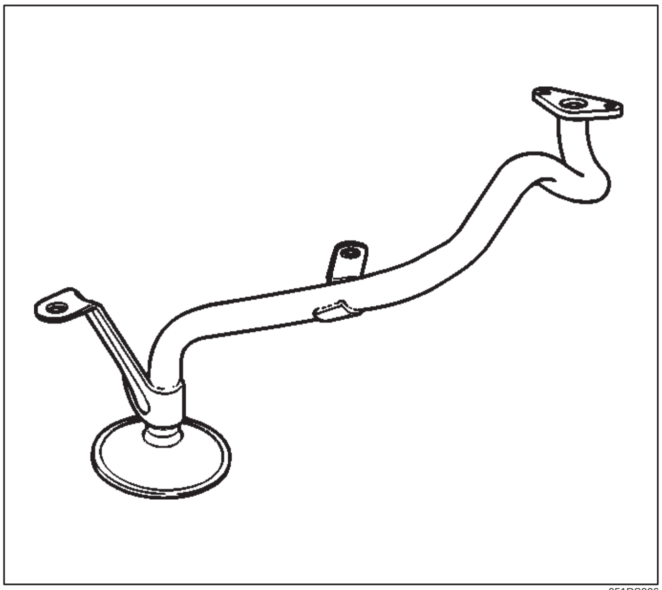
Limit : 0.15mm (0.0059 in)



051RS005

Oil Strainer

Check the oil strainer for cracking and scoring. If cracking and scoring are found, the oil strainer must be replaced.



051RS006

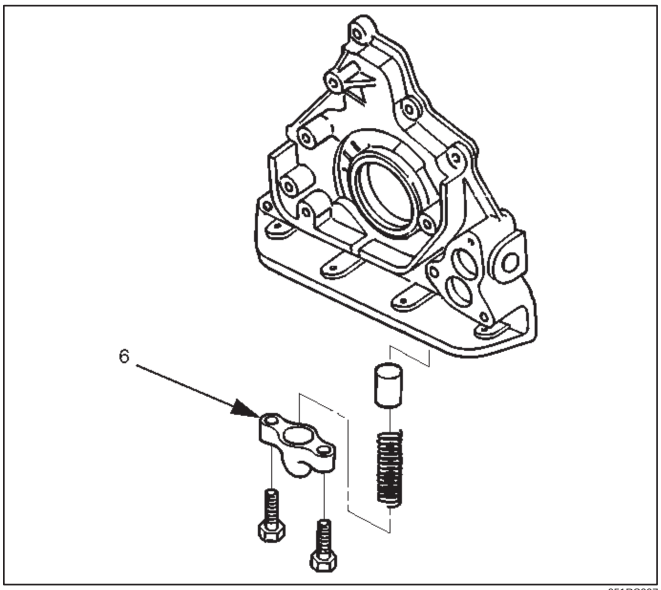
Reassembly

1. Install drive gear (11).
2. Install driven gear (10).
3. Install oil pump cover (9) and first, loosely tighten all of the attaching screws. Next, tighten the attaching screws to the specified torque.

   Torque : 10 N·m (89 lb in)

   After installation, check that the gear rotates smoothly.
4. Install relief valve (8) and apply engine oil to the relief valve and spring (7).
5. Install spring (7).
6. Install the plug (6).

   Torque : 8 N·m (69 lb in)



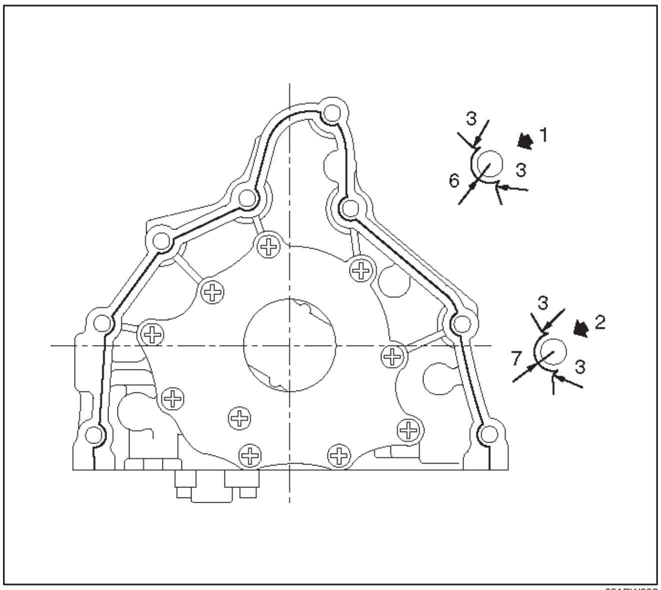
051RS007

7. Install oil pump assembly (5).
   - Carefully remove any oil from the cylinder body and the pump. Apply sealant (TB–1207B or equivalent) to the pump fitting face as shown in illustration. Take care that sealant is not applied to oil port surfaces. The oil pump assembly must be installed within 5 minutes after sealant application before the sealant hardens.

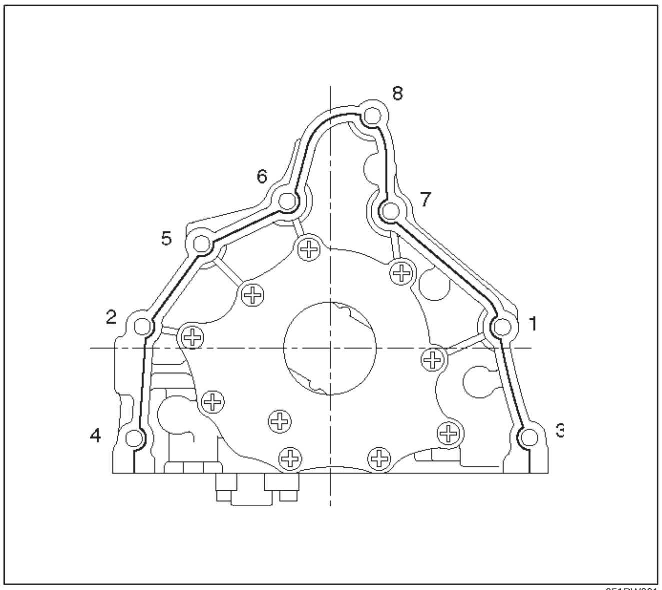
CAUTION: Do not apply an excessive amount of sealant to the contact surface. Applying too much sealant will overflow the contact surfaces. This could cause serious damage to the engine.

- **Attach oil pump assembly to cylinder body.**
- **Tighten the oil pump fixing bolts.**

  Torque : 25 N·m (18 lb·ft)



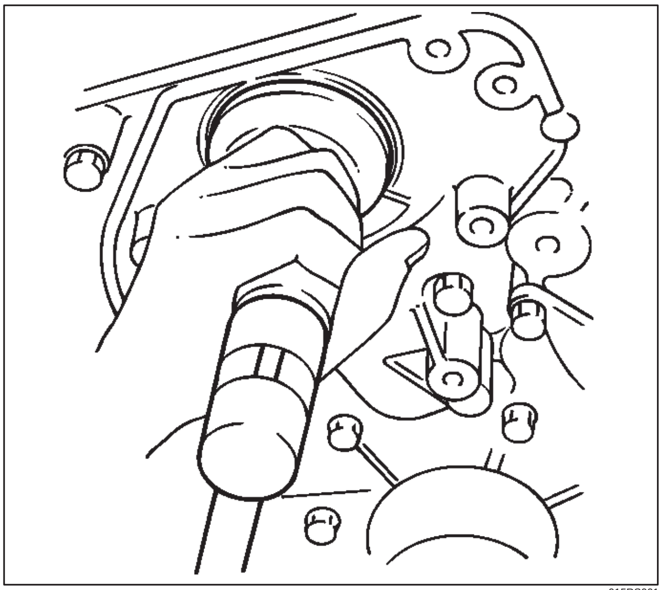
051RW002



051RW001

Legend
(1) Around Bolt Holes
(2) Around Dowel Pin

8. Install the new oil seal (12). Apply engine oil to the oil seal lip before installation then use J–39202 oil seal Installer, install oil seal.


015RS001

9. Install oil strainer (4) with O-ring (13).

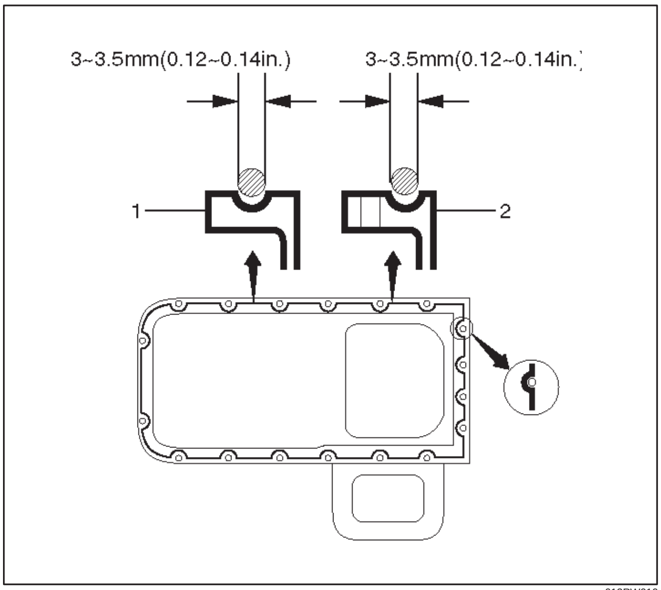
Torque: 25 N·m (18 lb ft)

10. Install oil pipe (3) with O-ring (13).

Torque: 25 N·m (18 lb ft)

11. Install crankcase with oil pan (2).
    - Remove oil on crankcase mounting surface and dry the surface.
    - Apply a proper 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the crankcase mounting surface. The bead must be continuous.
    - The crankcase must be installed within 5 minutes after sealant application before the sealant hardens.
    - Tighten fixing bolts to the specified torque.

Torque : 10 N·m (89 lb in)



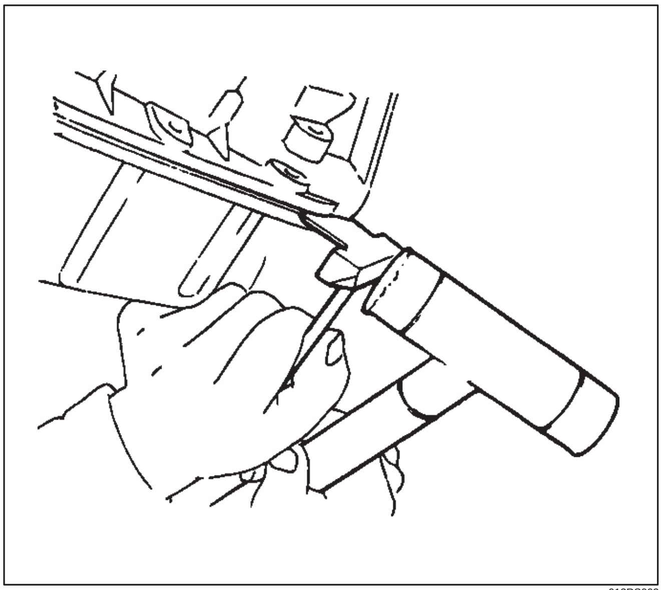
013RW010

12. Install crankshaft timing pulley.

Oil Pan and Crankcase

Removal

1. Disconnect battery ground cable.
2. Lift vehicle by supporting the frame.
3. Remove under cover.
4. Drain engine oil.
5. Remove front wheels.
6. Remove oil level dipstick from level gauge tube.
7. Remove radiator under fan shroud.
8. Remove suspension cross member fixing bolts, 2 pcs each per side and remove suspension cross member.
9. Remove pitman arm and relay lever assembly, using the J-29107 remover, remove pitman arm from the steering unit and remove four fixing bolts for relay lever assembly.
10. Remove axle housing assembly four fixing bolts from housing isolator side and mounting bolts from wheel side. At this time support the axle with a garage jack and remove axle housing assembly. (For 4×4)
11. Remove starter fixing bolts.
12. Remove oil pan fixing bolts.
13. Remove oil pan, using J-37228 sealer cutter, remove oil pan.

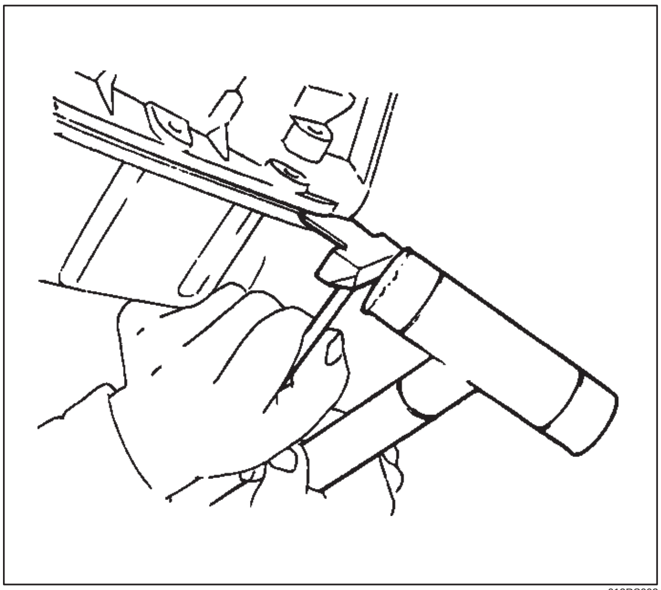


013RS003

14. Remove crankcase fixing bolts.
15. Remove crankcase, using J-37228 sealer cutter, remove crankcase.

NOTE: Do not deform or damage the flange of oil pan and crankcase.

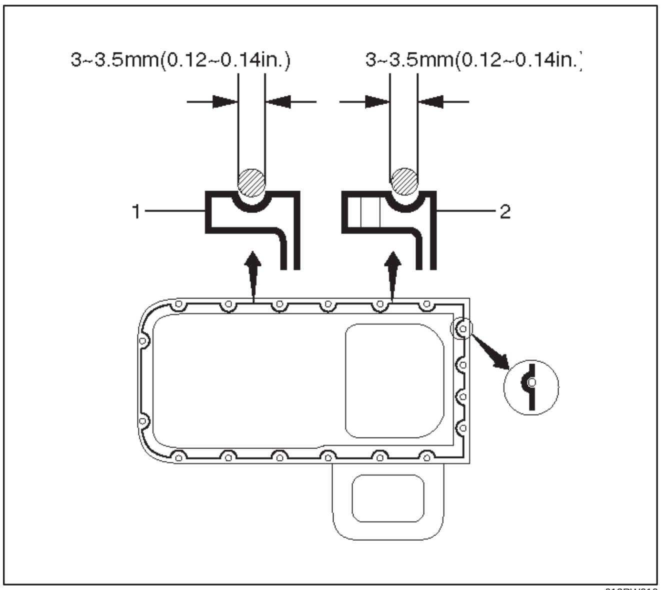
Replace the oil pan and/or crankcase if deformed or damaged.



013RS003

Installation

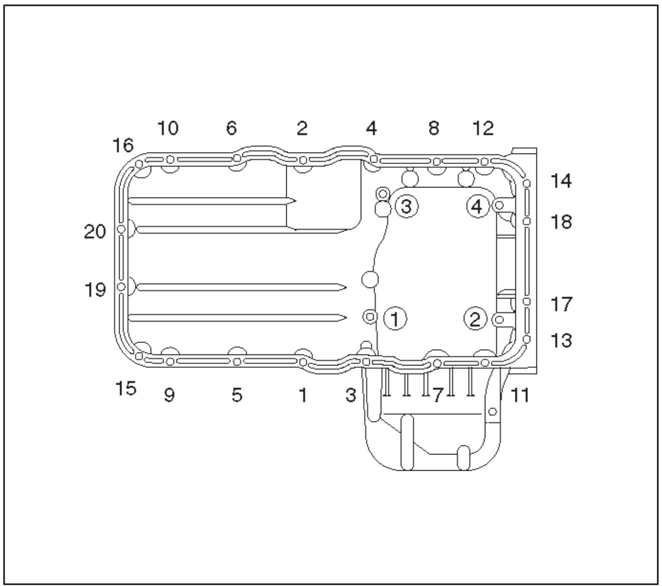
1. Install crankcase.
   A. Remove residual sealant, lubricant and moisture from mounting surface, then dry thoroughly.
   B. Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB-1207C or equivalent) to mounting surface of crankcase.
   Sealant beat must be continuous.
   - The crankcase must be installed within 5 minutes after sealant application before the sealant hardens.



013RW010

C. Install crankcase, tighten crankcase fixing bolts to the specified torque.

Torque : 10 N·m (89 lb in)

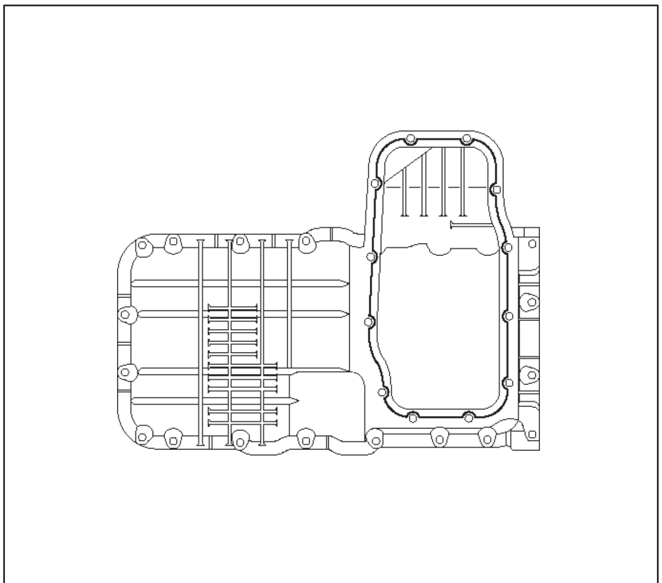


013RW004

2. Install oil pan
   1. Remove residual sealant, lubricant and moisture from mounting surface, then dry thoroughly.
   2. Properly apply a 4.5 mm (07 in) wide bead of sealant (TB-1207C or equivalent) to mounting surface of oil pan.

      Sealant beat must be continuous.

      - The crankcase must be installed within 5 minutes after sealant application befor the sealant hardens.



013RW003

   3. Install oil pan, tighten oil pan fixing bolts to the specified torque.

Torque : 25 N·m (18 lb ft)

3. Install starter and tighten fixing bolts.

Torque: 40 N·m (30 lb ft)

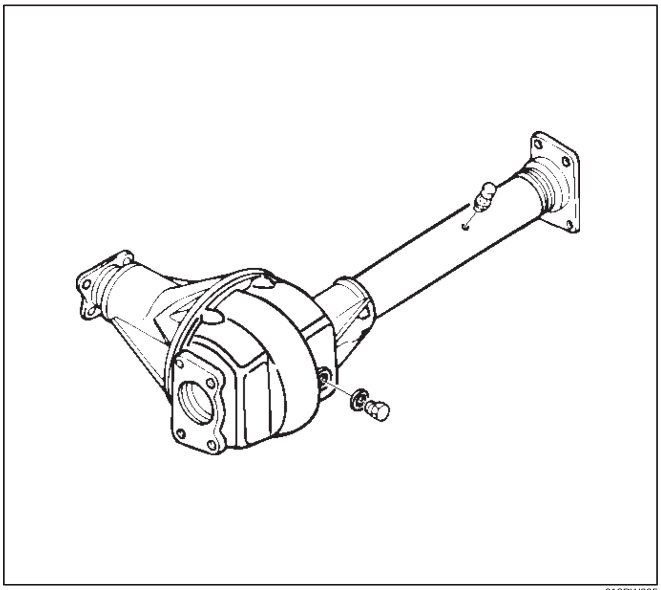
4. Install axle housing assembly and tighten fixing bolts to the specified torque. (For 4×4)

Axle case bolts

Torque : 82 N·m (60 lb ft)

Mounting bolts

Torque : 152 N·m (112 lb ft)



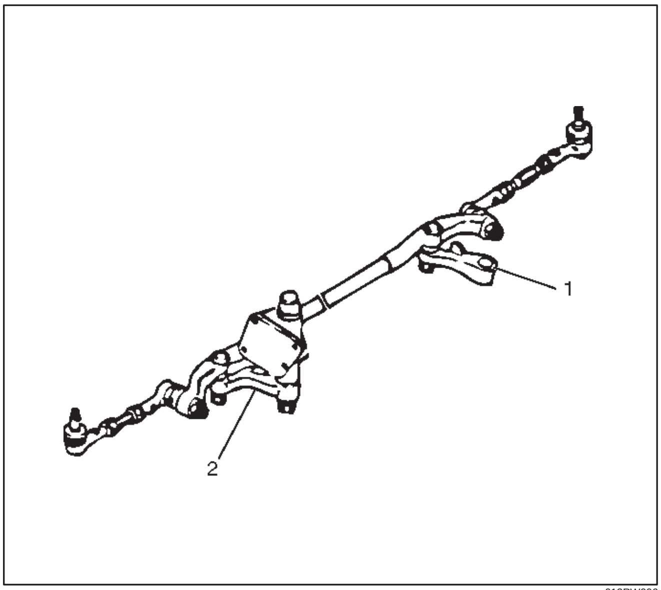
013RW005

5. Install relay lever assembly and tighten fixing bolts.

Torque: 44 N·m (32 lb ft)

6. Engage teeth of pitman arm and steering unit, and tighten nut to the specified torque.

Torque : 216 N·m (159 lb ft)



013RW006

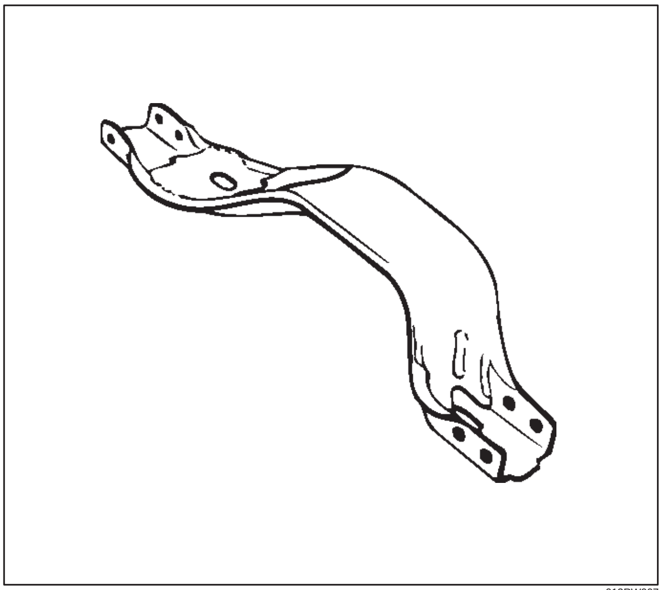
Legend

(1) Pitman Arm

(2) Relay Lever

7. Install suspension cross member and tighten fixing bolts to the specified torque.

Torque : 78 N·m (58 lb ft)



013RW007

8. Install radiator under fan shroud.
9. Install under cover.
10. Install engine oil level dipstick.
11. Fill engine oil until full level on engine oil gauge dipstick.

Oil Pump

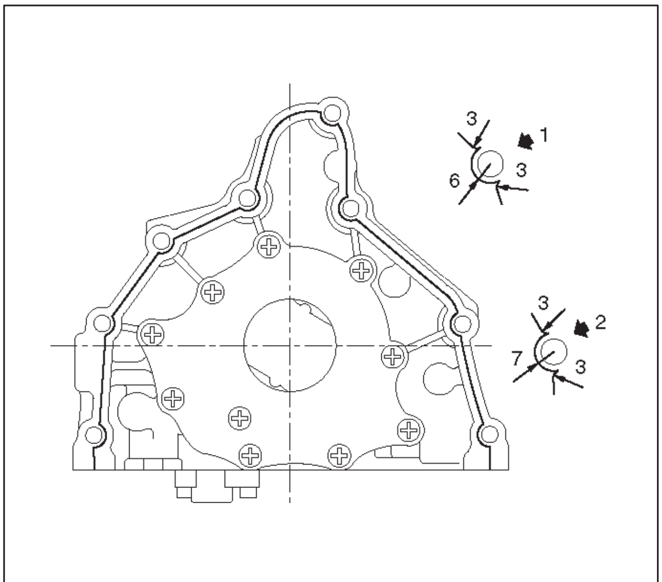
Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove crankcase assembly.
   - Refer to removal procedure for Oil Pan and Crankcase in this manual.
4. Remove crankshaft pulley.
   - Refer to removal procedure for Crankshaft Pulley in this manual.
5. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
6. Remove timing pulley from crankshaft.
7. Remove four fixing bolts from oil filter assembly.
8. Remove oil strainer fixing bolts, remove oil strainer assembly with O-ring.
9. Remove three bolts from oil pipe and O-ring.
10. Remove eight oil pump fixing bolts, then oil pump assembly.
11. Remove sealant from mounting surface of oil pump assembly, cylinder block and take care not to damage mounting surfaces of oil pump and cylinder block.

Installation

1. Install oil pump assembly
   - Apply sealant (TB-1207B or equivalent) to the oil pump mounting surfaces as shown in the illustration.
   - The oil pump assembly must be installed within 5 minutes after sealant application before the sealant hardens.

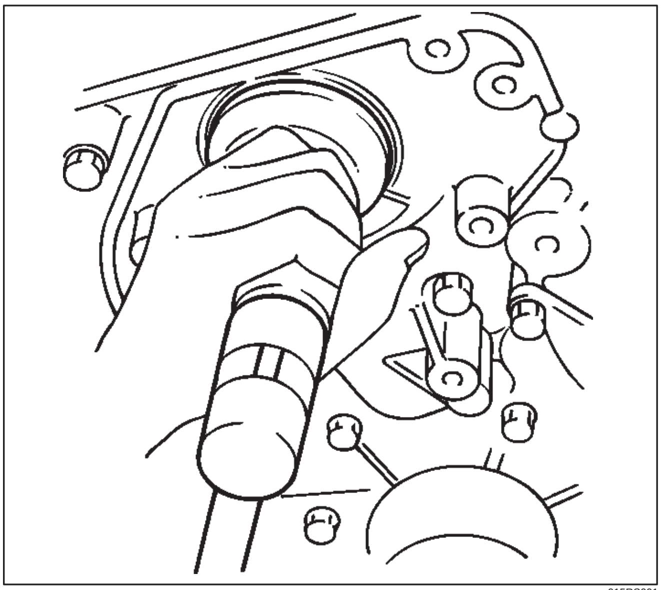
NOTE: Do not apply sealant to the oil ports.



051RW002

   - Use J-39202 installer when installing new oil seal.
   - Apply engine oil to oil seal lip.
   - Install oil pump assembly to the cylinder block.

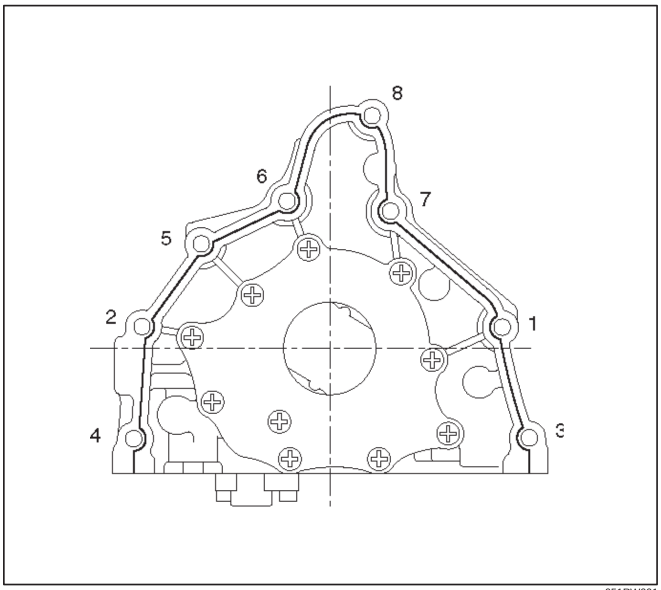
NOTE: Do not damage oil seal during installation of oil pump assembly.



015RS001

   - Tighten fixing bolts to the specified torque.

Torque : 25 N·m (18 lb ft)



051RW001

2. Install oil pipe with O-ring, tighten fixing bolt to the specified torque.

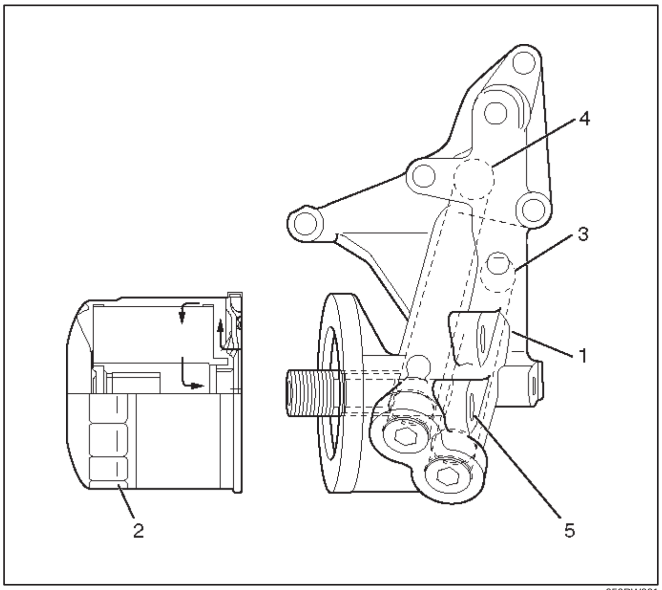
Torque : 10 N·m (89 lb in)

3. Install oil strainer with O-ring, tighten fixing bolt to the specified torque.

Torque : 25 N·m (18 lb ft)

4. Install oil filter assembly and tighten bolts to the specified torque.

Torque : 25 N·m (18 lb ft)



050RW001

Legend

(1) Oil Pump
(2) Oil Filter
(3) Oil Gallery
(4) From Oil Filter
(5) To Oil Filter

5. Install timing pulley on crankshaft.
   Install timing belt.
   - Refer to installation procedure for Timing Belt in this manual.
6. Install crankshaft pulley.
   - Refer to install procedure for Crankshaft Pulley in this manual.
7. Install crankcase assembly.
   - Refer to installation procedure for Oil Pan and Crankcase in this manual.
8. Refill engine oil until full level on engine oil dipstick.

Oil Pump Oil Seal

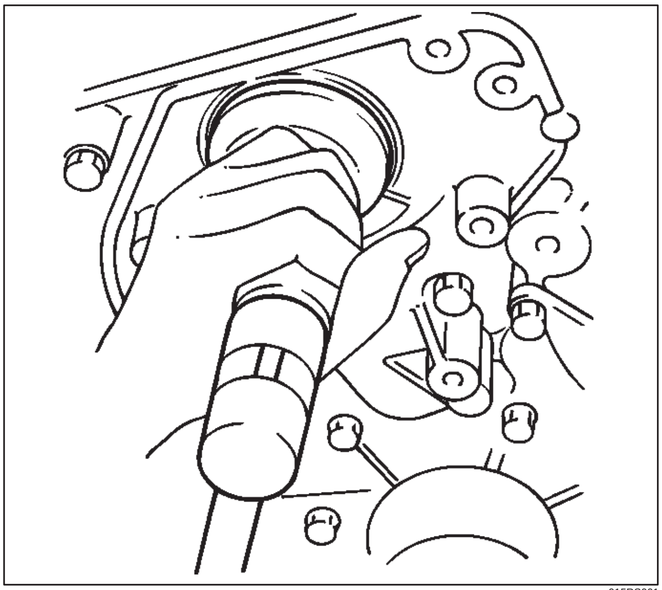
Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove crankshaft pulley.
   - Refer to removal procedure for Crankshaft Pulley in this manual.
4. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
5. Remove timing pulley from crankshaft.
6. Remove oil pump oil seal using a sealer puller.

NOTE: Take care not to damage sealing surfaces of oil pump and crankshaft when removing oil seal.

Installation

1. Install oil pump oil seal, apply engine oil to oil seal lip, then install oil seal using J-39202 installer.



015RS001

2. Install timing pulley to crankshaft.
3. Install timing belt.
   - Refer to installation procedure for Timing Belt in this manual.
4. Install crankshaft pulley.
   - Refer to installation procedure for Crankshaft Pulley in this manual.
5. Refill engine oil until full level.

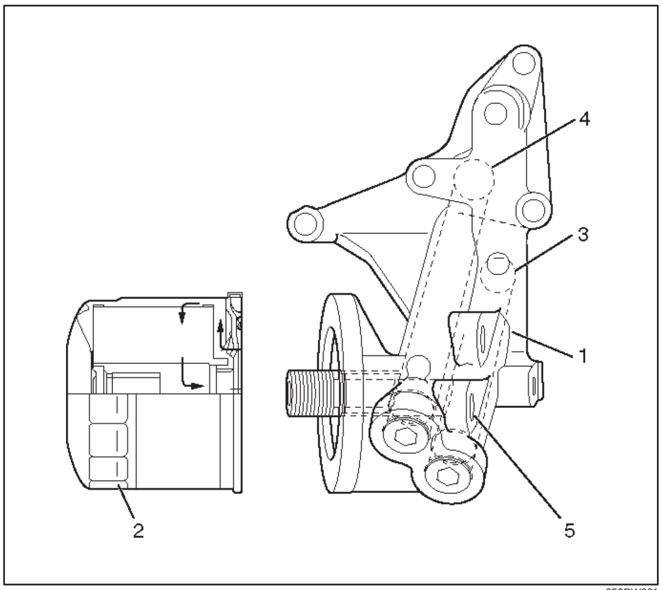
Oil Filter

Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove oil filter using J-36390 filter wrench.

Installation

1. Clean filter fitting surface and apply small amount of engine oil to sealing surface.
2. Install oil filter cartridge by hand until it comes in contact with sealing surface then rotate additional 2/3 turn to tighten using J-36390 filter wrench.



050RW001

Legend

(1) Oil Pump
(2) Oil Filter
(3) Oil Gallery
(4) From Filter
(5) To Filter

3. Fill engine oil until full level on dipstick.
4. Reconnect battery ground cable.

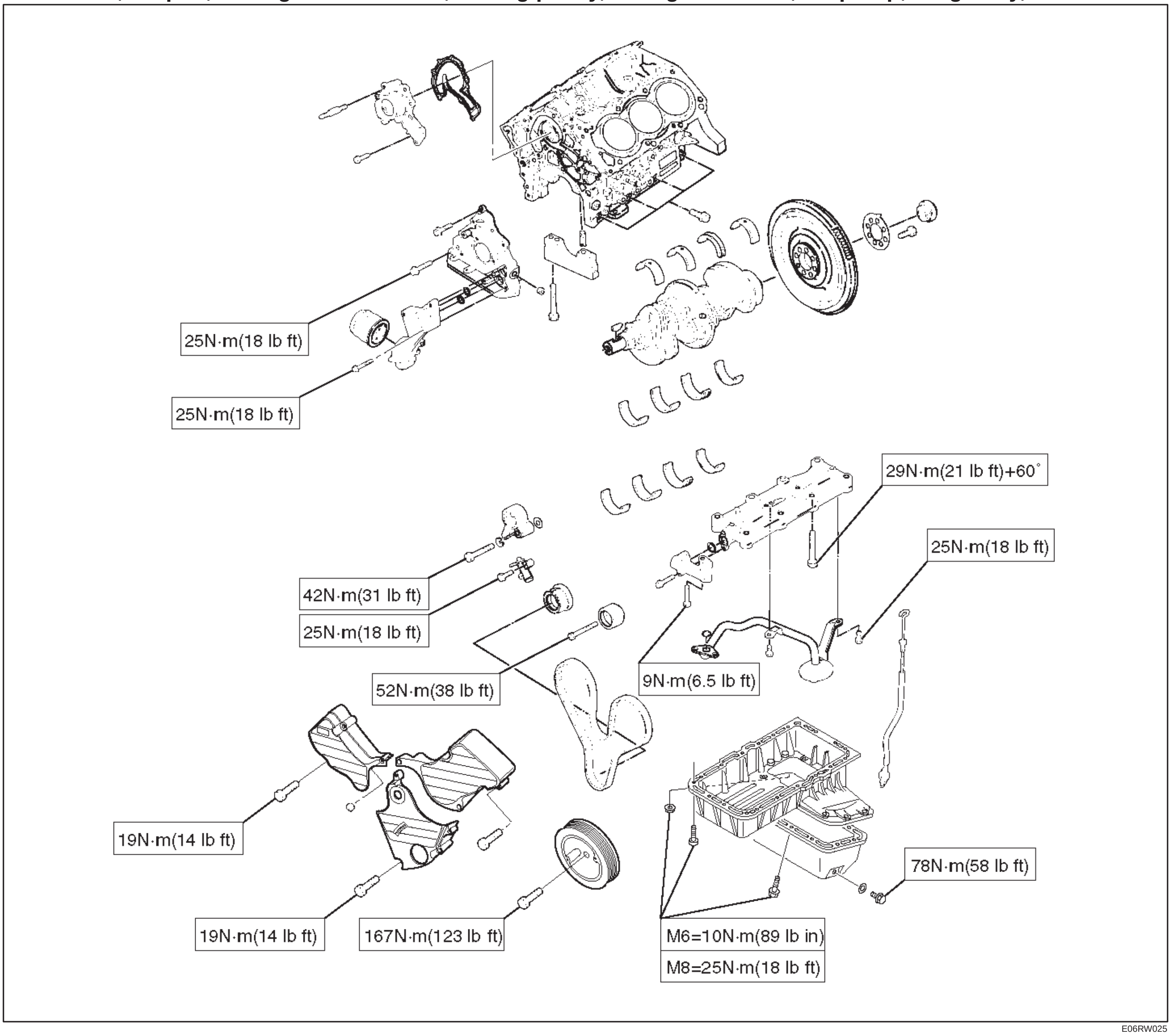
Main Data and Specification

General Specification

Item	Specifications
	6VE1
Oil capacity	5.3 liters

Torque Specifications

Crankcase, Oil pan, Timing belt tensioner, Timing pulley, timing belt cover, Oil pump, Oil gallery, Oil strainer



TROOPER

ENGINE

ENGINE SPEED CONTROL SYSTEM

CONTENTS

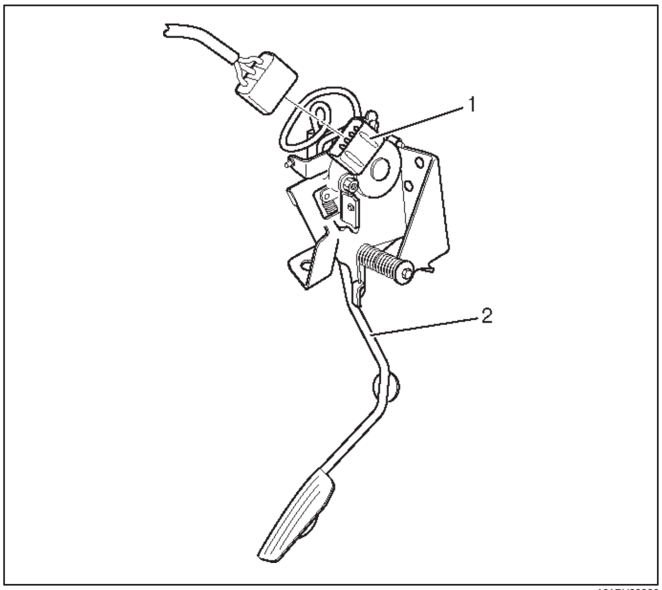
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Accelerator Pedal

Accelerator Pedal and Associated Parts



101RY00006

Legend

(1) Accelerator Position Sensor
(2) Accelerator Pedal Assembly

Removal

1. Disconnect battery ground cable.
2. Disconnect Accelerator position (AP) sensor (1) connector from Accelerator pedal assembly.
3. Remove Accelerator pedal assembly (2).

Installation

1. Install Accelerator pedal assembly (2).
2. Connect AP sensor (1) harness connector.
3. Connect battery ground cable.

TROOPER

ENGINE

INDUCTION

CONTENTS

Service Precaution

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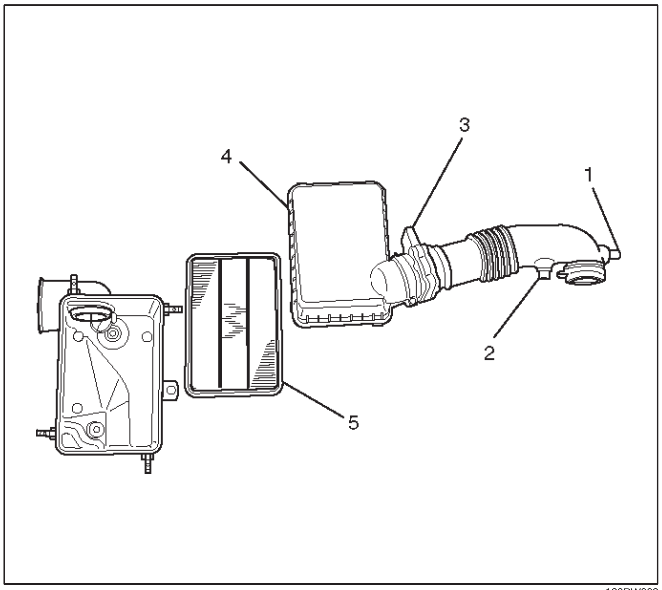
Air Cleaner Element

Removal

1. Remove positive ventilation hose connector(1).
2. Remove intake air temperature sensor(2).
3. Remove air flow sensor(3).
4. Remove air cleaner duct assembly(4).
5. Remove air cleaner element(5).



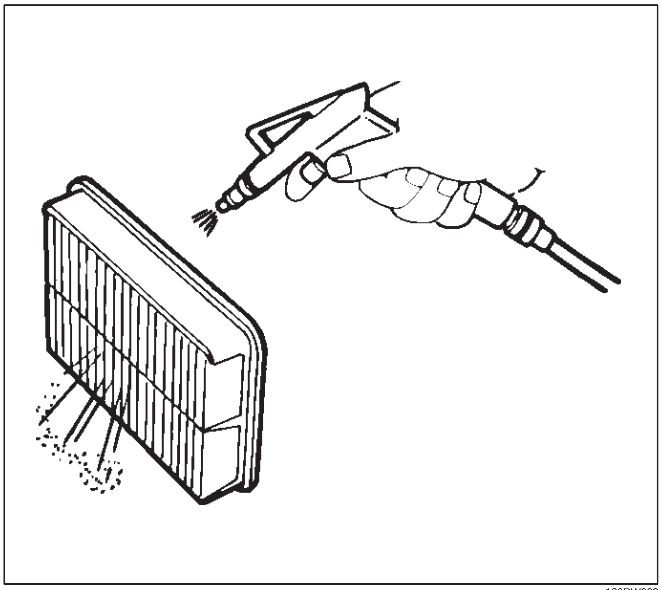
130RW003

Inspection

Check the air cleaner filter for damage or dust clogging. Replace if it is damaged, or clean if it is clogged.

Cleaning Method

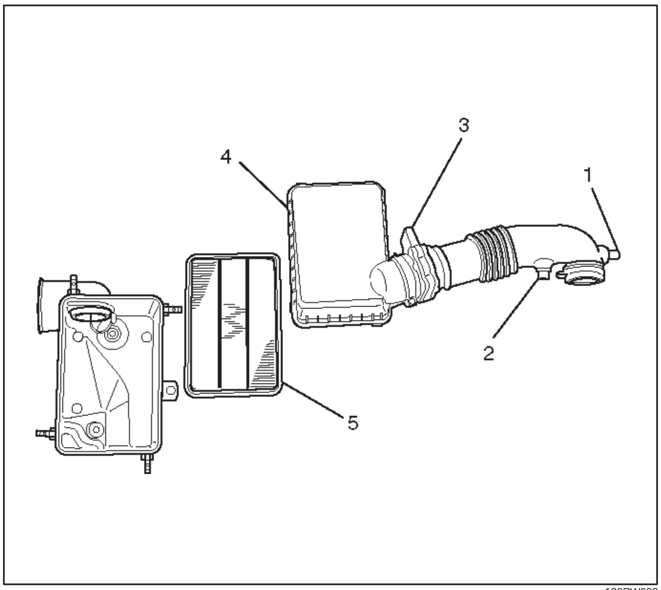
Tap the air cleaner filter gently so as not to damage the paper filter, or clean the element by blowing with compressed air of about 490 kPa (71 psi) from the clean side if it is extremely dirty.



130RW002

Installation

1. Install air cleaner element(5).
2. Attach the air cleaner duct cover to the body completely, then clamp it with the clip(4).
3. Install mass air flow sensor(3).
4. Install air temperature sensor(2).
5. Install positive crankcase ventilation hose connector(1).



130RW003

TROOPER

TRANSMISSION

CONTENTS

AUTOMATIC TRANSMISSION (4L30–E)

CONTENTS

Service Precaution

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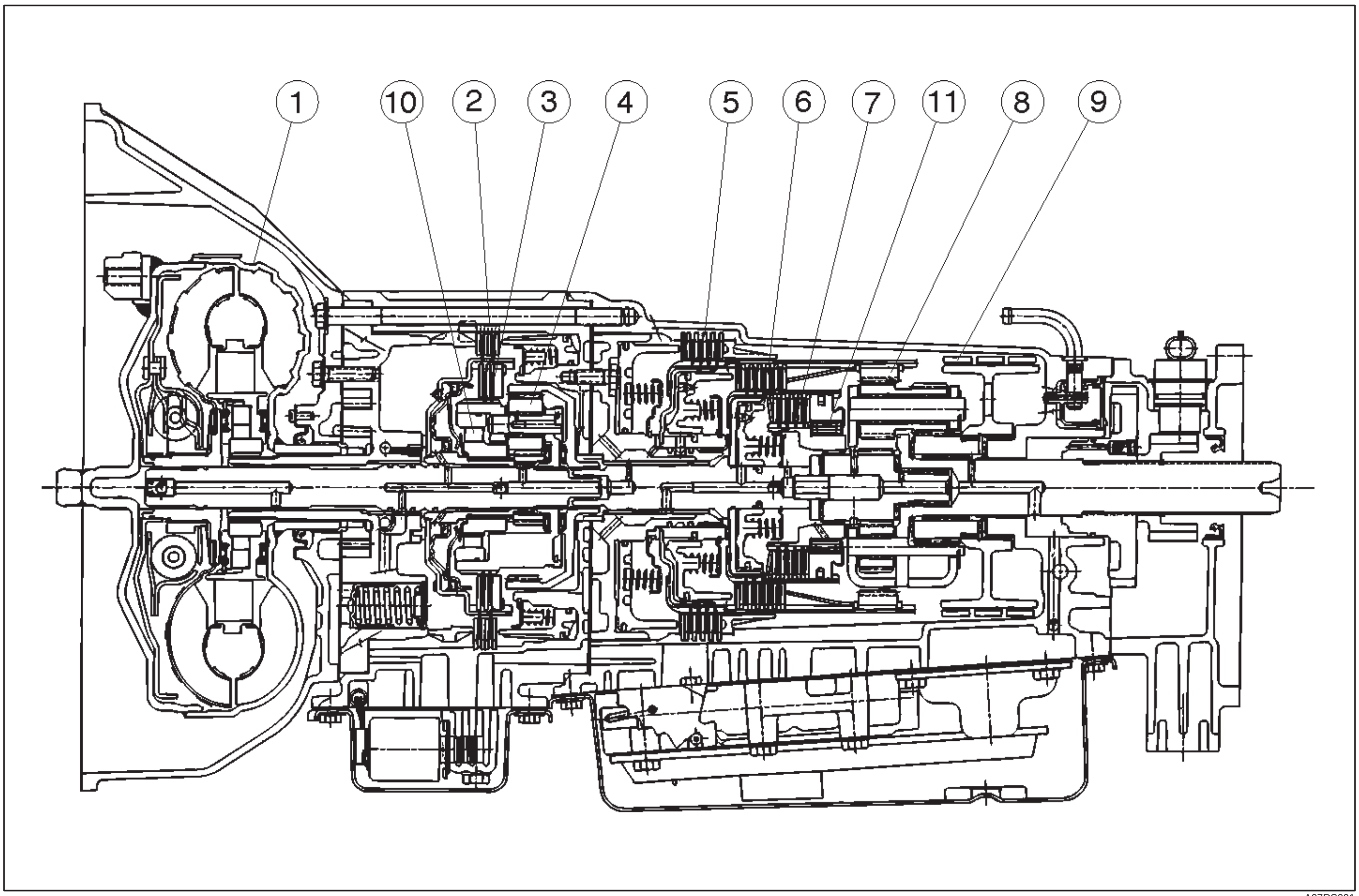
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

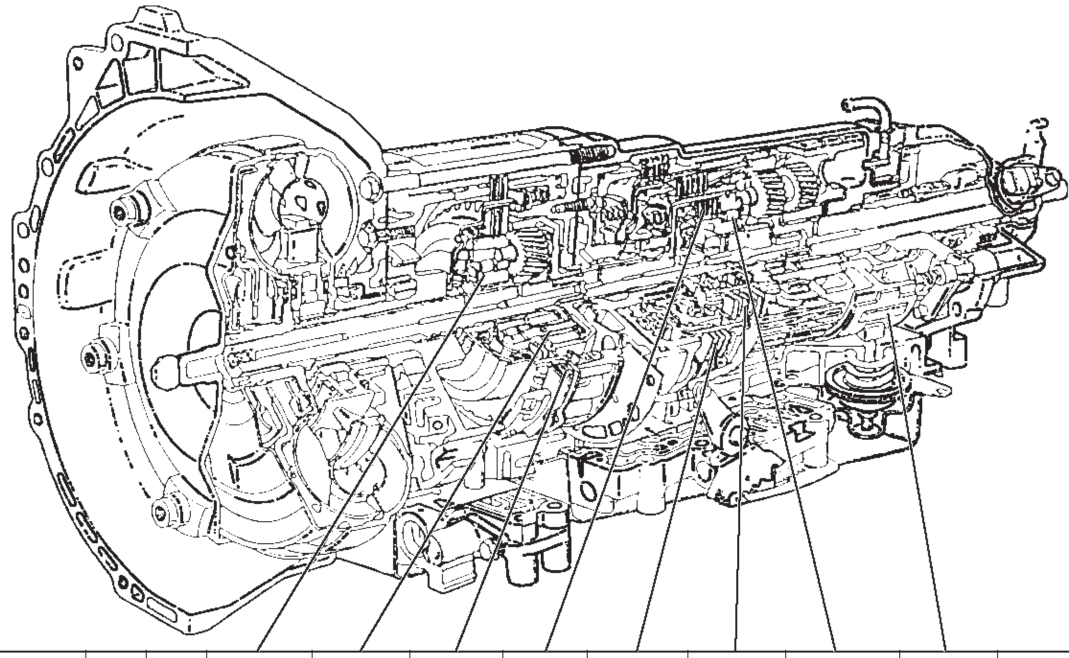
Construction



Legend

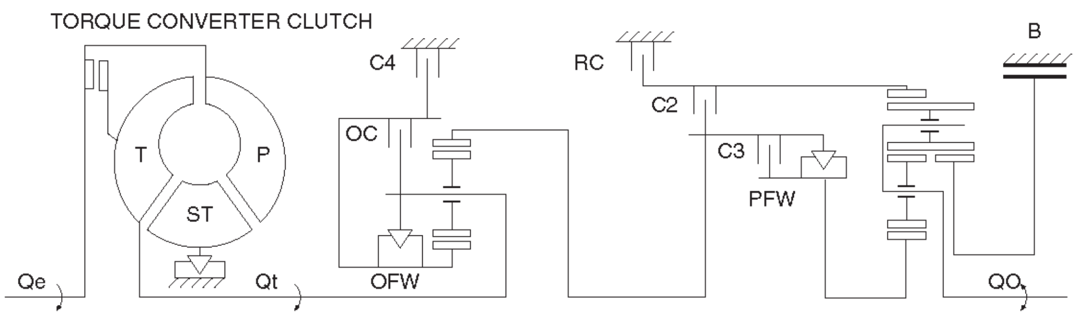
- (1) Torque Converter Clutch (TCC)
- (2) Fourth Clutch (C4)
- (3) Overrun Clutch (OC)
- (4) Overdrive Unit
- (5) Reverse Clutch (RC)
- (6) Second Clutch (C2)
- (7) Third Clutch (C3)
- (8) Ravigneaux Planetary Gear Set
- (9) Brake Band (B)
- (10) Overdrive Free Wheel (One Way Clutch) (OFW)
- (11) Principle Sprag Assembly (One Way Clutch) (PFW)

Range Reference Chart



RANGE	GEAR	SOL A N.C.	SOL B N.O.	O/DRIVE FREE WHEEL (OFW)	O/RUN CLUTCH (OC)	FOURTH CLUTCH (C4)	THIRD CLUTCH (C3)	REVERSE CLUTCH (RC)	SECOND CLUTCH (C2)	PRINCIPLE SPRAG ASM (PFW)	BAND ASM (B)	ENGINE BRAKING	TORQUE CONV. CLUTCH
P-N		OFF	ON		APP							NO	NO
R	REVERSE	OFF	ON	LD	APP			APP		LD		NO	NO
D	1ST	OFF	ON	LD	APP					LD	APP	NO	NO
	2ND	ON	ON	LD	APP				APP	FW	APP	YES	ECCC
	3RD	ON	OFF	LD	APP		APP		APP	NE		YES	ECCC
	4TH	OFF	OFF	FW		APP	APP		APP	NE		YES	ECCC
3	1ST	OFF	ON	LD	APP					LD	APP	NO	NO
	2ND	ON	ON	LD	APP				APP	FW	APP	YES	ECCC
	3RD	ON	OFF	LD	APP		APP		APP	NE		YES	ECCC
2	1ST	OFF	ON	LD	APP		APP			LD	APP	YES	NO
	2ND	ON	ON	LD	APP				APP	FW	APP	YES	ECCC
L	1ST	OFF	ON	LD	APP		APP			LD	APP	YES	NO

LD : LOCKED IN DRIVE FW : FREEWHEELING NE : NOT EFFECTIVE APP : APPLIED



Qe: ENGINE TORQUE Qt: TURBINE TORQUE QO: OUTPUT SHAFT TORQUE

C07RY00032

Normal Operation Of 2000 4L30–E Transmission

Torque Converter Clutch (Electronically Controlled Capacity Clutch : ECCC) Application Conditions:

The clutch apply is controlled by moving the converter clutch control valve by commanding Torque Converter Clutch (TCC) solenoid using the PWM signal.
The TCC is normally applied in 2nd, 3rd and 4th gears only when all of the following conditions exist:

— The engine coolant temperature is above 70˚C (158˚F) and ATF temperature is above 18˚C (64.5˚F).

— The brake pedal is released.

— The shift pattern requests TCC apply.

Moreover, TCC is always applied in 2nd, 3rd and 4th gears when the transmission oil temperature is above 135˚C (275˚F).
This mode should be canceled at 125˚C (257˚F).

ATF Warning Lamp

The ATF warning lamp will be constantly on (not flashing) if the transmission oil temperature is above 145˚C (293˚F).
The ATF warning lamp goes off again when the transmission oil temperature is below 125˚C (257˚F).

Reverse Lock Out

With the selector lever in reverse position, the PCM will not close the PWM solenoid until the vehicle is below 11 km/h (6.8 mph), thus preventing reverse engagement above this speed.

Diagnosis

Introduction

The systematic troubleshooting information covered by this Section offers a practical and systematic approach to diagnosing 4L30–E transmission, using information that can be obtained from road tests, electrical diagnosis, oil pressure checks or noise evaluation.
The key to correcting a complaint is to make use of all of the available symptoms and logically letting them direct you to the cause.
When dealing with automatic transmission complaints, it is best to gather as many symptoms as possible before making the decision to remove the transmission from the vehicle.
Frequently, the correction of the complaint does not require removal of the transmission from the vehicle.

Driver Information

To analyze the problem fill out a complete description of the owner's complaint.
Please draw a circle around the right information and complete the following form. (The next page is an example of a completed form). You can draw a circle around many numbers if you are not sure.

A - Today's date :	Month :	Day :	Year : ....
B - End User Name, Address :			
C - Date of Problem :	Month :	Day :	Year : ....
D - Mileage : .... Miles / Km	**E - With Ignition ON is CHECK TRANS Indicator :** 1- Flashing 2- Not Flashing	**F -Car load when problem occured :** 1 - Towing a trailer 2- .... people OR .... Kg	
G - Weather conditions when problem : 1- Clear 2- Cloudy 3- Rain 4- Snow 5- Unstable 6-Any	**H - Weather Temperature when problem:** 1- Hot 2- Warm 3- Cool 4- Cold 5- Unstable 6- Any	**I - Road Conditions when problem :** 1- Any 2- Inter City 3- Outside City 4- Highway 5 - Uphill 6- Downhill 7- Unpaved 8- Snow 9 - Others :	**J - Frequency of the Problem :** 1- Always 2- Occasional : .... times/day, ... times/month 3- Only Once 4- Others :
K - Engine Condition : 1- Always 2- At Cold 3- During Warming up 4- After Warming or Hot 5- Others	**L - Engine Speed when the problem occured :** 1- Idling 2- Starting 3- Stalling 4- High RPM 5- Low RPM	**M - Transmission Condition when it occured :** 1- Any 2- Idling 3- Starting 4- Driving 5- Accelerating 6-Coasting 7- In corner 8- Shifting	

N - If there is a Transmission driveability problem BEFORE THE CHECK TRANS INDICATOR WAS FLASHING :

1- No Power	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
2- No shift	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
3- Shift Shock	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
4- Shift Slip	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
5- Shift Delayed	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
6- Shift Point too high	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
7- Shift Point too low	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
8- TCC Shudder	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
9- Noise	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
Noise type : 1- Buzz 2- Whine 3- Clunk 4- Rattle	5- Whistle // 6- light 7-medium 8- heavy	
10- Other :	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1

O - Other customer concern and comments

P - Isuzu Vehicle Code :	....	**Q - VIN Number**	....
R - Date of Vehicle Registration	Month :	Day :	Year : ....
S - Trans. model :	....	**T - A/T Serial Number :**	....
U - Your name :	....		

V - Dealer Name, Address, Phone

F07RT036

Example of form completed.

A - Today's date :	Month : April.............	Day : .13............	Year : .1994.............
B - End User Name, Address :	Dave Smith 6584, Arlington road Plymouth MI 48170 USA		
C - Date of Problem :	Month : April..................	Day : .8................	Year : .1994...............

D - Mileage :	E - With Ignition ON is CHECK TRANS Indicator :	F - Car load when problem occured :
12230...Mile / Km	1- Flashing 2- Not Flashing	1 - Towing a trailer 2- ..2....... people OR ....Kg

G - Weather conditions when problem :	H - Weather Temperature when problem:	I - Road Conditions when problem :	J - Frequency of the Problem :
1- Clear 2- Cloudy 3- Rain 4- Snow 5- Unstable 6- Any	1- Hot 2- Warm 3- Cool 4- Cold 5- Unstable 6- Any	1- Any 2- Inter City 3- Outside City 4- Highway 5 - Uphill 6- Downhill 7- Unpaved ~~8- Snow~~ 9 - Others	1- Always 2- Occasional : .... times/day, ...3... times/month 3- Only Once 4- Others :

this means do not take this into account

K - Engine Condition :	L - Engine Speed when the problem occured :	M - Transmission Condition when it occured :
1- Always 2- At Cold 3- During Warming up 4- After Warming or Hot 5- Others	1- Idling 2- Starting 3- Stalling 4- High RPM 5- Low RPM	1- Any 2- Idling 3- Starting 4- Driving 5- Accelerating 6- Coasting 7- In corner 8- Shifting

N - If there is a Transmission driveability problem BEFORE THE CHECK TRANS INDICATOR WAS FLASHING :

1- No Power	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
2- No shift	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
3- Shift Shock	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
4- Shift Slip	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
5- Shift Delayed	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
6- Shift Point too high	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
7- Shift Point too low	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
8- TCC Shudder	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
9- Noise	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
Noise type : 1- Buzz 2- Whine 3- Clunk	4- Rattle 5- Whistle // 6- light	7-medium 8- heavy
10- Other :	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1

O - Other customer concern and comments :

(This is just an example). Shift shock very harsh overall during a downshift. Not sure if it's the 4-3 or 3-2.

P - Isuzu Vehicle Code :	94 UCR	Q - VIN Number	4S2CV58ZXM4324047
R - Date of Vehicle Registration	Month : November.	Day : ....18........	Year : ..1993.........
S - Trans. model :	4L30-E	T - A/T Serial Number :	96 358 654
U - Your name :	Joe Spring		

V - Dealer Name, Address, Phone

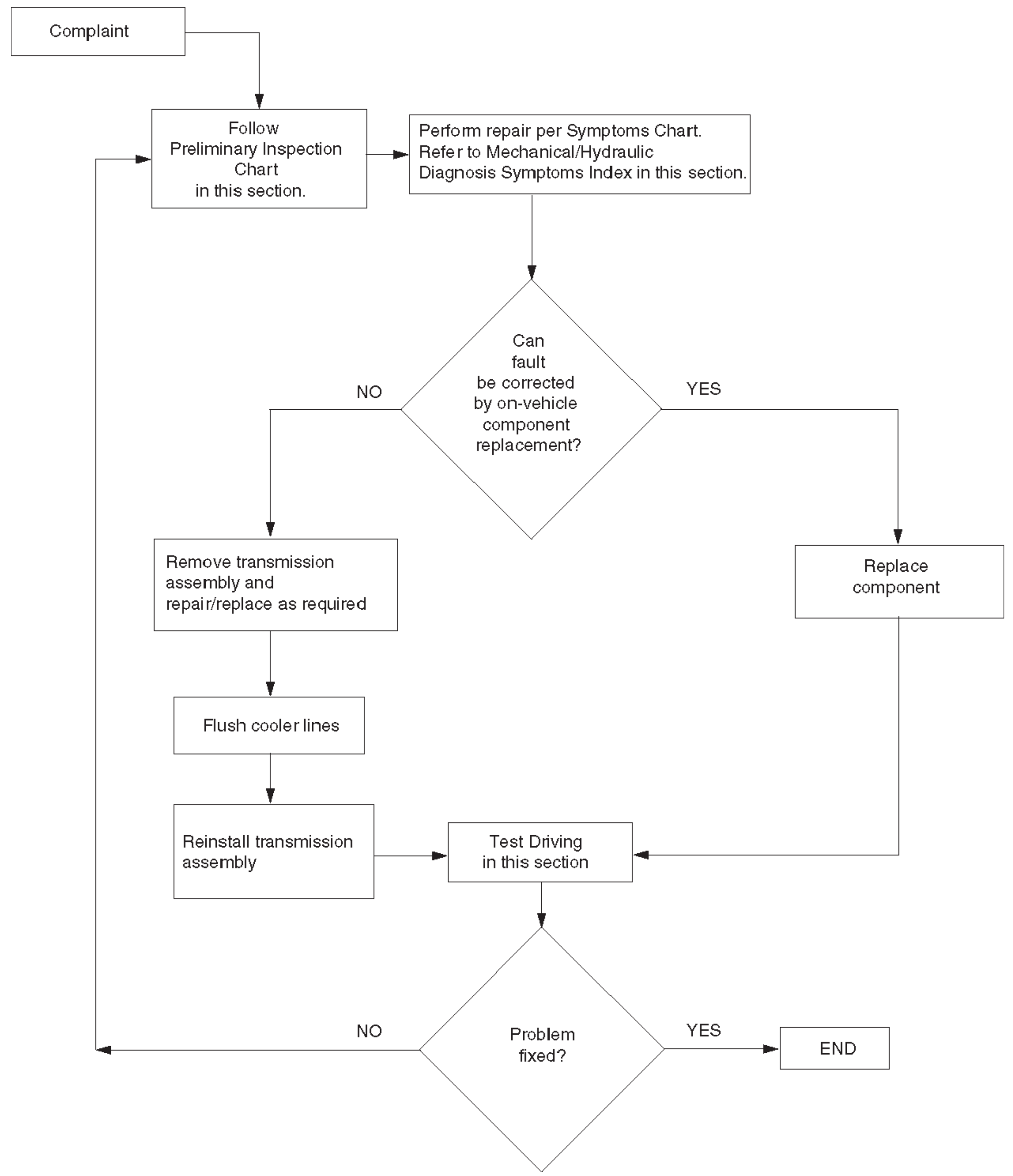
Kent Helfrich

Home-town ISUZU

900 - 999 - 9999

F07RT037

General Diagnosis Procedure



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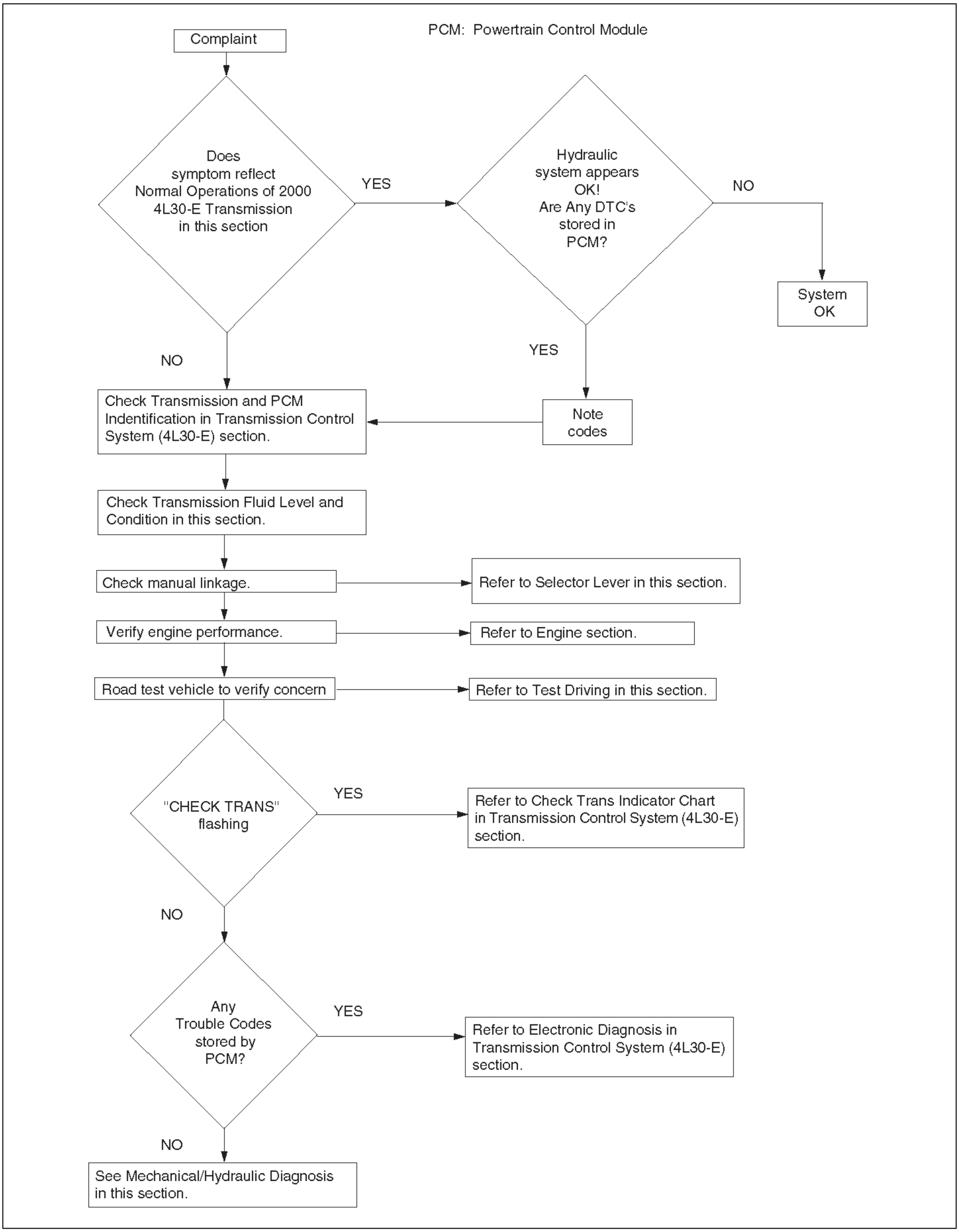
Preliminary Inspection Chart



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Checking Transmission Fluid Level and Condition

Checking fluid level and condition (color and odor) at regular intervals will provide early diagnosis information about the transmission. This information may be used to correct a condition that, if not detected early, could result in major transmission repairs.

IMPORTANT: When new, automatic transmission fluid is red in color. As the vehicle is driven, the transmission fluid will begin to look darker in color. The color may eventually appear light brown.

A dark brown color with burnt odor may indicate excessive fluid deterioration and signal a need for fluid change.

Fluid Level

When adding or changing fluid, use only DEXRON ®–III. Refer to Maintenance and Lubrication in General Information section for maintenance information and servicing interval.

CAUTION: DO NOT OVERFILL.

Overfilling will cause foaming, loss of fluid, abnormal shifting and possible damage to the transmission.

1. Park the vehicle on level ground and apply the parking brake firmly.
2. Check fluid level with engine running at idle.

NOTE: Be sure that transmission fluid temperature is below 30°C (86°F).

3. Move the selector lever through all gear ranges.
4. Move the selector lever to “Park”.
5. Let engine idle for 3 minutes and open the overfill screw (1).
6. Add released transmission fluid until it flows out over the overfill screw opening.
7. Let engine idle until a fluid temperature between 32°C (90°F) and 57°C (135°F) is reached, then close the overfill screw (1).

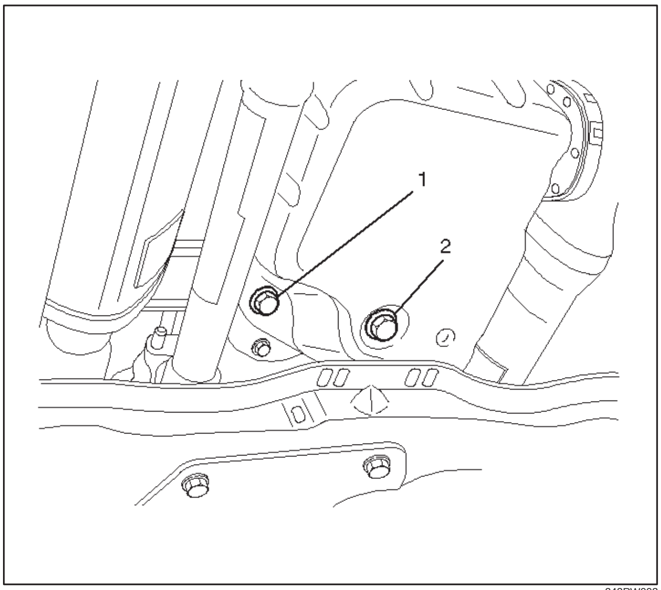
Torque: 38 N•m (28 lb ft)

NOTE: To prevent fluid leaks, the overfill screw and oil drain screws gasket must be replaced each time these screws are removed.

NOTE: Check transmission fluid temperature with scan tool.

Minimum fluid level → 57°C (135°F)

Maximum fluid level → 32°C (90°F)



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CAUTION: Do not open overfill screw with engine stopped.

CAUTION: DO NOT CHECK FLUID LEVEL UNDER THESE CONDITIONS:

- Immediately after driving at sustained highway speeds.
- In heavy city traffic during hot weather.
- If vehicle is towing a trailer.

If the vehicle has been operated under these conditions, shut the engine off and allow the vehicle to “cool” for thirty (30) minutes. After the cool down period, restart the vehicle and continue from step 2 above.

Fluid Condition

	FLUID CONDITION			
	NORMAL*		CONTAMINATED	
COLOR	RED OR LIGHT BROWN	BROWN	NON–TRANSPARENT / PINK	BROWN
DRAIN REQUIRED?	NO	YES	YES	YES
CONTAMINA–TION	NONE	Very small amount of foreign material in bottom of pan	Contamination by coolant or other source	Large pieces of metal or other foreign material in bottom of pan
CORRECT LEVEL AND CONDITION	1. LOW LEVEL: A. Add fluid to obtain proper level & check for external leaks. B. Correct cause of leak. 2. HIGH LEVEL: – Remove excess fluid	– Remove both pans – Change filter – Flush cooler – Add new fluid – Check level	– Repair/replace radiator cooler – Transmission overhaul required – Check for: ● Damaged plates and seals ● Contaminated solenoids – Flush cooler – Add new fluid – Check level	– Transmission overhaul required – Flush cooler and cooler lines – Add new fluid – Check level

*Fluid should be changed according to maintenance schedule.

Test Driving

Some 4L30–E automatic transmission complaints will require a test drive as a part of the diagnostic procedure. Some codes will not set unless the vehicle is moving. The purpose of the test drive is to duplicate the customer's complaint condition and set a current Powertrain Control Module (PCM) trouble code. Perform this procedure before each 4L30–E automatic transmission repair, and again after repairs are made.

IMPORTANT:

- Duplicate the condition under which the customer's complaint was observed.
- Depending on the complaint, the line pressure gauge and the scan tool may be required during the test drive.
- During the test drive, it is important to record all necessary data from the areas being monitored, for use in diagnosis. Also listen for and note any unusual noises.

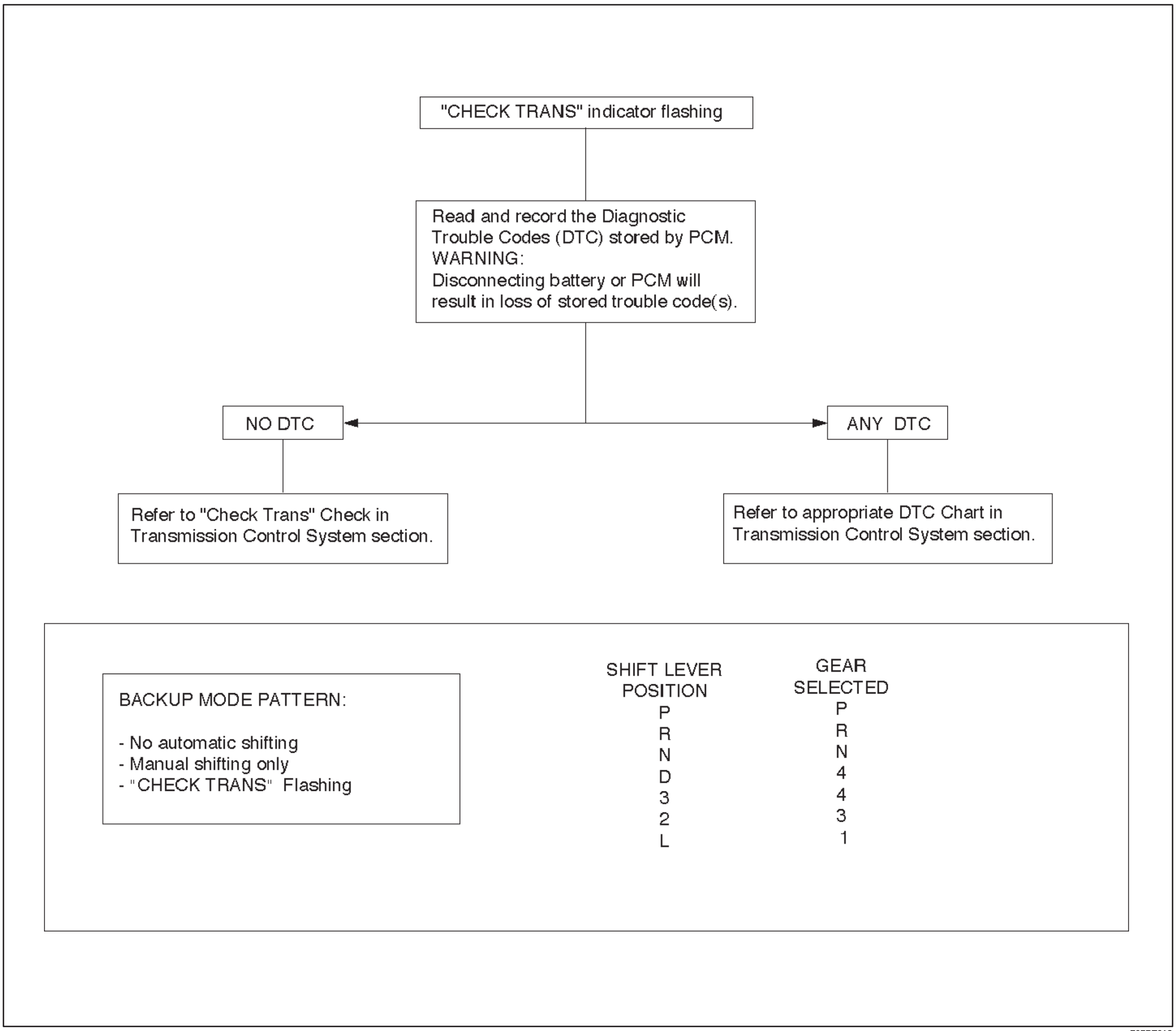
The following procedure should be used to test drive 4L30–E automatic transmission complaint vehicles:

1. Turn the ignition ON without starting the engine. Check that the "CHECK TRANS" lamp comes on for approximately 2 seconds and then goes out and remains out.
   - If the lamp is flashing, GOTO Check Trans Indicator in Transmission Control System (4L30–E) section.
   - If no serial data is present, GOTO OBD System Check. Refer to Driveability and Emissions in Engine section.
   - If the lamp stays ON or stays OFF, GOTO "Check Trans" Check in Transmission Control System (4L30–E) section.
2. Drive the vehicle. During the test drive, be sure that the transmission achieves normal operating temperature (approx. 20 minutes).
   Allow the transmission to go through all of its gear ranges, checking shift timing and firmness. Duplicate the owner's complaint condition as closely as possible during the test drive.
3. If, during the test drive, the "CHECK TRANS" lamp comes on, use the scan tool to check for trouble codes.
4. If, during the test drive, a problem is felt, but the "CHECK TRANS" lamp does not come on and no trouble codes are present, drive the vehicle with the PCM disconnected (manually shifting the vehicle).
   - In Manual L, the vehicle operates in first gear.
   - In Manual 2, the vehicle operates in third gear.
   - In Manual 3 or "D", the vehicle operates in fourth gear.

   If the problem still exists with the PCM disconnected, refer to Mechanical/Hydraulic Diagnosis in this section.
5. If no problem has been found at this point, check all underhood connections that supply power to the PCM and ignition fuses. Physically and visually inspect all the PCM harness connectors for loose or corroded terminals. Inspect the PCM ground points.

Mechanical / Hydraulic Diagnosis Check Trans Indicator Chart

Perform Preliminary Inspection First!



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When the “CHECK TRANS” indicator is flashing, it indicates that a problem related to the transmission, the Powertrain Control Module (PCM), or the vehicle harness has occurred.

The system is now operating in a “BACKUP MODE” where the risk of further damaging the transmission has been reduced. The vehicle may be shifted manually.

If the initial problem is intermittent or seldom, switching the engine OFF/ON might allow normal operation again until the problem reoccurs.

Mechanical / Hydraulic Diagnosis Symptoms Index

Perform Preliminary Inspection First!

CHART	SYMPTOMS
1	NO ENGINE START IN NEUTRAL OR PARK
2	NO FORWARD GEARS IN ANY RANGE/NO REVERSE
3	NO ENGINE BRAKE IN ANY RANGE
4	POOR SHIFTING IN ALL GEARS (ALL HARSH OR ALL SOFT)
5a	DELAYS IN DRIVE AND REVERSE
5b	DELAYS IN REVERSE ONLY
6	DIAGNOSTIC TROUBLE CODE (DTC) P0730
7	HARSH 1–2 SHIFT
8	HARSH 3–4 SHIFT
9a	3–2 DOWNSHIFT COMPLAINT
9b	HARSH SHIFT WHEN SHIFTING INTO “D” OR ACCELERATING FROM STOP
9c	COASTDOWN HARSH SHIFT OR CLUNK AT 3–2 DOWNSHIFT
10	INTERMITTENT 4TH TO 2ND GEAR DOWNSHIFT AT STEADY SPEED
11	ENGINE FLARE AT SHIFTING DURING TURNING ONLY (USUALLY WITH WARM ENGINE)
12	ENGINE FLARE DURING 1–2 OR 2–3 SHIFT
13	SHUDDER ONLY DURING TORQUE CONVERTER CLUTCH (TCC) APPLYING
14	POSSIBLE CAUSES OF TRANSMISSION NOISE
15a	POSSIBLE CAUSES OF LOW LINE PRESSURE
15b	POSSIBLE CAUSES OF HIGH LINE PRESSURE
16	POSSIBLE CAUSES OF TRANSMISSION FLUID LEAKS

NOTE: Numbers with parenthesis on the following charts refer to Parts List at end of this section.

Chart 1: No Engine Start In Neutral Or Park

Step	Action	Yes	No
1	Does engine start when shift lever moved from drive to neutral mostly in hot condition?	Go to Step 2	Go to Step 3
2	Does engine start in park at any condition?	Re–test vehicle	Go to Step 4
3	Does engine also not start in neutral when shift lever moved from park to neutral?	Go to Step 4	Go to Step 5
4	Check mode switch (63) setting. Readjust if necessary. Problems fixed?	Re–test vehicle	Go to Step 5
5	Check start circuit of mode switch (63) open in neutral. Was open found?	Locate and repair open(s)	Replace mode switch (63)

Chart 2: No Forward Gears In Any Range/No Reverse

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section
2	1. Check internal linkage: – Manual linkage (58) not moving manual valve (326). 2. Check for internal mechanical damage: – Turbine shaft (506) broken loose. – Overrun roller clutch (516) broken loose. Was the problem found?	Repair or replace	—

Chart 3: No Engine Brake In Any Range

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section
2	1. Check for overrun clutch leaks caused by: – Damaged piston lip (513) – Check ball defective (504) 2. Check for overrun lockout valve (705) stuck by foreign material. 3. Check for leaks at turbine shaft (506) caused by: – Teflon seal rings damaged (508) – Excessive wear of turbine shaft bearing surfaces. Was the problem found?	Repair or replace	—

Chart 4: Poor Shifting In All Gears (All Harsh Or All Soft)

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Go to Step 3
2	1. Check for these conditions which could affect clutch apply time: – Defective band apply solenoid (323). – Defective servo or/and accumulator piston. – Excessive clutch piston travel. 2. Check of possible causes of internal leaks: – Cut or damaged sealing ring(s) – Damaged sealing gasket(s) – Check ball missing or out of location in 2nd and 3rd clutch pistons. 3. Check for causes of burned clutch plates or band. Was the problem found?	Repair or replace	—
3	Was the line pressure high?	Go to Step 4	Use Chart 15a: Possible Causes of Low Line Pressure in this section
4	Does DTC P0705 set?	Diagnose those DTC(s) first	Use Chart 15b: Possible Causes of High Line Pressure in this section

Chart 5a: Delays In Drive And Reverse

NOTE: A short delay (less than 3 seconds) when first engaging drive or reverse after allowing vehicle to sit overnight is normal.

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	More than 3 second delay in drive and reverse with engine off 1 hour or less. Teflon seals (508) on turbine shaft damaged. Repair	Use Chart 15a: Possible Causes of Low Line Pressure in this section.

Chart 5b: Delays In Reverse Only

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section.
2	Main case valve body gasket (88) damaged. – Reverse check ball (85) in valve body (84) missing or out of location. – Check for restrictions at valve body transfer plate orifice. Was the problem found?	Repair	—

Chart 6: Diagnostic Trouble Code (DTC) P0730

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15b: Possible Causes of High Line Pressure in this section
2	1. 1st and 2nd gear missing or 3rd and 4th gear missing. Check appropriate shift valve. If OK replace solenoid. 2. No engine brake in any range (All ranges in Drive and Reverse are OK). Check for suspected conditions modifying delays to clutch apply: – Overrun clutch seal damaged. – Excessive overrun clutch piston travel. – Defective 3–4 accumulator piston. – Causes of internal leaks. – Causes of burned clutch plates. 3. 1st and 4th gear missing or 2nd and 3rd gear missing. Shift solenoid A stuck. Replace shift solenoid A. 4. DTC P0730 is set in D range 1st gear above 3500 rpm. Go to Step 3. 5. DTC P0730 is set in D range 3rd gear between 55-80 mph. NOTE: Perform this test within safe and legal limits. Check for suspected conditions modifying delays to clutch apply: – 4th clutch seal damaged. – Excessive 4th clutch piston travel. – Defective 3–4 accumulator piston. – Causes of internal leaks. – Causes of burned clutch plates. Was the problem found?	Repair or replace	—
3	Check 3rd gear in “D” in winter mode. Does vehicle move?	Shift solenoid A stuck. Replace shift solenoid A.	Go to Step 4
4	Check for suspected conditions modifying delays to clutch apply: – 2nd clutch seal damaged. – Excessive 2nd clutch piston travel. – Defective accumulator piston. – Causes of internal leaks. – Check ball missing or out of location in 2nd clutch. – Seals cut, damaged or missing. – Gaskets defective. – Causes of burned clutch plates. Was the problem found?	Repair or replace	—

Chart 7: Harsh 1–2 Shift

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Check for 1–2 accumulator valve (320) stuck by foreign material in main case valve body.	Use Chart 15b: Possible Causes of High Line Pressure in this section.

Chart 8: Harsh 3–4 Shift

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15b: Possible Causes of High Line Pressure in this section
2	1. Check for 3–4 accumulator valve (407) stuck in adapter case valve body (401). 2. Check for 3–4 accumulator piston (18) stuck in adapter case (20). Was the problem found?	Repair or replace	—

Chart 9a: 3–2 Downshift Complaint

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section
2	Does DTC P1850 set?	Diagnose P1850 first	Replace band apply solenoid (PWM) (323)

Chart 9b: Harsh Shift When Shifting Into “D” Or Accelerating From Stop

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15b: Possible Causes of High Line Pressure in this section
2	Does DTC P1850 set?	Diagnose P1850 first	Replace band apply solenoid (PWM) (323)

Chart 9c: Coastdown Harsh Shift Or Clunk At 3–2 Downshift

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15b: Possible Causes of High Line Pressure in this section
2	Does DTC P1850 set?	Diagnose P1850 first	Replace band apply solenoid (PWM) (323)

Chart 10: Intermittent 4TH TO 2ND Gear Downshift At Steady Speed

Step	Action	Yes	No
1	Check for consistent speed sensor reading with scan tool. Was the reading correct?	Replace mode switch for intermittent contact.	Go to Step 2
2	1. Check for wiring harness damage or short to ground. If OK, go to (2). 2. Check transmission speed sensor connections. If OK, go to (3). 3. Replace transmission speed sensor. Was the replacement complete?	—	Replace speed sensor.

Chart 11: Engine Flare At Shifting During Turning Only (Usually With Warm Engine)

Step	Action	Yes	No
1	Check for oil leaks at transmission. Was the problem found?	Replace transmission oil filter and gasket	—

Chart 12: Engine Flare During 1–2 Or 2–3 Shift

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section
2	1. Check for a stuck 1–2 accumulator valve (320). 2. Check for servo piston (106) leaks. 3. Check for a stuck band apply solenoid (323). Was line pressure normal?	Repair or replace	—

Chart 13: Shudder Only During Torque Converter Clutch (TCC) Applying

Step	Action	Yes	No
1	1. TCC shudder is one of the most commonly misdiagnosed conditions in an automatic transmission. The key to diagnosing TCC shudder is to note when it happens and under what conditions. Once the TCC has been fully applied, it is nearly impossible to make it shudder. TCC shudder (short burst of noise normally less than 1 second) will only occur during clutch applying. It is not a steady state condition. 2. Drive until whole drivetrain is at normal operating temperature. – On 4WD vehicles, the test must be performed with transfer case selector lever in “2H” position. – Shudder is a short burst of noise normally less than 1 second in duration, and can be induced by the following maneuver: 3. From coast condition at 50 mph in “D” range (Normal mode), depress the throttle to 1/4-1/3 throttle. If present, shudder will occur within 5 seconds together with TCC application.(The scan tool may be used to determine the exact time of TCC applying) Was the problem found?	Replace transmission fluid and filter (remove both pans) and flush cooler lines. Replace converter assembly and O-ring on turbine shaft	Perform mechanical inspection of other drivetrain components.

Chart 14: Possible Causes Of Transmission Noise

CAUTION: Before checking transmission for what is believed to be transmission noise, ensure presence and positioning of insulating plugs, pads etc. Also make sure that noise does not come from other drivetrain components.

Condition	Possible cause	Correction
Whine or Buzz	Oil level low	Fill with ATF, check for external leaks.
	Plugged or restricted oil filter	Inspect oil filter. Replace oil filter or ATF as necessary.
	Damaged oil filter gasket	Replace oil filter gasket.
Knocking noise from front of transmission.	Loose bolts (Converter to flex plate)	Tighten to specifications.
	Cracked or broken flex plate	Replace flex plate.
	Converter damaged	Replace converter.
Knocking noise while driving, mostly on acceleration.	Transmission mount loose or broken	Tighten mount bolts or replace transmission mount.
	Cooler line mounts loose or broken	Tighten or replace cooler line mounts.
	Cooler lines touching body or frame	Repair or replace as necessary.
Knocking noise when vehicle is stationary.	Loose flex plate mounting bolts	Tighten to specifications.
	Cracked or broken flex plate	Replace flex plate.
	Damaged converter	Replace converter.

Chart 15a: Possible Causes of Low Line Pressure

Step	Action	Yes	No
1	Check oil level. Was the problem found?	Fill with ATF	Go to Step 2
2	Check for defective throttle position sensor. Was the problem found?	Replace throttle position sensor	Go to Step 3
3	Check for plugged, loose, or damaged oil filter (79). Was the problem found?	Inspect oil filter, tighten bolts or replace oil filter (79)	Go to Step 4
4	Check for a stuck force motor plunger (404). (Adapter case valve body) Was the problem found?	Replace force motor plunger (404)	Go to Step 5
5	Check for a stuck feed limit valve (412). (Adapter case valve body) Was the problem found?	Replace feed limit valve (412)	Go to Step 6
6	Check for loose converter bolts (4 & 5). Was the problem found?	Tighten converter bolts (4 & 5)	Go to Step 7
7	Check for a stuck pressure regulator valve (217). (Oil pump) Was the problem found?	Replace pressure regulator valve (217)	Go to Step 8
8	Check for a stuck boost valve (213).(Oil pump) Was the problem found?	Replace boost valve (213)	Go to Step 9
9	Check for blocked intermediate oil passages to pressure regulator valve. (Oil pump) Was the problem found?	Replace oil pump	Go to Step 10
10	Check for defective oil pump (9, 201, 202 & 228). Was the problem found?	Replace oil pump	Go to Step 11
11	Check for internal leaks. – Check balls missing or out of location in valve bodies – Seals cut or damaged – Gaskets defective, etc. Was the problem found?	Install balls, or correct ball location Replace seals Replace gaskets	—

Chart 15b: Possible Causes Of High Line Pressure

NOTE: If transmission is operating in backup mode, high line pressure will be present.

Step	Action	Yes	No
1	Check for defective throttle position sensor. Was the problem found?	Replace throttle position sensor.	Go to Step 2.
2	Check for a stuck force motor plunger (404). (Open circuit/intermittent) (Adapter case valve body) Was the problem found?	Replace force motor plunger (404)	Go to Step 3
3	Check for a stuck feed limit valve (412). (Adapter case valve body) Was the problem found?	Replace force motor plunger (412)	Go to Step 4
4	Check converter bolts (4 & 5). Was the problem found?	Tighten converter bolts (4 & 5)	Go to Step 5
5	Check for a stuck pressure regulator valve (217). (Oil pump) Was the problem found?	Replace pressure regulator valve (217)	Go to Step 6
6	Check for a stuck boost valve (213). (Oil pump) Was the problem found?	Replace boost valve (213)	Go to Step 7
7	Check for internal leaks. – Check balls missing or out of location in valve bodies – Seals cut or missing – Gaskets defective, etc. Was the problem found?	Install balls, or correct ball location Replace seals Replace gaskets	—

Chart 16: Possible Causes Of Transmission Fluid Leaks

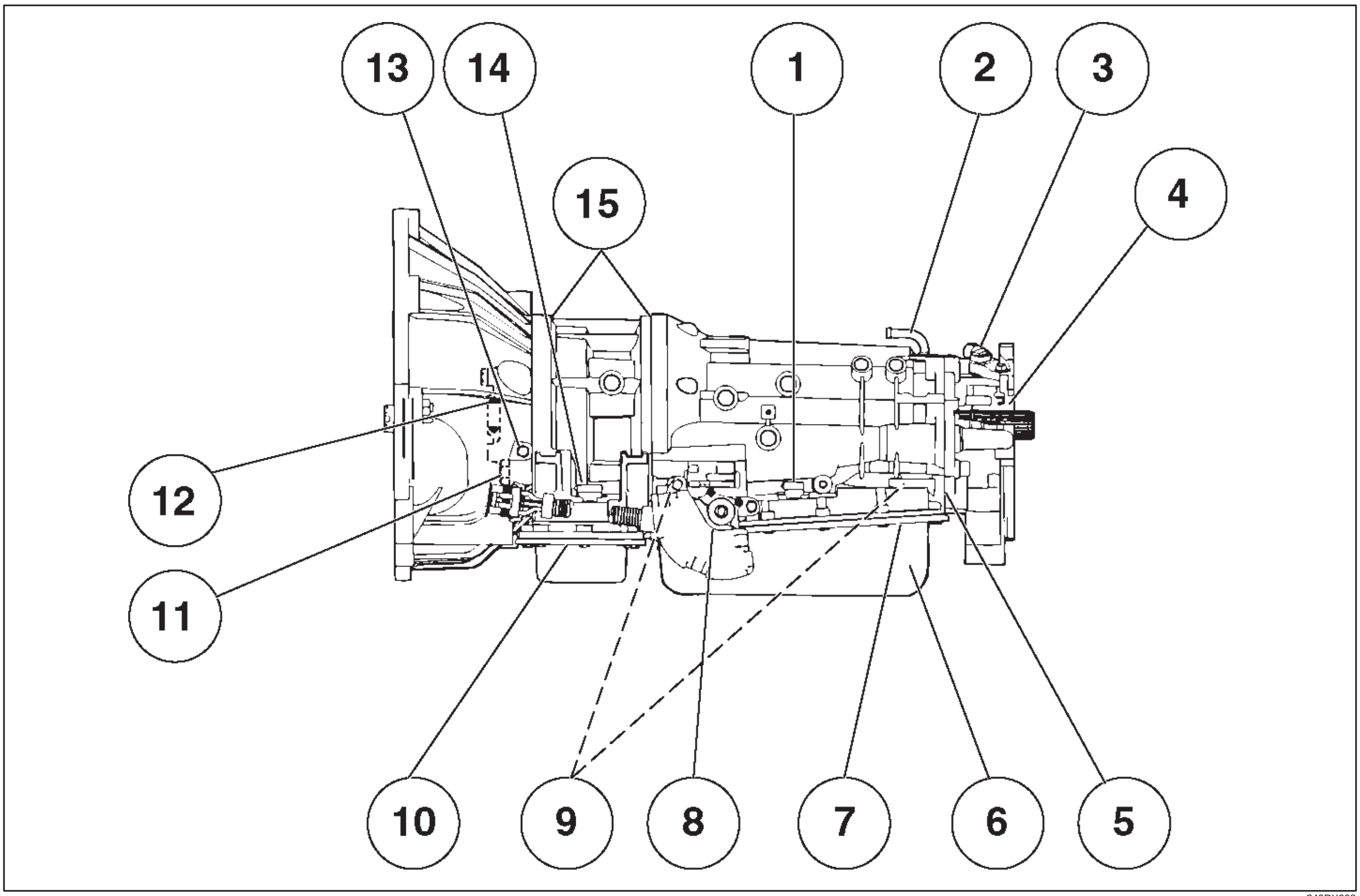
Before attempting to correct an oil leak, the actual source of the leak must be determined. In many cases, the source of the leak may be difficult to determine due to “wind flow” around the engine and transmission.

The suspected area should be wiped clean before inspecting for the source of the leak.

Oil leaks around the engine and transmission are generally carried toward the rear of the vehicle by the air stream. In determining the source of an oil leak, the following two checks should be made:

1. With the engine running, check for external line pressure leaks.
2. With the engine off, check for oil leaks due to the raised oil level caused by drainback of converter oil into the transmission.

Possible Causes Of Fluid Leaks Due To Sealing Malfunction



Legend

(1) Electrical Connector (Main Case) Seal
(2) Transmission Vent (Breather)
(3) Speed Sensor O–Ring
(4) Extension (Adapter) Lip Seal
(5) Extension (Adapter) to Main Case Gasket
(6) Overfill and Oil Drain Screws Gasket
(7) Oil Pan Gasket (Main Case)
(8) Selector Shaft Seal
(9) Oil Cooler Connectors (2)
(10) Oil Pan Gasket (Adapter Case)
(11) Converter housing attaching bolts not correctly torqued
(12) Converter Housing Lip Seal
(13) Line Pressure Tap Plug
(14) Electrical Connector (Adapter Case) Seal
(15) Adapter Case Seal Rings (2)

Stall Test

The stall test allows you to check the transmission for internal abrasion and the one way clutch for slippage. Torque converter performance can also be evaluated.
The stall test results together with the road test results will identify transmission components requiring servicing or adjustment.

Stall Test Procedure:

1. Check the level of the engine coolant, the engine oil, and the automatic transmission fluid. Replenish if necessary.
2. Block the wheels and set the parking brake.
3. Connect a tachometer to the engine.
4. Start the engine and allow it to idle until the engine coolant temperature reaches 70 – 80˚C (158 – 176˚F).
5. Hold the brake pedal down as far as it will go.
6. Place the selector in the "D" range.
7. Gradually push the accelerator pedal to the floor.
   The throttle valve will be fully open.
   Note the engine speed at which the tachometer needle stabilizes.

Stall Speed : 2,100 ±150 rpm

NOTE: Do not continuously run this test longer than 5 seconds.

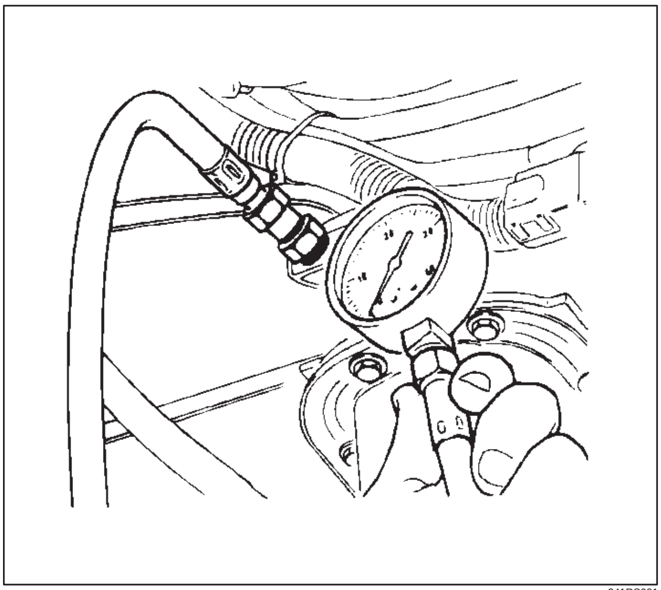
8. Release the accelerator pedal.
9. Place the selector in the "N" range.
10. Run the engine at 1,200 rpm for one minute.
    This will cool the transmission fluid.
11. Repeat Steps 7 – 10 for the "3", "2", "L" and "R" ranges.

Line Pressure Test

The line pressure test checks oil pump and control valve pressure regulator valve function. It will also detect oil leakage.

Line Pressure Test Procedure:

1. Check the level of the engine coolant, the engine oil, and the automatic transmission fluid.
   Replenish if required.
2. Block the wheels and set the parking brake.
3. Remove the pressure detection plug at the left side of the transmission case.
   Set J–29770–A pressure gauge and adapter to the pressure detection plug hole.



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4. Start the engine and allow it to idle until the engine coolant temperature reaches 70 – 80˚C (158 – 176˚F).
5. Hold the brake pedal down as far as it will go.
6. Place the selector in the "D" range.
7. Note the pressure gauge reading with the engine idling.
8. Gradually push the accelerator pedal to the floor. The throttle valve will be fully open.
   Note the pressure gauge reading with the accelerator pedal fully depressed.

NOTE: Do not continuously run this test longer than 5 seconds.

9. Release the accelerator pedal.
10. Place the selector in the "N" range.
11. Run the engine at 1,200 rpm for one minute.
    This will cool the transmission fluid.
12. Repeat Steps 7 – 11 for the "3", "2", "L", and "R" ranges.
13. Install a pressure detection plug to the transmission case, applying recommended thread locking agent (LOCTITE 242) or its equivalent to thread of plug. Make sure that thread is cleaned before applying locking agents.
14. Tighten the pressure detection plug to the specified torque.

Torque: 9 – 14N·m (7 – 10lb ft)

MODE	LEVER POSITION	ENGINE SPEED	LINE PRESSURE		FORCE MOTOR CURRENT (mA)
			kPa	PSI	
NORMAL/POWER	D,3,2,L	IDLE	590 – 730	86 – 106	680 – 720
WINTER	D	IDLE	300 – 390	44 – 57	1,020 – 1,060
NORMAL/POWER WINTER	REVERSE	IDLE	460 – 630	67 – 91	880 – 920
NORMAL/POWER	D, 3, 2, L	STALL SPEED	1,250 – 1,380	181 – 200	70 – 110
WINTER	D	STALL SPEED	1,250 – 1,380	181 – 200	70 – 110
NORMAL/POWER WINTER	REVERSE	STALL SPEED	1,400 – 1,580	203 – 229	340 – 380

Shift Speed Chart

Transfer gear ratio:	High: 1.000
Rear axle ratio:	4.300

“Normal mode”

Upshift

Range	Throttle opening	1 → 2 (First Gear) (Second Gear) km/h (mph)	2 → 3 (Second Gear) (Third Gear) km/h (mph)	3 → 4 (Third Gear) (Fourth Gear) km/h (mph)
D (Drive)	Fully opened	53 ~ 59 (33 ~ 37)	110 ~ 116 (68 ~ 72)	166 ~ 172 (103 ~ 107)
	Half throttle	32 ~ 38 (20 ~ 24)	57 ~ 63 (35 ~ 39)	99 ~ 105 (61 ~ 65)
3 (Third)	Fully opened	53 ~ 59 (33 ~ 37)	110 ~ 116 (68 ~ 72)	—
	Half throttle	32 ~ 38 (20 ~ 24)	57 ~ 63 (35 ~ 39)	—
2 (Second)	Fully opened	53 ~ 59 (33 ~ 37)	—	—
	Half throttle	32 ~ 38 (20 ~ 24)	—	—

Downshift

Range	Throttle opening	1 ← 2 (First Gear) (Second Gear) km/h (mph)	2 ← 3 (Second Gear) (Third Gear) km/h (mph)	3 ← 4 (Third Gear) (Fourth Gear) km/h (mph)
D (Drive)	Fully opened	45 ~ 51 (28 ~ 32)	87 ~ 93 (54 ~ 58)	155 ~ 161 (96 ~ 100)
	Half throttle	14 ~ 20 (9 ~ 12)	33 ~ 39 (20 ~ 24)	64 ~ 70 (40 ~ 43)
	Fully closed	13 ~ 19 (8 ~ 12)	19 ~ 25 (12 ~ 16)	27 ~ 33 (17 ~ 21)
3 (Third)	Fully opened	45 ~ 51 (28 ~ 32)	87 ~ 93 (54 ~ 58)	—
	Half throttle	14 ~ 20 (9 ~ 12)	33 ~ 39 (20 ~ 24)	—
	Fully closed	13 ~ 19 (8 ~ 12)	19 ~ 25 (12 ~ 16)	—
2 (Second)	Fully opened	45 ~ 51 (28 ~ 32)	92 ~ 98 (57 ~ 61)	—
	Half throttle	14 ~ 20 (9 ~ 12)	92 ~ 98 (57 ~ 61)	—
	Fully closed	13 ~ 19 (8 ~ 12)	92 ~ 98 (57 ~ 61)	—
L (First)	—	48 ~ 54 (30 ~ 34)	—	—

“Power mode”

Upshift

Range	Throttle opening	1 → 2 (First Gear) (Second Gear) km/h (mph)	2 → 3 (Second Gear) (Third Gear) km/h (mph)	3 → 4 (Third Gear) (Fourth Gear) km/h (mph)
D (Drive)	Fully opened	53 ~ 59 (33 ~ 37)	110 ~ 116 (68 ~ 72)	174 ~ 180 (108 ~ 112)
	Half throttle	41 ~ 47 (25 ~ 29)	84 ~ 90 (52 ~ 56)	136 ~ 142 (84 ~ 88)
3 (Third)	Fully opened	53 ~ 59 (33 ~ 37)	110 ~ 116 (68 ~ 72)	—
	Half throttle	41 ~ 47 (25 ~ 29)	84 ~ 90 (52 ~ 56)	—
2 (Second)	Fully opened	53 ~ 59 (33 ~ 37)	—	—
	Half throttle	41 ~ 47 (25 ~ 29)	—	—

Downshift

Range	Throttle opening	1 ← 2 (First Gear) (Second Gear) km/h (mph)	2 ← 3 (Second Gear) (Third Gear) km/h (mph)	3 ← 4 (Third Gear) (Fourth Gear) km/h (mph)
D (Drive)	Fully opened	45 ~ 51 (28 ~ 32)	104 ~ 110 (65 ~ 68)	163 ~ 169 (101 ~ 105)
	Half throttle	22 ~ 28 (14 ~ 17)	57 ~ 63 (35 ~ 39)	108 ~ 114 (67 ~ 71)
	Fully closed	13 ~ 19 (8 ~ 12)	23 ~ 29 (14 ~ 18)	46 ~ 52 (29 ~ 32)
3 (Third)	Fully opened	45 ~ 51 (28 ~ 32)	104 ~ 110 (65 ~ 68)	—
	Half throttle	22 ~ 28 (14 ~ 17)	57 ~ 63 (35 ~ 39)	—
	Fully closed	13 ~ 19 (8 ~ 12)	23 ~ 29 (14 ~ 18)	—
2 (Second)	Fully opened	45 ~ 51 (28 ~ 32)	92 ~ 98 (57 ~ 61)	—
	Half throttle	22 ~ 28 (14 ~ 17)	92 ~ 98 (57 ~ 61)	—
	Fully closed	13 ~ 19 (8 ~ 12)	92 ~ 98 (57 ~ 61)	—
L (First)	—	48 ~ 54 (30 ~ 34)	—	—

“Winter mode”

D range, winter mode ON → OFF	31 ~ 37 km/h (19 ~ 23 mph)

Lockup Speed Chart

Transfer gear ratio	High: 1.000
Rear axle ratio	4.300

D range Throttle opening 6%	Mode	ECCC Apply			ECCC Release		
		2nd Km/h (mph)	3rd Km/h (mph)	4th Km/h (mph)	2nd Km/h (mph)	3rd Km/h (mph)	4th Km/h (mph)
	Normal	57 ~ 63 (35 ~ 39)	42 ~ 48 (26 ~ 30)	43 ~ 49 (27 ~ 31)	52 ~ 58 (32 ~ 36)	32 ~ 38 (20 ~ 24)	41 ~ 47 (25 ~ 29)
	Power	57 ~ 63 (35 ~ 39)	67 ~ 73 (42 ~ 45)	57 ~ 63 (35 ~ 39)	52 ~ 58 (32 ~ 36)	32 ~ 38 (20 ~ 24)	49 ~ 55 (30 ~ 34)

Changing Transmission Fluid

There is no need to change the transmission fluid unless the transmission is used under one or more of the following heavy duty conditions.

A. Repeated short trips
B. Driving on rough roads
C. Driving on dusty roads
D. Towing a trailer

If the vehicle is used under these conditions, change the fluid every 20,000 miles (32,000 km).

1. Place a large drain pan under the oil pan.
2. Remove the transmission oil drain screw (2) and drain fluid.
3. Tighten drain screw (2).

   Torque: 38 N•m (28 lb ft)

4. Remove the transmission overfill screw (1) and fill transmission through overfill screw opening, using DEXRON®–III ATF.

NOTE: Add transmission fluid until it flows out over the overfill screw opening.

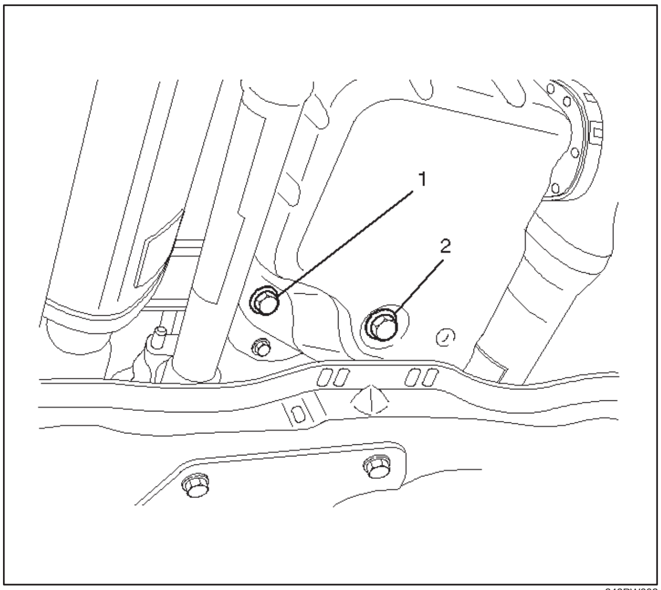
5. Let engine idle until a fluid temperature between 32˚C (90˚F) and 57˚C (135˚F) is reached.
6. Add transmission fluid until it flows out over the overfill screw opening, then close the overfill screw (1).

   Torque: 38 N•m (28 lb ft)

NOTE: To prevent fluid leaks, the overfill screw and oil drain screws gasket must be replaced each time these screws are removed.

NOTE: Check transmission fluid temperature with service scan tool.

7. Reset "Oil Life Monitor" data by using Tech 2.
   Refer to Tech 2 OBD II Connection in Transmission Control System (4L30-E) section.

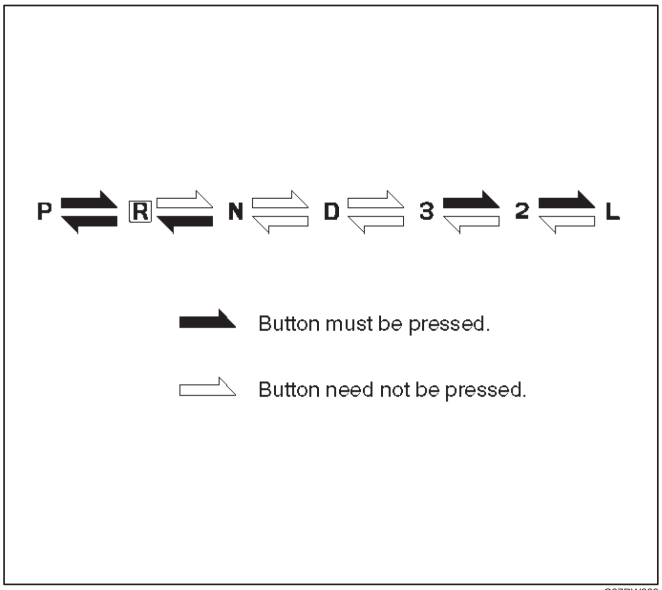


242RW003

Selector Lever

Inspection

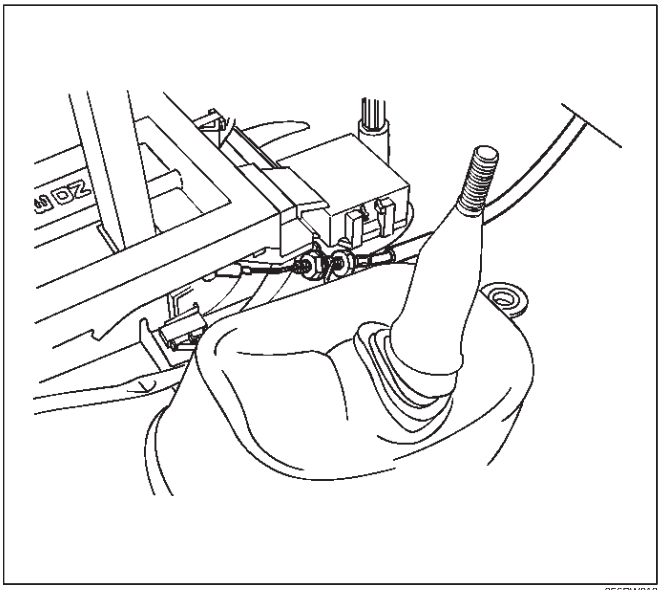
1. Make sure that when the selector lever is shifted from "P" to "L", a "clicking" can be felt at each shift position. Make sure that the gear corresponds to that of the position plate indicator.
2. Check to see if the selector lever can be shifted as shown in illustration.



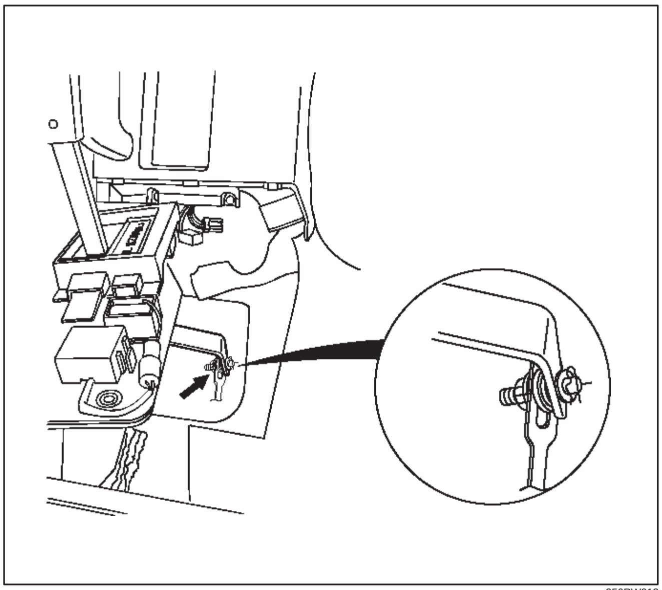
C07RW009

Removal

1. Disconnect battery ground cable.
2. Remove transfer control lever knob (4×4).
3. Remove front console.
   - Disconnect wiring harness connectors from front console.
4. Disconnect shift lock cable (1) from the selector lever assembly side.


256RW012

5. Disconnect shift control rod (2) from the selector lever assembly side.



256RW013

6. Disconnect wiring harness connectors from the selector lever assembly.
7. Remove selector lever assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

Adjustment of select lever and control rod

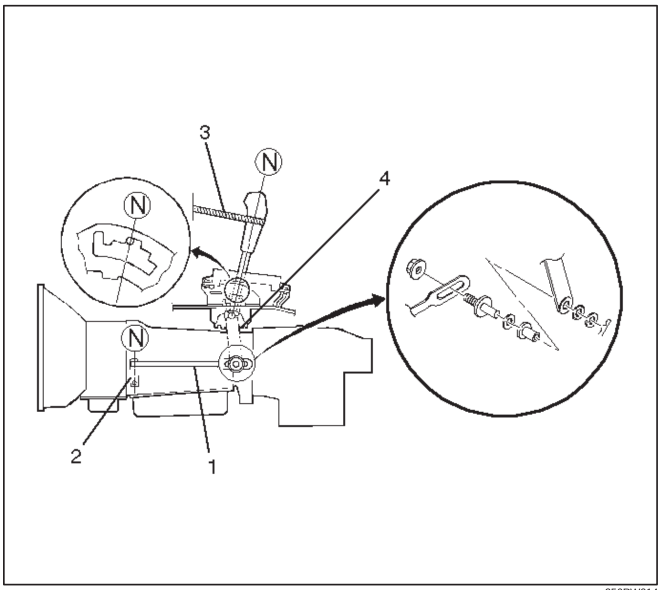
1. Place the vehicle on a level surface.

NOTE: If the vehicle is not on level surface, the shift select cable set positions will vary with the movement of engine. To prevent possible misadjustment of the cable, the vehicle must be placed on a level surface.

2. Install the shift control rod (1) to the transmission select lever (2), and then place the lever in the "N" position.
3. Set select lever in the "N" position.
4. Push select lever forward ("R" position side) and secure it (using a rubber band (3), etc.) so that the pin comes into contact with the wall of the detent plate.
5. Install the shift control rod (1) to the selector lever arm (4).

Torque: 32 N•m (24 lb ft)

NOTE: Do not apply oil to the threaded portions.



256RW014

6. After adjustment, make sure that the selector lever operates normally, and that each selector position is properly indicated. (The red mark shows through the window.)

Adjustment of shift lock cable

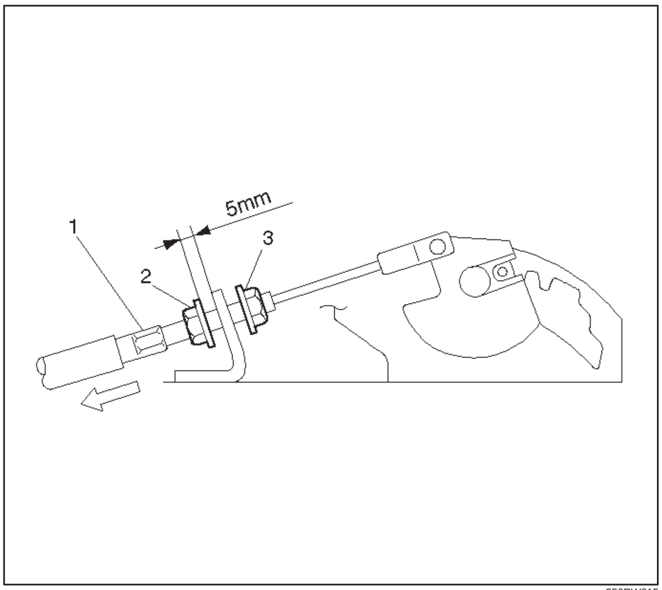
1. Set ignition key in "LOCK" position and selector lever in "P" position.
2. Adjust cable screw cap on selector lever side to provide a gap (slack for cable) of 1 – 2 mm between rod on steering lock side and stopper.

   Adjust cap as follows:

   a. Pull screw cap (1) in arrow direction to remove inner cable slack.
   b. With cable kept as (a), adjust gap between nut (2) and bracket to 5 mm (0.2 in).
   c. Lock inner cable by turning nut (3) while holding nut (2) in place.

Torque : 3.7 N•m (33 lb in)

NOTE: Clean the cable threads, and do not apply oil to them.



256RW015

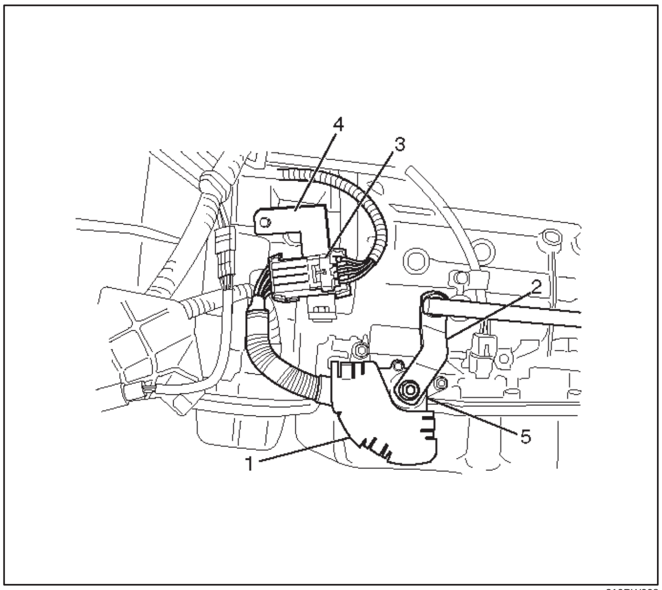
3. Check the shift lock operation:
   a. Selector lever should not move out of “P” position with ignition key in “Lock” position.
   b. Selector lever can be moved out of “P” position with ignition key in “ON” position only when brake pedal is depressed.
   c. Ignition key can be turned to “LOCK” position only when selector lever is in “P” position (key can be pulled out).

   If (a) and (c) fail, readjust cable. If (b) fails, readjust connector wiring and brake pedal switch.

Mode Switch

Removal

1. Place selector lever in neutral.
2. Disconnect battery ground cable.
3. Remove mode switch cover (1).
4. Disconnect selector lever (2) from the mode switch.
5. Disconnect transmission harness from the mode switch connector (3).
6. Remove bracket with mode switch connector from the transmission case.
7. Remove mode switch connector (3) from the bracket (4).
8. Remove two mode switch bolts and nut then remove mode switch (5).



210RW008

Installation

To install, follow the removal steps in the reverse order, noting the following points;

1. Torque

   Mode switch bolt: 13 N•m (113 lb in)

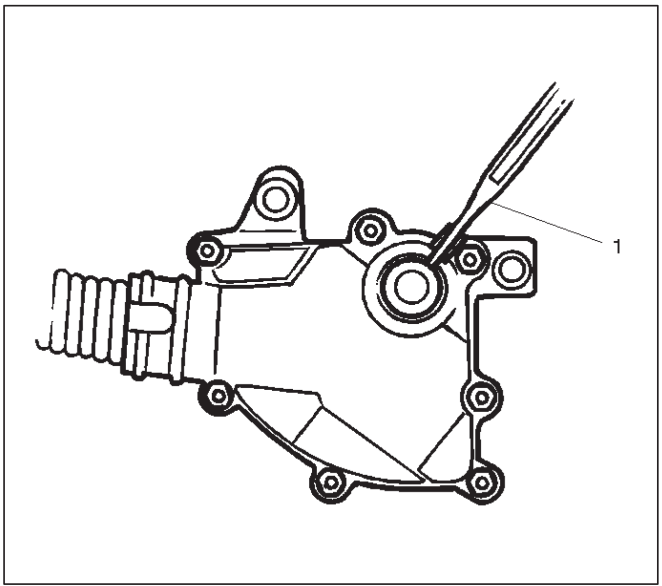
   Selector lever nut: 23 N•m (17 lb ft)

2. Mode switch setting procedure

   Perform either of the following adjustment procedures:

   Procedure 1

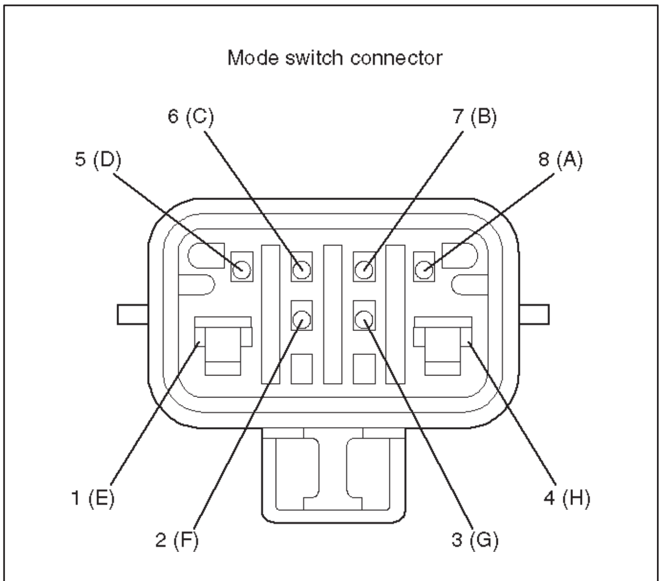
   a. Place selector lever in neutral.
   b. Remove selector lever from the mode switch.
   c. Remove the mode switch cover.
   d. Loosen the two 10 mm screws.
   e. Rotate the mode switch until the slot in the mode switch housing aligns with the selector shaft bushing, and insert a 3/32 in. (2.4 mm) drill bit or punch (1) into the slot.
   f. Tighten the screws to 13 N·m (113 lb in).
   g. After completing adjustment, snap the mode switch cover into place.
   h. Reinstall the selector lever.



249RW001

Procedure 2

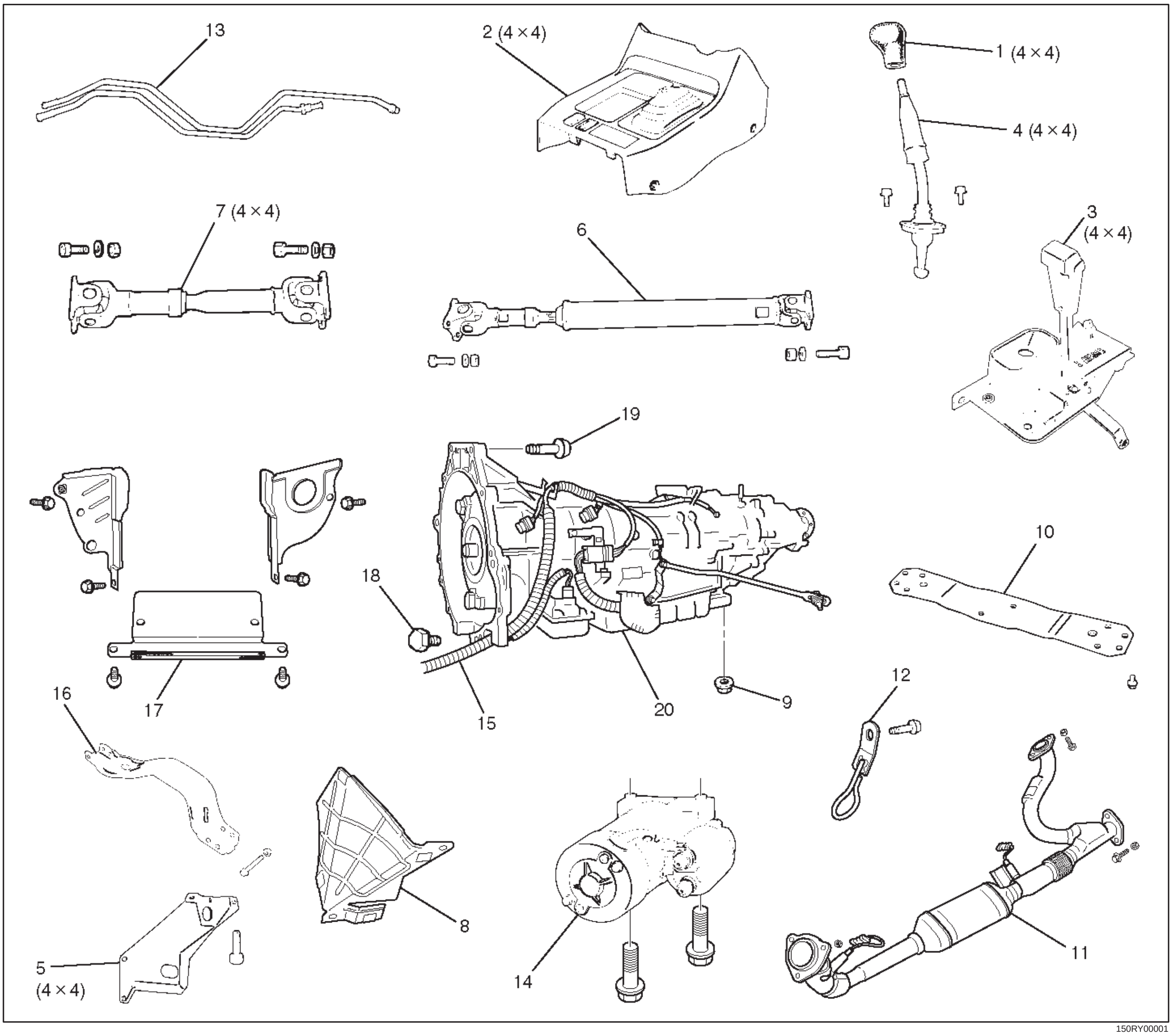
a. Place selector lever in neutral.
b. Disconnect transmission harness connector from mode switch connector.
c. Remove mode switch connector with bracket from the transmission case.
d. Connect multimeter (resistance mode) to terminals 1(E) and 4(H) on mode switch connector.
e. Loosen two mounting screws.
f. Rotate mode switch slightly in both directions to determine the range (approx. 5 degrees) of electrical contact.
g. Position mode switch in middle of contact range.
h. Tighten two mounting screws.
i. Remove multimeter and install mode switch harness connector with bracket to the transmission case.
j. Connect transmission harness connector to mode switch connector.



F07RW003

Transmission (With Transfer Case / Extension Assembly)

Transmission And Associated Parts



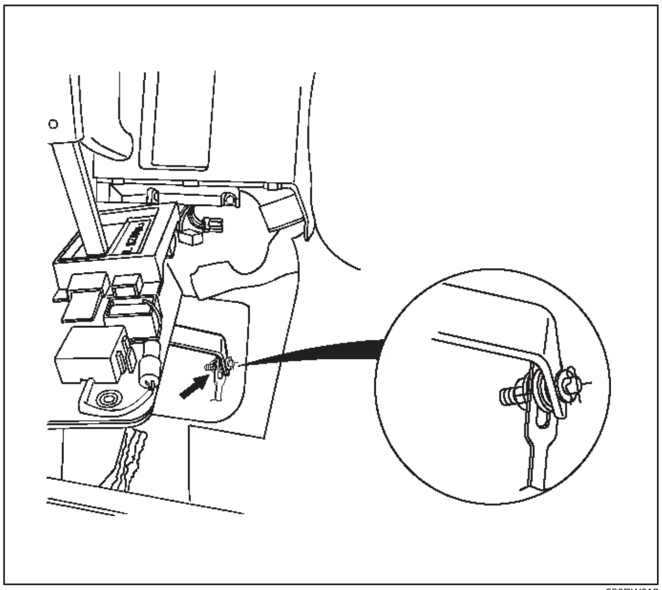
Legend

(1) Transfer Control Lever Knob (4×4)
(2) Front Console
(3) Selector Lever Assembly
(4) Transfer Control Lever (4×4)
(5) Transfer Protector (4×4)
(6) Rear Propeller Shaft
(7) Front Propeller Shaft (4×4)
(8) Harness Protector
(9) Rear Mount Nut
(10) Third Crossmember
(11) Left Catalytic Converter Assembly
(12) Seat Belt Tension Rod
(13) Transmission Oil Cooler Pipe
(14) Starter
(15) Transmission Harness Connector
(16) Front Crossmember
(17) Under Cover
(18) Torque Converter Bolt
(19) Engine Transmission Bolt
(20) Transmission Assembly (With Transfer Case / Extension Assembly)

Removal

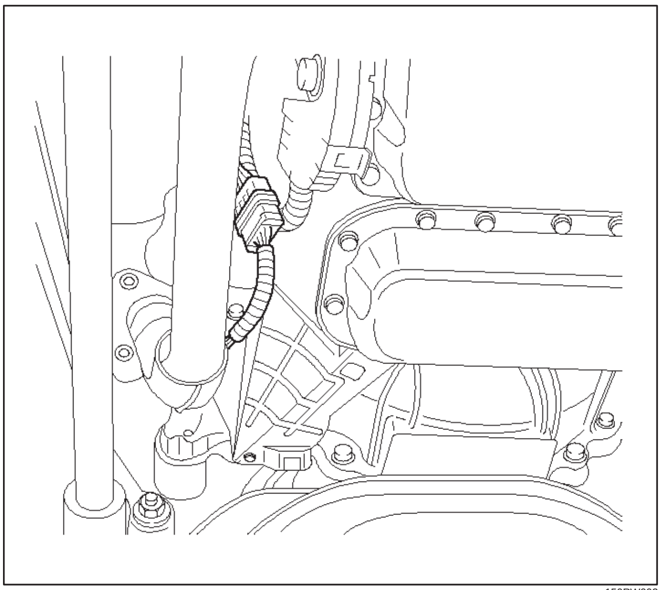
NOTE: Before remove transmission and transfer assembly from vehicle, change the tansfer mode to 2WD using push button on dash panel.

1. Remove engine hood.
2. Disconnect battery ground cable.
3. Remove transfer control lever knob (1) (4×4) and disconnect wiring harness connectors, then remove front console (2).
4. Remove selector lever assembly (3).
5. Remove transfer control lever (4) (4×4).
6. Remove transfer protector (5) (4×4).
7. Disconnect shift control rod from the selector lever assembly side.



256RW013

8. Remove rear propeller shaft (6).
9. Remove front propeller shaft (7) (4×4).
10. Remove harness protector (8).
11. Support transfer case (4×4) or transmission (4×2) with a jack and remove two rear mount nuts (9) from the 3rd crossmember side.
12. Remove eight third crossmember bolts and third crossmember (10).
13. Remove front exhaust silencer mounting nuts.
14. Remove left seat belt tension rod.
15. Disconnect two left side oxygen sensor connectors from the transmission harness.

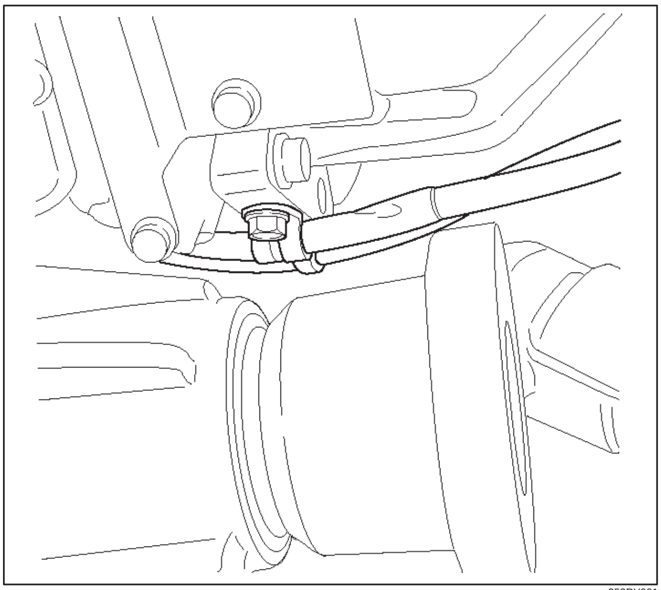


150RW002

16. Remove left catalytic converter assembly (11).
17. Loosen right catalytic converter nuts to exhaust manifold.

NOTE: This will make the next steps easier.

18. Disconnect transmission oil cooler pipe (12) from A/T side.
19. Remove oil pipe clamp from torque converter housing bracket.



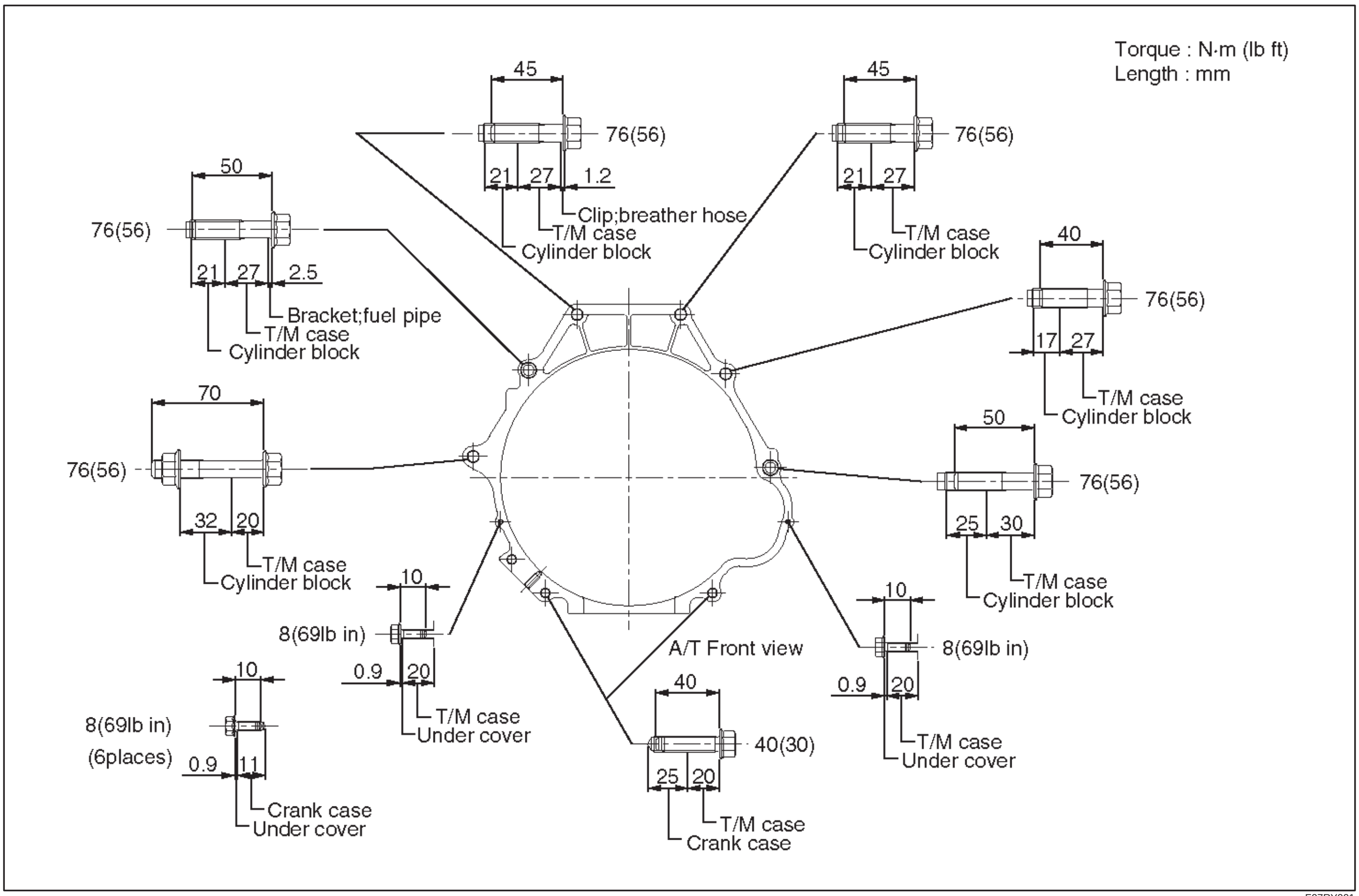
253RY001

20. Loosen oil pipe clamp bolt at the engine mount side.
21. Remove starter (14).
22. Disconnect fuel pipe clamp brackets from transmission side.
23. Disconnect transmission harness connectors (15) from transmission, transfer, and right catalytic converter.
24. Remove front crossmember (16).
25. Remove under covers (3 pieces) (17) from transmission case.
26. Remove flex plate torque converter fixing bolts (6 pieces) (18) by turning crankshaft.

27. Support the transmission with a transmission jack, and hoist engine with a chain block.
28. Remove engine transmission fixing bolts (19).
29. Remove transmission assembly with transfer case (4×4) / extension assembly (4×2) (20).
30. Remove transfer case / extension assembly from the transmission assembly if necessary.

Installation

1. Slowly raise transmission jack until front of the transmission is aligned with rear of the engine, then install transmission assembly.
2. Tighten engine transmission bolts, to the specified torque.

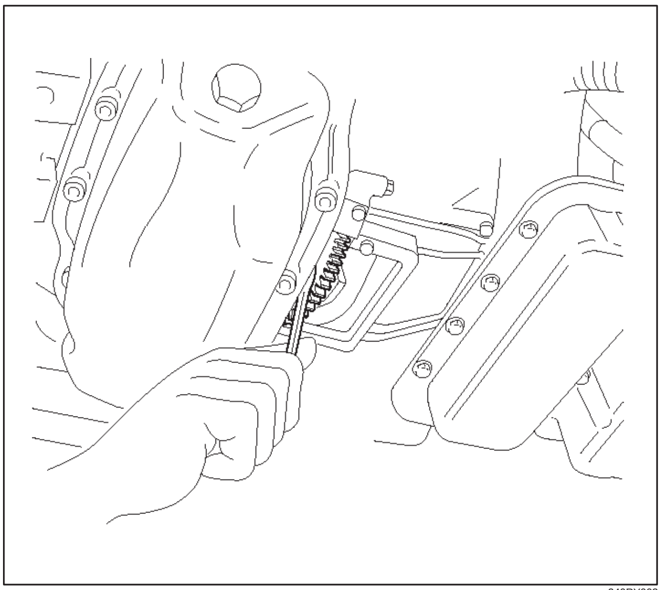


F07RY001

3. Support transfer case with a jack, and remove the transmission jack.
4. Install flex plate torque converter bolts (6 pieces) by turning crankshaft.

Torque: 54 N•m (40 lb ft)

NOTE: Do not reuse the flex plate torque converter bolt.


240RY003

5. Install the under cover (3 pieces), and tighten the bolts to the specified torque.

   Torque: 8 N•m (69 lb in)

6. Install front crossmember.

   Torque: 78 N•m (58 lb ft)

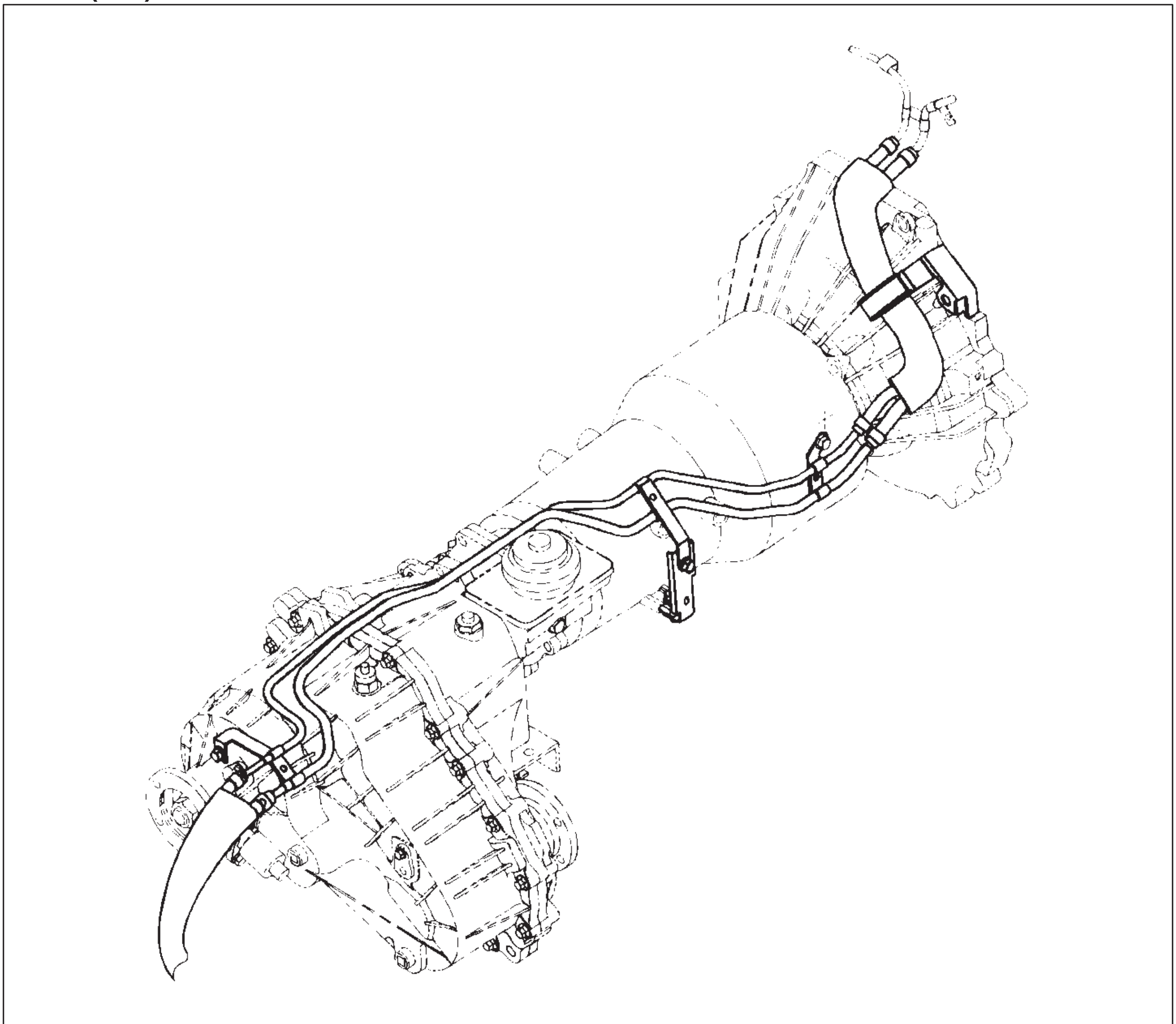
7. Install the starter, and tighten the bolts to the specified torque.

   Torque: 40 N•m (30 lb ft)

8. Connect transmission harness connectors to transmission, transfer, and right catalytic converter.

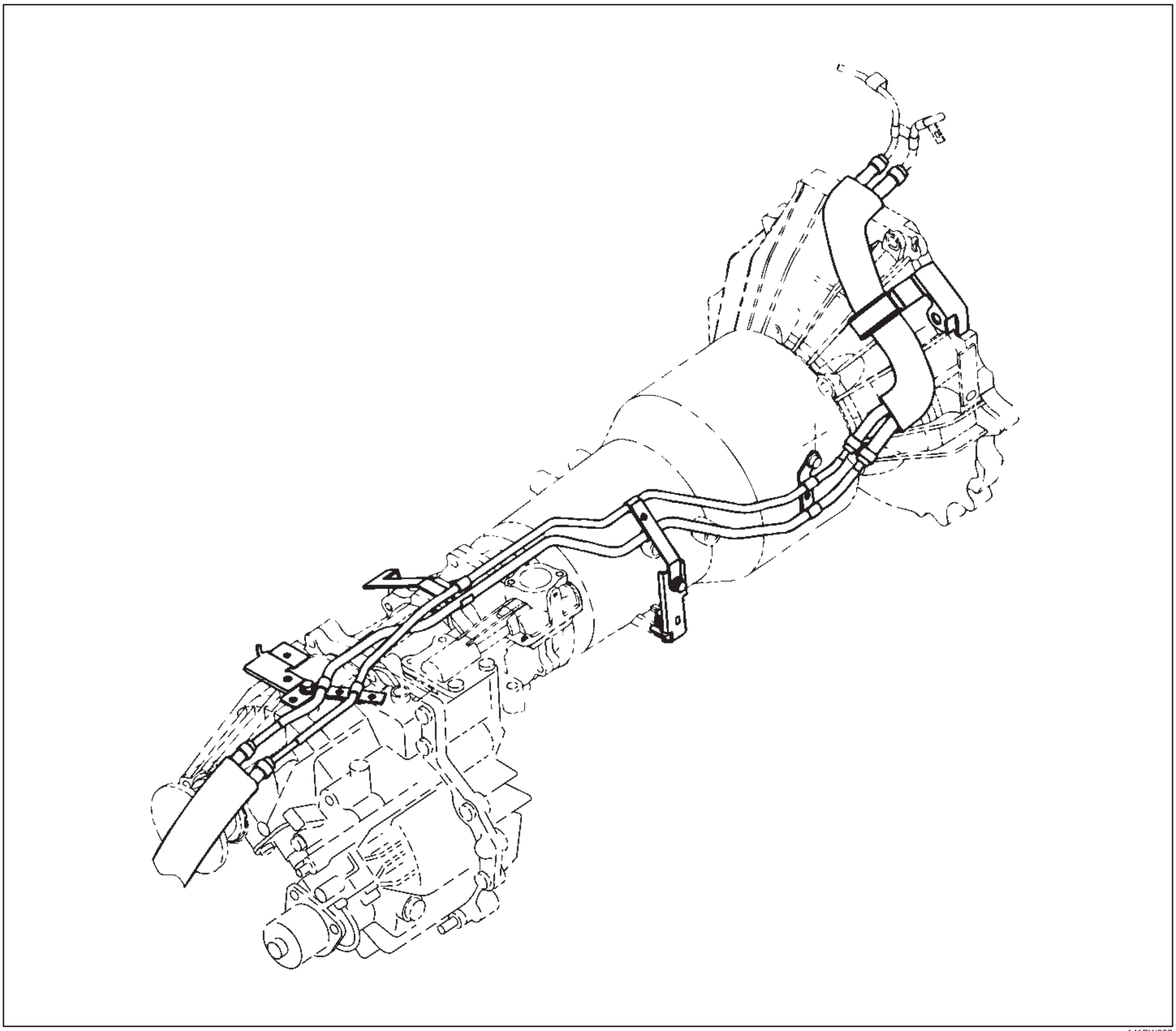
9. Connect fuel pipe brackets to transmission side.

For 4×4 (TOD)



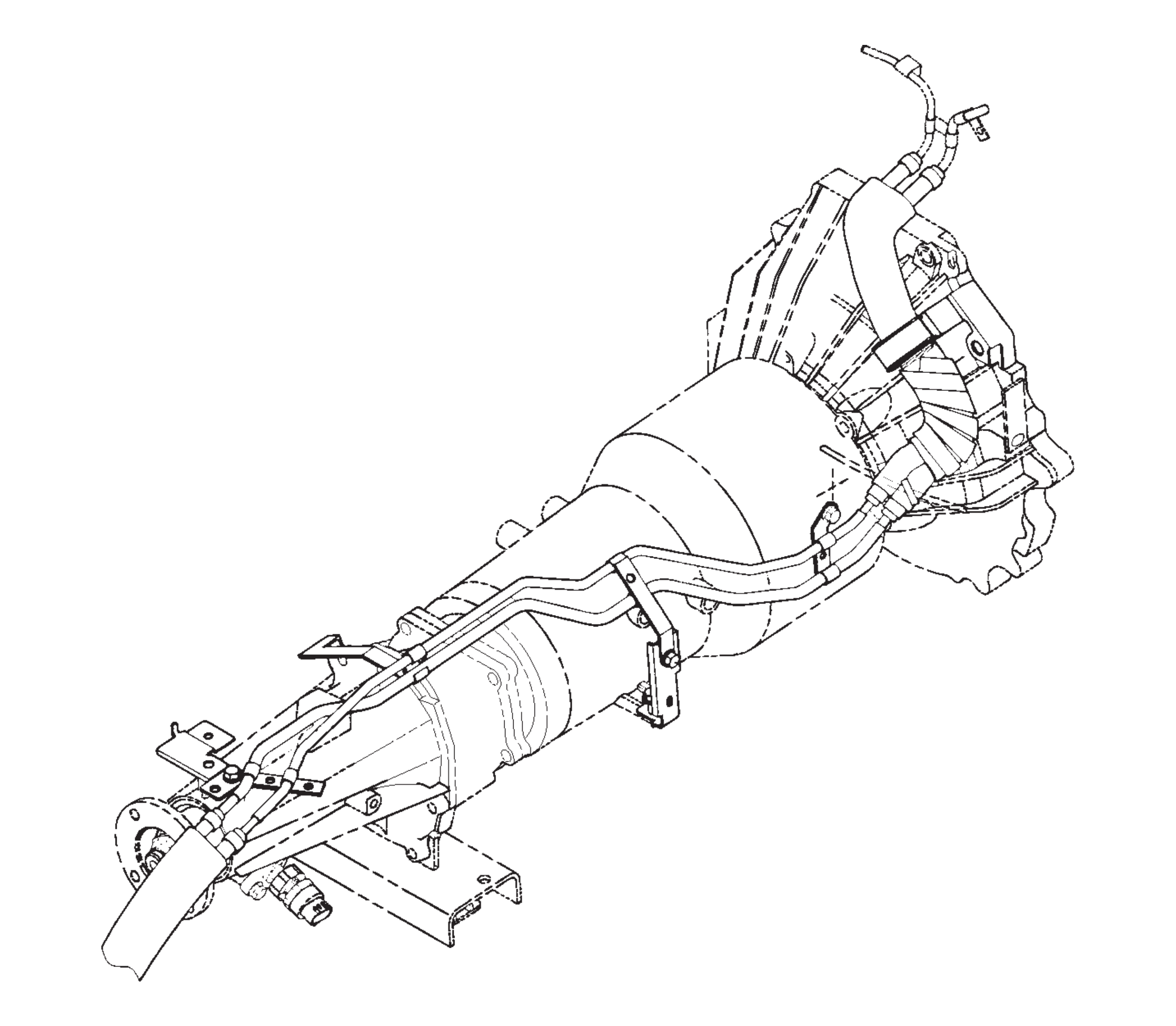
141RW001

For 4×4



141RW027

For 4×2



10. Install transmission oil cooler pipe to transmission.

    Torque: 44 N•m (33 lb ft)

11. Install oil pipe clamp to torque converter housing bracket.
12. Tighten oil pipe clamp bolt at engine mount side.
13. Install right catalytic converter, tighten to the specified torque.

    Torque: 67 N•m (49 lb ft)

14. Install left catalytic converter assembly, and tighten the bolts to the specified torque.

    Exh. pipe to exh. manifold 67 N•m (49 lb ft)

    Exh. pipe flange bolt 43 N•m (32 lb ft)

15. Install left seat belt tension rod.

    Torque: 39 N•m (29 lb ft)

16. Connect two left side oxygen sensor connectors to the transmission harness.
17. Install front exhaust silencer mounting nuts.
18. Install third crossmember, and tighten the bolts to the specified torque.

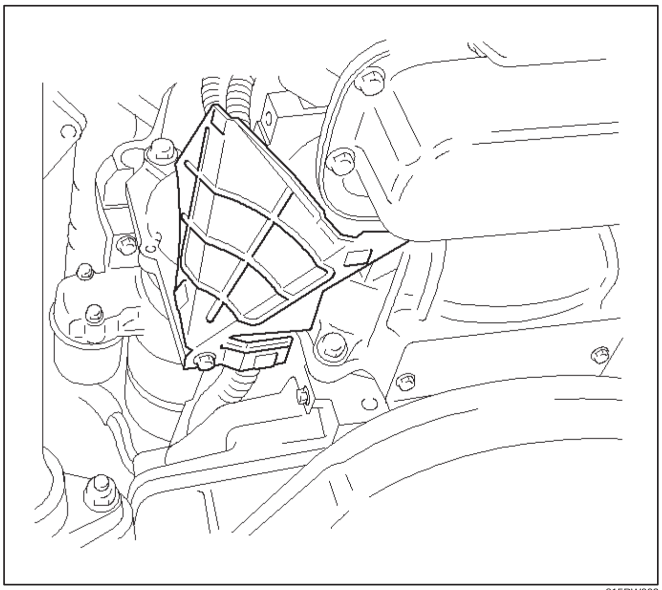
    Torque: 76 N•m (56 lb ft)

19. Install rear mount nuts, and tighten the bolts to the specified torque.

    Torque: 50 N•m (37 lb ft)

20. Remove the jack from the transfer case.

21. Install harness protector.



815RW002

22. Install the front propeller shaft, and tighten the bolts to the specified torque (4×4).

Torque: 63 N•m (46 lb ft)

23. Install the rear propeller shaft, and tighten the bolts to the specified torque.

Torque: 63 N•m (46 lb ft)

24. Connect the shift control rod to selector lever assembly.
25. Install the transfer protectors, and tighten the bolts to the specified torque (4×4).

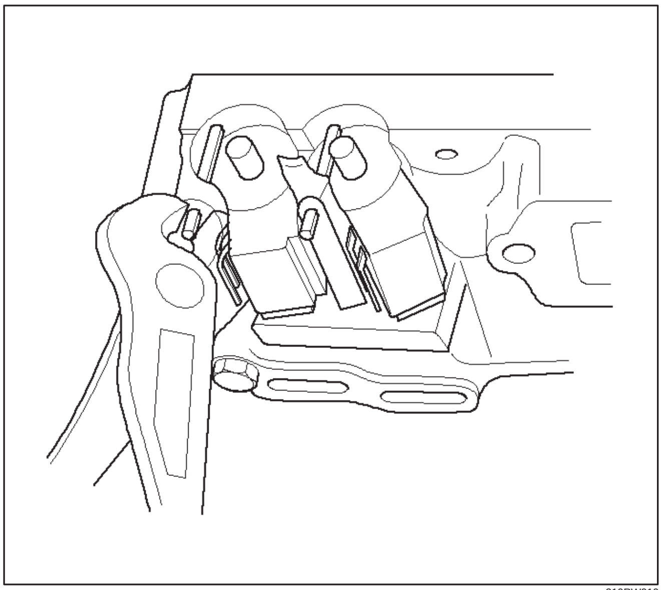
Torque: 37 N•m (27 lb ft)

26. Install the transfer control lever (4×4).
27. Install the selector lever assembly.
28. Connect the wiring harness connectors to front console.
29. Install the front console.
30. Install the transfer control lever knob (4×4).
31. Connect the battery ground cable.
32. Install the engine hood.

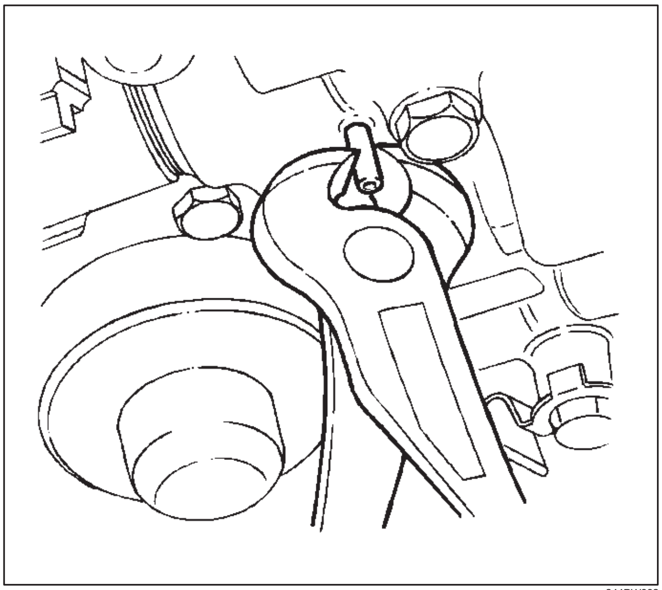
Solenoid (Main Case Valve Body)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Remove transfer protector (4×4).
4. Drain fluid.
5. Support transfer case with a jack and remove third crossmember.
6. Remove sixteen 10 mm screws, main case oil pan, magnet, and gasket.
7. Remove three 13 mm screws, oil filter.
8. Disconnect wiring harness from band control solenoid and shift solenoids. Pull only on connectors, not on wiring harness.
9. Remove spring pin for shift solenoid A, shift solenoid B, and band control solenoid respectively, using suitable pliers taking care not to damage solenoids.



210RW010

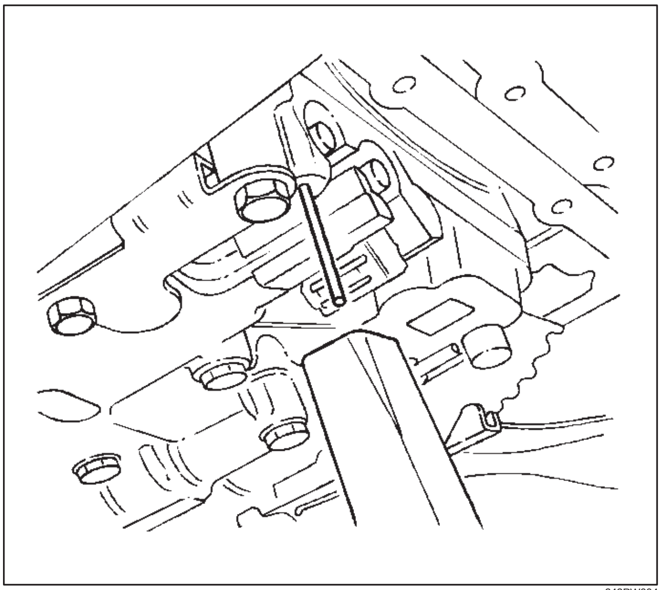


244RW003

10. Remove shift solenoid A, shift solenoid B, band control solenoid, and gaskets from main case valve body. Do not pull on wiring harness. Remove solenoids by grasping the metal tip.

Installation

1. Install shift solenoid A, shift solenoid B, band control solenoid with new gaskets to main case valve body respectively.
2. Carefully install spring pin with hammer to avoid damage to valve body, etc.



243RW004

3. Connect wiring harness to solenoids.
4. Install oil filter with a new gasket and the three 13 mm screws. Tighten the screws to the specified torque.

   Torque: 20 N•m (15 lb ft)

5. Install magnet, main case oil pan with new gasket, sixteen 10 mm screws. Tighten the screws to the specified torque.

   Torque: 11 N•m (96 lb in)

6. Install third crossmember and rear mount nuts. Tighten the nuts and bolts to the specified torque.

   Third crossmember bolt: 76 N•m (56 lb ft)

   Rear mount nut: 50 N•m (37 lb ft)

7. Install the transfer protector. Tighten the bolts to the specified torque (4×4).

   Torque: 37 N•m (27 lb ft)

8. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®–III. Refer to Changing Transmission Fluid in this section.
9. Connect the battery ground cable.

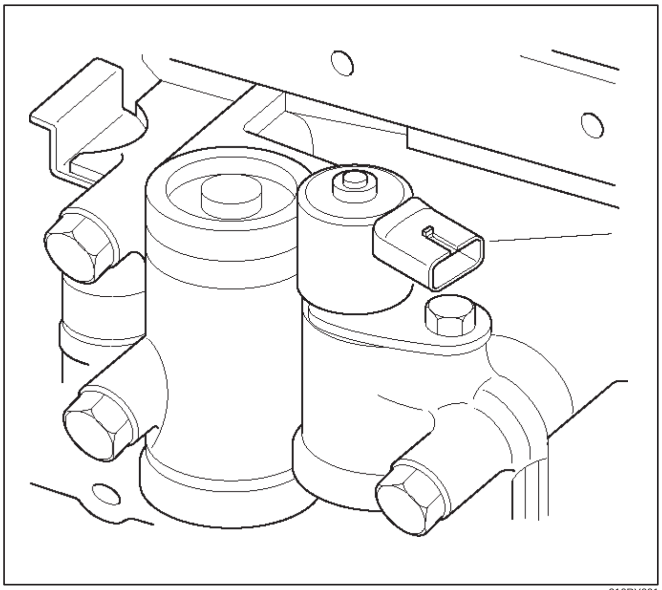
Solenoid (Adapter Case Valve Body)

Removal

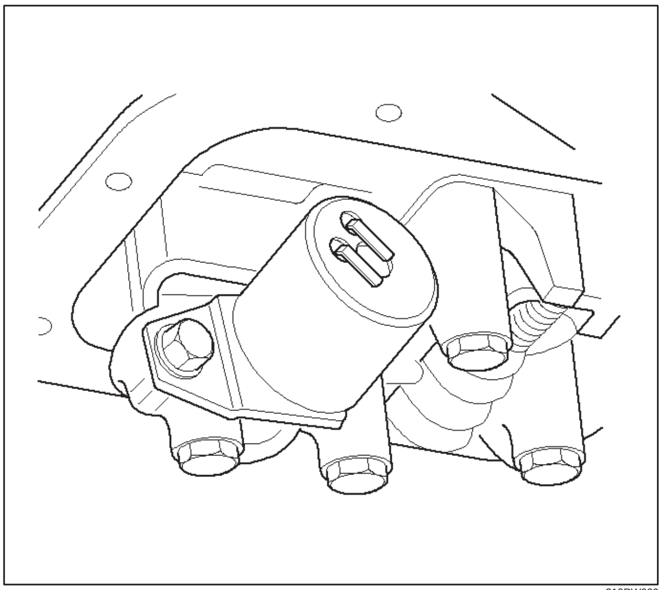
1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove adapter case oil pan twelve fixing 10 mm screws, adapter case oil pan, and gasket.

NOTE: Oil pan still contains transmission fluid. Place a large drain container under the oil pan and drain the fluid carefully.

5. Disconnect wiring harness from force motor solenoid and converter clutch PWM solenoid. Pull only on connectors, not on wiring harness.
6. Remove 11 mm bolt, bracket and converter clutch PWM solenoid with two O–rings.


210RY001

7. Remove 11 mm bolt, retainer, and force motor solenoid.


210RW009

Installation

1. Install force motor solenoid, retainer, and 11 mm bolt to adapter case valve body. Tighten the bolt to the specified torque.

Torque: 10 N•m (87 lb in)

2. Install converter clutch PWM solenoid with two O–rings, bracket, and 11 mm bolt to adapter case valve body. Tighten the bolt to the specified torque.

Torque : 10 N•m (87 lb in)

3. Connect wiring harness assembly to solenoids.
4. Install adapter case oil pan, new gasket, and twelve 10 mm screws. Tighten the screws to the specified torque.

Torque : 11 N•m (96 lb in)

5. Fill transmission through overfill screw hole oil pan, using ATF DEXRON®–III. Refer to Changing Transmission Fluid in this section.
6. Connect battery ground cable.

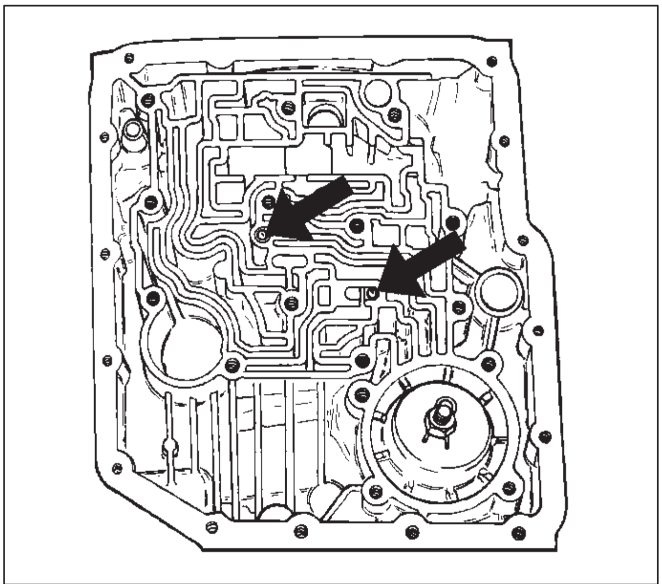
Valve Body Assembly (Main Case)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Remove transfer protector (4×4).
4. Drain fluid.
5. Support transfer case with a jack and remove third crossmember.
6. Remove sixteen 10 mm screws, main case oil pan, magnet and gasket.
7. Remove three 13 mm oil filter fixing screws, then remove oil filter.
8. Remove two 13 mm manual detent fixing screws, then remove roller and spring assembly.
9. Disconnect wiring harness from band control solenoid and shift solenoids. Pull only on connectors, not on wiring harness.
10. Remove four 13 mm servo cover fixing screws, then remove servo cover and gasket.
11. Remove seven 13 mm valve body fixing screws.
12. Remove main case valve body with manual valve link and transfer plate. Note the position of the link (long end into valve, short end into range selector lever).
13. Remove transfer plate gasket from main case.
14. Remove two check balls from main case.

Installation

1. Install two check balls to main case.



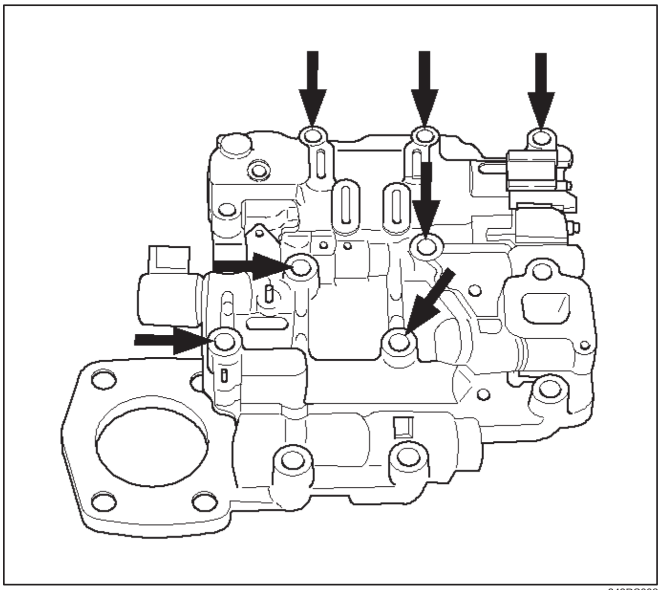
244RW002

2. Inspect electrical 7 way connector and seal of main case. Replace if necessary.
3. Use two J–25025–B guide pin to install main case.
   - Install valve body assembly and manual valve link.

NOTE: Valve must be extended as the short end of manual valve link is connected to the range selector lever. Long end of link goes into valve.

4. Install seven 13 mm screws, and tighten them to the specified torque.

Torque: 20 N•m (15 lb ft)



243RS008

5. Remove two guide pins from main case.
6. Install servo cover gasket, cover, and four 13 mm screws. Tighten the screws to the specified torque.

Torque: 25 N•m (18 lb ft)

7. Connect wiring harness to band control and shift solenoids.
8. Install roller and spring assembly to manual detent.
   - Install two 13 mm screws, and tighten them to the specified torque.

Torque: 20 N•m (15 lb ft)

9. Install oil filter and three 13 mm screws. Tighten the screws to the specified torque.

Torque : 20 N•m (15 lb ft)

10. Install oil pan gasket, magnet, oil pan and sixteen 10 mm screws. Tighten the screws to the specified torque.

Torque: 11 N•m (96 lb in)

11. Install third crossmember and rear mount. Tighten the bolts and nuts to the specified torque.

Torque

Third crossmember bolt: 76 N•m (56 lb ft)

Rear mount nut: 50 N•m (37 lb ft)

12. Install transfer protector. Tighten the bolts to the specified torque (4×4).

Torque: 37 N•m (27 lb ft)

13. Fill transmission through overfill screw hole of oil pan, using ATF DEXRON®–III. Refer to Changing Transmission Fluid in this section.
14. Connect battery ground cable.

Valve Body Assembly (Adapter Case)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove twelve 10 mm adapter case oil pan fixing screws, adapter case oil pan, and gasket.

NOTE: Oil pan still contains transmission fluid. Place a large drain container under the oil pan.

Drain the fluid carefully.

5. Disconnect wiring harness from force motor solenoid and converter clutch solenoid. Pull only on connectors, not on wiring harness.
6. Remove seven 13 mm screws from adapter case valve body assembly, then remove transfer plate, two gaskets, and adapter case valve body.

Installation

1. Inspect electrical 4 way connector and seal of adapter case. Replace if necessary.
2. Install gasket, transfer plate, and gasket.
3. Install adapter case valve body and seven 13 mm screws. Tighten the screws to the specified torque.

Torque: 20 N•m (15 lb ft)

4. Connect wiring harness assembly to converter clutch solenoid and force motor.
5. Install oil pan gasket, oil pan, and twelve 10 mm screws. Tighten the screws to the specified torque.

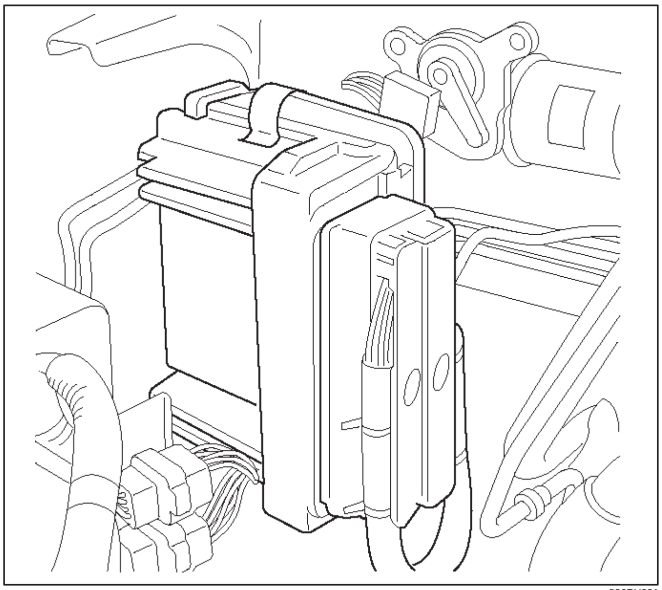
Torque: 11 N•m (96 lb in)

6. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®–III. Refer to Changing Transmission Fluid in this section.
7. Connect battery ground cable.

Powertrain Control Module (PCM)

Removal

1. Disconnect battery ground cable.
2. Disconnect PCM wiring harness connectors from PCM.
3. Remove PCM from bracket.


826RY001

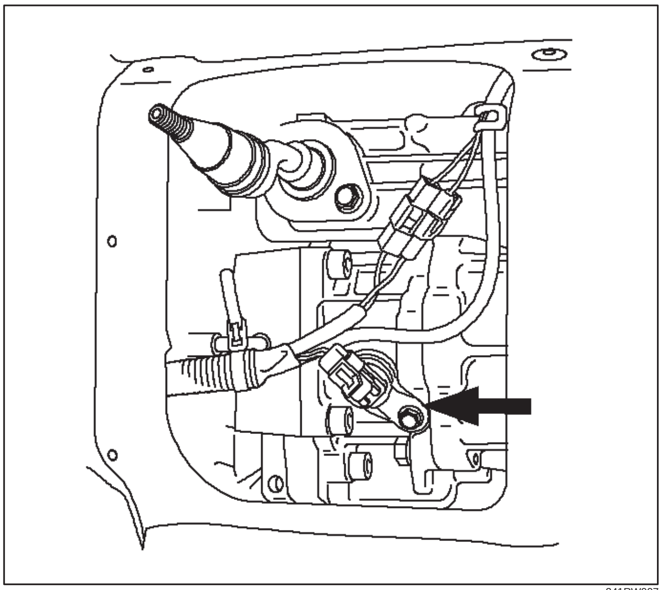
Installation

1. Install PCM to bracket.
2. Connect PCM wiring harness connectors to PCM.
3. Connect battery ground cable.

Speed Sensor (Extension Housing)

Removal

1. Disconnect battery ground cable.
2. Remove front console.
3. Remove selector lever assembly.
4. Disconnect speed sensor harness connector from speed sensor.
5. Remove one 10 mm screw and speed sensor with O–ring.



241RW007

Installation

1. Inspect the speed sensor O–ring, and replace it if necessary.
2. Install speed sensor assembly and 10 mm screw.

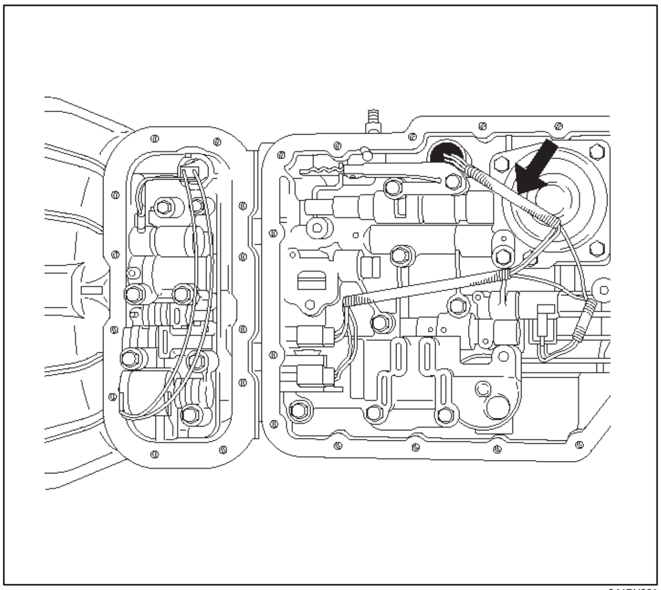
Torque: 9 N•m (78 lb in)

3. Connect speed sensor harness connector to speed sensor.
4. Install selector lever assembly.
   - Adjust shift lock cable. Refer to Selector Lever in this section.
5. Install front console.
6. Connect battery ground cable.

Transmission Oil Temperature Sensor (Main Case)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove sixteen 10 mm main case oil pan fixing screws, main case oil pan, and gasket.
5. Disconnect wiring harness from shift solenoids, band apply solenoid, and 7 way connector of main case. Pull only on connectors, not on wiring harness.
6. Remove wiring harness assembly with transmission oil temperature sensor.



244RY001

Installation

1. Install wiring harness assembly with transmission oil temperature sensor to band apply solenoid, shift solenoids, and 7 way connector of main case.

2. Install oil pan gasket, oil pan, and sixteen 10 mm fixing screws. Tighten the screws to the specified torque.

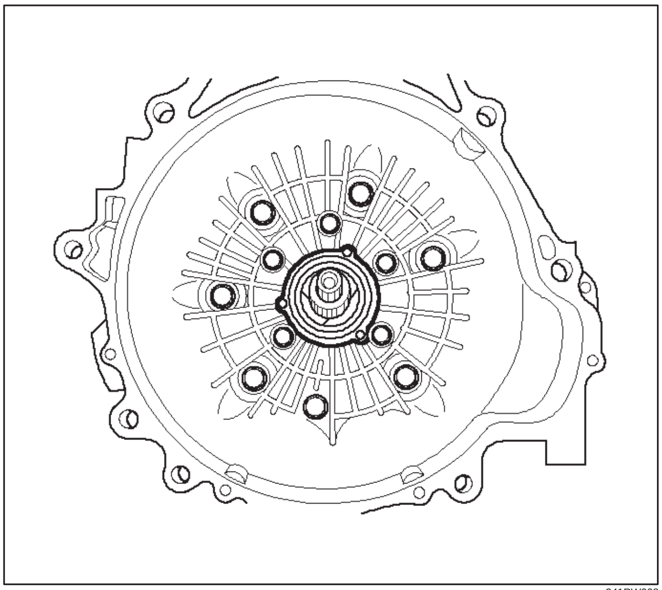
Torque: 11 N•m (96 lb in)

3. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®–III.
   Refer to Changing Transmission Fluid in this section.
4. Connect battery ground cable.

Front Oil Seal (Converter Housing)

Removal

1. Remove transmission assembly with transfer case from the vehicle. Refer to Transmission (With Transfer Case / Extension Assembly) in this section.
2. Remove torque converter from converter housing.
3. Remove three screws and oil seal ring from converter housing.



241RW008

Installation

1. Apply clean ATF to the new oil seal ring lip.
   - Install oil seal ring to converter housing. Tighten the screws to the specified torque.

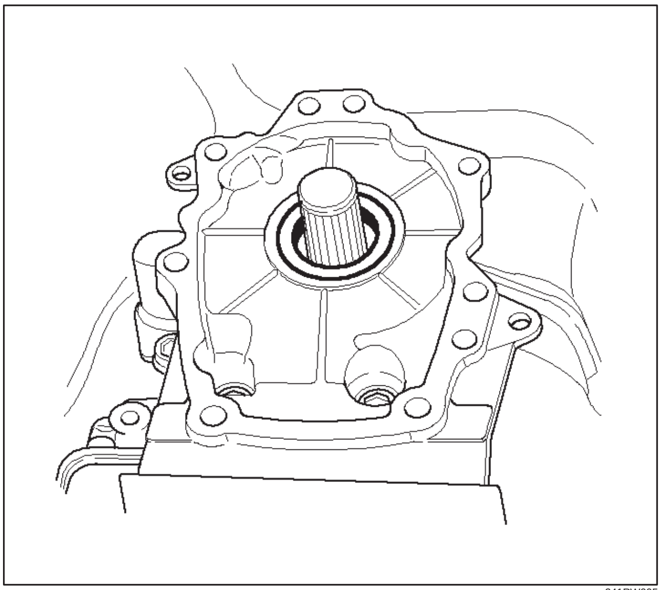
Torque: 3 N•m (26 lb in)

2. Install torque converter to converter housing.
3. Install transmission assembly with transfer case (4×4) / extension assembly (4×2) to the vehicle. Refer to Transmission (With Transfer Case / Extension Assembly) in this section.

Rear Oil Seal (Extension Housing)

Removal

1. Remove transfer case assembly (4×4) or extension assembly (4×2) from the vehicle. Refer to Transfer Case in Drive Line/Axle section.
2. Remove rear oil seal from transmission extension housing.



241RW005

Installation

1. Use J–36797 extension housing oil seal installer, and install the rear oil seal to the transmission extension housing.
2. Install the transfer case assembly (4×4) or extension assembly (4×2) to the vehicle. Refer to Transfer Case in Drive Line/Axle section.

Transmission (4L30–E)

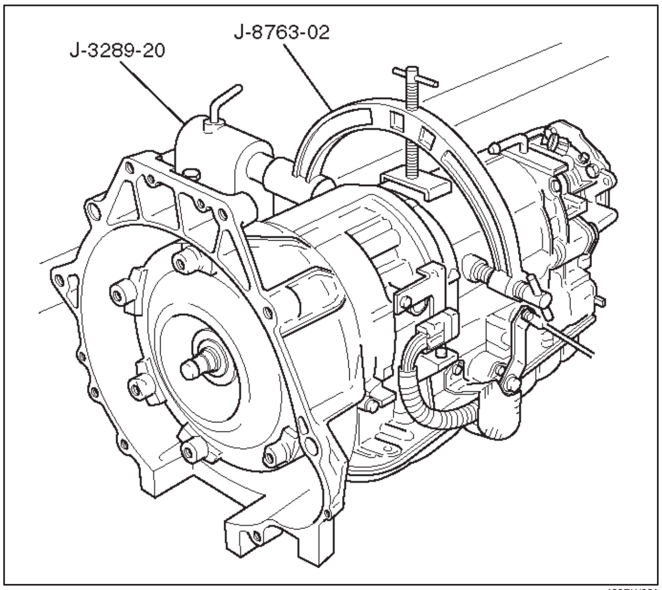
Disassembly

NOTE: During the disassembly and reassembly, perform the following:

- Wash each part thoroughly, and blow air through each oil passage and groove to eliminate blockage.
- Seal rings, roll pins, and gaskets should be replaced.
- When assembling the components, apply DEXRON®–III Automatic Transmission Fluid (ATF) to each seal, rotating part, and sliding part.
- Do not dip part facings, such as clutch or brake drive plates, in cleaner when washing it.
  Also, always coat parts with new ATF two or three times after cleaning with solvent.

1. Remove torque converter (1).
   - Drain fluid from torque converter.
   - Attach J–8763–02 holding fixture to the transmission and set it on J–3289–20 holding fixture base.

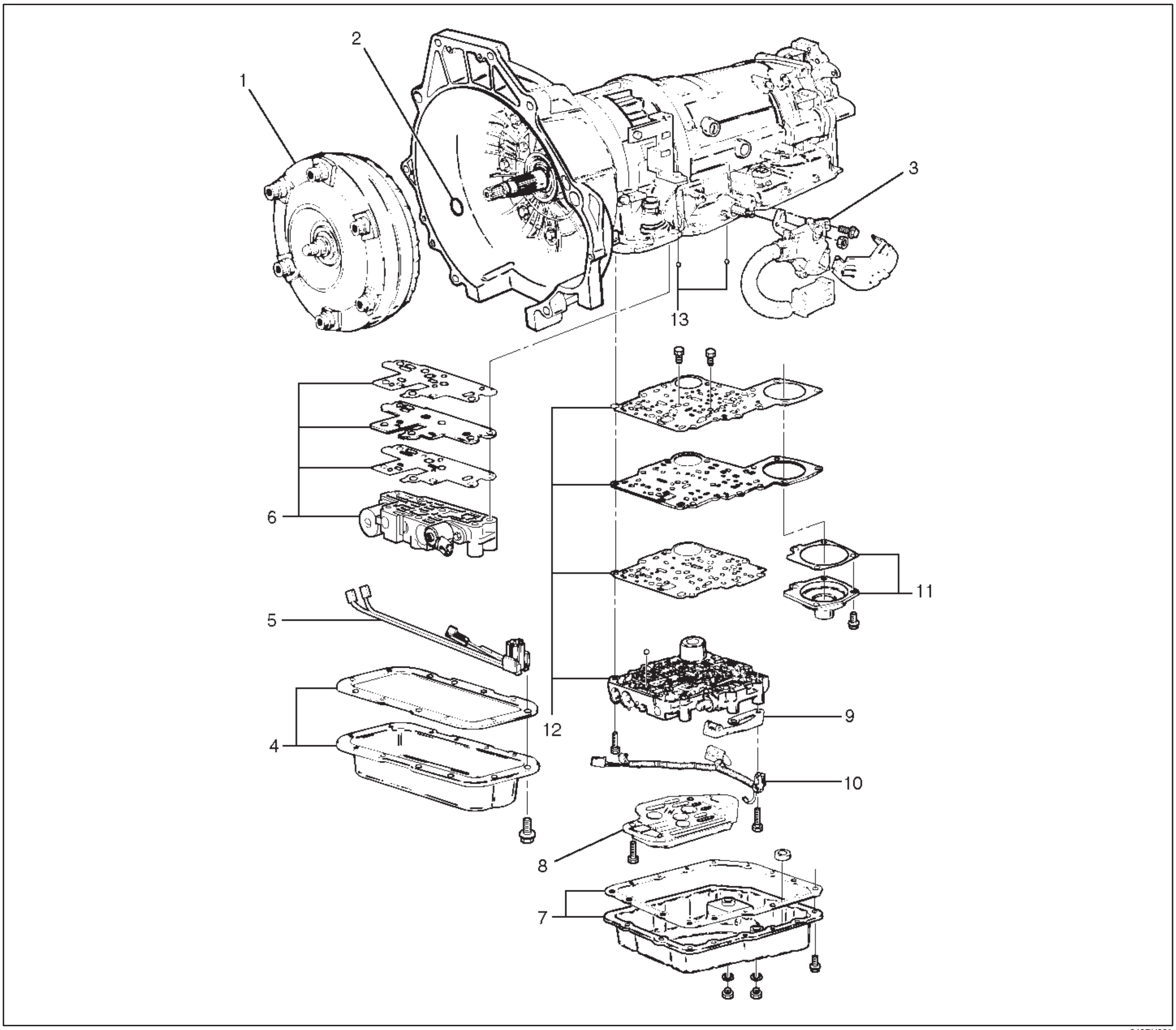
NOTE: Do not overtighten the tool, as case damage may result.



420RW021

2. Remove O–ring (2) from turbine shaft.
3. Remove two 10mm mode switch screws, selector lever nut, cover, and mode switch (3).
4. Remove twelve 10mm adapter case oil pan (4) fixing screws, adapter oil pan, and gasket.
5. Disconnect electrical wiring connections (5) from solenoids and 4 way connector of adapter case. Pull on connectors only, not on wiring harness.
6. Remove seven 13mm adapter case valve body (6) fixing screws, adapter case valve body assembly, transfer plate, and two gaskets.
   - Remove wiring harness and 4 way connector.
7. Remove sixteen 10mm main case oil pan (7) fixing screws, main oil pan, magnet, and gasket.
8. Remove three 13mm oil filter (8) fixing screws and oil filter.
9. Remove two 13mm manual detent (9) fixing screws, roller and spring, and manual detent.
10. Disconnect wiring harness assembly (10) from band apply solenoid, shift solenoids, and main case 7 way connector.
    Pull on connectors only, not on wiring harness.
11. Remove four 13mm servo cover (11) fixing screws, servo cover, and gasket.
12. Remove seven 13mm valve body screws and ground wire from main case.
    - Remove wiring harness assembly (5) from the adapter case side.
    - Remove main valve body assembly (12) with manual valve link and transfer plate. Note the position of the link (long end into valve, short end into range selector lever).
    - Remove 7 way connector.
    - Remove gasket transfer plate from main case.

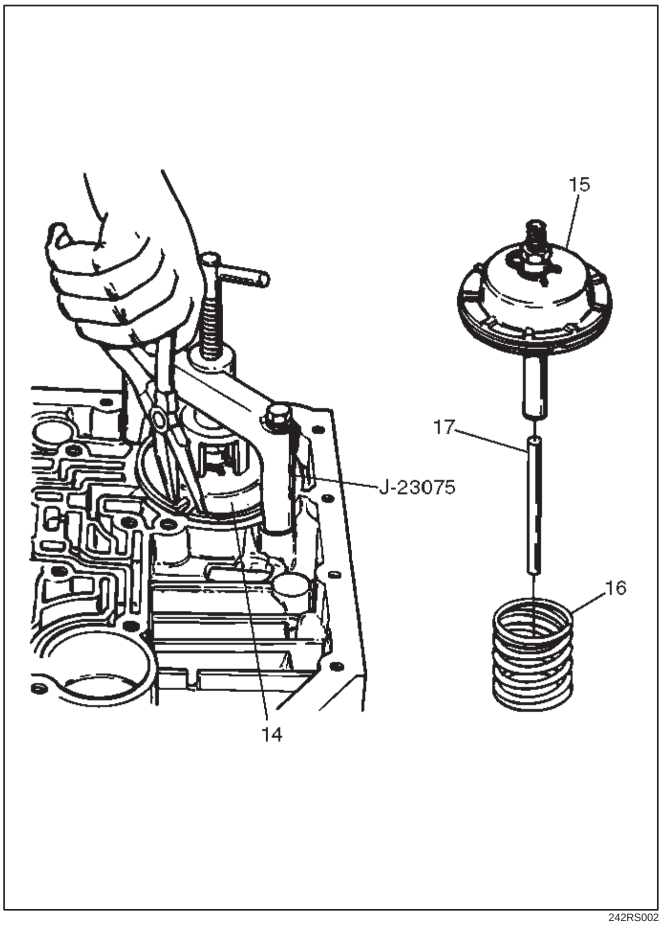
13. Remove two check balls (13) from main case.



240RY001

14. Turn transmission to vertical position to drain fluid. Return back to horizontal position when drained.
    - Install J–23075 servo piston spring compressor with offset to the rear of case.
    - Compress servo piston assembly.
    - Remove servo piston retaining ring (14).
    - Slowly release servo piston assembly (15).
    - Remove tool.

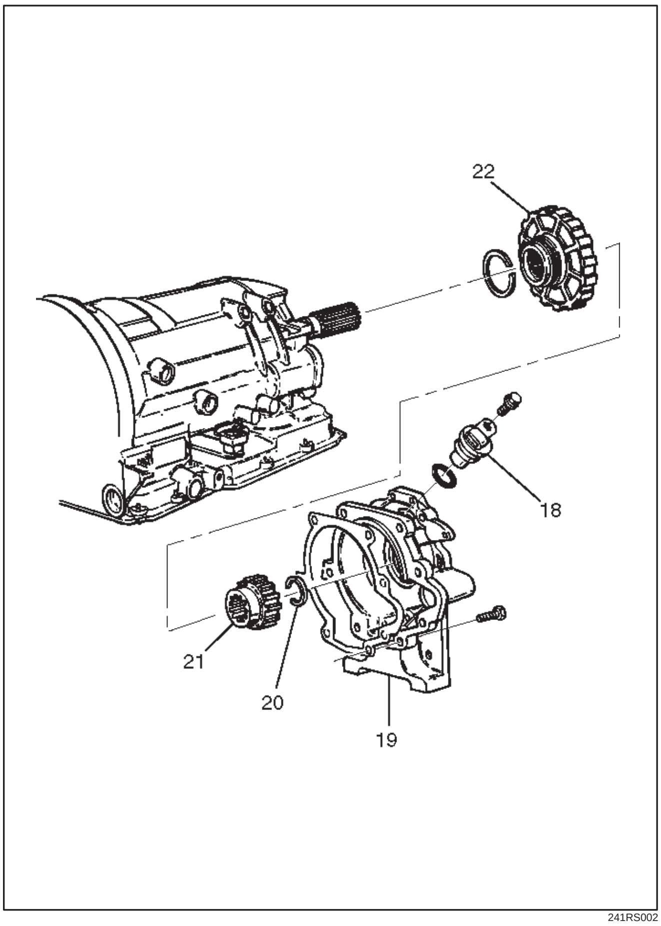
15. Remove servo piston assembly (15), return spring (16), and servo apply rod (17).



16. Rotate transmission to horizontal position, pan side down.
    - Remove one 10mm screw, and speed sensor (18) with “O” ring.
17. Remove seven 8mm extension housing hexagon socket head screws, extension housing assembly (19), and gasket.
18. Remove retaining ring (20).

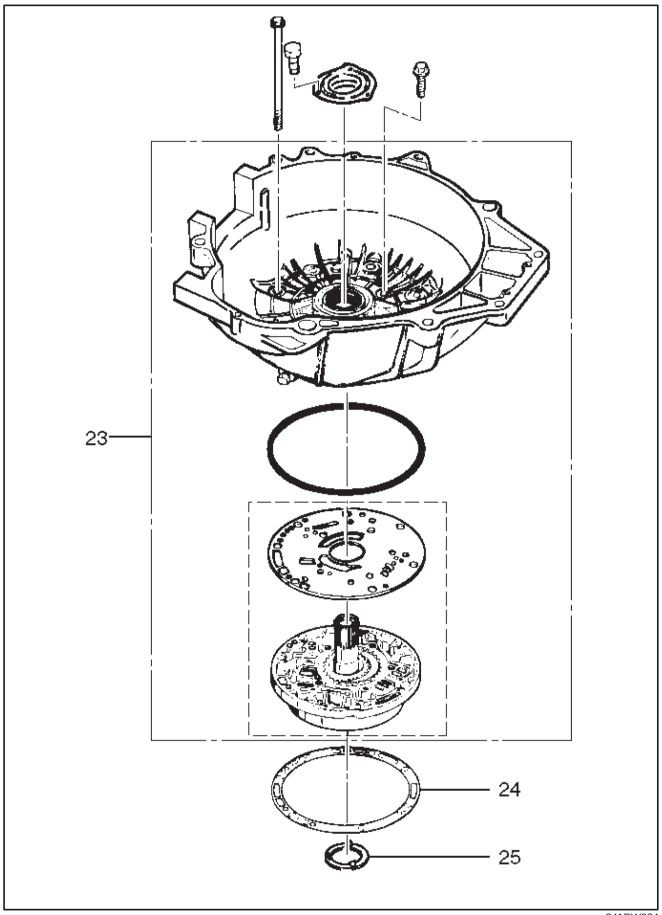
NOTE: Use extra long, needle- nose pliers.

19. Remove speed wheel (21).
20. Remove wheel parking lock (with seal ring) (22).



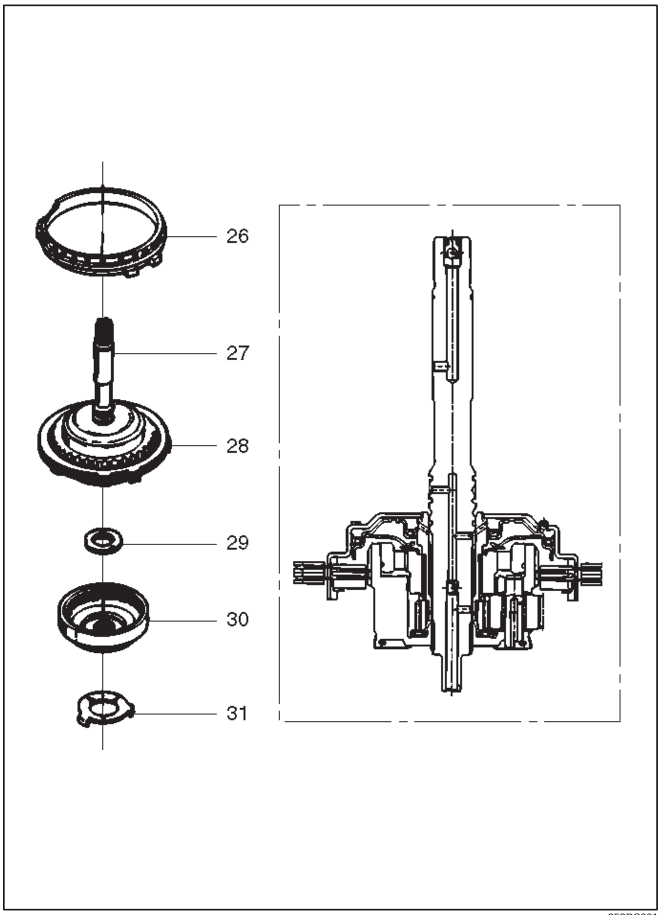
21. Rotate transmission to vertical position, converter housing up.
    - Loosen the converter housing and oil pump assembly fixing screws, but do not remove the five 13 mm inner screws if oil pump disassembly is required.
    - Remove seven outer screws.
    - Remove converter housing and oil pump assembly (23).
22. Remove gasket (24).

23. Remove selective thrust washer (25).



241RW004

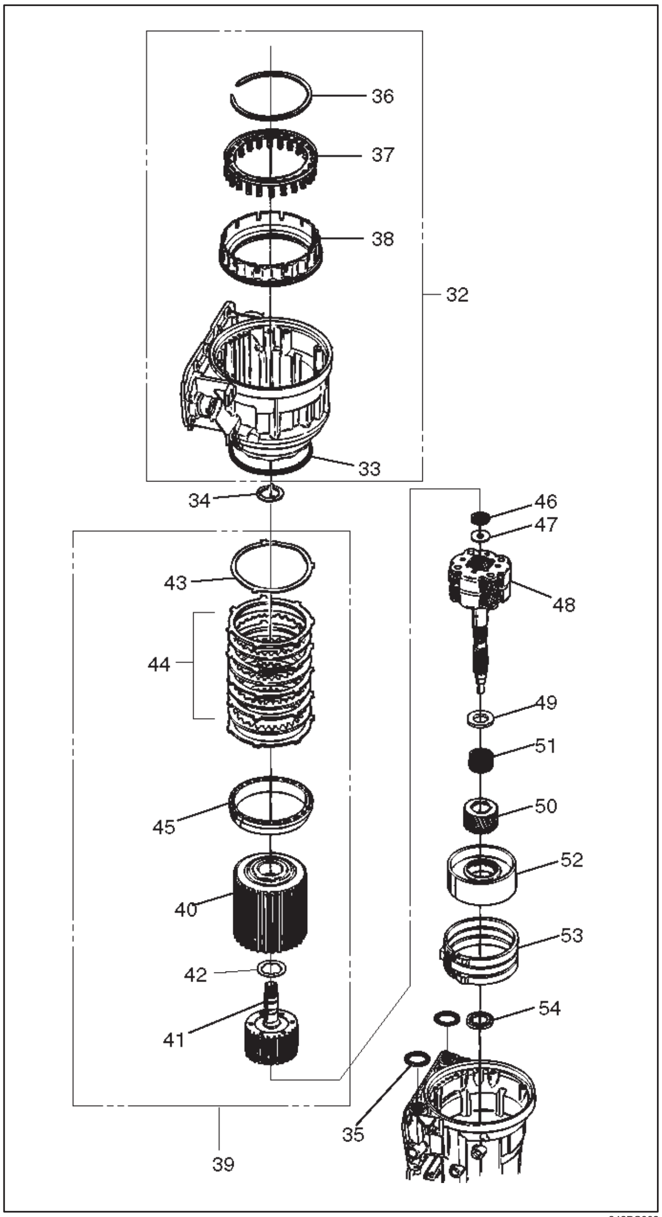
24. Remove fourth clutch retainer (26).
25. Grasp turbine shaft and lift out the overrun clutch housing assembly (27) and fourth clutch plates (28).
26. Remove thrust bearing assembly (29).
27. Remove overdrive internal gear (30).
28. Remove thrust washer (31).



252RS001

29. Remove adapter case and center support assembly (with fourth clutch piston) (32).
30. Remove seal ring (33).
31. Remove selective thrust washer (34) and two O–ring seals (35) from main case.
32. Use J–23327 and J–23327–90 compressor to compress the fourth clutch spring retainer and springs (37).
    - Release snap ring (36) from groove.
    - Remove clutch compressor and snap ring (36).
33. Remove retainer and spring assembly (37).
34. Insert two converter housing/main case screws to hold adapter case while pulling out fourth clutch piston (38).
    - Remove fourth clutch piston assembly (38) from the adapter case.
    - Remove converter housing/main case screws.
35. Grasp intermediate shaft, twist and pull out the second and third clutch drum assemblies with reverse clutch plates while holding onto output shaft (39).

36. Separate second (40) and third clutch (41) assemblies.
37. Remove thrust washer (42).
38. Remove reverse clutch plates (43 and 44) and reverse clutch pressure plate (45).
39. Remove bearing (46) and washer (47).
40. Remove planetary carrier assembly (48).
41. Remove thrust bearing (49).
42. Remove reaction sun gear (50)
43. Remove needle bearing (51).
44. Remove brake drum (52).
45. Remove brake band (53).
46. Remove thrust bearing (54).



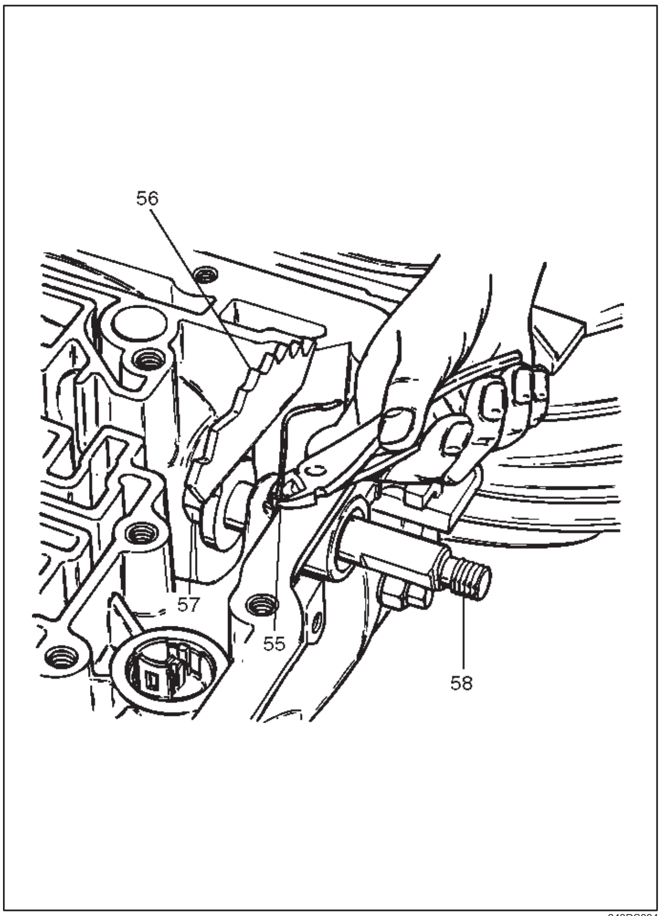
242RS003

47. Rotate case to horizontal position, valve body side facing up.
    - Remove spring pin (55), using cutting pliers, then remove parking lock and selector lever assembly (56).

NOTE: Insert wire in the center of the spring pin to prevent it from collapsing during removal. Be aware of pin height. Protect machined face of main case.

48. Remove parking lock and range selector lever 17 mm nut (57).
49. Remove parking lock and range selector lever (56), and actuator assembly.
50. Remove selector shaft (58).

NOTE: Inspect the shaft for burrs before removing to prevent damaging seal. If necessary, remove burrs by lightly sanding with an oilstone.



249RS004

Reassembly

1. Inspect selector shaft seal, and replace it if necessary.

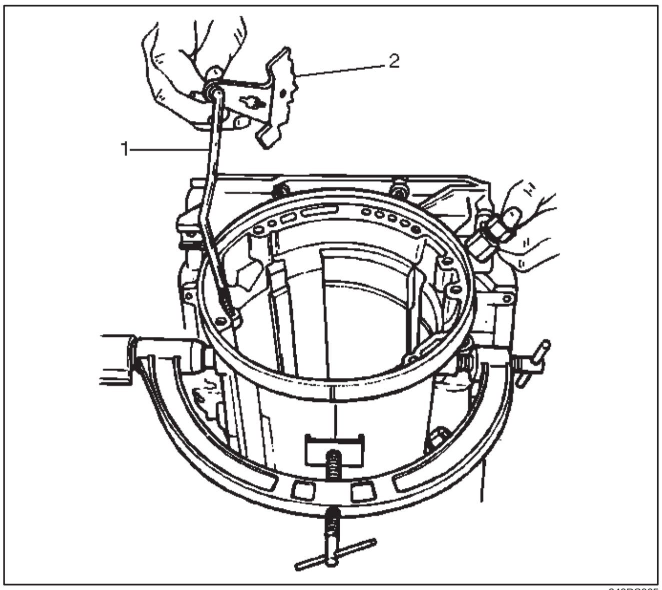
NOTE: Use a seal installer when replacing the seal.

- Install selector shaft.

NOTE: Spring pin groove must be positioned inside the case.

2. Install spring pin. Be sure the selector shaft can move freely. Do not push the pin flush with the case surface. Leave enough height for removal.
3. Install actuator assembly (1).
4. Install parking lock and range selector lever (2) and new 17 mm nut. Tighten the nut to the specified torque.

Torque: 22 N•m (16 lb ft)



249RS005

5. Rotate main case to vertical position, extension end facing down.
   - Install brake band assembly (3).

NOTE: Be sure to align servo pin area with the servo hole.

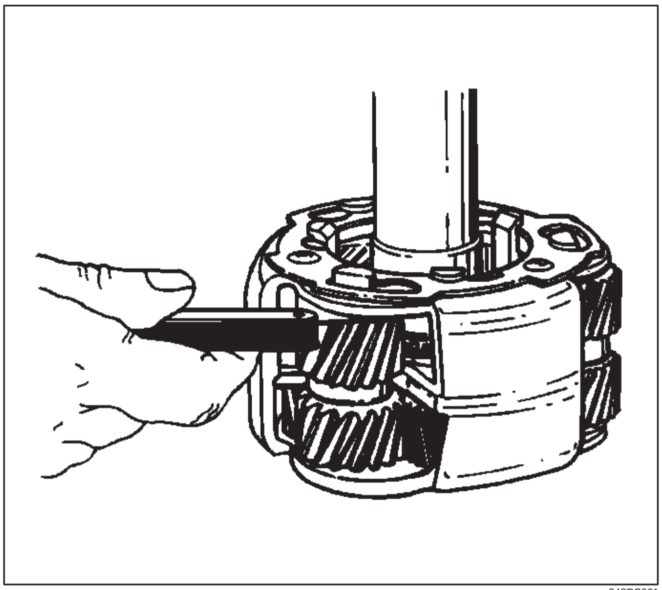
6. Install thrust bearing (4).

NOTE: The case bushing acts as a guide for the thrust bearing.

7. Install brake drum (5).
8. Install reaction sun gear (6).
9. Install needle bearing (7).
10. Inspect planetary carrier assembly (8) for wear and damage. If necessary replace it.
    - Measure pinion end play clearance with a feeler gauge.

Clearance: 0.13mm–0.89mm (0.005 in–0.035 in)

If clearance is outside specified value, replace the planetary carrier assembly.



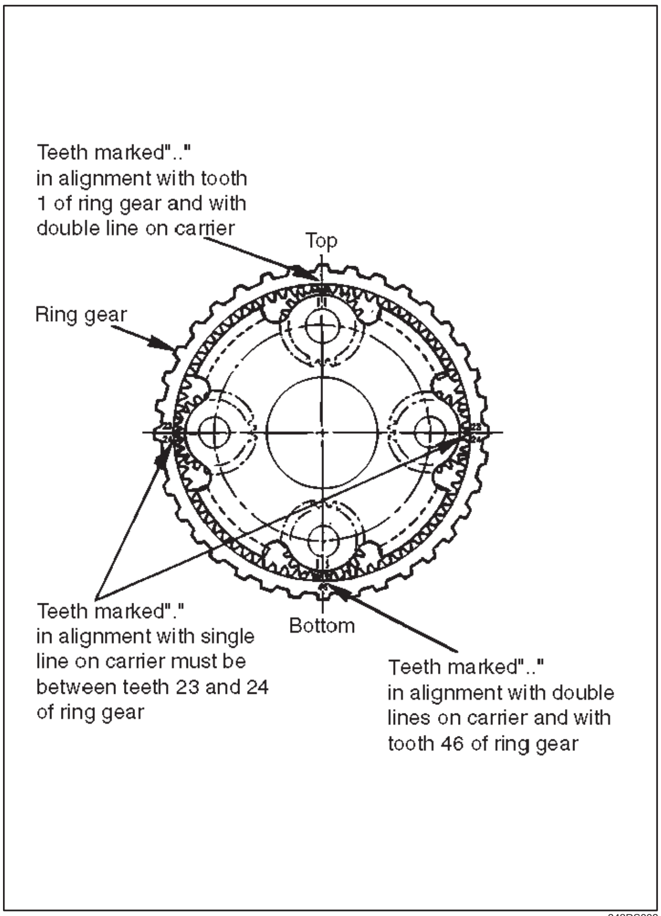
248RS001

11. Install the thrust bearing (9) on the output shaft.

NOTE: Use petroleum jelly to hold the thrust bearing in place.

12. Align planetary pinions. Each pinion is marked with double points to indicate the master tooth space and exactly opposite with a single point to indicate the master tooth. The markings on the planetary carrier consist of double lines which are to be lined up with the double points on two opposite pinions; the single lines are to be lined up with the single points on the other two pinions.
    - After all four pinions are lined up, slide on the third clutch assembly. Rotate third clutch and check mark alignment. Considering that the ring gear tooth between the double points of one planetary pinion is tooth number 1, count the teeth to check that the single points on the two adjacent pinions are between teeth 23 and 24 of the ring gear, and that the ring gear tooth between the double points of the opposite pinion is tooth number 46. If the ring gear and pinions are not lined up, remove, and realign them.
13. Install planetary carrier (8) with third clutch (12).

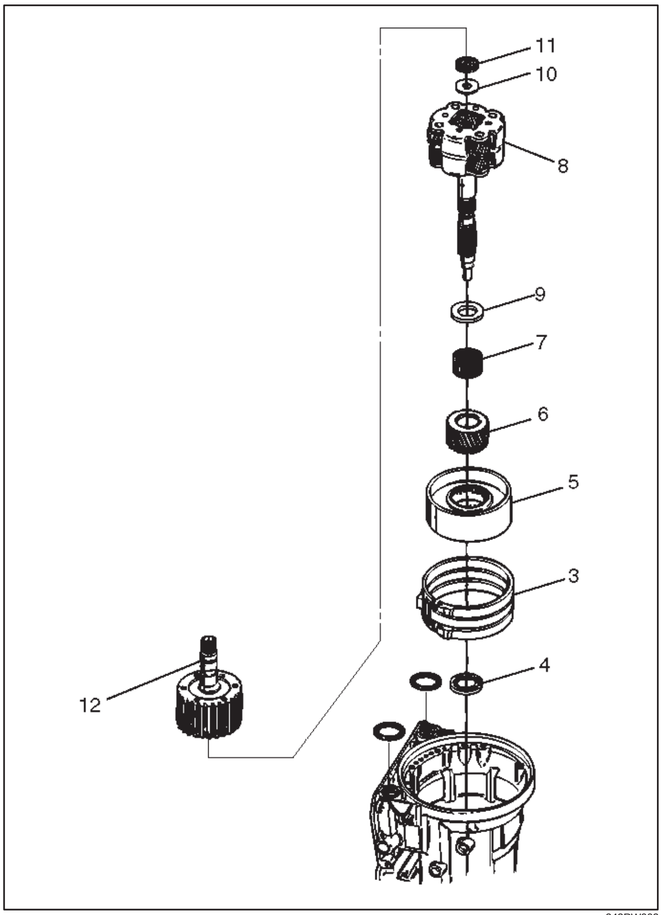
NOTE: Do not force. When properly aligned, the parts will fit together easily.



248RS002

14. Remove the third clutch (12).
15. Install bearing (11) and washer (10).

NOTE: Use petroleum jelly to hold the washer and bearing in place.

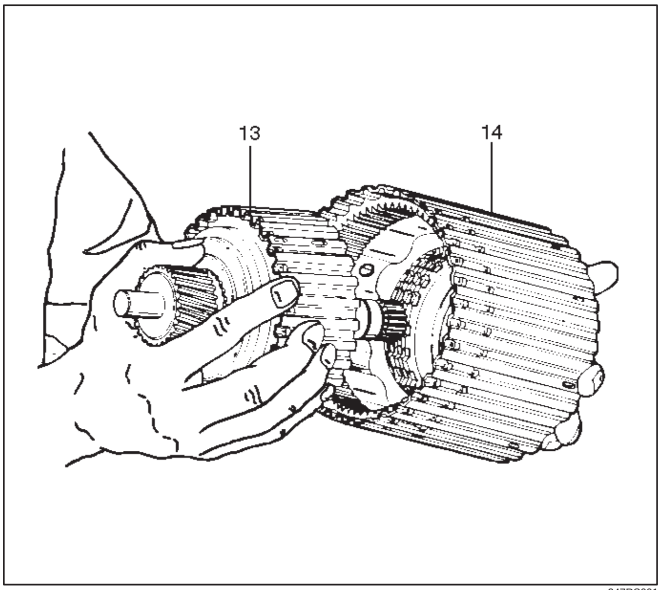


242RW002

16. Carefully align the second clutch plate inner tangs.
    - Install thrust washer, tangs pointing downward, and locating tang positioned in slot on second clutch hub.

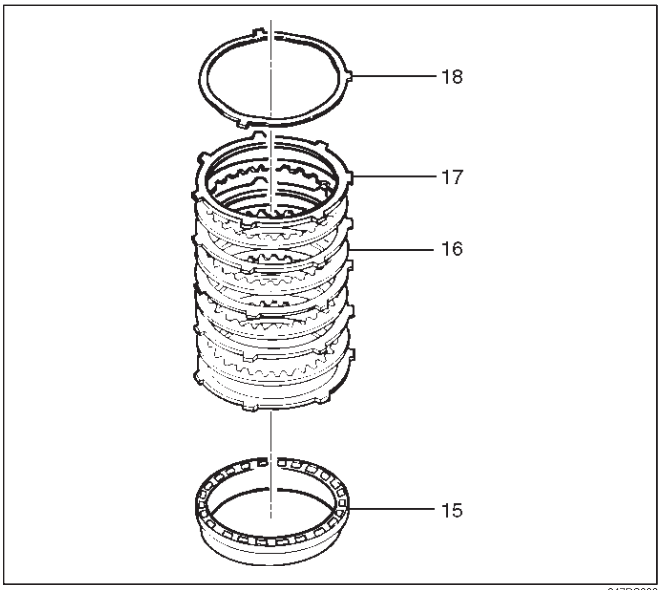
NOTE: Use petroleum jelly to hold thrust washer in place.

17. Install third clutch and intermediate shaft assembly (13) into the second clutch drum (14).
18. Install second and third clutch assemblies into the main case. Twist output shaft and clutch assemblies to ensure proper fit.



247RS001

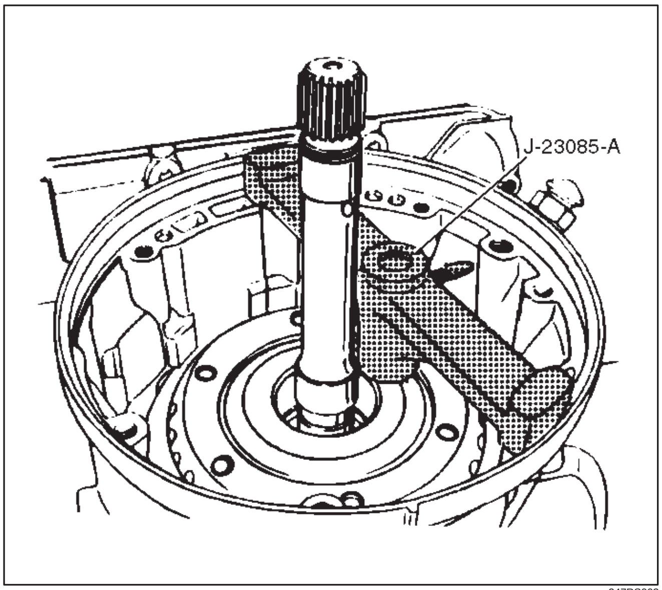
19. Install pressure plate (15) with lip side up, tang facing valve body face.
20. Install reverse clutch plates. Start with a steel plate (17) and alternate with a lined plate (16).
21. Install waved clutch plate (18) with center tang facing valve body side.



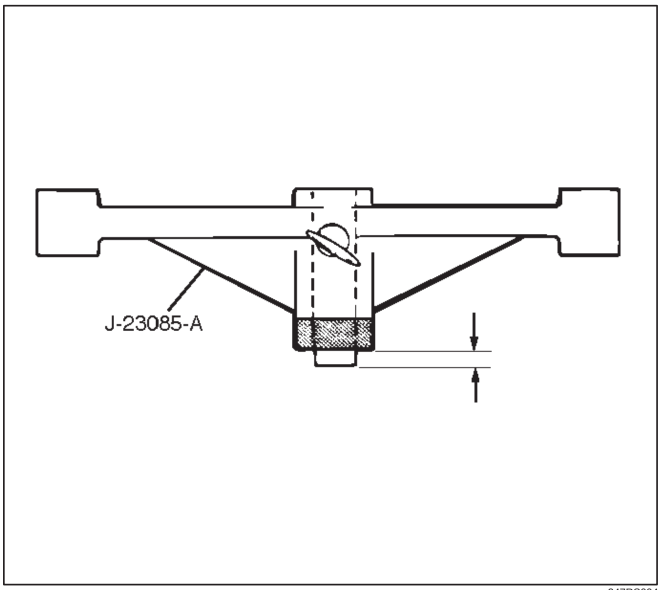
247RS002

22. Second clutch end play measurement
    1. Install the J–23085–A Selective washer gauging tool (with spacer ring) on the case flange and against the intermediate shaft.
    2. Position the inner shaft of the gauging tool against the thrust surface of the second clutch hub.
    3. Tighten thumb screw. Remove the tool.
    4. Fit the spacer ring on the inner shaft of the tool.
    5. Measure the gap, and select the appropriate washer as shown in the chart.

Selective Thrust Washer	
Gap: mm(in)	**Color**
1.53 – 1.63 (0.060 – 0.064)	Yellow
1.72 – 1.82 (0.068 – 0.072)	Red
1.91 – 2.01 (0.075 – 0.079)	Black
2.10 – 2.20 (0.083 – 0.087)	Natural
2.29 – 2.39 (0.090 – 0.094)	Green
2.48 – 2.58 (0.098 – 0.102)	Blue
FOLLOWING THE PROCEDURE SHOULD RESULT IN FINAL END–PLAY FROM 0.36 mm TO 0.79 mm (0.014 in TO 0.031 in)	

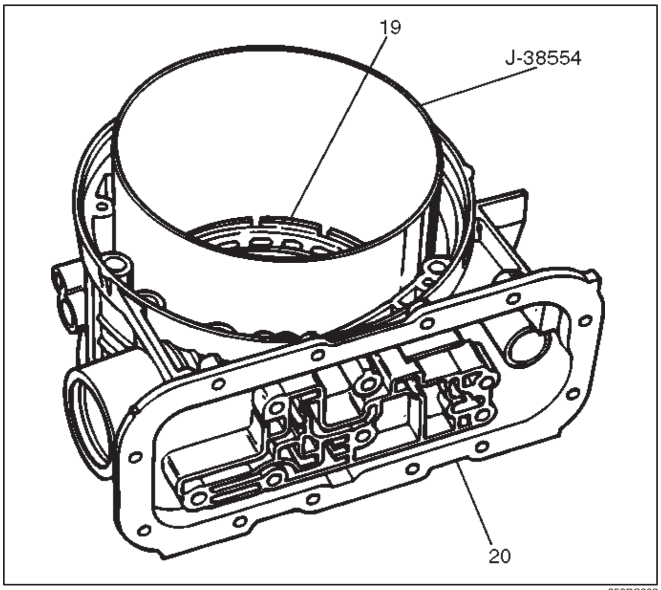


247RS003



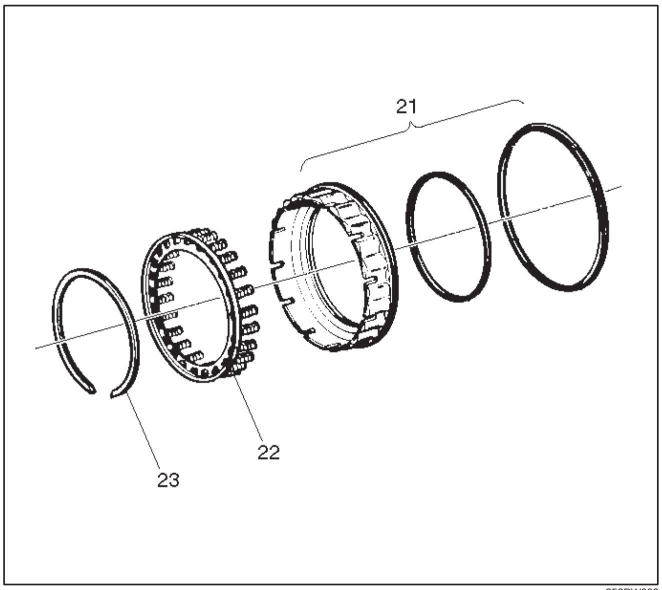
247RS004

23. Inspect fourth clutch piston seals and replace if necessary.
    - Lubricate J–38554 fourth clutch piston fitter and install it on fourth clutch piston (19).
    - Install fourth clutch piston (19) in adapter case (20).
    - Remove fitter.

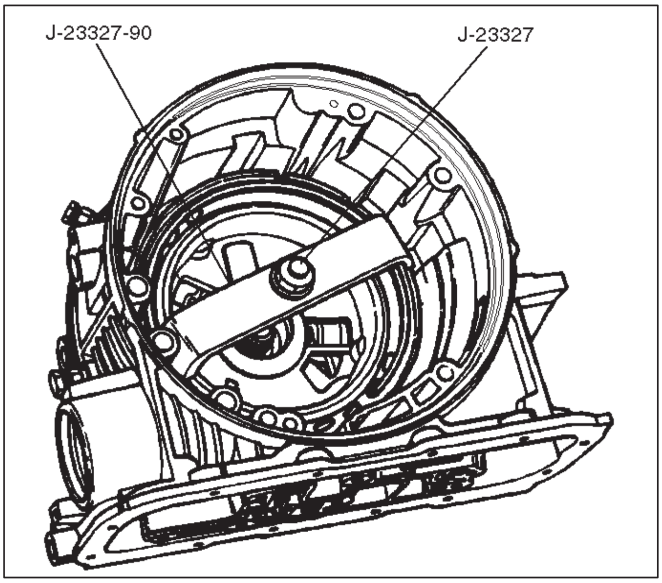


252RS003

24. Install retainer and spring assembly (22) into fourth clutch piston (21).
25. Install snap ring (23) in adapter case.
    - Install J–23327 and J–23327–90 fourth clutch spring compressor.
    - Seat snap ring in groove.
    - Remove compressor.

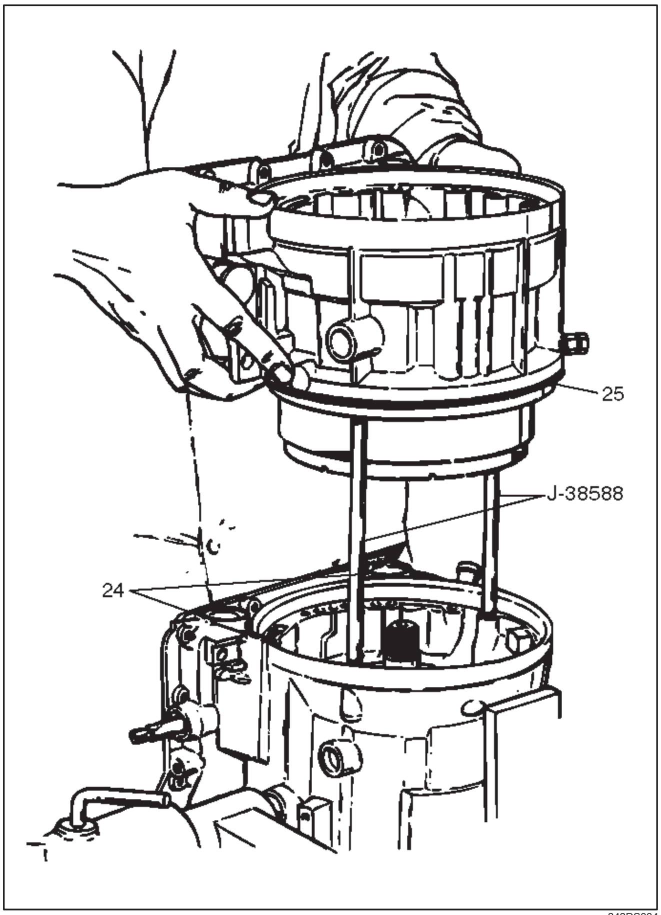


252RW002



252RS004

26. Install selective washer using petroleum jelly.
27. Install two O–ring seals (24) in main case and adapter case/main case seal ring (25).
28. Install J–38588 guide pins.
    - Install adapter case and center support assembly to main case.



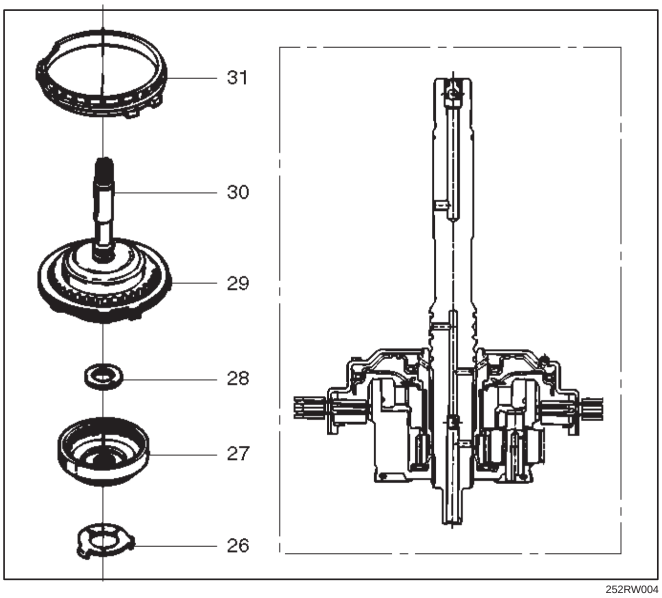
242RS004

29. Install thrust washer (26) into adapter case, with tangs pointing downwards.
30. Preassemble overdrive internal gear (27) and thrust bearing assembly (28) onto the turbine shaft and overrun clutch assembly.

NOTE: Install bearing assembly, black side up. Use petroleum jelly to keep assembly in place.

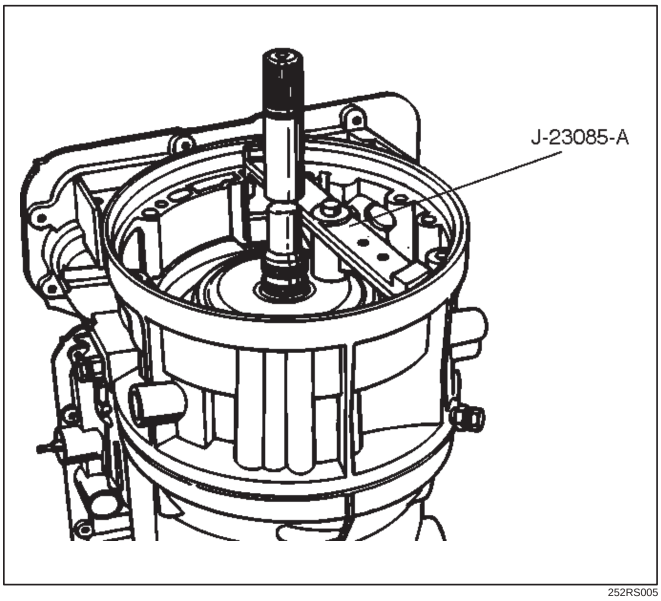
31. Install overdrive carrier (30) and internal gear assembly into adapter case.
32. Install fourth clutch plates (29) in the following order: Steel, Lined, Steel, Steel, Lined, Steel. Steel plates go in with short tang facing towards valve body surface.

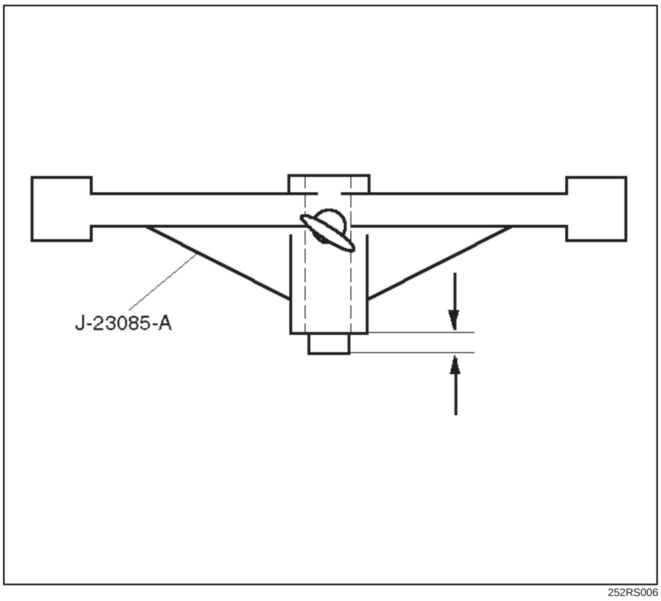
33. Install fourth clutch retainer (31) with the notch facing up and positioned towards valve body surface.



34. Overdrive clutch end play measurement
    1. Install the J–23085–A selective washer gauging tool on the adapter case flange and against the input shaft.
    2. Position the inner shaft of the tool against the thrust surface of the overrun clutch housing.
    3. Tighten thumb screw. Remove the tool.
    4. Measure gap. Select appropriate size washer as shown in the chart.
    5. Set selective thrust washer aside.

Selective Thrust Washer	
Gap: mm(in)	**Color**
1.53 – 1.63 (0.060 – 0.064)	Yellow
1.72 – 1.82 (0.068 – 0.072)	Red
1.91 – 2.01 (0.075 – 0.079)	Black
2.10 – 2.20 (0.083 – 0.087)	Natural
2.29 – 2.39 (0.090 – 0.094)	Green
2.48 – 2.58 (0.098 – 0.102)	Blue
FOLLOWING THE PROCEDURE SHOULD RESULT IN FINAL END–PLAY FROM 0.1 mm TO 0.8 mm (0.004 in TO 0.03 in)	





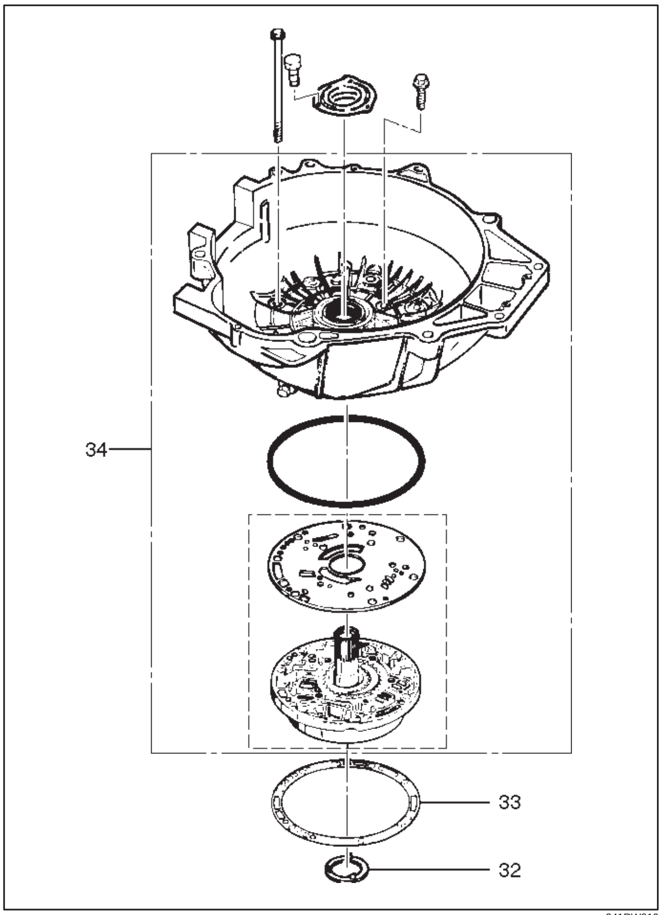
35. Install selective washer (32).

NOTE: Use petroleum jelly to hold selective washer in place.

36. Install gasket (33).
37. Install converter housing and oil pump assembly (34) to adapter case.
    - Fit and tighten seven outer 13 mm screws.

Torque: 39 N•m (29 lb ft)

- Ensure free rotation of pump using J–23082–01 oil pump rotation tool.



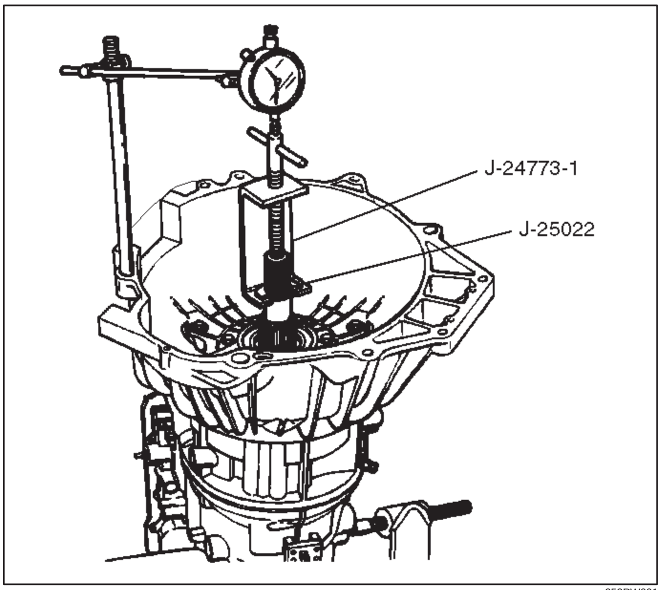
241RW010

38. Overdrive clutch end play measurement
    1. Fit J–25022 and J–24773–1 turbine shaft puller on turbine shaft.
    2. Position axial play checking tool on converter housing mating face.
    3. Pull turbine shaft upwards with puller until first resistance is met. (due to weight of overdrive assembly).
    4. Maintain shaft in this position and set indicator to zero.
    5. Pull turbine shaft further upwards with puller. Read end play shown on indicator.

End play: 0.1mm – 0.8mm (0.004 in – 0.031in)

6. Remove axial play checking tool and puller.

NOTE: If end play is not correct, repeat selective washer selection.



252RW001

39. Inspect extension housing oil seal and replace if necessary, using J–36797 extension housing oil seal installer.
    - Rotate transmission to horizontal position, with valve body side down.
    - Inspect parking wheel seal ring. Replace if necessary.
    - Install wheel parking lock assembly (35).
40. Install speed wheel (36) and snap ring (37).

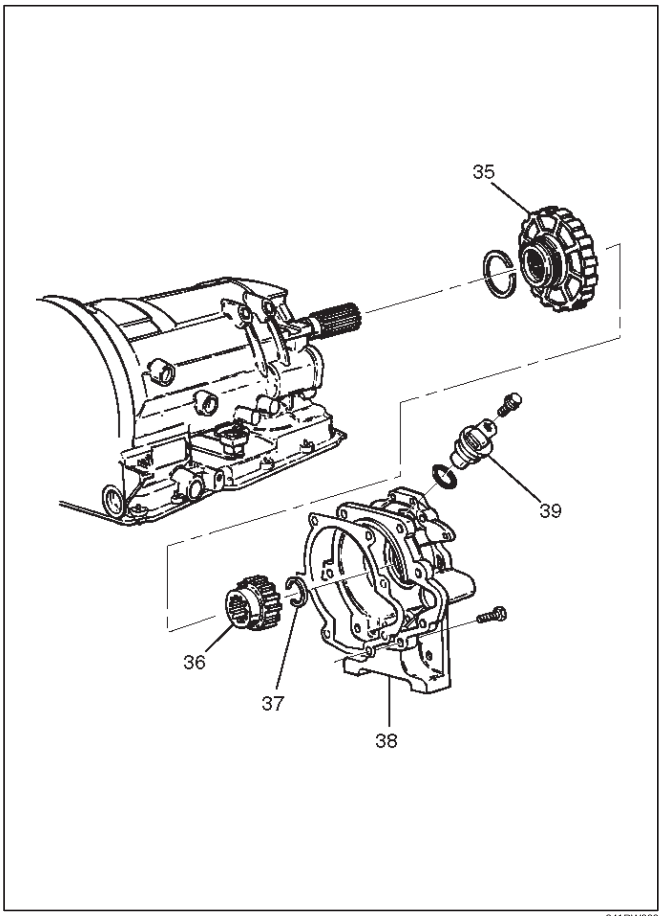
NOTE: Use extra long, needle-nose pliers.

41. Install gasket onto extension assembly with a thin coating of oil.
    - Install extension housing assembly (38), and align parking pawl shaft.
    - Install actuator assembly into extension assembly.
    - Install seven 8 mm hexagon socket head screws.

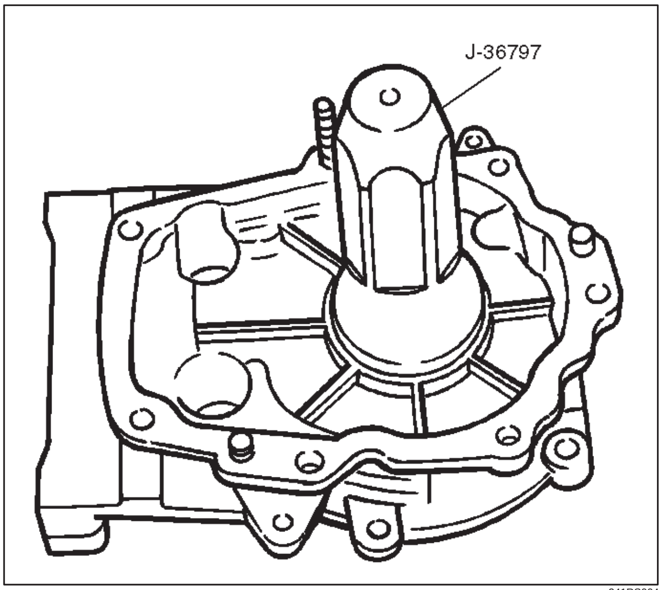
Torque: 32 N•m (24 lb ft)

42. Inspect speed sensor O–ring. Replace if necessary.
    - Install speed sensor assembly (39) and 10 mm screw.

Torque: 9 N•m (78 lb in)



241RW009

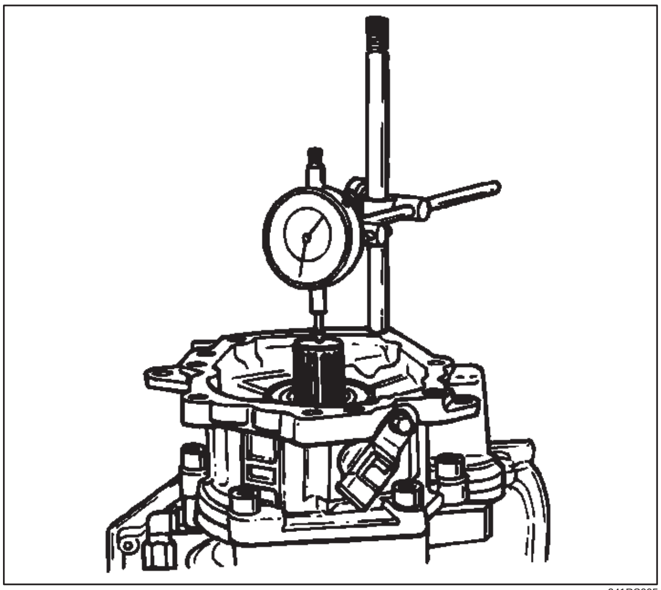


241RS004

43. Main case end play measurement
    1. Attach axial play checking tool on the extension housing and set indicator to zero on output shaft.
    2. Manually push output shaft upwards.

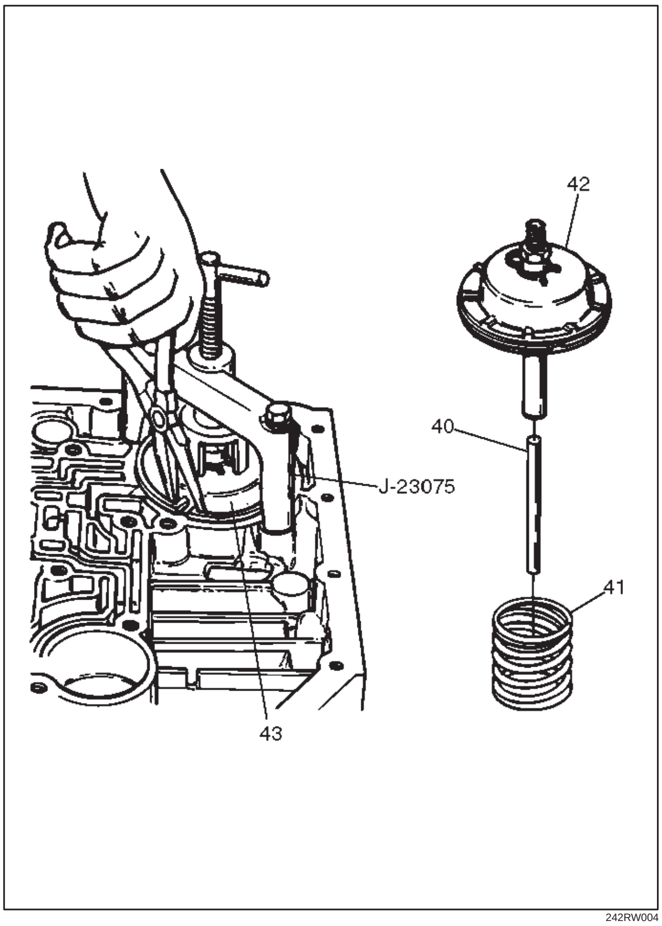
    End play: 0.36mm – 0.80mm (0.014 in – 0.031in)

    3. Remove axial play checking tool.
    4. If end play is not correct, repeat selective washer selection.

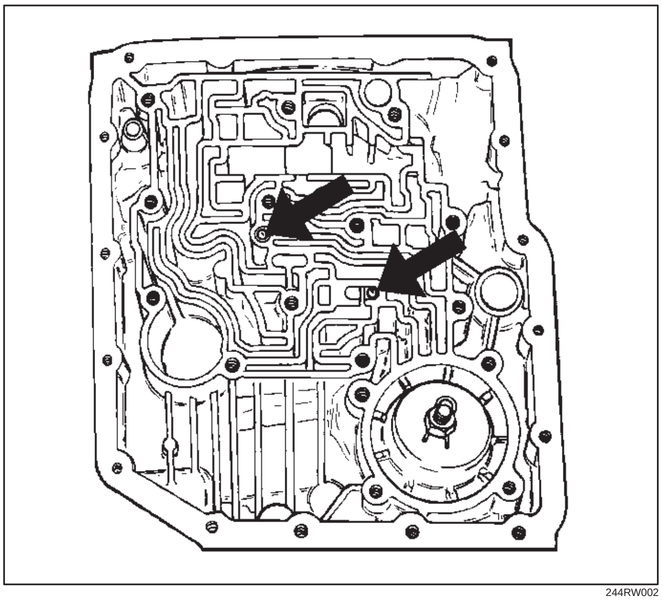


241RS005

44. Inspect servo piston seal ring. Replace if necessary.
    - Ensure brake band is correctly positioned. Rotate output shaft if necessary.
    - Install J–38428 servo piston fitter in servo bore.
    - Install apply rod (40), round end toward band, return spring (41) and piston assembly (42).
45. Install the J–23075 servo spring compressor with offset to rear of case.
    - Compress servo piston seal ring, using fitter while tightening the tool screw.
    - Install servo piston retaining ring (43).
    - Remove tool.
    - Adjust the brake band by tightening the servo adjusting screw to 4.5 N·m torque. Be certain the lock nut is loose, then back–off the screw five turns exactly. Hold piston sleeve with wrench and tighten lock nut to 18.5 N·m torque. Be certain the adjusting screw does not turn.



46. Install two check balls (44).



47. Inspect main case electrical connector and seal, replace if necessary.
   - Install electrical 7 way connector/main case and wiring harness.
48. Install two J–25025–B guide pins into main case.
   - Install main case valve body complete assembly (45) and manual valve link.

NOTE: Valve must be extended as the short end of manual valve link is connected to the range selector lever. Long end of link goes into valve.

   - Install seven 13 mm screws.

Torque: 20 N•m (15 lb ft)

   - Remove two guide pins.
49. Install servo cover gasket, cover (46) and four 13 mm screws.

Torque: 25 N•m (18 lb ft)

50. Connect wiring harness (47) to band control, shift solenoids, and main case 7 way connector.
51. Install manual detent roller and spring assembly (48) with clip.
   - Install two 13 mm screws.

Torque: 20 N•m (15 lb ft)

52. Install oil filter (49), and three 13 mm screws.

Torque: 20 N•m (15 lb ft)

53. Install oil pan gasket, magnet, main oil pan (50), and sixteen 10 mm screws.

Torque: 11 N•m (96 lb in)

54. Inspect adapter case electrical connector and seal. Replace if necessary.
   - Install electrical five pin connector and harness assembly (52) in bottom of adapter case.
55. Install gasket, transfer plate, and gasket.
   - Install adapter case valve body (51) and seven 13 mm screws.

Torque: 20 N•m (15 lb ft)

56. Connect wiring harness harness assembly (52) to converter clutch PWM solenoid, force motor, and 4 way connector.
57. Install oil pan gasket, adapter case oil pan (53), and twelve 10 mm screws.

Torque: 11 N•m (96 lb in)

   - Rotate transmission, with bottom pan facing down.
58. Install mode switch (54), two 10 mm screws, selector lever nut, and cover.

10 mm screw

Torque: 13 N•m (113 lb in)

Nut

Torque: 23 N•m (17 lb ft)

   - Adjust using setting tool, refer to Mode Switch in this section.
59. Install O–ring (55) on turbine shaft.
60. Install torque converter (56).
   The converter assembly must be replaced under any of the following conditions:
   a. Evidence of damage to the pump assembly.
   b. Metal particles are found after flushing the cooler lines.
   c. External leaks in hub weld area.
   d. Converter pilot broken, damaged, or poor fit into crankshaft.

e. Converter hub scored or damaged.

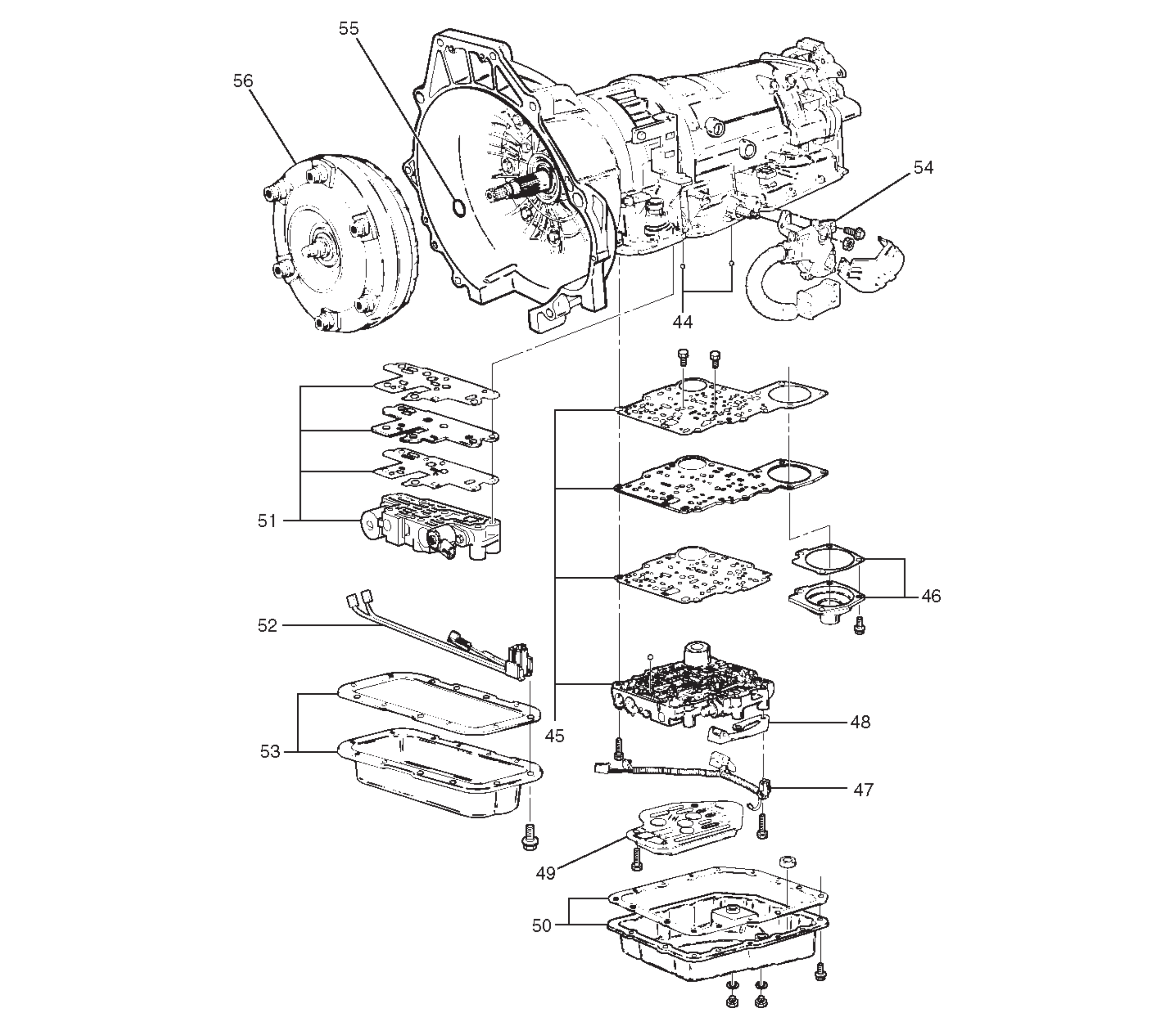
f. Internal failure in stator.

g. Contamination from engine coolant.

h. Excess end play.

- Rotate transmission, bell housing up. Spin converter to insure proper fit.

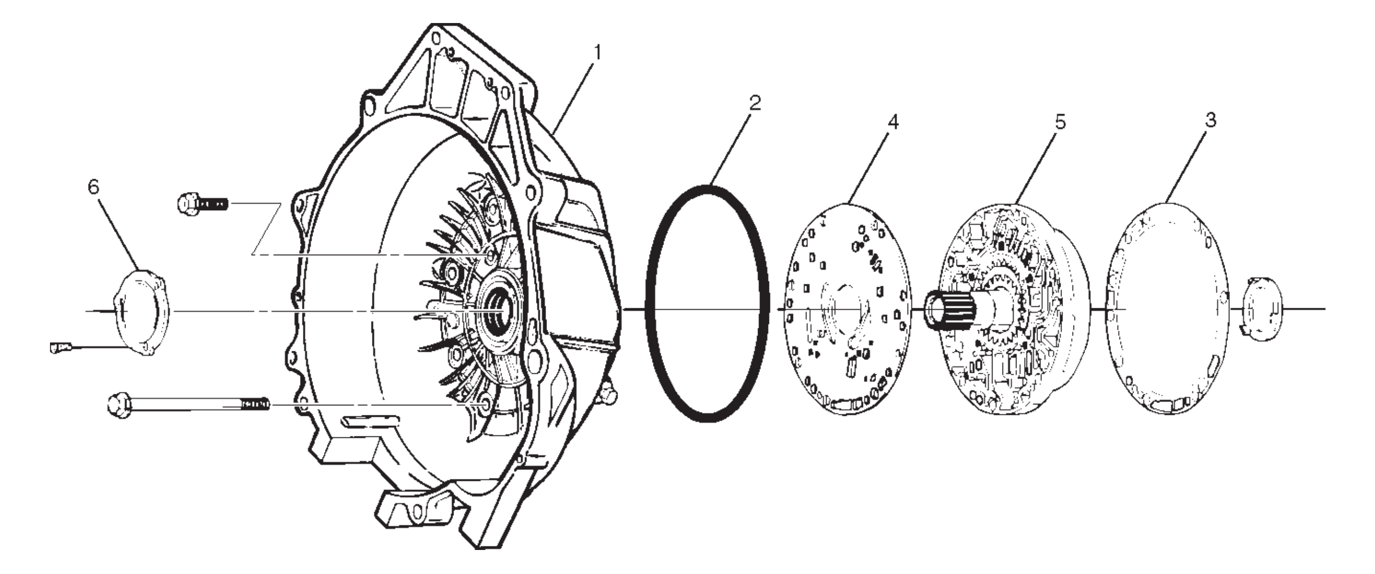
61. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®–III. Refer to Changing Transmission Fluid in this section.



240RY002

Converter Housing And Oil Pump Assembly

Disassembled View



241RY001

Legend

(1) Converter Housing
(2) Outer Seal Ring
(3) Gasket
(4) Wear Plate
(5) Oil Pump Assembly
(6) Oil Seal Ring

Disassembly

1. Remove oil pump assembly from converter housing.
2. Remove outer seal ring.
3. Remove gasket.
4. Remove wear plate.
5. Remove oil seal ring.

Inspection And Repair

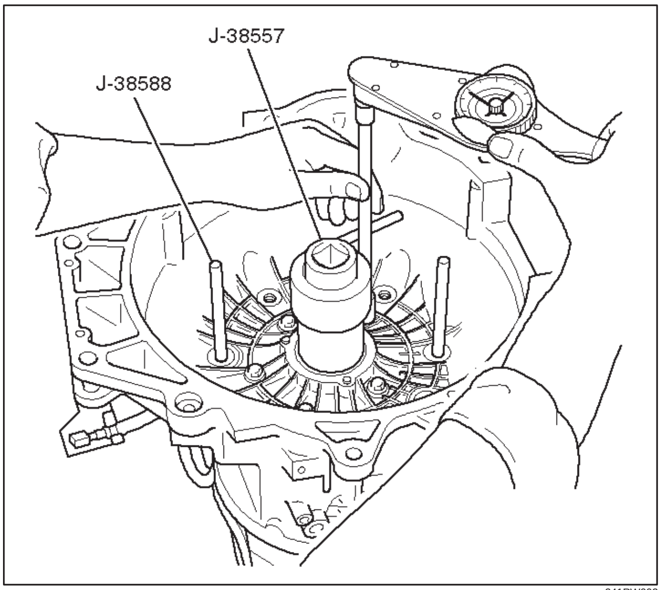
Visual Check:

If any damage, deformation, or local wear is found in a converter housing, outer seal ring, wear plate, or oil seal ring, replace it.

Reassembly

1. Install wear plate onto oil pump assembly.
2. Install converter housing onto complete oil pump assembly. Align with two short J–38588 guide pins on outer bolt holes.
   - Loosely install five 13mm bolts.
   - Center converter housing using J–38557 centering tool.
   - Tighten five inner 13mm bolts in an alternating pattern.

   Torque: 20 N•m (15 lb ft)



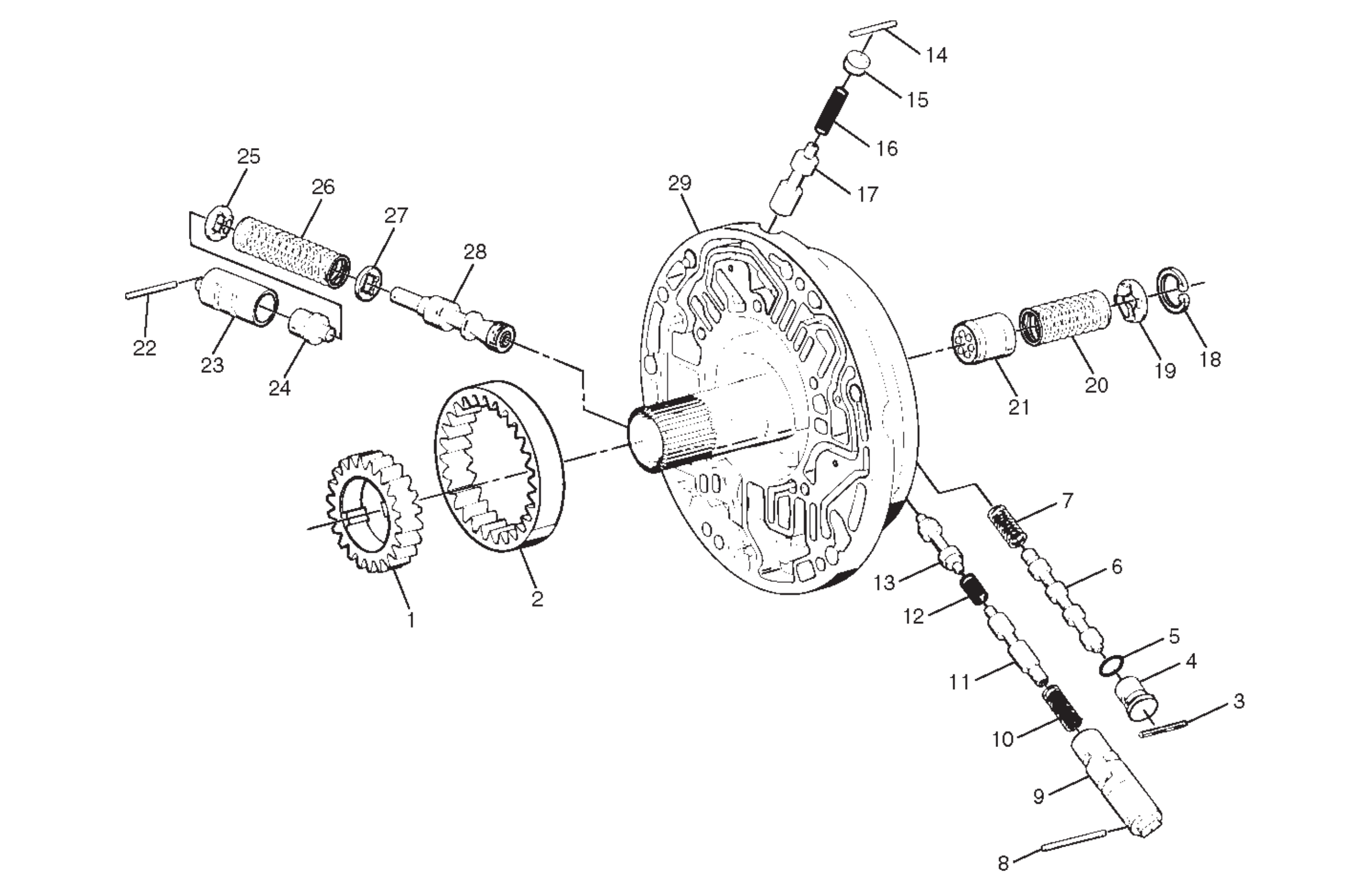
241RW002

3. Install oil seal ring (3 screws).

   Torque: 3 N•m (26 lb in)
4. Install gasket.
5. Install outer seal ring.

Oil Pump

Disassembled View



Legend

(1) Oil Pump Drive Gear
(2) Oil Pump Driven Gear
(3) Pin
(4) Plug
(5) Seal Ring
(6) Torque Converter Clutch Control Valve
(7) Converter Clutch Control Valve Spring
(8) Pin
(9) Converter Clutch Regulator Sleeve
(10) Converter Clutch Regulator Spring
(11) Converter Clutch Regulator Valve
(12) Isolator Spring
(13) Isolator Valve
(14) Pin
(15) Enable Valve Spring Guide
(16) Enable Valve Spring
(17) Enable Valve
(18) Snap Ring
(19) Spring Seat
(20) Throttle Signal Accumulator Spring
(21) Throttle Signal Accumulator Piston
(22) Sleeve Pin
(23) Boost Valve Sleeve
(24) Boost Valve
(25) Spring Seat
(26) Pressure Regulator Valve Spring
(27) Spring Seat
(28) Pressure Regulator Valve
(29) Oil Pump Assembly

Disassembly

1. Remove oil pump drive gear (1) and driven gear (2).
2. Remove pin (3) from oil pump assembly (29).
3. Remove plug (4) and seal ring (5), torque converter clutch control valve (6) and spring (7).
4. Remove pin (8) from oil pump assembly (29).
5. Remove torque converter regulator sleeve (9), converter clutch regulator spring (10), converter clutch regulator valve (11), isolator spring (12) and isolator valve (13).
6. Remove pin (14) from oil pump assembly (29).
7. Remove enable valve spring (16), spring guide (15) and enable valve (17).
8. Remove snap ring (18) from oil pump assembly (29).

9. Remove spring seat (19), spring (20) and throttle signal accumulator piston (21).
10. Remove sleeve pin (22) from oil pump assembly (29).
11. Remove boost valve sleeve (23), boost valve (24), spring seat (25), valve spring (26), spring seat (27), and pressure regulator valve (28).

Inspection And Repair

Visual Check:

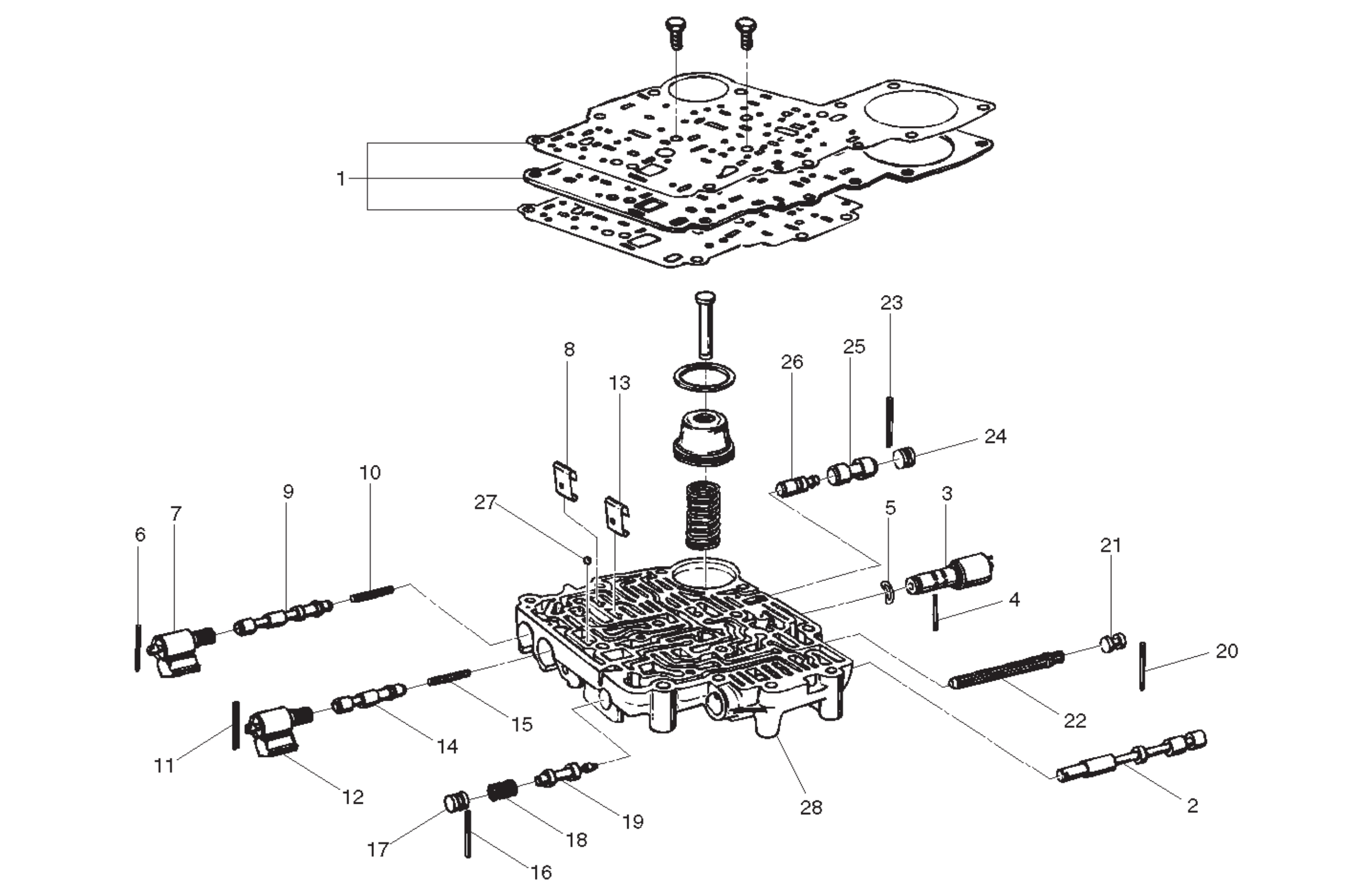
If any damage, deformation or wear is found, replace the damaged part.

Reassembly

1. Lubricate and preinstall pressure regulator spring seat (27) on valve (28), with the flat side against shoulder.
2. Install pressure regulator valve (28) and spring seat (27) assembly, valve spring (26), and spring seat (25) with the flat side away from spring to oil pump assembly (29).
3. Assemble boost valve (24) into sleeve (23).
4. Install boost valve and sleeve assembly, and sleeve pin (22) to oil pump assembly (29).
5. Install throttle signal accumulator piston (21), spring (20), and spring seat (19), with the flat side away from the spring, and snap ring (18) to oil pump assembly (29).
6. Install enable valve (17), spring guide (15), enable valve spring (16) and retainer pin (14) to oil pump assembly (29).
7. Assemble torque converter regulator spring (10) and torque converter regulator valve (11) into sleeve (9).
8. Install isolator valve (13), isolator valve spring (12) and the torque converter regulator sleeve and valve assembly into the oil pump assembly (29).
9. Install torque converter clutch control valve spring (7), torque converter clutch control valve (6), plug (4) and seal ring (5), and retainer pin (3) to oil pump assembly (29).
10. Install oil pump driven gear (2) and drive gear (1).

Main Case Valve Body

Disassembled View



Legend

(1) Gaskets and Transfer Plate
(2) Manual Valve
(3) Band Control Solenoid
(4) Pin
(5) Waved Washer
(6) Spring Pin
(7) Solenoid A
(8) Retainer
(9) 1–2/3–4 Shift Valve
(10) Spring
(11) Spring Pin
(12) Solenoid B
(13) Retainer
(14) 2–3 Shift Valve
(15) Spring
(16) Spring Pin
(17) Plug
(18) Spring
(19) Low Pressure Control Valve
(20) Spring Pin
(21) Plug
(22) Band Control Screen Assembly
(23) Spring Pin
(24) Plug
(25) 1–2 Accumulator Valve
(26) 1–2 Accumulator Control Valve
(27) Check Ball
(28) Main Case Valve Body

Disassembly

1. Remove two 11mm bolts from valve body (28), then remove gaskets and transfer plate (1).
2. Remove manual valve (2).
3. Push in band control solenoid (3) to compress waved washer (5), and remove pin (4).
4. Remove band control solenoid (3) and waved washer (5).
5. Remove spring pin (6) with a 3 mm dia punch.
6. Remove solenoid A (7) by grasping the metal tip. Do not grasp the connector housing.
7. Remove retainer (8), 1–2/3–4 shift valve (9), and spring (10).
8. Remove spring pin (11) with a 3 mm dia punch.
9. Remove solenoid B (12) by grasping the metal tip. Do not grasp the connector housing.

10. Remove retainer (13), 2–3 shift valve (14), and spring (15).
11. Remove spring pin (16), plug (17), spring (18), and low pressure control valve (19).
12. Remove spring pin (20), plug (21), and band control screen assembly (22).
13. Remove spring pin (23), plug (24), 1–2 accumulator valve (25), and 1–2 accumulator control valve (26).
14. Remove check ball (27) from valve body (28).

Inspection And Repair

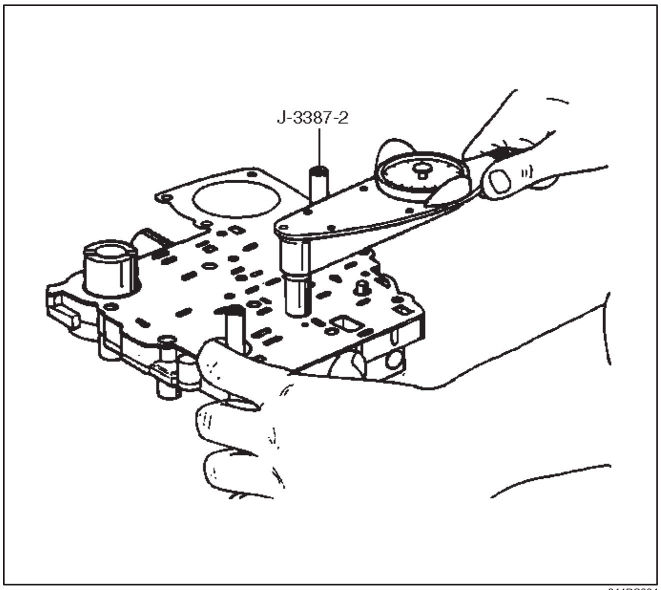
Inspect for the following, and replace any damaged or worn parts:

1. Damage or wear to each valve.
2. Damage in oil passeges.
3. Cracks or damage to valve body.
4. Valve operations.
5. Spring fatigue.

Reassembly

1. Install 1–2 accumulator control valve (26), 1–2 accumulator valve (25), plug (24), and spring pin (23).
2. Install band control screen assembly (22), plug (21), and spring pin (20).
3. Install low pressure control valve (19), spring (18), plug (17), and spring pin (16).
4. Install spring (15), 2–3 shift valve (14), retainer (13), solenoid B (12), and spring pin (11).
5. Install spring (10), 1–2/3–4 shift valve (9), retainer (8), solenoid A (7), and spring pin (6).
6. Install waved washer (5), band control solenoid (3), and pin (4).
7. Install manual valve (2).
8. Install check ball (27) to valve body (28).
9. Install gasket (valve body/transfer plate) and transfer plate using two J–3387–2 guide pins.
   - Install two 11mm bolts.

Torque: 13 N•m (113 lb in)

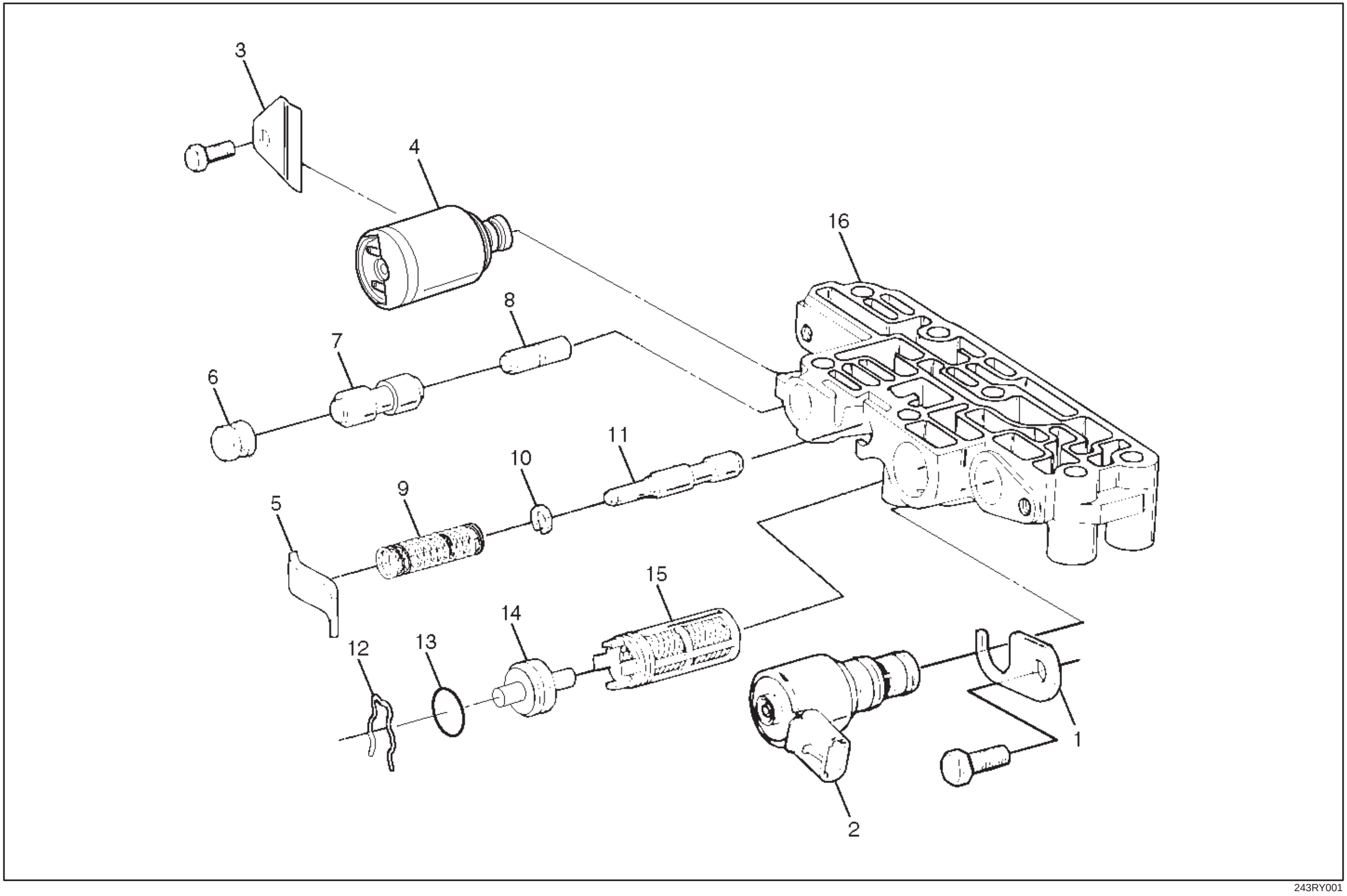


244RS004

- Install gasket (transfer plate/main case).

Adapter Case Valve Body

Disassembled View



Legend

(1) Bracket
(2) Converter Clutch PWM Solenoid
(3) Retainer
(4) Force Motor Solenoid
(5) Retainer
(6) Plug
(7) 3/4 Accumulator Valve
(8) 3/4 Accumulator Control Valve
(9) Spring
(10) Retaining Ring
(11) Feed Limit Valve
(12) Plug Retainer
(13) O–Ring
(14) Plug
(15) Force Motor Screen Assembly
(16) Adapter Case Valve Body

Disassembly

1. Remove 11mm bolt from valve body.
   - Remove bracket (1) and converter clutch PWM solenoid (2).
2. Remove 11mm bolt and retainer (3) from valve body.
   - Remove force motor solenoid (4).
3. Remove retainer (5), plug (6), 3/4 accumulator valve (7), and 3/4 accumulator control valve (8).
4. Remove spring (9), retaining ring (10), and feed limit valve (11).
5. Remove plug retainer (12), O–ring (13), plug (14), and force motor screen assembly (15).
   - Use 5 mm bolt to pull plug.

Inspection And Repair

Inspect for the following, and replace any damaged or worn parts:

1. Damage or wear to each valve.
2. Damage in oil passeges.
3. Cracks or damage to valve body.
4. Valve operations.
5. Spring fatigue.

Reassembly

1. Install force motor screen assembly (15), plug (14), O–ring (13), and plug retainer (12).

2. Install feed limit valve (11), retaining ring (10), and spring (9).
3. Install 3/4 accumulator control valve (8), 3/4 accumulator valve (7), plug (6), and retainer (5).
4. Install force motor solenoid (4).
   - Place solenoid terminals pointing towards mating face.
   - Install retainer (3) and bolt.

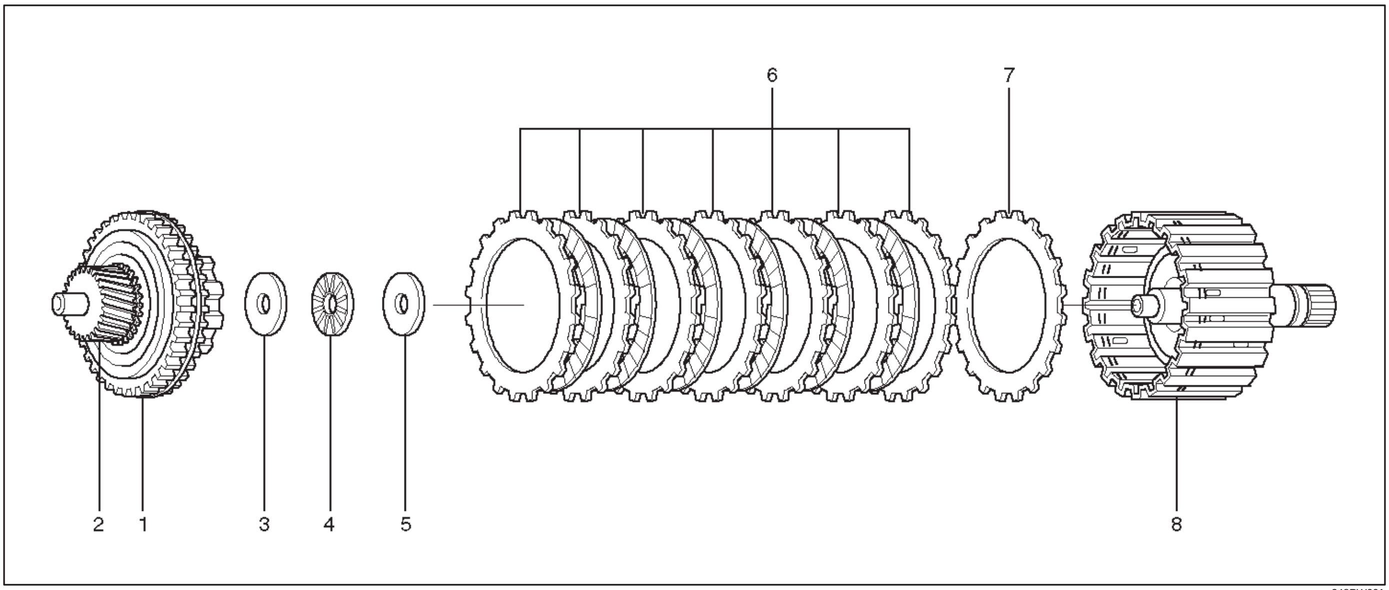
Torque: 10 N•m (87 lb in)

5. Install converter clutch PWM solenoid (2) with two O–rings (2) and bracket (1) to valve body.
   - Install bolt.

Torque: 10 N•m (87 lb in)

Third Clutch And Sprag Unit

Disassembled View



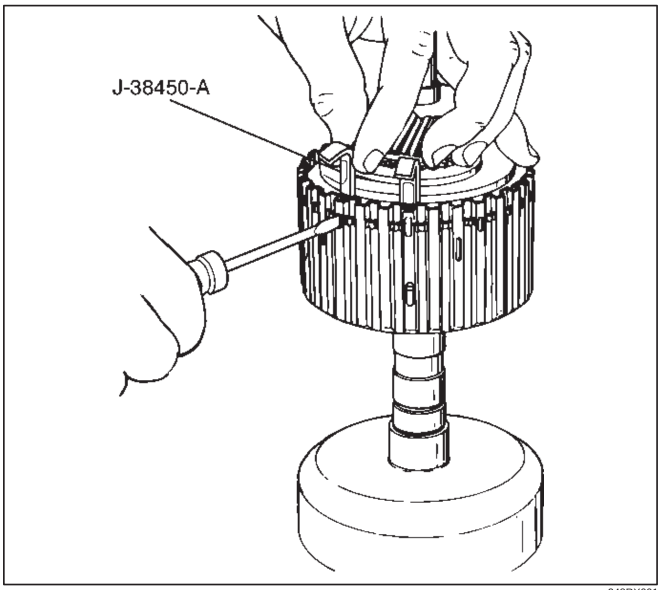
248RW001

Legend

(1) Retaining Ring
(2) Input Sun Gear and Sprag Unit Assembly
(3) Retaining Washer
(4) Bearing
(5) Thrust Washer
(6) Clutch Plates
(7) Third Clutch Spring Cushion Plate
(8) Third Clutch Drum Assembly

Disassembly

1. Place the third clutch drum and intermediate shaft assembly upright, using the overdrive internal gear as a support.
2. Locate the ends of the retaining ring. Depress one end of the ring using a small screwdriver instead of the depressor handle provided with the tool J-38450-A. Slide one blade down between the third clutch drum and the retaining ring.
3. Remove a screwdriver and repeat this step for the other end of retaining ring.
4. Install the remaining four blades approximately (five) notches apart using a screwdriver to depress the retaining ring.
5. Pull up on input sun gear and sprag unit assembly (1 and 2) to release the retaining ring from third clutch drum assembly (8).
6. Remove the tool blades.



248RX001

7. Remove retaining washer (3), bearing (4), thrust washer (5), and clutch plates (6 and 7) from the third clutch drum assembly (8).

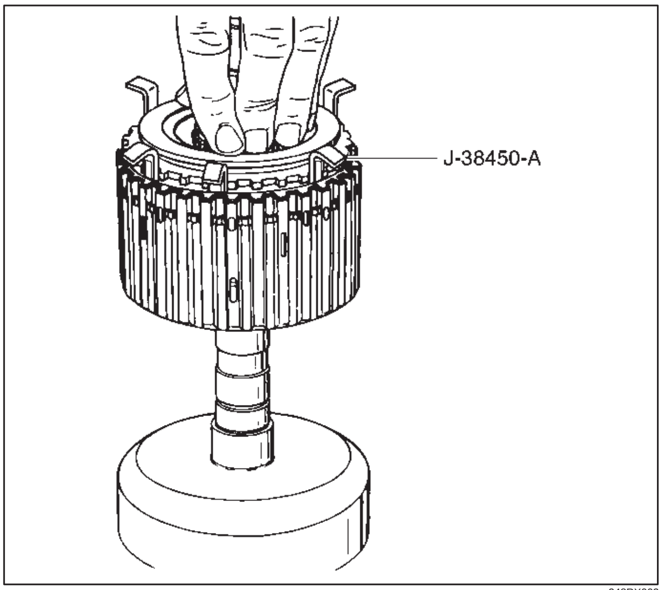
Inspection And Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Reassembly

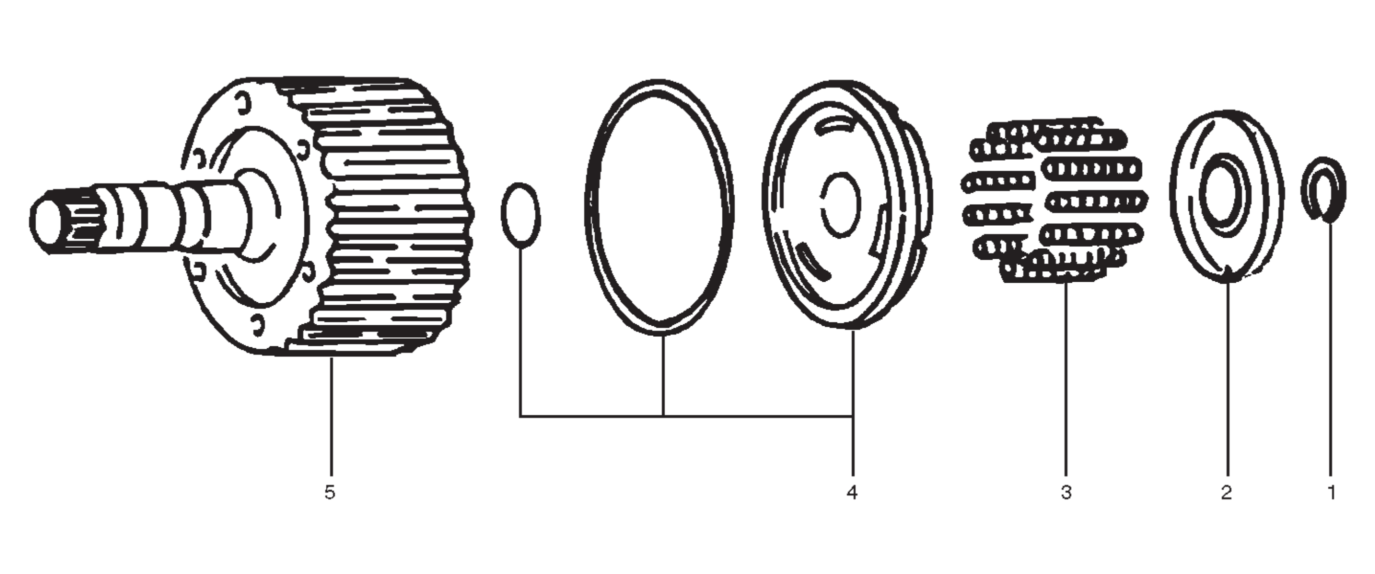
1. Place third clutch drum and intermediate shaft assembly upright, using the overdrive internal gear as a support.
2. Install third clutch spring cushion plate (7), bevel face down.
3. Install third clutch plates (6) into third clutch drum assembly (8). Start with the steel clutch plate and alternate with lined plates.
4. Install thrust washer (5), bearing (4), and retaining washer (3).
5. Fully engage the hub splines of the input sun gear and sprag unit assembly (2) into the third clutch inner tangs.
   - Simultaneously rotate the outer sprag race to engage into the third clutch drum assembly (8).
6. Place J-38450-A blades between the retaining ring and the third clutch drum apporximately (five) notches apart, and one blade at each end of the retaining ring (1). Push down on sprag assembly until the assembly is seated into the third clutch drum assembly (8).
7. Remove the tool blades and engage retaining ring into groove of third clutch drum.



248RX002

Third Clutch

Disassembled View



Legend

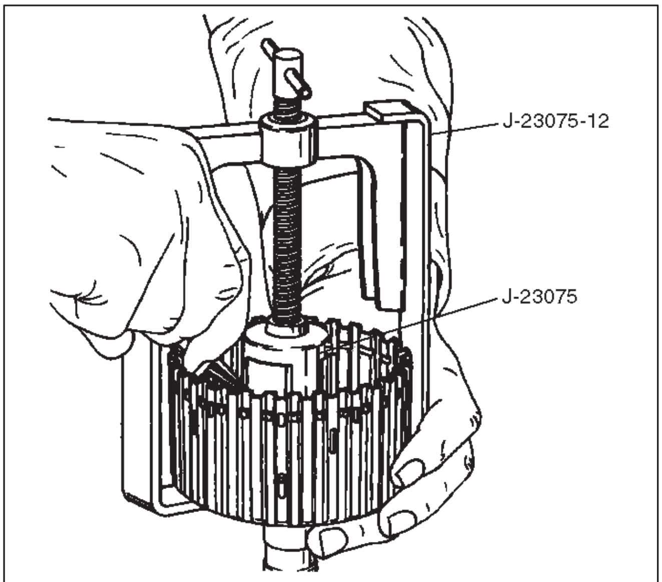
(1) Retaining Ring
(2) Spring Seat
(3) Springs
(4) Piston Assembly
(5) Third Clutch Drum

Disassemble

1. Compress spring seat using the J–23075 spring compressor and J–23075–12 adapter tool.

NOTE: Do not over–stress the springs and seat. This will cause damage to the spring seat.

- Remove the tool.
- Remove retaining ring (1).



2. Release the spring seat (2).

NOTE: Do not let the spring seat catch in the ring groove.

- Remove spring seat (2) and springs (3).

3. Remove piston assembly (4) from third clutch drum (5).

Inspection And Repair

Visual check:

If any damage, deformation or wear is found, replace the damaged part.

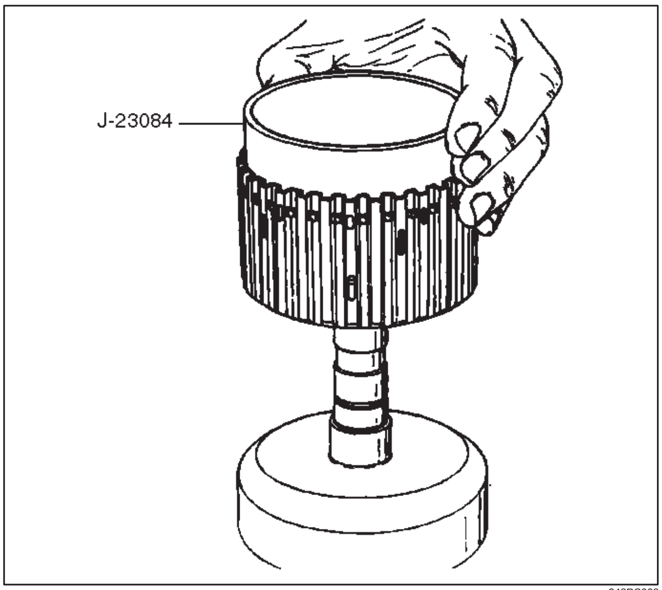
Operation check:

Shake the piston and listen for check ball movement indicates proper check ball operation. Replace the piston if the check ball is missing or falls out.

Reassembly

1. The lip of the piston seal must point toward the front of the transmission. Lubricate the seal lip with transmission fluid.

- Install piston assembly (4) into the third clutch drum (5). Use the J–23084 third clutch piston installer to protect the outer seal during installation.
- Remove the seal installer.



248RS008

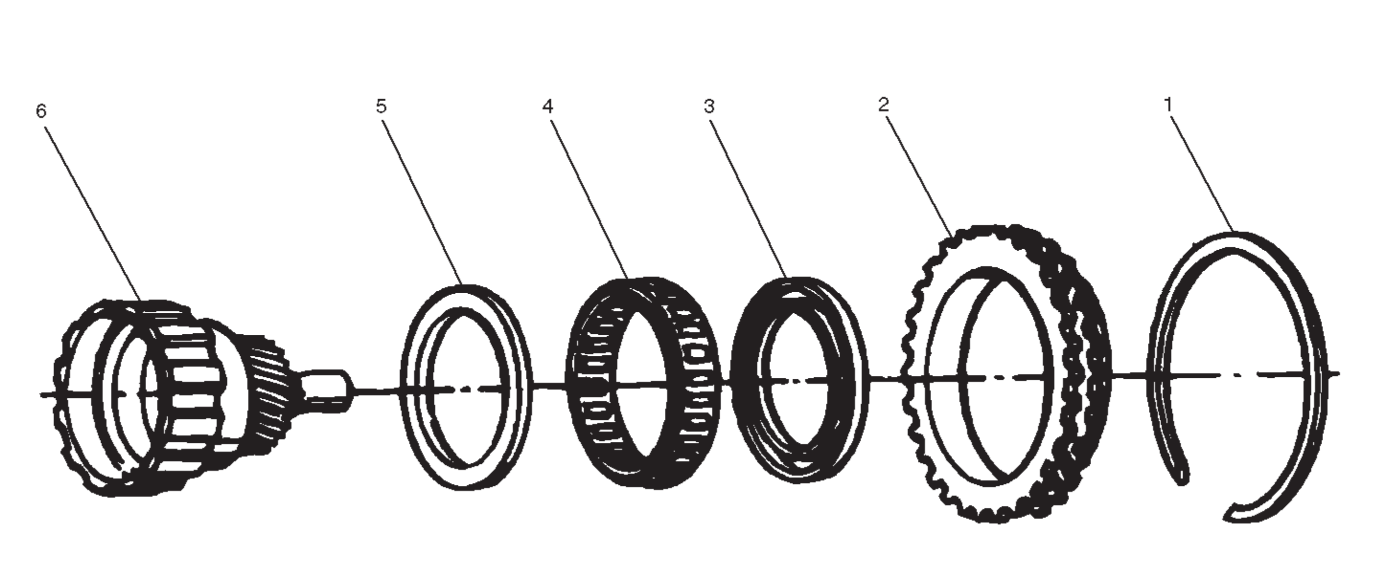
2. Install twelve springs (3) and spring seat (2).
3. Place retaining ring (1) onto spring seat.
   - Compress the piston springs, using the J–23075 piston spring compressor and J–23075–12 adapter.

CAUTION: Do not over stress the springs and seat. Do not let the spring seat catch in the ring groove. This may cause damage to the spring seat.

- Install spring seat retaining ring (1).
- Remove the piston spring compressor and adapter.

Sprag Unit

Disassembled View



248RS009

Legend

(1) Retaining Ring
(2) Sprag Outer Race
(3) Ring
(4) Sprag Assembly
(5) Ring
(6) Third Clutch Hub and Sun Gear Assembly

Disassembly

1. Remove the sprag outer race, retaining ring, and sprag assembly from the third clutch hub and sun gear assembly.
2. Remove the rings and sprag assembly from the sprag outer race.

Inspection And Repair

Visual Check:

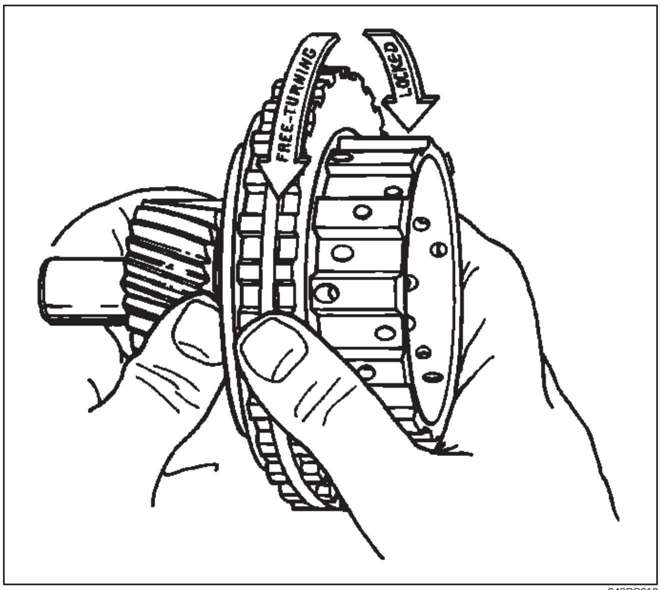
If any damage, deformation or wear is found, replace the damaged part.

Reassembly

NOTE: Flared shoulder of the sprag cage faces the sun gear. This procedure must be followed exactly to be sure that the sprag assembly is installed properly.

1. Install rings and sprag assembly onto the third clutch hub and sun gear.
2. Install sprag outer race and retaining ring assembly over the sprag cage assembly.
   - Place third clutch hub and sun gear assembly on a flat surface, sun gear facing up. Place sprag outer race and sprag assembly over the sun gear assembly, push down and turn the input sun counterclockwise at the same time.

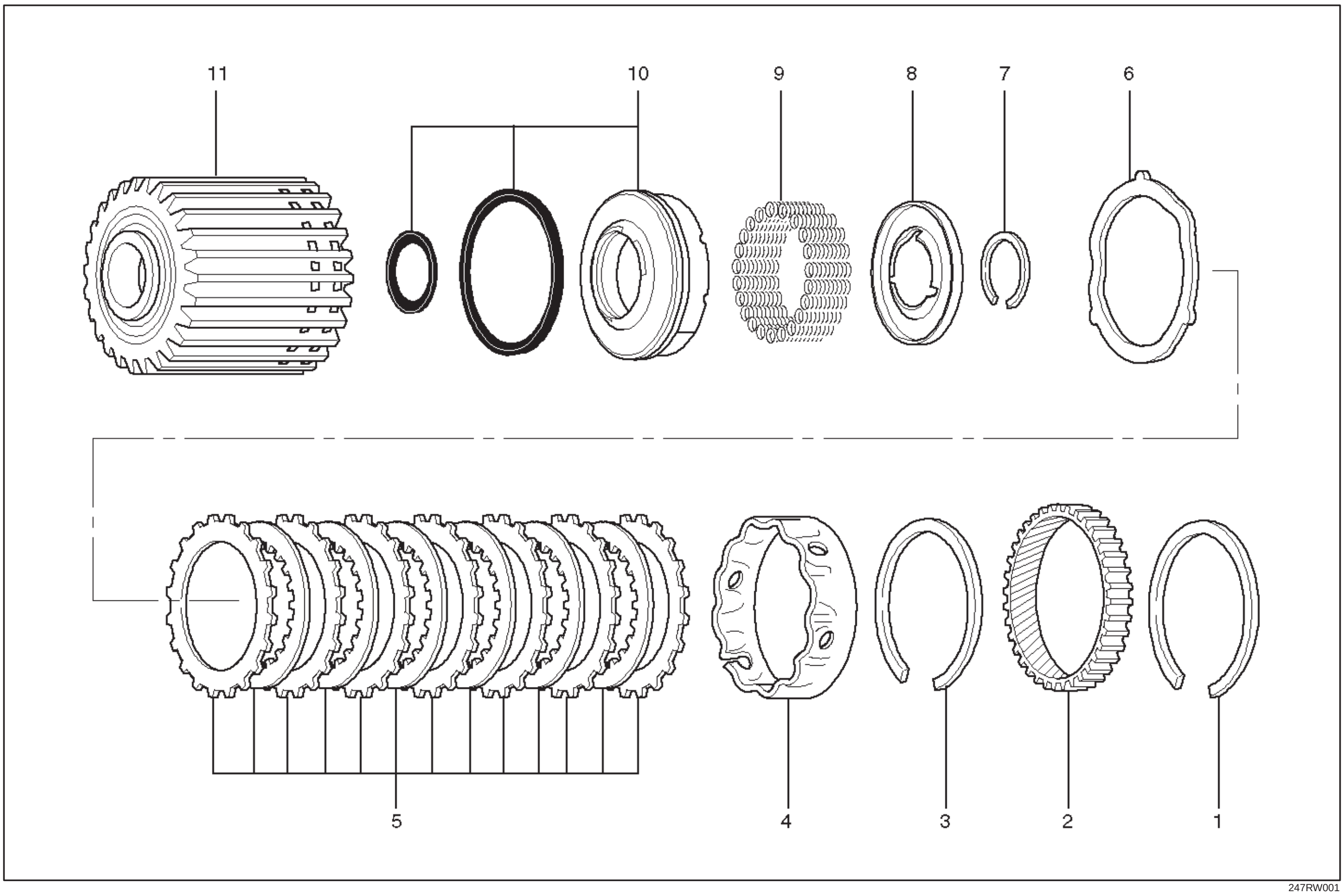
NOTE: Check correct rotation by holding the sun gear in your left hand and turning the outer race. The outer sprag race should turn freely towards you and should lock turning away from you.



248RS010

Second Clutch

Disassembled View

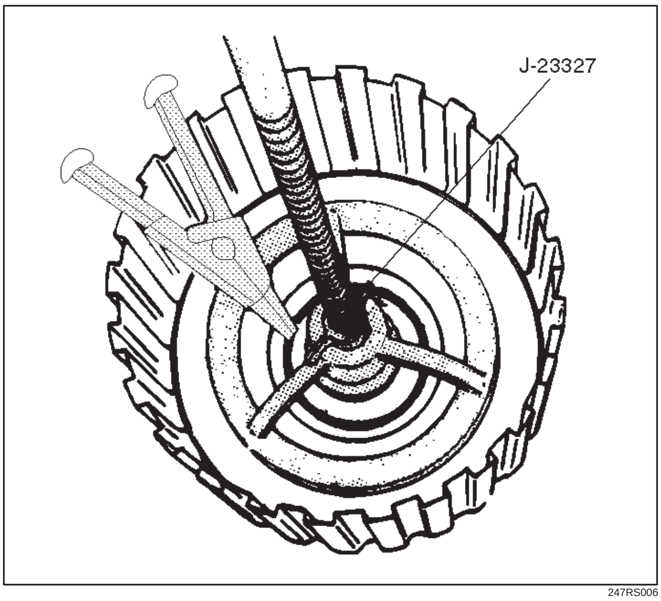


Legend

(1) Retaining Ring
(2) Ring Gear
(3) Retaining Ring
(4) Spacer
(5) Clutch Plates
(6) Waved Washer
(7) Retaining Ring
(8) Spring Seat
(9) Springs
(10) Piston Assembly
(11) Second Clutch Drum

Disassembly

1. Remove retaining ring (1) from second clutch drum (11).
2. Remove ring gear (2), retaining ring (3), and spacer (4).
3. Remove clutch plates (5) and waved washer (6).
4. Remove retaining ring (7) using J–23327 compressor to compress the spring seat (8).
5. Remove spring seat (8), springs (9) and piston assembly (10) from second clutch drum (11).



Inspection And Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Operation Check:

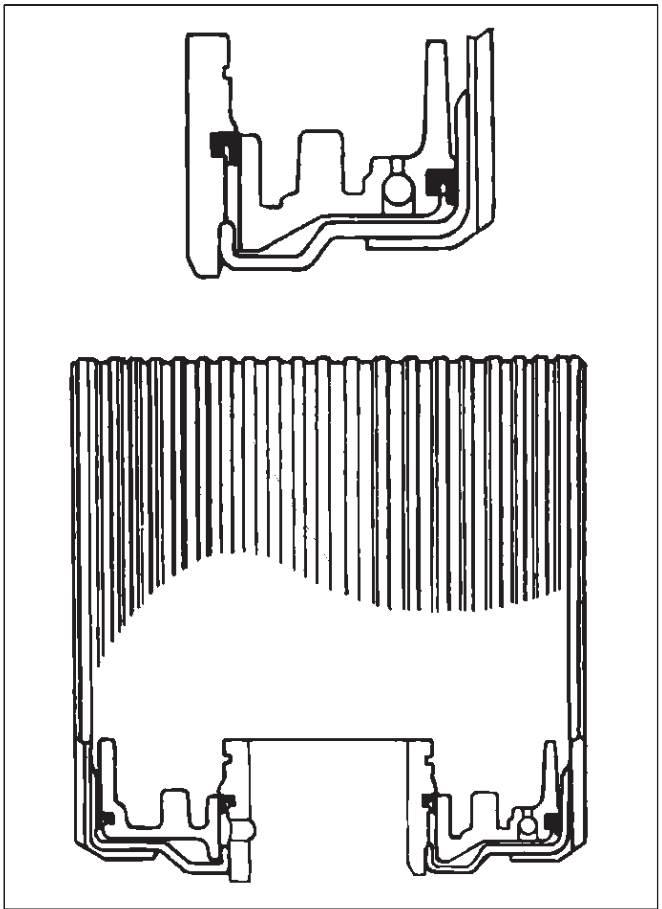
Shake the piston and listen for check ball movement. Movement indicates proper check ball operation. Replace the piston if the check ball is missing or falls out.

Reassembly

1. Install piston assembly (10) into the second clutch drum (11).
   - Lubricate the lip seal with transmission fluid. Use the J–23080–A second clutch piston installer to protect the outer piston lip seal.

NOTE: Lip of the seal should point toward front of transmission.

- Remove the installer.



247RS007

2. Install twenty–two piston springs (9) and spring seat (8) on the second clutch piston (10). Place retaining ring (7) onto spring seat.
   - Use the J–23327 compressor to compress the piston springs.

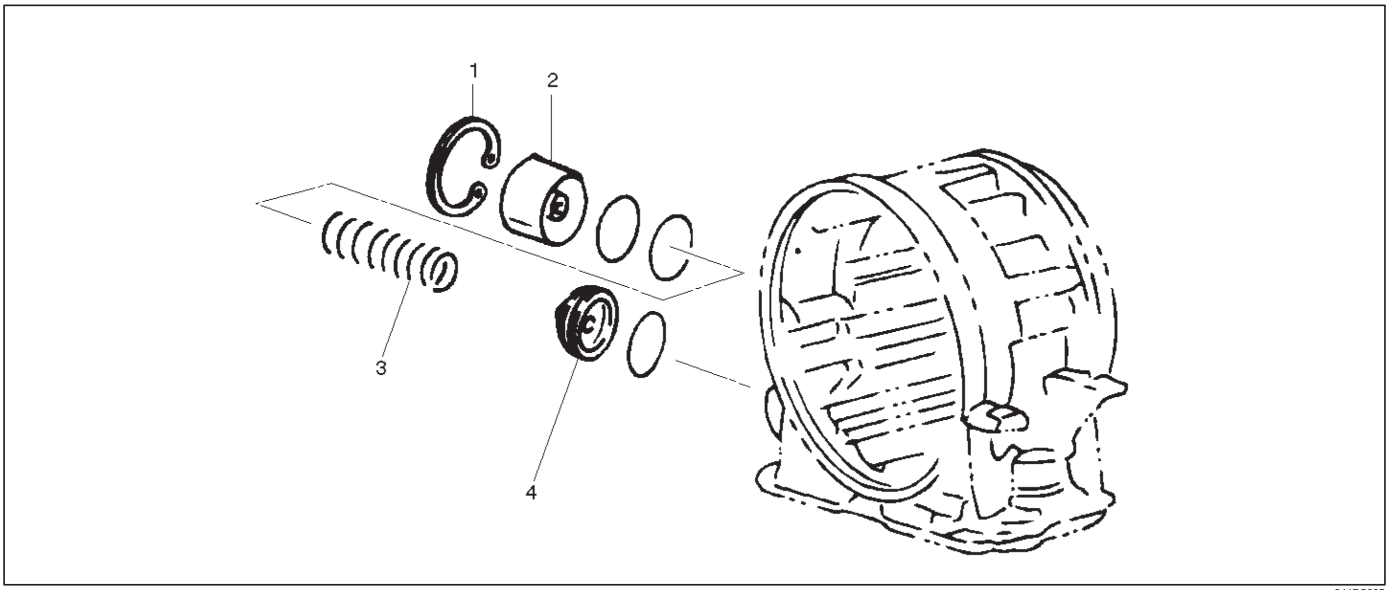
NOTE: Do not let spring seat catch in ring groove.

- Remove the compressor.

3. Install waved plate (6) and clutch plates (5). Start with a steel plate and alternate with lined plates.
   - Align second clutch inner tangs.
4. Install spacer (4), with the fluted end toward clutch plates.
5. Install retaining ring (3), ring gear (2) and retaining ring (1).

3–4 Accumulator Piston

Disassembled View



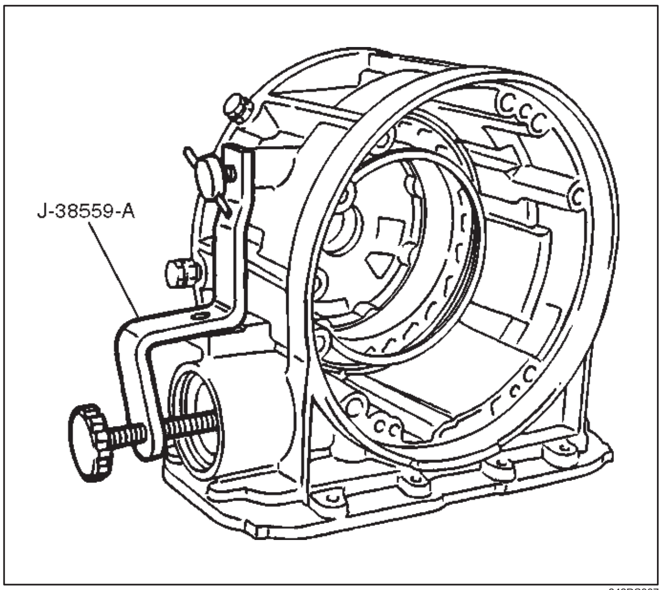
244RS005

Legend

(1) Snap Ring
(2) Cover
(3) Spring
(4) Piston Assembly

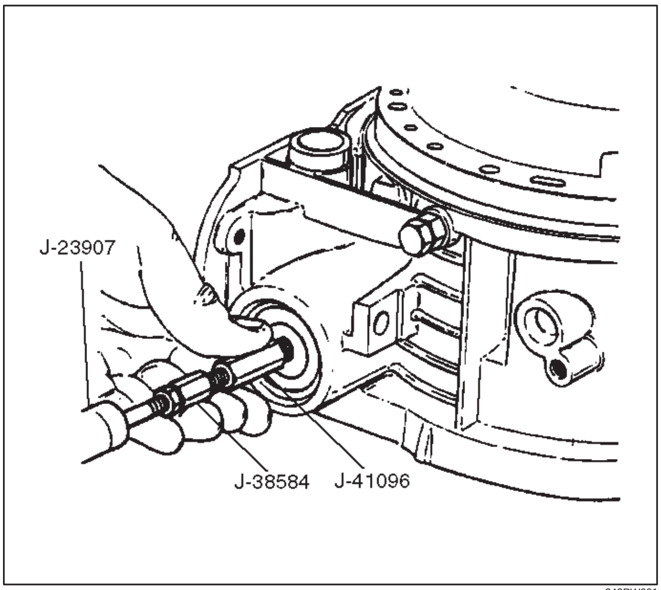
Disassembly

1. Install the J–38559–A cover compressor on adapter case.
   - Compress piston cover then remove snap ring.



242RS007

2. Install the J–41096 cover remover and J–38584 adapter to center hole of cover.
   - Use the J–23907 slide hammer to remove cover.
3. Remove spring and piston assembly.



242RW001

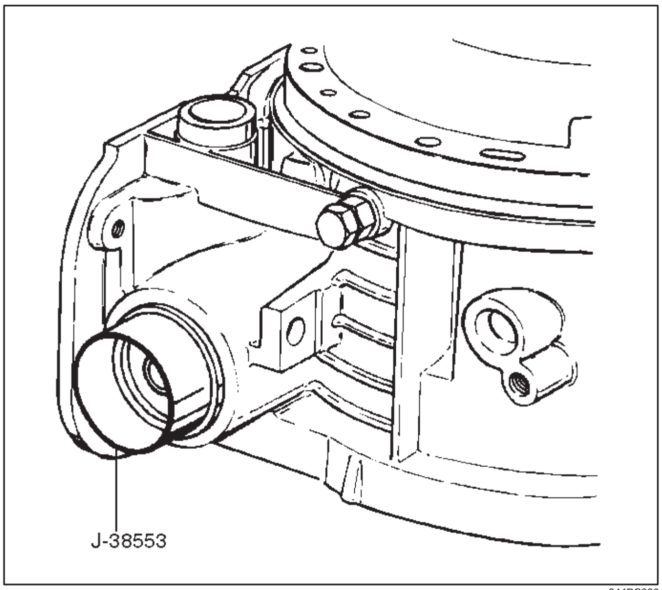
Inspection And Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

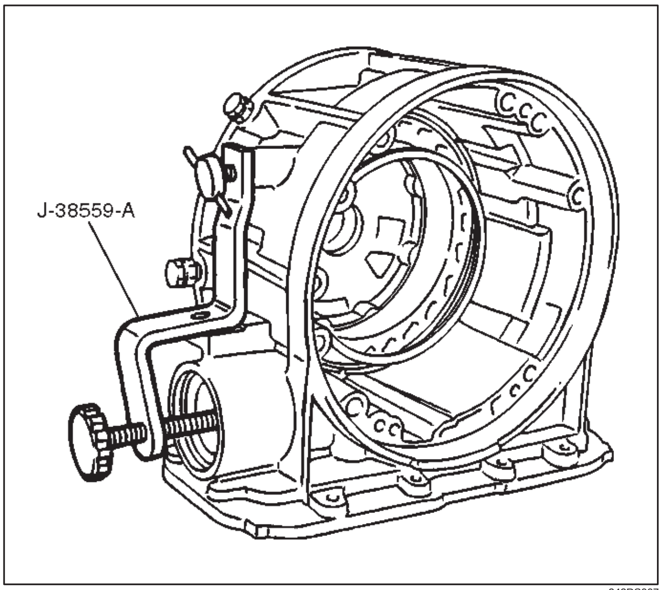
Reassembly

1. Place the J–38553 piston fitter into adaptor case and push the piston into position, using suitable diameter tube.
   - Remove the piston fitter.



244RS006

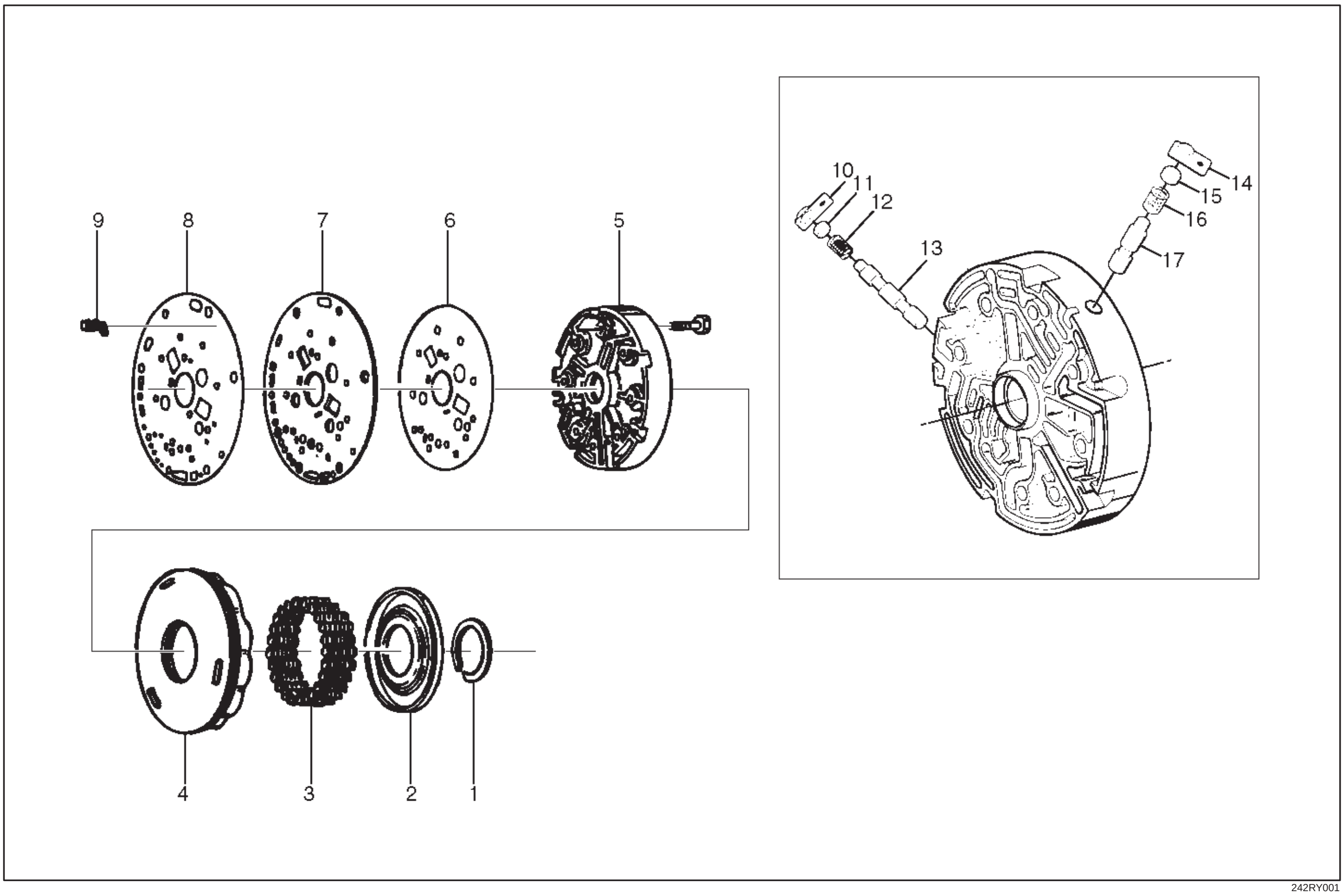
2. Install spring and cover.
3. Install snap ring, using the J–38559–A compressor tool.
   - Install snap ring in groove.
   - Remove the compressor tool.



242RS007

Reverse Clutch Piston And Center Support

Disassembled View



Legend

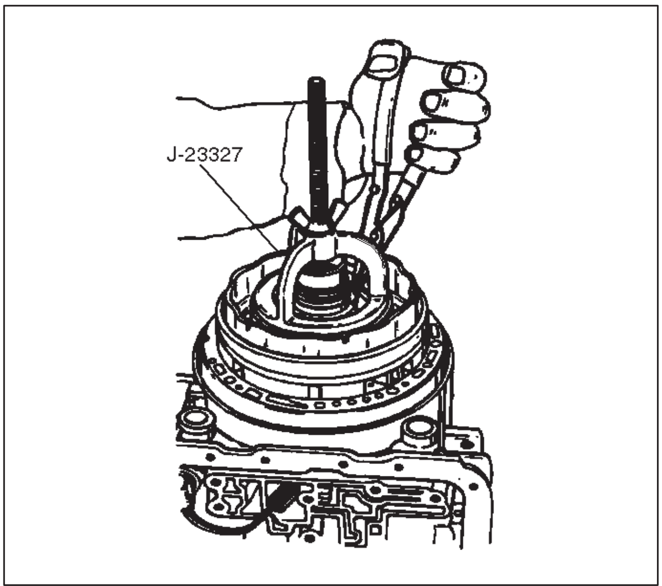
(1) Retaining Ring
(2) Spring Seat
(3) Springs
(4) Piston Assembly
(5) Center Support
(6) Gasket
(7) Transfer Plate
(8) Gasket
(9) Restrictor
(10) Retainer Plate
(11) Plug
(12) Spring
(13) Overrun Lock Out Valve
(14) Retainer Plate
(15) Plug
(16) Spring
(17) Reverse Lock Out Control Valve

Disassembly

1. Install the J–23327 compressor tool on spring seat, then compress the spring seat.
   - Remove retaining ring (1).

NOTE: Do not over–stress the springs and seat, as this will cause damage to the spring seat.

   - Remove the compressor tool.



247RS008

2. Remove spring seat (2) and springs (3).
3. Remove piston assembly (4).
4. Remove 8 bolts from center support (5), then remove center support (5) from adapter case.
5. Remove gasket transfer plate/outer support (6), center support transfer plate (7), and gasket transfer plate/adapter case (8).
6. Remove restrictor (9) from adapter case housing.
7. Remove retainer plate (10), plug (11), spring (12), and overrun lock out valve (13) from center support (5).
8. Remove retainer plate (14), plug (15), spring (16) and reverse lock out valve (17) from center support (5).

Inspection And Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Reassembly

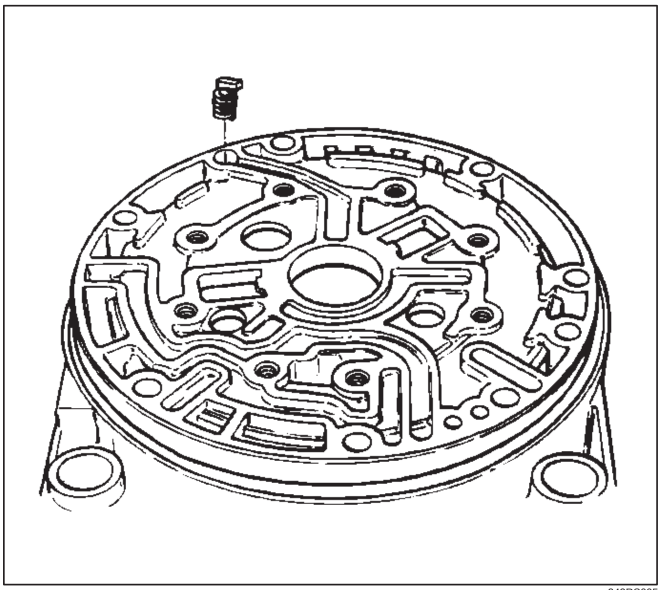
1. Install reverse lock out valve (17) and spring (16) to center support.

NOTE: Ensure correct assembly of valve. The spring should be located over the long small diameter end.

2. Install plug (15) and retainer plate (14).
3. Install overrun lock out valve (13) and spring (12) to center support.

NOTE: Ensure correct assembly of valve. The spring should be located over the long small diameter end.

4. Install plug (11) and retainer plate (10).
5. Place restrictor (9) in the lube overdrive channel in the adapter case housing.



242RS005

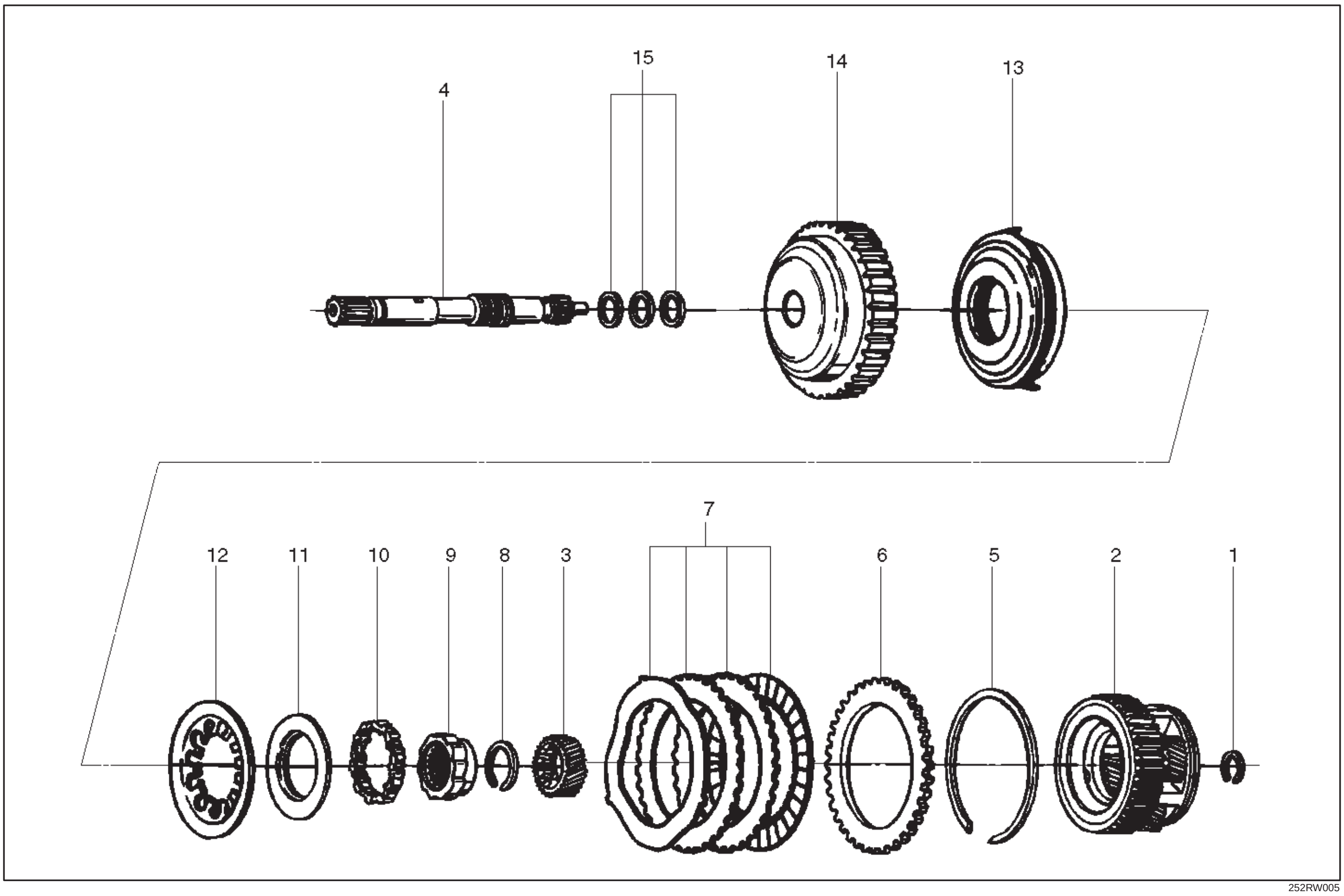
6. Install gasket transfer plate/adapter case (8), center support transfer plate (7), and gasket transfer plate/center support (6).
7. Install center support (5) with 8 bolts.

Torque : 25 N•m (18 lb ft)

8. Install piston assembly (4) into center support (5).
9. Install twenty four springs (3), spring seat (2), and retaining ring (1).
   - Install the J–23327 compressor and compress spring seat (2) and springs (3), then seat snap ring (1) in groove.
   - Remove the tool.

Overrun Clutch And Turbine Shaft

Disassembled View

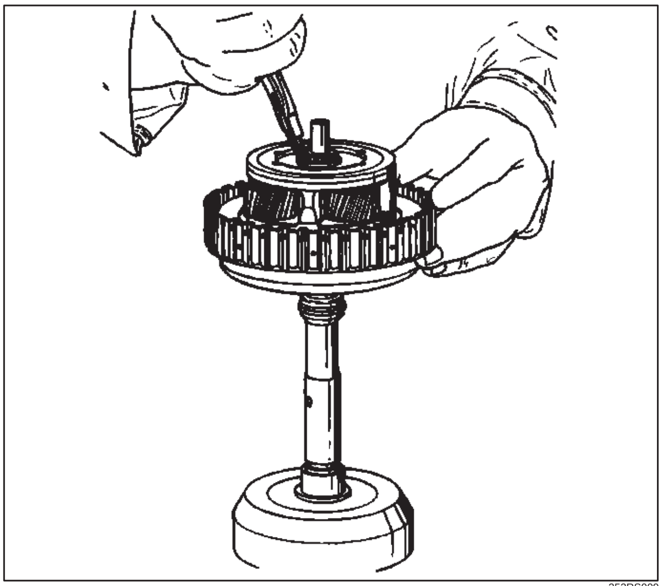


Legend

(1) Snap Ring
(2) Overdrive Carrier Assembly
(3) Sun Gear
(4) Turbine Shaft
(5) Snap Ring
(6) Backing Plate
(7) Clutch Plates
(8) Snap Ring
(9) Overrun Roller Clutch Cam
(10) Roller Clutch Assembly
(11) Overrun Clutch Release Spring Retainer
(12) Diaphragm Spring
(13) Piston Assembly
(14) Overrun Clutch Drum
(15) Turbine Shaft Seal Rings

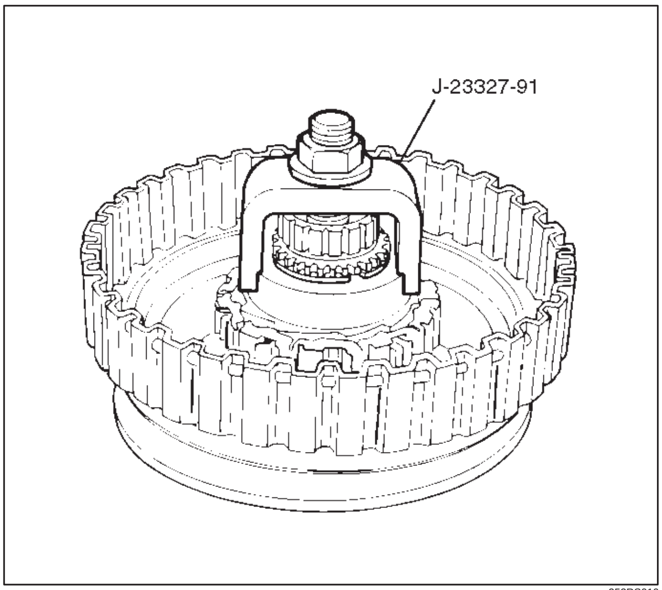
Disassembly

1. Position overrun clutch assembly upright, using the overdrive internal gear as a support.
   - Remove snap ring (1).



252RS009

2. Remove overdrive carrier assembly (2), sun gear (3) and turbine shaft (4).
3. Remove snap ring (5), backing plate (6), and clutch plates (7).
4. Compress diaphragm spring with the J–23327–91 compressor, then remove snap ring (8).



252RS010

5. Remove overrun roller clutch cam (9) and roller clutch assembly (10).
6. Remove overrun clutch release spring retainer (11) and diaphragm spring (12).
7. Remove piston assembly (13) from overrun clutch drum (14).
8. Remove turbine shaft seal rings (15).

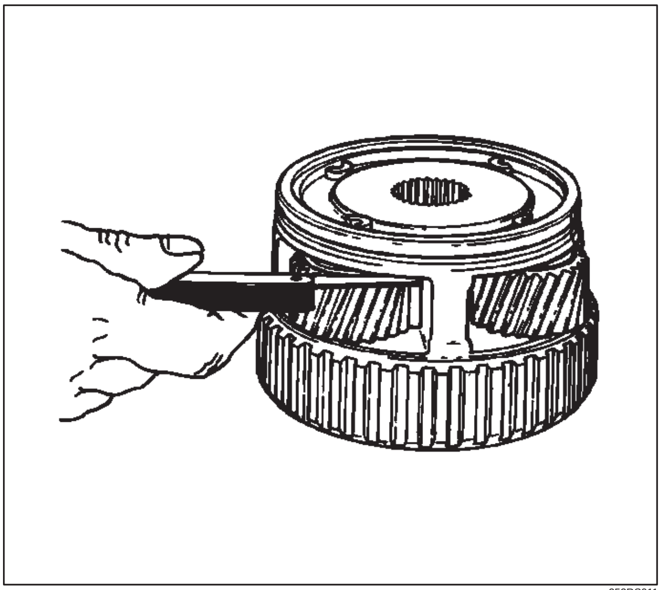
Inspection And Repair

Overdrive Carrier Check

- Check pinion end play with a feeler gauge.

Clearance: 0.24mm–0.64mm (0.0094in–0.025in)

If clearance is outside specified value, replace overdrive carrier assembly.



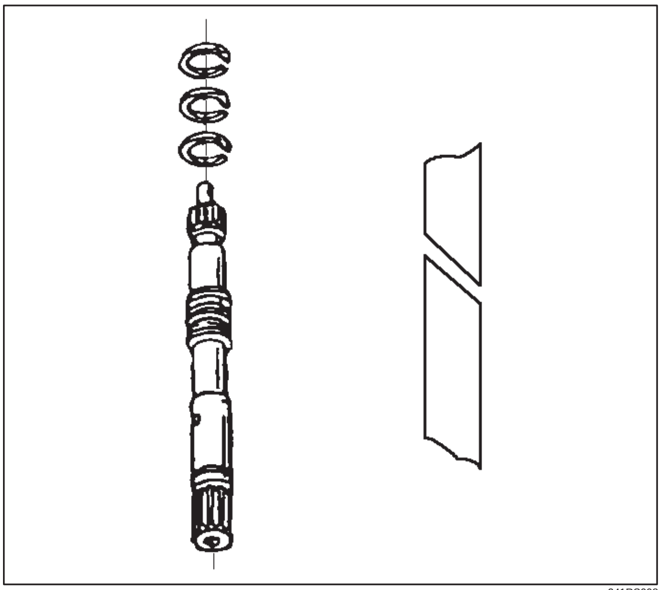
252RS011

Visual Check:

If any damage, deformation or local wear is found, replace the damaged part.

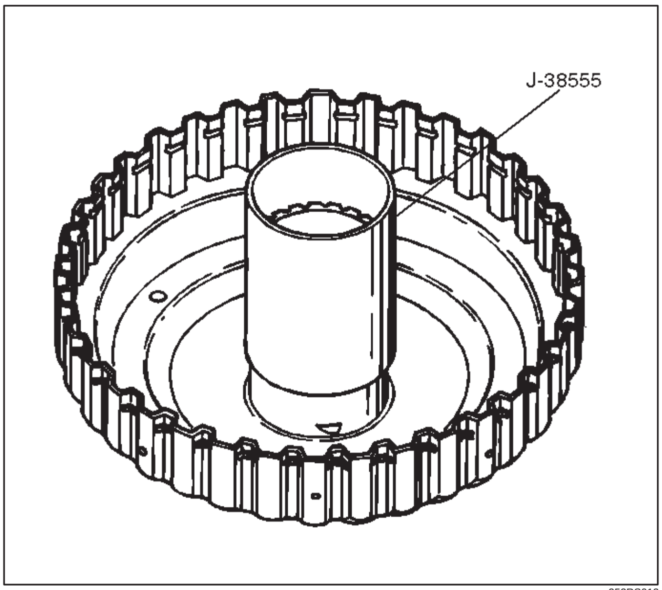
Reassembly

1. Install turbine shaft seal rings (15) with grease (petroleum jelly).

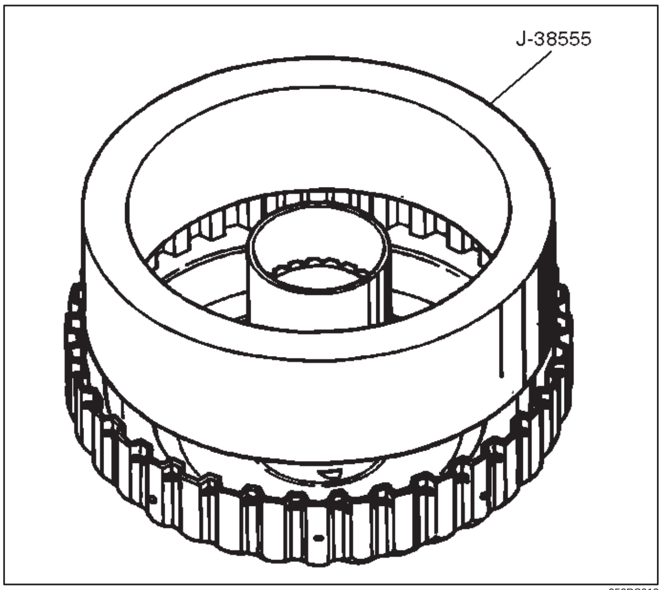


241RS008

2. Install the J–38555 inner installer on the drum (14).
   - Pre–install piston assembly into J–38555 outer installer.
   - Install overrun clutch piston assembly (13). Use the outer installer while pushing piston into drum (14).
   - Remove the installer.



252RS012



252RS013

3. Install diaphragm spring (12).
4. Install overrun clutch release spring retainer (11) (lip faces upwards), overrun roller clutch assembly (10), and cam (9).
5. Place snap ring loosely on spring retainer.
   - Hold the J–23327–91 compressor in a vise and compress piston return spring with compressor.
   - Set snap ring (8) in ring groove.
   - Remove the compressor.
6. Install clutch plates (7), start with steel plate and alternate with lined plates.
7. Install backing plate (6).
8. Install snap ring (5).
9. Install overdrive sun gear with countersink pointing downwards.
10. Install the overdrive carrier assembly (2).

NOTE: Turn the assembly in a counter–clockwise direction only until roller clutch enters the outer race. After installation, rotate the assembly and listen for loose rollers.

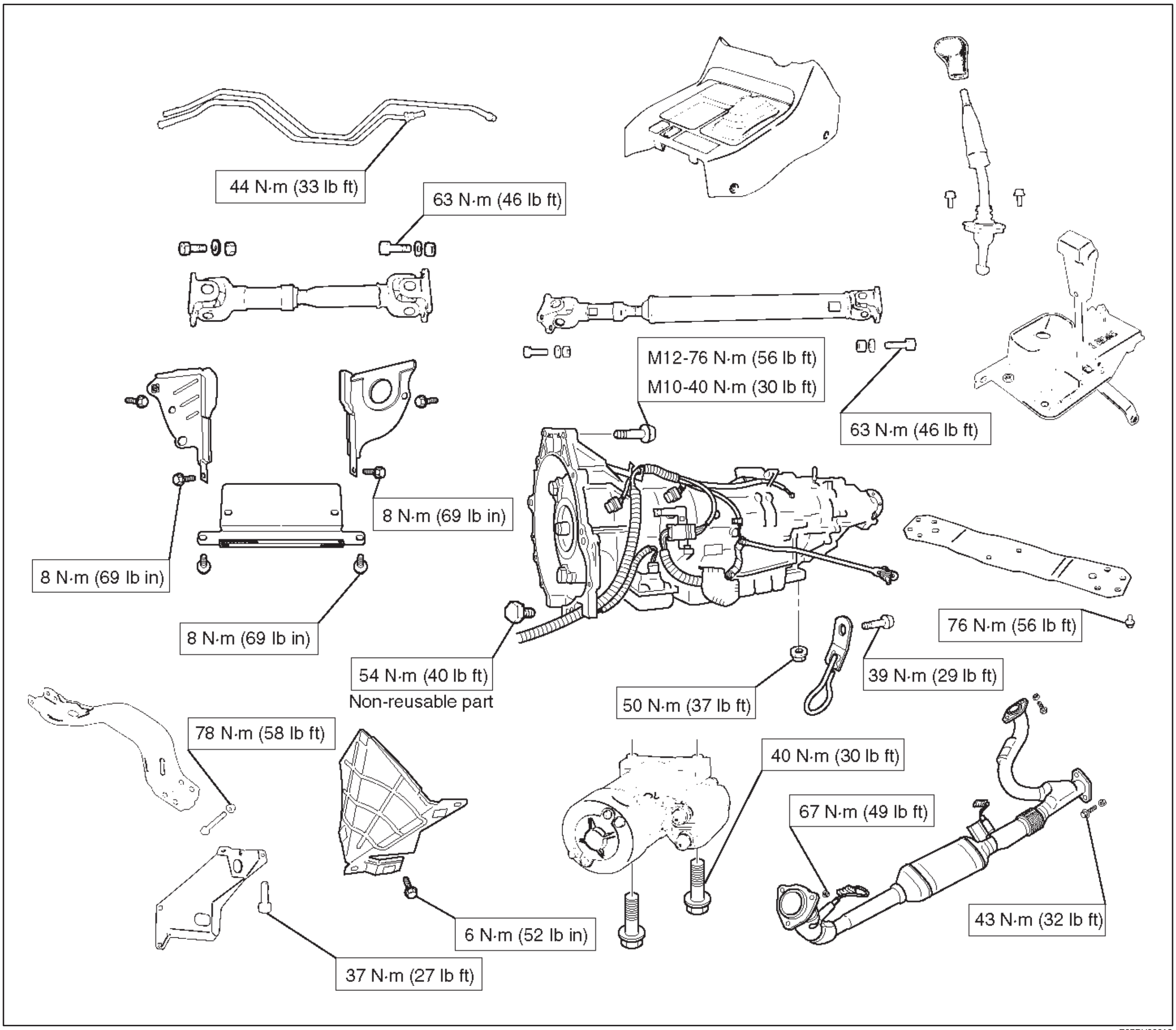
11. Install turbine shaft (4) and snap ring (1).

Main Data And Specification

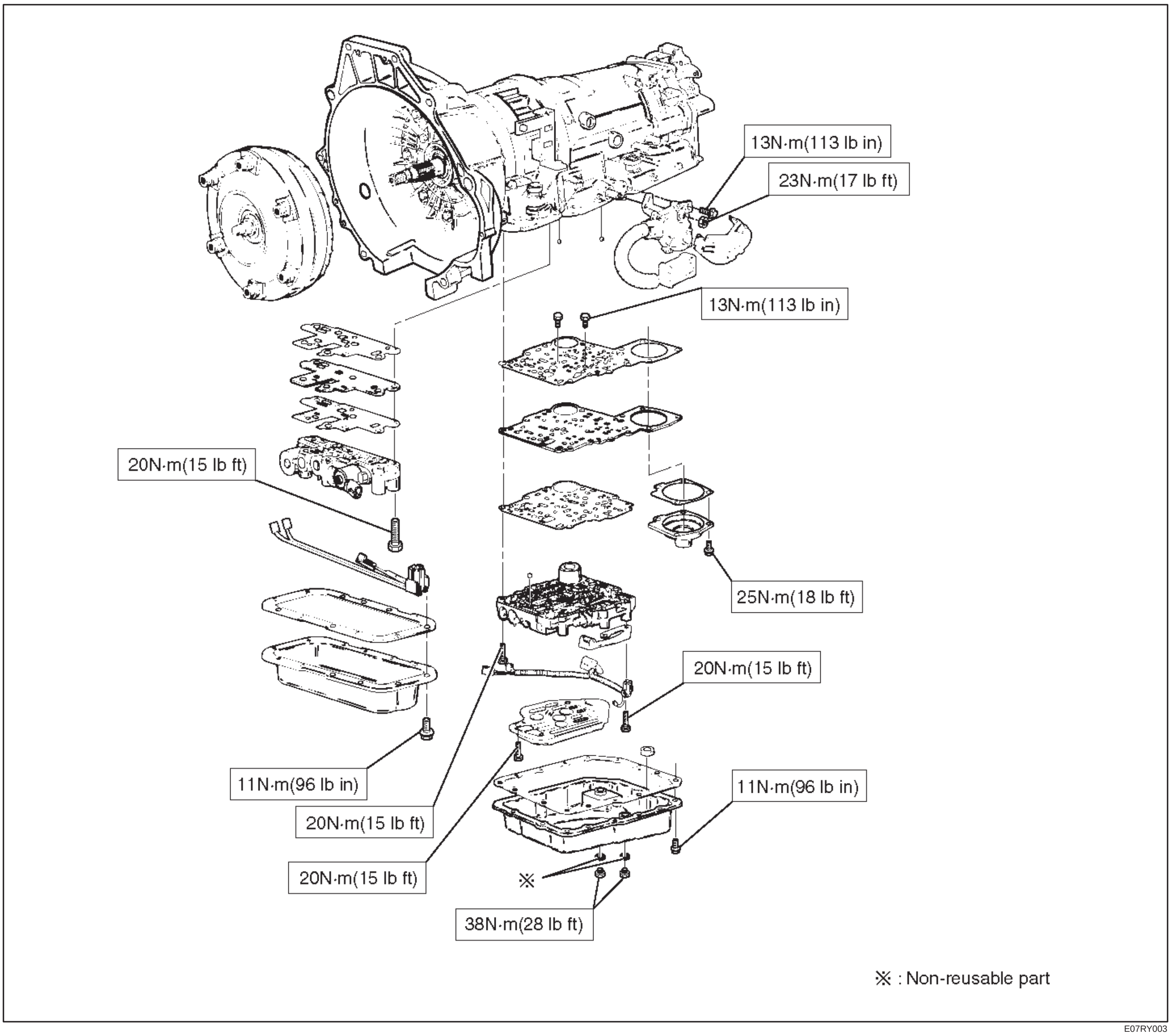
General Specifications

				Remarks
Model			THM 4L30–E	
Engine			V6 3.5L 6VE1	DOHC
Type			Automatic four speed overdrive in 4th gear lock–up clutch torque converter	
Control systems	Shift control		Hydraulic	
	Shift pattern		Electronic	
	Shift quality		Electronic	
	Lock–up clutch		Electronic	
Gear ratio	1st		2.856	
	2nd		1.618	
	3rd		1.000	
	4th (O/D)		0.723	
	Reverse		2.000	
Gear set			Noiseless, high torque capability	
Oil used	Name		ATF DEXRON®–III	
	Q'ty liter (qt)		8.6 (9.1)	
Torque converter			2,100 ± 150	Stall speed (rpm)
	Reverse clutch	RC	4	Number of discs
	Second clutch	C2	6	
	Third clutch	C3	6	
	Brake band		Double wrap	
	Fourth clutch	C4	2	Number of discs
	Overrun clutch	OC	1	
	Overdrive	OFW	10	Number of rollers
	Principal	PFW	26	Number of sprags
	Ravigneaux planetary gear set	Input sun gear	30	Number of teeth
		Pinion gear	19	
		Long pinion	23	
		Ring gear	90	
		Long pinion	19	
		Output sun gear	46	
	Overdrive planetary gear set	Sun gear	31	
		Pinion gear	24	
		Ring gear	81	

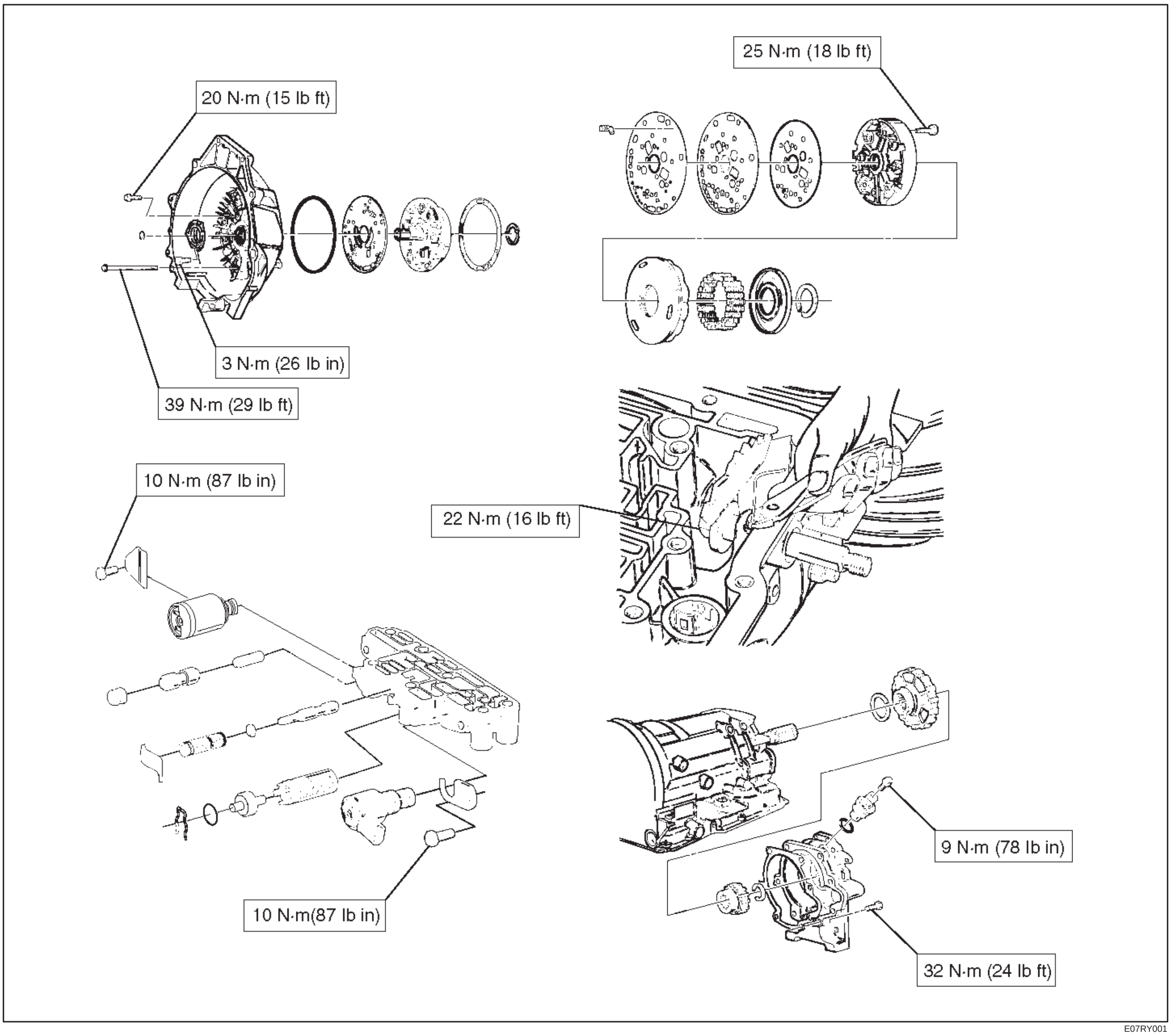
Torque Specifications



E07RY00013



13N·m(113 lb in)
23N·m(17 lb ft)
13N·m(113 lb in)
20N·m(15 lb ft)
25N·m(18 lb ft)
20N·m(15 lb ft)
11N·m(96 lb in)
11N·m(96 lb in)
20N·m(15 lb ft)
20N·m(15 lb ft)
※
38N·m(28 lb ft)
※ : Non-reusable part
E07RY003



25 N·m (18 lb ft)
20 N·m (15 lb ft)
3 N·m (26 lb in)
39 N·m (29 lb ft)
10 N·m (87 lb in)
22 N·m (16 lb ft)
9 N·m (78 lb in)
10 N·m(87 lb in)
32 N·m (24 lb ft)
E07RY001

Special Tools

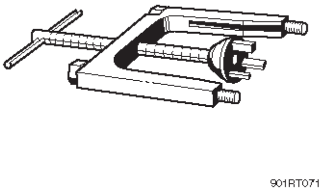
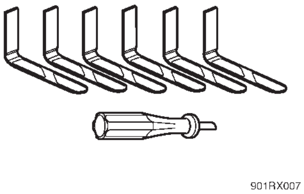
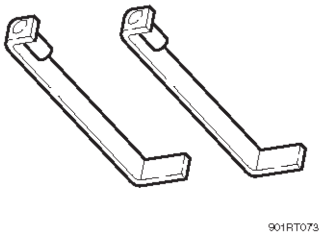
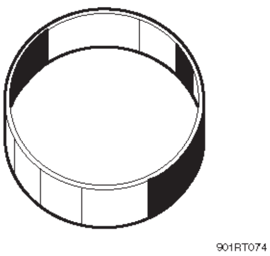
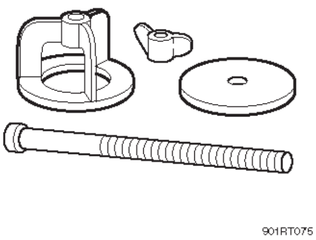
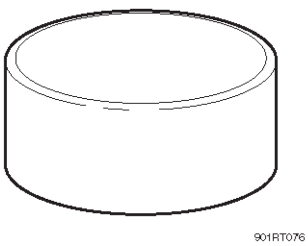
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–23075** Spring compressor (For servo piston)
	**J–38450–A** Third clutch snap ring compressor
	**J–23075–12** Third clutch spring compressor adapter (Use with J–23075)
	**J–23084** Third clutch piston installer
	**J–23327** Third clutch spring compressor
	**J–23080–A** Second clutch piston installer

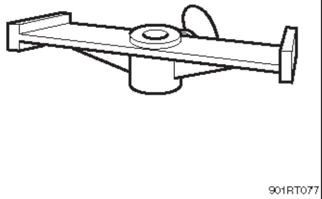
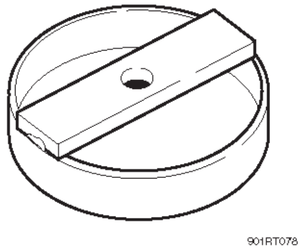
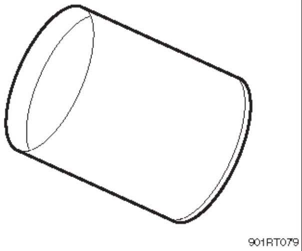
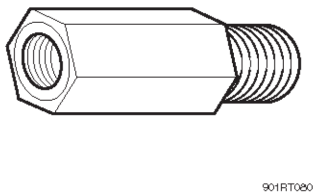
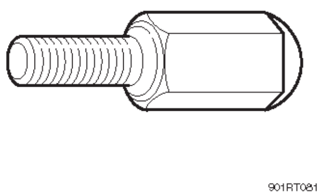
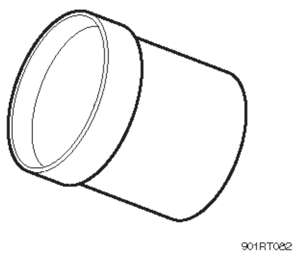
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–23085–A** Selective washer gauging tool
	**J–23327–90** Fourth clutch spring compressor (Use with J–23327)
	**J–38553** 3/4 Accumulator piston fitter
	**J–41096** Cover remover (Use with J–38584)
	**J–38584** Slide hammer adapter (Use with J–23907)
	**J–38554** Fourth clutch piston fitter

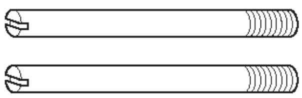
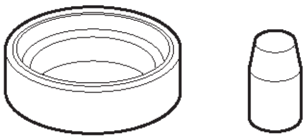
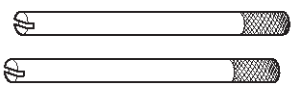
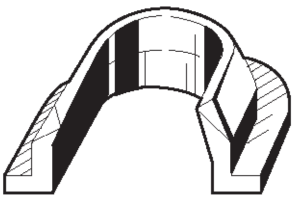
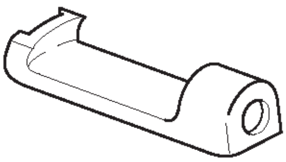
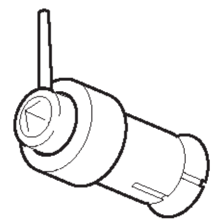
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–38588** Guide pins; adapter case to main case
	**J–38555** Overrun clutch piston seal installer set
	**J–3387–2** Guide pins; gasket and transfer plate to valve body
	**J–25022** Turbine shaft puller (Use with J–24773–1)
	**J–23129** Oil seal remover (Use with J–23907 and J–38584)
	**J–38557** Oil pump centering tool

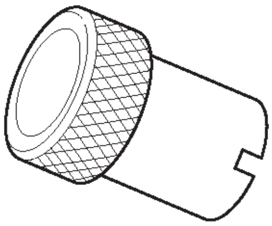
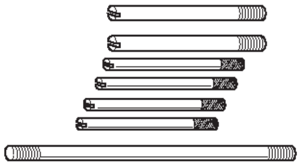
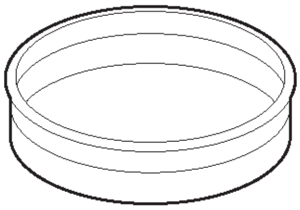
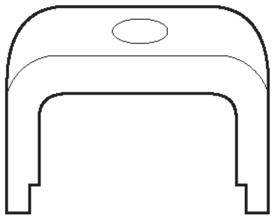
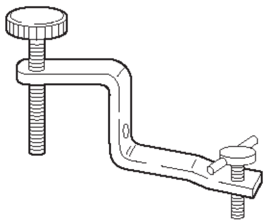
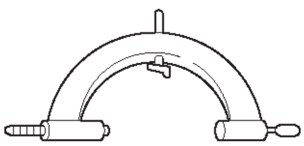
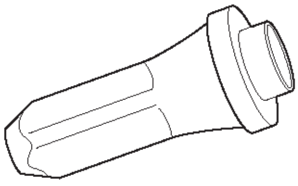
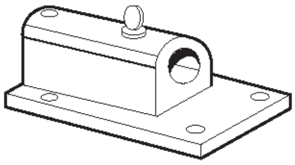
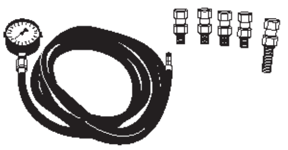
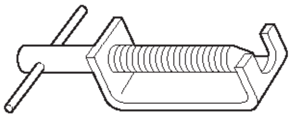
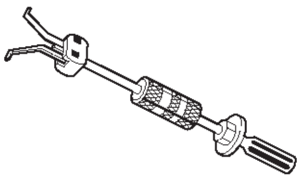
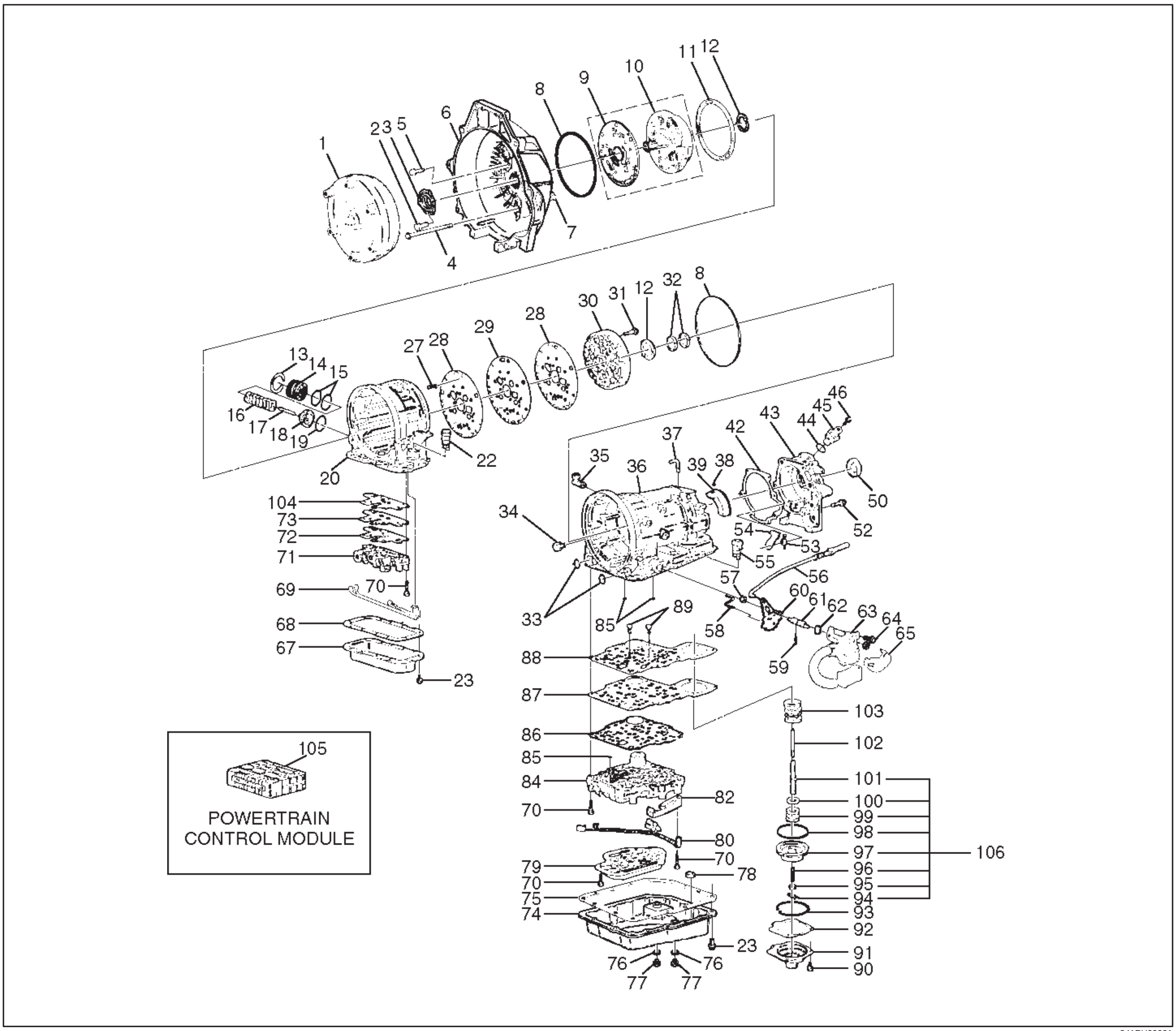
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–23082–01** Oil pump rotation tool
	**J–25025–B** Guide pins; valve body to main case
	**J–38428** Servo piston fitter
	**J–23327–91** Overrun clutch spring compressor
	**J–38559–A** 3/4 Accumulator piston cover compressor
	**J–8763–02** Holding fixture

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RT095	**J–36797** A/T extension housing oil seal installer (Inside)
 901RT096	**J–3289–20** Holding fixture base
 901RT097	**J–29770–A** Pressure gauge
 901RT098	**J–24773–1** End play fixture (Use with J–25022)
 901RT099	**J–23907** Slide hammer

4L30–E Parts List

Case And Associated Parts

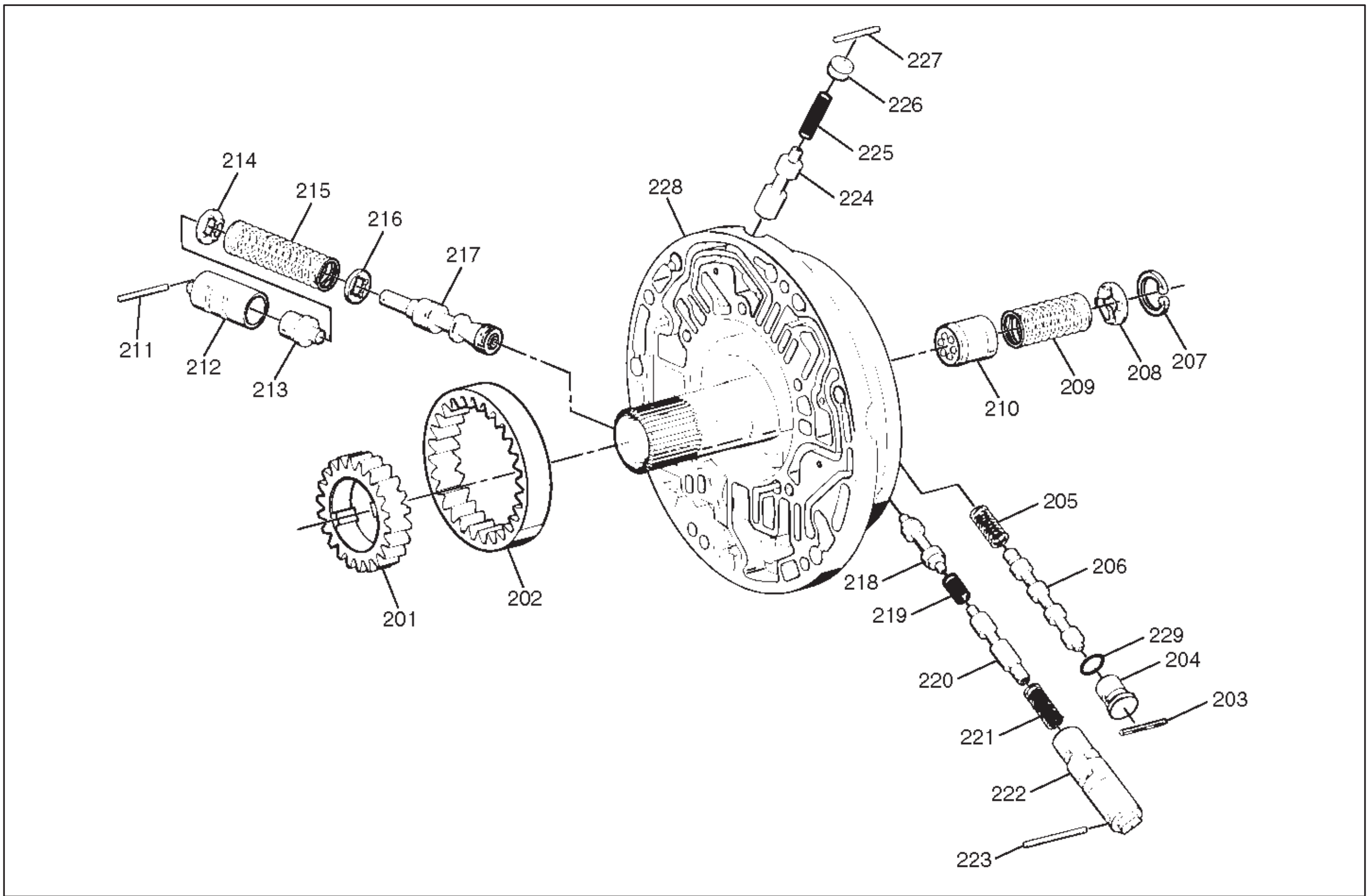


Legend

(1) Torque Converter
(2) Screw, Seal Ring Assembly
(3) Seal Ring Assembly, Converter Housing
(4) Screw, Converter Housing/Main Case
(5) Screw, Converter Housing/Oil Pump
(6) Housing, Converter
(7) Plug, Converter Housing
(8) Seal, O–Ring
(9) Wear Plate, Oil Pump Body
(10) Pump Assembly, Oil
(11) Gasket
(12) Washer, Thrust Selective
(13) Ring, Snap
(14) Cover, 3–4 Accumulator Piston
(15) Seal, O–Ring, 3–4 Accumulator
(16) Spring, 3–4 Accumulator Piston
(17) Pin, 3–4 Accumulator Piston
(18) Piston, 3–4 Accumulator
(19) Ring, 3–4, Accumulator Piston
(20) Case, Adapter
(22) Connector, Electrical/Adapter Case
(23) Screw, Pan
(27) Restrictor, Oil
(28) Gasket, Transfer Plate/Adapter
(29) Plate, Transfer Adapter/Center Support
(30) Support Assembly, Center
(31) Screw, Center Support
(32) Ring, Oil Seal
(33) Seal, O–Ring Main Case
(34) Fitting, Cooler
(35) Fitting Assembly, Cooler
(36) Case, Main
(37) Breather, Pipe

(38) Seal, O–Ring
(39) Reservoir
(42) Gasket, Extension Case
(43) Extension Assembly
(44) Seal, O–Ring/Speed Sensor
(45) Sensor Assembly, Speed
(46) Screw, Speed Sensor
(50) Seal, Extension Assembly
(52) Screw, Extension/Main Case
(53) Spring, Parking Pawl Lock
(54) Pawl, Parking Lock
(55) Connector, Electrical/Main Case
(56) Actuator Assembly, Parking Lock
(57) Nut, Parking Lock Lever
(58) Link, Manual Valve
(59) Pin, Spring
(60) Lever, Parking Lock and Range Selector
(61) Shaft, Selector
(62) Seal, Selector Shaft
(63) Mode Switch Assembly
(64) Screw and Conical Washer Assembly
(65) Shield, Mode Switch
(67) Pan, Bottom/Adapter Case
(68) Gasket, Bottom Pan/Adapter Case
(69) Harness Assembly, Adapter Case
(70) Screw, Valve Body
(71) Valve Body Assembly, Adapter Case
(72) Gasket, Adapter Valve Body
(73) Plate, Adapter Valve Body/Transfer
(74) Pan, Bottom/Main Case
(75) Gasket, Bottom Pan/Main Case
(76) Gasket, Oil Drain or Overfill Screw
(77) Screw, Oil Drain or Overfill
(78) Magnet, Chip Collector
(79) Filter Oil
(80) Harness Assembly, Main Case
(82) Roller and Spring Assembly, Manual Detent
(84) Valve Body Assembly, Main Case
(85) Ball, Check
(86) Gasket, Main V.B./Transfer Plate
(87) Plate, Main V.B./Transfer
(88) Gasket, Transfer/Main Case
(89) Screw, Transfer Plate on V.B.
(90) Screw, Servo Cover
(91) Cover, Servo Piston
(92) Gasket, Cover/Servo Piston
(93) Ring, Retaining Servo Piston
(94) Clip, Servo Piston
(95) Nut, Servo Screw
(96) Screw, Servo Piston
(97) Piston, Servo
(98) Seal, Ring/Servo Piston
(99) Spring, Cushion/Servo Piston
(100) Seat, Cushion Spring
(101) Sleeve, Servo Piston Adjust
(102) Rod, Apply/Servo Piston
(103) Spring, Return/Servo Piston
(104) Gasket, Adapter Case/Transfer Plate
(105) Powertrain Control Module
(106) Servo Piston Assembly

Pump Assembly

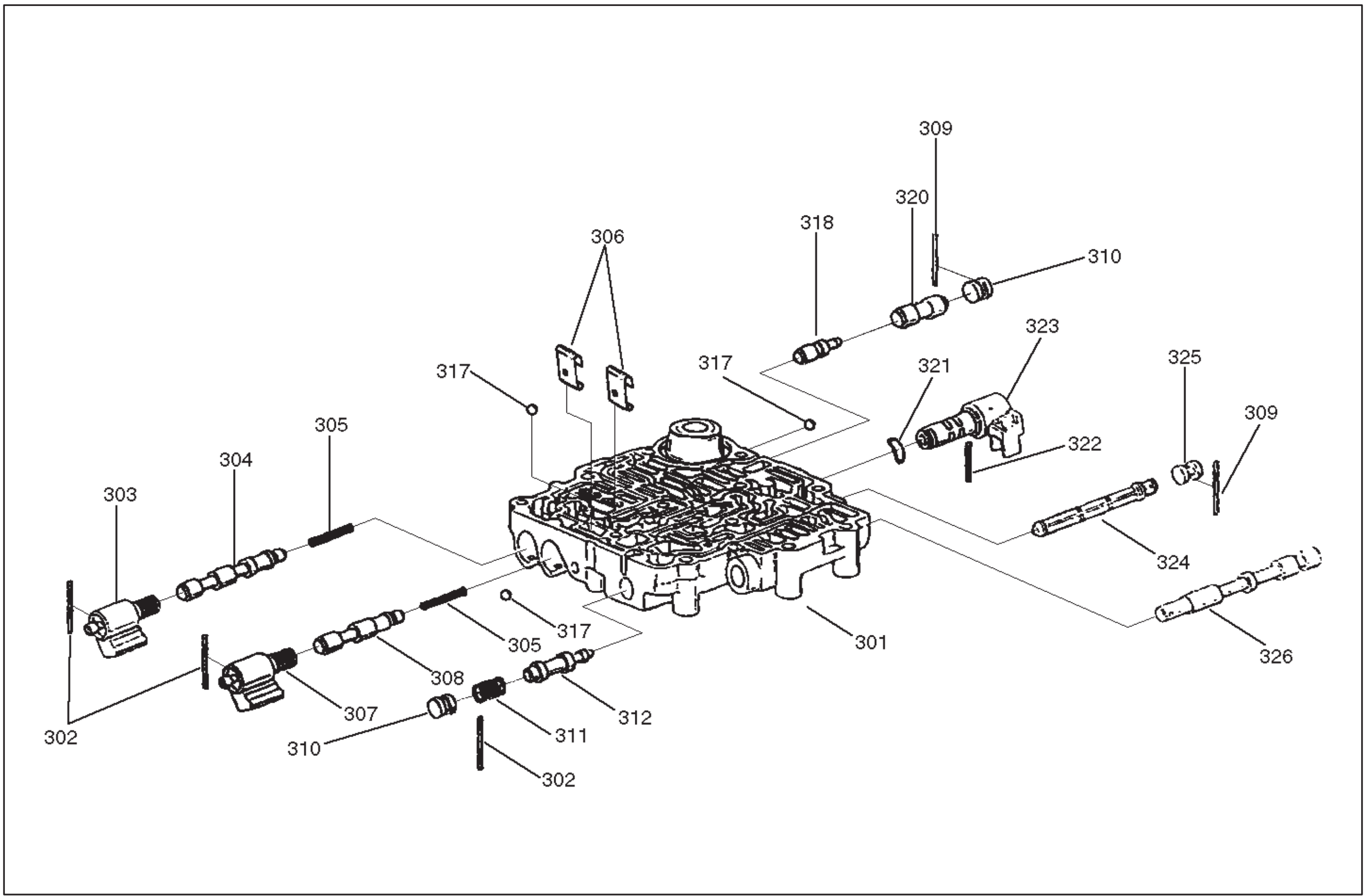


241RY003

Legend

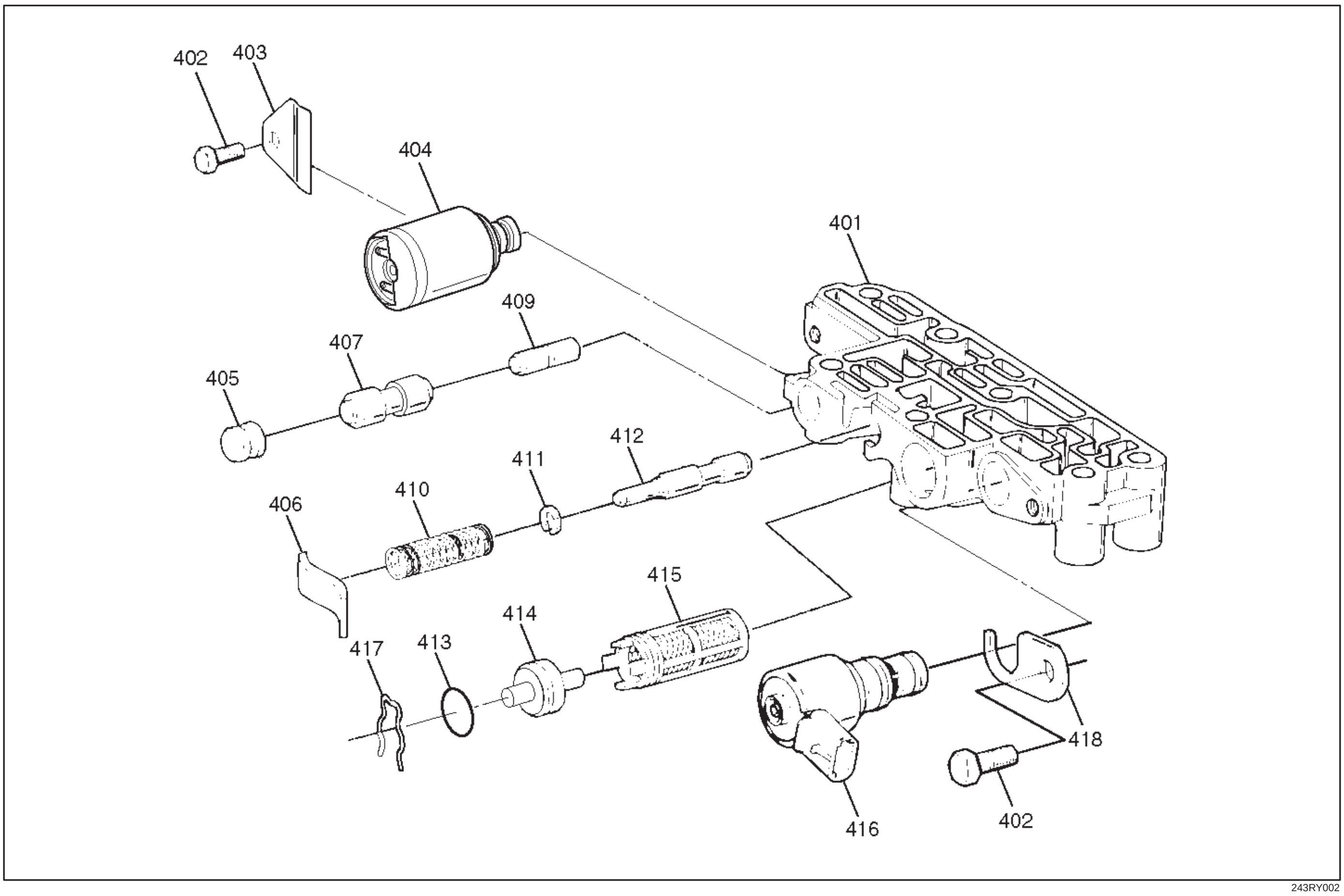
- (201) Gear, Oil Pump Drive
- (202) Gear, Oil Pump Driven
- (203) Pin, Plug Converter Clutch Control
- (204) Plug, Converter Clutch Control Valve
- (205) Spring, Converter Clutch Control Valve
- (206) Valve, Converter Clutch Control
- (207) Ring, Snap/Throttle Signal Accumulator
- (208) Seat, Spring/Throttle Signal Accumulator
- (209) Spring, Throttle Signal Accumulator
- (210) Piston, Throttle Signal Accumulator
- (211) Pin, Boost Valve Sleeve
- (212) Sleeve, Boost Valve
- (213) Valve, Boost
- (214) Seat, Spring/Pressure Regulator Valve
- (215) Spring, Pressure Regulator Valve
- (216) Seat, Spring/Pressure Regulator Valve
- (217) Valve, Pressure Regulator
- (218) Isolator Valve
- (219) Spring, Isolator
- (220) Valve, Converter Clutch Regulator
- (221) Spring, Converter Clutch Regulator
- (222) Sleeve, Converter Clutch Regulator
- (223) Pin, Retainer Sleeve
- (224) Valve, Enable
- (225) Spring, Enable Valve
- (226) Spring Guide, Enable Valve
- (227) Pin, Enable Valve
- (228) Pump Assembly
- (229) Seal Ring, Plug

Valve Body Assemblies



Legend

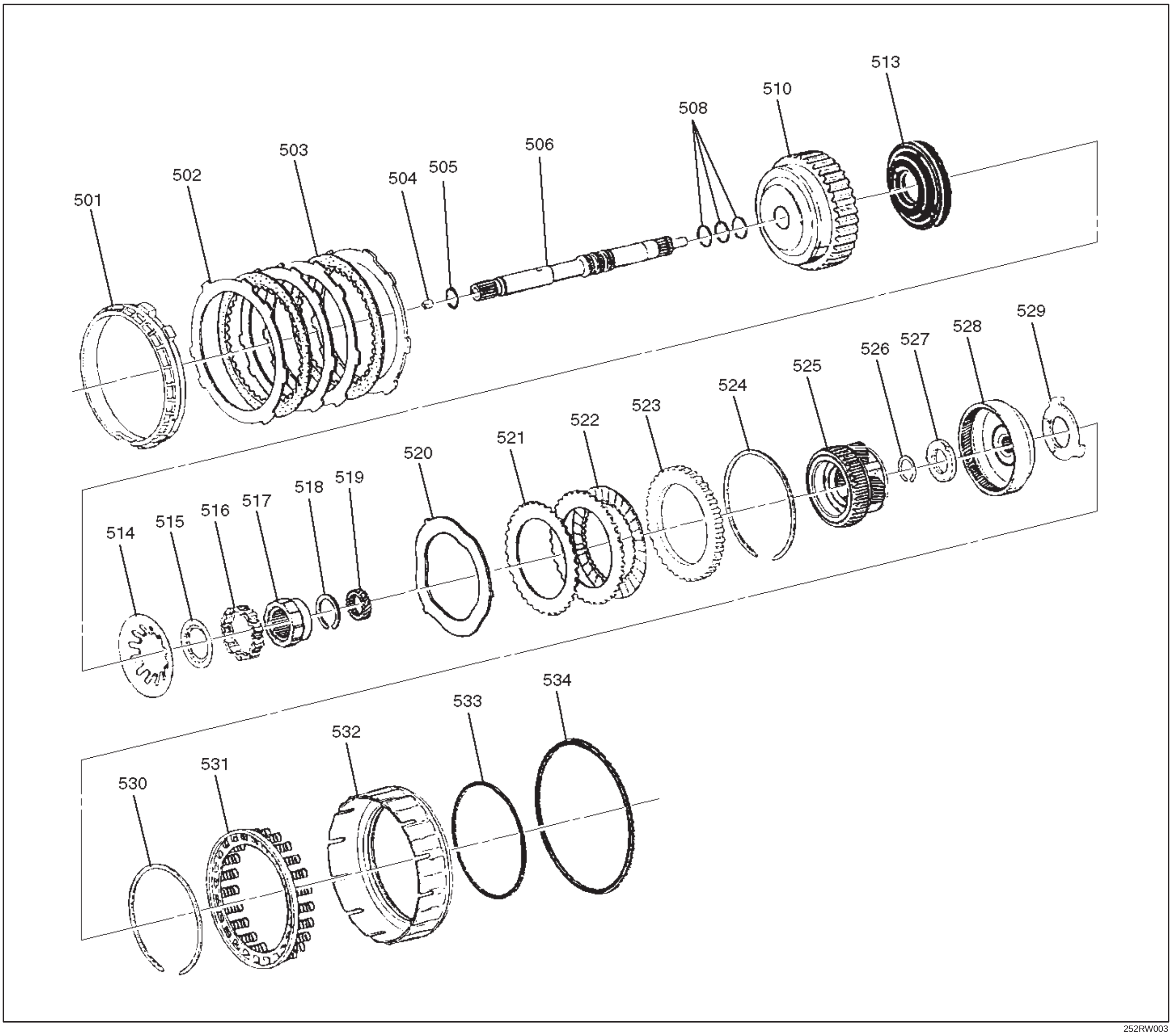
(301) Body, Valve Main Case
(302) Pin, Spring
(303) Solenoid Assembly, ON/OFF N.C.
(304) Valve, 1–2 and 3–4 Shift
(305) Spring, 1–2 and 3–4 (2–3) Shift
(306) Retainer, Valve
(307) Solenoid Assembly, ON/OFF N.O.
(308) Valve, 2–3 Shift
(309) Pin, Spring
(310) Plug, Valve Bore
(311) Spring, Valve Low Pressure Control
(312) Valve, Low Pressure Control
(317) Ball, Check
(318) Valve, 1–2 Accumulator Control
(320) Valve, 1–2 Accumulator
(321) Washer, Waved PWM Solenoid
(322) Pin, Solenoid PWM
(323) Solenoid Assembly, Band Control PWM
(324) Screen Assembly, PWM Solenoid
(325) Plug, Screen
(326) Valve, Manual



Legend

(401) Body, Valve/Adapter Case
(402) Screw, Solenoid Force Motor
(403) Retainer, Force Motor
(404) Solenoid, Force Motor
(405) Plug, 3–4 Accumulator
(406) Plug and Spring Retainer
(407) Valve, 3–4 Accumulator
(409) Valve, 3–4 Accumulator Control
(410) Spring, Feed Limit Valve
(411) Ring, Retainer
(412) Valve, Feed Limit
(413) Seal, O–Ring Plug Filter
(414) Plug, Screen
(415) Screen Assembly, Force Motor
(416) Solenoid, Torque Converter Clutch, PWM
(417) Retainer, Screen Plug
(418) Bracket, PWM Solenoid

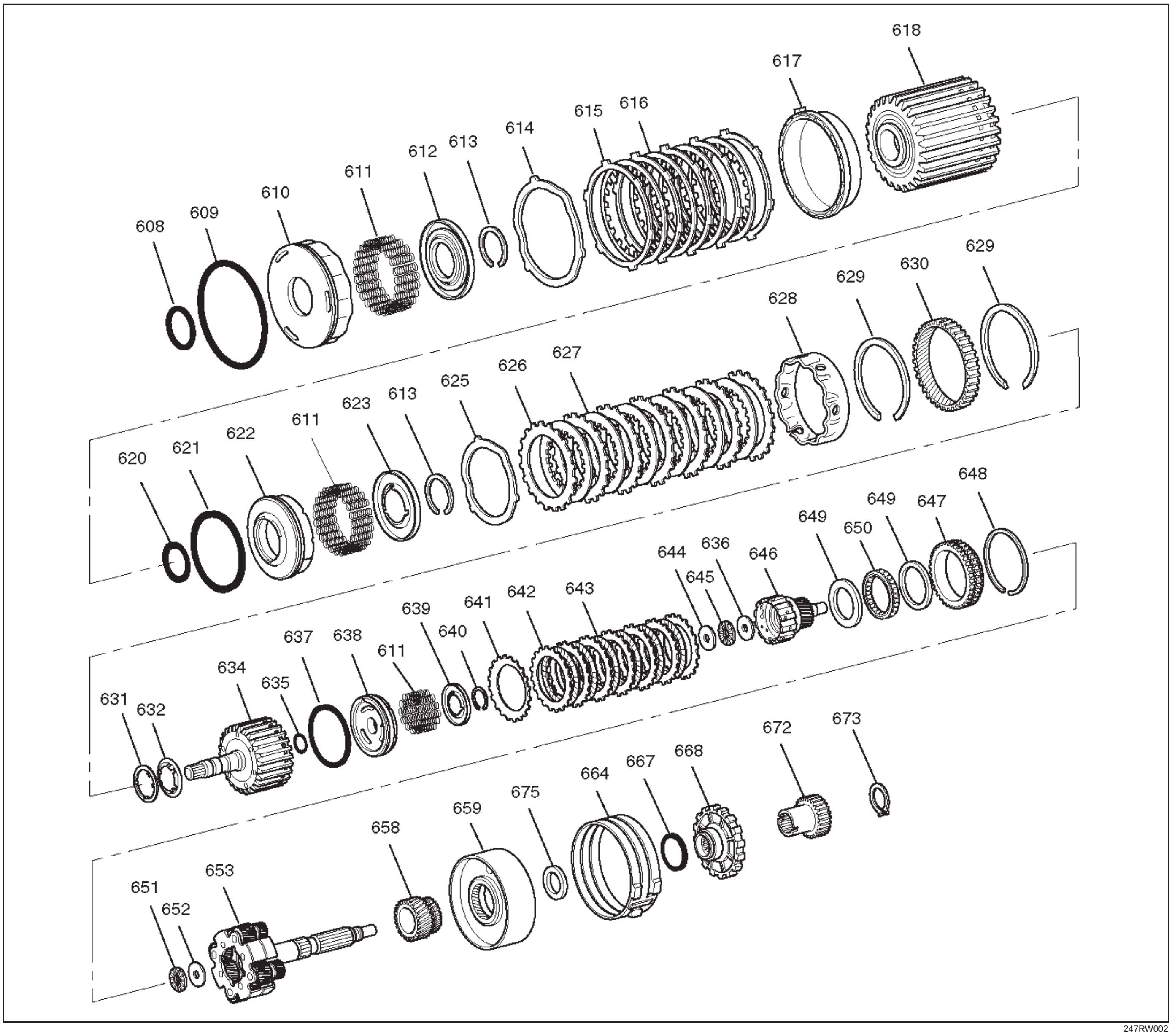
Overdrive Internal Components



Legend

- (501) Retainer, 4th Clutch
- (502) Plate, 4th Clutch (Steel)
- (503) Plate Assembly, 4th Clutch (Lined)
- (504) Retainer And Ball Assembly, Check Valve
- (505) Seal, O–Ring/Turbine Shaft
- (506) Shaft, Turbine
- (508) Ring, Oil Seal/Turbine Shaft
- (510) Housing, Overrun Clutch
- (513) Piston, Overrun Clutch
- (514) Spring, Overrun Clutch Release
- (515) Retainer, Release Spring/Overrun Clutch
- (516) Roller Assembly, Overdrive Clutch
- (517) Cam, Overdrive Roller Clutch
- (518) Ring, Snap/Overrun Clutch Hub
- (519) Gear, Overdrive Sun
- (520) Plate, Waved/Overrun Clutch
- (521) Plate, Overrun Clutch (Steel)
- (522) Plate Assembly, Overrun Clutch (Lined)
- (523) Plate, Backing/Overrun Clutch
- (524) Ring, Snap/Overrun Clutch Housing
- (525) Carrier Assembly, Overdrive Complete
- (526) Ring, Snap/Turbine Shaft/Carrier
- (527) Bearing Assembly, Thrust
- (528) Gear, Overdrive Internal
- (529) Washer, Thrust/Internal Gear/Support
- (530) Ring, Snap/Adapter/4th Clutch Spring
- (531) Retainer and spring assembly, 4th clutch
- (532) Piston, 4th Clutch
- (533) Seal, 4th Clutch Piston (Inner)
- (534) Seal, 4th Clutch Piston (outer)

Internal Components

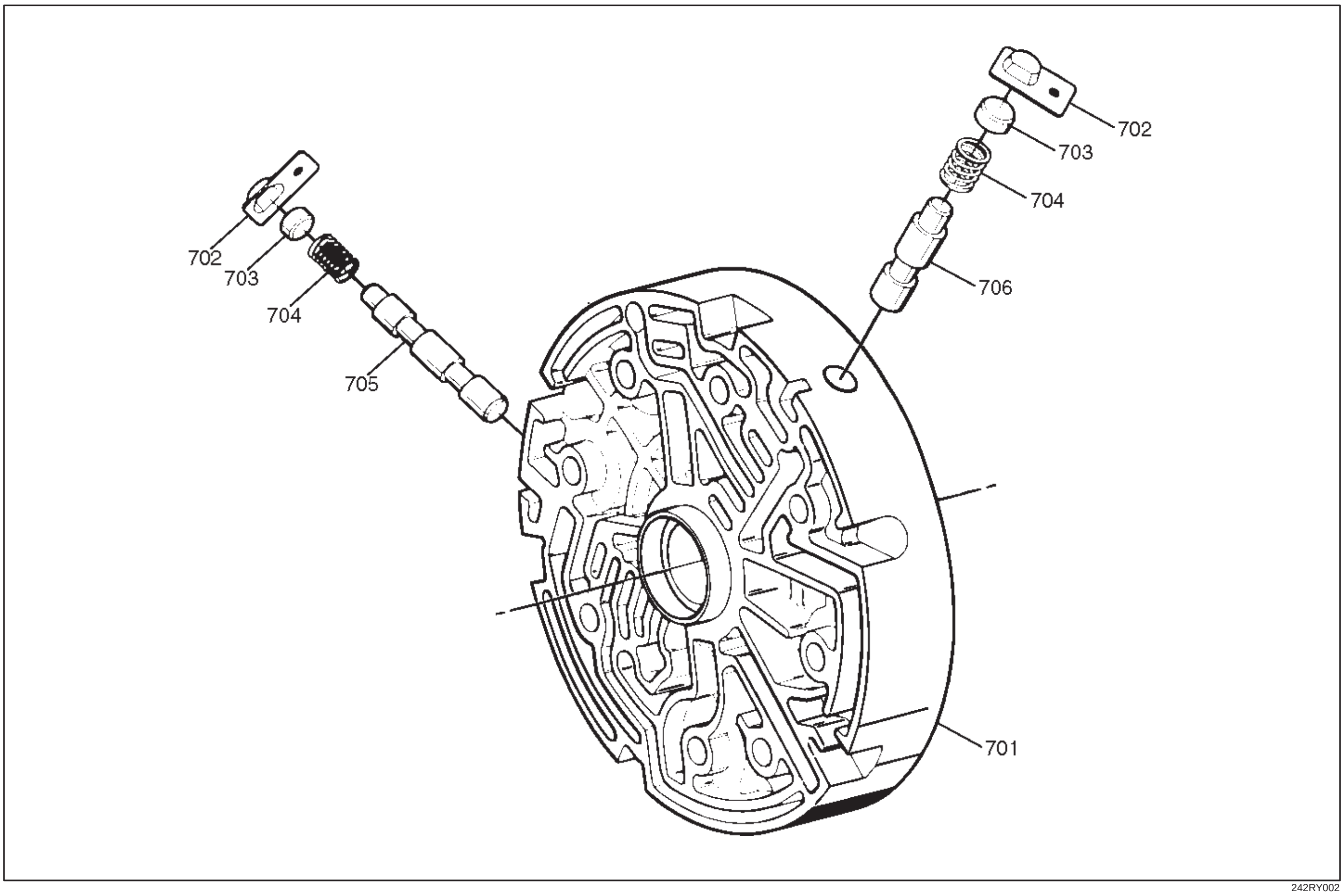


Legend

(608) Seal, Reverse Clutch Piston (Inner)
(609) Seal, Reverse Clutch Piston (Outer)
(610) Piston, Reverse Clutch
(611) Spring, Piston Clutch
(612) Seat, Spring/Reverse Clutch
(613) Ring, Retaining
(614) Plate, Waved/Reverse Clutch
(615) Plate, Reverse Clutch (Steel)
(616) Plate Assembly, Reverse Clutch (Lined)
(617) Plate, Reverse Clutch Pressure/Selective
(618) Drum Assembly, 2nd Clutch
(620) Seal, 2nd Clutch Piston (Inner)
(621) Seal, 2nd Clutch Piston (Outer)
(622) Piston, 2nd Clutch
(623) Seat, Spring/2nd Clutch
(625) Plate, Waved/2nd Clutch
(626) Plate, 2nd Clutch (Steel)
(627) Plate Assembly, 2nd Clutch (Lined)
(628) Spacer, 2nd Clutch
(629) Ring, Retaining
(630) Gear, Ring
(631) Washer, Thrust/2nd Clutch/3rd Clutch
(632) Thrust Washer, Clutch Hub
(634) Drum Assembly, 3rd Clutch
(635) Seal, 3rd clutch piston (Inner)
(636) Washer, Retaining
(637) Seal, 3rd Clutch Piston (Outer)
(638) Piston 3rd Clutch
(639) Seat, Spring/3rd Clutch
(640) Ring, Retaining
(641) Plate, Spring Cushion/3rd Clutch
(642) Plate, 3rd Clutch (Steel)
(643) Plate Assembly, 3rd Clutch (Lined)
(644) Washer, Thrust/Input Sun
(645) Bearing, Input Shaft/Gear Assembly

(646) Gear Assembly, Input Sun
(647) Race Assembly, Sprag
(648) Ring, Retaining/Sprag
(649) Ring, Retaining
(650) Cage Assembly, Sprag
(651) Bearing, Output Shaft/Input Sun
(652) Washer, Output Shaft/Input Sun
(653) Carrier Assembly, Planetary
(658) Gear, Reaction Sun
(659) Drum, Reaction Sun
(664) Band Assembly, Brake
(667) Seal, Ring/Wheel Parking Lock
(668) Wheel, Parking Lock
(672) Wheel, Speed
(673) Ring, Retaining
(675) Bearing, Thrust Assembly

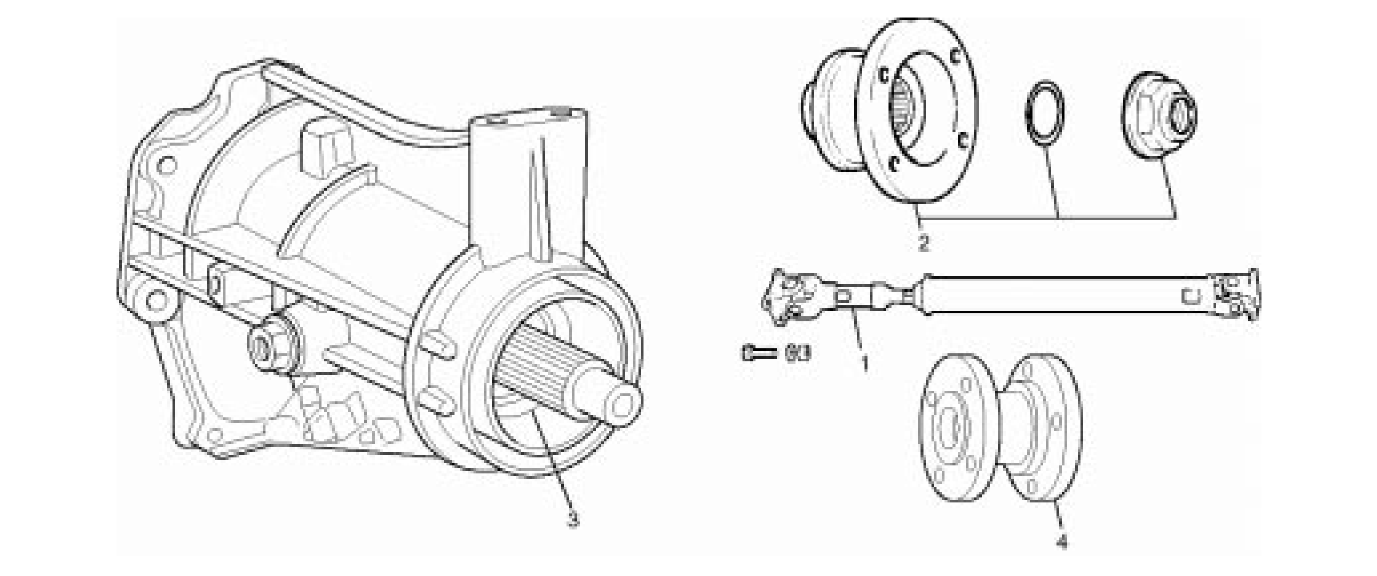
Center Support Assembly



Legend
(701) Center Support
(702) Retainer Plate
(703) Plug, Lockout
(704) Spring, Lockout
(705) Valve, Overrun Lockout
(706) Valve, Reverse Lockout Control

Extension Housing Assembly Oil Seal

Extension Housing Assembly Rear Oil Seal and Associated Parts



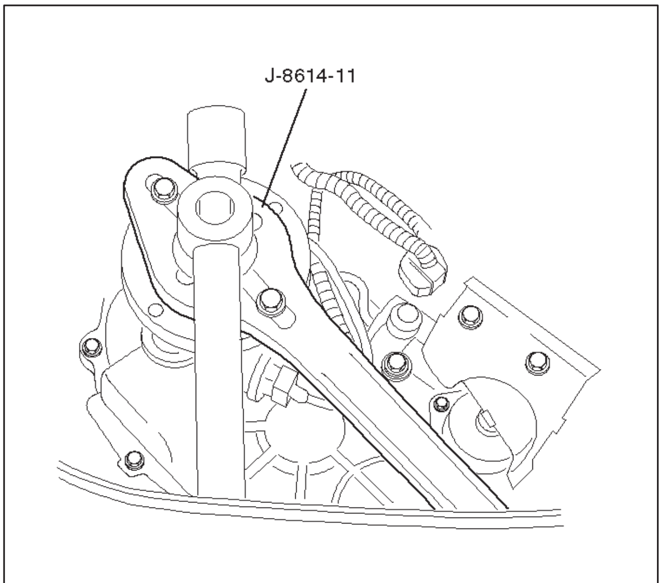
220RY00010

Legend

(1) Propeller Shaft
(2) End Nut and Companion Flange
(3) Oil Seal
(4) Mass

Removal

1. Disconnect the propeller shaft (1) and mass (4) from the extension housing assembly.
2. Remove end nut and companion flange (2), using the companion flange holder J–8614–11.

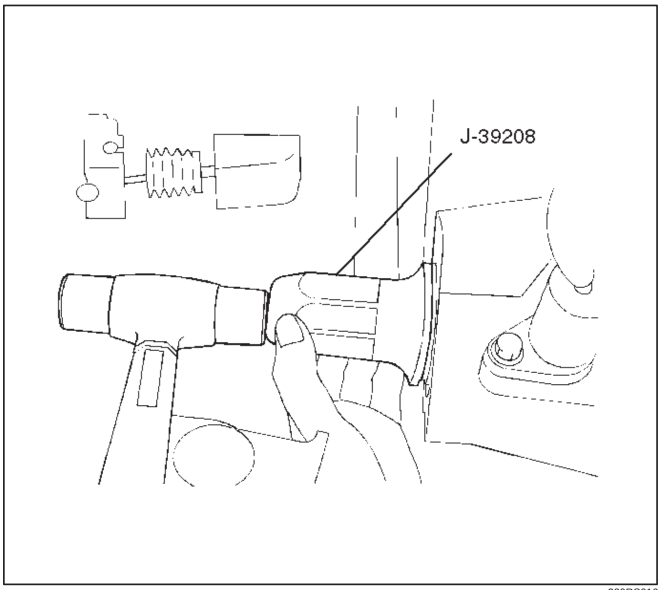


266RW001

3. Use the universal puller to remove the companion flange and O–ring.
4. Remove the oil seal from the extension housing assembly.

Installation

1. Install oil seal and apply engine oil to the oil seal outer surfaces.
2. Apply the recommended grease (BESCO L2) or equivalent to the oil seal lip.
3. Use the oil seal installer J–39208 to install the rear seal (3) to the extension housing assembly.



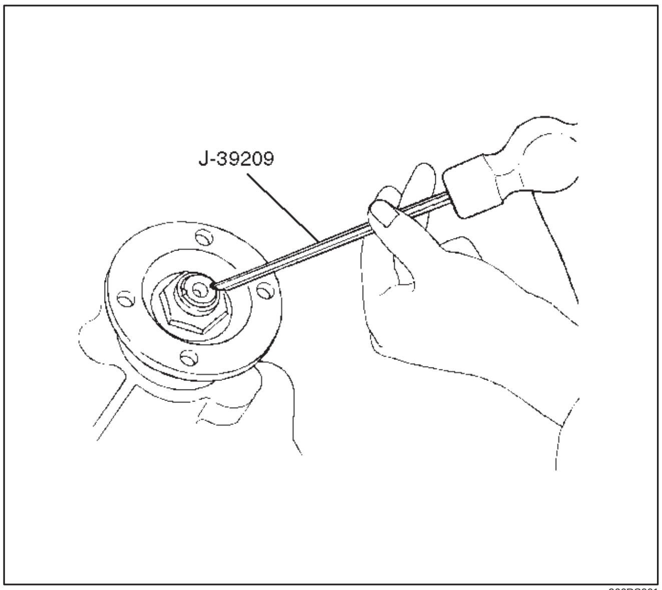
220RS016

4. Install the companion flange (2) and O–ring (2).
5. Use the companion flange holder J–8614–11 to install a new end nut (2) and tighten to the specified torque.

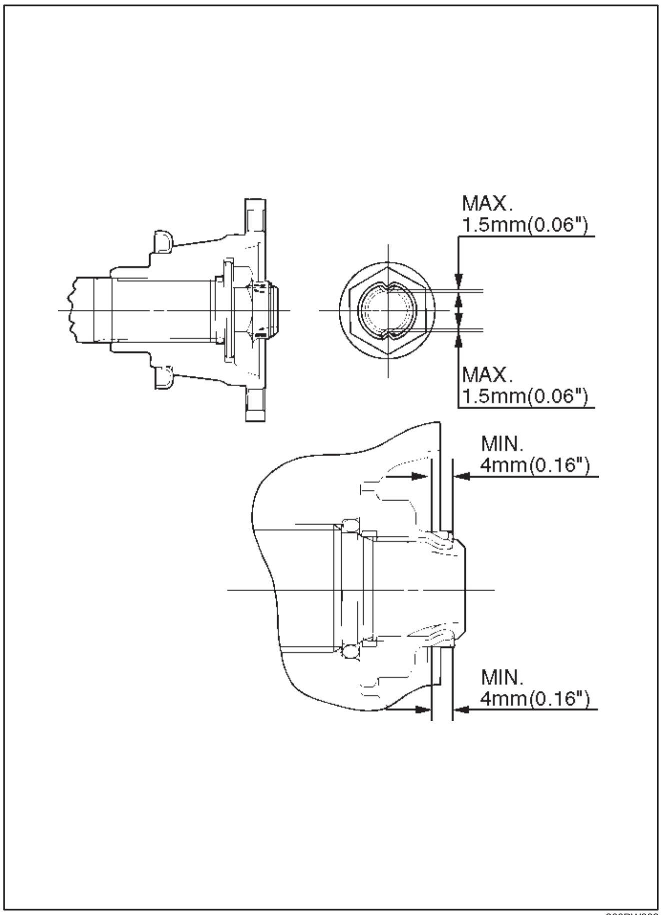
Torque: 167 N·m (123 lb ft)

6. Use the punch J–39209 to stake the end nut at two spots.

NOTE: Be sure to confirm that there is no crack at the staked portion of the end nut (2) after staking.



266RS001



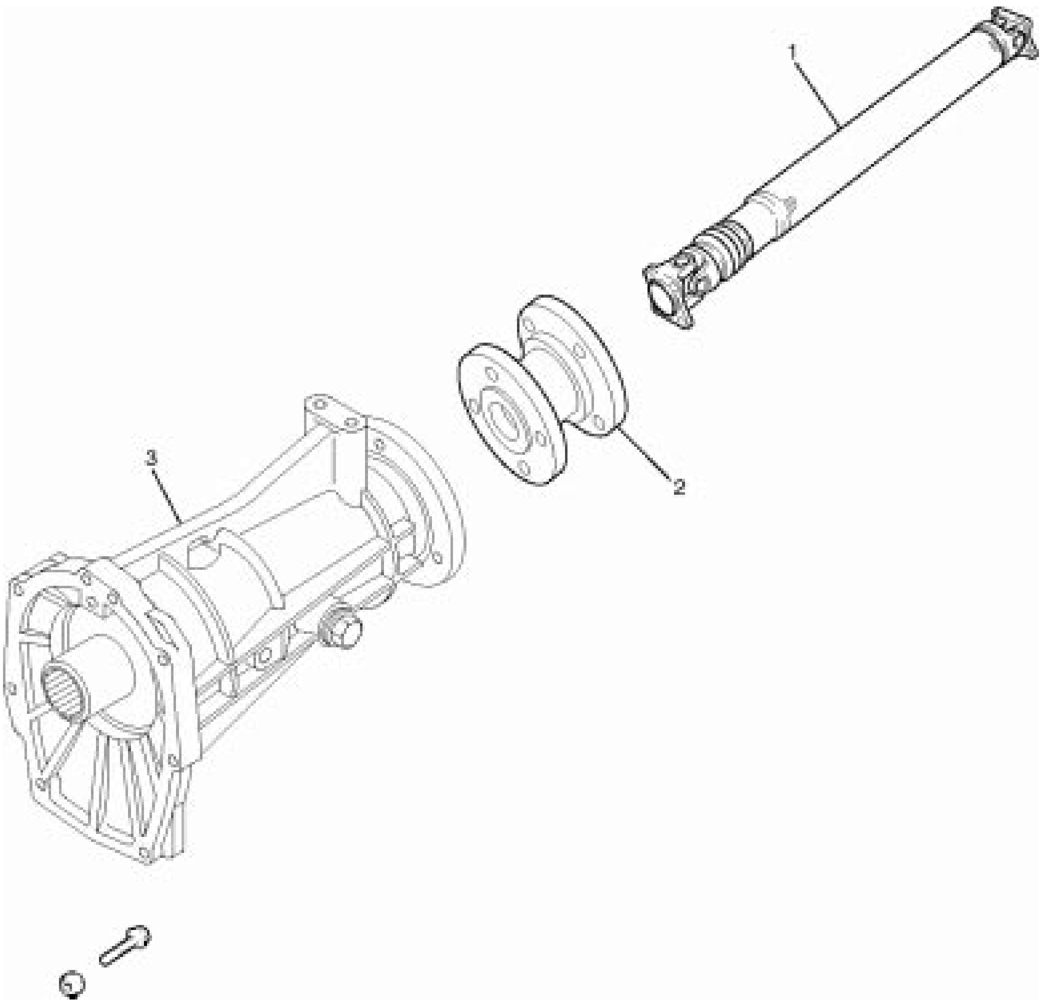
266RW002

7. Connect the mass and propeller shaft to the extension housing assembly and tighten to the specified torque.

Torque: 63 N·m 46 (lb ft)

Extension Housing Assembly

Extension Housing Assembly and Associated Parts



260RY00006

Legend

(1) Propeller Shaft
(2) Mass
(3) Extension Housing Assembly

Removal

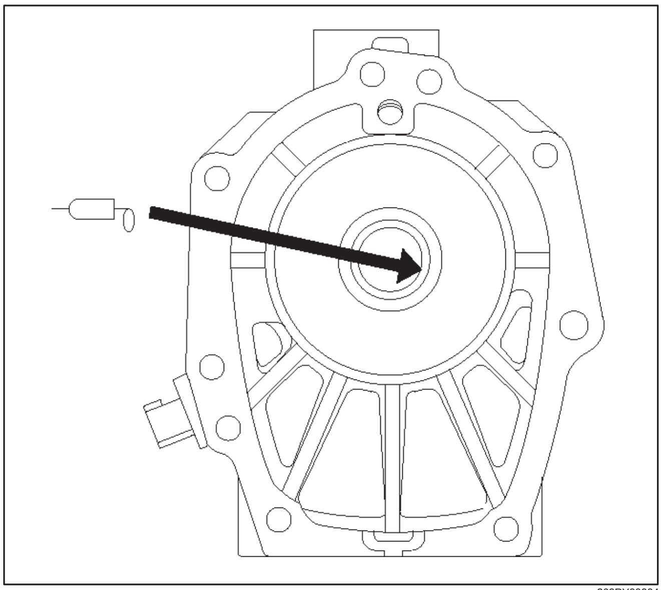
1. Disconnect battery ground cable.
2. Raise and support vehicle with suitable stands.
3. Disconnect harness connectors and fuel pipe fix bolt.
   Connector: speed sensor.
4. Removing the speedometer driven gear bushing and driven gear, drain extension housing assembly fluid.
5. Remove propeller shaft (1) and mass (2).

NOTE: Apply alignment marks on the flange at both front and rear sides.

6. Remove extension housing assembly (3) from the vehicle.

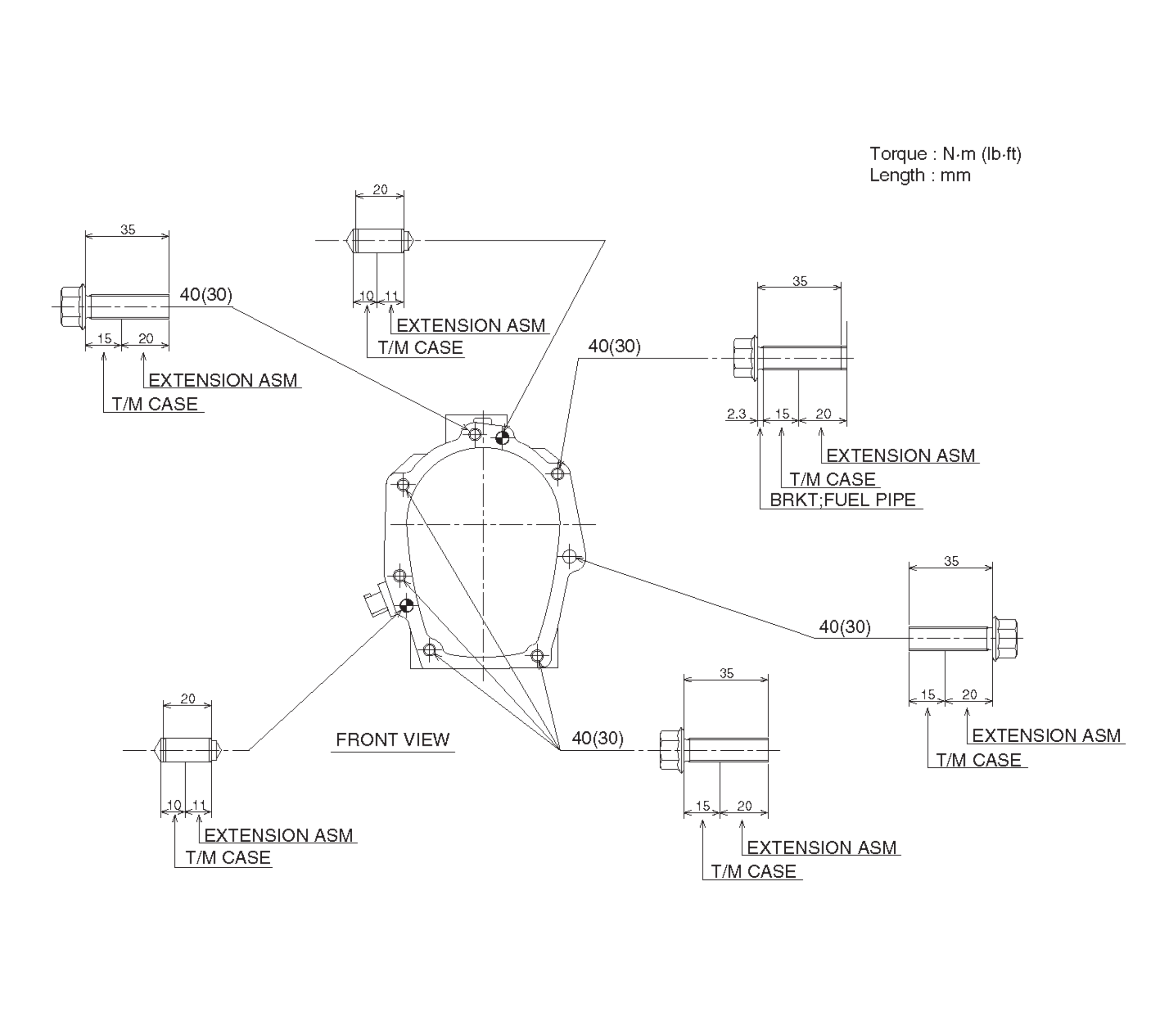
Installation

1. Apply a thin coat of molybdenum disulfide grease to the extension shaft spline as shown in the figure.



260RY00004

2. Install extension housing assembly (3) to the transmission. Tighten extension housing assembly bolts as shown in the figure.



261RY00001

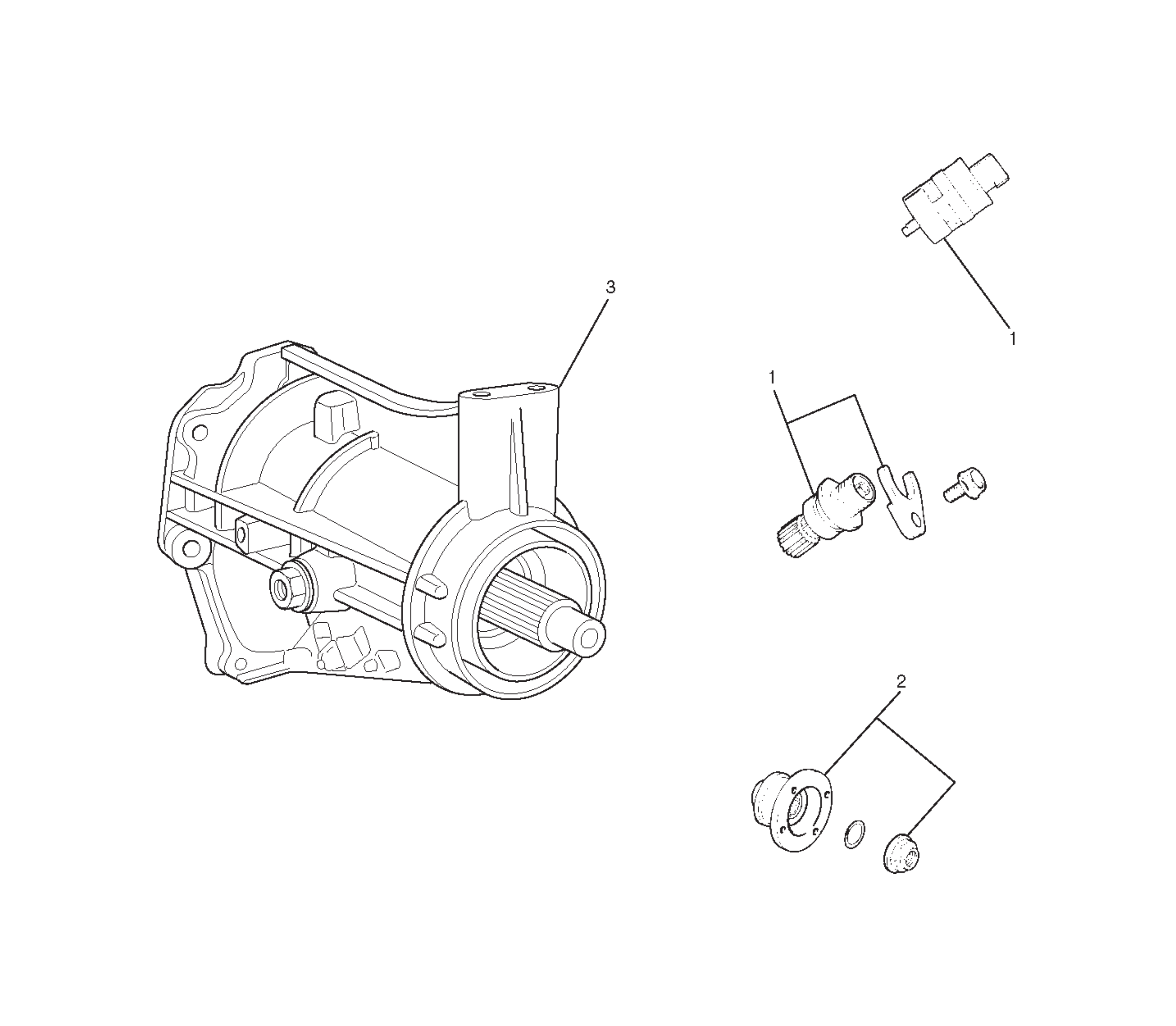
3. Install speedometer driven gear bushing and driver gear.
4. Connect harness connectors and fuel pipe fix bolt. Connector: speed sensor.
5. Install propeller shaft (1) and mass (2).

Torque: 63 N·m (46 lb ft)

6. Fill extension housing assembly fluid.
7. Connect battery ground cable.

Extension Housing Assembly

Extension Housing Assembly and Associated Parts



Legend

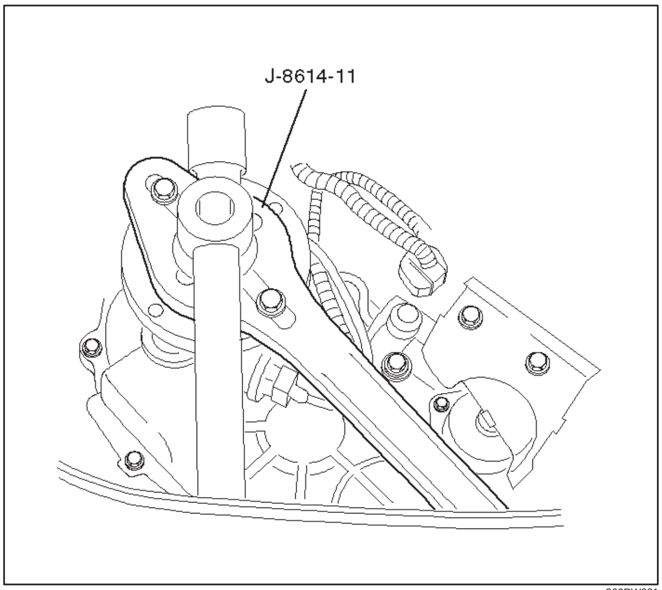
(1) Speedometer Sensor, Speedometer Driven Gear and Plate
(2) Companion Flange
(3) Extension Housing Assembly

Removal

1. Remove the speedometer sensor (1).
2. Remove the plate (1).
3. Remove the speedometer driven gear bushing and driven gear (1).

NOTE: Apply a reference mark to the driven gear bushing before removal.

4. Remove rear companion flange (2), using the flange companion holder J–8614–11 to remove the end nut.



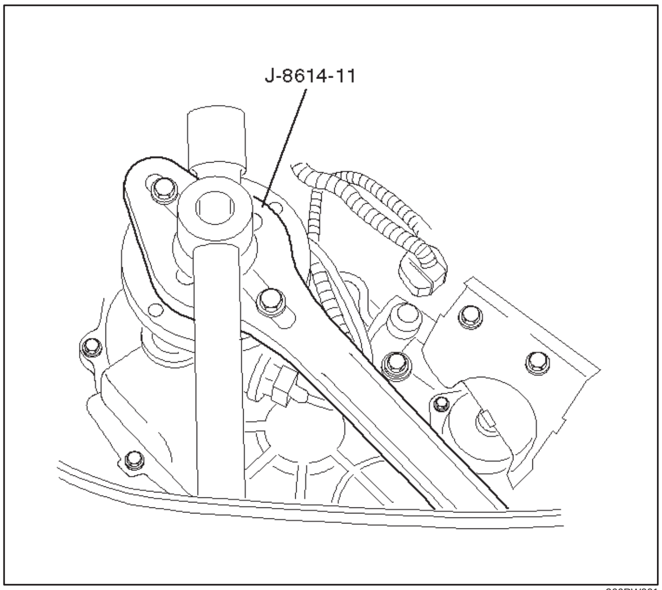
266RW001

5. Remove the rear companion flange.

NOTE: Use the universal puller to remove the rear companion flange.

Installation

1. Install companion flange (2), using the companion flange holder J–8614–11 to tighten the flange nuts to the transfer case.



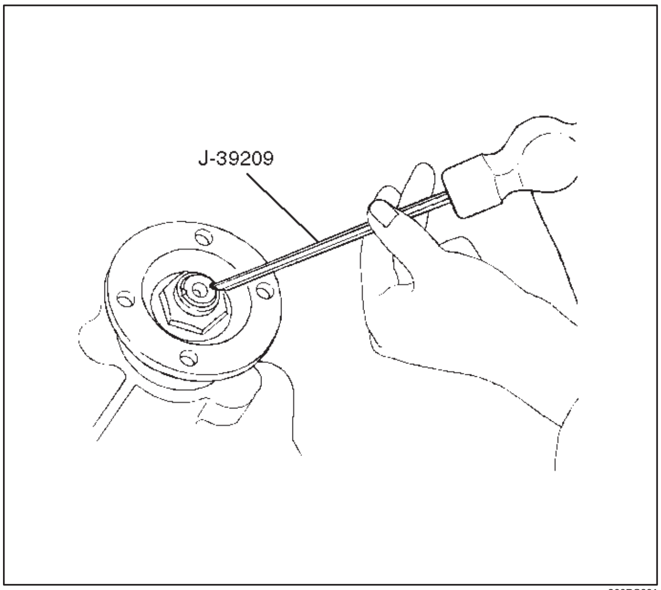
266RW001

2. Tighten the new transfer flange nuts to the specified torque.

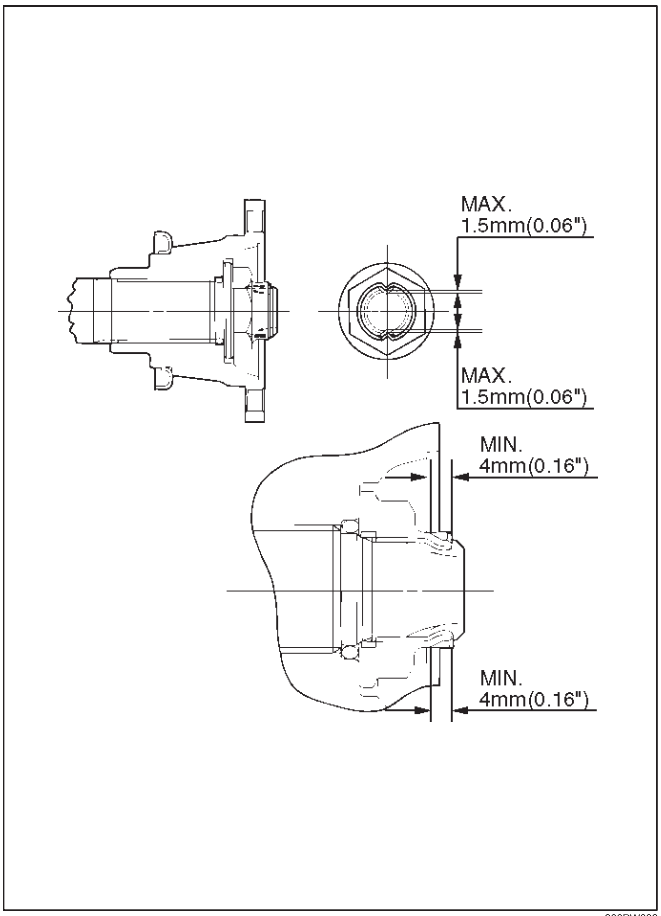
Torque

Companion flange: 167 N·m (123 lb ft)

3. Use the punch J–39209 to stake the companion flange nut (3) at two spots.



266RS001



266RW002

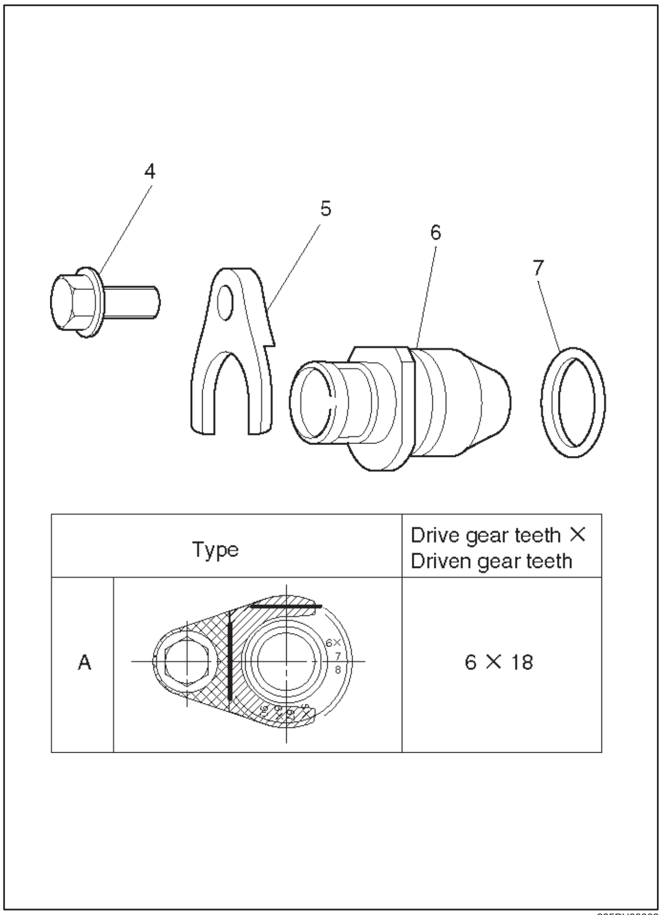
NOTE: Be sure to confirm that there is no crack at the staked portion of the flange nut after staking.

4. Install the O–ring (7) to the speedometer driven gear bushing (6).
5. Install the driven gear to the speedometer driven gear bushing (6).
6. Install the speedometer driven gear assembly to the extension housing assembly.
7. Install the plate (5) to the extension housing assembly and tighten to the specified torque.

Torque: 15 N·m (11 lb ft)

8. Install the speedometer sensor and tighten to the specified torque.

Torque: 27 N·m (20 lb ft)

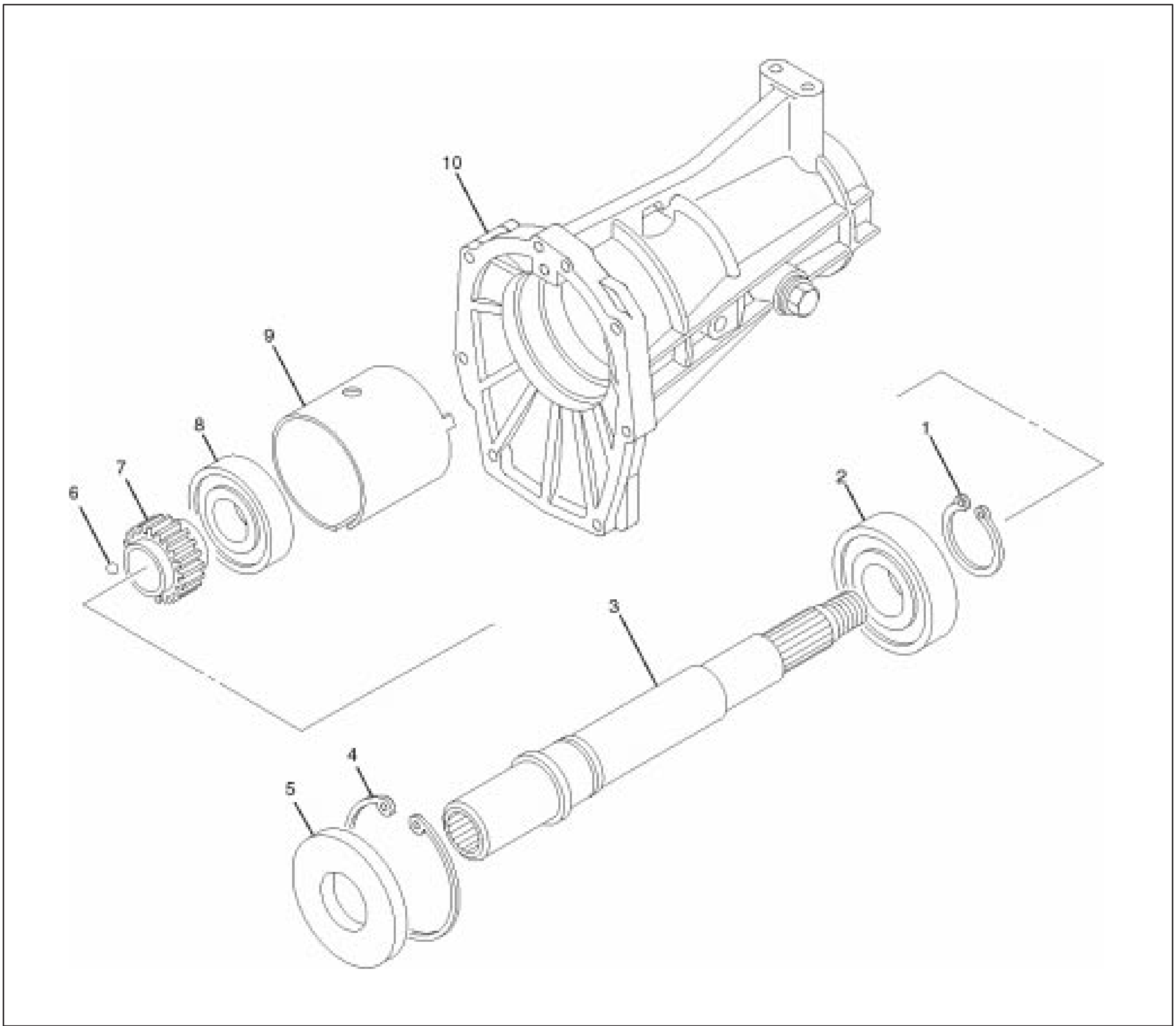


225RY00003

Legend

(4) Bolt
(5) Plate
(6) Bushing
(7) O–ring

Extension Housing Assembly

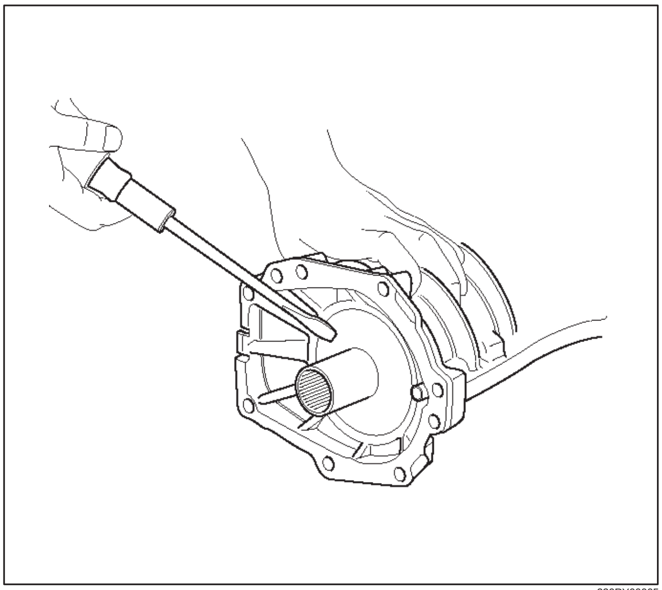


Legend

(1) Bearing Snap Ring
(2) Front Ball Bearing
(3) Extension Shaft
(4) Bearing Snap Ring
(5) Front Oil Seal
(6) Ball
(7) Speedometer Drive Gear
(8) Rear Ball Bearing
(9) Air Breather Pipe Collar
(10) Extension Case

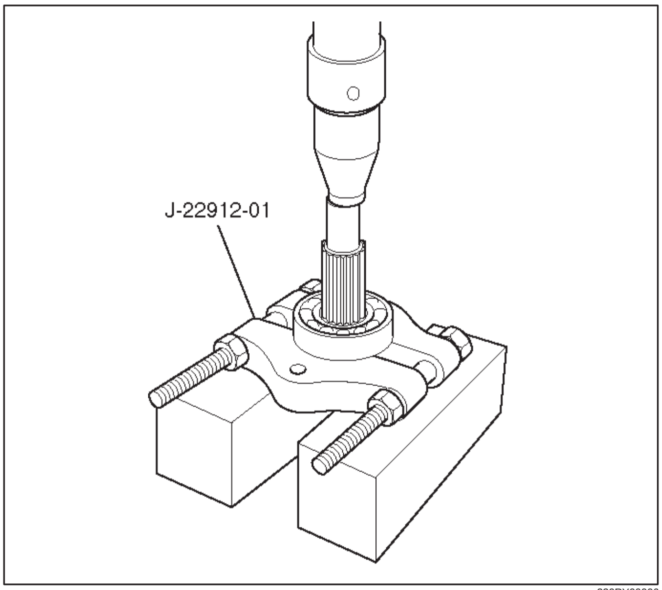
Disassembly

1. Remove front oil seal (5) from the extension housing assembly.



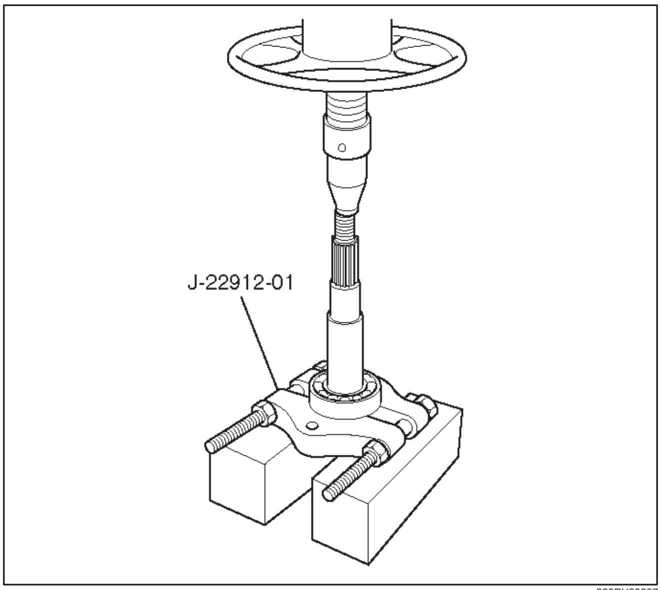
220RY00005

2. Remove front snap ring (4), use a pair of snap ring pliers to remove the snap ring.
3. Remove the extension shaft with ball bearing from the extension case (10).
4. Remove rear ball bearing (8), using a bench press and the bearing remover J–22912–01.



220RY00006

5. Remove speedometer drive gear (7).
6. Remove ball (6).
7. Remove bearing snap ring (1), using a pair of snap ring pliers.
8. Remove extension shaft (3) from the front ball bearing (2), using a bench press and bearing remover J–22912–01.



220RY00007

9. Remove air breather pipe collar (9) from the extension housing assembly.

Reassembly

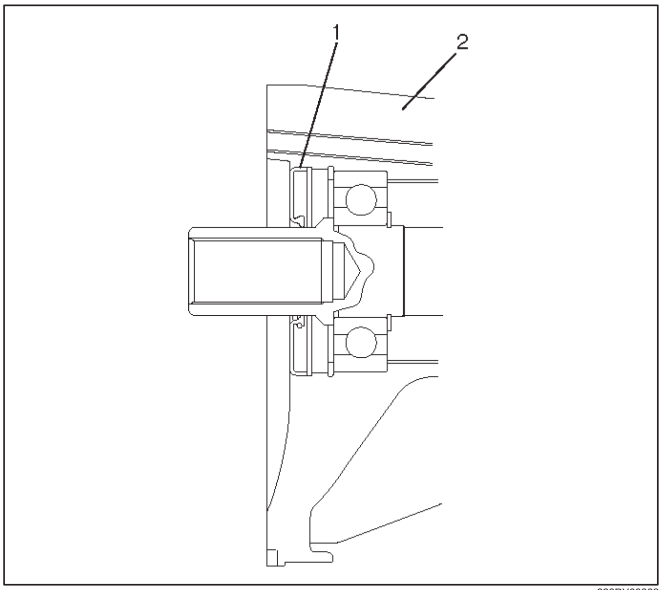
1. Install air breather pipe collar (9) to the extension housing assembly.

CAUTION: PUT THE AIR BREATHER PIPE COLLAR INTO THE EXTENSION CASE AS MATCHING THE PROTRUSION OF THE AIR BREATHER PIPE COLLAR WITH THE DEPRESSION OF THE EXTENSION CASE.

2. Install front ball bearing (2) to the extension shaft (3), using the ball bearing installer J–22912–01.
3. Install bearing snap ring (1), using a pair of snap ring pliers.
4. Install ball (6).
5. Install speedometer drive gear (7).
6. Use the ball bearing installer J–22912–01 to install the rear ball bearing (8).
7. Install the extension shaft with ball bearing to the extension case (10).
8. Install front snap ring (4).

9. Install front oil seal (5).

CAUTION: Hammering the outside of the oil seal equally, install it to the extension case entirely.



220RY00008

Legend

(1) Front Oil Seal
(2) Extension Case

Inspection and Repair

1. Make the necessary repair or parts replacement if wear, damage or any other abnormal conditions are found during inspection.
2. Wash all parts thoroughly in clean solvent. Be sure all old lubricant, metallic particles, dirt, or foreign material are removed from the surfaces of every part. Apply compressed air to each oil feed port and channel in each case half to remove any obstructions or cleaning solvent residue.

Bearings

1. Inspect the condition of all bearings. Wash bearings thoroughly in a cleaning solvent. Apply compressed air to the bearings.

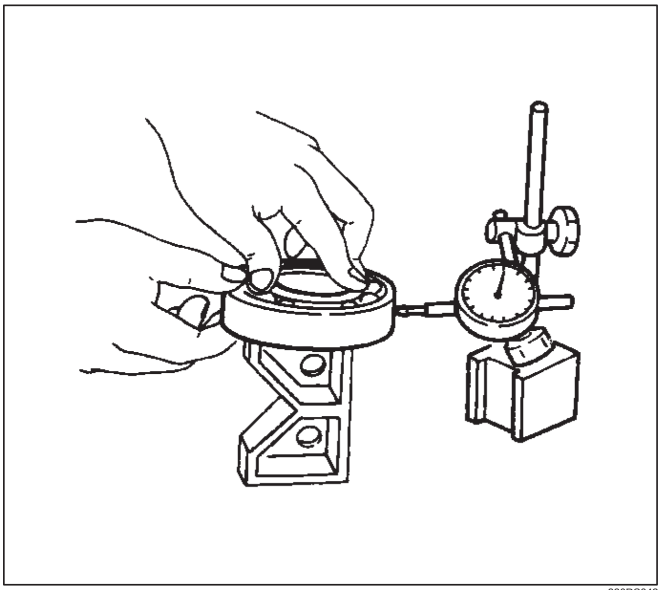
NOTE: Do not allow the bearings to spin. Turn them slowly by hand. Spinning bearings may damage the rollers.

2. Lubricate the bearings with a light oil and check them for roughness by slowly turning the race by hand.

Ball Bearing Play

1. Use a dial indicator to measure the ball bearing play.
2. If the measured value exceeds the specified limit, the ball bearing must be replaced.

Limit : 0.2 mm (0.008 in)



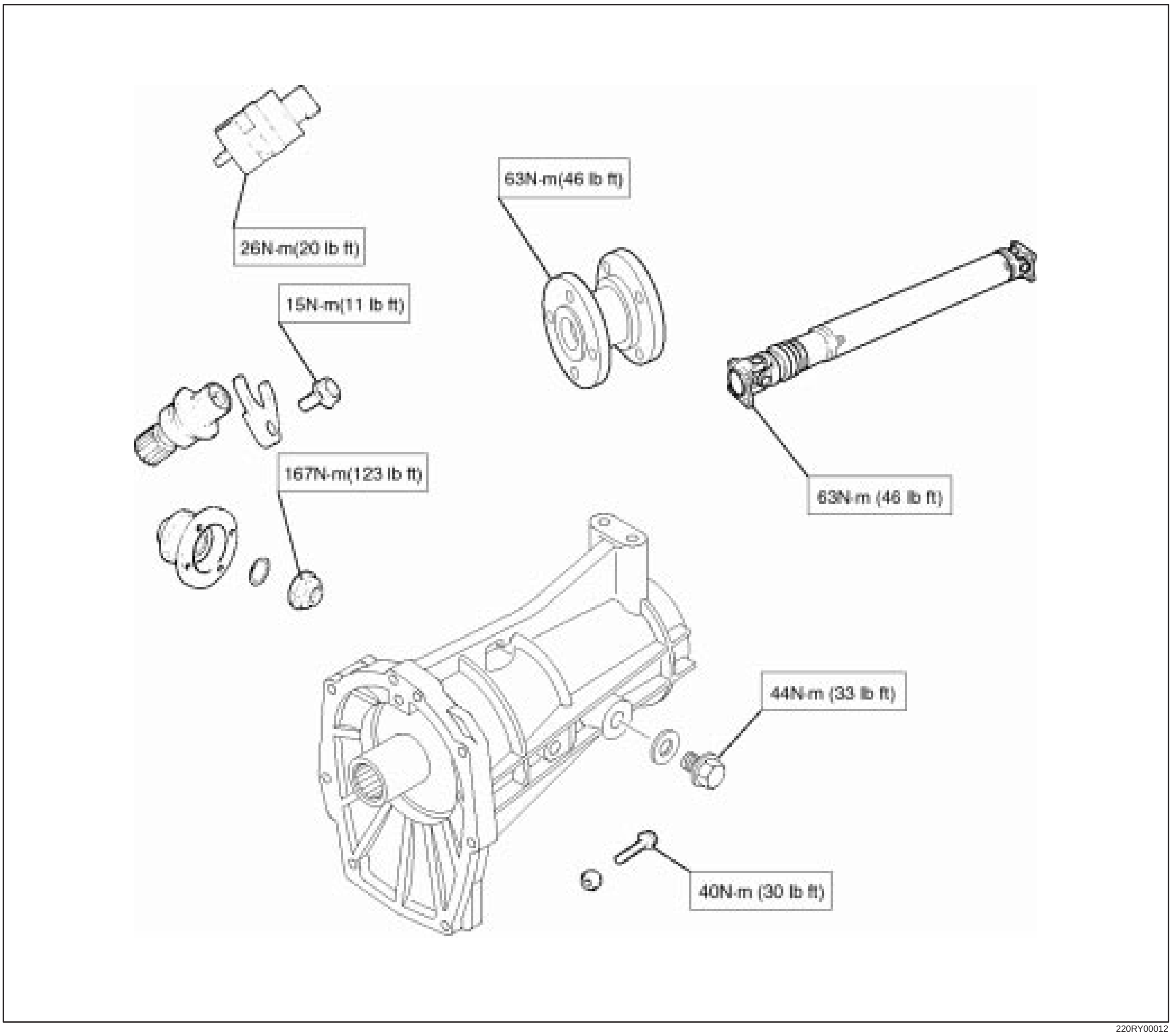
226RS043

Main Data and Specifications

General Specifications

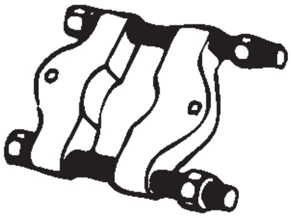
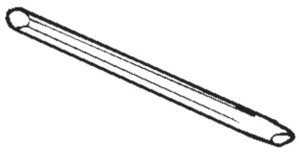
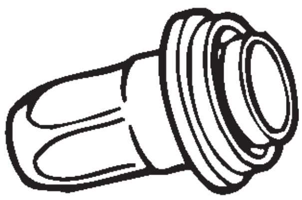
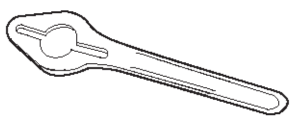
Oil capacity	0.185 lit. (0.195 U.S. quart)
Type of lubricant	ATF DEXRON®–III

Torque Specifications



220RY00012

Special Tools

ILLUSTRATION	**PART NO.** PART NAME
 901RS258	**J–22912–01** Bearing remover/installer
 901RS263	**J–39209** Punch; end nut
 901RS272	**J–39208** Rear oil seal installer
 901RW071	**J–8614–11** Flange holder

TROOPER

TRANSMISSION

TRANSMISSION CONTROL SYSTEM (4L30–E)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The 4L30–E is a 4–speed fully automatic transmission. It uses a microcomputer as a control unit to judge running conditions including throttle opening rate and vehicle speed, then it sets the shifting point in the optimum timing so that best driving performance can be achieved.
In addition, the built–in shift mode select function can select three shift modes according to the driver's preference:

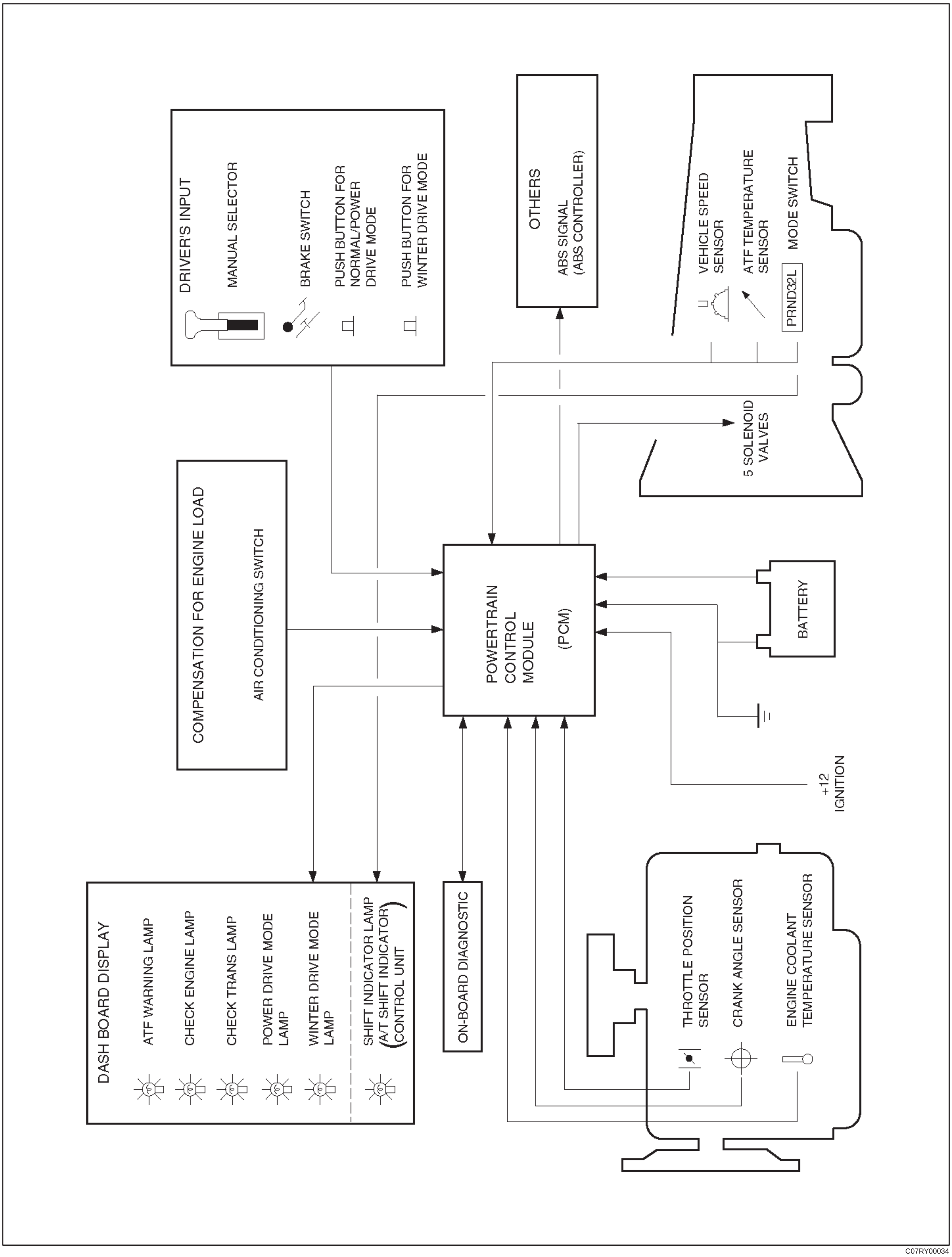
- Normal mode –Normal shift pattern.
- Winter mode –Starts in 3rd gear to reduce slippage on ice or snow.
- Power mode has a delayed upshift for when more powerful acceleration is required.

Also, the built–in fail safe function ("backup mode") assures driving performance even if the vehicle speed sensor, throttle signal or any solenoid fails.
Further, the self–diagnostic function conducts diagnosis in a short time when the control system fails, thus improving serviceability.
The major features of 4L30–E are as follows:

- A compact structure consisting of 2 sets of planetary gears and flat torque converter.
- Electronic control selects the optimum shift mode according to the driving conditions.
- Electronic control maintains the optimum hydraulic pressure for clutch, band brake as well as transmission so that shift feeling is improved.
- Two sets of planetary gears reduce friction of power train.

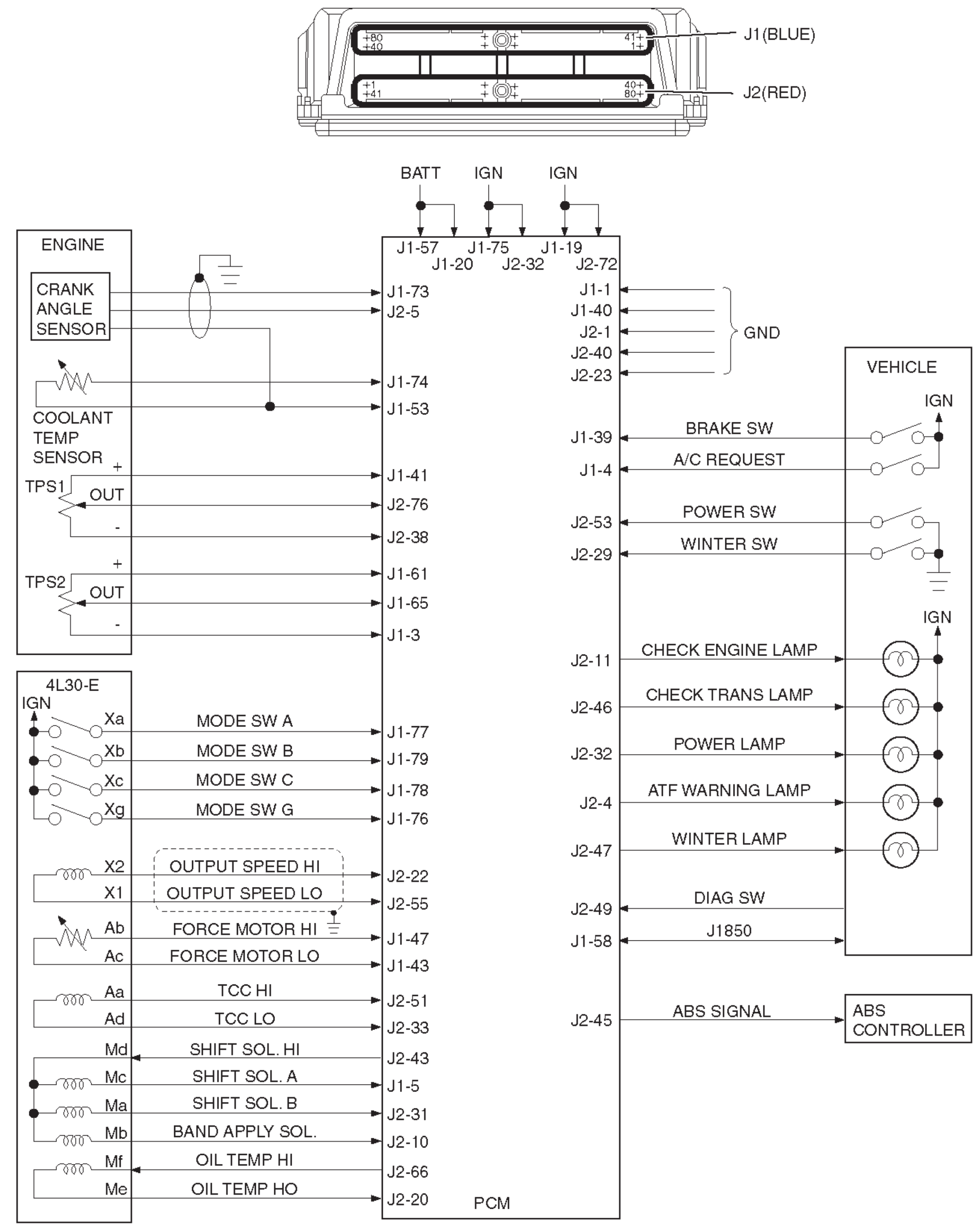
  Also, a lockup mechanism in the torque converter reduces fuel consumption.
- Wide gear ratio and high torque rate of torque converter provide excellent starting performance.

Electronic Control Diagram



C07RY00034

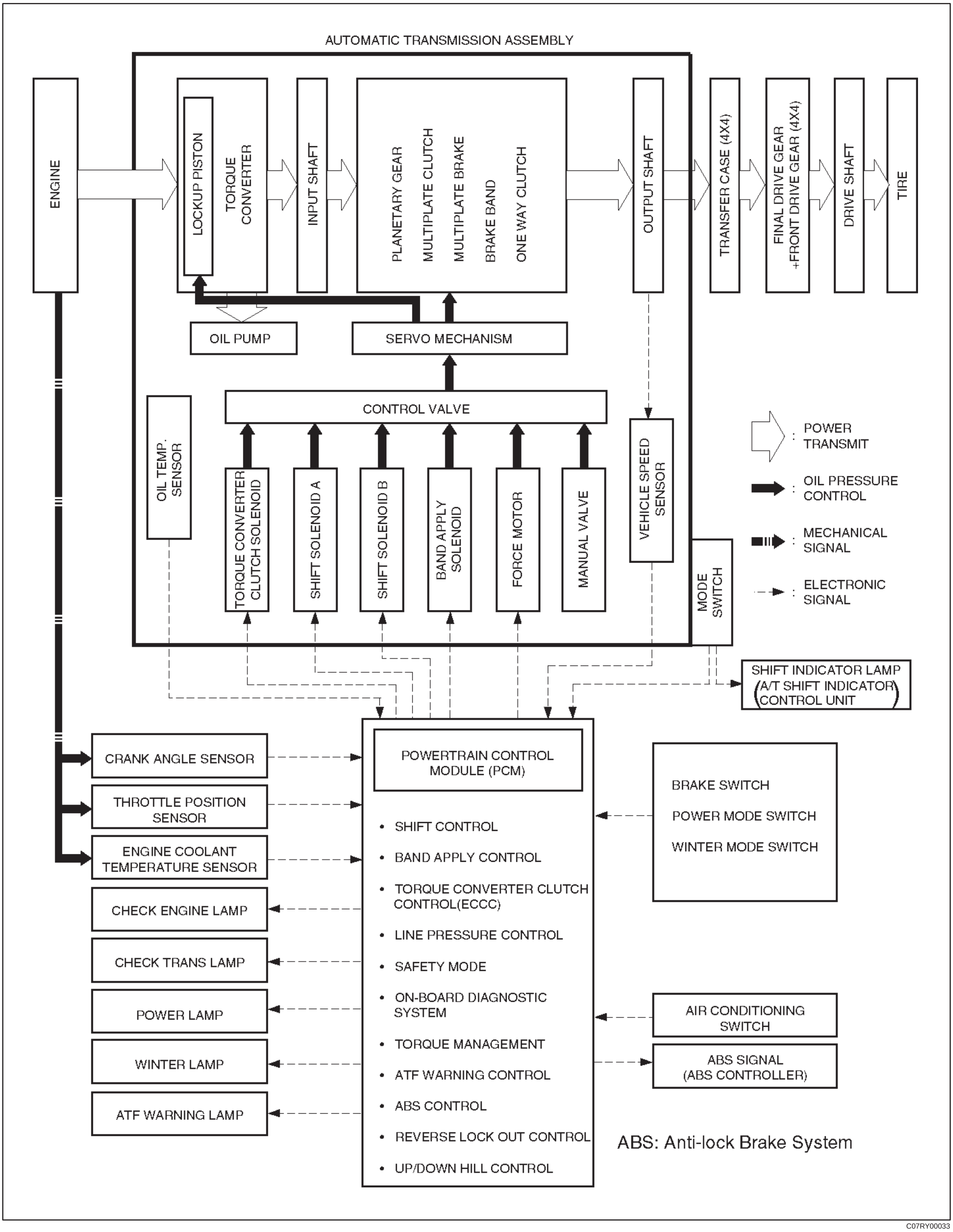
Powertrain Control Module (PCM)



TPS : Throttle Position Sensor
TCC : Torque Converter Clutch
ABS : Anti-Lock Brake System

C07RY002

Control System Diagram



Shift Control

The transmission gear is shifted according to the shift pattern selected by the driver. In shifting gears, the gear ratio is controlled by the ON/ OFF signal using the shift solenoid A and the shift solenoid B.

Band Apply Control

The band apply is controlled when in the 3–2 downshift (engine overrun prevention) and the garage shift (shock control).
The band apply solenoid is controlled by the signal from the Pulse Width Modulation (PWM) to regulate the flow of the oil.

Torque Converter Clutch Control (Electronically Controlled Capacity Clutch = ECCC)

The clutch apply is controlled by moving the converter clutch valve by commanding Torque Converter Clutch (TCC) solenoid using the PWM signal.

Line Pressure Control

The throttle signal allows the current signal to be sent to the force motor. After receiving the current signal, the force motor activates the pressure regulator valve to regulate the line pressure.

On–Board Diagnostic System

Several malfunction displays can be stored in the Powertrain Control Module (PCM) memory, and read out of it afterward.
The serial data lines, which are required for the testing of the final assembly and the coupling to other electronic modules, can be regulated by this function.

Fail Safe Mechanism

If there is a problem in the transmission system, the PCM will go into a “backup” mode.
The vehicle can still be driven, but the driver must use the select lever to shift gears.

Torque Management Control

The transmission control side sends the absolute spark advance signal to the engine control side while the transmission is being shifted. This controls the engine spark timing in compliance with the vehicle running condition to reduce the shocks caused by the change of speed.

ATF Warning Control

The oil temperature sensor detects the ATF oil temperature to control the oil temperature warning, TCC, and the winter mode.

ABS Control

When the select lever is at “L” or “R” range, a signal is sent to the ABS controller as one of the ABS control conditions.

Reverse Lock Out Control

With the selector lever in reverse position, the PCM will not close the PWM solenoid until the vehicle is below 15 km/h (9.3 mph), thus preventing reverse engagement above this speed.

Downhill Control

This mode is automatically activated from “NORMAL” mode only when downhill conditions are recognized.
The shift pattern is identical to “NORMAL” mode except 3-4 and 4-3 shift lines at low throttle modified to get engine braking on a larger speed range.
ECCC lines unchanged compared to “NORMAL” mode.

Uphill Control

When Uphill condition are recognized the 2-3 and 3-4 shift and TCC apply are down only when the engine torque is sufficient in order to avoid shift hunting.

Shift Mode Control

① Mode Type

Mode Type	Select lever position
Normal drive mode (NOR)	Entire range (excluding "R")
Power drive mode (PWR)	Entire range (excluding "R")
Winter drive mode	"D" range only

② Mode selection

	SWITCH (SW)		LAMP	
Mode Type	POW/NOR. SW	WINTER SW	POWER DRIVE LAMP	WINTER DRIVE LAMP
Normal drive mode (NOR)	OFF	OFF	OFF	OFF
Power drive mode (PWR)	ON	OFF	ON	OFF
Winter drive mode	ON/OFF	ON	OFF	ON

However, the winter switch prevails over the PWR/NOR switch.
The mode becomes normal drive mode when the winter switch is operated from ON to OFF.

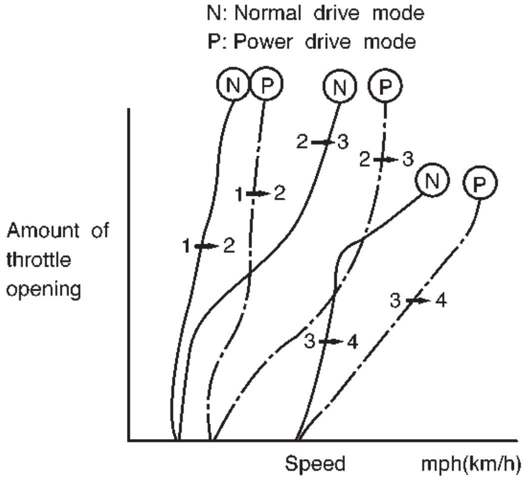
③ Comparison of mode

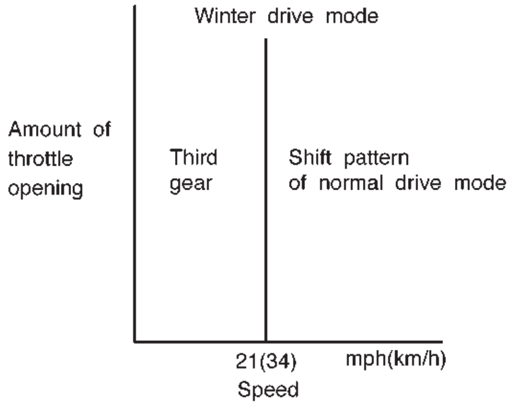
(1) The normal drive mode is set at the normal shift points.

(2) The shift points of the power drive mode are shifted to the higher speed side, compared to the normal drive mode.

(3) The winter drive mode is a special mode used exclusively for starting in third gear.

Shift diagram





F07RX001

Gear Shift Control

1 Shift pattern

SELECT LEVER RANGE	SHIFT PATTERN
D (Drive)	1⇄2TCC ⇄3TCC ⇄4TCC
3 (Third)	1⇄2TCC ⇄3TCC ←4TCC
2 (Second)	1⇄2TCC ←3TCC
L (First)	1←2

TCC = Torque Converter Clutch

2 Gear position

The gear is selected by ON/OFF of two solenoids.

Gear \ SOL	A	B
4 (Fourth)	×	×
3 (Third)	○	×
2 (Second)	○	○
1 (First)	×	○
P (park) R (Reverse) N (Neutral)	×	○

○ = ON

× = OFF

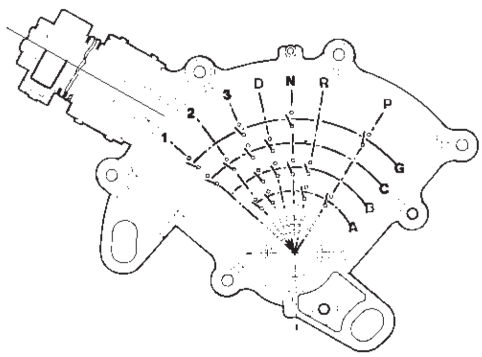
Shift solenoid A (Normally closed) ON → PRESSURE TO SHIFT VALVE

Shift solenoid B (Normally open) OFF → PRESSURE TO SHIFT VALVE

3 Selecting gear pisition

Seven types of positions can be selected according to 5 signals from the mode switch as below.

	MODE SW TERMINALS				
SELECT LEVER RANGE	5(D)	8(A)	7(B)	6(C)	3(G)
P (park)	•	•			•
R (Reverse)	•	•	•		
N (Neutral)	•		•		•
D (Drive)	•		•	•	
3 (Third)	•	•	•	•	•
2 (Second)	•	•		•	
L (First)	•			•	•



• = Continuity

F07RT034

Winter Drive Mode

1. **Operation**
   The winter switch will operate when switched on after all of the following conditions are present:

   Conditions:

   a. The select lever position is "D" range only.
   b. Vehicle speed is 7 mph (11 km/h) or less.
   c. Transmission oil temperature is 130°C (266°F) or less.
   d. Accelerator opening is at 8% or less.
2. **Cancel Release**
   1. Cancellation by driver
      a. Turning off the winter drive mode switch
      b. Shifting select position to "3", "2", or "L" (winter drive mode is not canceled by selecting "D", "N", "R", or "P").
      c. Ignition key is turned off.
   2. Automatic cancellation
      a. When vehicle runs at 21mph (34 km/h) or more for 1 second or more
      b. When transmission oil temperature reaches 130°C (266°F) or above

NOTE: The mode returns to normal drive mode or power drive mode after the winter drive mode is canceled.

Backup Mode

If a major system failure occurs which could affect safety or damage the transmission under normal vehicle operation, the diagnostic system detects the fault and overrides the Powertrain Control Module (PCM).
The "CHECK TRANS" light flashes to alert the driver, and the transmission must be manually shifted as follows:

Select lever position	Gear Ratio Selected
D	4 (Fourth)
Manual 3	4 (Fourth)
Manual 2	3 (Third)
Manual L	1 (First)
R	Reverse

Shifts are firmer to prevent clutch slip and consequent wear. The fault should be corrected as soon as possible.

Functions of Input / Output Components

Components			Function
INPUT SIGNAL		Speed sensor (fixed to transmission)	Senses rotation of output shaft and feeds the data to Powertrain Control Module (PCM).
		Throttle position sensor (TPS) (fixed to engine)	Senses the extent of throttle valve opening and the speed of the throttle valve lever motion to open the valve. Feeds the data to PCM.
		Brake switch (fixed to brake pedal)	Senses whether the driver has pressed the brake pedal or not and feeds the information to PCM.
		Mode switch (fixed to transmission)	Senses the select lever position, and feeds the information to PCM.
		Power drive switch (fixed to front console)	Senses whether the driver has selected the power mode, and feeds the information to PCM.
		T/M oil temperature sensor	Senses the T/M oil temperature and feeds the data to PCM
		Engine coolant tempera-ture sensor	Senses the engine coolant temperature, and feeds the data to PCM.
		Engine speed signal	Feeds the signals monitoring engine speed to PCM from crank angle sensor.
		Air conditioning information	Senses whether the air conditioner has been switched on or not, and feeds the information to PCM.
		Winter switch (fixed to front console)	Senses whether the driver has selected the winter mode, and feeds the information to PCM.
		Cruise controller (Over-drive OFF signal)	Downshift takes place when overdrive OFF signal is received from auto cruise controller integrated in PCM.
OUTPUT SIGNAL	SOLENOID	Shift solenoid A, B	Selects shift point and gear position suited to the vehicle running condition on the basis of PCM output.
		Band apply solenoid	Controls oil flow suited to the vehicle running condition on the basis of PCM output.
		Torque Converter Clutch PWM solenoid	Controls clutch apply suited to the vehicle running condition on the basis of PCM output.
		Force motor (Pressure regulator valve)	Adjusts the oil pump delivery pressure to line pressure suited to the vehicle running condition on the basis of PCM output.
		Power drive mode lamp	Informs the driver whether the vehicle is in power mode or not.
		Winter drive mode lamp	Informs the driver whether the vehicle is in winter mode or not.
		CHECK TRANS lamp	Informs the driver of failure in the system.
		ATF warning lamp	Lights when ATF oil temperature rises.
		ABS signal	When the select lever is at “Reverse” or “L” range, sends a signal to the ABS controller as one of the ABS control conditions.

Diagnosis

Electronic Diagnosis

How To Diagnose The Problem

1. To avoid incorrect diagnostics, this book needs to be followed accurately. Unless stated, do not jump directly to a section that could contain the solution. Some important information may be missed.
2. The sections in CAPITALS and bold are the main sections that can be found in the contents.
3. The GOTO **"SECTION"** means to continue to check going to the "section".
4. The GOTHROUGH **"SECTION"** means to go through the "section" and then to go back to the place the GOTHROUGH was written.
5. BASIC ELECTRIC CIRCUITS:
   You should understand the basic theory of electricity. This includes the meaning of voltage, amps, ohms, and what happens in a circuit with an open or shorted wire. You should also be able to read and understand wiring diagrams.

Check Trans Indicator

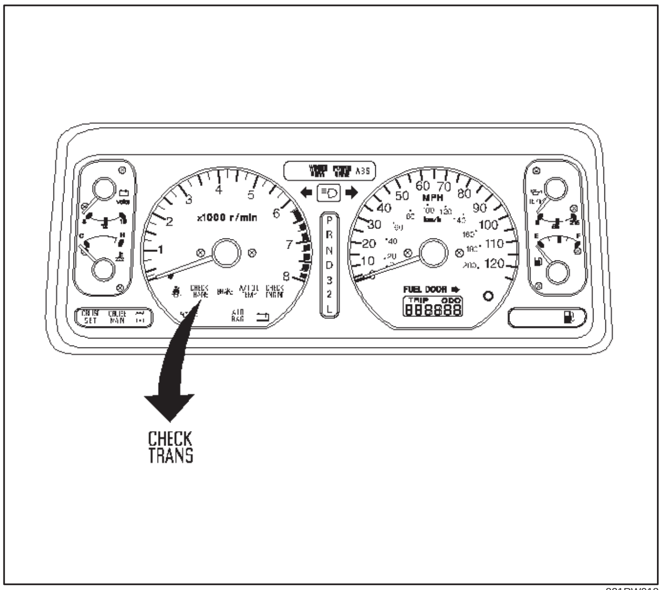
Find CHECK TRANS indicator and verify if it is

A. Flashing: GOTO **DIAGNOSTIC CHECK.**

B. Staying on: GOTHROUGH **CHECK TRANS CHECK**.

C. Is never ON when the ignition key is turned on: GOTHROUGH **CHECK TRANS CHECK**

D. Is ON during 2 seconds at ignition but OFF after: Normal operation. No DTC or malfunction.



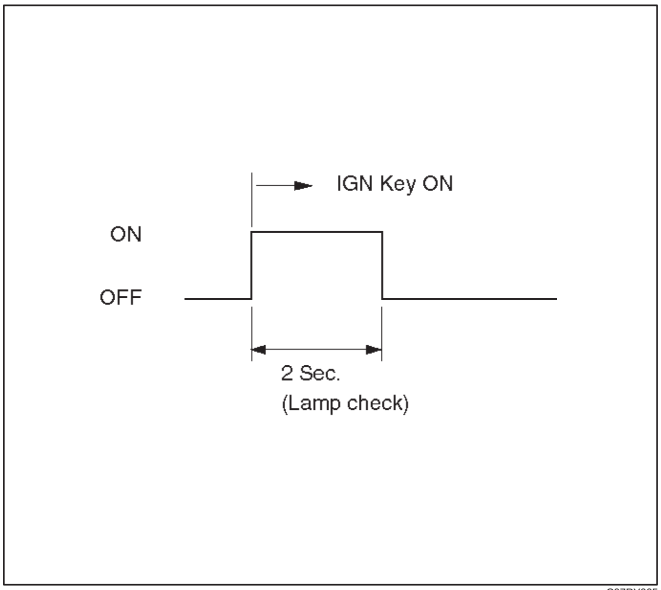
821RW018

Diagnostic Check

This test determines if the transmission or its input or output connections or sensors are failing.

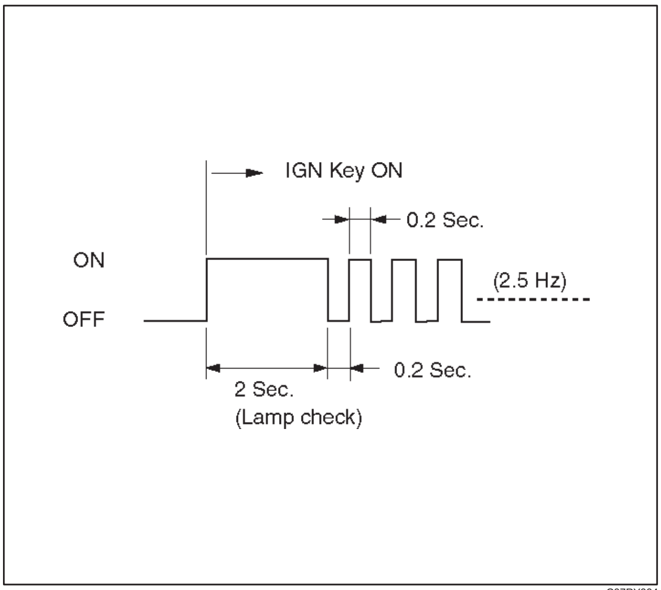
1. Connect the Tech 2: GOTHROUGH **Tech 2 OBD II CONNECTION**.
2. Turn on the ignition but not the engine.
3. Push "F0" on Tech 2 to see the Diagnostic Trouble Code (DTC):
4. Do you have a DTC?
   YES: write down all code numbers and do the **DTC CHECK**
   NO: the DTC can not help you finding the problem.
   1. GOTHROUGH **"CHECK TRANS" CHECK**
   2. IF it is flashing and the flash is 0.2 seconds ON and 0.2 seconds OFF, this means that you should have a DTC stored. Please recheck GOTO **DIAGNOSTIC CHECK** and if you find the same problem, replace the Powertrain Control Module (PCM).

Normal



C07RY005

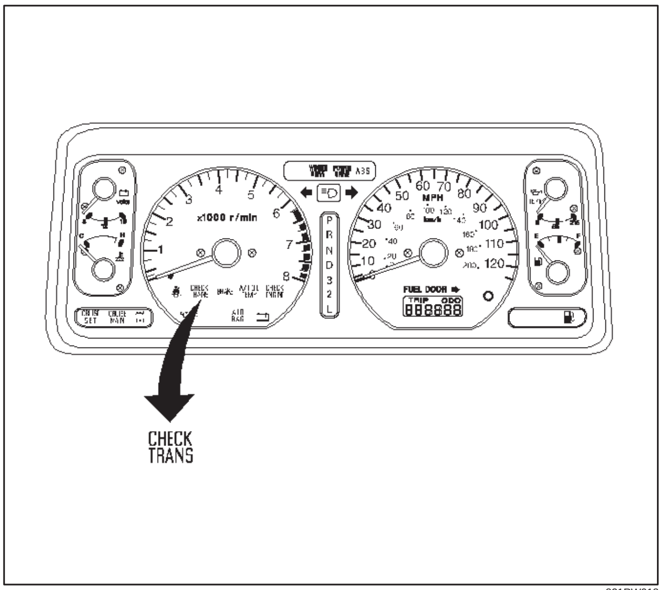
Abnormal



C07RY004

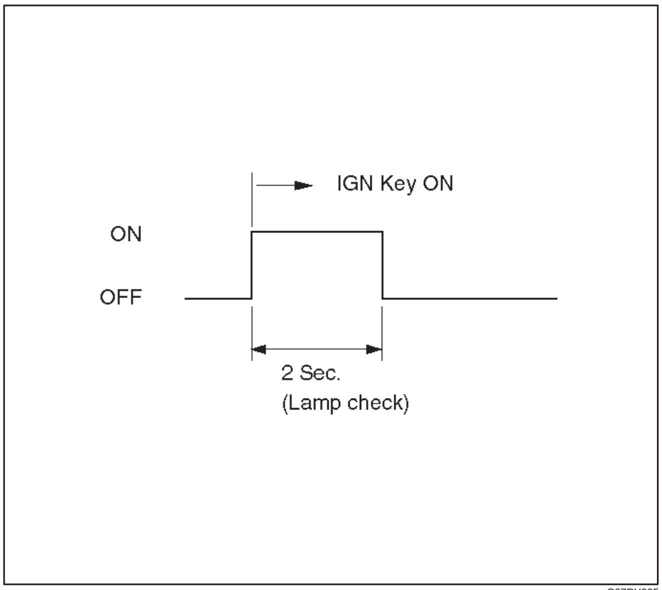
"Check Trans" Check

1. Indicator it is ON during 2 seconds at ignition (or when the engine is cranked) but it is OFF after the engine starts. The indicator is working normally GOTO **DIAGNOSTIC CHECK**.



821RW018

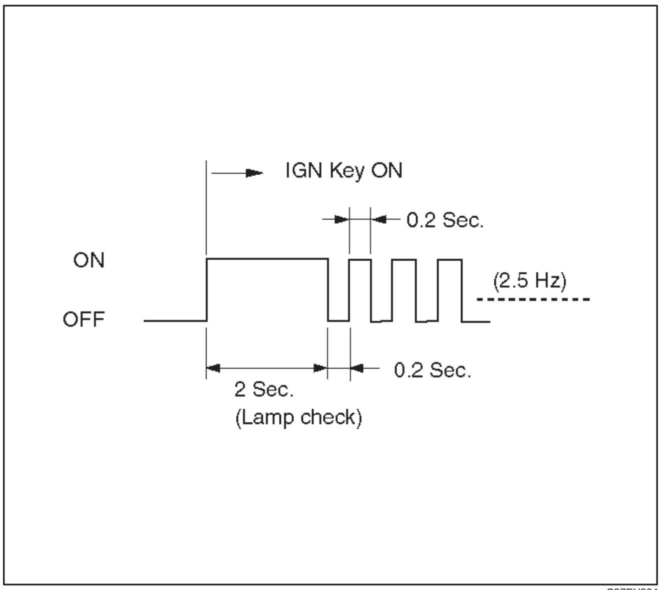
Normal



C07RY005

2. Indicator it is flashing and the flash is 0.2 seconds ON and 0.2 seconds OFF always when ignition is on (engine cranked or not). This means that there is a malfunction. GOTO **DIAGNOSTIC CHECK**.

Abnormal



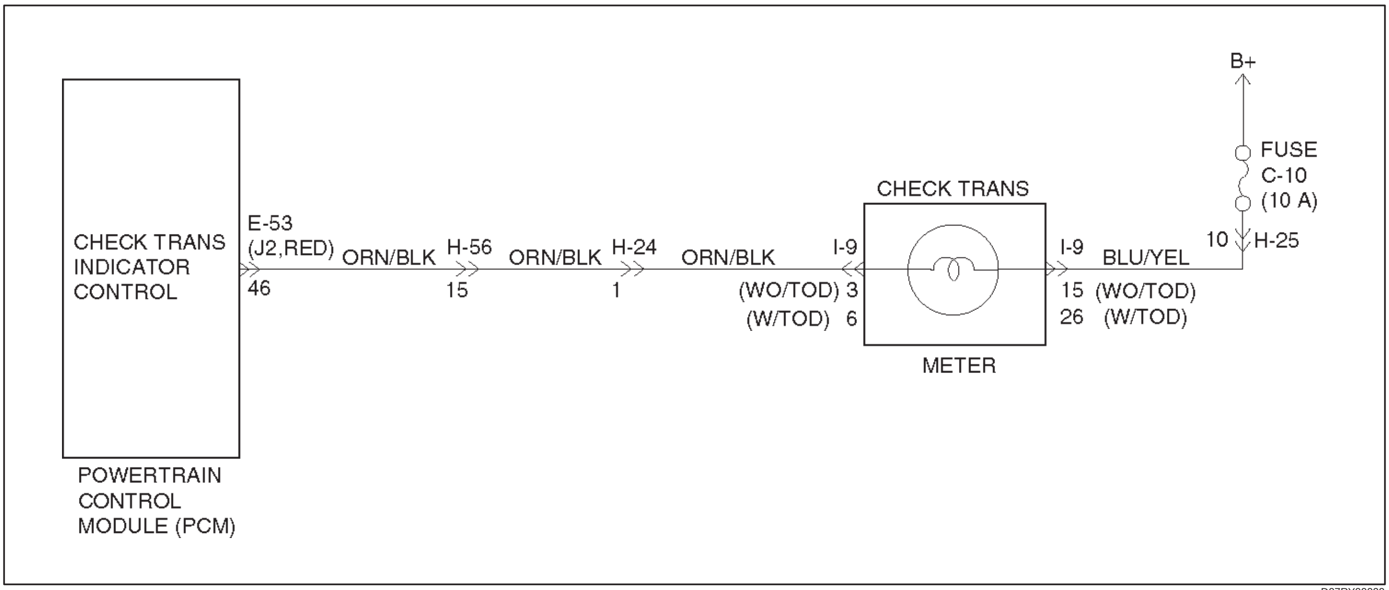
C07RY004

3. Indicator it is staying ON always when Ignition is ON.
   1. This means that connection between the lamp and the PCM is shorted to ground.
   2. Verify if instrument panel terminal 3 (WO/TOD) or 6 (WO/TOD) of connector I–9 is shorted to ground.
   3. Verify if the PCM connector J2 (RED) terminal 46 is shorted to ground.
   4. Verify that the instrument panel terminal 15 (WO/TOD) or 26 (W/TOD) of connector I–9 is connected to battery.
   5. IF problem solved: GOTO **CHECK TRANS INDICATOR**.

   NO:Replace Powertrain Control Module (PCM).
4. Indicator it is staying OFF with the ignition ON (engine OFF).
   1. This means that connection between the lamp and the PCM is shorted to battery or opened.
   2. Verify if instrument panel terminal 3 (WO/TOD) or 6 (WO/TOD) of connector I–9 is shorted to battery or open.
   3. Verify if the PCM connector J2 (RED) terminal 46 is shorted to battery or open.
   4. Verify that the instrument panel terminal 15 (WO/TOD) or 26 (W/TOD) of connector I–9 is connected to battery. If not, check the fuses and the connections (terminal 10 of connector H–25) voltage.

5. IF problem solved: GOTO **CHECK TRANS INDICATOR**.

   NO: Replace Powertrain Control Module (PCM).

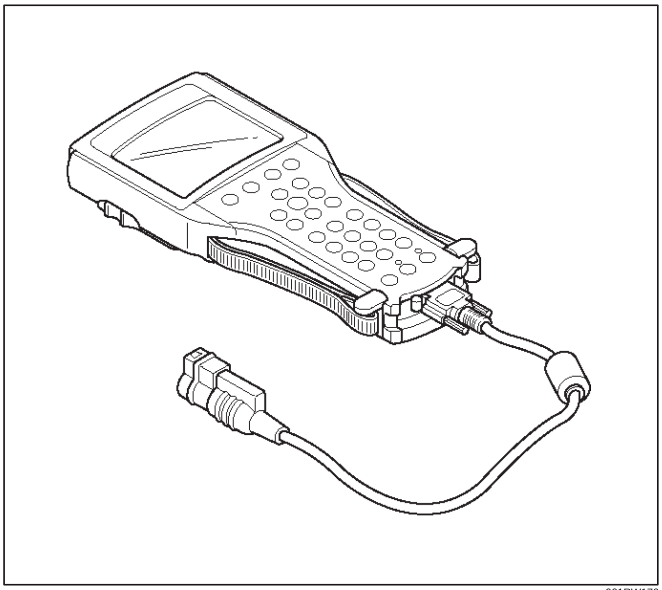


D07RY00009

Tech 2 OBD II Connection

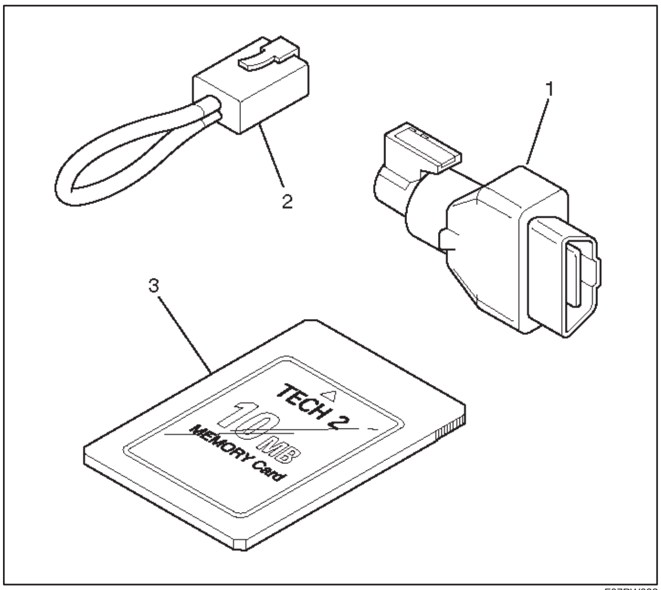
In order to access OBD II Powertrain Control Module (PCM) data, use of the Tech 2 scan tool kit (7000086) is required.

1. The electronic diagnosis equipment is composed of:
   1. Tech 2 hand held scan tool unit (7000057) and DLC cable (3000095).



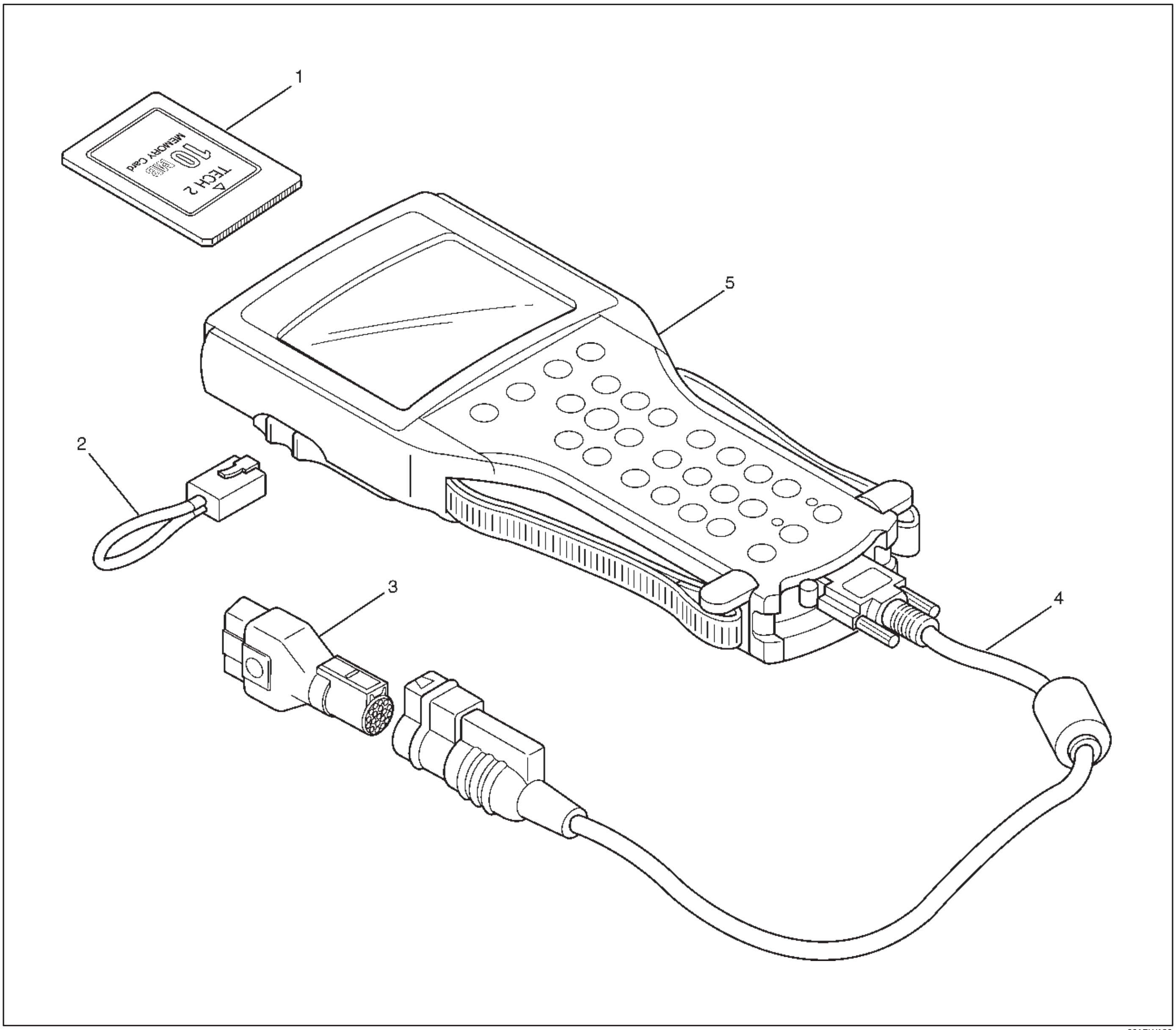
901RW176

   2. SAE 16/19 adaptor (3000098) (1), RS 232 loop back connector (3000112) (2), and PCMCIA card (3000117) (3).



F07RW033

2. Connecting the TECH2



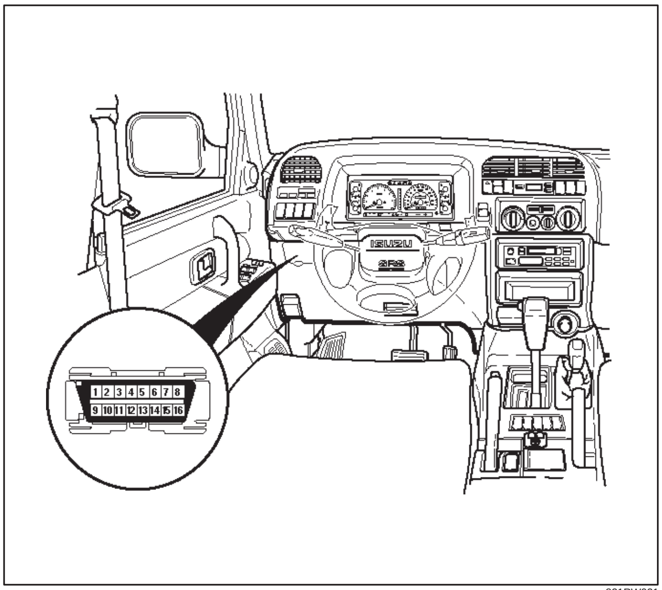
901RW180

Legend
(1) PCMCIA Card
(2) RS 232 Loop Back Connector
(3) SAE 16/19 Adapter
(4) DLC Cable
(5) Tech 2

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 2000 System PCMCIA card (1) inserts into the Tech 2 (5).
2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (5)
4. Make sure the vehicle ignition is off.

5. Connect the Tech 2 SAE 16/19 adaptor to the vehicle DLC.



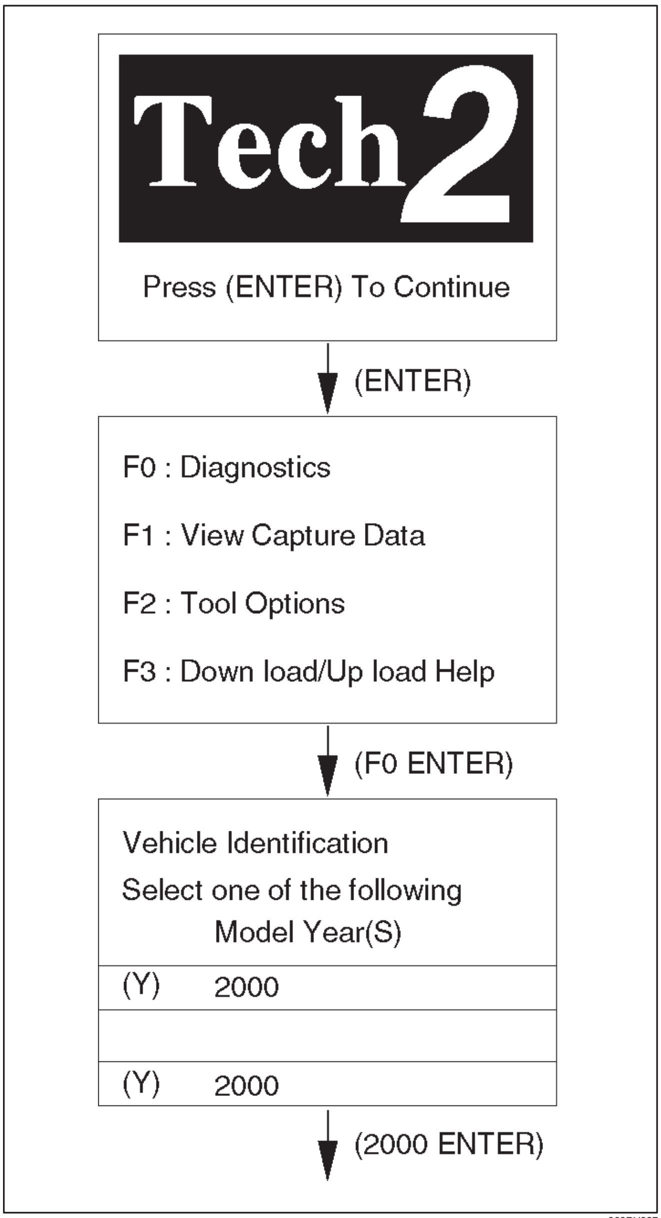
821RW021

6. The vehicle ignition turns on.
7. Verify the Tech 2 power up display.

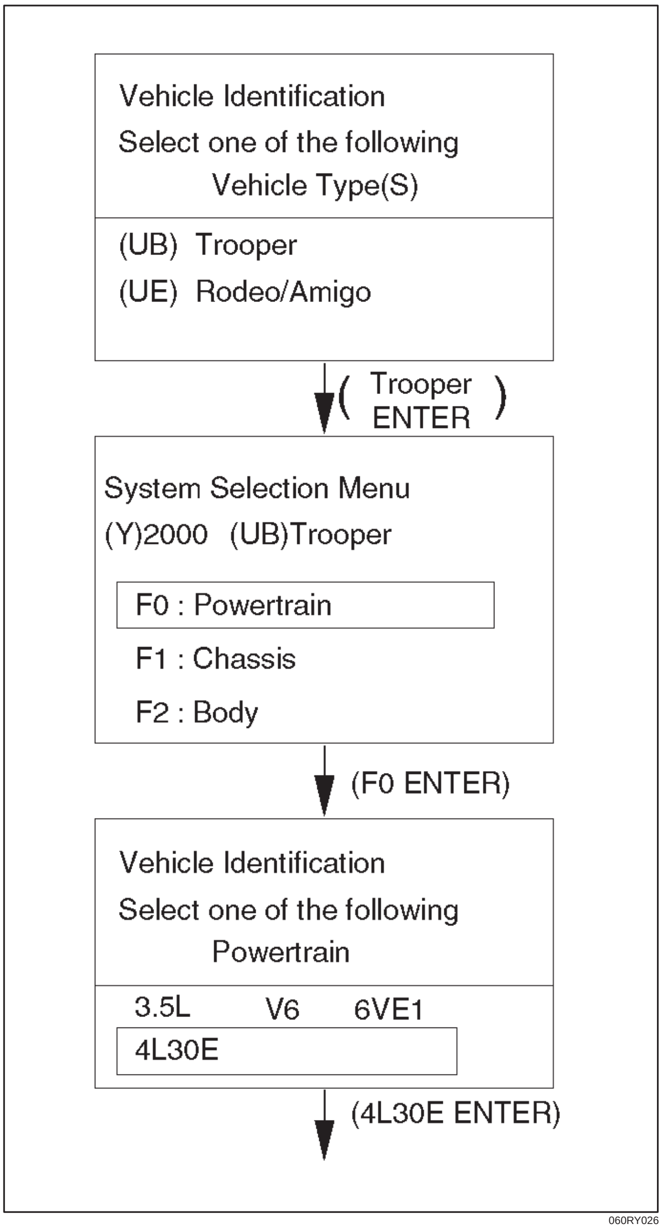
060RW009

NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2 and refer to user guide of the Tech 2.

8. The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



060RY027



Once the test vehicle has been identified an "Application (Powertrain) Menu" screen appears. Please select the appropriate application.

The following table shows, which functions are used for the available equipment versions.

F0: Diagnostic Trouble Codes
F0: Read DTC Info Ordered By Priority
F1: Clear DTC Information
F2: DTC Information
F1: Data Display
F0: Transmission Data
F1: Output Driver Data
F2: Snap Shot
F3: Actuator Tests
F0: Lamps
F0: Check Light
F1: Winter Drive Lamp
F2: Power Drive Lamp
F3: AT Oil Temperature Lamp
F1: Solenoids
F0: Solenoid 1-2/3-4 Test
F1: Solenoid 2-3 Test
F2: TCC Solenoid
F3: Band Apply Solenoid
F4: Pressure Control Solenoid (PCS)
F4: Function Tests
F0: Reset Oil Life Monitor

Diagnostic Trouble Codes

The purpose of the "Diagnostic Trouble Codes" mode is to display stored PCM trouble codes.
When "Diagnostic Trouble Codes" is selected an "Application Menu" screen appears.

Clear DTC Information

The purpose of the "Clear DTC Information" mode is to command the clearing of stored PCM trouble codes.
When "Clear DTC Information" is selected, a "Clear DTC Information", warning screen appears. This screen informs you that by cleaning DTC's, "all stored DTC information in controller will be erased".
Do you want to clear DTC's (Yes/No).
Press either the Yes or No key when answering.
After clearing codes, confirm system operation by test driving the vehicle.
Allow the vehicle to shift through all four forward gears in a manner which attempts to repeat the failure condition.

NOTE: When the trouble has not been repaired and the trouble code cannot be erased, check the vehicle again.

DTC Information

When "DTC Information" is selected, an "Application Menu" appears with a list of DTC information function keys addressing DTC specifics and their origins.
Function key selections may vary for particular vehicle and/or system.

Data Display

The purpose of the "Data Display" mode is to continuously monitor data parameters.
The current actual values of all important sensors and signals in the system are display through F1 mode.
When "Data Display" is selected an "Application Menu" appears. Please select either "Engine" or "Transmission Data Display".
See "Transmission Data" on next page.

Snapshot

When "Snapshot" is selected an "Application Menu" appears.
When "Transmission Snapshot" application is selected from the "Application Menu", a "Snapshot Menu" appears, displaying several options. "Snapshot" options may vary from one system to another.
"Snapshot" allows a recording of all vehicle parameters. There parameters may then be replayed at a future point in time.
This action allows you to focus on making the condition occur, rather than trying to view all of the data in anticipation of the fault. The snapshot will collect parameter information around a trigger point that you select.
When a snapshot is taken. It is recorded onto the PCMCIA memory card. When the Tech 2 is powered down. Snapshots are not lost.

Actuator Tests

The purpose of "Actuator Tests" mode is to check for correct operation of electronic system actuators.

Lamps

You can operate the lamps by pressing the ON and OFF buttons.
Preconditions: none

Solenoid

Solenoid 1-2/3-4, Solenoid 2-3, TCC Solenoid

You can operate the solenoids by pressing the ON and OFF buttons.
Preconditions: P–N position, no vehicle speed, no engine speed

Band Apply Solenoid

You can operate the solenoid by pressing the ON and OFF buttons.
Preconditions: P-N position, idle engine speed, no vehicle speed.

Pressure Control Solenoid (PCS)

You can set desired PCS Current using the UP (+25) and DOWN (–25) button. The PC Solenoid Data informs about PCS Current, Pressure and Duty Cycle.
Preconditions: P–N position, no engine speed, no vehicle speed

Reset Oil Life Monitor

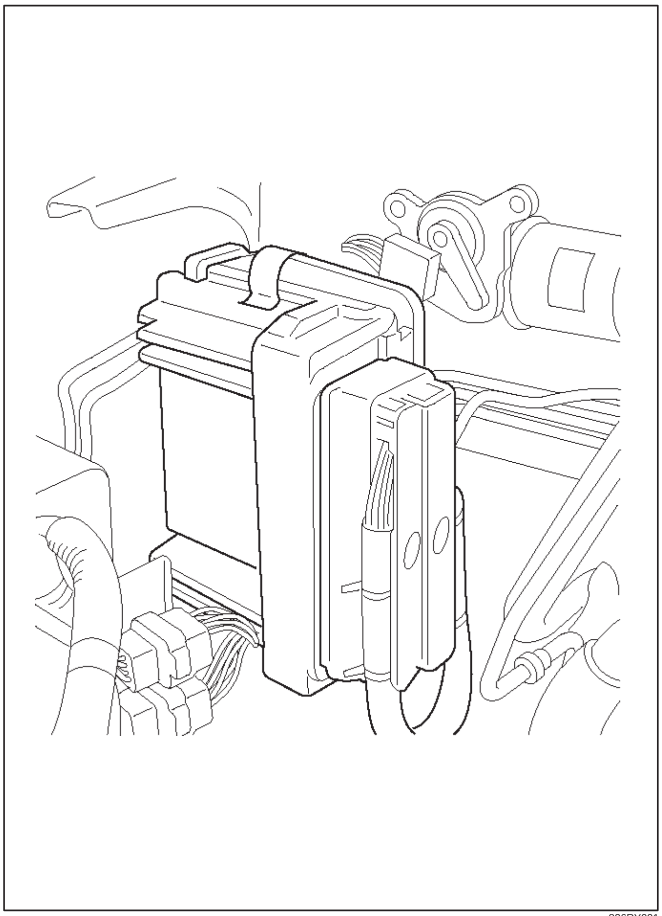
Displays parameter "Oil Life Monitor" and resets to 100% if Yes-button is pressed on Reset-question. "No" leaves test.
Preconditions: no vehicle speed, no engine speed

Transmission Data

Item	Unit	Engine running at idle
Ignition Voltage	V	12.8 ~ 14.1 V
Engine Speed	RPM	750 ~ 900 RPM
Vehicle Speed	km/h, MPH	0 MPH
AT Output Speed (Automatic Transmission)	RPM	0 RPM
AT Input Speed Ratio (Automatic Transmission)		0.0
Throttle Position	%	0 %
AT Oil Temperature (Automatic Transmission)	˚C, ˚F	70 ~ 80˚C (158 ~ 176˚F)
Transmission Temperature	˚C, ˚F	75 ~ 110˚C (167 ~ 230˚F)
AT Oil Temperature Lamp (Automatic Transmission)	Off, On	Off
AT Oil Life Monitor (Automatic Transmission)	%	100 %
AT Oil Life Lamp (Automatic Transmission)	Off, On	Not used
Commanded Gear		1
Current Gear		1
Mode Switch A	Inactive, Active	Active
Mode Switch B	Inactive, Active	Inactive
Mode Switch C	Inactive, Active	Inactive
Mode Switch G	Inactive, Active	Active
Selector Position		Park
1–2 Shift Solenoid A	Off, On	Off
2–3 Shift Solenoid B	Off, On	On
Solenoid Brake Band	Off, On	Off
TCC Slip Speed	RPM	750 ~ 900 RPM
TCC Solenoid	Off, On	Off
TCC Duty Cycle	%	0 %
PCS Current (Pressure Control Solenoid)	A	approx. 1.0 A
PCS Duty Cycle (Pressure Control Solenoid)	%	approx. 45 %
Desired PCS Pressure (Pressure Control Solenoid)	kPa	43 ~ 52 kPa
Shift Pressure	kPa	43 ~ 52 kPa
Brake Switch	Off, On	On
Kickdown Switch	On, Off	Not used
Winter Switch	On, Off	Off
Winter Drive Lamp	Off, On	Off
Power Switch	Power Drive Normal	Normal
Power Drive Lamp	Off, On	Off
Emergency Mode	Off, On	Off
ABS Status	On, Off	Off

OBD II Diagnostic Management System

Powertrain Control Module (PCM) Location



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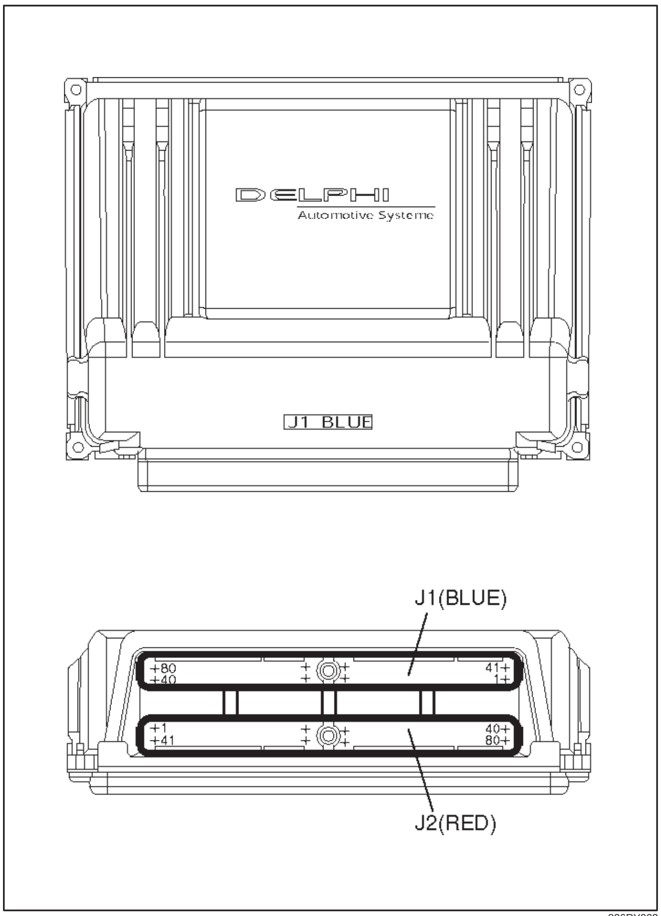

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Class 2 Serial Data Bus

OBD II technology requires a much more sophisticated PCM than does OBD I technology. The OBD II PCM diagnostic management system not only monitors systems and components that can impact emissions, but they also run active tests on these systems and components. The decision making functions of OBD II PCMs have also greatly increased. To accommodate this expansion in diagnostic complexity, Isuzu engineers have designed the Class 2 serial data bus, which meets SAE J1850 recommended practice for serial data.

“Serial Data” refers to information which is transferred in a linear fashion – over a single line, one bit at a time. A “Data Bus” is an electronic pathway through which serial data travels.

TROOPER previously used a 5 volt data bus called UART, which is an acronym for “Universal Asynchronous Receive and Transmit”. When neither the vehicle’s control module nor the diagnostic tool, such as a Tech 2, are “talking,” the voltage level of the bus at rest is 5 volts. The two computers talk to each other at a rate of 8,192 bits per second, by toggling or switching the voltage on the data bus from 5 volts to ground.

Class 2 data, which is used on OBD II vehicles, is quite different. Data is transferred at a rate of 10.4 kilobits per second, and the voltage is toggled between zero and 7 volts.

C07RT006

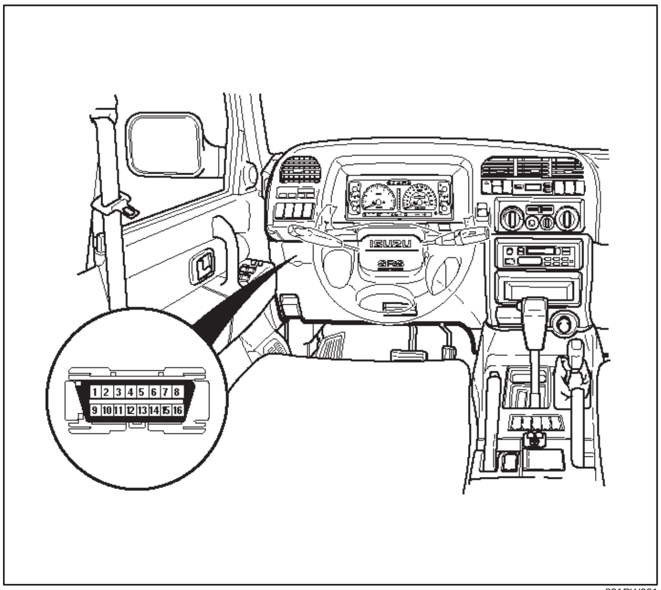
Class 2 data is also pulse width modulated. Each bit of information can have one of two lengths: long or short. On the other hand, UART data bits come in only one length (short). The pulse width modulation of Class 2 data allows better utilization of the data line.

The message carried on Class 2 data streams are also prioritized. This means that if two devices try to communication on the data line at the same time, only the higher priority message will continue. The device with the lower priority message must wait.

NOTE: The Class 2 data wire is always terminal 2 of the new 16–terminal Data Link Connector (DLC).

16 – Terminal Data Link Connector (DLC)

OBD II standardizes Data Link Connector (DLC) configurations. The DLC, formerly referred to as the ALDL, will be a 16–terminal connector found on the lower left side of the driver’s side instrument panel. All manufacturers must conform to this 16–terminal standard.



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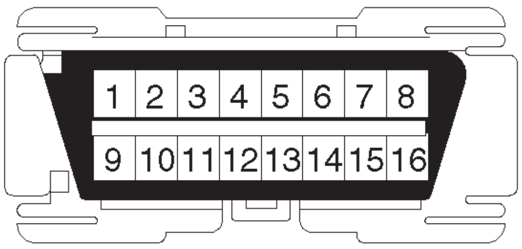


810RT022

PIN 1 –	DIAG. SW
PIN 2 –	J1850 Bus + L line on 2–wire systems, or single wire (Class 2)
PIN 3 –	(Not used)
PIN 4 –	Chassis ground pin
PIN 5 –	Signal ground pin
PIN 6 –	(Not used)
PIN 7 –	ABS diagnostic enable
PIN 8 –	TOD diagnostic enable
PIN 9 –	Primary UART
PIN 10 –	(Not used)
PIN 11 –	(Not used)
PIN 12 –	ABS diagnostic or CCM diagnostic enable
PIN 13 –	SIR diagnostic enable
PIN 14 –	(Not used)
PIN 15 –	(Not used)
PIN 16 –	Battery power from vehicle unswitched (4 AMP MAX.)

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) looks the same as the MIL you are already familiar with (“CHECK ENGINE” lamp). However, OBD II requires that it illuminate under a strict set of guidelines. Basically, the MIL is turned on when the PCM detects a DTC that will impact the vehicle’s emissions.

The MIL is under the control of the Diagnostic Executive. The MIL will be turned on if a component or system which has an impact on vehicle emissions indicates a malfunction or fails to pass an emissions–related diagnostic test. It will stay on until the system or component passes the same test, for three consecutive trips, with no emissions–related faults.

Types Of Diagnostic Trouble Codes (DTCs)

The Diagnostic Executive classifies Diagnostic Trouble Codes (DTCs) into certain categories. Each type has different requirements to set the code, and the Diagnostic Executive will only illuminate the Malfunction Indicator Lamp (MIL) for emissions related DTCs. DTCs fall into four categories: A, B, C, and D; only types A and B are emission related The following descriptions define these categories:

TYPE A

Will store the DTC and turn on the MIL (“Check Engine” lamp) on the first trip in which an emission related diagnostic test has run and reported a “test failed” to the Diagnostic Executive.

TYPE B

Will store the DTC and turn on the MIL on the second consecutive trip in which an emission related diagnostic test has run and reported a “test failed” to the Diagnostic Executive. After one failure, the type B DTC is “armed,” or prepared to store a history code and turn on the MIL if a second failure occurs. One passed test will disarm a type B DTC. Some special conditions apply to misfire and fuel trim DTCs. For a type B DTC to store and turn on the MIL, two ignition cycles are required.

TYPE C

Will store the DTC and turn on a “SERVICE” lamp (“Check Trans” lamp) on the first trip that a non emission related diagnostic test has run and reported a “test failed” to the Diagnostic Executive. This type of DTC will be used in future applications.

TYPE D

Will store a DTC but will not turn on the MIL on the first trip that a non emission related diagnostic test has run and reported a “test failed” to the Diagnostic Executive. These codes can be very helpful for vehicle service when the driver may comment about a condition, but the MIL did not turn on.

Clear DTC

NOTE: If you clear the DTC (Diagnostic Trouble Codes) you will not be able to read any codes recorded during the last occurrence.

NOTE: To use the DTC again to identify a problem, you will need to reproduce the fault or the problem. This may require a new test drive or just turning the ignition on (this depends on the nature of the fault).

1. IF you have a Tech 2:
   1. Connect the Tech 2 if it is still not connected GOTHROUGH **Tech 2 OBD II CONNECTION.**
   2. Push “F1: Clear DTC Information” in the Application Menu and answer “Yes” to the question “Do you want to clear DTC’s?”
      a. When a malfunction remains as it is the Tech 2 displays “4L30E CODES NOT CLEARED”. This means that the problem is still there or that the recovery was not done. Please **GOTO DTC CHECK.**
      b. When a malfunction has been repaired and the recovery is done. The Tech 2 displays “4L30E CODES CLEARED”.
2. IF you have no Tech 2:
   To clear the DTC, remove Fuse “PCM” (F13, 30A) for at least 10 seconds.

DTC Check

1. Diagnostic Trouble Codes (DTC) have been identified by Tech 2.
2. You have written the list of the DTCs. The order of the malfunctions has no meanings for this PCM. Usually only one or two malfunctions should be set for a given problem.
3. Check directly the DTCs you identified. The DTCs are sorted by number. Refer to Diagnostic Trouble Code (DTC) Identification in this section.

PCM Precaution

The PCM can be damaged by:

1. Electrostatic discharge
2. The short circuit of some terminals to voltage or to ground.

Electrostatic Discharge Damage Description:

1. Electronic components used to control systems are often designed to carry very low voltage, and are very susceptible to damage caused by electrostatic discharge. It is possible for less than 100 volts of static electricity to cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.
2. There are several ways for a person to become statically charged. The most common methods of charging are by friction and induction. An example of charging by friction is a person sliding across a car seat, in which a charge of as much as 25,000 volts can build up. Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges for the same polarity are drained off, leaving the person highly charged with the opposite polarity. Static charges of either type can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTICE: **To prevent possible electrostatic discharge damage:**

1. Do not touch the PCM connector pins or soldered components on the PCM circuit board.
2. Be sure to follow the guidelines listed below if servicing any of these electronic components:
3. Do not open the replacement part package until it is time to install the part.
4. Avoid touching electrical terminals of the part.
5. Before removing the part from its package, ground the package to a known good ground on the vehicle.
6. Always touch a known good ground before handling the part. This step should be repeated before installing the part if the part has been handled while sliding across the seat, while sitting down from a standing position or while walking some distance.

Information On PCM

1. The Powertrain Control Module (PCM) is located in the center console and is the control center of the electronic transmission control system.
2. The PCM must be maintained at a temperature below 85° (185°F) at all times. This is most essential if the vehicle is put through a paint baking process. The PCM will become inoperative if its temperature exceeds 85°C (185°F). Therefore, it is recommended that the PCM be removed or that temporary insulation be placed around the PCM during the time the vehicle is in a paint oven or other high temperature process.
3. The PCM is designed to process the various inputs and then respond by sending the appropriate electrical signals to control transmission upshift, downshift, shift feel and torque converter clutch engagement.
4. The PCM constantly interprets information from the various sensors, and controls the systems that affect transmission and vehicle performance. By analyzing operational problems, the PCM is able to perform a diagnostic function by displaying DTC(s) and aid the technician in making repairs.

Intermittent Conditions

If the Tech 2 displays a diagnostic trouble code as intermittent, or if after a test drive a DTC does not reappear though the detection conditions for this DTC are present, the problem is most likely a faulty electrical connection or loose wiring. Terminals and grounds should always be the prime suspect. Intermittents rarely occur inside sophisticated electronic components such as the PCM.

Use the DTC information to understand which wires and sensors are involved.

When an intermittent problem is encountered, check suspect circuits for:

1. Poor terminal to wire connection.
2. Terminals not fully seated in the connector body (backed out).
3. Improperly formed or damaged terminals.
4. Loose, dirty, or corroded ground connections:
   HINT: Any time you have an intermittent in more than one circuit, check whether the circuits share a common ground connection.
5. Pinched or damaged wires.
6. Electro–Magnetic Interference (EMI):
   HINT: Check that all wires are properly routed away from coil, and generator. Also check for improperly installed electrical options, such as lights, 2–way radios, etc.

Use the F2 SNAPSHOT mode of the Tech 2 to help isolate the cause of an intermittent fault. The snapshot mode will record information before and after the problem occurs. Set the snapshot to “trigger” on the suspect DTC. If you notice the reported symptom during the test drive, trigger the snapshot manually.

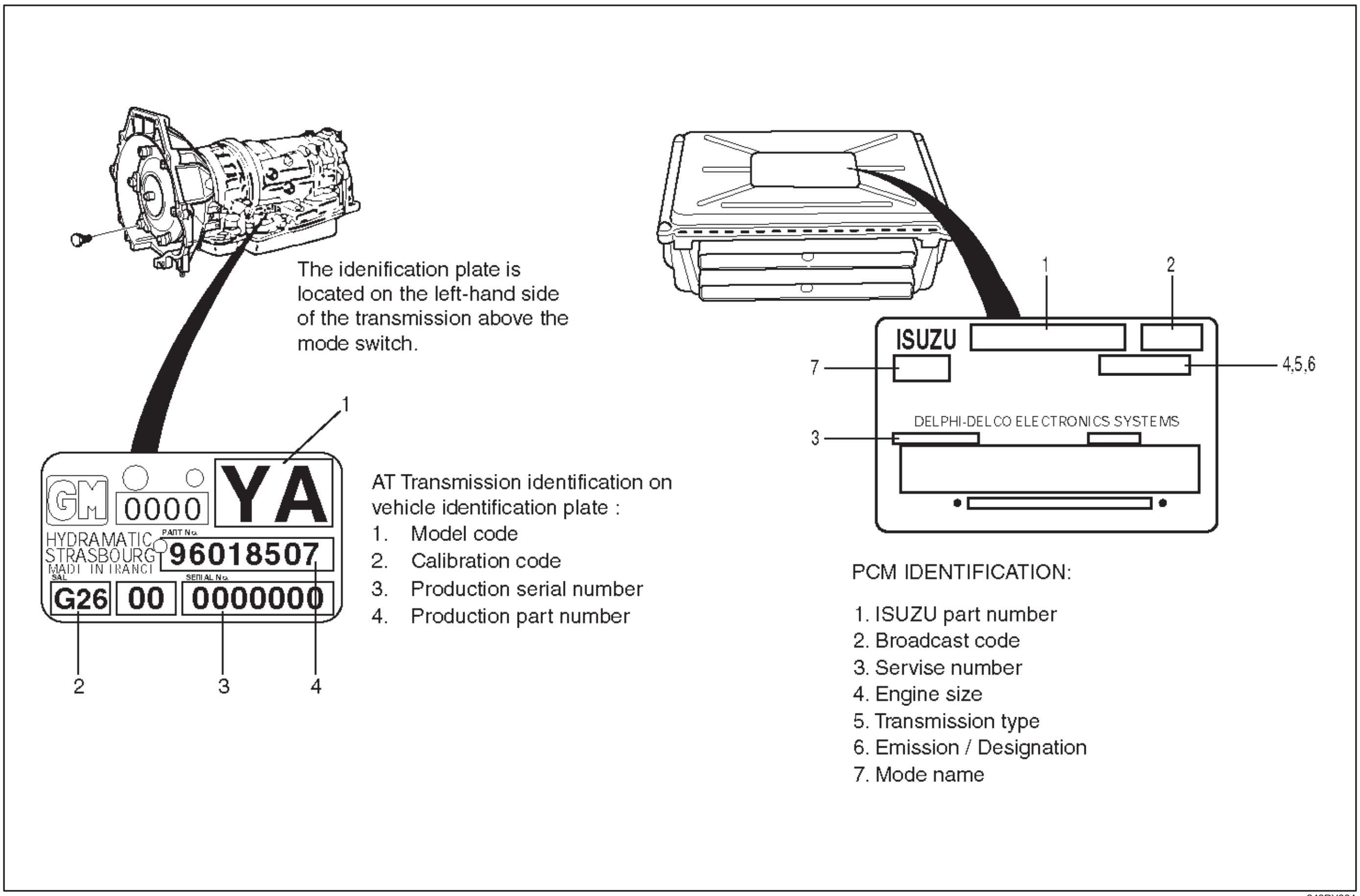
After the snapshot has been triggered, command the Tech 2 to play back the flow of data recorded from each of the various sensors. Signs of an intermittent fault in a sensor circuit are sudden unexplainable jump in data values out of the normal range.

Transmission And PCM Identification

The chart below contains a list of all important information concerning rear axle ratio, Powertrain Control Module (PCM), and transmission identification.

VEHICLE		Rr axle Ratio	PCM	TRANSMISSION		
Type	Engine		ISUZU Parts No.	Calibration Code	Isuzu Part No.	Model Code
Isuzu / Trooper	3.5L V6	4.300	8–09385–189–0 8–09385–199–0	G26	8–96018–507–0	YA

Isuzu Trooper



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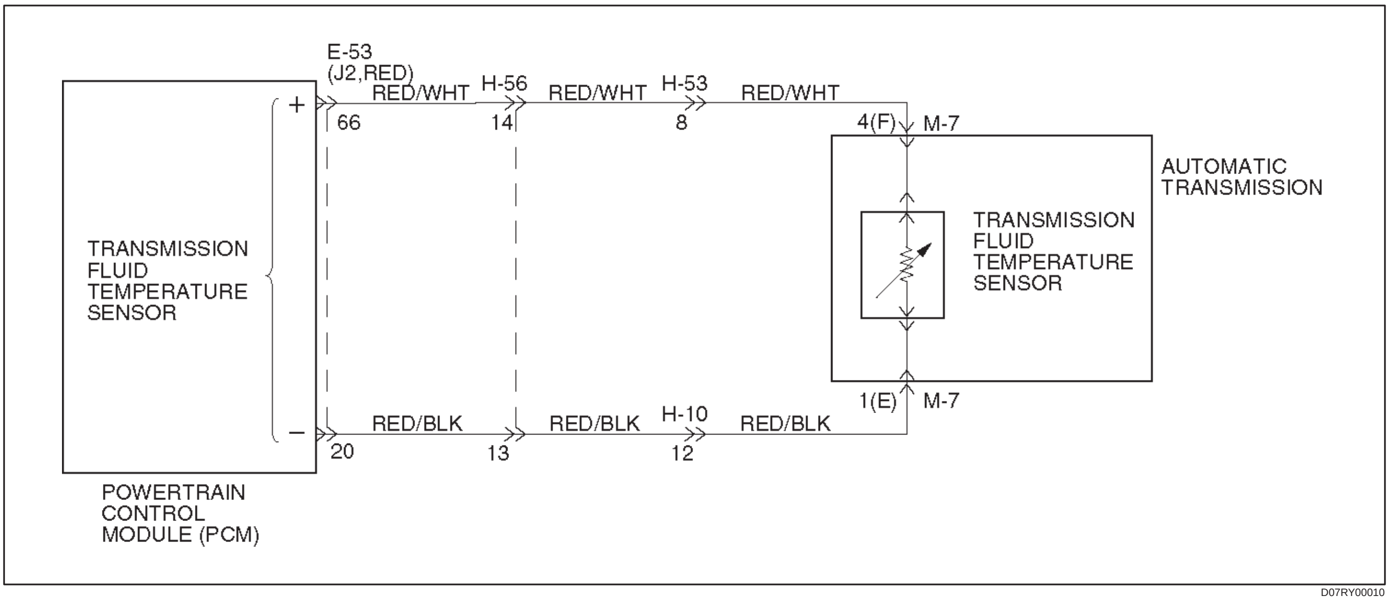
Diagnostic Trouble Code (DTC) Identification

DTC NUMBER	DTC NAME	DTC TYPE	MIL "CHECK ENGINE"	"CHECK TRANS"
P0218	Transmission Fluid Over Temperature	D		
P0705	Transmission Range Switch (Mode Switch) Illegal Position	D		
P0706	Transmission Range Switch (Mode Switch) Performance	D		
P0711	Transmission Fluid Temperature (TFT) Sensor Performance	D		
P0712	Transmission Fluid Temperature (TFT) Sensor Circuit Low Input	D		
P0713	Transmission Fluid Temperature (TFT) Sensor Circuit High Input	D		
P0719	Brake Switch Circuit Low (Stuck ON)	D		
P0722	Automatic Transmission Output Speed Sensor (OSS) Low Input	B	ON	Flash
P0723	Automatic Transmission Output Speed Sensor (OSS) Intermittent	B	ON	Flash
P0724	Brake Switch Circuit High (Stuck OFF)	D		
P0730	Gear Error Without Input Speed	C		Flash
P0742	Torque Converter Clutch (TCC) System Stuck ON	B	ON	Flash
P0748	Pressure Control Solenoid (PCS) (Force Motor) Circuit Electrical	C		Flash
P0751	Shift Solenoid A Performance (Stuck OFF)	B	ON	Flash
P0752	Shift Solenoid A Performance (Stuck ON)	B	ON	Flash
P0753	Shift Solenoid A Electrical	B	ON	Flash
P0756	Shift Solenoid B Performance (Stuck OFF)	B	ON	Flash
P0757	Shift Solenoid B Performance (Stuck ON)	B	ON	Flash
P0758	Shift Solenoid B Electrical	B	ON	Flash
P1850	Brake Band Apply Solenoid Malfunction	D		
P1860	TCC Solenoid Electrical	B	ON	Flash
P1870	Transmission Component Slipping (TCC Stuck OFF)	B	ON	Flash

DTC TYPE	DEFINITION
B	Emission related, turn on MIL (Check Engine) and flashing Check Trans after 2 consecutive trips (Removal to confirmed)
C	Non–emission related, flashing Check Trans on 1st failure
D	Non–emission related, no lamps

NOTE: On the following charts, refer to the Powertrain Control Module (PCM) section for the Wiring System, and the Body and Accessories section for circuit diagram details, parts location, and connector configuration.

DTC P0218 Transmission Fluid Over Temperature



Circuit Description

The Transmission Fluid Temperature (TFT) sensor is a thermister that controls the signal voltage to the PCM. The PCM supplies a 5–volt reference to the sensor on circuit RED/WHT. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage. As the fluid temperature warms to a normal transmission operating temperature of 100˚C (212˚F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2.0 volts.
This DTC detects a high transmission temperature for a long period of time. This is a type “D” DTC.

Conditions For Setting The DTC

- No TFT DTCs P0712 or P0713.
- TFT is greater than 135˚C (275˚F).
- All conditions met for 21 seconds.

Action Taken When The DTC Sets

- Hot mode TCC Shift Pattern.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- ATF Lamp ON. (TFT is greater than 145˚C (293˚F).)
- Disable E–side TCC OFF request.

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warm–up cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and at the transmission 16–way connectors. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.

  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check harness routing for a potential short to ground in circuit RED/WHT.
- Scan tool TFT sensor temperature should rise steadily to about 100˚C (212˚F), then stabilize.
- Check for a “skewed” (mis–scaled) sensor by comparing the TFT sensor temperature to the ambient temperature after a vehicle cold soak. A “skewed” sensor can cause delayed garage shifts or TCC complaints.
- Check for a possible torque converter stator problem.
- Verify customer driving habits, trailer towing, etc.

Test Description

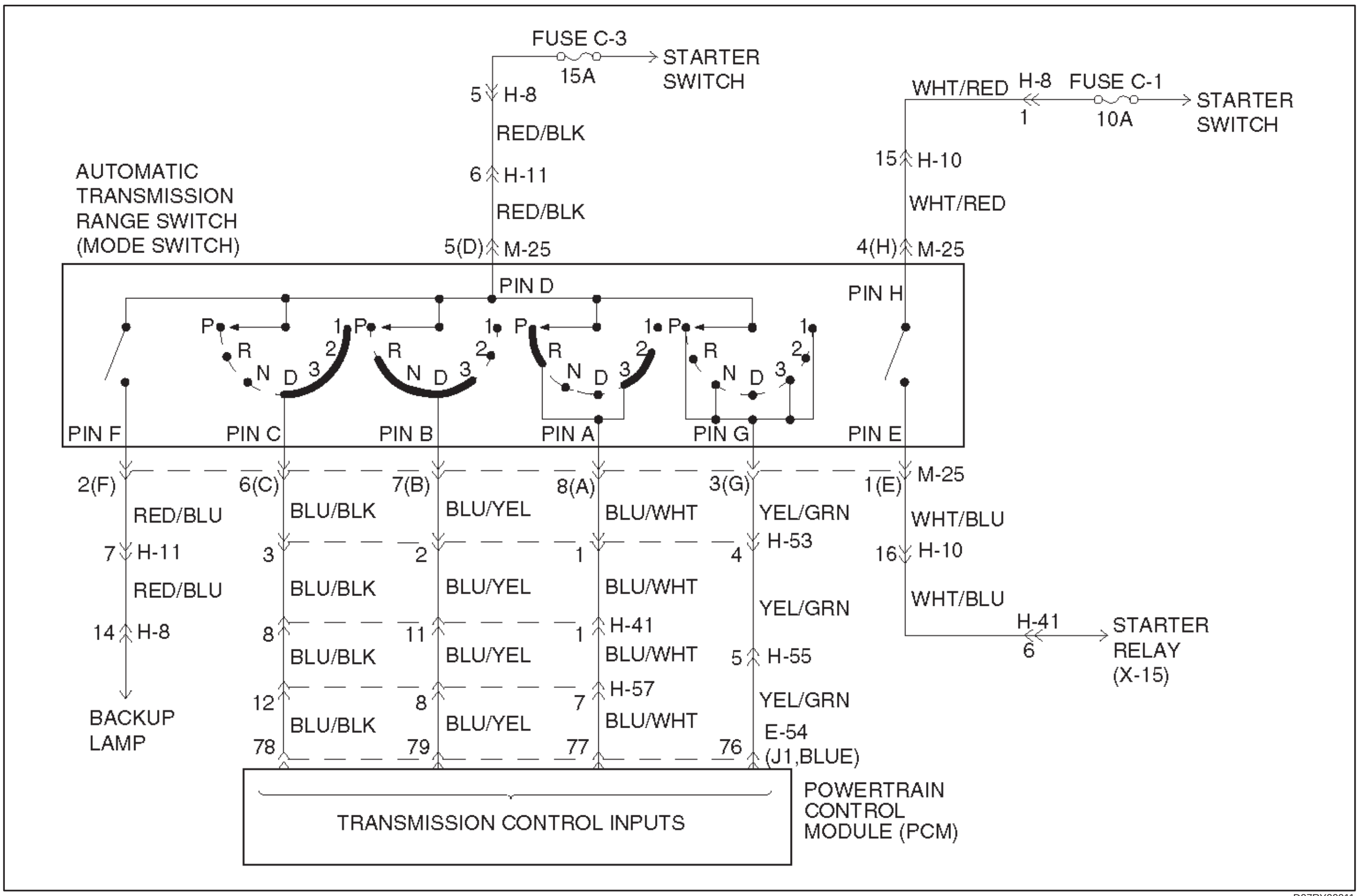
The numbers below refer to the step numbers on the diagnostic chart.

3. This test checks for a “skewed” sensor or shorted circuit.
4. This test simulates a TFT DTC P0713.

DTC P0218 Transmission Fluid Over Temperature

Step	Action	Yes	No
1	Were you sent here from the "Powertrain On–Board Diagnostic (OBD) System Check"?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	Perform the following checks: ● Check for possible engine system problems. ● Transmission fluid checking procedure. Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) Section. Were the checks performed?	Go to Step 3	—
3	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when "Clear Info" function is used. 3. Record the DTC "Failure Records". Is the TFT sensor signal voltage less than 0.33 volts?	Go to Step 4	Go to Diagnostic Aids
4	1. Turn the ignition "off". 2. Disconnect the transmission 16–way connector H–56 (additional DTCs may set). Is the TFT sensor signal voltage greater than 4.92 volts?	Go to Internal Wiring Harness Check.	Go to Step 5
5	Inspect/repair circuit RED/WHT for a short to ground. Was a problem found?	Go to Step 7	Go to Step 6
6	1. Inspect the PCM for poor connections. 2. Replace the PCM if no poor connections were found. Is the replacement complete?	Go to Step 7	—
7	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: TFT is less than 125°C (257°F) for at least 10 seconds. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0705 Transmission Range Switch (Mode Switch) Illegal Position



D07RY00011

Circuit Description

- The range switch supplies the Powertrain Control Module (PCM) with information regarding the selector lever position: P, R, N, D 3, 2 or L. The selector lever position is indicated by the state of four ON/OFF contacts. The range switch is located on one side of the transmission. It is on the transmission manual shaft and is fixed to the main case.
- The range switch is also used to provide the information P or N to the engine crank wiring. The engine can be cranked only if connector M–25 terminal 4(H) is connected to terminal 1(E) which is connected to ground.
- The range switch is also used to provide the backup lamp power in reverse. This is why the range switch is supplied through a 15A fuse (C–3). This fuse can burn due to a short circuit in the backup lamp.

This DTC detects when a fuse is open or the range switch circuit does not work. This is a type “D” DTC.

Conditions For Setting The DTC

- Range switch illegal positions met for 5 seconds.

Action Taken When The DTC Sets

- Default to D position.
- Inhibit torque management.
- Maximum line pressure.
- Turn force motor OFF.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Refer to accompanying chart for the normal range signals and the illegal combinations.
- Inspect the wiring for poor electrical connections at the PCM and at the transmission 8–way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Refer to the “Range Switch Logic Table” or “Functional Test Procedure” for further information.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks the indicated range signal to the manual valve actually selected.
6. This test checks for continuity between each selected range switch connector terminals.

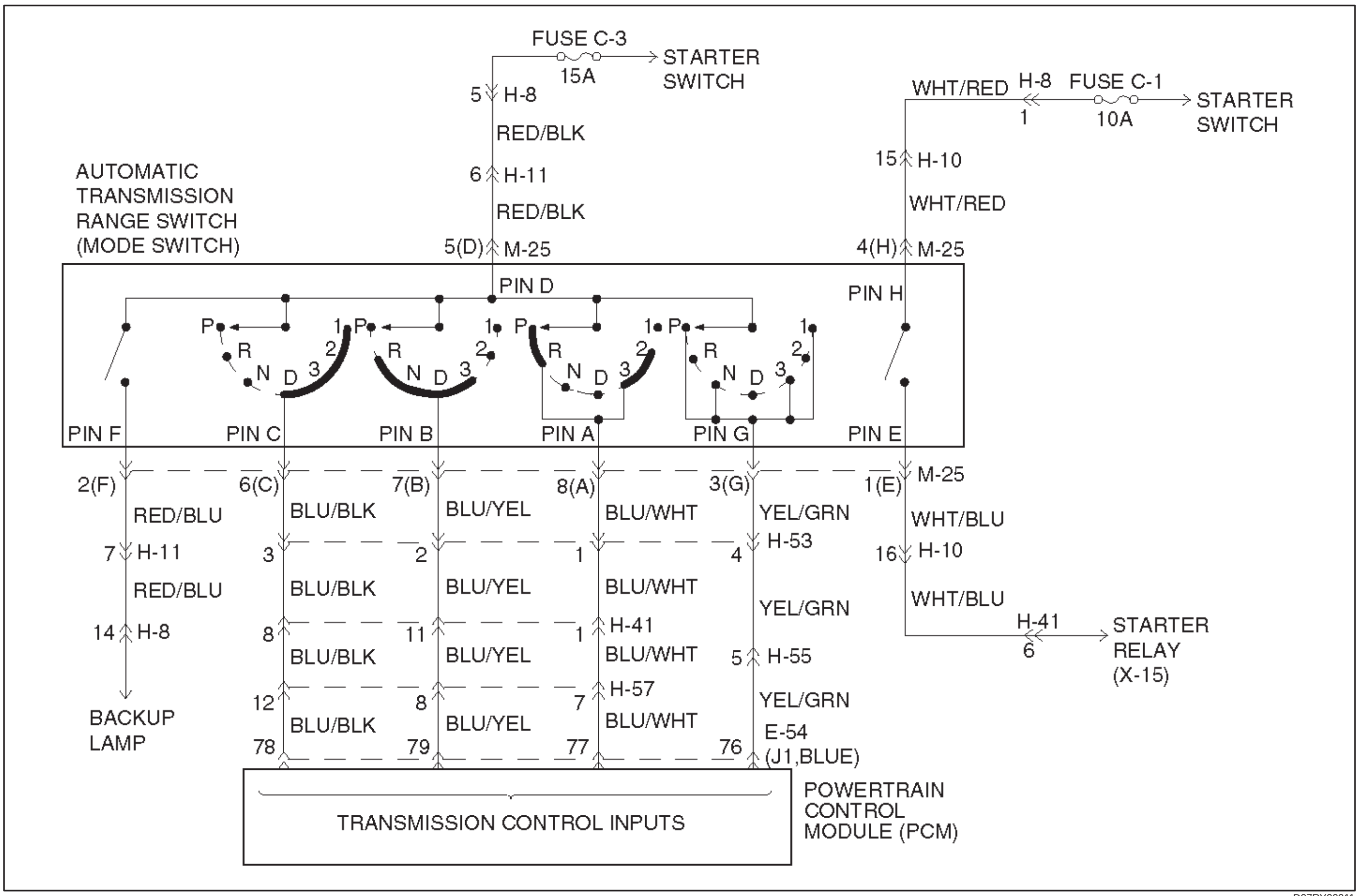
Range Switch Logic Table

Range Position	Range Switch Pin			
	A	B	C	P(G)
Park	ON	OFF	OFF	ON
Reverse	ON	ON	OFF	OFF
Neutral	OFF	ON	OFF	ON
D4	OFF	ON	ON	OFF
D3	ON	ON	ON	ON
2	ON	OFF	ON	OFF
L	OFF	OFF	ON	ON
Illegal	OFF	OFF	OFF	OFF
Illegal	OFF	OFF	OFF	ON

DTC P0705 Transmission Range Switch (Mode Switch) Illegal Position

Step	Action	Yes	No
1	Were you sent here from the "Powertrain On–Board Diagnostic (OBD) System Check"?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	Perform the following checks: ● The transmission linkage from the select lever to the manual valve is adjusted properly. ● Diagnostic circuit check. Were the checks performed?	Go to Step 3	—
3	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Freeze Frame" and "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Freeze Frame" and "Failure Records". 4. Select each transmission range: D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the scan tool "Range Switch" display?	Go to Diagnostic Aids	Go to Step 4
4	Are all range switch pin displays incorrect?	Go to Step 5	Go to Step 6
5	Check fuse and wiring to the 8–way connector terminal 5(D) for opens. Refer to Mode Switch in Automatic Transmission (4L30–E) section. If no problem was found, replace the range switch. Is the replacement complete?	Go to Step 9	—
6	1. Disconnect the 8–way range switch connector. 2. Using ohmmeter, check continuity between terminal 5(D) and respectively terminals 3(G), 6(C), 7(B) and 8(A) of the 8–way range switch connector. 3. Move shift selector lever through all positions and compare results with "Range Switch Logic Table". Is one range switch pin display incorrect?	Go to Step 7	Go to Step 8
7	Check the affected wiring and connector, and repair. Is the repair complete?	Go to Step 9	—
8	Check the Powertrain Control Module (PCM) connectors for poor connection. If no problem was found, replace the PCM. Is the replacement complete?	Go to Step 9	—
9	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and road test the vehicle. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0706 Transmission Range Switch (Mode Switch) Performance



D07RY00011

Circuit Description

- The range switch supplies the Powertrain Control Module (PCM) with information regarding the selector lever position: P, R, N, D, 3, 2 or L. The selector lever position is indicated by the state of four ON/OFF contacts. The range switch is located on one side of the transmission. It is on the transmission manual shaft and is fixed to the main case.
- The range switch is also used to provide the information P or N to the engine crank wiring. The engine can be cranked only if connector M–25 terminal 4(H) is connected to terminal 1(E) which is connected to ground.
- The range switch is also used to provide the backup lamp power in reverse. This is why the mode switch is supplied through a 15A fuse (C–3). This fuse can burn due to a shot circuit in the backup lamp.
- This DTC detects an invalid state of the range switch or the range switch circuit by deciphering the range switch inputs. This is a type “D” DTC.

Conditions For Setting The DTC

This DTC will set if any of the following conditions occurs:

Condition 1 (“R” bad position):

- Engine is running.
- No output speed DTCP0722, P0723.
- Output speed greater than 3,200 RPM.
- Range switch indicates “R”.
- All conditions met for 4 seconds.

Condition 2 (“P” or “N” bad position):

- Engine is running.
- No TPS codes.
- Engine speed is less than 3,000 RPM.
- TP angle is greater than 20%.
- Range switch indicates “P” or “N”.
- All conditions met for 4 seconds.

Action Taken When The DTC Sets

- Default to “D” position.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Refer to the accompanying chart for the normal range signals and the illegal combinations.
- Inspect the wiring for poor electrical connections at the PCM and at the transmission 8–way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Refer to the “Range Switch Logic Table” or “Functional Test Procedure” for further information.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks the indicated range signal to the manual valve actually selected.
6. This test checks for continuity between each selected range switch connector terminals.

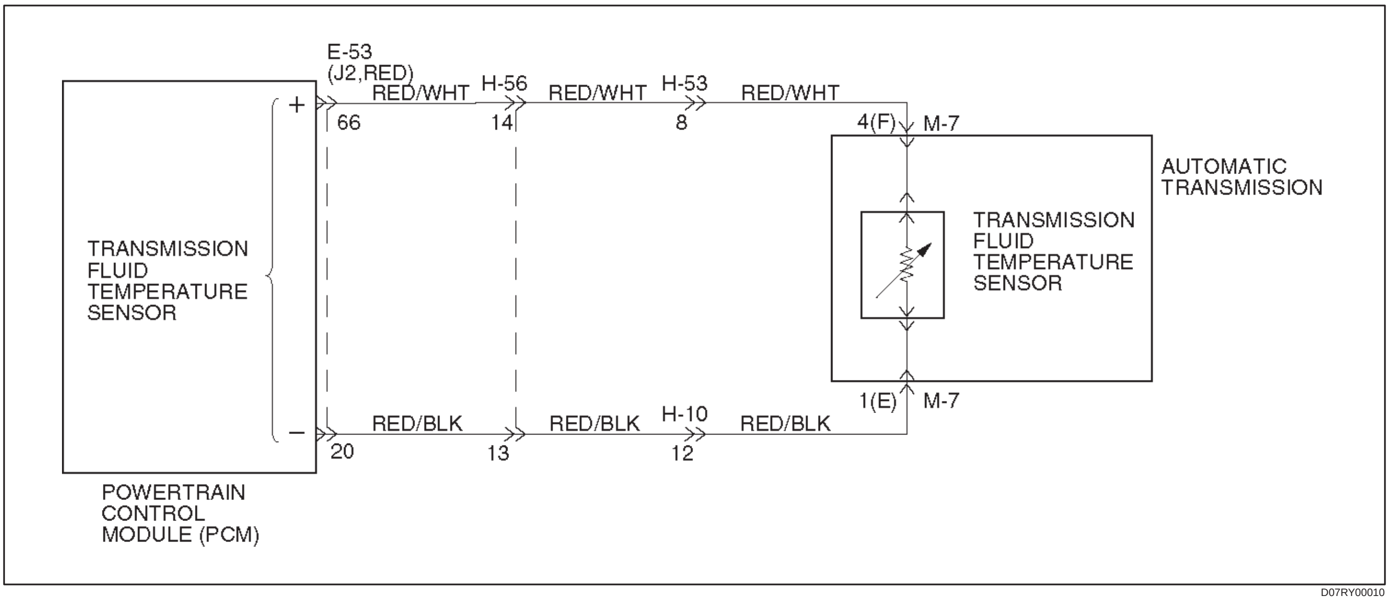
Range Switch Logic Table

Range Position	Range Switch Pin			
	A	B	C	P(G)
Park	ON	OFF	OFF	ON
Reverse	ON	ON	OFF	OFF
Neutral	OFF	ON	OFF	ON
D4	OFF	ON	ON	OFF
D3	ON	ON	ON	ON
2	ON	OFF	ON	OFF
L	OFF	OFF	ON	ON
Illegal	OFF	OFF	OFF	OFF
Illegal	OFF	OFF	OFF	ON

DTC P0706 Transmission Range Switch (Mode Switch) Performance

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	Perform the following checks: ● The transmission linkage from the select lever to the manual valve is adjusted properly. ● Diagnostic circuit check. Were the checks performed?	Go to Step 3	—
3	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. Select each transmission range: D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the scan tool “Range Switch” display?	Go to Diagnostic Aids	Go to Step 4
4	Are all range switch pin displays incorrect?	Go to Step 5	Go to Step 6
5	Check fuse and wiring to the 8–way connector terminal 5(D) for opens. Refer to Mode Switch in Automatic Transmission (4L30–E) section. If no problem was found, replace the range switch. Is the replacement complete?	Go to Step 9	—
6	1. Disconnect the 8–way range switch connector. 2. Using ohmmeter, check continuity between terminal 5(D) and respectively terminals 3(G), 6(C), 7(B) and 8(A) of the 8–way range switch connector. 3. Move shift selector lever through all positions and compare results with “Range Switch Logic Table”. Is one range switch pin display incorrect?	Go to Step 7	Go to Step 8
7	Check the affected wiring and connector, and repair. Is the repair complete?	Go to Step 9	—
8	Check the Powertrain Control Module (PCM) connectors for poor connection. If no problem was found, replace the PCM. Is the replacement complete?	Go to Step 9	—
9	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0711 Transmission Fluid Temperature (TFT) Sensor Performance



Circuit Description

The TFT sensor is a thermister that controls the signal voltage to the PCM. The PCM supplies a 5–volt reference signal to the sensor on circuit RED/WHT. When the transmission fluid is cold, the sensor resistance is high and the PCM detects high signal voltage. As the transmission fluid temperature increases to normal operating temperature of 100°C (212°F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2 volts.
When the PCM detects a TFT sensor that remains at the startup value, or a sensor that has a change delta of greater than 20°C (36°F) less than 1 second, DTC P0711 sets. DTC P0711 is a type D.

Conditions For Setting The DTC

- No VSS DTCs P0722 or P0723.
- No Transmission Component Slipping DTC P1870.
- Engine is running.
- TFT is between 20 A/D (Analog/Digital) counts and 248 A/D counts.
- TFT is between –40°C (–40°F) and +21°C (69.8°F) at engine startup.
- Engine coolant temperature is greater than 70°C (150°F).
- Engine coolant temperature has changed by greater than 50°C (90°F) since engine startup.
- Vehicle speed has been greater than 5 mph for greater than 410 seconds since engine startup (cumulative timer).
- TCC slip speed has been greater than 120 rpm for greater than 410 seconds since engine startup (cumulative timer).
- Battery voltage is between 10 and 16 volts.

All of the above is true and either of the following occurs:

- If the sensor is stuck, the TFT has not changed for greater than 2 counts (from startup temperature) for greater than 410 seconds.
- If the sensor shows an unrealistic change, the TFT exhibits a change delta of greater than 20°C (36°F), greater than 14 times in 7 seconds.

Action Taken When The DTC Sets

- Transmission default temperature will be:

  80°C (176°F) if engine temperature code is set.

  100°C (212°F) if engine temperature is warm.

  80°C (176°F) if engine run time is greater than 5 minutes.

  21°C (69.8°F) if engine run time is less than 5 minutes.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM. Inspect the wiring for poor electrical connections at the transmission 16–way connectors. Look for the following conditions:
  a. A bent terminal
  b. A backed out terminal
  c. A damaged terminal
  d. Poor terminal tension
  e. A chafed wire
  f. A broken wire inside the insulation

- When diagnosing for an intermittent short or open connection, move the wiring harness while watching the test equipment for a change.
- First diagnose and clear any engine DTCs or TP Sensor codes. Then inspect for any transmission DTCs that may have reset.

Test Description

The number below refers to the step number on the diagnostic chart:

3. This test checks PCM and associated wiring up to the 16–way connectors. If the voltage increases to match chart the problem is isolated to the transmission wiring.

Resistance Chart

˚C	˚F	Resistance (kΩ)
–40	–40	672
0	32	65
20	68	25
80	176	2.5
120	248	0.78
150	304	0.37

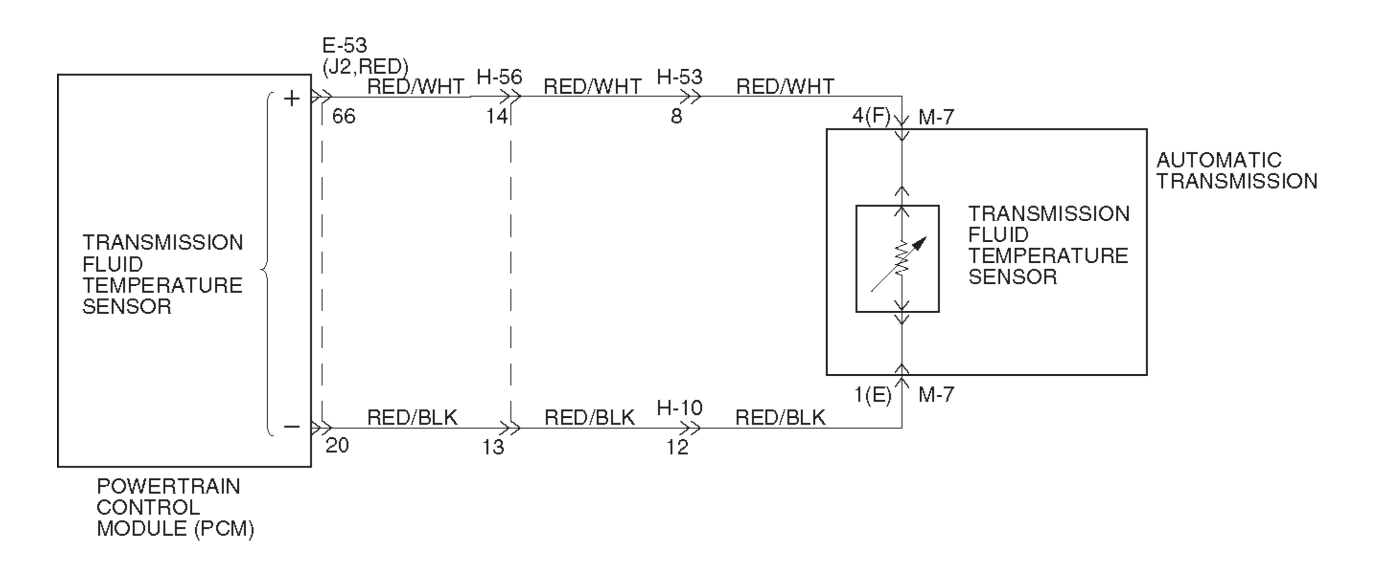
DTC P0711 Transmission Fluid Temperature (TFT) Sensor Performance

Step	Action	Yes	No
1	Was the Powertrain On–Board Diagnostic (OBD) System Check performed?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	Perform the transmission fluid checking procedure. Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section. Did you perform the fluid checking procedure?	Go to Step 3	Go to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section
3	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch to the “on” position. NOTE: Before clearing DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data. 3. Record the DTC Freeze Frame and Failure Records. 4. Select TFT on the scan tool. 5. While observing the scan tool display, move or massage the engine wiring harness from PCM connectors J2–66 and J2–20 to the transmission 16–way connectors. Does the TFT change by more than ±20˚C (36˚F)?	Go to Step 6	Go to Step 4
4	1. Turn the ignition “off”. 2. Disconnect the transmission 16–way connector H–56. 3. Install Jumper Harness on the transmission side of the 16–way connector H–56. 4. Using the J39200 DVOM and J35616 Connector Test Adapter Kit, connect the DVOM leads from terminal M7–4(F) to terminal M7–1(E). 5. Set the DVOM on MIN/MAX to measure resistance. 6. Record the TFT sensor resistance. 7. Move or massage the automatic transmission wiring harness assembly from the 16–way connector H–56 to the TFT sensor connector. Does the DVOM MAX display a resistance greater than the value recorded in Action item 6 of this step?	Go to Step 7	Go to Step 5
5	Does the DVOM MIN display a resistance less than the value recorded in Action item 6 of step 4?	Go to Step 8	—

DTC P0711 Transmission Fluid Temperature (TFT) Sensor Performance (Cont'd)

Step	Action	Yes	No
6	Inspect circuit RED/WHT and RED/BLK of the engine wiring harness for an intermittent open or short condition. Repair the circuits if necessary. Did you find a problem?	Go to Step 12	Go to Step 11
7	Inspect the automatic transmission wiring harness assembly for an intermittent open in circuits RED/WHT and RED/BLK. Did you find a problem?	Go to Step 9	Go to Step 10
8	Inspect the automatic transmission wiring harness assembly for an intermittent shorted condition in circuits RED/WHT and RED/BLK. Did you find a problem?	Go to Step 9	Go to Step 10
9	Replace the automatic transmission wiring harness assembly. Is the replacement complete?	Go to Step 12	—
10	Replace TFT Sensor. Refer to Transmission Oil Temperature Sensor (Main Case) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 12	—
11	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 12	—
12	In order to verify your repair, perform the following procedure. 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle and ensure the following conditions are met: ● The TFT changes by more than 2.25˚C (4.05˚F) for 11 seconds since startup. ● The TFT does not change by more than 20˚C (36˚F) within 0.200 second for a period of at least 11 seconds. 4. Select Specific DTC. 5. Enter DTC P0711. Has the test run and passed?	System OK	Begin the diagnosis again Go to Step 1

DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input



D07RY00010

Circuit Description

The TFT sensor is a thermister that controls the signal voltage to the PCM. The PCM supplies a 5–volt reference signal to the sensor on circuit RED/WHT. When the transmission fluid is cold, the sensor resistance is high. The PCM detects high signal voltage. As the transmission fluid temperature increases to the normal operating temperature of 100°C (212°F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2 volts. With transmission fluid over temperature and DTC P0218 also set, check the transmission cooling system.

This DTC detects a continuous short to ground in the TFT signal circuit or the TFT sensor. This is a type “D” DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- Ignition is “on”.
- TFT sensor indicating a voltage less than 0.4 volts.
- All conditions met for 20 seconds.

Action Taken When The DTC Sets

- Transmission default temperature will be:

  80°C (176°F) if engine temperature code is set.

  100°C (212°F) if engine temperature is warm.

  80°C (176°F) if engine run time is greater than 5 minutes.

  21°C (69.8°F) if engine run time is less than 5 minutes.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Check harness routing for a potential short to ground in circuit RED/BLK. Scan tool TFT display should rise steadily to about 100°C (212°F), then stabilize.
- Inspect the wiring for poor electrical connection at the PCM and at the transmission 16–way connectors. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- The temperature to resistance value scale may be used to test the TFT sensor at the various temperature levels to evaluate the possibility of a “skewed” (mis–scaled) sensor.

  A “skewed” sensor could result in delayed garage shifts or TCC complaints.
- Verify customer driving habits, trailer towing, etc.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for a short to ground or a “skewed” sensor.
4. This test checks for an internal fault within the transmission by creating an open.

Resistance Chart

˚C	˚F	Resistance (kΩ)
–40	–40	672
0	32	65
20	68	25
80	176	2.5
120	248	0.78
150	304	0.37

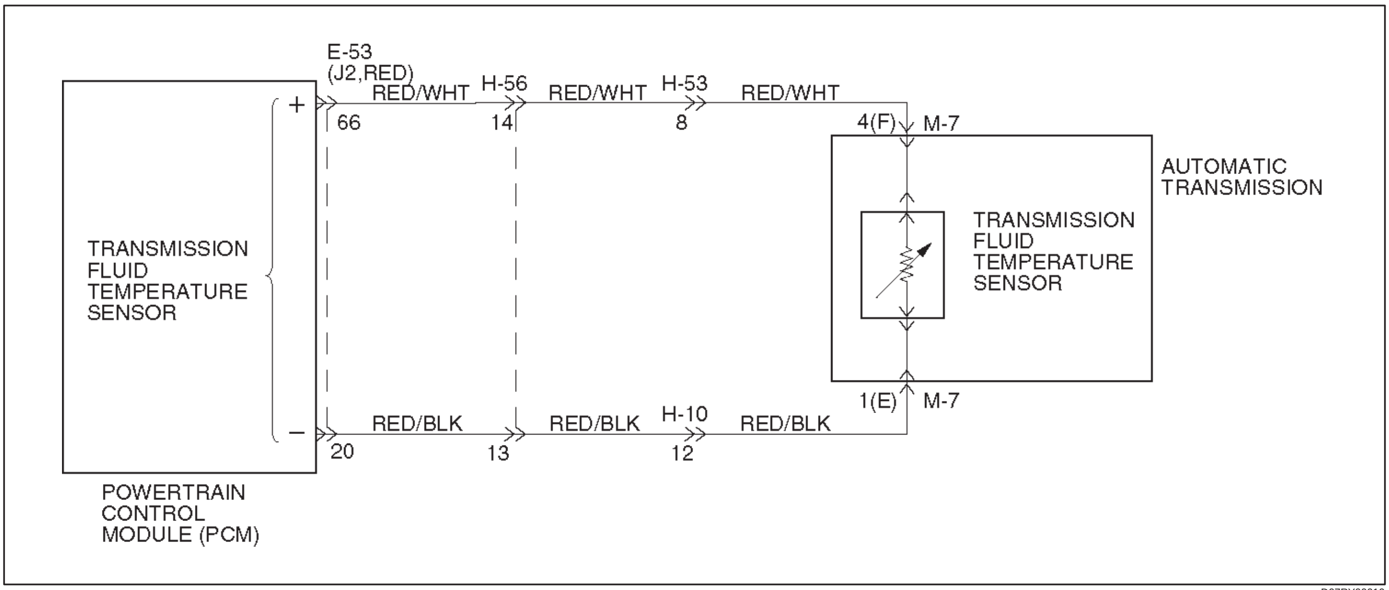
DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input

Step	Action	Yes	No
1	Were you sent here from the "Powertrain On–Board Diagnostic (OBD) System Check"?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	Perform the transmission fluid checking procedure. Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section. Was the fluid checking procedure performed?	Go to Step 3	Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section
3	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Freeze Frame" and "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Freeze Frame" and "Failure Records". Does the scan tool display a TFT sensor signal voltage less than 0.4 volts?	Go to Step 4	Go to Diagnostic Aids
4	1. Turn the ignition "off". 2. Disconnect the transmission 16–way connector H–56. 3. Turn the ignition "on". Does the TFT signal voltage change to match the voltage 4.92 volts?	Go to Step 5	Go to Step 10
5	Using the J39200 DVOM, measure the resistance between terminals M7–4(F) and M7–1(E). Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 6
6	1. Disconnect the transmission 7–way connector M–7. 2. Using the J39200 DVOM, measure the resistance between terminals M7–4(F) and M7–1(E). Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 7
7	1. Remove the transmission oil pan. Refer to Transmission Oil Temperature Sensor (Main Case) in Automatic Transmission (4L30–E) section. 2. Check the internal wiring harness for a short to ground. Was a problem found?	Go to Step 9	Go to Step 8

DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input (Cont'd)

Step	Action	Yes	No
8	1. Disconnect the internal wiring harness at the TFT sensor. 2. Measure the resistance of the TFT sensor. Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 9
9	Replace the TFT Sensor. Is the replacement complete?	Go to Step 13	—
10	Check circuit RED/WHT for a short to ground. Was a problem found?	Go to Step 13	Go to Step 11
11	Check the PCM for faulty connections. Was a problem found?	Go to Step 13	Go to Step 12
12	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 13	—
13	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: TFT sensor indicates a voltage greater than 0.33 volts for 2 seconds. 2. Review the scan tool "DTC info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input



D07RY00010

Circuit Description

The TFT sensor is a thermistor that controls the signal voltage to the PCM. The PCM supplies a 5–volt reference signal to the sensor on circuit RED/WHT. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage. As the transmission fluid temperature warms to the normal operating temperature of 100˚C (212˚F), the sensor resistance becomes less and the voltage decreases to about 1.5 to 2 volts.

This DTC detects a continuous open or short to power in the TFT signal circuit or the TFT sensor. This is a type "D" DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- Ignition is "on".
- TFT sensor indicating a voltage greater than 4.86 volts.
- All conditions met for 20 seconds.

Action Taken When The DTC Sets

- Transmission default temperature will be:

  80˚C (176˚F) if engine temperature code is set.

  100˚C (212˚F) if engine temperature is warm.

  80˚C (176˚F) if engine run time is greater than 5 minutes.

  21˚C (69.8˚F) if engine run time is less than 5 minutes.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and at the transmission 16–way connectors. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Scan tool displays transmission fluid temperature in degrees. After transmission is operating, the temperature should rise steadily to about 100˚C (212˚F), then stabilize.
- The temperature to resistance value scale may be used to check the TFT sensor at the various temperature levels to evaluate the possibility of a "skewed" (mis–scaled) sensor.

  A "skewed" sensor could result in hard shifts or TCC complaints.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This check verifies problem in the TFT sensor circuit.
4. This test simulates a TFT sensor DTC P0712. If the PCM recognizes the low signal voltage (high temperature), and the scan tool displays 146˚C (295˚F) or greater, the PCM and wiring are OK.

5. This test checks the TFT sensor and internal wiring harness.

Resistance Chart

˚C	˚F	Resistance (kΩ)
–40	–40	672
0	32	65
20	68	25
80	176	2.5
120	248	0.78
150	304	0.37

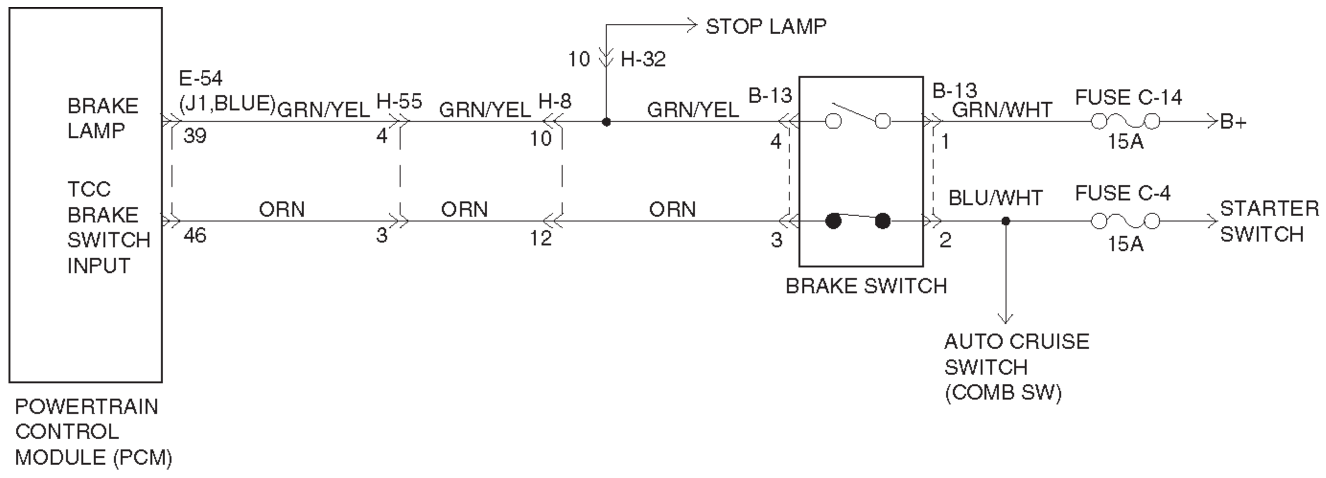
DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	Perform the transmission fluid checking procedure. Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section. Was the fluid checking procedure performed?	Go to Step 3	Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section
3	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Does the scan tool display a TFT sensor signal voltage greater than 4.86 volts?	Go to Step 4	Go to Diagnostic Aids
4	1. Turn the ignition “off”. 2. Disconnect the transmission 16–way connector H–56. 3. Install a fused jumper wire from terminal M7–4(F) and M7–1(E) on the engine harness. 4. Turn the ignition “on”. Does the TFT signal voltage drop to less than 0.4 volts?	Go to Step 5	Go to Step 10
5	1. Turn the ignition “off”. 2. Using the J39200 DVOM, measure the resistance between terminals M7–4(F) and M7–1(E). Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 6
6	1. Disconnect the transmission 7–way connector M–7. 2. Using the J39200 DVOM, measure the resistance between terminals M7–4(F) and M7–1(E). Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 7

DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input (Cont'd)

Step	Action	Yes	No
7	1. Remove the transmission oil pan. 2. Check the internal wiring harness for an open. Refer to Transmission Oil Temperature Sensor (Main Case) in Automatic Transmission (4L30–E) section. Was a problem found and corrected?	Go to Step 14	Go to Step 8
8	1. Disconnect the internal wiring harness at the TFT sensor. 2. Measure the resistance of the TFT sensor. Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 9
9	Replace TFT sensor. Refer to Transmission Oil Temperature Sensor (Main Case) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 14	—
10	Check circuit RED/WHT for an open or short to B+. Was a problem found?	Go to Step 14	Go to Step 11
11	Check circuit RED/BLK for an open. Was a problem found?	Go to Step 14	Go to Step 12
12	Check the PCM for faulty or intermittent connections. Was a problem found?	Go to Step 14	Go to Step 13
13	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 14	—
14	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: 2. TFT sensor indicates a voltage less than 4.92 volts for 2 seconds. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0719 Brake Switch Circuit Low (Stuck On)



D07RY00012

Circuit Description:

The brake switch indicates brake pedal status to the Powertrain Control Module (PCM). The brake switch is a normally–closed switch that supplies battery voltage on circuit ORN to the PCM. Applying the brake pedal opens the switch, interrupting voltage to the PCM. When the brake pedal is released, the PCM receives a constant voltage signal. If the PCM receives a zero voltage signal at the brake switch input, and the Torque Converter Clutch (TCC) is engaged, the PCM de–energizes the Torque Converter Clutch Solenoid Valve (TCC Sol. Valve). The PCM disregards the brake switch input for TCC scheduling if there is a brake switch circuit fault (Refer to Diagnostic Aids).

When the PCM detects an open brake switch circuit (0 volts, low input) during accelerations, then DTC P0719 sets. DTC P0719 is a type D DTC.

Conditions For Setting The DTC

- No OSS Assy. DTCs P0722 or P0723.
- The PCM detects an open brake switch or circuit (0 volts) for 15 minutes without changing for 2 seconds, and the following events occur seven consecutive times:
  - The vehicle speed is less than 8 km/h (5 mph);
  - then the vehicle speed is 8–32 km/h (5–20 mph) for 4 seconds;
  - then the vehicle speed is greater than 32 km/h (20 mph) for 4 seconds.

Action Taken When The DTC Sets

- The PCM does not illuminate the Malfunction Indicator Lamp (MIL).
- DTC P0719 stores in PCM history.

Conditions For Clearing The DTC

- A scan tool can clear the DTC from the PCM history. The PCM clears the DTC from the PCM history if the vehicle completes 40 warm–up cycles without a failure reported.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and brake switch. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check customer driving habits and/or unusual driving conditions (i.e. stop and go, highway).
- Check brake switch for proper mounting and adjustment.

Test Description

The numbers below refer to the step numbers on the diagnostic chart.

3. This step isolates the brake switch as a source for setting the DTC.

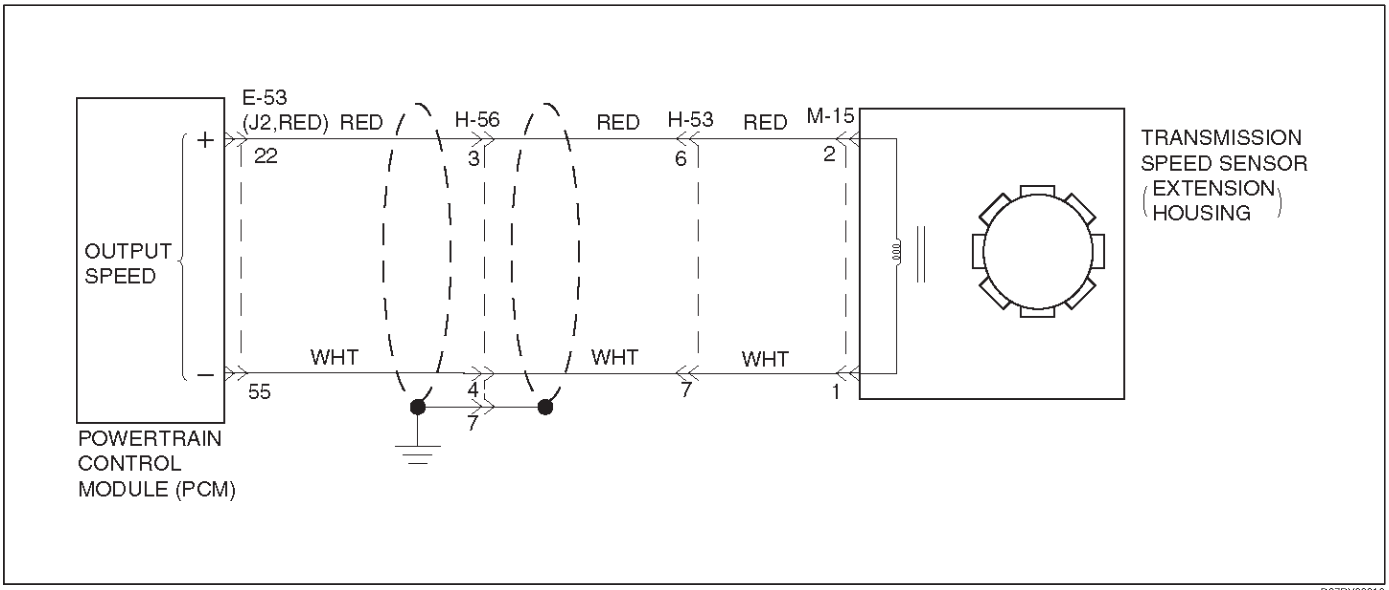
DTC P0719 Brake Switch Circuit Low (Stuck On)

Step	Action	Yes	No
1	Was the Powertrain On–Board Diagnostic (OBD) System Check performed?	Go to Step 2	Go to Powertrain OBD System Check
2	1. Install the scan tool. 2. With the engine “off,” turn the ignition switch to the “on” position. NOTE: Before clearing the DTC(s), use the scan tool in order to record the “Failure Records” for reference. Using the “Clear Info” function will erase the stored “Failure Records” from the PCM. 3. Record the “DTC Failure Records”, then clear the DTC(s). 4. Select “TCC Brake Switch” on the scan tool. 5. Disconnect the brake switch connector from the brake switch. 6. Connect a test lamp from cavity B13–2 of the brake switch connector to a known good ground. Is the test lamp ON?	Go to Step 3	Go to Step 4
3	Install a J 36169–A Fused Jumper Wire from terminal B13–3 to terminal B13–2 of the brake switch connector. Did the TCC Brake Switch status change from Open to Closed?	Go to Step 7	Go to Step 9
4	1. Remove the fuse C–4 (15A). 2. Inspect the fuse for an open. Is the fuse open?	Go to Step 5	Go to Step 8
5	Inspect circuit BLU/WHT for a short to ground condition. Repair the circuit if necessary. Did you find a short to ground condition?	Go to Step 11	Go to Step 6
6	Inspect circuit ORN for a short to ground condition. Repair the circuit if necessary. Did you find a short to ground condition?	Go to Step 11	Go to Step 10
7	Replace the brake switch. Is the replacement complete?	Go to Step 11	—
8	Inspect circuit BLU/WHT for an open condition. Repair the circuit if necessary. Did you find and correct an open condition?	Go to Step 11	—
9	Inspect circuit ORN for an open. Did you find an open condition?	Go to Step 11	Go to Step 10

DTC P0719 Brake Switch Circuit Low (Stuck On) (Cont'd)

Step	Action	Yes	No
10	Replace the PCM. Is the replacement complete?	Go to Step 11	—
11	In order to verify your repair, perform the following procedure: 1. Select DTC. 2. Select Clear Info. 3. With the engine "off," turn the ignition switch to the "on" position. 4. Do not depress the brake pedal. 5. Verify that the TCC Brake Switch status indicates "Closed" (12 volts) for 2 seconds. 6. Select Specific DTC. Enter DTC P0719. Has the test run and passed?	System OK	Begin the diagnosis again. Go to Step 1

DTC P0722 Automatic Transmission Output Speed Sensor (OSS) Low Input



D07RY00016

Circuit Description

Output speed information is provided to the PCM by the OSS, which is a permanent magnet (PM) generator. The PM generator produces a pulsing AC voltage. The AC voltage level and number of pulses increases as the speed of the vehicle increases. The PCM then converts the pulsing voltage to output speed, which is used for calculations. The vehicle speed can be displayed with a scan tool.

This DTC detects a low output speed when there is a high engine speed in a drive gear range. This is a type “B” DTC.

Conditions For Setting The DTC

- No MAP DTCs P0107 or P0108, P0106, P1106, P1107.
- No TPS DTCs P0122 or P0123.
- Not in Park or Neutral.
- TP angle is greater than 10%.
- Engine vacuum is between 0 and 70kPa.
- Engine speed is between 3,000 and 7,000 rpm.
- Transmission output speed is less than 0 rpm.
- All conditions met for 5 seconds.

Action Taken When The DTC Sets

- Fixed to 4th gear.
- Maximum line pressure.
- Inhibit TCC engagement.
- For lamp illuminate refer to DTC type definition (type B).

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool. The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- An OSS DTC P0722 will set when no output speed is at detected at start off.
- Inspect the wiring for poor electrical connection at the PCM. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

4. This test checks the OSS circuit.
5. This test checks the integrity of the OSS.
7. This test checks the 5–volt and ground circuit of the PCM.

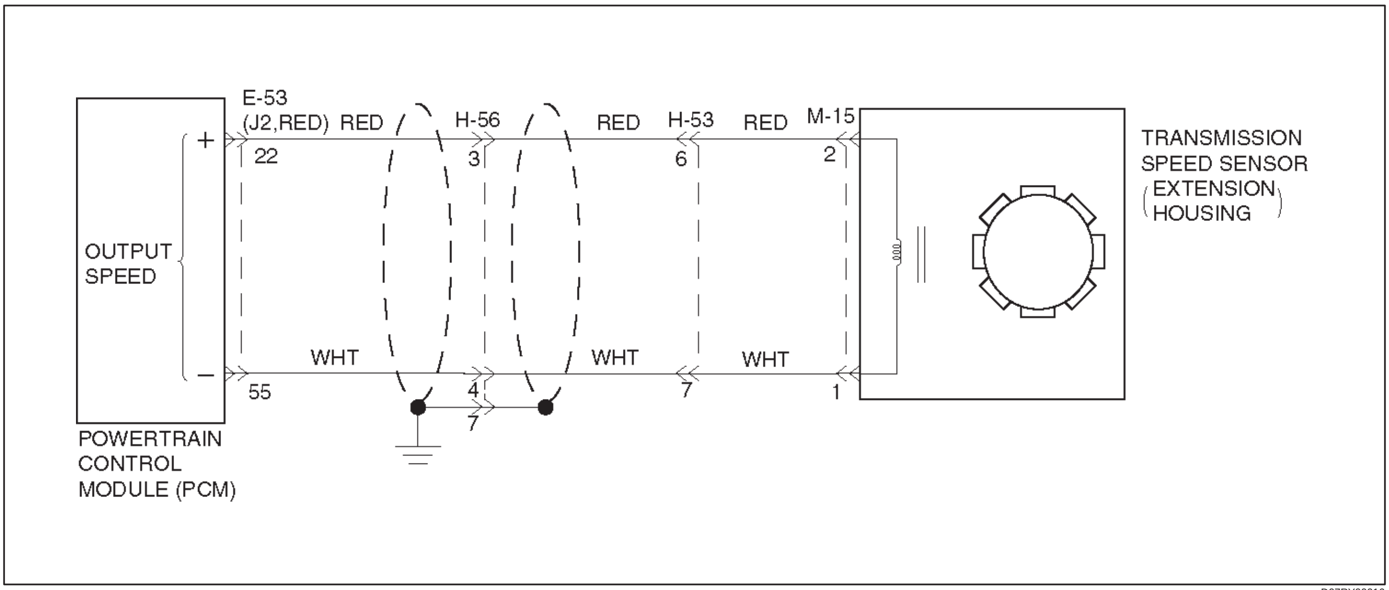
DTC P0722 Automatic Transmission Output Speed Sensor (OSS) Low Input

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. Raise the drive wheels. 5. Start the engine. 6. Place the transmission in any drive range. With the drive wheels rotating, does the “Trans Output Speed” increase with the drive wheel speed?	Go to Diagnostic Aids	Go to Step 3
3	Check for the most current and/or incorrect calibration. Is the calibration current?	Go to Step 16	Go to Step 4
4	1. Turn the ignition “off”. 2. Disconnect the J2 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between harness connector terminals J2–22 and J2–55. Is the reading 3,000 ohms?	Go to Step 5	Go to Step 6
5	1. Select AC volts. 2. Rotate the rear wheels, ensuring the driveshaft is turning. Is the voltage greater than 0.5 volts?	Go to Step 7	Go to Step 8
6	Inspect circuits RED and WHT for a poor connection or an open circuit. Was a problem found?	Go to Step 17	Go to Step 8
7	1. Reconnect the J2 (RED) PCM connector. 2. Disconnect the OSS harness from the OSS. 3. With the engine “off”, turn the ignition “on”. 4. Using the J 39200 DVOM, measure the voltage at the OSS harness connector terminals M15–2 and M15–1. Is the reading between 4.0 to 5.1 volts?	Go to Step 16	Go to Step 10
8	1. Remove the OSS. 2. Check the output shaft speed sensor rotor for damage or misalignment. Refer to Speed Sensor (Extension Housing) in Automatic Transmission (4L30–E) section. Was a problem found?	Go to Step 17	Go to Step 9
9	Replace the OSS. Is the replacement complete?	Go to Step 17	—
10	Was the reading in step 7 less than 4.0 volts?	Go to Step 12	Go to Step 11
11	Was the reading in Step 7 greater than 5.1 volts?	Go to Step 15	—
12	Using the J 39200 DVOM to chassis ground, measure the voltage on circuit RED. Is the reading between 4.0 to 5.1 volts?	Go to Step 13	Go to Step 14

DTC P0722 Automatic Transmission Output Speed Sensor (OSS) Low Input (Cont'd)

Step	Action	Yes	No
13	Repair the open in circuit WHT. Is the repair complete?	Go to Step 17	—
14	Check circuit RED for a short to ground or open. Was a problem found and corrected?	Go to Step 17	Go to Step 16
15	Repair the short to B+ in circuit RED. Is the repair complete?	Go to Step 17	—
16	Replace the PCM. Refer to Powertrain Control Module (PCM) in automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 17	—
17	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: Transmission output speed is greater than 101 rpm for 3 seconds. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0723 Automatic Transmission Output Speed Sensor (OSS) Intermittent



D07RY00016

Circuit Description

Output speed information is provided to the PCM by the OSS, which is a permanent magnet (PM) generator. The PM generator produces a pulsing AC voltage. The AC voltage level and number of pulses increases as the speed of the vehicle increases. The PCM then converts the pulsing voltage to output speed, which is used for calculations. The vehicle speed can be displayed with a scan tool.

This DTC detects a low output speed when there is a high engine speed in a drive gear range. This is a type “B” DTC.

Conditions For Setting The DTC

Drive range

- Engine running time is greater than 5 seconds.
- Output speed is greater than 1300 rpm for 2 seconds.
- NORAW-NORAWLAST < 200 rpm for 2 seconds.

  NORAW Latest raw data of output shaft speed.

  NORAWLAST Filtered pervious data of output speed.
- Transmission negative output speed change is greater than 1300 rpm.
- Conditions met for 3 seconds.

Action During Detection Time

Output speed value is frozen.

Action Taken When The DTC Sets

- Fixed to 4th gear.
- Maximum line pressure.
- Inhibit TCC engagement.
- For lamp illumination refer to DTC type definition (type B).

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive trips without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- A OSS DTC P0723 will set when output speed has been detected and is lost.
- Inspect the wiring for poor electrical connection at the PCM. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

4. This test checks the OSS circuit.
5. This test checks the integrity of the OSS.
7. This test checks the 5–volt and ground circuit of the PCM.

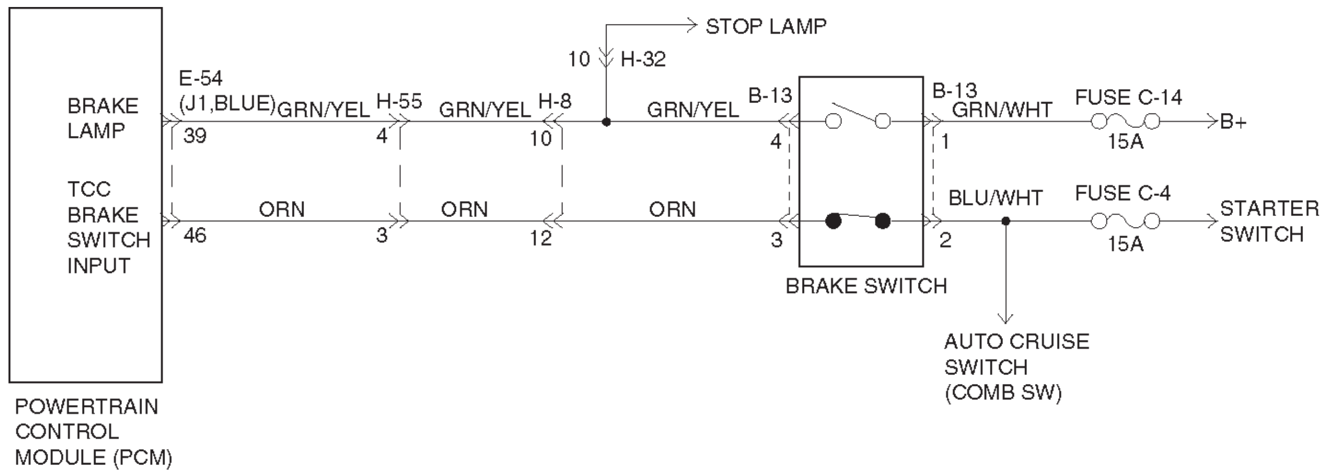
DTC P0723 Automatic Transmission Output Speed Sensor (OSS) Intermittent

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. Raise the drive wheels. 5. Start the engine. 6. Place the transmission in any drive range. With the drive wheels rotating, does the “Trans Output Speed” increase with the drive wheel speed?	Go to Diagnostic Aids	Go to Step 3
3	Check for the most current and/or incorrect calibration. Is the calibration current?	Go to Step 16	Go to Step 4
4	1. Turn the ignition “off”. 2. Disconnect the J2 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between harness connector terminals J2–22 and J2–55. Is the reading 3,000 ohms?	Go to Step 5	Go to Step 6
5	1. Select AC volts. 2. Rotate the rear wheels, ensuring the driveshaft is turning. Is the voltage greater than 0.5 volts?	Go to Step 7	Go to Step 8
6	Inspect circuits RED and WHT for a poor connection or an open circuit. Was a problem found?	Go to Step 17	Go to Step 8
7	1. Reconnect the J2 (RED) PCM connector. 2. Disconnect the OSS harness from the OSS. 3. With the engine “off”, turn the ignition “on”. 4. Using the J 39200 DVOM, measure the voltage at the OSS harness connector terminals M15–2 and M15–1. Is the reading between 4.0 to 5.1 volts?	Go to Step 16	Go to Step 10
8	1. Remove the OSS. 2. Check the output shaft speed sensor rotor for damage or misalignment. Refer to Speed Sensor (Extension Housing) in Automatic Transmission (4L30–E) section. Was a problem found?	Go to Step 17	Go to Step 9
9	Replace the OSS. Is the replacement complete?	Go to Step 17	—
10	Was the reading in step 7 less than 4.0 volts?	Go to Step 12	Go to Step 11
11	Was the reading in Step 7 greater than 5.1 volts?	Go to Step 15	—
12	Using the J 39200 DVOM to chassis ground, measure the voltage on circuit RED. Is the reading between 4.0 to 5.1 volts?	Go to Step 13	Go to Step 14

DTC P0723 Automatic Transmission Output Speed Sensor (OSS) Intermittent (Cont'd)

Step	Action	Yes	No
13	Repair the open in circuit WHT. Is the repair complete?	Go to Step 17	—
14	Check circuit RED for a short to ground or open. Was a problem found and corrected?	Go to Step 17	Go to Step 16
15	Repair the short to B+ in circuit RED. Is the repair complete?	Go to Step 17	—
16	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 17	—
17	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: Transmission output speed is greater than 101 rpm for 3 seconds. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0724 Brake Switch Circuit High (Stuck Off)



D07RY00012

Circuit Description:

The brake switch indicates brake pedal status to the Powertrain Control Module (PCM). The brake switch is a normally–closed switch that supplies battery voltage on circuit ORN to the PCM. Applying the brake pedal opens the switch, interrupting voltage to the PCM. When the brake pedal is released, the PCM receives a constant voltage signal. If the PCM receives a zero voltage signal at the brake switch input, and the Torque Converter Clutch (TCC) is engaged, the PCM de–energizes the Torque Converter Clutch Solenoid Valve (TCC Sol. Valve). The PCM disregards the brake switch input for TCC scheduling if there is a brake switch circuit fault (Refer to Diagnostic Aids).

When the PCM detects a closed brake switch circuit (12 volts, high input) during decelerations, then DTC P0724 sets. DTC P0724 is a type D DTC.

Conditions For Setting The DTC

- No OSS Assy. DTCs P0722 or P0723.
- The PCM detects a closed brake switch circuit (12 volts) without changing and the following events occur seven consecutive times:
  - The vehicle speed is greater than 32 km/h (20 mph) for 4 seconds;
  - then the vehicle speed is between 8–32 km/h (5–20 mph) for 4 seconds;
  - then the vehicle speed is less than 8 km/h (5 mph).

Action Taken When The DTC Sets

- The PCM does not illuminate the Malfunction Indicator Lamp (MIL).
- DTC P0724 stores in PCM history.

Conditions For Clearing The DTC

- A scan tool can clear the DTC from the PCM history. The PCM clears the DTC from the PCM history if the vehicle completes 40 warm–up cycles without a failure reported.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check customer driving habits and/or unusual traffic conditions (i.e. stop and go, expressway).
- Check brake switch for proper mounting and adjustment.

Test Description

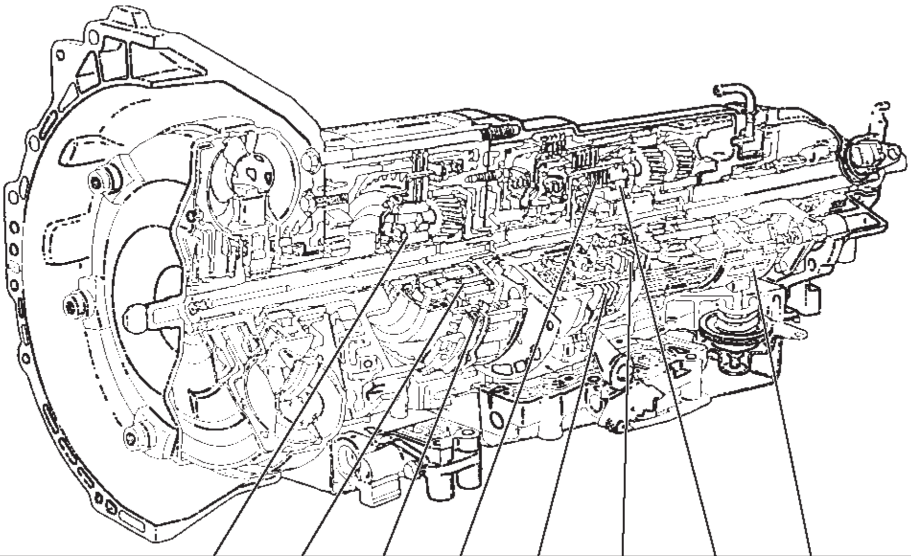
The numbers below refer to the step numbers on the diagnostic chart.

2. This step isolates the brake switch as a source for setting the DTC.

DTC P0724 Brake Switch Circuit High (Stuck Off)

Step	Action	Yes	No
1	Was the Powertrain On–Board Diagnostic (OBD) System Check performed?	Go to Step 2	Go to Powertrain OBD System Check
2	1. Install the scan tool. 2. With the engine “off,” turn the ignition switch to the “on” position. NOTE: Before clearing the DTC(s), use the scan tool in order to record the “Failure Records” for reference. Using the “Clear Info” function will erase the stored “Failure Records” from the PCM. 3. Record the DTC Failure Records, then clear the DTC(s). 4. Select “TCC Brake Switch” on the scan tool. 5. Disconnect the brake switch connector from the brake switch. Did the TCC brake switch status change from “Closed” to “Open”?	Go to Step 3	Go to Step 4
3	Replace the brake switch. Is the replacement complete?	Go to Step 6	—
4	Inspect circuit ORN for a short to B+ condition. Repair the circuit if necessary. Did you find a short to B+ condition?	Go to Step 6	Go to Step 5
5	Replace the PCM. Is the replacement complete?	Go to Step 6	—
6	In order to verify your repair, perform the following procedure: 1. Select DTC. 2. Select “Clear Info”. 3. With the engine “off” turn the ignition switch to the “on” position. 4. Apply the brake pedal. 5. Verify that the TCC brake switch status indicates “Open” (0 volts) for 2 seconds. 6. Select Specific DTC. Enter DTC P0724. Has the test run and passed?	System OK	Begin the diagnosis again. Go to Step 1

DTC P0730 Gear Error Without Input Speed



RANGE	GEAR	SOL A N.C.	SOL B N.O.	O/DRIVE FREE WHEEL (OFW)	O/RUN CLUTCH (OC)	FOURTH CLUTCH (C4)	THIRD CLUTCH (C3)	REVERSE CLUTCH (RC)	SECOND CLUTCH (C2)	PRINCIPLE SPRAG ASM (PFW)	BAND ASM (B)	ENGINE BRAKING	TORQUE CONV. CLUTCH
P-N		OFF	ON		APP							NO	NO
R	REVERSE	OFF	ON	LD	APP			APP		LD		NO	NO
D	1ST	OFF	ON	LD	APP					LD	APP	NO	NO
	2ND	ON	ON	LD	APP				APP	FW	APP	YES	ECCC
	3RD	ON	OFF	LD	APP		APP		APP	NE		YES	ECCC
	4TH	OFF	OFF	FW		APP	APP		APP	NE		YES	ECCC
3	1ST	OFF	ON	LD	APP					LD	APP	NO	NO
	2ND	ON	ON	LD	APP				APP	FW	APP	YES	ECCC
	3RD	ON	OFF	LD	APP		APP		APP	NE		YES	ECCC
2	1ST	OFF	ON	LD	APP		APP			LD	APP	YES	NO
	2ND	ON	ON	LD	APP				APP	FW	APP	YES	ECCC
L	1ST	OFF	ON	LD	APP		APP			LD	APP	YES	NO

LD : LOCKED IN DRIVE FW : FREEWHEELING NE : NOT EFFECTIVE APP : APPLIED

D07RY00055

Circuit Description

- The Powertrain Control Module (PCM) calculates the slippage of the converter and transmission based upon the engine speed, the output speed, and the current gear ratio.
- The slippage of the converter at a high enough engine speed is low. The transmission should not slip more than a given value when there is no shift.
- This DTC detects a slip at each gear. This is a type "C" DTC.

Conditions For Setting The DTC

- No Output Speed Sensor DTC(s) P0722, P0723.
- Not in Park, Neutral, or Reverse.
- Engine speed is greater than 3,500 rpm.
- 3 seconds since upshift.
- No Transmission Range Switch DTC(s) P0705, P0706.
- 3 seconds since downshift.
- 3 seconds since garage shift (N→D).
- And one of the following conditions occur:
  - Slip is greater than 508 rpm in 1st gear.
  - Slip is greater than 468 rpm in 2nd gear.
  - Slip is greater than 449 rpm on 3rd gear.
  - Slip is greater than 440 rpm on 4th gear.
- All conditions met for 5.5 seconds.

Action Taken When The DTC Sets

- Maximum line pressure.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

- The PCM will illuminate the CHECK TRANS Lamp.
- Turn force motor OFF.

Conditions For Clearing The DTC/CHECK TRANS Lamp

- The PCM will turn “off” the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from PCM memory by using a scan tool.
- The DTC can also be cleared from memory when the vehicle has made 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC Actions Taken items when the fault conditions no longer exist and the ignition is cycles “off” long enough to power down the PCM.

Diagnostic Aids

- Check for intermittent output speed sensor circuit problems.
- Check for possible incorrect calibration. (PCM part No., tire specification, and rear axle ratio)

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This step checks for possible low fluid level causing slipping resulting in an undefined gear ratio.
4. This step checks for correct gear ratios for commanded gears.
5. This step checks for low line pressure.

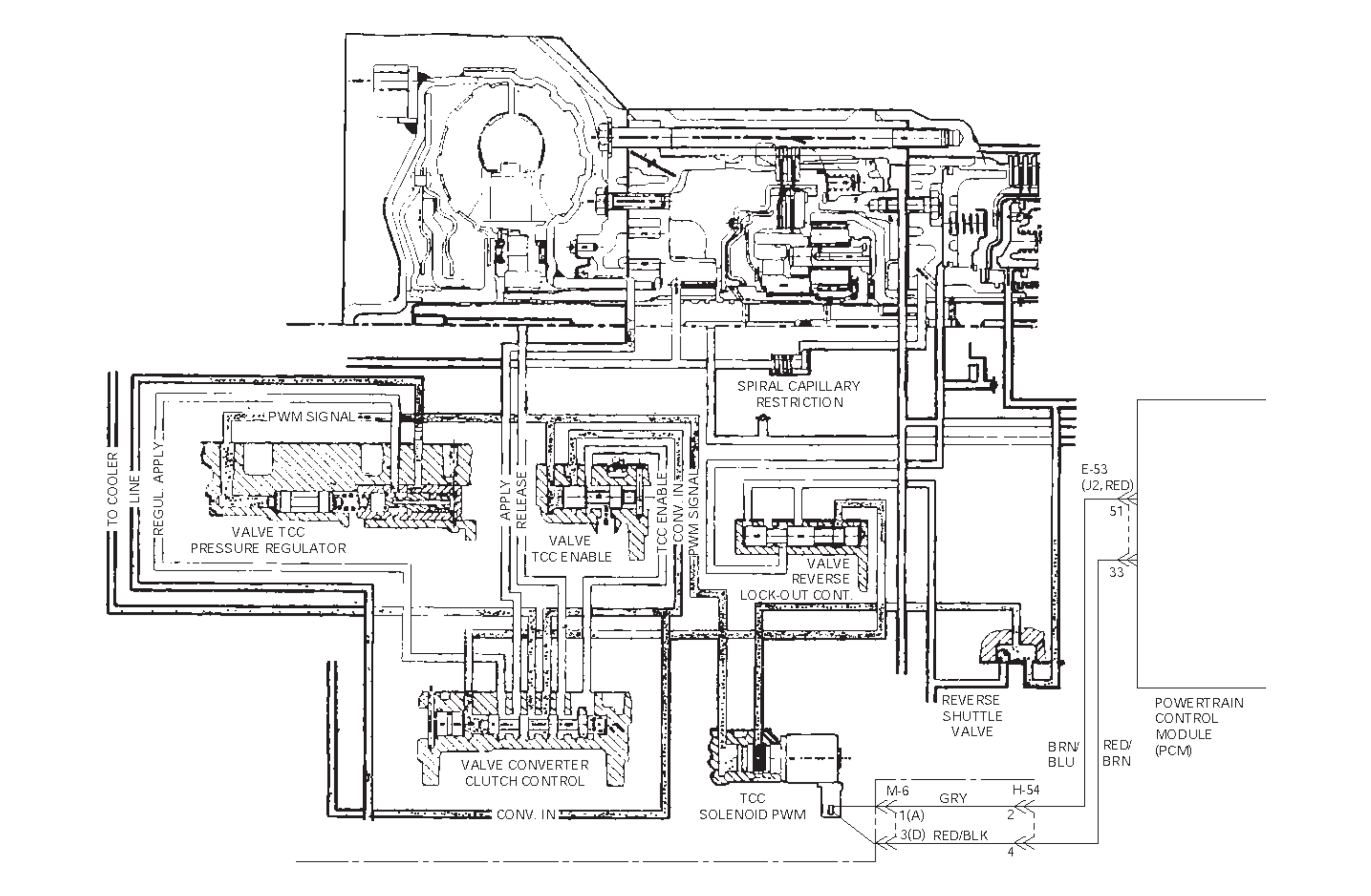
DTC P0730 Gear Error Without Input Speed

Step	Action	Yes	No
1	Were you sent here from the “On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	Visually inspect the transmission cooling system for fluid leaks. ● Refer to Chart 16: Possible Causes of Transmission Fluid Leaks of Mechanical/Hydraulic Diagnosis Symptoms Index in Automatic Transmission (4L30–E) section Was condition found and corrected?	Go to Step 7	Go to Step 3
3	Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section. Has transmission fluid checking procedure been performed?	Go to Step 4	Go to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section
4	1. Install the scan tool. 2. Turn the ignition switch to the “on” position. 3. Engine not running. NOTE: Before clearing DTC(s) use the scan tool to record the “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 4. Record the Failure Record data. 5. Use the scan tool snapshot mode to record transmission gear ratios. 6. Drive vehicle in transmission gear ranges 1, 2, 3, and D with the engine speed is greater than 3,500 rpm for 5.5 seconds. 7. Record each transmission gear. 1st:2.73 – 2.99 2nd:1.54 – 1.71 3rd:0.93 – 1.05 4th:0.66 – 0.78 Does commanded gear ratio match ranges as shown?	Refer to Diagnostic Aids	Go to Step 5

DTC P0730 Gear Error Without Input Speed (Cont'd)

Step	Action	Yes	No
5	Perform line pressure check. ● Refer to Line Pressure Test in Automatic Transmission (4L30–E) section. Was condition found and corrected?	Go to Step 7	Go to Step 6
6	Check for possible clutch slippage. ● Refer to Chart 6: Diagnostic Trouble Code (DTC) P0730 of Mechanical/Hydraulic Diagnosis Symptoms Index in Automatic Transmission (4L30–E) section. Was condition found and corrected?	Go to Step 7	—
7	1. After the repair is complete, use the scan tool to select "DTC", then "Clear info" function. 2. Operate the vehicle under the following conditions: ● Drive the vehicle in D4 with the engine speed greater than 3,500 rpm to obtain anyone of the following gear ratios for seven seconds. 1st 1:2.73 – 1:2.99 2nd 1:1.54 – 1:1.71 3rd 1:0.93 – 1:1.05 4th 1:0.66 – 1:0.78 Has the last test failed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0742 Torque Converter Clutch (TCC) System Stuck On



D07RY002

Circuit Description

The PCM energizes the TCC solenoid by creating an ignition voltage on circuit BRN/BLU. When ignition voltage is energized by the PCM, the TCC solenoid stops converter signal oil from exhausting. This causes converter signal oil pressure to increase and move the TCC valve. The TCC solenoid will deenergize when the PCM no longer provides ignition voltage. When the TCC solenoid is deenergized, it will exhaust fluid and release the TCC.

This DTC detects low torque converter slip when the TCC is commanded “off”. This is a type “B” DTC.

Conditions For Setting The DTC

The following conditions occur once per TCC cycle, three consecutive times:

- No TPS DTCs P0122 or P0123.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTC P1860.
- TP angle is greater than 20%.
- Engine speed is greater than 500 rpm and less than 3,000 rpm.
- Engine vacuum is between 0 and 70 kPa.
- Commanded gear is not 1st.
- Gear range is D4.
- TCC is commanded “off”.
- No TCC Stuck off DTC P1870.
- TCC slip speed is between –20 and 40 rpm for 2 seconds.
- Vehicle speed is greater than 25 km/h (15 mph) and less than 120 km/h (75 mph).
- Speed ratio is greater than 0.9 and less than 2.0.

Action Taken When The DTC Sets

- For lamp illuminate refer to DTC type definition (type B).
- Inhibit TCC engagement.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- If the TCC is mechanically stuck “on” with the parking brake applied and any gear range selected, the TCC fluid will mechanically apply the TCC, possibly causing an engine stall.

Test Description

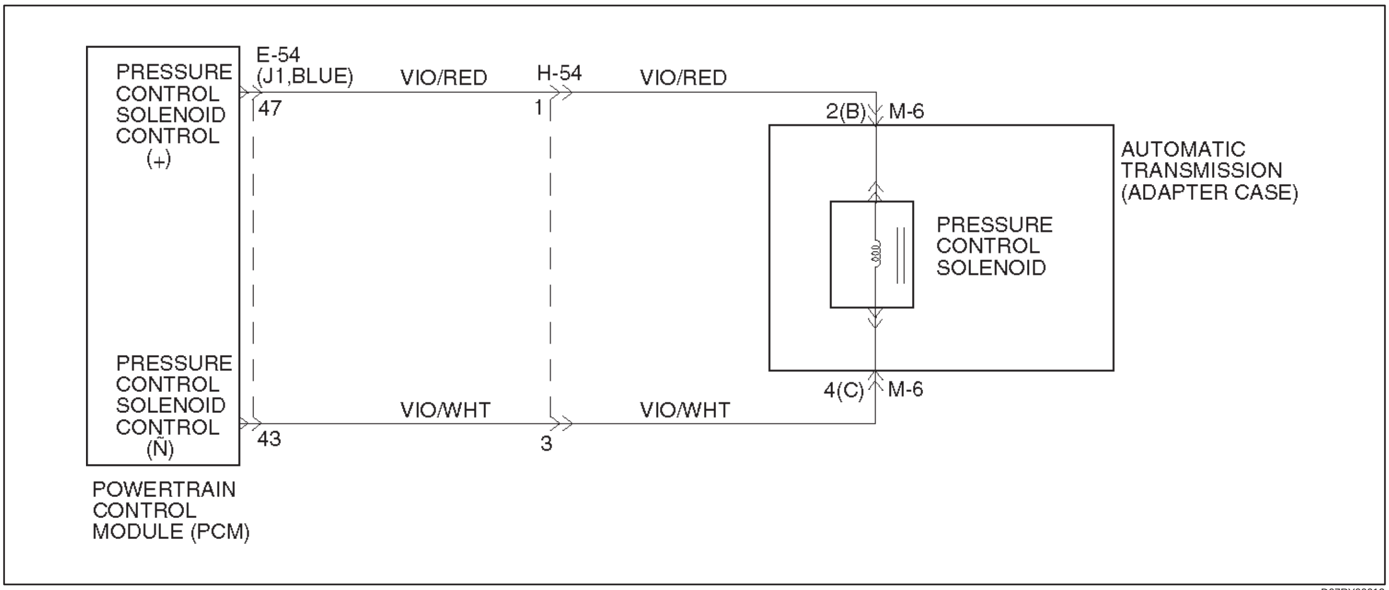
The number below refers to the step number on the diagnostic chart:

3. This test checks the mechanical state of the TCC. (When the PCM commands the TCC solenoid “off”, the slip speed should increase).

DTC P0742 Torque Converter Clutch (TCC) System Stuck On

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. Using the scan tool, verify the “TP Sensor” operation. Are the “TP Sensor” values within 0.6 – 5.0 volts?	Go to Step 3	Go to Diagnostic Aids
3	Drive the vehicle in the D4 drive range in fourth gear under steady acceleration, with a TP angle greater than 20%. Does the scan tool display “TCC Slip Speed” between –30 and +30 rpm, while the displayed TCC solenoid state is “off”?	Go to Step 4	Go to Diagnostic Aids
4	The TCC is mechanically stuck “on”. Check the following items: • Clogged exhaust orifice in the TCC solenoid. • Converter clutch apply valve stuck in the apply position. • Misaligned or damaged valve body gasket. • Restricted release passage. Was a problem found and corrected?	Go to Step 5	—
5	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and ensure the following conditions are met: TCC slip speed must be between 200 and 2,500 rpm for 4 seconds. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0748 Pressure Control Solenoid (PCS) (Force Motor) Circuit Electrical



D07RY00013

Circuit Description

The PCS is a PCM–controlled device used to regulate transmission line pressure. The PCM compares TPS voltage, engine rpm, and other inputs to determine the line pressure appropriate for a given load. The PCM will regulate the pressure by applying a varying amperage to the PCS. The applied amperage can vary from 0.1 to 1 amp, and is monitored by the PCM.

This DTC detects a continuous open or short to ground in the PCS circuit or the PCS. This is a type “C” DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- The PCM detects that the different between commanded and actual current is 200 milliampere (mA) for over 1 second.
- Engine speed is greater than 300 rpm.

Action Taken When the DTC Sets

- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- Maximum line pressure.
- The PCM will illuminate the CHECK TRANS Lamp.
- Turn force motor OFF (Durability).

Conditions For Clearing The DTC/CHECK TRANS Lamp

- The PCM will turn “off” the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from PCM history by using a scan tool.
- The DTC will be cleared from memory when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and at the transmission 4–way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

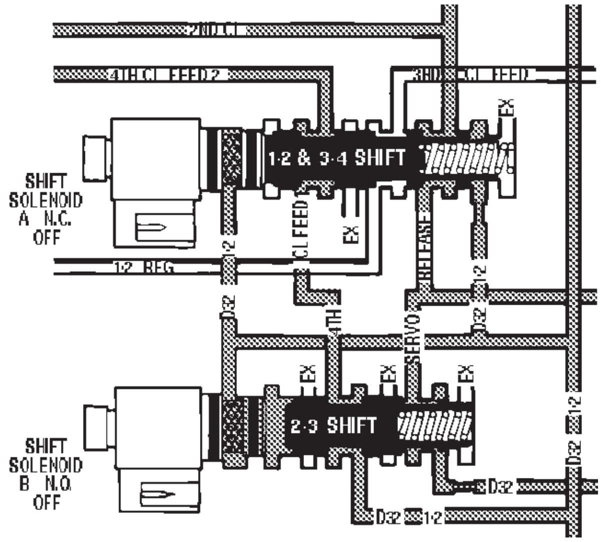
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the ability of the PCM to command the PCS.
3. This test checks the PCS and internal wiring harness for incorrect resistance.

DTC P0748 Pressure Control Solenoid (PCS) (Force Motor) Circuit Electrical

Step	Action	Yes	No
1	Were you sent here from the "Powertrain On–Board Diagnostic (OBD) System Check"?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Failure Records". 4. While the engine is operating, put the transmission in Park. 5. Using the scan tool, apply 0.1 amp through 1.0 amp while observing "PC Ref. Current" and "PC Act. Current". Is the "PC Act. Current" reading always within 0.16 amp?	Go to Diagnostic Aids	Go to Step 3
3	1. Turn the ignition "off". 2. Disconnect the transmission 4–way connector M–6. 3. Using the J39200 DVOM, measure the resistance between terminals M6–2(B) and M6–4(C). Is the resistance within 3–7 ohms?	Go to Step 7	Go to Step 4
4	1. Remove the transmission oil pan. Refer to Solenoid (Adapter Case Valve Body) in Automatic Transmission (4L30–E) section. 2. Disconnect the internal wiring harness at the PCS. 3. Measure the resistance of the PCS. Is the resistance within 3–7 ohms?	Go to Step 6	Go to Step 5
5	Replace the PCS. Is the replacement complete?	Go to Step 10	—
6	Repair the internal wiring harness for an open. Is the repair complete?	Go to Step 10	—
7	Inspect/repair circuits J1–47, M6–2(B), J1–43, and M6–4(C). Was a problem found?	Go to Step 10	Go to Step 8
8	Inspect/repair circuits J1–47, M6–2(B), J1–43, and M6–4(C) for a short to ground or poor connections. Was a problem found?	Go to Step 10	Go to Step 9
9	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 10	—
10	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: The PCS duty cycle is not at its electrical high or low limit. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0751 Shift Solenoid A Performance (Stuck OFF)



D07RT011

Circuit Description

The shift solenoid A is used to control fluid flow acting on the 1–2 and 3–4 shift valves. The solenoid is a normally close exhaust valve that is used with the shift solenoid B to allow four different shifting combinations.

The DTC detects when there is only a 1–1–4–4 shift pattern depending on the state of the mechanical failure instead of a 1–2–3–4 shift pattern. This is a type "B" DTC.

Conditions For Setting The DTC

- No ETC DTCs.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTC P0742, P1860, P1870.
- No shift solenoid A DTC P0753.
- No shift solenoid B DTC P0758.
- Gear range is D4.
- Output speed is greater than 375 rpm.
- Transmission temperature is between 20° and 130°C (68° and 266°F).
- No range code P0705, P0706.
- No torque code (to be confirmed).
- Engine run for more 0 seconds and not influed cut-off (to be confirmed).

All the above conditions have been met and the combination of conditions 1, 2 occur two consecutive times.

Condition 1:

- 2nd gear is commanded for ≥ 1 sec
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle positon ≥ 10%
- 800 ≤ TCC slip ≤ 4000 rpm
- Speed ratio ≥ 0.6
- 2.75 ≤ Modeled Ratio ≤ 3.2 for 1 seconds.

Condition 2:

- 3rd Gear is commanded for ≥ 1 sec.
- 40 ≤ Engine Torque ≤ 400 N·m
- Trottle position ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Speed ratio ≥ 0.45
- 0.62 ≤ Modeled Ratio ≤ 0.92 for 3 seconds

Action Taken When the DTC Sets

- Maximum line pressure.
- For lamp illuminate refer to DTC type definition (type B).
- Turn force motor OFF.

Conditions For Clearing The The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the 4L30–E shift speed chart.
- Other internal transmission failures may allow more than one shift to occur.

Test Description

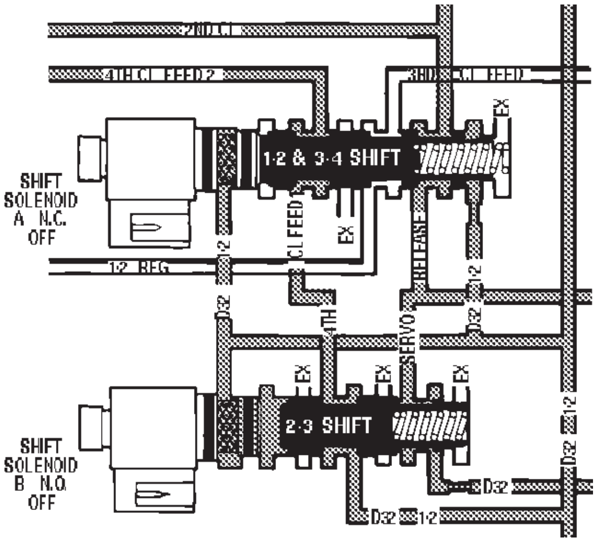
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the function of the range switch (mode switch).
3. This test checks that the scan tool commanded all shifts, all shifts solenoids responded correctly, but all the shifts did not occur.

DTC P0751 Shift Solenoid A Performance (Stuck OFF)

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. With the engine operating, apply the brake pedal and select each transmission range D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the “TR Switch” on the scan tool?	Go to Step 3	Go to“Range Switch Logic Table”
3	1. While the engine is operating, raise the drive wheels. 2. With the transmission in D4 range, use the scan tool to command 1st, 2nd and 3rd, and 4th gears while accelerating the vehicle. Was a 2–3 or 1–4 only shift pattern detected? (Road testing the vehicle may be necessary).	Go to Step 4	Go to Diagnostic Aids
4	Check the shift solenoid/hydraulic circuit for: ● One or both of the shift solenoids for an internal malfunction. ● Contamination or sediment in one or both of the shift solenoids. ● Damaged seals on one or both of the shift solenoids. Refer to Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section. Was a problem found and corrected?	Go to Step 5	Go to Diagnostic Aids
5	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0752 Shift Solenoid A Performance (Stuck ON)



D07RT011

Circuit Description

The shift solenoid A is used to control fluid flow acting on the 1–2 and 3–4 shift valves. The solenoid is a normally close exhaust valve that is used with the shift solenoid B to allow four different shifting combinations.

The DTC detects when there is only a 2–2–3–3 shift pattern depending on the state of the mechanical failure instead of a 1–2–3–4 shift pattern. This is a type “B” DTC.

Conditions For Setting The DTC

- No ETC DTCs.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTC P0742, P1860, P1870.
- No shift solenoid A DTC P0753.
- No shift solenoid B DTC P0758.
- Gear range is D4.
- Output speed is greater than 375 rpm.
- Transmission temperature is between 20˚ and 130˚C (68˚ and 266˚F).
- No range code P0705, P0706.
- No torque code (to be confirmed).
- Engine run for more 0 seconds and not influed cut-off (to be confirmed).

All the above conditions have been met and the combination of condition 1, 2 occur two consecutive times.

Condition 1:

- 1st gear is commanded for ≥ 1 sec
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle positon ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Transmission out speed ≥ 375 rpm
- Speed ratio ≥ 0.3
- 1.5 ≤ Modeled Ratio ≤ 2.4 for 0.687 seconds

Condition 2:

- 4th Gear is commanded for ≥ 1 sec.
- 40 ≤ Engine Torque ≤ 400 N·m
- Trottle position ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Speed ratio ≥ 0.6
- 0.92 ≤ Modeled Ratio ≤ 1.5 for 7 seconds

Action Taken When the DTC Sets

- Maximum line pressure.
- For lamp illuminate refer to DTC type definition (type B).
- Turn force motor OFF.

Conditions For Clearing The The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the 4L30–E shift speed chart.
- Other internal transmission failures may cause more than one shift to occur.

Test Description

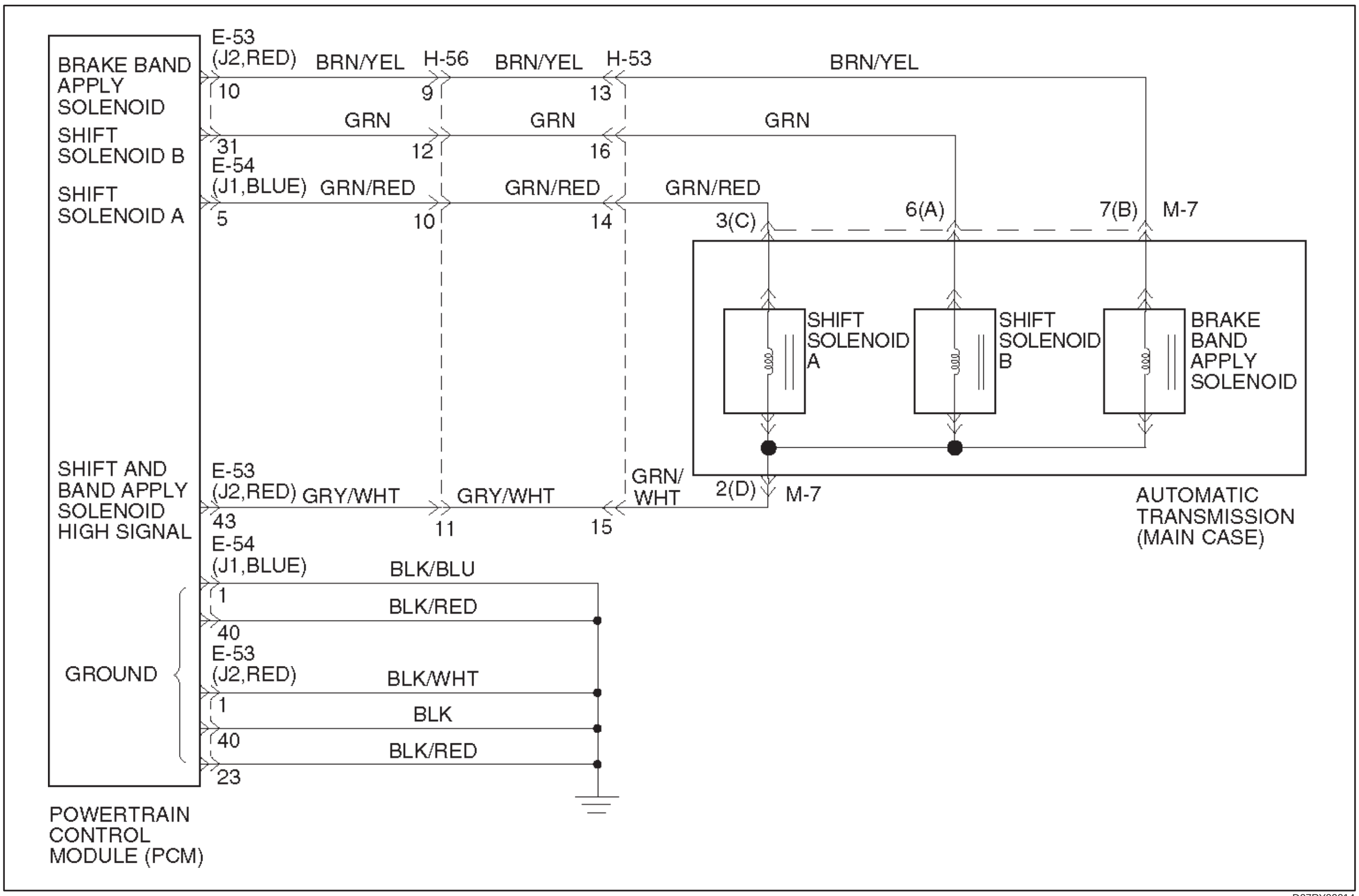
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the function of the range switch (mode switch).
3. This test checks that the scan tool commanded all shifts, all shifts solenoids responded correctly, but all the shifts did not occur.

DTC P0752 Shift Solenoid A Performance (Stuck ON)

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. With the engine operating, apply the brake pedal and select each transmission range D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the “TR Switch” on the scan tool?	Go to Step 3	Go to“Range Switch Logic Table”
3	1. While the engine is operating, raise the drive wheels. 2. With the transmission in D4 range, use the scan tool to command 1st, 2nd and 3rd, and 4th gears while accelerating the vehicle. Was a 2–3 or 1–4 only shift pattern detected? (Road testing the vehicle may be necessary).	Go to Step 4	Go to Diagnostic Aids
4	Check the shift solenoid/hydraulic circuit for: ● One or both of the shift solenoids for an internal malfunction. ● Contamination or sediment in one or both of the shift solenoids. ● Damaged seals on one or both of the shift solenoids. Refer to Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section. Was a problem found and corrected?	Go to Step 5	Go to Diagnostic Aids
5	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0753 Shift Solenoid A Electrical



Circuit Description

- The shift solenoid A is a simple on/off solenoid located in the main case valve body. The solenoid is the normally closed type. In second or third gear, the Powertrain Control Module (PCM) energizes the solenoid to open a fluid inlet port. When the port is open, fluid pressure actuates the shift valve.
- The solenoid is activated by current. This current is produced by applying a voltage to one side (the High side) and a ground to the other side (Low side).
- The High Side Driver (HSD) is a circuit of the PCM that acts as a switch between the solenoids and the supply voltage. The High side of the solenoid is permanently supplied with voltage, except in BACKUP MODE or when ignition is off the HSD is turned off.

This DTC detects a continuous open or short to ground in the shift solenoid A circuit or the shift solenoid A. This is a type “B” DTC.

Conditions For Setting The DTC

- Ignition is “on”, Engine “run”.
- Battery voltage is between 10 and 16 volts.
- The PCM commands the solenoid “on” and the voltage remains high (B+) or the PCM commands the solenoid “off” and the voltage remains low (zero volts).
- All conditions met for 0.84 ~ 1.0 seconds.

Action Taken When The DTC Sets

- Maximum line pressure.
- Immediate landing to 4th gear.
- Inhibit TCC engagement.
- For lamp illuminate refer to DTC type definition (type B).

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and at the transmission 16–way connectors. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.

- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- An open ignition feed circuit can cause multiple DTCs to set.
- A shift solenoid B DTC P0758 could also set with a shift solenoid A electrical failure.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for power to the shift solenoid A from the ignition through the PCM.
5. This test measures the resistance of the component.
9. This test checks the function of the shift solenoid A and the transmission internal wiring harness.

Shift Solenoid Status Chart

Gear	Shift solenoid A	Shift solenoid B
1st	OFF	ON
2nd	ON	ON
3rd	ON	OFF
4th	OFF	OFF

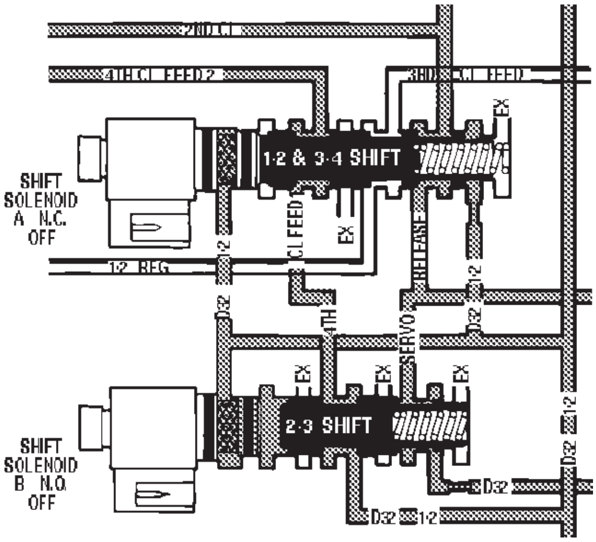
DTC P0753 Shift Solenoid A Electrical

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “on”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Were DTCs P0753, P0758, P1860 set?	Go to Step 3	Go to Diagnostic Aids
3	1. Turn the ignition “on”. 2. Using the J39200 DVOM, measure the voltage between PCM connector terminals J2–43 and J1–1 (GND). Is the voltage within 10–12 volts?	Go to Step 4	Go to Step 5
4	1. Turn the ignition “off”. 2. Disconnect the J2 (RED) PCM connector. 3. Turn the ignition “on”. 4. Using the J39200 DVOM, measure the voltage between PCM connector terminals J1–5 and ground. Is the voltage within 10 – 12 volts?	Go to Step 11	Go to Step 5
5	1. Turn the ignition “off”. 2. Disconnect the J2 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals J2–43 and J1–5. Is the resistance within 18 – 20 ohms?	Go to Step 6	Go to Step 7
6	1. Disconnect the J1 (BLUE) and J2 (RED) PCM connectors. 2. Using the J39200 DVOM, check a continuity between PCM terminals J2–43 and ground. Is there a continuity?	Go to Step 12	Go to Step 8
7	1. Disconnect the 16–way harness connector H–56. 2. Using the J39200 DVOM, measure the resistance between terminals H56–11 and H56–10. Is the resistance within 18–20 ohms?	Go to Step 14	Go to Step 9

DTC P0753 Shift Solenoid A Electrical (Cont'd)

Step	Action	Yes	No
8	Using the J39200 DVOM, check a continuity between J2 (RED) PCM terminal 43 and ground. Is there a continuity?	Go to Step 13	Go to Step 10
9	1. Disconnect the transmission main case 7 pin connector M–7. 2. Using the J39200 DVOM, measure the resistance between terminals M7–2(D) and M7–3(C). Is the resistance within 18–20 ohms?	Go to Step 15	Go to Step 16
10	Check every connection at the PCM connector. Was a problem found?	Go to Step 18	Go to Step 17
11	The wiring harness between PCM connector terminals J1–5 and transmission harness terminal M7–3(C) is shorted to voltage. Was a problem found and corrected?	Go to Step 19	—
12	The wiring harness between PCM connector terminal J1–5 and transmission harness terminal M7–3(C) is shorted to ground. Was a problem found and corrected?	Go to Step 19	—
13	The wiring harness between PCM connector terminals J2–43 and transmission harness terminal M7–2(D) is shorted to ground. Was a problem found and corrected?	Go to Step 19	—
14	The wiring harness between PCM connector J1 or J2 and transmission 16–way connector H–56 is open or poor connection. Was a problem found and corrected?	Go to Step 19	—
15	The wiring harness between transmission 16–way connector H–56 and transmission main case connector M–7 is open or has a poor connection. Was a problem found and corrected?	Go to Step 19	—
16	The shift solenoid A is faulty. Replace the shift solenoid A. Refer to Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 19	—
17	The PCM may be faulty. Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 19	—
18	Repair the PCM connector connection. Was a problem found and corrected?	Go to Step 19	—
19	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: ● The shift solenoid A is commanded "on" and voltage drops to zero. ● The shift solenoid A is commanded "off" and voltage increases to B+. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0756 Shift Solenoid B Performance (Stuck OFF)



D07RT011

Circuit Description

The shift solenoid B is used to control fluid flow acting on the 2–3 shift valves. The solenoid is a normally open exhaust valve that is used with the shift solenoid A to allow four different shift combinations.

This DTC detects when there is only a 4–3–3–4 shift pattern depending on the state of the mechanical failure instead of a 1–2–3–4 shift pattren. This is a type “B” DTC.

Conditions For Setting The DTC

- No ETC DTCs.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTC P0742, P1860., P1870.
- No shift solenoid A DTC P0753.
- No shift solenoid B DTC P0758.
- Gear range is D4.
- Output speed is greater than 375 rpm.
- Transmission fluid temperature is between 20° and 130°C (68° and 266°F).
- No range code P0705, P0706.
- No torque code (to be confirmed).
- Engine run for more 0 seconds and influed cut-off (to be confirmed).

All the above conditions have been met and the combination of condition 1, 2 occur two consecutive times.

Condition 1:

- 1st gear is commanded for ≥ 1 sec
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle position ≥ 10%
- –2300 ≤ TCC slip ≤ 200 rpm
- Transmission out speed ≥ 400 rpm
- Speed ratio ≥ 0.3
- 0.60 ≤ Modeled Ratio ≤ 1.49 for 1 seconds

Condition 2:

- 2nd Gear is commanded for ≥ 1 sec.
- 40 ≤ Engine Torque ≤ 400 N·m
- Trottle position ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Speed ratio ≥ 0.6
- 0.92 ≤ Modeled Ratio ≤ 1.5 for 0.687 seconds

Action Taken When the DTC Sets

- Maximum line pressure.
- For lamp illuminate refer to DTC type definition (type B).
- Turn force motor OFF.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exist and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the 4L30-E shift speed chart.
- Other internal transmission failures may allow more than one shift to occur.

Test Description

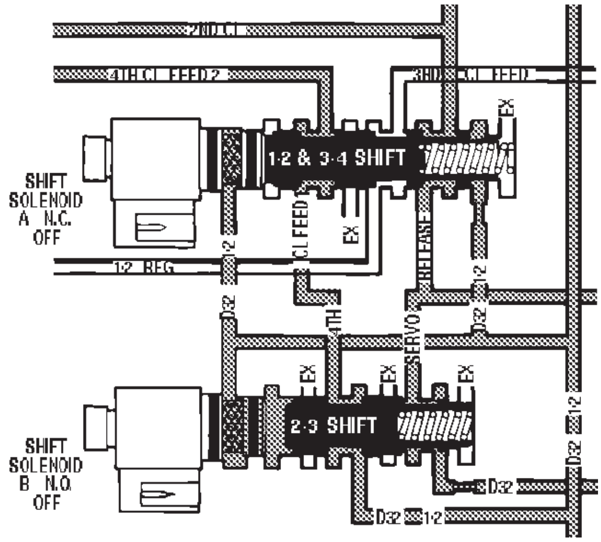
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the function of the range switch (mode switch).
3. This test checks for selected gear ratio vs. a ratio not obtainable under normal driving conditions.

DTC P0756 Shift Solenoid B Performance (Stuck OFF)

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. With the engine operating, apply the brake pedal and select each transmission range D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the “TR Switch” on the scan tool?	Go to Step 3	Go to “Range Switch Logic Table”
3	1. While the engine is operating, raise the drive wheels. 2. With the transmission in D4 range, use the scan tool to command 1st, 2nd, and 3rd, and 4th gears while accelerating the vehicle. Was 1st gear commanded and not achieved, or 4th gear commanded and other than 4th gear occurred? (Road testing the vehicle may be necessary.)	Go to Step 4	Go to Diagnostic Aids
4	Check the shift solenoid/hydraulic circuit for: • One or both of the shift solenoids for an internal malfunction. • Contamination or sediment in one or both of the shift solenoids. • Damaged seals on the one or both of the shift solenoids. Refer to Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section. Was a problem found and corrected?	Go to Step 5	Go to Diagnostic Aids
5	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0757 Shift Solenoid B Performance (Stuck ON)



D07RT011

Circuit Description

The shift solenoid B is used to control fluid flow acting on the 2–3 shift valves. The solenoid is a normally open exhaust valve that is used with the shift solenoid A to allow four different shift combinations.

This DTC detects when there is only a 1–2–2–1 shift pattern depending on the state of the mechanical failure instead of a 1–2–3–4 shift pattern. This is a type "B" DTC.

Conditions For Setting The DTC

- No ETC DTCs.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTC P0742, P1860, P1870.
- No shift solenoid A DTC P0753.
- No shift solenoid B DTC P0758.
- Gear range is D4.
- Output speed is greater than 375 rpm.
- Transmission fluid temperature is between 20° and 130°C (68° and 266°F).
- No range code P0705, P0706.
- No torque code (to be confirmed).
- Engine run for more 0 seconds and not influed cut-off (to be confirmed).

All the above conditions have been met and the combination of condition 1,2 occur two consecutive times.

Condition 1:

- 3rd gear is commanded for ≥ 1 sec
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle positon ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Transmission out speed ≥ 375 rpm
- Speed ratio ≥ 0.6
- 1.44 ≤ Modeled Ratio ≤ 2.4 for 4 seconds

Condition 2:

- 4th Gear is commanded for ≥ 1 sec.
- 15 ≤ Engine Torque ≤ 400 N·m
- Trottle position ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Speed ratio ≥ 0.6
- 2.75 ≤ Modeled Ratio ≤ 3.2 for 2 seconds

Action Taken When the DTC Sets

- Maximum line pressure.
- For lamp illuminate refer to DTC type definition (type B).
- Turn force motor OFF.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the 4L30-E shift speed chart.
- Other internal transmission failures may cause more than one shift to occur.

Test Description

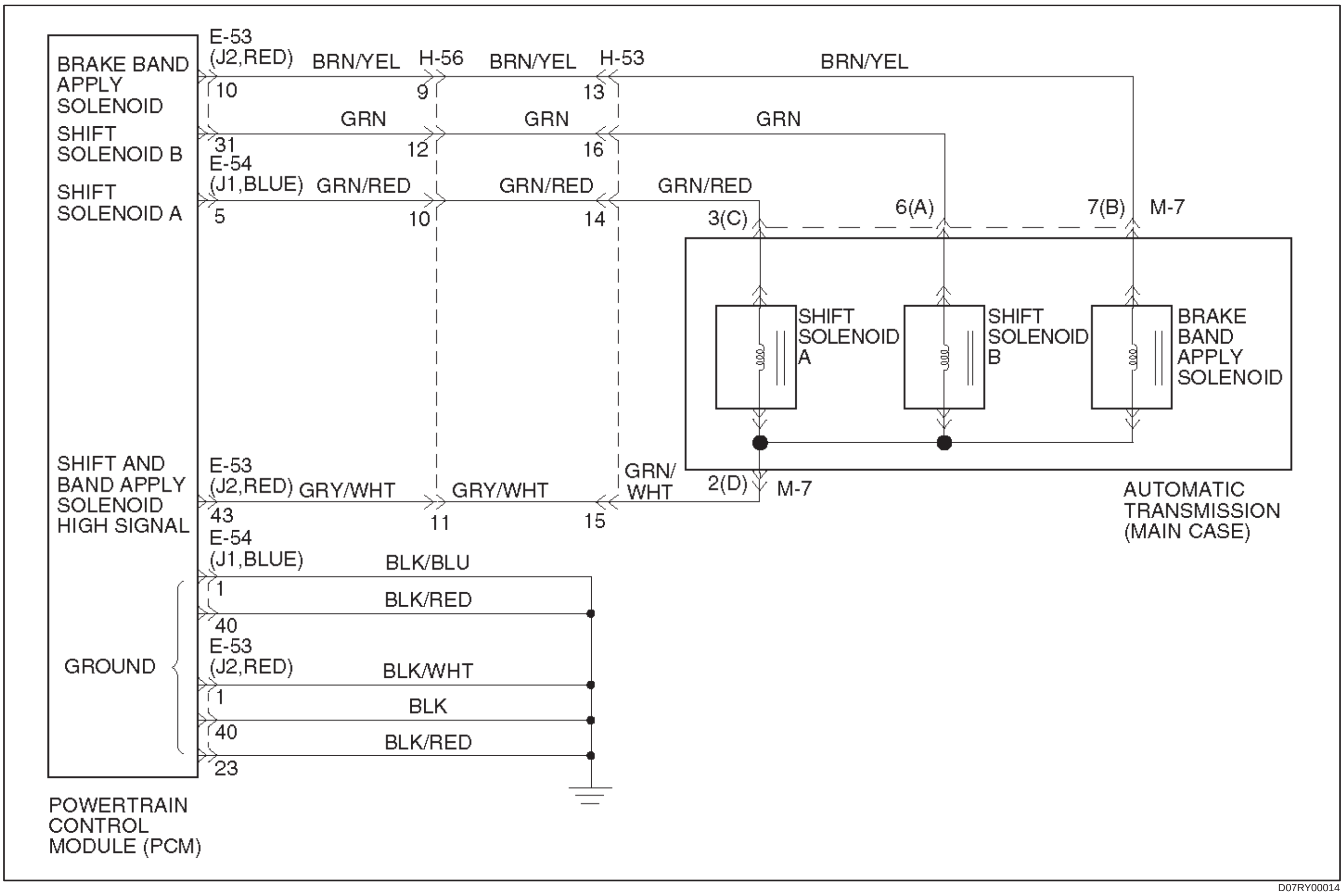
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the function of the range switch (mode switch).
3. This test checks for selected gear ratio vs. a ratio not obtainable under normal driving conditions.

DTC P0757 Shift Solenoid B Performance (Stuck ON)

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. With the engine operating, apply the brake pedal and select each transmission range D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the “TR Switch” on the scan tool?	Go to Step 3	Go to “Range Switch Logic Table”
3	1. While the engine is operating, raise the drive wheels. 2. With the transmission in D4 range, use the scan tool to command 1st, 2nd, and 3rd, and 4th gears while accelerating the vehicle. Was 1st gear commanded and not achieved, or 4th gear commanded and other than 4th gear occurred? (Road testing the vehicle may be necessary.)	Go to Step 4	Go to Diagnostic Aids
4	Check the shift solenoid/hydraulic circuit for: ● One or both of the shift solenoids for an internal malfunction. ● Contamination or sediment in one or both of the shift solenoids. ● Damaged seals on the one or both of the shift solenoids. Refer to Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section. Was a problem found and corrected?	Go to Step 5	Go to Diagnostic Aids
5	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0758 Shift Solenoid B Electrical



Circuit Description

- The shift solenoid B is a simple on/off solenoid located in the main case valve body. It is normally open. When the port is open, fluid pressure actuates the shift valve. In first or second gear, the Powertrain Control Module (PCM) energizes the solenoid to close a fluid inlet port.
- The solenoid is activated by current. This current is produced by applying a voltage to one side (the High side) and a ground to the other side (Low side).
- The High Side Driver (HSD) is a circuit of the PCM that acts as a switch between the solenoids and the supply voltage. The High side of the solenoid is permanently supplied with voltage. In BACKUP MODE or when the ignition is off, the HSD is turned off.

This DTC detects a continuous open or short to ground in the shift solenoid B circuit or shift solenoid B. This is a type “B” DTC.

Conditions For Setting The DTC

- Ignition is “on”, Engine “run”.
- Battery voltage is between 10 and 16 volts.
- The PCM commands the solenoid “on” and the voltage remains high (B+)or the PCM commands the solenoid “off” and the voltage remains low (zero volts).
- All conditions met for 0.84 ~ 1.0 seconds.

Action Taken When The DTC Sets

- Fixed to 4th gear.
- Maximum line pressure.
- Inhibit TCC engagement.
- The PCM will illuminate the Malfunction Indicator Lamp (MIL) and CHECK TRANS Lamp.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and at the transmission 16–way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.

- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

5. This test measures the resistance of the component.
7. This test checks the function of the shift solenoid B and the transmission internal wiring harness.
11. This test checks for power to the shift solenoid B from the ignition through the PCM.

Shift Solenoid Status Chart

Gear	Shift solenoid A	Shift solenoid B
1st	OFF	ON
2nd	ON	ON
3rd	ON	OFF
4th	OFF	OFF

DTC P0758 Shift Solenoid B Electrical

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “on”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Were DTCs P0753, P0758, P1860 set?	Go to Step 4	Go to Step 3
3	1. The engine “on”. 2. Apply brake pedal and select transmission range “D”. 3. Press and hold down the winter switch and select transmission mode “winter”. Does the scan tool display DTC P0758 at 3rd gear?	Go to Step 8	Go to Diagnostic Aids
4	1. Turn the ignition “off”. 2. Disconnect the J1 (BLUE) and J2 (RED) PCM connectors. 3. Turn the ignition “on”. 4. Using the J39200 DVOM, measure the voltage between PCM connector terminals J2–31 and J1–1. Is the voltage within 10 – 12 volts?	Go to Step 15	Go to Step 5
5	1. Turn the ignition “off”. 2. Using the J39200 DVOM, measure the resistance between PCM connector terminals J2–43 and J2–31. Is the resistance within 18 – 20 ohms?	Go to Step 16	Go to Step 6
6	1. Disconnect the transmission 16–way connector H–56. 2. Using the J39200 DVOM, measure the resistance between terminals H56–11 and H56–12. Is the resistance within 18 – 20 ohms?	Go to Step 17	Go to Step 7
7	1. Disconnect the transmission main case connector M–7. 2. Using the J39200 DVOM, measure the resistance between terminals M7–2(D) and M7–6(A). Is the resistance within 18 – 20 ohms?	Go to Step 18	Go to Step 19

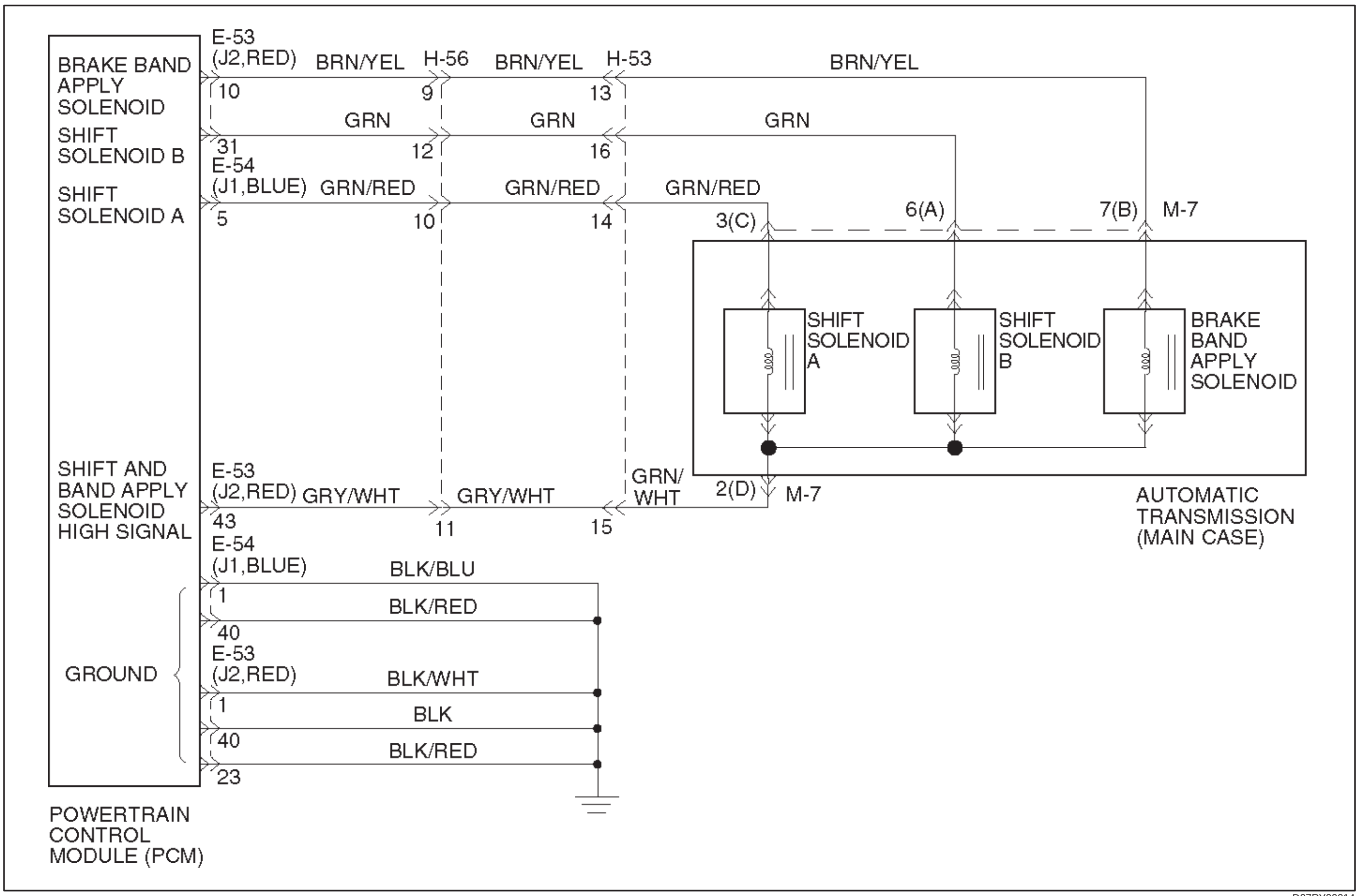
DTC P0758 Shift Solenoid B Electrical (Cont'd)

Step	Action	Yes	No
8	1. Turn the ignition "off". 2. Disconnect the J1 (BLUE) and J2 (RED) PCM connectors. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals J2–43 and J2–31. Is the resistance within 18 – 20 ohms?	Go to Step 9	Go to Step 10
9	Using the J39200 DVOM, check a continuity between PCM connector terminal J2–31 and ground. Is there a continuity?	Go to Step 20	Go to Step 11
10	1. Disconnect the transmission 16–way connector H–56. 2. Using the J39200 DVOM, measure the resistance between terminals H56–11 and H56–12. Is the resistance within 18–20 ohms?	Go to Step 21	Go to Step 12
11	Using the J39200 DVOM, check a continuity between PCM connector terminal J2–43 and ground. Is there a continuity?	Go to Step 22	Go to Step 13
12	1. Disconnect the transmission main case connector M–7. 2. Using the J39200 DVOM, measure the resistance between terminals M7–2(D) and M7–6(A). Is the resistance within 18 – 20 ohms?	Go to Step 23	Go to Step 24
13	Check every connection of the PCM and transmission 16–way connector H–56. Was a problem found and corrected?	Go to Step 26	Go to Step 14
14	1. Connect the J1 (BLUE) and J2 (RED) PCM connectors to the PCM. 2. Turn the ignition "on", the engine "on". 3. Repeat Step 3. Does the scan tool display DTC P0758 at 3rd gear?	Go to Step 25	Go to Diagnostic Aids
15	The wiring harness between PCM connector terminal J2–31 and transmission main case terminal M7–6(A) is shorted to voltage. Was a problem found and corrected?	Go to Step 26	—
16	The PCM internal terminal J2–31 is shorted to voltage. Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 26	—
17	The wiring harness between PCM connector and transmission 16–way connector is shorted. Was a problem found and corrected?	Go to Step 26	—
18	The wiring harness between transmission 16–way connector and transmission main case connector is shorted. Was a problem found and corrected?	Go to Step 26	—
19	The shift solenoid B is faulty, or the internal wiring harness from the shift solenoid B is shorted. Was a problem found and corrected?	Go to Step 26	—
20	The wiring harness between PCM connector terminal J2–31 and transmission main case connector terminal M7–6(A) is shorted to ground. Was a problem found and corrected?	Go to Step 26	—

DTC P0758 Shift Solenoid B Electrical (Cont'd)

Step	Action	Yes	No
21	The wiring harness between PCM connector terminal J2–31 and transmission 16–way connector terminal H56–12, or between PCM connector terminal J2–43 and 16–way connector terminal H56–11 is open. Was a problem found and corrected?	Go to Step 26	—
22	The wiring harness between PCM connector terminal J2–43 and transmission main case connector terminal M7–2(D) is shorted to ground. Was a problem found and corrected?	Go to Step 26	—
23	The wiring harness between transmission 16–way connector terminal H56–12 and transmission main case connector terminal M7–6(A), or between H56–11 and M7–2(D) is open. Was a problem found and corrected?	Go to Step 26	—
24	The internal wiring harness from the shift solenoid B is open, or the shift solenoid B is faulty. Was a problem found and corrected?	Go to Step 26	—
25	Replace the PCM. Is the replacement complete?	Go to Step 26	—
26	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: ● The shift solenoid B is commanded "on" and voltage drop to zero. ● The shift solenoid B is commanded "off" and voltage increases to B+. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P1850 Brake Band Apply Solenoid Malfunction



Circuit Description

- The brake band apply solenoid is a normally open solenoid which controls the flow of fluid for brake band application. The Powertrain Control Module (PCM) uses Pulse Width Modulation (PWM) and changes the duty cycle to control the solenoid. The PCM turns the solenoid on (energized) and off (deenergized) at a constant frequency. The length of time the solenoid is energized during each on/off cycle is called the pulse width. By varying or "modulating" the pulse width, the solenoid output pressure is changed. Since the solenoid is normally open, increasing the pulse width increases the duty cycle and decreases the output pressure. PWM control provides smooth band application without an accumulator. The band is only applied in first and second gears.
- In the event of an electrical failure (open), the solenoid regulates at the maximum oil flow (0% duty cycle).
- The solenoid is activated by current. This current is produced by applying a voltage to one side (the High side) and a ground to the other side (Low side).
- The High Side Driver (HSD) is a circuit of the PCM that acts as a switch between the solenoids and the supply voltage. The High side of the solenoid is permanently supplied with voltage. When the ignition is off, the HSD is turned off.

This DTC detects a continuous open or short to ground in the brake band apply solenoid circuit or the brake band apply solenoid. This is a type "D" DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- Ignition is "on", Engine "run".
- The PCM commands the solenoid "on" and the voltage remains high (B+) or the PCM commands the solenoid "off" and the voltage remains low (zero volts).
- All conditions met in 1.34 ~ 1.56 seconds.

Action Taken When The DTC Sets

- Inhibit brake band apply solenoid.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and at the transmission 16–way connectors. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for power to the brake band apply solenoid from the ignition through the PCM.
4. This test checks the resistance of the transmission internal wiring harness and brake band apply solenoid.
5. This test checks the ability of the PCM and wiring to control the ground circuit.

DTC P1850 Brake Band Apply Solenoid Malfunction

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “on”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Were DTCs P0753, P0758 set?	Go to Step 3	Go to Step 4
3	Using the J39200 DVOM, back probe between PCM connector terminals J2–43 and J1–1. Is the voltage between 10 to 12 volts?	Go to Step 5	Go to Step 6
4	1. Turn the ignition “off”. 2. Disconnect the J1 (BLUE) and J2 (RED) PCM connectors. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals J2–43 and J2–10. Is the resistance within 10–12 ohms?	Go to Step 12	Go to Step 13
5	Using the J39200 DVOM, back probe between PCM connector terminals J2–10 and J1–1. Is the voltage between 10 to 12 volts?	Go to Step 26	Go to Step 4
6	1. Turn the ignition “off”. 2. Disconnect the J1 (BLUE) and J2 (RED) PCM connectors. 3. Using the J39200 DVOM, check continuity between PCM terminal J2–43 and ground. Is there a continuity?	Go to Step 7	Go to Step 9
7	1. Disconnect the transmission 16–way connector H–56. 2. Using the J39200 DVOM, check continuity between connector H56–9 and ground. Is there a continuity?	Go to Step 8	Go to Step 17
8	1. Disconnect the transmission main case connector M–7. 2. Using the J39200 DVOM, check continuity between the terminal M7–7(B) and ground. Is there a continuity?	Go to Step 18	Go to Step 19

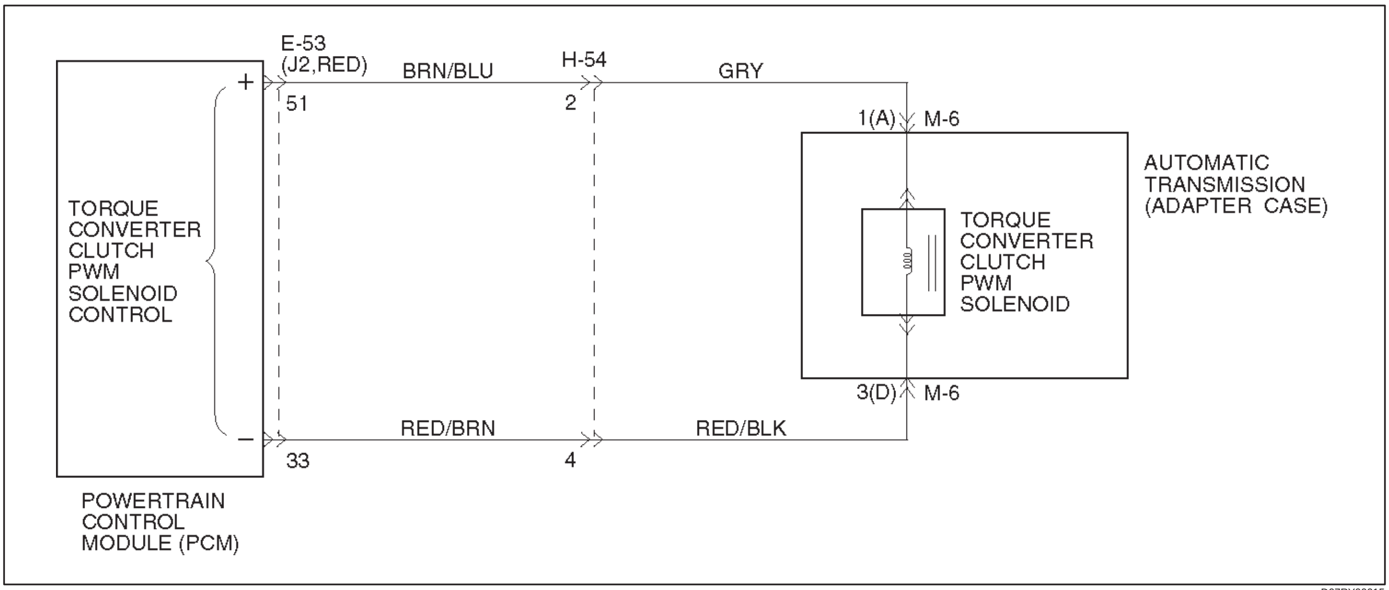
DTC P1850 Brake Band Apply Solenoid Malfunction (Cont'd)

Step	Action	Yes	No
9	1. Disconnect the J1 (BLUE) and J2 (RED) PCM Connector. 2. Using the J39200 DVOM, measure the resistance between PCM connector terminals J2–43 and J2–10. Is the resistance within 10–12 ohms?	Go to Step 26	Go to Step 10
10	1. Disconnect the transmission 16–way connector H–56. 2. Using the J39200 DVOM, measure the resistance between terminal H56–11 and H56–9. Is the resistance within 10–12 ohms?	Go to Step 17	Go to Step 11
11	1. Disconnect the transmission main case connector M–7. 2. Using the J39200 DVOM, measure the resistance between terminals M7–2(D) and M7–7(B). Is the resistance within 10–12 ohms?	Go to Step 20	Go to Step 21
12	Using the J39200 DVOM, check continuity between PCM terminal J2–10 and ground. Is there a continuity?	Go to Step 14	Go to Step 26
13	1. Disconnect the transmission 16–way connector H–56. 2. Using the J39200 DVOM, measure the resistance between terminal H56–11 and H56–9. Is the resistance within 10–12 ohms?	Go to Step 24	Go to Step 15
14	1. Disconnect the transmission 16–way connector H–56. 2. Using the J39200 DVOM, check continuity between terminal H56–9 and ground. Is there a continuity?	Go to Step 16	Go to Step 22
15	1. Disconnect the transmission main case connector M–7. 2. Using the J39200 DVOM, measure the resistance between terminals M7–2(D) and M7–7(B). Is the resistance within 10–12 ohms?	Go to Step 25	Go to Step 21
16	1. Disconnect the transmission main case connector M–7. 2. Using the J39200 DVOM, check continuity between the terminal M7–7(B) and ground. Is there a continuity?	Go to Step 18	Go to Step 23
17	The wiring harness between PCM terminal J2–43 and transmission 16–way connector terminal H56–11 is open. Was a problem found and corrected?	Go to Step 27	—
18	The brake band apply solenoid is faulty, or the internal wiring harness from the brake band apply solenoid is shorted to ground. Was a problem found and corrected?	Go to Step 27	—
19	The wiring harness between the transmission 16–way connector terminal H56–11 and the transmission main case connector terminal M7–2(D) is shorted to ground. Was a problem found and corrected?	Go to Step 27	—
20	The wiring harness between the transmission 16–way connector terminal H56–11 and the transmission main case connector terminal M7–2(D) is open. Was a problem found and corrected?	Go to Step 27	—
21	The brake band apply solenoid is faulty, or the internal wiring harness from the brake band apply solenoid is open. Was a problem found and corrected?	Go to Step 27	—

DTC P1850 Brake Band Apply Solenoid Malfunction (Cont'd)

Step	Action	Yes	No
22	The wiring harness between the PCM connector terminal J2–10 and transmission 16–way connector terminal H56–9 is shorted to ground. Was a problem found and corrected?	Go to Step 27	—
23	The wiring harness between the transmission 16–way connector terminal H56–9 and the transmission main case connector terminal M7–7(B) is shorted to ground. Was a problem found and corrected?	Go to Step 27	—
24	The wiring harness between the PCM connector terminal J2–10 and the 16–way connector terminal H56–9 is open. Was a problem found and corrected?	Go to Step 27	—
25	The wiring harness between the transmission 16–way connector terminal H56–9 and the transmission main case connector terminal M7–7(B) is open. Was a problem found and corrected?	Go to Step 27	—
26	Check every connection at the PCM. If OK, replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 27	—
27	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: ● The brake band apply solenoid is commanded "on" and the volts drop to zero. ● The brake band apply solenoid is commanded "off" and the volts increase to B+. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P1860 TCC PWM Solenoid Electrical



D07RY00015

Circuit Description

The PCM allows current to flow through the solenoid coil according to the duty cycle (percentage of “on” and “off” time). This current flow through the solenoid coil creates a magnetic field that magnetizes the solid core. The magnetized core attracts the check ball to seat against spring pressure. This blocks the exhaust for the TCC signal fluid and allows solenoid feed drive fluid to feed to TCC signal circuit. The TCC signal fluid pressure acts on the TCC regulator valve to regulate line pressure and to apply fluid pressure to the torque converter clutch shift control valve. When the TCC control valve is in the apply position, regulated apply fluid pressure is directed through the TCC valve to apply the torque converter clutch. The TCC PWM solenoid is used in conjunction with the TCC reglator valve to regulate fluid to the torque converter. The TCC PWM solenoid is attached to the valve body within the transmission.

This DTC detects a continuous open or short to ground or ignition in the TCC circuit or the TCC PWM solenoid. This is a type “B” DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- No shift solenoid A DTCs P0751 or P0752 or P0753.
- No shift solenoid B DTCs P0756 or P0757 or P0758.
- Ignition is “on”, Engine “run”.
- The PCM commands the solenoid “on” and the voltage remains low (zero volts).
- The PCM commands the solenoid “off” and the voltage remains high (B+).
- All conditions met for 0.875 ~ 1.25 seconds.

Action Taken When The DTC Sets

- Inhibit TCC engagement.
- For lamp illuminate refer to DTC type definition (type B).

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and at the transmission connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for voltage to the solenoid.
4. This test checks the ability of the PCM and wiring to control the ignition circuit.
9. This test checks the resistance of the TCC solenoid and the internal wiring harness.

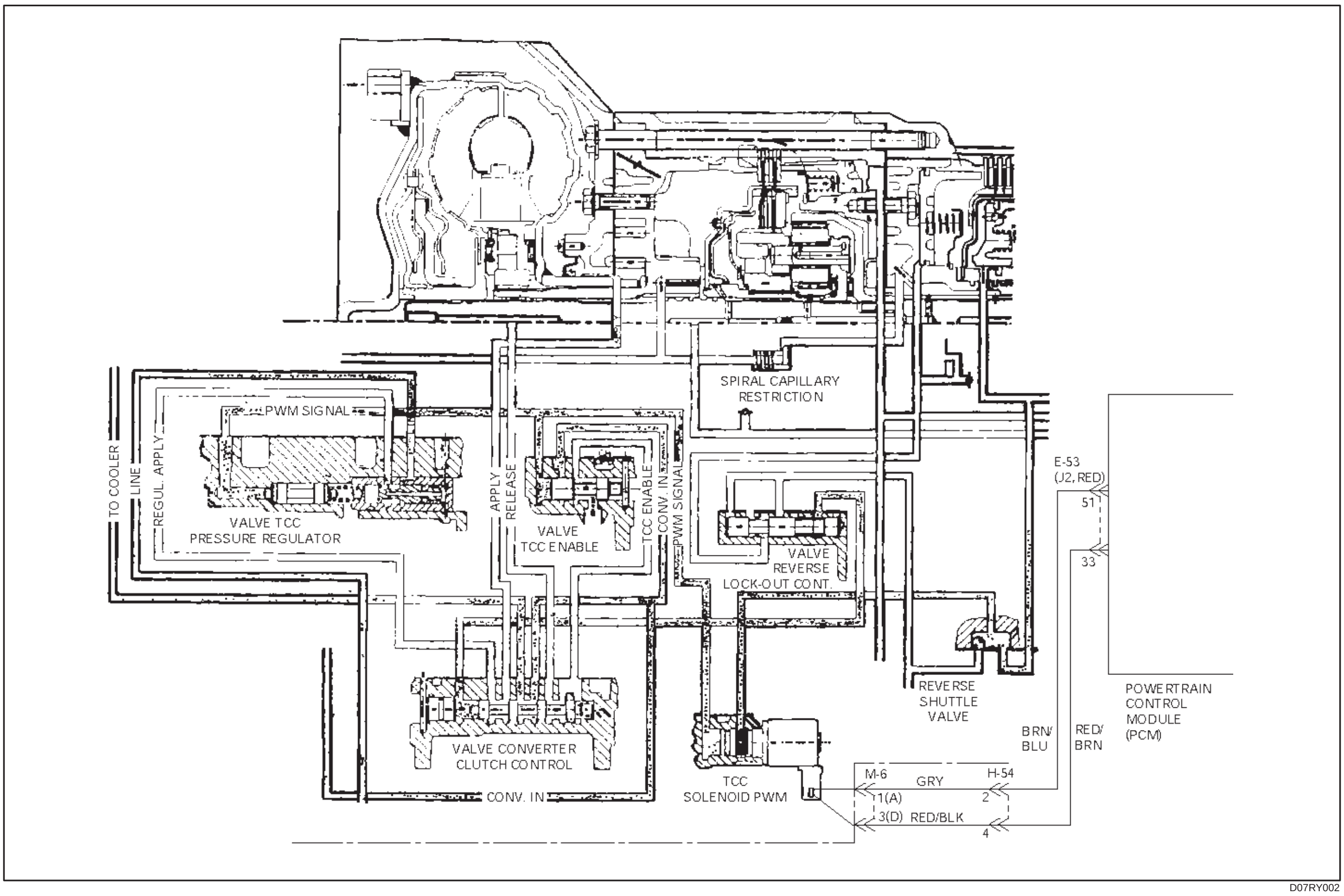
DTC P1860 TCC PWM Solenoid Electrical

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “on”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the“Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”.	Go to Step 3	Go to Step 4
3	Using the J39200 DVOM, back probe between PCM connector terminals J2–51 and J2–33. Is the voltage 0 ?	Go to Step 5	Go to Step 6
4	1. Apply brake pedal and select transmission range “D”. 2. Do a test drive, and increase the vehicle speed to TCC “on” at 4th. Does the scan tool display DTC P1860 at TCC “ON”?	Go to Step 10	Go to Diagnostic Aids
5	1. Turn the ignition “off”. 2. Disconnect the J2 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals J2–51 and J2–33. Is the resistance within 18 – 20 ohms?	Go to Step 7	Go to Step 8
6	The wiring harness between PCM connector terminal J2–51 and transmission adapter case connector terminal M6–1(A) is shorted to voltage. Was a problem found and corrected?	Go to Step 19	Go to Step 20
7	Intermittent condition. Check the wiring harness and terminals between PCM connector J2 and transmission adapter case connector M–6. Was a problem found and corrected?	Go to Step 19	Go to Step 20
8	1. Disconnect the transmission 4–way connector H–54. 2. Using the J39200 DVOM, measure the resistance between terminal H54–2 and ground. Is the resistance within 18 – 20 ohms?	Go to Step 16	Go to Step 9
9	1. Disconnect the transmission adapter case connector M–6. 2. Using the J39200 DVOM, measure the resistance between terminal M6–1(A) and ground. Is the resistance within 18 – 20 ohms?	Go to Step 17	Go to Step 18
10	1. Turn the ignition “off”. 2. Disconnect the J2 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between terminals J2–51 and J2–33. Is the resistance within 18 – 20 ohms?	Go to Step 19	Go to Step 11
11	1. Disconnect the transmission 4–way connector H–54. 2. Using the J39200 DVOM, measure the resistance between terminal H54–2 and ground. Is the resistance within 18–20 ohms?	Go to Step 13	Go to Step 12

DTC P1860 TCC PWM Solenoid Electrical (Cont'd)

Step	Action	Yes	No
12	1. Disconnect the transmission adapter case connector M–6. 2. Using the J39200 DVOM, measure the resistance between terminal M6–1(A) and ground. Is the resistance within 18–20 ohms?	Go to Step 14	Go to Step 15
13	The wiring harness between PCM connector terminal J2–51 and transmission 4–way connector terminal H54–2 is shorted to ground. Was a problem found and corrected?	Go to Step 21	—
14	The wiring harness between transmission 4–way connector H–54 and adapter case connector M–6 is shorted to ground. Was a problem found and corrected?	Go to Step 21	—
15	The TCC solenoid is faulty, or the internal wiring harness from the TCC solenoid is shorted to ground. Was a problem found and corrected?	Go to Step 21	—
16	The wiring harness between PCM connector terminal J2–51 and transmission 4–way connector terminal H54–2 is open. Was a problem found and corrected?	Go to Step 21	—
17	The wiring harness between transmission 4–way connector terminal H54–2 and adapter case terminal M6–1(A) is open. Was a problem found and corrected?	Go to Step 21	—
18	The TCC solenoid is faulty, or the internal wiring harness from the TCC solenoid is open. Was a problem found and corrected?	Go to Step 21	—
19	Check every connection at the PCM. If OK, replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 21	—
20	Check the PCM connector terminal J2–51, transmission 4–way connector terminal H54–2 and transmission adapter case connector terminal M6–1(A). Was a problem found and corrected?	Go to Step 21	—
21	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: • The TCC solenoid is commanded "on" and the volts increase to B+. • The TCC solenoid is commanded "off" and the volts drop to zero. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P1870 Transmission Component Slipping (TCC Stuck OFF)



Circuit Description

The PCM monitors the difference in engine speed and transmission output speed. For example in D3 drive range with the ECCC commanded, the engine speed should closely match transmission output speed.
This DTC detects excessive TCC slip when the ECCC is engaged. This is a type “B” DTC.

Conditions For Setting The DTC

The following conditions are met for three TCC cycles with reported excessive TCC slip conditions.

- No OSS DTCs P0722 or P0723.
- No shift solenoid A DTCs P0751 or P0752 or P0753.
- No shift solenoid B DTCs P0756 or P0757 or P0758.
- No TCC solenoid DTCs P0742 or P1860 or P1870.
- Engine speed is between 1,000 and 3,500 rpm for 0.5 seconds.
- Gear range is D4.
- 13% < TPS < 99%
- 50 < Engine Torque < 300 N·m
- TFT is between 20° and 150°C (68° and 302°F).
- TCC slip speed is between 250 rpm and 800 rpm for 3 times 7 seconds.
- Vehicle speed is between 25 km/h (15 mph) and 225 km/h (158 mph).
- Speed ratio is between 0.6 and 0.95.
- ECCC is “ON”.
- Low (0.8) < TCC Capacity < hi (0.99) for 5 seconds

Action Taken When The DTC Sets

- Only stored in memory.
- For lamp illuminate refer to DTC type definition (type B).

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exist and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Range switch malfunction could set a DTC P1870.
- A mechanical failure of the shift solenoids, TCC solenoid, or TCC PWM solenoid could set a DTC P1870.
- Internal transmission failures may set a DTC P1870.
- An intermittent or incorrect engine speed signal may set a DTC P1870.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the indicated range signal to the actual selected range. A faulty switch could set a DTC P1870.
3. This test checks the torque converter for slippage while in a commanded lockup state.

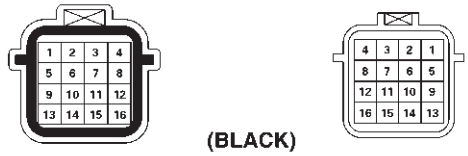
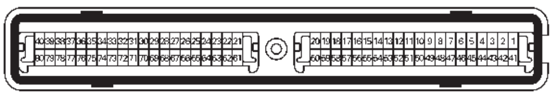
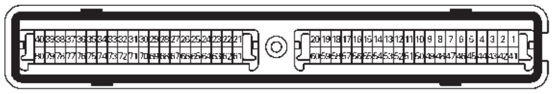
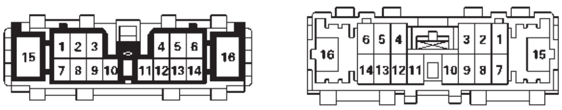
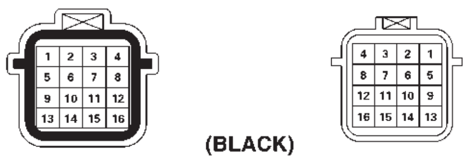
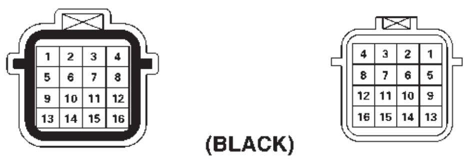
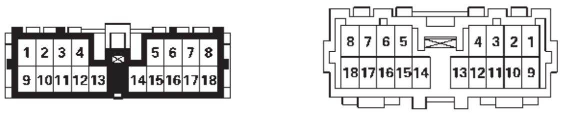
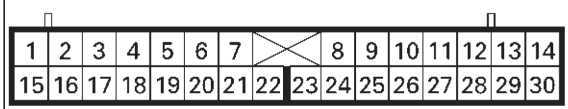
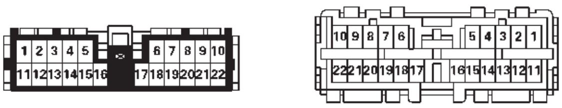
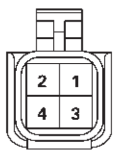
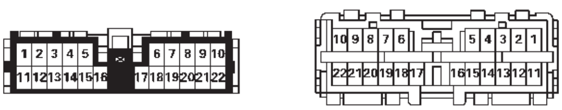
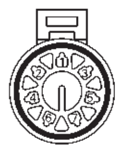
Range Switch Logic Table

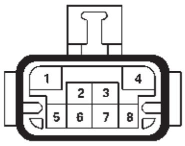
Range Position	Range Switch Pin			
	A	B	C	P(G)
Park	ON	OFF	OFF	ON
Reverse	ON	ON	OFF	OFF
Neutral	OFF	ON	OFF	ON
D4	OFF	ON	ON	OFF
D3	ON	ON	ON	ON
2	ON	OFF	ON	OFF
L	OFF	OFF	ON	ON
Illegal	OFF	OFF	OFF	OFF
Illegal	OFF	OFF	OFF	ON

DTC P1870 Transmission Component Slipping (TCC Stuck OFF)

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. Apply the brake pedal. 5. Select each transmission range: D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the scan tool “TR Switch” display?	Go to Step 3	Go to “Range Switch Logic Table”
3	Drive the vehicle in 4th gear while the TCC is engaged. At any time is the “TCC Slip Speed” greater than 130 rpm for 8 seconds while the TCC is engaged?	Go to System Diagnosis Charts	Go to Diagnostic Aids

Connector List

No.	Connector face	No.	Connector face
B-13		H-41	
E-53 (J2)		H-53	
E-54 (J1)		H-54	
H-8		H-55	
H-10		H-56	
H-11		H-57	
H-24		I-9	
H-25		M-6	
H-32		M-7	

No.	Connector face	No.	Connector face
M-15		M-25	

TROOPER

TRANSMISSION

MANUAL TRANSMISSION

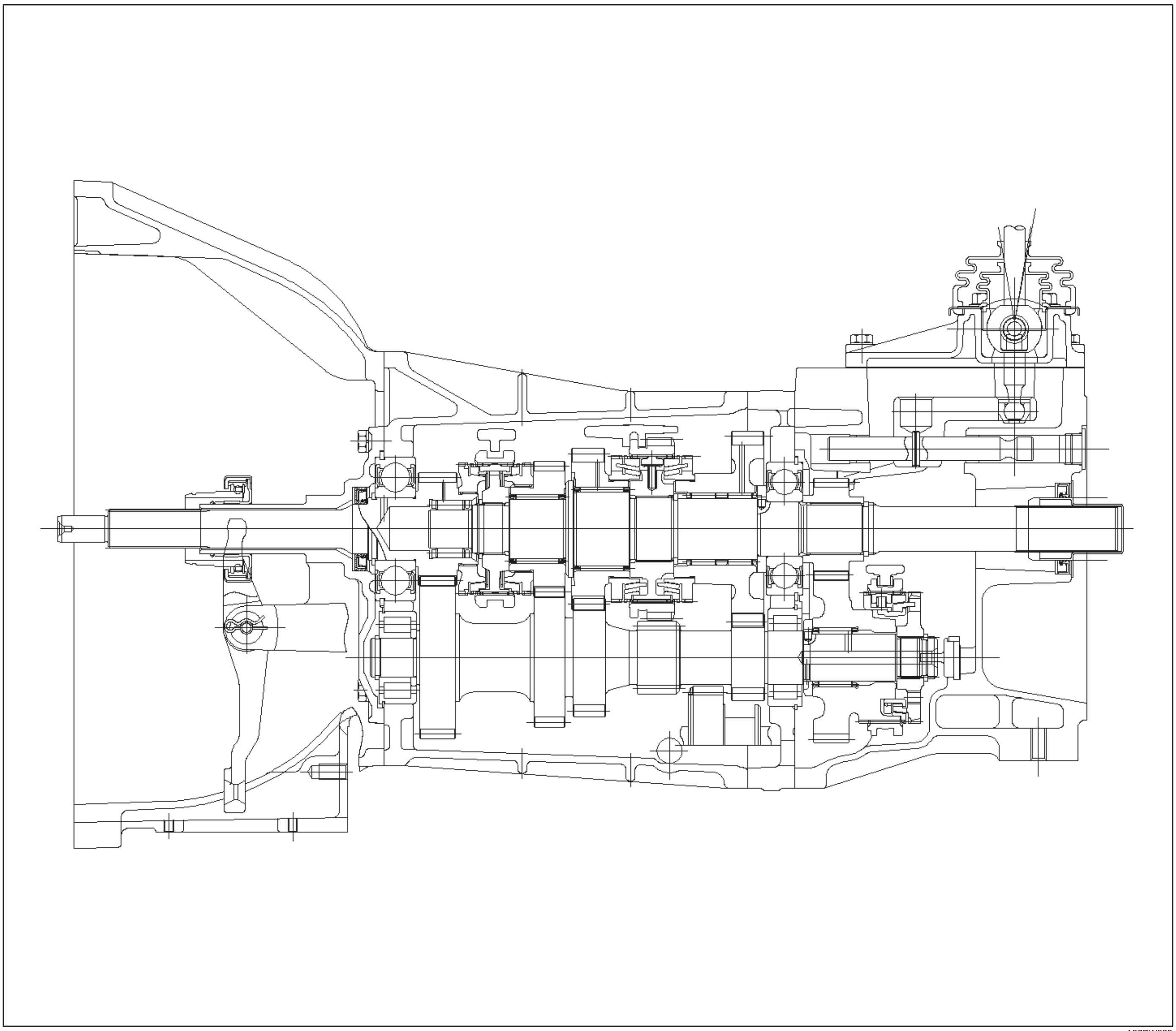
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



A07RW023

Diagnosis

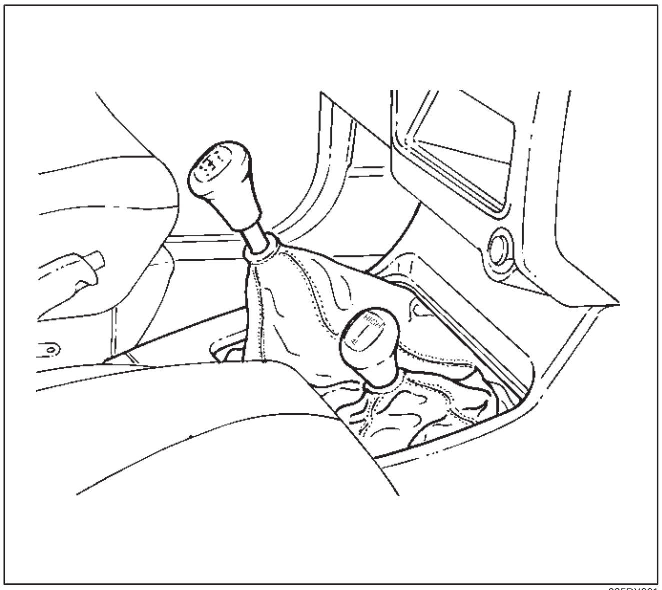
Condition	Possible cause	Correction
Abnormal noise	Flywheel pilot bearing worn	Replace
	Bearings worn or broken (Mainshaft, counter shaft, and transfer shaft)	Replace
	Gear tooth contact surfaces worn or scuffed (Mainshaft, counter shaft, reverse idler gear and transfer gears)	Replace
	Splines worn (Mainshaft, synchronizer clutch hub)	Replace
	Gear or bearing thrust face seized	Replace
	Lack of backlash between meshing gears	Replace
Hard Shifting	Improper clutch pedal free play	Readjust
	Change lever sliding portions worn	Repair or replace Regrease
	Shift block, shift rod and/or control box sliding faces worn	Replace
	Shift arm and synchronizer sleeve groove worn	Replace worn parts
	Thrust washer, collar, and/or gear thrust faces worn (Mainshaft and counter shaft thrust play)	Replace worn parts
	Synchronizer parts worn	Replace
Walking or Jumping out of gear	Detent ball worn	Replace
	Detent spring weakened or broken	Replace
	Shift rod and/or control box sliding faces worn	Replace
	Shift arm and synchronizer sleeve groove worn	Replace worn parts
	Thrust washer, collar, and/or gear thrust faces worn (Mainshaft and counter shaft thrust play)	Replace worn parts
	Bearings worn or broken	Replace
	Splines worn (Mainshaft, synchronizer hub)	Replace
	Synchronizer spring weakened or broken	Replace
Oil leakage	Loose drain plug(s) and/or filler plug(s)	Tighten Replenish oil
	Defective or improperly installed gasket(s)	Replace
	Oil seal worn or scratched	Replace

Manual Transmission Assembly

Removal

NOTE: Before remove the transmission and transfer assembly from the vehicle, change the transfer mode to 2WD using push button on dash panel.

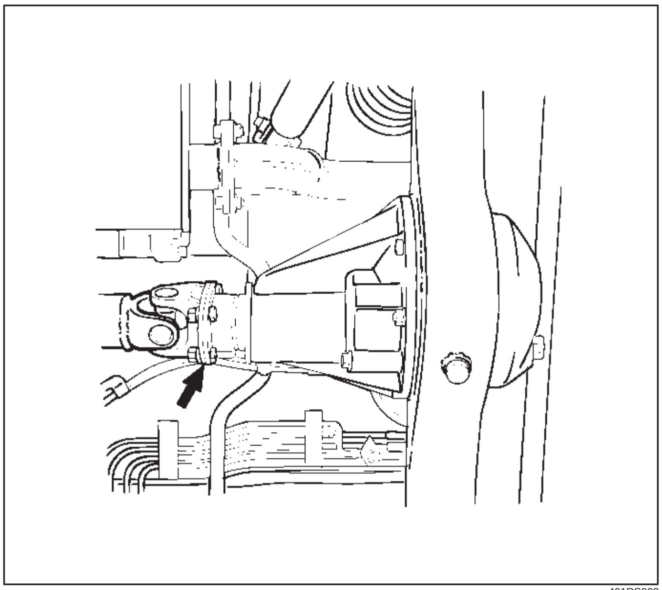
1. Remove engine hood.
2. Disconnect battery ground cable.
3. Remove the gear control lever knob.
4. Remove the front console assembly.
5. Remove the grommet assembly.
6. Remove the transmission control lever and transfer control lever.



235RX001

7. Remove transfer protector.
8. Remove the rear propeller shaft.

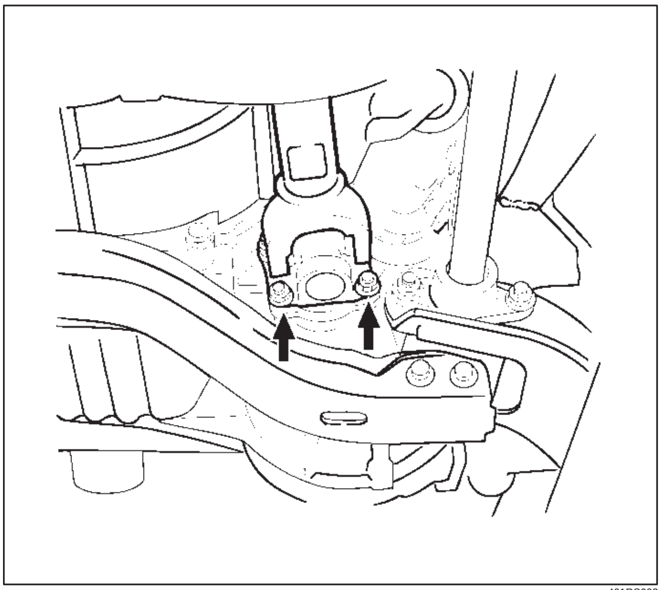
NOTE: Apply alignment marks on the flange at the both front and rear side.



401RS002

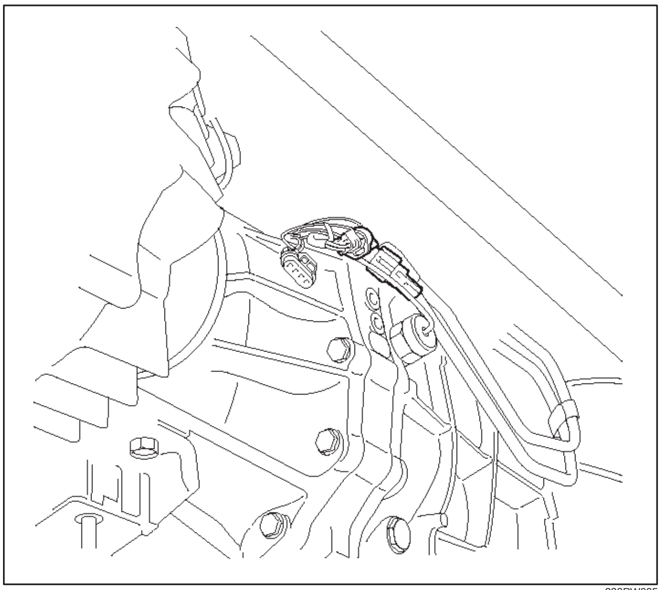
9. Remove the front propeller shaft.

NOTE: Apply alignment marks on the flange at both the front and rear sides.



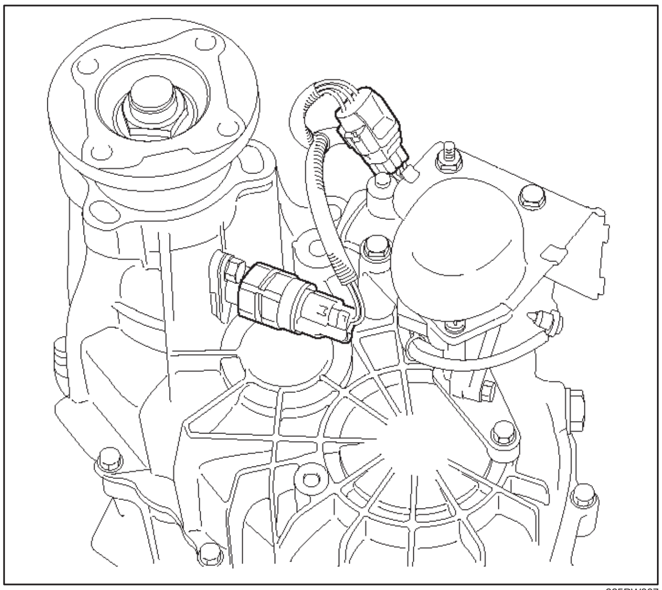
401RS003

10. Disconnect the reverse lamp switch, 4WD indicator switch, and 1-2 indicator switch harness connectors.



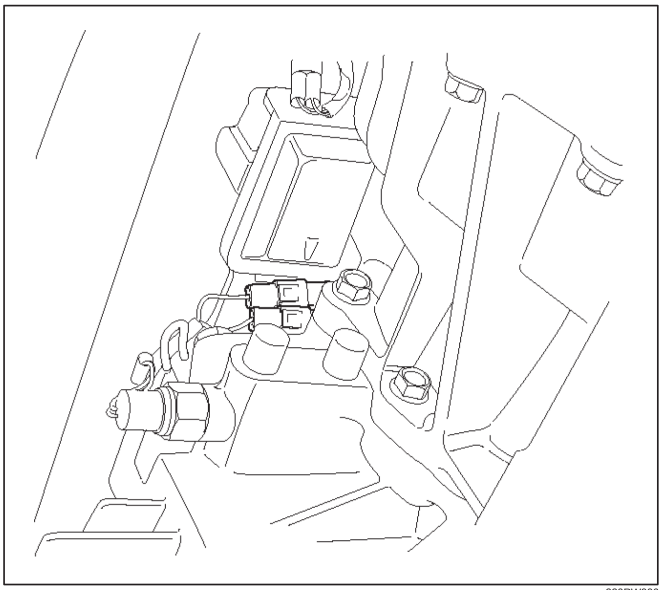
230RW005

11. Disconnect the speed sensor and 2WD-4WD actuator harness connectors.



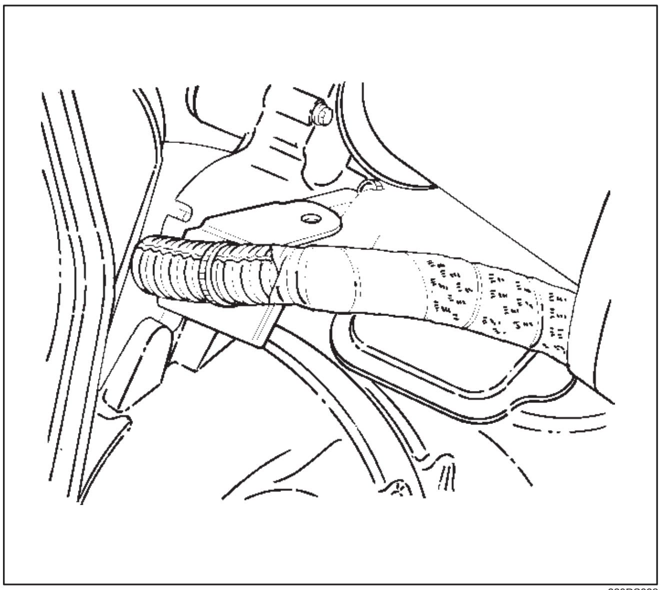
225RW007

12. Disconnect the 4WD indicator harness connector.



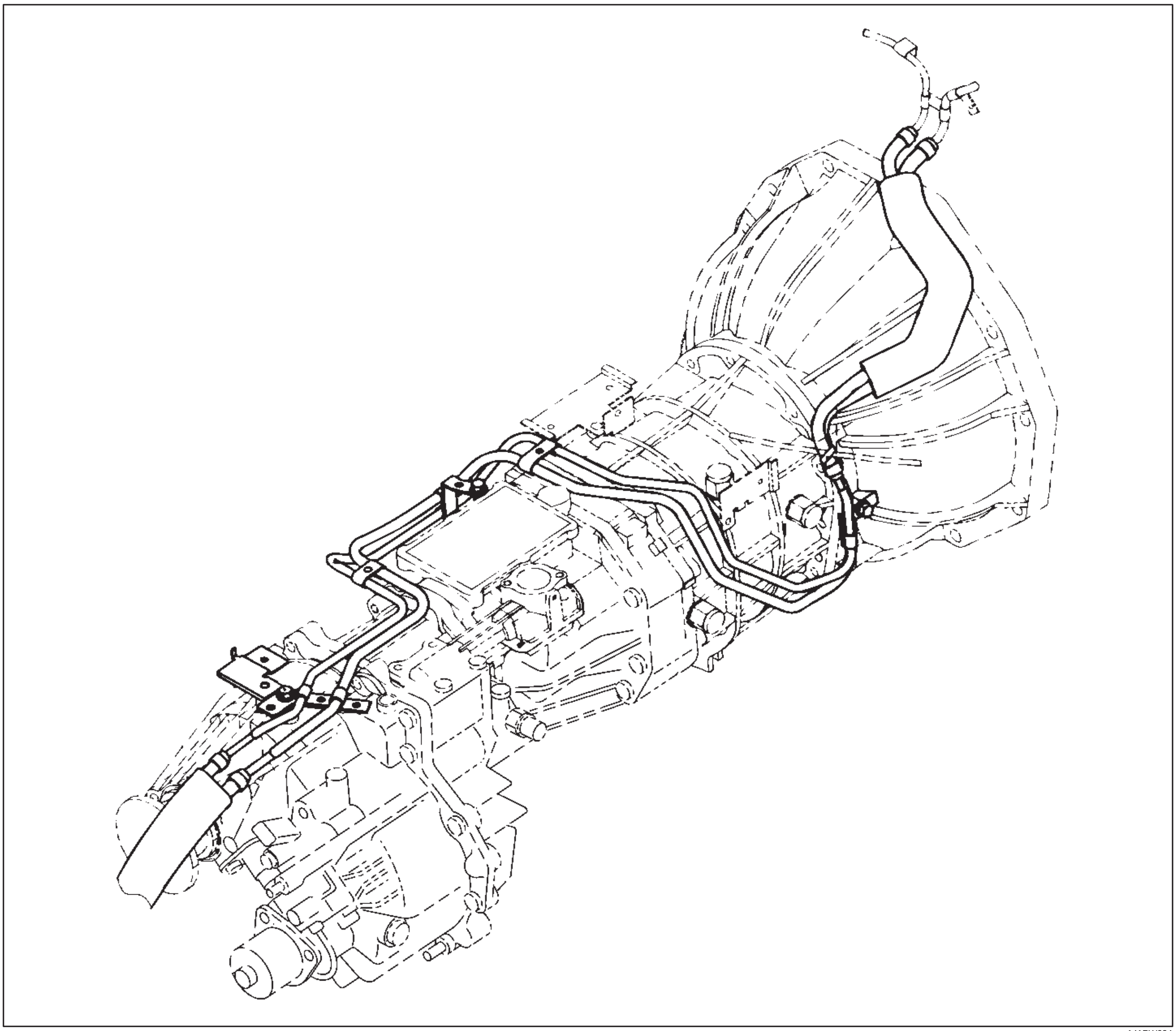
220RW006

13. Remove two transmission harness clamps from the transmission case and bracket .



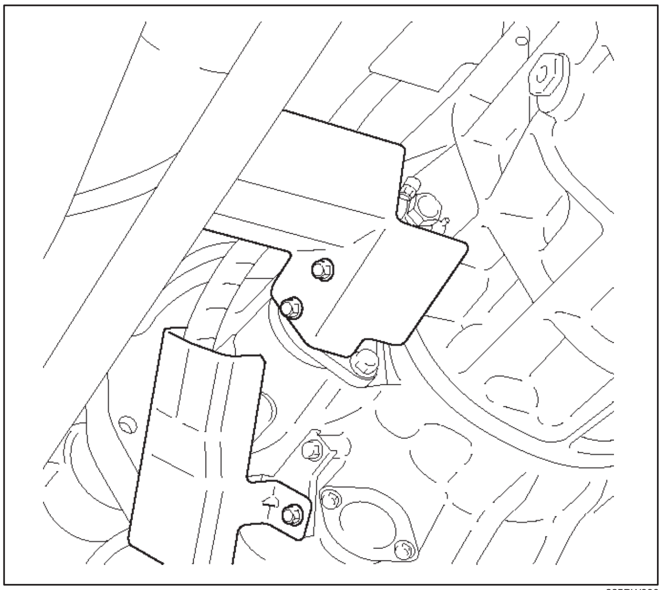
220RS028

14. Remove four fuel pipe bracket.



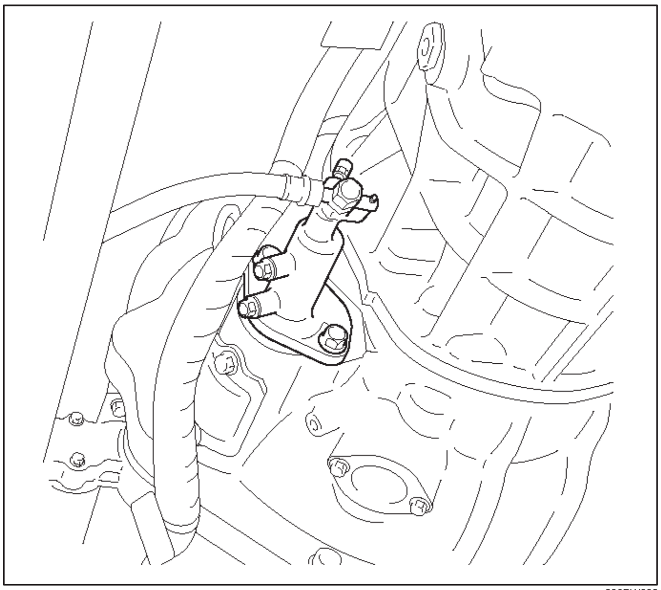
141RW024

15. Remove the heat protector.



225RW006

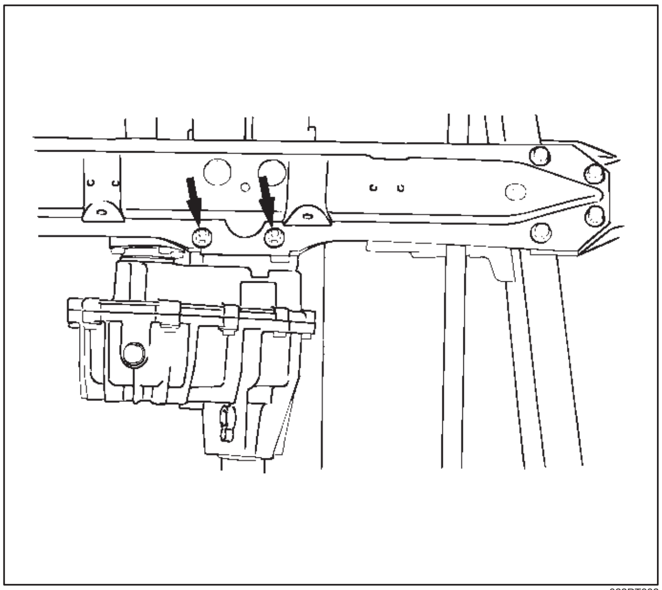
16. Remove the slave cylinder.



206RW002

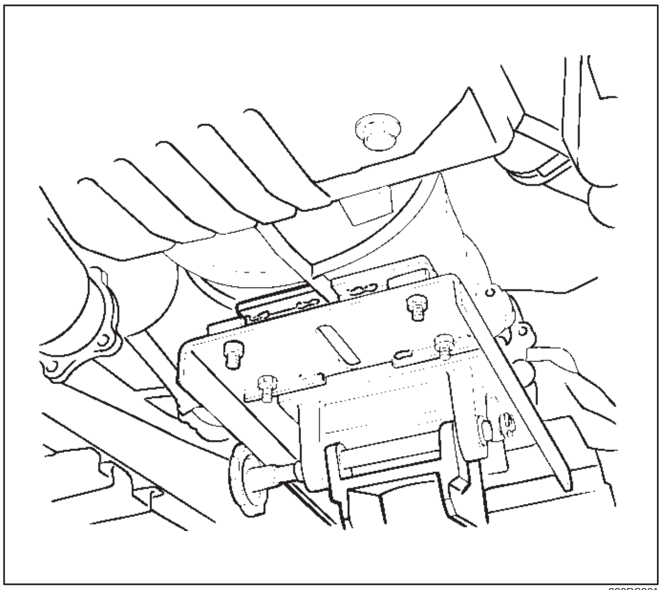
- Remove the dust cover from the clutch housing.

17. Support the transfer case with a jack.
18. Remove two engine rear mount nuts.



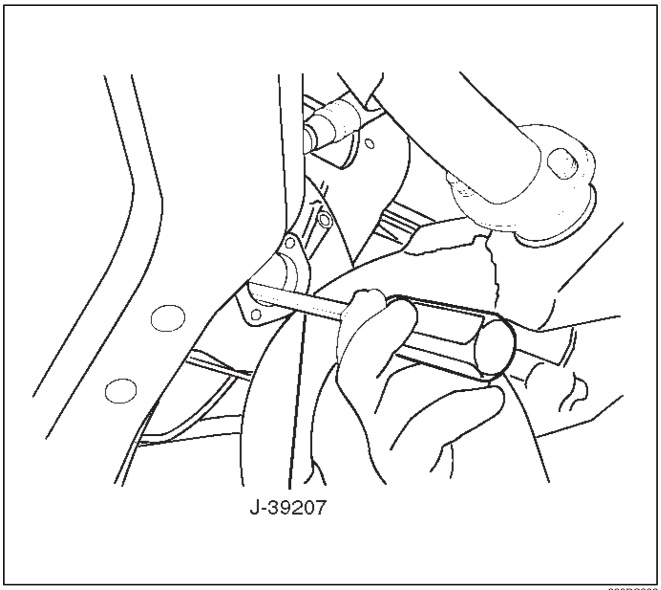
022RT002

19. Remove third crossmember.
20. Disconnect four oxygen sensor connectors from the transmission harness.
21. Remove the right front exhaust pipe and catalytic converter assembly.
22. Remove the harness heat protector.
23. Remove two engine rear mount bolts.
24. Remove the rear mount from the transmission.
25. Remove three flywheel under cover.
26. Support the transmission with a transmission jack and then remove jack from the transfer case side.



220RS001

27. Use the clutch release bearing remover J–39207 to disconnect the clutch release bearing from the clutch pressure plate.

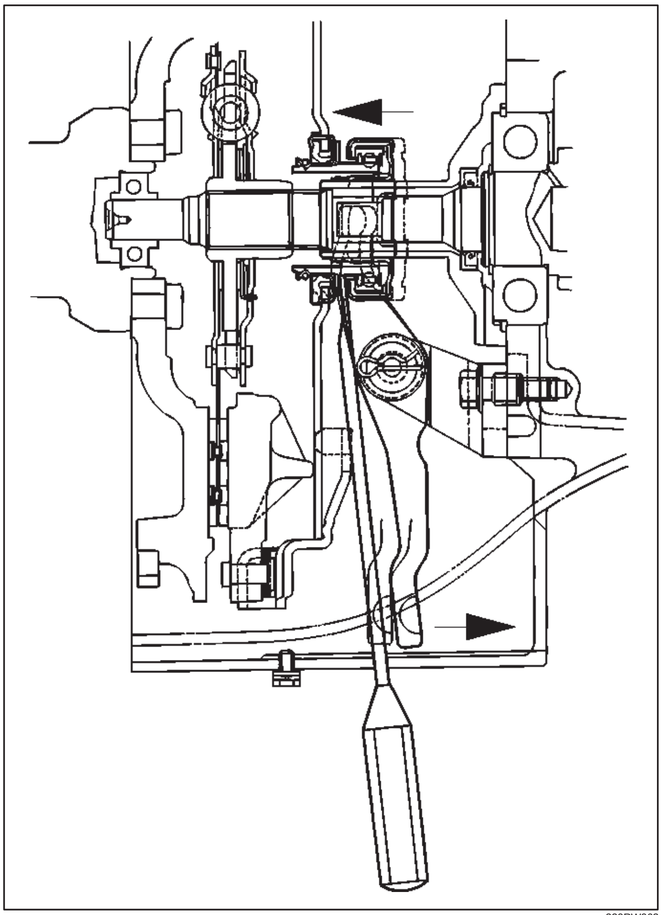


220RS002

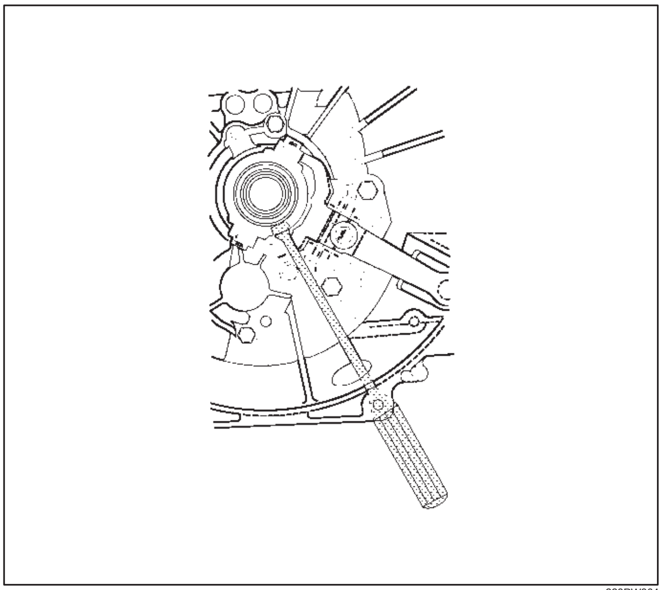
Release bearing disconnection

1. Pull the shift fork toward the transmission to press the clutch release bearing against the clutch.
2. Insert the clutch release bearing remover between the wedge collar and the release bearing.
3. Turn the remover to separate the release bearing.

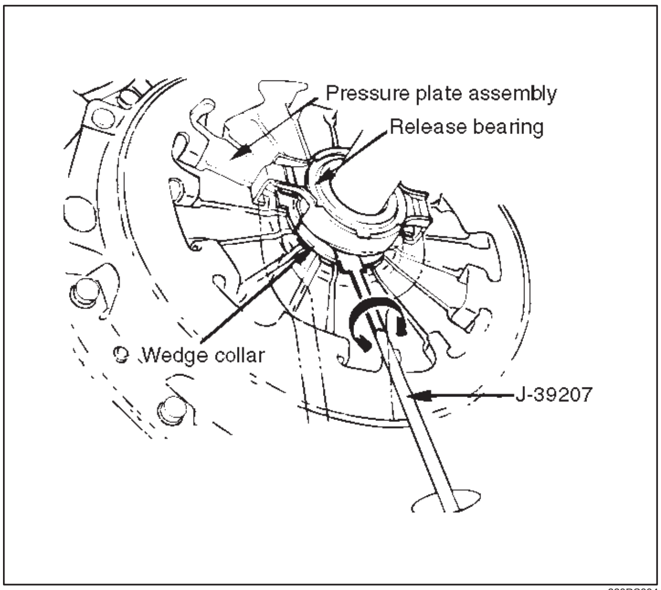
NOTE: Be sure not to insert the remover between the wedge collar and the clutch.



220RW063



220RW064



220RS004

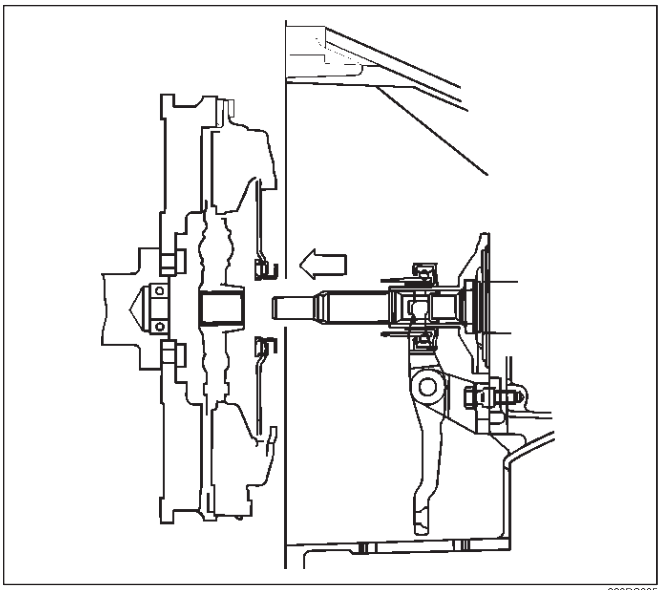
28. Remove the transmission retaining nuts and bolts.
29. Remove the transmission assembly with transfer case from the vehicle.

NOTE: Remove the transfer case from the transmission assembly if the transmission disassembly required.

Refer to Transfer Case in Drive Line/Axle section.

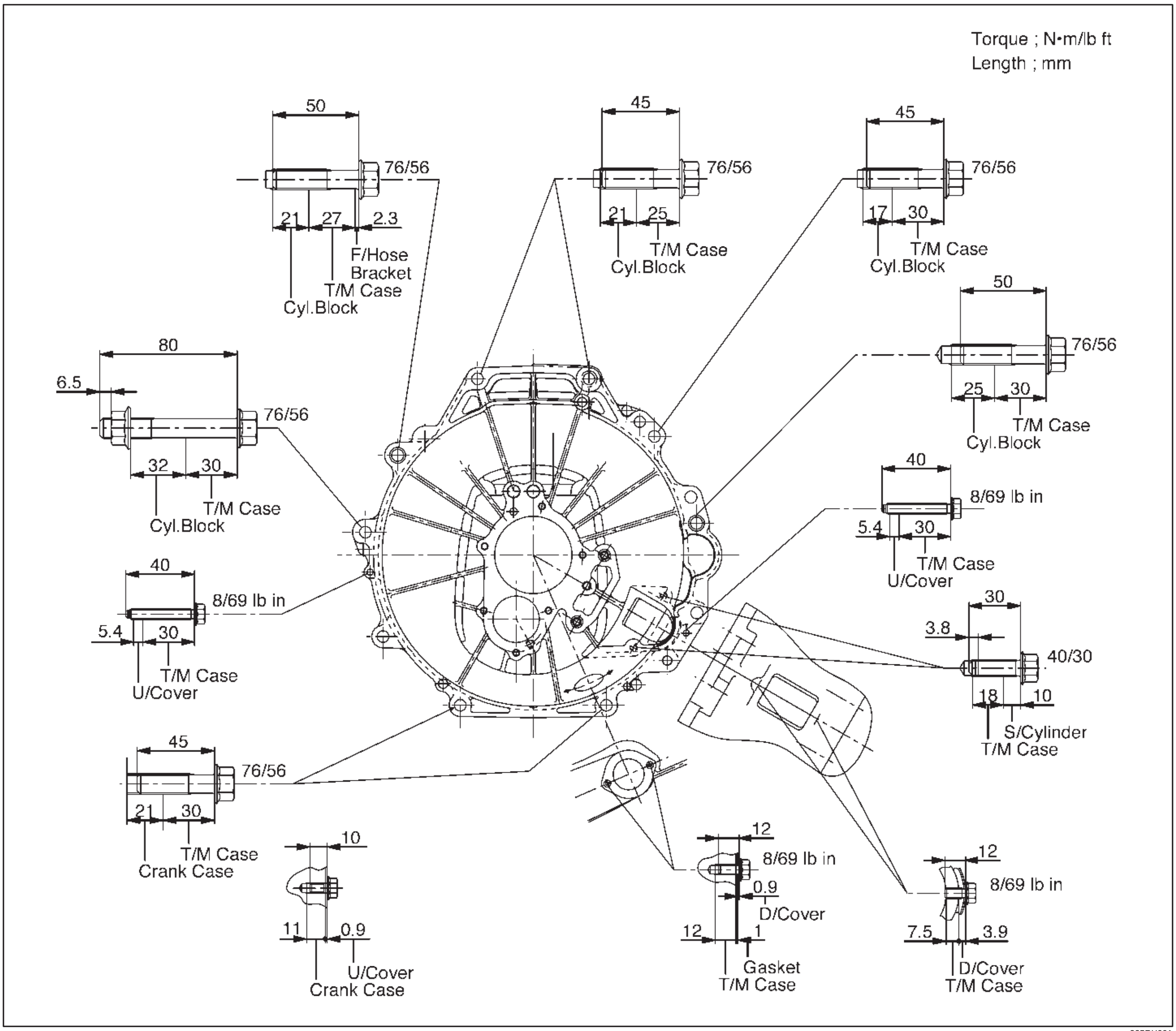
Installation

1. Apply a thin coat of molybdenum disulfide grease to the top gear shaft spline.
2. Slowly operate the transmission jack until the front of transmission is aligned with the rear of the engine.
   The slope of the engine and the transmission must be the same.
3. Align the top gear shaft spline with the clutch driven plate spline.



220RS005

4. Install the transmission to the engine.
   Tighten the transmission retaining nuts and bolts.

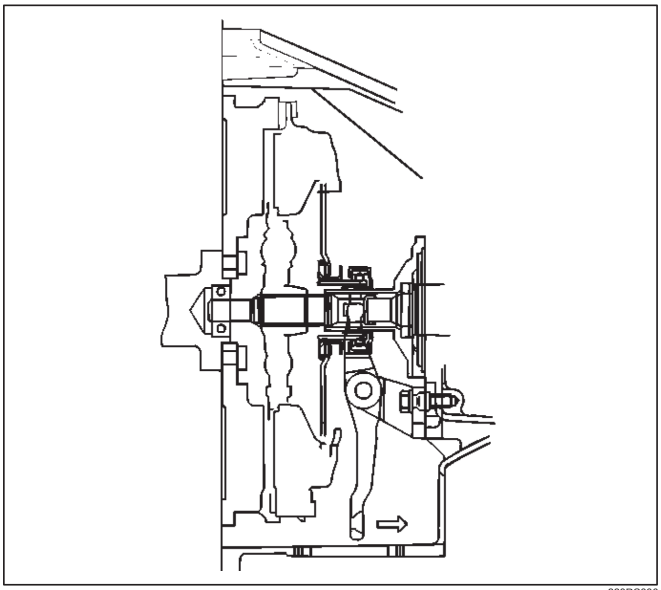


225RX001

5. Apply a force of about 113 N (26 lb) to the tip of the shift fork in the direction of the transmission to engage the clutch pressure plate and release bearing.

NOTE: A clicking sound is heard when the release bearing and the tip of the diaphragm spring engage each other.

Check to see if they are securely engaged by pushing the tip of the shift fork toward the engine while applying a force of about 25 N (5.5 lb). If the shift fork will not move, then they are securely engaged.



220RS006

6. Install three flywheel under cover.

7. Install the engine rear mount to the transmission case and tighten the fixing bolts specified torque.

Torque: 41 N·m (30 lb ft)

8. Install the harness heat protector.
9. Install the right front exhaust pipes and catalytic converter assembly.

Torque

Exh. pipe to exh. manifold: 67 N·m (49 lb ft)

Exh. pipe flange bolt: 43 N·m (32 lb ft)

10. Connect four oxygen sensor connectors to the transmission harness.
11. Install the third crossmember to the frame and tighten the fixing bolts specified torque.

Torque: 50 N·m (37 lb ft)

12. Tighten the engine rear mount nuts specified torque.

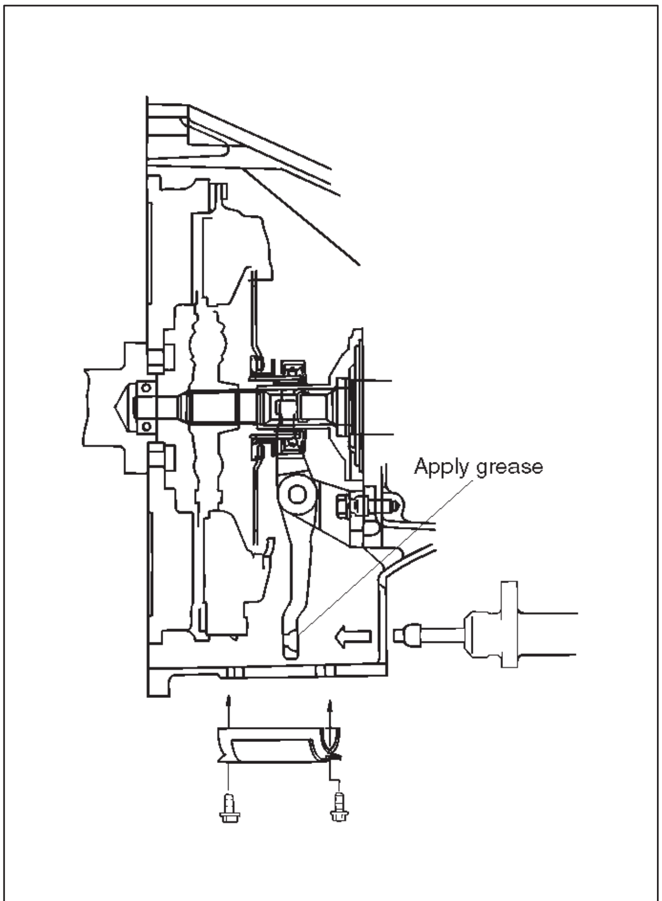
Torque: 50 N·m (37 lb ft)

13. Remove the transmission jack.
14. Apply the grease to top hole portion of the shift fork.
15. Install the slave cylinder and tighten the fixing bolts specified torque.

Torque: 43 N·m (32 lb ft)

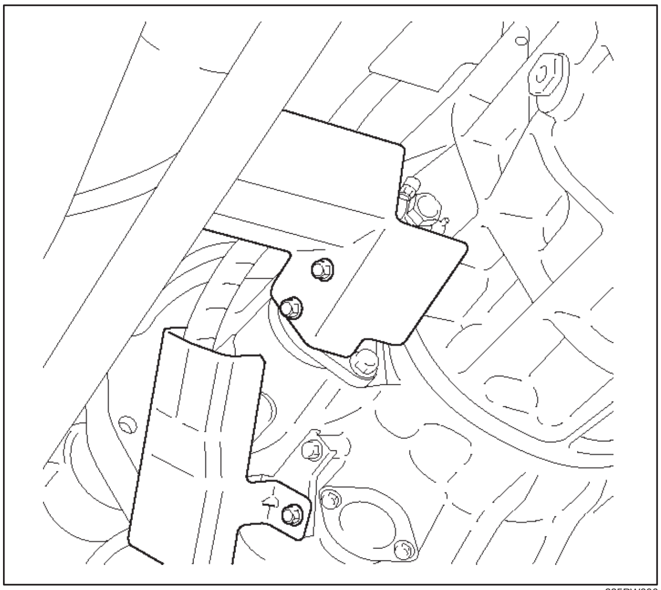
Install the clutch dust cover to the clutch housing and tighten the fixing bolts specified torque.

Torque: 8 N·m (69 lb in)



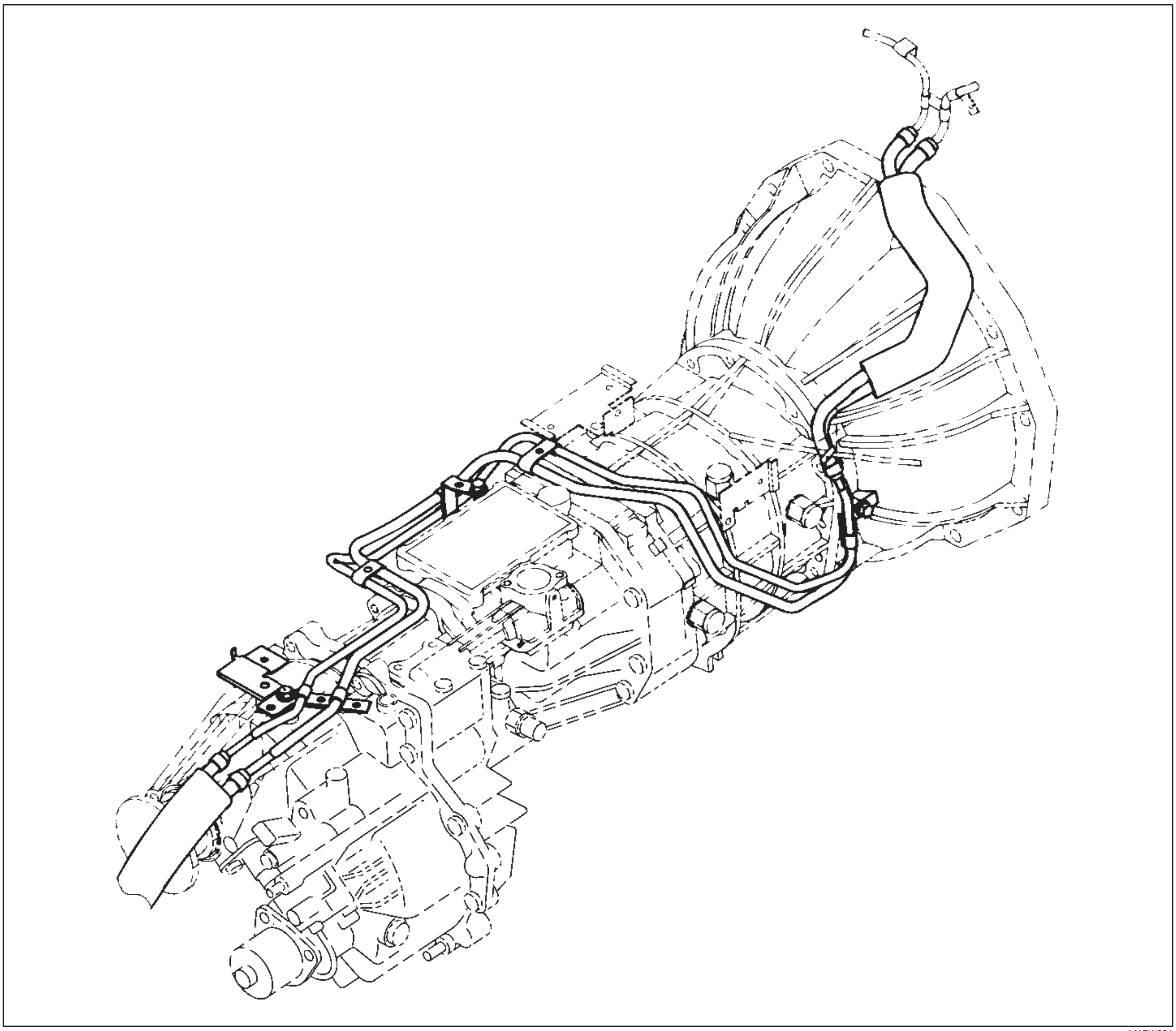
220RS007

16. Install the slave cylinder heat protector to the slave cylinder.
17. Install harness heat protector.



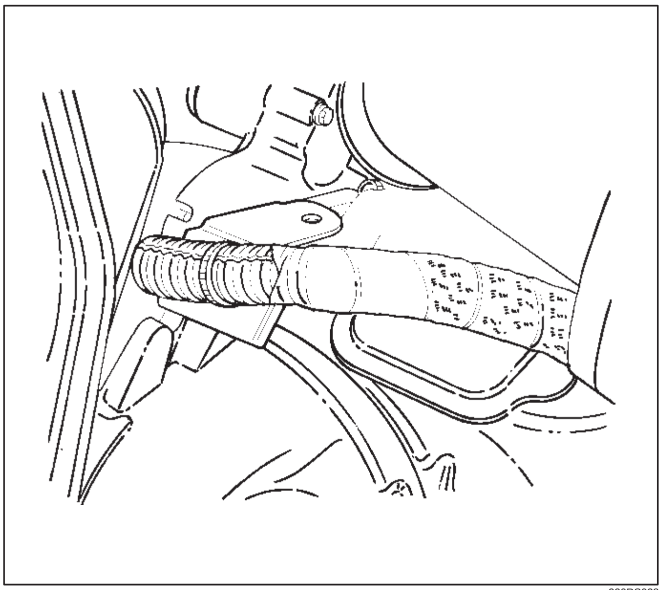
225RW006

18. Install four fuel pipe bracket.



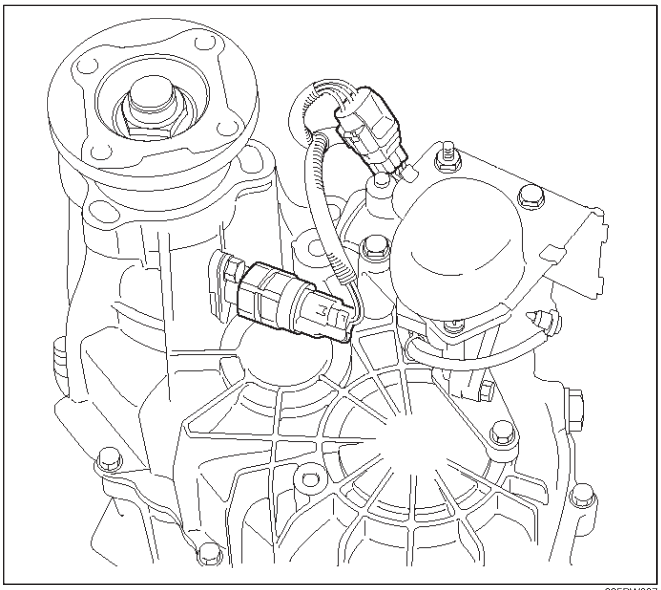
141RW024

19. Install bracket and two transmission harness clamps to the transmission case.



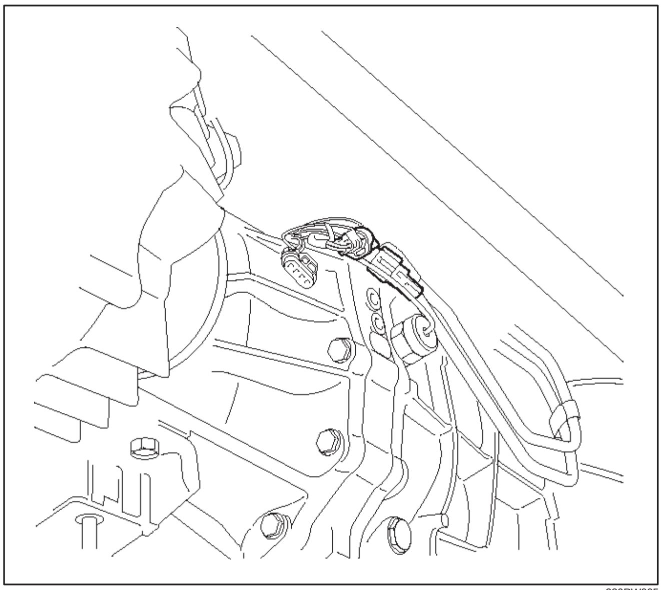
220RS028

20. Connect the speedometer sensor and 2WD–4WD actuator harness connector.



225RW007

21. Connect the backup lamp switch, 4WD indicator switch, and 1-2 indicator switch harness connectors.



230RW005

22. Install the front propeller shaft and tighten the fixing bolts and nuts specified torque.

Torque: 63 N·m (46 lb ft)

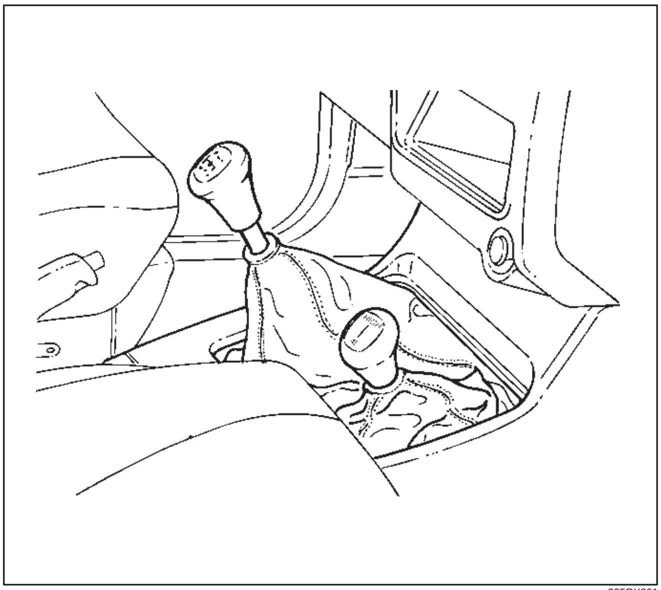
23. Install the rear propeller shaft and tighten the fixing bolts and nuts specified torque.

Torque: 63 N·m (46 lb ft)

24. Install transfer protector and tighten the fixing bolts specified torque.

Torque: 37 N·m (27 lb ft)

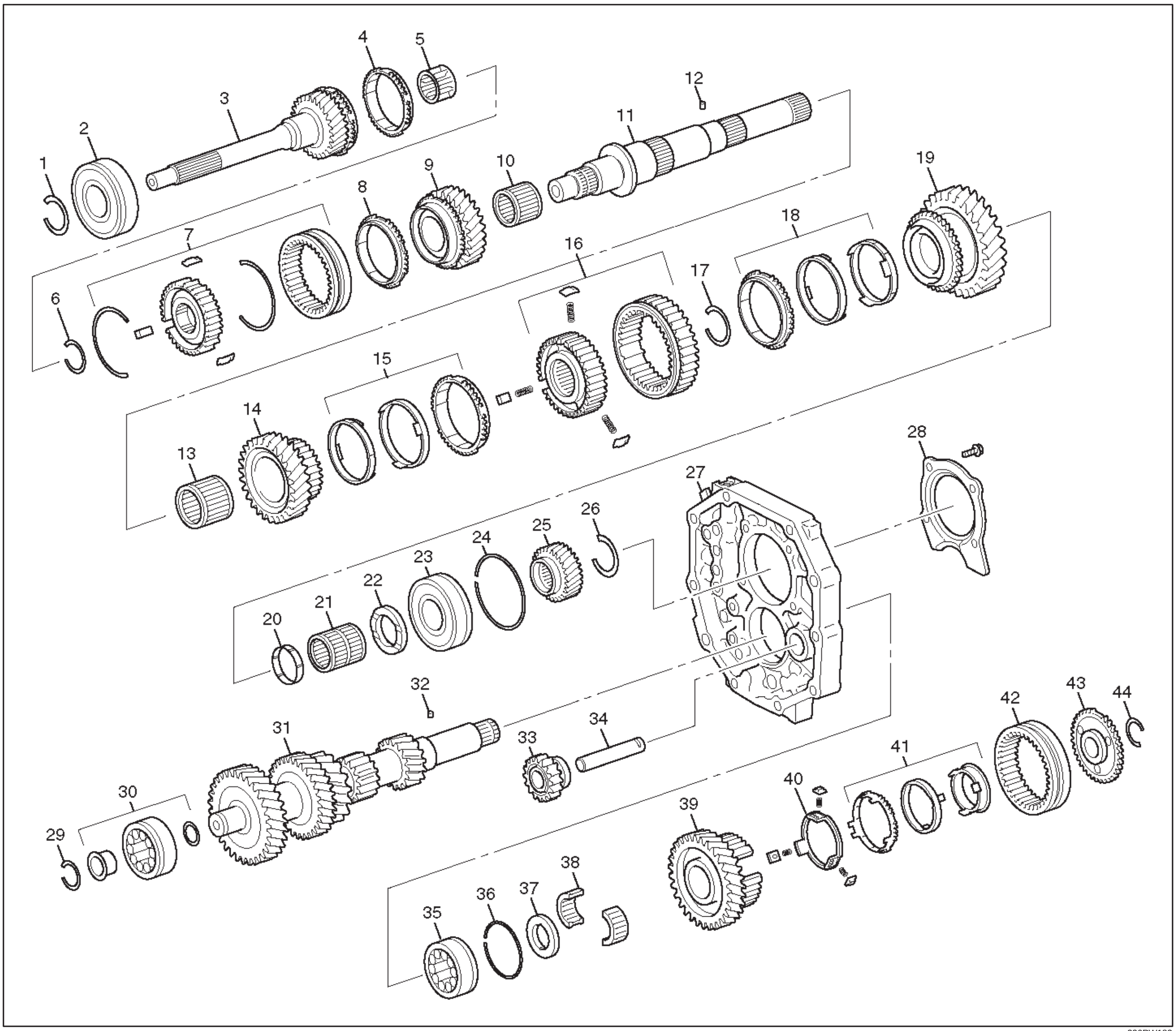
25. Install the transmission control lever and transfer control lever.
26. Install the grommet assembly.
27. Install the front console assembly.
28. Install the gear control lever knob.



235RX001

29. Connect battery ground cable.
30. Install engine hood.

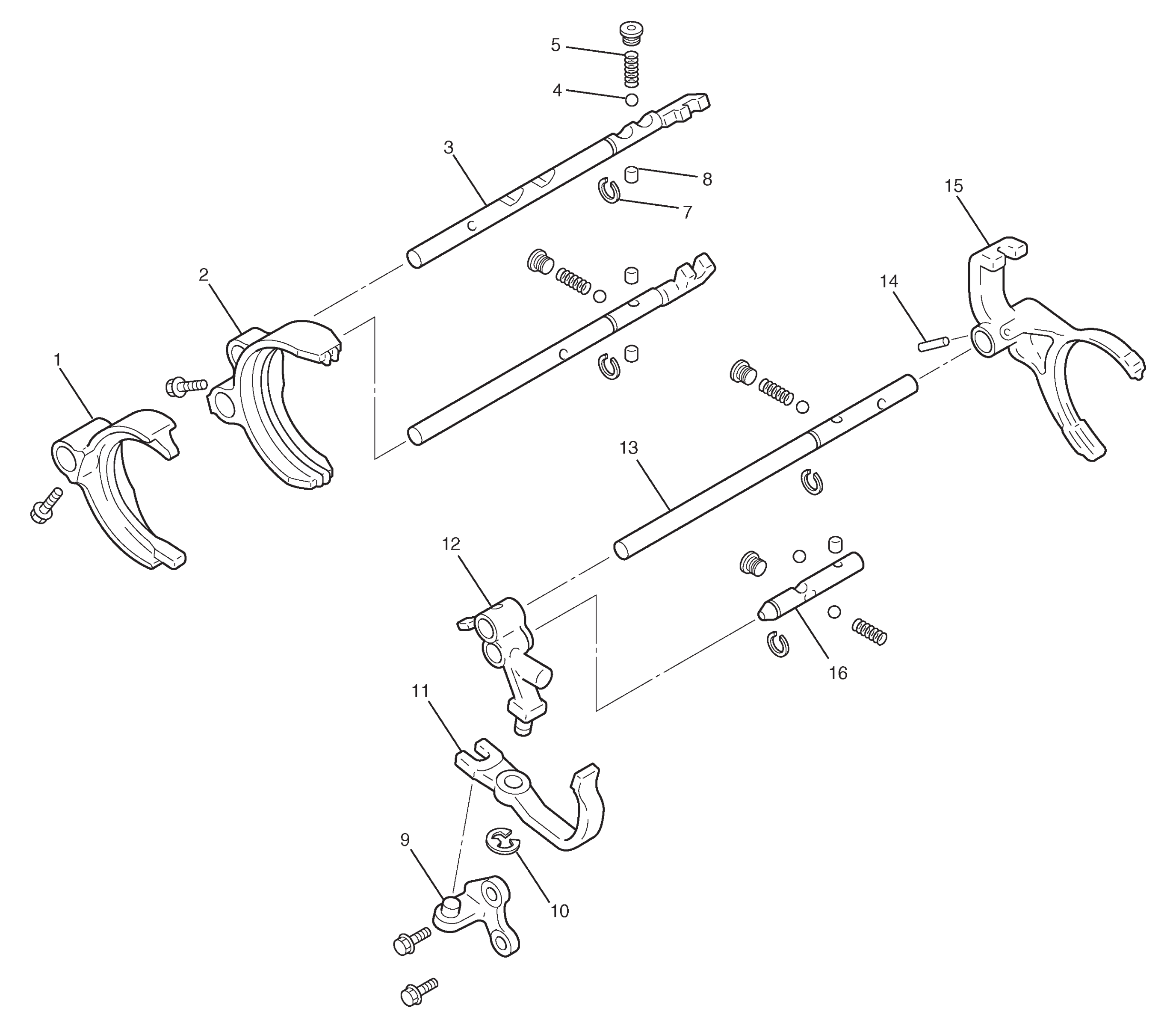
Disassembled View



Legend

(1) Snap Ring
(2) Bearing
(3) Top Gear Shaft
(4) Block Ring
(5) Roller Bearing
(6) Snap Ring
(7) Clutch Hub No.2 Assembly
(8) 3rd Block Ring
(9) 3rd Gear
(10) 3rd Gear Needle Roller Bearing
(11) Mainshaft
(12) Thrust Washer Pin
(13) 2nd Gear Needle Roller Bearing
(14) 2nd Gear
(15) Synchronizer Assembly
(16) Clutch Hub No.1 Assembly
(17) Snap Ring
(18) Synchronizer Assembly
(19) 1st Gear
(20) 1st Gear Bearing Spacer
(21) 1st Gear Needle Roller Bearing
(22) 1st Gear Thrust Washer
(23) Mainshaft Bearing
(24) Snap Ring
(25) 5th Gear
(26) Snap Ring
(27) Intermediate Plate
(28) Bearing Retainer
(29) Snap Ring
(30) Front Bearing Assembly
(31) Counter Gear Shaft
(32) Thrust Washer Pin
(33) Reverse Idle Gear
(34) Reverse Idle Gear Shaft
(35) Counter Gear Shaft Center Bearing
(36) Snap Ring
(37) Thrust Washer

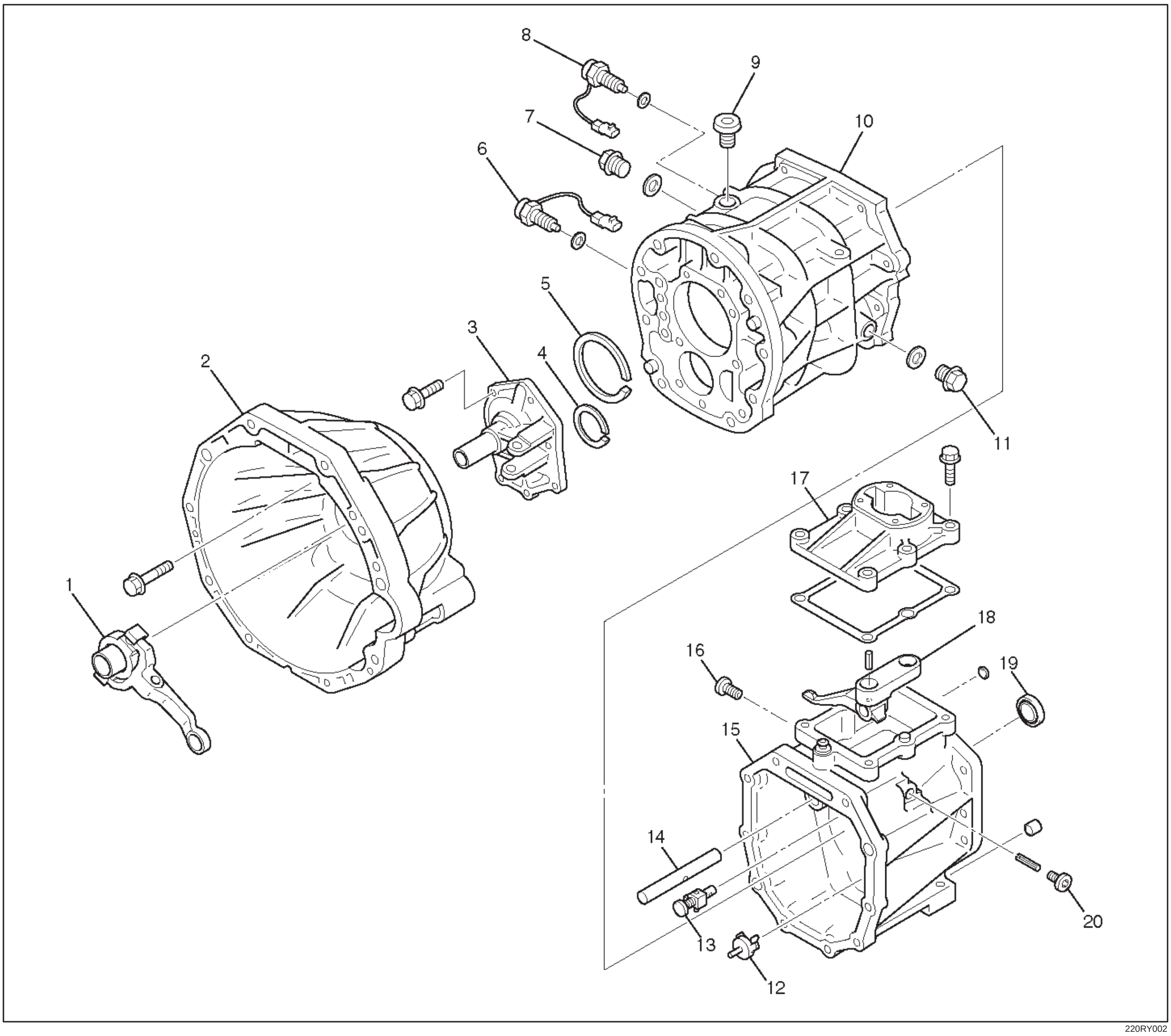
(38) Roller Bearing
(39) Counter 5th Gear
(40) Reverse Block Ring
(41) Synchronizer Assembly
(42) Hub Sleeve No.3
(43) 5th Gear Spline Piece
(44) Snap Ring



226RW181

Legend

(1) 3rd-4th Shift Arm
(2) 1st-2nd Shift Arm
(3) 3rd-4th Shift Rod
(4) Ball
(5) Spring
(6) 1st-2nd Shift Rod
(7) Snap Ring
(8) Interlock Pin
(9) Reverse Shift Arm Bracket
(10) E–Ring
(11) Reverse Shift Arm No.2
(12) Reverse Shift Arm No.1
(13) 5th Reverse Shift Rod
(14) Spring Pin
(15) 5th Shift Arm
(16) Reverse Shift Rod

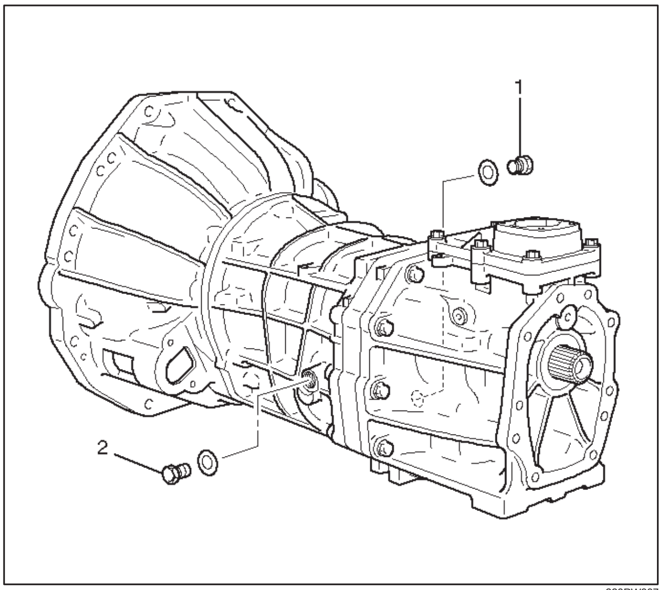


Legend

(1) Release Bearing and Shift Fork
(2) Clutch Housing
(3) Front Cover
(4) Snap Ring
(5) Snap Ring
(6) 1st and 2nd Switch
(7) Drain Plug
(8) Backup Light Switch
(9) Plug
(10) Transmission Case
(11) Filler Plug
(12) Oil Receiver Pipe
(13) Reverse Restrict Pin
(14) Gear Control Rod
(15) Transfer Adapter
(16) Plug
(17) Gear Control Box
(18) Shift Lever Housing
(19) Oil Seal
(20) Plug

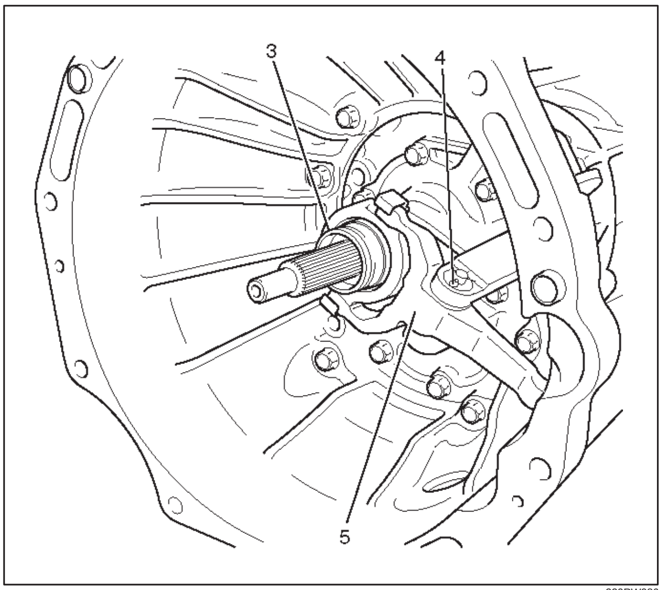
Disassembly

1. Remove the drain plag and filler plug.
   1. Remove the drain plug (1) and gasket.
   2. Remove the filler plug (2) and gasket.



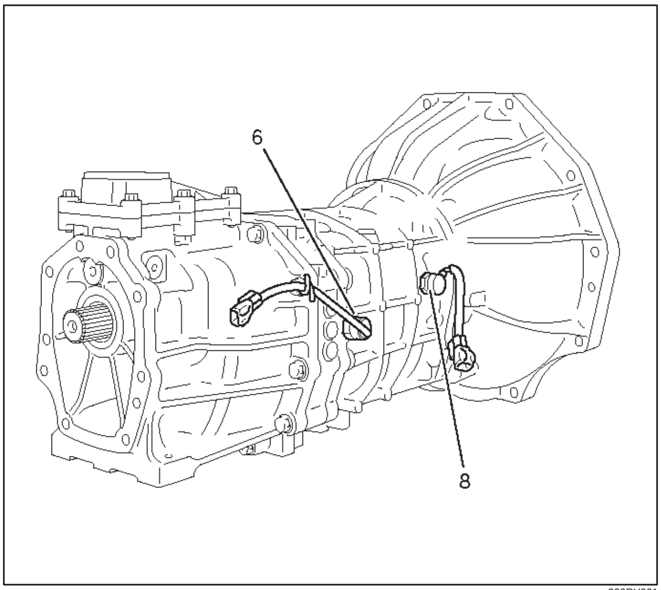
220RW007

2. Remove the clutch release bearing and shift fork.
   1. Remove the clutch release bearing (3) from the front cover.
   2. Remove the split pin (4). Remove the shaft from the under. Remove the shift fork (5).



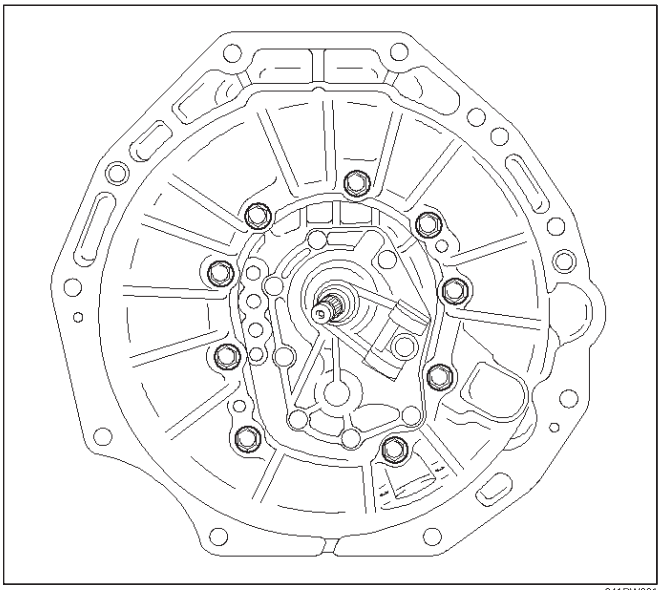
220RW086

3. Remove the switch.
   1. Remove backup light switch (6) and gasket.
   2. Remove 1st and 2nd switch (8) and gasket.



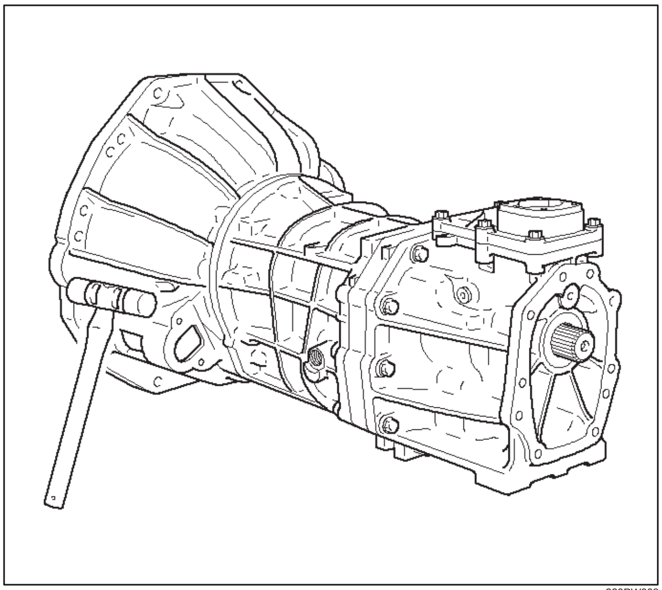
220RY001

4. Remove the clutch housing.
   1. Remove the 9 bolts.



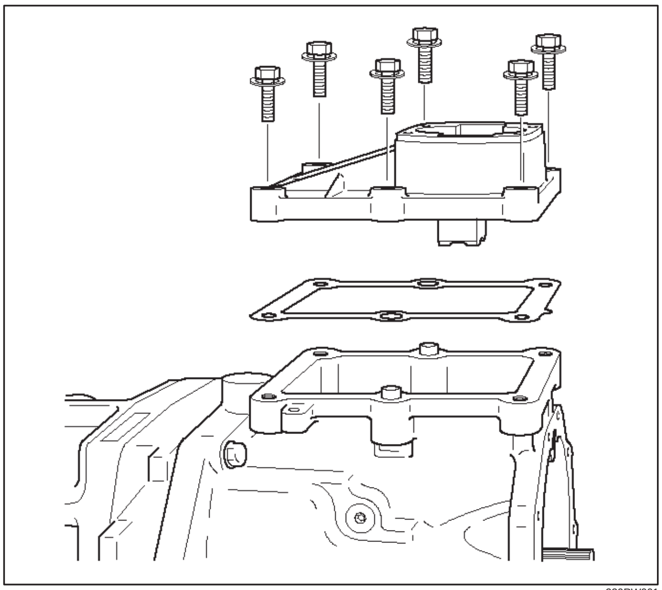
241RW001

2. Using a plastic hammer, carefully tap the clutch housing.



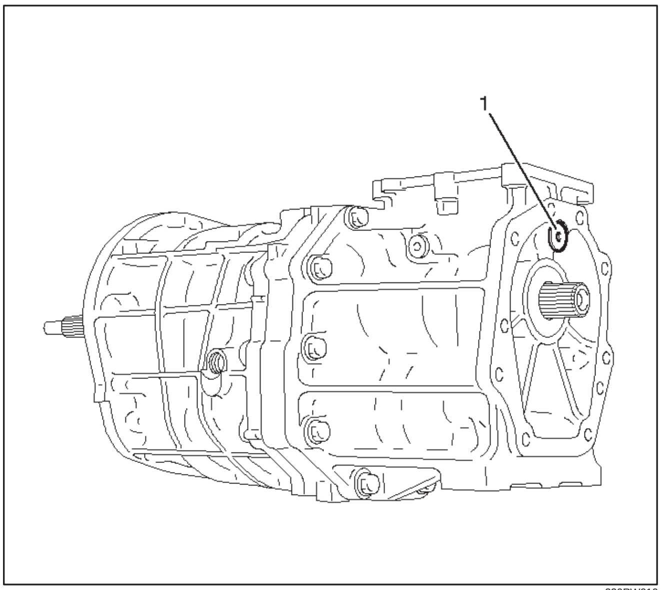
220RW008

5. Remove gear control box and gasket.
   1. Remove the 6 bolts, gear control box and gasket.



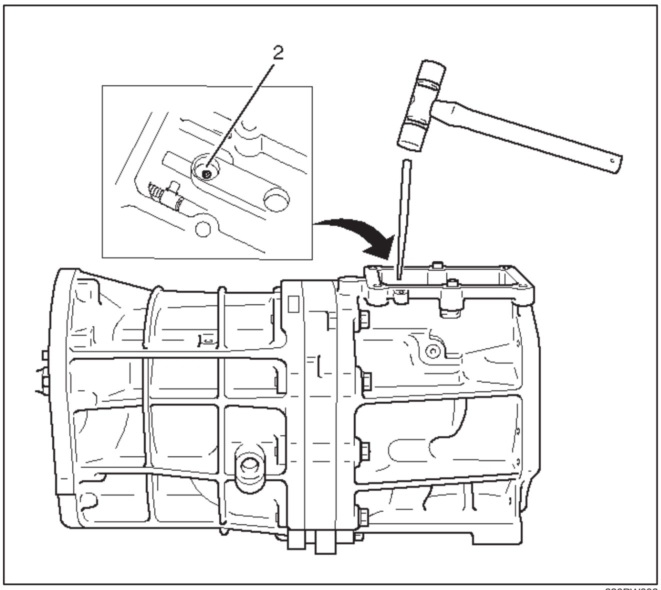
230RW001

6. Remove transfer adapter.
   1. Using a hexagon wrench, remove the plug (1).



220RW010

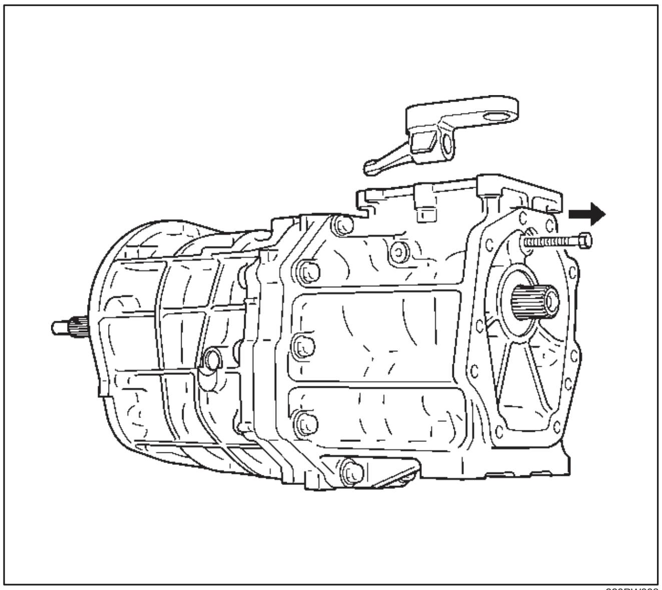
   2. Using a pin punch and hammer, drive out the slotted spring pin (2).



230RW002

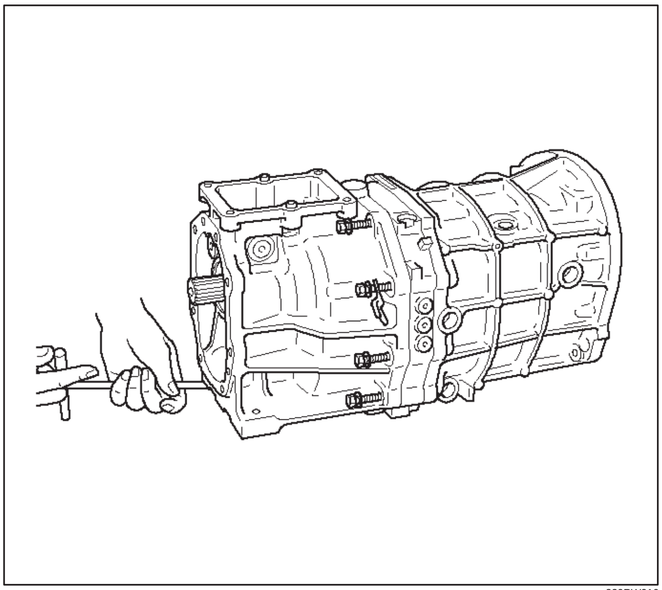
3. Using the M8 × 1.25 bolt, remove the gear control rod and the shift lever housing.

NOTE: Turn the M8 bolt a few times, before remove the gear control rod.



220RW098

4. Remove the 10 bolts and clamp.

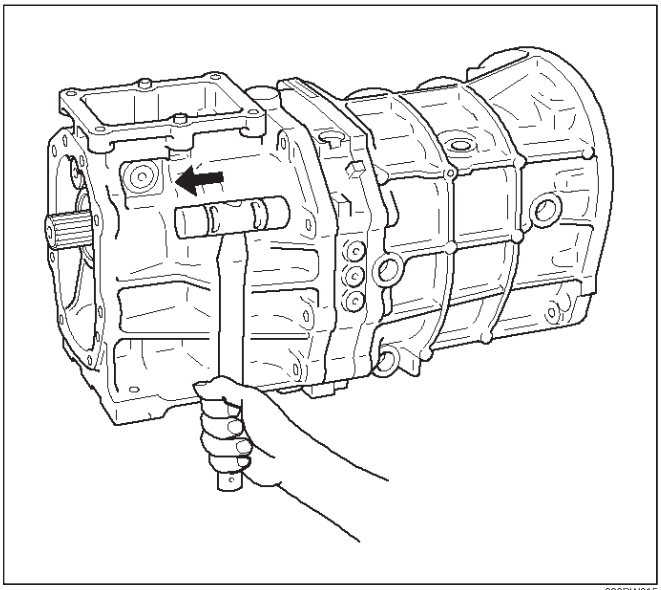


220RW016

5. Using a plastic hammer, tap the transfer adapter.

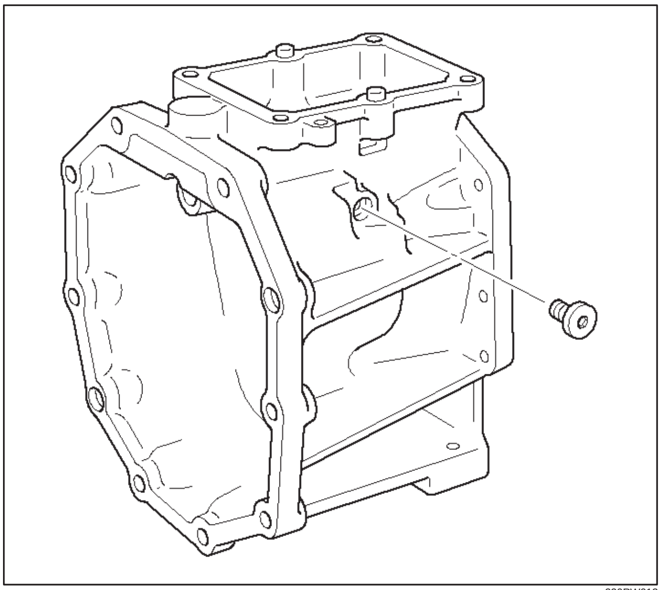
NOTE:

- Be careful not to lose the pin.
- Cover the mainshaft splines with adhesive tape. This will prevent damage to the oil seal lip.



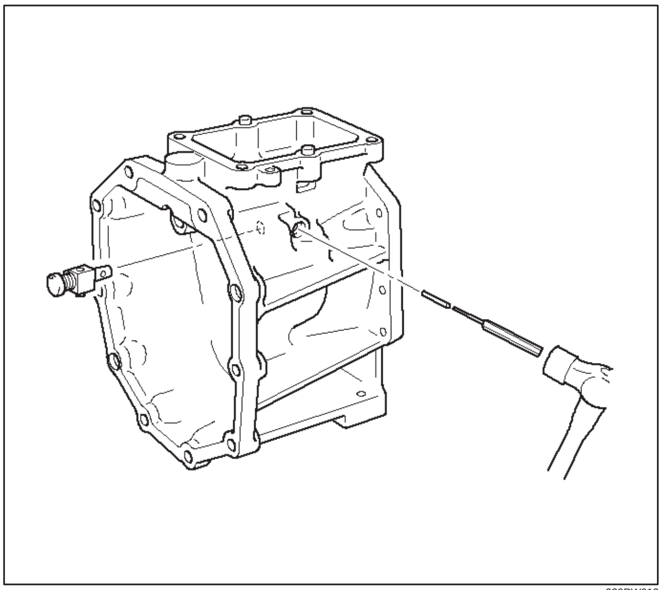
220RW015

7. Disassemble the transfer adapter assembly.
   1. Using a torx socket wrench(T40), remove the plug.



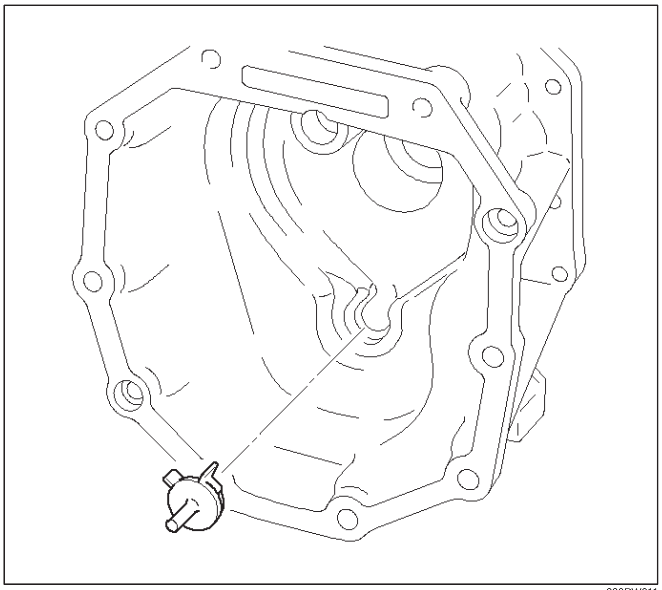
220RW013

2. Using a pin punch and hammer, drive out the slotted spring pin. Remove the reverse restrict pin.



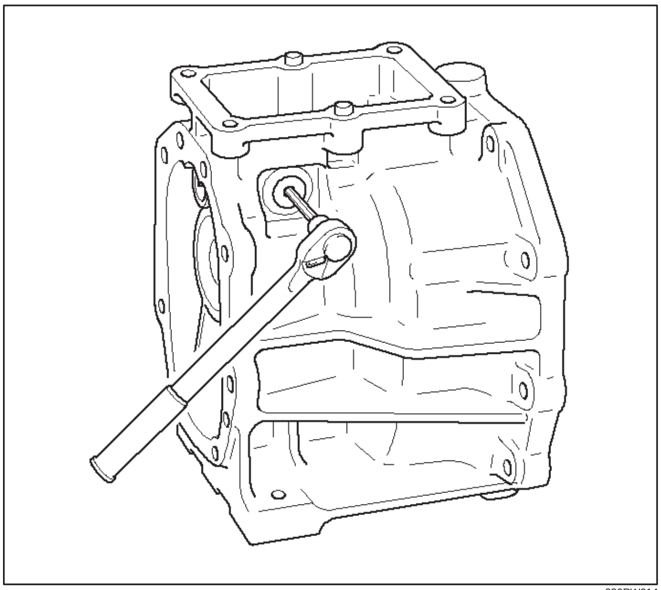
220RW012

3. Remove the oil receiver pipe.



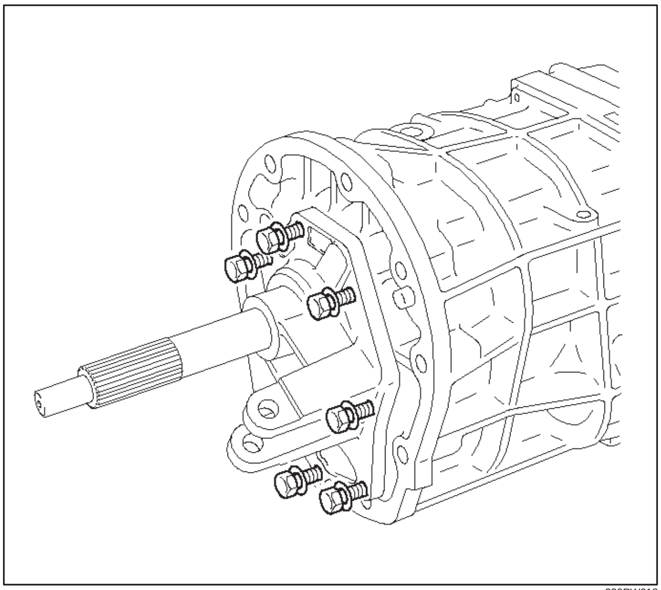
220RW011

4. Remove the oil seal.
5. Using socket hexagon wrench, remove the plug.



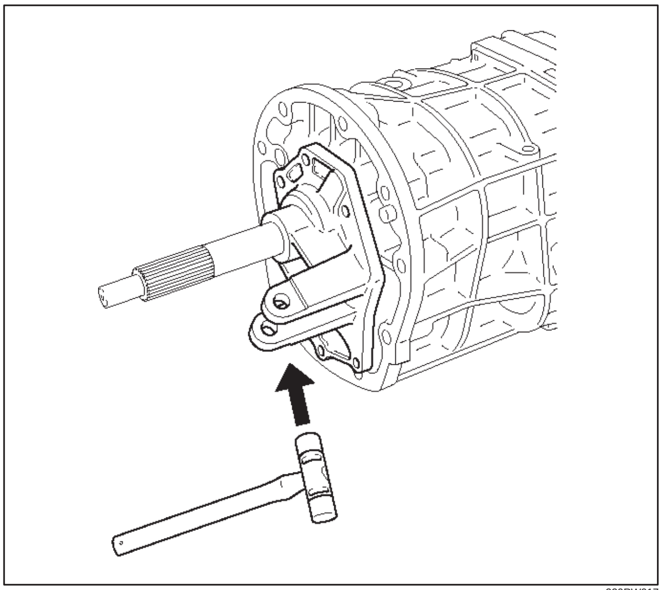
220RW014

8. Remove the front cover.
   1. Remove the 8 bolts.



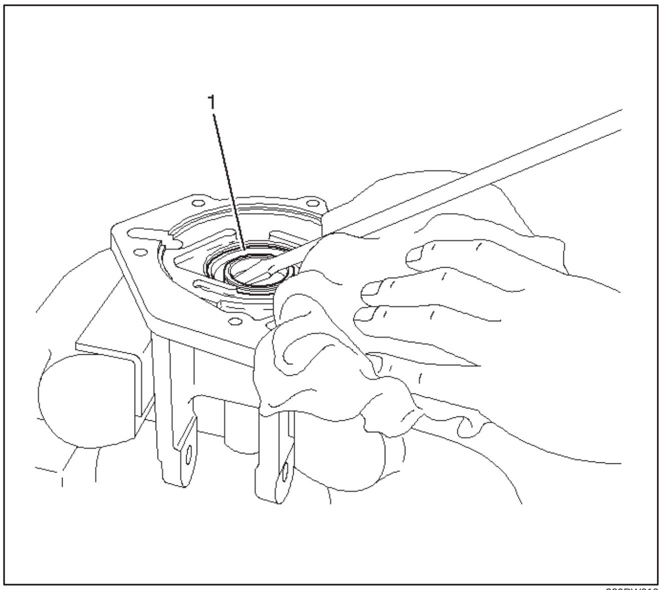
220RW018

2. Using a plastic hammer, carefully tap the front cover.



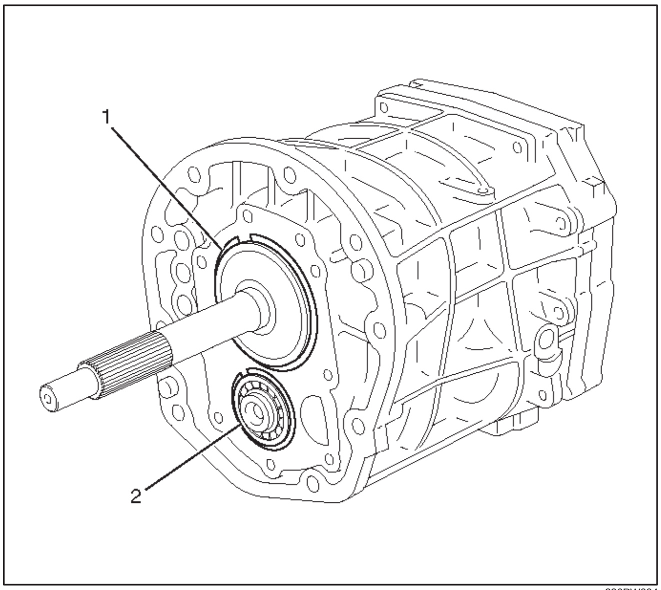
220RW017

9. Remove the front cover oil seal.
   1. Mount the front cover through the aluminum plate in a vise.
   2. Using screwdriver, remove oil seal (1).



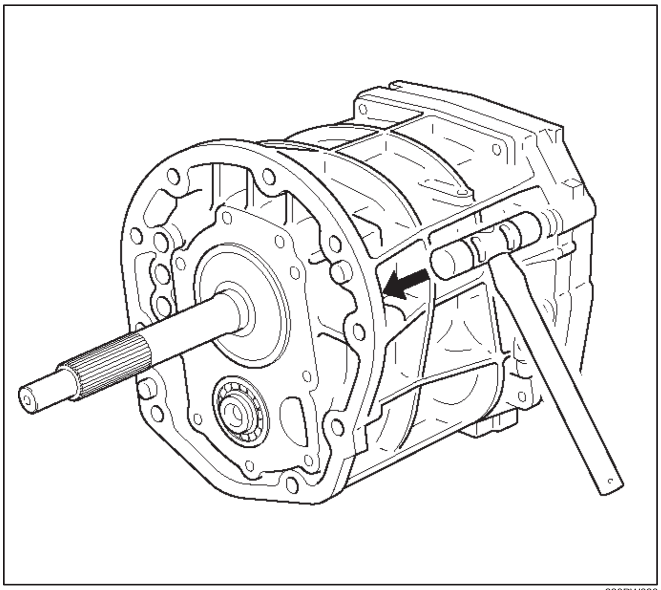
220RW019

10. Remove the transmission case.
    1. Using a snap ring expander, remove the 2 snap rings (1)(2).



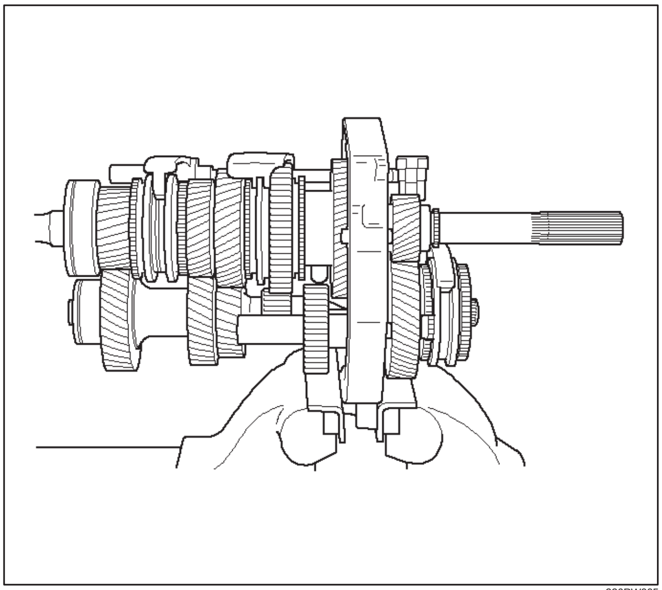
226RW004

   2. Using a plastic hammer, carefully tap the transmission case.



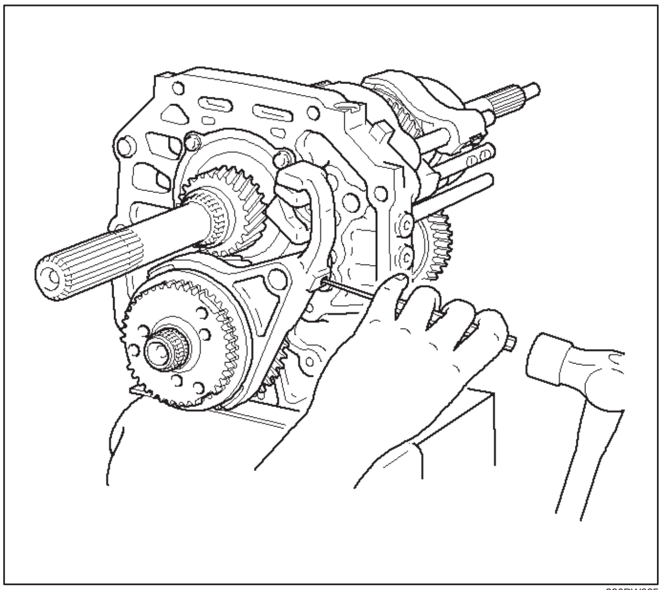
220RW020

11. Mount the intermediate plate.
    1. Mount the intermediate plate through the aluminum plate in a vise.



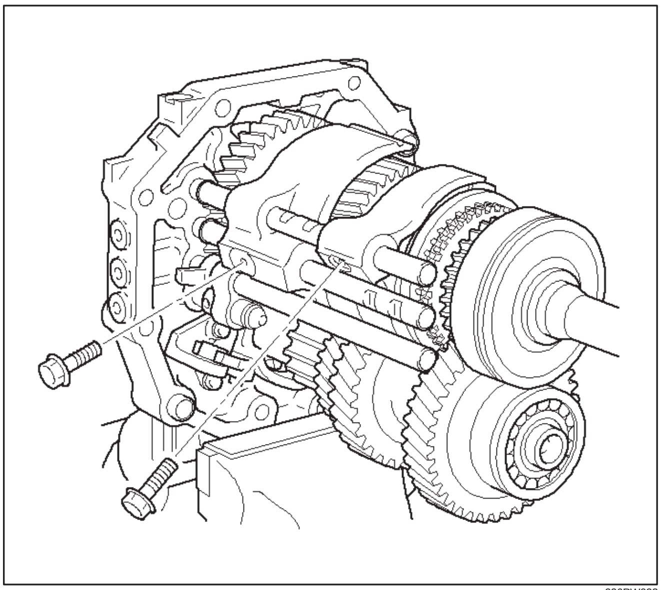
226RW005

12. Remove the slotted spring pin.
    1. Using a pin punch and hammer, drive out the pin from the arm.



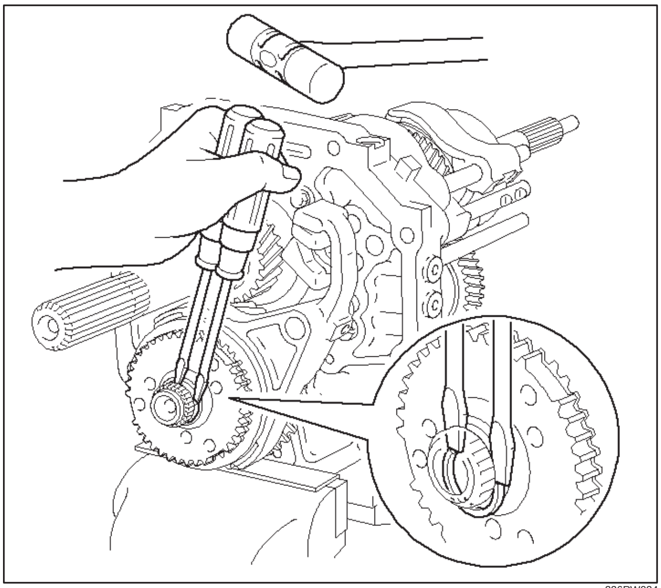
226RW025

13. Remove the shift arm set bolt.
    1. Remove the 2 bolts from the shift arm.



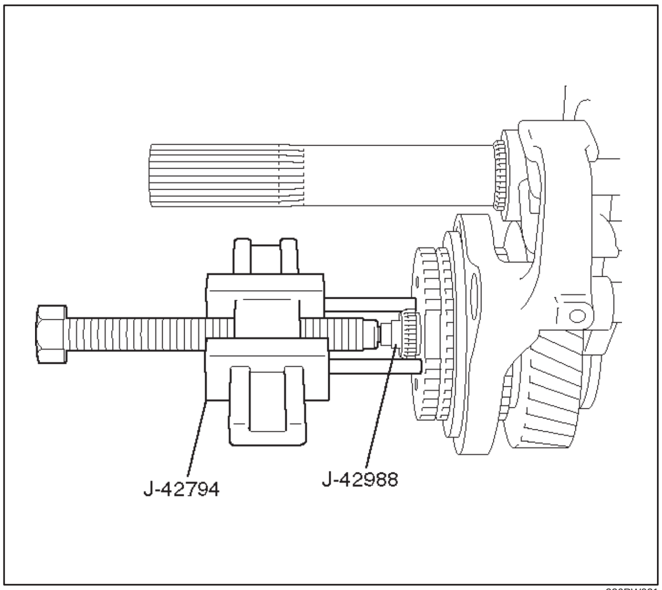
226RW023

14. Remove the counter 5th gear.
    1. Using 2 screwdrivers and hammer, tap out the snap ring.



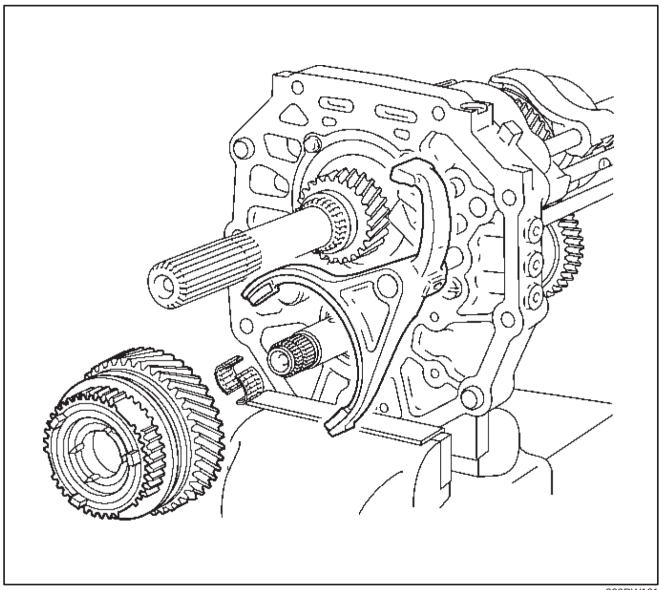
226RW024

2. Using remover J–42794 and attachment J–42988, remove the 5th gear spline piece.



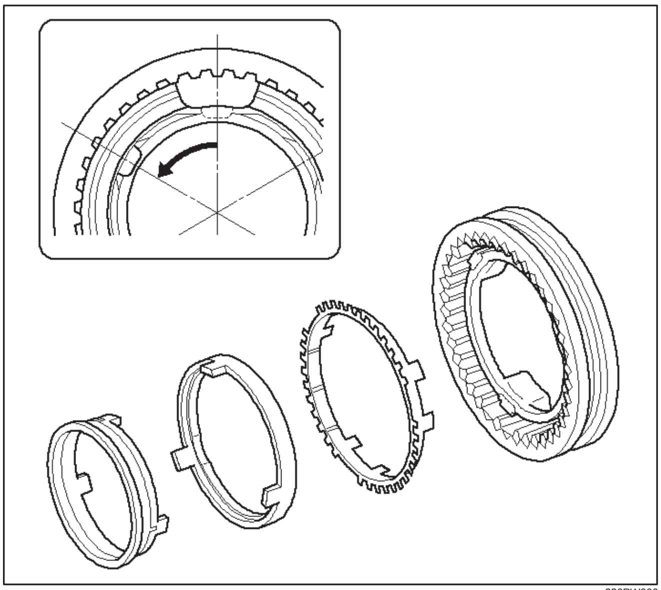
226RW021

3. Remove the hub sleeve No.3, block ring set, counter 5th gear, bearing and 5th shift arm.



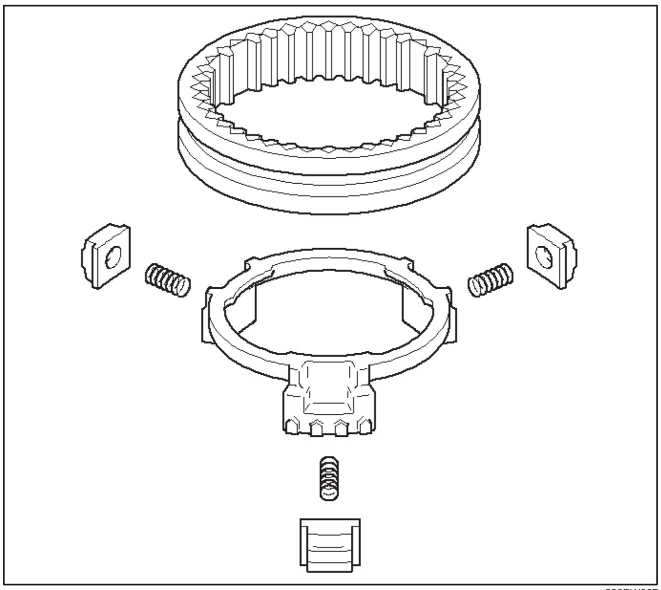
220RW101

4. Remove the synchronizer pull ring, synchronizer cone ring, and synchronizer outer ring from hub sleeve No.3.



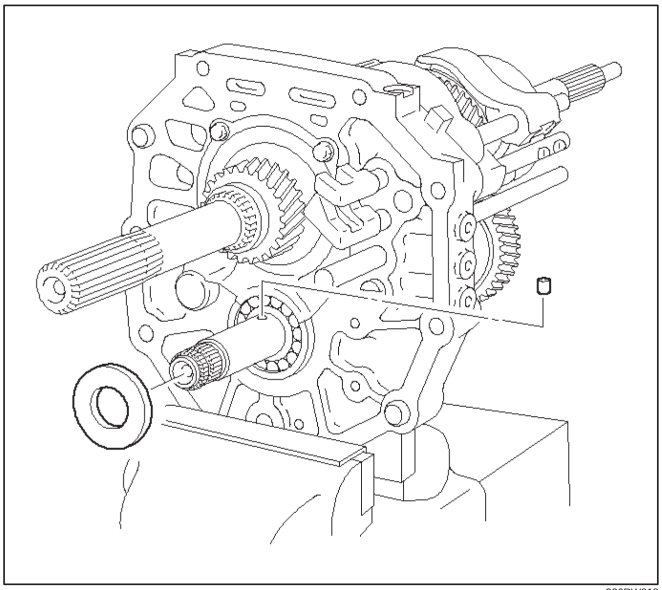
226RW066

5. Remove the reverse block ring from the hub sleeve No.3. Remove the 3 inserts and 3 compression springs.



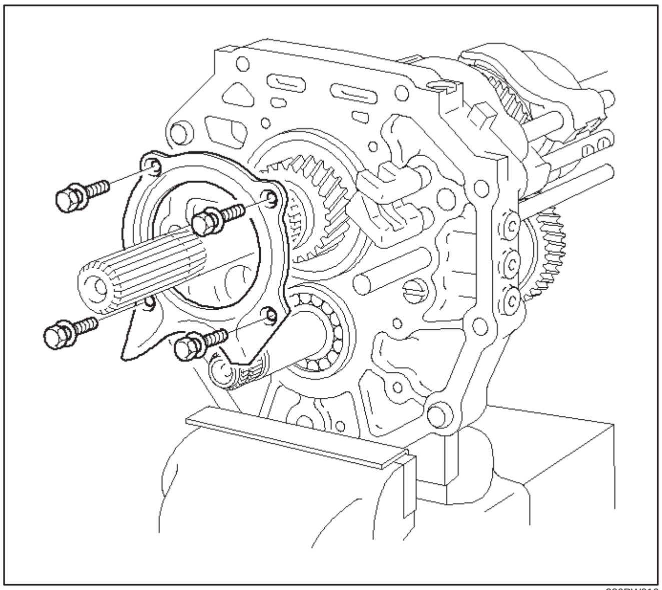
226RW067

15. Remove the thrust washer.
    1. Remove the thrust washer from counter gear shaft.
    2. Remove the thrust washer pin from counter gear shaft.



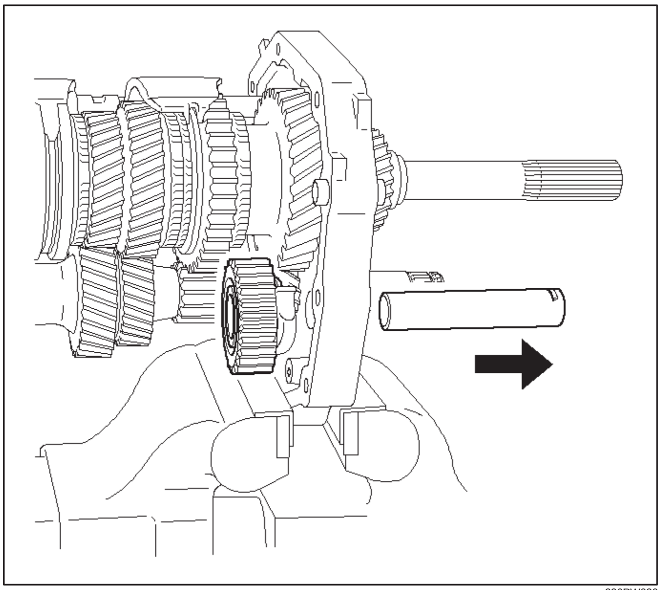
226RW018

16. Remove the bearing plate.
    1. Remove the 4 bolts and bearing retainer.



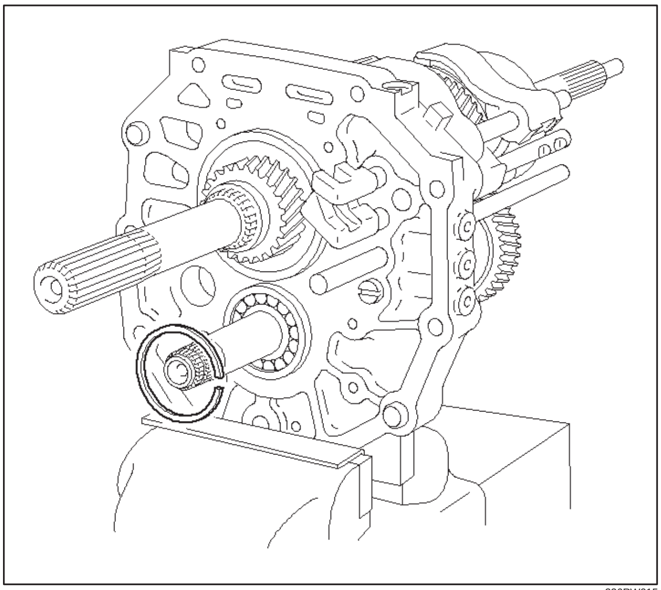
226RW016

17. Remove the reverse idle gear.
    1. Pull out the shaft foward the rear and remove the reverse idle gear.



226RW020

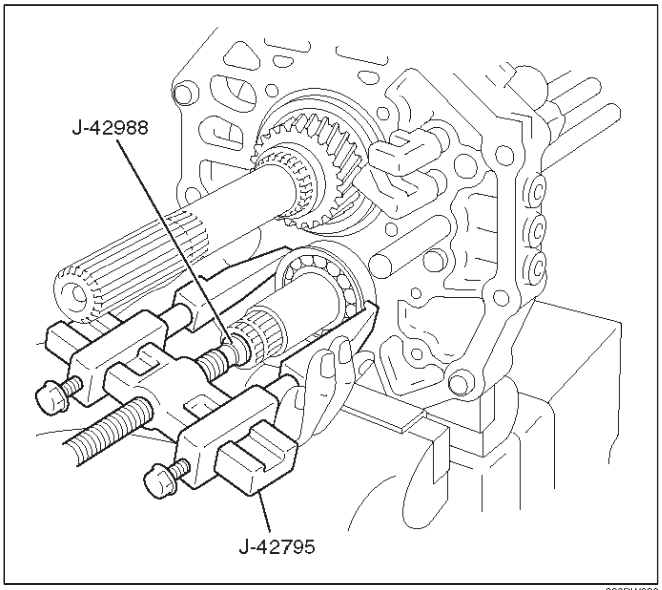
18. Remove the counter gear shaft.
    1. Using snap ring plier, remove counter gear shaft center bearing snap ring.



226RW015

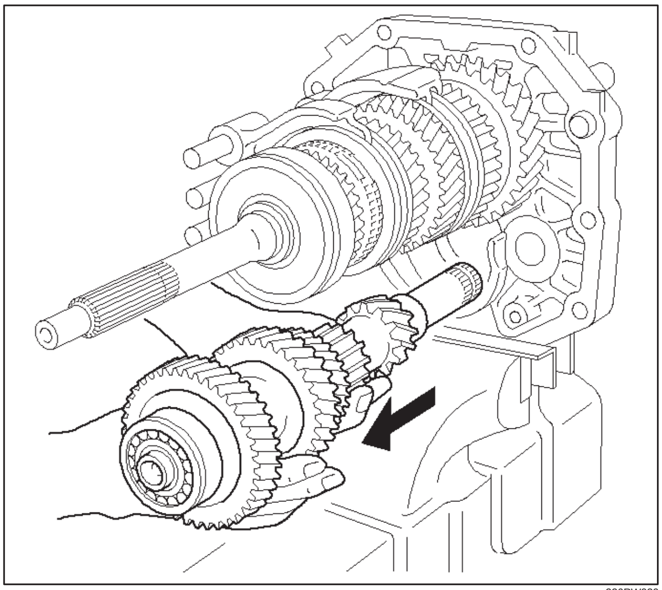
2. Using remover J–42795 and attachment J–42988, remove counter gear shaft center bearing.

NOTE: Be careful not to drop the counter gear, when removing the bearing.



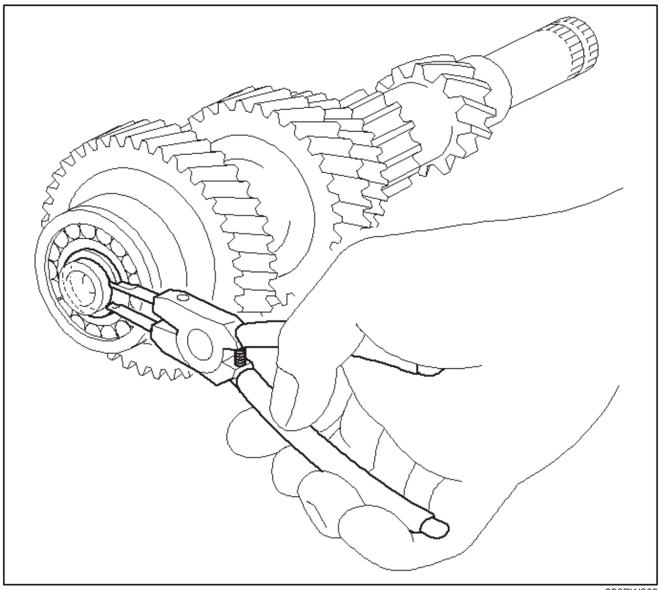
226RW036

3. Remove the counter gear from intermediate plate.



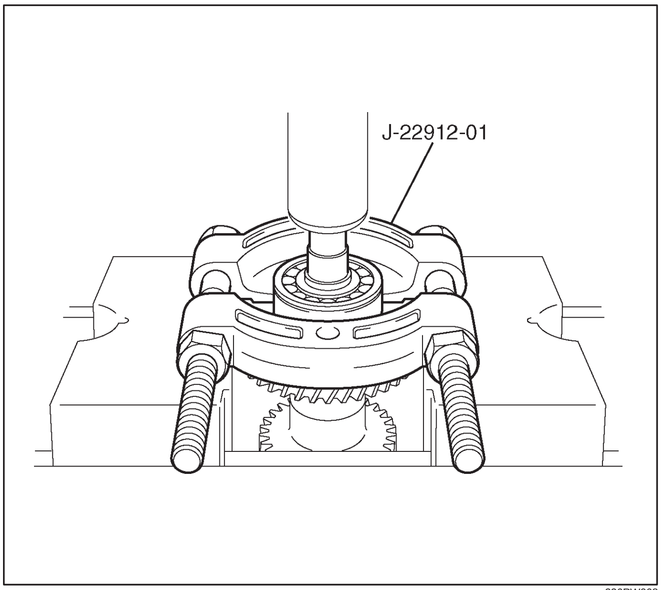
226RW030

19. Disassemble the counter gear shaft assembly.
    1. Using snap ring pliers, remove the counter gear shaft front bearing snap ring.



226RW065

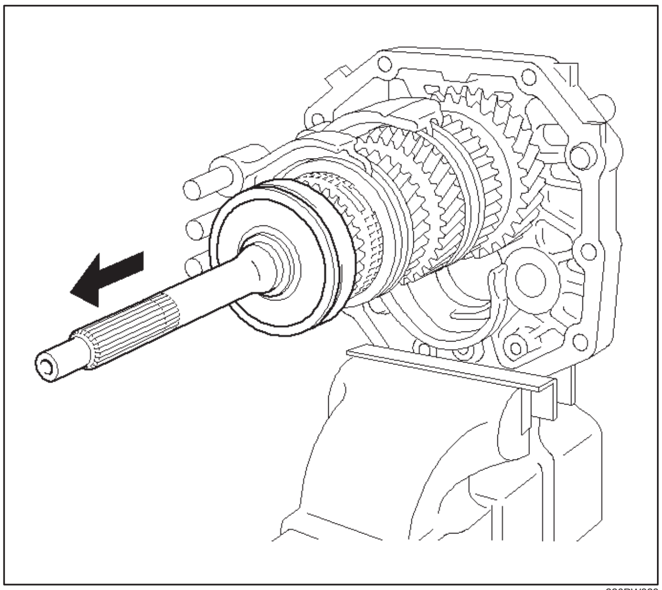
2. Using bearing separator J–22912–01 and a press, remove the bearing.



226RW068

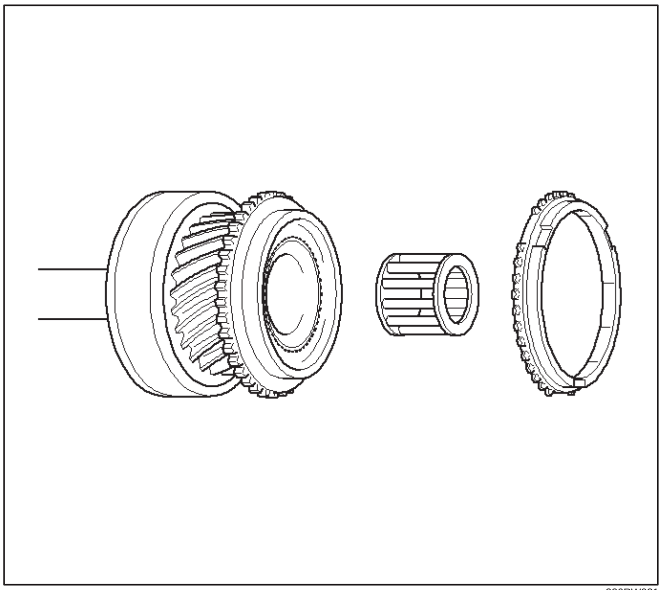
20. Remove the top gear shaft.
    1. Remove the top gear shaft from mainshaft.

NOTE: Don’t fall needle roller bearing.



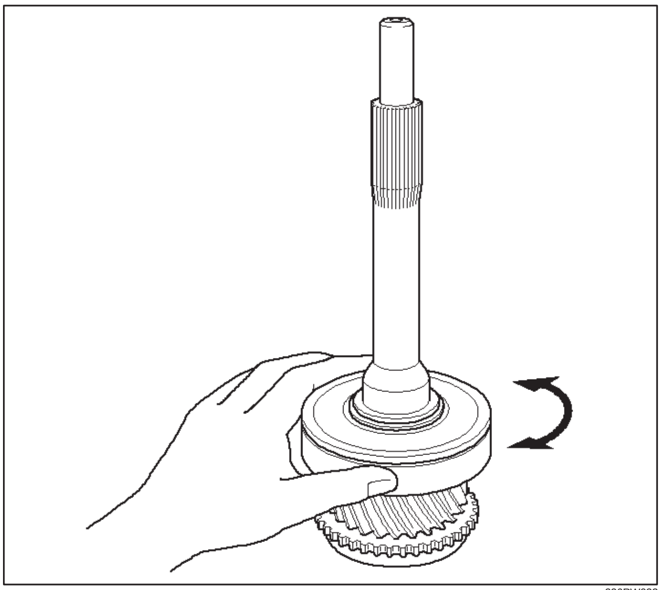
226RW029

    2. Remove the 4th block ring and roller bearing.



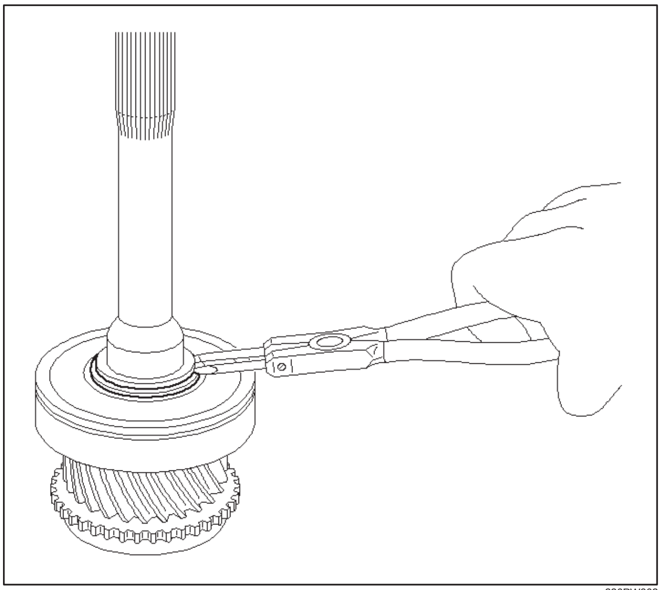
226RW031

21. Disassemble the top gear shaft assembly.
    1. Check for wear or damage.



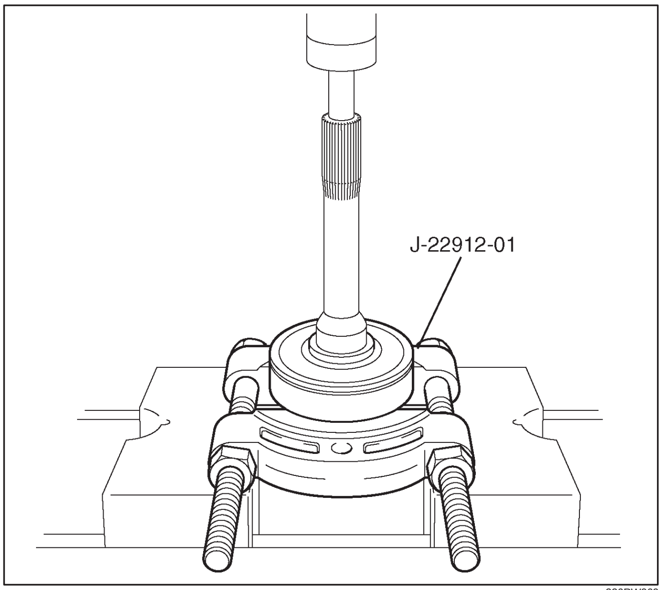
226RW033

    2. Remove the front bearing shaft snap ring.



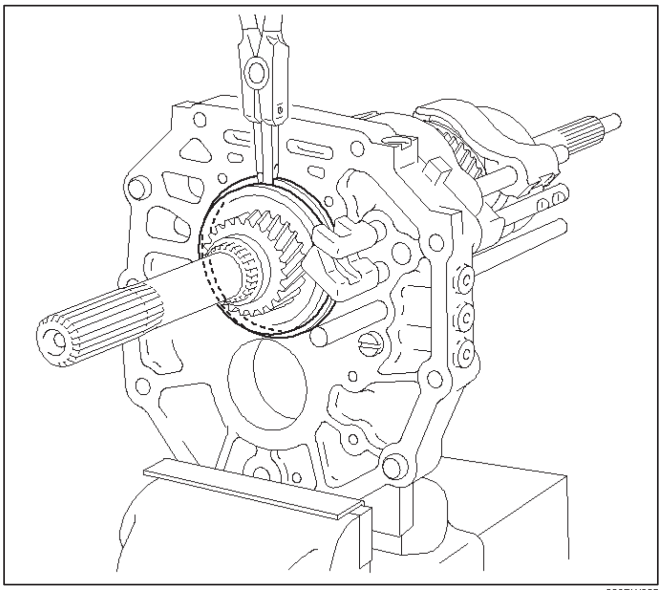
226RW062

3. Using bearing separator J–22912–01 and a press, remove the bearing.



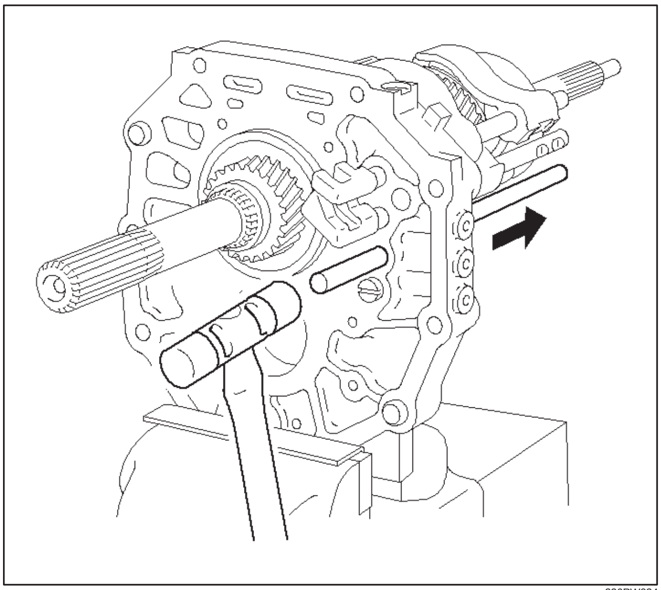
226RW069

22. Remove the mainshaft.
1. Remove mainshaft bearing snap ring.



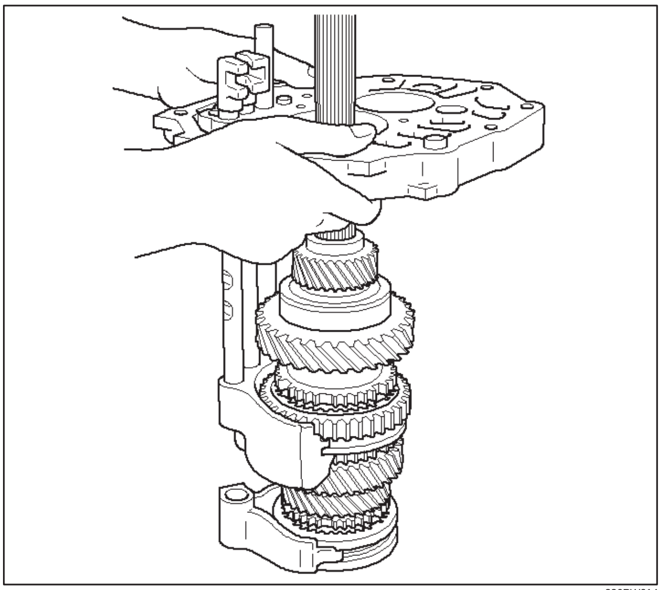
226RW035

2. Using a plastic hammer, tap the 5th-reverse shift rod at the reverse shift side.



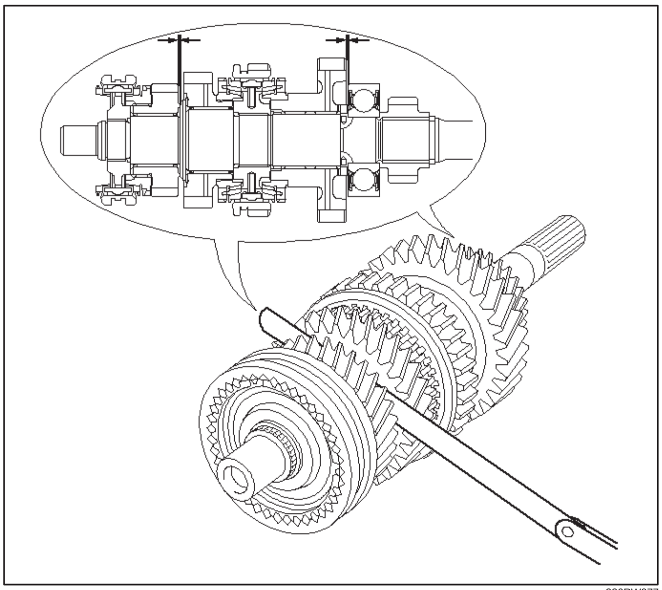
226RW034

3. Remove the intermediate plate from a vise.
4. Remove the mainshaft, 1st-2nd shift arm and 3rd-4th shift arm.



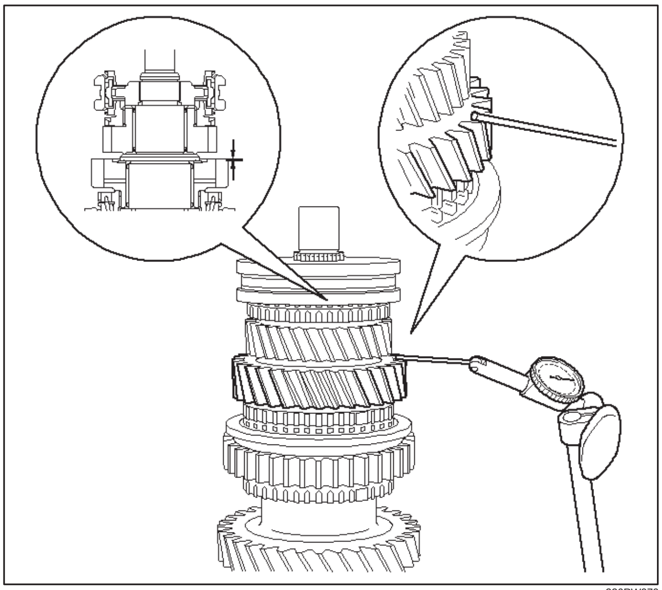
226RW014

23. Disassemble the main shaft assembly.
    1. Inspect each gear thrust clearance.
        1. Using thickness gauge, inspect thrust clearance (1st gear, 3rd gear).


226RW077

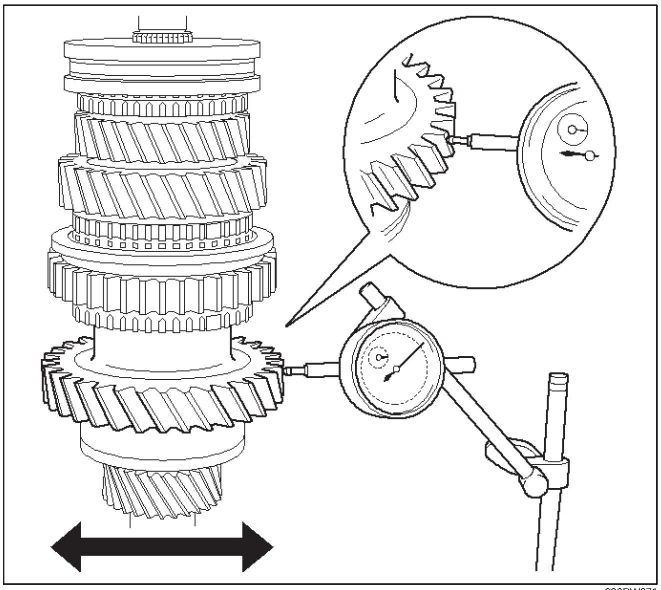
        2. Mount the mainshaft through the aluminum plate in a vise.
        3. Using a dial indicator, measure each gear thrust clearance.

Gear	Standard Clearanse
1st	0.15 – 0.45 mm (0.0059 – 0.0177 in)
2nd	0.10 – 0.25 mm (0.0039 – 0.0098 in)
3rd	0.10 – 0.25 mm (0.0039 – 0.0098 in)

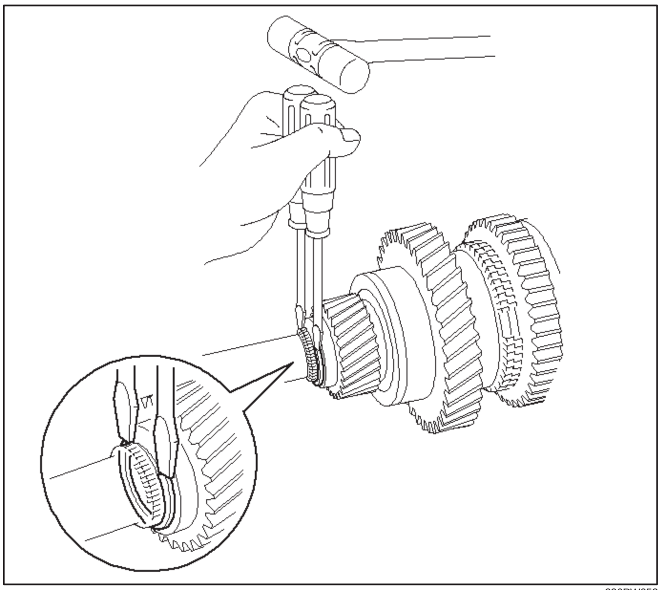

226RW070

    2. Inspect each gear radial clearance.
        1. Using a dial indicator, measure the radial clearance of each gear.

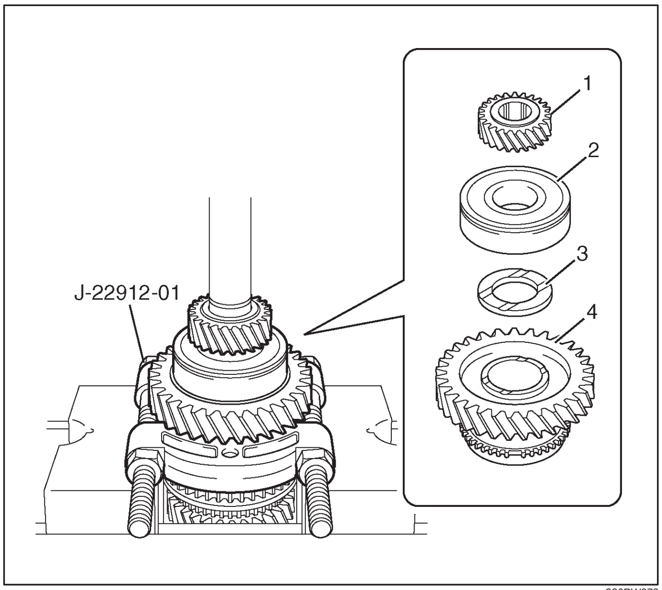
Gear	Standard Clearanse
1st	0.020 – 0.074 mm (0.00078 – 0.00291 in)
2nd	0.015 – 0.068 mm (0.00059 – 0.00268 in)
3rd	0.015 – 0.068 mm (0.00059 – 0.00268 in)


226RW071

    3. Using 2 screwdrivers and hammer, tap out the snap ring.

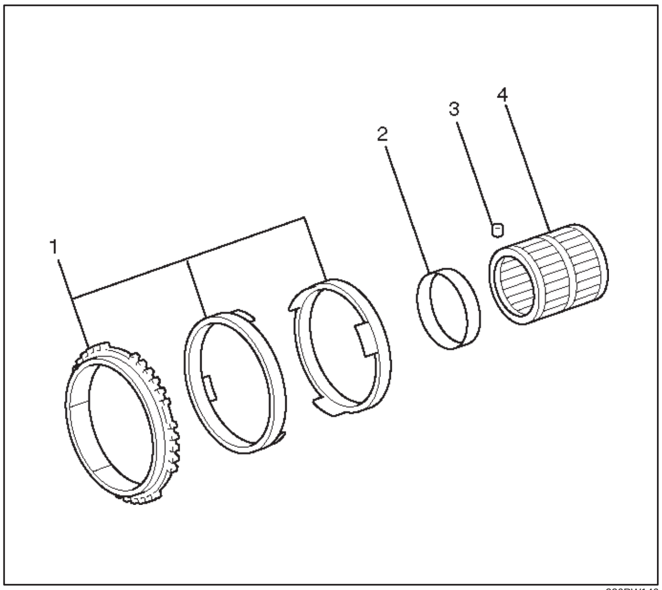

226RW053

4. Using bearing separator J–22912–01 and a press, remove the following parts.
    1. 5th gear (1).
    2. Mainshaft bearing (2).
    3. 1st gear thrust washer (3).
    4. 1st gear (4).



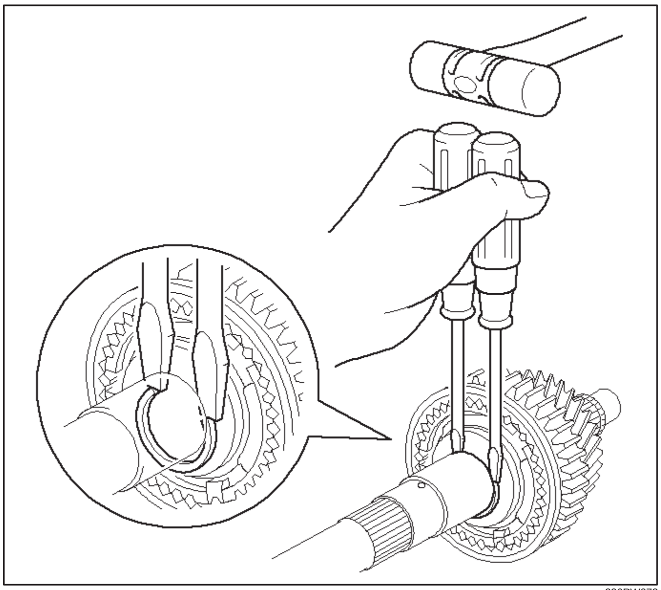
226RW072

5. Remove following parts from mainshaft.
    1. Synchronizer assembly (1).
    2. 1st gear thrust washer pin (3).
    3. 1st gear needle roller bearing (4).
    4. 1st gear bearing spacer (2).



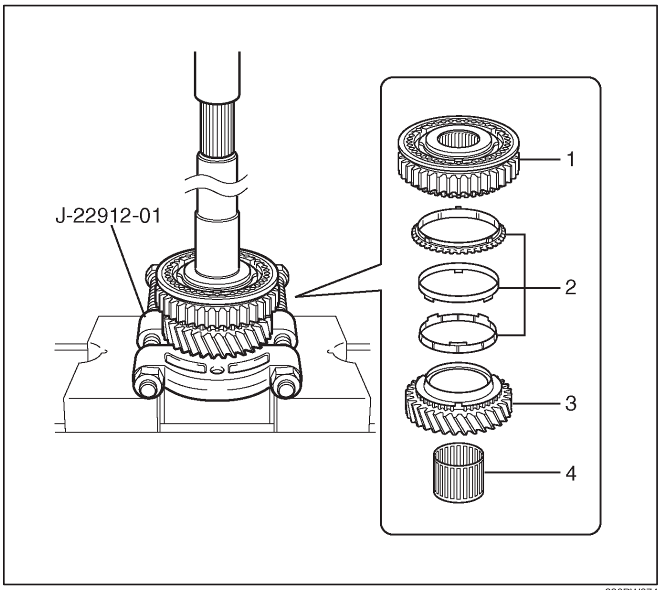
226RW146

6. Using 2 screwdrivers and hammer, tap out snap ring.



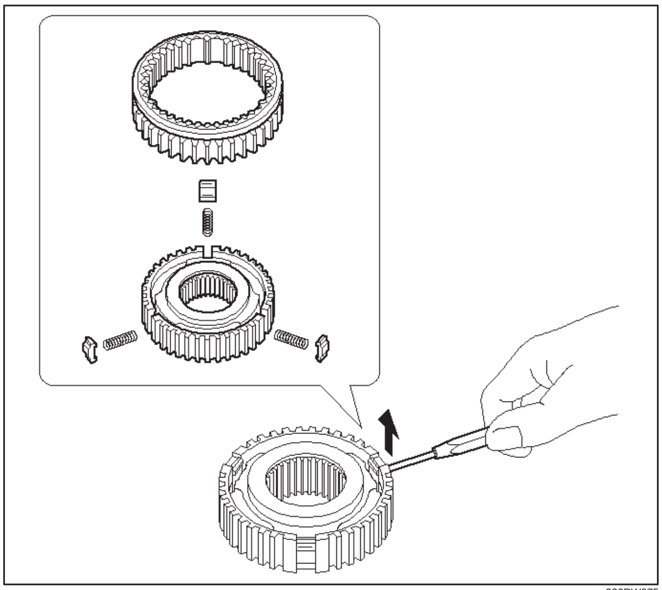
226RW073

7. Using bearing separator J–22912–01 and a press, remove the following parts.
    1. Clutch hub No.1 assembly (1).
    2. Synchronizer assembly (2).
    3. 2nd gear (3).
    4. 2nd gear needle roller bearing (4).



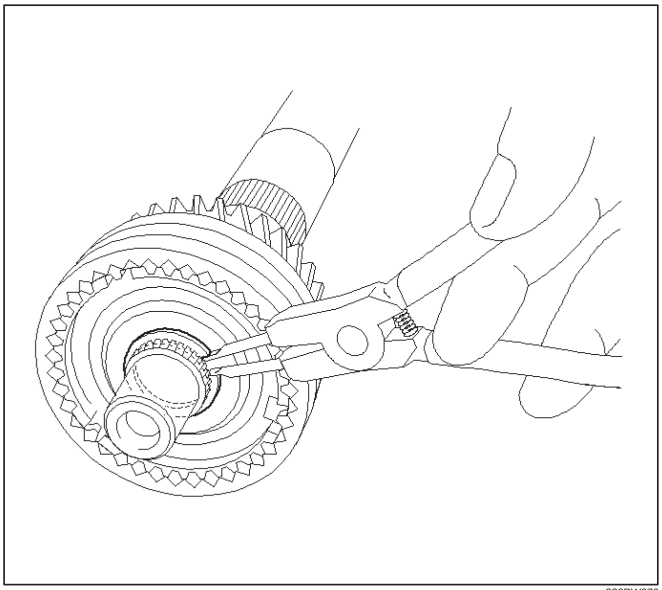
226RW074

8. Remove the reverse gear from clutch hub No.1.
9. Remove the 3 inserts and 3 compression springs.
   - When removing the inserts, push the insert spring with a screwdriver.

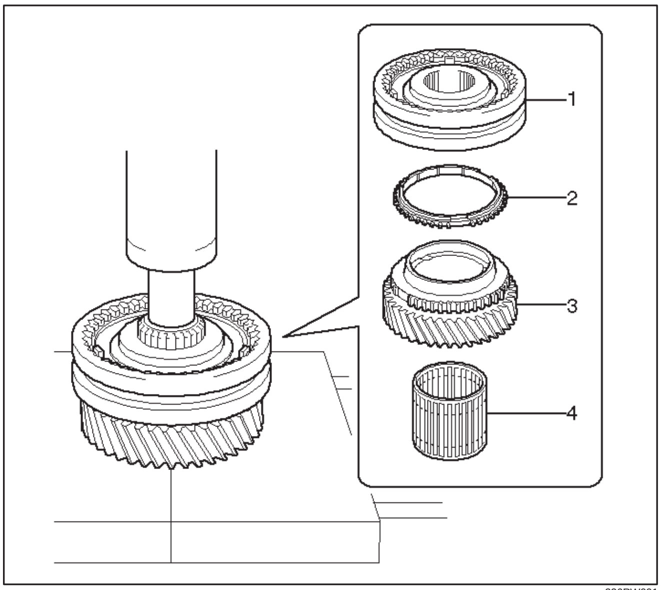

226RW075

10. Remove the snap ring.

NOTE: Don’t damage the bearing surface.

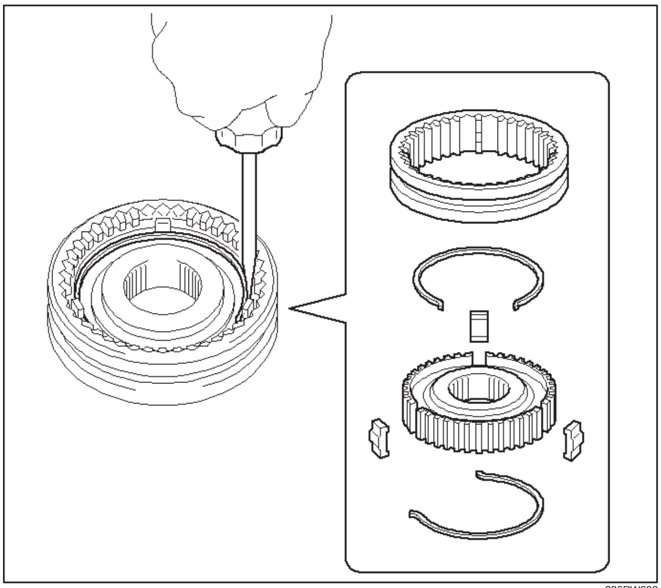

226RW076

11. Using a press, remove following parts.
    1. Clutch hub No.2 assembly (1).
    2. 3rd block ring (2).
    3. 3rd gear (3).
    4. 3rd gear needle roller bearing (4).

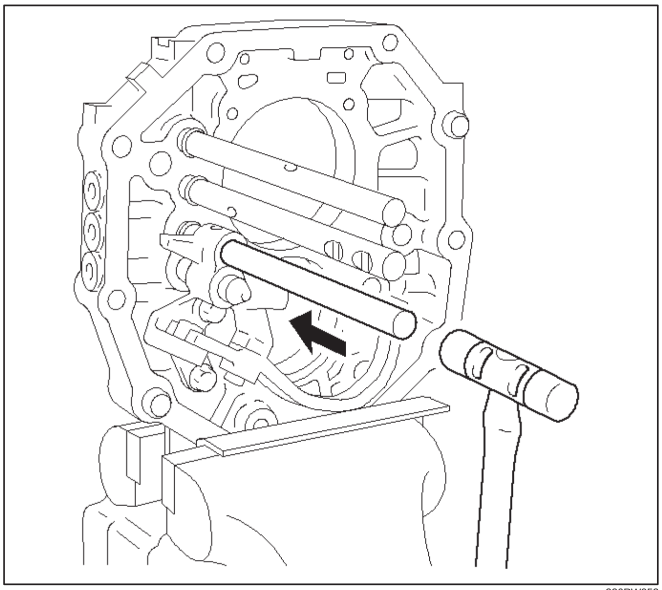


226RW091

12. Using screwdriver, remove the 2 insert springs, hub sleeve No.2, clutch hub No.2 and 3 inserts.

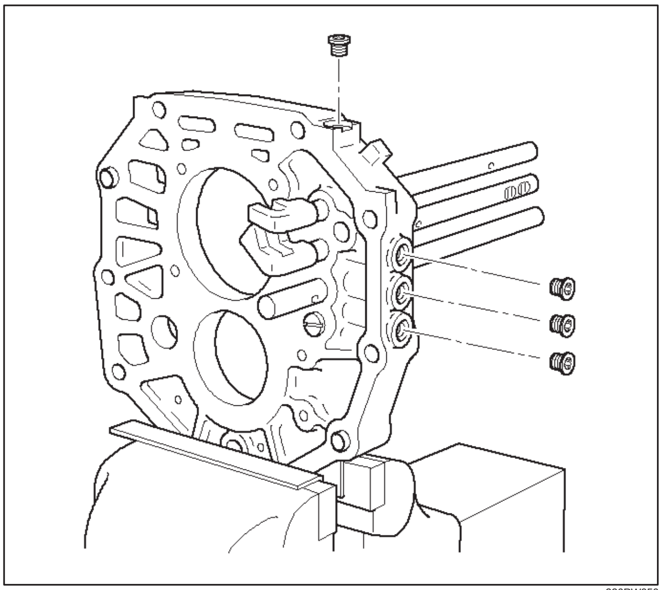

226RW090

24. Remove the shift parts and interlock parts.
    1. Mount the intermediate plate through the aluminum plate in a vise.
    2. Using a plastic hammer, tap the 5th shift rod on the neutral.



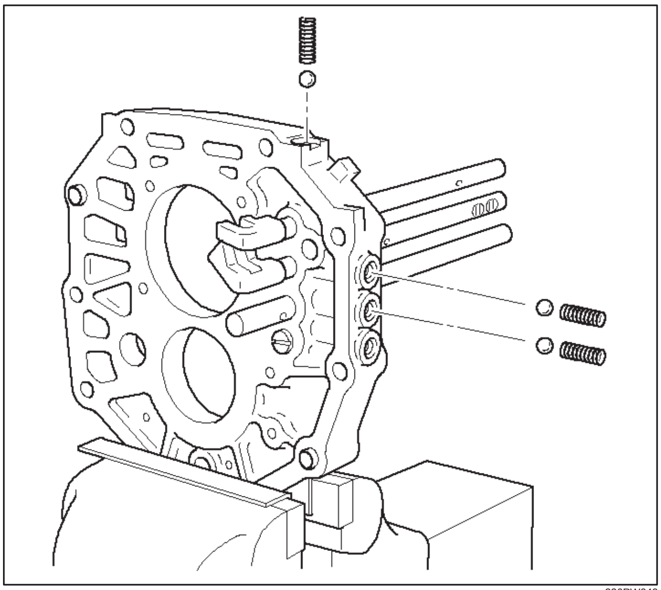
226RW052

    3. Using a torx socket wrench(T40), remove the 4 plugs.



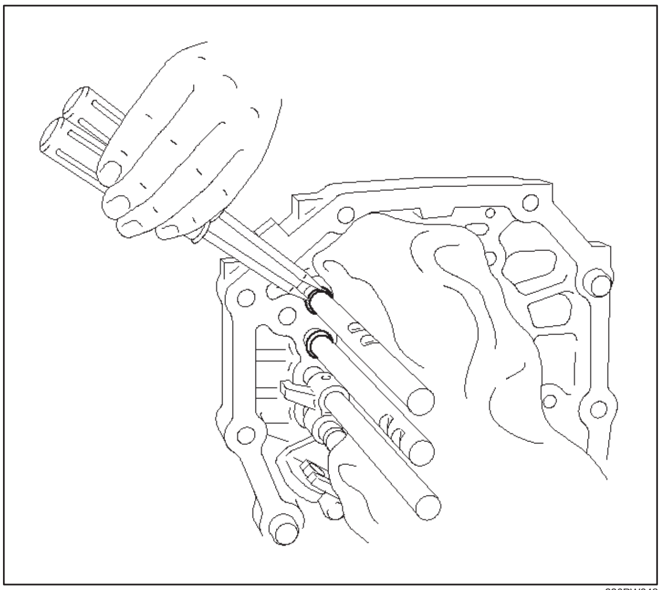
226RW050

    4. Using a magnetic finger, remove 3 springs and balls.



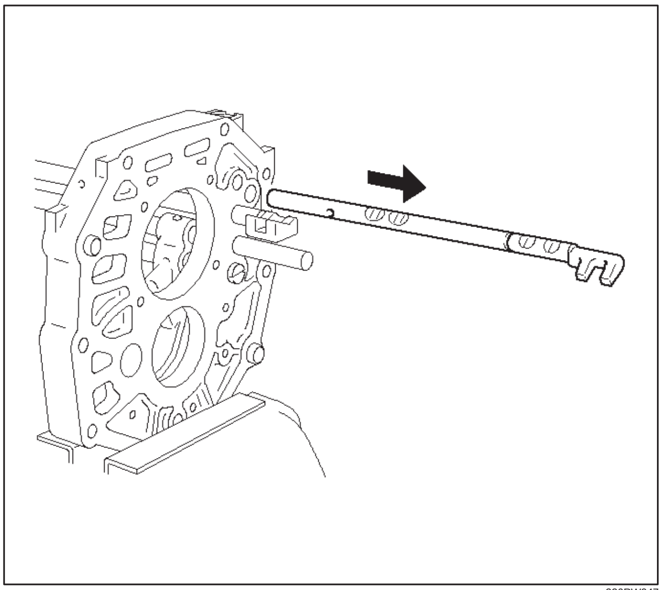
226RW049

    5. Using 2 screwdrivers and a hammer, remove 2 snap rings from each shift fork rod.



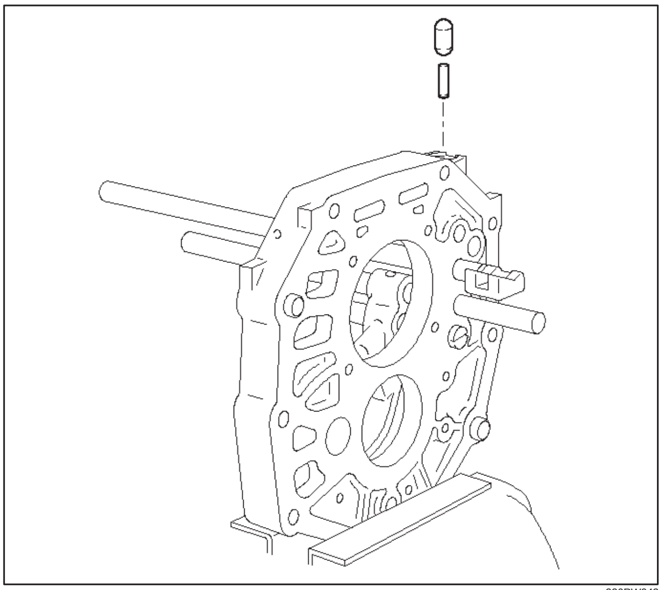
226RW048

6. Pull out the 3rd–4th shift rod at the rear.



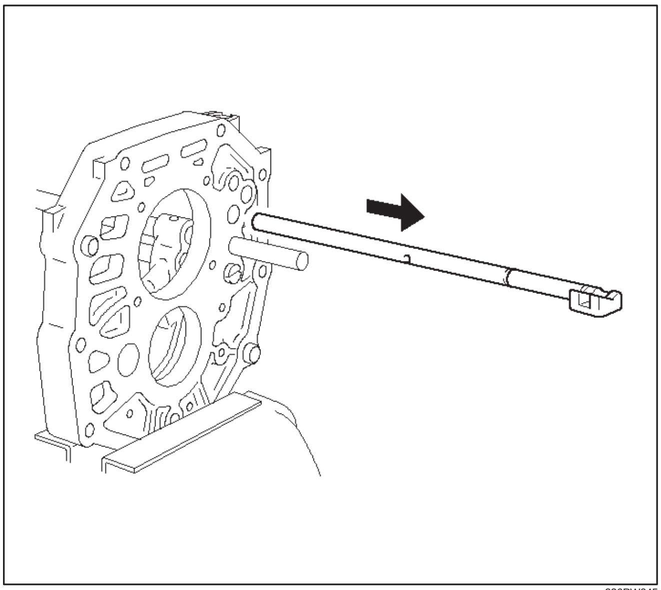
226RW047

7. Using a magnetic finger, remove the interlock pin and straight pin.



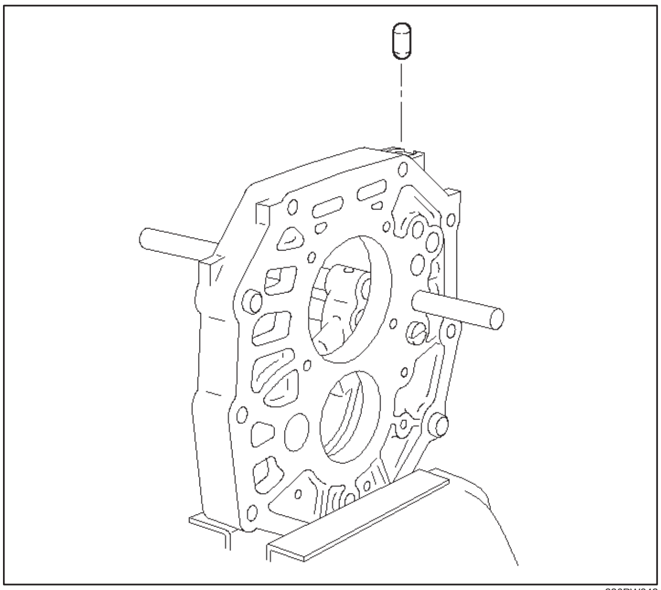
226RW043

8. Pull out the 1st–2nd shift rod at the rear.



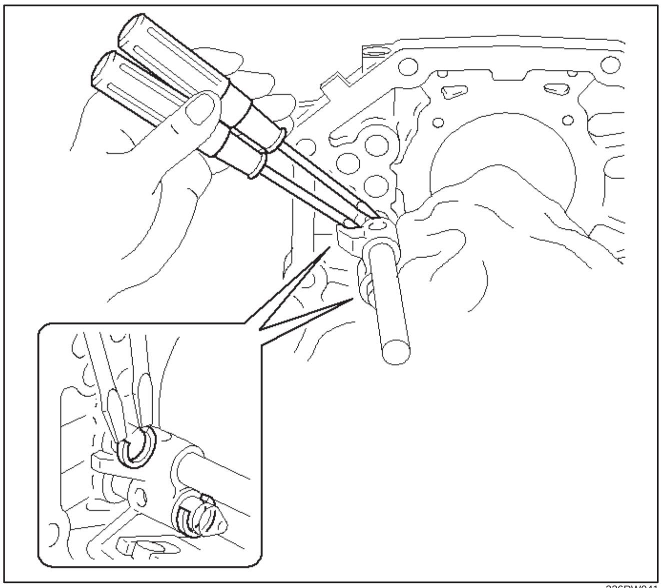
226RW045

9. Using a magnetic finger, remove the interlock pin.



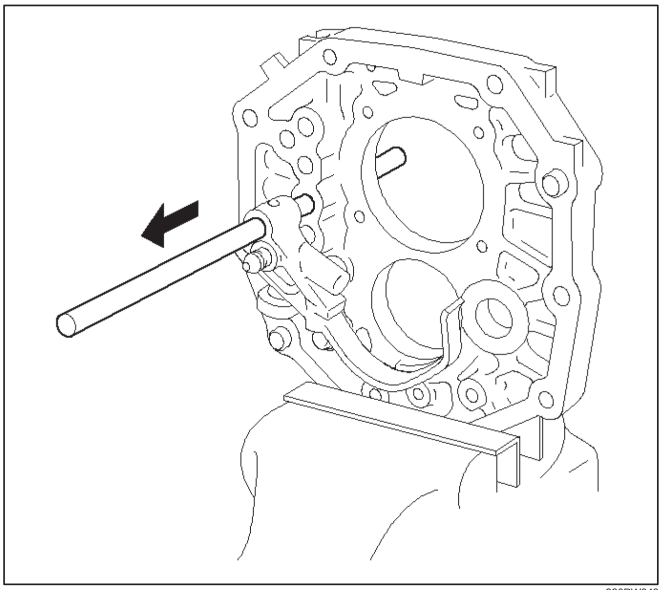
226RW042

10. Using 2 screwdrivers and a hammer, remove 2 snap rings.



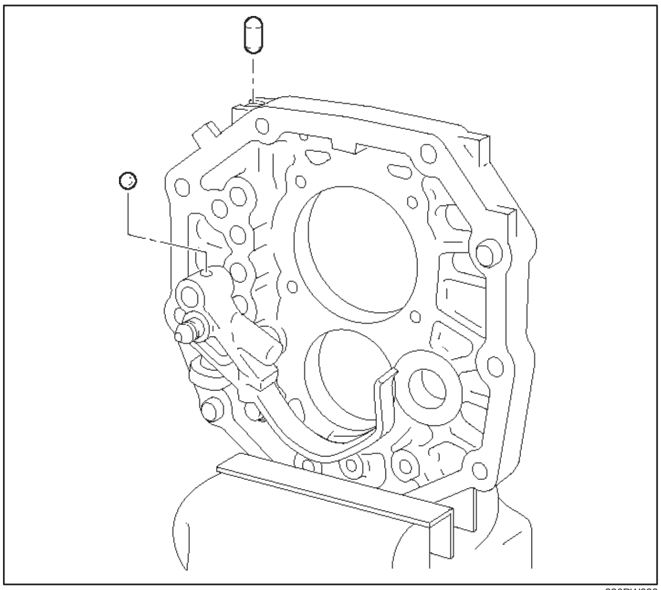
226RW041

11. Pull out the 5th-reverse shift rod at the front.



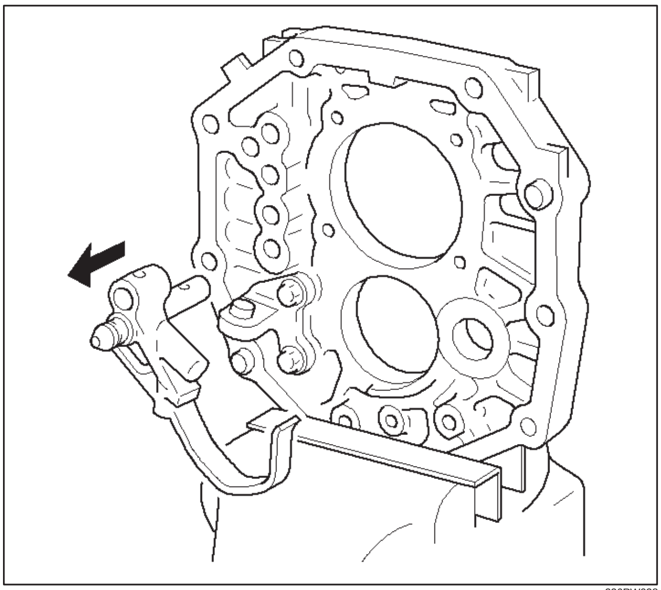
226RW040

12. Using a magnetic finger, remove the interlock pin from the intermediate plate. Remove the ball from the reverse shift arm No.1.



226RW039

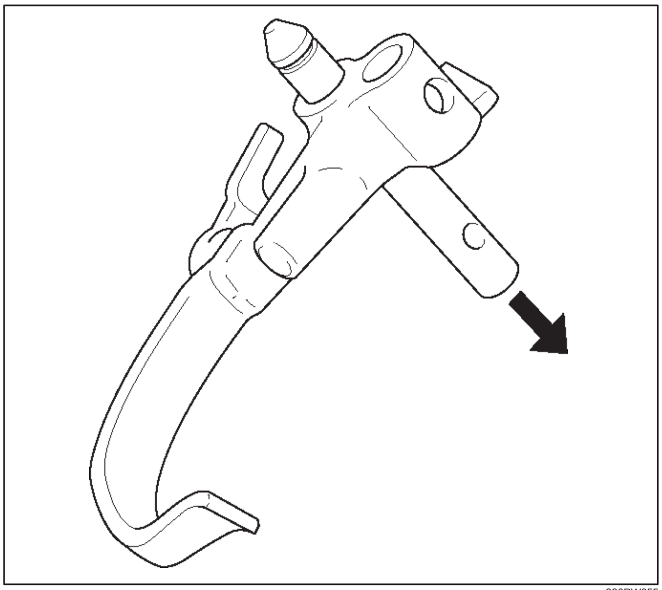
13. Pull out at the rear reverse shift rod, reverse shift arm No.1 and reverse shift arm No.2 at the same time.



226RW038

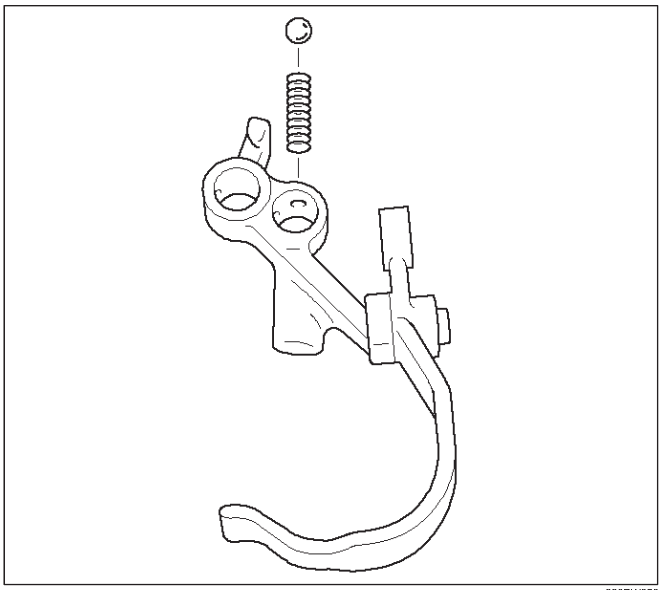
14. Pull out reverse shift rod from reverse shift arm No.1.

NOTE: Be sure remove at the rear.



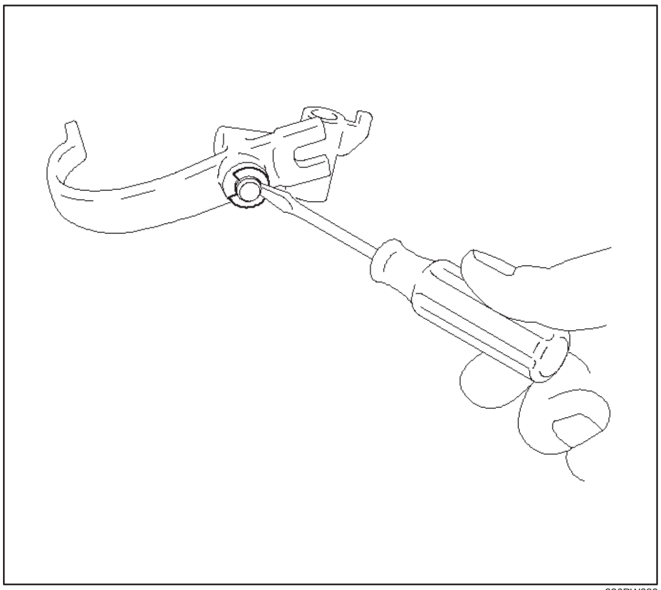
226RW055

15. Using a magnetic finger, remove the ball and spring from reverse shift arm No.1.



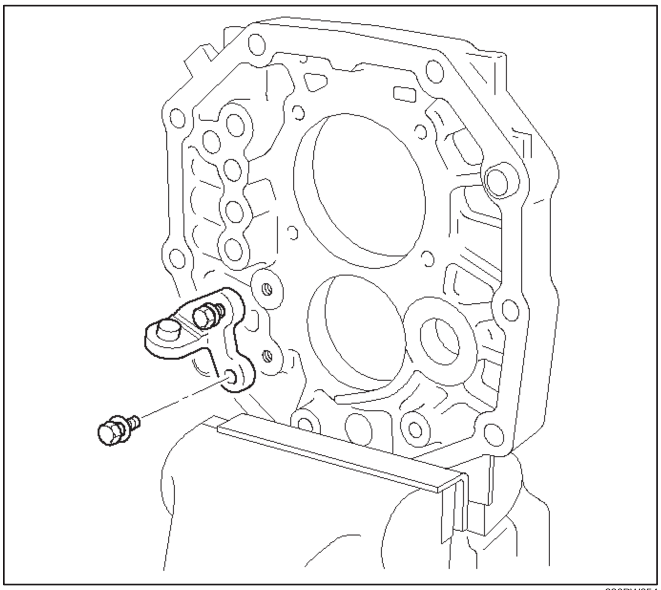
226RW056

16. Remove the reverse shift arm No.2 E–ring. Remove the reverse shift arm No.2 from reverse shift arm No.1.



226RW089

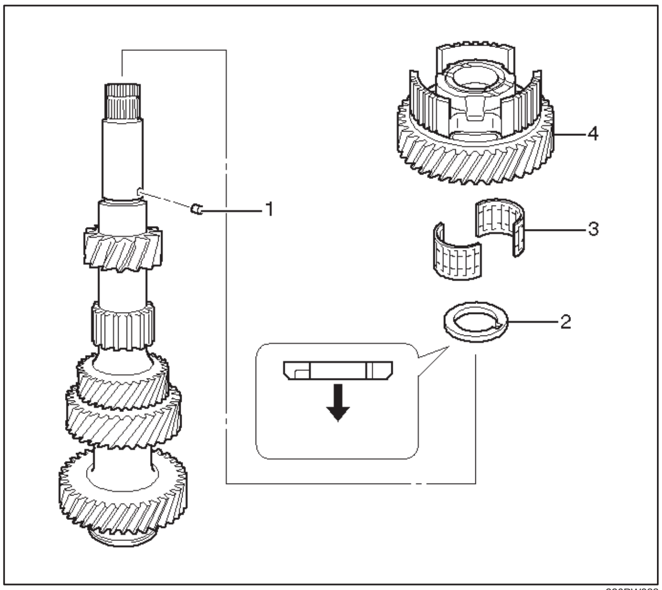
17. Remove the 2 bolts and reverse shift arm bracket.



226RW054

Inspection

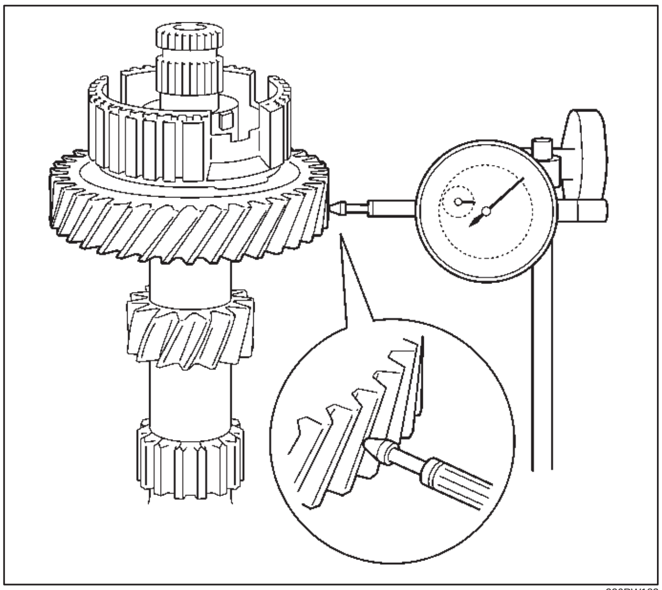
1. Counter 5th gear radial clearance.
   1. Install the following parts to the counter gear shaft.
      1. Counter 5th gear thrust washer pin (1).
      2. Counter 5th gear thrust washer (2).
      3. Counter 5th gear needle bearing(3).
      4. Counter 5th gear (4).



226RW088

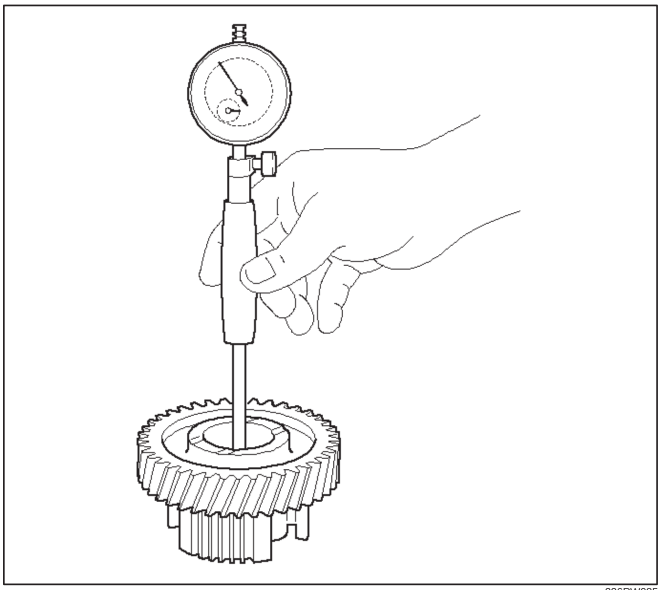
   2. Mount the counter gear shaft through the aluminum plate in vise.
   3. Using a dial indicator, measure the counter 5th gear radial clearance.

Standard: 0.015 – 0.068 mm (0.00059 – 0.00268 in)


226RW183

   4. Using a inside dial indicator, measure the gear inside diameter.

Standard: 38.015 – 38.040 mm (1.49665 – 1.49763 in)


226RW085

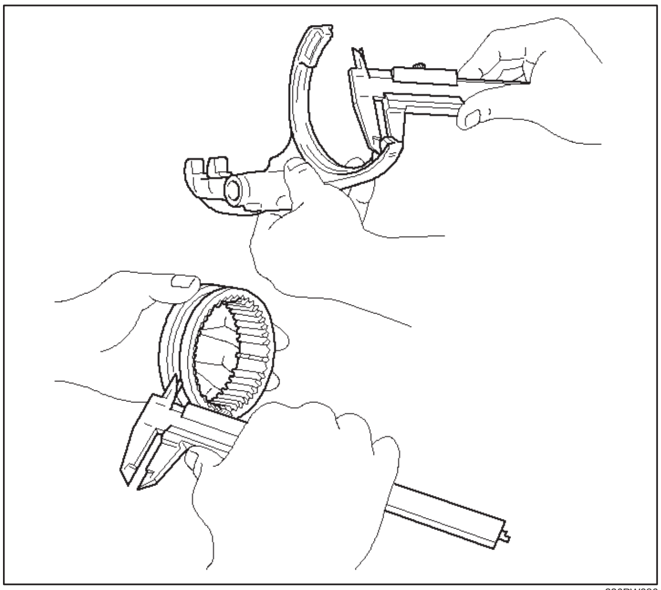
2. 5th-reverse shift arm and hub sleeve No.3 clearance.
   1. Using a vernier caliper, measure the 5th-reverse shift arm thickness.

Reference: 10.2 mm (0.402 in)

   2. Using a vernier caliper, measure the center groove of hub sleeve No.3. Calculate the clearance between the hub sleeve No.3 and shift arm.

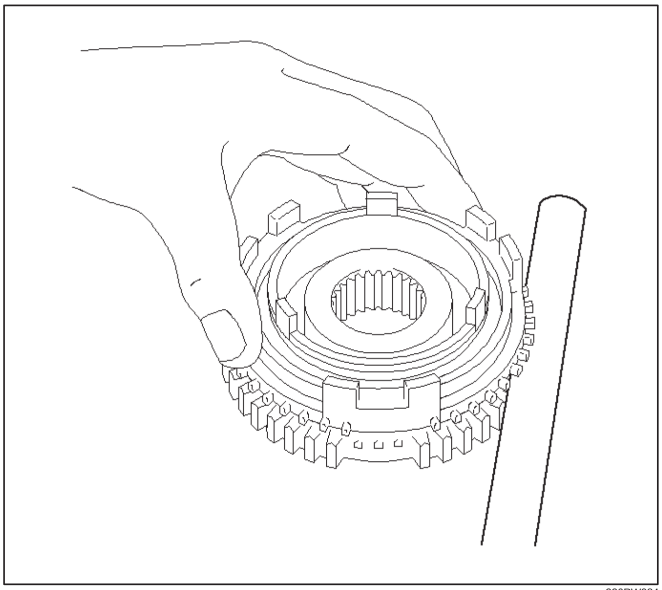
Standard: 0.26 – 0.84 mm (0.0102 – 0.0331 in)

Reference: Center groove dimension 10.5mm (0.413 in)


226RW086

3. Reverse block ring set.
   1. Using a thickness gauge, measure the clearance between the counter 5th gear spline piece and reverse block ring.

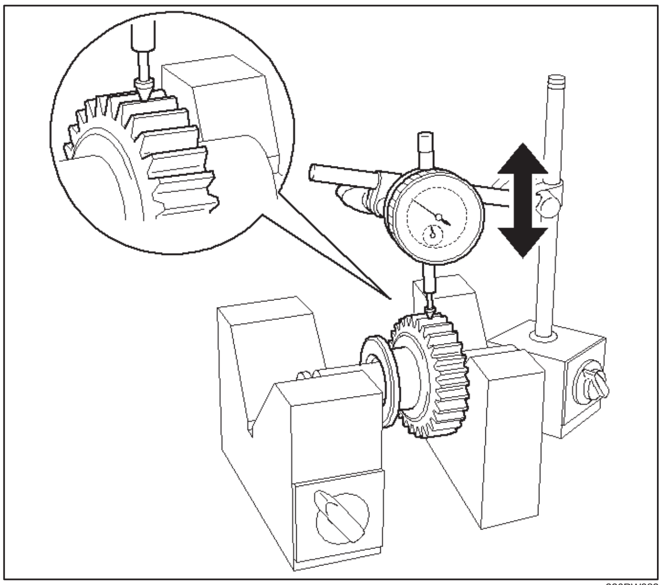
Standard: 0.7 – 1.7 mm (0.028 – 0.067 in)



226RW084

4. Reverse idle gear and reverse idle gear shaft.
   1. Mount the reverse idle gear and reverse idle gear shaft in a vise.
   2. Using a dial indicator, measure the reverse idle gear radial clearance.

Standard: 0.040 – 0.082 mm (0.0016 – 0.0032 in)



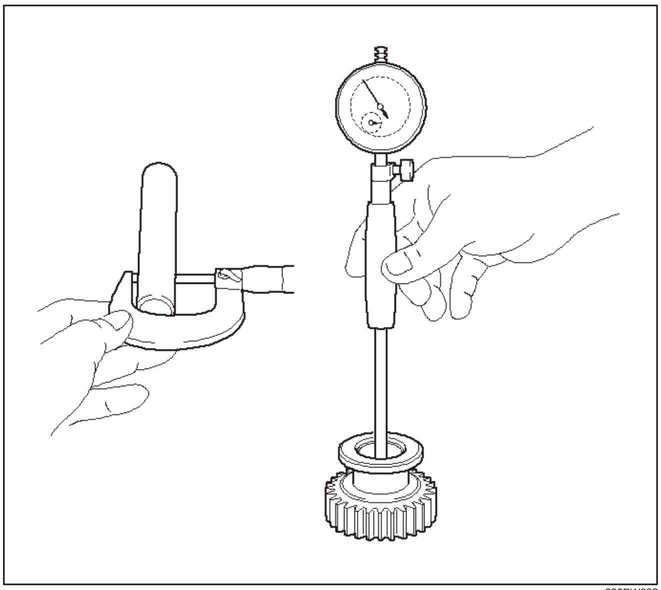
226RW083

   3. If the clearance exceeds the maximum, measure the gear inside diameter and shaft diameter.

Standard

Shaft Diameter: 23.979 – 24.000 mm (0.94405 – 0.94488 in)

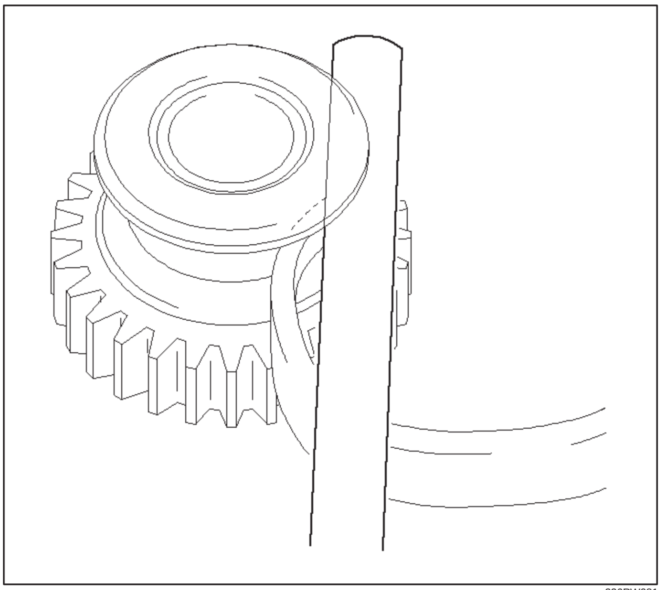
Gear Diameter: 24.040 – 24.061 mm (0.94645 – 0.94728 in)



226RW082

5. Reverse shift arm No.2 thrust clearance.
   1. Using a thickness gauge, measure the clearance between the reverse idle gear and shift arm No.2.

Standard: 0.05 – 0.35 mm (0.002 – 0.014 in)

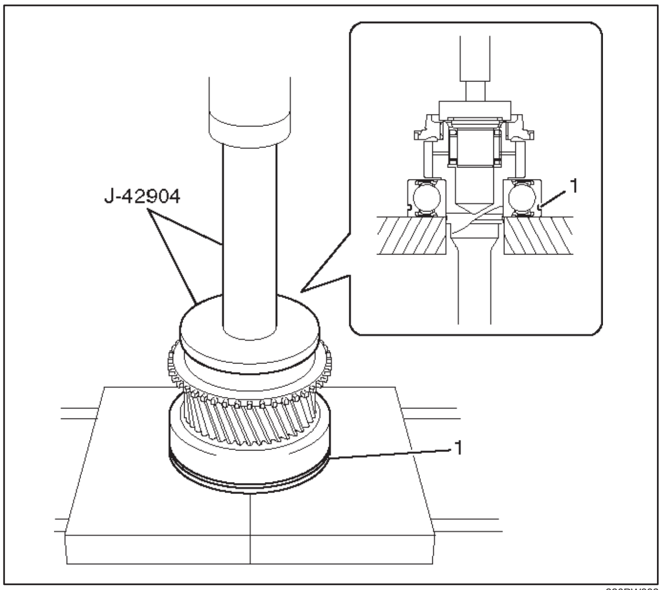


226RW081

Reassembly

1. Install the top gear shaft assembly.
   1. Using installer J–42904 and a press, install a new bearing.

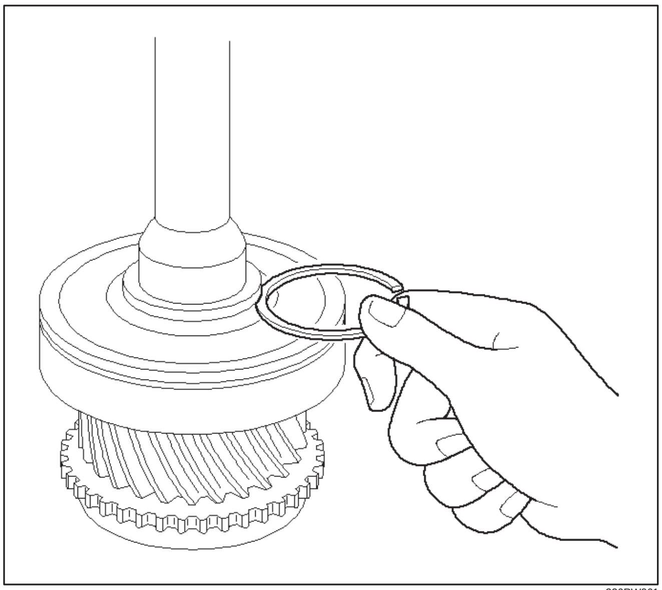
NOTE: Outer race snap ring groove (1) toward front.



226RW092

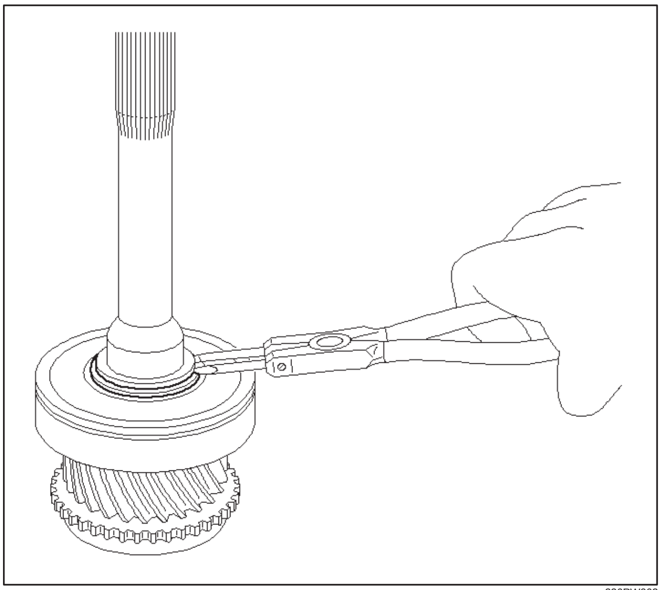
2. Select a snap ring that will allow minimum axial play.

Mark	Thickness
A	2.10 – 2.15 mm (0.083 – 0.085 in)
B	2.15 – 2.20 mm (0.085 – 0.087 in)
C	2.20 – 2.25 mm (0.087 – 0.089 in)
D	2.25 – 2.30 mm (0.089 – 0.091 in)
E	2.30 – 2.35 mm (0.091 – 0.093 in)
F	2.35 – 2.40 mm (0.093 – 0.095 in)
G	2.40 – 2.45 mm (0.095 – 0.097 in)



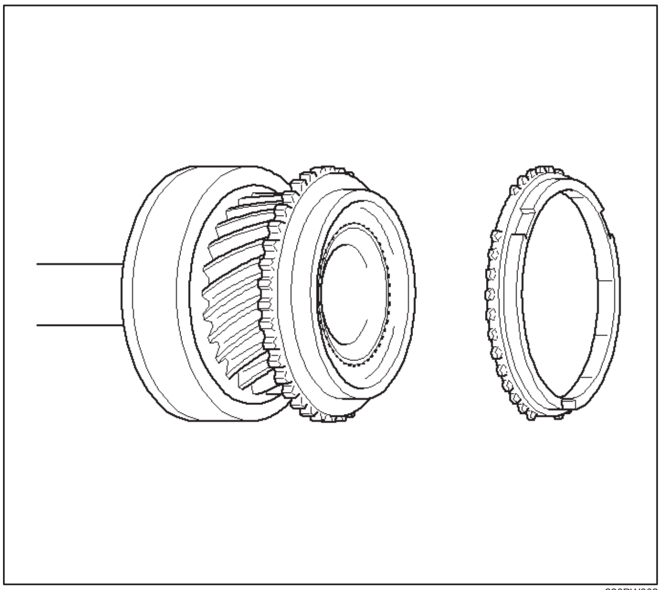
226RW061

3. Using a snap ring expander, install the new snap ring.



226RW062

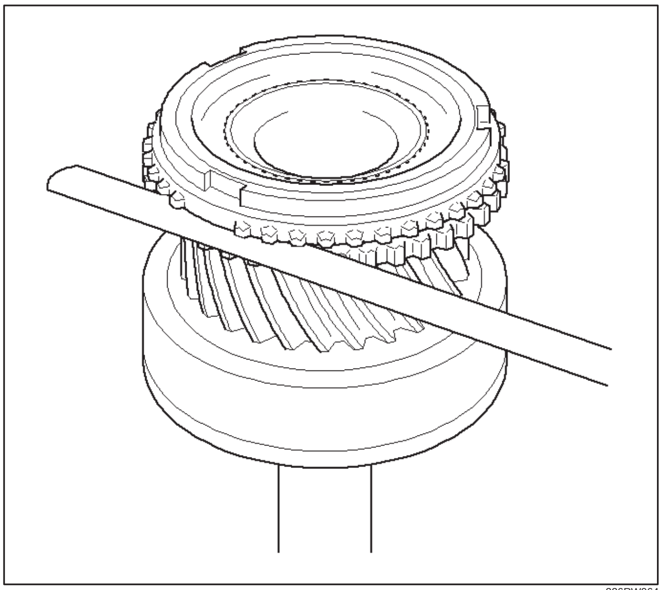
4. Install the 4th block ring.



226RW063

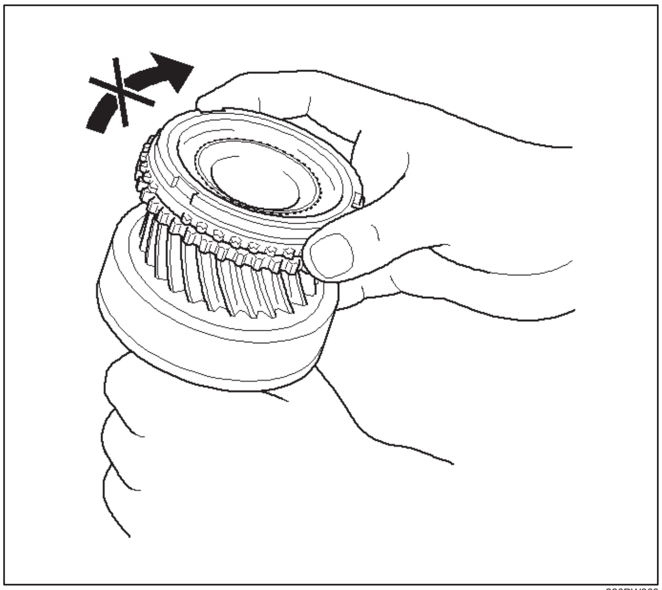
5. Using a thickness gauge, measure the clearance between the 4th block ring back and gear spline end.

Standard: 0.75 – 1.65 mm (0.030 – 0.065 in)



226RW064

6. Check the braking effect of the block ring. Turn the block ring in one direction while pushing it to the gear cone. Check that the ring locks. If it does not lock, replace the block ring.



226RW060

7. Install the needle roller bearing.

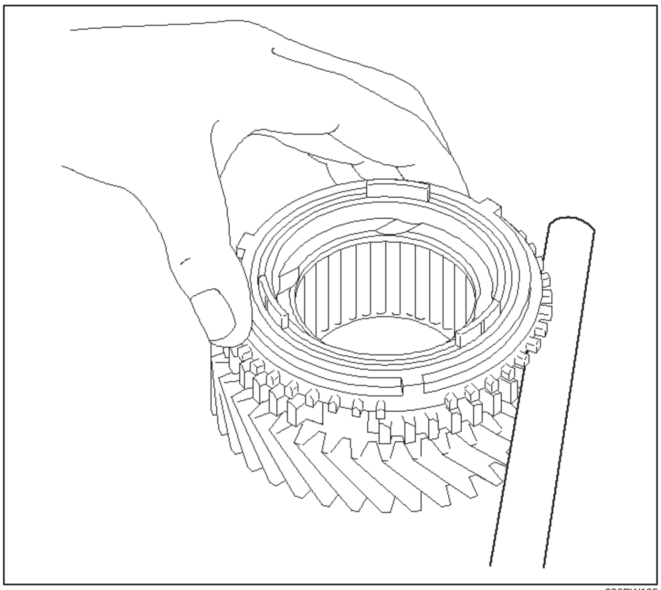
2. Reassemble the mainshaft assembly.

NOTE: Apply all parts with gear oil before installing them.

3. Inspect block ring.

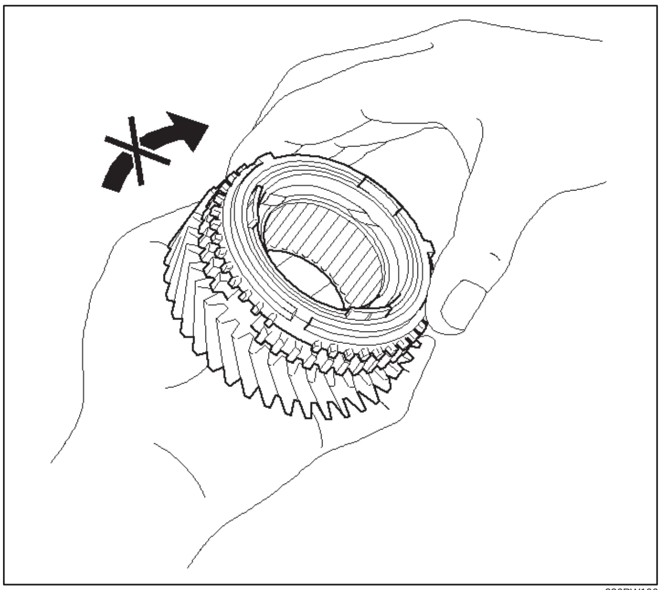
1. Using a thickness gauge, measure the clearance between the synchronizer ring back and gear spline end.

Gear	Standard Clearanse
1st	0.80 – 1.60 mm (0.032 – 0.063 in)
2nd	0.65 – 1.75 mm (0.026 – 0.069 in)
3rd	0.75 – 1.65 mm (0.030 – 0.065 in)



226RW105

2. Turn the synchronizer ring in one direction while pushing it to the gear cone. Check that the ring locks.



226RW106

4. Inspect hub sleeve and shift arm.

1st–2nd shift arm

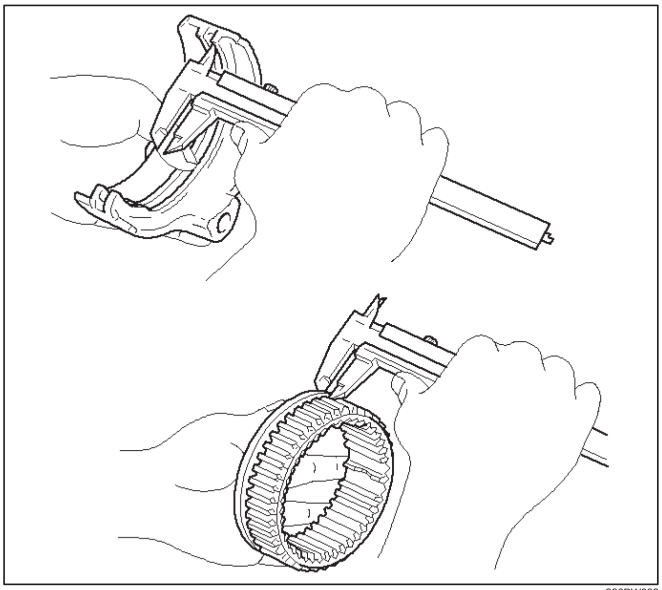
1. Using a vernier caliper, measure center groove of the 1st–2nd shift arm.

Reference: 5.28 mm (0.208 in)

2. Using a vernier caliper, measure flange of the reverse gear. Calculate the clearance between the reverse gear and shift arm.

Reference: Reverse gear flange thickness 5.0 mm (0.197 in)

Standard: 0.15 – 0.41 mm (0.006 – 0.016 in)


226RW093

3rd–4th shift arm

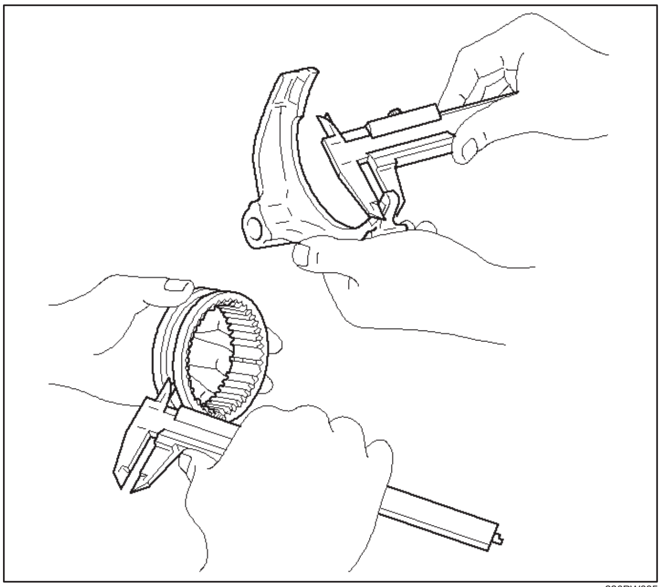
1. Using a vernier caliper, measure tip of the shift arm thickness.

Reference: 10.0mm (0.39 in)

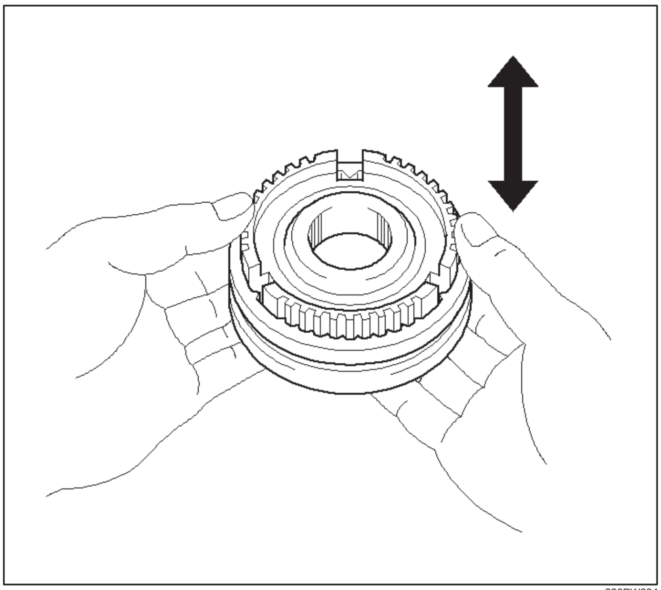
2. Using a vernier caliper, measure center groove of the hub sleeve No.2. Calculate the clearance between the hub sleeve No.2 and shift arm.

Reference: Center groove dimension 10.2 mm (0.402 in)

Standard: 0.15 – 0.35 mm (0.006 – 0.014 in)

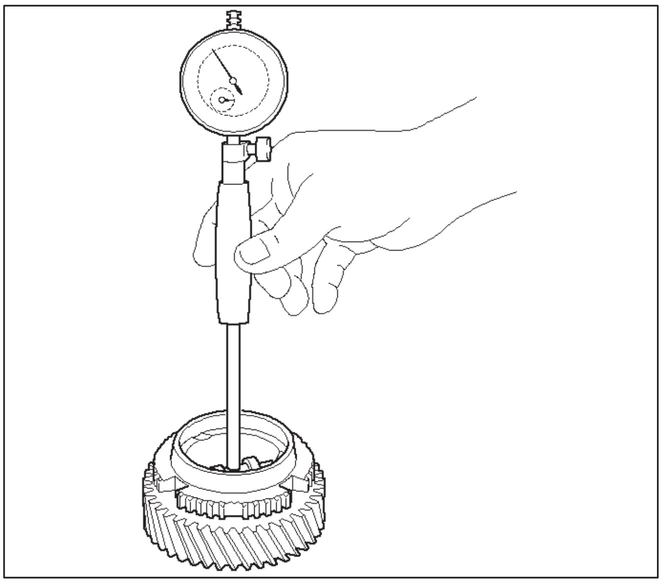

226RW095

5. Inspect clutch hub and hub sleeve.
   1. Check for wear or damage.
   2. Install the hub sleeve to the clutch hub, and check sliding smoothly.


226RW094

6. Inspect gear inside diameter.
   1. Using a inside dial indicator, measure the gear inside diameter.

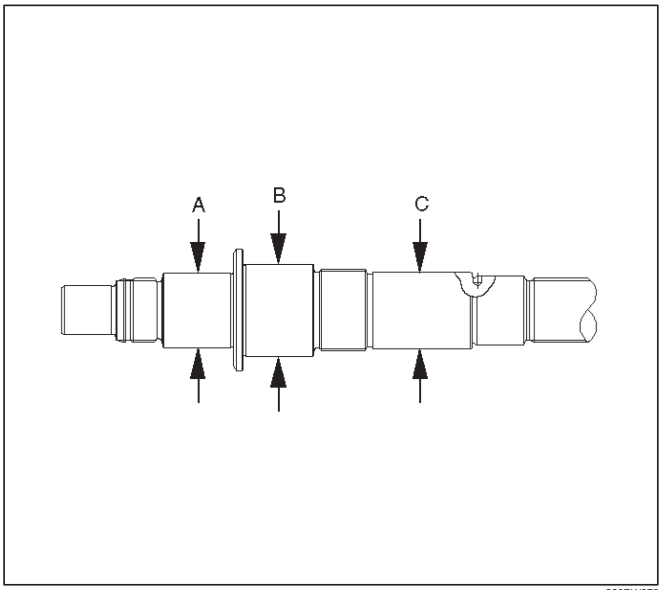
Gear	Standard Diameter
1st	46.015 – 46.040 mm (1.8116 – 1.8126 in)
2nd	53.015 – 53.040 mm (2.0872 – 2.0882 in)
3rd	44.015 – 44.040 mm (1.7329 – 1.7339 in)



226RW096

7. Inspect mainshaft.
   1. Using a micrometer, measure the outer diameter of the mainshaft journal.

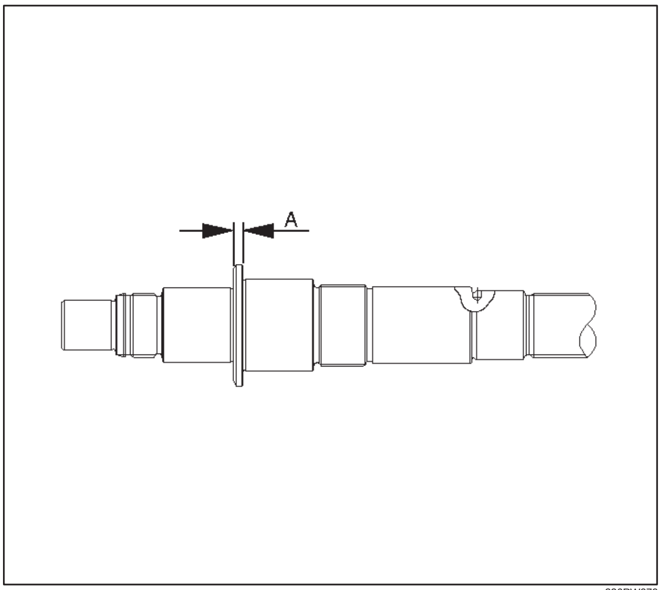
Mea-sure Position	Standard
A	37.984 – 38.000 mm (1.4954 – 1.4961 in)
B	46.984 – 47.000 mm (1.8498 – 1.8504 in)
C	38.979 – 38.995 mm (1.5346 – 1.5352 in)



226RW078

   2. Using a micrometer, measure the mainshaft flange thickness.

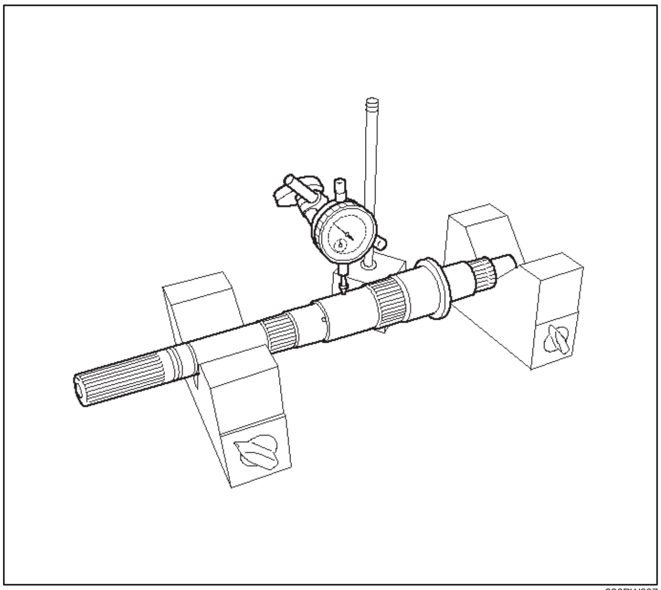
Standard: 5.0 mm (0.197 in)



226RW079

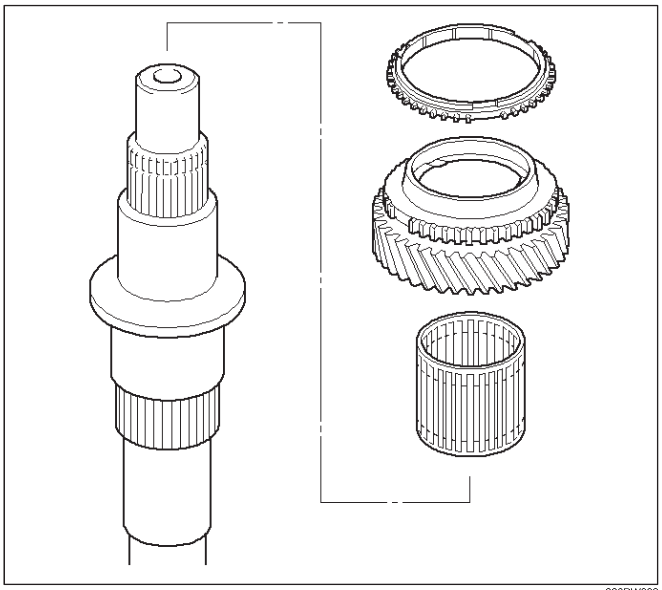
   3. Install the mainshaft to V-blocks.
   4. Use a dial indicator to measure the mainshaft central portion run-out.

Standard: less than 0.015 mm (0.0006 in)



226RW097

8. Install 3rd gear.
   1. Install the 3rd gear needle bearing, 3rd gear and 3rd block ring to the mainshaft.



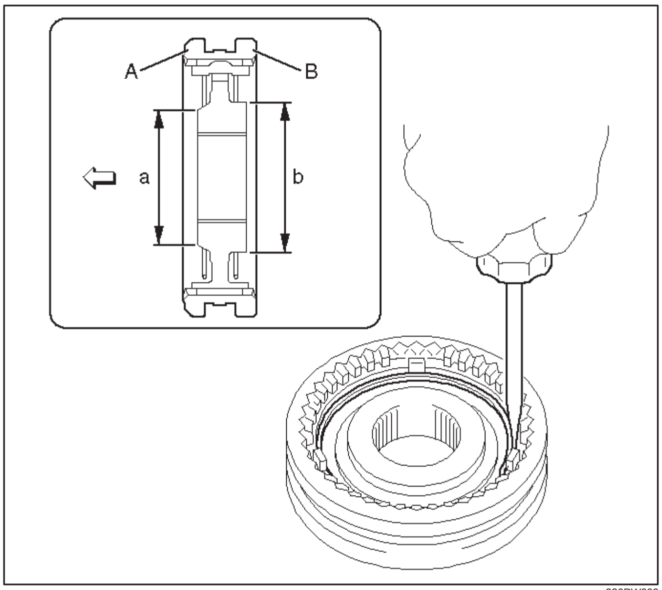
226RW098

9. Install the clutch hub No.2.
   1. Install the clutch hub No.2 and hub sleeve No.2.

NOTE: Be careful the direction of the clutch hub No.2, as shown.

   2. Using a screwdriver, install 3 inserts and 2 springs.

NOTE: Position the insert springs so that their end gaps are not in line.

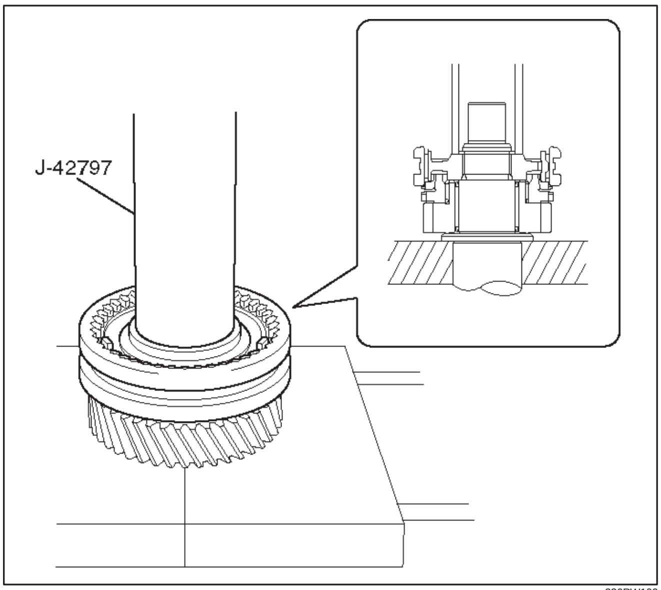


226RW099

   3. Using installer J–42797 and a press, install the clutch hub No.2 and hub sleeve No.2 to the mainshaft.

NOTE:

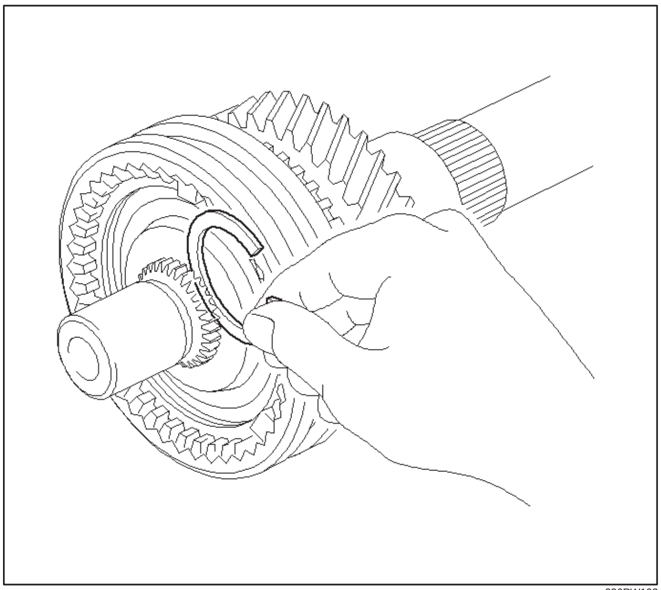
- Align the block ring slots with the inserts.
- Check that the gear rotates smoothly.



226RW100

   4. Select a snap ring that will allow minimum axial play.

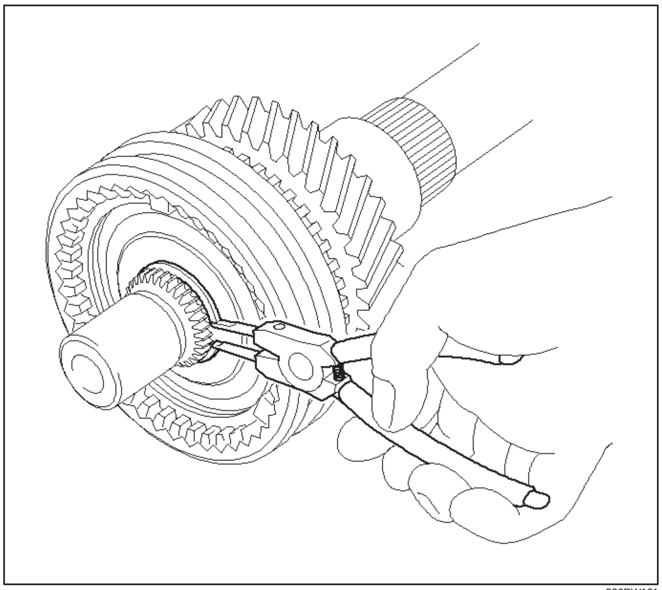
Mark	Thickness
A	1.80 – 1.85 mm (0.071 – 0.073 in)
B	1.85 – 1.90 mm (0.073 – 0.075 in)
C	1.90 – 1.95 mm (0.075 – 0.077 in)
D	1.95 – 2.00 mm (0.077 – 0.079 in)
E	2.00 – 2.05 mm (0.079 – 0.081 in)
F	2.05 – 2.10 mm (0.081 – 0.083 in)
G	2.10 – 2.15 mm (0.083 – 0.085 in)



226RW102

5. Using a snap ring expander, install the new snap ring.

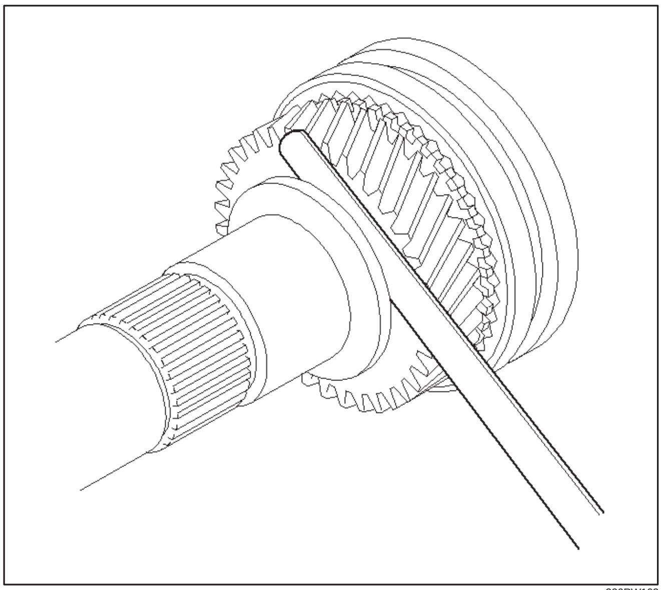
NOTE: Be careful not to damage the bearing surface.



226RW101

6. Using a thickness gauge, inspect the 3rd gear thrust clearance.

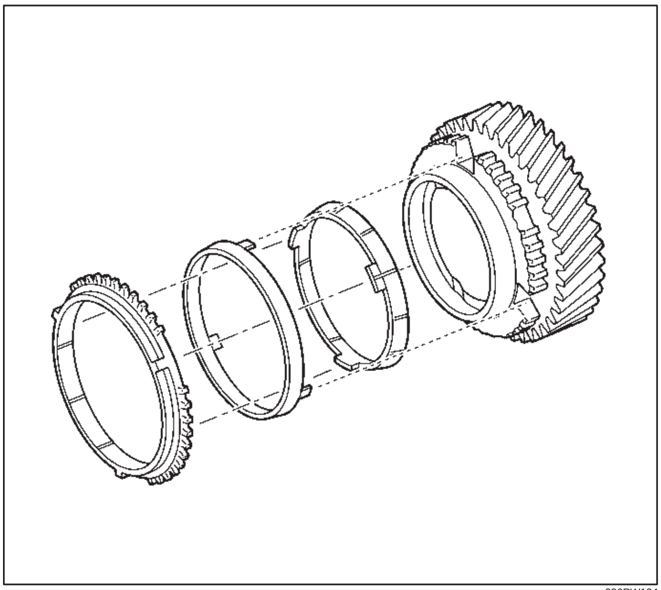
Standard: 0.10 – 0.25mm (0.004 – 0.010 in)



226RW103

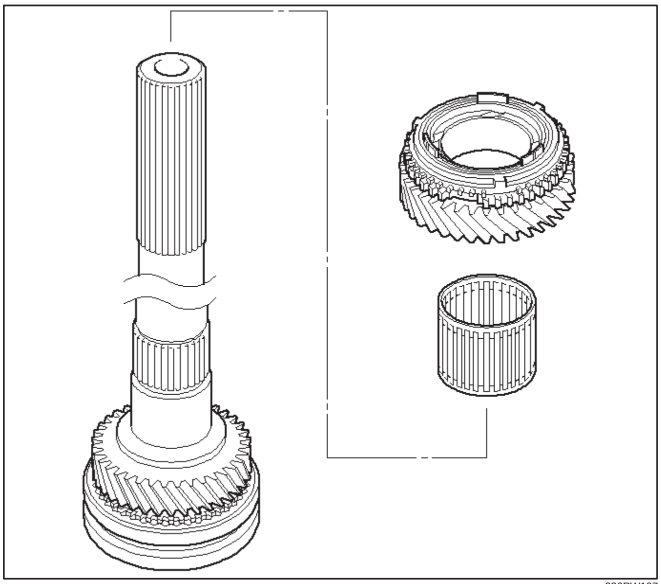
10. Install the 2nd gear.
    1. Install the synchronizer ring set NO.1 to the 2nd gear.

NOTE: Align the nail of middle ring with gear spline slots.



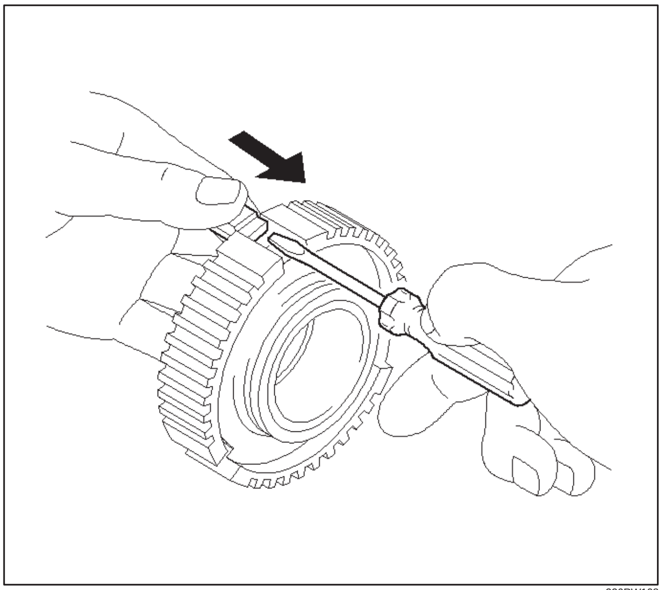
226RW104

2. Install the needle roller bearing, 2nd gear and 2nd gear block ring set to the mainshaft.



226RW107

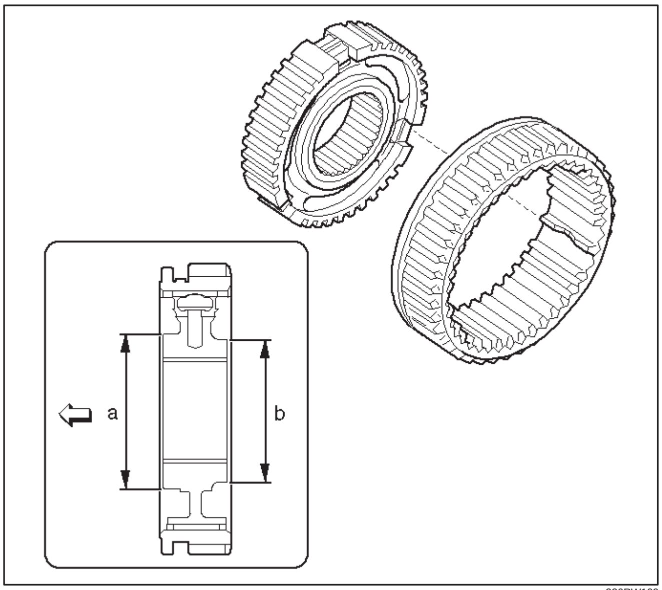
11. Install the clutch hub No.1.
    1. Install the 3 inserts and 3 insert springs to the clutch hub No.1.
       Reference: While pushing the insert spring with a screwdriver, install the inserts.



226RW108

2. Install the clutch hub No.1 to the reverse gear.

NOTE: Check the clutch hub No.1 installing direction, as shown.

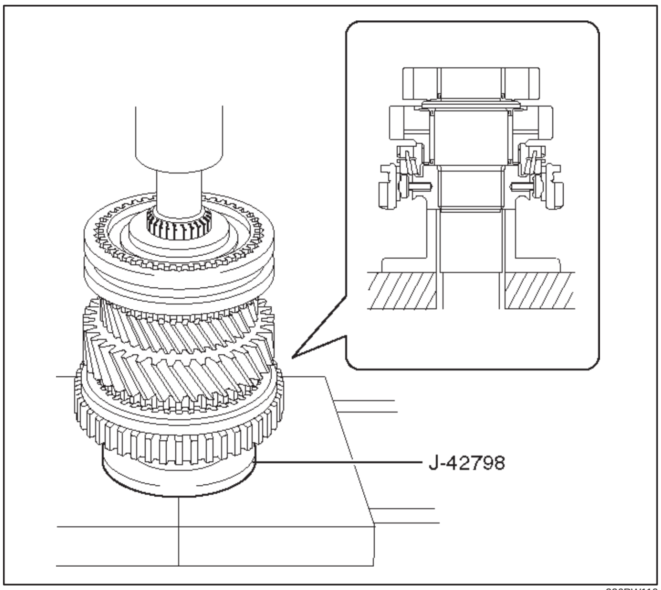


226RW109

3. Using installer J–42798 and a press, install the hub No.1 by retaining the reverse gear.

NOTE:

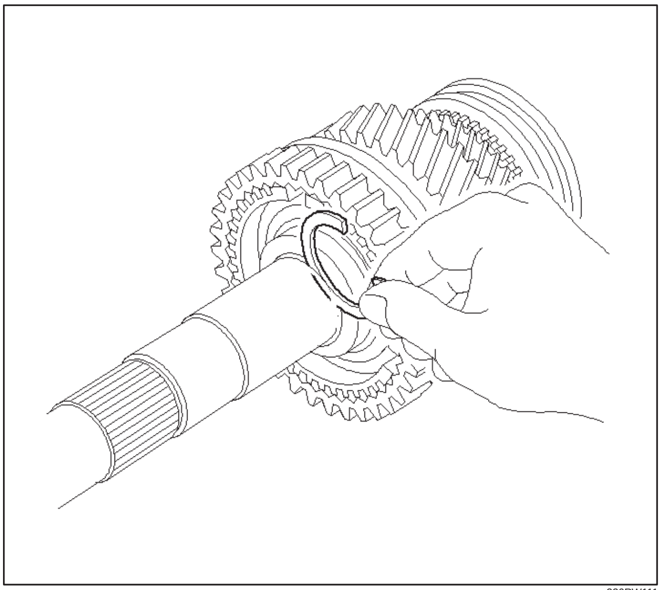
- Align the projection of inner ring with hub No.1 slots.
- Check that the gear rotates smoothly.



226RW110

4. Select a snap ring that will allow minimum axial play.

Mark	Thickness
A	2.30 – 2.35 mm (0.091 – 0.093 in)
B	2.35 – 2.40 mm (0.093 – 0.095 in)
C	2.40 – 2.45 mm (0.095 – 0.097 in)
D	2.45 – 2.50 mm (0.097 – 0.098 in)
E	2.50 – 2.55 mm (0.098 – 0.100 in)
F	2.55 – 2.60 mm (0.100 – 0.102 in)
G	2.60 – 2.65 mm (0.102 – 0.104 in)

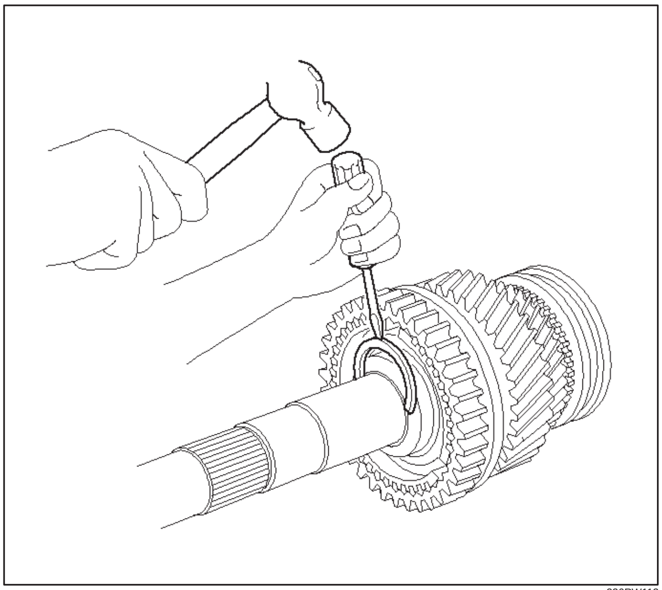


226RW111

5. Using a screwdriver and hammer, install the snap ring.

NOTE: Be careful not to damage the bearing surface.

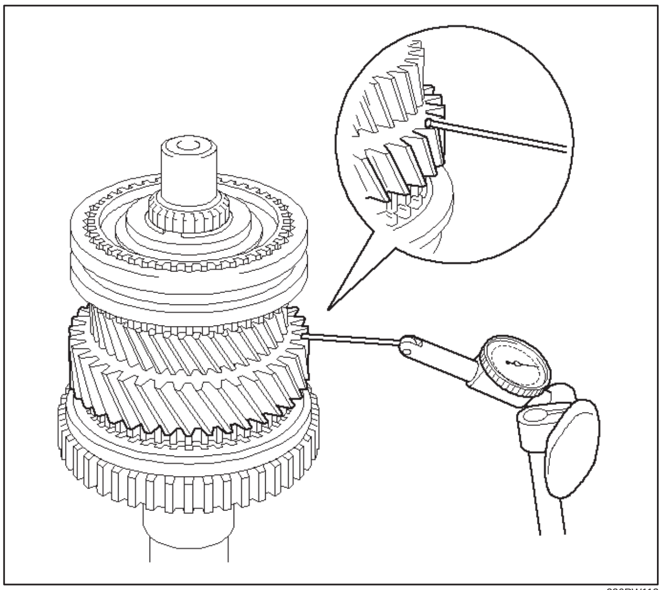
6. Check that the gear rotates smoothly.



226RW112

7. Using a dial indicator, measure the 2nd gear thrust clearance.

Standard: 0.10 – 0.25mm (0.004 – 0.010 in)



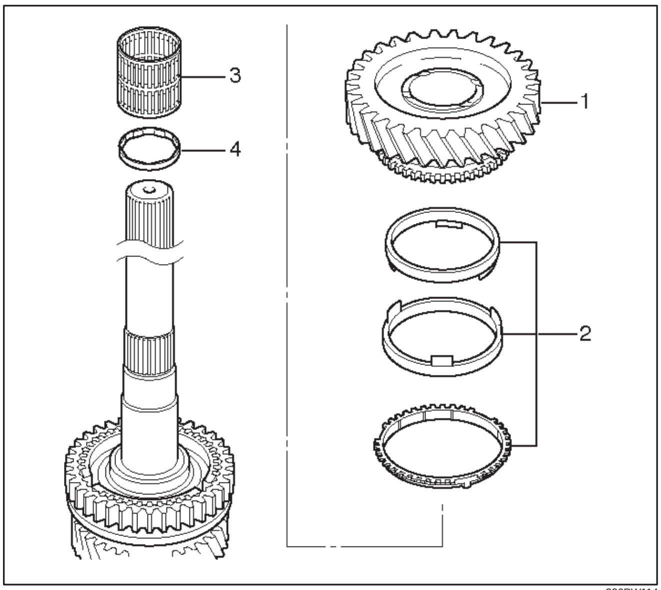
226RW113

12. Install the 1st gear.

1. Install the following parts:
   1. 1st gear bearing spacer (4).
   2. 1st gear needle roller bearing (3).
   3. Synchronizer assembly (2).
   4. 1st gear (1).

NOTE:

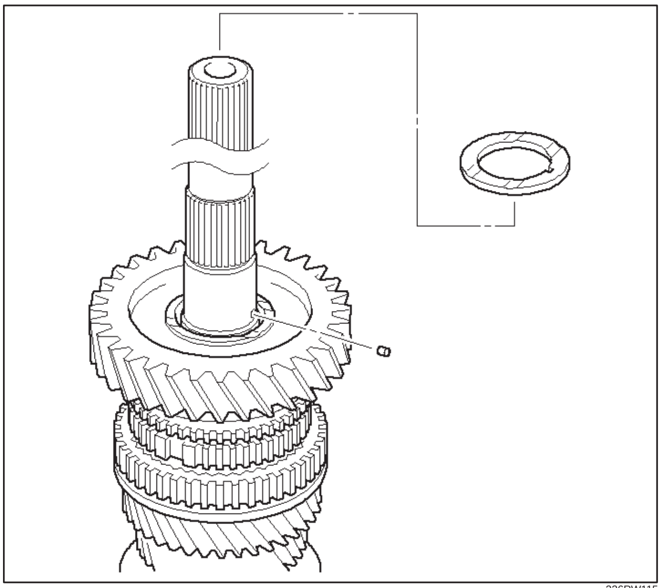
- Align the projection of inner ring with hub No.1 slots.
- Check that the gear rotates smoothly.



226RW114

2. Install the 1st gear thrust washer pin and 1st gear thrust washer to the mainshaft.

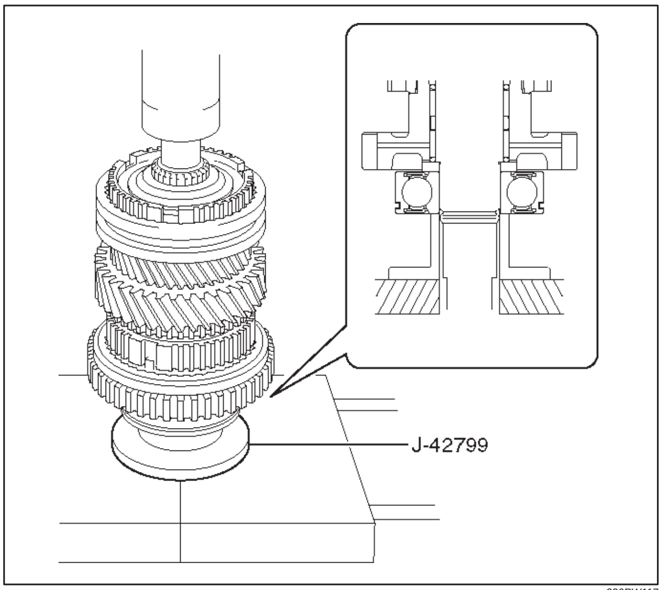
NOTE: Align the straight pin with the thrust washer slot.



226RW115

13. Install the mainshaft center bearing.
    1. Using installer J–42799 and a press, install the mainshaft center bearing.

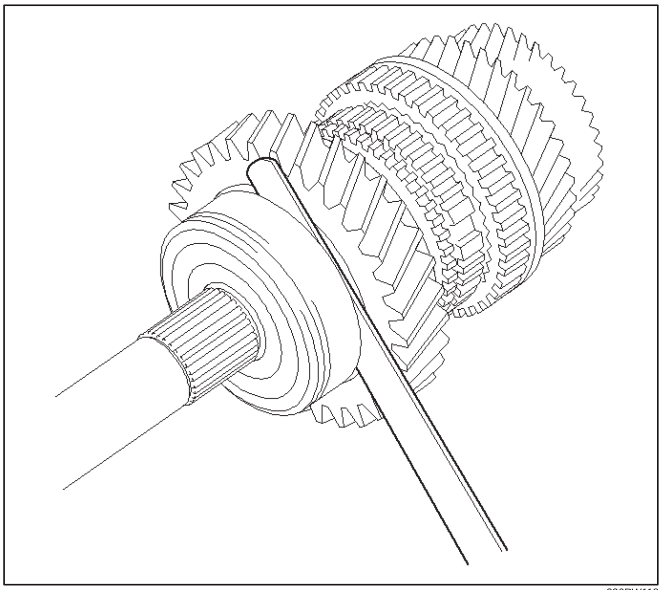
NOTE: Center bearing snap ring groove toward rear.



226RW117

    2. Using a thickness gauge, measure 1st gear thrust clearance.

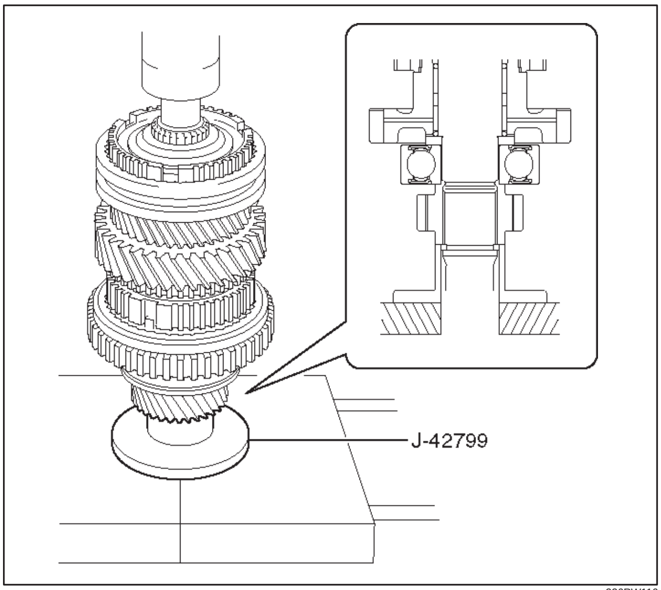
Standard: 0.10 – 0.45mm (0.004 – 0.018 in)



226RW118

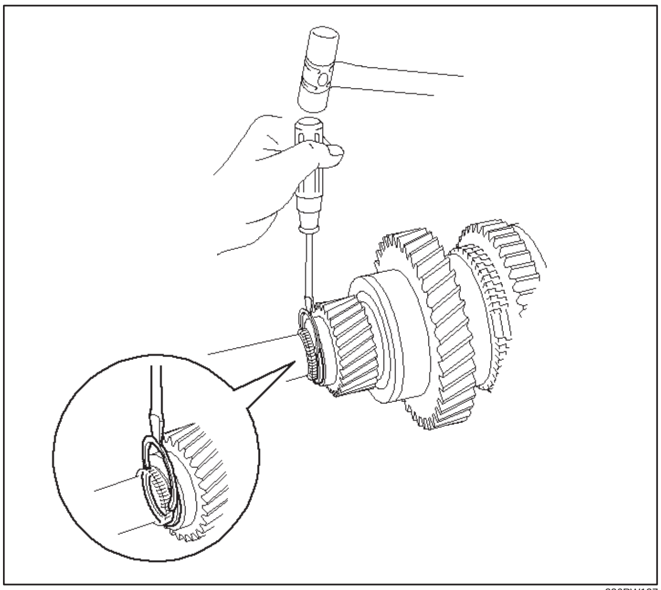
14. Install the 5th gear.
    1. Using installer J–42799 and a press, install the 5th gear.
    2. Select a snap ring that will allow minimum axial play.

Mark	Thickness
C	2.75 – 2.80 mm (0.108 – 0.110 in)
D	2.80 – 2.85 mm (0.110 – 0.112 in)
E	2.85 – 2.90 mm (0.112 – 0.114 in)
F	2.90 – 2.95 mm (0.114 – 0.116 in)
G	2.95 – 3.00 mm (0.116 – 0.118 in)
H	3.00 – 3.05 mm (0.118 – 0.120 in)
J	3.05 – 3.10 mm (0.120 – 0.122 in)
K	3.10 – 3.15 mm (0.122 – 0.124 in)
L	3.15 – 3.20 mm (0.124 – 0.126 in)
M	3.20 – 3.25 mm (0.126 – 0.128 in)
N	3.25 – 3.30 mm (0.128 – 0.130 in)
P	3.30 – 3.35 mm (0.130 – 0.132 in)



226RW116

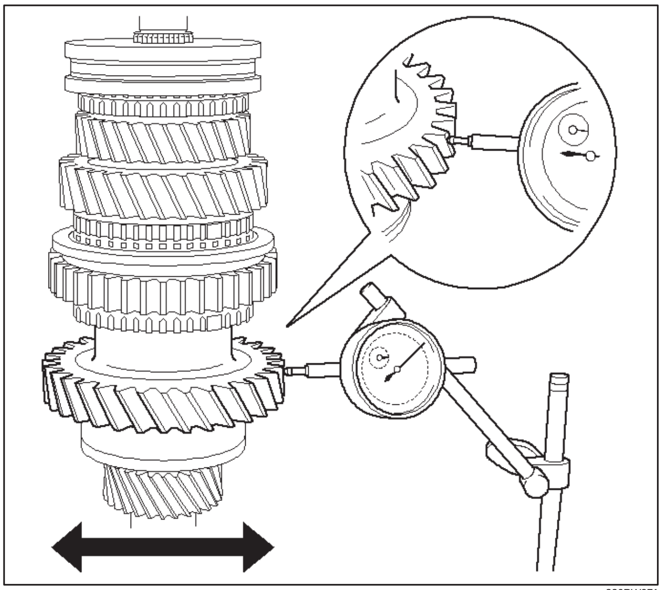
    3. Using a screwdriver and hammer, install the new snap ring.



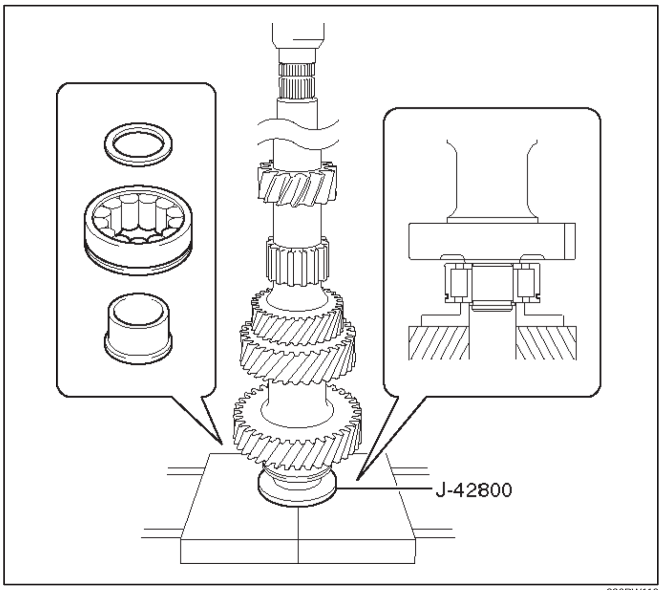
226RW127

15. Inspect each gear radial clearance.
    1. Mount the mainshaft through the aluminum plate in a vise.
    2. Using a dial indicator, measure the radial clearance of each gear.

Gear	Standard Clearanse
1st	0.020 – 0.073 mm (0.0008 – 0.0029 in)
2nd	0.015 – 0.068 mm (0.0006 – 0.0027 in)
3rd	0.015 – 0.068 mm (0.0006 – 0.0027 in)


226RW071

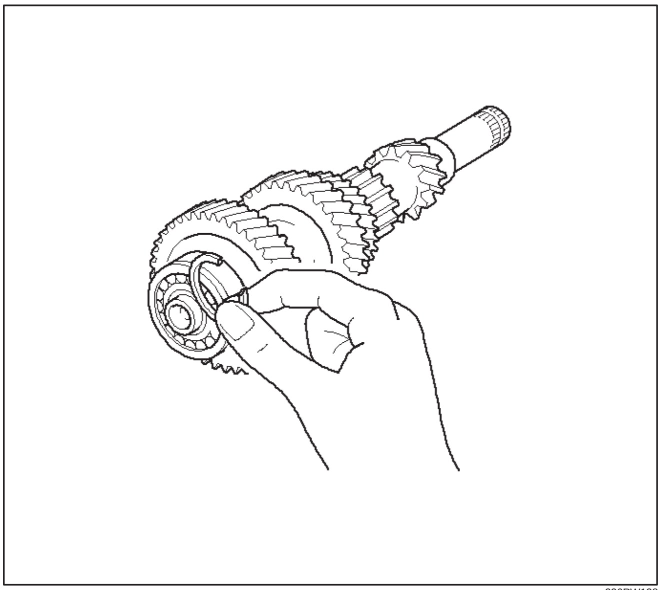
16. Install the counter gear shaft.
    1. Check the new counter front bearing inner race and the side race, as shown.
    2. Using installer J–42800 and a press, install the counter gear shaft front bearing.



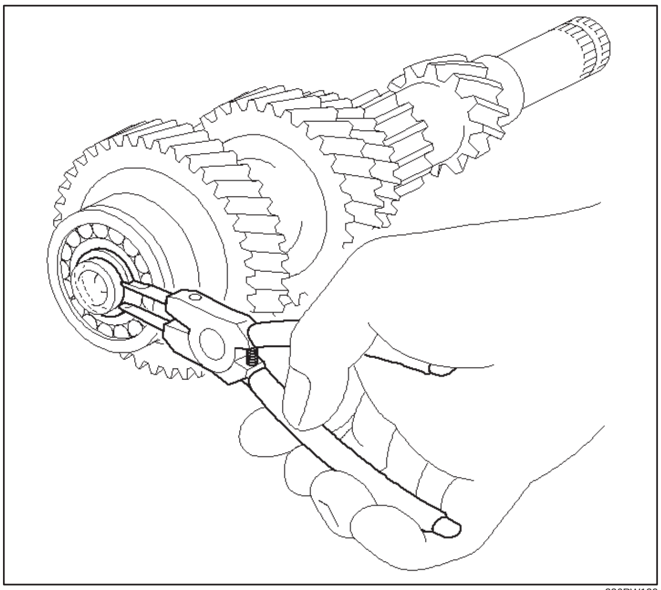
226RW119

3. Select a snap ring that will allow minimum axial play.

Mark	Thickness
A	2.00 – 2.05 mm (0.079 – 0.081 in)
B	2.05 – 2.10 mm (0.081 – 0.083 in)
C	2.10 – 2.15 mm (0.083 – 0.085 in)
D	2.15 – 2.20 mm (0.085 – 0.087 in)
E	2.20 – 2.25 mm (0.087 – 0.089 in)
F	2.25 – 2.30 mm (0.089 – 0.091 in)


226RW128

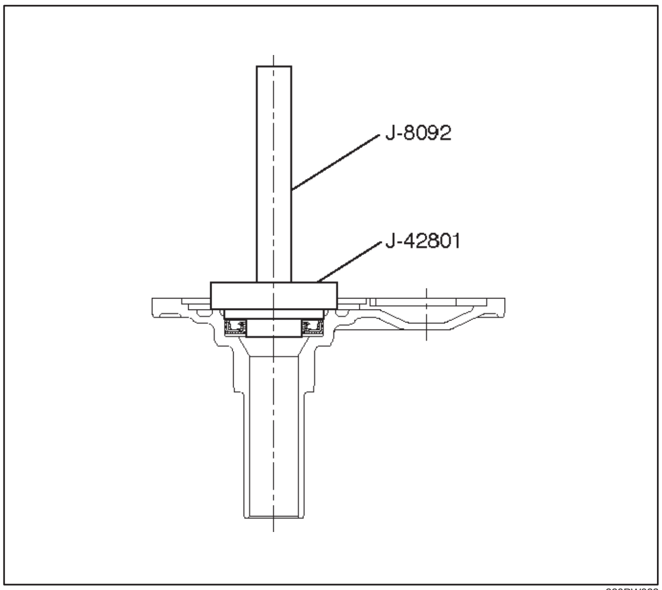
4. Using a snap ring expander, install the new snap ring.


226RW129

17. Install the front cover.
    1. Using installer J–42801, grip J–8092 and a hammer, drive in a new oil seal.

Drive in depth (from cover end): 11.7 ± 0.5 mm (0.46 ± 0.02 in)

    2. Apply grease to the seal lip.

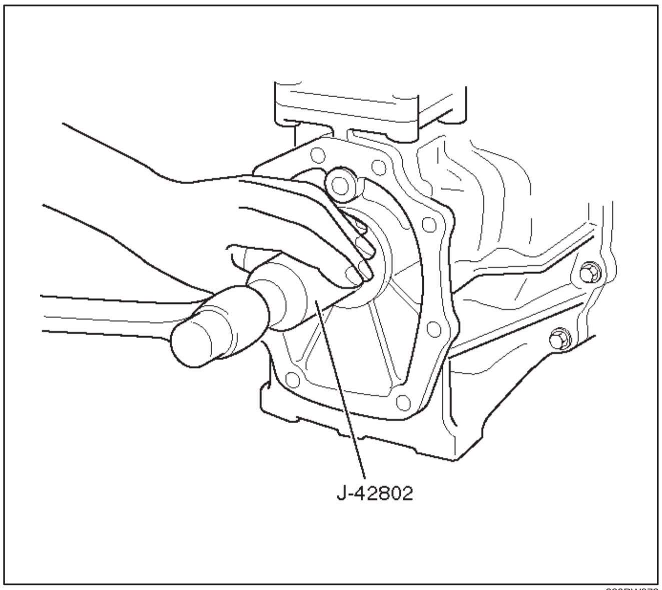


220RW023

18. Install the transfer adapter.
    1. Using installer J –42802, and a hammer drive in a new oil seal.

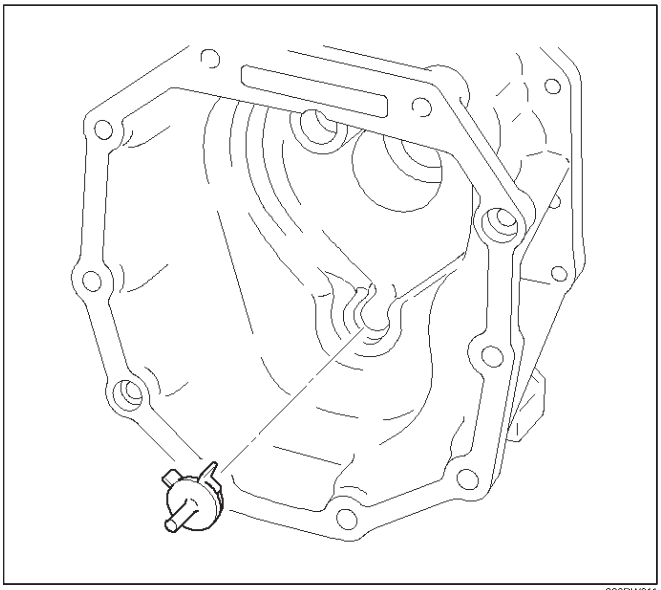
Drive in depth (from transfer adapter): 10.95 ± 0.5 mm (0.431 ± 0.02 in)

    2. Apply grease to the oil seal lip.

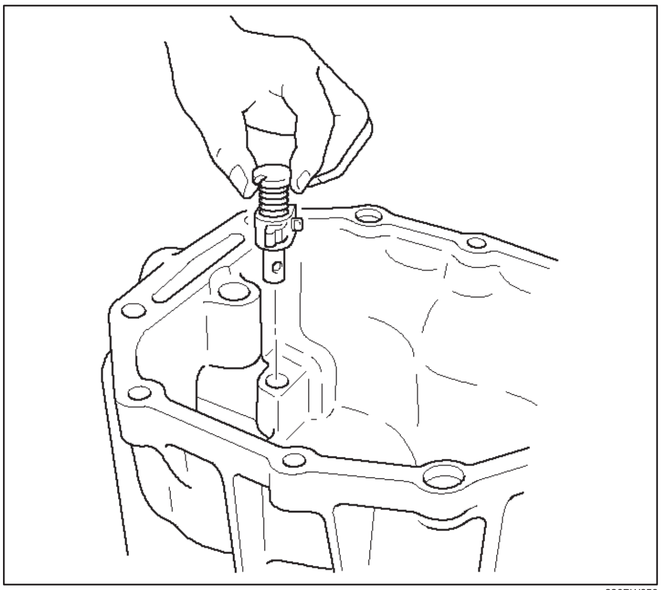


220RW073

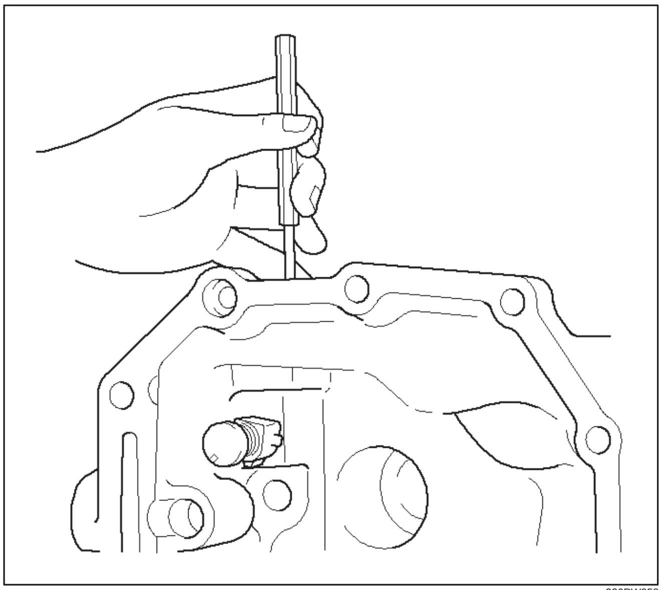
3. Install the oil receiver pipe.


220RW011

4. Install the reverse restrict to the transfer adapter.


226RW059

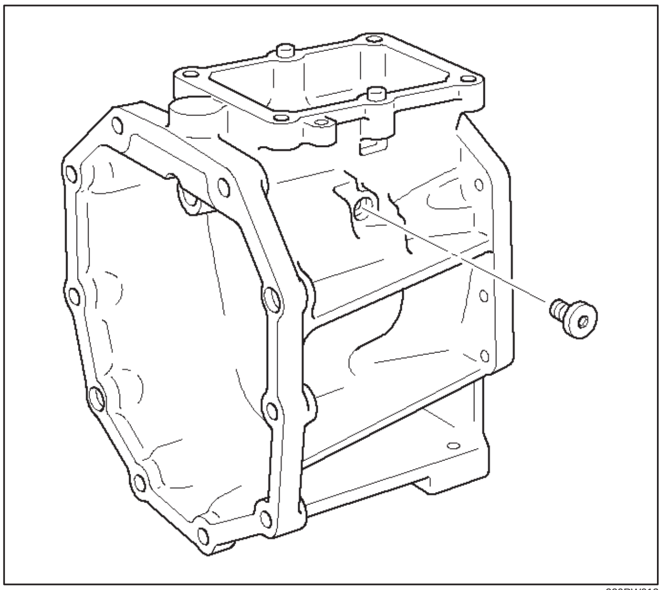
5. Using a pin punch and hammer, drive in the slotted spring pin.



226RW058

6. Clean up the plug and plug hole.
7. Apply sealant to the plug threads. (THREE BOND 1344 or equivalent)
8. Using a torx socket wrench(T40), install and torque the plug.

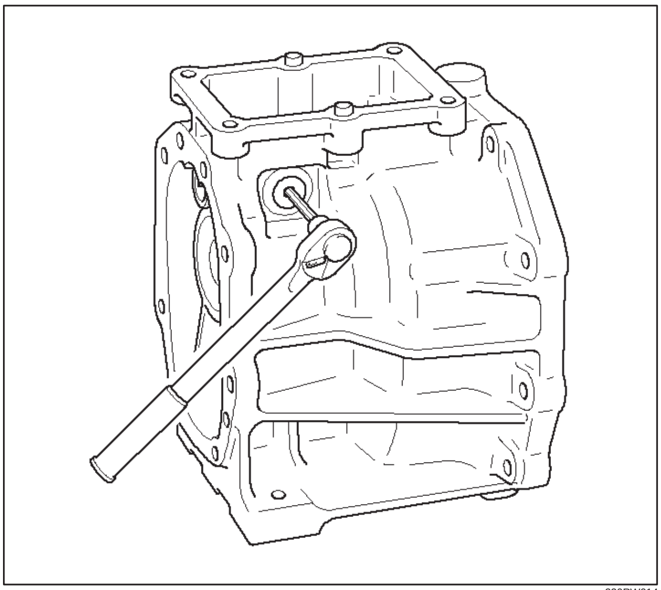
Torque: 18.5 N·m (13.5 lb ft)



220RW013

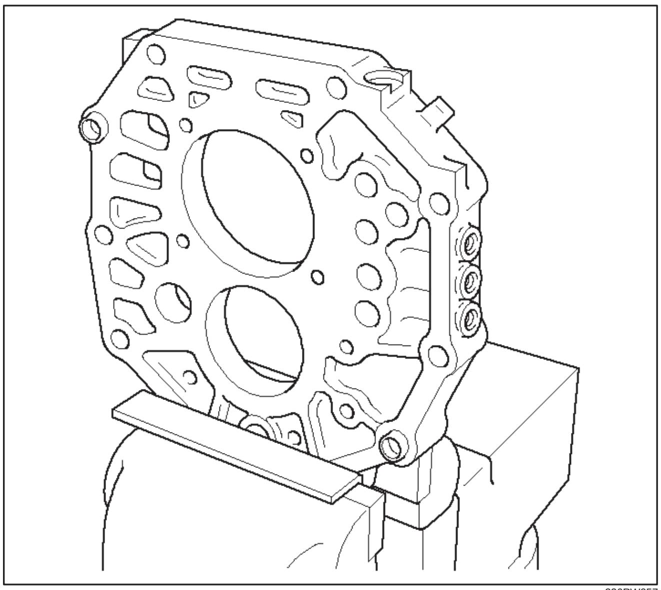
9. Using hexagon wrench, install and torque the plug.

Torque: 37 N·m (27 lb ft)



220RW014

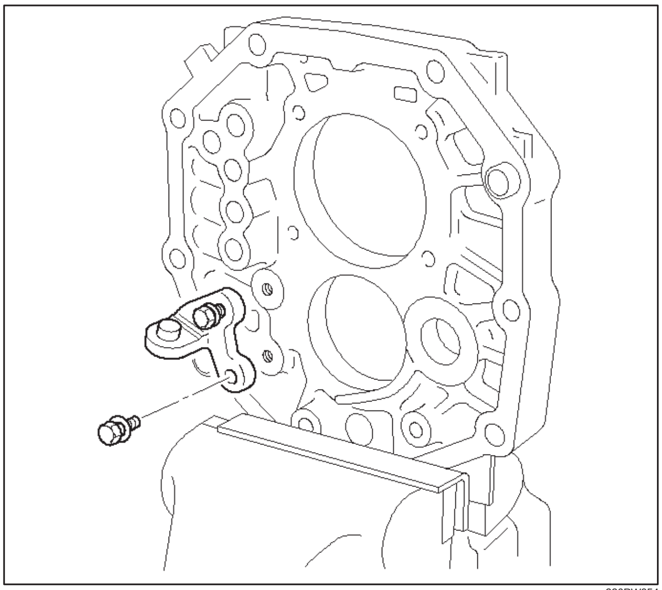
19. Install the reverse shift arm No.1 and reverse shift arm No.2.
    1. Mount the intermediate plate through the aluminum plate in a vise.



226RW057

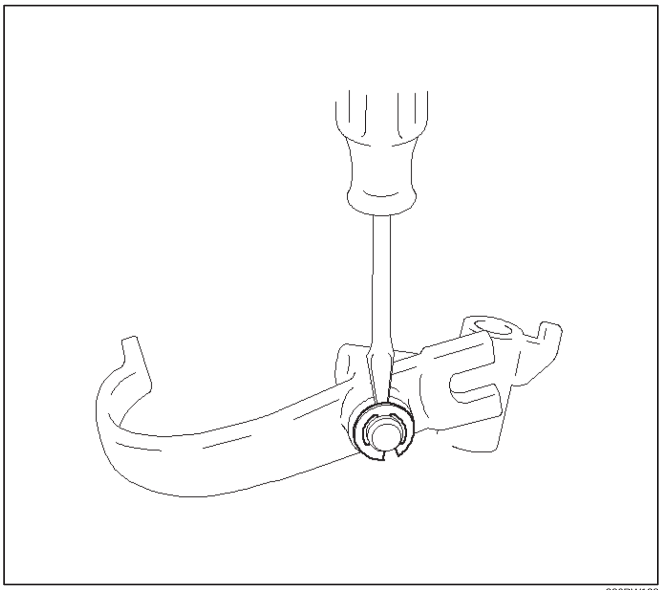
2. Using 2 bolts, install reverse shift arm bracket.

Torque: 18 N·m (13 lb ft)



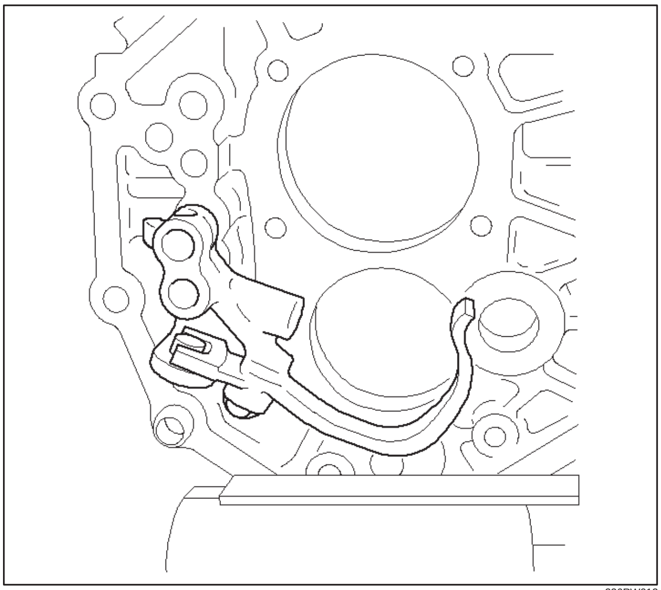
226RW054

3. Install reverse shift arm No.2 to the reverse shift arm No.1. Using screwdriver and a hammer, install the new E-ring.



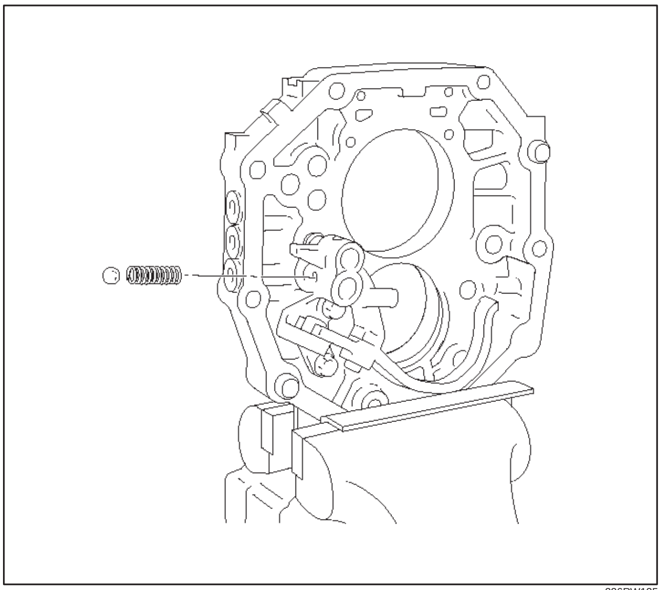
226RW138

4. Install reverse shift arm No.2 to the reverse shift arm bracket.



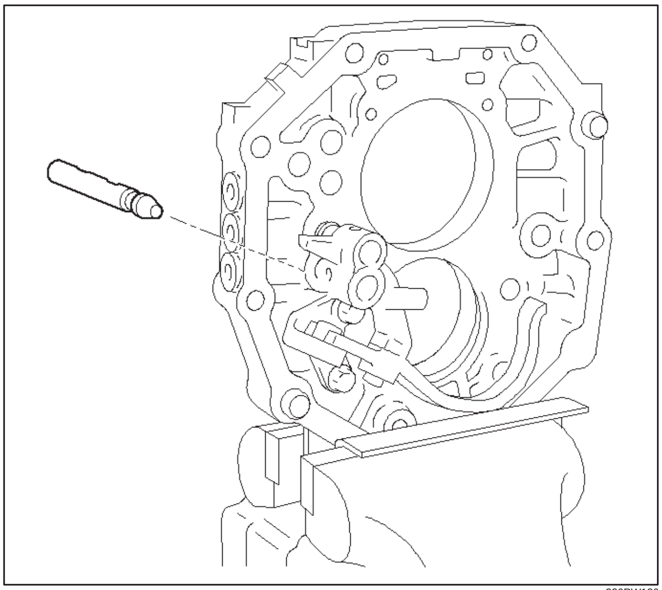
226RW012

20. Install the reverse shift rod.
    1. Install the reverse shift arm No.1 compression spring and ball to the reverse shift arm No.1.



226RW125

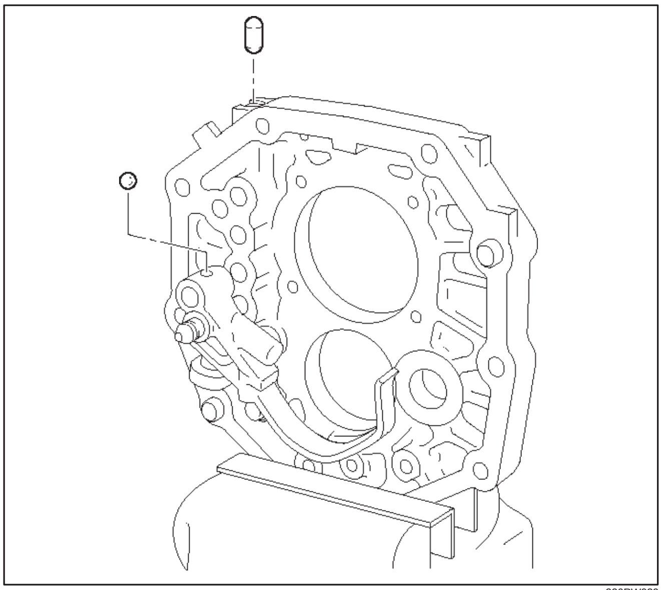
2. Install the reverse shift rod from the rear side by pushing the ball on using a screwdriver.



226RW126

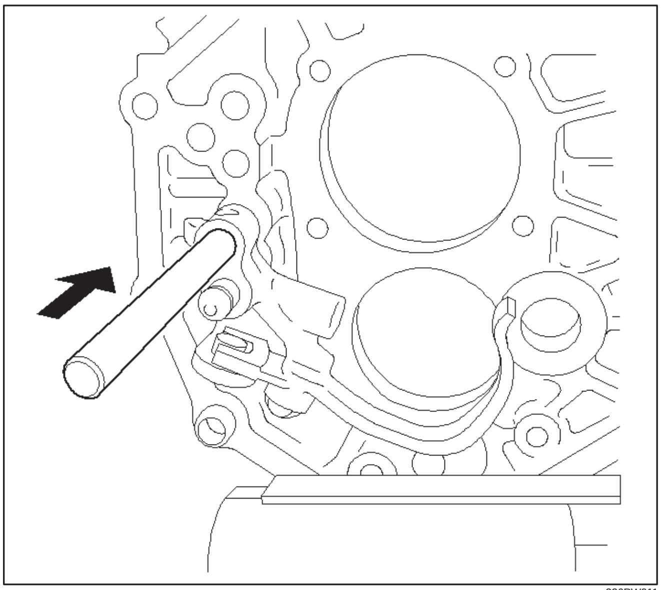
21. Install the reverse-5th shift rod.

1. Install the reverse shift arm No.1 lock ball to the reverse shift arm No.1.
2. Install the interlock pin to the intermediate plate.



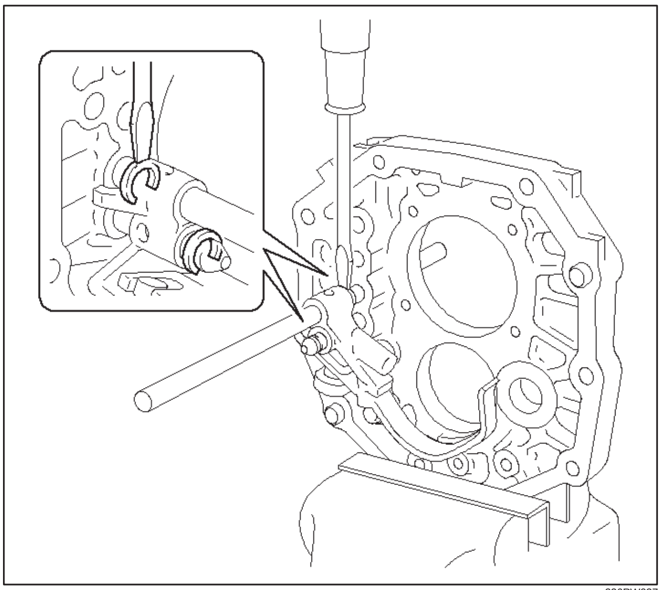
226RW039

3. Put in the reverse-5th shift rod from the front.



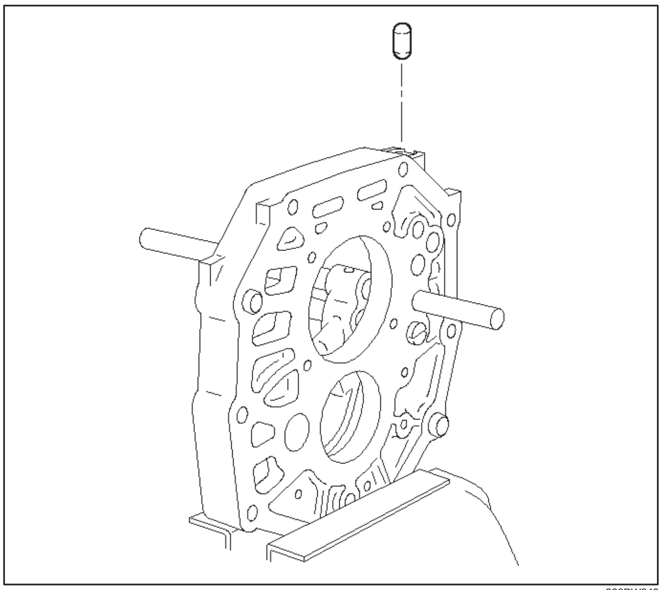
226RW011

4. Using a screwdriver and a hammer, install the 2 new shift rod snap rings to the 5th-reverse shift rod and reverse shift rod.



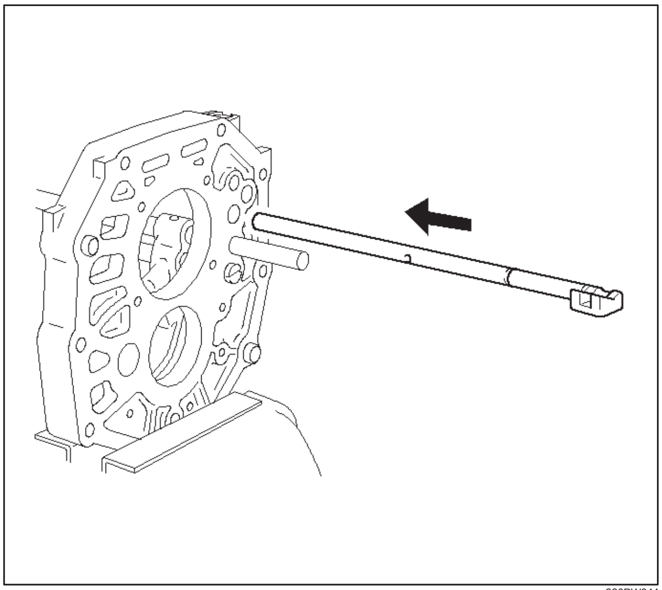
226RW037

22. Install 1st–2nd shift rod.
    1. Install the interlock pin to the intermediate plate.



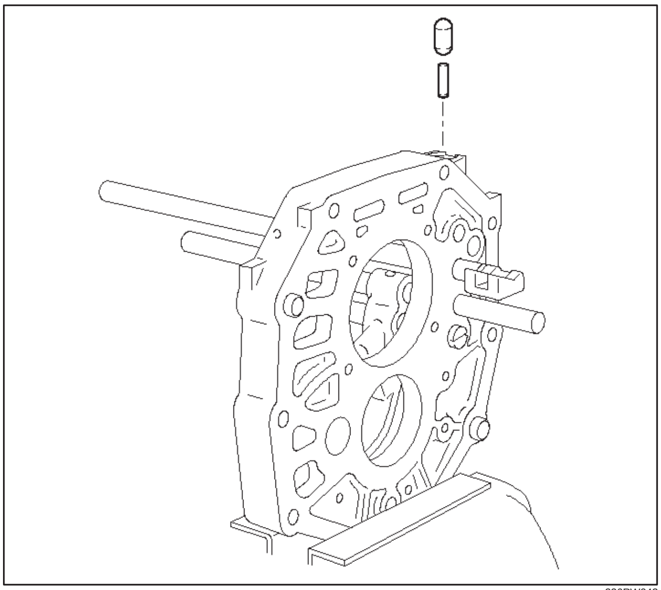
226RW042

    2. Put in the 1st–2nd shift rod from the rear.



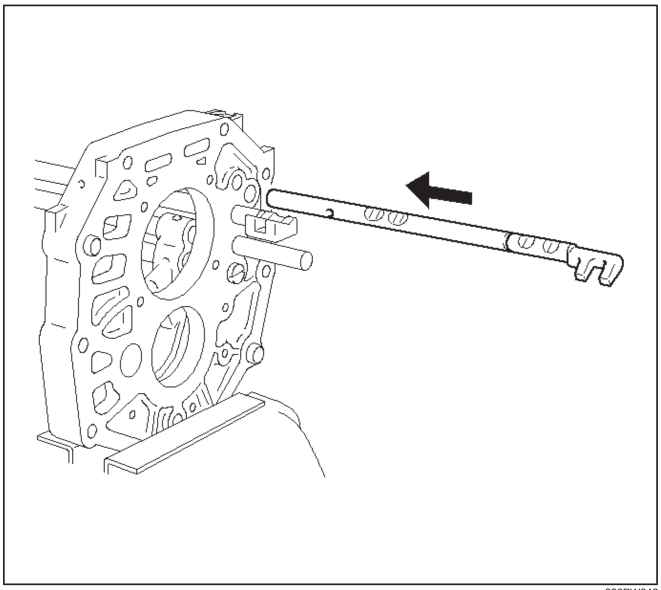
226RW044

23. Install 3rd–4th shift rod.
    1. Install the straight pin and interlock pin to the intermediate plate.



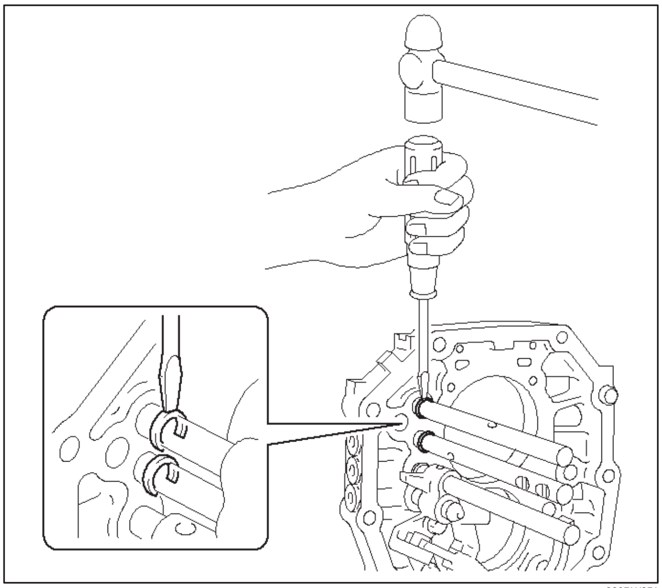
226RW043

    2. Put in the 3rd–4th shift rod from the rear.



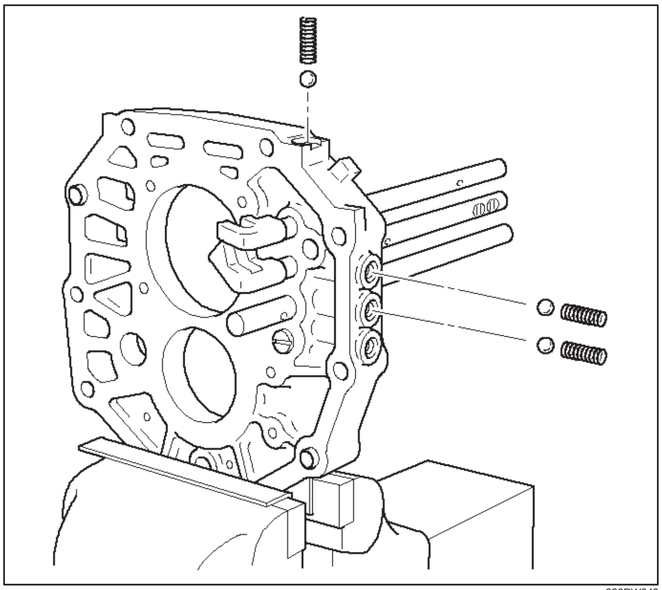
226RW046

24. Install the interlock parts.
    1. Using a screwdriver and hammer, 2 new shift rod snap rings to the 1st–2nd and 3rd–4th shift rod.



226RW051

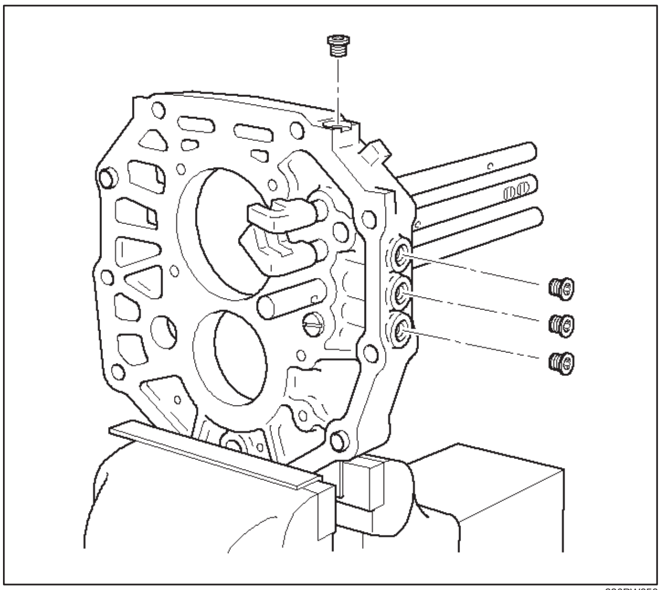
    2. Install the 3 shift detent ball and springs to the intermediate plate.



226RW049

    3. Clean up the plug hole.
    4. Apply sealant to the plug threads.
       sealant: three bond 1344 or equivalent
    5. Using a torx socket wrench(T40) install and torque the 4 plugs.

Torque: 18.5 N·m (13.5 lb ft)

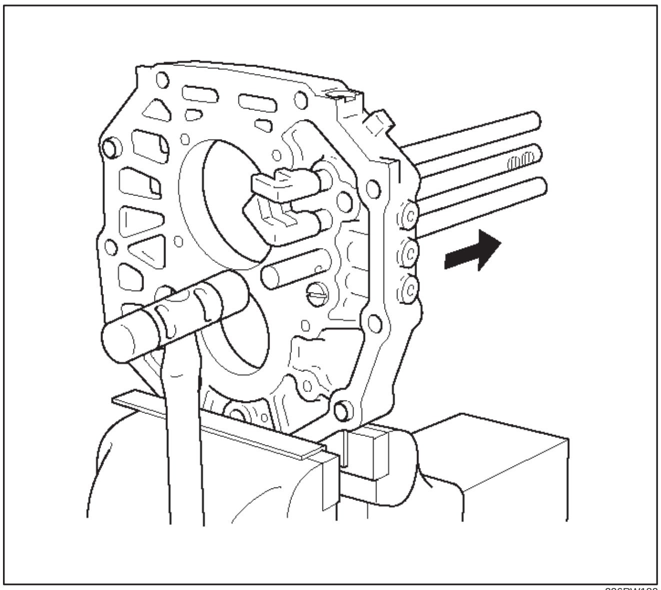


226RW050

25. Install mainshaft assembly.

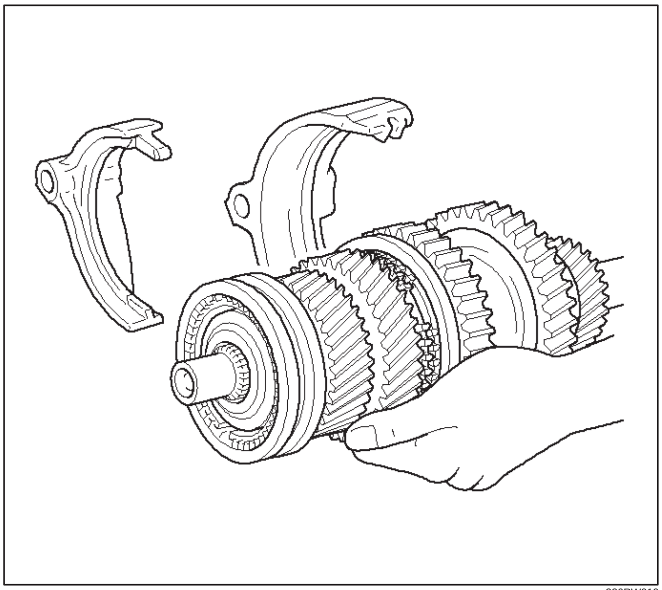
NOTE: Coat all parts with gear oil before installing them.

    1. Using a plastic hammer, tap the 5th-reverse shift rod at the reverse shift.



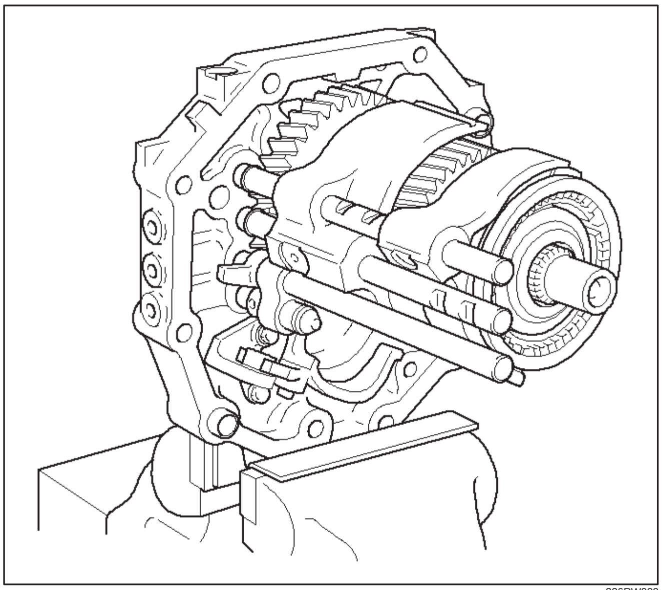
226RW180

2. Install the shift arm No.1 and No.2 to the mainshaft.



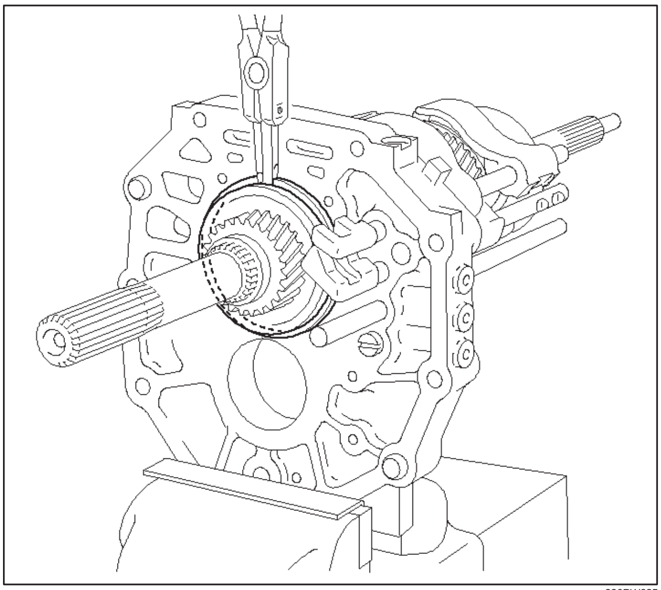
226RW010

3. Using a plastic hammer, tap the intermediate plate and install the mainshaft. Through the shift arm No.1 and No.2 to the shift rod.



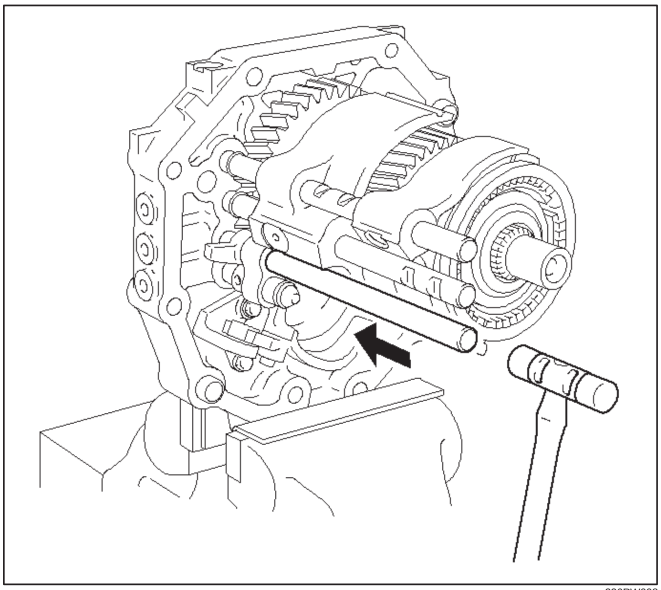
226RW009

4. Using a snap ring expander, install the snap ring.



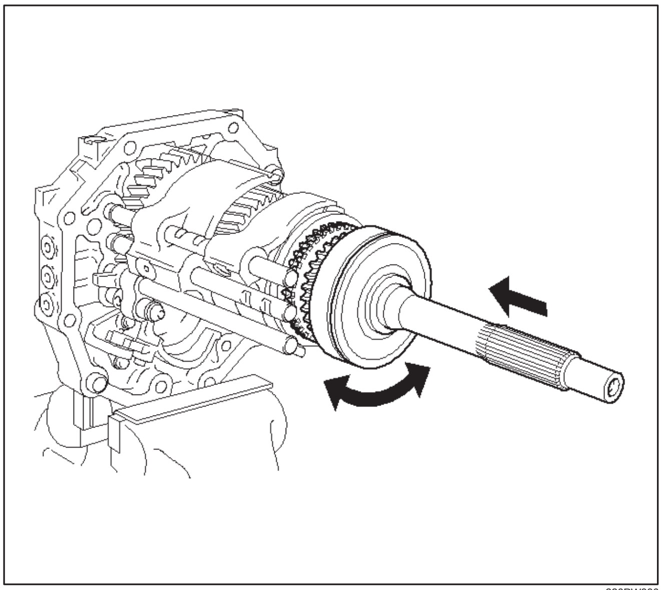
226RW035

5. Using a plastic hammer, tap the 5th-reverse shift rod at the neutral shift.

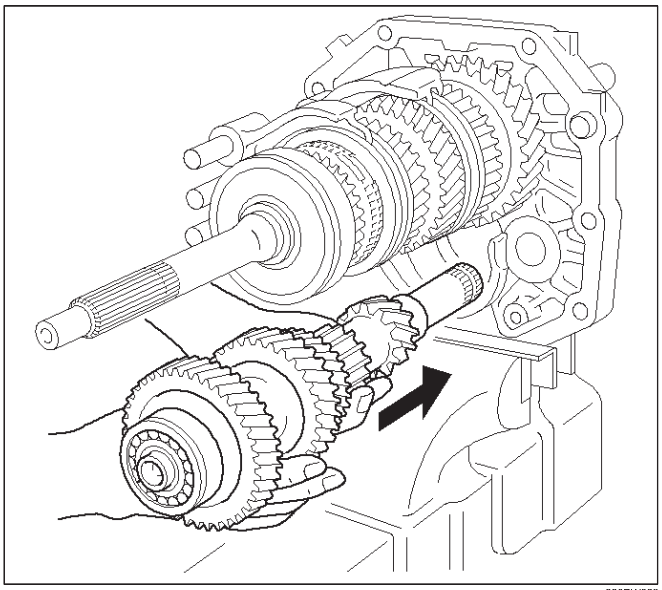


226RW008

26. Install the top gear shaft.
    1. Align the projection of the hub No.2 with the synchronizer ring slots, and install the top gear shaft assembly to the mainshaft.
    2. Check that the gear rotates smoothly.

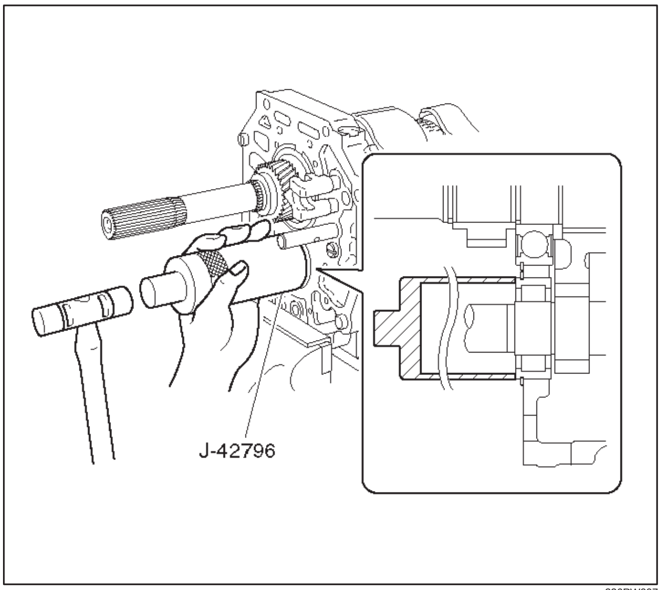

226RW006

27. Install the counter gear shaft.
    1. Temporarily install the counter gear shaft to the intermediate plate.


226RW028

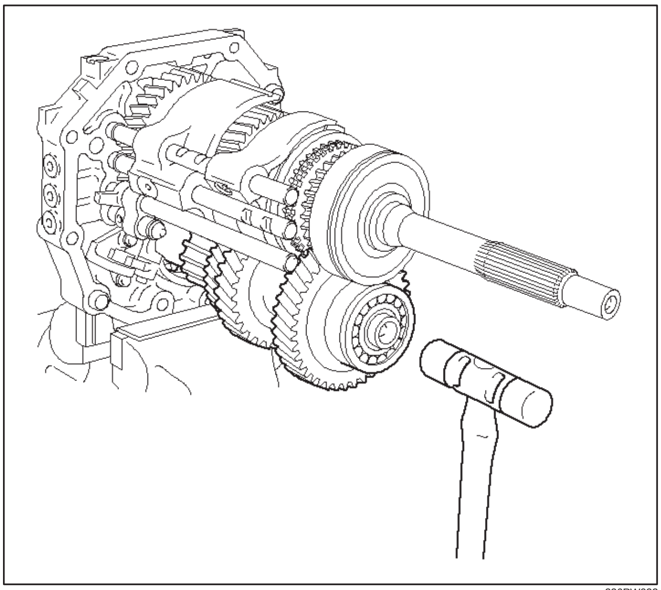
    2. Using installer J–42796 and a hammer, drive in the center bearing as shown.

NOTE: Outer race snap ring groove toward rear.



226RW007

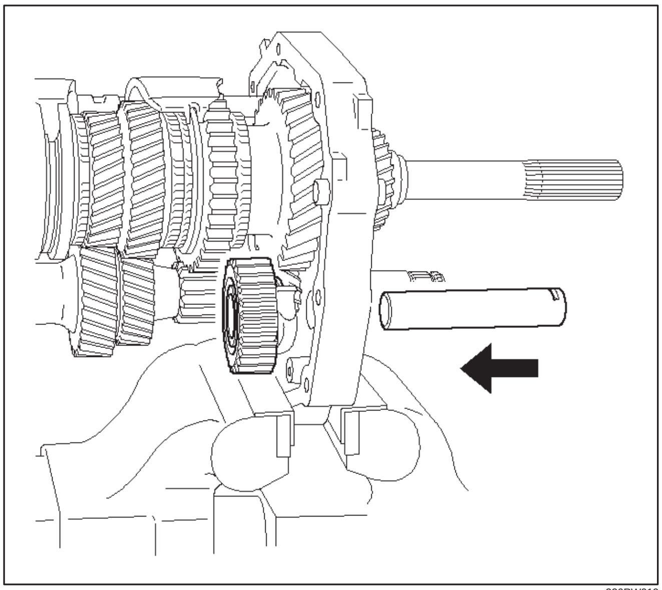
Reference: Drive in the counter rear bearing by tapping on the front end of the counter shaft.


226RW022

28. Install the reverse idle gear.
    1. Install the reverse idle gear and reverse idle gear shaft.

NOTE:

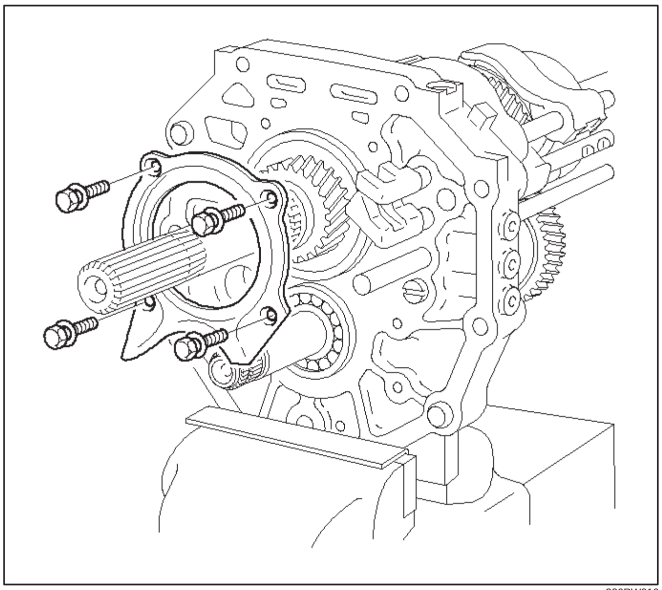
- Insert the reverse idle gear shaft with the slot toward rear.
- Install the reverse idle gear with the reverse shift arm No.2.



226RW019

29. Install the bearing plate.
    1. Align the bearing plate to groove of the reverse idle gear shaft.

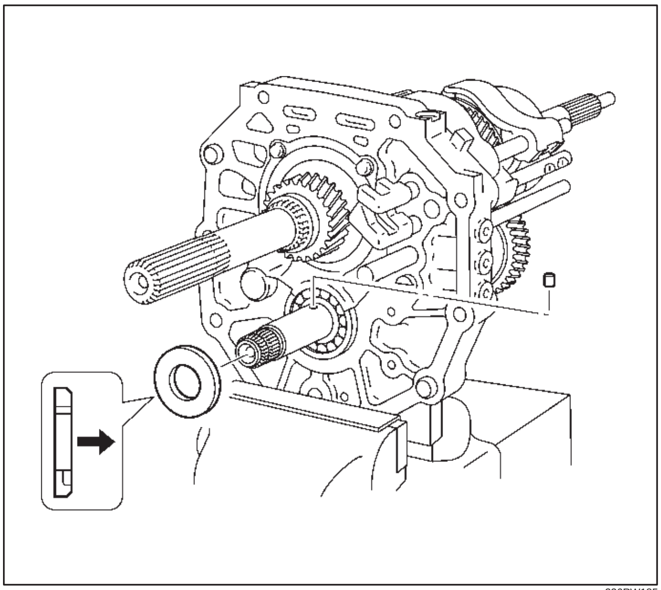
Torque: 12.5 N·m (109 lb in)



226RW016

30. Install the 5th gear thrust washer.
    1. Install the 5th gear thrust washer pin to the counter gear shaft.
    2. Install the 5th gear thrust washer to the counter gear shaft.

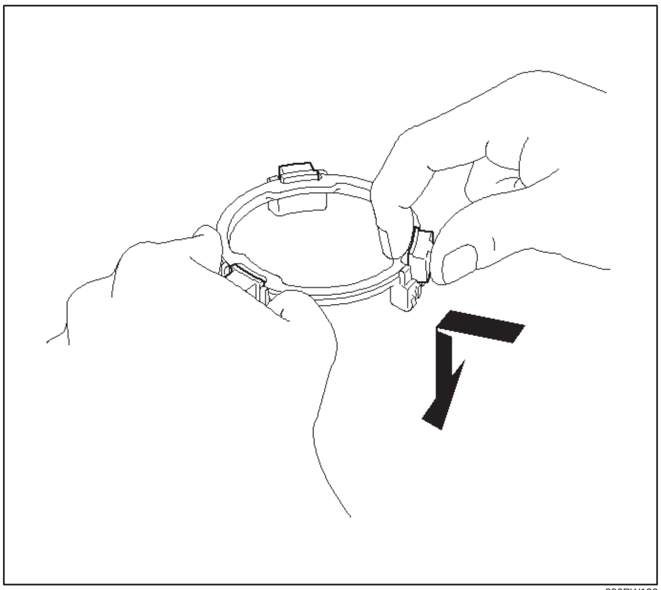
NOTE: Thrust washer must be assembled with the chamfered face of the washer toward the front.



226RW185

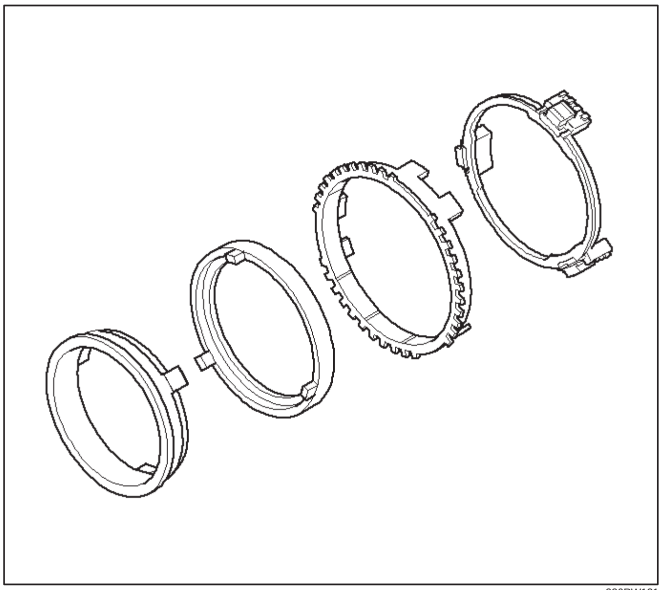
31. Install the counter 5th gear.
    1. Install the 3 inserts and 3 compression springs to the reverse block ring.

    Reference: Push the 3 inserts with the 3 compression springs to the reverse synchronizer ring.



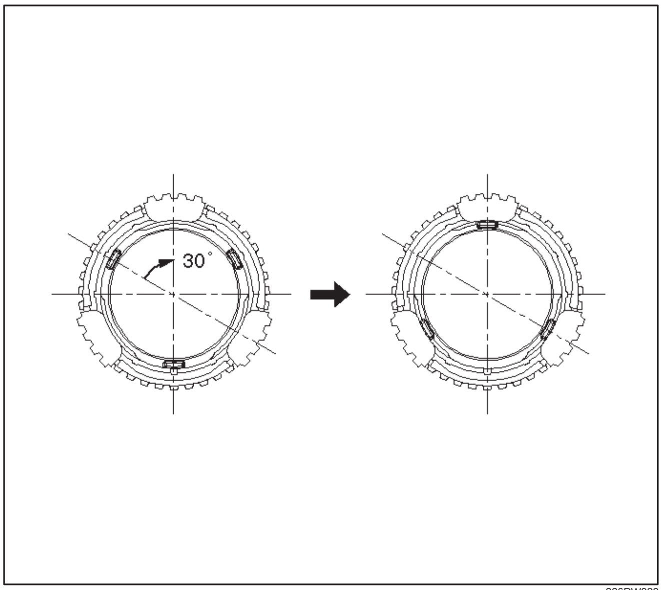
226RW120

2. Install the synchronizer outer ring, synchronizer cone ring, and synchronizer pull ring to the reverse block ring.



226RW121

3. Turn to 30 degree the reverse synchronizer pull ring.

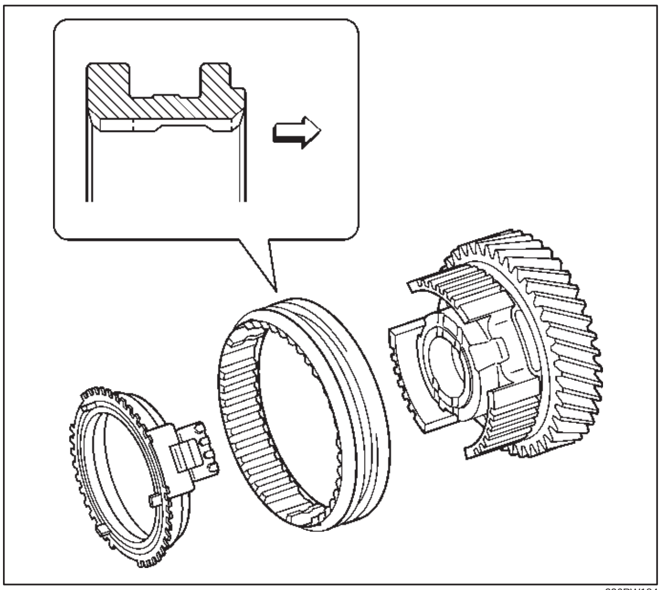


226RW080

4. Install the hub sleeve No.3 and reverse block ring set to the counter 5th gear.

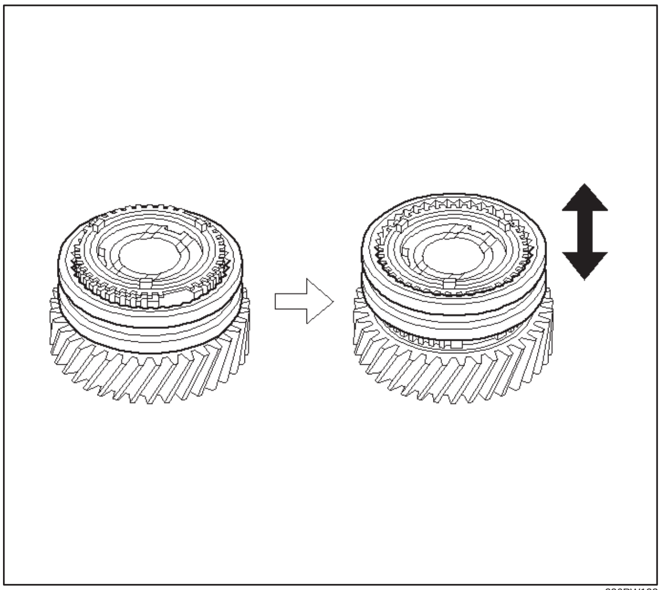
NOTE: Check the hub sleeve No.3 direction, as shown.

Reference: While pushing the 3 inserts, install the synchronizer ring assembly to the hub sleeve No.3.



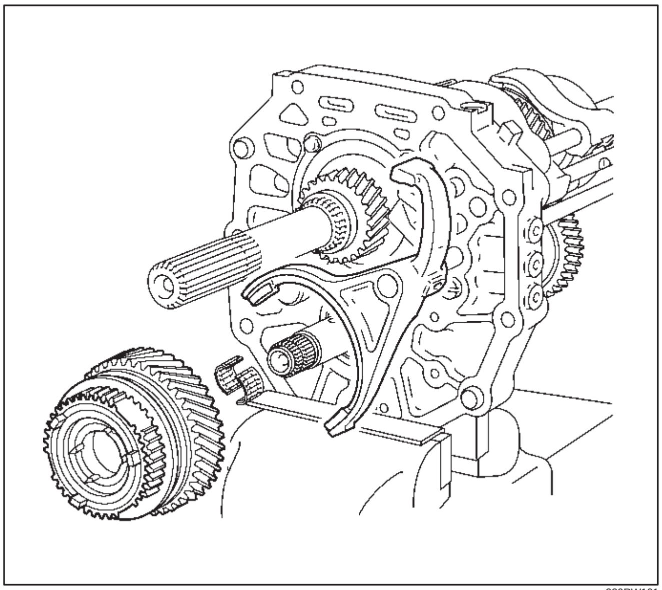
226RW184

5. Slide the hub sleeve No.3.



226RW123

6. Install the counter 5th gear bearing, counter 5th gear and reverse block ring set to the counter gear shaft, through the 5th reverse shift arm to the 5th reverse shift rod.

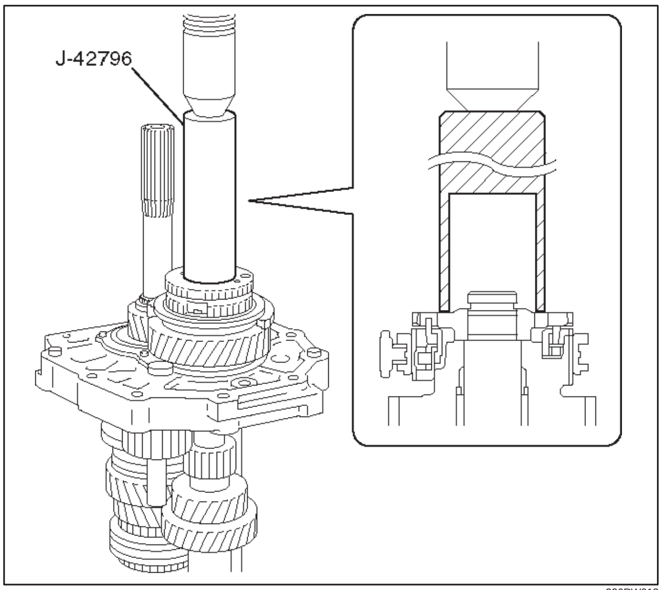


220RW101

7. Using installer J–42796 and a press, install counter 5th gear spline piece.

NOTE:

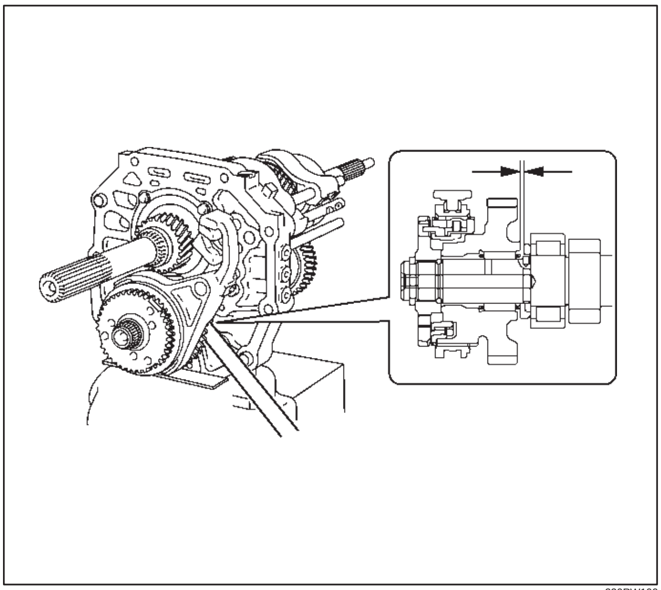
- Align the projection of the cone ring to the holes of the 5th gear spline piece.
- Check that the gear rotates smoothly.



226RW013

8. Using thickness gauge, measure the counter 5th gear thrust clearance.

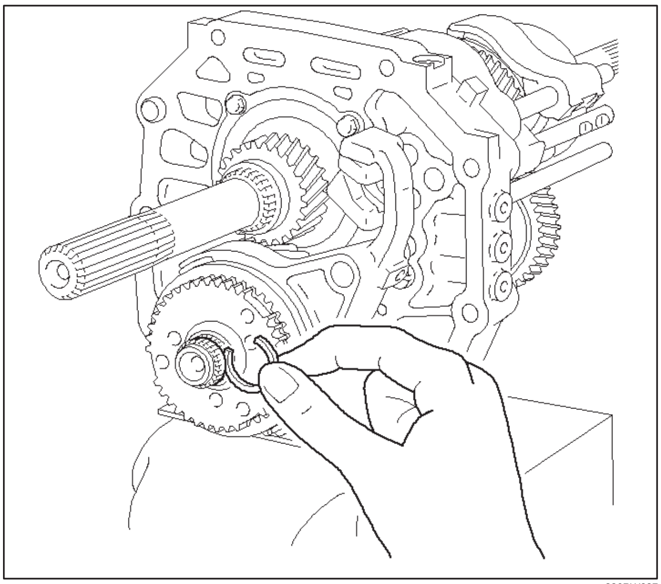
Standard: 0.10 – 0.35mm (0.004 – 0.014 in)



220RW100

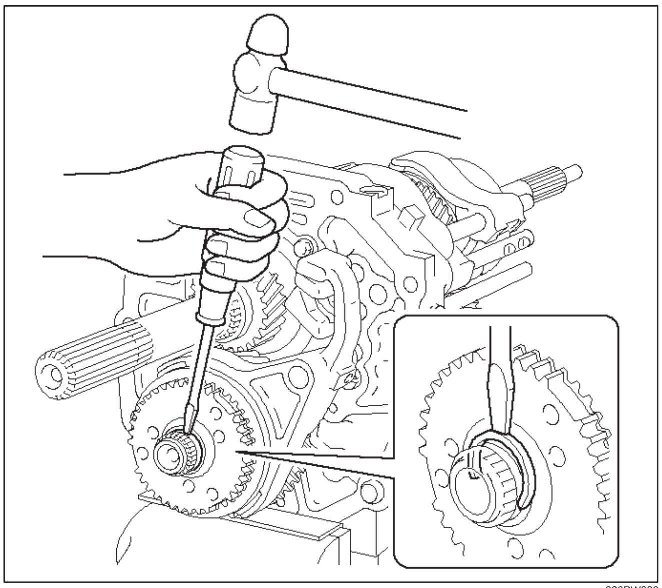
9. Select a snap ring that will allow minimum axial play.

Mark	Thickness
A	2.80 – 2.85 (0.110 – 0.112 in)
B	2.85 – 2.90 (0.112 – 0.114 in)
C	2.90 – 2.95 (0.114 – 0.116 in)
D	2.95 – 3.00 (0.116 – 0.118 in)
E	3.00 – 3.05 (0.118 – 0.120 in)
F	3.05 – 3.10 (0.120 – 0.122 in)
G	3.10 – 3.15 (0.122 – 0.124 in)



226RW027

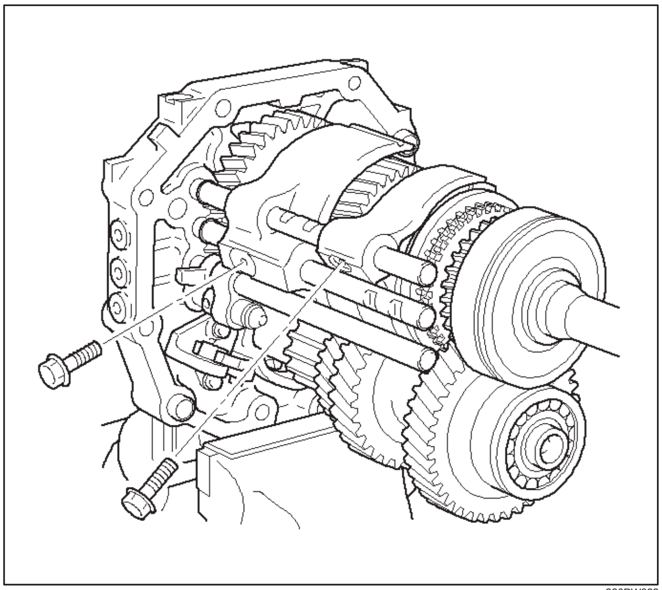
10. Install the new snap ring.



226RW026

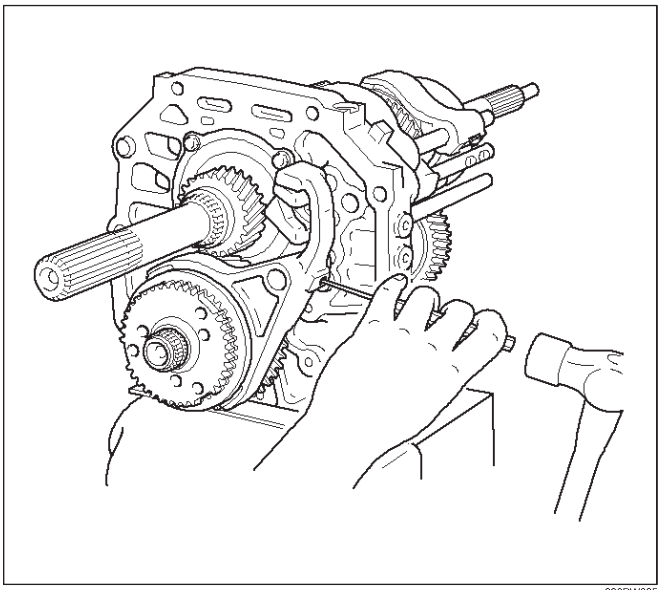
32. Install the shift arm bolts.
    1. Install and torque the 2 shift arm bolts.

Torque: 19.5 N·m (14 lb ft)



226RW023

33. Install the shift arm slotted pin.
    1. Using a pin punch and a hammer, drive in the slotted pin to the shift arm.

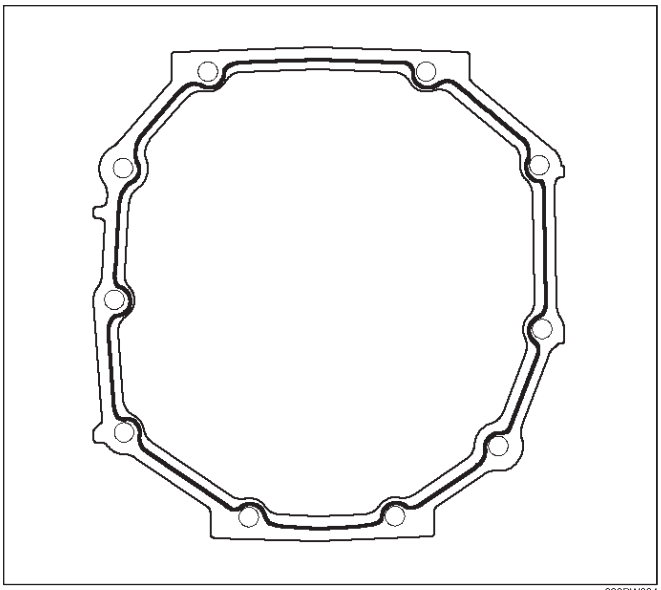


226RW025

34. Install the transmission case.
    1. Clean up the fitting surface.
    2. Apply recommended liquid gasket (THREE BOND 1281 or equivalent), as shown.

NOTE:

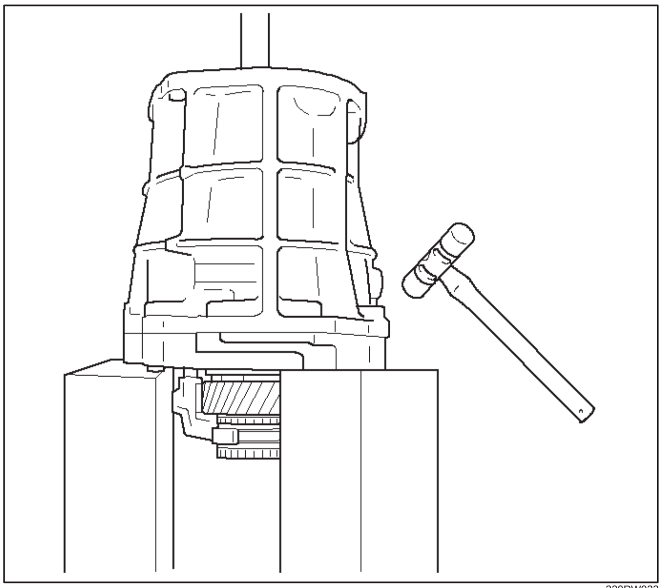
- Don't dry the liquid gasket.



220RW024

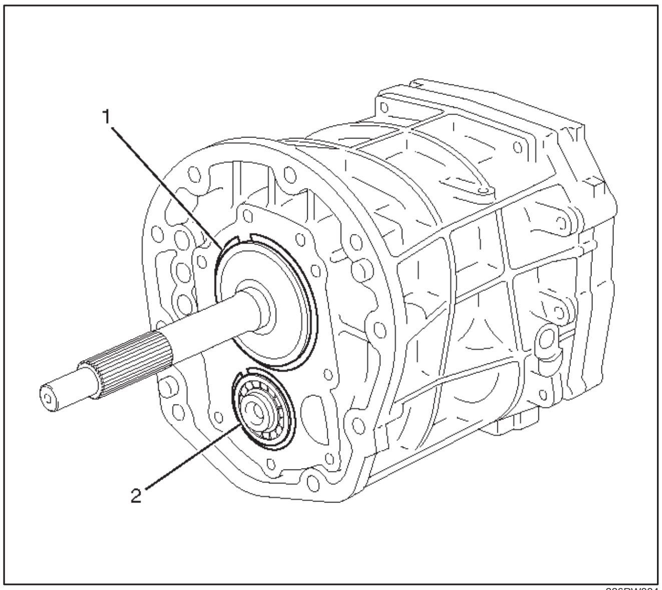
3. Stand the transmission by the wood blocks.
4. Using a plastic hammer, tap the transmission case and attach it to the intermediate plate.

NOTE: Be careful not to add over force to bearing.



220RW022

5. Using a snap ring expander, install the front bearing shaft snap ring (1) and counter gear shaft bearing snap ring (2).

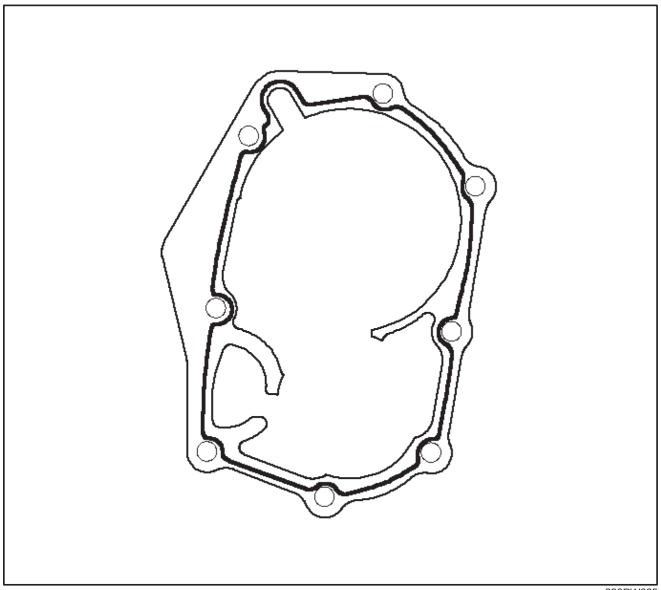


226RW004

6. Turn over the transmission.

35. Install the front cover.
1. Clean up the fitting surface.
2. Apply recommended liquid gasket (THREE BOND 1281 or equivalent), as shown.

NOTE:
- Don’t dry the liquid gasket.

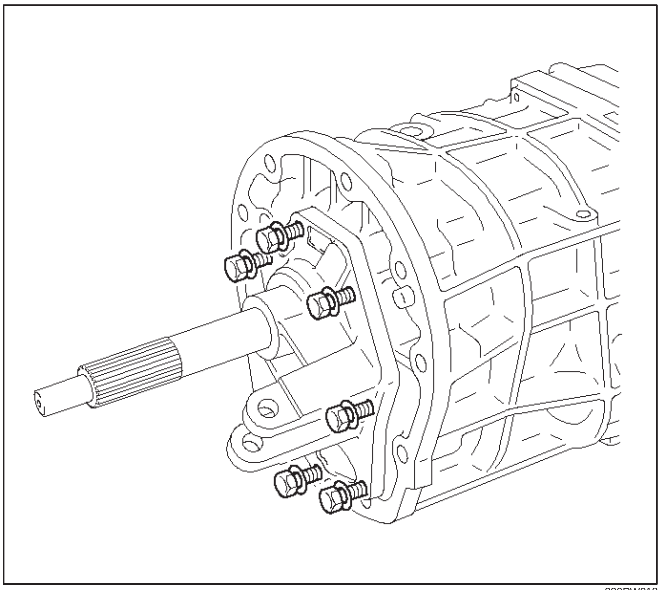


220RW025

3. Clean up and dry the bolts.
4. Apply thread sealant (THREE BOND 1344 or equivalent) to the 8 bolts.
5. Using 8 bolts, install the front cover to the transmission case.

Torque: 16.5 N·m (12 lb ft)

NOTE:
- Tighten the all bolts evenly.
- Be careful not to damage the oil seal.

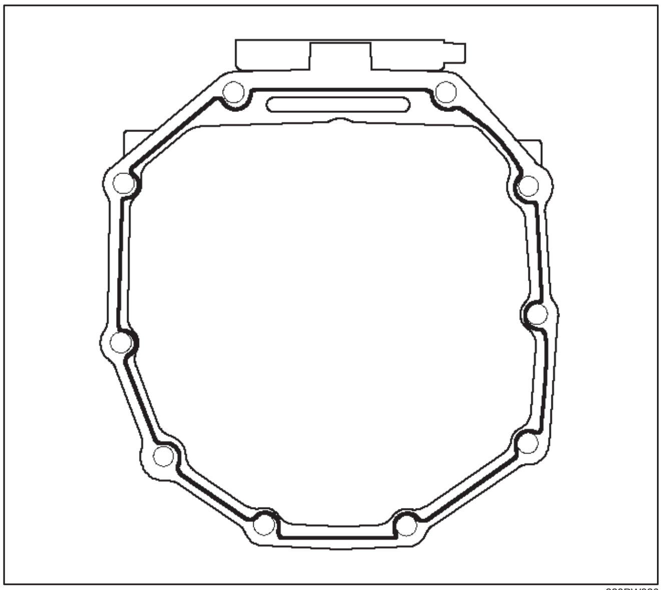


220RW018

6. Check that the top gear shaft and mainshaft rotate.

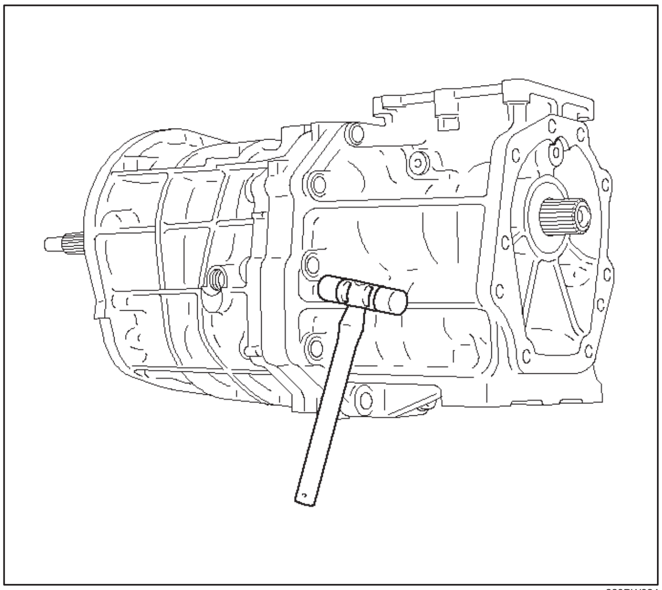
36. Install the transfer adapter.
1. Clean up the fitting surface.
2. Apply recommended liquid gasket (THREE BOND 1281 or equivalent), as shown.

NOTE:
- Don't dry the liquid gasket.



220RW026

3. Using a plastic hammer, tap the transfer adapter and attach it to the intermediate plate.

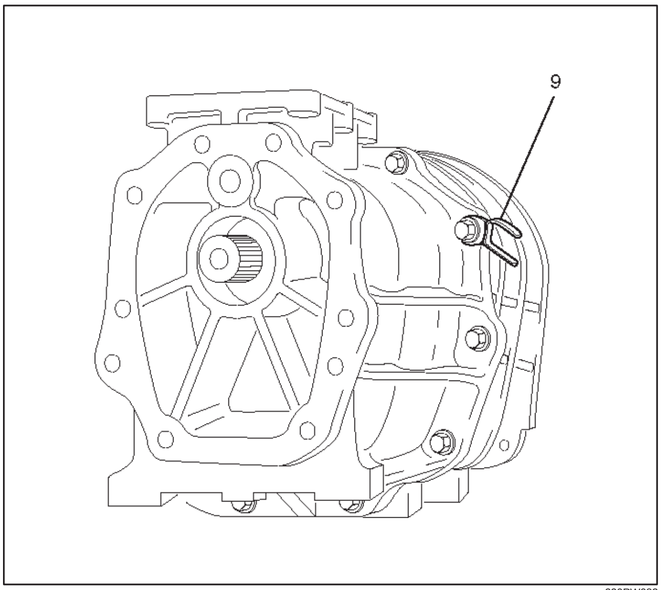


220RW034

4. Using 10 bolts, install the transfer adapter.

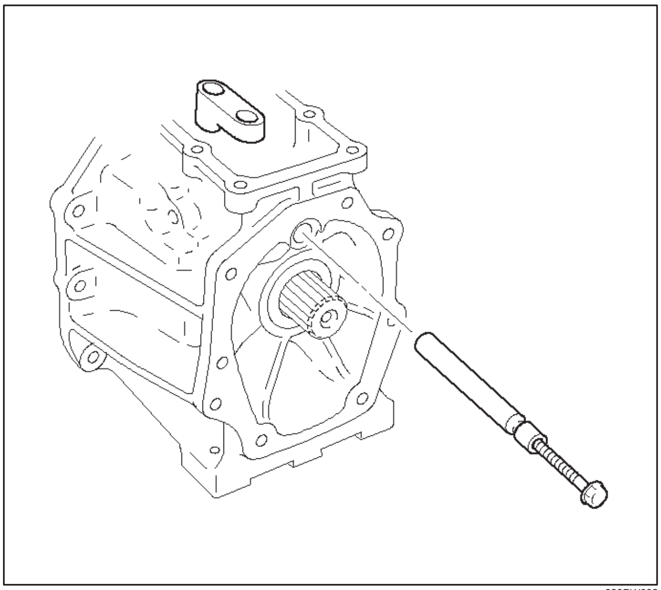
Torque: 37 N·m (27 lb ft)

NOTE:
- Tighten the all bolts evenly.
- Don't damage the lip of the oil seal.
- Install the wire clamp (9) to the transfer adapter.



220RW083

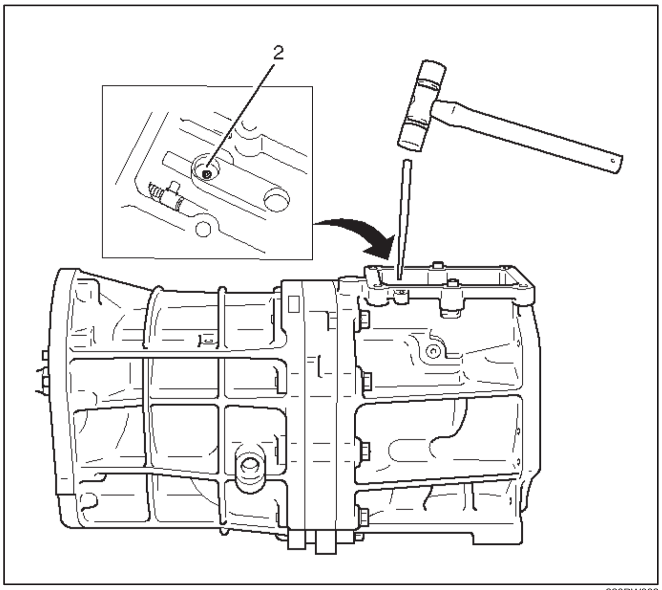
37. Install the gear control box.
1. Align the projection of the shift lever housing to the shift rod groove, and install the gear control rod.



230RW003

2. Using a pin punch and hammer, drive in the slotted spring pin (2) to the shift lever housing.

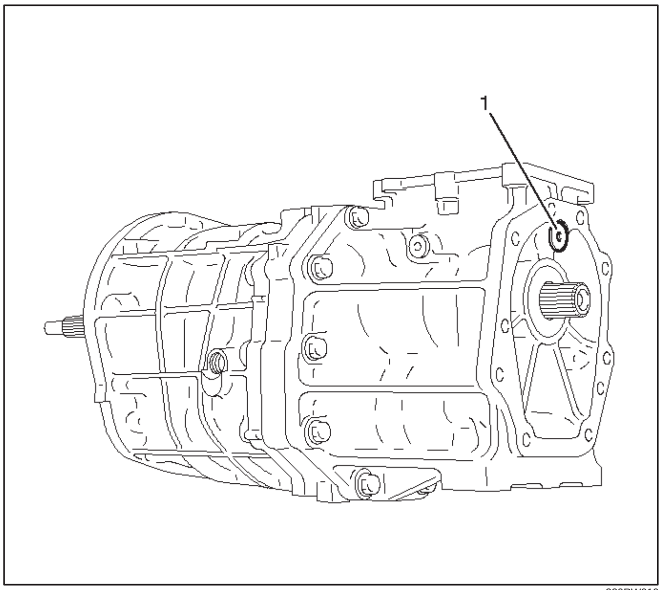
NOTE: Be carefull not to drop the slotted spring pin.



230RW002

3. Apply sealant (THREE BOND 1344 or equivalent) to the plug (1) thread.
4. Using hexagon wrench, install and torque the plug (1).

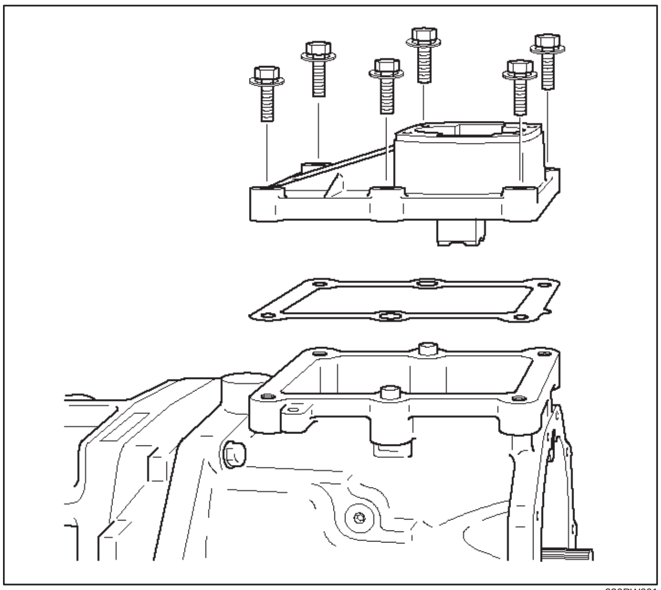
Torque: 18 N·m (13 lb ft)



220RW010

5. Clean up the bolts and bolt hole.
6. Using 6 bolts, install the gear control box through the gasket.

Torque 18 N·m (13 lb ft)

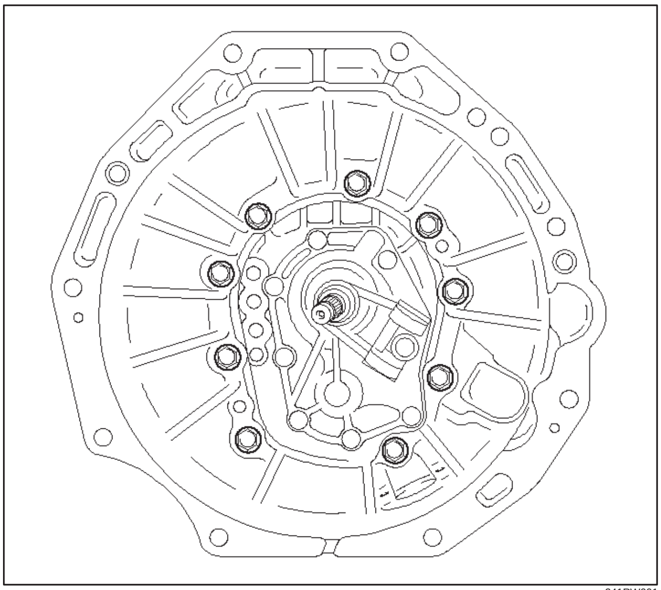


230RW001

38. Install clutch housing.
    1. Install the clutch housing to the transmission case.

Torque: 36 N·m (27 lb ft)

NOTE: Tighten the all bolts evenly.



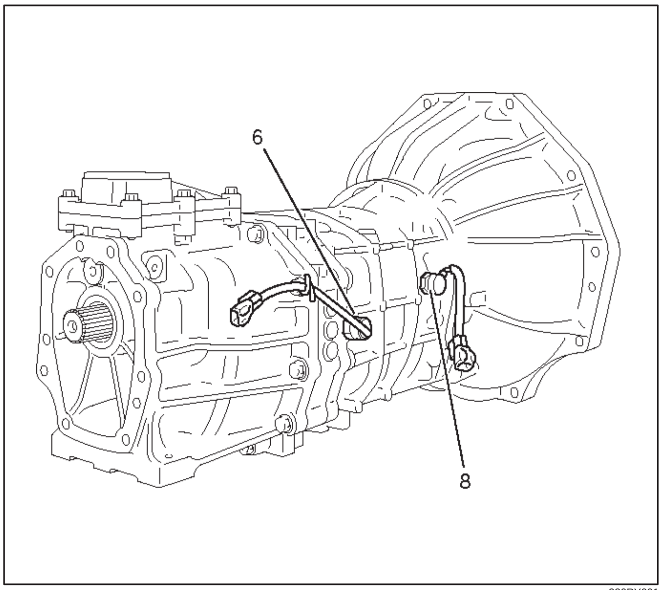
241RW001

39. Install the switches.
    1. Install the new gasket to the 1st and 2nd switch.
    2. Install the 1st and 2nd switch assembly (8).

Torque: 39 N·m (29 lb ft)

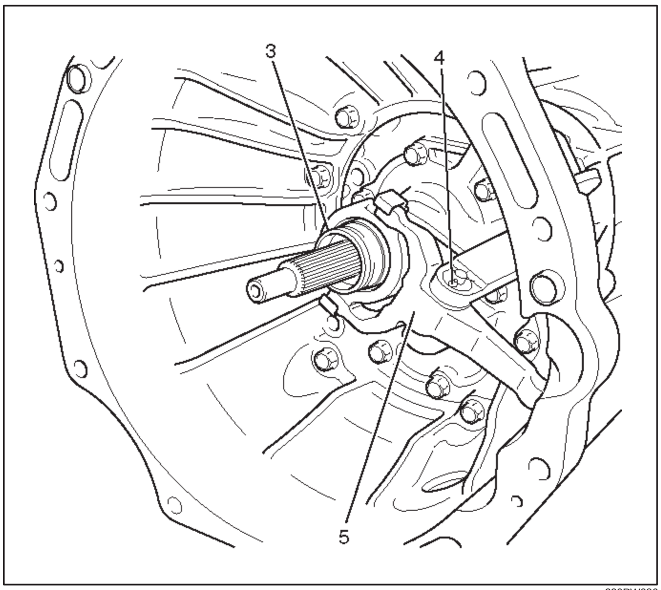
    3. Install the new gasket to the backup light switch.
    4. Install the backup light switch assembly (6).

Torque: 44 N·m (33 lb ft)



220RY001

40. Install the clutch release bearing (3) and clutch shift fork (5).
    1. Apply the clutch release grease.
        1. Fitting surface of the cylinder push rod.
        2. Fitting surface of the release bearing hub.
        3. The hole of the fork split pin (4).
    2. Apply the clutch release grease.
        1. The spline surface of the top gear shaft.
    3. Install the clutch shift fork (5).
    4. Install the snap pin.
    5. Install the clutch release bearing (3) to the clutch shift fork (5).



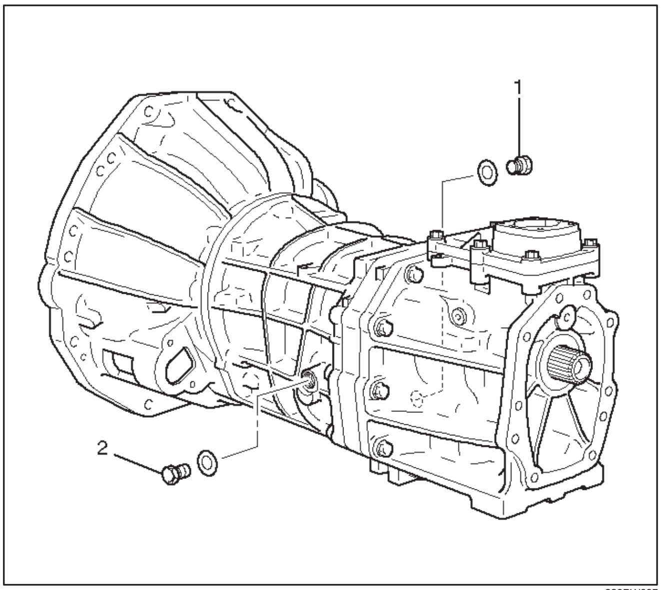
220RW086

41. Install the drain plug and filler plug.
    1. Install the drain plug (1) through the new gasket.

Torque: 37 N·m (27 lb ft)

    2. Install the filler plug (2) through the new gasket.

Reference: Plug after the gear oil fill in.
Torque: 37 N·m (27 lb ft)



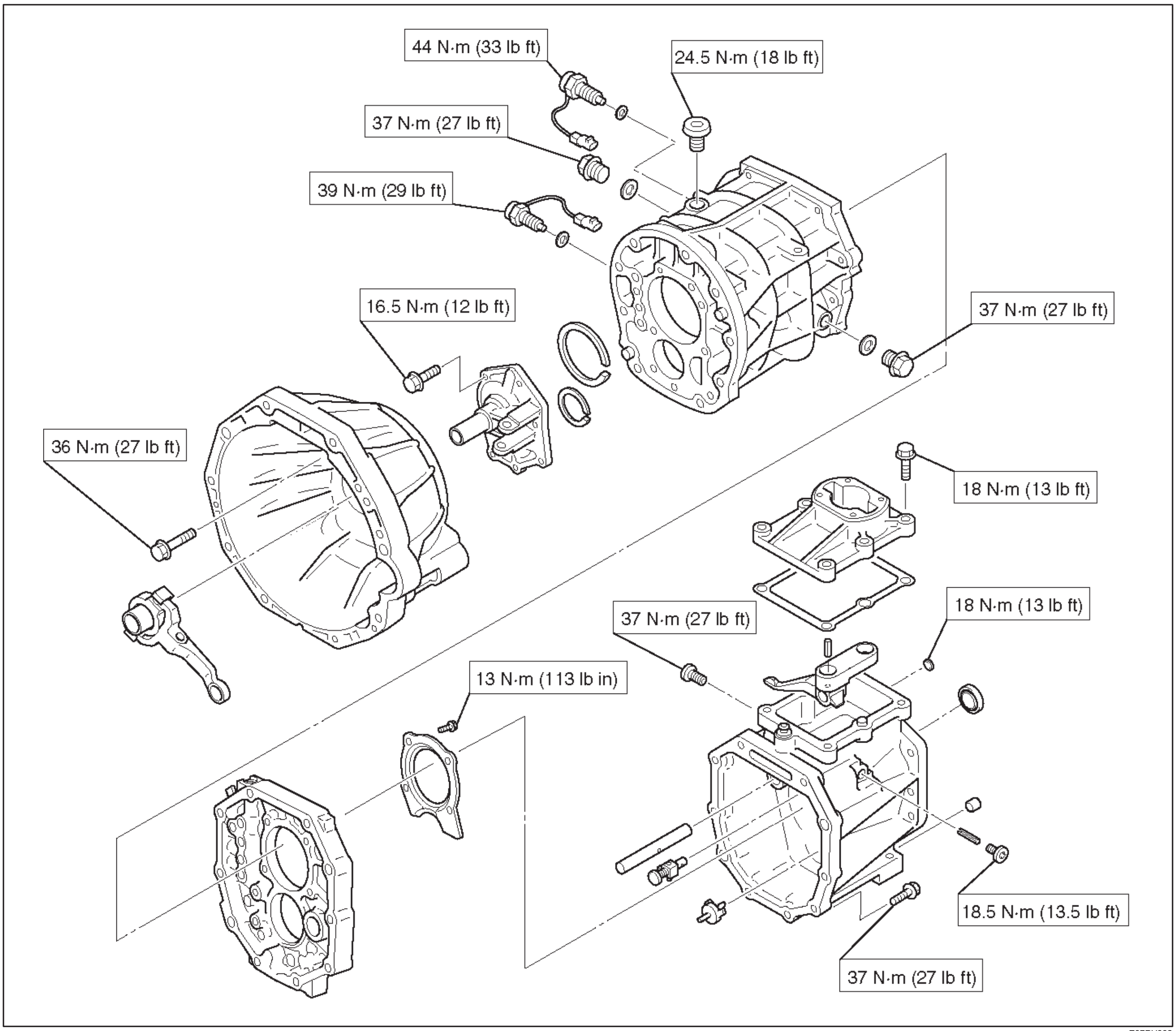
220RW007

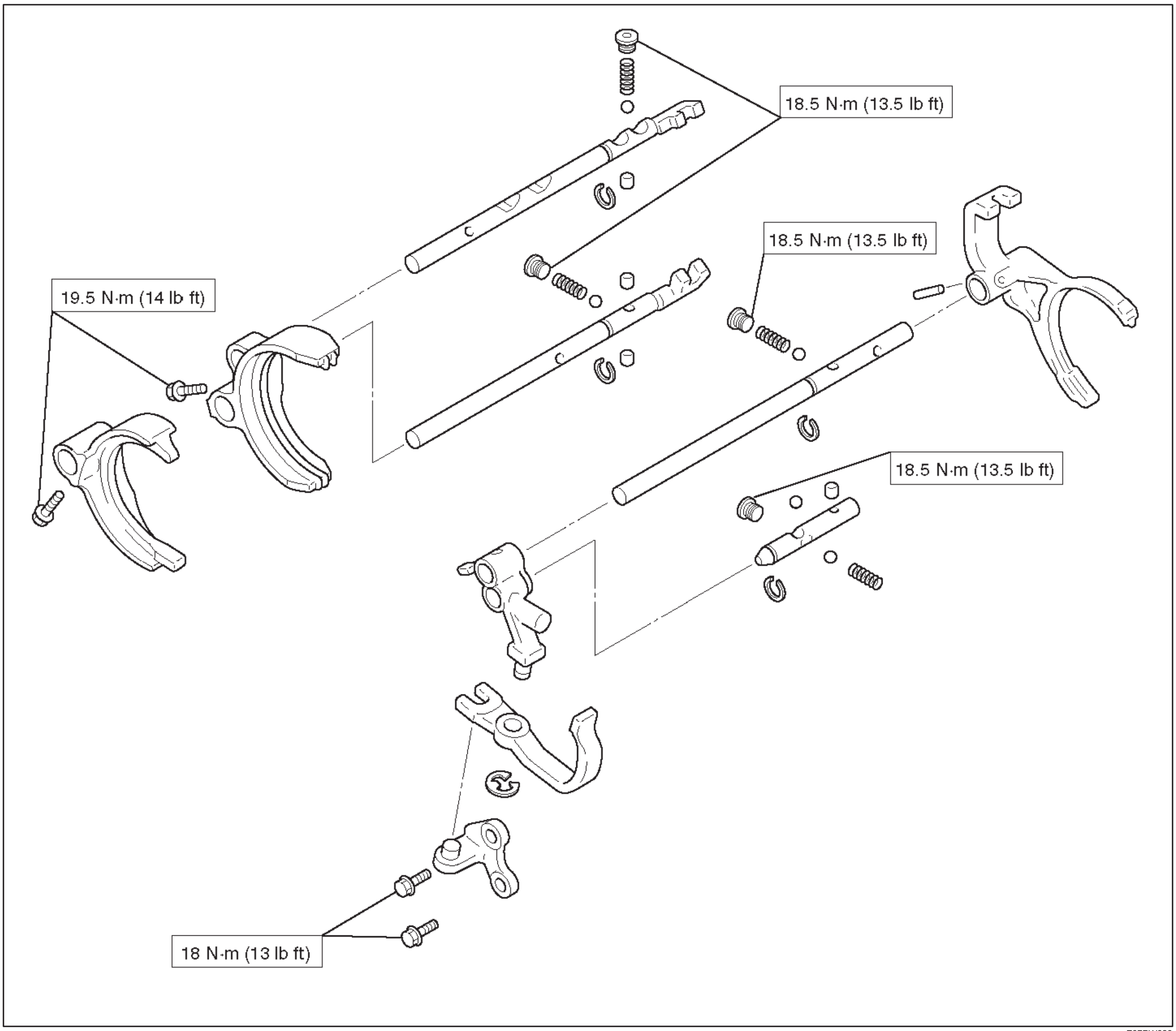
Main Data and Specifications

General Specifications

Transmission type		Fully synchronized forward and reverse gears
Control method		Direct control with the gear shift lever on the floor
Gear ratio	1st	3.954
	2nd	2.330
	3rd	1.436
	4th	1.000
	5th	0.788
	Rev	3.918
Oil capacity lit (US qt)		2.7 (2.86)
Type of lubricant		Engine oil : Refer to the chart in "SECTION 0"

Torque Specifications




18.5 N·m (13.5 lb ft)
18.5 N·m (13.5 lb ft)
19.5 N·m (14 lb ft)
18.5 N·m (13.5 lb ft)
18 N·m (13 lb ft)

E07RW030

Special Tools

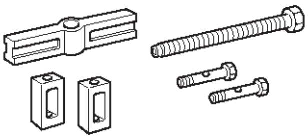
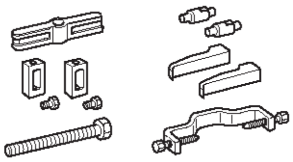
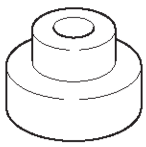
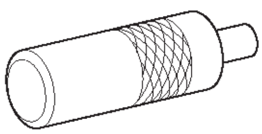
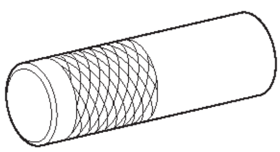
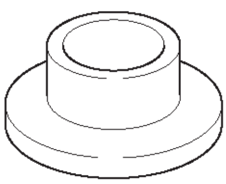
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–42794** Gear spline pieace remover
	**J–42795** Center bearing remover
	**J–42988** Attachment
	**J–42796** Counter gear shaft center bearing installer
	**J–42797** Clutch hub (No.2) installer
	**J–42798** Clutch hub (No.1) installer

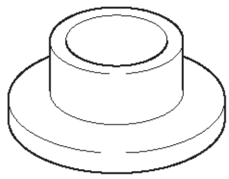
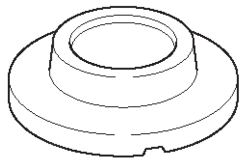
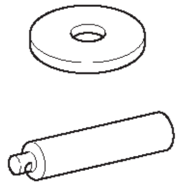
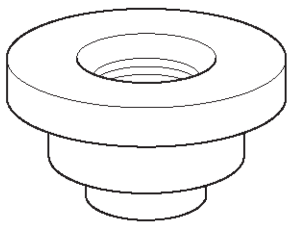
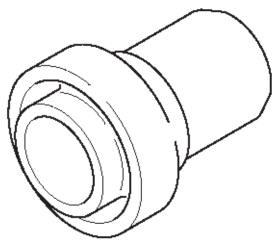
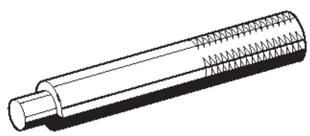
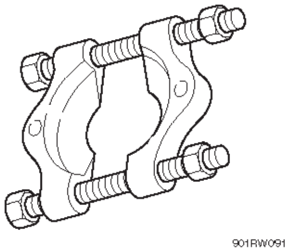
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–42799** Installer
	**J–42800** Counter gear shaft front bearing installer
	**J–42904** Top gear shaft front bearing installer
	**J–42801** Front rerainer oil seal installer
	**J–42802** Transfer adapter oil seal installer
	**J–8092** Driver handle

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–22912–01** Bearing separator

TRANSMISSION

CLUTCH

CONTENTS

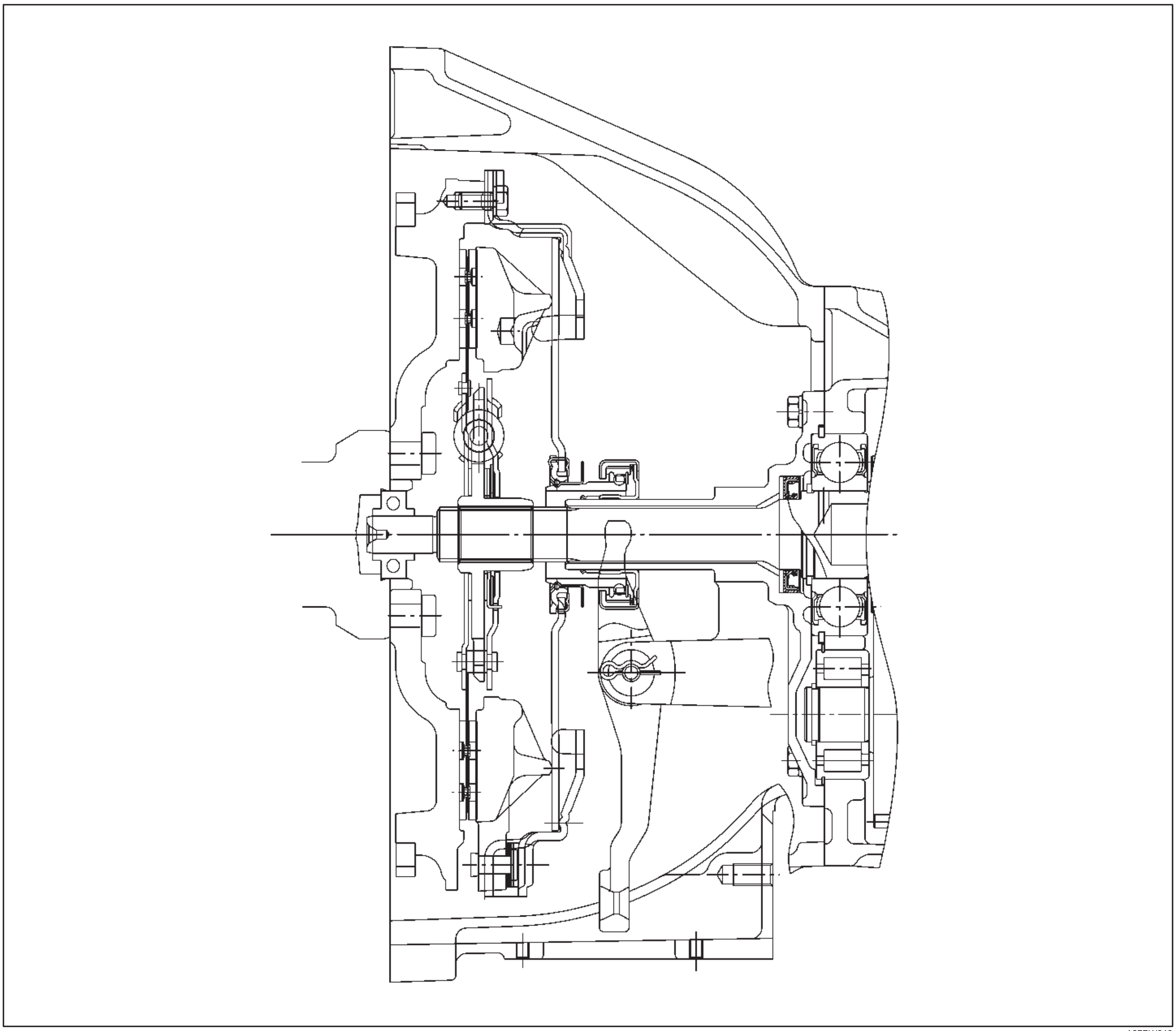
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM(SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFOMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastner in the proper location. When you reolace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that requir a replacement after removal. ISUZU will also call out the fasteners that requir thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED , do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fastners or fastner joint interfaces. Generally,such coatings adversely affect the fastner torque and the joint clamping force, and may damage the fastner. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

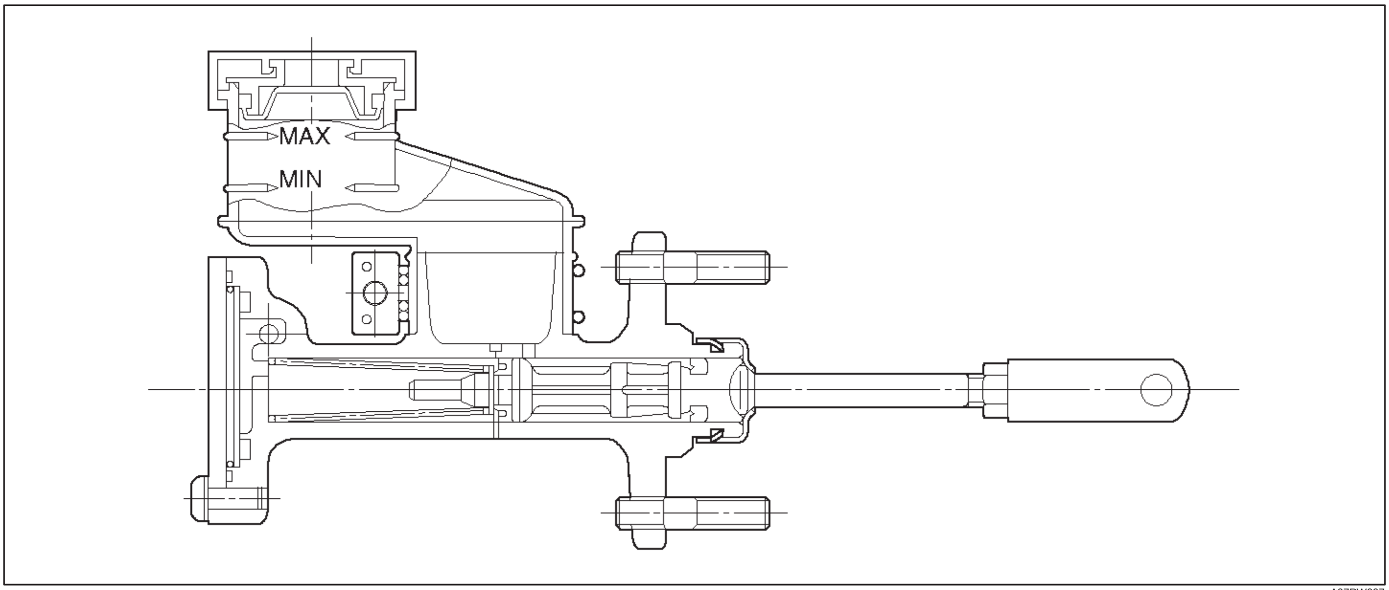
Clutch



A07RW046

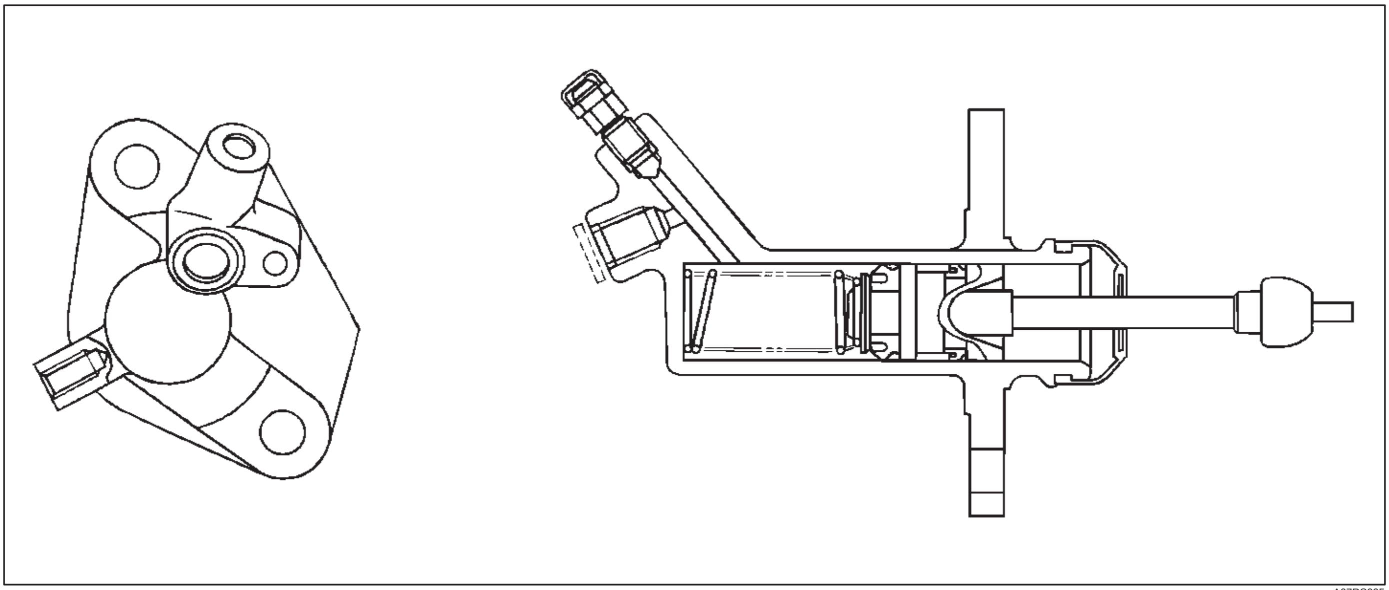
For 6VE1 (3.5L) engine model, the pull-type clutch is employed. The pull-type clutch is disengaged by pulling the release lever (release bearing) to disengage the pressure plate.

Master Cylinder



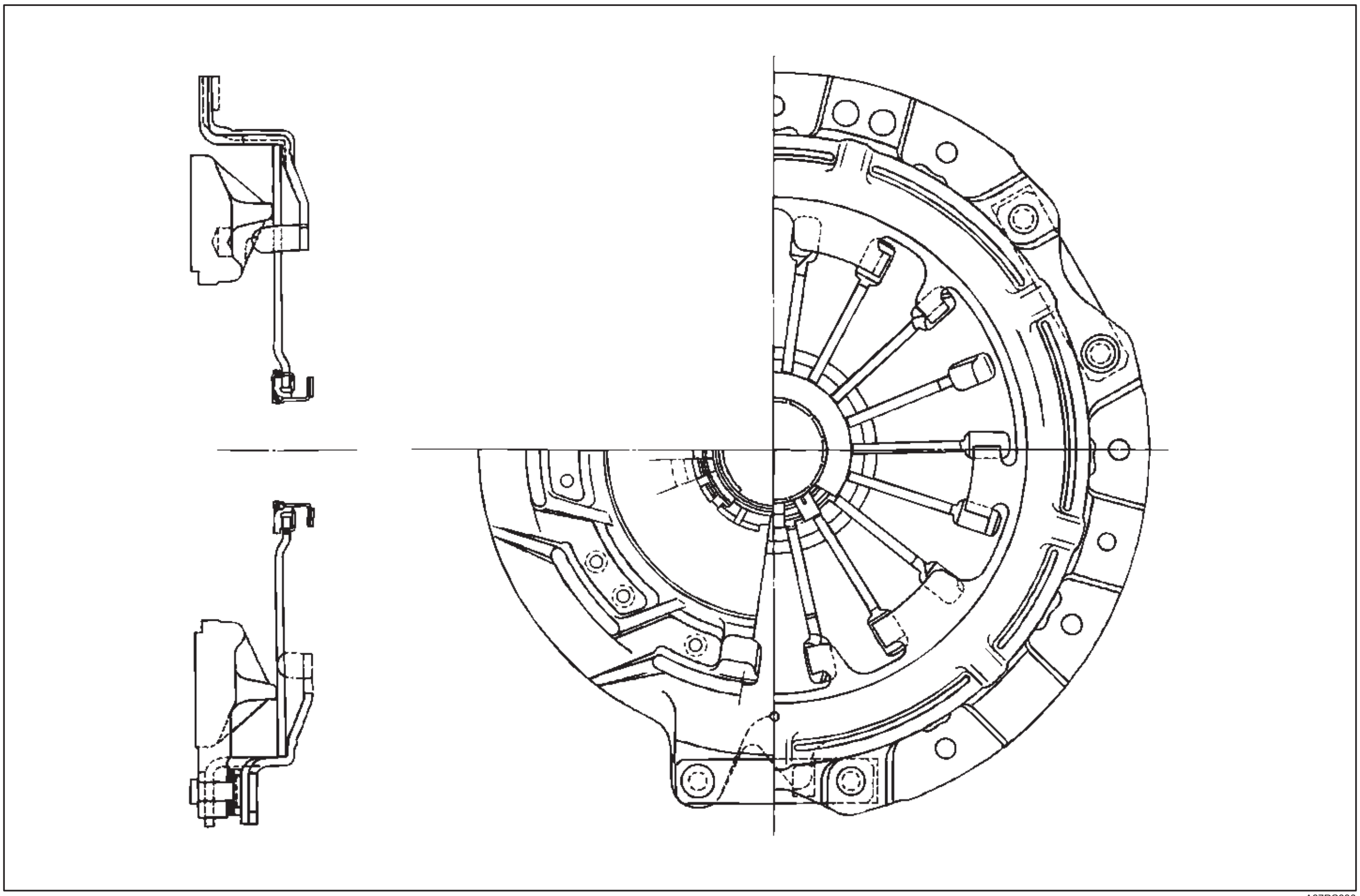
A07RW007

Slave Cylinder



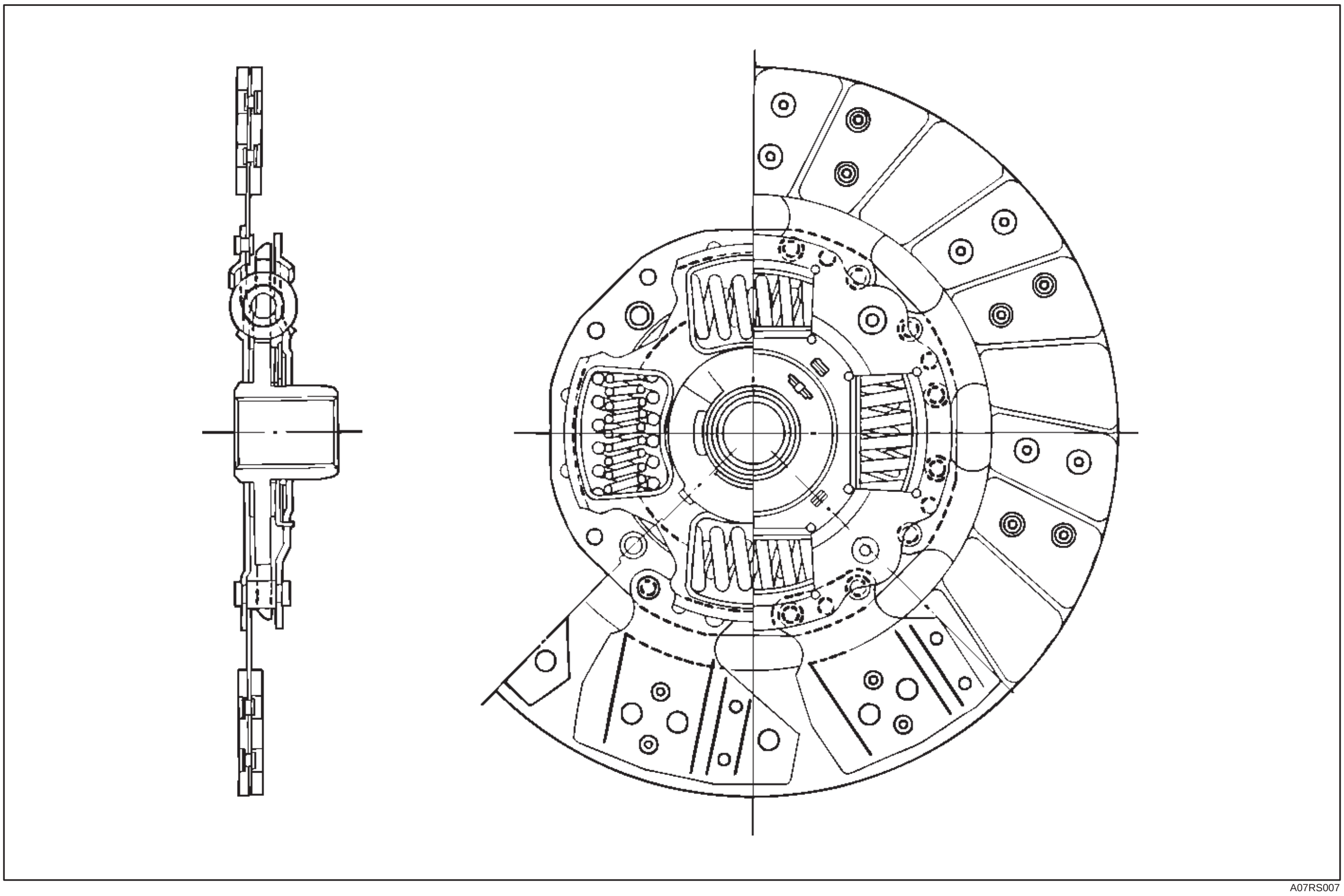
A07RS005

Pressure Plate Assembly



A07RS006

Driven Plate Assembly

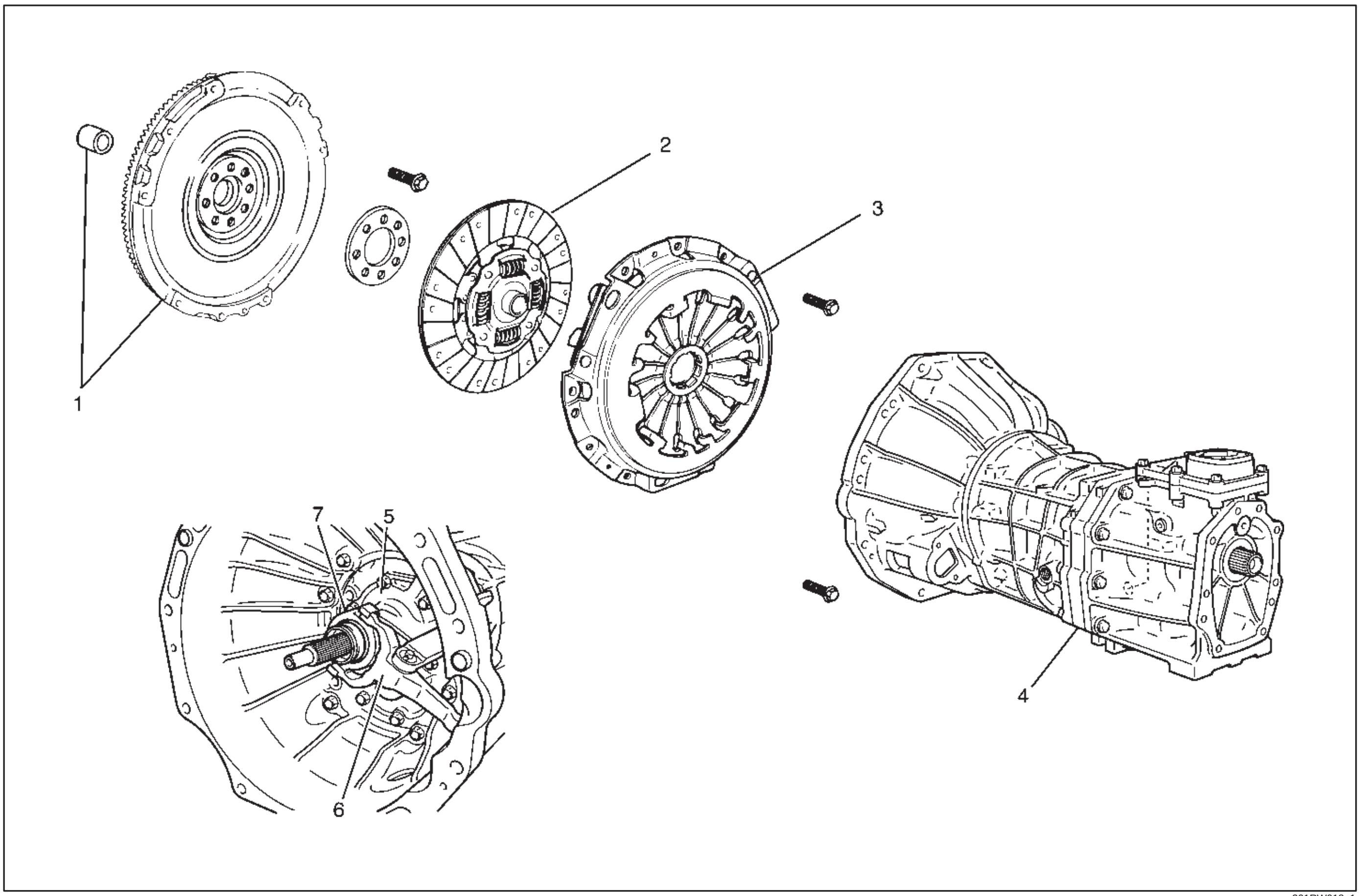


Diagnosis

Condition	Possible cause	Correction
Dragging	Fluid leakage.	Repair
	Air in hydraulic line.	Bleed
	Master cylinder and slave cylinder seals worn.	Replace seals.
	Driven plate warped.	Replace driven plate.
	Diaphragm spring weakened or tip of fingers worn.	Replace pressure plate
	Driven plate sticking on splines.	Lubricate with grease or replace.
	Clutch spline worn.	Repair
	Release bearing worn or damaged.	Replace release bearing.
Slipping	Driven plate facing worn or oil soaked.	Replace driven plate and check for leaks.
	Diaphragm spring weakened.	Replace pressure plate.
	Pressure plate or flywheel warped.	Correct or replace.
	Master cylinder and slave cylinder seals worn.	Replace seals.
Chattering	Engine mounts loose or damaged.	Tighten or replace.
	Driven plate facing warped.	Replace driven plate.
	Surface of facing hardened.	Replace driven plate
	Driven plate facing oil soaked.	Replace driven plate and check for leaks.
	Damper springs weakened or broken.	Replace.
	Pressure plate or flywheel warped.	Correct or replace.
Noisy	Replace bearing binding.	Correct, or replace if damaged, and lubricate.
	Replace bearing worn or damaged.	Replace release bearing.
	Release bearing poorly lubricated.	Lubricate.
	Pilot bearing worn.	Replace pilot bearing.
	Damper springs weakened or broken.	Replace driven plate.
	Rivets of driven plate exposed.	Replace driven plate.
Replace driven plate.	Hydraulic line blocked.	Clean out or replace.
	Master or slave cylinders binding.	Repair or replace as needed.

Clutch Assembly

Clutch Assembly and Associated Parts



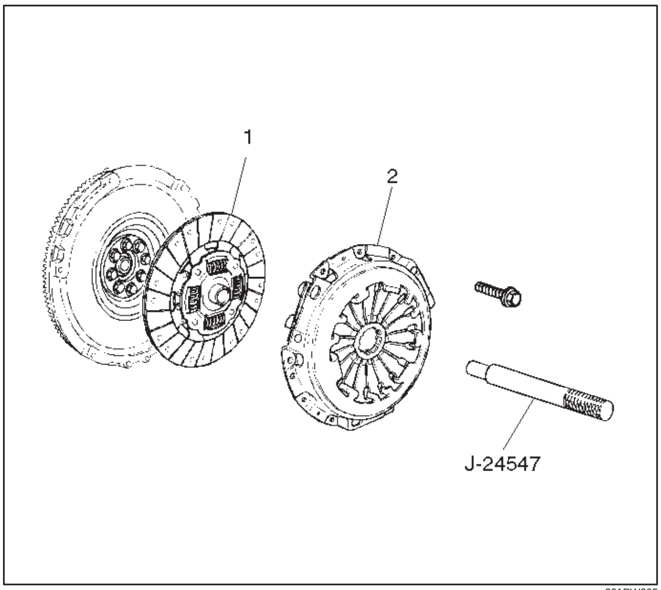
201RW018–1

Legend

(1) Flywheel Assembly and Crankshaft Bearing
(2) Driven Plate Assembly
(3) Pressure Plate Assembly
(4) Transmission Assembly
(5) Front Cover
(6) Shift Fork
(7) Release Bearing

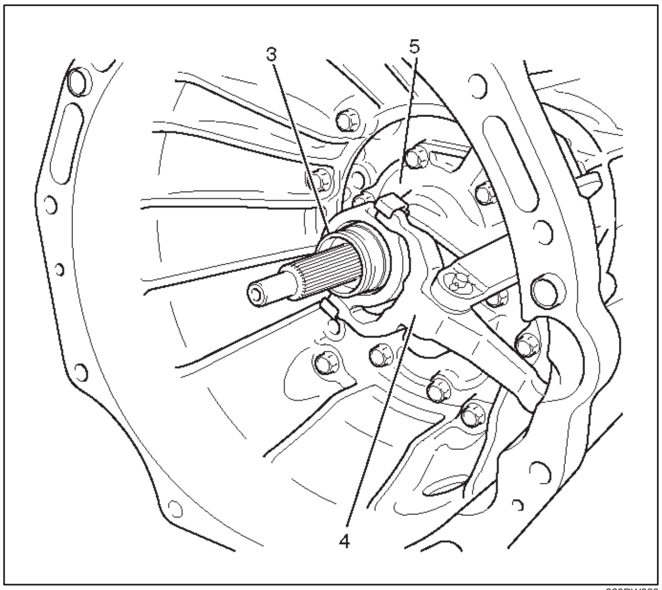
Removal

1. Remove transmission assembly, refer to ”MANUAL TRANSMISSION” of Section 7B for ”Removal AND INSTALLATION” procedure.
2. Remove pressure plate assembly (2).
3. Remove driven plate assembly (1), use the pilot aligner J-24547 to prevent the driven plate assembly (1) from falling free.



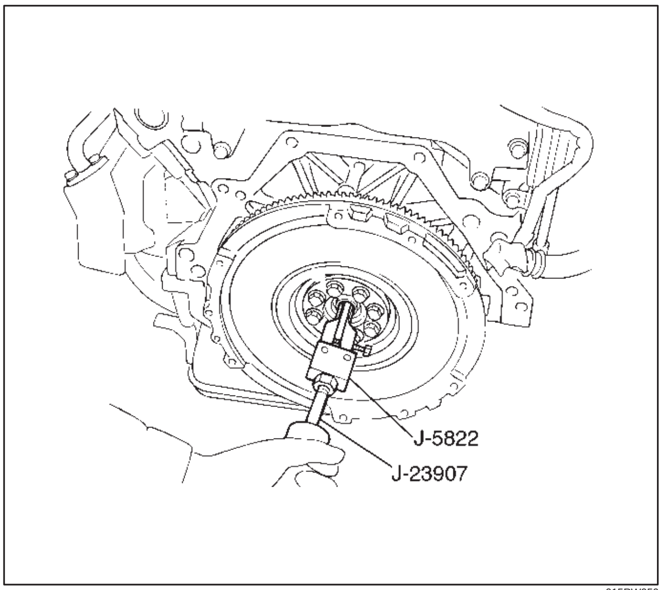
201RW005

4. Mark the flywheel, clutch cover and pressure plate lug for alignment when installing.
5. Remove the release bearing (3) from the transmission case .
6. Remove the shift fork snap pin.
7. Remove the shift fork pin and shift fork (4) from the front cover.
8. Remove the front cover bolts.
9. Remove the front cover (5) from the transmission case.



220RW088

10. Remove flywheel assembly and crankshaft bearing, do not remove except for replacement.
11. Use the remover J–5822 and sliding hammer J–23907 to remove the crankshaft bearing.

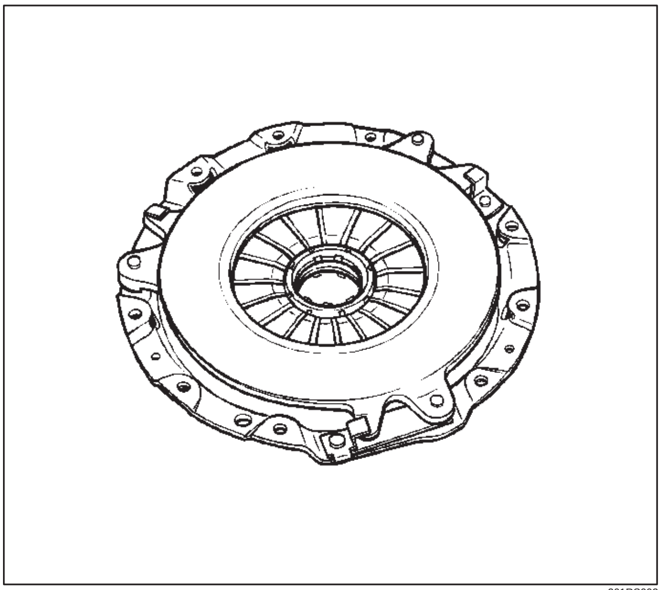


015RW050

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, or any other abnormal condition are found through inspection.

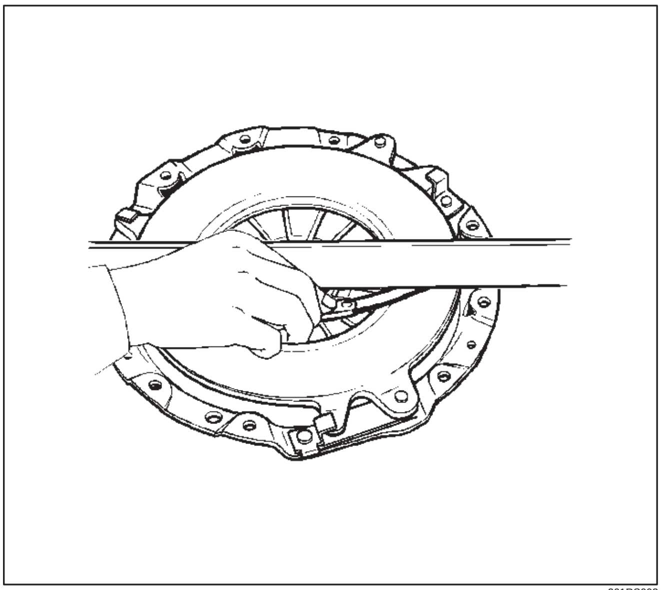
Pressure Plate Assembly



201RS002

1. Visually check the pressure plate friction surface for excessive wear and heat cracks.
2. If excessive wear or deep heat cracks are present, the pressure plate must be replaced.

Pressure Plate Warpage



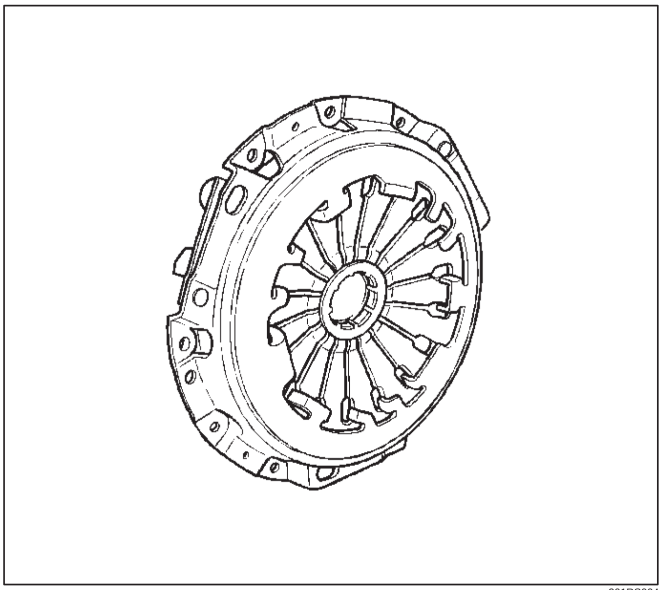
201RS003

1. Use a straight edge and a feeler gauge to measure the pressure plate friction surface flatness in four directions.
2. If any of the measured values exceeds the specified limit, the pressure plate must be replaced.

Pressure Plate Warpage

Limit: 0.3 mm (0.012 in)

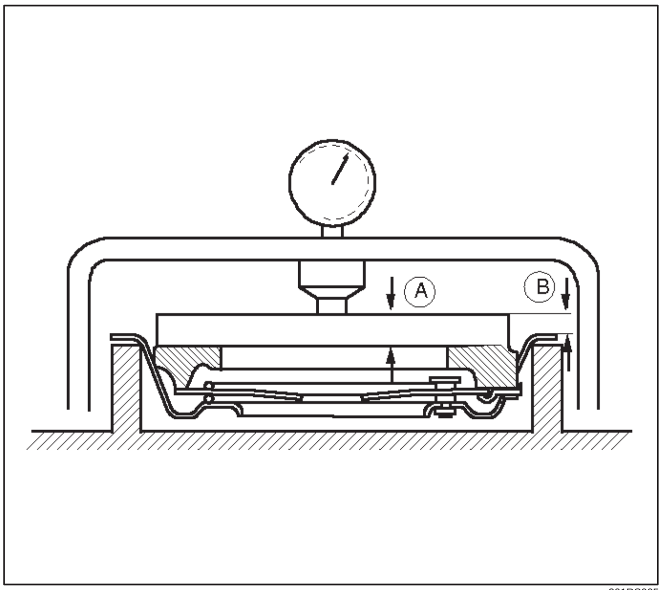
Clutch Cover



201RS004

1. Visually check the entire clutch cover for excessive wear, cracking, and other damage.
2. The clutch cover must be replaced if any of these conditions are present.

Clutch Set Force



201RS005

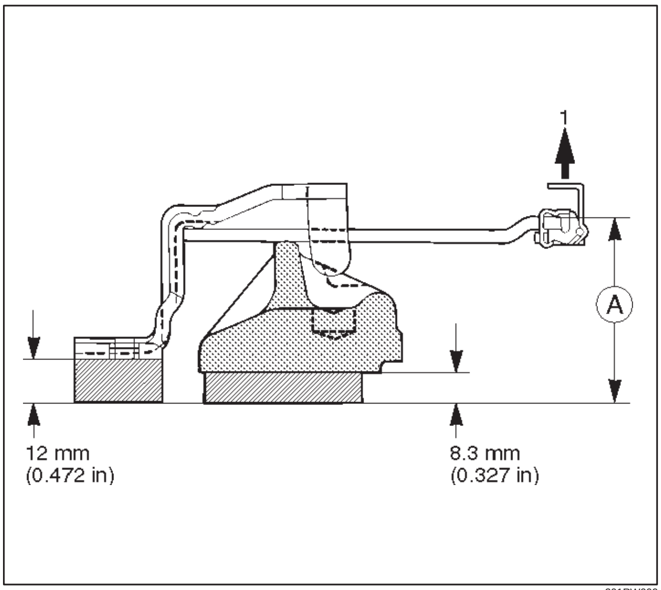
1. Invert the pressure plate assembly.
2. Place a new driven plate over the pressure plate. A metal sheet with A thickness of 8.3 mm (0.327 in) may be used in place of the driven plate.
3. Compress the pressure plate assembly until the distance B becomes 12 mm (0.472 in).
4. Note the pressure gauge reading.
5. If the measured value is less than the specified limit, the pressure plate assembly must be replaced.

Clutch Set Force

Standard: 7208 N (1621 lb)

Limit: 6468 N (1454 lb)

Diaphragm Spring Finger Height



201RW009

Legend

(1) Release Side

1. Place a new driven plate or a 8.3 mm (0.327 in) spacer beneath the pressure plate.
2. Fully compress the pressure plate and diaphragm spring.
3. There are two ways to do this.
4. Use a bench press to press down on the assembly from the top.
5. Tighten the fixing bolts.

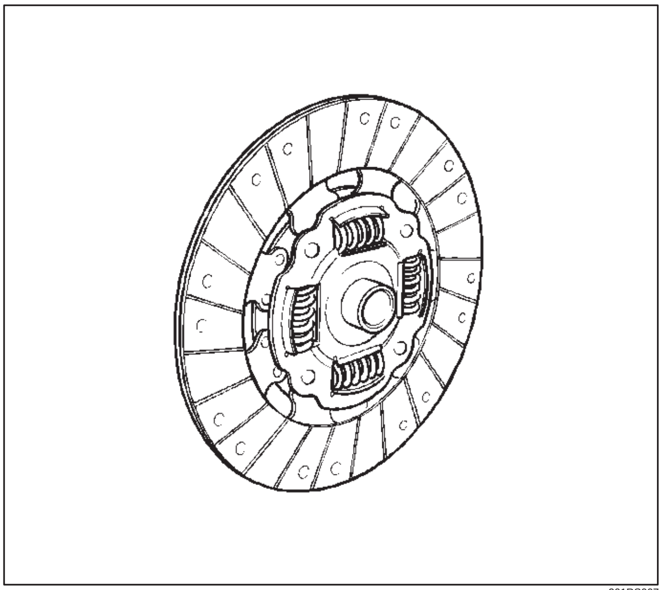
NOTE: Preload on diaphragm spring finger must be 49 – 98 N (11 – 22 lb) in direction of release, when clutch cover assembly is bolted to the flywheel.

6. Measure the spring height from base to spring tip A. If the measured value exceeds the specified limit, the pressure plate assembly must be replaced.

Spring Finger Height

Standard: 49.9 mm – 51.9 mm (1.965 in – 2.043 in)

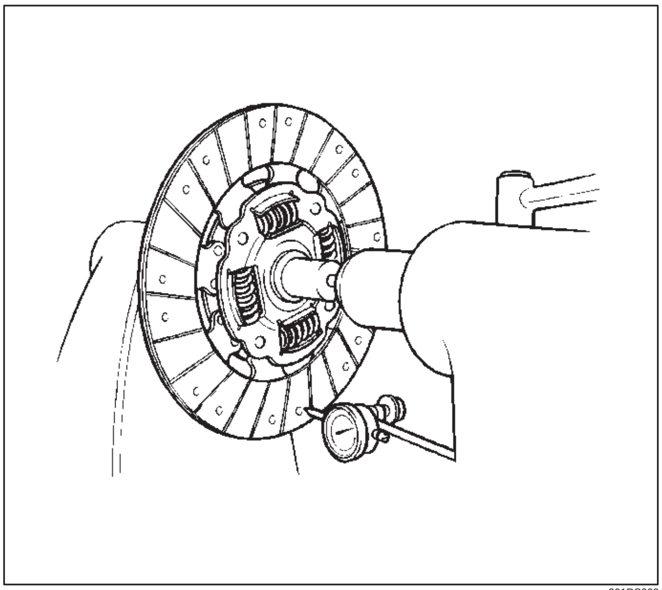
Driven Plate Assembly



201RS007

1. Visually check the torsion spring for looseness, breakage, and weakening.
2. If any of these conditions are discovered, the driven plate assembly must be replaced.
3. Visually check the facing surfaces for cracking and excessive scorching.
4. Visually inspect the facing surfaces for the presence of oil or grease.
5. If any of these conditions are discovered, the facing must be cleaned or replaced.
6. Check that the driven plate moves smoothly on the transmission top gear shaft spline.
7. Minor ridges on the top gear shaft spline may be removed with an oil stone.

Driven Plate Warpage



201RS008

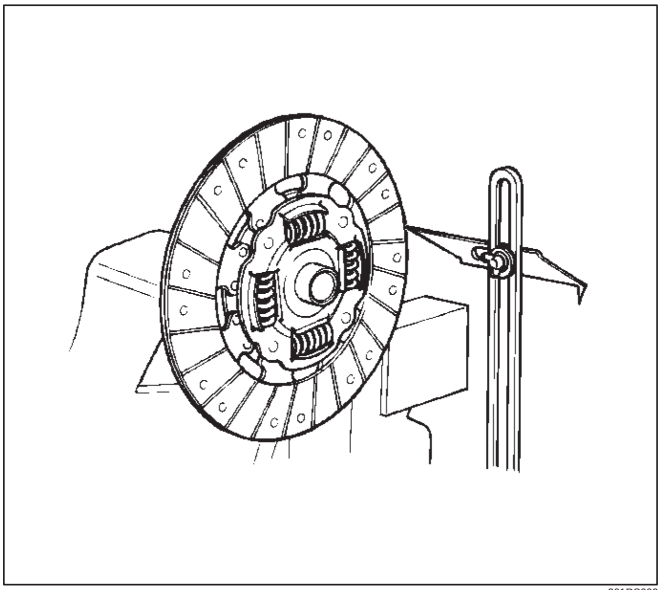
1. Insert the clutch pilot aligner into the driven plate splined hub.
2. The clutch pilot aligner J-24547 must be held perfectly horizontal.
3. Set a dial indicator to the driven plate outside circumference.
4. Slowly turn the driven plate.
5. Read the dial indicator as you turn the driven plate.
6. If the measured value exceeds the specified limit, the driven plate assembly must be replaced.

Driven Plate Warpage

Standard: 0.7 mm (0.028 in)

Limit: 1.0 mm (0.039 in)

Driven Plate Splined Hub Spline Wear



201RS009

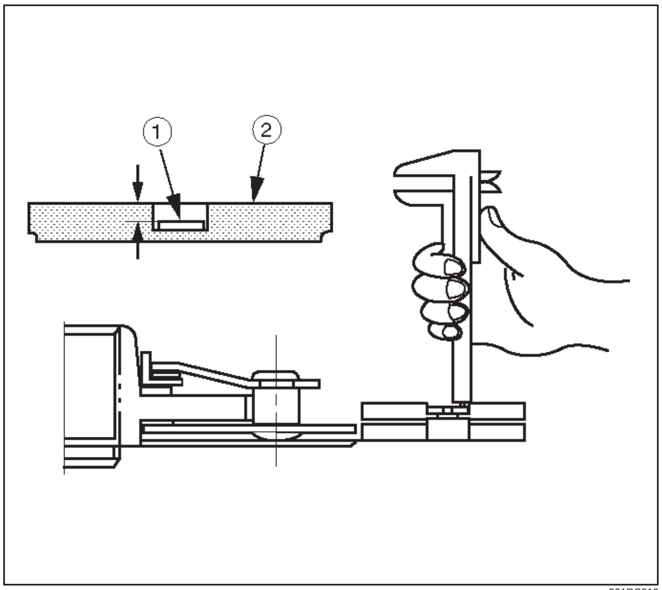
1. Clean the driven plate splined hub.
2. Install the driven plate to the transmission top gear shaft spline.
3. Set a surface gauge to the driven plate outside circumference.
4. Slowly turn the driven plate counterclockwise.
5. Measure the spline rotation play as you turn the driven plate.
6. If the measured value exceeds the specified limit, the driven plate assembly must be replaced.

Driven Plate Splined Hub Spline Wear

Standard: 0.5 mm (0.020 in)

Limit: 1.0 mm (0.039 in)

Rivet Head Depression



201RS010

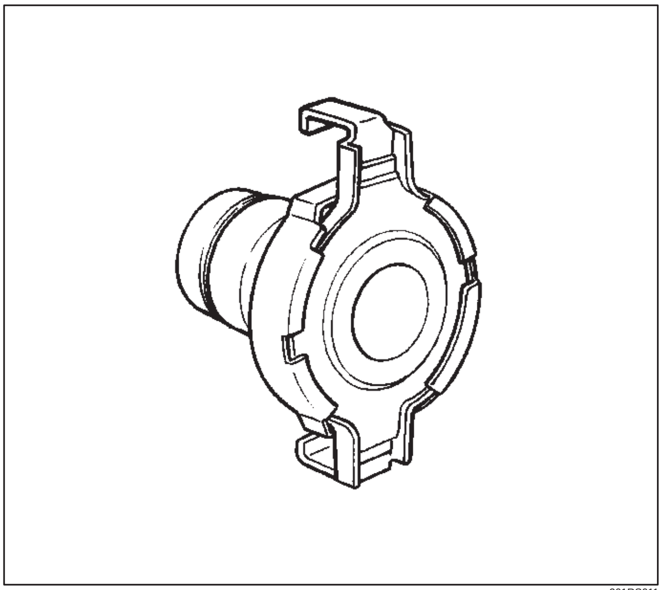
1. Use a depth gauge or a straight edge with steel rule to measure the rivet head depression 1 from the facing surface 2.
2. Be sure to measure the rivet head depression on both sides of the driven plate.
3. If the measured value is less than the specified limit, the driven plate assembly must be replaced.

Rivet Head Depression

Standard: 1.95 mm (0.077 in)

Limit: 0.2 mm (0.008 in)

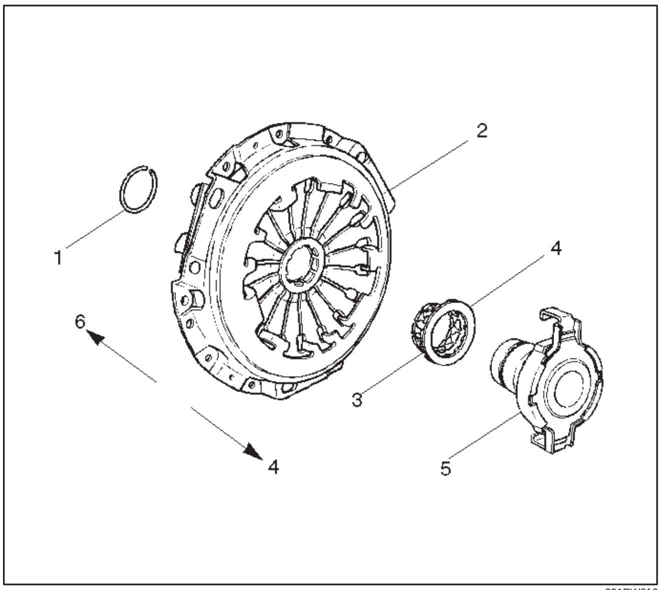
Release Bearing



201RS011

1. Visually check the release bearing for excessive play, noise and breakage.
2. If any of these conditions are discovered, the release bearing must be replaced.

3. When replacing the release bearing, replace both the wedge collar and wire ring at the same time.

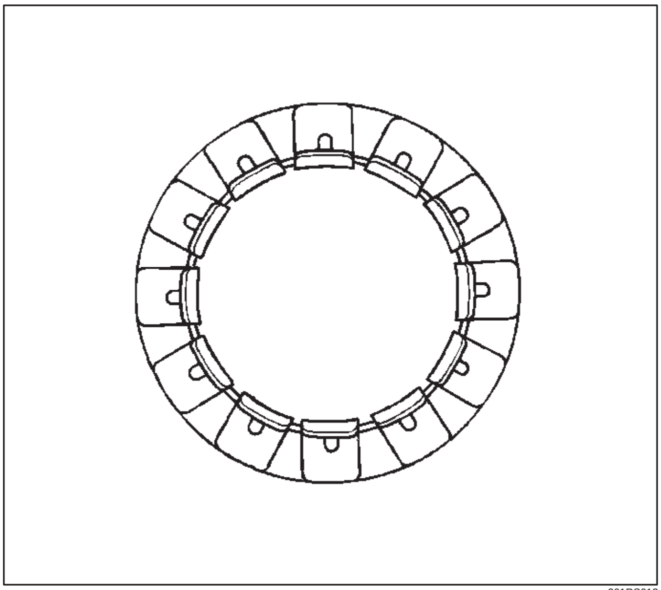


201RW010

Legend

(1) Wire Ring
(2) Pressure Plate Assembly
(3) Wedge Collar
(4) T/M Side
(5) Release Bearing
(6) Engine Side

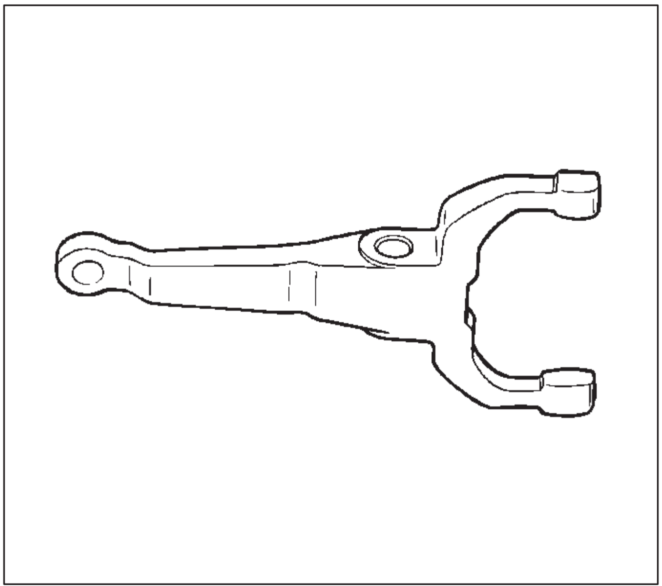
Wedge Collar



201RS013

1. Visually check the surfaces of the wedge collar making contact with the release bearing for excessive wear and damage.
2. Replace any exhibiting excessive wear or damage.

Shift Fork



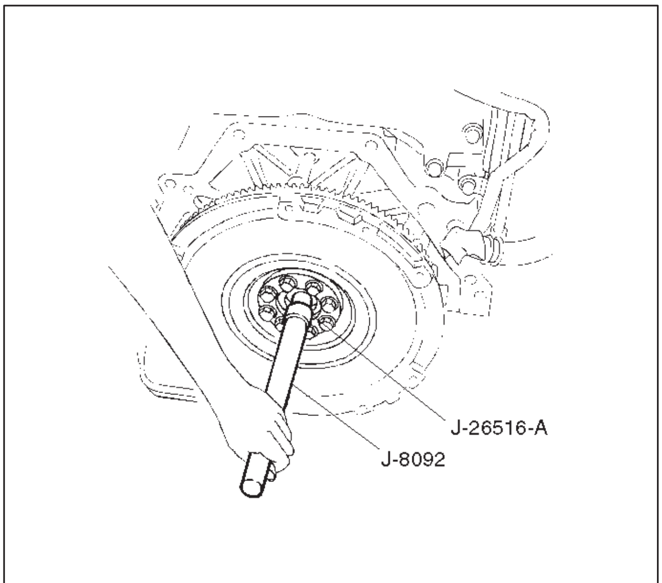
201RS014

1. Visually check the surfaces of the shift fork making contact with the release bearing for excessive wear and damage.
2. Remove any minor stepping or abrasion from shift fork with an oil stone.
3. Replace any exhibiting excessive wear or damage.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Install flywheel assembly and crankshaft bearing, use the installer J-26516-A and driver handle J-8092 to install the crankshaft bearing then clean and lubricate with grease.

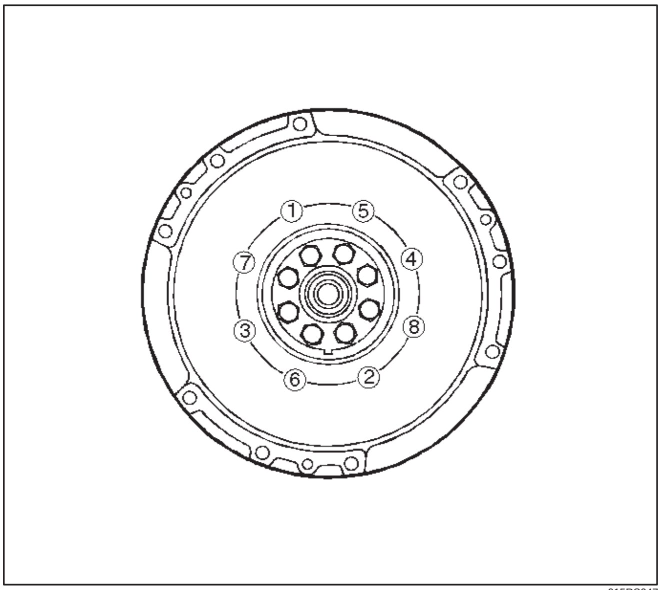


015RS046

2. Install new flywheel fixing bolts in the order illustrated and tighten them to the specified torque.

Torque: 54 N·m (40 lb ft)

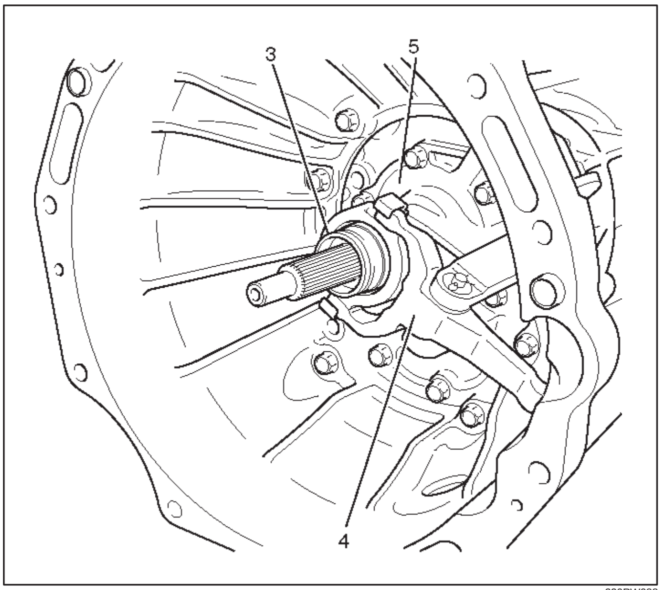
NOTE: Do not reuse the bolt and do not apply oil or thread lock to the bolt.



015RS047

3. Install the front cover (5) to the transmission case.
4. Tighten three fulcrum bridge bolts to the specified torque.

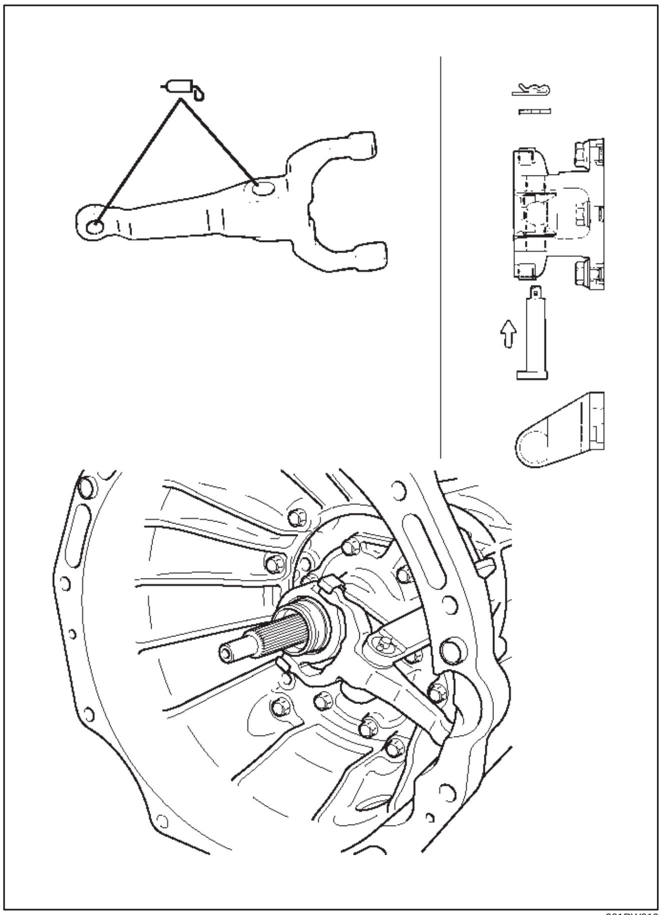
Torque: 16.5 N·m (12 lb ft)



220RW088

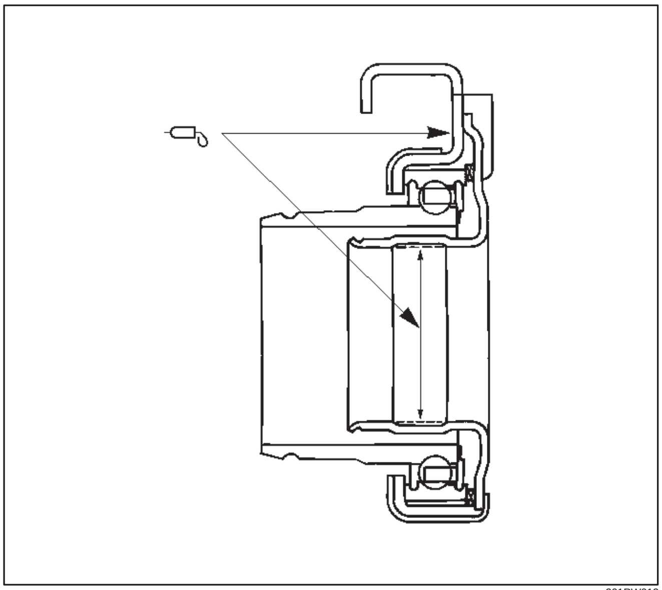
5. Apply molybednum disulfide type grease to the pin hole inner circumferences and thrust surfaces.
6. Attach the shift fork to the front cover and insert the pin from below of the front cover.

7. Install the washer and snap pin.



201RW019

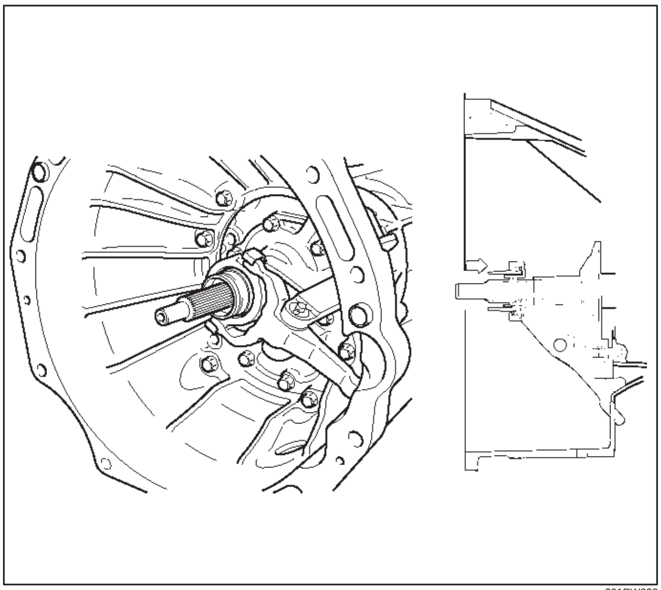
8. Apply molybdenum disulfide type grease to the areas shown in illustration.



201RW012

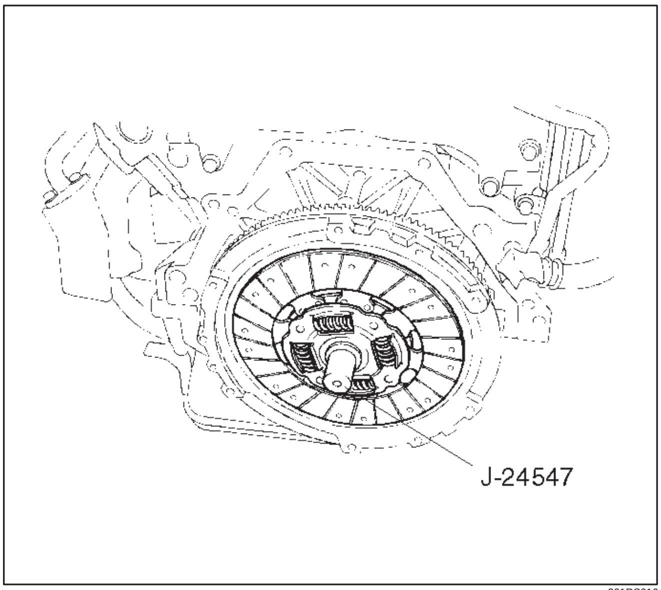
9. Install the release bearing in the proper direction.

NOTE: Ensure release bearing is properly positioned during installation, as shown in illustration.



201RW020

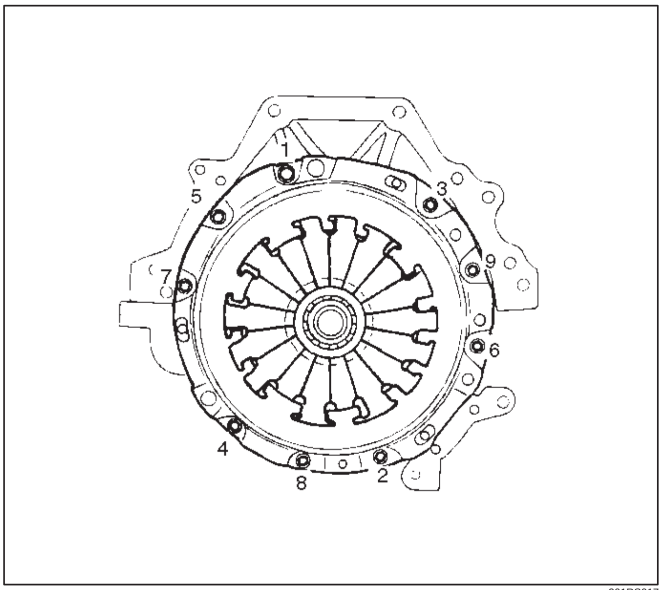
10. Install driven plate assembly, use the pilot aligner J-24547 to install the driven plate assembly.



201RS016

11. Install pressure plate assembly and tighten the bolts holding the pressure plate assembly in the order shown in illustration.

Torque: 18 N·m (13 lb ft)



201RS017

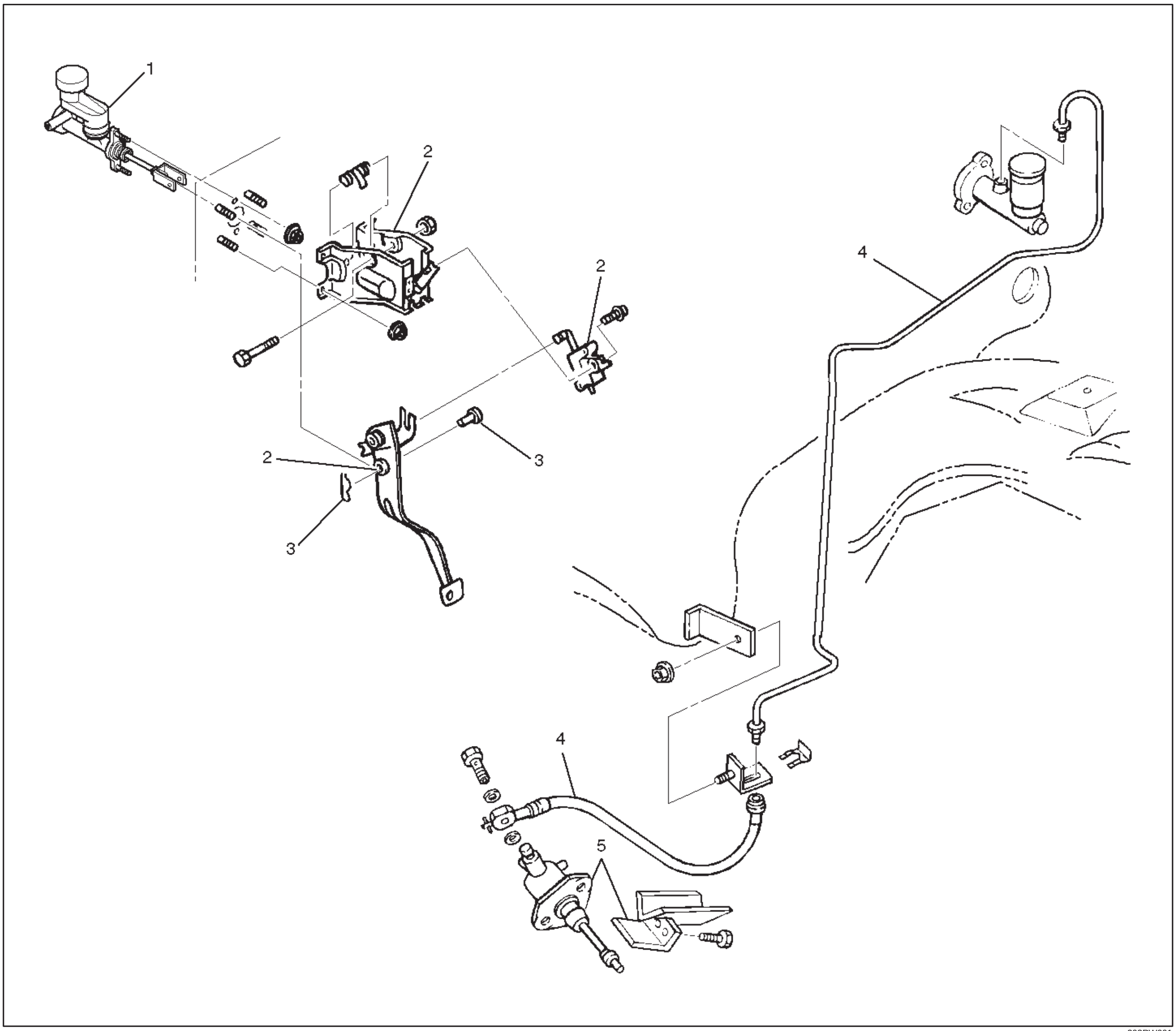
12. Remove the aligner.

NOTE: Do not strike the aligner with a hammer to remove it.

13. Install transmission assembly.

Clutch Control

Clutch Control Parts



Legend

(1) Master Cylinder Assembly
(2) Pedal Assembly and Switch
(3) Pin and Jaw Joint Pin
(4) Oil Line Pipe
(5) Slave Cylinder Assembly and Heat Protector

Removal

1. Remove pin and jaw joint pin.
2. Remove pedal assembly and switch.
3. Remove oil line pipe.
4. Remove slave cylinder assembly and heat protector.
5. Remove master cylinder assembly.
6. Remove damper cylinder assembly.

Inspection and Repair

Make necessary adjustments, repairs, and part replacement if wear, damage or other problems are discovered during inspection.

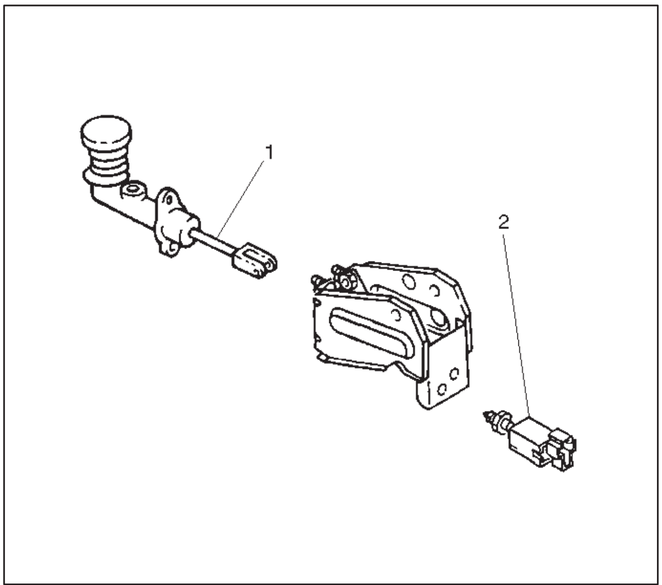
Installation

1. Install damper cylinder assembly.
2. Install master cylinder assembly.
3. Install slave cylinder assembly and heat protector.
4. Install oil line pipe.
5. Install pedal assembly and switch.
6. Install pin and jaw joint pin.

Adjustment

Clutch Pedal Adjustment

1. With clutch switch
   1. Disconnect clutch switch (2) connector.
   2. Loosen lock nut, then turn switch out until there is a gap between the switch plunger and clutch pedal.



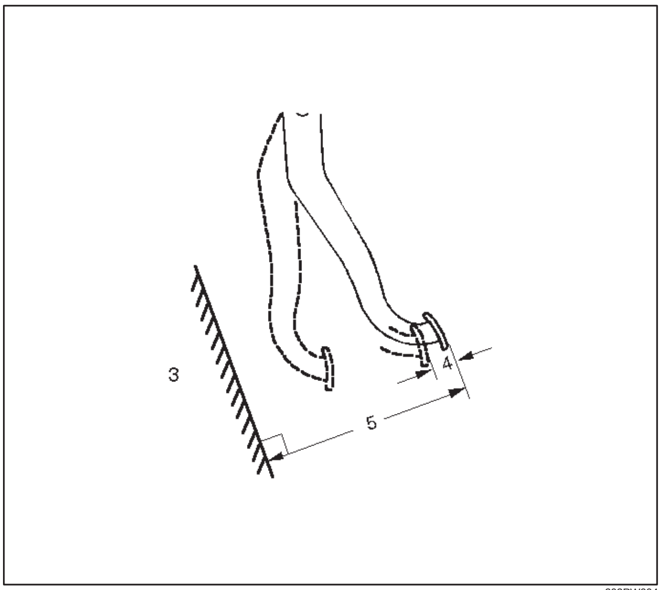
203RW003

Legend

(1) Push Rod
(2) Clutch Switch

2. Loosen clutch master cylinder push rod lock nut. Turn push rod by hand to set clutch pedal height (5) to within specification.

Clutch pedal height (5): 217 mm – 227 mm (8.543 in – 8.937 in)

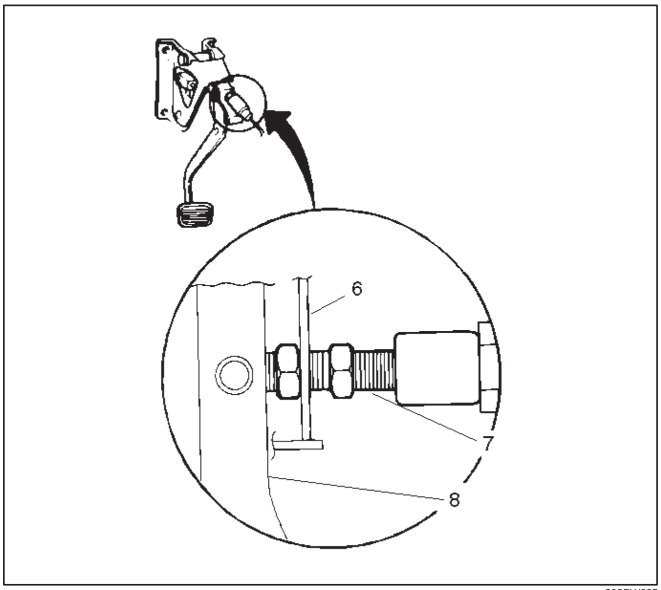


203RW004

Legend

(3) Floor Panel
(4) Pedal Free Play
(5) Clutch Pedal Height

3. Tighten push rod lock nut.
4. With clutch switch
   1. Turn the clutch switch until the switch bolt just touches the clutch pedal arm.

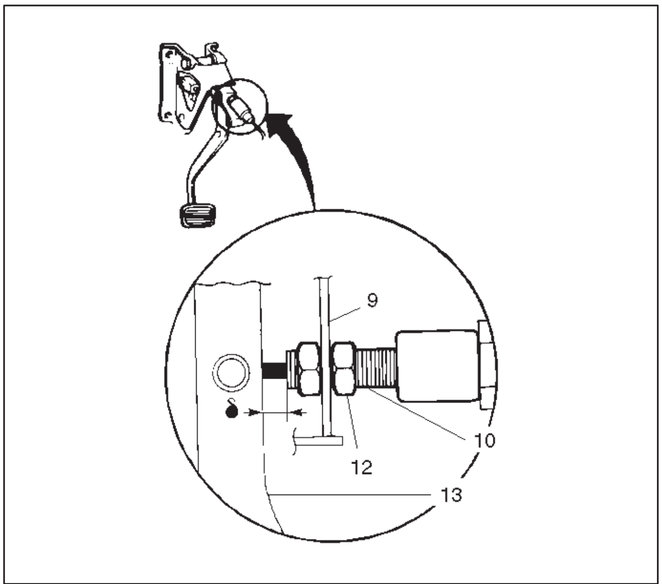


203RW005

Legend

(6) Blacket
(7) Clutch Switch Bolt
(8) Clutch Pedal Arm

2. Adjust clutch switch by backing it out half a turn, and measure the clearance (E) between the clutch pedal arm and the clutch switch.



203RW006

Legend

(9) Back out Switch 1/2 turn
(10) Bracket
(11) Clutch Switch Bolt
(12) Lock Nut
(13) Clutch Pedal Arm

3. Lock the lock nut.
4. Connect clutch switch connector.

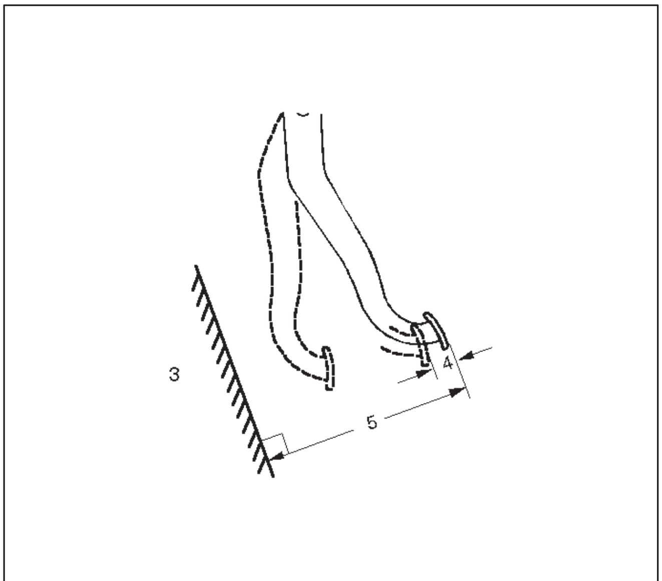
Clutch Switch and Clutch Pedal Clearance (E)

0.5 mm – 1.5 mm (0.020 in – 0.059 in)

5. After adjusting the clutch pedal height, push the clutch pedal by hand rightly to check the clutch pedal free play (4) to within specification.

Pedal Free Play (4)

5 mm – 15 mm (0.20 in – 0.59 in)



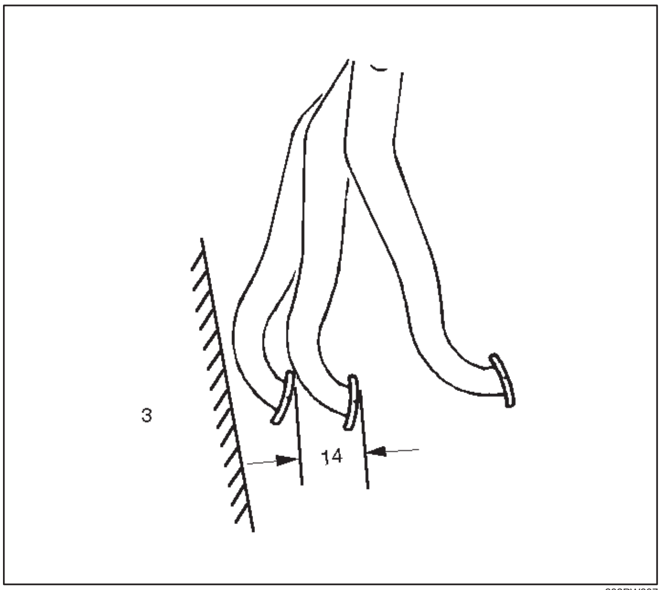
203RW004

6. Clutch pedal engagement height inspection:
   1. Operate the parking brake lever and block the wheels.
   2. Start the engine, fully step on the clutch pedal, and move the shift lever to 1st position.
   3. With the engine idling, release the clutch pedal slowly and measure its stroke just prior to its clutching position.

Clutch Pedal Engagement Height (14)

MIN. 30 mm (1.18 in)

7. If the measured value exceeds the specified limit, check the following points. Repair if necessary:
   - Hydraulic circuit for fluid leakage or air in circuit.
   - Clutch disc warped.
   - Diaphragm spring weakened or tip of fingers worn.
   - Driven plate sticking on sprines.
   - Release bearing worn or damaged.
   - Master cylinder and slave cylinder worn.



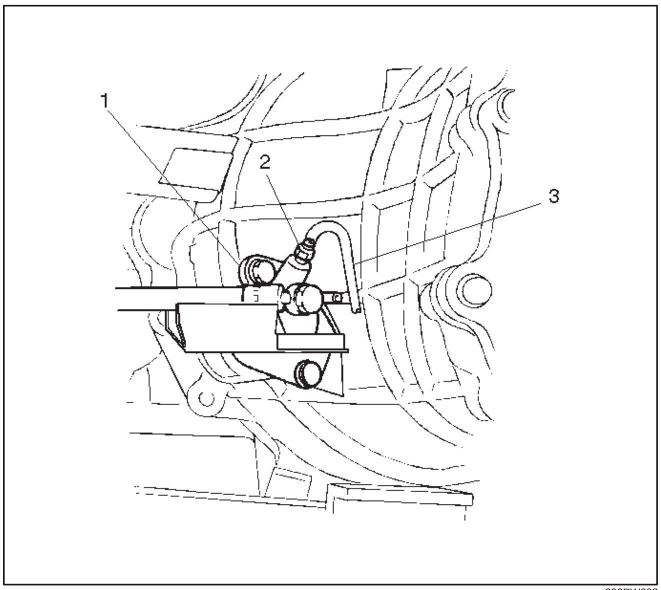
203RW007

Legend

(3) Floor Panel
(14) Clutch Pedal Engagement Height

Torque Specifications

- **Master cylinder to dash panel**
  Torque: 16 N·m (12 lb ft)
- **Clutch pedal to dash panel**
  Torque: 21 N·m (15 lb ft)
- **Master cylinder push rod to yoke**
  Torque: 17 N·m (12 lb ft)
- **Clutch pipe to master cylinder**
  Torque: 12 N·m (9 lb ft)
- **Clutch pipe to flexible hose**
  Torque: 16 N·m (12 lb ft)
- **Slave cylinder to case**
  Torque: 43 N·m (32 lb ft)
- **Slave cylinder bleeder screw**
  Torque: 8 N·m(69 lb in)
- **Flexible hose to slave cylinder**
  Torque: 20 N·m (14 lb ft)



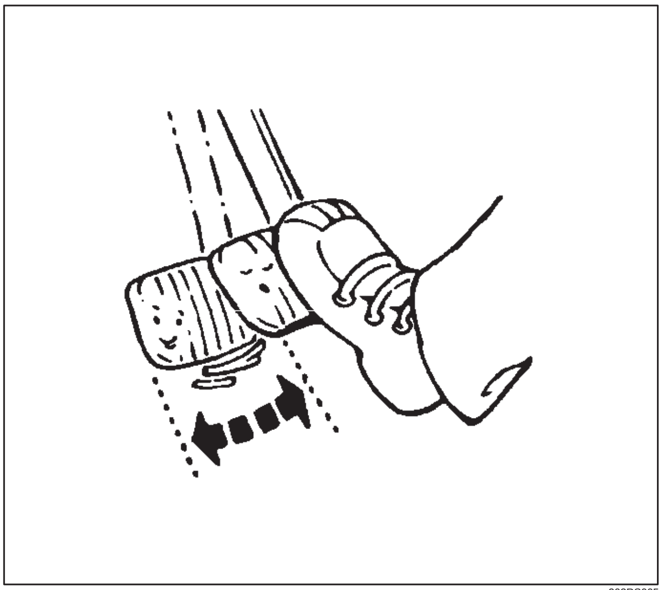
206RW003

Legend

(1) Slave Cylinder
(2) Bleeder Screw
(3) Vinyl Tube

Bleeding

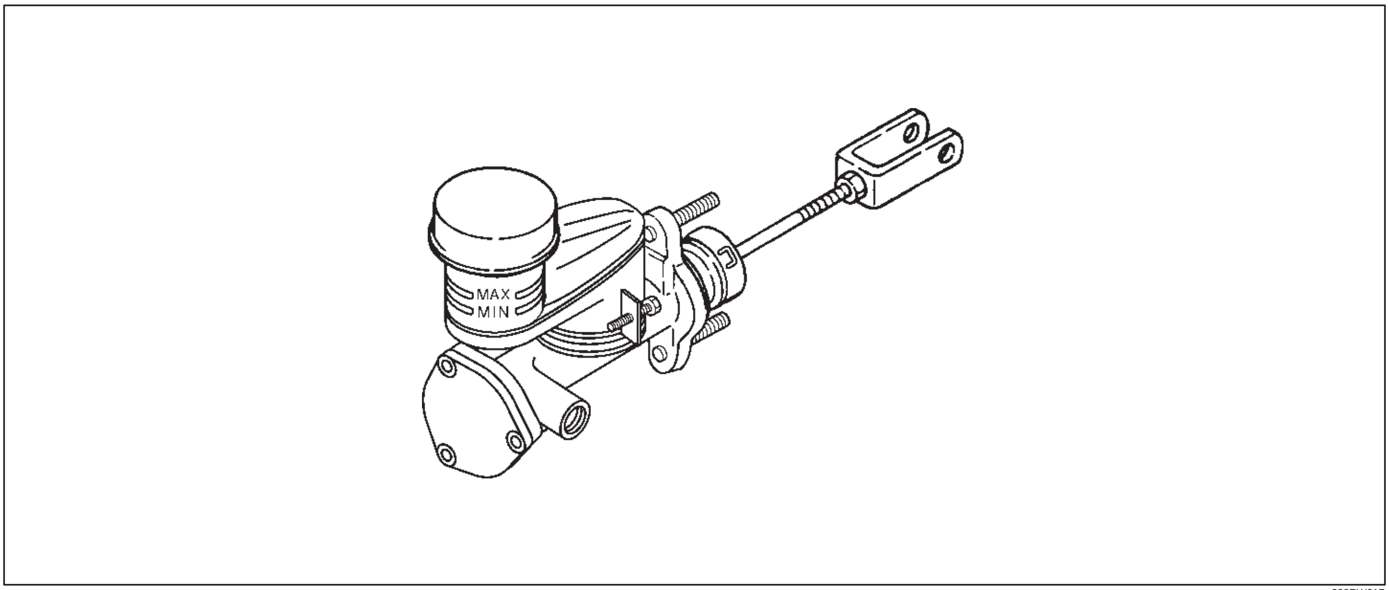
1. Check the level of clutch fluid in the reservoir and replenish if necessary
2. Bleeding the slave cylinder.
   1. Remove the rubber cap from the bleeder screw and wipe clean the bleeder screw. Connect a vinyl tube to the bleeder screw and insert the other end of the vinyl tube into a transparent container.
   2. Pump the clutch pedal repeatedly and hold it depressed.



203RS005

   3. Loosen the bleeder screw to release clutch fluid with air bubbles into the container, then tighten the bleeder screw immediately.
   4. Release the clutch pedal carefully. Repeat the above operation until air bubbles disappear from the clutch fluid being pumped out into the container. During the bleeding operation, keep the clutch fluid reservoir filled to the specified level. Reinstall the rubber cap.

Master Cylinder



208RW017

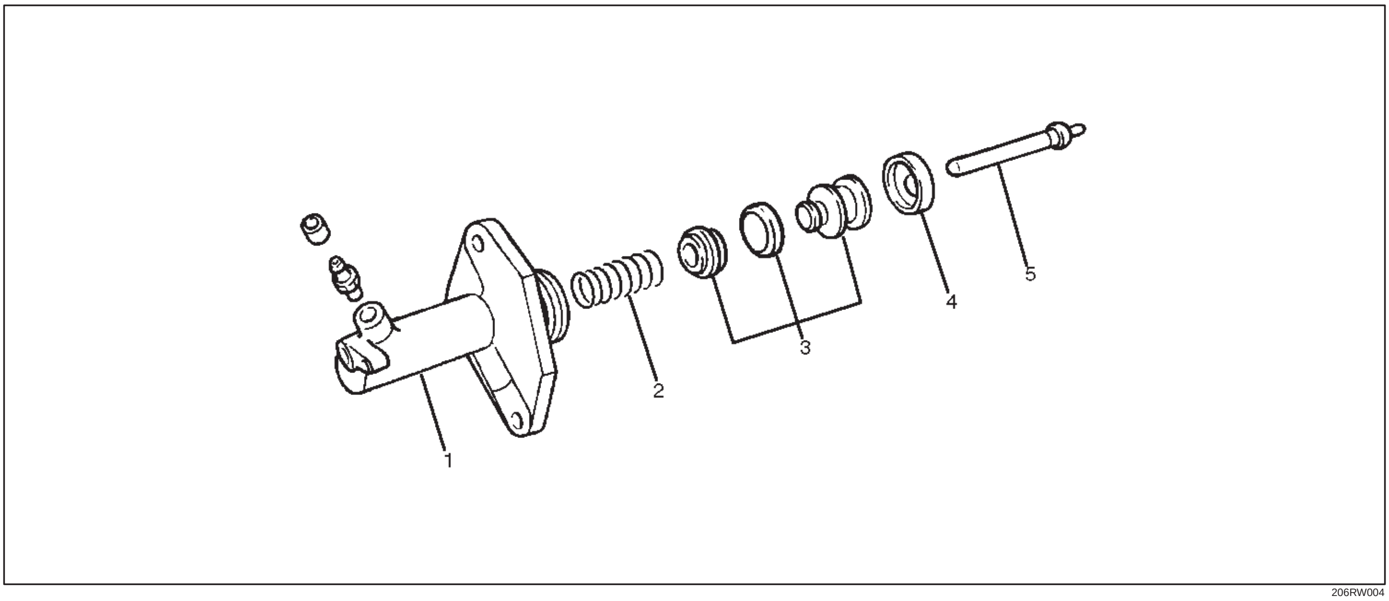
Inspection and Repair

Inspect the removed parts. If there are abnormalities such as wear, oil leak or other damage, replace the master cylinder assembly.

NOTE: The master cylinder assembly cannot be disassembled because of point–staked rod stopper.

Slave Cylinder

Disassembled View



Legend

(1) Cylinder Body
(2) Spring
(3) Piston and Piston Cup
(4) Boot
(5) Push Rod

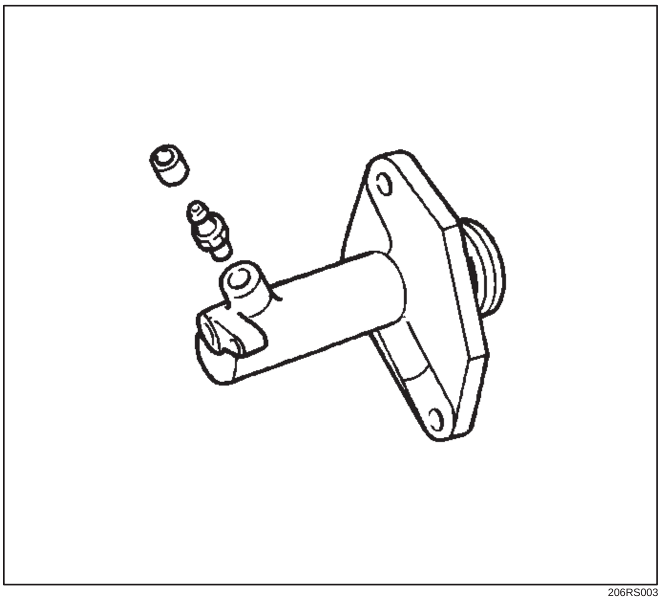
Disassembly

1. Remove boot.
2. Remove push rod.
3. Remove piston and piston cup.
4. Remove spring.
5. Remove cylinder body.

Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

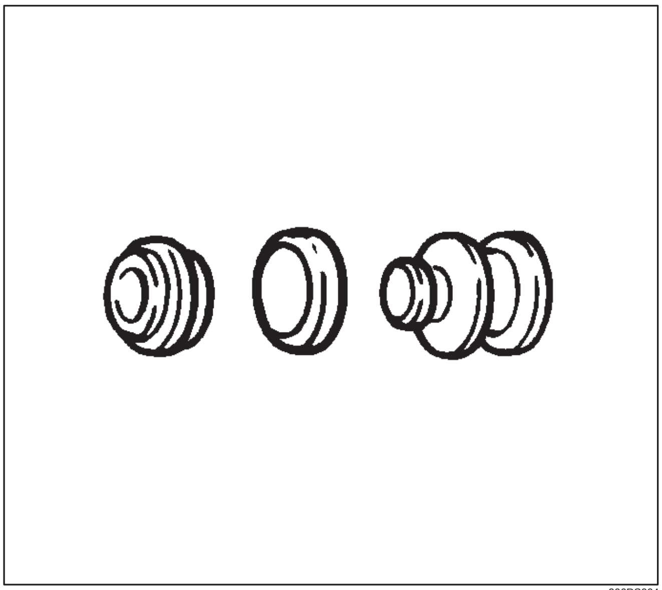
Cylinder Body



1. Clean the cylinder body.
2. Check the fluid return port for restrictions and clean it if necessary.

Piston and Piston Cup

1. Visually inspect the disassembled piston and piston cup for excessive wear and damage.
2. Replace the inner parts with new parts shown in the illustration.

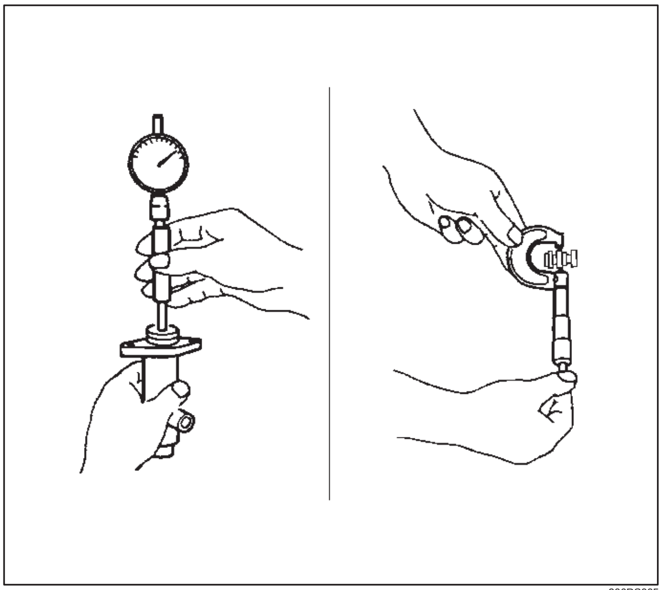


206RS004

3. Measure the clearance between slave cylinder wall and piston.
4. If the measured value exceeds the specified limit, the slave cylinder assembly must be replaced.

Standard: 0.07 mm (0.0028 in)

Limit: 0.15 mm (0.0059 in)

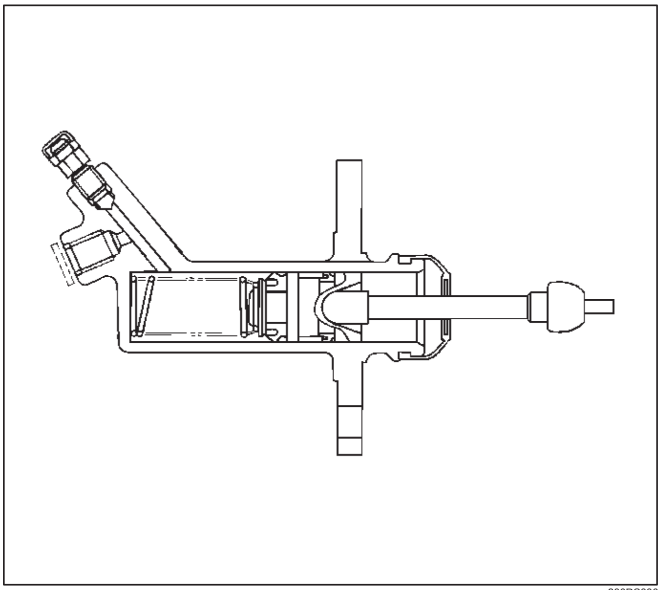


206RS005

Reassembly

To reassemble, follow the disassembly steps in the reverse order, noting the following points:

1. Before installing the parts, apply a thin coat of rubber grease.
2. Install cup in groove in piston with the lip turned to the front of cylinder. Use care so as not to scratch the cylinder.



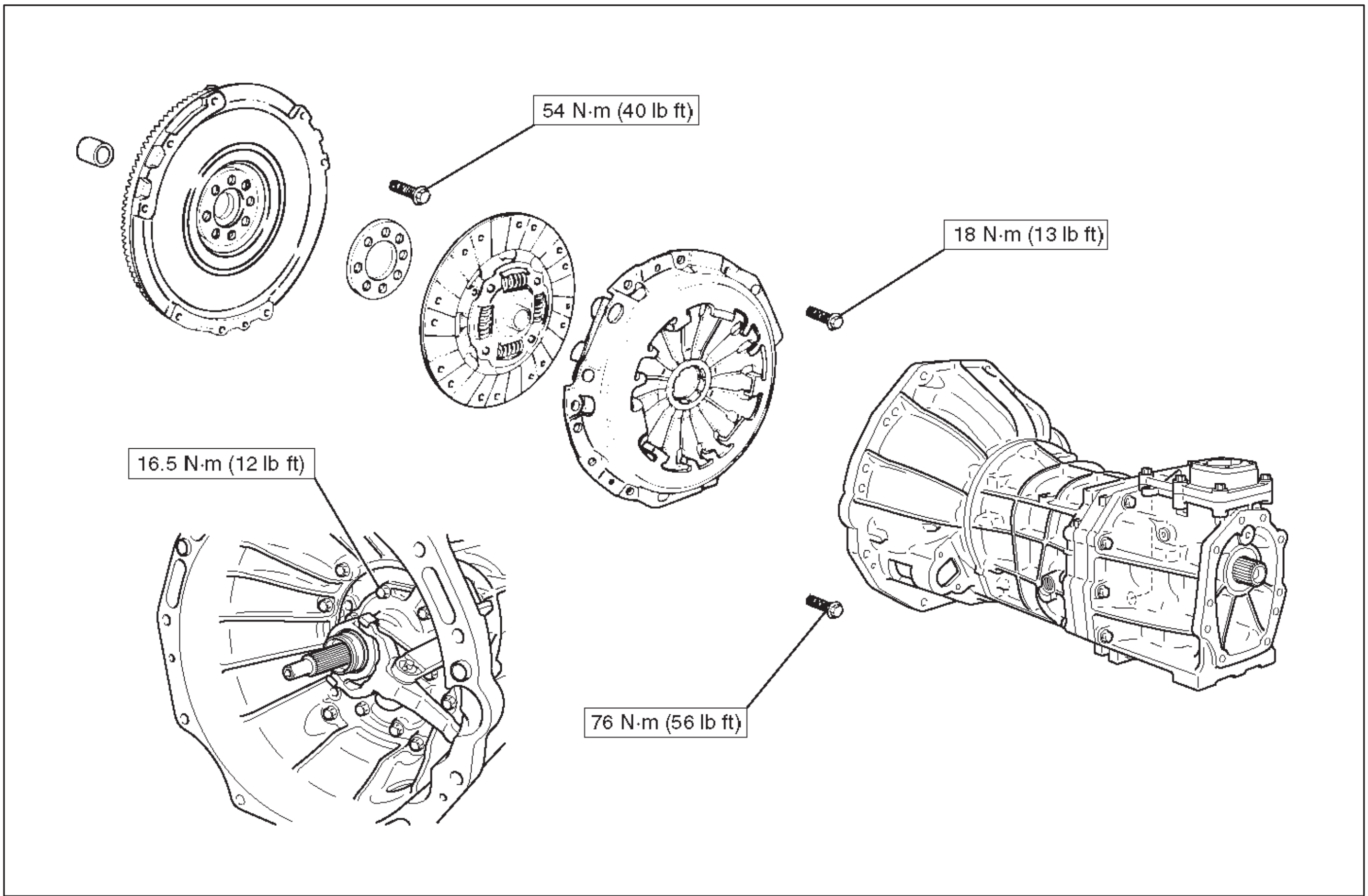
206RS006

Main Data and Specifications

General Specifications

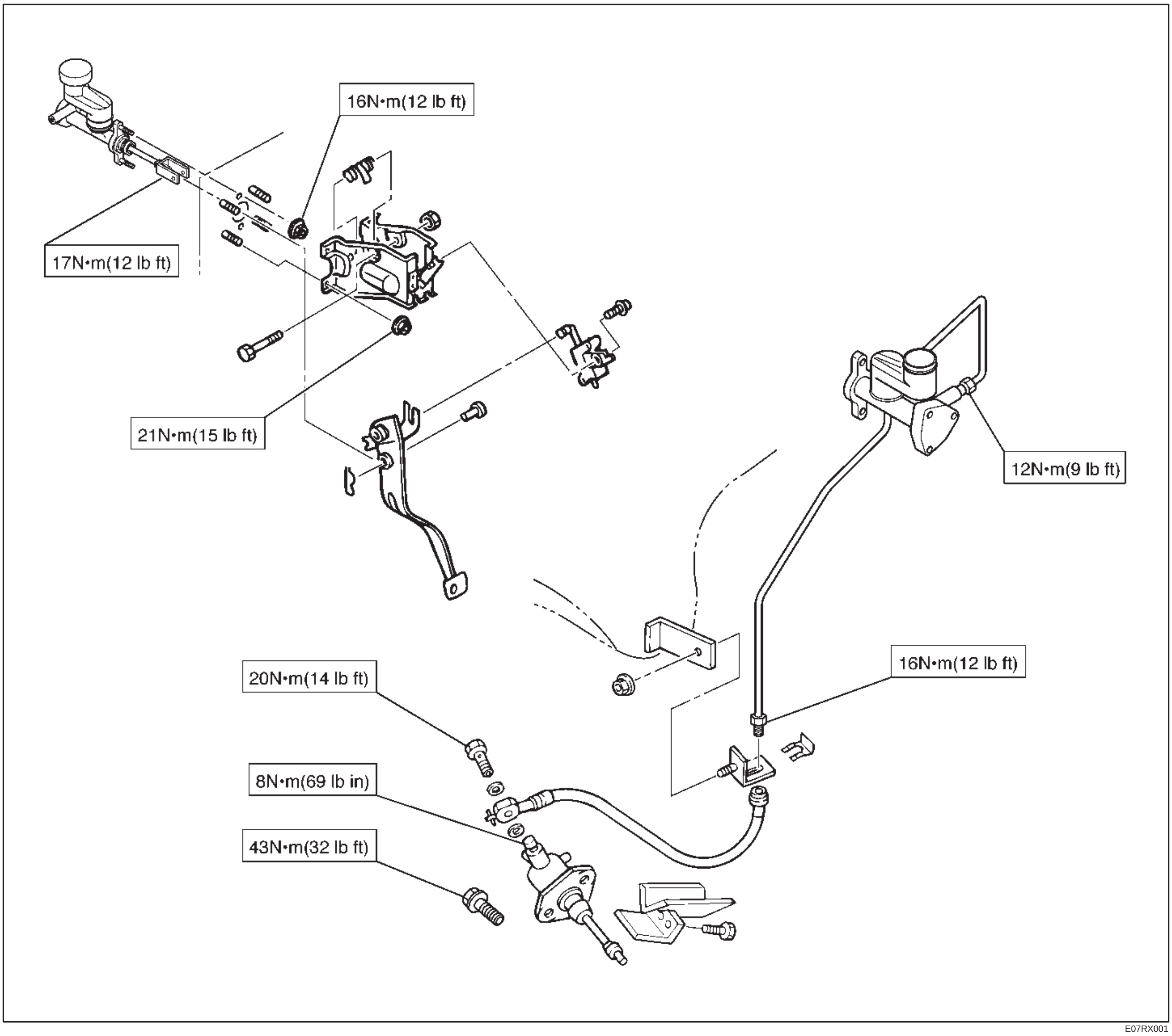
Type	Dry single plate type with diaphragm spring
Size	275 mm (10.83 in)
Pressure plate Outside diameter	332 mm (13.07 in)
Pressure plate Clamping force	7208 N (1621 lb)
Pressure plate Spring finger height	49.9 – 51.9 mm (1.965 – 2.043 in)
Driven plate Outside diameter x inside diameter	275 × 180 mm (10.83 × 6.69 in)
Thickness Clutch disengaged	8.8 mm (0.346 in)
Thickness Clutch engaged	8.3 mm (0.327 in)
Total friction area	339 ×2 cm^2 (52 ×2 in^2)
Clutch control type	Hydraulic
Clutch pedal free play	5 – 15 mm (0.20 –0.59 in)
Clutch pedal height	217 –227 mm (8.543 –8.937 in)
Clutch pedal stroke	152.5 –162.5 mm (6.004 –6.398 in)

Torque Specifications

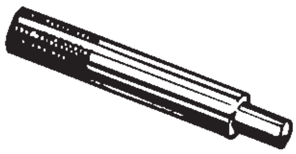
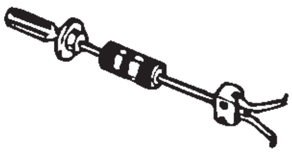
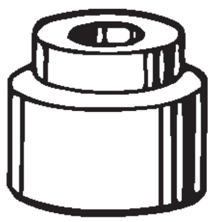
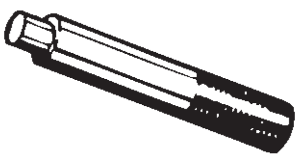


E07RW032

Torque Specifications (Cont'd)



Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS265	**J-24547** Driven plate aligner
 901RS266	**J-5822 and J-23907** Pilot bearing remover and Sliding hammer
 901RS267	**J-26516-A** Crankshaft pilot bearing installer
 901RS268	**J-8092** Driver handle

TROOPER

BODY AND ACCESSORIES

LIGHTING SYSTEM

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

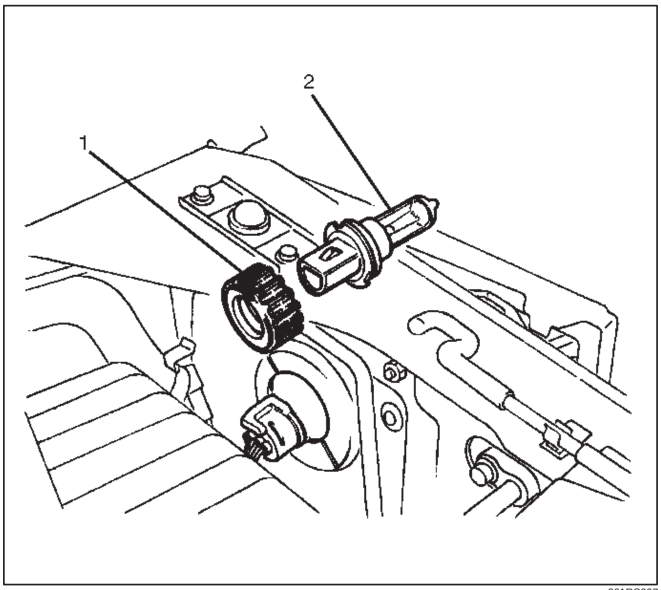
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Headlight Bulb

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector.
3. Remove the cap(1) while turning it counter clockwise.
4. Pull the bulb(2) out from the headlight body.

CAUTION: The halogen bulb develops a very high temperature. Do not touch the glass portion. If any stain is on the glass surface, It will scorch and the glass will be damaged.



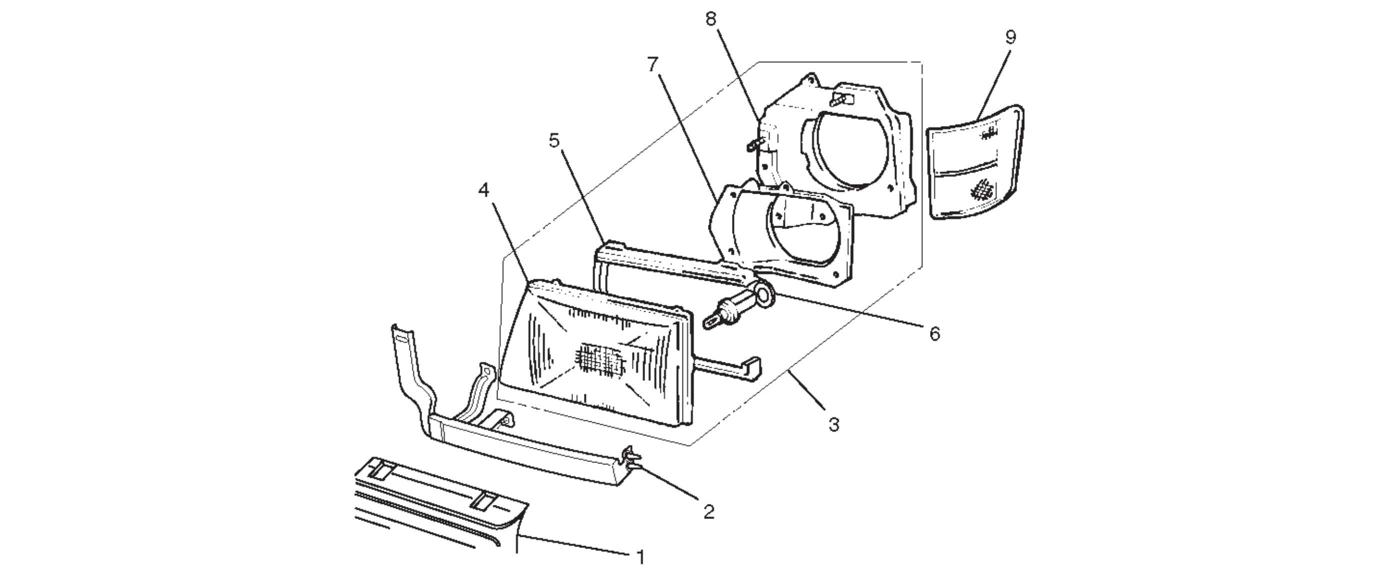
801RS007

Installation

To install, follow the removal steps in the reverse order.

Headlight

Headlight and Associated Parts



801RW003

Legend

(1) Radiator Grille
(2) Front End Lower Panel
(3) Headlight Assembly
(4) Headlight
(5) Headlight Rim
(6) Headlight Bulb
(7) Rear Cover
(8) Bracket
(9) Front Combination Light

Removal

1. Disconnect the battery ground cable.
2. Remove the screw and pull out the two projecting portions on the fender to remove the front combination light.
3. Remove five clips and two screws to remove the radiator grille.
4. Remove two screws to remove the front end lower panel(2).
5. Remove two bolts and two nuts to remove the headlight assembly (with bracket).
6. Remove the headlight bulb.
7. Remove two screws, two nuts and the spring for the headlight aim adjustment to remove the bracket.
8. Remove four screws to remove the rear cover.
9. Remove the headlight rim.
10. Remove the headlight.

Installation

To install, follow the removal steps in the reverse order.

CAUTION: After installing the headlight, be sure to adjust the headlight aim.

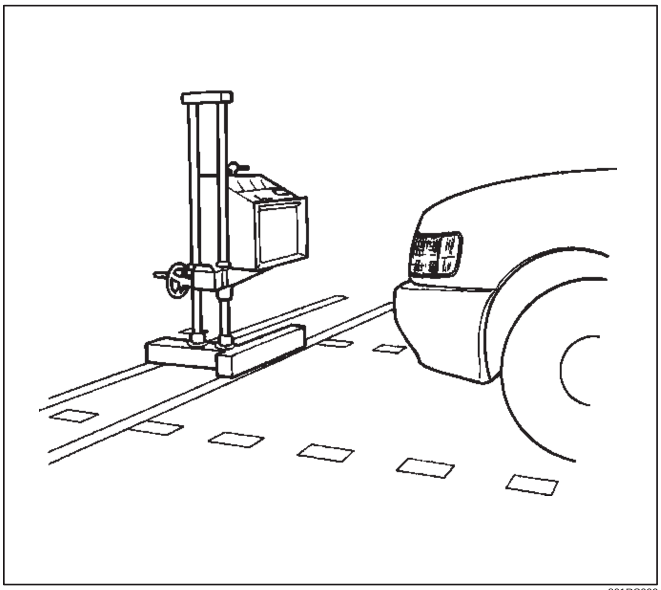
Headlight Adjustment

Preparation

Place the unloaded vehicle on a level surface and check to see if the inflation pressure of the tires is correct, the lenses are clean, and the battery is sufficiently charged.

Adjust the aim with the headlight tester, if necessary.

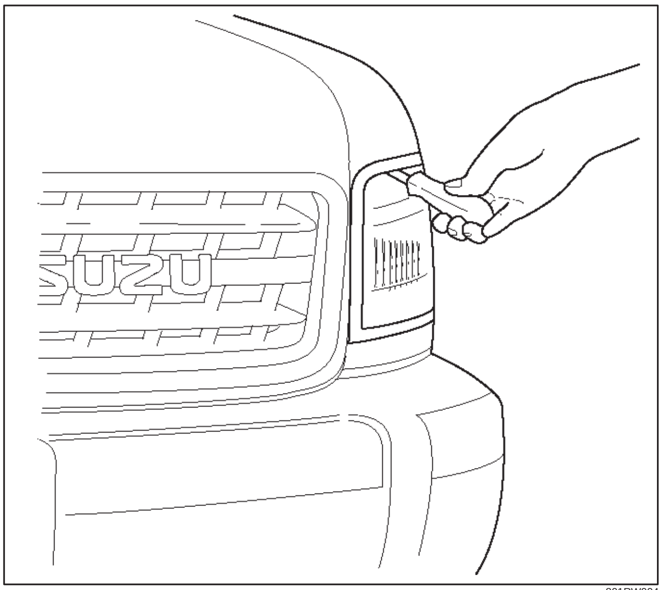
When adjusting, follow the procedure of the tester manufacturer's.



801RS009

Vertical adjustment

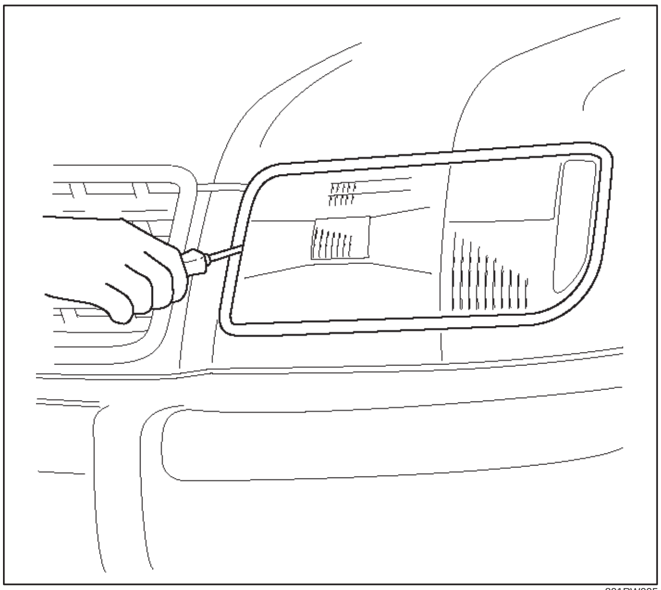
Use a screwdriver for vertical adjustment.



801RW004

Horizontal adjustment

Use a screwdriver for horizontal adjustment.

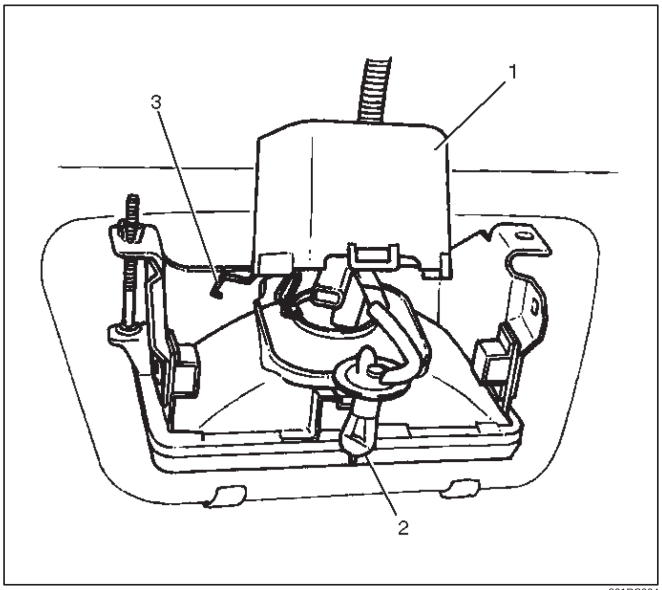


801RW005

Fog Light Bulb

Removal

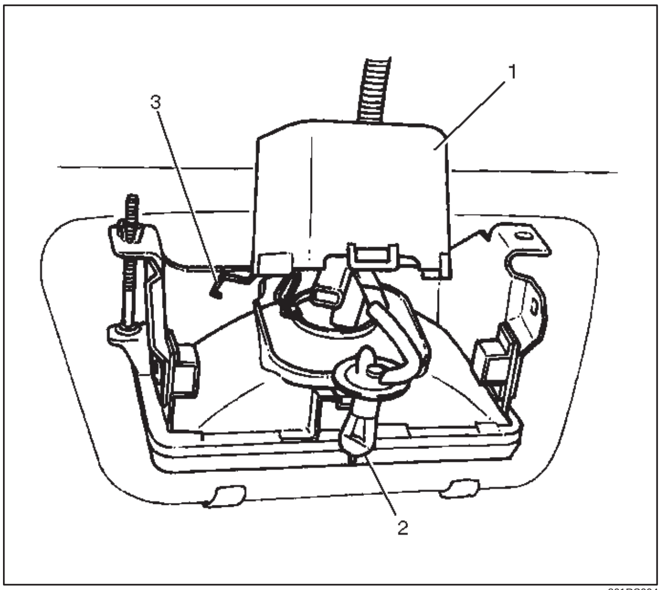
1. Disconnect the battery ground cable.
2. Open the rear cover(1) of the case.
3. Remove the dust cover.
4. Disconnect the bulb connector.
5. Remove the clip(3).
6. Remove the fog light bulb(2).



801RS004

Installation

1. Install the fog light bulb(2).
2. Install the clip(3).
3. Connect the bulb connector.
4. Install the dust cover.
5. Close the rear cover(1) of the case.



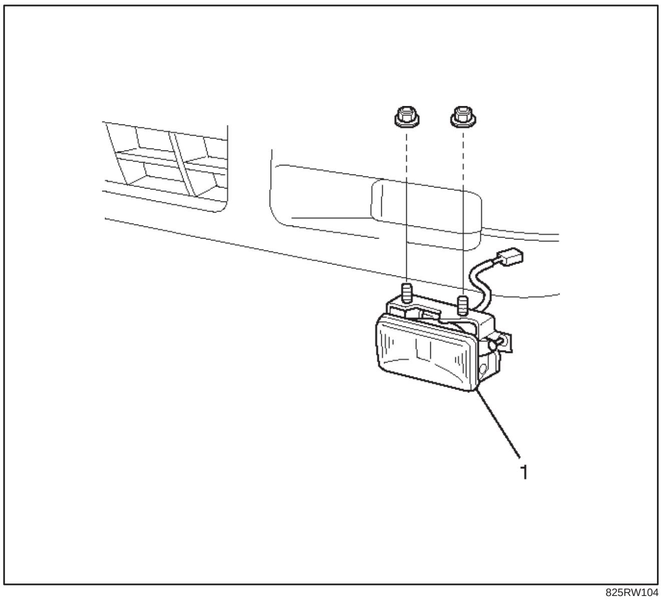
801RS004

6. Connect the battery ground cable.

Fog Light Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove two nuts from the bracket.
3. Disconnect the connector.
4. Remove the fog light assembly(1).



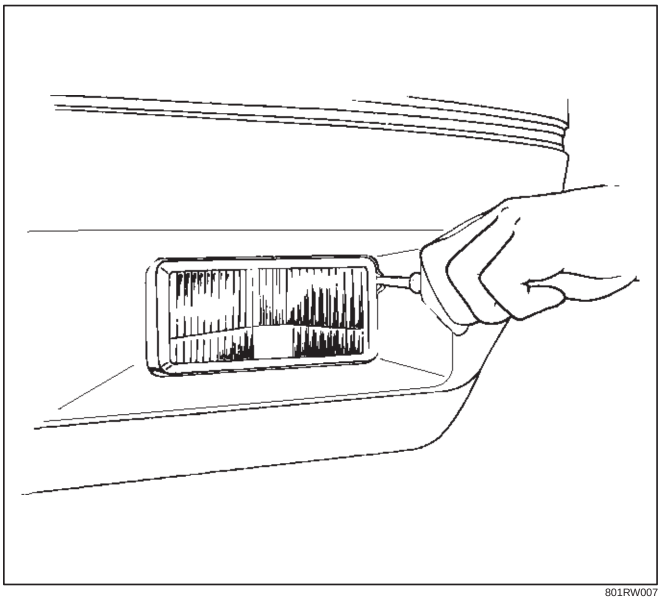
Installation

To install, follow the removal steps in the reverse order.

CAUTION: After installing the fog light, be sure to adjust the fog light aim.

Fog Light Adjustment

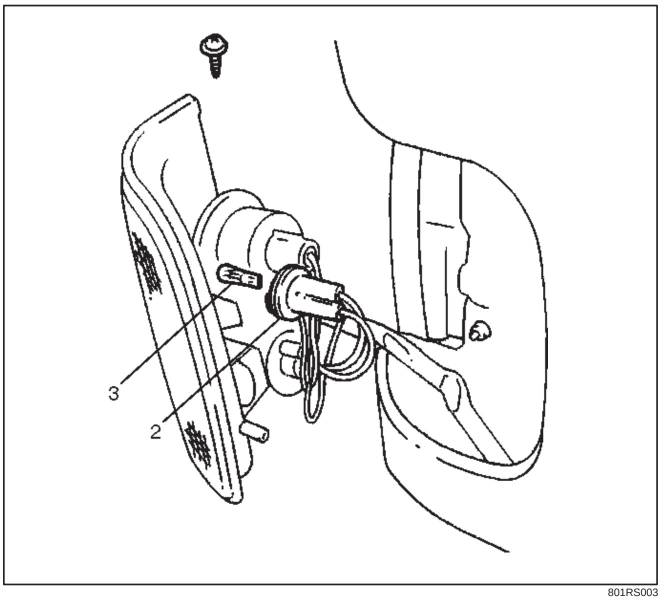
Turn the adjusting screw with a screwdriver to adjust the aim of the fog light vertically.



Front Side Marker Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the screw at the upper portion of the light bracket and then remove the bracket from the fender.
3. Remove the front combination light assembly(1).
4. Remove the front side marker light socket(2) by turning it counterclockwise.
5. Pull out the bulb(3) from the socket.



Installation

To install, follow the removal steps in the reverse order.

Parking Light Bulb

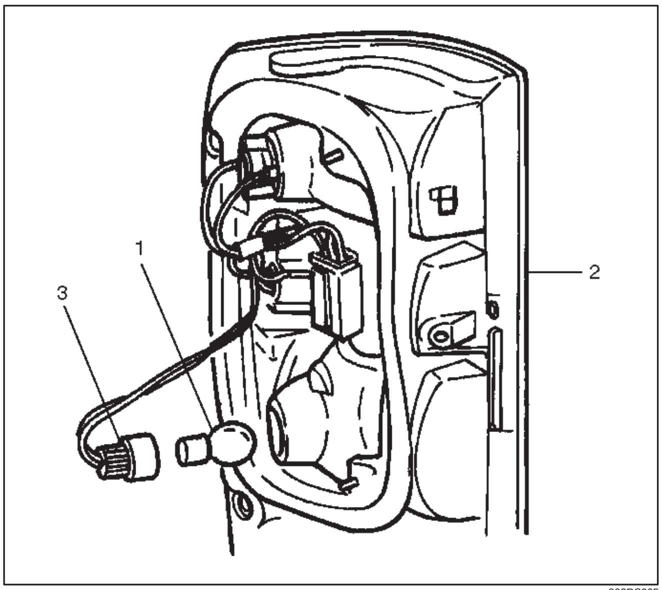
Removal and Installation

Refer to the Front Turn Signal Light Bulb in this section.

Taillight Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove three screws and release locks at two locations to remove the rear combination light assembly(2).
3. Remove the socket(3) by turning it counterclockwise.
4. Turn the bulb(1) counterclockwise while pushing it to remove it from the socket.



803RS005

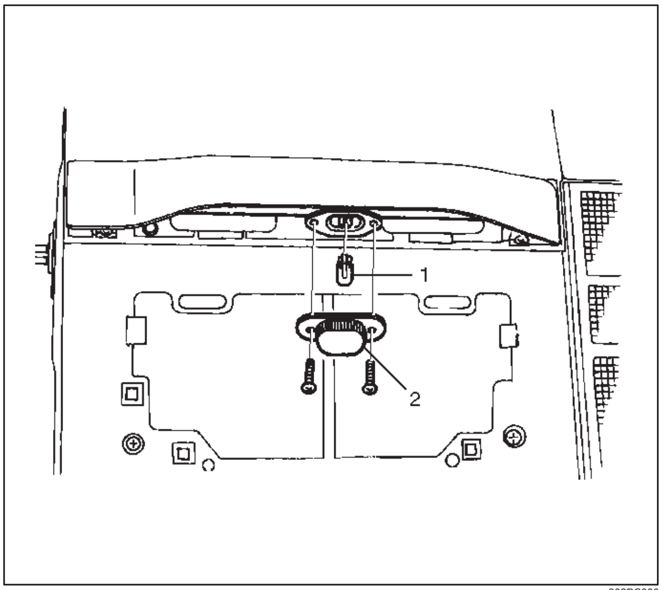
Installation

To install, follow the removal steps in the reverse order.

License Plate Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove two screws to remove the lens(2).
3. Pull out the bulb(1) from the socket.



803RS006

Installation

To install, follow the removal steps in the reverse order.

Stoplight Bulb

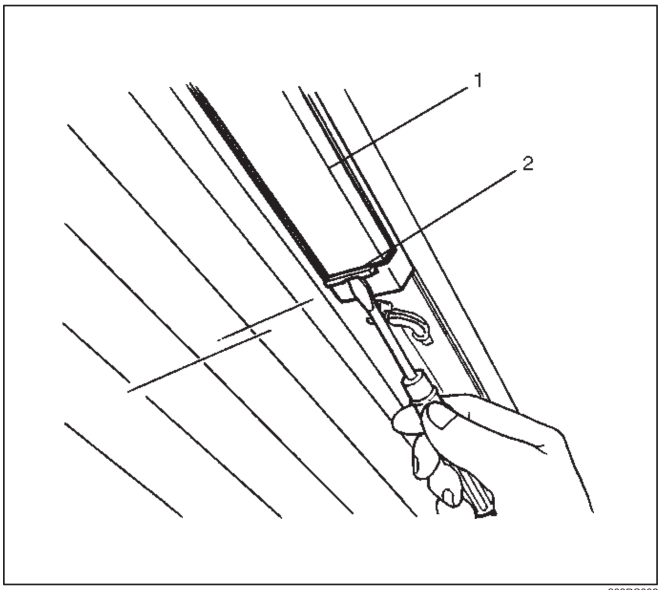
Removal and Installation

Refer to the Taillight Bulb in this section.

High Mount Stoplight

Removal

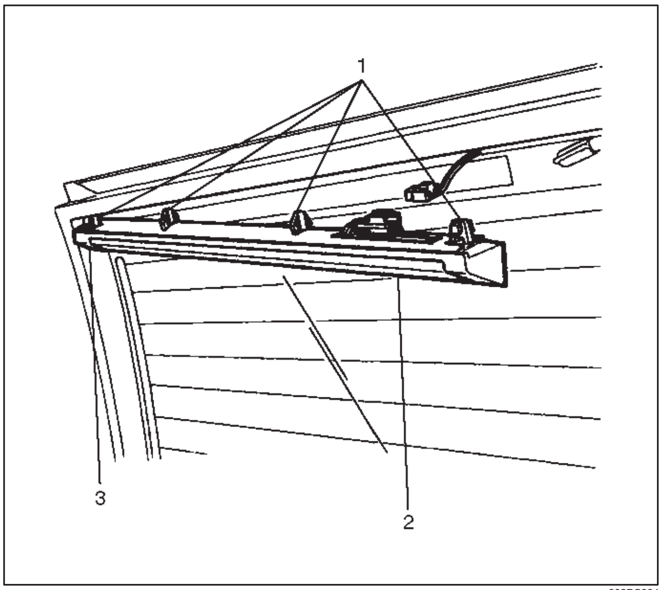
1. Disconnect the battery ground cable.
2. Remove the clips(2).
3. Pull out the high mount stoplight(1).
4. Remove the connector.
5. Remove the high mount stoplight.



803RS003

Installation

1. Insert the clips(1)(3) into the high mount stoplight(2).
2. Reconnect the connector.
3. Install the high mount stoplight.

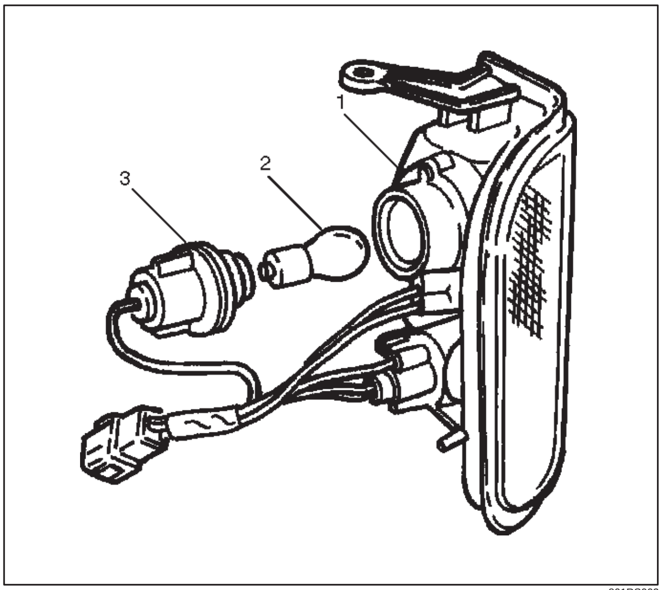


803RS004

Front Turn Signal Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the screw at the upper portion of the light bracket, and remove the bracket from the fender.
3. Remove the front combination light(1).
4. Remove the turn signal light socket(3) by turning it counterclockwise.
5. Remove the bulb(2) by turning it counterclockwise while pushing it at the same time.



801RS002

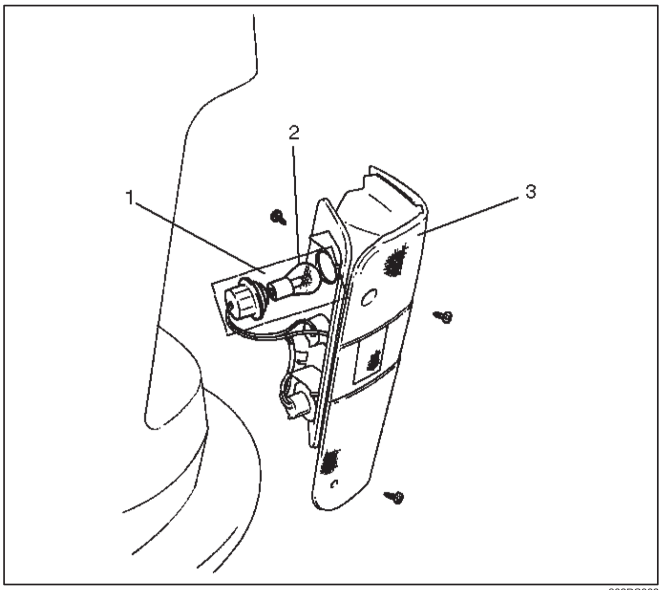
Installation

To install, follow the removal steps in the reverse order.

Rear Turn Signal Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the three screws and release the lock at two positions.
3. Remove the rear combination light(3).
4. Remove the turn signal light socket/bulb(1) by turning it counterclockwise.
5. Remove the bulb(2) by turning it counterclockwise while pushing it at the same time.



803RS002

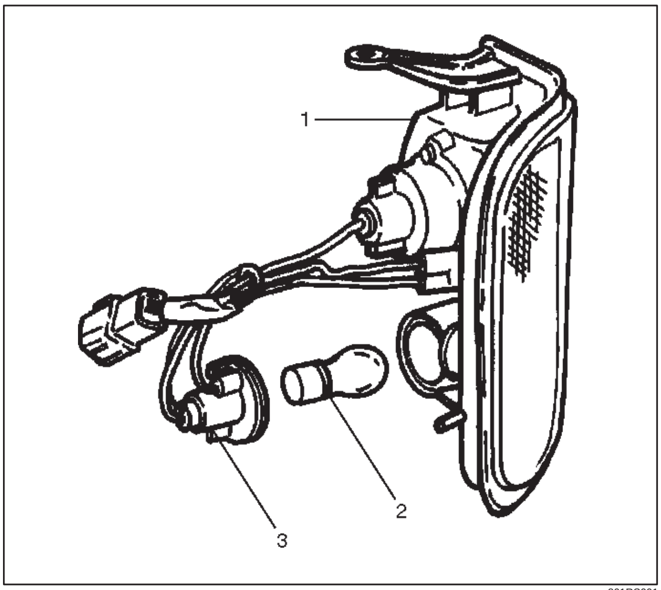
Installation

To install, follow the removal steps in the reverse order.

Cornering Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the screws at the upper portion of the light bracket, and remove the bracket from the fender.
3. Remove the front combination light(1).
4. Remove the cornering light bulb socket(3) by turning it counterclockwise.
5. Remove the bulb(2) by turning it counterclockwise while pushing it at the same time.



801RS001

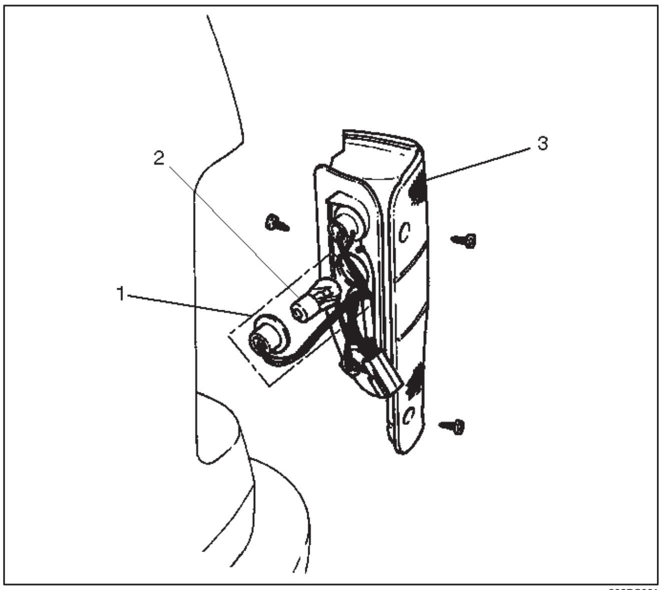
Installation

To install, follow the removal steps in the reverse order.

Backup Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove three screws and release the lock at two positions.
3. Remove the rear combination light(3).
4. Remove the backup light socket/bulb(1) by turning it counterclockwise.
5. Remove the bulb(2) by turning it counterclockwise while pushing it at the same time.



803RS001

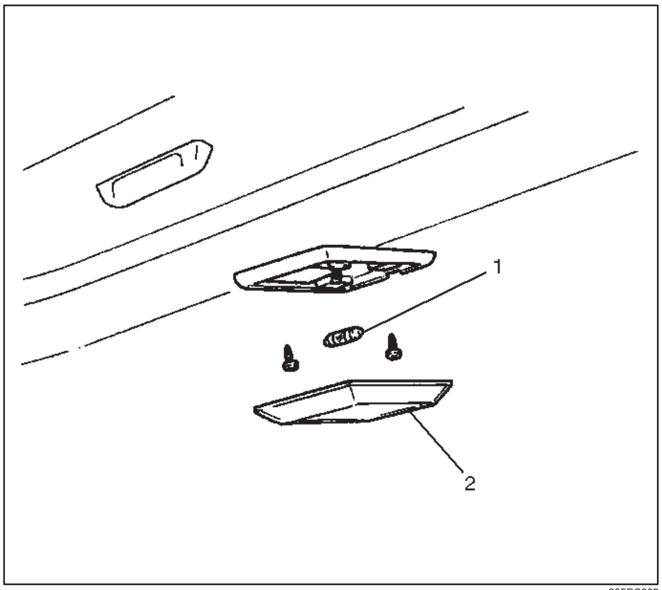
Installation

To install, follow the removal steps in the reverse order.

Dome Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens(2) by releasing the locks at three locations.
3. Remove the bulb(1).



805RS005

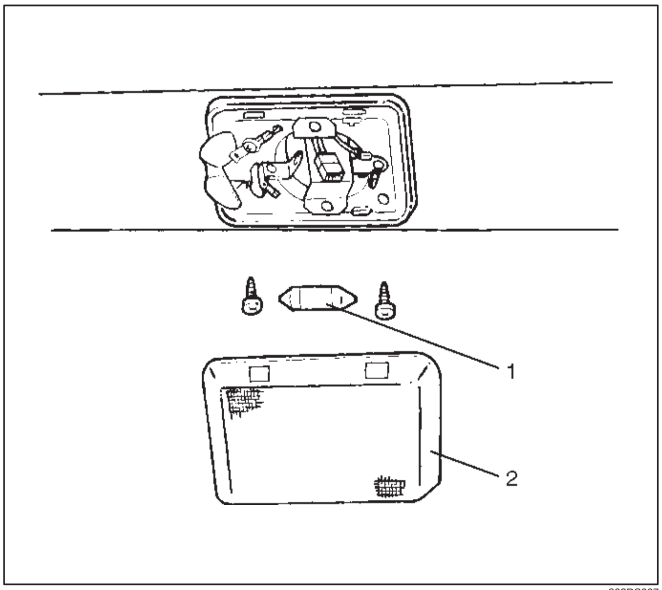
Installation

To install, follow the removal steps in the reverse order.

Luggage Room Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens(2) by releasing the locks at four locations.
3. Remove the bulb(1).



803RS007

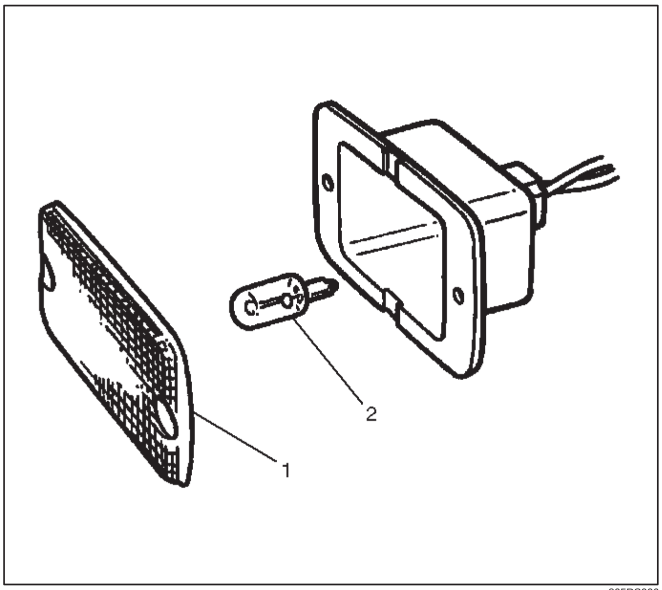
Installation

To install, follow the removal steps in the reverse order.

Courtesy Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove two screws to remove the lens(1).
3. Pull out the bulb(2) from the socket.



805RS006

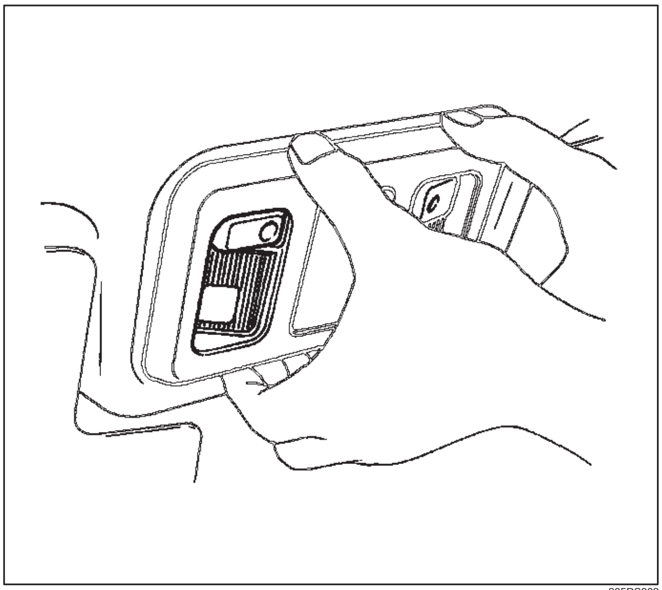
Installation

To install, follow the removal steps in the reverse order.

Map Light Switch/Bulb

Removal

1. Disconnect the battery ground cable.
2. Pull the map light body downward to release the lock.
3. Disconnect the connectors of the map light and the sun roof switch.
4. Remove the map light switch.
5. Turn the socket counterclockwise to remove it.
6. Pull out the bulb from the socket.



805RS008

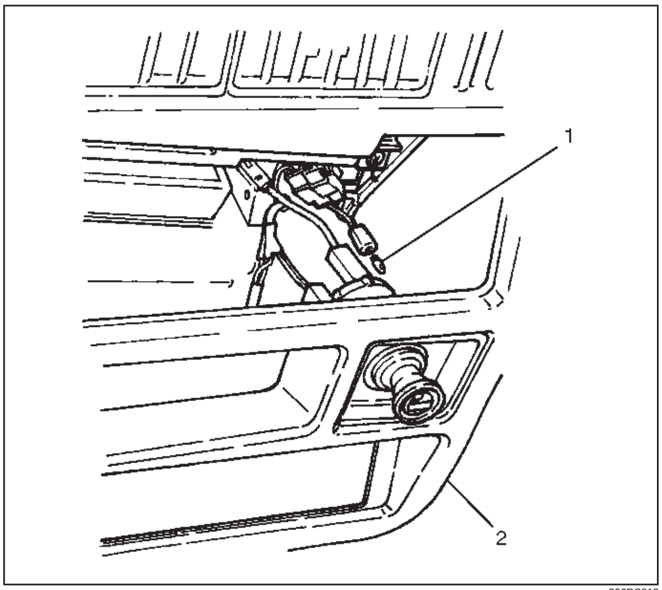
Installation

To install, follow the removal steps in the reverse order.

Cigarette Lighter Illumination Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove eight screws to remove the instrument cluster panel(2).
3. Turn the socket counterclockwise to remove it then pull out the bulb(1).



826RS013

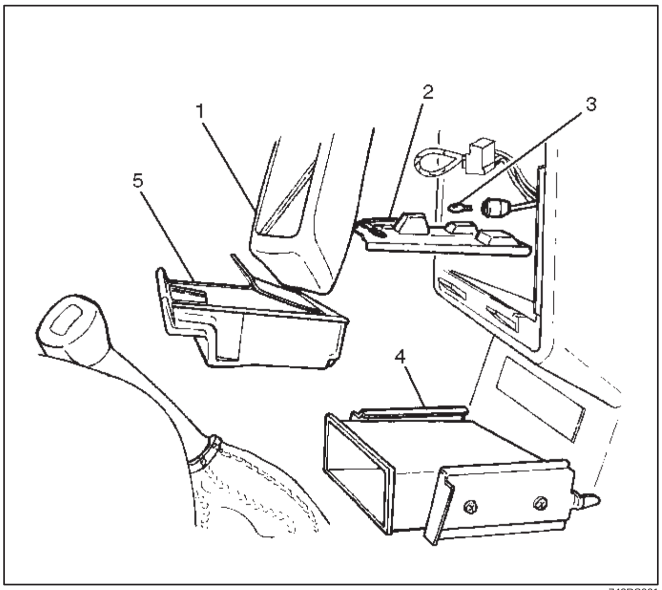
Installation

To install, follow the removal steps in the reverse order.

Ashtray Illumination Bulb

Removal

1. Disconnect the battery ground cable.
2. Removal eight screws to remove the instrument cluster panel(1).
3. Remove the ashtray(5).
4. Remove four screws to remove the audio box(4).
5. Remove two screws to remove the ashtray guide(2).
6. Turn the socket counterclockwise to remove it then pull out the bulb(3).



742RS001

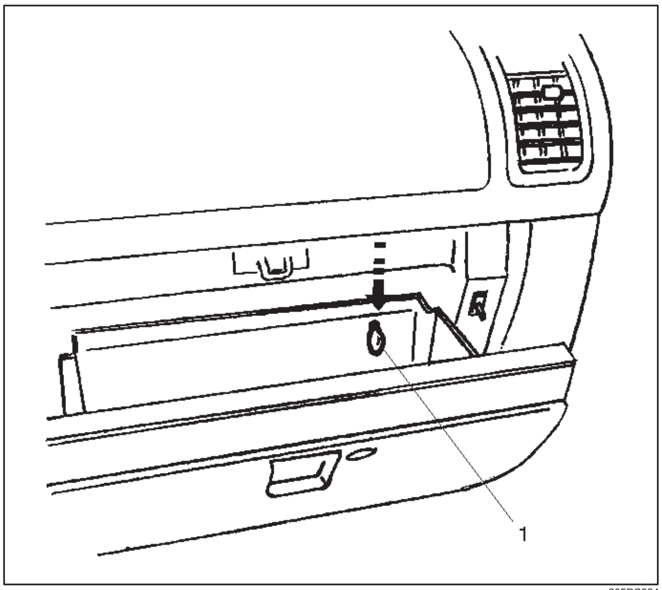
Installation

To install, follow the removal steps in the reverse order.

Glove Box Illumination Bulb

Removal

1. Disconnect the battery ground cable.
2. Open the glove box lid, and then pull out the bulb(1).



805RS004

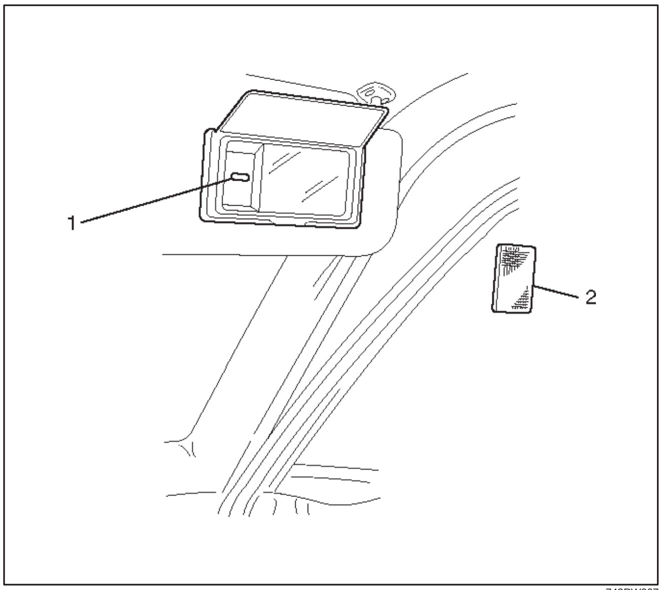
Installation

To install, follow the removal steps in the reverse order.

Vanity Mirror Illumination Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens(2).
3. Remove the bulb(1).



743RW007

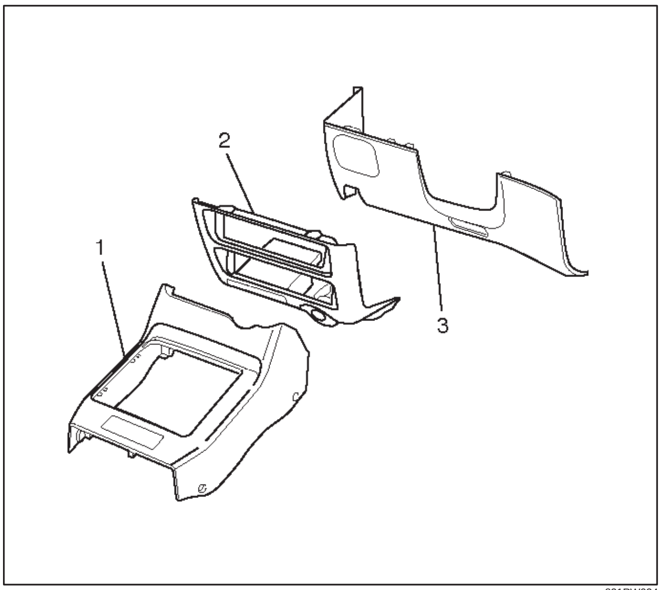
Installation

To install, follow the removal steps in the reverse order.

Starter Switch

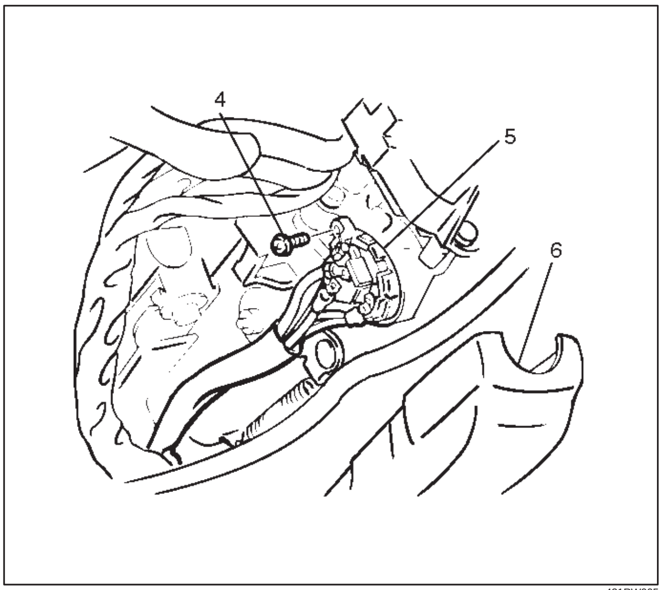
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
   Refer to Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
   Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
   Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove seven screws to remove the steering cowl(6).
6. Disconnect the connector, remove the screw(4) and then remove the starter switch(5).

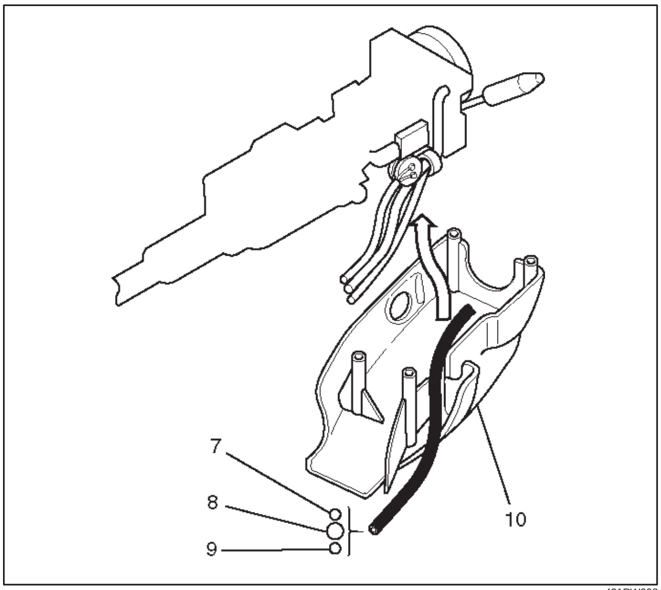


431RW005

Installation

To install, follow the removal steps in the reverse order noting the following point.

1. When installing the steering cowl(10), be sure to pass the harnesses through the route as shown in the figure so that the starter switch harness(7), the combination switch harness(8) and the inflator module harness(9) will not get caught.



431RW008

Lighting Switch (Combination Switch)

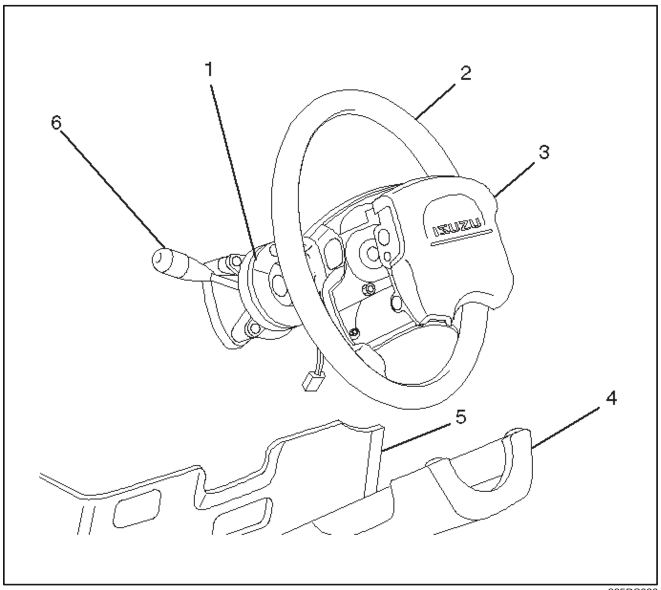
Removal

1. Disconnect the battery ground cable.
2. Remove the instrument panel driver lower cover(5).
   Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove seven screws to remove the steering cowl(4).
4. Disconnect the SDM (air bag controller) connector located at lower of the instrument panel driver lower cover.
5. Remove four fixing screws and disconnect the driver inflator module connector to remove the driver inflator module(3).

CAUTION: When carrying a live inflator module, make sure the bag opening is pointed away from you. In case of an accidental deployment, the bag will then deploy with minimal chance of injury. Never carry the inflator module by the wires or connector on the underside of the module.

When placing a live inflator module on a bench or other surface, always face the bag and trim cover up, away from the surface. This is necessary so that a free space is provided to allow the air bag to expand in the unlikely event of accidental deployment.

6. Remove the steering wheel(2).
   Refer to the Steering Wheel in Steering section.
7. Disconnect the SRS coil assembly connector,remove four fixing screws to remove the SRS coil assembly(1).
8. Disconnect the lighting switch connector, remove four fixing screws to remove the lighting switch(6).

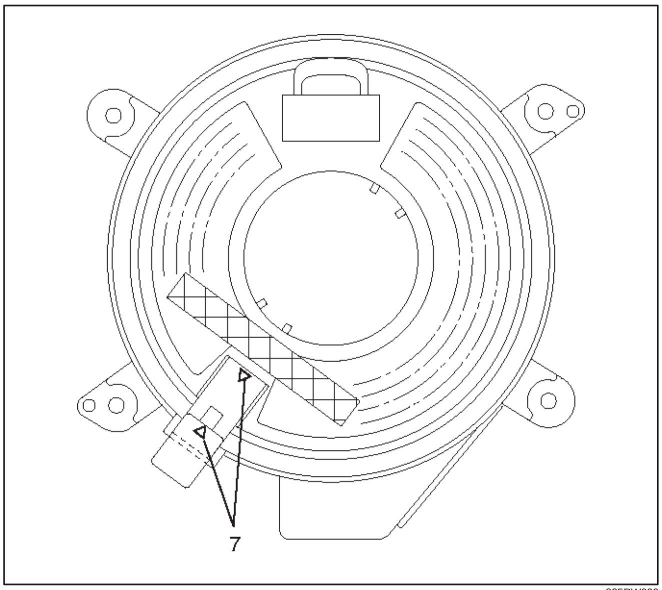


825RS039

Installation

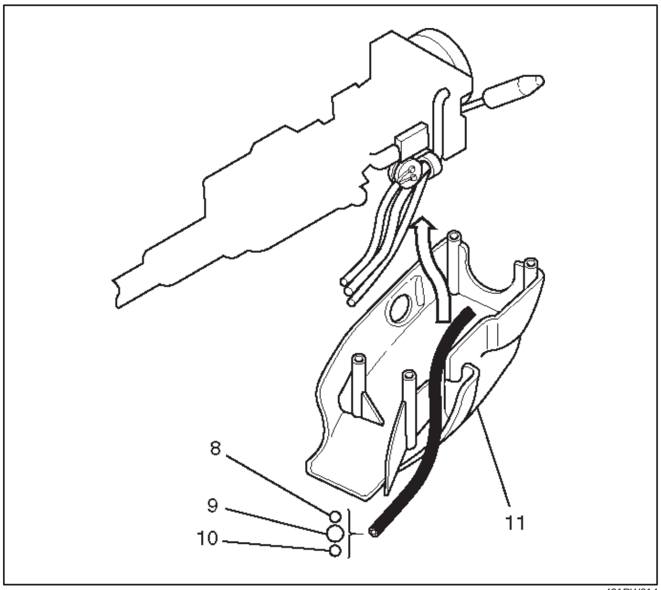
To install, follow the removal steps in the reverse order, noting the following points.

1. Check to see if the vehicle is in the straight driving condition and turn the rotary section of the SRS coil assembly provided to the upper surface of the lighting switch (combination switch) counterclockwise fully until it stops.
   Then from where it stops, turn it back about 3 rotations to set the alignment marks(7) together before installing the steering wheel.



825RW099

2. Tighten the steering shaft nut to the specified torque.
   Torque: 34 N·m (25 lb ft)
3. When connect the double lock type of inflator module connector, insert the connector completely and lock at outside.
   Imperfect locking may cause malfunction of SRS system circuit.
4. When installing the steering cowl(11),be sure to pass the harnesses through the route as shown in the figure so that the starter switch harness(8), the combination switch harness(9) and inflator module harness(10) will not get caught.

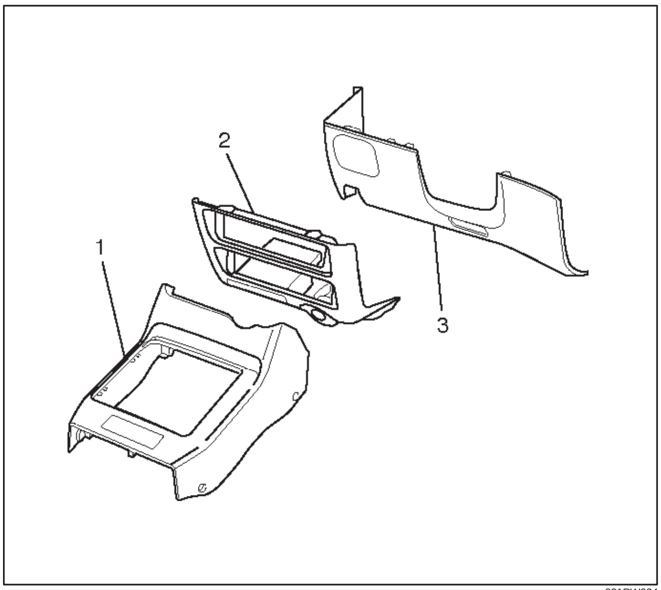


431RW014

Fog Light Switch

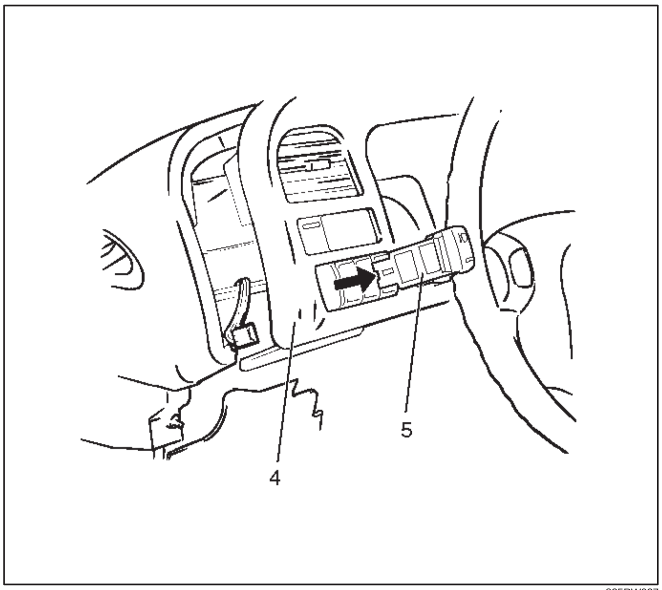
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
   Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
   Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
   Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4). Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the connector and push the lock from the back side of the instrument panel cluster assembly to remove the fog light switch(5).



825RW027

Installation

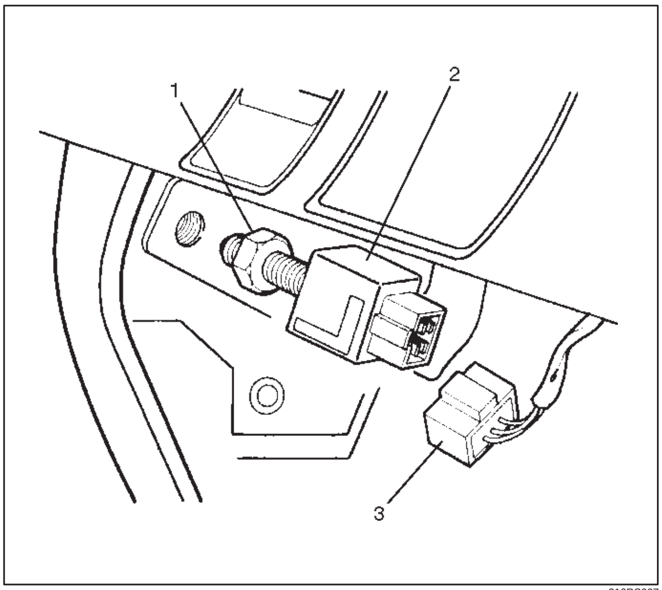
To install, follow the removal steps in the reverse order, noting the following point:

1. Push in the switch with your fingers until the switch is locked securely.

Stoplight Switch (W/O Cruise Control)

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector(3), loosen the lock nut(1) and then remove the stoplight switch(2) by turning it.

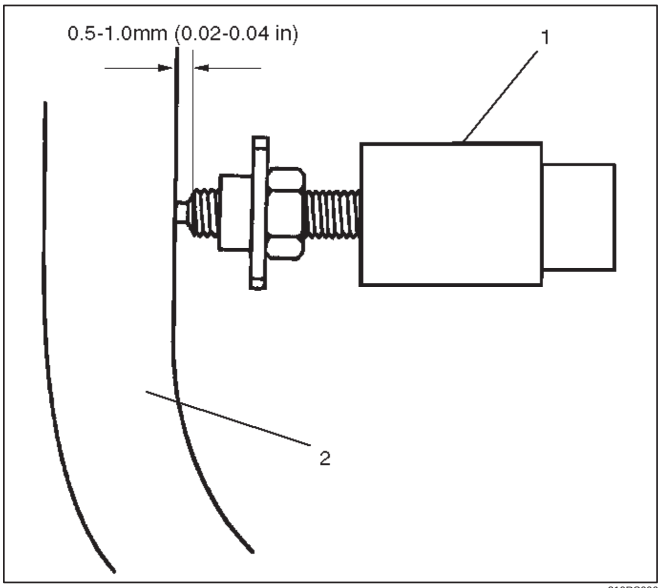


310RS007

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Check to see if the brake pedal has been returned by the return spring to the specified position.
2. Turn the stoplight switch(1) clockwise until the tip of the threaded portion of the switch contacts the pedal arm(2).
3. Turn the switch counterclockwise until the space between the tip of the threaded portion and the pedal arm is 0.5 to 1.0 mm (0.02 – 0.04 in.).

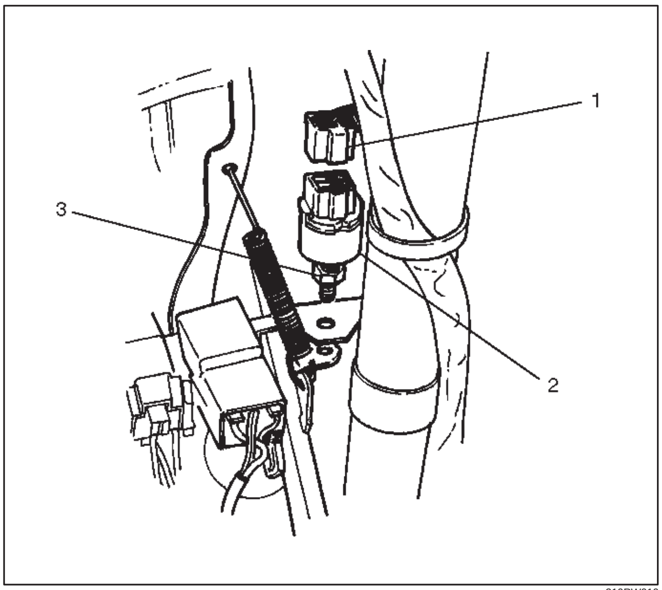


310RS006

Brake Switch (W/Cruise Control)

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector(1), loosen the lock nut(3) and then remove the brake switch(2) by turning it.

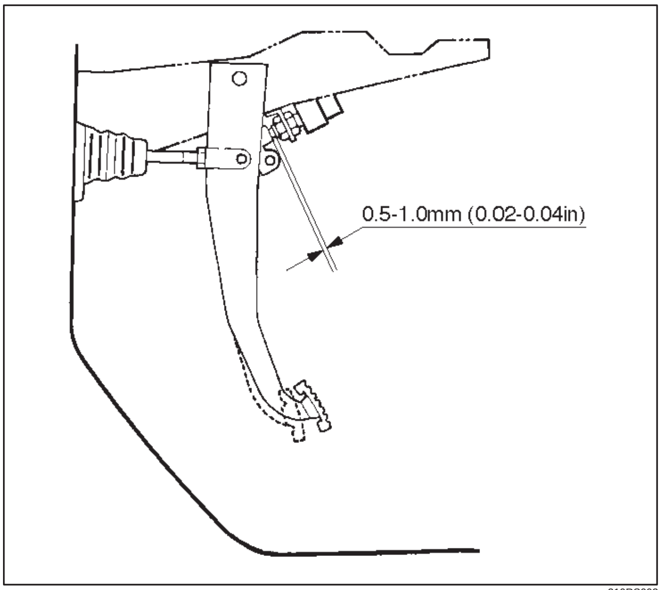


310RW010

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Check to see if the brake pedal has been returned by the return spring to the specified position.
2. Turn the switch clockwise until the tip of the threaded portion of the brake switch contacts the pedal arm.
3. Turn the switch counterclockwise until the space between the tip of the threaded portion and the pedal arm is 0.5 to 1.0 mm (0.02 – 0.04 in.).



310RS003

Turn Signal Switch/Cornering Light Switch (Combination Switch)

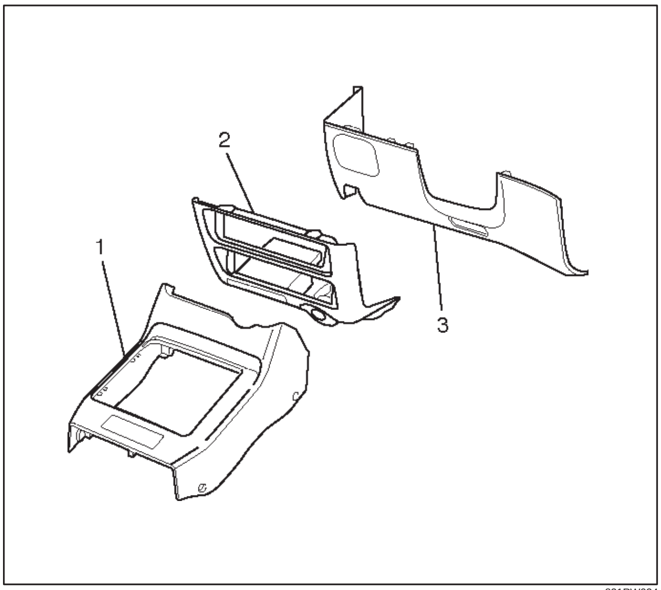
Removal and Installation

Refer to the removal and installation steps of the Lighting Switch (Combination Switch) in this section.

Hazard Warning Switch

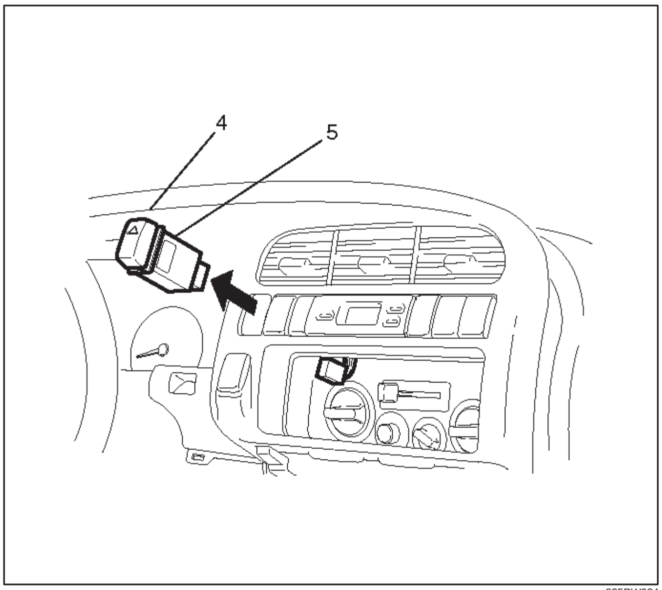
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
   Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
   Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
   Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4).
   Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the connector and push the lock from the back side of the instrument panel cluster assembly to remove the hazard warning switch(5).



825RW024

Installation

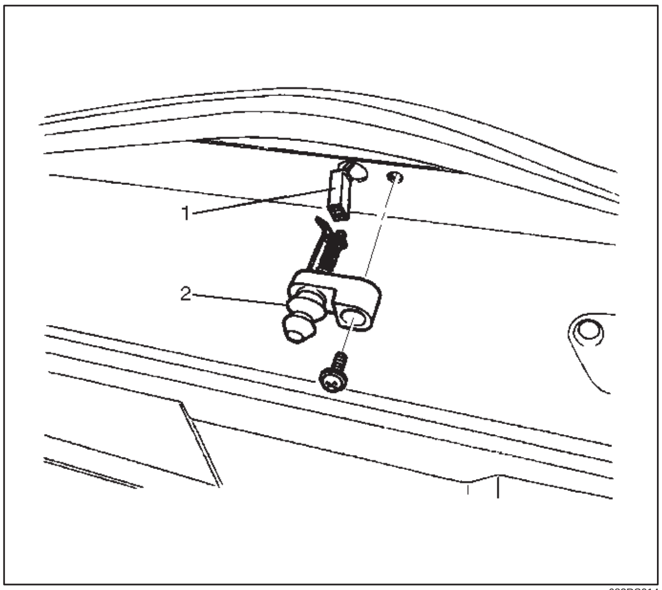
To install, follow the removal steps in the reverse order, noting the following point.

1. Push in the switch with your fingers until it locks securely.

Tailgate Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the screw and disconnect the connector(1) to remove the tailgate switch(2).



683RS014

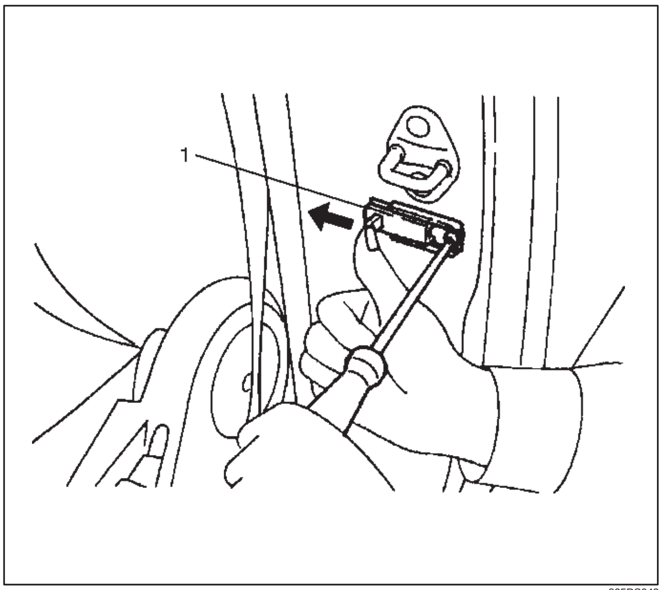
Installation

To install, follow the removal steps in the reverse order.

Door Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the screw and disconnect the connector to remove the door switch(1).



825RS043

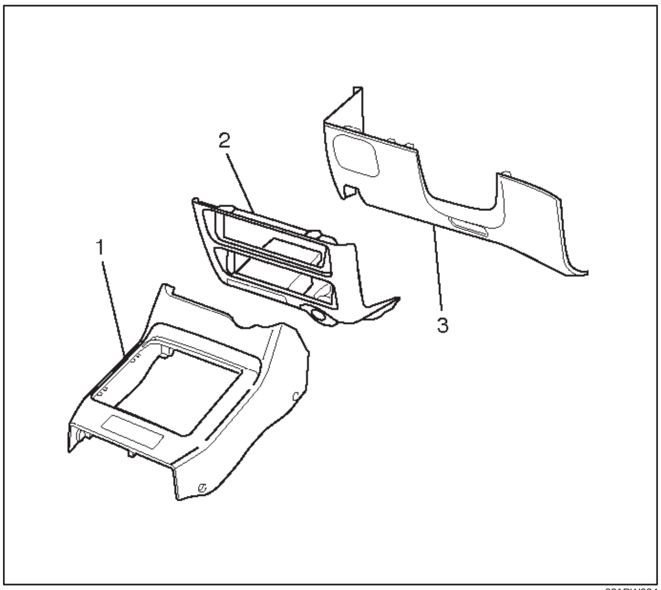
Installation

To install, follow the removal steps in the reverse order.

Rear Defogger Switch

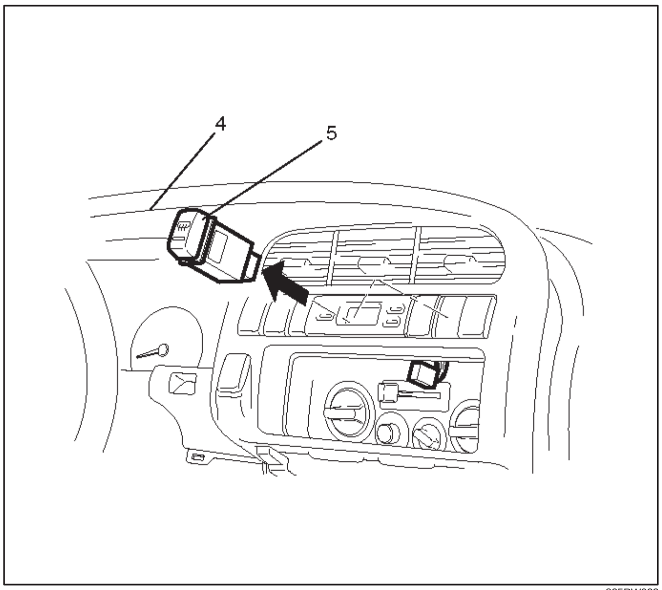
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
   Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
   Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
   Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4).
   Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the connector and push the lock from the back side of the instrument panel cluster assembly to remove the rear defogger switch(5).



825RW023

Installation

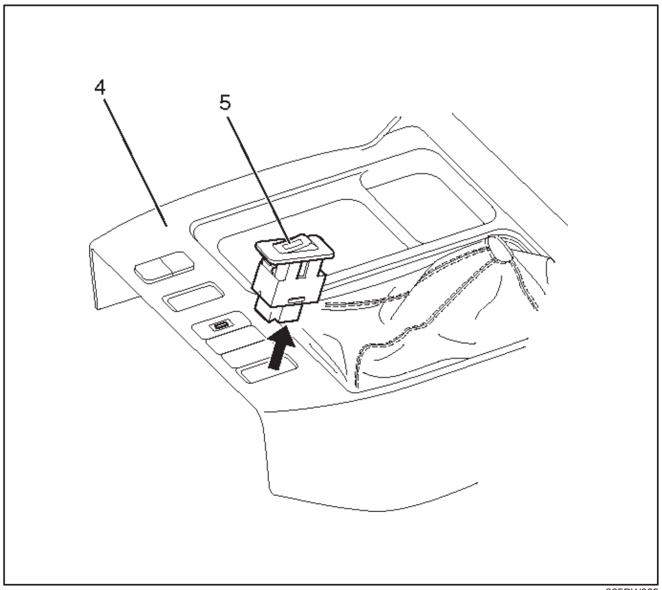
To install, follow the removal steps in the reverse order, noting the following point.

1. Push in the switch with your fingers until it locks securely.

Seat Heater Switch

Removal

1. Disconnect the battery ground cable.
2. Remove four fixing screws and disconnect the switch connectors to remove the front console assembly(4).
3. Push the lock from the back side of the front console assembly to remove the seat heater switch(5).



825RW025

Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Push the switch with your fingers until it locks securely.

Key Remind Switch (Starter Switch)

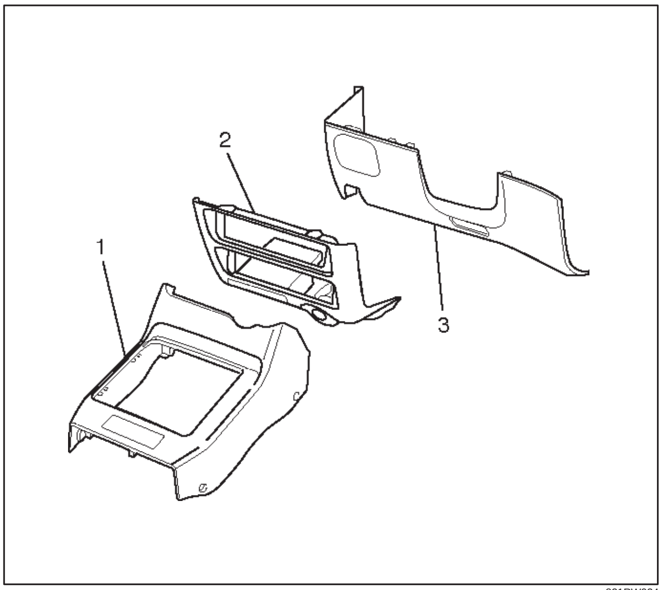
Removal and Installation

Refer to the removal and installation on steps of the Starter Switch in this section.

Illumination Controller

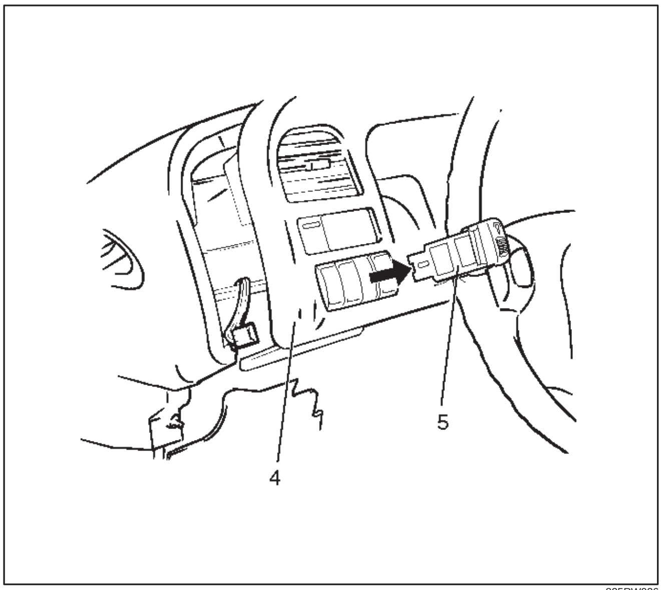
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
   Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
   Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
   Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4).
   Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the connector and push the lock from the back side of the instrument panel cluster assembly to remove the illumination controller(5).



825RW026

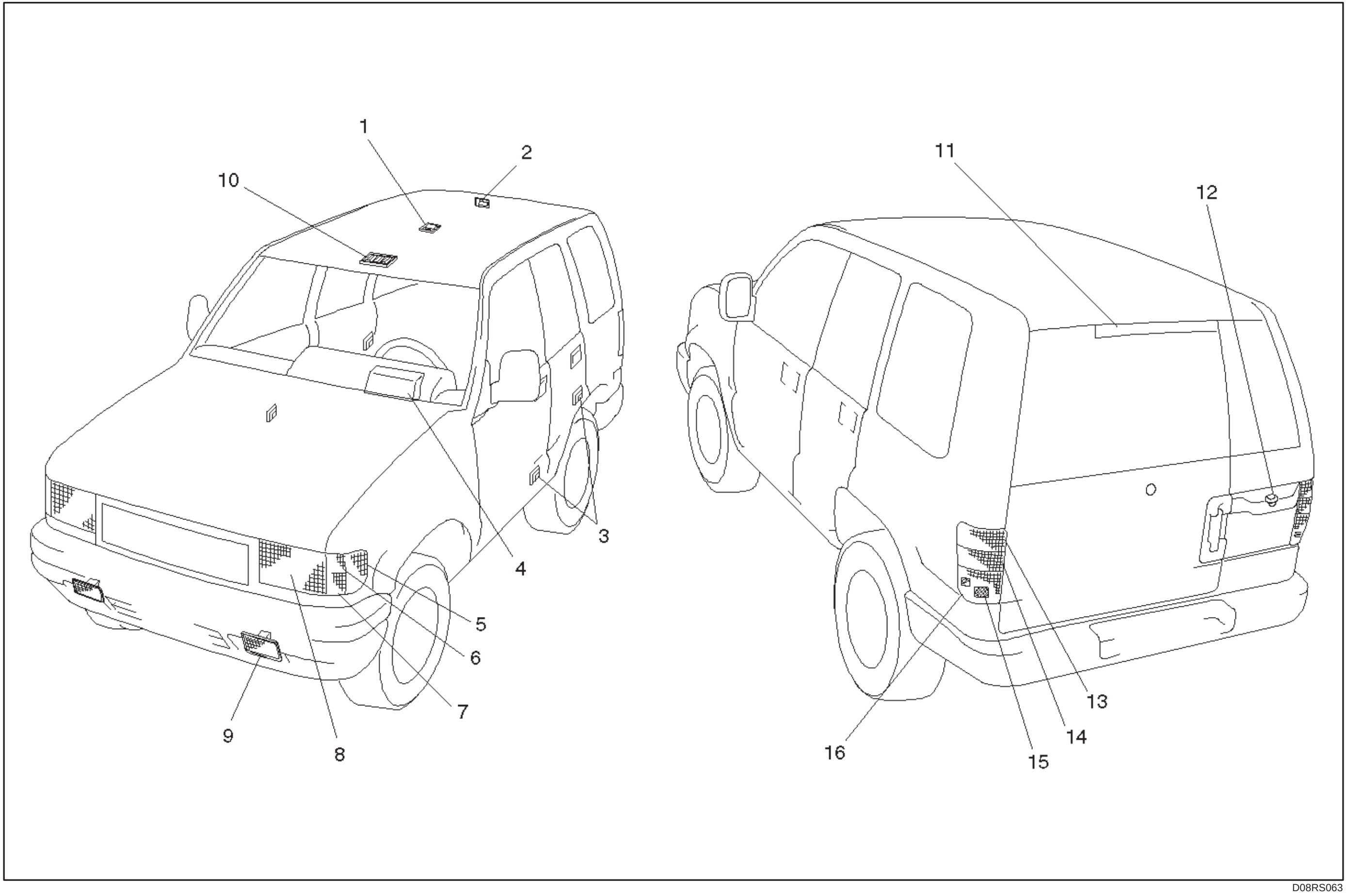
Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Push in the switch with your fingers until the switch is locked securely.

Main Data and Specifications

Light and Bulb Specifications



Legend

(1) Dome Light
(2) Luggage Room Light
(3) Courtesy Light
(4) Meter
(5) Side Marker Light
(6) Turn Signal Light/Parking Light
(7) Cornering Light
(8) Headlight
(9) Fog Light
(10) Map Light
(11) High Mount Stoplight
(12) License Plate Light
(13) Turn Signal Light
(14) Backup Light
(15) Taillight/Stoplight
(16) Rear Combination Light

Light Name		Bulb No.	Rated Power	Number of Bulbs	Lens Color	Remarks
Headlight		9004	65W/45W	2	White	Halogen
Front Combination Light	Turn Signal Light/Parking Light	1157	27W/8W	2	White	
	Side Marker Light	194	3.8W	2	Amber	
	Cornering Light	1156	27W	2	White	
Fog Light		—	55W	2	White	Halogen
Rear Combination Light	Taillight/Stoplight	1157	8W/27W	2	Red	
	Turn Signal Light	1156	27W	2	Amber	
	Backup Light	1156	27W	2	White	
High Mount Stoplight		—	—	50	Red	LED

License Plate Light			—	5W	1	White	
Map Light			—	5W	2	White	
Dome Light			—	10W	1	White	
Luggage Room Light			—	8W	1	White	
Courtesy Light			194	3.8W	4	White	
Indicator / Warning light	Air Conditioning Sw		—	60mA	1		
	RR Defogger Sw		—	60mA	1		w/o Timer
			—	80mA	1		w/Timer
	Anti–Theft		—	20mA	1		Warning box
	Check Trans		74	1.4W	1	Red	Meter
	A/T Oil Temp		74	1.4W	1	Red	Meter
	Seat Heater SW		—	50mA	2		
	Mirror Defogger Sw		—	0.84W	1		
	Fog Light SW		—	0.7W	1		
	Cruise Set		74	1.4W	1	Green	Meter
	Cruise Main		74	1.4W	1	Green	Meter
	Power Drive		74	1.4W	1	Amben	Meter
	Winter Driver		74	1.4W	1	Green	Meter
	Turn Signal		74	1.4W	2	Green	Meter
	Upshift		74	1.4W	1	Amben	Meter
	High Beam		74	1.4W	1	Blue	Meter
	ABS		74	1.4W	1	Amben	Meter
	Seat Belt		80	2W	1	Red	Meter
	Malfunction Indicator (Check Engine)		74	1.4W	1	Amben	Meter
	Low Fuel		74	1.4W	1	Amben	Meter
	4WD		74	1.4W	1	Green	Meter
	Oil Pressure		74	1.4W	1	Red	Meter
	Brake System		74	1.4W	1	Red	Meter
	Charge		74	1.4W	1	Red	Meter
	A/T Shift Position		74	1.4W	7	P,N,D,3,2, L : Green R : Amben	Meter
	Air Bag		80	2W	1	Red	Meter
	TOD	Front–1	74	1.4W	1	Green	
		Front–2	74	1.4W	1	Green	
		Front–3	74	1.4W	1	Green	
		Rear	74	1.4W	1	Green	
		Auto	74	1.4W	1	Green	
		Check	74	1.4W	1	Red	

Torque Specifications

Application	N·m	Lb Ft	Lb In
Steering Shaft Nut	34	25	—

TROOPER

BODY AND ACCESSORIES

WIPER / WASHER SYSTEM

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Windshield Wiper/Washer System

General Description

The circuit consists of the starter switch, windshield wiper & washer switch, windshield wiper motor, windshield washer motor and windshield intermittent relay.

When the wiper & washer switch is turned on with the starter switch on, the battery voltage is applied to the wiper motor to activate the wiper.
The washer motor squirts glass cleaning fluid while the washer switch is being pushed. The intermittent relay is used to control motion of the wiper.

Windshield Wiper And Washer Switch

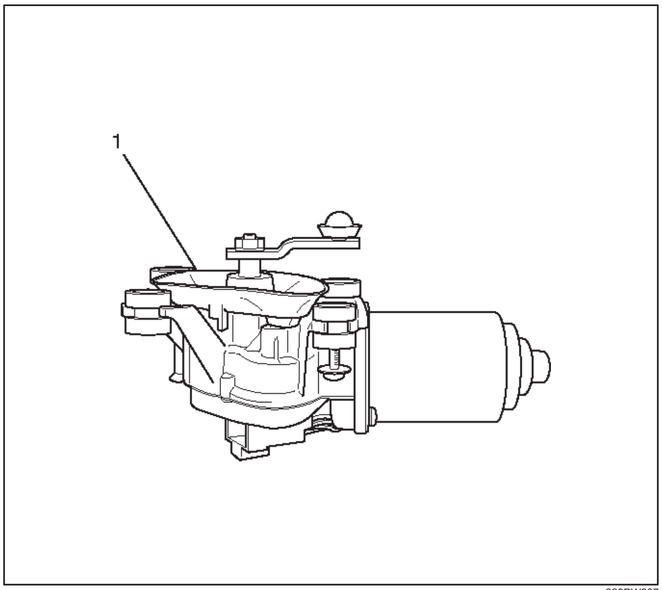
Removal and Installation

Refer to the Lighting Switch (Combination Switch) in Lighting System section.

Windshield Wiper Motor

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector.
3. Remove 4 mounting bolts.
4. Remove the windshield wiper motor(1).



880RW007

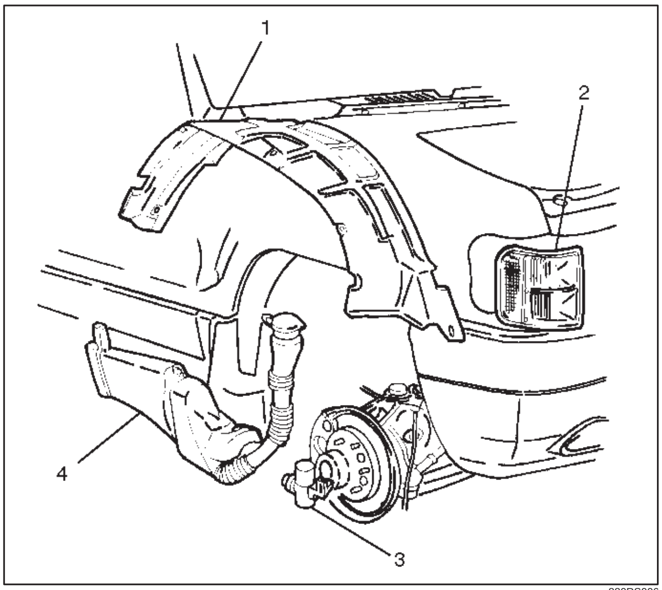
Installation

To install, follow the removal steps in the reverse order.

Windshield Washer Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the fender inner liner (right side) (1).
3. Remove the screws and then remove the front combination light(2).
4. Remove 2 screws, the filler neck and the hose.
5. Disconnect the windshield washer motor connector and remove the washer tank (4).
6. Pull the windshield washer motor(3) from the washer tank(4).



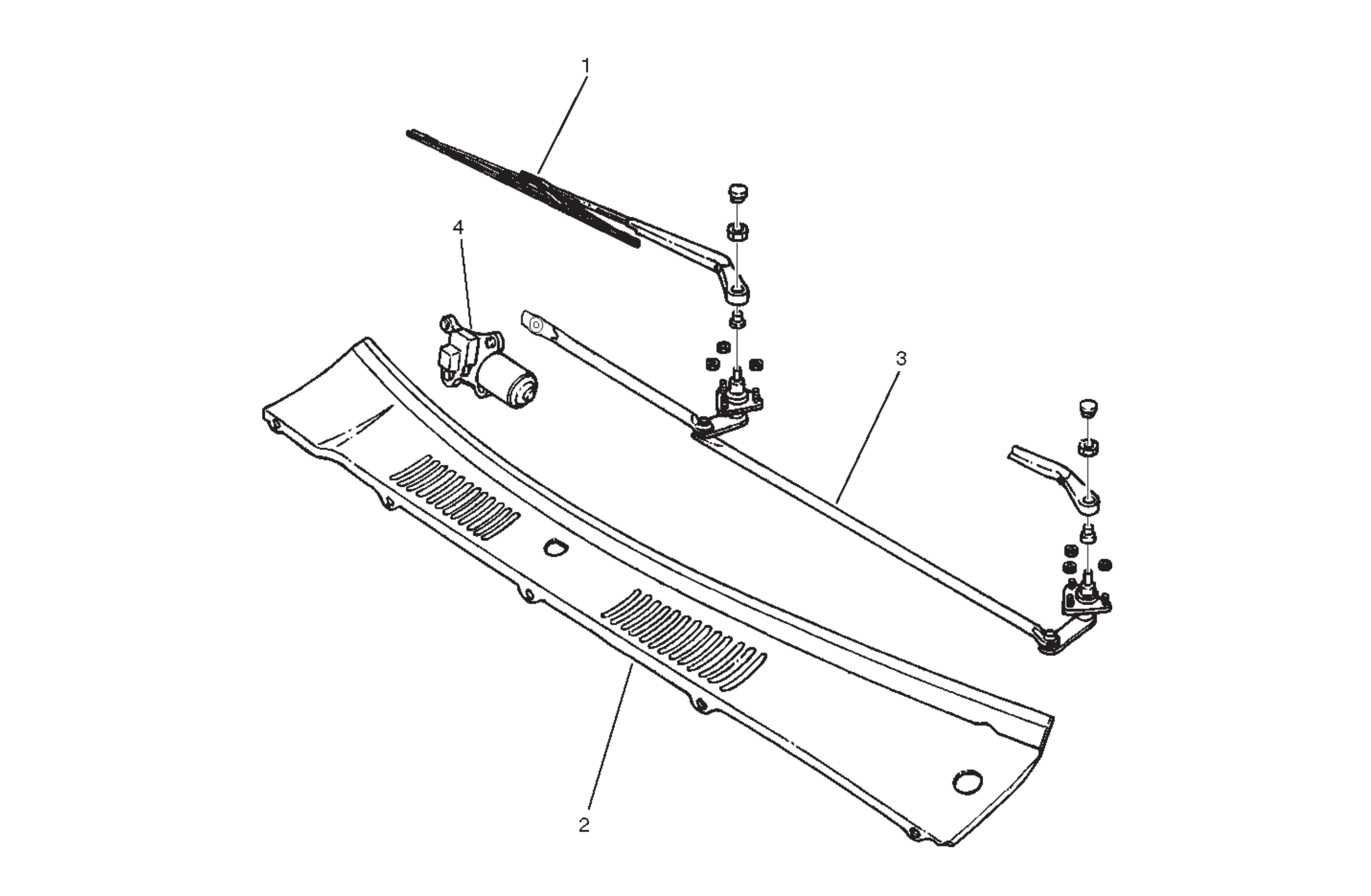
880RS006

Installation

To install, follow the removal steps in the reverse order.

Windshield Wiper Linkage

Windshield Wiper Linkage and Associated Parts



Legend

(1) Windshield Wiper Arm/Blade
(2) Vent Cowl Cover
(3) Windshield Wiper Linkage Assembly
(4) Windshield Wiper Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the windshield wiper arm/blade.
3. Remove the windshield wiper motor.
4. Remove the pivot assembly mounting nuts, fixing screws and then remove the vent cowl cover.
5. Take out the windshield wiper linkage assembly from the opening of the cowl.

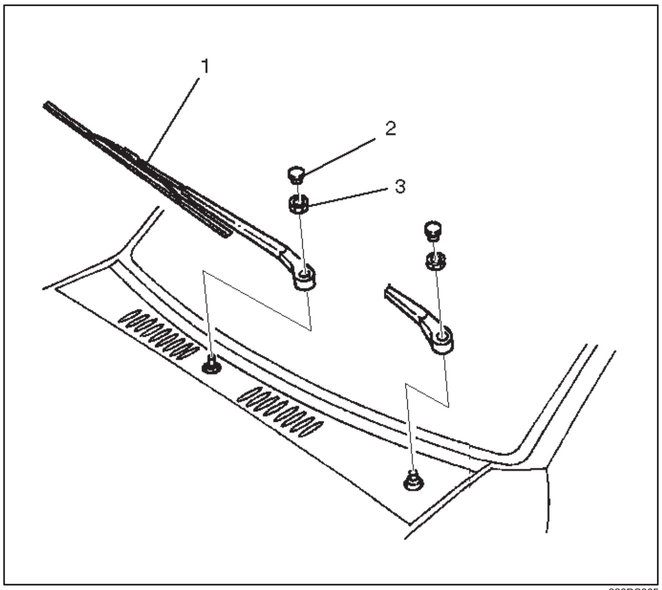
Installation

To install, follow the removal steps in the reverse order.

Windshield Wiper Arm/Blade

Removal

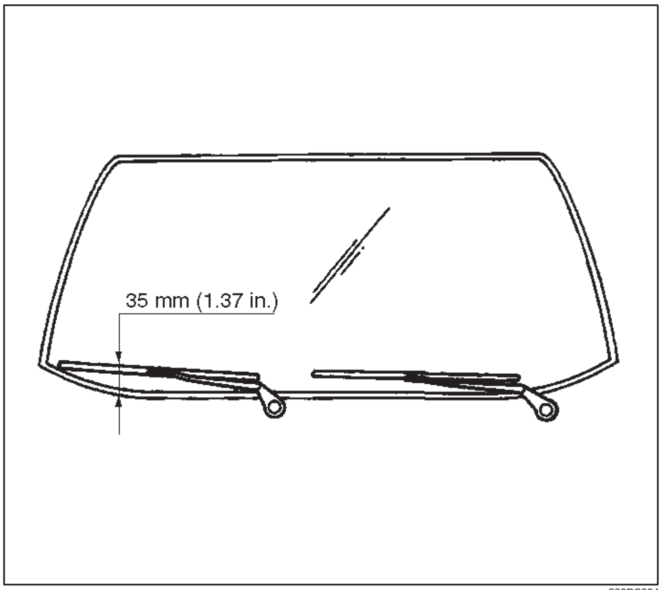
1. Pry the cap(2) off with the tip of a screwdriver.
2. Remove the nut(3).
3. Remove the wiper/blade(1).



880RS005

Installation

To install, follow the removal steps in the reverse order, noting the following points.



880RS004

1. Wiper arm/blade
   - Before installing the wiper arm/blade to the shaft, confirm that the motor stops at the auto-stop position.
   - Set the wiper arm/blade so that the tips of both blades are positioned about 35 mm (1.37 in) from the upper edge of the cowl cover as shown in the figure.
   - Tighten the nuts to the specified torque.

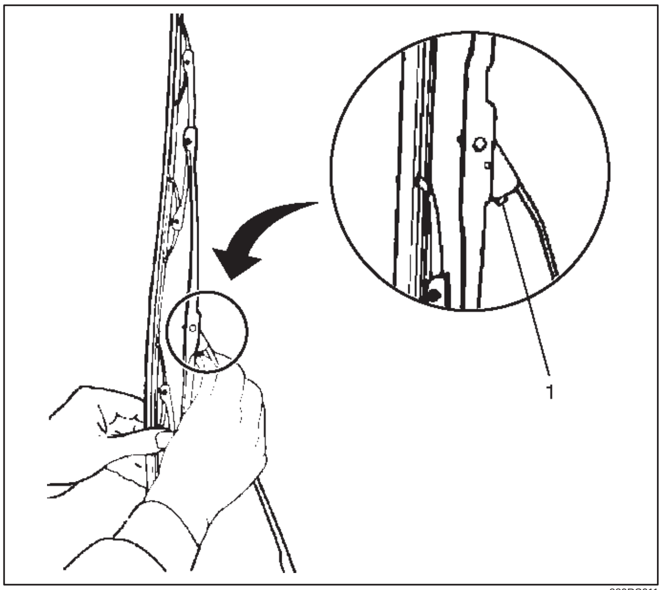
Torque: 31 N·m (23 lb ft)

Windshield Wiper Blade Rubber

Removal

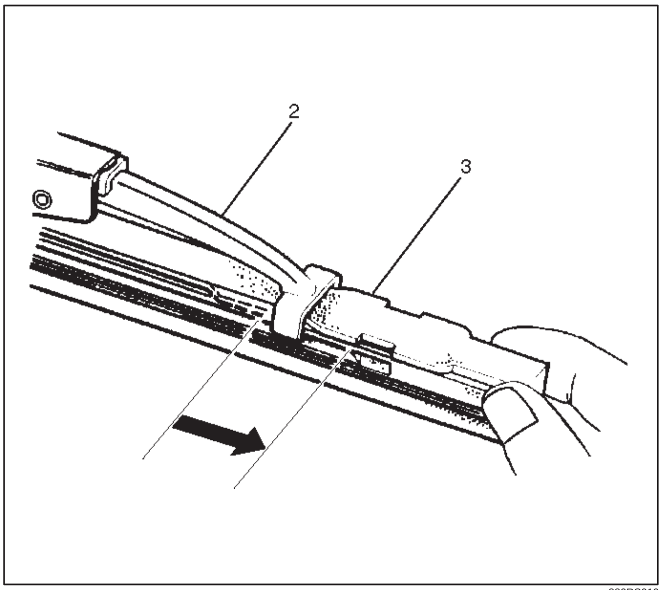
1. Push the wiper blade lock(1) while pulling the wiper blade in the arrow direction as shown in the figure.

CAUTION: When the wiper blade has been removed, wrap the tip of the wiper arm with cloth, to avoid damaging the glass.



880RS011

2. Pull the end of rubber and remove the projection(3) from the click of the blade stay (2).



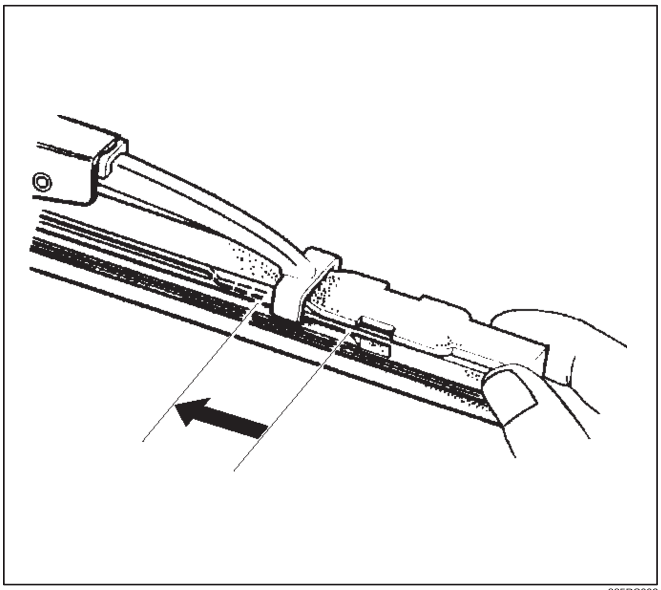
880RS010

3. Pull the rubber out in the same direction.

Installation

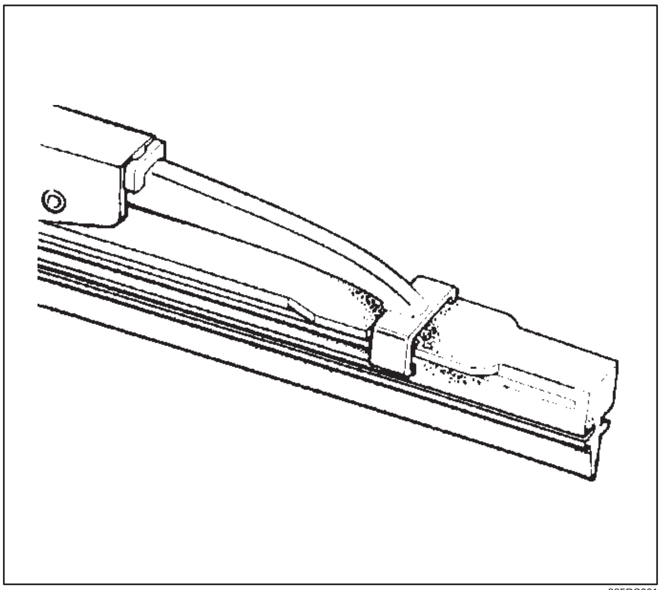
To install, follow the removal steps in the reverse order, noting the following points.

1. Install the click of the blade stay in the groove of the new rubber and slide it in. Complete wiper blade installation by pushing the click.



885RS002

2. Finally, check that the click of the stay has caught in the hole of the rubber.



885RS001

Rear Wiper/Washer System

General Description

The circuit consists of the starter switch, rear wiper & washer switch, rear wiper motor, rear washer motor and rear intermittent relay.

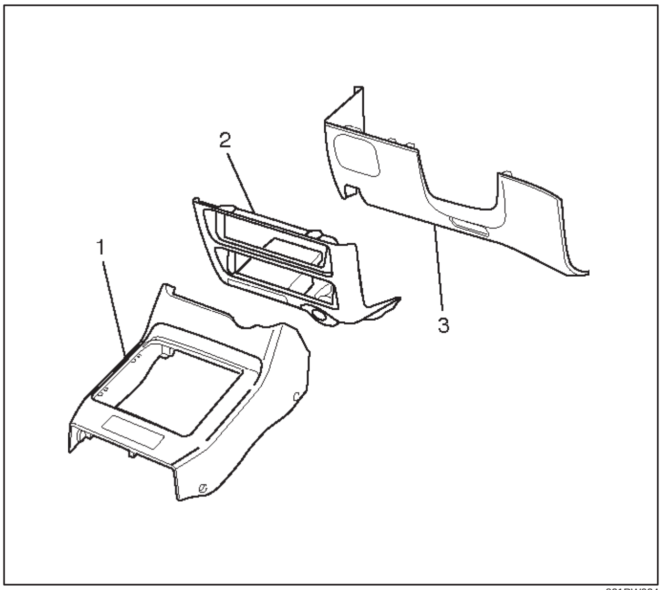
When the wiper & washer switch is turned on with the starter switch on, the battery voltage is applied to the wiper motor to activate the wiper.

The washer motor squirts glass cleaning fluid while the washer switch is being pushed. The intermittent relay is used to control motion of the wiper.

Rear Wiper and Washer Switch

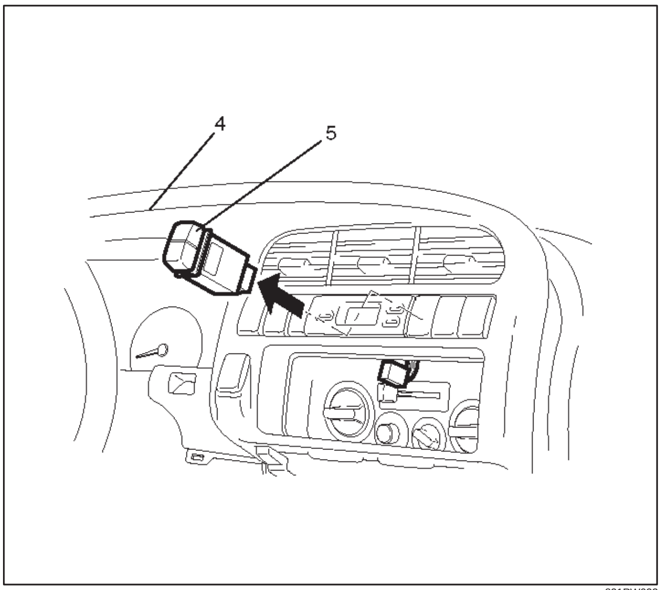
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
   Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
   Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover(3).
   Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4).
   Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the connector and push the lock from the back side of the instrument panel cluster assembly to remove the rear wiper & washer switch(5).



821RW023

Installation

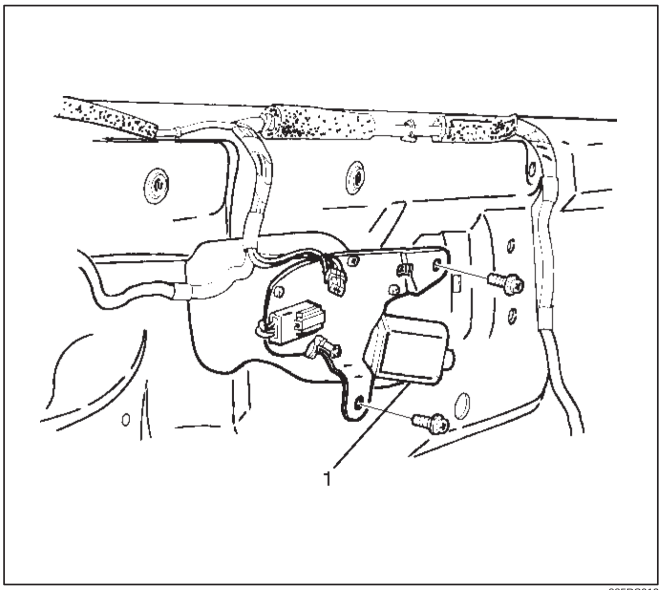
To install, follow the removal steps in the reverse order, noting the following point:

1. Push the switch with your fingers until it locks securely.

Rear Wiper Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim pad.
3. Remove the wiper arm/blade.
   Refer to the removal steps of the Rear Wiper Arm/Blade in this section.
4. Disconnect the connector remove the wiper shaft nut, remove the fixing screws and then remove the rear wiper motor(1).

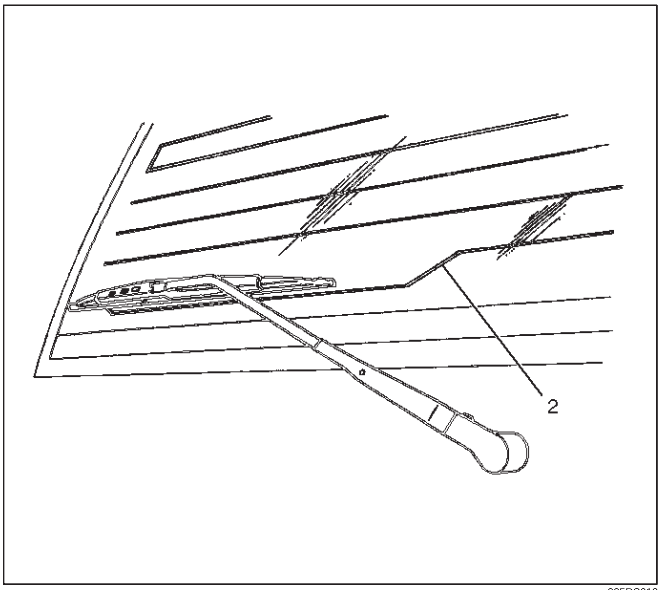


885RS013

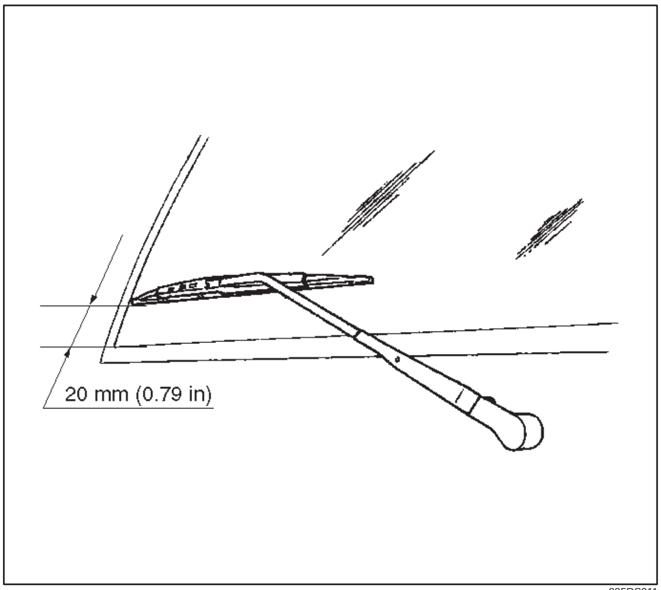
Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Before installing the wiper arm/blade to the motor shaft, confirm that the motor stops at the auto-stop position.
2. Install the wiper arm so that the blade gets parallel to the lowermost heat wire(2) of the rear defogger (w/rear defogger), or position the blade 20 mm (0.79 in) from edge of tailgate glass (W/O rear defogger).



885RS012



885RS011

3. Tighten the motor shaft nut to the specified torque.

   Torque: 6 N·m (52 lb in)

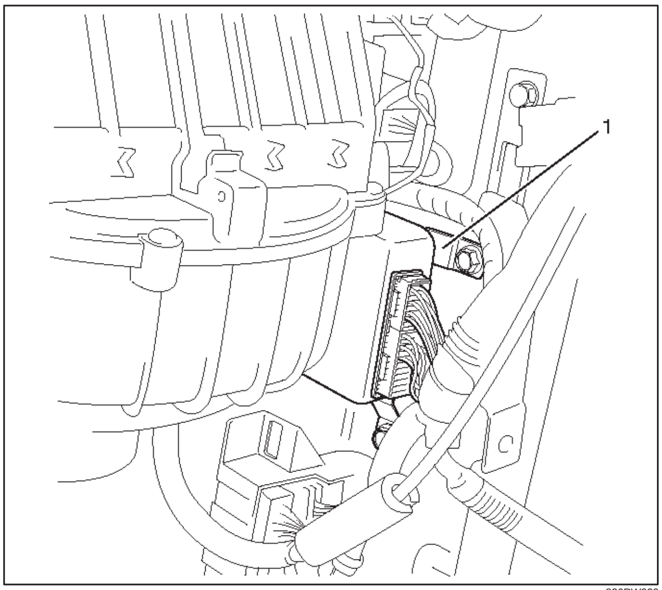
4. Tighten the wiper arm nut to the specified torque.

   Torque: 9 N·m (78 lb in)

Alarm & Relay Control Unit

Removal

1. Disconnect the battery ground cable.
2. Remove the glove box.
3. Remove the instrument panel passenger lower cover assembly.
4. Remove the passenger Knee bolster reinforcement assembly.
5. Remove the fixing bolts, disconnect the connectors and then remove the alarm & relay control unit (1).



826RW020

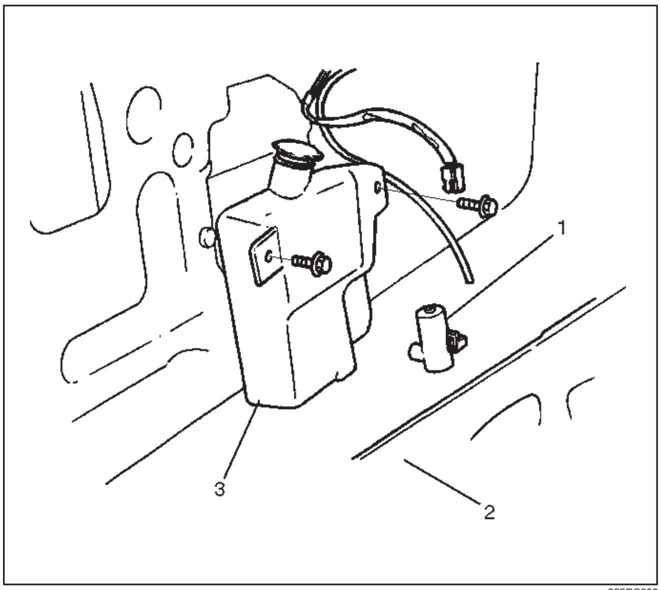
Installation

To install, follow the removal steps in the reverse order.

Rear Washer Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim pad(2).
3. Remove two screws, disconnect the connector, remove the washer hose and then remove the rear washer tank(3).
4. Pull out the rear washer motor(1) from the washer tank.



885RS009

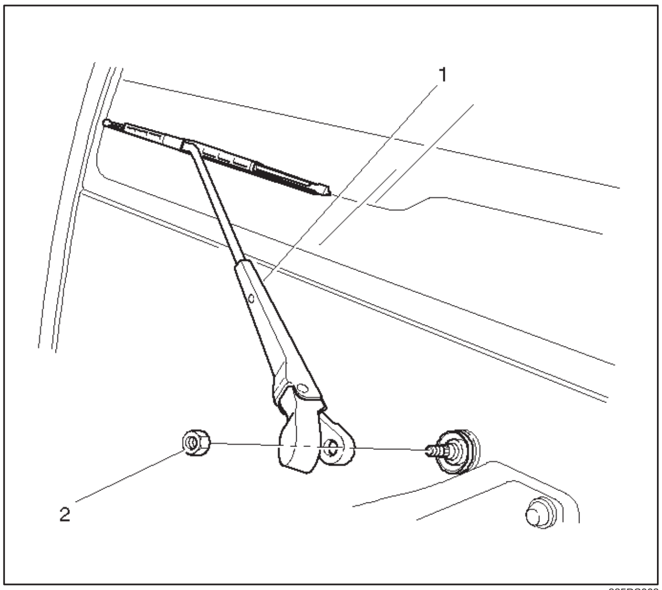
Installation

To install, follow the removal steps in the reverse order.

Rear Wiper Arm/Blade

Removal

1. Remove the arm nut(2).
2. Remove the wiper arm/blade(1).



885RS008

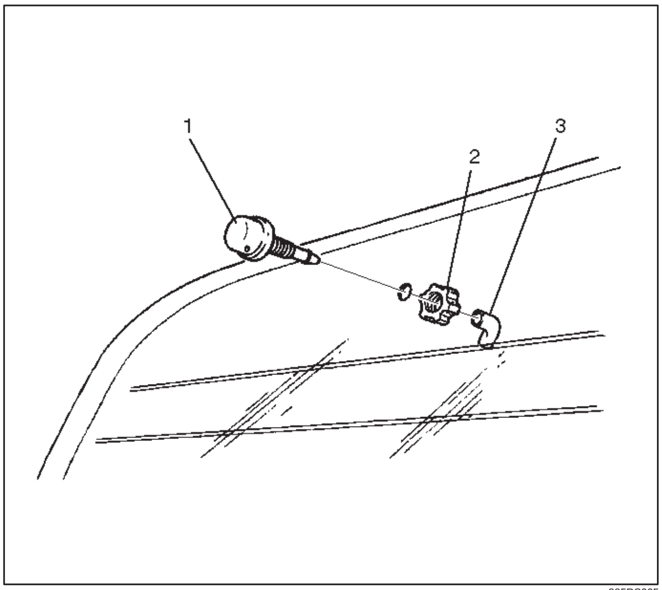
Installation

Refer to the installation steps of the Rear Wiper Motor in Wiper/Washer System section.

Rear Washer Nozzle

Removal

1. Disconnect the hose(3).
2. Remove the lock nut(2), and then remove the washer nozzle(1).



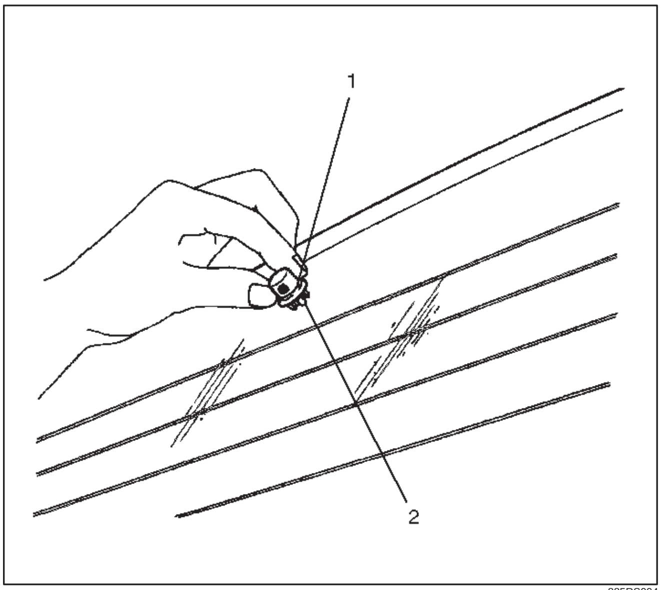
885RS005

Installation

To install, follow the removal steps in the reverse order.

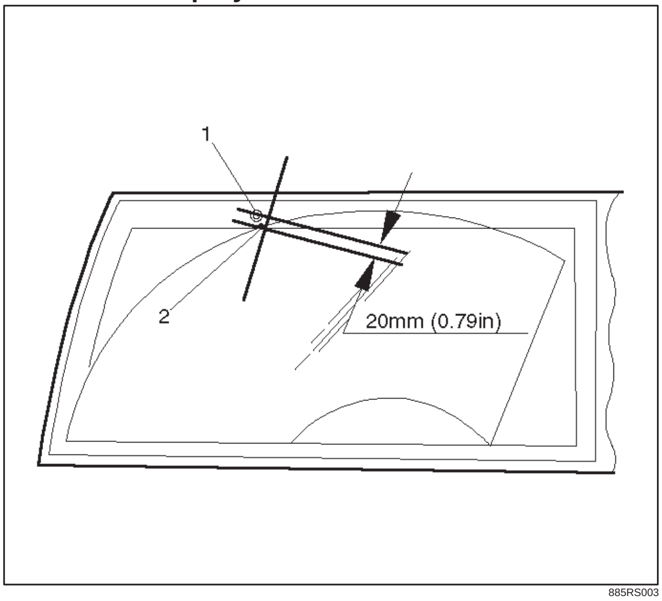
Rear Washer Nozzle Angle Adjustment

Loosen the lock nut(2) of the washer nozzle(1) to adjust the injection angle of the cleaning fluid, and then retighten the lock nut(2).



885RS004

Rear Washer Spray Pattern



Legend
(1) Washer Nozzle
(2) Spray Target

Rear Wiper Blade Rubber

Removal and Installation

Refer to the Windshield Wiper Blade Rubber in this section.

Main Data and Specifications

Torque Specifications

Application	N·m	Lb Ft	Lb In
Windshield Wiper Motor Shaft Nut	14	—	122
Windshield Wiper Arm Nuts	31	23	—
Rear Wiper Motor Shaft Nut	6	—	52
Rear Wiper Arm Nut	9	—	78

TROOPER

BODY AND ACCESSORIES

ENTERTAINMENT

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

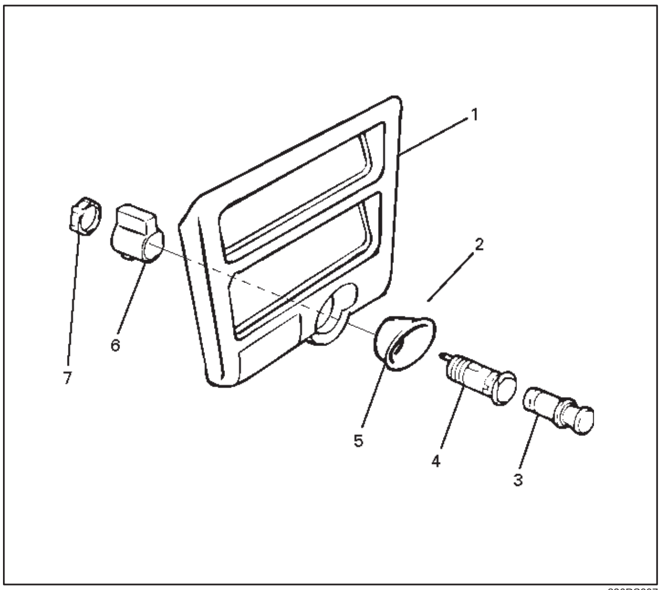
Cigarette Lighter

General Description

When the cigarette lighter is pushed in with the starter switch at either “ACC” or “ON” position, a circuit is formed in the cigarette lighter case to heat the lighter coil.
The cigarette lighter is sprung back to its original position after the lighter coil is heated.

Removal

1. Disconnect the battery ground cable.
2. Remove the lower cluster assembly(1).
   Refer to the Instrument Panel Assembly removal steps in Body Structure section.
3. Disconnect the connectors, remove the socket of the illumination light, the retaining ring(7), the outer case(6), the cigarette lighter(3) and socket(4), the bezel(5) and then remove the cigarette lighter assembly(2).



826RS007

Installation

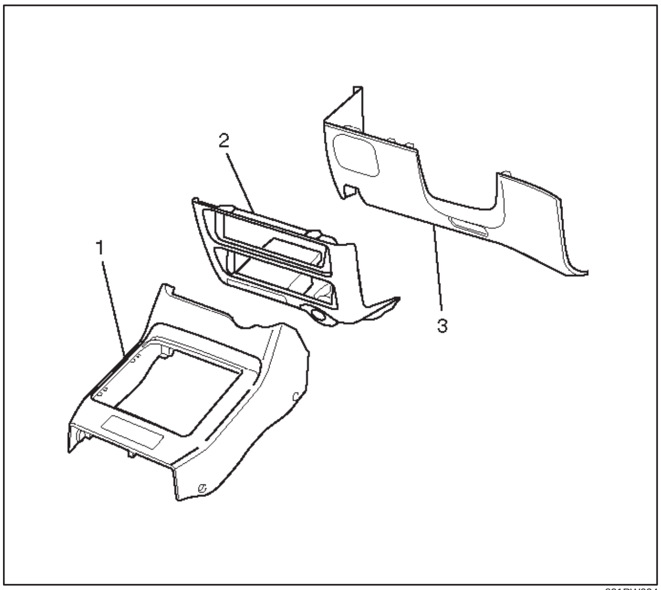
To install, follow the removal steps in the reverse order, noting the following point.

1. When installing the bezel, align the projected portion of the socket with the notch of the bezel.

Digital Clock

Removal

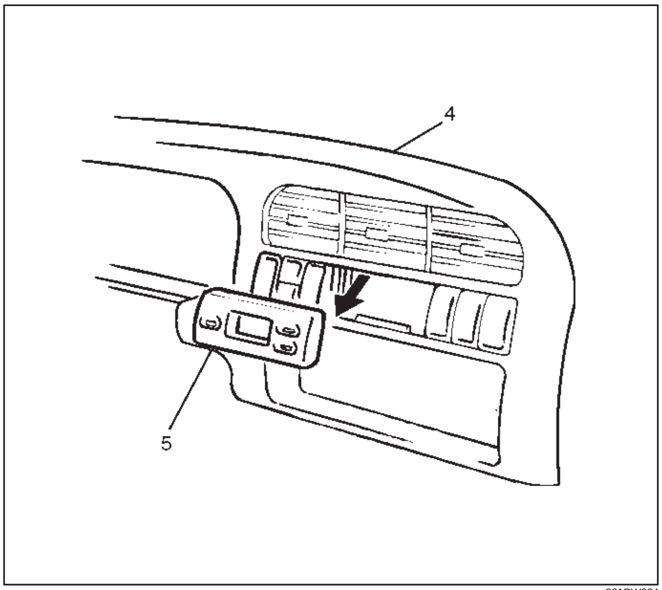
1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
   Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
   Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
   Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4).
   Refer to the Instrument Panel Assembly in Body Structure section.

6. Disconnect the connector and push the lock from the back side of the instrument panel cluster assembly to remove the digital clock(5).



821RW034

Installation

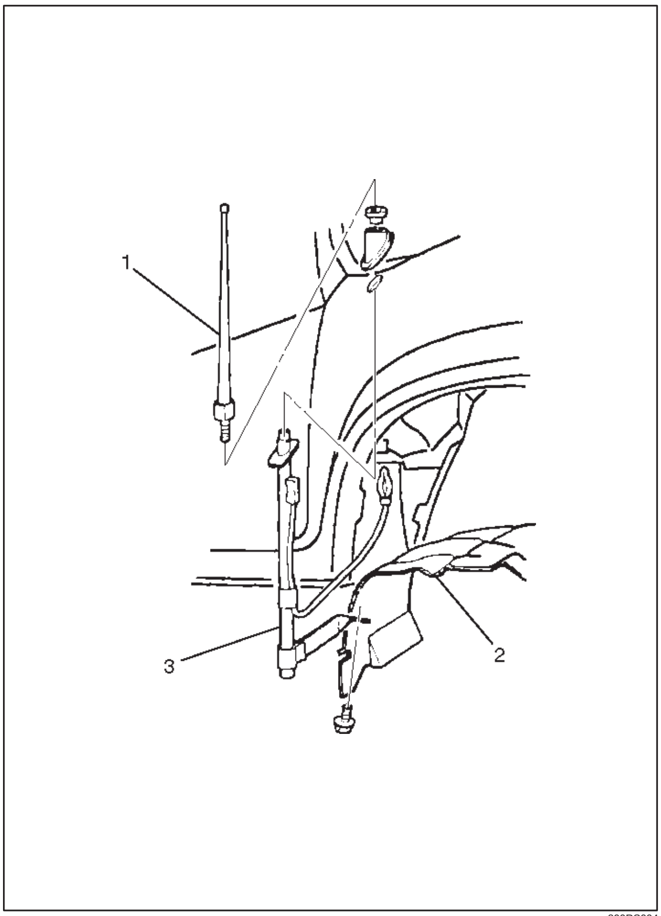
To install, follow the removal steps in the reverse order, noting the following point.

1. Push in the switch with your fingers until it locks securely.

Rod Type Antenna

Removal

1. Disconnect the battery ground cable.
2. Turn the antenna rod(1) counterclockwise to remove it.
3. Remove three screws and nine clips to remove the fender inner liner(2).
4. Disconnect the feeder cable connector at the inside of the vehicle, remove the housing bracket screw, turn the lock nut counterclockwise to remove it together with the base mold and then remove the housing(3).



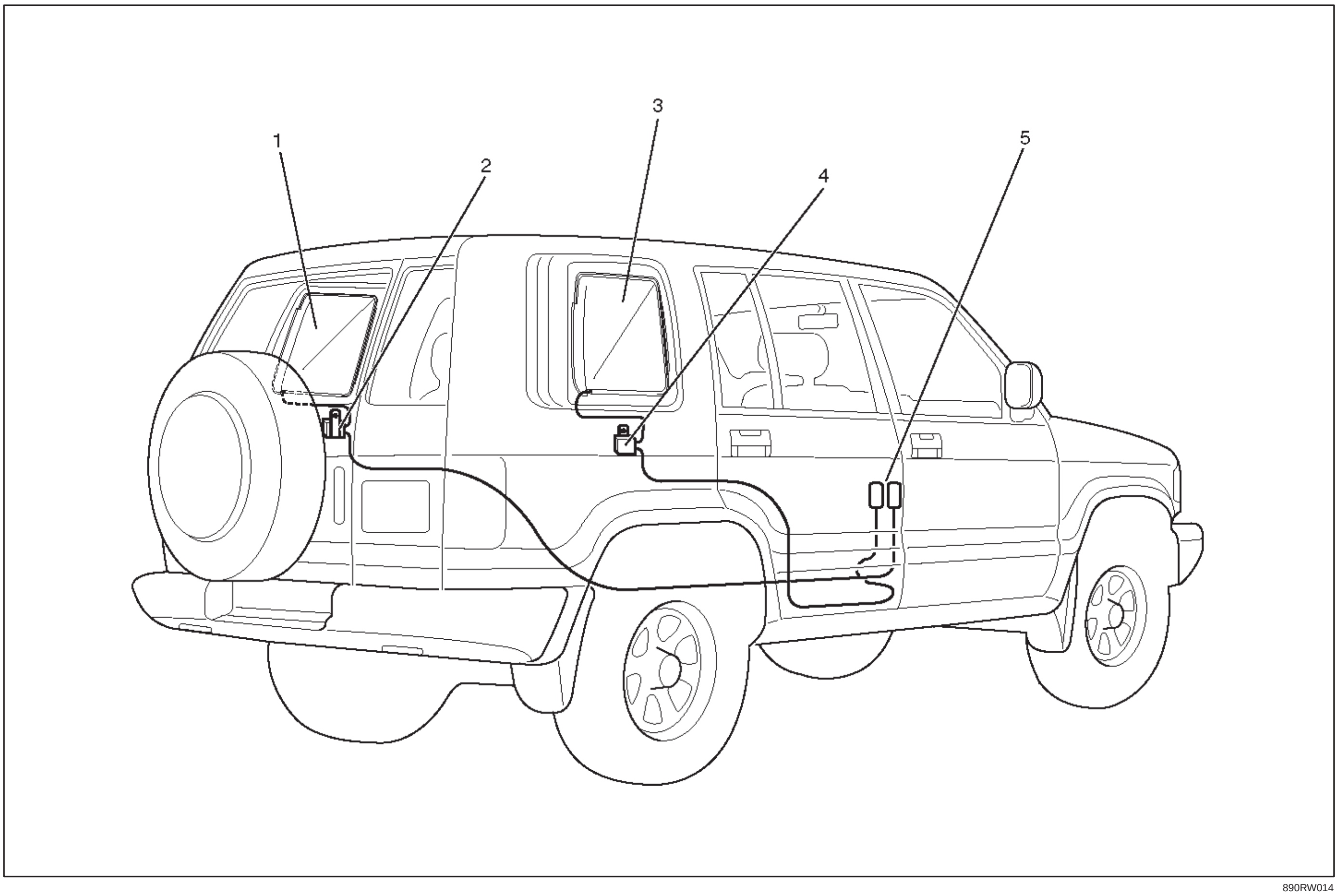
890RS004

Installation

To install, follow the removal steps in the reverse order.

Diversity Glass Antenna

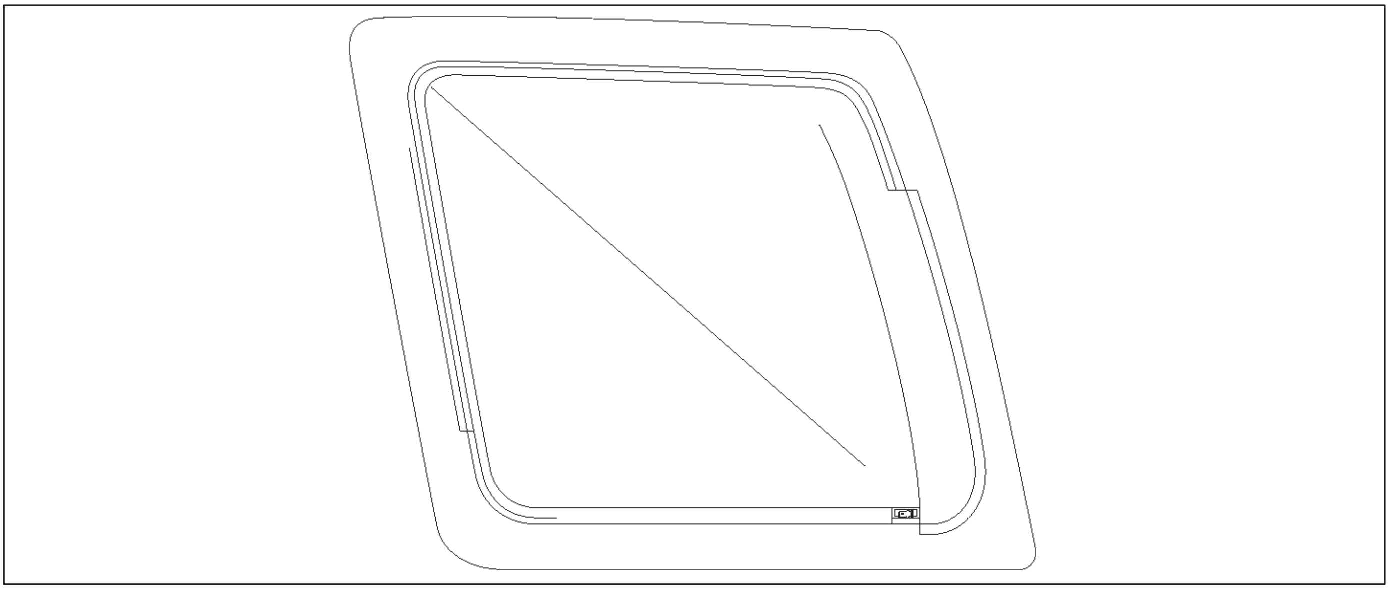
Glass Antenna System Parts Location



Legend

(1) Glass Antenna (LH)
(2) Glass Antenna Amplifier
(3) Glass Antenna (RH)
(4) Glass Antenna Amplifier
(5) Connection with the audio side feeder cables at the dash side (RH)

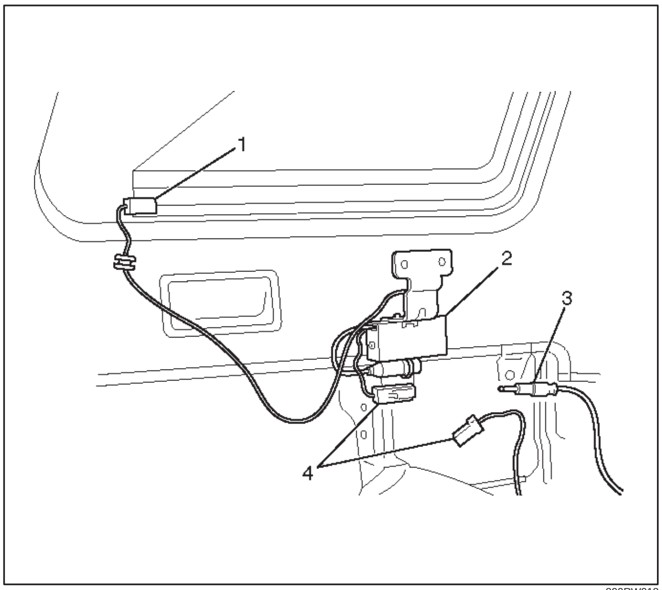
Glass Antenna Pattern



890RW016

Glass Antenna Amplifier Removal

1. Disconnect the battery ground cable.
2. Remove the luggage side trim cover.
   Refer to the Interior Trim Panels removal steps in Exterior/Interior Trim section.
3. Disconnect the connector(1)&(4), feeder cable(3) and remove two screws to remove the glass antenna amplifier(2).



890RW018

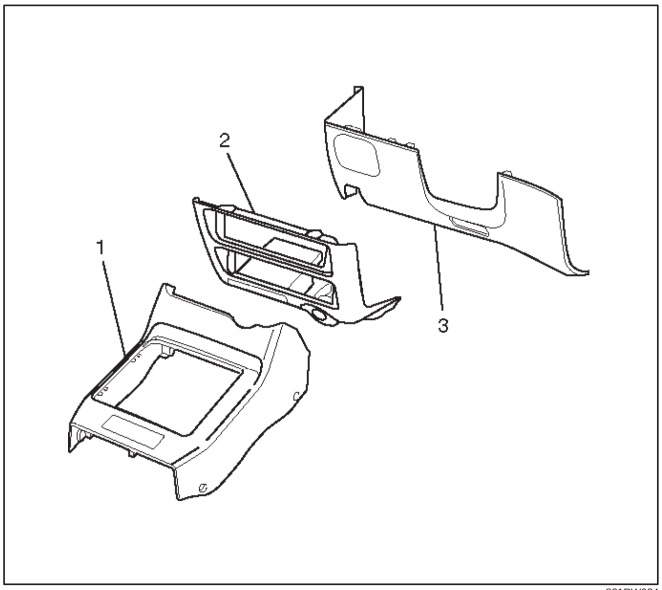
Glass Antenna Amplifier Installation

To install, follow the removal steps in the reverse order.

Radio

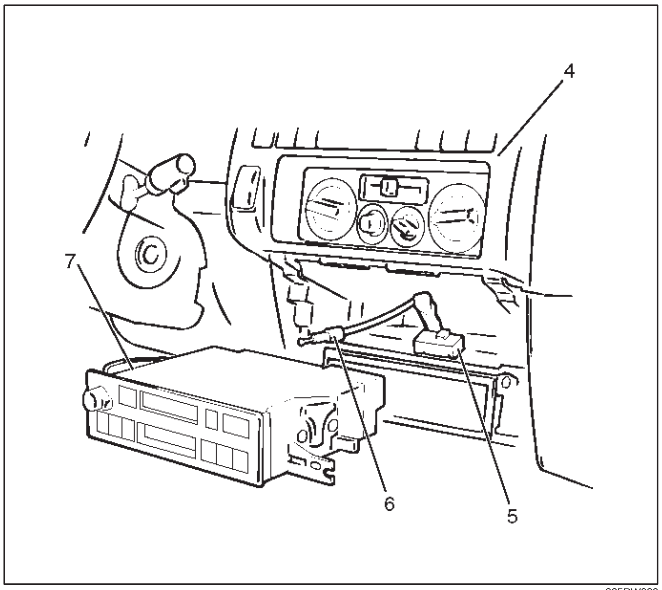
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly (1).
   Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly (2).
   Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly (3).
   Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4).
   Refer to the Instrument Panel Assembly in Body Structure section.
6. Remove two screws and disconnect the radio connector(5) and antenna feeder plug(6) to remove the radio(7).



825RW039

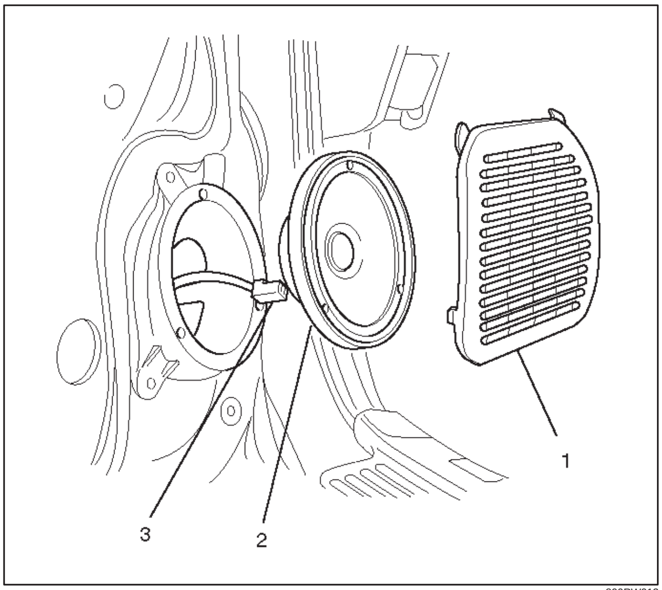
Installation

To install, follow the removal steps in the revers order.

Front Speaker

Removal

1. Disconnect the battery ground cable.
2. Pull the grille(1) to release the locks and then remove it.
3. Remove four screws and disconnect the connector(3) to remove the speaker(2).



890RW013

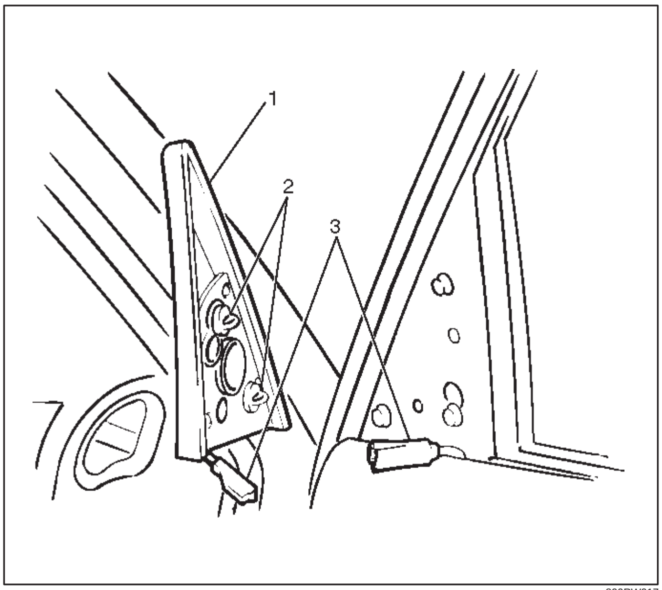
Installation

To install, follow the removal steps in the reverse order.

Tweeter Assembly

Removal

1. Disconnect the battery ground cable.
2. Pull the tweeter, assembly(1) to release the clips(2) and disconnect the connector(3) to remove the tweeter assembly.



890RW017

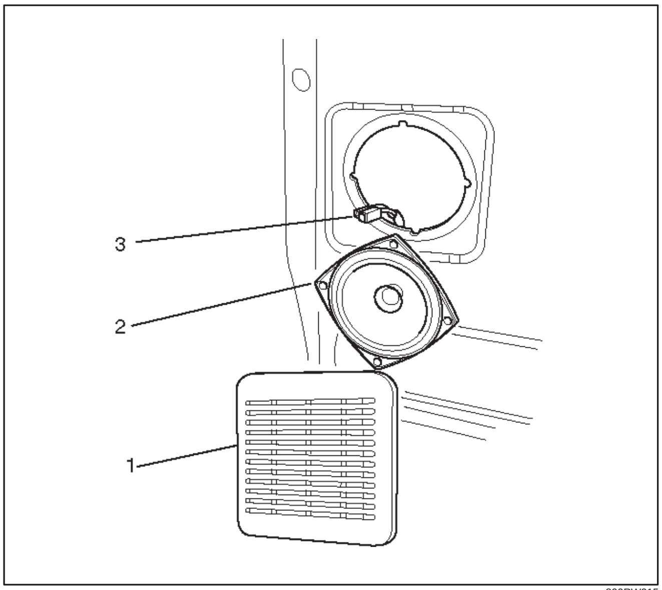
Installation

To install, follow the removal steps in the reverse order.

Rear Speaker

Removal

1. Disconnect the battery ground cable.
2. Pull the grille(1) to release the locks and then remove it.
3. Remove four screws and disconnect the connector(3) to remove the speaker(2).



890RW015

Installation

To install, follow the removal steps in the reverse order.

TROOPER

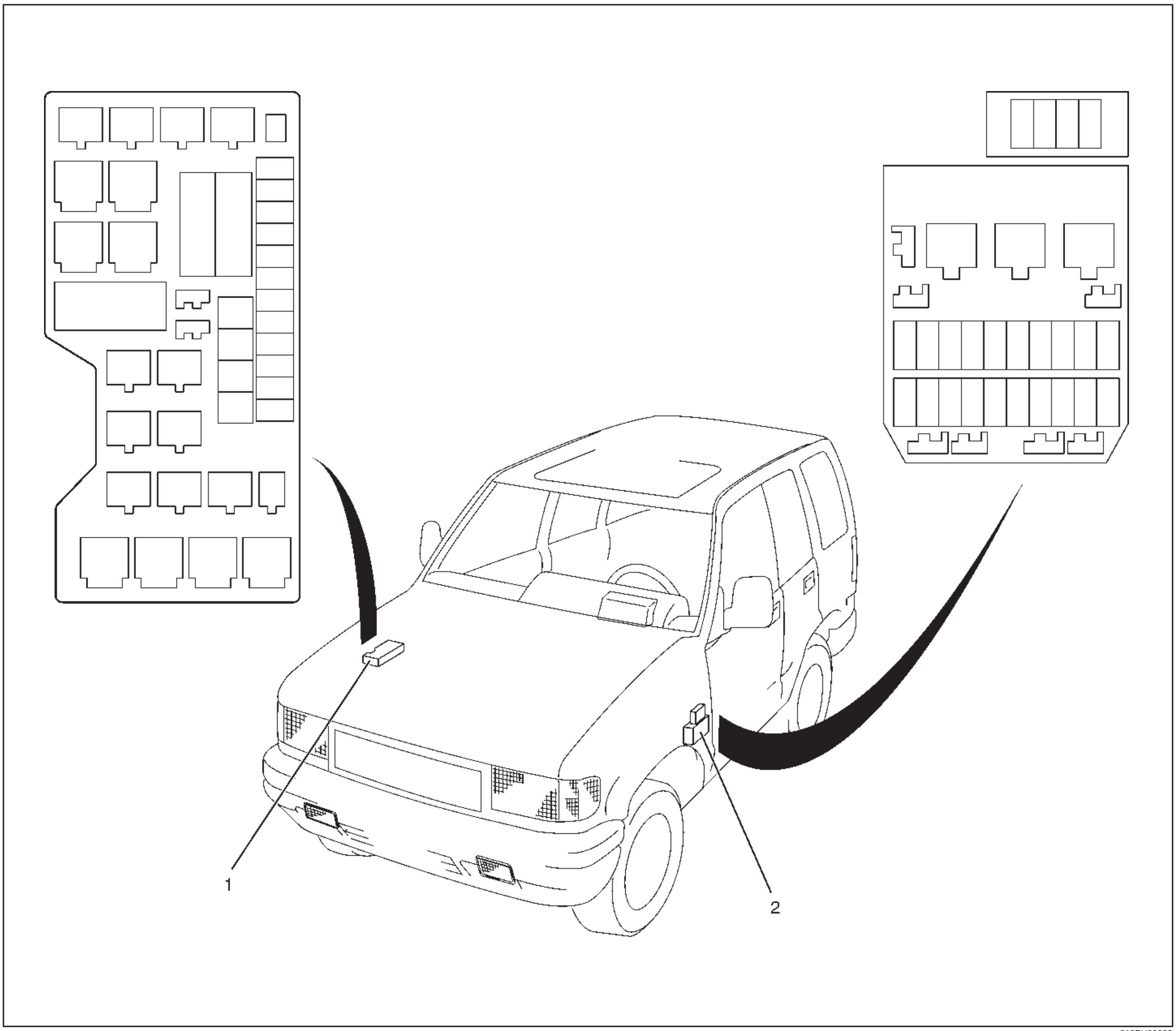
BODY AND ACCESSORIES

WIRING SYSTEM

CONTENTS

Fuse, Relay and Diode

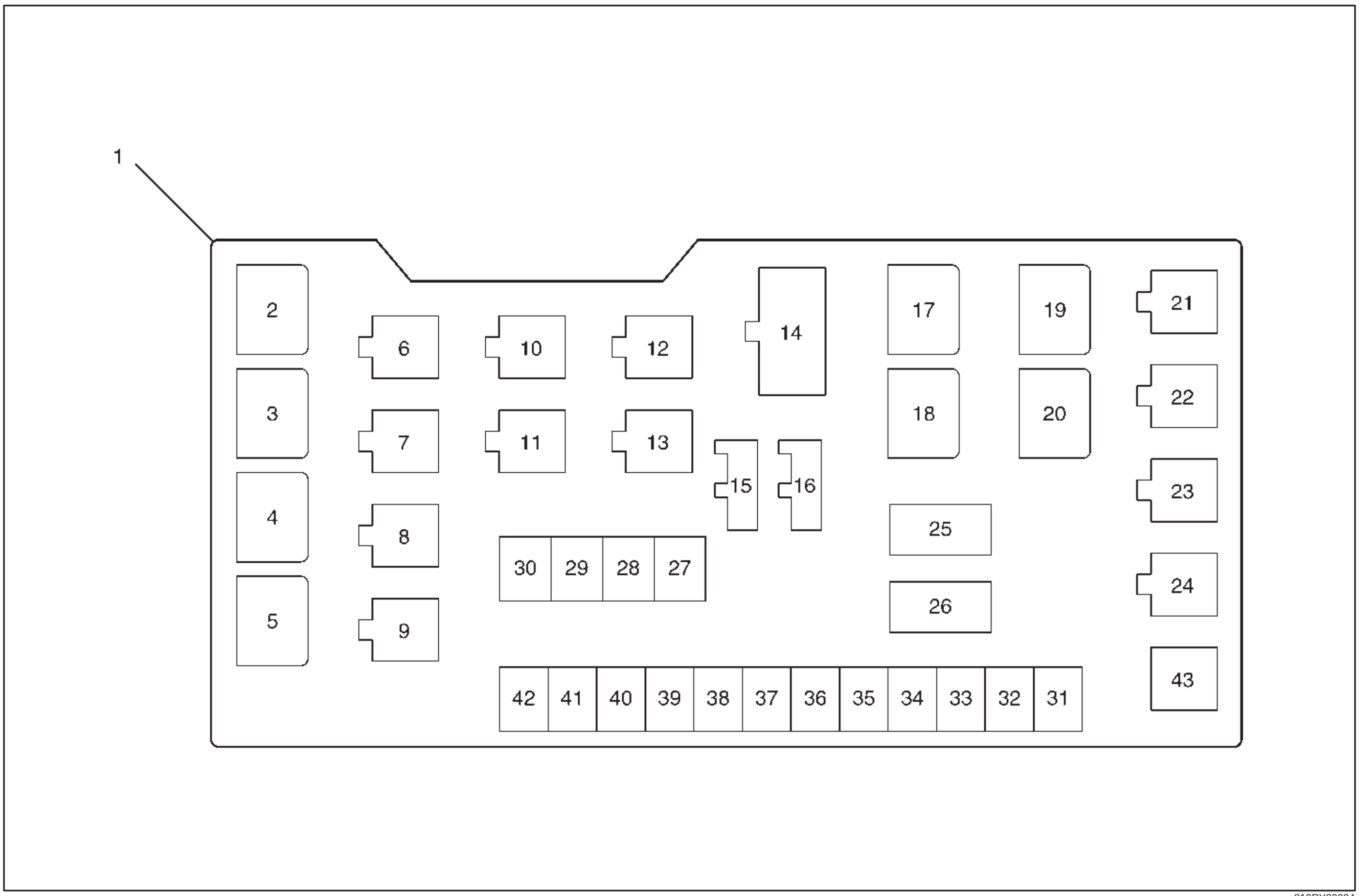
Relay and Fuse Box / Fuse Box Location



Legend

(1) Relay and Fuse Box
(2) Fuse Box

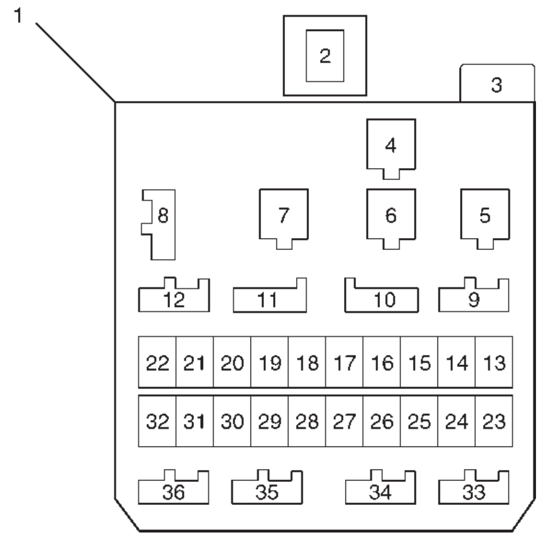
Relay & Fuse Box



Legend

(1) Relay & Fuse Box
(2) Lighting Relay
(3) Not Used
(4) Not Used
(5) Not Used
(6) Thermo Relay
(7) Not Used
(8) Compressor Relay
(9) Horn Relay
(10) Tail Relay
(11) Not Used
(12) Fuel Pump Relay
(13) PCM Main Relay
(14) Not Used
(15) Not Used
(16) Diode
(17) Upshift Relay–1
(18) Starter Relay
(19) Not Used
(20) Not Used
(21) Not Used
(22) Not Used
(23) Cornering Relay
(24) Fog Light Relay
(25) Fusible Link (Main)
(26) Fusible Link (Key SW)
(27) Fusible Link (ECM)
(28) Fusible Link (Condenser Fan)
(29) Not Used
(30) Fusible Link (ABS)
(31) Fuse F–1 (Not Used)
(32) Fuse F–2 (20A)
(33) Fuse F–3 (15A)
(34) Fuse F–4 (15A)
(35) Fuse F–5 (15A)
(36) Fuse F–6 (10A)
(37) Fuse F–7 (Not Used)
(38) Fuse F–8 (15A)
(39) Fuse F–9 (20A)
(40) Fuse F–10 (15A)
(41) Fuse F–11 (Not Used)
(42) Fuse F–12 (15A)
(43) Upshift Resistor

Fuse Box

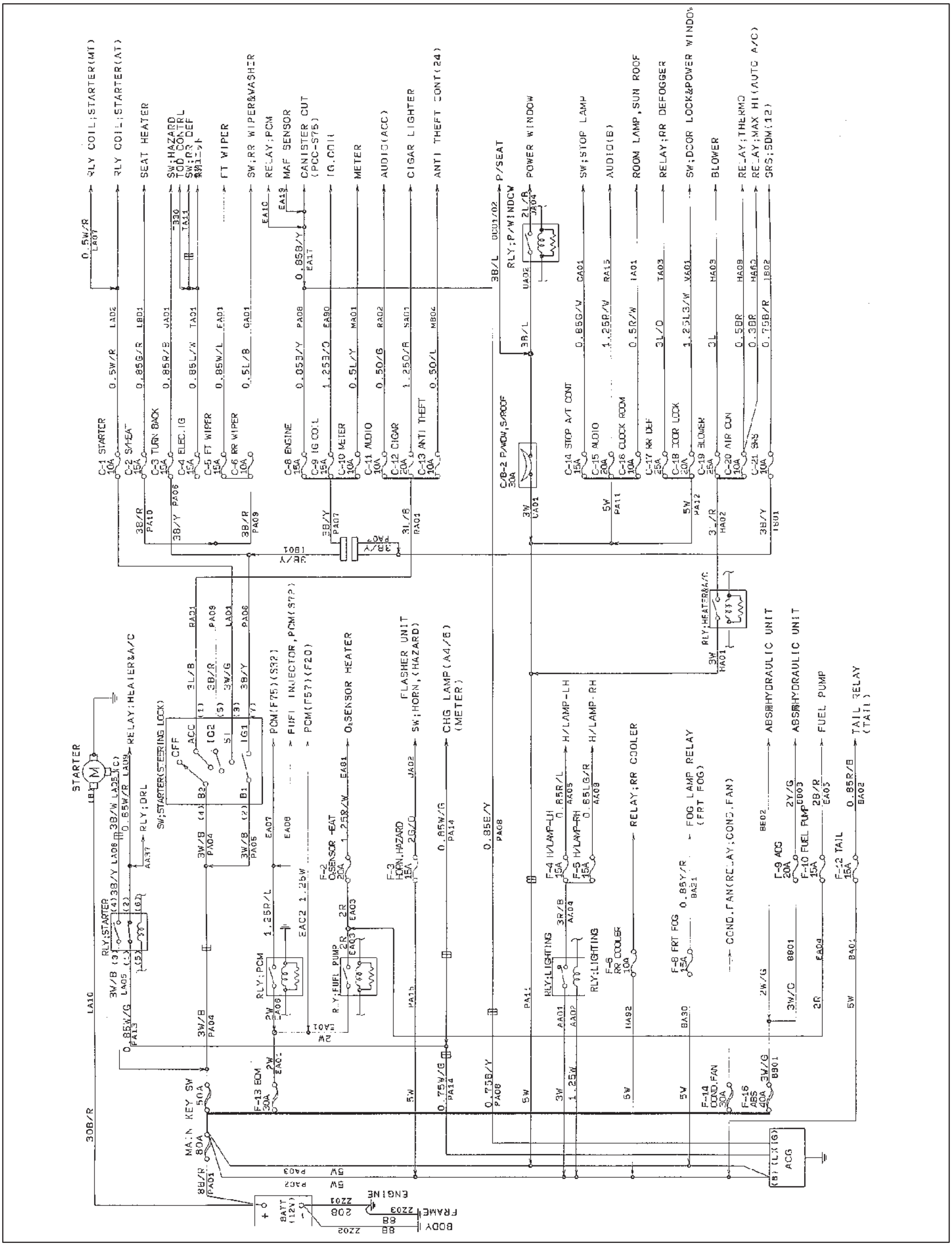


Legend

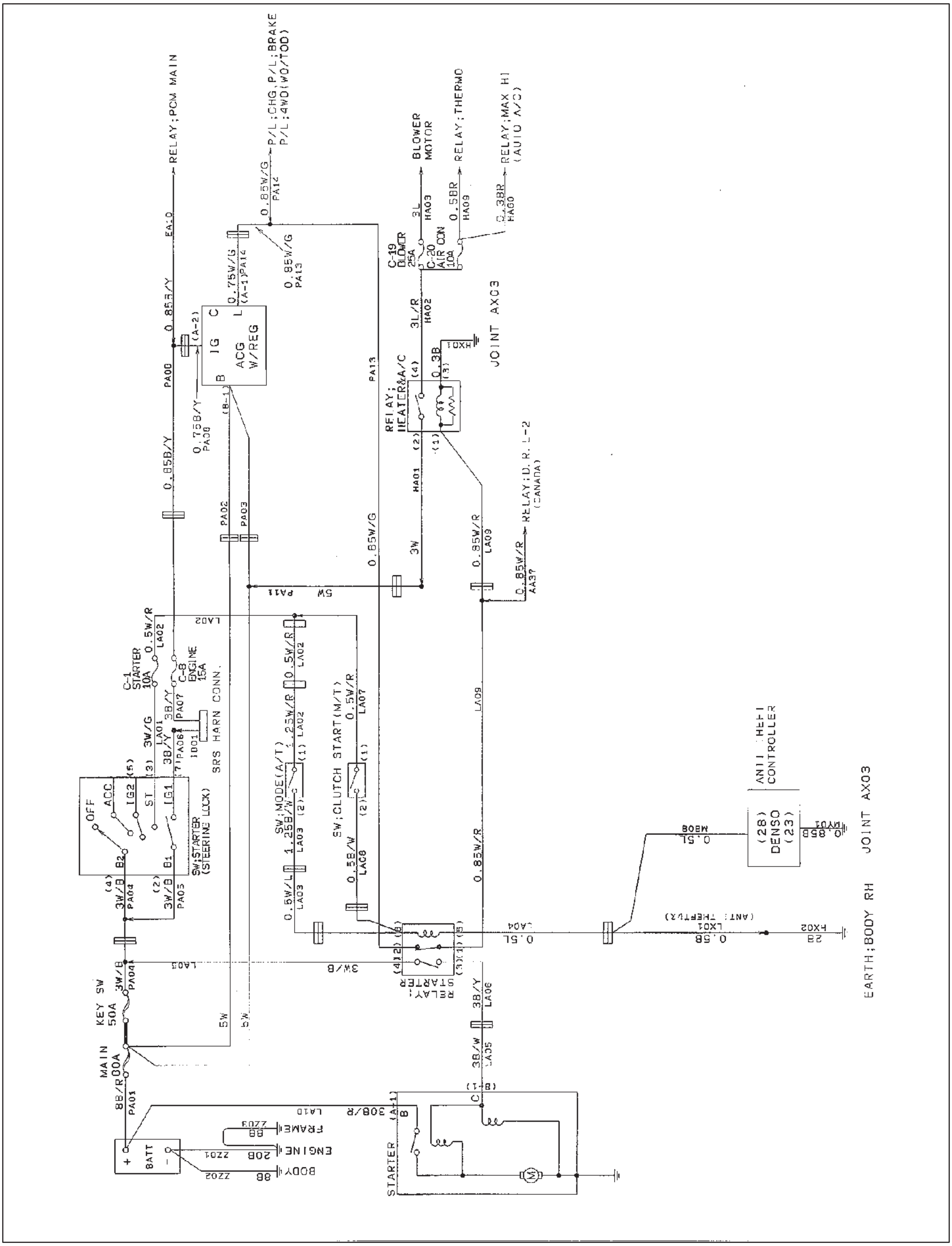
(1) Fuse Box
(2) Fuse C–21 (10A)
(3) Flasher Unit
(4) H–49
(5) Rear Defogger Relay
(6) Power Window Relay
(7) Heater & A/C Relay
(8) Diode (Not Used)
(9) Diode (Not Used)
(10) Circuit Breaker C/B–2
(11) Circuit Breaker C/B–1 (Not Used)
(12) Diode (Not Used)
(13) Fuse C–1 (10A)
(14) Fuse C–2 (15A)
(15) Fuse C–3 (15A)
(16) Fuse C–4 (15A)
(17) Fuse C–5 (15A)
(18) Fuse C–6 (10A)
(19) Fuse C–7 (Not Used)
(20) Fuse C–8 (15A)
(21) Fuse C–9 (15A)
(22) Fuse C–10 (10A)
(23) Fuse C–11 (10A)
(24) Fuse C–12 (20A)
(25) Fuse C–13 (10A)
(26) Fuse C–14 (15A)
(27) Fuse C–15 (20A)
(28) Fuse C–16 (10A)
(29) Fuse C–17 (25A)
(30) Fuse C–18 (20A)
(31) Fuse C–19 (25A)
(32) Fuse C–20 (10A)
(33) Diode (Not Used)
(34) Diode (Not Used)
(35) Diode (Not Used)
(36) Diode (Lighting)

Circuit Diagram

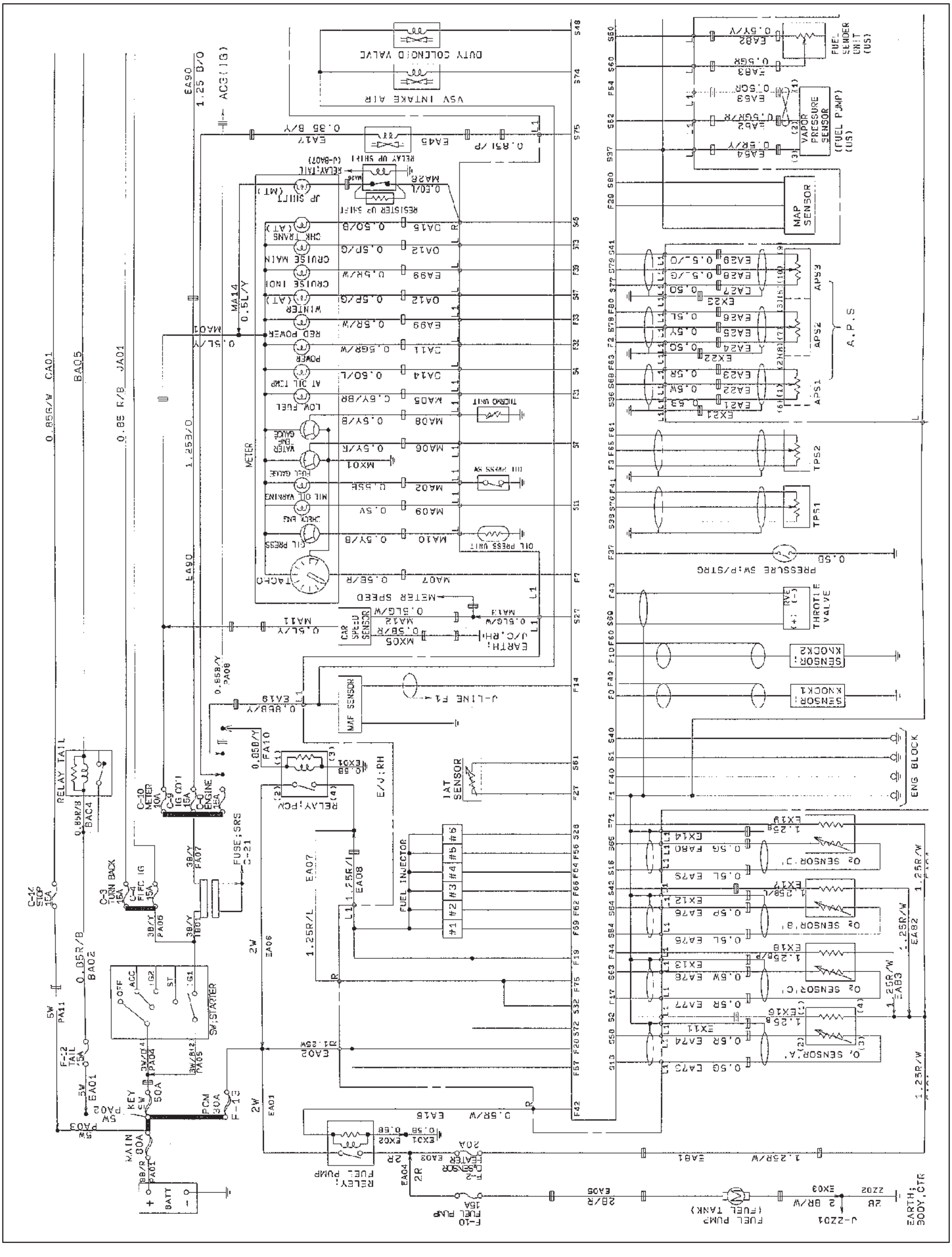
Fuse Block Circuit



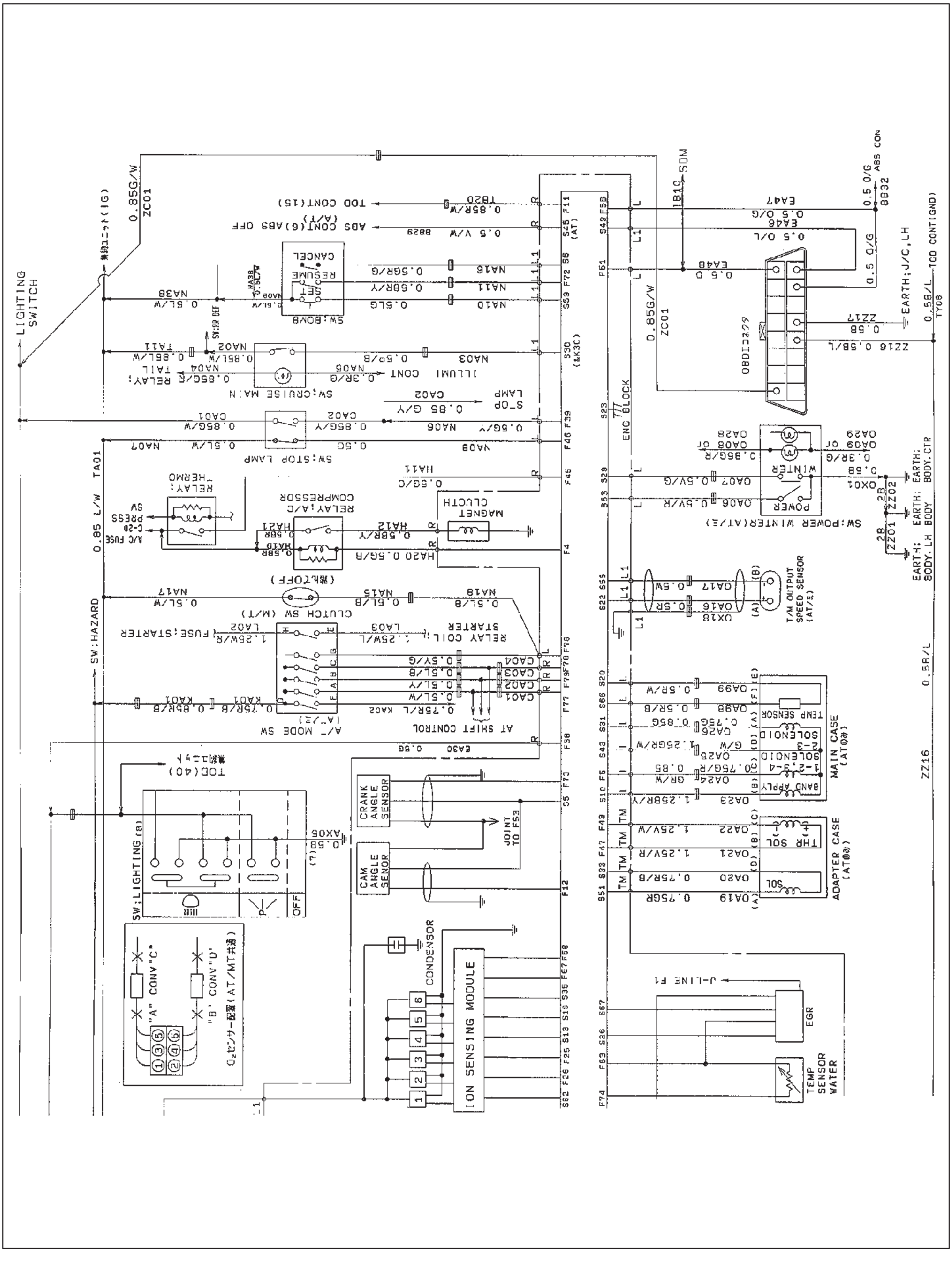
Starter and Generator



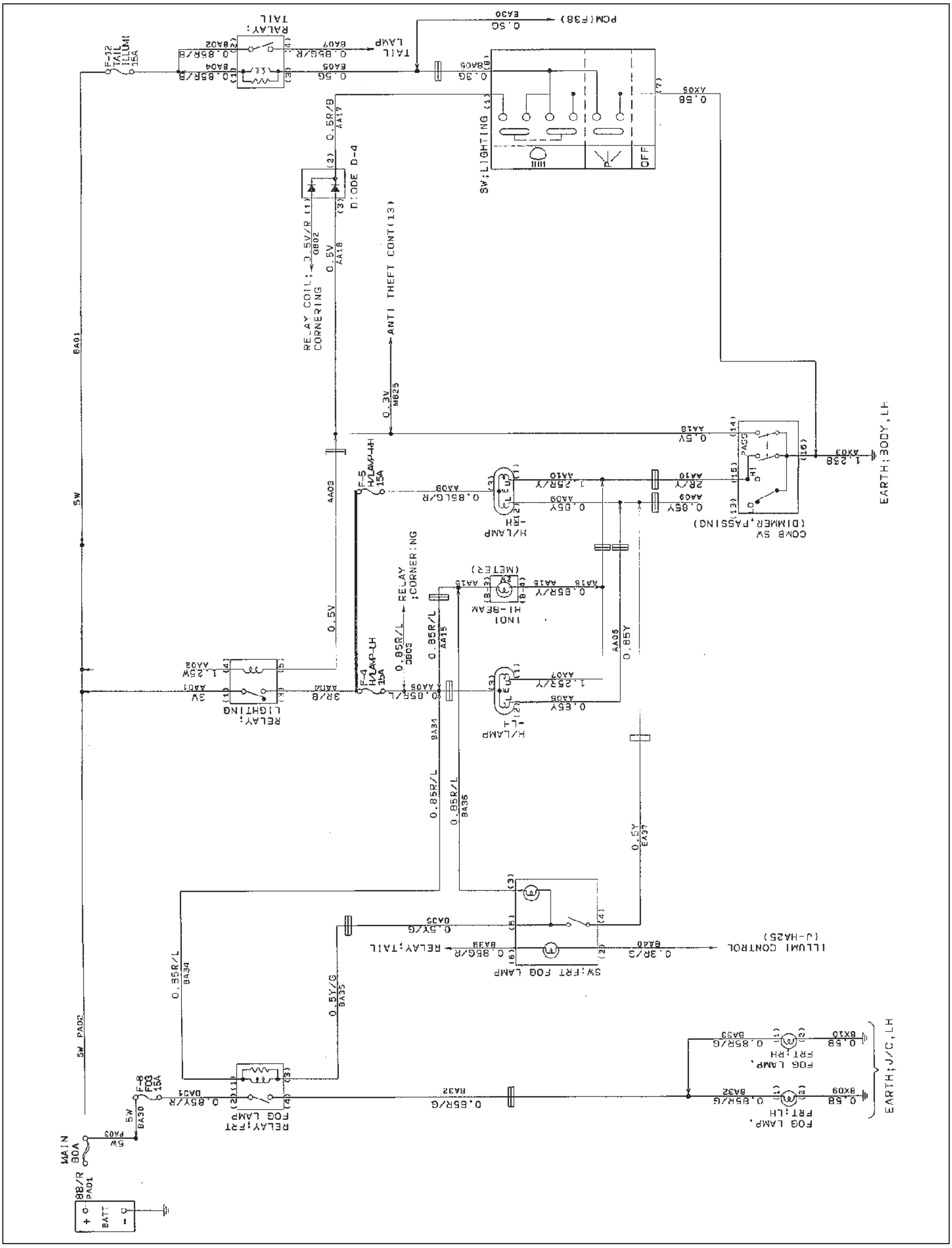
PCM–1



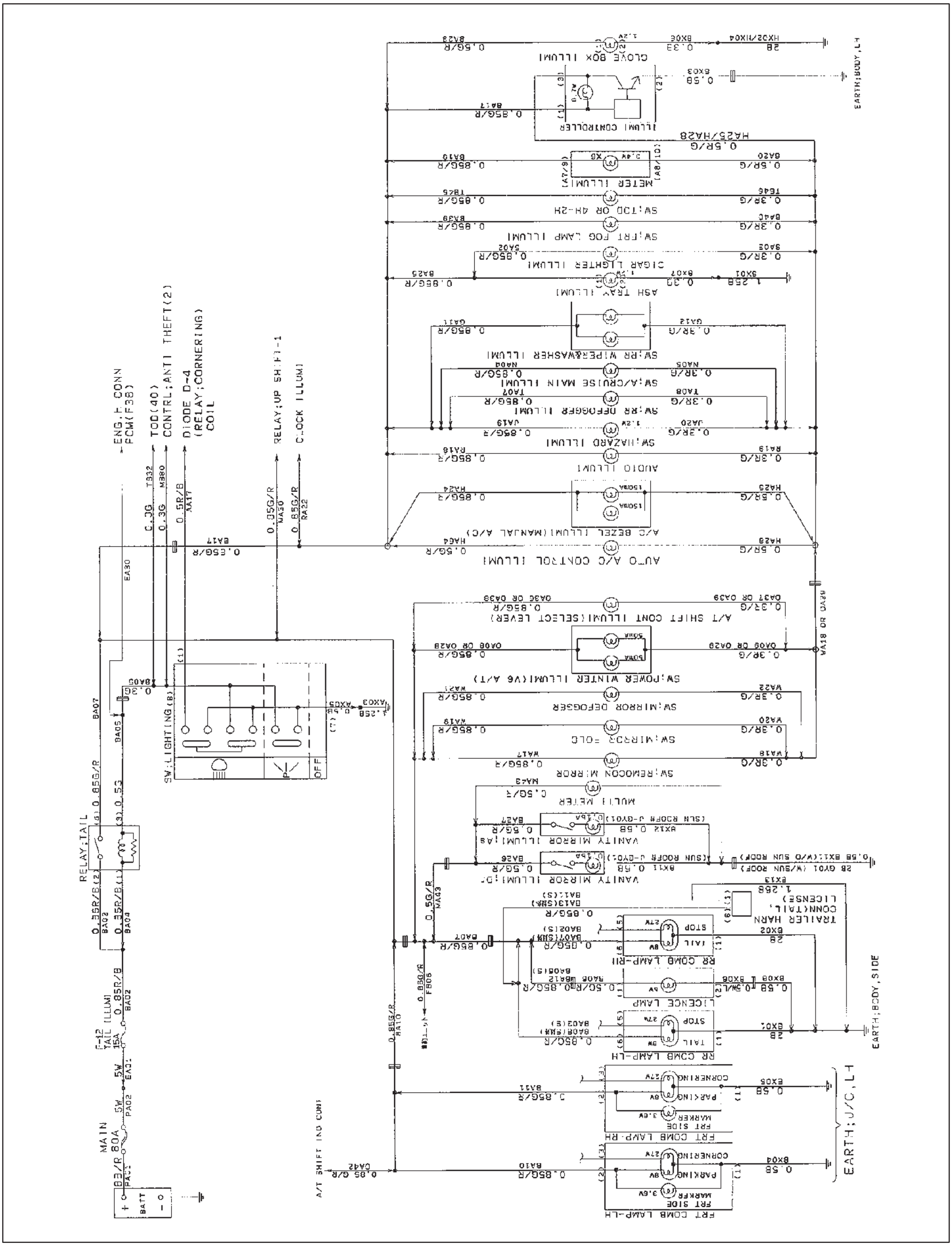
PCM–2



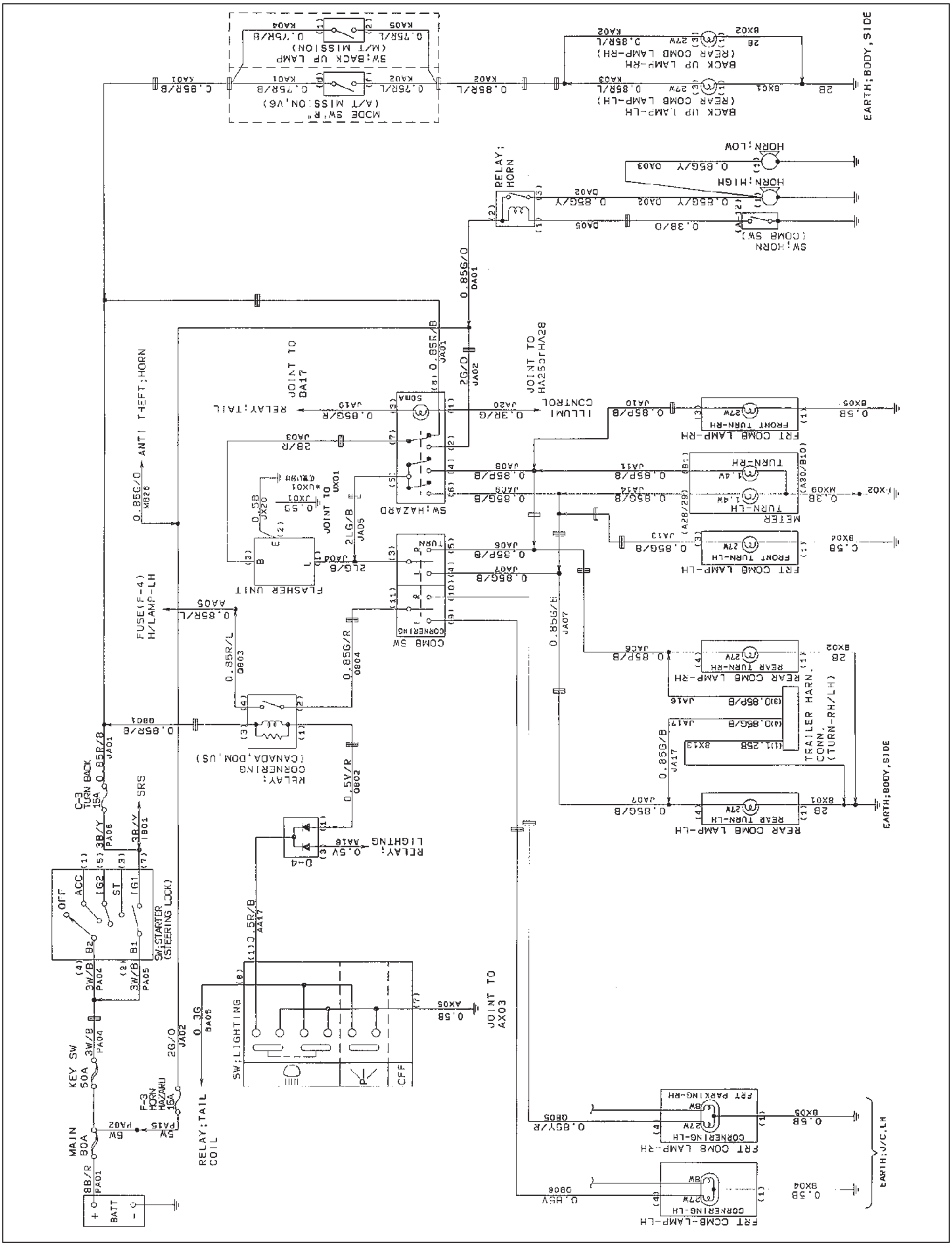
Headlight and Fog Light



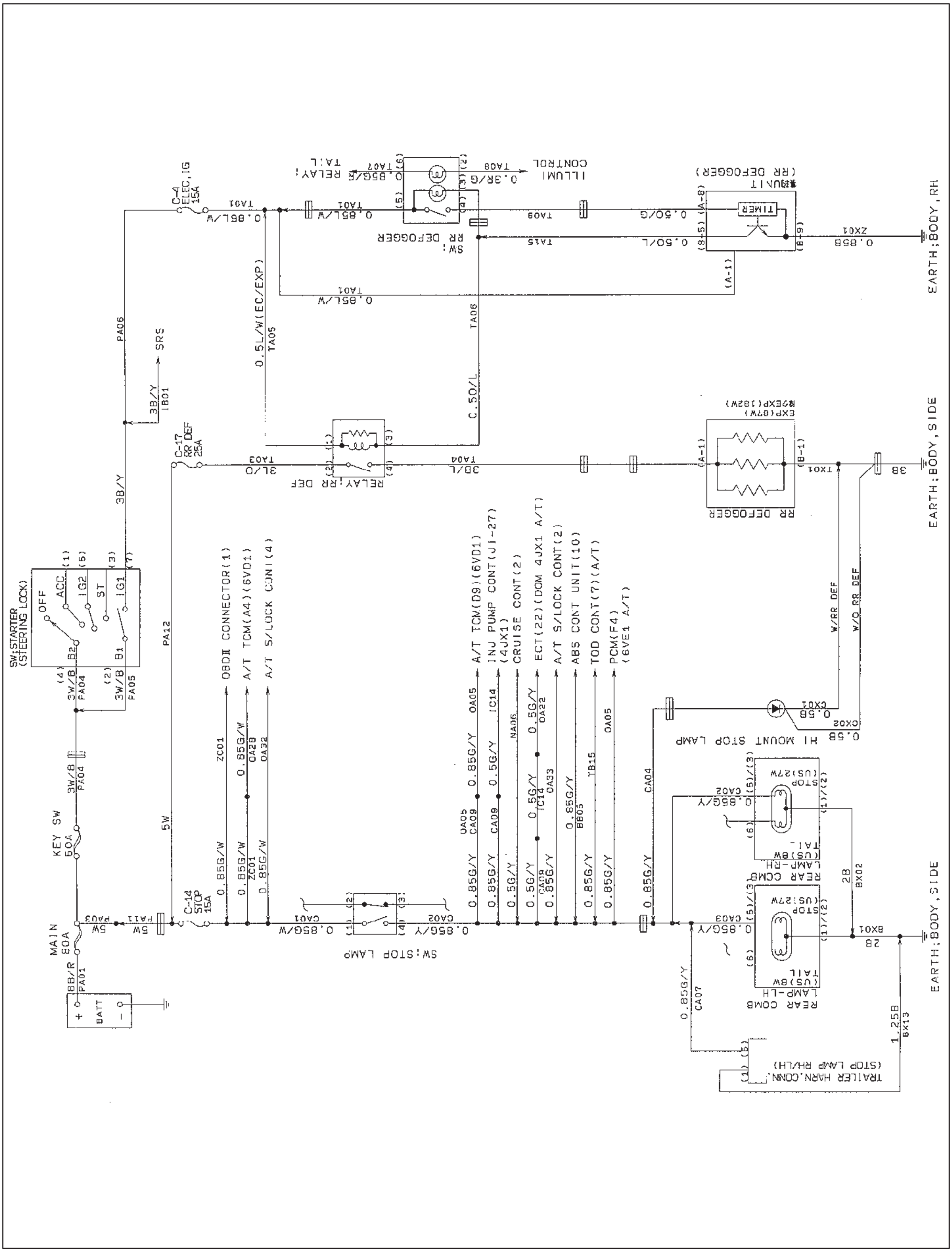
Illumination Light



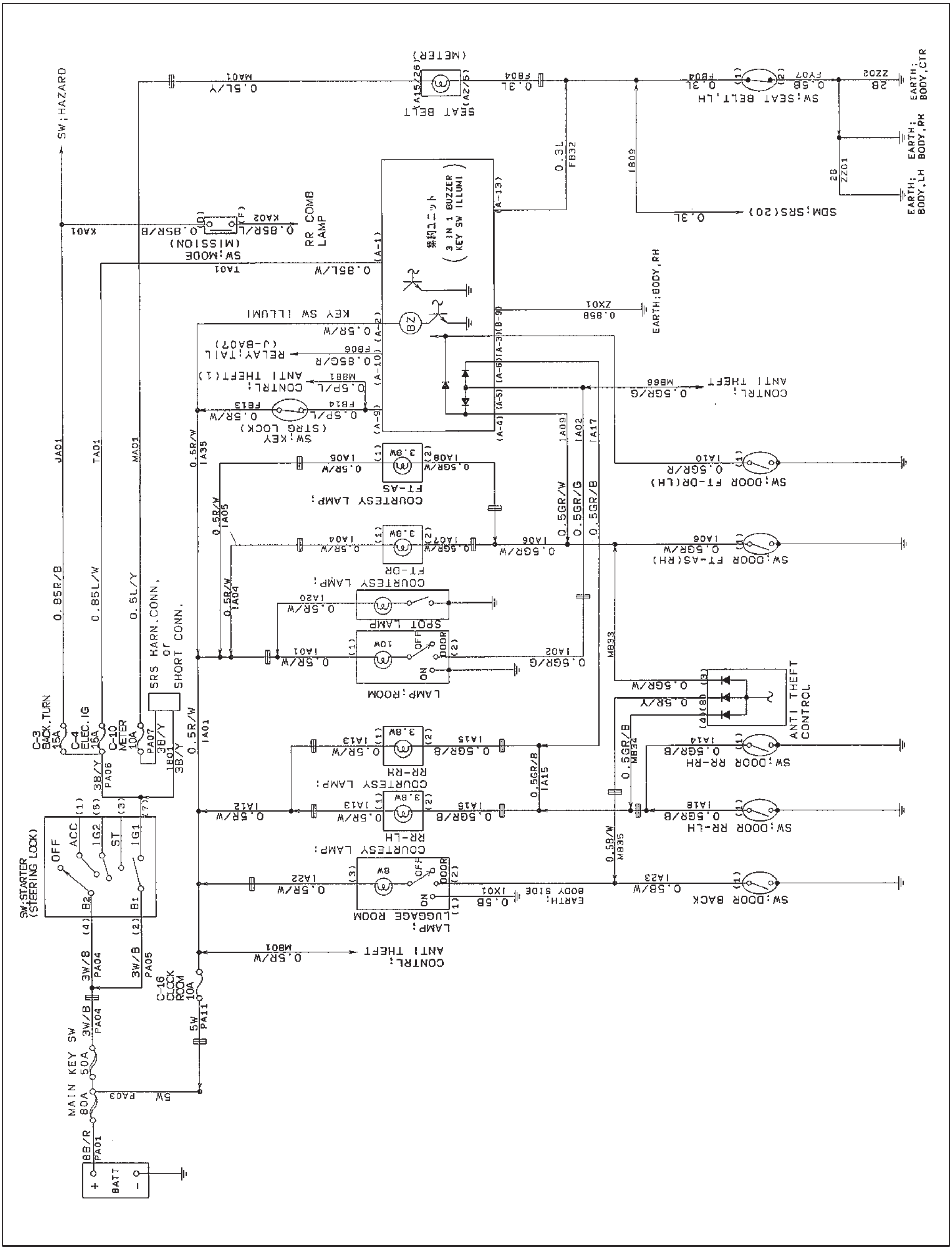
Turn Signal Light and Hazard Warning Light



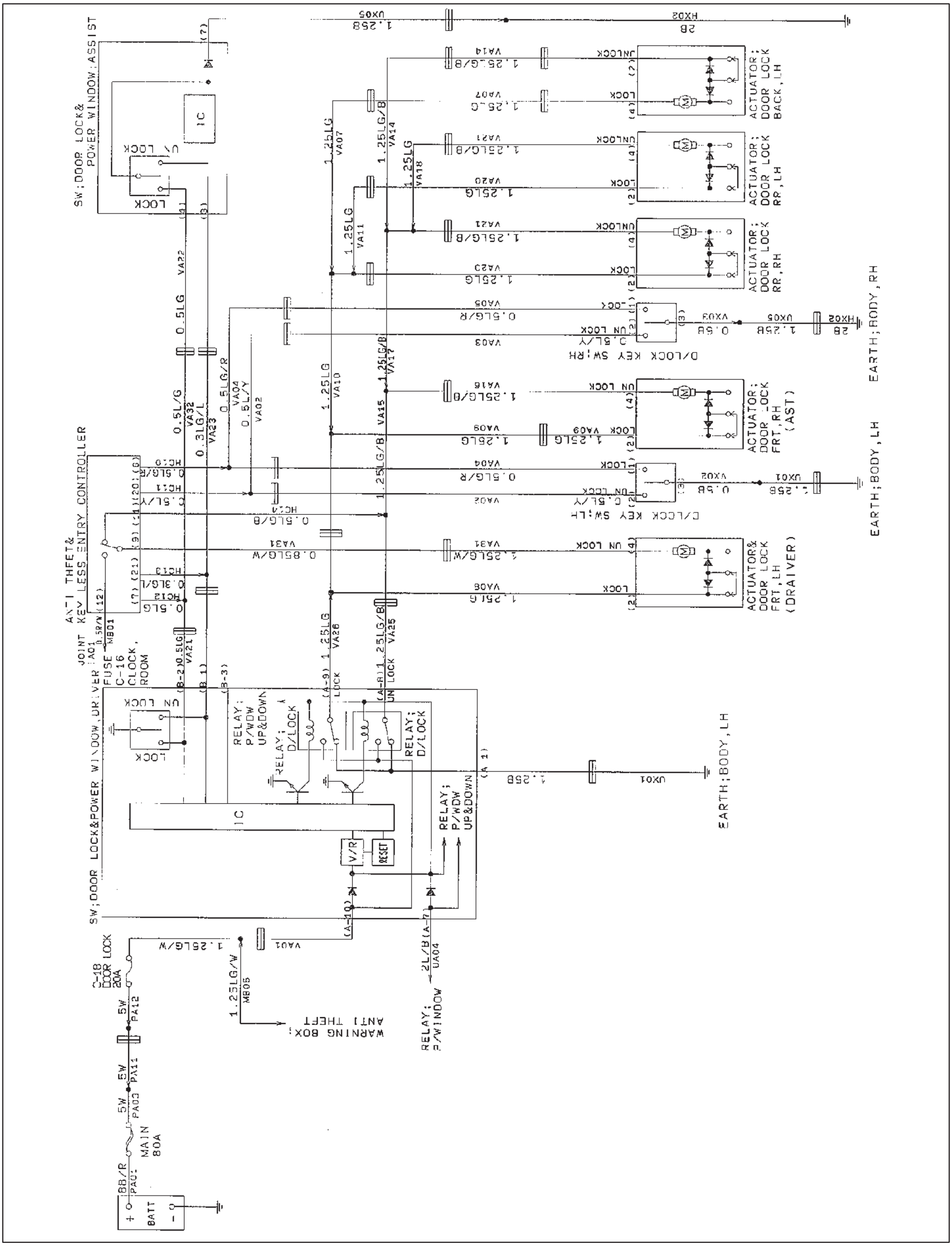
Stoplight and Rear Defogger



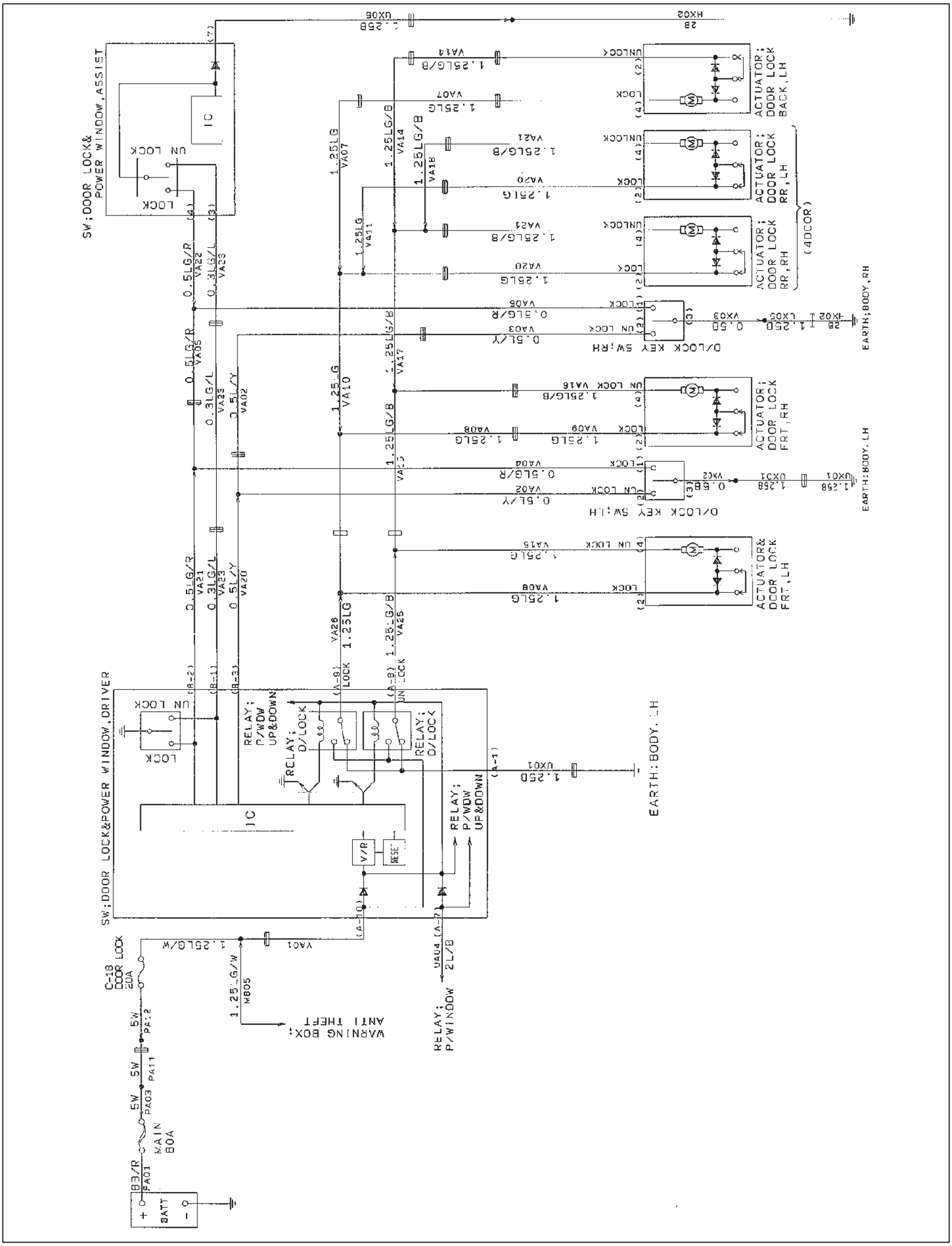
Dome Light, Courtesy Light, Stop Light and Luggage Room Light



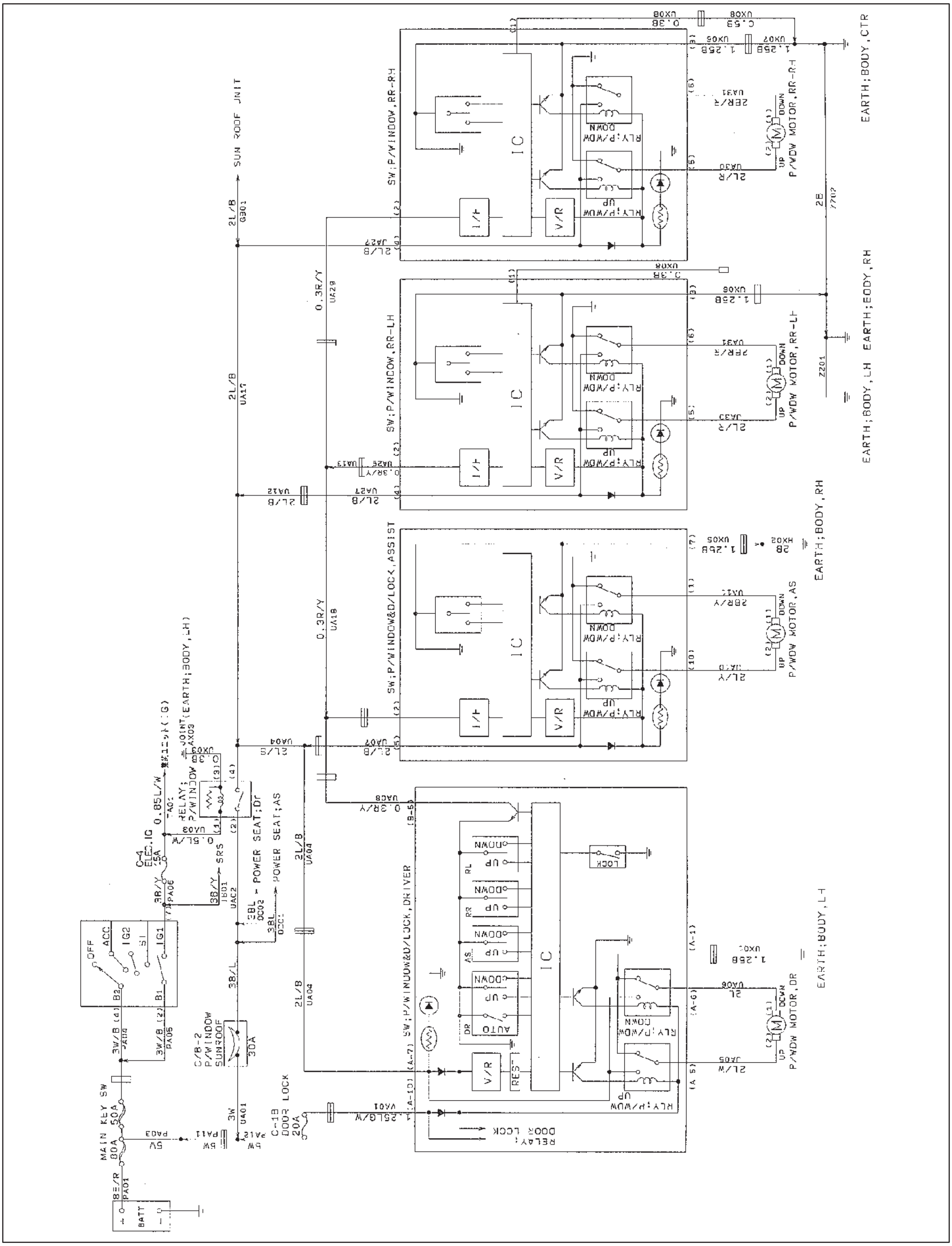
Door Lock (W/ Keyless Entry)



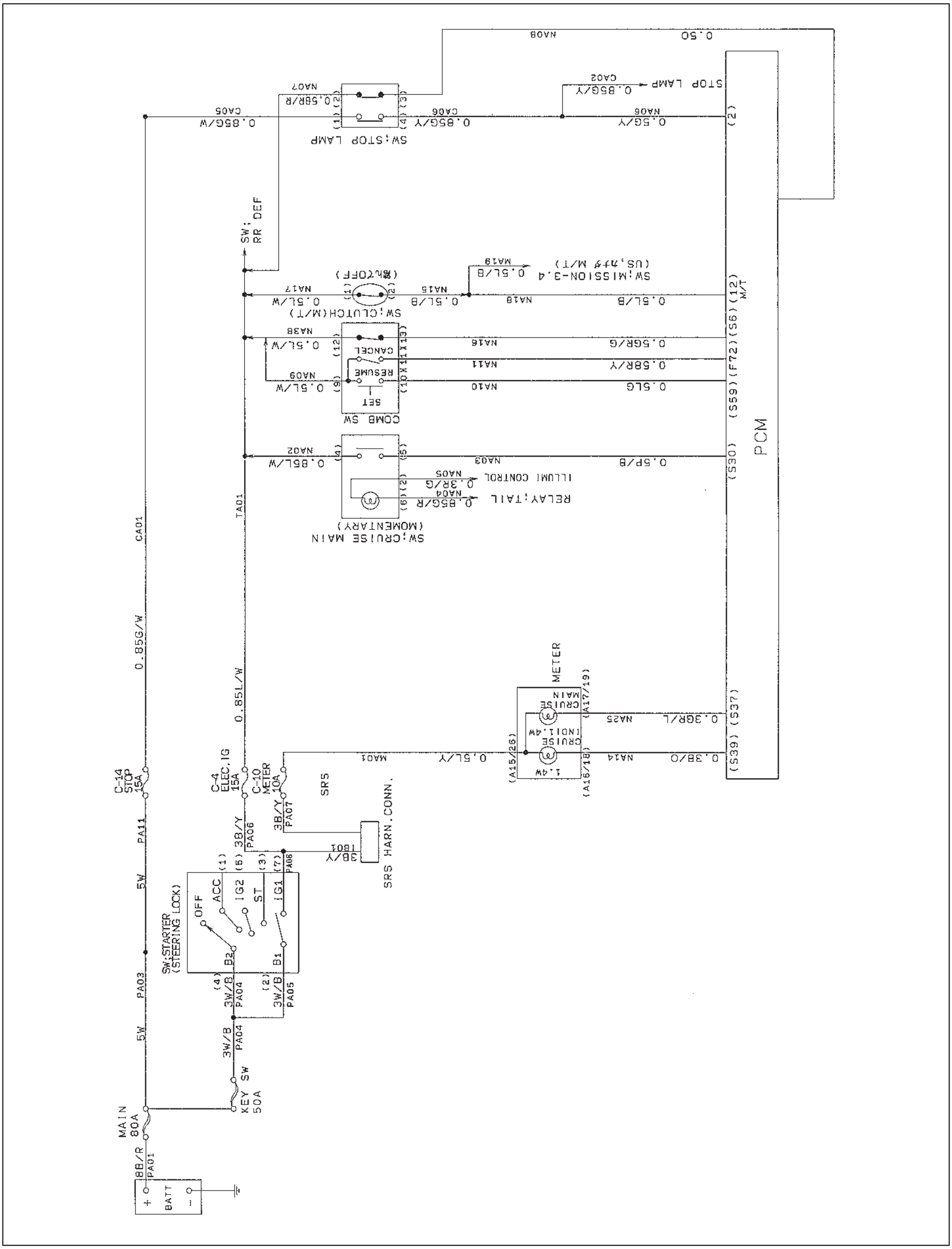
Door Lock (W/O Keyless Entry)



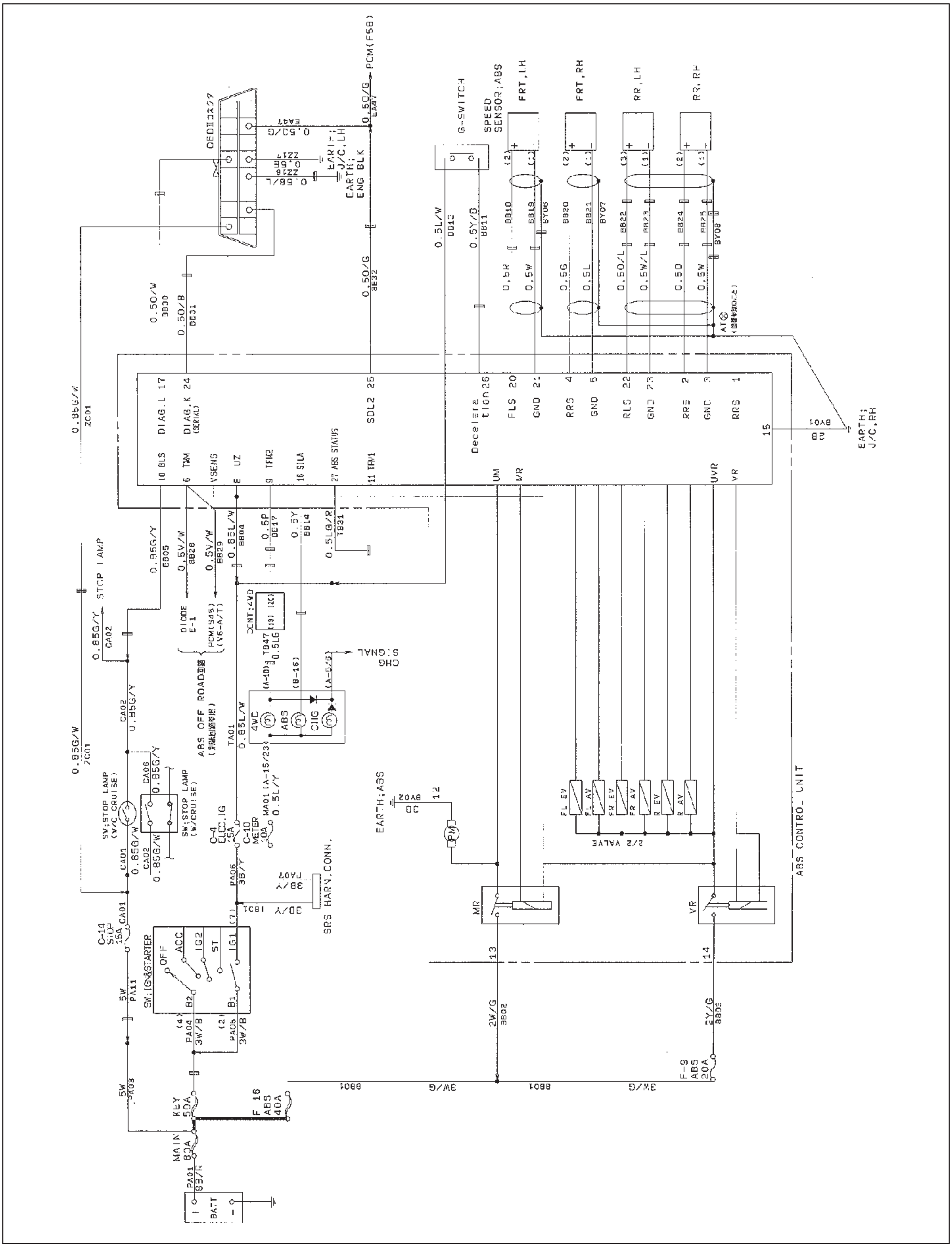
Power Window



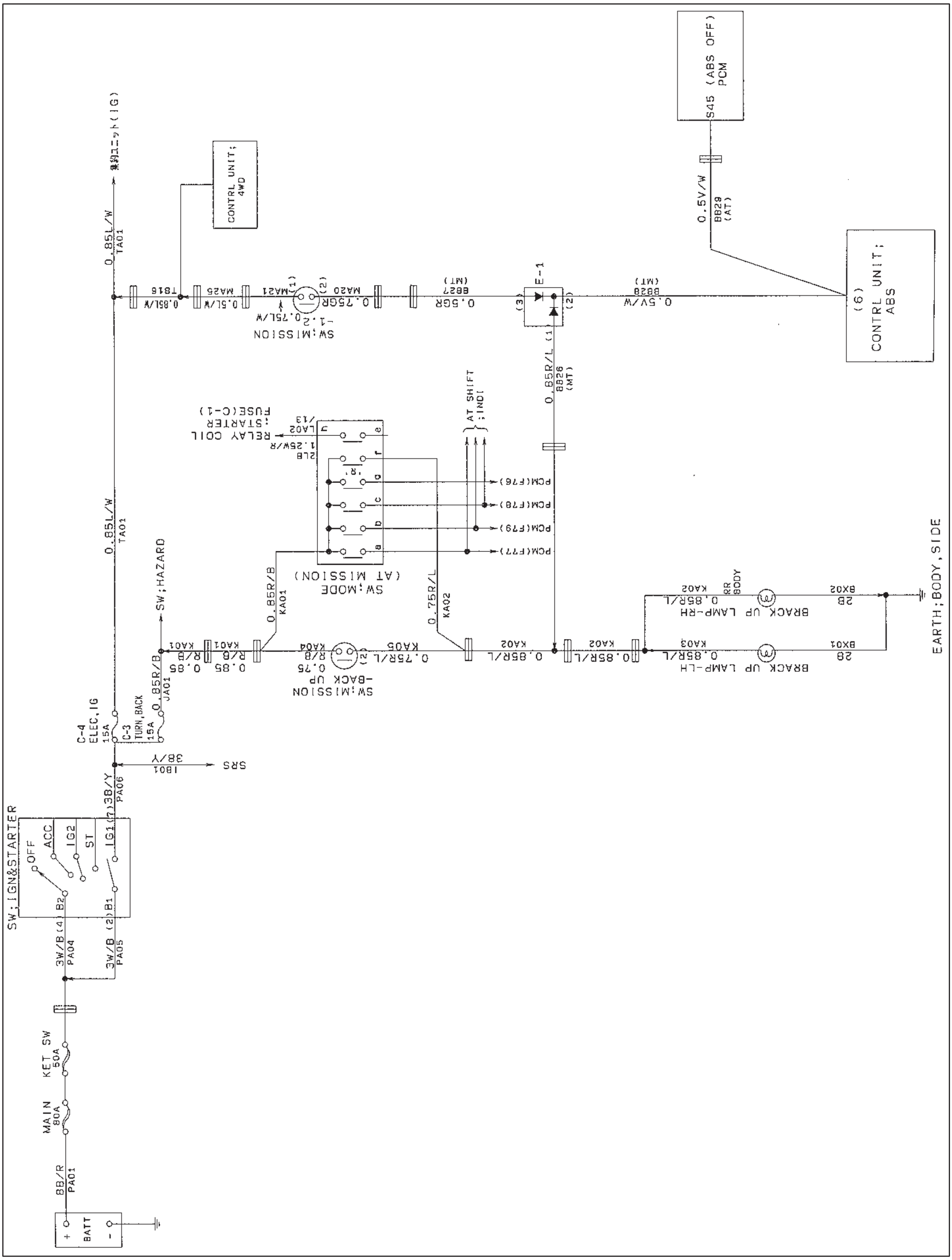
Cruise Control



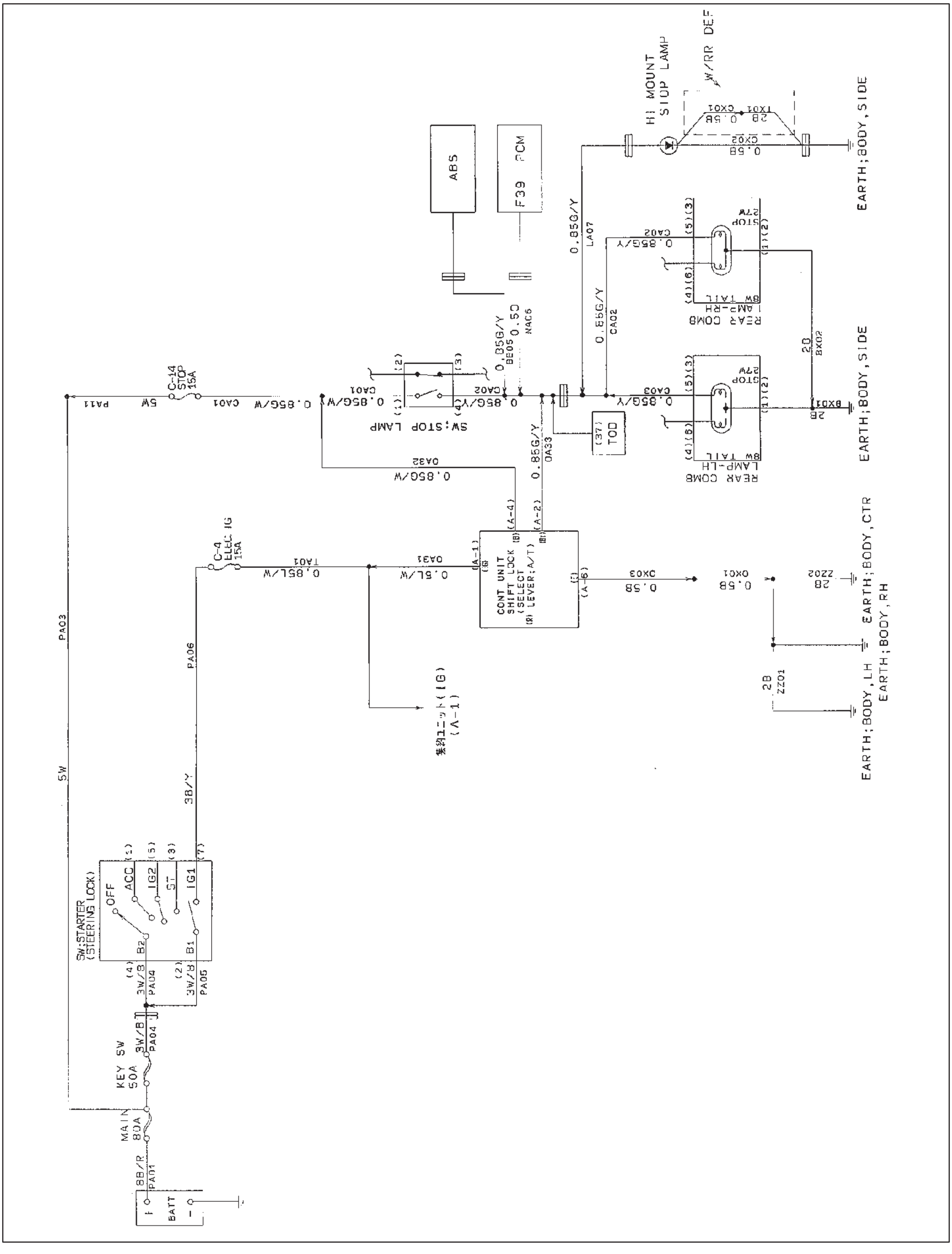
ABS–1


ABS CONTROL UNIT
2/2 VALVE
SPEED SENSOR;ABS
FRT,LH
FRT,RH
RR,LH
RR,RH
G-SWITCH
EARTH;ABS
EARTH;J/C,RH
SRS HARN.CONN.
STOP LAMP
CHG SIGNAL
SW;IG&STARTER
BATT

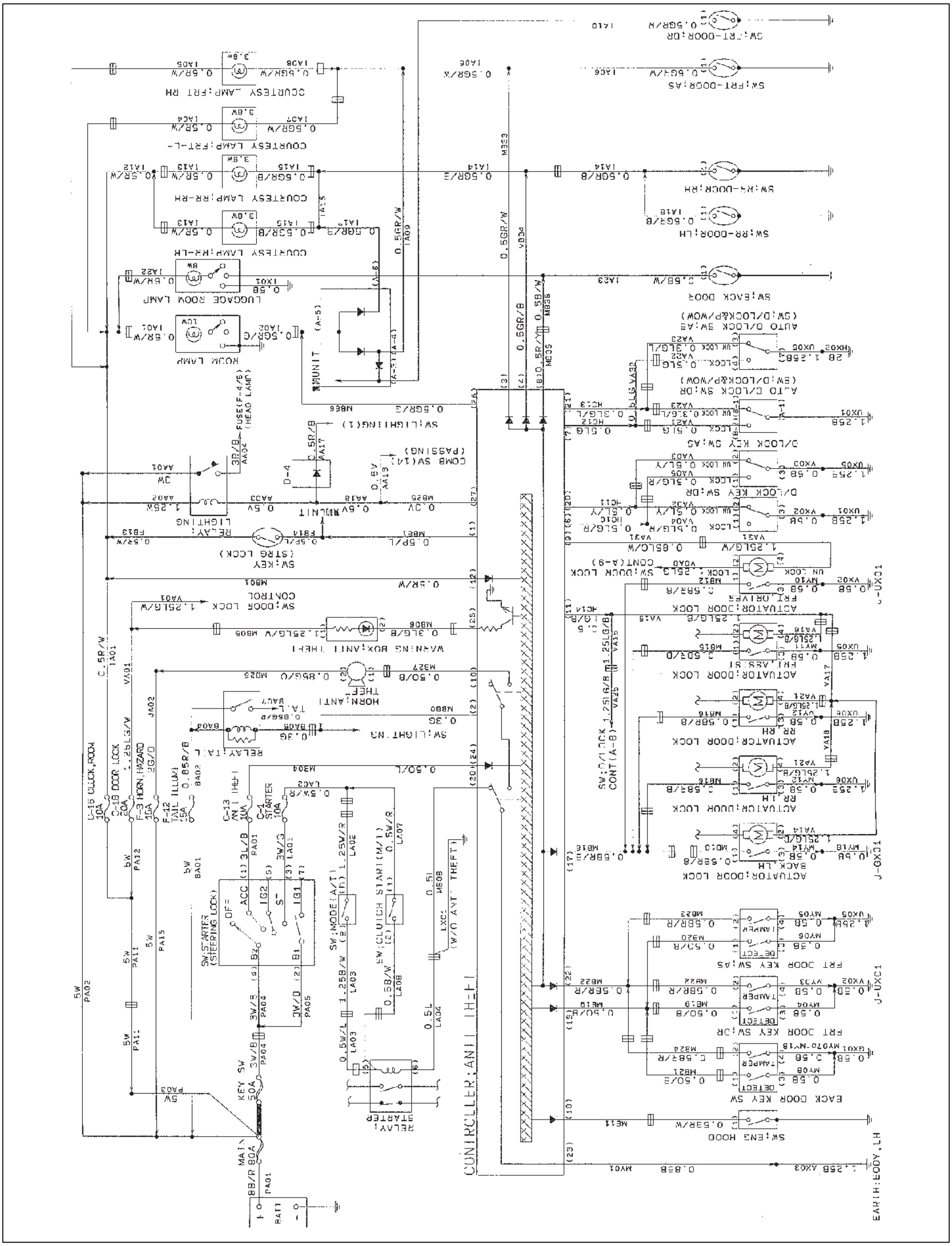
ABS–2


S45 (ABS OFF)
PCM
CONTRL UNIT; 4WD
CONTRL UNIT; ABS
E-1
SW;MODE
(AT MISSION)
SW;HAZARD
SRS
C-4 ELEC,IG 15A
C-3 TURN,BACK 15A
SW;IGN&STARTER
OFF
ACC
IG2
ST
IG1
KET SW 50A
MAIN 80A
BATT
BRACK UP LAMP-LH
BRACK UP LAMP-RH
EARTH;BODY,SIDE

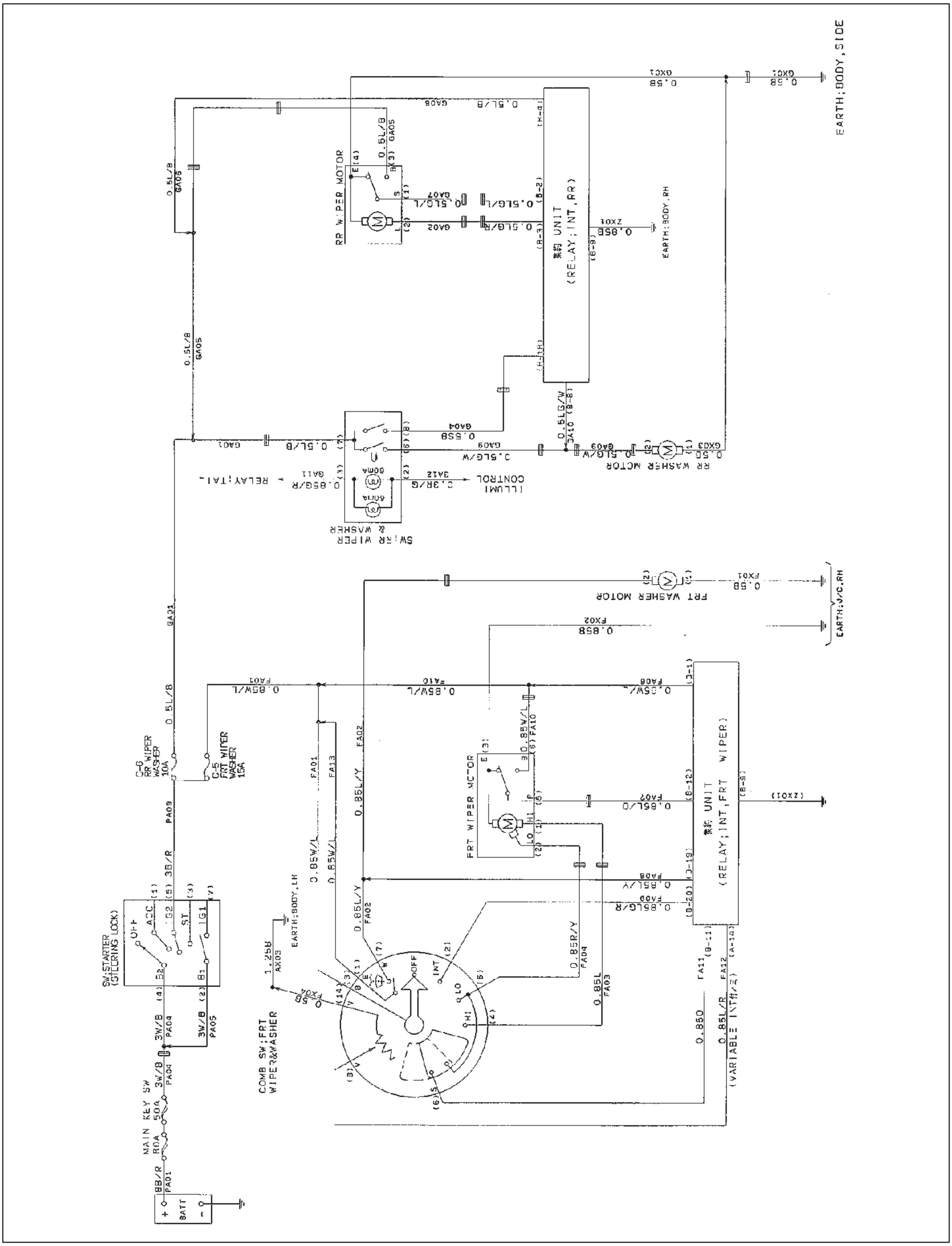
A/T Shift Lock



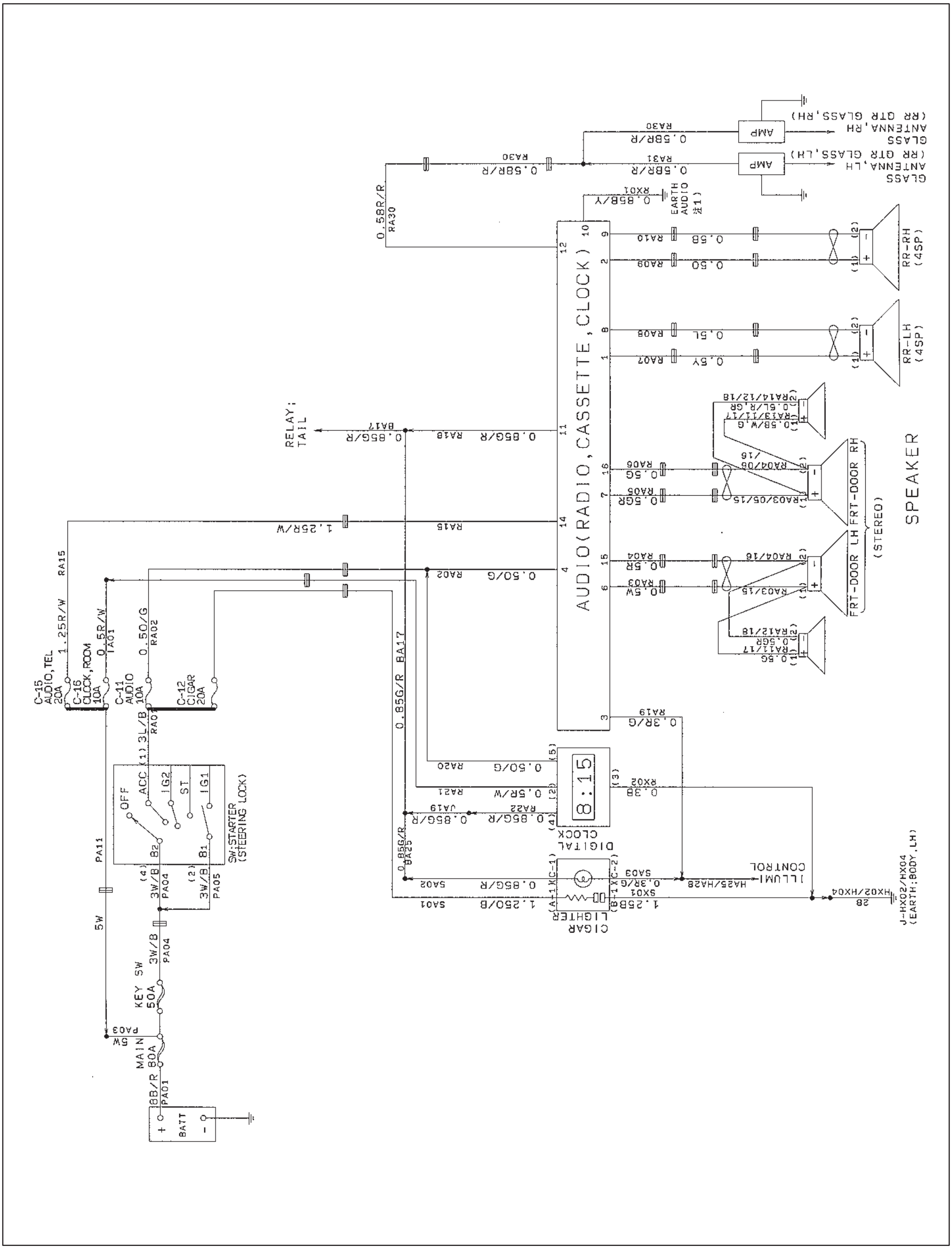
Anti–theft W/ Keyless Entry



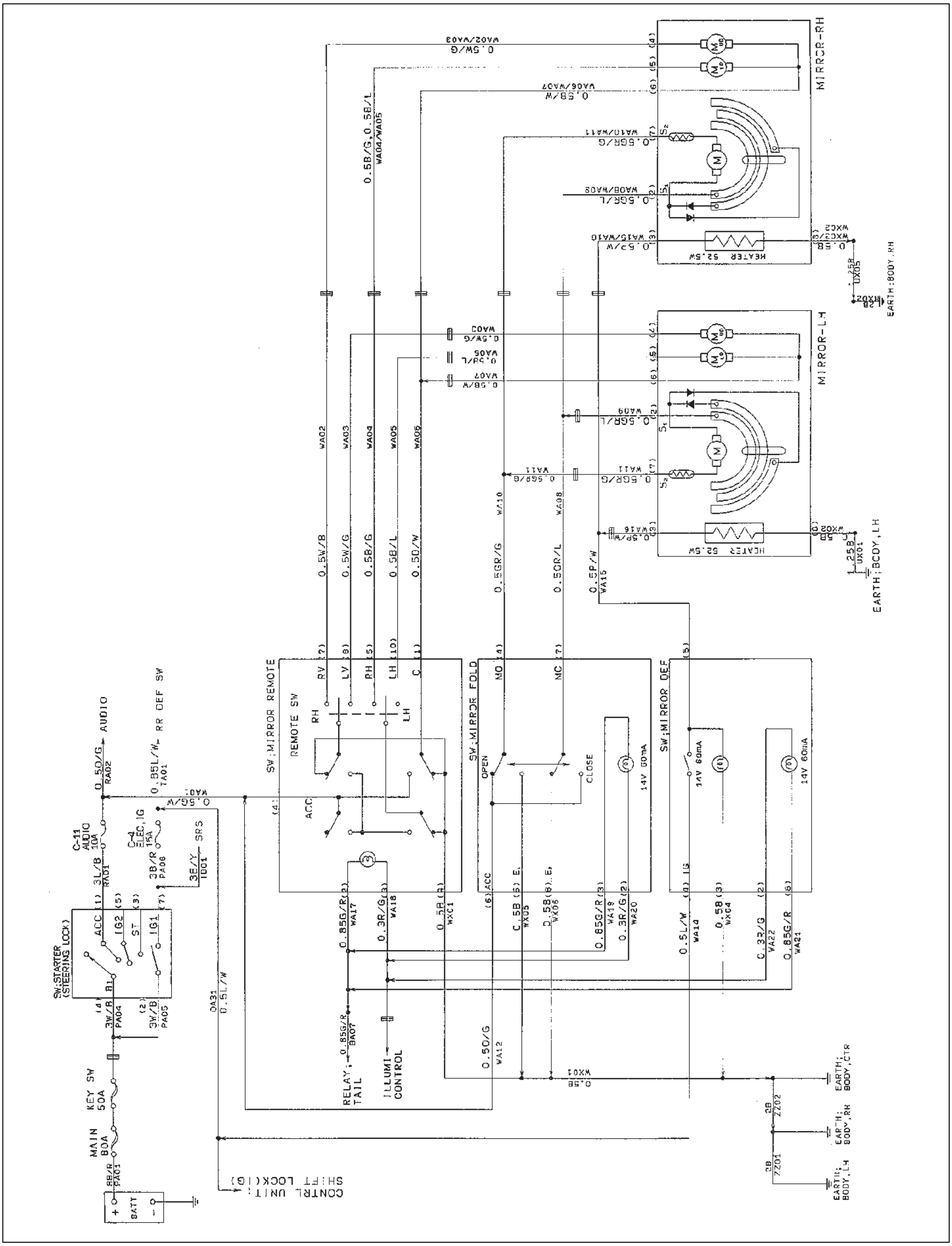
Windshield Wiper and Washer



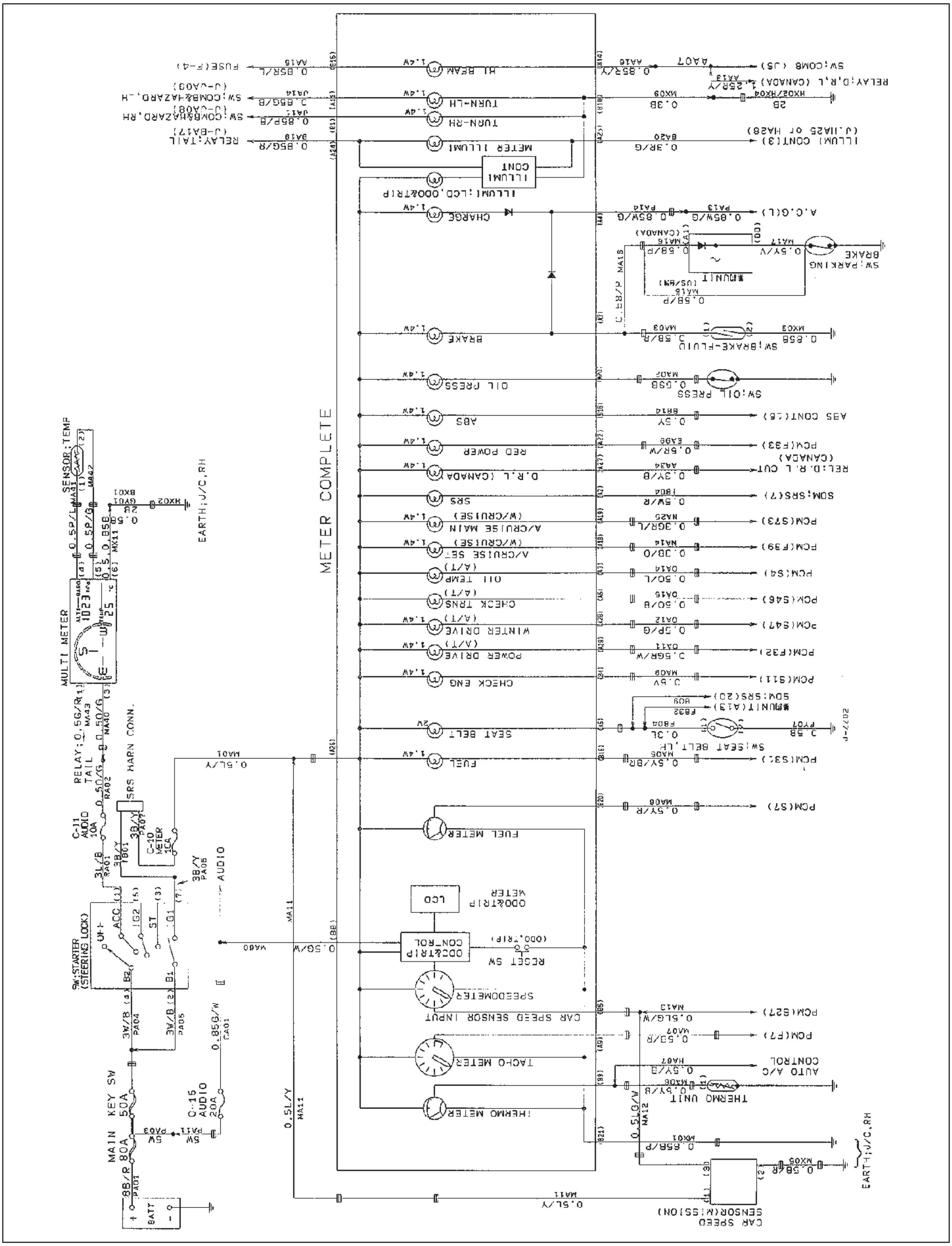
Audio


AUDIO(RADIO,CASSETTE,CLOCK)
SPEAKER
FRT-DOOR RH
FRT-DOOR LH
(STEREO)
RR-RH (4SP)
RR-LH (4SP)
GLASS ANTENNA,RH (RR QTR GLASS,RH)
GLASS ANTENNA,LH (RR QTR GLASS,LH)
AMP
EARTH AUDIO
RELAY; TAIL
DIGITAL CLOCK
CIGAR LIGHTER
ILLUMI-CONTROL
J-HX02/HX04 (EARTH;BODY,LH)
C-15 AUDIO,TEL 20A
C-16 CLOCK,ROOM 10A
C-11 AUDIO 10A
C-12 CIGAR 20A
SW;STARTER (STEERING LOCK)
OFF
ACC
IG2
ST
IG1
KEY SW 50A
MAIN 80A
BATT

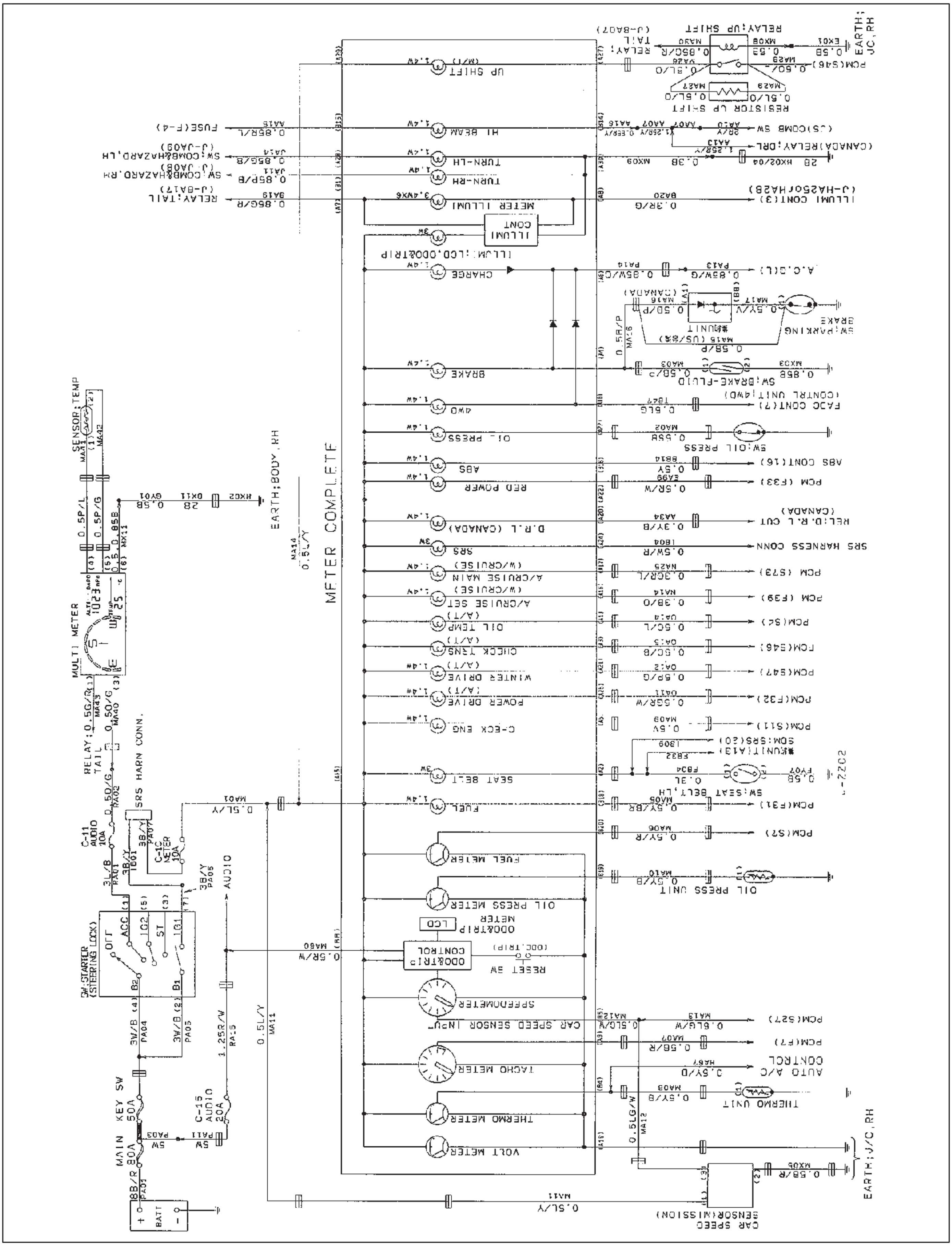
Door Mirror



Meter (W/ T,O,D)

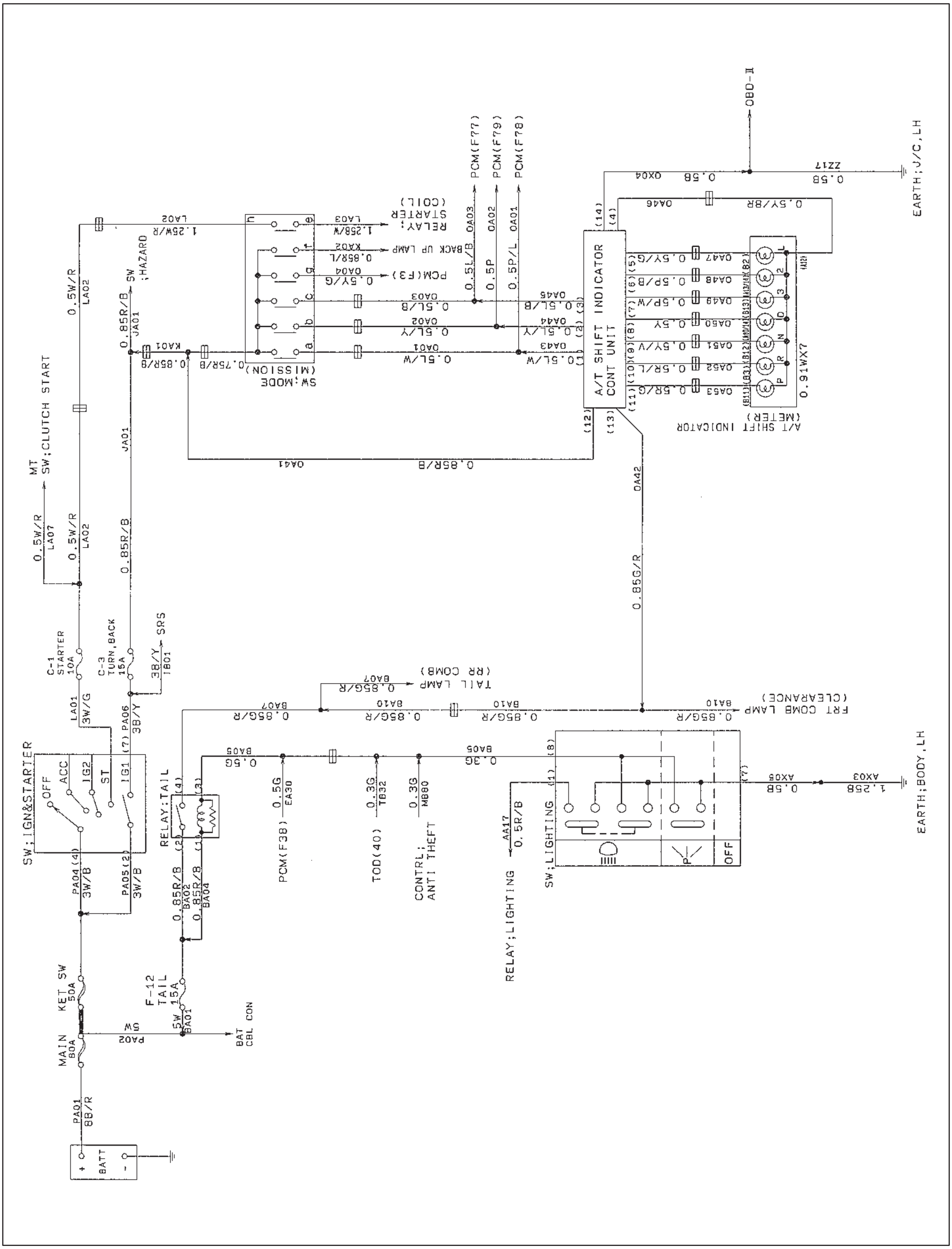

METER COMPLETE
MULTI METER
SENSOR:TEMP
SRS HARN CONN.
SW:STARTER (STEERING LOCK)
MAIN KEY SW 50A
BATT
EARTH;J/C,RH

Meter (W/O T,O,D)

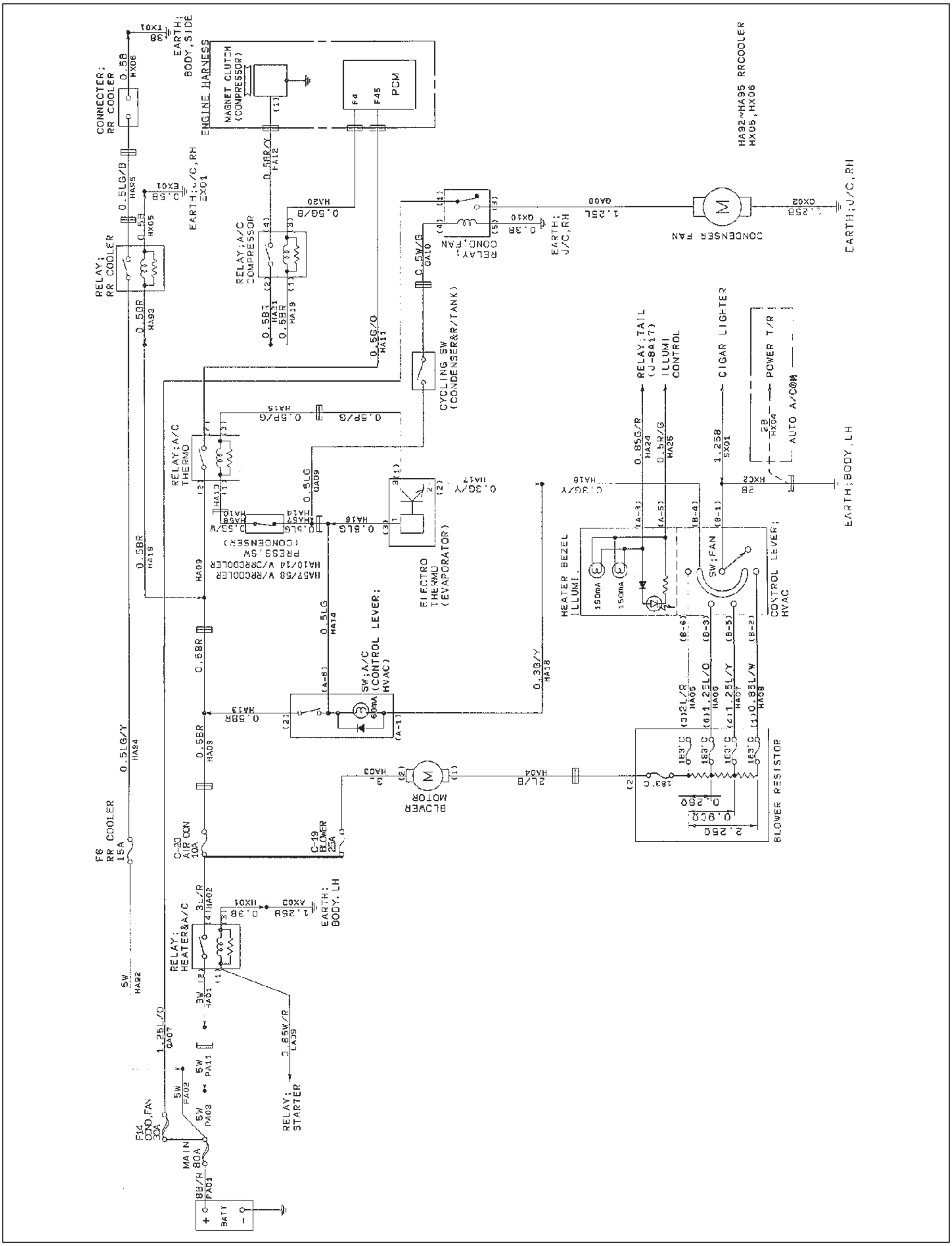


METER COMPLETE
MULTI METER
SENSOR;TEMP
EARTH;BODY,RH
SRS HARN CONN.
SW;STARTER (STEERING LOCK)
MAIN KEY SW
BATT
AUDIO

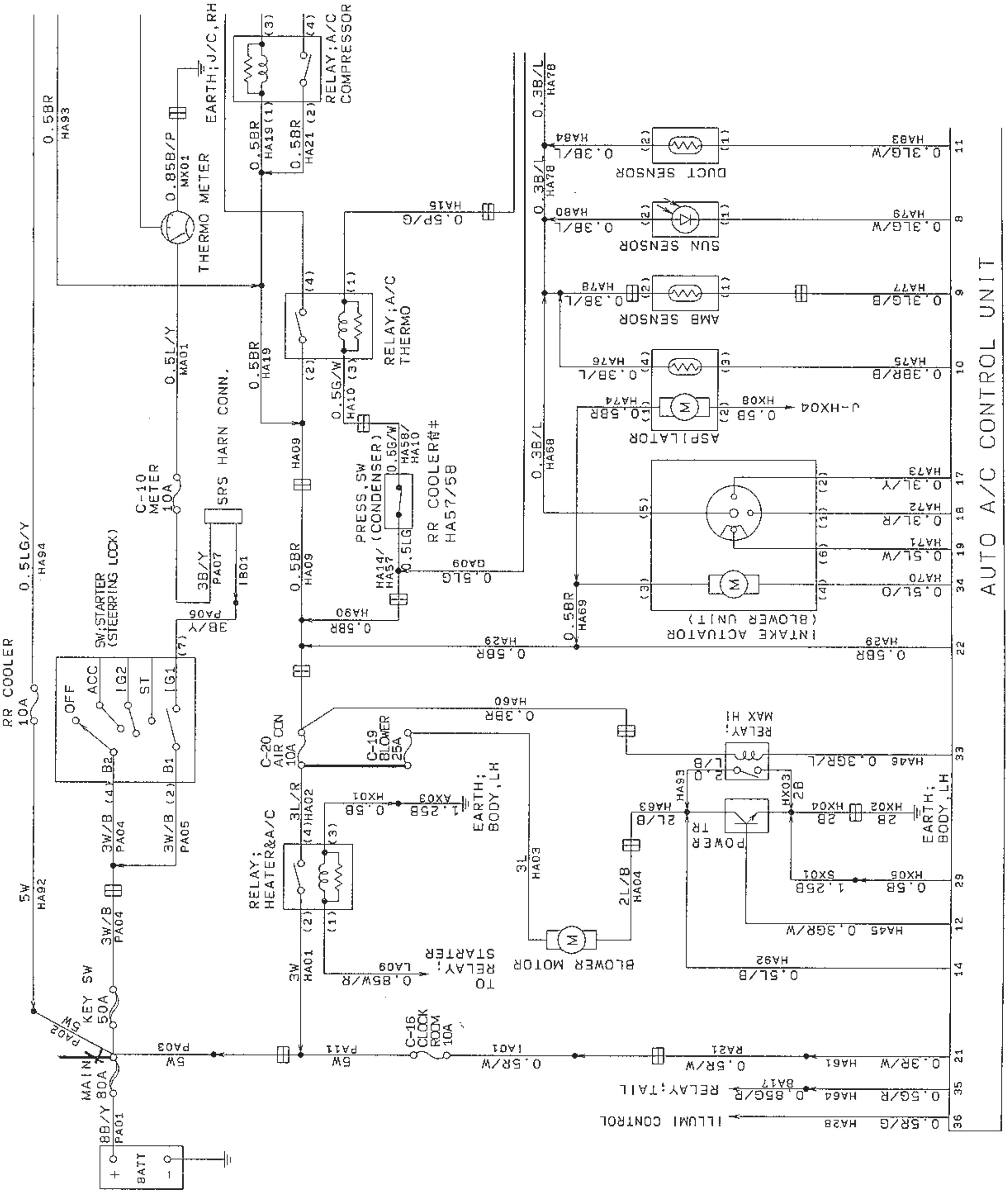
A/T Shift Indicator



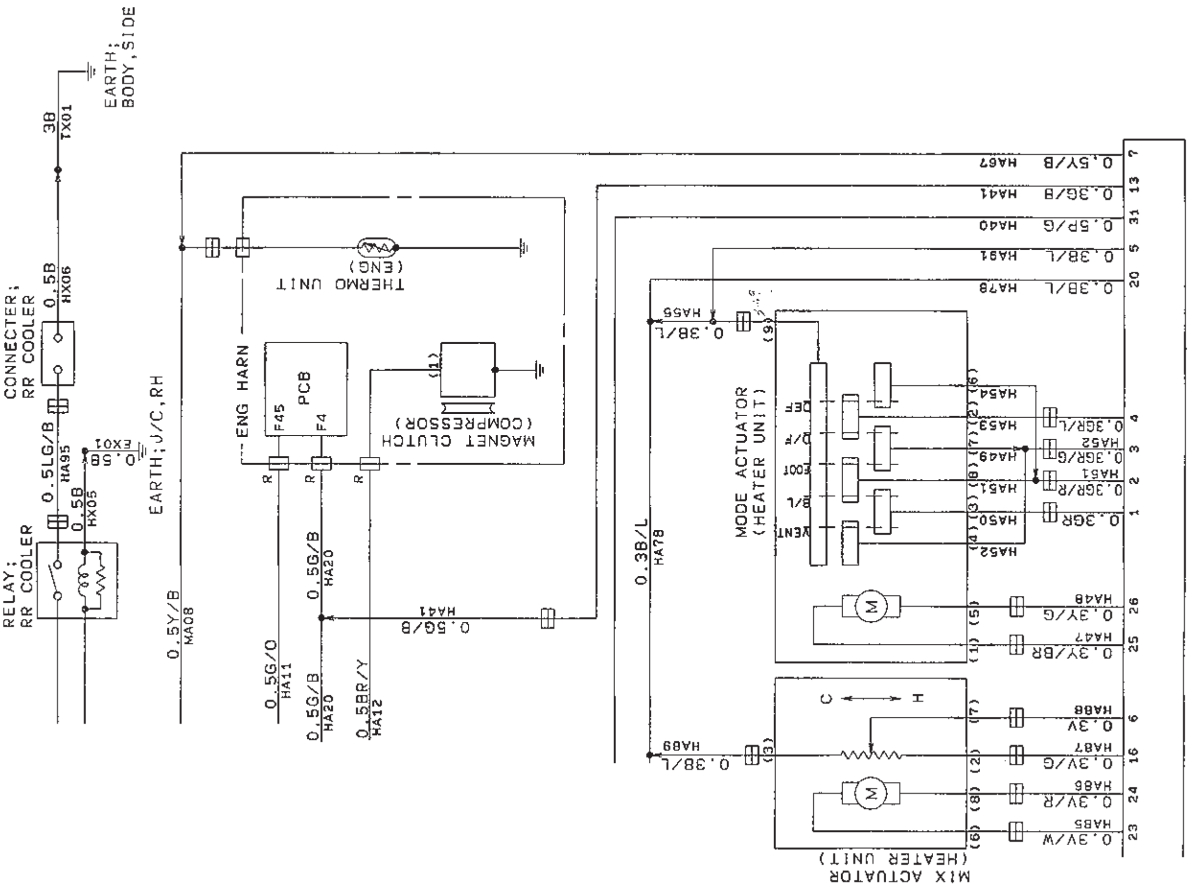
Air Conditioning (Manual)



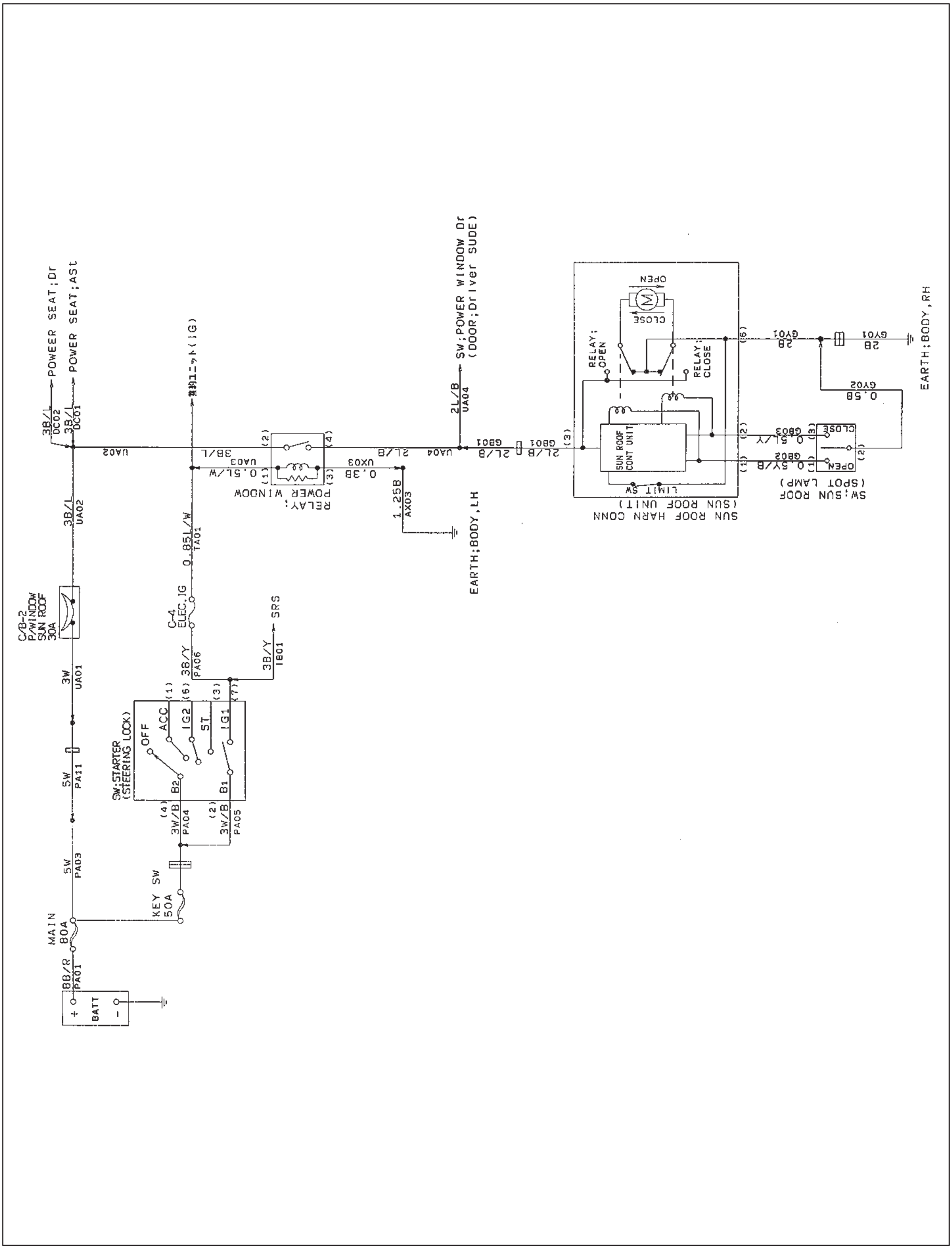
Air Conditioning (Auto)–1



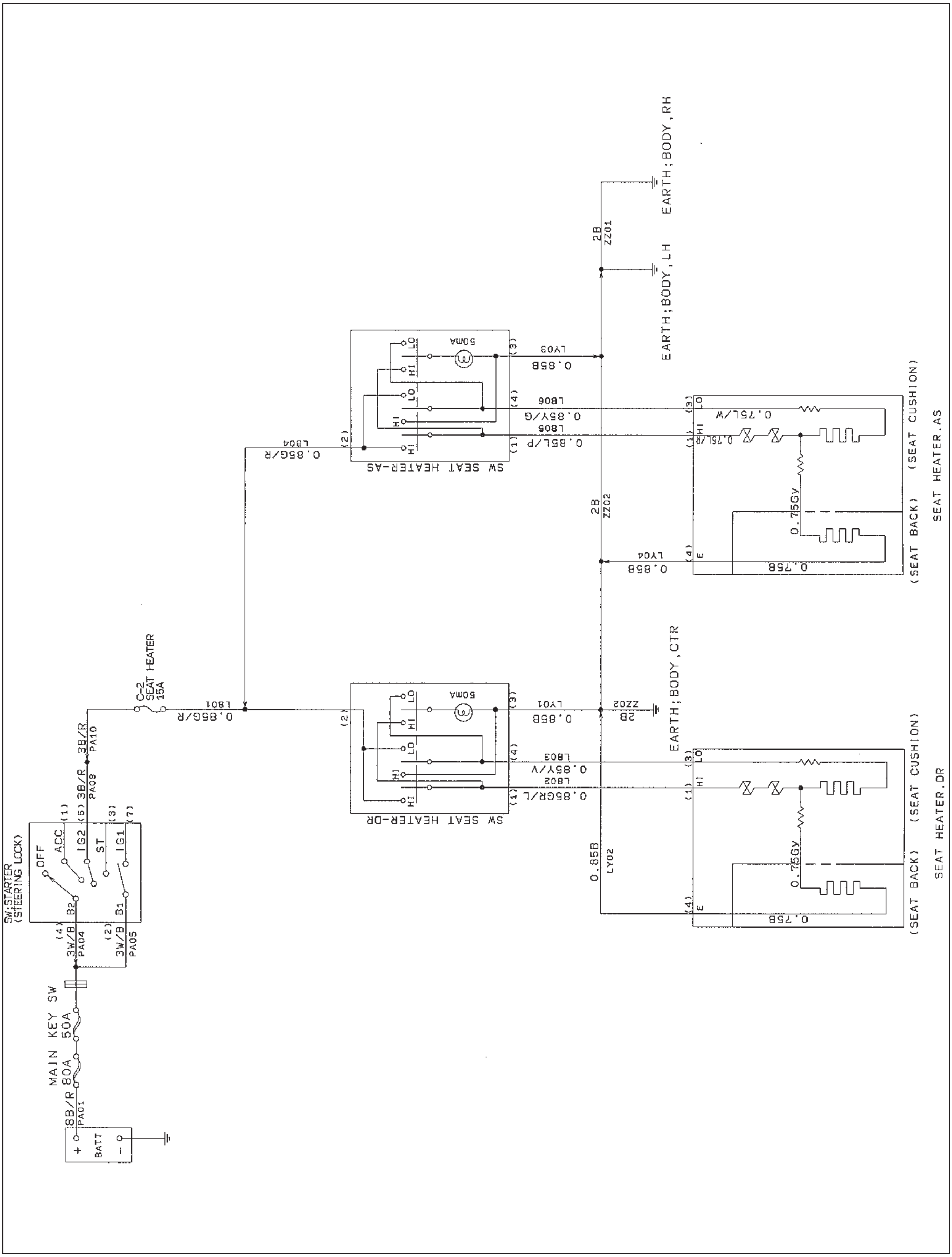
Air Conditioning (Auto)–2



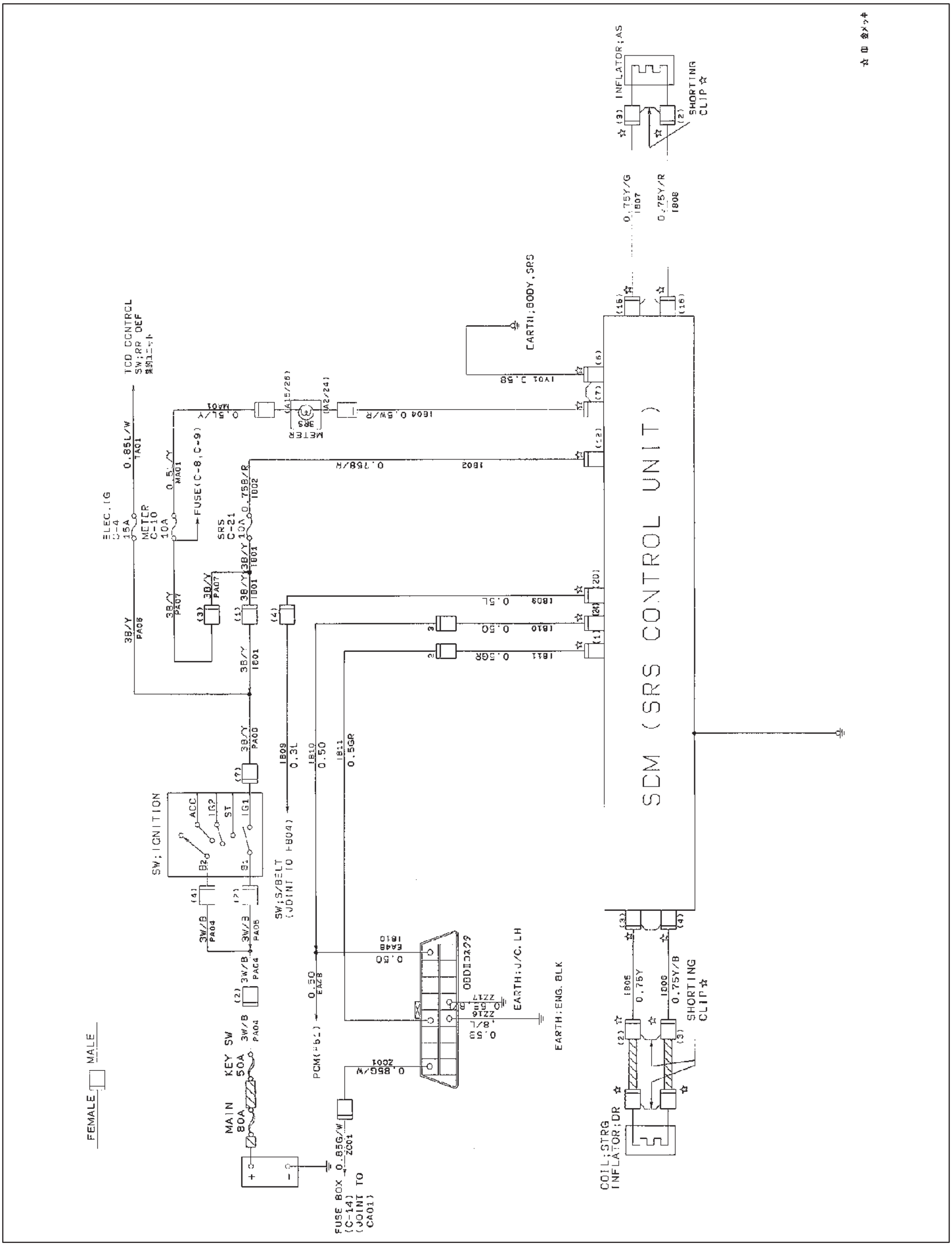
Sun Roof


BATT
MAIN 80A
KEY SW 50A
SW;STARTER (STEERING LOCK)
OFF
ACC
IG2
ST
IG1
B2
B1
C/B-2 P/WINDOW SUN ROOF 30A
C-4 ELEC.IG
SRS
POWEER SEAT;Dr
POWER SEAT;ASt
RELAY; POWER WINDOW
SW;POWER WINDOW Dr (DOOR;Driver SUDE)
EARTH;BODY,LH
RELAY; OPEN
RELAY; CLOSE
OPEN
CLOSE
SUN ROOF CONT UNIT
LIMIT SW
SUN ROOF HARN CONN (SUN ROOF UNIT)
SW;SUN ROOF (SPOT LAMP)
EARTH;BODY,RH

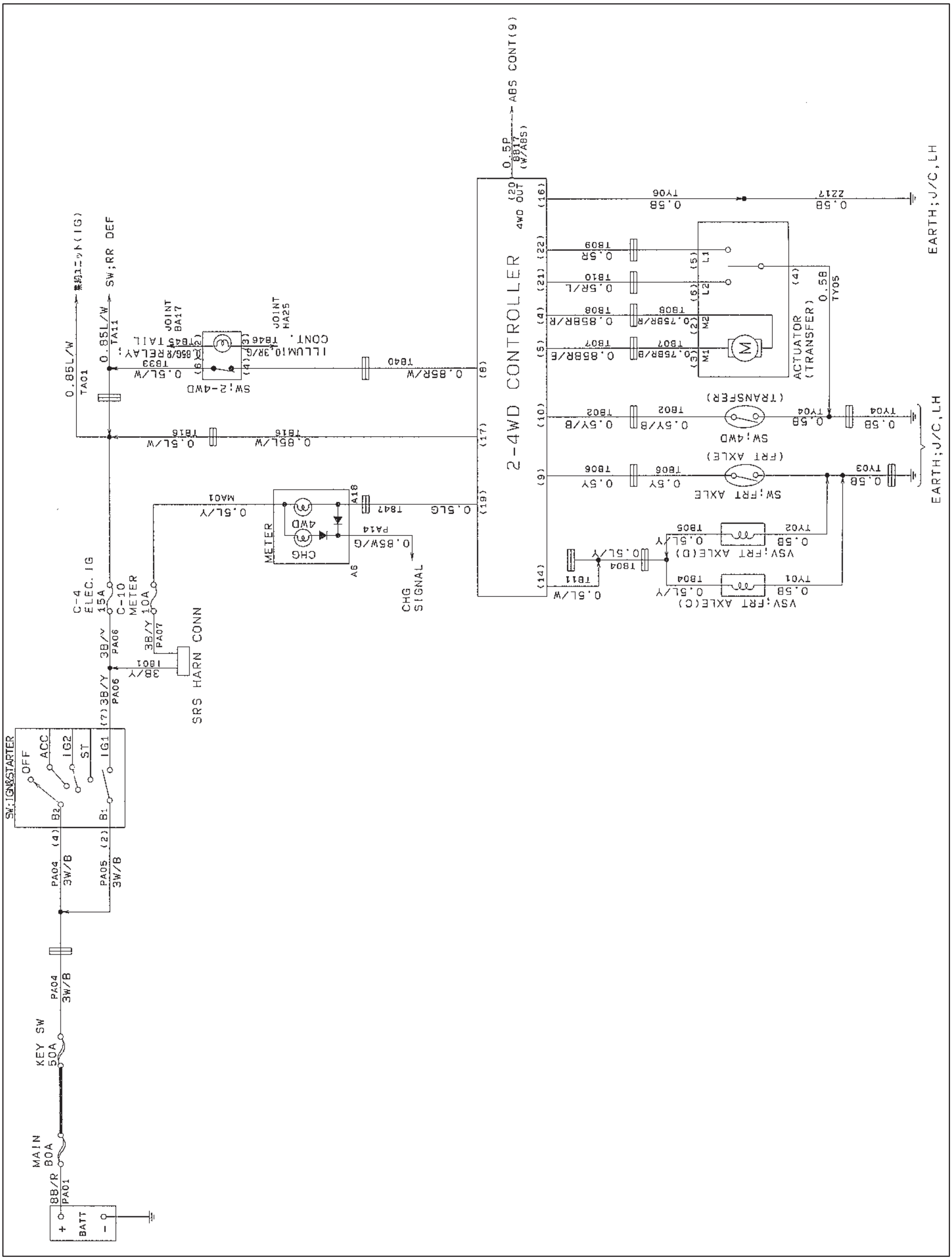
Seat Heater



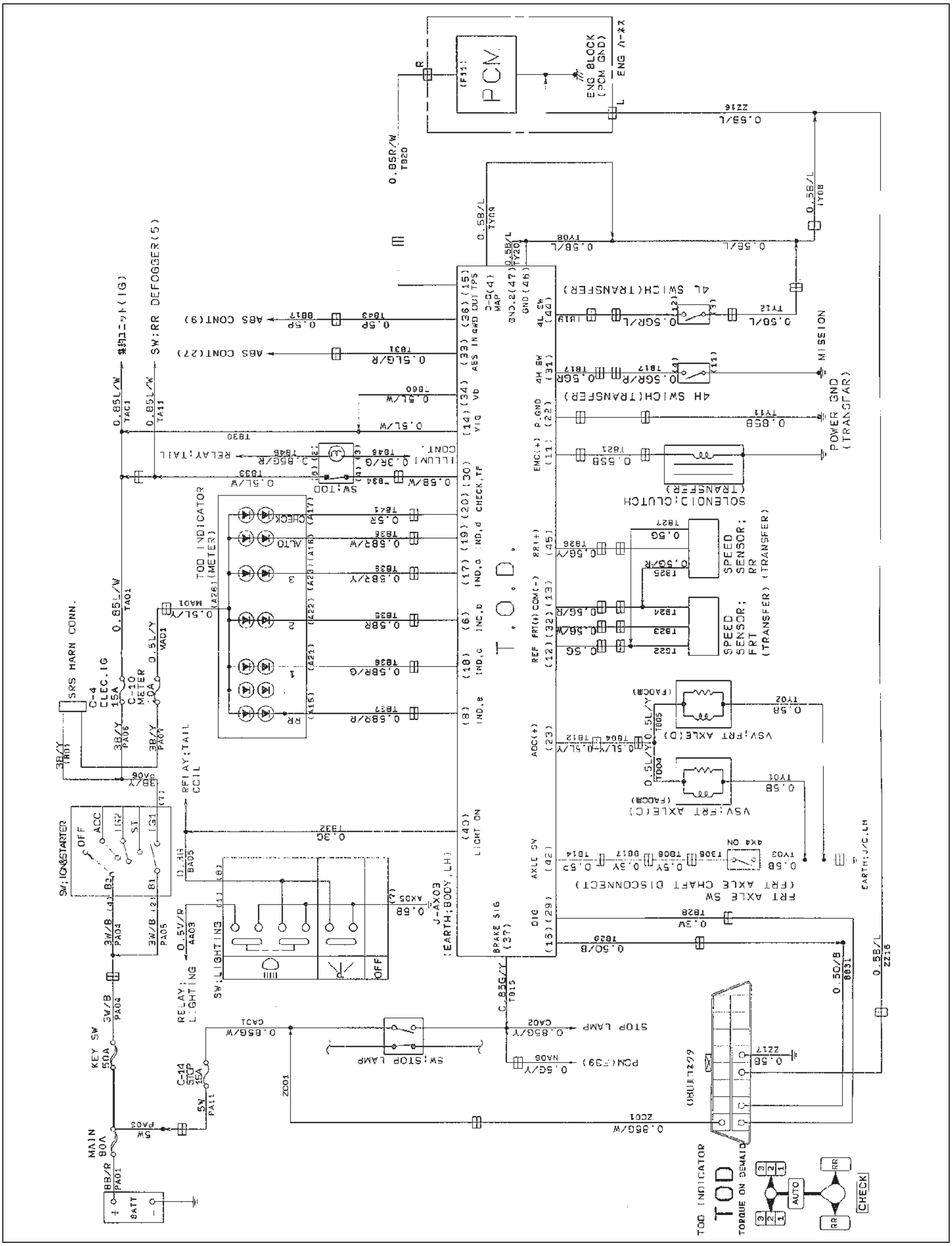
SRS–Air Bag



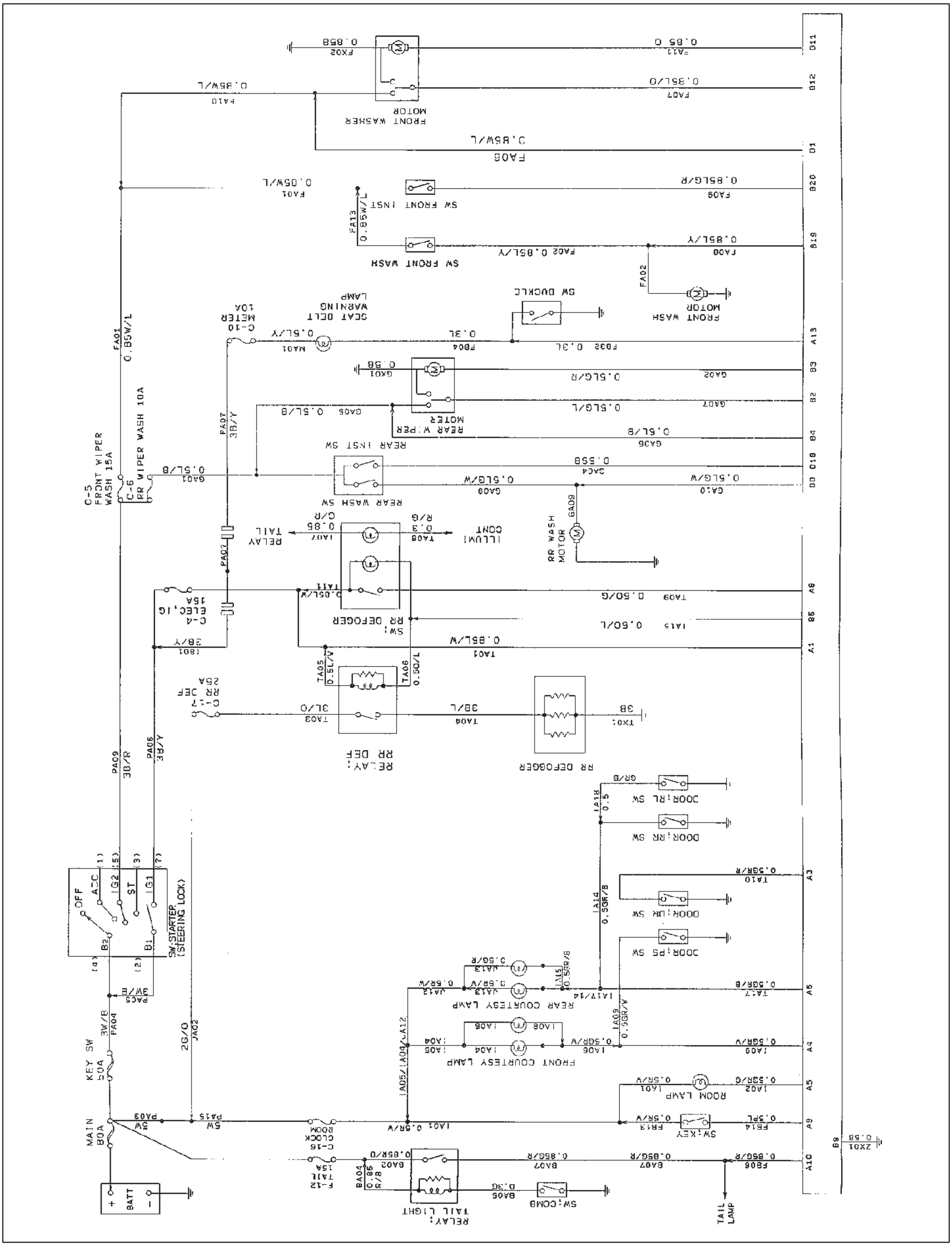
Shift on the Fly



Torque on Demand (T,O,D)



Alarm and Relay Control Unit



TROOPER

BODY AND ACCESSORIES

METER AND GAUGE

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The circuit consists of the starter switch, meter assembly, vehicle speed sensor, transmission switch, lighting switch, turn signal switch, thermo unit, oil pressure unit, Powertrain Control Module (PCM), fuel tank unit, 4WD switch, oil pressure switch, parking brake switch, brake fluid switch, seat belt switch, illumination controller, multi meter and ambient sensor.

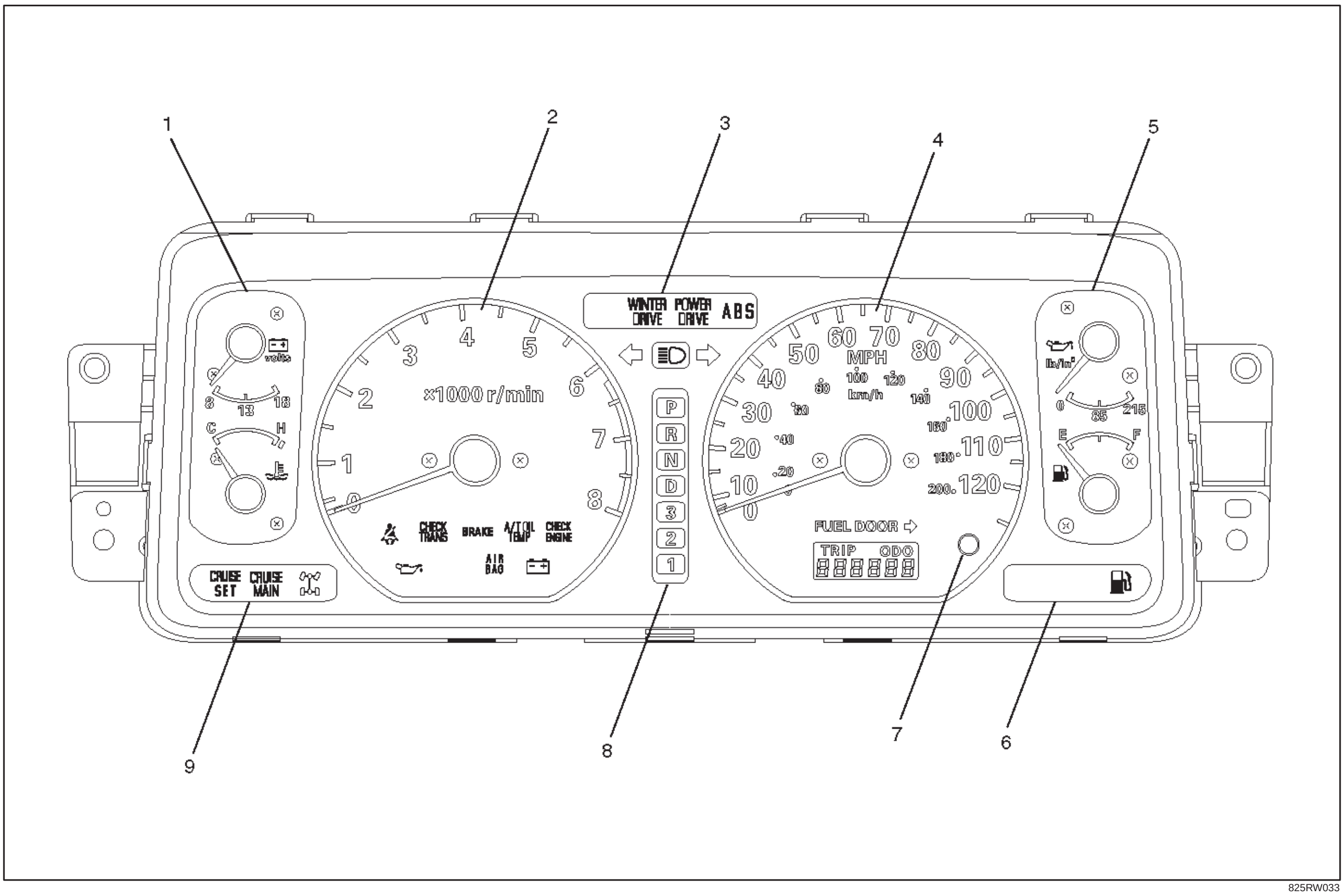
Meter Assembly

General Description

The meter assembly has the speedometer, tachometer, engine coolant temperature gauge, fuel gauge and warning/indicator lights.In addition, the meter assembly containing TOD (Torque on Demand) has the TOD indicator light, or the meter assembly not containing TOD has the voltmeter and oil pressure gauge instead of the TOD indicator.

Layout for Meters/Gauges, Warning Lights, Indicator Lights and Illumination Lights

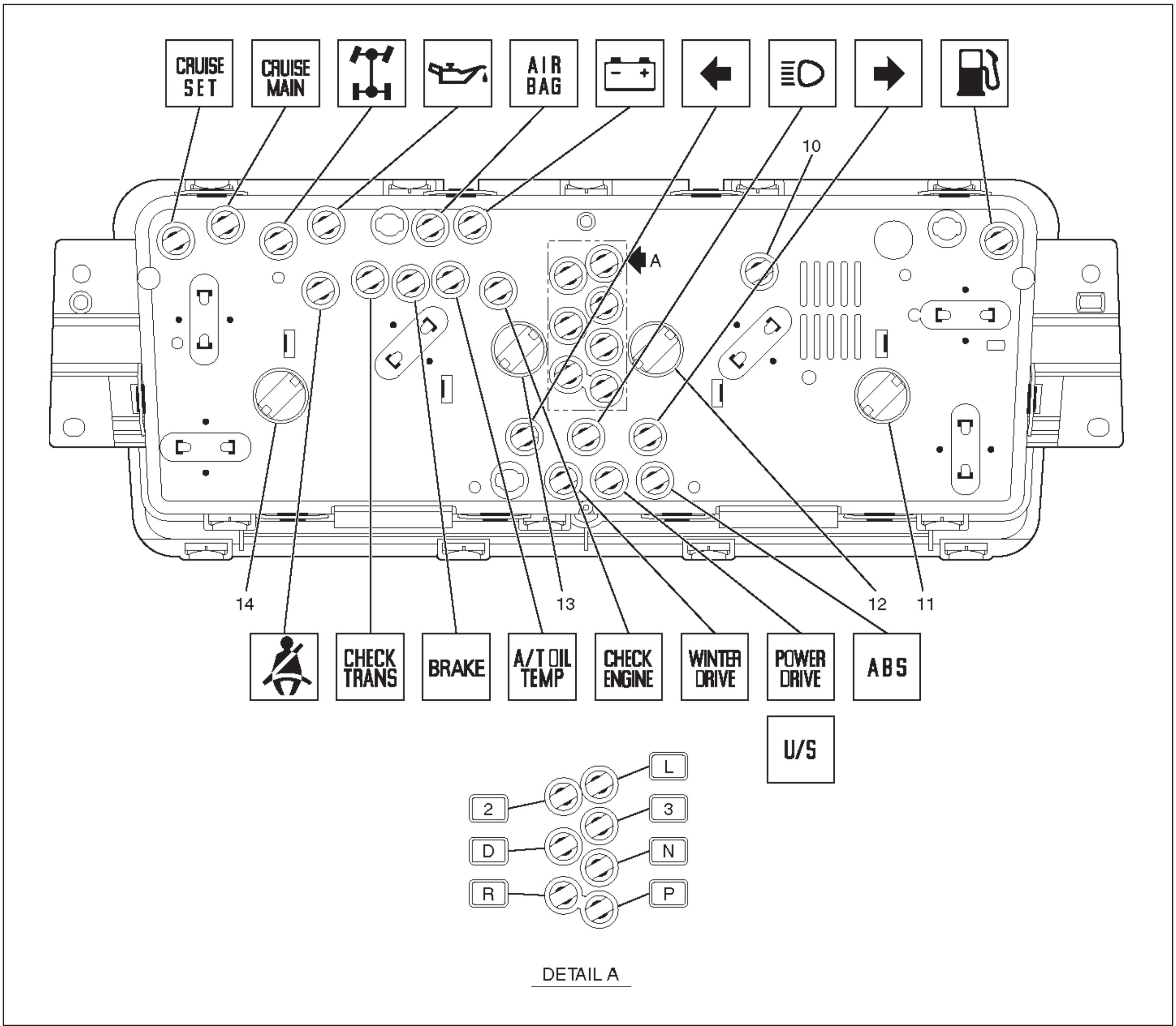
Meter Assembly W/O TOD (Front View)



Legend

(1) Voltmeter & Engine Coolant Temperature Gauge
(2) Tachometer
(3) Warning Light Lens
(4) Speedometer
(5) Oil Pressure Gauge & Fuel Gauge
(6) Warning Light Lens
(7) Reset Knob
(8) A/T Shift Indicator
(9) Warning Light Lens

Meter Assembly W/O TOD (Rear View)

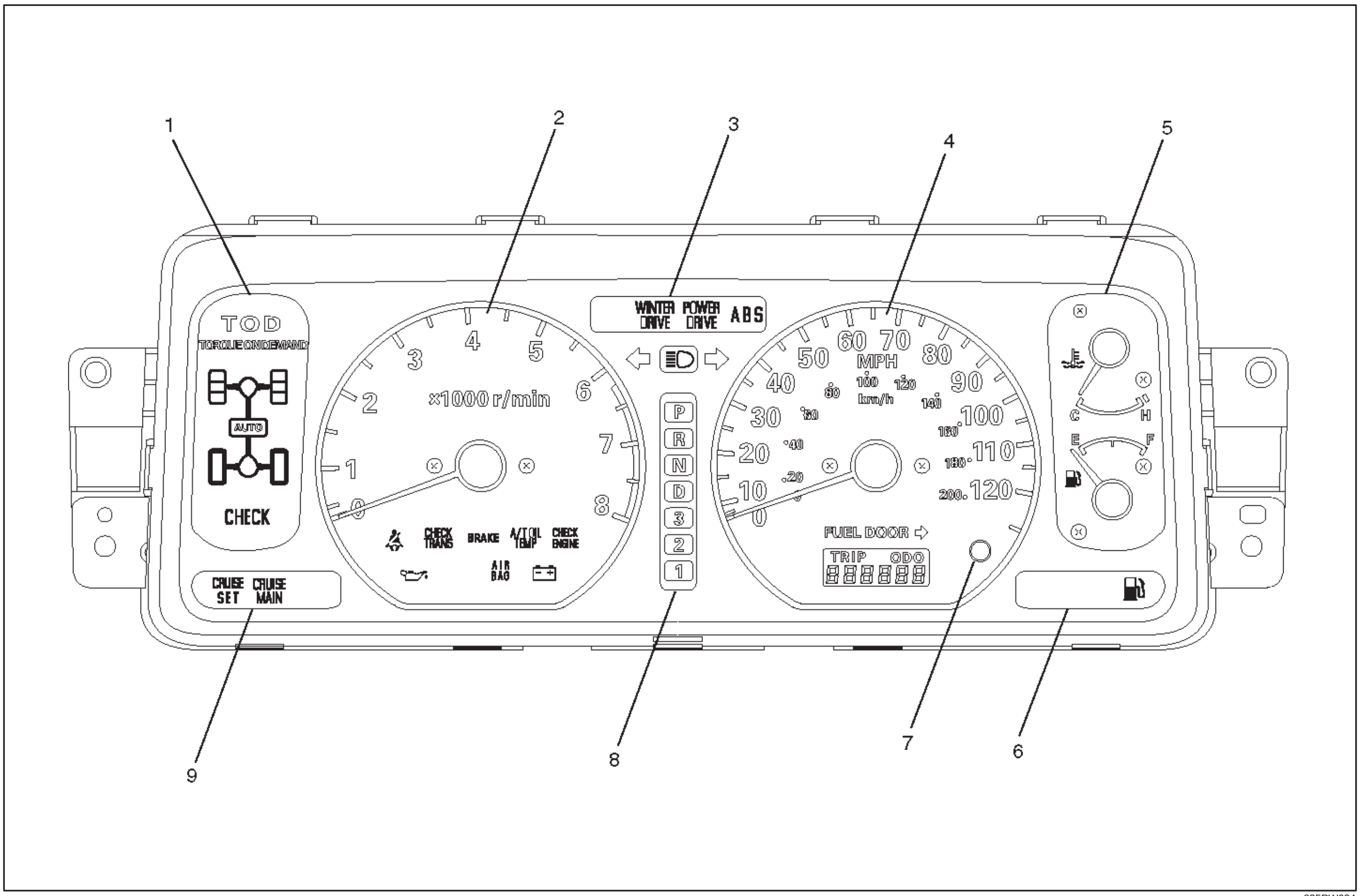


825RW038

Legend

(10) LCD Light
(11) Illumination Light
(12) Illumination Light
(13) Illumination Light
(14) Illumination Light

Meter Assembly W/TOD (Front View)

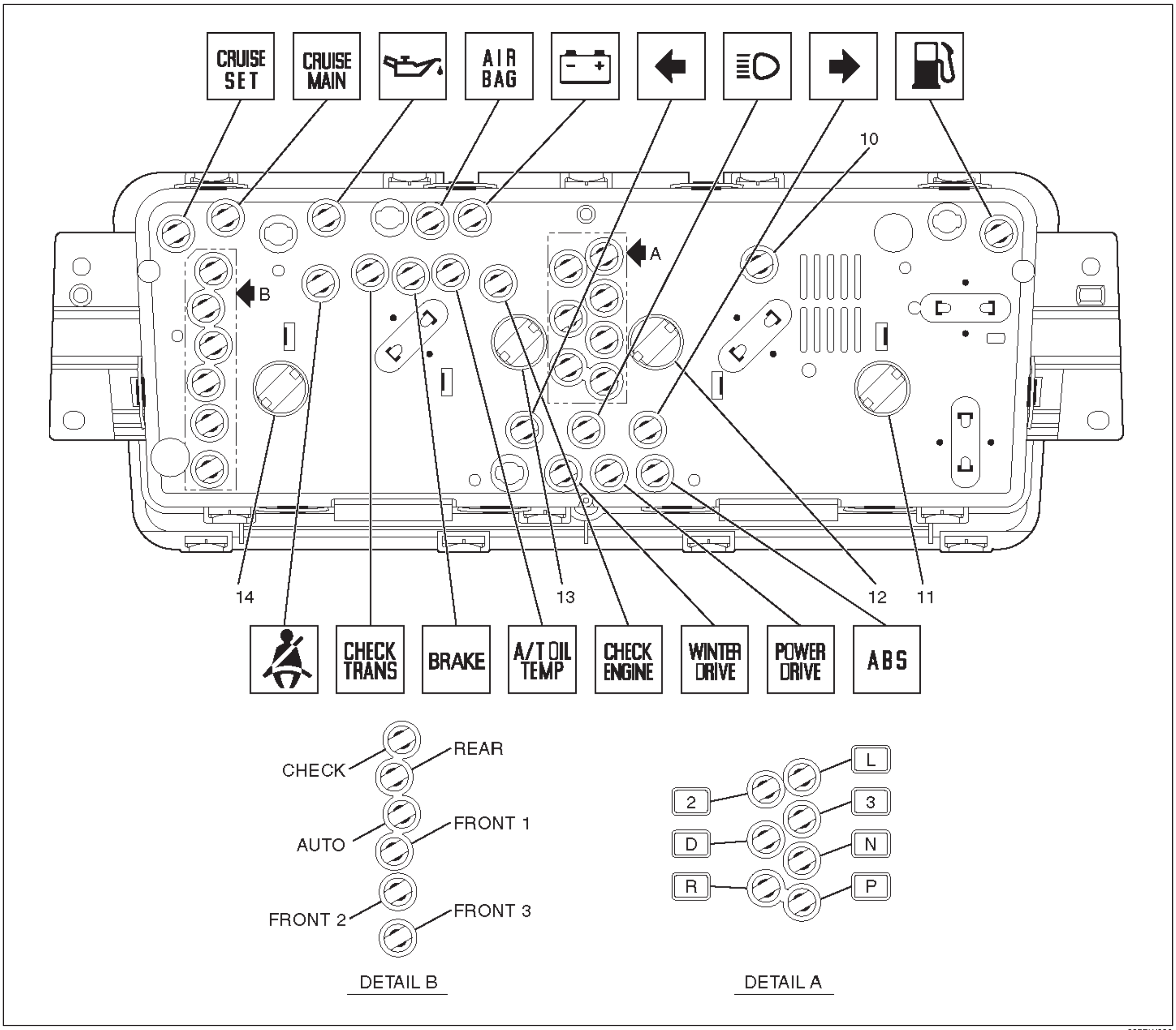


825RW034

Legend

(1) TOD Indicator
(2) Tachometer
(3) Warning Light Lens
(4) Speedometer
(5) Coolant Temperature Gauge & Fuel Gauge
(6) Warning Light Lens
(7) Reset Knob
(8) A/T Shift Indicator
(9) Warning Light Lens

Meter Assembly W/TOD (Rear View)

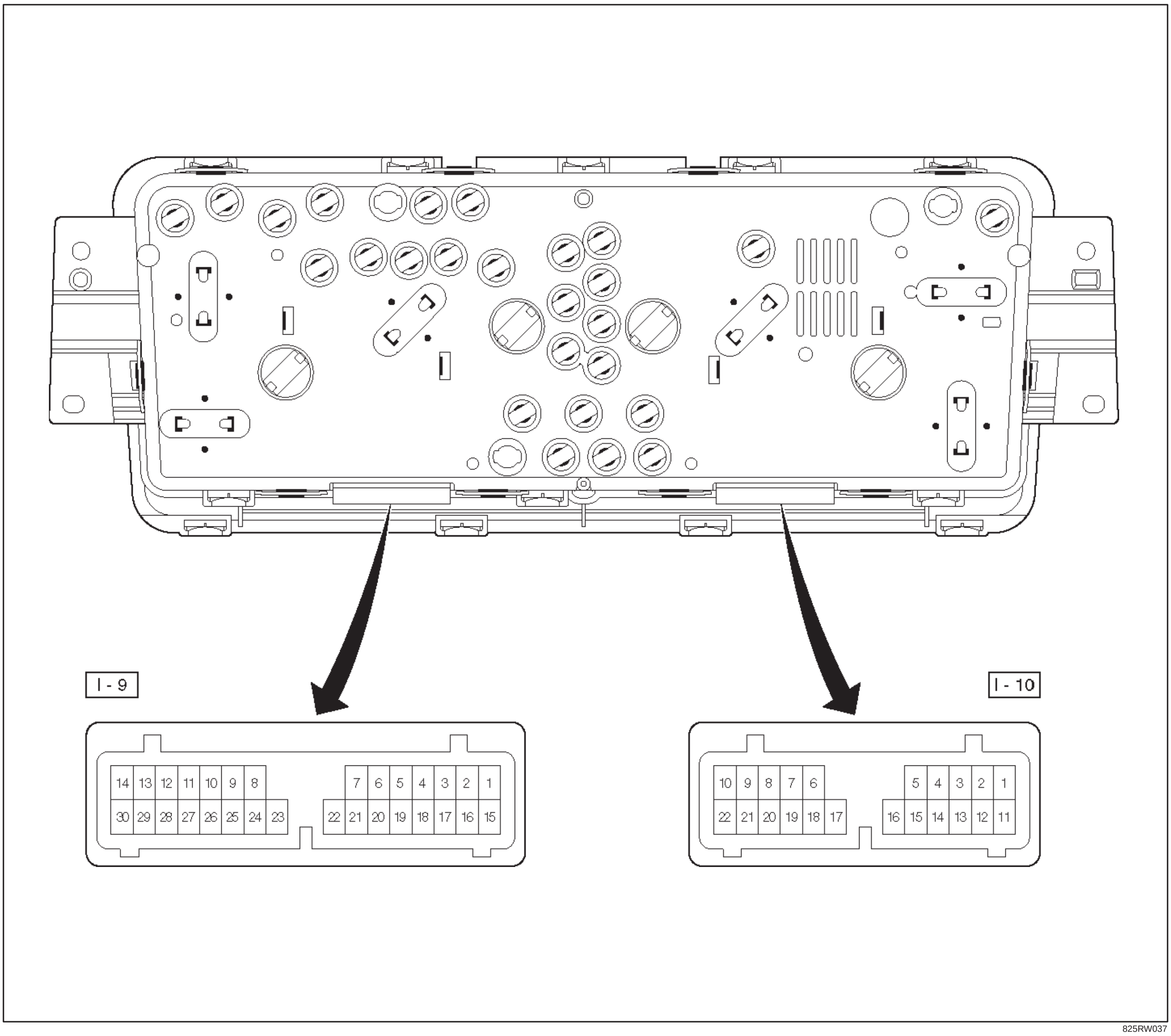


Legend

(10) LCD Light
(11) Illumination Light
(12) Illumination Light
(13) Illumination Light
(14) Illumination Light

Table for Meter/Gauge Connector Terminal Connections

Meter Assembly W/O TOD–1

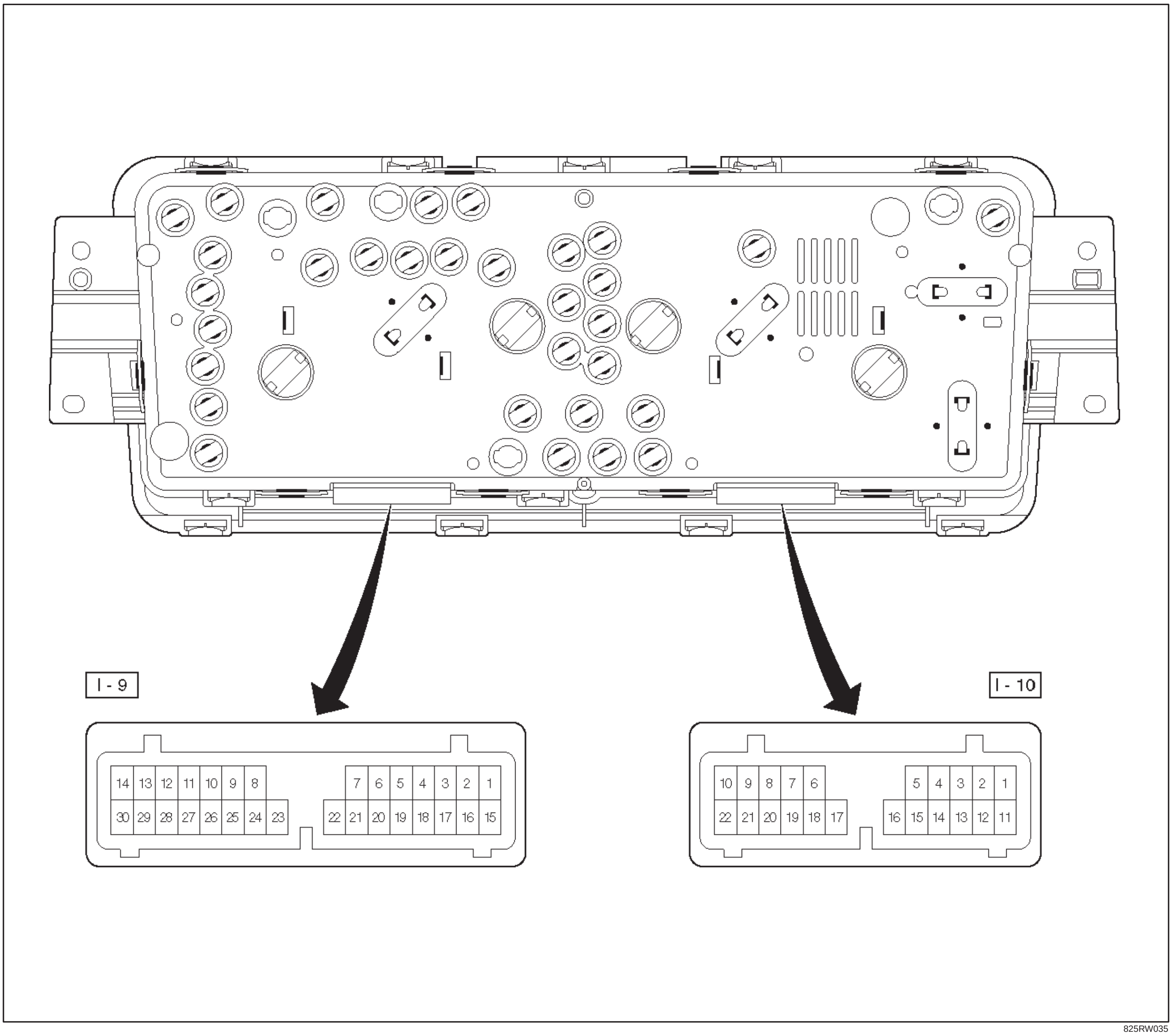


Meter Assembly W/O TOD–2

Connector No. I–9	
Terminal	**Function**
1	A/T oil temp warning light
2	Seat belt warning light
3	Check trans warning light
4	Brake warning light
5	Check engine warning light
6	Charge warning light
7	Lighting switch
8	Illumination controller
9	Tachometer
10	D position (A/T)
11	—
12	A/T shift indicator control unit
13	—
14	2 position (A/T)
15	Starter switch
16	Cruise set indicator light
17	Cruise main indicator light
18	4WD indicator light
19	Ground (Gauge)
20	—
21	Winter drive indicator light
22	Oil pressure warning light
23	—
24	Air bag warning light
25	Power drive indicator light
26	—
27	Up shift indicator light (–)
28	Turn signal indicator light (Left)
29	Up shift indicator light (+)
30	Ground (Warning)

Connector No. I–10	
Terminal	**Function**
1	Turn signal indicator light (Right)
2	L position (A/T)
3	R position (A/T)
4	Engine coolant temperature gauge
5	Speedometer
6	—
7	—
8	Battery (+)
9	—
10	—
11	P position (A/T)
12	N position (A/T)
13	3 position (A/T)
14	High-beam indicator light (–)
15	High-beam indicator light (+)
16	ABS indicator light
17	—
18	Fuel warning light
19	Oil pressure gauge
20	Fuel gauge
21	—
22	—

Meter Assembly W/TOD–1



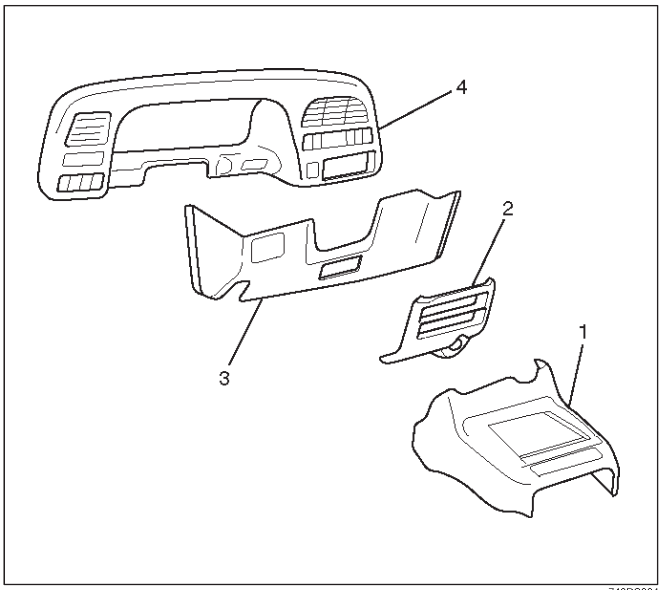
Meter Assembly W/TOD–2

Connector No. I–9	
Terminal	**Function**
1	—
2	Air bag warning light
3	A/T oil temp warning light
4	Charge warning light
5	Seat belt warning switch
6	Check trans warning light
7	Brake warning light
8	—
9	Tachometer
10	—
11	Turn signal indicator light (Left)
12	A/T shift indicator control unit
13	2 position (A/T)
14	D position (A/T)
15	Rear (TOD)
16	Auto (TOD)
17	Check (TOD)
18	Cruise set indicator light
19	Cruise main indicator light
20	Oil pressure warning light
21	Front “1” (TOD)
22	Front “2” (TOD)
23	Front “3” (TOD)
24	Lighting switch
25	Illumination controller
26	Starter switch
27	—
28	Winter drive indicator light
29	Power drive indicator light
30	—

Connector No. I–10	
Terminal	**Function**
1	Turn signal indicator light (Right)
2	L position (A/T)
3	R position (A/T)
4	Check engine warning light
5	Speedometer
6	—
7	—
8	Battery (+)
9	Engine coolant temperature gauge
10	Ground (Warning)
11	P position (A/T)
12	N position (A/T)
13	3 position (A/T)
14	High beam indicator light (–)
15	High beam indicator light (+)
16	ABS indicator light
17	—
18	Fuel warning light
19	—
20	Fuel gauge
21	Ground (Gauge)
22	—

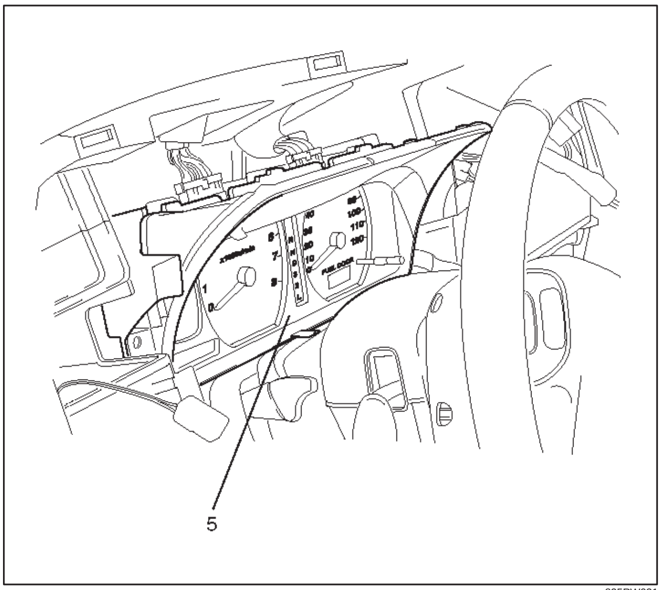
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
   Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
   Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover(3).
   Refer to the Instrument Panel Assembly in Body Structure section.



740RS004

5. Remove four fixing screws and disconnect the meter connectors to remove the meter assembly(5).



825RW031

CAUTION: The removed meter assembly should be placed upright or with its face side up.

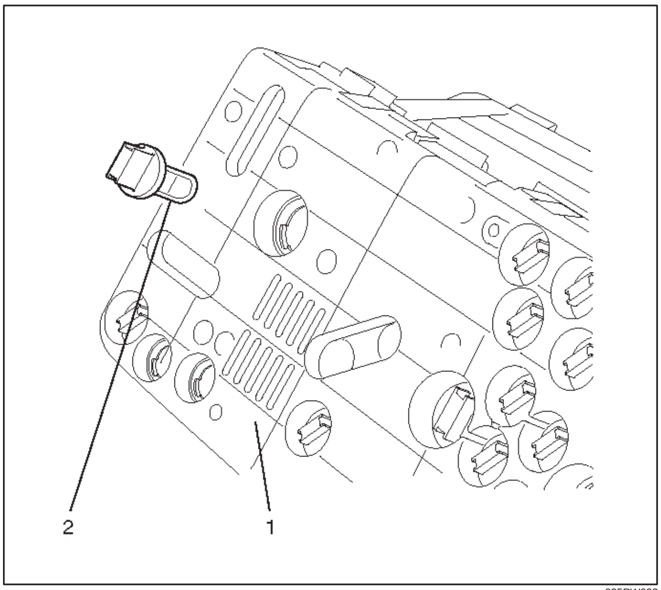
Installation

To install, follow the removal steps in the reverse order.

Warning Light Bulb, Indicator Light Bulb, Illumination Light Bulb, A/T Indicator Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the meter assembly(1).
   Refer to the Meter Assembly removal steps in this section.
3. Hold the bulb socket by hand and rotate it counterclockwise to remove the socket & bulb(2) from the meter body.



825RW032

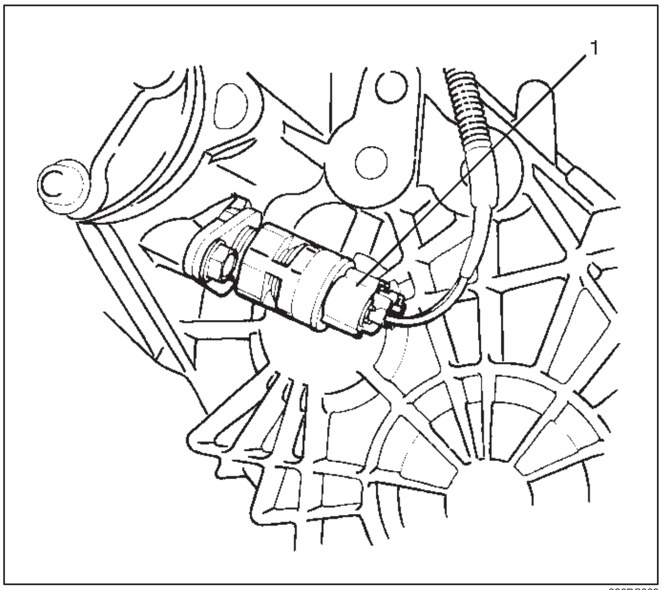
Installation

To install, follow the removal steps in the reverse order.

Vehicle Speed Sensor

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector, remove the vehicle speed sensor body by rotating it and then remove the vehicle speed sensor(1).



826RS009

Installation

To install, follow the removal steps in the reverse order, noting the following point.

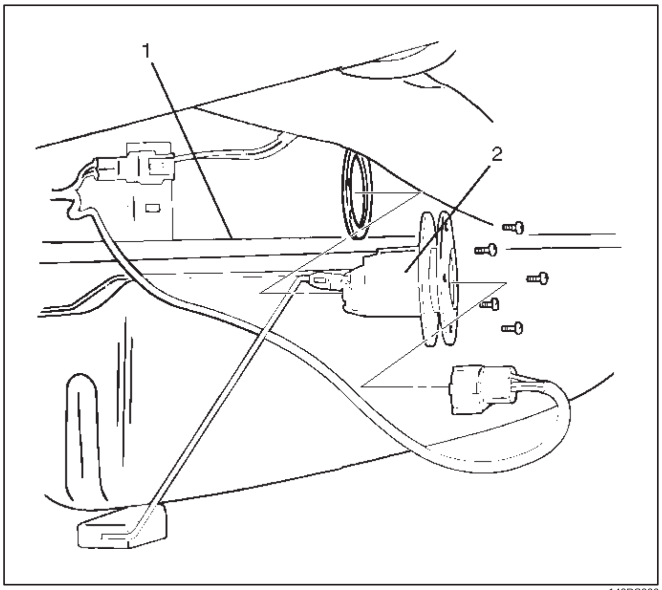
1. Tighten the vehicle speed sensor to the specified torque.

Torque: 27 N·m (20 lb ft)

Fuel Tank Unit

Removal

1. Disconnect the battery ground cable.
2. Remove the fuel tank(1).
   Refer to the Fuel Tank removal steps in Engine section
3. Disconnect the connectors, remove five screws and then remove the fuel tank unit(2).



140RS006

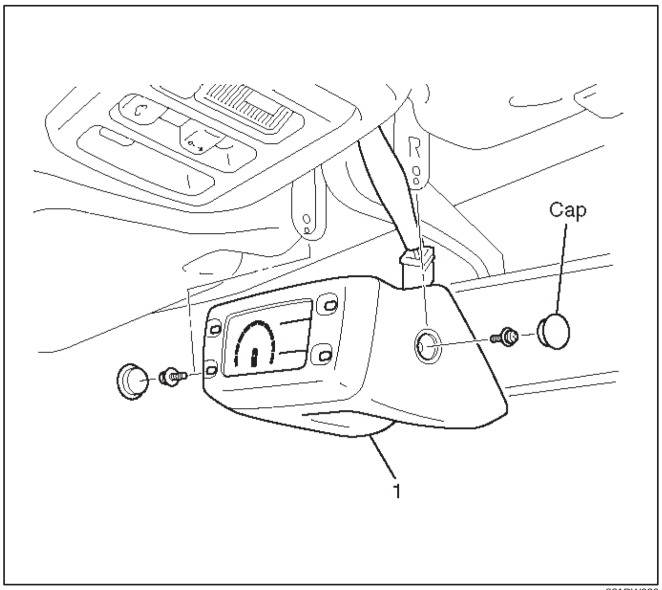
Installation

To install, follow the removal steps in the reverse order.

Multi Meter

Removal

1. Disconnect the battery ground cable.
2. Remove two caps, two screws and disconnect the connector to remove the multi meter(1).



821RW036

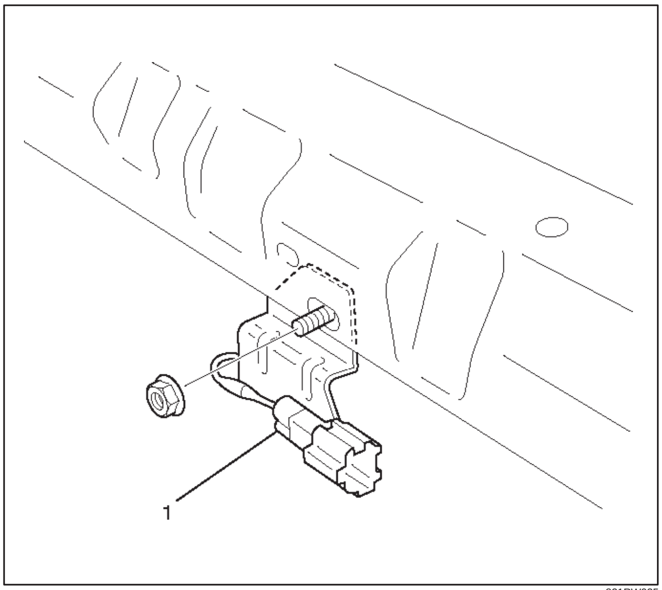
Installation

To install, follow the removal steps in the revers order.

Ambient Sensor

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector and remove the nut to remove the ambient sensor(1).



821RW035

Installation

To install, follow the removal steps in the reverse order.

Main Data and Specifications

Torque Specifications

Application	N·m	Lb Ft	Lb In
Vehicle Speed Sensor Fixing	27	20	—

TROOPER

BODY AND ACCESSORIES

BODY STRUCTURE

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

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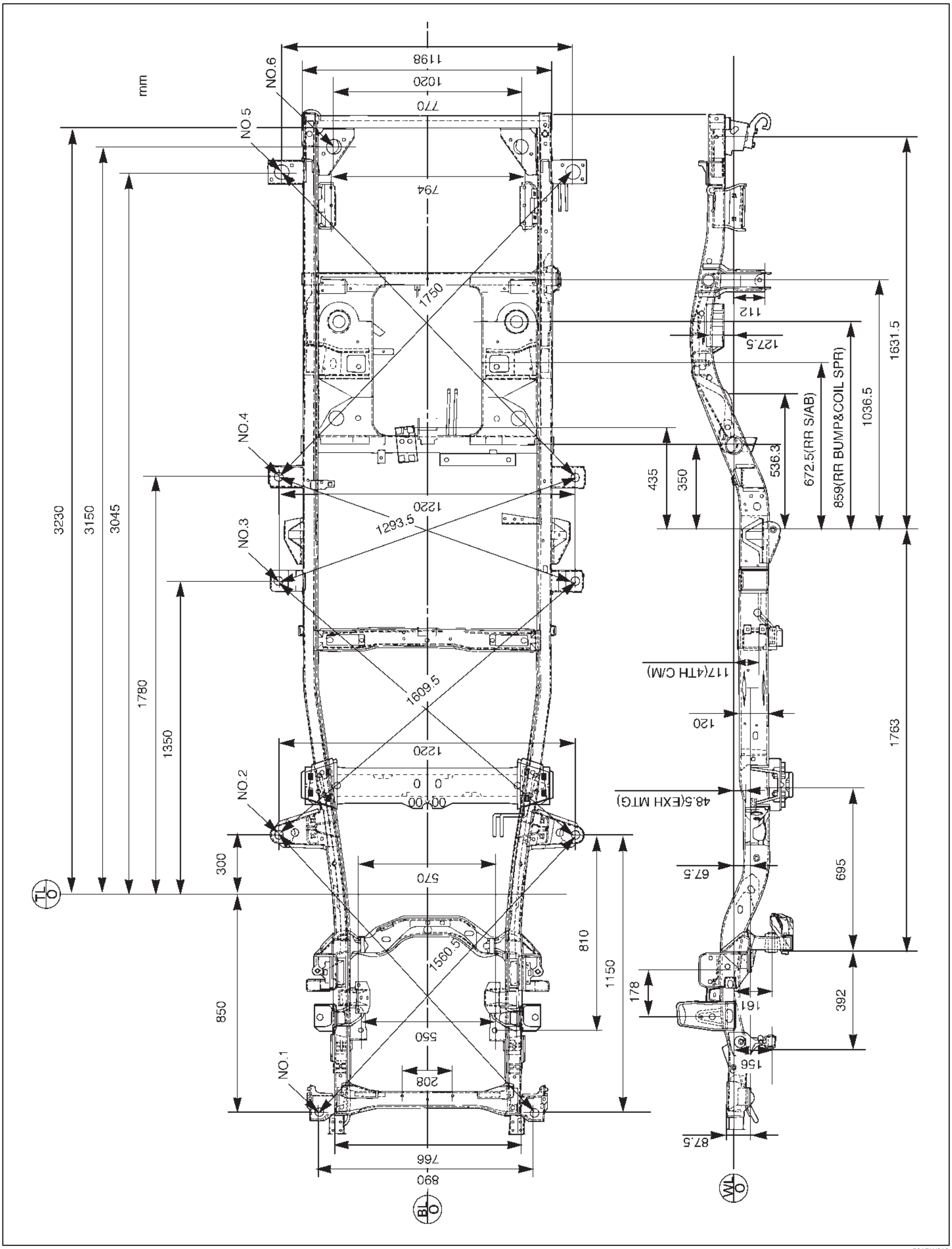
Frame

General Description

Proper frame alignment is important to assure normal vehicle life and performance of many other parts of the vehicle. If the vehicle has been involved in a fire, collision or has been overloaded, it is necessary to check the frame alignment.

Frame Dimensions



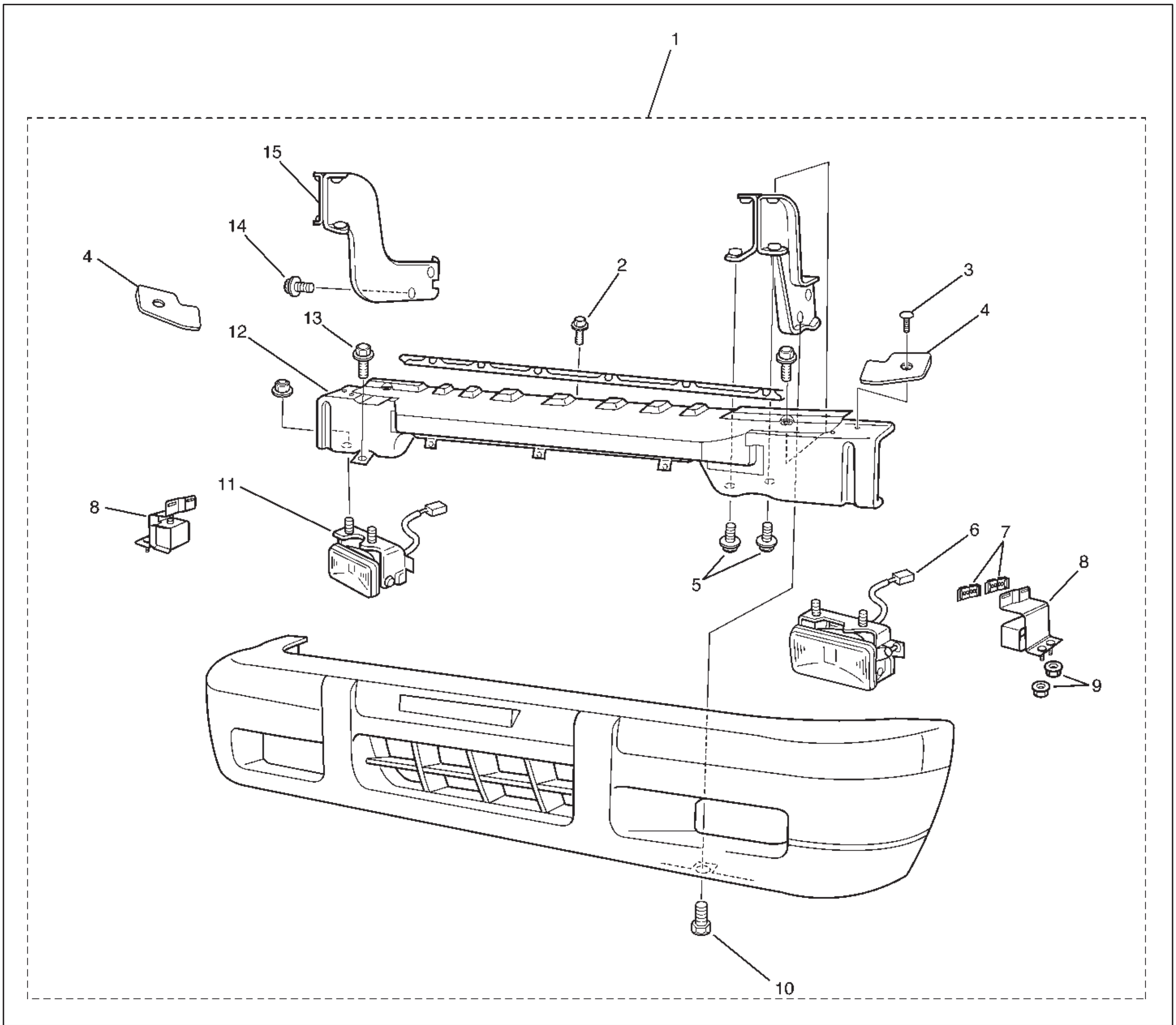
501RW013

General Description

This section describes how to remove and install front and rear bumpers. Each bumper is installed with two fixing bolts used on either side to fasten the backbar to the frame, a slider is used to fasten the bumper fascia to the fender panel. The bumpers can be removed by taking them out forward or backward after removing the two fixing bolts on either side.

Front Bumper

Parts Location



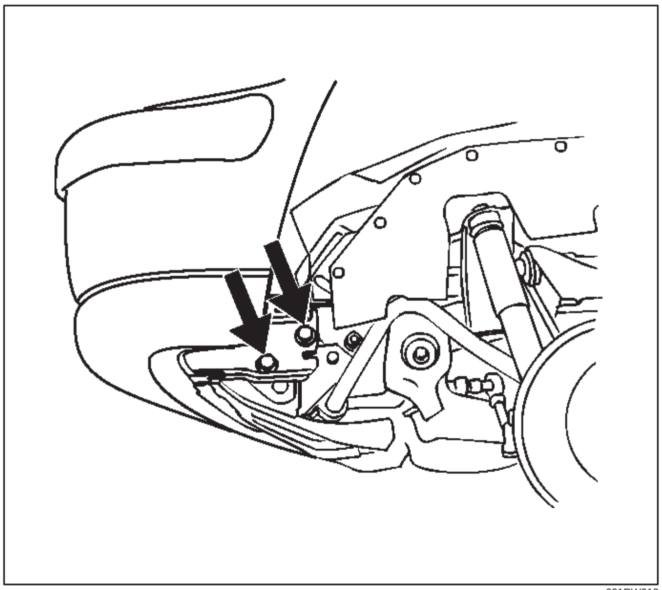
601RX001

Legend

(1) Front Bumper Assembly
(2) Front Bumper Retainer Bolt
(3) Clip
(4) Bumper Spacer Support
(5) Back Bar Fixing Bolt
(6) Front Fog Light Connector
(7) Front Bumper Slider Fixing Clip
(8) Front Bumper Slider
(9) Front Bumper Slider Fixing Nut
(10) Bumper Fascia Lower Bolt
(11) Front Fog Light Assembly
(12) Reinforce Assembly
(13) Reinforce Lower Bolt
(14) Front Bumper Fixing Bolt
(15) Back Bar

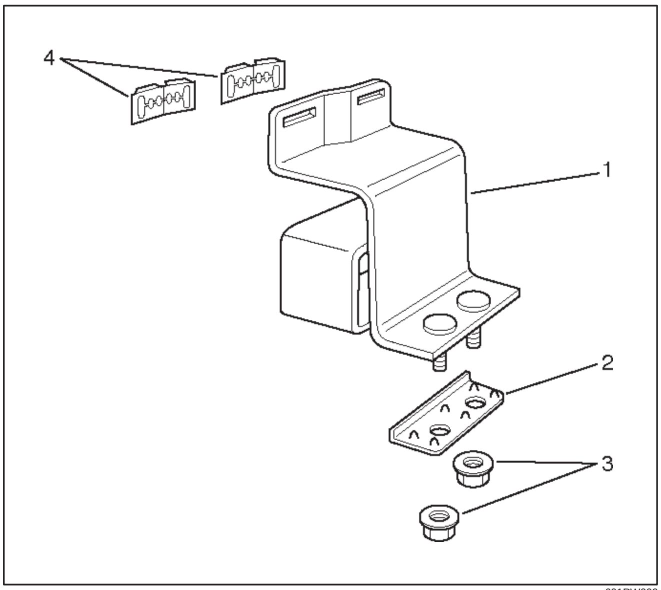
Removal

1. Remove front fog light connector.
2. Remove front bumper assembly fixing bolt.
   - Remove the two bolts from both sides of the front bumper.



601RW010

3. Remove front bumper assembly.
4. Remove bumper fascia lower bolts.
5. Remove front bumper retainer.
6. Remove reinforce lower bolts.
   - Loosen the five bolts and release claws.
7. Remove reinforce assembly.
8. Remove backbar fixing bolts.
   - Remove the four bolts at each backbar.
9. Remove front fog light assembly.
10. Remove the front bumper slider(1).
    - Remove the two clips(4) and the two nuts(3), and release the claw from the washer(2).



601RW009

Installation

To install, follow the removal steps in reverse order noting the following points:

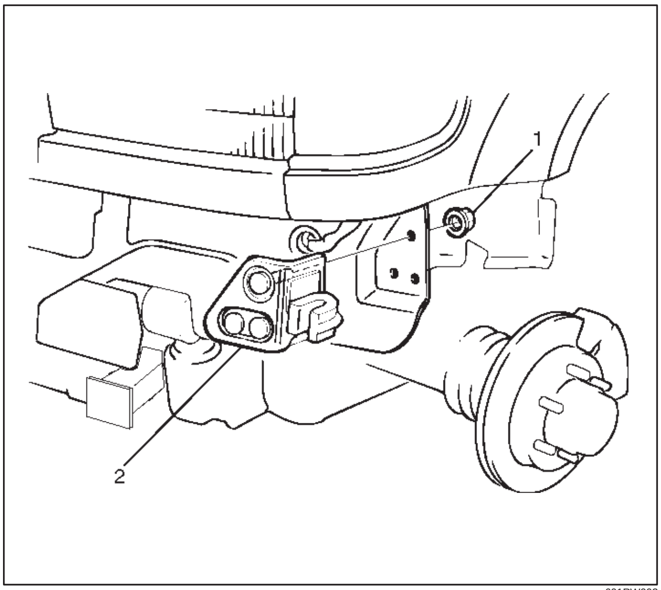
1. Tighten the front bumper assembly fixing bolts to the specified torque.

Torque: 132 N•m (98 lb ft)

Front Bumper Slider Bracket

Removal

1. Remove the Front bumper.
   - Refer to Front Bumper in this section.
2. Remove the three nuts(1) and draw out the slider bracket(2).



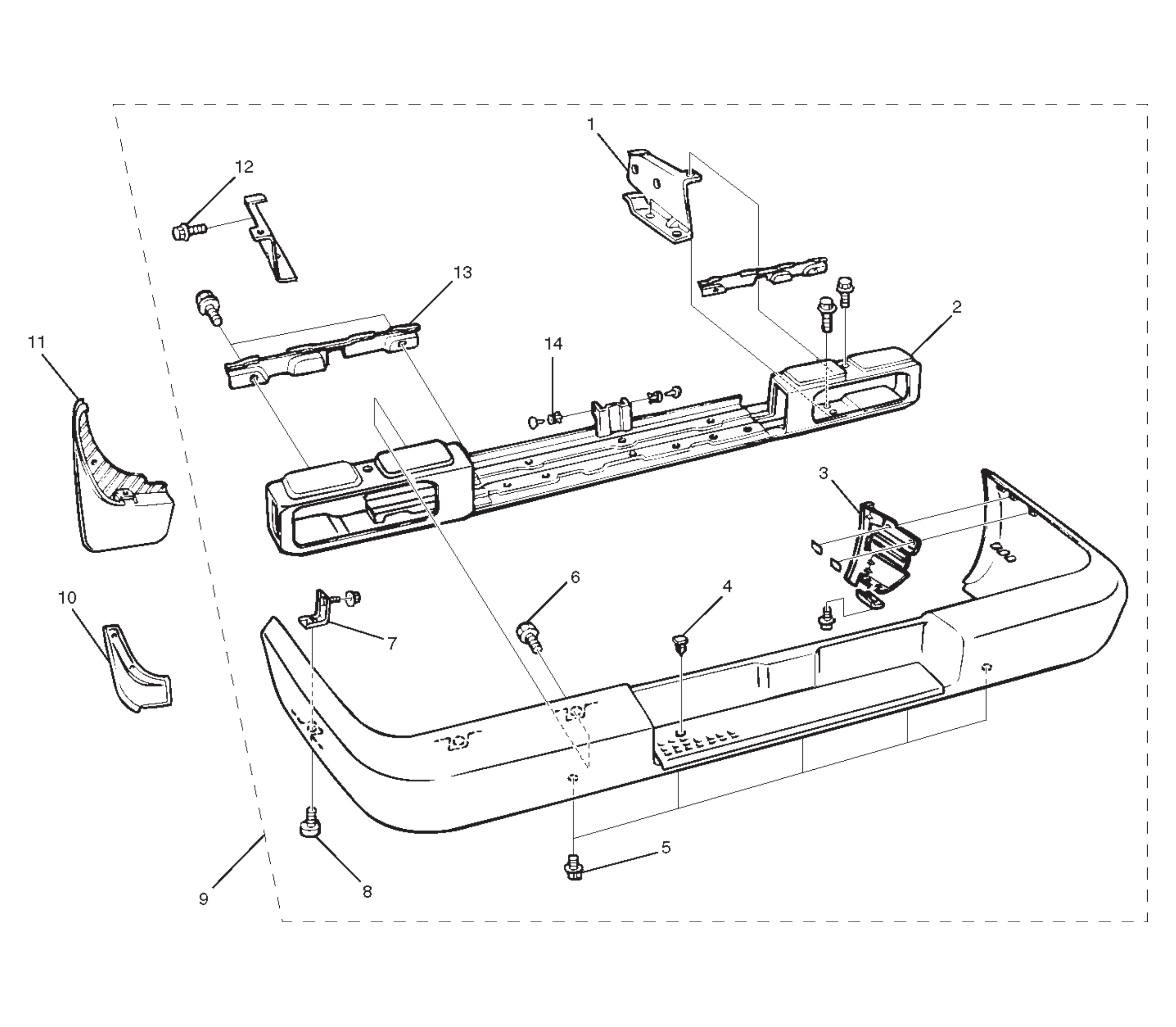
601RW003

Installation

To install, follow the removal steps in reverse order.

Rear Bumper

Parts Location



690RW001

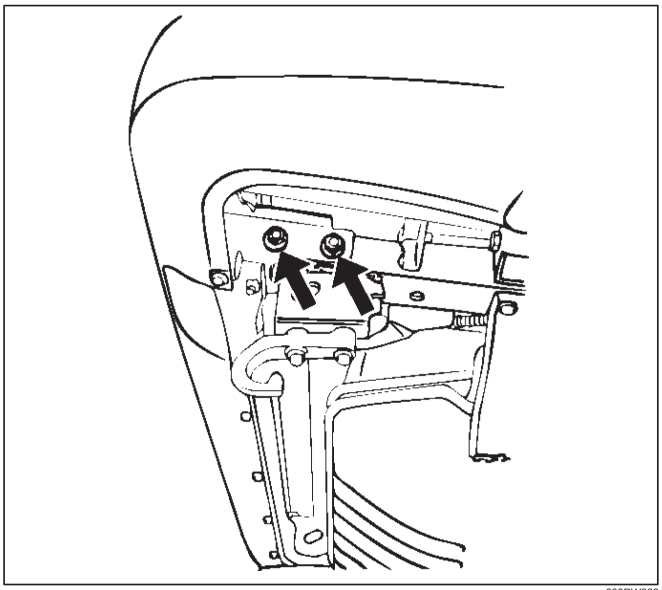
Legend

(1) Back Bars
(2) Reinforce Assembly
(3) Rear Bumper Slider Brackets
(4) Rear Step Clips
(5) Reinforce Lower Bolts
(6) Reinforce Upper Bolts
(7) Rear Bumper Fascia Brackets
(8) Rear Bumper Fascia Bracket Screws
(9) Rear Bumper Assembly
(10) Rear Bumper Side Covers
(11) Mud Flaps
(12) Rear Bumper Assembly Fixing Bolts
(13) Rear Bumper Retainers
(14) Clips

Removal

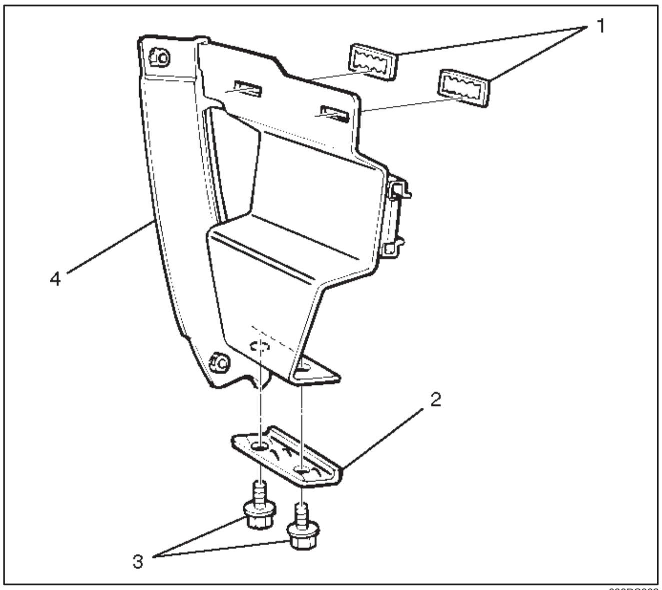
1. Remove rear bumper side covers.
2. Remove mud flaps.
   - Remove three screws.
3. Remove bumper fascia bracket screws.

4. Remove rear bumper assembly fixing bolts.
   - Remove two bolts from each side.



690RW002

5. Remove rear bumper assembly.
6. Remove rear bumper retainers.
7. Remove reinforce upper bolts.
   - Remove the rear bumper retainer from each side, and then remove two upper bolts.
8. Remove reinforce lower screws.
9. Remove clips.
10. Remove rear step clips.
11. Remove reinforce assembly.
    - Pull out both ends of the bumper fascia and take out the reinforce assembly.
12. Remove backbars.
    - Remove the three bolts from each backbar.
13. Remove rear bumper slider brackets(4).
    - Remove the two clips(1) and two screws(3), and then remove claw caught in the washer(2).



690RS003

14. Remove bumper fascia brackets.
    - Remove the fixing nut on the back side of the fender panel.

Installation

To install, follow the removal steps in reverse order noting the following points:

1. Tighten the front bumper assembly fixing bolts to the specified torque.

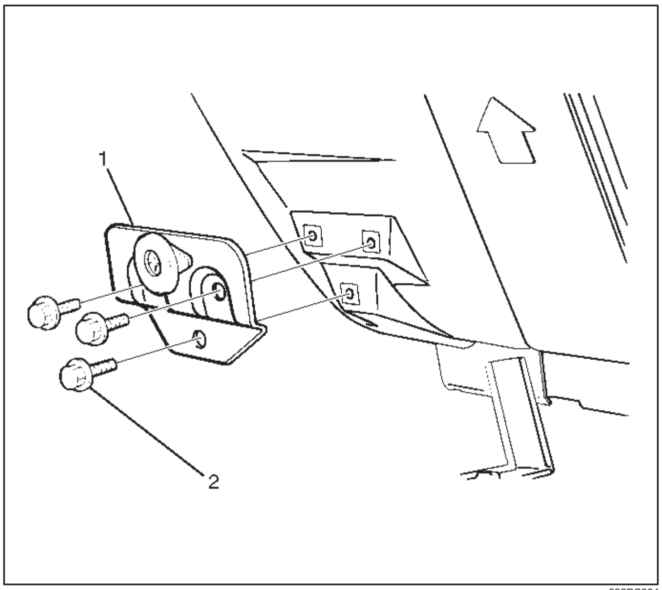
   Torque: 132 N•m (98 lb ft)

2. Apply chassis grease to the slider and the slider bracket moving surface.

Rear Bumper Slider

Removal

1. Remove the rear bumper.
   - Refer to Rear Bumper in this section.
2. Remove the three bolts (2).
3. Remove rear bumper slider (1).



690RS004

Installation

To install, follow the removal steps in reverse order noting the following points:

1. Apply chassis grease to the slider and the slider bracket moving surface.

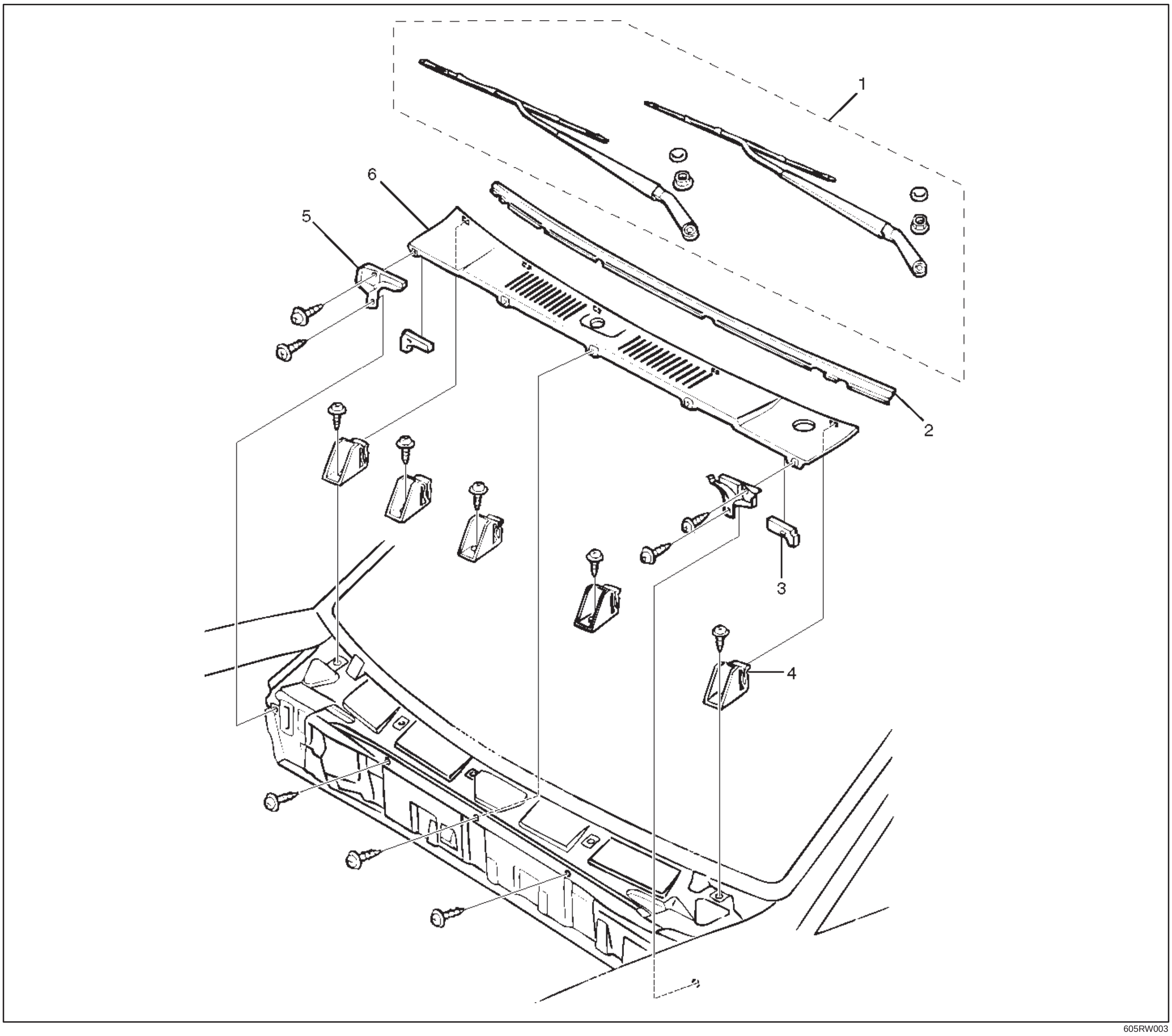
General Description

This section includes items of front end sheet metal that are attached by bolts, screws or clips and related accessory components.

Anti-corrosion materials have been applied to the interior surfaces of some metal panels to provide rust resistance. When servicing these panels, areas on which this material has been disturbed should be properly recoated with service-type anti-corrosion material.

Cowl Cover

Parts Location



Legend

(1) Front Wiper Arms
(2) Front Window Lower Molding
(3) Cowl Cover Seals
(4) Cowl Cover Stoppers
(5) Cowl Cover Brackets
(6) Cowl Cover

Removal

1. Open the hood.
2. Support the hood.
3. Remove front wiper arms.
   - Refer to Windshield Wiper Arm/Blade in Wiper/Washer System section.
4. Remove front window lower molding.

5. Remove cowl cover brackets.
   - Disconnect two screws each side.
6. Remove cowl cover.
   - Disconnect three screws.
7. Remove cowl cover seals.
8. Remove cowl cover stoppers.

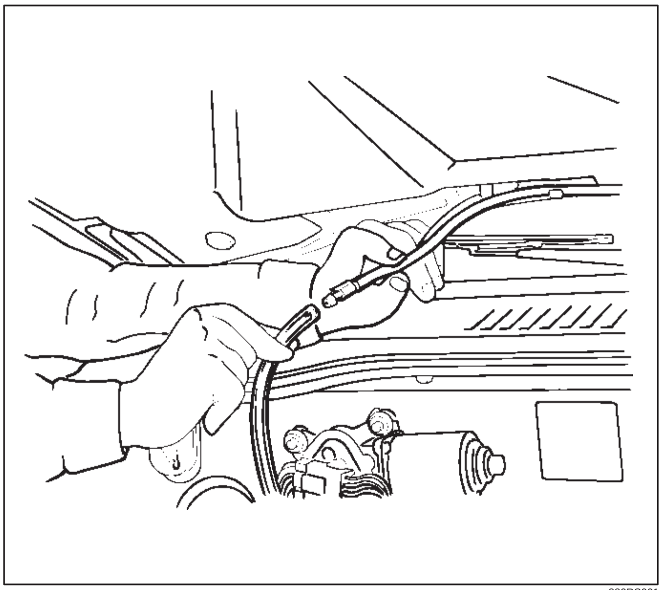
Installation

To install, follow the removal steps in reverse order.

Engine Hood

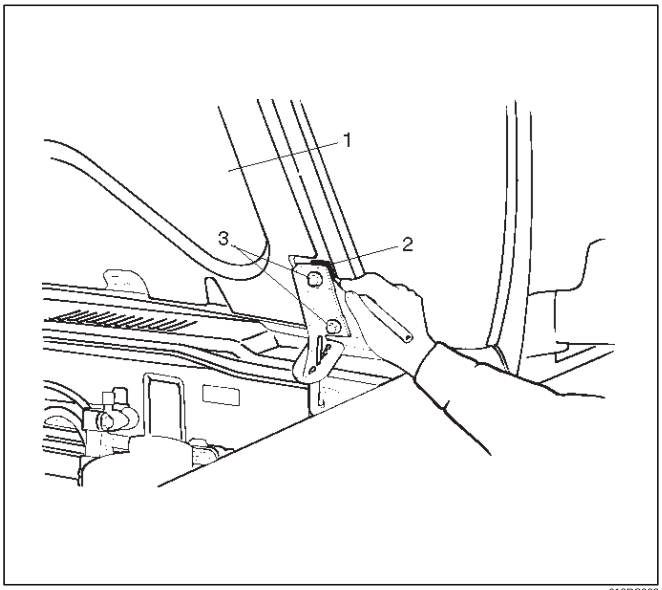
Removal

1. Open the hood.
2. Support the hood.
3. Remove windowshield washer nozzle tube.



880RS001

4. Remove hood hinge bolts (3).
   - Before removing the hinges from the Engine hood (1), scribe a mark (2) showing location of the hinges to facilitate installation in the original position.



610RS003

5. Remove engine hood.

Installation

To install, follow the removal steps in the reverse order noting the following points:

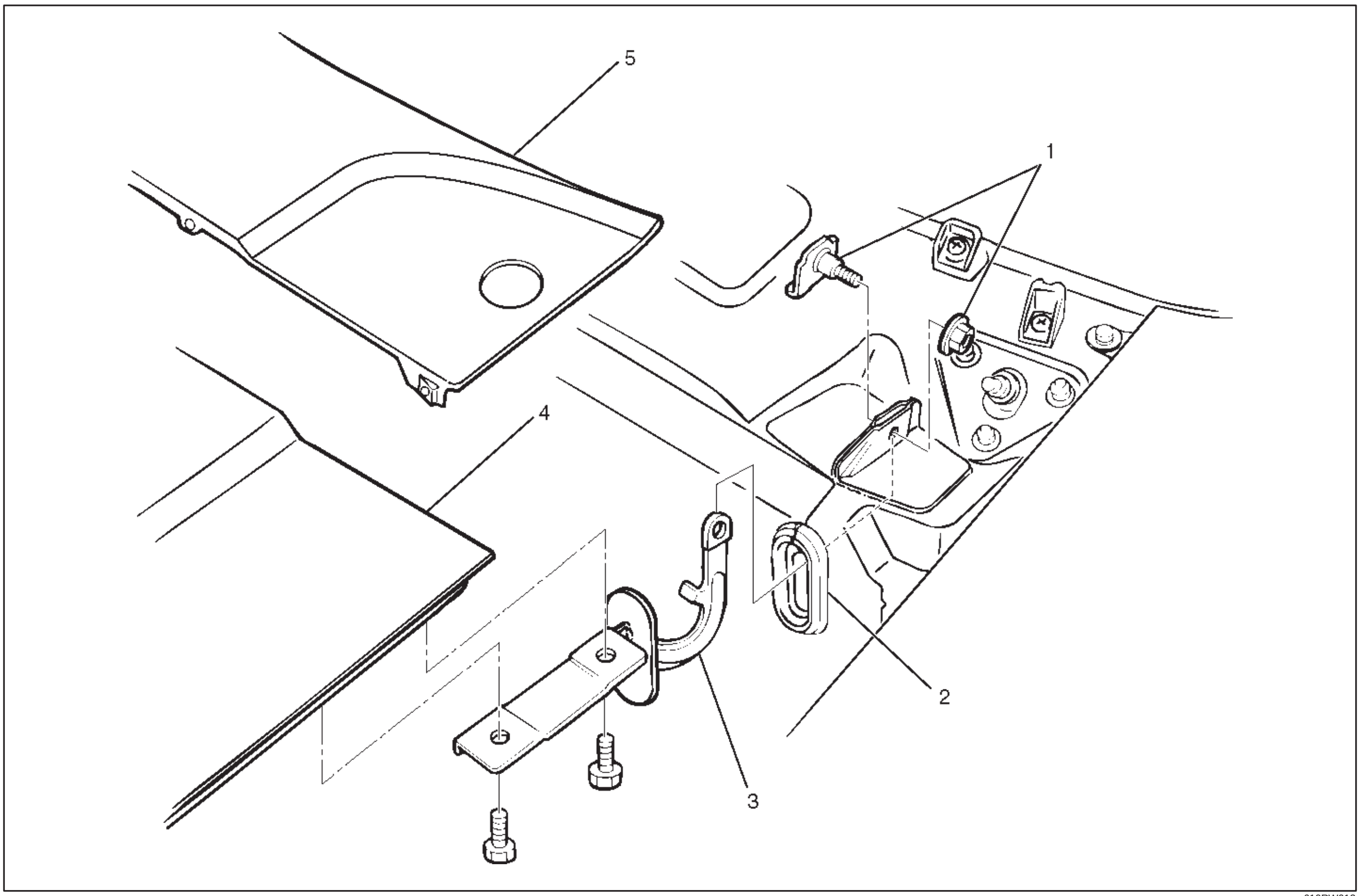
1. Tighten the engine hood fixing bolts to the specified torque.

   Torque: 13 N•m (113 lb in)

2. Adjust the engine hood mounting gap with reference to Body Dimension in this section.
3. Check and see if the engine hood lock operates normally.

Engine Hood Hinge

Parts Location



610RW012

Legend
(1) Hinge Fixing Bolts And Nuts
(2) Hood End Seal
(3) Engine Hood Hinge
(4) Engine Hood
(5) Cowl Cover

Removal

1. Remove cowl cover.
   - Refer to Cowl Cover in this section.
2. Remove engine hood.
   - Refer to Engine Hood in this section.
3. Remove hinge fixing bolt and nut.
4. Remove engine hood hinge.
5. Remove hood end seal.

Installation

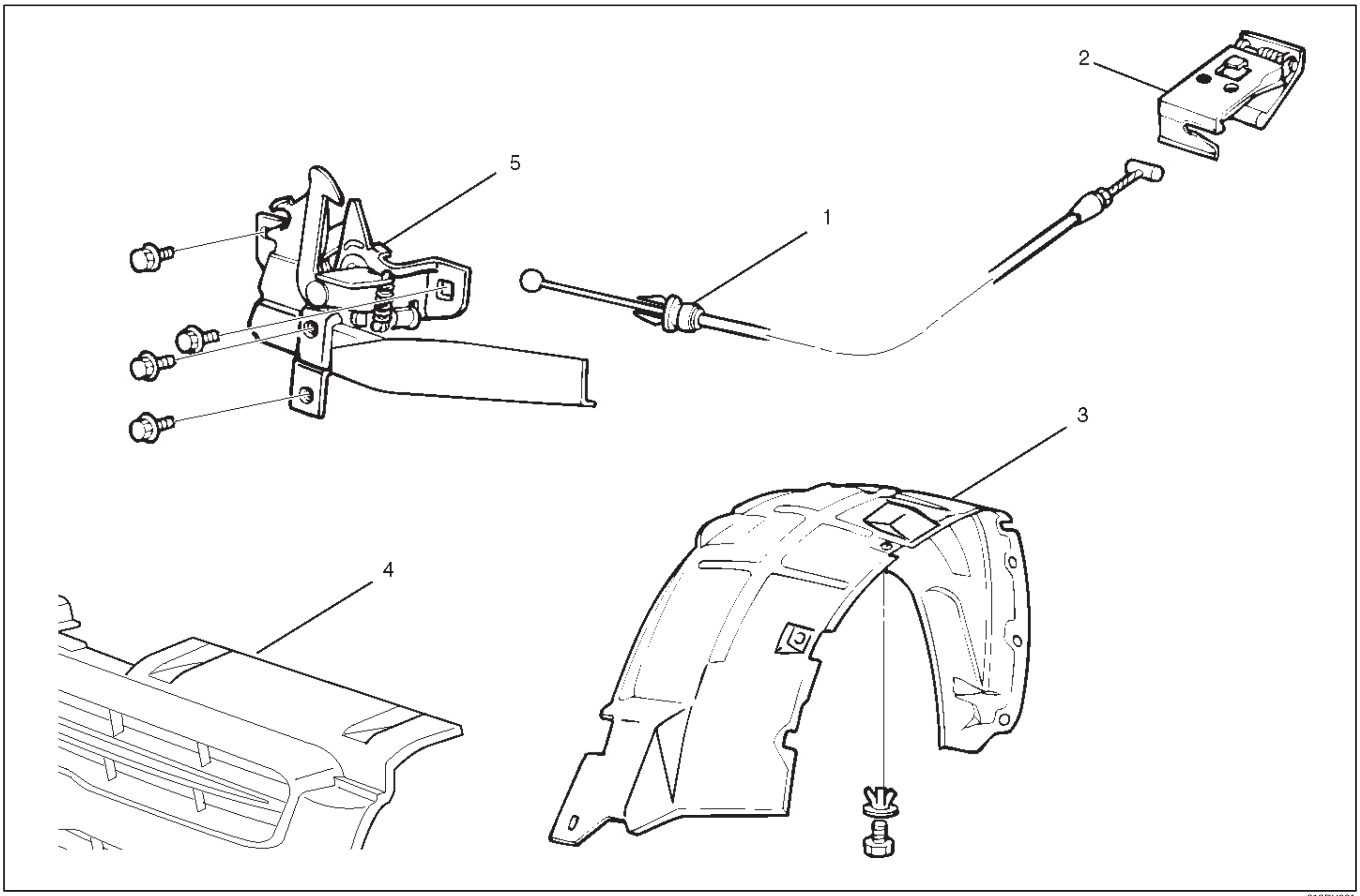
To install, follow the removal steps in reverse order noting the following points:

1. Tighten the hood hinge fixing bolt and nut to the specified torque.

   Torque 13 N•m (113 lb in)

Engine Hood Lock

Parts Location

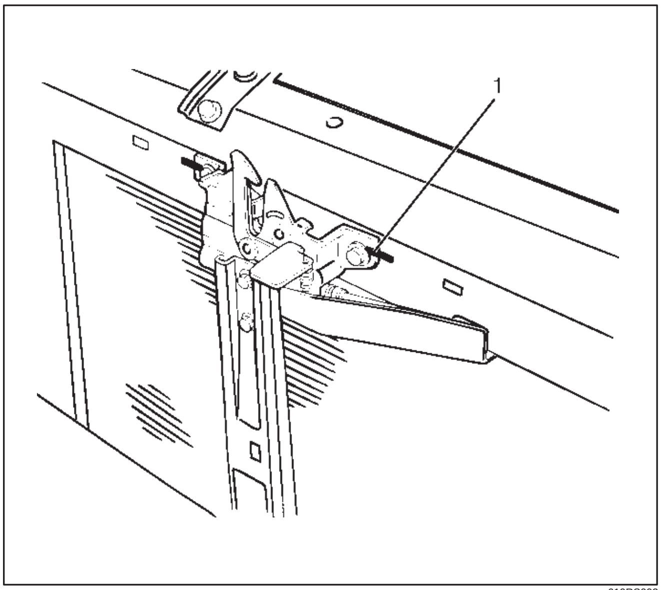


610RY001

Legend
(1) Control Cable
(2) Hood Lock Control Lever
(3) Inner Liner
(4) Radiator Grille
(5) Engine Hood Lock Assembly

Removal

1. Remove hood lock control lever.
2. Remove inner liner.
3. Remove control cable.
   - Remove the cable fixing clips from the body panel.
4. Remove radiator grille.
   - Refer to Radiator Grille And Front End Lower Panel in this section.
5. Remove engine hood lock assembly.
   - Apply setting marks (1) to the hood lock assembly and the body prior to removal.



610RS002

Installation

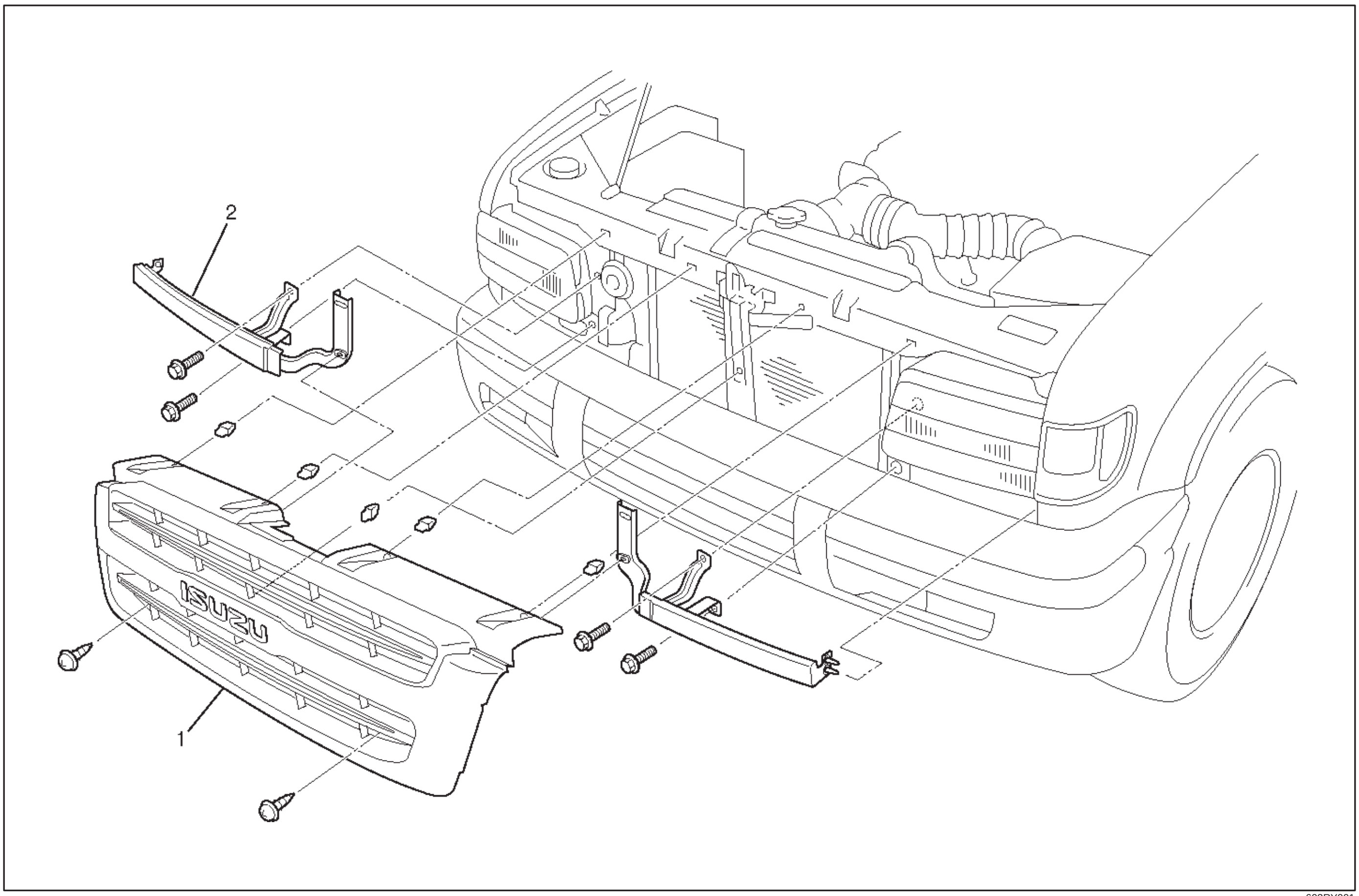
To install, follow the removal steps in reverse order noting the following points:

1. Reroute the control cable to its original position, and check and see if the lock assembly and control lever work normally.
2. Tighten the hood lock assembly fixing bolts to the specified torque.

Torque : 10 N•m (87 lb in)

Radiator Grille And Front End Lower Panel

Parts Location



603RY001

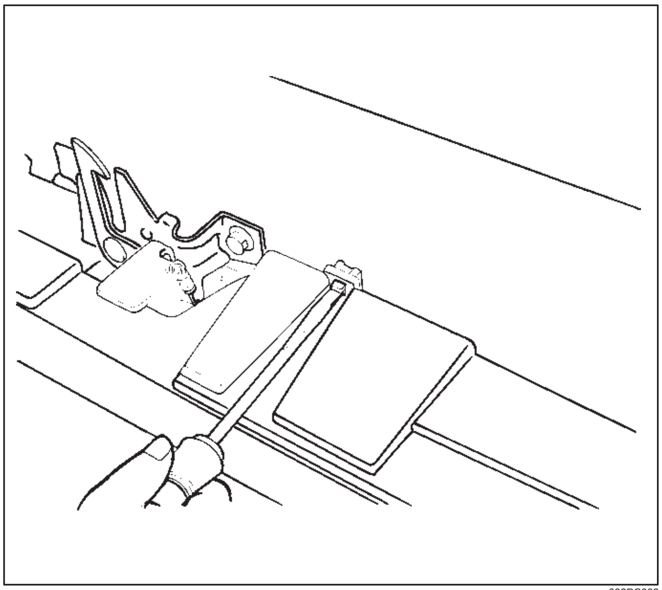
Legend

(1) Radiator Grille
(2) Front End Lower Panel

Removal

1. Open the hood.
2. Support the hood.

3. Remove radiator grille.
   - Raise the five clips on the radiator grille and remove two screws.



603RS002

4. Remove front end lower panel.
   - Remove two fixing bolts and remove the panel from the fender.

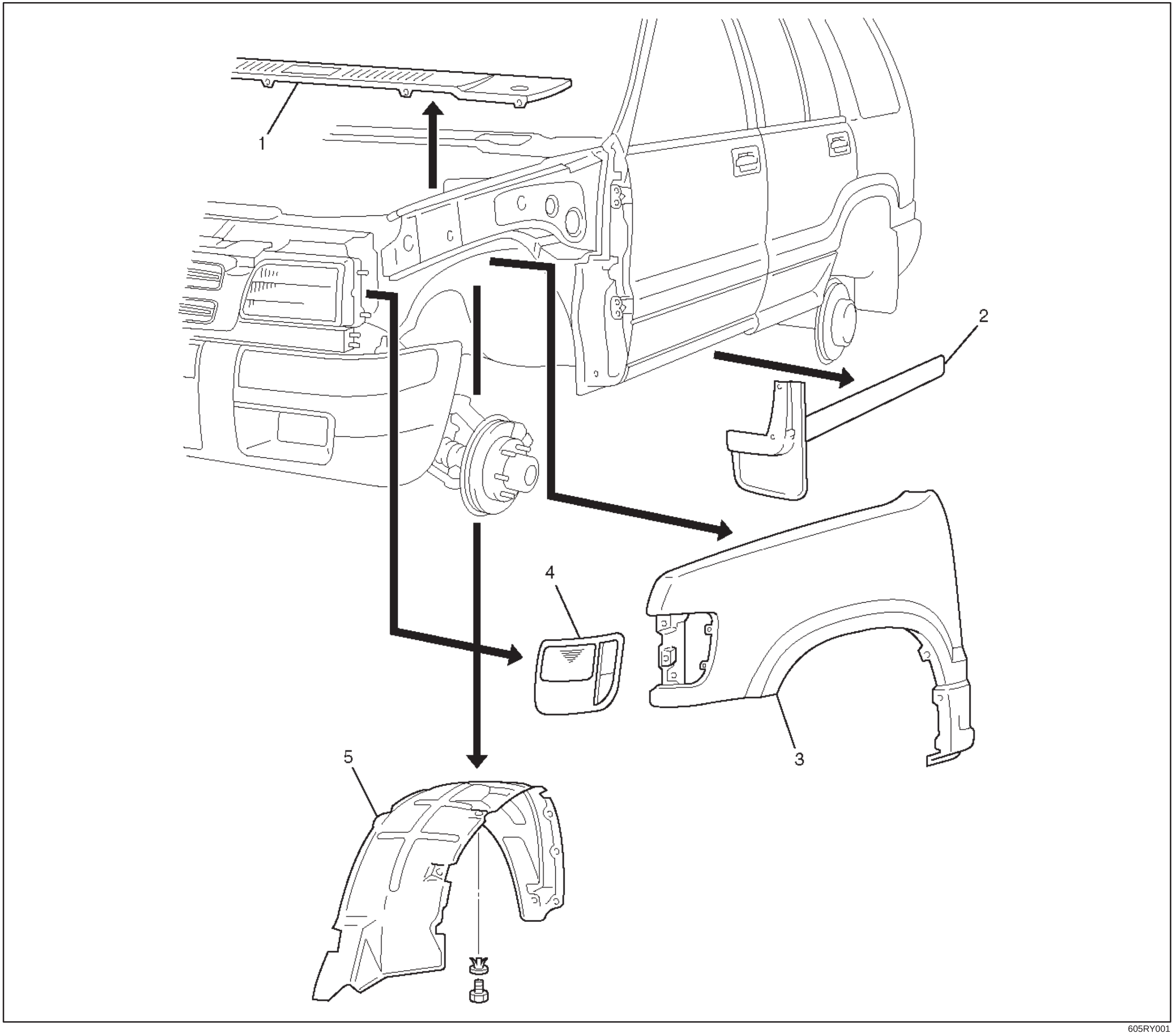
Installation

To install, follow the removal steps in reverse order, noting the following point.

1. Install the radiator grille clips remaining on the body side in the radiator grille, and then install the radiator grille on the body.

Front Fender Panel

Parts Location

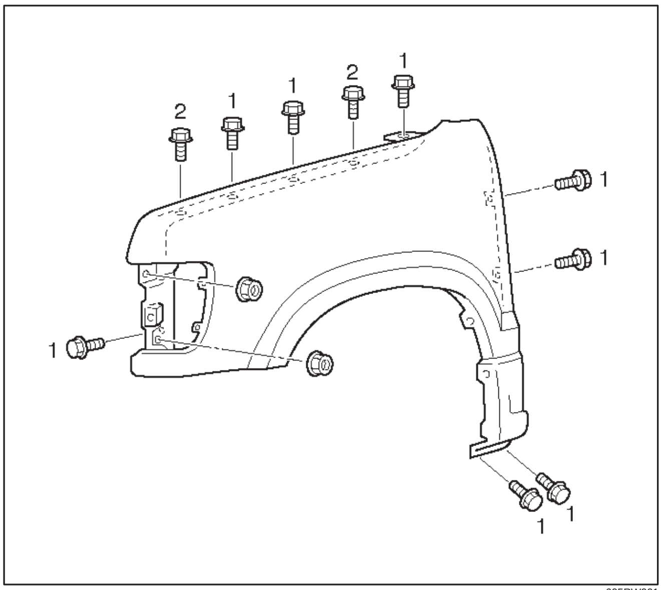


Legend
(1) Cowl Cover
(2) Front Mud Flap
(3) Front Fender Panel
(4) Front Combination Lamp Assembly
(5) Inner Liner

Removal

1. Open the hood.
2. Support the hood.
3. Remove cowl cover.
   - Refer to Cowl Cover in this section.
4. Remove front combination lamp assembly.
   - Disconnect fixing screw and connector.
5. Remove front mud flap.
   - Disconnect three fixing screws and four clips.
6. Remove inner liner.

7. Remove front fender panel.
   - Disconnect ten fixing bolts and two nuts.



605RW001

Installation

To install, follow the removal steps in the reverse order noting the following points:

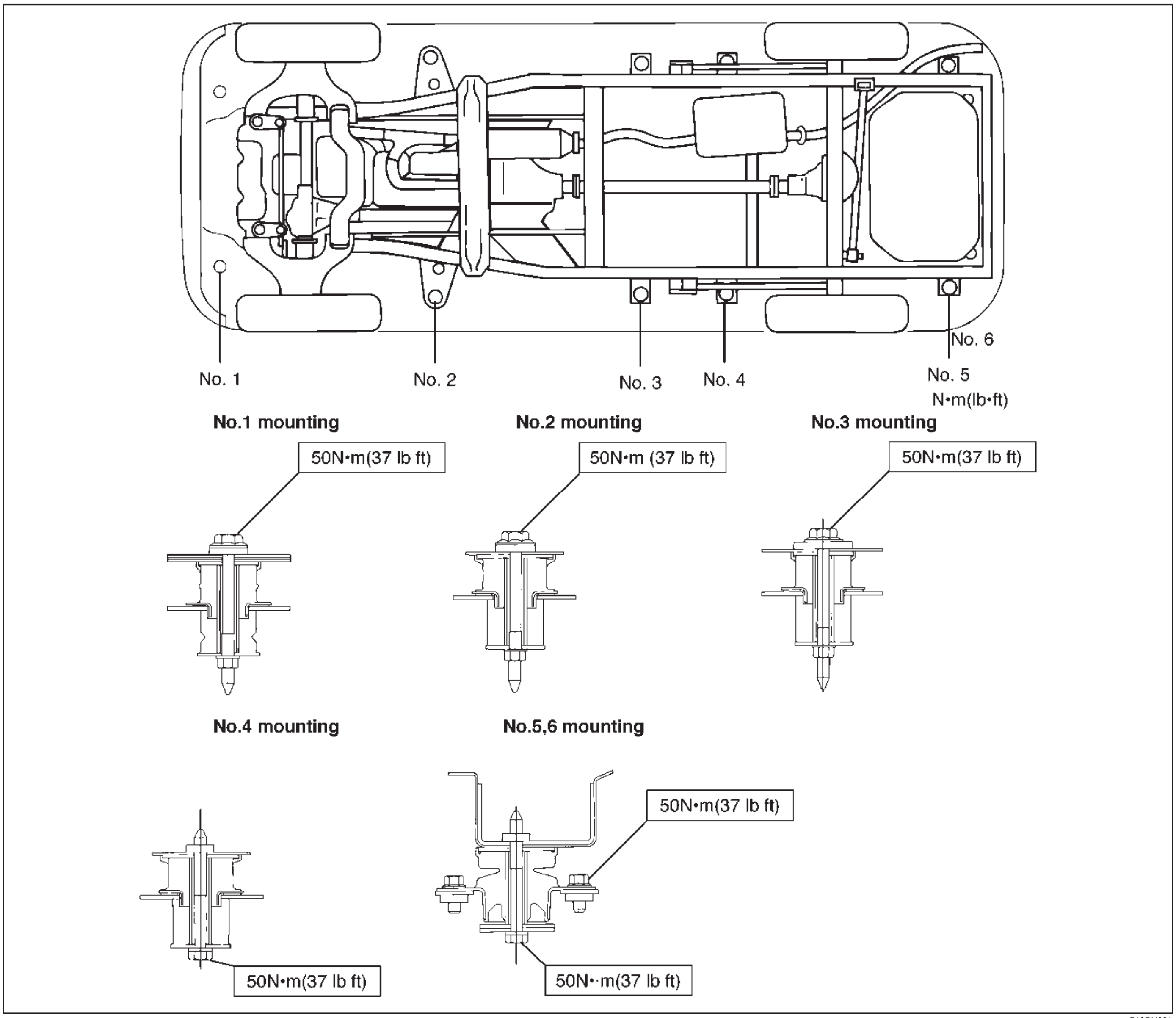
1. Tighten the front fender panel fixing bolts to the specified torque.

   (1) Torque : 9 N•m (78 lb in)

   (2) Torque : 7 N•m (61 lb in)

Body Mounting

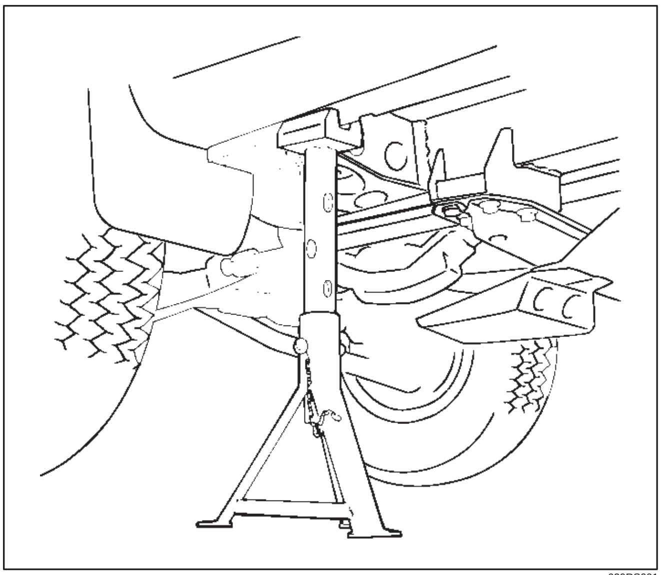
Parts Location



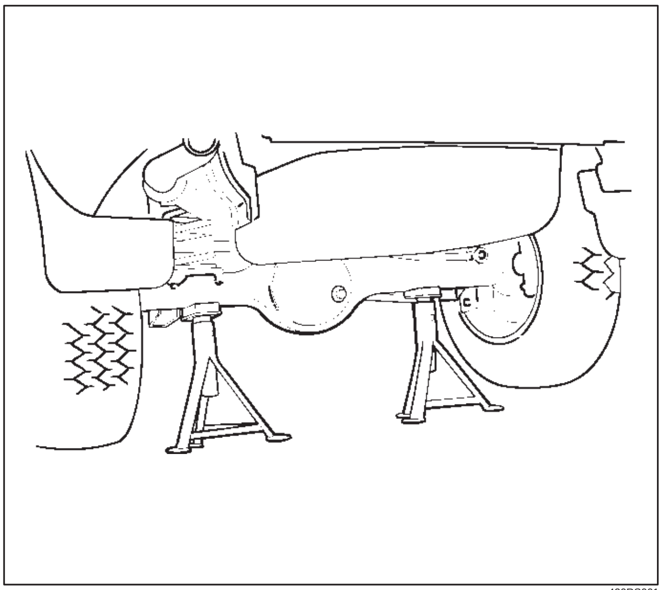
510RX001

Removal (No.1 – No. 2)

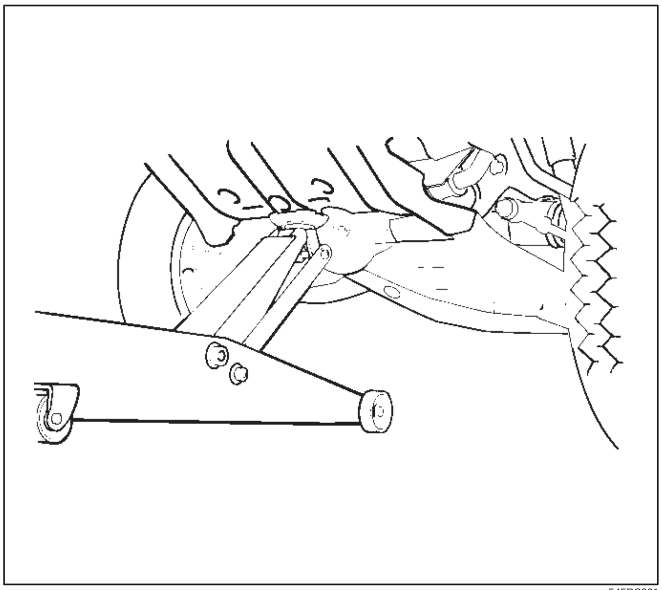
1. Remove the front bumper.
2. Jack up the vehicle by the frame.
3. Support the front side sill and rear axle with stands. Further, support the front jack up point with a jack.



620RS001

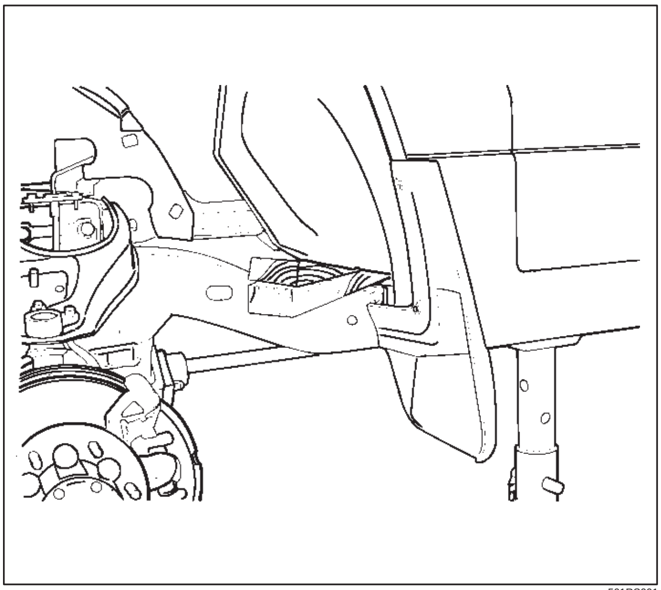


420RS001



545RS001

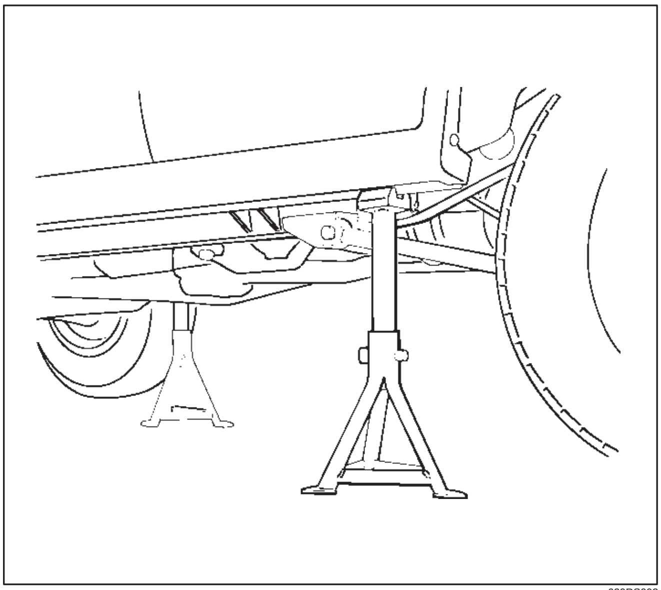
4. Remove the mounting bolts (No. 1-4) on either side.
   - No. 1 – Hold in check not to turn from the inside of the front fender.
   - No. 2 – Remove the front door sill plate and dash side trim panel, turn over the floor carpet and hold the bolt in check not to turn.
   - No. 3 – Remove the rear door sill plate and center pillar lower trim cover, turn over the floor carpet and hold the bolt in check not to turn.
   - No. 4 – Remove the bolt from under the frame.
5. Loosen the mounting bolts (No. 5-6) on either side.
6. Remove the frame side mounting and washer.
7. Gently lower the jack supporting the front axle until the cab side mounting can be removed.
8. Remove the cab side mounting.
   - Be sure to use a splice bar around the mounting to be removed.



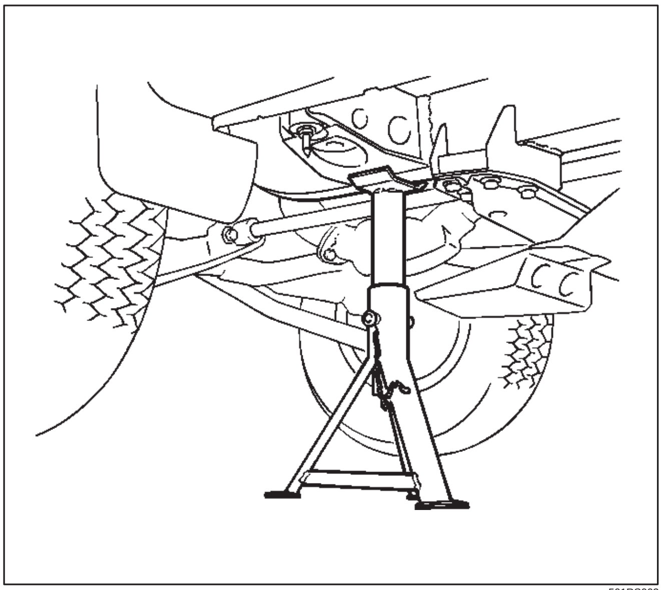
501RS001

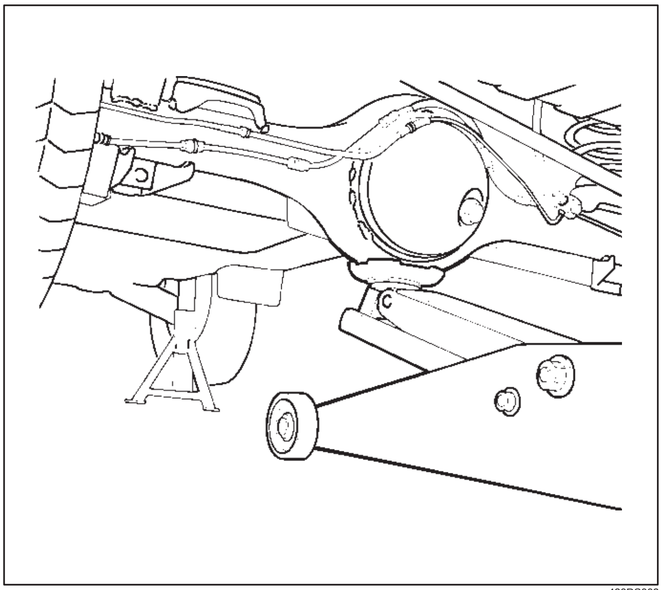
Removal (No. 3 — No. 6)

1. Remove the rear bumper.
2. Jack up the vehicle by the frame.
3. Support the rear side sill and frame stands, and support the rear axle with a jack.

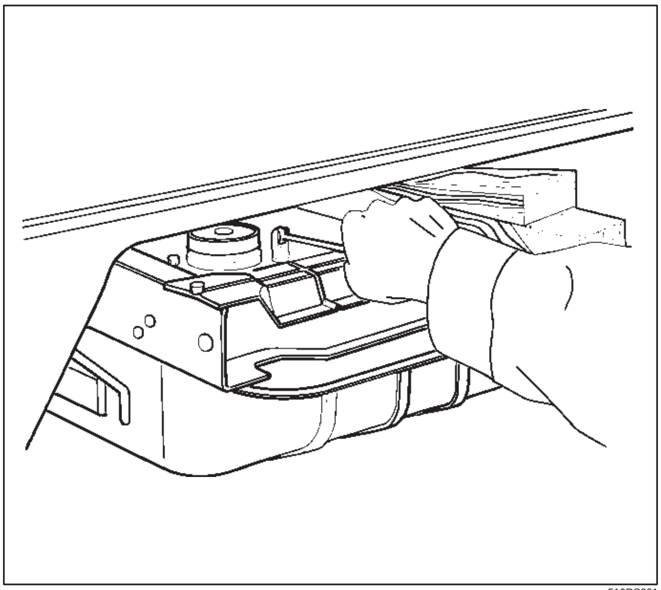


620RS002


501RS003


420RS002

4. Remove the mounting bolts (No. 3-6) on either side.
   - No. 3 — Remove the rear door sill plate and center pillar lower-trim cover, turn over the floor carpet and hold the bolt in check not to turn.
   - No. 4, 5 and 6 — Remove the bolts from the lower side of the frame.
5. Remove the frame side mounting and washer.
6. Gently lower the jack supporting the rear axle until the cab side mounting can be removed.
7. Remove the cab side mounting.
   - Be sure to use a splice bar around the mounting to be removed.
   - As for No. 5 and 6, remove the frame side bracket fixing bolts after lowering the frame gently.


510RS001

Installation

To install, follow the removal steps in the reverse order, noting the following point:

1. Tighten each mounting bolt to the specified torque.

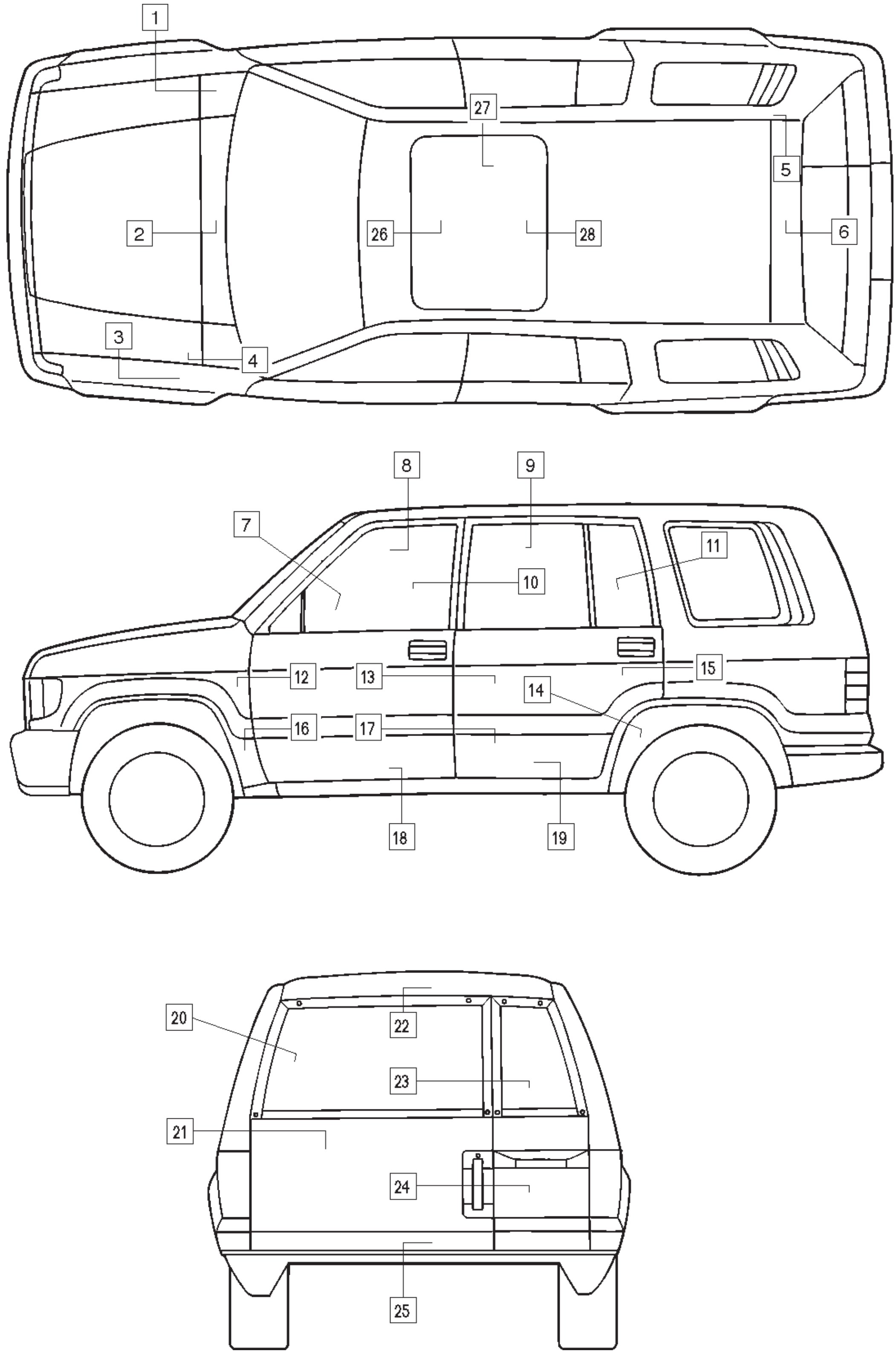
   Torque : 50 N•m (37 lb ft)

General Description

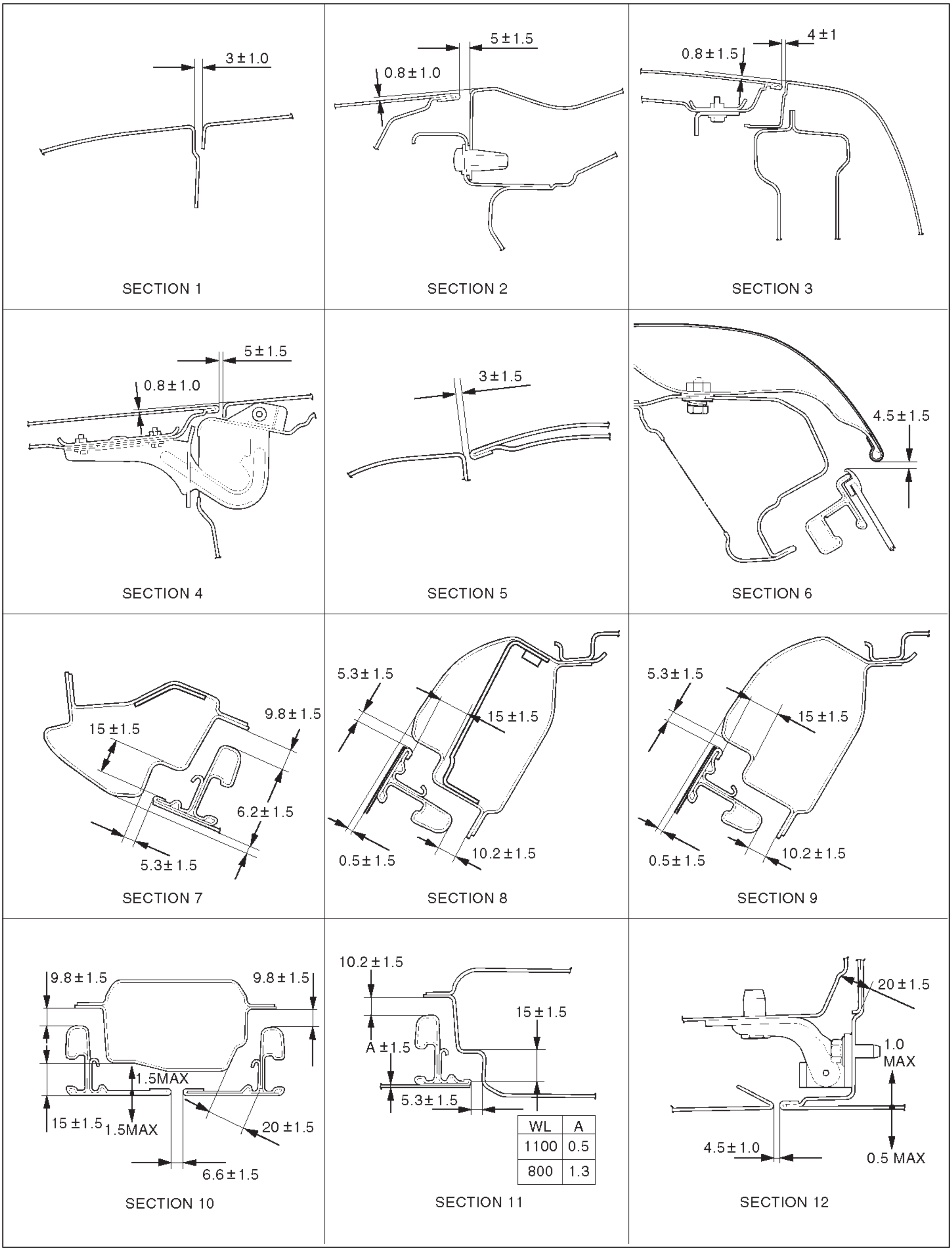
This section describes major items of the removal, installation and servicing procedures pertaining to the TROOPER body. Each servicing instruction is applicable to all models of the TROOPER, unless otherwise specifically mentioned. For those differing by specific models from the common procedures, they are detailed for each model.

Body Dimension

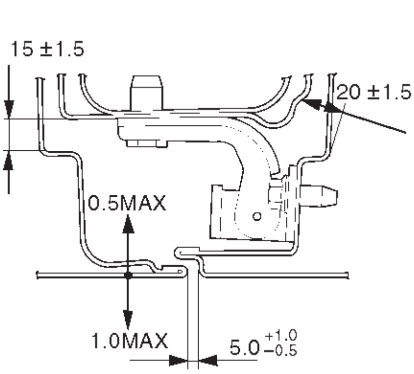
Upper Body



A10RW001


3 ± 1.0
SECTION 1
5 ± 1.5
0.8 ± 1.0
SECTION 2
4 ± 1
0.8 ± 1.5
SECTION 3
5 ± 1.5
0.8 ± 1.0
SECTION 4
3 ± 1.5
SECTION 5
4.5 ± 1.5
SECTION 6
9.8 ± 1.5
15 ± 1.5
6.2 ± 1.5
5.3 ± 1.5
SECTION 7
5.3 ± 1.5
15 ± 1.5
0.5 ± 1.5
10.2 ± 1.5
SECTION 8
5.3 ± 1.5
15 ± 1.5
0.5 ± 1.5
10.2 ± 1.5
SECTION 9
9.8 ± 1.5
9.8 ± 1.5
1.5MAX
15 ± 1.5
1.5MAX
20 ± 1.5
6.6 ± 1.5
SECTION 10
10.2 ± 1.5
15 ± 1.5
A ± 1.5
5.3 ± 1.5
WL A
1100 0.5
800 1.3
SECTION 11
20 ± 1.5
1.0 MAX
4.5 ± 1.0
0.5 MAX
SECTION 12

A10RY00001



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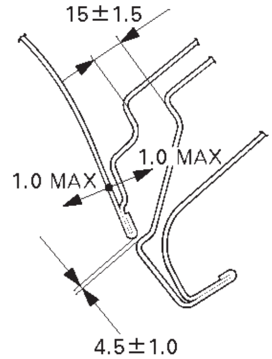

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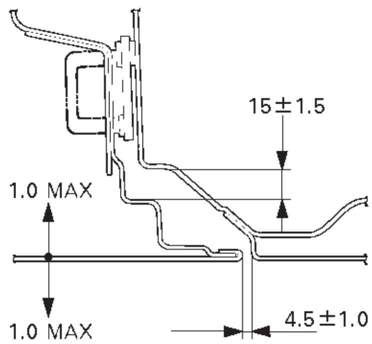

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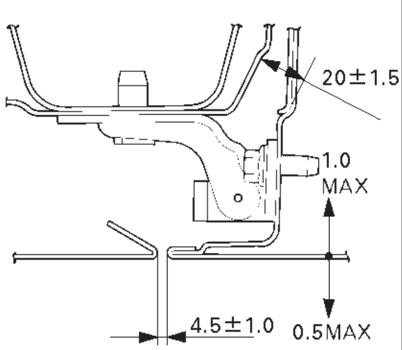

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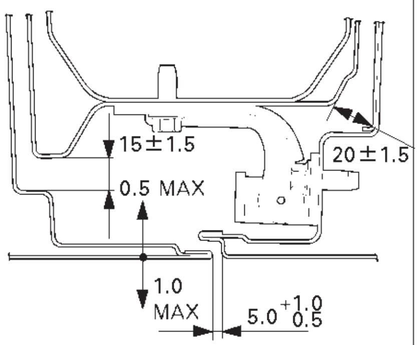

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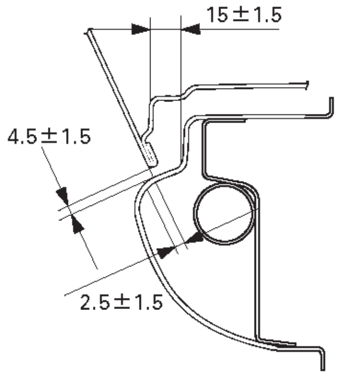

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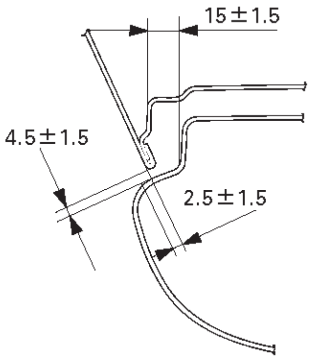

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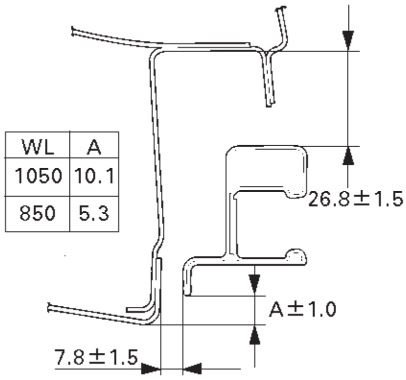
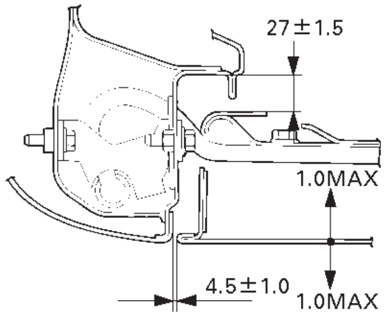


WL	A
1050	10.1
850	5.3

SECTION 20



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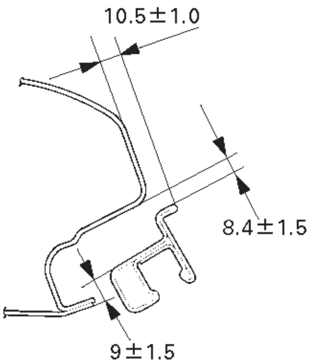

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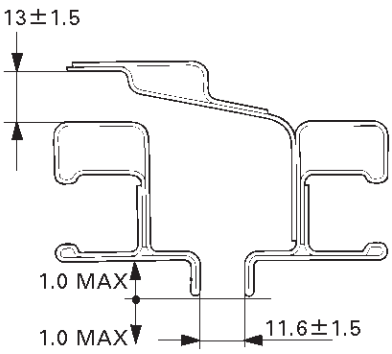

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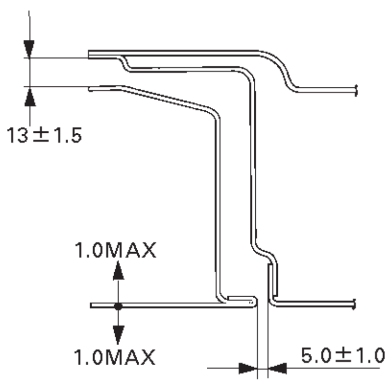
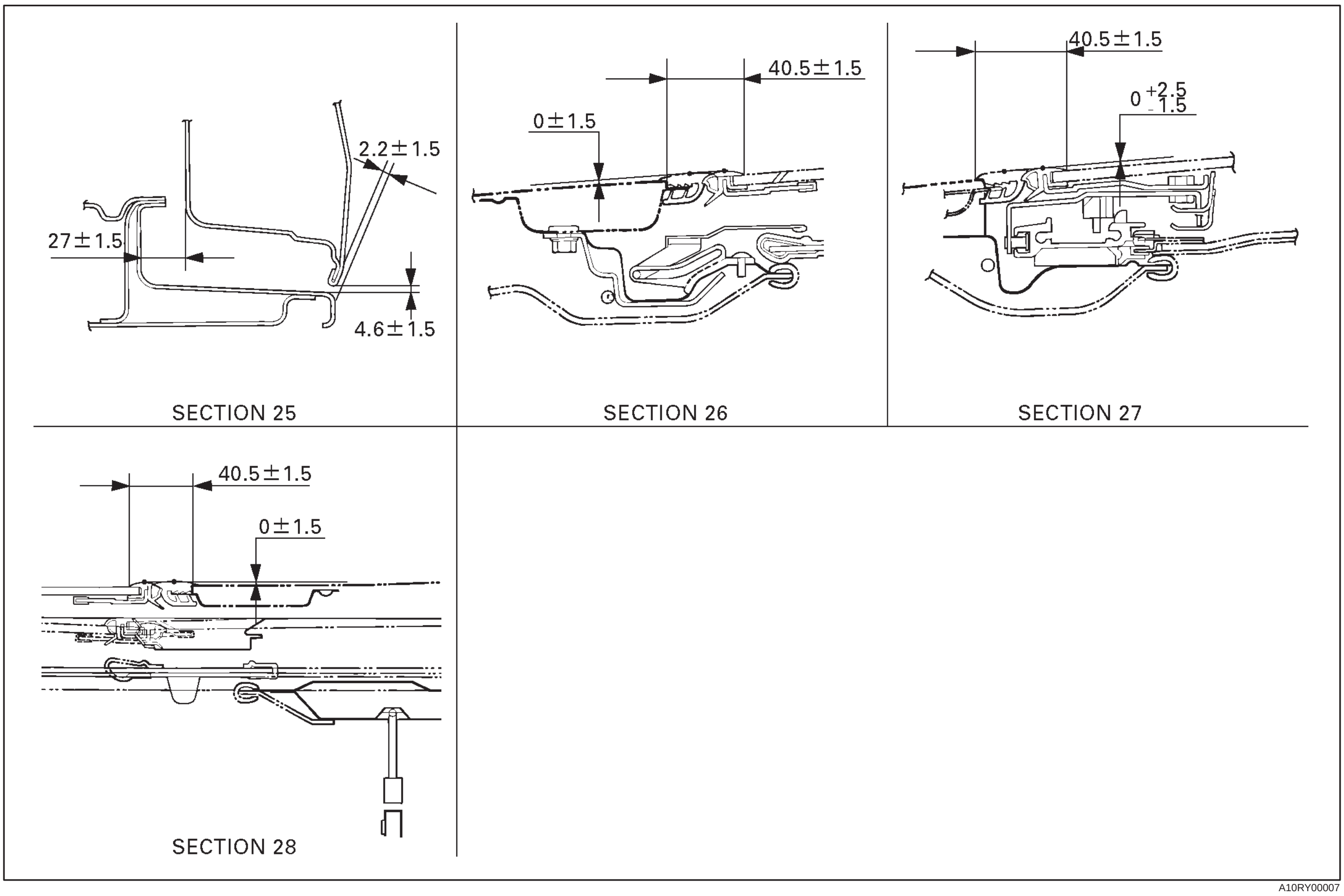
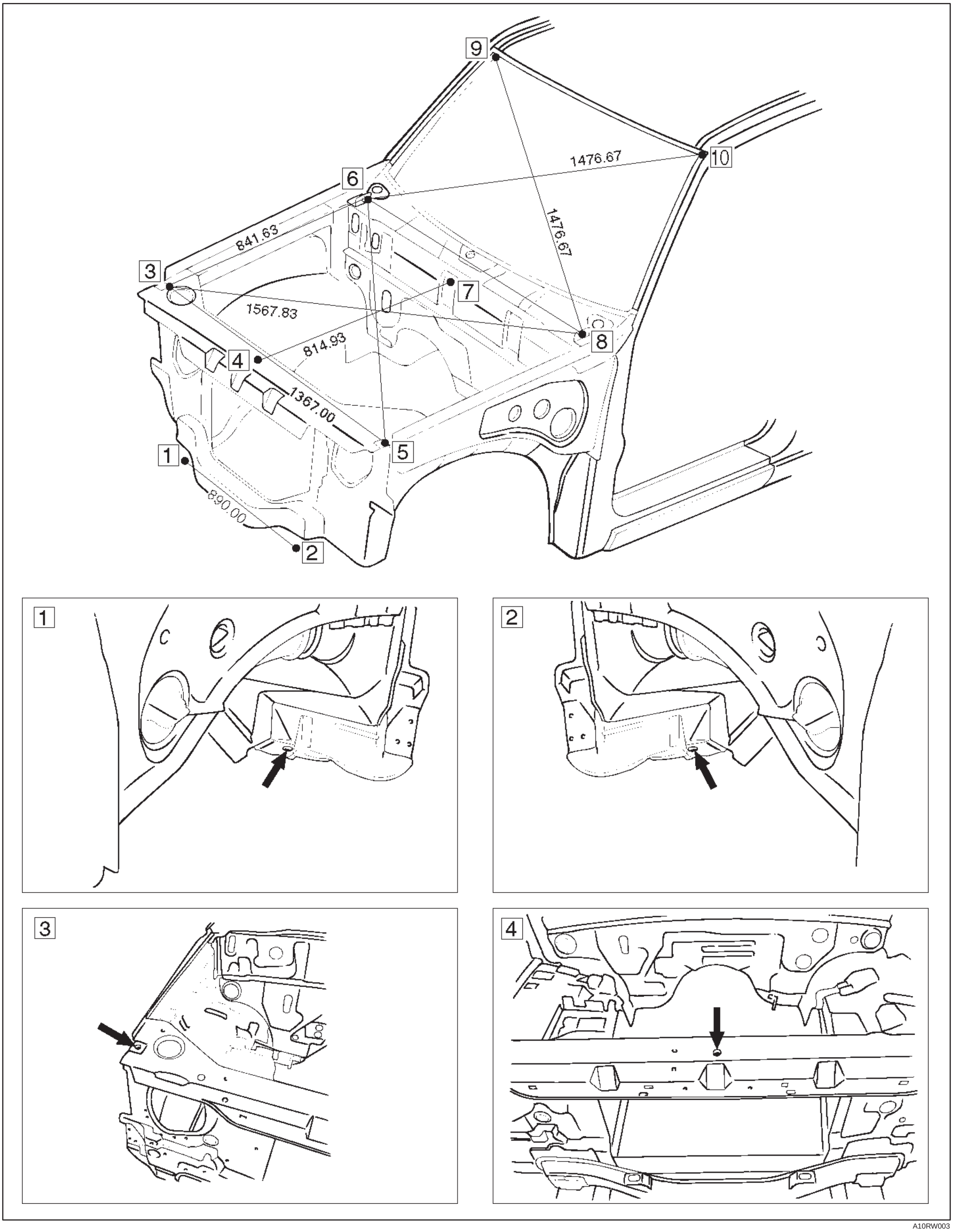


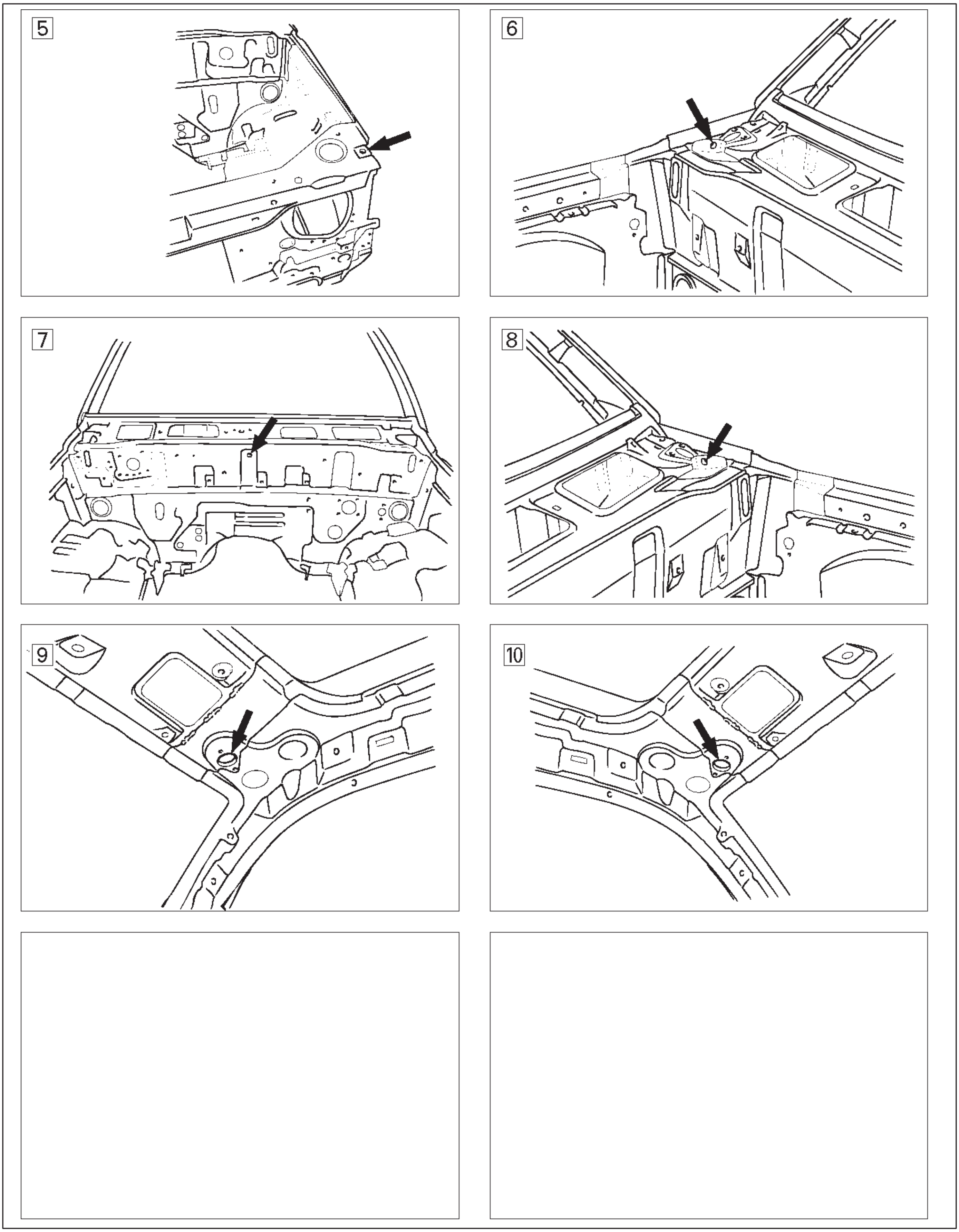
SECTION 24

A10RY00002


27±1.5
2.2±1.5
4.6±1.5
SECTION 25
0±1.5
40.5±1.5
SECTION 26
40.5±1.5
0 +2.5 -1.5
SECTION 27
40.5±1.5
0±1.5
SECTION 28
A10RY00007

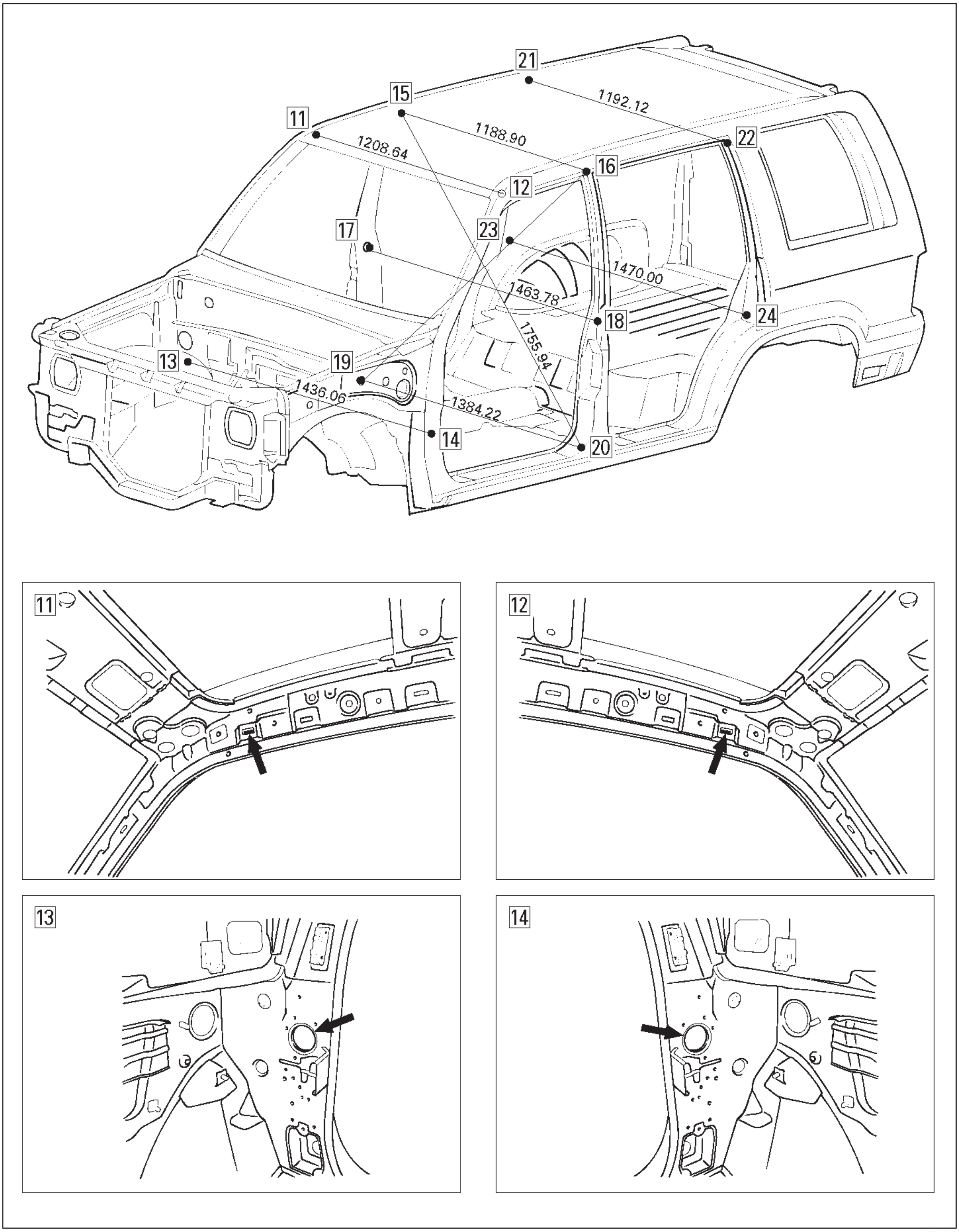
Front Section





A10RW004

Room Section



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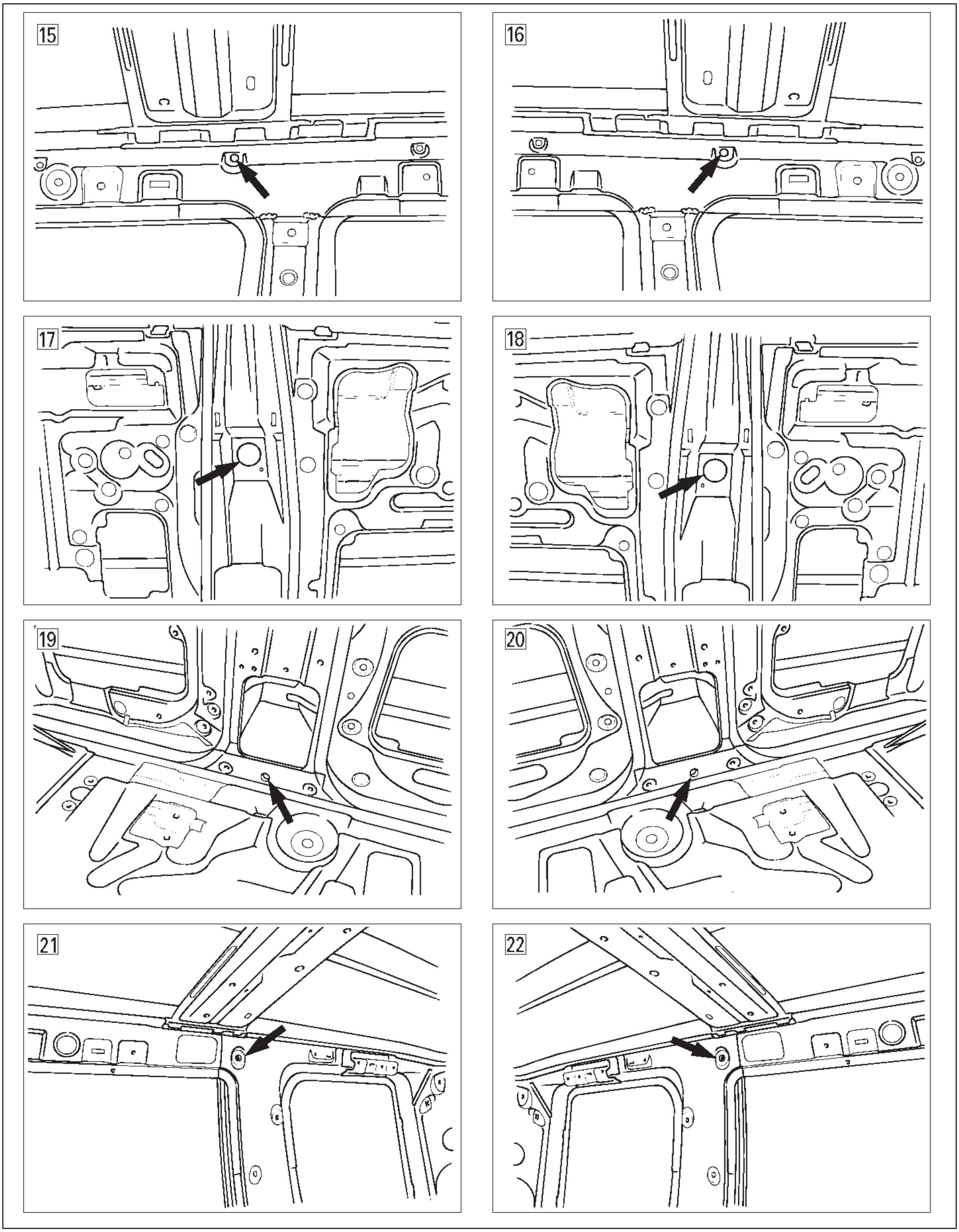

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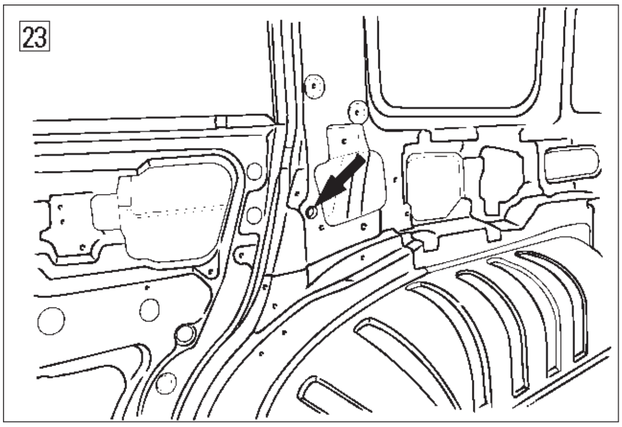
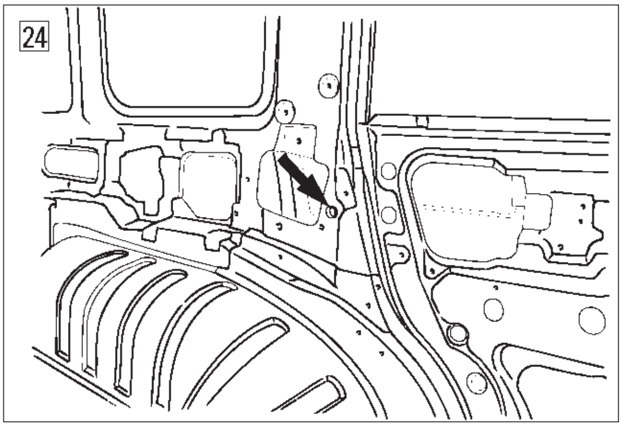
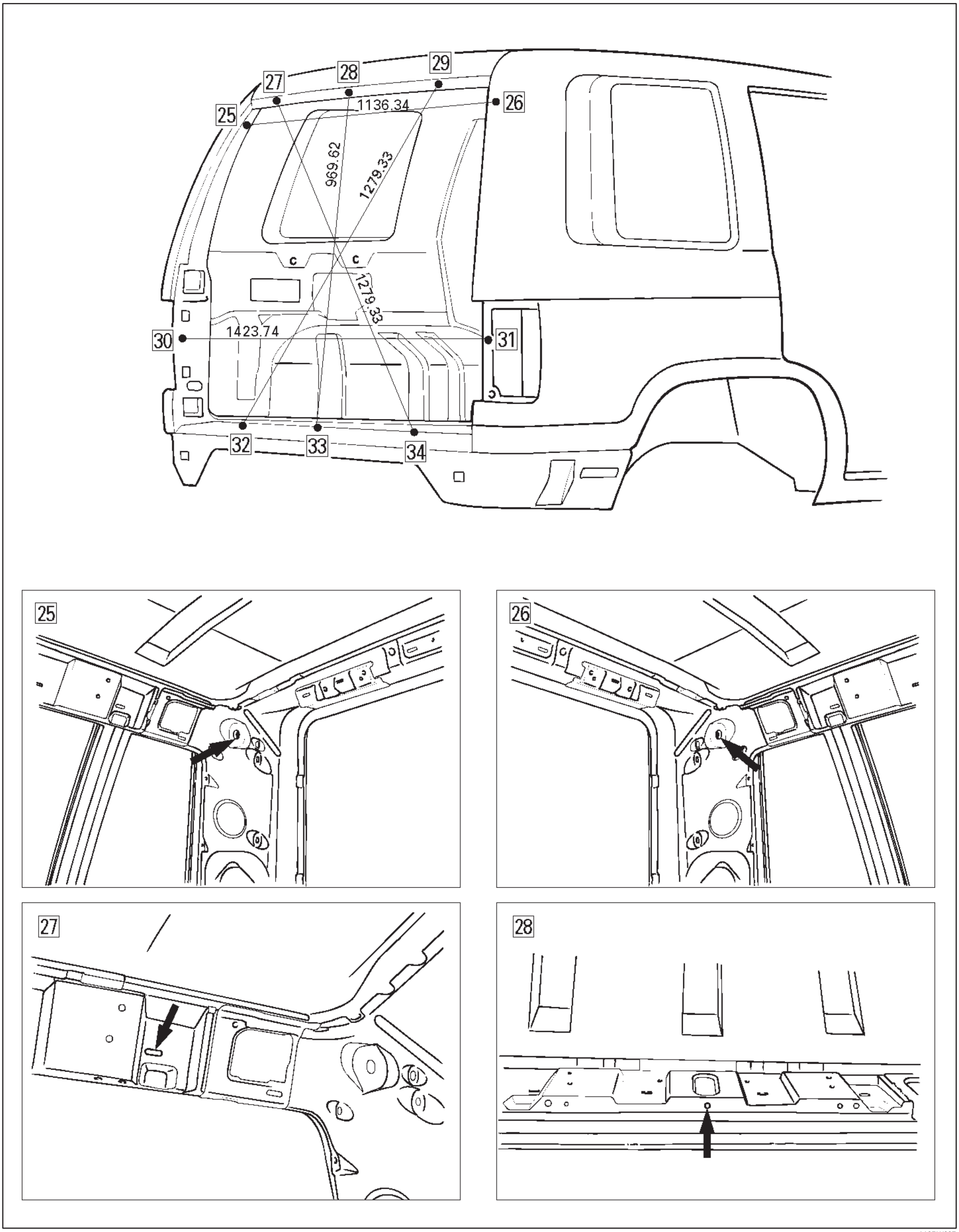




A10RW006

Rear Section



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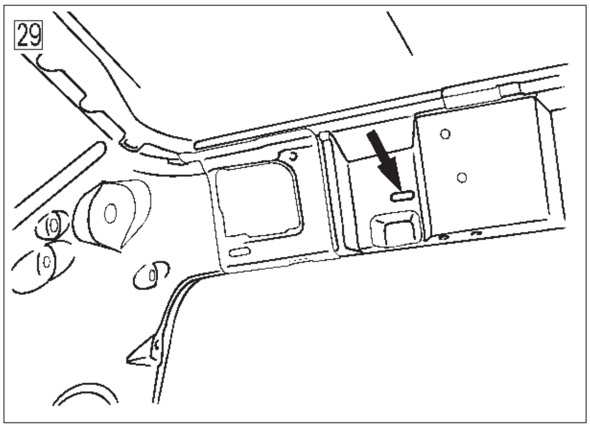
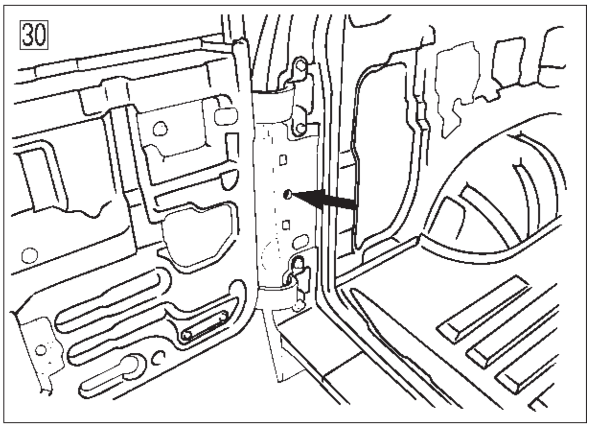
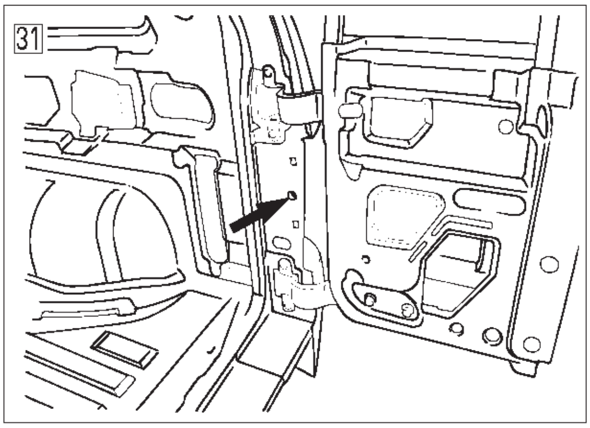
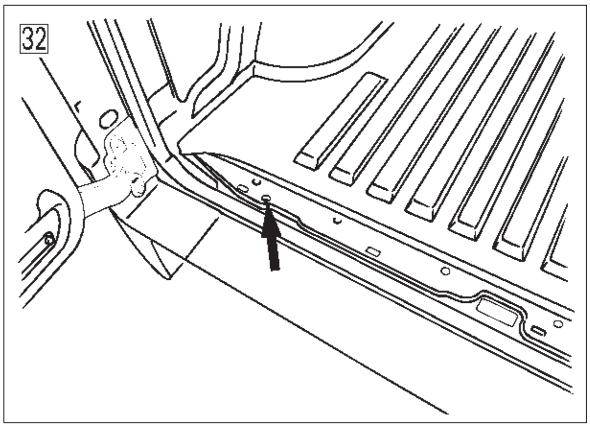
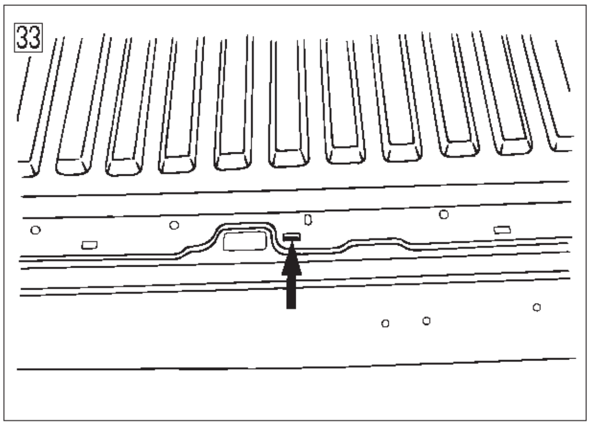
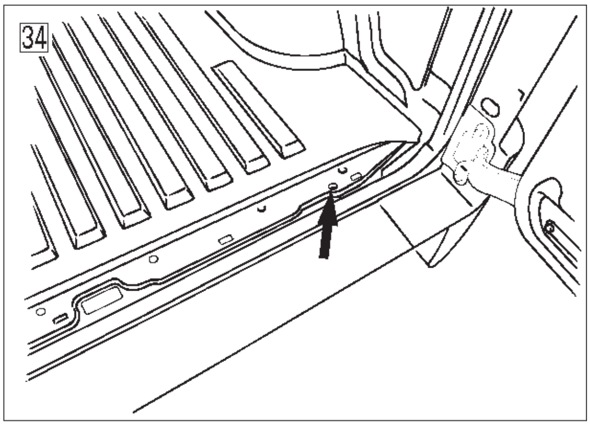






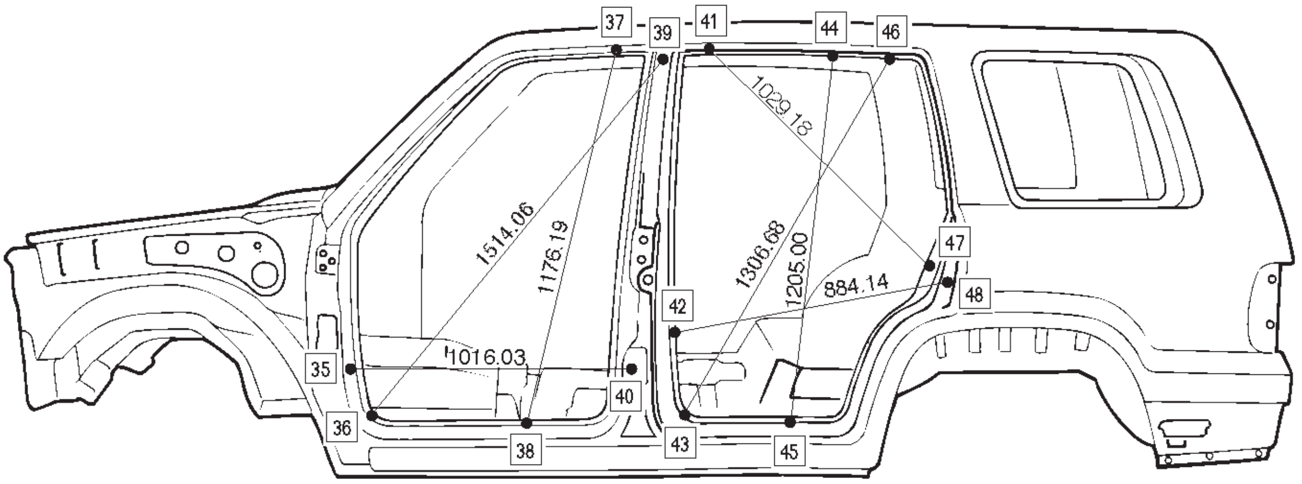


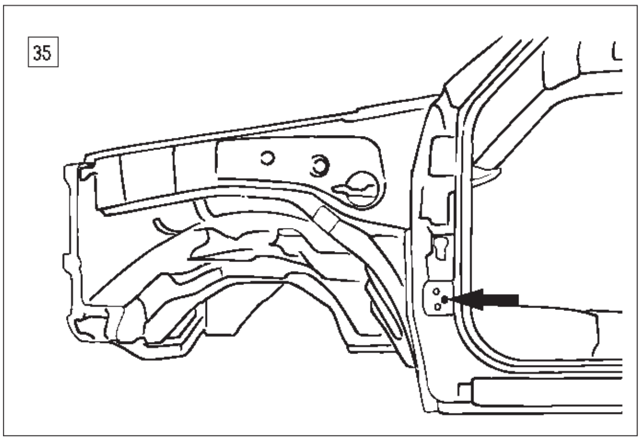


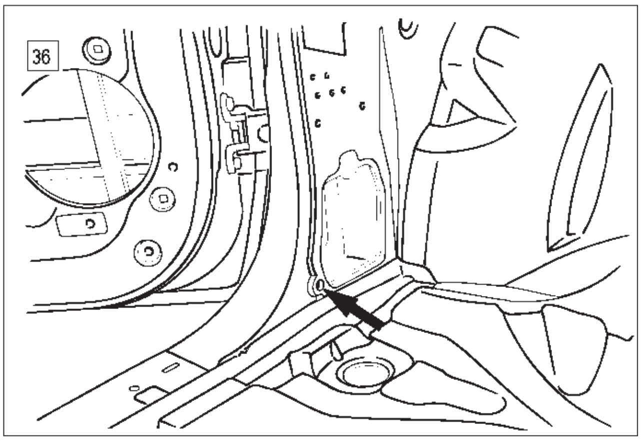


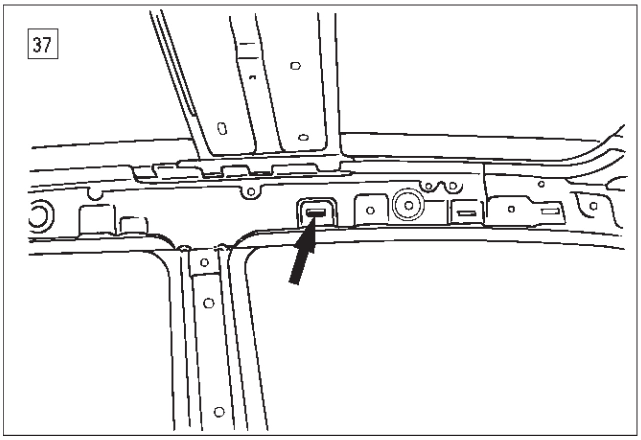
A10RW008

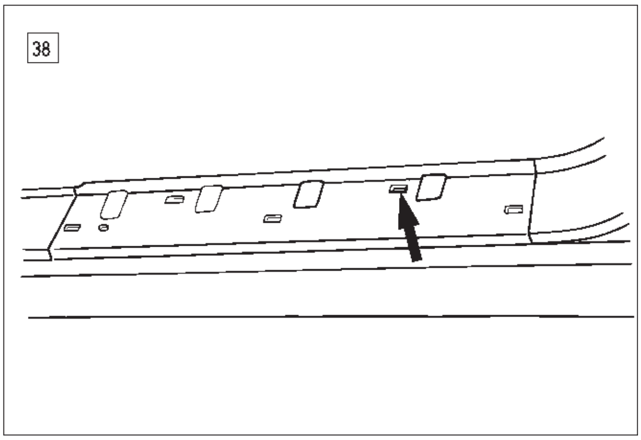
Side Body











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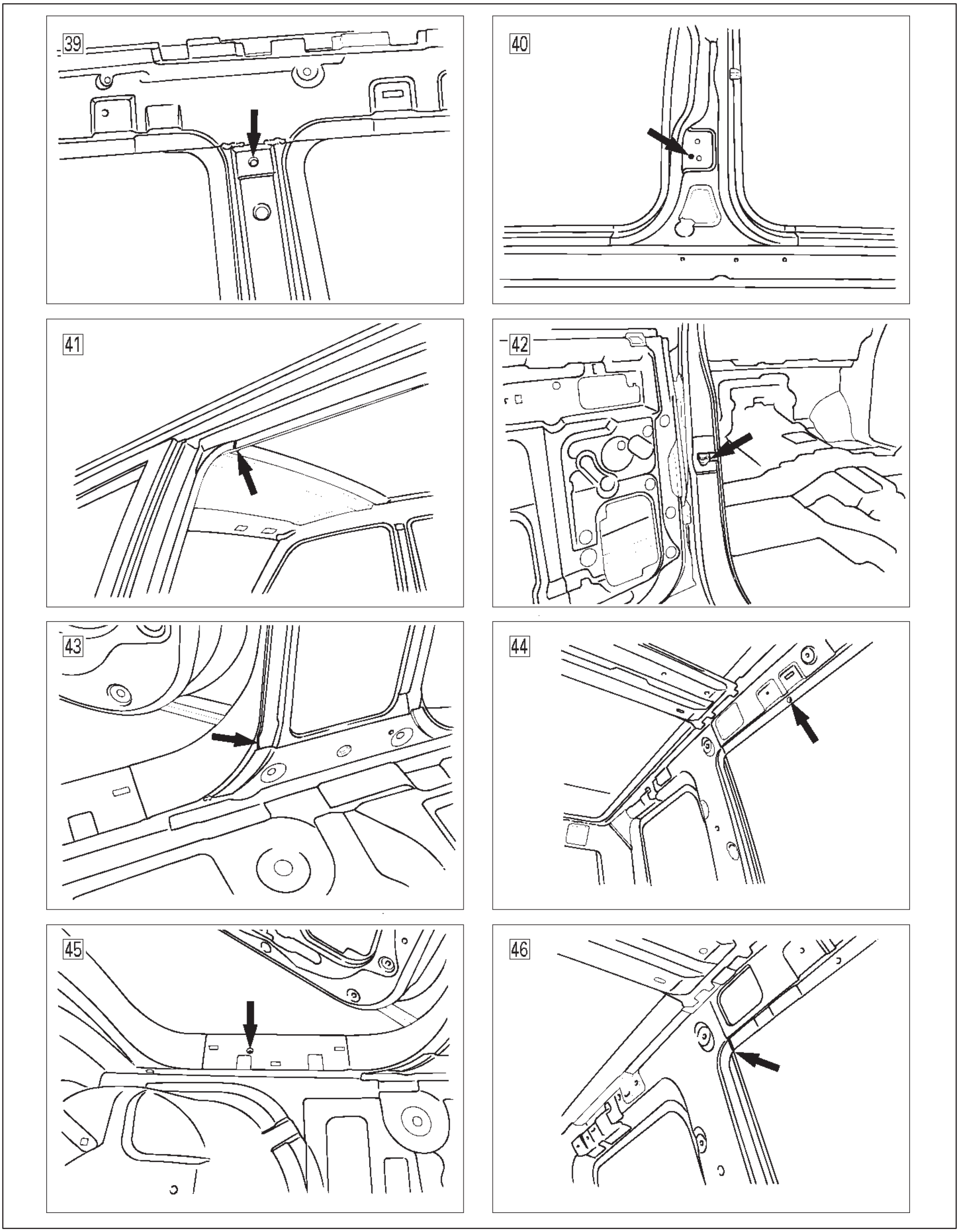

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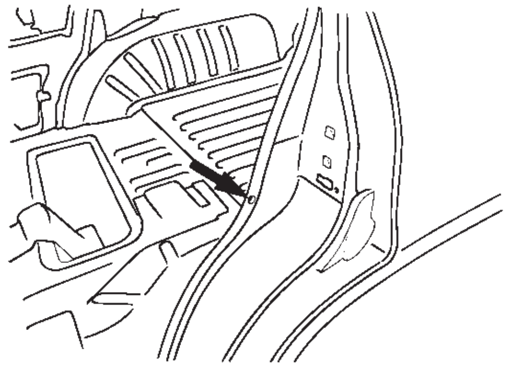

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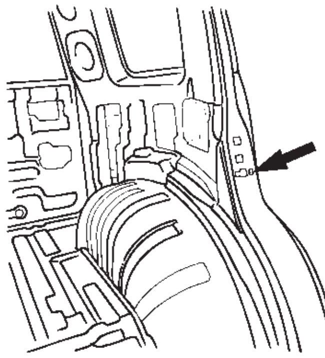
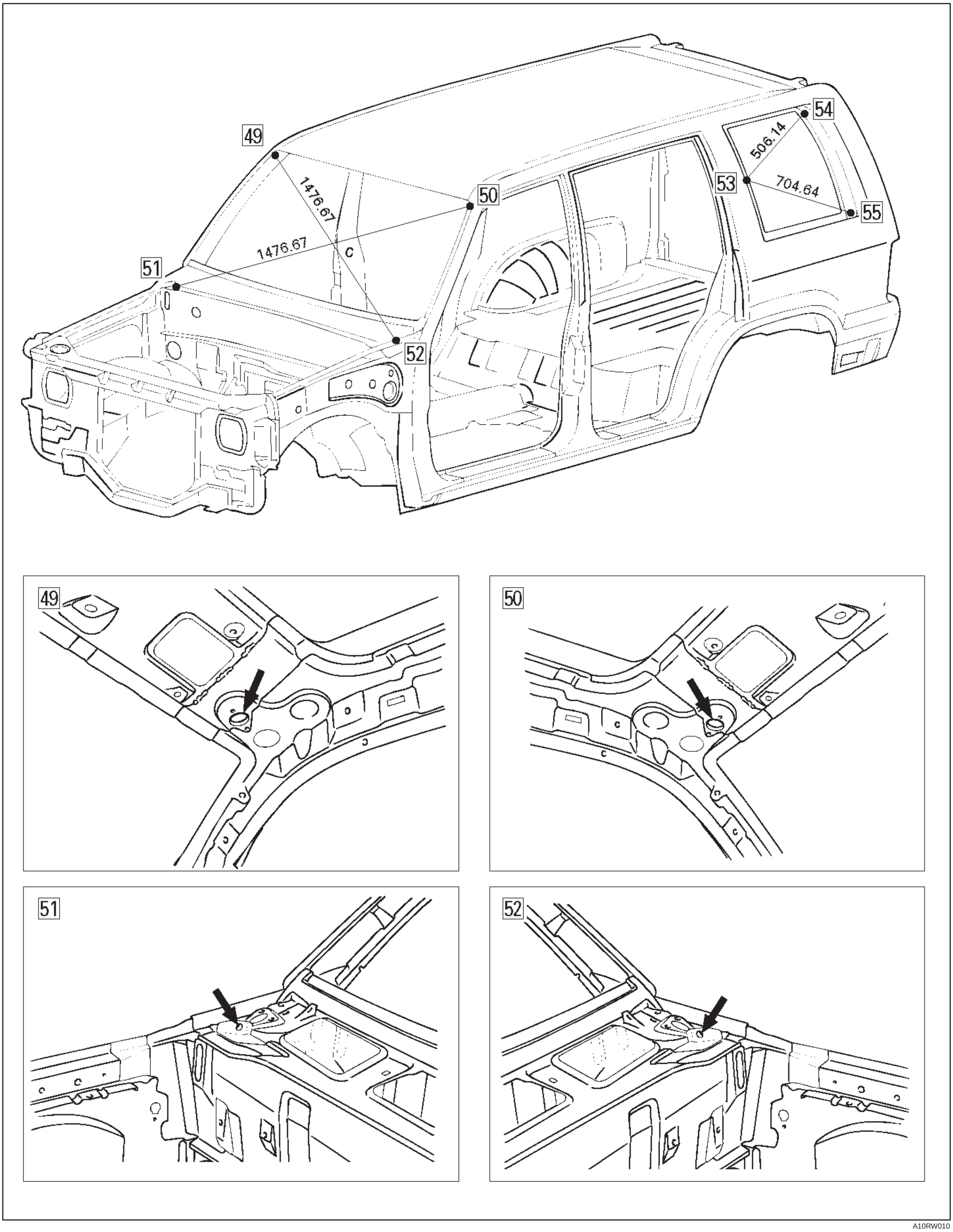


A10RW017

Window Glass



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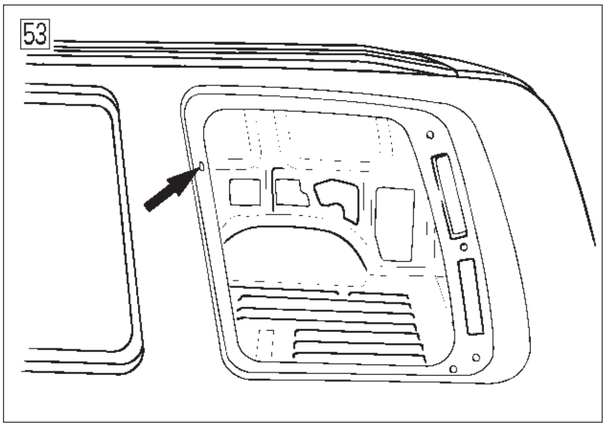

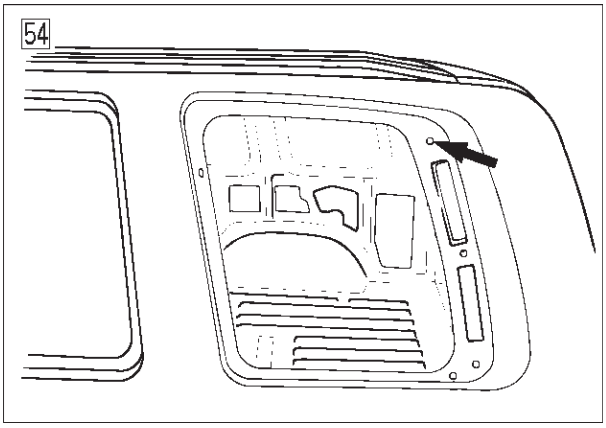

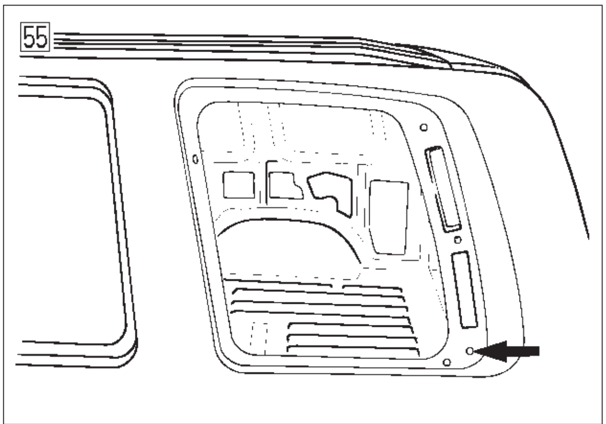

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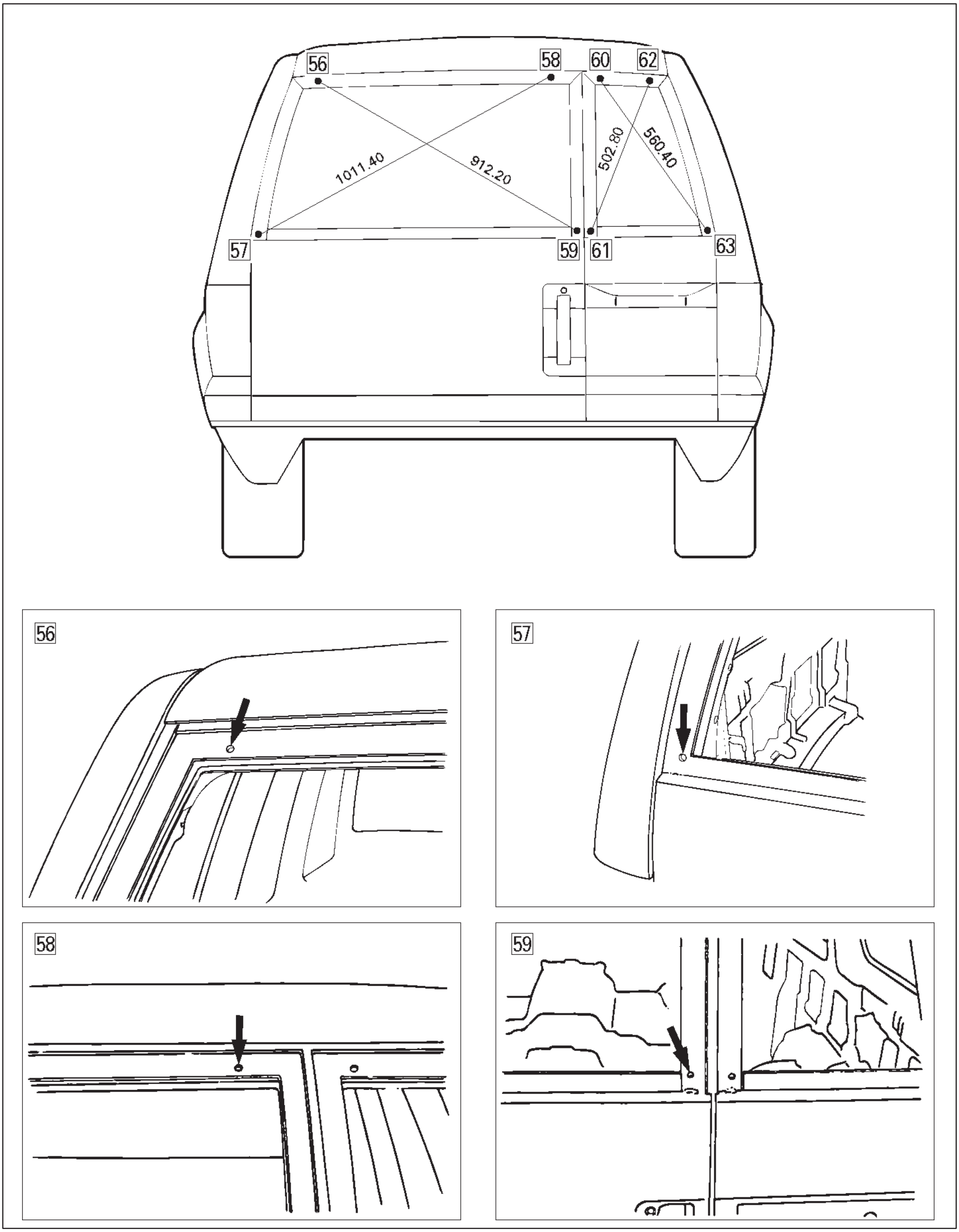

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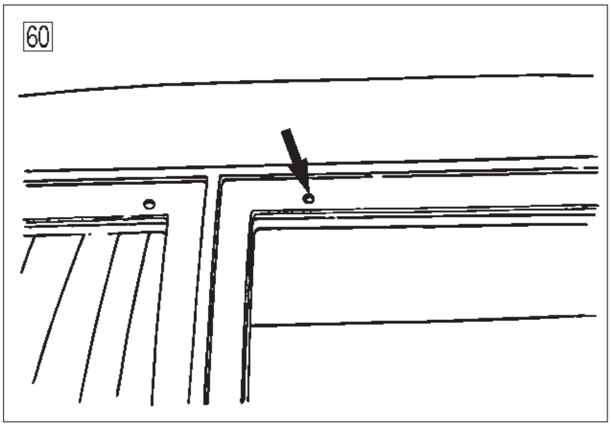
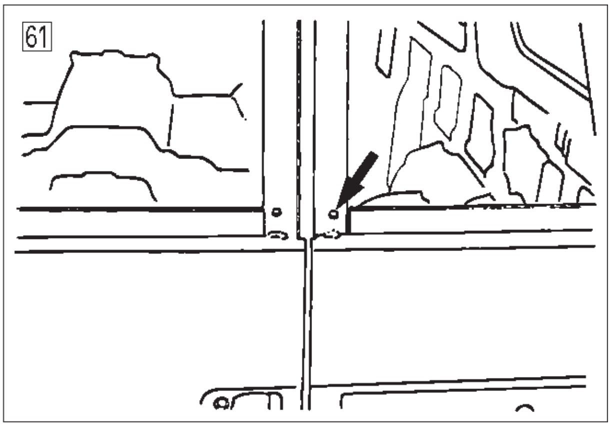
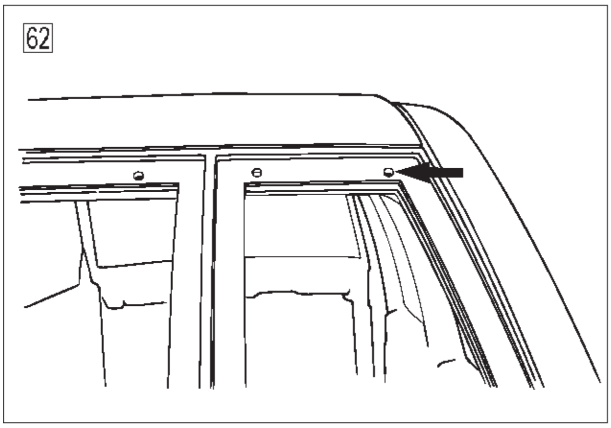
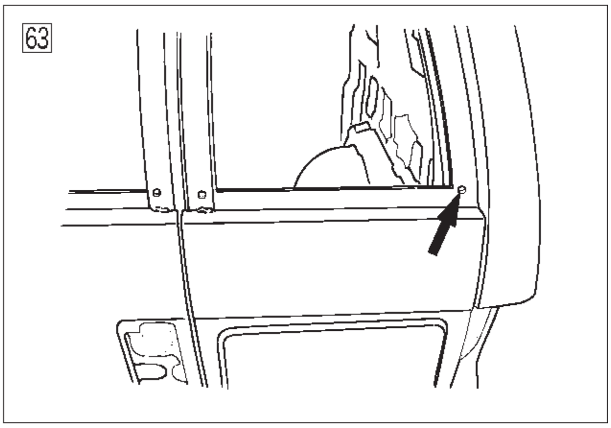




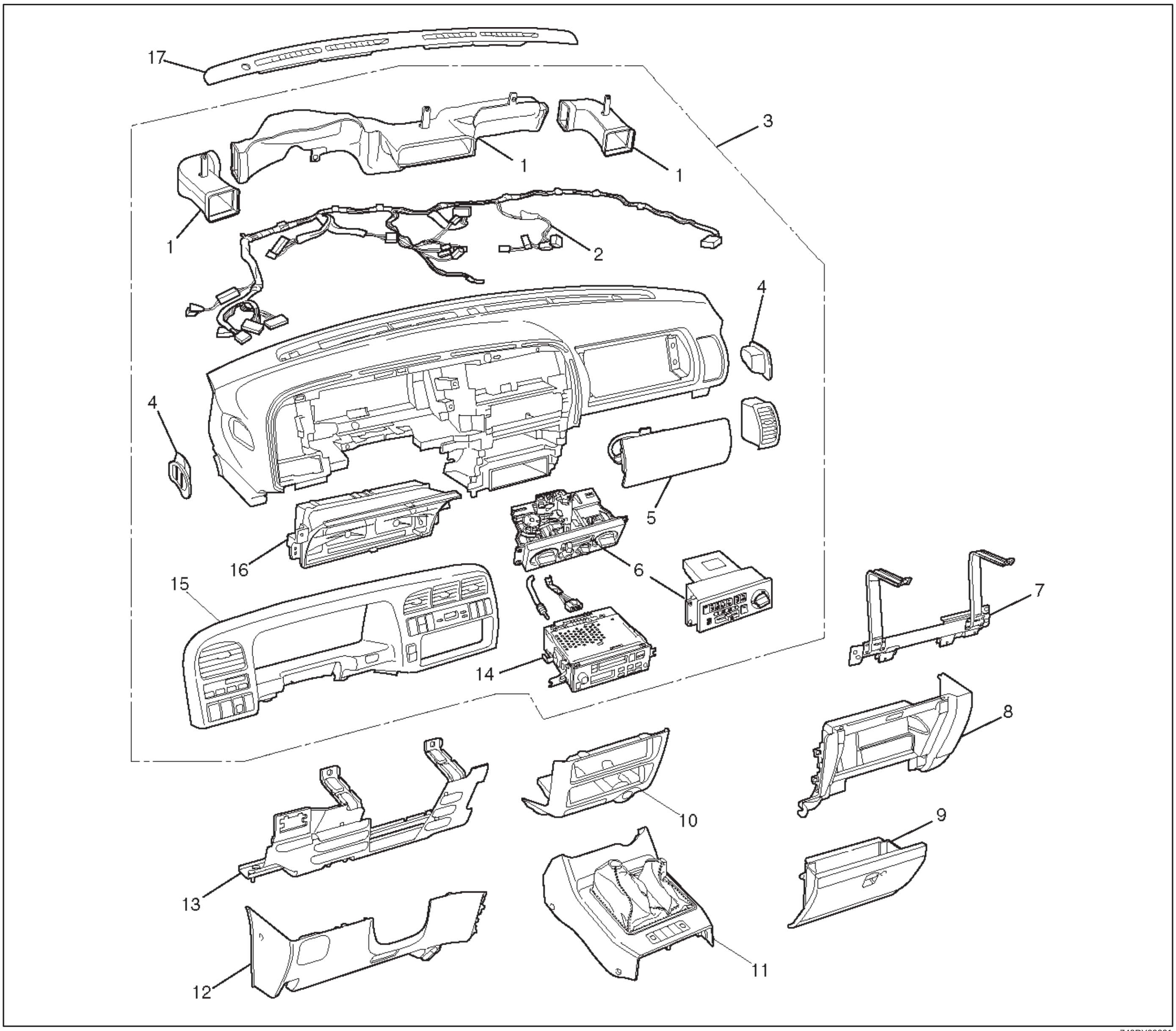




A10RW013

Instrument Panel Assembly

Parts Location



740RY00001

Legend

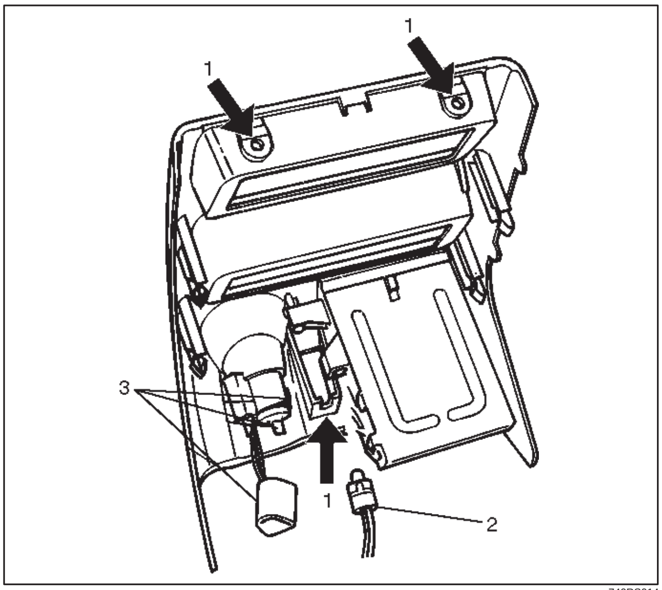
(1) Vent Duct Assembly
(2) Instrument Harness Assembly
(3) Instrument Panel Assembly
(4) Side Defroster Grille
(5) Passenger Inflator Module
(6) Control Lever Assembly / Control Panel Assembly
(7) Passenger Knee Bolster Reinforcement Assembly
(8) Instrument Panel Passenger Lower Cover Assembly
(9) Glove Box
(10) Lower Cluster Assembly
(11) Front Console Assembly
(12) Instrument Panel Driver Lower Cover Assembly
(13) Driver Knee Bolster Assembly
(14) Radio Assembly
(15) Instrument Panel Cluster Assembly
(16) Meter Assembly
(17) Front Defroster Grille

Removal

CAUTION: For precautions on installation or removal of SRS—air bag system, refer to Supplemental Restraint System (SRS) — AIR BAG in Restraint section.

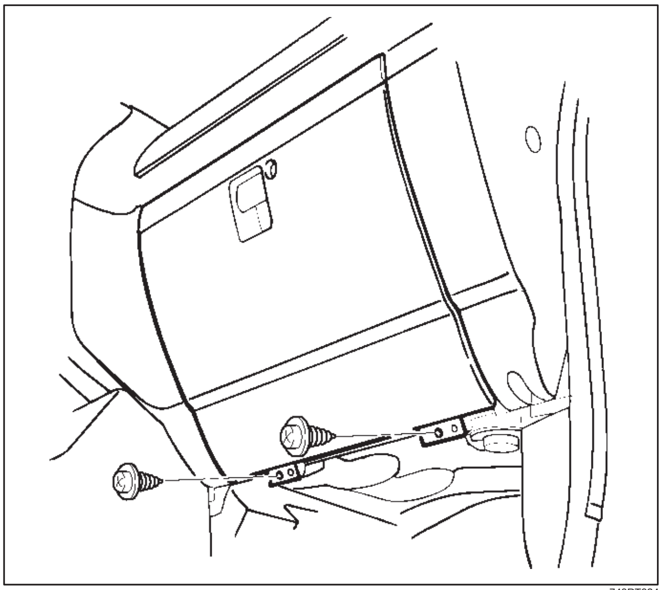
1. Disconnect the battery ground cable.

2. Remove front console assembly.
   - Remove the 4 fixing screws and disconnect the switch connectors.
3. Remove lower cluster assembly.
   - Remove the 3 fixing screws (1) in order to disconnect the cigarette lighter (3) and the illumination (2) connectors.

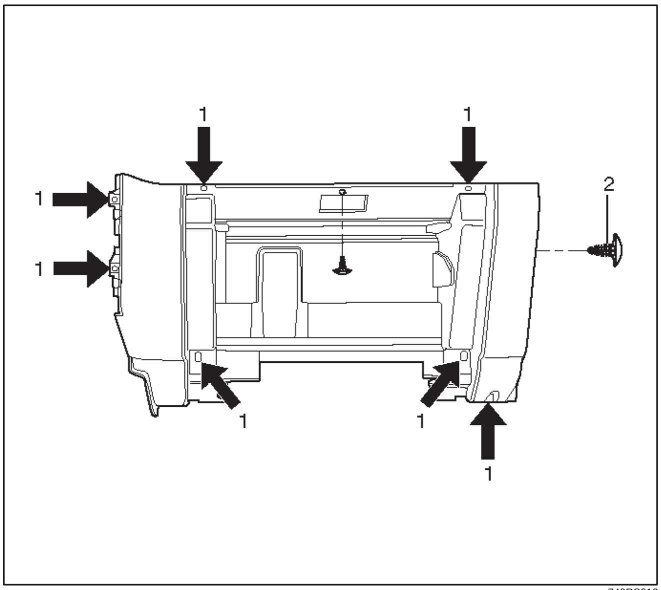


740RS014

4. Remove glove box.
   - Remove the 2 fixing screws.

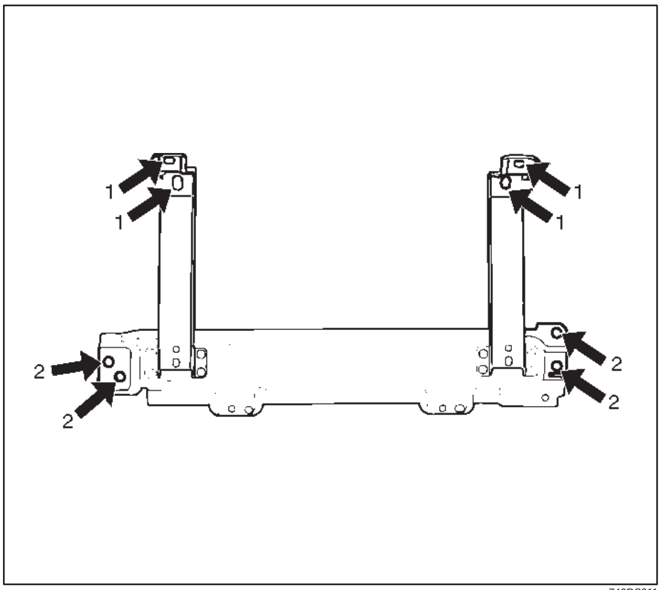

740RT024

5. Remove instrument panel passenger lower cover assembly.
   - Remove the 7 fixing screws (1) and 1 clip (2).



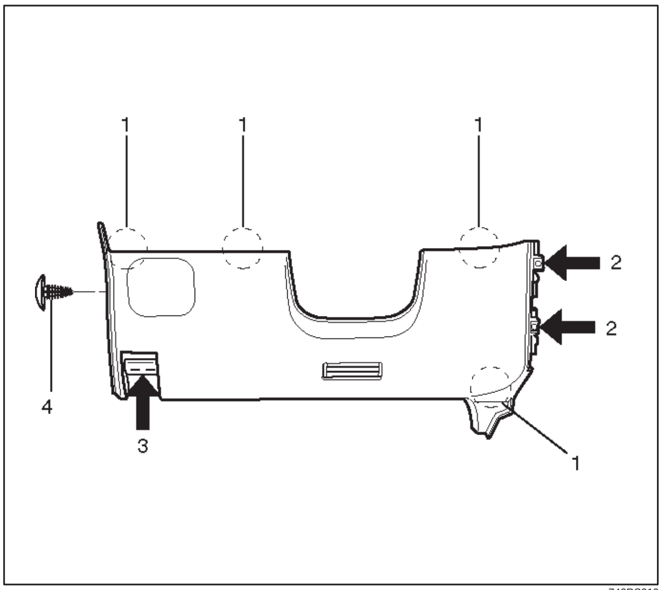
740RS012

6. Remove passenger knee bolster reinforcement assembly.
   - Remove the 4 fixing bolts (2) and 4 nuts (1).



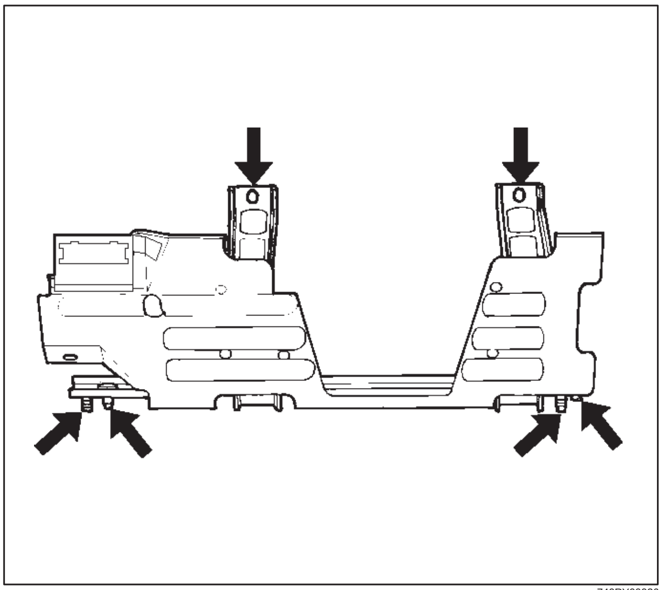
740RS011

7. Remove instrument panel driver lower cover assembly.
   - Remove the engine hood opener fixing screws.
   - Remove the 2 fixing screws (2), 1 fixing bolt (3), and 1 clip (4). Pull out the fasteners at the 4 positions (1).



740RS010

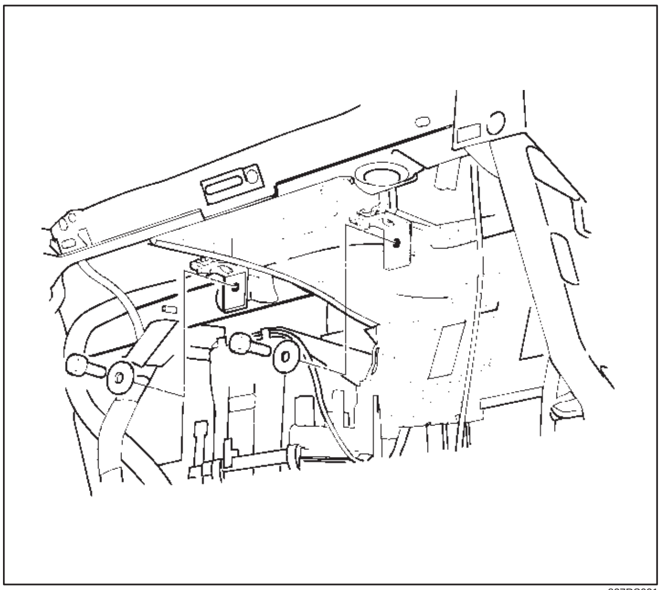
8. Remove driver knee bolster assembly.
   - Remove the 6 fixing nuts.



740RY00026

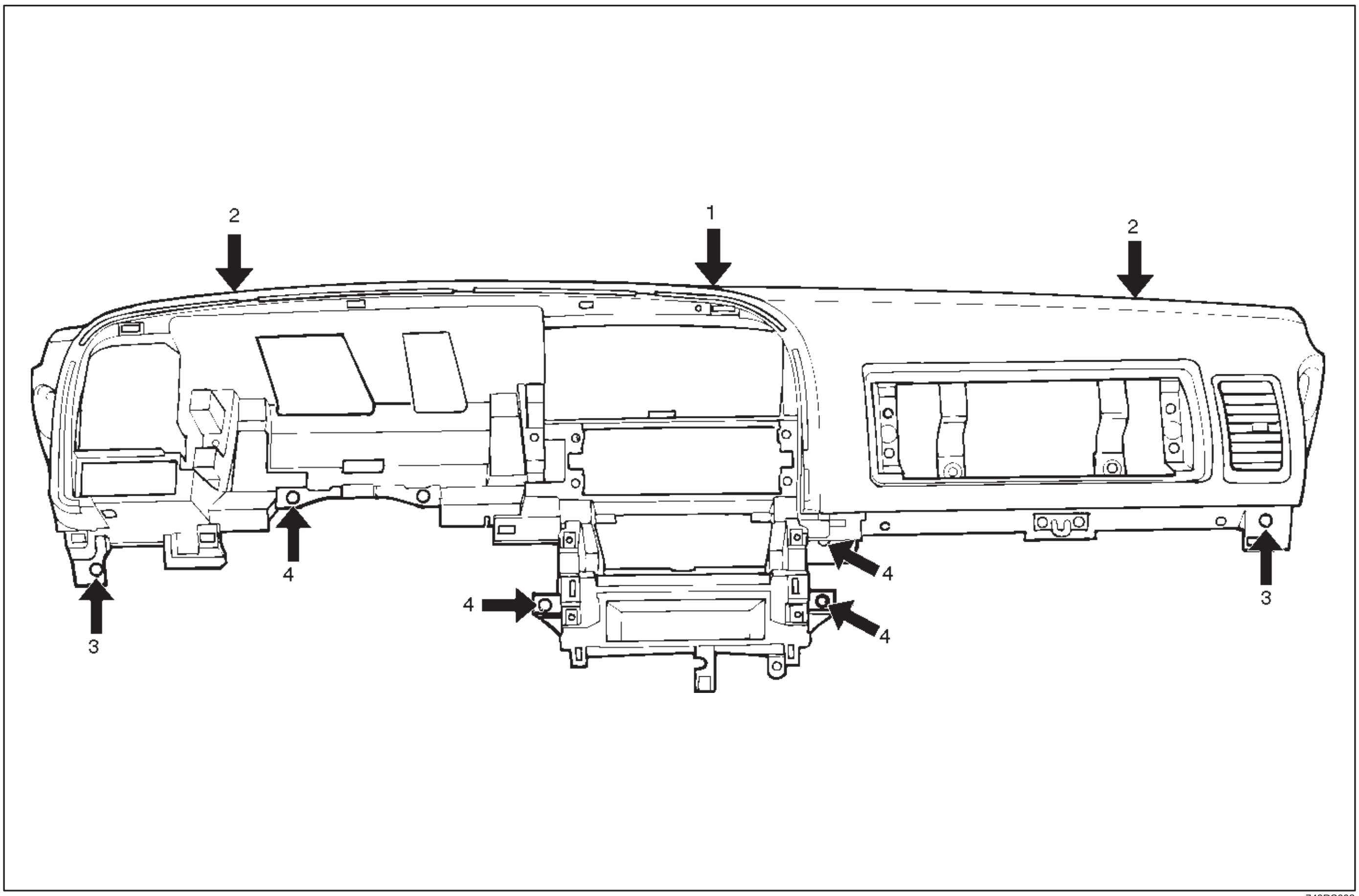
9. Remove front defroster grille.
   - Pry 8 claws on the front side toward you side (room side) and raise the grille upward.
10. Remove instrument panel assembly.
    - Remove the 2 fixing bolts on the SRS adjust bracket and the cross beam under the passenger inflator module.

CAUTION: For precautions on installation or removal of SRS — air bag system, refer to Supplemental RestraintSystem (SRS) — AIR BAG in Restraint section.



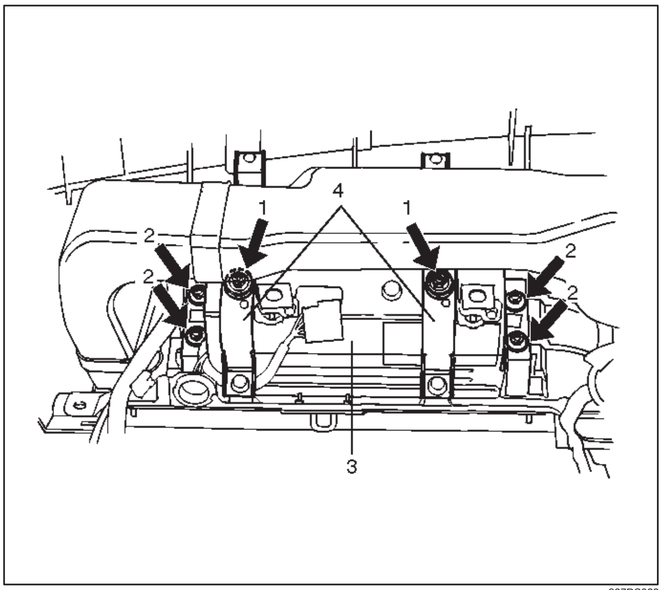
827RS021

- Disconnect the 3 air conditioner control cables on the unit side.
- Remove the instrument harness connectors (5 connectors on the drivers side and 3 connectors on the passenger side), the passenger inflator module connector, the radio antenna cable plug, and the ground cable fixing bolt on the center bracket.
- Remove the 4 bolts (4) and the 2 nuts (3) under the instrument panel assembly, and the upper left and the upper right bolts (2) and the center nut (1).



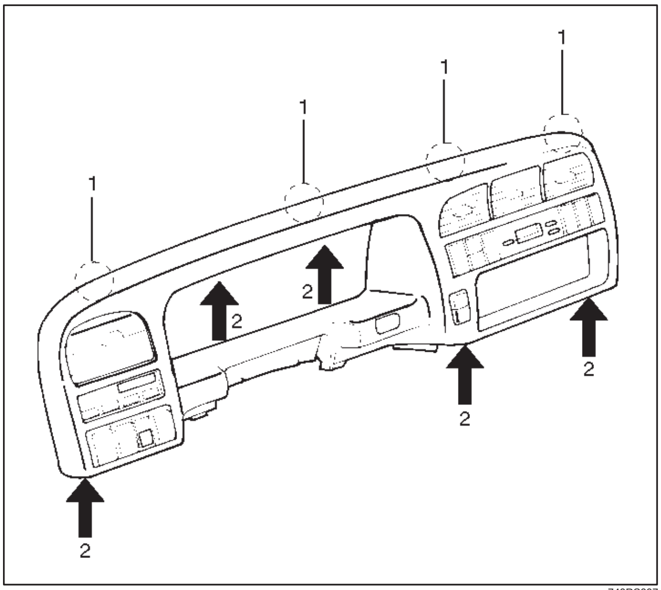
740RS008

11. Remove passenger inflator module.
   - From the back of the instrument panel, remove the 4 fixing nuts (2) on the passenger inflator module (3) and the 2 fixing nuts (1) and washers on the support bracket (4), then disengage the 2 clips in order to remove the passenger inflator module.



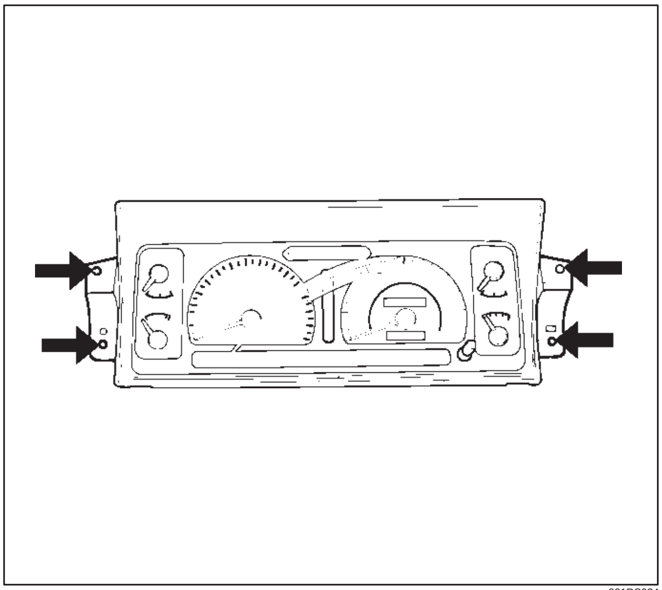
827RS022

12. Remove instrument panel cluster assembly.
   - Remove the 5 fixing screws (2) and pull the main unit toward you and remove the clips at the 4 positions (1). Disconnect the switch connectors.



740RS007

13. Remove meter assembly.
    - Remove the 4 meter assembly fixing screws and disconnect the meter harness connectors.



821RS034

14. Remove control lever assembly / control panel assembly.
    - Refer to Control Lever Assembly and / or Control Cable in HVAC section.
15. Remove radio assembly.
    - Remove 2 fixing screws.
16. Remove vent duct assembly.
    - Remove 5 fixing screws.
17. Remove instrument harness assembly.
    - Remove the 4 fixing screws, fasteners at the 4 positions and the clips at the 7 positions.
18. Remove side defroster grille.
    -

NOTE: For the order of removal steps in which each items contained in the instrument panel assembly are removed individually, refer to the chart.

Installation

To install, follow the removal steps in the reverse order.

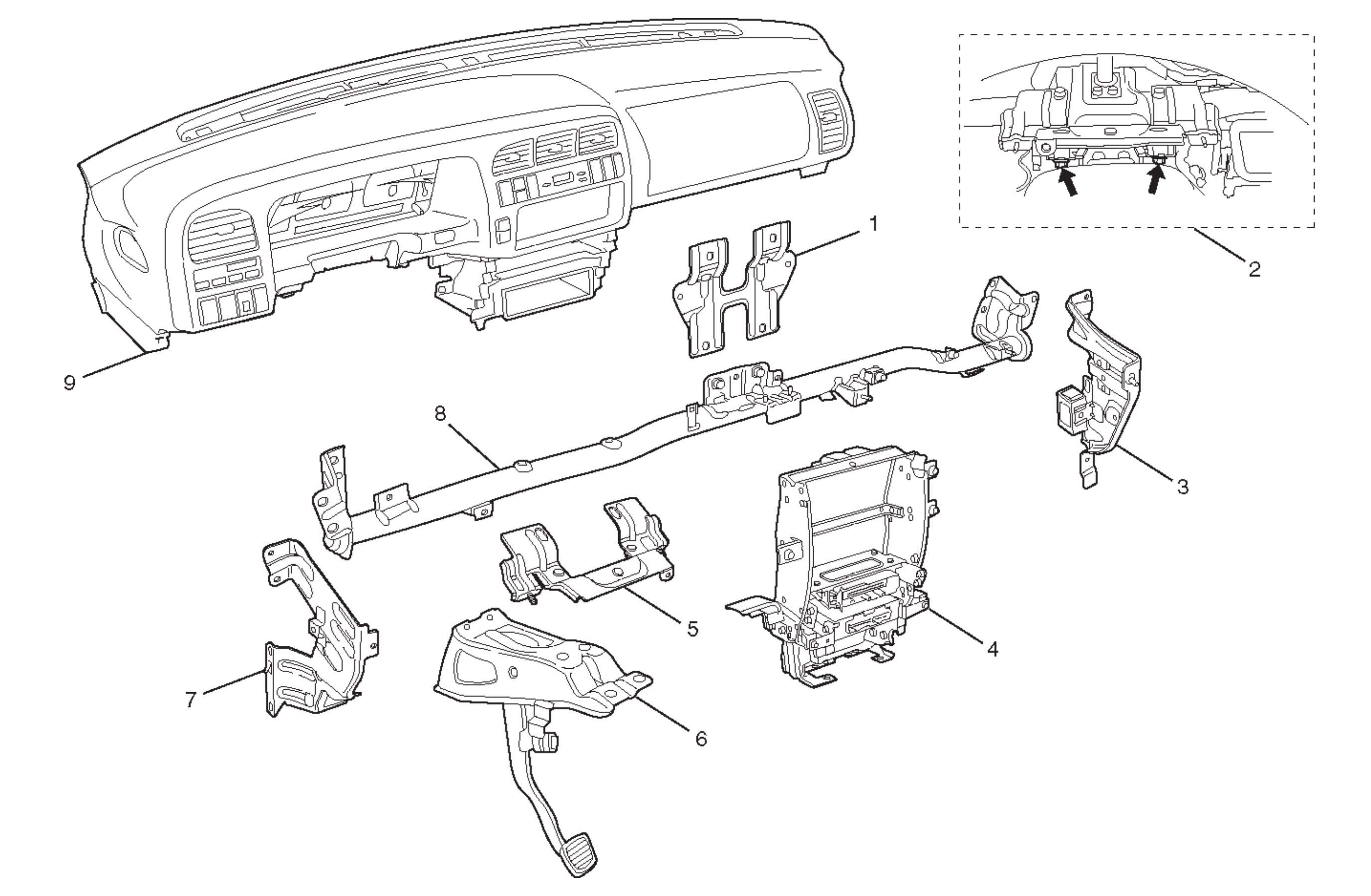
Order Of Removal/Installation Steps For Each Item

Removal Item	Removal Procedure	Removal Step
Front console assembly	Shift knob (M/T), Power & Winter SW (A/T), Transfer knob, Seat heater/Miller SW conn. and 4 screws	1, 2
Lower cluster assembly	3 screws, Ciger lighter conn. and Ashtray illumination conn.	1~3
Glove box	2 screws	4
Instrument panel passenger lower cover	7 screws and 1 clip	1~5
Passenger knee bolster reinforcement	4 nuts and 4 bolts	1~6
Instrument panel driver lower cover	Engine hood opening fixing screw, 2 screws, 1 bolt, 1 clip and fasteners at 4 positions	1~3, 7
Driver knee bolster	6 nuts	1~3, 7, 8
Front defroster grille	Claws at 8 positions	9
Instrument panel assembly	2 bolts (SRS adjust bracket~ cross beam), A/C control cable (Unit side at 3 position), Instrument harness connector (Driver side 5 position, assist side 3 position), SRS module conn., Radio antenna jack, Earth cable, 9 bolts and 3 nuts	1~10
Passenger inflator module	4 nuts (SRS module~Instrument panel), 2 nuts 0 and 2 washers (SRS module~support bracket) and 2 clips	1~6, 11
Instrument panel cluster	5 Screws, fastener at 4 position and each SW conn.	1~3, 7, 12
Meter assembly	4 screws and connectors	1~3, 7, 12, 13
A/C control panel assembly	4 screws and connectors	1~3, 7, 12, 14
Radio assembly	2 screws	1~3, 15
Vent duct assembly	5 screws	1~10, 16
Instrument harness assembly	4 screws, fasteners at 4 position, and clips at 7 position	1~10, 17
Side defroster grille		18

M/T = Manual Transmission
A/T = Automatic Transmission
SRS = Supplemental Restraint System
A/C = Air Conditioning

Cross Beam Assembly

Parts Location



740RT013

Legend

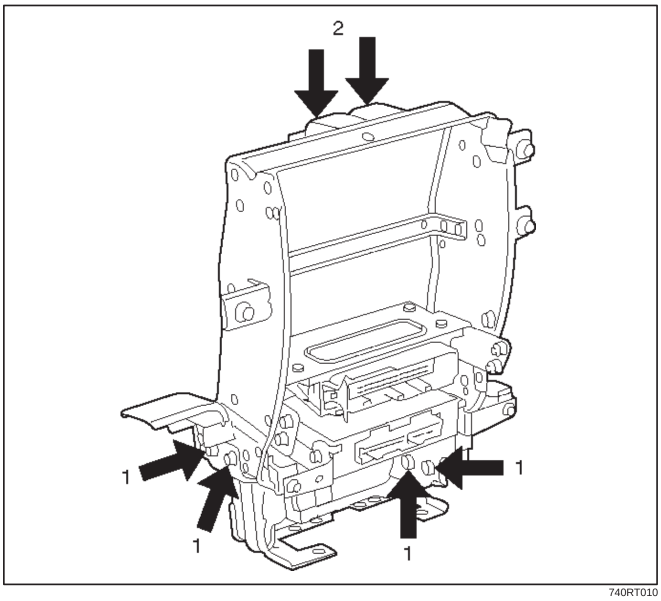
(1) Cross Beam Center Bracket
(2) Steering Column Fixing Bolts
(3) Side Support Bracket Assembly (RH)
(4) Instrument Panel Center Bracket
(5) Steering Support Bracket Assembly
(6) Brake Pedal Mounting Bracket Assembly
(7) Side Support Bracket Assembly (LH)
(8) Cross Beam Assembly
(9) Instrument Panel Assembly

Removal

1. Disconnect battery ground cable.
2. Remove instrument panel assembly.
   - Refer to Instrument Panel Assembly in this section.
3. Remove side support bracket assembly (LH/RH).
   - Remove the 4 fixing bolts on both sides.
4. Remove cross beam center bracket
   - Remove 2 fixing nuts.
5. Remove instrument panel center bracket.
   - Disconnect the PCM and EBCM connector.
   - Remove the DERM (SRS) with 3 fixing nuts.

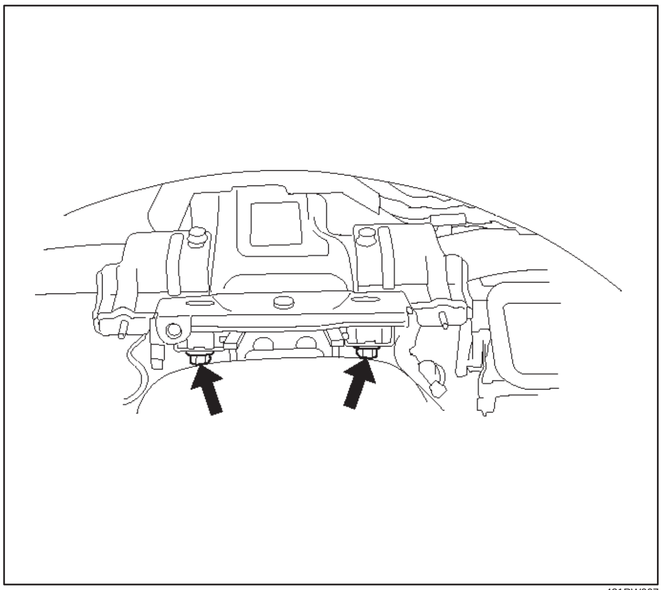
CAUTION: For precautions on installation or removal of SRS — air bag system, refer to Supplemental Restraint System (SRS) — AIR BAG in Restraint section.

- Remove the 2 fixing nuts (upper) and the 4 fixing bolts (lower).



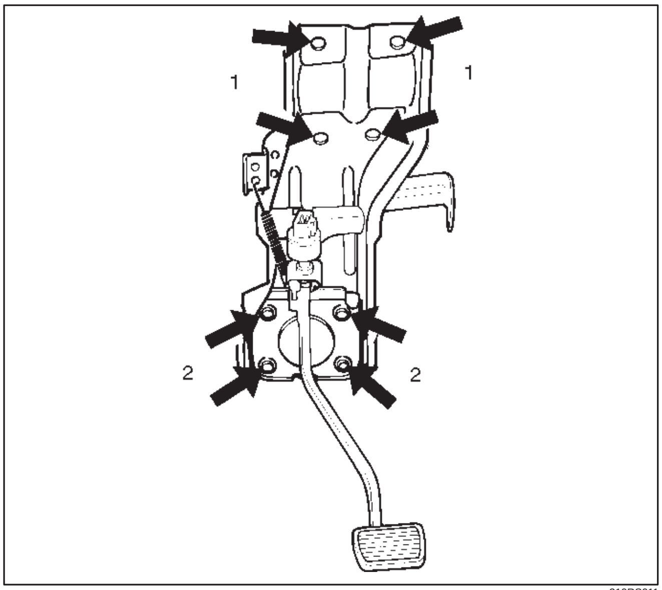
740RT010

6. Remove steering column fixing bolts.
   - Remove 2 fixing bolts.



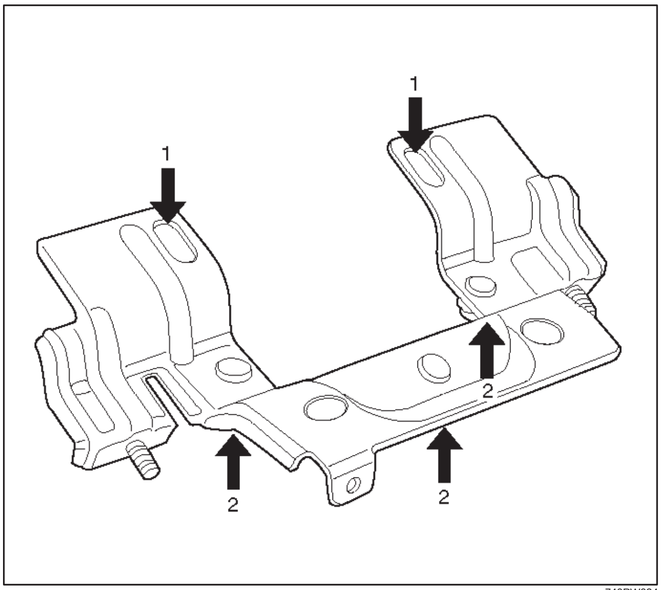
431RW007

7. Remove brake pedal mounting bracket assembly.
   - Disconnect the 2 brake pedal mounting bracket assembly fixing nuts, and remove the antitheft controller.
   - Disconnect the brake pedal link and the brake switch, and remove the 4 fixing bolts and the nuts on the bracket.



310RS011

8. Remove steering support bracket assembly.
   - Remove the 2 fixing bolts (upper side) (1) and the 3 fixing nuts (lower side) (2).



740RW024

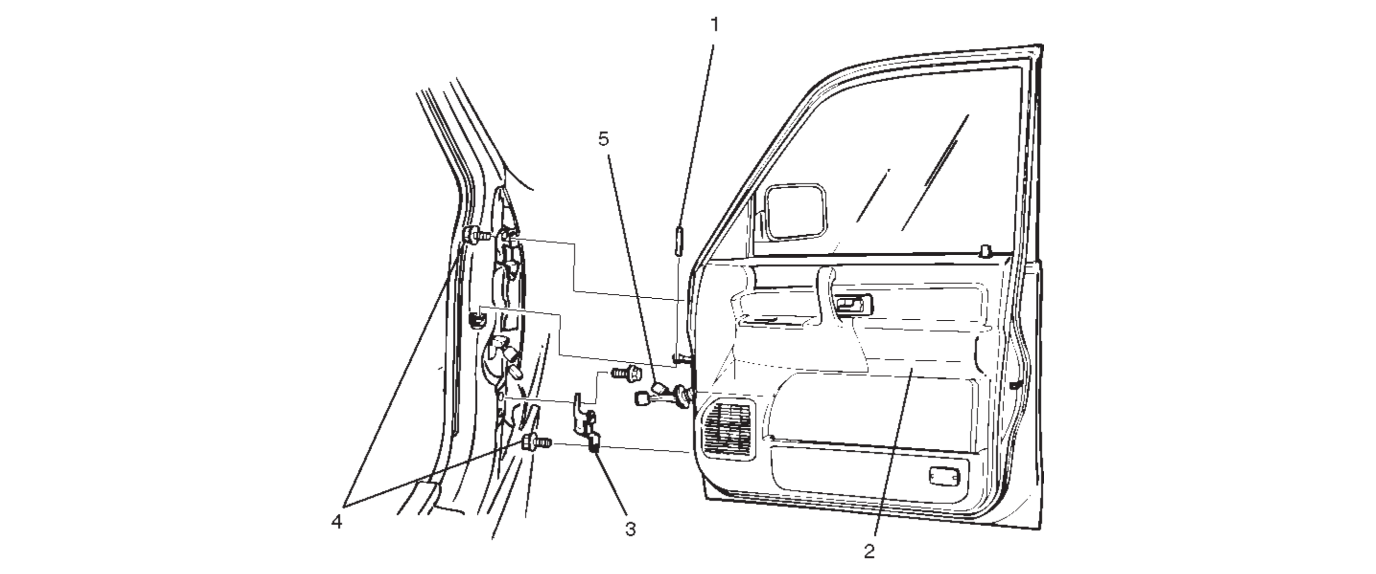
9. Remove cross beam assembly.
   - Disconnect the harness clips from the crossbeam assembly, and remove 2 fixing bolts on both sides and 2 fixing nuts in the center.

Installation

To install, follow the removal steps in the reverse order.

Front Door Assembly

Parts Location



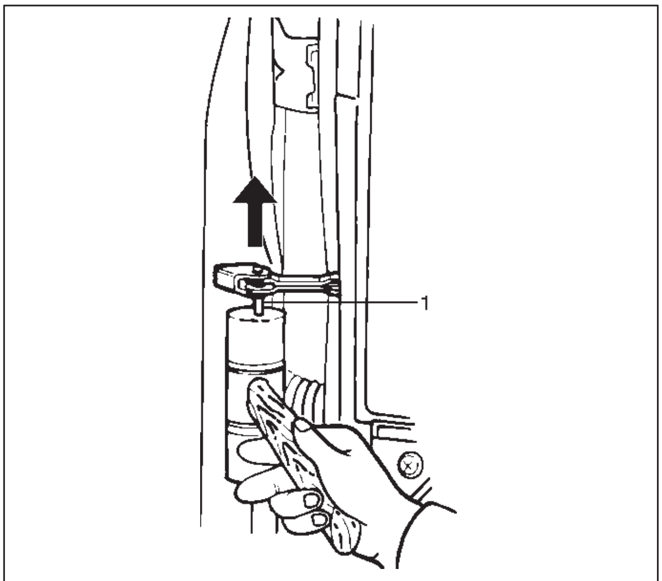
630RS001

Legend

(1) Door Check Arm Pin
(2) Front Door Assembly
(3) Door Hinge Assembly
(4) Hinge Bolt
(5) Door Harness Connection

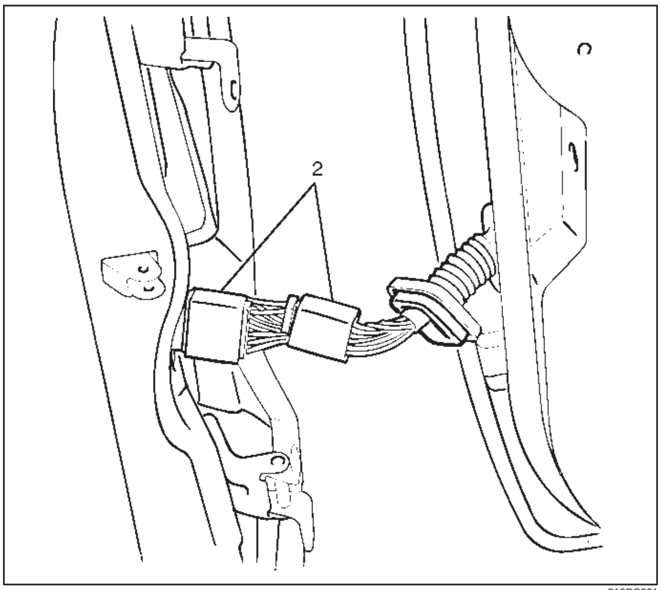
Removal

1. Disconnect the battery ground cable.
2. Remove door check arm pin (1).



630RS002

3. Remove hinge bolt.
   - Align the hinge bolt to the door side hinge and put a marker on it.
4. Remove door harness connection (2).
   - Pull the door harness grommet out in order to disconnect the harness connection.



810RS001

5. Remove front door assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

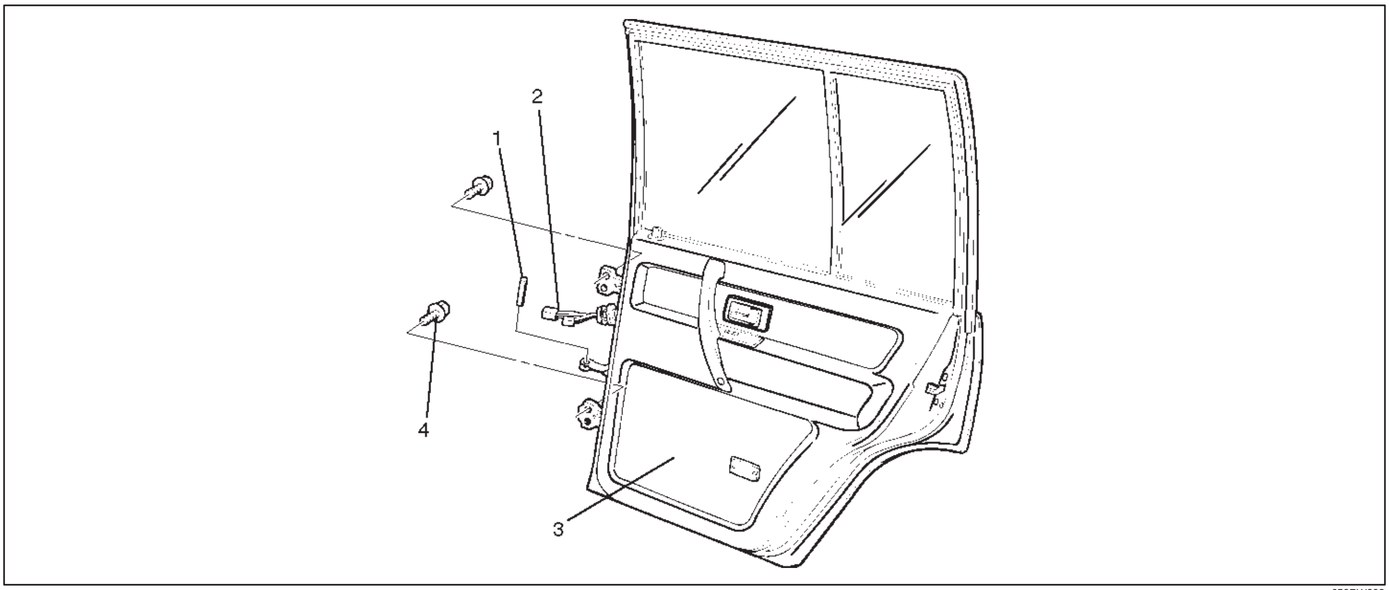
1. Align the door fitting to the body by referring to Body Dimensions in this section.
2. Tighten the door hinge bolts to the specified torque.

   Torque : 34 N•m (25 lb ft)

3. Apply chassis grease to the door check arm pin and the door hinge moving surface.

Rear Door Assembly

Parts Location



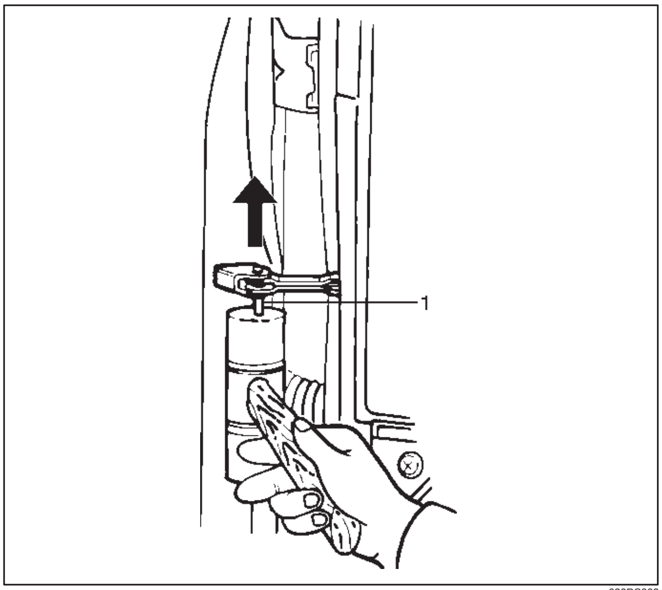
650RW002

Legend

(1) Door Check Arm Pin
(2) Door Harness Connection
(3) Rear Door Assembly
(4) Hinge Bolt

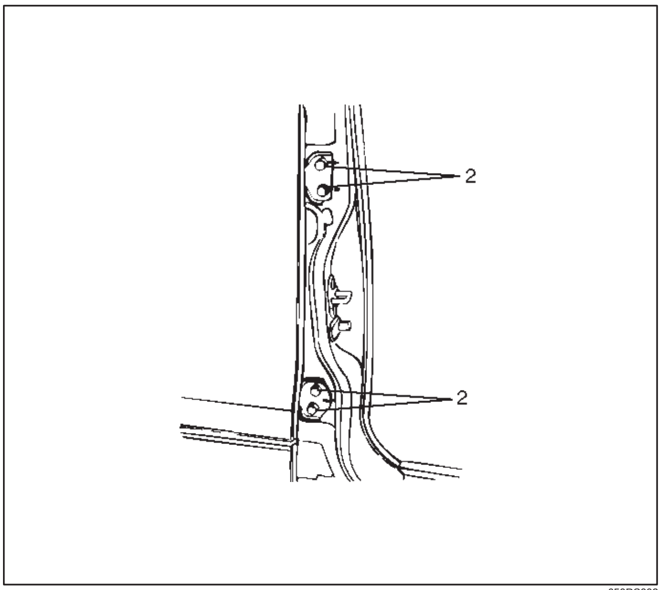
Removal

1. Disconnect the battery ground cable.
2. Apply a setting mark on the body side hinge.
3. Remove door check arm pin (1).



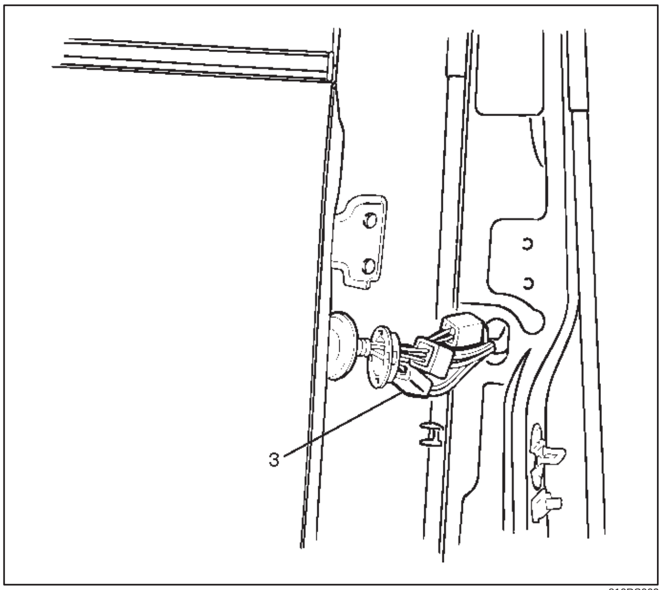
630RS002

4. Remove hinge bolt.
   - Open the front door and remove the body side hinge bolts (2).



650RS002

5. Remove door harness connection (3).
   - Pull the door harness grommet out in order to disconnect the door harness connection.



810RS002

6. Remove door assembly

Installation

To install, follow the removal steps in the reverse order, noting the following points.

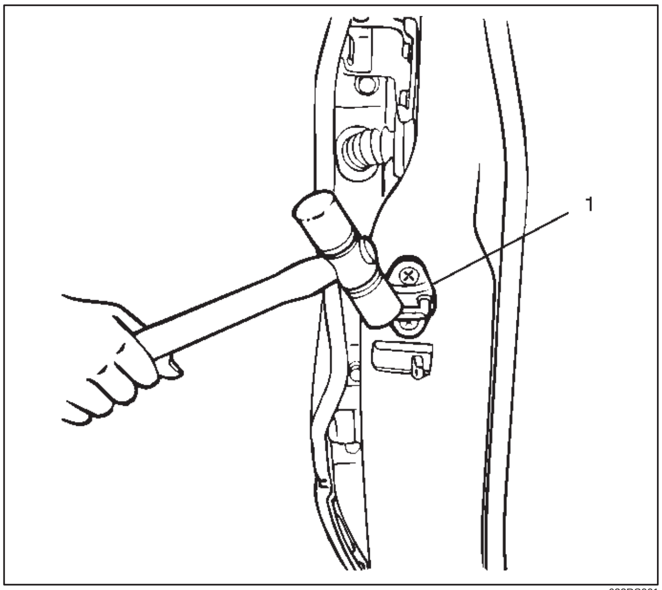
1. Align the door fitting to the body by refer to Body Dimensions in this section.
2. Tighten the door hinge bolts to the specified torque.

   Torque : 34 N•m (25 lb ft)

3. Apply chassis grease to the check arm pin and the door hinge moving surface.

Door Strikers

Adjustment



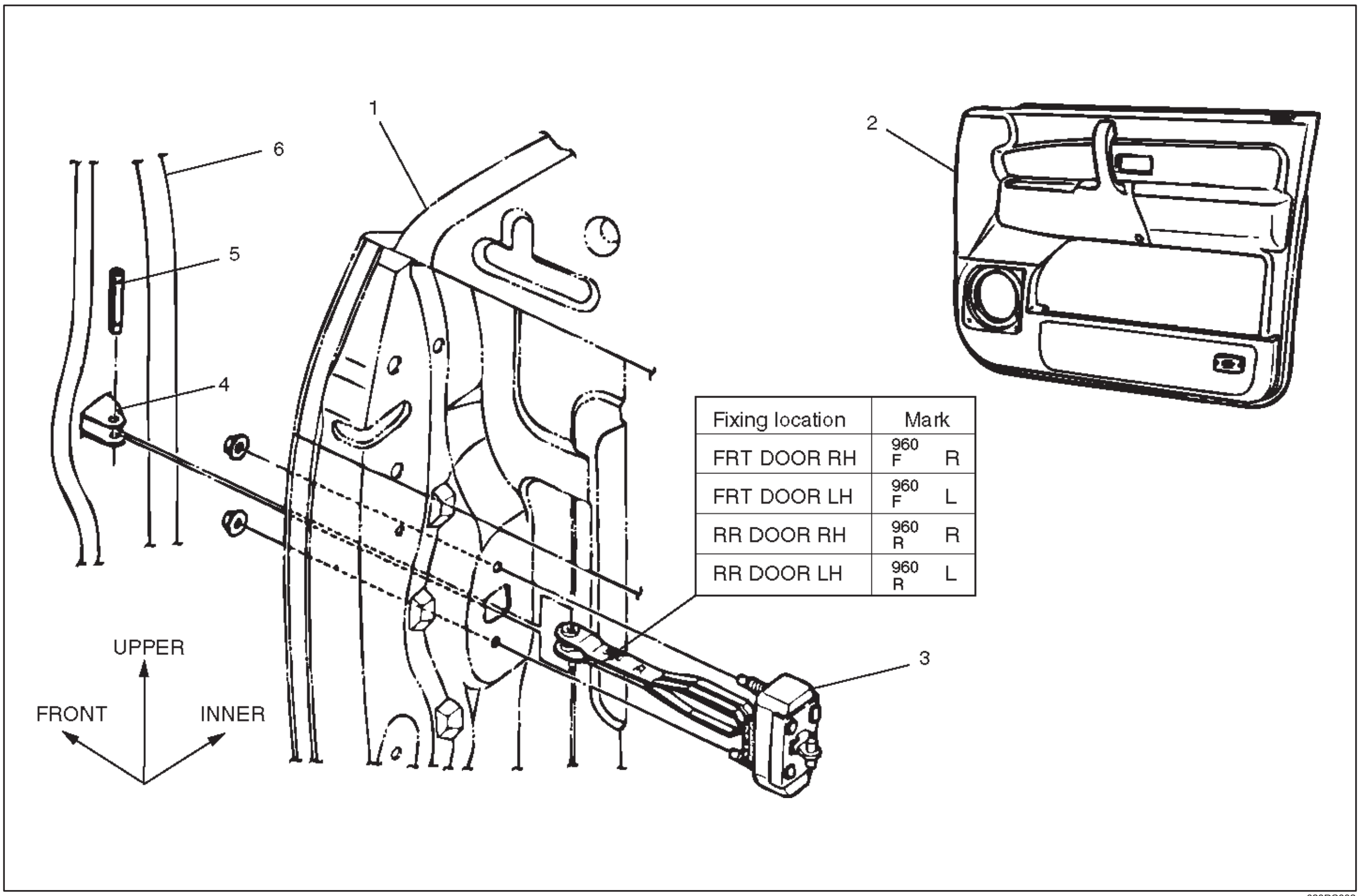
632RS001

1. Loosen the striker (1) screws.
2. Tap with a plastic hammer to align.
3. Tighten the striker screws.

   Torque : 15 N•m (11 lb ft)

Door Check Arm Assembly (Front & Rear)

Parts Location



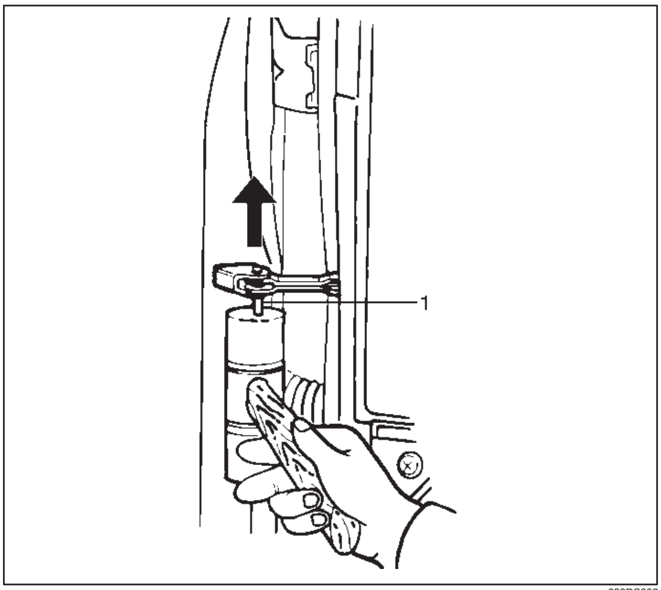
630RS003

Legend

(1) Front or Rear Door
(2) Door Trim Panel
(3) Check Arm Assembly
(4) Check Arm Pin Bracket
(5) Check Arm Pin
(6) Front or Center Pillar

Removal

1. Disconnect the battery ground cable.
2. Remove door trim panel.
   - Refer to Front / Rear Door Trim Panel in Exterior / Interior Trim section.
3. Remove check arm pin (1).



630RS002

4. Remove check arm assembly.
   - Carefully peel off the water proof sheet as much as necessary, for check arm removal.

Installation

To install, follow the removal steps in the reverse order, noting the following point.

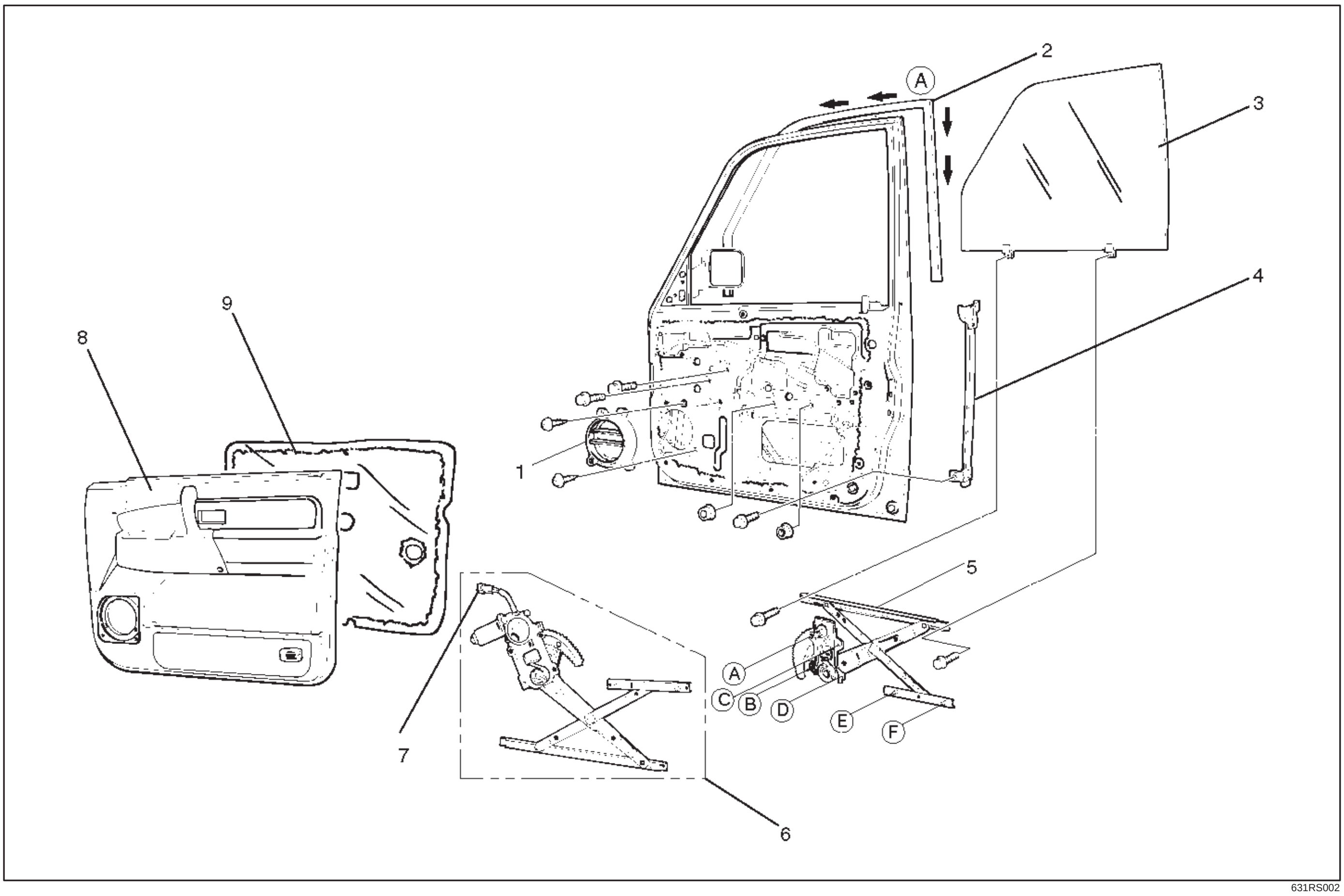
1. When installing the check arm assembly, note its marking to ensure using the appropriate part.
2. Tighten the check arm fixing nuts to the specified torque.

Torque : 13 N•m (113 lb in)

3. Apply chassis grease to the check arm pin moving surface.

Front Window Regulator, Glass And Glass Run

Parts Location



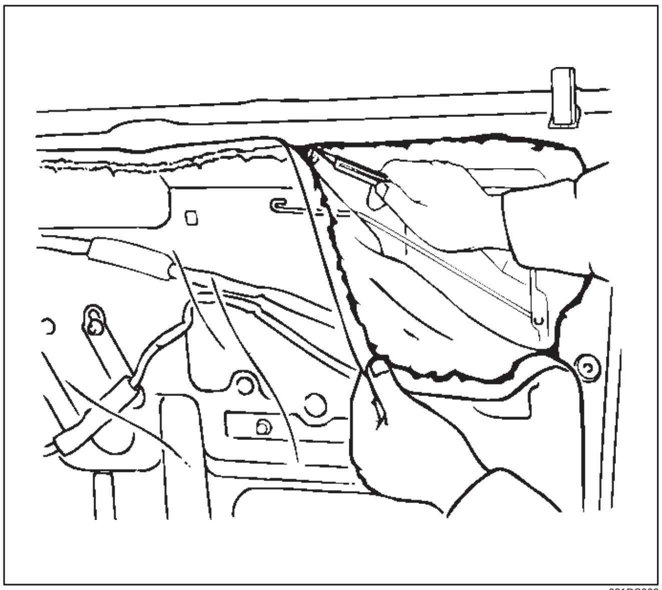
Legend

(1) Speaker Box
(2) Glass Run
(3) Glass
(4) Rear Guide Rail
(5) Window Regulator
(6) Window Regulator with Power Window
(7) Window Regulator Motor Connector
(8) Door Trim Panel
(9) Waterproof Sheet

Removal

1. Disconnect the battery ground cable.
2. Remove door trim panel.
   - Refer to Front Door Trim Panel in Exterior / Interior Trim section.
3. Remove speaker box.

4. Remove waterproof sheet.

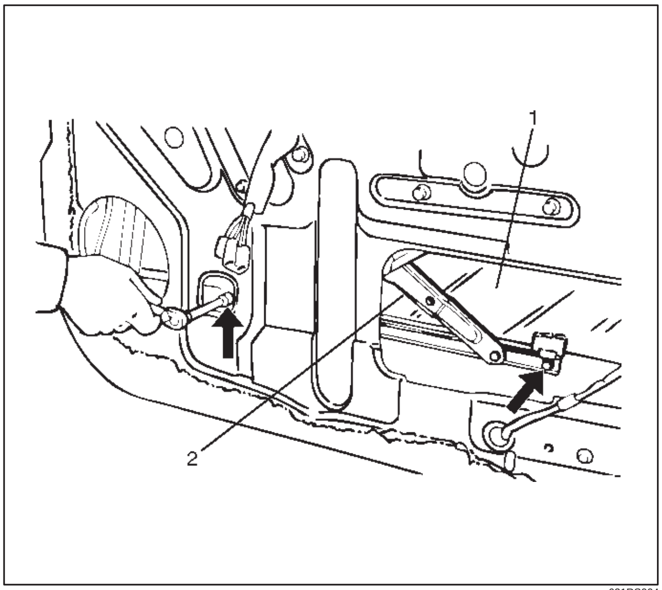


631RS003

- Take notice of the door harness and the grommet, peel the waterproof sheet off the door panel carefully.

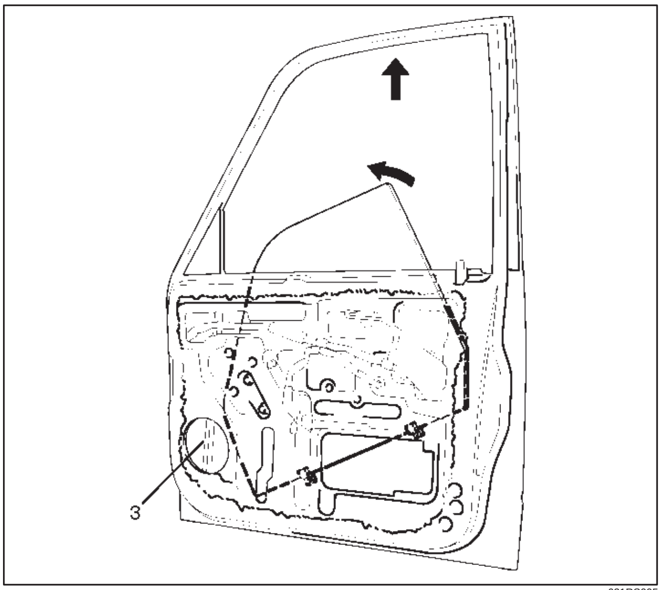
5. Remove glass.

- Bring the glass (1) down to the position where the fixing bolts can be seen.



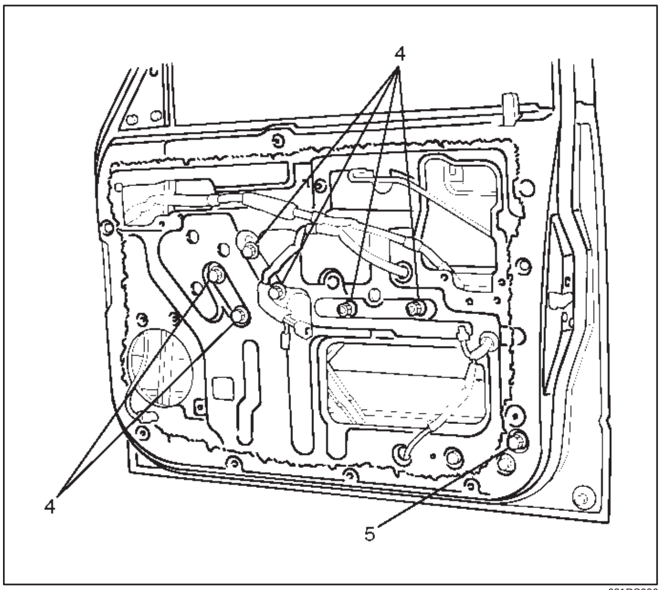
631RS004

- Remove the glass fixing bolts from the window regulator (2) and lower thefront side of the glass.
  When the front side of the glass comes off the glass run (3), turn the glass inside out and pull it up from its rear side.



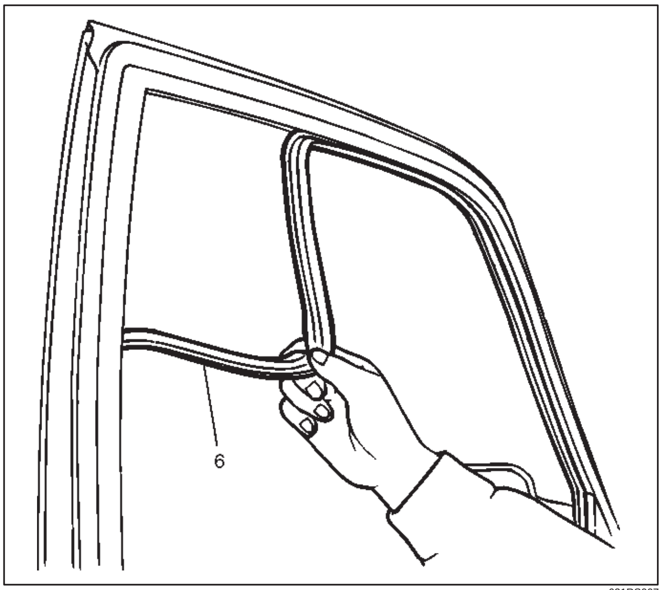
631RS005

6. Remove window regulator.
   - Remove the window regulator fixing bolts (4) and the rear guide rail fixing bolt (5).
   - Disconnect the window regulator motor harness connector, if equipped with power windows.



631RS006

7. Remove glass run.
   - Pull the glass run (6) out from the door frame groove.



631RS007

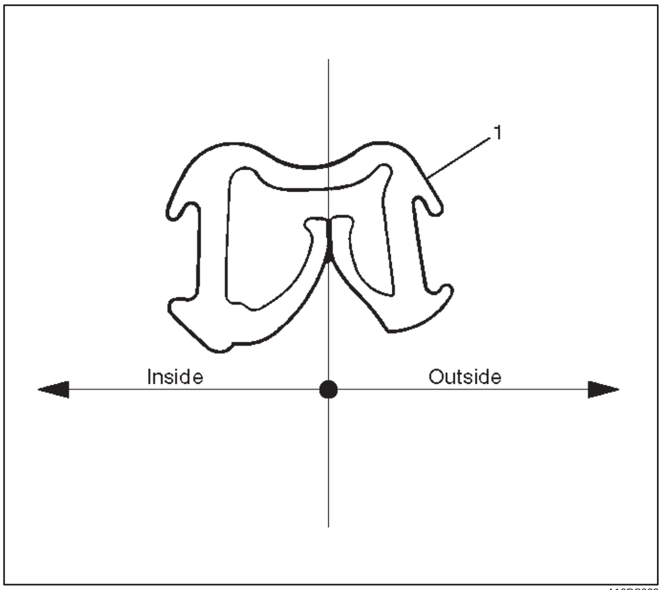
8. Remove rear guide rail.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Apply soap and water to the door frame groove. Insert the glass run (1) to the door frame from the A corner in the arrow–marked directions.

   Install the glass run with its wider end pointed to the inside of the vehicle.



A10RS023

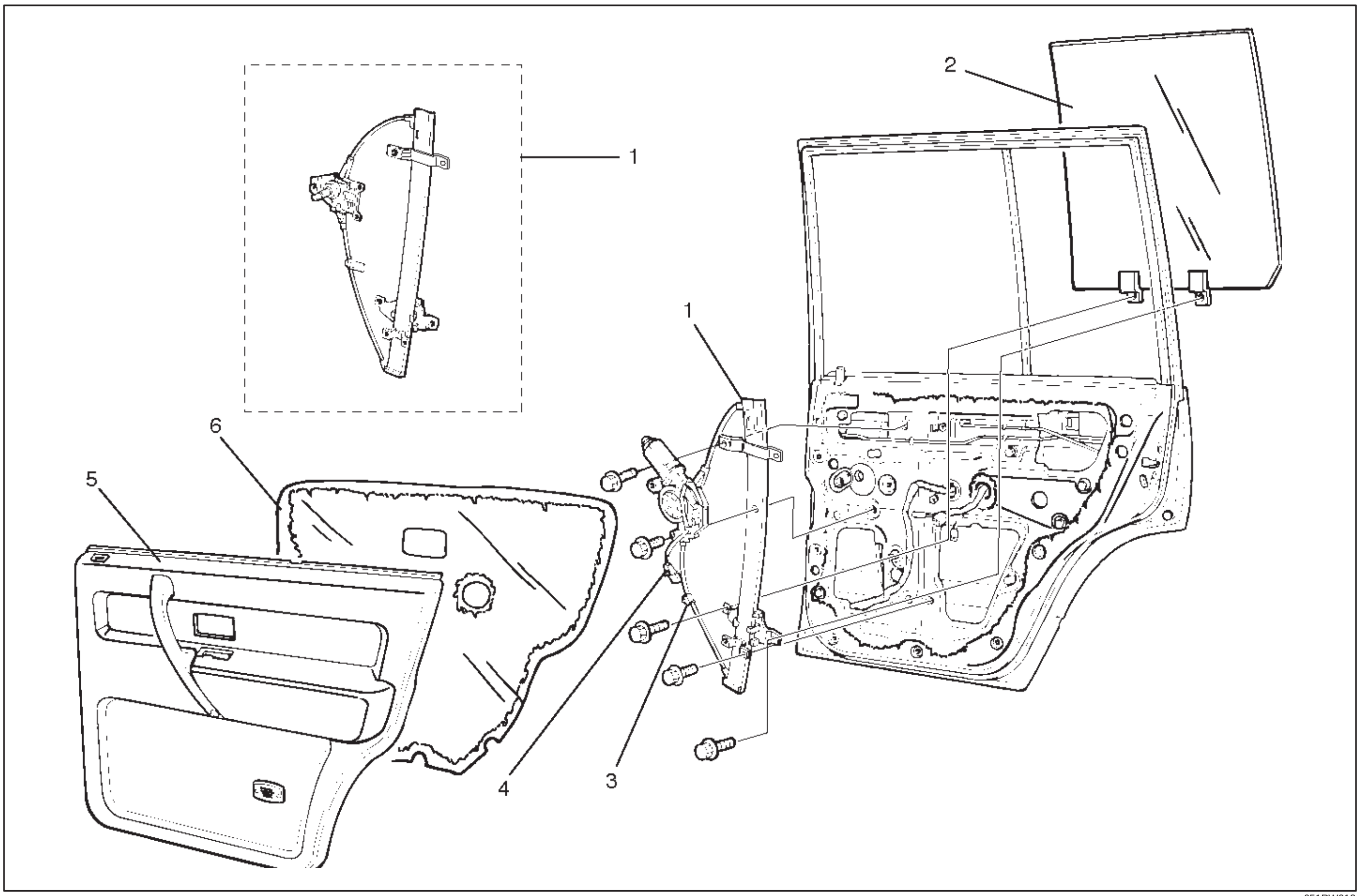
2. Set the glass into the door panel with the front side of the glass lowered and insert the rear side of the glass into the glass run (1). Then insert the front side of the glass into the glass run in order to install the glass to the glass run while raising it up along the glass run.
3. Tighten the window regulator and the glass fixing bolts and nuts to the specified torque.

Torque : 8 N•m (69 lb in)

4. Check to see of the window regulator operates smoothly and the glass opens and closes properly. Install the waterproof sheet with no clearance between the door panel and the waterproof sheet.

Rear Window Regulator And Glass

Parts Location

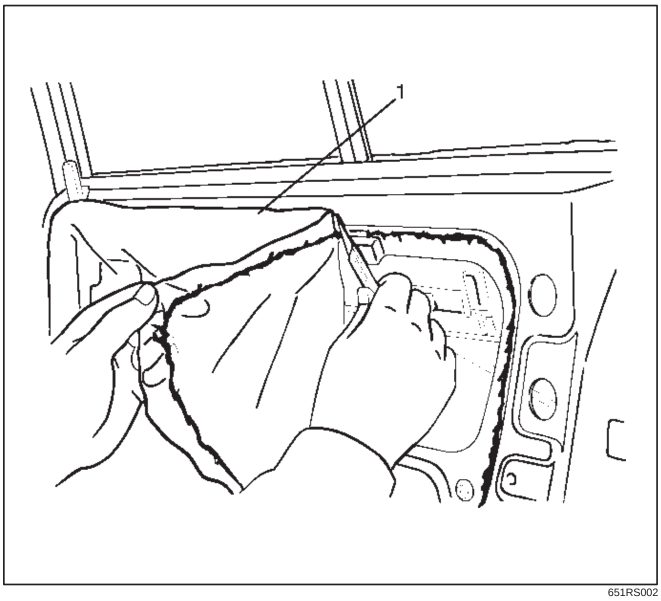


651RW012

Legend
- (1) Window Regulator
- (2) Glass
- (3) Cable Fixing Clip
- (4) Window Regulator Motor Connector
- (5) Door Trim Panel
- (6) Waterproof Sheet

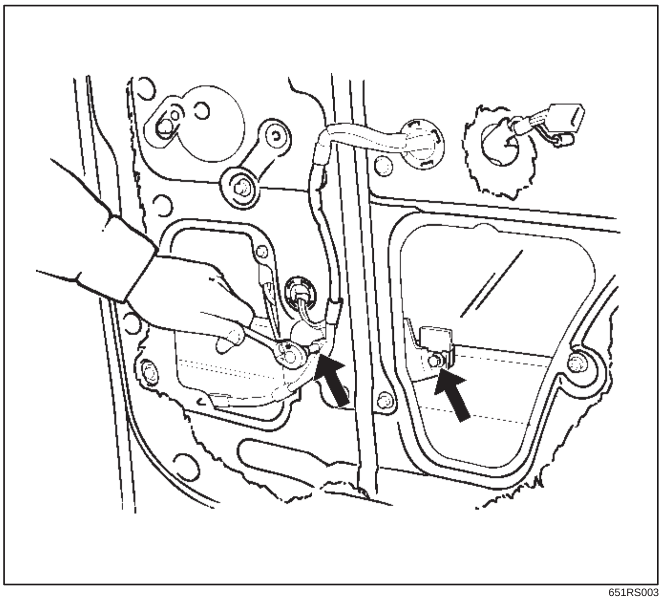
Removal

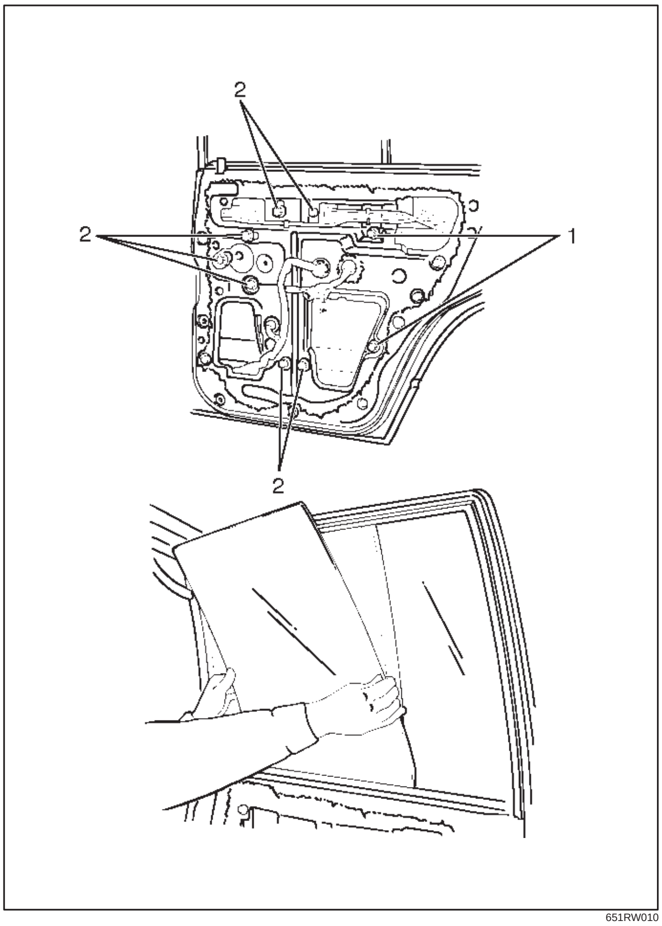
1. Disconnect the battery ground cable.
2. Remove door trim panel.
   - Refer to Rear Door Trim Panel in Exterior / Interior Trim section.
3. Remove waterproof sheet (1).
   - Taking notice of the door harness, peel the waterproof sheet off the door panel carefully.



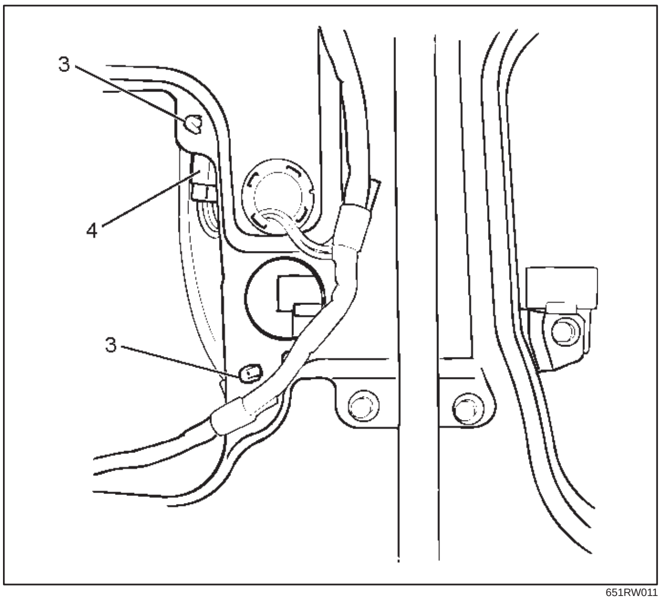
651RS002

4. Remove glass.
   - Bring the glass down to the position where the bolt can be seen.
   - Remove the sash division 2 fixing bolts (1) and then remove the glass fixing bolt to remove the glass upwards.





5. Remove window regulator.
   - Disconnect the regulator motor connector (4) and remove the window regulator cable fixing clip (3) from the door panel, if model is equipped with power windows.
   - Remove the window regulator 7 fixing bolts (2) and pull the regulator out from the lower hole of the door panel.



Installation

To install, follow the removal steps in the reverse order, noting the following points.

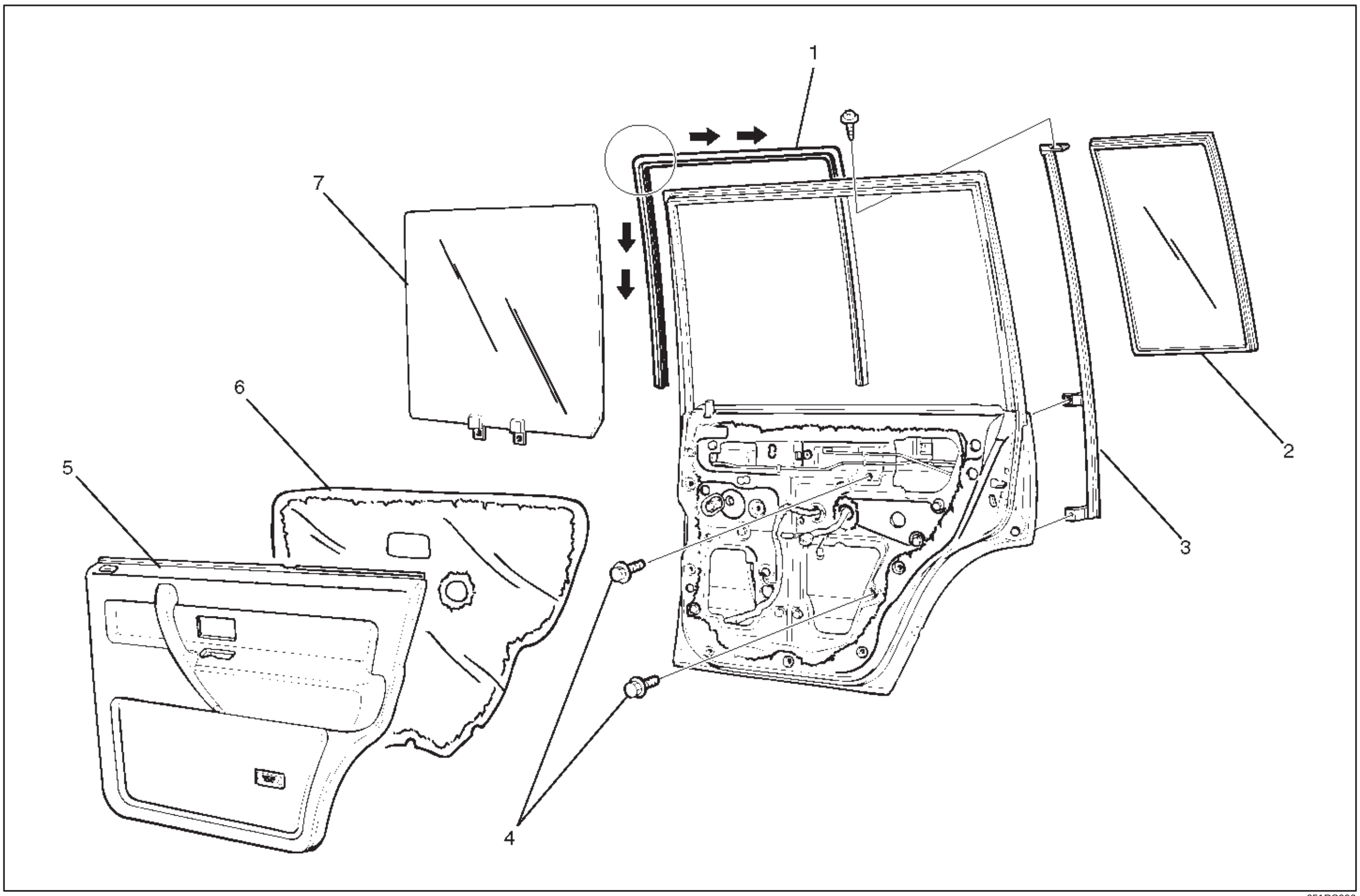
1. Tighten the window regulator and the glass fixing bolts to the specified torque.

   Torque : 8 N•m (69 lb in)

2. Install the waterproof sheet with no clearance between the door panel and the waterproof sheet.

Rear Door Fixed Glass And Glass Run

Parts Location

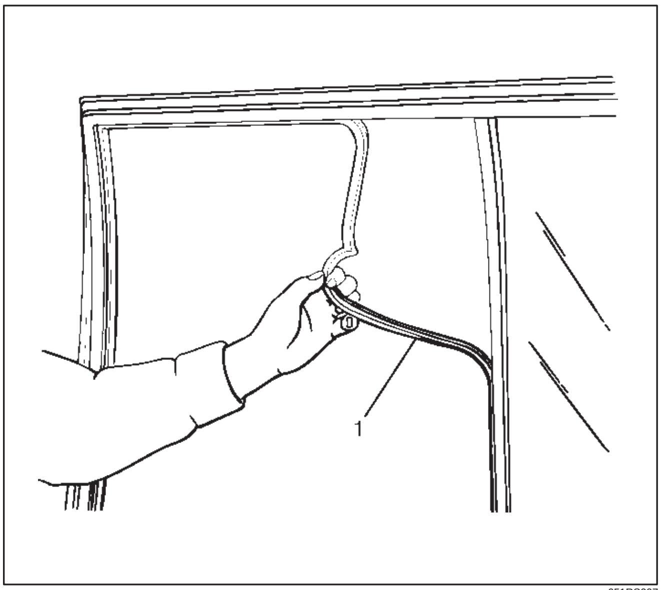


651RS006

Legend
(1) Glass Run
(2) Rear Fixed Glass
(3) Sash Division
(4) Sash Division Fixing Bolts
(5) Door Trim Panel
(6) Waterproof Sheet
(7) Glass

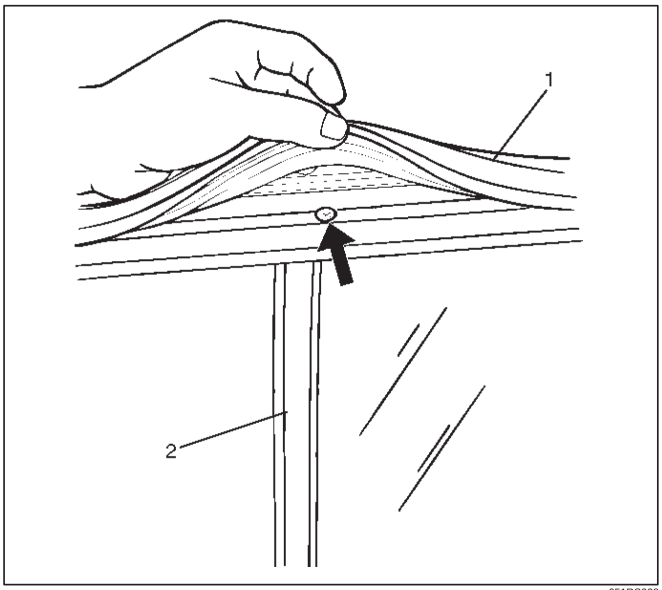
Removal

1. Disconnect the battery ground cable.
2. Remove door trim panel.
3. Remove waterproof sheet.
4. Remove glass.
   - Refer to Rear Window Regulator and Glass in this section.
5. Remove glass run.
   - Pull the glass run (1) out from the door frame.



651RS007

6. Remove sash division (2).



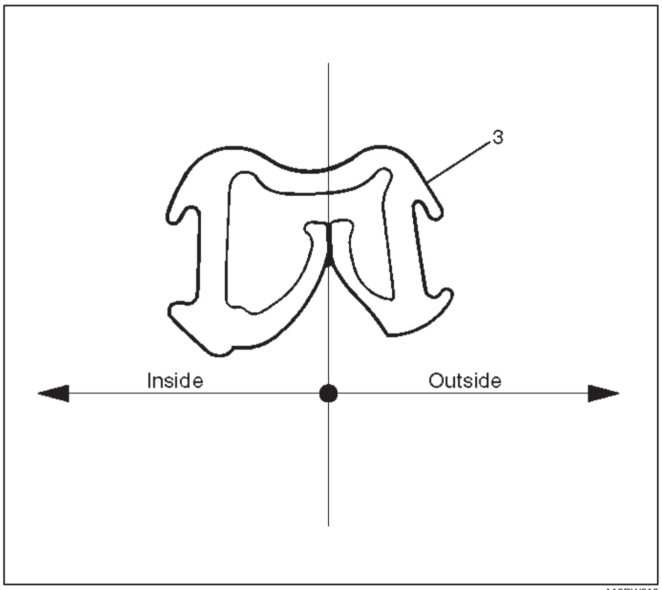
651RS008

7. Remove door fixed glass.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

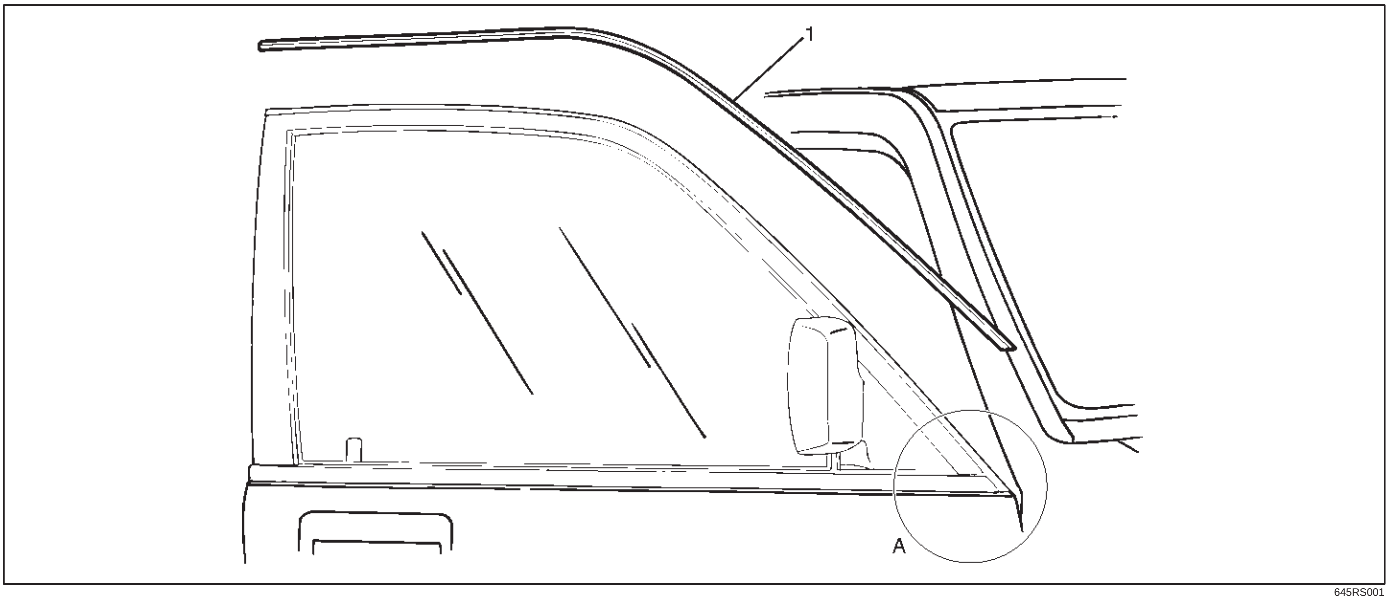
1. Apply soap and water to the fixed glass.
2. Apply soap and water to the door groove and insert the glass run (3) to the frame from the corner in the arrow-marked directions.
3. Be sure to install the glass run with its end pointed to the inside of the vehicle.



A10RW019

Front Door Sash Moulding

Parts Location

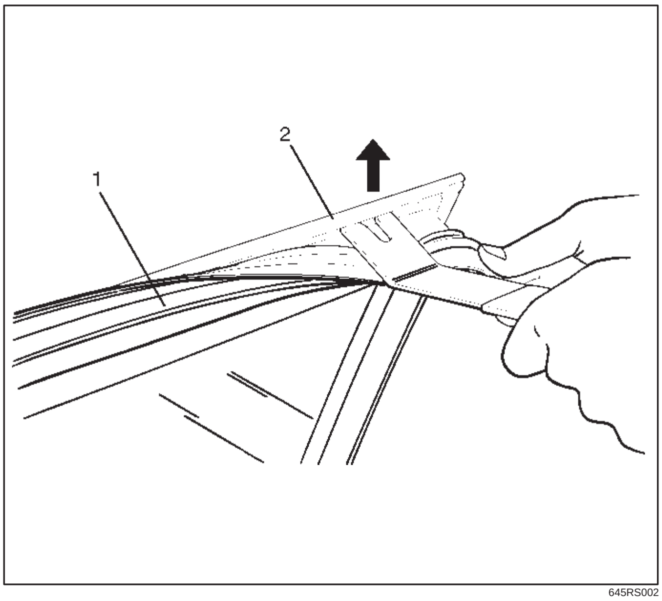


Legend

(1) Front Door Sash Moulding

Removal

1. Remove front door slash moulding.
   - To avoid the weatherstrip (1) and pry the door sash moulding (2) out from the door panel.

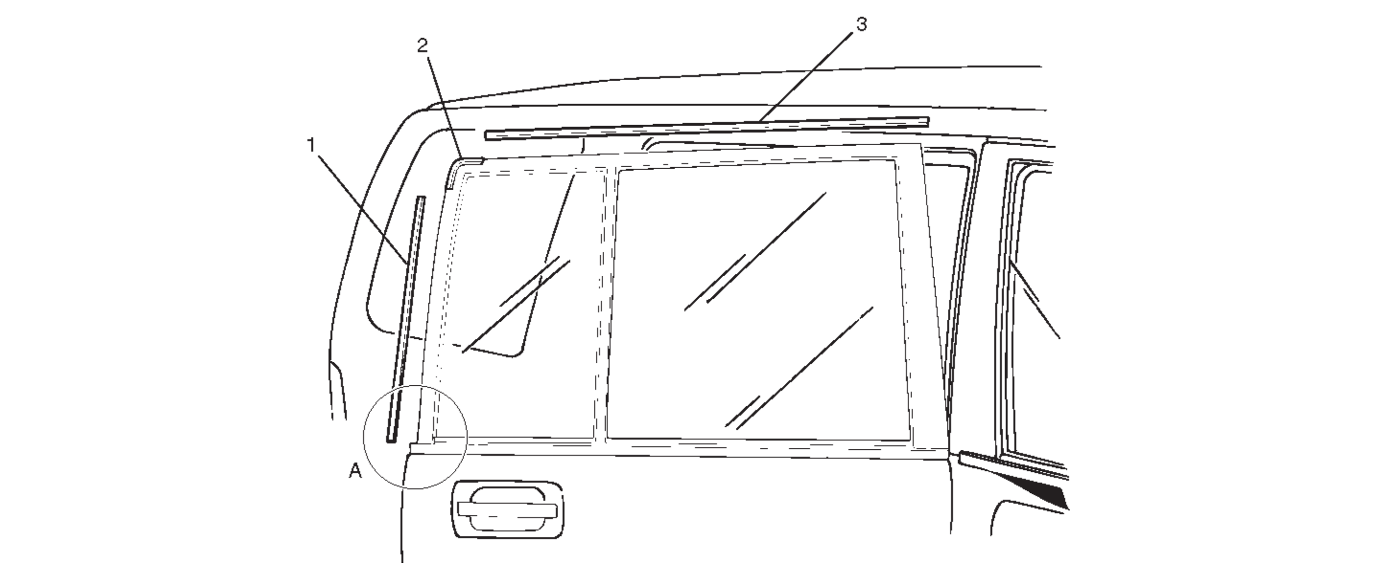


Installation

1. Front door sash moulding.
   - Assemble the edge portion (A portion) of the moulding so that the clearance between the moulding and the waist seal becomes 1 mm (0.04 in).

Rear Door Moulding

Parts Location



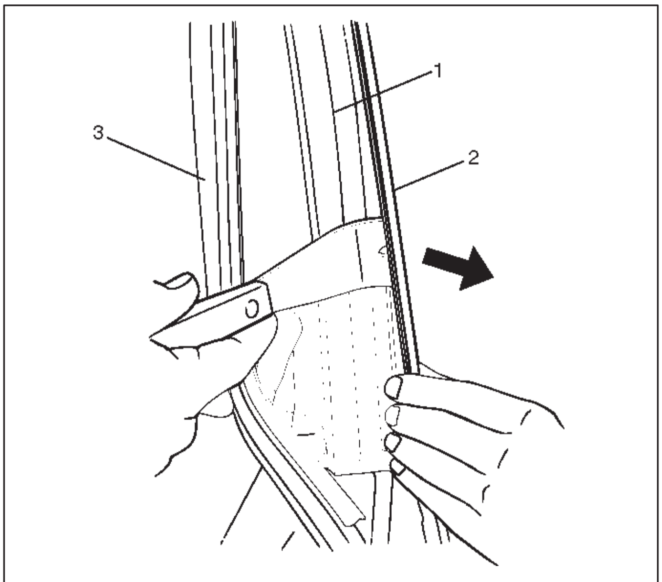
645RS003

Legend

(1) Rear Door Side Moulding
(2) Rear Door Corner Moulding
(3) Rear Door Upper Moulding

Removal

1. Disconnect the battery ground cable.
2. Remove rear door side moulding.
3. Remove rear door upper moulding.
4. Remove rear door corner moulding.
   - Avoiding the weatherstrip (3), pry the moulding (2) out from the door frame (1).



645RS004

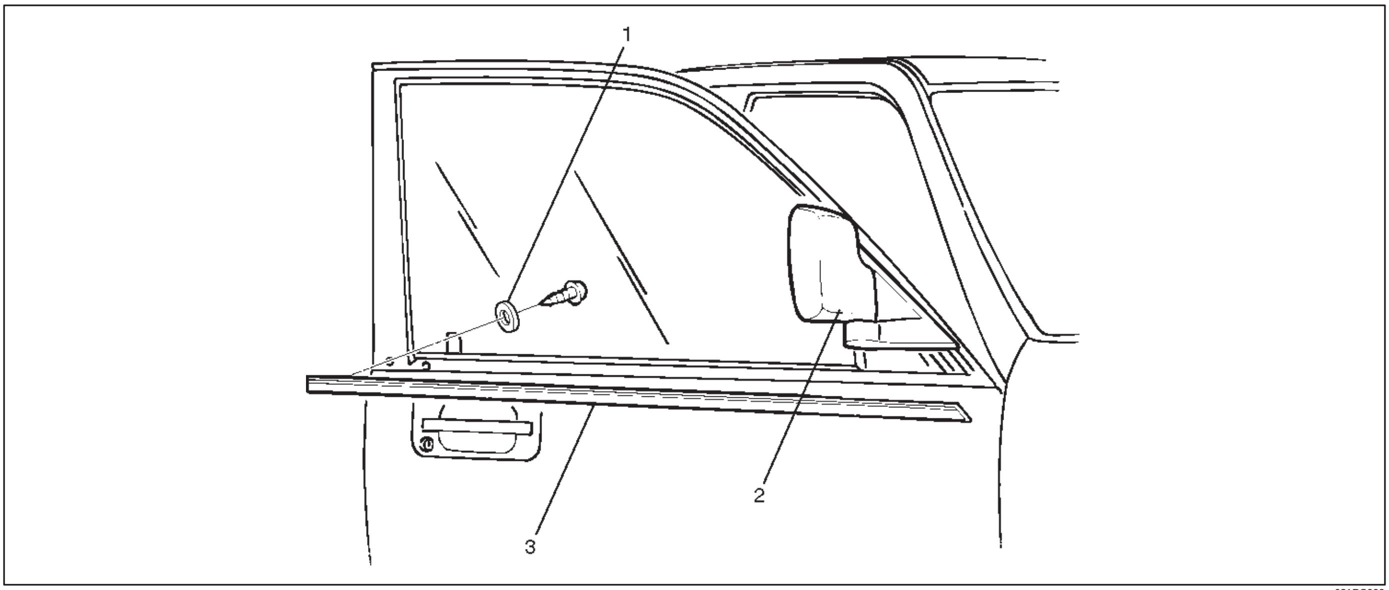
Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Install each moulding with no clearance between each piece of moulding.
2. Assemble the edge portion (A portion) of the moulding so that the clearance between the rear side moulding and the waist seal is 1 mm (0.04 in).

Front Door Waist Seal

Parts Location

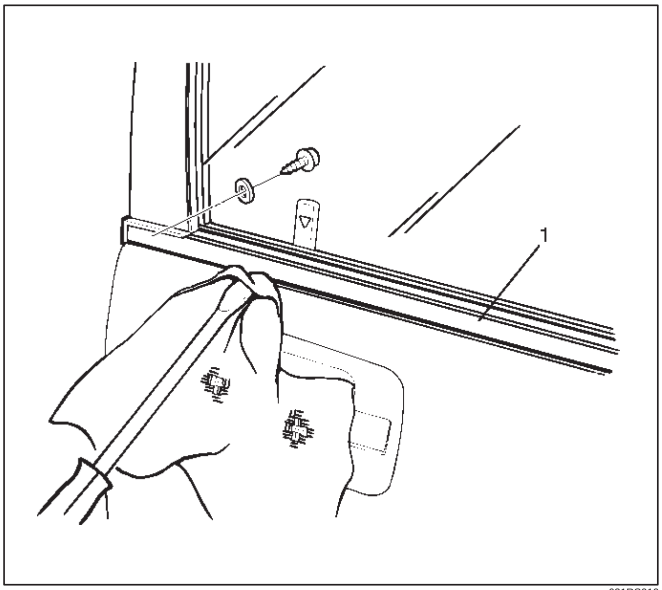


631RS009

Legend
(1) Nylon Washer
(2) Door Mirror
(3) Front Door Waist Seal

Removal

1. Disconnect the battery ground cable.
2. Remove door mirror.
   - Refer to Door Mirror in this section.
3. Remove front door waist seal.
   - Remove the fixing screw and pull out the waist seal (1) from the door frame while prying it up.



631RS010

Installation

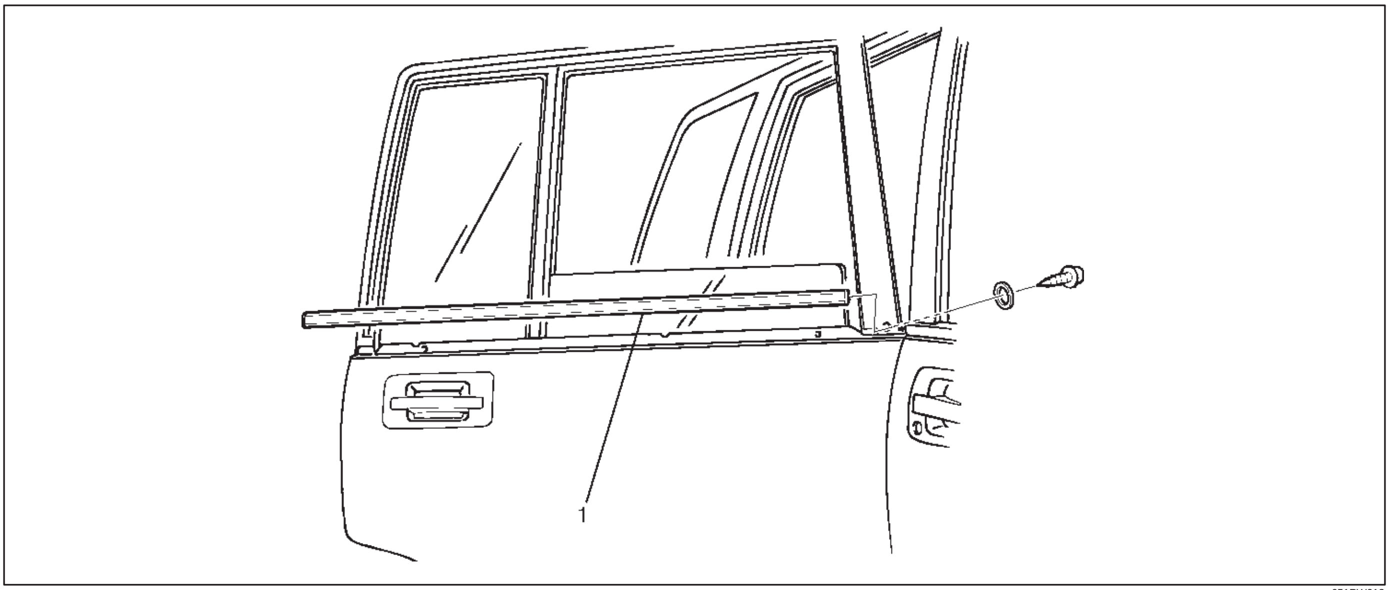
To install, follow the removal steps in the reverse order, noting the following point.

1. Apply soap and water to the inside of the waist seal and align the screw hole of the waist seal to the door panel hole, and gently tap the seal with a rubber hammer.

   Be sure not to tap the seal hard. This may result in deforming the seal.

Rear Door Waist Seal

Parts Location



651RW013

Legend

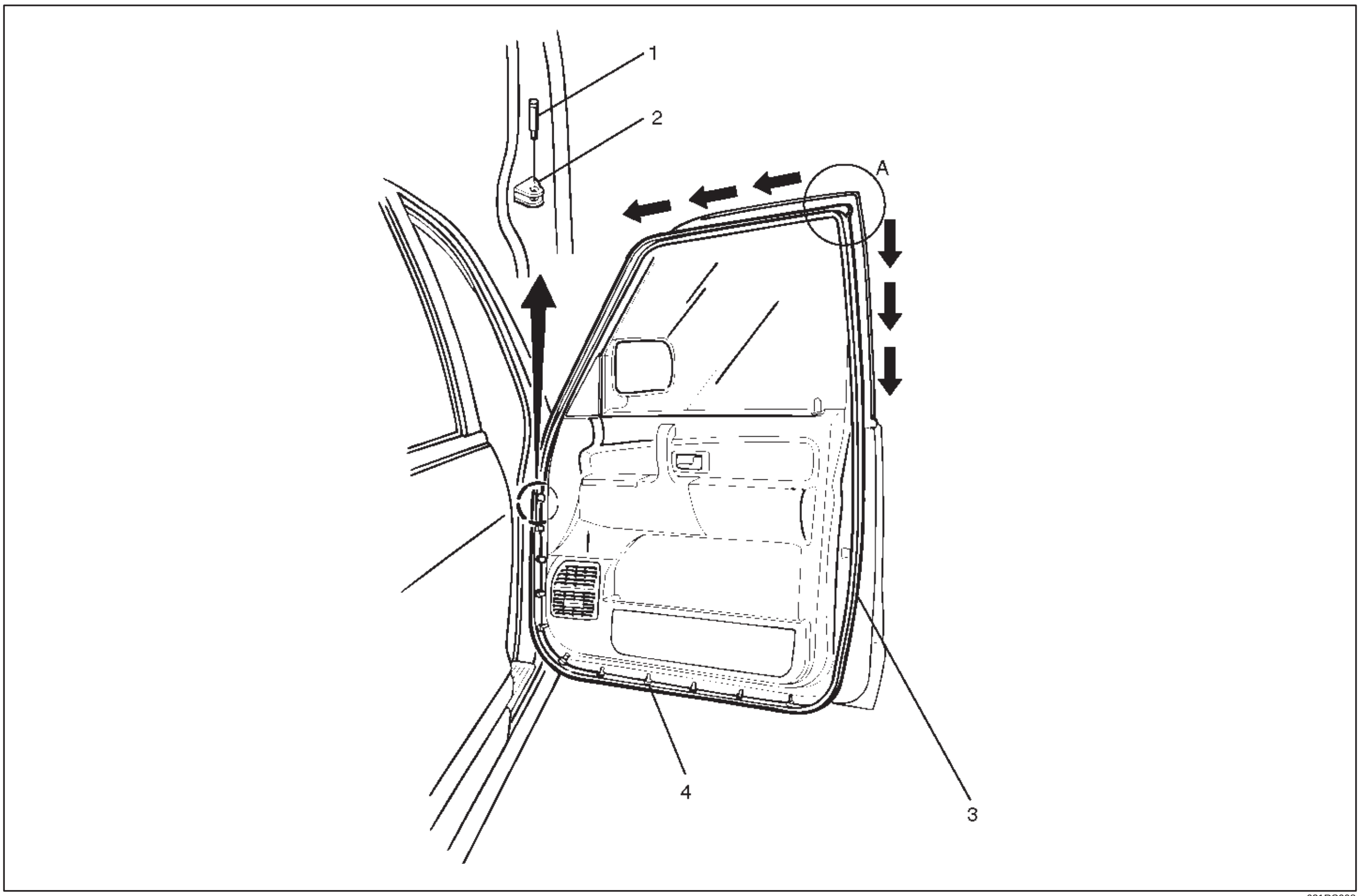
(1) Rear Door Waist Seal

Removal and Installation

Refer to Front Door Waist Seal in this section.

Front Door Weatherstrip

Parts Location



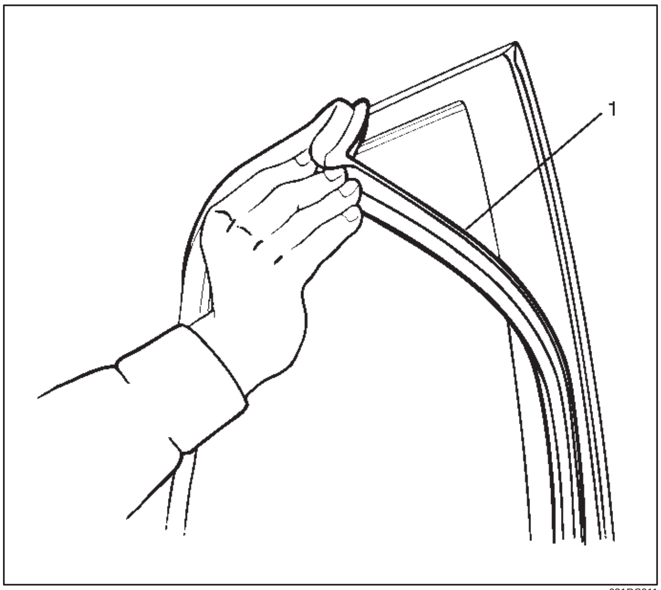
631RS008

Legend

(1) Check Arm Pin
(2) Bracket
(3) Weather Strip
(4) Clip

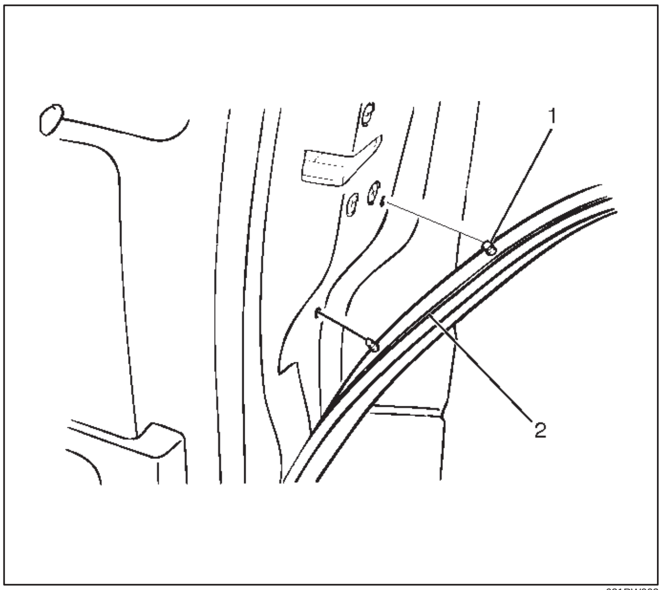
Removal

1. Remove check arm pin.
2. Remove front door weatherstrip.
   - Pull the weatherstrip (1) out from the door frame.



631RS011

- Carefully remove the weatherstrip (2) from the door panel.

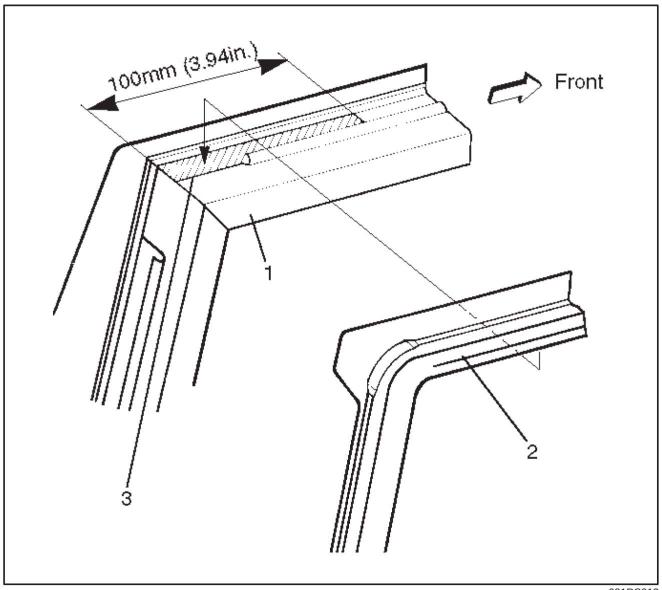


631RW003

Installation

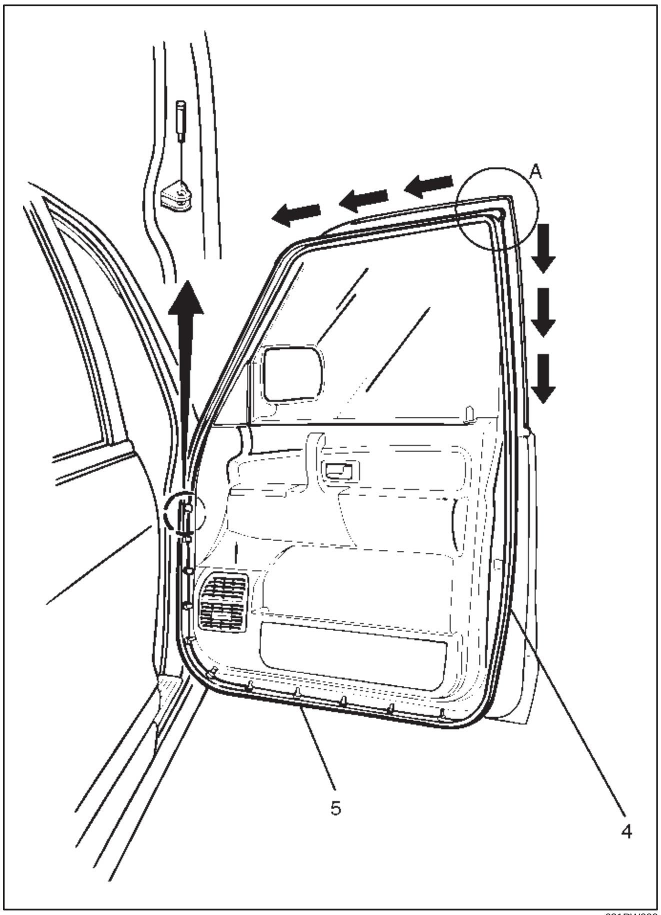
To install, follow the removal steps in the reverse order, noting the following points.

1. Apply soapy water to the door frame groove, when installing the front door weatherstrip (2).
2. Apply the sealing adhesive (3) to the upper A portion of the door frame (1) and press it for installation after assembling the weatherstrip (2).



631RS013

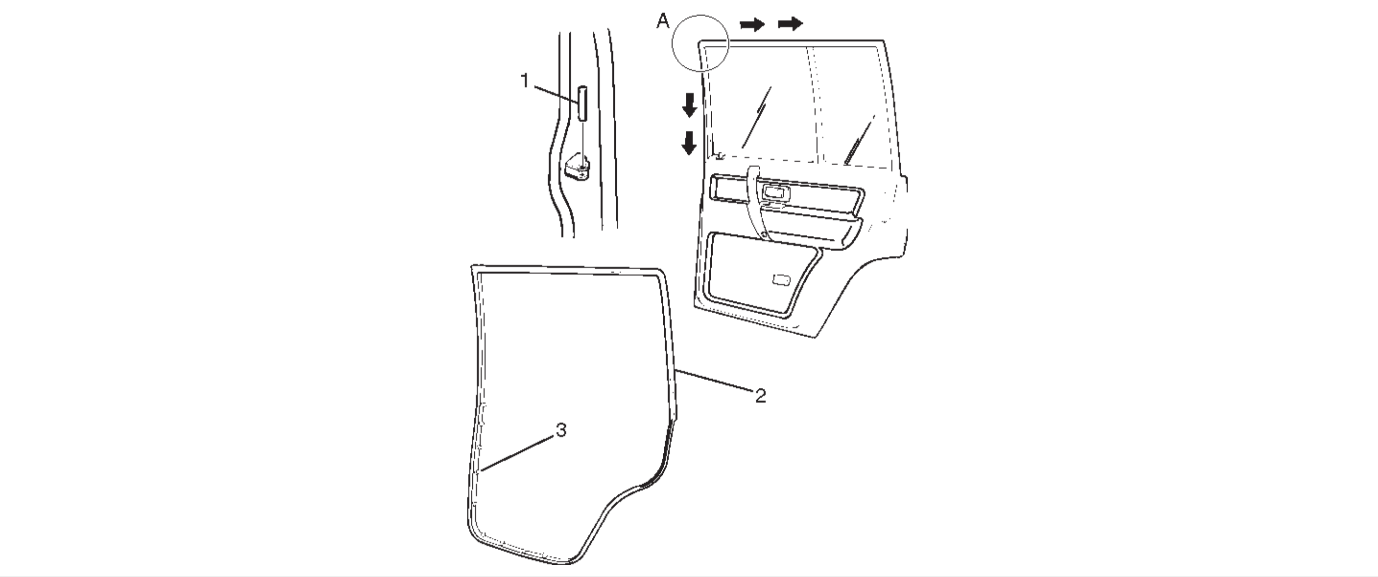
3. After positioning the weatherstrip (4) corner, insert the weatherstrip into the door frame groove from A point in the arrow–marked direction.
4. Insert the weatherstrip clip (5) into the door panel up to its base.



631RW009

Rear Door Weatherstrip

Parts Location



Legend

(1) Check Arm Pin

(2) Rear Door Weather Strip

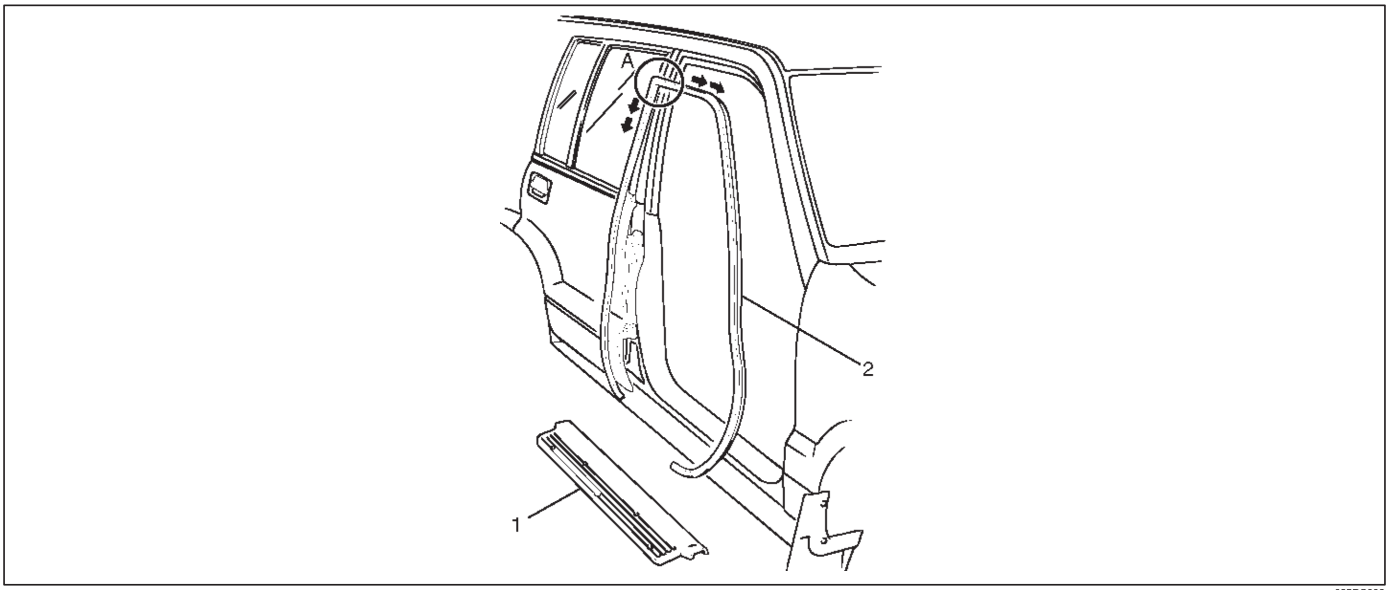
(3) Clip

Removal and Installation

Refer to Front Door Weatherstrip in this section.

Front Door Seal Finisher

Parts Location

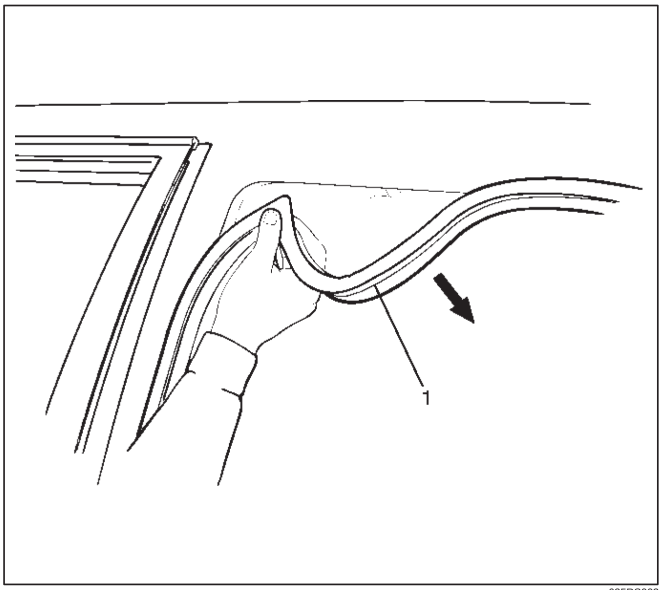


635RS002

Legend
(1) Front Door Sill Plate
(2) Front Door Seal Finisher

Removal

1. Disconnect the battery ground cable.
2. Remove front door sill plate.
3. Remove front door seal finisher (1).
   - Pull the finisher out from the body panel.

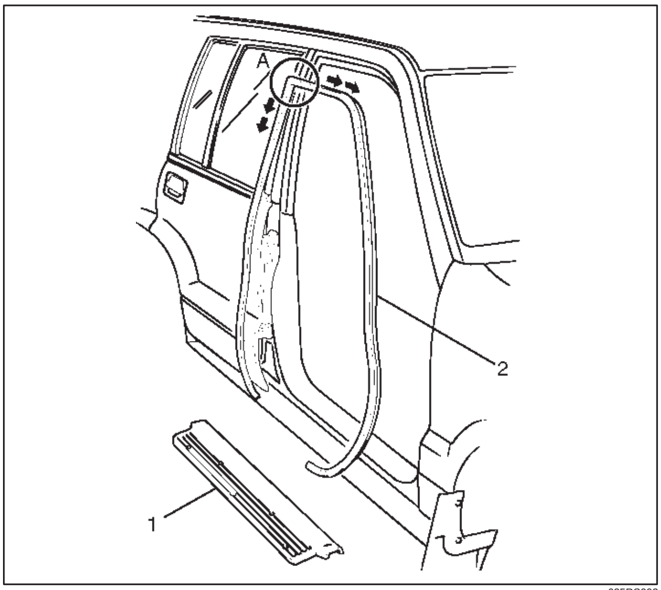


635RS003

Installation

To install, follow the removal steps in the reverse order, noting the following points.

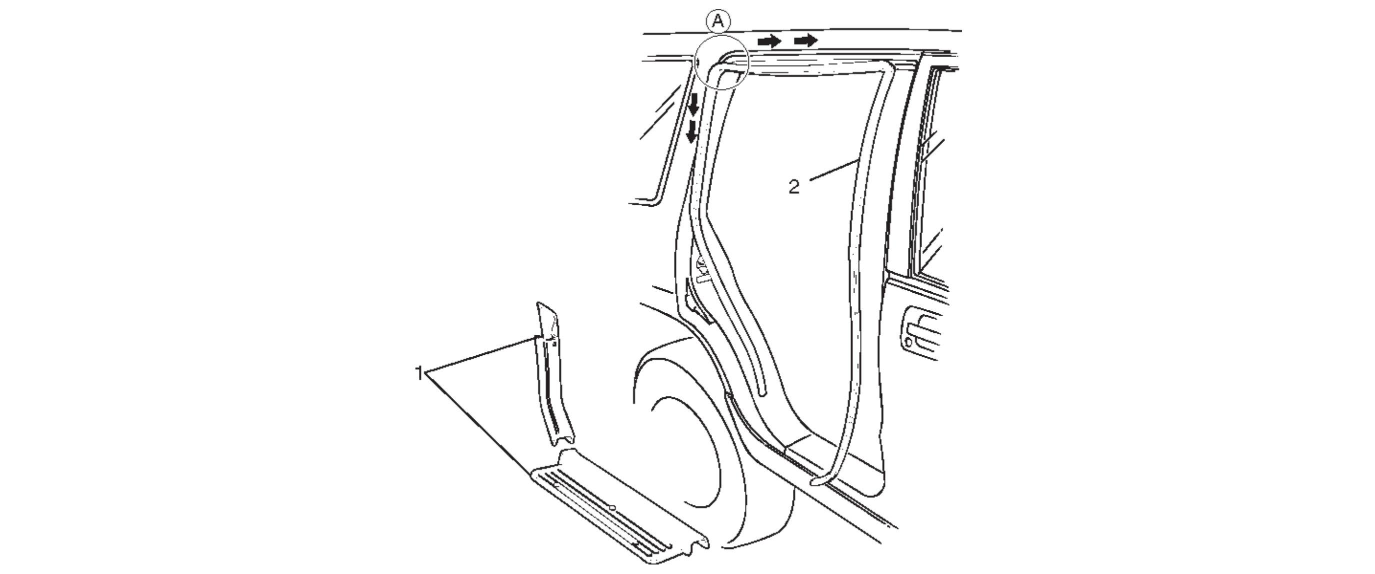
1. Insert the finisher (2) into the A corner and install the finisher in the arrow–marked directions.
2. Take care not to allow the sill plate (1) to distort or twist the finisher.



635RS002

Rear Door Seal Finisher

Parts Location



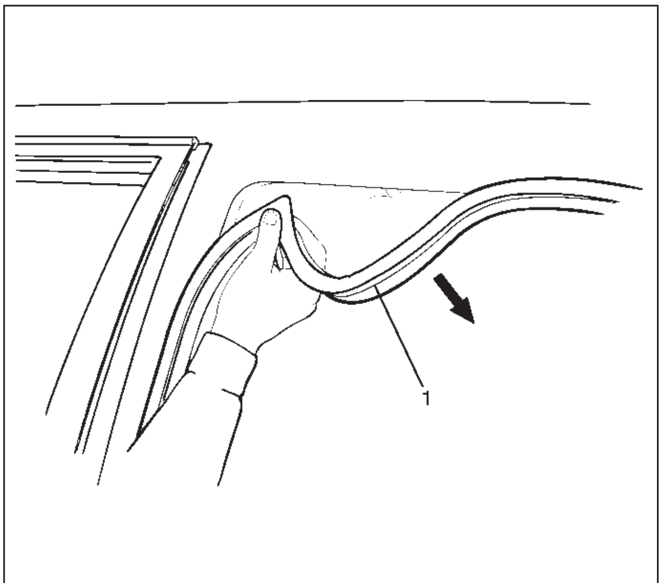
655RS002

Legend

(1) Rear Door Sill Plate and Luggage Side Lower Cover
(2) Rear Door Seal Finisher

Removal

1. Disconnect the battery ground cable.
2. Remove rear door sill plate and the luggage side lower cover.
3. Remove rear door seal finisher (1).
   - Pull the rear door seal finisher (1) out from the body panel.

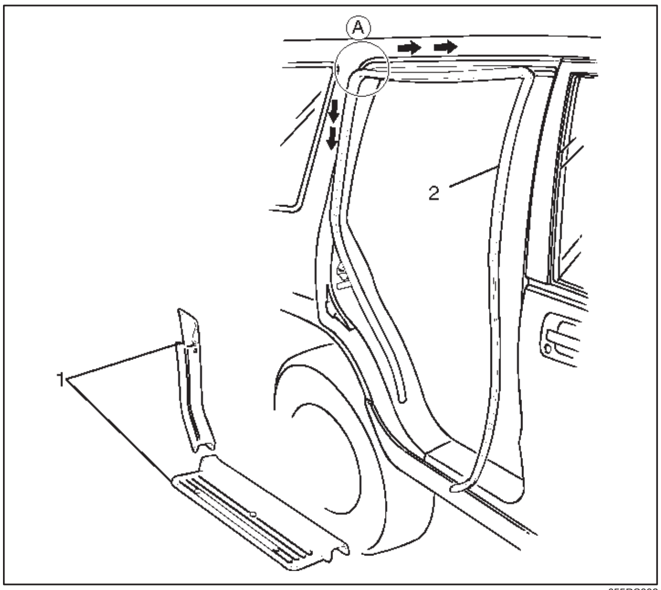


635RS003

Installation

To install, follow the removal steps in the reverse order, noting the following points.

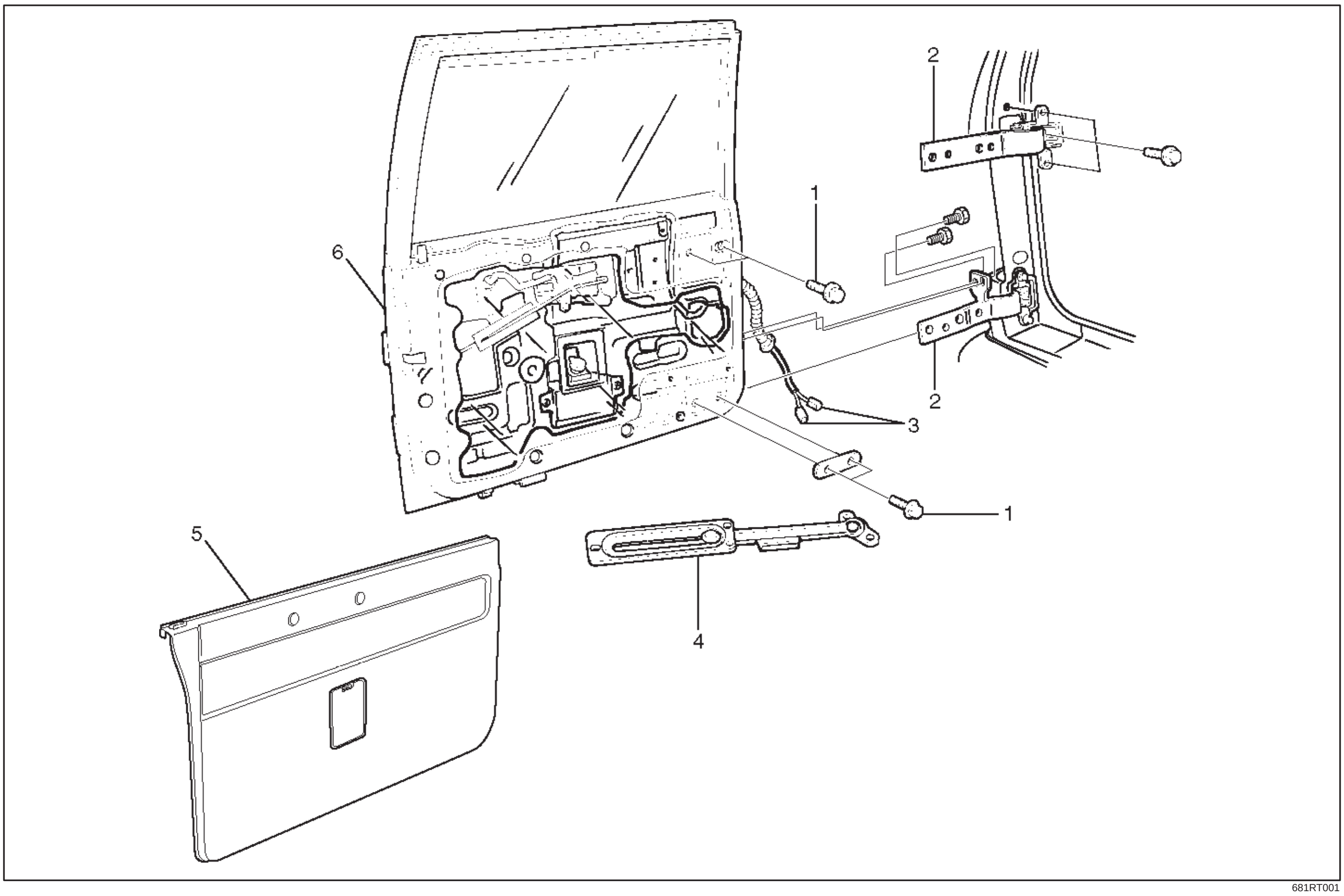
1. Insert the rear door seal finisher (2) into the A corner and install the finisher in the arrow-marked directions.
2. Be careful not to allow the sill plate and cover (1) to distort or twist the finisher.



655RS002

Tailgate Assembly (LH)

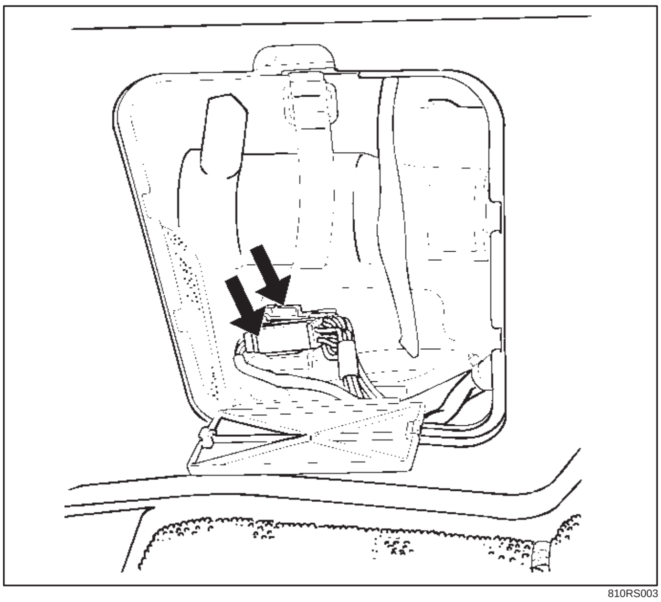
Parts Location



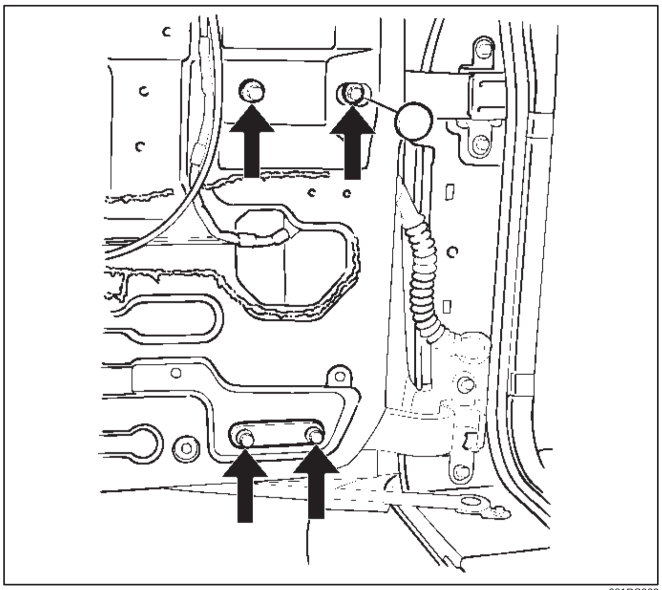
Legend
(1) Tailgate Fixing Bolt
(2) Tailgate Hinge
(3) Tailgate Harness Connection
(4) Tailgate Stopper Assembly
(5) Tailgate Trim Panel (LH)
(6) Tailgate Assembly (LH)

Removal

1. Disconnect the battery ground cable.
2. Remove tailgate time panel (LH).
   - Refer to Tailgate Trim Panel (LH) in Exterior / Interior Trim section.
3. Remove tailgate stopper assembly
4. Remove tailgate harness connection.
   - Open the luggage trim panel lid and disconnect the tailgate harness connection.

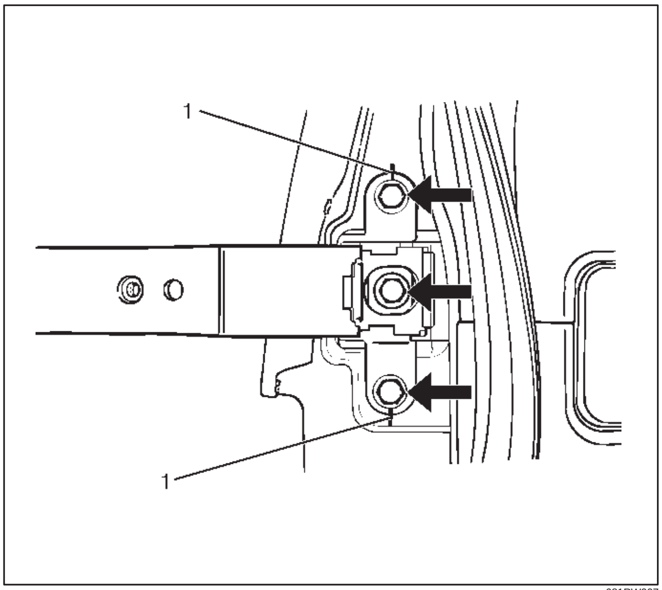


5. Remove tailgate fixing bolts.



681RS002

6. Remove tailgate assembly (LH).
7. Remove tailgate hinge.
   - Apply a setting mark (1) on the body side hinge and remove the hinge fixing bolts.



681RW007

Installation

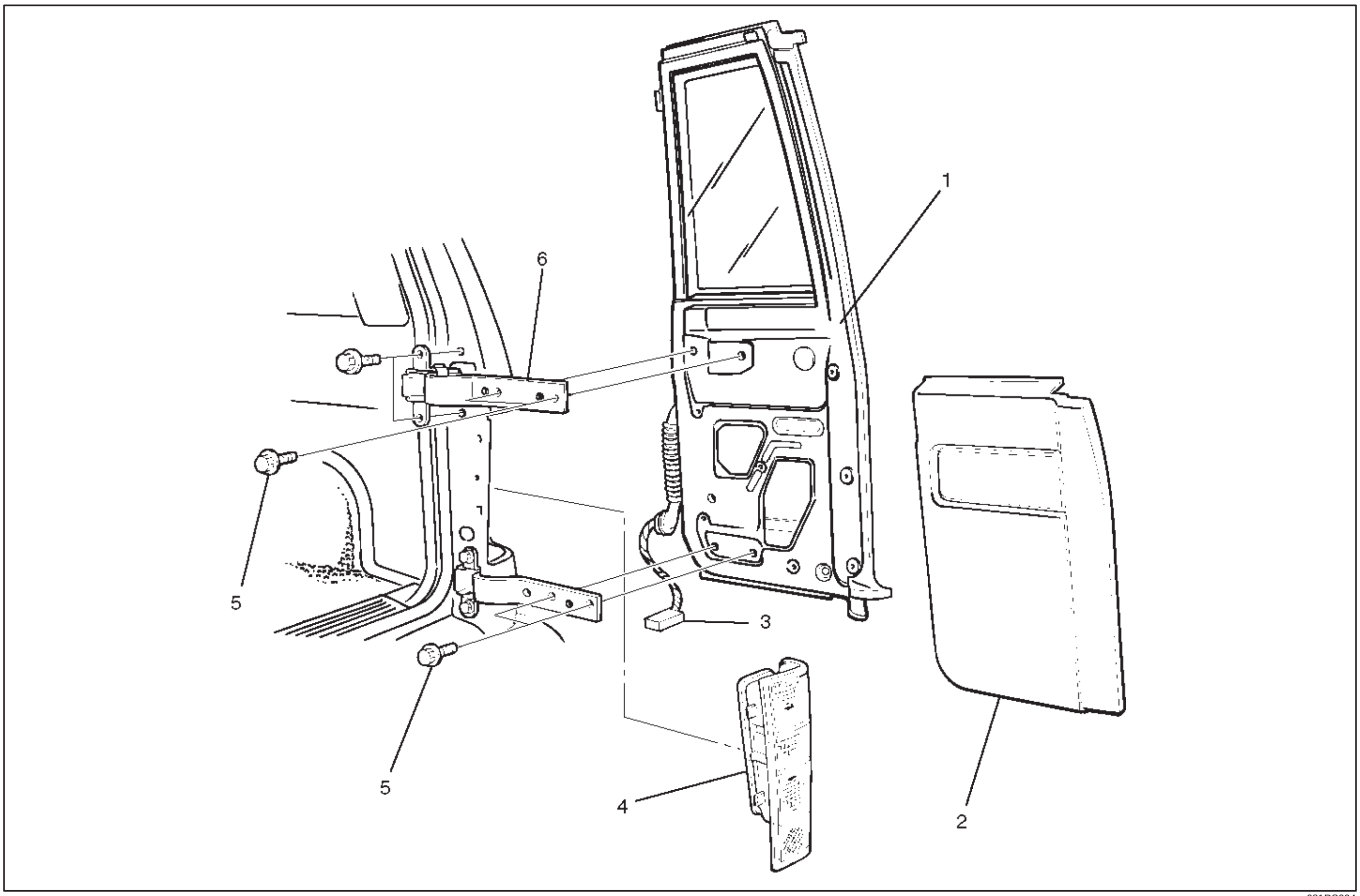
To install, follow the removal steps in the reverse order, noting the following points.

1. Apply chassis grease to the tailgate hinge and the tailgate stopper moving surface.
2. Align the tailgate fitting to the body by referring to Body Dimension in this section.
3. Tighten the hinge bolts to the specified torque.

Torque : 34 N•m (25 lb ft)

Tailgate Assembly (RH)

Parts Location



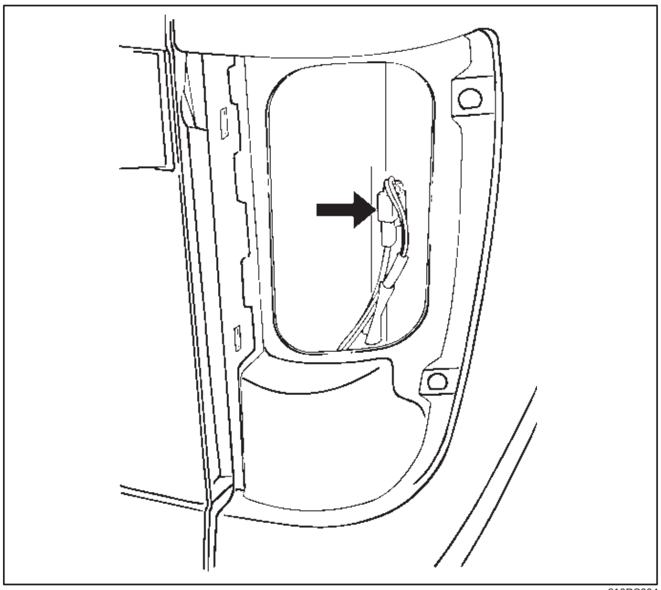
681RS004

Legend

(1) Tailgate Assembly (LH)
(2) Tailgate Trim Panel (RH)
(3) Tailgate Harness Connection
(4) Rear Combination Light (RH)
(5) Tailgate Fixing Bolt
(6) Tailgate Hinge

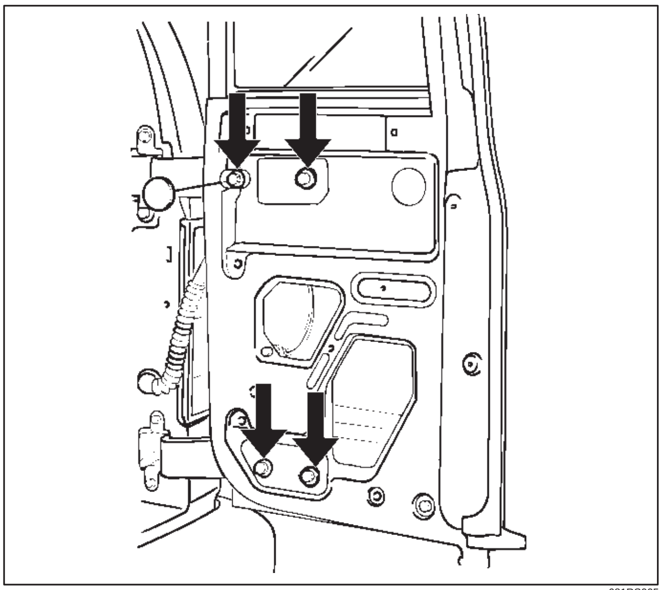
Removal

1. Disconnect the battery ground cable.
2. Remove rear combination light (RH).
3. Remove tailgate trim panel (RH).
   - Refer to Tailgate Trim Panel (RH) in Exterior / Interior Trim section.
4. Remove tailgate harness connection.
   - Disconnect the tailgate harness connection.



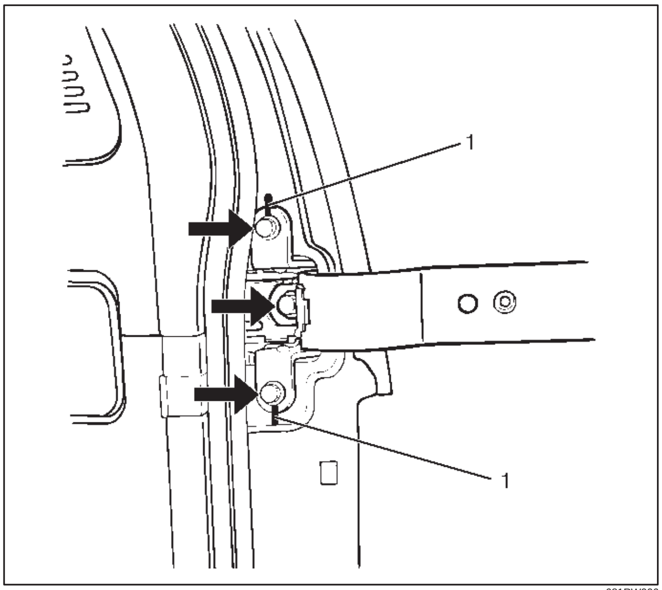
810RS004

5. Remove tailgate fixing bolt.



681RS005

6. Remove tailgate assembly (RH).
7. Remove tailgate hinge.
   - Apply a setting mark (1) on the body side hinge and remove the hinge fixing bolts.



681RW006

Installation

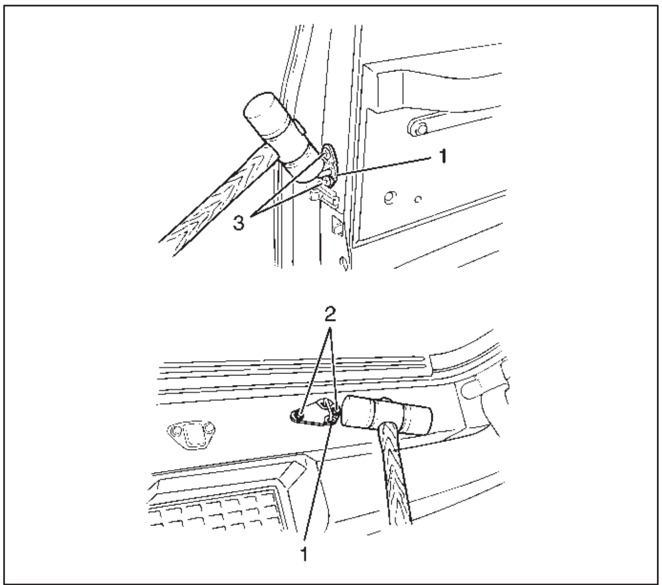
To install, follow the removal steps in the reverse order, noting the following point.

1. Apply chassis grease to the tailgate hinge moving surface.
2. Align the tailgate fitting to the body. Refer to Body Dimension in this section.
3. Tighten the hinge bolts to the specified torque.

Torque : 34 N•m (25 lb ft)

Tailgate Strikers

Adjustment



683RW012

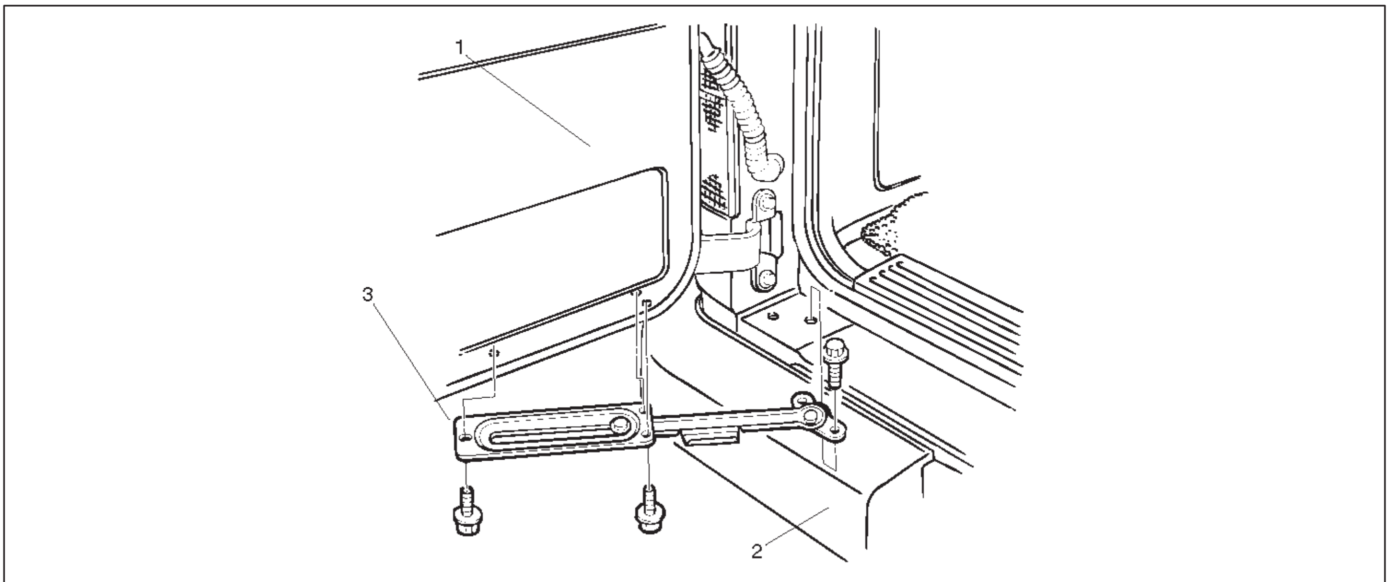
1. Loosen the striker screws (3) (or bolts (2)).
2. Tap the striker (1) with a plastic hammer to align.
3. Tighten the striker screws (3) (or bolts (2)).

Screw Torque : 15 N•m (11 lb ft)

Bolt Torque : 12 N•m (104 lb in)

Tailgate Stopper Assembly

Parts Location



683RS010

Legend

(1) Tailgate

(2) Rear Bumper

(3) Tailgate Stopper Assembly

Removal

1. Remove tailgate stopper assembly.
   - Remove the five bolts.

Installation

To install, follow the removal steps in the reverse order, nothing the following points.

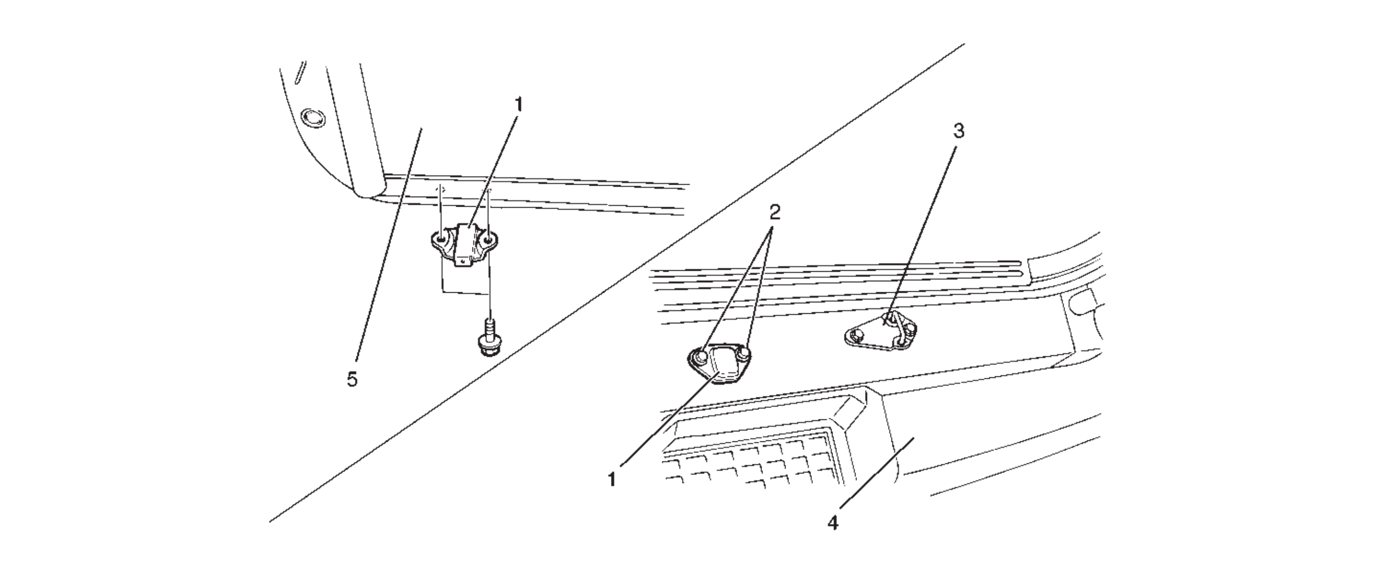
1. Tighten the fixing bolts to the specified torque.

   Torque : 12 N•m (104 lb in)

2. Apply chassis grease to the stopper moving surface.

Tailgate Dove-Tail

Parts Location



683RW011

Legend

(1) Dove-Tail
(2) Fixing Bolt
(3) Tailgate Striker
(4) Rear Bumper
(5) Tailgate (LH)

Removal

1. Remove tailgate dove-tail.
   - Remove the two bolts from each side.

Installation

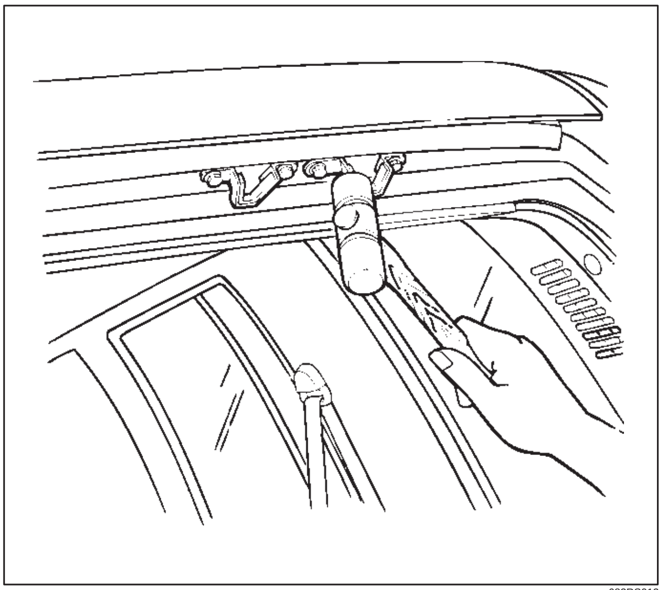
To install, follow the removal steps in the reverse order, nothing the following points.

1. Apply chassis grease to the dove–tail (A) moving surface.
2. Tighten the fixing bolts to the specified torque.

Torque : 12 N•m (104 lb in)

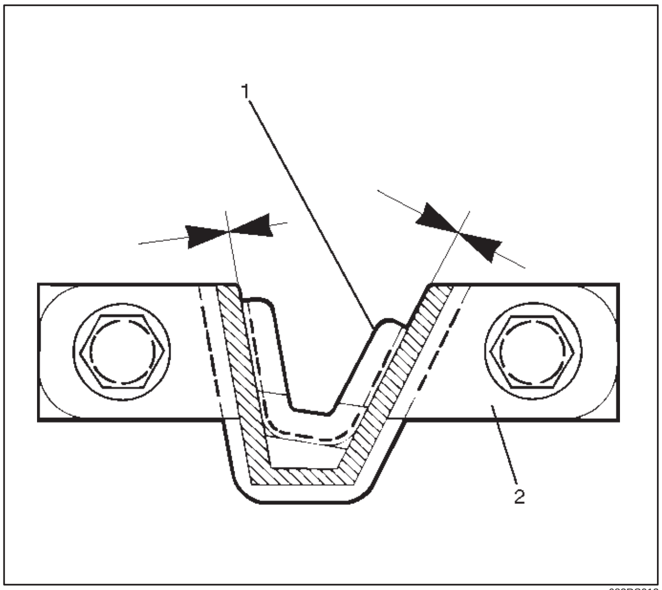
Tailgate Dove-Tail Striker

Adjustment



683RS012

1. Loosen the striker bolts.
2. Tap with a plastic hammer to align.
   - Gaps between Dove–Tail Striker (2) and bracket (1) are 0 mm (No clearance).



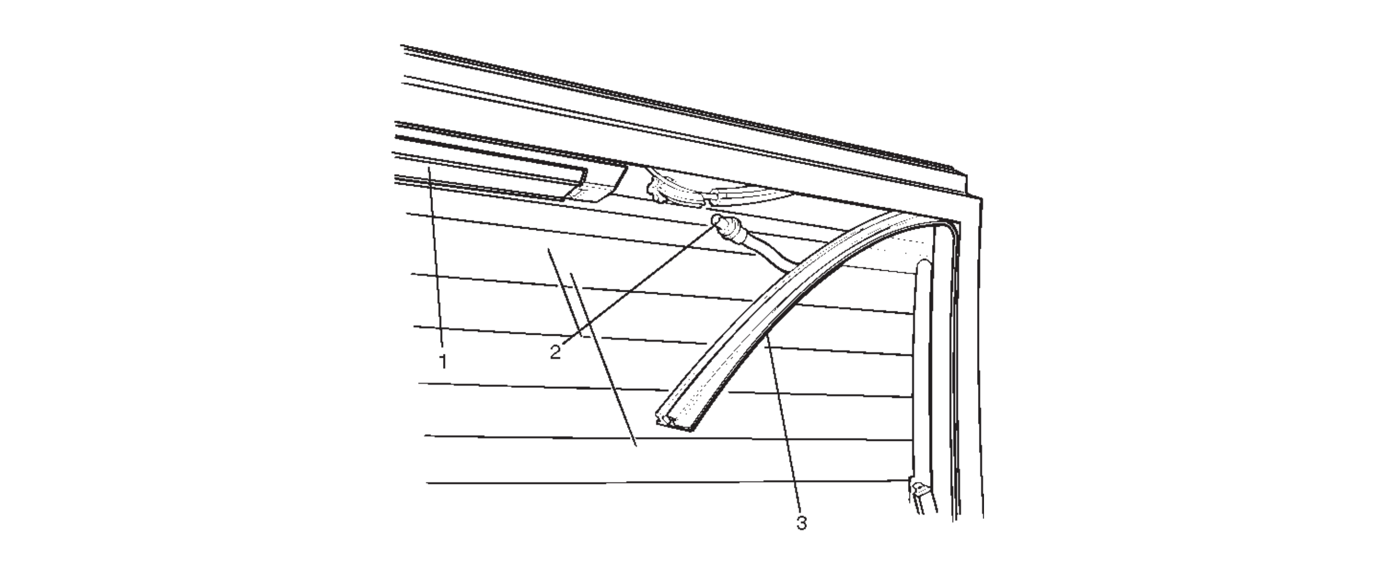
683RS013

3. Tighten striker bolts.

Torque : 12 N•m (104 lb in)

Tailgate Frame Cover (LH)

Parts Location



684RW001

Legend

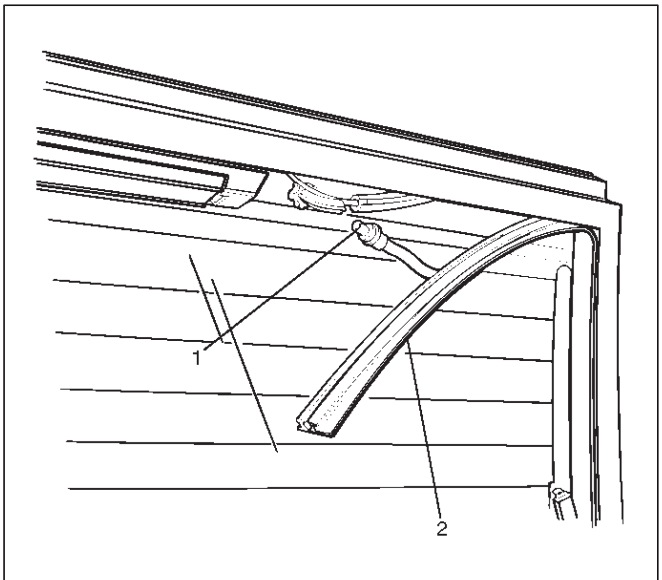
(1) High Mount Stop Light

(2) Washer Tube

(3) Tailgate Frame Cover

Removal

1. Disconnect the battery ground cable.
2. Remove tailgate frame cover.
   - Pull the tailgate frame cover (2) out.
   - Disconnect the washer tube (1) at the nozzle and pull the washer tube out from the frame cover (2).
   - Disconnect the rear defogger and pull the harness from the cover.

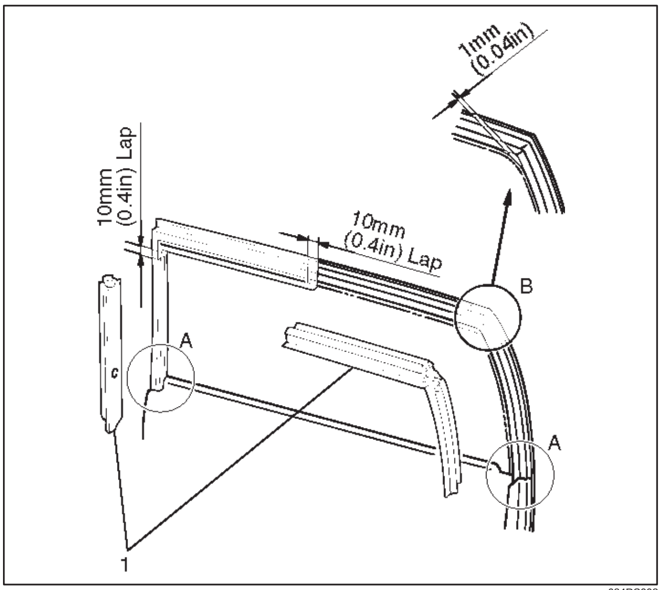


684RW002

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Hit the lower A edge portion of the cover (1) to the tailgate flange.
2. Clearance between the frame cover and the tailgate panel (B portion) is 1 mm (0.04 in).

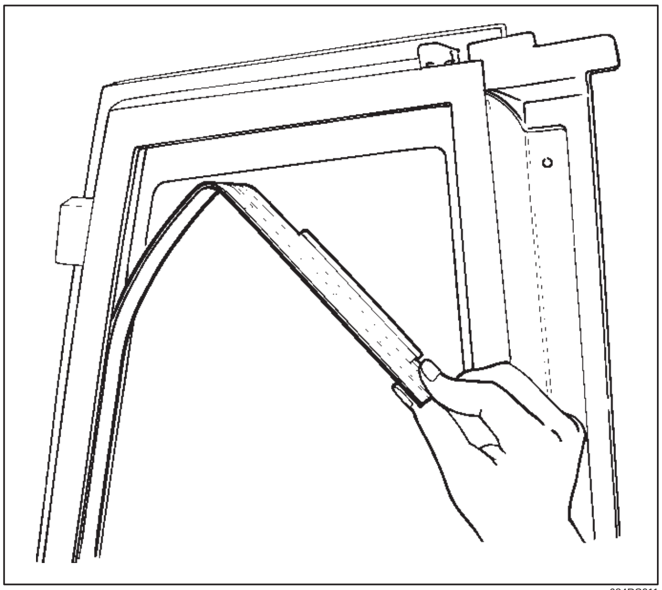


684RS008

Tailgate Frame Cover (RH)

Removal

1. Remove tailgate frame cover (RH).
   - Pull the frame cover out from the tailgate frame.

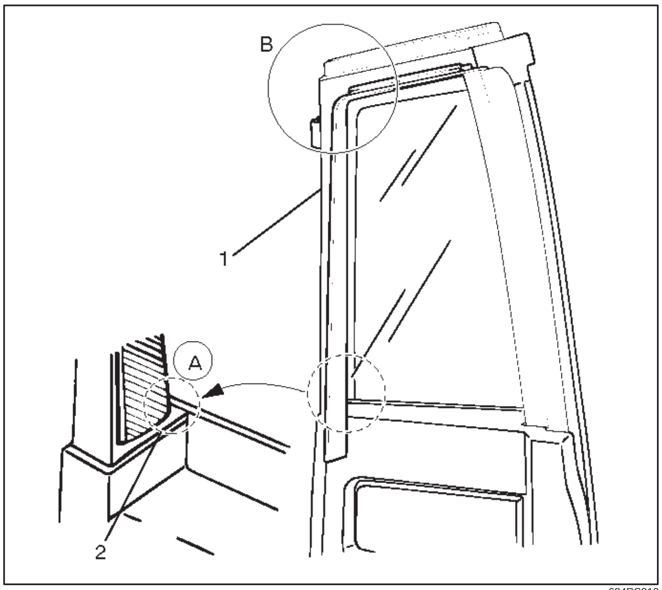


684RS011

Installation

To install, follow the removal steps in the reverse order, noting the following points.

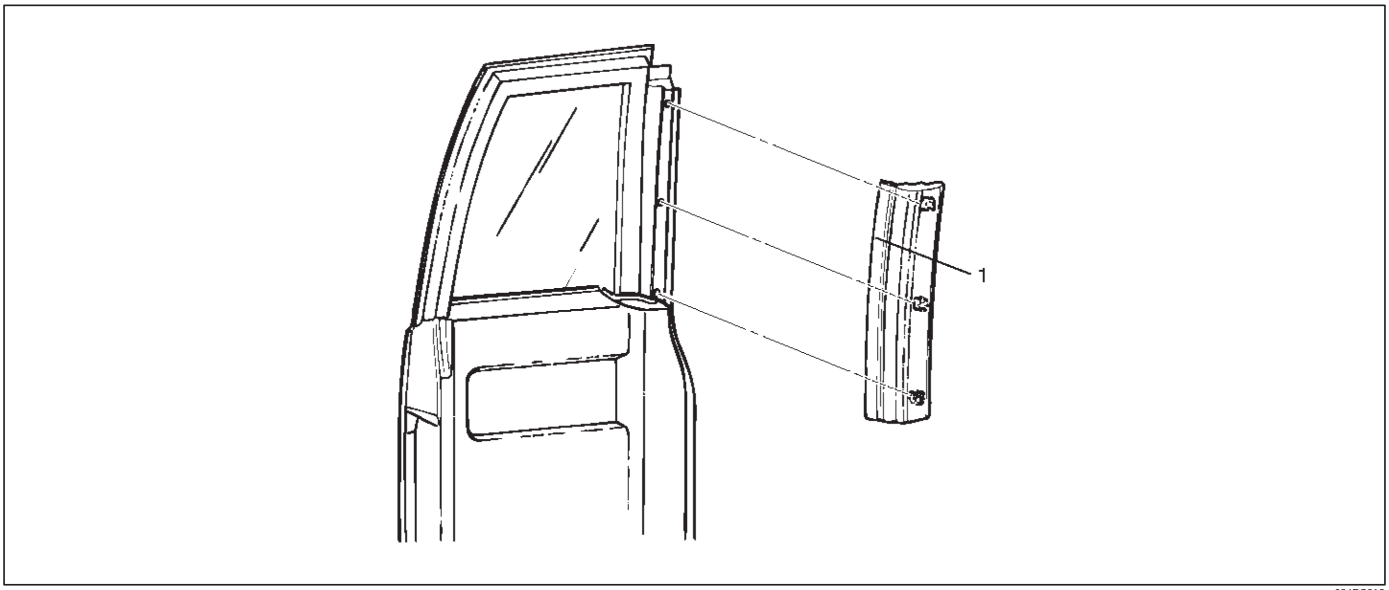
1. Hit the lower A edge portion (2) of the tailgate frame cover (1).
2. Clearance between the frame cover and the tailgate panel (B portion) is 1 mm (0.04 in).



684RS010

Tailgate Sash Trim Cover

Parts Location



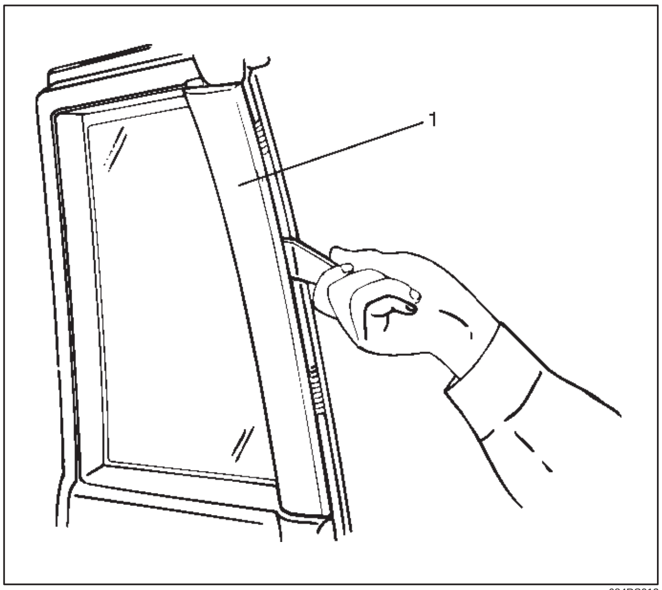
684RS012

Legend

(1) Tailgate Sash Trim Cover

Removal

1. Remove tailgate sash trim cover (1).
   - Pry the tailgate trim cover retainers free from the tailgate panel.



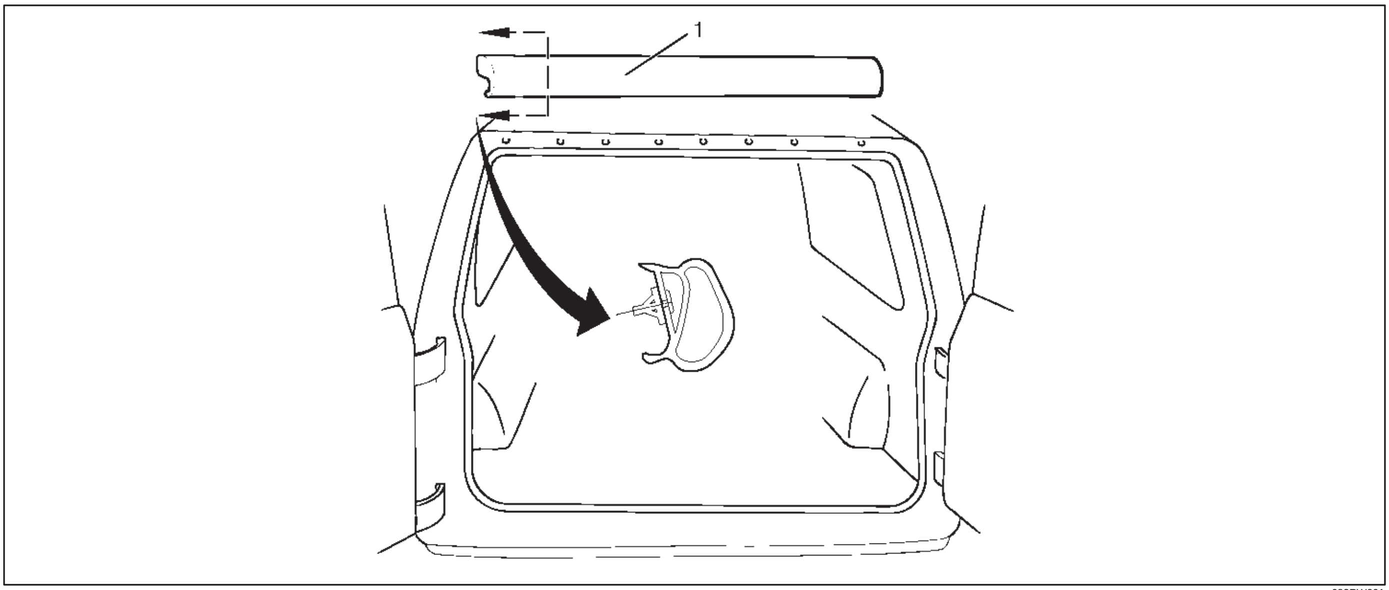
684RS013

Installation

1. Tailgate sash trim cover (1).
   - Insert the trim cover retainers into the tailgate hole securely so that there are no gaps between them.

Tailgate Outer Weatherstrip

Parts Location



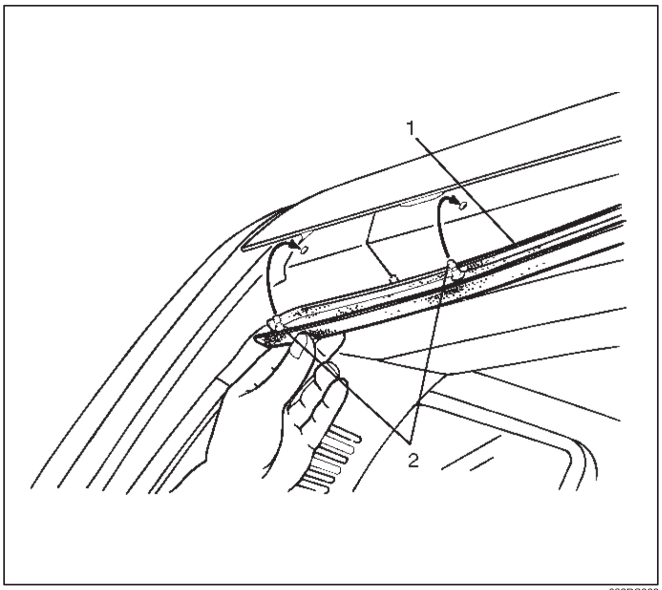
682RW001

Legend

(1) Tailgate Outer Weatherstrip

Removal

1. Disconnect the battery ground cable.
2. Remove tailgate outer weatherstrip (1).
   - Pry the tailgate outer weatherstrip clips (2) free from the body panel.



682RS002

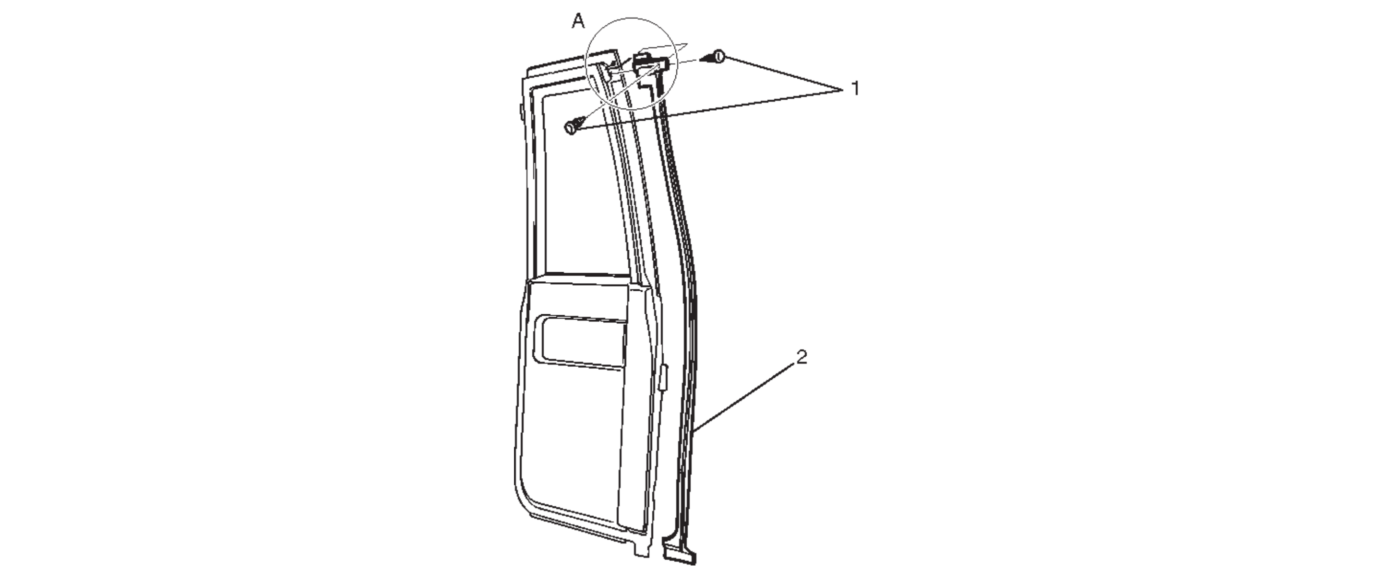
Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Insert the tailgate outer weatherstrip clip into the body panel hole securely in order to install the tailgate outer weatherstrip with the gap between the body panel and the weatherstrip.

Tailgate Center Weatherstrip

Parts Location



682RS003

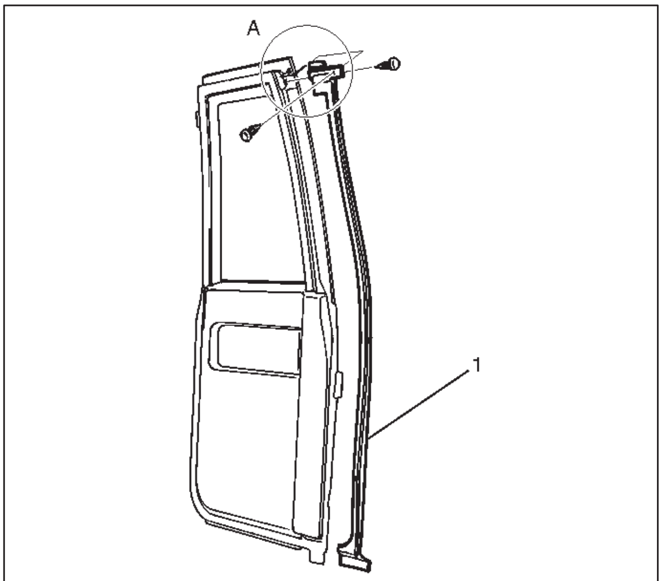
Legend
(1) Clip
(2) Tailgate Center Weatherstrip

Removal

1. Remove tailgate center weatherstrip.
   - Remove the fixing clips in order to pull the tailgate center weatherstrip out from the tailgate panel.

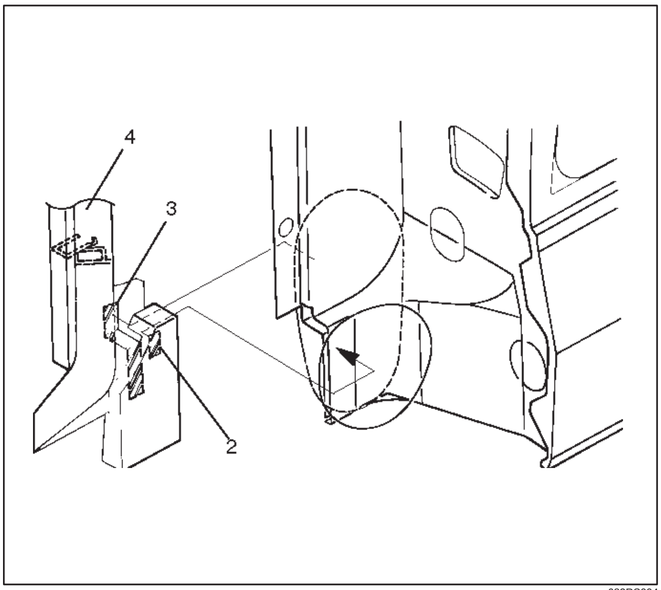
Installation

1. Tailgate center weatherstrip (1).
   - Start assembling at the A portion.



682RW006

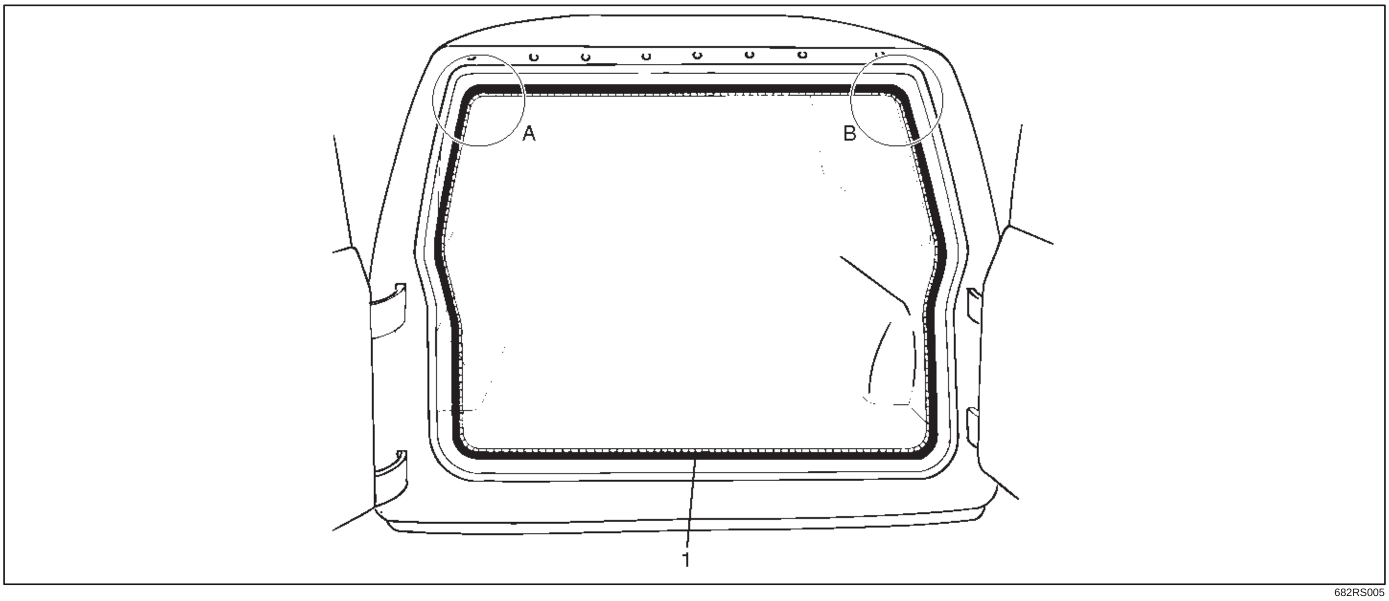
- Clean the tailgate center weatherstrip (4) adhesive tape (2) and the butyl seal (3) fitting position of the tailgate panel.
- Affix new adhesive tape and the butyl seal to the weatherstrip (lower side) in order to install the tailgate center weatherstrip to the tailgate panel with no gap between them.



682RS004

Tailgate Main Weatherstrip

Parts Location



Legend

(1) Tailgate Main Weatherstrip

Removal

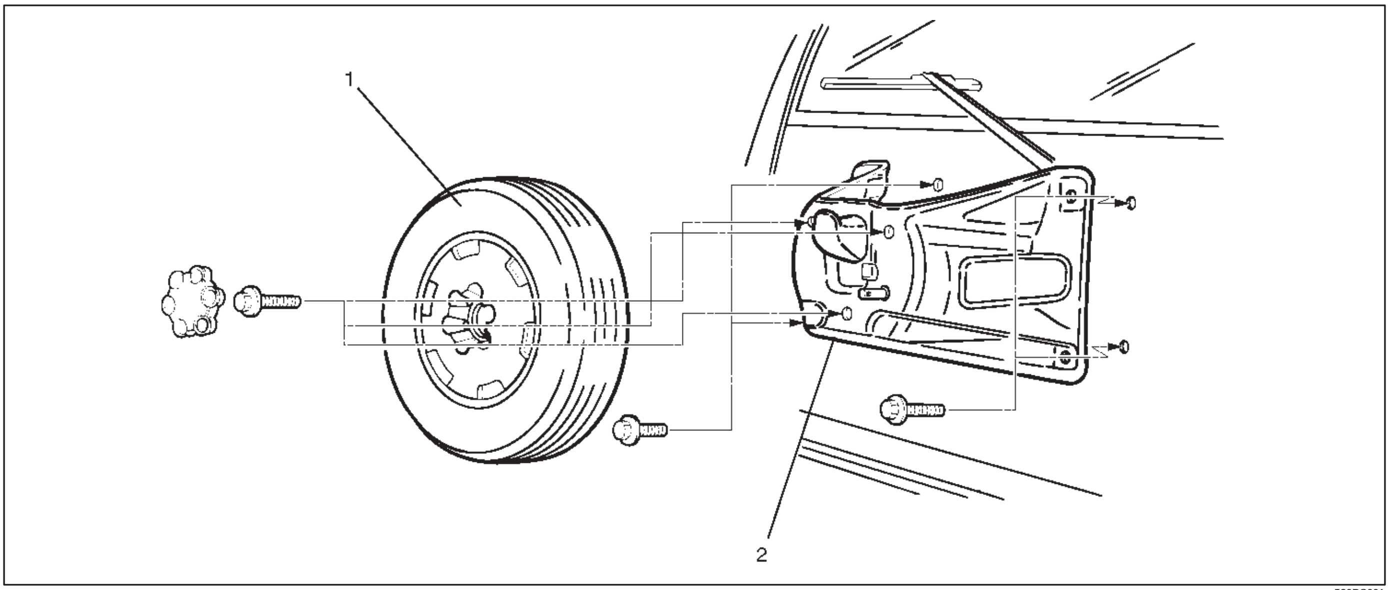
1. Remove tailgate main weatherstrip.
   - Pull the tailgate main weatherstrip out from the body panel.

Installation

1. Tailgate main weatherstrip.
   - Align the A and B positions to the corners of the body panel. Install the tailgate main weatherstrip to the body panel by gently tapping with a plastic hammer. There should be not clearance between the body panel the tailgate main weatherstrip.

Spare Tire Carrier

Parts Location



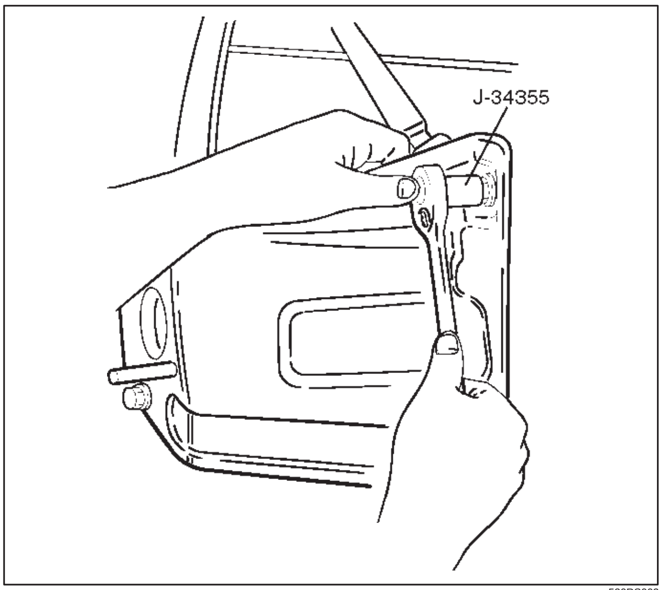
530RS001

Legend

(1) Spare Tire
(2) Spare Tire Carrier

Removal

1. Remove spare tire.
2. Remove spare tire carrier by using spare tire carrier nut wrench J–34355.



530RS002

Installation

1. Install the spare tire carrier.
   - Tighten the carrier fixing bolts to the specified torque.

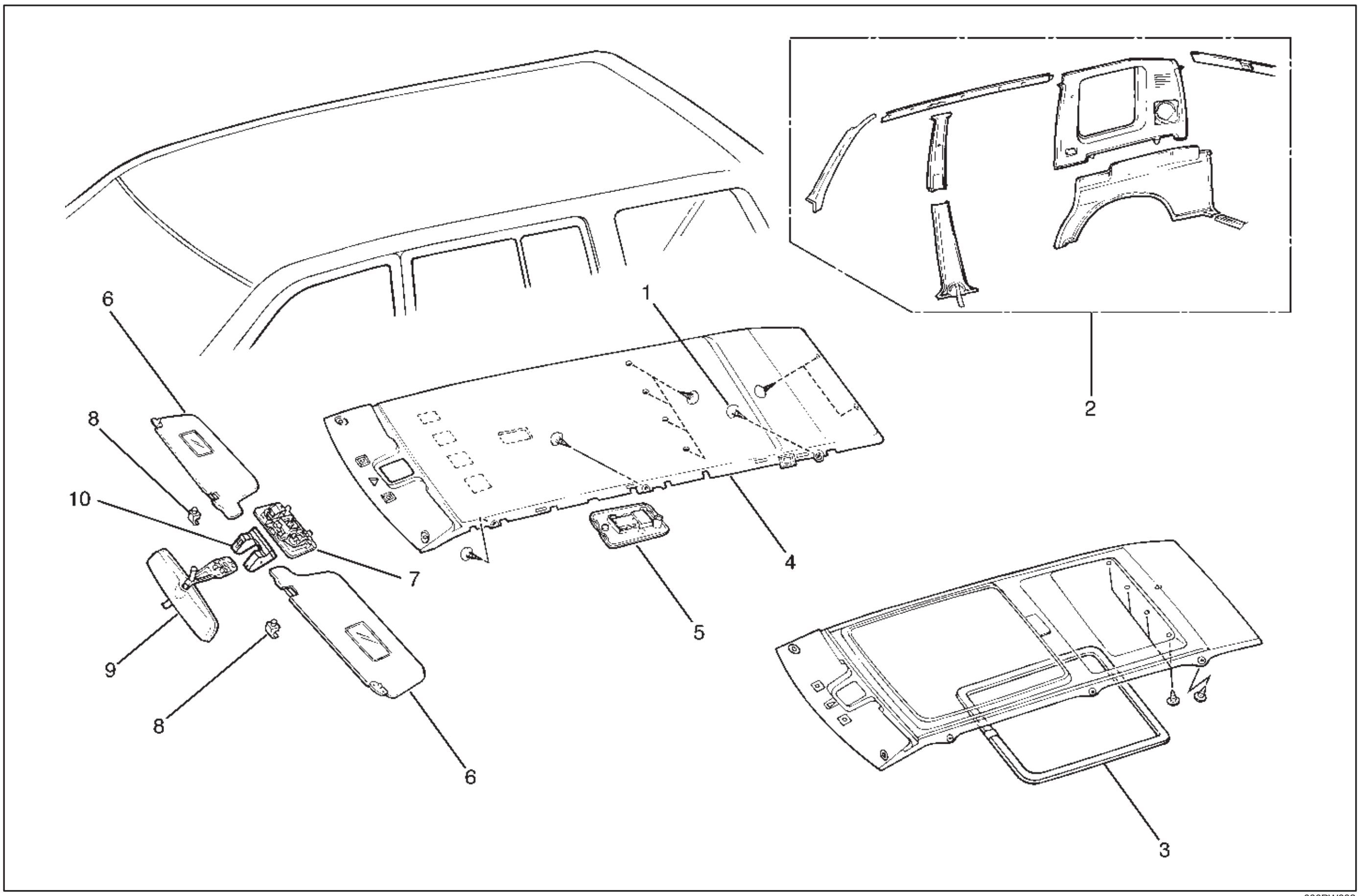
   Torque : 31 N•m (23 lb ft)

2. Install the spare tire.
   - Tighten the spare tire fixing bolts to the specified torque.

   Torque : 118 N•m (87 lb ft)

Headlining

Parts Location



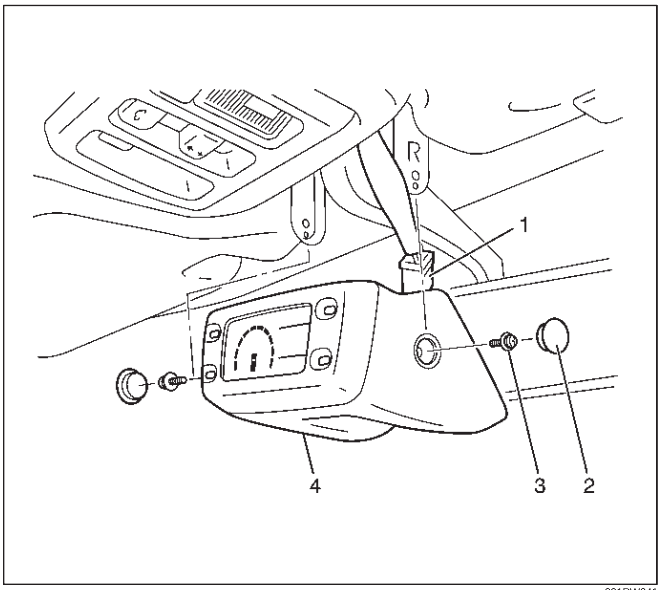
666RW003

Legend

(1) Clip
(2) Interior Trim Panels
(3) Sun Roof Finisher (W/Sun Roof)
(4) Headlining
(5) Dome Light
(6) Sunvisors
(7) Map Light
(8) Sunvisor Holder
(9) Rear View Mirror
(10) Multi Meter

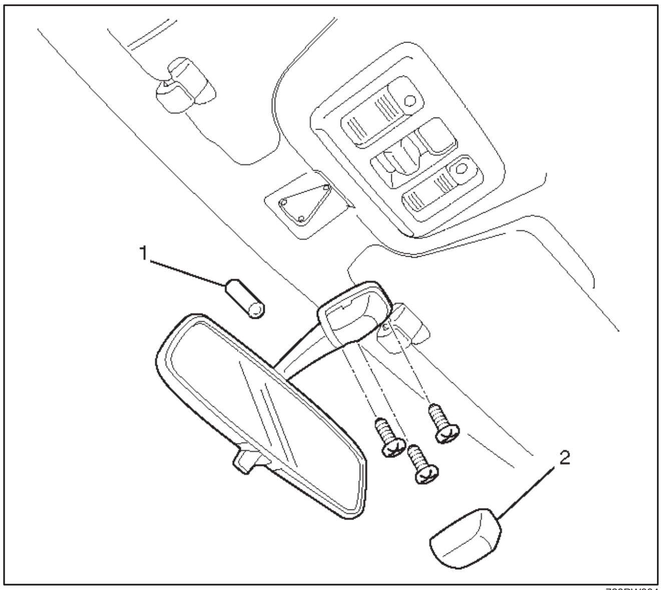
Removal

1. Disconnect the battery ground cable.
2. Remove interior trim panels.
   - Refer to the Exterior / Interior Trim section.
3. Remove dome light.
   - Remove the dome light lens and the fixing screws.
   - Disconnect the dome light connectors.
4. Remove multi meter (4).
   - Remove two caps (2), two screws (3) and disconnect the connector (1).



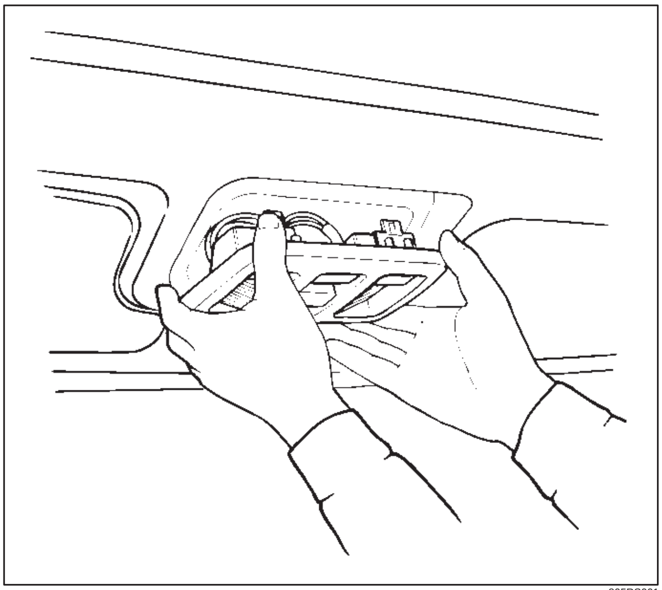
821RW241

5. Remove rear view mirror.
   - Remove the rubber stopper (1).
   - Pry off the mirror stay cover (2) and remove 3 screws.



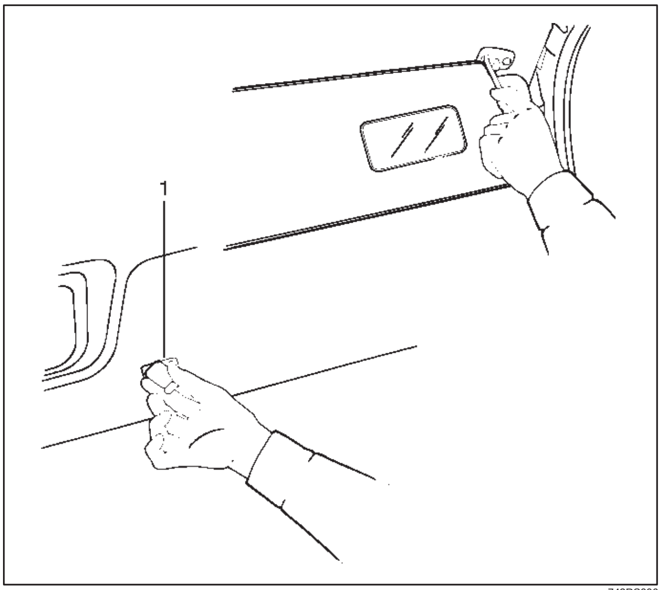
720RW004

6. Remove map light/sun roof switch.
   - Pry the map light clip free from the map light/sun roof switch bracket and disconnect the connector.



805RS001

7. Remove sunvisors.
   - Remove the fixing screw and turn the sunvisor holder (1) to remove it.
   - Disconnect the vanity mirror illumination connector.



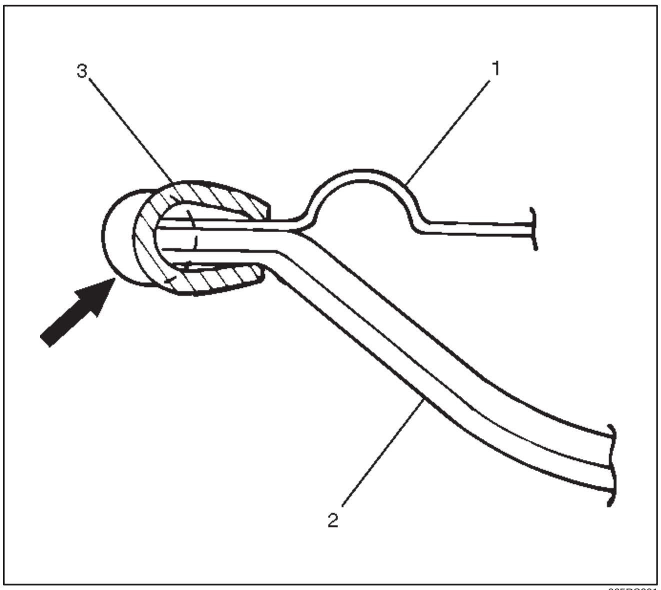
743RS006

8. Remove sun roof finisher (W/Sun roof).
9. Remove headlining.
   - Remove the headlining fixing clips.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

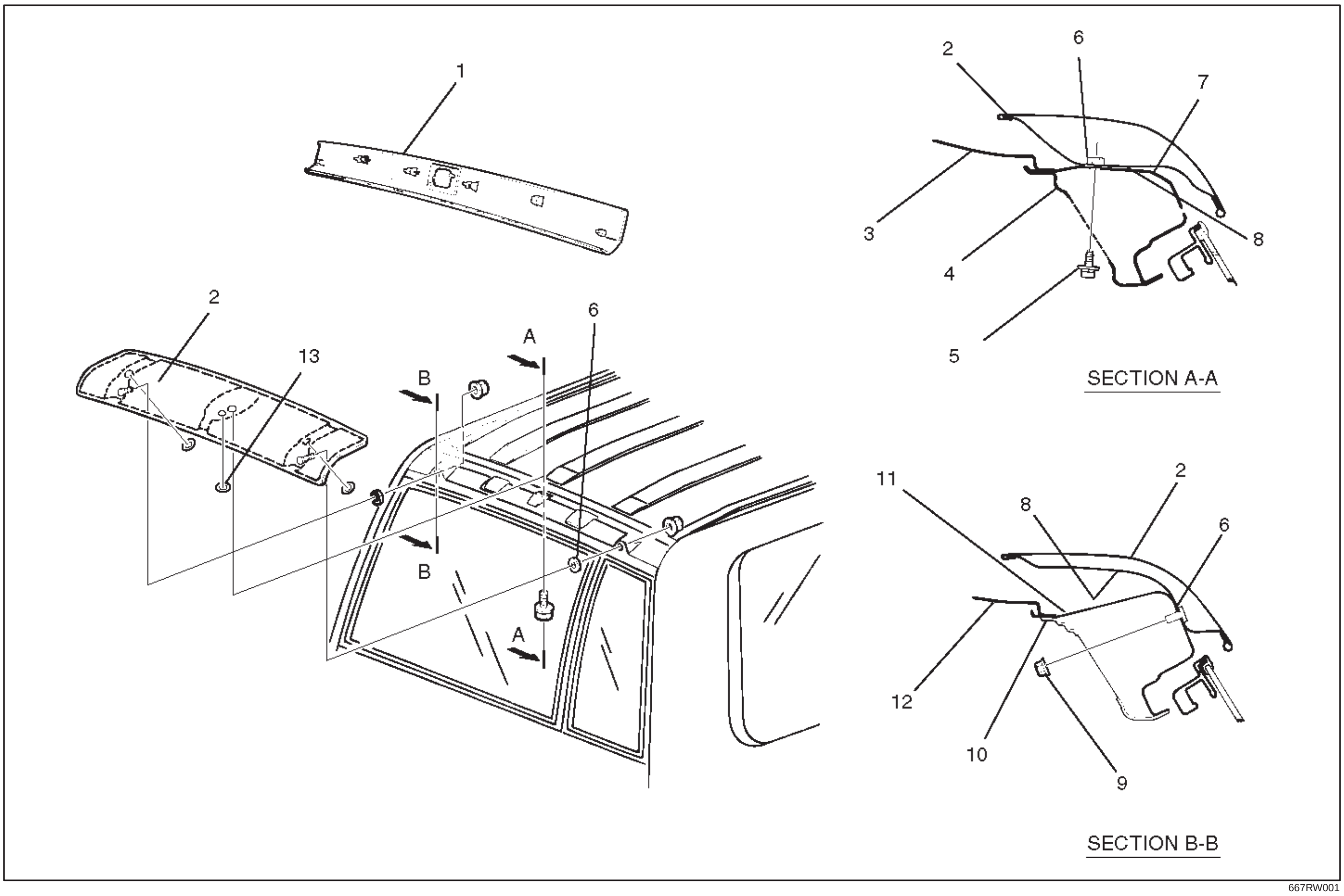
1. Install the headlining so that the fixing clips will not come off.
2. To install the sun roof finisher (3), first fit in at one place with the head lining (2) close to the sun roof frame complete (1), then install the entire finisher tightly by hitting it with a plastic hammer, not allowing it to move up.



665RS001

Rear Air Deflector

Parts Location



Legend

(1) Rear Roof Trim Cover
(2) Rear Air Deflector
(3) Roof Rail
(4) Rear Inner Roof Rail
(5) Fixing Bolt
(6) Nylon Washer
(7) Rear Outer Roof Panel
(8) Seal
(9) Fixing Nut
(10) Rear Pillar Upper Reinforcement
(11) Rear Outer Roof Rail
(12) Roof Panel
(13) Grommet

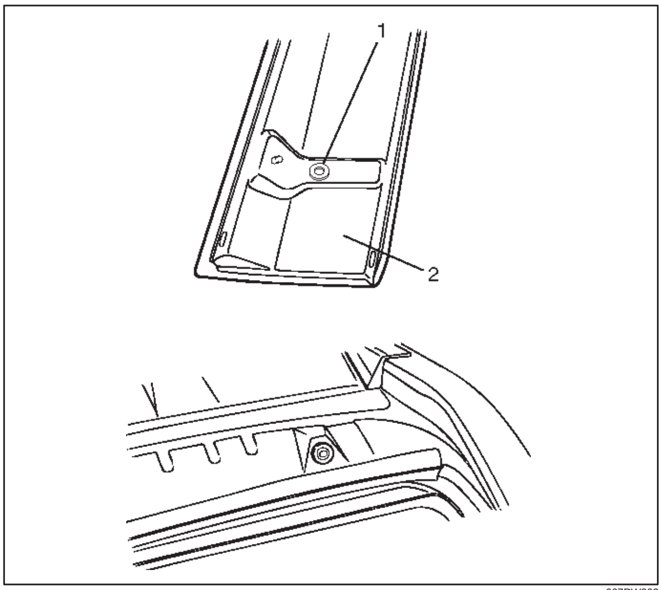
Removal

1. Disconnect the battery ground cable
2. Remove rear roof trim cover.
   - Refer to Luggage Side and Quarter Upper Trim Cover in Exterior / Interior Trim section.
3. Remove rear air deflector.
   - Take notice of the grommet and the nylon washer.

Installation

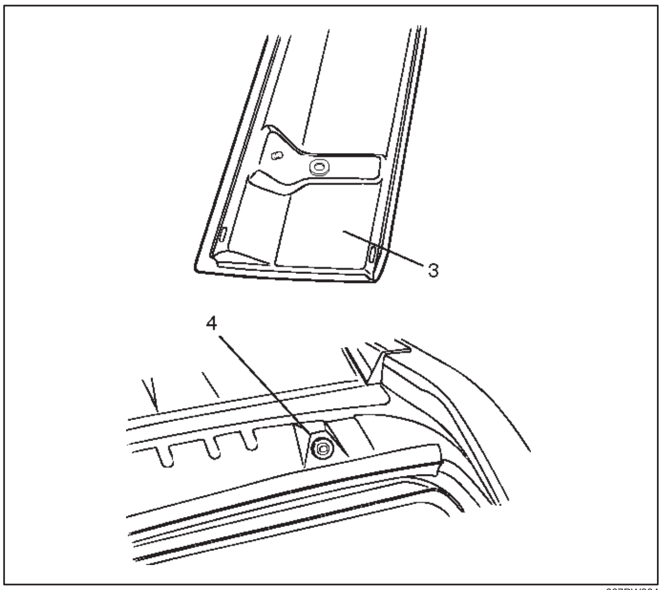
To install, follow the removal steps in the reverse order, noting the following points.

1. Install the grommet (1) to the air deflector (2) drain hole.



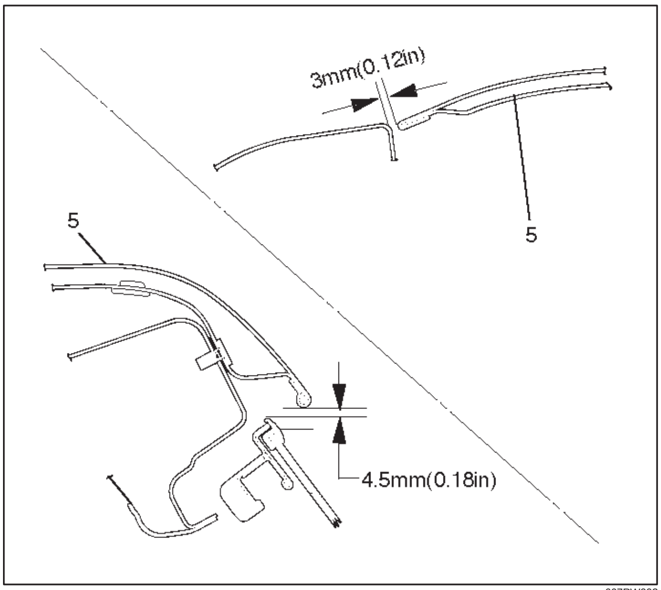
667RW002

2. Use a new nylon washer (4). Peel off the adhesive tape of the washer to install the nylon washer to the air deflector (3).



667RW004

3. Install the air deflector (2) to the roof by referring to the specified values shown in the illustration.



667RW003

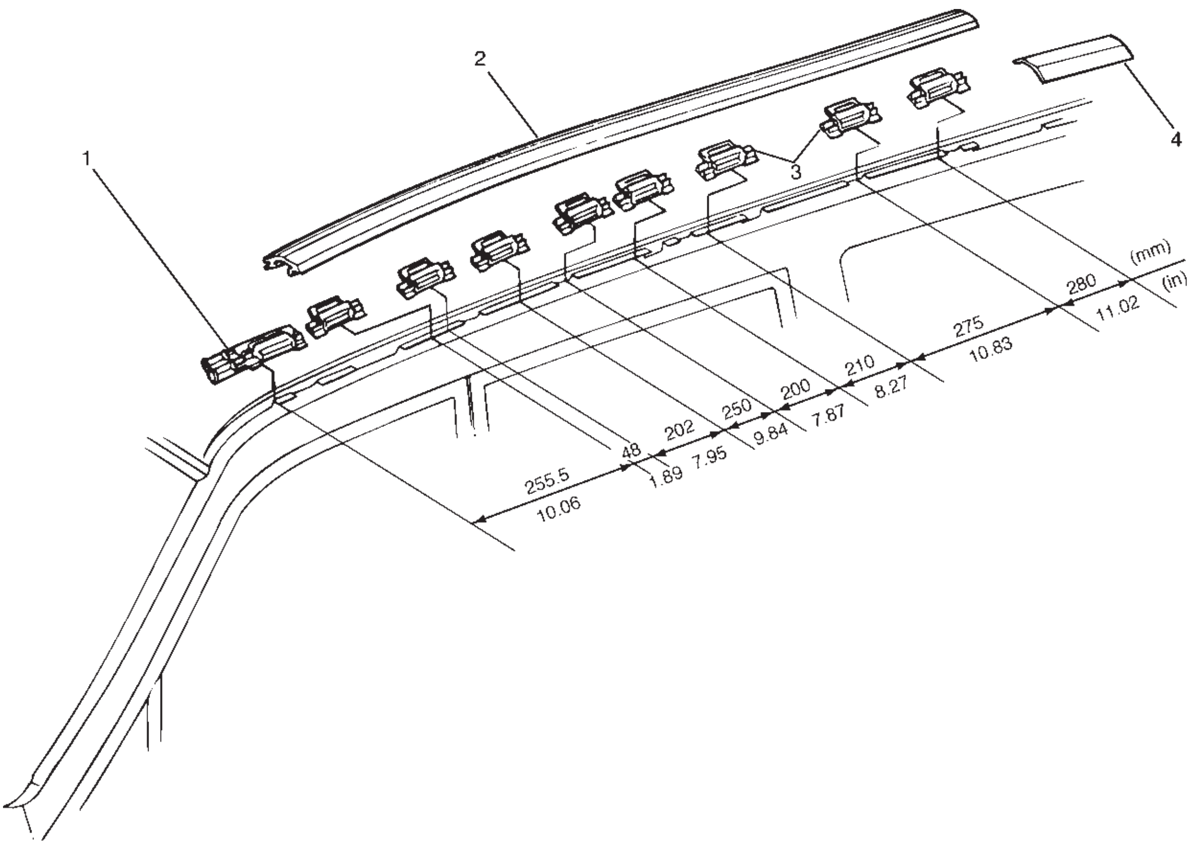
4. Tighten the deflector fixing to the specified torque.

Bolt Torque : 6 N•m (52 lb in)

Nut Torque : 8 N•m (69 lb in)

Roof Moulding

Parts Location



645RX002

Legend

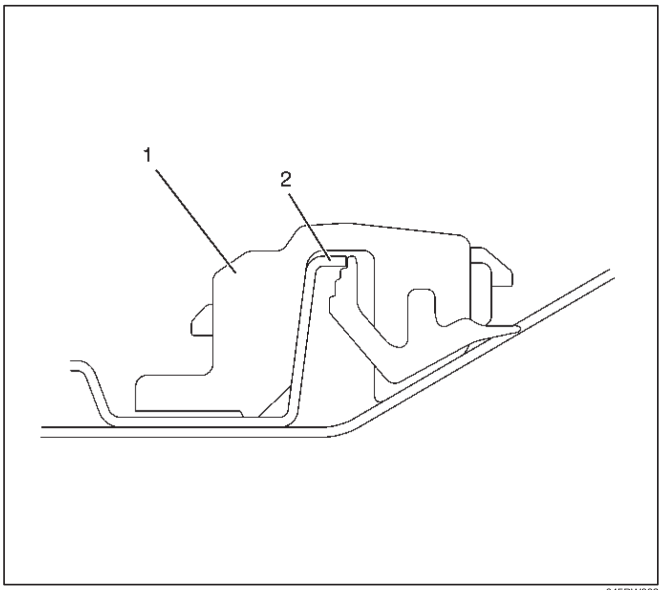
(1) Windshield Side Moulding Upper Clip
(2) Roof Moulding
(3) Roof Moulding Clip
(4) Roof End Moulding

Removal

1. Disconnect the battery ground cable.
2. Remove roof moulding.
3. Remove roof end moulding.
   - Remove the sealing adhesive and the adhesive tape of the roof end moulding from the panel using a knife or scraper while you peel them off.
4. Remove roof moulding clip.
   - Remove the clips.

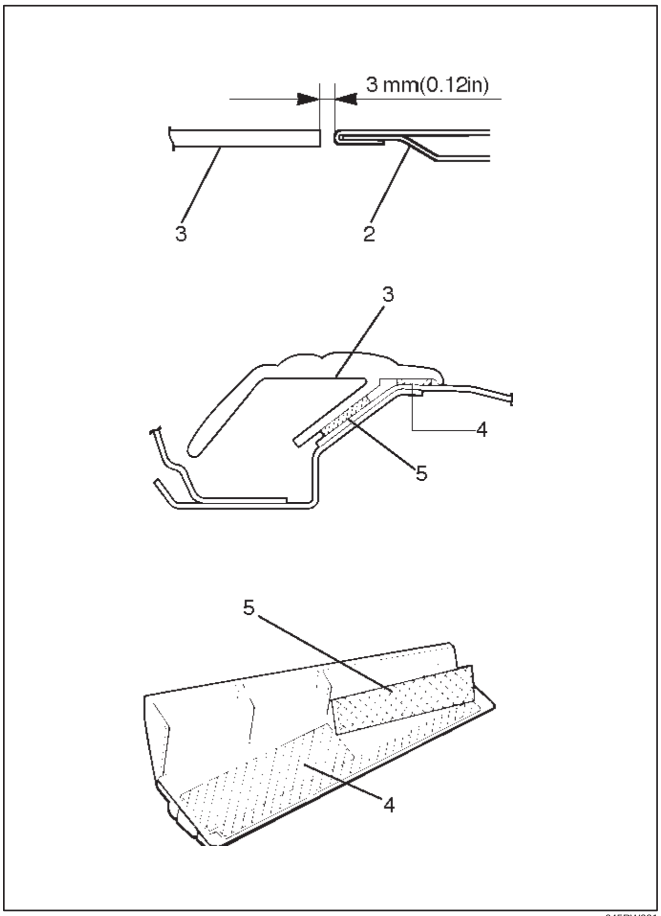
Installation

1. Install the roof moulding clip (1).
   - Install the clips to the specified positions on the roof panel flange (2).



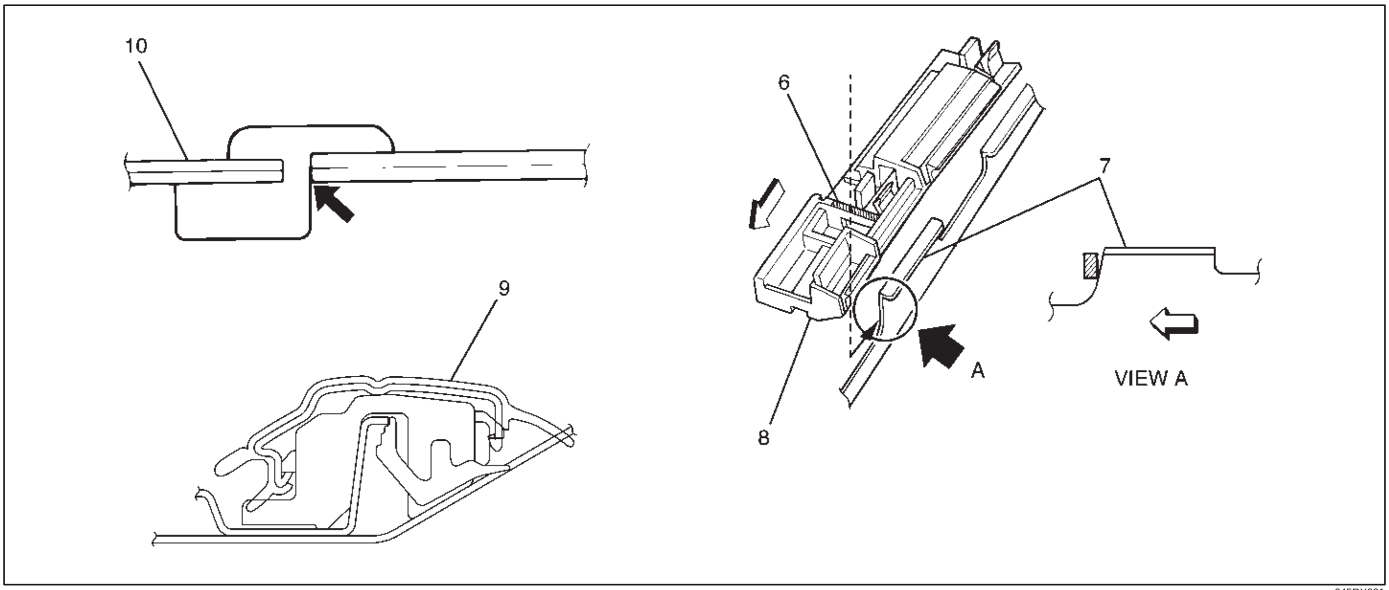
645RW003

2. Install the roof end moulding (3).
   - Clean the body panel where the roof end moulding is installed.
   - Install the roof end moulding and the rear air deflector (2) so that the installation clearance between them is within the specified values. Securely fix it with the adhesive tape (4) and sealing adhesive (5).



645RW001

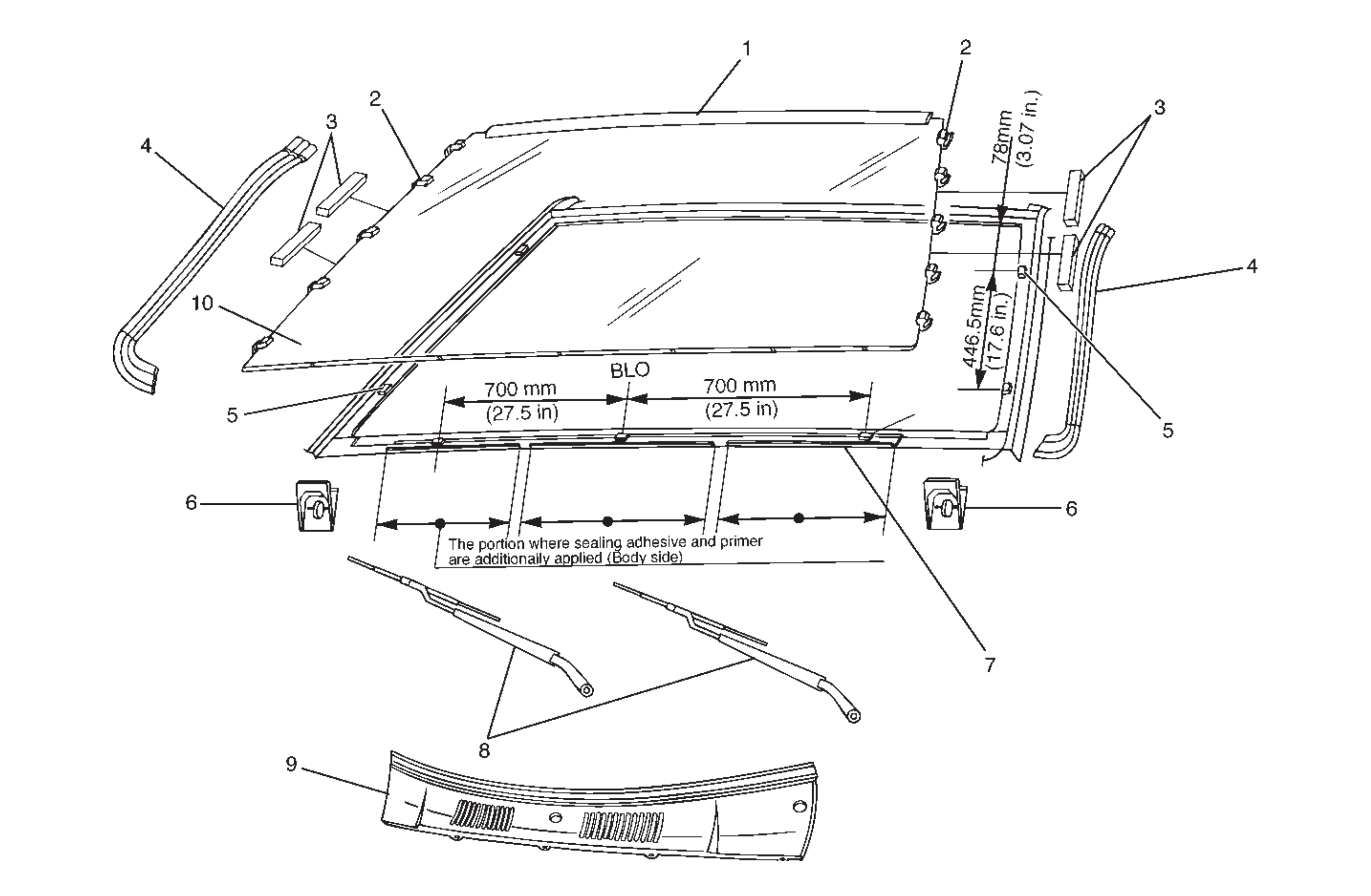
3. Install the roof moulding (9).
   - Assemble the windshield side moulding upper clip (8) to the roof panel with the clip positioning rib (6) (oblique lines portion) attached to the roof panel flange (7). Assemble the roof moulding (9) while you attach the front edge portion of the roof molding to the windshield side moulding (10).



645RX001

Windshield

Parts Location



607RX001

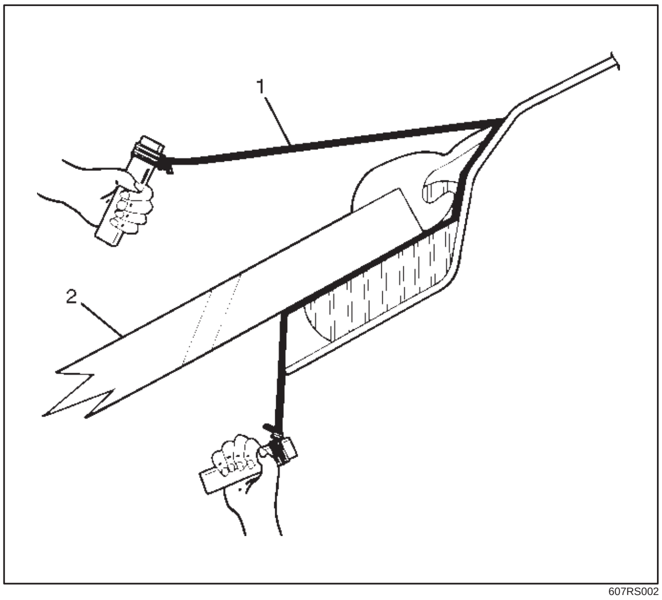
Legend
- (1) Windshield Upper Moulding
- (2) Moulding Clip
- (3) Windshield Side Seal
- (4) Windshield Side Moulding
- (5) Spacer
- (6) Windshield Support
- (7) Cowl Upper Rail Flange
- (8) Windshield Wiper
- (9) Front Cowl Cover
- (10) Windshield

Removal

1. Disconnect the battery ground cable.
2. Remove windshield wiper.
   - Refer to Windshield Wipper Arm/Blade in Wiper/Washer System section.
3. Remove front cowl cover.
   - Refer to Cowl Cover in this section.
4. Remove windshield side moulding.
   - Pull the moulding out from the windshield side moulding clip.
5. Remove windshield support.
6. Remove windshield side seal.
7. Remove windshield (2).

- Use a knife or pick to make a hole in part of the adhesive caulking material.

- Secure one end of a piece of steel piano wire (1) (0.02 inches in diameter) to a piece of wood that can serve as a handle.

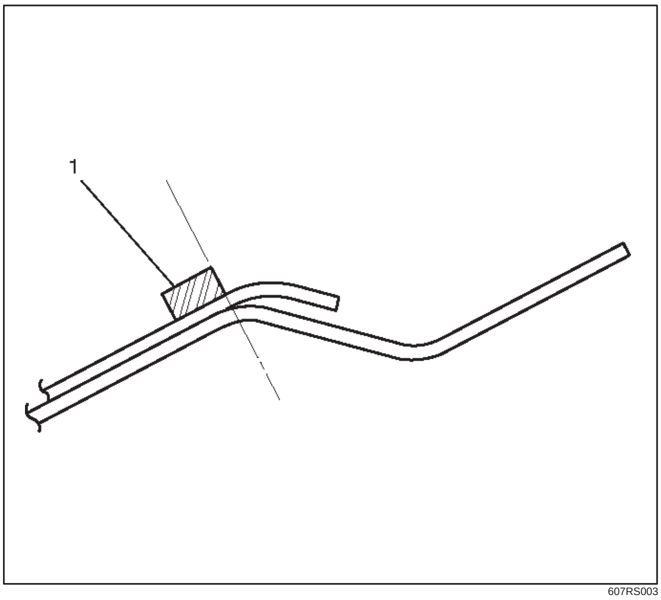


- Use a pair of needle nose pliers to insert the other end of the piano wire through the adhesive caulking material at the edge of the windshield glass.
- Secure the other end of the piano wire to another piece of wood.
- With the aid of an assistant, carefully move the piano wire with a sawing motion to cut through the adhesive caulking material around the entire circumference of the windshield glass.
- Clean the remaining adhesive caulking material from the area of the body which holds the windshield.

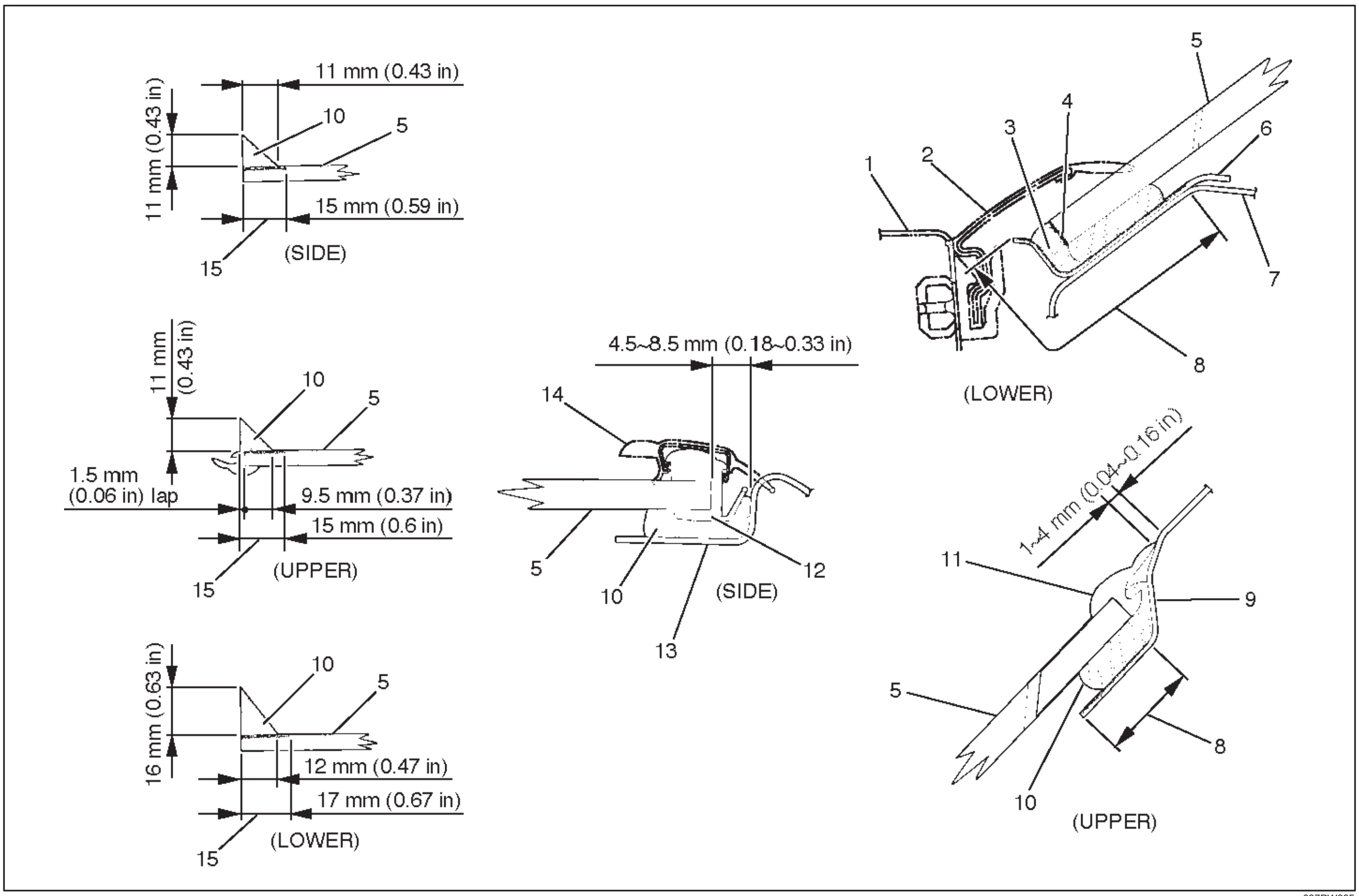
8. Remove windshield upper moulding.
   - Taking notice of the adhesive tape, and peel the moulding off the windshield upper portion.
9. Remove moulding clip.
10. Remove spacer.

Installation

1. Install the spacer (1).
   - Clean the bonding surfaces of both the windshield and the body panel.
   - When installing the spacers, align the lower side spacer to the R stop of the body panel and the side spacer to the end of the body panel. Be sure to always use a new spacer.



   - Be absolutely sure to apply glass primer and body primer to the body panel as shown in the illustration.

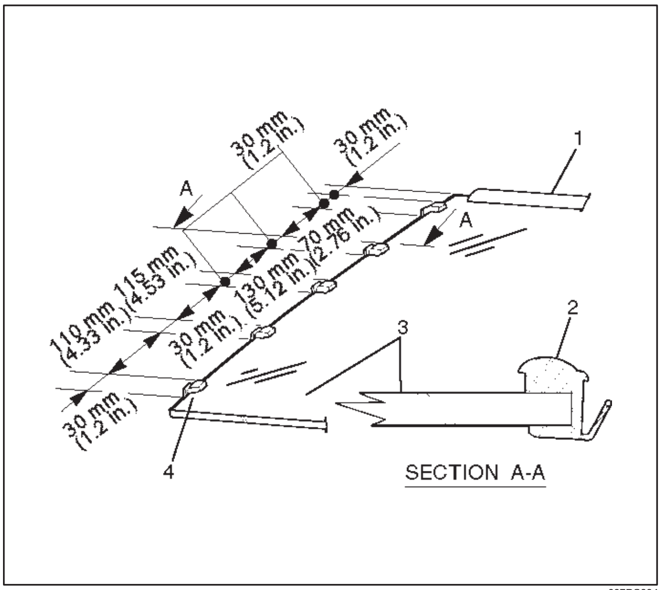


607RW005

Legend

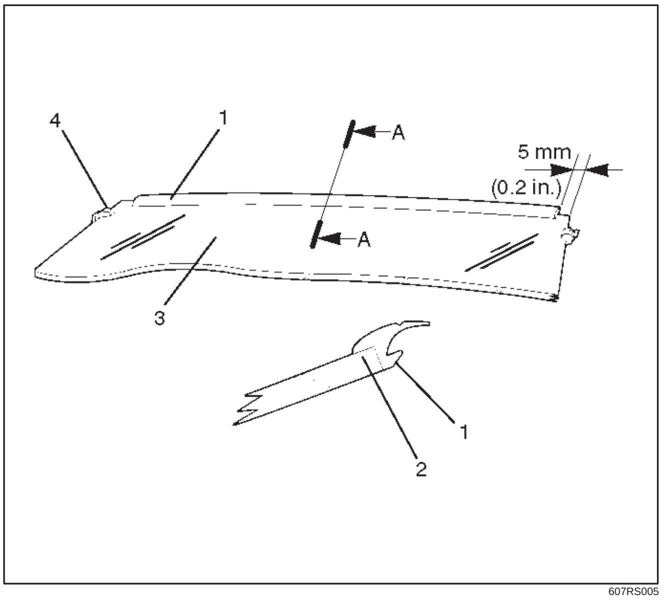
(1) Front Cowl Cover
(2) Windshield Lower Moulding
(3) The portion of the cowl upper rail flange where sealing adhesive is additionally filled
(4) Apply primer to the glass and portion where sealing adhesive is additionally filled
(5) Windshield
(6) Cowl Upper Rail
(7) Cowl Upper Panel
(8) Body Primer
(9) Roof Panel
(10) Sealing Adhesive
(11) Windshield Upper Moulding
(12) Moulding Clip
(13) Front Pillar Outer Panel
(14) Windshield Side Moulding
(15) Sealing Adhesive

2. Install the moulding clip (2).
   - Install new moulding clips to the fixed position of the windshield (3).
   - Always use new moulding clips (4).

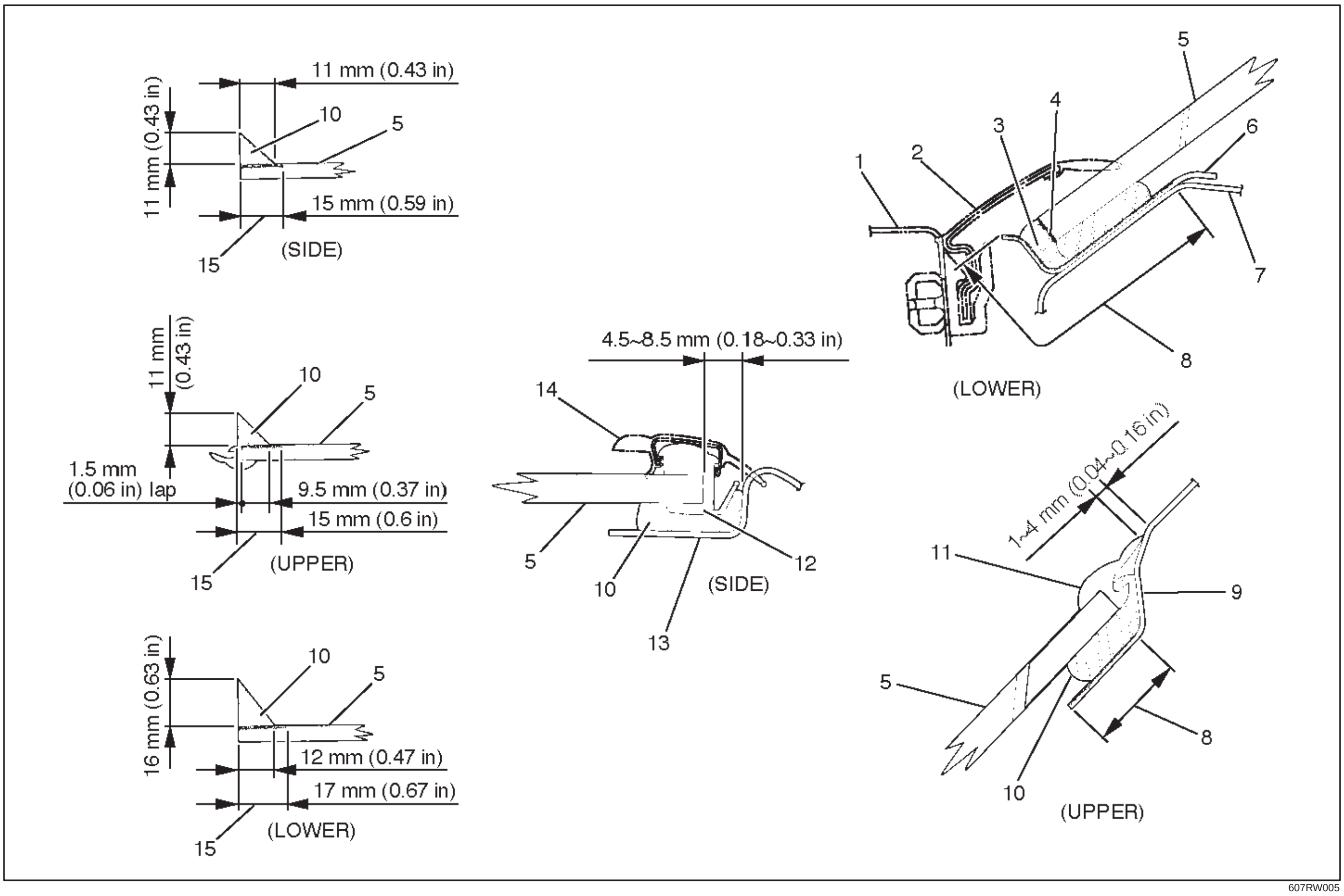


607RS004

3. Install the windshield upper moulding (1).
   - Peel off the adhesive tape (2) and install the moulding to the fixed position of the windshield (3).
   - Always use new upper moulding (1).



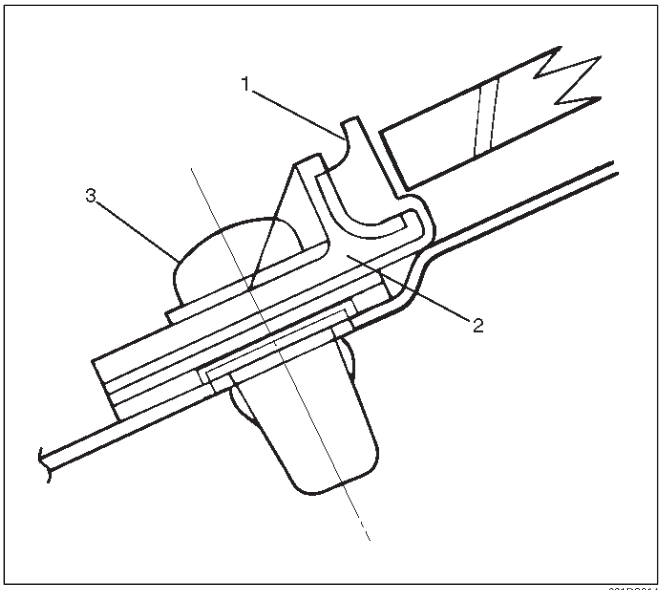
4. Install the windshield.



Legend

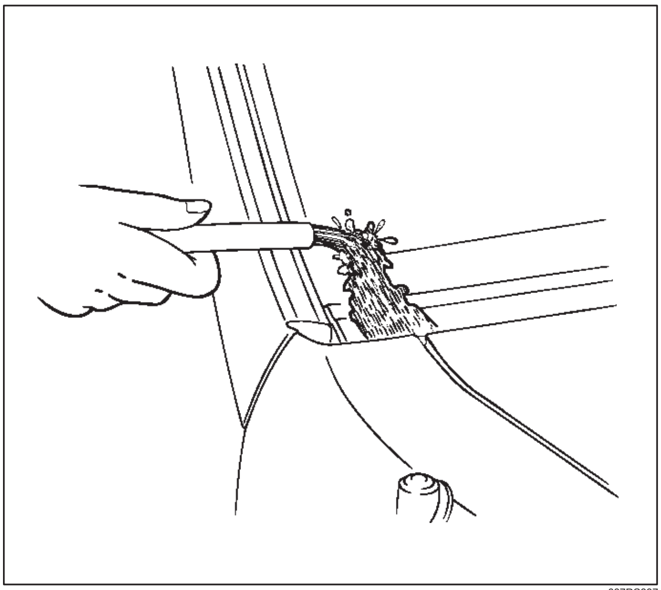
(1) Front Cowl Cover
(2) Windshield Lower Moulding
(3) The portion of the cowl upper rail flange where sealing adhesive is additionally filled
(4) Apply primer to the glass and portion where sealing adhesive is additionally filled
(5) Windshield
(6) Cowl Upper Rail
(7) Cowl Upper Panel
(8) Body Primer
(9) Roof Panel
(10) Sealing Adhesive
(11) Windshield Upper Moulding
(12) Moulding Clip
(13) Front Pillar Outer Panel
(14) Windshield Side Moulding
(15) Sealing Adhesive

5. Install the windshield side seal.
6. Install the windshield support (2).

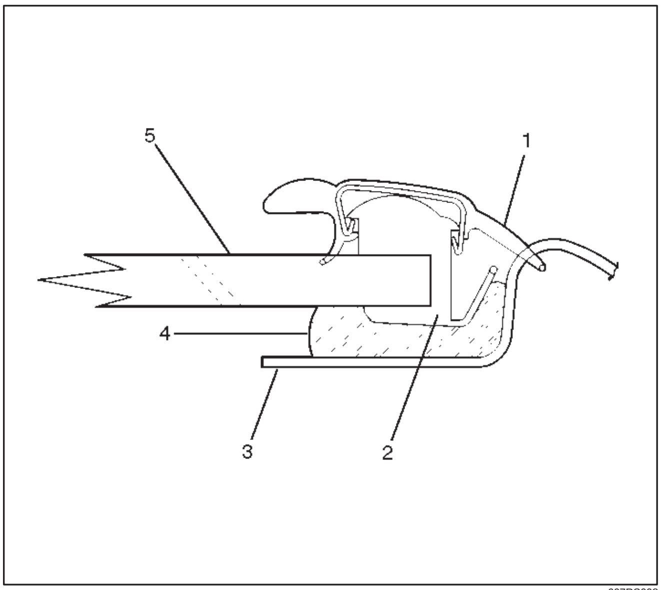


631RS014

- Apply a sealing adhesive (4) to the circumference of the windshield (5).
- Apply the sealing adhesive to the frange portion of the cowl upper rail.
- Adjust the gap clearance of the windshield (5).
- Install the windshield to the body panel by applying pressure to the windshield.
- Cure the adhesive at a temperature of 20~30˚C (68~86˚F) for 24 hours.
- Check that the windshield does not leak water.


607RS007

7. Install the windshield side moulding.
   - Insert the windshield (5) side moulding (1) into the moulding clip (2).



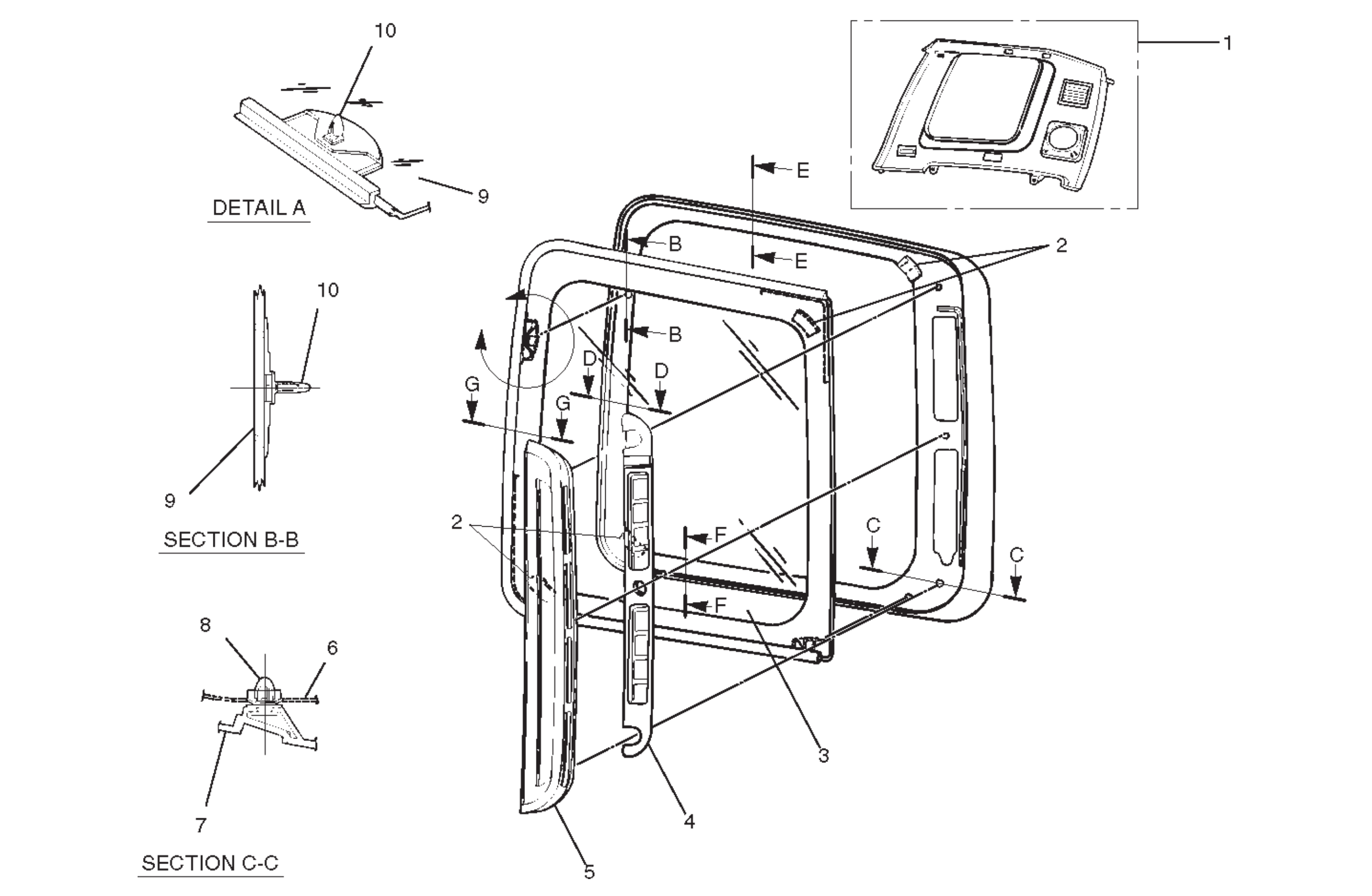
607RS008

   - Take care not to damage the side moulding when you install it.

8. Install the front cowl cover.
9. Install the windshield wiper.

Rear Quarter Side Glass

Parts Location



641RS005

Legend

(1) Rear Quarter Upper Trim Panel
(2) Fastener
(3) Rear Quarter Side Glass
(4) Valve Assembly
(5) Ventilation Assembly
(6) Side Outer Panel
(7) Ventilation Assembly
(8) Ventilation Fixing Clip
(9) Rear Quarter Side

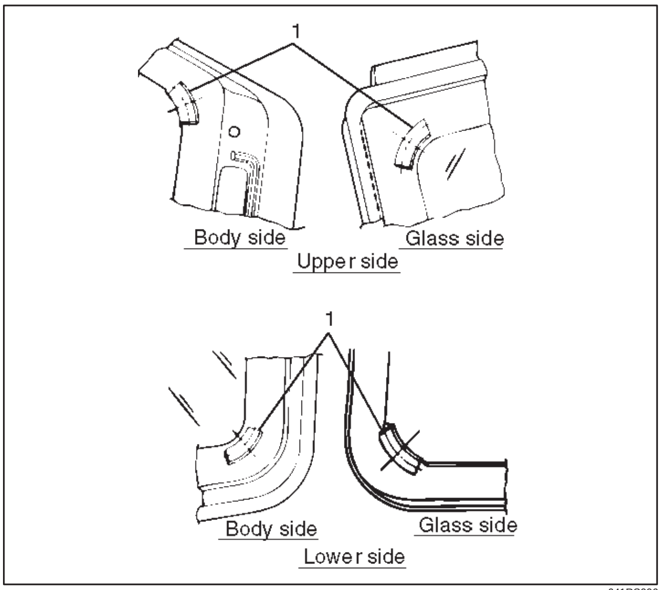
Removal

1. Disconnect the battery ground cable.
2. Remove rear quarter upper trim panel.
   - Refer to Laggage Side and Quarter Upper Trim Cover in Exterior / Interior Trim section.
3. Remove ventilation assembly.
4. Remove valve assembly.
   - Refer to Ventilation Assembly in this section.
5. Remove rear quarter side glass.
   - Refer to windshield in this section.

Installation

1. Install the rear quarter side glass.

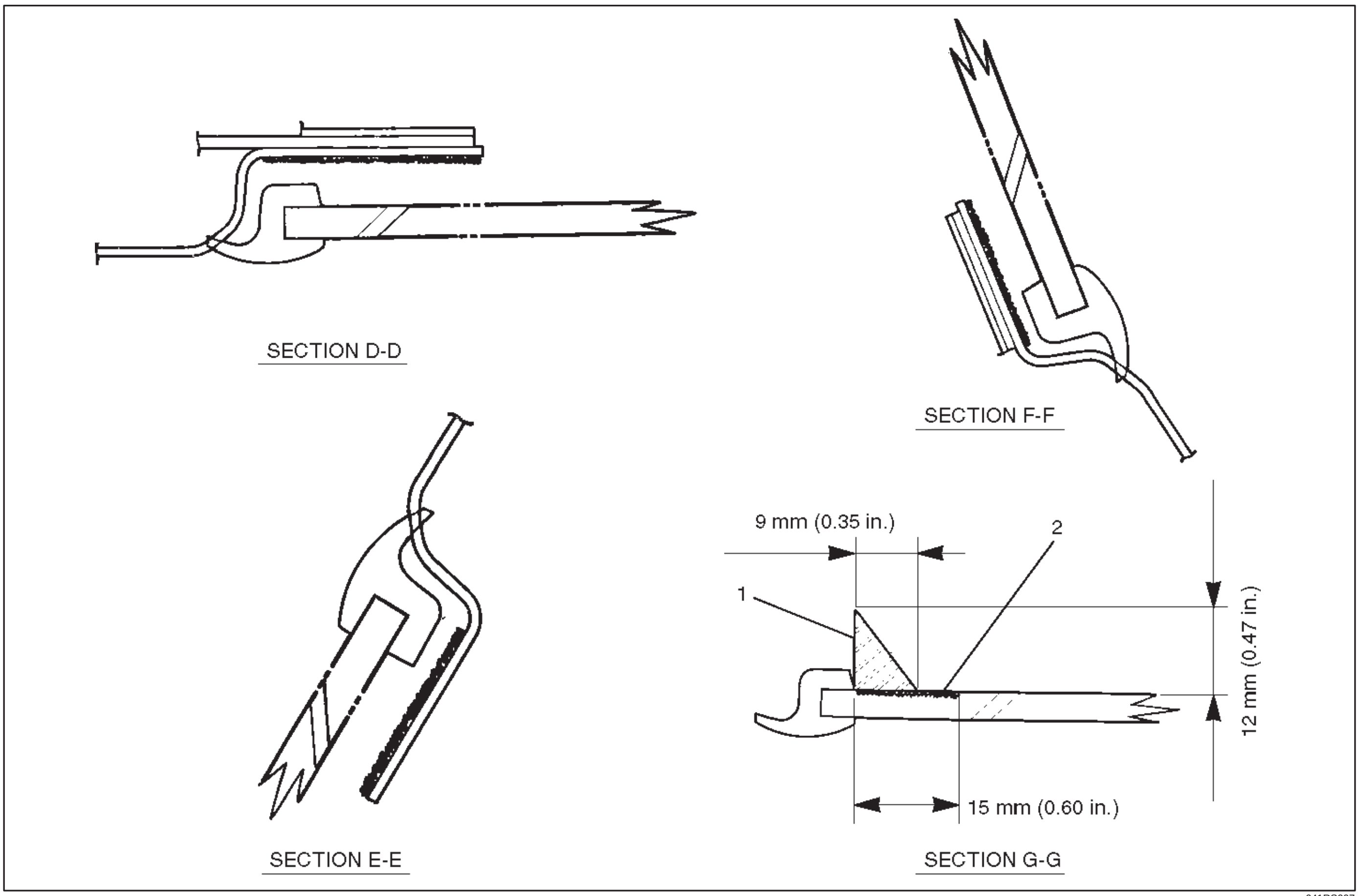
- Clean the bonding surfaces of both the glass and the body panel.
- Install the fasteners (1) to the fixed positions of the glass and the body panel.



641RS006

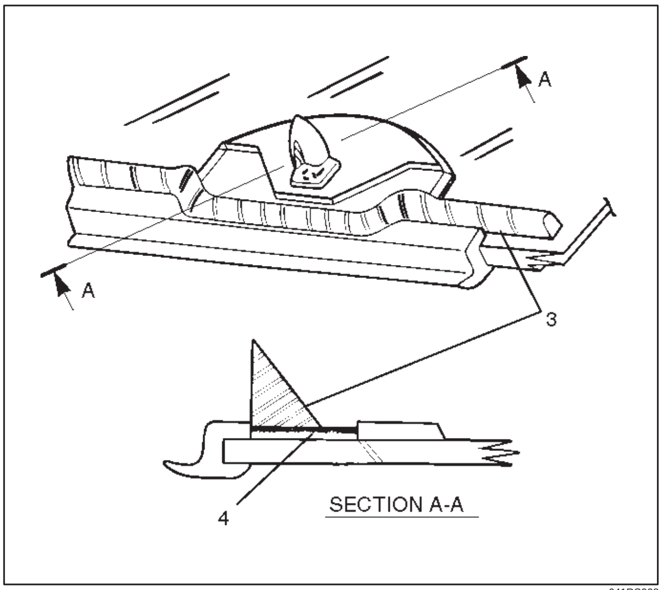
- Always use new fasteners.

- Be absolutely sure to apply glass primer to the side glass.



641RS007

- Apply a sealing adhesive (1) to the glass circumference.



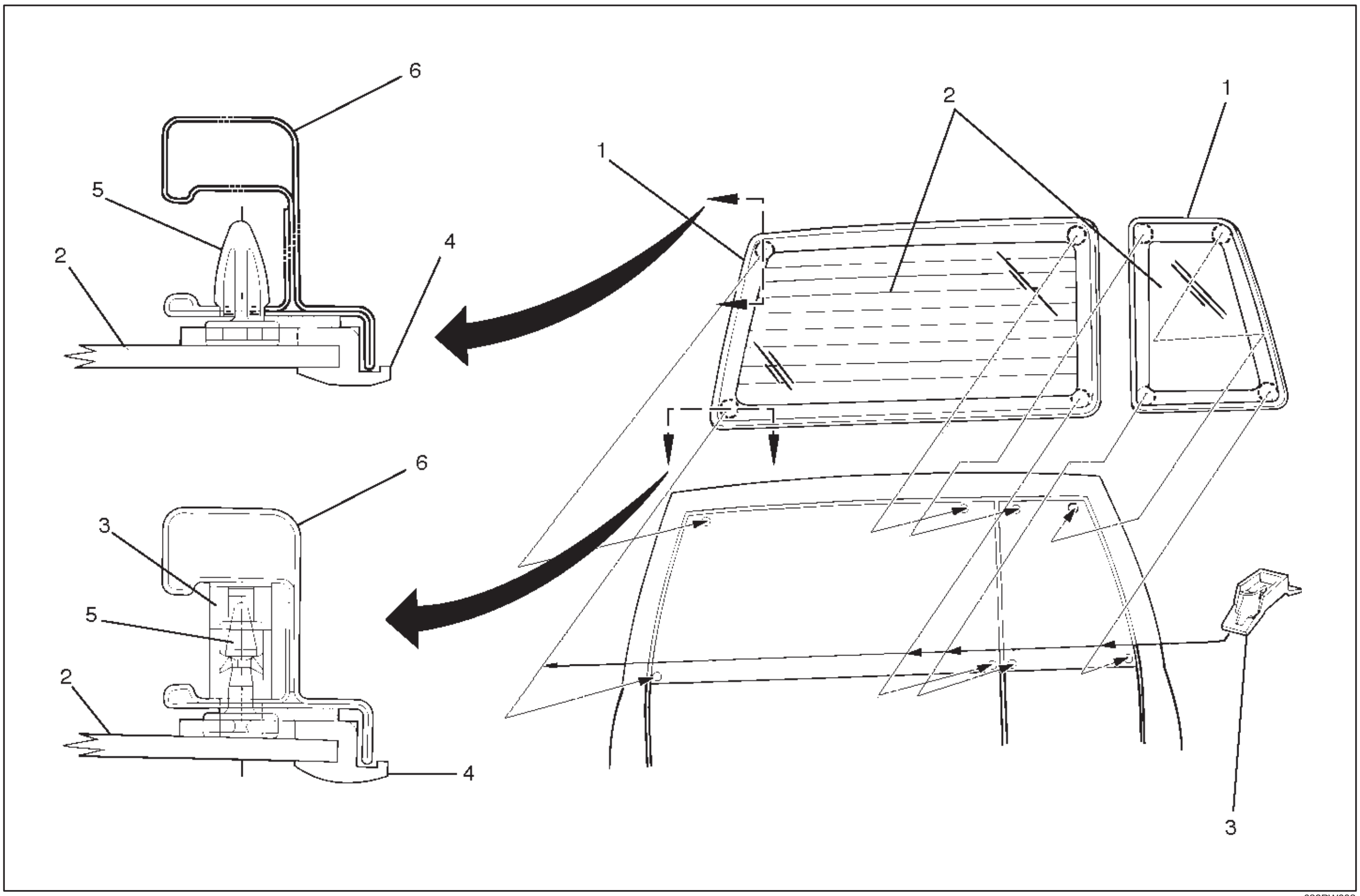
641RS008

- Apply PVC primer (4) to the A clip portion.
- Insert the fixing clip on the side glass into the body panel.
- Push the side glass against the body panel and bond them.
- Cure the adhesive at a temperature of 20~30˚C (68~86˚F) for 24 hours.
- Check that the rear quarter side glass does not leak water.

2. Install the valve assembly.
3. Install the ventilation assembly.
4. Install the rear quarter upper trim panel.

Tailgate Glass

Parts Location



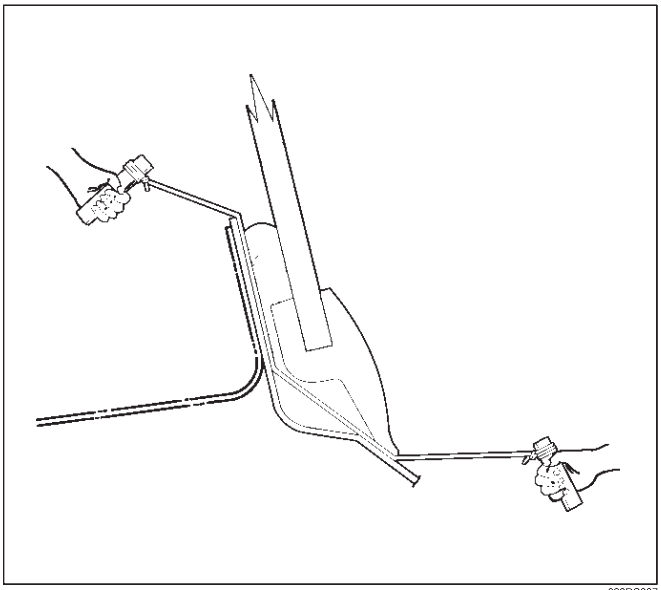
682RW008

Legend

(1) Tailgate Glass Moulding
(2) Tailgate Glass
(3) Tailgate Glass Clip
(4) Glass Moulding
(5) Clip
(6) Body Panel

Removal

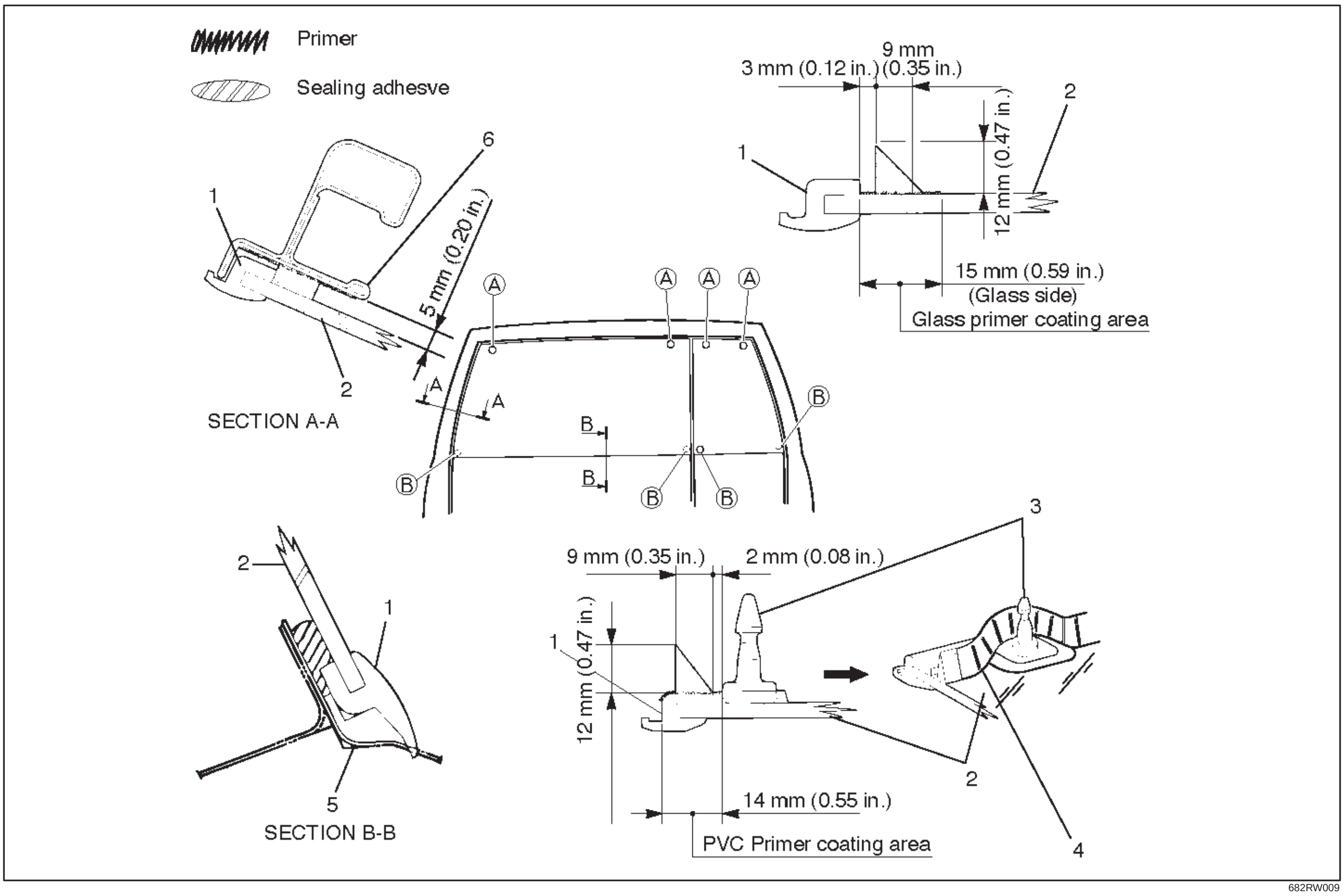
1. Remove battery ground cable.
2. Remove tailgate trim panel.
3. Remove tailgate sash trim cover (RH only).
4. Remove the tailgate frame cover.
   - Refer to Tailgate Frame Cover (RH & LH) in this section
5. Remove tailgate glass.
   - Refer to Windshield in this section.



682RS007

6. Remove tailgate glass clip.

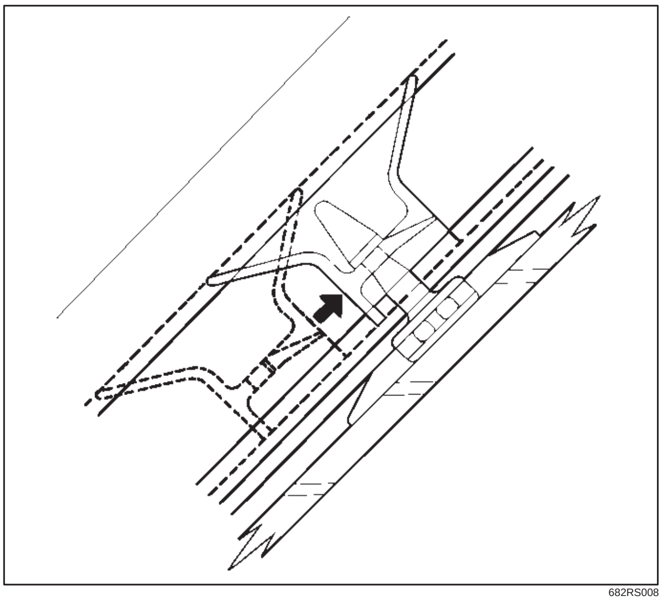
Installation



Legend

(1) Glass Moulding
(2) Tailgate Glass
(3) Clip
(4) Sealing Adhesive
(5) Body Panel
(6) Tailgate Frame

1. Install the tailgate glass clip.

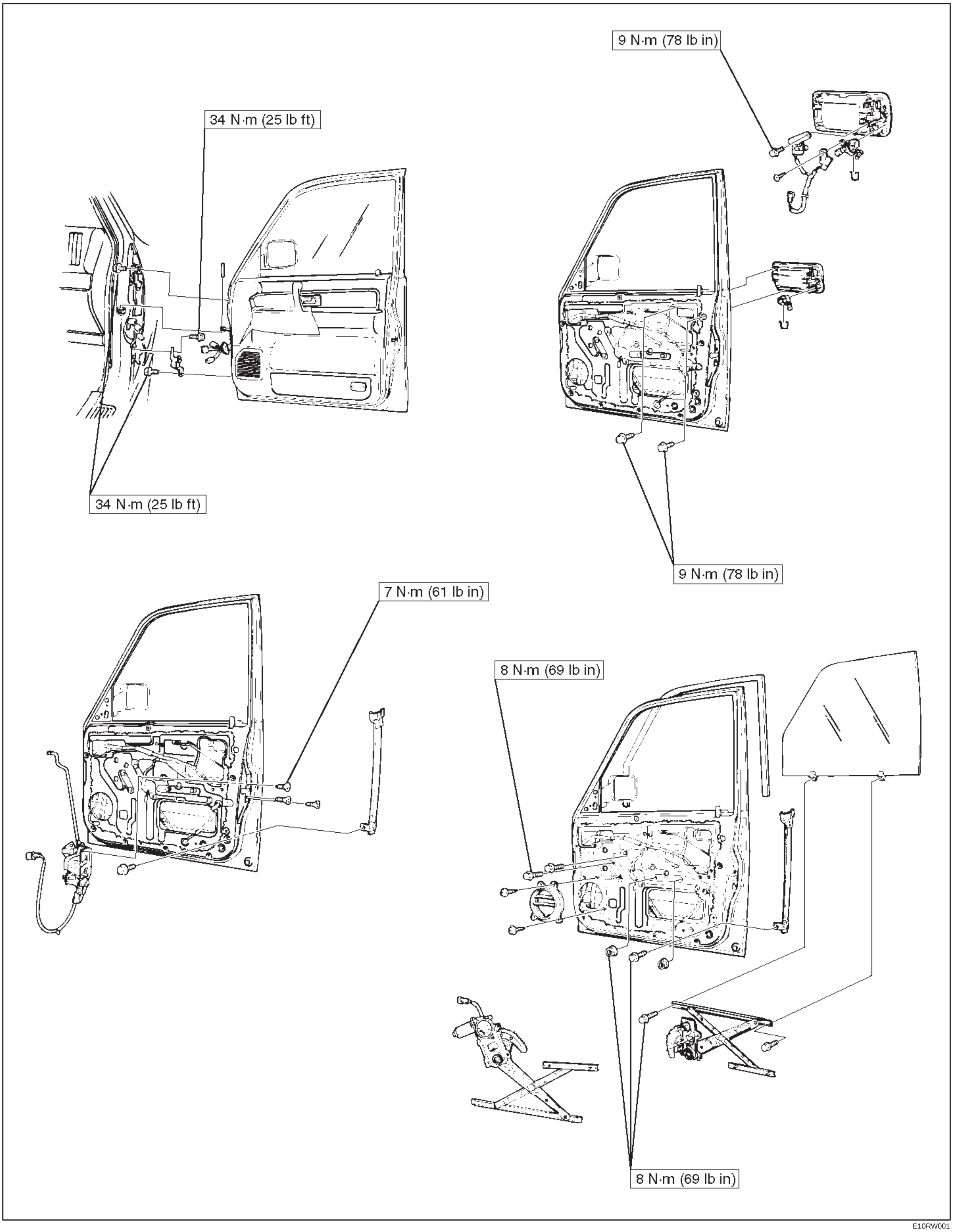


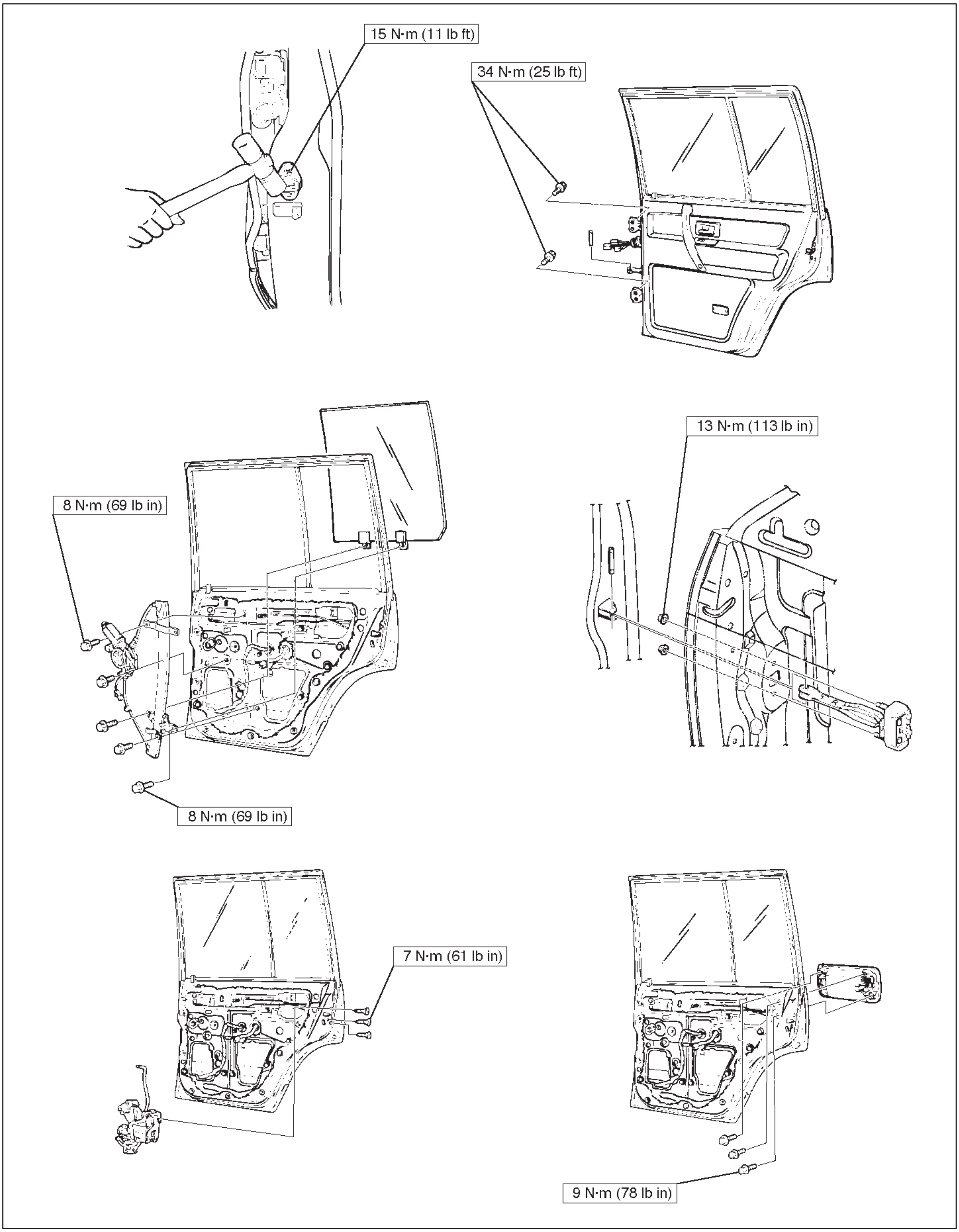
2. Install the tailgate glass (2).
   - Clean the bonding surfaces of both the tailgate glass and the tailgate panel.
   - Be absolutely sure to apply glass primer to the tailgate glass and PCV primer to the glass moulding (1).
   - Apply a sealing adhesive to the circumference of the tailgate glass as shown.
   - Insert the clip of the tailgate glass A portion into the tailgate panel hole to position the glass.
   - Install the new tailgate glass clip to the clip of the tailgate glass B portion while sliding it, and bond the glass to the tailgate panel by applying pressure.

     Always use new tailgate glass clips.
   - Cure the bonding at a temperature of 20~30˚C (68~86˚F) for 24 hours.
   - Check that the tailgate glass does not leak water.

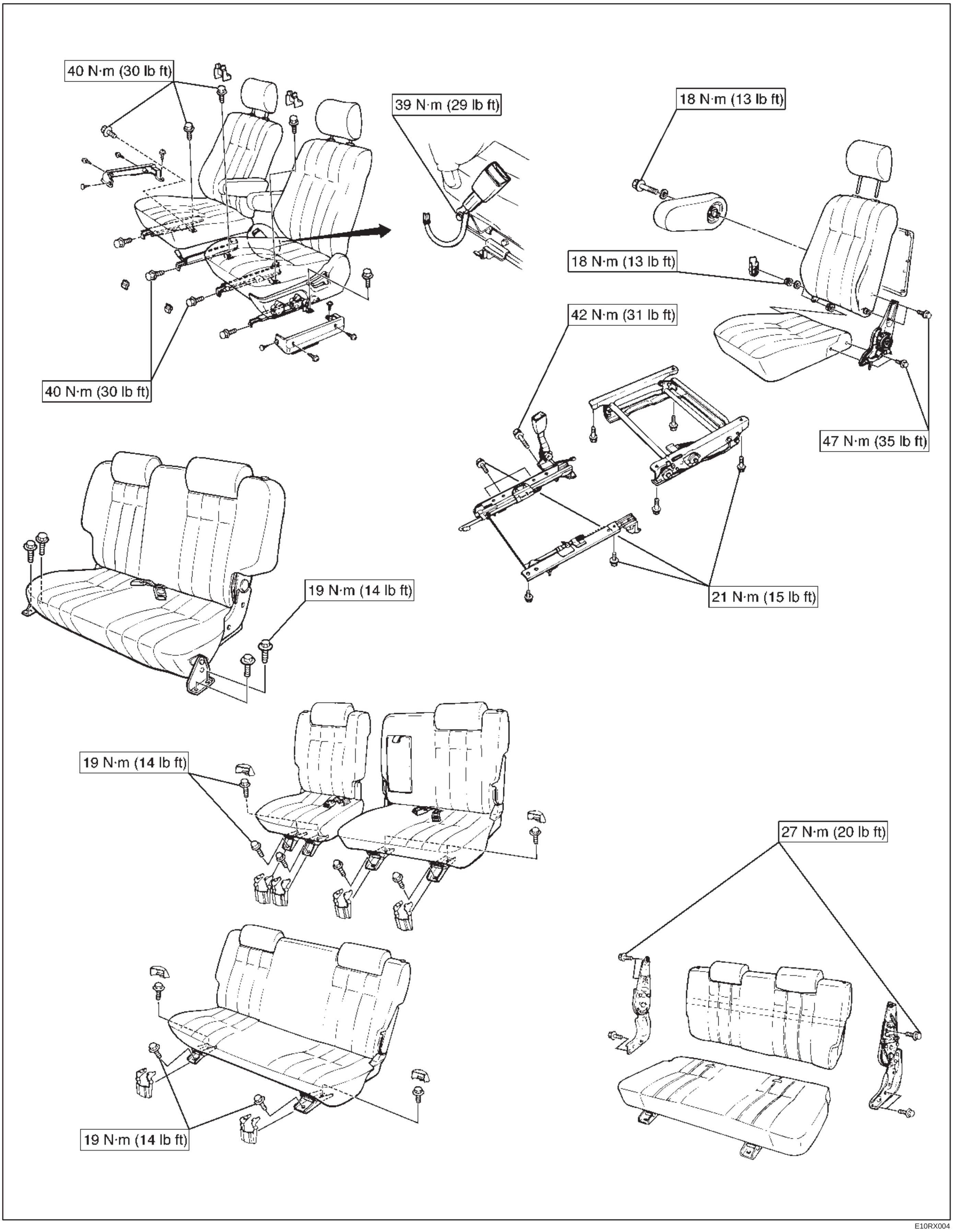
Main Data and Specifications

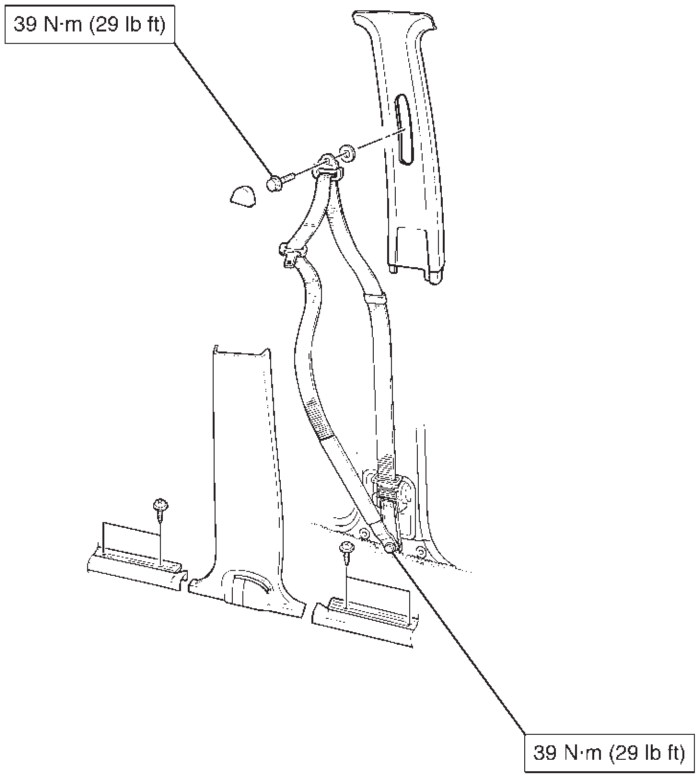
Torque Specifications

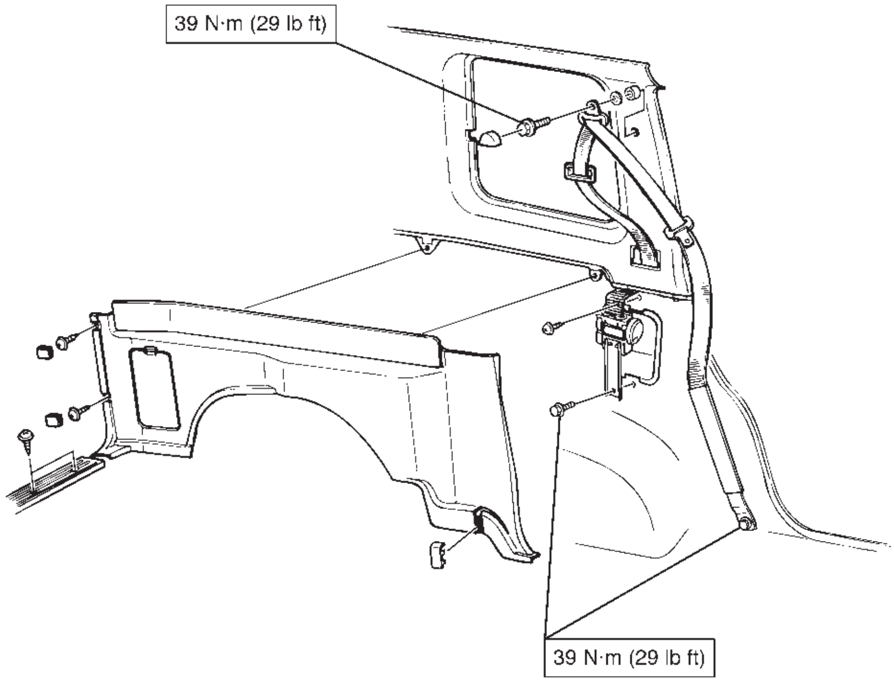



15 N·m (11 lb ft)
34 N·m (25 lb ft)
13 N·m (113 lb in)
8 N·m (69 lb in)
8 N·m (69 lb in)
7 N·m (61 lb in)
9 N·m (78 lb in)

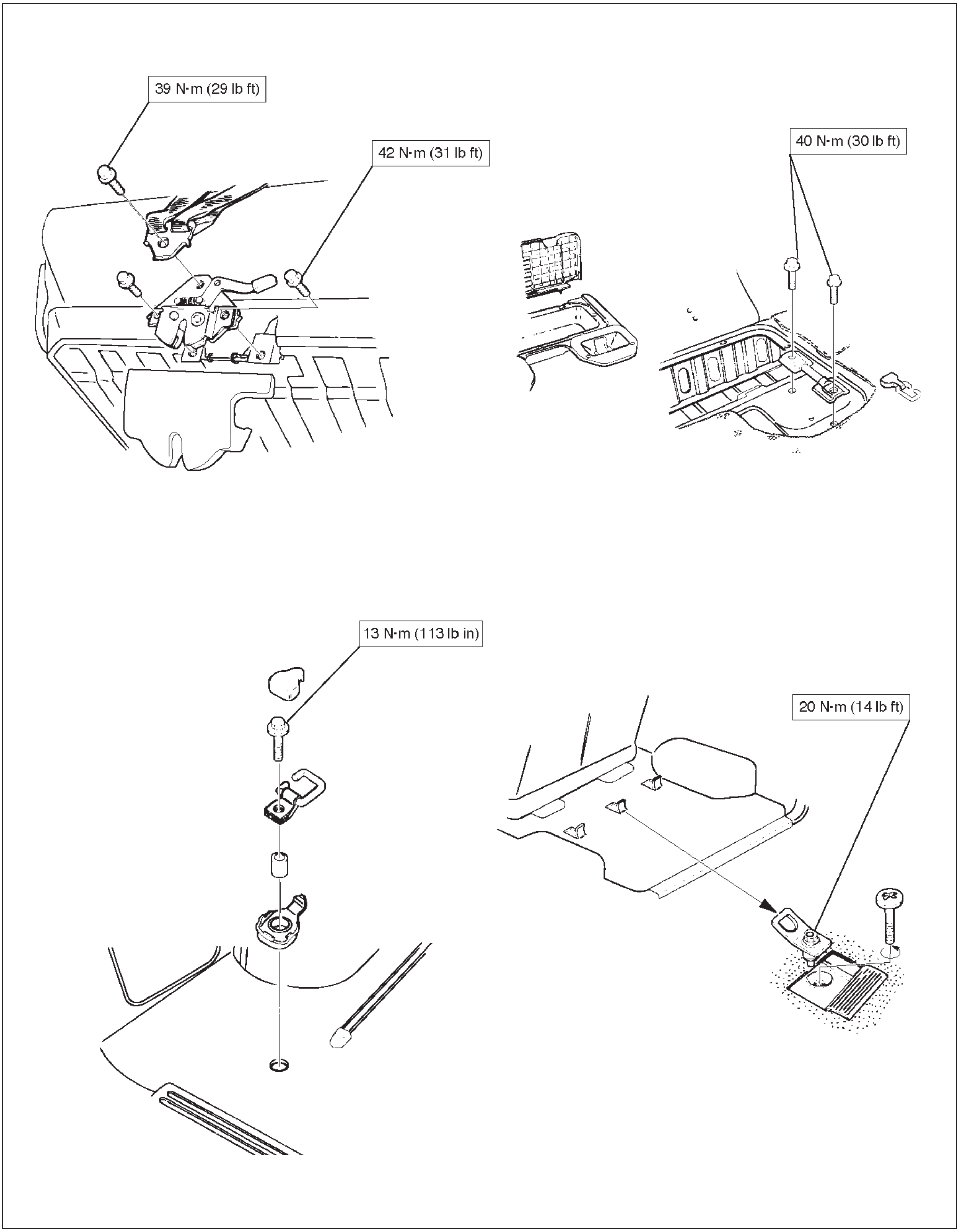
E10RW002


40 N·m (30 lb ft)
39 N·m (29 lb ft)
18 N·m (13 lb ft)
18 N·m (13 lb ft)
42 N·m (31 lb ft)
40 N·m (30 lb ft)
47 N·m (35 lb ft)
19 N·m (14 lb ft)
21 N·m (15 lb ft)
19 N·m (14 lb ft)
27 N·m (20 lb ft)
19 N·m (14 lb ft)
E10RX004

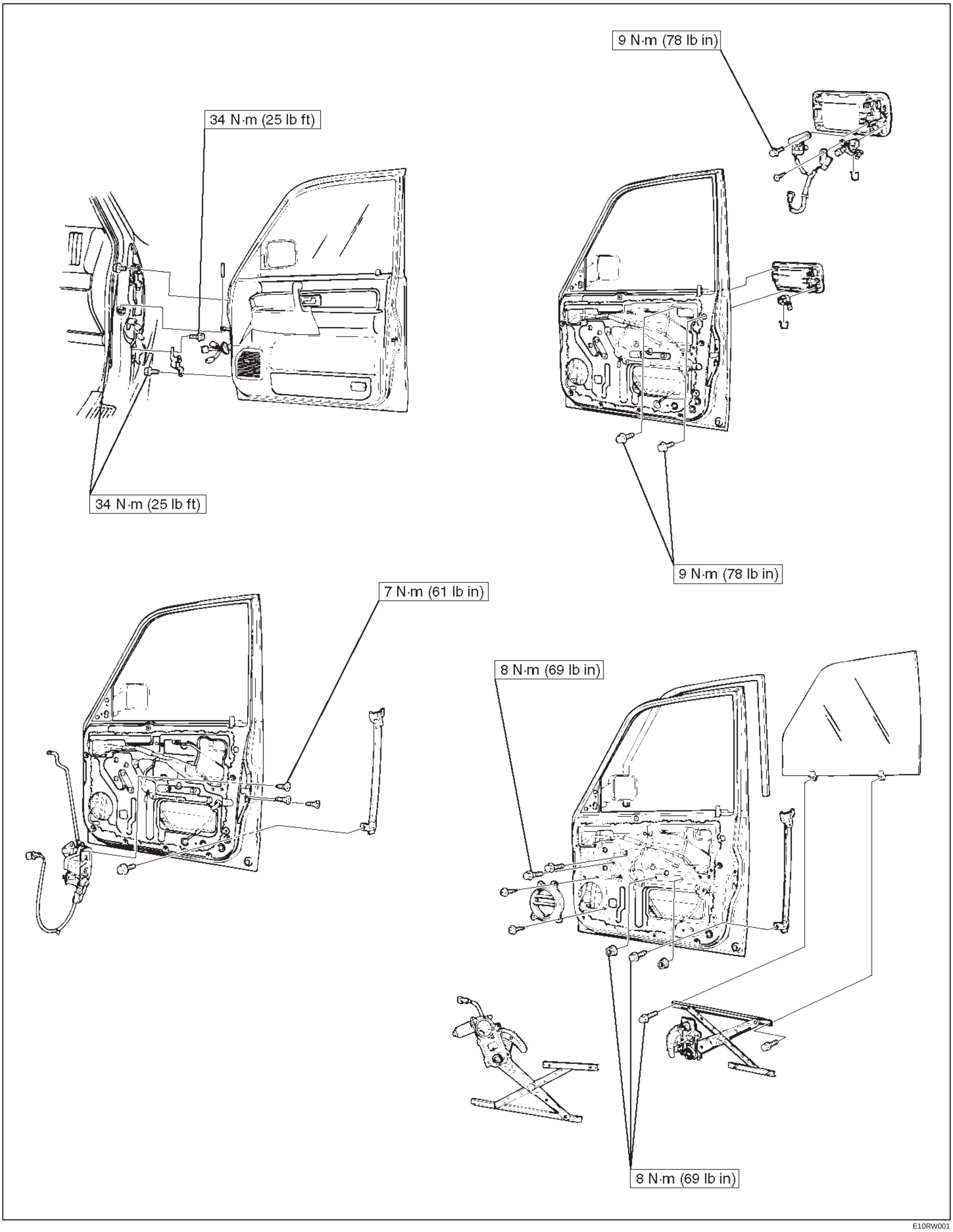




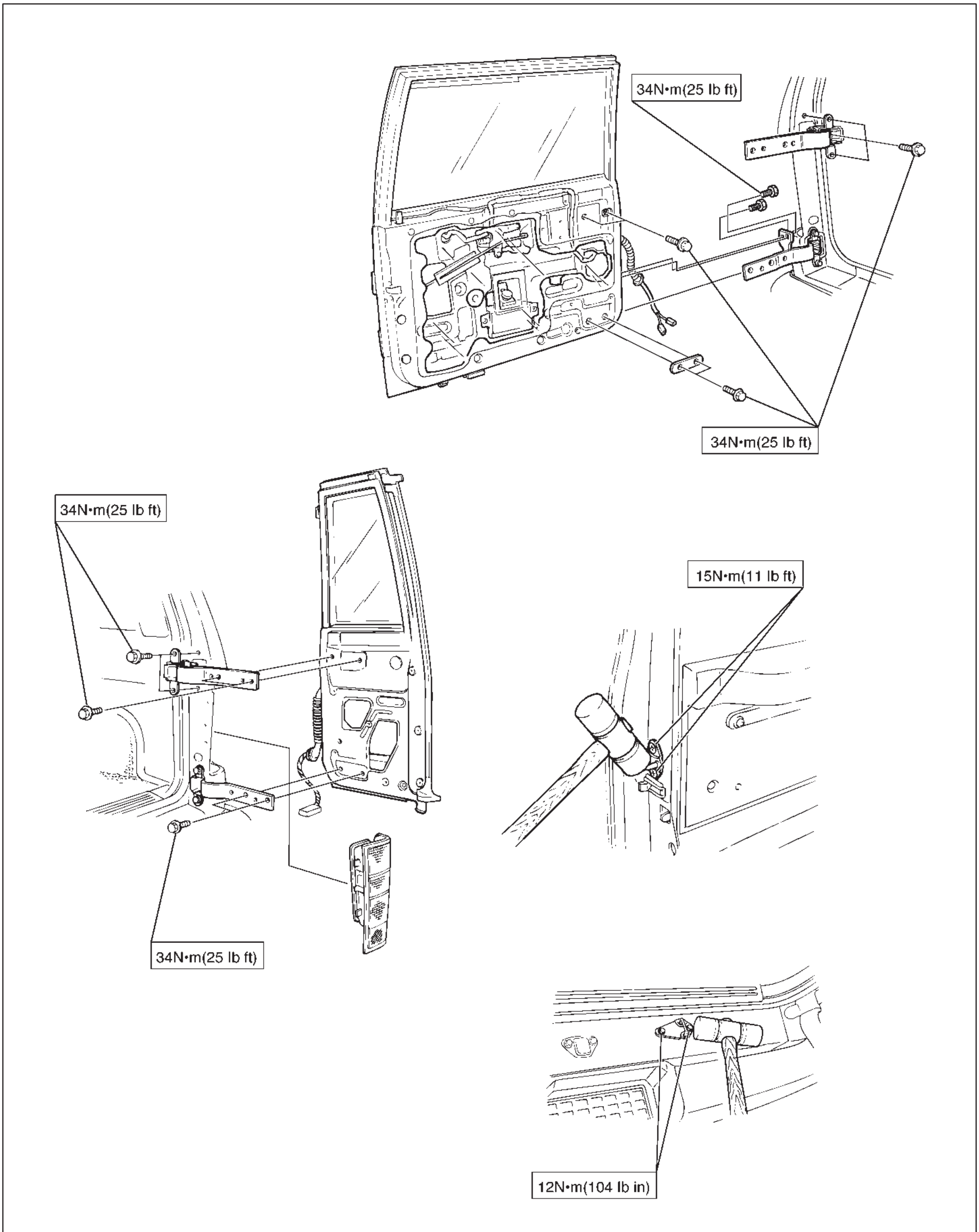
E10RX005


39 N·m (29 lb ft)
42 N·m (31 lb ft)
40 N·m (30 lb ft)
13 N·m (113 lb in)
20 N·m (14 lb ft)

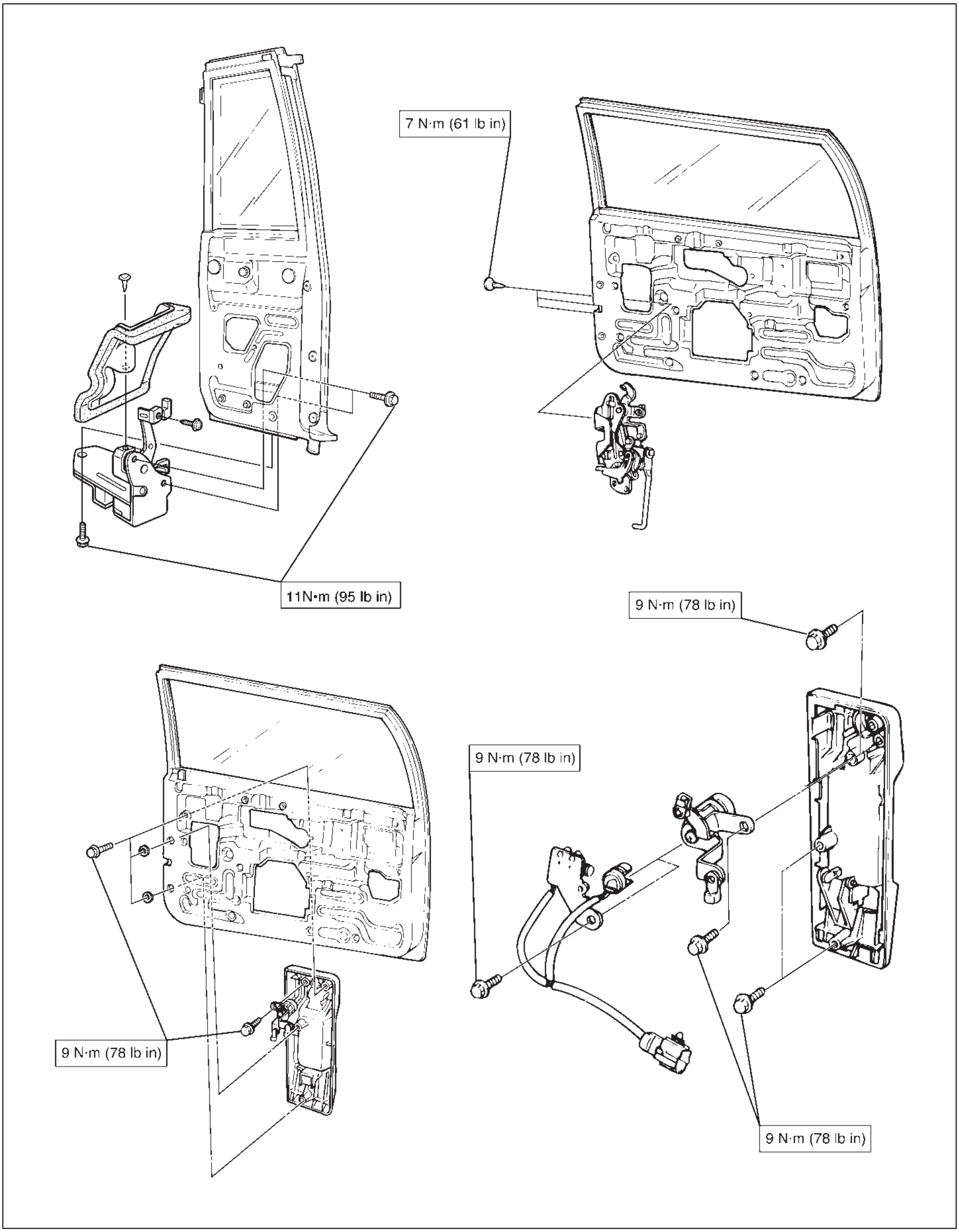
E10RW005


9 N·m (78 lb in)
34 N·m (25 lb ft)
34 N·m (25 lb ft)
9 N·m (78 lb in)
7 N·m (61 lb in)
8 N·m (69 lb in)
8 N·m (69 lb in)

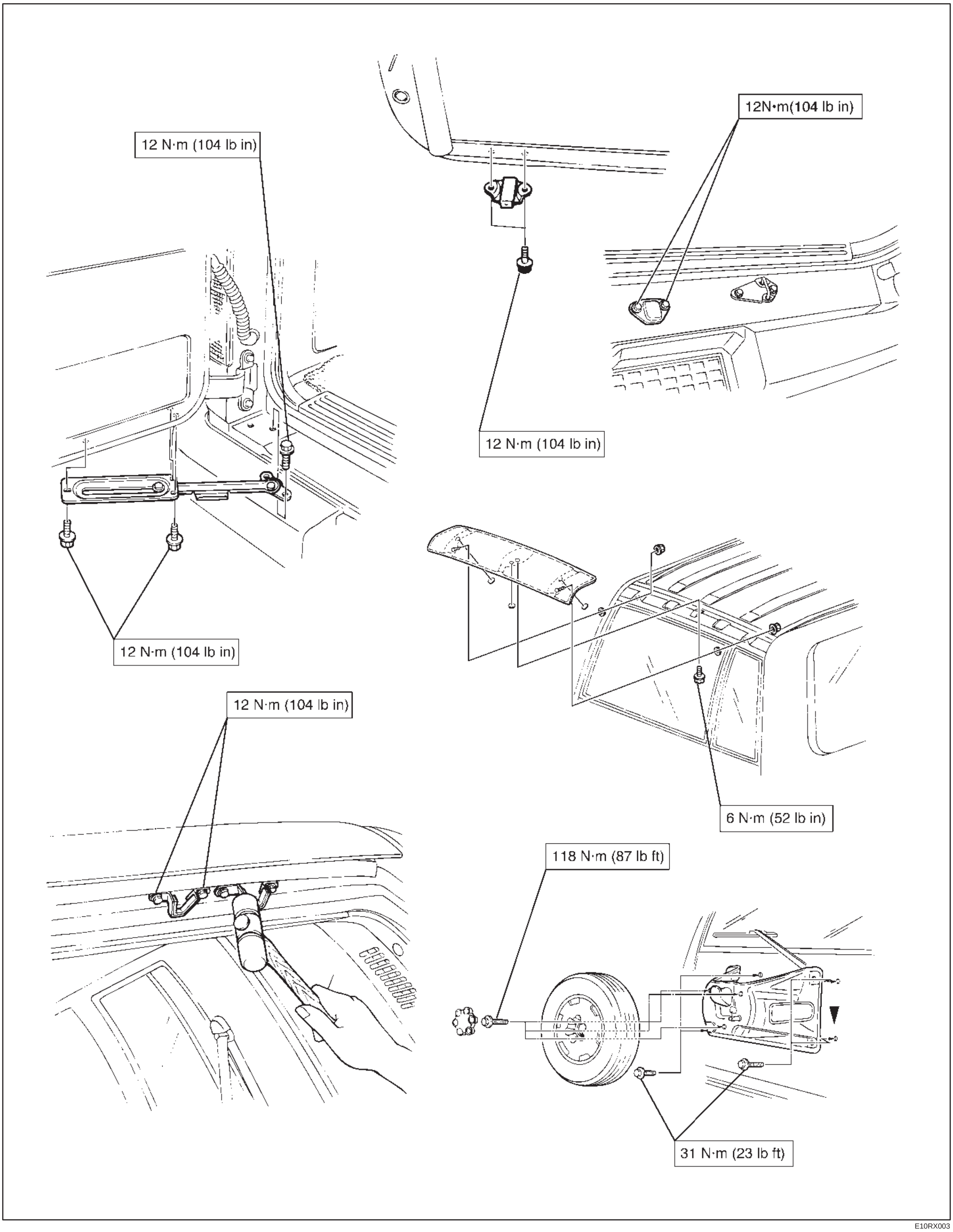
E10RW001

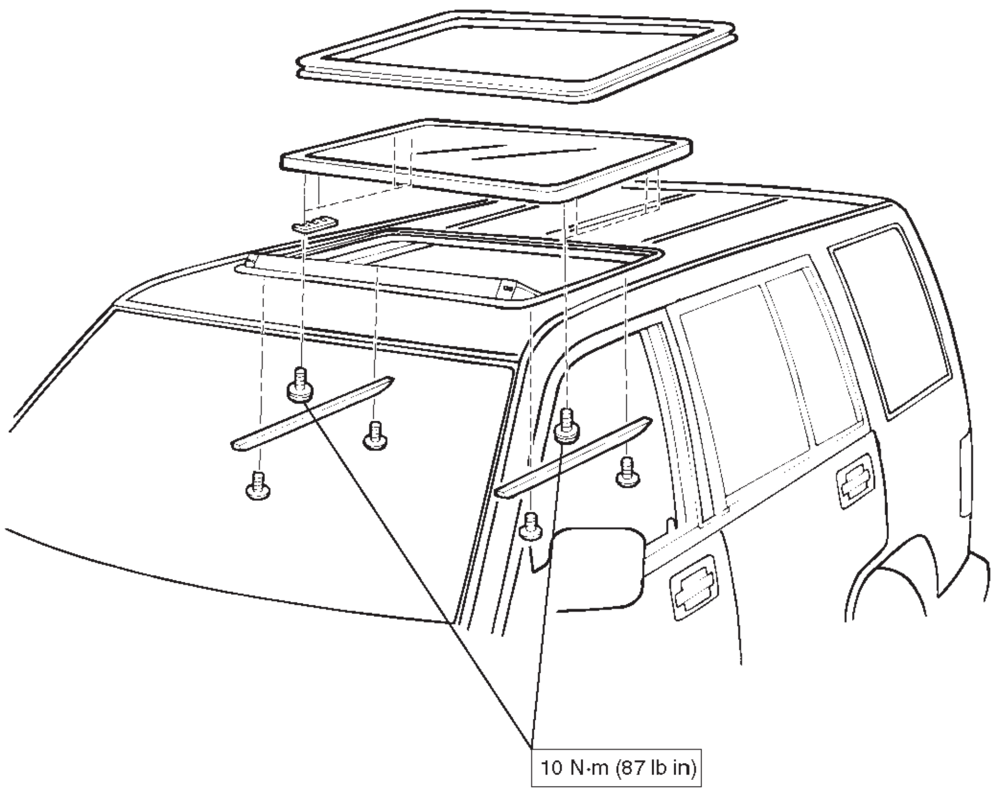

34N•m(25 lb ft)
34N•m(25 lb ft)
34N•m(25 lb ft)
15N•m(11 lb ft)
34N•m(25 lb ft)
12N•m(104 lb in)

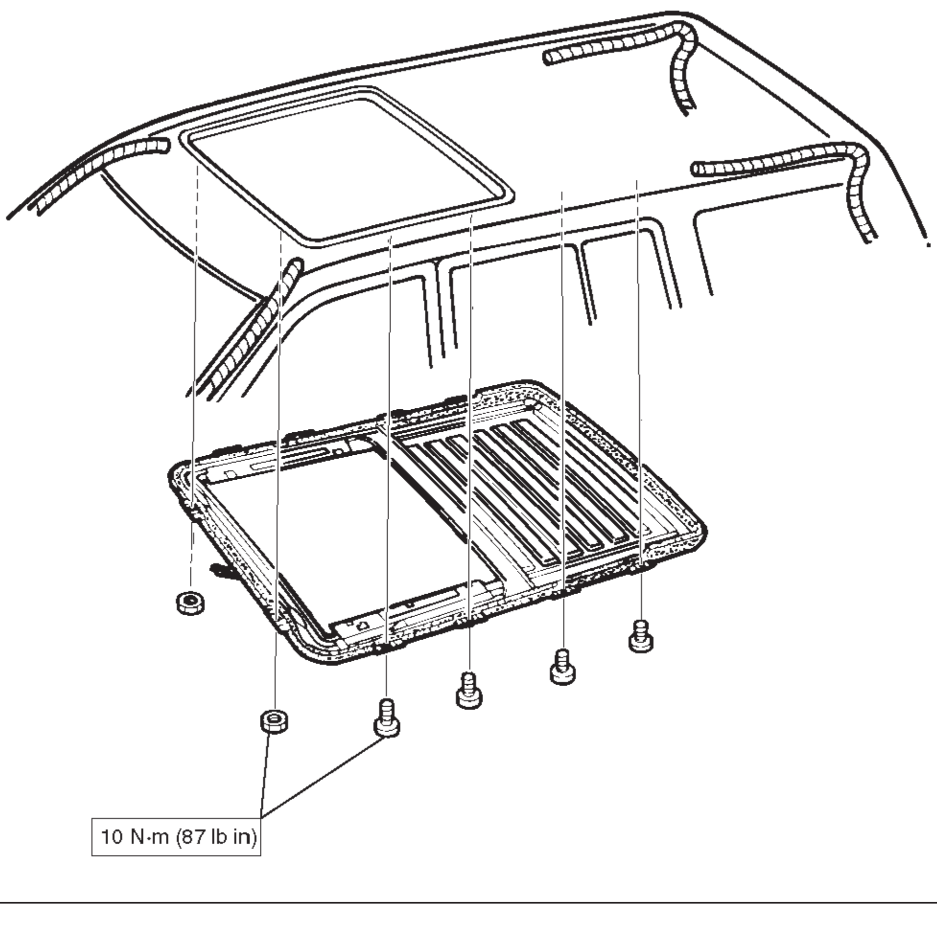
E10RX001



7 N·m (61 lb in)
11N•m (95 lb in)
9 N·m (78 lb in)
9 N·m (78 lb in)
9 N·m (78 lb in)
9 N·m (78 lb in)
E10RX002

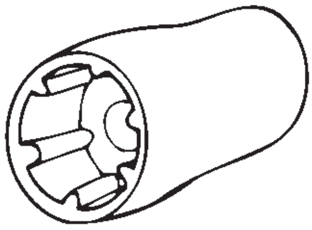

12 N·m (104 lb in)
12N•m(104 lb in)
12 N·m (104 lb in)
12 N·m (104 lb in)
12 N·m (104 lb in)
6 N·m (52 lb in)
118 N·m (87 lb ft)
31 N·m (23 lb ft)
E10RX003





E10RS010

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–34355** Spare Tire Carrier Nut Wrench

TROOPER

BODY AND ACCESSORIES

SEATS

CONTENTS

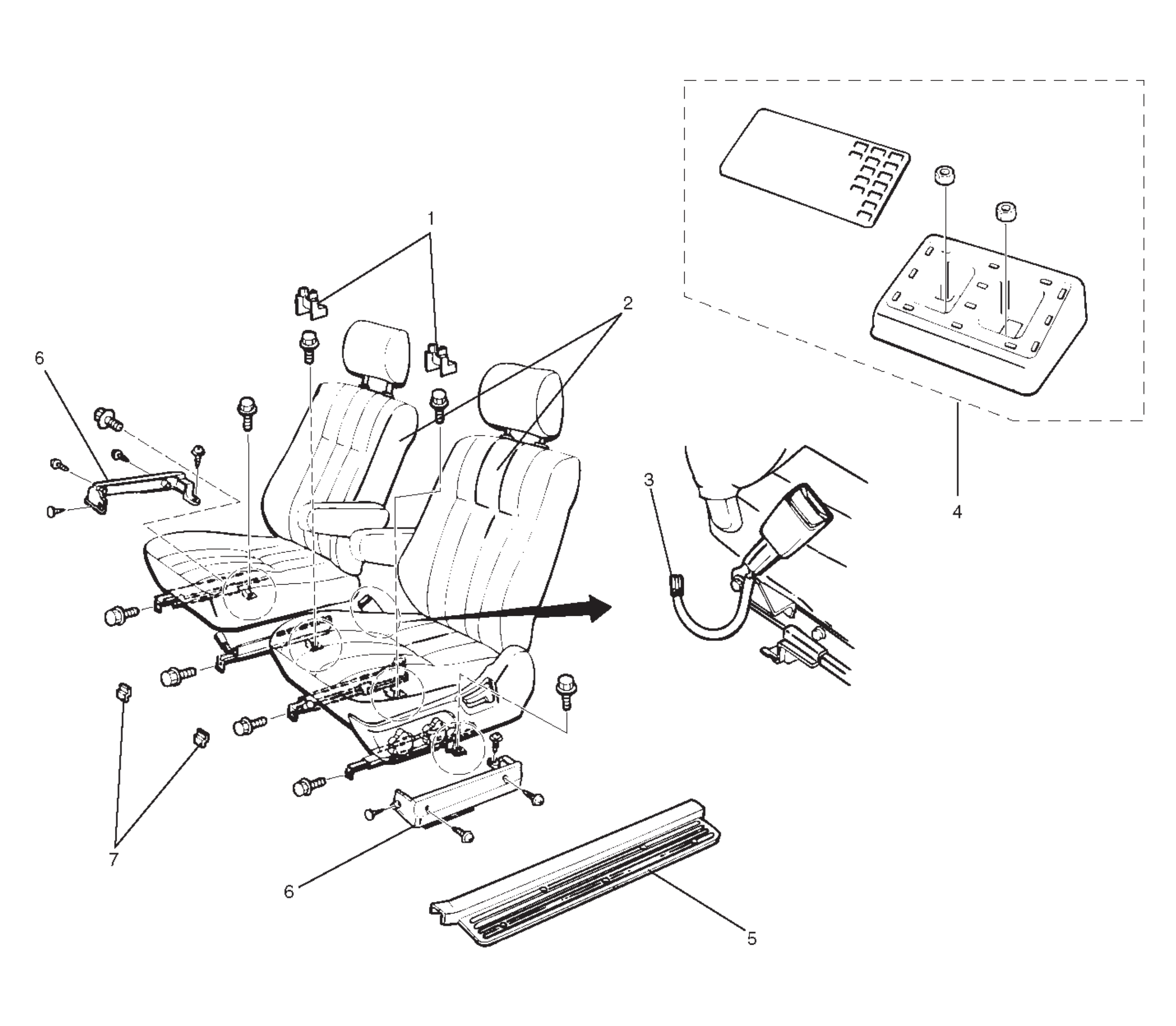
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Front Seat Assembly

Front Seat Assembly and Associated Parts



Legend

(1) Rear Cover
(2) Front Seat Assembly
(3) Seat Belt Warning Connector
(4) Rear Seat Foot Rest
(5) Door Sill Plate
(6) Riser Cover
(7) Front Cover

Removal

1. Disconnect the battery ground cable.
2. Remove the front cover.
3. Remove the rear cover.
   - Remove the cover fixing screw from the rear inner cover, if this model is equipped with the power seats.
4. Remove the door sill plate.
5. Remove the rear seat foot rest.
   - Refer to the Rear Seat Foot Rest in this section.
6. Remove the riser cover.
7. Remove the seat belt warning connector (Driver's side only).
8. Remove the front seat assembly.
   - Disconnect the power seat connector, if this model is equipped with the power seats.

Installation

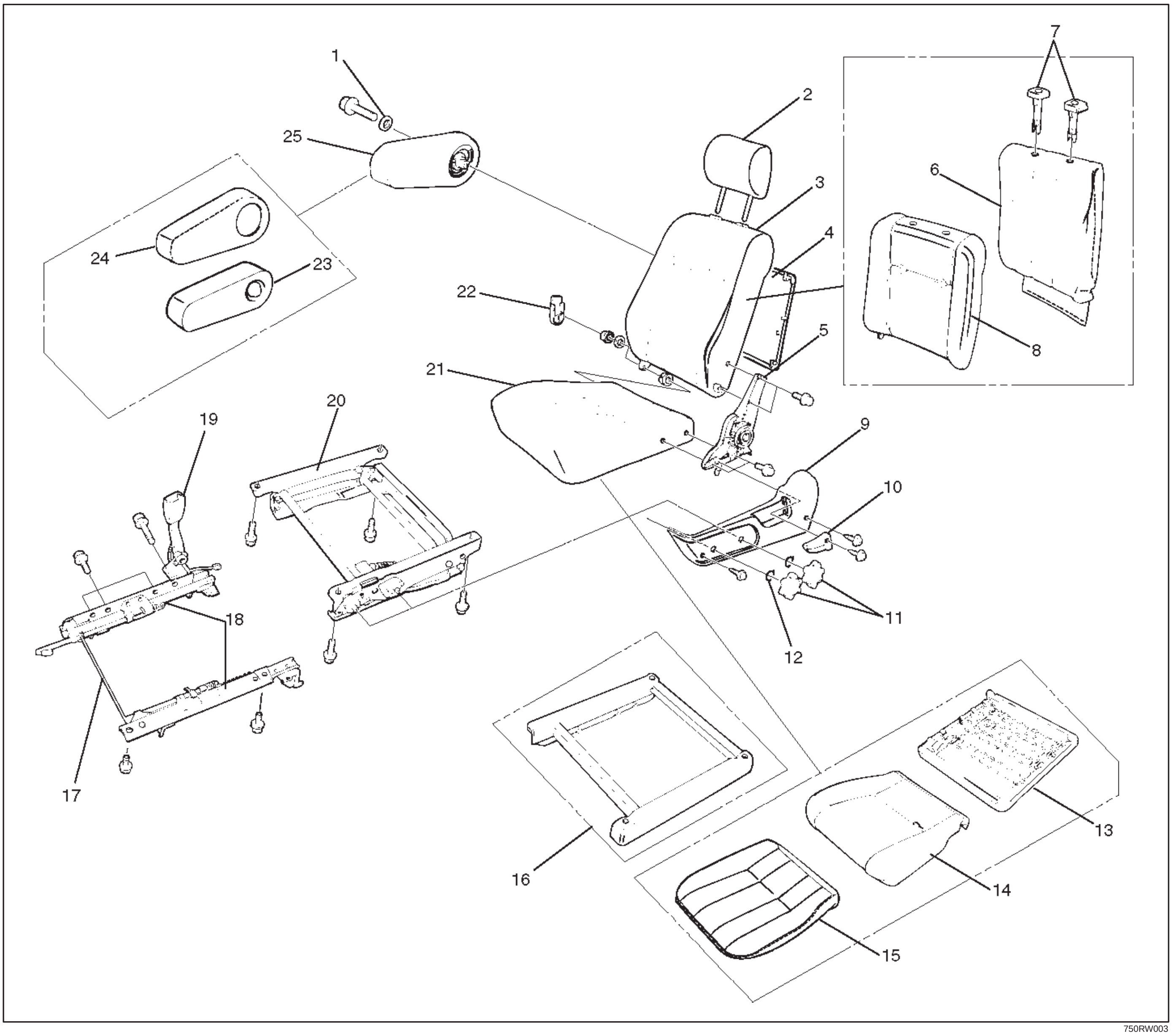
To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the front seat assembly fixing bolts to the specified torque.

Torque: 40 N·m (30 lb ft)

2. Install the longest bolt to the rear inner side fixing location, if this model is equipped with power seats.

Disassembled View

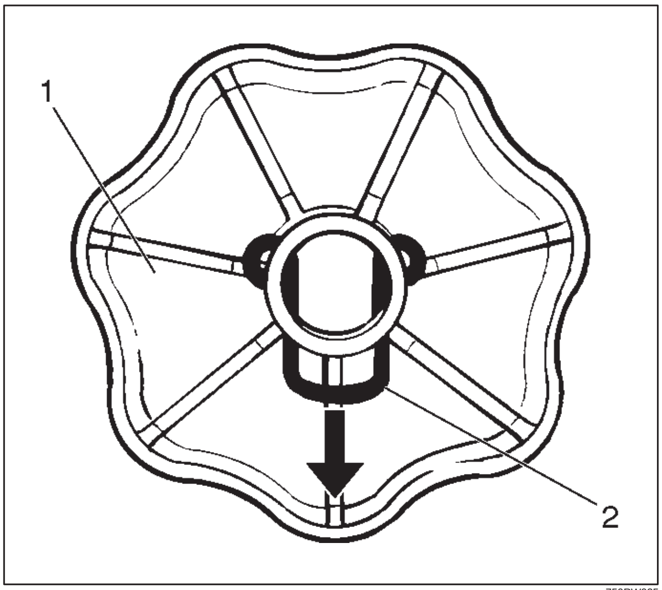


Legend

(1) Spring Washer
(2) Head Rest
(3) Seat Back Assembly
(4) Back Board Assembly
(5) Reclining Device
(6) Trim Cover
(7) Guide Holder
(8) Pad & Frame Assembly
(9) Slide Cover
(10) Reclining Knob
(11) Dial (W/Height Adjuster)
(12) Lock Spring
(13) Frame Assembly
(14) Pad Assembly
(15) Trim Cover
(16) Spacer (W/O Height Adjuster)
(17) Release Wire
(18) Seat Adjuster
(19) Seat Belt Knuckle Assembly
(20) Height Adjuster
(21) Seat Cushion Assembly
(22) Hinge Cover
(23) Pad & Frame Assembly
(24) Trim Cover
(25) Armrest Assembly

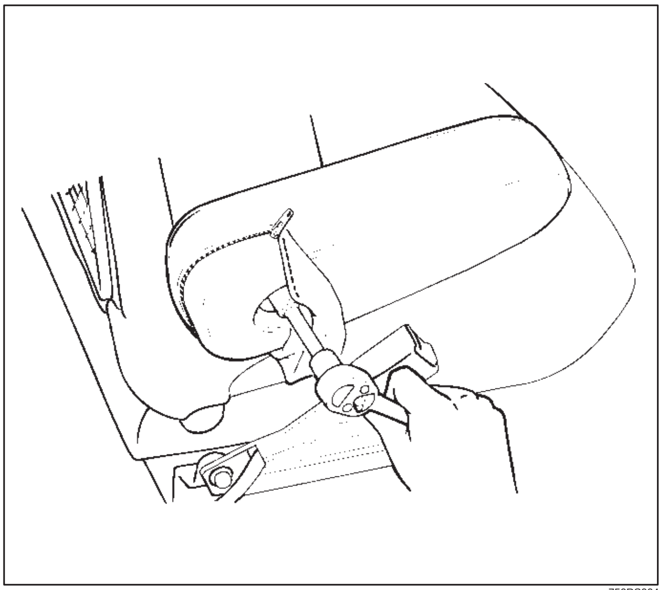
Disassembly

1. Remove the head rest.
2. Remove the reclining knob.
3. Remove the dial(1) (W/height adjuster).
   - Remove the side cover fixing screws and the dial lock spring(2).



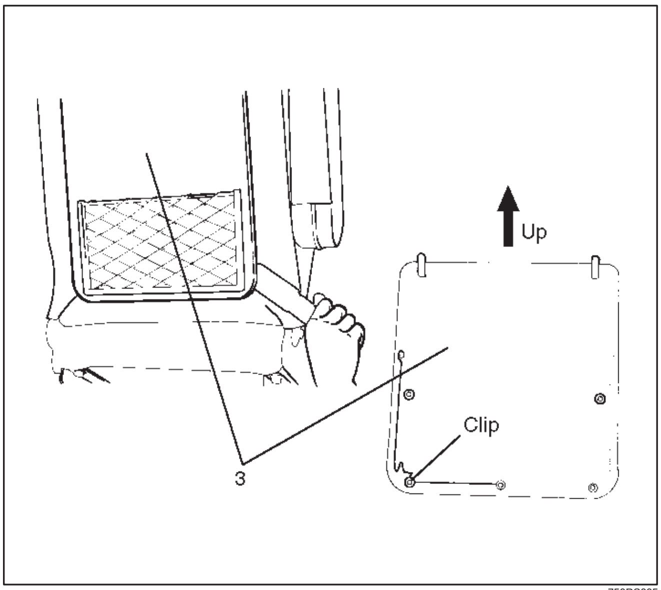
750RW025

4. Remove the side cover.
5. Remove the armrest assembly.
   - Open the armrest fastener and remove the armrest fixing bolt.



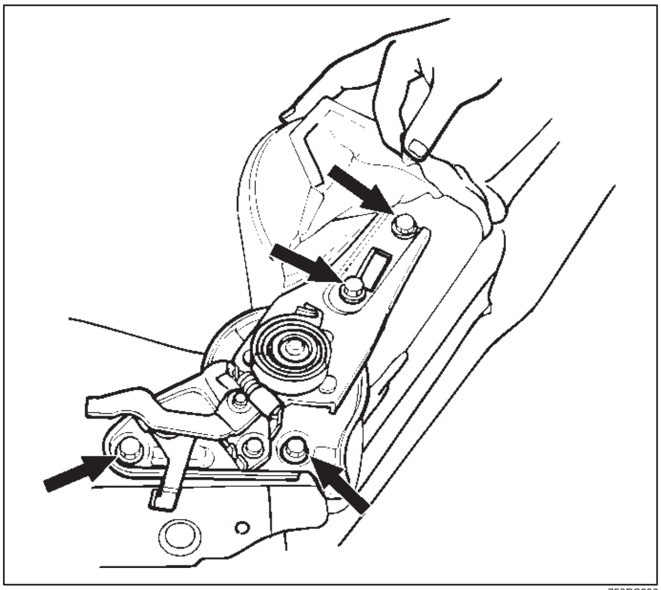
750RS004

6. Remove the trim cover.
7. Remove the pad and frame assembly.
8. Remove the hinge cover.
9. Remove the back board assembly(3).
   - Pull out the back board while prying the clip of the back board free from the seat back assembly.



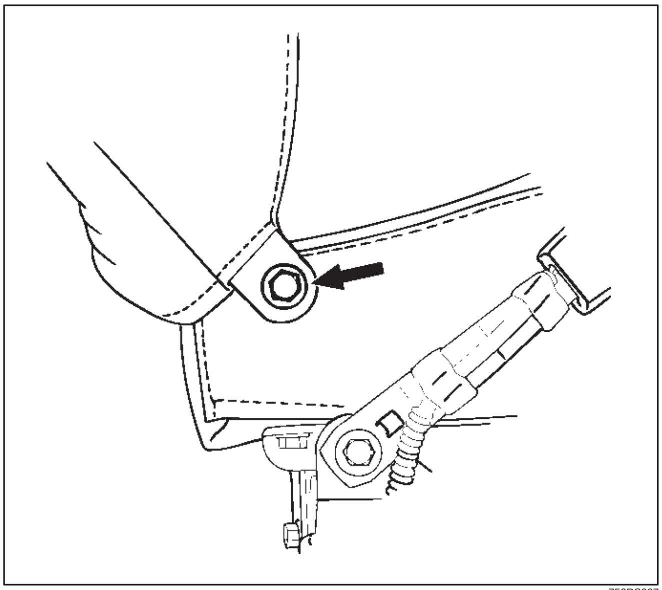
750RS005

10. Remove the reclining device.
    - Turn up the seat back trim cover in order to remove the reclining device fixing bolts.



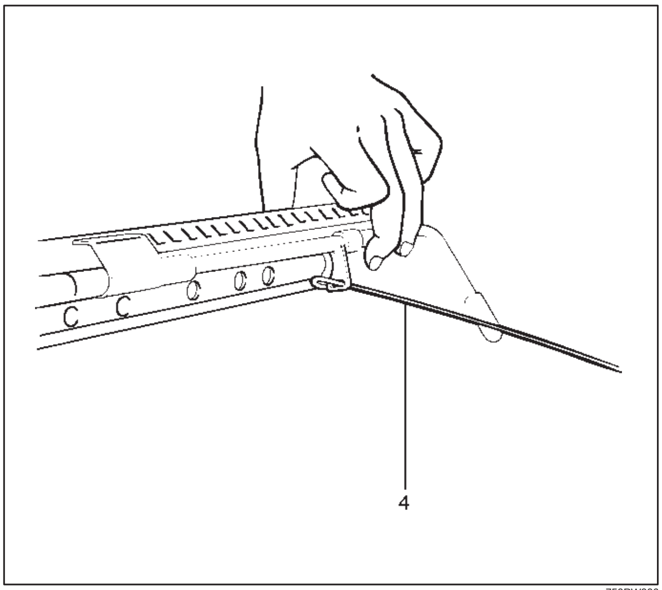
750RS006

11. Remove the seat back assembly.
    - Remove the seat back assembly fixing nut on the opposite side of the reclining device.



750RS007

12. Remove the guide holder.
    - Pull the guide holder out by holding the bottom end of it from the seat back assembly.
13. Remove the trim cover.
    - Remove the trim cover hog rings from the back side of the seat back.
    - With close attention paid to the hog rings and the wire which connect the trim cover and the pad and frame assembly, remove the trim cover while turning it up.
14. Remove the pad and frame assembly.
15. Remove the seat adjuster.
    - Disconnect the release wire(4) and remove the fixing bolts.



750RW006

- Remove the seat belt buckle assembly.

16. Remove the height adjuster.
17. Remove the spacer (W/O height adjuster).
18. Remove the seat cushion assembly.
19. Remove the trim cover.
    - Remove the trim cover hog rings from the back side of the seat cushion assembly.
    - With close attention paid to the hog rings and the wire which connect the trim cover and the pad and frame assembly, remove the trim cover while turning it up.
20. Remove the frame assembly.
21. Remove the pad assembly.

Reassembly

To reassembly, follow the disassembly steps in the reverse order, noting the following points.

1. Tighten the armrest assembly fixing bolts to the specified torque.

   Torque: 18 N·m (13 lb ft)
2. Tighten the reclining device fixing bolts to the specified torque.

   Torque: 47 N·m (35 lb ft)

Power Seat Assembly

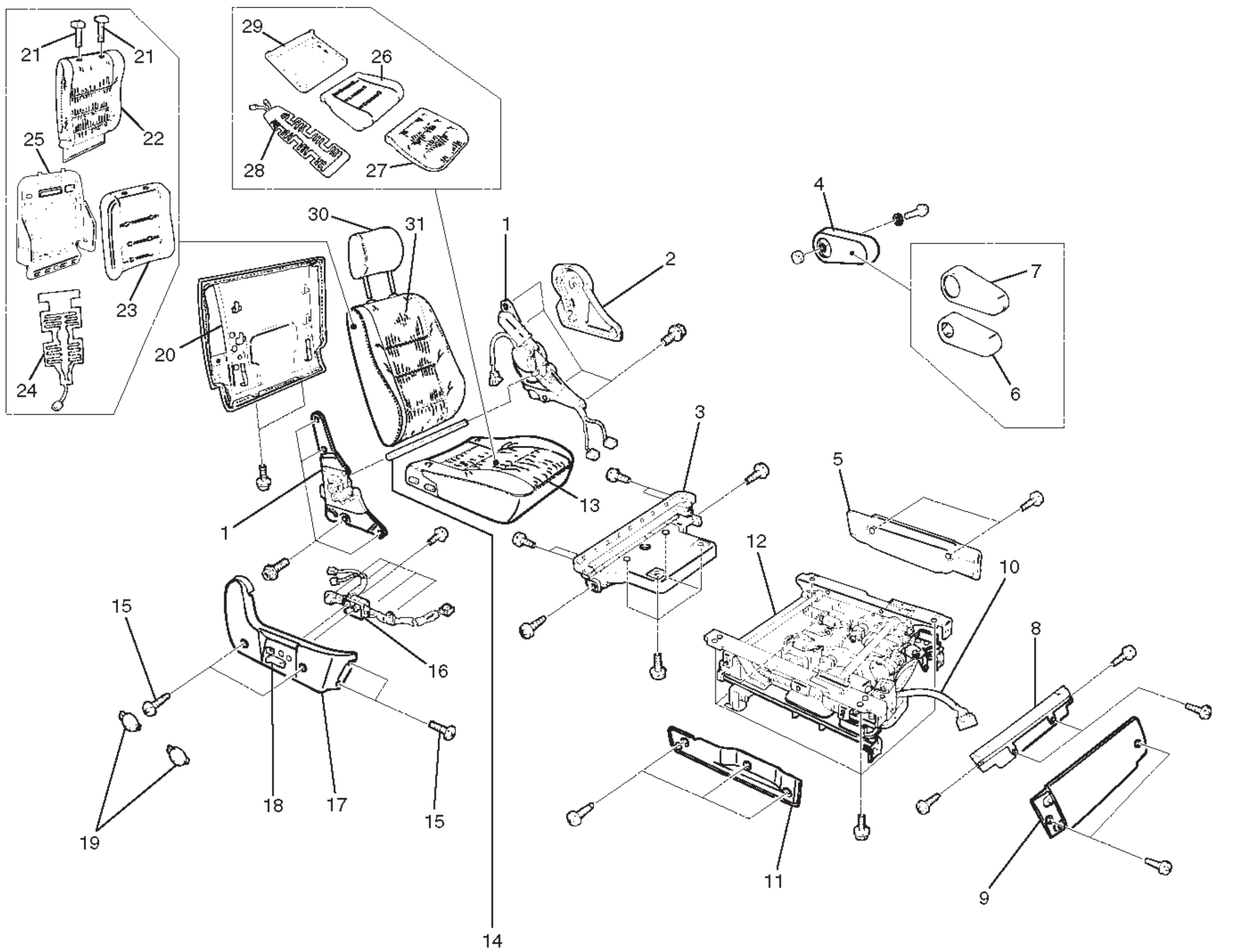
General Description

The circuit consists of the power seat switch, front tilt motor (driver's seat only), rear tilt motor (driver's seat only), slide motor and the recliner motor.

The power seat switch has a tilt & slide switch and a recliner switch.

The motor built in the seat can be actuated by operating these switches to move the seat to desired position, independent of the position of the starter switch.

Disassembled View



750RS011

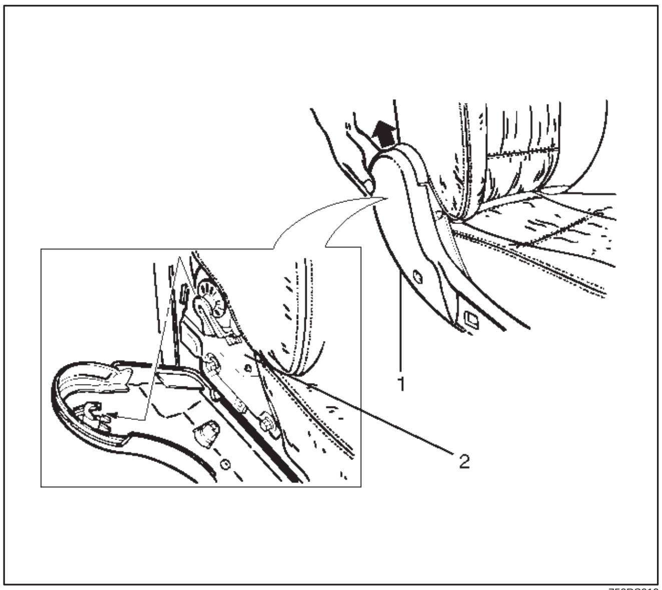
Legend

(1) Reclining Device
(2) Inner Cover
(3) Rear Cover
(4) Armrest Assembly
(5) Inner Lower Cover
(6) Pad & Frame Assembly
(7) Trim Cover
(8) Front Lower Cover
(9) Front Cover
(10) Power Seat Harness
(11) Outer Lower Cover
(12) Adjuster Assembly
(13) Seat Cushion Assembly
(14) Connecting Shaft
(15) Outer Cover Fixing Screws
(16) Switch Assembly
(17) Outer Cover
(18) Switch Knob
(19) Outer Cover Cap
(20) Back Board Assembly
(21) Guide Holder

(22) Trim Cover
(23) Pad Assembly
(24) Seat Heater
(25) Frame Assembly
(26) Pad Assembly
(27) Trim Cover
(28) Seat Heater
(29) Frame Assembly
(30) Head Rest
(31) Seat Back Assembly

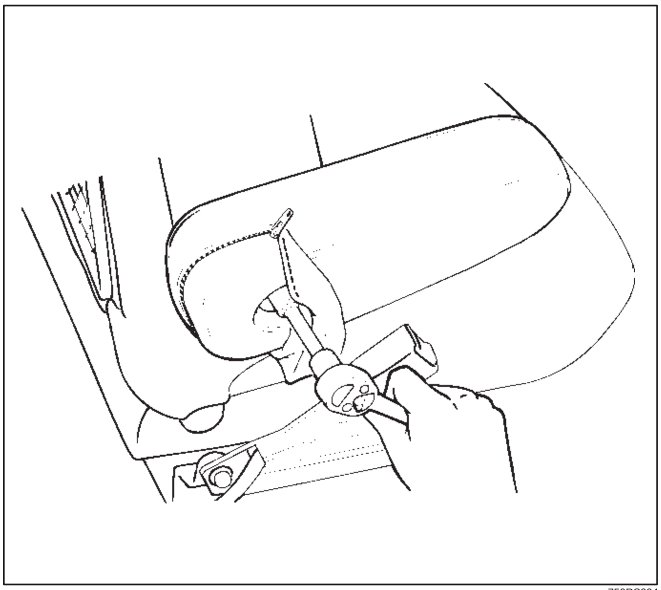
Disassembly

1. Disconnect the battery ground cable.
2. Remove the head rest.
3. Remove the switch knob.
   - Pull the switch knob out.
4. Remove the outer cover cap.
5. Remove the outer cover fixing screws.
   - Pull up the outer cover(1) to remove the cover from the reclining device(2).



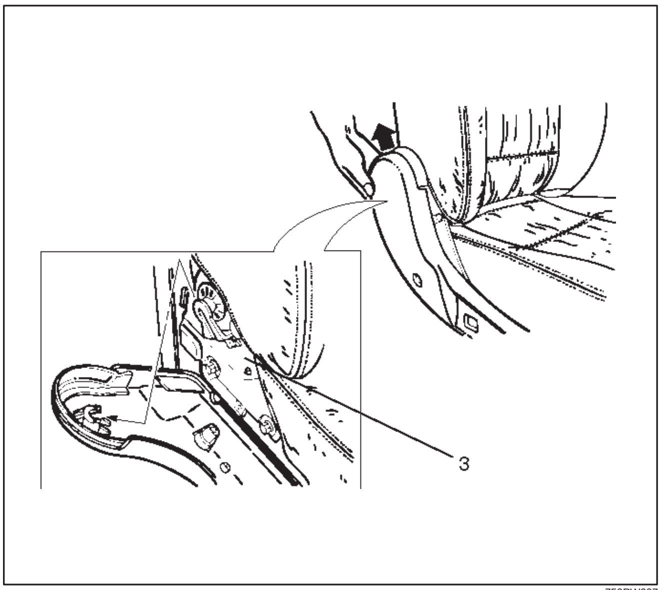
750RS012

6. Remove the front cover.
7. Remove the front lower cover.
8. Remove the rear cover.
9. Remove the outer cover.
   - Disconnect the switch connectors and remove the harness fixing clips.
10. Remove the switch assembly.
    - Remove the switch fixing screws from the outer cover.
11. Remove the armrest assembly.
    - Open the armrest fastener and remove the fixing bolt.



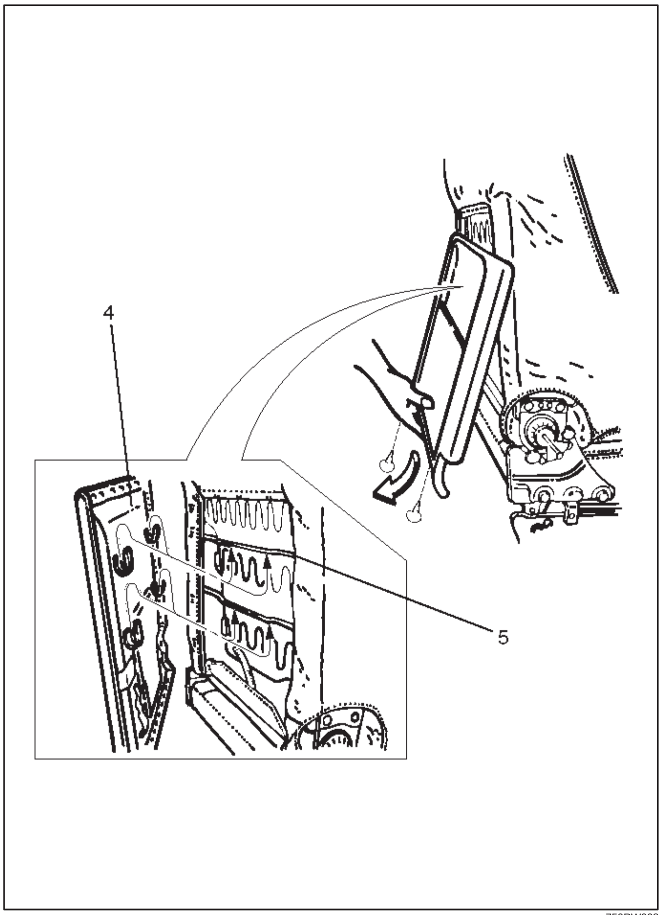
750RS004

12. Remove the trim cover.
13. Remove the pad & frame assembly.
14. Remove the inner cover
    - Remove the cover fixing screw.
    - Pull up the inner cover to remove the cover from the reclining device(3).



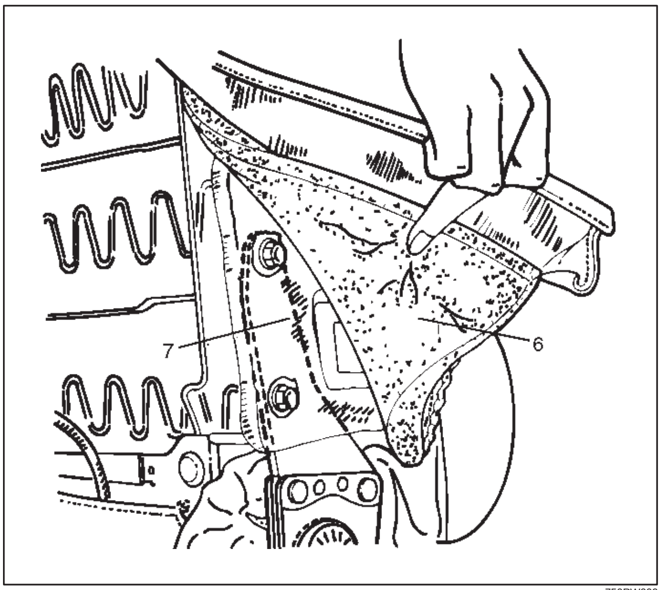
750RW007

15. Remove the back board assembly(4).
    - Remove the board fixing screws.
    - Pull the back board downward and remove the board from the seat back frame(5).



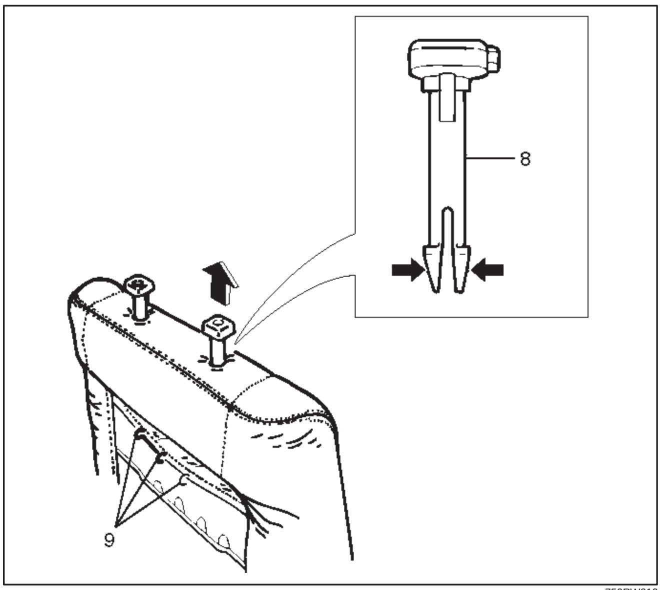
750RW008

16. Remove the reclining device(7).
    - Remove the device lower side fixing bolt in order to separate the seat back from the seat cushion.
    - Disconnect the seat heater connector.
    - Remove the trim cover(6) hog rings from the backside of the seat back assembly.
    - Turn up the seat back trim cover to remove the reclining device upper side fixing bolt.
    - Disconnect the connecting shaft and the reclining device connectors.



750RW009

17. Remove the seat back assembly.
18. Remove the guide holder(8).
    - Remove the trim cover fixing hog rings(9) from the backside of the seat back assembly.
    - Hold the tip end of the guide holder and pull the holder out from the seat back assembly.



750RW010

19. Remove the trim cover.
    - Remove the trim cover hog rings from the backside of the seat back.
    - With close attention paid to the hog rings and the wire which connect the trim cover and pad & frame assembly, remove the trim cover while turning it up.
20. Remove the seat heater.
21. Remove the pad assembly.
22. Remove the frame assembly.
23. Remove the outer lower cover.
24. Remove the inner lower cover.
25. Remove the adjuster assembly.
    - Disconnect the connectors and remove the fixing bolts.

- Remove the power seat harness from the adjuster assembly.

26. Remove the seat cushion assembly.
27. Remove the trim cover.
    - Remove the trim cover hog rings from the backside of the seat cushion assembly.
    - With close attention paid to the hog rings and the wire which connect the trim cover and the pad & frame assembly, remove the trim cover while turning it up.
28. Remove the seat heater.
29. Remove the frame assembly.
30. Remove the pad assembly.

Reassembly

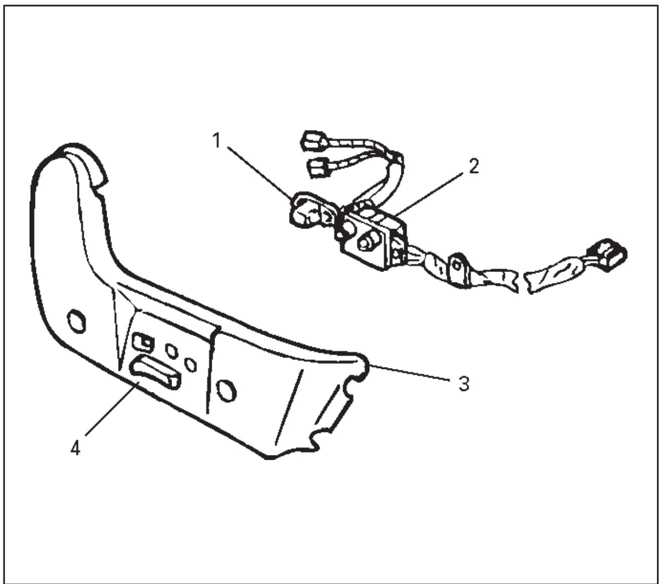
To reassemble, follow the disassembly steps in the reverse order, noting the following point.

1. Tighten the fixing bolts to the specified torque.
    - Refer to the Torque Specifications in this section.

Power Seat Switch

Removal

1. Remove the side cover(3).
    - Refer to the Power Seat Assembly in this section.
2. Remove the tilt & slide switch lever(4).
    - Hold the switch lever with your fingers and pull it toward you.
3. Remove the tilt & slide switch(2).
    - Remove two screws.
4. Remove the recliner switch(1).
    - Remove two screws.



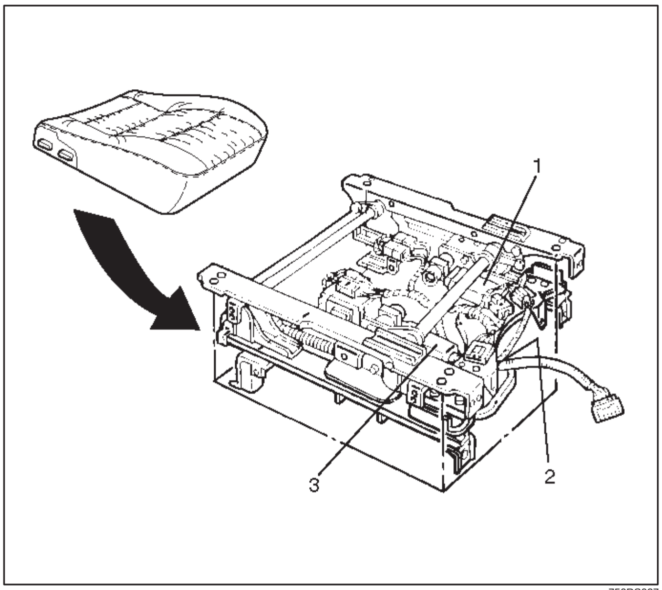
750RS025

Installation

To install, follow the removal steps in the reverse order.

Front Tilt Motor / Rear Tilt Motor / Slide Motor / Recliner Motor

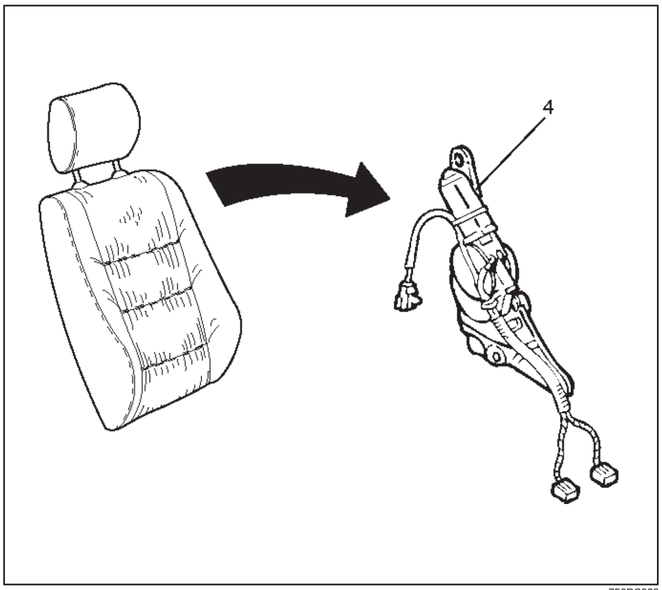
Parts Location



750RS027

Legend

(1) Tilt Motor
(2) Slide Motor
(3) Tilt Motor



750RS028

Legend

(4) Recliner Motor

Removal and Installation

Refer to the Power Seat Assembly in this section.

Seat Heater System

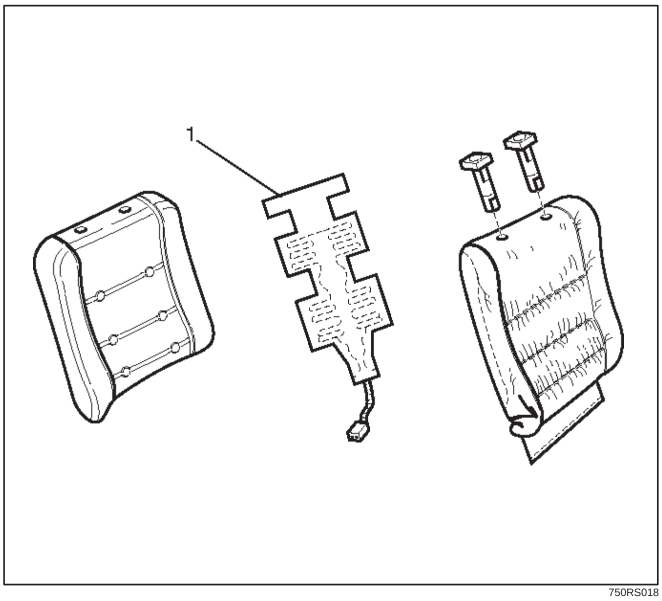
General Description

The circuit consists of the starter switch, seat heater switch and the heat unit.
The seat heater is provided in driver's and front passenger seats (as option).
When the seat heater switch is ON, the seat heat built in the seat back and cushion is switched on to warm the seats.
To prevent the seats from being overheated, the circuit is fitted with a thermostat.

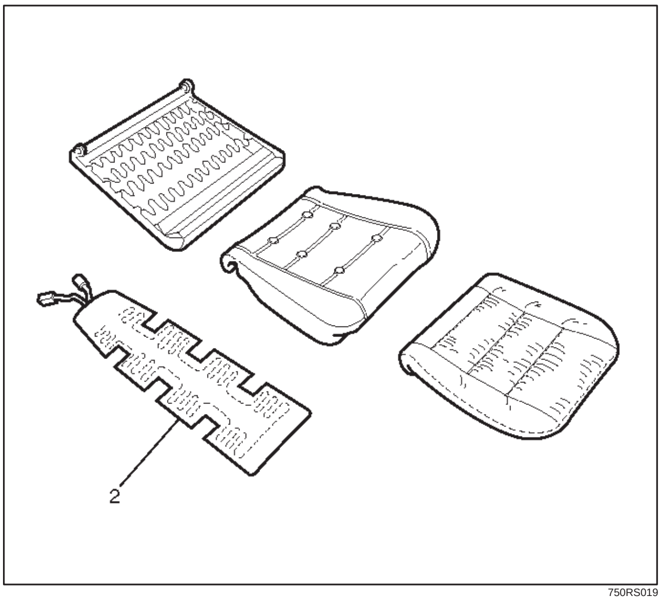
Seat Heater Switch Removal and Installation

Refer to the Seat Heater Switch in Lighting System section.

Heat Unit Parts Location



Legend
(1) Heat Unit (Seat Back Side)



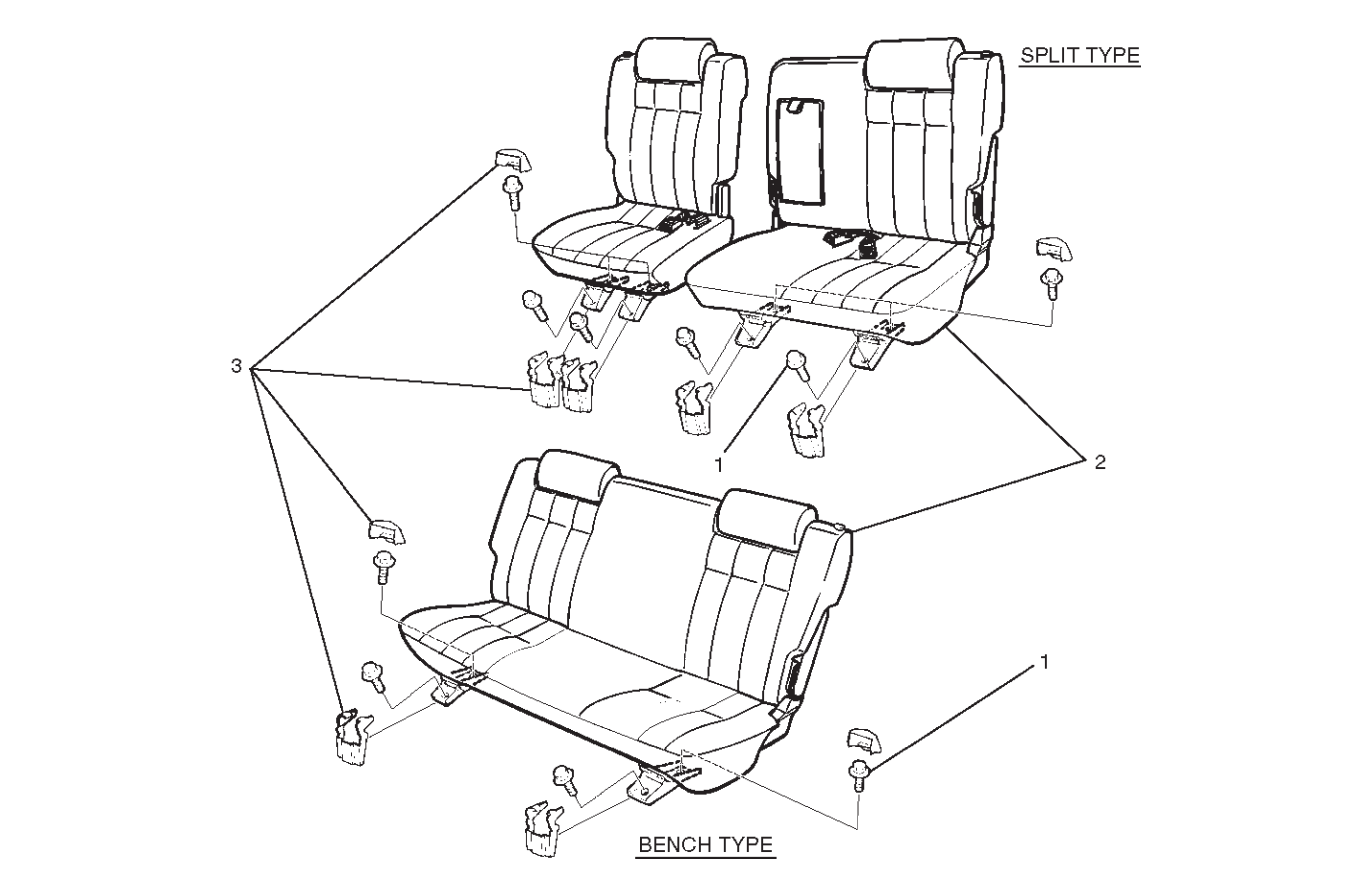
Legend
(2) Heat Unit (Seat Cushion Side)

Heat Unit Removal and Installation

Refer to the Power Seat Assembly in this section.

Rear Seat Assembly

Rear Seat Assembly and Associated Parts



755RW016

Legend

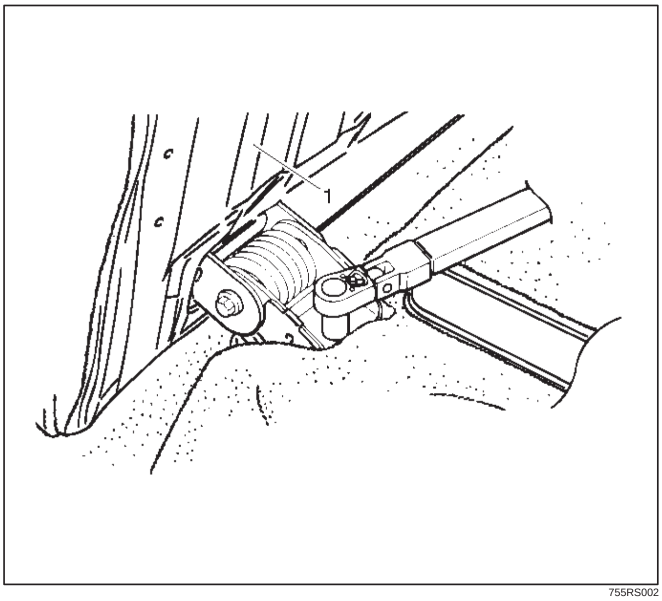
(1) Fixing Bolts

(2) Rear Seat Assembly

(3) Mounting Bracket Cover

Removal

1. Unlock the rear seat(1) lock to remove it.
2. Remove the mounting bracket cover.
3. Remove the fixing bolts.



755RS002

4. Remove the rear seat assembly.

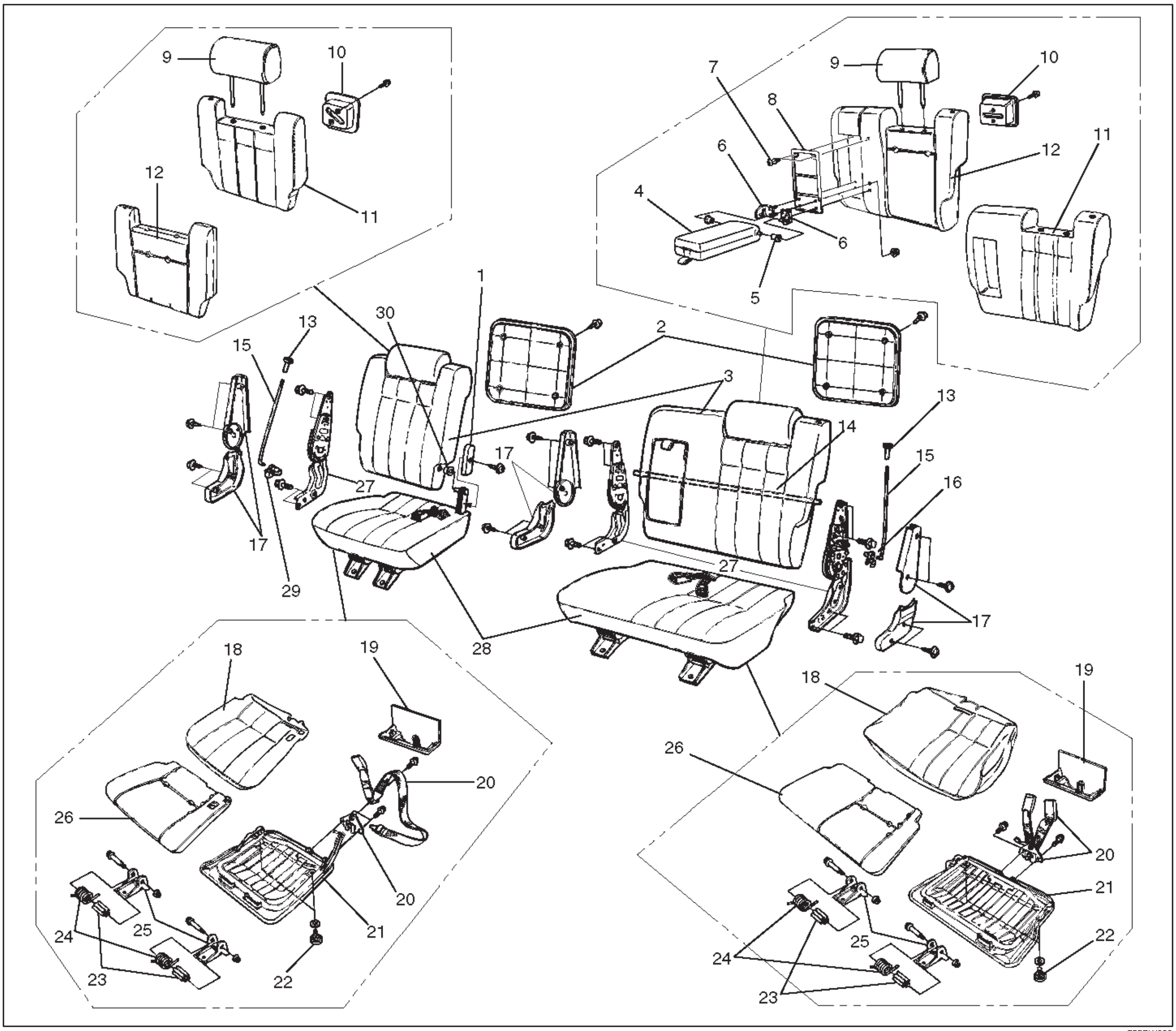
Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the rear seat fixing bolts to the specified torque.

   Torque: 19 N·m (14 lb ft)

Disassembled View (Split Type)

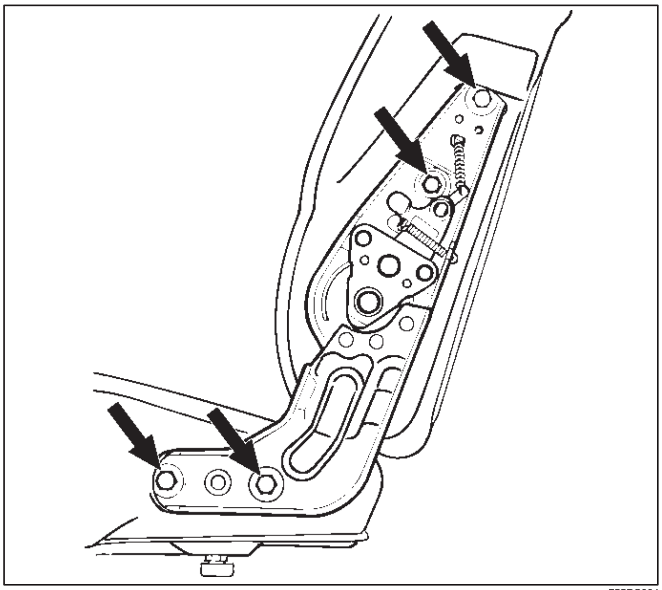


Legend

(1) Free Hinge Cover
(2) Back Board
(3) Seat Back Assembly
(4) Armrest Assembly
(5) Bush
(6) Armrest Set Bracket
(7) Clip
(8) Armrest Board
(9) Pillow Assembly
(10) Band Hook Cover
(11) Trim Cover
(12) Pad & Frame Assembly
(13) Release Knob
(14) Connecting Shaft
(15) Release Rod
(16) Linkage Bush
(17) Device Cover
(18) Trim Cover
(19) Seat Lock Cover
(20) Rear Seat Belt Buckle and Lock Assembly
(21) Frame Assembly
(22) Stopper Rubber
(23) Spring Collar
(24) Return Spring
(25) Mounting Bracket
(26) Pad Assembly
(27) Reclining Device
(28) Seat Cushion Assembly
(29) Linkage Bush
(30) Bush

Disassembly (Split Type)

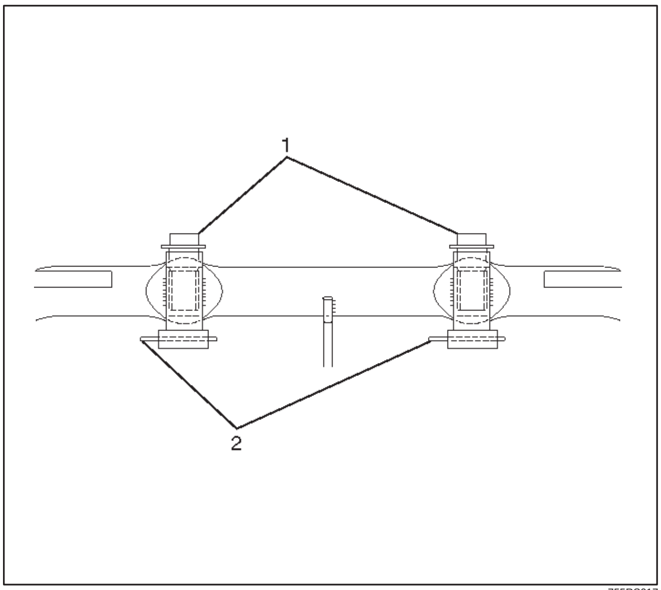
1. Remove the back board.
   - Remove the clips and the back board.
2. Remove the device cover.
3. Remove the release knob.
   - Turn the knob counterclockwise to remove it.
4. Remove the release rod.
   - Disconnect the rod from the linkage bush.
5. Remove the reclining device.



755RS004

6. Remove the connecting shaft.
7. Remove the seat back assembly.
8. Remove the band hook cover.
9. Remove the pillow assembly.
   - Turn up the seat back trim cover and slit the pad from the back around to the place where the lock spring(2) of the guide bush(1) is.

   Then insert a finger through the slit and pull out the pillow while you are pressing down on the lock spring.



755RS017

10. Remove the armrest assembly.
    - Turn up the seat back trim cover and remove the fixing nuts.
11. Remove the armrest set bracket.
12. Remove the armrest board.
13. Remove the trim cover.
    - Remove the trim cover fixing hog rings from the backside of the seat back.
    - With close attention paid to the hog rings and the wire which connect the trim cover and the pad and frame assembly, remove the trim cover while turning it up.
14. Remove the pad & frame assembly.
15. Remove the seat cushion assembly.
16. Remove the seat lock cover.
17. Remove the rear seat belt buckle and lock assembly.
18. Remove the mounting bracket.
19. Remove the return spring.
20. Remove the spring collar.
21. Remove the trim cover.
    - Remove the hog rings and pull the trim cover out from the frame assembly groove.
    - With close attention paid to the hog rings and the wire which connect the trim cover and the pad & frame assembly, remove the trim cover while turning it up.
22. Remove the frame assembly.
23. Remove the pad assembly.
24. Remove the stopper rubber.

Reassembly (Split Type)

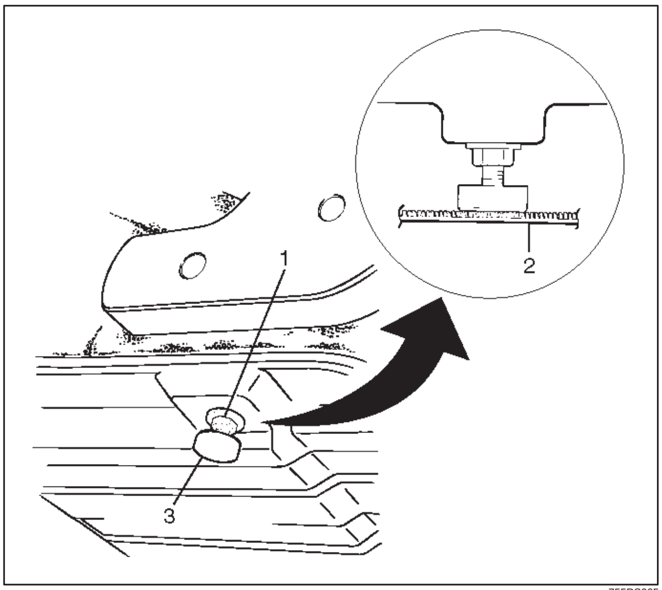
To reassemble, follow the disassembly steps in the reverse order, noting the following points.

1. Tighten the reclining device fixing bolts to the specified torque.

   Torque: 27 N·m (20 lb ft)

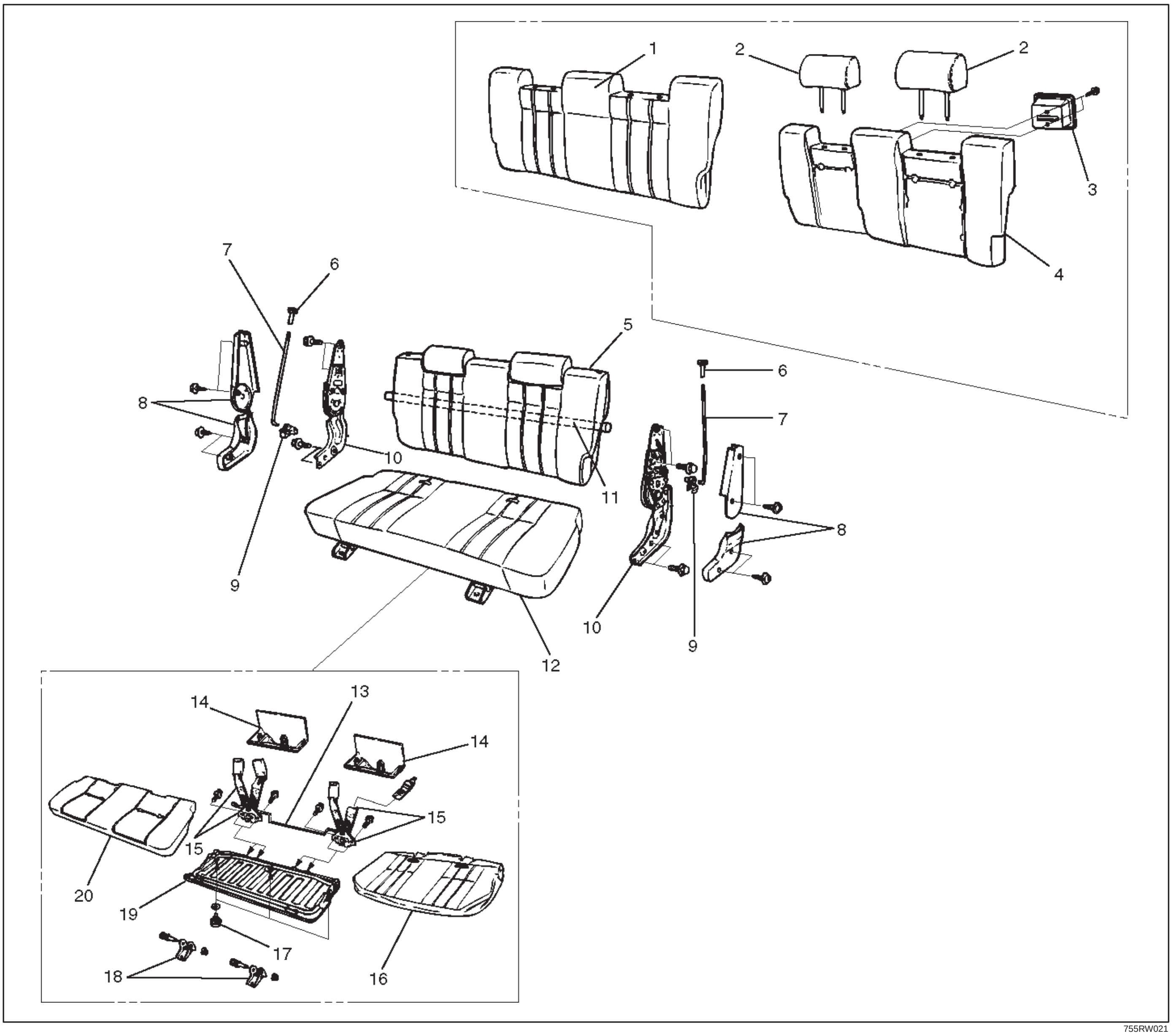
2. Loosen the rubber stopper lock nut(1). Adjust the stopper(3) so there is no clearance between the bottom of the stopper and the carpet(2) while you make sure the rear seat is firmly locked.

   Then tighten the lock nut securely.



755RS005

Disassembled View (Bench Type)

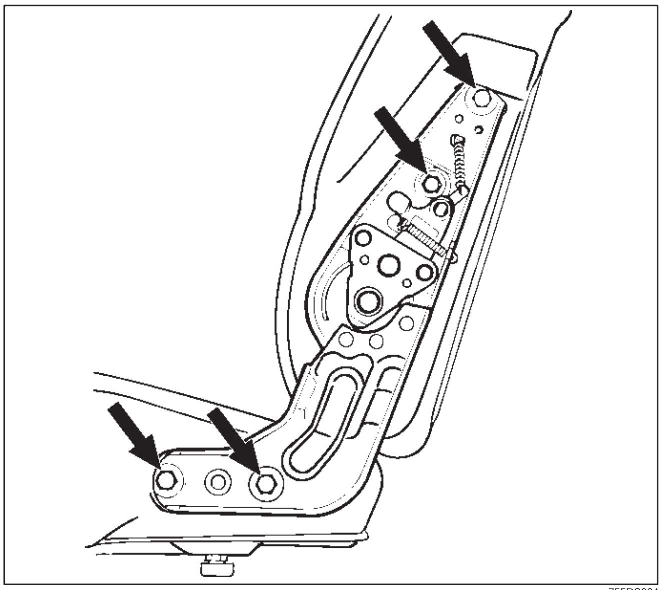


Legend

(1) Trim Cover
(2) Pillow Assembly
(3) Band Hook Cover
(4) Pad & Frame Assembly
(5) Seat Back Assembly
(6) Release Knob
(7) Release Rod
(8) Device Cover
(9) Linkage Bush
(10) Reclining Device
(11) Connecting Shaft
(12) Seat Cushion Assembly
(13) Connecting Link
(14) Seat Lock Cover
(15) Rear Seat Belt Buckle and Lock Assembly
(16) Trim Cover
(17) Stopper Rubber
(18) Mounting Bracket
(19) Frame Assembly
(20) Pad Assembly

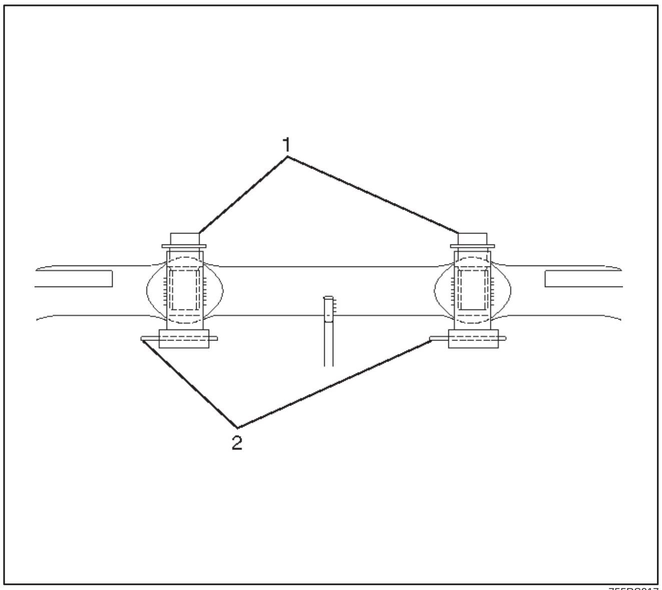
Disassembly (Bench Type)

1. Remove the device cover.
2. Remove the release knob.
   - Turn the knob to the counterclockwise to remove it.
3. Remove the release rod.
   - Disconnect the rod from the linkage bush.
4. Remove the reclining device.



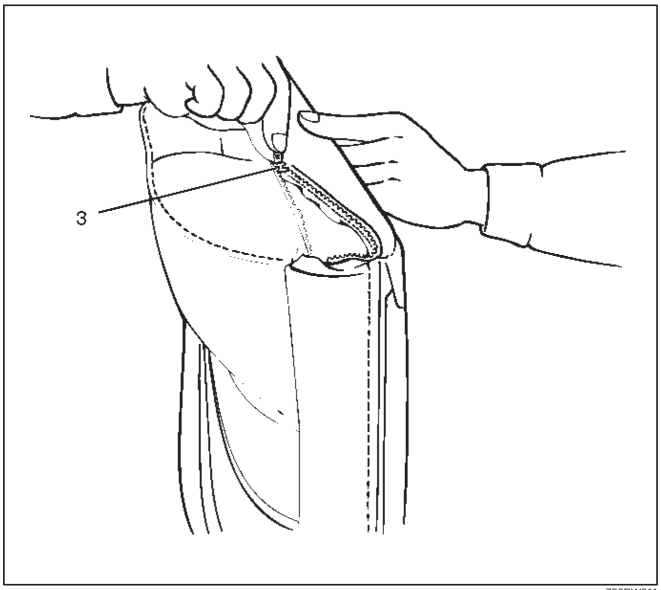
755RS004

5. Remove the connecting shaft.
6. Remove the seat back assembly.
7. Remove the band hook cover.
8. Remove the pillow assembly.
   - Refer to the Disassembly (Split Type) in this section.



755RS017

9. Remove the trim cover.
   - Open the fastener(3), and with close attention paid to the hog rings and wire which connect the trim cover and the pad and frame assembly, remove the trim cover as you turn it up.



750RW011

10. Remove the pad & frame assembly.
11. Remove the seat cushion assembly.
12. Remove the seat lock cover.
13. Remove the rear seat belt buckle and lock assembly.
14. Remove the mounting bracket.
15. Remove the trim cover.
    - Remove the hog rings and pull the trim cover out from the frame assembly groove.
    - With close attention paid to the hog rings and the wire which connect the trim cover and the pad and frame assembly, remove the trim cover while turning it up.
16. Remove the frame assembly.
17. Remove the pad assembly.
18. Remove the stopper rubber.

Reassembly (Bench Type)

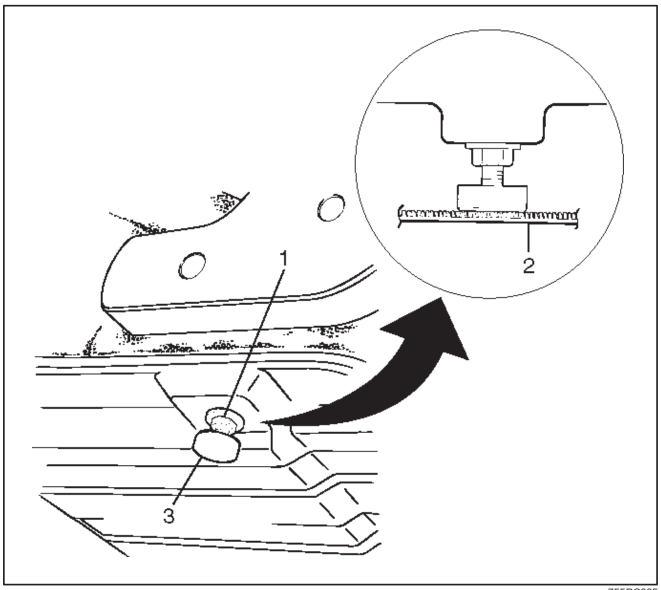
To reassemble, follow the disassembly steps in the reverse order, noting the following points.

1. Tighten the reclining device fixing bolts to the specified torque.

   Torque: 27 N·m (20 lb ft)

2. Loosen the rubber stopper lock nut(1) and adjust the stopper rubber(3) so there is no clearance between the bottom of the stopper and the carpet(2), while ensuring the rear seat is firmly locked.

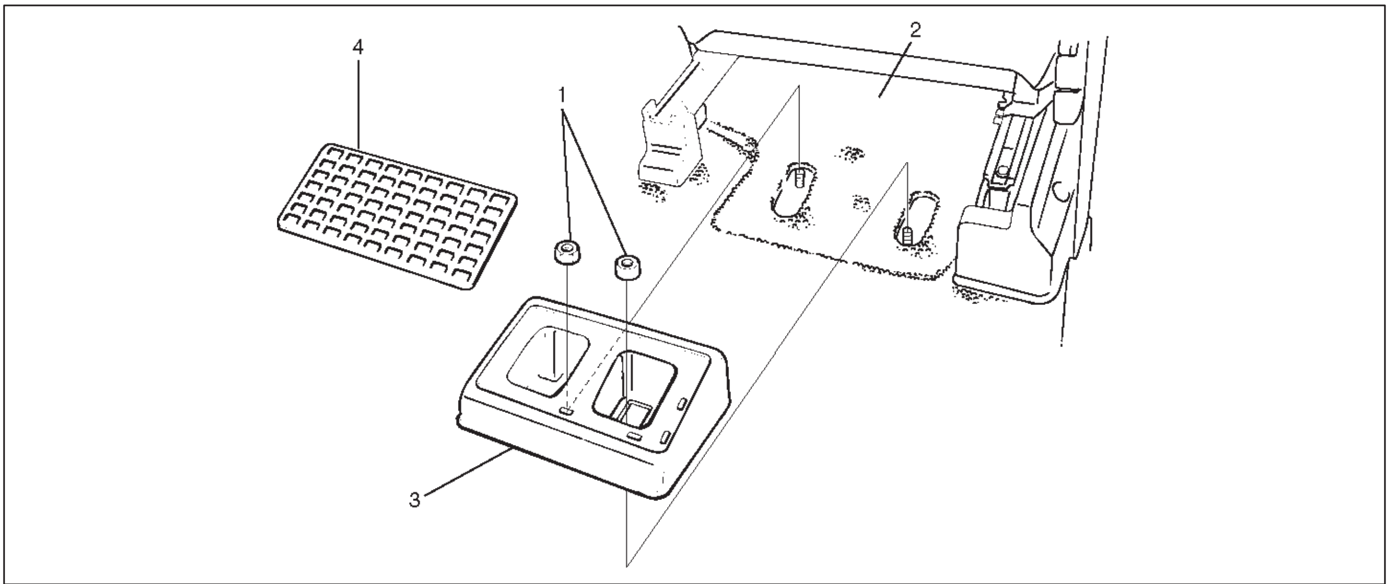
   Tighten the lock nut securely.



755RS005

Rear Seat Foot Rest

Rear Seat Foot Rest and Associated Parts



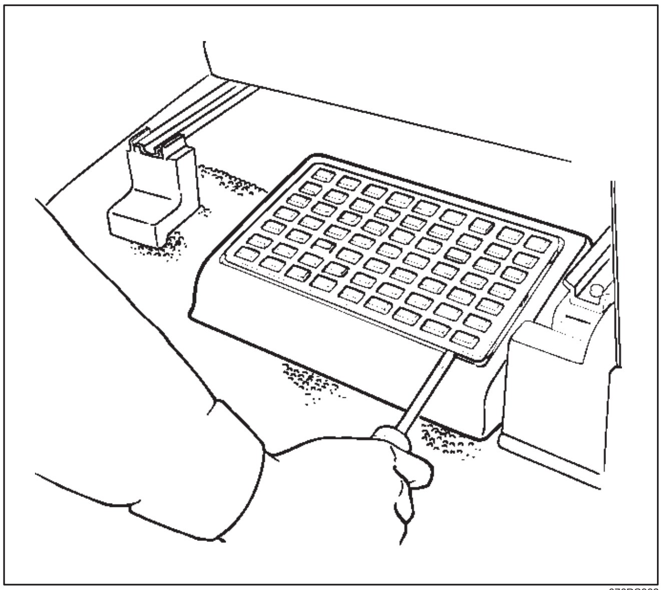
676RY001

Legend

- (1) Fixing Nut
- (2) Front Seat
- (3) Rear Seat Foot Rest
- (4) Foot Rest Pad

Removal

1. Remove the foot rest pad.



676RS002

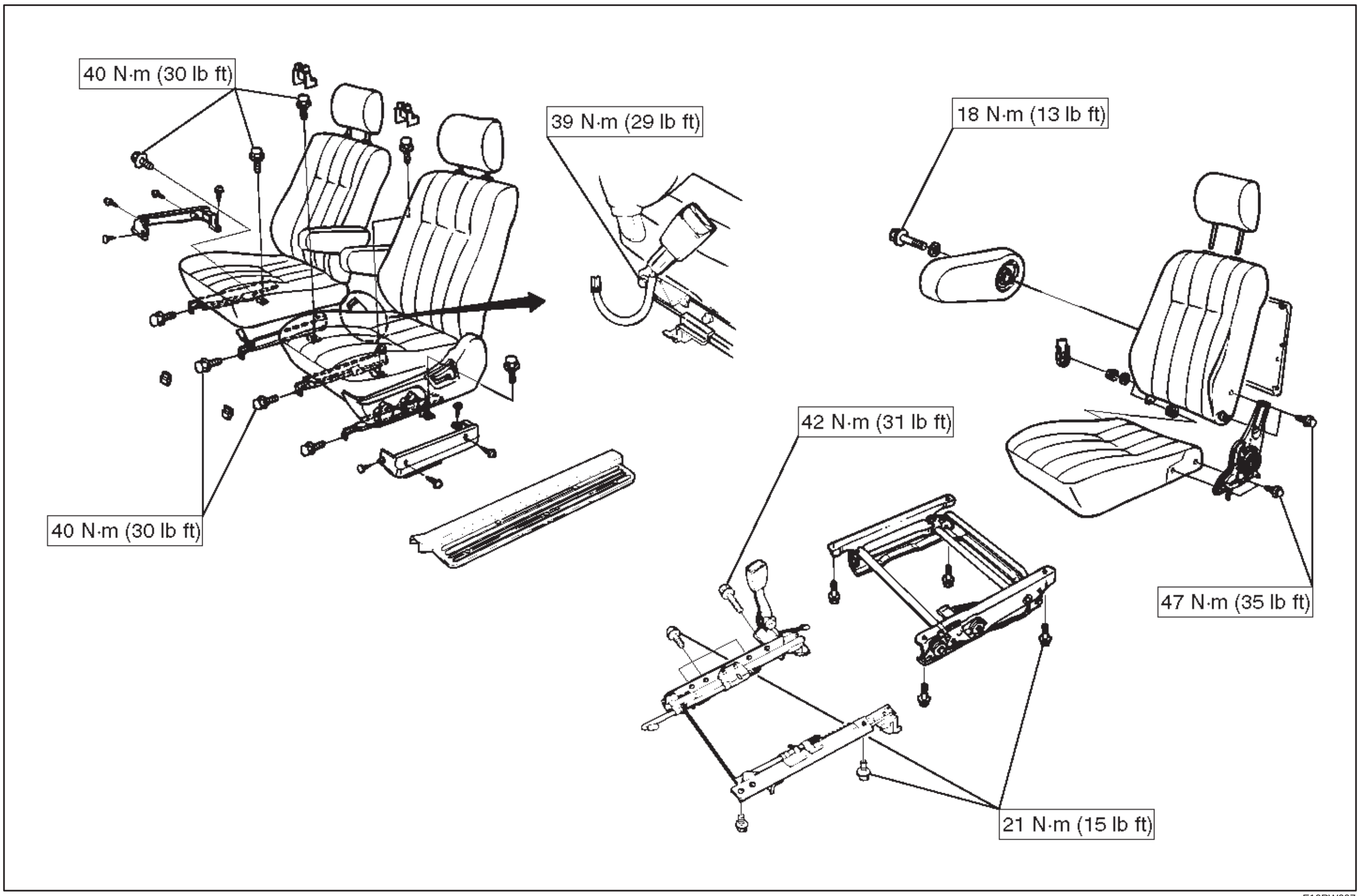
2. Remove the fixing nut.
3. Remove the rear seat foot rest.

Installation

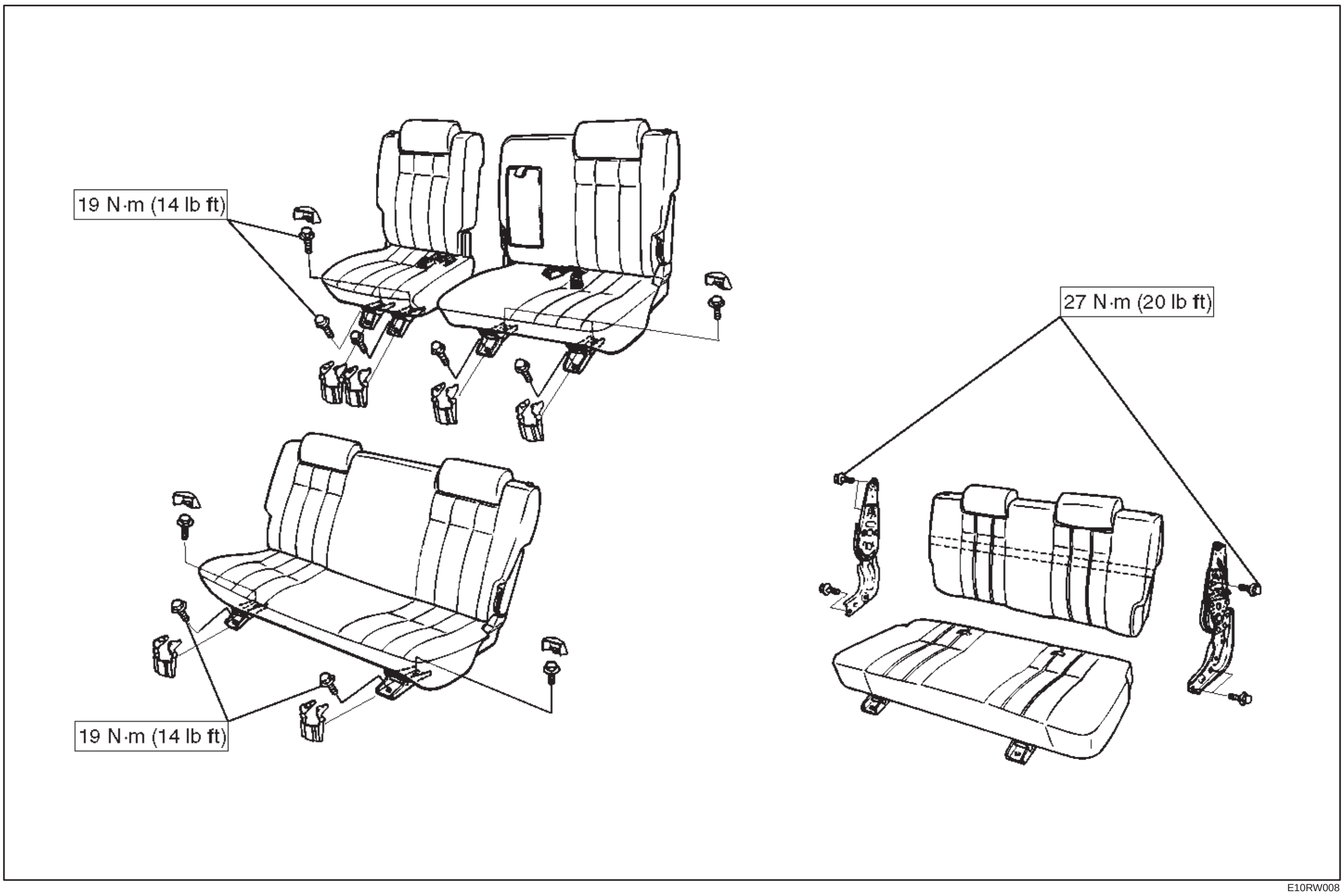
To install, follow the removal steps in the reverse order.

Main Data and Specifications

Torque Specifications



E10RW007


19 N·m (14 lb ft)
19 N·m (14 lb ft)
27 N·m (20 lb ft)
E10RW008

TROOPER

BODY AND ACCESSORIES

SECURITY AND LOCKS

CONTENTS

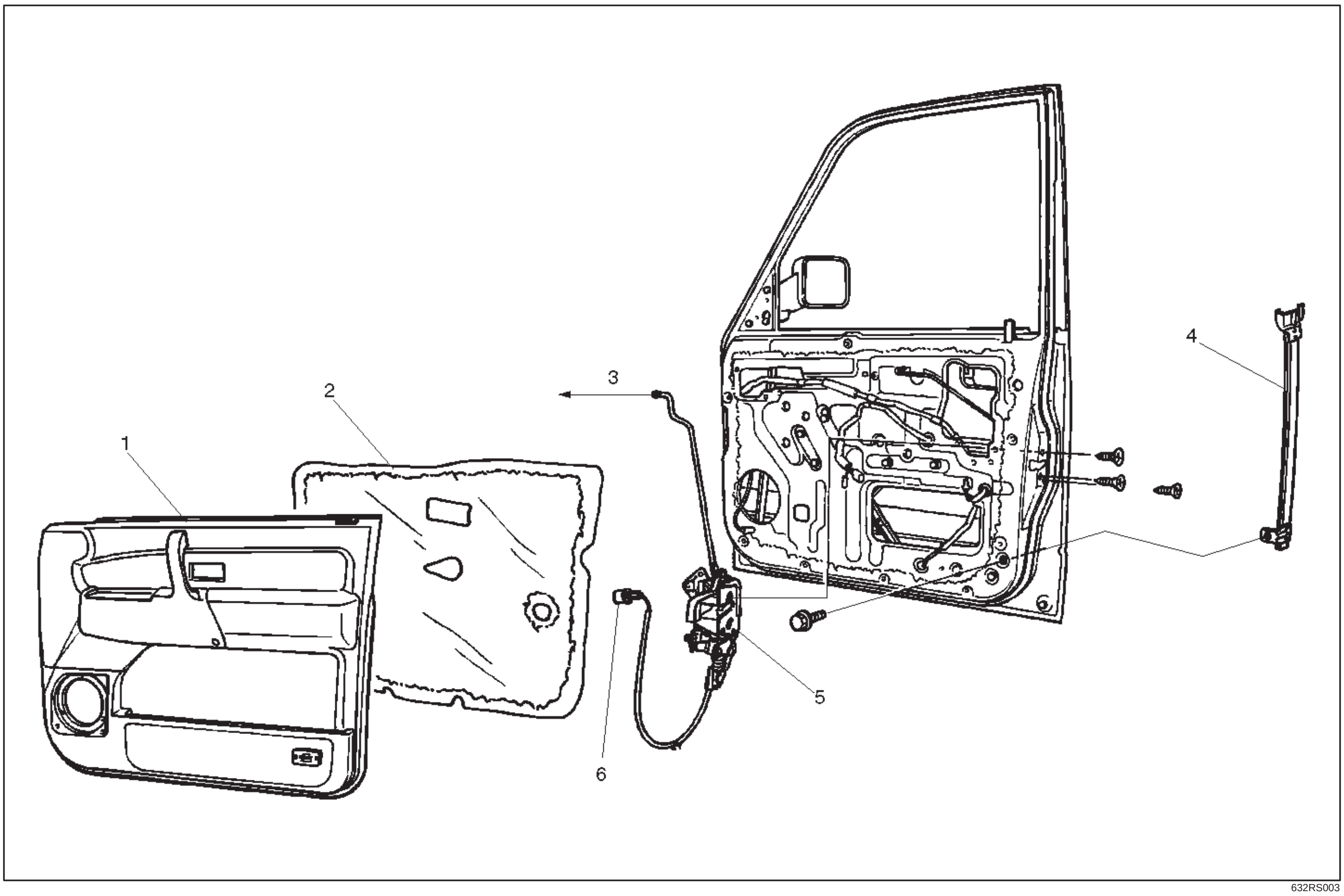
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Front Door Lock Assembly

Front Door Lock Assembly and Associated Parts

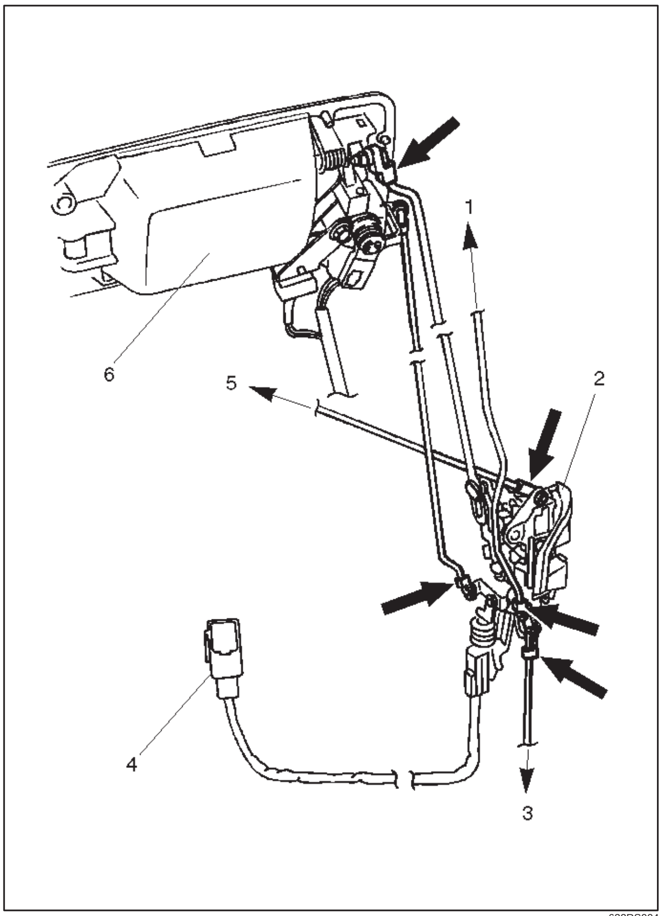


Legend
(1) Door Trim Panel
(2) Waterproof Sheet
(3) To Outside Handle
(4) Rear Guide Rail
(5) Door Lock Assembly
(6) Door Lock Switch Connector (W/Power Door Lock)

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel.
3. Remove the waterproof sheet.
   - Refer to the Front Window Regulator, Glass And Glass Run in Body Structure section.

4. Raise the glass up to the uppermost position, and then remove the rear guide rail.
5. Disconnect the door lock switch connector (w/power door lock) and locking links (arrow marks positions), then remove the door lock assembly fixing screws and door lock assembly.



Legend

(1) To Inside Lock Knob
(2) Door Lock Assembly
(3) To Actuator
(4) Door Lock Switch Connector
(5) To Inside Handle
(6) Outside Handle

Installation

To install, follow the removal steps in the reverse order, noting the following points.

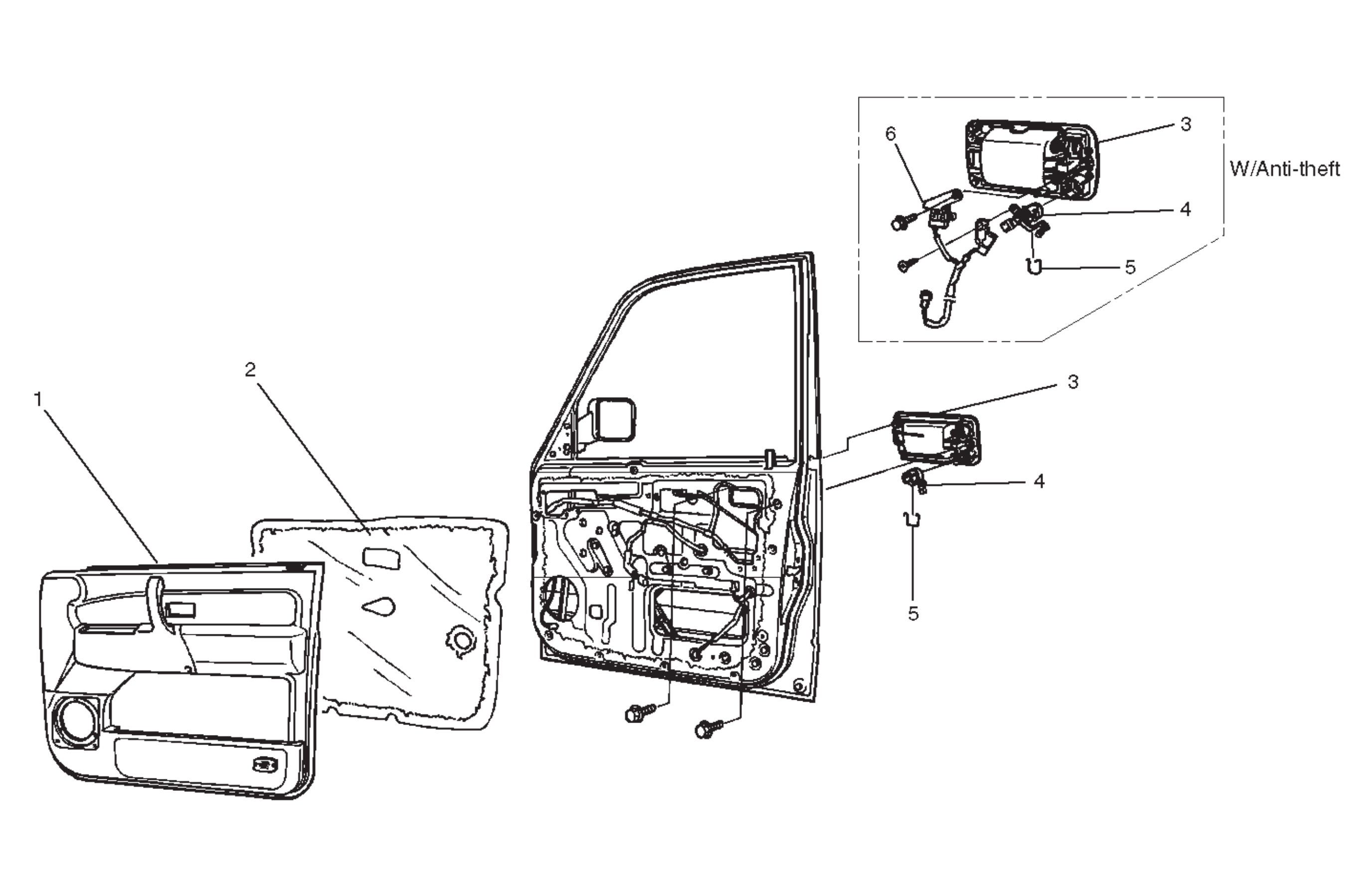
1. Apply chassis grease to the lock assembly and striker moving surface.
2. Tighten the door lock assembly fixing screws to the specified torque.

Torque: 7 N·m (61 lb in)

3. Check that the door lock operates smoothly.

Front Outside Handle and Door Lock Cylinder

Front Outside Handle, Door Lock Cylinder and Associated Parts



632RS006

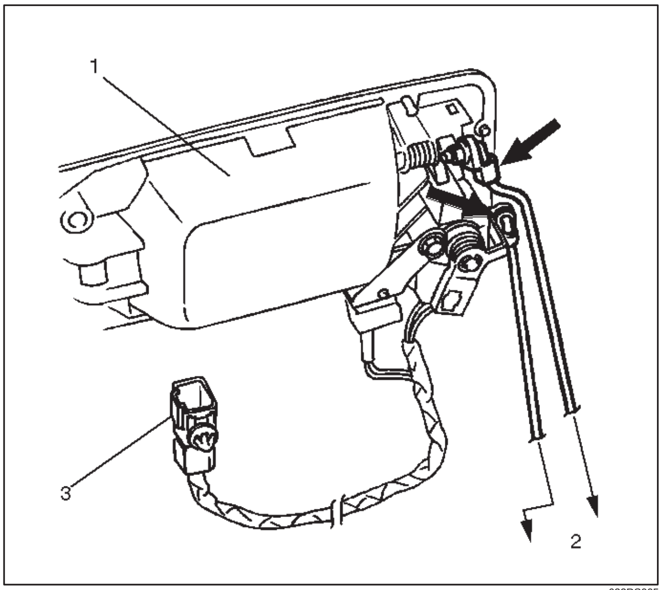
Legend

(1) Door Trim Panel
(2) Waterproof Sheet
(3) Outside Handle
(4) Door Lock Cylinder
(5) Clip
(6) Key Switch (W/Anti-Theft)

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel.
3. Remove the waterproof sheet.
   - Refer to the Front Window Regulator, Glass And Glass Run in Body Structure section.

4. Disconnect the locking links (arrow marks positions) and key switch connector (w/anti-theft) to remove the outside handle.

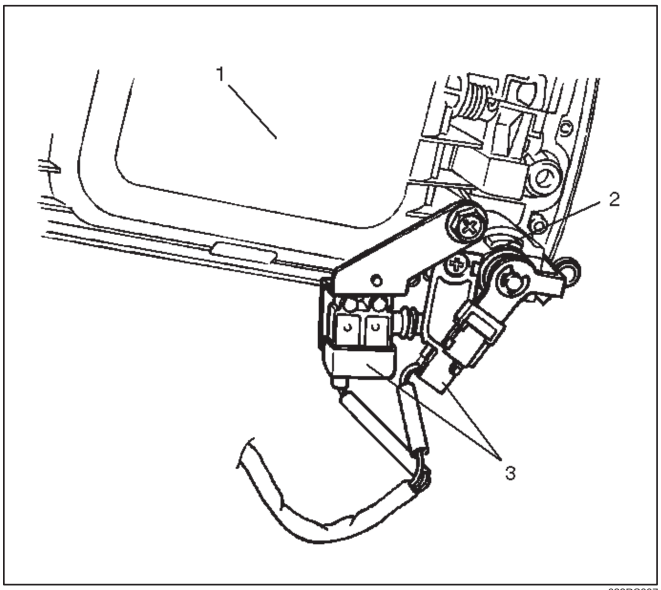


632RS005

Legend

(1) Outside Handle
(2) To Door Lock Assembly
(3) Key Switch Connector

5. Remove the key Switch.

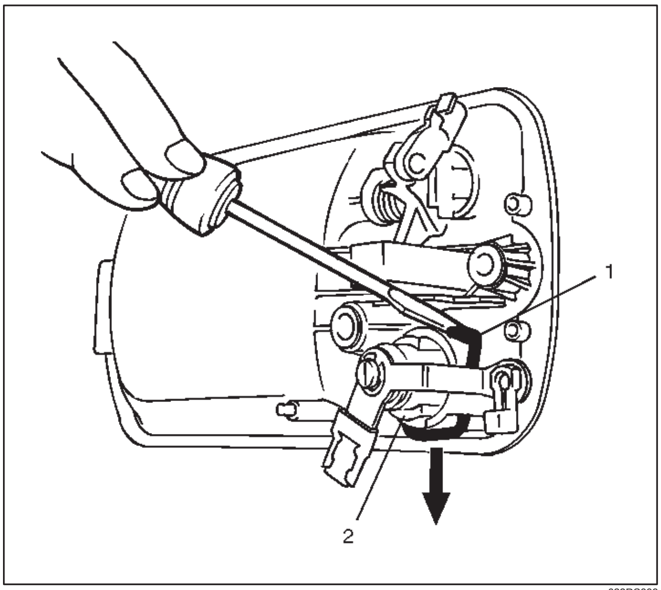


632RS007

Legend

(1) Outside Handle
(2) Lock Cylinder
(3) Key Switch

6. Remove the fixing clip(1) to remove the door lock cylinder(2).

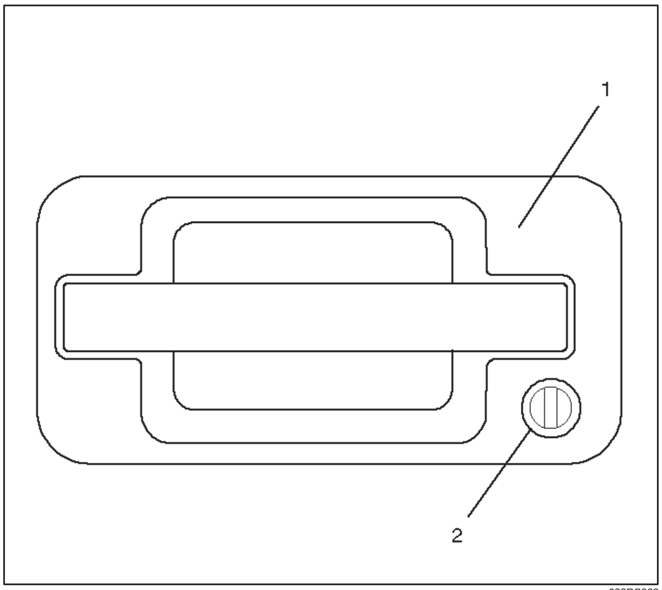


632RS009

Installation

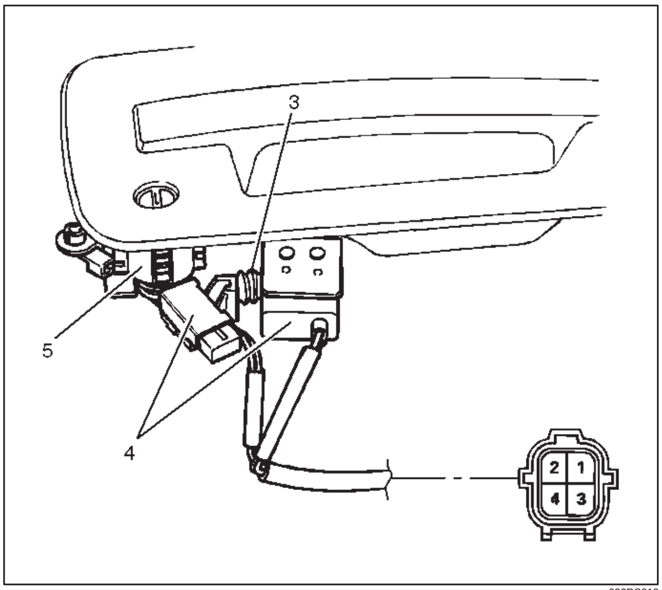
To install, follow the removal steps in the reverse order, noting the following points.

1. Be sure to install the door lock cylinder(2) at a right angle to the outside handle(1).



632RS008

2. For the anti-theft system, be sure to install the push rod(3) of key switch while pressing it to the door lock cylinder(5) so that there is no continuity between the key switch(4) side connector terminal No. D6–2 and D6–4 (No. D16–2 and D16–4: passenger side).



632RS010

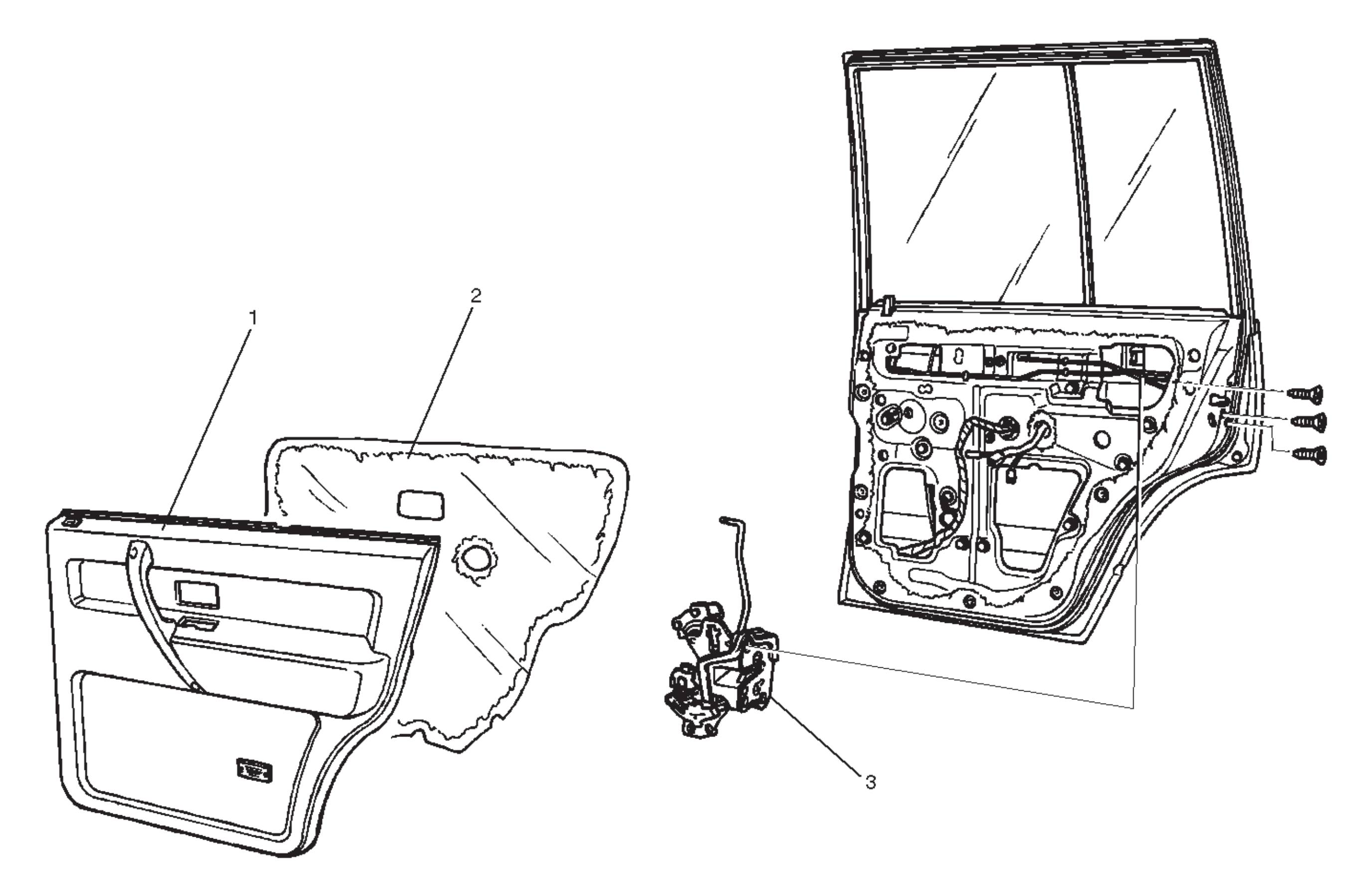
3. Tighten the outside handle and key switch fixing bolts to the specified torque.

Torque: 9 N·m (78 lb in)

4. Check for smooth outside handle and lock cylinder operation.

Rear Door Lock Assembly

Rear Door Lock Assembly and Associated Parts



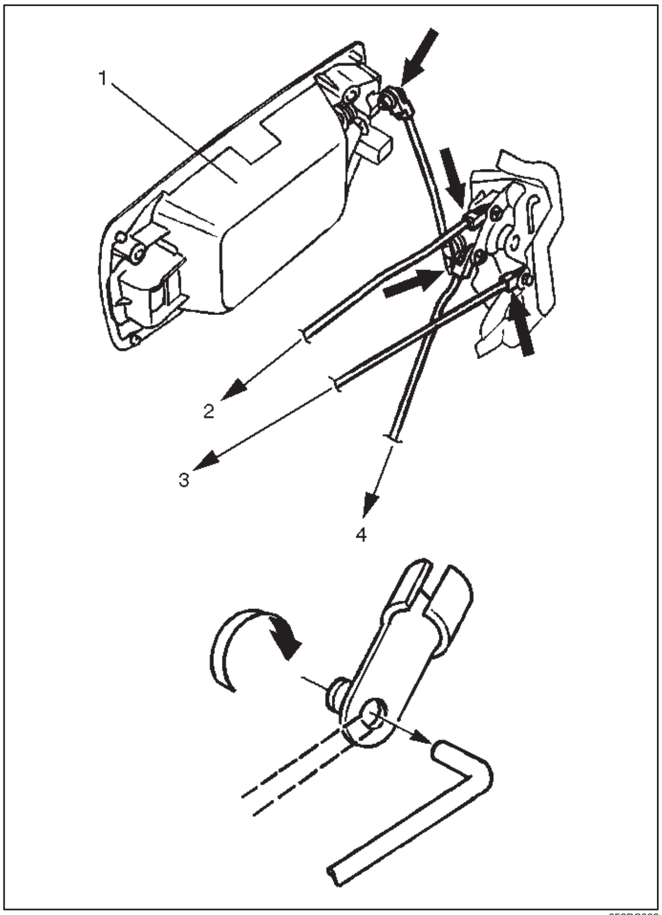
Legend

(1) Door Trim Panel
(2) Waterproof Sheet
(3) Door Lock Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel.
3. Remove the waterproof sheet.
   - Refer to the Rear Window Regulator And Glass in Body Structure section.

4. Disconnect the locking links (arrow marks positions) and remove the fixing screws to remove the door lock assembly.



652RS002

Legend

(1) Outside Handle
(2) To Inside Lock Knob
(3) To Inside Handle
(4) To Actuator

Installation

To install, follow the removal steps in the reverse order, noting the following points.

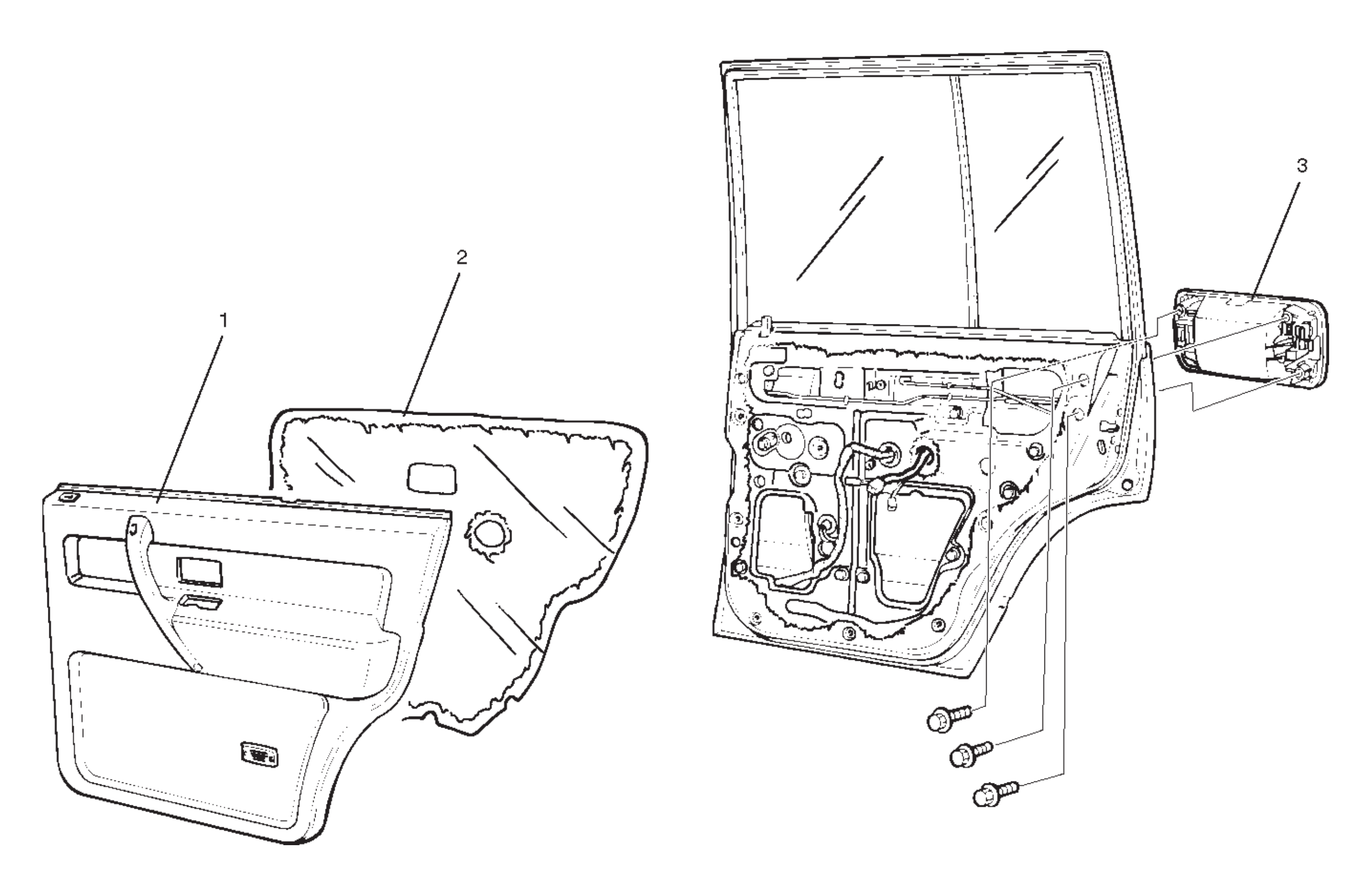
1. Apply chassis grease to the lock assembly and striker moving surface.
2. Tighten the door lock assembly fixing screws to the specified torque.

   Torque: 7 N·m (61 lb in)

3. Check that the door lock operates smoothly.

Rear Outside Handle

Rear Outside Handle and Associated Parts

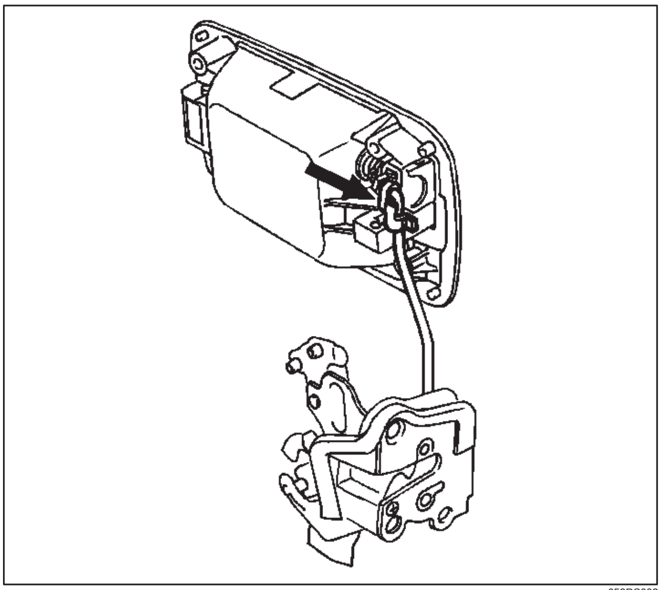


652RS004

Legend
(1) Door Trim Panel
(2) Waterproof Sheet
(3) Outside Handle

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel.
3. Remove the waterproof sheet.
   - Refer to the Rear Window Regulator And Glass in Body Structure section.
4. Disconnect the locking link (arrow mark position) and remove three fixing bolts to remove the outside handle.



652RS003

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Tighten the outside handle fixing bolts to the specified torque.

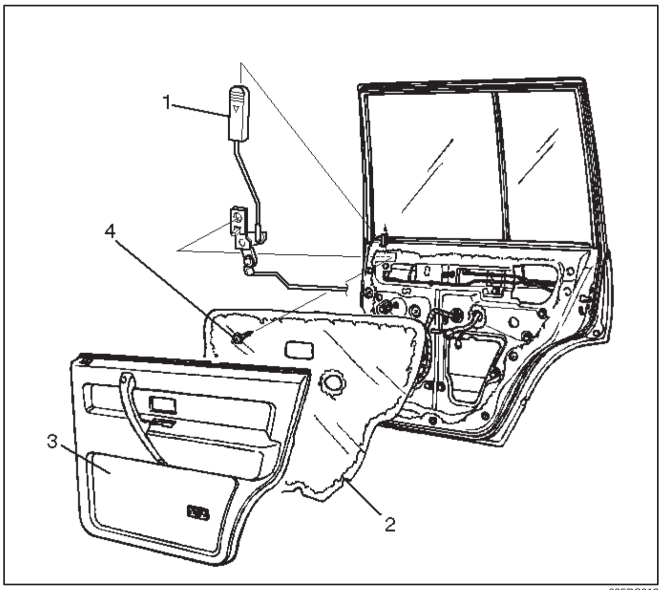
   Torque: 9 N·m (78 lb in)

2. Check that the outside handle operates smoothly.

Rear Door Inside Lock Knob Link

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel(3).
3. Remove the waterproof sheet(2).
   - Refer to the Rear Window Regulator And Glass in Body Structure section.
4. Remove the fixing screw(4) and disconnect the locking link at the door lock assembly to remove the rear door inside lock knob link(1).



635RS013

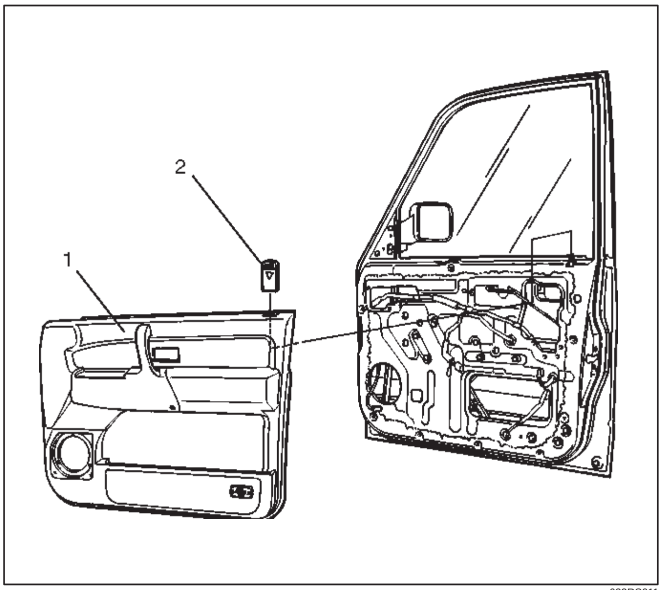
Installation

To install, follow the removal steps in the reverse order.

Door Inside Lock Knob

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel(1).
   - Refer to the Front / Rear Door Trim Panel in Exterior/Interior Trim section.
3. Turn the door inside lock knob counterclockwise and then remove the door inside lock knob (2).



632RS011

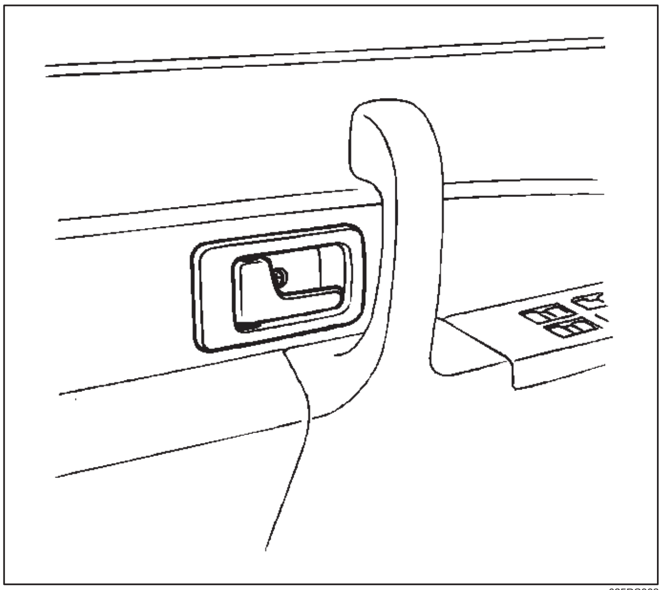
Installation

To install, follow the removal steps in the reverse order.

Door Inside Handle

Removal and Installation

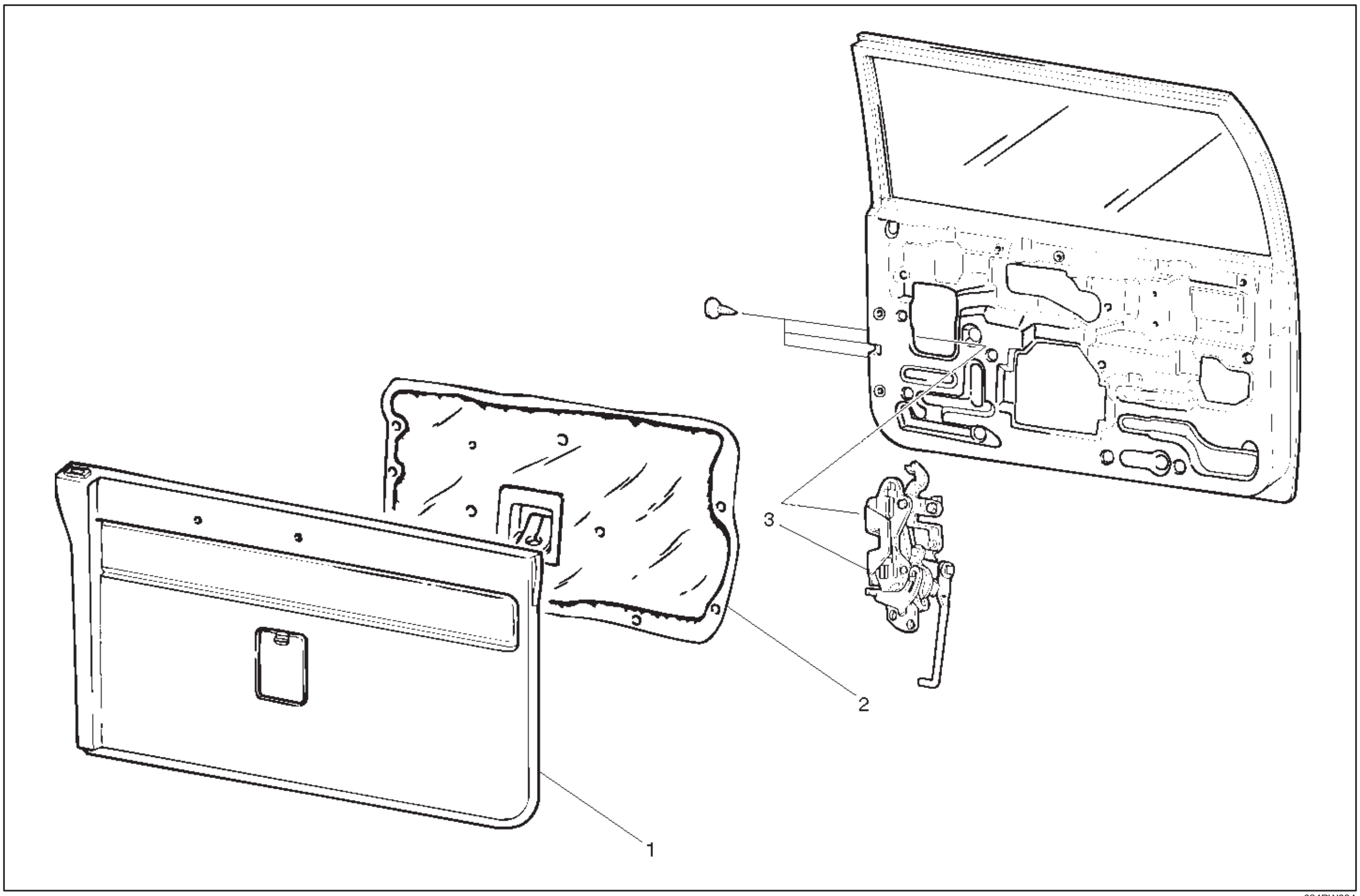
- Refer to the Front/Rear Door Trim Panel in Exterior/Interior Trim section.



635RS008

Tailgate Lock Assembly (LH)

Tailgate Lock Assembly (LH) and Associated Parts

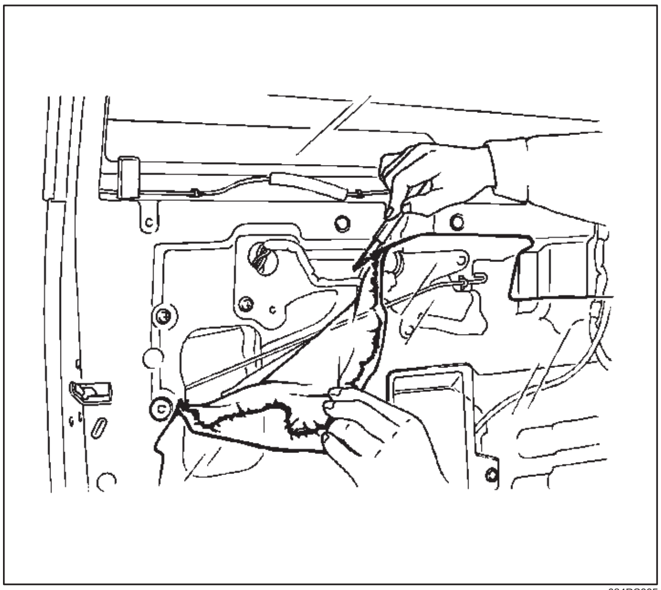


684RW004

Legend
(1) Tailgate Trim Panel(LH)
(2) Waterproof Sheet
(3) Tailgate Lock Assembly

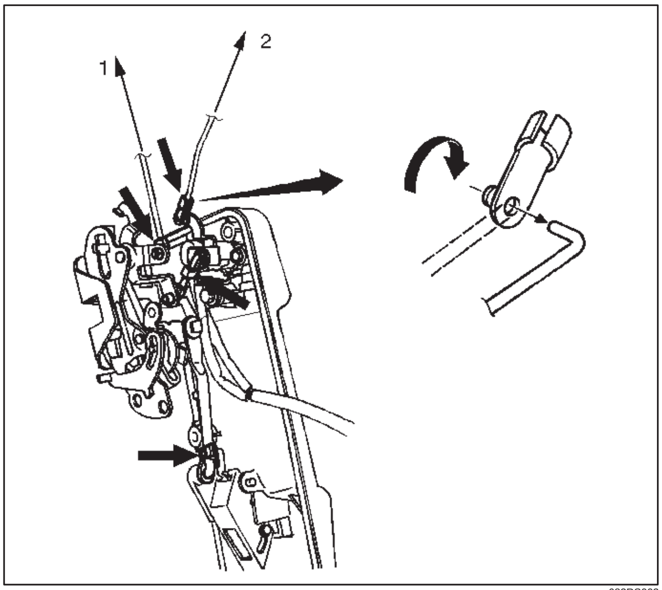
Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim panel (LH).
   - Refer to the Tailgate Trim Panel (LH) in Exterior/Interior Trim section.
3. Taking notice of the tailgate harness, peel the waterproof sheet off the tailgate panel carefully and then remove the waterproof sheet.



684RS005

4. Disconnect the locking links (arrow marks positions), remove three fixing screws and then remove the tailgate lock assembly (LH).



683RS003

Legend
(1) To Inside Lock Knob
(2) To Actuator

Installation

To install, follow the removal steps in the reverse order, noting the following points.

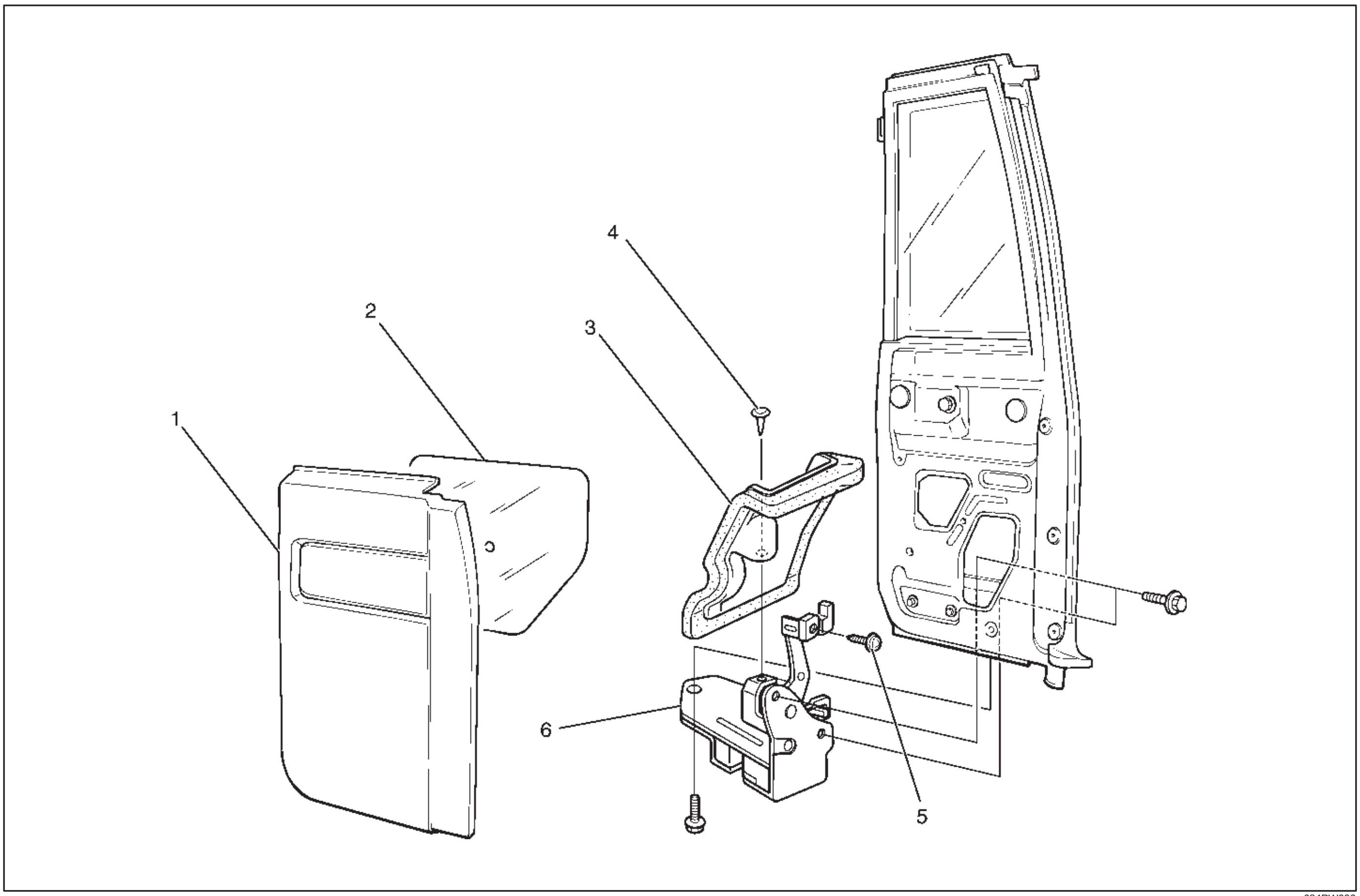
1. Apply chassis grease to the lock assembly and striker moving surface.
2. Tighten the tailgate lock assembly fixing screws to the specified torque.

Torque: 7 N·m (61 lb in)

3. Check that the tailgate lock operates correctly after installing it.

Tailgate Lock Assembly (RH)

Tailgate Lock Assembly (RH) and Associated Parts



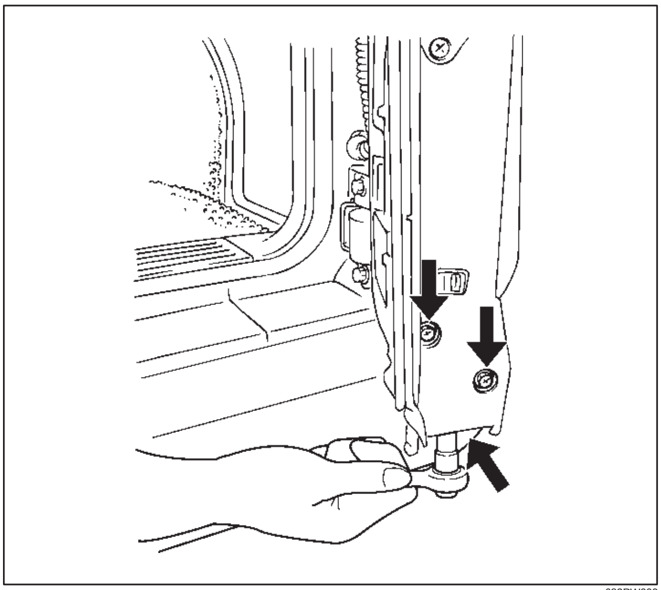
684RW006

Legend

(1) Tailgate Trim Panel (RH)
(2) Waterproof Sheet
(3) Tailgate Lock Seal
(4) Clip
(5) Screw
(6) Tailgate Lock Assembly (RH)

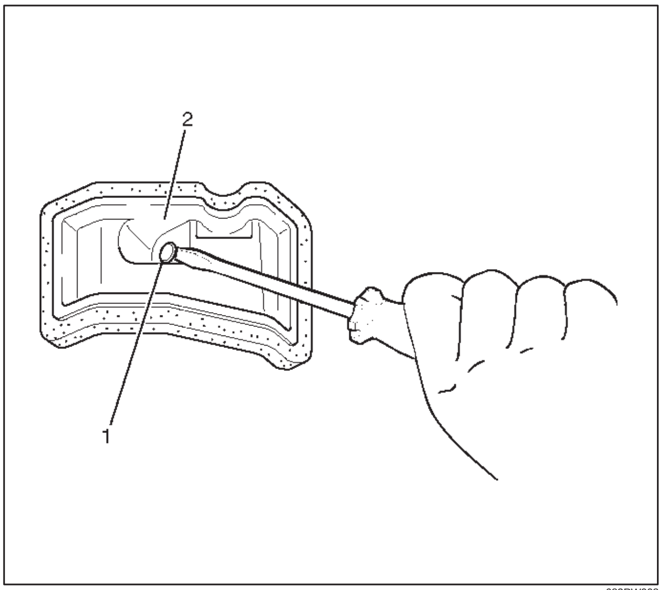
Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim panel (RH).
   - Refer to Tailgate Trim Panel (RH) in Exterior/Interior Trim section.
3. Peel the waterproof sheet off the tailgate panel carefully and then remove the waterproof sheet.
4. Remove three fixing bolts and then remove the tailgate lock assembly (RH).



683RW009

5. Remove the tailgate lock seal fixing clip(1) and then remove the tailgate lock seal(2).



683RW008

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Apply chassis grease to the lock assembly and striker moving surface.
2. Tighten the tailgate lock assembly fixing bolts to the specified torque.

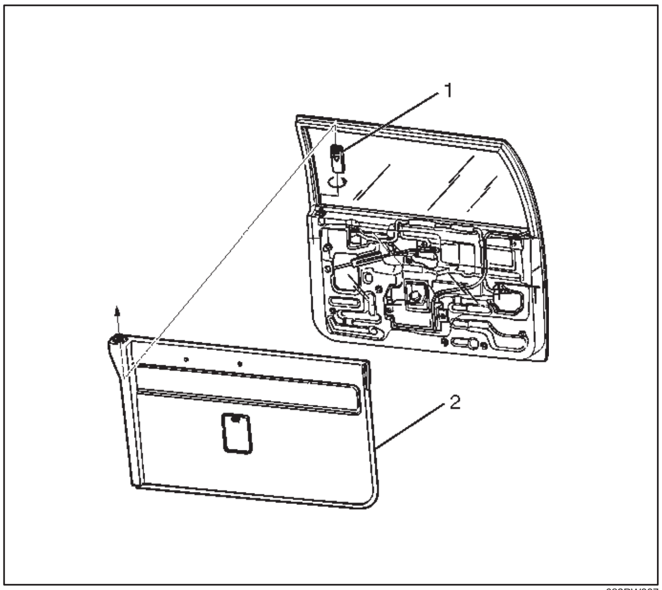
   Torque: 11 N·m (95 lb in)

3. Check that the tailgate lock operates correctly after installing it.

Tailgate Inside Lock Knob

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim panel (LH)(2).
   - Refer to the Tailgate Trim Panel (LH) in Exterior/Interior Trim section.
3. Take care of cushion to turn the lock knob counterclockwise and then remove the tailgate inside lock knob(1).



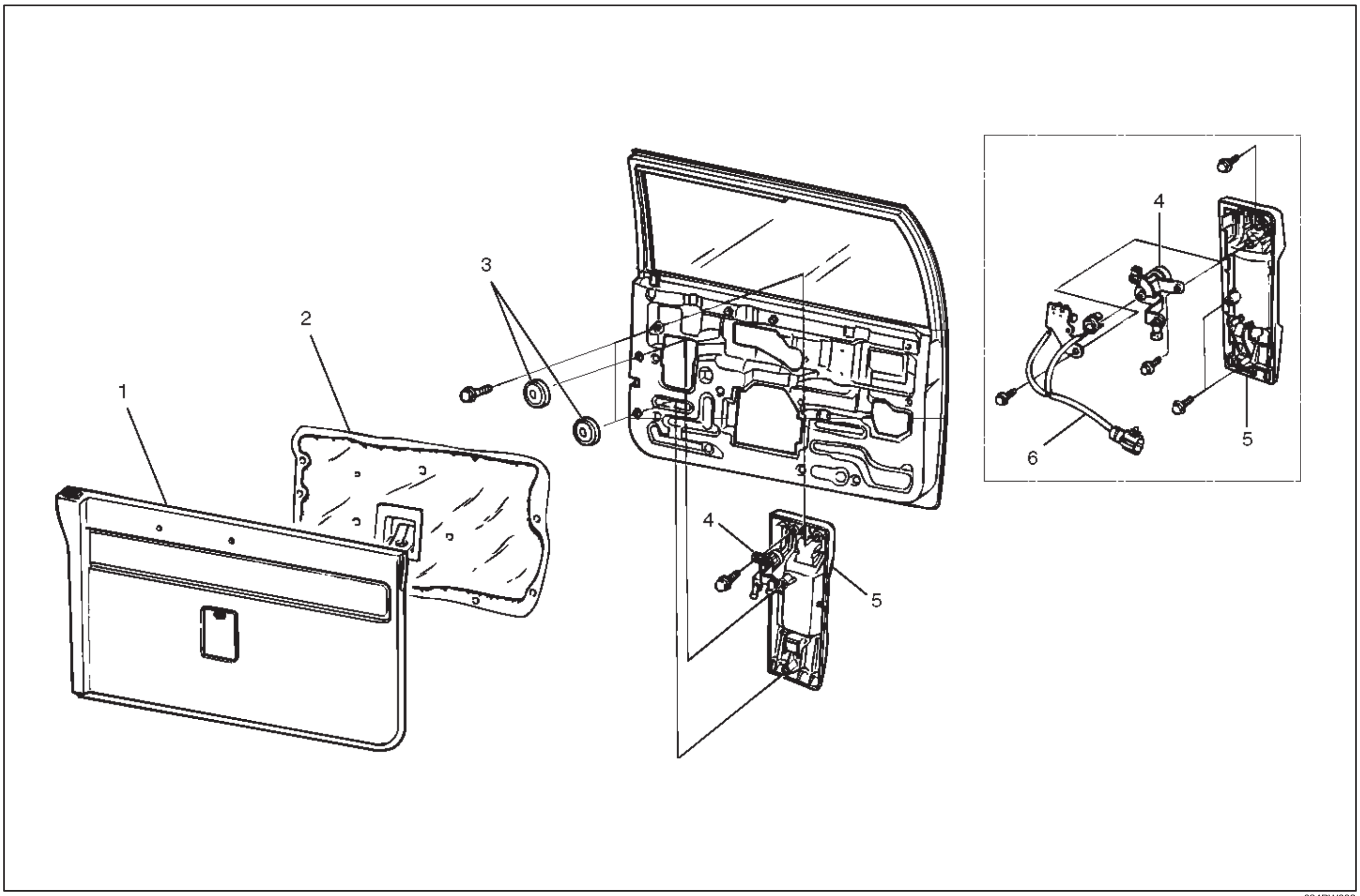
683RW007

Installation

To install, follow the removal steps in the reverse order.

Tailgate Outside Handle and/or Tailgate Lock Cylinder

Tailgate Outside Handle and/or Tailgate Lock Cylinder and Associated Parts

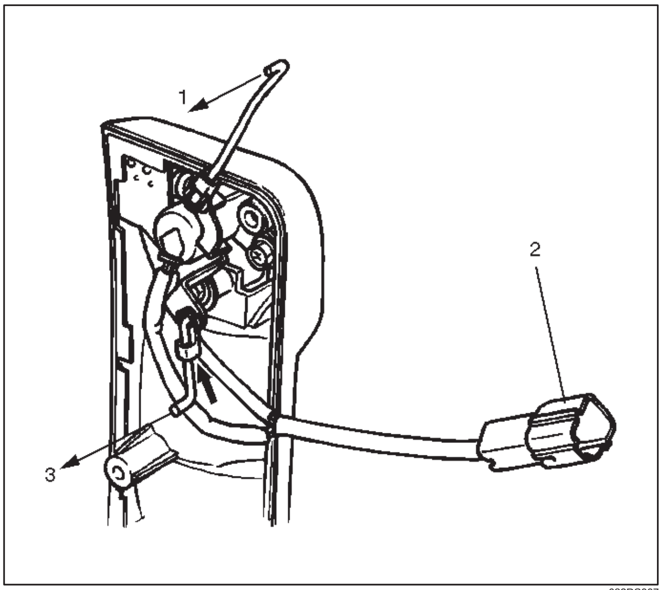


Legend
(1) Tailgate Trim Panel (LH)
(2) Waterproof Sheet
(3) Grommet
(4) Tailgate Lock Cylinder
(5) Tailgate Outside Handle
(6) Key Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim panel.
3. Remove the waterproof sheet.
   - Refer to the Tailgate Lock Assembly (LH) in this section.
4. Remove the grommet.

5. Disconnect the locking links (arrow marks positions), key switch connector (w/anti-theft) and remove three fixing bolts to remove the tailgate outside handle.

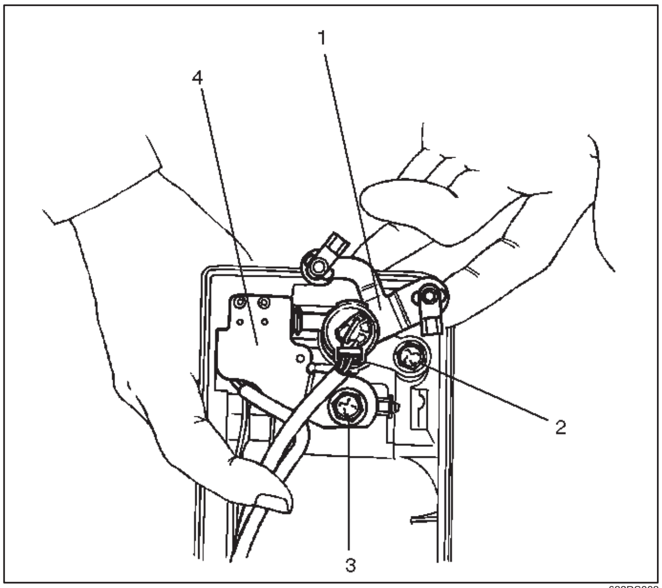


683RS007

Legend
(1) To Actuator
(2) Key Switch Connector
(3) To Lock Assembly

6. Remove the key switch fixing bolt(3) to remove the key switch(4) from the tailgate lock cylinder (w/anti-theft)(1).

   And remove the tailgate lock cylinder fixing bolt(2) to remove the tailgate lock cylinder.

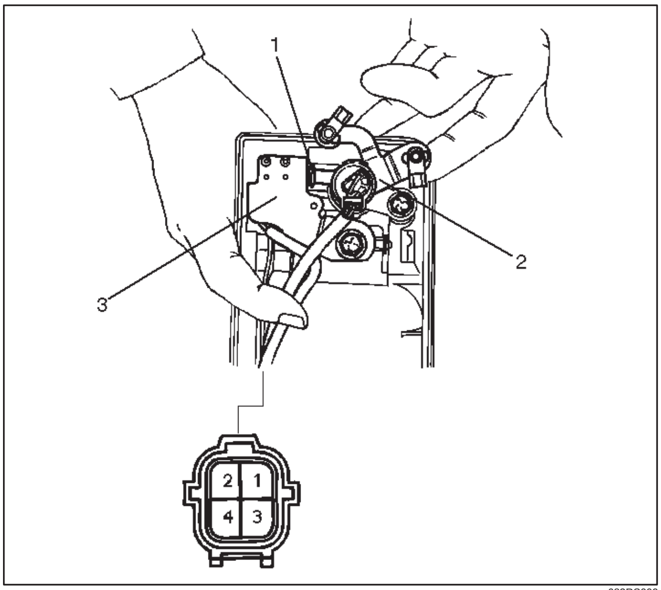


683RS008

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. For the anti-theft system, install the push rod(1) of the key switch(3) to the key cylinder(2) while pressing it so that there is not continuity between the key switch side connector terminals No. G5–2 and G5–4 as shown in the figure.



683RS009

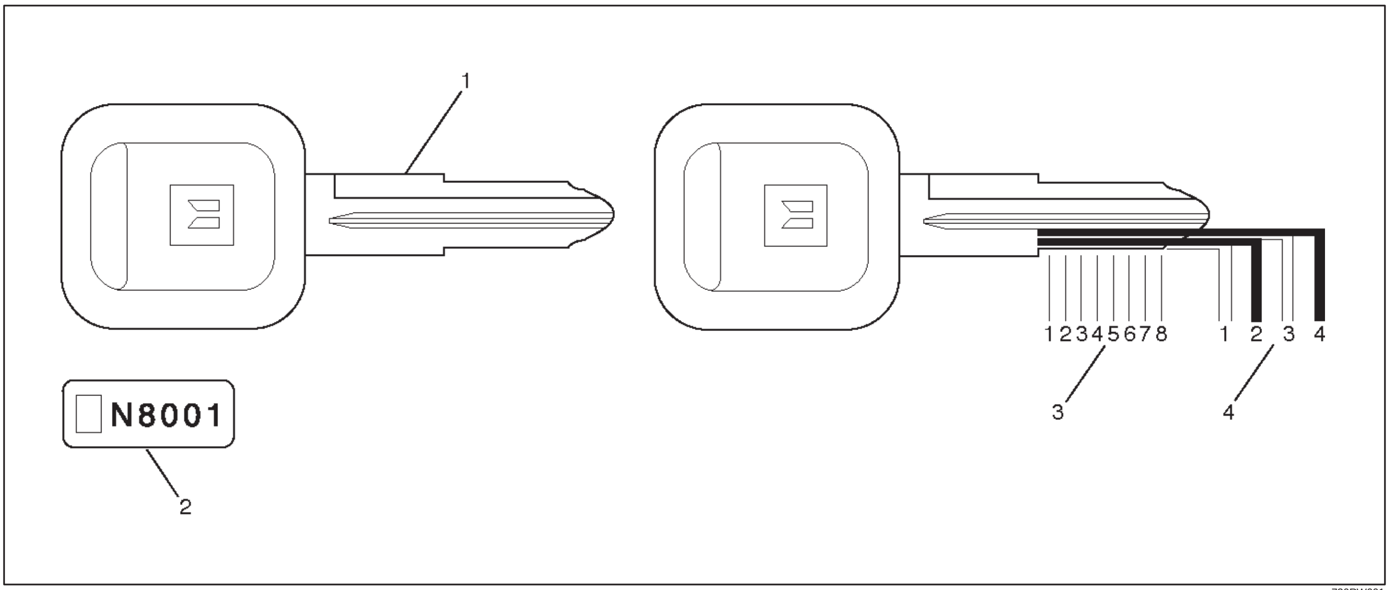
2. Tighten the outside handle and key cylinder fixing bolts to the specified torque.

   Torque: 9 N·m (78 lb in)

3. Check that the outside handle and key cylinder operate correctly after installing them.

Key

Key Coding

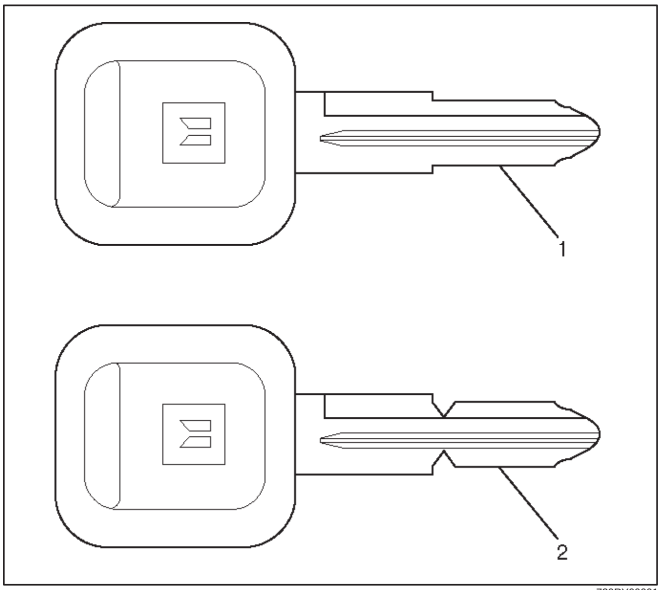


730RW001

Legend
(1) Key(Actual Size)
(2) Key Code Tag
(3) Position
(4) Level

One key is used for the ignition, door, and tailgate lock cylinders. The keys are cut on both edges to make them reversible.
Key identification is obtained from the five character key code stamped on the key code tag. From this key code, the key code cutting combination can be determined from a code list (available to owners of key cutting equipment from suppliers).
If key codes are not available from records or tags, the key code can be obtained from the right hand door lock cylinder (if lock has not been replaced). Lock cylinders supplied by the factory as service parts are unmarked.
If the original key is available, the key code cutting combination can be determined by laying the key on the diagram shown in the figure.

Key Styles



730RY00001

Legend
(1) Blank Key Style “A”
(2) Blank Key Style “B”

The keys come in styles A or B depending on the key code cutting combination. When the first position in the combination is a 1, 2 or 3, Style A is used. When the first position is a 4, Style B (factory pre-cut key) is used.

Power Door Lock System

General Description

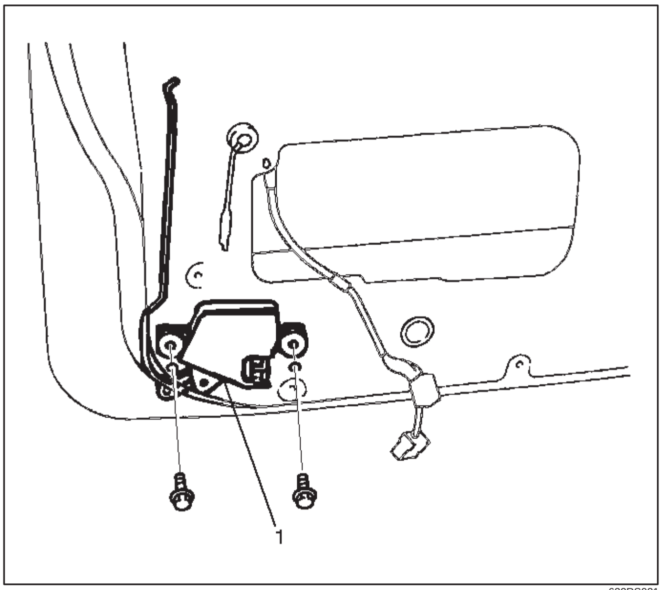
The circuit consists of the door lock (& power window) switch, door lock actuator for the front and rear door, tailgate lock actuator and the door lock key switch. The front door lock switch –LH is always provided with battery voltage.

The key or the inside lock button on the both driver's and the front passenger's door can activate the lock mechanism of all the doors (including the tailgate).

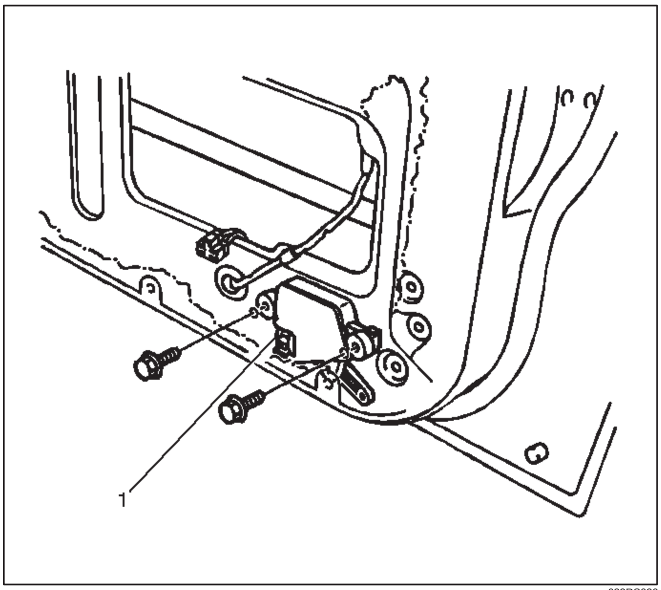
When the driver's door lock switch or the front passenger's door lock switch is turned on, current flows for about one second to the door lock actuator of each door connected in parallel with the front door lock (& power window) switch –LH to activate the actuator to lock and unlock the doors.

Front Door Lock Actuator Removal

1. Refer to the Front Door Lock Assembly removal procedure in this section.
2. Remove the door lock actuator(1).



632RS021



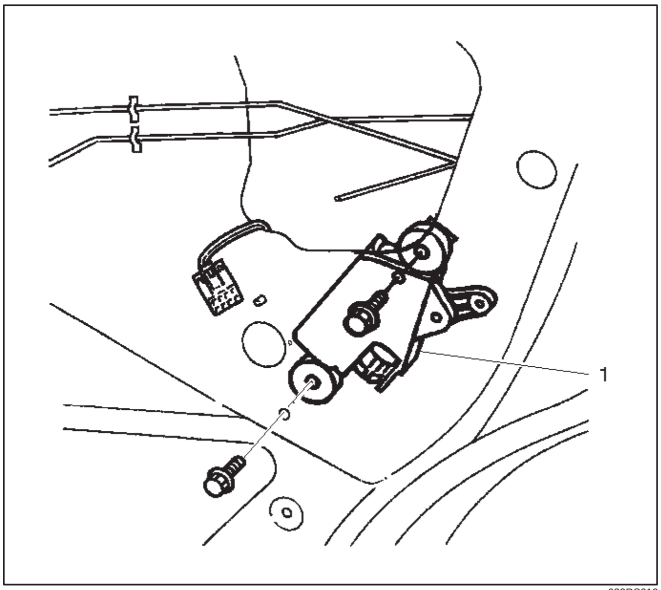
632RS020

Front Door Lock Actuator Installation

To install, follow the removal steps in the reverse order.

Rear Door Lock Actuator Removal

1. Refer to the Rear Door Lock Assembly removal procedure in this section.
2. Removal the door lock actuator(1).



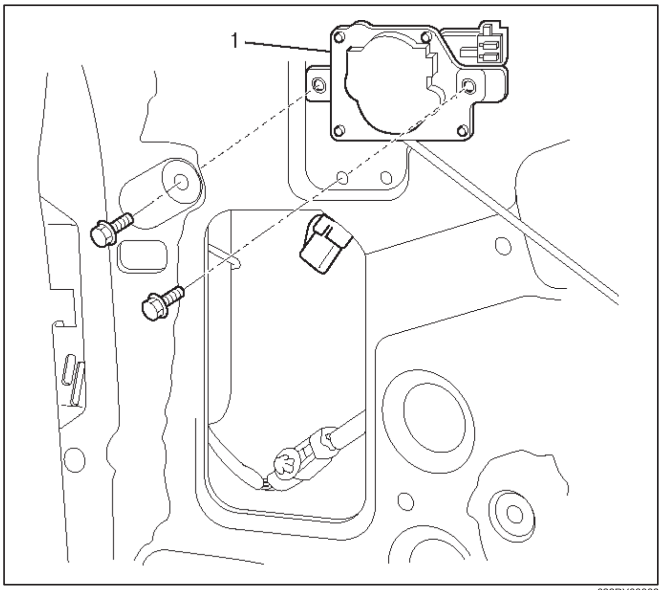
632RS019

Rear Door Lock Actuator Installation

To install, follow the removal steps in the reverse order.

Tailgate Lock Actuator Removal

1. Refer to the Tailgate Lock Assembly removal procedure in this section.
2. Remove the tailgate lock actuator(1).



632RY00002

Tailgate Lock Actuator Installation

To install, follow the removal steps in the reverse order.

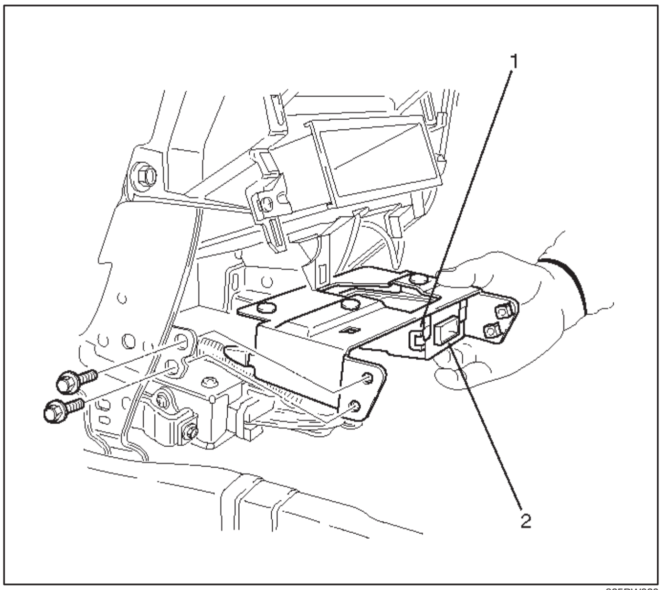
Anti-theft System

General Description

The circuit consists of the starter switch, anti-theft & keyless entry control unit, anti-theft horn, front door and tailgate key switch (detect and tamper switch), door lock (& power window) switch, door lock actuator for each door, engine hood switch, clutch start switch (M/T), ANTI-THEFT indicator light and mode switch (A/T).
The system operates as follows: After locking the starter switch and removing the starter key (this sets the alarm), if the door is unlocked in any way other than with the proper key, the headlights start flashing, the horn sounds, and the starter circuit is disabled. (However, the engine hood and all the doors must be locked and closed.)
Once the system has been placed in the warning or alarm condition, it can be released only when the starter switch is shifted from “OFF” to “ACC” by the starter key, or when the lock of the front door or the tailgate is released (to activate the detect switch) by the starter key.

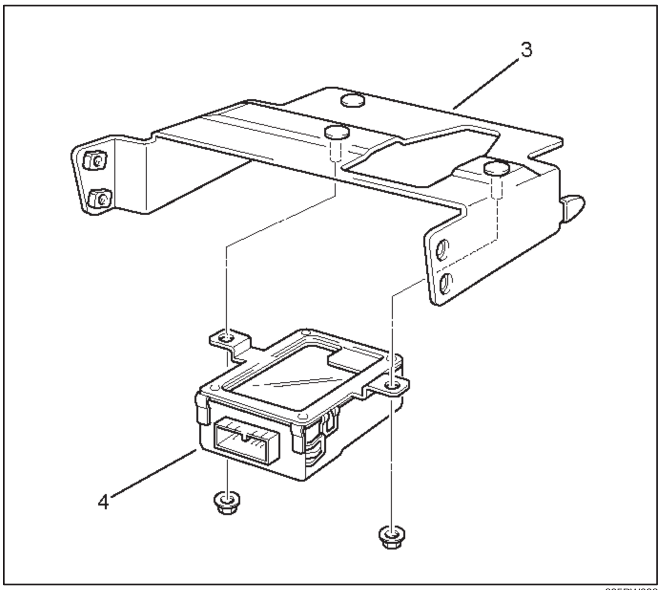
Anti-theft & Keyless Entry Control Unit Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly.
   - Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly.
   - Refer to the Instrument Panel Assembly in Body Structure section.
4. Disconnect the connector(2).
5. Remove four screws to remove the anti-theft & keyless entry control unit with bracket(1).



825RW029

6. Remove two nuts from the anti-theft & keyless entry control unit with bracket(3) to remove the anti-theft & keyless entry controller(4).



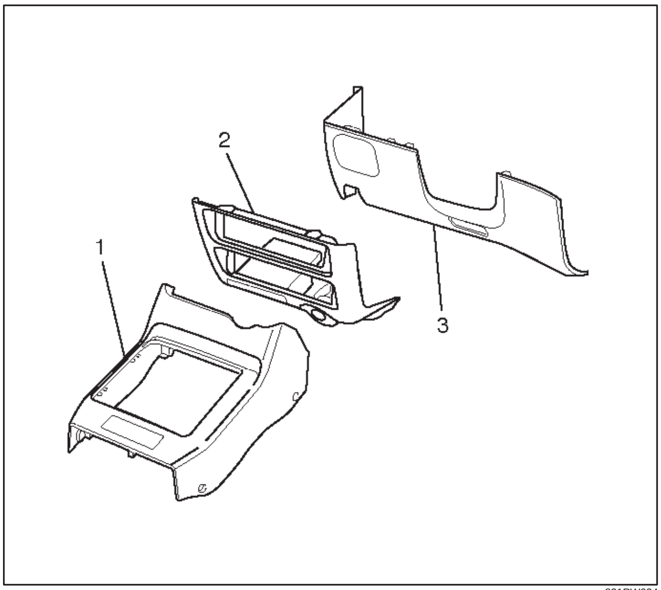
825RW028

Anti-theft & Keyless Entry Control Unit Installation

To install, follow the removal steps in the reverse order.

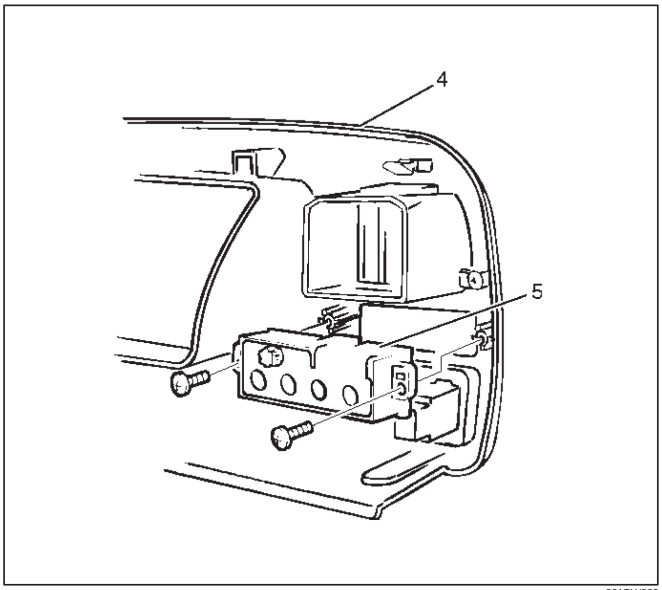
Anti-theft Indicator Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(1).
   - Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly(2).
   - Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly(3).
   - Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly(4).
   - Refer to the Instrument Panel Assembly in Body Structure section.
6. Remove two screws and then remove the anti-theft indicator(5).



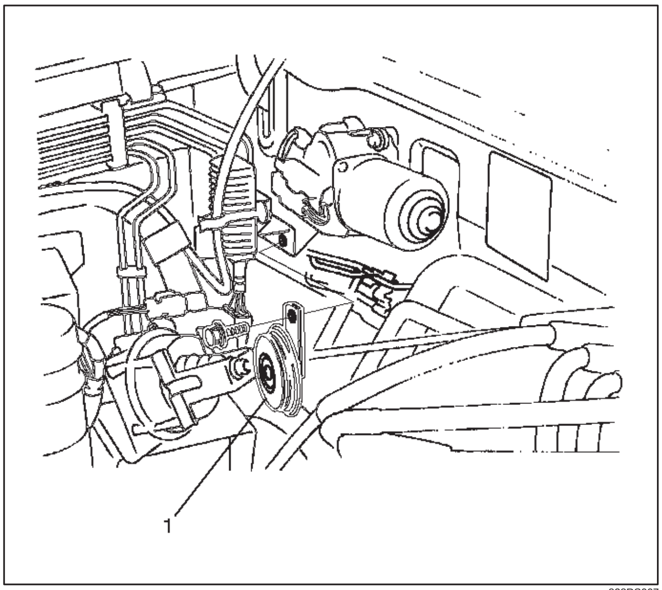
821RW032

Anti-theft Indicator Installation

To install, follow the removal steps in the reverse order.

Anti-theft Horn Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector and remove the fixing bolt to remove the anti-theft horn(1).



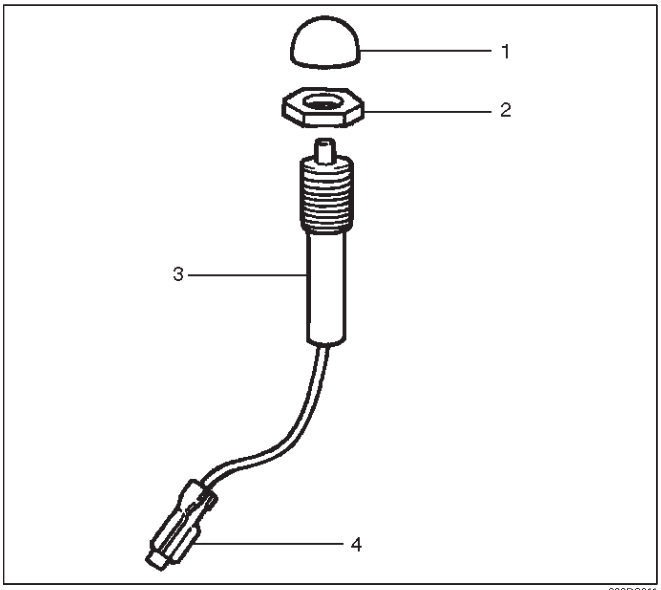
828RS007

Anti-Theft Horn Installation

To install, follow the removal steps in the reverse order.

Engine Hood Switch Removal

1. Disconnect the battery ground cable.
2. Remove the cap(1).
3. Remove the lock nut(2).
4. Disconnect the connector(4).
5. Remove the engine hood switch(3).



828RS011

Engine Hood Switch Installation

To install, follow the removal steps in the reverse order.

Keyless Entry System

ID Code Registration

There are four kinds of ID codes which can be registered, for which these two modes, ID code new registration and ID code additional registration, are available.

ID Code New Registration

This procedure erases all registered ID codes and registers a new received ID code instead.

Step	Action	Yes	No
1	1. Confirm that all the doors are closed and unlocked. 2. Open the driver's side door. 3. Insert the key into the starter switch. Is the action complete?	Go to Step 2	Go to Step 1
2	Turn the starter switch to ACC position and then to OFF position three times. NOTE: This step must be carried out within five seconds after step 1. Is the action complete?	Go to Step 3	Go to Step 1
3	Close the driver's side door and then open it two times. NOTE: This step must be carried out within ten seconds after step 2. Is the action complete?	Go to Step 4	Go to Step 1
4	1. Turn the starter switch to ACC position and then to OFF position five times. 2. Close the driver's side door and then open it. NOTE: This step must be carried out within ten seconds after step 3. Is the action complete?	Go to Step 5	Go to Step 1
5	The control unit locks and unlocks the doors one time. Does the control unit work normally?	Go to Step 6	Go to Step 1
6	Operate the lock or unlock button of the transmitter. NOTE: This step must be carried out within twenty seconds after step 5. Is the action complete?	Go to Step 7	Go to Step 1
7	The control unit locks and unlocks the doors one time. Does the control unit work normally?	Go to Step 8	Go to Step 1

Step	Action	Yes	No
8	Operate the lock or unlock button of the transmitter. NOTE: This step must be carried out within twenty seconds after step 7. Is the action complete?	Go to Step 9	Go to Step 1
9	The control unit compares the two codes sent from the transmitter. If the code succeeds in registration, the control unit locks and unlocks the doors one time. If the two codes are different from each other or fails in registration, the control unit locks and unlocks the doors three times. NOTE: In any case, this procedure is finished.	Go to Step 1	Go to Step 1

ID Code Additional Registration

This procedure additionally registers a new received ID code with holding registered ID codes. When total number of registered ID codes and newly registered ID code exceeds four, they are erased in order of older one.

Step	Action	Yes	No
1	1. Confirm that all the doors are closed and unlocked. 2. Open the driver's side door. 3. Insert the key into the starter switch. Is the action complete?	Go to Step 2	Go to Step 1
2	Turn the starter switch to ACC position and then to OFF position three times. NOTE: This step must be carried out within five seconds after step 1. Is the action complete?	Go to Step 3	Go to Step 1
3	Close the driver's side door and then open it two times. NOTE: This step must be carried out within ten seconds after step 2. Is the action complete?	Go to Step 4	Go to Step 1
4	1. Turn the starter switch to ACC position and then to OFF position three times. 2. Close the driver's side door and then open it. NOTE: This step must be carried out within ten seconds after step 3. Is the action complete?	Go to Step 5	Go to Step 1
5	The control unit locks and unlocks the doors two times. Does the control unit work normally?	Go to Step 6	Go to Step 1
6	Operate the lock or unlock button of the transmitter. NOTE: This step must be carried out within twenty seconds after step 5. Is the action complete?	Go to Step 7	Go to Step 1
7	The control unit locks and unlocks the doors one time. Does the control unit work normally?	Go to Step 8	Go to Step 1

Step	Action	Yes	No
8	Operate the lock or unlock button of the transmitter. NOTE: This step must be carried out within twenty seconds after step 7. Is the action complete?	Go to Step 9	Go to Step 1
9	The control unit compares the two codes sent from the transmitter. If the code succeeds in registration, the control unit locks and unlocks the doors one time. If the two codes are different from each other or fails in registration, the control unit locks and unlocks the doors three times. NOTE: In any case, this procedure is finished.	Go to Step 1	Go to Step 1

Anti–theft & Keyless Entry Control Unit/Transmitter Replacement

Anti–theft & Keyless Entry Control Unit Replacement

1. Remove and install the control unit.
   - Refer to Anti–theft & Keyless Entry Control Unit Removal and Installation in this section.
2. Register ID code.
   - Refer to ID Code Registration in this section.
3. Check that the keyless entry system works normally.

Transmitter Replacement

1. Prepare a new transmitter.
2. Regiter ID code.
   - Refer to ID Code Registration in this section.
3. Check that the keyless entry system works normally.

Transmitter Battery Replacement

1. Remove a screw to remove the cover.
2. Remove the batteries.
3. Set the new batteries into the transmitter.
4. Install the cover to the transmitter.
5. Check that the keyless entry system works normally.

Main Data and Specifications

Torque Specifications

Application	N·m	Lb Ft	Lb In
Front Door Lock Assembly Fixing Screws	7	—	61
Front Outside Handle and Key Switch Fixing Bolts	9	—	78
Rear Door Lock Assembly Fixing Screws	7	—	61
Rear Outside Handle Fixing Bolts	9	—	78
Tailgate Lock Assembly (LH) Fixing Screws	7	—	61
Tailgate Lock Assembly (RH) Fixing Bolts	11	—	95
Tailgate Outside Handle and Key Cylinder Fixing Bolts	9	—	78

TROOPER

BODY AND ACCESSORIES

SUN ROOF/CONVERTIBLE TOP

CONTENTS

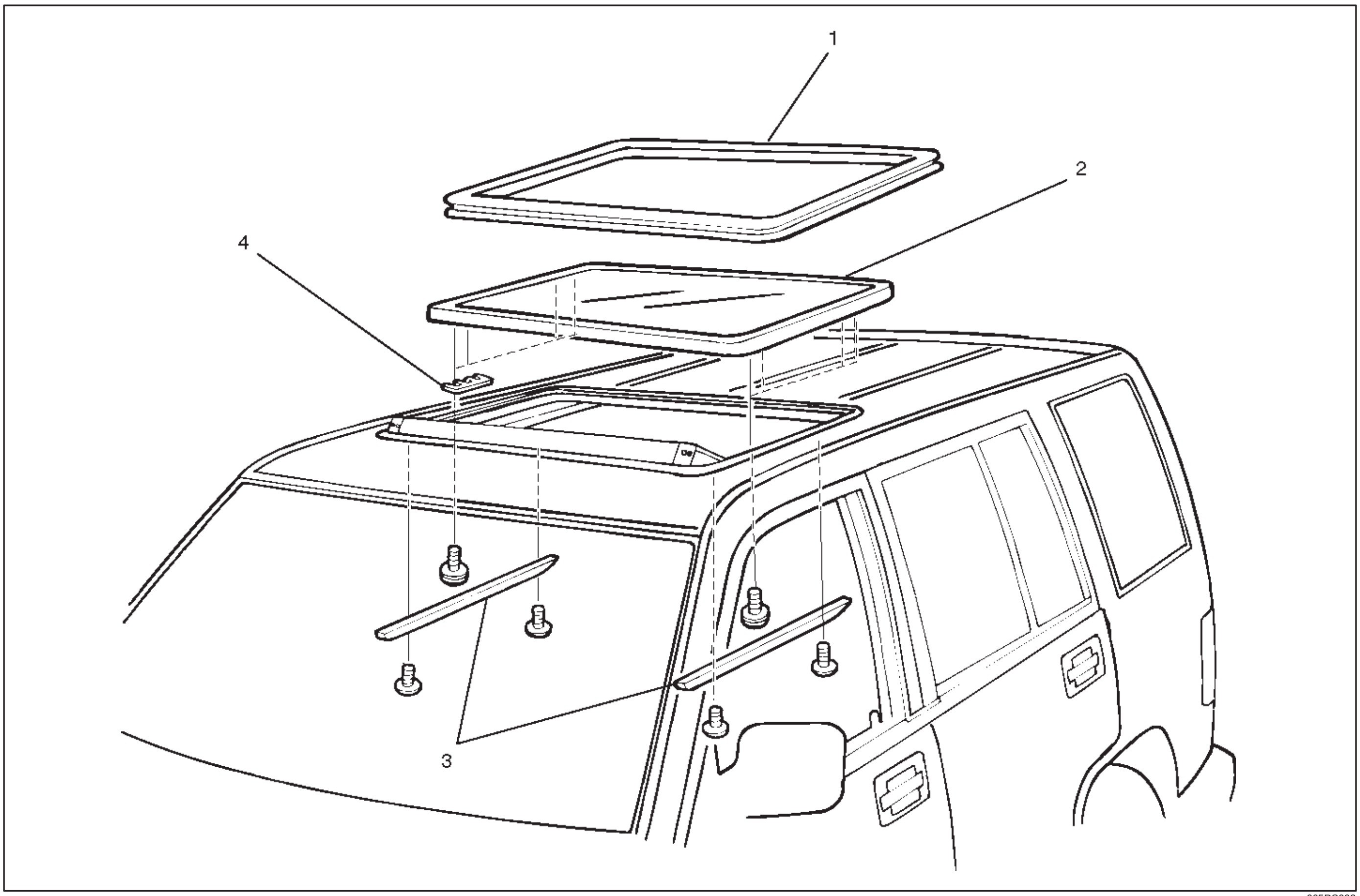
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Sun Roof Glass

Sun Roof Glass and Associated Parts

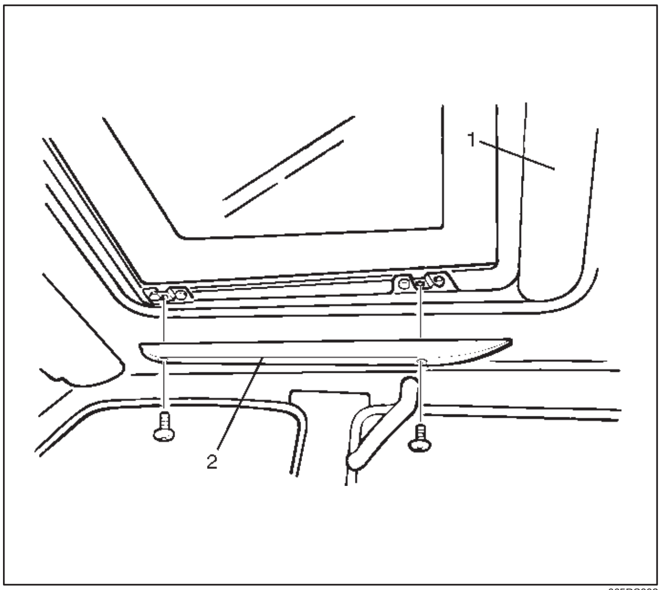


665RS002

Legend
(1) Sun Roof Weatherstrip
(2) Sun Roof Glass
(3) Decoration Cover
(4) Sun Roof Shim

Removal

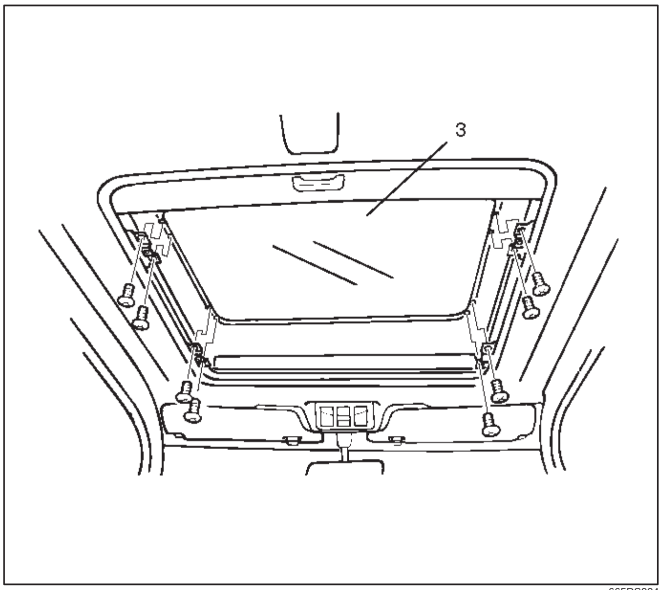
1. Open the sun roof and pull the sun roof weatherstrip out from the roof panel.
2. Disconnect the battery ground cable.
3. Close the sun roof and open the sunshade(1). Then, remove the decoration cover fixing screws and decoration cover(2).



665RS003

4. Remove eight sun roof glass fixing screws to remove the sun roof glass(3).

NOTE: If shims are used between the sun roof set plate and the glass, note the number of shims used.

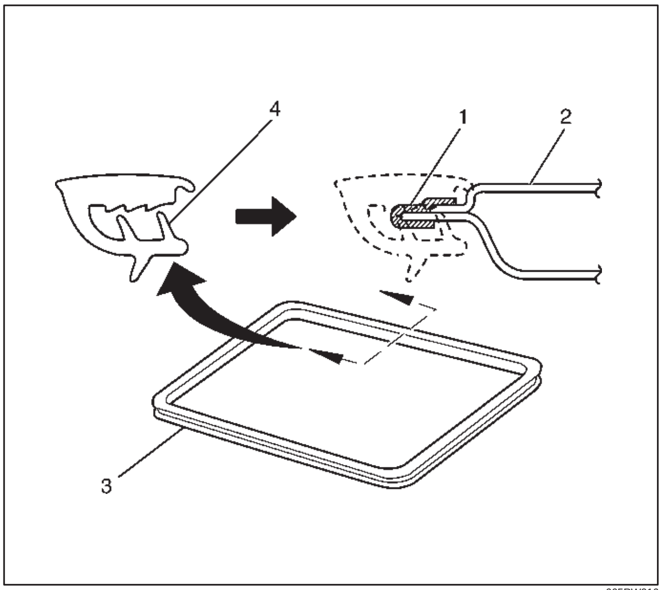


665RS004

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Clean the body panel of the weatherstrip fixing portion.
   - If the protective film(1) of the body panel is peeled, it cannot be reused.
     Install the new protective film around the body panel(2).
2. Install the new weatherstrip(3).
   - Always replace with a new one.
   - Be sure to install the sun roof weatherstrip so that the white marking location(4) of the weatherstrip is on the front side of the vehicle.



665RW016

3. Temporarily install the glass to the sun roof frame.
4. Open and shut the sun roof four to five times to position correctly the sun roof weatherstrip and the glass in the longitudinal and latitudinal setting positions.
5. Insert the original shims between the sun roof set plate and the glass.
6. Tighten the sun roof glass fixing screws to the specified torque.

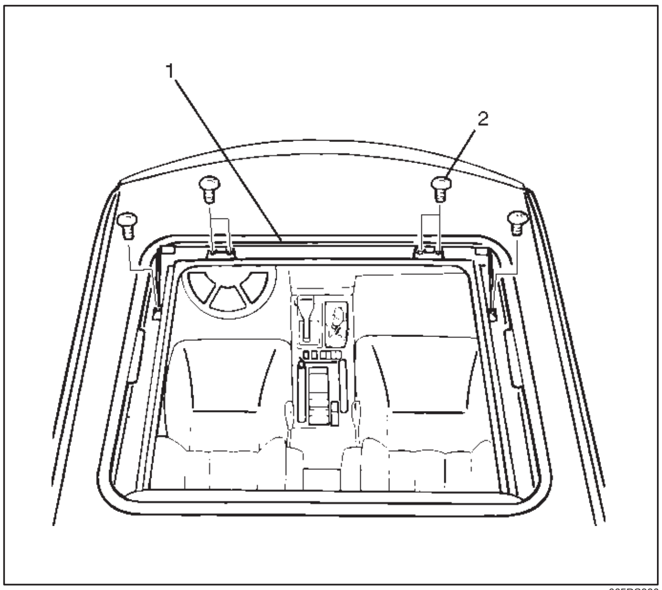
Torque: 10 N·m (87 lb in)

7. After the sun roof glass is installed, check the roof panel and sun roof glass for vertical install position.
   If out of standard, adjust with shim.
   For the installation standard, refer to Body Dimension in Body Structure section.
8. Install the decoration cover.

Sun Roof Deflector

Removal

1. Open the sun roof.
2. Remove the fixing screws(2) to remove the sun roof deflector(1).



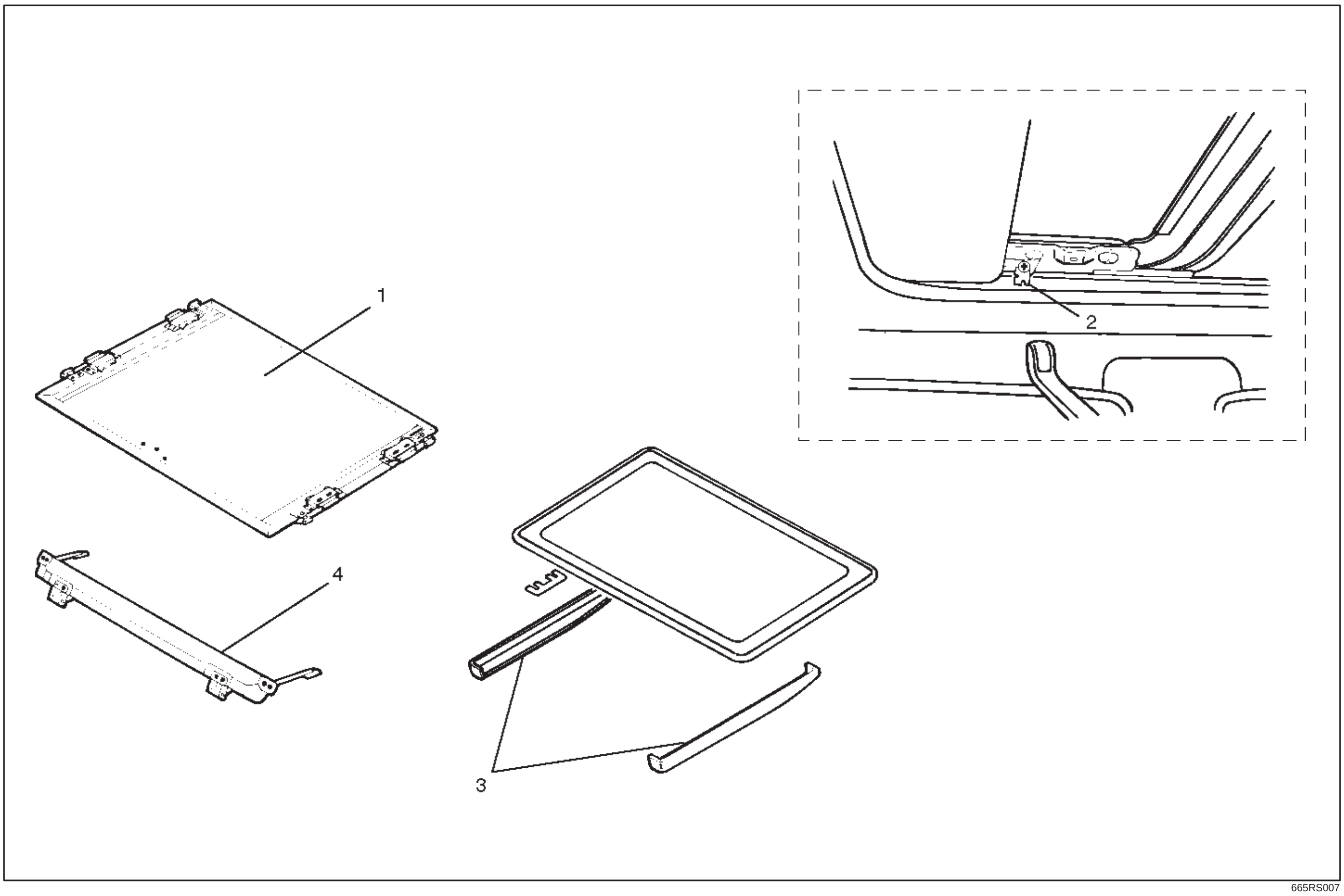
665RS006

Installation

To install, follow the removal steps in the reverse order.

Sunshade

Disassembled View



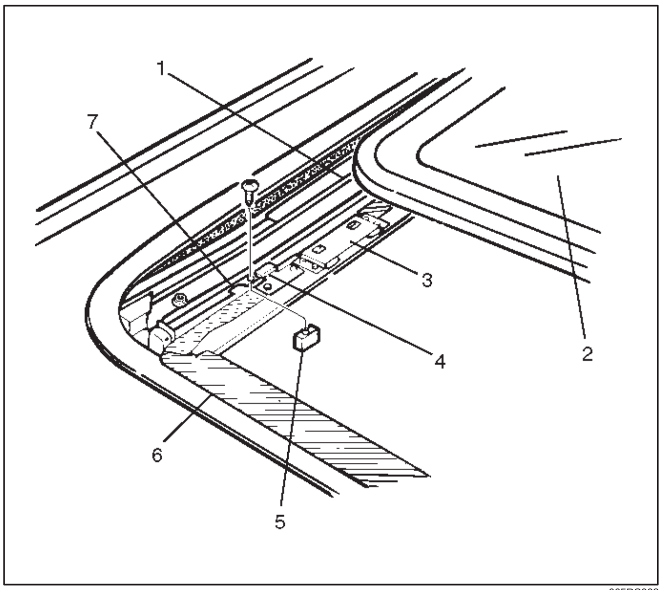
665RS007

Legend

(1) Sunshade
(2) Sunshade Stopper
(3) Decoration Cover
(4) Sun Roof Deflector

Removal

1. Remove the decoration cover.
2. Open the sun roof half position, remove the sunshade stopper screw and pull out the sunshade(6) until its front side protrudes a little from the sun roof glass(2) to remove the sunshade stopper.
3. Remove the sun roof deflector.
   - Refer to the Sun Roof Deflector in this section.
4. Open the sun roof completely.
5. Remove the sunshade guide rail stopper(5), and pull out the sunshade up to the rail edge.
6. Remove the guide pin(4) in the sunshade through the notch(7) of guide rail(1) and then draw the sunshade out of the roof by pushing inward the retaining clips(3) on both sides.



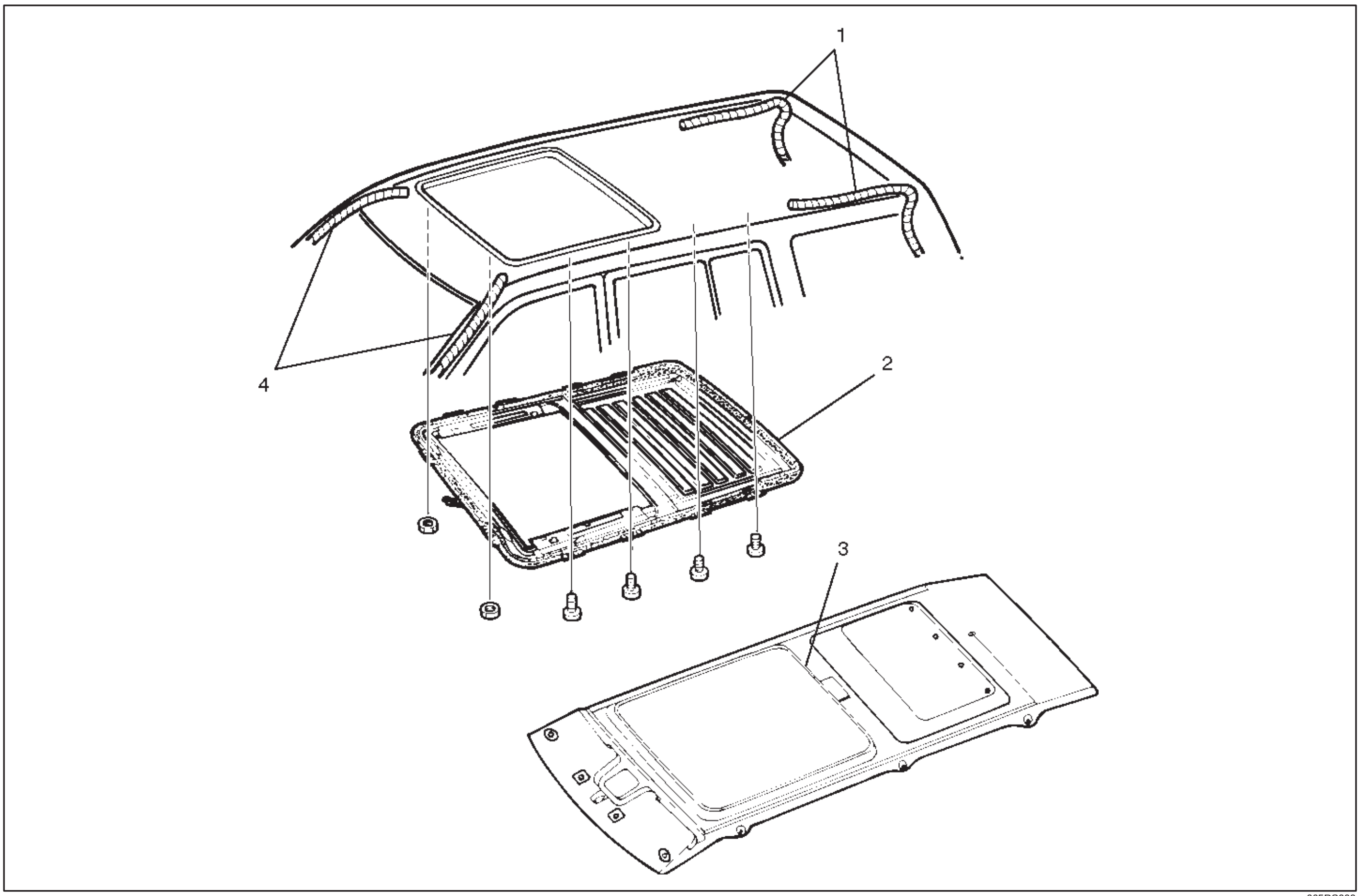
665RS008

Installation

To install, follow the removal steps in the reverse order.

Sun Roof Frame Complete Assembly

Sun Roof Frame Complete Assembly and Associated Parts



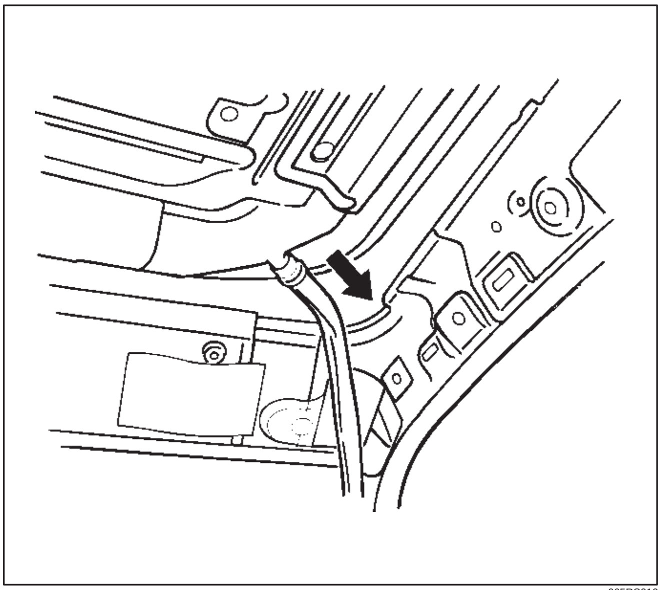
665RS009

Legend

(1) Sun Roof Drain Hose
(2) Sun Roof Frame Complete Assembly
(3) Headlining
(4) Sun Roof Drain Hose

Removal

1. Disconnect the battery ground cable.
2. Remove the headlining.
   - Refer to the Headlining in Body Structure section.
3. Disconnect the sun roof drain hose at the sun roof frame side as shown in the figure.



665RS010

4. Disconnect the sun roof harness connection.

5. Remove two sun roof frame complete assembly fixing nuts (front side) and four fixing bolts (each side) from the frame complete, and then remove the sun roof frame complete assembly.

NOTE: Be sure to remove the frame complete while supporting it.

Installation

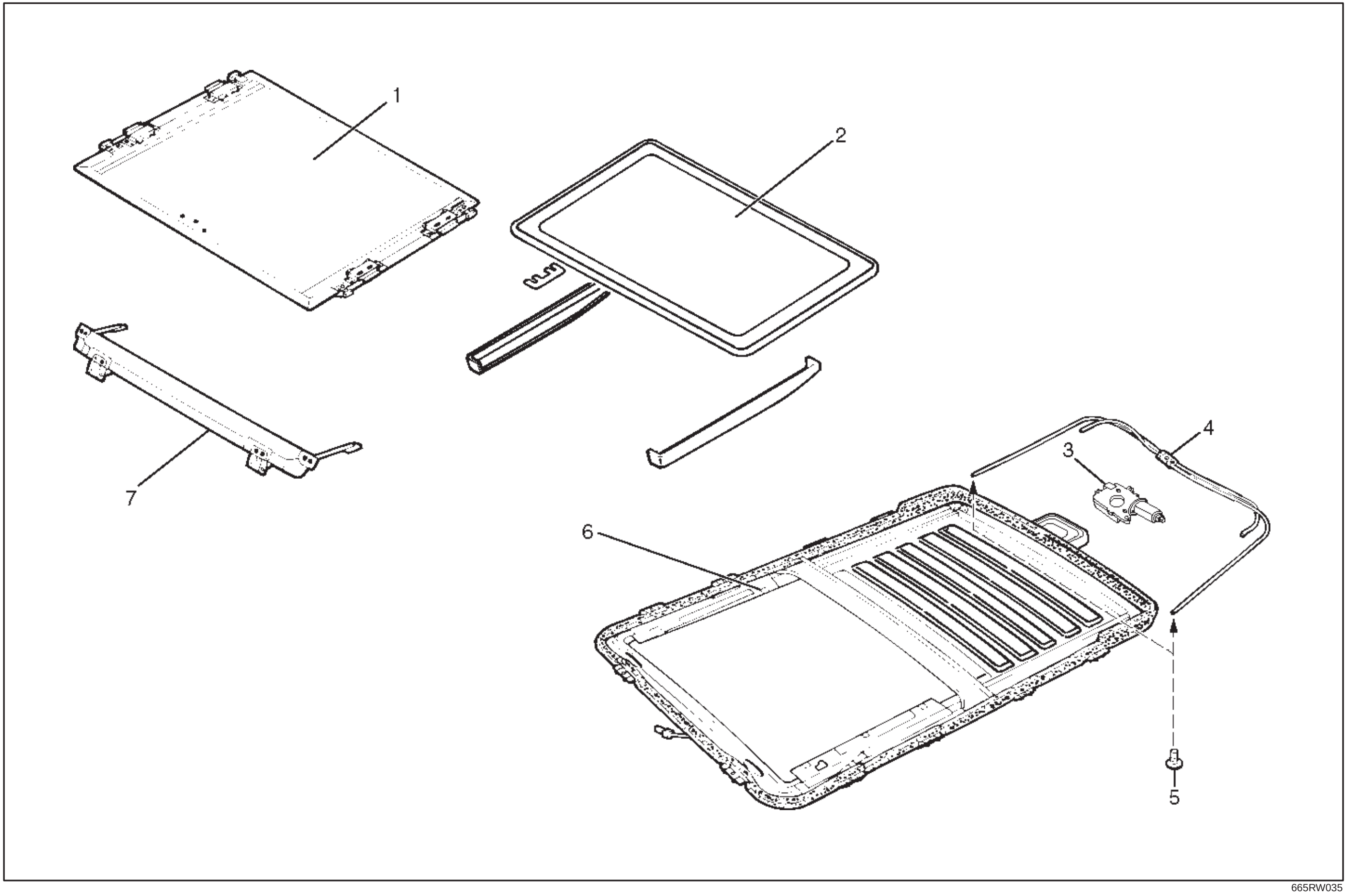
To install, follow the removal steps in the reverse order, noting the following points.

1. Tighten the sun roof frame complete assembly fixing bolts and nuts to the specified torque.

Torque: 10 N·m(87 lb in)

2. After installing the frame complete, loosen the sun roof glass fixing nuts and adjust the sun roof glass setting position.
   - Refer to the Sun Roof Glass in this section.

Disassembled View



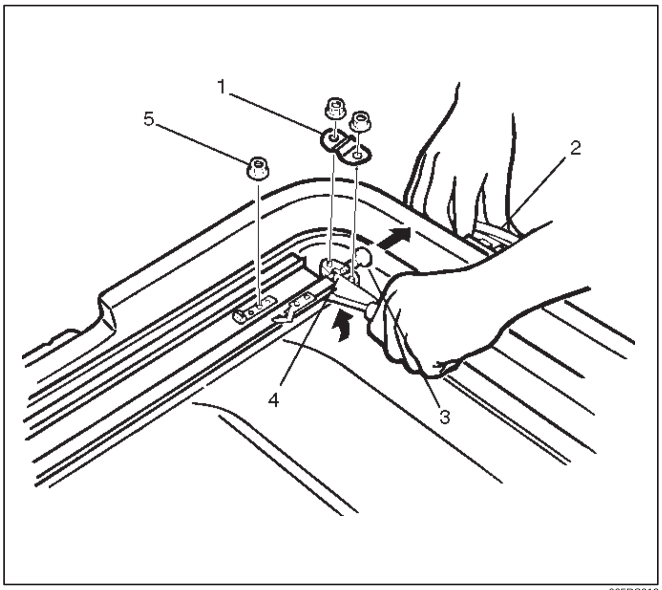
Legend

(1) Sunshade
(2) Sun Roof Glass
(3) Sun Roof Motor
(4) Sun Roof Drive Unit Assembly
(5) Outer Tube Fixing Screw
(6) Sun Roof Frame Assembly
(7) Sun Roof Deflector

Disassembly

1. Open the sun roof.
2. Remove the sun roof deflector fixing screws and then remove the sun roof deflector.
3. Remove the sunshade.
   - Refer to the Sunshade in this section.
4. Close the sun roof, remove the decoration cover and the fixing screws and then remove the sun roof glass.
5. If the shims are used between the sun roof set plate and the glass, note the number of the shims.

6. Disconnect the sun roof motor connector, remove the sun roof fixing nuts and screws, and then remove the sun roof motor.
7. Remove the cable outer tube(2) fixing screws.
8. Remove the cable outer tube fixing clamps(1) and guide rail fixing nuts(5).
9. Prying the guide rail a little with a screwdriver, draw the outer tube out of the grommet(3).
   - At this time, the inner cable(4) remains on the frame assembly.
10. Remove the sun roof frame assembly.

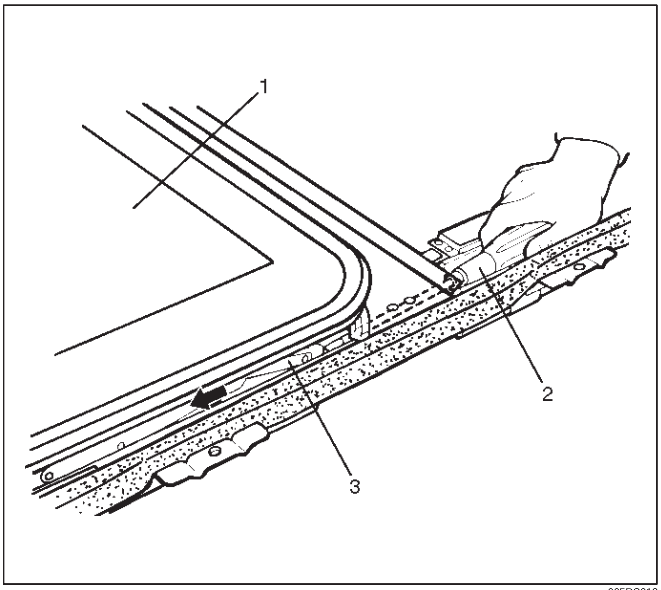


665RS012

Reassembly

To reassembly, follow the disassembly steps in the reverse order, noting the following points.

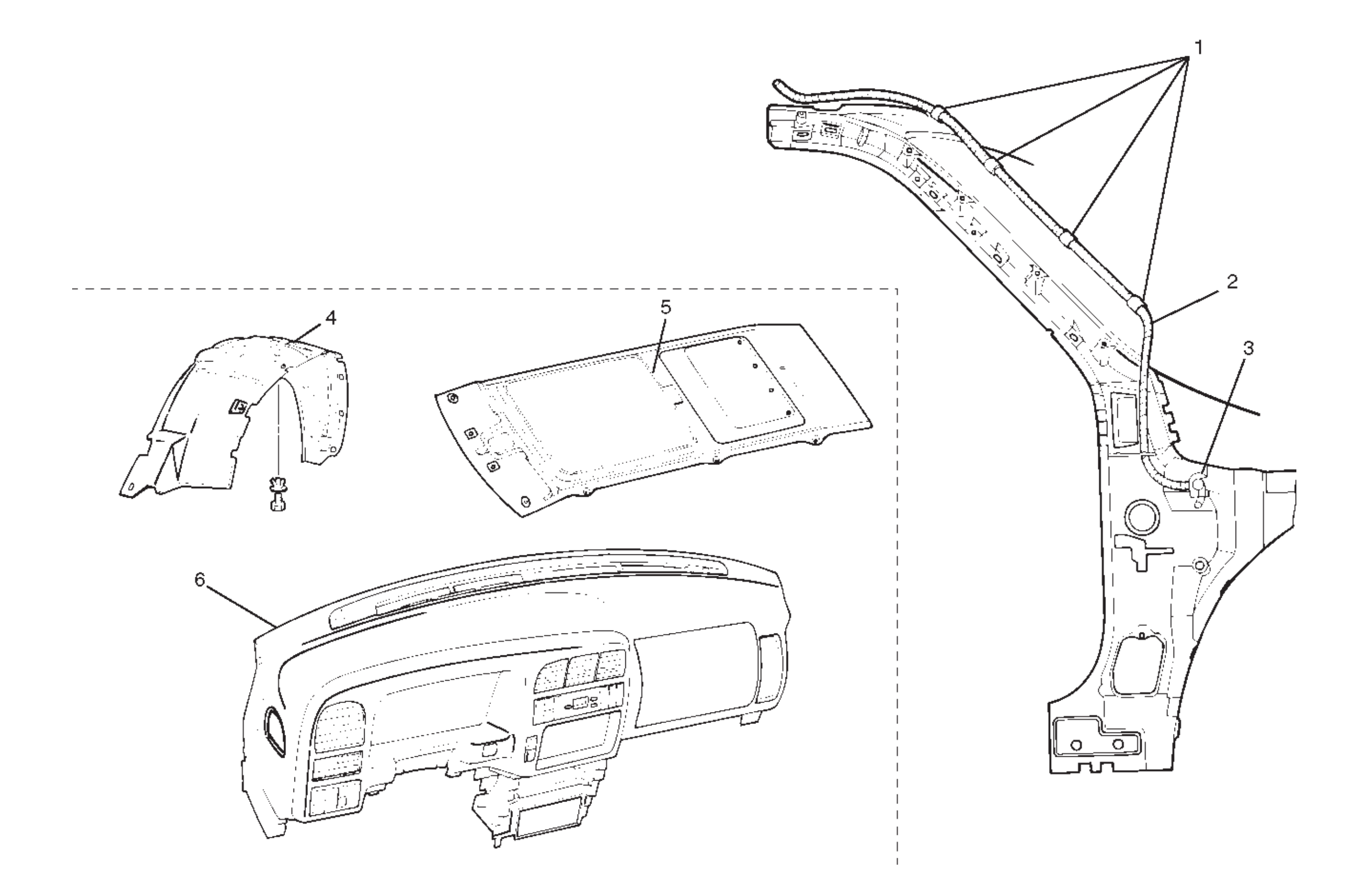
1. When installing the motor or drive unit, set the sun roof set plate in the full closed position by pushing the link(3) portion using the screwdriver(2).
2. When installing the sun roof glass(1) to the sun roof set plate, insert the original shims in the same position before removing the sun roof glass.



665RS013

Sun Roof Drain Hose (Front Side)

Sun Roof Drain Hose (Front Side) and Associated Parts



Legend
(1) Clip
(2) Sun Roof Drain Hose
(3) Grommet
(4) Front Inner Liner
(5) Headlining
(6) Instrument Panel Assembly

Removal

1. Remove the front inner liner.
2. Remove the headlining.
   - Refer to the Headlining in Body Structure section.
3. Remove the instrument panel assembly.
   - Refer to the Instrument Panel Assembly in Body Structure section.
4. Disconnect the drain hose at the frame complete side.
5. Apply the soap and water to the body panel grommet.
6. Pass the string from the sun roof frame side through the drain port side, and remove the drain hose from the hose fixing clips. Taking care not to allow the body panel grommet to be removed together with the hose, pull the drain hose only to the inside of the vehicle. (The string should be kept as it is.)

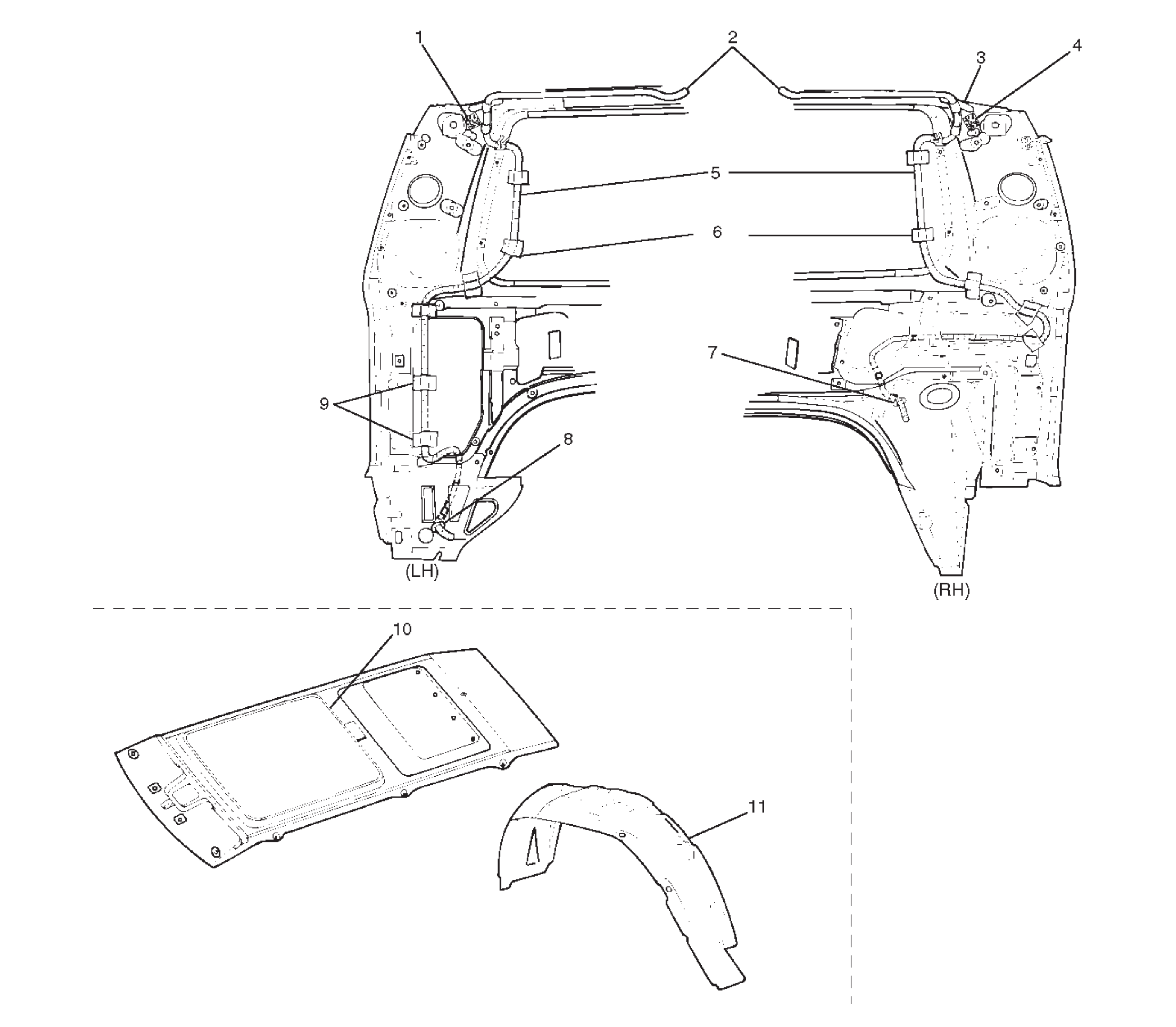
Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Apply the soap and water to the body panel grommet.
2. Install the drain hose from inside of the vehicle by utilizing, as a guide, the string passed during removal step.
3. The body panel grommet must not be twisted or caught in during installation.
4. Complete routing, avoiding extreme bends or curves.
5. After routing, install the trim with care not to allow the drain hose to be caught in.
6. Test the drain condition.
7. The protrusion of drain hose from the body panel must be within 50 mm (2.0 in). If it exceeds 50 mm (2.0 in) after correct routing, cut the leading edge so that the protrusion is within 50 mm (2.0 in).

Sun Roof Drain Hose (Rear Side)

Sun Roof Drain Hose (Rear Side) and Associated Parts



Legend

(1) Soft Tape
(2) Pipe
(3) Clip
(4) Soft Tape
(5) Sun Roof Drain Hose
(6) Tape
(7) Grommet
(8) Grommet
(9) Clip
(10) Headlining
(11) Rear Fender Inner Liner

Removal

1. Disconnect the battery ground cable.
2. Remove the rear fender inner liner.
3. Remove the headlining.
   - Refer to the Headlining in Body Structure section.
4. Disconnect the drive hose at the frame complete side.
5. Remove the hose fixing tapes and clips.
6. Apply the soap and water to the body panel grommet.
7. Pull the drain hose to the inside of the vehicle.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Apply the soap and water to the body panel grommet.
2. Insert the drain hose from inside of vehicle, restore routing, and fix with new soft tape and clip.
   If the grommet is removed during removal of drain hose, insert the grommet into drain hose from outside of the vehicle, and install on the body panel, avoiding any twisting.
3. After installing the drain hose, install the trim while taking care not to crush the drain hose.
   Also, care should be taken not to allow the drain hose connected to the pipe to be caught in.
4. Test the drain condition.
5. The protrusion of the drain hose from the body panel must be within 50 mm (2.0 in). If it exceeds 50 mm (2.0 in) after correct routing, cut the leading edge so that the protrusion is within 50 mm (2.0 in).

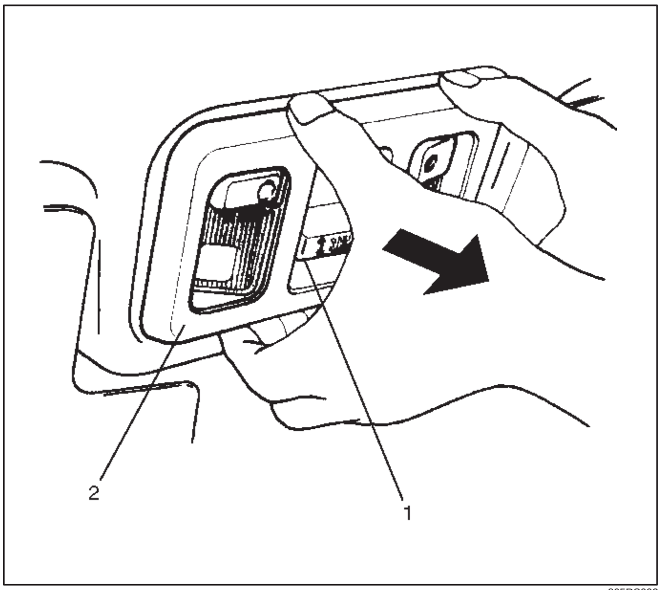
Sun Roof Switch

General Description

Sun roof operation can be controlled by pushing continuously the sun roof switch to activate the sun roof control unit and sun roof motor.
While the switch is being pushed to the “OPEN” side, the sun roof stops about 165 mm (6.5 in) before fully open position. Push the switch again to the “OPEN” side to open it fully. When the switch is being continuously pushed to the “CLOSE” side, the sun roof stops about 180 mm (7.1 in) short of the fully closed position and remains in this state. Push the switch again to the “CLOSE” side to close it completely.

Removal

1. Disconnect the battery ground cable.
2. Pull down the switch housing(2) and disconnect the sun roof switch and map light connectors to remove the sun roof switch(1).



805RS002

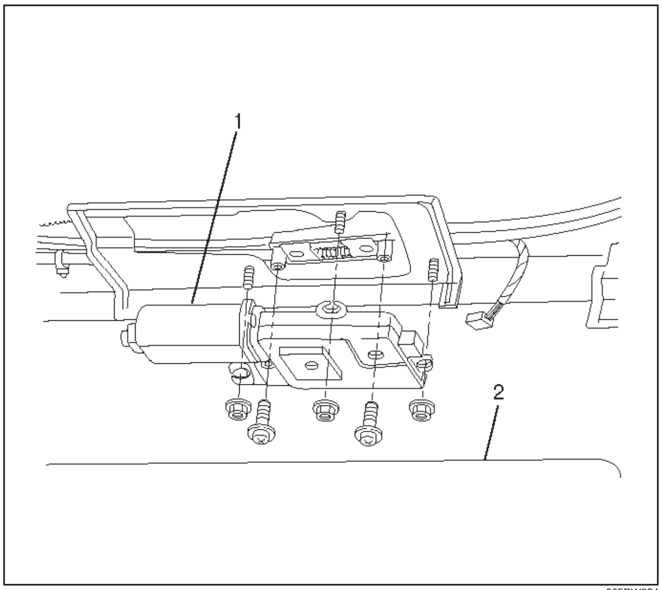
Installation

To install, follow the removal steps in the reverse order.

Sun Roof Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the headlining(2).
   - Refer to the Headlining in Body Structure section.
3. Disconnect the connector, and remove three nuts and two screws to remove the sun roof motor(1).



665RW034

Installation

To install, follow the removal steps in the reverse order.

Main Data and Specifications

Torque Specifications

Application	N·m	Lb Ft	Lb In
Sun Roof Frame Complete Assembly Fixing Bolts	10	—	87
Sun Roof Glass Fixing Screws	10	—	87

TROOPER

BODY AND ACCESSORIES

EXTERIOR / INTERIOR TRIM

CONTENTS

Service Precaution

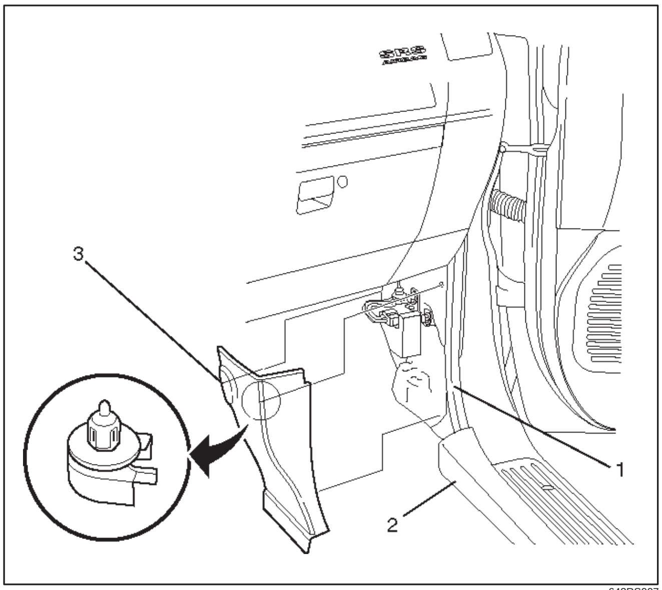
WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Dash Side Trim Panel

Removal

1. Disconnect the battery ground cable.
2. Remove the front door sill plate(2).
3. Remove the dash side trim panel(3).
   - Turn up the door inner seal(1) of the body panel to remove the clips of the trim panel.
   - Take care not to damage the harness and the controller on the back of the trim panel.



643RS007

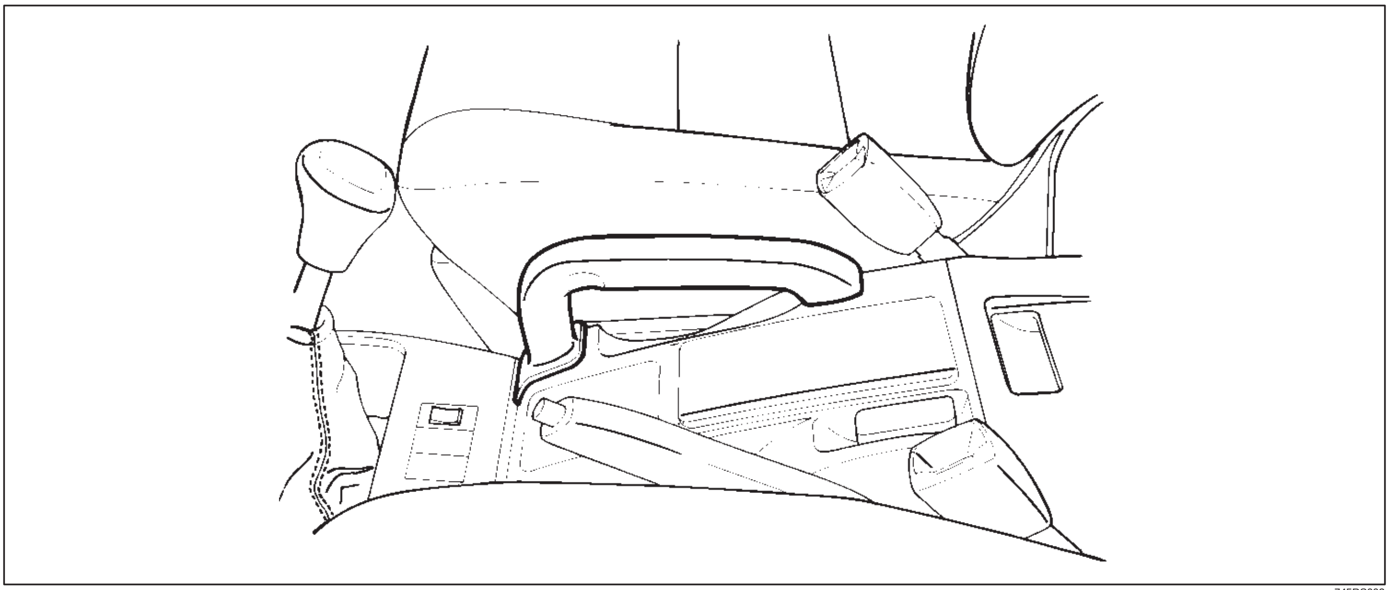
Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Lap the door inner seal over the trim panel to install them securely to the body panel.

Assist Grip

Parts Location



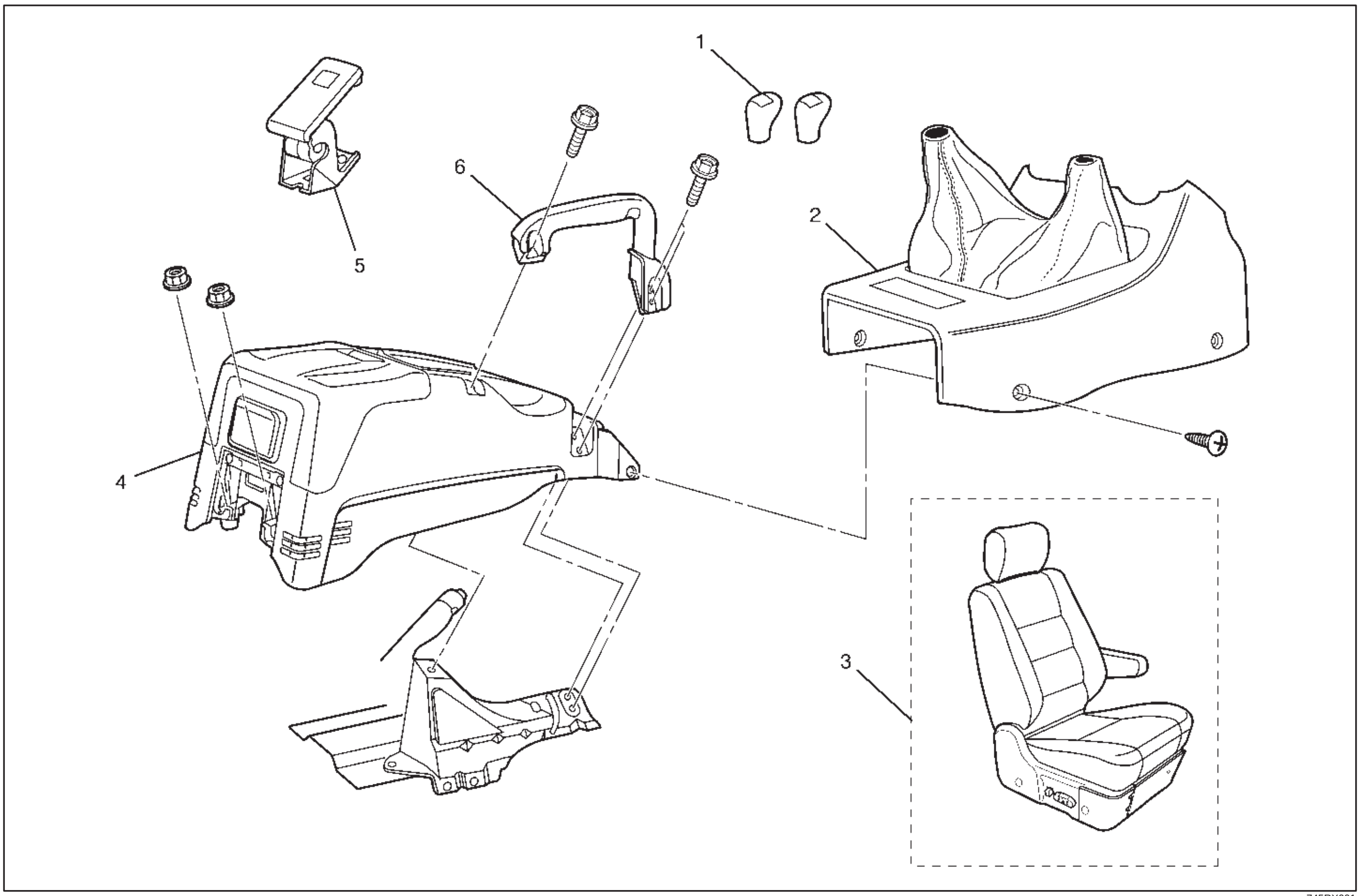
745RS002

Removal and Installation

- Refer to the Consoles removal and installation steps in this section.

Consoles

Consoles and Associated Parts



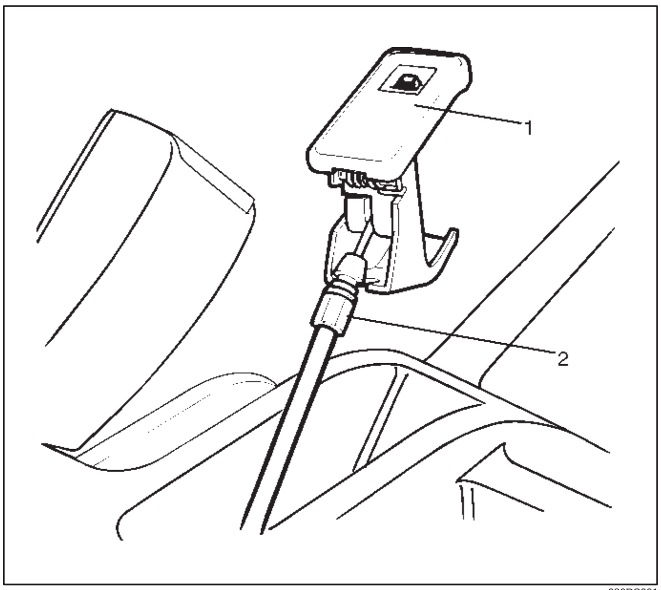
745RX001

Legend

(1) Shift Knob (M/T) / Transfer Knob (A/T)
(2) Front Console Assembly
(3) Front Seat Assembly (RH)
(4) Center Console Assembly
(5) Fuel Filler Lid Opener
(6) Assist Grip

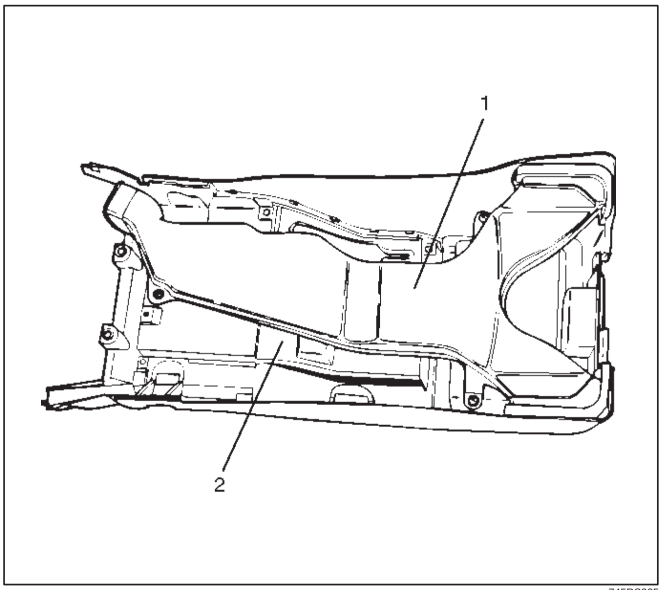
Removal

1. Disconnect the battery ground cable.
2. Remove the shift knob (M/T) / transfer knob (4x4 only).
3. Remove the front console assembly.
   - Remove four fixing screws and disconnect the switch connectors.
4. Remove the front seat assembly(RH).
   - Refer to Front Seat Assembly in Seats section.
5. Remove the assist grip.
   - Remove three bolts.
6. Remove the fuel filler lid opener.
   - Remove the fuel filter lid opener(1) and disconnect the cable(2).



686RS001

7. Remove the center console assembly(2).
   - Remove two fixing screws on the front side.
     Open the rear cover, remove two nuts, then the center console assembly.
   - Remove the rear heater duct(1) from the center console.



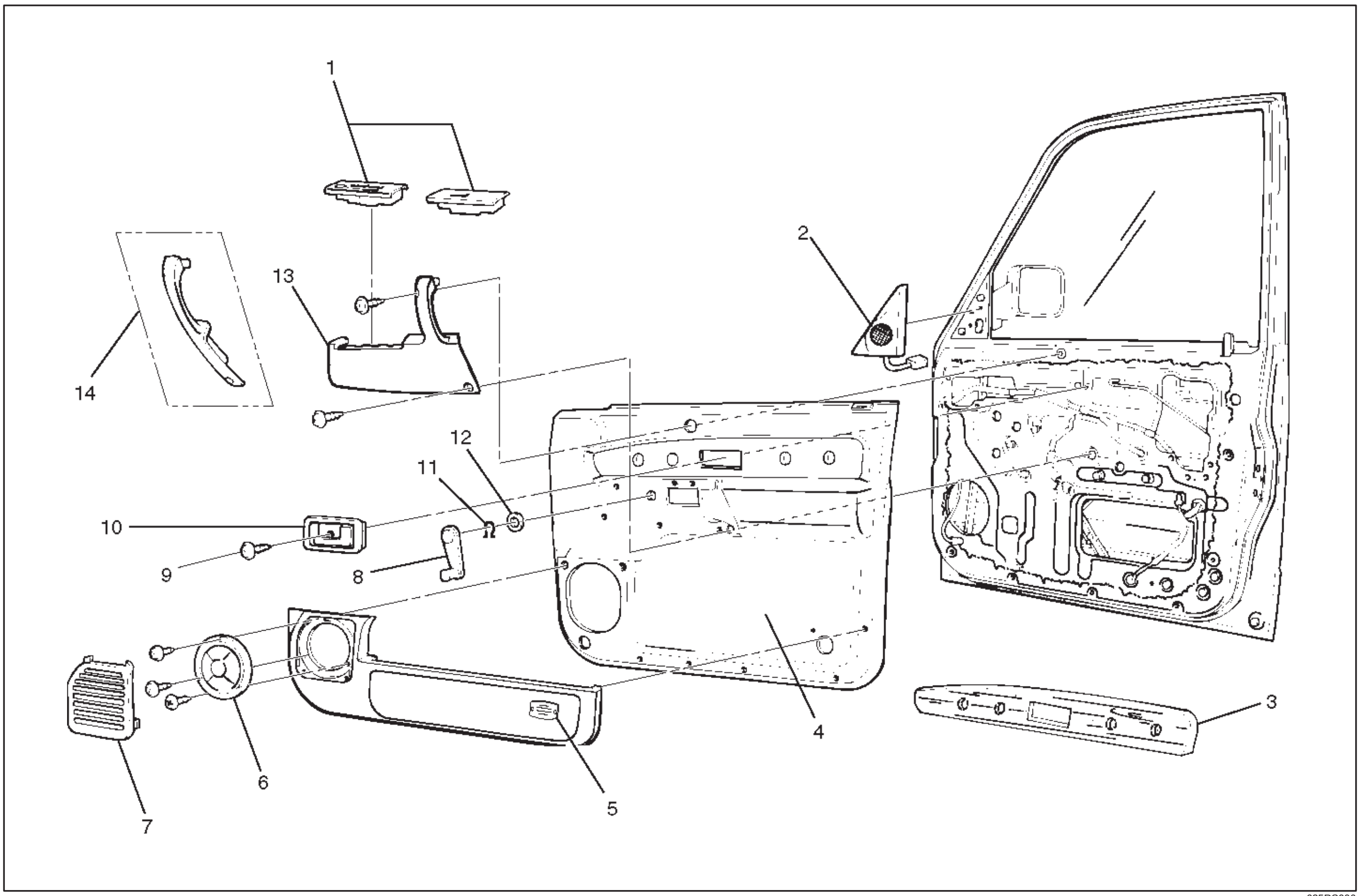
745RS005

Installation

To install, follow the removal steps in the reverse order.

Front Door Trim Panel

Front Door Trim Panel and Associated Parts



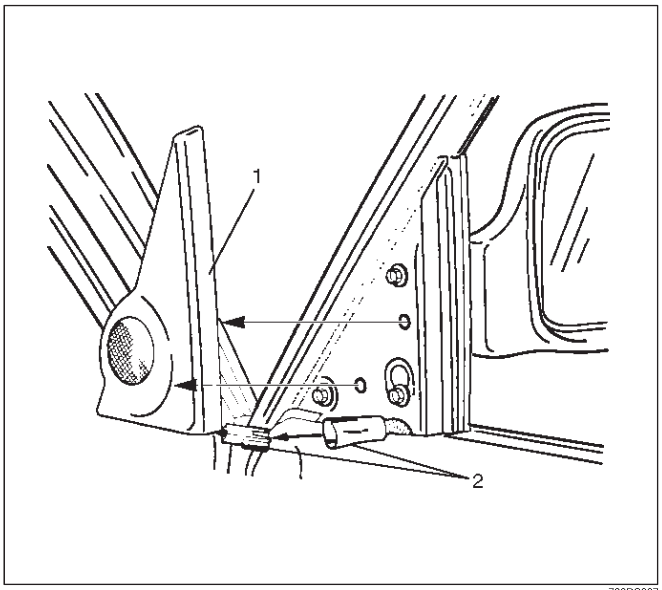
Legend

(1) Power Window Switch
(2) Door Mirror Cover/Tweeter
(3) Door Wood Panel
(4) Door Trim Panel
(5) Courtesy Light
(6) Front Speaker
(7) Speaker Cover
(8) Regulator Handle
(9) Inside Handle Fixing Screw
(10) Inside Handle
(11) Hook
(12) Washer
(13) Inside Pull Handle
(14) Inside Pull Handle (W/O Power Window)

Removal

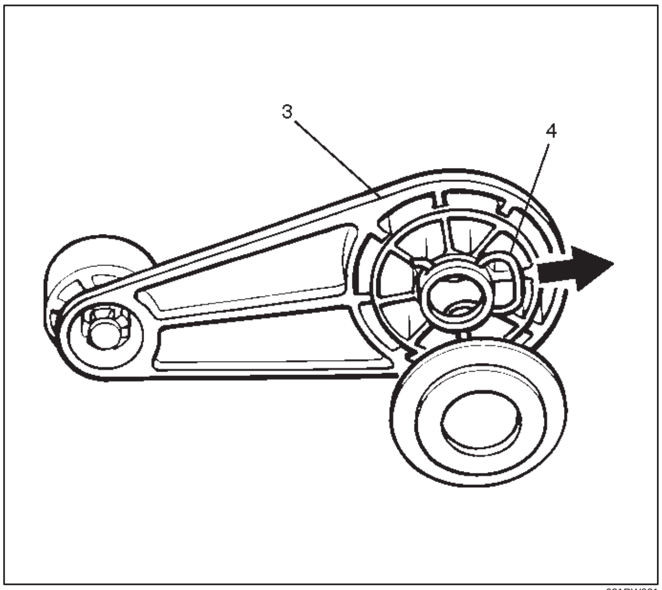
1. Disconnect the battery ground cable.

2. Remove the door mirror cover/tweeter(1).
   - On a model equipped with a tweeter, remove the connector(2).



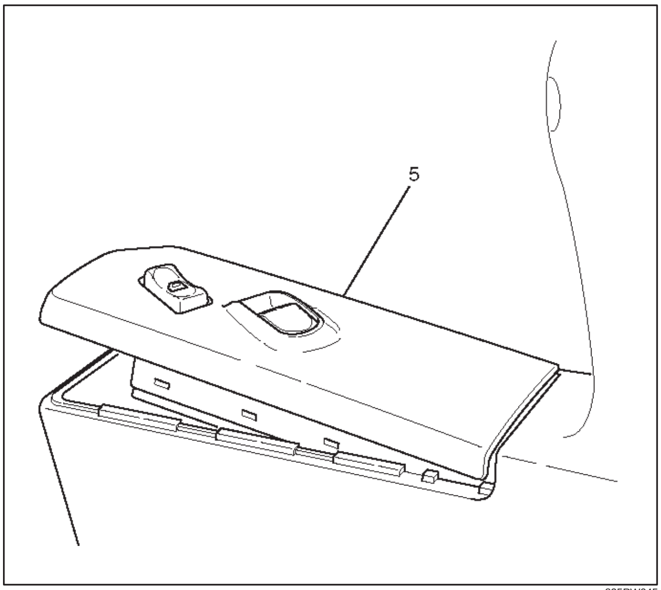
720RS007

3. Remove the regulator handle(3).
   - Pull the hook(4) out and remove the regulator handle.



631RW001

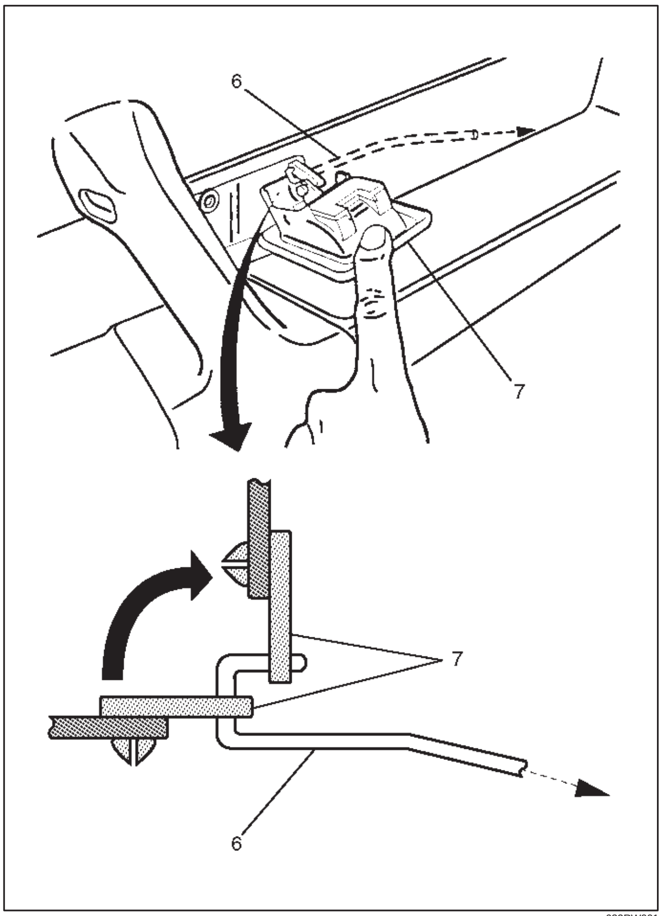
4. Remove the power window switch(5).
   - Pry the power window switch out and disconnect the switch connector.



825RW045

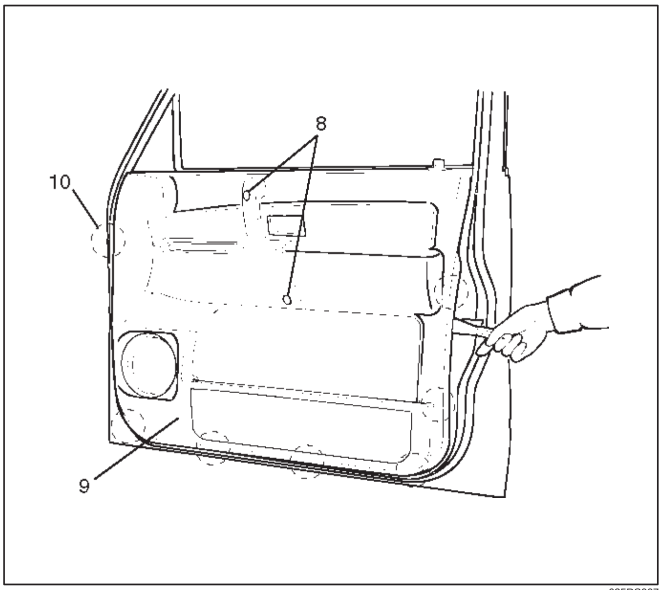
5. Remove the speaker cover.
6. Remove the front speaker.
   - Remove the front speaker fixing screws in order to disconnect the speaker connector.
7. Remove the inside handle fixing screw.
   - Remove the screw that fixes the inside handle(7), slide the inside handle to the position illustrated, and leave it there for the moment.

CAUTION: Take care not to impose excessive force on the inside handle link(6), lest this link is elongated, which could make it impossible to operate the door with the inside handle.



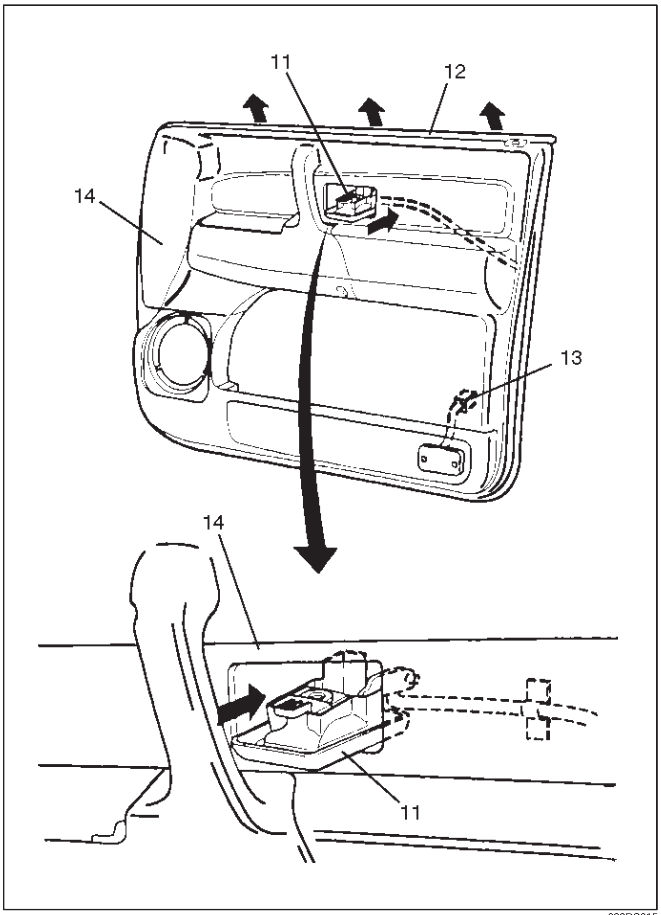
632RW001

8. Remove the door trim panel(9).
   - Remove two fixing screws(8) in order to take off seven clips(10) from the door panel.



635RS007

- Disconnect the courtesy light connector(13) to lift the door trim panel(14) and unlock the engagement of the waist seal(12) section. Then, pass the inside handle(11) through the mounting hole of the trim panel, and detach the trim panel.



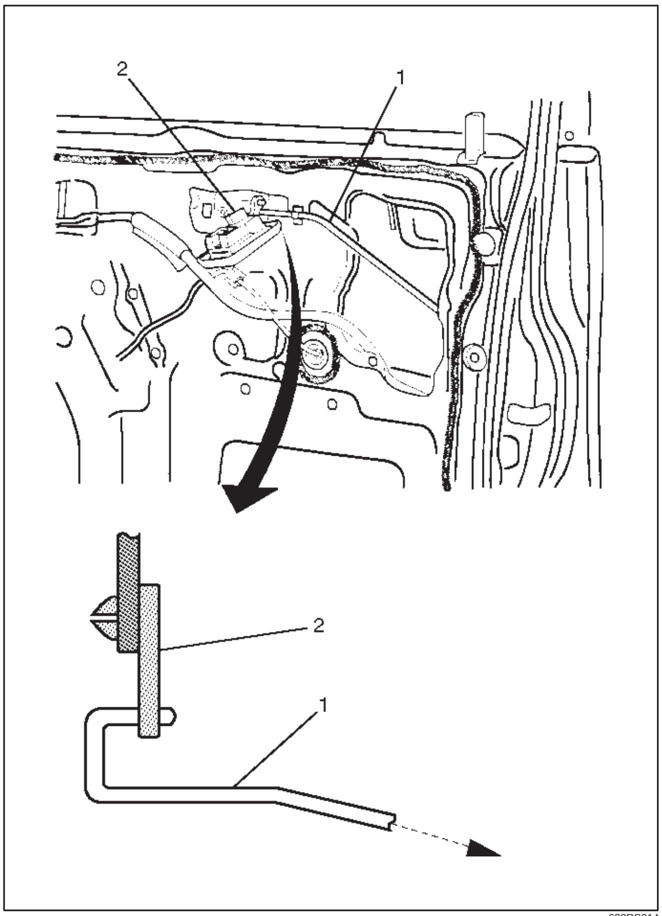
632RS015

9. Remove the inside handle.
10. Remove the door wood panel.
    - Refer to the Door Wood Panel Assembly in this section.

Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. When installing the inside handle(2), assemble it temporarily to the inside handle link(1).

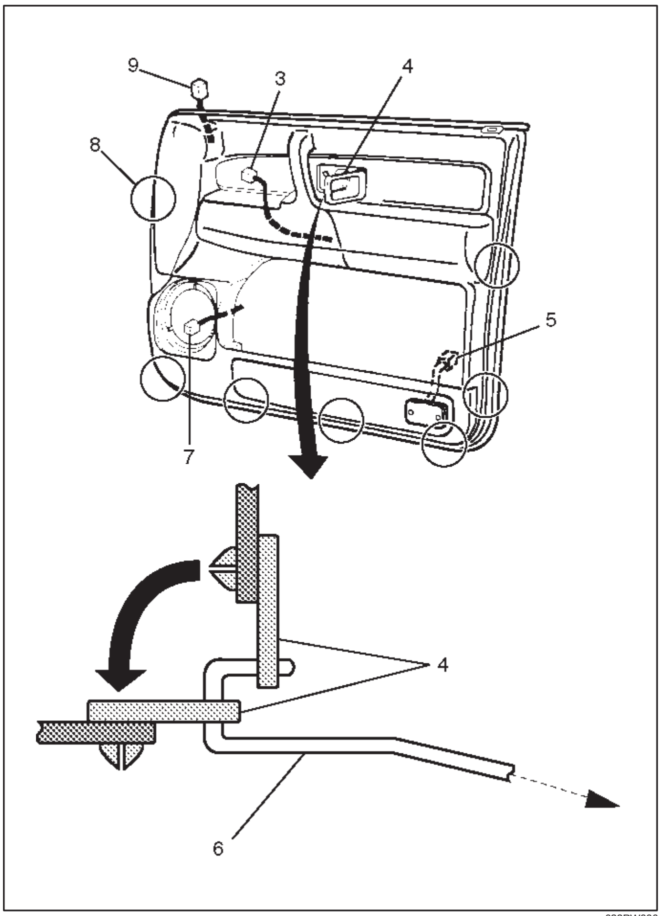


632RS014

2. Pass the inside handle(4) through the mounting hole of the trim panel and assemble the trim panel.

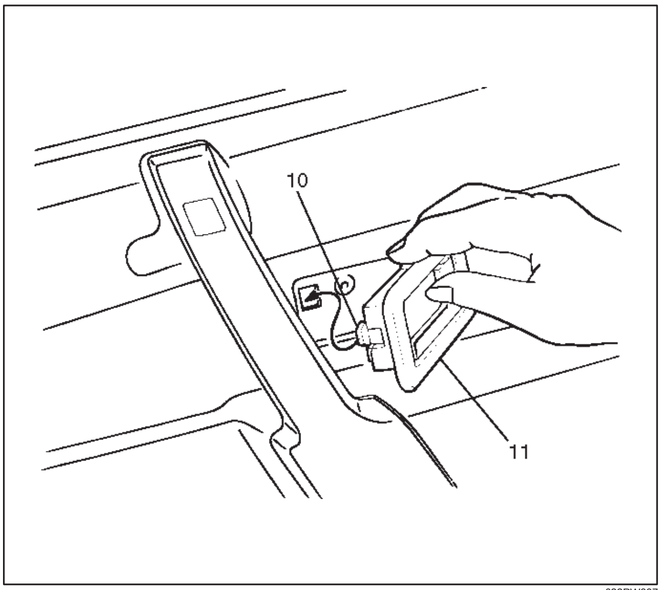
   Engage seven clips(8) into the door panel. Also, connect the courtesy light connector(5) and leave the connectors of the speaker(7), tweeter(9) and power window(3) drawn out to their prescribed positions, so that they will not be caught.

   Then, put the inside handle(4) to the normal position of the inside handle link(6).



632RW006

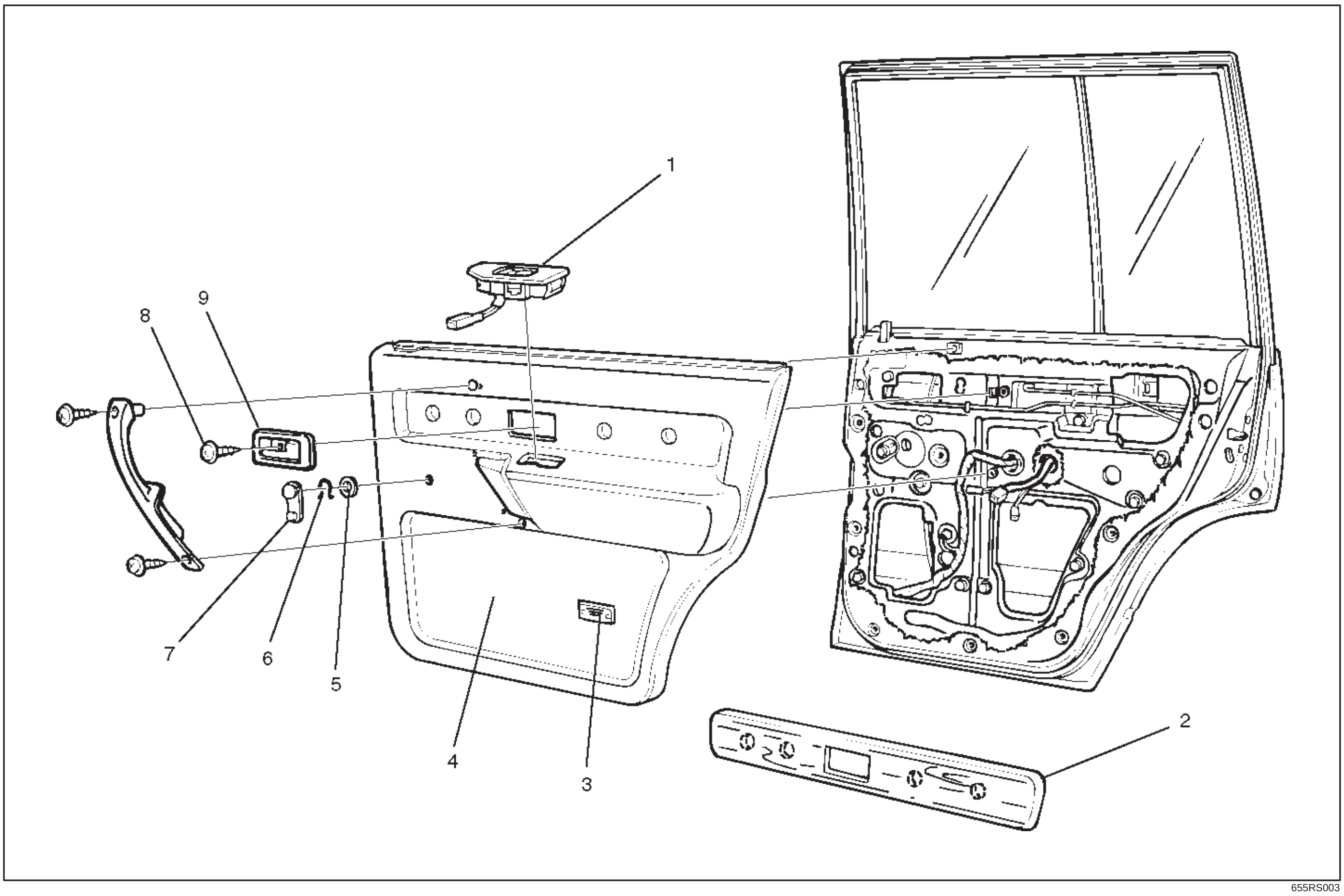
3. Fit the claw(10) of the inside handle(11) securely into the hole of the door panel and fix the inside handle with the screw.



632RW007

Rear Door Trim Panel

Rear Door Trim Panel and Associated Parts

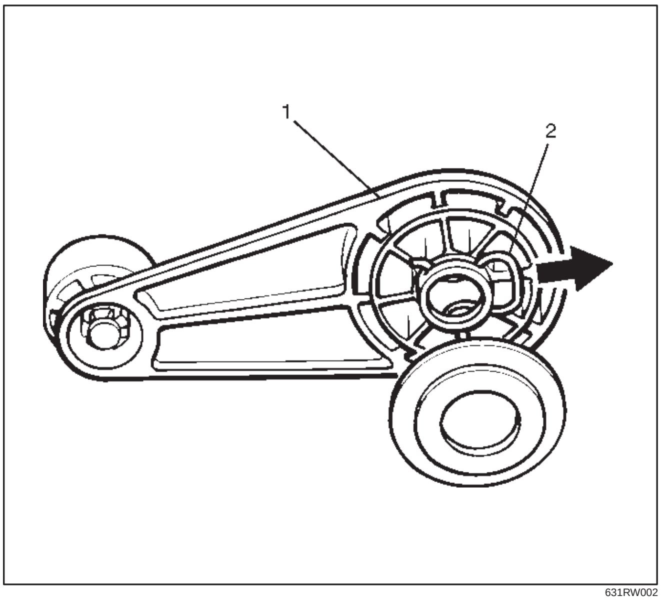


Legend

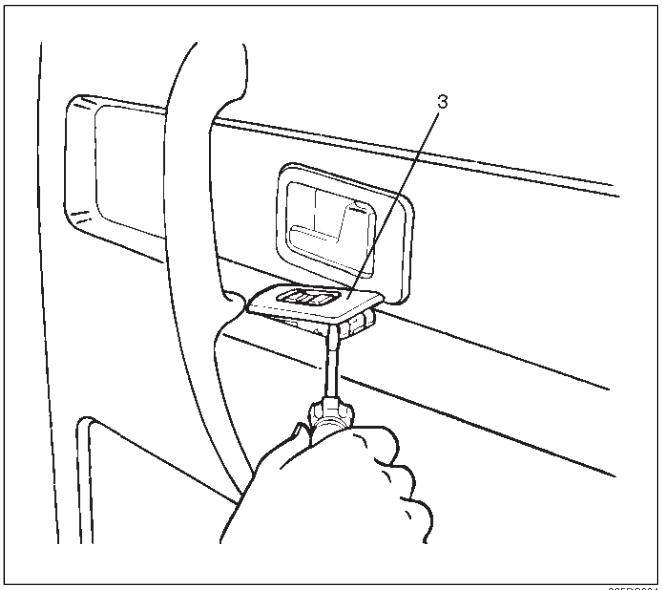
(1) Power Window Switch
(2) Door Wood Panel
(3) Courtesy Light
(4) Door Trim Panel
(5) Washer
(6) Clip
(7) Regulator Handle
(8) Inside Handle Fixing Screw
(9) Inside Handle

Removal

1. Disconnect the battery ground cable.
2. Remove the regulator handle(1).
   - Pull the hook(2) out and remove the regulator handle.



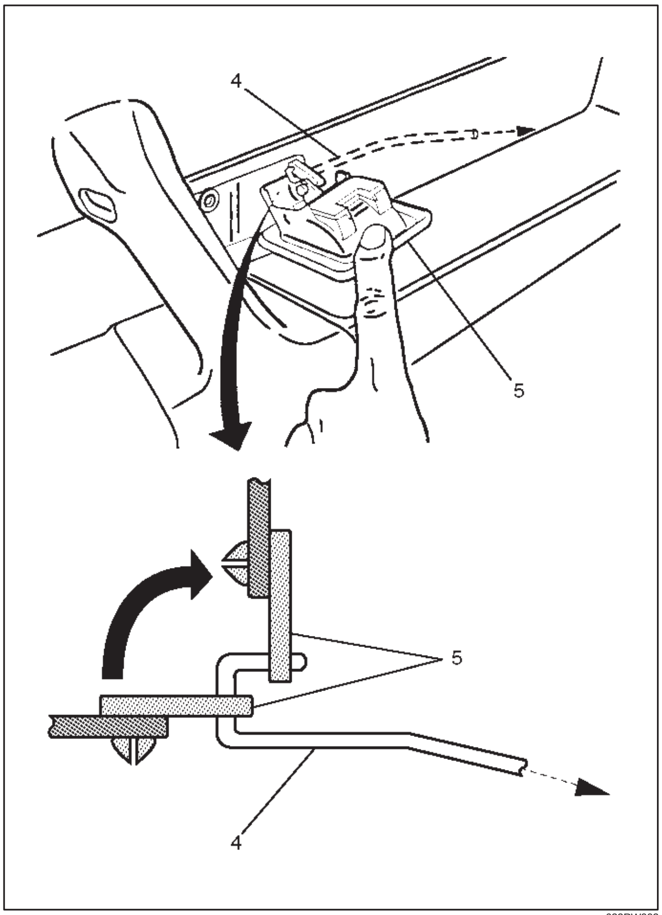
3. Remove the power window switch(3).
   - Pry the power window switch out and disconnect the switch connector.



825RS084

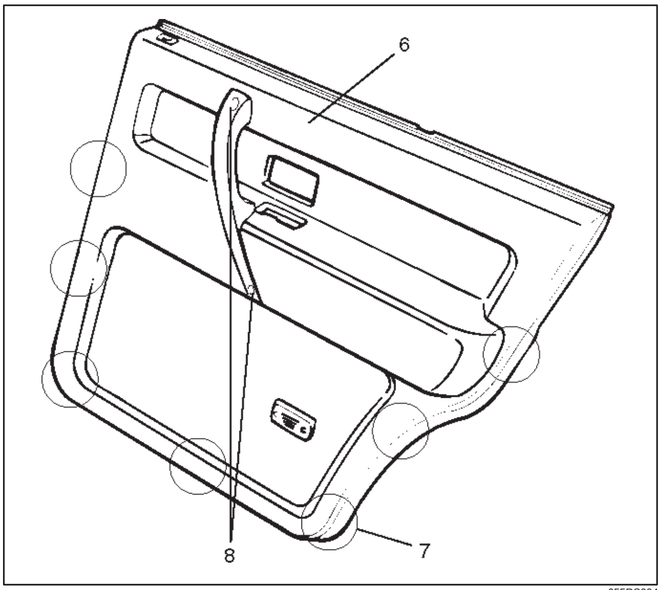
4. Remove the inside handle fixing screw.
   - Remove the screw that fixes the inside handle(5), slide the inside handle to the position illustrated, and leave it there for the moment.

CAUTION: Take care not to impose excessive force on the inside handle link(4), lest this link be elongated, which could make it impossible to operate the door with the inside handle.



632RW002

5. Remove the door trim panel(6).
   - Remove two fixing screws(8) to take off seven clips(7) from the door panel.



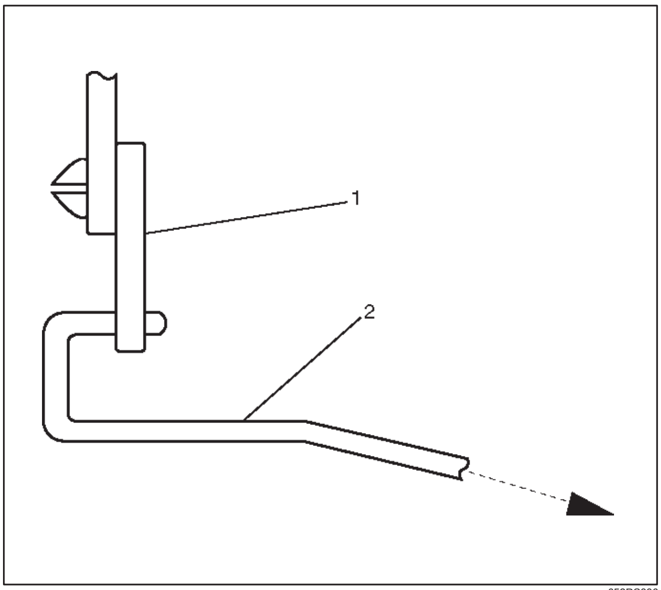
655RS004

   - Unplug the courtesy light connector to lift the trim panel and unlock the engagement of the waist seal section. Then, pass the inside lever through the mounting hole of the trim panel, and detach the trim panel.
6. Remove the inside handle.
7. Remove the door wood panel.
   - Refer to the Door Wood Panel Assembly in this section.

Installation

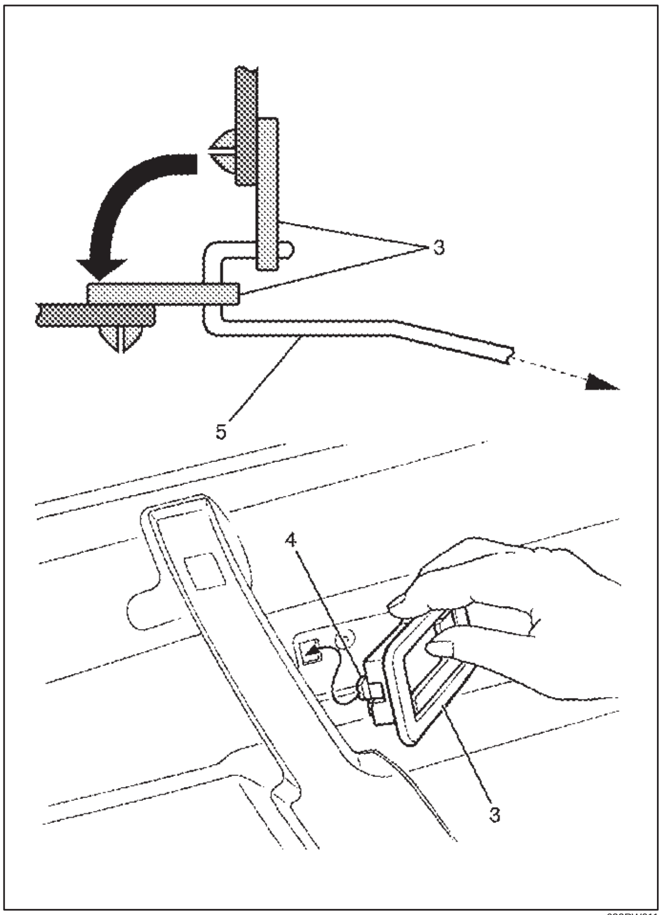
To install, follow the removal steps in the reverse order, noting the following point.

1. When installing the inside handle(1), assemble temporarily to the inside handle link(2).



652RS006

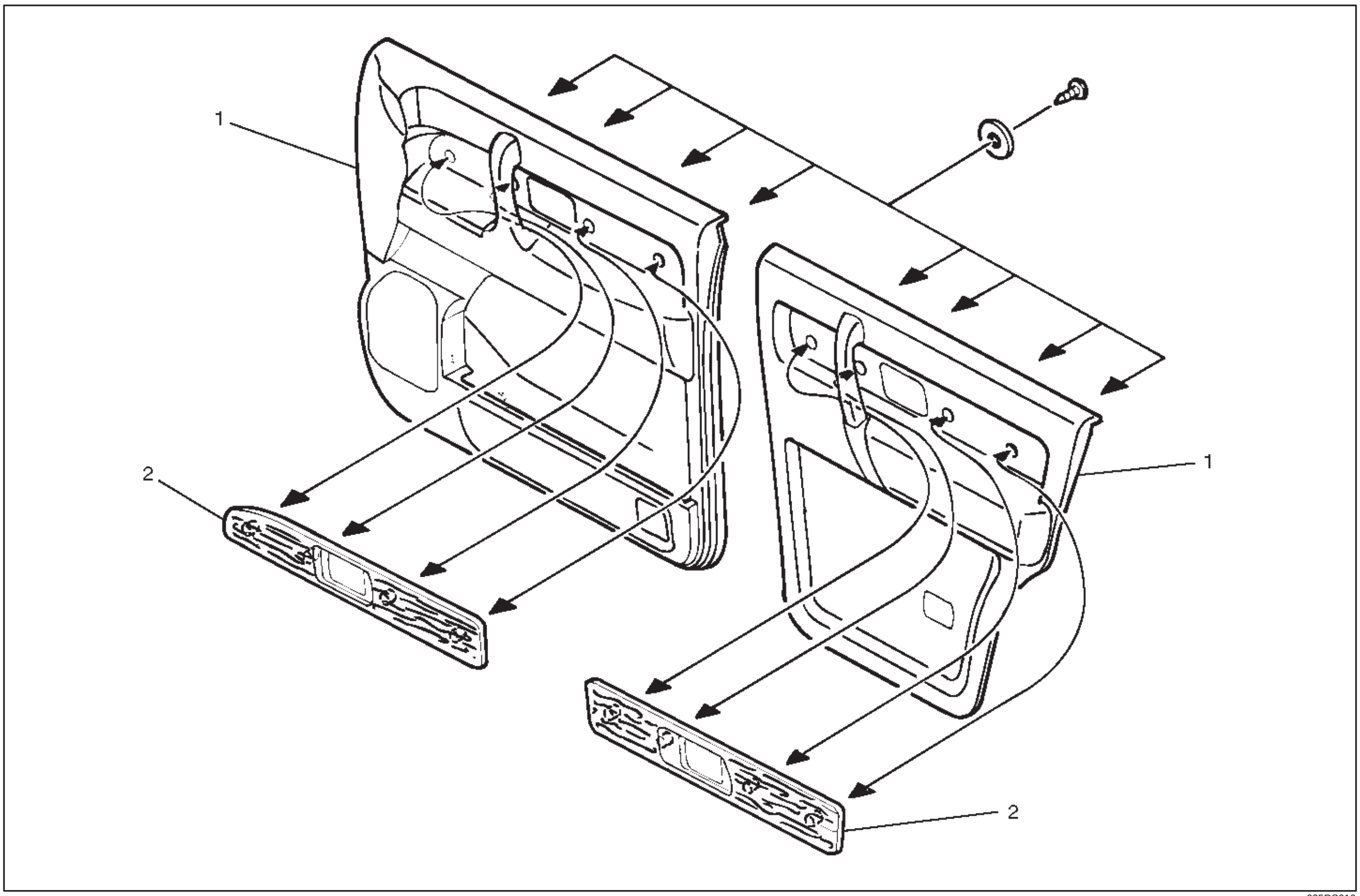
2. Pass the inside handle through the mounting hole of the trim panel. Assemble the trim panel. Engage securely seven clips into the door panel. Also, connect the courtesy light connector. Leave the connector of the power window drawn out to its prescribed position, so that it will not caught.
3. Put back the inside handle(3) to the original position of the link(5). Fit the claw(4) of the inside handle securely into the hole of the door panel. Fix the handle with the screw.



632RW011

Door Wood Panel Assembly

Door Wood Panel Assembly and Associated Parts



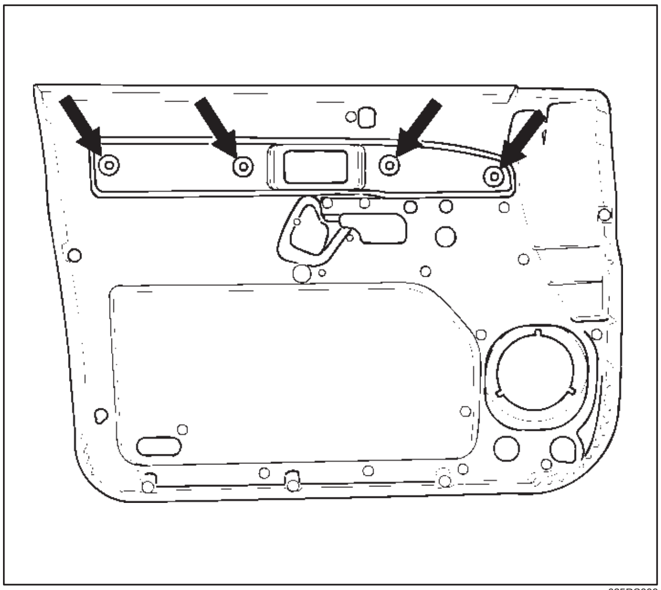
Legend

(1) Door Trim Panel
(2) Door Wood Panel Assembly

Removal

1. Remove the door trim panel(1).
   - Refer to the Front / Rear Door Trim Panel in this section.
2. Remove the door wood panel assembly(2).
   - Remove four door wood panel assembly fixing screws and washers.

NOTE: The removal and installation steps are common to both front and rear doors.

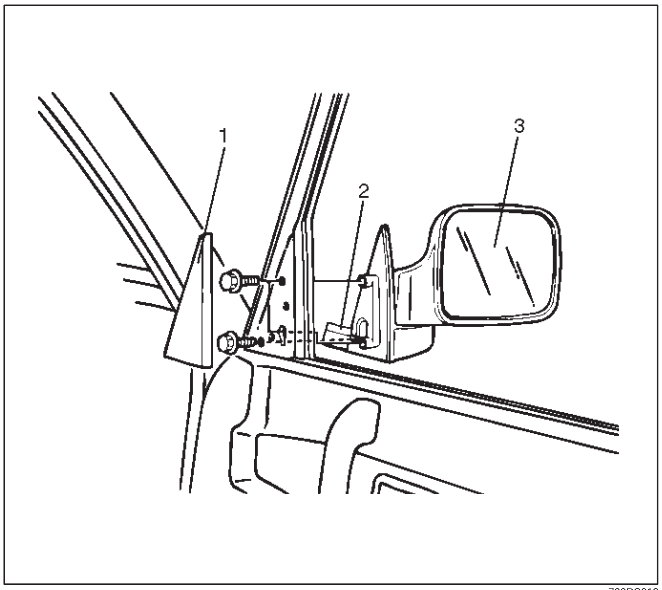


Installation

To install, follow the removal steps in the reverse order.

Door Mirror

Door Mirror and Associated Parts



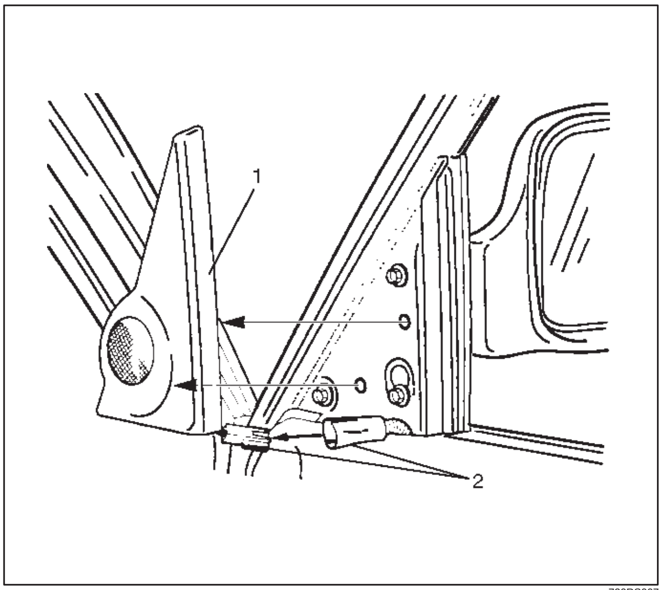
720RS012

Legend

(1) Door Mirror Cover / Tweeter
(2) Door Mirror Connector
(3) Door Mirror

Removal

1. Disconnect the battery ground cable.
2. Remove the door mirror cover(1).
   - Remove the connectors(2) and the door mirror cover, if equipped with a tweeter.



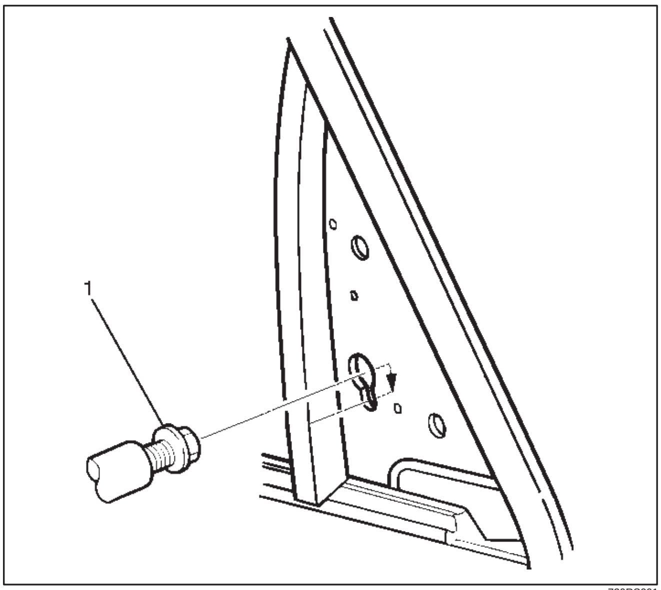
720RS007

3. Remove the door mirror connector.
4. Remove the door mirror.

Installation

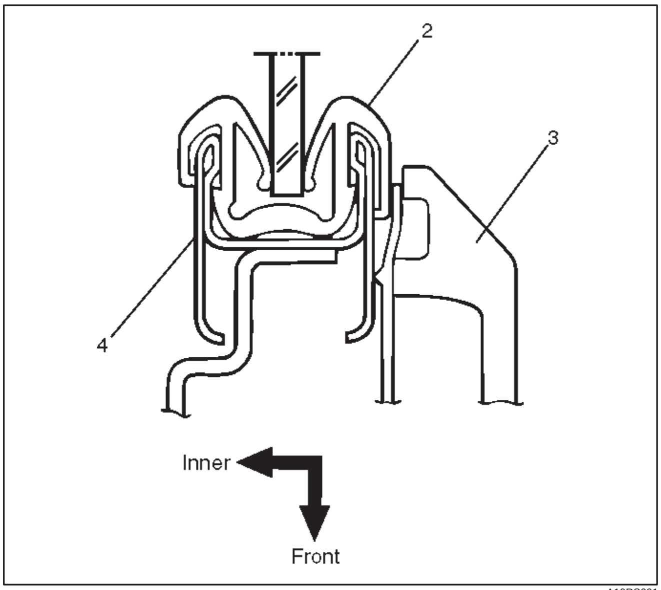
To install, follow the removal steps in the reverse order, noting the following points.

1. When you install the door mirror, install the bolt(1) to the mirror temporarily, hook the bolt to the door side hole and tighten the bolt from the inside.



720RS001

2. When installing the door mirror, hold the glass run lip(2) between the door mirror base(3) and the center sash(4).



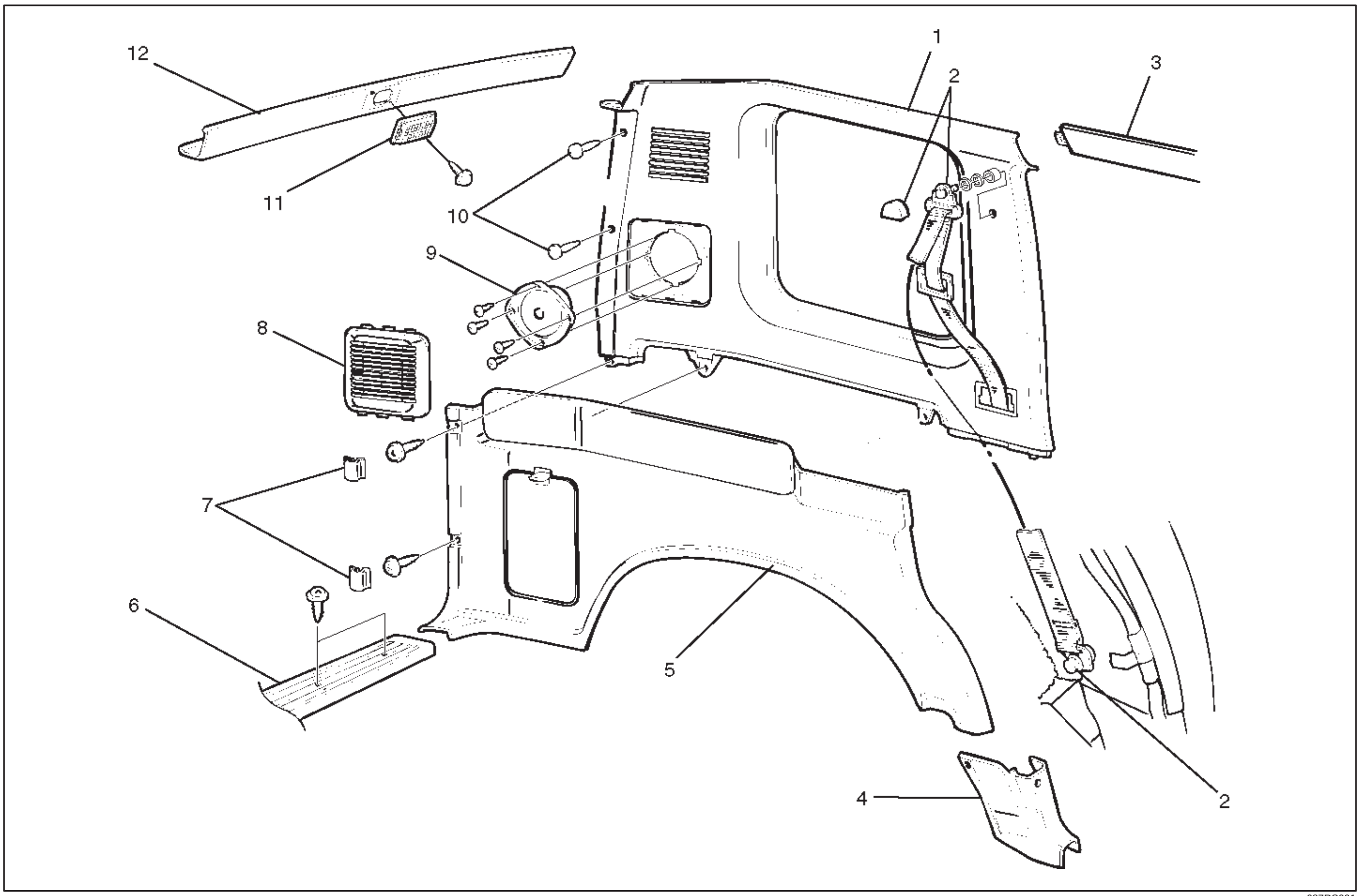
A10RS001

3. Tighten the door mirror fixing bolts to the specified torque.

Torque: 8 N·m (69 lb in)

Luggage Side and Quarter Upper Trim Cover

Luggage Side, Quarter Upper Trim Cover and Associated Parts



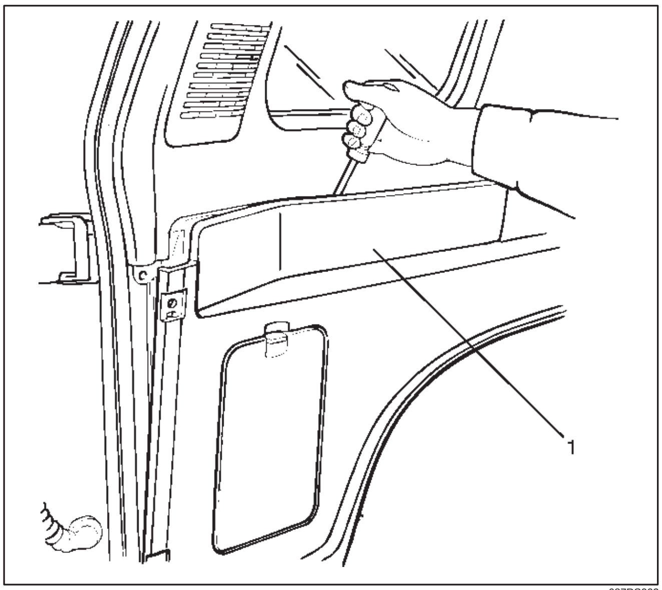
687RS001

Legend

(1) Quarter Upper Trim Cover
(2) Rear Seat Belt Anchor Bolt Cover and Anchor Bolt
(3) Roof Side Trim Cover
(4) Luggage Side Lower Cover
(5) Luggage Side Trim Cover
(6) Rear End Floor Trim Cover
(7) Luggage Side Cap
(8) Speaker Grille
(9) Rear Speaker
(10) Clip
(11) Luggage Room Light
(12) Rear Roof Trim Cover

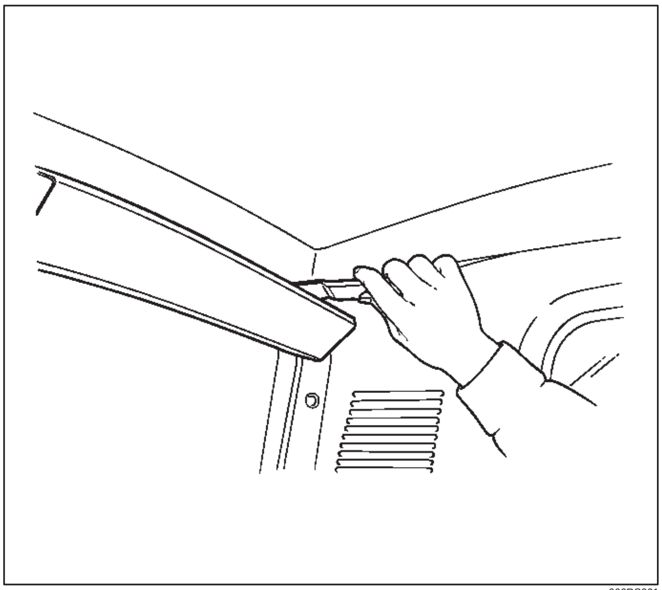
Removal

1. Disconnect the battery ground cable.
2. Remove the rear end floor trim cover.
3. Remove the luggage side cap.
4. Remove the luggage side lower cover.
5. Remove the luggage side trim cover (1).
   - Remove the rear side fixing screws and pry the trim cover retainers free from the body panel and the upper trim cover.

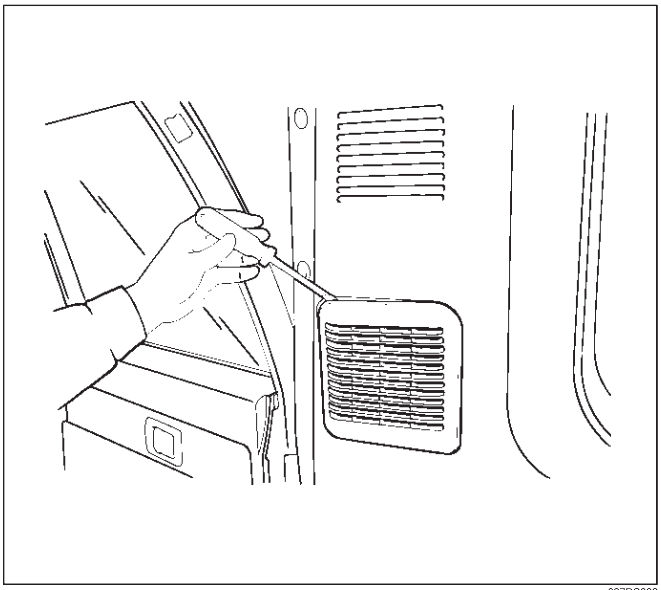


687RS002

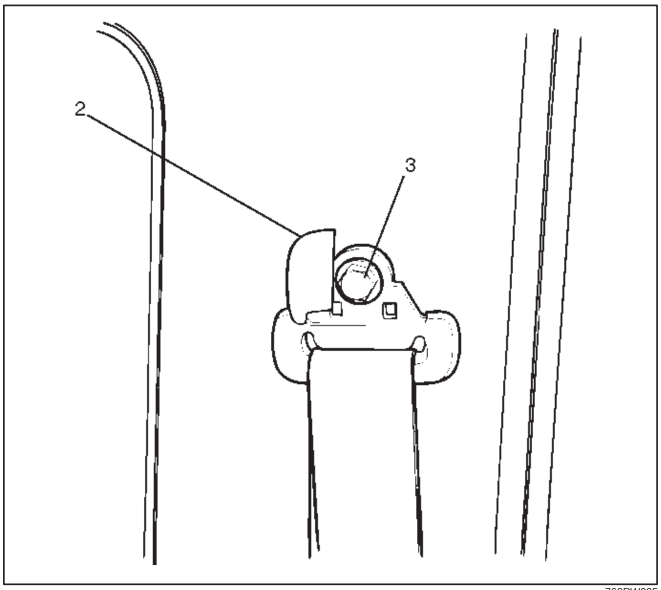
6. Remove the luggage room light.
   - Remove the luggage room light lens and the fixing screws.
   - Disconnect the luggage room light connector.
7. Remove the rear roof trim cover.
   - Pry the trim cover retainers free from the body panel.


666RS001

8. Remove the speaker grille.

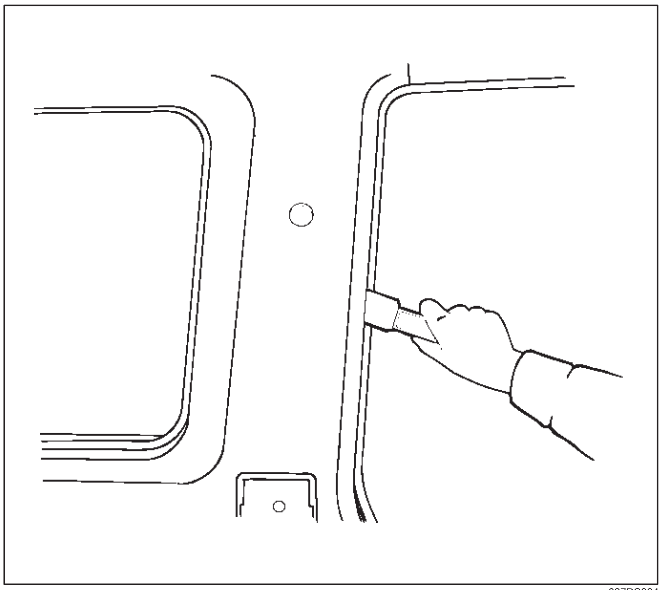

687RS003

9. Remove the rear speaker.
   - Remove the rear speaker fixing screws and disconnect the connector.
10. Remove the rear seat belt anchor bolt cover (2) and the anchor bolt (3).



760RW005

11. Remove the quarter upper trim cover.
    - Remove the rear side clips of the trim cover and pry the quarter upper trim cover retainers free from the body panel.


687RS004

Installation

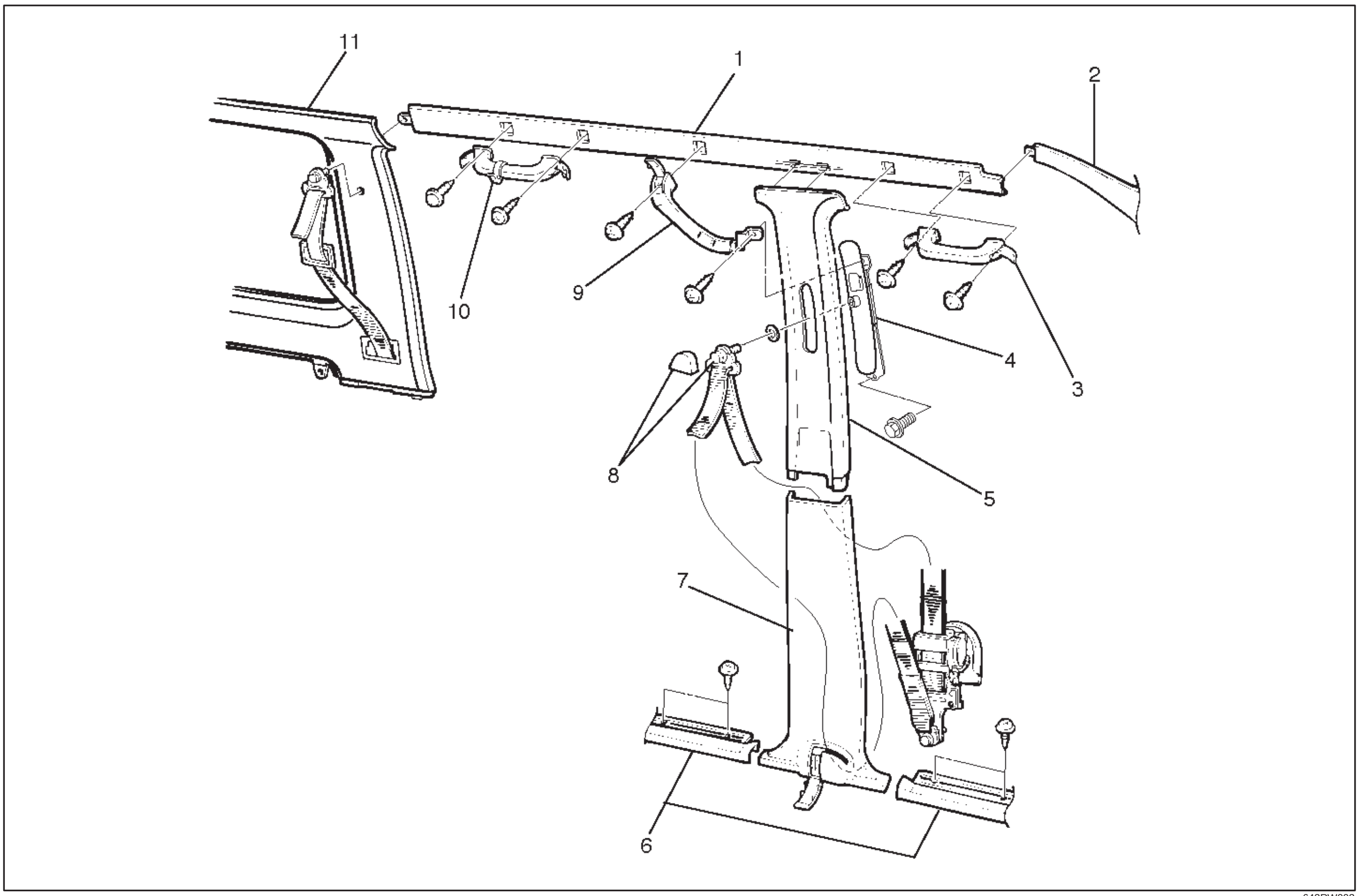
To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the seat belt anchor bolt to the specified torque.

Torque: 39 N·m (29 lb ft)

Center Pillar and Roof Side Trim Cover

Center Pillar, Roof Side Trim Cover and Associated Parts



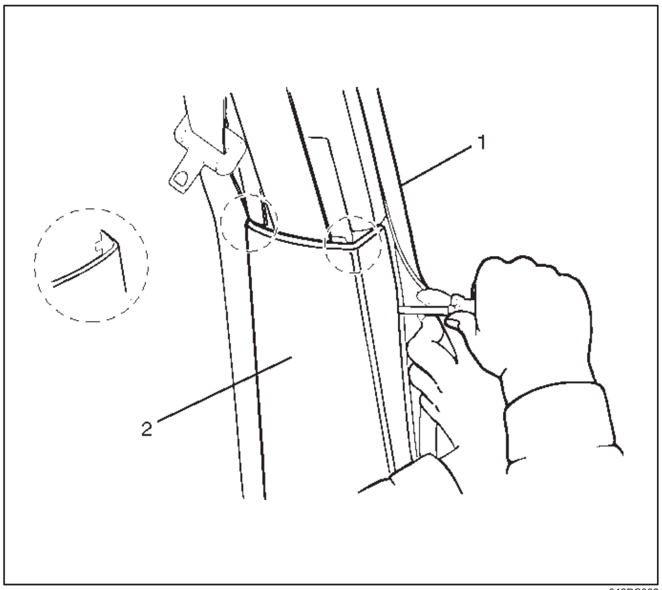
643RW003

Legend

- (1) Roof Side Trim Cover
- (2) Front Pillar Trim Cover
- (3) Assist Grip (RH only)
- (4) Adjust Shoulder Anchor Assembly
- (5) Center Pillar Upper Trim Plate
- (6) Door Sill Plate (Front and Rear)
- (7) Center Pillar Lower Trim Cover
- (8) Front Seat Anchor Bolt Cover and Anchor Bolt
- (9) Center Pillar Assist Grip
- (10) Assist Grip
- (11) Rear Quarter Upper Trim Cover

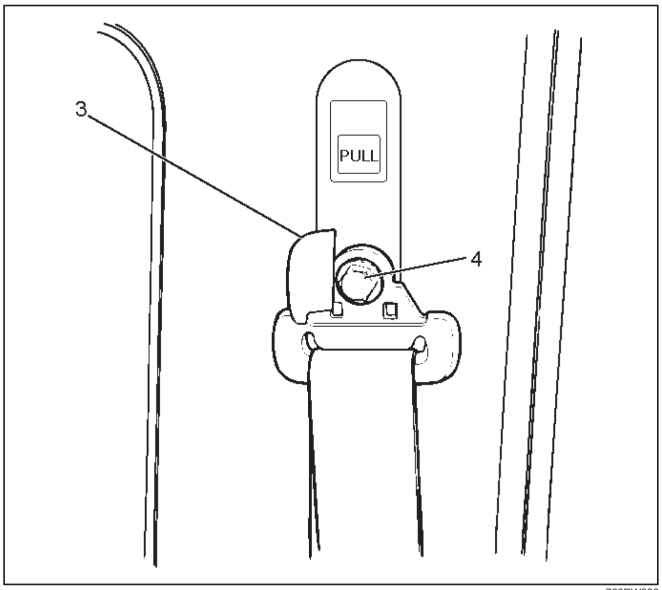
Removal

1. Disconnect the battery ground cable.
2. Remove the door sill plate (front and rear).
3. Remove the center pillar lower trim cover (2).
   - Turn up the finisher (1) and pry the trim cover retainers free from the body panel, then slide the trim cover downward.



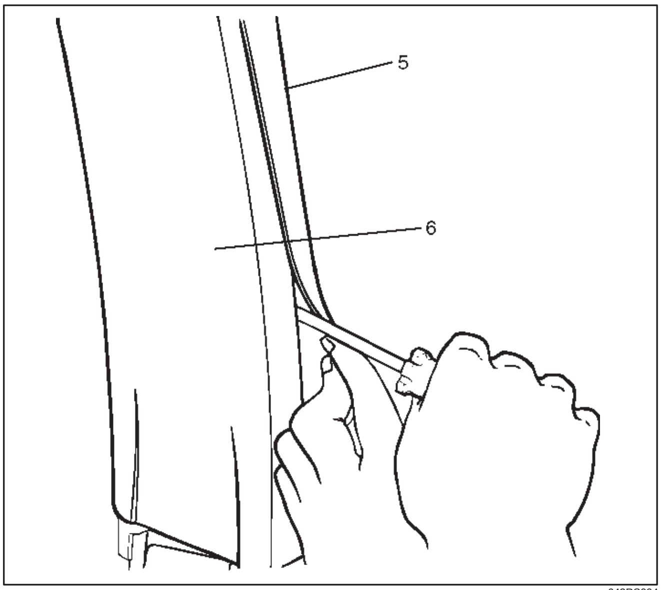
643RS003

4. Remove the front seat belt anchor bolt cover (3) and the anchor bolt (4).



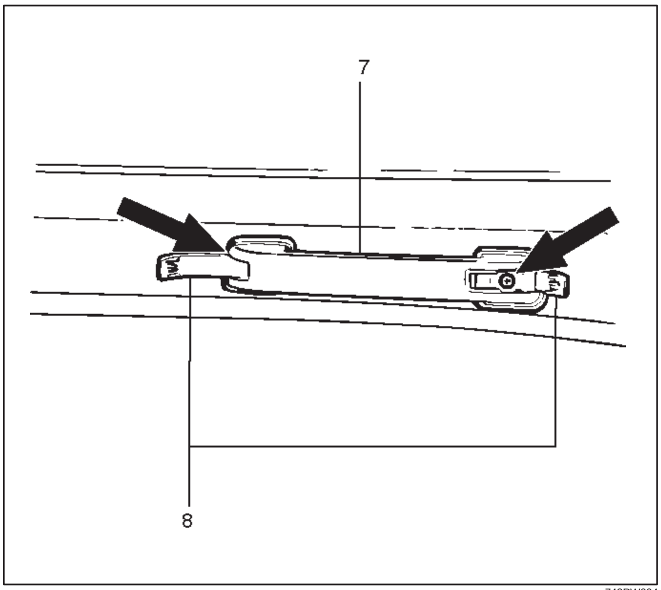
760RW006

5. Remove the center pillar upper trim cover (6).
   - Turn up the finisher (5) and pry the trim cover retainers free from the body panel.



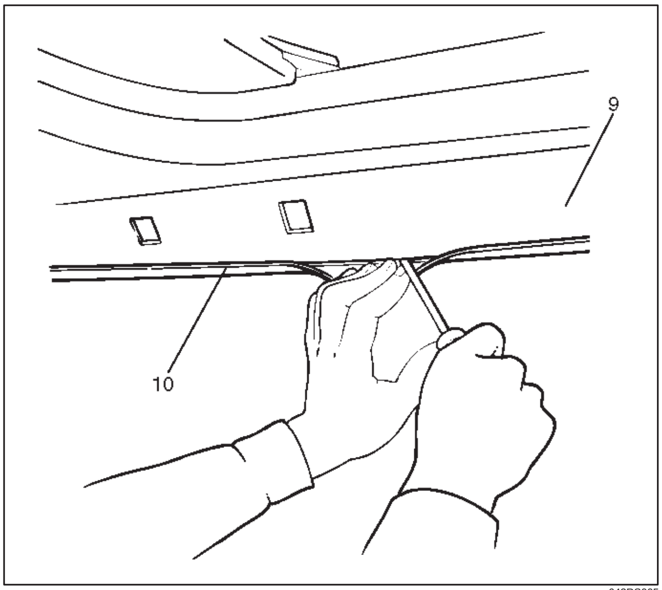
643RS004

6. Remove the center pillar assist grip.
7. Remove the seat belt anchor plate.
8. Remove the assist grip (7).
   - Open the both side of the assist grip cover (8) and remove two fixing screws.



743RW004

9. Remove the roof side trim cover (9).
   - Turn up the finisher (10) and pry the trim cover retainers free from the body panel.



Installation

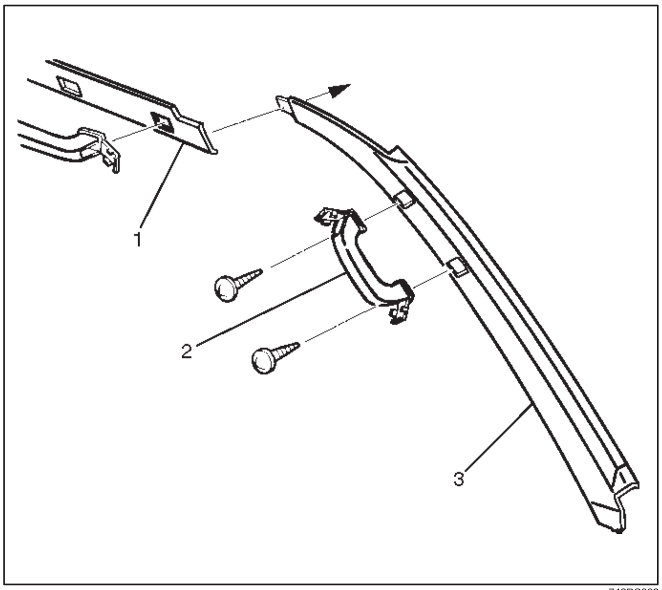
To install, follow the removal steps in the reverse order, noting the following point.

1. Install the seat belt anchor bolts to the specified torque.

Torque: 39 N·m (29 lb ft)

Front Pillar Trim Cover

Front Pillar Trim Cover and Associated Parts

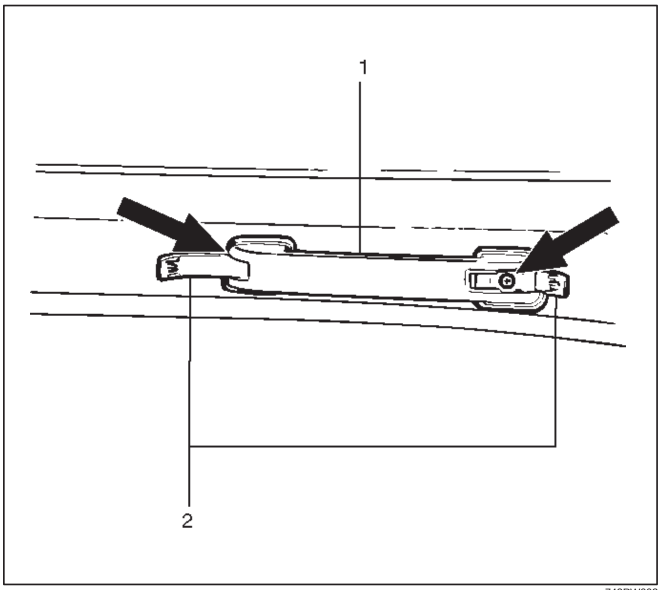


Legend

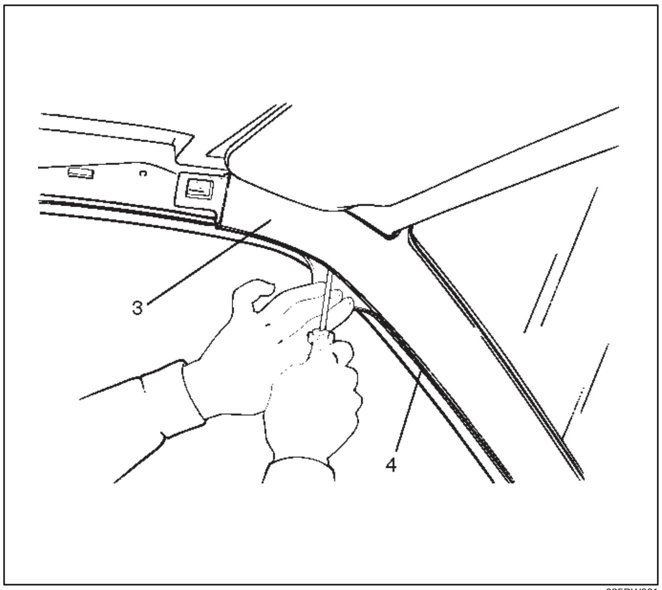
(1) Roof Side Trim Panel
(2) Assist Grip (RH only)
(3) Front Pillar Trim Panel

Removal

1. Remove the front pillar assist grip(1).
   - Open the both sides of the assist grip cover (2) and remove the fixing screws and the front pillar assist grip.



2. Remove the front pillar trim cover (3).
   - Turn up the finisher (4) and pry the trim cover retainers free from the body panel.



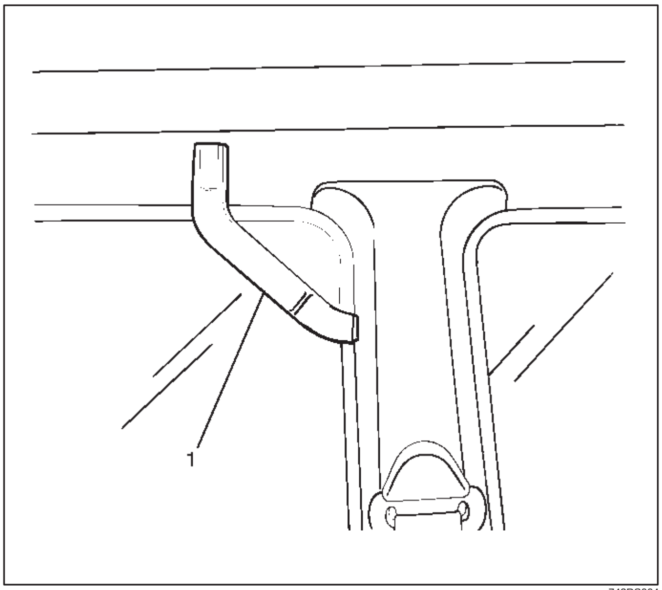
635RW001

Installation

To install, follow the removal steps in the reverse order.

Center Pillar Assist Grip

Parts Location



743RS004

Legend

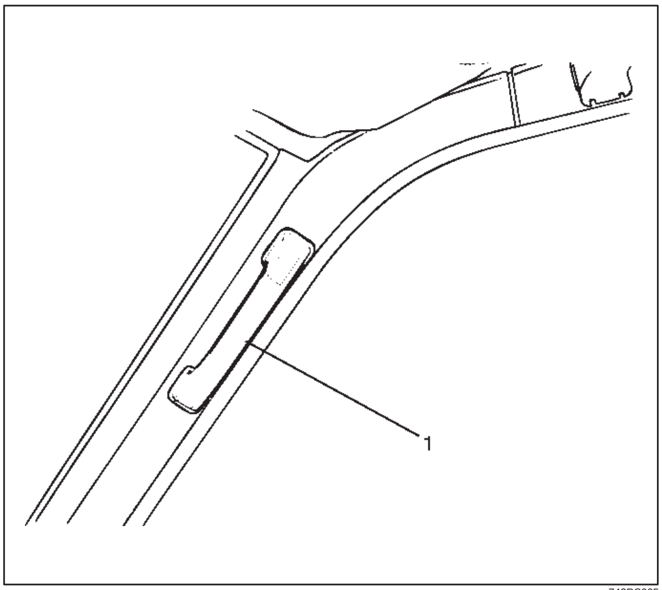
(1) Center Pillar Assist Grip

Removal and Installation

Refer to the Center Pillar and Roof Side Trim Cover in this section.

Assist Grip

Parts Location



743RS005

Legend

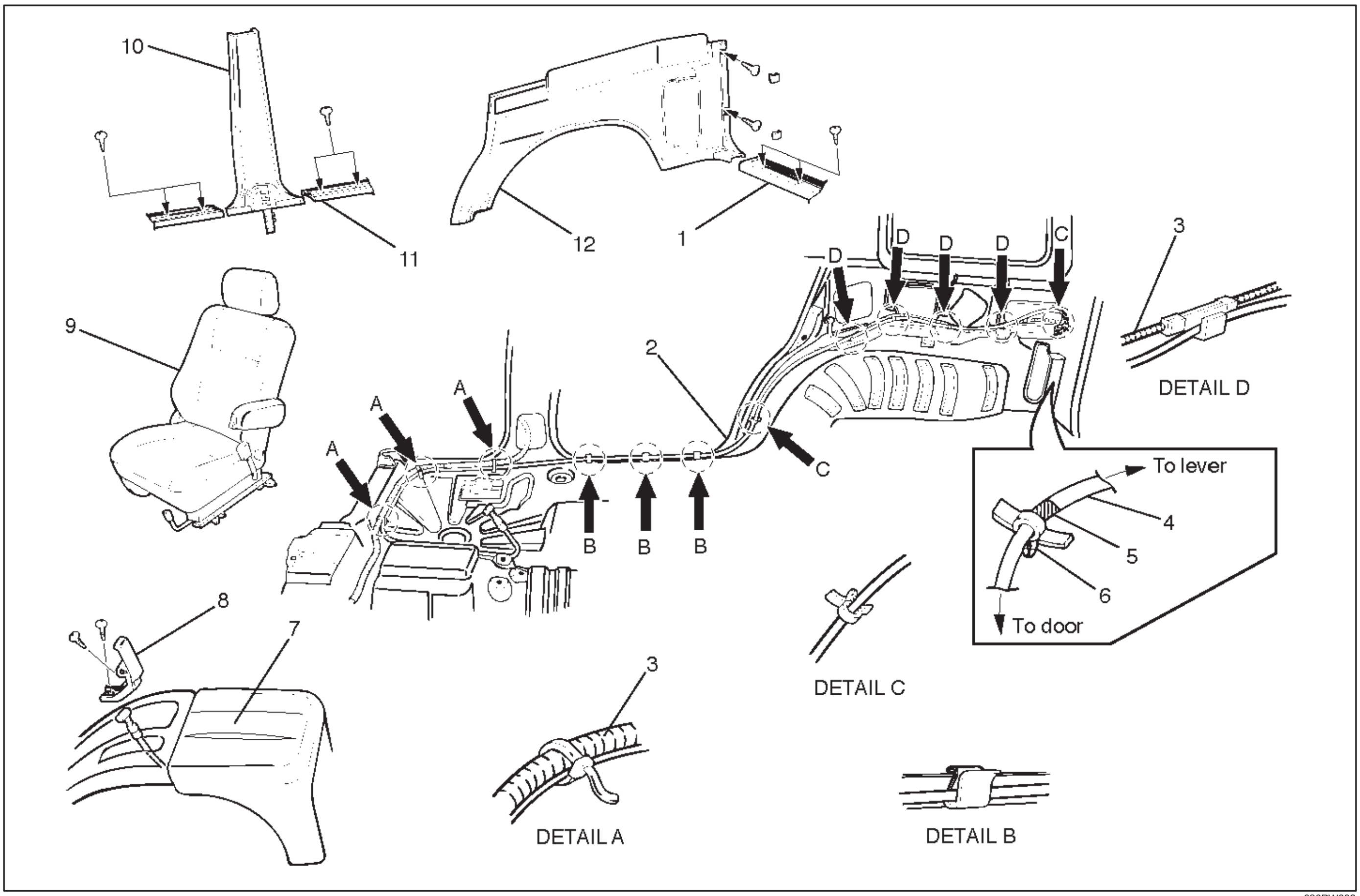
(1) Assist Grip

Removal and Installation

Refer to the Center Pillar and Roof Side Trim Cover in this section.

Fuel Filler Lid Opener Cable

Fuel Filler Lid Opener Cable and Associated Parts



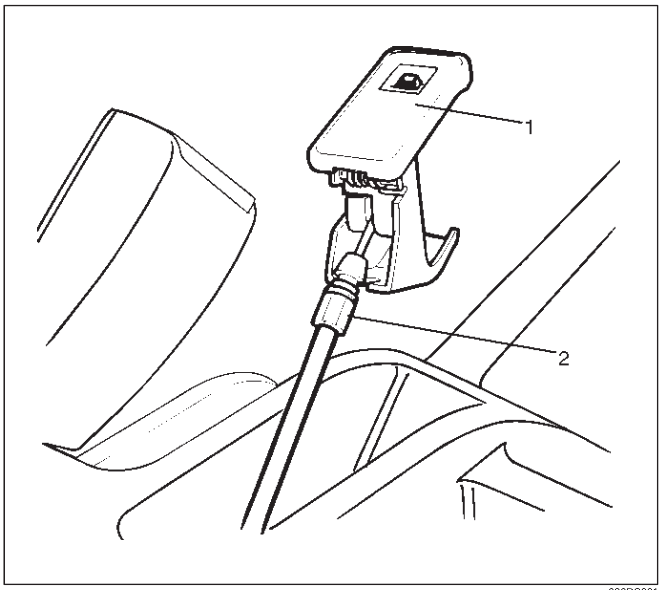
Legend

(1) Rear End Floor Trim Cover
(2) Fuel Filler Lid Opener Cable
(3) Chassis Harness
(4) Cable
(5) Marking
(6) Clip
(7) Center Console Assembly
(8) Fuel Filler Lid Opener
(9) Front Seat (RH)
(10) Center Pillar Lower Trim Cover
(11) Rear Door Sill Plate (RH)
(12) Luggage Side Trim Panel (RH)

Removal

1. Disconnect the battery ground cable.
2. Remove the front seat (RH).
3. Remove the rear door sill plate (RH).
4. Remove the center pillar lower trim cover.
5. Remove the rear end floor trim panel.
6. Remove the luggage side trim panel (RH).
   - Refer to the Luggage Side and Quarter Upper Trim Cover in this section.

7. Remove the fuel filler lid opener(1).
   - Remove two opener fixing screws and disconnect the cable(2).



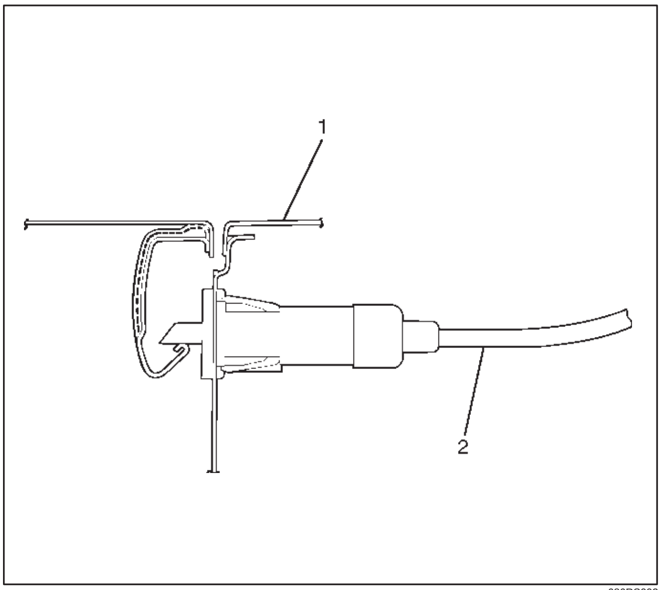
686RS001

8. Remove the center console assembly.
9. Remove the filler lid opener cable.
   - Roll up the floor carpet and remove the clips of the chassis harness and body panel to pull out the cable toward the fuel filter lid.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Insert the opener cable(2) into the body panel(1) securely.

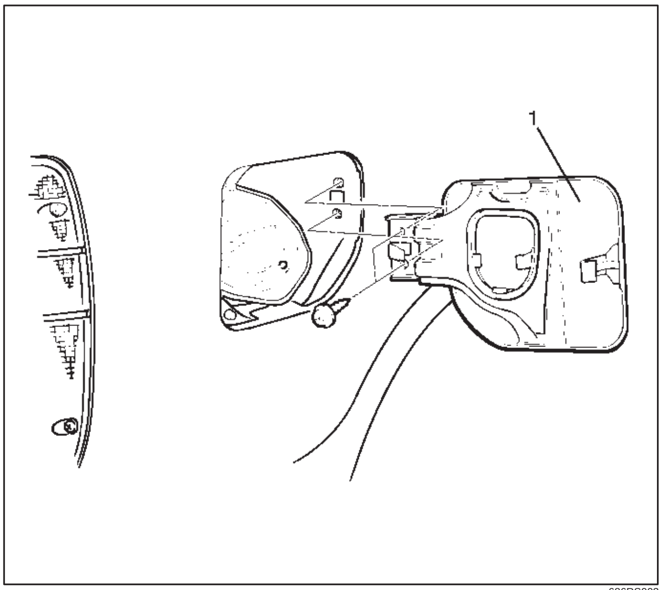


686RS002

2. Install the cable and clips to its original position to the chassis harness and the body panel.
3. Check that the opener operates smoothly.

Fuel Filler Door

Parts Location



686RS003

Legend

(1) Fuel Filler Door

Removal

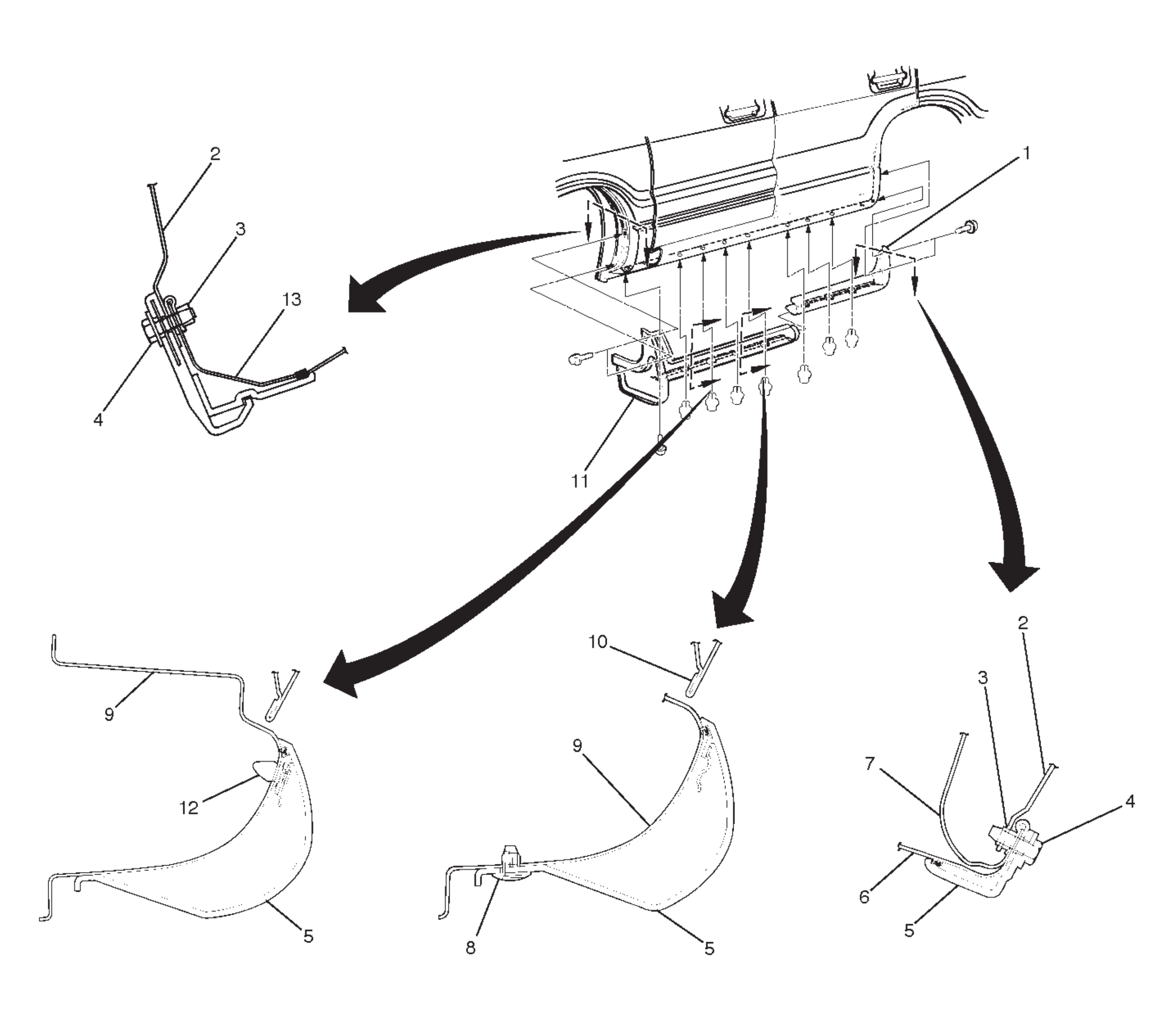
1. Remove the fuel filler door.

Installation

1. Install the fuel filler door.

Rocker Protector (Without Wheel Opening Extension)

Rocker Protector (Without Wheel Opening Extension) and Associated Parts



603RW002

Legend

(1) Rear Rocker Protector
(2) Inner Liner
(3) Spare Nut
(4) Fixing Screw
(5) Rocker Protector
(6) Outer Side Panel
(7) Outer Wheel House Panel
(8) Fixing Clip
(9) Outer Rocker Panel
(10) Door Panel
(11) Front Rocker Protector
(12) Clip (W/Rocker Protector)
(13) Fender Panel

Removal

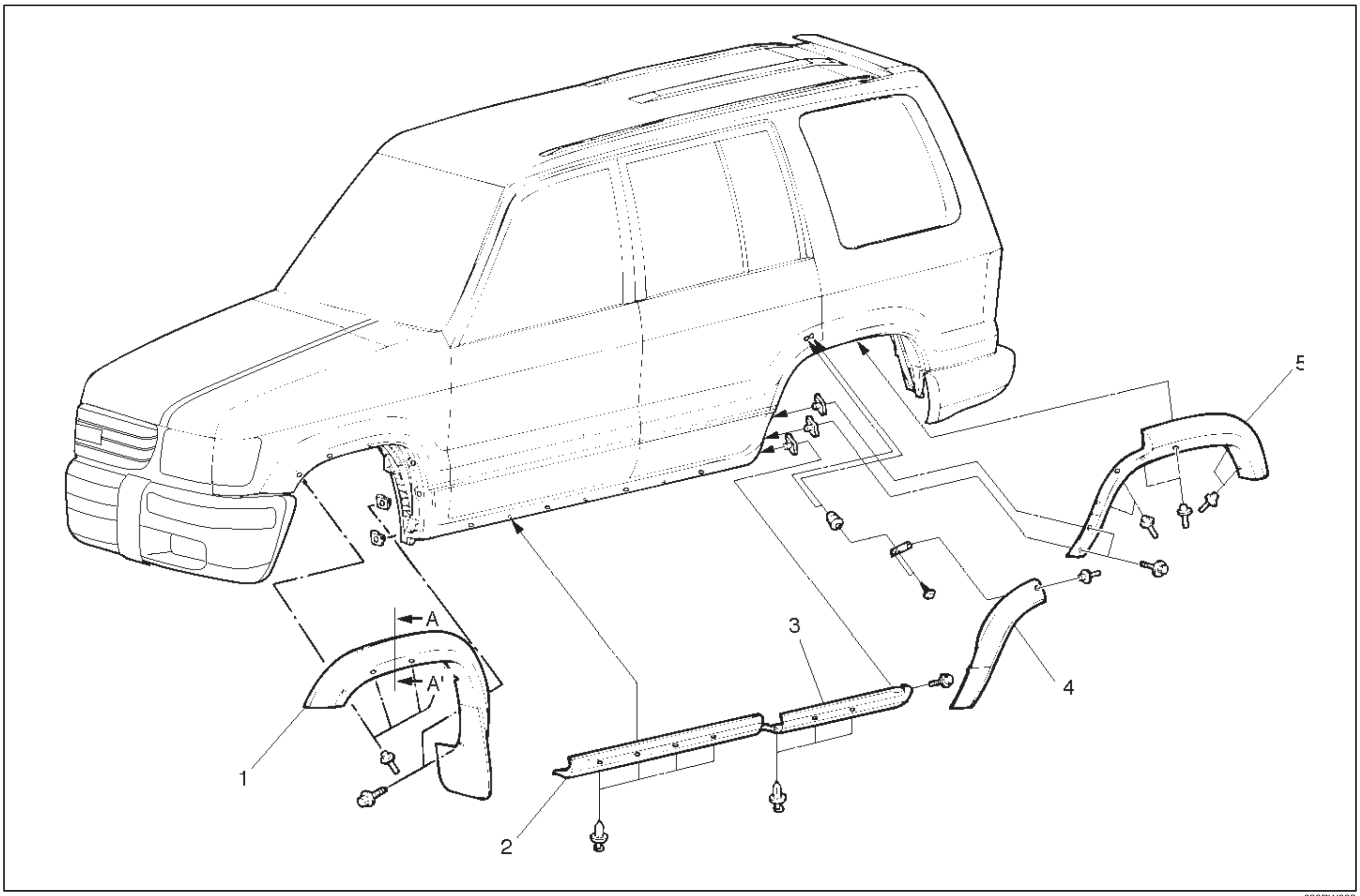
1. Remove the rear rocker protector.
2. Remove the front rocker protector.

Installation

To install, follow the remove steps in the reverse order.

Wheel Opening Extension and Rocker Protector Assembly

Wheel Opening Extension, Rocker Protector Assembly and Associated Parts



620RW002

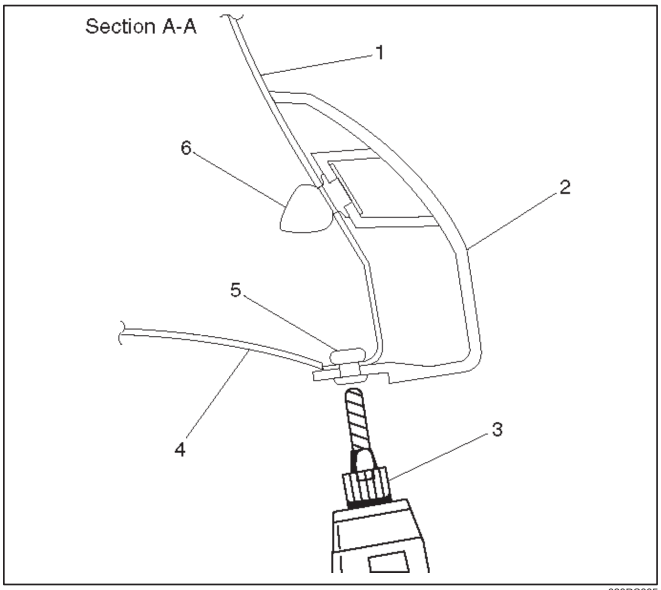
Legend

- (1) Front Wheel Opening Extension Assembly
- (2) Front Rocker Protector Assembly
- (3) Rear Rocker Protector Assembly
- (4) Rear Quarter Wheel Opening Extension Assembly
- (5) Rear Door Wheel Opening Extension Assembly

Removal

1. Remove the front rocker protector assembly.
   - Loosen and pull clips, and remove the front rocker protector assembly.
2. Remove the rear rocker protector assembly.
   - Loosen and pull three clips, remove a rear screw, and remove the rear rocker protector assembly.
3. Remove the front wheel opening extension(2).
   - Let a 5mm drill(3) go through four blind rivets(5) to disengaged riveted portions.

     Remove two screws and disengage five clips, then remove the front wheel opening extension assembly.



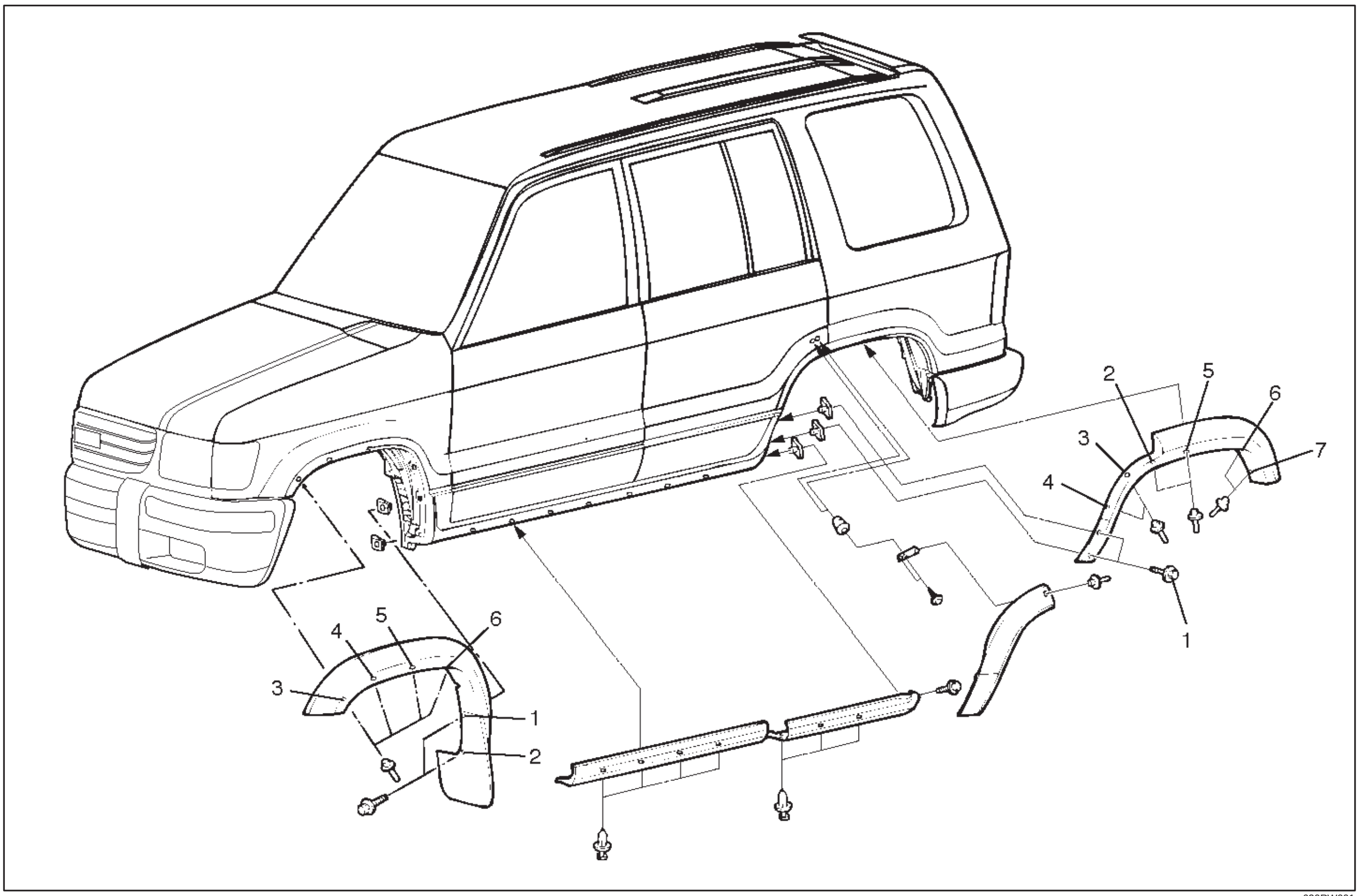
620RS005

4. Remove the rear quarter wheel opening extension assembly.
   - Let a 5mm drill go through six blind rivets to disengage riveted portions.
     Disengage four clips, remove two screws, and remove the rear quarter wheel opening extension assembly.
5. Remove the rear door wheel opening extension assembly.
   - Let a 5mm drill go through a blind rivet to disengage riveted portions.
     Disengage three clips, peel off the bonded portions with two double surface adhesive tape and the rear door wheel opening extension assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

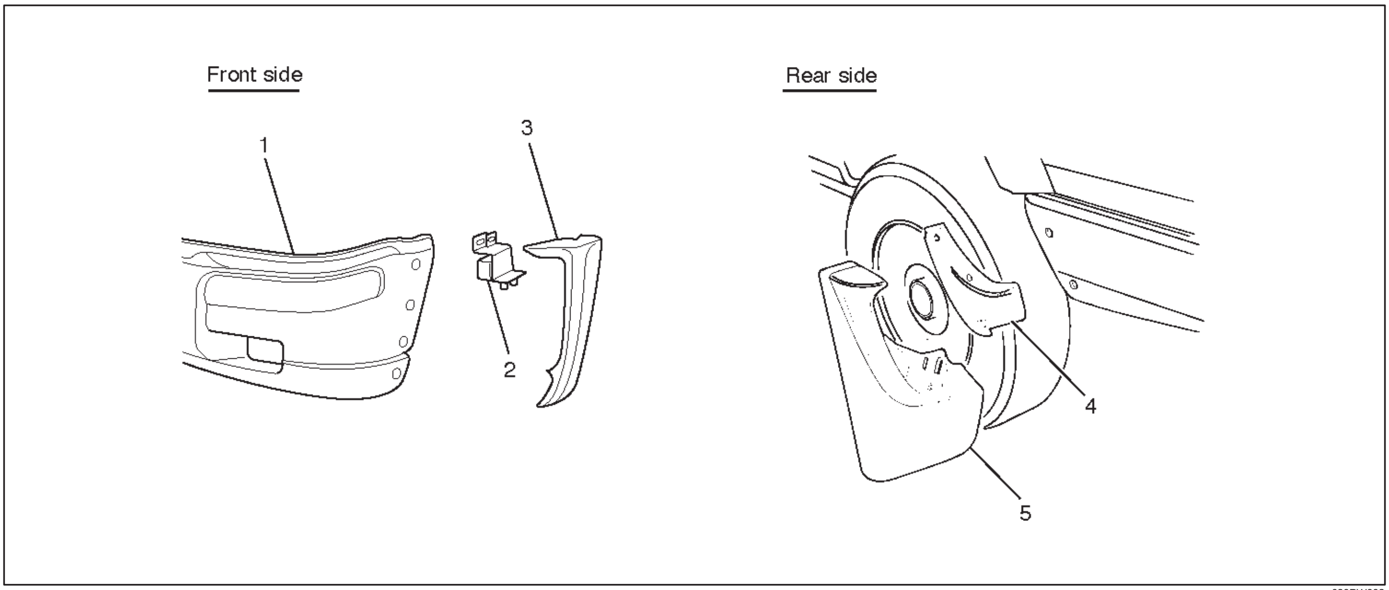
1. Use a new 2–sided adhesive tape whenever installing each wheel opening extension assembly and rocker protector assembly. Using a white gasoline, clean the places in advance where a 2–sided adhesive tape is affixed. Also, install the clips, screws and blind rivets in the order specified as shown in the figure.



620RW001

Mud Flaps (With Wheel Opening Extension)

Mud Flaps (With Wheel Opening Extension) and Associated Parts



620RW003

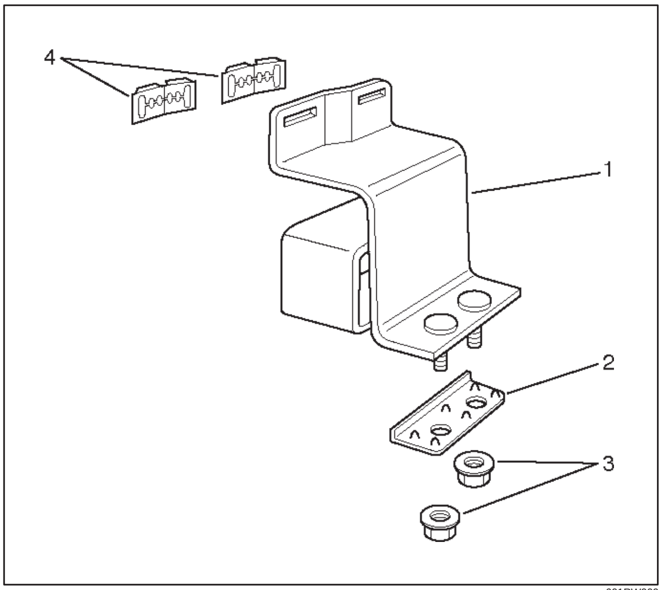
Legend

(1) Front Bumper Assembly
(2) Front Bumper Slider
(3) Front Mud Flap
(4) Bumper Side Cover
(5) Rear Mud Flap

Removal

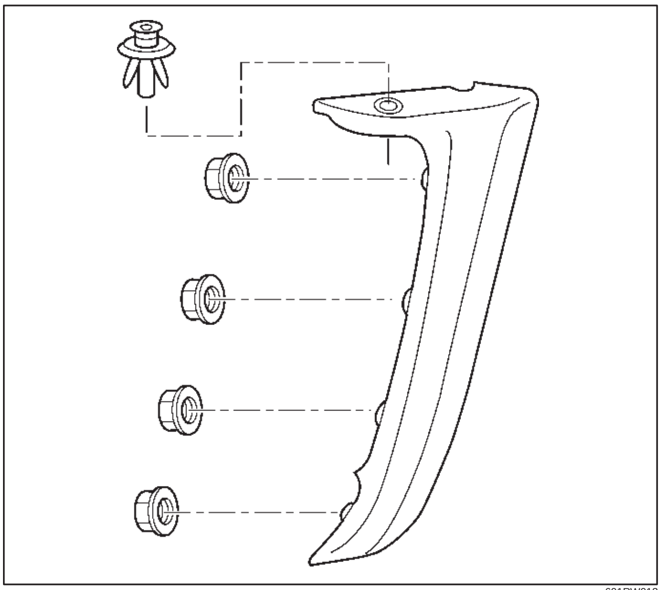
Front Side

1. Remove the front bumper assembly.
   - Disconnect the front fog light connector and remove two bolts from both sides of the front bumper.
2. Remove the front bumper slider(1).
   - Remove two clips(4) and two nuts(3), release the claw from the washer(2).



601RW009

3. Remove the front mud flap.
   - Remove four nuts and a clip.



601RW013

Rear Side

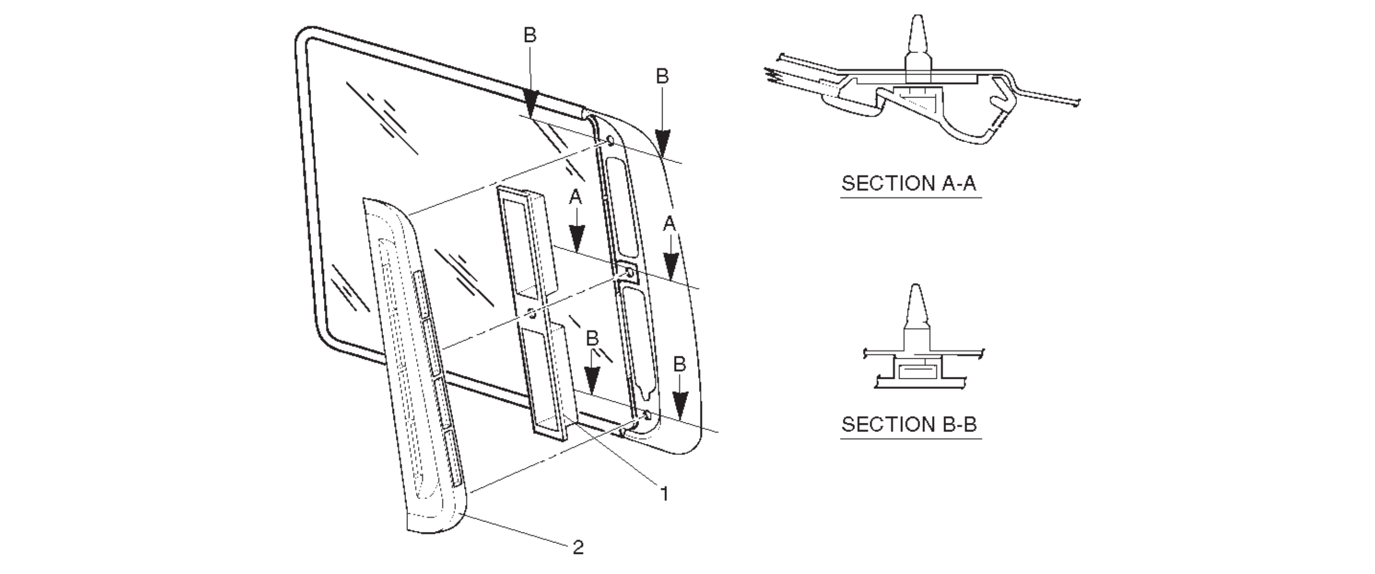
1. Remove the bumper side cover.
2. Remove the rear mud flap.
   - Remove four bolts and two nuts.

Installation

To install, follow the removal steps in the reverse order.

Ventilation Assembly

Ventilation Assembly and Associated Parts



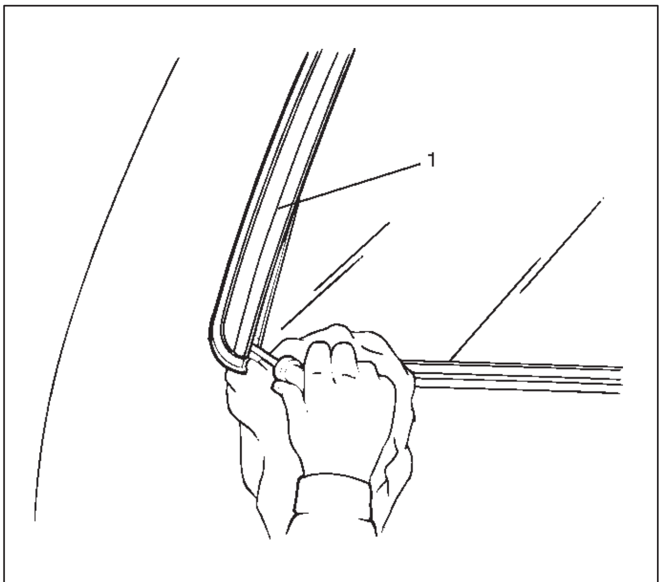
641RS001

Legend

(1) Outlet Valve Assembly
(2) Ventilation Assembly

Removal

1. Remove the ventilation assembly(1).
   - Pry the ventilation assembly retainers free from the body panel.



641RS002

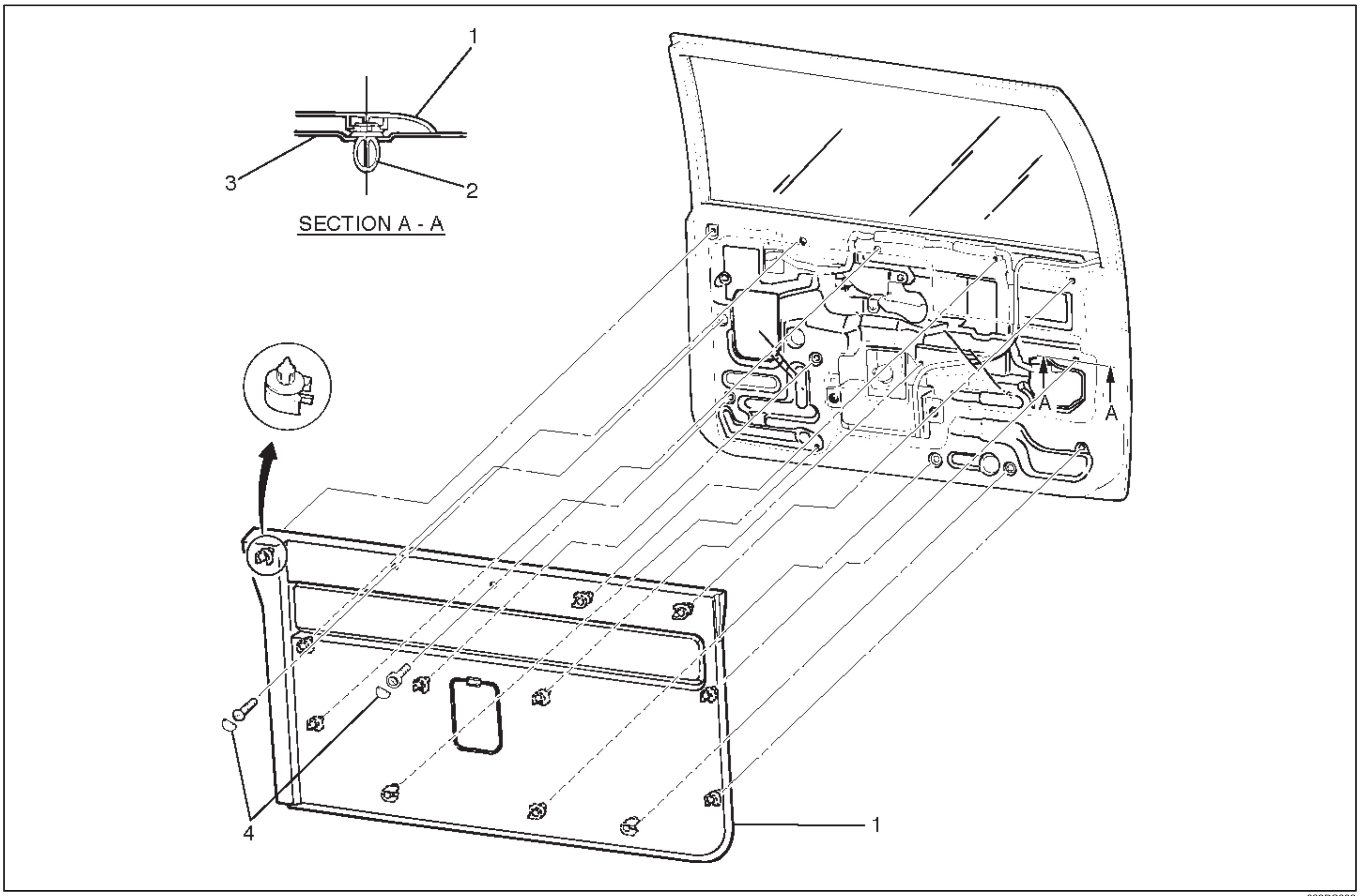
2. Remove the outlet valve assembly.

Installation

1. Install the outlet valve assembly.
   - Insert the upper and lower catches of the outlet valve into the body panel flange and fix them securely.
2. Install the ventilation assembly.
   - Fix the clips to the body panel securely so that the ventilation assembly will not come off the body panel.

Tailgate Trim Panel (LH)

Tailgate Trim Panel (LH) and Associated Parts



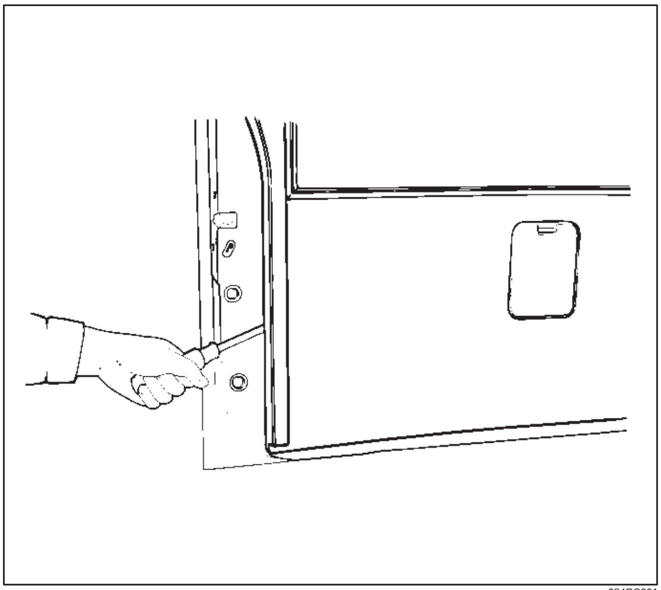
683RS002

Legend

(1) Tailgate Trim Panel (LH)
(2) Clip
(3) Tailgate Panel
(4) Cap and Screw

Removal

1. Disconnect the battery ground cable.
2. Remove the cap and screw.
3. Remove the tailgate trim panel (LH).
   - Pry the trim panel retainers free from the tailgate panel.



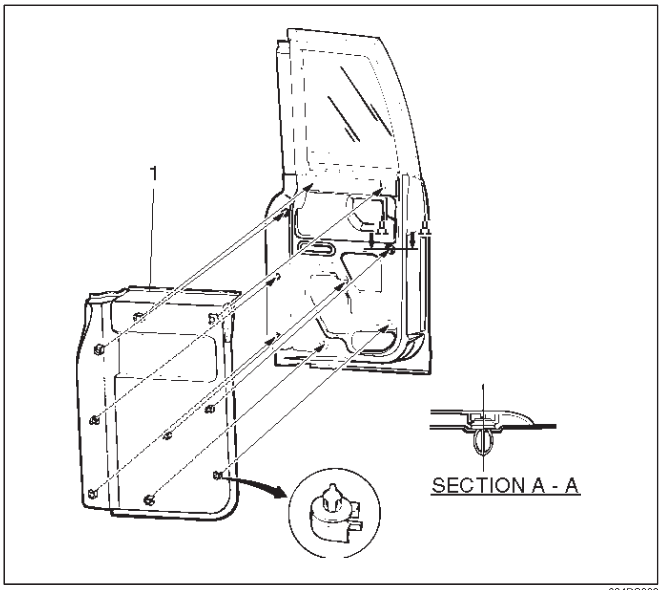
684RS001

Installation

To install, follow the removal steps in the reverse order.

Tailgate Trim Panel (RH)

Parts Location



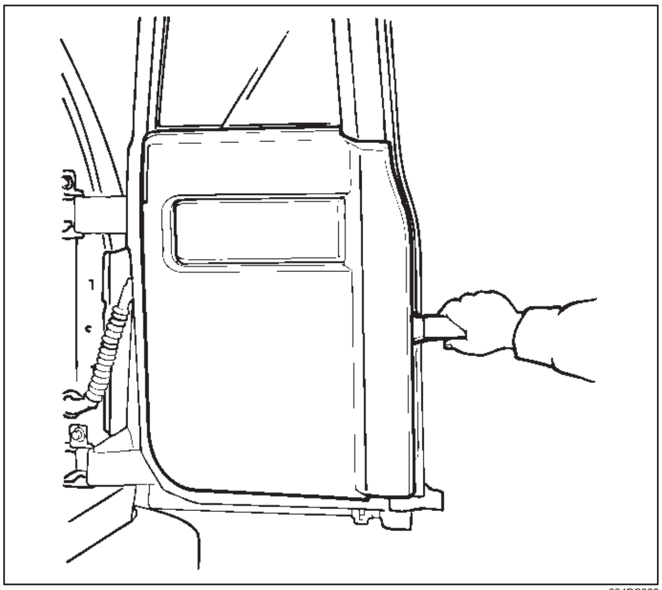
684RS002

Legend

(1) Tailgate Trim Panel

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim panel (RH).
   - Pry trim panel retainer free from the tailgate panel.



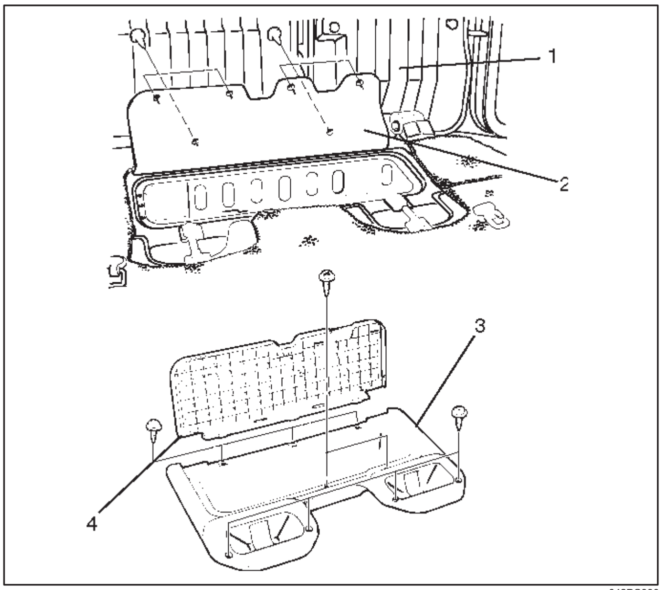
684RS003

Installation

1. Install the trim panel (RH).
   - Insert the retainer of the trim panel into the tailgate panel and fix it securely.

Luggage Floor Box

Luggage Floor Box and Associated Parts



643RS006

Legend

(1) Rear Seat
(2) Floor Carpet
(3) Luggage Floor Box
(4) Luggage Floor Box Cover

Remove

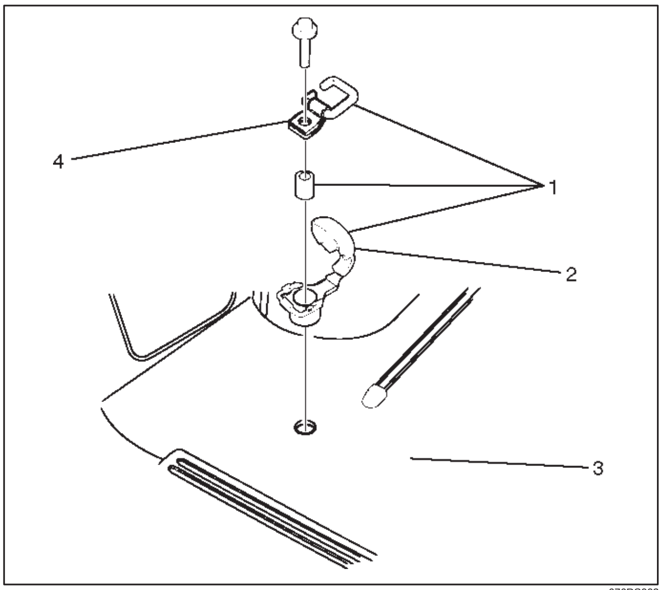
1. Fold the rear seat assembly to the front direction.
2. Remove the luggage floor box cover.
   - Remove the clips which connect the floor carpet and the luggage floor box cover.
3. Remove the luggage floor box.

Installation

To install, follow the removal steps in the reverse order.

Rope Hook Set

Rope Hook Set and Associated Parts



676RS003

Legend

(1) Rope Hook Set
(2) Cover
(3) Luggage Floor Carpet
(4) Hook

Removal

1. Remove the rope hook set.
   - Open the hook cover and hook fixing bolt.

Installation

1. Install the rope hook set.
   - Tighten the hook fixing bolt to the specified torque.

Torque: 13 N·m (113 lb in)

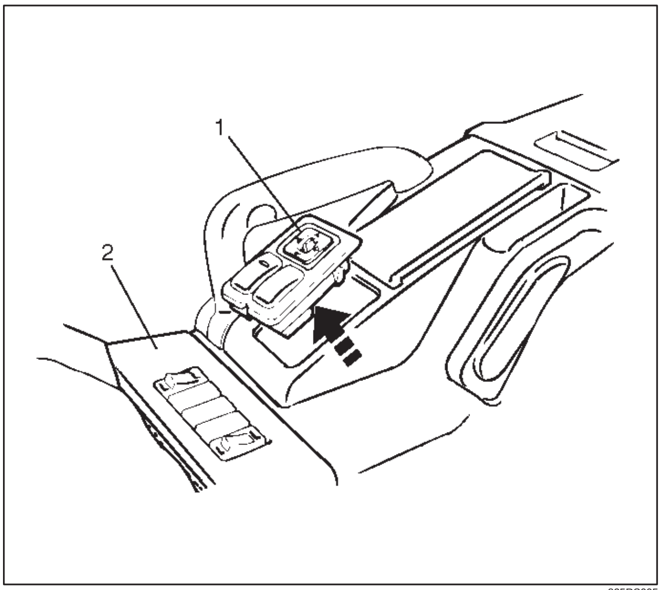
Power Door Mirror System

General Description

The circuit consists of the starter switch, door mirror control switch, folding switch, defogger switch and door mirrors on both sides.
The door mirror switch consists of the control switch, folding switch and defogger switch.
When the control switch is operated with the starter switch at either “ACC” or “ON” position, the motors incorporated in the door mirrors on both sides rotates to allow the horizontal and vertical adjustment of mirror angles.
The folding switch can be used to fold the mirror and return it to its original position.
When turning on the door mirror defogger switch with the starter switch at “ON” position, built-in heater in the mirror is activated to perform the defogger function.

Door Mirror Switch Assembly (Control Switch, Folding Switch and Defogger Switch) Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly(2).
   - Remove four screws.
   - Remove the transmission shift lever knob.
   - Remove the transfer shift lever knob.
   - Disconnect the seat heater switch connectors (if so equipped).
   - Disconnect the door mirror switch connectors.
   - Disconnect the power & winter switch connectors. (A/T only)
3. Remove the door mirror switch assembly(1).
   - Push the lock from the back side of the front console.



825RS005

Installation

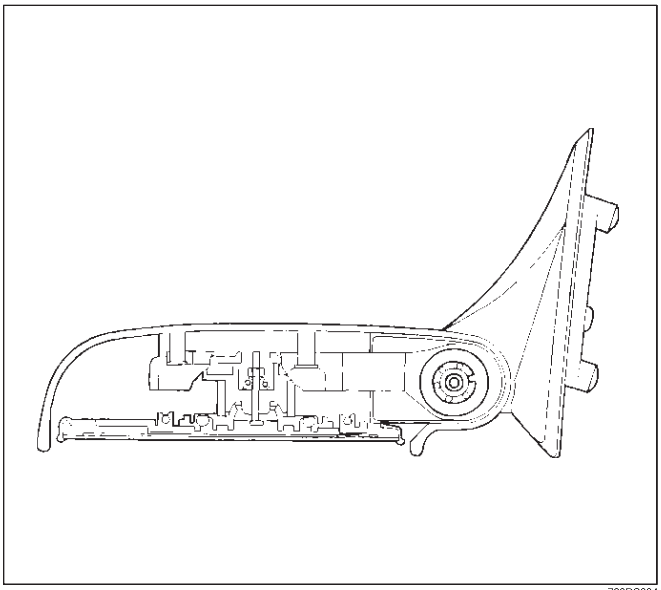
To install, follow the removal steps in the reverse order, noting the following point.

1. Depress the switch with your fingers until it locks securely.

Power Door Mirror

General Description

Mirrors contain two driving motors for the horizontal and vertical movement of the mirror and one motor for folding the mirror.
The movement of the mirror is controlled by the direction of current running through these motors.
The housing portion of the mirror is provided with the auto-stop mechanism which is interlocked with the motor for folding the mirror. When the mirror moves to the stop position (with the mirror folded or returned to its original position), the current to the motor is shut off.
When the mirror cannot operate due to some obstacle and the motor stops its rotation, the resistor prevents current overflow.


720RS004

Removal and Installation

Refer to the Door Mirror removal and installation steps in this section.

Power Window System

General Description

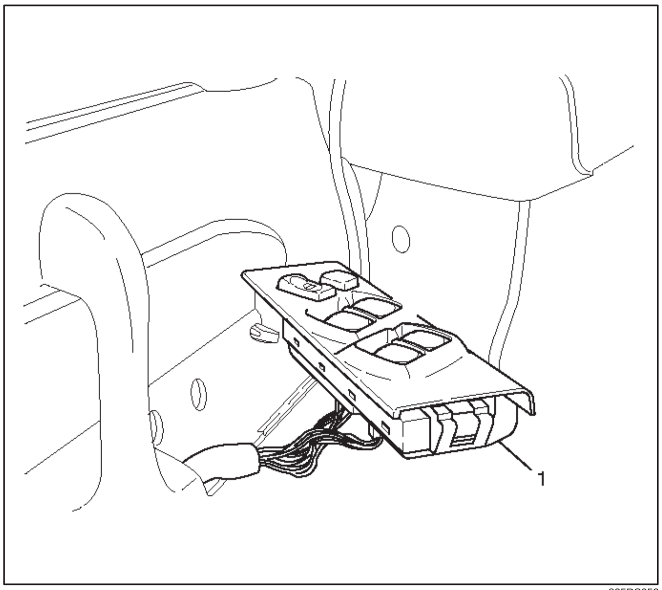
The circuit consists of the starter switch, (door lock &) power window switch for each of the front windows, power window switch for rear windows and power window motors.
When the starter switch is turned on, the battery voltage is applied to each of the power window switches through the circuit breaker and the power window relay on the circuit.
The “Down” switch of the driver’s power window switch has a built-in function which can be operated by just touching it.
Accordingly, the window will roll down automatically by just setting the switch to the “AUTO” position.
When the driver’s power lock switch at the driver side is depressed, the power source to the passenger’s power window switches are shut off. So, even if these switches are operated, the power window motor will not operate.

Power Window Switch Removal and Installation

Driver Seat Side

Removal

1. Disconnect the battery ground cable.
2. Remove the switch(1).
   - Pull out the switch by pushing the spring with the tip of a screwdriver.
   - Disconnect two connectors.



825RS052

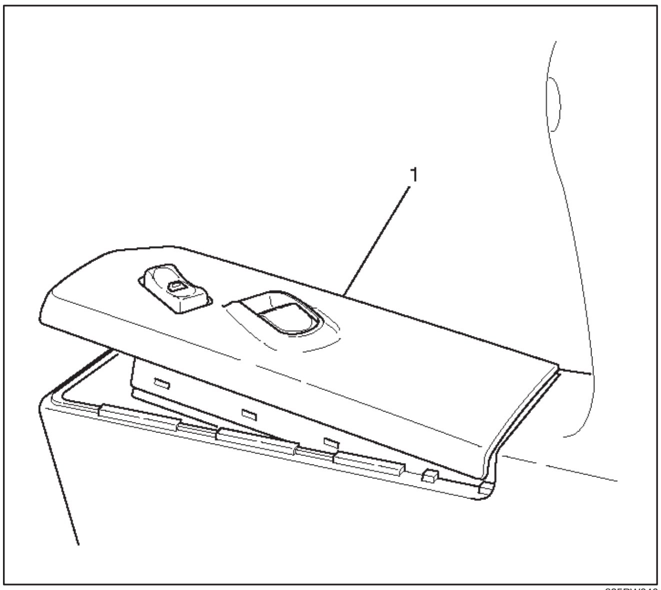
Installation

To install, follow the removal steps in the reverse order.

Front Passenger Seat Side

Removal

1. Disconnect the battery ground cable.
2. Remove the switch(1).
   - Pull out the switch by pushing the spring with the tip of a screwdriver.
   - Disconnect the connector.



825RW046

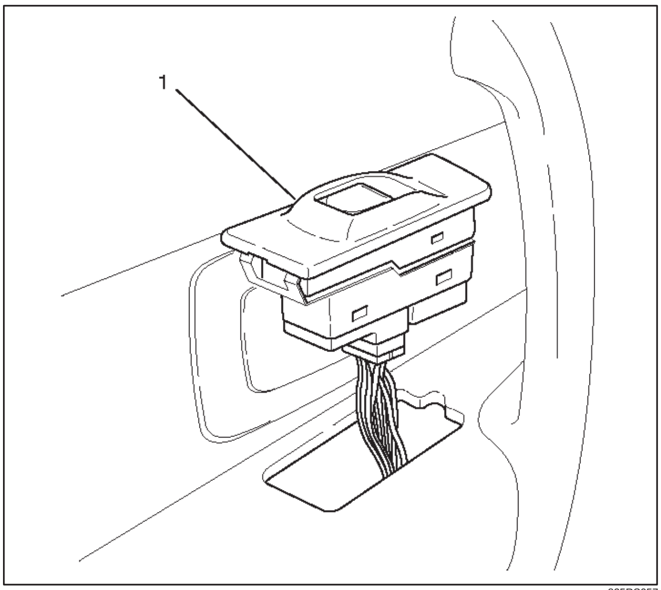
Installation

To install, follow the removal steps in the reverse order.

Rear-Left and Right Sides

Removal

1. Disconnect the battery ground cable.
2. Remove the switch(1).
   - Pull out the switch by pushing the spring with the tip of a screwdriver.
   - Disconnect the connector.



825RS057

Installation

To install, follow the removal steps in the reverse order.

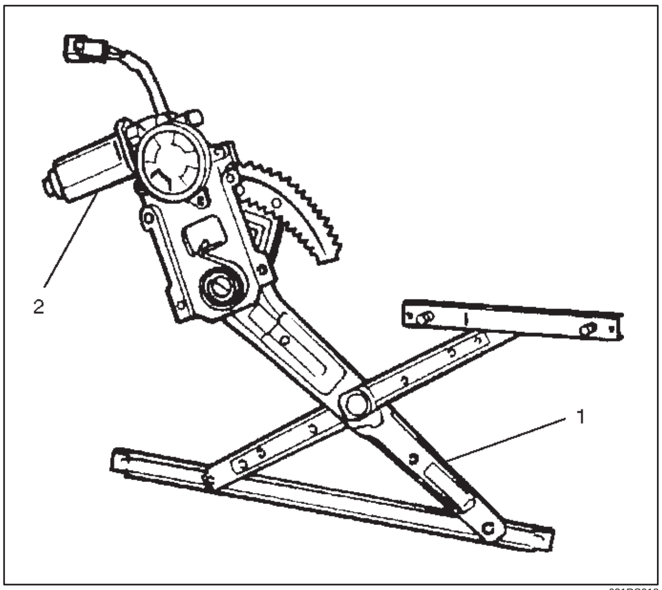
Power Window Motor Removal and Installation

Driver Seat Side

Removal

1. Disconnect the battery ground cable.
2. Remove the window regulator assembly (1).
   - Refer to Front Window Regulator, Glass and Glass Run in Body Structure section.
3. Remove the power window motor(2).
   - Remove three screws.

CAUTION: When removing the motor from the regulator(1), be careful not to get injured by the strong repellent force of the regulator spring.



631RS018

Installation

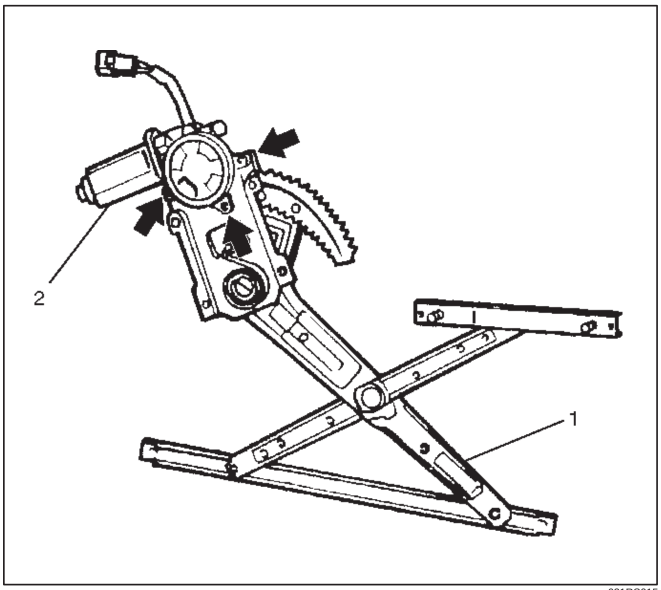
To install, follow the removal steps in the reverse order.

Front Passenger Seat Side

Removal

1. Disconnect the battery ground cable.
2. Remove the window regulator assembly (1).
   - Refer to Front Window Regulator, Glass and Glass Run in Body Structure section.
3. Remove the power window motor(2).
   - Remove three screws.

CAUTION: When removing the motor from the regulator(1), be careful not to get injured by the strong repellent force of the regulator spring.



631RS015

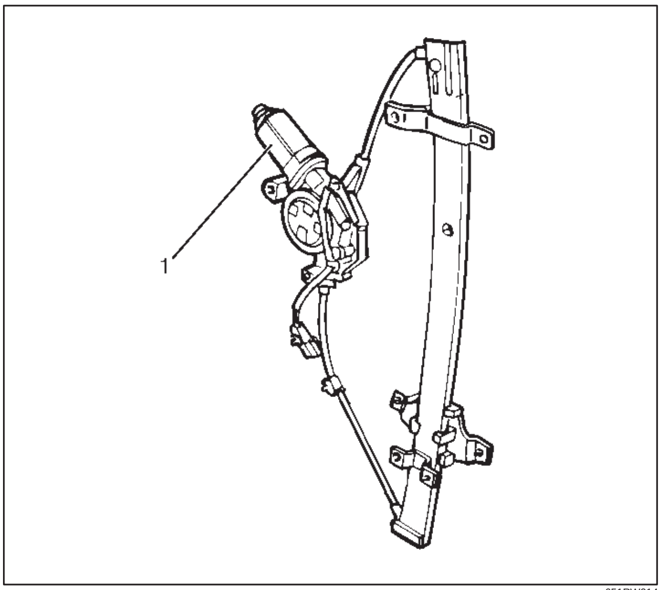
Installation

To install, follow the removal steps in the reverse order.

Rear-Left Side

Removal

1. Disconnect the battery ground cable.
2. Remove the rear window regulator assembly.
   - Refer to Rear Window Regulator and Glass in Body Structure section.
3. Remove the power window motor(1).
   - Remove four screws.



651RW014

Installation

To install, follow the removal steps in the reverse order.

Rear-Right Side

Removal and Installation

Refer to the Rear Power Window Motor-Left Side in this section.

Main Data and Specifications

Torque Specifications

Application	N·m	Lb Ft	Lb In
Door Mirror Fixing Bolts	8	—	69
Seat Belt Anchor Bolts	39	29	—
Hook Fixing Bolt	13	—	113

TROOPER

RESTRAINTS

CONTENTS

SEAT BELT SYSTEM

CONTENTS

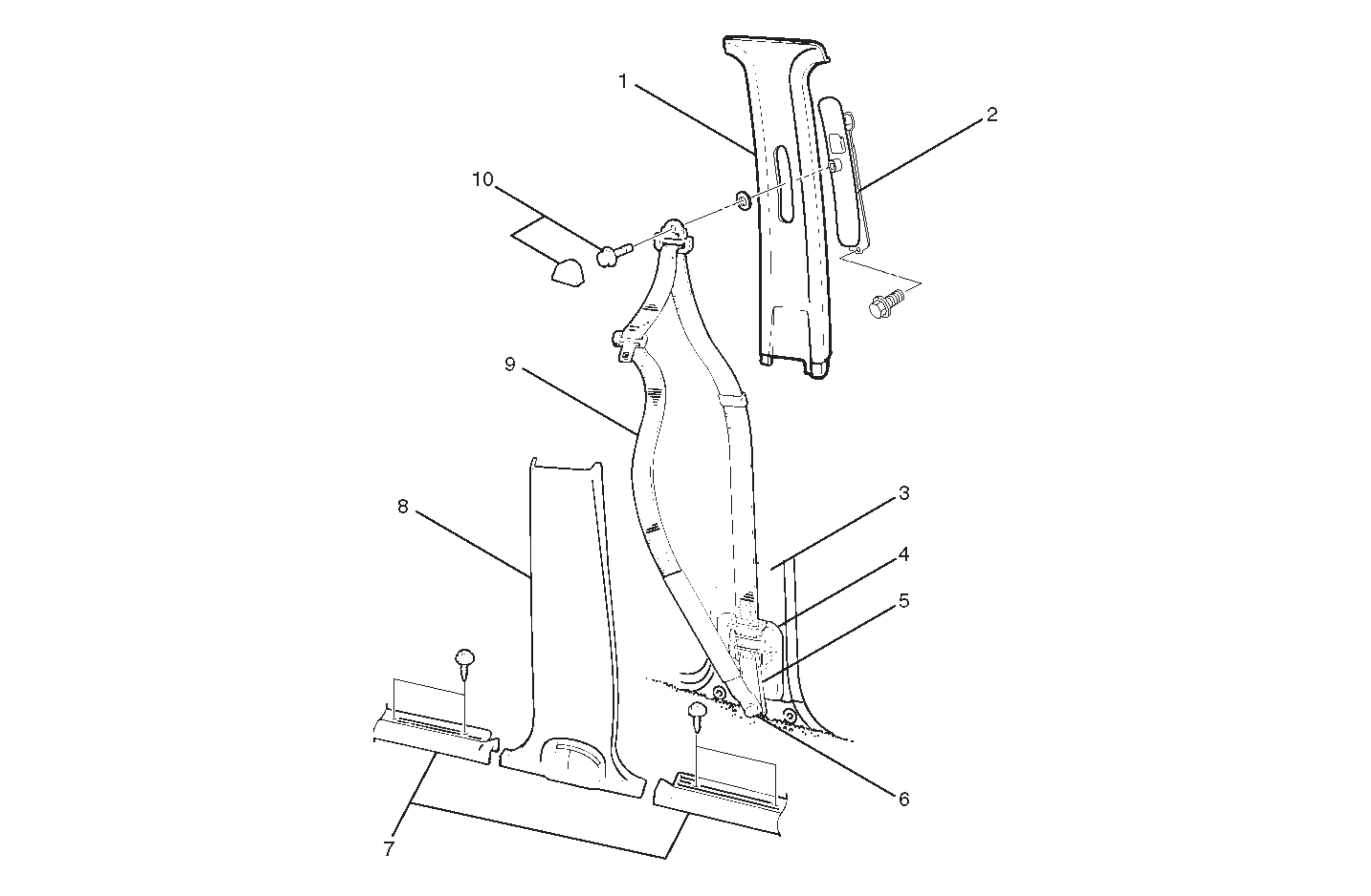
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Seat Belt

Front Seat Belt and Associated Parts



760RW014

Legend
- (1) Center Pillar Upper Trim Cover
- (2) Adjustable Shoulder Anchor Assembly
- (3) Center Pillar
- (4) Dust Cover
- (5) Retractor
- (6) Anchor Bolt (Lower)
- (7) Door Sill Plate (Front & Rear)
- (8) Center Pillar Lower Trim Cover
- (9) Front Seat Belt Assembly
- (10) Front Seat Belt Anchor Bolt Cover and Anchor Bolt

Removal

1. Disconnect the battery ground cable.
2. Remove the door sill plate (Front & Rear).
3. Remove the center pillar lower trim cover.
4. Remove the front seat belt anchor bolt cover and anchor bolt (Upper Side).
   - Refer to Center Pillar and Roof Side Trim Cover in Exterior/Interior Trim section.
5. Remove the seat belt lower anchor bolt and screw, and then remove the front seat belt.

Inspection

If any of the following abnormalities is found, replace on an assembly basis:

- Deform and malfunction of adjustable shoulder anchor.
- No smooth move of upper/lower anchors in the circumferential direction.
- Damaged and/or deformed through ring.
- Damaged and/or deformed tongue.
- Damaged and/or frayed of webbing.
- Deformed retractor bracket.
- Seat belt not rewound up.
- Resistance or abnormal sound when seat belt is wound out and rewound.
- Retractor abnormality.

Inspection of retractor

1. ELR (Emergency Locking Retractor) lock inclining angle check.
   - When the retractor is moved gently from its installing position, make sure it is not locked within 15° in any directions, and it remains locked at 45° or larger.
2. ELR lock check.
   - When the seat belt is drawn slowly with the retractor installed, make sure it is not locked. And when it is drawn quickly, make sure it is locked.
3. ALR (Automatic Locking Retractor)/ELR check (Except for driver's seat).
   - When rewound after winding out the seat belt, make sure the seat belt cannot be taken out. After rewinding, make sure it has returned to its normal operation.

CAUTION: Do not disassemble the retractor.

Installation

To install, follow the removal steps in the reverse order, noting the following points;

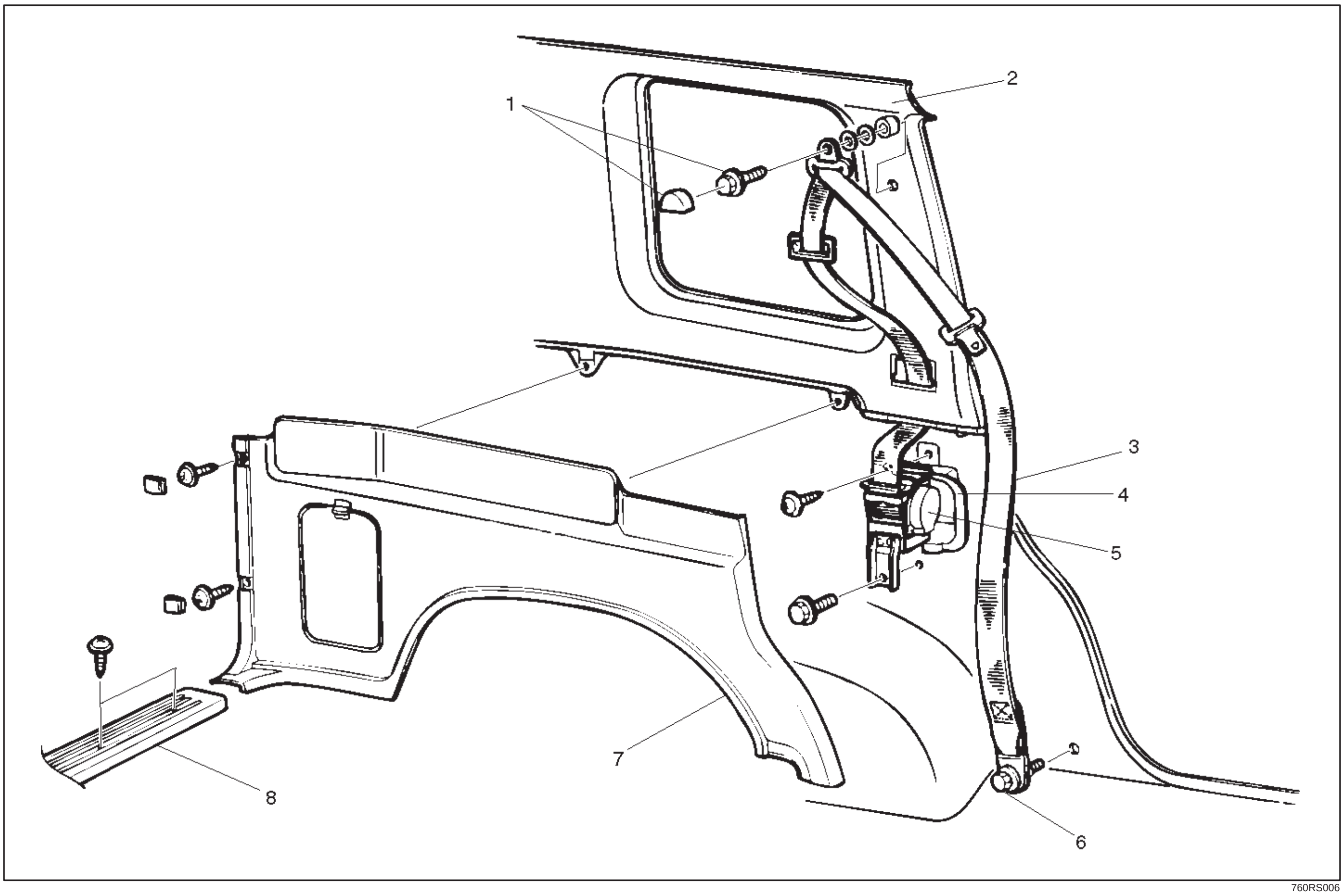
CAUTION: The front seat belt for '99model is differently specified from that for '98model.
When replacing, be sure to replace with the one for '99model after making sure of part No..

1. Pass the seat belt through the lower trim cover hole, and tighten the seat belt anchor bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

2. After installing the trim cover to the body panel securely, close the lower trim cover.

Rear Seat Belt and Associated Parts



Legend

(1) Rear Seat Belt Anchor Bolt Cover and Anchor Bolt (Upper Side)
(2) Quarter Upper Trim Cover
(3) Rear Seat Belt Assembly
(4) Dust Cover
(5) Retractor
(6) Anchor Bolt (Lower Side)
(7) Luggage Side Trim Cover
(8) Rear End Floor Trim Cover

Removal

1. Disconnect the battery ground cable.
2. Remove the rear end floor trim cover.
3. Remove the luggage side trim cover.
   - Refer to Luggage Side and Quarter Upper Trim Cover in Exterior/Interior Trim section.
4. Remove the rear seat belt anchor bolt cover and anchor bolt (Upper Side).
5. Remove the seat belt lower anchor bolt and remove the retractor from dust cover slit to remove the rear seat belt.

Inspection

If any of the following abnormalities is found, replace on an assembly basis:

- No smooth move of upper/lower anchors in the circumferential direction.
- Damaged and/or deformed through ring.
- Damaged and/or deformed tongue.
- Damaged and/or frayed of webbing.
- Deformed retractor bracket.
- Seat belt not rewound up.
- Resistance or abnormal sound when seat belt is wound out and rewound.
- Retractor abnormality.

Inspection of retractor

1. ELR (Emergency Locking Retractor) lock inclining angle check.
   - When the retractor is moved gently from its installing position, make sure it is not locked within 15° in any directions, and it remains locked at 45° or larger.
2. ELR lock check.
   - When the seat belt is drawn slowly with the retractor installed, make sure it is not locked. And when it is drawn quickly, make sure it is locked.
3. ALR (Automatic Locking Retractor)/ELR check (Except for driver's seat).
   - When rewound after winding out the seat belt, make sure the seat belt cannot be taken out. After rewinding, make sure it has returned to its normal operation.

CAUTION: Do not disassemble the retractor.

Installation

To install, follow the removal steps in the reverse order, noting the following point.

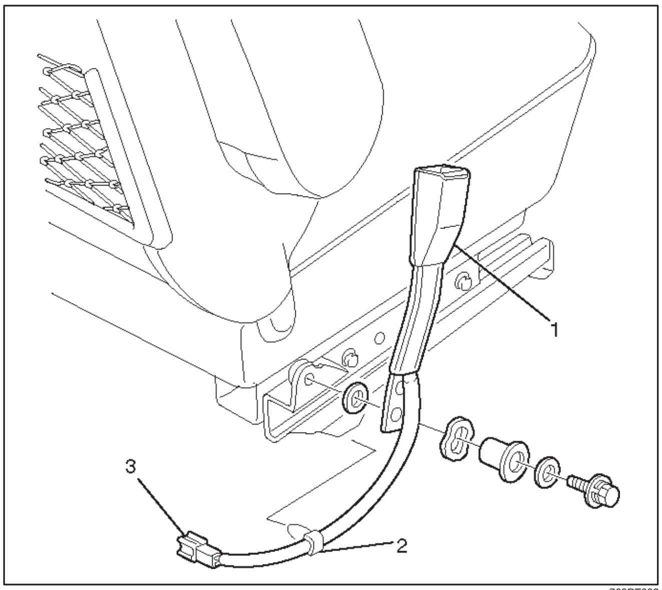
1. Tighten the seat belt anchor bolts to the specified torque.

Torque: 39 N·m (29 lb ft)

Front Seat Buckle Assembly

Removal

1. Disconnect the battery ground cable.
2. Disconnect the seat belt warning connector (driver's side) (3) and remove a clip(2).
3. Remove the front seat buckle assembly(1).

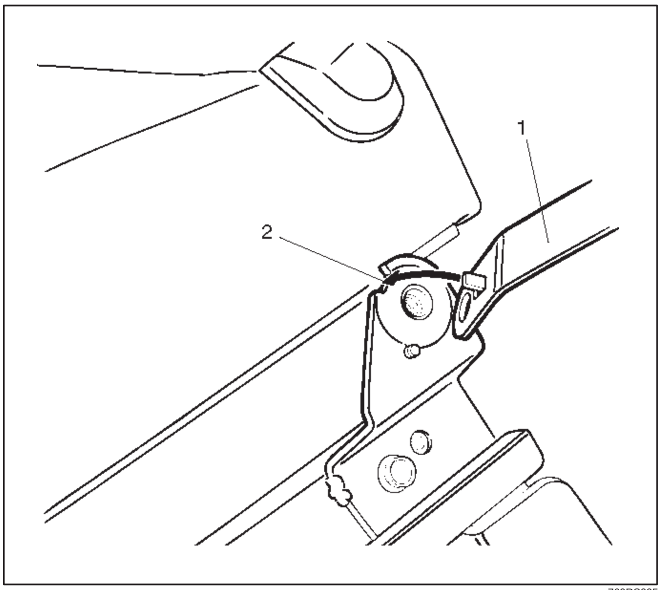


760RT003

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Fix the buckle to the rotation-stop position(2) securely to install the front seat buckle assembly(1).



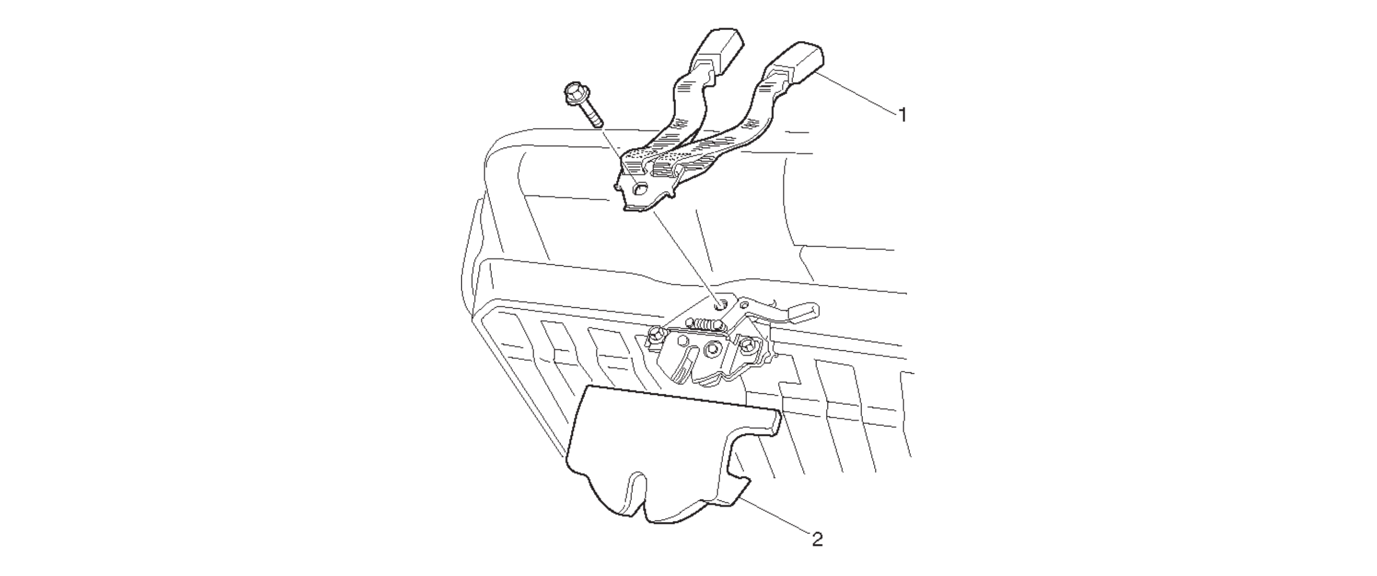
760RS005

2. Tighten the buckle anchor bolt to the specified torque.

Torque: 39 N·m (29 lb ft)

Rear Center Seat Belt / Buckle Assembly

Rear Center Seat Belt / Buckle Assembly and Associated Parts



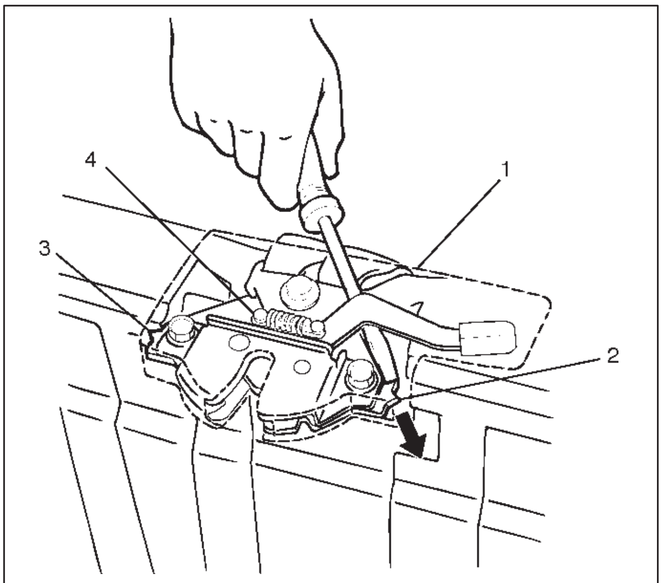
760RW007

Legend

(1) Rear Seat Belt Buckle Assembly
(2) Seat Lock Cover

Removal

1. Remove the catch portions(2) & (3) of the seat lock assembly(4) from the cover, and then remove the seat lock cover(1).



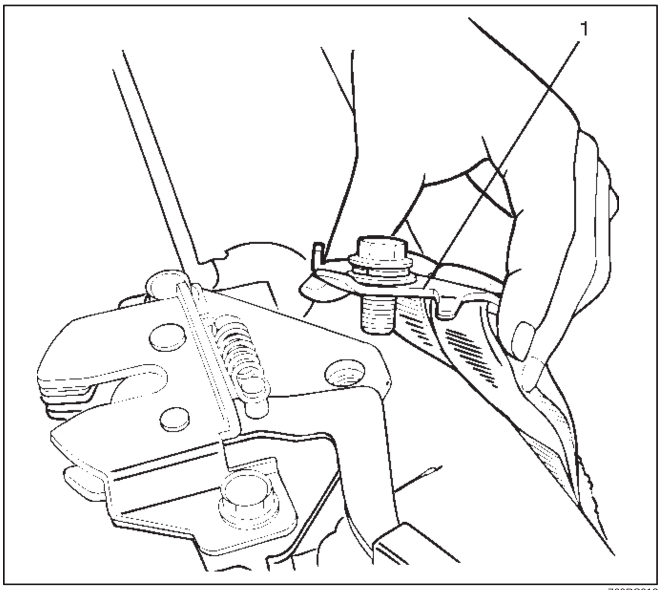
760RW016

2. Remove the rear seat buckle assembly.

Installation

1. Fix the rear seat buckle assembly(1) to the rotation stopper and tighten the anchor bolt to the specified torque.

Torque: 39 N·m (29 lb ft)



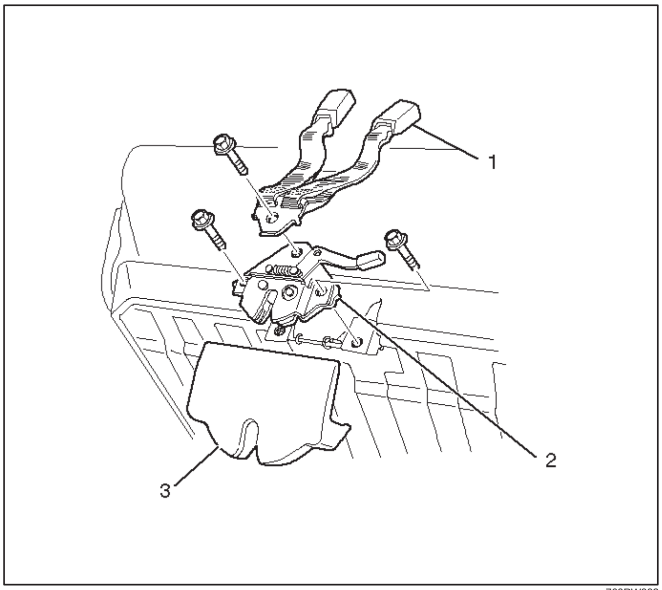
760RS013

2. Install the seat lock cover.

Rear Seat Lock Assembly

Removal

1. Remove the seat lock cover(3).
2. Remove the rear seat belt buckle assembly(1).
3. Remove the rear seat lock assembly(2).



760RW002

Installation

To install, follow the removal steps in the reverse order, noting the following point.

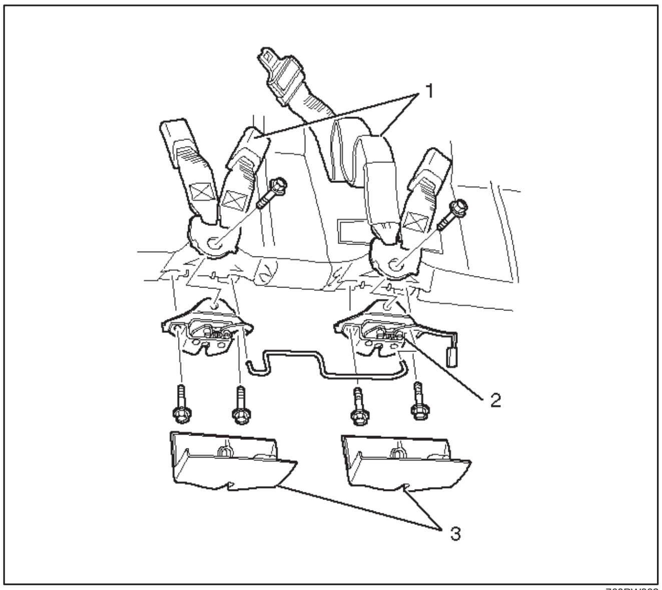
1. Tighten the seat lock fixing bolts to the specified torque.

Torque:42 N·m (31 lb ft)

Rear Seat Lock Assembly (Bench Type)

Removal

1. Remove the seat lock cover(3).
2. Remove the rear seat belt/buckle assembly(1).
3. Disconnect the link connecting the lock assemblies on the both sides, and then remove the rear seat lock assembly(2).



760RW003

Installation

To install, follow the removal steps in the reverse order, noting the following point.

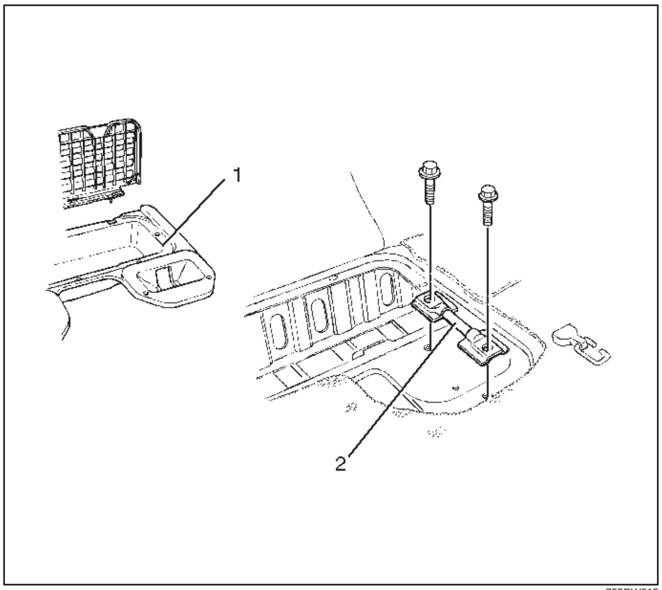
1. Tighten the seat lock fixing bolts to the specified torque.

Torque: 42 N·m (31 lb ft)

Rear Seat Strikers

Removal

1. Fold the rear seat assembly to the front direction.
2. Remove the luggage floor box(1).
3. Remove the rear seat striker(2).



755RW015

Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the striker fixing bolts to the specified torque.

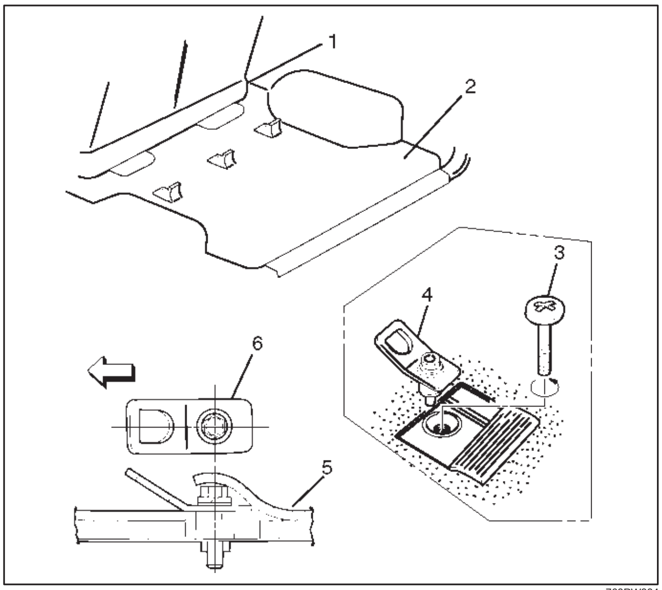
Torque: 40 N·m (30 lb ft)

Child Seat Tether Anchor Bracket (Child Restraint)

General Description

Plastic plug is provided at three places on the luggage floor panel. Remove the center plug from the floor panel. Install the bracket to the hole where the plug is removed. Alternatively, the bracket may be installed in the right-hand or left-hand plug hole.

Child Seat Tether Anchor Bracket and Associated Parts



760RW004

Legend

(1) Rear Seat
(2) Luggage Floor
(3) Plug
(4) Child Seat Tether Anchor Bracket
(5) Floor Carpet
(6) Child Seat Tether Anchor Bracket

Installation

1. Turn the plug counterclockwise to remove it.
2. Install the bracket such that its tether belt hook hole is facing toward the front of the vehicle.
3. Tighten the fixing bolt to the specified torque.

Torque: 20 N·m (14 lb ft)

Main Data and Specifications

Torque Specifications

Application	N·m	Lb Ft	Lb In
Front Seat Belt Anchor Bolts	39	29	—
Rear Seat Belt Anchor Bolts	39	29	—
Front Seat Buckle Anchor Bolt	39	29	—
Rear Seat Buckle Anchor Bolt	39	29	—
Rear Seat Lock Fixing Bolts	42	31	—
Rear Seat Striker Fixing Bolts	40	30	—
Child Seat Tether Anchor Bolt	20	14	—

TROOPER

RESTRAINTS

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

CONTENTS

Service Precaution

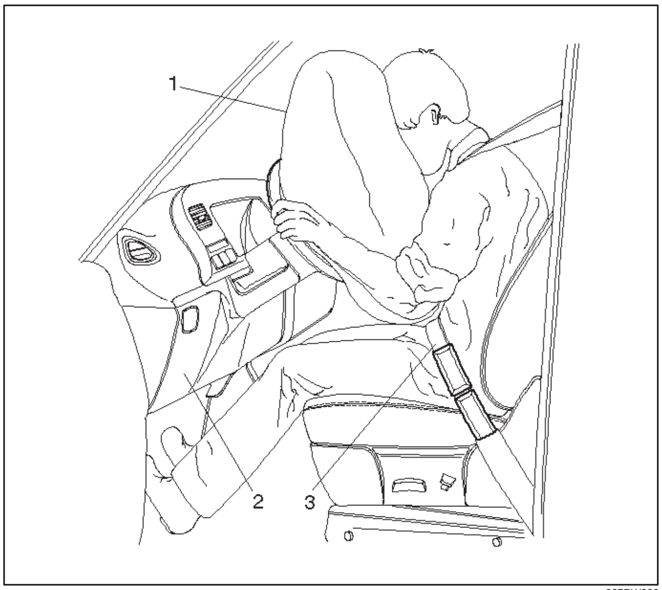
WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

CAUTION: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

Restraint Devices

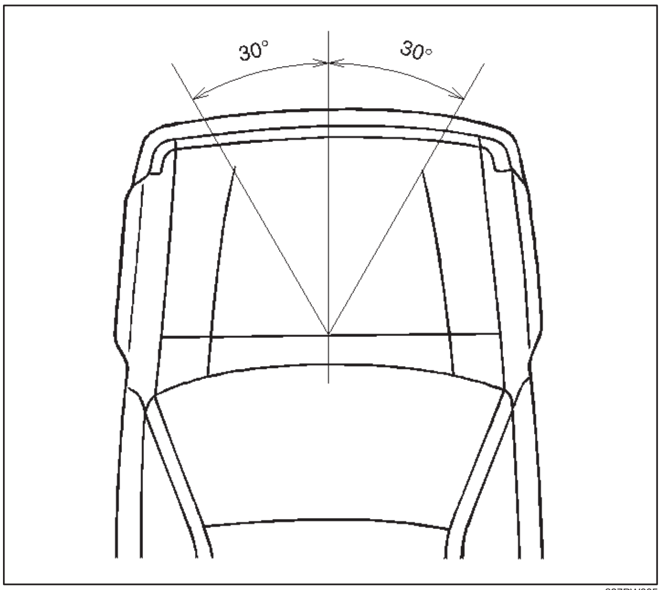


827RW006

Legend
- (1) Deployed Air Bag
- (2) Knee Bolster
- (3) Seat Belt

The Supplemental Restraint System (SRS) helps supplement the protection offered by the driver and front passenger seat belts by deploying an air bag from the center of the steering wheel and from the top of the right side of the instrument panel.

The air bag deploys when the vehicle is involved in a frontal crash of sufficient force up to 30 degrees off the centerline of the vehicle. To further absorb the crash energy there is a knee bolster located beneath the instrument panel for both the driver and passenger, and the steering column is collapsible.

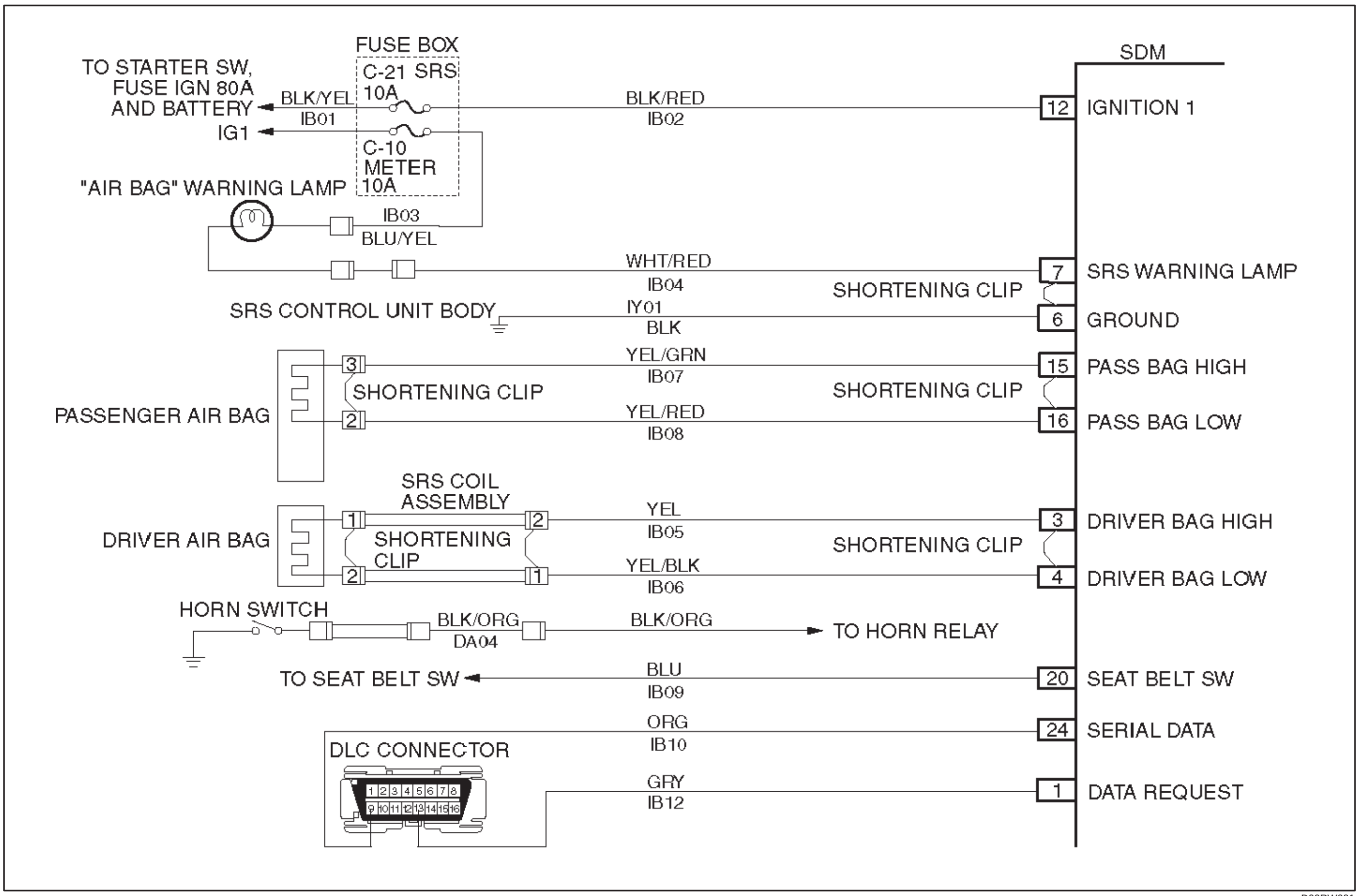


827RW005

System Description

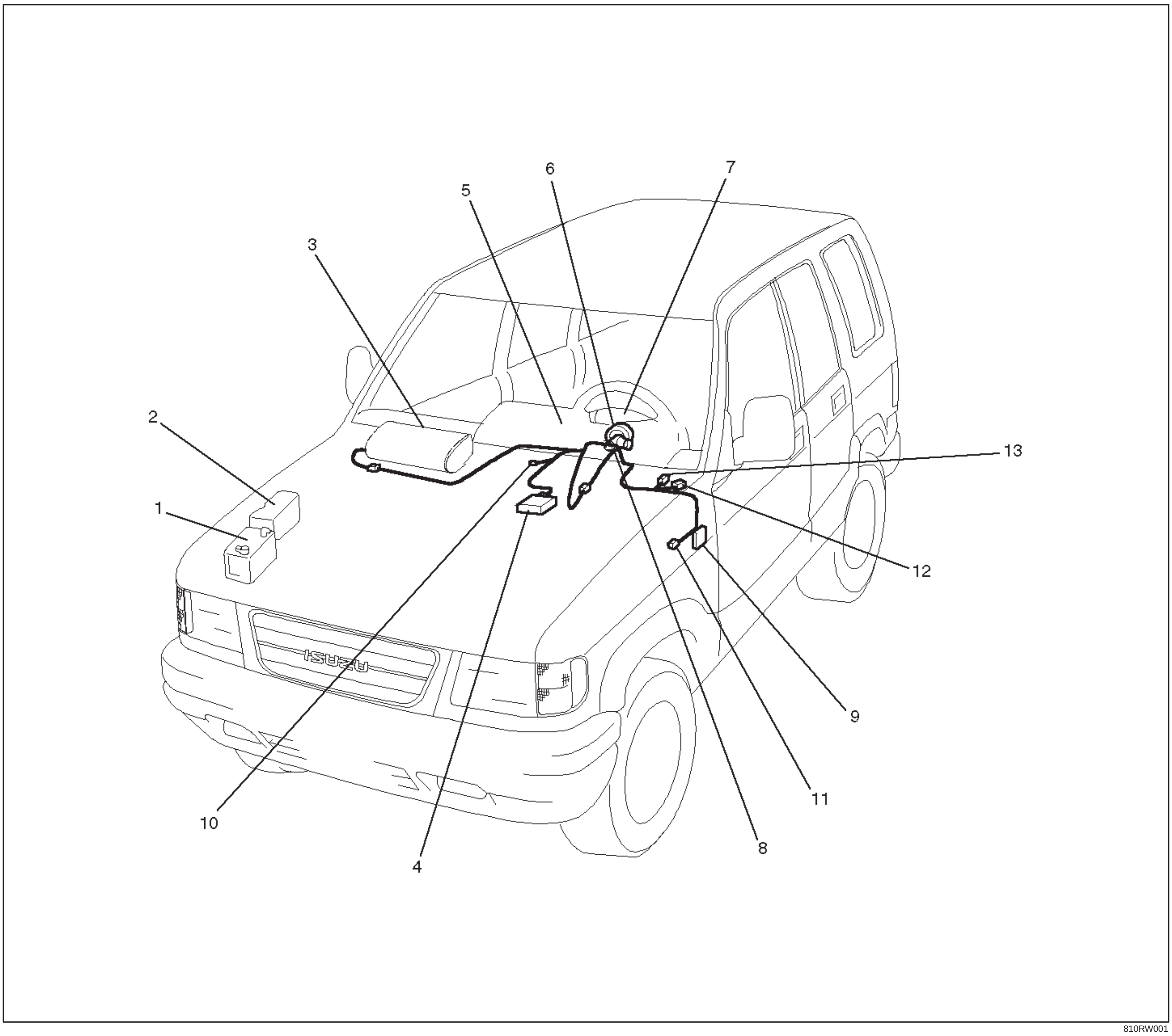
The SRS consists of the Sensing and Diagnostic Module (SDM), the driver air bag assembly, the SRS coil assembly, the passenger air bag assembly and the “AIR BAG” warning lamp in the instrument cluster. The SDM, SRS coil assembly (driver side only), driver air bag assembly, passenger air bag assembly and connector wire make up the deployment loops. The function of the deployment loops is to supply current through air bag assembly, which will cause deployment of the air bags in the event of a frontal crash of sufficient force, up to 30 degrees off the centerline of the vehicle. The air bag assemblies are only supplied enough current to deploy when the SDM detects vehicle velocity changes severe enough to warrant deployment.

The SDM contains a sensing device which converts vehicle velocity change to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the air bag assembly deploying the air bags.



D09RW001

SRS Component And Wiring Location View



Legend

(1) Battery
(2) Relay & Fuse Box
(3) Passenger Air Bag Assembly
(4) SDM
(5) Meter Assembly
(6) SRS Coil Assembly
(7) Driver Air Bag Assembly
(8) Starter Switch
(9) Fuse Box, C–21
(10) SRS Body Earth
(11) Body Harness Connector
(12) Instrument Harness Connector
(13) Engine Haness Connector

Component Description

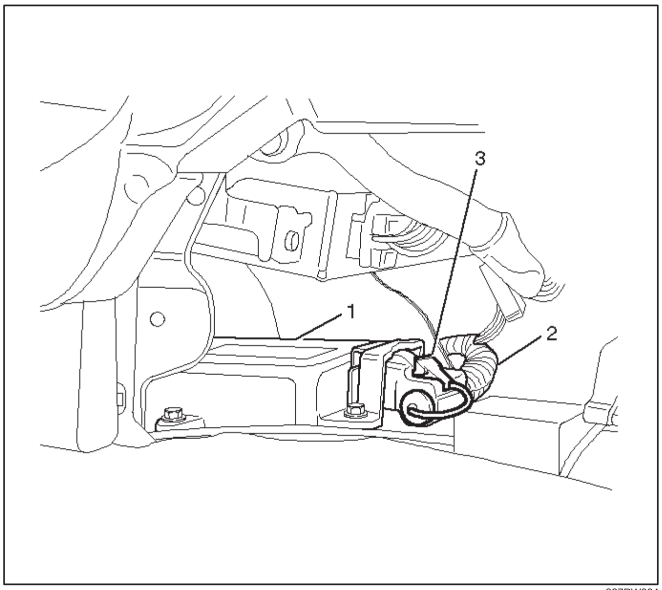
SDM (Sensing and Diagnostic Module)

WARNING: DURING SERVICE PROCEDURES, BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTED TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

The Sensing and Diagnostic Module (SDM) is designed to perform the following functions in the SRS:

1. Energy Reserve — The SDM maintains 24–Volt Loop Reserve (24VLR) energy supply to provide deployment energy when ignition voltage is lost in a frontal crash.
2. Frontal Crash Detection — The SDM monitors vehicle velocity changes to detect frontal crashes which are severe enough to warrant deployment.
3. Air Bag Deployment — When a frontal crash of sufficient force is detected, the SDM will cause enough current to flow through the air bag assembly to deploy the air bag.
4. Malfunction Detection — The SDM performs diagnostic monitoring of SRS electrical components and sets a diagnostic trouble code when a malfunction is detected.
5. Frontal Crash Recording — The SDM records information regarding SRS status during frontal crash.
6. Malfunction Diagnosis — The SDM displays SRS diagnostic trouble codes and system status information through the use of a scan tool.
7. Driver Notification — The SDM warns the vehicle driver of SRS malfunctions by controlling the “Air Bag” warning lamp.

The SDM is connected to the SRS wiring harness by a 24–pin connector. This harness connector uses a shorting clip across certain terminals in the contact area. This shorting clip connects the “AIR BAG” warning lamp to ground when the SDM harness connector is disconnected or CPA (Connector Position Assurance) is not inserted even if completely connected. This will cause the “AIR BAG” warning lamp to come “ON” steady whenever the ignition switch is at the ON or START positions with the SDM disconnected.



827RW004

Legend

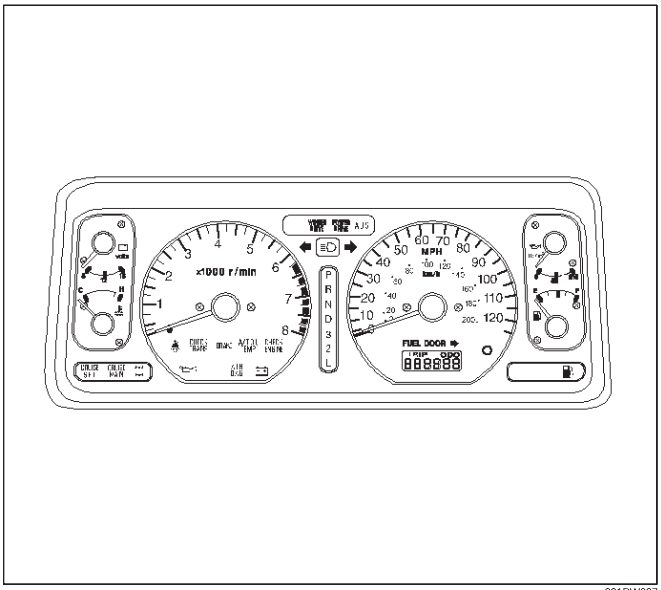
(1) SDM
(2) SRS Harness
(3) Connector Position Assurance

“Air Bag” Warning Lamp

Ignition voltage is applied to the “AIR BAG” warning lamp when the ignition switch is at the ON or START positions. The SDM controls the lamp by providing ground with a lamp driver. The “AIR BAG” warning lamp is used in the SRS to do the following:

1. Verify lamp and SDM operation by flashing SEVEN (7) times when the ignition switch is first turned “ON”.
2. Warn the vehicle driver of SRS electrical system malfunctions which could potentially affect the operation of the SRS. These malfunctions could result in nondeployment in case of a frontal crash or deployment for conditions less severe than intended.

The “AIR BAG ” warning lamp is the key to driver notification of SRS malfunctions. For proper lamp operation, refer to the “SRS Diagnostic System Check” in this section.



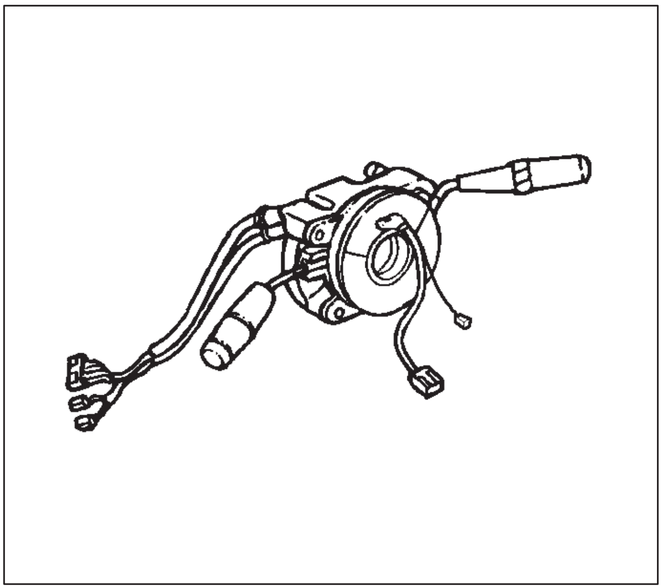
821RW037

SRS Coil Assembly

The SRS coil assembly consists of two current carrying coils. This is attached to the steering column and allow rotation of the steering wheel while maintaining continuous contact of the driver deployment loop to the driver air bag assembly.

There is a shorting clip on the yellow 2–pin connector near the base of steering column which connects the SRS coil to the SRS wiring harness.

The shorting clip shorts to the SRS coil and driver air bag assembly when the yellow 2–pin connector is disconnected. The circuit to the driver air bag assembly is shorted in this way to help prevent unwanted deployment of the air bag when servicing the steering column or other SRS components.



825RS017

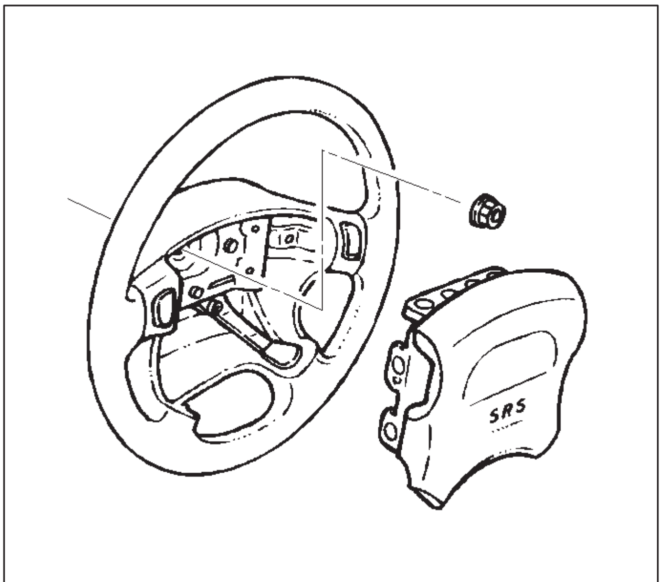
Air Bag Assemblies

The air bag assembly consist of an inflatable air bag assembly and an inflator (a canister of gas–generating material and an initiating device). When the vehicle is in a frontal crash of sufficient force.

The SDM causes current flow through the deployment loops. Current passing through the inflator ignites the material in the air bag assembly. The gas produced from this reaction rapidly inflates the air bag assembly.

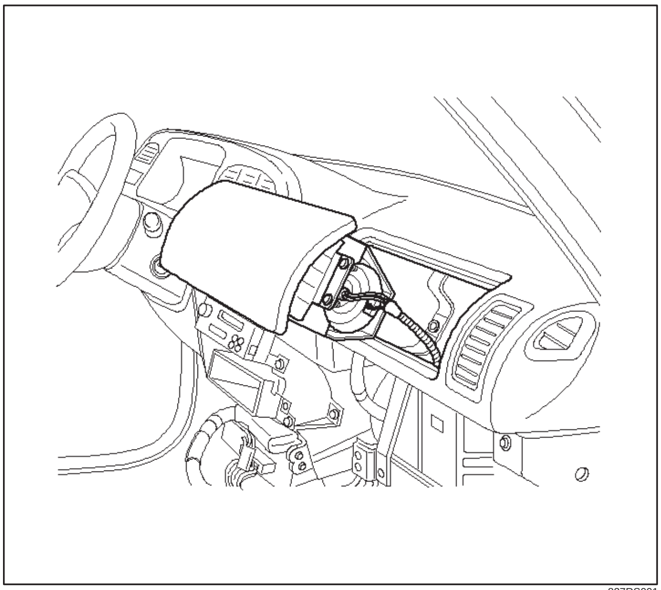
There is a shorting clip on the driver air bag assembly connector which connects the SRS coil assembly. The shorting clip shorts across the driver air bag assembly circuits when driver air bag assembly connector is disconnected.

The circuit to the driver air bag assembly is shorted in this way to help prevent unwanted deployment of the air bag when servicing the driver air bag assembly, the steering column or other SRS components.



827RS008

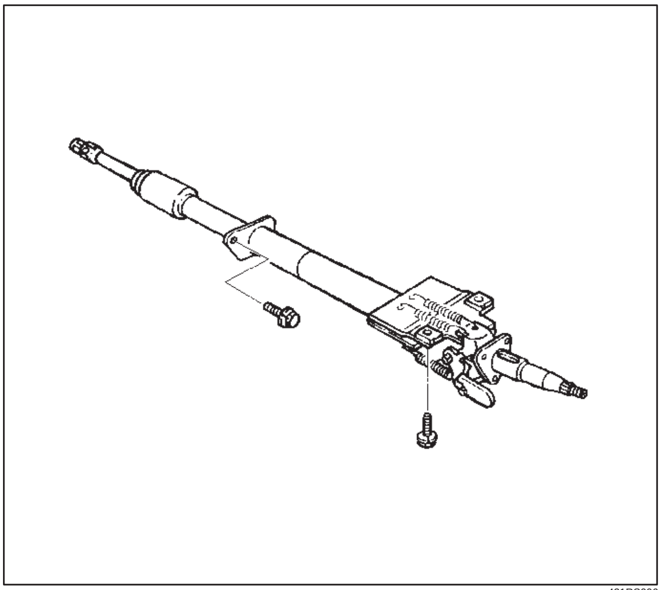
There is a shorting clip on the passenger air bag assembly connector which connects to the SRS harness. The shorting clip shorts across the passenger air bag assembly circuit when the passenger air bag assembly connector is disconnected. The circuit to the passenger air bag assembly is shorted in this way to help prevent unwanted deployment of the air bag when servicing the passenger air bag assembly, the instrument panel or other SRS components.



827RS001

Steering Column

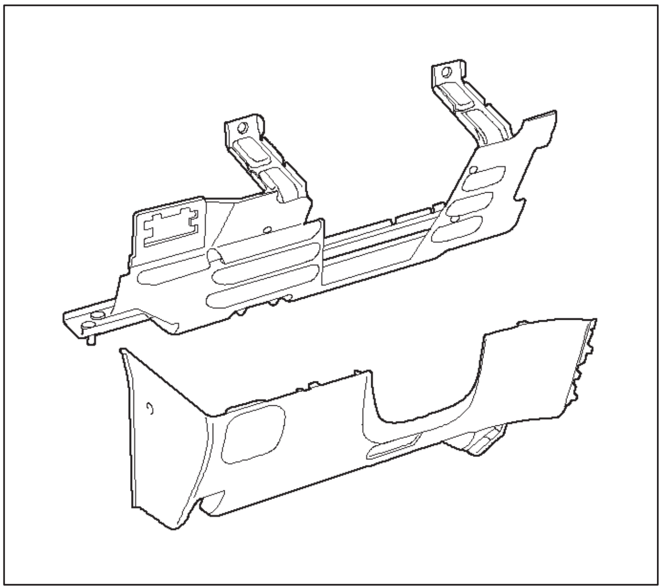
The steering column absorbs energy and is designed to compress in a frontal crash to decrease the chance of injury to the driver.



431RS006

Knee Bolster

The knee bolsters are used to absorb energy to protect knees and control the forward movement of the vehicle's front seat occupants during a frontal crash, by limiting leg movement.



740RT015

Definitions

Air Bag
An inflatable cloth cushion designed to deploy in certain frontal crashes. It supplements the protection offered by the seat belts by distributing the impact load more evenly over the vehicle occupant's head and torso.

Asynchronous
Performed in a nonperiodic fashion, (i.e., no defined time or interval).

B+
Battery voltage, (B+) The voltage available at the battery at the time of the indicated measurement. With the key "ON" and the engine not running, the system voltage will likely be between 12 and 12.5 volts. At idle, the voltage may be 14 to 16 volts. The voltage could be as low as 10 volts during engine cranking.

Bulb Check
The SDM will cause the "AIR BAG" warning lamp to flash seven times and then go "OFF" whenever the ignition switch transitions to the ON position from any other ignition switch position and no malfunctions are detected.

"Continuous Monitoring"
Tests performed by the SDM on the SRS every 100 milliseconds while "Ignition 1" voltage is in the normal operating voltage range at the SDM.

Data Link Connector (DLC)
Formerly "DLC" a connector which allows communication with an external computer, such as a scan tool.

Datum Line
A base line parallel to the plane of the underbody or frame from which all vertical measurements originate.

Deploy
To inflate the air bag.

Deployment Loops
The circuits which supply current to the air bag assemblies to deploy the air bag.

Diagnostic Trouble Code (DTC)
Formerly "Code", a numerical designator used by the SDM to indicate specific SRS malfunctions.

Driver Current Source
An output of the SDM which applies current into the driver air bag assembly circuit during the "Initiator Assembly Resistance Test".

Driver Air Bag Assembly
An assembly located in the steering wheel hub consisting of an inflatable bag, an inflator and an initiator.

EEPROM
Electrically Erasable Programmable Read Only Memory. Memory which retains its contents when power is removed from the SDM.

Ignition Cycle
The voltage at the SDM "Ignition 1" inputs, with ignition switch "ON", is within the normal operating voltage range for at least ten seconds before turning ignition switch "OFF".

Ignition 1
A battery voltage (B+) circuit which is only powered with the ignition switch in the ON, or START positions.

Initiator
The electrical component inside the air bag assembly which, when sufficient current flows, sets off the chemical reaction that inflates the air bag.

"Initiator Assembly Resistance Test"
Tests performed once each ignition cycle when no malfunctions are detected during "Turn–ON" or "Continuous Monitoring". This test checks for the correct SDM configuration for the vehicle, shorts to "Ignition 1" in the deployment loops, high resistance or opens in the "Driver Side High", "Driver Side Low", "Passenger Side High" and "Passenger Side Low" circuits and measures the resistance of the inflator assembly consisting of 1) Initiators, 2) SRS coil assembly (driver side only), 3) Connectors and associated wiring.

Normal Operating Voltage Range
The voltage measured between the SDM "Ignition 1" terminals and "Ground" terminals is between 9 and 16 volts.

Passenger Current Source
An output of the SDM which applies current into the passenger air bag assembly circuit during the "Initiator Assembly Resistance Test".

Passenger Air Bag Assembly
An assembly located in the right side of the instrument panel consisting of an inflatable bag, an inflator and an initiator.

Scan Tool
An external computer used to read diagnostic information from on–board computers via the data link connector.

SDM
Sensing and Diagnostic Module which provides reserve energy to the deployment loops, deploys the air bags when required and performs diagnostic monitoring of all SRS components.

Serial Data
Information representing the status of the SRS.

SRS
Supplemental Restraint System.

SRS Coil Assembly
An assembly of two current–carrying coils in the driver deployment loop that allows the rotation of the steering wheel while maintaining the continuous contact of the driver deployment loop to the driver air bag assembly.

SRS Wiring Harness
The wires and connectors that electrically connect the components in the SRS.

"Turn–ON"
Test which the SDM performs on the SRS once during each ignition cycle immediately after "Ignition 1" voltage is applied to the SDM and before "Continuous Monitoring".

Diagnosis

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY–POWERED OR AC–POWERED VOLTMETER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NONPOWERED PROBE–TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

Diagnostic Trouble Codes

The "SRS Diagnostic System Check" must always be the starting point of any SRS diagnosis. The "SRS Diagnostic System Check" checks for proper "AIR BAG" warning lamp operation and checks for SRS diagnostic trouble codes using the scan tool.

1. Current diagnostic trouble codes – Malfunctions that are presently being detected. Current diagnostic trouble codes are stored in RAM (Random Access Memory).
2. History diagnostic trouble codes – All malfunctions detected since the last time the history memory was cleared. History diagnostic trouble codes are stored in EEPROM.

Scan Tool Diagnostics

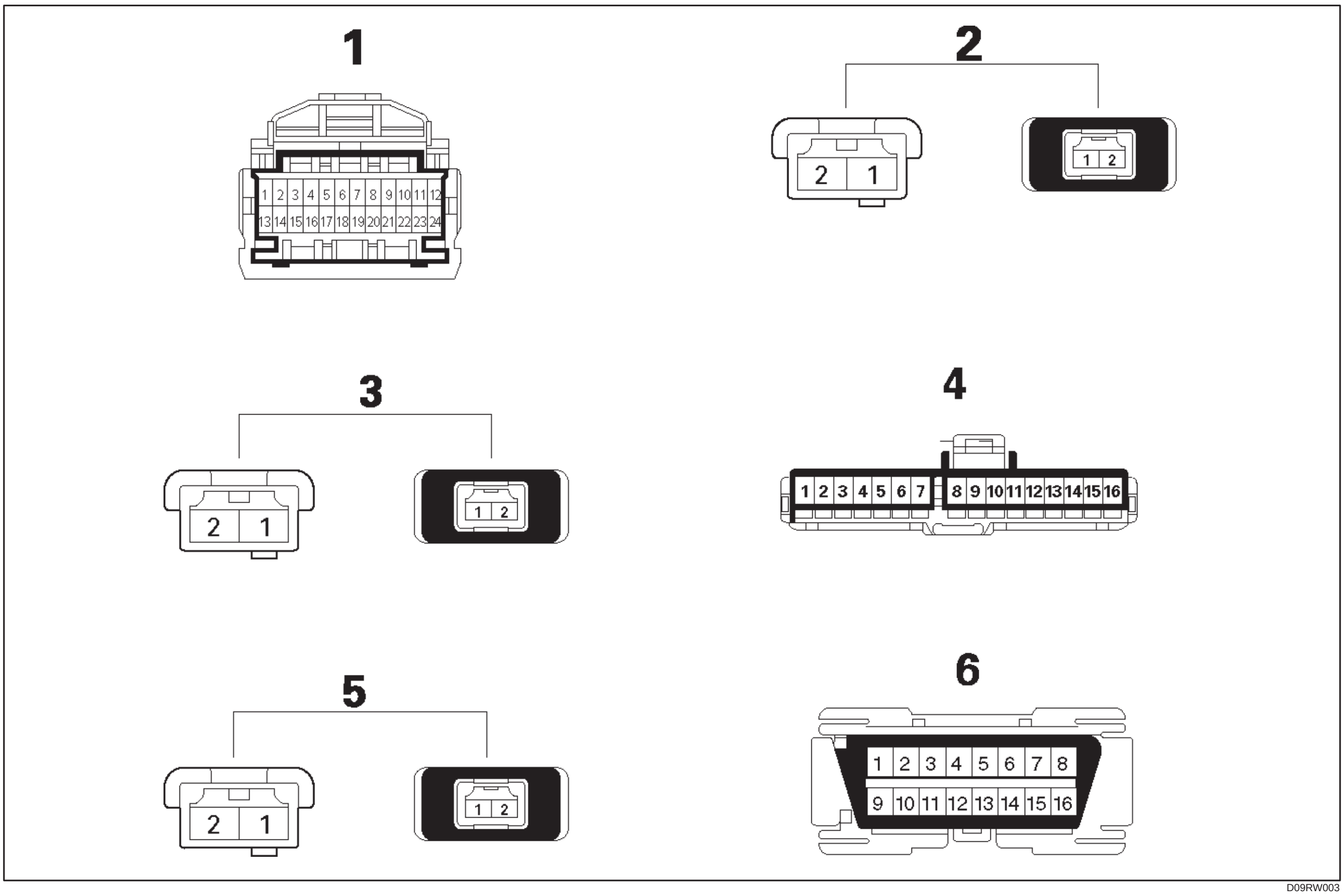
A scan tool is used to read current and history diagnostic trouble codes and to clear all diagnostic trouble codes after a repair is completed. The scan tool must be updated to communicate with the SRS through a replaceable cartridge before it can be used for SRS diagnostics. To use the scan tool, connect it to the data link connector and turn the ignition switch "ON". The scan tool reads serial data from the SDM "Serial Data" line terminal "24" to the data link connector terminal "9".

Use Of Special Tools

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY–POWERED OR AC–POWERED VOLTMETER, OHMMETER, ETC, OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NON POWERED PROBE–TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT. YOU SHOULD BE FAMILIAR WITH THE TOOLS LISTED IN THIS SECTION UNDER THE HANDLING SRS SPECIAL TOOLS.

You should be able to measure voltage and resistance. You should be familiar with proper use of a scan tool such as the Tech 2 Diagnostic Computer, SRS Driver/Passenger Load Tool J–41433, Connector Test Adapter Kit J–35616–A, and the DVM (Digital Multimeter) J–39200.

SRS Connector Body Face Views



Legend

(1) SDM
(2) Driver Air Bag Assembly
(3) Passenger Air Bag Assembly
(4) “Air Bag” Warning Lamp
(5) SRS Coil Assembly
(6) DLC Connector

Repairs And Inspections Required After An Accident

NOTE: If any SRS components are damaged, they must be replaced. If SRS component mounting points are damaged, they must be replaced.

- Never use SRS parts from another vehicle. This does not include remanufactured parts purchased from an authorized dealer; they may be used for SRS repairs.
- Do not attempt to service the SDM, the SRS coil assembly, or the air bag assembly. Service of these items is by replacement only.
- Verify the part number of replacement air bag assembly.

CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label from ’00 model as follows.

Yellow color for driver air bag assembly.

White color for passenger air bag assembly.

Use only new air bag assembly proper to the Trooper which is being repaired.

CAUTION: Proper operation of the sensors and supplemental restraint system (SRS) requires that any repairs to the vehicle structure return it to the original production configuration. Deployment requires, at a minimum, replacement of the SDM, air bag assembly and dimensional inspection of the steering column. Any visible damage to the SDM mounting bracket (s) requires replacement, and the steering column must be dimensionally inspected, whether deployment occurred or not.

Accident With Deployment – Component Replacement And Inspections

Certain SRS components must be replaced or inspected for damage after a frontal crash involving air bag deployment. Those components are:

- Air bag assembly
- SDM

CAUTION: Refer to "SDM Replacement Guidelines" below for important information on SDM replacement in both deployment and non deployment crashes.

- SRS coil assembly — Inspect wiring and connector for any signs of scorching, melting, or damage due to excessive heat. Replace if damaged. Refer to section "SRS Coil Assembly" in this manual.

Accident With or Without Deployment – Component Inspection

Certain SRS system components and rotation parts must be inspected after any crash, whether the air bag deployed or not. Those components are:

- Steering column — Refer to Inspection Required "After an Accident" in this manual.
- Knee bolsters and mounting points — Inspect for any distortion, bending, cracking, or other damage.
- I/P steering column reinforcement plate — Inspect for any distortion, bending, cracking, or other damage.
- I/P braces — Inspect for any distortion, bending, cracking, or other damage.
- Seat belts and mounting points — Refer to "Seat Belts" in Section "Seat Belt" of this workshop manual.

SDM Replacement Guidelines

SDM replacement policy requires replacement of SDM, after crash involving air bag deployment when "SRS Warning Lamp" turn "ON", "SRS Diagnosis" should be done according to Section "Restraint Control System."

Wiring Damage

If any SRS wire harness is damaged, it should be replaced. Don't repair SRS harness. It is replace only.

SRS Connector (Plastic Body And Terminal Metal Pin) Damage

If any connector or terminal in the SRS wire harness (except pigtails) is damaged, it should be replaced.

SRS Wire Pigtail Damage

If the wiring pigtail (a wire or wires attached directly to the device, not by a connector) is damaged, the entire component (with pigtail) must be replaced. Examples of "pigtail" components are the driver air bag assembly, the passenger air bag assembly, and the SRS coil assembly.

On–Vehicle Service

Service Precaution

WARNING: WHEN PERFORMING SERVICE ON OR AROUND SRS COMPONENTS OR SRS WIRING, FOLLOW THE PROCEDURES LISTED BELOW TO TEMPORARILY DISABLE THE SRS. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY OR OTHERWISE UNNEEDED SRS REPAIRS.

The SDM in Driver–Passenger SRS can maintain sufficient voltage to cause a deployment for up to 15 seconds after the ignition switch is turned "OFF," the battery is disconnected, or the fuse powering the SDM is removed.

Many of the service procedures require removal of the "C–21" fuse, and disconnection of the air bag assembly from the deployment loop to avoid an accidental deployment. If the air bag assembly is disconnected from the deployment loop as noted in the "Disabling the SRS" procedure that follows, service can begin immediately without waiting for the 15 second time period to expire.

Disabling The SRS

Removal

Turn the ignition switch to "LOCK" and remove key.

1. Remove SRS fuse C–21, from left dash side lower fuse block or disconnect battery.
2. Disconnect yellow 2–pin connector at the base of steering column.
3. Remove glove box assembly, refer to "Passenger Air Bag Assembly Replacement" in this manual.
4. Disconnect yellow 2–pin connector behind the glove box assembly.

CAUTION: With the "C–21" fuse removed and ignition switch "ON", the "AIR BAG" warning lamp will be "ON". This is normal operation and does not indicate an SRS malfunction.

Enabling The SRS

Installation

CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label from '00 model as follows.

Yellow color for driver air bag assembly.

White color for passenger air bag assembly.

Use only new air bag assembly proper to the Trooper which is being repaired.

Turn ignition switch to "LOCK" and remove key.

1. Connect yellow 2–pin connector passenger air bag assembly.
2. Install glove box assembly. Refer to "Passenger air bag assembly replacement" in this manual.
3. Connect yellow 2–pin connector at the base of steering column.
4. Install "AIR BAG" fuse C–21 to left dash side lower fuse block or connect battery.

Turn ignition switch to "ON" and verify that the "AIR BAG" warning lamp flashes seven times and then turns "OFF." If it does not operate as described, perform the "SRS Diagnostic System Check" in this manual.

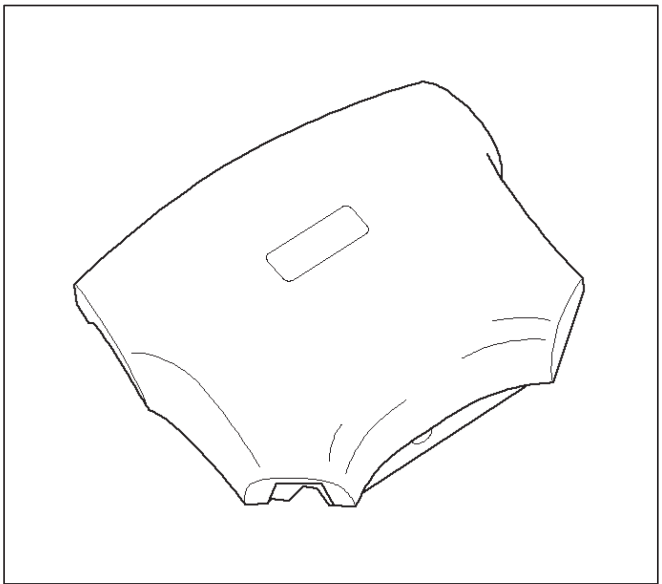
Handling / Installation / Diagnosis

1. Air bag assembly should not be subjected to temperatures above 65˚C (150˚F).
2. Air bag assembly, and SDM should not be used if they have been dropped from a height of 100 centimeters (3.28 feet) or more.
3. When a SDM is replaced, it must be oriented with the arrow on the sensor pointing toward the front of the vehicle. It is very important for the SDM to be located flat on the mounting surface, parallel to the vehicle datum line. It is important that the SDM mounting surface is free of any dirt or other foreign material.
4. Do not apply power to the SRS unless all components are connected or a diagnostic chart requests it, as this will set a diagnostic trouble code.
5. The “SRS Diagnostic System Check” must be the starting point of any SRS diagnostics. The “SRS Diagnostic System Check” will verify proper “AIR BAG” warning lamp operation and will lead you to the correct chart to diagnose any SRS malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacement.

Air Bag Assembly Handling / Shipping / Scrapping

Live (Undeployed) Air Bag Assembly

Special care is necessary when handling and storing a live (undeployed) air bag assembly. The rapid gas generation produced during deployment of the air bag could cause the air bag assembly, or an object in front of the air bag assembly, to be thrown through the air in the unlikely event of an accidental deployment.



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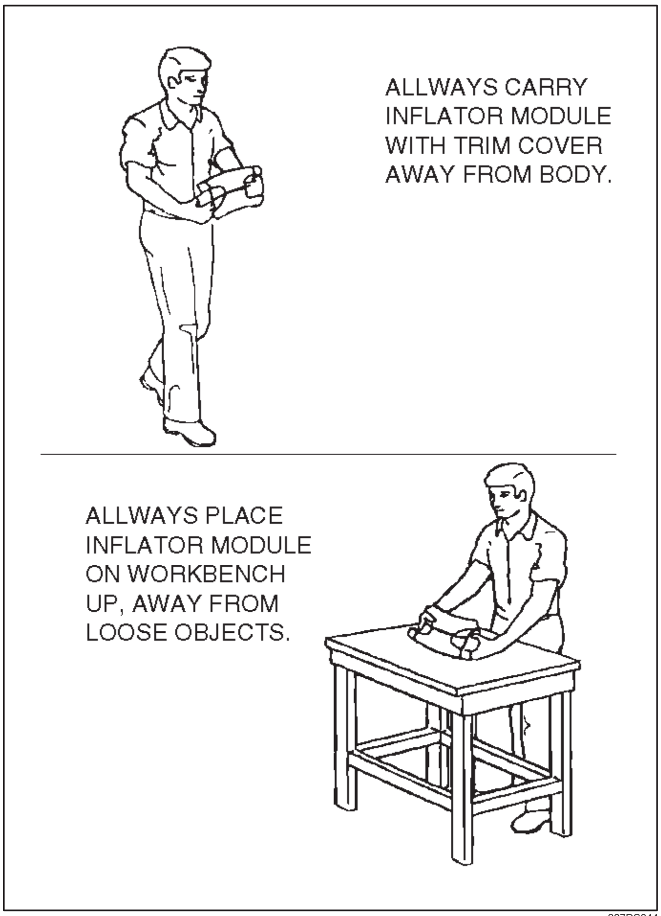
WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG OPENING IS POINTED AWAY FROM YOU. IN CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. NEVER CARRY THE AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF THE MODULE.



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Air Bag Assembly Shipping Procedure For Live (Undeployed) Air Bag Assemblies

Service personnel should refer to the latest Service Bulletins for proper SRS air bag assembly shipping procedures.

Deployed Air Bag Assembly (Driver Side)

You should wear gloves and safety glasses. After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present.

Air Bag Assembly Scrapping Procedure

During the course of a vehicle’s useful life, certain situations may arise which will necessitate the disposal of a live (undeployed) air bag assembly. This information covers proper procedures for disposing of a live air bag assembly.

Before a live air bag assembly can be disposed of, it must be deployed. A live air bag assembly must not be disposed of through normal refuse channels.

WARNING: FAILURE TO FOLLOW PROPER SUPPLEMENTAL RESTRAINT SYSTEM (SRS) AIR BAG ASSEMBLY DISPOSAL PROCEDURES CAN RESULT IN AIR BAG DEPLOYMENT WHICH MAY CAUSE PERSONAL INJURY. AN UNDPLOYED AIR BAG ASSEMBLY MUST NOT BE DISPOSED OF THROUGH NORMAL REFUSE CHANNELS. THE UNDEPLOYED AIR BAG ASSEMBLY CONTAINS SUBSTANCES THAT CAN CAUSE SEVERE ILLNESS OR PERSONAL INJURY IF THE SEALED CONTAINER IS DAMAGED DURING DISPOSAL. DISPOSAL IN ANY MANNER INCONSISTENT WITH PROPER PROCEDURES MAY BE A VIOLATION OF FEDERAL, STATE, AND / OR LOCAL LAW.

In situations which require deployment of a live air bag assembly, deployment may be accomplished inside or outside the vehicle. The method employed depends upon the final disposition of the particular vehicle, as noted in “Deployment Outside Vehicle” and “Deployment Inside Vehicle” in this section.

Deployment Outside Vehicle (Driver Air Bag Assembly)

Deployment outside the vehicle is proper when the vehicle is to be returned to service. This includes, for example, situations in which the vehicle will be returned to useful service after a functionally or cosmetically deficient air bag assembly is replaced. Deployment and disposal of a malfunctioning air bag assembly is, of course, subject to any required retention period.

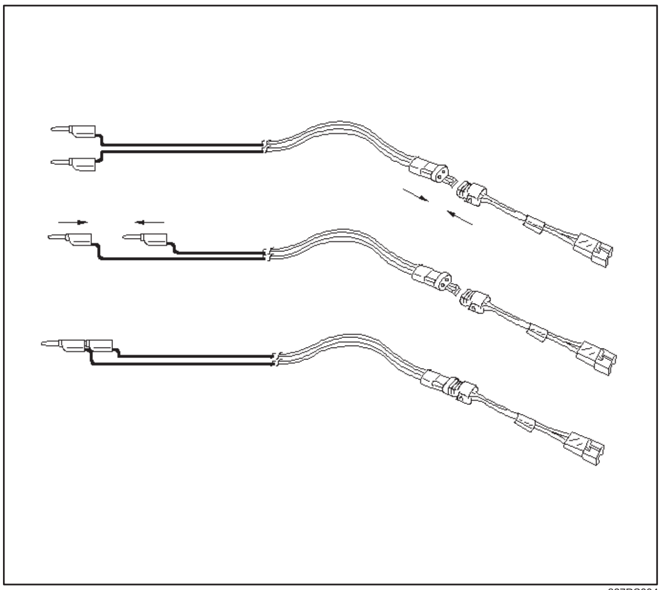
For deployment of a live (undeployed) air bag assembly outside the vehicle, the deployment procedure must be followed exactly. Always wear safety glasses during this deployment procedure until a deployed air bag assembly is scrapped or until an undeployed air bag assembly is shipped. Before performing the procedures you should be familiar with servicing the SRS and with proper handling of the air bag assembly. Procedures should be read fully before they are performed.

The following procedure requires use of J–42986 SRS deployment harness with appropriate pigtail adapter. Do not attempt procedure without J–42986 adapter.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT HARNESS TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT HARNESS TO THE DRIVER AIR BAG ASSEMBLY. DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

NOTE: This information applies only to driver air bag assembly . Refer to “Deployment Outside Vehicle (Passenger Air Bag assembly)” in this section for information on passenger air bag assembly scrapping.

1. Turn ignition switch to “LOCK”, remove key and put on safety glasses.
2. Inspect J–42986 SRS Deployment Harness and appropriate pigtail adapter for damage. If harness or pigtail adapter is damaged, discard and obtain a replacement.
3. Short the two SRS deployment harness leads together by fully seating one banana plug into the other. SRS deployment harness shall remain shorted and not be connected to a power source until the air bag is to be deployed.



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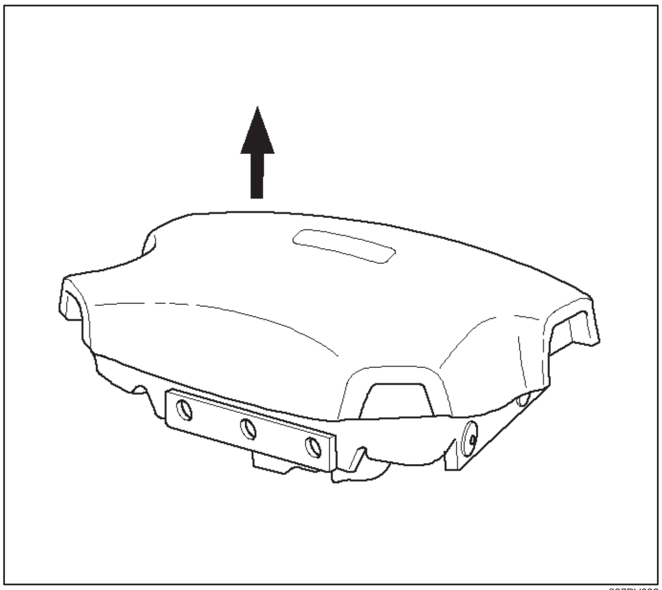
4. Connect the appropriate pigtail adapter to the SRS deployment harness.
5. Remove the driver air bag assembly from vehicle. Refer to “Inflator Module Removal” in this manual.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE AIR BAG ASSEMBLY UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE AIR BAG AND TRIM COVER UP AND AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

6. Place the driver air bag assembly on a work bench or other surface away from all loose or flammable objects with its trim cover facing up, away from the surface.



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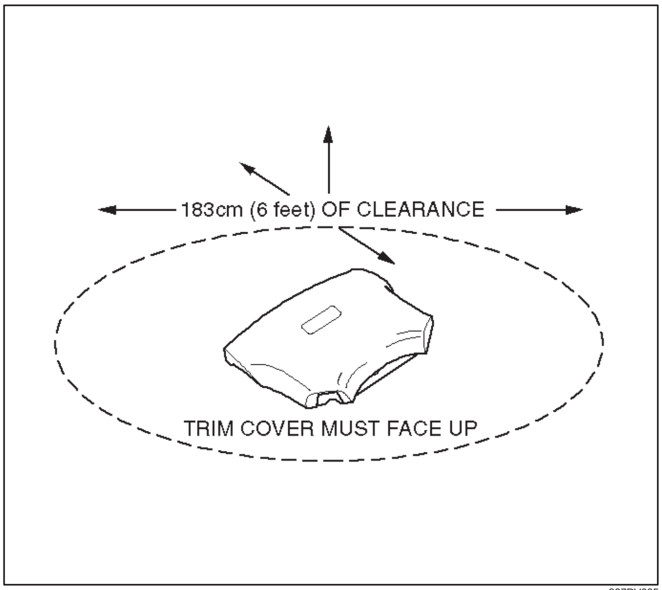
7. Clear a space on the ground about 183 cm (six feet) in diameter where the driver air bag assembly is to be deployed. A paved, outdoor location where there is no activity is preferred. If an outdoor location is not available, a space on the shop floor where there is no activity and sufficient ventilation is recommended. Ensure no loose or flammable objects are within the deployment area.



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8. Place the driver air bag assembly, with its trim cover facing up, on the ground in the space just cleared.
9. Stretch the SRS deployment harness and pigtail adapter from the driver air bag assembly to its full length.
10. Place a power source near the shorted end of the SRS deployment harness. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
11. Connect the driver air bag assembly to the pigtail adapter on the SRS deployment harness. Deployment harness shall remain shorted and not be connected to a power source until the air bag is to be deployed. The driver air bag assembly will immediately deploy the air bag when a power source is connected to it.

NOTE: Ensure that the pigtail adapter is firmly seated into the driver air bag assembly connector. Failure to fully seat the connectors may leave the shorting bar located in the driver air bag assembly connector functioning (shorted) and may result in nondeployment of the driver air bag assembly.

12. Verify that the area around the driver air bag assembly is clear of all people and loose or flammable objects.
13. Verify that the driver air bag assembly is resting with its trim cover facing up.
14. Notify all people in the immediate area that you intend to deploy the driver air bag. The deployment will be accompanied by a substantial noise which may startle the uninformed.
15. Separate the two banana plugs on the SRS deployment harness.

NOTE: When the air bag deploys, the driver air bag assembly may jump about 30 cm (one foot) vertically. This is a normal reaction of the driver air bag to the force of the rapid gas expansion inside the air bag.

NOTE: When the air bag deploys, the rapid gas expansion will create a substantial noise. Notify all people in the immediate area that you intend to deploy the driver air bag.

WARNING: DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT HARNESS TO THE POWER SOURCE SHOULD ALWAYS BE THE LAST STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY.

16. Connect the SRS deployment harness wires to the power source to immediately deploy the driver air bag. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
17. Disconnect the SRS deployment harness from the power source.
18. Short the two SRS deployment harness leads together by fully seating one banana plug into the other.

19. In the unlikely event that the driver air bag assembly did not deploy after following these procedures, proceed immediately with Steps 24 through 26. If the driver air bag assembly did deploy, proceed with Steps 20 through 23.
20. Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed driver air bag assembly. After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This power consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with the atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment.

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE AIR BAG ASSEMBLY WILL BE VERY HOT. ALLOW THE INFLATOR MODULE TO COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE DEPLOYED AIR BAG ASSEMBLY NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN FIRE OR PERSONAL INJURY.

AFTER A DRIVER AIR BAG ASSEMBLY HAS BEEN DEPLOYED, THE METAL CANISTER AND SURROUNDING AREAS OF THE DRIVER AIR BAG ASSEMBLY WILL BE VERY HOT. DO NOT TOUCH THE METAL AREAS OF THE DRIVER AIR BAG ASSEMBLY FOR ABOUT TEN MINUTES AFTER DEPLOYMENT. IF THE DEPLOYED DRIVER AIR BAG ASSEMBLY MUST BE MOVED BEFORE IT IS COOL, WEAR GLOVES AND HANDLE BY THE AIR BAG OR TRIM COVER.

21. Disconnect the pigtail adapter from the driver air bag assembly as soon after deployment as possible. This will prevent damage to the pigtail adapter or SRS deployment harness due to possible contact with the hot driver air bag assembly canister. The pigtail adapter can be reused. They should, however, be inspected for damage after each deployment and replaced if necessary.
22. Dispose of the deployed driver air bag assembly through normal refuse channels after it has cooled for at least 30 minutes.
23. Wash your hands with mild soap and water afterward.

NOTE: The remaining steps are to be followed in the unlikely event that the driver air bag assembly did not deploy after following these procedures.

24. Ensure that the SRS deployment harness has been disconnected from the power source and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
25. Disconnect the pigtail adapter from the driver air bag assembly.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE INFLATOR MODULE UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG AND TRIM COVER UP AND AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

26. Temporarily store the driver air bag assembly with its trim cover facing up, away from the surface upon which it rests.

Deployment Outside Vehicle (Passenger Air Bag Assembly)

WARNING: FAILURE TO FOLLOW PROPER SRS AIR BAG ASSEMBLY DISPOSAL PROCEDURES CAN RESULT IN AIR BAG DEPLOYMENT WHICH MAY CAUSE PERSONAL INJURY. UNDEPLOYED AIR BAG ASSEMBLIES MUST NOT BE DISPOSED OF THROUGH NORMAL REFUSE CHANNELS. THE UNDEPLOYED AIR BAG ASSEMBLY CONTAINS SUBSTANCES THAT CAN CAUSE SEVERE ILLNESS OR PERSONAL INJURY IF THE SEALED CONTAINER IS DAMAGED DURING DISPOSAL. DISPOSAL IN ANY MANNER INCONSISTENT WITH PROPER PROCEDURES MAY BE A VIOLATION OF FEDERAL, STATE AND/OR LOCAL LAWS.

Deployment out of the vehicle is proper when the vehicle is to be returned to service. This includes, for example, situations in which a functionally or cosmetically deficient air bag assembly is replaced. Deployment and disposal of an air bag assembly is, of course, subject to any required retention period.

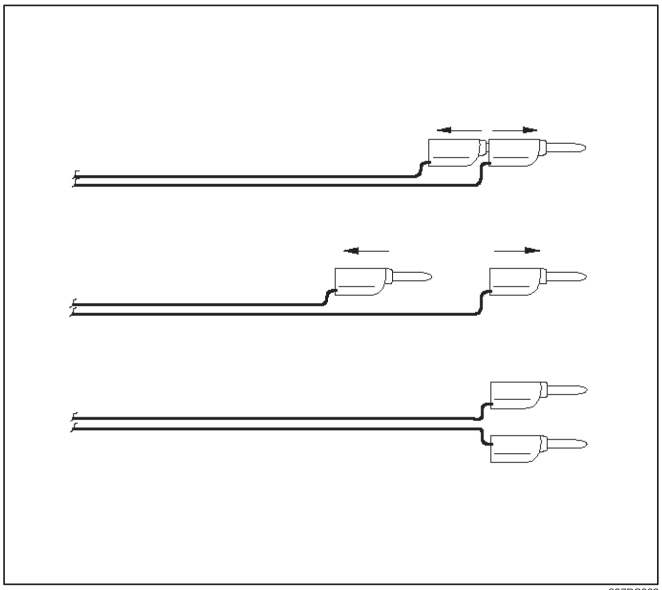
For deployment of a live air bag assembly out of the vehicle, the deployment procedure must be followed exactly. Always wear safety glasses during this deployment procedure until the deployed air bag assembly is scrapped. Before performing the procedures, you should be familiar with servicing the SRS system and with proper handling of the air bag assembly. Procedures should be read fully before they are performed.

The following procedure requires use of J–42986 SRS Deployment Harness with the appropriate pigtail adapter. The procedure also requires the use of J–41497 Passenger Side SRS Module Deployment Fixture. Do not attempt this procedure without J–42986 and adapter, and J–41497.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT HARNESS TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT HARNESS TO THE AIR BAG ASSEMBLY. DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

NOTE: This information applies only to passenger air bag assembly. Information for disposing of a live driver air bag assembly can be found in "Deployment Outside Vehicle" (Driver Air Bag Assembly) in this section.

1. Turn ignition switch to "LOCK" remove key, and put on safety glasses.
2. Inspect J–42986 SRS Deployment Harness and appropriate pigtail adapter for damage. If harness or pigtail is damaged, discard and obtain a replacement.
3. Short the two SRS Deployment Harness leads together by fully seating one banana plug into the other. The SRS Deployment Harness shall remain shorted and not be connected to a power source until the air bag is to be deployed.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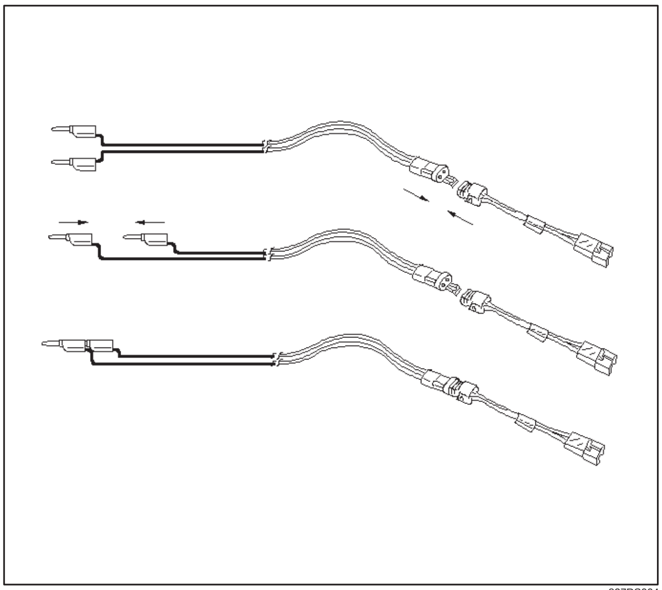
4. Connect the appropriate pigtail adapter to the SRS Deployment Harness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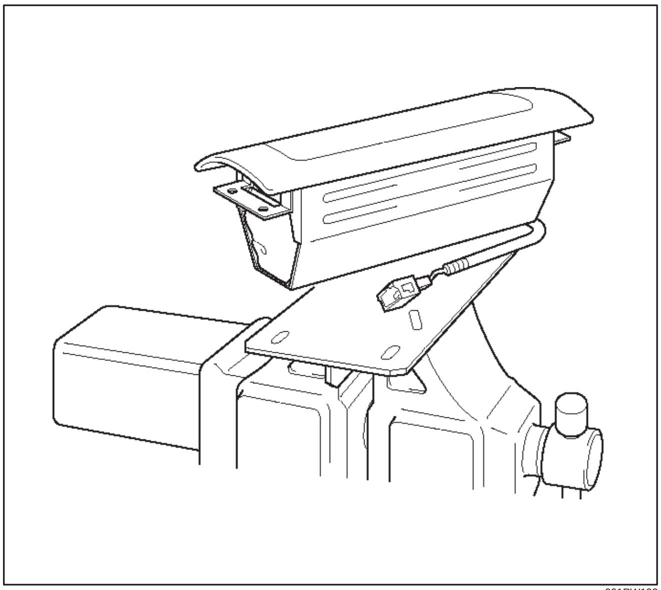
5. Remove passenger air bag assembly from vehicle. Refer to "Passenger Air Bag Assembly Removal " in this Section 9J–3.
6. Clear a space on the ground approximately 183 cm (six feet) in diameter where the fixture with attached air bag assembly is to be placed for deployment. A paved outdoor location where there is no activity is preferred. If an outdoor location is not available, a space on the shop floor where is no activity and sufficient ventilation is recommended. Ensure that no loose or flammable objects are within the deployment area.
7. Place the J–41497 on the bench vice. This is necessary to provide sufficient stabilization of the fixture during deployment.
8. Attach the passenger air bag assembly in the J–41497. An air bag assembly must be mounted such that the bag will deploy upward. SECURELY HAND–TIGHTEN ALL FASTENERS PRIOR TO DEPLOYMENT.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9. Stretch the SRS Deployment Harness and pigtail adapter from the air bag assembly to its full length.
10. Place a power source near the shorted end of the SRS deployment harness. (Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.)
11. Connect the air bag assembly to the pigtail adapter on the SRS deployment harness. The SRS Deployment Harness shall remain shorted and not be connected to a power source until the air bag is to be deployed. The air bag assembly will immediately deploy the air bag when a power source is connected to it.

NOTE: Ensure that the pigtail adapter is firmly seated into the air bag assembly connector. Failure to fully seat the connectors may leave the shorting bar located in the air bag assembly connector functioning (shorting the deployment circuit) and may result in nondeployment of the air bag assembly.

12. Verify that the area around the passenger air bag assembly is clear of all people and loose or flammable objects.
13. Verify that the passenger air bag assembly is firmly and properly in J–41497.

14. Notify all people in the immediate area of your intention to deploy the passenger air bag assembly. The deployment will be accompanied by a substantial noise which may startle the uninformed.
15. Separate the two banana plugs on the SRS deployment harness.

NOTE: When air bag deploys, the rapid gas expansion will create a substantial noise. Notify all people in the immediate area that you intend to deploy the air bag assembly.

WARNING: DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT HARNESS TO THE POWER SOURCE SHOULD ALWAYS BE THE LAST STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY.

16. Connect the SRS deployment harness wires to the power source to immediately deploy the air bag assembly. Recommended application : 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
17. Disconnect the SRS deployment harness from the power source.
18. Short the two SRS deployment harness leads together by fully seating one banana plug into the other.
19. In the unlikely event that the passenger air bag assembly did not deploy after following these procedures, proceed immediately with Steps 24 through 26. If the passenger air bag assembly deployed as intended, proceed with Steps 20 through 23.
20. The passenger inflator requires no special precaution after deployment. 95% of the particulate emission are potassium ckloride (KLC), which is commonly sold as an edible salt–substitutes. even if water is applied. Post deployment products are relatively pH neutral. Disposing the inflator by burying it in a landfill will not produce any hazardous products. As with any dusty environment, safety goggles, dust mask and gloves should be worn.

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE AIR BAG ASSEMBLY WILL BE HOT. ALLOW THE AIR BAG ASSEMBLY TO COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE DEPLOYED INFLATOR MODULE NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN FIRE OR PERSONAL INJURY. AFTER AN AIR BAG ASSEMBLY HAS BEEN DEPLOYED, THE METAL CANISTER AND SURROUNDING AREAS OF THE AIR BAG ASSEMBLY WILL BE HOT. DO NOT TOUCH THE METAL AREAS OF THE AIR BAG ASSEMBLY FOR ABOUT THIRTY MINUTES AFTER DEPLOYMENT. IF THE DEPLOYED AIR BAG ASSEMBLY MUST BE MOVED BEFORE IT IS COOL, WEAR GLOVES AND HANDLE BY THE AIR BAG ITSELF.

21. Disconnect the pigtail adapter from the air bag assembly as soon after deployment as possible to avoid damage to the pigtail adapter or SRS deployment harness from contacting the hot air bag assembly canister. The pigtail adapter and SRS deployment harness are designed to be reused. They should, however, be inspected for damage after each deployment and replaced if necessary.
22. Dispose of the deployed air bag assembly through normal refuse channels after it has cooled for at least 30 minutes.
23. Wash your hands with mild soap and water afterward.

NOTE: The remaining steps are to be followed in the unlikely event that the air bag assembly did not deploy after following the above procedures.

24. Ensure that the SRS deployment harness has been disconnected from the power source and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
25. Disconnect the pigtail adapter from the air bag assembly.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE AIR BAG ASSEMBLY UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG UP AND AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

26. Temporarily store the air bag assembly with the bag facing up, away from the surface upon which it rests.

Deployment Inside Vehicle (Vehicle Scrapping Procedure)

Deployment inside vehicle is proper when the vehicle is to be destroyed or salvaged for component parts. This includes, but is not limited to, the following situations:

1. The vehicle has completed its useful life.
2. The vehicle has been damaged beyond repair in a nondeployment type accident.
3. The vehicle has been stripped or damaged beyond repair in a theft.
4. The vehicle will be salvaged for component parts to be used on a vehicle with a different Vehicle Identification Number (VIN) as opposed to being rebuilt as same VIN. Never use SRS components from another vehicle.

WARNING: FAILURE TO FOLLOW PROPER SRS AIR BAG ASSEMBLY DISPOSAL PROCEDURES CAN RESULT IN AIR BAG DEPLOYMENT WHICH MAY CAUSE PERSONAL INJURY. UNDEPLOYED AIR BAG ASSEMBLIES MUST NOT BE DISPOSED OF THROUGH NORMAL REFUSE CHANNELS. THE UNDEPLOYED AIR BAG ASSEMBLY CONTAINS SUBSTANCES THAT CAN CAUSE SEVERE ILLNESS OR PERSONAL INJURY IF THE SEALED CONTAINER

IS DAMAGED DURING DISPOSAL. DISPOSAL IN ANY MANNER INCONSISTENT WITH PROPER PROCEDURES MAY BE A VIOLATION OF FEDERAL, STATE AND/OR LOCAL LAWS.

1. Turn ignition switch to “LOCK,” remove key and put on safety glasses.
2. Remove all loose objects from front seats.
3. Disconnect driver air bag assembly, yellow 2–pin connector located at the base of the steering column.
4. Cut the driver air bag assembly yellow 2–pin harness connector from the vehicle leaving at least 15 cm (six inches) of wire at the connector.
5. Strip 13 mm (1/2 inch) of insulation from yellow – green and yellow – black wire lead of the connector.
6. Cut two 900 cm (30 feet) deployment wires from 0.8 mm^2 (18 gauge) or thicker multi–strand wire. These wires will be used to fabricate the driver deployment harness.
7. Strip 13 mm (1/2 inch) of insulation from both ends of the wires cut in the previous step.
8. Short the wires by twisting together one end from each. Deployment wires shall remain shorted and not be connected to a power source until the air bag is to be deployed.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT WIRES TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT WIRES TO THE AIR BAG ASSEMBLY LEADS. DEPLOYMENT WIRES SHALL REMAIN SHORTED AND BE NOT CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

9. Twist together one connector wire lead to one deployment wire. The connection should be mechanically secure.
10. Bend twisted connection made in the previous step flat and wrap tightly with electrical tape to insulate and secure.
11. Twist together, bend and tape the remaining connector wire lead to the remaining deployment wire.
12. Connect the deployment harness to the driver air bag assembly, yellow 2–pin connector at the base of the steering column. Route deployment harness out the driver side of the vehicle.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED.

THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT.

CONNECTING THE DEPLOYMENT WIRES TO THE POWER SOURCE SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE.

FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

13. Disconnect passenger air bag assembly, yellow 2–pin connector located behind glove box assembly.
14. Cut the passenger air bag assembly harness connector from the vehicle leaving at least 15 cm (six inches) of wire at the connector.
15. Strip 13 mm (1/2 inch) of insulation from blue–white and pink–blue wire lead of the connector.
16. Cut two 900 cm (30 feet) deployment wires from 0.8 mm^2 (18 gauge) or thicker multi–strand wire. These wires will be used to fabricate the passenger deployment harness.
17. Strip 13 mm (1/2 inch) of insulation from both ends of the wires cut in the previous step.
18. Short the wires by twisting together one end from each. Deployment wires shall remain shorted and not be connected to a power source until the air bag is to be deployed.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT WIRES TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT WIRES TO THE AIR BAG ASSEMBLY LEADS. DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

19. Twist together one connector wire lead to one deployment wire. The connection should be mechanically secure.
20. Bend twisted connection made in the previous step flat and wrap tightly with electrical tape to insulate and secure.
21. Twist together, bend and tape the remaining connector wire lead to the remaining deployment wire.
22. Connect the deployment harness to the passenger air bag assembly, yellow 2–pin connector located behind the glove box assembly. Route deployment harness out the passenger side of the vehicle.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT WIRES SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

23. Verify that the inside of the vehicle and the area surrounding the vehicle are clear of all people and loose or flammable objects.
24. Stretch the driver and passenger deployment harness to their full length.
25. Completely cover windshield area and front door window openings with a drop cloth, blanket or similar item. This reduces the possibility of injury due to possible fragmentation of the vehicle's glass or interior.
26. Notify all people in the immediate area that you intend to deploy the air bags. The deployment will be accompanied by a substantial noise which may startle the uninformed.
27. Separate the two ends of the driver deployment harness wires.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT WIRES TO THE POWER SOURCE SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

NOTE: When the air bag deploys, the rapid gas expansion will create a substantial noise. Notify all people in the immediate area that you intend to deploy the air bags.

28. Connect the driver deployment harness wires to a power source to immediately deploy the driver air bag assembly. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
29. Separate the two ends of the passenger deployment harness wires.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT WIRES TO THE POWER SOURCE SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

30. Connect the passenger deployment harness wires to a power source to immediately deploy the passenger air bag assembly. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.(Driver air bag assembly) Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed air bag assembly. After an air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment.(Passenger air bag assembly) The passenger inflator requires no special precaution after deployment. 95% of the particulate emission are potassium chloride (KLC), which is commonly sold as an edible salt–substitutes. even if water is applied. Post deployment products are relatively pH neutral. Disposing the inflator by burying it in a landfill will not products any hazardous products. As with any dusty environment, safety goggles, dust mask and gloves should be worn.

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE AIR BAG ASSEMBLY WILL BE VERY HOT. ALLOW THE AIR BAG ASSEMBLY TO COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE HOT DEPLOYED AIR BAG ASSEMBLY NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN FIRE OR PERSONAL INJURY.

After an air bag assembly has been deployed, the metal canister and surrounding areas of the air bag assembly will be very hot. Do not touch the metal areas of the air bag assembly for about 30 minutes after deployment. If the deployed air bag assembly must be moved before it is cool, wear gloves and handle by the air bag or trim cover.

31. Short the driver deployment harness wires by twisting together one end from each. Repeat this procedure for the passenger deployment harness.
32. Carefully remove drop cloth from vehicle and clean off any fragments or discard drop cloth entirely.
33. Disconnect driver deployment harness and passenger deployment harness from vehicle and discard.
34. In the unlikely event that either or both of the air bag assemblies did not deploy after following these procedures, proceed immediately with Steps 36 through 37. If the air bag assembly deployed, proceed to step 35.
35. With both air bags deployed, the vehicle may be scrapped in the same manner as a non–SRS equipped vehicle.

NOTE: The remaining steps are to be followed in the unlikely event that the air bag assembly did not deploy after following these procedures.

36. Remove the undeployed air bag assembly (s) from the vehicle. For driver air bag assembly refer to in the "Passenger Air Bag Assembly Removal" in this manual.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE AIR BAG ASSEMBLY UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN PERSONAL INJURY.

37. Temporarily store the air bag assembly with the air bag opening facing up, away from the surface upon which it rests.

Deployed Air Bag Assembly Handling

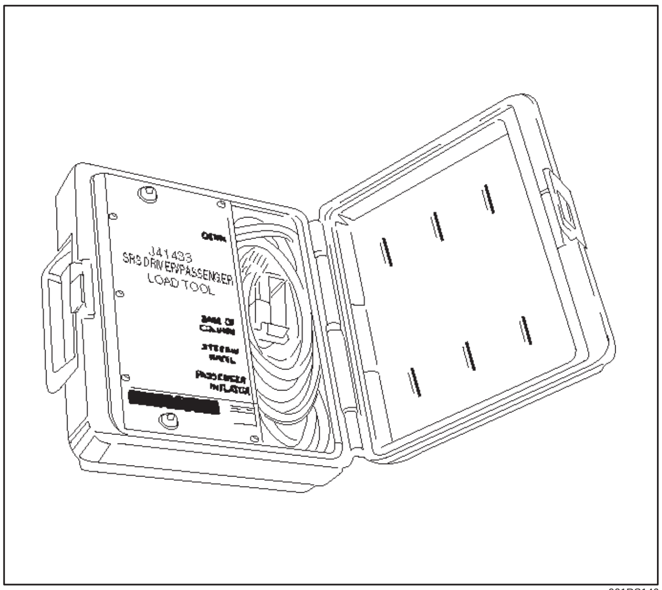
Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed air bag assembly.

After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment.

Special Tools

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY–POWERED OR AC–POWERED VOLTMETER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NONPOWERED PROBE–TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

J–41433 SRS Driver/Passenger Load Tool



901RS146

The SRS Driver/Passenger Load Tool J–41433 is used only when called for in this section. It is used as a diagnostic aid and safety device to prevent inadvertent air bag assembly deployment.

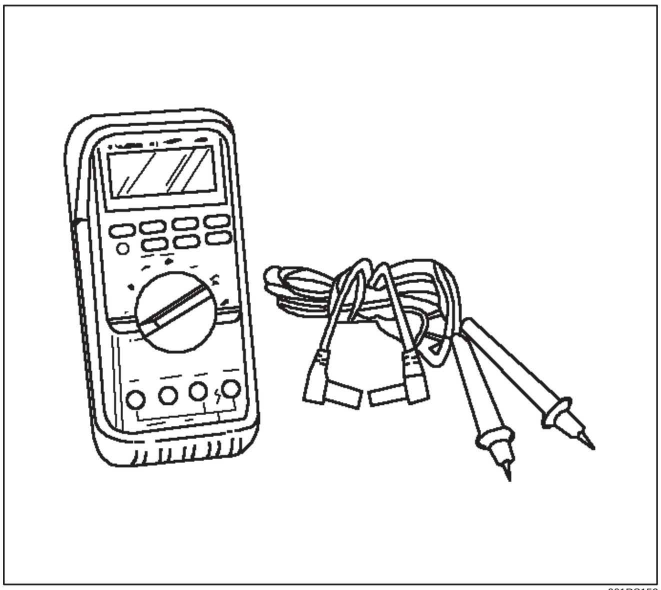
The load tool has three yellow connectors attached to its case.

The three small connectors are electrically functional and serve as resistive load substitutions.

No more than two connectors are used at any time. One of the small connectors is used to substitute for the load of the driver air bag assembly when it is connected at the top of the column to the SRS coil assembly. Another small connector is used to substitute for the load of the driver air bag assembly and the SRS coil assembly when it is connected at the base of the column to the SRS wiring harness. The third small connector is used to substitute for the load of the passenger air bag assembly when connected to the passenger air bag assembly harness connector.

By substituting the resistance of the load tool when called for, a determination can be made as to whether an inflator circuit component is causing system malfunction and which component is causing the malfunction. The load tool should be used only when specifically called for in the diagnostic procedures.

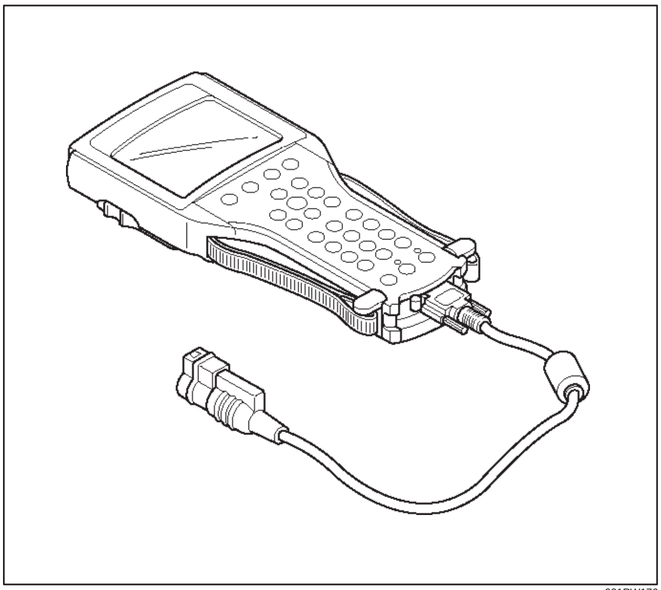
J–39200 DVM



901RS153

The J–39200 DVM is the preferred DVM for use in SRS diagnosis and repair. However, J–34029—A may be used if J–39200 is not available. No other DVMs are approved for SRS diagnosis and repair.

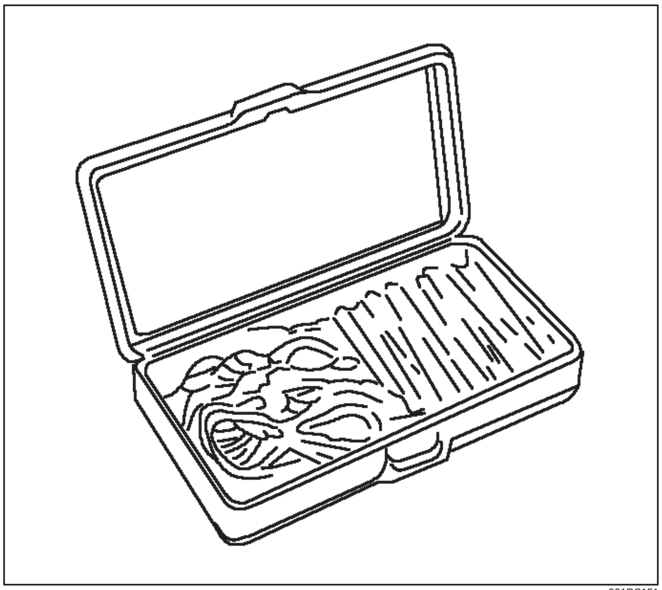
Scan Tool



901RW176

The Tech 2 is used to read and clear SRS Diagnostic Trouble Codes (DTCs). Refer to the Tech 2 Operators, Manual for specific information on how to use the Tech 2.

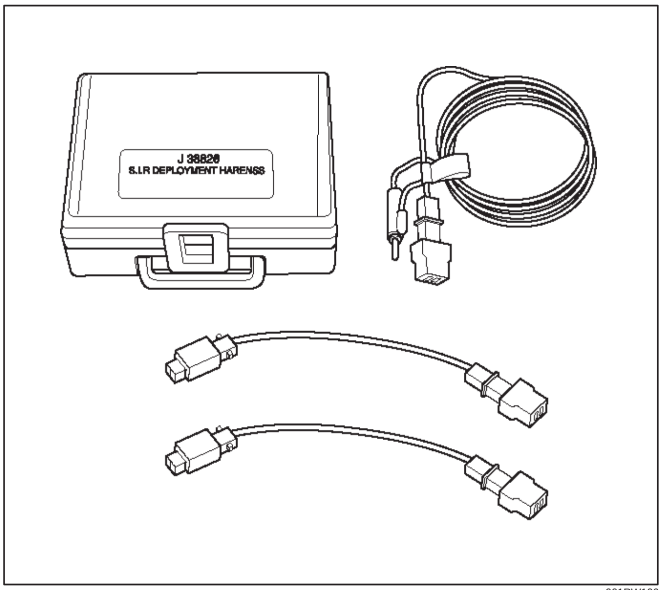
J–35616—A Connector Test Adapter Kit



901RS151

The J–35616–A Connector Test Adapter Kit must be used whenever a diagnostic procedure requests checking or probing a terminal. Using the appropriate adapter will ensure that no damage to the terminal will occur from the DVM prove, such as spreading or bending. The adapter will also give an idea of whether contact tension is sufficient, helping to find an open or intermittent open due to poor terminal contact.

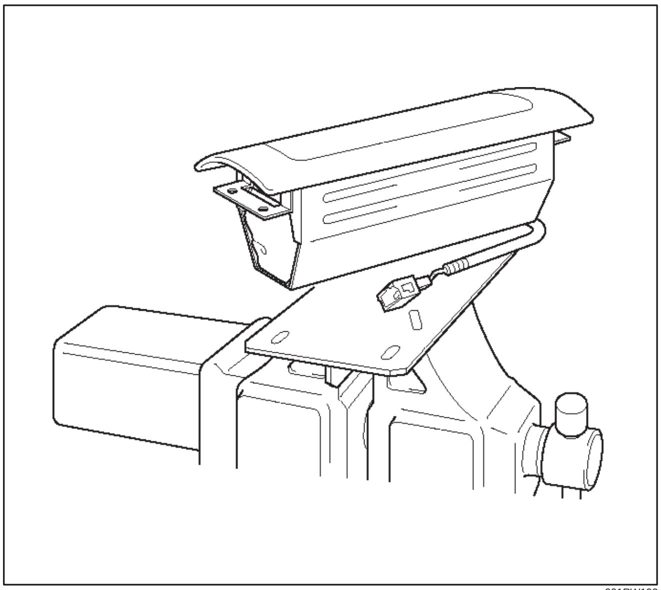
J–42986 SRS Deployment Tool



901RW106

The J–42986 SRS Deployment Tool must be used for deployment of the undeployed air bag.

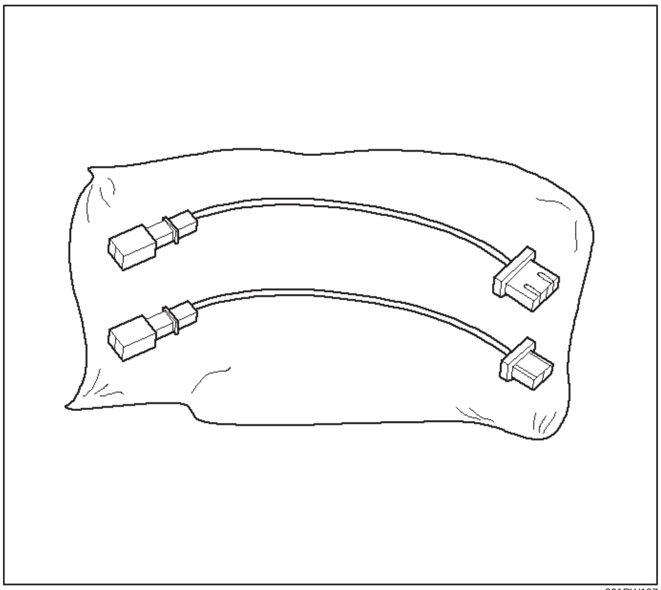
J–41497 SRS Deployment Fixture



901RW199

The J–41497 SRS Deployment Fixture must be used for deployment of the undeployed passenger side air bag.

J–42987 SRS Adapter for Load Tool.

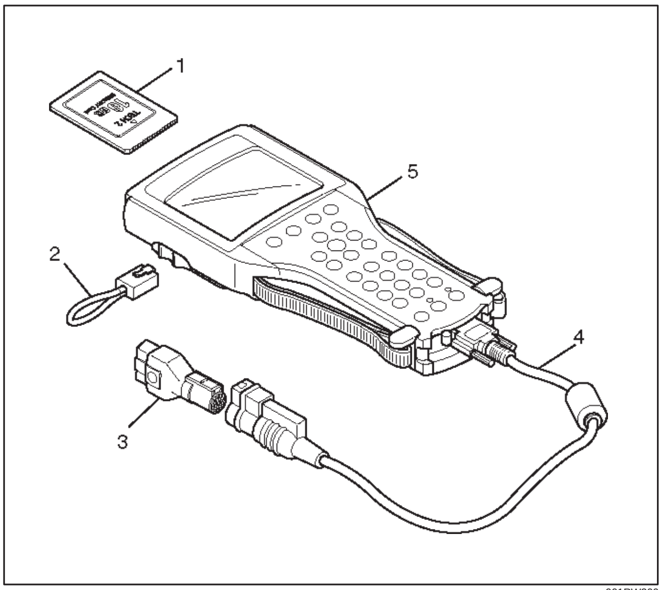


901RW107

The J–42987 SRS Adapter for Load Tool must be used with J–41433 SRS Driver/Passenger Load Tool.

Tech 2 Scan Tool

From 98 MY, Isuzu dealer service departments are recommended to use Tech 2. Please refer to Tech 2 scan tool user guide.



901RW200

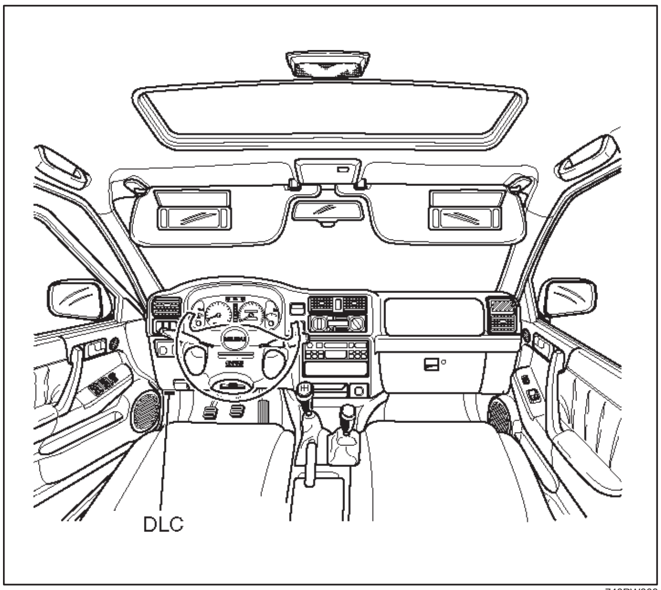
Legend

(1) PCMCIA Card
(2) RS 232 Loop Back Connector
(3) SAE 16/19 Adaptor
(4) DLC Cable
(5) Tech–2

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. Insert the Isuzu 98 System PCMCIA card (1) into the Tech 2 (5).
2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (5)
4. Make sure of the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle ALDL/DLC connector.



740RW060

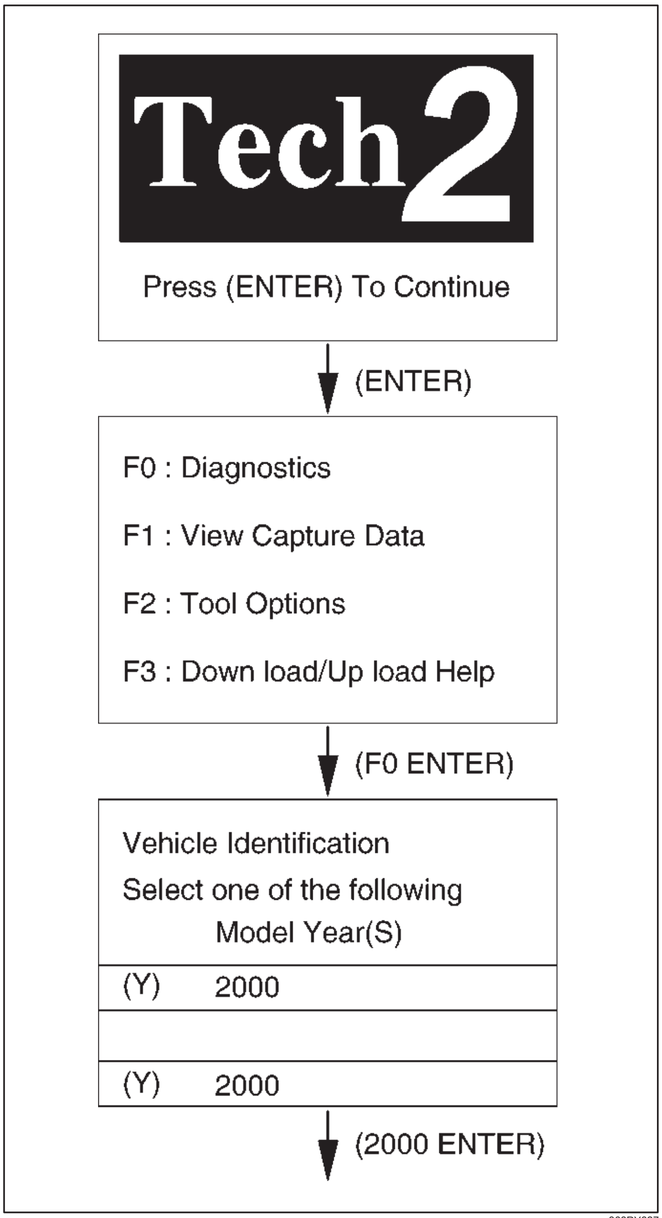
6. Turn on the vehicle ignition switch.
7. Verify the Tech 2 power up display.

060RW009

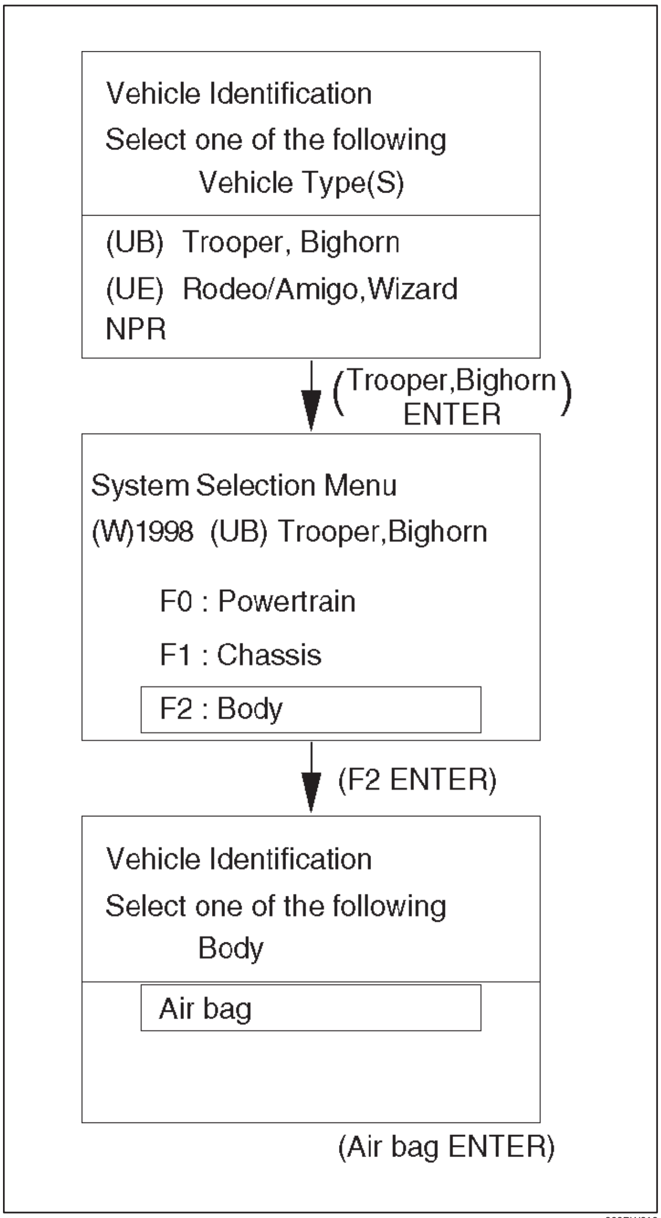
NOTE: The RS232 Loop back connector is only used to diagnosis Tech 2. Refer to user guide of the Tech 2.

Operating Procedure

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



060RY027



060RW019

Service Precautions for SRS Component Service

CAUTION: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

WARNING: WHEN PERFORMING SERVICE ON OR AROUND SRS COMPONENTS OR SRS WIRING, FOLLOW THE PROCEDURES LISTED BELOW TO TEMPORARILY DISABLE THE SRS. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY OR OTHERWISE UNNEEDED SRS REPAIRS.

The SDM in Driver–Passenger SRS can maintain sufficient voltage to cause a deployment for up to 15 seconds after the ignition switch is turned "OFF," the battery is disconnected, or the fuse powering the SDM is removed.

Many of the service procedures require removal of the "C–21" fuse, and disconnection of the air bag assembly from the deployment loop to avoid an accidental deployment. If the air bag assembly is disconnected from the deployment loop as noted in the "Disabling the SRS" procedure that follows, service can begin immediately without waiting for the 15 second time period to expire.

Disabling The SRS

Removal

Turn the ignition switch to "OFF" and turn the steering wheel so that the vehicle's wheels are pointing straight ahead.

1. Remove SRS fuse "C–21" from left dash side lower fuse block or disconnect battery.
2. Disconnect yellow 2–pin connector at the base of steering column.
3. Remove glove box assembly; Refer to "Passenger air bag assembly replacement" in this section.
4. Disconnect passenger air bag assembly yellow 2–pin connector behind the glove box assembly.

CAUTION: With the "C–21" fuse removed and ignition switch "ON," the "AIR BAG" warning lamp will be "ON." This is normal operation and does not indicate an SRS malfunction.

Enabling The SRS

Installation

Turn ignition switch to "LOCK" and remove key.

1. Connect yellow 2–pin connector passenger air bag assembly.
2. Install glove box assembly. Refer to "Passenger Air Bag Assembly Replacement" in this section.
3. Connect yellow 2–pin connector at the base of the steering column.
4. Install "AIR BAG" fuse "C–21" to left dash side lower fuse block or connect battery.

Turn ignition switch to "ON" and verify that the "AIR BAG" warning lamp flashes seven times and then turns "OFF." If it does not operate as described, perform the "SRS Diagnostic System Check" in this section.

Handling / Installation / Diagnosis

1. Air bag assembly should not be subjected to temperatures above 65°C (150°F).
2. Air bag assembly, and SDM should not be used if they have been dropped from a height of 100 centimeters (3.28 feet) or more.
3. When a SDM is replaced, it must be oriented with the arrow on the SDM pointing toward the front of the vehicle. It is very important for the SDM to be located flat on the mounting surface, parallel to the vehicle datum line. It is important that the SDM mounting surface is free of any dirt or other foreign material.
4. Do not apply power to the SRS unless all components are connected or a diagnostic chart requests it, as this will set a diagnostic trouble code.
5. The "SRS Diagnostic System Check" must be the starting point of any SRS diagnostics. The "SRS Diagnostic System Check" will verify proper "AIR BAG" warning lamp operation and will lead you to the correct chart to diagnose any SRS malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacements.

Inspections Required After An Accident

CAUTION: Certain SRS components must be replaced after a frontal crash involving air bag deployment.

In all types of accidents regardless of "Air Bag" deployment, visually inspect all of the following components and replace as required:

— Driver air bag assembly
— Passenger air bag assembly
— Steering wheel
— SRS coil assembly
— Steering column
— Knee bolster and instrument panel mounting attachments
— Driver seat and belt
— Passenger seat and belt
— SDM

SDM always should be checked according to "SDM Replacement Guidelines."

CAUTION: Refer to "SDM Replacement Guidelines" below for important information on SDM replacement in both deployment and non–deployment crashes.

Inspect SRS coil assembly wiring and steering wheel for any sign of scorching, melting, or damage due to excessive heat. If coil assembly wire or steering wheel is

damaged, replace them. The steering column and wheel must be dimensionally checked to determine if they are damaged. Refer to steering wheel of in this manual.
Never use SRS parts from another vehicle. This does not include remanufactured parts purchased from an authorized Isuzu Retailer; they may be used for SRS repairs.
Do not attempt to repair the SDM, the SRS harness, the SRS coil assembly, the air bag assembly, the steering wheel, or the steering column. Service of these items is replacement only. Verify replacement part numbers.

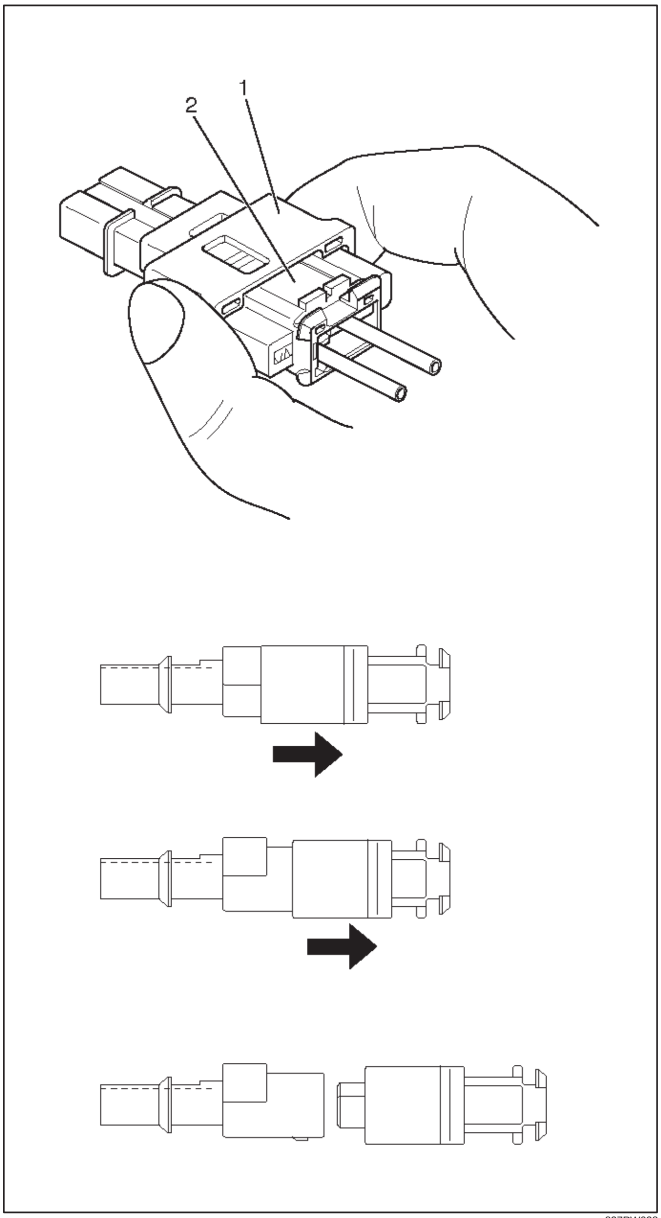
CAUTION: Proper operation of the SDM and supplemental restraint system (SRS) requires that any repairs to the vehicle structure return it to its original production configuration.

SRS Connectors

CAUTION: The special yellow color connectors are used for supplemental restraint system-air bag circuit. When removing the oable harnese, do not pull the cables otherwile, cable disconnection may occur. When connect the SRS connector, insert the connector completely. Imperfect locking may cause malfunction of SRS circuit.

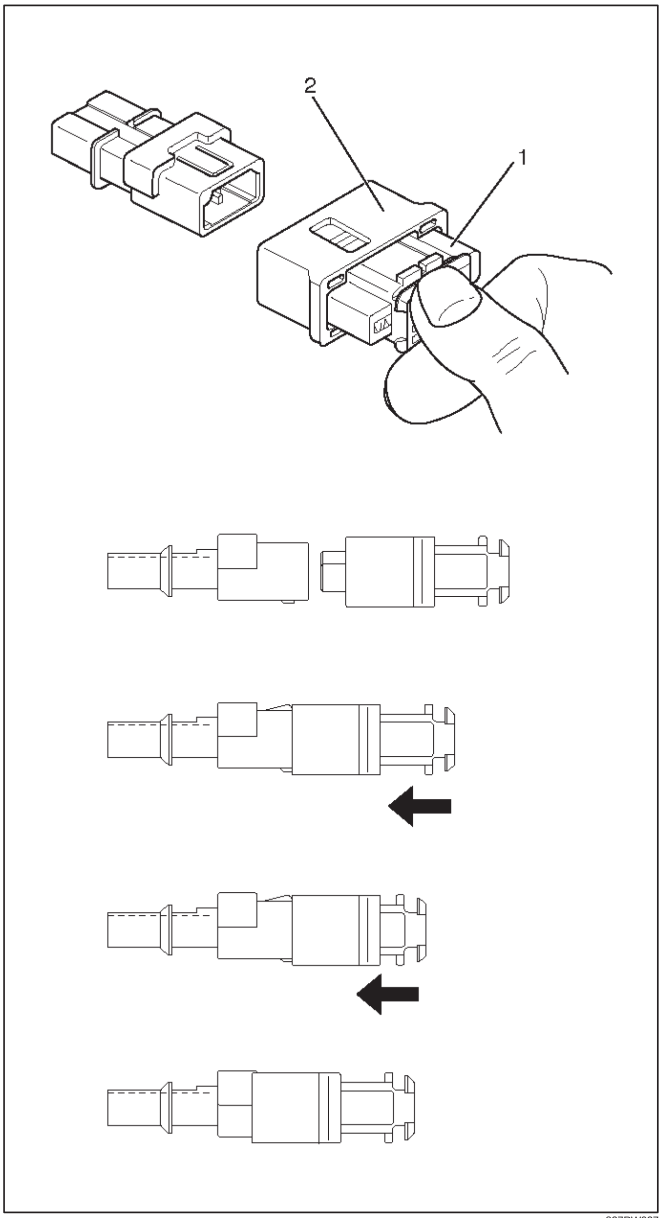
Removal

To remove the connector, hold the cover insulator (1) and pull it. The cover insulator slides and lock will be released. Do not hold the socket insulator (2).



Installation

To install the connector, hold the socket insulator (1) and insert it. The cover insulator slides and connector will be locked. Do not hold the cover insulator (2).



827RW027

Sensing And Diagnostic Module (SDM)

Service Precautions

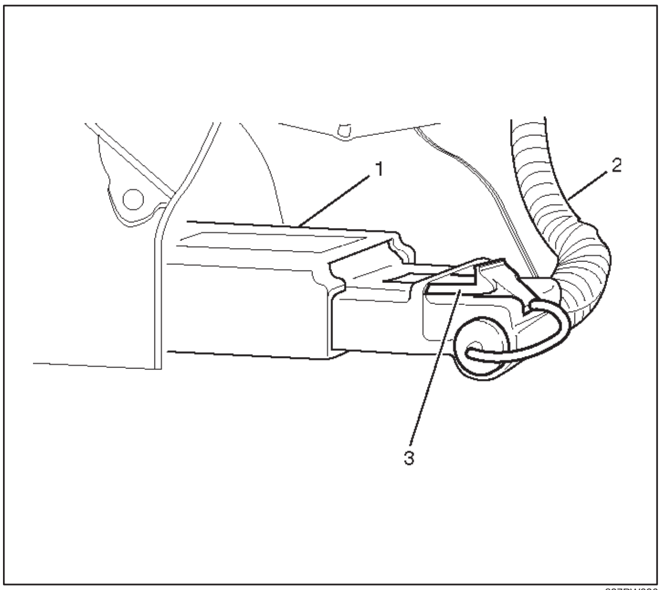
WARNING: DURING SERVICE PROCEDURES, BE VERY CAREFUL WHEN HANDLING SDM. NEVER STRIKE OR JAR SDM. UNDER SOME CIRCUMSTANCES, IT COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY OR IMPROPER OPERATION OF THE SUPPLEMENTAL RESTRAINT SYSTEM (SRS) . SDM MOUNTING BRACKET BOLTS MUST BE CAREFULLY TORQUED TO ASSURE PROPER OPERATION. NEVER POWER UP THE SRS WHEN SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

WARNING: PROPER OPERATION OF THE SENSING AND DIAGNOSTIC MODULE (SDM) REQUIRES THE SDM TO BE RIGIDLY ATTACHED TO THE VEHICLE STRUCTURE AND THAT THE ARROW ON THE SENSOR BE POINTING TOWARD THE FRONT OF THE VEHICLE.

SDM is specifically calibrated and is keyed to the SDM location SRS wiring harness. Caution should be used to ensure proper location of the SDM. The keying of the SDM to its location and wiring harness connectors should never be modified in the field.

Removal

1. Disable the SRS (Refer to “Disabling the SRS” in this section).
2. Remove the transmission knob (for M/T) and transfer lever knob.
3. Remove the front console assembly and disconnect wiring harness connector.
4. Pull CPA (Connector Position Assurance) out and push connector lock down to disconnect the SDM harness connector.
5. Remove the three SDM fixing bolts and remove SDM.



827RW026

Legend

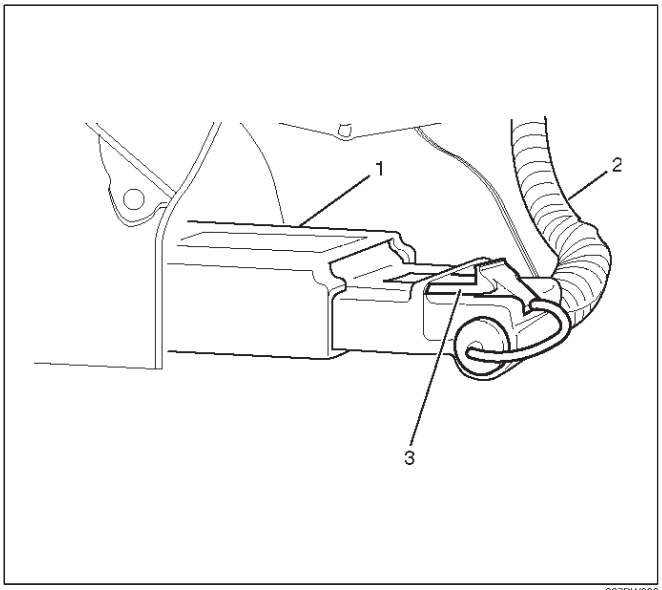
(1) SDM
(2) SRS Harness
(3) Connector Position Assurance

Installation

1. Install the SDM on bracket and fixing bolts and tighten the fixing bolts to the specified torque.

   Torque: 10 N·m (87 lb in)
2. Connect the SDM harness connector and after that, put CPA into connector.
3. Install the front console.
4. Install the transmission knob (for M/T) and transfer lever knob.

5. Enable the SRS (Refer to “Enabling the SRS” in this section).



Legend

(1) SDM
(2) SRS Harness
(3) Connector Position Assurance

Driver Air Bag Assembly

Service Precautions

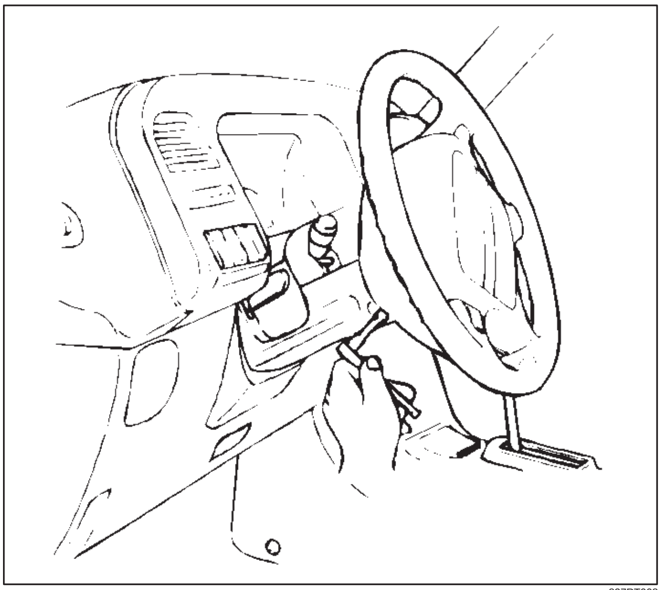
WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING ALIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

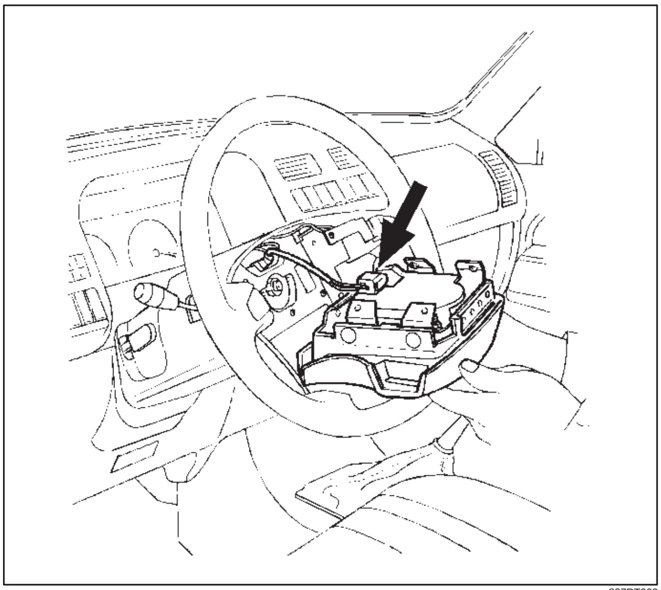
Removal

1. Disable the SRS (Refer to “Disabling the SRS” in this section).
2. Loosen the air bag assembly fixing bolts from behind the steering wheel assembly using a TORX® driver or equivalent until the air bag assembly can be released from steering wheel.



827RT008

3. Disconnect the yellow 2–pin connector located behind the air bag assembly and remove air bag assembly. Refer to “SRS Connectors” in this section for removal and installation.

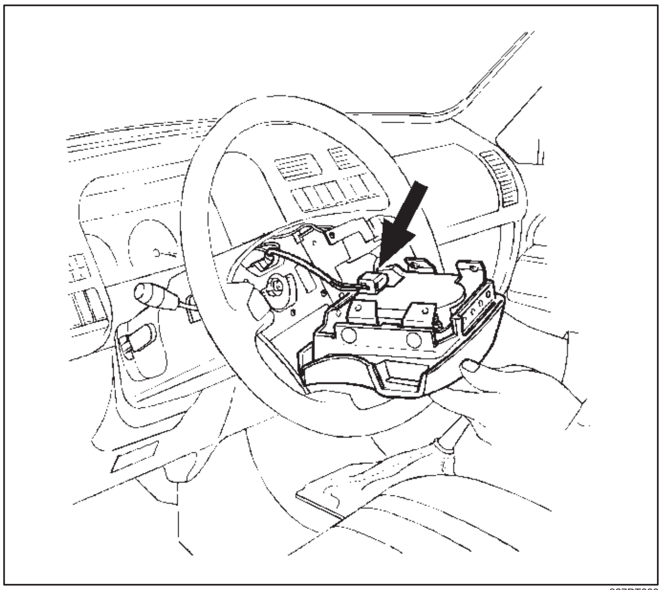


827RT009

Installation

1. Connect air bag to wiring harness connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.



827RT009

2. Install air bag into steering wheel and tighten bolts to specified sequence as shown in figure.

Torque: 8 N·m (69 lb in)

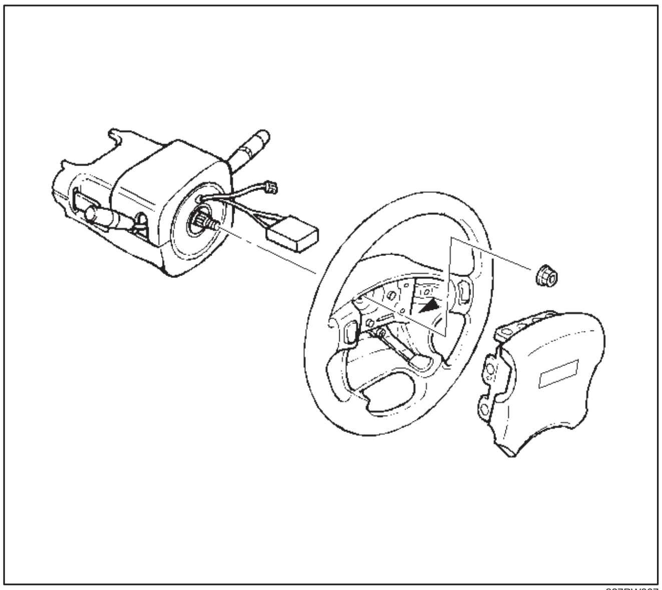
CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label from '00 model as follows.

Yellow color for driver air bag assembly.

White color for passenger air bag assembly.

Use only new air bag assembly proper to the Trooper which is being repaired.



827RW007

3. Enable the SRS (Refer to "Enabling the SRS" in this section).

Steering Wheel

Service Precautions

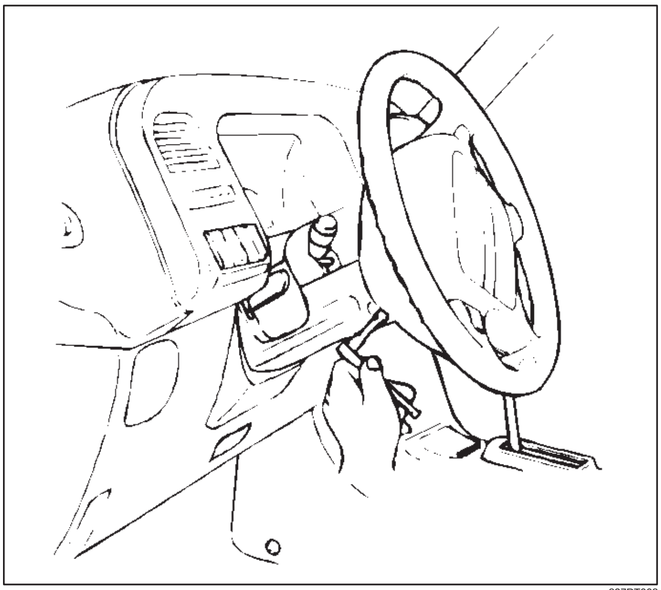
WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING ALIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND RIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

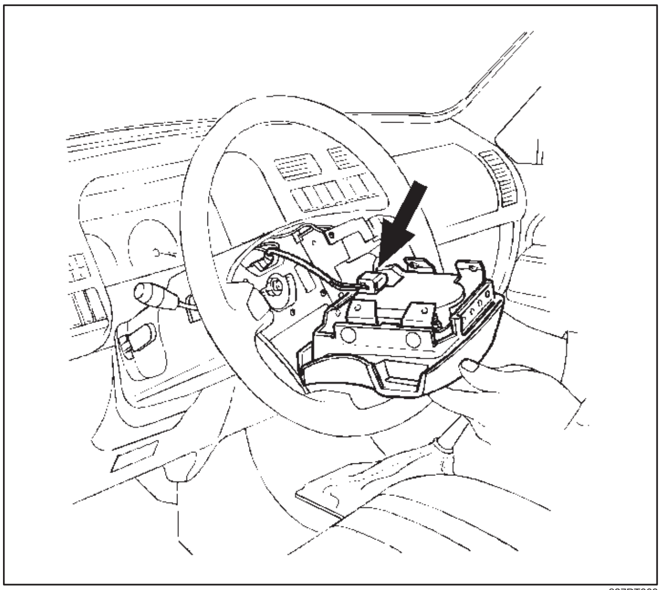
Removal

1. Disable the SRS (Refer to “Disabling the SRS” in this section).
2. Loosen the air bag assembly fixing bolts from behind the steering wheel assembly using a TORX® driver or equivalent until the air bag assembly can be released from steering wheel.



827RT008

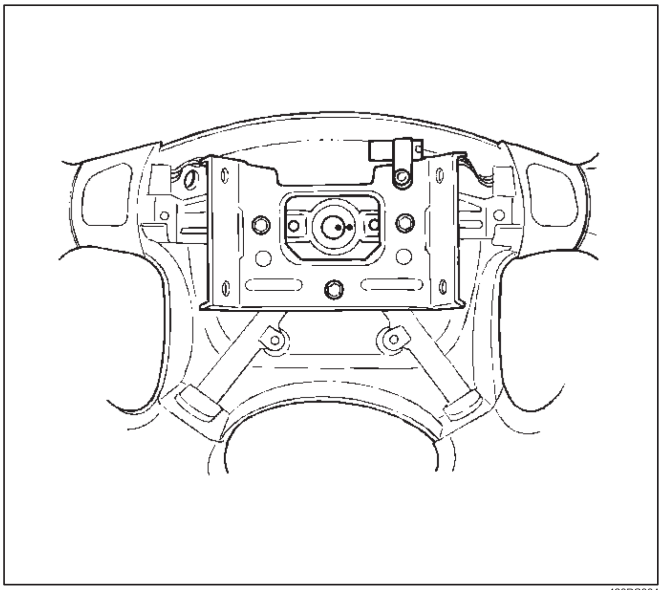
3. Disconnect the yellow 2–pin connector located behind the air bag assembly and remove air bag assembly.Refer to “SRS Connectors” in this section for removal and installation.
4. Disconnect horn lead.



827RT009

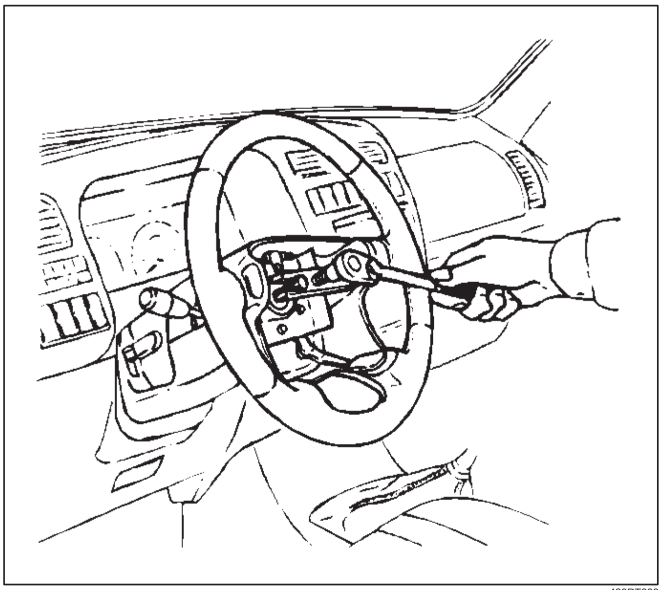
5. Remove steering wheel attachment nut.

6. Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.



430RS004

7. Move the tires to the straight ahead position before removing the steering wheel. Install steering wheel puller onto steering wheel and remove steering wheel with J–29752.



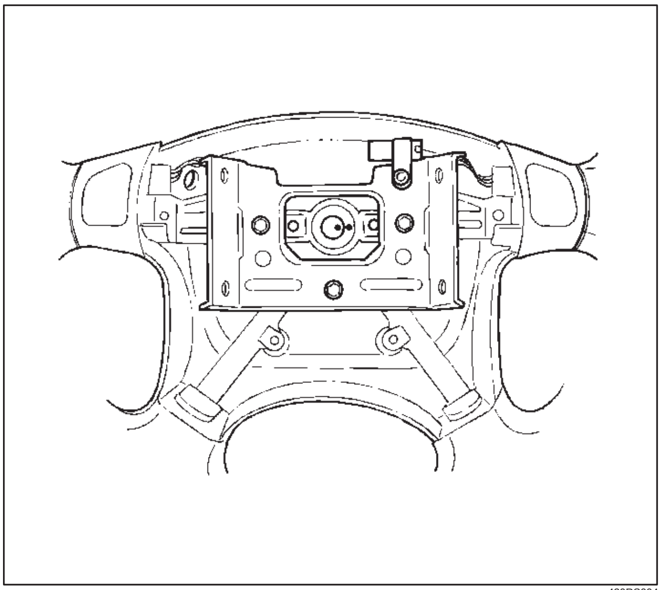
430RT009

8. Feed wiring through the wheel and remove wheel.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

Installation

1. Install the steering wheel and align the setting marks.



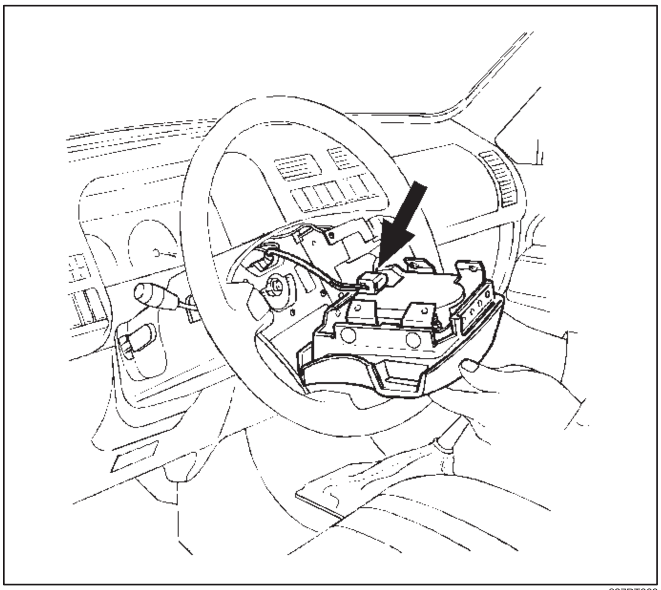
430RS004

2. Tighten the steering wheel fixing nut to the specified torque.

Torque : 34 N · m (25 lb·ft)

3. Connect horn lead.
4. Connect air bag to wiring harness connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.



827RT009

5. Install air bag into steering wheel and tighten bolts to specified sequence as show in figure.

Torque: 8 N·m (69 lb in)

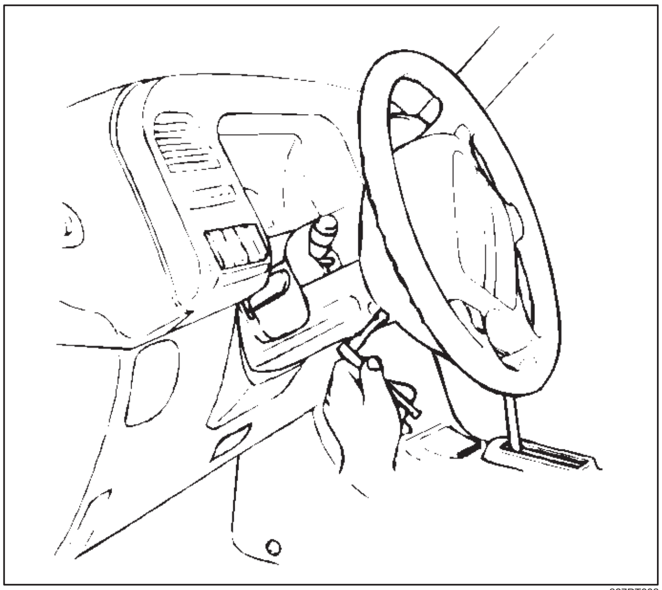
CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label from '00 model as follows.

Yellow color for driver air bag assembly.

White color for passenger air bag assembly.

Use only new air bag assembly proper to the Trooper which is being repaired.



827RT008

6. Enable the SRS (Refer to "Enabling the SRS" in this section).

SRS Coil Assembly

Service Precautions

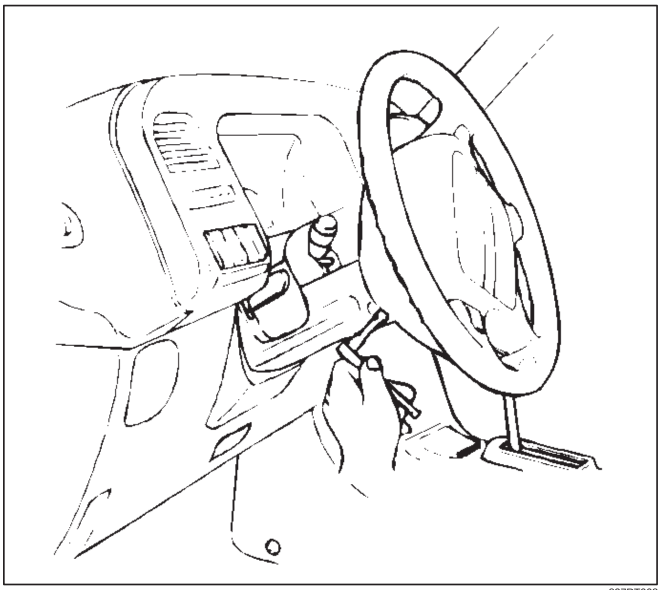
WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING ALIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND RIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

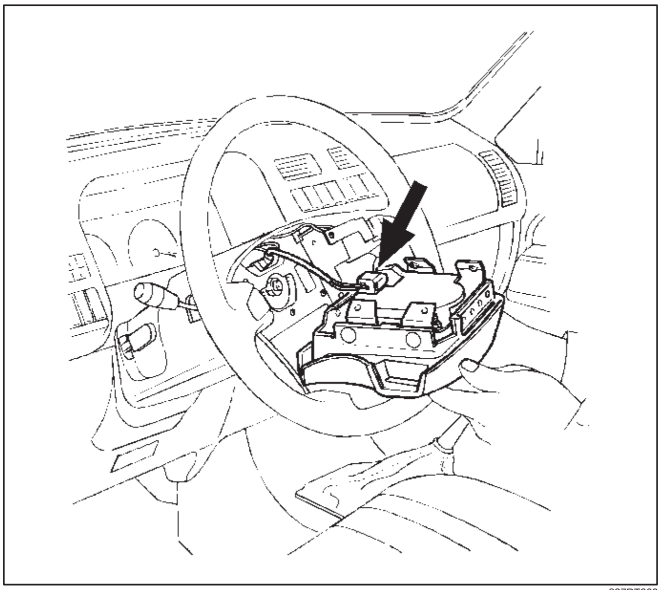
Removal

1. Disable the SRS (Refer to “Disabling the SRS” in this section).
2. Loosen the air bag assembly fixing bolts from behind the steering wheel assembly using a TORX® driver or equivalent until the air bag assembly can be released from steering wheel.



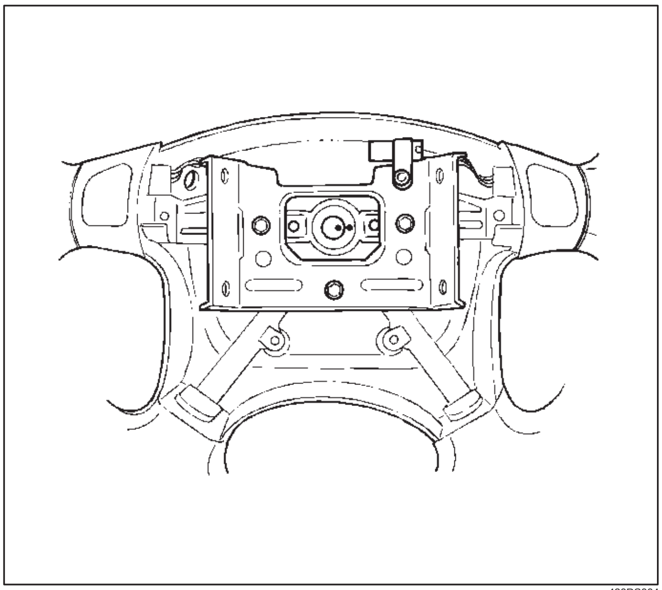
827RT008

3. Disconnect the yellow 2–pin connector located behind the air bag assembly and remove air bag assembly.Refer to “SRS Connectors” in this section for removal and installation.
4. Disconnect horn lead connector.



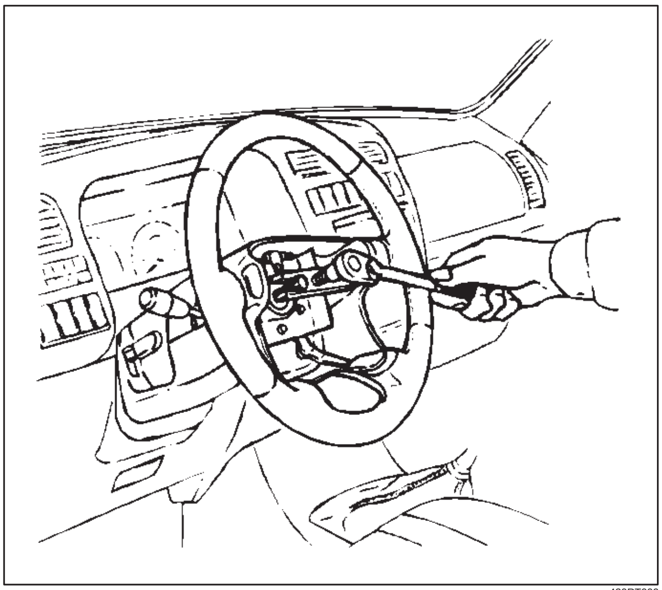
827RT009

5. Remove the steering wheel attachment nut.
6. Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.



430RS004

7. Move the tires to the straight ahead position before removing the steering wheel and remove wheel with J–29752.



430RT009

8. Feed wiring though the wheel and remove wheel.
9. Remove the steering lower cover and engine hood opening lever.
10. Remove the driver knee bolster assembly.
11. Remove the steering column cover.
12. Remove air conditioning lower duct.
13. Disconnect the 2–pin wiring harness connectors located at the base of steering column.

CAUTION: Never apply force to the steering wheel in the direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

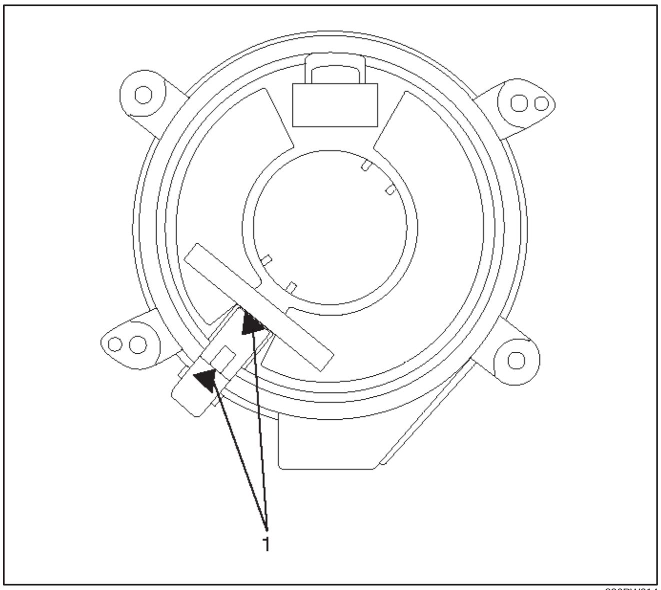
14. Remove the combination switch assembly with SRS coil.

NOTE: SRS coil is a part of combination switch assembly, which cannot be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.

Installation

1. Install the combination switch assembly with SRS coil.
2. Turn the SRS coil counterclockwise to full, return about 3 turns and align the neutral mark (1).

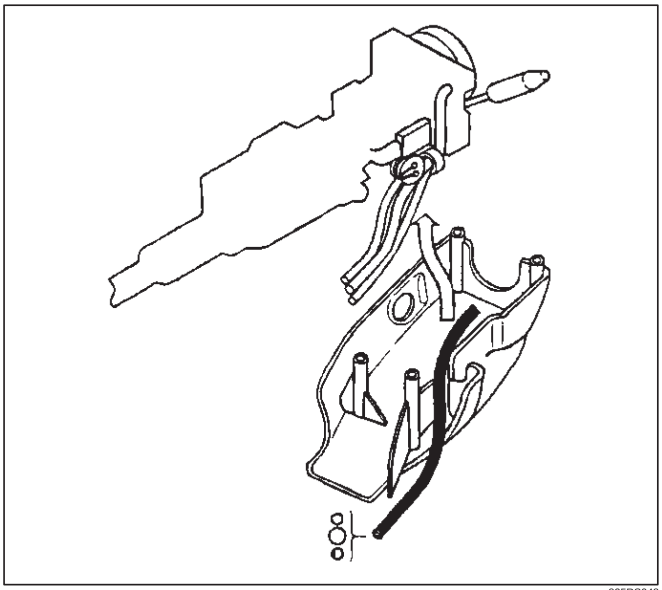
CAUTION: When turning the SRS coil counterclockwise to full, stop turning if resistance is felt. Forced further turning may damage the cable in the SRS coil.



826RW014

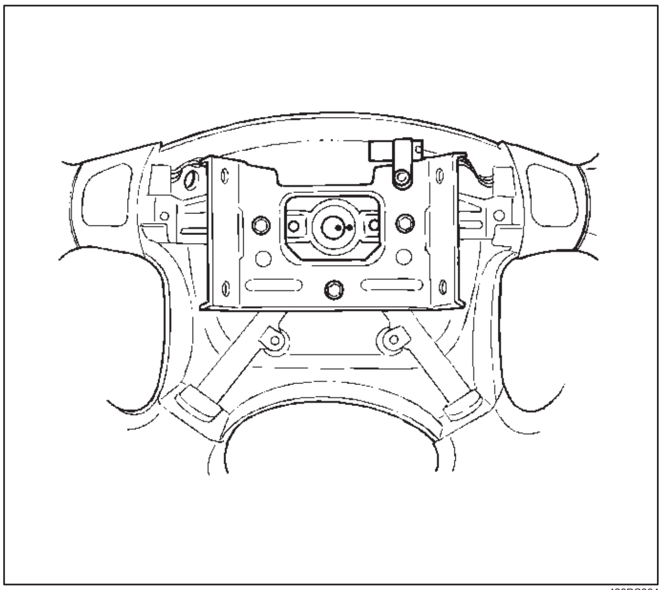
3. Connect the wiring harness connectors located at the base of steering column.
4. Install the air conditioning lower duct.
5. Install the steering column cover.

CAUTION: When installing the steering column cover, be sure to wire (through each harness) as illustrated so that the harness starter switch, combination switch and SRS coil may not catch wiring.



825RS048

6. Install the driver knee bolster assembly.
7. Install the steering lower cover and engine hood opening lever.
8. Install the steering wheel and align the setting marks.



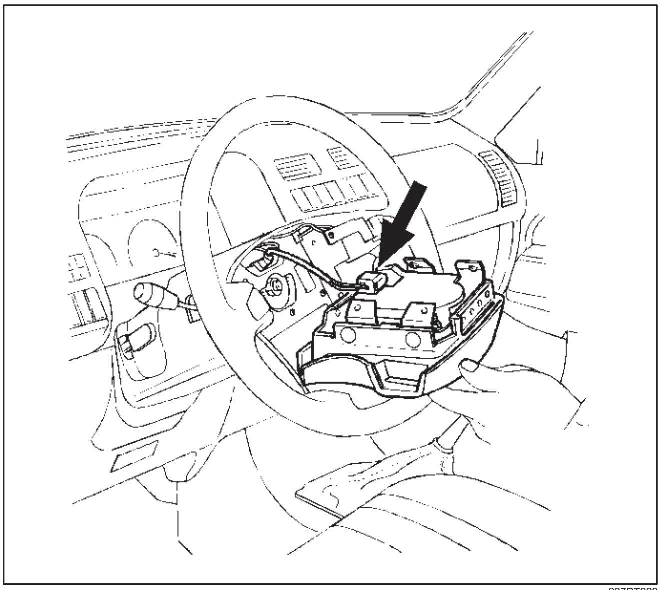
430RS004

9. Tighten the steering wheel fixing nut to the specified torque.

Torque: 34 N·m (25 lb·ft)

10. Connect horn lead.
11. Connect air bag to wiring harness connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air to prevent lead wire from being pinches.

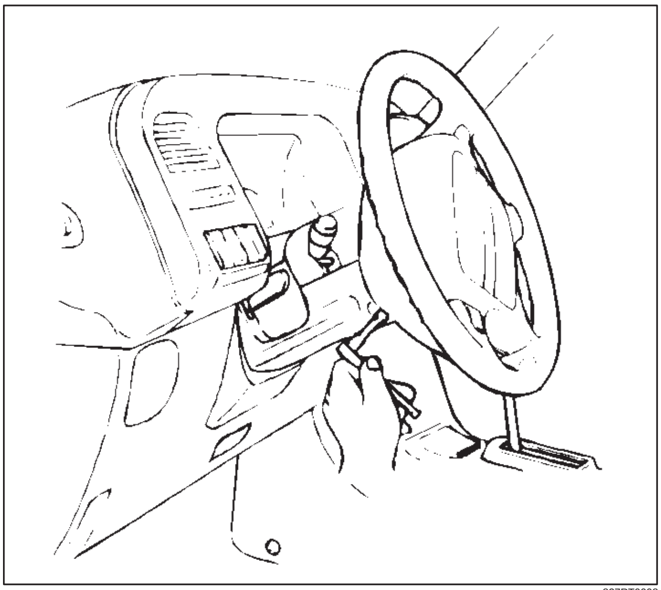


827RT009

12. Install air bag into steering wheel and tighten bolts to specified sequence as shown in figure.

Torque: 8 N·m (69 lb in)

CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.
The air bag assembly has identification colors on the bar code label from ’00 model as follows.
Yellow color for driver air bag assembly.
White color for passenger air bag assembly.
Use only new air bag assembly proper to the Trooper which is being repaired.



827RT0008

13. Enable the SRS (Refer to “Enabling the SRS” in this section).

Steering Column

Service Precautions

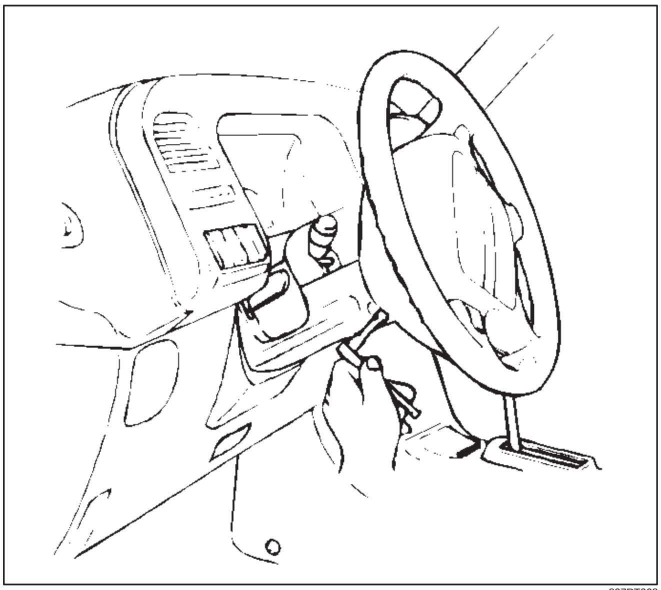
WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING ALIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND RIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

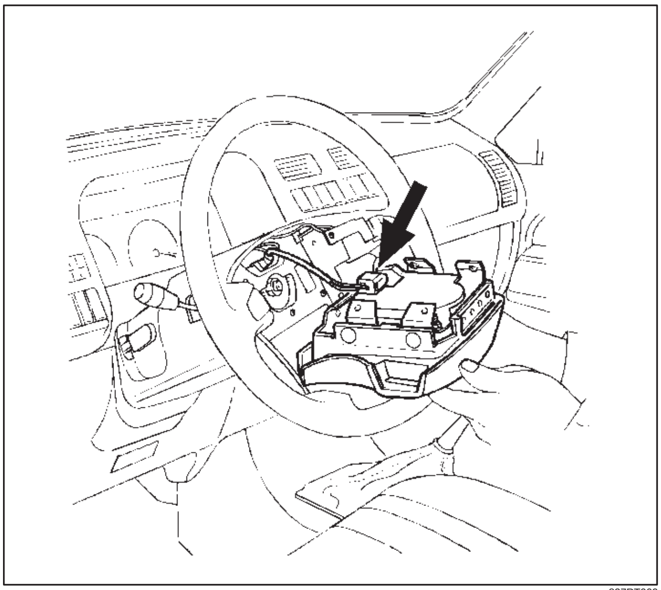
Removal

1. Disable the SRS (Refer to “Disabling the SRS ” in this section).
2. Loosen the air bag assembly fixing bolts from behind the steering wheel assembly using a TORX® driver or equivalent until the air bag assembly can be released from steering wheel.



827RT008

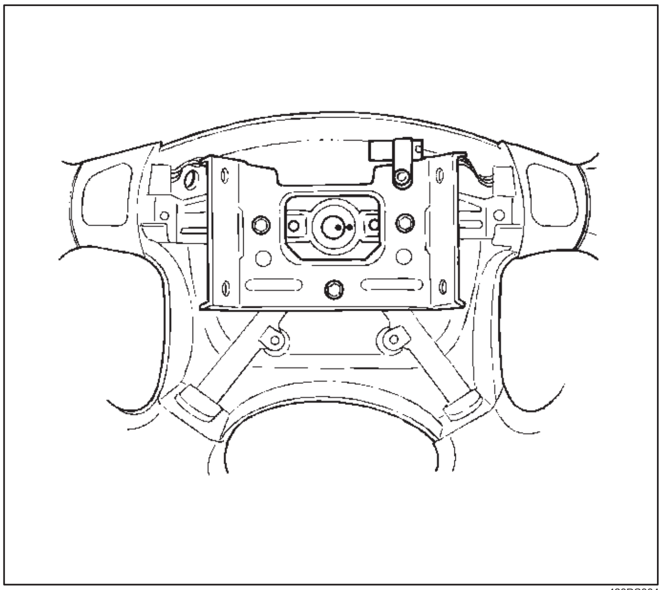
3. Disconnect the yellow 2–pin connector located behind the air bag assembly and remove air bag assembly.Refer to “SRS Connectors” in this section for removal and installation.



827RT009

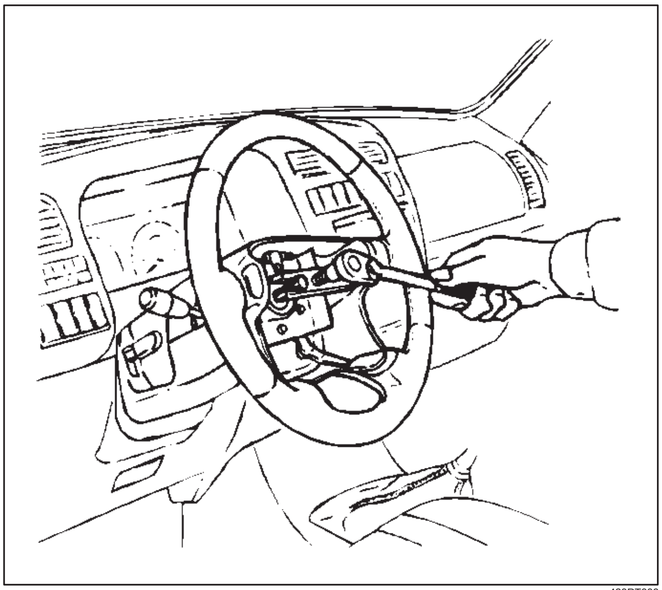
4. Disconnect horn lead connector.
5. Remove the steering wheel attachment nut.

6. Apply a setting mark across the steering wheel and shaft so parts can be reassembled in their original position.



430RS004

7. Move the tires to the straight ahead position before removing the steering wheel and removing wheel with J–29752.

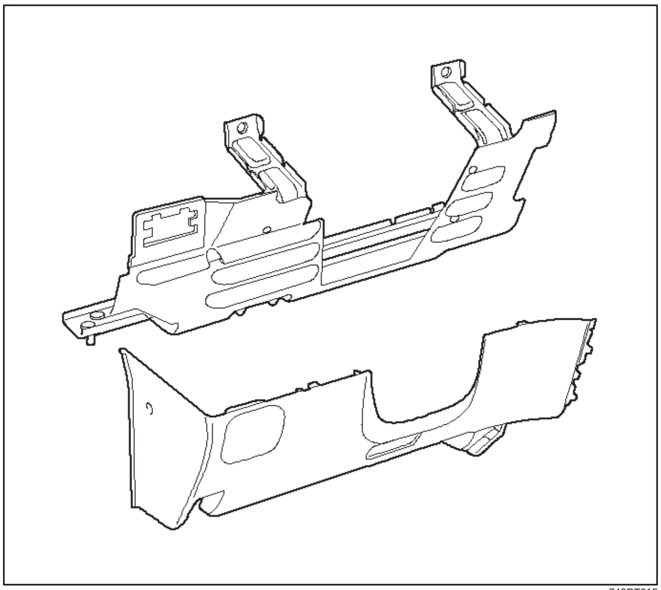


430RT009

8. Feed wiring though the wheel and remove wheel.

9. Remove the steering lower cover and engine hood opening lever.

10. Remove the driver knee bolster assembly.



740RT015

11. Remove the steering column cover.

12. Remove air conditioning lower duct.

13. Disconnect the wiring harness connectors located at the base of steering column.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

14. Remove the combination switch assembly with SRS coil.

NOTE: SRS coil is a part of combination switch assembly, which cannot be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.

15. Remove the snap ring.

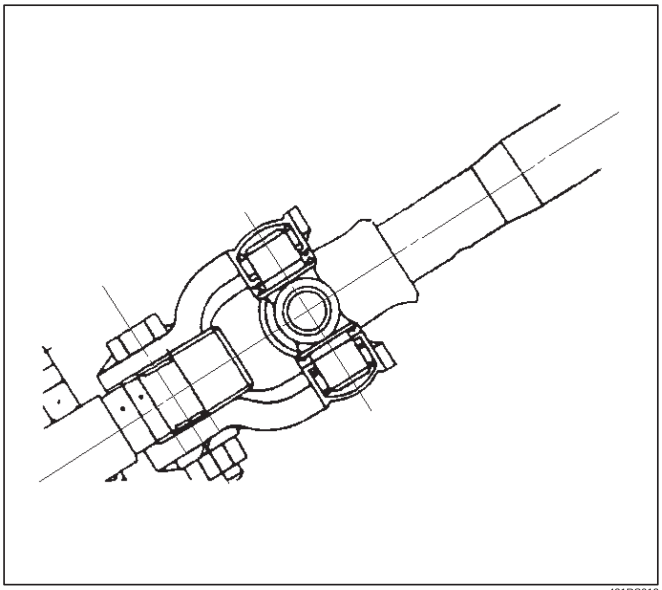
16. Remove the cushion rubber.

17. Disconnect shift lock cable (A/T only).

18. Disconnect the starter switch harness connector located base of steering column.

19. Remove steering lock cylinder assembly.

20. Apply a setting mark across the universal joint and steering shaft to reassemble the parts in their original position.

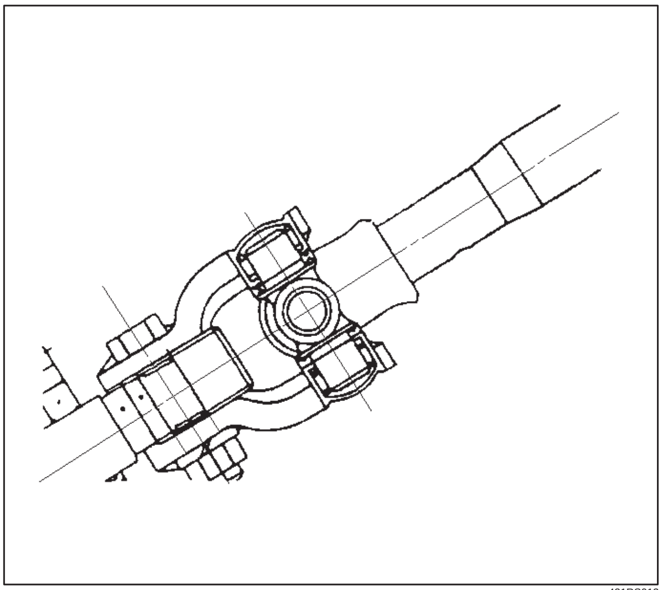


431RS013

21. Remove steering column assembly.

Installation

1. Install the steering column assembly and align the setting marks on the universal joint and steering shaft made during removal.



431RS013

2. Tighten the steering column fixing bolts (dash panel side) to the specified torque.

Torque: 20 N·m (14 lb ft)

3. Tighten the steering column fixing bolts (Pedal bracket) to the specified torque.

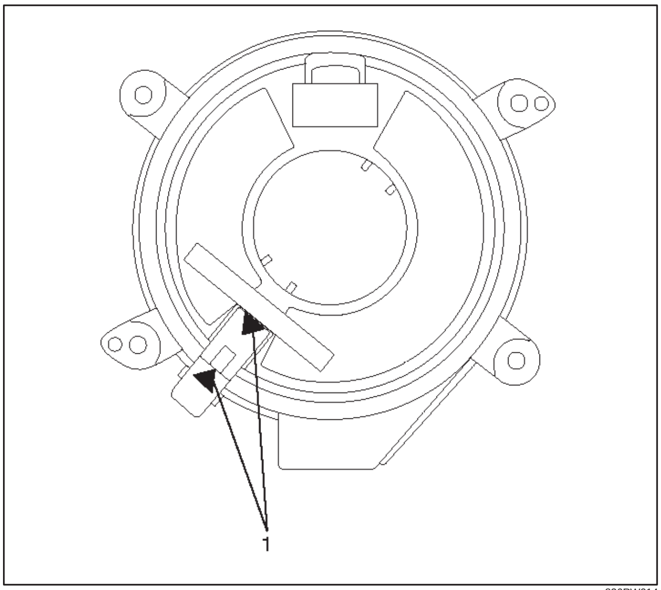
Torque: 20 N·m (14 lb ft)

4. Tighten the universal joint to the specified torque.

Torque: 31 N·m (23 lb ft)

5. Install steering lock cylinder assembly.
6. Connect shift lock cable (For A/T)
7. Install cushion rubber.
8. Install snap ring.
9. Install the combination switch assembly with SRS coil.
10. Connect the wiring harness connector located on the base of steering column.
11. Turn the SRS coil counterclockwise to full, return about 3 turns and align the neutral mark (1).

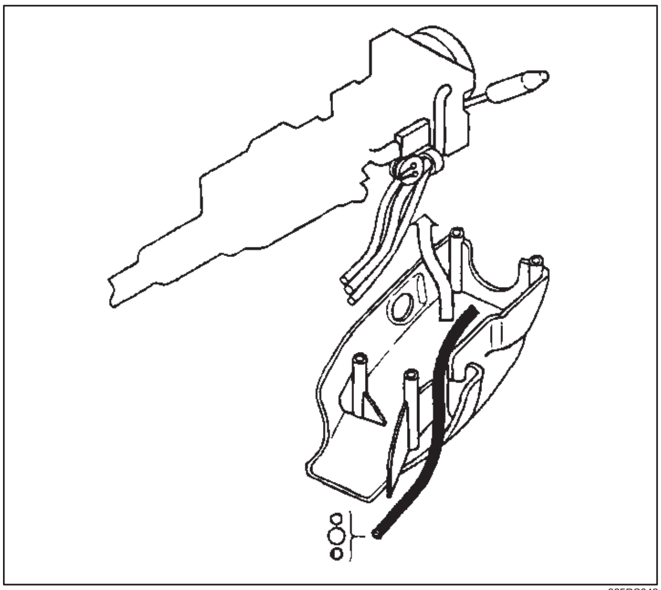
CAUTION: When turning the SRS coil counterclockwise to full, stop turning if resistance is felt. Forced further turning may damage to the cable in the SRS coil.



826RW014

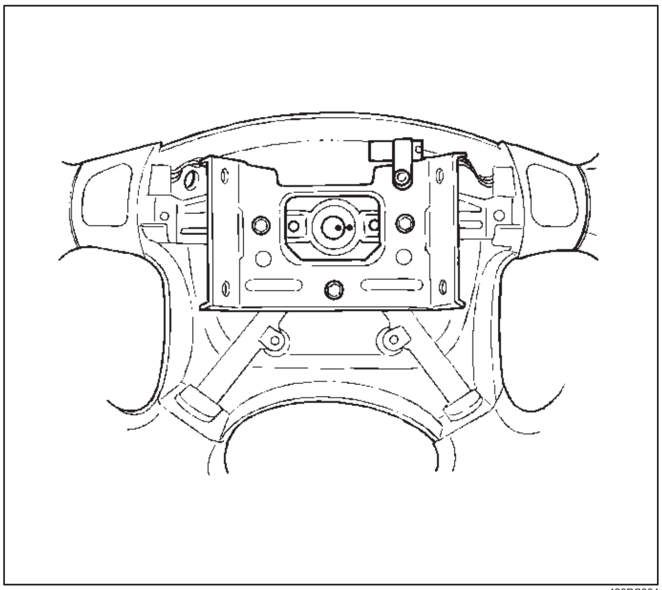
12. Install steering column cover.

CAUTION: When installing the steering column cover, be sure to wire (through each harness) as illustrated so that the harness starter switch, combination switch and SRS coil may not catch wiring.



825RS048

13. Install the steering wheel and align the setting marks.



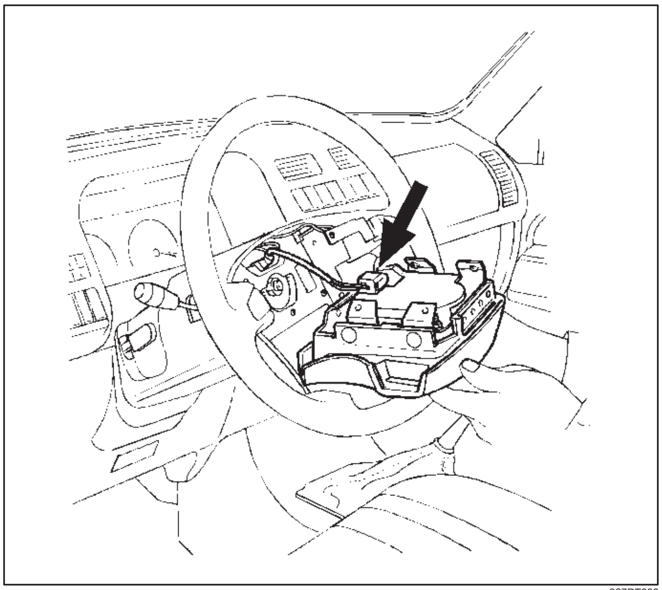
430RS004

14. Tighten the steering wheel fixing nut to the specified torque.

Torque: 34 N·m (25 lb ft)

15. Connect horn lead.
16. Connect air bag wiring harness connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.



827RT009

17. Install air bag into steering wheel and tighten bolts to specified sequence as shown in figure.

Torque: 8.8 N·m (78 lb in)

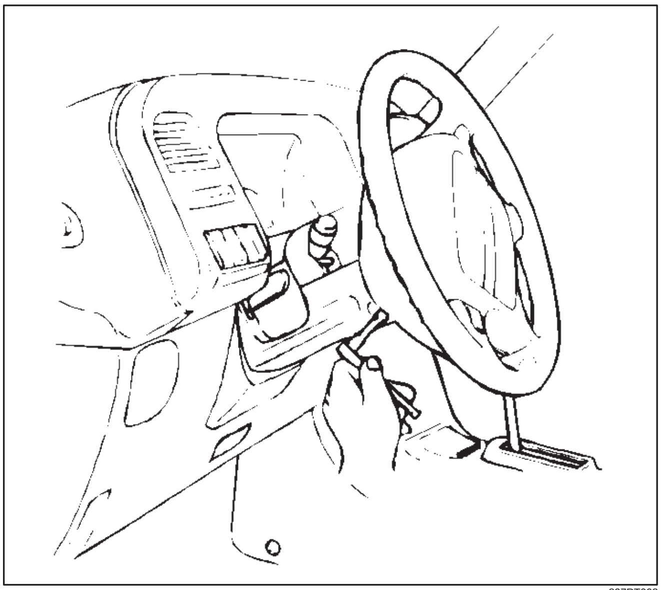
CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label from '00 model as follows.

Yellow color for driver air bag assembly.

White color for passenger air bag assembly.

Use only new air bag assembly proper to the Trooper which is being repaired.



827RT008

18. Enable the SRS (Refer to "Enabling the SRS" in this section).

Passenger Air Bag Assembly

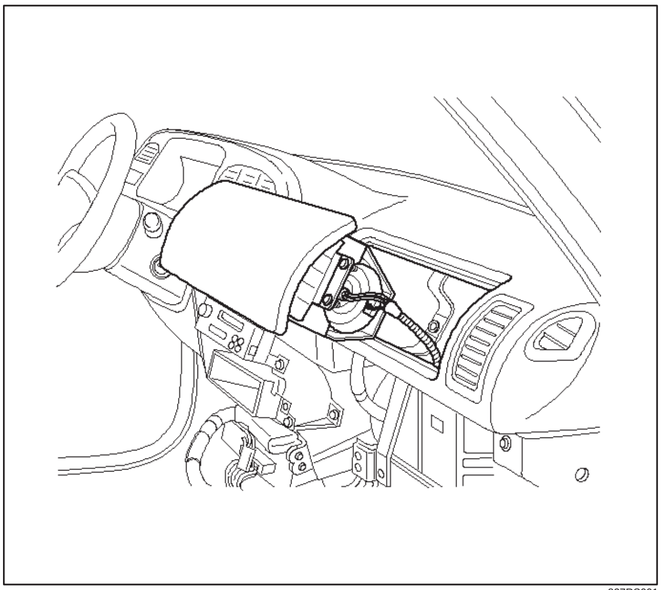
Service Precautions

WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING ALIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND RIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: **IN THE EVENT DEPLOYMENT HAS OCCURRED, INSPECT COIL ASSEMBLY WIRE FOR ANY SIGNS OF SCORCHING, MELTING OR ANY OTHER DAMAGE DUE TO EXCESSIVE HEAT. IF THE COIL HAS BEEN DAMAGED, REPLACE IT.**

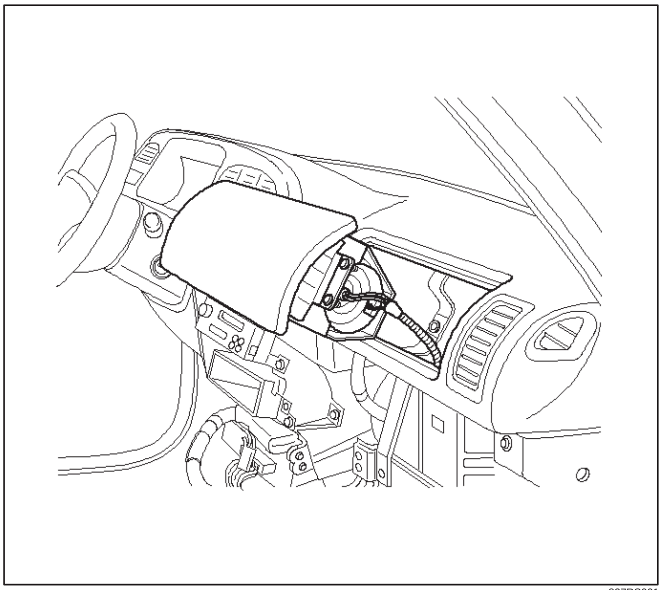
Removal



827RS001

1. Disable the SRS (Refer to “Disabling the SRS ” in this section).
2. Remove gear control knob.
3. Remove front console assembly.
4. Remove rear console assembly and disconnect harness connector.
5. Remove ECM and SDM cover.
6. Remove glove box assembly with lid.
7. Remove glove box cover.
8. Remove instrument panel assist side lower cover.
9. Disconnect engine hood opener lever.
10. Remove instrument panel door side lower cover.
11. Remove lower cluster with ashtray.
12. Remove meter cluster assembly and disconnect harness connector.
13. Remove instrument panel lower center cover.
14. Disconnect passenger air bag assembly harness connector.
15. Remove air bag assembly fixing bolts and nuts.
16. Remove passenger air bag assembly.

Installation



827RS001

1. Install passenger air bag assembly.
2. Install air bag assembly fixing nuts and tighten to specified torque.

Torque: 6 N·m (52 lb in)

3. Connect air bag assembly harness connector.
4. Install instrument panel lower center cover.
5. Install meter cluster assembly and connect harness connector.
6. Install lower cluster with ashtray.
7. Install instrument panel door side lower cover.
8. Connect engine hood opener lever.
9. Install instrument panel assist side lower cover.
10. Install glove box cover.
11. Install glove box assembly with lid.
12. Install ECM and SDM cover.
13. Install rear console assembly and connect harness connector.
14. Install front console assembly.
15. Install gear control knob.
16. Enable the SRS (Refer to “Enabling the SRS” in this section).

Main Data and Specifications

Fastener Tightening Specification

Application	N·m	Lb Ft	Lb In.
SDM	10	—	87
Driver air bag fixing bolt	8.8	—	78
Steering wheel fixing bolt	34	25	—
Steering column (dash panel side fixing bolts)	20	14	—
Steering column (Pedal bracket fixing bolt)	20	14	—
Steering column (Universal joint fixing bolt)	31	23	—
Passenger Air Bag fixing nuts	6	—	52

Trooper

RESTRAINTS

RESTRAINT CONTROL SYSTEM

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Diagnostic Information

CAUTION: When fasteners are removed, always reinstall them at the same location from which they were removed. if a fastener needs to be replaced, use the correct part number fastener for that application. if the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. fasteners that are not reused, and those requiring thread locking compound will be called out. the correct torque value must be used when installing fasteners that require it. if the above conditions are not followed, parts or system damage could result.

Diagnostic Procedures

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY–POWERED OR AC–POWERED VOLTMETER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NON POWERED, PROBE–TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

The diagnostic procedures used in this section are designed to aid in finding and repairing SRS problems. Outlined below are the steps to find and repair SRS problems quickly and effectively. Failure to carefully follow these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.

1. **Perform The “SRS Diagnostic System Check”.**
   The “SRS Diagnostic System Check” should always be the starting point of any SRS diagnostics. The “SRS Diagnostic System Check” checks for proper “AIR BAG” warning lamp operation and checks for SRS trouble codes using both “Flash Code” and “Scan Tool” Methods.
2. **Refer To The Proper Diagnostic Chart As Directed By The “SRS Diagnostic System Check”.**
   The “SRS Diagnostic System Check” will lead you to the correct chart to diagnose any SRS problems. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.
3. **Repeat The “SRS Diagnostic System Check” After Any Repair Or Diagnostic Procedures Have Been Performed.**
   Preforming the “SRS Diagnostic System Check” after all repair or diagnostic procedures will assure that the repair has been made correctly and that no other conditions exist.

Diagnostic Codes

The Sensing and Diagnostic Module (SDM) maintains a history record of all diagnostic codes that have been detected since the SRS codes were last cleared during service.

1. Active Codes — Faults that are presently detected this ignition cycle. Active codes are stored in RAM (Random Access Memory).
2. History Codes — All faults detected since the last time the history fault memory was cleared. History codes are stored in EEPROM. (Electronically Erasable Programmable Read only Memory)

How To Read Trouble Codes

All codes (Active and history) can be read (or cleared) by using a scan tool or equivalent.
If a PDT is not available, have the vehicle serviced by ISUZU dealer.

How To Clear Trouble Codes

Trouble codes can only be cleared by using a Scan Tool. If a “scan tool” is not available then inform the owner of the stored codes and suggest that the codes are cleared upon the next visit to an Isuzu dealership.

Scan Tool Diagnostics

A scan tool can be used to read current and history codes and to clear all history codes after a repair is complete. The scan tool must be updated to communicate with the SRS through a replaceable cartridge or a manufacturer’s update before it can be used for SRS diagnostics. To use the scan tool, connect it to the DLC connector and turn the ignition switch “ON”. Then follow the manufacturer’s directions for communication with the SRS. The scan tool reads serial data from the SDM “Serial Data” output (terminal 24) to the DLC connector (terminal 9).

Basic Knowledge Required

Before using this section of the Service Manual, there is some basic knowledge which will be required. Without this knowledge, you will have trouble using the diagnostic procedures in this section. Use care to prevent harm or unwanted deployment. Read all cautions in the service manual and on warning labels attached to SRS components.

Basic Electrical Circuits

You should understand the basic theory of electricity including series and parallel circuits, and understand the voltage drops across series resistors. You should know the meaning of voltage (volts), current (amps), and resistance (ohms). You should understand what happens in a circuit with an open or a shorted wire. You should be able to read and understand a wiring diagram.

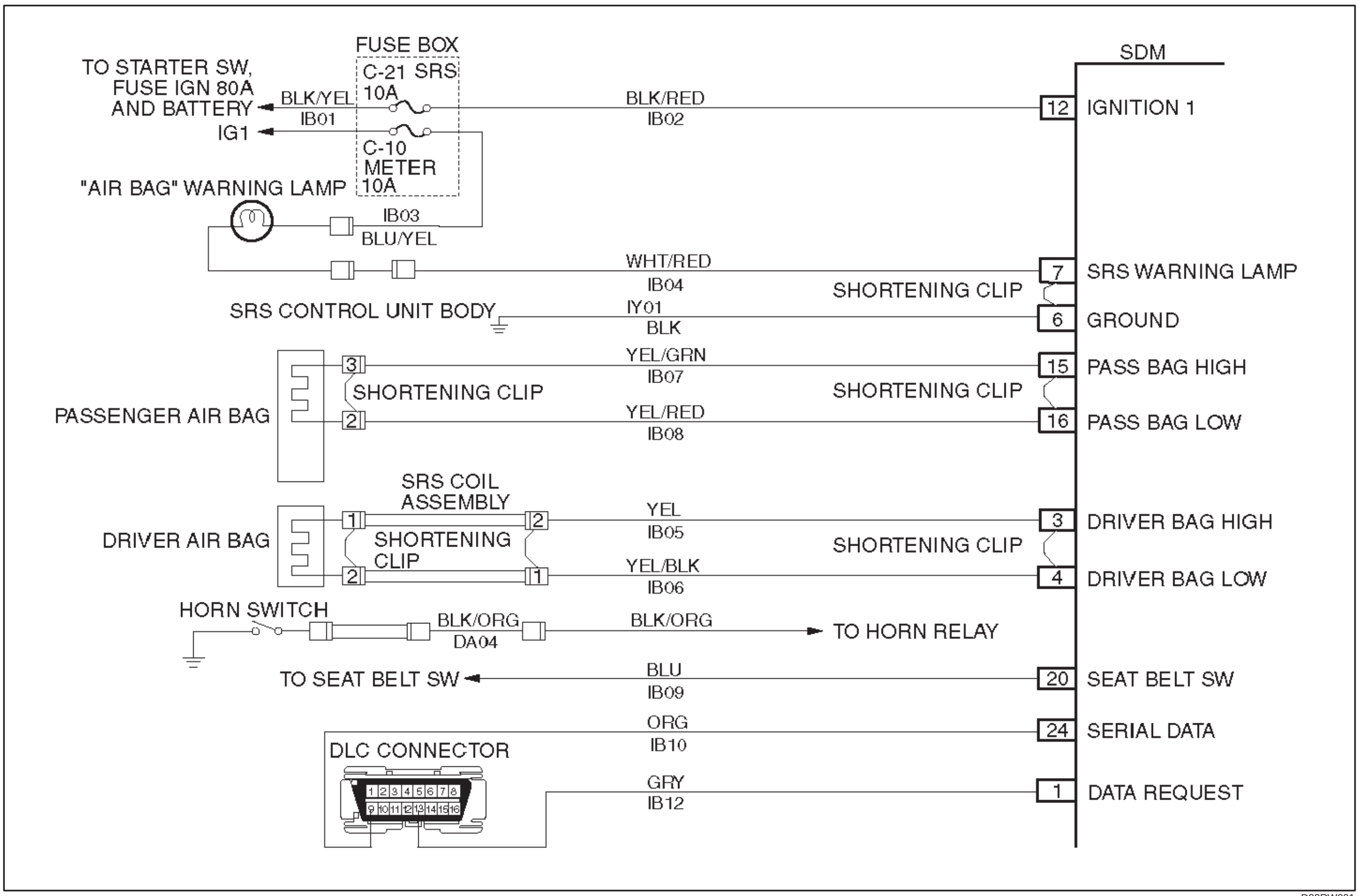
“Flash Code” Diagnostics

Flash code diagnostics can be used to read active codes and to determine if history codes are present but cannot be used to clear codes or read history codes. Flash code diagnostics is enabled by grounding by terminal 4 shorting to terminal 13 of the DLC connector with the ignition switch “ON”. Grounding terminal 4 of the DLC connector pulls the “Diagnostics Request” input (Terminal 1) of the SDM low and signals the SDM to enter the flash code diagnostic display mode.

The SDM displays the trouble codes by flashing the warning lamp. Each code that is displayed will consist of a number of flashes which represents the tens digit, a 1.2 second pause, following by a number of flashes which represents the ones digit of the code. Each code is displayed one time before moving on to the next code. After all of the codes have been displayed, the entire code sequence will continually by repeated until ground is removed from terminal 4 of the DLC connector.

Two special codes exist when reading in the flash code mode (Flash Code 12 and Flash Code 13). “Flash Code 12“ will always be the first code displayed when the flash code mode is enable Code 12 is not an indication of a SRS problem but an indication that the flash code mode has been enabled. If there are no active or history codes present, the SDM will display code 12 until ground is removed from the DLC connector at terminal 4. “flash Code 13” will be displayed if history codes are present. To read the history codes a scan tool must be used.

System Schematic



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SRS Diagnostic System Check

The diagnostic procedures used in this section are designed to find and repair SRS malfunctions. To get the best results, it is important to use the diagnostic charts and follow the sequence listed below:

A. Perform the "SRS Diagnostic System Check."

The "SRS Diagnostic System Check" must be the starting point of any SRS diagnostics. The "SRS Diagnostic System Check" checks for proper "AIR BAG" warning lamp operation, the ability of the SDM to communicate through the "Serial Data" line and whether SRS diagnostic trouble codes exist.

B. Refer to the proper diagnostic chart as directed by the "SRS Diagnostic System Check."

The "SRS Diagnostic System Check" will lead you to the correct chart to diagnose any SRS malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.

C. Repeat the "SRS Diagnostic System Check" after any repair or diagnostic procedures have been preformed.

Performing the "SRS Diagnostic System Check" after all repair or diagnostic procedures will ensure that the repair has been made correctly and that no other malfunctions exist

Circuit Description

When the ignition switch is first turned "ON", "Ignition 1" voltage is applied from the "C–21" fuse to the SDM at the "Ignition 1" input terminals "12". The SDM responds by flashing the "AIR BAG" warning lamp seven times, while performing tests on the SRS.

Notes On System Check Chart:

1. The "AIR BAG" warning lamp should flash seven times after ignition is first turned "ON".
2. After the "AIR BAG" warning lamp flashes seven times, it should turn "OFF"
3. This test checks for the proper operation of the "Serial Data" line. This test will also determine whether history diagnostic trouble codes are stored and, if so, identify them.
4. Improper operation of the "AIR BAG" warning lamp is indicated. This test differentiates a warning lamp stays "ON" condition from a warning lamp does not come "ON" condition.
5. This test checks for proper operation of the "Serial Data" line. This test will also identify the stored diagnostic trouble codes and whether they are current or history.

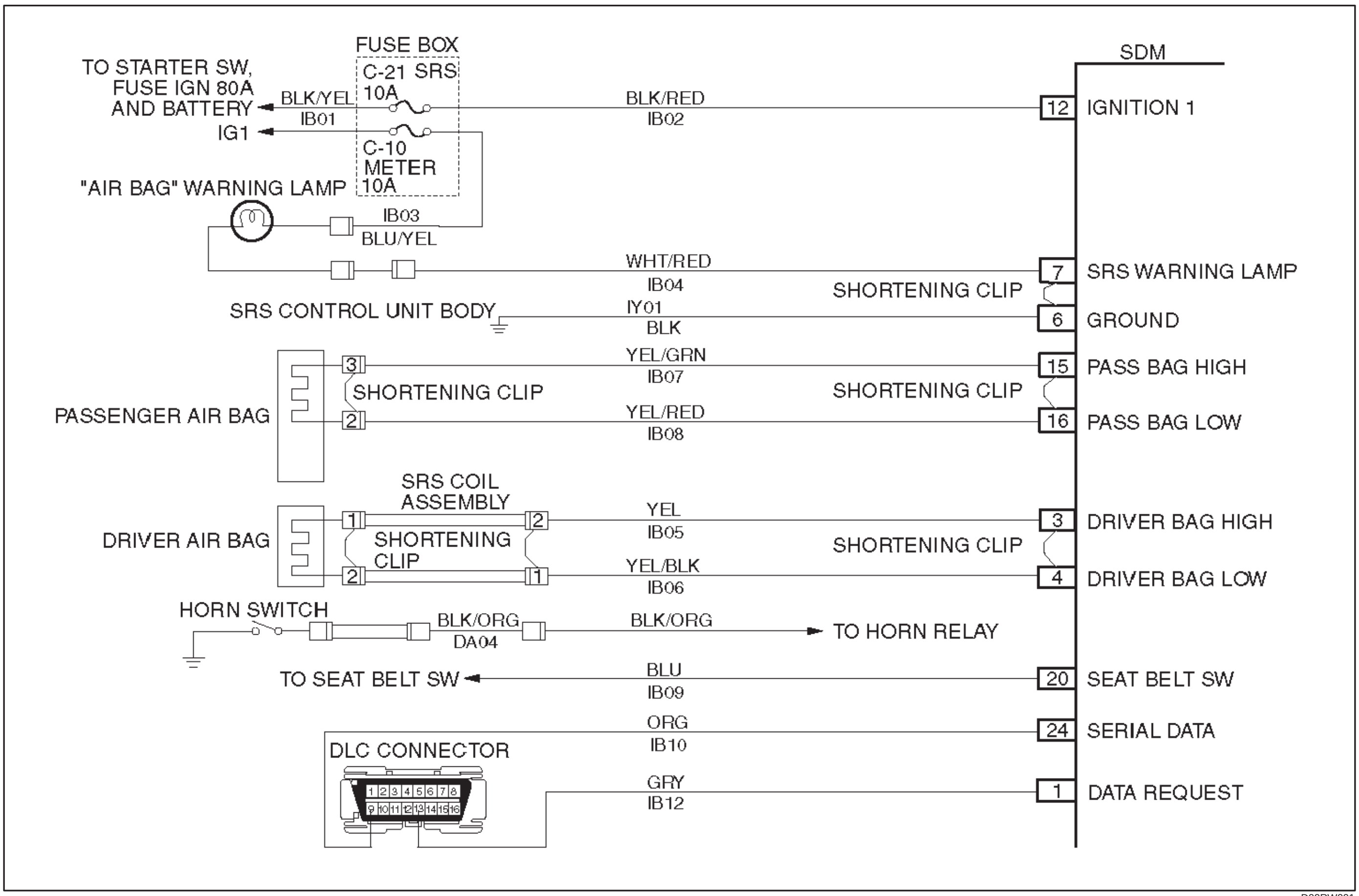
Diagnostic Aids:

The order in which diagnostic trouble codes are diagnosed is very important. Failure to diagnose the diagnostic trouble codes in the order specified may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.

SRS Diagnostic System Check

Step	Action	Yes	No
1	Note the "Air Bag" warning lamp as ignition switch is turned "ON." Does the "AIR BAG" warning lamp flash seven (7) times?	Go to Step 2	Go to Step 3
2	Note the "AIR BAG" warning lamp after it flashed 7 times. Does the "AIR BAG" warning lamp go "OFF"?	Go to Step 4	Go to Step 5
3	Note the "AIR BAG" warning lamp as ignition switch is turned "ON". Does the "AIR BAG" warning lamp come "ON" steady?	Go to Chart B	Go to Chart C
4	1. Note the "AIR BAG" warning lamp as that ignition switch is turned "ON." Ignition switch "OFF." 2. Connect a scan tool to data link connector. 3. Follow direction given in the scan tool instruction manual. Ignition switch "ON." 4. Request the SRS diagnostic trouble code display, recode all history diagnostic trouble code(s). specify as such, on repair order Is (are) diagnostic trouble code(s) displayed?	Ignition switch "OFF" When DTC 71 is set, go to DTC 71 Chart For all other history codes refer to "Diagnostic Aids" For that specific DTC A history DTC indicates the malfunction has been repaired or is intermittent	SRS is functional and free of malfuncitons, no further diagnosis is required If scan tool indicated "NO DATA RECEIVED," refer to chassis electrical section8
5	1. Ignition switch "OFF." 2. Connect a scan tool to data link connector. 3. Follow directions as given in the scan tool instruction manual. 4. Ignition switch "ON." 5. Request the SRS diagnostic trouble code display, Recode all diagnostic trouble code(s), specifying as current or history on repair order. Is (are) diagnostic trouble code (s) displayed?	Ignition switch "OFF" When DTC 53 is set, go to DTC 53 chart When DTC 51 is set, go to DTC 51 chart When DTC 19 is set, go to DTC 19 chart When DTC 25 is set, go to DTC 25 chart Diagnose remaining current DTCs from lowest to highest. When only history DTCs exist, refer to "Diagnostics Aids" for that specific DTC A history DTC indicates the malfunction has been repaired or is intermittent	If scan tool indicates "No Data Received," refer to chassis electrical section8

Chart A SDM Integrity Check



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Circuit Description:

When the SDM recognizes “Ignition 1” voltage, applied to terminals “12”, is greater than 9 volts, the “AIR BAG” warning lamp is flashed 7 times to verify operation. At this time the SDM performs “Turn–ON” tests followed by “Continuous Monitoring” tests. When a malfunction is detected, the SDM sets a current diagnostic trouble code and illuminates the “AIR BAG” warning lamp. The SDM will clear current diagnostic trouble codes and move them to a history file when the malfunction is no longer detected and/or the ignition switch is cycled, except for DTCs 19, 25, 51, 53 and 71. DTC 71 can only be cleared using a scan tool “Clear Codes” command. If DTCs 51, 53 are not indicated then DTC 71 is not existing. DTCs 51, 53 and 71 can not be cleared after a “Clear Codes” command is issued.

Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

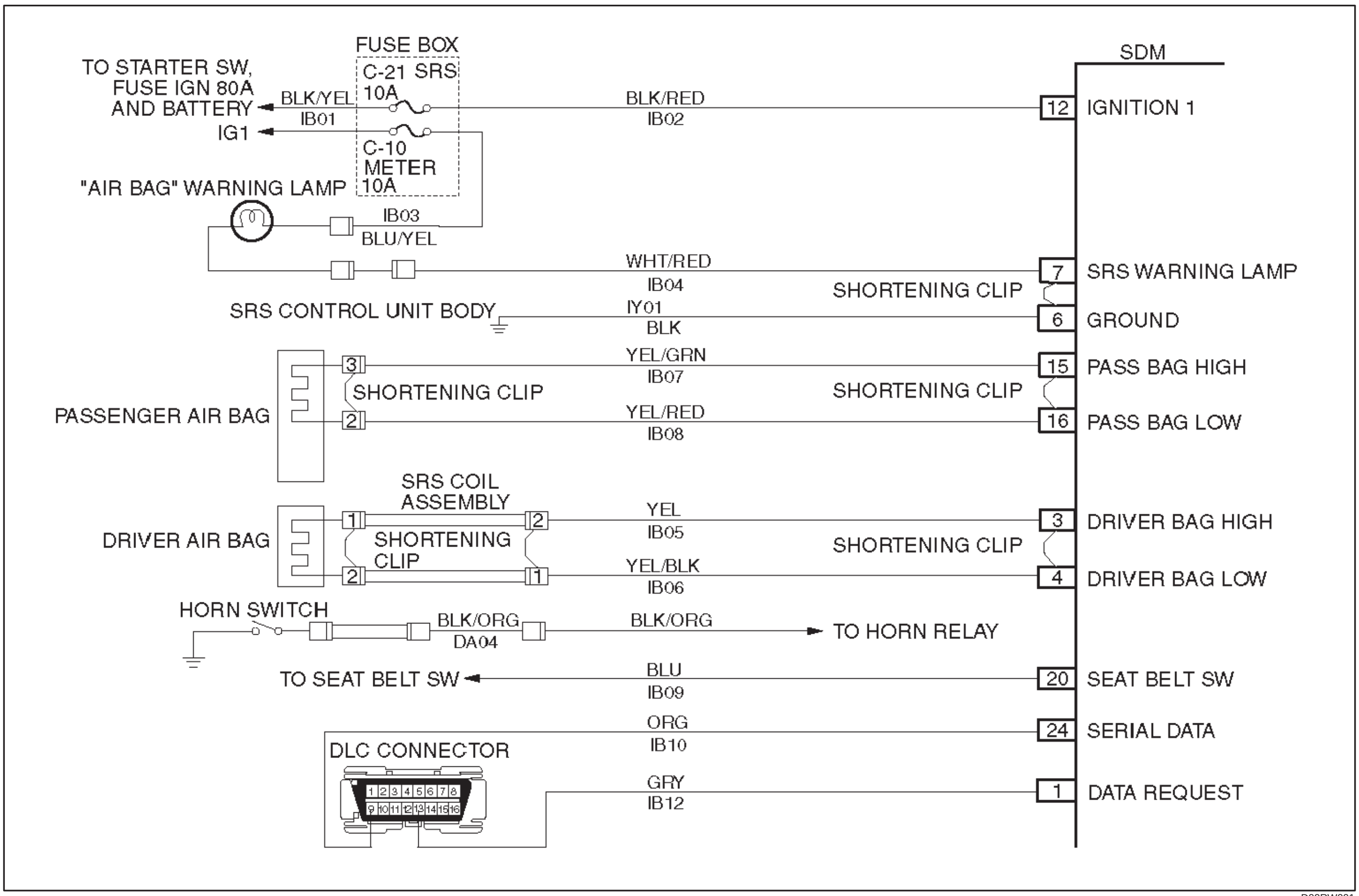
1. This test confirms a current malfunction. If no current malfunction is occurring (history DTC set) the “Diagnostic Aids” for the appropriate diagnostic trouble code should be referenced. The SDM should not be replaced for a history diagnostic trouble code.
2. This test checks for a malfunction introduced into the SRS during the diagnostic process. It is extremely unlikely that a malfunctioning SDM would cause a new malfunction to occur during the diagnostic process.
3. When all circuitry outside the SDM has been found to operate properly, as indicated by the appropriate diagnostic chart, then and only then should the SDM be replaced.

Chart A SDM Integrity Check

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

Step	Action	Yes	No
1	1. This chart assumes that the “SRS Diagnostic System Check” and either a symptom chart or a diagnostic trouble code chart diagnosis have been performed. When all circuitry outside the SDM has been found to operate properly, as indicated by the appropriate diagnostic chart, and the symptom or DTC remains current, the following 2. Diagnostic procedures must be performed to verify the need for SDM replacement. 3. Ignition switch “OFF”. 4. Reconnect all SRS components, ensure all components are properly mounted. 5. Ensure the ignition switch has been “OFF” for at least 15 seconds. 6. Note “AIR BAG” warning lamp as ignition switch is turned “ON.” Does warning lamp flash 7 times then go “OFF”?	The symptom or DTC is no longer occurring Clear SRS diagnostic trouble codes Repeat “SRS Diagnostic System Check”	Go to Step 2
2	Using a scan tool request diagnostic trouble code display. Is the same symptom or DTC occurring as was when the “SRS Diagnostic System Check ” was first performed?	Go to Step 3	Ignition switch “OFF” Go to the appropriate chart for the indicated malfunction
3	1. Clear “SRS Diagnostic Trouble Codes”. 2. Ignition switch “OFF” for at least two minutes. 3. Note “AIR BAG” warning lamp as ignition switch is turned “ON.” Does warning lamp flash 7 times then go “OFF”?	SRS is functional and free of malfunctions No further diagnosis is required Go to Step 4	Ignition switch “OFF” Replace SDM Go to Step 4
4	Reconnect all SRS components, ensure all components are properly mounted. Was this step finished?	Repeat the “SRS Diagnostic System Check”	Go to Step 4

Chart B “AIR BAG” Warning Lamp Comes “ON” Steady



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Circuit Description:

When the ignition switch is first turned “ON”, “Ignition 1” voltage is applied from the “C–10” fuse to “AIR BAG”, warning lamp which is connected to “SRS Warning Lamp”, terminal “7”. The “C–21” fuses apply system voltage to the “Ignition 1” inputs, terminals “12”. The SDM responds by flashing the “AIR BAG” warning lamp 7 times. If “Ignition 1” is less than 9 volts, the “AIR BAG” warning lamp will come “ON” solid with no DTCs set.

Chart Test Description:

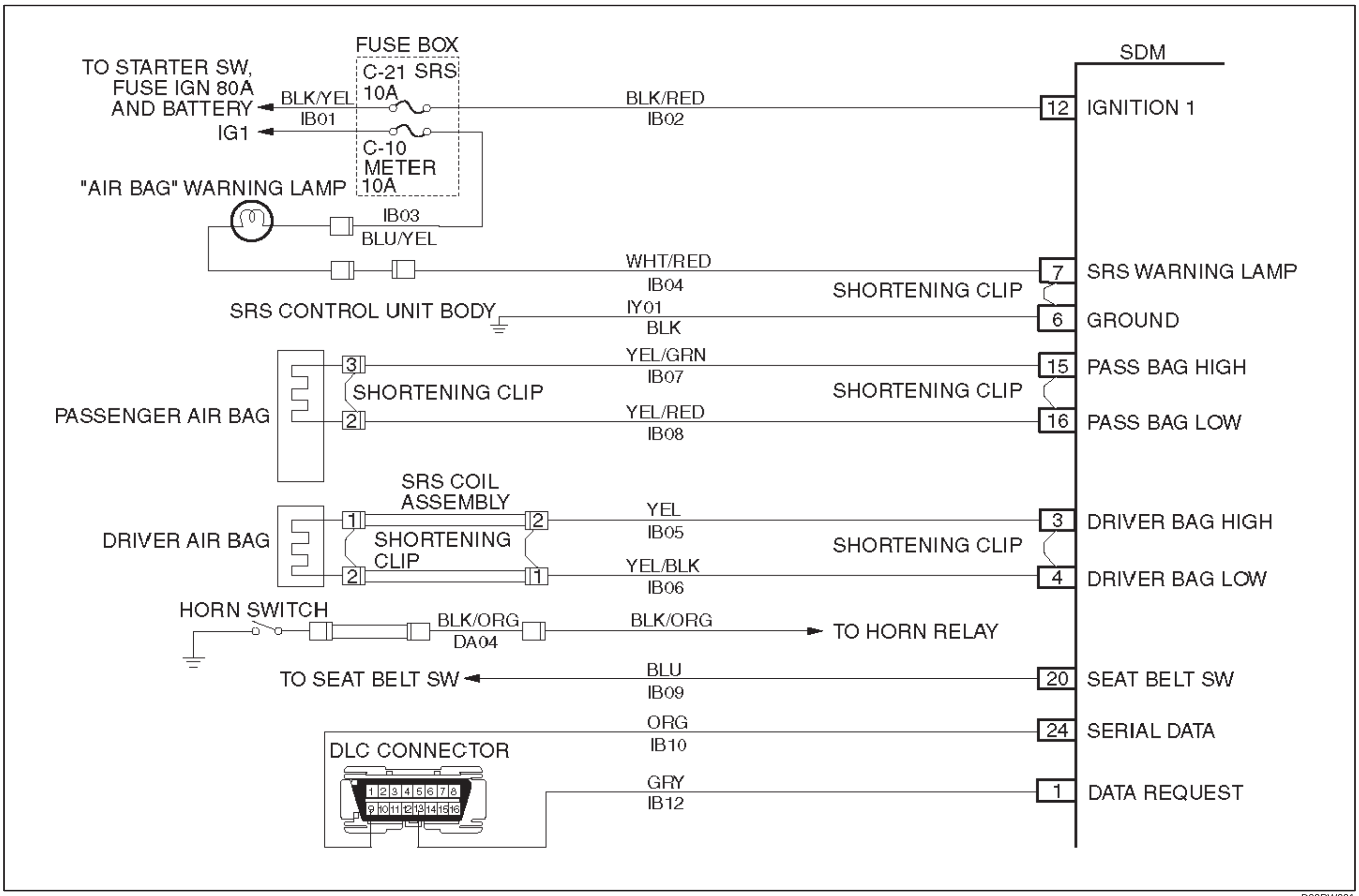
Number(s) below refer to step number(s) on the diagnostic chart.

2. This test checks for an open in the “Ignition 1” circuit to the SDM.
3. This test checks for the voltage of “IGNITION 1”.
4. This test determines whether the malfunction is a short to ground in CKT IB04–WHT/RED.

Chart B “AIR BAG” warning lamp comes “ON” Steady

Step	Action	Yes	No
1	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch “OFF.” 3. Connect scan tool to data link connector, follow directions as given in the scan tool instruction MANUAL. 4. Ignition switch “ON.” 5. Request SRS diagnostic trouble code display. Dose scan tool indicate “No Data Received”?	Go to Step 2	Go to Step 3
2	1. Ignition switch “OFF”. 2. Inspect SDM harness connector connection to SDM. Is it securely connected to the SDM?	Ignition switch “OFF” Replace SDM Go to Step 5	Connect SDM securely to de–activate shorting clip in SDM harness connector Go to Step 5
3	Using scan tool, request SRS data list. Is “ignition” more than 9 volts?	Go to Step 4	Ignition switch “OFF” Replace SDM Go to Step 5
4	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag assemblies. yellow 2–pin connector located at base of steering column and behind the glove box assembly. Disconnect SDM. 3. Disconnect the connector of “SRS Warning Lamp” of instrument cluster. 4. Measure resistance from SDM harness connector terminal “6” to ground. Does J–39200 display “OL” (Infinite)?	Go to Chart A	Replace SRS harness Go to Step 5
5	Reconnect all SRS components, ensure all components are properly mounted. Was this step finished?	Repeat the “SRS Diagnostic System Check”	Go to Step 5

Chart C "AIR BAG" Warning Lamp Does Not Come "ON" Steady (1/2)



Circuit Description:

When the ignition switch is first turned "ON", "Ignition 1" voltage is applied from the "C–10" fuse to the "AIR BAG" warning lamp which is connected to "SRS Warning Lamp", terminal "7". The "C–21" fuse apply system voltage to the "Ignition 1" inputs, terminals "12". The SDM responds by flashing the "AIR BAG" warning lamp seven times. If "Ignition 1" is more than 16 volts, the "AIR BAG" warning lamp will be still "OFF" solid with no DTCs set.

Chart Test description:

Number(s) below refer to step number(s) on the diagnostic chart:

1. This test decides whether power is available to SDM warning lamp power feed circuit.
2. This test determines whether the voltage is present in the warning lamp circuit.
3. This test determines if the malfunction is in the instrument cluster.
4. This test checks for open in the warning lamp circuitry.
5. This test isolates the IB04–WHT/RED circuit and checks for a short in the IB04–WHT/RED circuit to B+.
8. This test checks for a short from the SDM warning lamp power feed circuit to ground.
9. This test determines whether the short to ground is due to a short in the wiring.

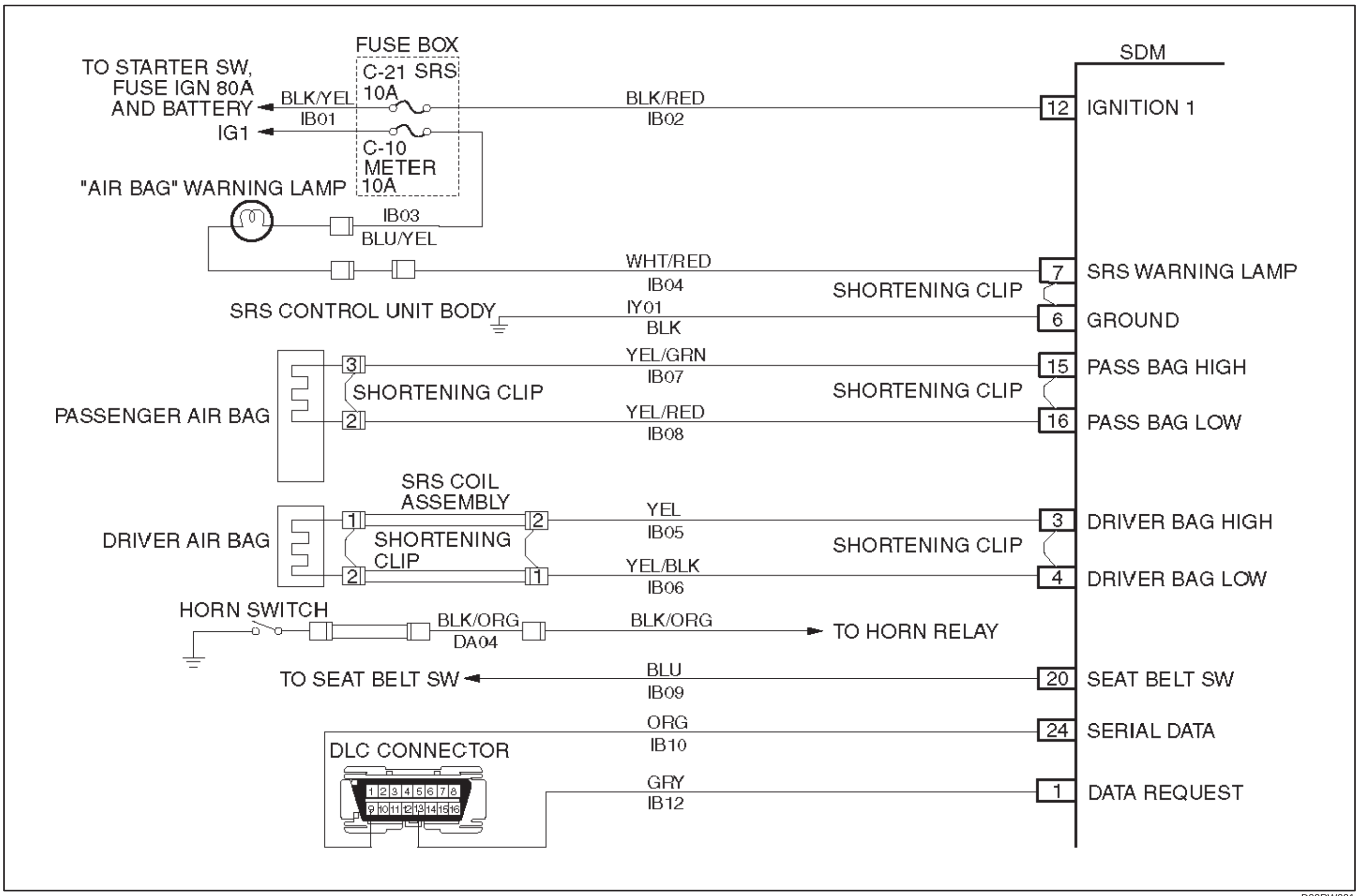
Chart C “AIR BAG” Warning Lamp Does Not Come “ON” Steady

Step	Action	Yes	No
1	1. When measurements are requested in this chart,use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch “OFF.” 3. Remove and inspect “C–10” fuse to the “AIR BAG” warning lamp. Is fuse good?	Go to Step 2	Go to Step 7
2	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag assemblies. Yellow 2–pin connector located at base of steering column and behind the glove box assembly. 3. Disconnect SDM. 4. Ignition switch “ON.” 5. Measure voltage on SDM harness connector from terminal “7” to terminal “6” (ground). Is system voltage present on terminal “7”?	Go to Step 4	Go to Step 3
3	1. Ignition switch “OFF.” 2. Remove instrument meter cluster. 3. Check for proper connection to instrument cluster at IB04–WHT/RED terminal. 4. If ok, then remove and inspect “AIR BAG” bulb. Is bulb good?	Go to Step 5	Replace bulb Go to Step 6
4	1. Ignition switch “OFF.” 2. Disconnect instrument meter cluster harness connector. 3. Ignition switch “ON.” 4. Measure voltage on SDM harness connector from terminal “7” to terminal “6” (GROUND). Is voltage 1 volt or less?	Go to Chart A	Replace SRS harness Go to Step 6
5	1. Install bulb. 2. Measure resistance from instrument meter cluster harness connector IB04–WHT/RED terminal to SDM harness connector terminal “7”. Is resistance 5.0 ohms or less?	Service instrument meter cluster Install instrument meter cluster Go to Step 6	Replace SRS harness Go to Step 6
6	Reconnect all SRS components, ensure all components are properly mounted. Was this step finished?	Repeat the “SRS Diagnostic System Check”	Go to Step 6
7	Perform chart C. Was this step finished?	Go to Step 8	Go to Step 1
8	1. Replace “C–10” fuse. 2. Ignition switch “ON” wait 10 Seconds then ignition switch “Off.” 3. Remove and inspect “C–10” fuse. Is fuse good?	Install “C–10” fuse Go to Step 10	Go to Step 9

Chart C “AIR BAG” Warning Lamp Does Not Come “ON” Steady (Cont’d)

Step	Action	Yes	No
9	1. Disconnect SRS coil and passenger air bag assemblies. Yellow 2–pin connector located at base of steering column and behind the glove box assembly. 2. Disconnect SDM. 3. Replace “C–10” fuse. 4. Ignition switch “ON” wait 10 seconds. 5. Ignition switch “OFF”. 6. Remove and inspection “C–10” fuse. Is fuse good?	Install“C–10” fuse Go to Chart A	Replace SRS harness Replace “C–10” fuse Go to Step 10
10	Reconnect all SRS components, ensure all components are properly mounted. Was this step finished?	Repeat the “SRS Diagnostic System Check”	Go to Step 10

DTC 15 Passenger Deployment Loop Resistance High



Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests “Ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the “Resistance Measurement Test”. “Passenger Bag Low” terminal “16” is grounded through a resister and the passenger current source connected to “Passenger Bag High” terminal “15” allows a known amount of current to flow. By monitoring the voltage difference between “Passenger Bag High” and “Passenger Bag Low” the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED connector terminal contact.

DTC Will Set When:

The combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED, and connector terminal contact is above a specified value. This test is run once each ignition cycle during the “Resistance Measurement Test” when:

1. No “higher priority faults” are detected during “Turn–ON”,
2. “Ignition 1” voltage is in the specified value.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned “OFF.”

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2–pin connector.
4. This test checks for proper contact and/or corrosion of the yellow 2–pin connector terminals.
5. The test checks for a malfunctioning passenger air bag assembly.
6. This test determines whether the malfunction is due to high resistance in the wiring.

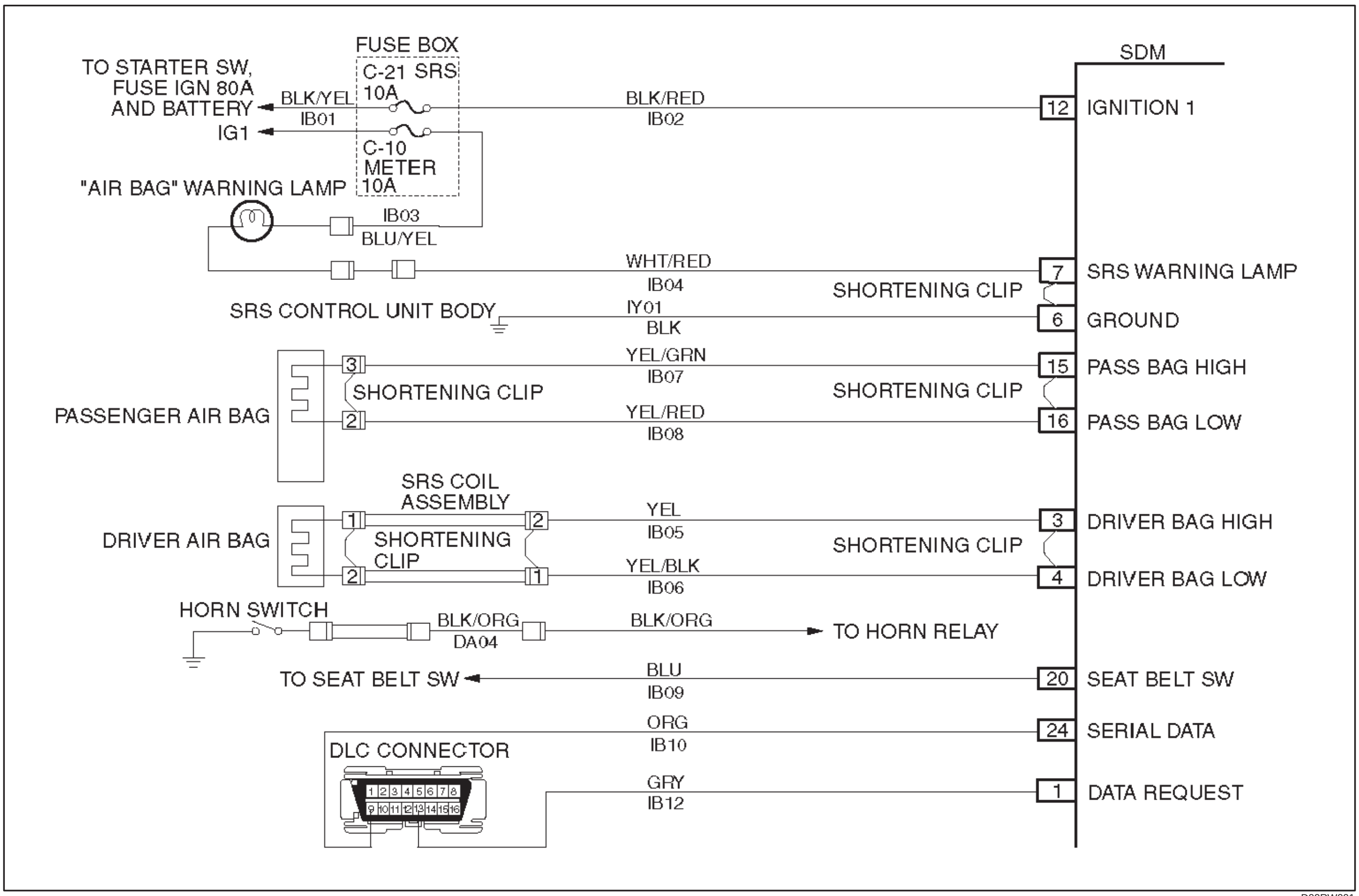
Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at the passenger air bag assembly harness connector terminals “1” and “2”, SDM terminal “15” and “16”, or a poor wire to terminal connection in CKTs IB07–YEL/GRN and IB08–YEL/RED. This test for this diagnostic trouble code is only run while the “AIR BAG” warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool “Clear Codes” command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 15 Passenger Deployment loop Resistance High

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” Performed?	Go to Step 2	Go to The “SRS Diagnostic System Check”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Use scan tool data list function, read and record the passenger deployment loop resistance. Is passenger resist. more than 2.9 ohms?	Go to Step 3	Go to Chart A
3	1. Ignition switch “Off.” 2. Make sure the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly is seated properly. Is the yellow 2–pin connector connected properly?	Go to Step 4	Seat passenger Air Bag assembly yellow 2–pin connector properly Go to Step 7
4	1. Disconnect and inspect the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly. 2. If ok, reconnect the passenger air bag assembly 2–pin connector. 3. Ignition switch “ON.” Is DTC 15 current?	Go to Step 5	Go to Step 7
5	1. Ignition switch “Off.” 2. Disconnect SRS coil and passenger air bag assembly, yellow 2–pin connector located at the base of the steering column and behind the glove box assembly. 3. Connect J–41433 SRS driver / passenger load tool and appropriate adapters to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 15 Current?	Go to Step 6	Ignition switch “Off” Replace the passenger air bag assembly Go to Step 7
6	1. Ignition switch “Off.” 2. There has been an increase in the total circuit resistance of the passenger inflator deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTS IB07–YEL/GRN and IB08–YEL/RED, and SDM connector terminal “15” and “16” to locate the root cause. Was a fault found?	Replace SRS harness Go to Step 7	Go to Chart A
7	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was This step finished?	Repeat the “SRS Diagnostic System Check”	Go to Chart 7

DTC 16 Passenger Deployment loop Resistance Low



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Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests “Ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the “Resistance Measurement Test”. “Passenger Bag Low” terminal “16” is grounded through a resistor and the passenger current source connected to “Passenger Bag High” terminal “15” allows a known amount of current to flow. By monitoring the voltage difference between “Passenger Bag High” and “Passenger Bag Low”, the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED connector terminal contact.

DTC Will Set When:

The combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED, and connector terminal contact is above a specified value. This test is run once each ignition cycle during the “Resistance Measurement Test” when:

1. No “higher priority faults” are detected during “Turn–ON”,
2. “Ignition 1” voltage is in the specified value.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned “OFF.”

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies connection of the yellow 2–pin connector.
4. This test cheeks for proper operation of the shorting clip in the yellow 2–pin connector.
5. The test checks for a malfunction passenger air bag assembly.
6. This test determines whether the malfunctioning is due to shortening in the wiring.

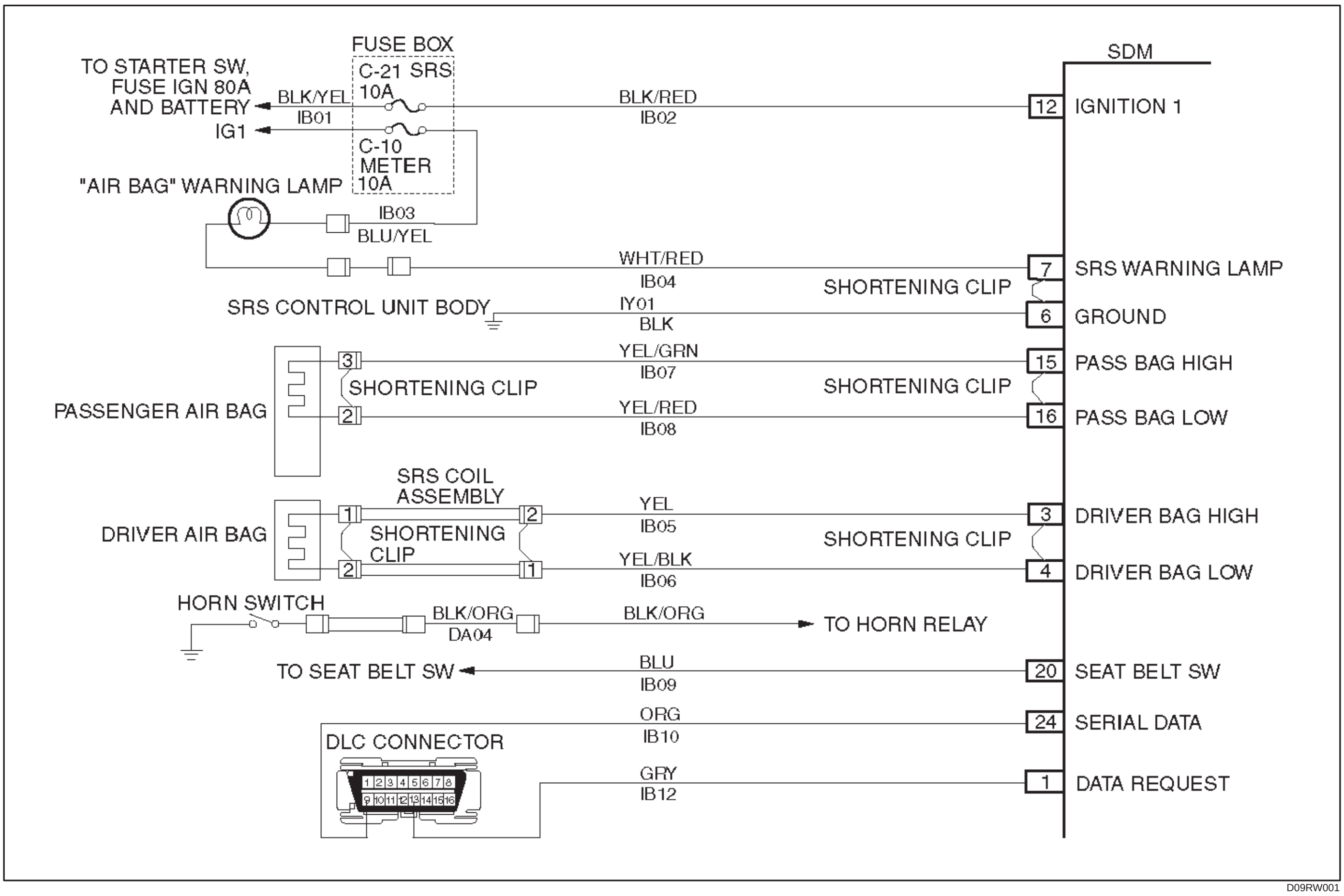
Diagnostic Aids:

An intermittent condition is likely to be caused by a short between CKTs IB07–YEL/GRN and IB08–YEL/RED, or a malfunctioning shorting clip on the passenger air bag assembly which would require replacement of the air bag assembly. The test for this diagnostic trouble code is only run while “AIR BAG” warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool “Clear Codes” command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 16 Passenger Deployment loop Resistance Low

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Repeat the “SRS Diagnostic System Check”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Using scan tool data list function, read and record the passenger deployment loop resistance. Is passenger resist. less than 1.4 ohms?	Go to Step 3	Go to Chart A
3	1. Ignition switch “Off.” 2. Make sure the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly is seated properly. Is the yellow 2–pin connector connected properly?	Go to Step 4	Seat passenger air bag assembly yellow 2–pin connector properly Go to Step 7
4	1. Disconnect and inspect the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly. 2. If ok, reconnect the passenger air bag assembly 2–pin connector. 3. Ignition switch “ON.” Is DTC 16 Current?	Go to Step 5	Go to Step 7
5	1. Ignition switch “Off.” 2. Disconnect SRS coil and passenger air bag assembly, yellow 2–pin connector located at the base of the steering column and behind the glove box assembly. 3. Connect J–41433 SRS driver/passenger load tool and appropriate adapters to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 16 current?	Go to Step 6	Ignition switch “Off” Replace the passenger air bag assembly Go to Step 7
6	1. Ignition switch “Off.” 2. There has been a decrease in the total circuit resistance of the passenger inflator deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTS IB07–YEL/GRN and IB08–YEL/RED, and SDM connector terminal “15” and “16” to locate the root cause. Was a fault found?	Replace SRS harness Go to Step 7	Go to Chart A
7	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check”	Go to Step 7

DTC 17 Passenger Deployment Loop Open



Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. During "Continuous Monitoring" diagnostics, a fixed amount of current is flowing in the deployment loop. This produces proportional voltage drops in the loop. By monitoring the voltage difference between "Passenger Bag High" and "Passenger Bag Low", the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN AND IB08–YEL/RED, and connector terminal contact.

DTC Will Set When:

The voltage difference between "Passenger Bag High" terminal "15" and "Passenger Bag Low" terminal "16" is above or equal to a specified value for 500 milliseconds during "Continuous Monitoring".

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The voltage difference between "Passenger Bag High" terminal "15" and "Passenger Bag Low" terminal "16" is below a specified value for 500 milliseconds during "Continuous Monitoring".

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2–pin connector.
4. This test cheeks for proper contact and/or corrosion of the shorting clip in the yellow 2–pin connector terminals.
5. The test checks for a malfunctioning passenger air bag assembly.
6. This test determines whether the open in the wiring.

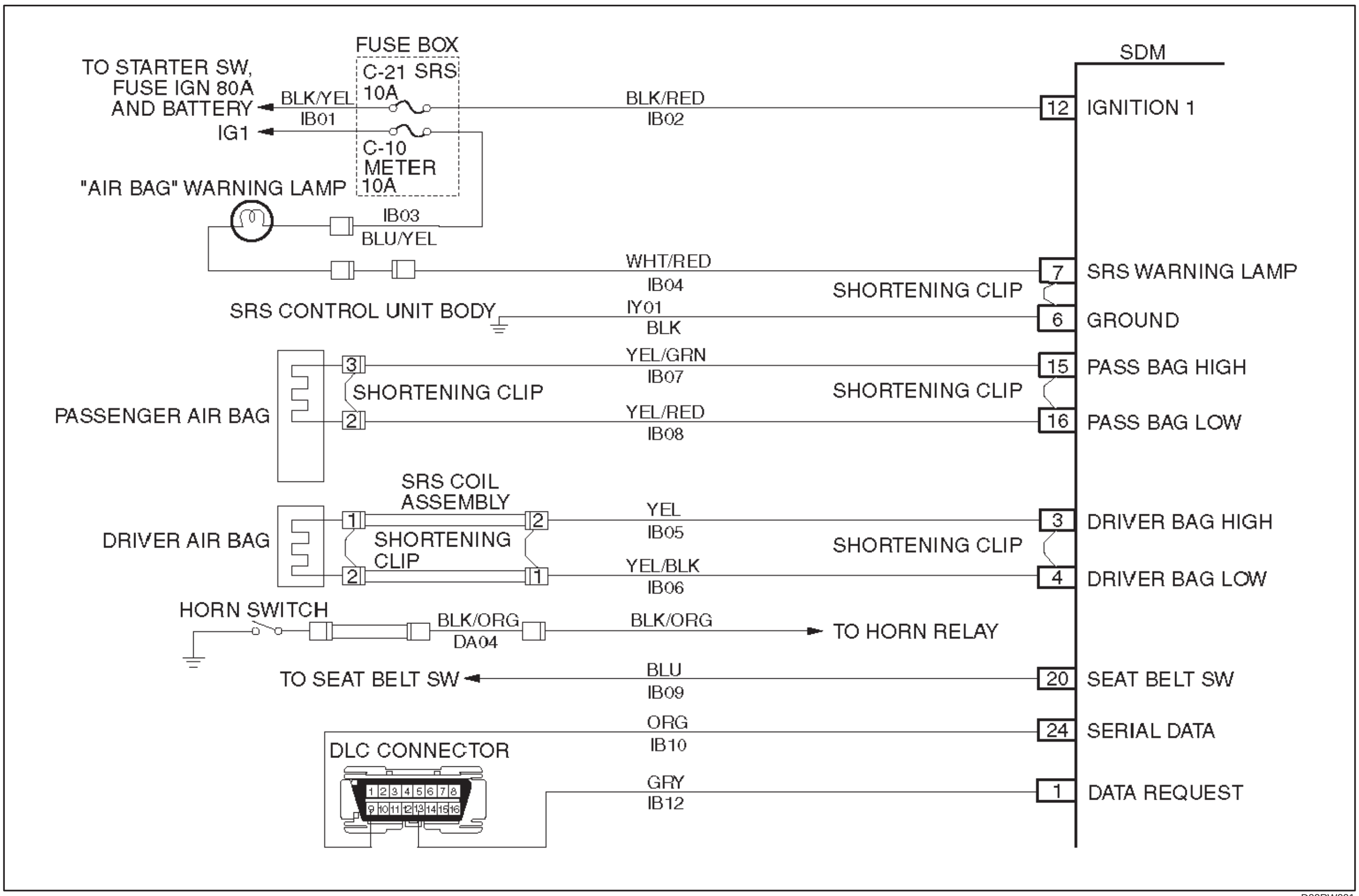
Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at the passenger air bag assembly harness connector terminals"1" and "2", SDM terminals "15" and "16", or an open in CKT IB07–YEL/GRN and IB08–YEL/RED.

DTC 17 Passenger Deployment Loop Open

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Using scan tool data list function, read and record the passenger differential voltage. Is passenger VDIF. 0.4 volts or more?	Go to Step 3	Go to Chart A
3	1. Ignition switch “OFF”. 2. Make sure the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly is seated properly. Is the yellow 2–pin connector connected properly?	Go to Step 4	Seat passenger air bag assembly yellow 2–pin connector properly Go to Step 7
4	1. Disconnect and inspect the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly. 2. If ok, reconnect the passenger air bag assembly 2–pin connector. 3. Ignition switch “ON”. Is DTC 17 current?	Go to Step 5	Go to Step 7
5	1. Ignition switch “Off.” 2. Disconnect SRS coil and passenger air bag assembly, yellow 2–pin connector located at the base of the steering column and behind the glove box assembly. 3. Connect J–41433 SRS driver / passenger load tool and appropriate adapters to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 17 current?	Go to Step 6	Ignition switch “Off” Replace the passenger air bag assembly Go to Step 7
6	1. Ignition switch “Off.” 2. There has been an open circuit resistance in the passenger deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTS IB07–YEL/GRN and IB08–YEL/RED, and SDM connector terminal “15” and “16” to locate the root cause. Was a fault found?	Replace SRS harness Go to Step 7	Go to Chart A
7	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Go to the “SRS Diagnostic System Check”	Go to Step 7

DTC 18 Passenger Deployment Loop Short To Ground



Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “Ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.

The SDM monitors the voltages at “Driver Bag Low” terminal “4” and “Passenger Bag Low” terminal “16” to detect short to ground in the air bag assembly circuits.

DTC Will Set When:

Neither of the two air bag assemblies is open.

“Ignition 1” is within the normal operating voltage range. Once these conditions are met and the voltage at “Passenger Bag Low” is below a specified value, DTC 18 will set. This test is run once each ignition cycle and “Continuous Monitoring”.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

This malfunction is no longer occurring and the ignition switch is turned “OFF”.

DTC Chart Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart.

2. This test determines whether the SDM is malfunctioning.
3. This test isolates the malfunction to one side of the passenger air bag assembly yellow 2–pin connector behind glove box compartment.
4. This test determines whether the malfunction is in CKT IB07–YEL/GRN.
5. This test determines whether the malfunction is in CKT IB08–YEL/RED.

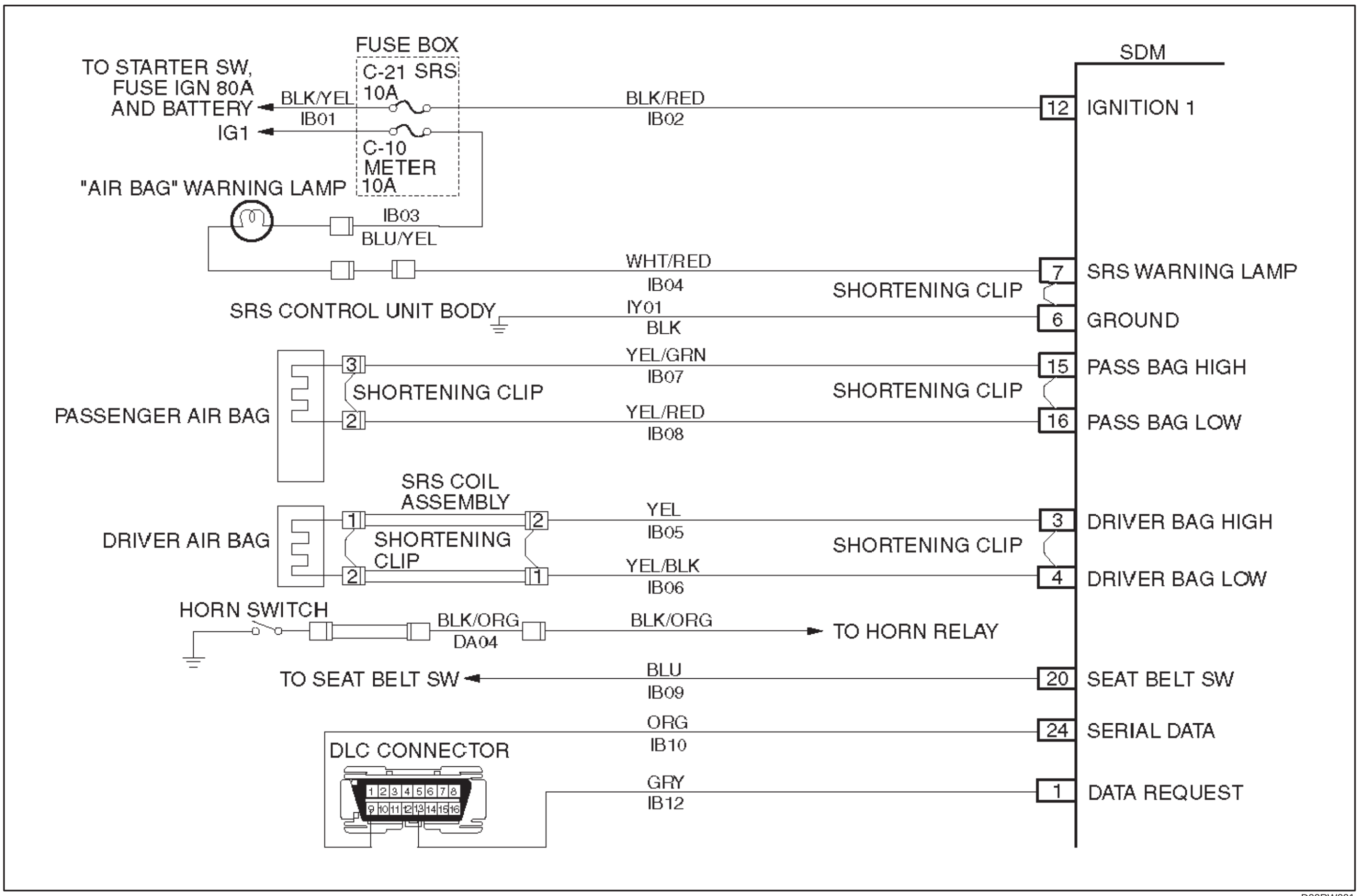
Diagnostic Aids:

An intermittent condition is likely to be caused by a short to ground in the passenger air bag assembly circuit. Inspect CKTs IB07–YEL/GRN and IB08–YEL/RED carefully for cutting or chafing. If the wiring pigtail of the passenger air bag assembly is damaged, the component must be replaced.

DTC 18 Passenger Deployment Loop Short To Ground

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch “OFF.” 3. Connect scan tool data link connector. follow directions as given in the scan tool operator’s MANUAL. 4. Ignition switch “ON.” 5. Read passenger sense LO. Is passenger sense LO less than 1.5 volts?	Go to Step 3	Go to Chart A
3	1. Ignition switch “OFF.” 2. Disconnect passenger air bag assembly yellow 2–pin connector behind the glove box assembly. 3. Leave driver air bag assembly connected. 4. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to passenger air bag assembly harness connector. 5. Ignition switch “ON.” Is DTC 18 current?	Go to Step 4	Ignition switch “OFF” Replace passenger air bag assembly Go to Step 6
4	1. Ignition switch “OFF”. 2. Disconnect SRS driver / passenger load tool 3. Measure resistance on SDM harness connector from terminal “15” to terminal “16” (ground). Does J–39200 display “OL” (Infinite)?	Go to Step 5	Replace SRS Harness Go to Step 6
5	Measure resistance on SDM harness connector from terminal “16” to terminal “6” (ground). Does J–39200 display “OL” (Infinite)?	Go to Chart A	Replace SRS Harness Go to Step 6
6	1. Reconnect all components and ensure all component are Properly Mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Go to the “SRS Diagnostic system check”	Go to Step 6

DTC 19 Passenger Deployment Loop Short To Voltage



D09RW001

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “Ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.

The SDM monitors the voltages at “Driver Bag Low” terminal “4” and “Passenger Bag Low” terminal “16” to detect short to B+ in the air bag assembly circuits.

DTC Will Set When:

“Ignition 1” is within the normal operating voltage range. Once these conditions are met and the voltage at “Passenger Bag Low” is above a specified value, DTC 19 will set. This test is run once each ignition cycle and “Continuous Monitoring”.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets DTC 19 and also DTC 71.

DTC Will Clear When:

The SDM is replaced.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test isolates the malfunction to one side of the passenger air bag assembly yellow 2–pin connector behind glove box assembly.
4. This test determines whether the malfunction is in CKT IB07–YEL/GRN.
5. This test determines whether the malfunction is in CKT IB08–YEL/RED.

Diagnostic Aids:

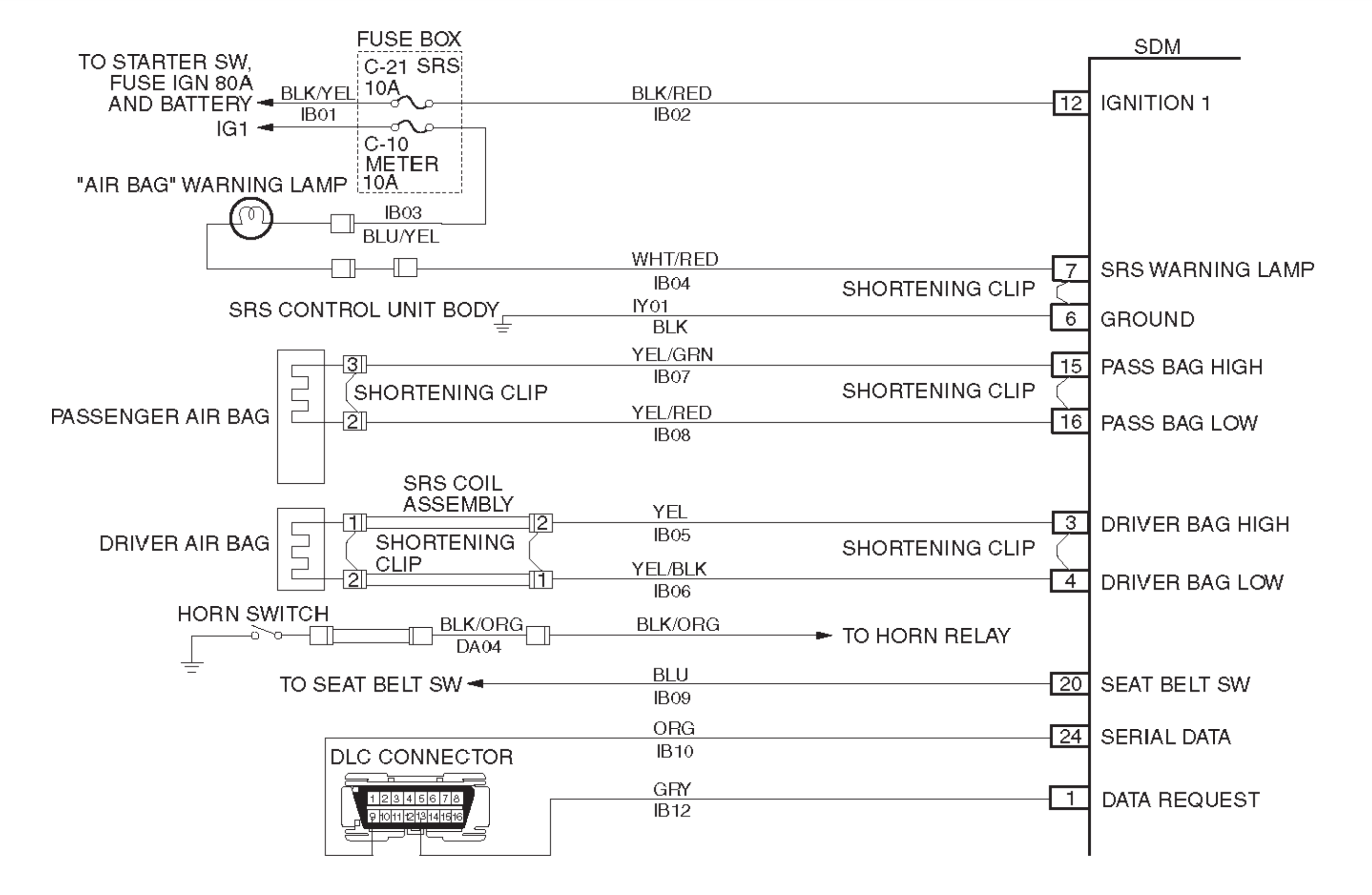
An intermittent condition is likely to be caused by a short to B+ in the passenger air bag assembly circuit. Inspect CKTs IB07–YEL/GRN and IB08–YEL/RED carefully for cutting or chafing. If the wiring pigtail of the passenger air bag assembly is damaged, the component must be replaced. A careful inspection of CKT IB07–YEL/GRN and IB08–YEL/RED, including the passenger air bag assembly pigtail is essential to ensure that the replacement SDM will not be damaged.

DTC 19 Passenger Deployment Loop Short To Voltage

CAUTION: When DTC 19 has been set, it is necessary to replace the SDM. Setting DTC 19 will also cause DTC 71 to set. When a scan tool "CLEAR CODES" command is issued and the malfunction is no longer present, DTC 71 will remain current. Ensure that the short to voltage condition is repaired prior to installing a replacement SDM to avoid damaging the SDM.

Step	Action	Yes	No
1	Perform the "SRS Diagnostic System Check." Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Repeat the "SRS Diagnostic System Check"
2	1. When measurements are requested in this chart use J–39200 DVM With correct terminal adapter from J–35616–A. 2. Ignition switch "OFF." 3. Connect scan tool data link connector. follow directions as given in the scan tool operator's manual. 4. Ignition switch "ON." 5. Read passenger sense LO. Is passenger sense LO more than 3.5 volts?	Go to Step 3	Go to chart A
3	1. Ignition switch "OFF". 2. Disconnect passenger air bag assembly yellow 2–pin connector behind the glove box assembly. 3. Leave driver air bag assembly connected. 4. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to passenger air bag assembly harness connector. 5. Ignition switch "ON." Is passenger sense LO more than 3.5 volts?	Go to Step 4	Ignition switch "OFF" Replace passenger air bag assembly Go to Step 6
4	1. Ignition switch "OFF." 2. Disconnect SDM. 3. Disconnect SRS driver / passenger load tool. 4. Measure resistance on SDM harness connector from terminal "15" to terminal "12" (ignition). Does J–39200 display "OL" (infinite)?	Go to Step 5	Replace SRS harness Go to Step
5	Measure resistance on SDM harness connector from terminal "16" and terminal "12" (ignition). Does J–39200 display "OL" (infinite)?	Go to Chart A	replace SRS harness Go to Step 6
6	1. Reconnect all components ensure all component are properly mounted. 2. Ignition switch "ON". Is passenger senslo less than 3.5 volts?	Ignition switch "OFF" Replace SDM Go to Step 7	Go to Chart A
7	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the "SRS Diagnostic System Check"	Go to Step 7

DTC 21 Driver Deployment Loop Resistance High



D09RW001

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “Ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.

The SDM then proceeds with the “Resistance Measurement Test” “Driver Bag Low” terminal “4” is grounded through a current sink and the driver current source connected to “Driver Bag High” terminal “3” allows a known amount of current to flow. By monitoring the voltage difference between “Driver Bag High” and “Driver Bag Low”, the SDM calculates the combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK, and connector terminal contact.

DTC Will Set When:

The combined resistance of the driver air bag assembly, SRS Coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK, and connector terminal contact is above a specified value. This test run once each ignition cycle during the “Resistance Measurement Test” when:

1. No “higher priority faults” are detected during “Turn–ON”
2. “Ignition 1” voltage is in the specified value.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets DTC 21.

DTC Will Clear When:

The ignition switch is turned “OFF”.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2–pin connector at the base of the steering column.
4. This test checks for proper contact and/or corrosion of the 2–pin connector terminals at the base of steering column.
5. This test isolate the malfunction to one side of the SRS coil assembly yellow 2–pin connector located at the base of the steering column.
6. This test determines whether the malfunction is due to high resistance in the wiring.
7. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at terminals “1” and “2” of the SRS coil 2–pin connector at the base of the steering column, terminal “1” and “2” of the driver air bag assembly 2–pin connector at the top of the steering column, SDM terminals “3” and “4” or a poor wire to terminal connection in CKT IB05–YEL or IB06–YEL/BLK. The test for this diagnostic trouble code is only run while the “AIR BAG” warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool “Clear Codes” command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

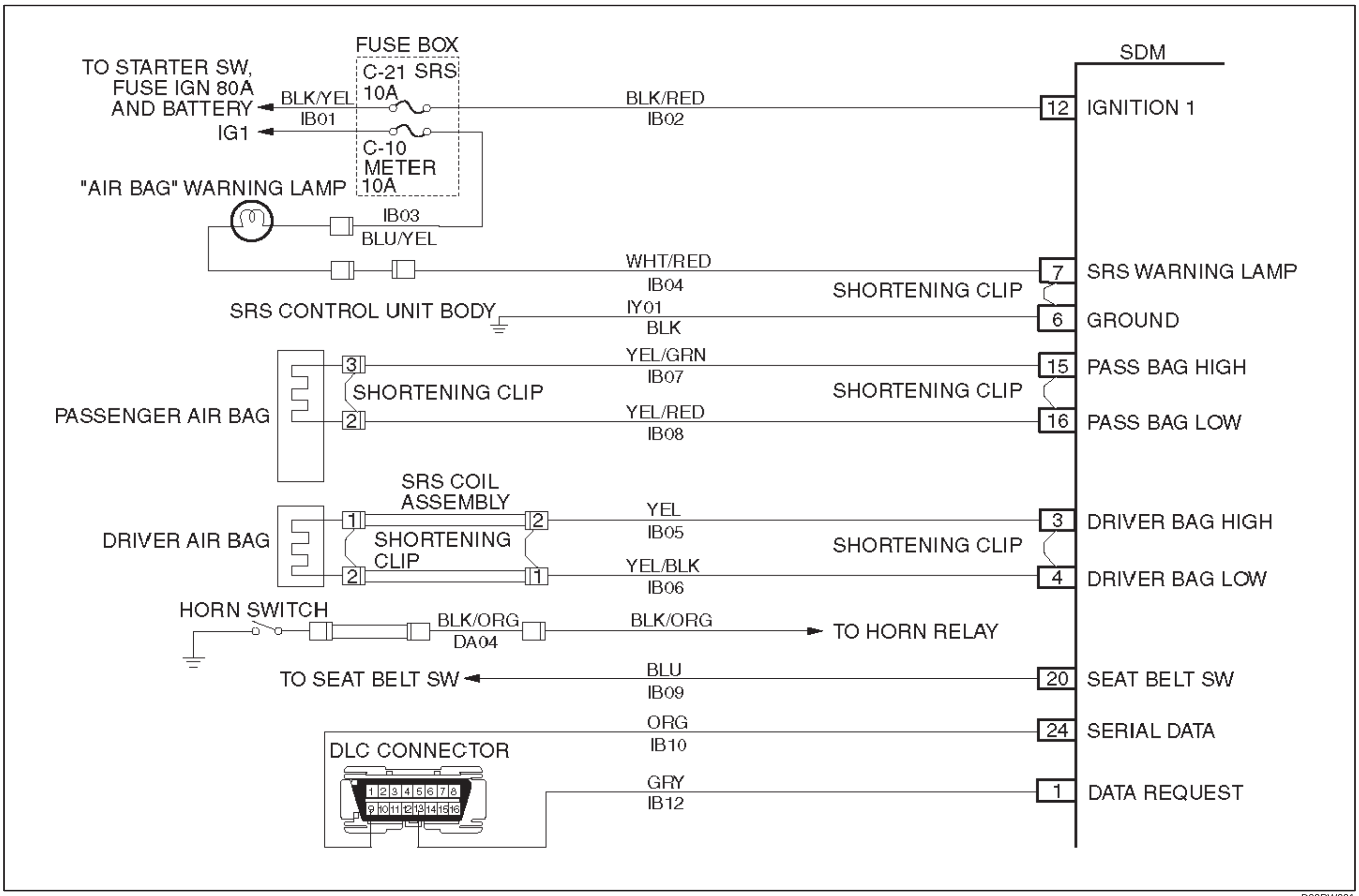
DTC 21 Driver Deployment Loop Resistance High

Step	Action	Yes	No
1	Perform the “SRS Diagnostic System Check”. Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Repeat the “SRS Diagnostic System Check”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Use scan tool data list function, read and record the driver deployment loop resistance. Is driver resistance more than 3.7 ohms?	Go to Step 3	Go to Chart A
3	1. Ignition switch “OFF.” 2. Disconnect SRS coil assembly yellow 2–pin connector located at base of steering column is seated properly. Is the 2–pin connector connected properly?	Go to Step 4	Seat SRS coil assembly 2–pin connector properly Go to Step 8
4	1. Disconnect and inspect the SRS coil assembly yellow 2–pin connector located base of steering column. 2. If ok, reconnect the SRS coil assembly yellow 2–Pin connector. 3. Ignition switch “ON.” Is DTC 21 current?	Go to Step 5	Go to Step 8
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag assembly, yellow 2–pin connector located at the base of steering column and behind the glove box assembly. 3. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 21 current?	Go to Step 6	Go to Step 7
6	1. Ignition switch “Off.” 2. There has been a increase in the total circuit resistance of the driver deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTS IB05–YEL and IB06–YEL/BLK, and SDM connector terminal “3” and “4” to locate the root cause. Was a fault found?	Replace SRS harness Go to Step 8	Go to Chart A

DTC 21 Driver Deployment Loop Resistance High (Cont'd)

Step	Action	Yes	No
7	1. Ignition switch "OFF." 2. Disconnect SRS driver / passenger load tool from SRS coil assembly harness connector. 3. Connect SRS driver / passenger load tool J–41433 on the top of steering column. 4. Reconnect SRS coil assembly harness connector as the base of steering column. 5. Ignition switch "ON." Is DTC 21 current?	Ignition switch "OFF" Replace SRS coil assembly Go to Step 8	Ignition switch "OFF" Replace driver air bag assembly Go to Step 8
8	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the "SRS Diagnostic System Check"	Go to Step 8

DTC 22 Driver Deployment Loop Resistance Low



D09RW001

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.

The SDM then proceeds with the "Resistance Measurement Test" "Driver Bag Low" terminal "4" is grounded through a current sink and the driver current source connected to "Driver Bag High" terminal "3" allows a known amount of current to flow. By monitoring the voltage difference between "Driver Bag High" and "Driver Bag Low" the SDM calculates the combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK and connector terminal contact.

DTC Will Set When:

The combined resistance of the driver air bag assembly, SRS Coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK and connector terminal contact is above a specified value. This test is run once each ignition cycle during the "Resistance Measurement Test" when:

1. No "higher priority faults" are detected during "Turn–ON"
2. "Ignition 1" voltage is in the specified value.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets DTC 22.

DTC Will Clear When:

The ignition switch is turned "OFF."

DTC Chart Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2–pin connector at the base of the steering column.
4. This test checks for proper operation of the shorting clip in the yellow 2–pin connector.
5. This test isolate the malfunction to one side of the SRS coil assembly yellow 2–pin connector located at the base of steering column.
6. This test determines whether the malfunction is due to shortening in the wiring.
7. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

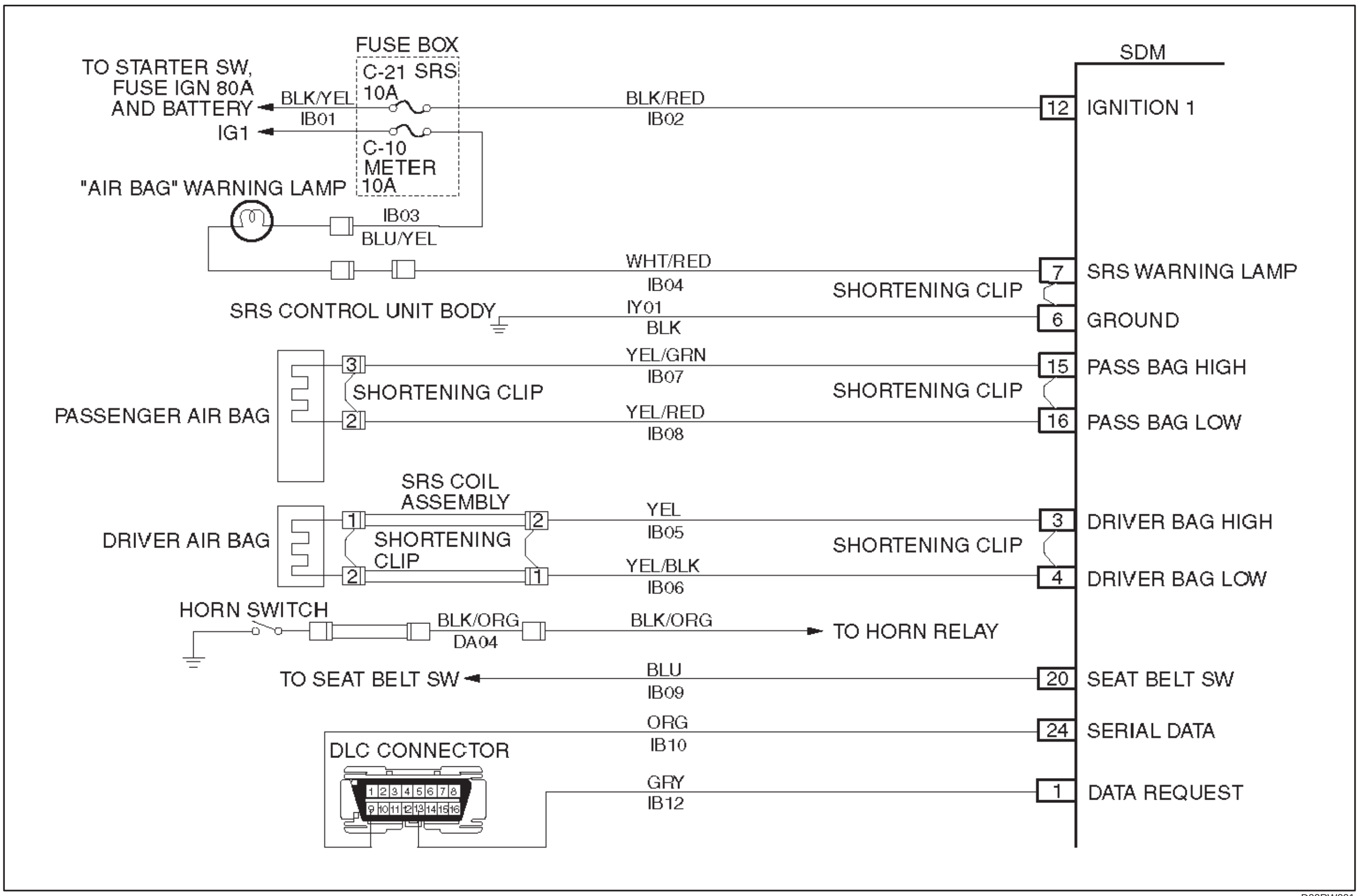
Diagnostic Aids:

An intermittent condition is likely to be caused by a short between CKT IB05–YEL or IB06–YEL/BLK or a malfunctioning shorting clip on the driver air bag assembly or SRS coil assembly which would require replacement of the component. The test for this diagnostic trouble code is only run while the “AIR BAG” warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool “Clear Codes” command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 22 Driver Deployment Loop Resistance Low

Step	Action	Yes	No
1	Perform the “SRS Diagnostic System Check.” WAS THE “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Use scan tool data list function, read and record the driver deployment loop resistance. Is driver deployment loop resistance less than 1.7 ohms?	Go to Step 3	Go to Chart A
3	1. Ignition switch “OFF.” 2. Make sure the SRS coil assembly yellow 2–pin connector located at the base of steering column is seated properly. Is the 2–pin connector connected properly?	Go to Step 4	Seat driver air bag assembly 2–pin connector properly Go to Step 8
4	1. Disconnect and inspect the SRS coil assembly yellow 2–pin connector located base of steering column. 2. If ok, reconnect the SRS coil assembly yellow 2–pin connector. 3. Ignition switch “ON.” Is DTC 22 current?	Go to Step 5	Go to Step 8
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag assembly, yellow 2–pin connector located at the base of steering column and behind the glove box assembly. 3. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 22 current?	Go to Step 6	Go to Step 7
6	1. Ignition switch “OFF.” 2. There has been a decrease in the total circuit resistance of the driver deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTS IB05–YEL and IB06–YEL/BLK, and SDM connector terminal “3” and “4” to locate the root cause. Was a fault found?	Replace SRS harness Go to Step 8	Go to Chart A
7	1. Ignition switch “OFF.” 2. Disconnect SRS driver / passenger load tool from driver air bag assembly harness connector. 3. Connect SRS driver / passenger load tool J–41433 to the top of steering column 2–pin connector. 4. Reconnect SRS coil assembly harness connector as the base of steering column. 5. Ignition switch “ON.” Is DTC 22 current?	Ignition switch “OFF” Replace SRS coil assembly Go to Step 8	Ignition switch “OFF” Replace driver air bag assembly Go to Step 8
8	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Go to the “SRS Diagnostic System Check”	Go to Step 8

DTC 24 Driver Deployment Loop Short To Ground



D09RW001

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.
The SDM monitors the voltage at "Driver Bag Low" terminal "4" and "passenger Bag Low" terminal "16" to detect shorts to ground in the air bag assembly circuits.

DTC Will Set When:

Neither of the two air bag assemblies is open.
"Ignition 1" is within the normal operating voltage range.
This test is run once each ignition cycle and "Continuous Monitoring". Once these conditions are met and the voltage at "Driver Bag Low" is below a specified value, DTC 24 will set.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The malfunction is no longer occurring and the ignition is turned "OFF".

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the SDM is malfunctioning
3. This test isolates the malfunction to one side of the SRS coil assembly yellow 2–pin connector at the base of the steering column.
4. This test determines whether the malfunction is in CKT IB05–YEL.
5. This test determines whether the malfunction is in CKT IB06–YEL/BLK.
6. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

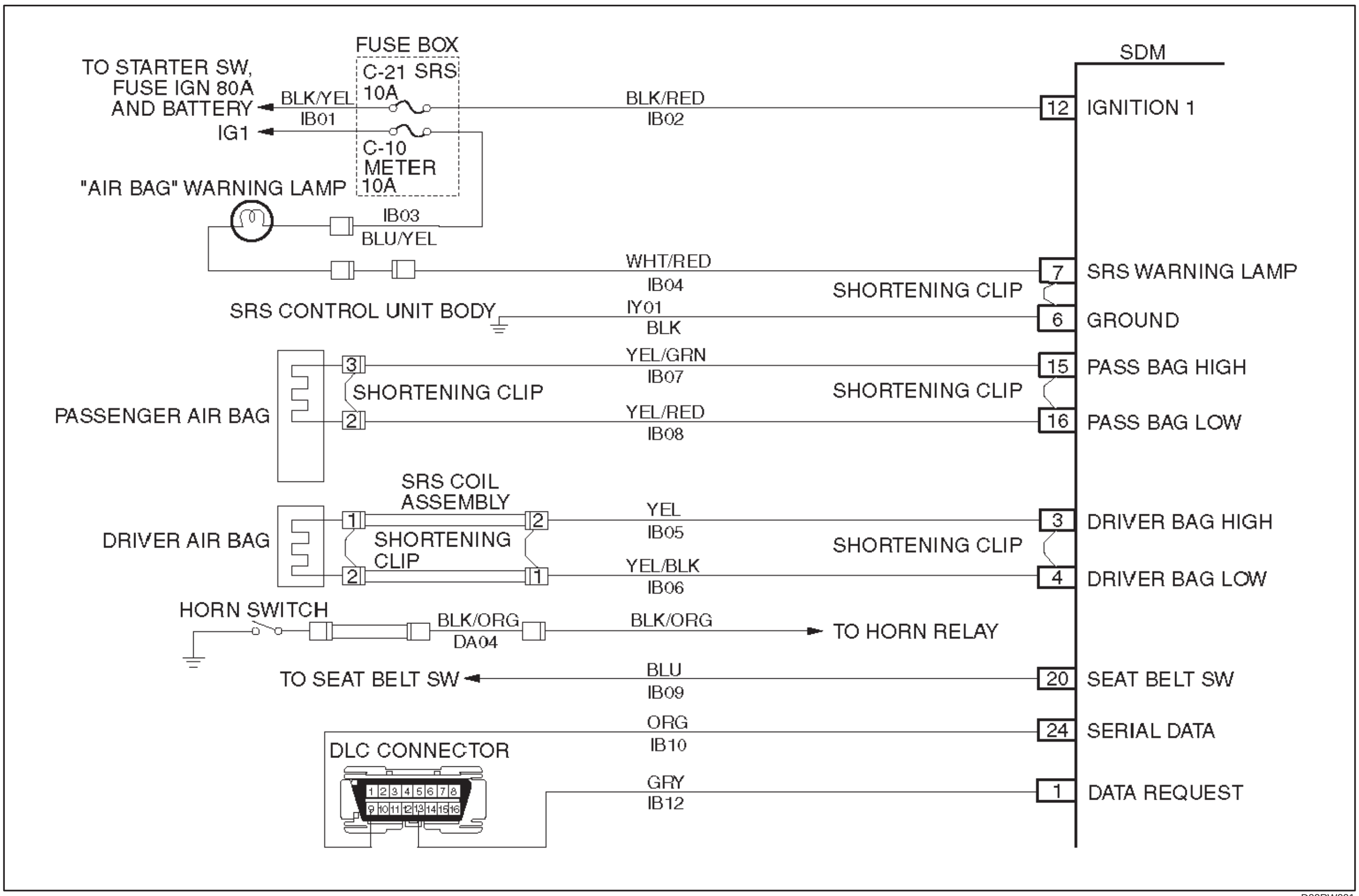
Diagnostic Aids:

An intermittent condition is likely to be caused by a short to ground in the driver air bag assembly circuit. Inspect CKTs IB05–YEL and IB06–YEL/BLK carefully for cutting or chafing.

DTC 24 Driver Deployment Loop Short To Ground

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch “OFF.” 3. Connect scan tool data link connector. follow directions as given in the scan tool operator’s manual. 4. Ignition switch “ON.” 5. Read driver sense LO. Is driver sense LO less than 1.5 volts?	Go to Step 3	Go to Chart A
3	1. Ignition switch “OFF.” 2. Disconnect SRS coil assembly yellow 2–pin connector located at base of the steering column. leave passenger air bag assembly connected. 3. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to SRS coil assembly harness connector. 4. ignition switch “ON.” Is DTC 24 current?	Go to Step 4	Go to Step 6
4	1. Ignition switch “OFF.” 2. Disconnect SDM. 3. Disconnect SRS driver / passenger load tool. 4. Measure resistance on SDM harness connector “3” to terminal “6” (ground). Does J–39200 display “OL” (infinite)?	Go to Step 5	Replace SRS harness Go to Step 7
5	measure resistance on SDM harness connector from terminal “4” to terminal “6” (ground). Does J–39200 display “OL” (infinite)?	Go to Chart A	Replace SRS harness Go to Step 7
6	1. Ignition switch “OFF.” 2. Disconnect SRS driver / passenger load tool J–41433 from SRS coil assembly harness connector. 3. connect SRS driver / passenger load tool J–41433 and appropriate adapter J–35616–A to driver air bag assembly harness connector. located top of the steering column 2–pin connector. 4. Reconnect SRS coil assembly harness connector as the base of steering column. 5. Ignition switch “ON.” Is DTC 24 current?	Ignition switch “OFF” Replace SRS coil assembly Go to Step 7	Ignition switch “OFF” Replace driver air bag assembly Go to Step 7
7	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Go to the “SRS Diagnostic System Check”	Go to Step 7

DTC 25 Driver Deployment Loop Short To Voltage



D09RW001

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “Ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.
The SDM monitors the voltage at “Driver Bag Low” terminal “4” and “Passenger Bag Low” terminal “16” to detect shorts to B+ in the air bag assembly circuits.

DTC Will Set When:

“Ignition 1” is in the normal operating voltage range. This test is run once each ignition cycle and “Continuous monitoring”. Once these conditions are met and the voltage at “Driver Bag Low” is above a specified value, DTC 25 will set.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets DTC 25 and also DTC 71

DTC Will Clear When:

The SDM is replaced.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the SDM is malfunctioning.
3. This test isolates the malfunction to one side of the driver air bag assembly yellow 2–pin connector at the base of steering column.
4. This test determines whether the malfunction is in CKT IB05–YEL.
5. This test determines whether the malfunction is in CKT IB06–YEL/BLK.
6. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

Diagnostic Aids:

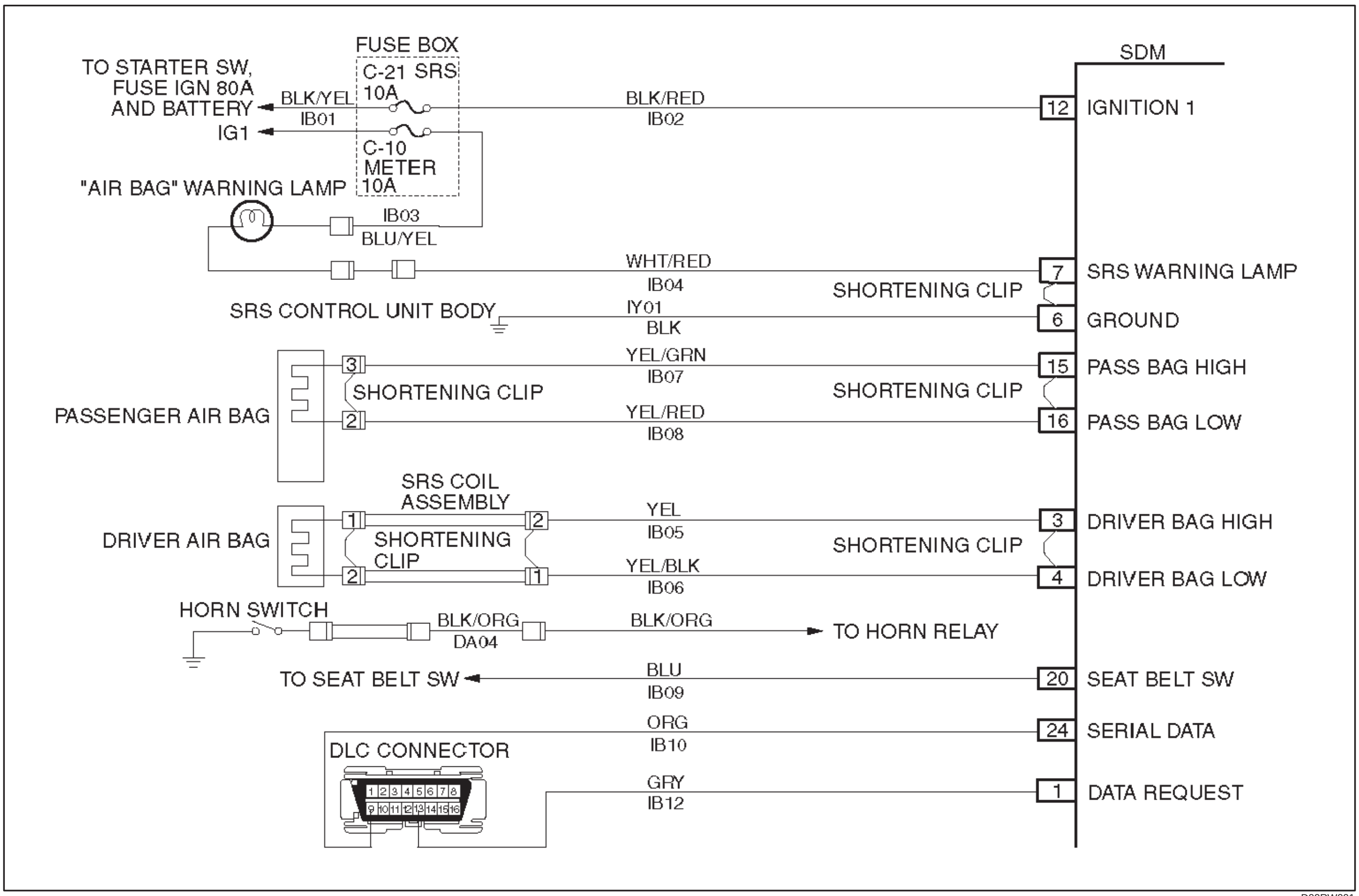
An intermittent condition is likely to be caused by a short to B+ in the driver air bag assembly circuit. Inspect CKTs IB05–YEL and IB06–YEL/BLK carefully for cutting or chafing. If the wiring pigtail of the driver air bag assembly and SRS coil assembly is damaged, the components must be replaced. A careful inspection of CKT IB05–YEL and IB06–YEL/BLK, including the SRS coil assembly and driver air bag assembly is essential to ensure that the replacement SDM will not be damaged.

DTC 25 Driver Deployment Loop Short To Ignition

CAUTION: When DTC 25 has been set, it is necessary to replace the SDM. Setting DTC 25 will also cause DTC 71 to set. When a scan tool "CLEAR CODES" command is issued and the malfunction is no longer present, DTC 71 will remain current. Ensure that the short to voltage condition is repaired prior to installing a replacement SDM to avoid damaging the SDM.

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. Ignition switch "OFF." Connect scan tool data link connector. follow directions as given in the scan tool operator's manual. 2. Ignition switch "ON." 3. Read driver sense LO . Is driver sense LO more than 3.5 volts?	Go to Step 3	Go to Chart A
3	1. Ignition switch "OFF." 2. Disconnect SRS coil assembly yellow 2–pin connector at the base of the steering column. leave passenger air bag assembly connected. 3. Connect SRS driver /passenger load tool J–41433 and appropriate adapter to SRS coil assembly harness connector. 4. Ignition switch "ON." Is driver sense LO more than 3.5 volts?	Go to Step 4	Go to Step 6
4	1. Ignition switch "OFF." 2. Disconnect SDM. 3. Disconnect SRS driver /passenger load tool. 4. Measure resistance on SDM harness connector "3" to terminal "12" (ignition). Does J–39200 display "OL" (infinite)?	Go to Step 5	Replace SRS harness Go to Step 7
5	Measure resistance on SDM harness connector from terminal "4" to terminal "12" (ignition). Does J–39200 display "OL" (infinite)?	Go to Chart A	Replace SRS harness Go to Step 7
6	1. Ignition switch "OFF." 2. Disconnect SRS driver / passenger load tool J–41433 and appropriate adapter J–35616–A to driver air bag assembly harness 2-pin connector located at top of the steering column. 3. Reconnect SRS coil assembly harness connector as the base of steering column. 4. Ignition switch "ON." Is driver sense LO more than 3.5 volts?	Ignition switch "OFF" Replace SRS coil assembly Go to Step 7	Ignition switch "OFF" Replace driver air bag assembly Go to Step 7
7	1. Reconnect all components, ensure all component are properly mounted. 2. Ignition switch "ON." Is passenger senslo less than 3.5 volts?	Ignition switch "OFF" Replace SDM Go to Step 8	Go to Chart A
8	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Go to the "SRS Diagnostic System Check"	Go to Step 8

DTC 26 Driver Deployment Loop Open



D09RW001

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, "Ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.

During "Continuous Monitoring" diagnostics, a fixed amount of current is following in the deployment loop. This produces proportional voltage drops in the loop. By monitoring the voltage difference between "Driver Bag High" and "Driver Bag Low", the SDM calculates the combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK, and connector terminal contact.

DTC Will Set When:

The voltage difference between "Driver Bag High" terminal "3" and "Driver Bag Low" terminal "4" is above or equal to a specified value for 500 milliseconds during "Continuous Monitoring".

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The voltage difference between "Driver Bag High" terminal "3" and "Driver Bag Low" terminal "4" is below a specified value for 500 milliseconds during "Continuous Monitoring".

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2–pin connector at the base of the steering column.
4. This test checks for proper contact and/or corrosion of the yellow 2–pin connector at the base of the steering column.
5. This test isolates the malfunction to one side of the SRS coil assembly yellow 2–pin connector located at the base of steering column.
6. This test determines whether the open is in the wiring.
7. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

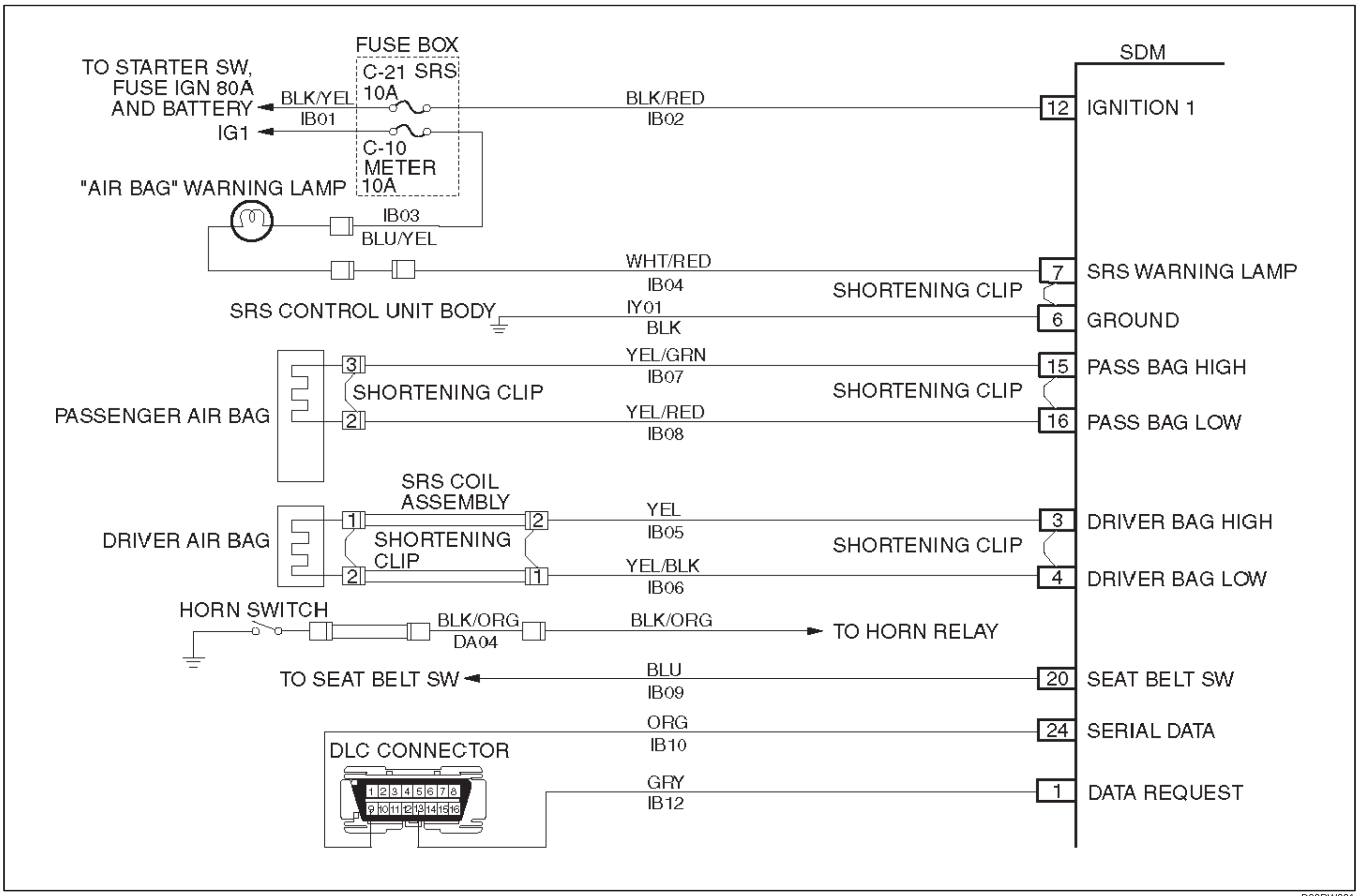
Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at the driver air bag assembly harness 2–pin connector terminals "1" and "2" at the top of the steering column, SRS coil assembly harness 2–pin connection terminals "1" and "2", SDM terminals "3" and "4", or an open in CKTs IB05–YEL and IB06–YEL/BLK.

DTC 26 Driver Deployment Loop Open

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check”
2	1. When measurements are requested in this chart use J-39200 DVM with correct terminal adapter from J–35616–A. 2. use scan tool data list function, read and record the driver differential voltage. Is driver VDIF more than 4 volts?	Go to Step 3	Go to Chart A
3	1. Ignition switch “OFF.” 2. Make sure the SRS coil assembly yellow 2–pin connector located at the base of steering column is seated properly. Is the yellow 2–pin connector connected properly?	Go to Step 4	Seat driver air bag assembly 2–pin connector Go to Step 8
4	1. Disconnect and inspect the SRS coil assembly yellow 2–pin connector located base of steering column. 2. If ok, reconnect the SRS coil assembly yellow 2–pin connector. 3. Ignition switch “ON.” Is DTC 26 current?	Go to Step 5	Go to Step 8
5	1. Ignition switch “OFF”. 2. Disconnect SRS coil and passenger air bag assembly, yellow 2–pin connector located at the base of steering column and behind the glove box assembly. 3. Connect SRS driver/passenger load tool J–41433 and appropriate adapter to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 26 current?	Go to Step 6	Go to Step 7
6	1. Ignition switch “OFF.” 2. there has been an open circuit in the driver inflator deployment loop. 3. use the high resolution ohmmeter mode of the DVM while checking CKTS IB05–YEL and IB06–YEL/BLK, and SDM connector terminal “3” and “4” to locate the root cause. Was a fault found?	Replace SRS harness Go to Step 8	Go to Chart A
7	1. Ignition switch “OFF.” 2. Disconnect SRS driver / passenger load tool from SRS coil assembly harness connector. 3. connect SRS driver / passenger load tool J–41433 on steering column 2–pin connector. 4. Reconnect SRS coil assembly harness connector at the base of steering column. 5. Ignition switch “ON.” IS DTC 26 CURRENT?	Ignition switch “OFF” Replace SRS coil assembly Go to Step 8	Ignition switch “OFF” Replace driver air bag assembly Go to Step 8
8	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check”	Go to Step 8

DTC 51 Deployment Event Commanded



D09RW001

Circuit Description:

The SDM contains a sensing device which converts vehicle velocity changes to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the air bag assembly deploying the air bags and causing DTC 51 to set.

DTC Will Set When:

The SDM detects a frontal crash, up to 30 degrees off the centerline of the vehicle, of sufficient force to warrant deployment of the air bags.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp records “Crash Data”, and sets a diagnostic trouble code.

DTC Will Clear When:

The SDM is replaced.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

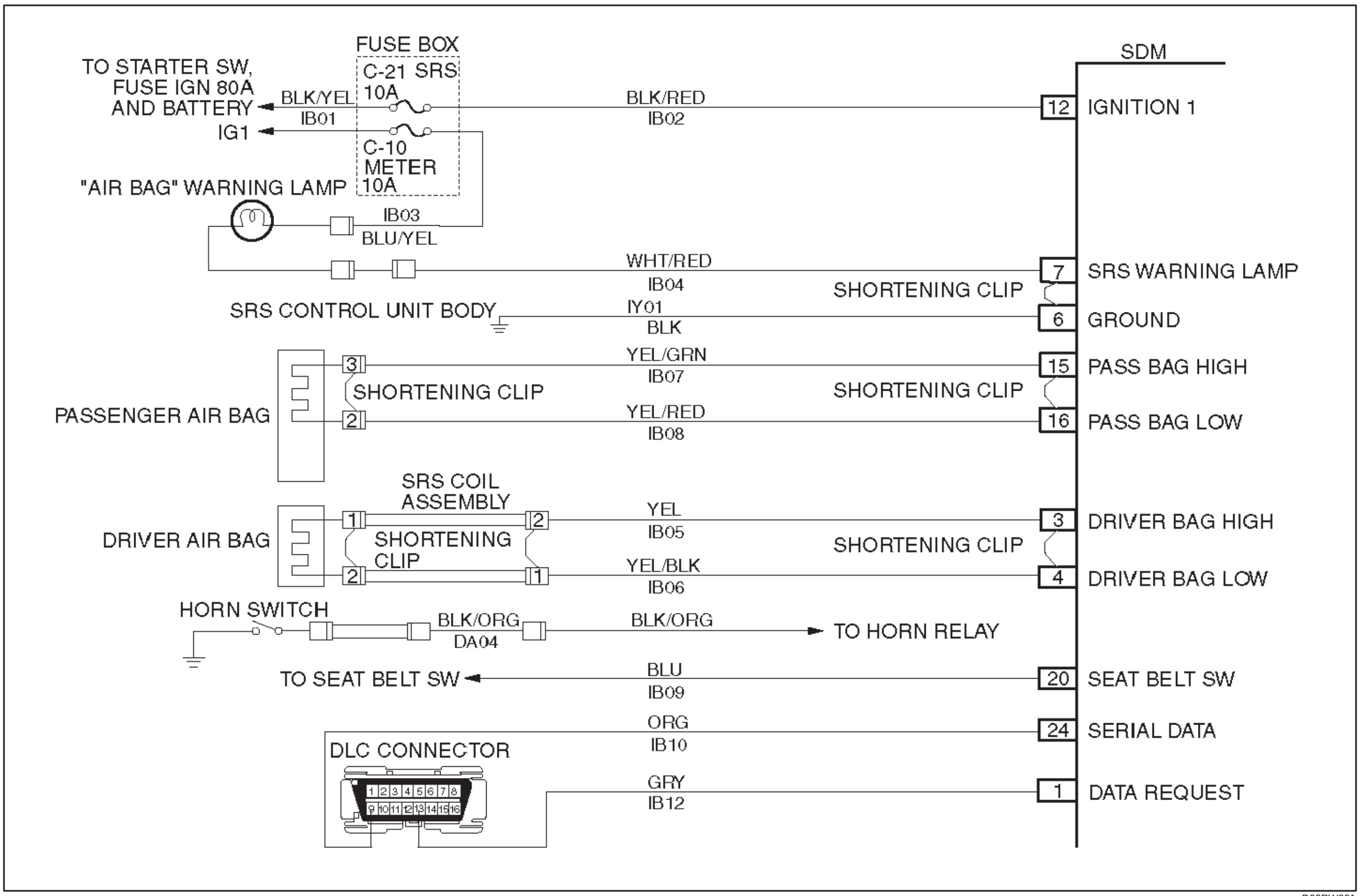
2. If air bag assembly (s) has not deployed, DTC 51 may have falsely set.
3. If DTC 51 has set with no signs of frontal impact, the diagnostic trouble code has falsely set.

DTC 51 Deployment Event Commanded

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check”
2	Ignition switch “OFF.” Have air bag assemblies deployed?	Replace components and perform inspections as directed in “repairs and inspections required after an accident” in this section clear diagnostic trouble codes Repeat “SRS Diagnostic System Check”	Go to Step 3
3	Inspect front of vehicle and undercarriage for sings of impact. Were signs of impact found?	Replace components and perform inspections as directed in “Repairs and Inspections Required After An Accident” in this section Clear diagnostic trouble codes Repeat “SRS Diagnostic System Check”	Ignition switch “OFF” Replace SDM Reconnect all SRS system components, ensure all components are properly mounted Repeat “SRS Diagnostic System Check”

DTC 53 Deployment Commanded With Deployment Loop Fault Or Energy Reserves Out Of Range



D09RW001

Circuit Description:

The SDM contains a sensing drive which converts vehicle velocity changes to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the air bag assembly deploying the air bags. DTC 53 is set accompanying with DTC 51 when a deployment occurs while an air bag assembly circuit fault is present that could possible result in a no deployment situation in one or both air bag assemblies.

DTC Will Set When:

The SDM detects a frontal crash, up to 30 degrees off the centerline of the vehicle, of sufficient force to warrant deployment of the air bags and an inflator circuit fault is present..

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp records “Crash Data”, and sets a diagnostic trouble code.

DTC Will Clear When:

The SDM is replaced. If DTC 53 is set, one or more DTCs will be set in addition to DTC 53. Malfunction(s) setting DTC(s) (other than DTC 71) must be repaired so that DTC(s) will not be set when a new SDM is installed.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

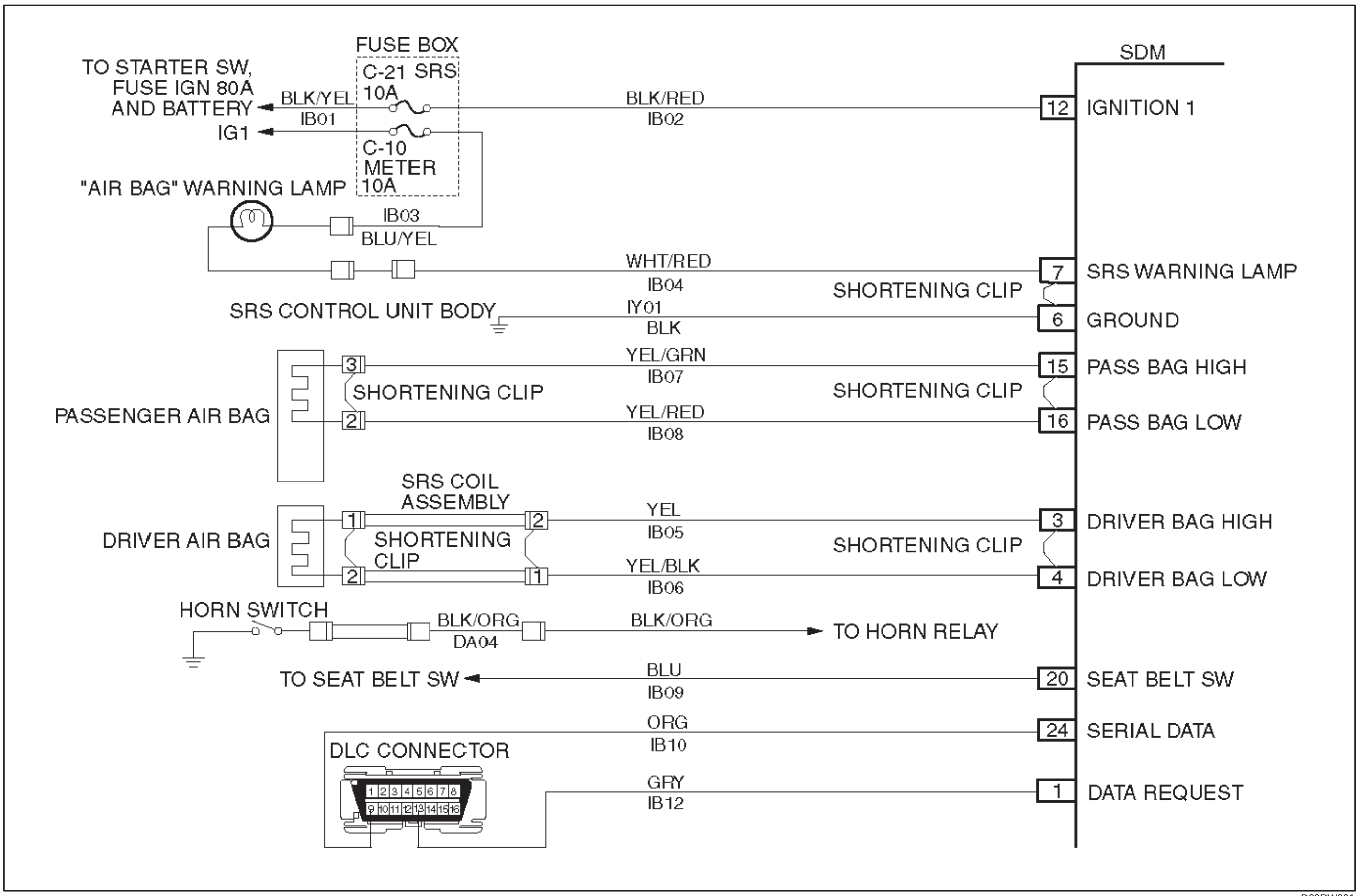
2. If air bag assembly have not deployed, DTC 53 may have falsely set.
3. If DTC 53 has set with no signs of frontal impact, the diagnostic trouble code has falsely set.

DTC 53 Deployment Commanded WITH Deployment Loop Fault Or Energy Reserves Out Of Range

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check”
2	Ignition switch “OFF.” Have air bag assembles deployed?	Replace components and perform inspections as directed in “Repairs And Inspections Required After An Accident” in this section Clear diagnostic trouble codes Repeat the “SRS Diagnostic System Check”	Go to Step 3
3	Inspect front of vehicle and undercarriage for signs of impact. Were signs of impact found?	Replace components and perform inspections as directed in “Repairs And Inspections Required After An Accident” in this section Clear diagnostic trouble codes Repeat “SRS Diagnostic System Check”	Ignition switch “OFF” Replace SDM Reconnect all SRS system components, ensure all components are properly mounted Repeat the “SRS Diagnostic System Check”

DTC 61 Warning Lamp Circuit Failure



D09RW001

Circuit Description:

When the ignition switch is turned “ON”, battery voltage is applied to the “AIR BAG” warning lamp and to the “Ignition 1” input terminal “12”. The SDM responds by flashing the “AIR BAG” warning lamp seven times. The SDM monitors the lamp driver output by comparing the output state at “SRS Warning Lamp” terminal “7” to the microprocessor commanded state. When “Ignition 1” is in the specified value, and the output state does not match the commanded state of the lamp driver for 500 milliseconds, DTC 61 is set.

DTC Will Set When:

“Ignition 1” voltage is in the specified value and the output state at the “SRS Warning Lamp” terminal does not match the commanded state of the lamp driver for 500 milliseconds. This test is run every 100 milliseconds during “Continuous Monitoring” tests and once per each ignition cycle at the beginning.

Action Taken:

SDM attempts to turn “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned “OFF.”

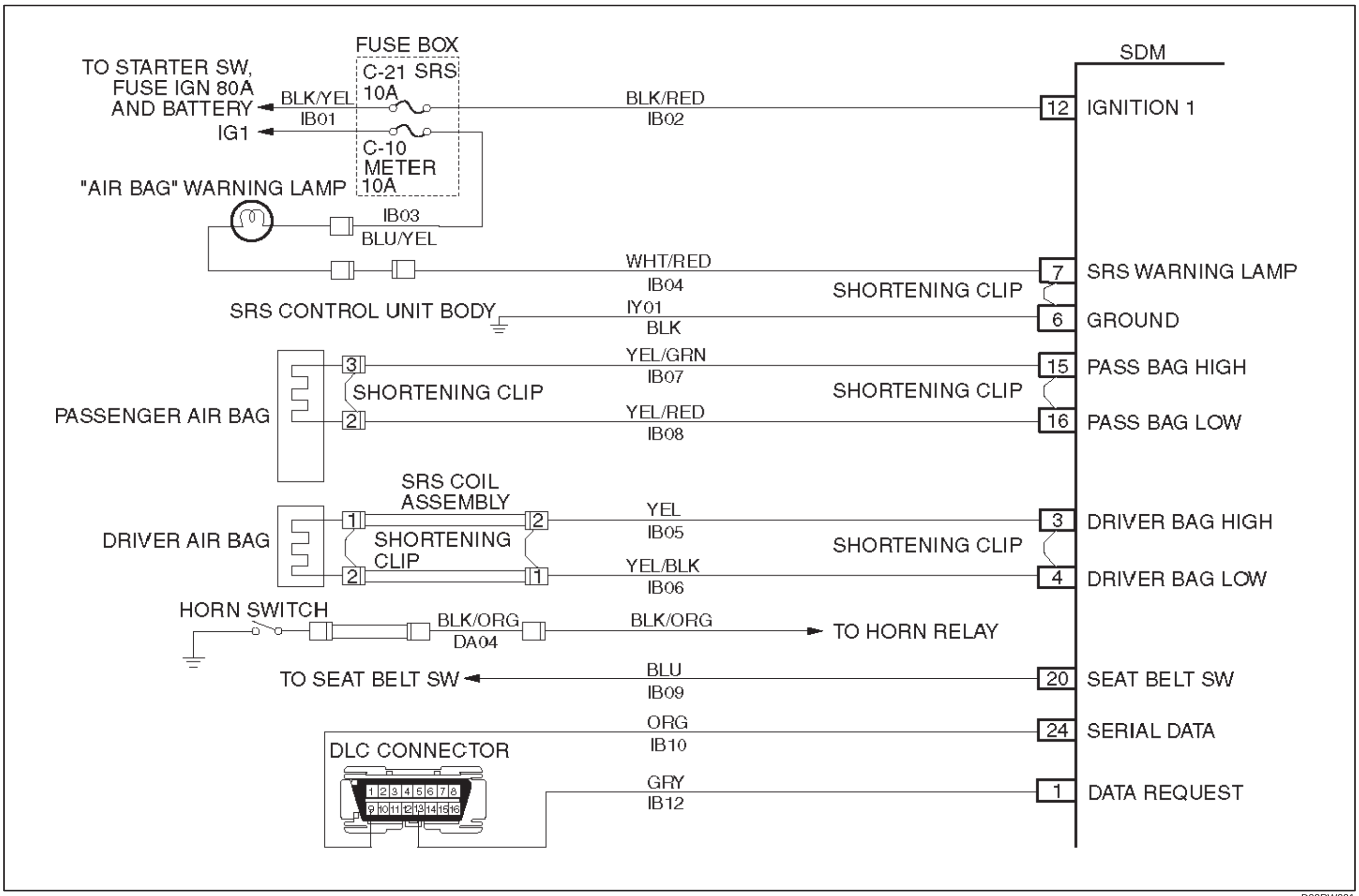
Diagnostic Aids:

Refer to Charts B and C to diagnose warning lamp circuit malfunctions.

DTC 61 Warning Lamp Circuit Failure

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check.”
2	1. Malfunctions within the “AIR BAG” warning lamp circuitry will set this diagnostic trouble code. 2. These malfunctions are addressed in the “SRS Diagnostic System Check” via Chart B and Chart C. 3. Failure to properly perform the “SRS Diagnostic System Check” may result in misdiagnosis. 4. Ignition switch “ON.” 5. Clear SRS diagnostic trouble codes. IS DTC 61 set?	Ignition switch “OFF.” Go to Chart A.	Repeat the “SRS Diagnostic System Check.”

DTC 71 Internal SDM Fault



D09RW001

Circuit Description:

DTC 71 is an indication of a potential internal SDM malfunction and will set if any of the following conditions are detected:

1) Deployment or microprocessor energy reserve failure.
2) EEPROM failure.
3) ROM failure.
4) RAM failure.
5) Calibration check sum failure.
6) Deployment switch faults.
7) Accelerometer fault.
8) Arming sensor fault.
9) Diagnostic current faults.
10) DTC 19
11) DTC 25
12) DTC 51
13) DTC 53

DTC Will Set When:

Any of the above indicated malfunctions are detected by the SDM. The malfunctions described above are tested mainly during “Continuous Monitoring” and some ones run each ignition cycle.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

A scan tool “Clear Codes” commanded is received by the SDM. Some of the indicated malfunctions will only allow the “AIR BAG” warning lamp to go out.
But when DTC 19, 25, 51, 53 are also set, SDM is replaced.

DTC 71 Internal SDM Fault

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

CAUTION: When DTC 19 or 25 has been set, it is necessary to replace the SDM. Setting DTC 19 and 25 or 51 or 53 will also cause DTC 71 to set. When a scan tool "CLEAR CODES" command is issued and the malfunction is no longer present, DTC 51 or 53 and DTC 71 will remain current. Ensure that the short to voltage condition DTC 19, 25 is repaired prior to installing a replacement SDM to avoid damaging the SDM.

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check"
2	Note SRS "Diagnostic System Check." Is DTC 19 or 25 or 51 or 53 also set (CURRENT OR HISTORY)? (refeer to notice above.)	Go to DTC 19 if DTC 19 is set Go to DTC 25 if DTC 25 is set Go to DTC 51 if DTC 51 is set Go to DTC 53 if DTC 53 is set	Ignition switch "OFF" Replace SDM Repeat the "SRS Diagnostic System Check"

TROOPER

CONTROL SYSTEM

CRUISE CONTROL SYSTEM

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The cruise control keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is received . When the main switch “AUTO CRUISE” is turned on with the vehicle in the running mode, the battery voltage is applied to the control unit. When a signal from the control switch is input to the PCM while the vehicle is in this state, the cruise control system is activated. Also, while the system is operating, the “AUTO CRUISE” indicator light in the meter assembly lights up.

1. SET/COAST Switch Function

1. **Set Function:** When the SET/COAST switch is pressed and released with the main switch on, the speed at which the vehicle is running at that moment is stored in the memory, and the vehicle automatically runs at the stored speed.
2. **Coast-down Function:** When the SET/COAST switch is kept on while the vehicle in running, the vehicle decelerates during that time. The speed at which vehicle is running when the control switch is turned off is stored in the memory, and the vehicle automatically returns to the stored speed.
3. **Tap-down Function:** When the SET/COAST switch is turned on and off instantaneously while the vehicle is running, the vehicle decelerates a mile for each on/off operation. The vehicle speed at which the vehicle was running when the SET/COAST was turned off last is stored in the memory, and the vehicle automatically returns to this stored speed.

2. RESUME/ACCEL Switch Function

1. **Resume Function:** When the RESUME/ACCEL switch is turned on/off after the system is temporarily deactivated by pressing the brake or clutch pedal while the vehicle is running, the vehicle resumes the speed stored before the system was released, and the vehicle automatically runs at the stored speed .
2. **Accelerate Function:** When the RESUME/ACCEL switch is kept on after the system is released completely, the vehicle accelerates its speed during that time. The vehicle speed at which the vehicle was running when the switch was turned off is stored in the memory, and the vehicle automatically returns to this speed.
3. **Tap-up Function:** When the RESUME/ACCEL switch is turned on and off instantaneously while the vehicle is running, the vehicle accelerates a mile for each on/off operation. The vehicle speed at which the vehicle was running when the switch was turned off last is stored in the memory, and the vehicle automatically returns to this stored speed.

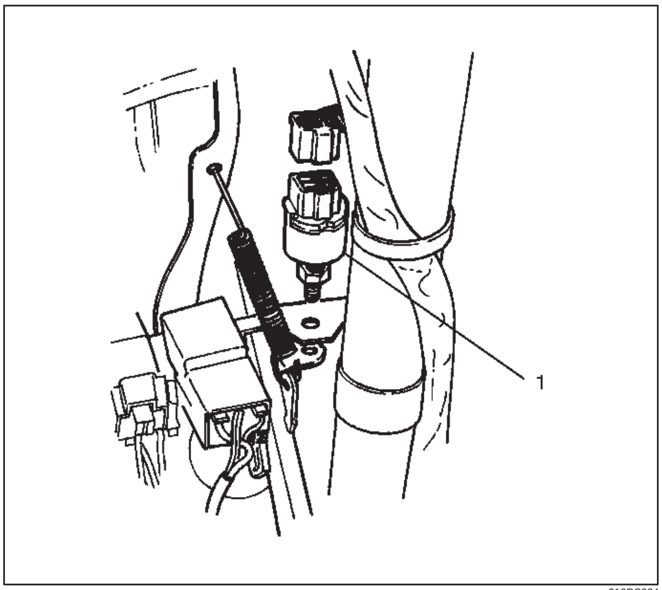
3. CANCEL Function

1. **Temporary Cancellation:**
   - When the cancel switch is turned on.
   - When the brake pedal is pressed.
   - When the clutch pedal is pressed. (M/T)
   - When the select lever is shifted to any position other than “D”, “3”, “2” or “L”. (A/T)
   - When the cancel switch is operated.
   - When the vehicle speed exceeds about 12.5mph over the vehicle speed stored in the memory.
   - Turning the RESUME/ACCEL switch will return the vehicle to the speed stored in the cruise control memory.
   - When the vehicle speed gets lower than 20 mph (32 km/h).
2. **Complete Cancellation:**
   - When the starter switch or the main switch is turned off.
   - When the fail-safe function is activated.
   - When the vehicle speed is about 24 mph.

Brake Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the brake switch (1).
   - Disconnect the connector.
   - Loosen the lock nuts of the switch.
   - Remove the switch by turning it.

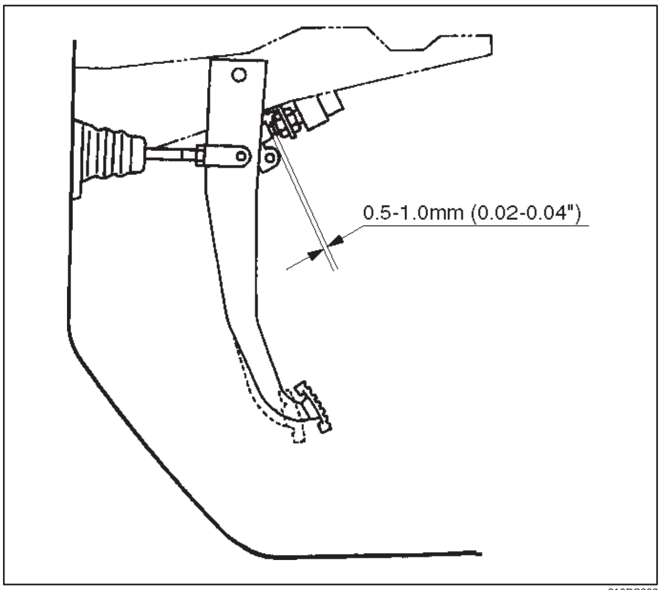


310RS004

Installation

To install, follow the removal steps in the reverse order, noting the following points.

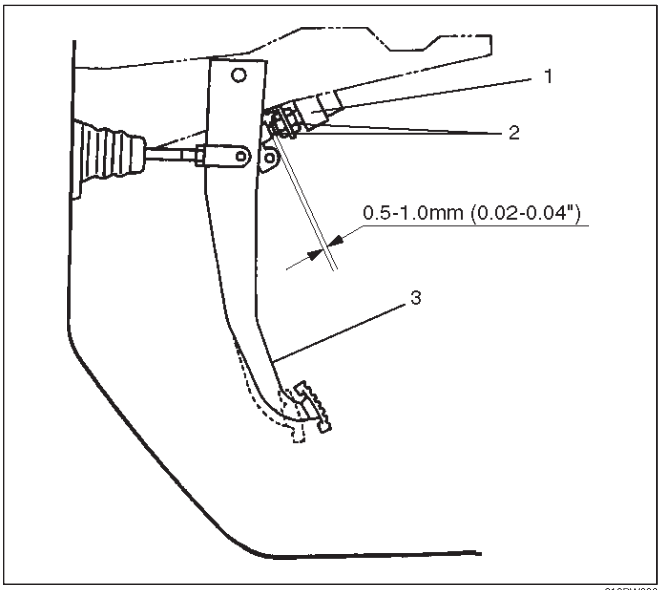
1. Check to see if the brake pedal has been returned by the return spring to the specified position.
2. Turn the switch clockwise until the tip of the threaded portion of the brake switch contacts the pedal arm.
3. Turn the switch counterclockwise until the space between the tip of the threaded portion and the pedal arm is 0.5 to 1.0 mm (0.02-0.04 in.) as shown in the figure.



310RS003

Adjustment

1. Check to be sure that the brake pedal (3) has been completely returned by the return spring.
2. Disconnect the switch connector.
3. Loosen the lock nut (1) of the switch (2).
4. Turn the switch clockwise until the tip of screw portion of the brake pedal hits the pedal arm.
5. Turn the switch counterclockwise until the clearance between the tip of the screw portion and the pedal arm becomes 0.5 to 1.0 mm (0.02-0.04 in).
6. Tighten the lock nut.
7. Connect the switch connector.



310RW006

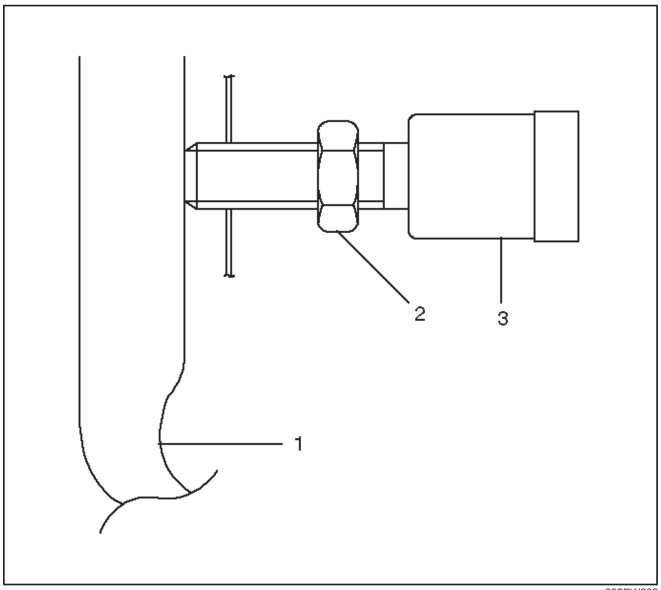
Clutch Switch

Removal and Installation

Refer to the Clutch Control removal and installation steps in Clutch section.

Adjustment

1. Check to be sure that the clutch pedal (1) has been completely returned by the return spring.
2. Disconnect the switch connector.
3. Loosen the lock nut (2) of the switch (3).
4. Push the switch by hand until the push rod cannot be seen from the tip portion of the switch.
5. Give the switch one reverse rotation.
6. Tighten the lock nut.
7. Connect the switch connector.

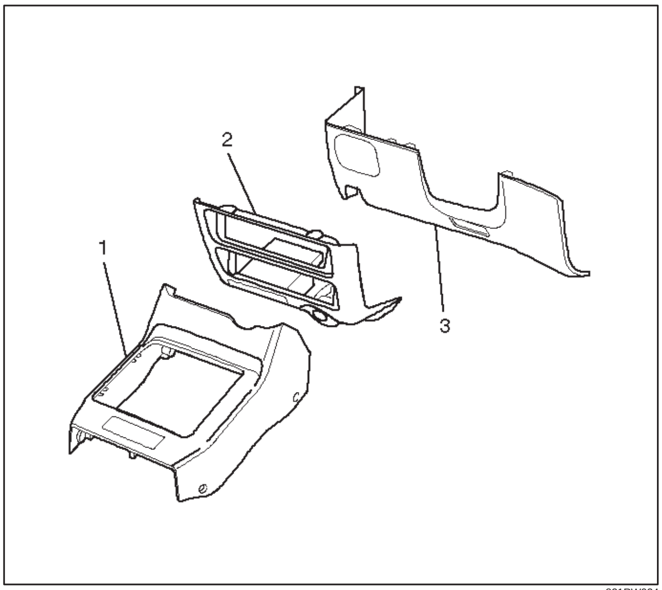


203RW002

Starter Switch

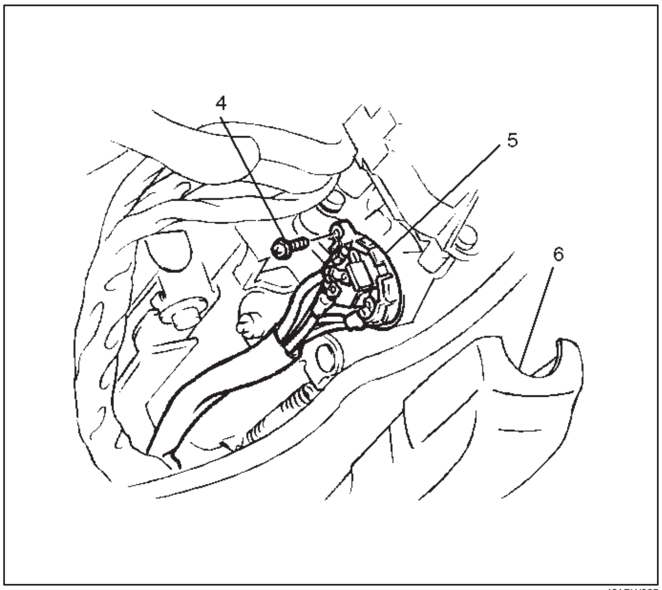
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly (1). Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly (2). Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly (3). Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove seven screws to remove the steering cowl (6).
6. Disconnect the connector, remove the screw (4) and then remove the starter switch (5).

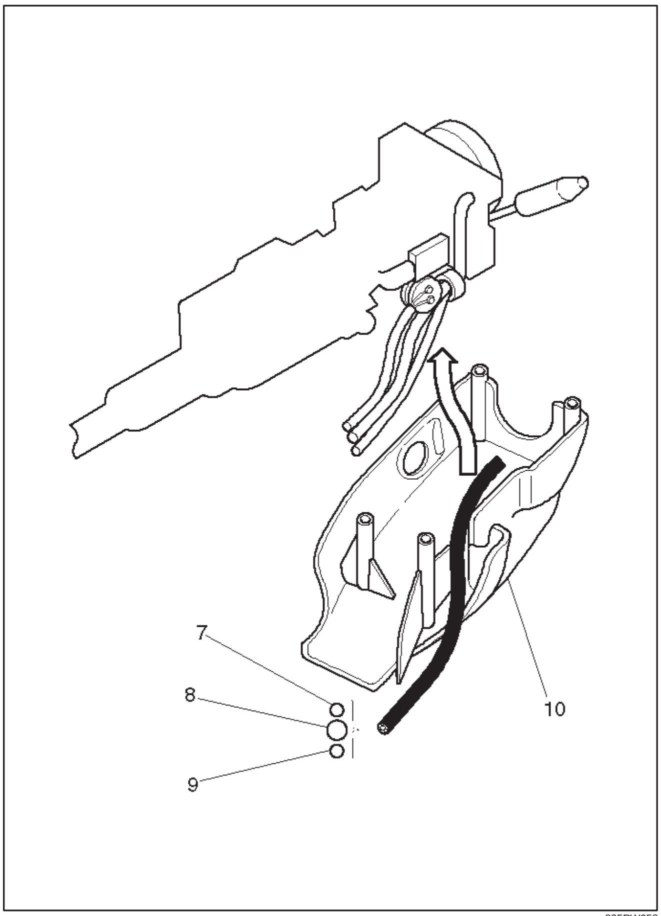


431RW005

Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. When installing the steering cowl (10), be sure to pass the harnesses through the route as shown in the figure so that the starter switch harness (7), the combination switch harness (8) and the inflator module harness (9) will not catch.

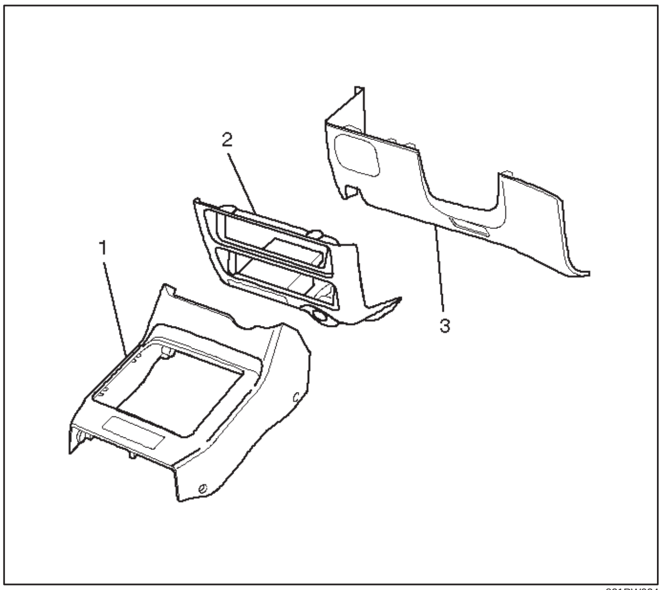


825RW058

Cruise Control Main Switch

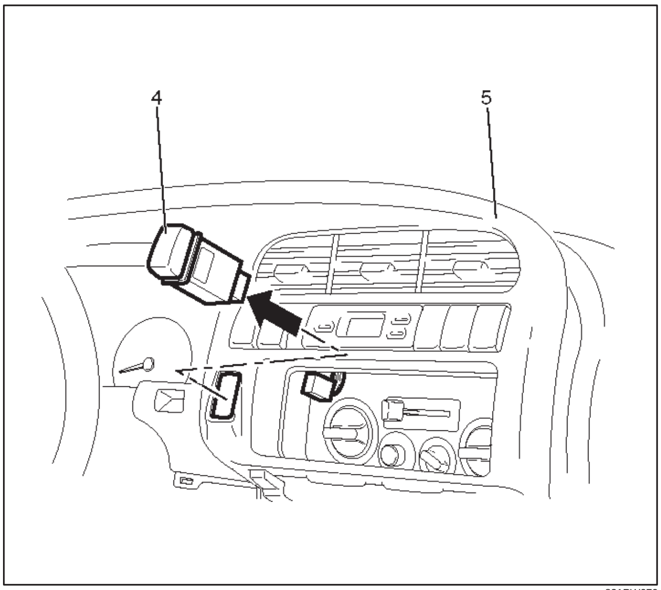
Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly (1). Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the lower cluster assembly (2). Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the instrument panel driver lower cover assembly (3). Refer to the Instrument Panel Assembly in Body Structure section.



821RW024

5. Remove the instrument panel cluster assembly (5). Refer to the Instrument Panel Assembly in Body Structure section.
6. Disconnect the and push the lock from the side of the instrument panel cluster assembly to remove the cruise control main switch (4).



821RW079

Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Push in the switch with your fingers until the switch is locked securely.

Cruise Control Switch (Combination Switch)

Removal and Installation

Refer to the Lighting Switch (Combination Switch) removal and installation steps of Lighting System in Body and Accessories section.

Powertrain Control Module (PCM)

Removal and Installation

Refer to Powertrain Control Module (PCM) in Engine section.

Mode Switch

Removal and Installation

Refer to the Mode Switch removal and installation steps in Automatic Transmission section.

Diagnosis

Cruise control system is controlled by the PCM as well as 6VE1 engine and automatic transmission. DTC codes are stored in the PCM if troubles occur in the circuit. DTC codes categorized “type D” are shown only by the Tech 2 scan tool. The following chart only shows some typical DTCs for cruise control system. Refer to PCM Diagnostic Trouble Codes in Driveability and Emissions for entire DTC diagnosis.

DTC	TROUBLE PART	DTC TYPE	MAJOR CONDITION OF TROUBLE	DIAGNOSIS PERIOD
P0565	CRUISE MAIN CIRCUIT	D	• THE SWITCH CONTACT REMAINS ON FOR 15 SECONDS OR MORE. • NOISES ARE GENERATED BY THE POOR SWITCH CONTACT 60 TIMES WITHIN 1 SECOND.	DIAGNOSIS IS ENABLED IN 130 SECONDS AFTER THE SWITCH OPERATED.
P0566	CRUISE CANCEL CIRCUIT	D	• THE SWITCH CONTACT REMAINS ON FOR 40 SECONDS OR MORE. • NOISES ARE GENERATED BY THE POOR SWITCH CONTACT 100 TIMES WITHIN 1.6 SECONDS.	DIAGNOSIS IS ENABLED IN 120 SECONDS AFTER THE SWITCH OPERATED.
P0567	CRUISE RESUME CIRCUIT	D	• THE SWITCH CONTACT REMAINS ON FOR 50 SECONDS OR MORE. • NOISES ARE GENERATED BY THE POOR SWITCH CONTACT 100 TIMES WITHIN 1.6 SECONDS.	DIAGNOSIS IS ENABLED IN 110 SECONDS AFTER THE SWITCH OPERATED.
P0568	CRUISE SET CIRCUIT	D	• THE SWITCH CONTACT REMAINS ON FOR 120 SECONDS OR MORE. • NOISES ARE GENERATED BY THE POOR SWITCH CONTACT 100 TIMES WITHIN 1.6 SECONDS.	DIAGNOSIS IS ENABLED IN 125 SECONDS AFTER THE SWITCH OPERATED.

DTC: Diagnostic Trouble Code

NOTE: The DTCs are detected while the engine is running

RODEO(UE)

CONTENTS

RODEO

GENERAL INFORMATION

CONTENTS

General Information

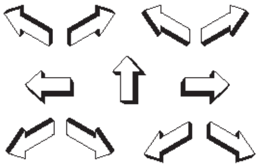
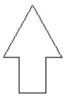
CONTENTS

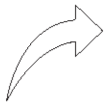
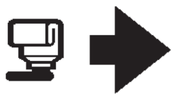
General Repair Instruction

1. If a floor jack is used, the following precautions are recommended.
   Park vehicle on level ground, "block" front or rear wheels, set jack against the recommended lifting points (see "Lifting Instructions" in this section), raise vehicle and support with chassis stands and then perform the service operations.
2. Before performing service operations, disconnect ground cable from the battery to reduce the chance of cable damage and burning due to short circuiting.
3. Use a cover on body, seats and floor to protect them against damage and contamination.
4. Brake fluid and anti–freeze solution must be handled with reasonable care, as they can cause paint damage.
5. The use of proper tools and recommended essential and available tools, where specified, is important for efficient and reliable performance of service repairs.
6. Use genuine Isuzu parts.
7. Used cotter pins, plastic clips, gaskets, O–rings, oil seals, lock washers and self–locking nuts should be discarded and new ones should be installed, as normal function of the parts cannot be maintained if these parts are reused.
8. To facilitate proper and smooth reassembly operation, keep disassembled parts neatly in groups. Keeping fixing bolts and nuts separate is very important, as they vary in hardness and design depending on position of installation.
9. Clean the parts before inspection or reassembly. Also clean oil ports, etc. using compressed air, and make certain they are free from restrictions.
10. Lubricate rotating and sliding faces of the parts with oil or grease before installation.
11. When necessary, use a sealer on gaskets to prevent leakage.
12. Carefully observe all specifications for bolt and nut torques.
13. When removing or replacing parts that require refrigerant to be discharged from the air conditioning system, be sure to use the Vehicle Refrigerant Recovery and Recycling Equipment (VRRRE) to recover and recycle Refrigerant–134a.
14. When a service operation is completed, make a final check to be sure the service has been done properly and the problem has been corrected.
15. SUPPLEMENTAL RESTRAINT SYSTEM
    The vehicle is equipped with a Supplemental Restraint System (SRS) – Air Bags. This system is not to be serviced without consulting the appropriate service information. Consult Section 9J "SRS System" if work is to be done on the front of the vehicle such as bumper, sheet metal, seats, wiring, steering wheel or column. Also review SRS system information if any arc welding is to be done on the vehicle. The SRS system equipped vehicle can be identified by:
    1. "AIR BAG" warning light on the instrument cluster.
    2. A Code "K" or "M" for fifth digit of Vehicle Identification Number.

Illustration Arrows

Arrows are designed for specific purposes to aid your understanding of technical illustrations.

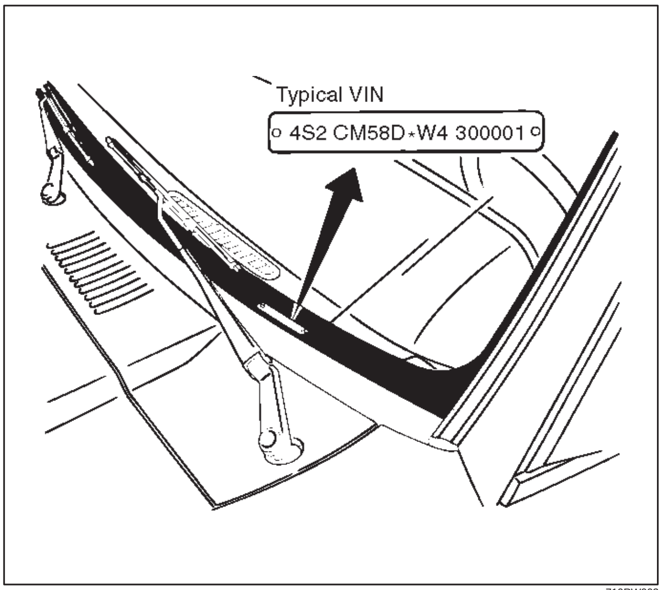
Arrow Type	Application
	Front of vehicle
	Up Side
	Task Related
	View Detail
A 	View Angle
	Dimension (1:2)
	Sectioning (1:3)

Arrow Type	Application
	• Ambient/Clean air flow • Cool air flow
	• Gas other than ambient air • Hot air flow
	• Ambient air mixed with another gas • Can indicate temperature change
	Motion or direction
	Lubrication point oil or fluid
	Lubrication point grease
	Lubrication point jelly

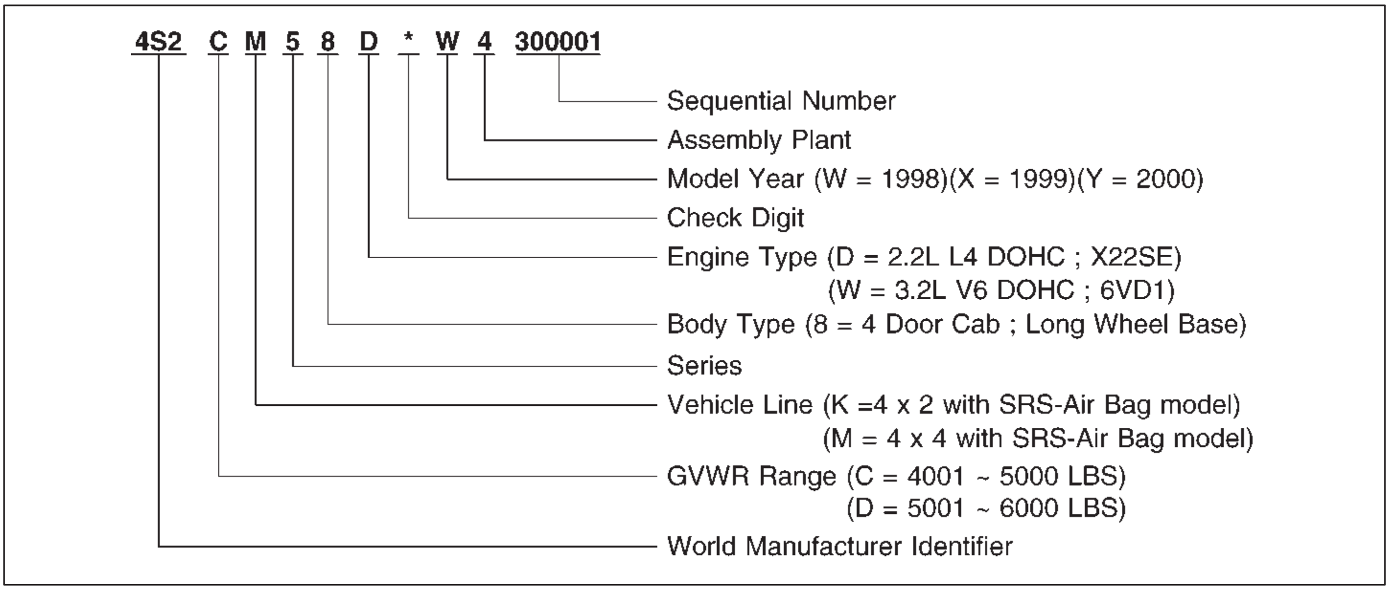
Identification

Vehicle Identification Number (VIN)

This is the legal identification of the vehicle. it is located on the left bottom of the windshield. It can be easily seen through the windshield from outside the vehicle.



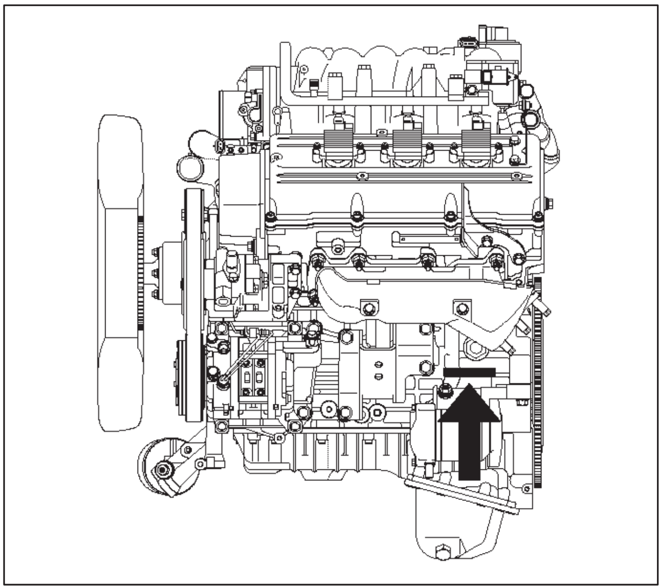
710RW003



Engine Serial Number

- **6VD1 Engine**

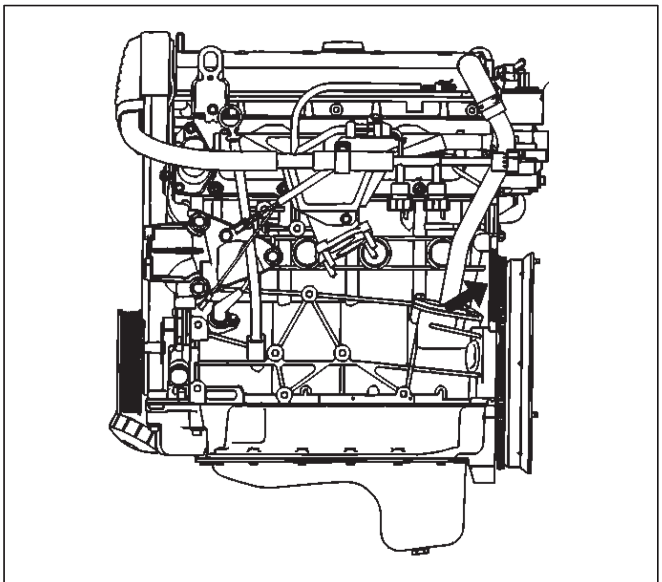
The gasoline engine serial number is stamped on the left rear lower area of the cylinder block above the starter.



F06RW001

- **X22SE Engine**

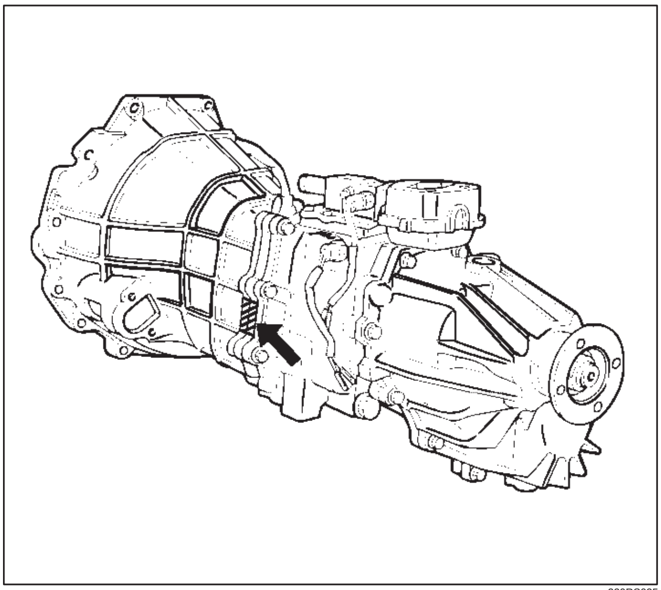
The gasoline engine serial number is stamped on the rear end raised area of the cylinder block left side.



035RW022

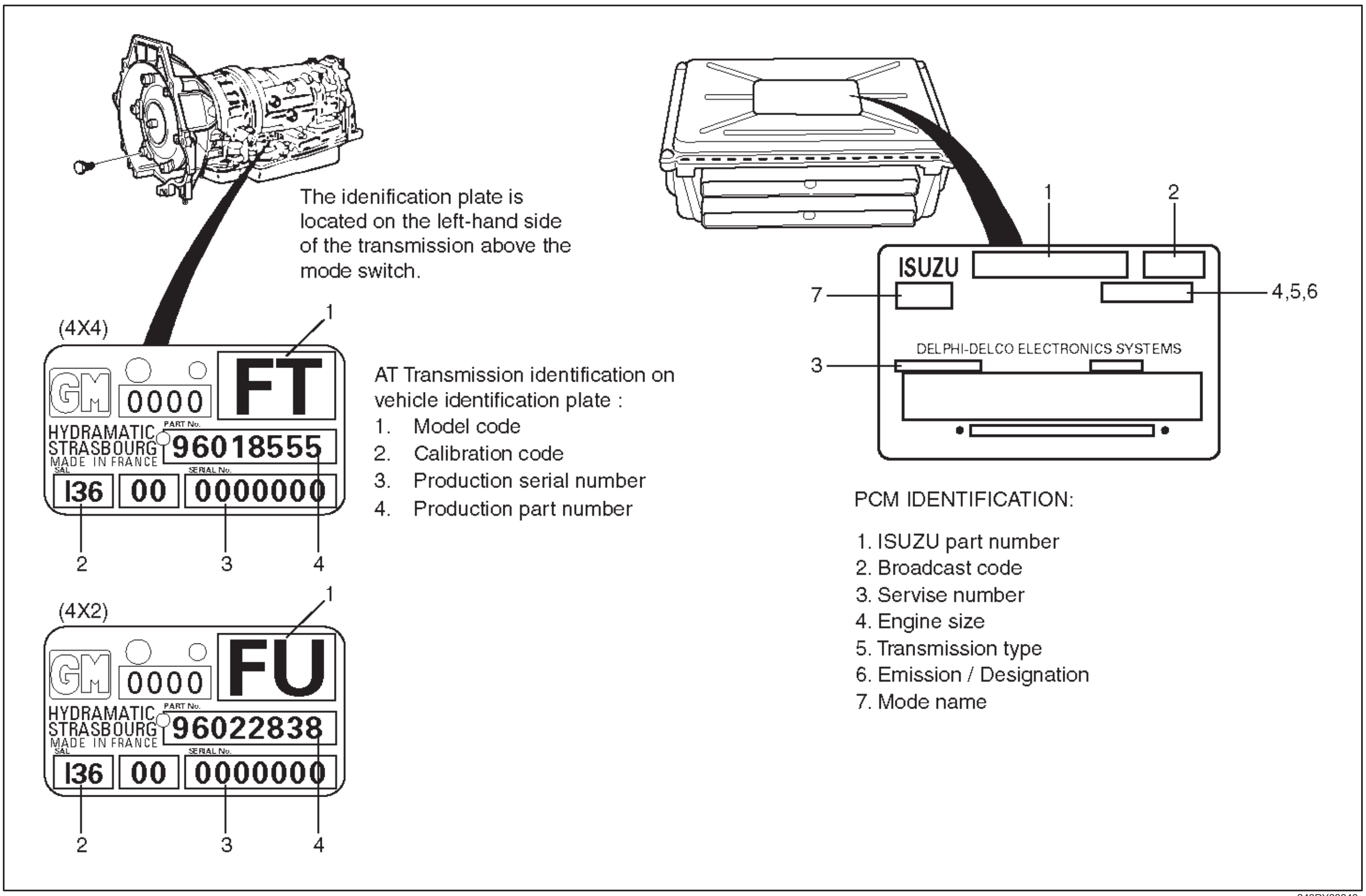
Transmission Serial Number

Manual : Stamped on the left side of the transmission intermediate plate.



220RS025

Automatic : Stamped on the identification plate, located on the left side of the transmission above the mode switch.



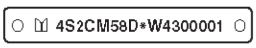
240RY00040

Theft Prevention Standard

The 11 major components listed below will be marked with 17 digit VIN at the stage of production. In addition its service parts will be marked with manufacturer's trade mark, "R" mark and "DOT" mark.

Reference Figure No.	COMPONENT		INDICATION	
			PRODUCTION	SERVICE PARTS
0A-10	ENGINE	1– 6VD1 – X22SE	VIN plate	"R DOT" Mark stamping
0A-11	TRANSMISSION	2– Manual transmission – Automatic transmission	VIN plate	"R DOT" Mark stamping
0A-11	BODY	3– Engine hood 4– Front door 5– Rear door 6– Fender 7– Rear Quarter panel 8– Front bumper 9– Back door left side 10– Back door right side 11– Rear bumper	VIN label	"R DOT" Mark label

Anti Theft Stamping/Plate/Label

	STAMPING/PLATE	LABEL
PRODUCTION	Example 	Example 
SERVICE PARTS	R DOT	R DOT

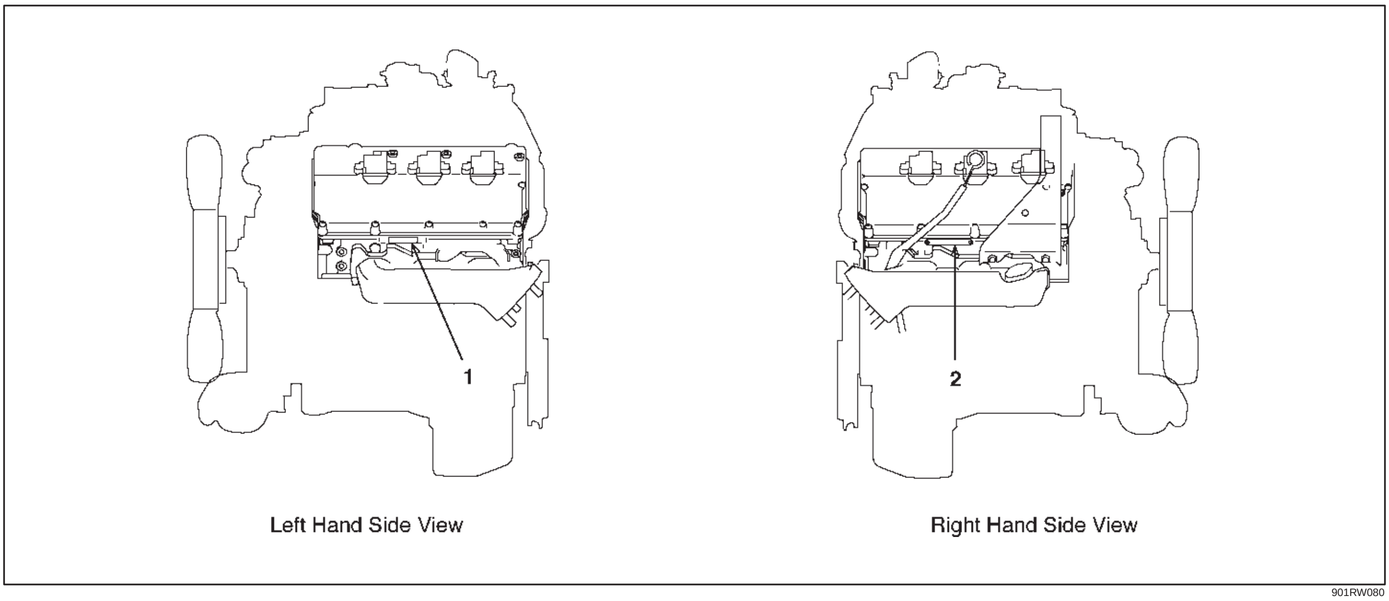
Anti Theft Stamping/Label/Plate Location

The stamping, label and plate locations are indicated by arrows in the illustration below.

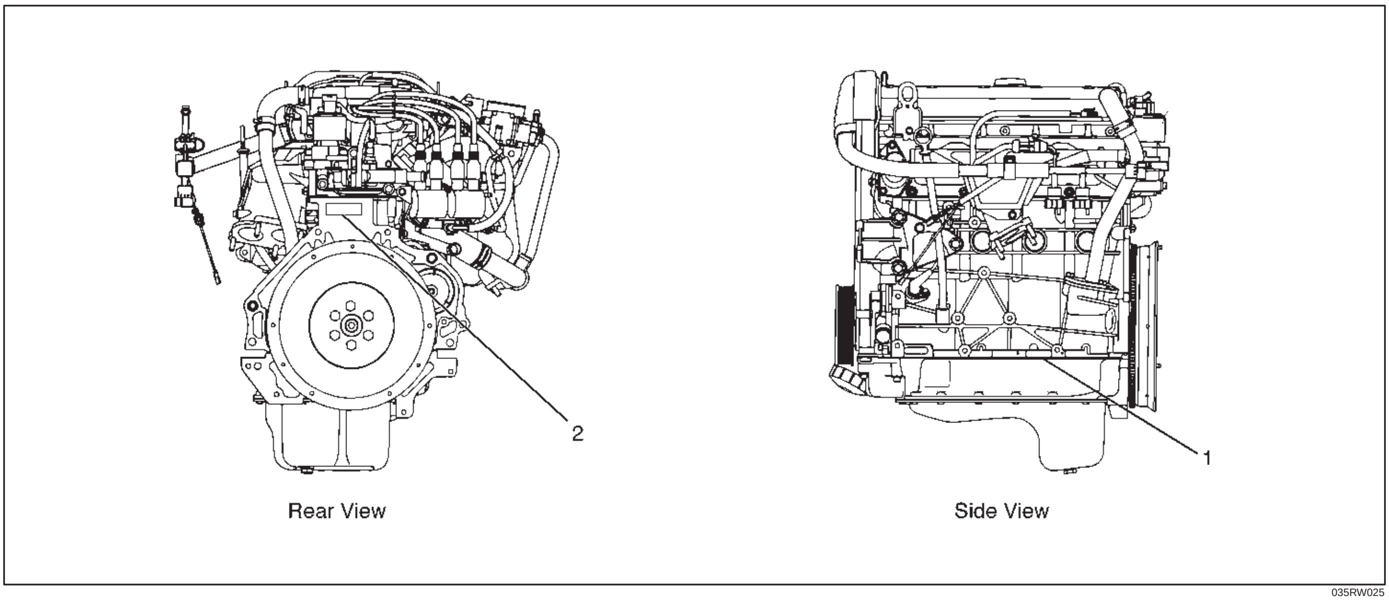
NOTE:

1. VIN plate locations for production.
2. Stamping locations for service parts.

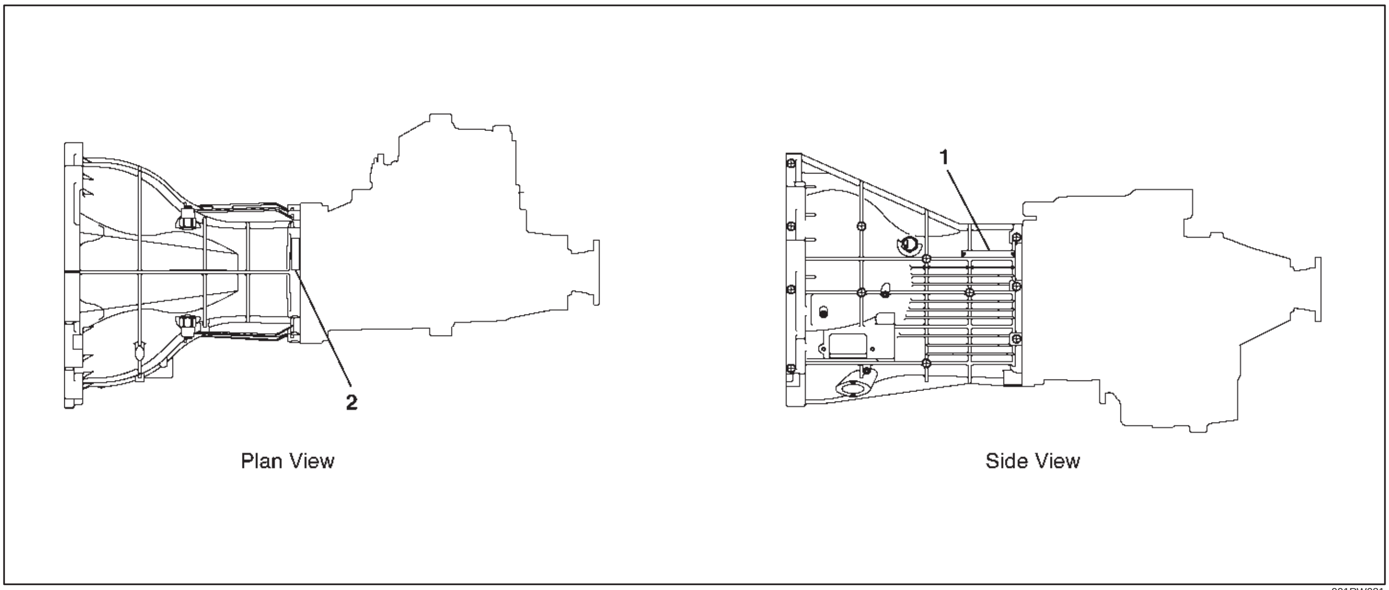
Engine (6VD1)



Engine (X22SE)

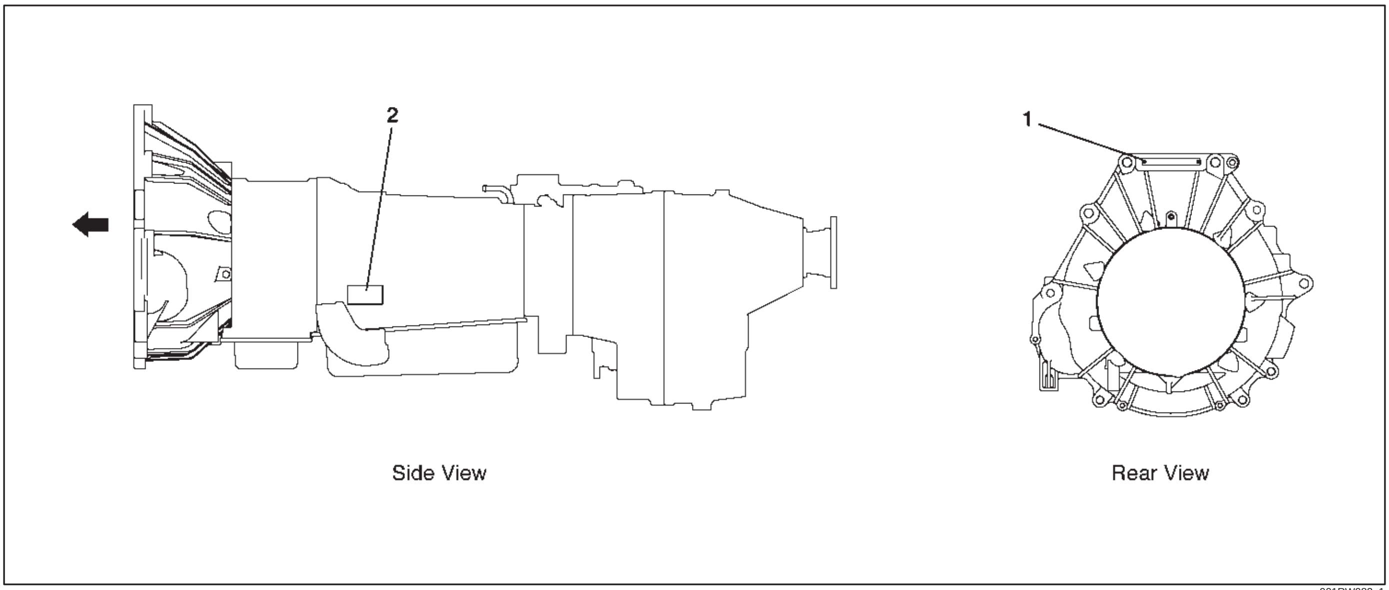


Manual Transmission (MUA)



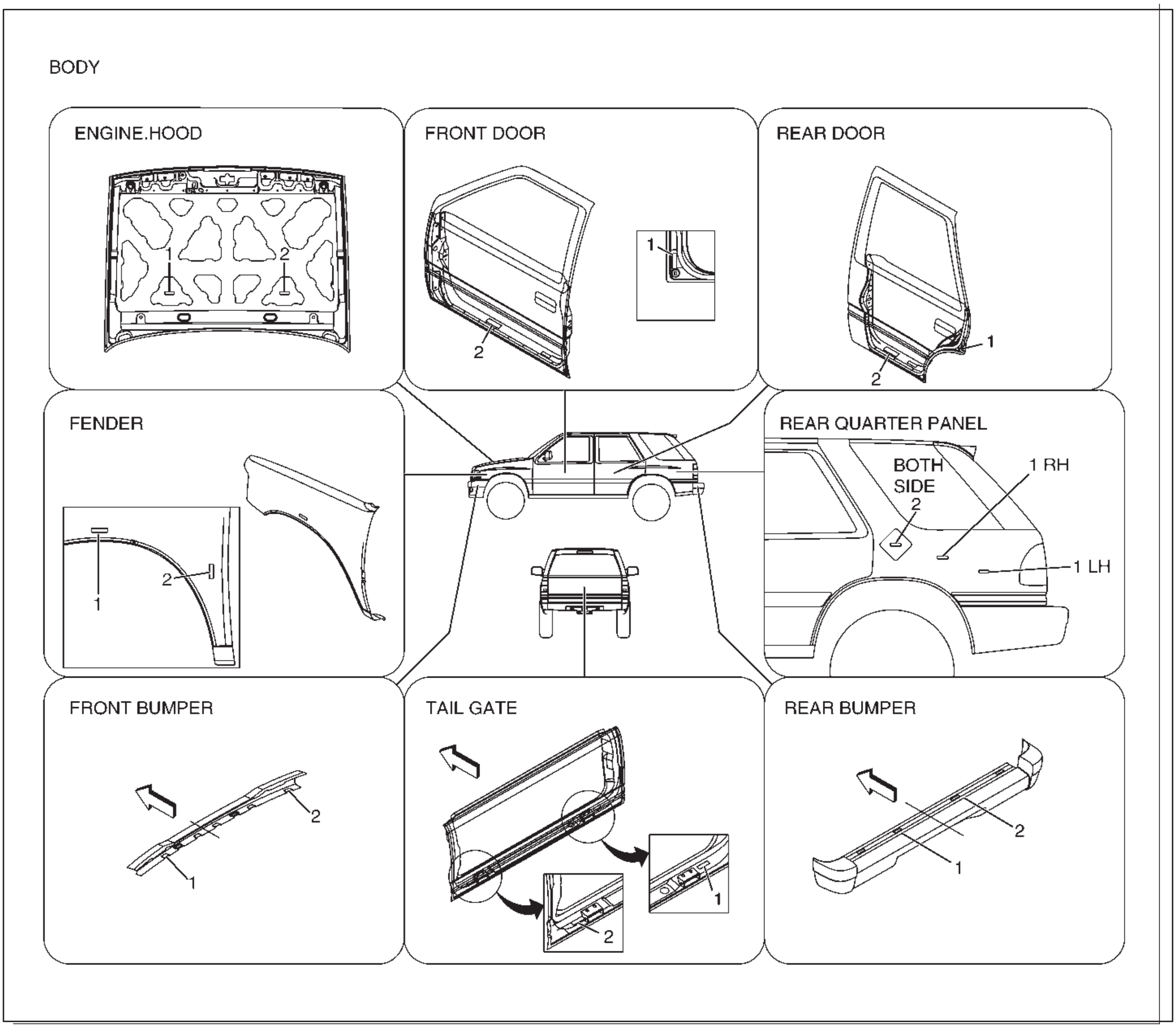
901RW081

Automatic Transmission (THM)



901RW082–1

Body



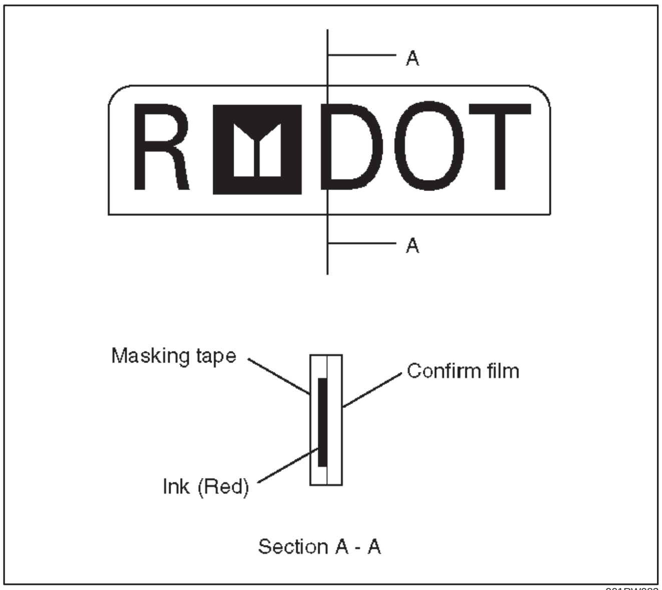
604RW023

Body Label Instructions

Do not peel off the masking tape until completion of paint work when replacing these parts, as the tape is affixed on the label attached to service parts for body of the anti–theft component.

NOTE: Be sure to pull off the masking tape after paint work has been completed.

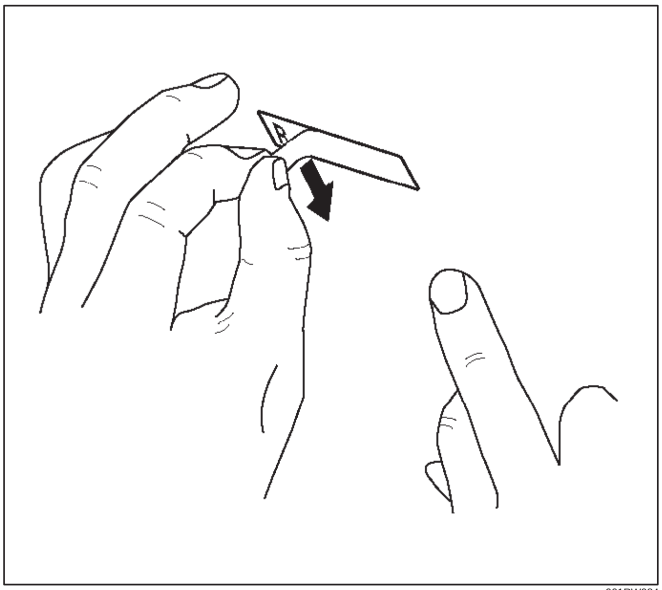
Do not attempt to remove this label for any reason.



901RW083

Precautions in pulling off the masking tape

1. Use only your finger nail or a similar blunt instrument to peel off the masking tape. Use of a sharp object will damage the underlying anti–theft label.
2. Be careful not to damage the paint around the label.



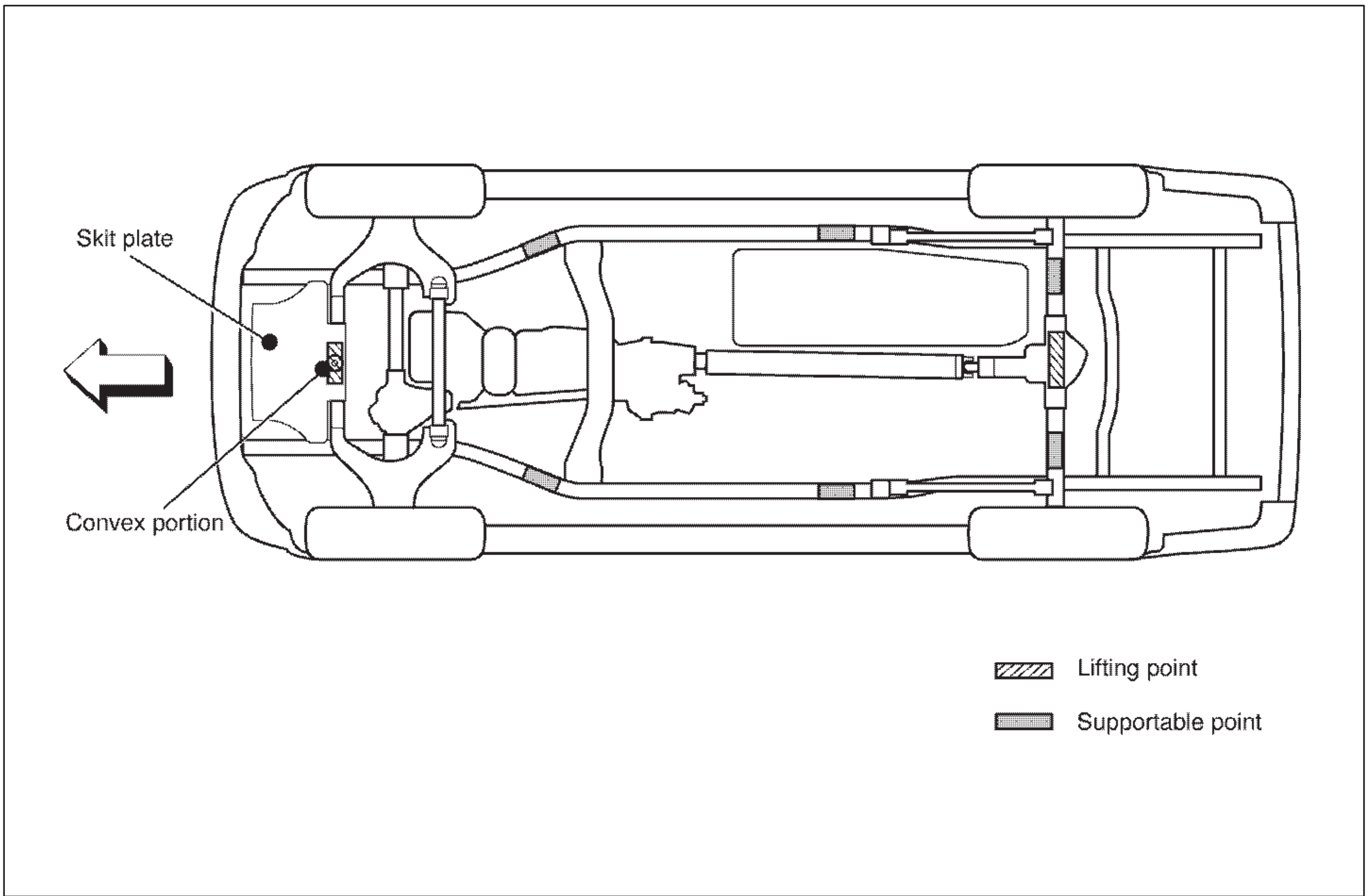
901RW084

Lifting Instructions

CAUTION:

- **If a lifting device other than the original jack is used, it is most important that the device be applied only to the correct lifting points. Raising the vehicle from any other point may result in serious damage.**
- **When jacking or lifting a vehicle at the frame side rail or other prescribed lift points, be certain that lift pads do not contact the catalytic converter, brake pipes or cables, or fuel lines. Such contact may result in damage or unsatisfactory vehicle performance.**

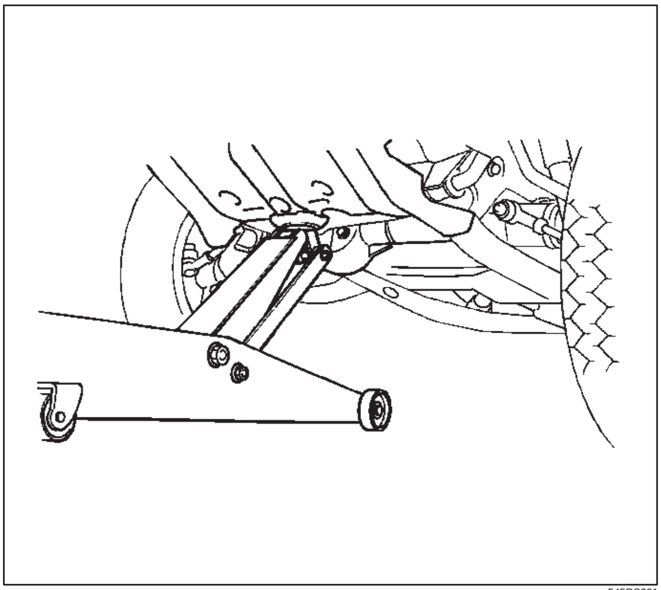
Lifting Points and Supportable Point Locations



C00RX002

Lifting Point: Front

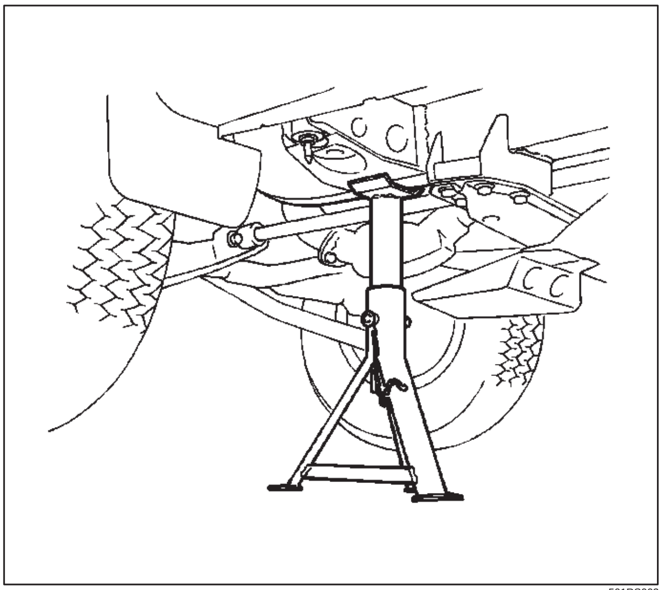
- When using a floor jack, lift on the Convex portion of the skid plate.



545RS001

Supportable Point: Front

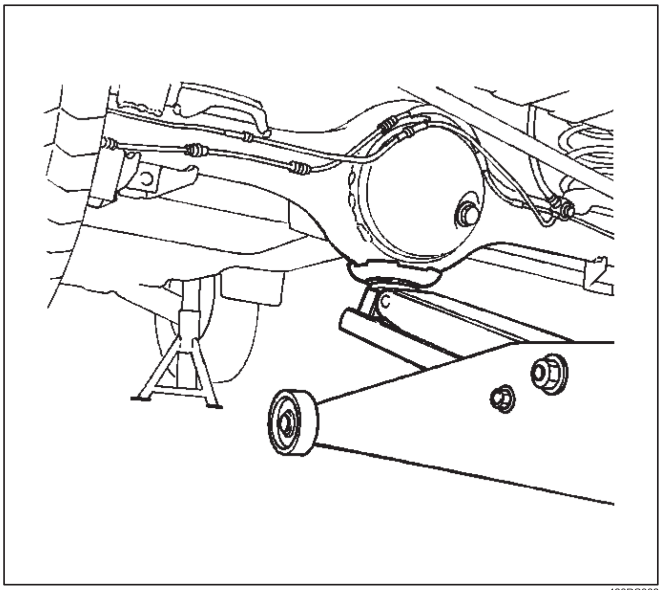
- Position the chassis stands at the bottom of the frame sidemember, behind the front wheel.



501RS003

Lifting Point: Rear

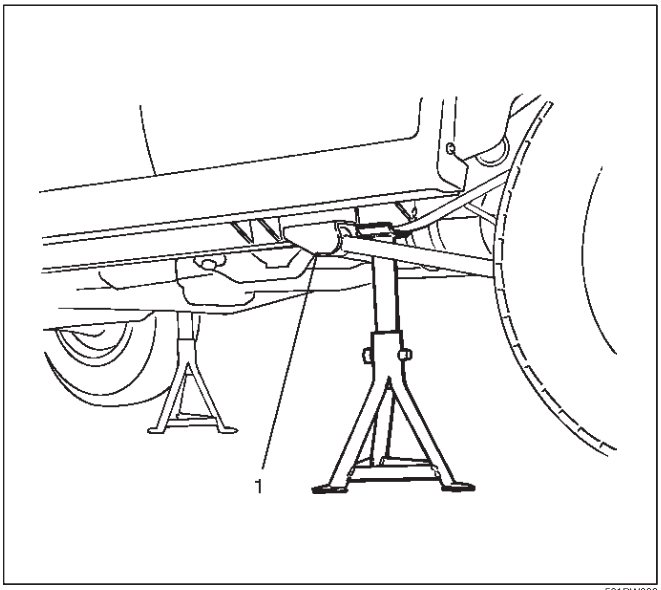
- Position the floor jack at the center of the rear axle case when lifting the vehicle.



420RS002

Supportable Point: Rear

- Position the chassis stands at the bottom of the frame sidemember, just behind the trailing link bracket.



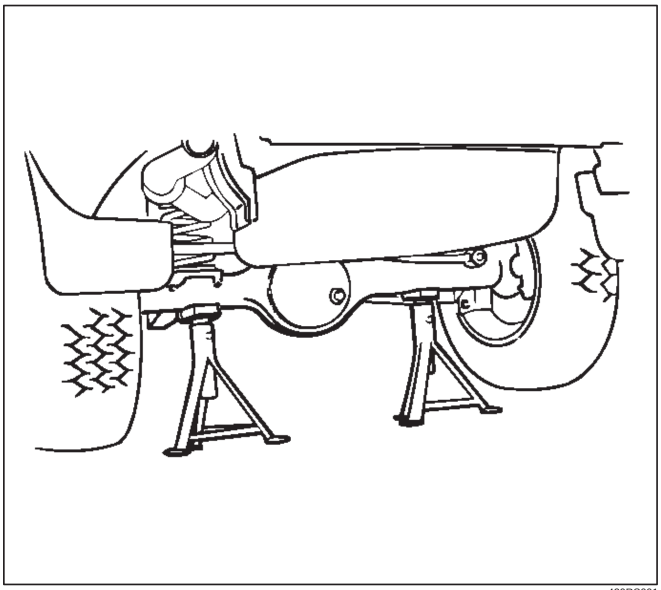
501RW002

Legend

(1) Trailing Link Bracket

Supportable Point: Rear

- Position the chassis stands at the bottom of the rear axle case.



420RS001

Standard Bolts Torque Specifications

The torque values given in the following table should be applied where a particular torque is not specified.

<table>
<tr><td rowspan="2">Strength Class</td><td rowspan="2">4.8</td><td colspan="2">8.8</td><td rowspan="2">9.8</td></tr>
<tr><td>Refined</td><td>Non-Refined</td></tr>
<tr><td rowspan="2">Bolt Identification</td><td></td><td></td><td></td><td></td></tr>
<tr><td>
No mark</td><td></td><td></td><td></td></tr>
<tr><td>Bolt Diameter × Pitch (mm)</td><td></td><td colspan="2"></td><td></td></tr>
<tr><td>M 6X1.0</td><td>4 – 8 N·m (3 – 6 lb ft)</td><td colspan="2">5 – 10 N·m (4 – 7 lb ft)</td><td>–</td></tr>
<tr><td>M 8X1.25</td><td>8 – 18 N·m (6 – 13 lb ft)</td><td colspan="2">12 – 23 N·m (9 – 17 lb ft)</td><td>17 – 30 N·m (12 – 22 lb ft)</td></tr>
<tr><td>M 10X1.25</td><td>21 – 34 N·m (15 – 25 lb ft)</td><td colspan="2">28 – 46 N·m (20 – 34 lb ft)</td><td>37 – 63 N·m (27 – 46 lb ft)</td></tr>
<tr><td>* M10X1.5</td><td>20 – 33 N·m (14 – 25 lb ft)</td><td colspan="2">28 – 45 N·m (20 – 33 lb ft)</td><td>36 – 60 N·m (27 – 44 lb ft)</td></tr>
<tr><td>M12X1.25</td><td>49 – 74 N·m (36 – 54 lb ft)</td><td colspan="2">61 – 91 N·m (45 – 67 lb ft)</td><td>76 – 114 N·m (56 – 84 lb ft)</td></tr>
<tr><td>* M12X1.75</td><td>45 – 69 N·m (33 – 51 lb ft)</td><td colspan="2">57 – 84 N·m (42 – 62 lb ft)</td><td>72 – 107 N·m (53 – 79 lb ft)</td></tr>
<tr><td>M14X1.5</td><td>77 – 115 N·m (56 – 85 lb ft)</td><td colspan="2">93 – 139 N·m (69 – 103 lb ft)</td><td>114 – 171 N·m (84 – 126 lb ft)</td></tr>
<tr><td>* M14X2.0</td><td>72 – 107 N·m (53 – 79 lb ft)</td><td colspan="2">88 – 131 N·m (65 – 97 lb ft)</td><td>107 – 160 N·m (79 – 118 lb ft)</td></tr>
<tr><td>M16X1.5</td><td>104 – 157 N·m (77 – 116 lb ft)</td><td colspan="2">135 – 204 N·m (100 – 150 lb ft)</td><td>160 – 240 N·m (118 – 177 lb ft)</td></tr>
<tr><td>* M16X2.0</td><td>100 – 149 N·m (74 – 110 lb ft)</td><td colspan="2">130 – 194 N·m (95 – 143 lb ft)</td><td>153 – 230 N·m (113 – 169 lb ft)</td></tr>
<tr><td>M18X1.5</td><td>151 – 226 N·m (111 – 166 lb ft)</td><td colspan="2">195 – 293 N·m (144 – 216 lb ft)</td><td>230 – 345 N·m (169 – 255 lb ft)</td></tr>
<tr><td>M20X1.5</td><td>206 – 310 N·m (152 – 229 lb ft)</td><td colspan="2">270 – 405 N·m (199 – 299 lb ft)</td><td>317 – 476 N·m (234 – 351 lb ft)</td></tr>
<tr><td>M22X1.5</td><td>251 – 414 N·m (185 – 305 lb ft)</td><td colspan="2">363 – 544 N·m (268 – 401 lb ft)</td><td>425 – 637 N·m (313 – 469 lb ft)</td></tr>
<tr><td>M24X2.0</td><td>359 – 539 N·m (265 – 398 lb ft)</td><td colspan="2">431 – 711 N·m (318 – 524 lb ft)</td><td>554 – 831 N·m (409 – 613 lb ft)</td></tr>
</table>

The asterisk * indicates that the bolts are used for female–threaded parts that are made of soft materials such as casting, etc.

Abbreviations Charts

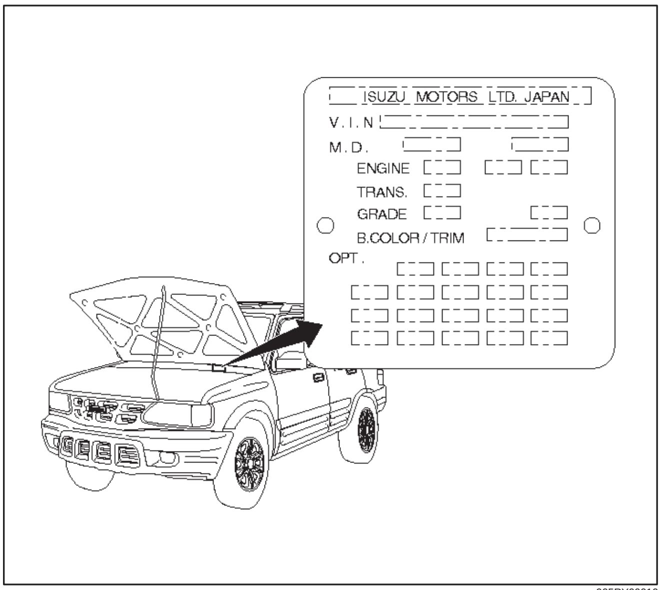
List of automotive abbreviations which may be used in this manual

A — Ampere(s)
ABS — Antilock Brake System
AC — Alternating Current
A/C — Air Conditioning
ACCEL — Accelerator
ACC — Accessory
ACL — Air Cleaner
Adj — Adjust
A/F — Air Fuel Ratio
AIR — Secondary Air Injection System
Alt — Altitude
AMP — Ampere(s)
ANT — Antenna
ASM — Assembly
A/T — Automatic Transmission/Transaxle
ATDC — After Top Dead Center
ATF — Automatic Transmission Fluid
Auth — Authority
Auto — Automatic
BARO — Barometric Pressure
Bat — Battery
B+ — Battery Positive Voltage
Bbl — Barrel
BHP — Brake Horsepower
BPT — Backpressure Transducer
BTDC — Before Top Dead Center
° C — Degrees Celsius
CAC — Charge Air Cooler
Calif — California
cc — Cubic Centimeter
CID — Cubic Inch Displacement
CKP — Crankshaft Position
CL — Closed Loop
CLCC — Closed Loop Carburetor Control
CMP — Camshaft Position
CO — Carbon Monoxide
Coax — Coaxial
Conn — Connector
Conv — Converter
Crank — Crankshaft
Cu. In. — Cubic Inch
CV — Constant Velocity
Cyl — Cylinder(s)
DI — Distributor Ignition
Diff — Differential
Dist — Distributor
DLC — Data Link Connector
DOHC — Double Overhead Camshaft
DTC — Diagnostic Trouble Code
DTM — Diagnostic Test Mode
DTT — Diagnostic Test Terminal
DVM — Digital Voltmeter (10 meg.)
DVOM — Digital Volt Ohmmeter
EBCM — Electronic Brake Control Module
ECM — Engine Control Module
ECT — Engine Coolant Temperature
EEPROM — Electronically Erasable Programmable Read Only Memory
EGR — Exhaust Gas Recirculation
EI — Electronic Ignition
ETR — Electronically Tuned Receiver
EVAP — Evaporation Emission
Exh — Exhaust
° F — Degrees Fahrenheit
Fed — Federal (All States Except Calif.)
FF — Front Drive Front Engine
FL — Fusible Link
FLW — Fusible Link Wire
FP — Fuel Pump
FRT — Front
ft — Foot
FWD — Front Wheel Drive
4WD — Four Wheel Drive
4 x 4 — Four Wheel Drive
4 A/T — Four Speed Automatic Transmission/Transaxle
Gal — Gallon
GEN — Generator
GND — Ground
Gov — Governor
g — Gram
Harn — Harness
HC — Hydrocarbons
HD — Heavy Duty
Hg — Hydrargyrum (Mercury)
HiAlt — High Altitude
HO2S — Heated Oxygen Sensor
HVAC — Heater–Vent–Air–Conditioning
IAC — Idle Air Control
IAT — Intake Air Temperature
IC — Integrated Circuit / Ignition Control
ID — Identification / Inside Diameter
IGN — Ignition
INJ — Injection
IP — Instrument Panel
IPC — Instrument Panel Cluster
Int — Intake
ISC — Idle Speed Control
J/B — Junction Block
kg — Kilograms
km — Kilometers
km/h — Kilometer per Hour
kPa — Kilopascals
kV — Kilovolts (thousands of volts)
kW — Kilowatts
KS — Knock Sensor
L — Liter
lb ft — Foot Pounds
lb in — Inch Pounds
LF — Left Front
LH — Left Hand
LR —Left Rear
LS — Left Side
LWB — Long Wheel Base
L–4 — In–Line Four Cylinder Engine
MAF — Mass Air Flow
MAN — Manual
MAP — Manifold Absolute Pressure
Max — Maximum
MC — Mixture Control
MFI — Multiport Fuel Injection
MIL — Malfunction Indicator Lamp
Min — Minimum
mm — Millimeter
MPG — Miles Per Gallon
MPH — Miles Per Hour
M/T — Manual Transmission/Transaxle
MV — Millivolt

N — Newtons
NA — Natural Aspirated
NC — Normally Closed
N·M — Newton Meters
NO — Normally Open
NOX — Nitrogen, Oxides of
OBD — On-Board Diagnostic
OD — Outside Diameter
O/D — Over Drive
OHC — Overhead Camshaft
OL — Open Loop
O2 — Oxygen
O2S — Oxygen Sensor
PAIR — Pulsed Secondary Air Injection System
P/B — Power Brakes
PCM — Powertrain Control Module
PCV — Positive Crankcase Ventilation
PRESS — Pressure
PROM — Programmable Read Only Memory
PNP — Park/Neutral Position
P/S — Power Steering
PSI — Pounds per Square Inch
PSP — Power Steering Pressure
Pt. — Pint
Pri — Primary
PWM — Pulse Width Modulate
Qt. — Quart
REF — Reference
RF — Right Front
RFI — Radio Frequency Interference
RH — Right Hand
RPM — Revolutions Per Minute
RPM Sensor — Engine Speed Sensor
RPO — Regular Production Option
RR — Right Rear
RS — Right Side
RTV — Room Temperature Vulcanizing
RWAL — Rear Wheel Antilock Brake
RWD — Rear Wheel Drive
SAE — Society of Automotive Engineers
Sec — Secondary
SFI — Sequential Multiport Fuel Injection
SI — System International
SIR — Supplemental Inflatable Restraint System
SOHC — Single Overhead Camshaft
Sol — Solenoid
SPEC — Specification
Speedo — Speedometer
SRS — Supplemental Restraint System
ST — Start / Scan Tool
Sw — Switch
SWB — Short Wheel Base
SYN — Synchronize
Tach — Tachometer
TB — Throttle Body
TBI — Throttle Body Fuel Injection
TCC — Torque Converter Clutch
TCM — Transmission Control Module
TDC — Top Dead Center
Term — Terminal
TEMP — Temperature
TOD— Torque On Demand
TP — Throttle Position
TRANS — Transmission/Transaxle
TURBO — Turbocharger
TVRS — Television & Radio Suppression
TVV — Thermal Vacuum Valve
TWC — Three Way Catalytic Converter
3 A/T — Three Speed Automatic Transmission/Transaxle
2WD — Two Wheel Drive
4 x 2 — Two Wheel Drive
U–joint — Universal Joint
V — Volt(s)
VAC — Vacuum
VIN — Vehicle Identification Number
VRRRE — Vehicle Refrigerant Recovery and Recycling Equipment
V–ref — ECM Reference Voltage
VSS — Vehicle Speed Sensor
VSV — Vacuum Switch Valve
V–6 — Six Cylinder “V” Engine
V–8 — Eight Cylinder ”V” Engine
W — Watt(s)
w/ — With
w/b — Wheel Base
w/o — Without
WOT — Wide Open Throttle

Service Parts Identification Plate

The Vehicle Information Plate (Service Parts ID plate) is provided on all vehicle models.
It is located on the center dash wall inside the engine compartment. The plate lists the VIN (Vehicle Identification Number), paint information and all production options and special equipment on the vehicle when it was shipped from the factory.



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RODEO

GENERAL INFORMATION

Maintenance and Lubrication

CONTENTS

Maintenance Schedule List

Normal Vehicle Use

The maintenance instructions in this Maintenance Schedule are based on the assumption that the vehicle will be used as designed:

- to carry passengers and cargo within the limitations specified on the tire placard located on the inside of the glove compartment door;
- to be driven on reasonable road surfaces within legal operating limits;
- to be driven on a daily basis, as a general rule, for at least several miles/kilometers;
- to be driven on unleaded fuel

Unusual or severe operating conditions will require more frequent vehicle maintenance, as specified in the following sections.

Severe Driving Conditions

If the vehicle is usually operated under any of the severe driving conditions listed below, it is recommended that the applicable maintenance services be performed at the specified interval shown in the chart below.

Severe driving conditions:

- Towing a trailer, using a camper or car top carrier.
- Repeated short trips of less than 8 Km (5 miles) with outside temperature remaining below freezing.
- Extensive idling and/or low speed driving for long distances, such as police, taxi or door–to–door delivery use.
- Operating on dusty, rough, muddy or salt spread roads.

ITEMS	INTERVAL
CHANGE ENGINE OIL AND OIL FILTER	Every 3,000 miles (4,800 km) or 3 months
CHANGE AUTOMATIC TRANSMISSION FLUID	Every 20,000 miles (32,000 km)
CHANGE REAR AXLE OIL	Every 15,000 miles (24,000 km)
REPLACE TIMING BELT	Every 75,000 miles (120,000 km)
REPLACE AIR CLEANER FILTER	See explanation of service, page 0B–5
CHANGE POWER STEERING FLUID	Every 30,000 miles (48,000 km)

Mileage Only Items

MILEAGE ONLY ITEMS

IN THOUSANDS OF MILES (USE ODOMETER READING) (x 1000 miles)

	MILEAGE ONLY ITEMS	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	DESCRIPTION
1	*(1) CHANGE FRONT AND *(1) REAR AXLE OIL																	
2	CHANGE MANUAL TRANSMISSION (M/T model) AND TRANSFER CASE OIL(4WD model)																	
3	*(1) CHECK AND ADJUST OR CHANGE AUTOMATIC TRANSMISSION FLUID (IF NECESSARY)																	
4	CHECK AUTOMATIC TRANSMSSION FLUID LEAKAGE																	
5	CHECK AND ADJUST VALVE CLEARANCE(V6-3.2L engine)	If noisy																
6	REPLACE AIR CLEANER ELEMENT																	
7	REPLACE SPARK PLUGS	Every 100,000 miles.																
8	CHANGE ENGINE COOLANT																	
9	*(2) REPLACE TIMING BELT	Every 100,000 miles.																
10	ROTATE TIRES																	
11	REPACK FRONT WHEEL BEARINGS GREASE																	
12	CLEAN RADIATOR CORE AND A/C CONDENSER																	
13	CHECK SPARK PLUG WIRES (I4- 2.2L engine)																	

*(1) : Under sever driving conditions, additional maintenance is required.
Refer to "Severe driving conditions".

*(2) : Replacement of the timing belt is recommended at every 100,000 miles (160,000km)

SHADED AREA INDICATES SERVICE TO BE PERFORMED.

UEROM2

Mileage/Months

MILEAGE/MONTHS

IN THOUSANDS OF MILES (USE ODOMETER READING) (x 1000 miles)

	MILEAGE/MONTHS whichever comes first	Max Months \ Max Miles	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	DESCRIPTION
1	CHECK ENGINE COOLANT LEVEL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
2	CHECK BRAKE FLUID LEVEL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
3	* (2) CHECK CLUTCH FLUID LEVEL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
4	CHECK FLUID LEAKS	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
5	* (1) CHANGE ENGINE OIL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
6	* (1) REPLACE ENGINE OIL FILTER	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
7	CHECK COOLING AND HEATER HOSES	12		■		■		■		■		■		■		■		■	
8	CHECK EXHAUST SYSTEM	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
9	CHECK FUEL LINE AND FUEL TANK/CAP	12								■								■	
10	CHECK ENGINE DRIVE BELTS	24				■				■				■				■	
11	CHECK TIRES AND WHEELS	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
12	CHECK STEERING OPERATION	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
13	CHECK BRAKE LINES AND HOSES	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
14	CHECK DRUM AND DISC BRAKES	12		■		■		■		■		■		■		■		■	
15	CHECK PARKING BRAKE	12		■		■		■		■		■		■		■		■	

SHADED AREA INDICATES SERVICE TO BE PERFORMED.

* (1) : Under severe driving conditions, additional maintenance is required. Refer to "Severe driving conditions".
* (2) : Manual Transmission model

UEROM3

MILEAGE/MONTHS

IN THOUSANDS OF MILES (USE ODOMETER READING) (x 1000 miles)

	MILEAGE/MONTHS whichever comes first	Max Months / Max Miles	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	DESCRIPTION
16	ADJUST BRAKE PEDAL PLAY	12		■		■		■		■		■		■		■		■	
17	LUBE ACCELERATOR LINKAGE	6	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
18	LUBE BODY AND CHASSIS	6	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
19	CHECK FRONT AND REAR PROPELLER SHAFT	6	■		■	■	■		■	■	■		■	■	■		■	■	
20	* (2) CHECK CLUTCH LINES AND HOSE	12				■				■				■				■	
21	* (2) LUBE CLUTCH PEDAL SPRING, BUSHING AND CLEVIS PIN	6		■		■		■		■		■		■		■		■	
22	* (2) CHECK CLUTCH PEDAL FREE PLAY	12		■		■		■		■		■		■		■		■	
23	CHECK PROPELLER SHAFT FLANGE TORQUE	12	■		■		■		■		■		■		■		■		
24	CHECK STARTER SAFETY SWITCH	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
25	* (4) CHECK THROTTLE LINKAGE	12		■		■		■		■		■		■		■		■	
26	CHECK SUSPENSION&STEERING	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
27	* (4) CHECK AUTO CRUISE CONTROL LINKAGE AND HOSE	12		■		■		■		■		■		■		■		■	
28	LUBE KEY LOCK CYLINDER	12		■		■		■		■		■		■		■		■	
29	* (3) CHECK SHIFT ON THE FLY SYSTEM GEAR FLUID	12		■		■		■		■		■		■		■		■	
30	* (1) CHECK POWER STEERING FLUID LEVEL	6	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	

SHADED AREA INDICATES SERVICE TO BE PERFORMED.

* (1) : Under severe driving conditions, additional maintenance is required. Refer to "Severe driving conditions".
* (2) : Manual Transmission model
* (3) : 4 Wheel Drive model
* (4) : I4-2.2L Engine model

UEROM4

Explanation of Complete Vehicle Maintenance Schedule

Brief explanations of the services listed in the preceding Maintenance Schedule are presented below.
Replace all questionable parts and note any necessary repairs as you perform these maintenance procedures.

Front and Rear Axle Lubricant Replacement

Check the lubricant level after every 7,500 miles (12,000 km) of operation and add lubricant to level of filler hole if necessary.
Replace the front and rear axle lubricant at 15,000 miles (24,000 km) and 30,000 miles (48,000 km) and after every 30,000 miles (48,000 km) of operation thereafter.

Manual Transmission Lubricant Replacement

Check the lubricant level after every 7,500 miles (12,000 km) of operation and add lubricant to level of filler hole if necessary.
Replace the transmission lubricant at 15,000 miles (24,000 km) and 30,000 miles (48,000 km) and after every 30,000 miles (48,000 km) of operation thereafter.

Transfer Case Lubricant Replacement

Check the lubricant level after every 7,500 miles (12,000 km) of operation and add lubricant to level of filler hole if necessary.
Replace the transfer case lubricant at 15,000 miles (24,000 km) and 30,000 miles (48,000 km) and after every 30,000 miles (48,000 km) of operation thereafter.

Air Cleaner Element Replacement

Replace the air cleaner under normal operating conditions every 30,000 miles (48,000 km).
Operation of the vehicle in dusty areas will necessitate more frequent replacement.

Spark Plug Replacement

Replace the plugs at 100,000 miles (160,000 km) intervals with the type specified at the end of this section.

Cooling System Service

Drain, flush and refill system with new engine coolant. Refer to “Recommended Fluids and Lubricants” in this section, or ENGINE COOLING (SEC.6B).

Timing Belt Replacement

Replacement of the timing belt is recommended at every 100,000 miles (160,000 km).
Failure to replace the timing belt may result in serious damage to the engine.

Valve Clearance Adjustment (V6, 3.2L ENG)

Incorrect valve clearance will result in increased engine noise and reduced engine output.
Retorque the camshaft bracket bolts before checking and adjusting the valve clearance.
Check and adjust the valve clearance every if noise occurs.

Tire Rotation

Rotate tires every 7,500 miles (12,000 km).

Spark Plug Wire Inspection

Check the spark plug wires at 60,000 mile (96,000 km) intervals.

Front Wheel Bearings Lubricant Replacement

Clean and repack the front wheel bearings at 30,000 miles (48,000 km) intervals.
Refer to DRIVE SHAFT SYSTEM (SEC. 4C).

Radiator Core and Air Conditioning Condenser Cleaning

Clean the front of the radiator core and air conditioning condenser, at 60,000 miles (96,000 km) intervals.

Fluid Level Check

A fluid loss in any system (except windshield washer) may indicate a problem. Repair the system at once.

Engine oil level

Check level and add if necessary. The best time to check the engine oil level is when the oil is warm. After stopping the engine with the vehicle on a level surface, wait a few minutes for the oil to drain back to the oil pan. Pull out the oil level indicator (dipstick). Wipe it clean and push the oil level indicator back down all the way. Pull out the oil level indicator, keeping the tip down, and look at the oil level on it.

Add oil, if needed, to keep the oil level above the “ADD” mark and between the “ADD” and “FULL” marks in the operating range area. Avoid overfilling the engine since this may cause engine damage. Push the oil level indicator back down all the way after taking the reading. If you check the oil level when the oil is cold, do not run the engine first. The cold oil will not drain back to the pan fast enough to give a true oil level.

Engine coolant level and condition

Check engine coolant level in the coolant reservoir and add engine coolant if necessary. Inspect the engine coolant and replace it if dirty or rusty.

Windshield washer fluid level

Check washer fluid level in the reservoir and add if necessary.

Power steering system reservoir level

Check and keep at the proper level.

Brake master cylinder reservoir level

Check fluid. Keep fluid at proper level. A low fluid level can indicate worn disc brake pads which may need to be serviced.

Hydraulic clutch system

Check fluid level in the reservoir. Add fluid as required.

Battery fluid level

Check fluid level in the battery.

Fluid Leak Check

Check for fuel, water, oil or other fluid leaks by looking at the surface beneath the vehicle after it has been parked for a while. Water dripping from the air conditioning system after use is normal. If you notice gasoline fumes or fluid at any time, locate the source and correct it at once.

Engine Oil and Oil Filter Replacement

Always use API SE, SF, SG, SH or ILSAC GF–1 quality oils of the proper viscosity.

When choosing an oil, consider the range of temperatures the car will be operated in before the next oil change. Then, select the recommended oil viscosity from the chart.

Always change the oil and the oil filter as soon as possible after driving in a dust storm.

Engine Cooling System Inspection

Inspect the coolant/anti–freeze. If the coolant is dirty or rusty, drain, flush and refill with new coolant. Keep coolant at the proper mixture for proper freeze protection, corrosion inhibitor level and best engine operating temperature. Inspect hoses and replace if cracked, swollen or deteriorated. Tighten the hose clamps if equipped with screw–type clamps. Clean outside of radiator and air conditioning condenser. Wash filler cap and neck. To help ensure proper operation, a pressure test of both the cooling system and the cap is also recommended.

Exhaust System Inspection

Visually inspect the exhaust pipes, muffler, heat shields and hangers for cracks, deterioration, or damage.

Be alert to any changes in the sound of the exhaust system or any smell of fumes. These are signs the system may be leaking or overheating. Repair the system at once, if these conditions exist. (See also “Engine Exhaust Gas Safety” and “Three Way Catalytic Converter” in the Owner’s manual.)

Fuel Cap, Fuel Lines, and Fuel Tank Inspection

Inspect the fuel tank, the fuel cap and the fuel lines every 60,000 miles (96,000 km) for damage which could cause leakage.

Inspect the fuel cap and the gasket for correct sealing and physical damage. Replace any damaged parts.

Drive Belt Inspection

Check the serpentine belt driving for cracks, fraying, wear, and correct tension every 30,000 miles (48,000 km). Replace as necessary.

Wheel Alignment, Balance and Tires Operation

Uneven or abnormal tire wear, or a pull right or left on a straight and level road may show the need for a wheel alignment. A vibration of the steering wheel or seat at normal highway speeds means a wheel balancing is needed. Check tire pressure when the tires are “cold” (include the spare).

Maintain pressure as shown in the tire placard, which is located on the driver’s door lock pillar.

Steering System Operation

Be alert for any changes in steering action. An inspection or service is needed when the steering wheel is harder to turn or has too much free play, or if there are unusual sounds when turning or parking.

Brake Systems Operation

Watch for the “BRAKE” light coming on. Other signs of possible brake trouble are such things as repeated pulling to one side when braking, unusual sounds when braking or between brake applications, or increased brake pedal travel. If you note one of these conditions, repair the system at once.

For convenience, the following should be done when wheels are removed for rotation: Inspect lines and hoses for proper hookup, bindings, leaks, crack, chafing etc. Inspect disc brake pads for wear and rotors for surface condition.

Inspect other brake parts, including parking brake drums, linings etc., at the same time. Check parking brake adjustment.

Inspect the brakes more often if habit or conditions result in frequent braking.

Parking Brake and Transmission Park Mechanism Operation

Park on a fairly steep hill and hold the vehicle with the parking brake only. This checks holding ability. On automatic transmission vehicles, shifting from “P” position to the other positions cannot be made unless the brake pedal is depressed when the key switch is in the “ON” position or the engine is running.

WARNING: BEFORE CHECKING THE STARTER SAFETY SWITCH OPERATION BELOW, BE SURE TO HAVE ENOUGH ROOM AROUND THE VEHICLE. THEN FIRMLY APPLY BOTH THE PARKING BRAKE AND THE REGULAR BRAKE. DO NOT USE THE ACCELERATOR PEDAL. IF THE ENGINE STARTS, BE READY TO TURN OFF THE KEY PROMPTLY. TAKE THESE PRECAUTIONS BECAUSE THE VEHICLE COULD MOVE WITHOUT WARNING AND POSSIBLY CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.

Starter Safety Switch Operation (Automatic Transmission)

Check by trying to start the engine in each gear while setting the parking brake and the foot brake. The starter should crank only in “P” (Park) or “N” (Neutral).

Starter Safety Switch Operation (Manual Transmission)

To check, place the shift lever in “Neutral”, push the clutch pedal halfway and try to start. The starter should not crank. The starter should crank only when the clutch pedal is fully depressed.

Accelerator Linkage Lubrication

Lubricate the accelerator pedal fulcrum pin with chassis grease.

Steering and Suspension Inspection

Inspect the front and rear suspension and steering system for damaged, loose or missing parts or signs of wear. Inspect power steering lines and hoses for proper hookup, binding, leaks, cracks, chafing, etc.

Body and Chassis Lubrication

Lubricate the key lock cylinders, the hood latch, the hood and door hinges, the door check link, the parking cable guides, the underbody contact points, and the linkage.

Propeller Shaft Inspection and Lubrication

Check the propeller shaft flange–to–pinion bolts for proper torque to 63 N•m (46 lb ft) for front and rear propeller shaft.

Automatic Transmission Fluid Replacement

Under harsh operating conditions, such as constant driving in heavy city traffic during hot weather, or in hilly or mountainous terrain, change the transmission fluid and service the sump filter after every 20,000 miles (32,000 km) of operation.
More over, the remaining life percentage of ATF can be estimated by using TECH–II as an auxiliary tool to judge the right time for ATF replacement.
The remaining life percentage is calculated from ATF'S heat history. When it is close to 0%, ATF replacement is recommended.

Auto Cruise Control Inspection

Check to see if the clearance between cruise link and accelerator link is normal. Also check that the connected properly.

Clutch Lines and Hoses Inspection

Check lines and hoses for proper attachment, binding, leaks, cracks, chafing, deterioration, etc. Any questionable parts should be replaced or repaired at once. When abrasion or wear is evident on lines or hoses, the cause must be corrected.

Clutch Control Lubrication

Lubricate the clutch pedal bushing, the clevis pin, and pedal spring every 15,000 miles (24,000 km) or 6 months. If a squeaking noise arises from around the bushing or the clevis pin at the clutch pedal arm when the clutch pedal is depressed, lubricate them.

Clutch Pedal Free Play Inspection

Note the clutch pedal free play. It should be 5 – 15 mm (0.2 – 0.6 in). Adjust clutch control when there is little or no free play.

Accelerator Linkage Inspection

Inspect for interference, binding, and damaged or missing parts. Check accelerator pedal for smooth operation and even pedal effort. Replace parts as needed.

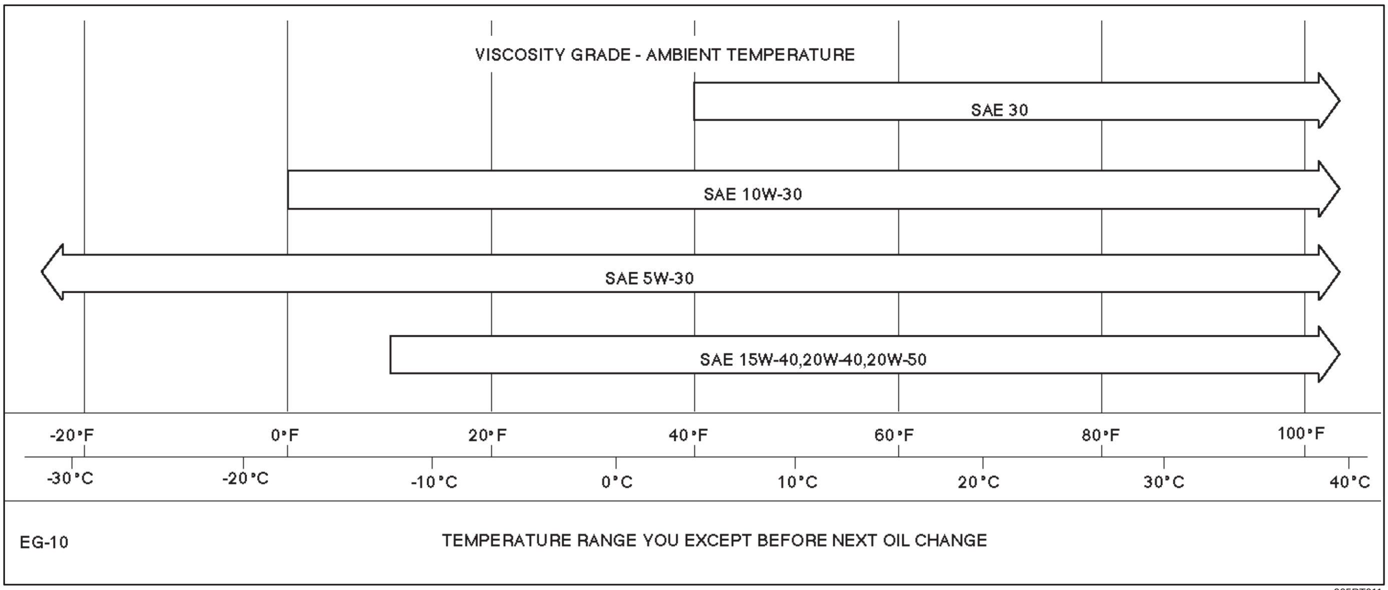
Recommended Fluids and Lubricants

USAGE	FLUID/LUBRICANT
Engine	API SE, SF, SG, SH or ILSAC GF-1 Engine oil (See oil chart on the following page for proper viscosity)
Engine coolant	Mixture of water and good quality ethylene glycol base type antifreeze.
Brake system	DOT-3 hydraulic brake fluid.
Power steering system	DEXRON® -III Automatic transmission fluid.
Automatic transmission	DEXRON® -III Automatic transmission fluid.
MUA Type Manual transmission & Transfer case	Engine oil (See oil chart on following page for proper viscosity)
Rear axle and front axle	GL-5 gear lubricant (Standard differential) GL-5 Limited slip differential gear lubricant together with limited slip differential lubricant additive (Part No. 8-01052-358-0) or equivalent (If equipped with optional limited slip differential) (See oil chart in this section for proper viscosity)
Clutch system a. Pivot points b. Clutch fork joint c. Master cylinder	 Chassis grease Chassis grease DOT-3 hydraulic brake fluid
Hood latch assembly a. Pivots and spring anchor b. Release pawl	 Engine oil Chassis grease
Hood and door hinges	Engine oil
Chassis lubrication	Chassis grease
Parking brake cables	Chassis grease
Front wheel bearings	Multipurpose grease
Shift on the fly system	GL-5 gear lubricant (SAE 75W-90)
Body door hinge pins and linkage, fuel door hinge, rear compartment lid hinges	Engine oil
Windshield washer solvent	Washer fluid
Key lock cylinder	Synthetic light weight engine oil (SAE 5W-30)
Accelerator linkage	Chassis grease

Lubricant Viscosity Chart

Lubricants should be carefully selected according to the lubrication chart. It is also important to select viscosity of lubricants according to the ambient temperature by referring to the following table.

Oil Viscosity Chart for Gasoline Engine



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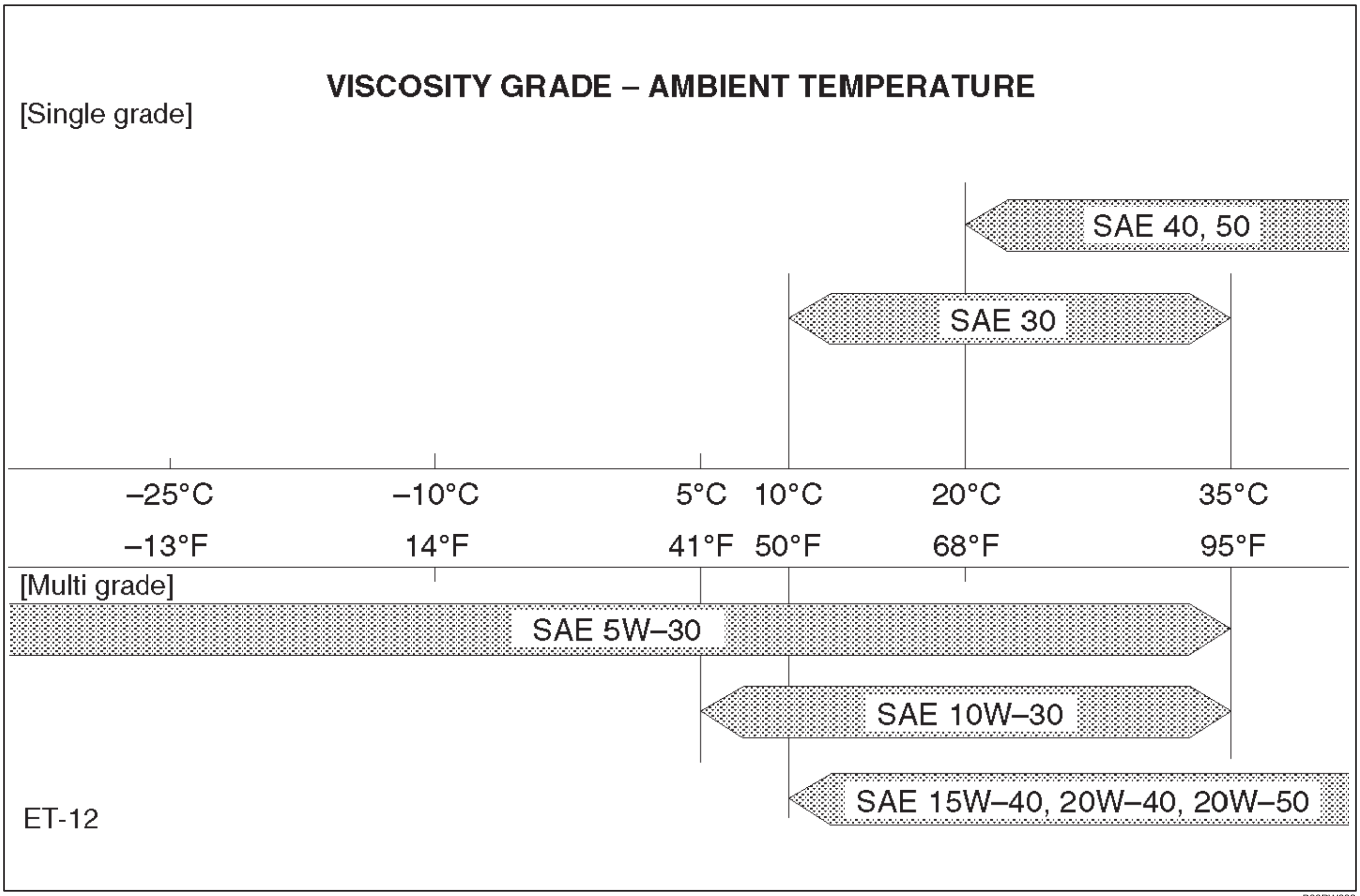
Oil Viscosity Chart for Manual Transmission and Transfer Case



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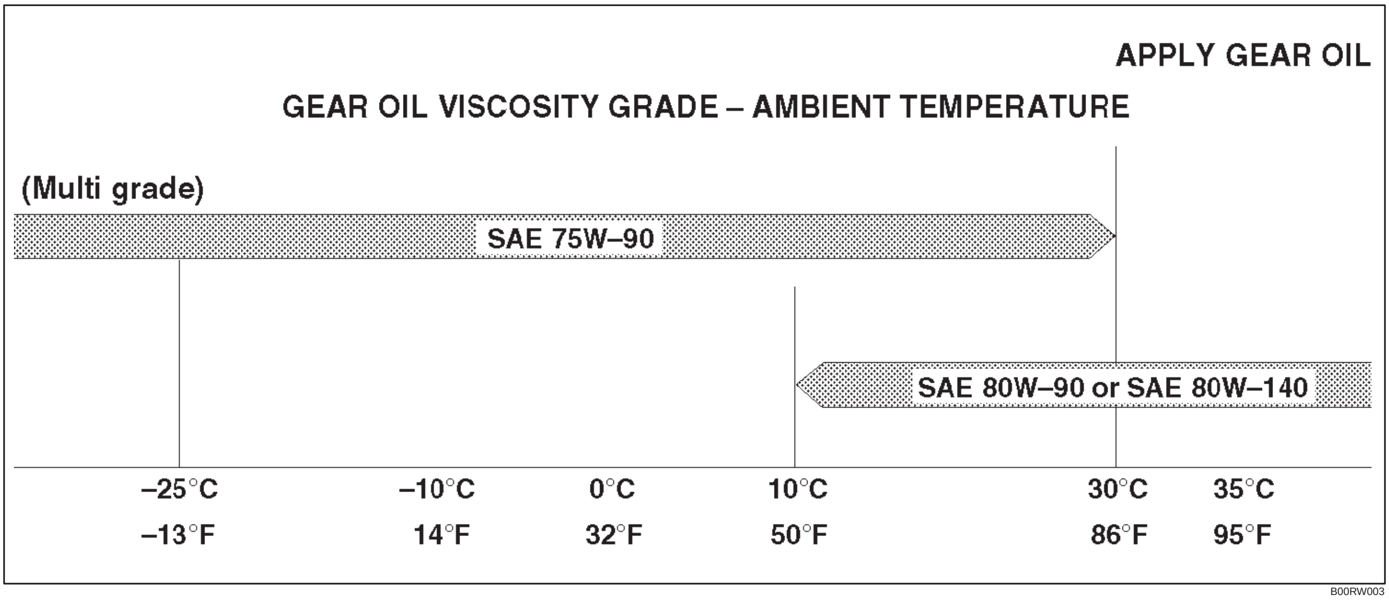
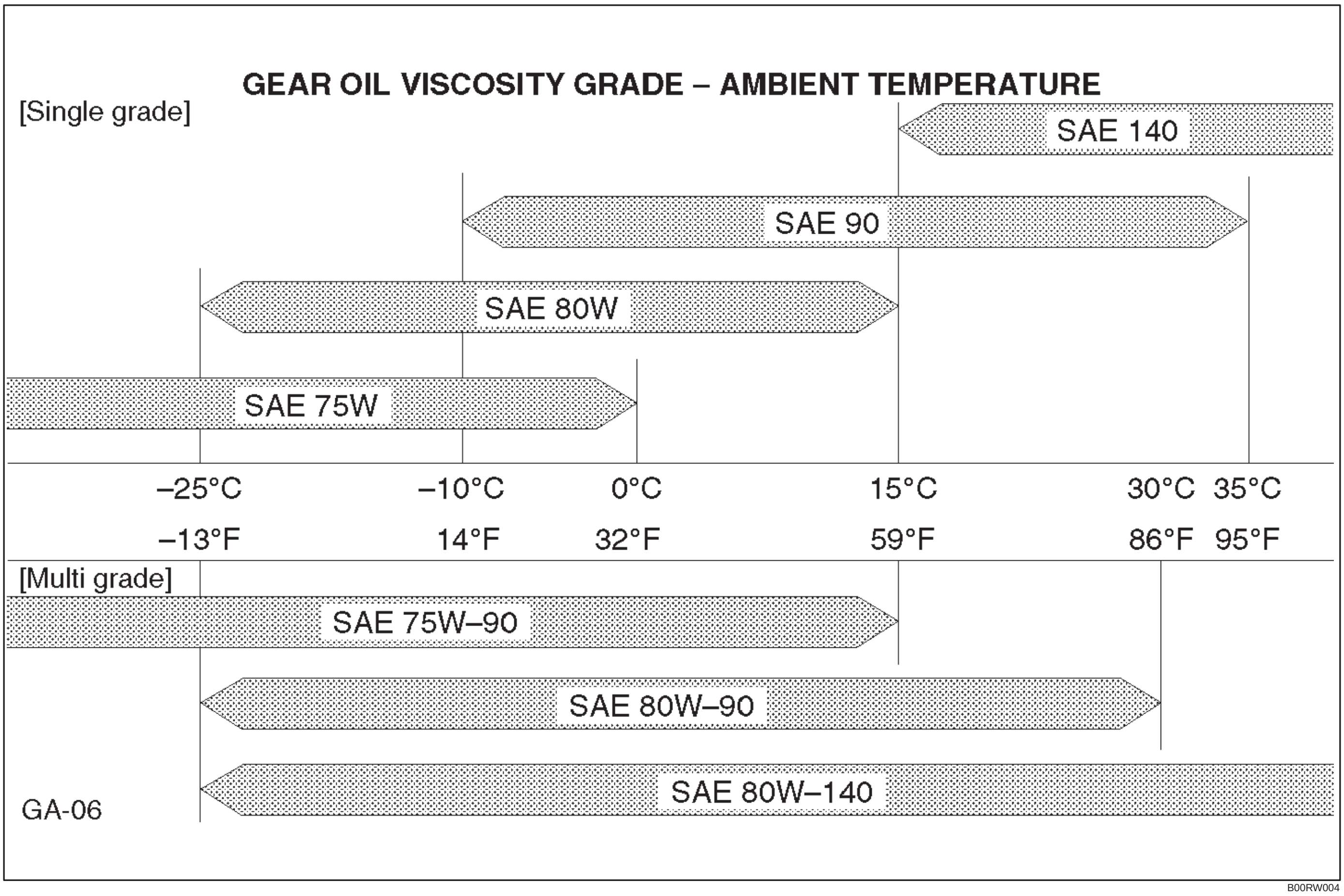
Oil Viscosity Chart for Front Axle



Oil Viscosty Chart for Rear Axle



Recommended Liquid Gasket

Type	Brand Name	Manufacturer	Remarks
RTV* Silicon Base	Three Bond 1207B Three Bond 1207C Three Bond 1215 Three Bond 1280 Three Bond 1281	Three Bond Three Bond Three Bond Three Bond Three Bond	For Engine Repairs For Axle Case Repairs T/M Repairs T/M
Water Base	Three Bond 1141E	Three Bond	For Engine Repairs
Solvent	Three Bond 1104 Belco Bond 4 Belco Bond 401 Belco Bond 402	Three Bond Isuzu Isuzu Isuzu	For Engine Repairs
Anaerobic	LOCTITE 515 LOCTITE 518 LOCTITE 17430	Loctite Loctite Loctite	All

* RTV: Room Temperature Vulcanizer

NOTE:

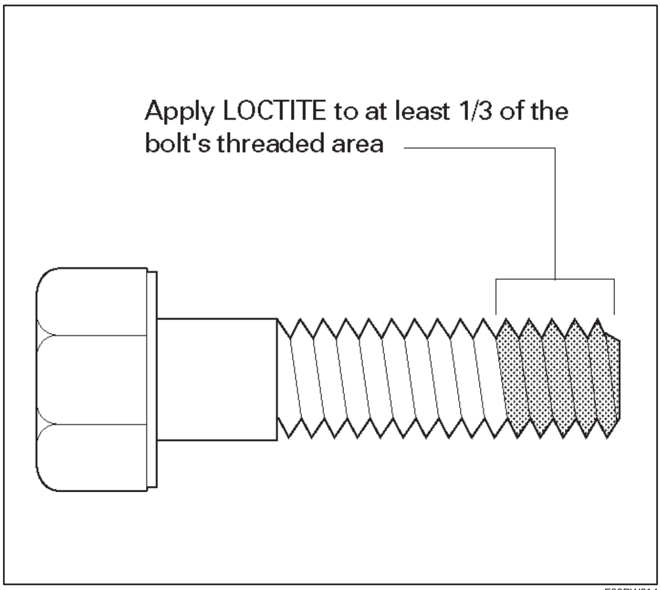
1. It is very important that the liquid gaskets listed above or their exact equivalent be used on the vehicle.
2. Be careful to use the specified amount of liquid gasket.
   Follow the manufacturer's instructions at all times.
3. Be absolutely sure to remove all lubricants and moisture from the connecting surfaces before applying the liquid gasket.
   The connecting surfaces must be perfectly dry.
4. Do not apply LOCTITE 17430, LOCTITE 515 and LOCTITE 518 between two metal surfaces having a clearance of greater than 0.25 mm (0.01 in). Poor adhesion will result.

Recommended Thread Locking Agents

LOCTITE Type	LOCTITE Color
LOCTITE 242	Blue
LOCTITE 262	Red
LOCTITE 271	Red

Application Steps

1. Completely remove all lubricant and moisture from the bolts and the female-threaded surfaces of the parts to be joined.
   The surfaces must be perfectly dry.
2. Apply LOCTITE to the bolts.



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3. Tighten the bolts to the specified torque.
   After tightening, be sure to keep the bolts free from vibration and torque for at least an hour until LOCTITE hardens.

NOTE: When the application procedures are specified in this manual, follow them.

Maintenance Service Data

Service Data and Specifications

ENGINE	Valve clearance (cold): only V6–3.2L ENG	Intake 0.28±0.05 mm (0.011±0.002 in) Exhaust 0.3±0.05 mm (0.012±0.002 in)	
	Spark plug type	K16PR-P11/PK16PR11/RC10PYP4	
	Spark plug gap	1.05 mm (0.04 in)	
CLUTCH	Clutch pedal free play	5-15 mm (0.20-0.59 in)	
BRAKE	Brake pedal free play	6-10 mm (0.24-0.39 in)	
	Parking brake travel	6-7 notches	
WHEEL ALIGNMENT	Toe-in (Front)	0±2 mm (0±0.08 in)	
	Toe-in (Rear)	0±5 mm (0±0.2 in)	
	Camber (Front)	0˚±30’	
	Camber (Rear)	0˚±1˚	
	Caster (Front)	2˚ 30’±45’	
	Toe–Axis (Rear)	±1˚	
PROPELLER SHAFT	Flange torque	63 N·m (46 lb ft)	
WHEEL AND TIRES	Size	P225/75R15	P245/70R16
	Wheel nut torque	118 N·m (87 lb ft)	
	Tire inflation pressure (Front)	200 kPa (29 psi)	180 kPa (26 psi)
	* Tire inflation pressure (Rear)	200 kPa (29 psi)	180 kPa (26 psi)

* Unless otherwise specified on tire information label on the vehicle.

Approximate Capacities

	Items		Metric Measure	U.S. Measure
Fuel tank			80 L	21.1 Gal.
* Crankcase (V6–3.2L ENGINE)	Oil Change with Filter		4.7 L	5.0 Qt
	Oil Change without Filter		4.0 L	4.2 Qt
* Crankcase (L4–2.2L ENGINE)	Oil Change with Filter		4.5 L	4.8 Qt
	Oil Change without Filter		4.2 L	4.4 Qt
Coolant	M/T (V6–3.2L ENG)		11.0 L	11.6 Qt
	M/T (L4–2.2L ENG)		6.9 L	7.3 Qt
	A/T		11.1 L	11.7 Qt
Transmission	Manual		2.95 L	3.1 Qt
	Automatic		8.6 L	9.1 Qt
Transfer			1.45 L	1.5 Qt
Axle	Rear		1.77 L	1.87 Qt
	Front	V6-3.2L ENG	1.25 L	1.33 Qt
		L4-2.2L ENG	1.05 L	1.10 Qt
Shift on the fly system			0.12 L	0.13 Qt
Power steering			1.0 L	1.1 Qt
Air conditioning (R-134a)			0.6 L	1.32 Qt

*Crankcase capacities shown are approximate refill capacities. After refill, recheck oil level.

RODEO

HEATING, VENTILATION AND AIR CONDITIONING (HVAC)

HVAC SYSTEMS

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Heating and Ventilation System

General Description

Heater

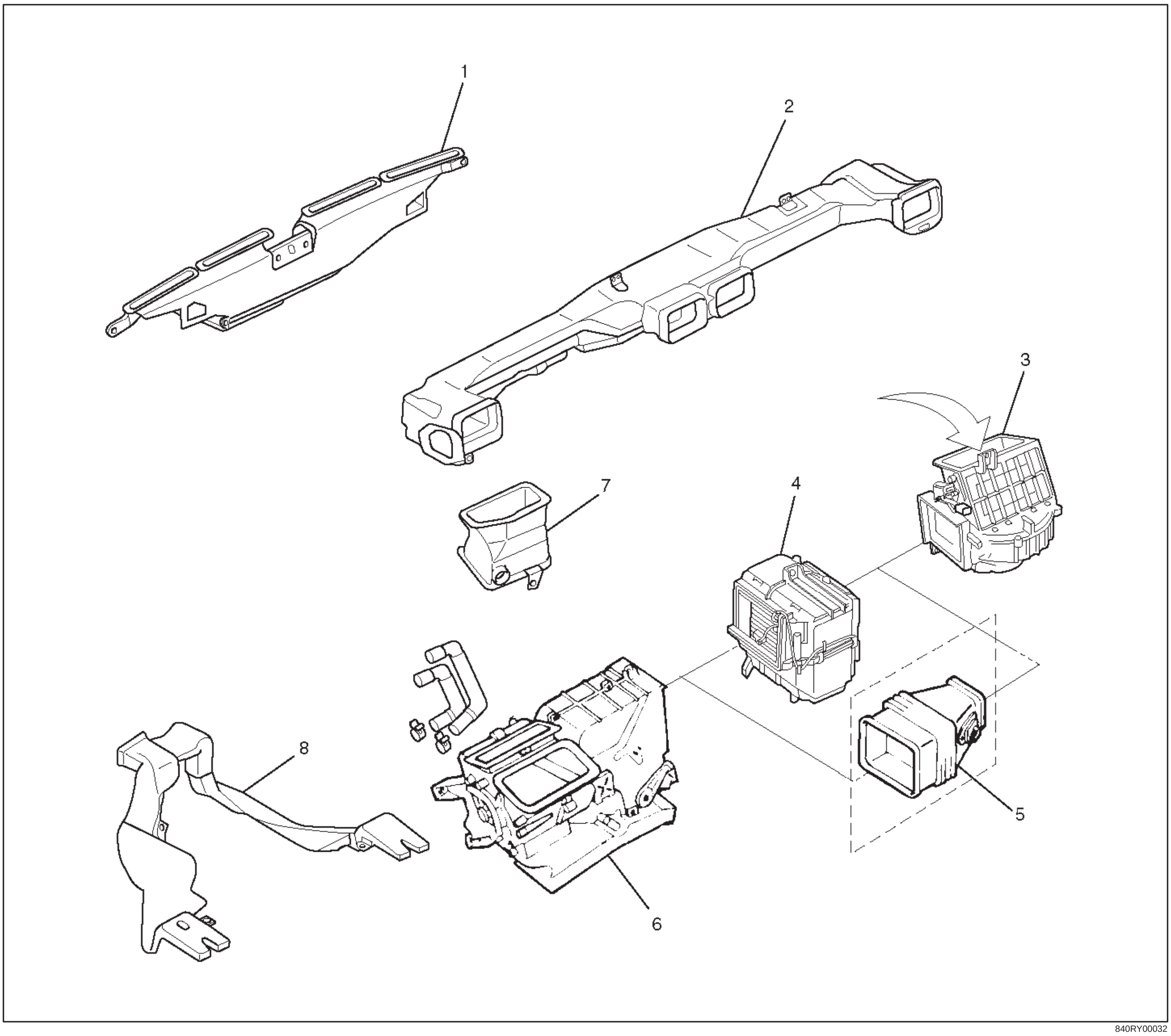
When the engine is warming up, the warmed engine coolant is sent out into the heater core. The heater system supplies warm air into the passenger compartment to warm it up.

Outside air is circulated through the heater core of the heater unit and then back into the passenger compartment. By controlling the mixture of outside air and heater core air, the most comfortable passenger compartment temperature can be selected and maintained.

The temperature of warm air sent to the passenger compartment is controlled by the temperature control knob. This knob acts to open and close the air mix door, thus controlling the amount of air passed through the heater core.

The air selector knob, with its different modes, also allows you to select and maintain the most comfortable passenger compartment temperature.

The air source select lever is used to select either “FRESH” for the introduction of the outside air, or “CIRC” for the circulation of the inside air. When the lever is set to “FRESH”, the outside air is always taken into the passenger compartment. When setting the lever to “CIRC” position, the circulation of air is restricted only to the inside air with no introduction of the outside air and the air in the passenger compartment gets warm quickly. However, the lever is normally set to “FRESH” to prevent the windshield from clouding.



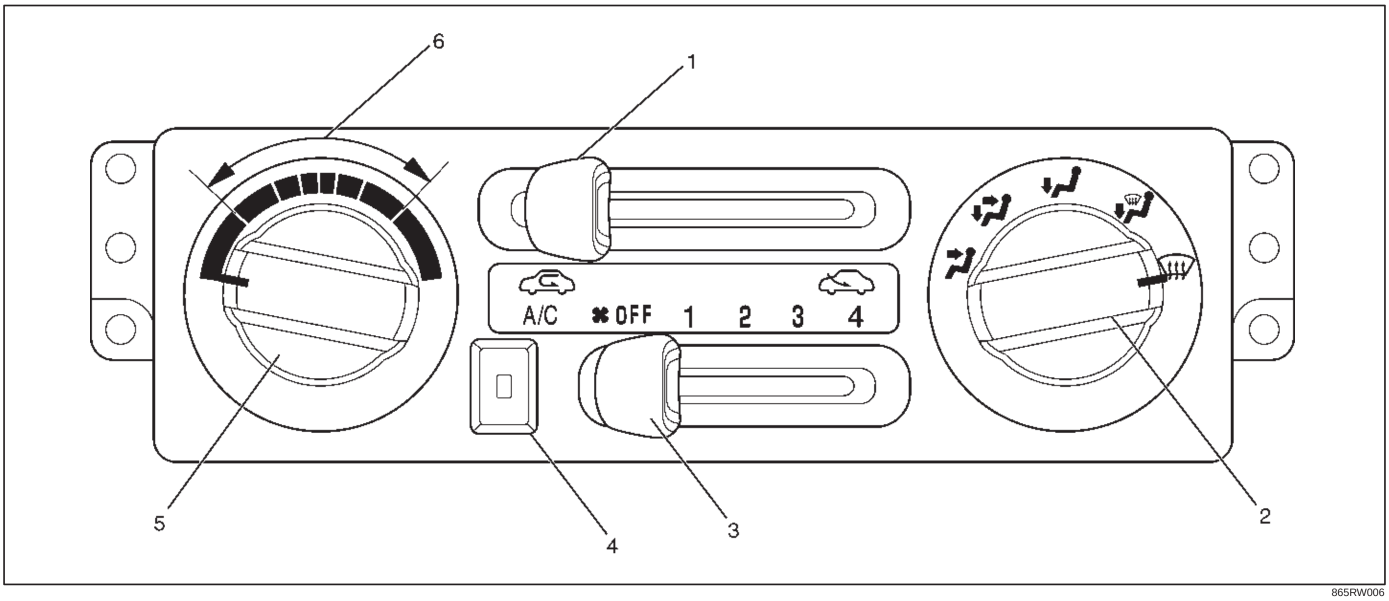
Legend

(1) Defroster Nozzle
(2) Ventilation Duct
(3) Blower Assembly
(4) Evaporator Assembly (With A/C)
(5) Duct (W/O A/C)
(6) Heater Unit
(7) Ventilation Lower Duct
(8) Rear Heater Duct

Control Lever Assembly

The control lever assembly has some cables to control the mode and temperature of the heater unit and the mode door for the air source of the blower assembly.

The fan control is used to control the amount of air sent out by the resistor at four levels from “LOW” to “HIGH”.



Legend

(1) Air Source Select Lever
(2) Air Select Knob
(3) Fan Control Lever (Fan Switch)
(4) Air Conditioning (A/C) Switch (W/ A/C)
(5) Temperature Control Knob
(6) Middle Position

Ventilation

Setting the air source select lever to “FRESH” position allows the heating system to work with sending the fresh air from outside.

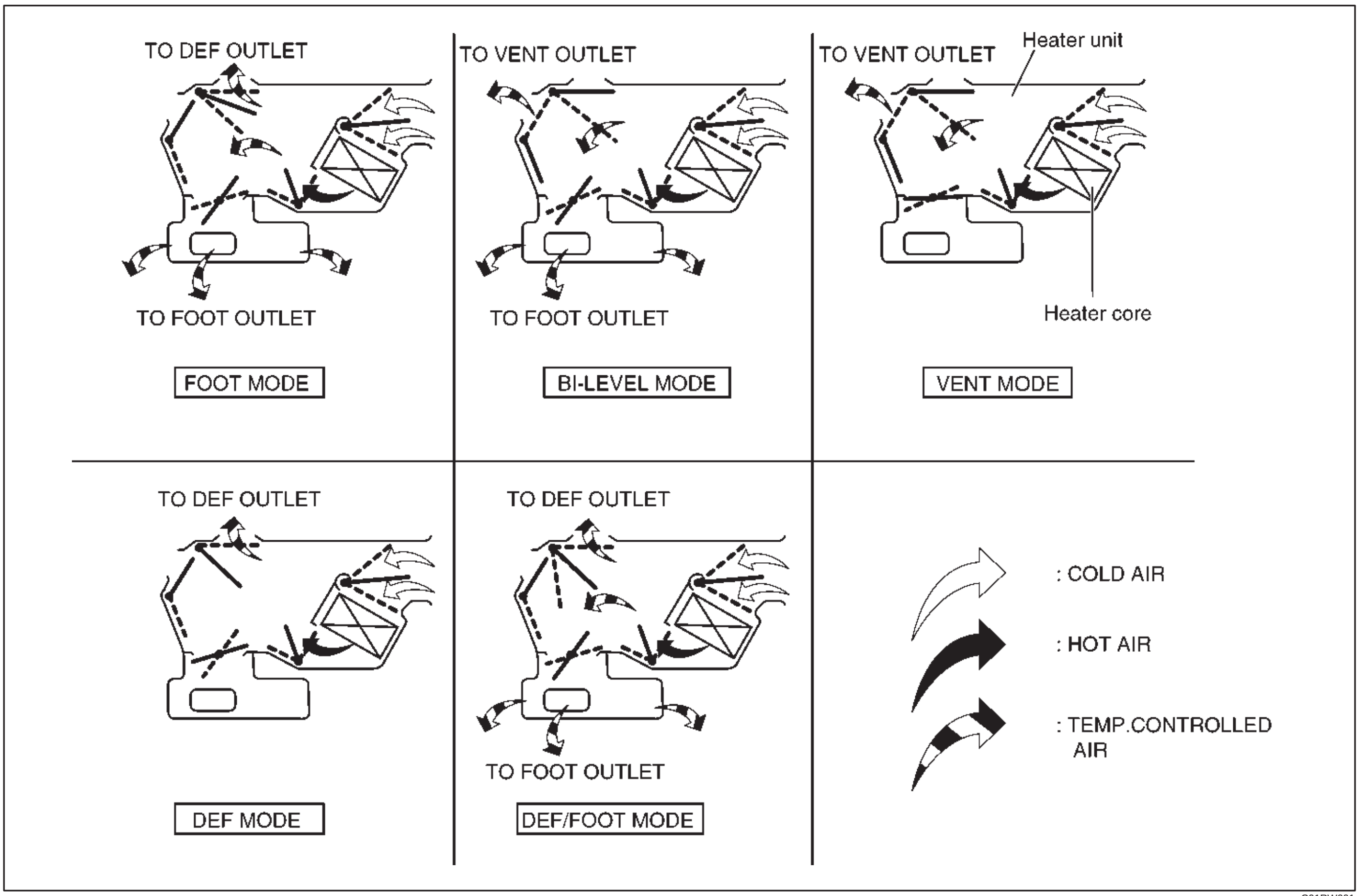
The blower fan also serves to deliver fresh outside air to the passenger compartment to assure adequate ventilation.

Air Select Knob

The air select knob allows you to direct heated air into the passenger compartment through different outlets.

1. **Vent** – In this position, air is discharged from the upper air outlet. Air quantity is controlled by the fan control lever.
2. **Bi-Level** – In this position, air flow is divided between the upper air outlets and the floor air outlets, with warmer air delivered to the floor outlets than the air delivered to the upper air outlets when the temp lever is in middle position.
3. **Foot** – In this position, air flow is delivered to the foot, while sending a small amount of air to the windshield.
4. **Def/Foot** – In this position, air flow is delivered to the foot, while sending approx. 40% of total amount of air to the windshield.
   Selecting this mode allows air conditioning system to work while the fan switch is turned to on position, even if the A/C switch is off.
   Also the fresh air can be delivered even when the circ position is selected.
5. **Defrost** – In this position, most of the air is delivered to the windshield and a small amount is delivered to the side windows.
   Selecting this mode allows air conditioning system to work while the fan switch is turned to on position, even if the A/C switch is off.
   Also the fresh air can be delivered even when the circ position is selected.

Moving the air source select lever to the “CIRC” position provides quickest heat delivery by closing the blower assembly mode door. In this position, outside air is not delivered to the passenger compartment.



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Air Source Select Lever

The intake of outside air and the circulation of inside air are controlled by sliding this lever left or right.
And even though the circ position is selected, the fresh air can be delivered while the DEF or DEF/FOOT position is selected.

Fan Control Lever

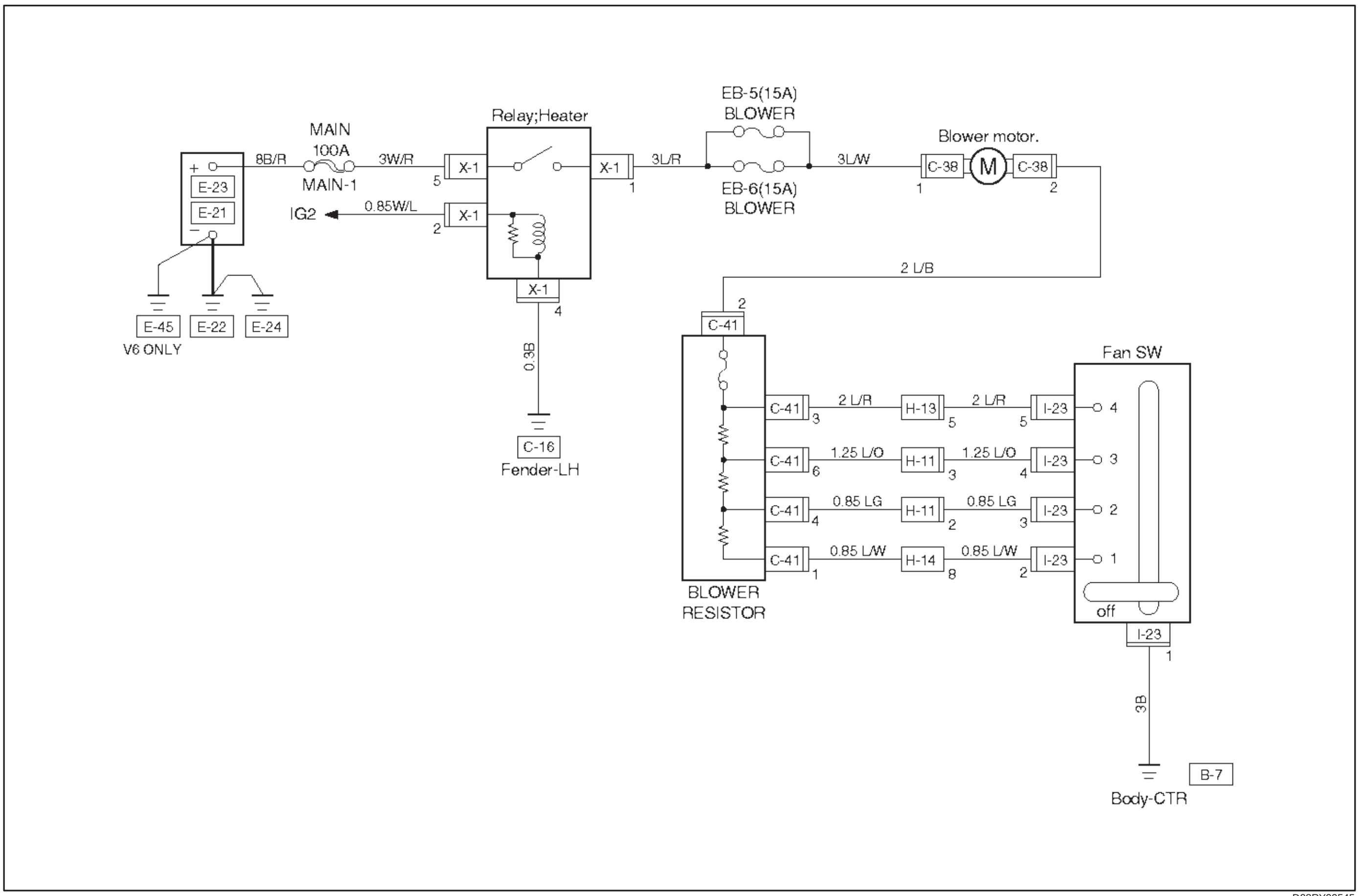
This lever controls the blower motor speed to regulate the amount of air delivered to the defrost, foot, and ventilation ducts:

1. Low
2. Medium Low
3. Medium High
4. High

Temperature Control Knob

When the temperature control knob is in the “COLD” position, the air mix door closes to block the flow air to the heater core.
When the temperature control knob is in the “HOT” position, the air mix door opens to allow air to pass through the heater core and heat the passenger compartment.
Placing the knob in a intermediate position will cause a lesser or greater amount air to reach the heater core. In this mode the passenger compartment temperature can be regulated.

Wiring Diagram



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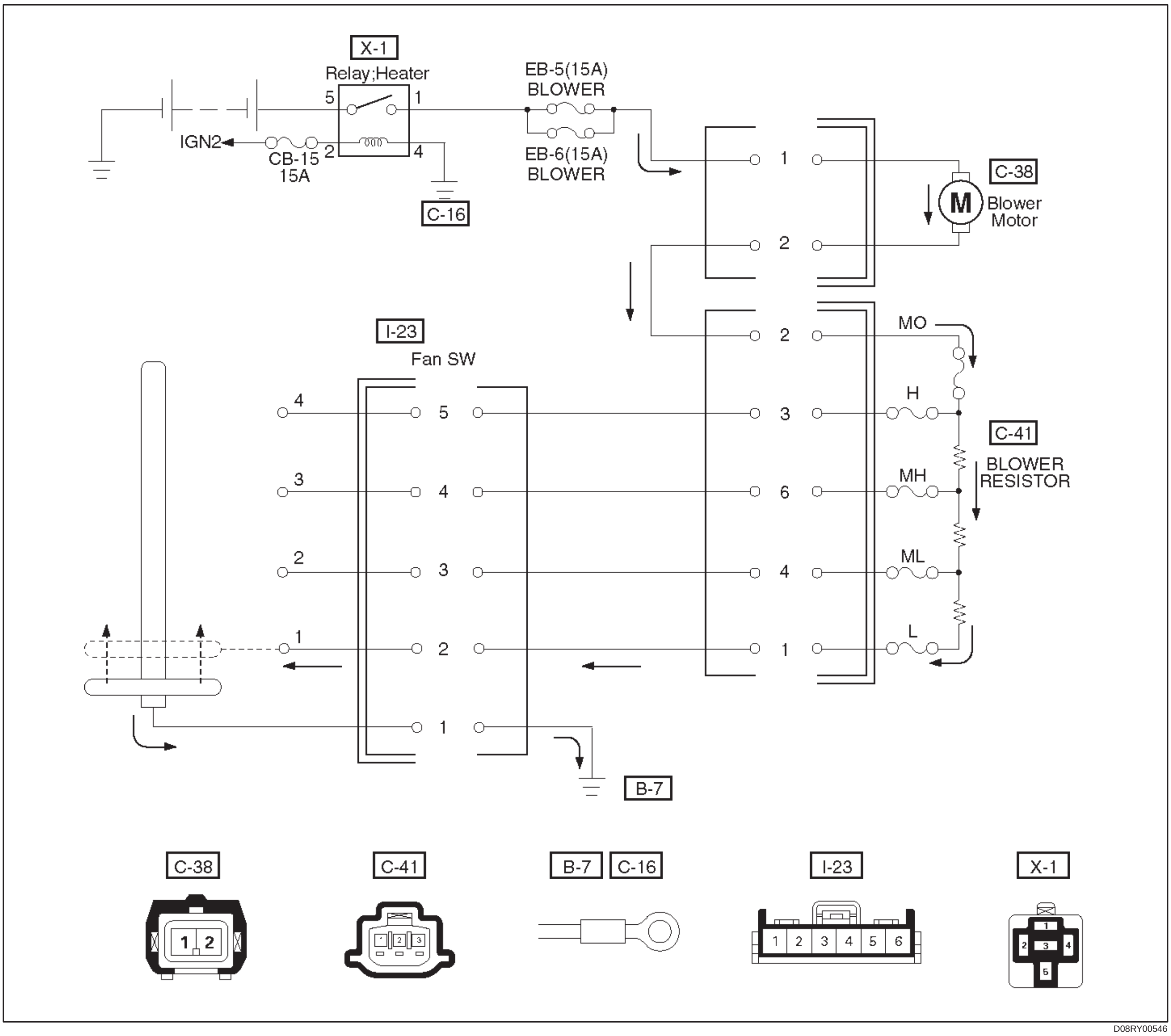
Diagnosis

Heating Cycle diagnosis

Condition	Possible cause	Correction
No heating or insufficient heating.	Blower motor does not run or runs improperly.	Refer to “FAN CONTROL LEVER (FAN SWITCH) DIAGNOSIS”.
	Engine coolant temperature is low.	Check the engine coolant temperature after warming up the engine and check the thermostat. Replace as necessary.
	Insufficient engine coolant.	Add engine coolant as required.
	Circulation volume of engine coolant is insufficient.	Check if the water hose to the heater core is clogged, collapsed or twisted. Repair or replace as necessary.
	Heater core clogged or collapsed.	Clean or replace as necessary.
	The heater cores is not provided with air sent from the blower motor.	Repair the temperature control link unit or mode doors.
	Duct connections defective or unsealing.	Repair or replace as necessary.
Control lever moves but mode door does not operate.	Cable attaching clip is not correct.	Repair
	Link unit of heater or blower assembly defective.	Repair
	The intake actuator is inoperative.	Refer to “AIR SOURCE SELECT LEVER DIAGNOSIS”
The mode door cannot be set to the mode selected.	Link unit of heater unit.	Repair.
	Control cable is not adjusted.	Adjust.

Fan Control Lever (Fan Switch) Diagnosis

Current flows to the blower motor through the heater relay (X-1) to activate the rotation of the blower motor by turning “ON” the fan control knob (fan switch). Blower motor speed is controlled in stages by the resistor, by operating the switch from “LOW” to “HIGH”.
For the inspection of the relays, switches and units in each table, refer to “INDIVIDUAL INSPECTION” in this section.



Condition	Possible cause	Correction
Blower motor does not run.	—	Refer to Chart A
Blower motor does not run in certain position (s).	—	Refer to Chart B, C, D and E
Blower motor does not stop at “OFF” position.	—	Refer to Chart F

Chart "A" Blower Motor Does Not Run

Step	Action	Yes	No
1	Is relay (X-1) OK?	Go to Step 2	Replace
2	Is fuse EB-5 (15A) OK?	Go to Step 3	Replace
3	Is fuse EB-6 (15A) OK?	Go to Step 4	Replace
4	Is resistor OK?	Go to Step 5	Replace
5	Is fan control lever OK?	Go to Step 6	Replace control lever assembly.
6	Is blower motor OK?	Go to Step 7	Replace
7	1. Turn the ignition switch "ON". 2. Turn fan control lever "ON". 3. Check to see if battery voltage is present at chassis side connector terminal No. C38-1 Is there a battery voltage?	Poor ground or open circuit either between chassis side connector terminal No. C38-2 and No. C41-2 or No. I23-1 and body ground (No. B-7).	Open circuit between No. EB-5 (15A) / EB-6 (15A) fuse and No. C38-1.

Chart "B" Blower Motor Does Not Run At Low Position

Step	Action	Yes	No
1	Is resistor OK?	Go to Step 2	Replace
2	Is fan control lever (Fan Switch) OK?	Open circuit between chassis side connector terminal No. C41-1 and No.I23-2.	Replace control lever assembly.

Chart "C" Blower Motor Does Not Run At Medium Low Position

Step	Action	Yes	No
1	Is resistor OK?	Go to Step 2	Replace
2	Is fan control lever (Fan Switch) OK?	Open circuit between the chassis side connector terminal No. C41-4 and No. I23-3.	Replace control lever assembly.

Chart “D” Blower Motor Does Not Run At Medium High Position

Step	Action	Yes	No
1	Is resistor OK?	Go to Step 2	Replace
2	Is fan control lever (Fan Switch) OK?	Open circuit between chassis side connector terminal No. C41-6 and No. I23-4.	Replace control lever assembly.

Chart “E” Blower Motor Does Not Run At High Position

Step	Action	Yes	No
1	Is resistor OK?	Go to Step 2	Replace
2	Is fan control lever (Fan Switch) OK?	Open circuit between Chassis side connector terminal No. C41-3 and No. I23-5.	Replace control lever assembly.

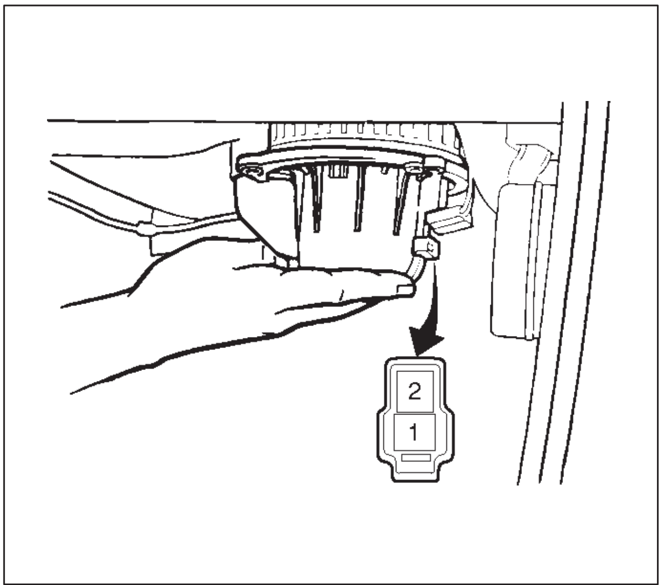
Chart “F” Blower Motor Does Not Stop In The “OFF” Position

Step	Action	Yes	No
1	Is the fan control lever (Fan Switch) OK?	Short circuit between chassis side connector terminal No. C38-2 and No. C41-2, No. C41-3 and No. I23-5, No. C41-6 and No. I23-4, No. C41-4 and No. I23-3 or No. C41-1 and No. I23-2	Replace control lever assembly.

Individual Inspection

Blower Motor

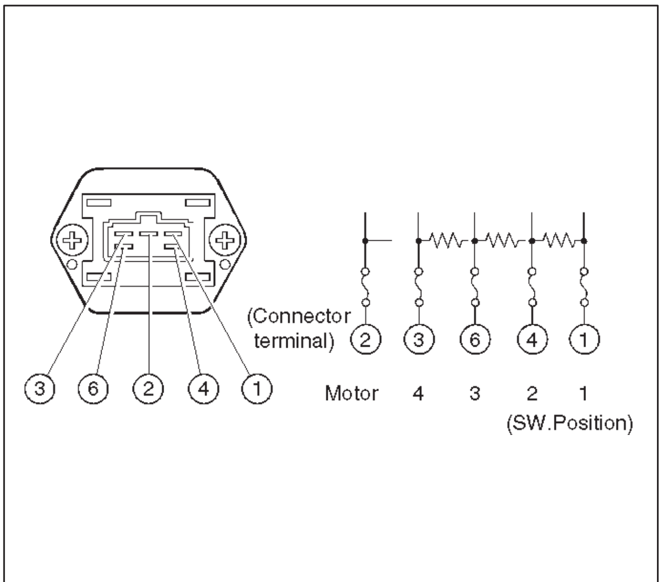
1. Disconnect the blower motor (C-38) connector from the blower motor.
2. Connect the battery positive terminal to the No. 1 terminal of the blower motor and the negative to the No. 2.
3. Be sure to check to see if the blower motor operates correctly.



873RS005

Resistor

1. Disconnect the resistor (C-41) connector.
2. Check for continuity and resistance between the terminals of the resistor.



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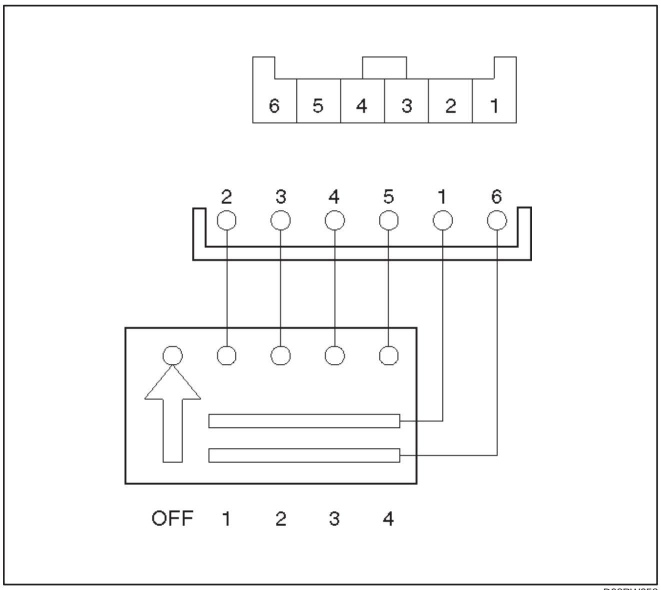
Fan Control Lever (Fan Switch)

1. Check for continuity between the terminals of the fan switch.



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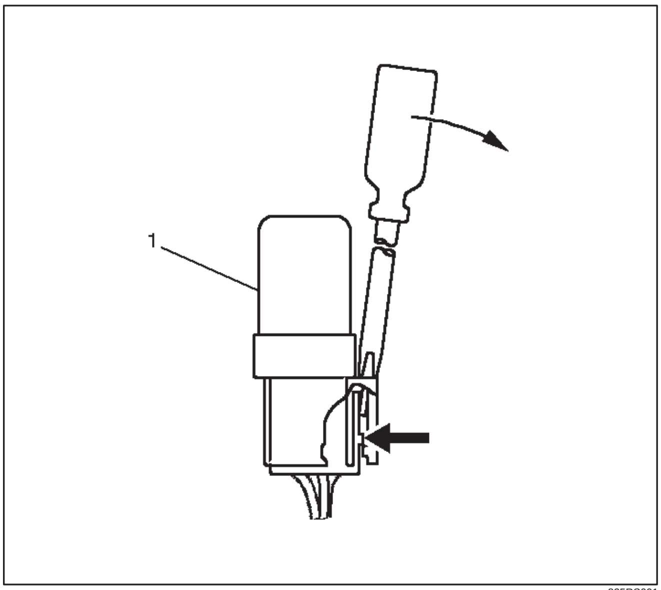
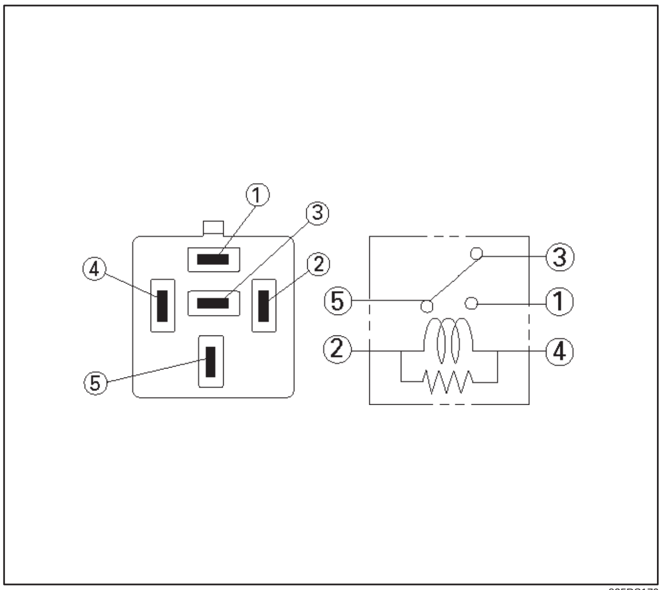
Heater Relay

1. Disconnect the heater relay (X-1).
   - When removing the connector for relay, unfasten the tank lock of the connector by using a screwdriver, then pull the relay (1) out.



825RS001

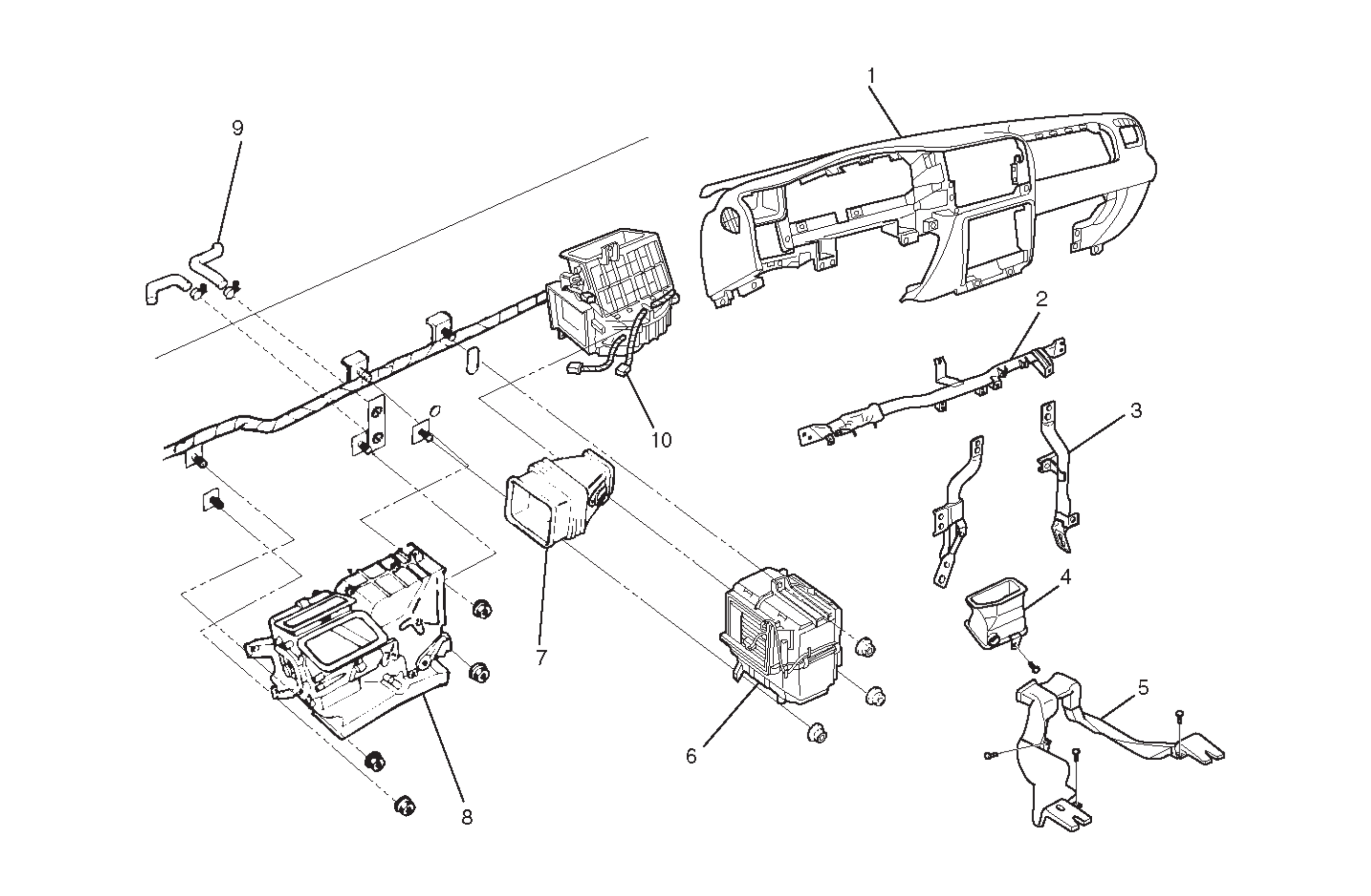
2. Check for continuity between the heater relay (X-1) terminals.



825RS179

Heater Unit

Heater Unit and Associated Parts



Legend

(1) Instrument Panel Assembly
(2) Cross Beam Assembly
(3) Instrument Panel Bracket
(4) Ventilation Lower Duct
(5) Rear Heater Duct
(6) Evaporator Assembly (A/C only)
(7) Duct
(8) Heater Unit Assembly
(9) Heater Hose
(10) Resistor Connector

Removal

1. Disconnect the battery ground cable.
2. Drain the engine coolant.
3. Discharge and recover refrigerant (with air conditioning).
   - Refer to Refrigerant Recovery in this section.
4. Remove the Instrument panel assembly.
   - Refer to Instrument Panel Assembly in Body and Accessories section.
5. Remove instrument panel bracket.
   - Refer to Cross Beam Assembly in Body and Accessories section.
6. Cross Beam Assembly.
   - Refer to Cross Beam Assembly in Body and Accessories section.
7. Disconnect resistor connector.
8. Remove duct.
9. Remove evaporator assembly (A/C only).
   - Refer to Evaporator Assembly in this section.
10. Remove ventilation lower duct.
11. Remove rear heater duct.
    - Remove foot rest, carpet and 3 clips.
12. Remove heater unit assembly.
    - Disconnect heater hoses at heater unit.

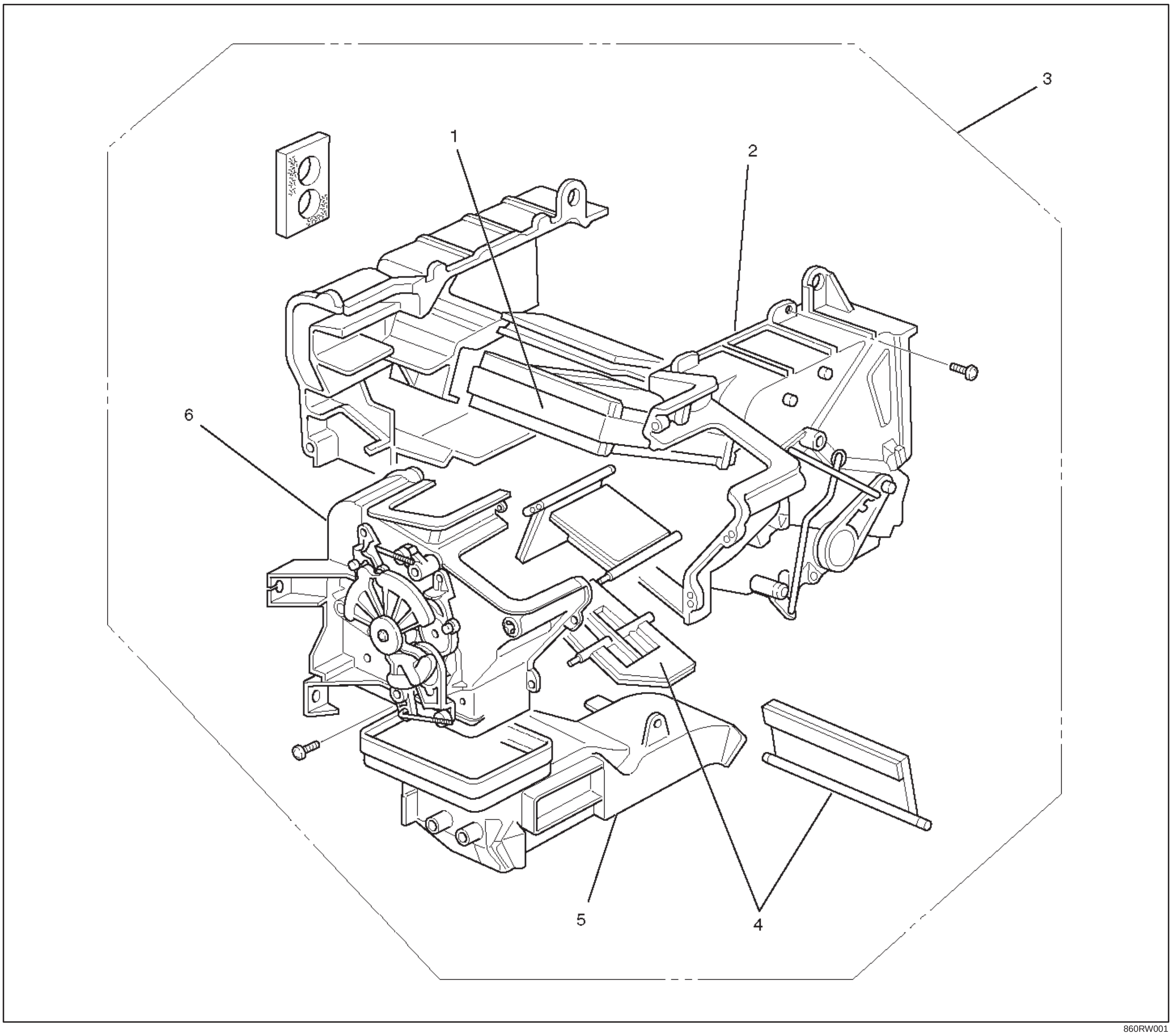
Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. When handling the PCM and the control unit, be careful not to make any improper connection of the connectors.
2. Adjust the control cables.
   - Refer to Control Lever Assembly in this section.
3. When installing the heater unit, defroster nozzle and center vent duct, be sure that the proper seal is made, without any gap between them.

Heater Core and / or Mode Door

Disassembled View



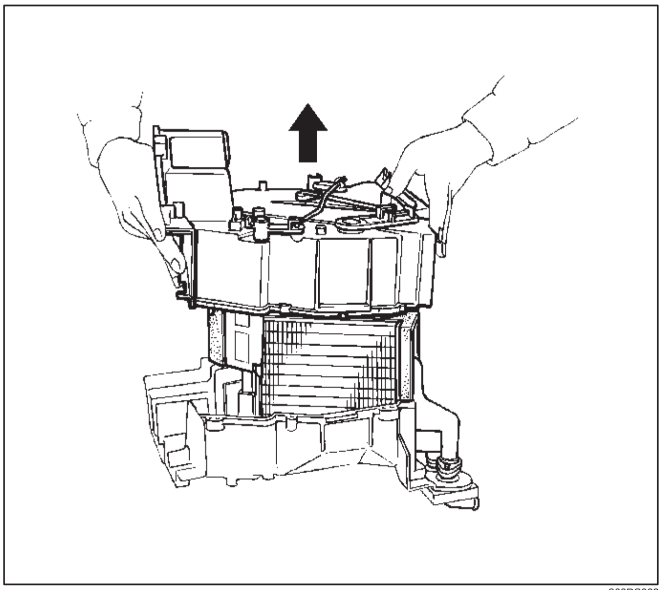
Legend

(1) Heater Core
(2) Case (Temperature Control)
(3) Heater Unit
(4) Mode Door
(5) Duct
(6) Case (Mode Control)

Removal

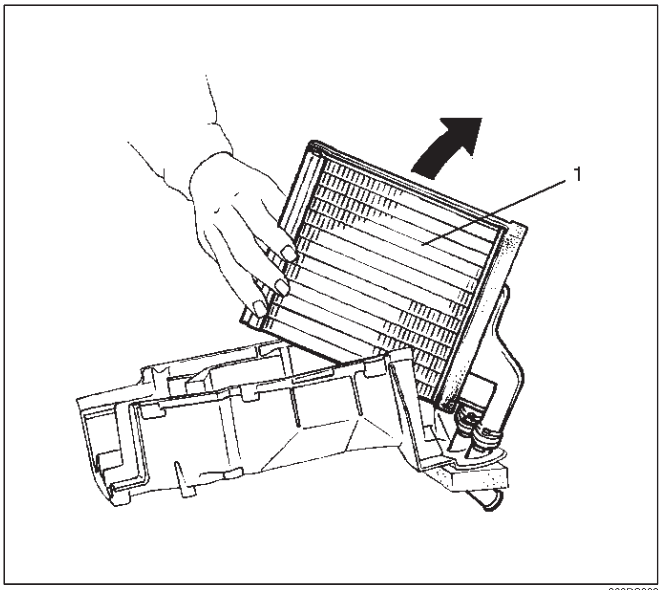
1. Disconnect the battery ground cable.
2. Drain the engine coolant.
3. Discharge and recover refrigerant (with air conditioning).
   - Refer to Refrigerant Recovery in this section.

4. Remove heater unit.
   - Refer to Heater Unit in this section.
5. Remove duct.
6. Remove case (Mode control) and do not remove link unit at this step.
7. Remove case (Temperature control) separate two halves of core case.



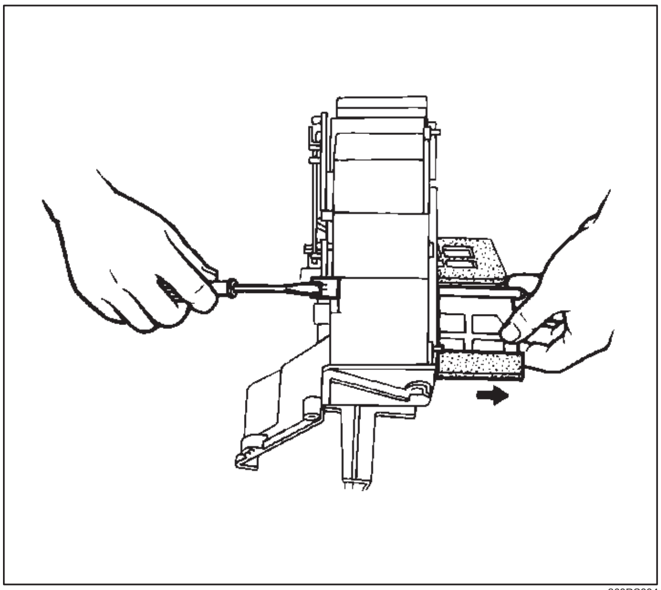
860RS002

8. Remove heater core (1).



860RS003

9. Pull out the mode door while raising up the catch of the door lever.



860RS004

Inspection

Check for foreign matter in the heater core, stain or the core fin defacement.

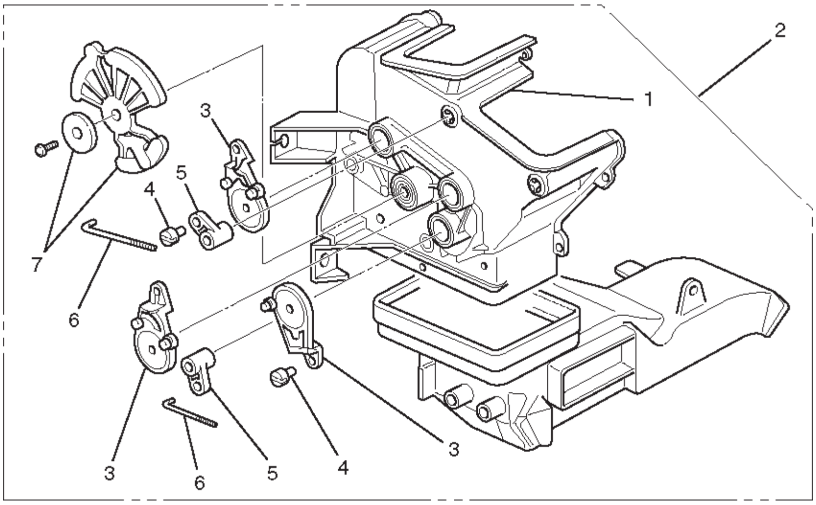
Installation

To install, follow the removal steps in the reverse order, noting the following point:

1. Check that each mode door operates properly.

Heater Mode Control Link Unit

Disassembled View



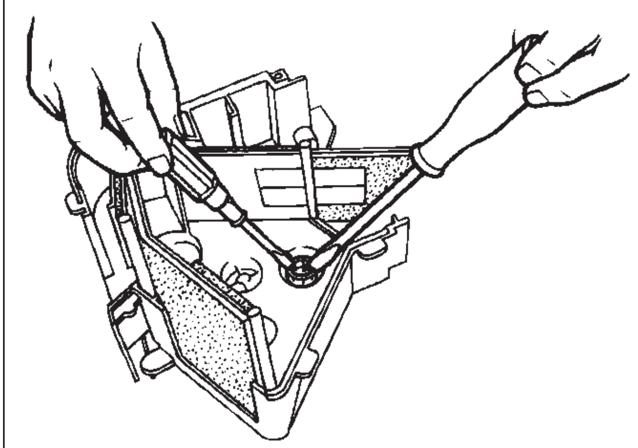
860RW002

Legend

(1) Case (Mode Control)
(2) Heater Unit
(3) Mode Sub-lever
(4) Clip
(5) Door Lever
(6) Rod
(7) Washer and Mode Main Lever

Removal

1. Disconnect the battery ground cable.
2. Drain engine coolant.
3. Discharge and recover refrigerant (with air conditioning)
   - Refer to Refrigerant Recovery in this section.
4. Remove heater unit.
   - Refer to Heater Unit in this section.
5. Remove the case (Mode control) from heater unit.
6. Remove washer and the mode main lever.
7. Remove rod.
8. Press the tab of the sub-lever inward, and take out the sub-lever.



860RS006

9. Pull out the door lever while raising up the catch of the door lever.
10. Remove clip.

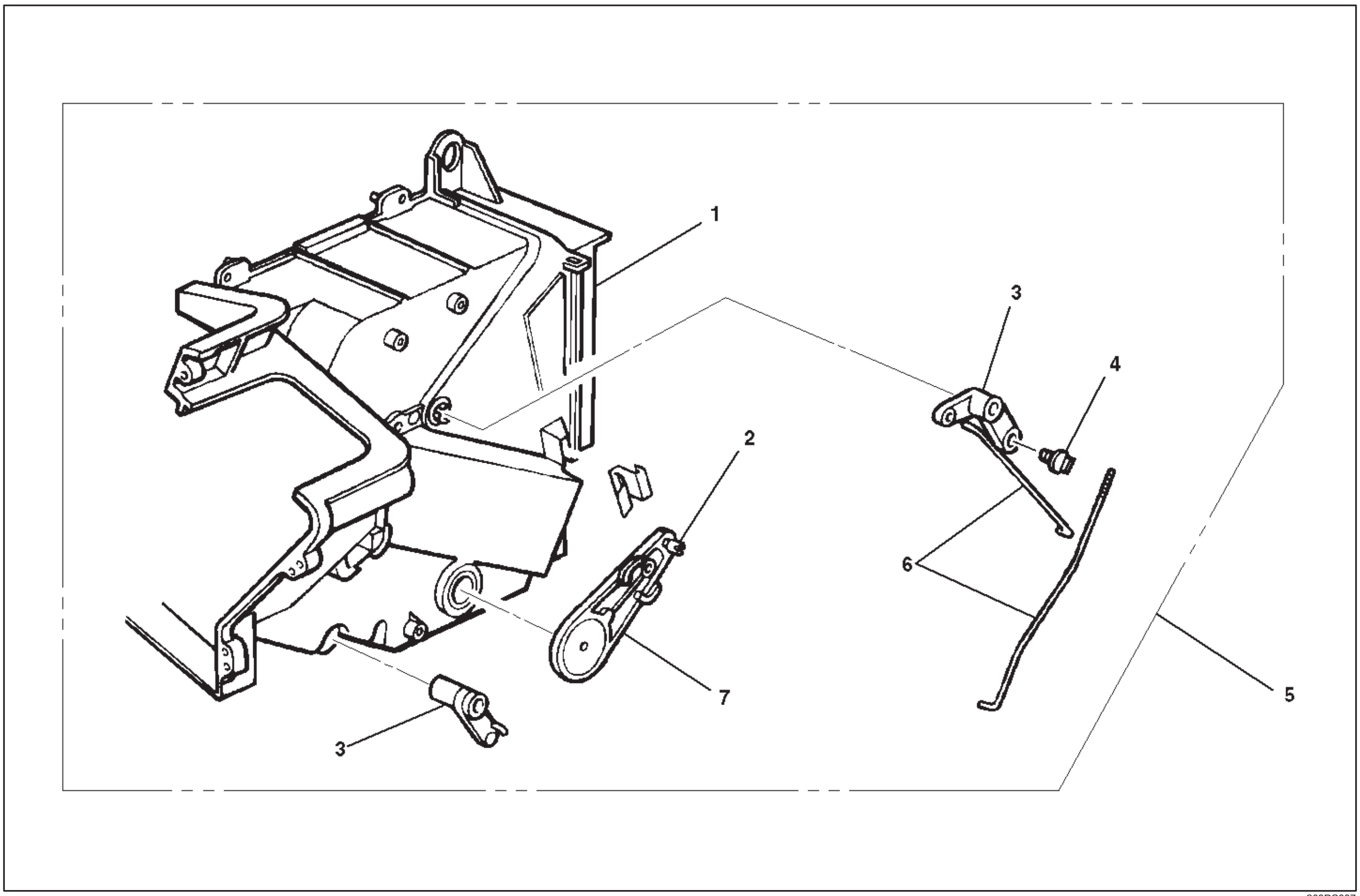
Installation

To install, follow the remove steps in the reverse order, noting the following points:

1. Apply grease to the mode sub-lever and to the abrasive surface of the heater unit.
2. After installing the link unit, check to see if the link unit operates correctly.

Heater Temperature Control Link Unit

Disassembled View



Legend

(1) Case (Temperature control)
(2) Clip
(3) Door Lever
(4) Clip
(5) Heater Unit
(6) Rod
(7) Sub-lever

Removal

1. Disconnect the battery ground cable.
2. Drain engine coolant.
3. Discharge and recover refrigerant (with air conditioning).
   - Refer to Refrigerant Recovery in this section.
4. Remove heater unit.
   - Refer to Heater Unit in this section.
5. Remove the case (Temperature control) from the heater unit.
6. Remove rod.
7. Remove sub-lever.
8. Pull out the door lever while raising up the catch of the door lever.
9. Remove clip.

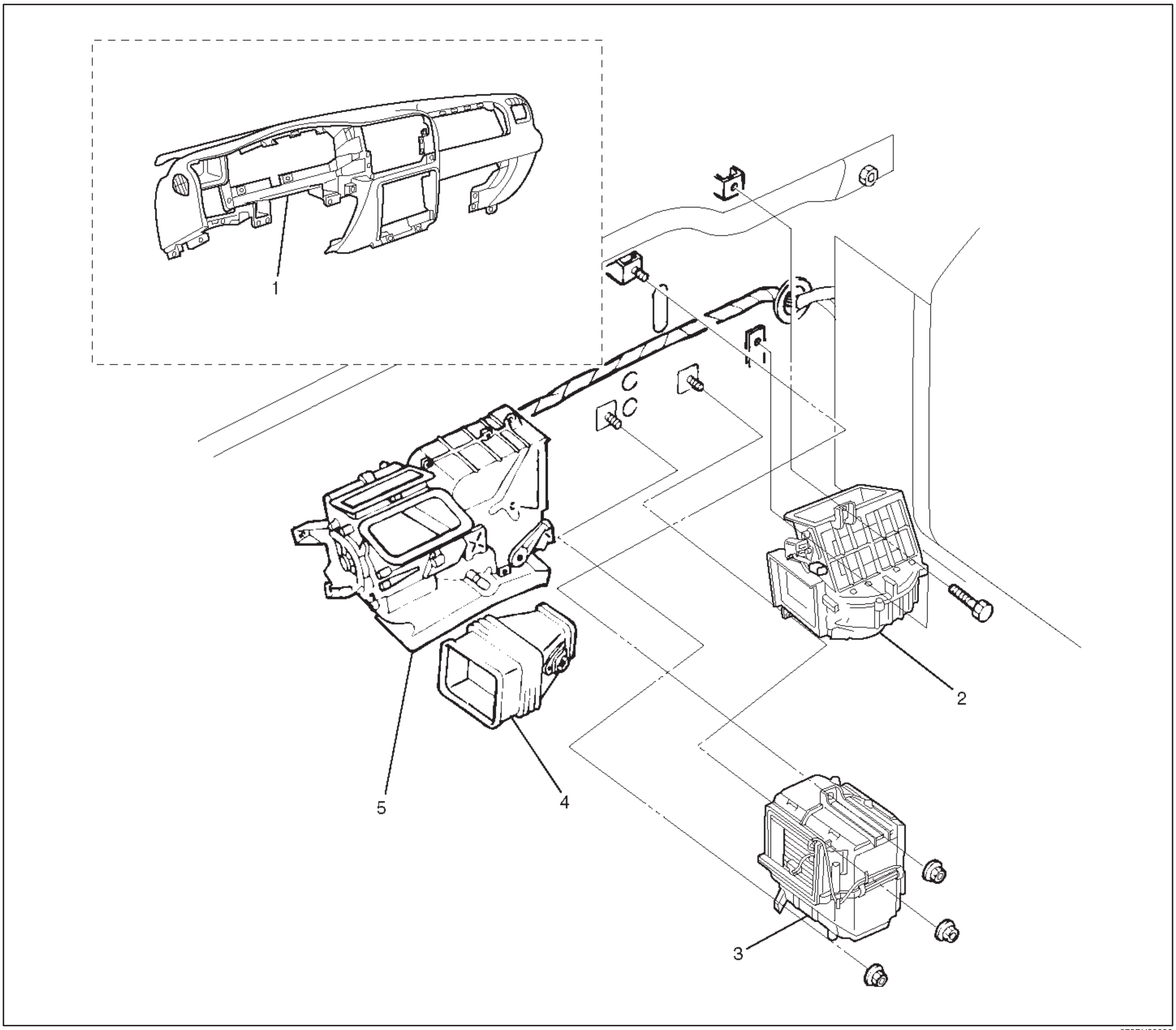
Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Apply grease to the sub-lever and to the abrasive surface of the heater unit.
2. After installing the link unit, check to see if the link unit operates correctly.

Blower Assembly

Blower Assembly and Associated Parts



Legend

(1) Instrument Panel Assembly
(2) Blower Assembly
(3) Evaporator Assembly (A/C only)
(4) Duct
(5) Heater Unit

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant (with air conditioning).
   - Refer to Refrigerant Recovery in this section.
3. Remove instrument panel assembly.
   - Refer to Instrument Panel Assembly in Body and Accessories section.
4. Disconnect resistor connector.
5. Remove duct.

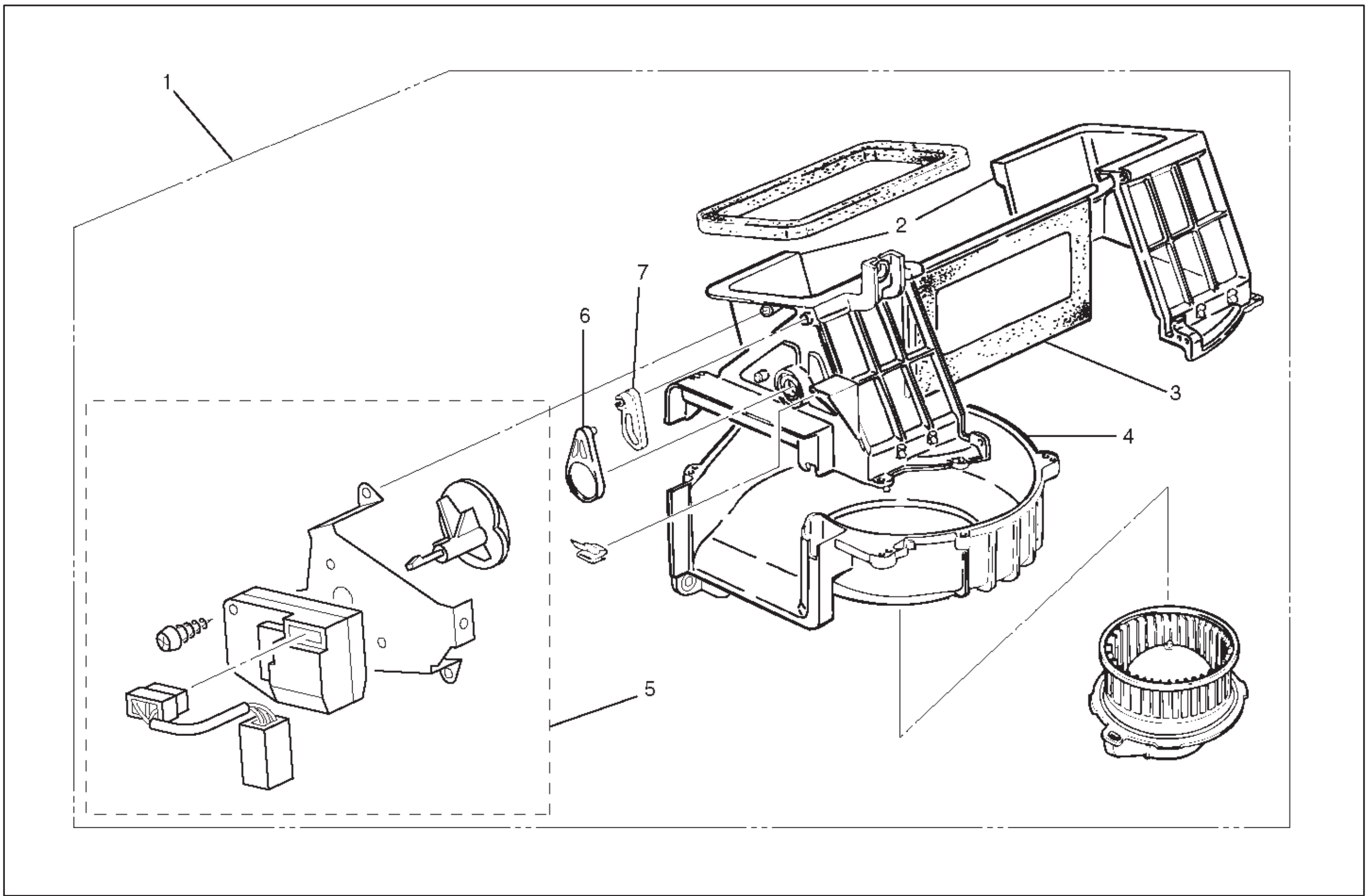
6. Remove evaporator assembly (A/C only).
   - Refer to Evaporator Assembly in this section.
7. Disconnect blower motor connector.
8. Remove blower assembly.

Installation

To install, follow the removal steps in the reverse order.

Blower Link Unit and / or Mode door

Disassembled View



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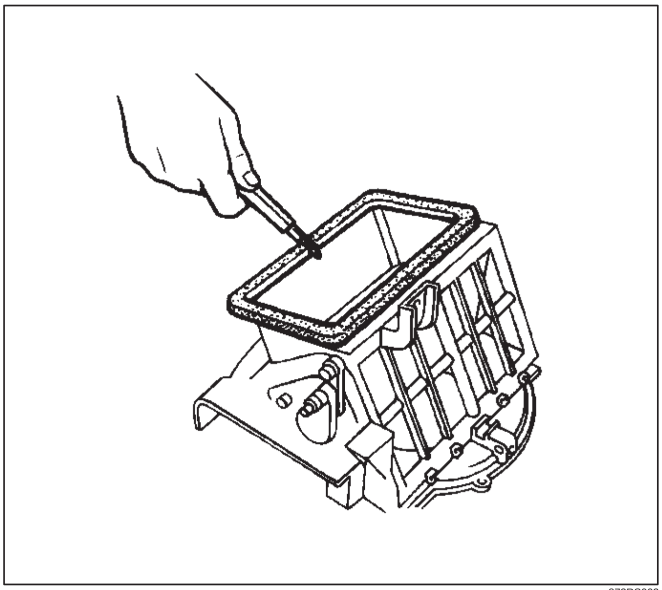
Legend

(1) Blower Assembly
(2) Upper Case
(3) Mode Door
(4) Lower Case
(5) Intake Actuator
(6) Sub Lever
(7) Door Lever

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant (with air conditioning).
   - Refer to Refrigerant Recovery in this section.
3. Remove blower assembly.
   - Refer to Blower Assembly in this section.
4. Remove intake actuator.
5. Remove lower case.

6. Separate the upper case and slit the lining parting face with a knife.



873RS002

7. Pull out the mode door while raising up the catch of door lever.
8. Remove sub-lever.
9. Remove door lever.

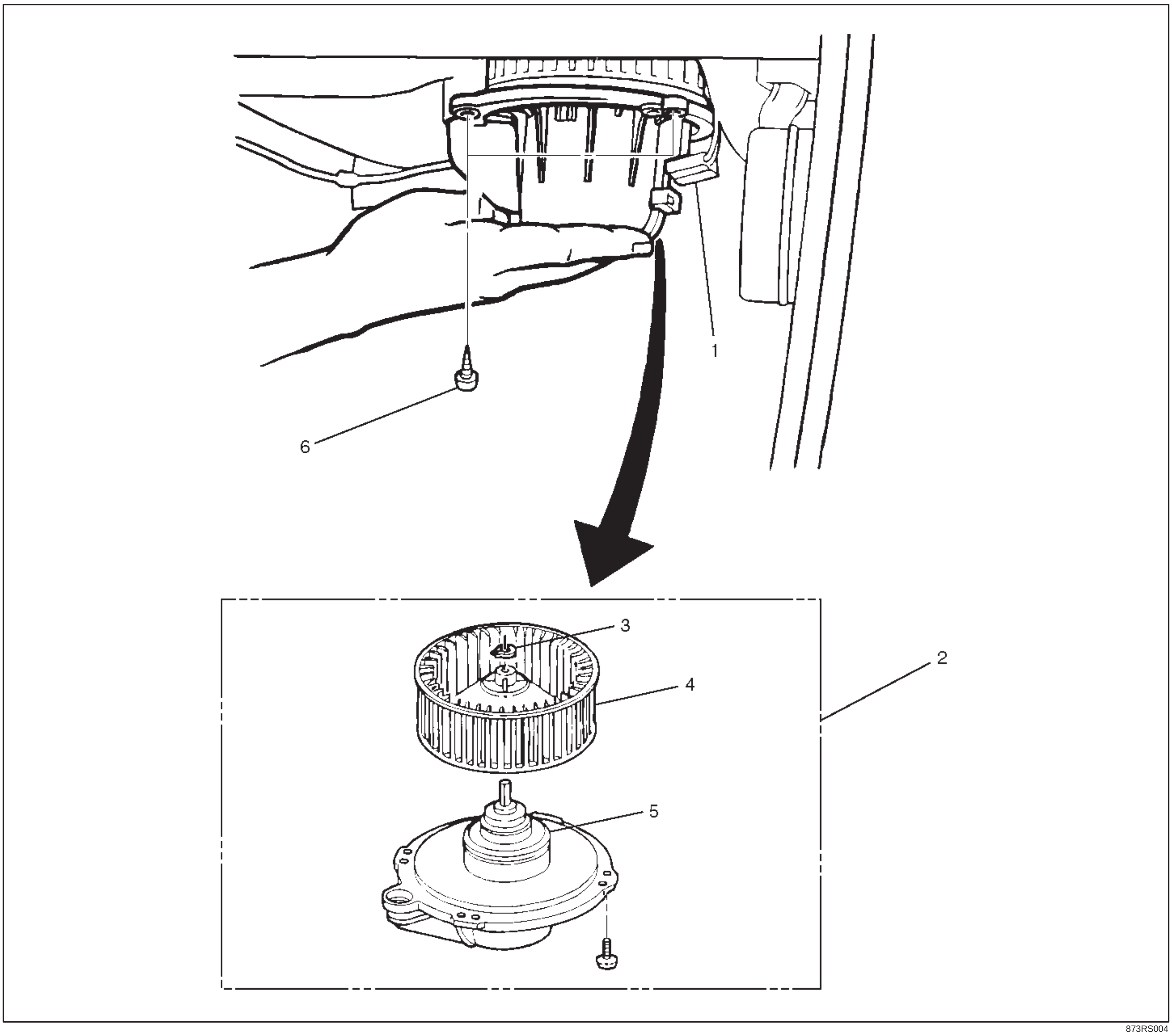
Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Apply grease to the door lever and to the abrasive surface of the upper case.
2. Apply an adhesive to the parting face of the lining when assembling the upper case.

Blower Motor

Blower Motor and Associated Parts



Legend

(1) Blower Motor Connector
(2) Blower Motor Assembly
(3) Clip
(4) Fan
(5) Blower Motor
(6) Attaching Screw

Removal

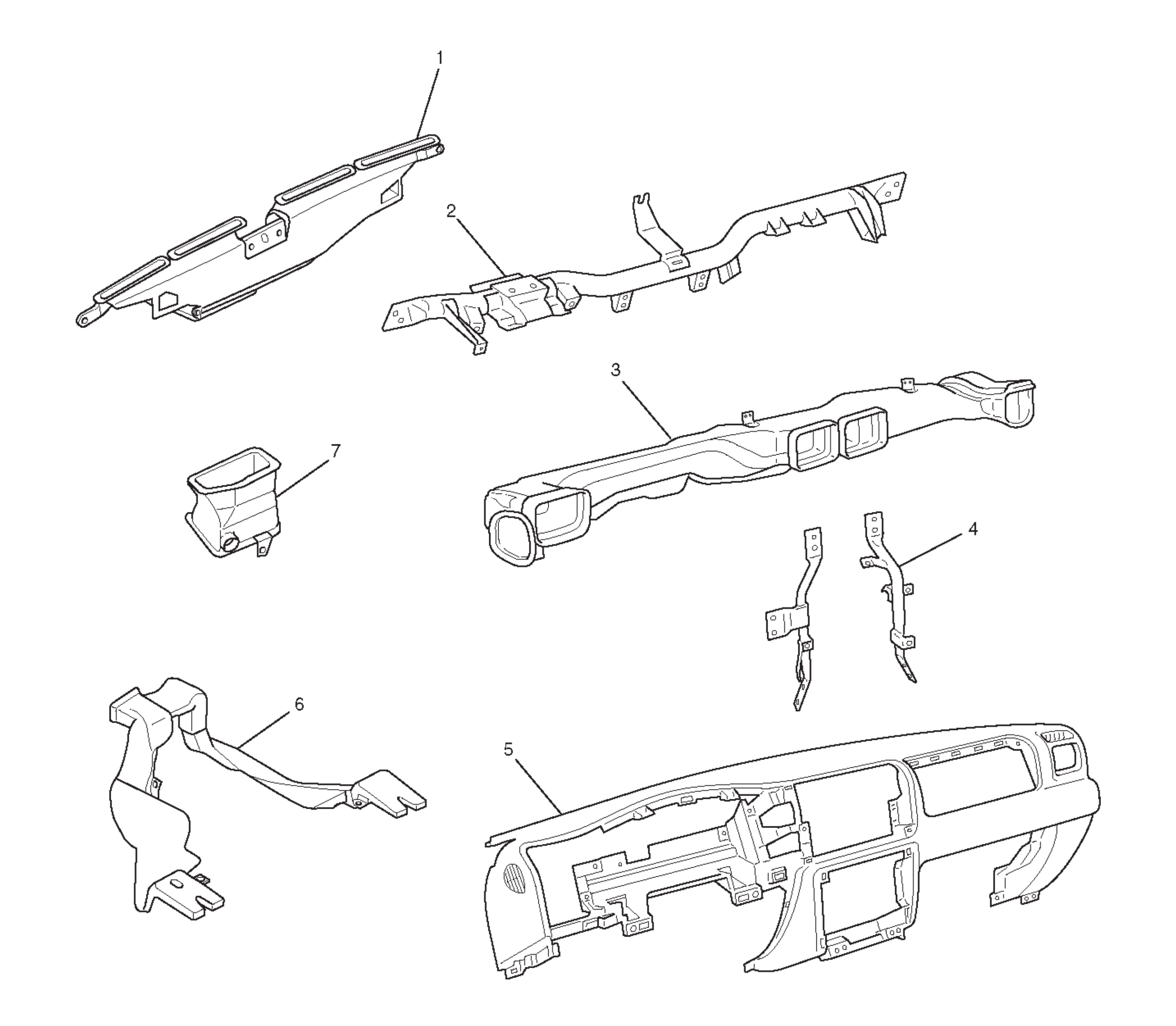
1. Disconnect the battery ground cable.
2. Remove blower motor connector.
3. Remove attaching screw.
4. Remove blower motor assembly.
5. Remove clip.
6. Remove fan.
7. Remove blower motor.

Installation

To install, follow the removal steps in the reverse order.

Rear Heater Duct, Defroster Nozzle and Ventilation Duct

Rear Heater Duct, Defroster Nozzle, Ventilation Duct and Associated Parts



Legend

(1) Defroster Nozzle
(2) Cross Beam Assembly
(3) Center Ventilation Duct and Side Defroster Duct
(4) Instrument Panel Bracket
(5) Instrument Panel Assembly
(6) Rear Heater Duct
(7) Ventilation Lower Duct

Removal

1. Disconnect the battery ground cable.
2. Remove instrument panel assembly.
   - Refer to Instrument Panel Assembly in Body and Accessories section.
3. Remove center ventilation duct and side defroster duct.
   - Remove 5 screws.
4. Remove instrument panel brackets.
   - Refer to Cross Beam Assembly in Body and Accessories section.
5. Remove cross beam assembly.
   - Refer to Cross Beam Assembly in Body and Accessories section.
6. Remove ventilation lower duct.
7. Remove rear heater duct.
   - Remove foot rest carpet and 3 clips.

8. Remove defroster nozzle.

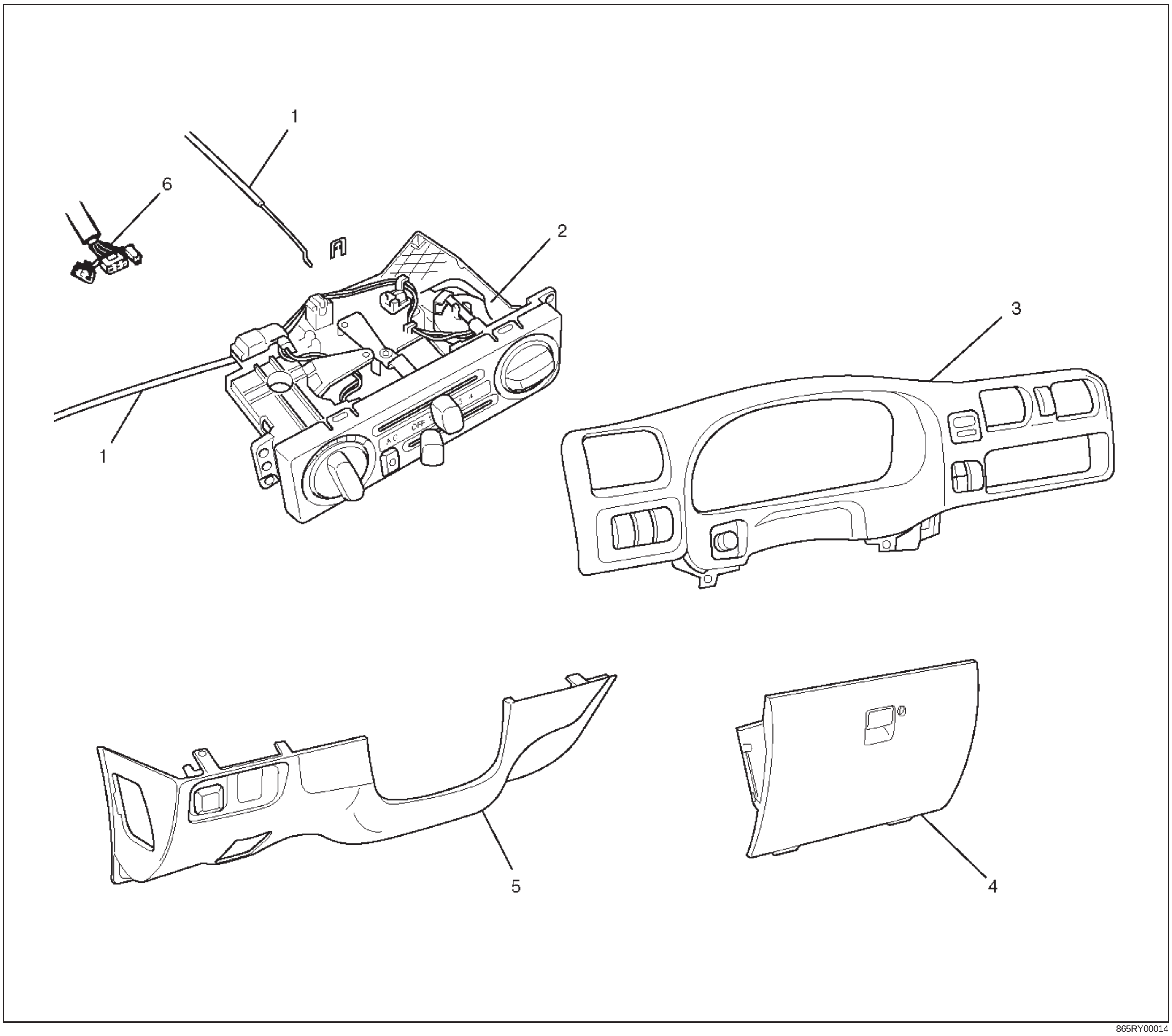
Installation

To install, follow the removal steps in the reverse order, noting the following point:

1. Connect each duct and nozzle securely leaving no clearance between them and making no improper matching.

Control Lever Assembly and / or Control Cable

Control Lever Assembly, Control Cable and Associated Parts

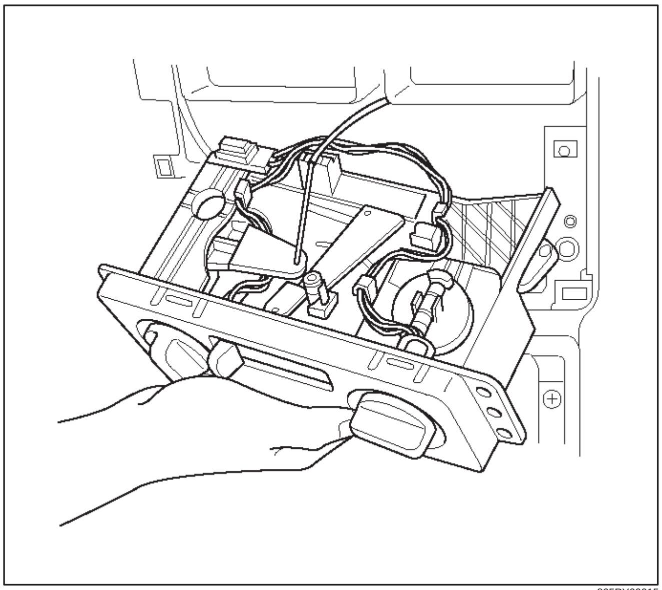


Legend

(1) Control Cable
(2) Control Lever Assembly
(3) Meter Cluster Assembly
(4) Glove Box
(5) Instrument Panel Driver Lower Cover Assembly
(6) Fan Switch Air Conditioning Switch Connector

Removal

1. Disconnect the battery ground cable.
2. Remove instrument panel driver lower cover assembly.
3. Remove meter cluster assembly.
   - Refer to Instrument Panel Assembly in Body and Accessories section.
4. Remove glove box.
5. Remove the control lever attaching screws.
6. Pull the control lever assembly out and disconnect the fan switch and air conditioning switch connectors.



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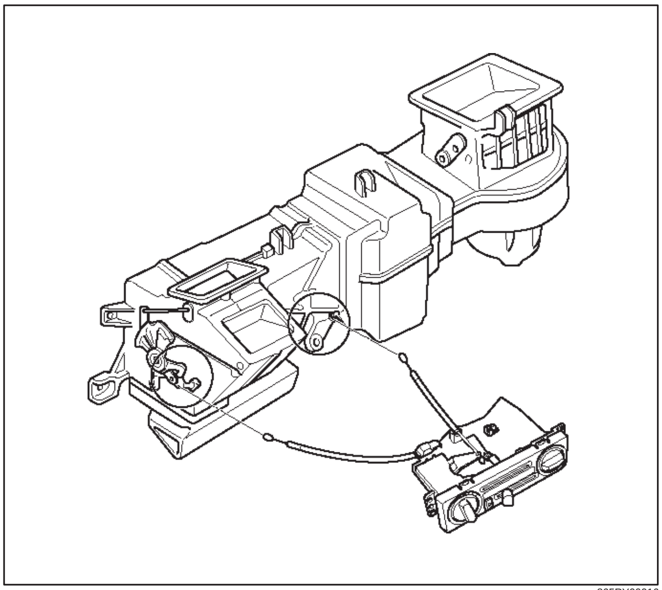
7. Remove control level assembly.
8. Disconnect control cables at each unit side.

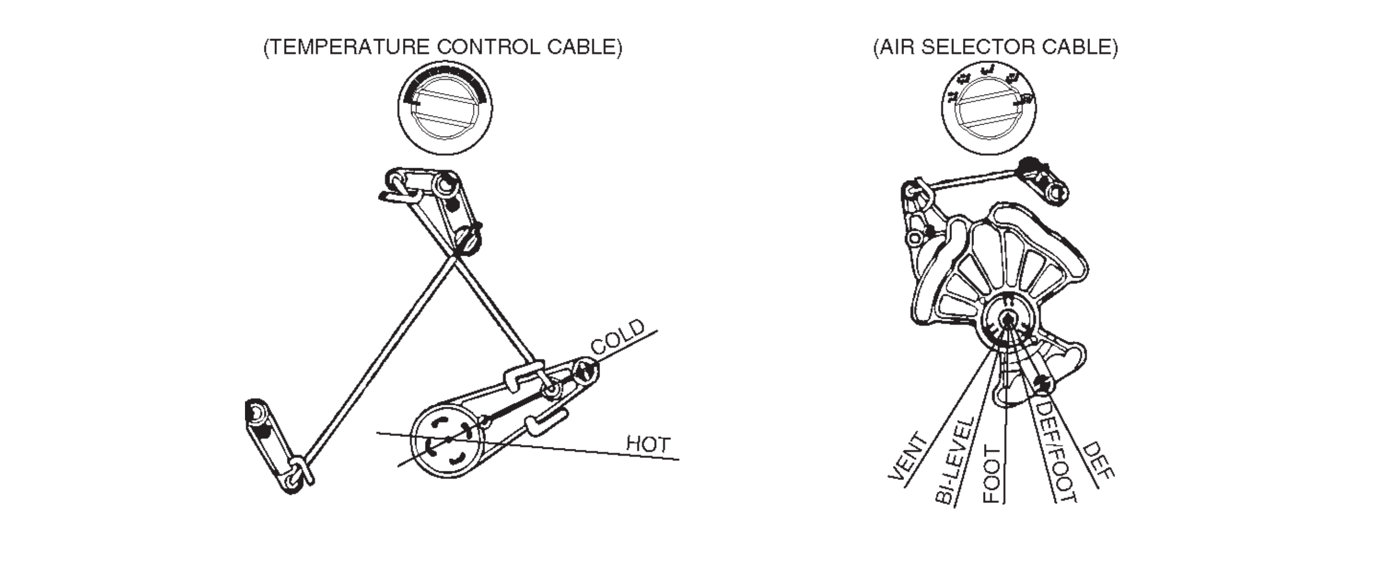


865RY00016

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Adjust the control cable.



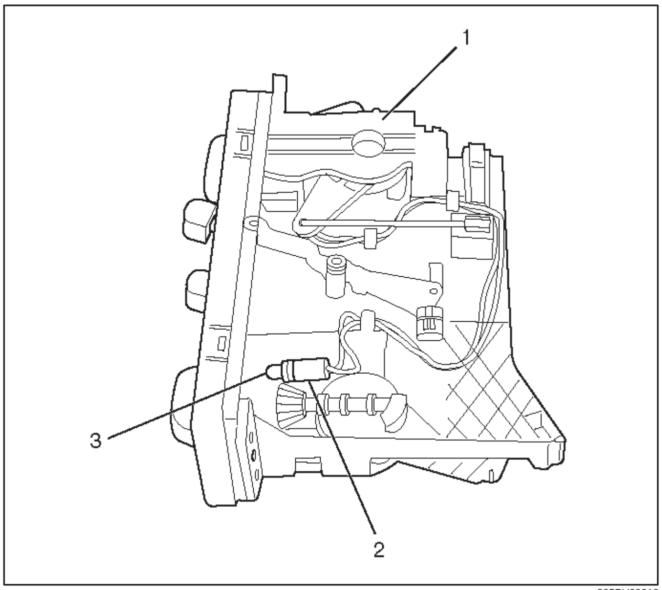
865RY00017

- Temperature control cable.
  1. Turn the control knob to the left (“MAX COLD” position).
  2. Connect the control cable at the “COLD” position of the temperature control link of the heater unit and secure it with the clip.
- Air select control cable
  1. Turn the control knob to the right (“DEFROST” position).
  2. Connect the control cable at the “DEFROST” position of the mode control link of the heater unit and secure it with the clip.

2. Check the control cable operation.

Control Panel Illumination Bulb

Control Panel Illumination Bulb and Associated Parts



865RY00018

Legend

(1) Control Lever Assembly
(2) Bulb Socket
(3) Illumination Bulb

Removal

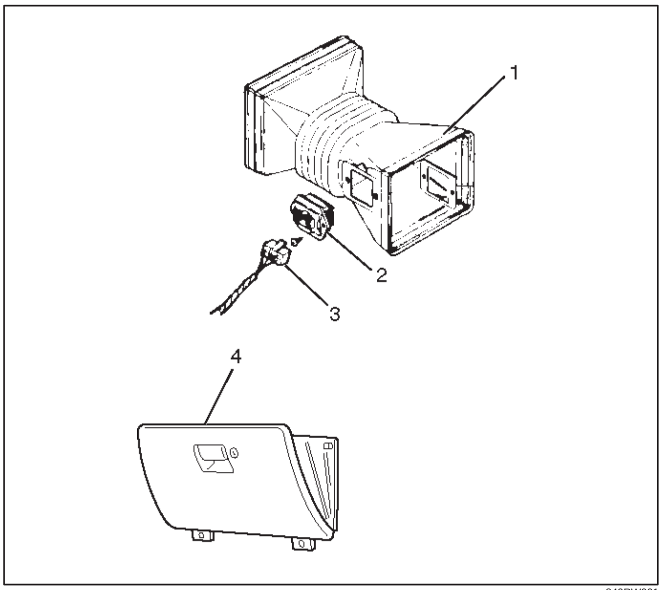
1. Disconnect the battery ground cable.
2. Remove control lever assembly.
   - Refer to Control Lever Assembly in this section.
3. Pull out the bulb socket from the panel by turning it counterclockwise.
4. Pull the illumination bulb from the socket.

Installation

To install, follow the removal steps in the reverse order.

Resistor

Resistor and Associated Parts



840RW001

Legend

(1) Duct (Heater only)
(2) Resistor
(3) Resistor Connector
(4) Glove Box

Removal

1. Disconnect the battery ground cable.
2. Remove glove box.
3. Remove resistor connector.
4. Remove duct (heater only).
5. Remove resistor.

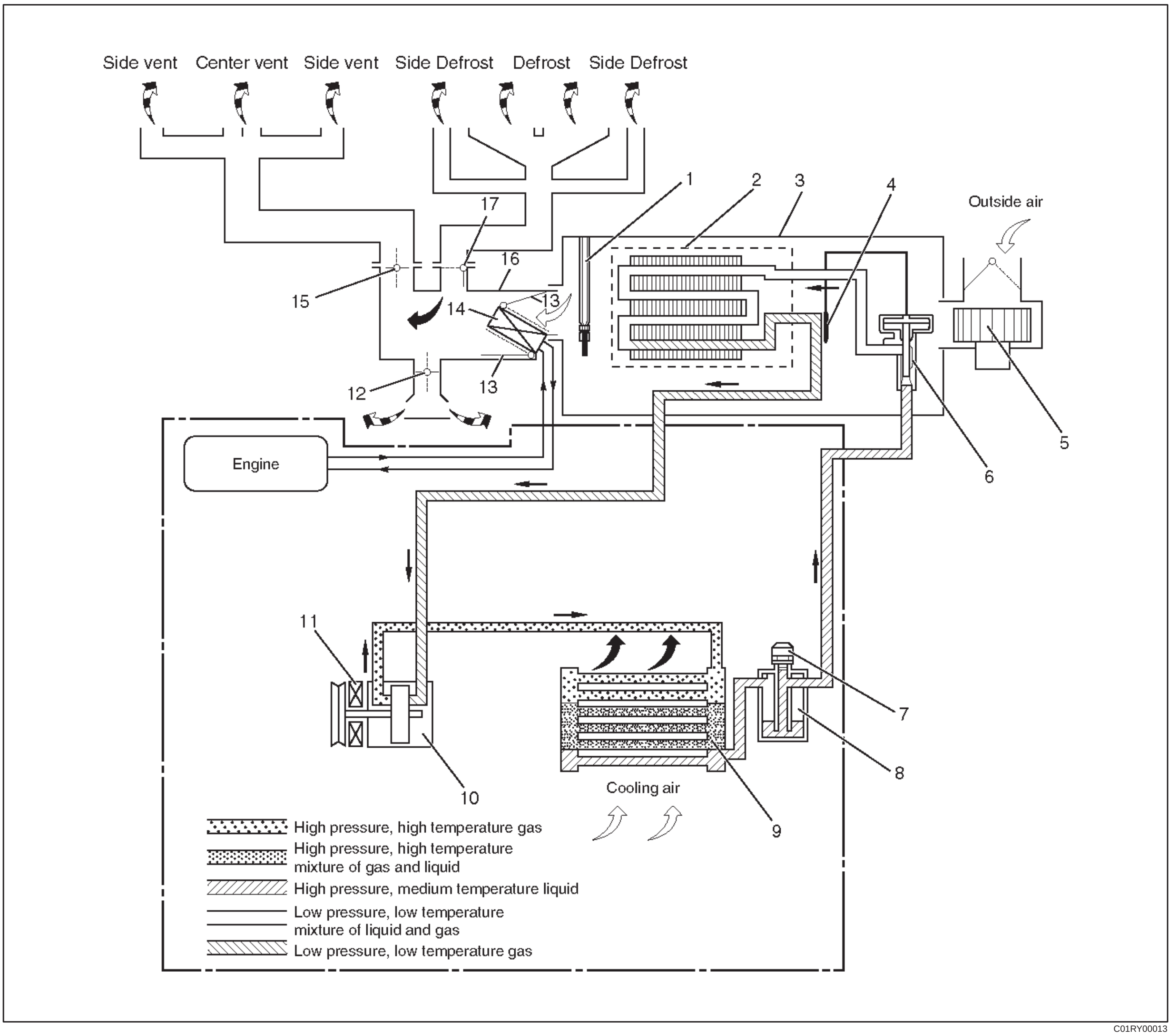
Installation

To install, follow the removal steps in the reverse order.

Air Conditioning System

General Description

Air Conditioning Refrigerant Cycle Construction



Legend

(1) Electronic Thermostat
(2) Evaporator Core
(3) Evaporator Assembly
(4) Temperature Sensor
(5) Blower Motor
(6) Expansion Valve
(7) Pressure Switch or Pressure Sensor
(8) Receiver/Drier
(9) Condenser
(10) Compressor
(11) Magnetic Clutch
(12) Mode (HEAT) Control Door
(13) Temp. Control Door (Air Mix Door)
(14) Heater Core
(15) Mode (VENT) Control Door
(16) Heater Unit
(17) Mode (DEF) Control Door

The refrigeration cycle includes the following four processes as the refrigerant changes repeatedly from liquid to gas and back to liquid while circulating.

Evaporation

The refrigerant is changed from a liquid to a gas inside the evaporator. The refrigerant mist that enters the

evaporator vaporizes readily. The liquid refrigerant removes the required quantity of heat (latent heat of vaporization) from the air around the evaporator core cooling fins and rapidly vaporizes. Removing the heat cools the air, which is then radiated from the fins and lowers the temperature of the air inside the vehicle.
The refrigerant liquid sent from the expansion valve and the vaporized refrigerant gas are both present inside the evaporator as the liquid is converted to gas.
With this change from liquid to gas, the pressure inside the evaporator must be kept low enough for vaporization to occur at a lower temperature. Because of that, the vaporized refrigerant is sucked into the compressor.

Compression

The refrigerant is compressed by the compressor until it is easily liquefied at normal temperature.
The vaporized refrigerant in the evaporator is sucked into the compressor. This action maintains the refrigerant inside the evaporator at a low pressure so that it can easily vaporize, even at low temperatures close to 0˚C (32˚F).
Also, the refrigerant sucked into the compressor is compressed inside the cylinder to increase the pressure and temperature to values such that the refrigerant can easily liquefy at normal ambient temperatures.

Condensation

The refrigerant inside the condenser is cooled by the outside air and changes from gas to liquid.
The high temperature, high pressure gas coming from the compressor is cooled and liquefied by the condenser with outside air and accumulated in the receiver/drier. The heat radiated to the outside air by the high temperature, high pressure gas in the compressor is called heat of condensation. This is the total quantity of heat (heat of vaporization) the refrigerant removes from the vehicle interior via the evaporator and the work (calculated as the quantity of heat) performed for compression.

Expansion

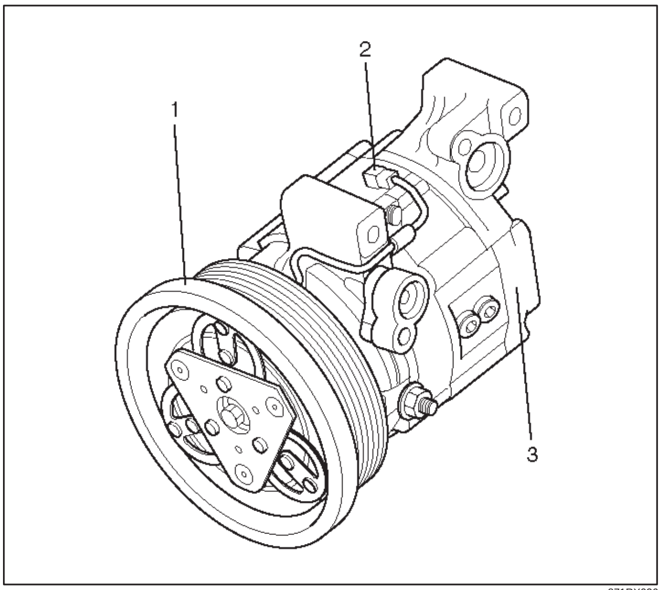
The expansion valve lowers the pressure of the refrigerant liquid so that it can easily vaporize.
The process of lowering the pressure to encourage vaporization before the liquefied refrigerant is sent to the evaporator is called expansion. In addition, the expansion valve controls the flow rate of the refrigerant liquid while decreasing the pressure.
That is, the quantity of refrigerant liquid vaporized inside the evaporator is determined by the quantity of heat which must be removed at a prescribed vaporization temperature. It is important that the quantity of refrigerant be controlled to exactly the right value.

Compressor

The compressor performs two main functions:
It compresses low-pressure and low-temperature refrigerant vapor from the evaporator into high-pressure and high-temperature refrigerant vapor to the condenser.
It pumps refrigerant and refrigerant oil through the air conditioning system.
This vehicle is equipped with a five-vane rotary compressor.
The specified amount of the compressor oil is 150cc (5.0 fl. oz.).
The oil used in the HFC-134a system compressor differs from that used in R-12 systems.
Also, compressor oil to be used varies according to the compressor model. Be sure to avoid mixing two or more different types of oil.
If the wrong oil is used, lubrication will be poor and the compressor will seize or malfunction.
The magnetic clutch connector is a waterproof type.

Magnetic Clutch

The compressor is driven by the drive belt from the crank pulley of the engine. If the compressor is activated each time the engine is started, this causes too much load to the engine. The magnetic clutch transmits the power from the engine to the compressor and activates it when the air conditioning is ON. Also, it cuts off the power from the engine to the compressor when the air conditioning is OFF. Refer to Compressor in this section for magnetic clutch repair procedure.



871RX026

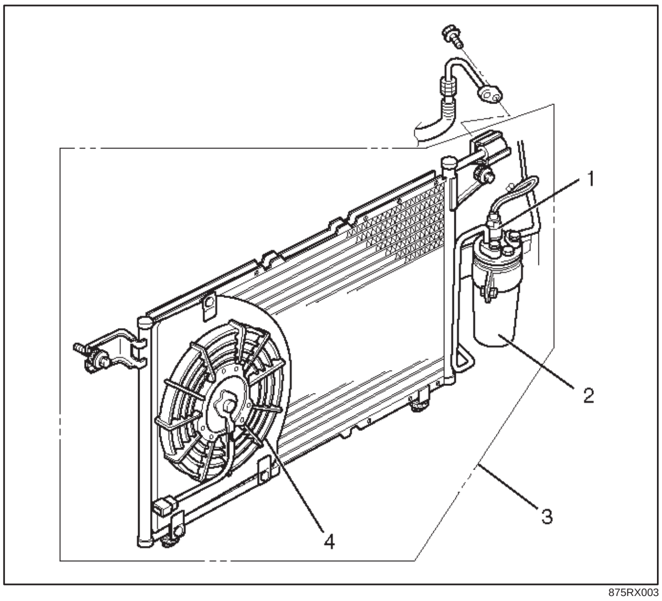
Legend

(1) Magnetic Clutch
(2) Magnetic Clutch Connector
(3) Compressor

Condenser

The condenser assembly is located in front of the radiator. It provides rapid heat transfer from the refrigerant to the cooling fins.
Also, it functions to cool and liquefy the high-pressure and high-temperature vapor sent from the compressor by the radiator fan or outside air.
A condenser may malfunction in two ways: it may leak, or it may be restricted. A condenser restriction will result in excessive compressor discharge pressure. If a partial restriction is present, the refrigerant expands after passing through the restriction.

Thus, ice or frost may form immediately after the restriction. If air flow through the condenser or radiator is blocked, high discharge pressures will result. During normal condenser operation, the refrigerant outlet line will be slightly cooler than the inlet line.
The vehicle is equipped with the parallel flow type condenser. A larger thermal transmission area on the inner surface of the tube allows the radiant heat to increase and the ventilation resistance to decrease.
The refrigerant line connection has a bolt at the block joint, for easy servicing.



Legend
(1) Pressure Switch
(2) Receiver Drier
(3) Condenser & Receiver Tank Assembly
(4) Condenser Fan (6VD1 A/T)

Receiver / Drier

The receiver/drier performs four functions:

- As the quantity of refrigerant circulated varies depending on the refrigeration cycle conditions, sufficient refrigerant is stored for the refrigeration cycle to operate smoothly in accordance with fluctuations in the quantity circulated.
- The liquefied refrigerant from the condenser is mixed with refrigerant gas containing air bubbles. If refrigerant containing air bubbles. If refrigerant containing air bubbles is sent to the expansion valve, the cooling capacity will decrease considerably. Therefore, the liquid and air bubbles are separated and only the liquid is sent to the expansion valve.
- The receiver/drier utilizes a filter and drier to remove the dirt and water mixed in the cycling refrigerant.
- The sight glass, installed atop the receiver/drier, show the state of the refrigerant.

A receiver/drier may fail due to a restriction inside the body of the unit. A restriction at the inlet to the receiver/drier will cause high pressure.
Outlet restrictions will be indicated by low pressure and little or no cooling. An excessively cold receiver/drier outlet may indicate a restriction.
The receiver/drier of this vehicle is made of aluminum with a smaller tank. It has a 300cc refrigerant capacity.
The refrigerant line connection has a bolt at the block joint, for easy servicing.

Dual Pressure Switch (V6,M/T)

The pressure switch (Dual pressure switch) is installed on the upper part of the receiver/drier, to detect excessively high pressure (high pressure switch) and prevent compressor seizure due to the refrigerant leaking (low pressure switch), so that the compressor is able to be turned “ON” or “OFF”.

Compressor	ON (kPa/psi)	OFF (kPa/psi)
Low-pressure control	205.9±29.4 (29.9±4.3)	176.5±19.6 (25.6±2.8)
High-pressure control	2059.4±196.1 (341.3±28.4)	2942.0±196.1 (426.6±28.4)

Triple Pressure Switch (V6, A/T)

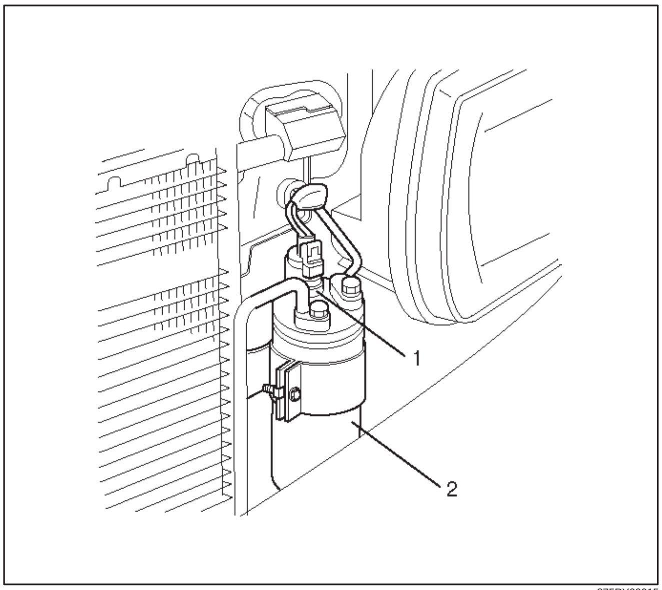
Triple pressure switch is installed on the upper part of the receiver/drier. This switch is constructed with a unitized type of two switches. One of them is a low and high pressure switch (Dual pressure switch) to switch “ON” or “OFF” the magnetic clutch as a result of irregularly high–pressure or low pressure of the refrigerant. The other one is a medium pressure switch (Cycling switch) to switch “ON” or “OFF” the condenser fan sensing the condenser high side pressure.

Compressor	ON (kPa/psi)	OFF (kPa/psi)
Low-pressure control	186.3±29.4 (27.0±4.3)	176.5±24.5 (25.6±3.6)
High-pressure control	2353.6±196.1 (341.3±28.4)	2942.0±196.1 (426.6±28.4)

Condenser fan	ON (kPa/psi)	OFF (kPa/psi)
Medium-pressure control	1471.0±98.1 (213.3±14.2)	1078.7±117.7 (156.4±17.1)

Pressure Sensor

The pressure sensor is installed on the upper part of the receiver/drier. This sensor converts high pressure detection of refrigerant to an electrical voltage signal and supplies it to the ECM. The ECM controls switching compressor idle speed and cooling fan operation by the electrical voltage signal.



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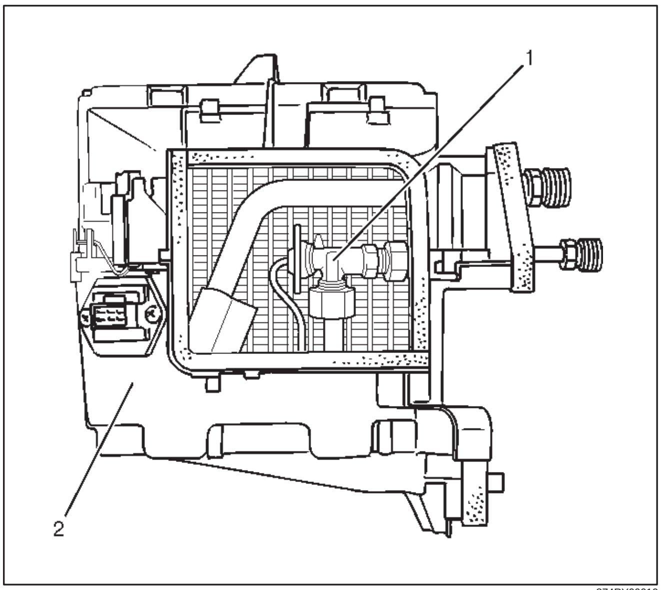
Legend

(1) Pressure Switch
(2) Receiver Drier



874RY00019

Legend

(1) Expansion Valve
(2) Evaporator Assembly

Expansion Valve

This expansion valve is an external pressure type and it is installed at the evaporator intake port.

The expansion valve converts the high pressure liquid refrigerant sent from the receiver/drier to a low pressure liquid refrigerant by forcing it through a tiny port before sending it to the evaporator.

This type of expansion valve consists of a temperature sensor, diaphragm, ball valve, ball seat, spring adjustment screw, etc.

The temperature sensor contacts the evaporator outlet pipe, and converts changes in temperature to pressure. It then transmits these to the top chamber of the diaphragm.

The refrigerant pressure is transmitted to the diaphragm's bottom chamber through the external equalizing pressure tube.

The ball valve is connected to the diaphragm. The opening angle of the expansion valve is determined by the force acting on the diaphragm and the spring pressure.

The expansion valve regulates the flow rate of the refrigerant. Accordingly, when a malfunction occurs to this expansion valve, both discharge and suction pressure get low, resulting in insufficient cooling capacity of the evaporator.

The calibration has been changed to match the characteristics of HFC-134a.

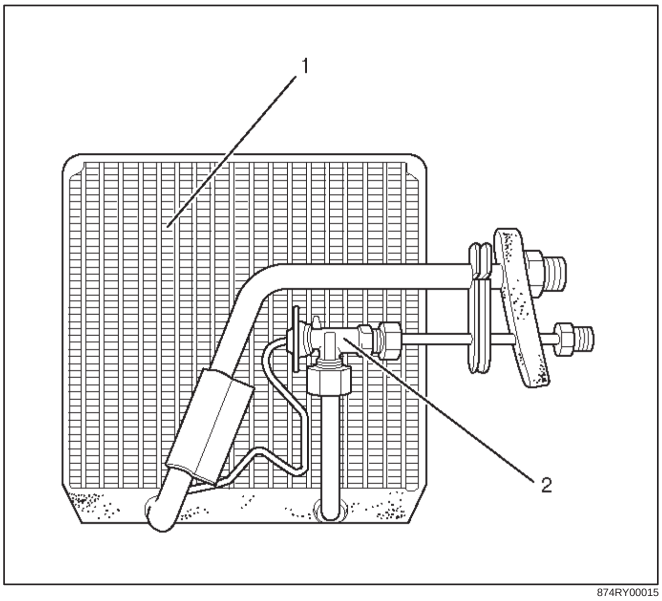
Evaporator

The evaporator cools and dehumidifies the air before the air enters the passenger compartment. High-pressure liquid refrigerant flows through the expansion valve into the low-pressure area of the evaporator. The heat in the air passing through the evaporator core is lost to the cooler surface of the core, thereby cooling the air.

As heat is lost between the air and the evaporator core surface, moisture in the vehicle condenses on the outside surface of the evaporator core and is drained off as water.

When the evaporator malfunctions, the trouble will show up as an inadequate supply of cool air. The cause is typically a partially plugged core due to dirt, or a malfunctioning blower motor.

The evaporator core with a laminate louver fin is a single-sided tank type where only one tank is provided under the core.



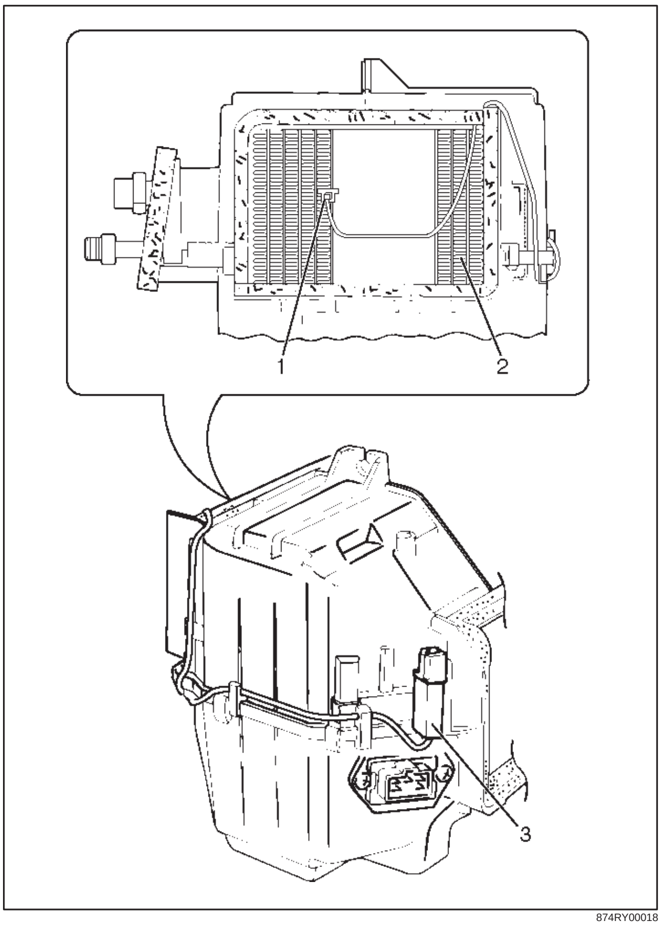
Legend

(1) Evaporator Core
(2) Expansion Valve

Electronic Thermostat

The thermostat consists of the duct sensor and thermostat unit which functions electrically to reduce the noises being generated while the system is in operation. The electronic duct sensor is mounted at the evaporator core outlet and senses the surface temperature of the evaporator core. Temperature signals are input to the thermostat unit. This information is compared by the thermo unit and results in the output to operate the A/C thermostat relay and turn the magnetic clutch ON or OFF to prevent evaporator freeze-up.

A characteristic of the sensor is that the resistance decreases as the temperature increases and the resistance increases as the temperature decreases.



Legend

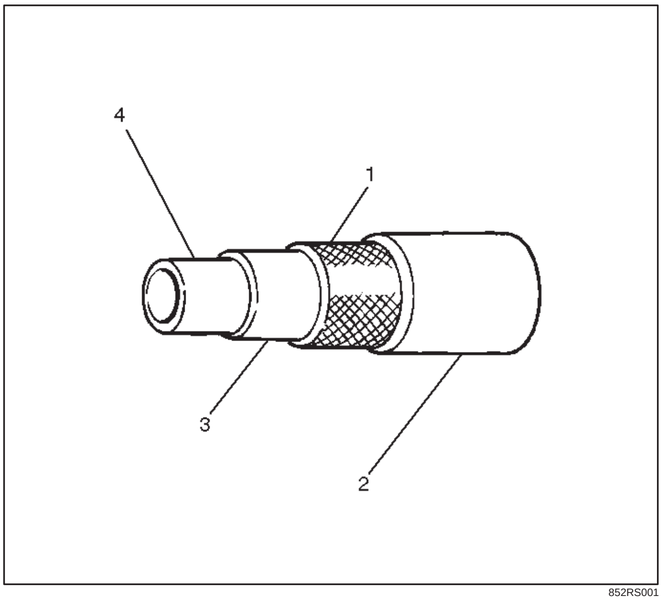
(1) Duct Sensor
(2) Evaporator Core
(3) Thermostat Unit

Refrigerant Line

Restriction in the refrigerant line will be indicated by:

1. Suction line — A restricted suction line will cause low suction pressure at the compressor, low discharge pressure and little or no cooling.
2. Discharge line — A restriction in the discharge line generally will cause the discharge line to leak.
3. Liquid line — A liquid line restriction will be evidenced by low discharge and suction pressure and insufficient cooling.

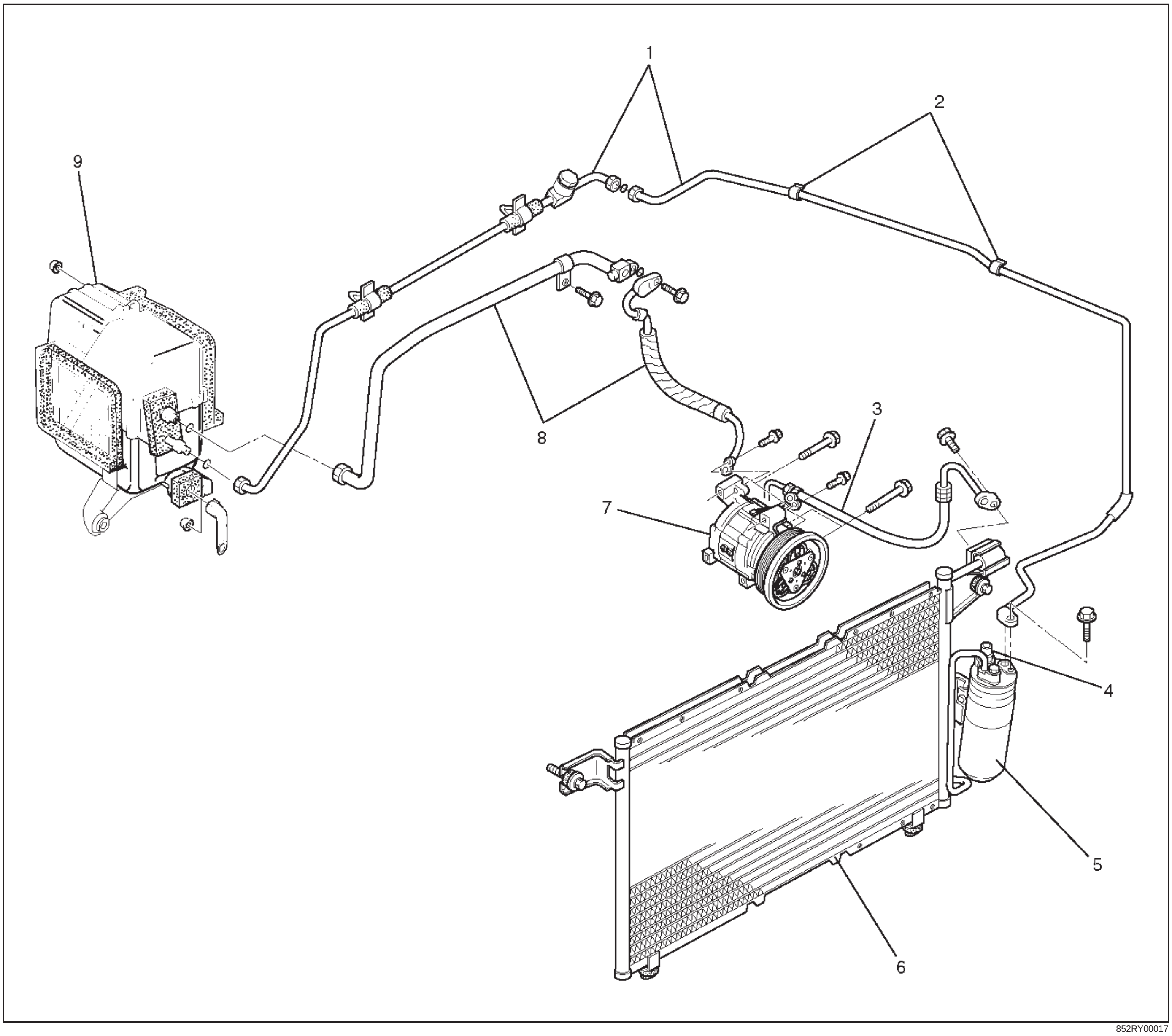
Refrigerant flexible hoses that have a low permeability to refrigerant and moisture are used. These low permeability hoses have a special nylon layer on the inside.



Legend

(1) Reinforcement Layer (Polyester)
(2) External Rubber Layer
(3) Internal Rubber Layer
(4) Resin Layer (Nylon)

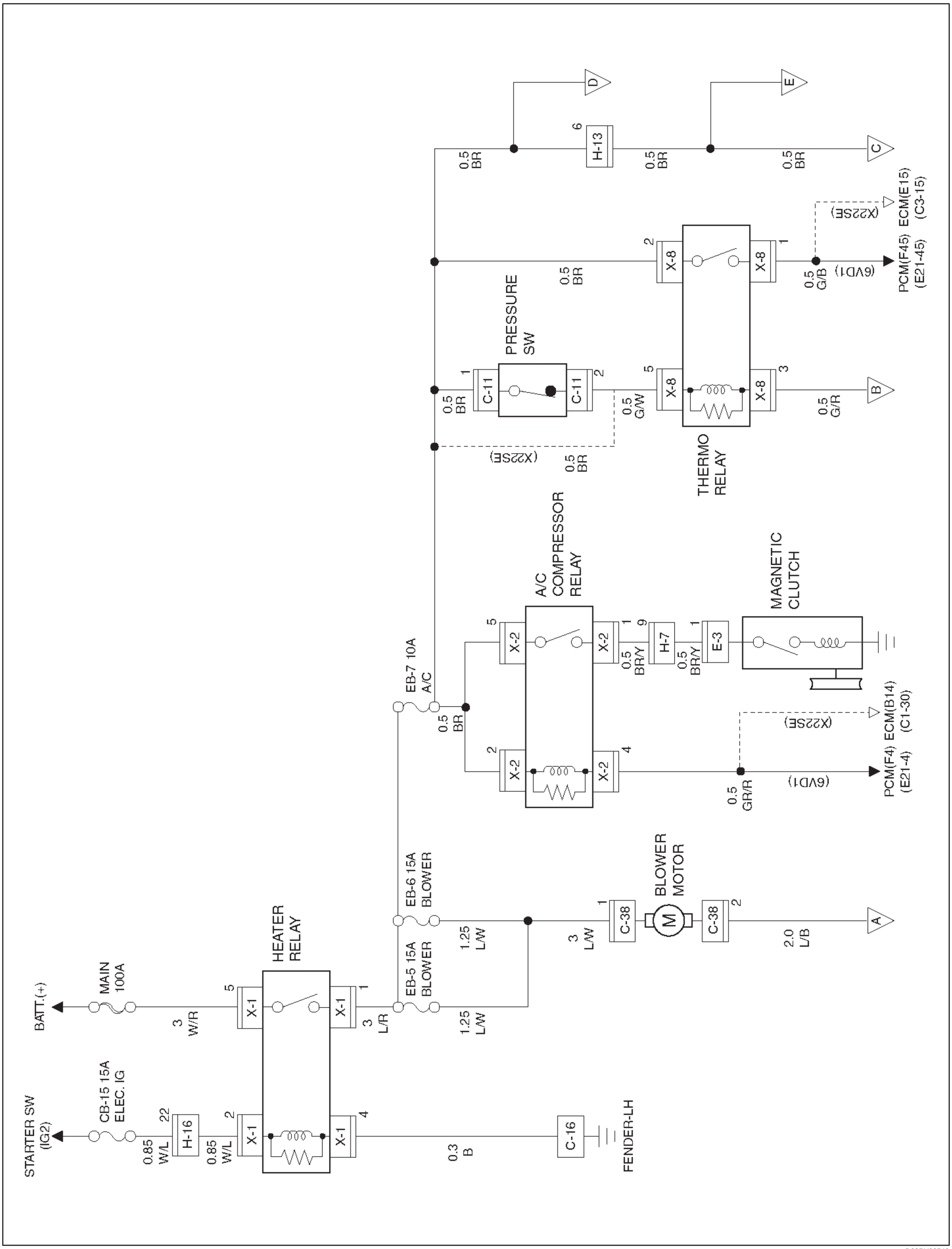
Air Conditioning Parts



Legend

(1) Liquid Line (High-Pressure Pipe)
(2) Clip
(3) Discharge Line (High-Pressure Hose)
(4) Pressure Switch
(5) Receiver/Drier
(6) Condenser Assembly
(7) Compressor
(8) Suction Line (Low-Pressure Hose)
(9) Evaporator Assembly

Wiring Diagram



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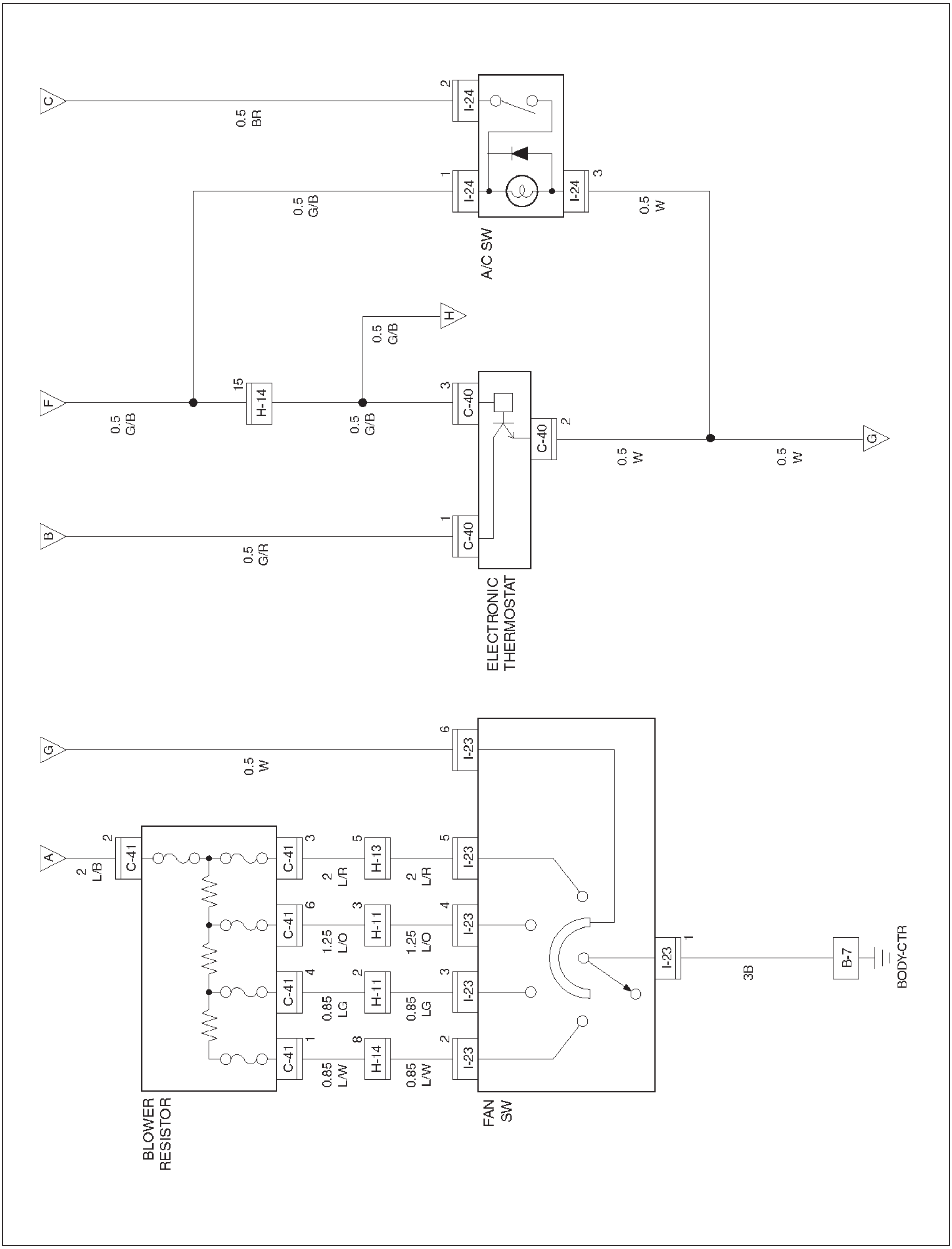
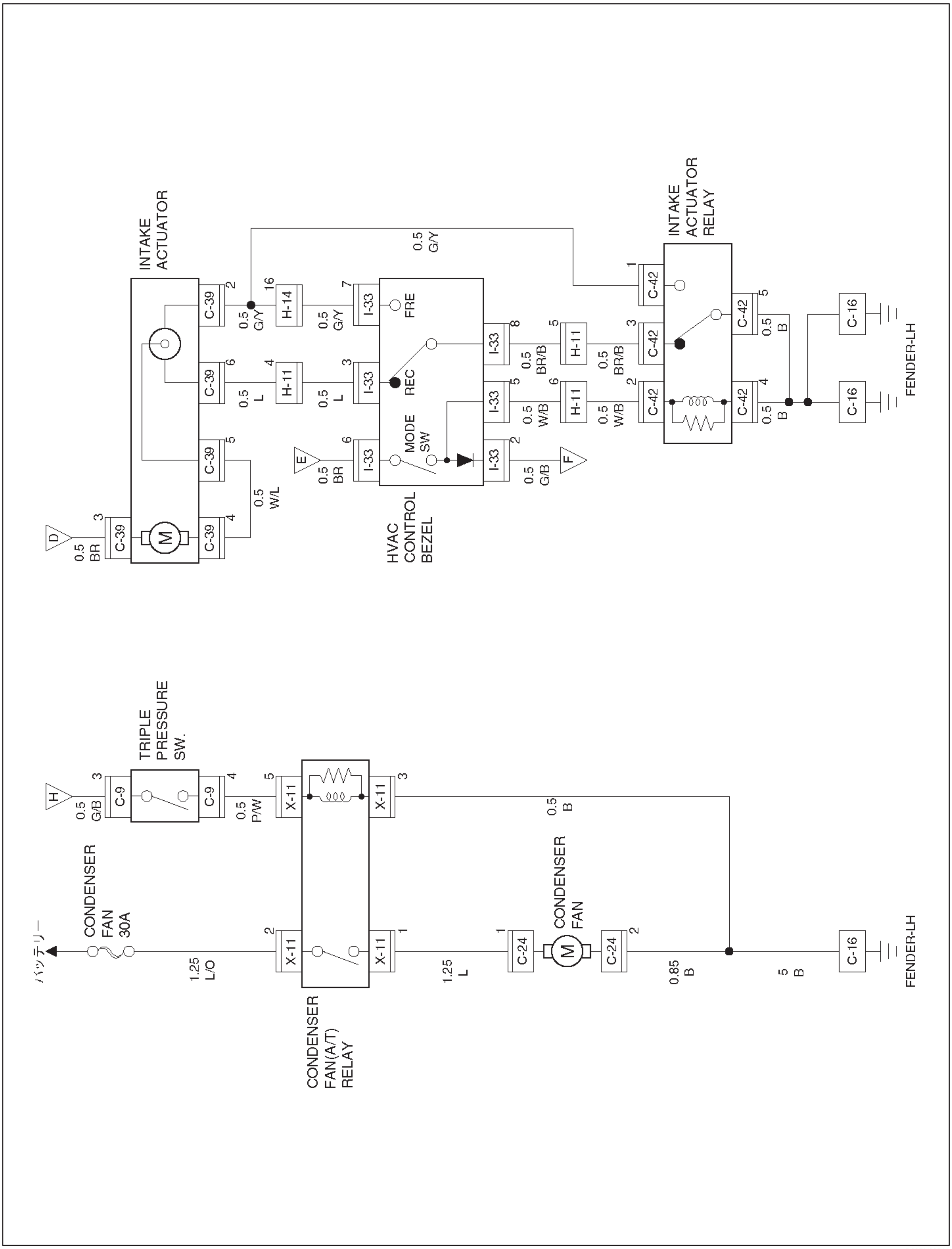

C
0.5
BR
I-24
A/C SW
F
0.5
G/B
H-14
H
C-40
ELECTRONIC
THERMOSTAT
B
0.5
G/R
G
0.5
W
A
2
L/B
C-41
BLOWER
RESISTOR
H-13
H-11
1.25
L/O
0.85
LG
0.85
L/W
2
L/R
I-23
FAN
SW
3B
B-7
BODY-CTR

D08RY00542


INTAKE ACTUATOR
C-39
M
D
0.5 BR
0.5 G/Y
0.5 L
0.5 W/L
H-14
H-11
I-33
FRE
REC
MODE SW
E
F
0.5 G/B
HVAC CONTROL BEZEL
0.5 BR/B
0.5 W/B
INTAKE ACTUATOR RELAY
C-42
0.5 B
C-16
FENDER-LH
バッテリー
CONDENSER FAN 30A
1.25 L/O
TRIPLE PRESSURE SW.
C-9
H
0.5 G/B
0.5 P/W
X-11
CONDENSER FAN(A/T) RELAY
1.25 L
C-24
CONDENSER FAN
0.85 B
5 B

D08RY00541

Diagnosis

Air Conditioning Cycle Diagnosis

Condition	Possible cause	Correction
No cooling or insufficient cooling.	Magnetic clutch does not run.	Refer to “Magnetic Clutch Diagnosis” in this section.
	Compressor is not rotating properly. Drive belt is loosened or broken.	Adjust the drive belt to the specified tension or replace the drive belt.
	Compressor is not rotating properly. Magnetic clutch face is not clean and slips.	Clean the magnetic clutch face or replace.
	Compressor is not rotating properly. Incorrect clearance between magnetic drive plate and pulley.	Adjust the clearance. Refer to Compressor in this section.
	Compressor is not rotating properly. Compressor oil leaks from the shaft seal or shell.	Replace the compressor
	Compressor is not rotating properly. Compressor is seized.	Replace the compressor
	Insufficient or excessive charge of refrigerant.	Discharge and recover the refrigerant. Recharge to the specified amount.
	Leaks in the refrigerant system.	Check the refrigerant system for leaks and repair as necessary. Discharge and recover the refrigerant. Recharge to the specified amount.
	Condenser is clogged or insufficient radiation.	Clean the condenser or replace as necessary.
	Temperature control link unit of the heat unit is defective.	Repair the link unit.
	Unsteady operation due to a foreign substance in the expansion valve.	Replace the expansion valve.
	Poor operation of the electronic thermostat.	Check the electronic thermostat and replace as necessary.
Insufficient velocity of cooling air.	Evaporator clogged or frosted.	Check the evaporator core and replace or clean the core.
	Air leaking from the cooling unit or air duct.	Check the evaporator and duct connection, then repair as necessary.
	Blower motor does not rotate properly.	Refer to Fan Control Lever (Fan Switch) Diagnosis in this section.

*For the execution of the charging and discharging operation in the table above, refer to Recovery, Recycling, Evacuating and Charging in this section.

Checking The Refrigerant System With Manifold Gauge

Since Refrigerant-134a (HFC-134a) is used in the air conditioning system in this vehicle, be sure to use manifold gauges, charging hoses and other air conditioning service tools for HFC-134a when checking the refrigerant system.

Conditions:

- Run the engine at Idling
- Air conditioning switch is “ON”
- Run the blower motor at “HIGH” position
- Temperature control lever set to “MAX COLD”
- Air source selector lever at “CIRC”
- Open the engine hood
- Close all the doors

Normal Pressure:

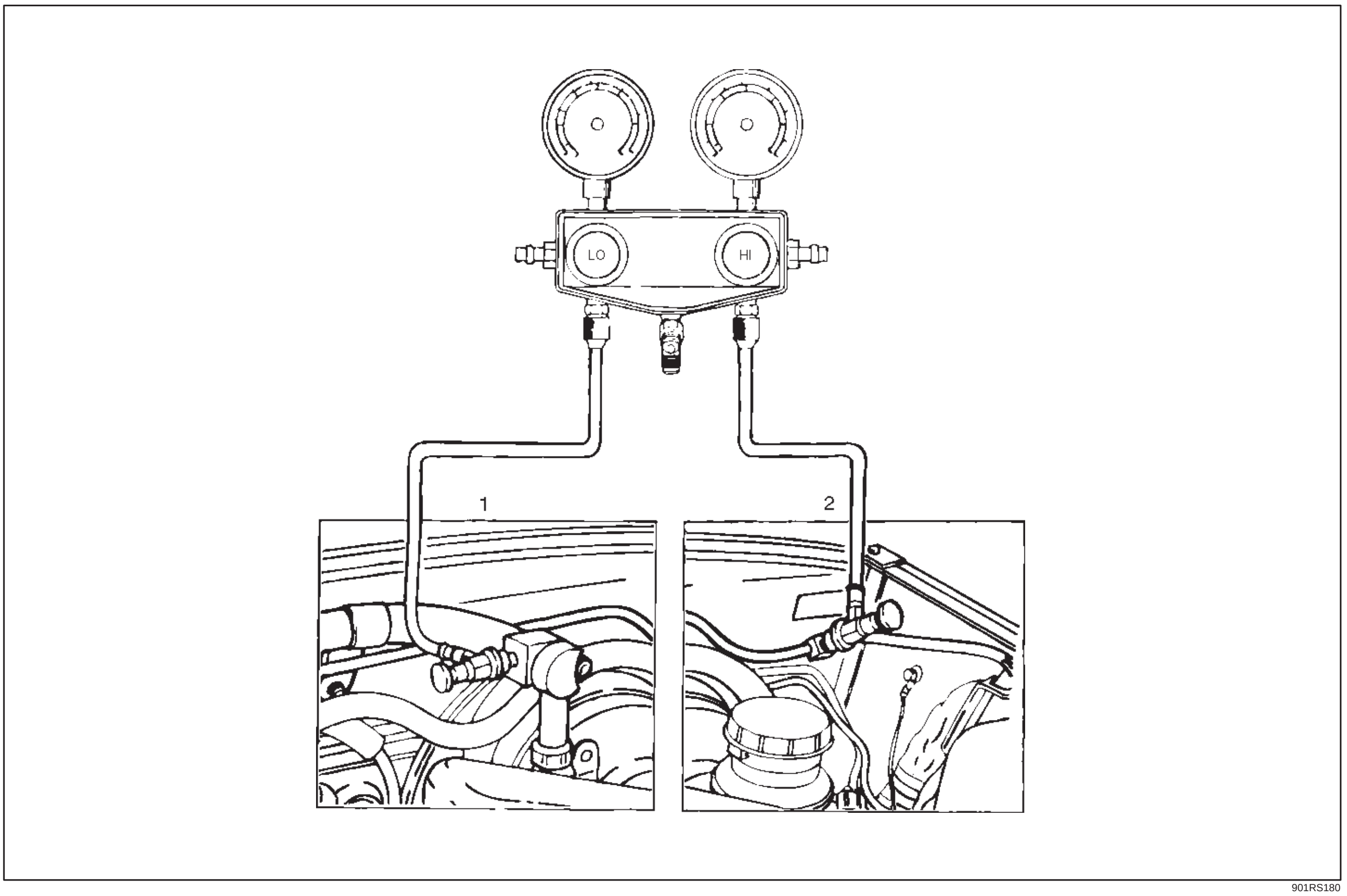
- At ambient temperature: approx. 25–30˚C (77–86˚F).
- At low-pressure side: approx. 147.1–294.2 kPa (21.3–42.7 psi).
- At high-pressure side: approx. 1372.9–1863.3 kPa (199.1–270.2 psi).

Refer to the table on the refrigerant pressure-temperature relationship.

HFC-134a Pressure-Temperature Relationship			
Pressure		Temperature	
(kPa)	(psi)	(˚C)	(˚F)
36	5.3	–20	–4.4
67	9.7	–15	5
104	15	–10	14
147	21	–5	23
196	28	0	32
255	37	5	41
314	45	10	50
392	57	15	59
471	68	20	68
569	82	25	77
677	98	30	86
785	114	35	95
912	132	40	104
1059	154	45	113
1216	176	50	122

Connect The Manifold Gauge

Low-pressure hose (LOW) — Suction side
High pressure hose (HI) — Discharge side



901RS180

Legend

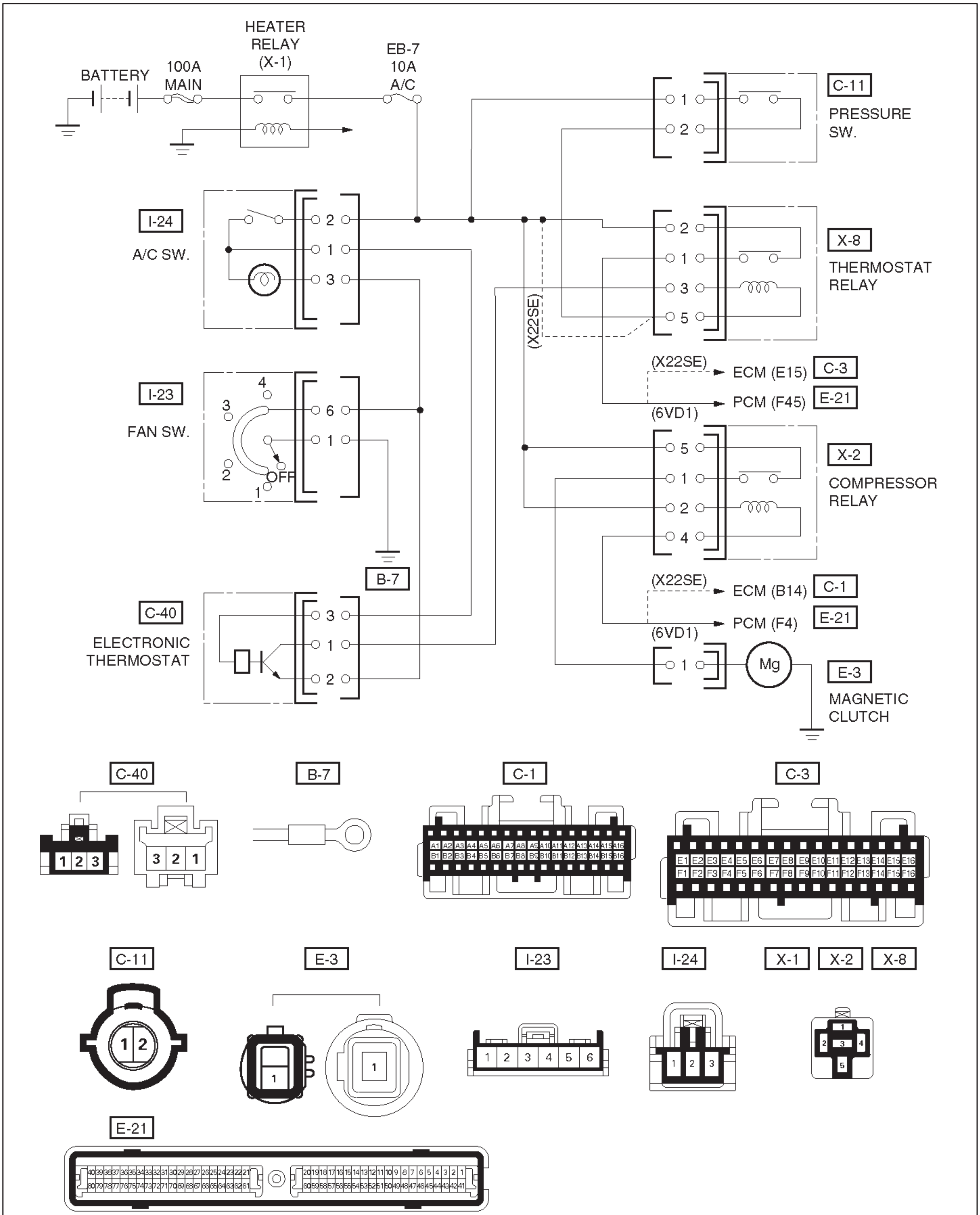
(1) Low Side
(2) High Side

Condition	Possible cause	Correction
Discharge (High Gauge) Pressure Abnormally High	Condenser clogged or dirty.	Clean the condenser fins
	Cooling fan does not operate properly.	Check the cooling fan operation.
Discharge (High Gauge) Pressure Abnormally High. Insufficient cooling.	Excessive refrigerant in system.	Discharge and recover refrigerant. Recharge to specified amount.
Discharge (High Gauge) Pressure Abnormally High. High pressure gauge drop. (After stopping A/C, the pressure drops approx. 196 kPa (28 psi) quickly)	Air in system.	Evacuate and charge refrigerant system.
Discharge (High Gauge) Pressure Abnormally Low. Insufficient cooling	Insufficient refrigerant in system.	Check for leaks. Discharge and recover the refrigerant. Recharge to the specified amount.
Discharge (High Gauge) Pressure Abnormally Low. Low pressure gauge indicates vacuum.	Clogged or defective expansion valve.	Replace the expansion valve.
Discharge (High Gauge) Pressure Abnormally Low. Frost or dew on refrigerant line before and after the receiver/drier or expansion valve, and low pressure gauge indicates vacuum.	Restriction caused by debris or moisture in the receiver/drier.	Check system for restriction and replace the receiver/drier.
Discharge (High Gauge) Pressure Abnormally Low. High and low pressure gauge balanced quickly. (After turned off A/C)	Compressor seal defective	Repair or replace the compressor.
	Poor compression due to a defective compressor gasket.	Repair or replace the compressor.
Suction (Low Gauge) Pressure Abnormally High. Low pressure gauge (Low pressure gauge is lowered after condenser is cooled by water.)	Excessive refrigerant in system.	Discharge and recover refrigerant Recharge to specified amount.
Suction (Low Gauge) Pressure Abnormally High. Low pressure hose temperature. (Low pressure hose temperature around the compressor refrigerant line connector is lower than around evaporator.)	Unsatisfactory valve operation due to defective temperature sensor of expansion valve.	Replace the expansion valve.
	Expansion valve opens too long.	Replace the expansion valve.
Suction (Low Gauge) Pressure Abnormally High. High and low pressure gauge balanced quickly. (After turned off A/C)	Compressor gasket is defective.	Repair or replace the compressor.
Suction (Low Gauge) Pressure Abnormally Low. Insufficient cooling.	Insufficient refrigerant in system.	Check for leaks. Discharge and recover the refrigerant. Recharge to specified amount.
Suction (Low Gauge) Pressure Abnormally Low. Frost on the expansion valve inlet line	Expansion valve clogged.	Replace the expansion valve.

Condition	Possible cause	Correction
Suction (Low Gauge) Pressure Abnormally Low Receiver/drier inlet and outlet refrigerant line temperature. (A distinct difference in temperature develops.)	Receiver/Drier clogged.	Replace the receiver/drier.
Suction (Low Gauge) Pressure Abnormally Low. Expansion valve outlet refrigerant line. (Not cold and low pressure gauge indicates vacuum.)	Expansion valve temperature sensor is defective.	Replace the expansion valve.
Suction (Low Gauge) Pressure Abnormally Low. When the refrigerant line is clogged or blocked, the low pressure gauge reading will decrease, or a vacuum reading may be shown.	Clogged or blocked refrigerant line.	Replace refrigerant line.
Suction (Low Gauge) Pressure Abnormally Low. Evaporator core is frozen.	Thermo switch defective.	Replace thermo switch.
Suction (Low Gauge) and Discharge (High Gauge) Pressure Abnormally High. Insufficient cooling.	Excessive refrigerant in system.	Discharge and recover the refrigerant, the Recharge to the specified amount.
	Condenser clogged or dirty.	Clean the condenser fin.
Suction (Low Gauge) and Discharge (High Gauge) Pressure Abnormally High. Suction (Low) pressure hose (Not cold).	Air in system.	Evacuate and charge refrigerant.
Suction (Low Gauge) and Discharge (High Gauge) Pressure Abnormally Low. Insufficient cooling	Insufficient refrigerant in system.	Check for leaks. Discharge and recover refrigerant. Recharge to specified amount.

A/C — Air Conditioning

Magnetic Clutch Diagnosis



PCM- Powertrain Control Module, A/C-S Air Conditioning

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When the air conditioning switch and the fan control knob (fan switch) are turned on with the engine running, current flows through the thermostat and the compressor relay to activate the magnetic clutch.
The air conditioning can be stopped by turning of the air conditioning switch or the fan control knob (fan switch). However, even when the air conditioning is in operation, the electronic thermostat, the pressure switch or the Powertrain Control Module (PCM;V6-3.2L)/ Engine Control Module (ECM;L4-2.2L) is used to stop the air conditioning temporarily by turning off the magnetic clutch in the prearranged conditions to reduce the engine load which is being caused by the rise in the engine coolant temperature, and the acceleration of the vehicle, etc.
For the inspection of the relays, switches and units in the table, refer to “Individual Inspection” in this section.

Magnetic Clutch Does Not Run

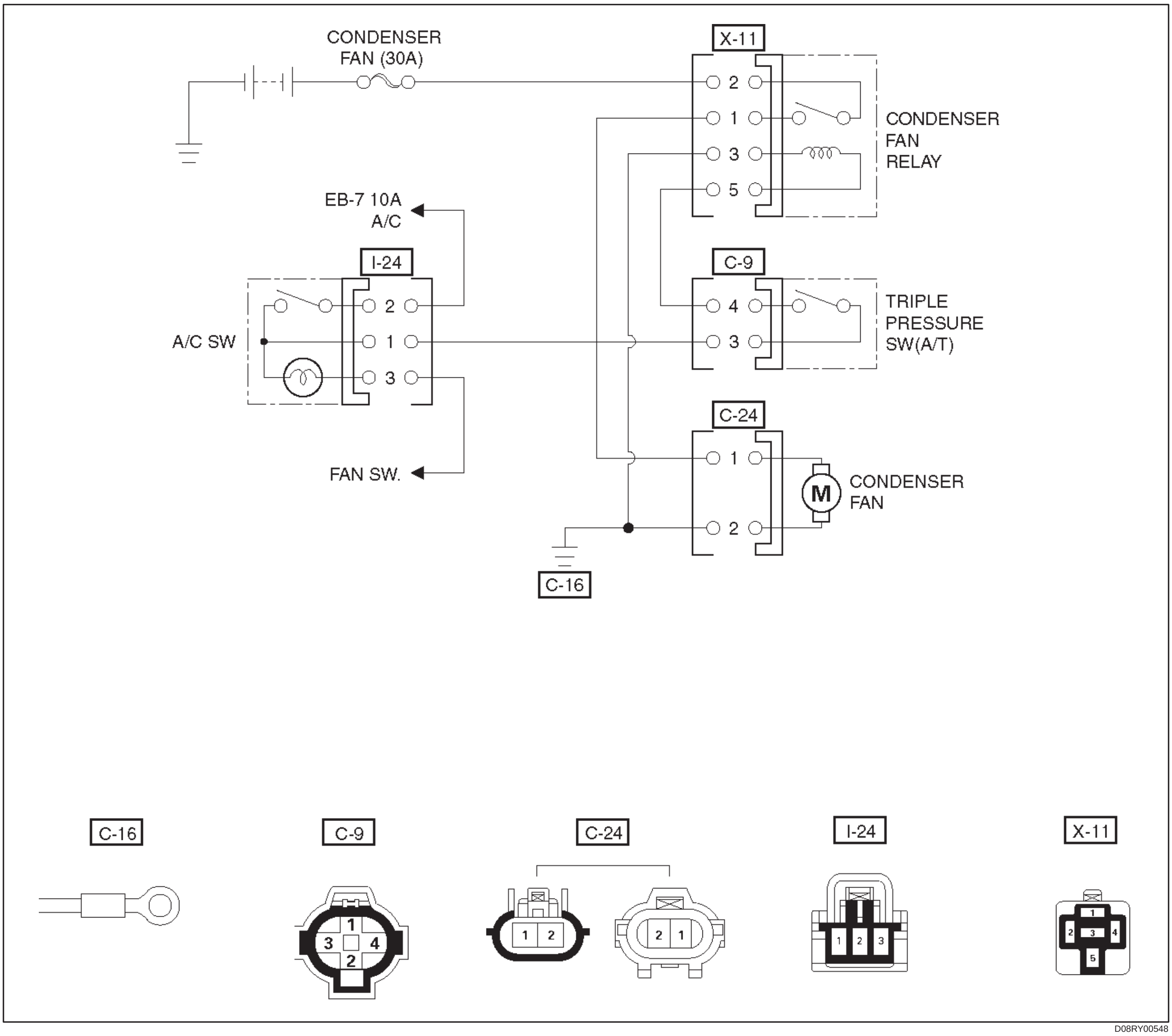
Step	Action	Yes	No
1	Are No. EB-7 (10A) fuse and No. EB-5 (15A) / EB-6 (15A) fuse OK?	Go to Step 2	Replace
2	Are heater (X-1), thermostat (X-8), and compressor (X-2) relays OK?	Go to Step 3	Replace
3	Is pressure switch OK?	Go to Step 4	Switch defective or insufficient refrigerant.
4	Are air conditioning switch and fan control lever (Fan Switch) OK?	Go to Step 5	Replace
5	1. Turn the ignition switch “ON” (Engine is running). 2. Air conditioning switch and fan control lever (Fan Switch) “ON”. 3. Check to see if battery voltage is present at chassis side connector terminal No. E3-1. Is there a battery voltage?	Go to Step 6	Go to Step 7
6	Check to see if continuity between compressor side connector terminal No. E3-1 and the magnetic clutch side connector terminal. Is there a continuity?	Magnetic clutch defective.	Compressor defective.
7	Check to see it battery voltage is present at chassis side connector terminal No.I24-2. Is there a battery voltage?	Go to Step 8	Open circuit between No.EB-7 (10A) fuse and No. I24-2.
8	Check to see if battery voltage is present at chassis side connector terminal No. C11-1 Is there a battery voltage?	Go to Step 9	Open circuit between No.I24-1 and No. C11-1.
9	1. Disconnect thermostat relay (X-8). 2. Check to see if battery voltage is present at the chassis side relay terminal NO. X8-2 Is there a battery voltage?	Go to Step 10	Open circuit between No. EB-7 and C11-2 (10A) fuse and No.X8-2.
10	Check to see if voltage (approx. 10V) is present between chassis side relay terminal No. X8-5 and No. X8-3. Is there a battery voltage?	Go to Step 11	Go to Step 17
11	1. Reconnect thermostat relay and disconnect compressor relay (X-2). 2. Check to see if battery voltage is present at the chassis side relay terminal No. X2-5. Is there a battery voltage?	Go to Step 12	Open circuit between No. EB-7 (10A) fuse and No. X2-5.
12	Check to see if continuity between chassis side relay terminal No. X2-1 and the chassis side connector terminal No. E3-1. Is there a continuity?	Go to Step 13	Open circuit.

Magnetic Clutch Does Not Run (Cont'd)

Step	Action	Yes	No
13	Check to see if battery voltage is present between chassis side relay terminal No. X2-2 and No. X2-4. Is there a battery voltage?	Go to Step 14	Go to Step 15
14	Check to see if battery voltage is present at chassis side relay terminal No. X2-2. Is there a battery voltage?	Go to Step 16	Open circuit between No. EB-7 (10A) fuse and No. X2-2.
15	Check to see if battery voltage is present at chassis side connector terminal No. E21-F4 / C1-B14. Is there a battery voltage?	Power train control module (PCM) defective. Refer to Driveability and Emissions in Engine section.	Open circuit between No. X2-4 and No. E21-F4 / C1-B14.
16	Check to see if continuity between chassis side relay terminal No. X8-1 and chassis side connector terminal No. E21-F45 / C3-E15. Is there a continuity?	Power train control module (PCM) defective. Refer to Driveability and Emissions in Engine section.	Open circuit
17	Check to see if battery voltage is present at chassis side relay terminal No.X8-5. Is there a battery voltage?	Go to Step 18	Open circuit between No.X8-5 and C11-2.
18	1. Reconnect thermostat relay. 2. Check to see if battery voltage is present at chassis side connector terminal No.C40-3. Is there a battery voltage?	Go to Step 19	Open circuit between No.I24-1 and No.C40-3.
19	Check to see if battery voltage (appox 10V) is present at chassis side connector terminal No. C40-1. Is there a battery voltage?	Go to Step 20	Open circuit between No. X8-3 and No. C40-1.
20	Check to see if continuity between chassis side connector terminal No. C40-2 and No.I23-6. Is there a continuity?	Electronic thermostat defective.	Open circuit between No. C40-2 and No.I23-6 or poor ground (Fan Switch Ground Circuit).

Condenser Fan Diagnosis

While the air conditioning is ON, the cycling switch in the triple pressure switch senses the refrigerant pressure, and activates the condenser fan to improve the cooling capacity of the condenser when the refrigerant pressure exceeds a set pressure value. The condenser fan stops when the air conditioning is turned “OFF” or when the pressure goes down below the set pressure value.



Condition	Possible cause	Correction
Condenser fan does not run.	–	Refer to “Chart A”.
	–	Refer to “Chart B”.

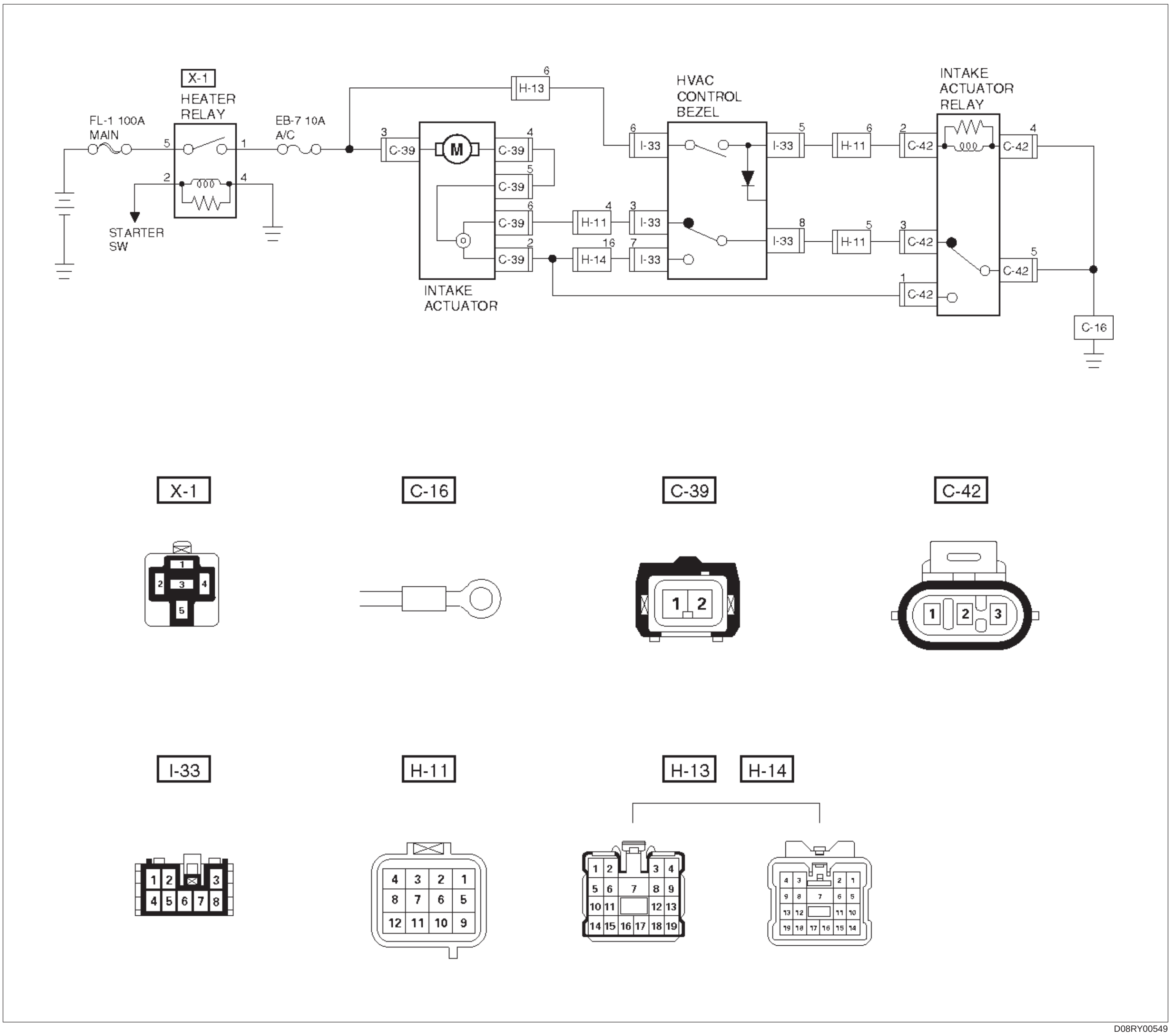
Chart “A” Condenser Fan Does Not Run

Step	Action	Yes	No
1	Are 30A fuse OK?	Go to Step 2	Replace
2	Is relay (X-11) OK?	Go to Step 3	Replace
3	Is pressure switch OK?	Go to Step 4	Switch defective or insufficient refrigerant.
4	Is air conditioning switch OK?	Go to Step 5	Replace
5	Is fan motor OK?	Go to Step 6	Replace
6	1. Disconnect condenser fan relay (X-11). 2. Check to see if battery voltage is present at the chassis side relay terminal NO. X11-2 Is there a battery voltage?	Go to Step 7	Open circuit between Condenser Fan fuse (30A) and No.X11-2.
7	1. Reconnect condenser fan relay (X-11). 2. Air conditioning switch “ON”. 3. Check to see if battery voltage is present at chassis side connector terminal No.C9-3. Is there a battery voltage?	Go to Step 8	Open circuit between I-24-1 and C9-3.
8	1. Air conditioning switch “OFF”. 2. Check to see if continuity between chassis side relay terminal No.X11-5 and the chassis side connector terminal No.C9-4. Is there a continuity?	Go to Step 9	Open circuit.
9	Check to see if continuity between chassis side connector terminal No. C24-1 and chassis side relay terminal No.X11-1. Is there a continuity?	Poor ground or open circuit between chassis side connector terminal No.X11-3 (or No.C24-2) and body ground (No.C16).	Open circuit.

Chart “B” Condenser Fan Does Not Stop

Step	Action	Yes	No
1	1. Air conditioning switch “OFF”. Does condenser fan stop?	Triple pressure switch defective.	Condenser fan relay (X11) defective.

Air Source Select Lever Diagnosis



Condition	Possible cause	Correction
FRESH mode inoperative	—	Refer to Chart A
RECIRC mode inoperative	—	Refer to Chart B

Chart "A": FRESH Mode Inoperative

Step	Action	Value(s)	Yes	No
1	Is the fuse EB-7 normal?	—	Go to Step 2	Replace the fuse
2	Is C-16 grounded securely?	—	Go to Step 3	Ground it securely
3	Remove the intake actuator relay. Is the relay normal?	—	Go to Step 4	Replace the relay
4	Is there continuity between the intake actuator relay harness side connector C-42 terminal 4/5 and the ground C-16?	—	Go to Step 5	Repair an open circuit
5	1. Set the HVAC control bezel to DEF/FOOT or DEF position. 2. Turn the starter switch on and keep the engine running. Is the battery voltage applied between the intake actuator harness side connector C-42 terminal 2 and the ground?	Approx. 12V	Go to Step 10	Go to Step 6
6	Disconnect the HVAC control bezel. Is the battery voltage applied between the bezel harness side connector I-33 terminal 6 and the ground?	Approx. 12V	Go to Step 8	Go to Step 7
7	Repair an open circuit between the fuse EB-7 and the connector I-33 terminal 6. Is the action complete?	—	Go to Step 6	—
8	Is there continuity between the HVAC control bezel side connector terminal 5 and 6?	—	Go to Step 9	Repair or replace the bezel
9	Is there continuity between the harness side connector I-33 terminal 5 and C-42 terminal 2?	—	Go to Step 10	Repair an open circuit
10	Disconnect the intake actuator connector C-39. Is the battery voltage applied between the harness side connector C-39 terminal 3 and the ground?	Approx. 12V	Go to Step 11	Repair an open circuit
11	Is there continuity between the harness side connector C-39 terminal 2 and C-42 terminal 1	Approx. 12V	Go to Step 12	Repair an open circuit
12	Is there continuity between the harness side connector C–39 terminal 4 and 5?	—	Go to Step 13	Repair an open circuit
13	Replace the intake actuator. Is the action complete?	—	Verify repair	—

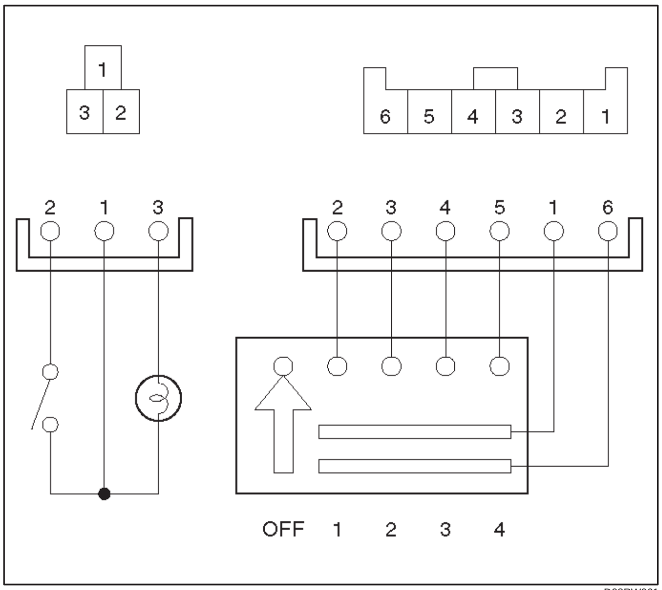
Chart “B”: RECIRC Mode Inoperative

Step	Action	Value(s)	Yes	No
1	Is the fuse EB-7 normal?	—	Go to Step 2	Replace the fuse
2	Is C-16 grounded securely?	—	Go to Step 3	Ground it securely
3	Is the Intake actuator relay normal?	—	Go to Step 4	Replace the relay
4	1. Disconnect the Intake actuator connector C-39 2. Connect the battery positive terminal to the Intake actuator side connector terminal No.3 and the battery negative terminal to terminal No.6. 3. Connect the switch side connector terminal No.4 and No.5. Does the actuator work normally?	—	Go to Step 5	Replace the actuator
5	Turn the Starter switch on. Is the battery voltage applied to the harness side connector C-39 terminal 3?	Approx.12V	Go to Step 6	Repair an open circuit
6	Is there continuity between harness side connector C–42 terminal No.5 and the ground?	—	Go to Step 7	Repair an open circuit
7	1. Remove the HVAC control bezel. 2. Move the air source select lever to REC position. Is there continuity between the control bezel side terminal No.3 and 8?	—	Go to Step 8	Repair or replace the control bezel
8	Is there continuity between harness side connector C-39 terminal 6 and connector I-33 terminal 3?	—	Go to Step 9	Repair an open circuit
9	Repair an open circuit between connector I-33 terminal 8 and connector C-42 terminal 3. Is the action complete?	—	Verify repair	—

Individual Inspection

Fan Control Knob (Fan Switch) And Air Conditioning (A/C) Switch

1. Check for continuity between the fan switch and the A/C switch side connector terminals.



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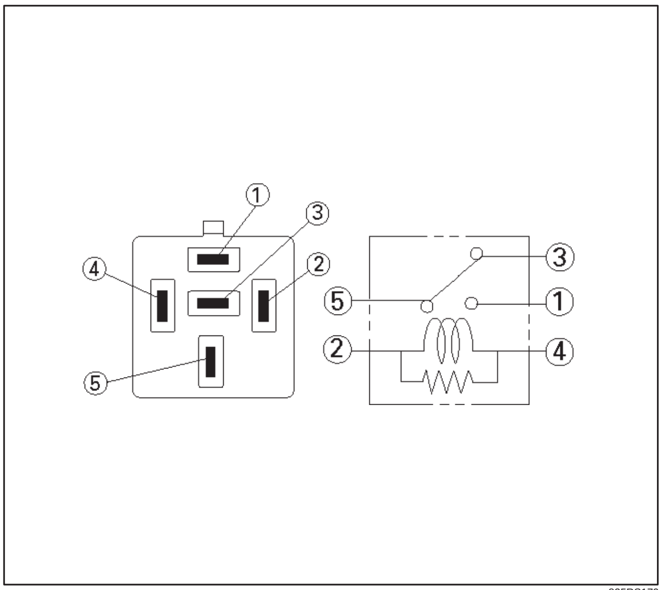
Heater (X-1), Thermostat (X-8), Condenser Fan (X-11) And Compressor (X-2) Relay

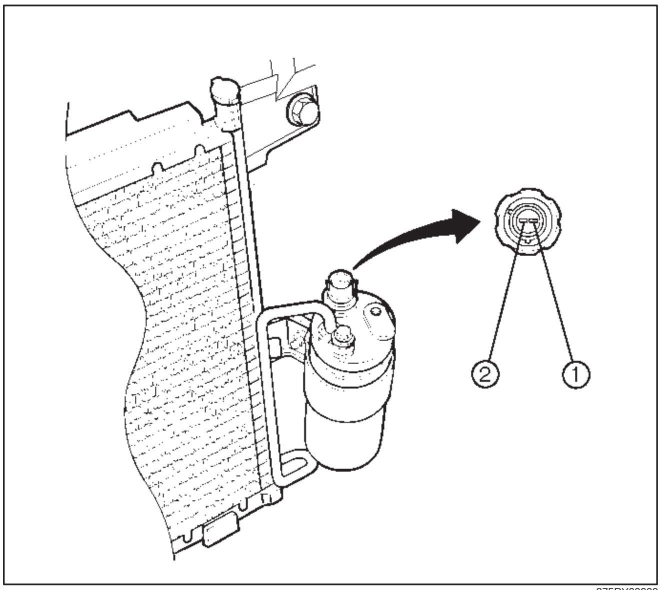
1. Disconnect relays and check for continuity and resistance between relay terminals.
   - For handling of these relays, refer to Heater Relay in this section.



825RS179

Pressure Switch

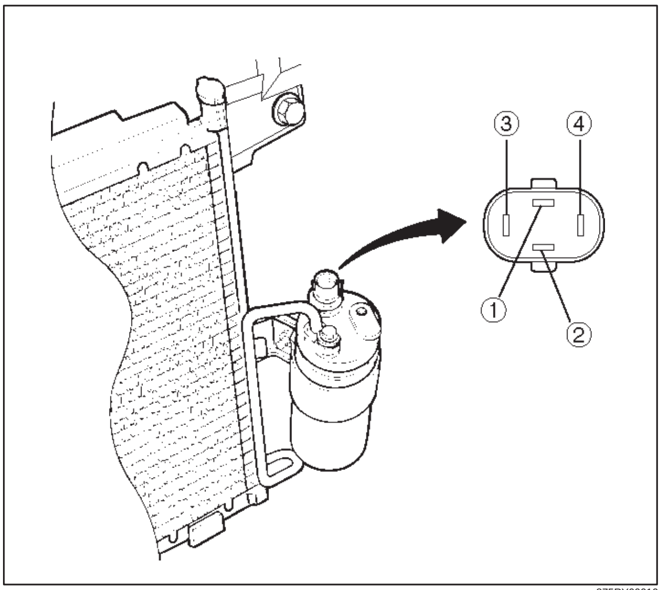
1. Disconnect pressure switch connector and check for continuity between pressure switch side connector terminals (1) and (2).



875RY00009

Triple Pressure Switch (V6, A/T)

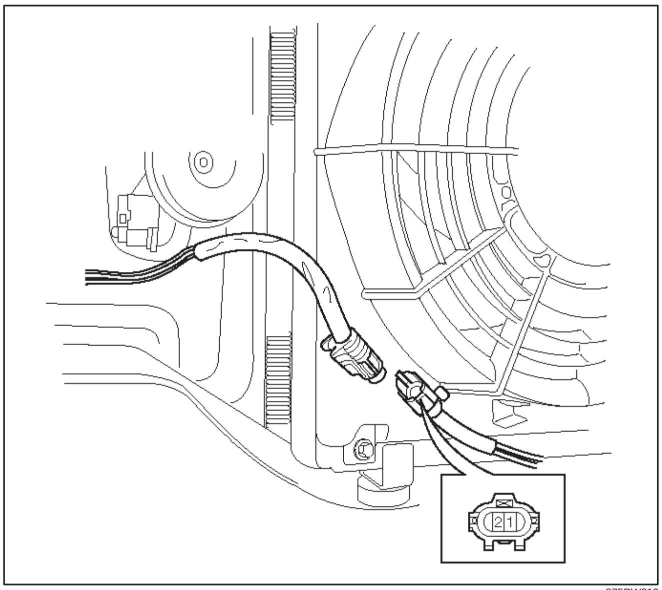
1. Disconnect the connector and check for continuity between pressure switch side connector terminals (1) and (2).
2. Reconnect the connector to activate the A/C switch, and check to see if there is continuity between the chassis side connector terminals (3) and (4) and the fan operates.



875RY00010

Condenser Fan

1. Disconnect the condenser fan connector.
2. Connect the battery positive terminal to the condenser fan side connector terminal No.C-24-1 and negative to the No.C-24-2.
3. Check that condenser fan is rotating correctly.



875RW010

General Repair Procedure

Precautions For Replacement or Repair of Air Conditioning Parts

There are certain procedures, practices and precautions that should be followed when servicing air conditioning systems:

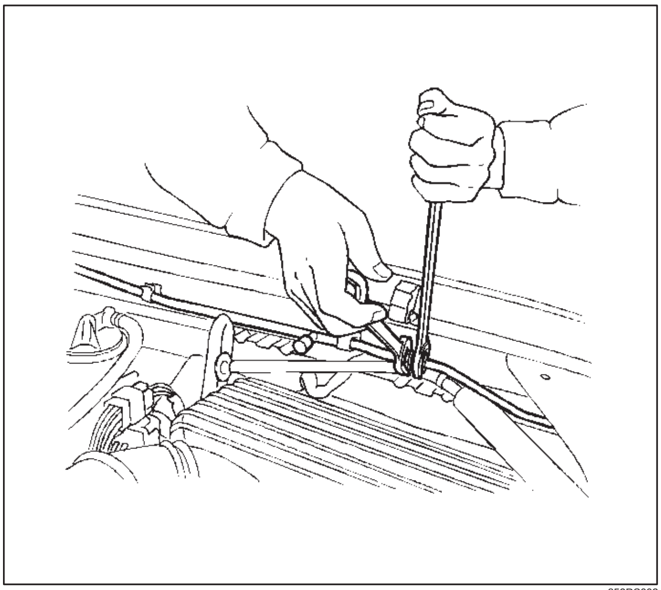
- Keep your work area clean.
- Always wear safety goggle and protective gloves when working on refrigerant systems.
- Beware of the danger of carbon monoxide fumes caused by running the engine.
- Beware of discharged refrigerant in enclosed or improperly ventilated garages.
- Always disconnect the negative battery cable and discharge and recover the refrigerant whenever repairing the air conditioning system.
- When discharging and recovering the refrigerant, do not allow refrigerant to discharge too fast; it will draw compressor oil out of the system.
- Keep moisture and contaminants out of the system. When disconnecting or removing any lines or parts, use plugs or caps to close the fittings immediately.
  Never remove the caps or plugs until the lines or parts are reconnected or installed.
- When disconnecting or reconnecting the lines, use two wrenches to support the line fitting, to prevent from twisting or other damage.
- Always install new O-rings whenever a connection is disassembled.
- Before connecting any hoses or lines, apply new specified compressor oil to the O-rings.
- When removing and replacing any parts which require discharging the refrigerant circuit, the operations described in this section must be performed in the following sequence:

1. Use the J-39500 (ACR4: HFC-134a Refrigerant Recovery / Recycling / Recharging / System) or equivalent to thoroughly discharge and recover the refrigerant.
2. Remove and replace the defective part.
3. After evacuation, charge the air conditioning system and check for leaks.

Repair Of Refrigerant Leaks

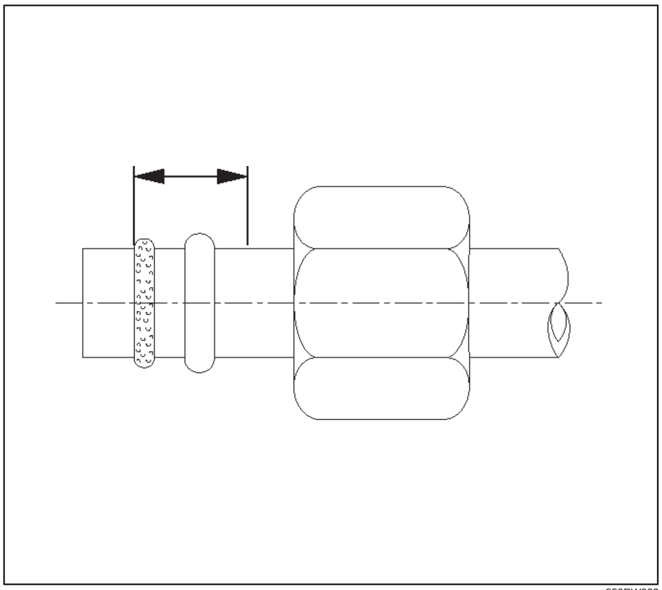
Refrigerant Line Connections

Install new O-rings, if required. When disconnecting or connecting lines, use two wrenches to prevent the connecting portion from twisting or becoming damaged.


852RS003

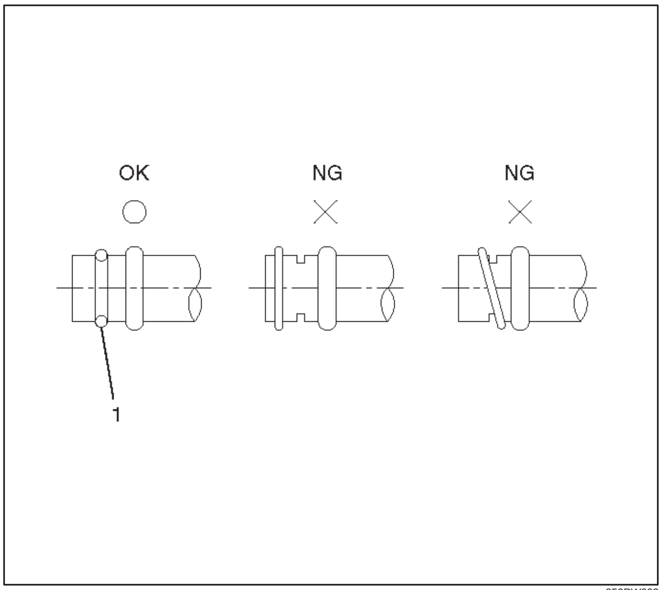
When connecting the refrigerant line at a block joint, securely insert the projecting portion of the joint portion into the connecting hole on the unit side and secure with a bolt. Apply the specified compressor oil to the O-rings prior to connecting.

CAUTION: Compressor (PAG) oil to be used varies according to the compressor model. Be sure to apply oil specified for the model of compressor.



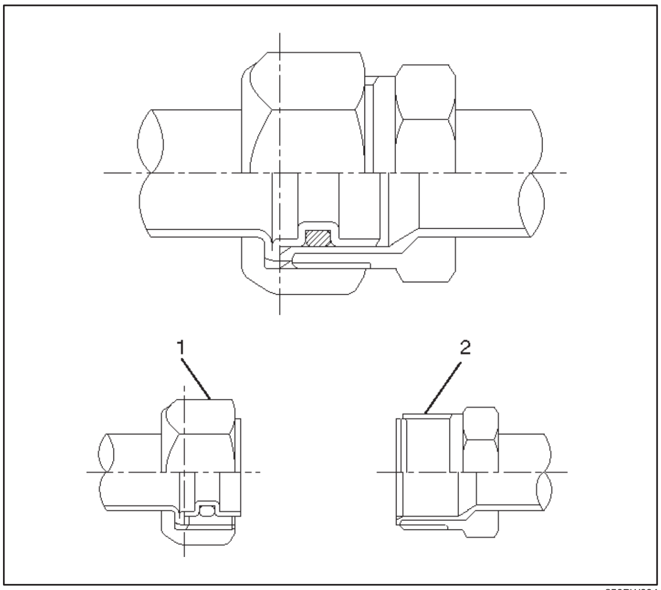
850RW002

O-rings (2) must be fitted in the groove (1) of refrigerant line.



850RW003

Insert the nut into the union.
First, tighten the nut by hand as much as possible, then tighten the nut to the specified torque.



850RW004

Leak Check

Inspection of refrigerant leak

Refrigerant leak may cause an adverse effect not only on the performance and durability of each component of the air–conditioner, but also on the global atmosphere. Therefore, it is most important to repair refrigerant leak when there is any leak found.

Inspection flow of refrigerant leak

Step	Action	Yes	No
1	1. Evacuate the refrigerant system. 2. Charge the refrigerant. Is there any refrigerant leak?	Repair refrigerant system.	Go to Step 2.
2	1. Operate the compressor for more than 5 minutes to raise the pressure on the high pressure side. Is there any refrigerant leak at high pressure components?	Repair refrigerant system.	Compressor operation to be confirmed.

Inspection Steps

Check the components of air–conditioner to see if there occurs any refrigerant leak along the flow of refrigerant.

NOTE:

- To avoid an error in the detection of refrigerant leak, make sure of there being no refrigerant vapor or cigarette smoke around the vehicle before conducting the inspection. Also, select a location where the refrigerant vapor will not get blown off with wind.
- Inspection should be conducted chiefly on the pipe connections and sections where a marked oil contamination is found. When refrigerant is leaking, oil inside is also leaking at the same time.
- It is possible to visually check the leak from inside the cooling unit. Follow the method below when checking. Remove the drain hose or resistor of the cooling unit, and insert a leak detector to see if there occurs any leak.

High Pressure Side

1. Discharger section of compressor.
2. Inlet/outlet section of condenser.
3. Inlet/outlet section of receiver driver.
4. Inlet section of cooling unit.

Low Pressure Side

1. Outlet section of cooling unit.
2. Intake section of compressor.

Major Checking Points of Refrigerant Leak

Compressor

- Pipe connection
- Sealing section of shaft
- Mating section or cylinder

Condenser

- Pipe connection
- Welds of condenser body

Receiver driver

- Pipe connection
- Attaching section of pressure switch
- Section around the sight glass

Evaporator unit (cooling unit)

- Pipe connections
- Connections of expansion valve
- Brazed sections of evaporator

NOTE:

- The evaporator and expansion valve are contained in the case. Remove the drain hose or the resistor of the cooling unit and insert a leak detector when checking for any leak.

Flexible hose

- Pipe connection
- Caulking section of the hose
- Hose (cracks, pinholes, flaws)

Pipe

- Pipe connection
- Pipe (cracks, flaws)

Charge valve

NOTE:

- The charge valve, which is used to connect the gauge manifold, is normally provided with a resin cap. When the valve inside gets deteriorated, refrigerant will leak out.

Leak at Refrigerant Line Connections

1. Check the torque on the refrigerant line fitting and, if too loose, tighten to the specified torque.
   - Use two wrenches to prevent twisting and damage to the line.
   - Do not over tighten.

2. Perform a leak test on the refrigerant line fitting.
3. If the leak is still present, discharge and recover the refrigerant from the system.
4. Replace the O-rings.
   - O-rings cannot be reused. Always replace with new ones.
   - Be sure to apply the specified compressor oil to the new O-rings.
5. Retighten the refrigerant line fitting to the specified torque.
   - Use two wrenches to prevent twisting and damage to the line.
6. Evacuate, charge and retest the system.

Leaks In The Hose

If the compressor inlet or outlet hose is leaking, the entire hose must be replaced. The refrigerant hose must not be cut or spliced for repair.

1. Locate the leak.
2. Discharge and recover the refrigerant.
3. Remove the hose assembly.
   - Cap the open connections at once.
4. Connect the new hose assembly.
   - Use two wrenches to prevent twisting or damage to the hose fitting.
   - Tighten the hose fitting to the specified torque.
5. Evacuate, charge and test the system.

Compressor Leaks

If leaks are located around the compressor shaft seal or shell, replace or repair the compressor.

Recovery, Recycling, Evacuation and Charging of HFC-134a

Air conditioning systems contain HFC-134a. This is a chemical mixture which requires special handling procedures to avoid personal injury.

- Always wear safety goggles and protective gloves.
- Always work in a well-ventilated area. Do not weld or steam clean on or near any vehicle-installed air conditioning lines or components.
- If HFC-134a should come in contact with any part of the body, flush the exposed area with cold water and immediately seek medical help.
- If it is necessary to transport or carry any container of HFC-134a in a vehicle, do not carry it in the passenger compartment.
- If it is necessary to fill a small HFC-134a container from a large one, never fill the container completely. Space should always be allowed above the liquid for expansion.
- HFC-134a and R-12 should never be mixed as their compositions are not the same.
- HFC-134a PAG oil tends to absorb moisture more quickly than R-12 mineral oil and, therefore, should be handled more carefully.
- Keep HFC-134a containers stored below 40°C (104°F).

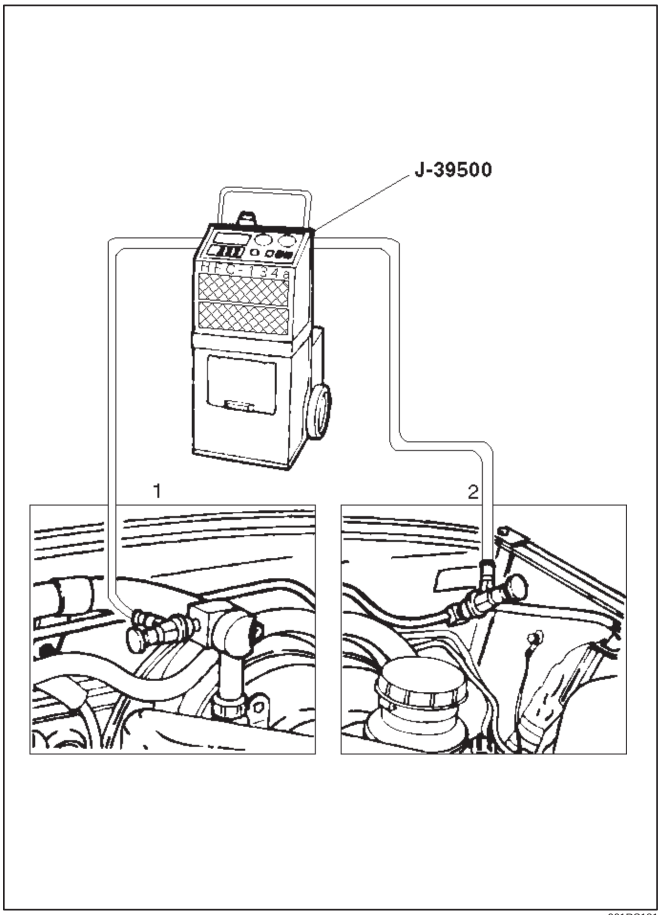
WARNING:

- **SHOULD HFC-134A CONTACT YOUR EYE(S), CONSULT A DOCTOR IMMEDIATELY.**
- **DO NOT RUB THE AFFECTED EYE(S). INSTEAD, SPLASH QUANTITIES OF FRESH COLD WATER OVER THE AFFECTED AREA TO GRADUALLY RAISE THE TEMPERATURE OF THE REFRIGERANT ABOVE THE FREEZING POINT.**
- **OBTAIN PROPER MEDICAL TREATMENT AS SOON AS POSSIBLE. SHOULD THE HFC-134A TOUCH THE SKIN, THE INJURY MUST BE TREATED THE SAME AS SKIN WHICH HAS BEEN FROSTBITTEN OR FROZEN.**

Refrigerant Recovery

The refrigerant must be discharged and recovered by using the J-39500 (ACR4:HFC-134a Refrigerant Recovery/Recycling/Recharging/System) or equivalent before removing or mounting air conditioning parts.

1. Connect the high and low charging hoses of the ACR4(or equivalent) as shown below.



901RS181

Legend

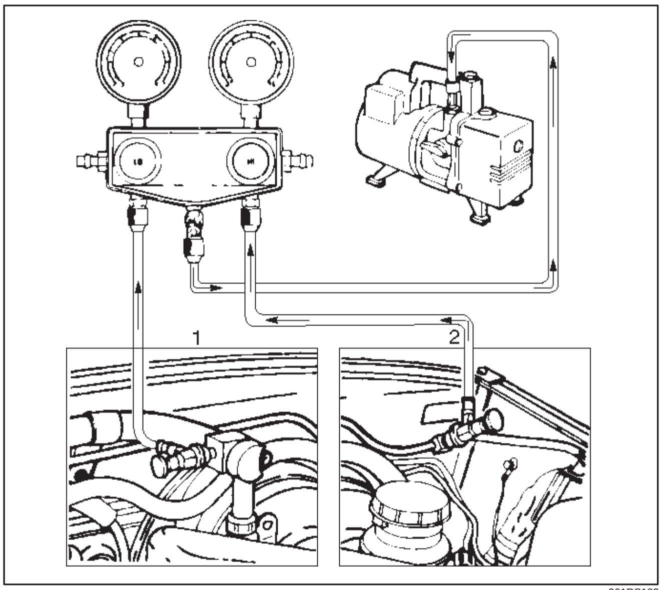
(1) Low Side
(2) High Side

2. Recover the refrigerant by following the Manufacturer's Instructions.
3. When a part is removed, put a cap or a plug on the connecting portion so that dust, dirt or moisture cannot get into it.

Refrigerant Recycling

Recycle the refrigerant recovered by J-39500 (ACR4:HFC-134a Refrigerant Recovery / Recycling / Recharging / System) or equivalent.
For the details of the actual operation, follow the steps in the ACR4(or equivalent) Manufacturer's Instructions.

Evacuation of The Refrigerant System



901RS182

Legend

(1) Low Side
(2) High Side

NOTE: Explained below is a method using a vacuum pump. Refer to the ACR4(or equivalent) manufacturer's instructions when evacuating the system with a ACR4(or equivalent).

Air and moisture in the refrigerant will cause problems in the air conditioning system. Therefore, before charging the refrigerant, be sure to evacuate air and moisture thoroughly from the system.

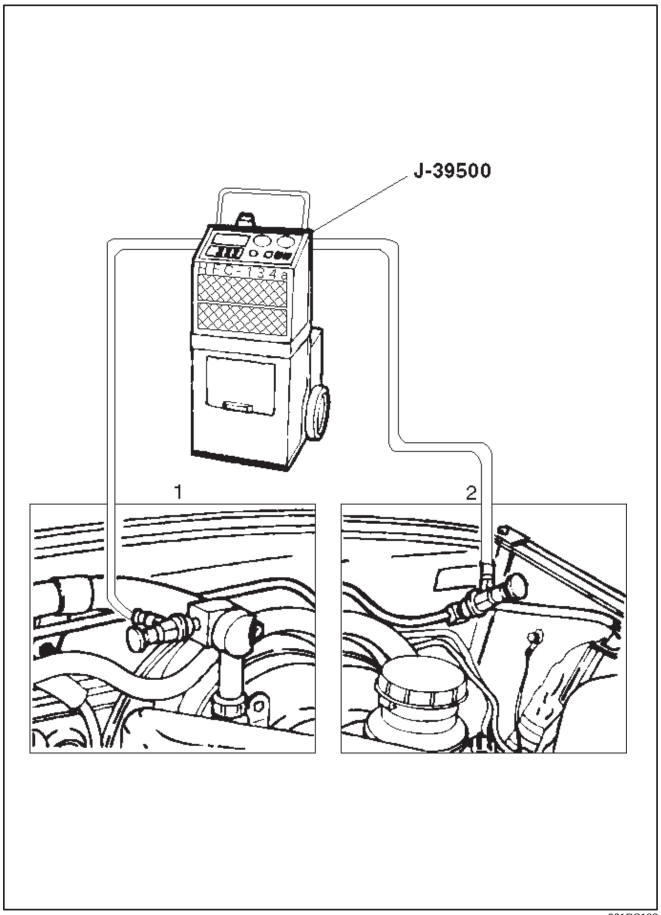
1. Connect the gauge manifold.
   - High-pressure valve (HI) — Discharge-side.
   - Low-pressure valve (LOW) — Suction-side.
2. Discharge and recover the refrigerant.
3. Connect the center hose of the gauge manifold set to the vacuum pump inlet.
4. Operate the vacuum pump, open shutoff valve and then open both hand valves.
5. When the low-pressure gauge indicates approximately 750 mmHg (30 inHg), continue the evacuation for 5 minutes or more.
6. Close both hand valves and stop the vacuum pump.
7. Check to ensure that the pressure does not change after 10 minutes or more.
   - If the pressure changes, check the system for leaks.
   - If leaks occur, retighten the refrigerant line connections and repeat the evacuation steps.
8. If no leaks are found, again operate the vacuum pump for 20 minutes or more. After confirming that the gauge manifold pressure is at 750 mmHg (30 inHg), close both hand valves.
9. Close positive shutoff valve. Stop the vacuum pump and disconnect the center hose from the vacuum pump.

Charging The Refrigerant System

There are various methods of charging refrigerant into the air conditioning system.
These include using J-39500 (ACR4:HFC-134a Refrigerant Recovery/Recycling/Recharging/System) or equivalent and direct charging with a weight scale charging station.

Charging Procedure

- **ACR4(or equivalent) Method**
  For the charging of refrigerant recovered by ACR4(or equivalent), follow the manufacturer's instruction.



901RS183

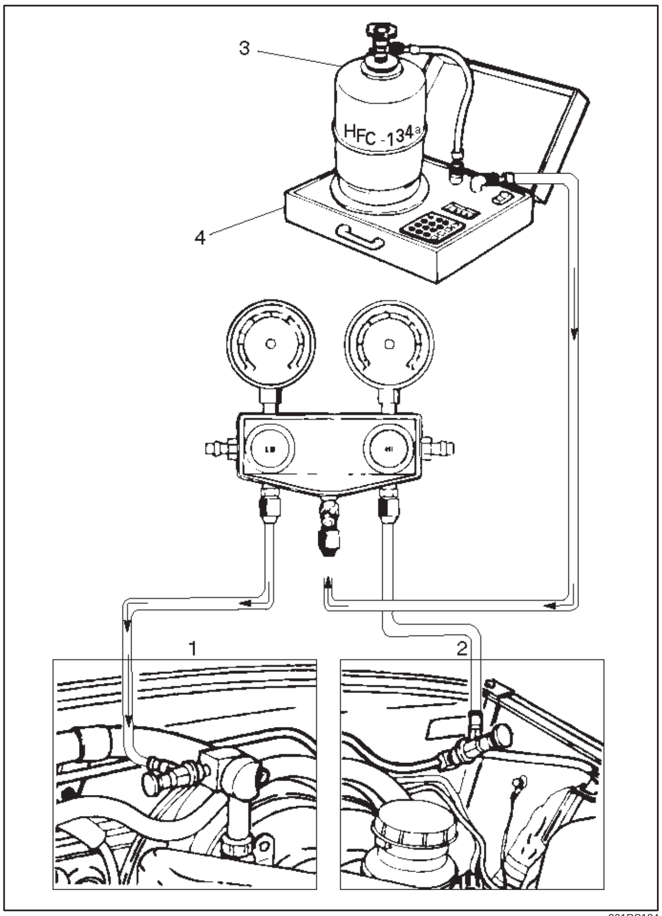
Legend

(1) Low Side
(2) High Side

- **Direct charging with a weight scale charging station method**

1. Make sure the evacuation process is correctly completed.
2. Connect the center hose of the manifold gauge to the weight scale.

3. Connect the low pressure charging hose of the manifold gauge to the low pressure side service valve of the vehicle.
4. Connect the high pressure charging hose of the manifold gauge to the high pressure side service valve of the vehicle.

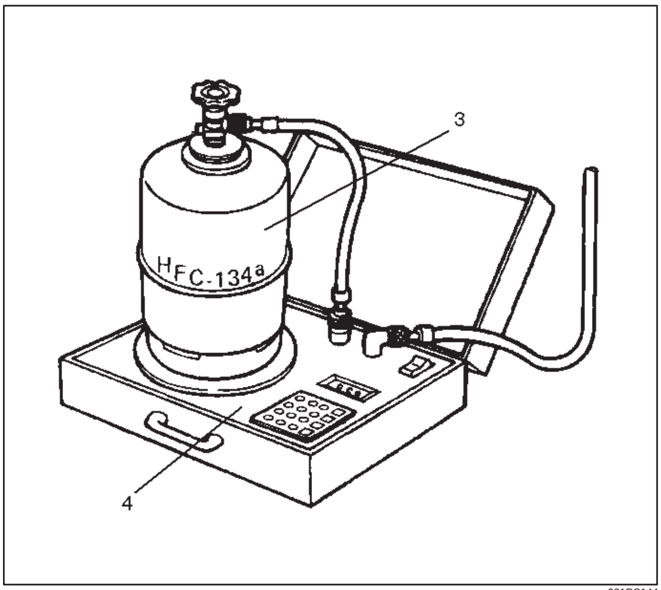


901RS184

Legend

(1) Low Side
(2) High Side
(3) Refrigerant Container
(4) Weight Scale

5. Place the refrigerant container(3) up right on a weight scale(4).
   Note the total weight before charging the refrigerant.
   a. Open the refrigerant container valve.
   b. Open the low side vale on the manifold gauge set. Refer to the manufacturer's instructions for a weight scale charging station.



901RS144

6. Perform a system leak test:
   - Charge the system with approximately 200 g (0.44 lbs) of HFC-134a.
   - Make sure the high pressure valve of the manifold gauge is closed.
   - Check to ensure that the degree of pressure does not change.
   - Check for refrigerant leaks by using a HFC-134a leak detector.
   - If a leak occurs, recover the refrigerant. Repair the leak and start all over again from the first step of evacuation.
7. If no leaks are found, continue charging refrigerant to the air conditioning system.
   - Charge the refrigerant until the scale reading decreases by the amount of the charge specified.

Specified amount: 650 g (1.43 lbs)

- If charging the system becomes difficult:

1. Run the engine at idle and close all the vehicle doors.
2. Turn A/C switch “ON”.
3. Set the fan switch to its highest position.
4. Set the air source selector lever to “CIRC”.
5. Slowly open the low side valve on the manifold gauge set.

WARNING: BE ABSOLUTELY SURE NOT TO OPEN THE HIGH PRESSURE VALVE OF THE MANIFOLD GAUGE. SHOULD THE HIGH PRESSURE VALVE BE OPENED, THE HIGH PRESSURE REFRIGERANT WOULD FLOW BACKWARD, AND THIS MAY CAUSE THE REFRIGERANT CONTAINER TO BURST.

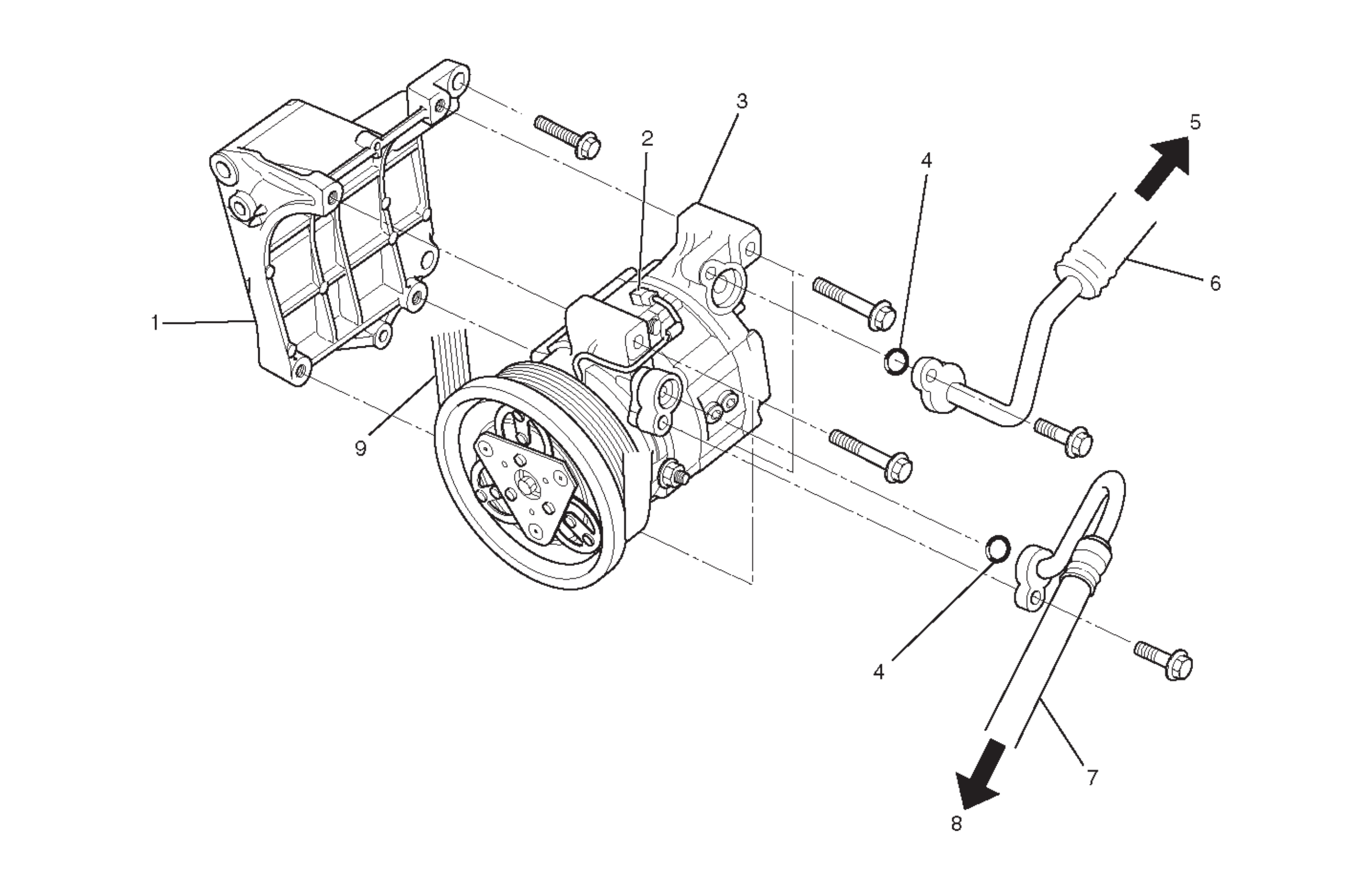
8. When finished with the refrigerant charging, close the low pressure valve of the manifold gauge and container valve.
9. Check for refrigerant leaks.

Checking The A/C System

1. Run the engine and close all the vehicle doors.
2. Turn A/C switch “ON”, set the fan switch to its highest position.
3. Set the air source lever to “CIRC”, set the temperature lever to the full cool position.
4. Check the high and low pressure of the manifold gauge.
   - Immediately after charging refrigerant, both high and low pressures might be slightly high, but they settle down to the pressure guidelines shown below:
   - The ambient temperature should be between 25–30°C (77–86°F).
   - The pressure guideline for the high-pressure side is approximately 1372.9–1863.3 kPa (199.1–270.2 psi).
   - The pressure guideline for the low-pressure side is approximately 147.1–294.2 kPa (21.3–42.7 psi).
   - If an abnormal pressure is found, refer to Checking The Refrigerant System With Manifold Gauge in this section.
5. Put your hand in front of the air outlet and move the temperature control lever of the control panel to different positions. Check if the outlet temperature changes as selected by the control knob.

Compressor Assembly

Compressor Assembly and Associated Parts



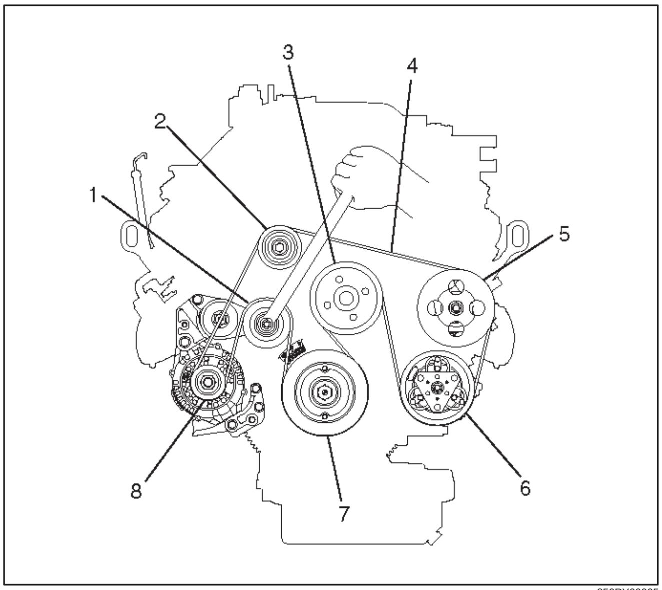
Legend

(1) Compressor Bracket
(2) Magnetic Clutch Harness Connector
(3) Compressor
(4) O-ring
(5) To Evaporator
(6) Suction Line (Low-Pressure Hose)
(7) Discharge Line (High-Pressure Hose)
(8) To Condenser
(9) Serpentine Belt

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant
   - Refer to Refrigerant Recovery in this section.
3. Disconnect magnetic clutch harness connector.

4. Remove serpentine belt.
   - Move serpentine belt tensioner to loose side using wrench then remove serpentine belt.



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Legend

(1) Auto Tensioner
(2) Idle Pulley
(3) Cooling Fan Pulley
(4) Serpentine Belt
(5) Power Steering Oil Pump
(6) Air Conditioner Compressor
(7) Crankshaft Pulley
(8) Generator

5. Disconnect refrigerant line connector.
   - When removing the line connector, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
6. Remove compressor.

Installation

1. Install compressor.
   - Tighten the compressor fixing bolts to the specified torque.

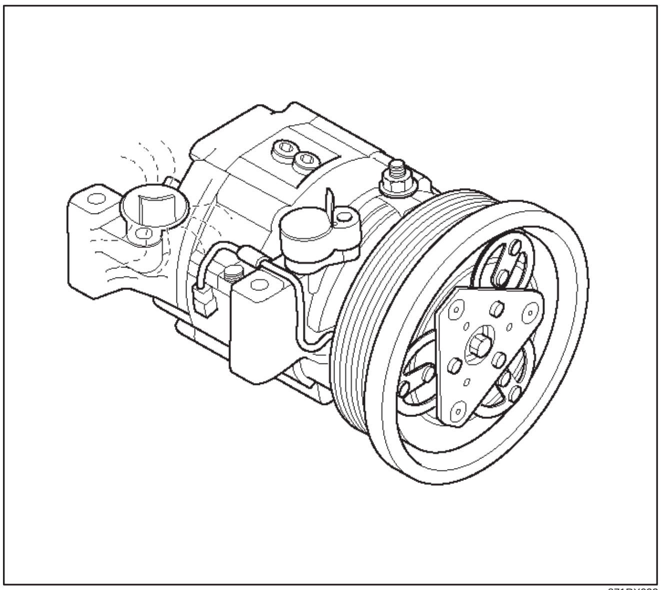
   Torque: 19 N•m (14 lb•ft)
2. Connect refrigerant line connector.
   - Tighten the refrigerant line connector fixing bolts to the specified torque.

   Torque: 15 N•m (11 lb•ft)
   - O-rings cannot be reused. Always replace with new ones.
   - Be sure to apply new compressor oil to the O-rings when connecting refrigerant lines.
3. Install serpentine belt.
   - Move serpentine belt tensioner to loose side using wrench, then install serpentine belt to normal position.
4. Connect magnetic clutch harness connector.

New Compressor Installation

The new compressor is filled with 150cc (5.0fl.oz.)of compressor oil and nitrogen gas. When mounting the compressor on the vehicle, perform the following steps;

1. Gently release nitrogen gas from the new compressor.
   - Take care not to let the compressor oil flow out.
   - Inspect O-rings and replace if necessary.



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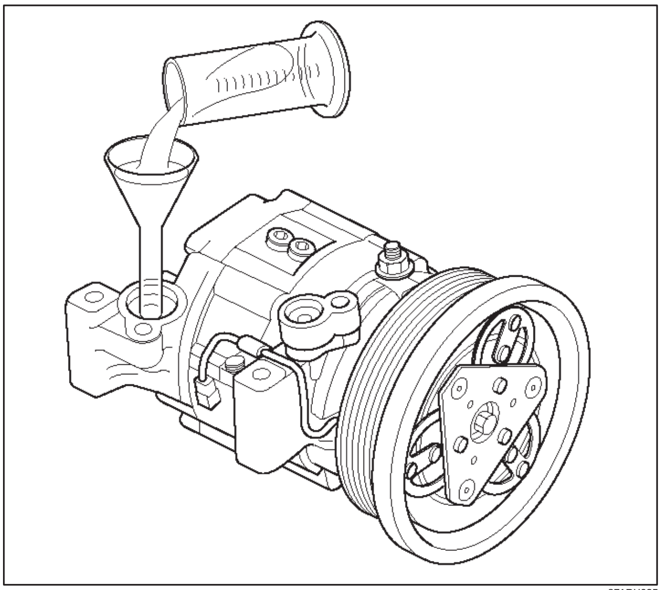
2. Turn the compressor several times by hand and release the compressor oil in the rotor.
3. When installing on a new system, the compressor should installed as it is. When installing on a used system, the compressor should be installed after adjusting the amount of compressor oil. (Refer to Compressor in this section)



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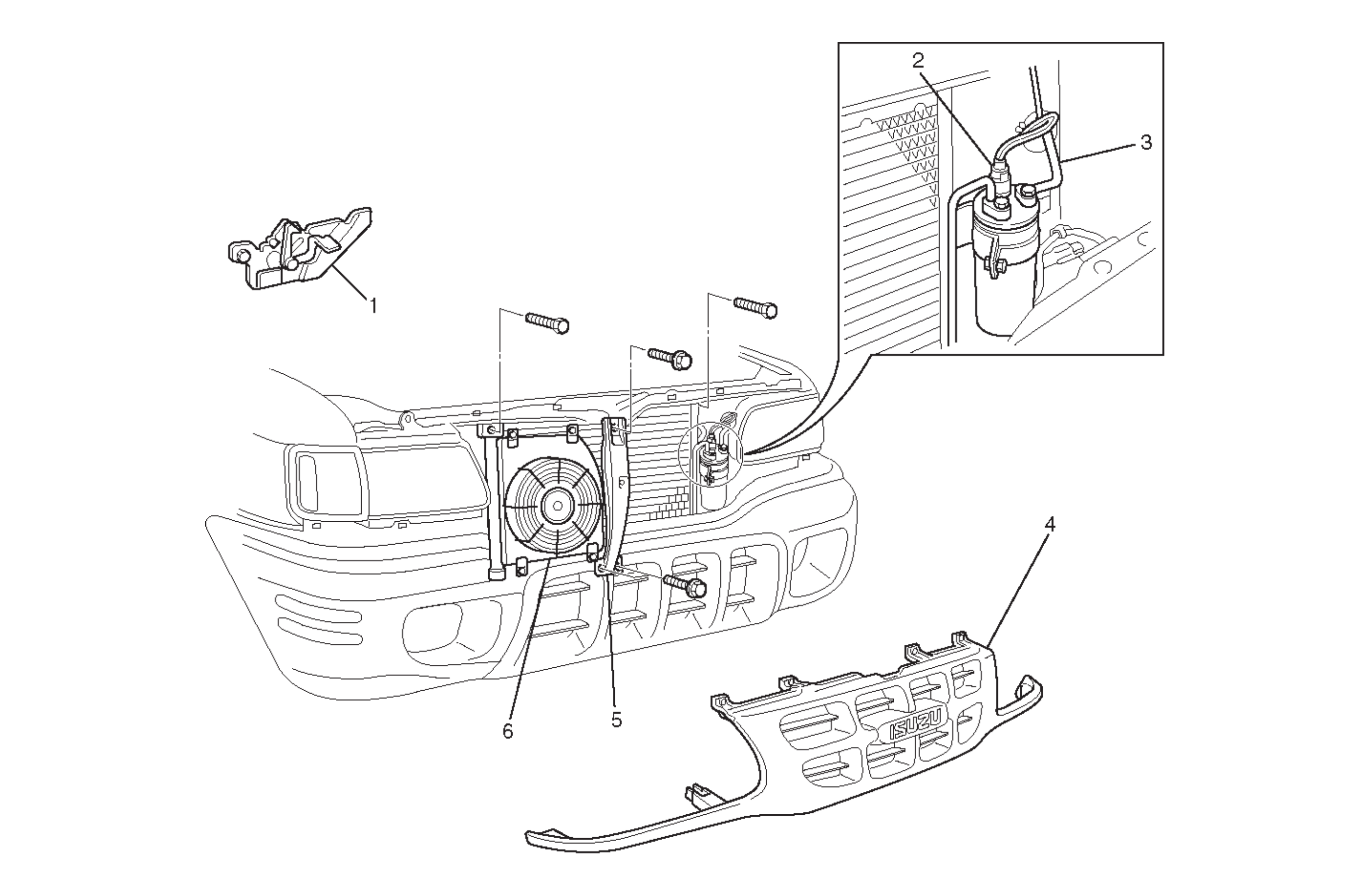
Condenser Assembly

Condenser Assembly and Associated Parts



Legend

(1) Engine Hood Lock
(2) Pressure Switch Connector
(3) Refrigerant Line
(4) Radiator Grille
(5) Engine Hood Front End Stay
(6) Condenser Assembly

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to Refrigerant Recovery in this section.
3. Remove radiator grille.
4. Remove engine hood front end stay.
5. Remove engine hood lock.
   - Apply setting mark to the engine hood lock fixing position before removing it.
6. Disconnect pressure switch connector.
7. Disconnect refrigerant line.
   - When removing the line connector, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
8. Remove condenser assembly.
   - Handle with care to prevent damaging the condenser or radiator fin.

Installation

1. Install condenser assembly.
   - If installing a new condenser, be sure to add 30cc (1.0 fl. oz.) of new compressor oil to a new one.
   - Tighten the condenser fixing bolts to the specified torque.

   Torque: 6 N•m (52 lb in)
2. Connect refrigerant line.
   - Tighten the inlet line connector fixing bolt to the specified torque.

   Torque: 15 N•m (11 lb ft)
   - Tighten the outlet line connector fixing bolt to the specified torque.

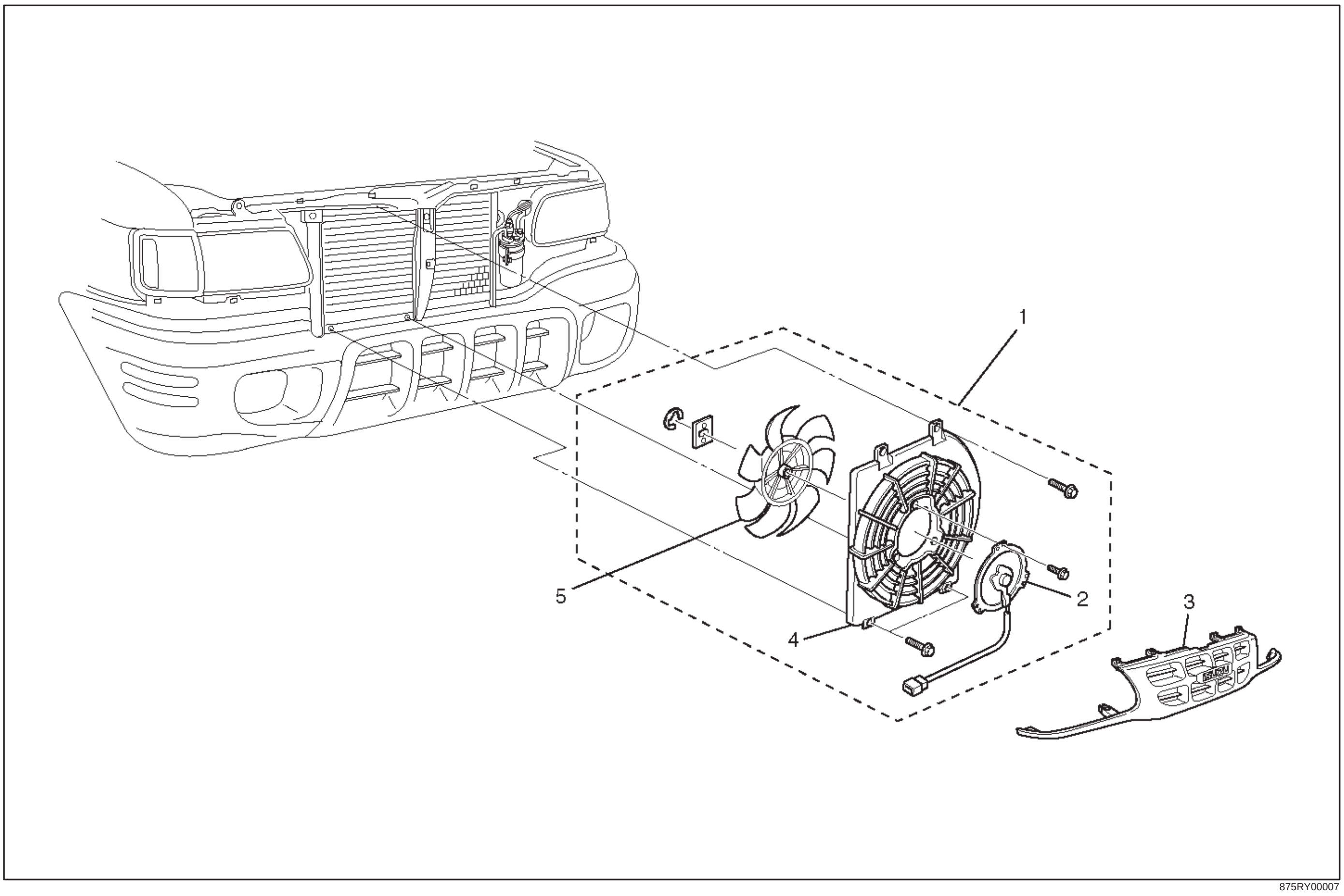
   Torque: 6 N•m (52 lb in)
   - O-rings cannot be reused. Always replace with new ones.

- Be sure to apply new compressor oil to the O-rings when connecting the refrigerant line.

3. Connect pressure switch connector.
4. Install engine hood lock.
5. Install engine hood front end stay.
6. Install radiator grille.

Condenser Fan Motor

Condenser Fan Motor and Associated Parts



Legend

(1) Condenser Fan Assembly
(2) Condenser Fan Motor
(3) Radiator Grille
(4) Shroud
(5) Fan

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to Refrigerant Recovery in this section.
3. Remove radiator grille.
4. Remove condenser fan assembly.
   - Disconnect the fan motor connector and remove the 4 fixing bolts.
5. Remove shroud.
   - Remove the 3 fixing nuts.
   - Loosen the condenser fixing nut and disconnect the fan motor connector from bracket.
6. Remove fan.
   - Remove the fan fixing C-ring and plate.
7. Remove condenser fan motor.

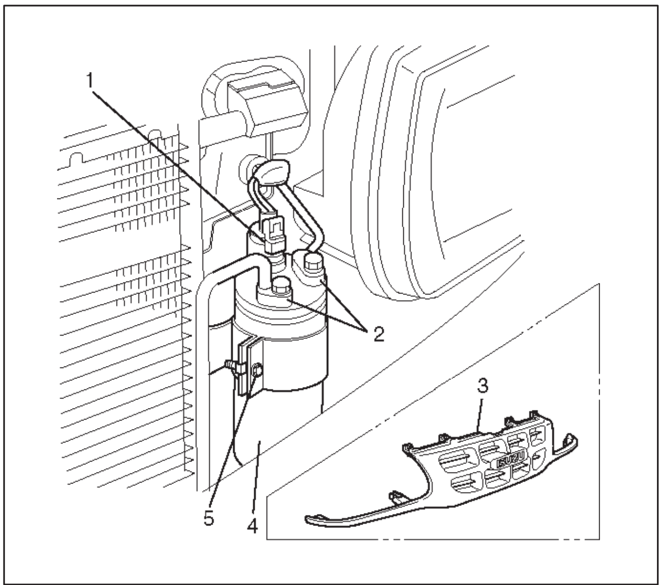
Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Route the fan motor harness in its previous position, and fix it securely with clip and bracket.

Receiver / Drier

Receiver / Drier and Associated Parts



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Legend

(1) Pressure Switch Connector
(2) Refrigerant Line
(3) Radiator Grille
(4) Receiver / Drier
(5) Bracket Bolt

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to Refrigerant Recovery in this section.
3. Remove radiator grille.
4. Disconnect pressure switch connector.
5. Disconnect refrigerant line.
   - When removing the line connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
6. Remove bracket bolt.
7. Remove receiver/drier.
   - Loosen the bolt, then, using care not to touch or bend the refrigerant line, carefully pull out the receiver/drier.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

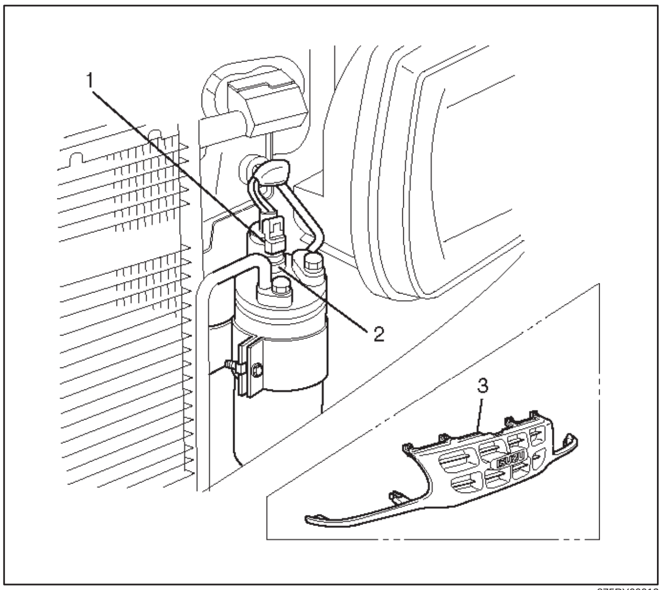
1. If installing a new receiver/drier, be sure to add 30cc (1.0 fl. oz.) of new compressor oil to a new one.
2. Put the receiver/drier in the bracket and connect with the refrigerant line. Check that no excessive force is imposed on the line. Fasten the bracket bolt to the receiver/drier.
3. Tighten the refrigerant line to the specified torque.

Torque: 6 N•m (52 lb in)

4. O-rings cannot be reused. Always replace with new ones.
5. Be sure to apply new compressor oil to the O-rings when connecting the refrigerant line.

Pressure Switch

Pressure Switch and Associated Parts



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Legend

(1) Pressure Switch Connector
(2) Pressure Switch
(3) Radiator Grille

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to “Refrigerant Recovery in this section.
3. Remove radiator grille.
4. Disconnect pressure switch connector.
5. Disconnect pressure switch.
   - When removing the switch connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.

Installation

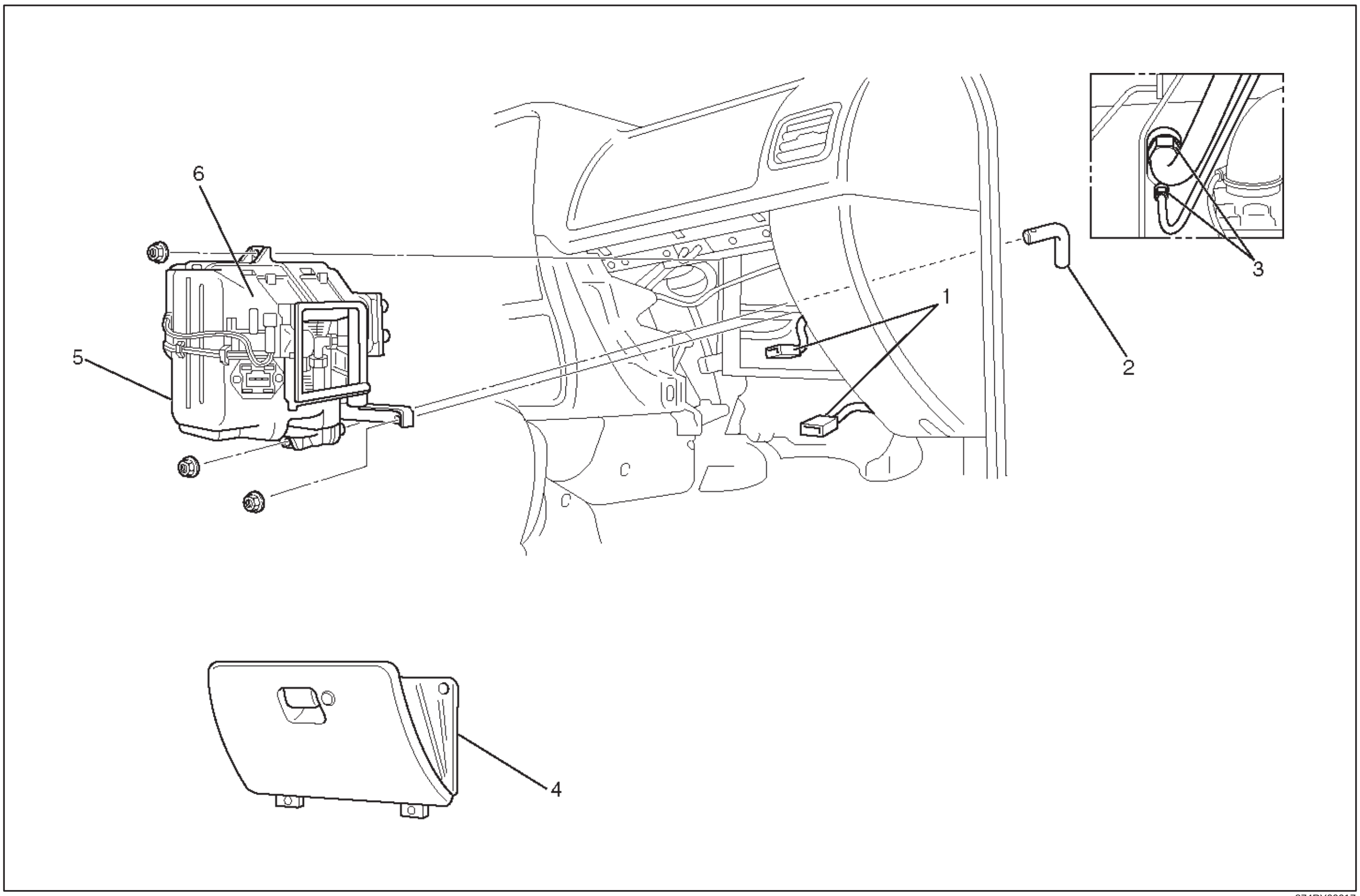
To install, follow the removal steps in the reverse order, noting the following point:

1. O-ring cannot be reused. Always replace with a new one.
2. Be sure to apply new compressor oil to the O-ring when connecting pressure switch.
3. Tighten the pressure switch to the specified torque.

   Torque: 13 N•m (113 lb in)

Evaporator Assembly

Evaporator Assembly and Associated Parts



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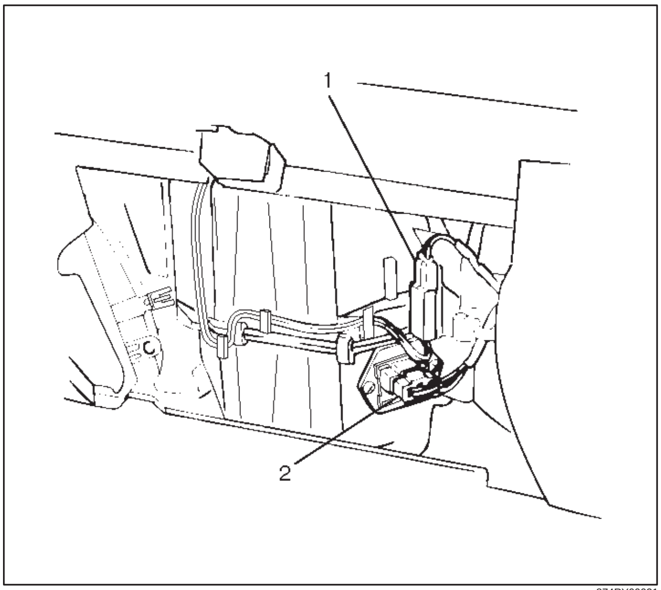
Legend

(1) Resistor and Electronic Thermostat Connector
(2) Drain Hose
(3) Refrigerant Line
(4) Glove Box
(5) Evaporator Assembly

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to Refrigerant Recovery in this section.
3. Remove glove box.
4. Disconnect resistor (2) and electronic thermostat connector (1).



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5. Disconnect drain hose.
6. Disconnect refrigerant line.
   - Use a back-up wrench when disconnecting and reconnecting the refrigerant lines.
   - When removing the refrigerant line connected part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.
7. Remove evaporator assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. To install a new evaporator assembly, add 50cc (1.7 fl. oz.) of new compressor oil to the new core.
2. Tighten the refrigerant outlet line to the specified torque.

Torque: 25 N•m (18 lb ft)

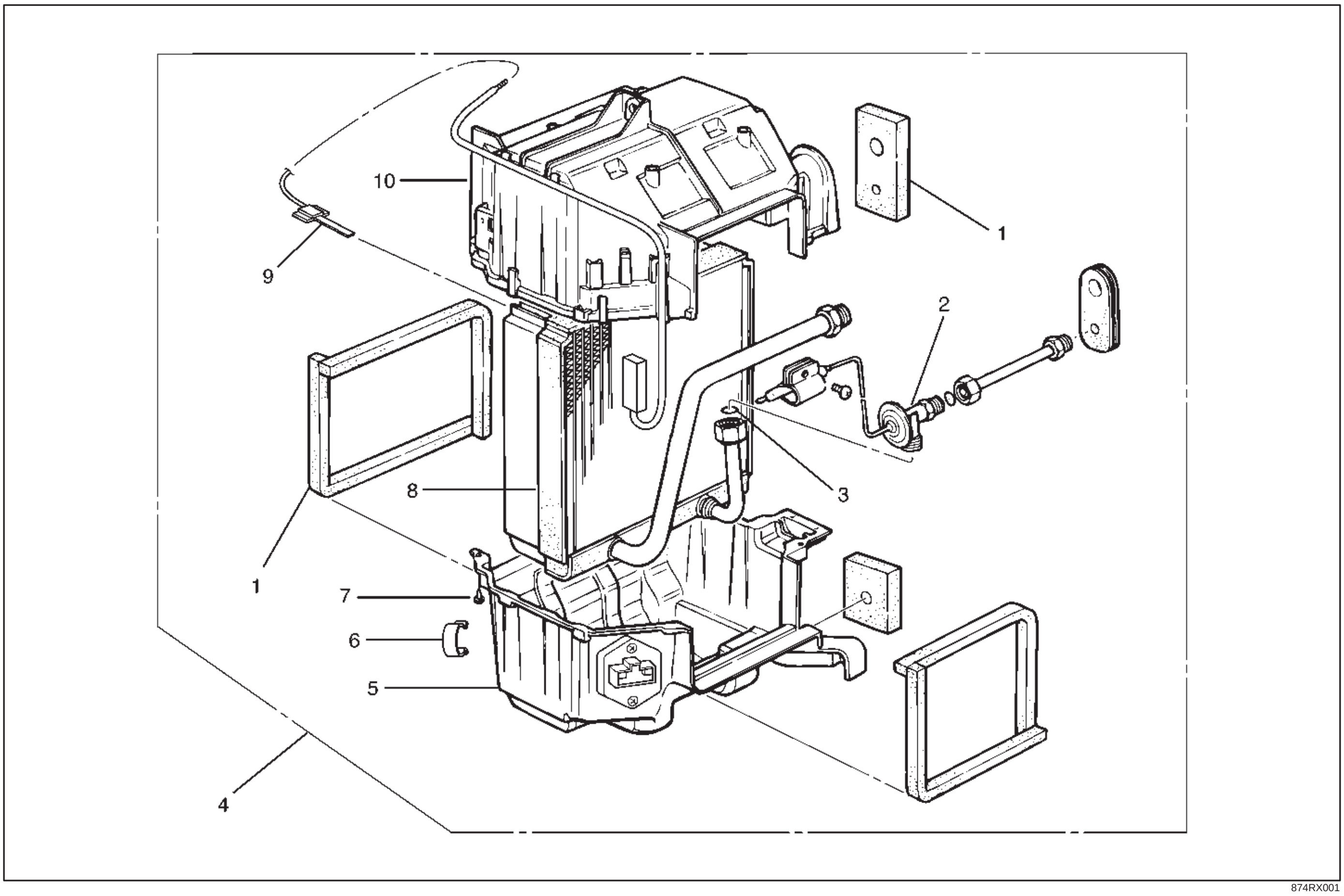
3. Tighten the refrigerant inlet line to the specified torque.

Torque: 15 N•m (11 lb ft)

4. O-rings cannot be reused. Always replace with new ones.
5. Be sure to apply new compressor oil to the O-rings when connecting lines.

Electronic Thermostat, Evaporator Core and/or Expansion Valve

Disassembled View

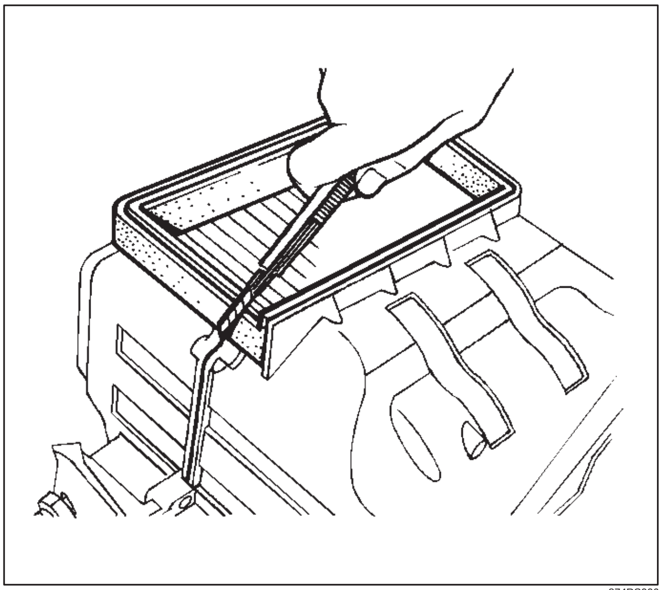


Legend

(1) Lining
(2) Expansion Valve
(3) O-ring
(4) Evaporator Assembly
(5) Lower Case
(6) Clip
(7) Attaching Screw
(8) Evaporator Core
(9) Electronic Thermostat
(10) Upper Case

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to Refrigerant Recovery in this section.
3. Remove evaporator assembly.
   - Refer to Evaporator Assembly in this section.
4. Remove the electronic thermostat sensor fixing clip. Pull the sensor from the evaporator assembly.
5. Remove clip.
6. Remove attaching screw.
7. Remove upper case.
8. Remove lower case.
   - Slit the case parting face with a knife since the lining is separated when removing the evaporator.



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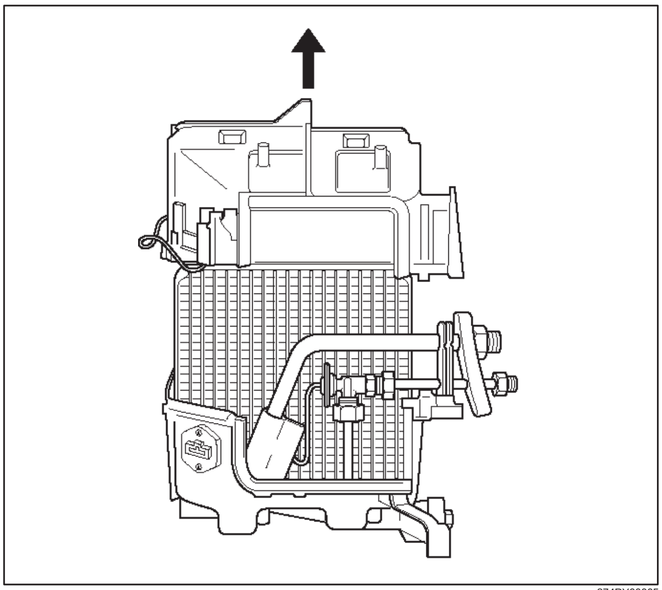
   - Lift to remove the upper case.



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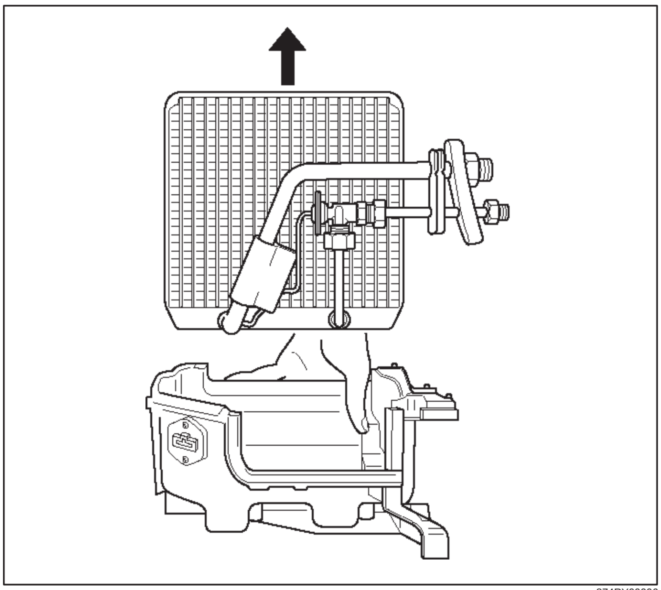
9. Remove evaporator core.



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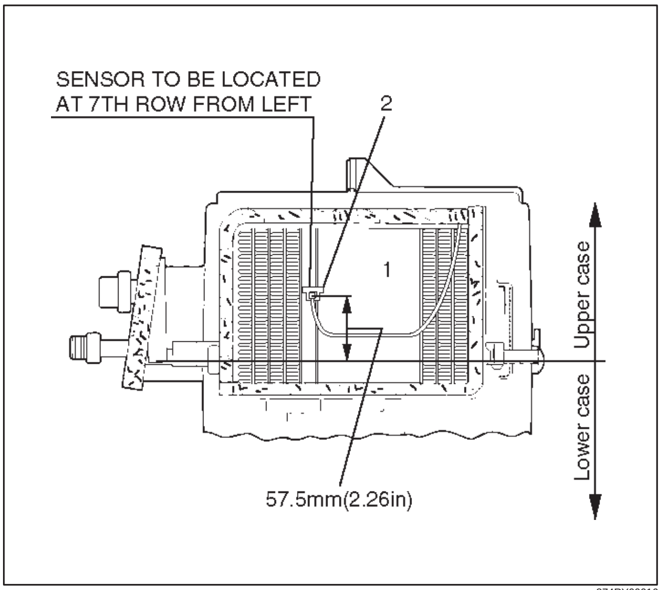
10. Remove expansion valve.
    - Tear off the insulator carefully.
    - Remove the sensor fixing clip.
    - Use a back-up wrench when disconnecting all refrigerant pipes.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. The sensor is installed on the core with the clip.
2. The sensor must not interfere with the evaporator core.
3. When installing the new evaporator core, install the duct sensor (2) to the evaporator core (1) specified position with the clip in the illustration.



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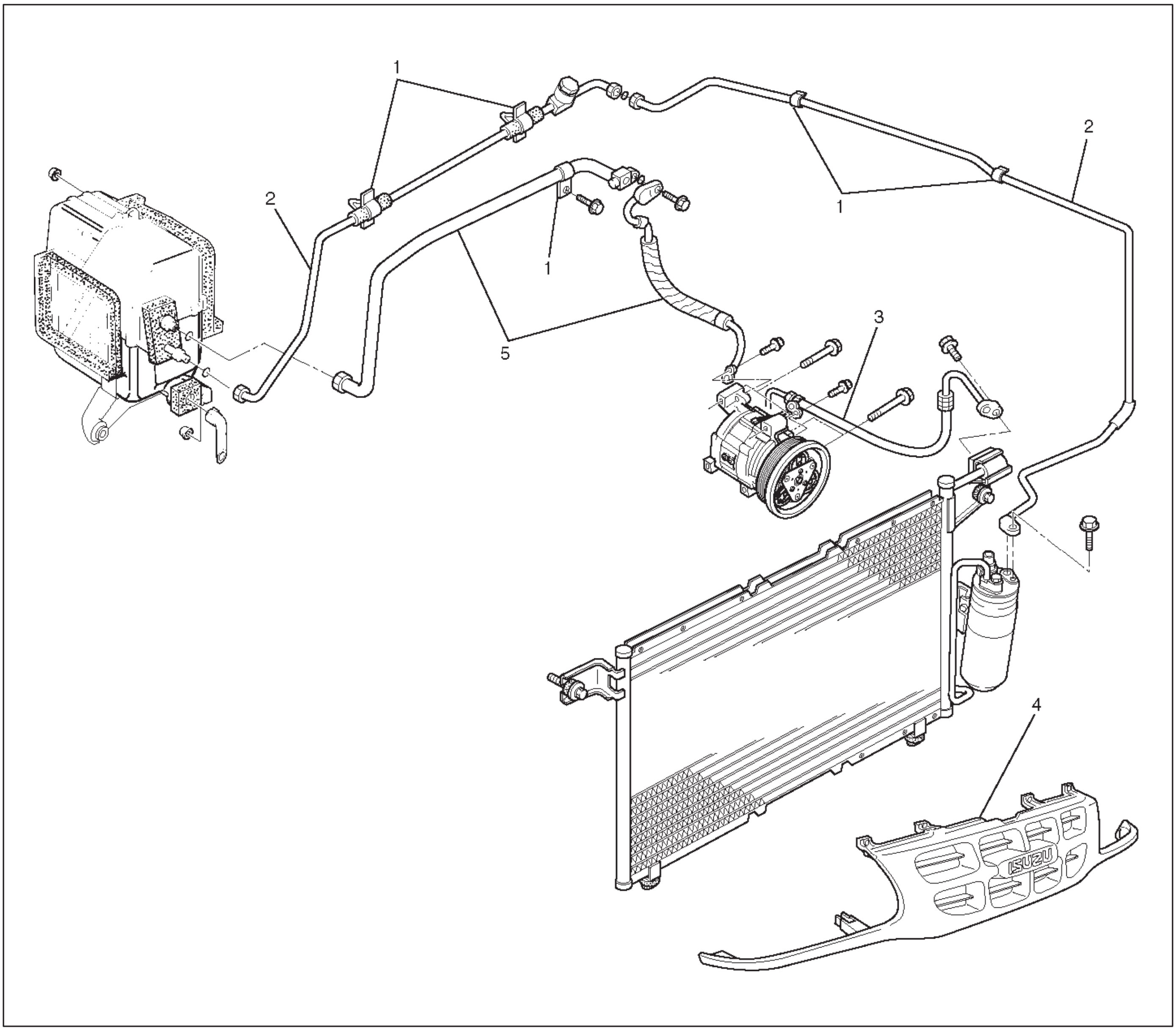
4. O-rings cannot be reused. Always replace with new ones.
5. Be sure to apply new compressor oil to the O-rings when connecting lines.
6. Be sure to install the sensor and the insulator on the place where they were before.
7. To install a new evaporator core, add 50cc (1.7 fl. oz.) of new compressor oil to the new core.
8. Tighten the refrigerant lines to the specified torque. Refer to Main Data and Specifications for Torque Specifications in this section.
9. Apply an adhesive to the parting face of the lining when assembling the evaporator assembly.

Refrigerant Line

Refrigerant Line and Associated Parts



Legend

(1) Clip and Clamp
(2) Liquid Line (High-Pressure Pipe)
(3) Discharge Line (High-Pressure Hose)
(4) Radiator Grille
(5) Suction Line (Low-Pressure Pipe)

Removal

1. Disconnect the battery ground cable.
2. Discharge and recover refrigerant.
   - Refer to Refrigerant Recovery in this section.
3. Remove radiator grille.
4. Remove clip and clamp.
5. Disconnect liquid line (High-pressure pipe).
6. Disconnect suction line (Low-pressure pipe) using a back-up wrench.
7. Disconnect suction line (Low-pressure hose) using a back-up wrench.
8. Disconnect discharge line (High-pressure hose) using a back-up wrench.
   - Use a backup wrench when disconnecting and reconnecting the refrigerant lines.
   - When removing the refrigerant line connecting part, the connecting part should immediately be plugged or capped to prevent foreign matter from being mixed into the line.

Installation

To install, follow the removal steps in the reverse order, noting the following point:

1. O-rings cannot be reused. Always replace with new ones.
2. Be sure to apply new compressor oil to the O-rings when connecting lines.
3. Tighten the refrigerant line to the specified torque.
   Refer to Main Data and Specifications for Torque Specifications in this section.

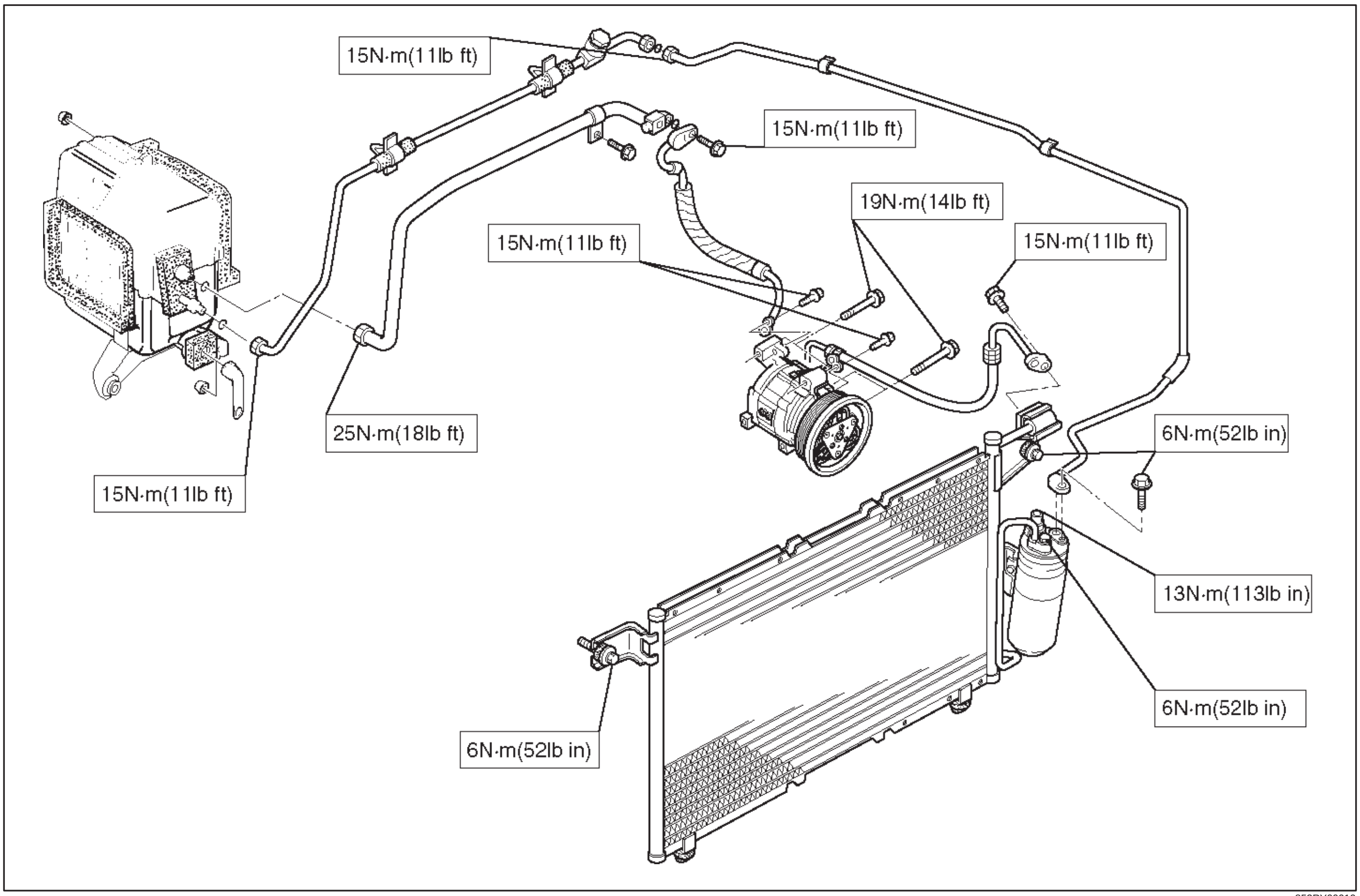
Main Data And Specifications

General Specifications

Heater Unit	
Temperature control	Reheat air mix system
Capacity	4.3 kw (3700 Kcal./hr.)
Air flow	280 m^3/h
HEATER CORE	
Type	Fin and tube type
Element dimension	167 mm (6.6 in.) × 151 mm (5.9 in.) × 35 mm (1.4 in.)
Radiating area	Approx. 2.4 m^2
EVAPORATOR ASSEMBLY	
Capacity	4.8 kw (4100 Kcal./hr.)
Air flow	430 m^3/hr
EVAPORATOR CORE	
Type	Al-laminate louver fin type
Element dimension	235 mm (9.3 in.) × 224 mm (8.8 in.) × 60 mm (2.4 in.)
EXPANSION VALVE	
Type	External pressure equalizer type
THERMOSTAT SWITCH	
Type	Electronic thermostat OFF: Below 1.0 ± 0.5 °C (33.8 ± 0.9 °F) ON: Above 3.5 ± 0.3 °C (38.3 ± 0.9 °F)
CONDENSER	
Type	Parallel flow type
Radiation performance	12.9 kw (11,100 Kcal./hr.)
RECEIVER/DRIER	
Type	Assembly includes sight glass with dual (triple) pressure switch (V6) or pressure sensor (L4)
Internal volume	300 cc (10 fl.oz.)

PRESSURE SWITCH	
Type	Dual pressure switch
	Low pressure control ON: 205.9±29.4 kPa (29.9±4.3 psi) OFF: 176.5±24.5 kPa (25.6±3.6 psi)
	High pressure control ON: 2353.6±196.1 kPa (341.3±28.4 psi) OFF: 2942.0±196.1 kPa (426.6±28.4 psi)
	Triple pressure switch (V6, A/T)
	Low pressure control ON: 196.3±29.4 kPa (27.0±4.3 psi) OFF: 176.5±19.6 kPa (25.6±2.8 psi)
	Medium pressure control ON: 1471.0±98.1 kPa (213.3±14.2 psi) OFF: 1078.7±117.7 kPa (156.4±17.7 psi)
	High pressure control ON: 2353.6±196.1 kPa (341.3±28.4 psi) OFF: 2942.0±196.1 kPa (426.6±28.4 psi)
REFRIGERANT	
Type	HFC-134a
Specified amount	650 g (1.43 lbs.)

Torque Specifications



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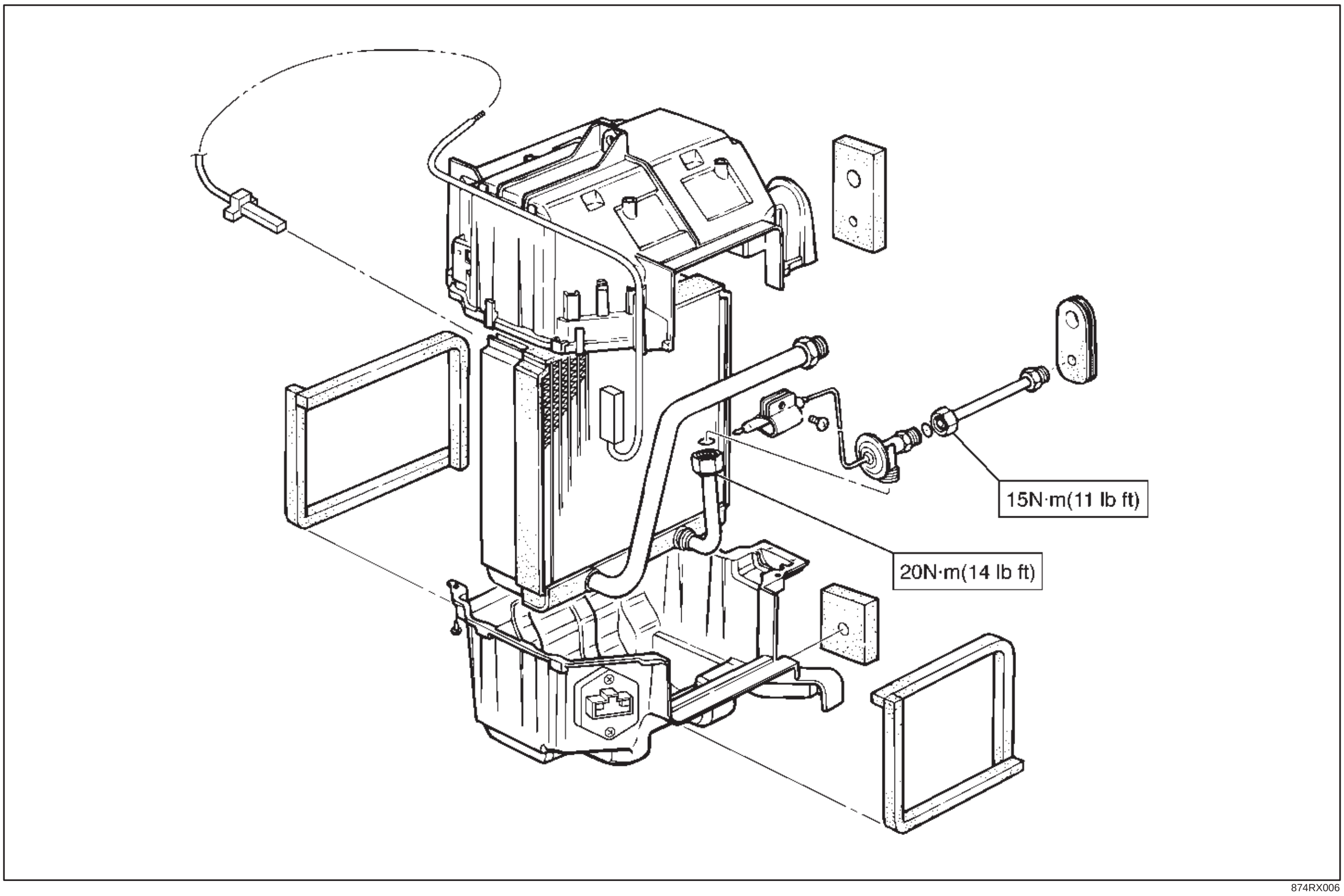

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Compressor

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS ON-VEHICLE SERVICE INFORMATION. FAILURE TO FOLLOW CAUTIONS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

When servicing the compressor, keep dirt or foreign material from getting on or into the compressor parts and system. Clean tools and a clean work area are important for proper service. The compressor connections and the outside of the compressor should be cleaned before any ”On–Vehicle” repair, or before removal of the compressor. The parts must be kept clean at all times and any parts to be reassembled should be cleaned with Trichloroethane, naphtha, kerosene, or equivalent solvent, and dried with dry air. Use only lint free cloths to wipe parts.

The operations described below are based on bench overhaul with compressor removed from the vehicle, except as noted. They have been prepared in order of accessibility of the components. When the compressor is removed from the vehicle for servicing, the oil remaining in the compressor should be discarded and new compressor oil added to the compressor.

Compressor malfunction will appear in one of four ways: noise, seizure, leakage or low discharge pressure. Resonant compressor noises are not cause for alarm; however, irregular noise or rattles may indicate broken parts or excessive clearances due to wear. To check seizure, de–energize the magnetic clutch and check to see if the drive plate can be rotated. If rotation is impossible, the compressor is seized. Low discharge pressure may be due to a faulty internal seal of the compressor, or a restriction in the compressor. Low discharge pressure may also be due to an insufficient refrigerant charge or a restriction elsewhere in the system. These possibilities should be checked prior to servicing the compressor. If the compressor is inoperative, but is not seized, check to see if current is being supplied to the magnetic clutch coil terminals.

The compressor oil used in the HFC–134a system compressor differs from that used in R–12 systems.

Also, compressor oil to be used varies according to the compressor model. Be sure to avoid mixing two or more different types of oil.

If the wrong oil is used, lubrication will be poor and the compressor will seize or malfunction.

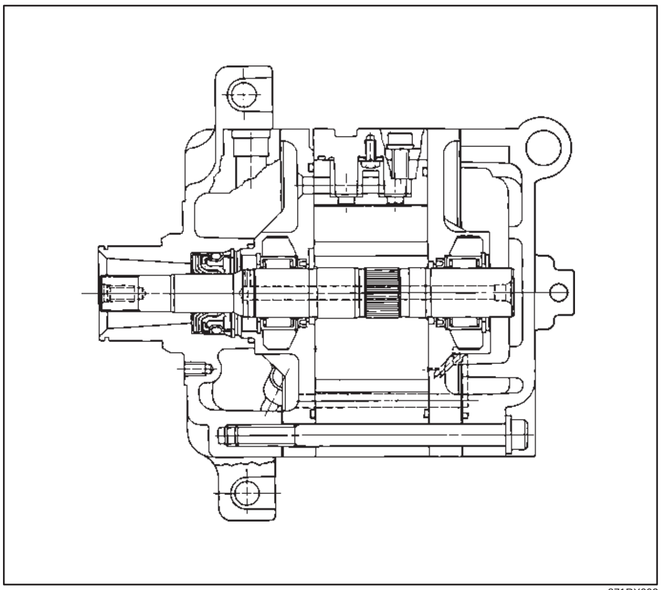
DKV-14G Type Compressor

DKV–14G is equipped with five–vane rotary compressor. These vanes are built into a rotor which is mounted on a shaft.

When the shaft rotates, the vanes built into the cylinder block assembly are operated by centrifugal force.

This changes the volume of the spare formed by the rotor and cylinder, resulting in the intake and compression of the refrigerant gas. The discharge valve and the valve stopper, which protects the discharge valve, are built into the cylinder block assembly. There is no suction valve but a shaft seal is installed between the shaft and head; a trigger valve, which applies back pressure to the vanes, is installed in the cylinder block and a refrigerant gas temperature sensor is installed in the front head.

The specified quantity of compressor oil is contained in the compressor to lubricate the various parts using the refrigerant gas discharge pressure.



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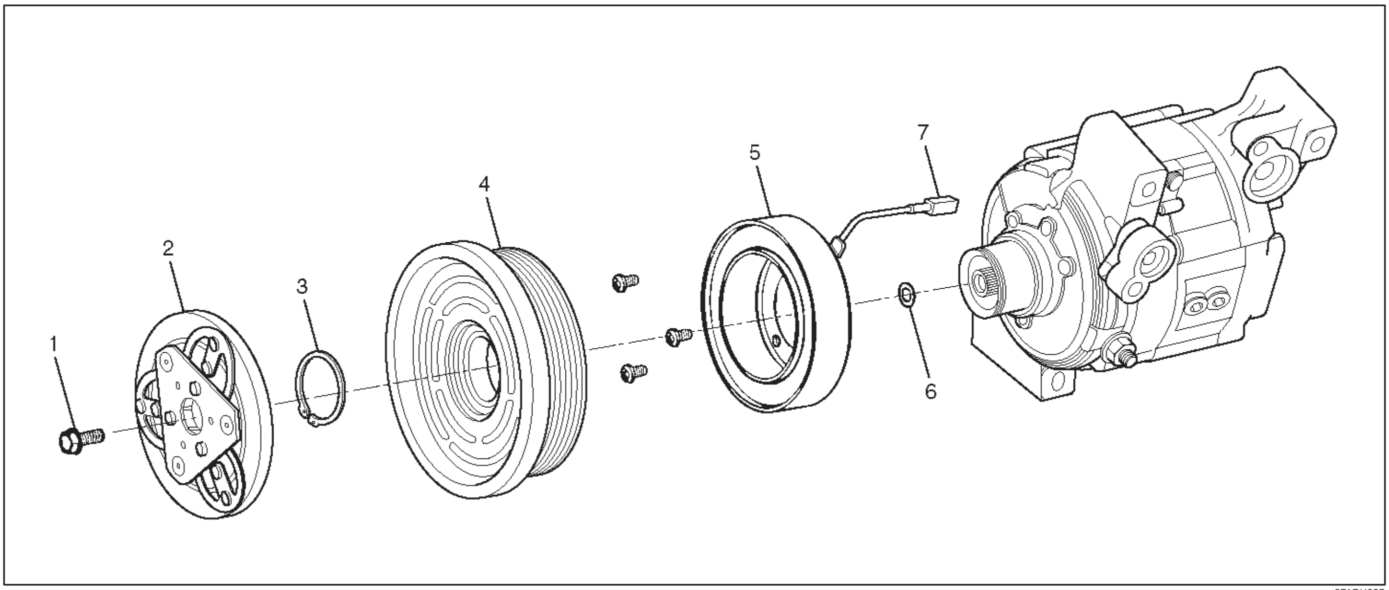
Diagnosis

Condition	Possible cause	Correction
Noise from compression	Defective rotor/piston	Replace compressor/cylinder and shaft assembly
	Defective shaft	Replace compressor/cylinder and shaft assembly
Noise from magnetic clutch	Defective bearing	Replace magnetic clutch
	Defective clutch	Replace magnetic clutch
	Clearance between drive plate and pulley not standard	Adjust the clearance or replace magnetic clutch
Insufficient cooling	Defective gasket	Replace compressor/gasket
	Defective rotor/reed valve	Replace compressor/valve plate
	Defective trigger valve/suction valve	Replace compressor/suction valve
Not rotating	Defective rotor/piston	Replace compressor/cylinder and shaft assembly
	Defective shaft	Replace compressor/cylinder and shaft assembly
	Rotating parts seized due to insufficient oil	Replace compressor
Oil and/or gas leakage	Defective seal	Replace compressor/shaft seal
	Defective O-ring	Replace

Magnetic Clutch Assembly (DKV-14G Type)

Parts Location View



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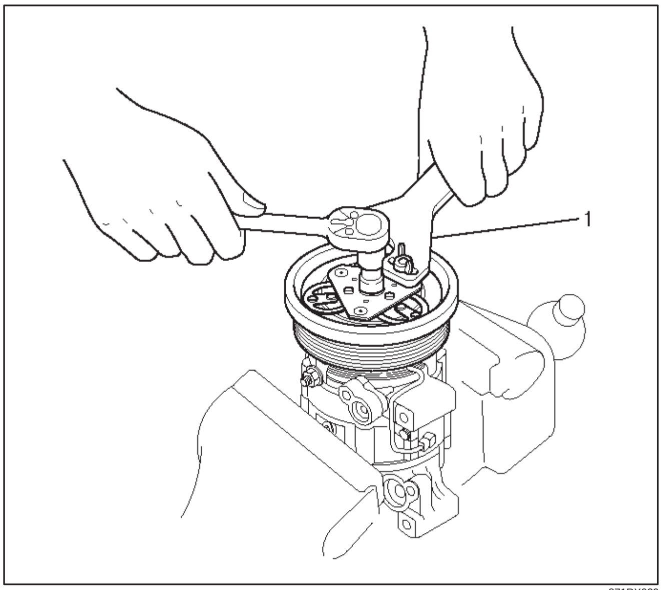
Legend

(1) Drive Plate bolt
(2) Drive Plate
(3) Snap Ring
(4) Pulley Assembly
(5) Field Coil
(6) Shim (s)
(7) Lead Wire

Removal

1. Using drive plate holder J-33939 (1) to prevent the drive plate from rotating, then remove the drive plate bolt.



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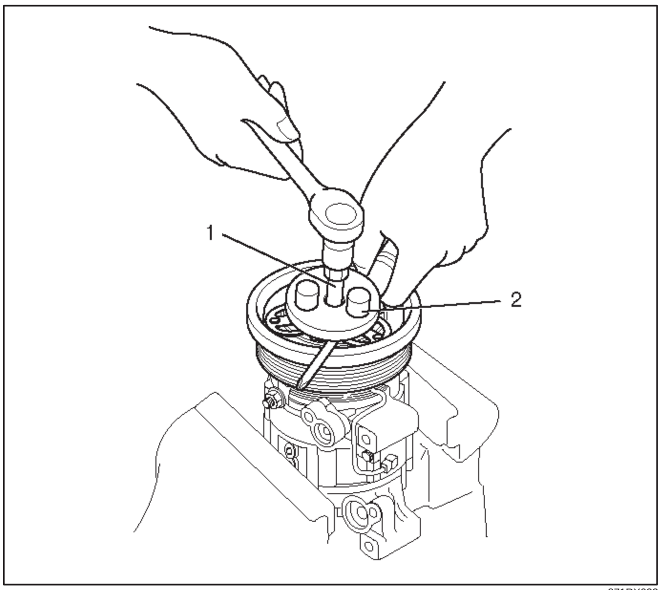
2. Remove drive plate by using drive plate puller J-33944-A (2) and forcing screw J-33944-4 (1).



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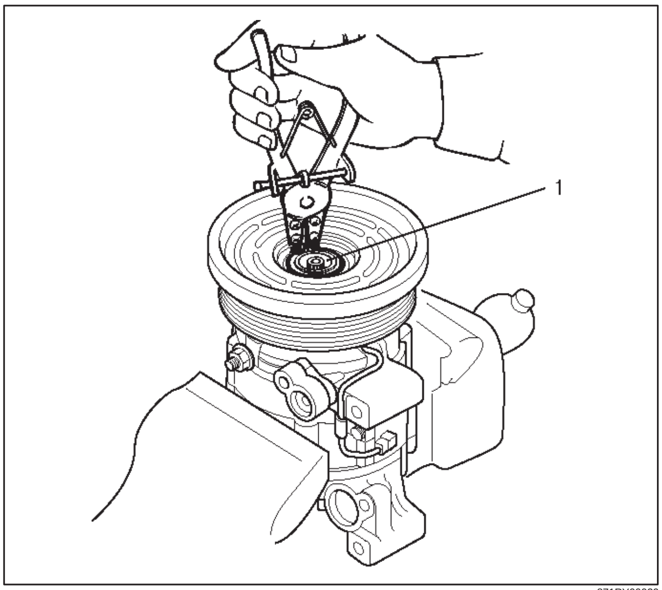
3. Remove shim (s).
4. Remove snap ring (1) by using snap ring pliers.



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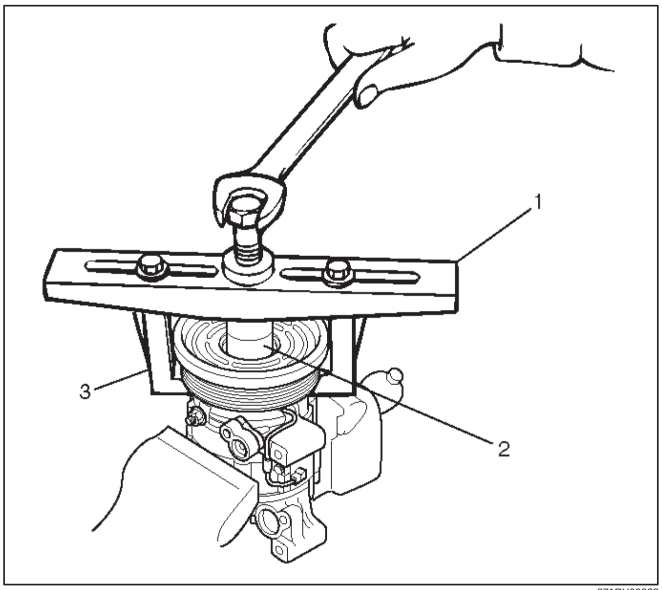
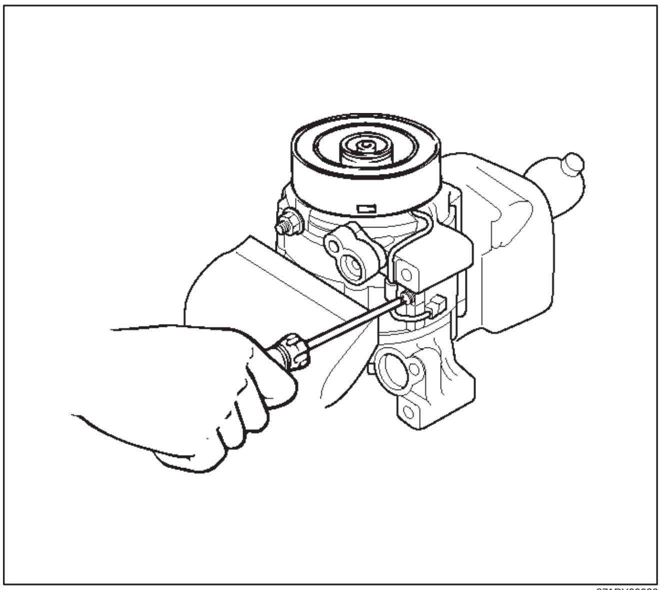
5. Remove pulley assembly by using pulley puller pilot J-38424 (2), pulley puller J-8433 (1) and pulley puller leg J-24092-2 (3).



871RY00033

6. Loosen screw and disconnect the field coil wire connector.



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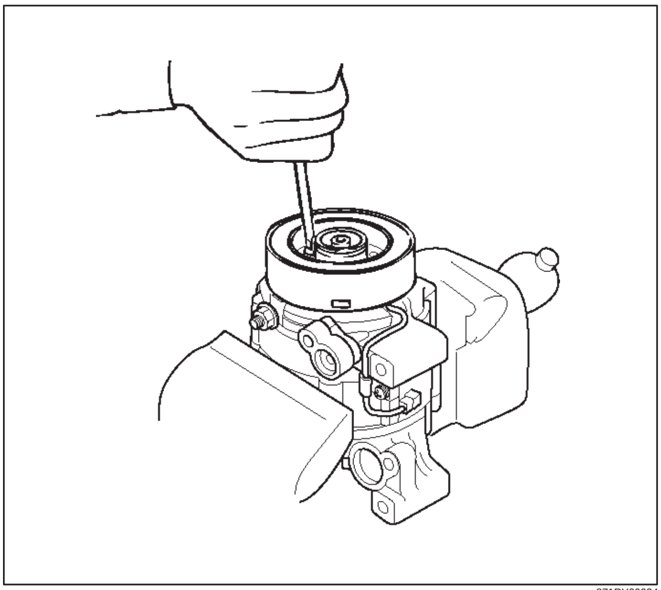
7. Loosen three screws and remove the field coil.



871RY00034

Inspection and Repair

Drive Plate

If the frictional surface shows signs of damage due to excessive heat, the drive plate and pulley should be replaced.

Pulley Assembly

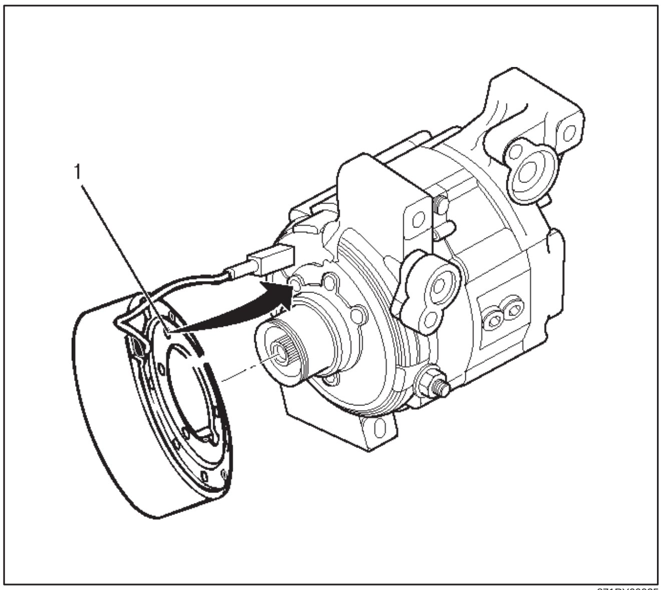
Check the appearance of the pulley assembly. If the frictional surface of the pulley shows signs of excessive grooving due to slippage, both the pulley and drive plate should be replaced. The frictional surfaces of the pulley assembly should be cleaned with a suitable solvent before reinstallation.

Coil

Check coil for loose connector or cracked insulation.

Installation

1. Install field coil.
   - Align the located portion (1) of the field coil and compressor.

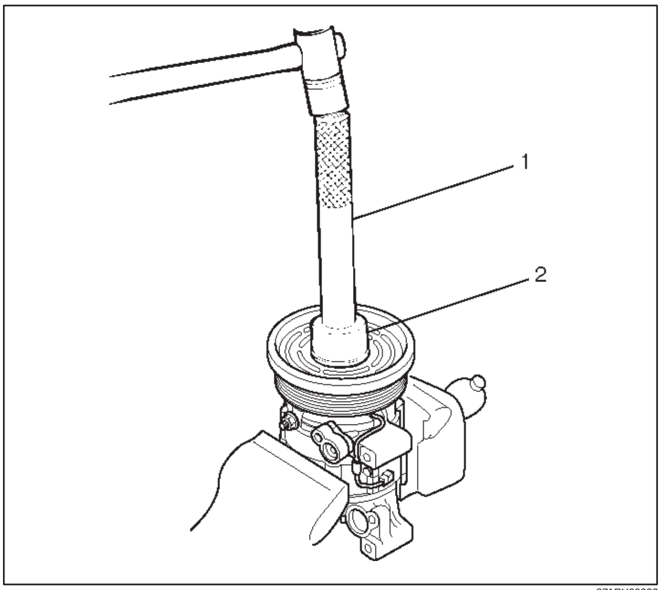


871RY00035

   - Tighten the mounting screw to the specified torque.

   Torque: 5N·m (44 lb in)

2. Connect the lead wire connector with the rubber hold and tighten the screw.
3. Install pulley assembly by using pulley installer J-33940-A (2) and drive handle J-8092 (1).



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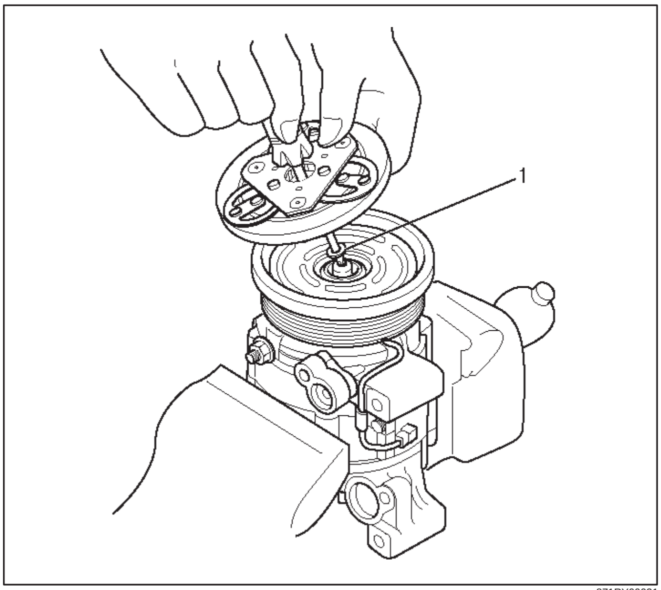
4. Install snap ring.
5. Install shim (s).
6. Install the drive plate to the compressor drive shaft together with the original shim(s)(1). Press the drive plate by hand.



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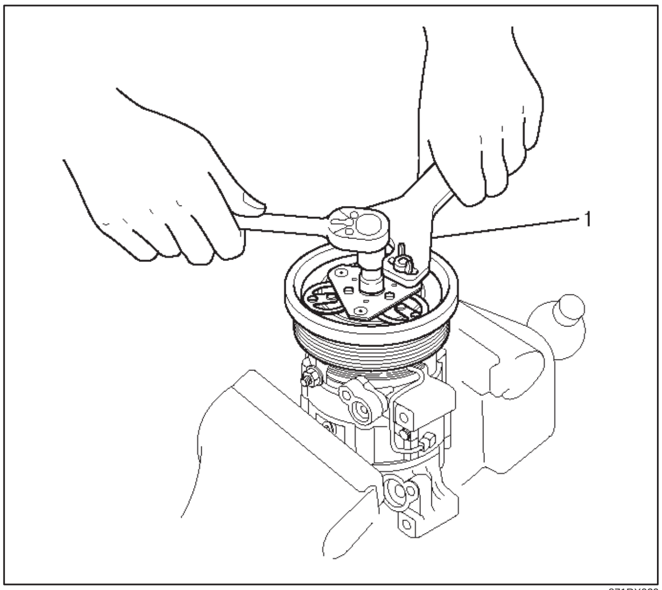
7. Install drive plate bolt by using drive plate holder J-33939 (1) to prevent the drive plate from rotating.

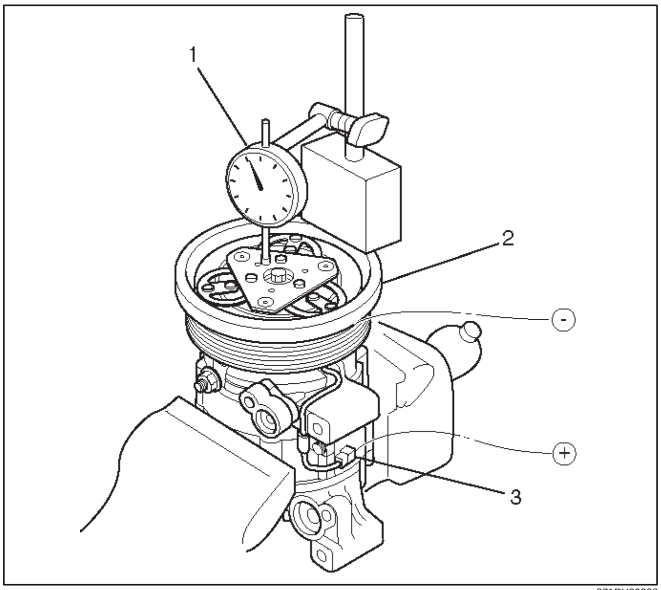


- Tighten the drive plate bolt to the specified torque.

Torque: 13 N·m (113 lb in)

- After tightening the drive plate bolt, check to be sure the pulley rotates smoothly.

- Check to be sure that the clutch clearance is between 0.3-0.6 mm (0.01-0.02 in.)



Legend

(1) Dial Gauge
(2) Pulley Assembly
(3) Field Coil Wire Connector

- If necessary, install adjusting shim(s).
- Adjusting shims are available in the following thickness.

Thickness

- **0.1 mm (0.0039 in.)**
- **0.3 mm (0.0118 in.)**
- **0.5 mm (0.0197 in.)**

Compressor Oil

Oil Specification

- The HFC-134a system requires a synthetic (PAG) compressor oil whereas the R-12 system requires a mineral compressor oil. The two oils must never be mixed.
- Compressor (PAG) oil varies according to compressor model. Be sure to use oil specified for the model of compressor.
- **Always use HFC-134a Vane Rotary Type Compressor Oil (AIPDN Part No.2-90188-301-0)**

Handling of Oil

- The oil should be free from moisture, dust, metal powder, etc.
- Do not mix with other oil.
- The water content in the oil increases when exposed to the air. After use, seal oil from air immediately. (HFC-134a Vane Rotary Compressor Oil absorbs moisture very easily.)
- The compressor oil must be stored in steel containers, not in plastic containers.

Compressor Oil Check

The oil used to lubricate the compressor is circulating with the refrigerant.
Whenever replacing any component of the system or a large amount of gas leakage occurs, add oil to maintain the original amount of oil.

Oil Capacity

Capacity total in system: 150cc (5.0 fl.oz)

Compressor (Service parts) charging amount: 150 cc (5.0 fl.oz)

Checking and Adjusting Oil Quantity for Used Compressor

1. Perform oil return operation. Refer to Oil Return Operation in this section.
2. Discharge and recover refrigerant and remove the compressor.
3. Drain the compressor oil and measure the extracted oil with a measuring cylinder.
4. If the amount of oil drained is much less than 90 cc (3.0 fl. oz.), some refrigerant may have leaked out. Conduct a leak tests on the connections of each system, and if necessary, repair or replace faulty parts.
5. Check the compressor oil contamination. (Refer to Contamination of Compressor Oil in this section.)
6. Adjust the oil level following the next procedure below.

(Charging Amount)	(Collected Amount)
more than 90cc (3.0 fl.oz)	same as collected amount
less than 90 cc (3.0 fl.oz)	90cc (3.0 fl.oz)

7. Install the compressor, then evacuate, charge and perform the oil return operation.
8. Check system operation.

When it is impossible to preform oil return operation, the compressor oil should be checked in the following order:

1. Discharge and recover refrigerant and remove the compressor.
2. Drain the compressor oil and measure the extracted oil with a measuring cylinder.
3. Check the oil for contamination.
4. If more than 90 cc (3.0 fl. oz.) of oil is extracted from the compressor, supply the same amount of oil to the compressor to be installed.
5. If the amount of oil extracted is less than 90 cc (3.0 fl. oz.), recheck the compressor oil in the following order.
6. Supply 90 cc (3.0 fl. oz.) of oil to the compressor and install it onto the vehicle.
7. Evacuate and recharge with the proper amount of refrigerant.
8. Perform the oil return operation.
9. Remove the compressor and recheck the amount of oil.
10. Adjust the compressor oil, if necessary.

(Collected Amount)	(Charging Amount)
more than 90 cc (3.0 fl.oz)	same as collected amount
less than 90 cc (3.0 fl.oz)	90 cc (3.0 fl.oz)

Checking and Adjusting for Compressor Replacement

150 cc (5.0 fl.oz.) of oil is charged in compressor (service parts). So it is necessary to drain the proper amount of oil from the new compressor.

1. Perform oil return operation.
2. Discharge and recover the refrigerant and remove the compressor.
3. Drain the compressor oil and measure the extracted oil.
4. Check the compressor oil for contamination.
5. Adjust the oil level as required.

(Amount of oil drained from used compressor)	(Draining amount of oil from new compressor)
less than 90 cc (3.0 fl.oz)	Same as drained amount
more than 90 cc (3.0 fl.oz)	90 cc (3.0 fl.oz)

6. Evacuate, charge and perform the oil return operation.
7. Check the system operation.

Contamination of Compressor Oil

Unlike engine oil, no cleaning agent is added to the compressor oil. Even if the compressor runs for a long period of time (approximately one season), the oil never becomes contaminated as long as there is nothing wrong with the compressor or its method of use.

Inspect the extracted oil for any of the following conditions:

- The capacity of the oil has increased.
- The oil has changed to red.
- Foreign substances, metal powder, etc., are present in the oil.

If any of these conditions exists, the compressor oil is contaminated. Whenever contaminated compressor oil is discovered, the receiver/drier must be replaced.

Oil Return Operation

There is close affinity between the oil and the refrigerant. During normal operation, part of the oil recirculates with the refrigerant in the system. When checking the amount of oil in the system, or replacing any component of the system, the compressor must be run in advance for oil return operation. The procedure is as follows:

1. Open all the doors and the engine hood.
2. Start the engine and air conditioning switch to “ON” and set the fan control knob at its highest position.
3. Run the compressor for more than 20 minutes between 800 and 1,000 rpm in order to operate the system.
4. Stop the engine.

Replacement of Component Parts

When replacing the system component parts, supply the following amount of oil to the component parts to be installed.

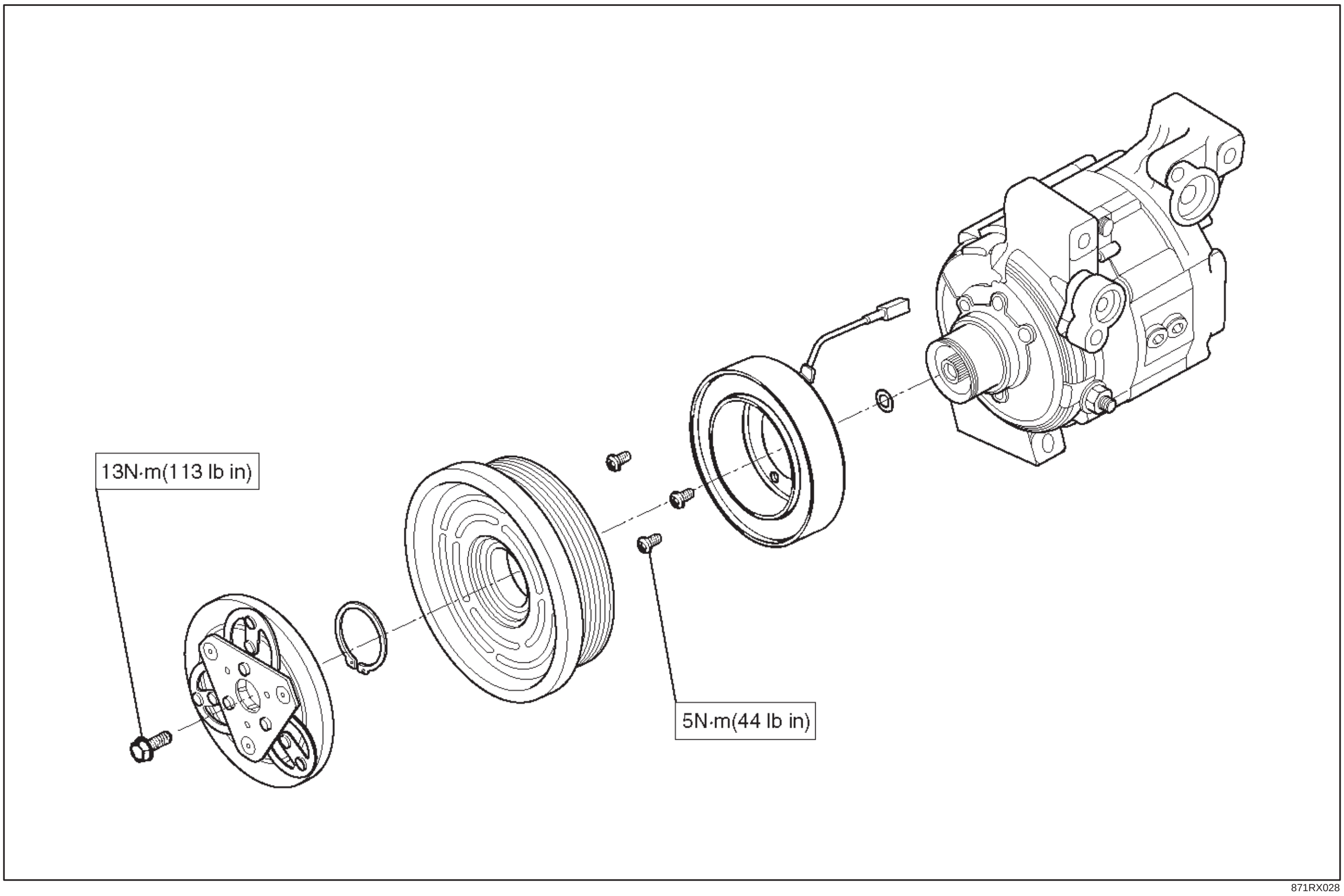
(Component parts to be installed)	(Amount of Oil)
Evaporator	50 cc (1.7 fl. oz.)
Condenser	30 cc (1.0 fl. oz.)
Receiver/dryer	30 cc (1.0 fl. oz.)
Refrigerant line (one piece)	10 cc (0.3 fl. oz.)

Main Data and Specifications

General Specifications

COMPRESSOR	
Model	DKV-14G
Type	Vane rotary type
Number of vanes	5
Rotor diameter	64 mm (2.52 in.)
Stroke	8.75 mm (0.34 in.)
Displacement	140 cc (47.3 fl.oz.)
Maximum speed	7,000 rpm (up to 8,400 rpm)
Direction of rotation	Clockwise (Front-side view)
Lubrication system	Pressure differential type
Lubricant	R-134a Vane Rotary Type Compressor Oil (AIPDN Part No.2-90188-301-0) 150 cc (5.0 fl.oz.)
Refrigerant	Refrigerant-134a (R-134a), 650 g (1.43 lbs.)
Shaft seal	Lip type
Weight	3.5 kg
MAGNETIC CLUTCH	
Type	Electromagnetic single-plate dry clutch
Rated voltage	12 Volts D.C.
Current consumption	3.7 A
Starting torque	49 N·m (36 lb·ft)
Direction of rotation	Clockwise (Front-side view)
Weight	3.0 kg (6.6 lbs.)

Torque Specifications



Special Tools

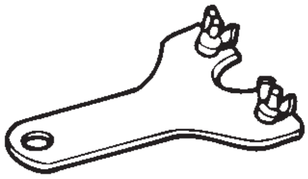
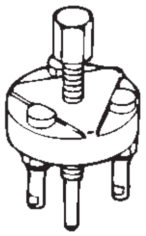
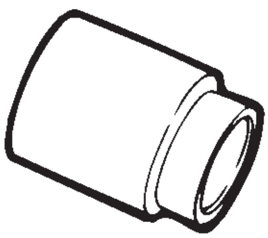
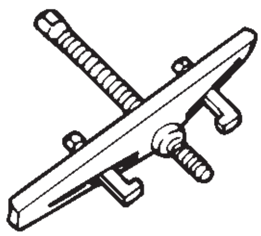
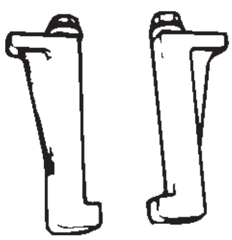
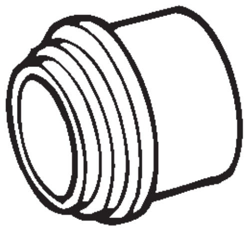
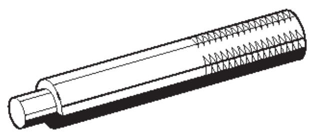
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J-33939** Drive plate holder
	**J-33944-A** Drive plate puller
	**J-33944-4** Forcing screw
	**J-38424** Pulley puller pilot
	**J-8433** Pulley puller
	**J-24092-2** Pulley puller leg

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J-33940-A** Pulley installer
	**J-8092** Drive handle

RODEO

STEERING

POWER-ASSISTED STEERING SYSTEM

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Diagnosis

Since the problems in steering, suspension, wheels and tires involve several systems, they must all be considered when diagnosing a complaint. To identify the symptom, always road test the vehicle first. Proceed with the following preliminary inspections and correct any defects which are found.

1. Inspect tires for proper pressure and uneven wear.
2. Raise vehicle on a hoist, then inspect front and rear suspension and steering linkage for loose or damaged parts.
3. Spin the front wheels. Inspect for out-of-round tires, out-of-balance tires, loose and/or rough wheel bearings.

General Diagnosis

Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
	Parts in power steering valve defective.	Replace power steering unit.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.

Condition	Possible cause	Correction
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
	Excessive wheel run–out.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial run–out of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering unit.	Tighten steering unit.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.
	Parts in power steering valve defective.	Replace power steering unit.
Hard Steering	Bind in steering linkage ball studs, upper or lower end ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to “Power steering system diagnosis”
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering unit or linkage.	Retighten or repair.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower end ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.

Condition	Possible cause	Correction
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering unit.	Retighten mounting bolt.
	Faulty steering unit.	Replace steering unit.
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Improper wheel alignment.	Adjust wheel alignment.
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.

Power Steering System

There is some noise in all power steering systems. One of the most common is a hissing sound when the steering wheel is fully turned and the car is not moving. This noise will be most evident when the steering wheel is operated while the brakes are applied. There is no relationship between this noise and steering performance. Do not replace the valve unless the “hissing” noise is extremely objectionable. A replacement valve will also have a slight noise, and is not always a cure for the condition.

Condition	Possible cause	Correction
Rattle or Chucking Noise	Pressure hose touching other parts of vehicle.	Adjust hose position. Do not bend tubing by hand.
	Tie rod ends loose.	Tighten or replace tie rod end.
	Loose steering unit mounting.	Tighten steering unit mounting.
Poor Return of Steering Wheel to Center	Improper front wheel alignment.	Adjust front wheel alignment.
	Wheel bearing worn.	Replace front wheel bearing.
	Tie rod end binding.	Replace tie rod end.
	Ball joint binding.	Replace ball joint.
	Tight or frozen steering shaft bearing.	Replace steering assembly.
	Sticky or plugged steering unit valve.	Flush or replace steering unit.
	Entry of air in the power steering system.	Bleed the system.
Momentary Increase In Effort When Turning Wheel Fast To Right or Left	High internal leakage.	Repair steering gear.
	Power steering fluid level low.	Replenish fluid.
Steering Wheel Surges or Jerks When Turning Especially During Parking	Insufficient pump pressure.	Repair pump assembly.
	Sticky steering unit valve.	Flush or replace steering unit.
	Power steering fluid level low.	Replenish fluid.
Excessive Wheel Kick Back or Loose Steering	Air in system.	Bleed hydraulic system.
	Tie rod end loose.	Tighten tie rod end.
	Wheel bearing worn.	Replace wheel bearing.
Hard Steering or Lack or Power Assist	Sticky steering unit valve.	Flush or replace steering unit.
	Insufficient pump pressure.	Repair pump assembly.
	Excessive internal pump leakage.	Repair pump assembly.
	Excessive internal steering gear leakage.	Repair steering gear.
	Power steering fluid level low.	Replenish fluid.
Unstable Engine Idling or Stalling When Turning	Pressure switch of the power steering pump or its harness is faulty.	Repair or replace.

Power Steering Pump

Foaming milky power steering fluid, low fluid level, and possible low pressure can be caused by air in the fluid, or loss of fluid due to internal pump leakage. Check for leak and correct. Bleed the system. Extremely cold temperatures will cause air bubbles in the system if the fluid level is low. If the fluid level is correct and the pump still foams, remove the pump from the vehicle and check housing for cracks. If the housing is cracked, replace the pump housing.

Condition	Possible cause	Correction
Low Pressure Due to Steering Pump	Relief valve sticking or inoperative.	Replace relief valve.
	Side plate not flat against cam ring.	Replace side plate.
	Extreme wear of cam ring.	Replace cam ring.
	Scored side plate or rotor.	Replace side plate or rotor.
	Vanes sticking in rotor slots.	Repair or replace vanes and rotor.
	Cracked or broken side plate.	Replace side plate.
	High internal leakage.	Repair internal leakage.
Low Pressure Due to Steering Gear	Scored housing bore.	Replace housing.
Growling Noise In Steering Pump	Excessive back pressure in hoses or steering unit caused by restriction.	Repair steering unit or pump.
	Scored side plate or rotor.	Replace side plate or rotor.
	Worn cam ring.	Replace cam ring.
Groaning Noise In Steering Pump	Air in the fluid.	Bleed hydraulic system.
	Low fluid level.	Replenish fluid.
	Pump mounting loose.	Tighten mounting bolt.
Rattling Noise In Steering Pump	Vanes sticking in rotor slots.	Repair or replace vanes and rotor.
	Vane improperly installed.	Repair rotor and vane.
Swishing Noise In Steering Pump	Damaged relief valve.	Replace relief valve.
Whining Noise In Steering Pump	Scored side plate and vanes.	Replace side plate and vanes.

Steering Column Lock System

Condition	Possible cause	Correction
Will Not Unlock	Damaged lock cylinder.	Replace lock cylinder.
	Damaged park lock cable.	Replace park lock cable.
Will Not Lock	Lock spring broken or worn.	Replace lock cylinder.
	Damaged lock cylinder.	Replace lock cylinder.
	Ignition switch stuck.	Repair or replace ignition switch.
	Park lock cable damaged.	Replace park lock cable.
Key Cannot be Removed in “OFF-LOCK”	Ignition switch is not set correctly.	Correct ignition switch.
	Damaged lock cylinder.	Replace lock cylinder.
	Faulty shift lock mechanism.	Repair or replace the shift lock mechanism.

Column

Condition	Possible cause	Correction
Noise in Column	Universal joint loose.	Tighten joint.
	Shaft lock snap ring not seated.	Place snap ring in proper position.

Turn Signal Switch

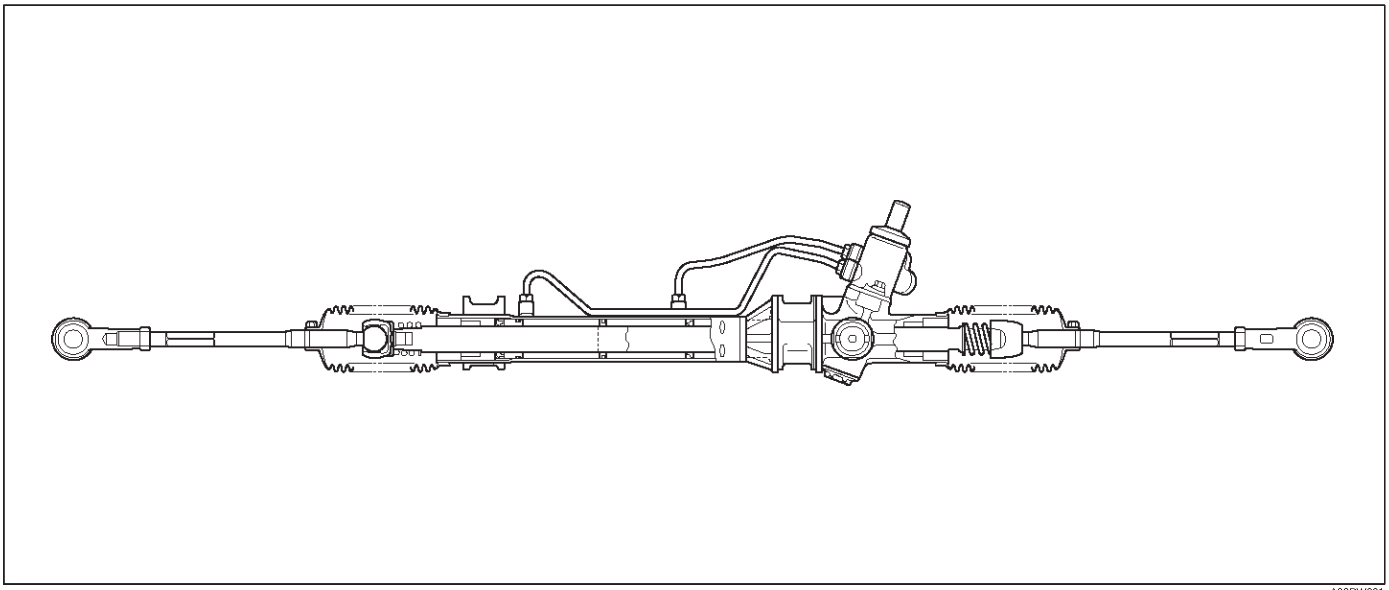
This diagnosis covers mechanical problems only. Refer to Turn Signal Switch in Electrical section for electrical diagnosis.

Condition	Possible cause	Correction
Turn Signal Will Not Stay In Turn Position	Foreign material or loose parts preventing movement of yoke.	Repair or replace signal switch.
	Broken or missing detent or canceling spring.	Replace signal switch.
Turn Signal Will Not Cancel	Loose switch mounting screws.	Tighten mounting screws.
	Switch or anchor bosses broken.	Replace turn signal switch.
	Broken, missing or out of position detent, return or canceling spring.	Replace turn signal switch.
	Worn canceling cam.	Replace turn signal switch.
Turn Signal Difficult To Operate	Turn signal switch arm loose.	Tighten arm screw.
	Broken or distorted yoke.	Replace turn signal switch.
	Loose or misplaced springs.	Replace turn signal switch.
	Foreign parts and/or material.	Repair turn signal switch.
	Loose turn signal switch mounting screws.	Tighten mounting screws.
Turn Signal Will Not Indicate Lane Change	Broken lane change pressure pad or spring hanger.	Replace turn signal switch.
	Broken, missing or misplaced lane change spring.	Replace turn signal switch.
	Base of wire damaged.	Replace turn signal switch.
Hazard Switch Cannot Be Turned Off	Foreign material between hazard switch to turn signal switch body.	Repair or replace hazard switch.
No Turn Signal Lights	Electrical failure in chassis harness.	Refer to Electrical section.
	Inoperative turn signal flasher unit.	Replace flasher unit.
	Loose chassis harness connector.	Repair loose connector.
Front or Rear Turn Signal Lights Not Flashing	Burned-out or damaged turn signal bulb.	Replace bulb.
	High resistance connection to ground at bulb socket.	Repair bulb socket.
	Loose chassis harness connector.	Repair loose connector.

General Description

The hydraulic power steering system consists of a pump, an oil reservoir, a steering unit, a pressure hose and a return hose.

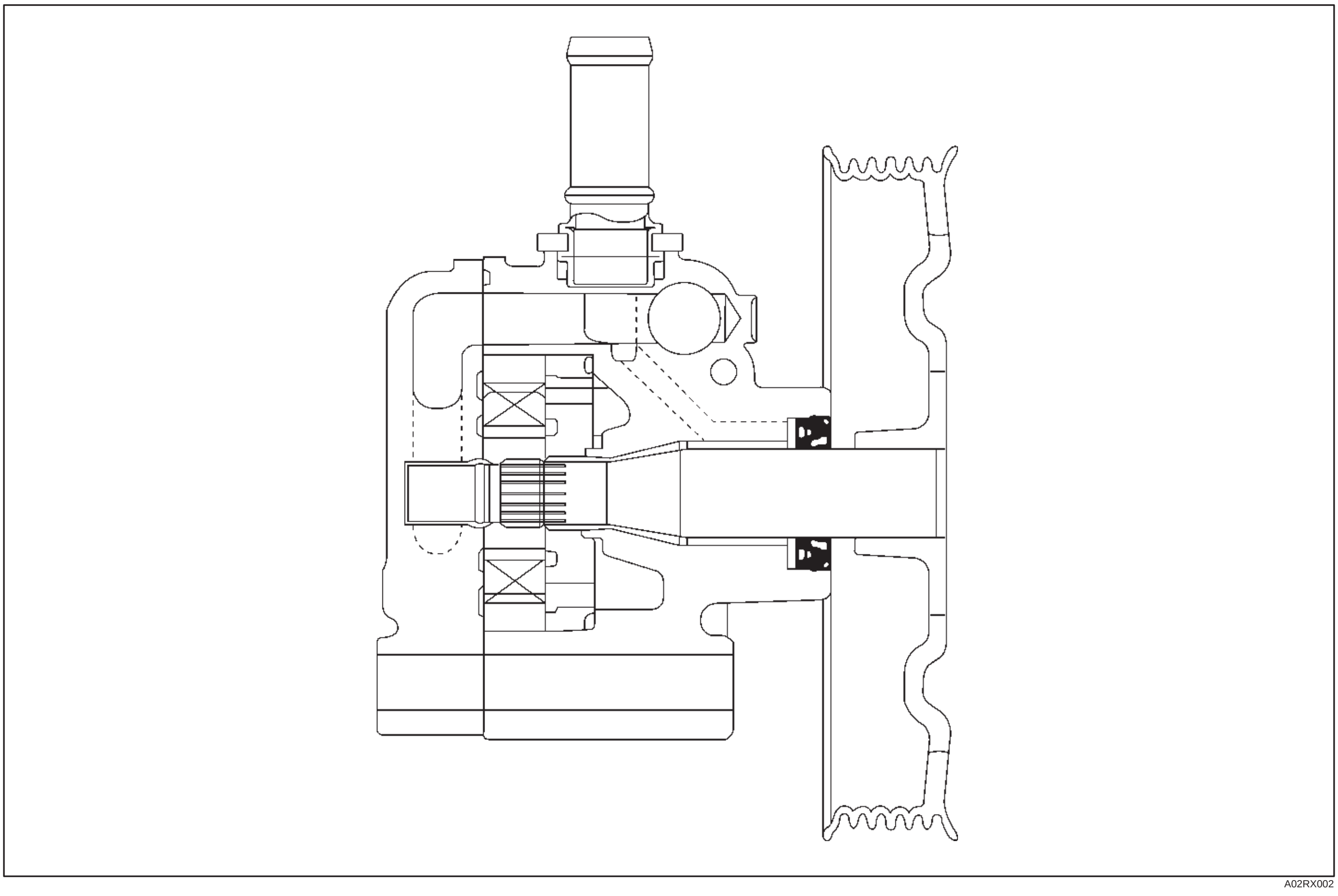
Power Steering Unit



A02RW001

The power steering unit is rack and pinion type.
The toe–in angle can be adjusted by turning the rod on each side.
The steering housing cannot be disassembled.

Hydraulic Pump



A02RX002

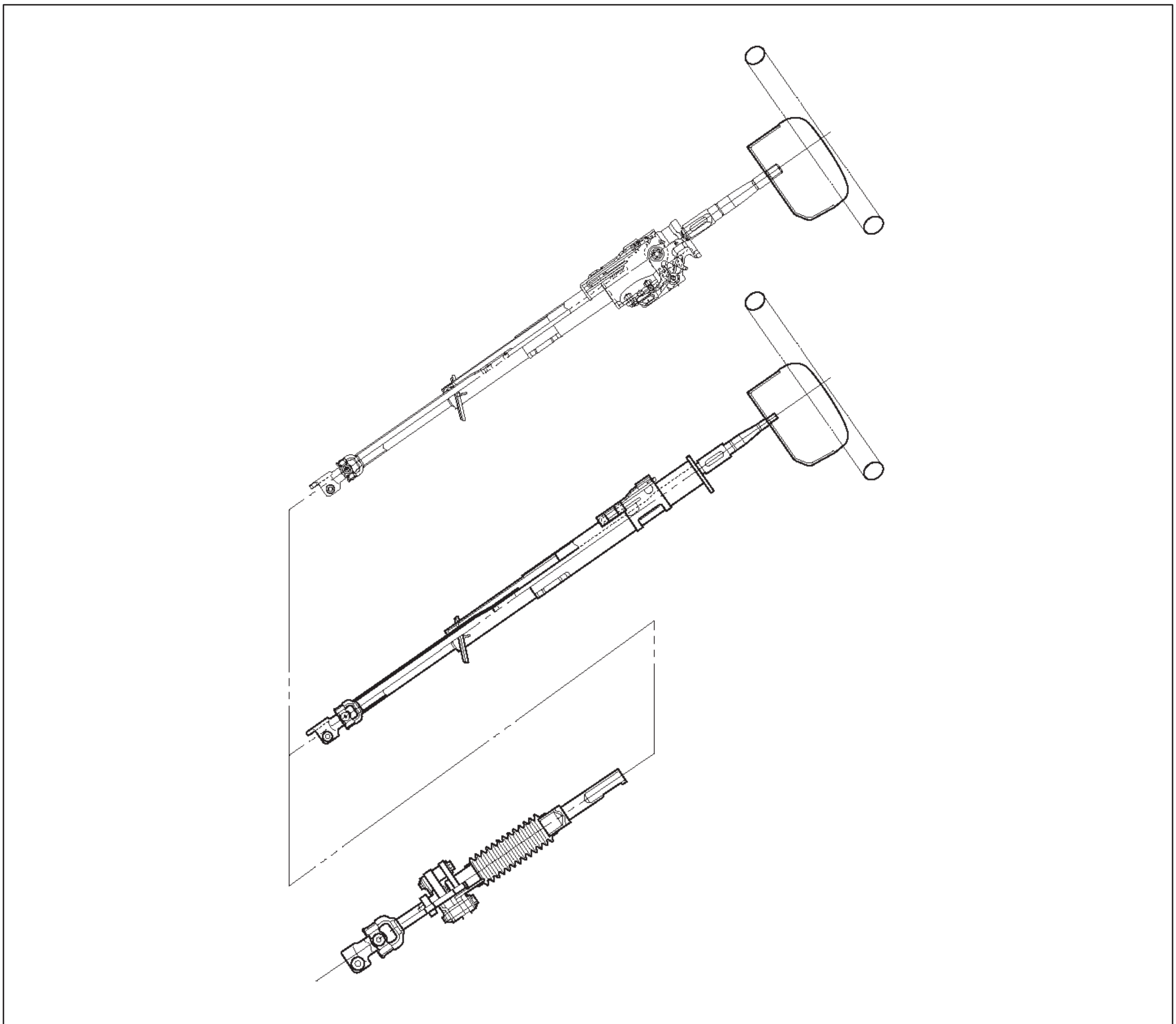
The hydraulic pump is vane-type design. The submerged pump has housing and internal parts that are inside the reservoir and operate submerged in oil. There are two bore openings at the rear of the pump housing. The larger opening contains the cam ring, pressure plate, thrust plate, rotor and vane assembly, and end plate. The smaller opening contains the pressure line union, flow control valve and spring.

The flow control orifice is part of the pressure line union. The pressure relief valve inside the flow control valve limits the pump pressure.

Pressure Switch

When hydraulic pressure reaches 3430 kPa (500 psi), the pressure switch of the power steering pump closes causing the Engine Control Module (ECM) to actuate the idle air control valve, which increases the engine rpm to prevent the overload-induced engine speed slow down. The switch opens when hydraulic pressure drops to 2940 kPa (430 psi).

Steering Column



431RY00004

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLE-SHOOTING THE SRS SYSTEM, DO NOT USE ELECTRICAL TEST EQUIPMENT, SUCH AS BATTERY-POWERED OR A/C-POWERED VOLT-METER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN SPECIFIED IN THIS MANUAL. DO NOT USE A NON-POWERED PROBE-TYPE TESTER.

INSTRUCTION IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

When servicing a vehicle equipped with Supplemental Restraint System, pay close attention to all WARNINGS and CAUTIONS.

For detailed explanation about SRS, refer to Restraints section.

The steering column has three important features in addition to the steering function:

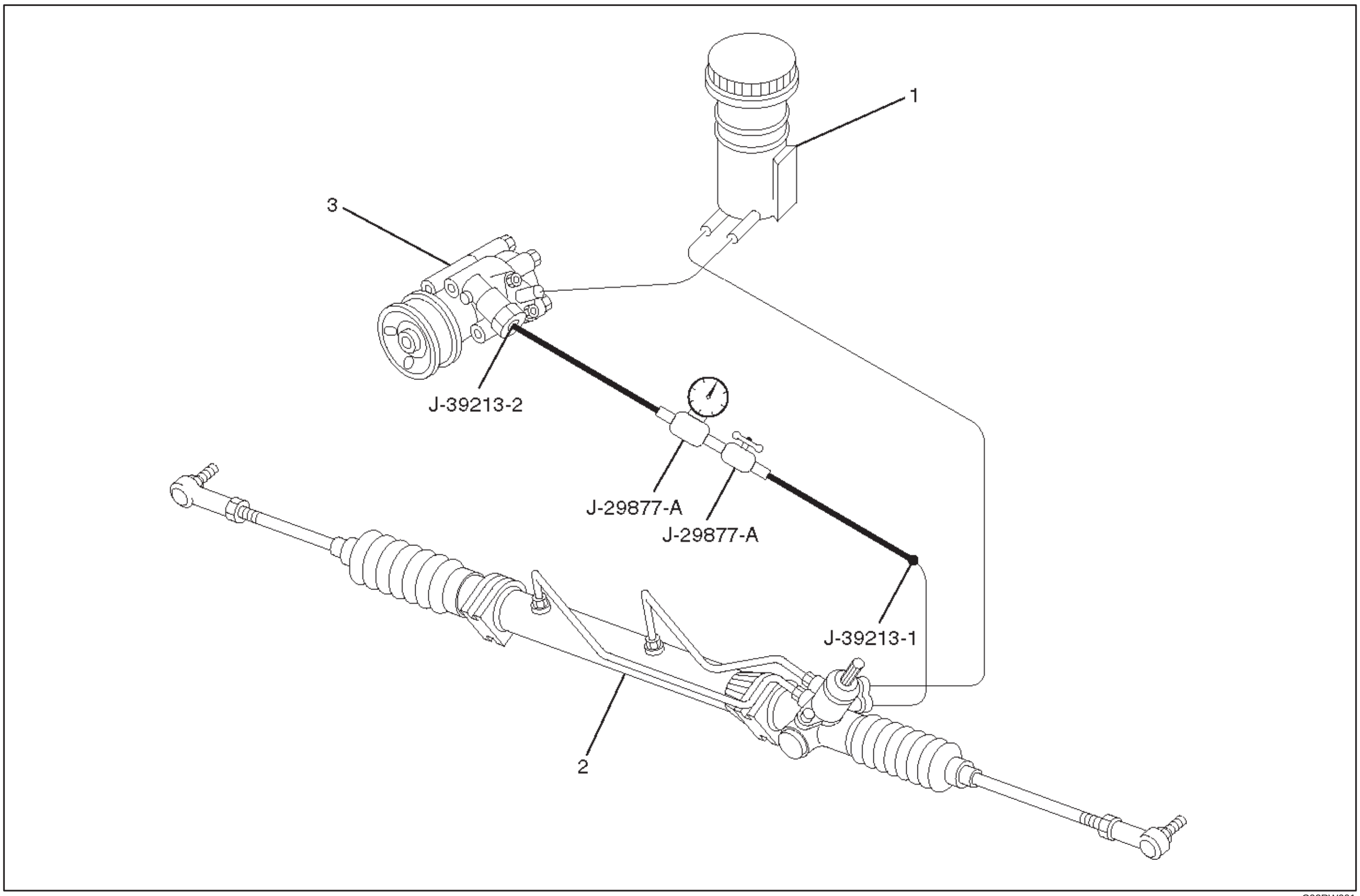
1. The column is energy absorbing, designed to compress in a front-end collision to minimize the possibility of injury to the driver of the vehicle.
2. The ignition switch and lock are mounted conveniently on the column.
3. With the column mounted lock, the ignition and steering operation can be locked to prevent theft of the vehicle.

The column can be disassembled and reassembled. However, to insure the energy absorbing action, use only the specified screws, bolts and nuts as designated, and tighten them to the specified torque.

Handle the column with care when it is removed from the vehicle. A sharp blow on the end of steering shaft or shift lever, or dropping the assembly could shear or loosen the fasteners that maintain column rigidity.

Power Steering System Test

Test Procedure



Legend

(1) Fluid Reservoir
(2) Power Steering Unit
(3) Power Steering Pump

Test of fluid pressure in the power steering system is performed to determine whether or not the oil pump and power steering unit are functioning normally.

The power steering system test is used to identify and isolate hydraulic circuit difficulties. Prior to performing this test, the following inspections and corrections, if necessary, must be made.

- Inspect pump reservoir for proper fluid level.
- Inspect pump belt for proper tension.
- Inspect pump driver pulley condition.

1. Place a container under the pump to catch the fluid when disconnecting or connecting the hoses.
2. With the engine NOT running, disconnect the pressure hose at the power steering pump and install power steering tester J-29877-A. The gage must be between the shutoff valve and pump. Open the shutoff valve.
3. Check the fluid level. Fill the reservoir with power steering fluid, to the “Full” mark. Start the engine, then turn the steering wheel and momentarily hold it against a stop (right or left). Turn the engine off and check the connections at tester for leakage.

4. Bleed the system. Refer to Bleeding the Power Steering System in this section.
5. Start the engine and check the fluid level. Add power steering fluid if required. When the engine is at normal operating temperature, increase engine speed to 1500 rpm.

CAUTION: Do not leave shutoff valve fully closed for more than 5 seconds, as the pump could become damaged internally.

6. Fully close the shutoff valve. Record the highest pressures.
   - If the pressure recorded is within 9300–9800 kPa (1350–1420 psi), the pump is functioning within its specifications.
   - If the pressure recorded is higher than 9800 kPa (1420 psi), the valve in the pump is defective.
   - If the pressure recorded is lower than 9300 kPa (1350 psi), the valve or the rotating group in the pump is defective.
7. If the pump pressures are within specifications, leave the valve open and turn (or have someone else turn) the steering wheel fully in both directions. Record the highest pressures and compare with the maximum pump pressure recorded in step 6. If this pressure cannot be built in either side of the power steering unit, the power steering unit is leaking internally and must be replaced.
8. Shut the engine off, remove the testing gauge.
9. Reconnect the pressure hose, check the fluid level and make the needed repairs.
10. If the problem still exists, the steering and front suspension must be thoroughly examined.

Maintenance

The hydraulic system should be kept clean and fluid level in the reservoir should be checked at regular intervals and fluid added when required. Refer to Recommended Fluids and Lubricants in General Information section for the type of fluid to be used and the intervals for filling.

If the system contains some dirt, flush it as described in this section. If it is exceptionally dirty, the pump must be completely disassembled before further usage. (The steering unit cannot be disassembled.)

All tubes, hoses, and fittings should be inspected for leakage at regular intervals. Fittings must be tight. Make sure the clips, clamps and supporting tubes and hoses are in place and properly secured.

Power steering hoses and lines must not be twisted, kinked or tightly bent. Air in the system will cause spongy action and noisy operation. When a hose is disconnected or when fluid is lost, for any reason, the system must be bled after refilling. Refer to Bleeding the Power Steering System in this section.

- Inspect belt for tightness.
- Inspect pulley for looseness or damage. The pulley should not wobble with the engine running.
- Inspect hoses so they are not touching any other parts of the vehicle.
- Inspect fluid level and fill to the proper level.

Fluid Level

1. Run the engine until the power steering fluid reaches normal operating temperature, about 55˚C (130˚F), then shut the engine off.
2. Check the level of fluid in the reservoir.
3. If the fluid level is low, add power steering fluid as specified in General Information to the proper level and install the receiver cap.
4. When checking the fluid level after the steering system has been serviced, air must be bled from the system. Refer to Bleeding the Power Steering System in this section.

Bleeding The Power Steering System

When a power steering pump or unit has been installed, or an oil line has been disconnected, the air that has entered the system must be bled out before the vehicle is operated. If air is allowed to remain in the power steering fluid system, noisy and unsatisfactory operation of the system may result.

Bleeding Procedure

When bleeding the system, and any time fluid is added to the power steering system, be sure to use only power steering fluid as specified in General Information.

1. Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two minutes.
2. Start the engine and let it run for a few seconds. Do not turn the steering wheel. Then turn the engine off.
3. Add fluid if necessary.
4. Repeat the above procedure until the fluid level remains constant after running the engine.
5. Raise and support the front end of the vehicle so that the wheels are off the ground.
6. Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.
7. Add power steering fluid if necessary.
8. Lower the vehicle, set the steering wheel at the straight forward position after turning it to its full steer positions 2 or 3 times, and stop the engine.
9. Check the fluid level and refill as required.
10. If the fluid is extremely foamy, allow the vehicle to set a few minutes, then repeat the above procedure.

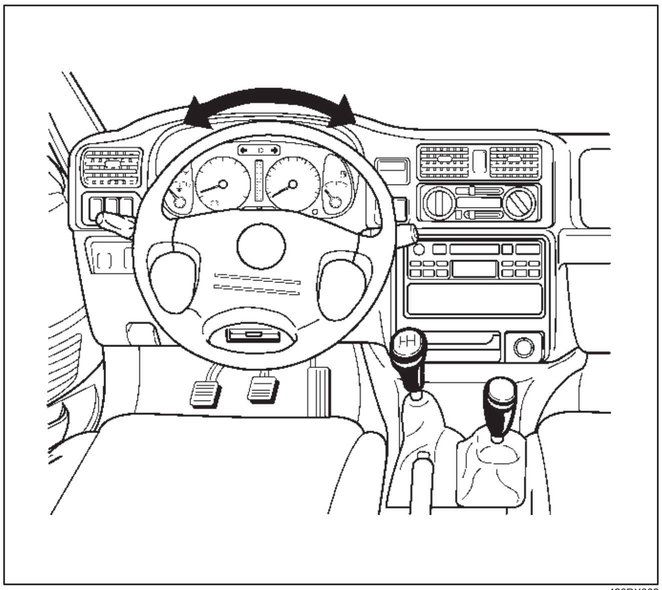
Flushing The Power Steering System

1. Raise and support the front end of the vehicle off the ground until the wheels are free to turn.
2. Remove the fluid return line at the pump inlet connector and plug the connector port on the pump. Position the line toward a large container to catch the draining fluid.
3. While running the engine at idle, fill the reservoir with new power steering fluid. Turn the steering wheel in both directions. Do not contact or hold the steering wheel to the wheel stops. This will cause the pump to go to pressure relief mode, which may cause a sudden fluid overflow at the reservoir.

4. Install all the lines and hoses. Fill the system with new power steering fluid and bleed the system as described in Bleeding The Power Steering System. Operate the engine for about 15 minutes.

   Remove the pump return line at the pump inlet and plug the connection on the pump. While refilling the reservoir, check the draining fluid for contamination. If foreign material is still evident, replace all lines, disassemble and clean or replace the power steering system components. Do not re-use any drained power steering fluid.

Steering Wheel Free Play Inspection



430RX003

1. With the tires in the straight-ahead position, check the amount of steering wheel play by turning the wheel in both directions until the tires begin to move.

NOTE: The wheel free play should be checked with the engine running.

Free play: 0 – 30 mm (0 – 1.18 in)

2. Also check the steering wheel for play and looseness in the mount by moving it back and forth and sideways. When test driving, check for hard steering, steering shimmy and tendency to pull to one side.

Front End Alignment Inspection and Adjustment

General Description

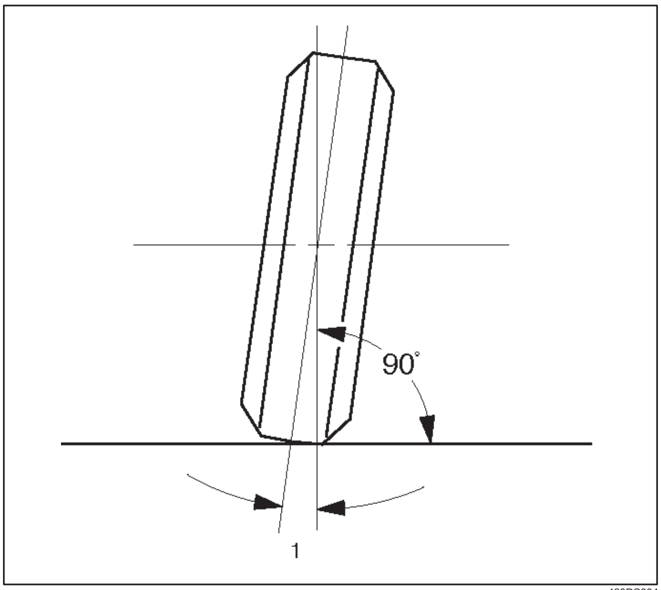
“Front End Alignment” refers to the angular relationship between the front wheels, the front suspension attaching parts and the ground.

Proper front end alignment must be maintained in order to insure efficient steering, good directional stability and to prevent abnormal tire wear.

The most important factors of front end alignment are wheel toe-in, wheel camber and axle caster.

Camber:

This illustration shows view from the front of the vehicle.

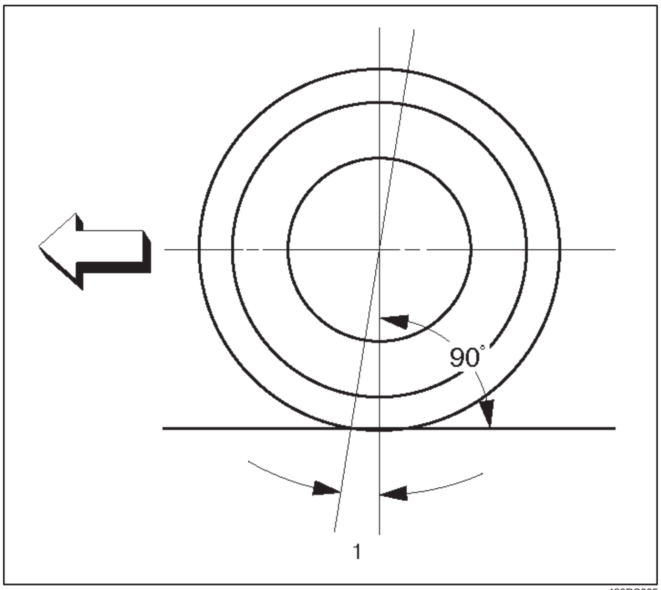


480RS004

Camber is the vertical tilting inward or outward of the front wheels. When the wheels tilt outward at the top, the camber is positive (+). When the wheels tilt inward at the top, the camber is negative (-). The amount of tilt measured in degrees from the vertical is called the camber angle (1). If camber is extreme or unequal between the wheels, improper steering and excessive tire wear will result. Negative camber causes wear on the inside of the tire, while positive camber causes wear to the outside.

Caster:

This illustration shows view from the side of the vehicle.

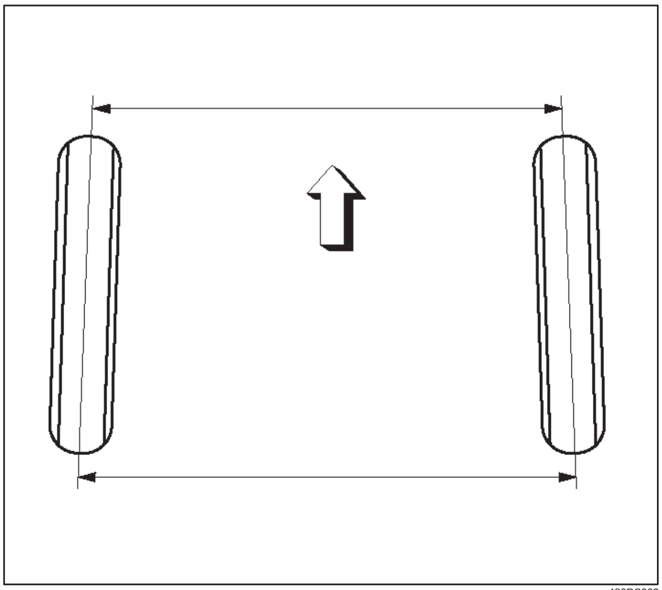


480RS005

Caster (1) is the vertical tilting of the wheel axis either forward or backward (when viewed from the side of the vehicle). A backward tilt is positive (+) and a forward tilt is negative (-). On the short and long arm type suspension you cannot see a caster angle without a special instrument, but if you look straight down from the top of the upper control arm to the ground, the ball joints do not line up (fore and aft) when a caster angle other than 0 degree is present. With a positive angle, the lower ball joint would be slightly ahead (toward the front of the vehicle) of the upper ball joint center line.

Toe-in:

This illustration shows view from the top of the vehicle.



480RS003

Toe-in is the measured amount the front wheels are turn in. The actual amount of toe-in is normally a fraction of a degree. Toe-in is measured from the center of the tire treads or from the inside of the tires. The purpose of toe-in is to insure parallel rolling of the front wheels and to offset any small deflections of the wheel support system which occurs when the vehicle is rolling forward. Incorrect toe-in results in excessive toe-in and unstable steering. Toe-in is the last alignment to be set in the front end alignment procedure.

Inspection

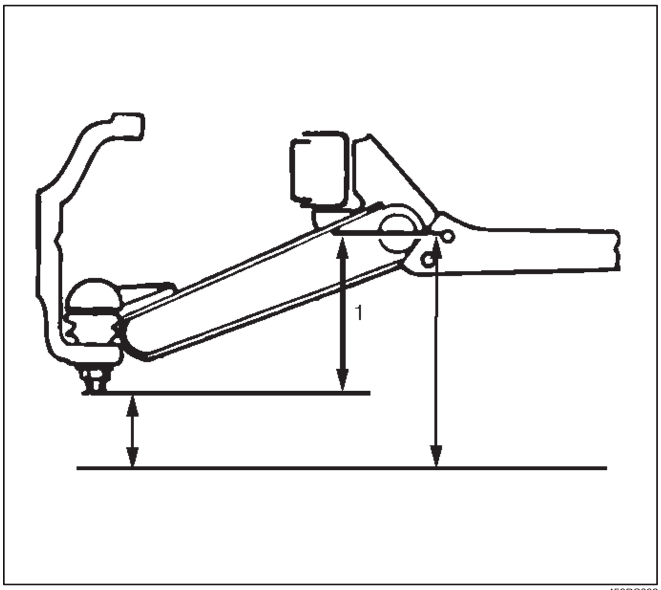
Before making any adjustments affecting caster, camber or toe-in, the following front end inspection should be made.

1. Inspect the tires for proper inflation pressure. Refer to Main Data and Specifications in Wheel and Tire System section.
2. Make sure that the vehicle is unladen condition (With no passenger or loading).
3. Make sure that the spare tire is installed at the normal position.
4. Inspect the front wheel bearings for proper adjustment. Refer to Front Hub and Disc Overhaul in Suspension section.
5. Inspect the ball joints and tie rod ends. If excessive looseness is noted, correct before adjusting. Refer to Steering Linkage in this section.
6. Inspect the wheel and tires for run-out. Refer to Wheel Replacement in Wheel and Tire System section.
7. Inspect the trim height. If not within specifications, the correction must be made before adjusting caster.
8. Inspect the steering unit for looseness at the frame.
9. Inspect shock absorbers for leaks or any noticeable noise. Refer to Shock Absorber in Suspension section.
10. Inspect the control arms or stabilizer bar attachment for looseness. Refer to Suspension section .
11. Inspect the front end alignment using alignment equipment. Follow the manufacturer’s instructions.
12. Park the vehicle must be on a level surface.

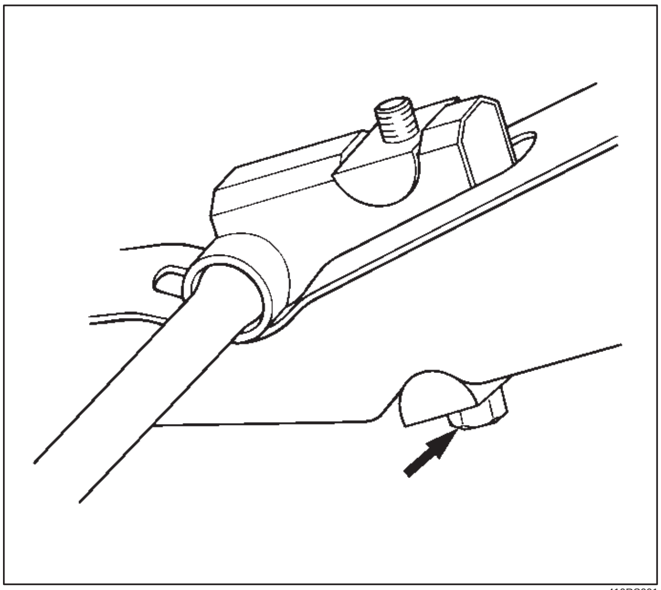
Trim Height Adjustment

Adjust the trim height (1) by means of the adjusting bolt on the height control arms.

CAUTION: When adjusting front end alignment, be sure to begin with trim height first, as it may change other adjusted alignments.



450RS003



410RS001

1. Check and adjust the tire inflation pressures.
2. Park the vehicle on a level ground and move the front of the vehicle up and down several times to settle the suspension.
3. Make necessary adjustment with the adjusting bolt on the height control arms.

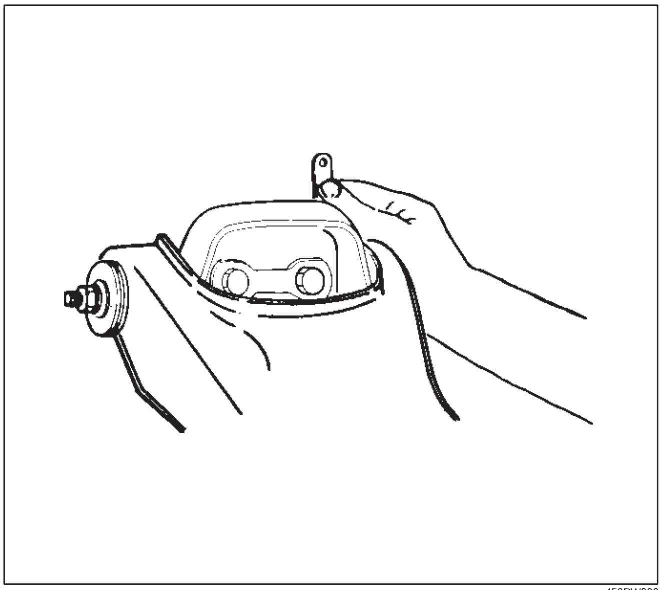
Trim height: 119 ± 5 mm (4.69 ± 0.2 in)

Caster Adjustment

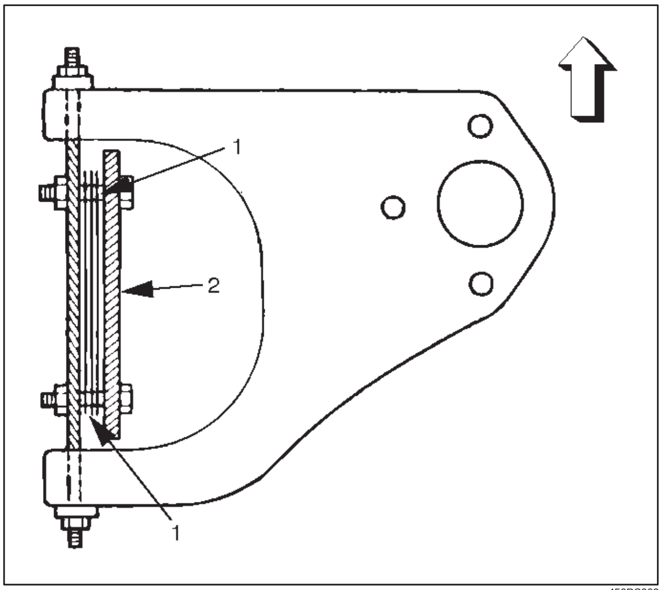
The caster angle can be adjusted by means of the caster shims (1) installed between the chassis frame (2) and fulcrum pins.

Caster angle: 2°30' ± 1°

CAUTION: Left and right side must be equal within 30'.



450RW006



450RS002

NOTE: Difference of the caster shim front/rear thickness should be 3.6 mm (0.142 in) or less. Overall thickness of caster shim and camber shim should be 10.8 mm (0.425 in) or less.

Tighten the fulcrum pin bolt to the specified torque.

Torque: 152 N·m 112 (lb ft)

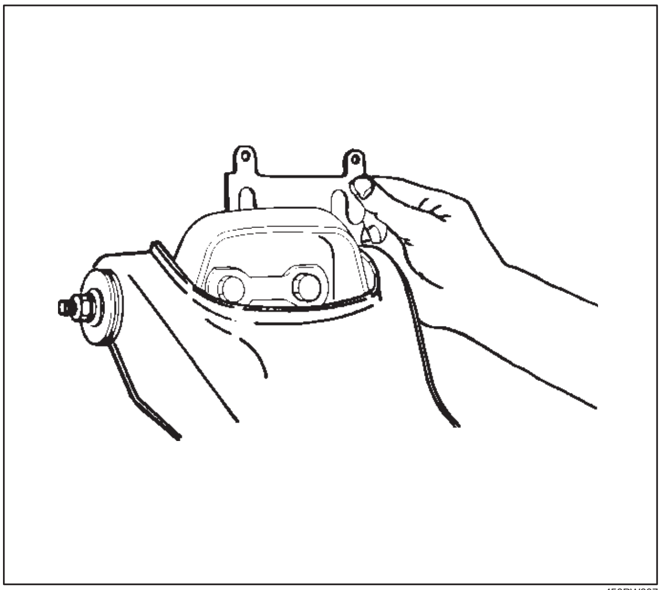
Camber Adjustment

The camber angle can be adjusted by means of the camber shims (2) installed in position between the chassis frame (1) and fulcrum pins

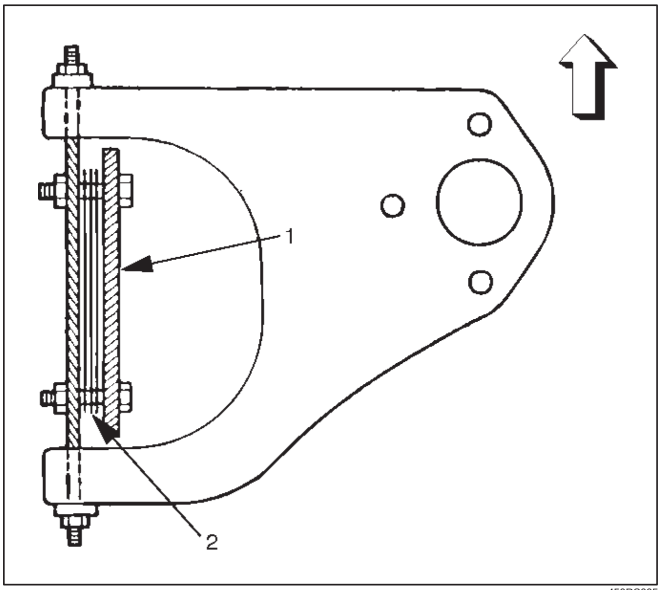
Camber angle: 0° ± 30'

King pin inclination: 12°30' ± 30'

CAUTION: Left and right side must be equal within 30'.



450RW007



450RS005

NOTE: Overall thickness of caster shim and camber shim should be 10.8 mm (0.425 in) or less.

Tighten the fulcrum pin bolt to the specified torque.

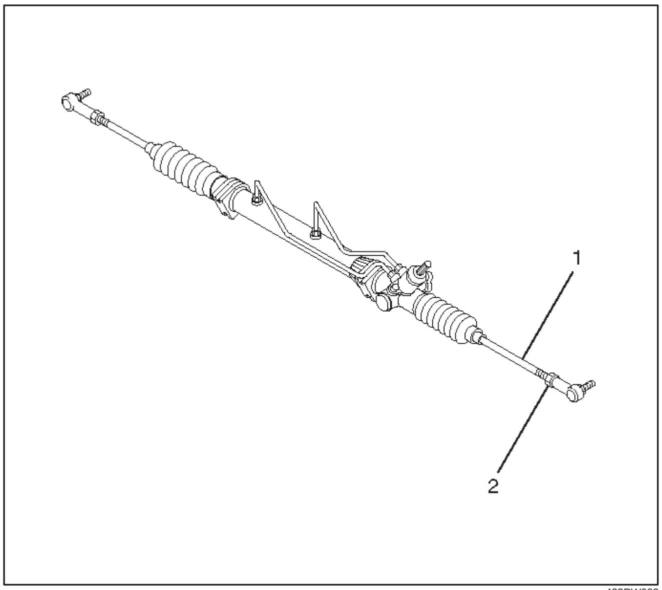
Torque: 152 N·m (112 lb ft)

	Position of shims		Camber angle	Caster angle
	Front side	Rear side		
Caster shim	When added	When removed	Decreases	Decreases
	When removed	When added	Increases	Increases
	—	When removed	Unchanged	Decreases
	—	When added	Unchanged	Increases
Camber shim	When added		Decreases	Unchanged
	When removed		Increases	Unchanged

Toe-in Adjustment

1. To adjust the toe-in angle, loosen the lock nuts (2) on the tie rod (1) and turn the tie rod. Turn both rods the same amount, to keep the steering wheel centered .

Toe-in: 0 ± 2 mm (0 ± 0.08 in)



433RW003

2. Tighten the lock nut to the specified torque.

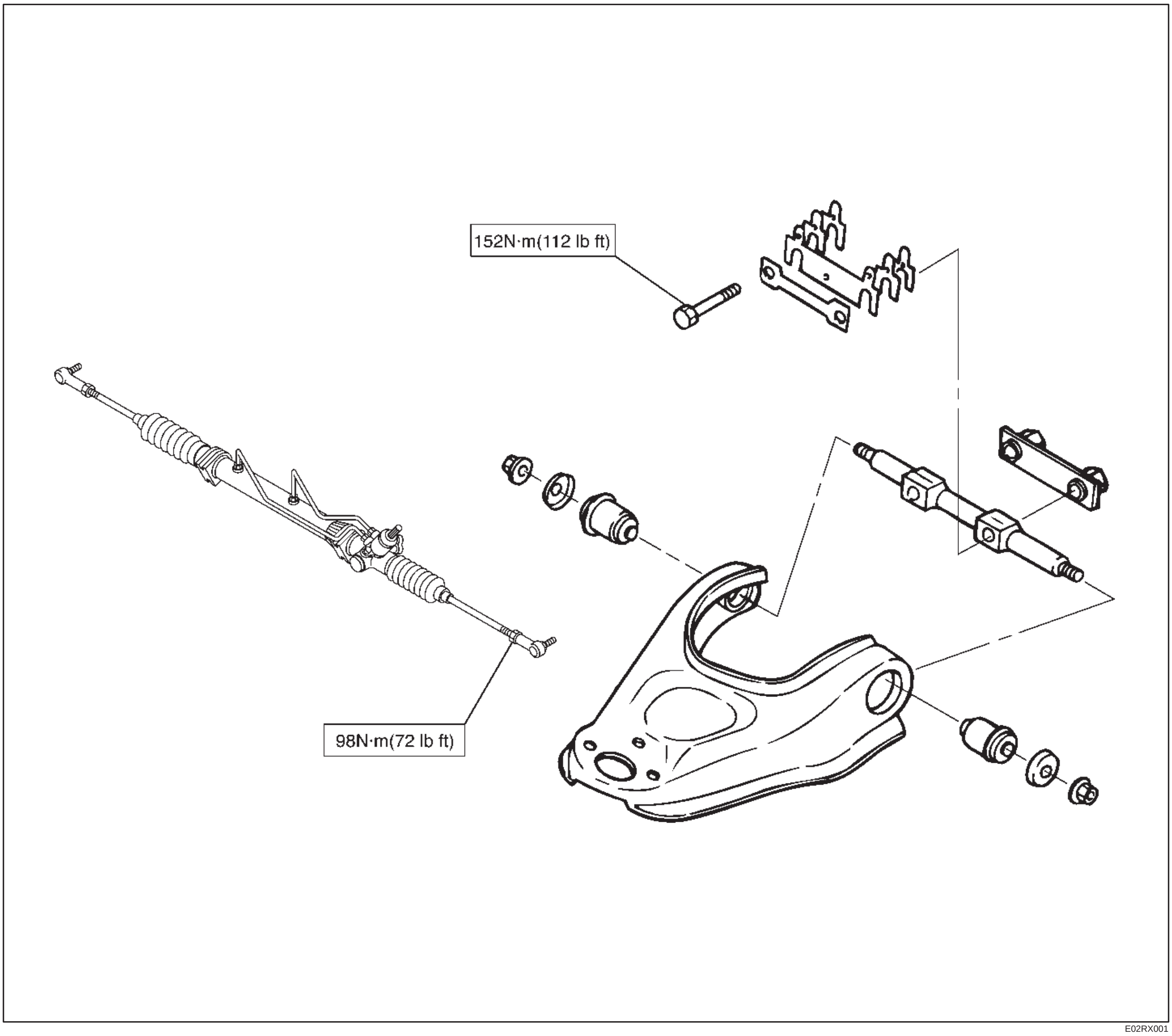
Torque: 98 N·m (72 lb ft)

Main Data and Specifications

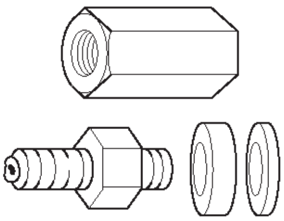
General Specification

Caster		2°30’ ± 1°
Camber		0° ± 30’
King pin inclination		12°30’ ± 30’
Toe-in		0 ± 2 mm (0 ± 0.08 in)
Max. steering angle	inside	32.6° (+0°30’ to –2°30’)
	outside	31.8°

Torque Specification

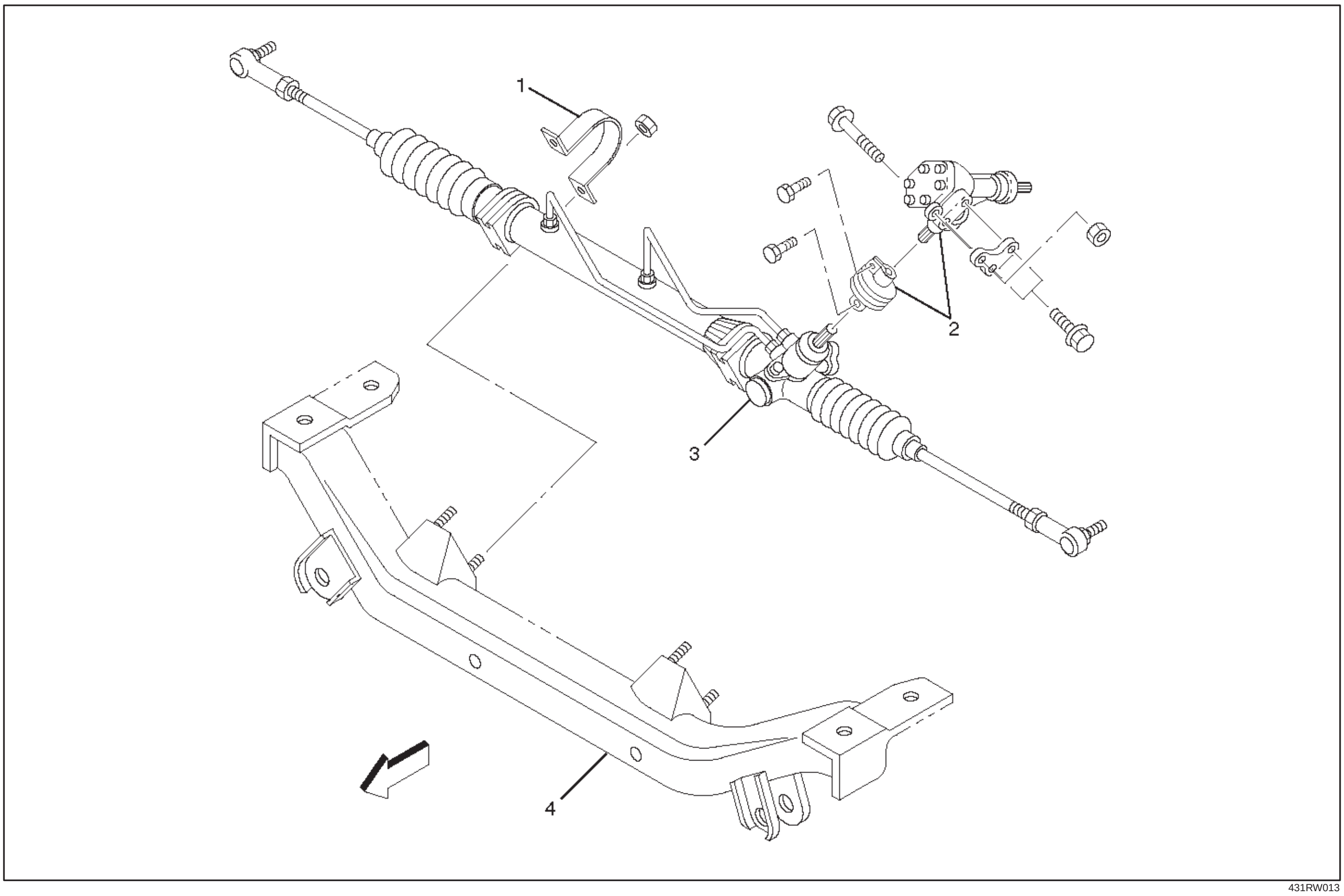


Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS276	**J–29877–A** Tester; Power steering
 901RS278	**J–39213** Adapter; Power steering tester

Power Steering Unit

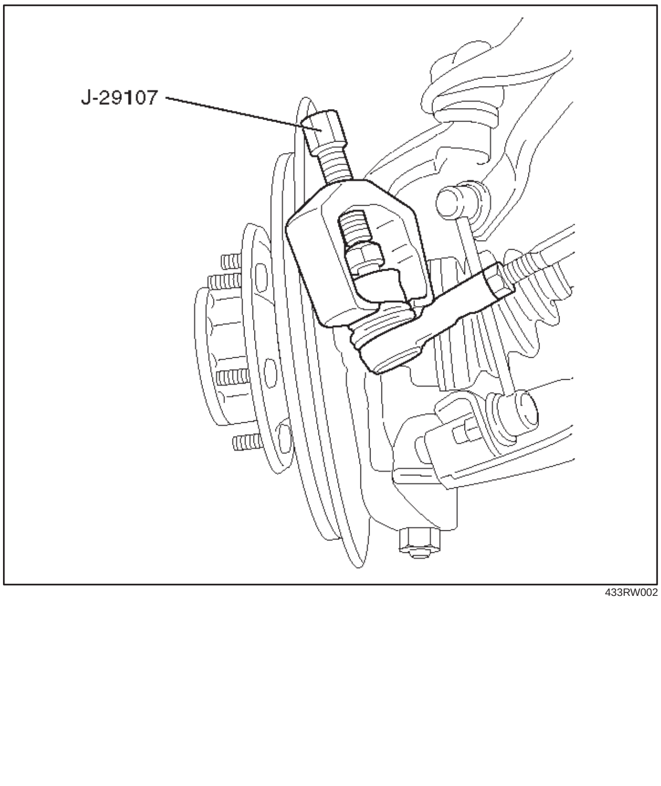
Power Steering Unit and Associated Parts



Legend
(1) Bracket
(2) Transfer Gear Assembly
(3) Power Steering Unit Assembly
(4) Crossmember

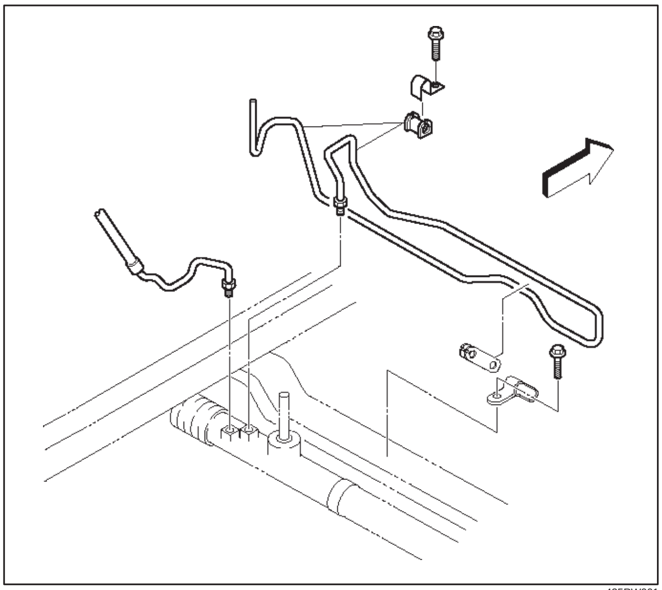
Removal

1. Remove the stone guard.
2. Remove the transfer gear assembly.
   Make a setting mark across the coupling flange and steering unit to ensure reassembly of the parts in the original position.
3. Drain power steering fluid.
4. Remove the tie rod end assembly from knuckle.
   Use tie rod end remover J–29107.



5. Disconnect the feed line and return line from steering unit.
   Remove the clips on the crossmember and frame.
   Wire the power steering line to frame.

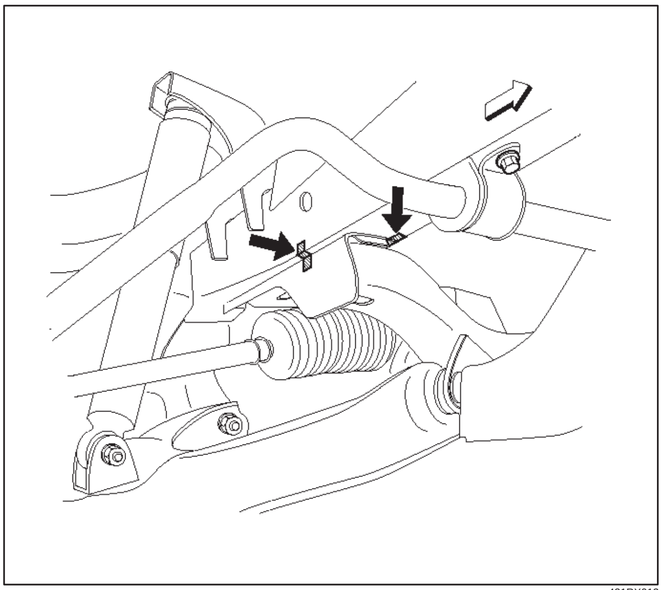
NOTE: Take care to prevent foreign matter from entry when disconnect the power steering line.



435RW001

4×4 model:

1. Remove the torsion bar. Refer to Front Suspension in Suspension section.
2. Remove the lower control arm bolt (Frame side).
   Refer to Front Suspension in Suspension section.
3. Apply a setting mark across the crossmember and frame so parts can be reassembled in their original position.



431RX013

4. Remove the crossmember fixing bolt.
5. Remove the power steering unit with the crossmember.
6. Remove the power steering unit.

4×2 model:

1. Remove the power steering unit from the crossmember.

Installation (4×2 Model)

1. Install power steering unit to crossmember.
   Tighten fixing bolt to specified torque.

   Torque: 116 N·m (85 lb ft)
2. Connect the feed line and return line.

   Torque: 25 N·m (18 lb ft)
3. Install tie–rod end assembly to knuckle.

   Torque: 118 N·m (87 lb ft)
4. Install transfer gear assembly.
   Align the setting marks made at removal.

   Torque: 31 N·m (23 lb ft)
5. Install the stone guard.
6. Bleed the system.
   Refer to Bleeding the Power Steering System in this section.

Installation (4×4 Model)

1. Install power steering unit to crossmember.
   Tighten fixing bolt to specified torque.

   Torque: 116 N·m (85 lb ft)
2. Install power steering unit with crossmember to frame by aligning the setting marks made when removing.
   Tighten crossmember mounting bolt to specified torque.

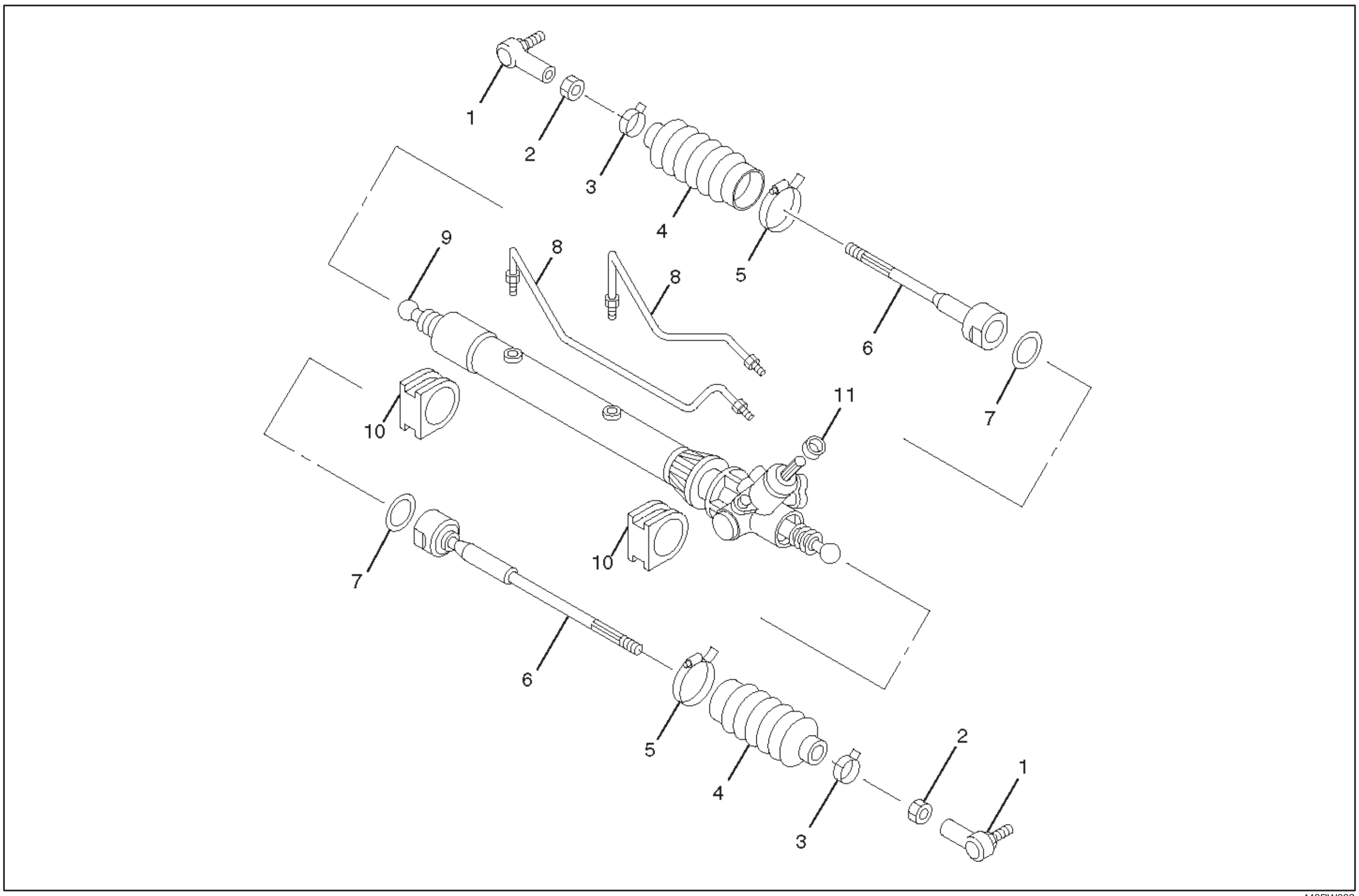
   Torque: 190 N·m (140 lb ft)
3. Install lower control arm bolt.
   Refer to Front Suspension in Suspension section.
4. Install torsion bar.
   Refer to Front Suspension in Suspension section.
5. Connect the feed line and return line.

   Torque: 25 N·m (18 lb ft)
6. Install tie–rod end assembly to knuckle.

   Torque: 118 N·m (87 lb ft)
7. Install transfer gear assembly.
   Align the setting marks made at removal.

   Torque: 31 N·m (23 lb ft)
8. Install the stone guard.
9. Bleed the system.
   Refer to Bleeding the Power Steering System in this section.

Power Steering Unit Disassembled View



Legend

(1) Tie-rod End
(2) Lock Nut
(3) Clip
(4) Bellows
(5) Band
(6) Tie-rod Assembly
(7) Tab Washer
(8) Oil Line
(9) Valve Housing Assembly
(10) Mounting Rubber
(11) Dust Cover

Disassembly

NOTE: The valve housing is made of aluminum and care should be exercised when clamping in a vise, etc. to prevent distortion or damage.

1. Loosen lock nut and remove tie–rod end.
2. Remove clip and band, then remove bellows.
3. Remove tie-rod assembly.
   To remove, move the boot toward the tie-rod end, then remove tab washer.
4. Remove oil line, mounting rubber and dust cover.

Inspection and Repair

Inspect the following parts for wear, damage or any abnormal conditions.

Tie-rod End

If looseness or play is found when checked by moving the end of ball joint at tie-rod end, replace tie-rod end.

Tie-rod Assembly

If the resistance is insufficient or play is felt when checked by moving the ball on the tie-rod, replace the tie-rod assembly.

Rubber Parts

If wear or damage is found through inspection, replace with new ones.

Reassembly

1. Install mounting rubber and dust cover (If removed).
2. Install oil line.

   Torque: 13 N· m (113 lb in)
3. Install tie-rod assembly with tab washer.
   Apply grease to ball joint, install tie-rod and tab washer, then tighten to specified torque.

   Torque: 83 N·m (61 lb ft)

   After tightening, bend tab washer against width across flat of inner ball joint.

4. Apply a thin coat of grease to the shaft for smooth installation. Then install bellows.
5. Install band and clip.
6. Install tie-rod end and tighten lock nut.

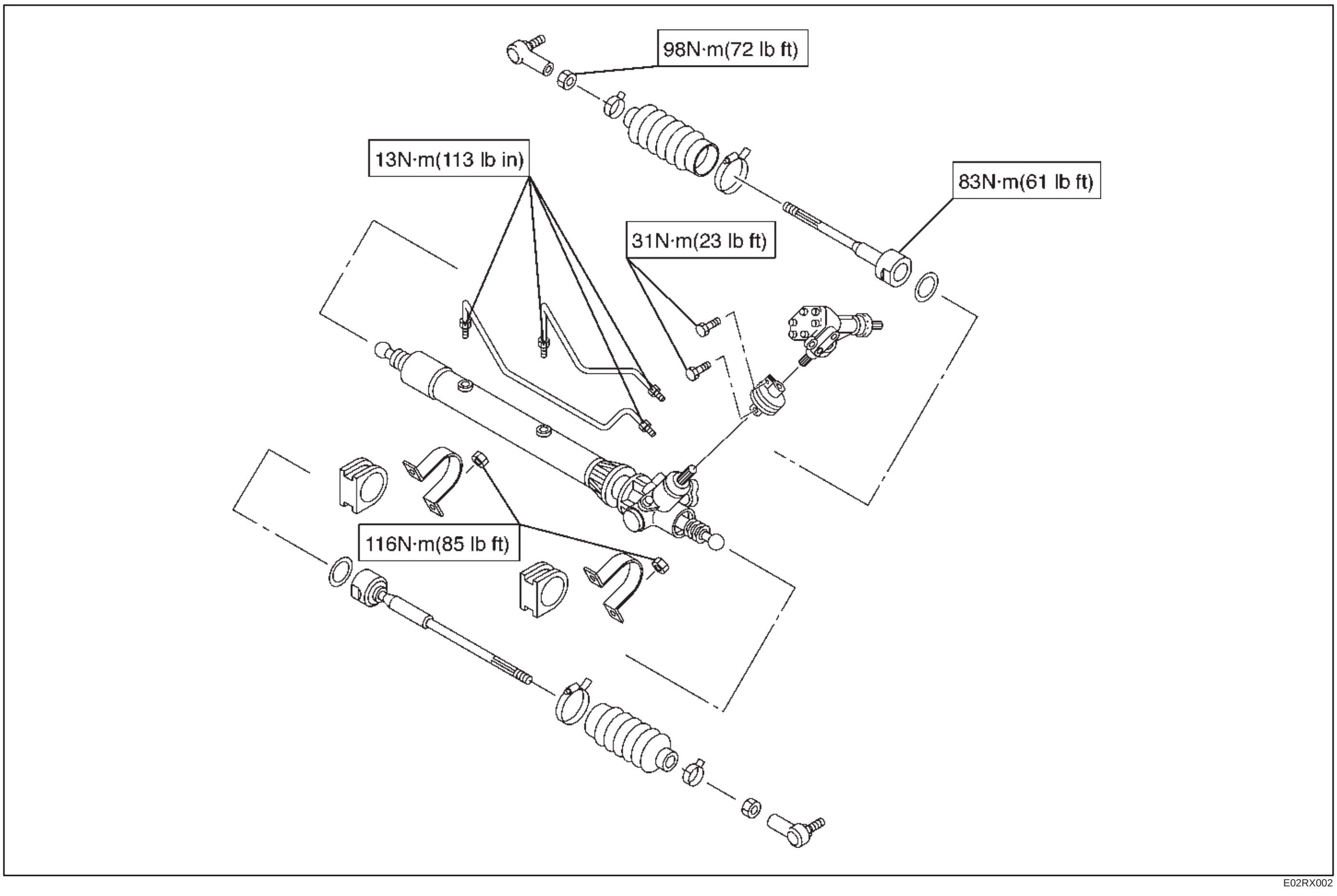
Torque: 98 N·m (72 lb ft)

Main Data and Specifications

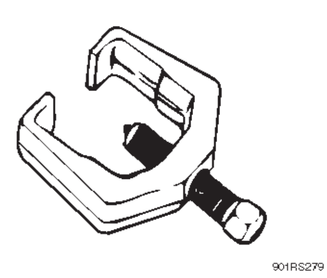
General Specifications

Power Steering unit	Type	Rack and pinion
	Rack stroke	152 mm (5.98 in)
	Lock to lock	3.64

Torque Specifications

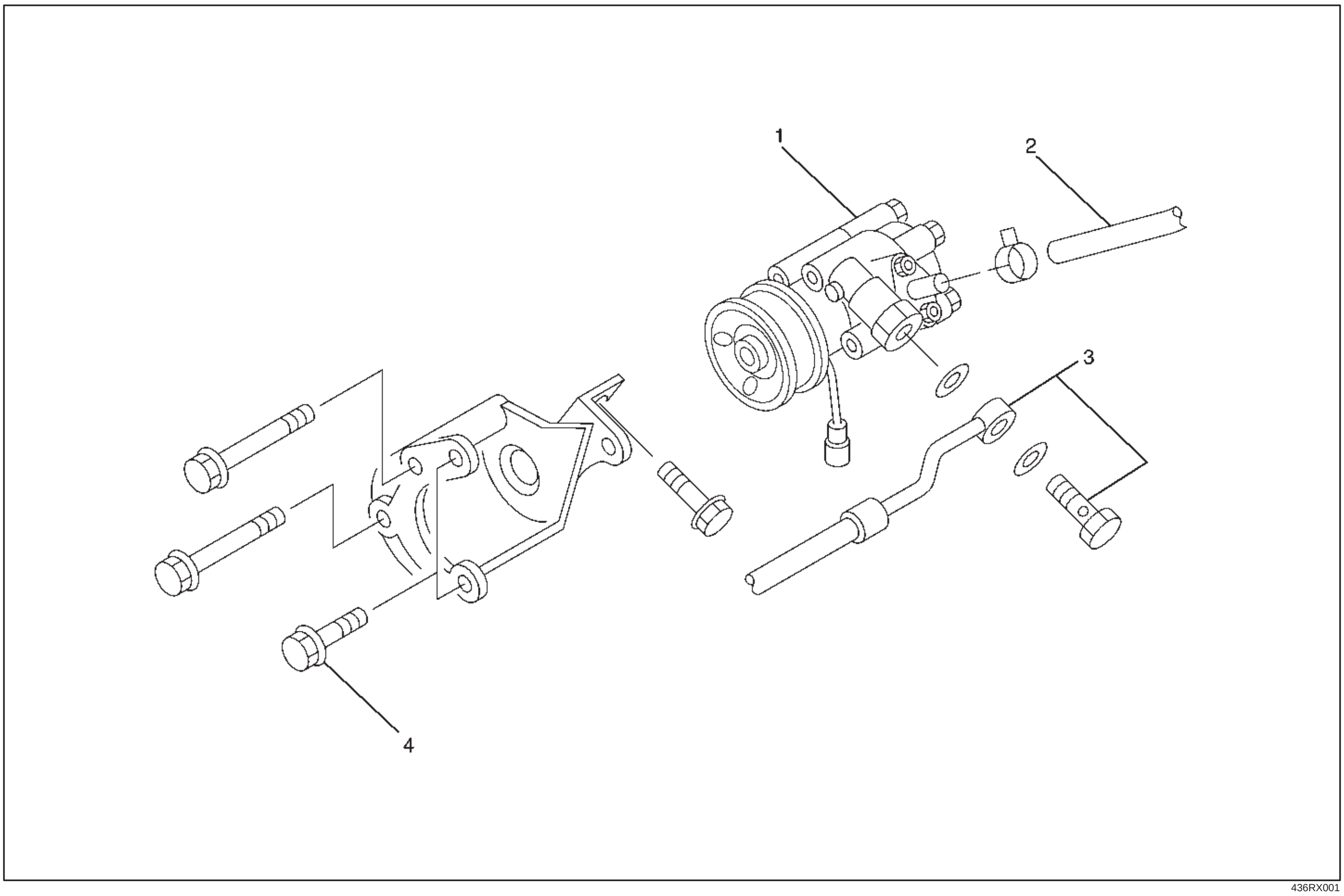


Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–29107** Tie rod end remover

Power Steering Pump

Power Steering Pump and Associated Parts



Legend
(1) Pump Assembly
(2) Hose, Suction
(3) Hose, Flexible
(4) Bolt

Removal

1. Remove the drive belt.
2. Place a drain pan below the pump.
3. Disconnect the suction hose.
4. Disconnect the flexible hose.
5. Remove the power steering fixing bolt and remove the pump assembly.

Installation

1. Install the pump assembly to the pump braket, tighten the fixing bolt to the specified torque.

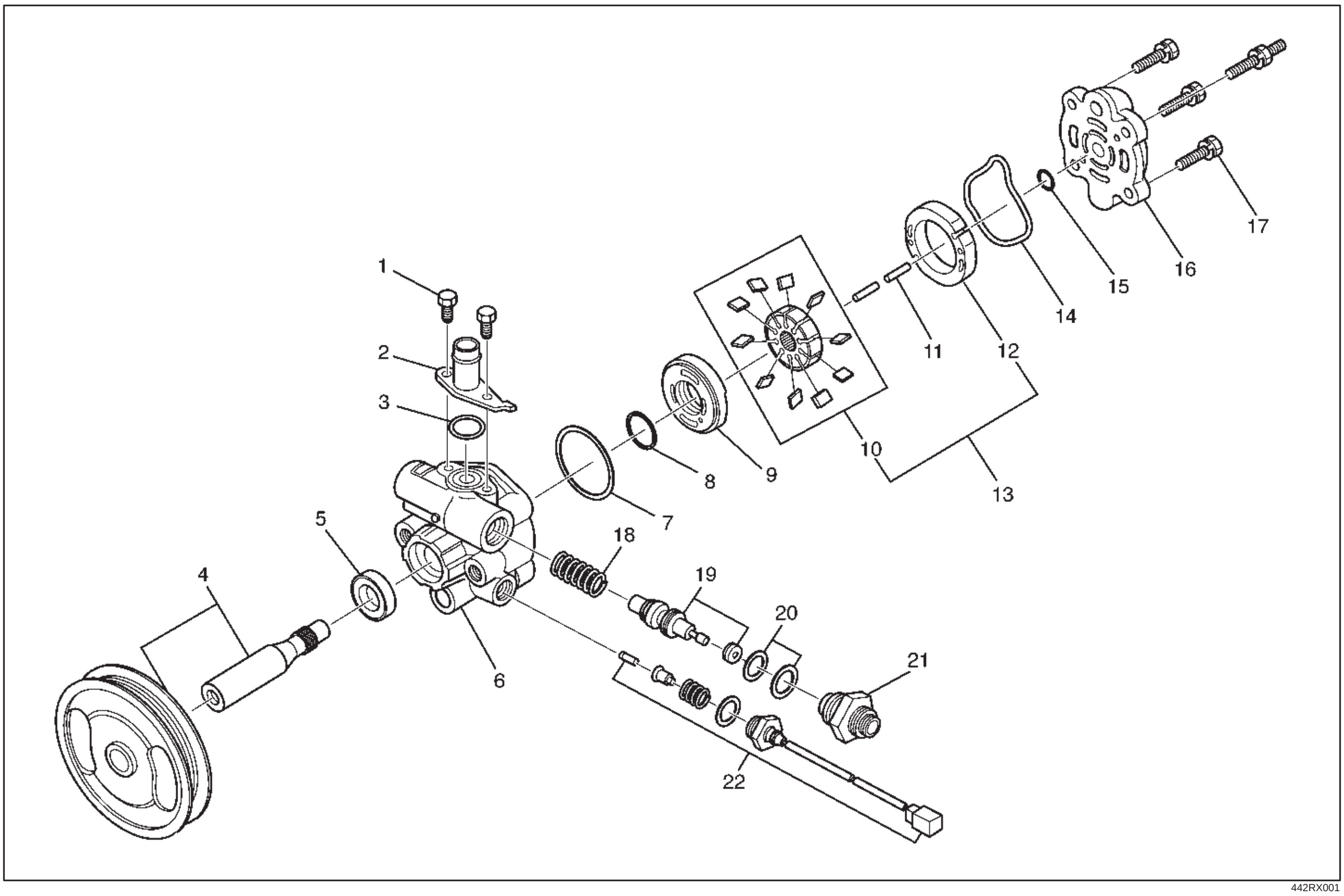
   Torque: 46 N·m (34 lb ft)

2. Install the flexible hose.
   Tighten the eye bolt to specified torque.

   Torque: 54 N·m (40 lb ft)

3. Install the drive belt.
4. Connect the suction hose, then fill and bleed system.
   Refer to Bleeding the Power Steering System in this section.

Power Steering Pump Disassembled View



Legend
- (1) Bolt
- (2) Suction Pipe
- (3) O-ring
- (4) Shaft Assembly
- (5) Oil Seal
- (6) Front Housing
- (7) O-ring
- (8) O-ring
- (9) Side Plate
- (10) Rotor and Vane
- (11) Pin
- (12) Cam
- (13) Pump Cartridge Assembly
- (14) O-ring
- (15) Snap Ring
- (16) Rear Housing
- (17) Bolt
- (18) Spring
- (19) Relief Valve
- (20) O-ring
- (21) Connector
- (22) Pressure Switch Assembly

Disassembly

1. Clean the oil pump with solvent (plug the discharge and suction ports to prevent the entry of solvent).
   Be careful not to expose the oil seal of shaft assembly to solvent.
2. Remove the bolt, suction pipe and O-ring.
3. Remove the connector, O-ring, relief valve and spring.
4. Remove the pressure switch assembly.
5. Remove the bolt, rear housing and O-ring.
6. Remove the snap ring.
7. Remove the shaft assembly.
8. Remove the oil seal.

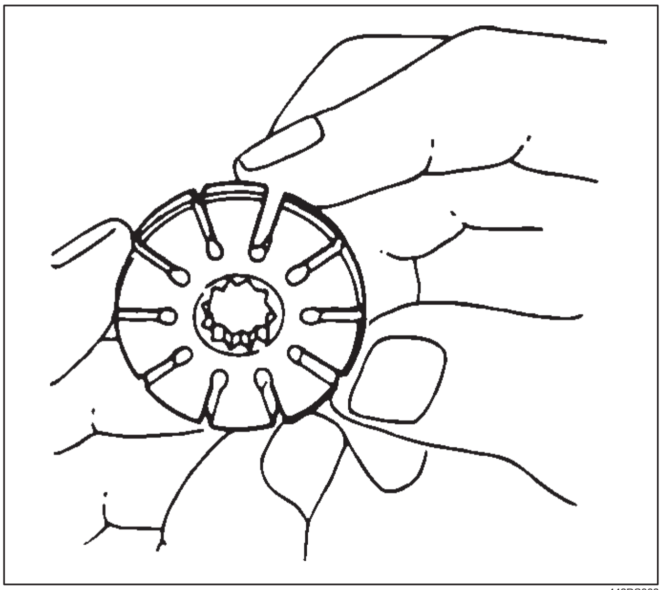
CAUTION: When removing the oil seal, be careful not to damage the housing.

9. Remove the pump cartridge assembly from the front housing.
10. Remove two O-rings.

Inspection and Repair

Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

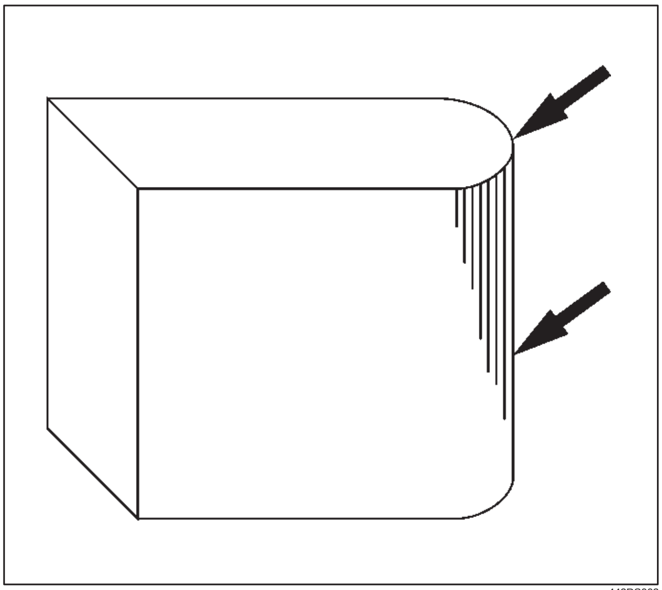
Rotor



442RS002

Check that the groove in the vane is free from excessive wear and that the vane slides smoothly. When part replacement becomes necessary, the pump cartridge should be replaced as a subassembly.

Vane



442RS003

Sliding faces of the vane should be free from wear. (Particularly the curved face at the tip that contact with the cam should be free from wear and distortion). When part replacement becomes necessary, the pump cartridge should be replaced as a subassembly.

Cam

The inner face of the arm should have a uniform contact pattern without a sign of step wear. When part replacement becomes necessary, the pump cartridge should be replaced as a subassembly.

Side Plate

The sliding faces of parts must be free from step wear (more than 0.01 mm), which can be felt by the finger nail. The parts with minor scores may be reused after lapping the face.

Relief Valve

The sliding face of the valve must be free from burrs and damage. The parts with minor scores may be reused after smoothing with emery cloth (#800 or finer).

Shaft

Oil seal sliding faces must be free from a step wear which can be felt by the finger nail. Bushing fitting face must be free from damage and wear.

O-ring, Oil Seal, Snap Ring

Be sure to discard used parts, and always use new parts for installation. Prior to installation, lubricate all seals and rings with power steering fluid.

Pressure Switch

Check the switch operation as follows:
With engine idling and A/C on, turn the steering wheel fully to the left; compressor should interrupt and engine idle speed will increase. Shut off A/C and again turn steering fully to the left; engine idle will increase. If system fails to function properly, disconnect connector at the pressure switch and repeat system check while testing continuity across disconnected SW connector.

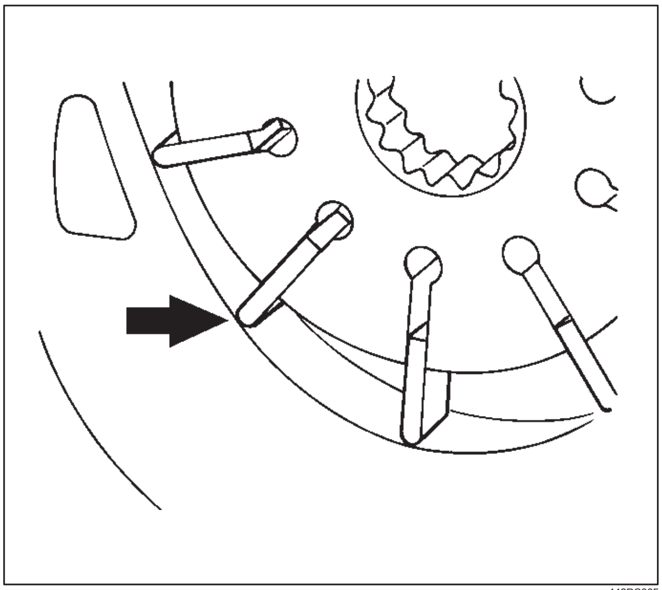
Reassembly

1. Install oil seal to front housing. Be sure to discard used oil seal, and always use new parts for installation.

CAUTION: When installing the oil seal, be careful not to damage the oil seal contacting surface of the housing.

2. Install shaft assembly.

3. Install the vanes to roter with curved face in contact with the inner wall of cam.


442RS005

4. Install roter and vanes to cam.
5. Install pin to front housing.
6. Install two new O-rings to front housing. Be sure to discard used O-ring.
7. Install side plate.

CAUTION: When installing side plate, be careful not to damage its inner surface. Damaged side plate may cause poor pump performance, pump seizure or oil leakage.

8. Install pump cartridge assembly to front housing.
9. Install snap ring to shaft end.
10. Install rear housing with a new O-ring. Be sure to discard used O-ring. Then install bolt and tighten it to specified torque.

    Torque: 24 N·m (17 lb ft)

11. Install suction pipe with a new O-ring. Be sure to discard used O-ring. Then install bolt and tighten it to specified torque.

    Torque: 10 N·m (87 lb in)

12. Install relief valve and spring.
13. Install connector with a new O-ring. Be sure to discard used O-ring. Tighten the connector to specified torque.

    Torque: 59 N·m (43 lb ft)

14. Install pressure switch assembly and tighten it to specified torque.

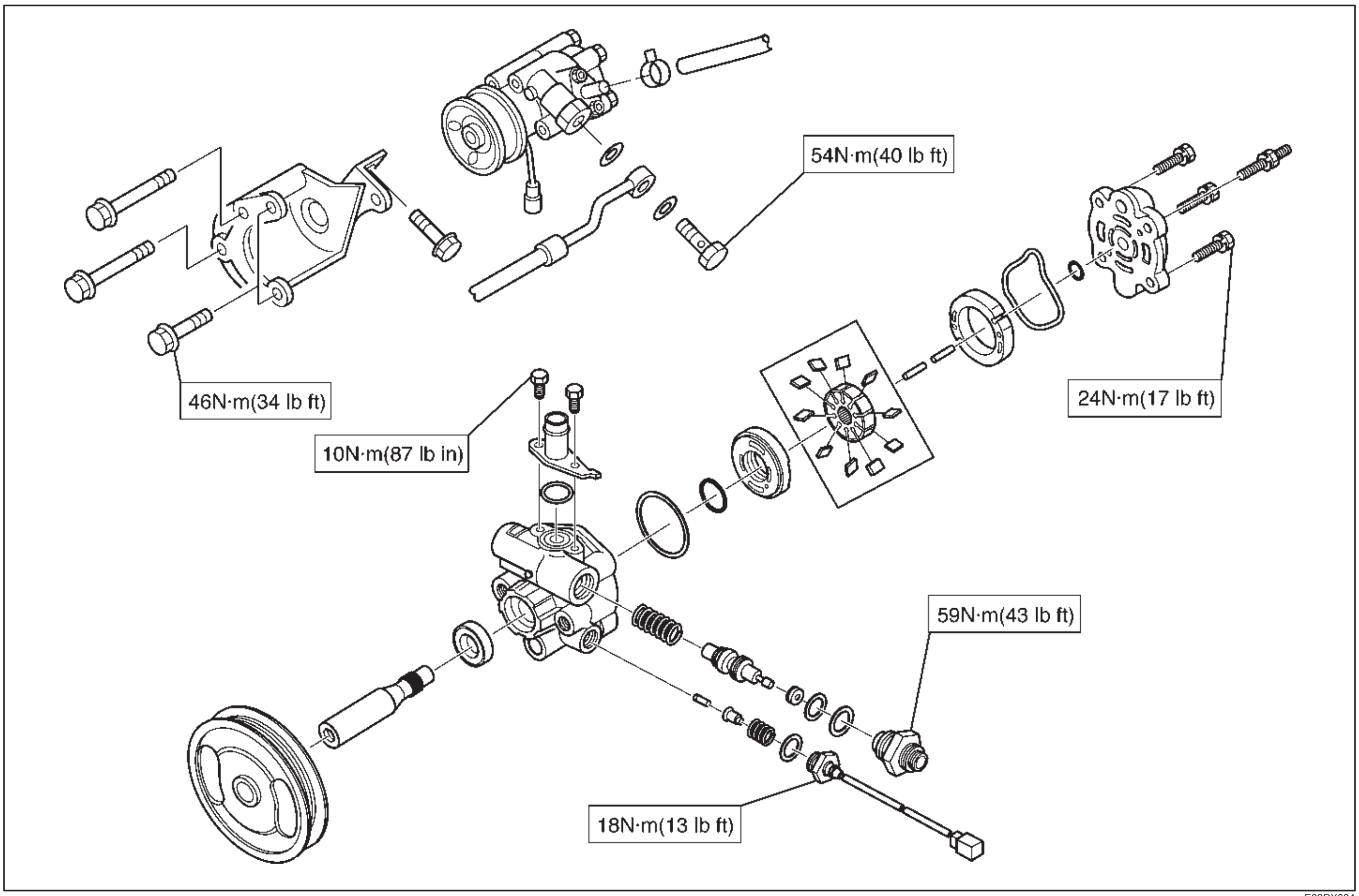
    Torque: 18 N·m (13 lb ft)

Main Data and Specifications

General Specifications

Oil pump	Type	Vane
	Operating fluid	ATF DEXRON®–III

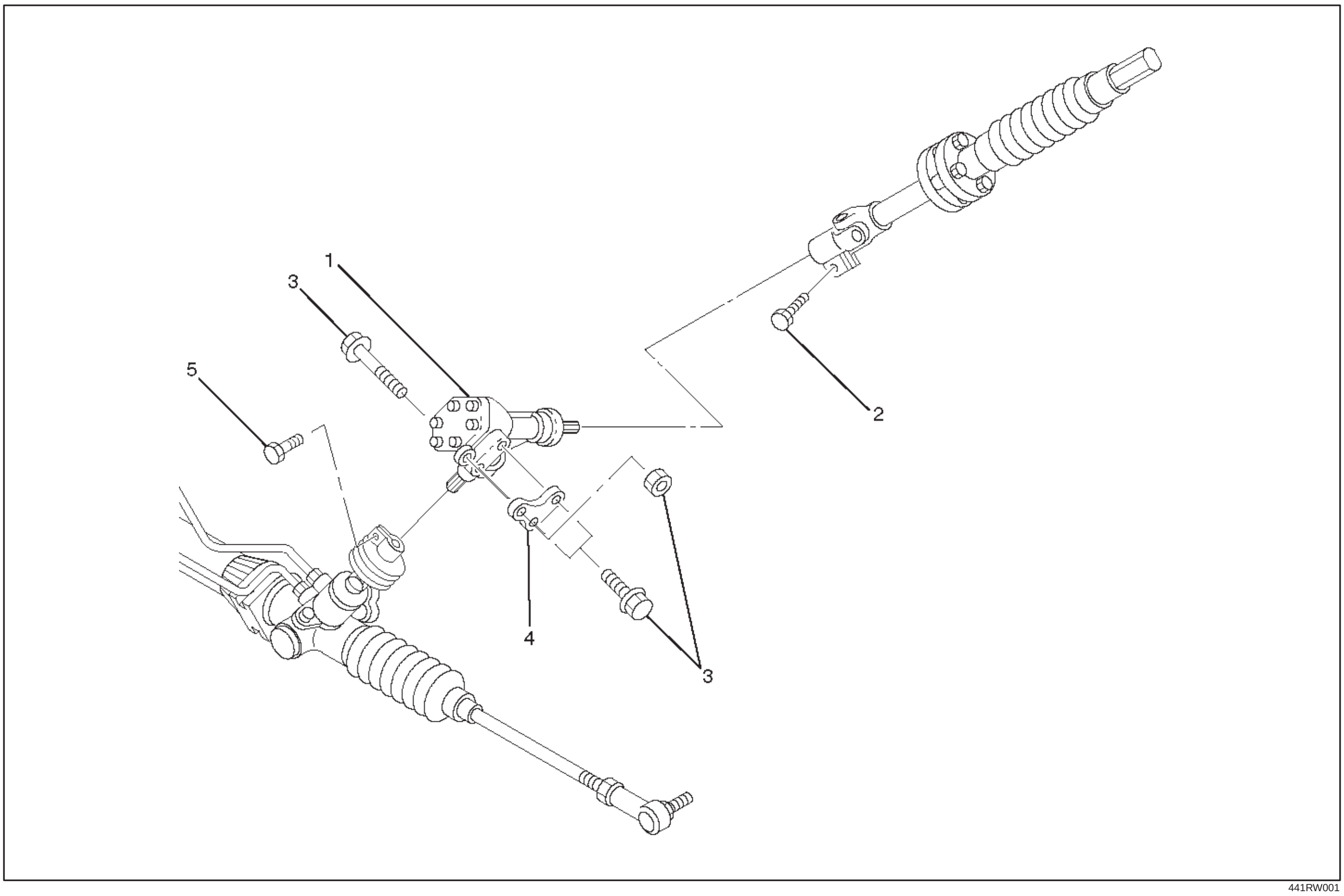
Torque Specifications



E02RX004

Transfer Gear Assembly

Transfer Gear Assembly and Associated Parts



Legend

(1) Transfer Gear Assembly
(2) Bolt, Universal Joint (Steering Shaft Side)
(3) Fixing Bolt Nut
(4) Shim
(5) Bolt, Universal Joint (Steering Unit Side)

Removal

1. Remove universal joint bolt (steering shaft side).
2. Remove universal joint bolt (steering unit side).
3. Loosen fixing bolt and nut and remove transfer gear assembly with shim.

Inspection and Repair

The transfer gear assembly cannot be disassembled. If damage or abnormal condition are found, replace to new ones.

Installation

1. Install transfer gear assembly with shim and tighten bolt and nut to the specified torque.

   Torque: 54 N·m (40 lb ft)

2. Connect universal joint (both side) and tighten the bolt to the specified torque.

   Torque: 31 N·m (23 lb ft)

Supplemental Restraint System Steering Wheel & Column

Service Precaution

This steering wheel and column repair section covers the Supplemental Restraint System (SRS) steering column. The following repair procedures are specific to SRS components. When servicing a vehicle equipped with Supplemental Restraint System, pay close attention to all WARNINGS and CAUTIONS.

For detailed explanation about SRS, refer to Restraints section.

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

SAFE HANDLING OF INFLATOR MODULES REQUIRES FOLLOWING THE PROCEDURES DESCRIBED BELOW FOR BOTH LIVE AND DEPLOYED MODULES.

SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY (AIR BAG). AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY (AIR BAG) SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY-PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY (AIR BAG) IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AN AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE.

NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS SYSTEM, DO NOT USE ELECTRICAL TEST EQUIPMENT, SUCH AS BATTERY-POWERED OR A/C-POWERED VOLT-METER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN SPECIFIED IN THIS MANUAL. DO NOT USE A NON-POWERED PROBE-TYPE TESTER.

INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

SRS Connectors

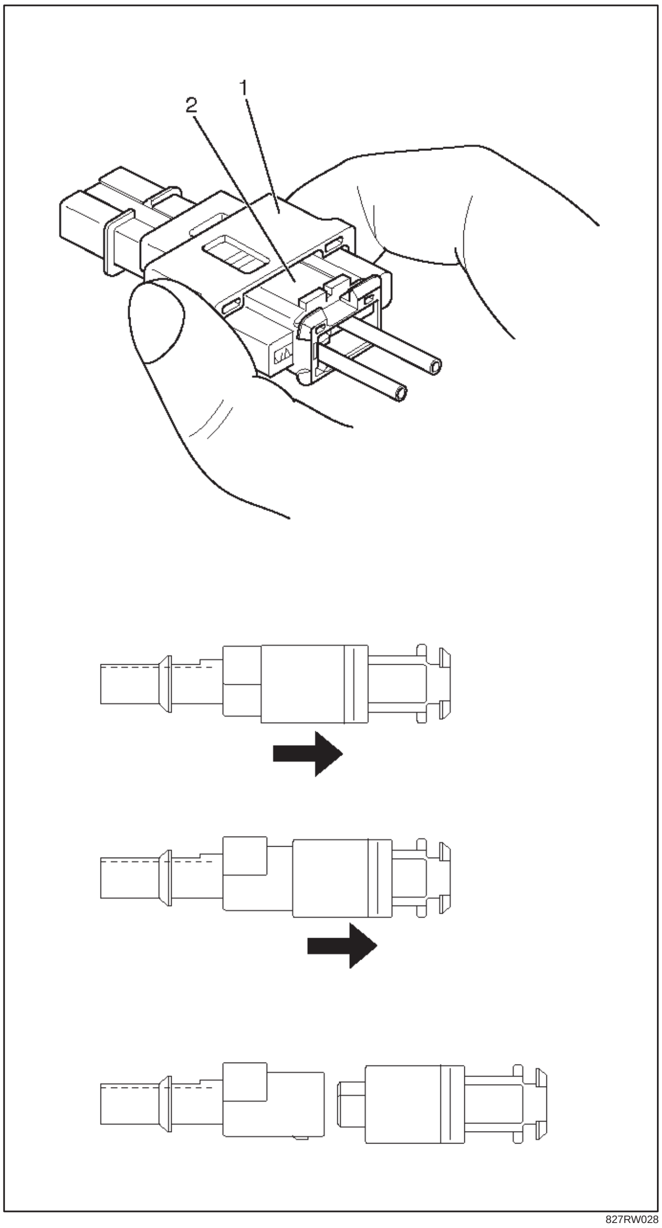
CAUTION: The special yellow color connectors are used for supplemental restraint system-air bag circuit.

When removing the cable harness, do not pull the cables. Otherwise, cable disconnection may occur.

When connect the SRS connector, insert the connector completely. Imperfect locking may cause malfunction of SRS circuit.

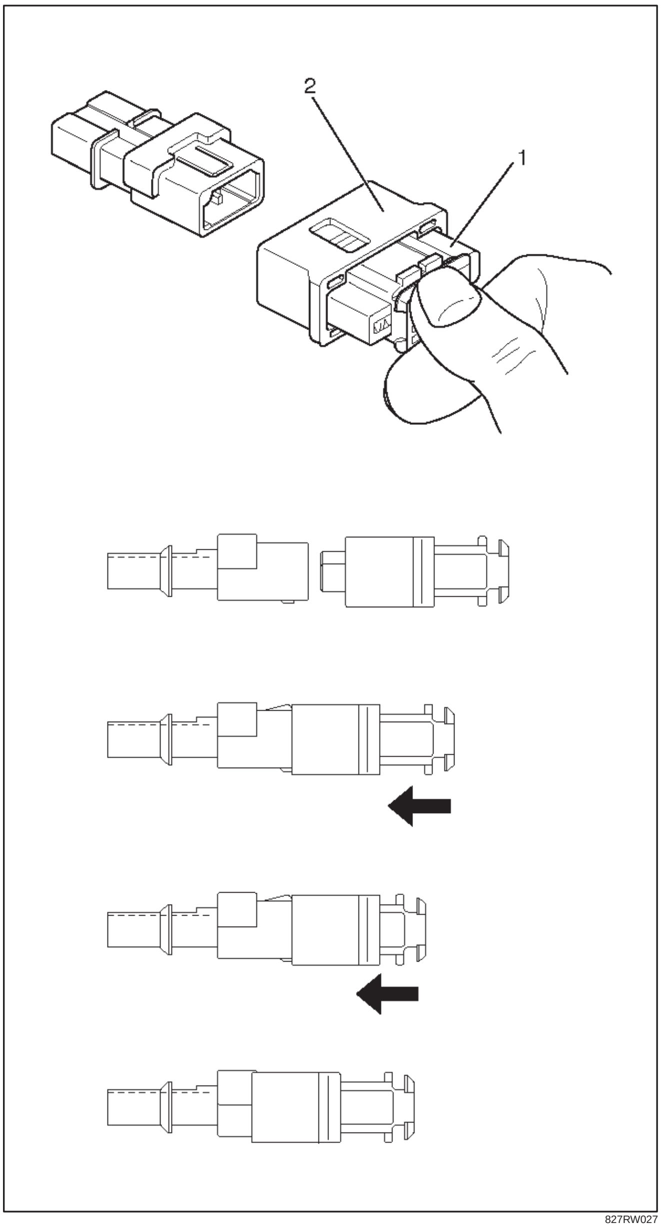
Removal

To remove the connector, hold the cover insulator(1) and pull it. The cover insulator slides and lock will be released. Do not hold the socket insulator(2).



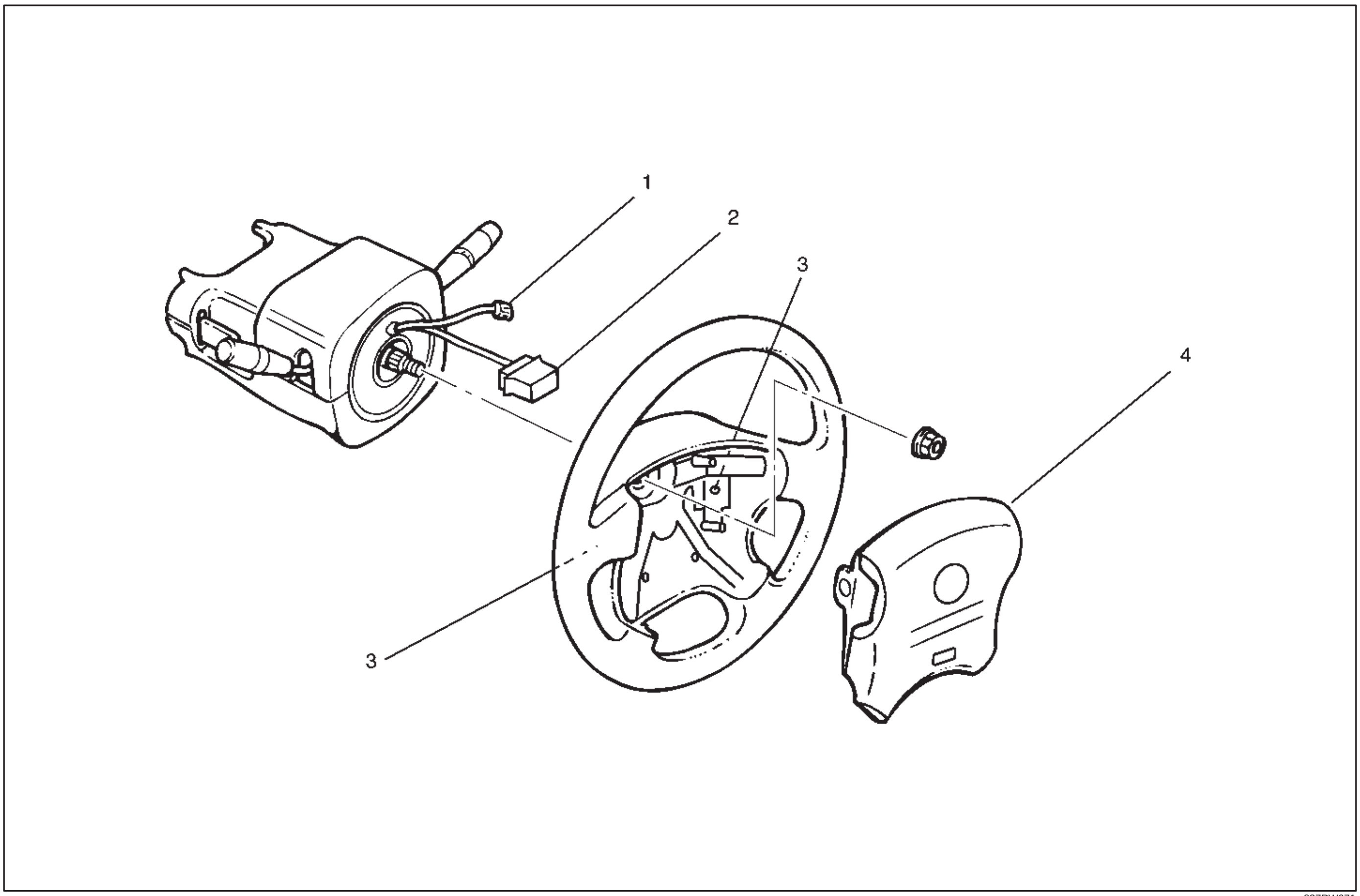
Installation

To install the connector, hold the soket insulator(1) and insert it. The cover insulator slides and connector will be locked.
Do not hold the cover insulator(2).



Inflator Module

Inflator Module and Associated Parts



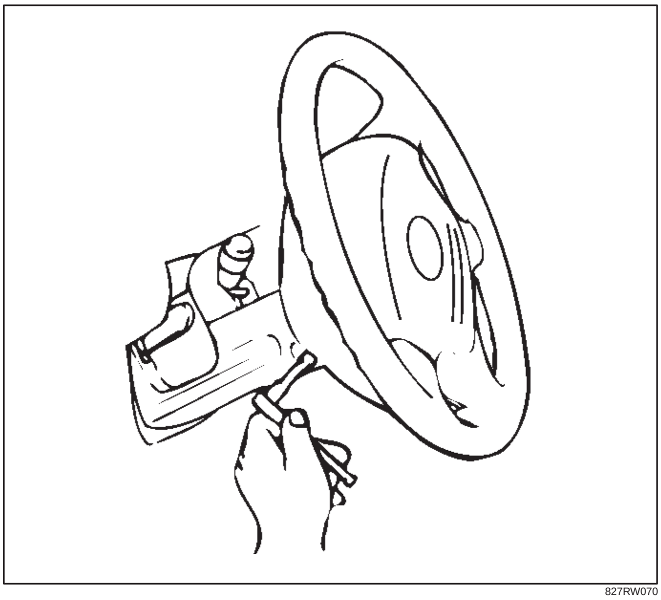
827RW071

Legend

(1) Horn Lead
(2) SRS Connector
(3) Fixing Bolt
(4) Inflator Module

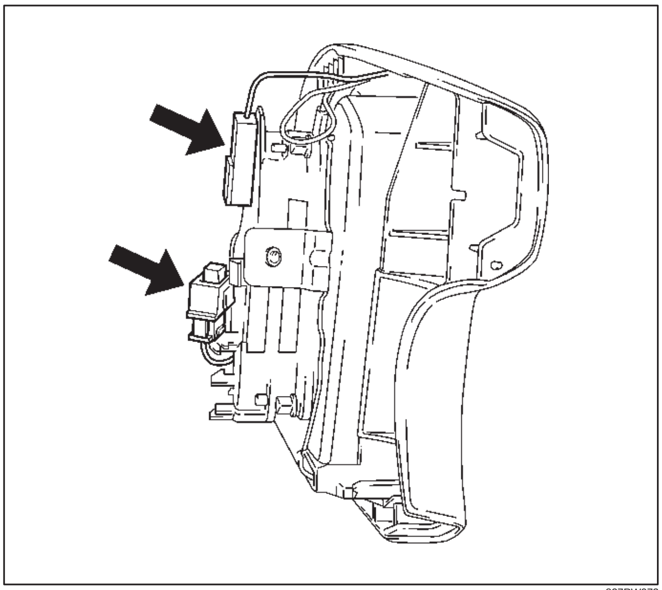
Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.
5. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly .



827RW070

6. Disconnect the yellow 2-way SRS connector and horn lead located behind the inflator module.

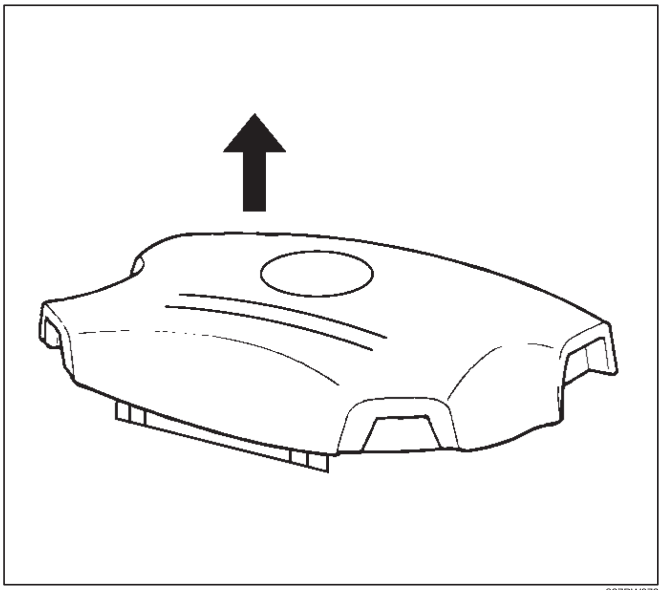


827RW073

7. Remove inflator module.

Inspection and Repair

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT .



827RW072

The inflator module consists of a cover, air bag, inflator, and retainer. Inspect the inflator module mainly for the following:

- Check for holes, cracks, severe blemishes and deformation on the cover.
- Check that the retainer is not deformed.
- Check for defects such as damage and breakage in the lead wire for the igniter.

If an abnormality is found as the result of the inspection, replace the inflator module with a new one.

Installation

1. Install inflator module.
2. Support the module and carefully connect the module connector and horn lead.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

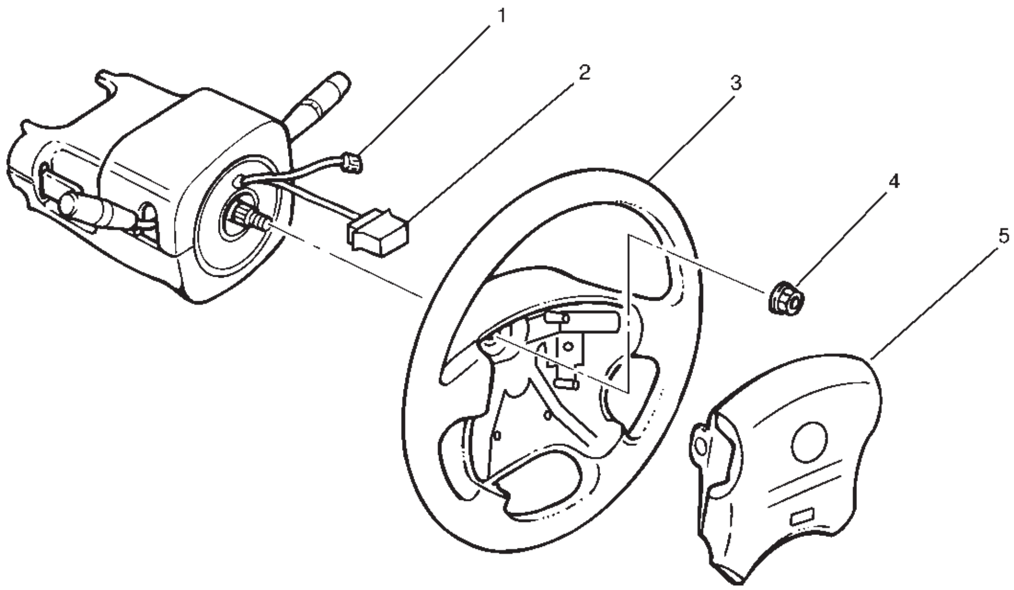
3. Tighten bolts to specified torque.

Torque: 9 N·m (78 lb in)

4. Connect the yellow 2-way SRS connector located under the steering column.
5. Connect the battery "–" terminal cable.
6. Set ignition to "ON" while watching warning light. Light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

Steering Wheel

Steering Wheel and Associated Parts



827RW069

Legend

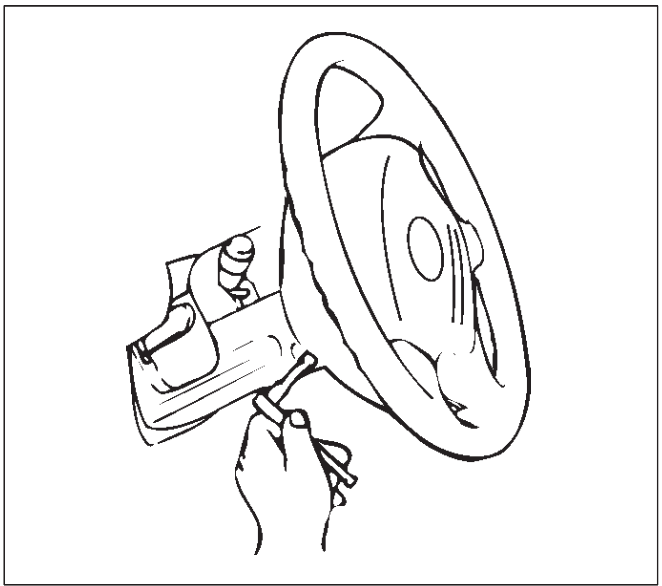
(1) Horn Lead
(2) SRS Connector
(3) Steering Wheel
(4) Steering Wheel Fixing Nut
(5) Inflator Module

CAUTION: Once the steering column is removed from the vehicle, the column is extremely susceptible to damage. Dropping the column assembly on its end could collapse the steering shaft or loosen the slide block which maintains column rigidity. Leaning on the column assembly could cause the jacket to bend or deform. Any of the above damage could impair the column's collapsible design. If it is necessary to remove the steering wheel, use only the specified steering wheel puller. Under no conditions should the end of the shaft be hammered upon, as hammering could loosen slide block which maintains column rigidity.

Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

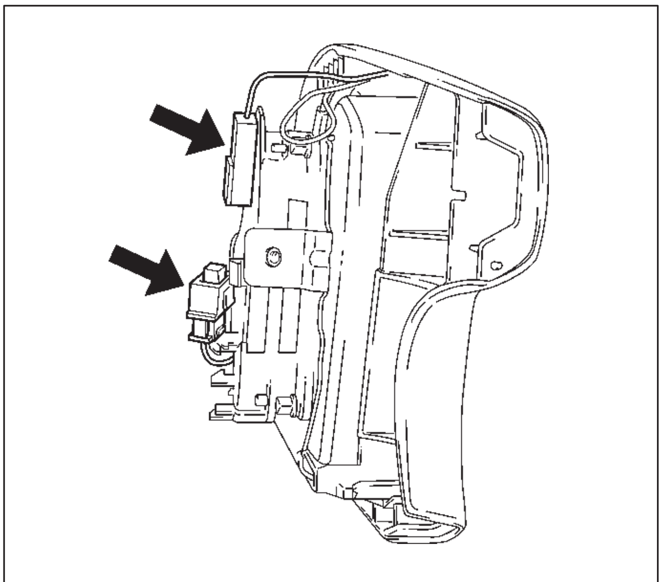
5. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.



827RW070

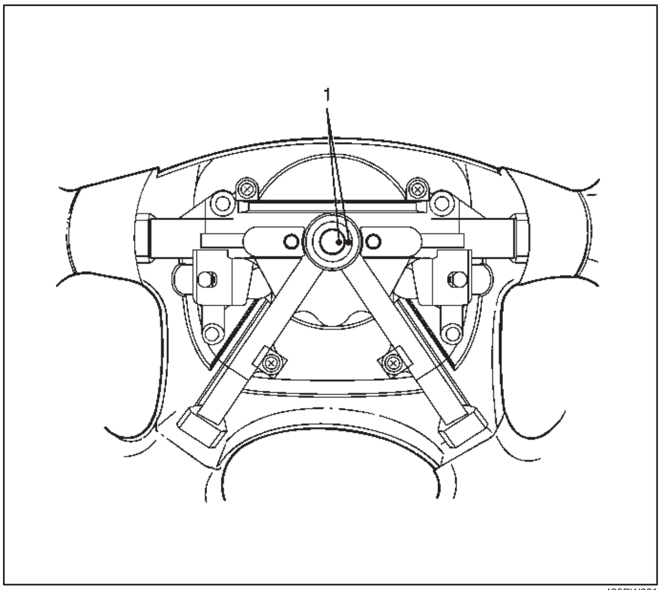
6. Disconnect the yellow 2-way SRS connector located behind the inflator module.

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



827RW073

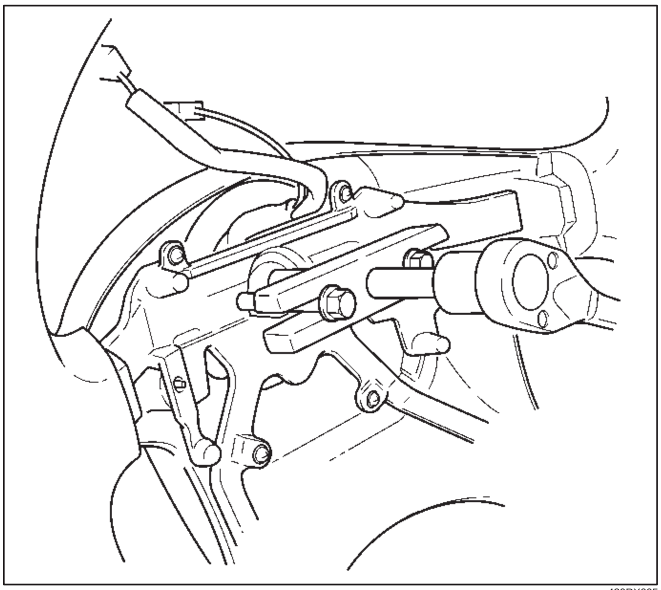
7. Disconnect horn lead.
8. Remove steering wheel fixing nut.
9. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position, then remove steering wheel.



430RW021

10. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



430RX005

Installation

1. Install steering wheel by aligning the setting marks made when removing.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

2. Tighten the steering wheel fixing nut to the specified torque.

   Torque: 34 N·m (25 lb ft)

3. Connect horn lead.
4. Support the module and carefully connect the SRS connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinches.

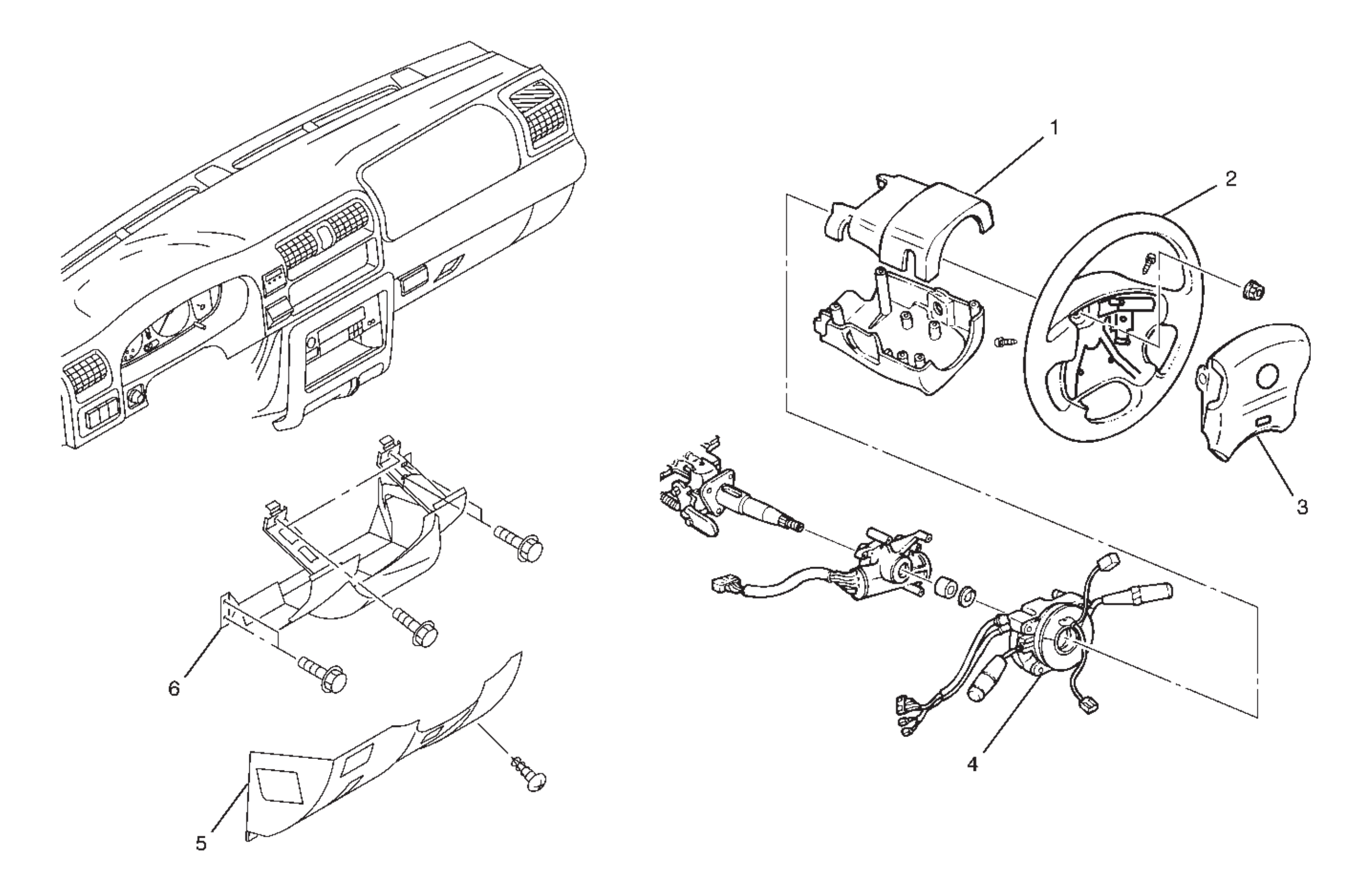
5. Tighten bolts to specified torque.

   Torque: 9 N·m (78 lb in)

6. Connect the yellow 2-way SRS connector located under the steering column.
7. Connect the battery "–" terminal cable.
8. Turn the ignition switch to "ON" while watching warning light. Light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

Combination Switch

Combination Switch and Associated Parts



Legend
- (1) Steering Column Cover
- (2) Steering Wheel
- (3) Inflator Module
- (4) Combination Switch and SRS Coil Assembly
- (5) Instrument Panel Lower Cover
- (6) Driver Knee Bolster (reinforcement)

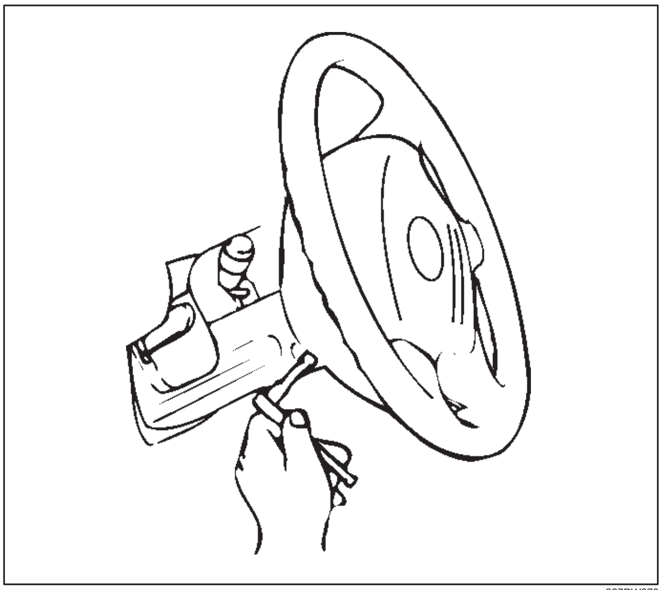
Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

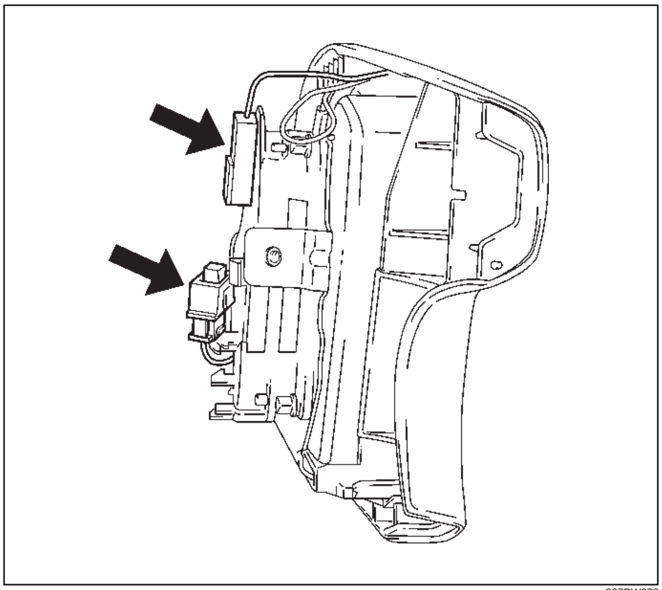
CAUTION: The wheels of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering wheel. Failure to do so will cause the coil assembly to become uncentered which will cause damage to the coil assembly.

5. Remove the engine hood opening lever, then remove instrument panel lower cover.
6. Remove the driver knee bolster (reinforcement).

7. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly. Disconnect the yellow 2-way SRS connector and horn lead located behind the inflator module, then remove inflator module.

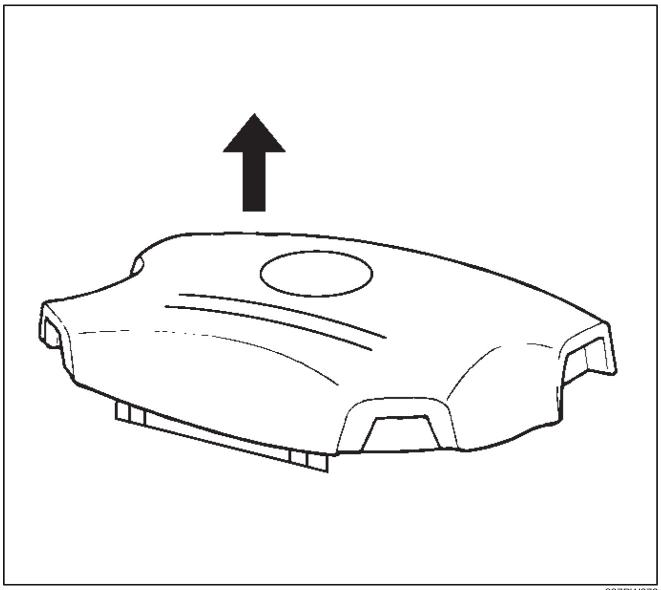


827RW070



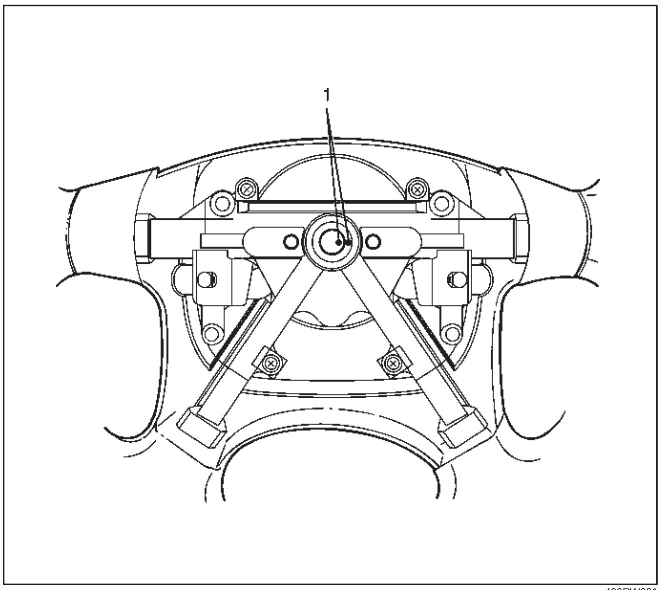
827RW073

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



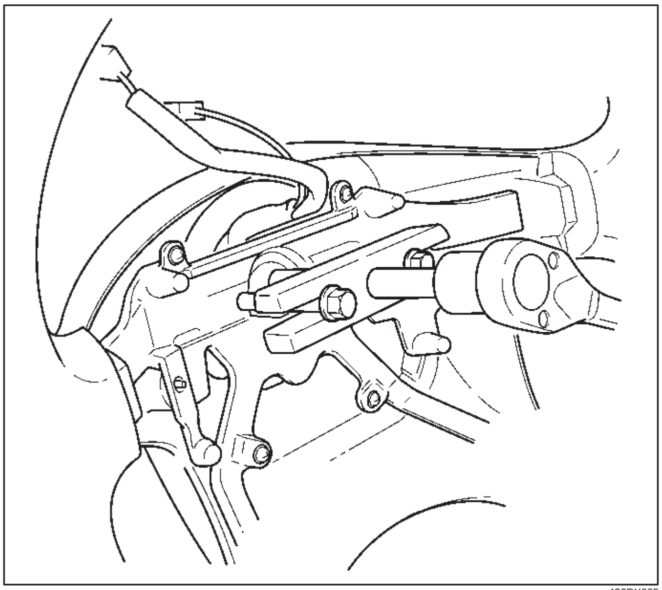
827RW072

8. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.



430RW021

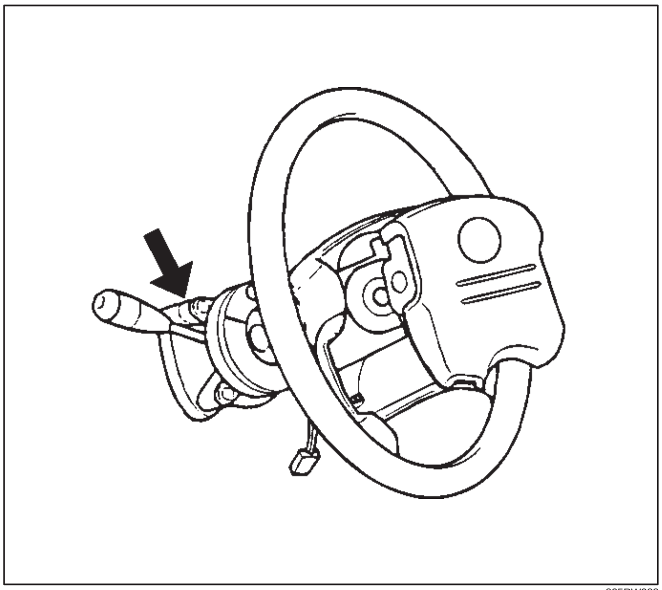
CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



430RX005

9. Remove steering column cover.
10. Disconnect the wiring harness connectors located under the steering column then remove combination switch and SRS coil assembly.

NOTE: The SRS coil is a part of the combination switch assembly, which can not be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.

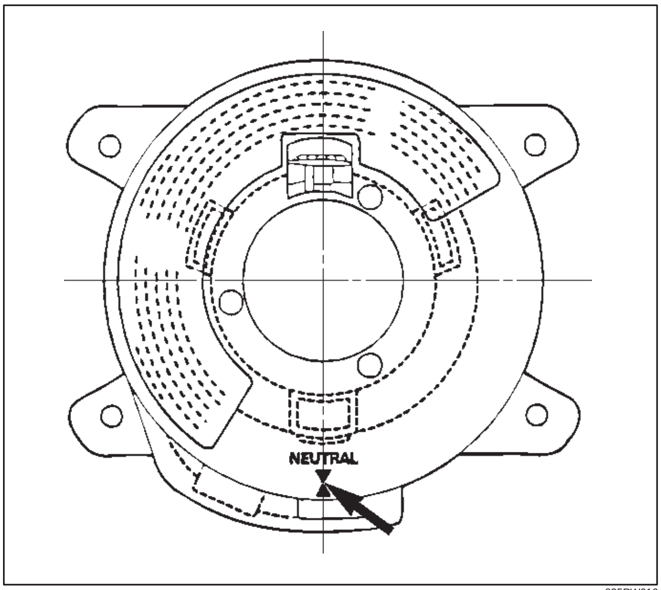


825RW288

Installation

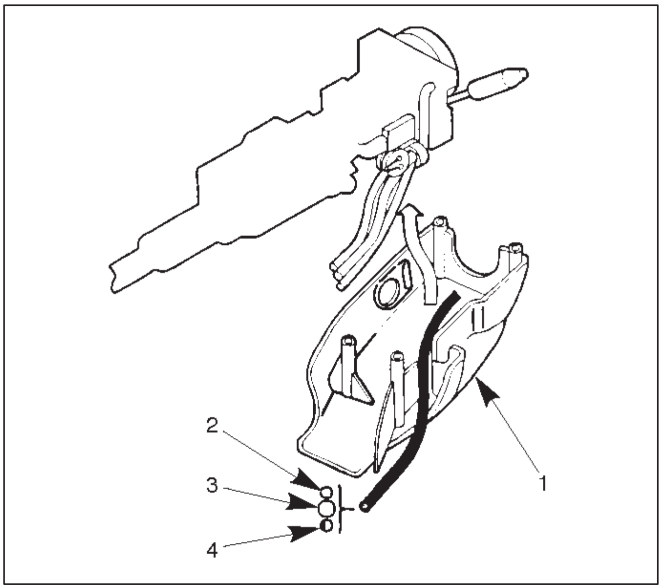
1. Install combination switch and SRS coil assembly. After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2-way connector located under the steering column. Then turn the SRS coil counter clockwise to full, return about 3 turns and align the neutral mark.

CAUTION: When turning the SRS coil counter clockwise to full, stop turning if resistance is felt. Forced further turning may damage to the cable in the SRS coil.



825RW016

2. When installing the steering column cover, be sure to route each wire harness as illustrated so that the harnesses do not catch on any moving parts.



825RW017

Legend

(1) Steering Column Cover
(2) Starter Switch Harness
(3) Combination Switch Harness
(4) Inflator Module Harness

3. Align the setting marks made when removing then install steering wheel.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

4. Tighten the steering wheel fixing nut to the specified torque.

Torque: 34 N·m (25 lb ft)

5. Support the inflator module and carefully connect the SRS connector and horn lead.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

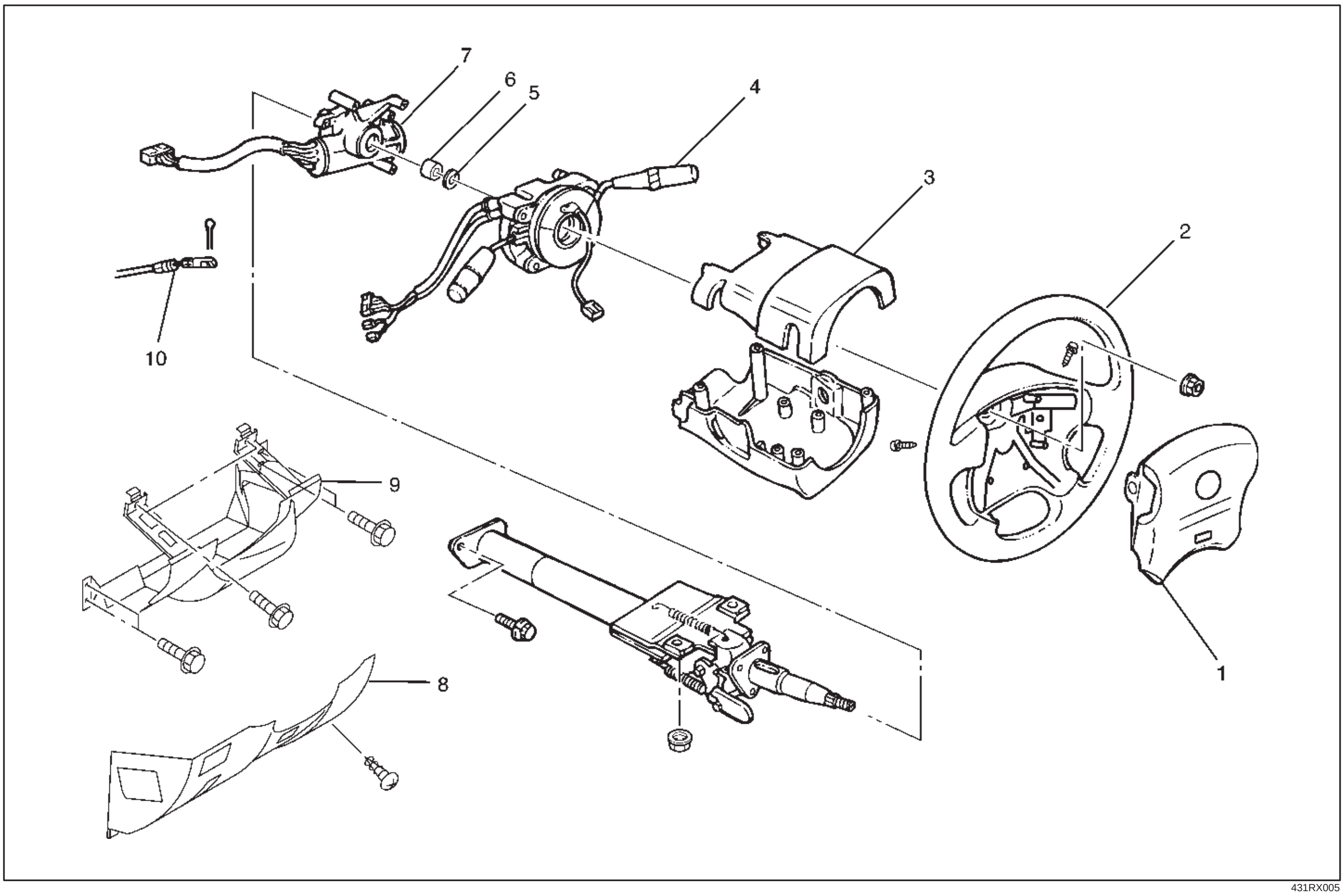
6. Tighten bolts to specified torque.

Torque: 9 N·m (78 lb in)

7. Install driver knee bolster (reinforcement).
8. Install instrument panel lower cover then Install the engine hood opening lever.
9. Connect the SRS connector.
10. Connect the battery “-” terminal cable.
11. Turn the ignition switch to “ON” while watching warning light and check the light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

Lock Cylinder

Lock Cylinder and Associated Parts



Legend

(1) Inflator Module
(2) Steering Wheel
(3) Steering Column Cover
(4) Combination Switch and SRS Coil Assembly
(5) Snap Ring
(6) Cushion Rubber
(7) Lock Cylinder Assembly
(8) Instrument Panel Lower Cover
(9) Driver Knee Bolster (reinforcement)
(10) Shift Lock Cable (for A/T)

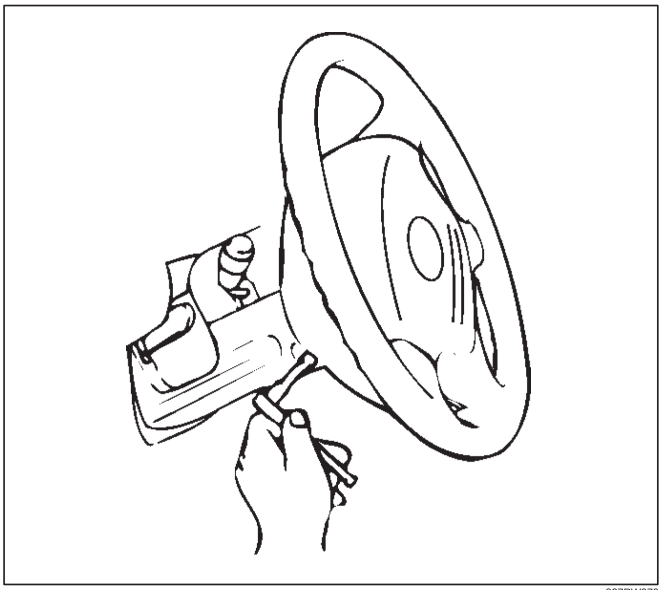
Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

CAUTION: The wheels of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering wheel. Failure to do so will cause the coil assembly to become uncentered which will cause damage to the coil assembly.

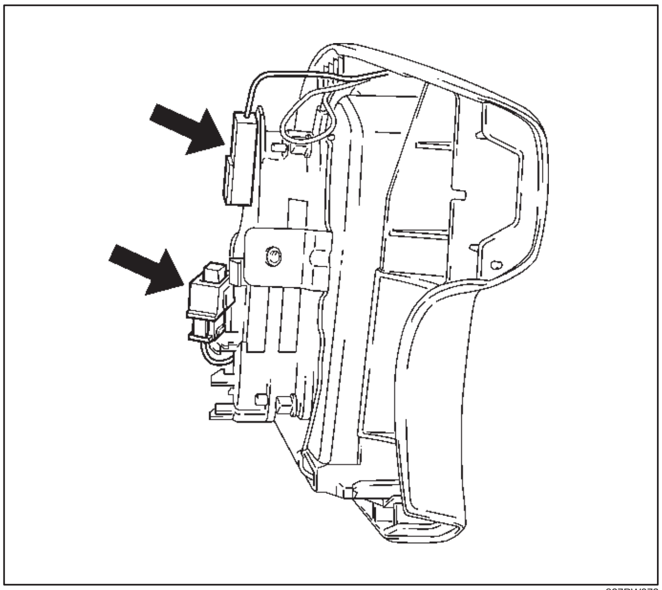
5. Remove the engine hood opening lever and steering lower cover.
6. Remove driver knee bolster (reinforcement).

7. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.



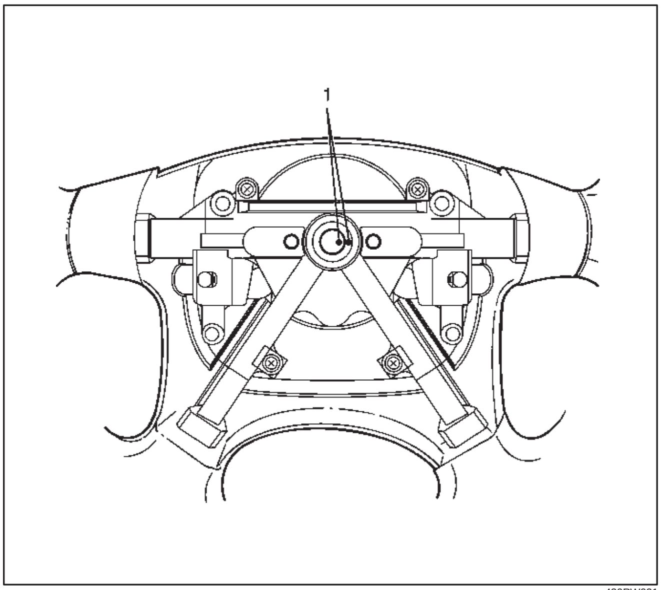
827RW070

8. Disconnect the yellow 2-way SRS connector and horn lead located behind the inflator module.



827RW073

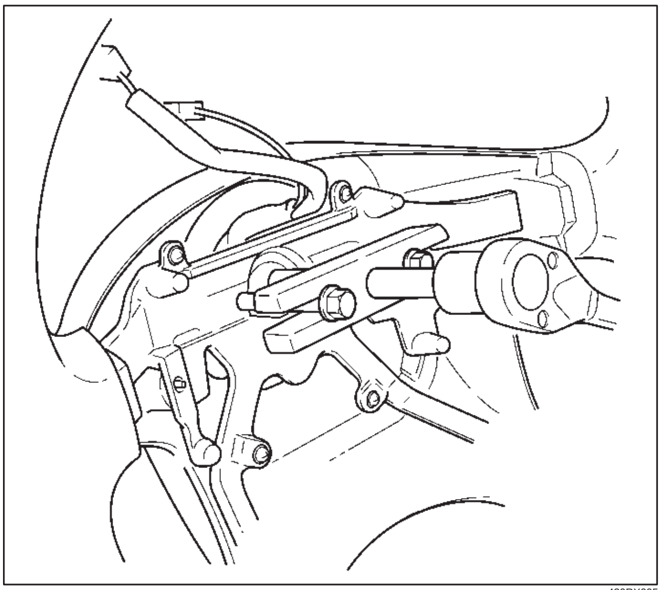
9. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position.



430RW021

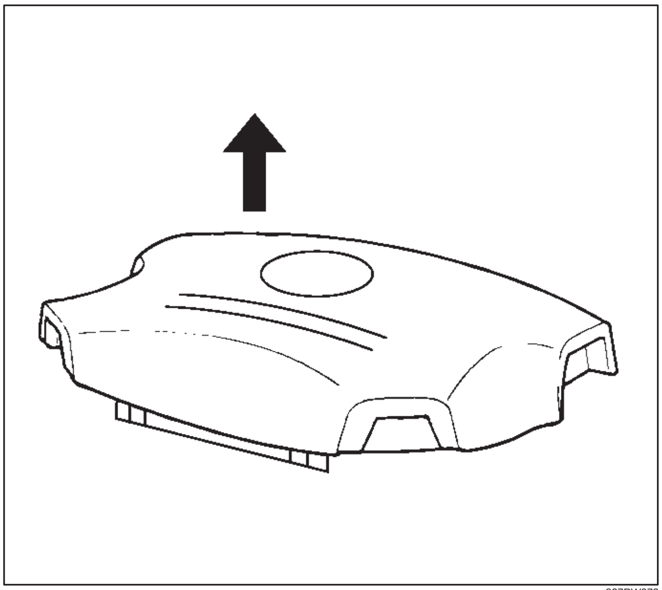
10. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



430RX005

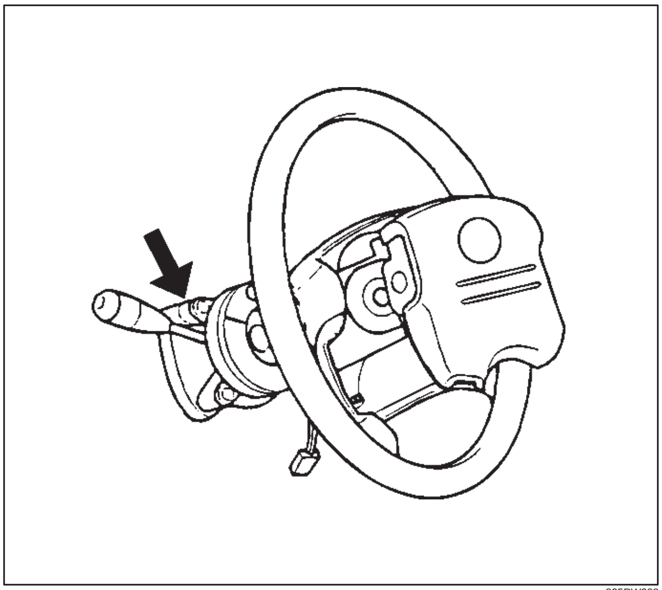
WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



827RW072

11. Remove steering column cover.
12. Disconnect the wiring harness connectors located under the steering column.
13. Remove the combination switch assembly with SRS coil.

NOTE: The SRS coil is a part of the combination switch assembly, which can not be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.



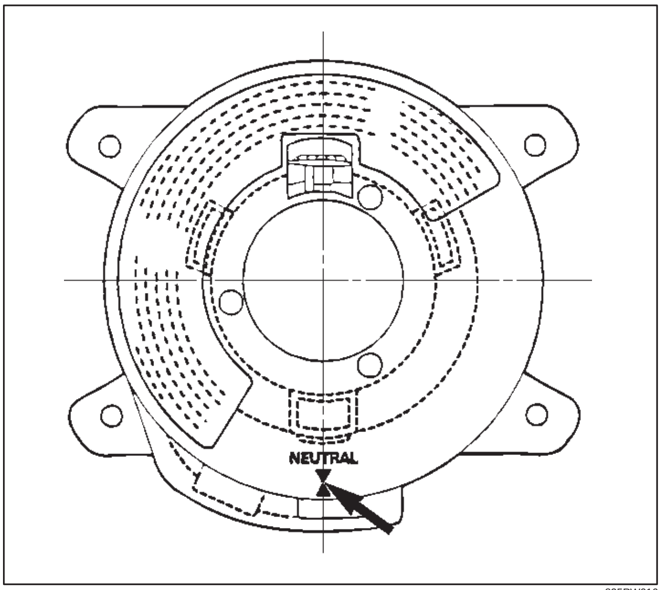
825RW288

14. Remove snap ring.
15. Remove cushion rubber.
16. Remove shift lock cable (for A/T).
17. Disconnect the starter switch harness connector located under the steering column then remove lock cylinder assembly.

Installation

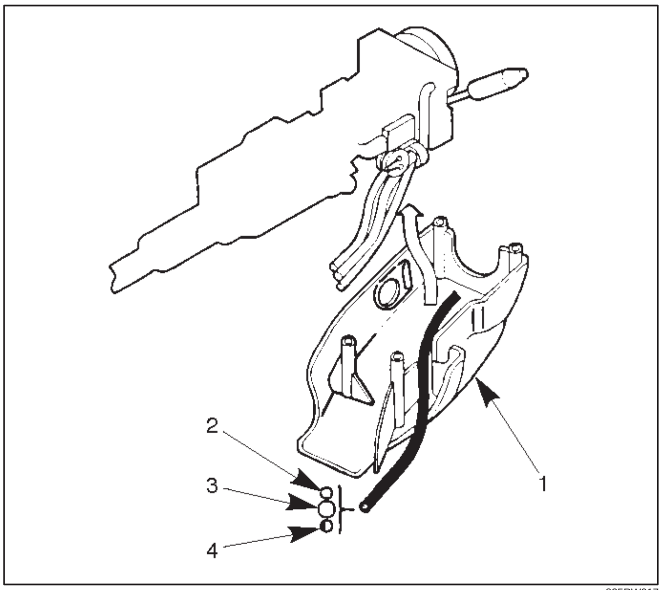
1. Install lock cylinder assembly.
2. Install shift lock cable (for A/T).
3. Install cushion rubber.
4. Install snap ring.
5. Install Combination switch and SRS coil assembly. After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2-way connector located under the steering column.
6. Turn the SRS coil counter clockwise to full, return about 3 turns and align the neutral mark.

CAUTION: When turning the SRS coil counter clockwise to full, stop turning if resistance is felt. Forced further turning may damage the cable in the SRS coil.



825RW016

7. When installing the steering column cover, be sure to wire (through each harness) as illustrated so that the harnesses starter switch, combination switch and SRS coil may not catch wiring.



825RW017

Legend

(1) Steering Column Cover
(2) Starter Switch Harness
(3) Combination Switch Harness
(4) Inflator Module Harness

8. Install steering wheel by aligning the setting marks made during removal.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

9. Tighten the steering wheel fixing nut to the specified torque.

Torque: 34 N·m (25 lb ft)

10. Support inflator module and carefully connect the SRS connector and horn lead, then install inflator module.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

11. Tighten fixing bolts to specified torque.

Torque: 9 N·m (78 lb in)

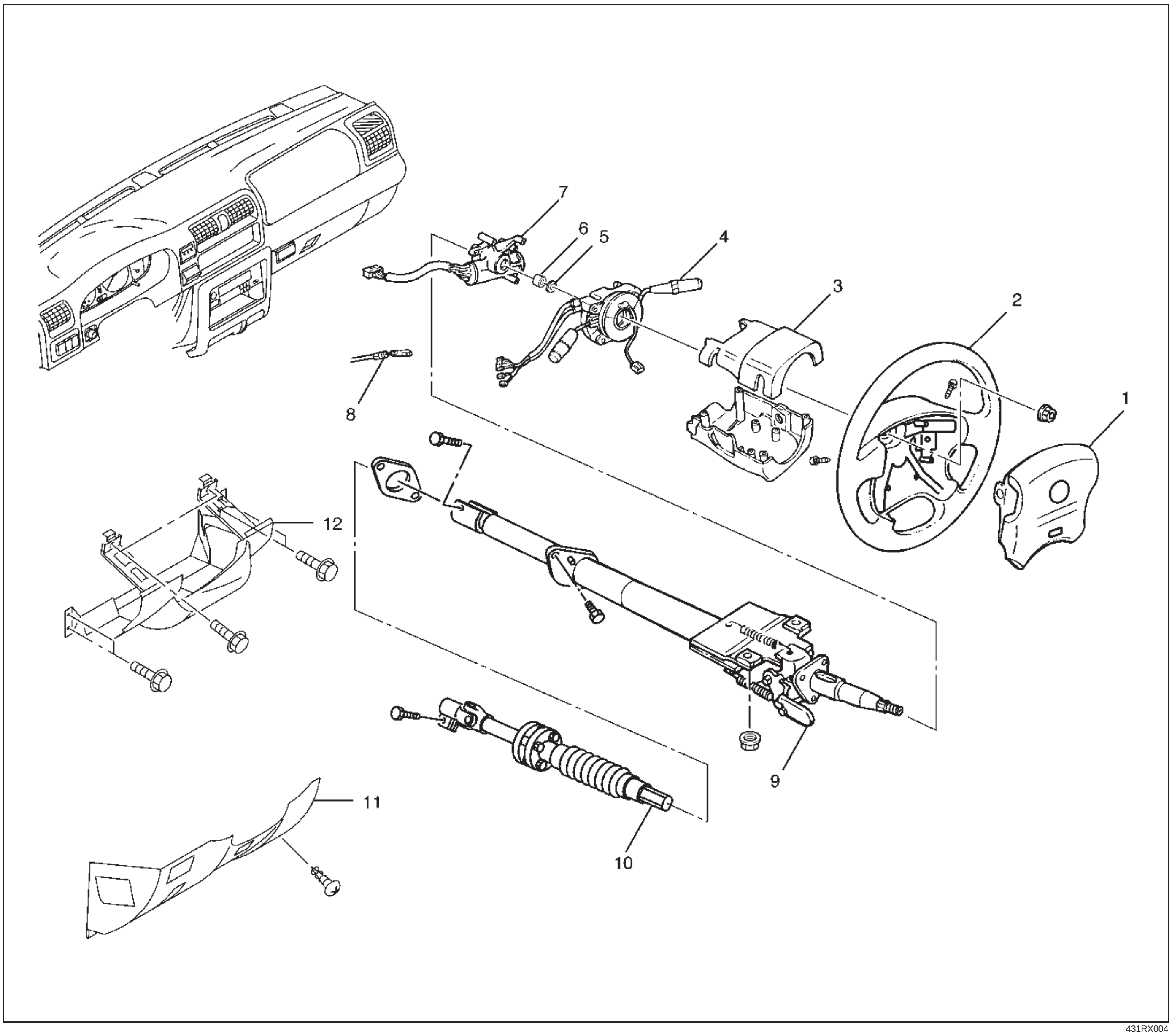
12. Install driver knee bolster (reinforcement).
13. Install instrument panel lower cover, then install the engine hood opening lever.
14. Connect the yellow 2-way SRS connector located under the steering column.
15. Connect the battery "–" terminal cable.

System Inspection

Turn the ignition switch to "ON" while watching warning light.
The light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

Steering Column

Steering Column and Associated Parts



Legend

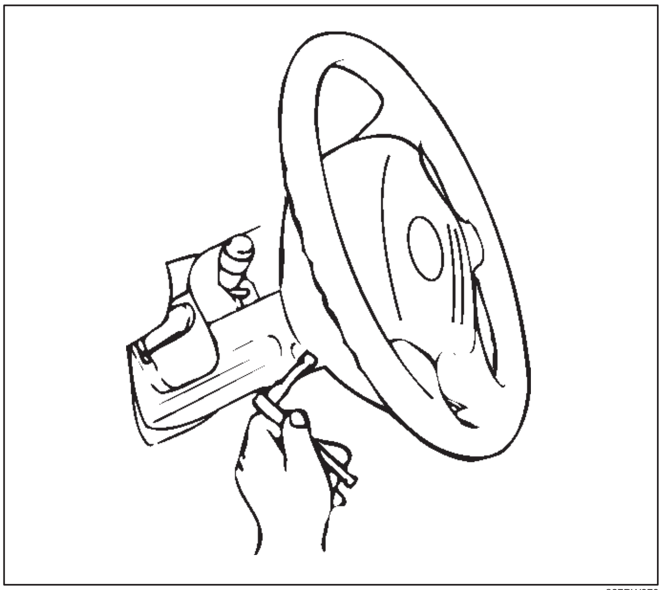
(1) Inflator Module
(2) Steering Wheel
(3) Steering Column Cover
(4) Combination Switch and SRS Coil Assembly
(5) Snap Ring
(6) Cushion Rubber
(7) Lock Cylinder Assembly
(8) Shift Lock Cable (For A/T)
(9) Steering Column Assembly
(10) Second Steering Shaft
(11) Instrument Panel Lower Cover
(12) Driver Knee Bolster (reinforcement)

Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

CAUTION: The wheel of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering column from the steering gear. Failure to do so will cause the SRS coil assembly to become uncentered which will cause damage to the SRS coil assembly.

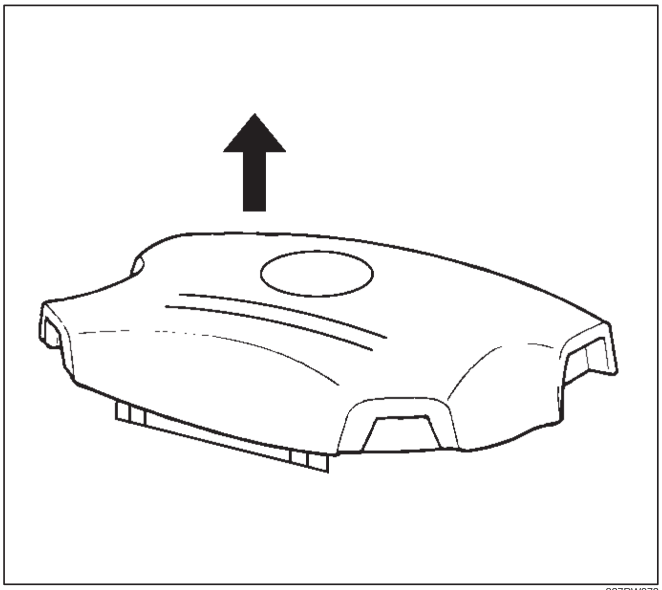
5. Remove the engine hood opening lever, then remove instrument panel lower cover.
6. Remove driver knee bolster (reinforcement).
7. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.



827RW070

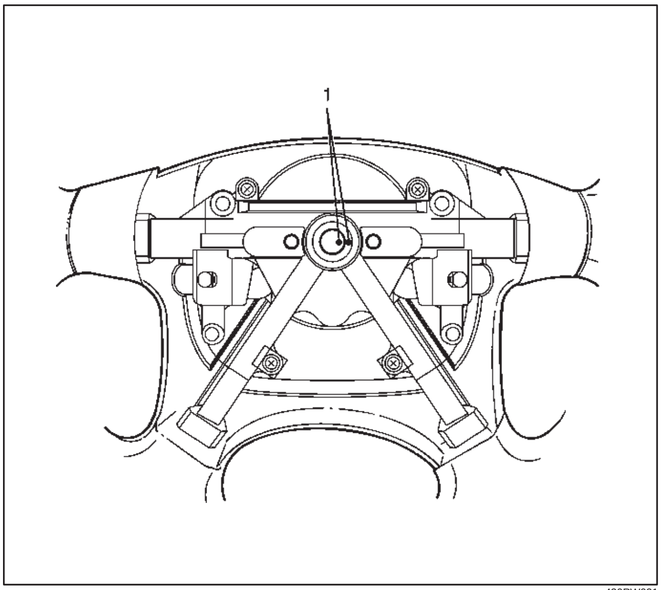
8. Disconnect the yellow 2-way SRS connector and horn lead located behind the inflator module.
9. Remove inflator module.

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.

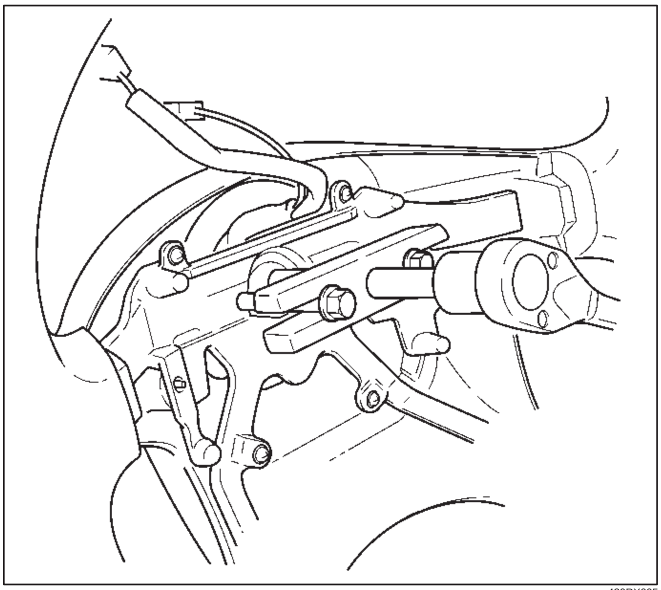


827RW072

10. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.



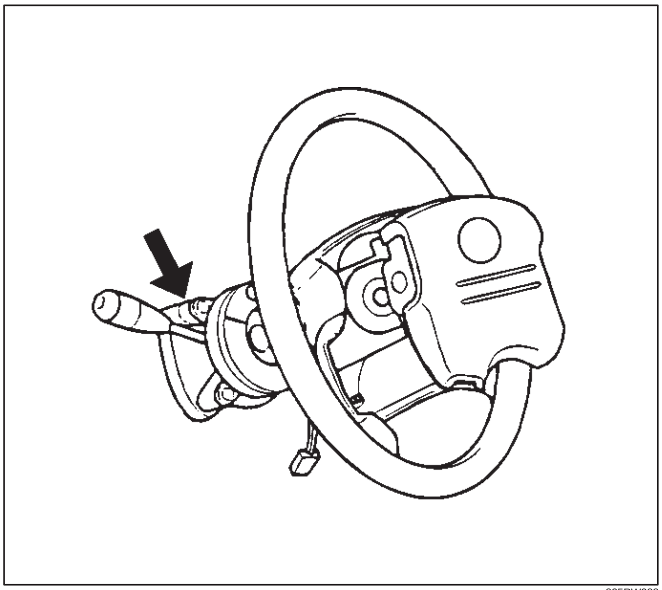
430RW021



430RX005

11. Remove steering column cover.
12. Disconnect the wiring harness connectors located under the steering column.
13. Remove the combination switch assembly with SRS coil.

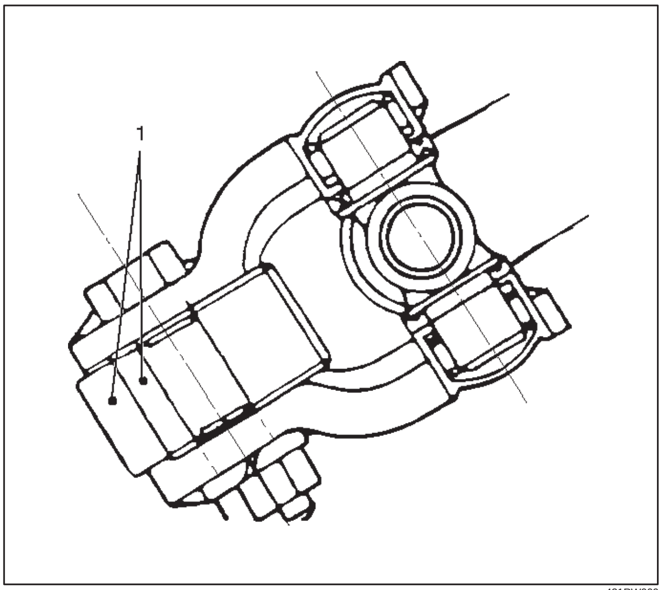
NOTE: SRS coil is a part of combination switch assembly, which can not be replaced singly. Therefore, be sure not to remove the SRS coil from the combination switch assembly.



825RW288

14. Remove snap ring.
15. Remove cushion rubber.
16. Remove shift lock cable (For A/T).
17. Disconnect the starter switch harness connector located under the steering column, then remove lock cylinder assembly.
18. Apply a setting mark (1) across the universal joint and second steering shaft to reassemble the parts in their original position, then remove steering column assembly and second shaft.

NOTE: A setting mark can be easily made if the shaft is withdrawn a little by loosening the steering shaft universal joint.



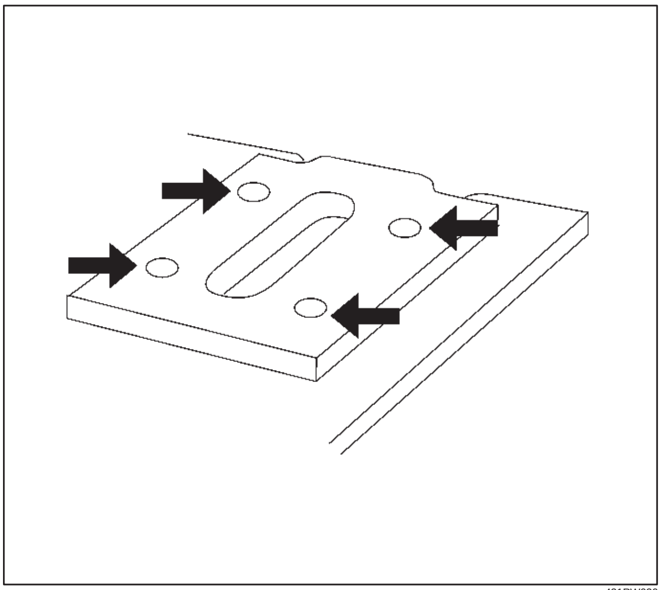
431RW009

Insepction

If the abnormal conditions are found through inspection, replace the steering column assembly.

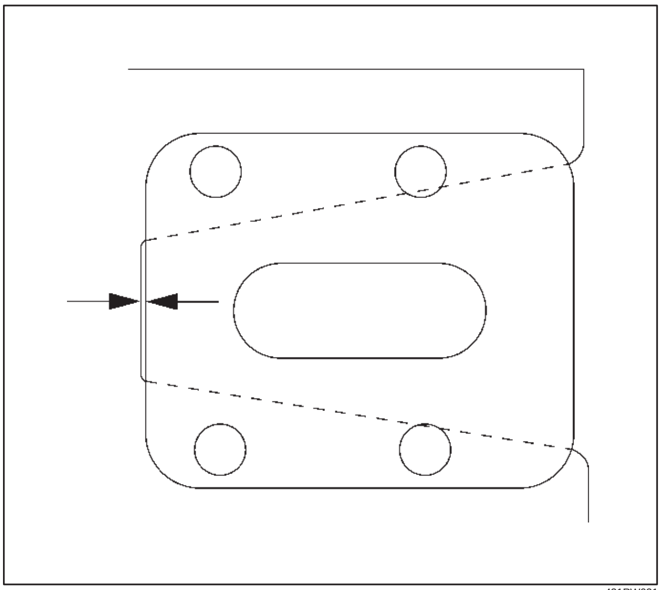
Column Capsule

Check capsules on steering column bracket assembly; all must be securely seated in bracket slots and checked for any loose conditions when pushed or pulled by hand.



431RW030

Check clearance between capsule and bracket. If must be within 1mm (0.039 in).

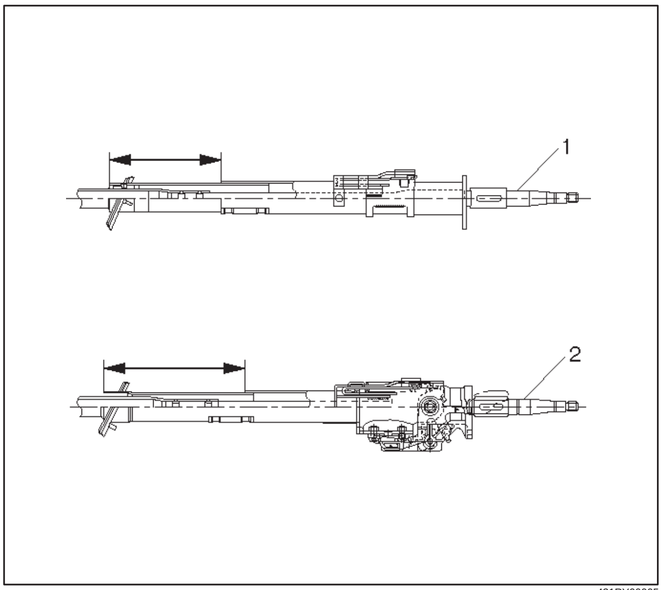


431RW031

Column Tube

Check for collapes by measuring the distance as shown in the figure.

Standard distance: 162.2-165.8 mm (6.386-6.528 in)



431RY00005

Legend

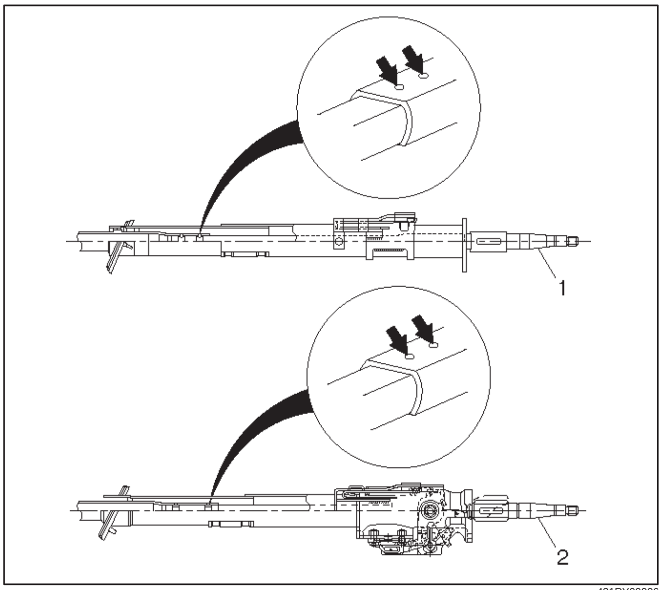
(1) NON TILT TYPE
(2) TILT TYPE

Column Universal Joint for Tilt Mechanism

If the resistance is felt when checked by rotate the joint, replace the steering column assembly.

Sheared Injected Plastic Pin

Check the sheared injected plastic pins for any loose conditions or damage.



431RY00006

Legend

(1) NON TILT TYPE
(2) TILT TYPE

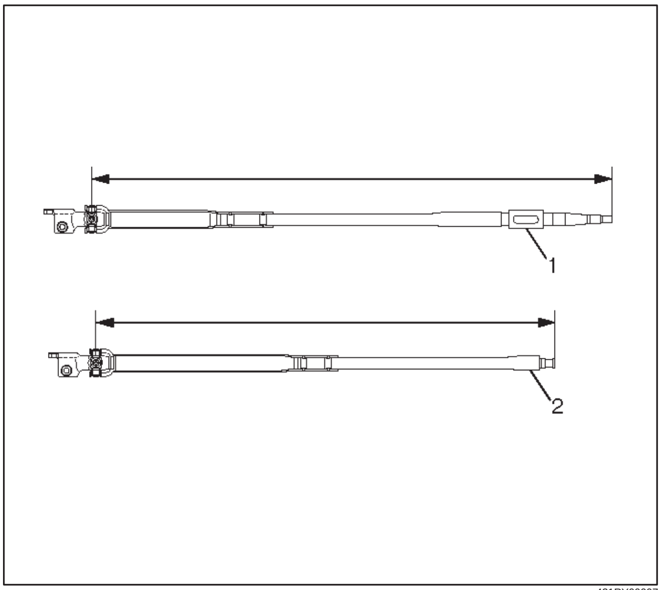
Shaft Length

Check the shaft length from the upper end of the slide joint to the end of the shaft. If column length is not in specifications, steering column should be replaced.

Standard length:

NON TILT TYPE: 912.4 – 914.4 mm (35.921 – 36.000 in)

TILT TYPE: 664.2 – 666.2 mm (26.149 – 26.228 in)



431RY00007

Legend

(1) NON TILT TYPE
(2) TILT TYPE

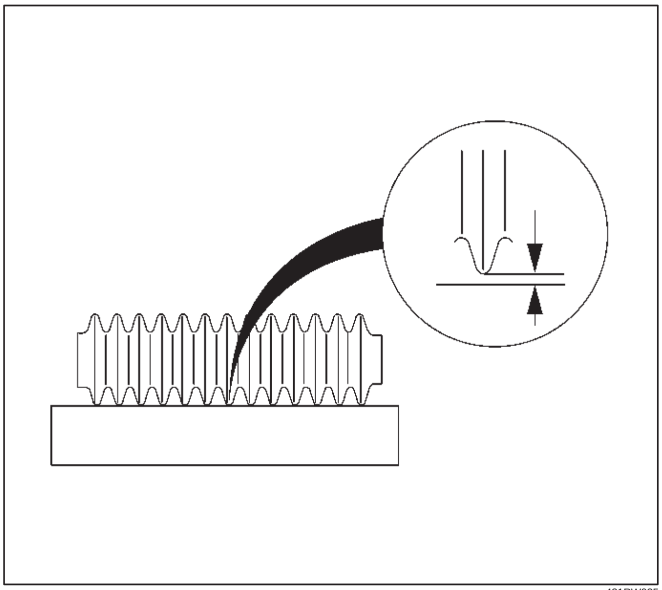
Shaft Universal Joint (Lower End)

If the resistance is felt when checked by rotate the joint, replace the steering column assembly.

Shaft Bellows Pipe

Check the shaft bellows pipe for bend by using straight edge. Measure the clearance between the bellows pipe and the straight edge (at center of the bellows pipe).

Standard: Less than 1mm (0.039 in)



431RW035

Tilt Mechanism

Tilt mechanism should moves smoothly.
While locked the tilt mechanism, be sure the steering column latch securely by pushing the steering wheel upward and downward.

Installation

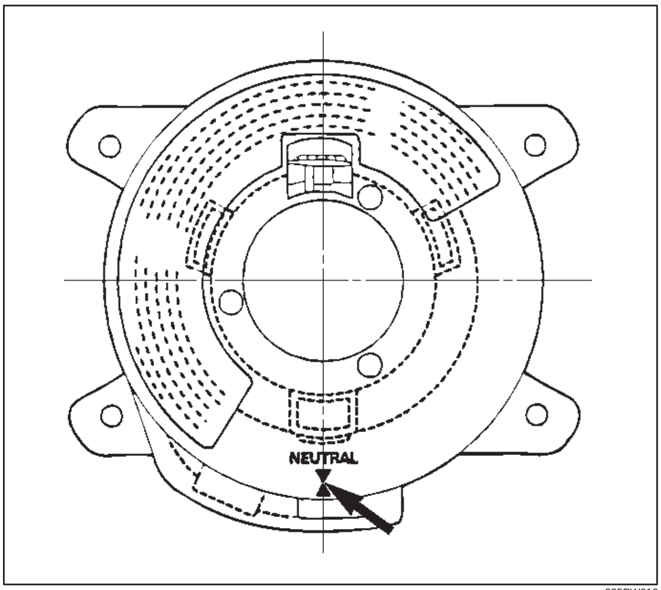
1. Install steering column assembly and second steering shaft.
2. Align the setting marks on the universal joint and second steering shaft made during removal.
3. Tighten the steering column fixing bolt (dash panel) to the specified torque.

   Torque: 20 N·m (14 lb ft)
4. Tighten the steering column fixing nuts (cross beam) to the specified torque.

   Torque: 17 N·m (12 lb ft)
5. Tighten the universal joint to the specified torque.

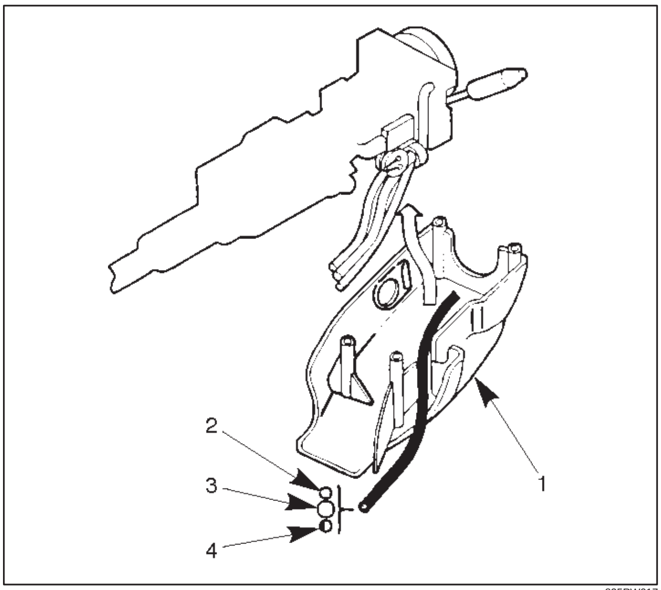
   Torque: 31 N·m (23 lb ft)
6. Install lock cylinder assembly.
7. Install shift lock cable (For A/T).
8. Install cushion rubber.
9. Install snap ring.
10. Install combination switch and SRS coil assembly. After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2-way connector located under the steering column.
11. Turn the SRS coil counter clockwise to full, return about 3 turns and align the neutral mark.

CAUTION: When turning the SRS coil counter clockwise to full, stop turning if resistance is felt. Forced further turning may damage to the cable in the SRS coil.



825RW016

12. When installing the steering column cover, be sure to route each wire harness as illustrated so that the harnesses do not catch any moving parts.



825RW017

Legend

(1) Steering Column Cover
(2) Starter Switch Harness
(3) Combination Switch Harness
(4) Inflator Module Harness

13. Install steering wheel and align the setting marks made when removing.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

14. Tighten the steering wheel fixing nut to the specified torque.

    Torque: 34 N·m (25 lb ft)

15. Support the module and carefully connect the module connector and horn lead, then install inflator module.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

16. Tighten bolts to specified torque.

    Torque: 9 N·m (78 lb in)

17. Install driver knee bolster (reinforcement).
18. Install instrument panel lower cover.
19. Install the engine hood opening lever.
20. Connect the yellow 2-way SRS connector and horn lead located under the steering column.
21. Connect the battery “–” terminal cable.

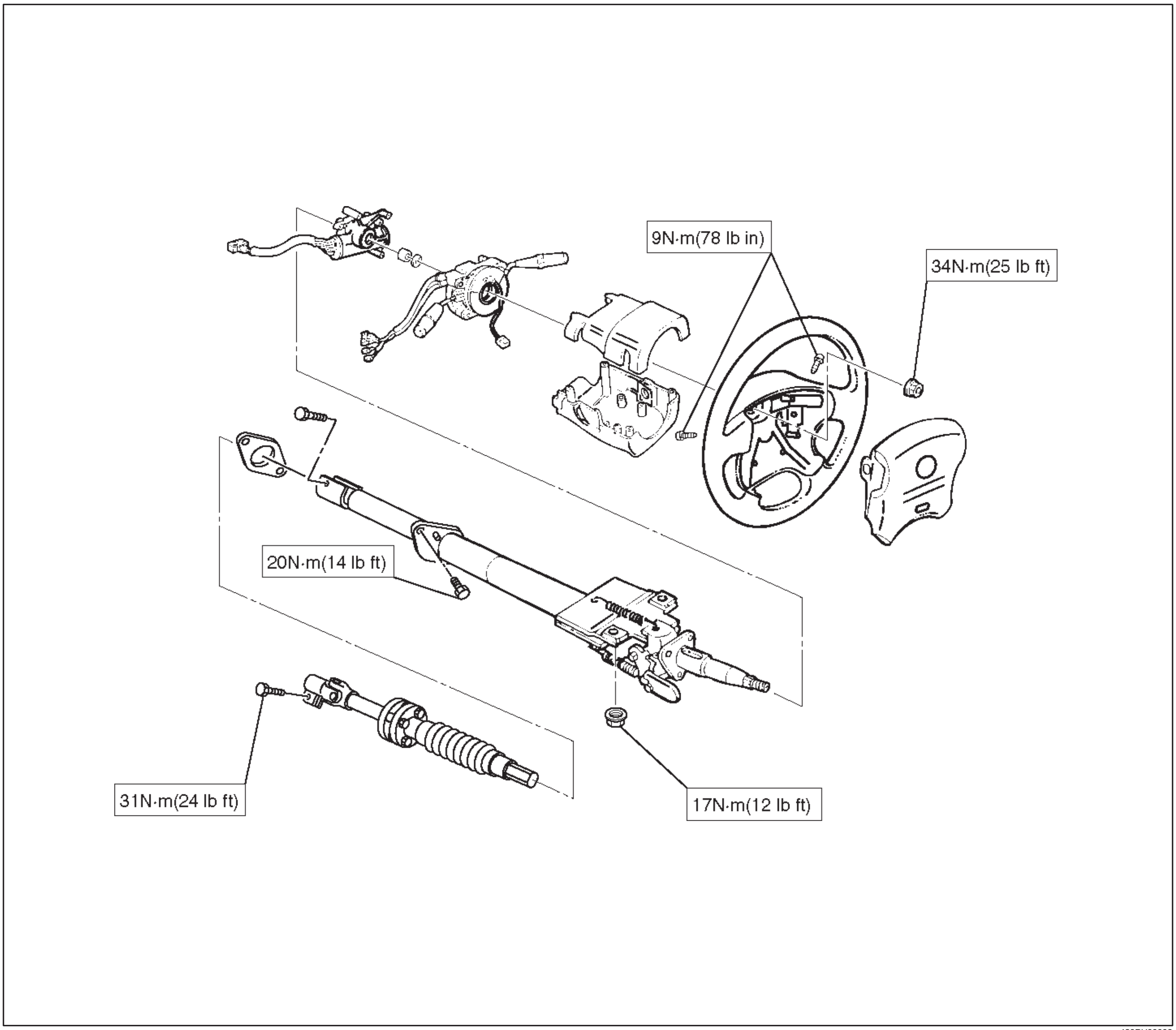
System Inspection

Turn the ignition switch to “ON” while watching warning light.
The light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

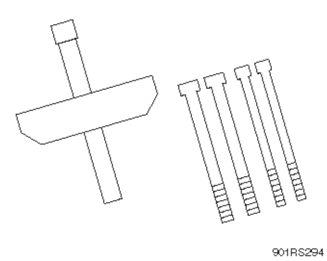
Supplemental Restraint System Steering Wheel & Column and Associated Parts

Main Data and Specifications

Torque Specifications



Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–29752** Steering wheel remover

RODEO

SUSPENSION

CONTENTS

FRONT SUSPENSION

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The front suspension is designed to allow each wheel to compensate for changes in the road surface level without greatly affecting the opposite wheel. Each wheel is independently connected to the frame by a steering knuckle, ball joint assemblies, and upper and lower control arms. The front wheels are held in proper relationship to each other by two tie-rods which are connected to steering arms on the knuckles, and to a steering unit.

All models have a front suspension system consisting of control arms, stabilizer bar, shock absorber and a torsion bar. The front end of the torsion bar is attached to the lower control arm. The rear of the torsion bar is mounted into a height control arm at the crossmember. Vehicle trim height is controlled by adjusting this arm.

Shock absorbers are mounted between the brackets on the frame and the lower control arms. The lower portion of each shock absorber is attached to the lower control arm. The upper portion of each shock absorber extends through a frame bracket and is secured with two rubber bushings, two retainers and a nut.

Ball joint assemblies are bolted to the outer end of the upper and lower control arm and are attached to the steering knuckle.

The inner ends of the upper control arm have pressed in bushings. Bolts, passing through the bushing, attach the control arm to the frame. The inner ends of the lower control arm are attached to the frame by bolts passing through the bushings.

Side roll of the front suspension is controlled by a spring steel stabilizer bar. It is mounted in rubber bushings, which are held to the frame by brackets. The ends of the stabilizer bar are connected to the lower control arms by links.

Diagnosis

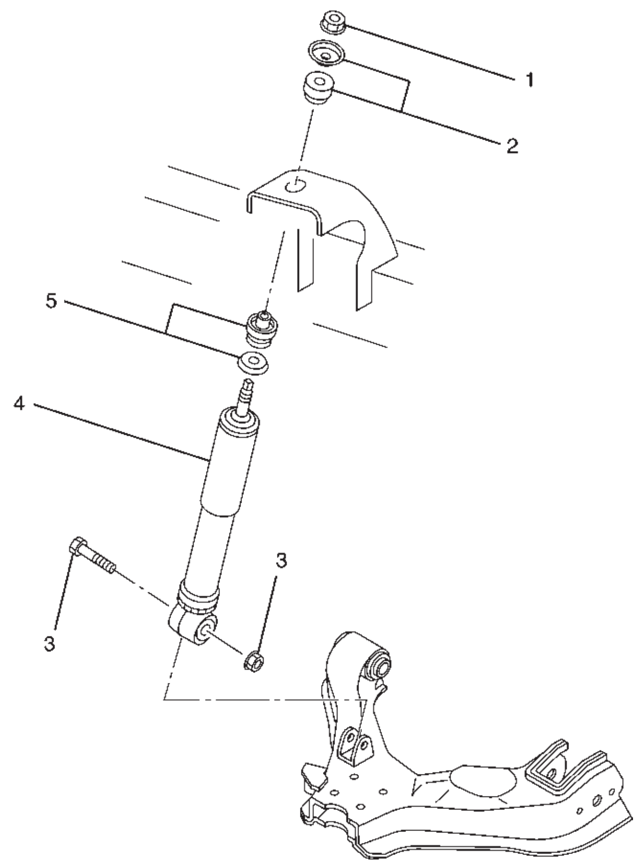
Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
	Parts in power steering valve defective.	Replace power steering unit.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.

Condition	Possible cause	Correction
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
	Excessive wheel runout.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial runout of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering unit.	Tighten steering unit.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.
	Parts in power steering valve defective.	Replace power steering unit.
Hard Steering	Bind in steering linkage ball studs, upper or lower ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to Steering section.
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering unit or linkage.	Retighten or repair.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.

Condition	Possible cause	Correction
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering unit.	Retighten mounting bolt.
	Faulty steering unit.	Replace steering unit.
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Improper wheel alignment.	Adjust wheel alignment.
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.
Low or Uneven Trim Height	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
	Incorrect springs.	Adjust or replace torsion bar.
Suspension Bottoms	Vehicle overloaded.	Reduce load.
	Faulty shock absorber.	Replace shock absorber.
	Incorrect, broken or sagging springs.	Replace springs.
Body Leans	Loose stabilizer bar.	Tighten stabilizer bar bolts or replace bushings.
	Faulty shock absorber, struts or mounting.	Replace shock absorber.
	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
Cupped Tires	Worn wheel bearings.	Replace wheel bearing.
	Excessive tire or wheel run out.	Replace tire or wheel.
	Worn ball joints.	Replace ball joints.
	Tire out of balance.	Adjust tire balance.

Shock Absorber

Shock Absorber and Associated Parts



450RW009

Legend
(1) Nut
(2) Rubber Bushing and Washer
(3) Bolt and Nut
(4) Shock Absorber
(5) Rubber Bushing and Washer

Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel Replacement in this section.
3. Remove bolt and nut.
4. Remove nut.
5. Remove rubber bushing and washer.
6. Remove shock absorber.
7. Remove rubber bushing and washer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts :

- Shock absorber
- Rubber bushing

Installation

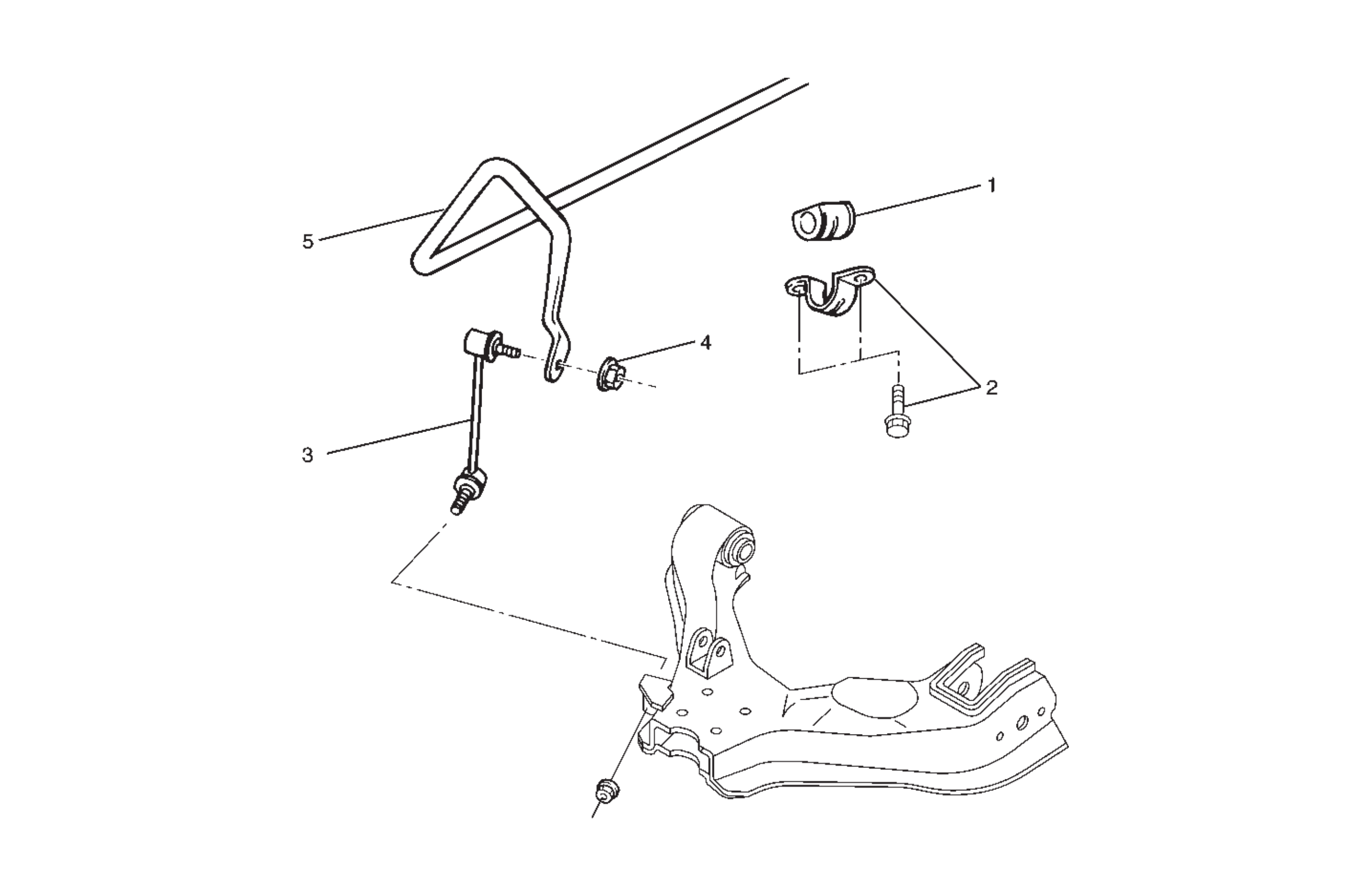
1. Install rubber bushing and washer.
2. Install shock absorber.
3. Install rubber bushing and washer.
4. Install nut, then tighten it to the specified torque.

   Torque: 20 N·m (14 lb ft)
5. Install bolt and nut, then tighten to the specified torque.

   Torque: 93 N·m (69 lb ft)

Stabilizer Bar

Stabilizer Bar and Associated Parts



Legend

(1) Rubber Bushing
(2) Bracket
(3) Link
(4) Nut
(5) Stabilizer Bar

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove the stone guard.
3. Remove wheel and tire assembly. Refer to Wheel Replacement in this section.
4. Remove nut.

CAUTION: Be careful not to break the ball joint boot.

5. Remove link.
6. Remove bracket.
7. Remove stabilizer bar.
8. Remove rubber bushing.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts :

- Stabilizer bar
- Rubber bushing
- Link ball joint

Installation

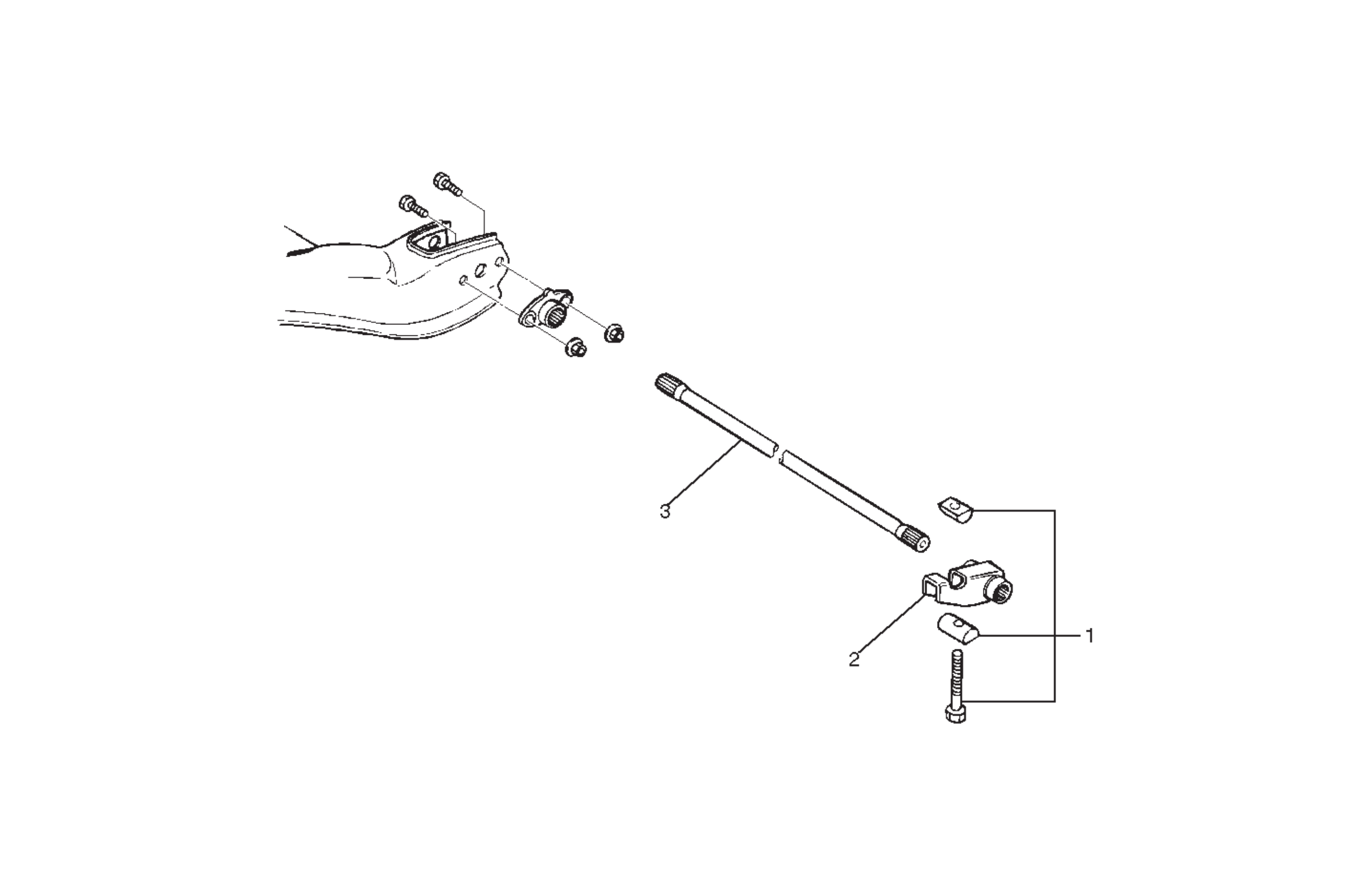
1. Install rubber bushing.
2. Install stabilizer bar.
3. Install bracket, then tighten it to the specified torque.

   Torque: 25 N·m (18 lb ft)
4. Install link.
5. Install nut, then tighten it to the specified torque.

   Torque: 50 N·m (37 lb ft)

Torsion Bar

Torsion Bar and Associated Parts



410RS003

Legend

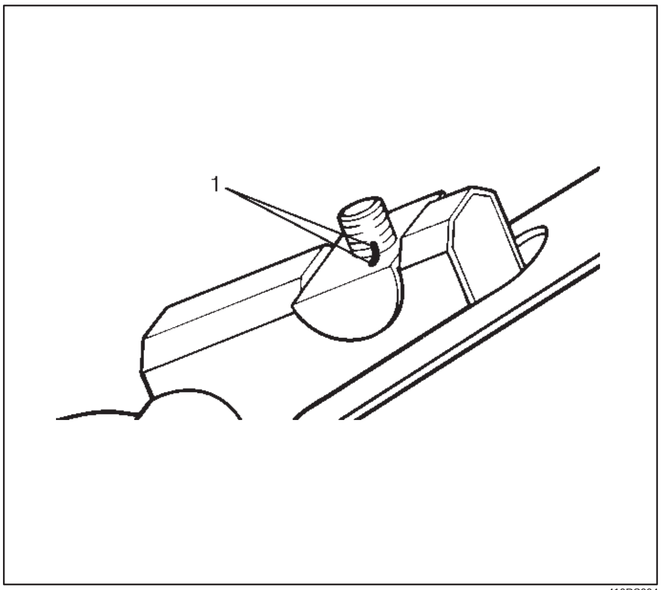
(1) Adjust Bolt, End Piece and Seat

(2) Height Control Arm

(3) Torsion Bar

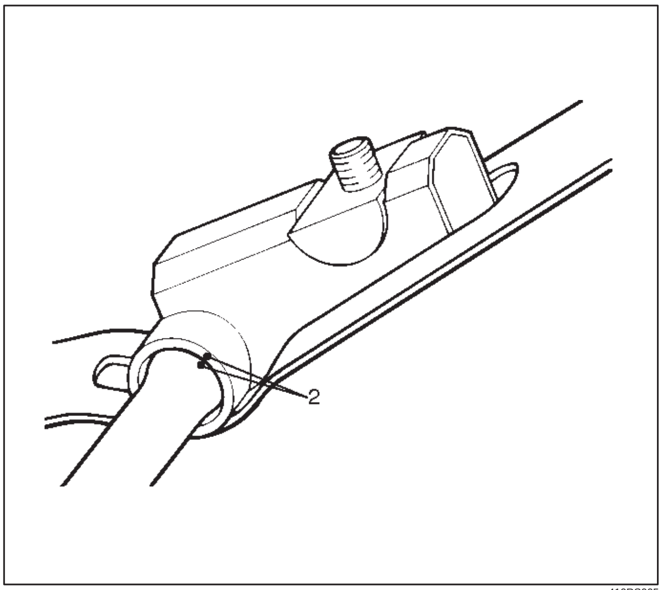
Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Apply the setting marks(1) to the adjust bolt and end piece, then remove adjust bolt, end piece and seat.



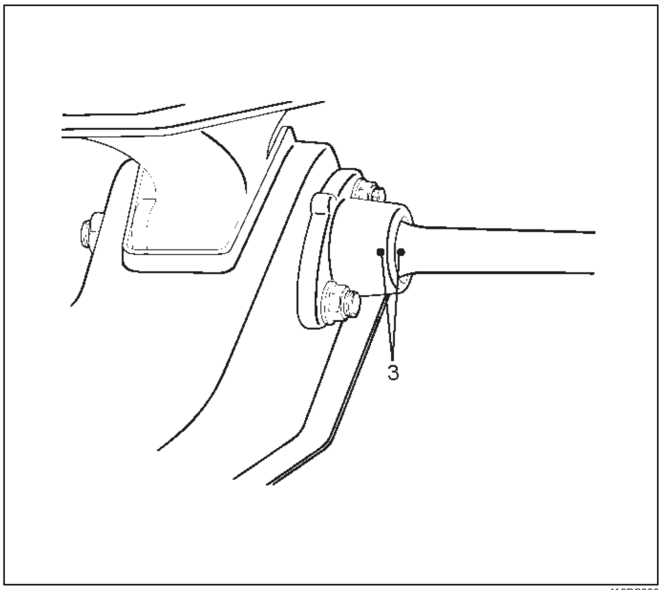
410RS004

3. Apply the setting marks(2) to the height control arm and torsion bar, then remove height control arm.



410RS005

4. Apply the setting marks(3) to the torsion bar and lower control arm, then remove torsion bar.



410RS006

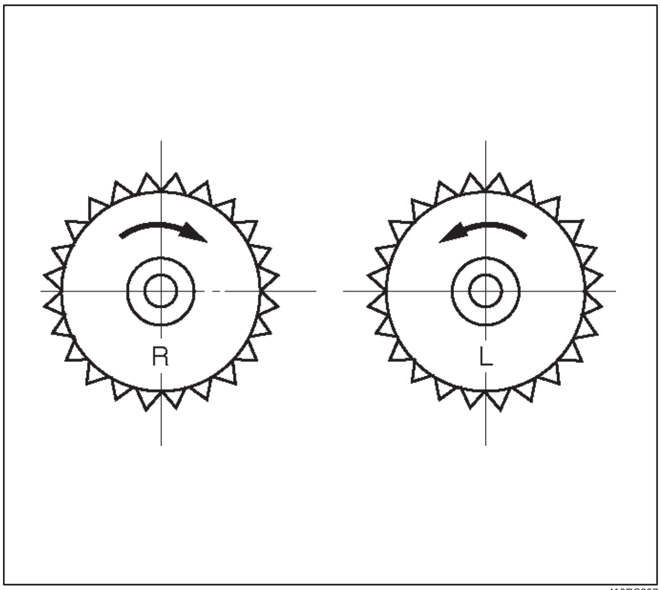
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

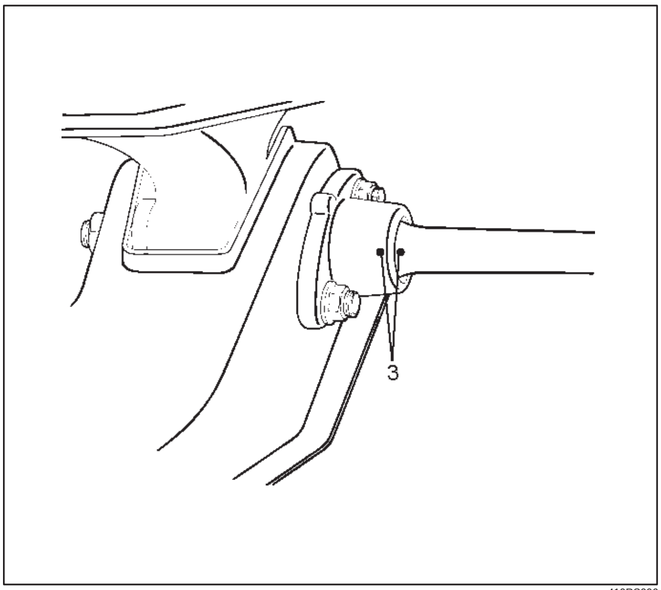
- Torsion bar
- Height control arm
- Adjust bolt
- Rubber seat

Installation

1. Apply grease to the serrated portions, then install torsion bar. Make sure the bars are on their correct respective sides and align the setting marks(3).

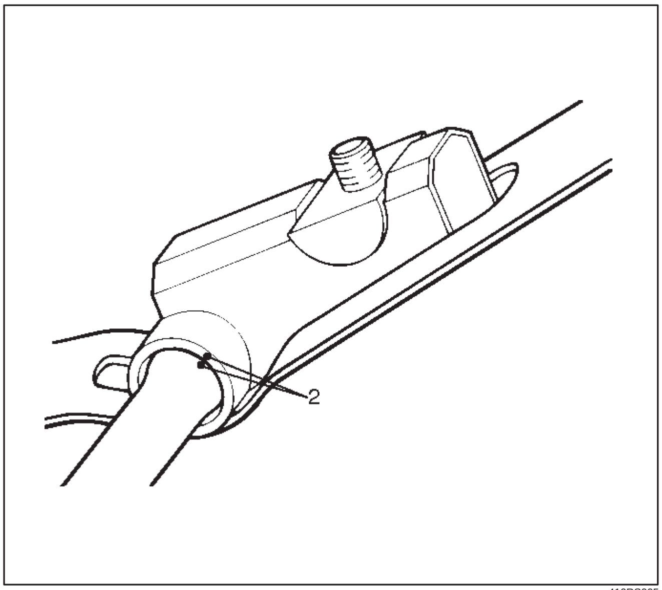


410RS007



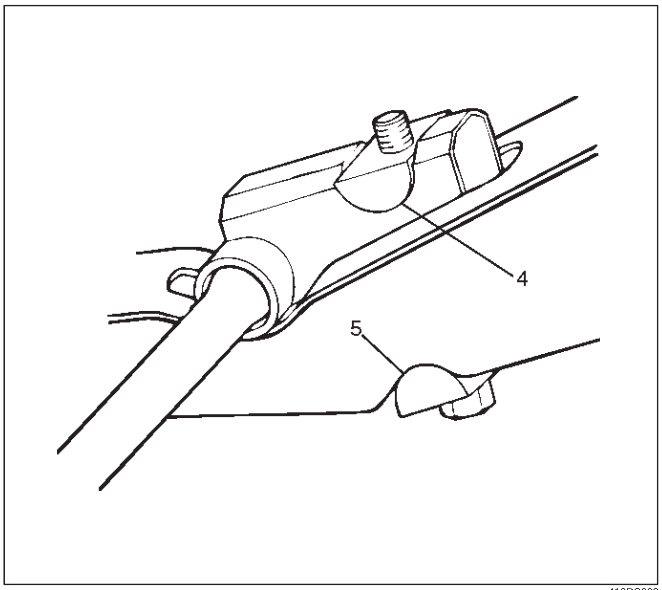
410RS006

2. Apply grease to the portion that fits into the bracket then install height control arm and align the setting marks(2).



410RS005

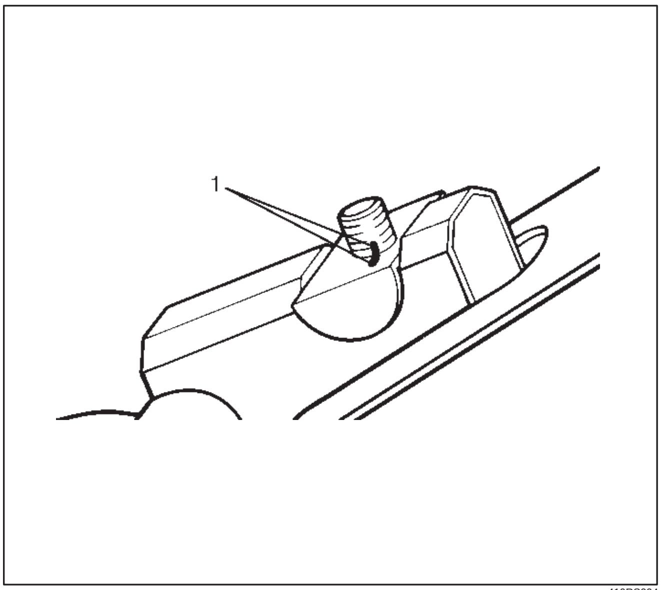
3. Apply grease to the bolt portion of the end piece(4). Apply grease to the portion of the seat(5) that fits into the bracket.



410RS008

4. Apply grease to the serrated portions.
5. Install adjust bolt and seat, then turn the adjust bolt to the setting mark(1) applied during disassembly.

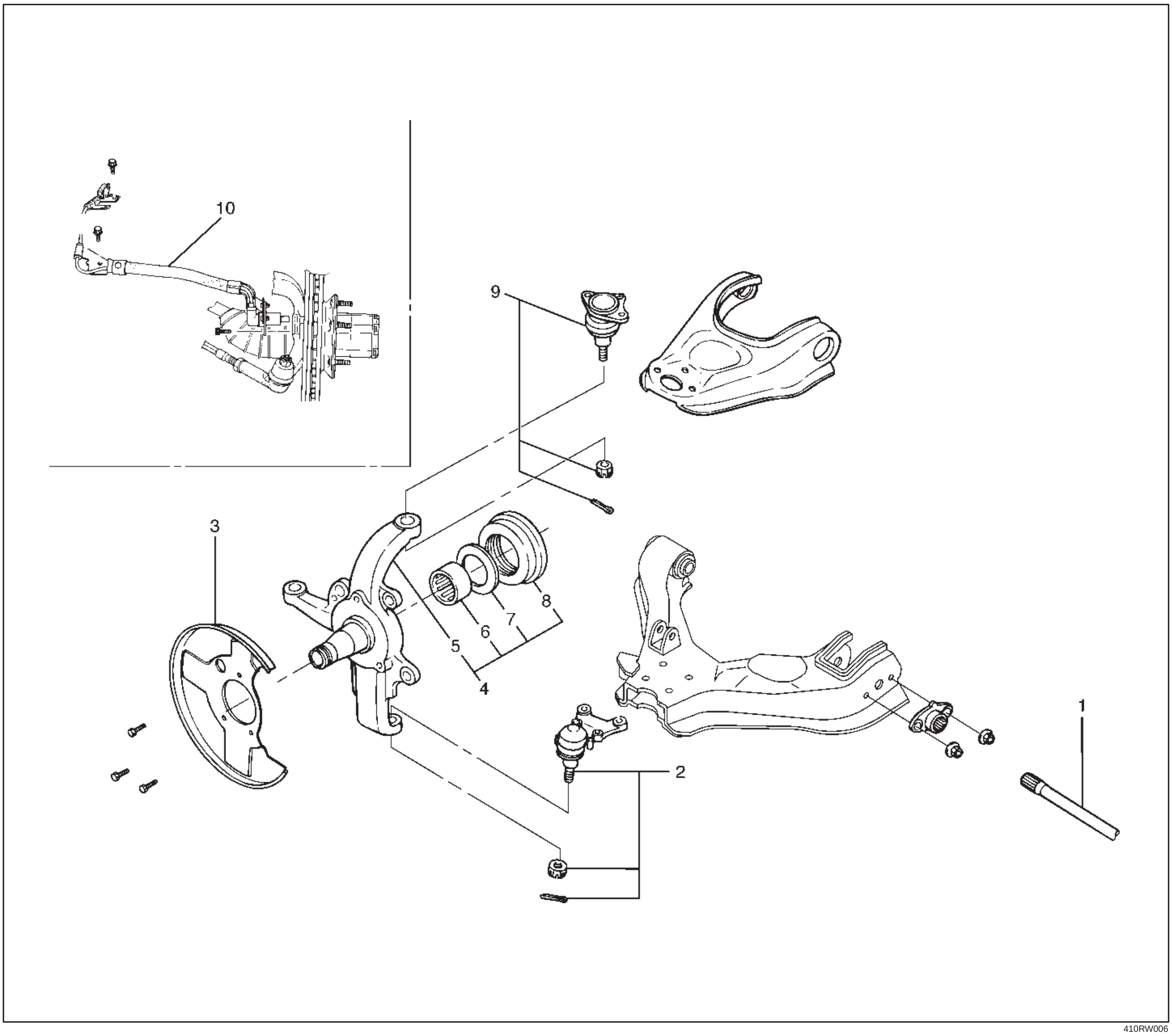
NOTE: Adjust the trim height. Refer to Front End Alignment Inspection and Adjustment in Steering section.



410RS004

Knuckle

Knuckle and Associated Parts



Legend

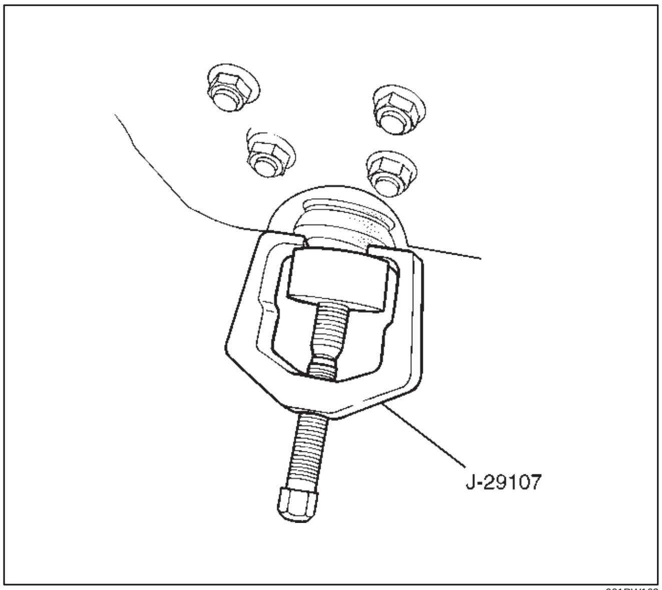
(1) Torsion Bar
(2) Lower Ball Joint
(3) Back Plate
(4) Knuckle Assembly
(5) Knuckle
(6) Needle Bearing
(7) Thrust Washer
(8) Oil Seal
(9) Upper Ball Joint
(10) Wheel Speed Sensor

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel in this section.
3. Remove the brake caliper. Refer to Disc Brakes in Brake section.
4. Remove the hub assembly. Refer to Front Hub and Disk in this section.
5. Remove tie–rod end from the knuckle. Refer to Power Steering Unit in Steering section.
6. Remove the speed sensor from the knuckle.
7. Loosen torsion bar by height control arm adjust bolt, then remove torsion bar. Refer to Torsion Bar in this section.
8. Remove wheel speed sensor.

9. Remove back plate.
10. Remove lower ball joint by using remover J–29107.

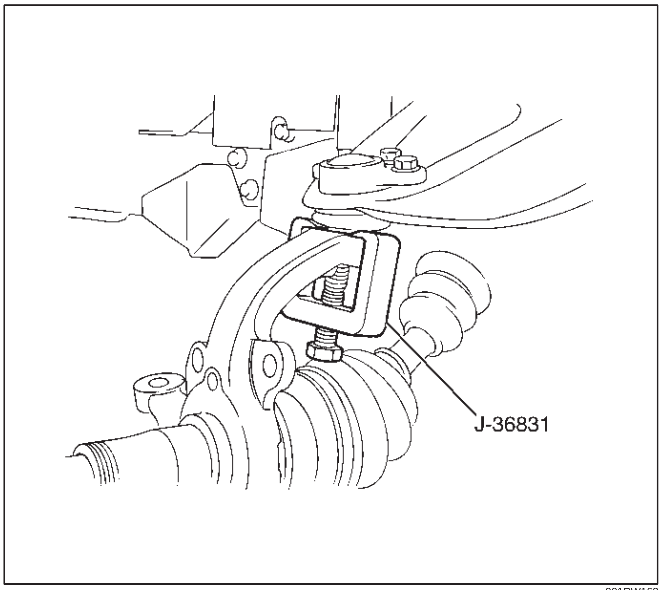
CAUTION: Be careful not to damage the ball joint boot.



901RW163

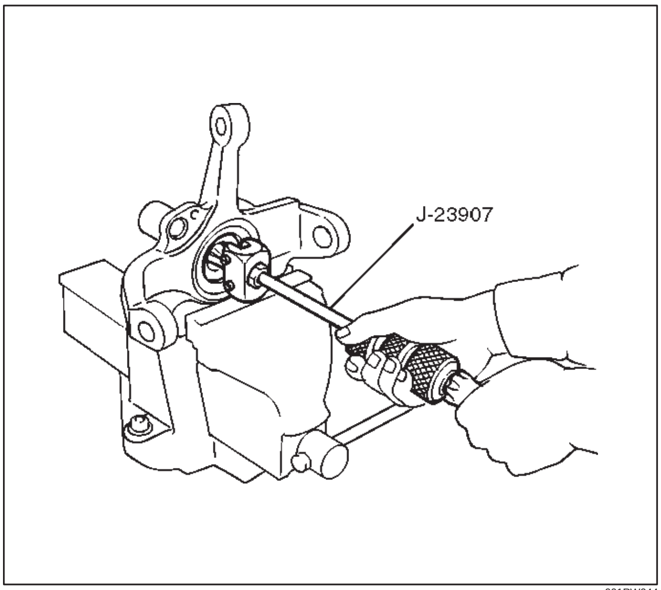
11. Remove upper ball joint by using remover J–36831.

CAUTION: Be careful not to damage the ball joint boot.



901RW162

12. Remove knuckle assembly.
13. Remove oil seal (Except 2WD model).
14. Remove washer (Except 2WD model).
15. Remove needle bearing by using remover J–23907 (Except 2WD model).



901RW044

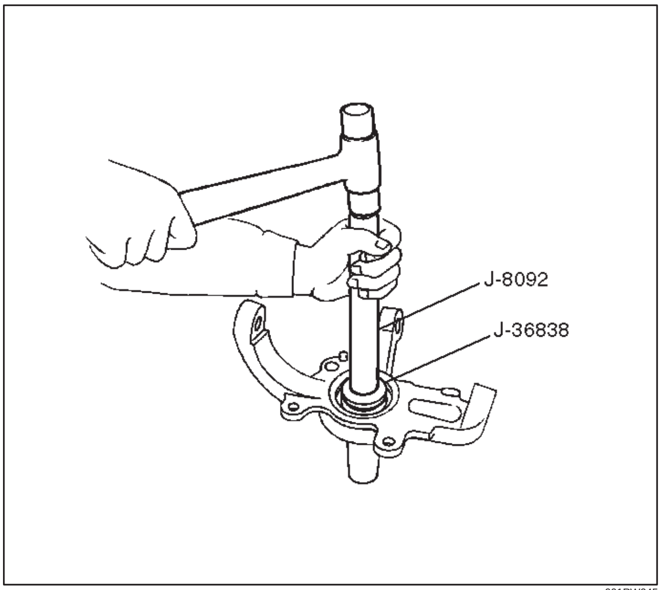
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- Knuckle
- Knuckle arm
- Needle bearing
- Thrust washer

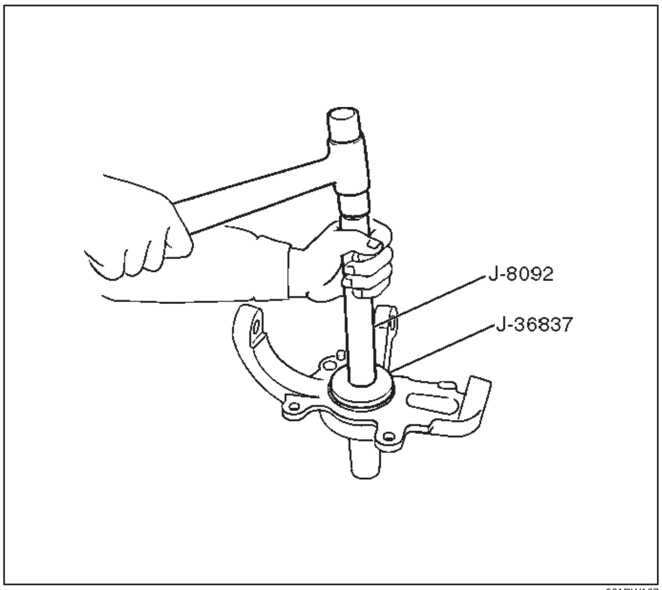
Installation

1. Apply appropriate amount of multipurpose type grease to the new bearing (Approx. 5 g) and install needle bearing by using installer J–36838 and J–8092 (Except 2WD model).



901RW045

2. Apply multipurpose type grease to the thrust washer, and install washer with chamfered side facing knuckle (Except 2WD model).
3. Use a new oil seal, and apply multipurpose type grease to the area surrounded by the lip (approx. 2 g). Then use installer J–36837 and J–8092 to install oil seal. After fitting the oil seal to the installer, drive it to the knuckle using a hammer or bench press until the tool front face contacts with the thrust washer (Except 2WD model).



901RW167

4. Install knuckle assembly.
5. Install upper ball joint and tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

Torque: 98 N·m (72 lb ft)

6. Install lower ball joint and tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

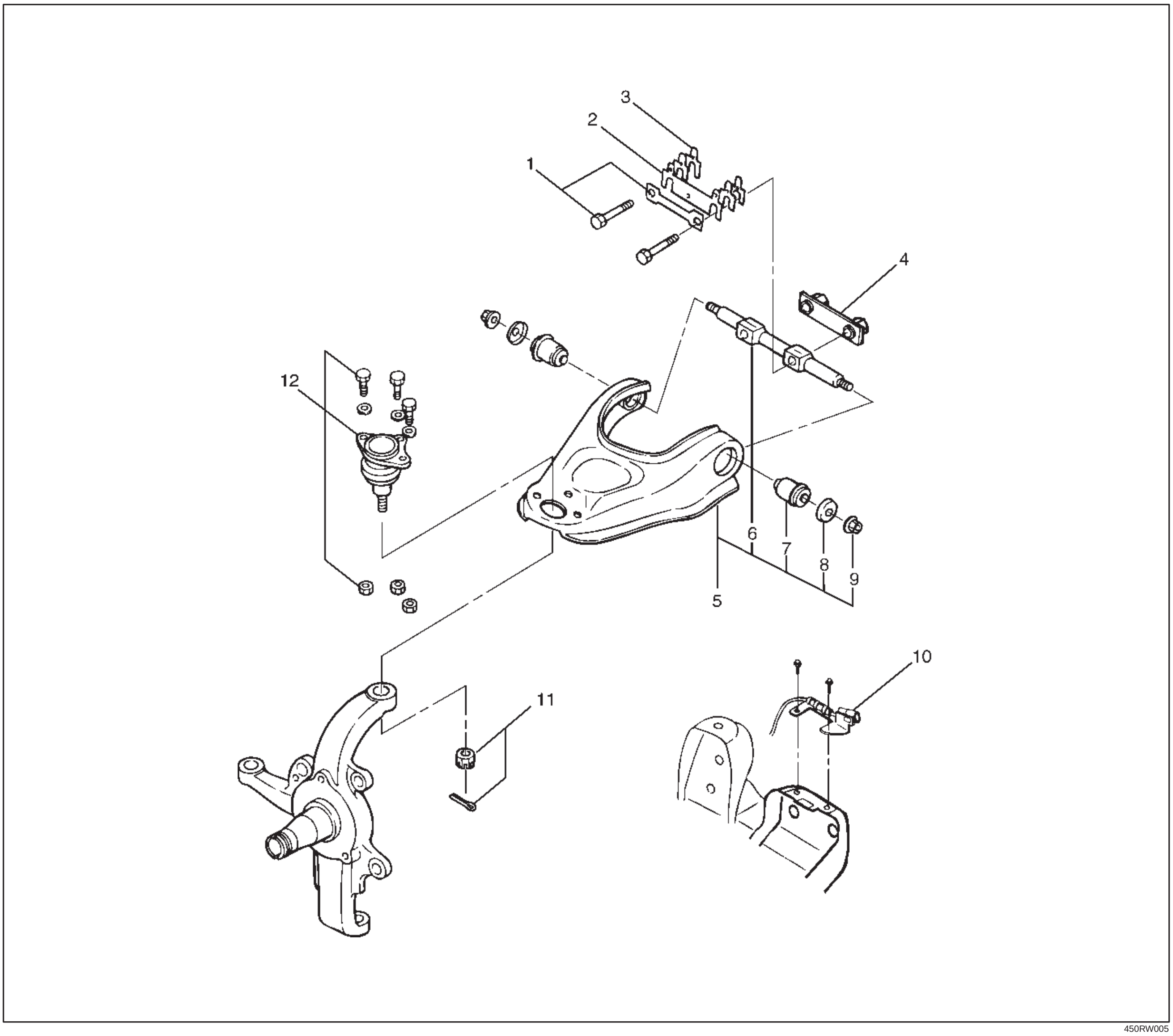
Torque: 147 N·m (108 lb ft)

7. Install back plate.
8. Install wheel speed sensor.
9. Install torsion bar, refer to Torsion Bar in this section.

NOTE: Adjust the trim height. Refer to Front End Alignment Inspection and Adjustment in Steering.

Upper Control Arm

Upper Control Arm and Associated Parts

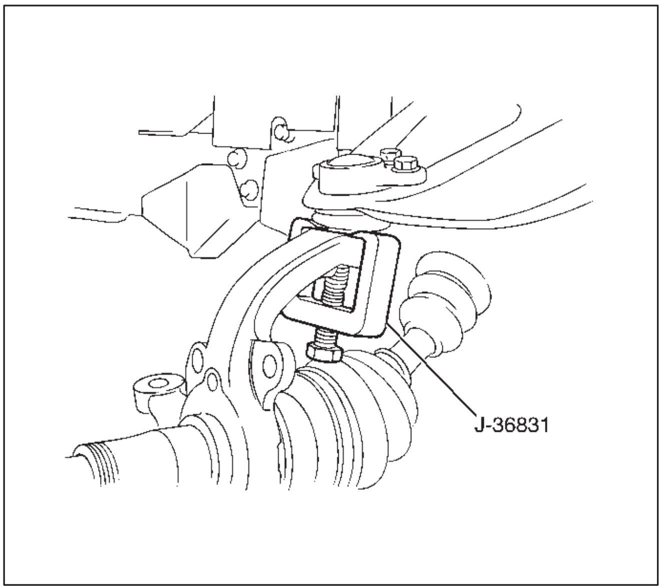


Legend
(1) Bolt and Plate
(2) Camber Shims
(3) Caster Shims
(4) Nut Assembly
(5) Upper Control Arm Assembly
(6) Fulcrum Pin
(7) Bushing
(8) Plate
(9) Nut
(10) Speed Sensor Cable
(11) Nut and Cotter Pin
(12) Upper Ball Joint

Removal

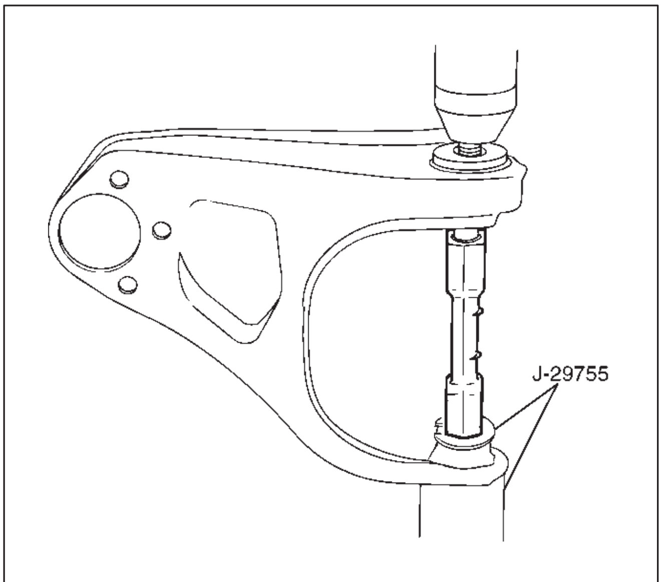
1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel in this section.
3. Remove the brake caliper and disconnect brake pipe. Refer to Disc Brakes in Brake section.
4. Support lower control arm with a jack.
5. Remove speed sensor cable.
6. Remove nut and cotter pin then use remover J–36831.

CAUTION: Be careful not to damage the ball joint boot.

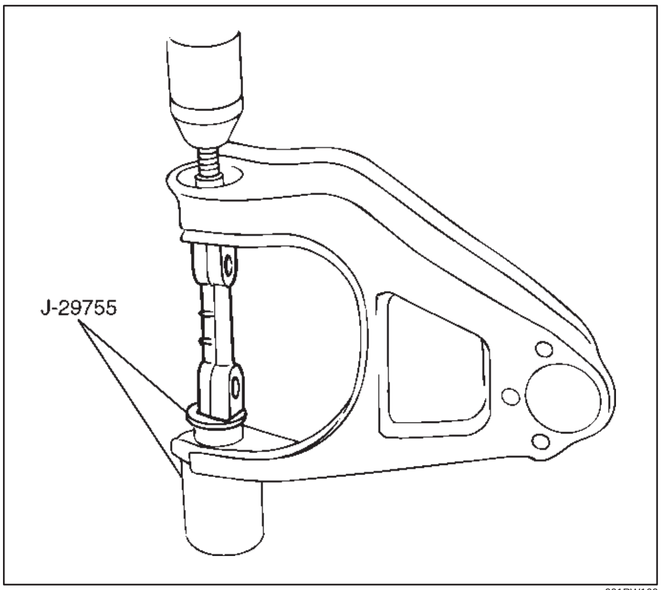


901RW162

7. Remove upper ball joint.
8. Remove bolt and plate.
9. Remove nut assembly.
10. Remove camber shims and note the positions and number of shims.
11. Remove caster shims and note the positions and number of shims.
12. Remove upper control arm assembly.
13. Remove nut.
14. Remove plate.
15. Remove bushing by using remover J–29755.



901RW161



901RW160

16. Remove fulcrum pin.

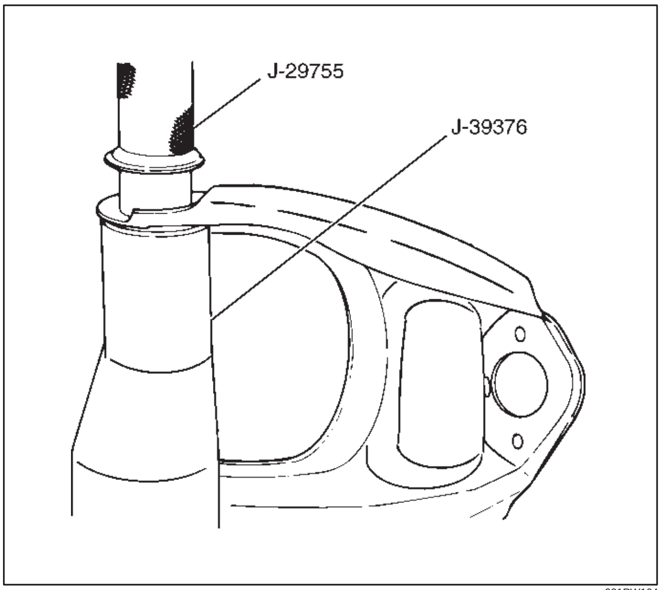
Inspection and Repair

Make necessary parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

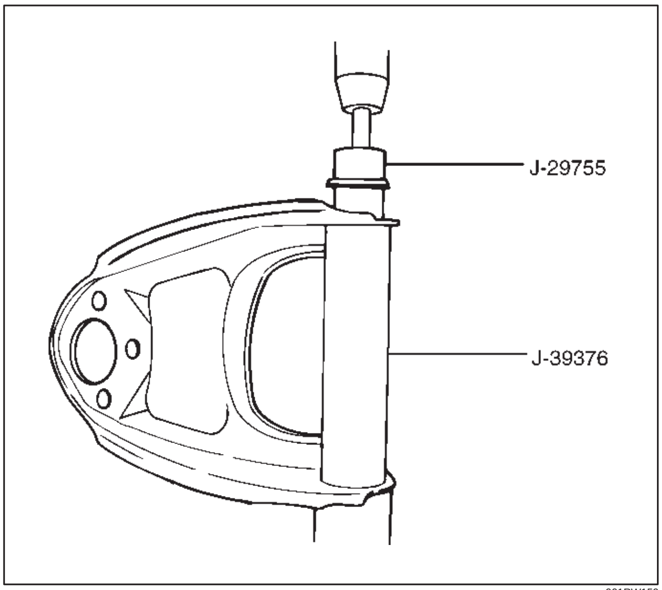
- Upper control arm
- Bushing
- Fulcrum pin

Installation

1. Install fulcrum pin.
2. Install bushing by using installer J–29755 and J–39376.



901RW164



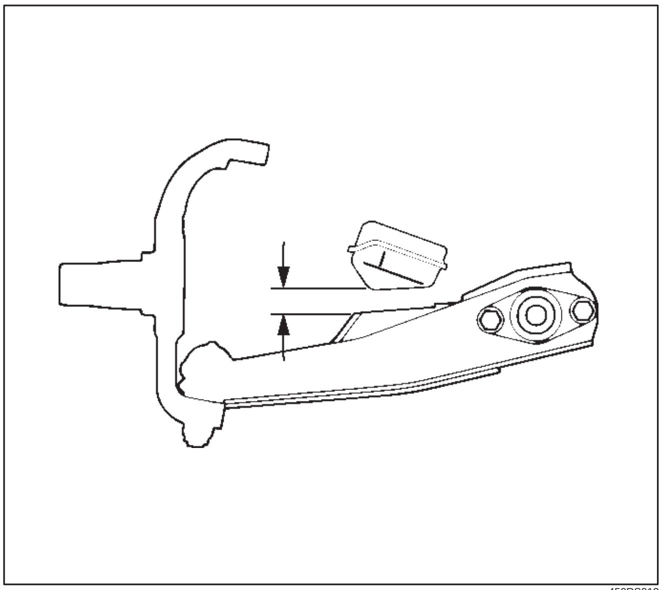
901RW159

3. Install plate.
4. Install nut and tighten fulcrum pin nut finger–tight.

NOTE: Torque fulcrum pin nut after adjusting buffer clearance.

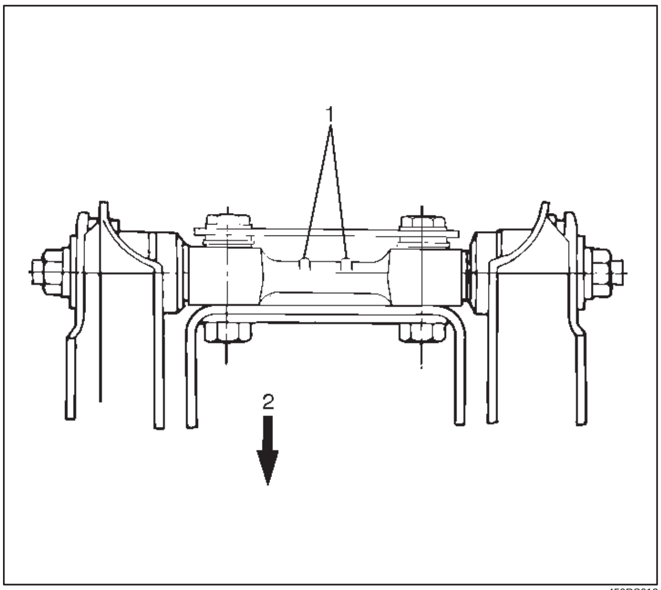
Buffer clearance: 22 mm (0.87 in)

Torque: 108 N·m (80 lb ft)



450RS012

5. Install upper control arm assembly with the fulcrum pin projections turned inward.

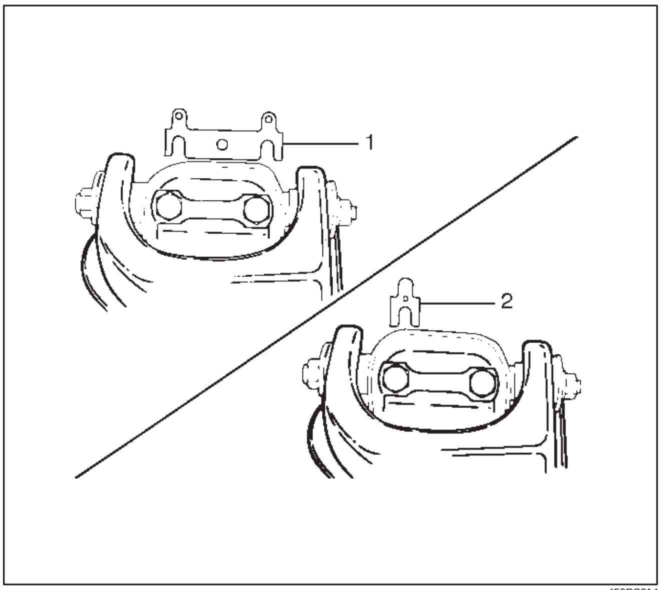


450RS013

Legend

(1) Projection
(2) Outward

6. Install the caster shims(2) between the chassis frame and fulcrum pin.
7. Install the camber shims(1) between the chassis frame and fulcrum pin.



450RS014

8. Install nut assembly.
9. Install bolt and plate, then tighten the bolt to the specified torque.

Torque: 152 N·m (112 lb ft)

10. Install upper ball joint and tighten it to the specified torque.

Torque: 57 N·m (42 lb ft)

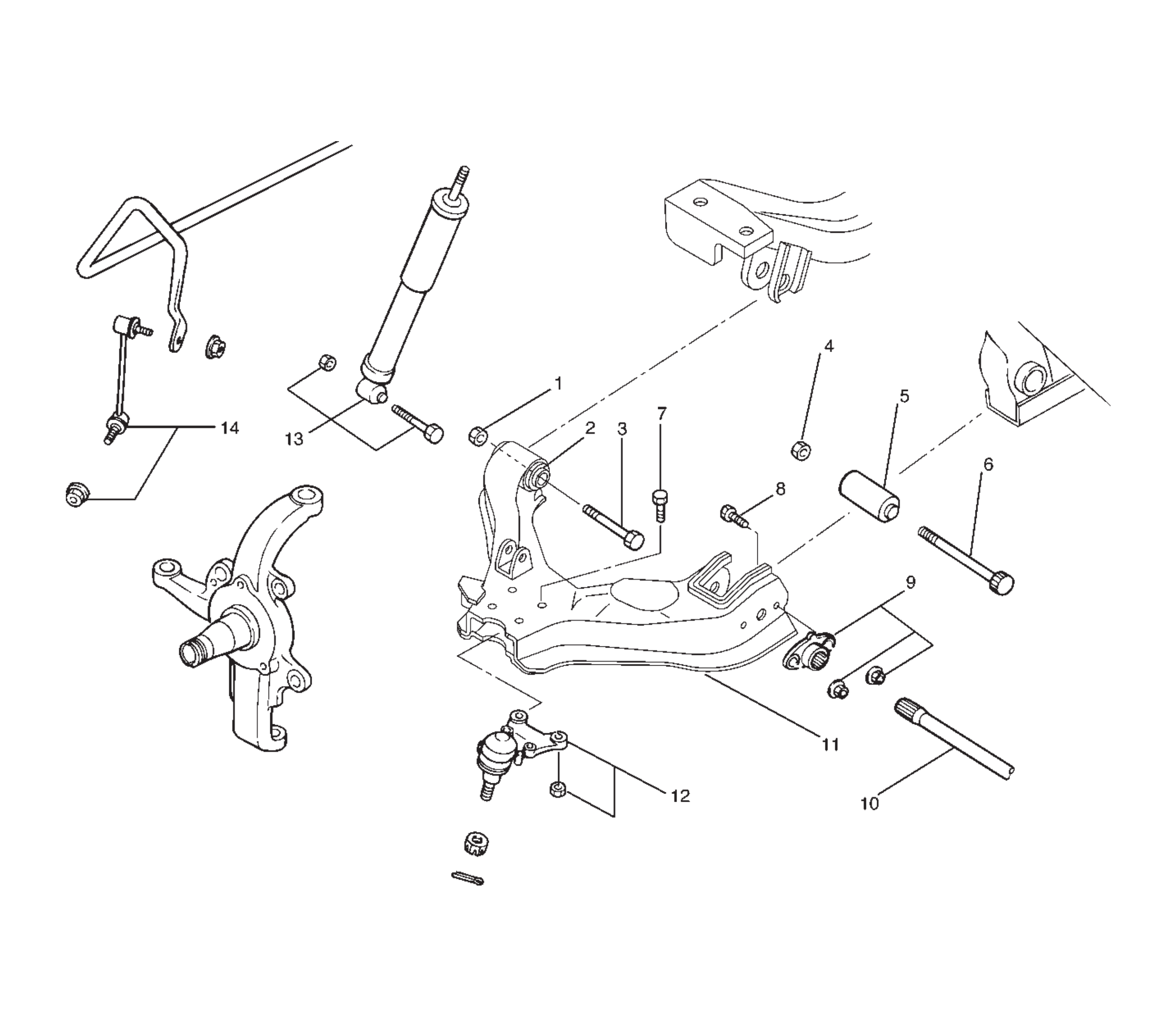
11. Install nut and cotter pin then tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

Torque: 98 N·m (72 lb ft)

12. Install speed sensor cable.

Lower Control Arm

Lower Control Arm and Associated Parts



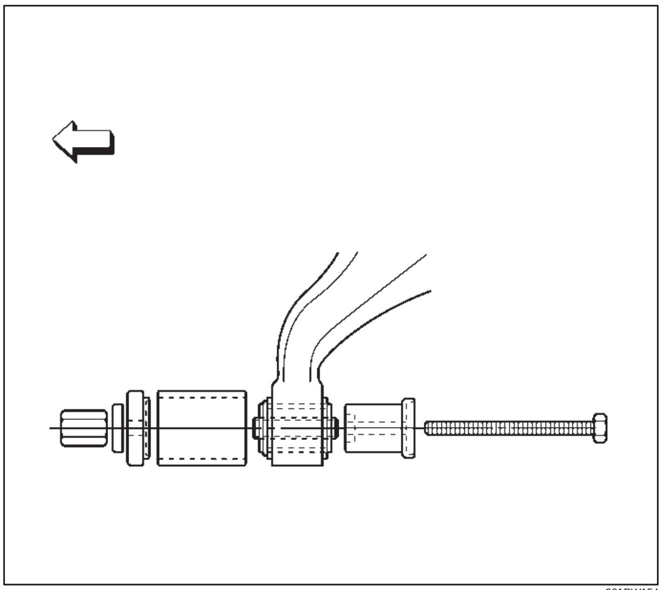
Legend

(1) Nut, Front
(2) Bush, Front
(3) Bolt, Front
(4) Nut, Rear
(5) Bush, Rear
(6) Bolt, Rear
(7) Bolt, Lower Ball Joint
(8) Bolt, Torsion Bar Arm
(9) Torsion Bar Arm Bracket
(10) Torsion Bar
(11) Lower Control Arm
(12) Lower Ball Joint
(13) Shock Absorber
(14) Stabilizer Link

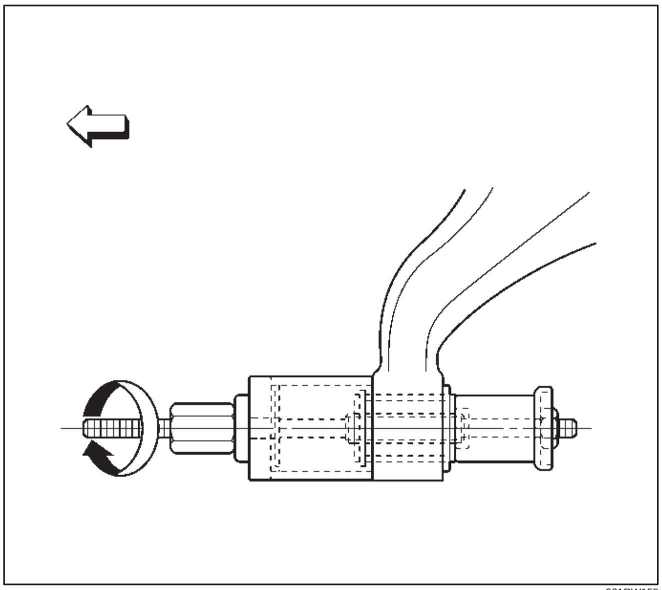
Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel in this section.
3. Remove the tie-rod end from the knuckle. Refer to Power Steering Unit in Steering section.
4. Remove the retaining ring from the front axle driving shaft to release the shaft from hub(Except 2WD model). Refer to Front Hub and Disc in Driveline/Axle section.
5. Support lower control arm with a jack.

6. Remove front nut.
7. Remove rear nut.
8. Remove torsion bar, refer to Torsion Bar in this section.
9. Remove torsion bar arm bracket.
10. Disconnect the stabilizer link at the lower control arm.
11. Remove the shock absorber lower end from the lower control arm.
12. Remove the lower ball joint from the lower control arm.
13. Remove front bolt.
14. Remove rear bolt.
15. Remove lower control arm.
16. Remove torsion bar arm bolt.
17. Remove lower ball joint bolt.
18. Remove front bushing by using remover J–36833.

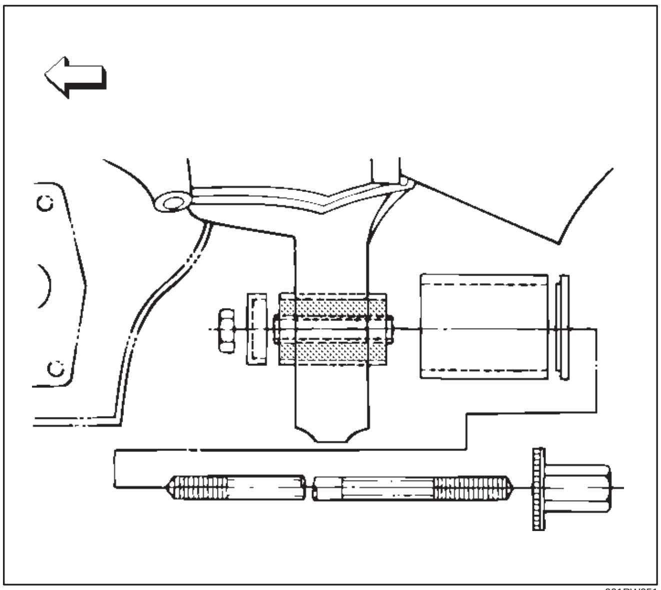


901RW154

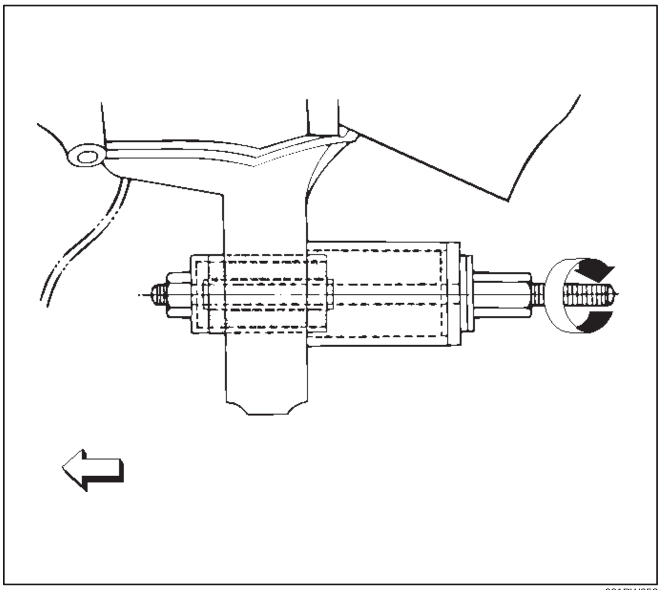


901RW155

19. Remove rear bushing by using remover J–36834.



901RW051



901RW052

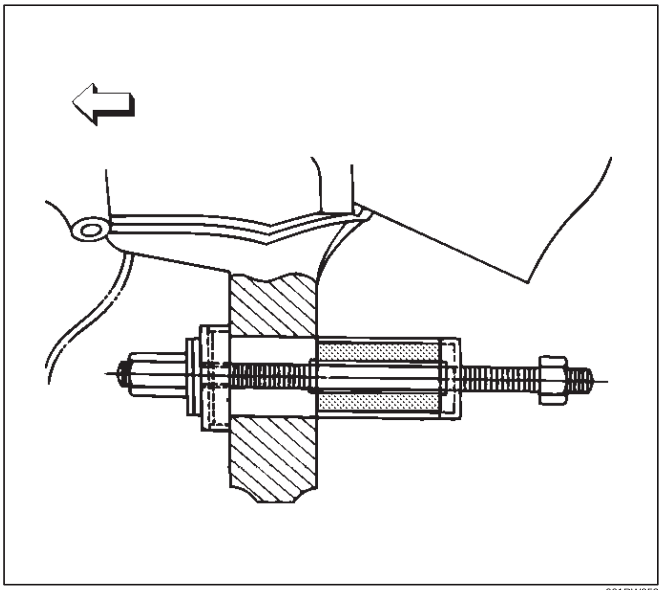
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- Lower control arm
- Bushing

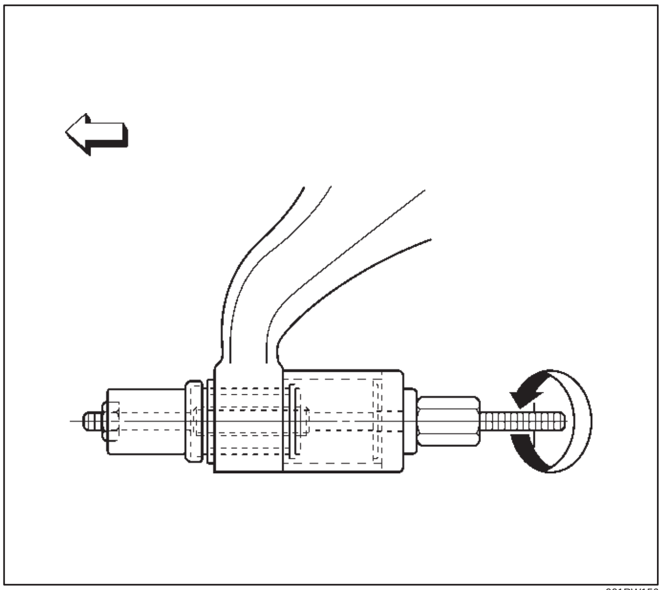
Installation

1. Install rear bushing by using installer J–36834.



901RW053

2. Install front bushing by using installer J–36833.



901RW156

3. Install lower ball joint bolt.
4. Install torsion bar arm bolt.
5. Install lower control arm.
6. Install rear bolt.
7. Install front bolt.
8. Install lower ball joint and tighten it to the specified torque.

   Torque: 116 N·m (85 lb ft)

9. Install shock absorber and tighten it to the specified torque.

   Torque: 93 N·m (69 lb ft)

10. Install stabilizer link and tighten it to the specified torque.

    Torque: 50 N·m (37 lb ft)

11. Install torsion bar arm bracket and tighten it to the specified torque.

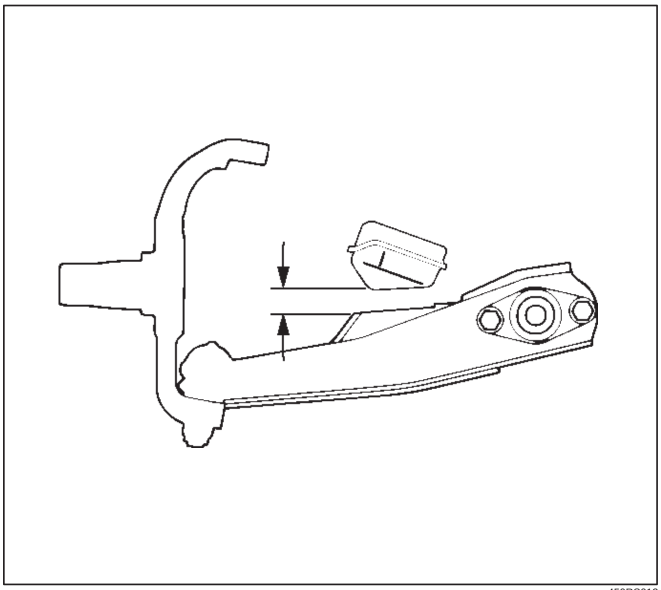
    Torque: 116 N·m (85 lb ft)

12. Install Torsion bar, refer to Torsion Bar in this section.
13. Install rear nut and tighten lower link nut finger–tight.

NOTE: Torque lower control arm nut after adjusting buffer clearance.

Buffer clearance: 22 mm (0.87 in)

Torque: 235 N·m (174 lb ft)



450RS012

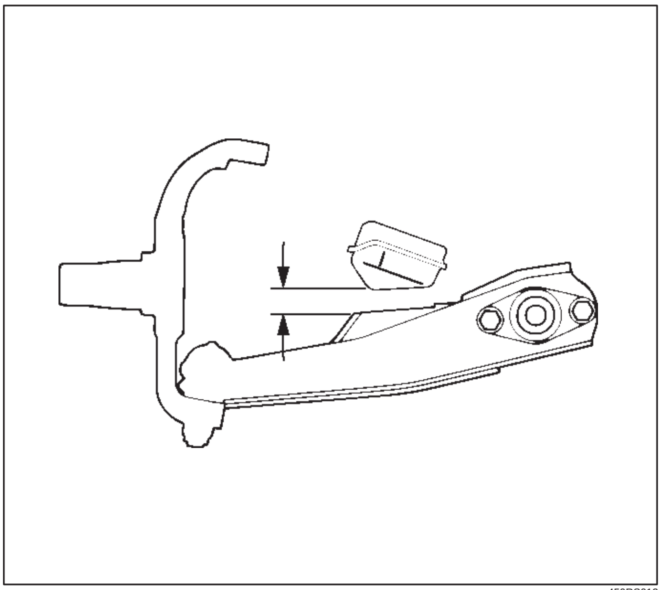
14. Install front nut then tighten lower link nut finger-tight.

NOTE: Torque lower control arm nut after adjusting buffer clearance .

Buffer clearance: 22 mm (0.87 in)

Torque: 190 N·m (140 lb ft)

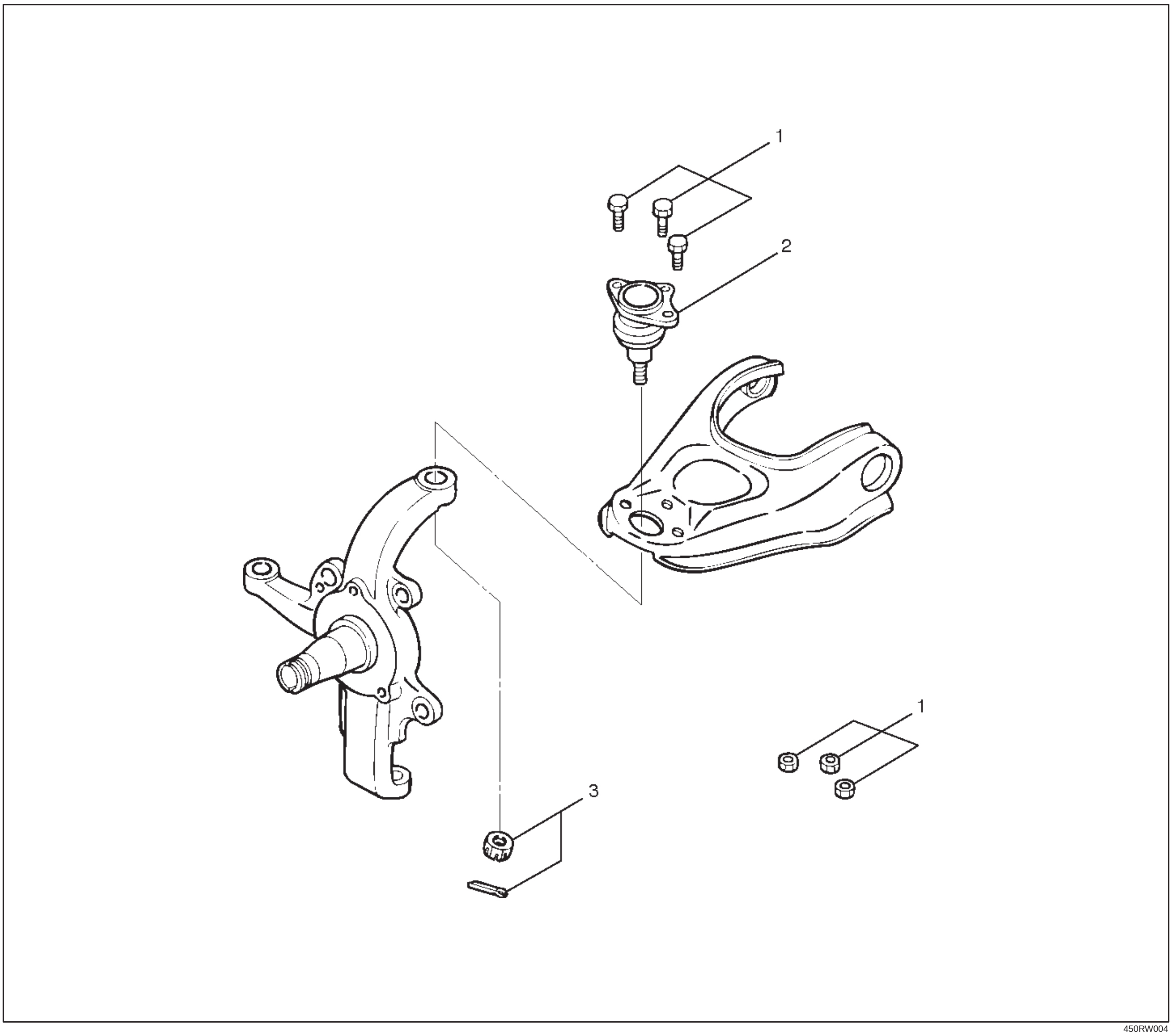
NOTE: Adjust the trim height. Refer to Front End Alignment Inspection and Adjustment in Steering section.



450RS012

Upper Ball Joint

Upper Ball Joint and Associated Parts



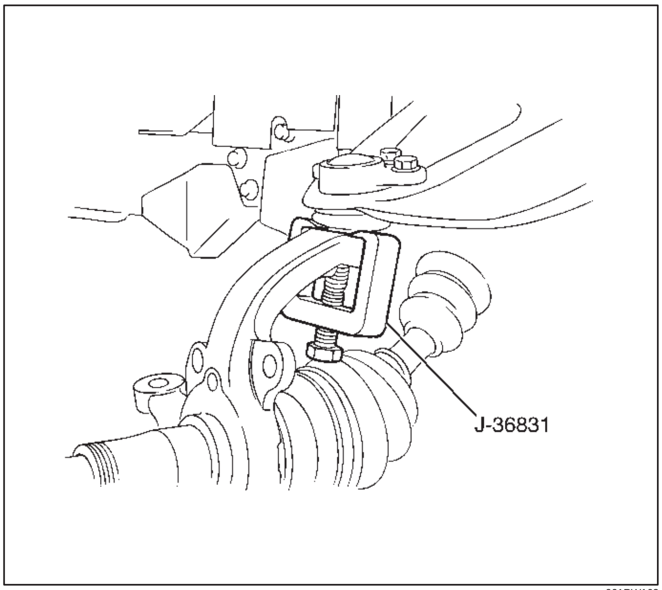
Legend
(1) Bolt and Nut
(2) Upper Ball Joint
(3) Nut and Cotter Pin

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove the speed sensor from the knuckle.

3. Remove upper ball joint nut and cotter pin, then use remover J–36831 to remove the upper ball joint from the knuckle.

CAUTION: Be careful not to damage the ball joint boot.



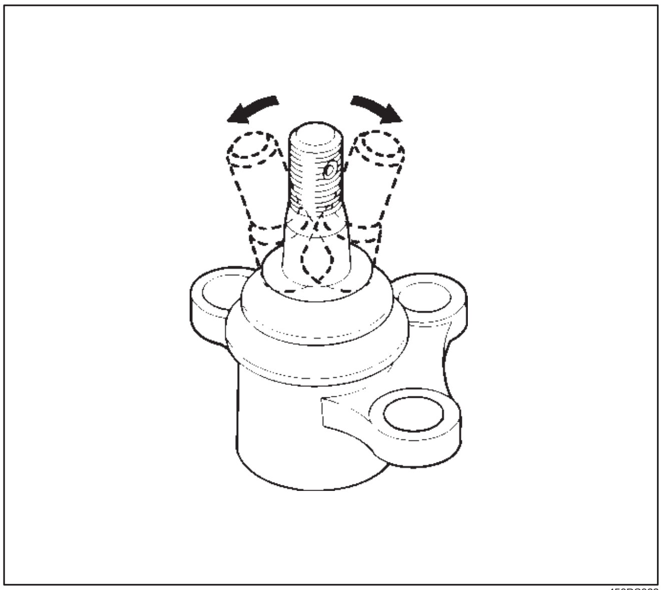
901RW162

4. Remove bolt and nut.
5. Remove upper ball joint.

Inspection and Repair

Make necessary parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

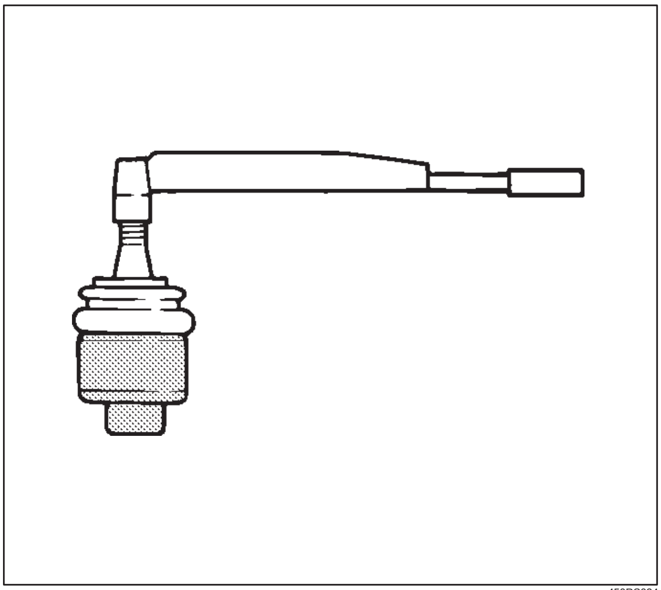
- Inspect the lower end boot for damage or grease leak. Move the ball joint as shown in the figure to confirm its normal movement.
- Inspect screw/taper area of ball for damage.
- If any defects are found by the above inspections, replace the ball joint assembly with new one.



450RS023

- After moving the ball joint 4 or 5 times, attach nut then measure the preload.

Starting torque: 0.5 –3.2 N·m (0.4–2.4 lb ft)



450RS024

If the above limits specified are exceeded, replace the ball joint assembly.

Installation

1. Install upper ball joint.
2. Install bolt and nut, then tighten them to the specified torque.

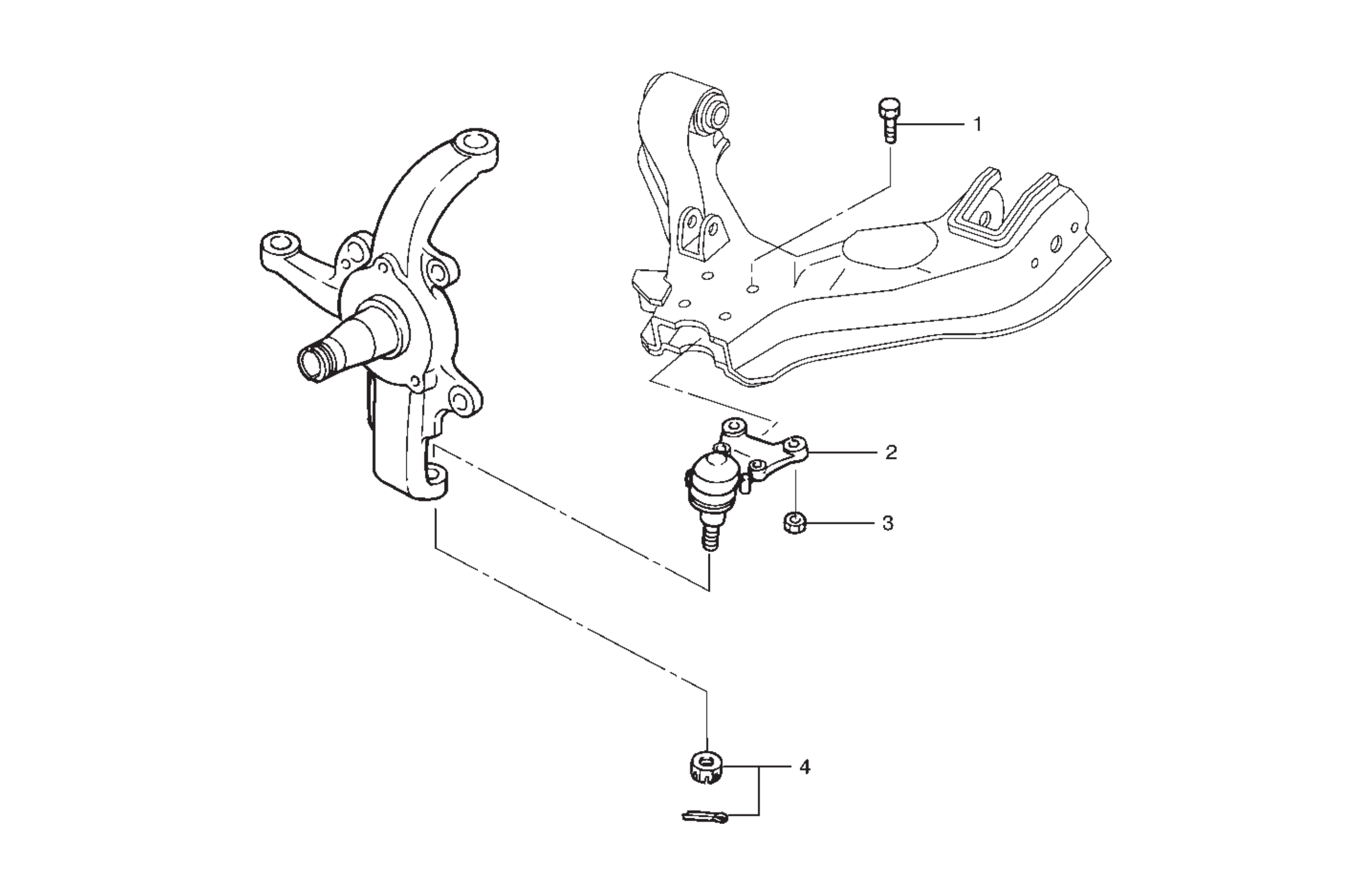
Torque: 57 N·m (42 lb ft)

3. Install nut and cotter pin, then tighten the nut to the specified torque with just enough additional torque to align cotter pin holes. Install new cotter pin.

Torque: 98 N·m (72 lb ft)

Lower Ball Joint

Lower Ball Joint and Associated Parts



450RW011

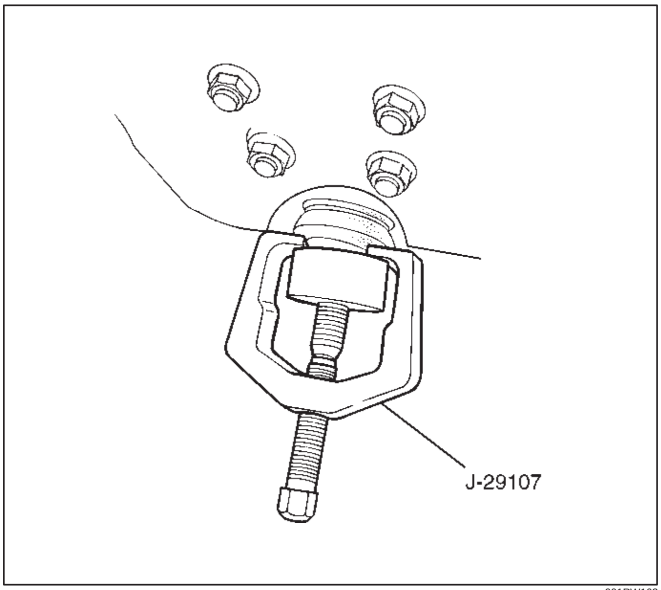
Legend

(1) Bolt
(2) Lower Ball Joint
(3) Nut
(4) Nut and Cotter Pin

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel in this section.
3. Remove the tie-rod end from the knuckle. Refer to Power Steering Unit in Steering section.
4. Remove the retaining ring from the front axle driving shaft to release the shaft from hub(Except 2WD model). Refer to Front Hub and Disc in Driveline/Axle section.
5. Support lower control arm with a jack.
6. Remove lower ball joint nut and cotter pin, then use remover J–29107 to remove the lower ball joint from the knuckle.

CAUTION: Be careful not to damage the ball joint boot.



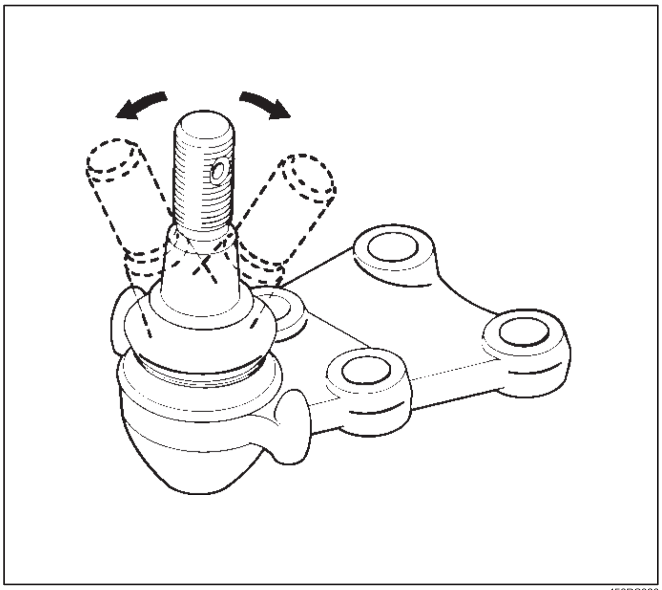
901RW163

7. Remove nut.
8. Remove bolt.
9. Remove lower ball joint.

Inspection and Repair

Make necessary parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

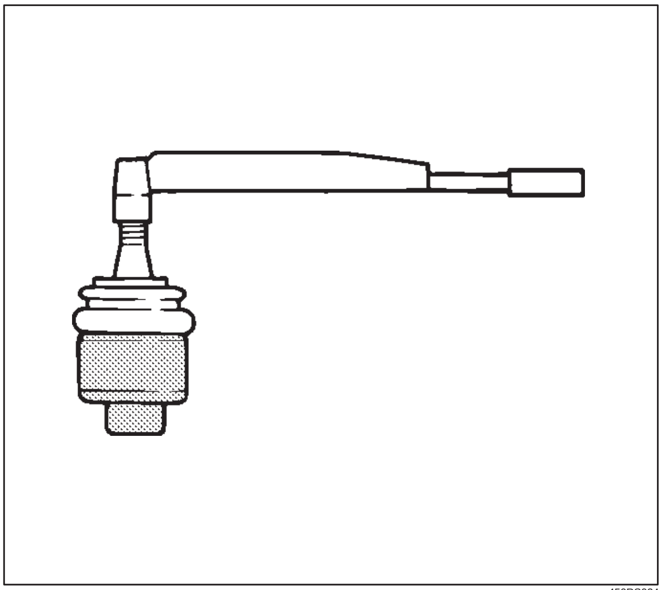
- Inspect the lower end boot for damage or grease leak. Move the ball joint as shown in the figure to confirm its normal movement .
- Inspect screw/taper area of ball for damage.
- If any defects are found by the above inspections, replace the ball joint assembly with new one.



450RS026

- After moving the ball joint 4 or 5 times, attach nut the measure the preload.

Starting torque: 0.5–6.4 N·m (0.4–4.7 lb ft)



450RS024

- If the above limits specified are exceeded, replace the ball joint assembly.

Installation

1. Install lower ball joint.
2. Install bolt.
3. Install nut and tighten it to the specified torque.

Torque: 116 N·m (85 lb ft)

4. Install ball joint nut, then tighten it to the specified torque with just enough additional torque to align cotter pin holes. Install new cotter pin.

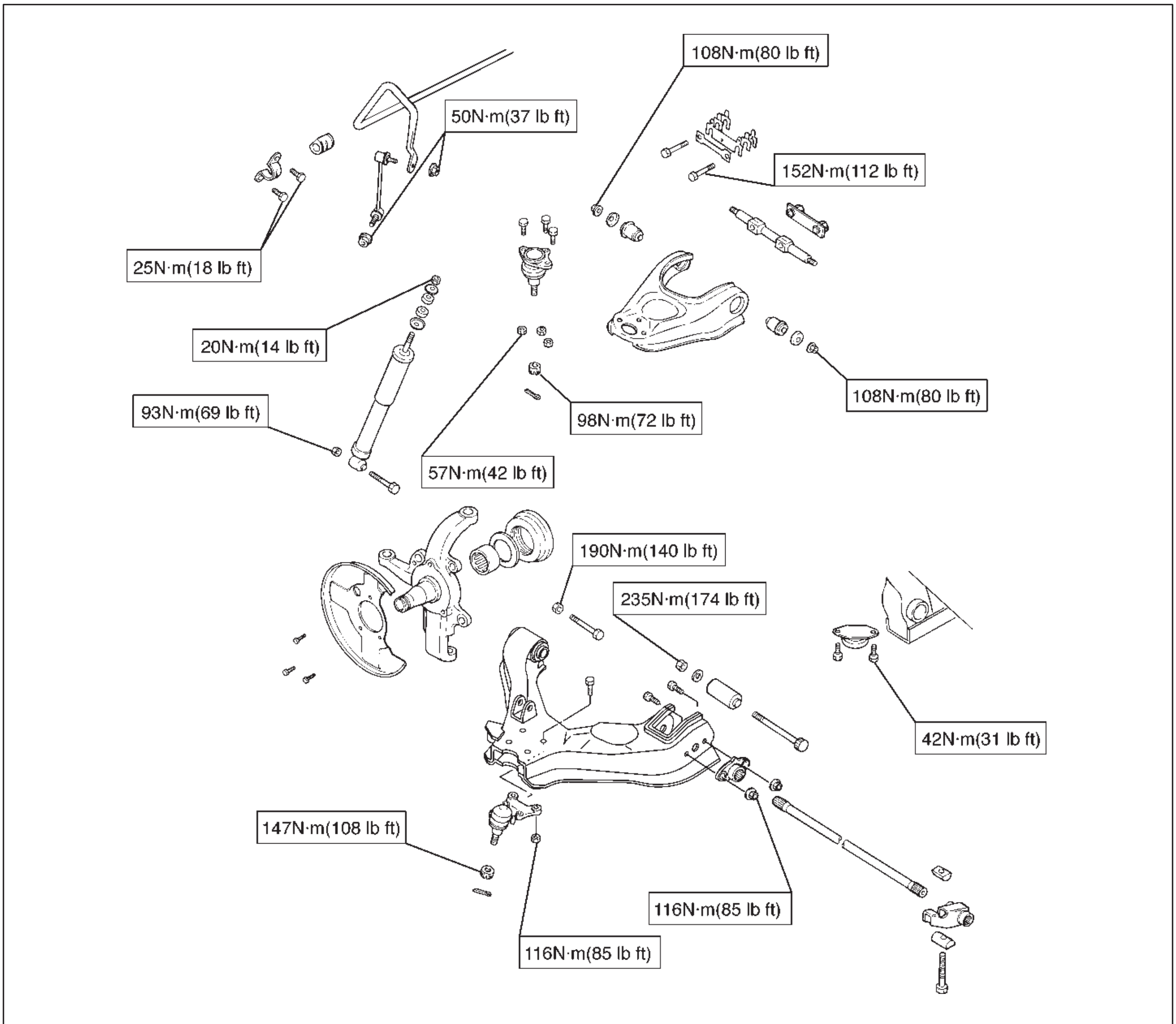
Torque: 147 N·m (108 lb ft)

Main Data and Specifications

General Specifications

Front suspension	Type	Independent wishbone arms, torsion bar spring with stabilizer bar.
Torsion bar spring	Length	1142 mm (45.0 in)
	Diameter	28.0 mm (1.10 in)
Front shock absorber	Type	Hydraulic, double acting, telescopic
	Piston diameter	30.0 mm (1.18 in)
	Stroke	125.0 mm (4.92 in)
	Compressed length	255.0 mm (10.04 in)
	Extended length	380.0 mm (14.96 in)
Stabilizer bar	Diameter	24.0 mm (0.94 in)

Torque Specifications



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Special Tools

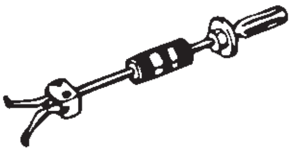
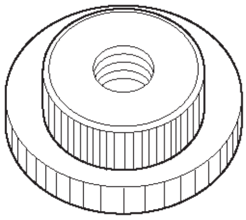
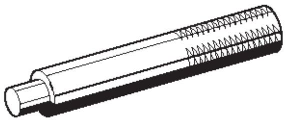
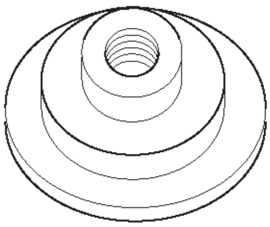
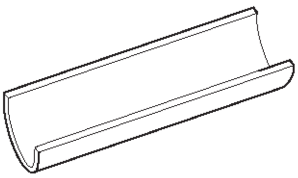
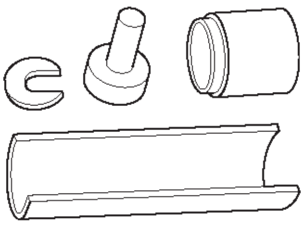
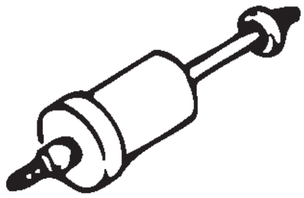
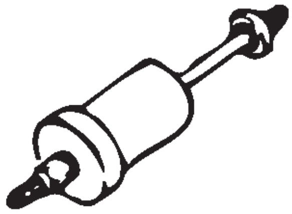
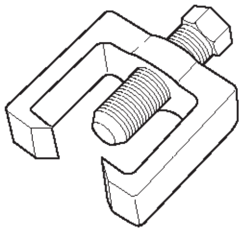
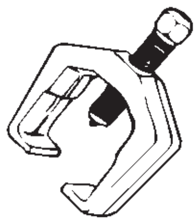
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS283	**J–23907** Remover;Needle bearing
 901RS284	**J–36838** Installer; Needle bearing
 901RS285	**J–8092** Grip
 901RS162	**J–36837** Installer; Oil seal
 901RS286	**J–39376** Installer; Upper arm bushing
 901RS287	**J–29775** Remover and Installer Upper arm bushing

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS288	**J–36833** Remover and Installer kit; Lower arm front bushing
 901RS289	**J–36834** Remover and Installer kit; Lower arm rear bushing
 901RS290	**J–36831** Ball joint remover
 901RS279	**J–29107** Tie-rod end remover

RODEO

SUSPENSION

REAR SUSPENSION

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The rear suspension is a 5-link, coil spring type suspension with a stabilizer bar, consisting of two trailing links, two upper links, lateral rod, shock absorber, and stabilizer. In this suspension, the links are specially arranged to enable the rear axle to move freely, thereby expanding suspension stroke, reducing friction, and improving lateral rigidity and roll control. All these result in improved stability, riding comfort, and rough road maneuverability.
Each link connects the axle housing with the frame through a runner bushing. The axle housing is supported by the trailing links and upper links longitudinally and by the lateral rod latitudinally.

Diagnosis

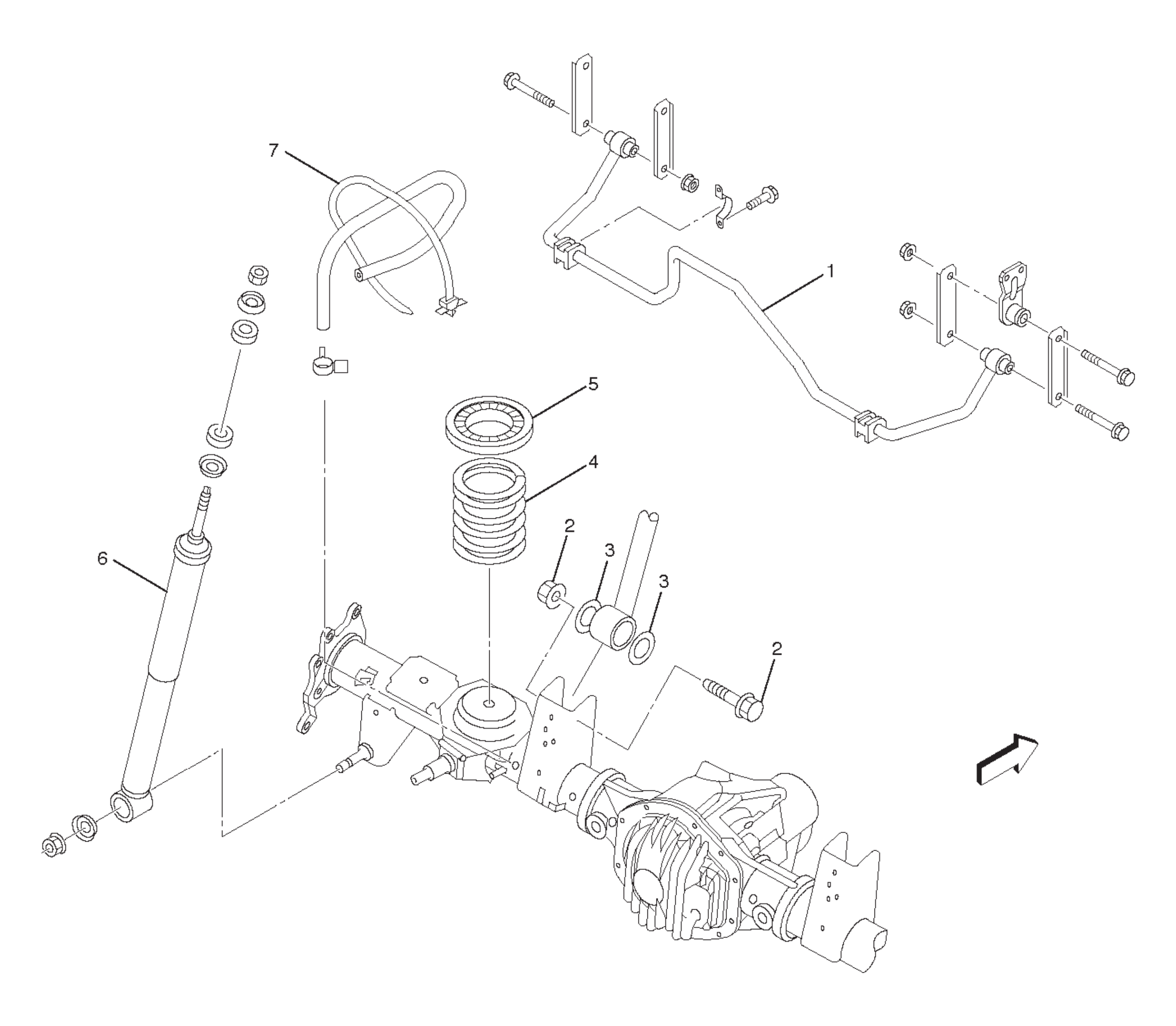
Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
	Parts in power steering valve defective.	Replace power steering unit.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
	Excessive wheel runout.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial runout of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering unit.	Tighten steering unit.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.
	Parts in power steering valve defective.	Replace power steering unit.

Condition	Possible cause	Correction
Hard Steering	Bind in steering linkage ball studs, upper or lower ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to Steering section.
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering unit or linkage.	Retighten or repair.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering unit.	Retighten mounting bolt.
	Faulty steering unit.	Replace steering unit.
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Improper wheel alignment.	Adjust wheel alignment.

Condition	Possible cause	Correction
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.
Low or Uneven Trim Height	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
	Incorrect springs.	Adjust or replace torsion bar.
Suspension Bottoms	Vehicle overloaded.	Reduce load.
	Faulty shock absorber.	Replace shock absorber.
	Incorrect, broken or sagging springs.	Replace springs.
Body Leans	Loose stabilizer bar.	Tighten stabilizer bar bolts or replace bushings.
	Faulty shock absorber, struts or mounting.	Replace shock absorber.
	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
Cupped Tires	Worn wheel bearings.	Replace wheel bearing.
	Excessive tire or wheel run out.	Replace tire or wheel.
	Worn ball joints.	Replace ball joints.
	Tire out of balance.	Adjust tire balance.

Coil Spring

Coil Spring and Associated Parts



Legend
- (1) Stabilizer Bar
- (2) Upper Link Fixing Bolt and Nut
- (3) Rubber Plate
- (4) Coil Spring
- (5) Insulator
- (6) Shock Absorbar
- (7) Breather Hose

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Support the rear axle case with a jack.
3. Disconnect brake hose at the crossmember.
4. Remove breather hose.
5. Remove upper link fixing bolt, nut and rubber plate on the rear axle case (left-side only).
6. Disconnect the stabilizer bar at the stabilizer link.
7. Remove the shock absorber from the axle case.
8. Remove spring insulator.
9. Remove the insulator and coil spring while lowering the rear axle case.

CAUTION: Be sure not to let the brake hose, parking brake cable, and breather hose extend to their full length.

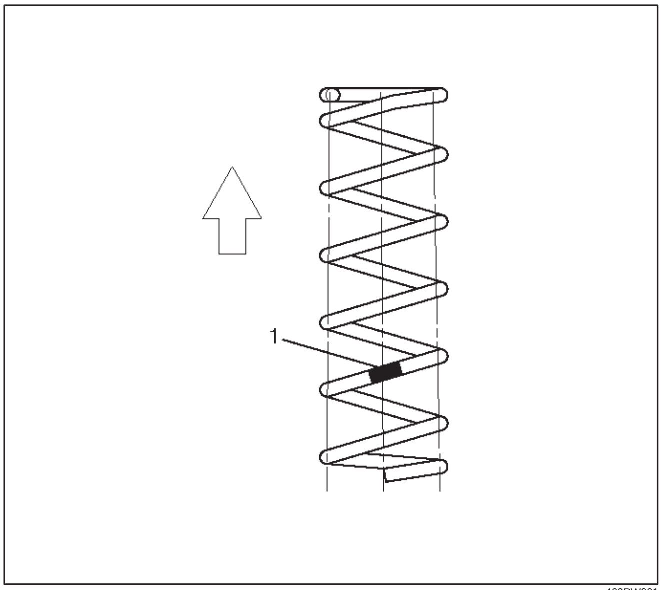
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- Coil spring
- Insulator

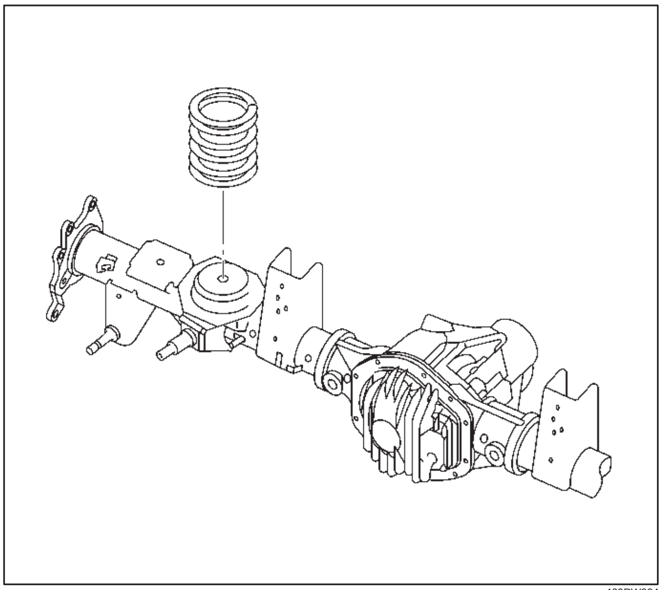
Installation

1. Install coil spring and make sure that the coil spring is installed in the proper position. Paint mark(1) should be downward.



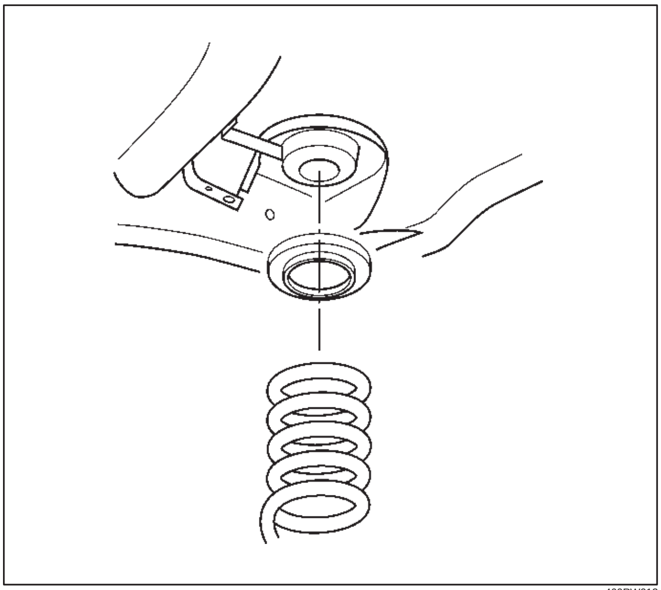
460RW001

2. Fit the end of the coil spring to the coil spring seat and mount the coil spring on the rear axle case.



460RW004

3. Install the insulator on the coil spring. Jack up the axle case gently with the top of the coil spring set to the spring seat on the frame side.



460RW013

4. Install shock absorber and tighten the nut lightly, then retighten it to the specified torque after the vehicle is at curb height.

NOTE: When mounting shock absorber, be sure not to use grease on bushings or any other nearby part.

Torque: 78 N·m (58 lb ft)

5. Install stabilizer bar.

Torque: 31 N·m (23 lb ft)

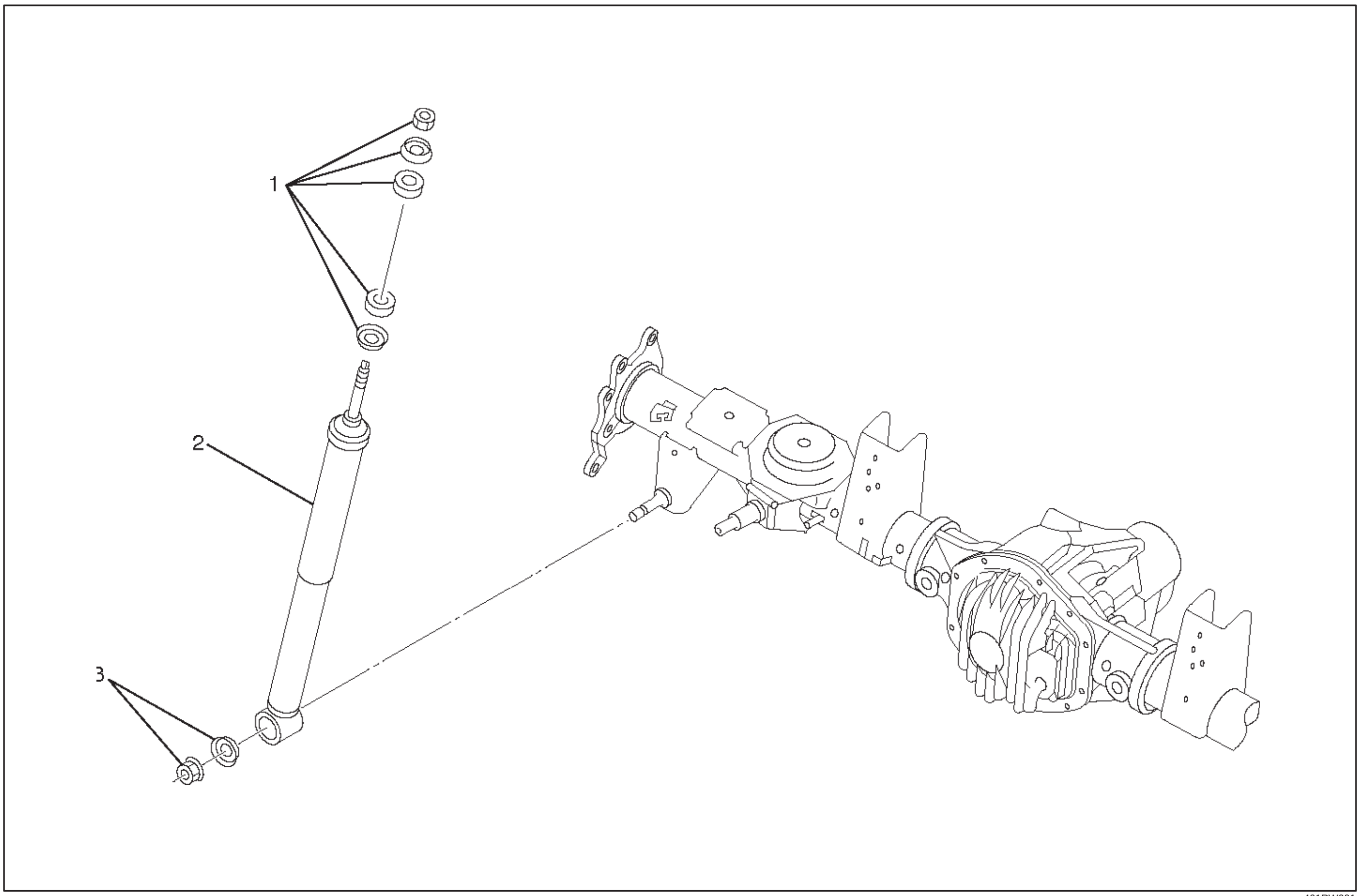
6. Install upper link with rubber plate and tighten fixing bolt.

Torque: 137 N·m (101 lb ft)

7. Install breather hose.
8. Connect brake hose and bleed the brake system.
   Refer to Bleeding the Brake Hydraulic System in Brake section.

Shock Absorber

Shock Absorber and Associated Parts



461RW001

Legend

(1) Nut, Bush and Washer
(2) Shock Absorber
(3) Nut and Washer

Removal

1. Remove shock absorber fixing nut, bush and washer (upper side).
2. Remove shock absorber fixing nut and washer (lower side).
3. Remove shock absorber.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- Shock absorber
- Rubber bushing

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

Installation

1. Install shock absorber. When mounting shock absorber, be sure not to use grease on bushings or any other nearby part.
2. Install nut and washer (lower side), then tighten the nut lightly. Retighten to the bolt and nut specified torque after the vehicle is at curb height.

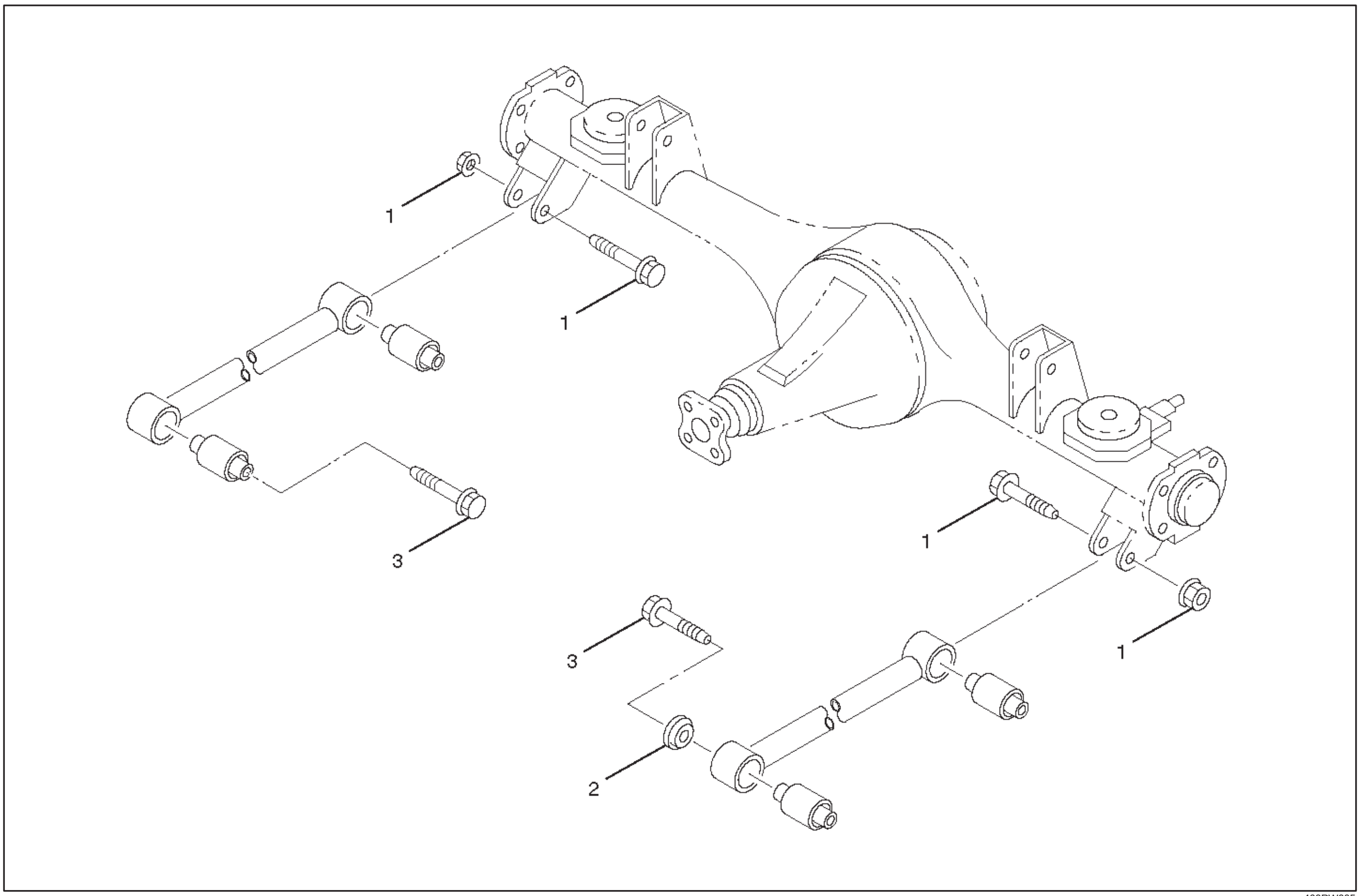
   Torque: 78 N·m (58 lb ft)

3. Install nut, bush and washer (upper side), then tighten the nut lightly. Retighten to the nut specified torque after the vehicle is at curb height.

   Torque: 20 N·m (14 lb ft)

Trailing Link

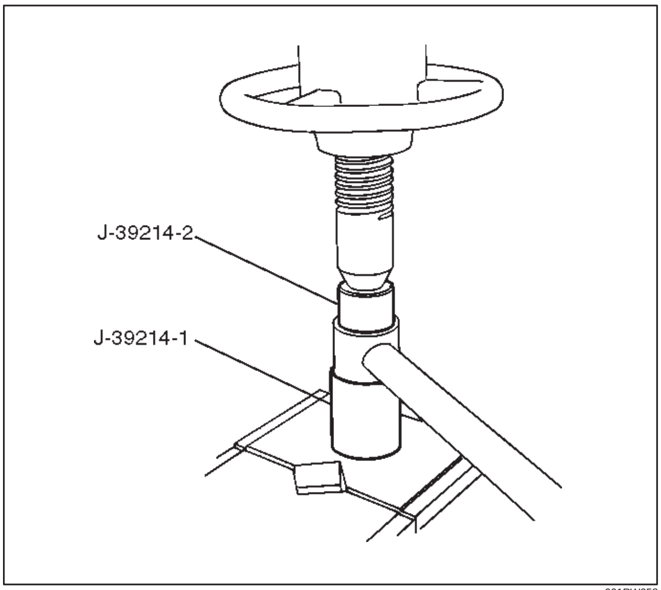
Trailing Link and Associated Parts



Legend
(1) Bolt and Nut (Axle side)
(2) Protector (Left side only)
(3) Bolt (Frame side)

Removal

1. Remove the parking brake cable from the trailing link.
2. Remove the trailing link fixing bolt, nut and protector.
3. Remove trailing link.



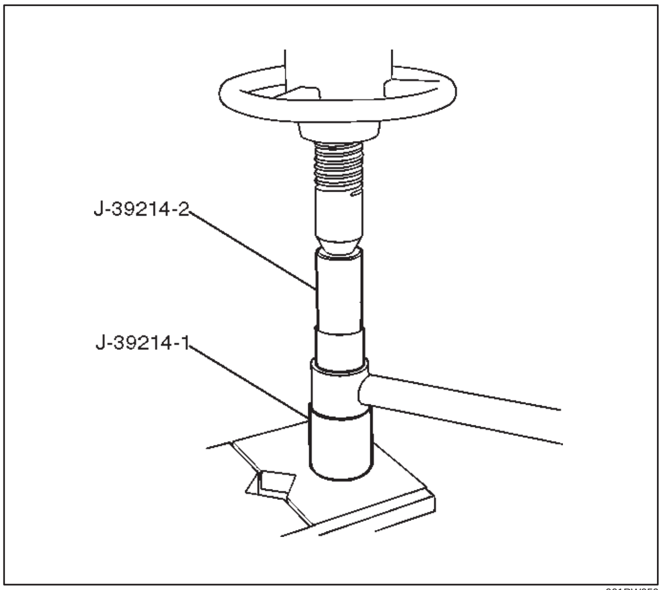
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

1. Trailing link
2. Rubber bushing
   - Remove the rubber bushing by using remover J–39214.

- Install the rubber bushing by using installer J–39214.

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

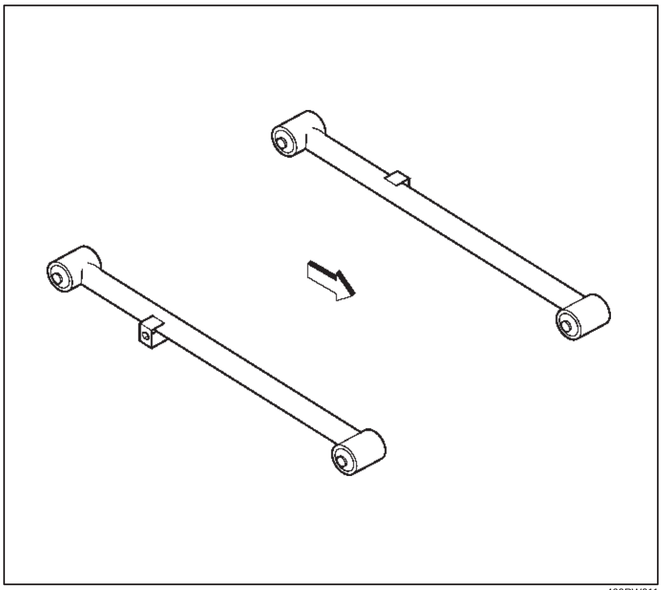


901RW059

Installation

1. Install trailing link. Make sure that the trailing link is in its correct position.

NOTE: When mounting trailing link, be sure not to use grease on bushings or any other nearby part.



460RW011

2. Install bolt, nut and protector. Tighten the bolts and nuts lightly, then retighten them to the specified torque after the vehicle is at curb height.

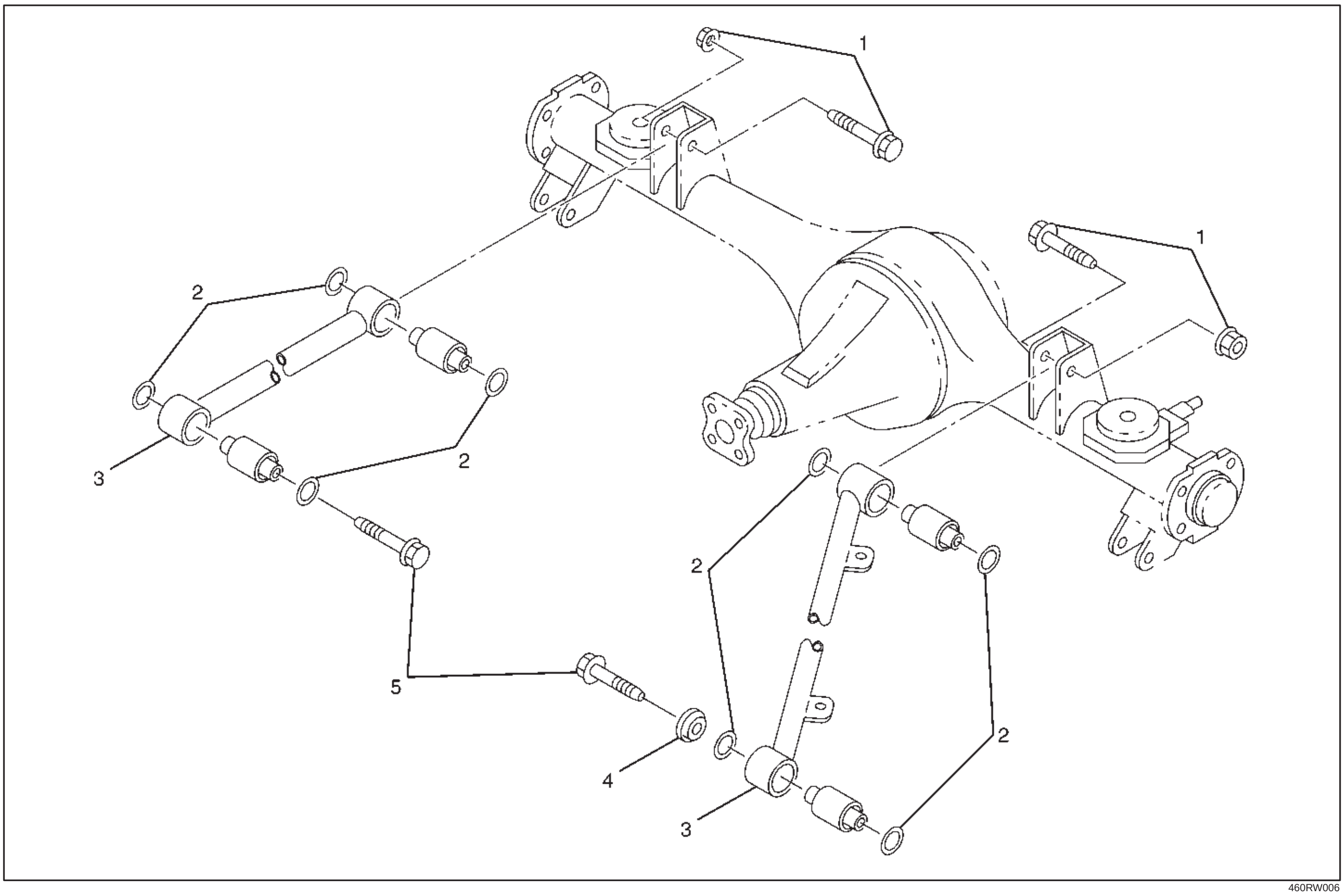
   Torque: 137 N·m (101 lb ft)

3. Install parking brake cable.

CAUTION: The parking brake cable should not be overstrained or slackened.

Upper Link

Upper Link and Associated Parts



Legend

(1) Bolt and Nut (Axle side)
(2) Rubber Plate
(3) Upper Link
(4) Protector (Left side only)
(5) Bolt (Frame side)

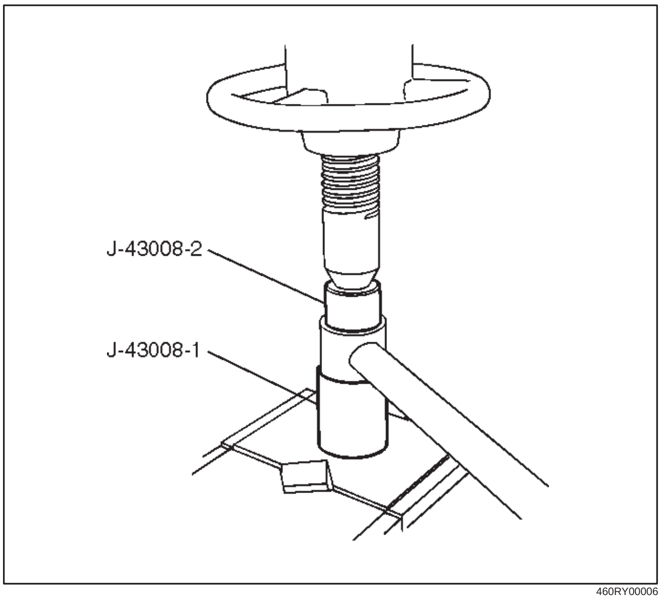
Removal

1. Remove fuel tank. Refer to Engine Fuel in Engine section.
2. Remove the speed sensor cable from the upper link.
3. Remove bolt, nut, rubber plate and protector.
4. Remove upper link.

Inspection and Repair

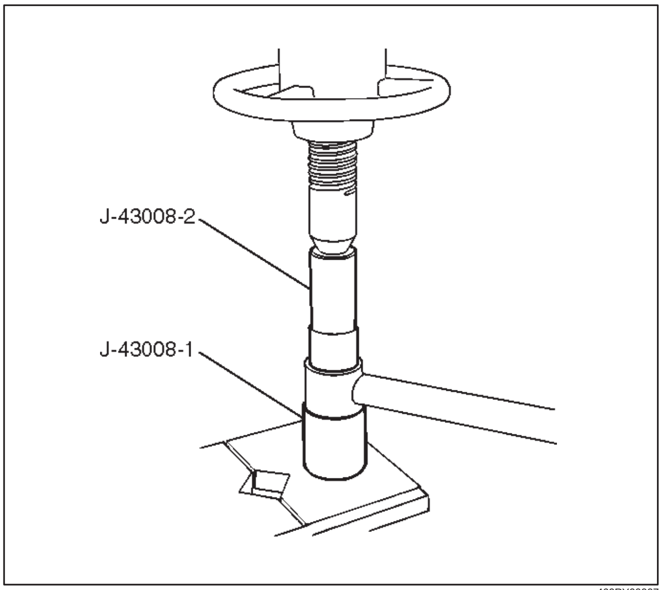
Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

1. Upper link
2. Rubber bushing
   - Remove the rubber bushing by using remover J–43008.



- Install the rubber bushing by using to installer J–43008.

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

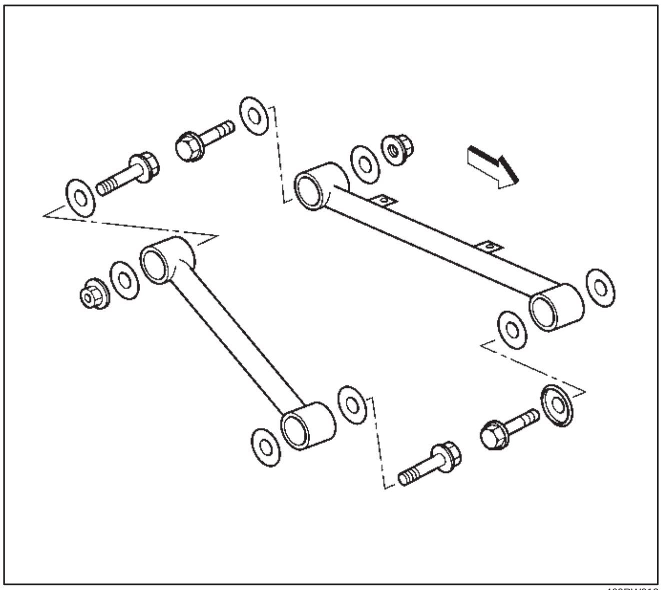


460RY00007

Installation

1. Install upper link. Make sure that the upper link is in its correct position.

NOTE: When mounting upper link, be sure not to use grease bushings or any other nearby part.



460RW012

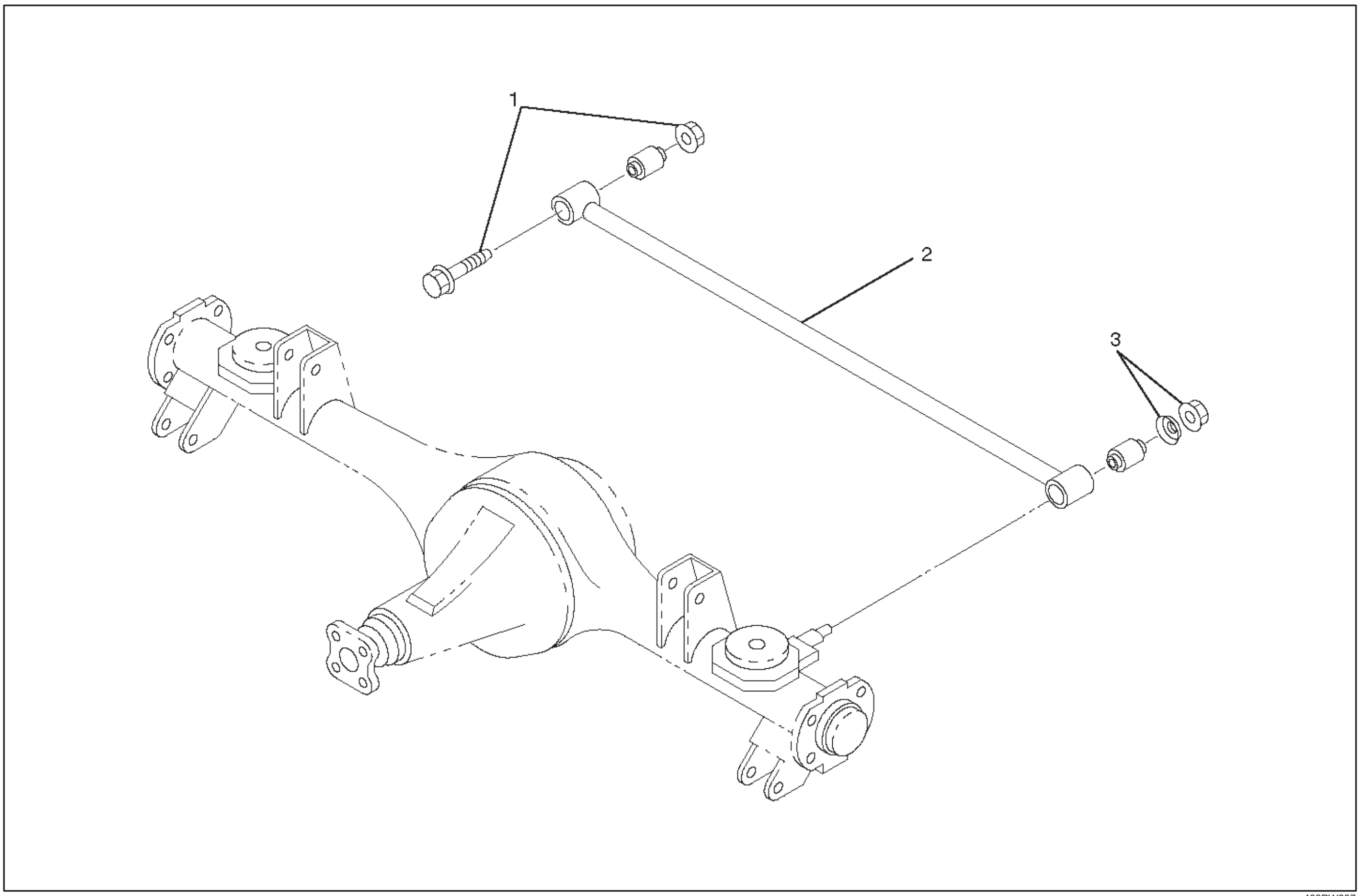
2. Install bolt, nut, rubber plate and protector. Tighten the bolts and nuts lightly, then retighten them to the specified torque after the vehicle is at curb height.

   Torque: 137 N·m (101 lb ft)

3. Install speed sensor cable.
4. Install fuel tank.

Lateral Rod

Lateral Rod and Associated Parts



460RW007

Legend

(1) Bolt and Nut (Frame side)

(2) Lateral Rod

(3) Nut and Washer (Axle side)

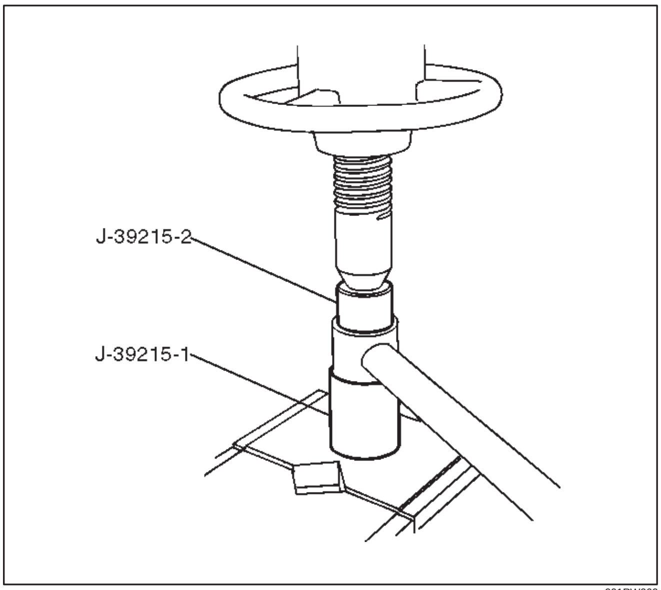
Removal

1. Remove nut and washer.
2. Remove bolt and nut.
3. Remove lateral rod.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

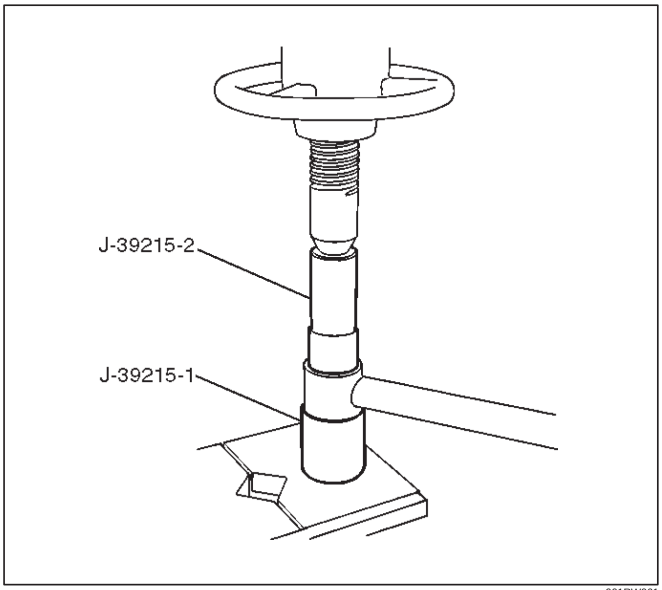
1. Lateral rod
2. Rubber bushing (Frame side)
   - Remove the rubber bushing (Frame side) by using remover J–39214.



901RW060

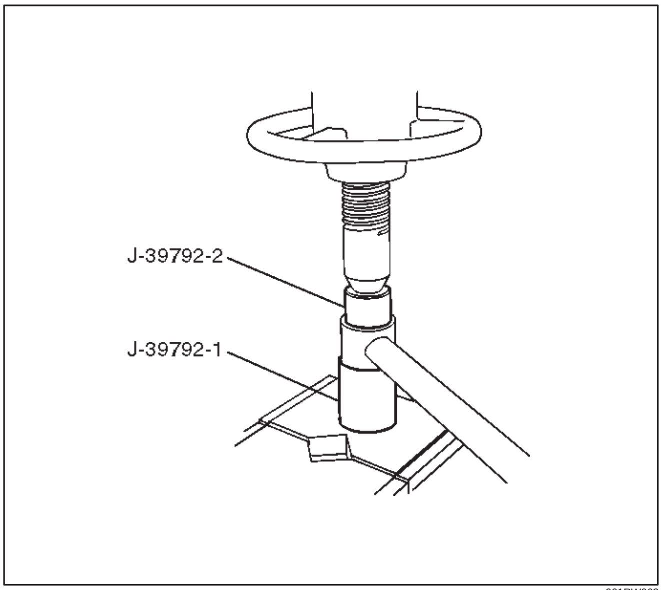
- Install the rubber bushing (Frame side) by using Installer J–39215.

NOTE: When mounting rubber bushings, do not use grease on bushings or any other nearby parts.



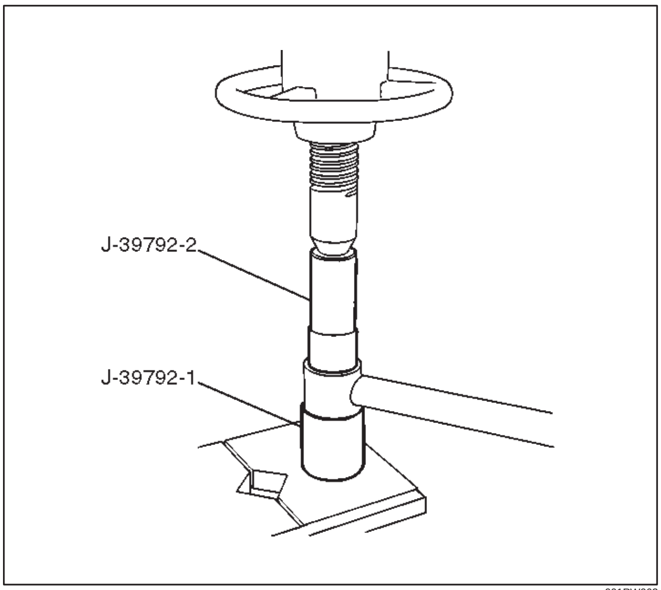
901RW061

3. Rubber bushing (Axle side)
   - Remove the rubber bushing (Axle side) by using remover J–39792.



901RW062

- Install the rubber bushing (Axle side) by using installer J–39792.

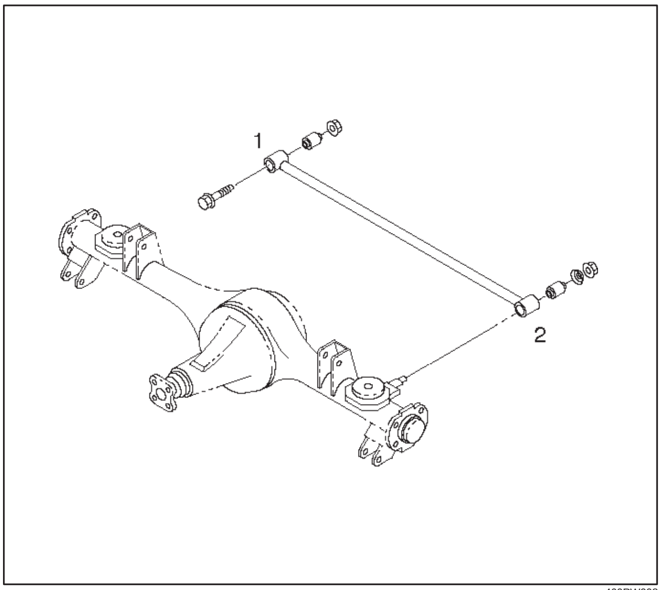


901RW063

Installation

1. Install lateral rod and make sure that the lateral rod is in its correct position.

NOTE: When mounting lateral rod, be sure not to use grease on bushings or any other nearby part.



460RW008

Legend

(1) Frame Side
(2) Axle Side

2. Install bolt and nut. Tighten the bolt and nut lightly, then retighten them to the specified torque after the vehicle is at curb height.

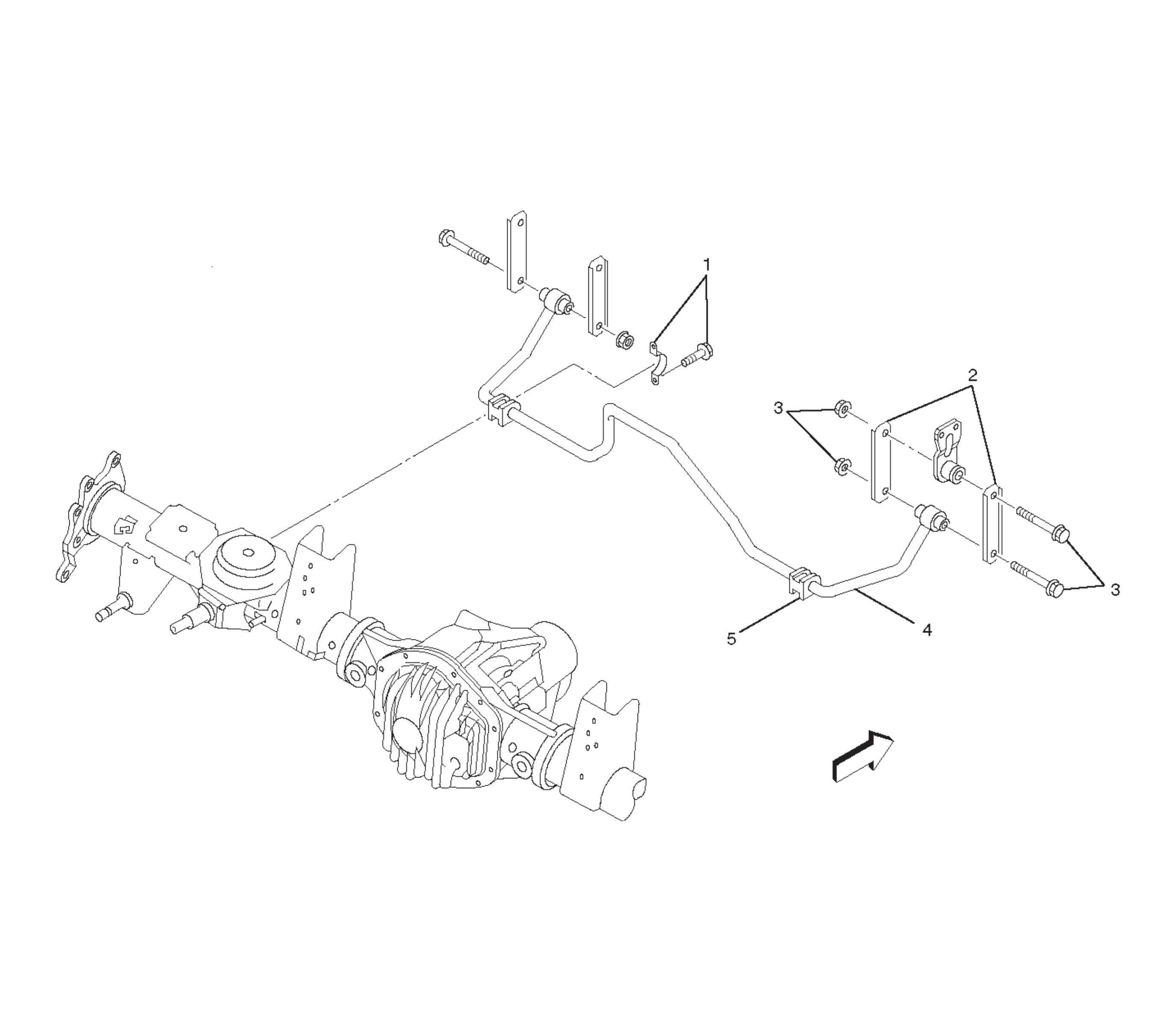
   Torque: 137 N·m (101 lb ft)

3. Install nut and washer. Tighten the nut lightly, then retighten the nut to the specified torque after the vehicle is at curb height.

   Torque: 78 N·m (58 lb ft)

Stabilizer Bar

Stabilizer Bar and Associated Parts



Legend

(1) Bracket
(2) Link
(3) Bolt and Nut
(4) Stabilizer Bar
(5) Rubber Bushing

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel in this section.
3. Remove bolt and nut.
4. Remove link.

CAUTION: Be careful not to damage the ball joint boot.

5. Remove bracket.
6. Remove rubber bushing.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

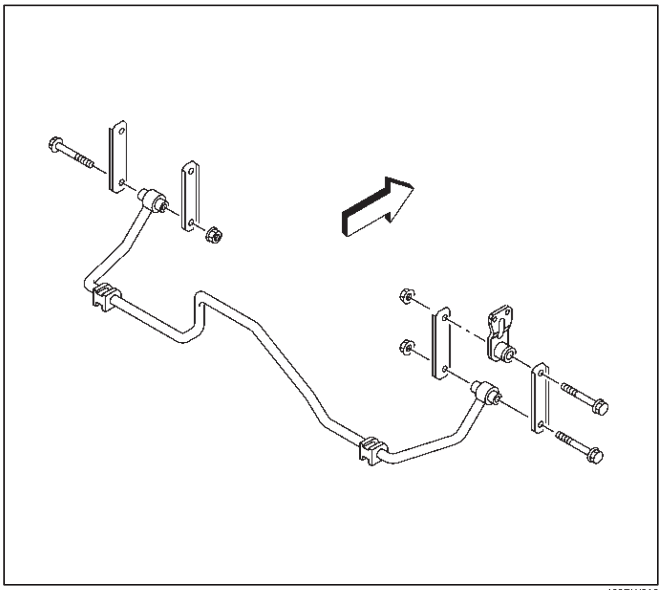
- Stabilizer bar
- Rubber bushing
- Link

Installation

1. Install rubber bushing.
2. Install bracket to axle housing and tighten to the specified torque.

   Torque: 25 N·m (19 lb ft)
3. Install link.
4. Install bolt and nut, then tighten the nut to the specified torque.

   Torque: 31 N·m (27 lb ft)



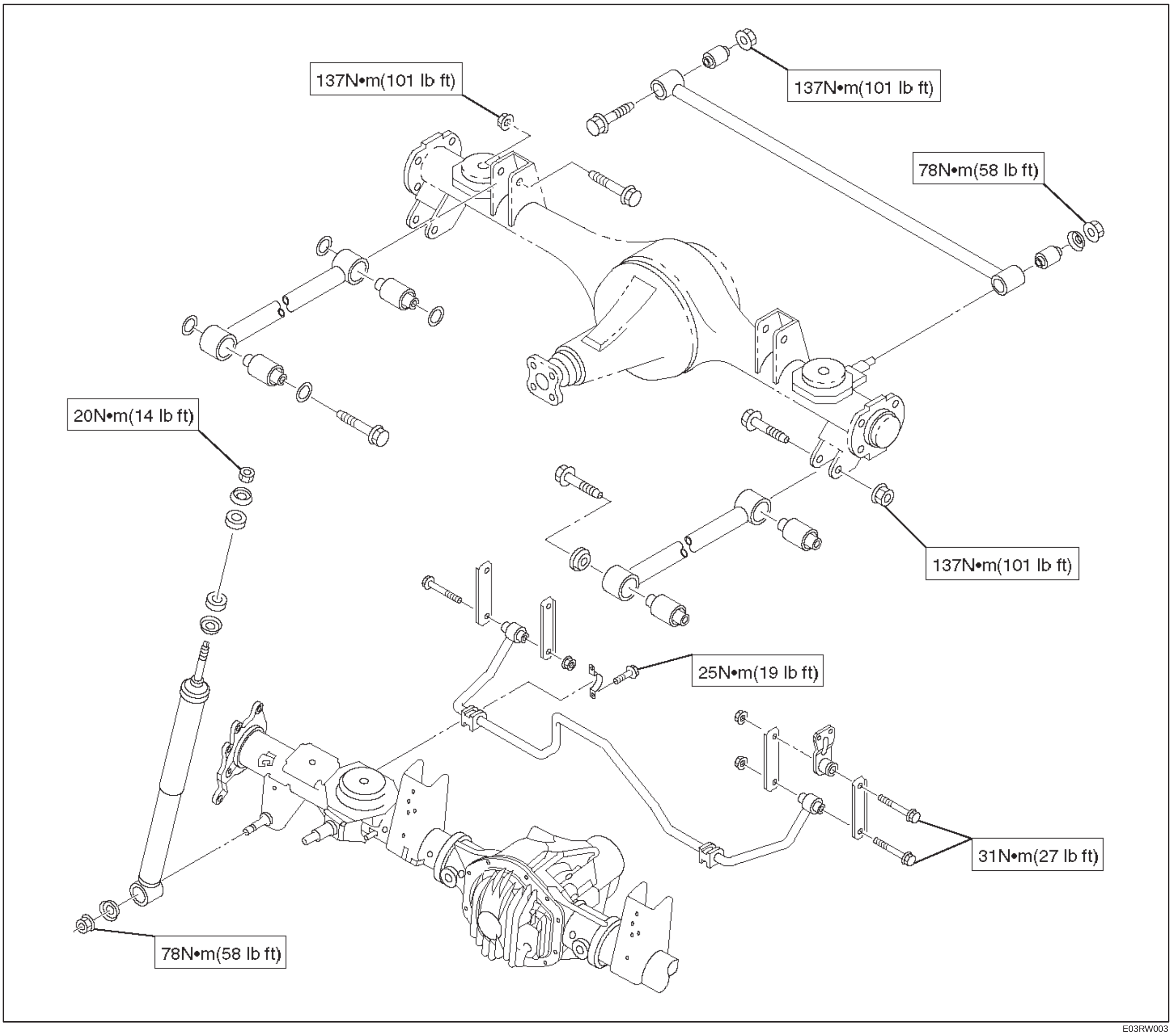
460RW010

Main Data and Specifications

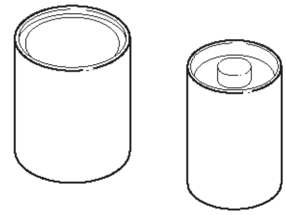
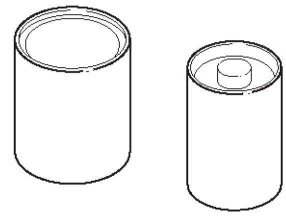
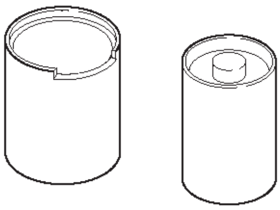
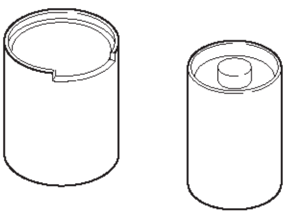
General Specifications

Rear suspension	Type	5–Link, coil spring type with stabilizer bar.
Coil spring	Free length	389.5mm (15.33in)
	Spring diameter	12.2mm (0.48in)
	Coil diameter (inner)	105mm (4.13in)
	Effective No. of turns	5.74
	Total No. of turns	7.24
Shock absorber	Type	Hydraulic, double acting, telescopic
	Piston diameter	30mm (1.18in)
	Stroke	175mm (6.89in)
	Extended length	473.5mm (18.64in)
	Compressed length	298.5mm (11.75in)
Stabilizer bar	Diameter	18mm (0.71in)

Torque Specifications



Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS291	**J–39214** Remover and Installer; Trailing link bushing
 901RS291	**J–43008** Remover and Installer; Upper link bushing
 901RS292	**J–39792** Remover and Installer; Lateral rod bushing (axle side)
 901RS293	**J–39215** Remover and Installer; Lateral rod bushing

RODEO

SUSPENSION

WHEEL AND TIRE SYSTEM

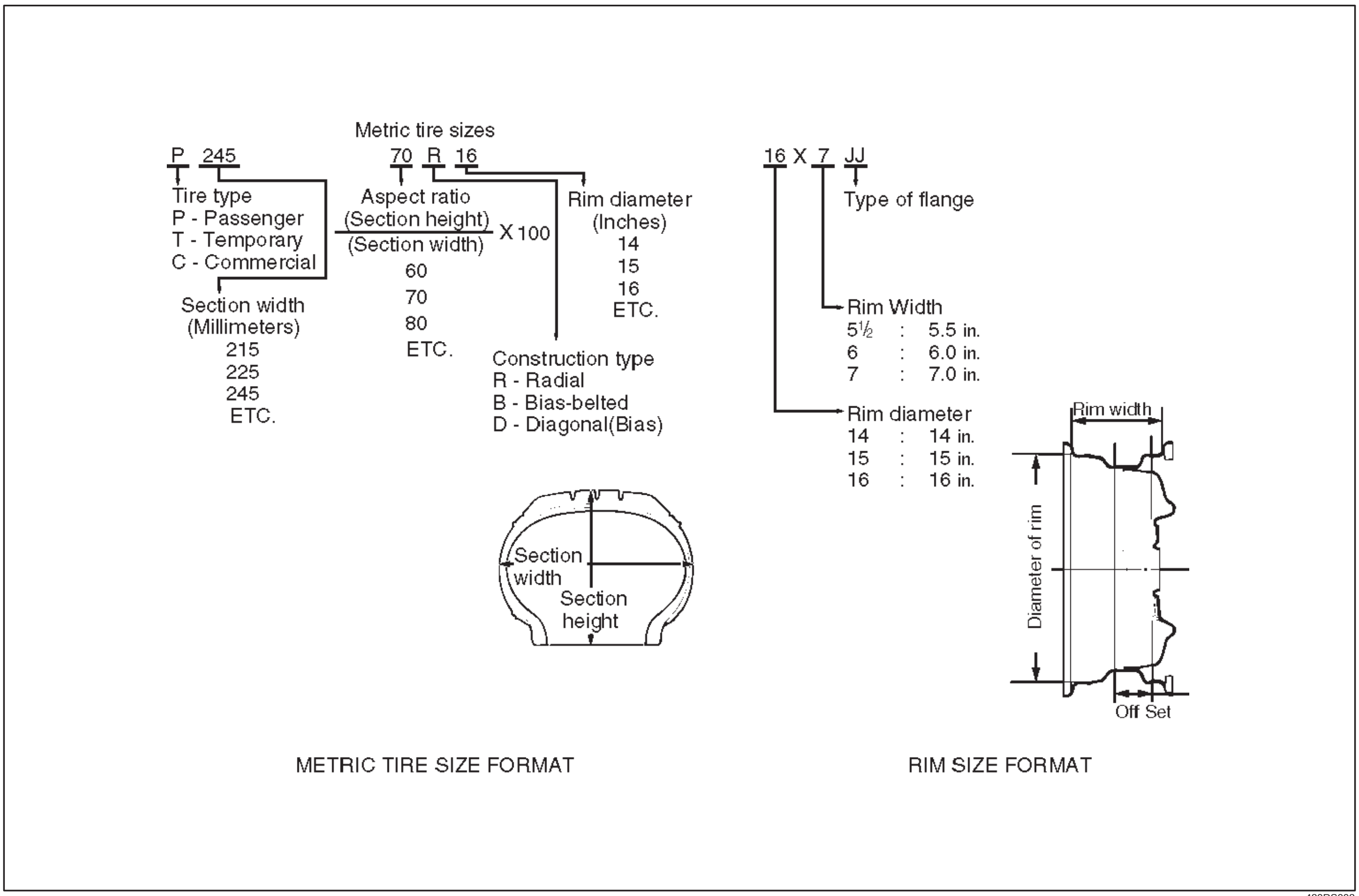
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



480RS008

Replacement wheels or tires must be equivalent to the originals in load capacity, specified dimension and mounting configuration. Improper size or type may affect bearing life, brake performance, speedometer/odometer calibration, vehicle ground clearance and tire clearance to the body and chassis. All model are equipped with metric sized tubeless steel belted radial tires. Correct tire pressures and driving habits have an important influence on tire life. Heavy cornering, excessively rapid acceleration and unnecessary sharp braking increase premature and uneven wear.

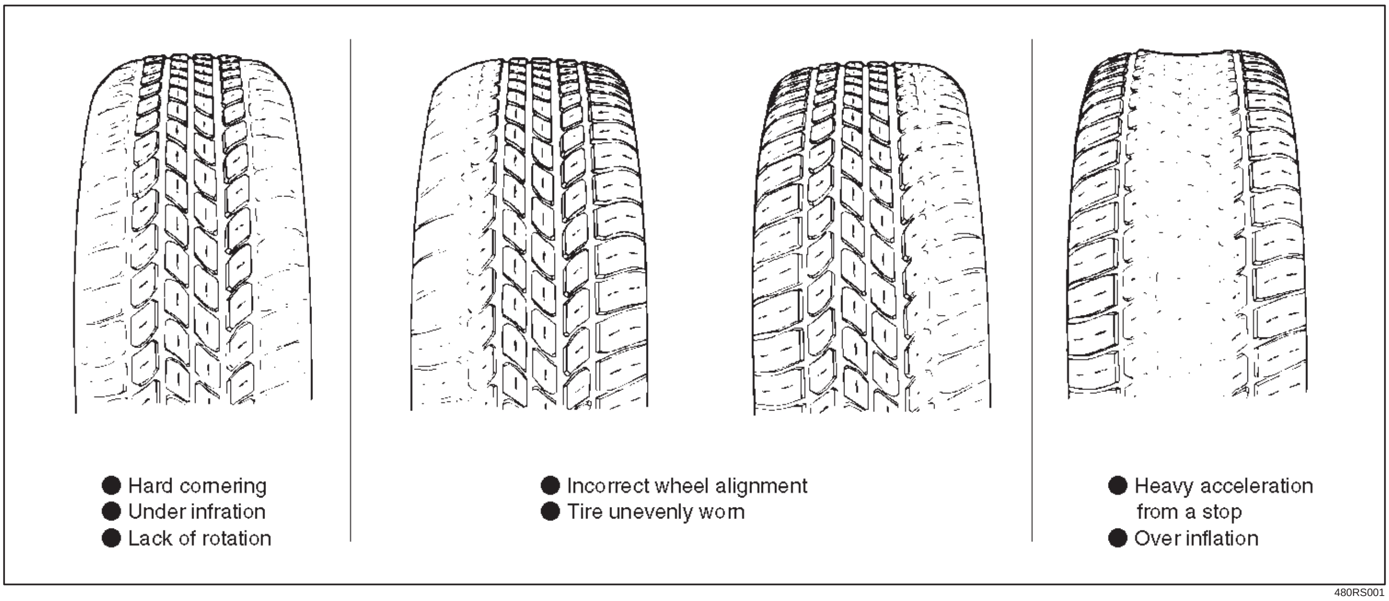
Diagnosis

Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
	Parts in power steering valve defective.	Replace power steering unit.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
	Excessive wheel runout.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial runout of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering unit.	Tighten steering unit.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.
	Parts in power steering valve defective.	Replace power steering unit.

Condition	Possible cause	Correction
Hard Steering	Bind in steering linkage ball studs, upper or lower ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to Steering section.
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering unit or linkage.	Retighten or repair.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering unit.	Retighten mounting bolt.
	Faulty steering unit.	Replace steering unit.
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Improper wheel alignment.	Adjust wheel alignment.

Condition	Possible cause	Correction
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.
Low or Uneven Trim Height	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
	Incorrect springs.	Adjust or replace torsion bar.
Suspension Bottoms	Vehicle overloaded.	Reduce load.
	Faulty shock absorber.	Replace shock absorber.
	Incorrect, broken or sagging springs.	Replace springs.
Body Leans	Loose stabilizer bar.	Tighten stabilizer bar bolts or replace bushings.
	Faulty shock absorber, struts or mounting.	Replace shock absorber.
	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
Cupped Tires	Worn wheel bearings.	Replace wheel bearing.
	Excessive tire or wheel run out.	Replace tire or wheel.
	Worn ball joints.	Replace ball joints.
	Tire out of balance.	Adjust tire balance.

Irregular and Premature Wear

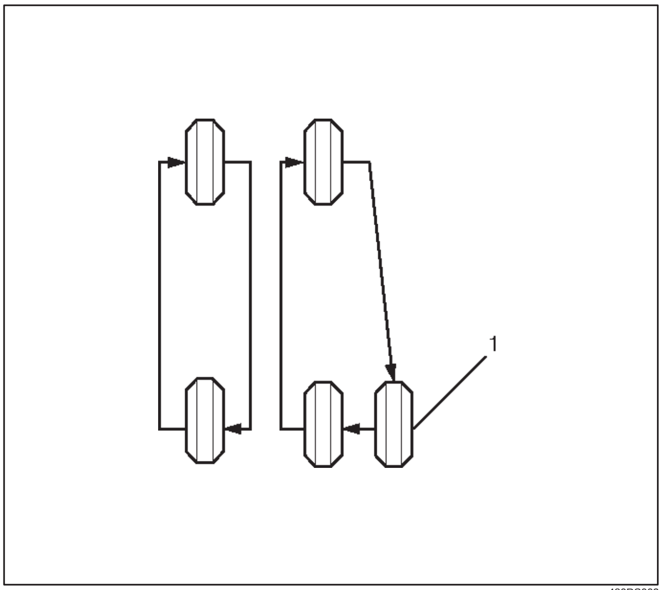


Irregular and/or premature wear has many causes. Some of them are incorrect inflation pressures, lack of tire rotation, poor driving habits or improper wheel alignment. Incorrect inflation is common cause of tire premature wear.

NOTE: Due to their design, radial tires tend to wear faster in the shoulder area, particularly on the front tires. This makes regular rotation especially necessary. After rotation, be sure to check wheel nut torque, and set tire pressures.

Tire Rotation

Tire rotation is recommended to equalize wear for longer tire life.



Legend

(1) Spare Tire

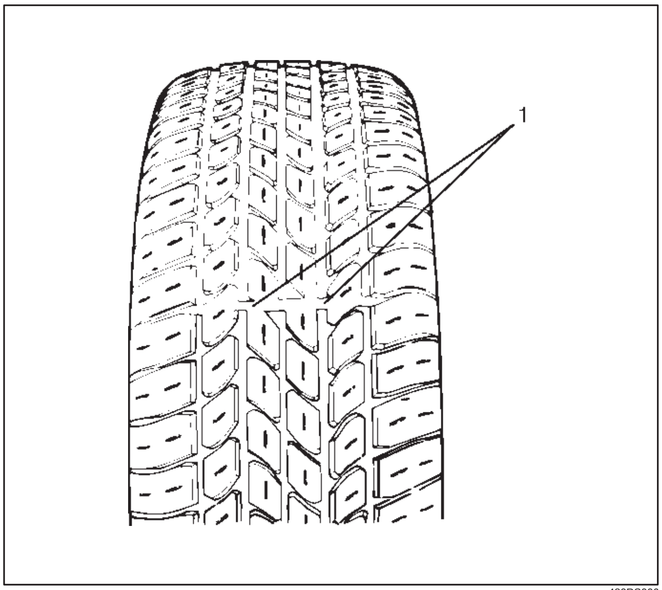
If the following conditions are noted, rotate the tires:

- Front tire wear is different from rear.
- Uneven wear exists across the tread of any tire.
- Left and right front tire wear is unequal.
- Left and right rear tire wear is unequal.

Check wheel alignment if the following conditions are noted:

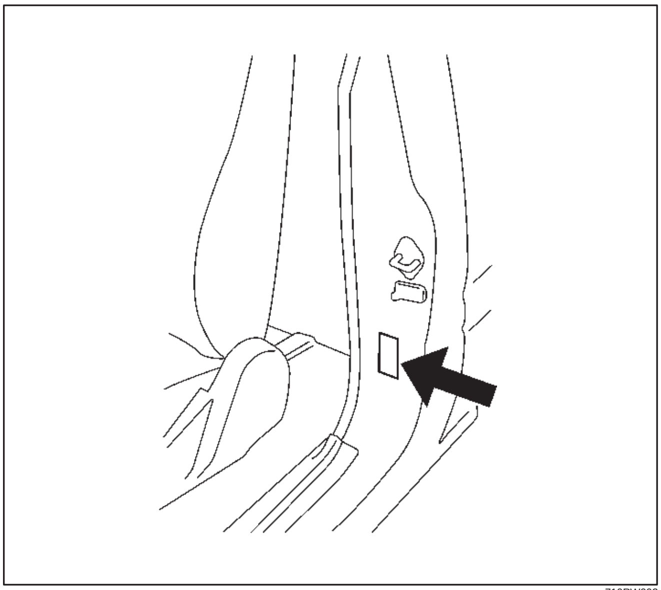
- Left and right front tire wear is unequal.
- Wear is uneven across the tread of any front tire.
- Front tire treads have a scuffed appearance with "feather" edges on one side of the tread ribs or blocks.

Tread Wear Indicators



The original equipment tires have built-in tread wear indicators(1) to show when tires need replacement. These indicators may appear as wide bands. When the indicators appear in two or more grooves at three locations, tire replacement is recommended.

Inflation of Tires



Tire pressure, in cold condition (after vehicle has set for three hours or more, and driven less than one mile), should be checked monthly or before any extended trip. Tire pressure increases approximately 15% when the tires become hot during driving. Tire pressure specification is shown on the label located on the left door lock pillar.

NOTE: Check the tire pressure whenever irregular wear is found. Tire inflation greatly affects tire wear. If the alignment check does not reveal any alignment problems, check the condition of the shock absorbers and wheel/tire balance.

Diagnosis List

If the following conditions are noted, rotation is required.

1. Front tire wear is different from rear.
2. Uneven wear exists across the tread of any tire.
3. Left and right front tire wear is unequal.
4. Left and right rear tire wear is unequal.

If the following conditions are noted, check the wheel alignment.

1. Left and right front tire wear is unequal.
2. Uneven wear exists across the tread of any tire.
3. Front tire treads have scuffed appearance with "feather" edges on one side of tread ribs or blocks.
4. There is cupping, flat spotting etc.

Higher than recommended pressure can cause:

1. Hard ride.
2. Poor steering stability.
3. Rapid and uneven wear at center of the tread.

Lower than recommended pressure can cause:

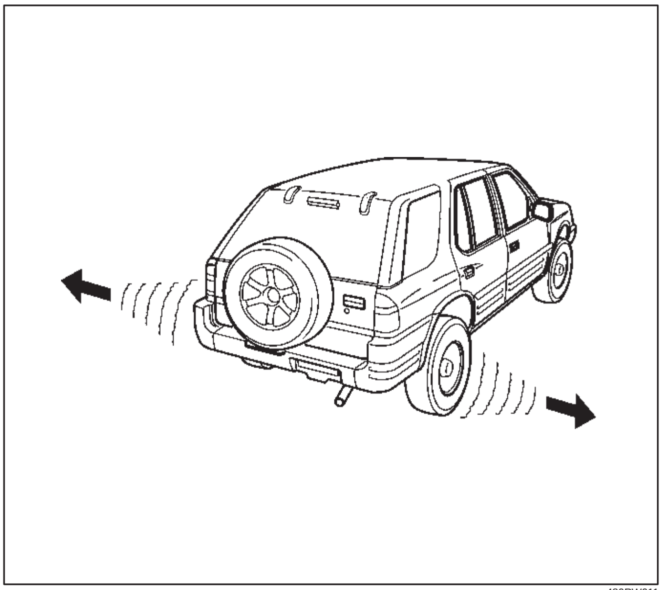
1. Tire squeal on turns.
2. Hard steering.
3. Rapid and uneven wear on the edges of the tread.
4. Tire rim bruises and rupture.

5. Tire cord breakage.
6. High tire temperatures.
7. Reduced handling.
8. Reduced fuel economy.

Unequal pressure on same axle can cause:

1. Uneven braking.
2. Steering lead.
3. Reduced handling.
4. Swerve on acceleration.

Radial Tire Waddle



480RW011

Waddle is side-to-side movement at the front and/or rear of the car. It can be caused by the steel belt not being straight within the tire, or by excessive lateral runout of the tire or wheel. It is most noticeable at low speed, about 8 to 48 km/h (5 to 30 mph). It may also cause rough ride at 80 to 113 km/h (50 to 70 mph).

The car can be road tested to see which end of the car has the faulty tire. If the tire causing the waddle is on the rear, the rear end of the car will "waddle". From the driver's seat, it feels as if someone is pushing on the side of the car.

If the faulty tire is on the front, the waddle is more easily seen. The front sheet metal appears to be moving back and forth. It feels as if the driver's seat is the pivot point in the car.

Another more time-consuming method of determining the faulty tire is substituting tire and wheel assemblies that are known to be good. Follow these steps:

1. Drive the car to determine if the waddle is coming from the front or rear.
2. Install tire and wheel assemblies known to be good (from a similar car) in place of those on the end of the car which is waddling. If the waddle cannot be isolated to front or rear, start with the rear tires.
3. Road test again. If improvement is noted, install the original tire and wheel assemblies one at a time until the faulty tire is found. If no improvement is noted, install tires known to be good in place of all four. Then, install the originals one at a time until the faulty tire is found.

Radial Tire Lead/Pull

"Lead/Pull" is vehicle deviation from a straight path, on a level road with no pressure on the steering wheel.

Lead is usually caused by:

1. Poorly manufactured radial tires.
2. Uneven brake adjustment.
3. Wheel alignment.

The way in which a tire is built can produce lead in a car. An example of this is placement of the belt. Off-center belts on radial tires can cause the tire to develop a side force while rolling straight down the road and the tire will tend to roll like a cone.

The "Radial Tire Lead/Pull Correction" chart should be used to make sure that front wheel alignment is not mistaken for tire lead.

Rear tires will not cause lead/pull.

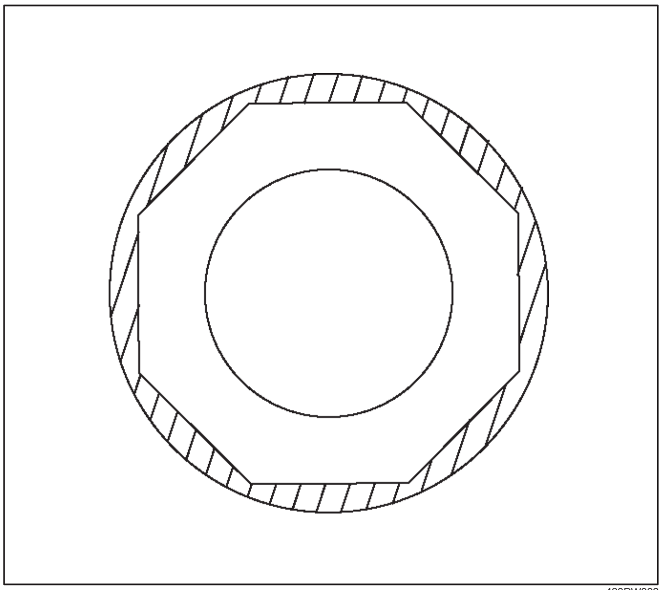
Radial Tire Lead/Pull Correction Chart

Step	Action	Yes	No
1	1. Inflate tires to recommended pressure. 2. Road test vehicle on level uncrowned road. Was a problem corrected?	End.	Go to Step 2
2	Switch front tires side to side and road test again. Was a problem corrected?	If roughness results,replace tires.	Go to Step 3
3	Did the vehicle lead in same direction?	Go to Step 4	Go to Step 5
4	Put tires back in original position and check alignment. Was a problem corrected?	End.	Go to Step 5
5	Install known good tire on one front side. Was a problem corrected?	Replace tire.	Install a known good tire in place of other front tire. If lead corrected, replace tire.

Typical examples of abnormal tire ahead wear and major causes:

CAUTION: Similar wear patterns can be caused by worn suspension parts, misalignment of wheels and tires, and other suspension related problems.

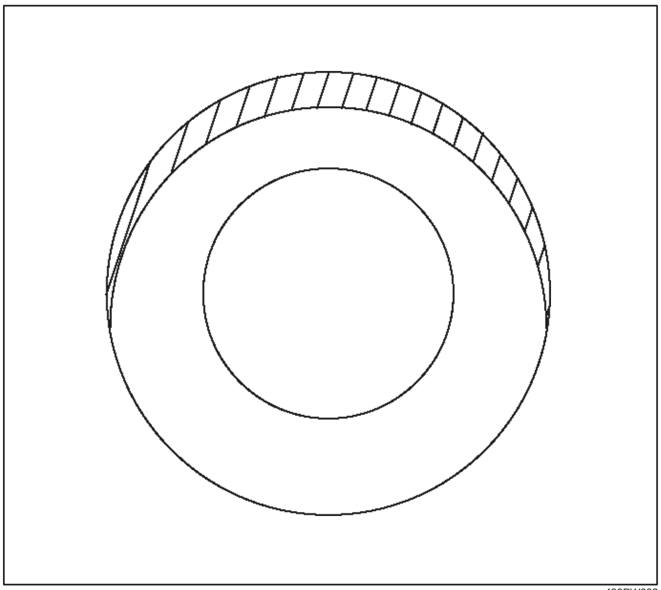
Spotty wear – wear localized on shoulder sections, and in an extreme cases, the tire becomes polygonal in shape.



480RW002

1. Tire or wheel out of round or distorted.
2. Hub or knuckle out of round or distorted.
3. Play in hub bearings or ball joint.
4. Rotating parts out of balance.

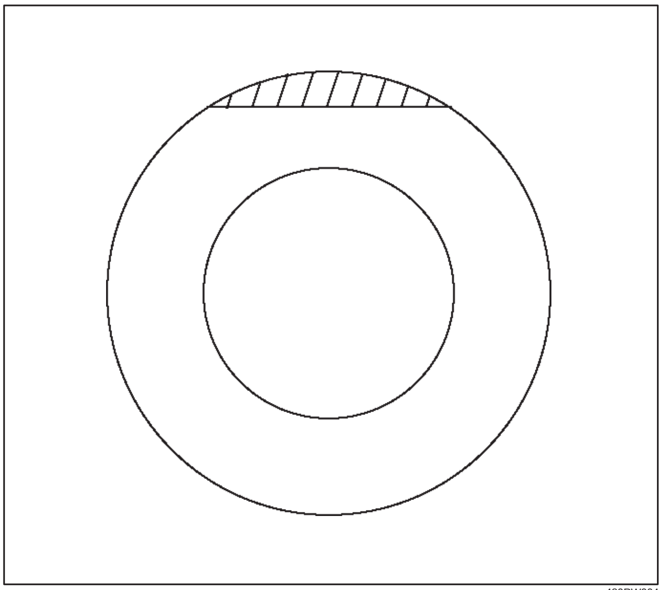
Tread wear one-sided.



480RW003

1. Rotating parts out of balance.
2. Tire or wheel out of round.
3. Hub or knuckle out of round or distorted.

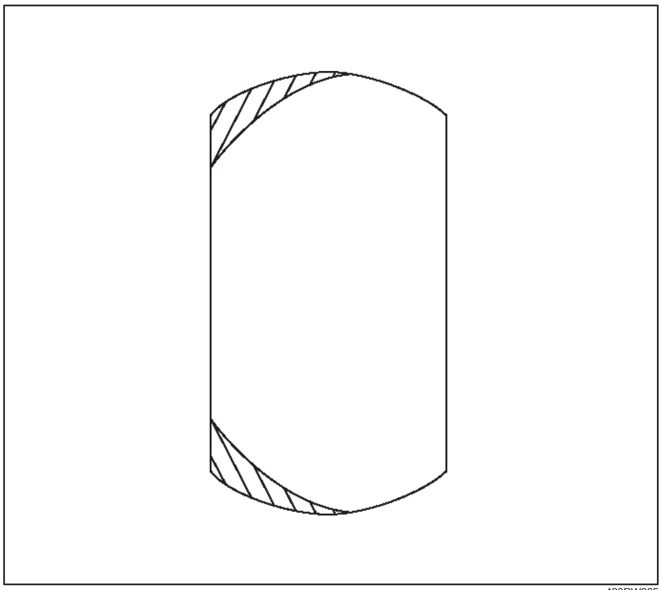
Localized tread wear.



480RW004

1. Once spotty wear develops in tread due to hard braking or abrupt starting, localized wear tends to be promoted.

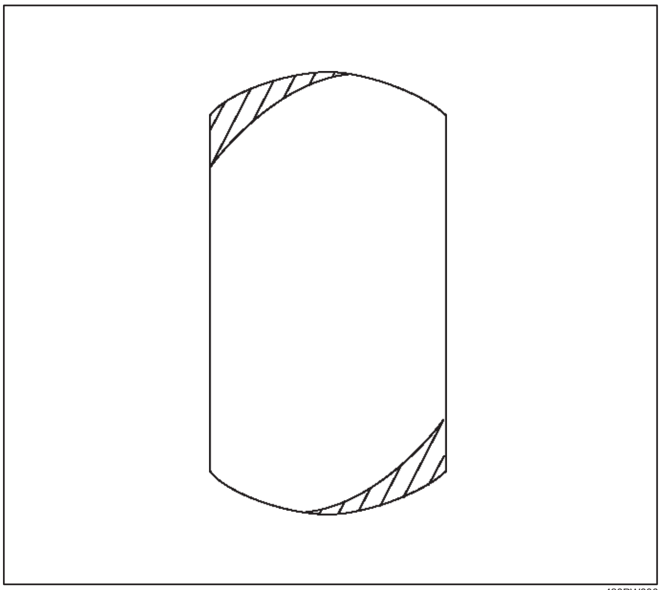
Shoulder wear (generally wear develops in outer shoulder):



480RW005

1. Camber or toe-in incorrect.
2. Shoulder wear caused by repeated hard-cornering.

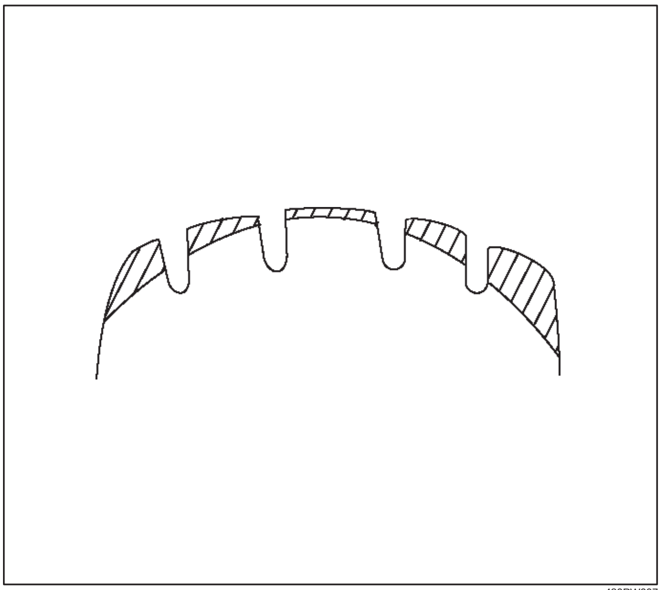
Wear in shoulders at points opposed to each other.



480RW006

1. Tire or wheel out of round or distorted.
2. Play in bearings or ball joint.

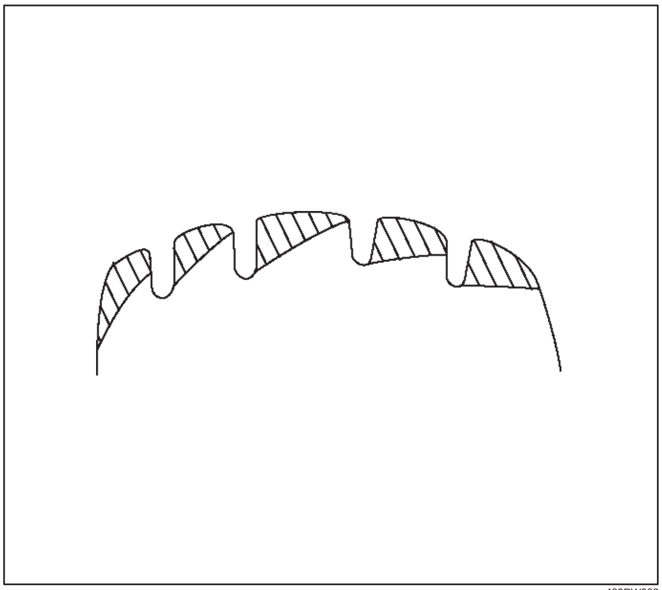
Premature wear in shoulders.



480RW007

1. Flexing of tire excessive due to under-inflation.

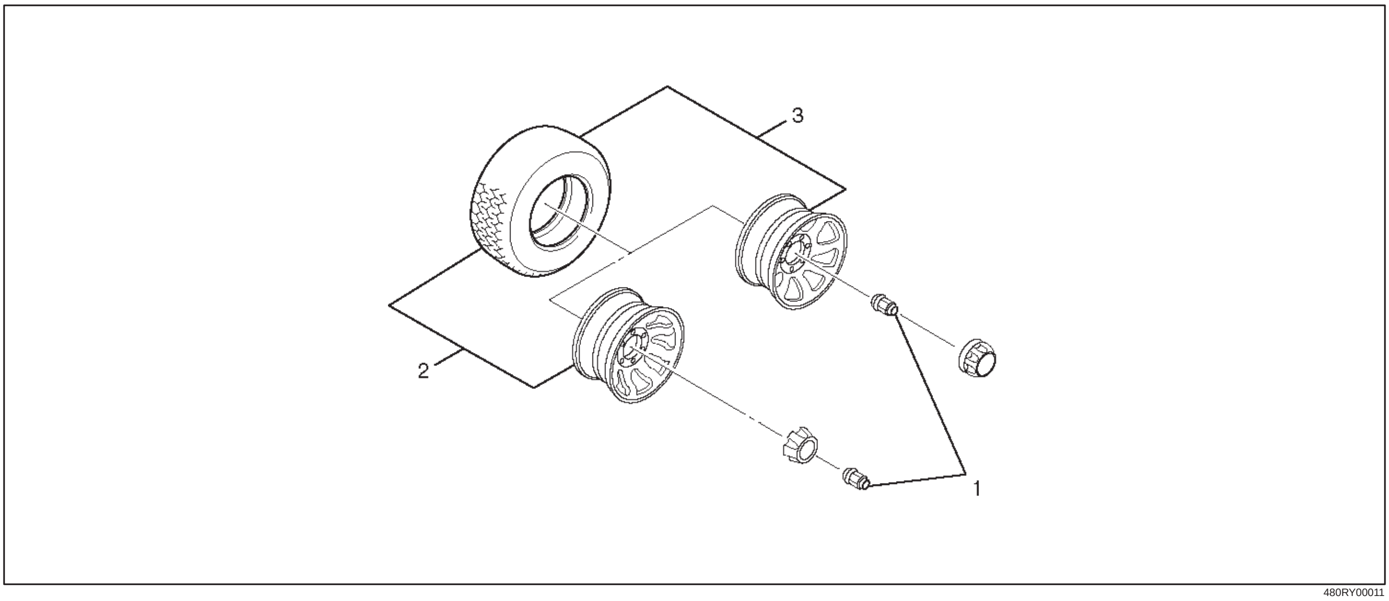
One sided feather edging.



1. Wear caused by repeated hard cornering.
2. Camber or toe-in incorrect.

Wheel

Wheel and Associated Parts



Legend

(1) Wheel Lug Nut

(2) Alumi Wheel and Tire

(3) Steel Wheel and Tire

Removal

1. Loosen wheel lug nut by approximately 180 g (half a rotation), then raise the vehicle and remove the nuts.
2. Remove wheel and tire.

NOTE: Never use heat to loosen a tight wheel lug nut. The application of heat to the hub can shorten the life of the wheel and may cause damage to wheel bearings.

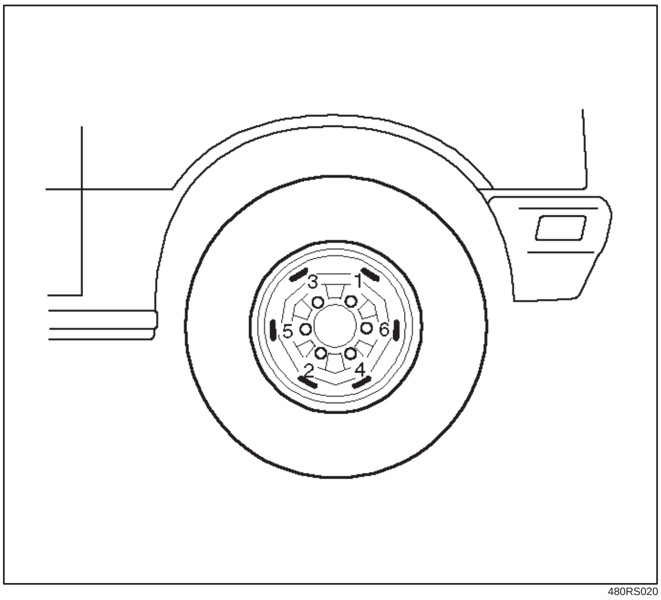
Installation

1. Install wheel and tire.
2. Install wheel lug nut, and lower the vehicle. Tighten the wheel lug nuts to the specified torque in numerical order.

   Torque: 118 N·m (87 lb ft)

CAUTION: Before installing wheels, remove any build-up of corrosion on the wheel mounting surface and brake disc mounting surface by scraping and wire brushing. Installing wheels without good metal-to-metal contact at mounting surfaces can cause wheel nuts to loosen, which can later allow a wheel to come off while the vehicle is moving.

NOTE: Valve caps should be on the valve stems to keep dust and water out.



Tire

Tire Replacement

When replacement is necessary, the original metric the size should be used. Most metric tire sizes do not have exact corresponding alphanumeric tire sizes. It is recommended that new tires be installed in pairs on the same axle. If necessary to replace only one tire, it should be paired with tire having the most tread, to equalize braking traction.

CAUTION: Do not mix different types of tires such as radial, bias and bias-belted tires except in emergencies, because vehicle handling may be seriously affected and may result in loss of control.

Tire Dismounting

Remove valve cap on valve step and deflate the tire. Then use a tire changing machine to mount or dismount tires. Follow the equipment manufacturer's instruction. Do not use hand tools or tire lever alone to change tires as they may damage the tire beads or wheel rim.

Tire Mounting

Rim bead seats should be cleaned with a wire brush or coarse steel wool to remove lubricants, and light rust. Before mounting a tire, the bead area should be well lubricated with an approved tire lubricant.
After mounting, inflate the tire to 196kPa (28 psi) so that beads are completely seated. Inflate the air to specified pressure and install valve cap to the stem.

WARNING: NEVER STAND OVER TIRE WHEN INFLATING. BEAD MAY BREAK WHEN BEAD SNAPS OVER RIM'S SAFETY HUMP AND CAUSE SERIOUS PERSONAL INJURY.

NEVER EXCEED 240 KPA (35 PSI) PRESSURE WHEN INFLATING. IF 240 KPA (35 PSI) PRESSURE WILL NOT SEAT BEADS, DEFLATE, RE-LUBRICATE AND RE-INFLATE. OVER INFLATION MAY CAUSE THE BEAD TO BREAK AND CAUSE SERIOUS PERSONAL INJURY.

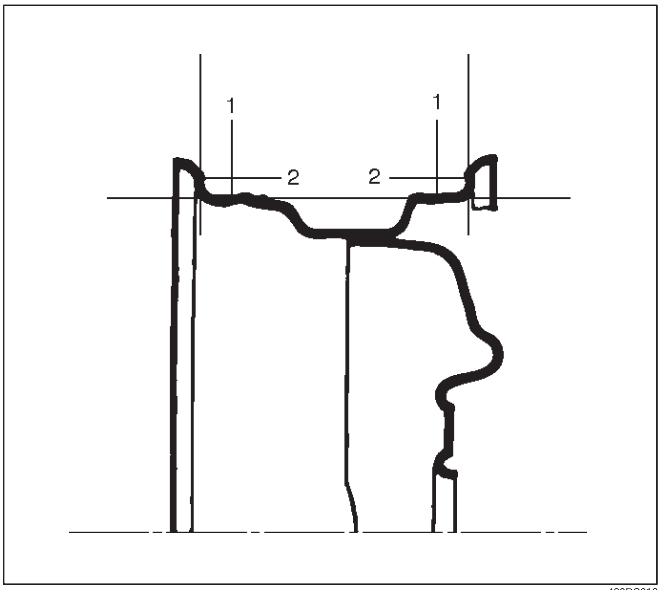
Tire Repair

There are many different materials on the market used to repair tires.
Manufacturers have published detailed instructions on how and when to repair tires. These instructions can be obtained from the tire manufacturer if they are not included with the repair kit.

Wheel Inspection

Damaged wheels and wheels with excessive run-out must be replaced.
Wheel run out at rim (Base on hub Bore):

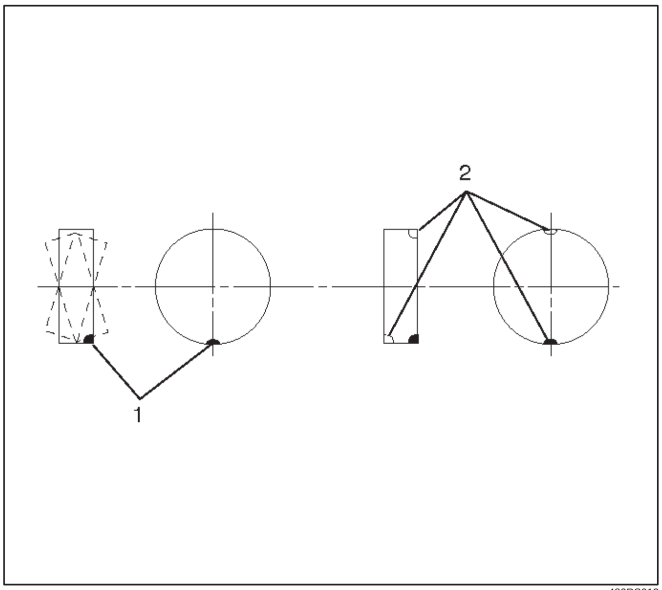
Steel	Aluminum
1– Vertical play: Less than 1.5 mm (0.059 in)	1– Vertical play: Less than 0.7 mm (0.028 in)
2– Horizontal play: Less than 1.5 mm (0.059 in)	2– Horizontal play: Less than 0.7 mm (0.028 in)



480RS012

General Balance Procedure

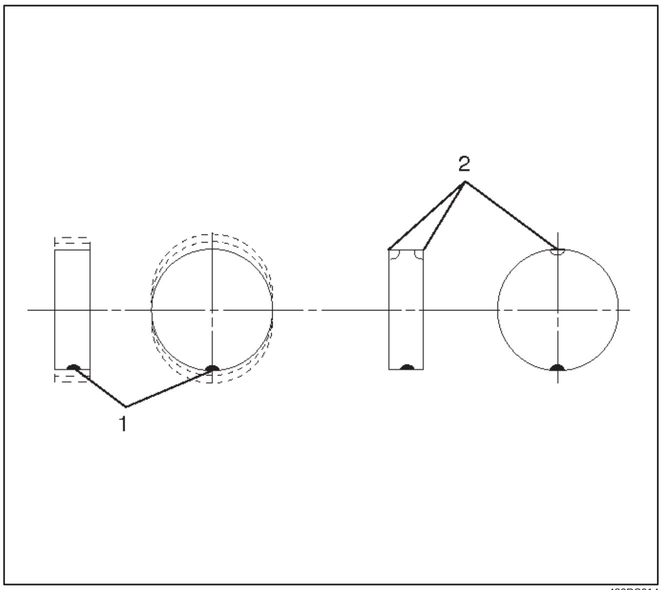
Deposits of mud, etc. must be cleaned from the inside of the rim.
The tire should be inspected for the following: match mount paint marks, bent rims, bulges, irregular tire wear, proper wheel size and inflation pressure. Then balance according to the equipment manufacturer's recommendations.
There are two types of wheel and tire balance.
Static balance is the equal distribution of weight around the wheel.
Assemblies that are statically unbalanced cause a bouncing action called tramp. This condition will eventually cause uneven tire wear.



480RS013

Legend
(1) Heavy Spot Wheel Shimmy
(2) Add Balance Weights Here

Dynamic balance is the equal distribution of weight on each side of the wheel center-line so that when the tire spins there is no tendency for the assembly to move from side to side. Assemblies that are dynamically unbalanced may cause shimmy.



480RS014

Legend
(1) Heavy Spot Wheel Hop
(2) Add Balance Weights Here

WARNING: STONES SHOULD BE REMOVED FROM THE TREAD TO AVOID OPERATOR INJURY DURING SPIN BALANCING AND TO OBTAIN A GOOD BALANCE.

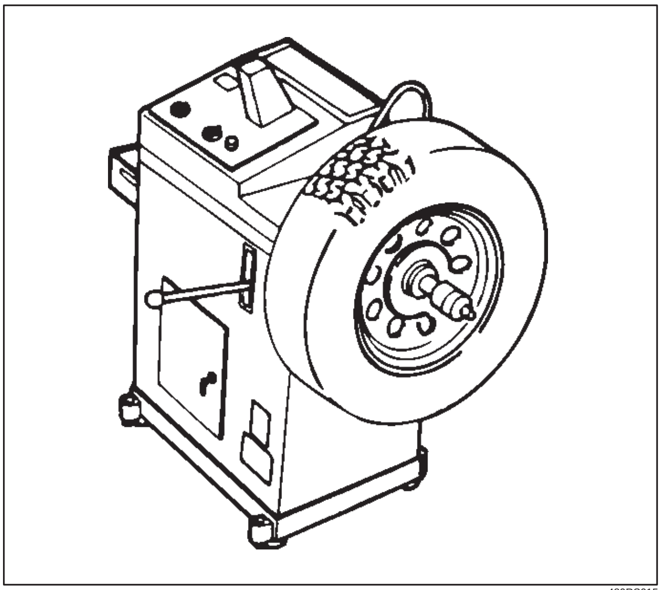
Balancing Wheel and Tire

On-vehicle Balancing

On-Vehicle balancing methods vary with equipment and tool manufacturers. Be sure to follow each manufacturer's instructions during balancing operation.

Off-vehicle Balancing

Most electronic off-vehicle balancers are more accurate than the on-vehicle spin balancers. They are easy to use and give a dynamic balance. Although they do not correct for drum or disc unbalance (as on- vehicle spin balancing does), they are very accurate.



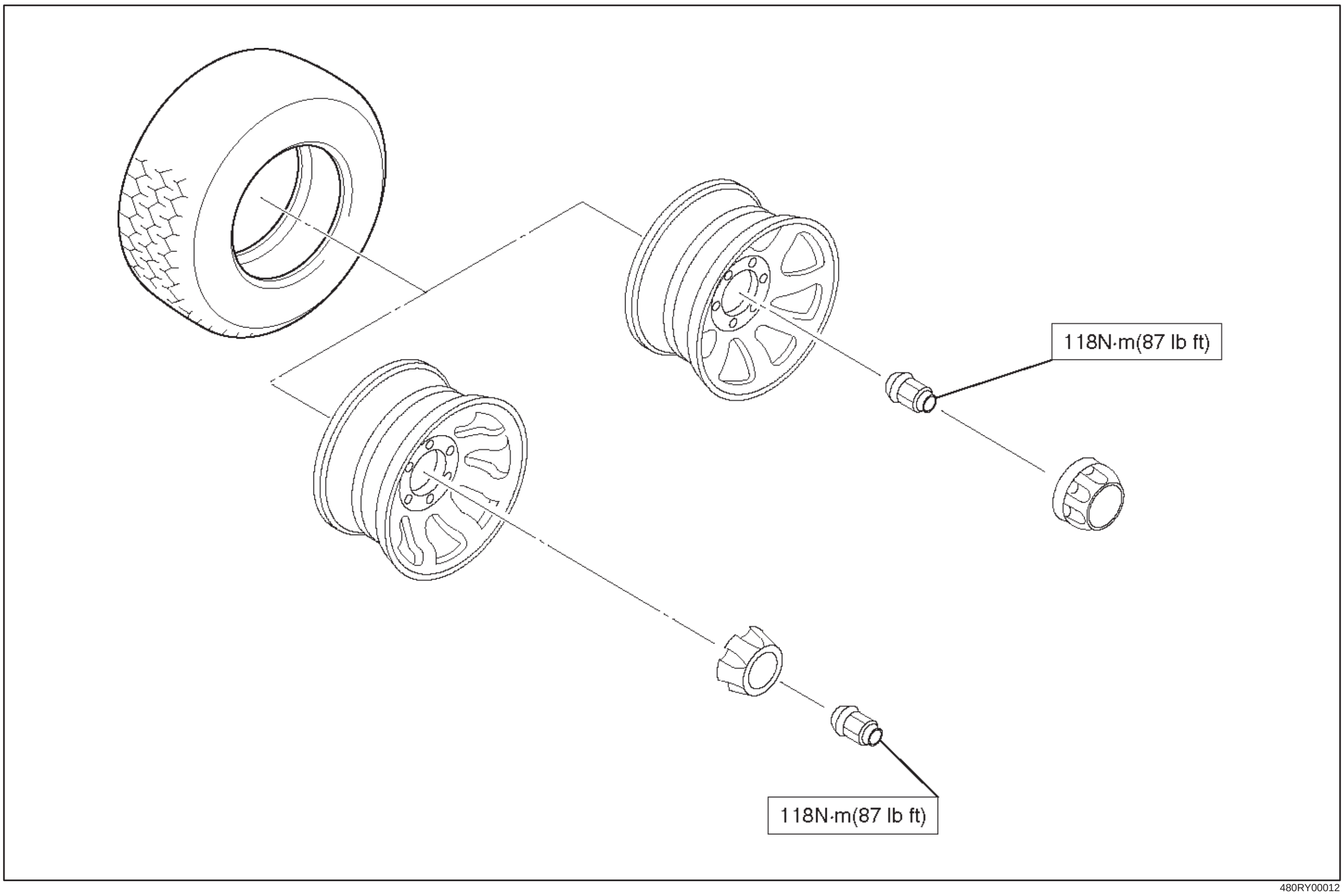
480RS015

Main Data and Specifications

General Specifications

Wheels	Size	16 x 7JJ	16 x 7JJ
	Offset	38.0 mm (1.50 in)	38.0 mm (1.50 in)
	P.C.D., wheel studs	139.7 mm (5.50 in)	139.7 mm (5.50 in)
Standard tire	Size	P225/75R16	P245/70R16
	Pressure(Front)	200 kPa (29 psi)	180 kPa (26 psi)
	Pressure(Rear)	200 kPa (29 psi)	180 kPa (26 psi)

Torque Specifications



RODEO

SUSPENSION

INTELLIGENT SUSPENSION SYSTEM

CONTENTS

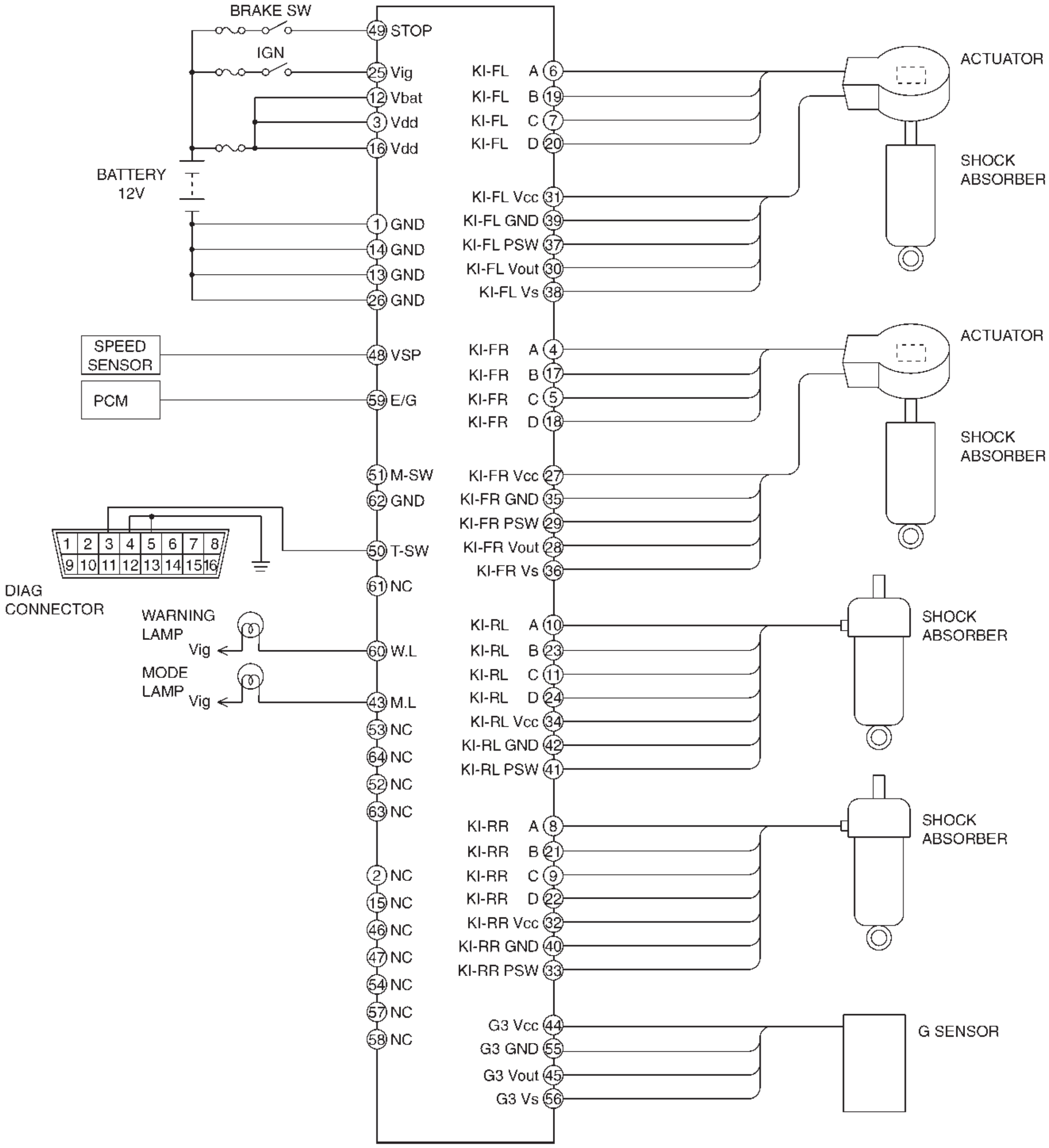
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Intellignet suspension system uses a microcomputer as a control unit to judge running conditions including engine revolution from Powertrain Control Module, vehicle speed from vehicle speed sensor, a brake switch signal, and vertical and horizontal G-sensor signal, then sets optimum damping force so that best running stability can be achieved.



CONTROL UNIT PIN ASSIGNMENT

1	2	3	4	5	6	7	8	9	10	11	12	13	27	28	29	30	31	32	33	34	43	44	45	46	47	48	49	50	51	52	53
14	15	16	17	18	19	20	21	22	23	24	25	26	35	36	37	38	39	40	41	42	54	55	56	57	58	59	60	61	62	63	64

826RY00019

PIN ASSIGNMENT TABLE

PIN No.	NAME	PIN No.	NAME	PIN No.	NAME	PIN No.	NAME
1	GND	17	KI-FR B	33	KI-RR PSW	49	STOP
2	NC	18	KI-FR D	34	KI-RL Vcc	50	T-SW
3	Vdd	19	KI-FL B	35	KI-FR GND	51	M-SW
4	KI-FR A	20	KI-FL D	36	KI-FR Vs	52	NC
5	KI-FR C	21	KI-RR B	37	KI-FL PSW	53	NC
6	KI-FL A	22	KI-RR D	38	KI-FL Vs	54	NC
7	KI-FL C	23	KI-RL B	39	KI-FL GND	55	G3 GND
8	KI-RR A	24	KI-RL D	40	KI-RR GND	56	G3 Vs
9	KI-RR C	25	Vig	41	KI-RL PSW	57	NC
10	KI-RL A	26	GND	42	KI-RL GND	58	NC
11	KI-RL C	27	KI-FR Vcc	43	M.L	59	E/G
12	Vbat	28	KI-FR Vout	44	G3 Vcc	60	W.L
13	GND	29	KI-FR PSW	45	G3 Vout	61	NC
14	GND	30	KI-FL Vout	46	NC	62	GND
15	NC	31	KI-FL Vcc	47	NC	63	NC
16	Vdd	32	KI-RR Vcc	48	VSP	64	NC

NC: NO CONNECTION

System Components

Control Unit, 3 Vertical G-sensors, Horizontal G-sensor, 4 Actuators, 4 Adjustable Damping Force Shock Absorbers, and Warning Lamp.

Control Unit

The Control Unit consists of Adjustable Damping Force Shock Absorber control circuits, fault detector, and a fail-safe. It drives the actuator according to the signal from each sensor.
The Control Unit has a self-diagnosing function which can indicate faulty circuits during diagnosis.
The Control Unit is mounted in the center of the instrument panel.

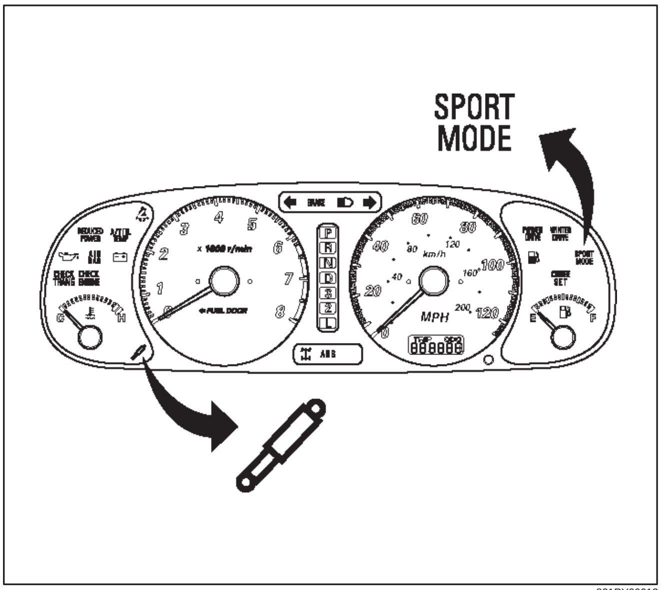
Actuator

Front actuators installed on front shock absorbers and rear actuator installed inside rear shock absorbers control damping force of shock absorber by the Control Unit signal.

Adjustable Damping Force Shock Absorber

This type shock absorber is used in front and rear intelligent suspension. According to running condition the Control Unit changes shock absorber damping force and obtains good running stability.

Warning Lamp



821RY00013

Vehicles equipped with the Intelligent Suspension have an amber warning lamp in the instrument panel. The warning lamp will illuminate if a malfunction in the Intelligent Suspension System is detected by the Control Unit. In case of an important electronic malfunction, the Control Unit will turn“ON” the warning lamp.

Vertical G-Sensor

Front G-sensors installed inside front actuators and the rear G-sensor installed on the rear left frame side detect the vehicle vertical gravity and send a signal to the Control Unit.

Horizontal G-Sensor

The G-sensor installed inside the Control Unit detects the vehicle turning speed and sends a signal to the Control Unit.

Acronyms and Abbreviations

Several acronyms and abbreviations are commonly used throughout this section:

BATT
Battery

DLC
Data Link Connector

DTC
Diagnostic Trouble Code

FL
Front Left

FR
Front Right

GND
Ground

HARN
Harness

IG
Ignition

PCM
Powertrain Control Module

RL
Rear Left

RR
Rear Right

SW
Switch

W/L
Warning Lamp

General Diagnosis

General Information

Intelligent Suspension System troubles can be classified into two types, those which can be detected by the warning lamp and those which can be detected as a vehicle abnormality by the driver.
In either case, locate the fault in accordance with the“BASIC DIAGNOSTIC FLOWCHART” and repair.
Please refer to Section 3 for the diagnosis of mechanical troubles such as abnormal noise, vehicle pulls, excessive tire wear, wheel hop and shimmy, shake or vibration.

Service Precautions

Required Tools and Items:

- Box Wrench
- Special Tool

Some diagnosis procedures in this section require the installation of a special tool.

J-39200 High Impedance Multimeter

When circuit measurements are requested, use a circuit tester with high impedance.

Computer System Service Precautions

The Intelligent Suspension System interfaces directly with the Control Unit which is a control computer that is similar in some regards to the Powertrain Control Module. These modules are designed to withstand normal current draws associated with vehicle operation. However care must be taken to avoid overloading any of the Control Unit circuits. In testing for opens or shorts, do not ground or apply voltage to any of the circuits unless instructed to do so by the appropriate diagnostic procedure. These circuits should only be tested with a high impedance multimeter (J-39200) or special tools as described in this section. Power should never be removed or applied to any control module with the ignition in the “ON” position.Before removing or connecting battery cables, fuses or connectors, always turn the ignition switch to the“OFF” position.

General Service Precautions

The following are general precautions which should be observed when servicing and diagnosing the Intelligent Suspension System and/or other vehicle systems. Failure to observe these precautions may result in Intelligent Suspension System damage.

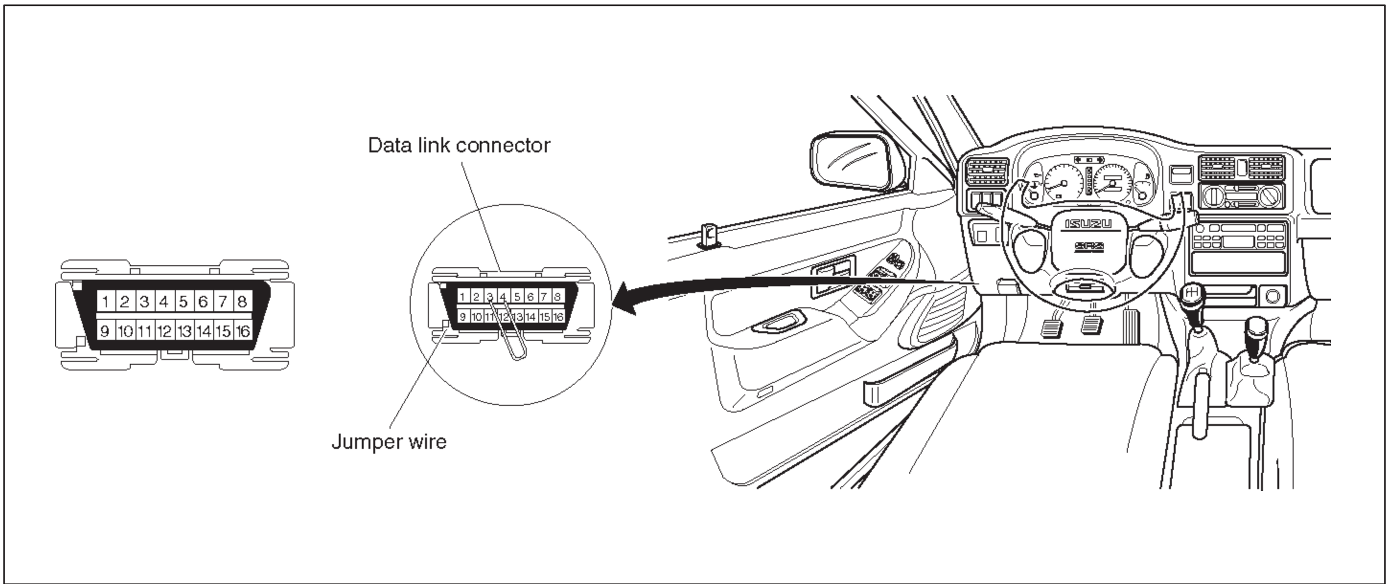
- If welding work is to be performed on the vehicle using an electric arc welder, the Control Unit connectors should be disconnected before the welding operation begins.
- The Control Unit connectors should never be connected or disconnected with the ignition“ON”.

Parts Handling

Be careful when handling the actuator, control unit, or G-sensor. They should not be dropped or thrown, because the semi-conductor G-sensor tip damage may result.

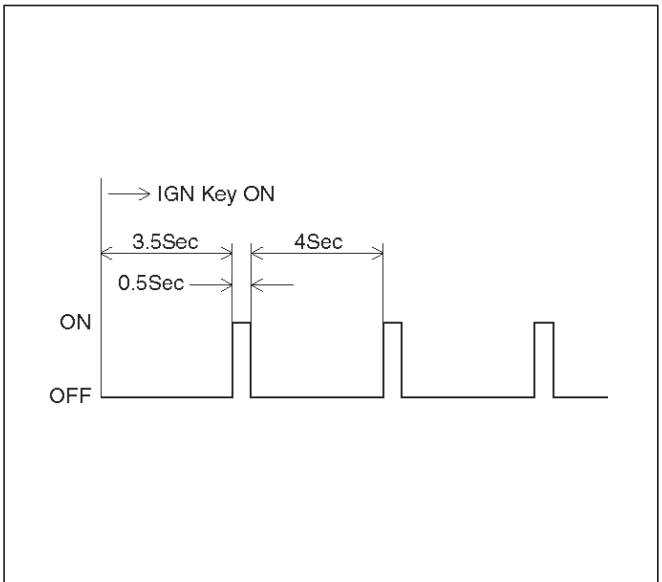
FLASHING CODES

1. ON BOARD DIAGNOSIS (SELF-DIAGNOSIS)
   1. The Control Unit conducts a self-test of most of the wiring and components in the system each time the key is turned ON. If a fault is detected the Control Unit will store a Diagnostic Trouble Code (DTC) in memory. It's a number that corresponds to a specific problem.
   2. When the problem detected is important: the warning lamp turns on until the fault is repaired and the Control Unit memory is cleared.
2. DIAGNOSTIC TROUBLE CODES (DTC)
   1. DTC can be displayed by the Control Unit by shorting together terminals 3 and 4 or 5 of the Diagnosis Connector (C-34) located left side of instrument panel.



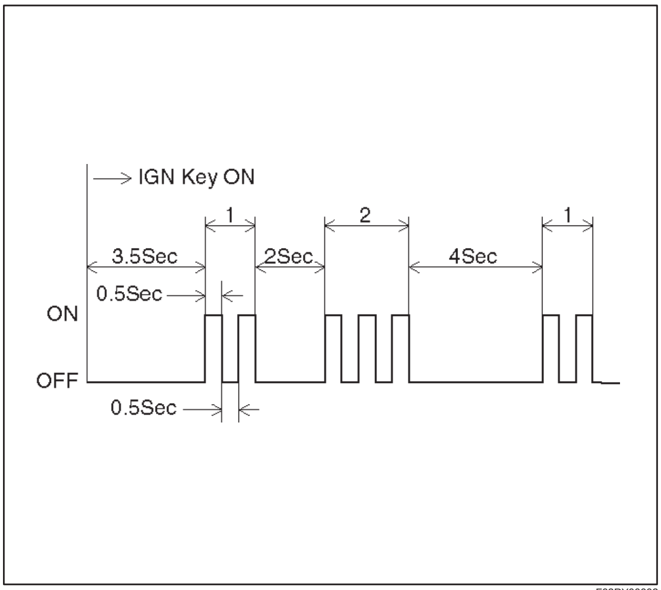
350RY00004

Normal



F03RY00001

Abnormal

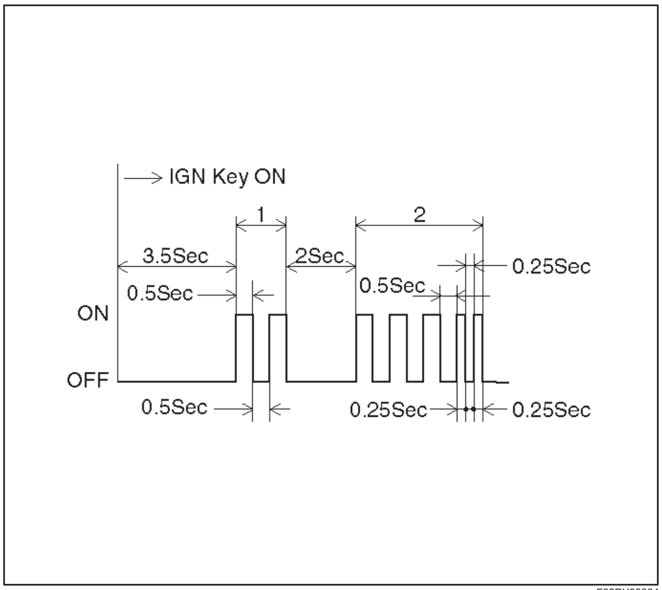


F03RY00002

Legend

(1) Diagnostic Trouble Code 2
(2) Diagnostic Trouble Code 3

It depends below in the case that the code that also, shows a malfunction place is added.



F03RY00004

Legend

1. Diagnostic Trouble Code 2
2. Diagnostic Trouble Code 3 + Position Code 2 Position Code

1: Actuator Front RH, G-sensor Front RH

2: Actuator Front LH, G-sensor Front LH

3: Actuator Rear RH, G-sensor Rear

4: Actuator Rear LH, Lateral G-sensor

3. After this, the warning lamp will be OFF for 3.5 seconds and then will flash each DTC.
   1. When there are more than 9 flashes this means that the indicator is constantly flashing, OFF for 4 seconds ON for 0.5 seconds. In this case there is no DTC stored in memory.
   2. When there are less than 9 flashes you will see DTC of a digit and when all codes have been displayed they are displayed again beginning from the first one.
   3. The DTCs are displayed in lower number order.

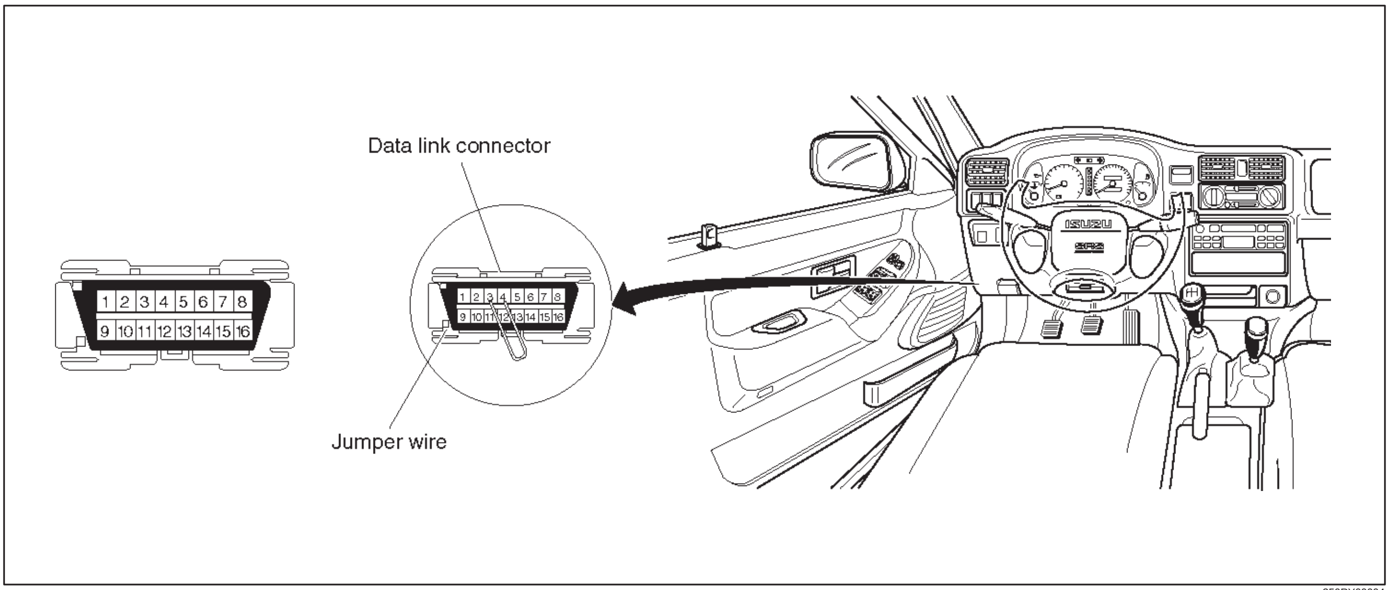
CLEAR DTC

Remark: If you clear the DTC (Diagnosis Trouble Codes) you will not be able to read any codes recorded during the last Trouble.

Remark: To be able to use the DTC again to identify a problem you will need to reproduce the fault or the problem. This may require a new test drive or just turning the ignition on (this depends on the nature of the fault).

1. Short the Diagnosis Connector C-34 terminal 3 to terminal 4 or 5 (ground).

- IF it is flashing and the flash is 0.5 seconds ON and 4 seconds OFF without interruption, this means that there is no DTC. The DTCs are already cleared.



350RY00004

2. IF a code is flashed, wait until the lamp is flashing.
3. Conduct brake switch ON/OFF 6 or more times on condition that one operation is within 2 seconds.

INTERMITTENT CONDITIONS

If the Warning Lamp flashes a diagnostic trouble code as intermittent, or if after a test drive a DTC does not reappear though the detection conditions for this DTC are present: the problem is most likely a faulty electrical connection or loose wiring. Terminals and grounds should always be the prime suspect. Intermittents rarely occur inside sophisticated electronic components such as the Control Unit.

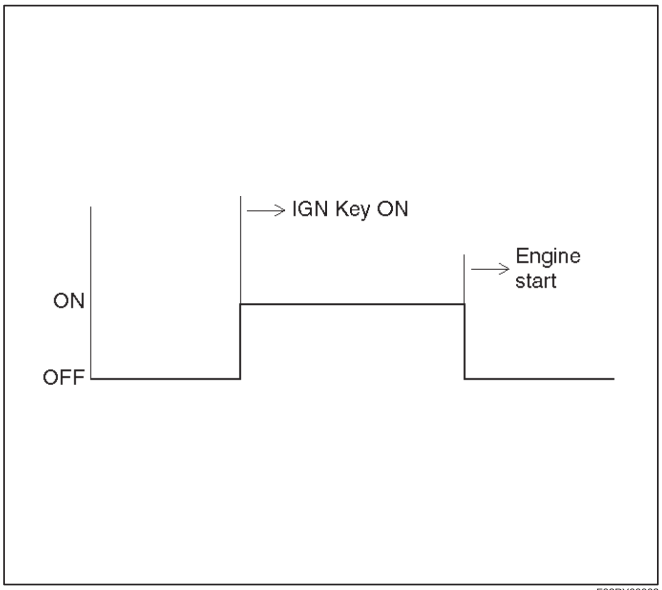
Use the DTC information to understand which wires and sensors are involved.

When an intermittent problem is encountered, check suspect circuits for:

1. Poor terminal to wire connection.
2. Terminals not fully seated in the connector body (backed out).
3. Improperly formed or damaged terminals.
4. Loose, dirty, or corroded ground connections:
   HINT: Any time you have an intermittent in more than one circuit, check whether the circuits share a common ground connection.
5. Pinched or damaged wires.
6. Electro-Magnetic Interference (EMI):
   HINT: Check that all wires are properly routed away from spark plug wires, distributor wires, coil, and generator. Also check for improperly installed electrical options, such as lights, 2-way radios, etc.

BULB CHECK

When the starter switch is turned on in the normal state, the Control Unit turns on the Warning Lamp to check the bulb. After the engine starts, the Warning Lamp turns off.

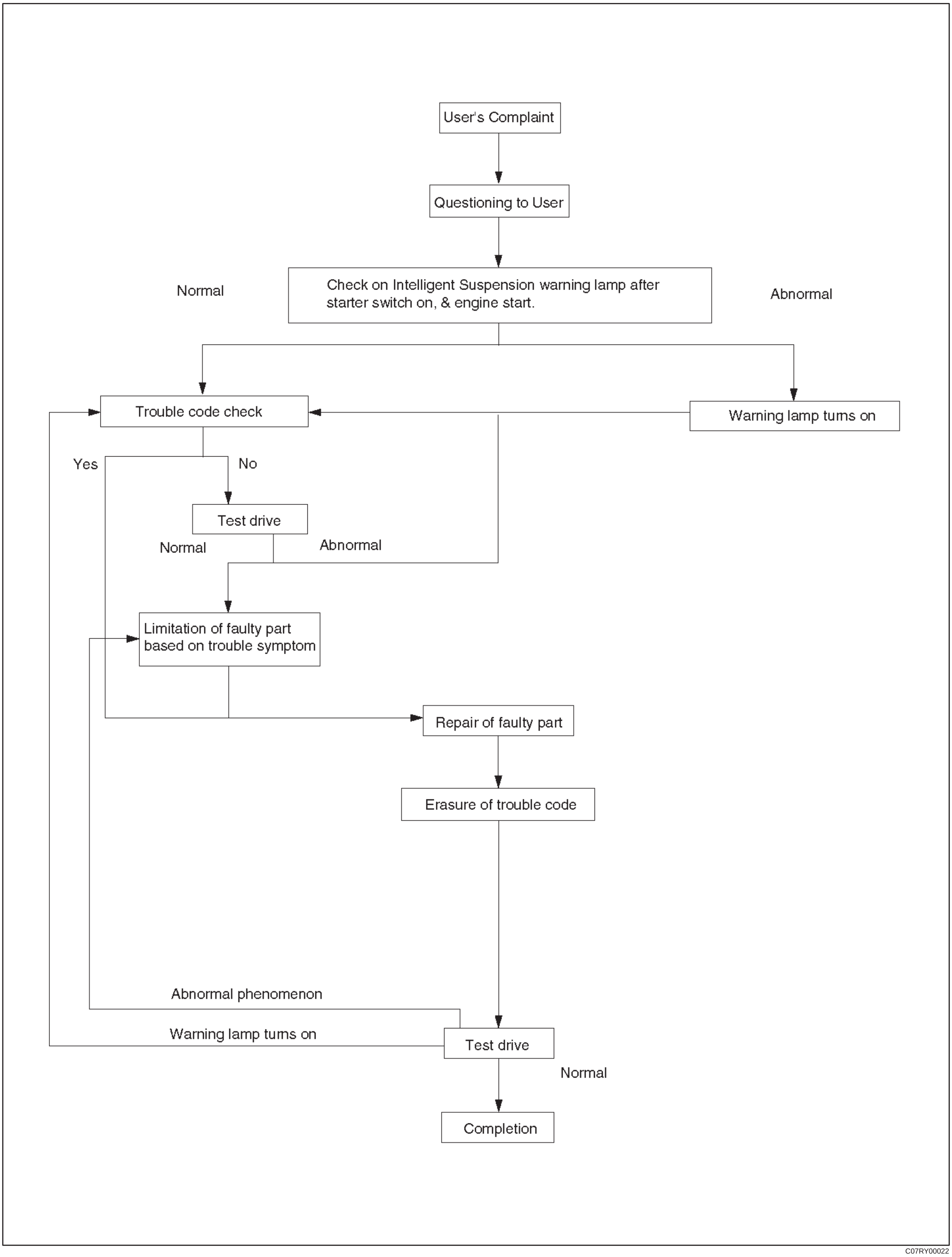


F03RY00003

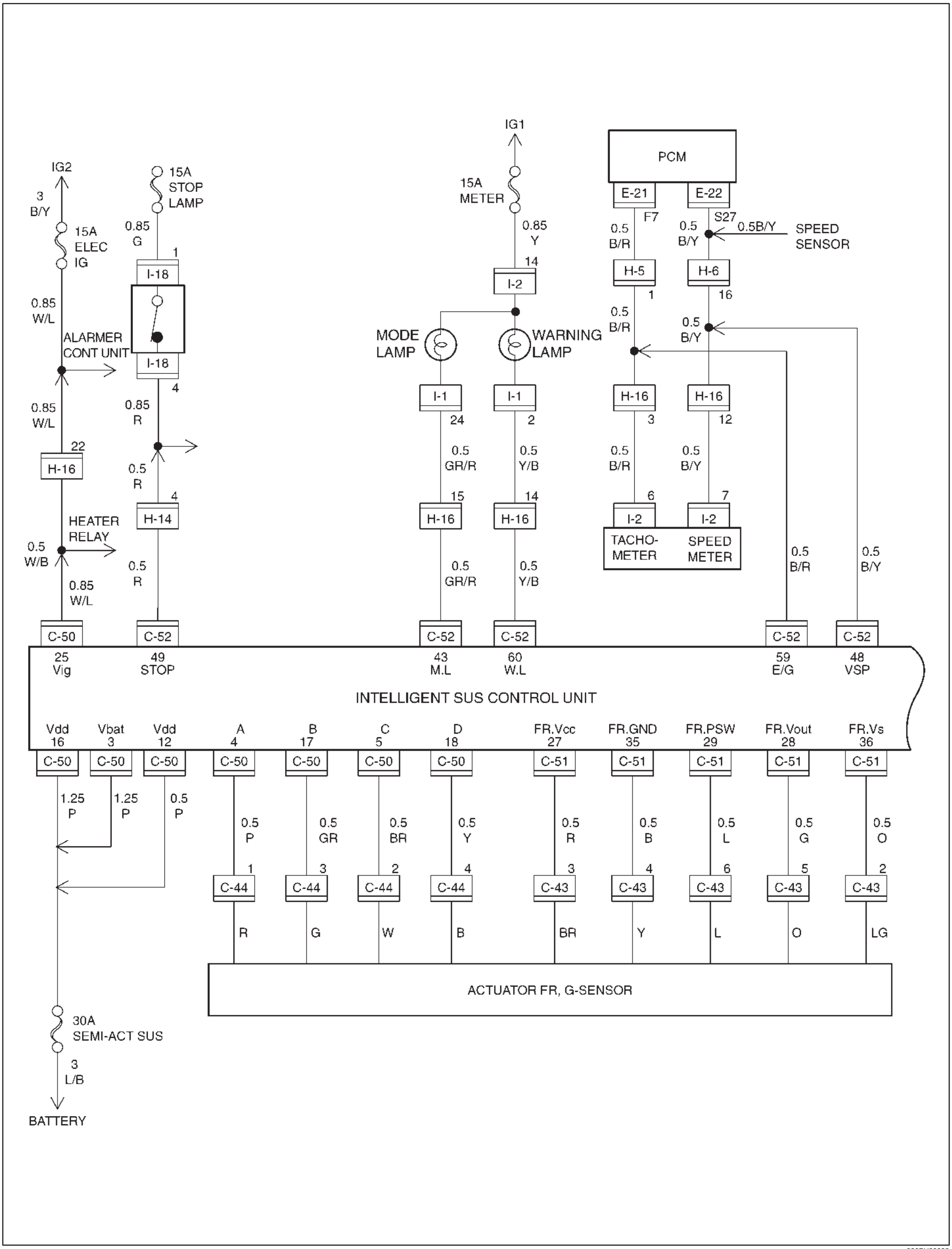
DTC CHECK

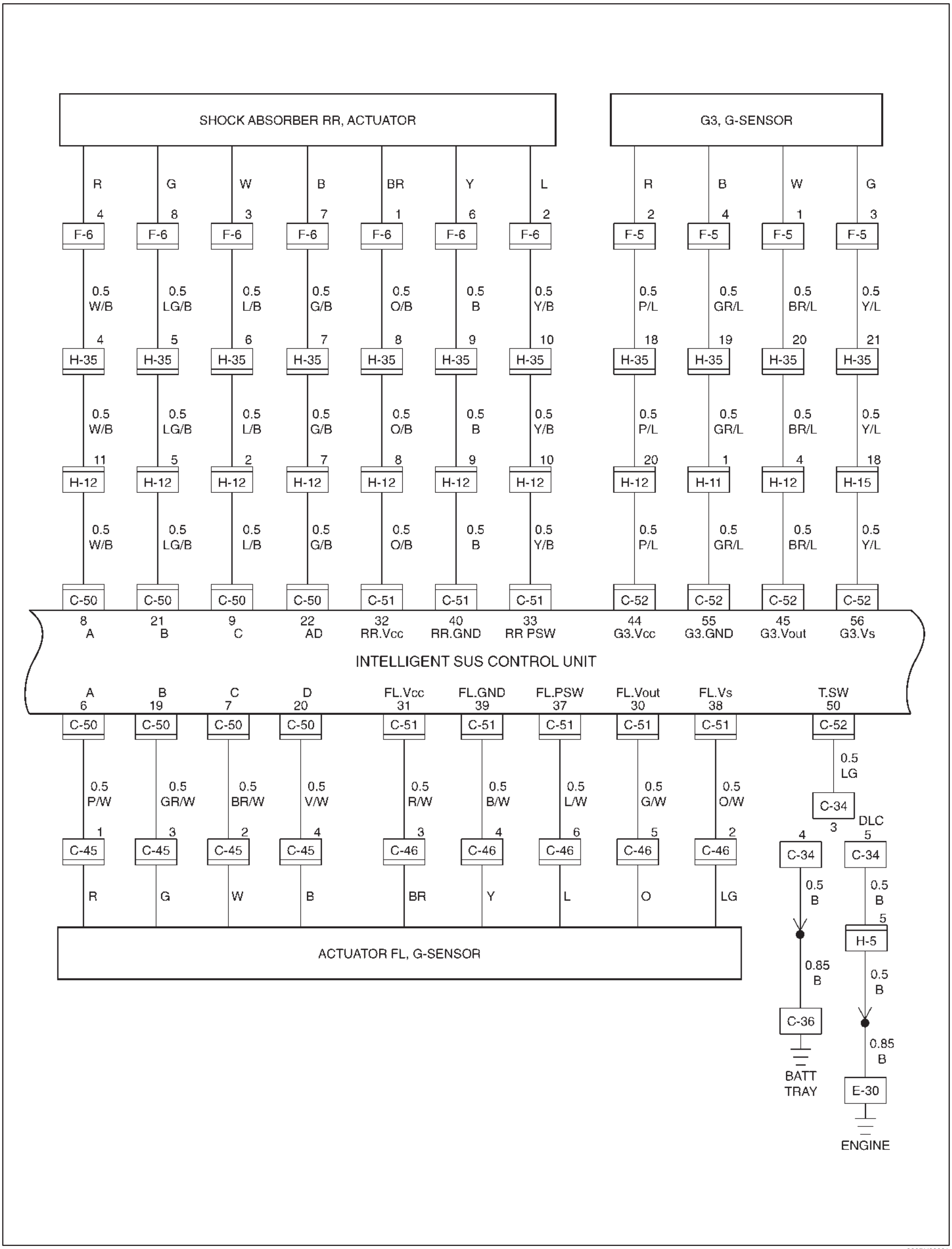
1. Diagnosis Trouble Codes (DTC) have been identified by FLASHING CODES.
2. You have written the list of the DTC. The order of the malfunctions has no meanings for this Control Unit. Usually only one or two malfunctions should be set for a given problem.
3. Check directly the DTCs you identified. The DTC are sorted by number:
   DIAGNOSTIC TROUBLE CODES.

Basic Diagnosis Flow

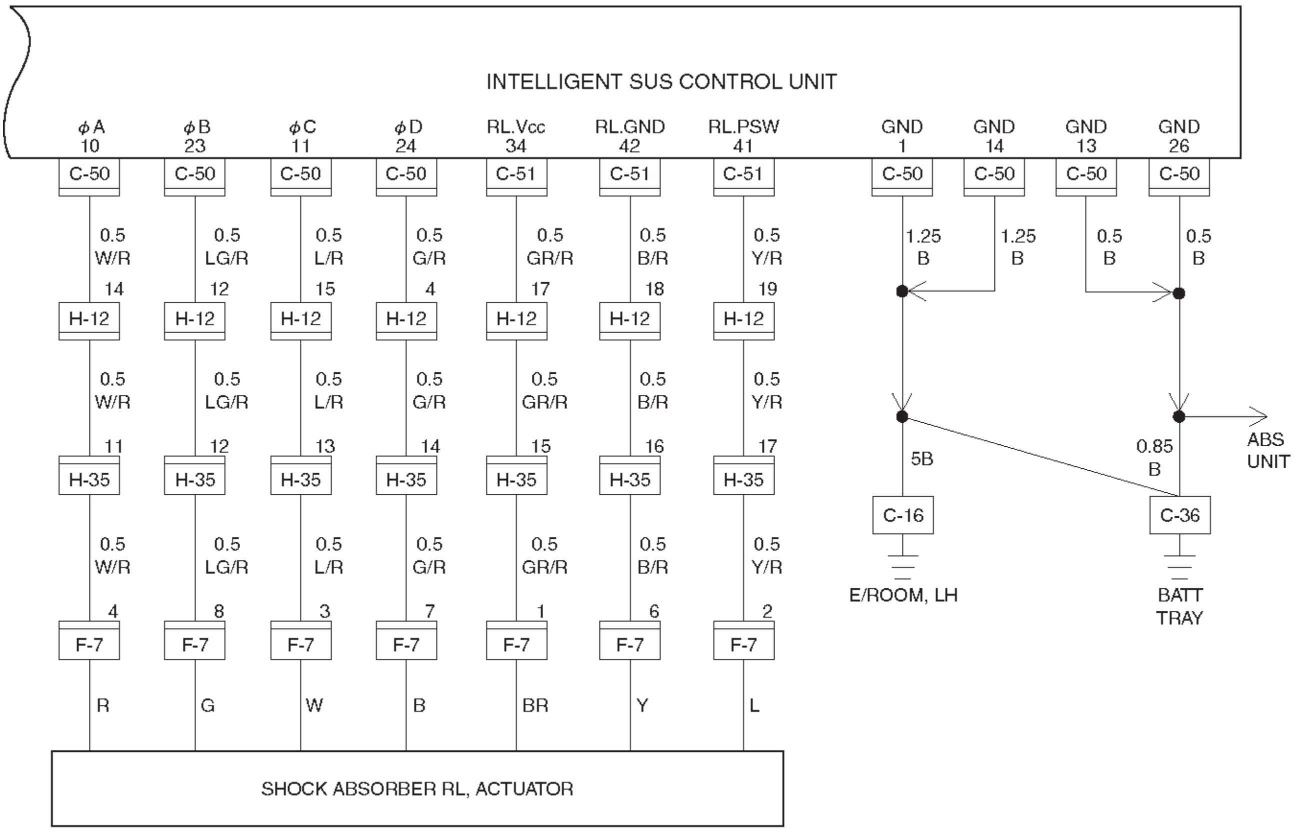


Circuit Diagram



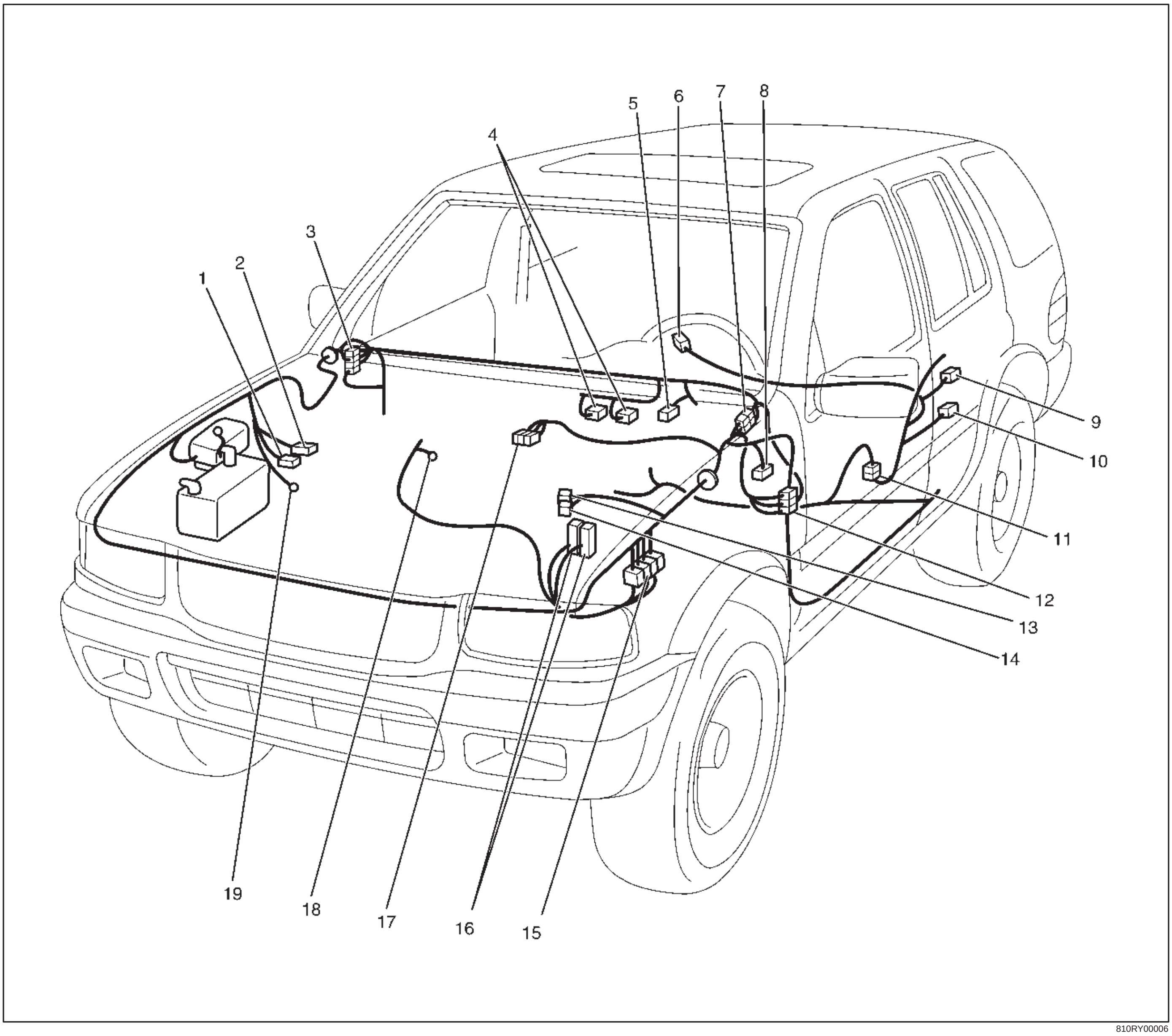

SHOCK ABSORBER RR, ACTUATOR
G3, G-SENSOR
R G W B BR Y L
R B W G
F-6 F-5
0.5 W/B
0.5 LG/B
0.5 L/B
0.5 G/B
0.5 O/B
0.5 B
0.5 Y/B
0.5 P/L
0.5 GR/L
0.5 BR/L
0.5 Y/L
H-35
H-12 H-11 H-15
C-50 C-51 C-52
8 A
21 B
9 C
22 AD
32 RR.Vcc
40 RR.GND
33 RR PSW
44 G3.Vcc
55 G3.GND
45 G3.Vout
56 G3.Vs
INTELLIGENT SUS CONTROL UNIT
A 6
B 19
C 7
D 20
FL.Vcc 31
FL.GND 39
FL.PSW 37
FL.Vout 30
FL.Vs 38
T.SW 50
0.5 P/W
0.5 GR/W
0.5 BR/W
0.5 V/W
0.5 R/W
0.5 B/W
0.5 L/W
0.5 G/W
0.5 O/W
0.5 LG
C-34
DLC
C-45 C-46
R G W B BR Y L O LG
ACTUATOR FL, G-SENSOR
0.5 B
0.85 B
H-5
C-36
BATT TRAY
E-30
ENGINE

826RY00021


INTELLIGENT SUS CONTROL UNIT
ϕA 10
ϕB 23
ϕC 11
ϕD 24
RL.Vcc 34
RL.GND 42
RL.PSW 41
GND 1
GND 14
GND 13
GND 26
C-50
C-51
0.5 W/R
0.5 LG/R
0.5 L/R
0.5 G/R
0.5 GR/R
0.5 B/R
0.5 Y/R
1.25 B
0.5 B
H-12
H-35
F-7
R
G
W
B
BR
Y
L
SHOCK ABSORBER RL, ACTUATOR
5B
0.85 B
C-16
C-36
E/ROOM, LH
BATT TRAY
ABS UNIT

D03RY00006

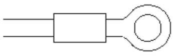
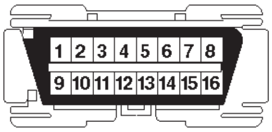
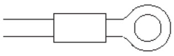
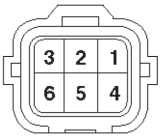
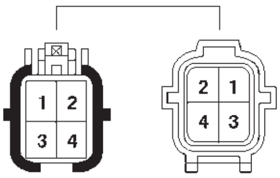
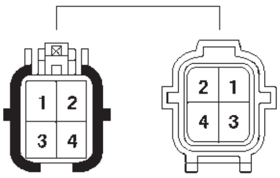
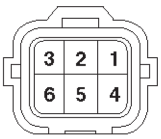
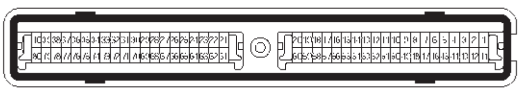
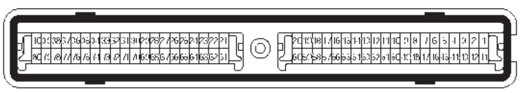
Parts Location

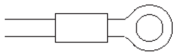
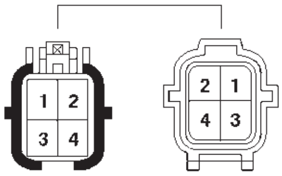
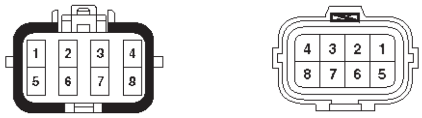
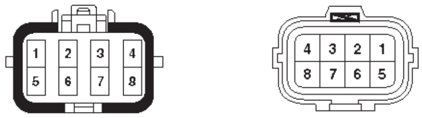
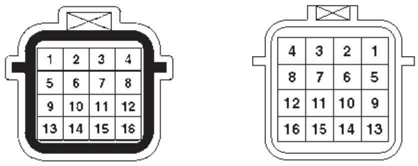
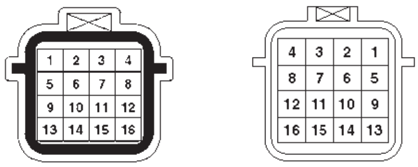
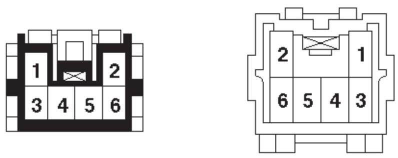
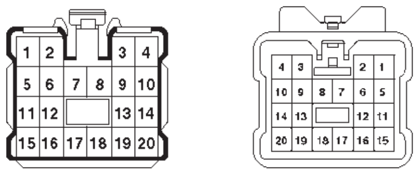
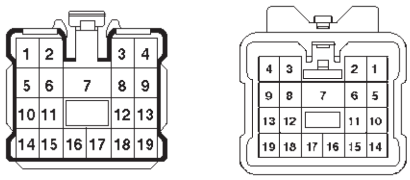


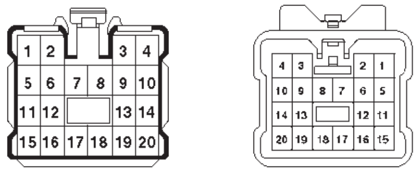
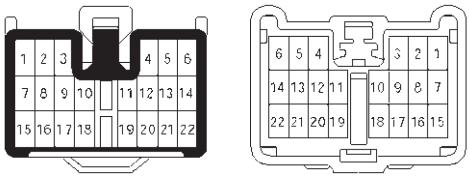
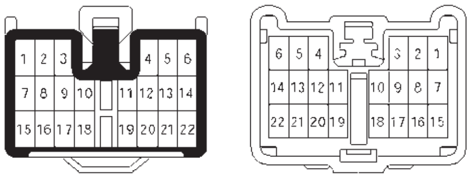
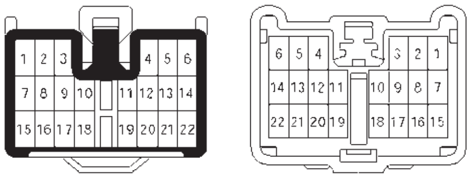
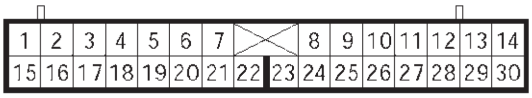
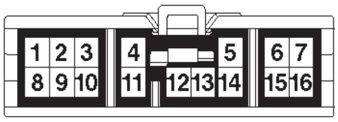
Legend

(1) C–44
(2) C–43
(3) H–12, H–13, H–14, H–18
(4) I–1, I–2
(5) I–18
(6) F–6
(7) H–31, H–32
(8) C–34
(9) F–7
(10) F–5
(11) H–35
(12) H–15, H–16, H–17
(13) C–46
(14) C–45
(15) H–5, H–6, H–7
(16) E–21, E–22
(17) C–50, C–51, C–52
(18) E–30
(19) C–36

Connector List

No.	Connector face
C-16	
C–34	
C-36	
C-43	
C-44	
C–45	
C–46	
E–21	
E–22	

No.	Connector face
E–30	
F–5	
F–6	
F–7	
H-5	
H-6	
H-11	
H-12	
H–14	

No.	Connector face
H–15	
H–16	
H–18	
H–35	
I–1	
I–2	
I–18	

Diagnostic Trouble Code (DTC) Identification

DTC No.	DTC NAME	CODE MEMORY	WARNING LAMP	NOTE
2	Actuator Coil Over Current	Yes	OFF	Stop drive circuit.
3	Actuator Coil/Position Sensor Open Circuit or Short	Yes	ON	Control stop in condition that actuator position fixed on R.
4	G–Sensor Open Circuit or Short	Yes	ON	Control stop in condition that actuator position fixed on R.
5	Vehicle Speed Sensor Open Circuit or Short	Yes	OFF	Control gain fixed on K3.
6	Stop Lamp Switch Open Circuit, Short or Contact Point Trouble	Yes	OFF	Drive control stop.
7	Engine Speed Signal Open Circuit or Short	Yes	OFF	Normal control.
9	Control Unit Abnormality	Yes	OFF	Control stop or normal drive circuit fixed on R mode.

DTC2 Actuator Coil Over Current

Circuit Description

The A, B, C, and D are the actuator motor coil terminals. DC 12V driving voltage is applied between terminals A and C and terminals B and D so that the shock absorber oil valves are rotated at every 7.5˚ step feed.

Diagnostic Aids

- Inspect the wiring for poor electrical connections between the control unit 24 way connector and the actuator connectors. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.
  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

DTC2 Actuator Coil Over Current

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the actuator connectors C–45, C–44, F–7, and F–6. 3. Measure the resistance between the actuator side connector C–44 terminals 1 and 2. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the actuator side connector C–44 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the actuator FR.	—	Go to *Step 4*	—
4	1. Measure the resistance between the actuator side connector C–45 terminals 1 and 2. Does the resistance indicate within the specified value?	6.4–7.2Ω	Go to *Step 5*	Go to *Step 6*
5	1. Measure the resistance between the actuator side connector C–45 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4–7.2Ω	Go to *Step 7*	Go to *Step 6*
6	Replace the actuator FL.	—	Go to *Step 7*	—
7	1. Measure the resistance between the shock absorber side connector F–6 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4–7.2Ω	Go to *Step 8*	Go to *Step 9*
8	1. Measure the resistance between the shock absorber side connector F–6 terminals 7 and 8. Does the resistance indicate within the specified value?	6.4–7.2Ω	Go to *Step 10*	Go to *Step 9*
9	Replace the rear shock absorber RR.	—	Go to *Step 10*	—

DTC2 Actuator Coil Over Current (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Measure the resistance between the shock absorber side connector F–7 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4–7.2Ω	Go to *Step 11*	Go to *Step 12*
11	1. Measure the resistance between the shock absorber side connector F–7 terminals 7 and 8. Does the resistance indicate within the specified value?	6.4–7.2Ω	Go to *Step 13*	Go to *Step 12*
12	Replace the rear shock absorber RL.	—	Go to *Step 16*	—
13	If all steps are correct, check the continuity between the control unit connector C–50 terminal 1 and connector terminal C50–4, C50–17, C50–5, C50–18, C50–6, C50–19, C50–7, C50–20, C50–8, C50–21, C50–9, C50–22, C50–10, C50–23, C50–11, and C50–24. Is there continuity?	—	Go to *Step 15*	Go to *Step 16*
14	Repair the circuit.	—	Go to *Step 16*	—
15	Replace the control unit.	—	Go to *Step 16*	—
16	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *"Basic Diagnosis Flow".*	Go to *Step 16*

DTC3 Actuator Coil/Position Sensor Open Circuit or Short

Circuit Description

The A, B, C, and D are the actuator motor coil terminals. DC 12V driving voltage is applied between terminals A and C and terminals B and D so that the shock absorber oil valves are rotated at every 7.5° step feed.
The PSW is actuator position signal and detects relative angles between the piston–rod and the control-rod. The actuator outputs the PSW to the control unit.

Diagnostic Aids

- Inspect the wiring for poor electrical connections between the control unit 16 way connector and the actuator connectors. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.
  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

DTC3 Actuator Coil/Position Sensor Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the actuator connectors C–50, C–45, C–44, F–7, and F–6. Is the continuity between the connector C–44 terminals 1 and 2?	—	Go to *Step 2*	Go to *Step 3*
2	Is the continuity between the connector C–44 terminals 3 and 4?	—	Go to *Step 4*	Go to *Step 3*
3	Replace the actuator FR.	—	Go to *Step 4*	—
4	Is the continuity between the connector C–45 terminals 1 and 2?	—	Go to *Step 5*	Go to *Step 6*
5	Is the continuity between the connector C–45 terminals 3 and 4?	—	Go to *Step 7*	Go to *Step 6*
6	Replace the actuator FL.	—	Go to *Step 7*	—
7	Is the continuity between the connector F–6 terminals 3 and 4?	—	Go to *Step 8*	Go to *Step 9*
8	Is the continuity between the connector F–6 terminals 7 and 8?	—	Go to *Step 10*	Go to *Step 9*
9	Replace the rear shock absorber RR.	—	Go to *Step 10*	—
10	Is the continuity between the connector F–7 terminals 3 and 4?	—	Go to *Step 11*	Go to *Step 12*
11	Is the continuity between the connector F–7 terminals 7 and 8?	—	Go to *Step 13*	—
12	Replace the rear shock absorber RL.	—	Go to *Step 13*	—
13	Is the continuity between the connector C–44 terminal 1 and connector C–50 terminal 4?	—	Go to *Step 14*	Go to *Step 15*
14	Is the continuity between the connector C–44 terminal 3 and connector C–50 terminal 17?	—	Go to *Step 16*	Go to *Step 15*
15	Repair the circuit.	—	Go to *Step 16*	—
16	Is the continuity between the connector C–44 terminal 2 and connector C–50 terminal 5?	—	Go to *Step 17*	Go to *Step 18*

DTC3 Actuator Coil/Position Sensor Open Circuit or Short (Cont'd)

Step	Action	Value(s)	Yes	No
17	Is the continuity between the connector C–44 terminals 4 and connector C–50 terminal 18?	—	Go to *Step 19*	Go to *Step 18*
18	Repair the circuit.	—	Go to *Step 19*	—
19	Is the continuity between the connector C–45 terminal 1 and connector C–50 terminal 6?	—	Go to *Step 20*	Go to *Step 21*
20	Is the continuity between the connector C–45 terminal 3 and connector C–50 terminal 19?	—	Go to *Step 22*	Go to *Step 21*
21	Repair the circuit.	—	Go to *Step 22*	—
22	Is the continuity between the connector C–45 terminal 2 and connector C–50 terminal 7?	—	Go to *Step 23*	Go to *Step 24*
23	Is the continuity between the connector C–45 terminal 4 and connector C–50 terminal 20?	—	Go to *Step 25*	Go to *Step 24*
24	Repair the circuit.	—	Go to *Step 25*	—
25	Is the continuity between the connector F–6 terminal 4 and connector C–50 terminal 8?	—	Go to *Step 26*	Go to *Step 27*
26	Is the continuity between the connector F–6 terminal 8 and connector C–50 terminal 21?	—	Go to *Step 28*	Go to *Step 27*
27	Repair the circuit.	—	Go to *Step 28*	—
28	Is the continuity between the connector F–6 terminal 3 and connector C–50 terminal 9?	—	Go to *Step 29*	Go to *Step 30*
29	Is the continuity between the connector F–6 terminal 7 and connector C–50 terminal 22?	—	Go to *Step 31*	Go to *Step 30*
30	Repair the circuit.	—	Go to *Step 31*	—
31	Is the continuity between the connector F–7 terminal 4 and connector C–50 terminal 10?	—	Go to *Step 32*	Go to *Step 33*
32	Is the continuity between the connector F–7 terminal 8 and connector C–50 terminal 23?	—	Go to *Step 34*	Go to *Step 33*
33	Repair the circuit.	—	Go to *Step 34*	—
34	Is the continuity between the connector F–7 terminal 3 and connector C–50 terminal 11?	—	Go to *Step 35*	Go to *Step 36*
35	Is the continuity between the connector F–7 terminal 7 and connector C–50 terminal 24?	—	Go to *Step 37*	Go to *Step 36*
36	Repair the circuit.	—	Go to *Step 37*	—
37	1. Disconnect the terminals C–51, C–43, C–46, F–6, and F–7. Is the continuity between the connector–terminal C51–29 and C43–6, C51–37 and C46–6, C51–33 and F6–2, C51–41 and F7–2?	—	Go to *Step 38*	Go to *Step 41*

DTC3 Actuator Coil/Position Sensor Open Circuit or Short (Cont'd)

Step	Action	Value(s)	Yes	No
38	Is the continuity between the connector C–50 terminal 1 (GND) and the connector C–51 terminals 29, 33, 37, and 41?	—	Go to *Step 41*	Go to *Step 39*
39	Is there the continuity between connector-terminal C51–27 and C51–35, C51–31 and C51–39, C51–32 and C51–40, and C51–34 and C51–42?	—	Go to *Step 41*	Go to *Step 40*
40	Is there the continuity between connector C–50 terminal 1 and connector C–51 terminals 27, 31, 32, and 34?	—	Go to *Step 41*	Go to *Step 42*
41	Repair the circuit.	—	Go to *Step 44*	—
42	1. If all steps are correct, replace following units one by one in the following order. Give a test drive and if normal, reinstall it. 1) actuator FR, 2) actuator FL, rear shock absorber, 3) RR and 4) RL. Does the DTC3 remain?	—	Go to *Step 43*	Go to *Step 44*
43	Replace the control unit.	—	Go to *Step 44*	—
44	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *"Basic Diagnosis Flow".*	Go to *Step 44*

DTC4 G-Sensor Open Circuit or Short

Circuit Description

The G-sensor sends the voltage (Vout) corresponding to the vehicle vertical gravity to the control unit.
The control unit supplies DC 5V power (Vcc) to each G-sensor.
The control unit watches the G-sensor operation through Vcc signal.

Diagnostic Aids

- Inspect the wiring for poor electrical connections between the control unit connectors and the actuator connectors. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.
  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

DTC4 G-Sensor Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the connectors C–51, C–52, C–43, C–46, and F–5. Is there the continuity between the connector-terminal C51–28 and C43–5, C51–30 and C46–5, and C52–45 and F5–1?	—	Go to *Step 2*	Go to *Step 5*
2	Is the continuity between the connector-terminal C51–27 and C43–1, C51–31 and C46–1, and C52–44 and F5–2?	—	Go to *Step 3*	Go to *Step 5*
3	Is there the continuity between the connector-terminal C51–36 and C43–2, C51–38 and C46–2, and C52–56 and F5–3?	—	Go to *Step 4*	Go to *Step 5*
4	1. Disconnect the connectors C–50, C–51, and C–52. Is there the continuity between the connector-terminal C51–28 and C51–35, C51–30 and C51–39, C52–45 and C52–55, C51–27 and C51–35, C51–31 and C51–39, C52–44 and C52–55, C51–32 and C51–40, C51–34 and C51–42, C51–36 and C51–35, C51–38 and C51–39, and C52–56 and C52–55?	—	Go to *Step 5*	Go to *Step 7*
5	Repair the circuit.	—	Go to *Step 6*	—
6	Replace following units one by one in the following order. Give a test drive and if normal, reinstall it. 1) G3-sensor 2) Actuator FL 3) Actuator FR 4) Control Unit	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear th DTC. Was this step finished?	—	Go to *“Basic Diagnosis Flow.”*	Go to *Step 7*

DTC5 Vehicle Speed Sensor Open Circuit or Short

Circuit Description

Output speed information is provided to the control unit by the vehicle speed sensor. The vehicle speed sensor produces a pulsing AC voltage. The AC voltage level and number of pulses increases as the speed of the vehicle increases. The control unit then converts the pulsing voltage to vehicle speed.

Diagnostic Aids

- Inspect the wiring for poor electrical connections between the control unit 22 way connector and the speed sensor connectors. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.

  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

DTC5 Vehicle Speed Sensor Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	1. Jack up and support the rear axle on the stand. 2. Change the transfer mode to 2WD, using the 4WD push button switch on instrument panel. 3. Shift the transmission lever in a forward position and rotate the rear wheels. Does the speedo-meter operate?	—	Go to *Step 2*	Go to *Step 3*
2	1. Open the throttle and rev up engine speed. 2. Using a volt meter, measure the voltage between the meter B connector I–2 terminals 7 and 16 (GND). Does the voltage change alternately at the specified values?	0V and 12V	Go to *Step 7*	Go to *Step 5*
3	1. Turn off the starter switch and disconnect the control connectors C–50 and C–52. 2. Check the continuity between the vehicle speed sensor connector terminal 3 and meter B connector I–2 terminal 7. Is there continuity?	—	Go to *Step 4*	Go to *Step 6*
4	1. Check the continuity between the control unit connector C–50 terminal 1 and control unit connector C–52 terminal 48. Is there continuity?	—	Go to *Step 5*	Go to *Step 6*
5	Repair or replace the vehicle speed sensor.	—	Go to *Step 8*	—
6	Repair the circuit between the vehicle speed sensor connector terminal 3 and the meter B connector I–2 terminal 7 or the circuit between the control unit connector C–52 terminal 48 and the speed sensor connector terminal 3.	—	Go to *Step 8*	—
7	Repair the circuit between the connector H–6 terminal 16 and the control unit connector C–52 terminal 48 or replace the control unit.	—	Go to *Step 8*	—
8	1. Reconnect all components, ensure all components are properly mounted. 2. Clear th DTC. Was this step finished?	—	Go to *“Basic Diagnosis Flow.”*	Go to *Step 8*

DTC6 Stop Lamp Switch Open Circuit or Short

Circuit Description

The brake switch is used to indicate brake pedal status. The normally opened brake switch signal voltage circuit is opened.

Brake switch supplies a B+ signal on circuit RED to the control unit when the brakes are applied. The control unit uses this signal to work dive control when the brakes are applied.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the control unit and brake switch. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check customer driving habits and/or unusual driving conditions (i.e. stop and go, highway).
- Check brake switch for proper mounting and adjustment.

DTC6 Stop Lamp Switch Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	1. With the engine “off”, turn the ignition switch “on”. If ABS code is set, check applicable fuse. 2. Apply then release the brake pedal. Is the brake lamp turned on with the brake pedal applied, and then turned off when the brake pedal is released?	—	Go to *Diagnostic Aids*	Go to *Step 2*
2	1. Connect the test light to ground. 2. Back probe ignition feed circuit terminal I18–1 at the brake switch. Is the test light “on”?	—	Go to *Step 3*	Go to *Step 4*
3	1. Connect the test light to ground. 2. Back probe circuit terminal I18–4 at the brake switch. Is the test light “off”?	—	Go to *Step 7*	Go to *Step 5*
4	Repair the open in battery feed circuit terminal I18–1 to the brake switch. If fuse is open, check circuit terminal I18–4 for a short to ground. Is the test light “off”?	—	Go to *Step 13*	—
5	Disconnect brake switch connector I–18 and ignition switch “on”.	—	Go to *Step 8*	Go to *Step 6*
6	Check the brake switch short (I18–1 and I18–4).	—	Go to *Step 9*	Go to *Step 10*
7	Check circuit terminal I18–4 for a short to voltage. Ignition switch “on”.	—	Go to *Step 8*	Go to *Step 10*
8	1. Disconnect the control unit connector C–52. 2. Check circuit terminal I18–4 for a short to voltage. Was a problem found?	—	Go to *Step 13*	Go to *Step 10*

DTC6 Stop Lamp Switch Open Circuit or Short (Cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the brake switch. Is the replacement complete?	—	Go to *Step 13*	—
10	1. Turn the ignition "off". 2. Reconnect the control unit connector C–52 Turn the ignition "on". Is the brake lamp turned on with the brake applied, then turned off with the brake pedal released?	—	Go to *Diagnostic Aids*	Go to *Step 11*
11	Check the control unit for faulty or intermittent connections. Was a problem found and corrected?	—	Go to *Step 13*	Go to *Step 12*
12	Replace the control unit. Is the replacement complete?	—	Go to *Step 13*	—
13	1. After the repair is complete, clear the DTC. The switch signal must indicate 0 volts for 1 seconds with the brake pedal applied. 2. Conduct a test drive. 3. Review the DTC. Has the last test failed or is the current DTC displayed?	—	Begin diagnosis again Go to *Step 1*	Go to *Repair verified*

DTC7 Engine Speed Signal Open Circuit or Short

Circuit Description

PCM (Powertrain Control Module) converts signals from the crankshaft position sensor into the engine speed signals (pulse) and sends these to the control unit and tachometer.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the control unit connector. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.
  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check harness routing for a potential short to ground in circuit BLK/RED.

DTC7 Engine Speed Signal Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	NOTE: Confirm that DTC P0336 or P0337 does not exist. If either exists, warning lamps, “CHECK ENGINE” and “CHECK TRANS” are turned on. Repair the engine, referring to Section 6E “Driveability and Emission”. 1. Turn on the starter switch. 2. Start the engine. 3. Open the throttle and rev up engine speed. Does the tachometer operate according to engine speed?	—	Go to *Step 3*	Go to *Step 2*
2	Repair the tachometer, referring to Section 8D Wiring System in Body and Accessories.	—	Go to *Step 6*	—
3	1. Turn off the starter switch. 2. Check continuity between the control unit connector C–52 terminal 59 and PCM connector E–21 terminal F7. Is there continuity ?	—	Go to *Step 4*	Go to *Step 5*
4	Replace the control unit.	—	Go to *Step 6*	—
5	Repair the circuit.	—	Go to *Step 6*	—
6	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. 3. Conduct a test drive. Has the last test failed or does the current DTC exist?	—	Begin diagnosis again Go to *Step 1*	Repair verified

DTC9 Control Unit Abnormality

Replace the control unit.

DTC9–1 Control Unit Blown Fuse for FR Actuator

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the actuator connector C–44. 3. Measure the resistance between the actuator side connector C–44 terminals 1 and 2. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the actuator side connector C–44 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the actuator FR.	—	Go to *Step 7*	—
4	1. If all steps are correct, check the continuity between the control unit connector C–50 terminal 1 and connector-terminal C50–4, C50–17, C50–5, C50–18. Is there continuity?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the circuit.	—	Go to *Step 7*	—
6	Replace the control unit.	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *“Basic Diagnosis FLow”.*	Go to *Step 7*

DTC9–2 Control Unit Blown Fuse for FL Actuator

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the actuator connector C–45. 3. Measure the resistance between the actuator side connector C–45 terminals 1 and 2. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the actuator side connector C–45 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the actuator FL.	—	Go to *Step 7*	—
4	1. If all steps are correct, check the continuity between the control unit connector C–50 terminal 1 and connector-terminal C50–6, C50–19, C50–7, C50–20. Is there continuity?	—	Begin diagnosis again Go to *Step 5*	Go to *Step 6*
5	Repair the circuit.	—	Go to *Step 7*	—
6	Replace the control unit.	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *“Basic Diagnosis FLow”.*	Go to *Step 7*

DTC9–3 Control Unit Blown Fuse for RR Shock Absorber

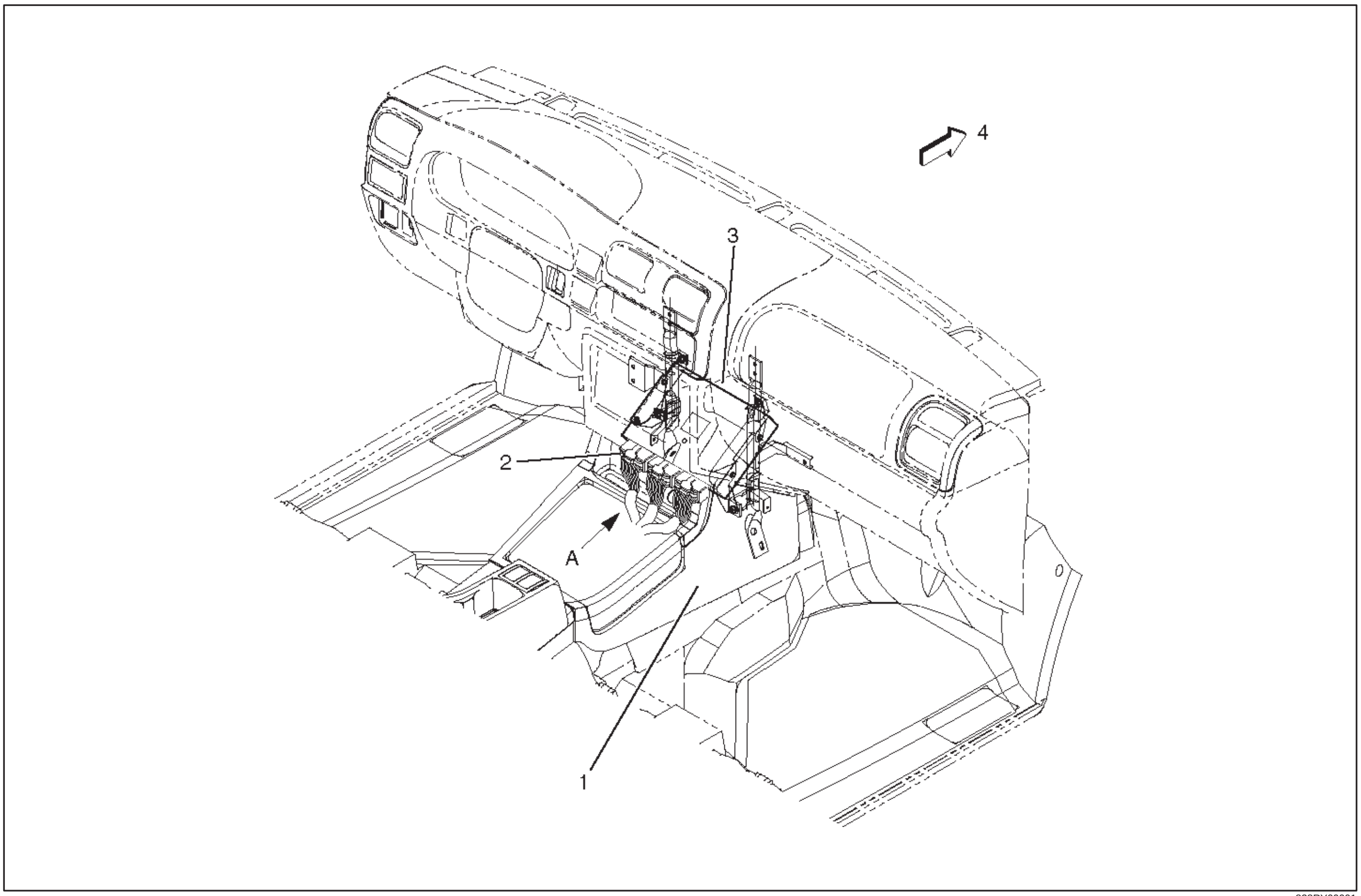
Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the shock absorber connector F–6. 3. Measure the resistance between the shock absorber side connector F–6 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the shock absorber side connector F–6 terminals 7 and 8. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the shock absorber RR.	—	Go to *Step 7*	—
4	1. If all steps are correct, check the continuity between the control unit connector C–50 terminal 1 and connector-terminal C50–8, C50–21, C50–9, C50–22. Is there continuity?	—	Begin diagnosis again Go to *Step 5*	Go to *Step 6*
5	Repair the circuit.	—	Go to *Step 7*	—
6	Replace the control unit.	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *“Basic Diagnosis FLow”.*	Go to *Step 7*

DTC9–4 Control Unit Blown Fuse for RL Shock Absorber

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the shock absorber connector F–7. 3. Measure the resistance between the shock absorber side connector F–7 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the shock absorber side connector F–7 terminals 7 and 8. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the shock absorber RL.	—	Go to *Step 7*	—
4	1. If all steps are correct, check the continuity between the control unit connector C–50 terminal 1 and connector-terminal C50–10, C50–23, C50–11, C50–24. Is there continuity?	—	Begin diagnosis again Go to *Step 5*	Go to *Step 6*
5	Repair the circuit.	—	Go to *Step 7*	—
6	Replace the control unit.	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *“Basic Diagnosis FLow”.*	Go to *Step 7*

Control Unit

Control Unit and Associated Parts



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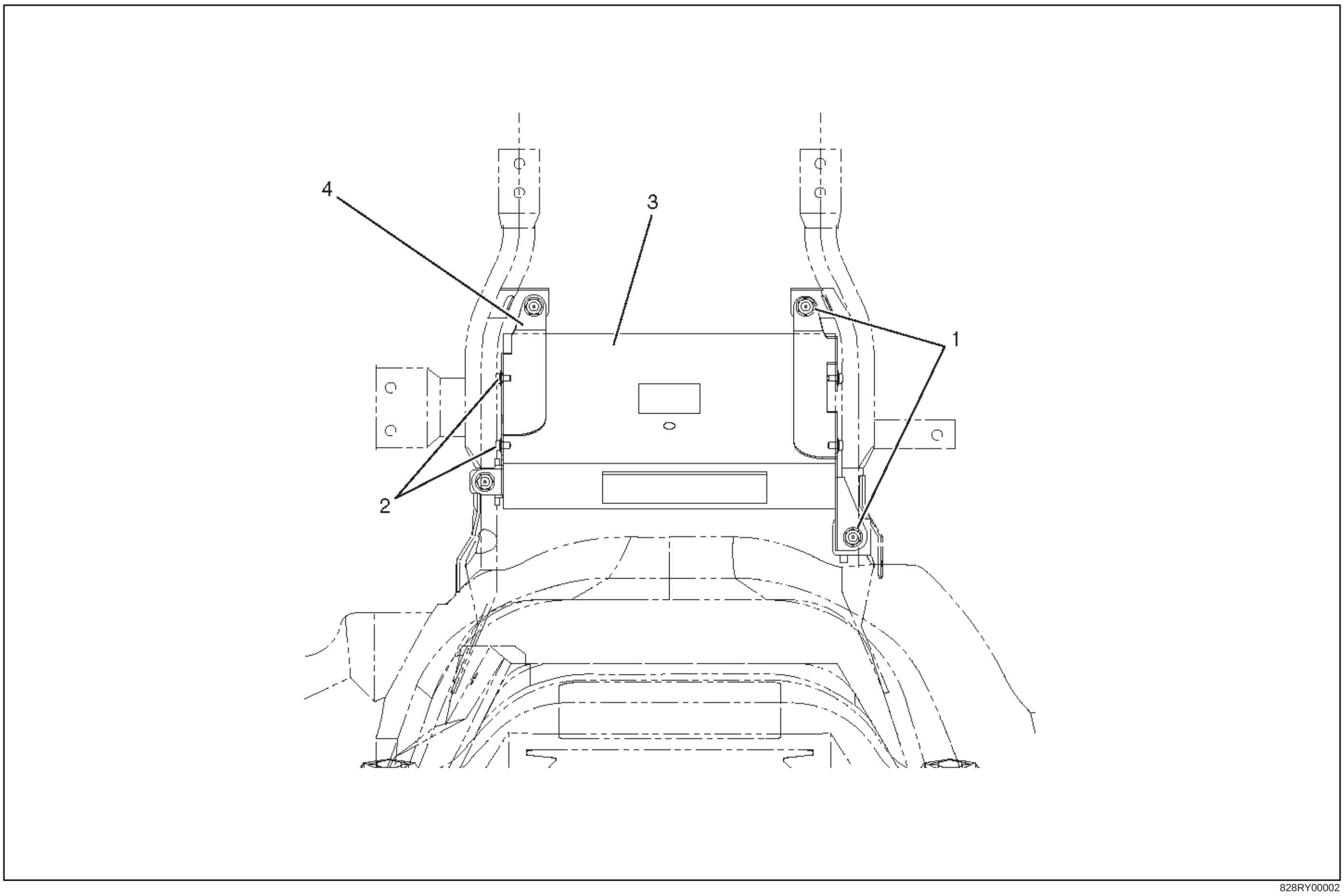
Legend

(1) Front Console
(2) Connector
(3) Control Unit
(4) Front

Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly.
   Refer to *Consoles in Body and Accessories section.*
3. Disconnect the connector from the control unit.

View A



Legend

(1) Nut
(2) Screw
(3) Control Unit
(4) Bracket

4. Remove 4 nuts.
5. Disconnect the control unit with brackets.
6. Remove 4 screws.
7. Disconnect the control unit from brackets.

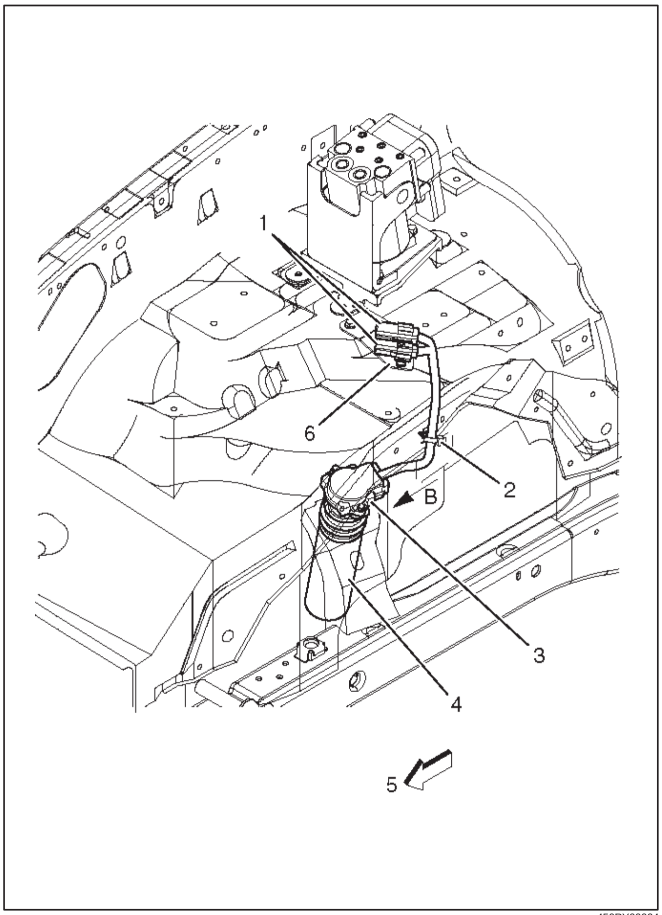
Installation

To install, follow the removal steps in the reverse order, noting the following points.
Torque:
Nut (1) 8N·m (69 lb in)

Front Actuator

Front Actuator and Associated Parts

RH

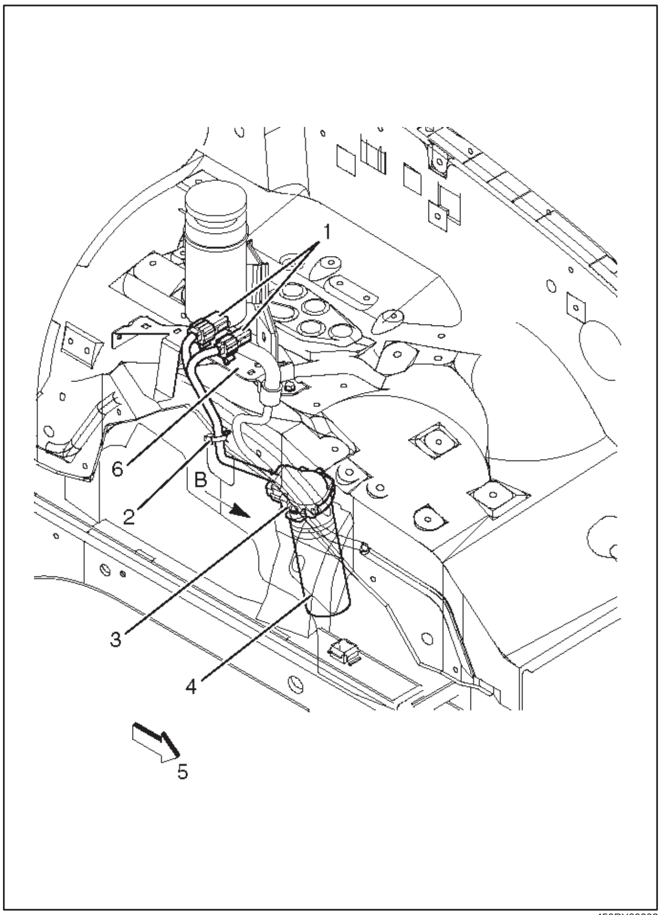


450RY00004

Legend

(1) Connector
(2) Clip
(3) Actuator
(4) Shock Absorber
(5) Front
(6) Bracket

LH



450RY00003

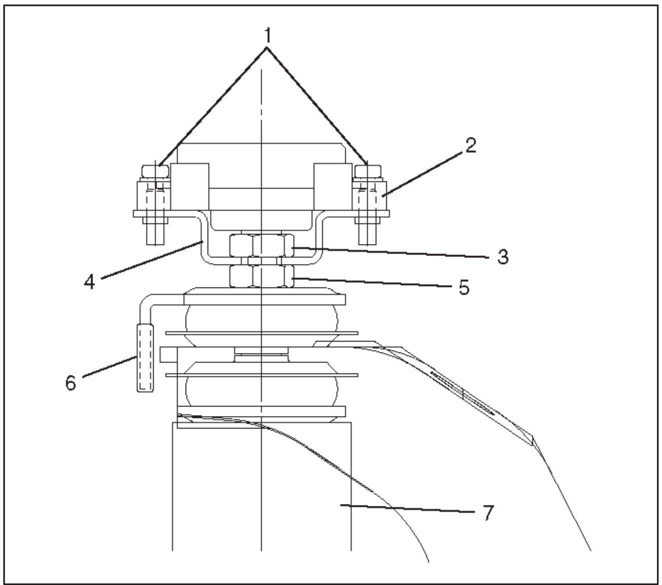
Legend

(1) Connector
(2) Clip
(3) Actuator
(4) Shock Absorber
(5) Front
(6) Bracket

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector from the harness and remove the connector from the bracket.
3. Remove the clip.

View B



450RY00005

Legend

(1) Screw
(2) Actuator
(3) Nut
(4) Bracket
(5) Nut
(6) Washer
(7) Shock Absorber

1. Removal 2 screws.
2. Disconnect the actuator.
3. Remove the nut.
4. Disconnect bracket.
5. Remove the nut.
6. Disconnect the washer.
7. Remove the shock absorber.
   Refer to *Shock Absorber in this section.*

Inspection and Repair

Refer to *shock Abosorber in this section.*

Installation

1. Install the shock absorber.
   Refer to *Shock Absorber in this section.*
2. Install the washer and nut (5), then tighten it to the specified torque.
   Torque: 37 N· m (27 lbft)
3. Install the bracket and nut (3), then tighten it to the specified torque.
   Torque: 37 N· m (27 lbft)
4. Fit the top of the shock absorber rod in the connection part of the actuator.

NOTE:

The mating section is width fitting across flats.

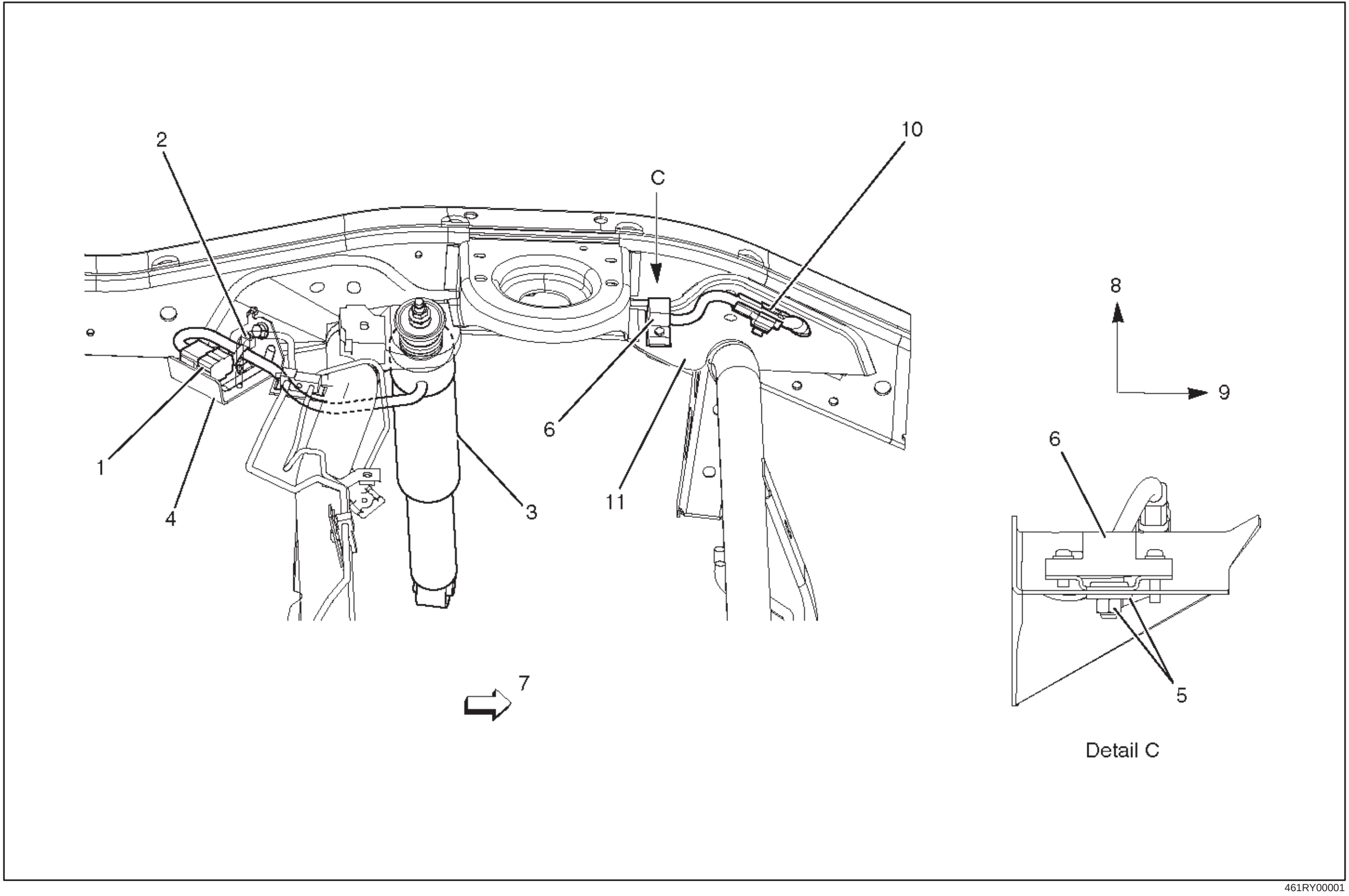
If these normally fit, the distance between the actuator lower face and the bracket upper face is about 1 mm.

5. Install 2 screws then tighten it to the specified torque.
   3 N· m (26 lbft)
6. Connect the connector to the harness and insert the connector to the bracket.
7. Connect the actuator harness with the clip.
8. Connect the battery ground cable.

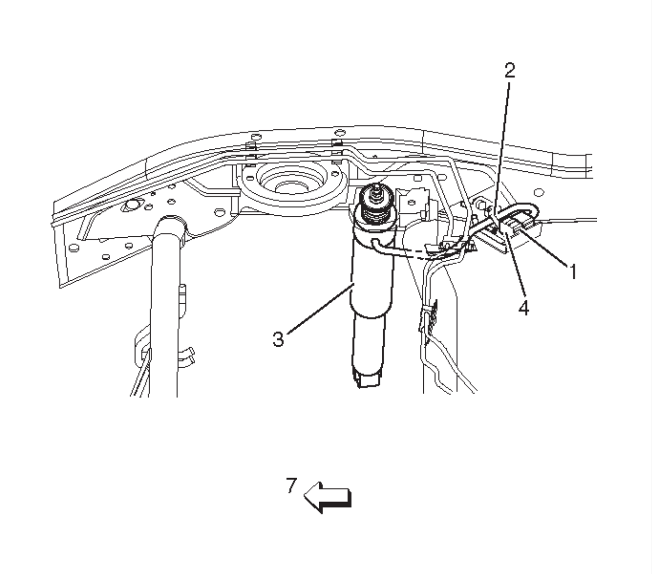
Rear Shock Absorber

Rear Shock Absorber and Associated Parts

LH



RH



461RY00002

Legend

(1) Connector
(2) Clip
(3) Rear Shock Absorber
(4) Bracket
(5) Nut and Washer
(6) G-Sensor
(7) Front
(8) Upper
(9) Right
(10) Connector
(11) Gusset

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector (1) from the harness and remove the connector (1) from the bracket.
3. Remove the clip.
4. Remove the rear shock absorber.
   Refer to *Shock Absorber in this section.*
5. Disconnect the connector (10) from the harness and remove the connector (10) from the gusset.
6. Remove the nut and washer.
7. Disconnect the G-sensor.

Inspection and Repair

Refer to Shock Absorber in this section.

Installation

1. Set the G-sensor on the gusset.
2. Install the washer and nut, then tighten it to the specified torque.
   Torque: 41 N· m (30 lbin)
3. Connect the connector (10) to the harness and insert the connector (10) to the gusset.
4. Install the rear shock absorber.
   Refer to *Shock Absorber in this section.*
5. Connect the connector (1) to the harness and insert the connector (1) to the bracket.
6. Insert the clip to the bracket.
7. Connect the battery ground cable.

RODEO

DRIVELINE/AXLE

CONTENTS

Differential (Front)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM(SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE REFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFOMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED , do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally,such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specification. Following these instructions can help you avoid damage to parts and systems.

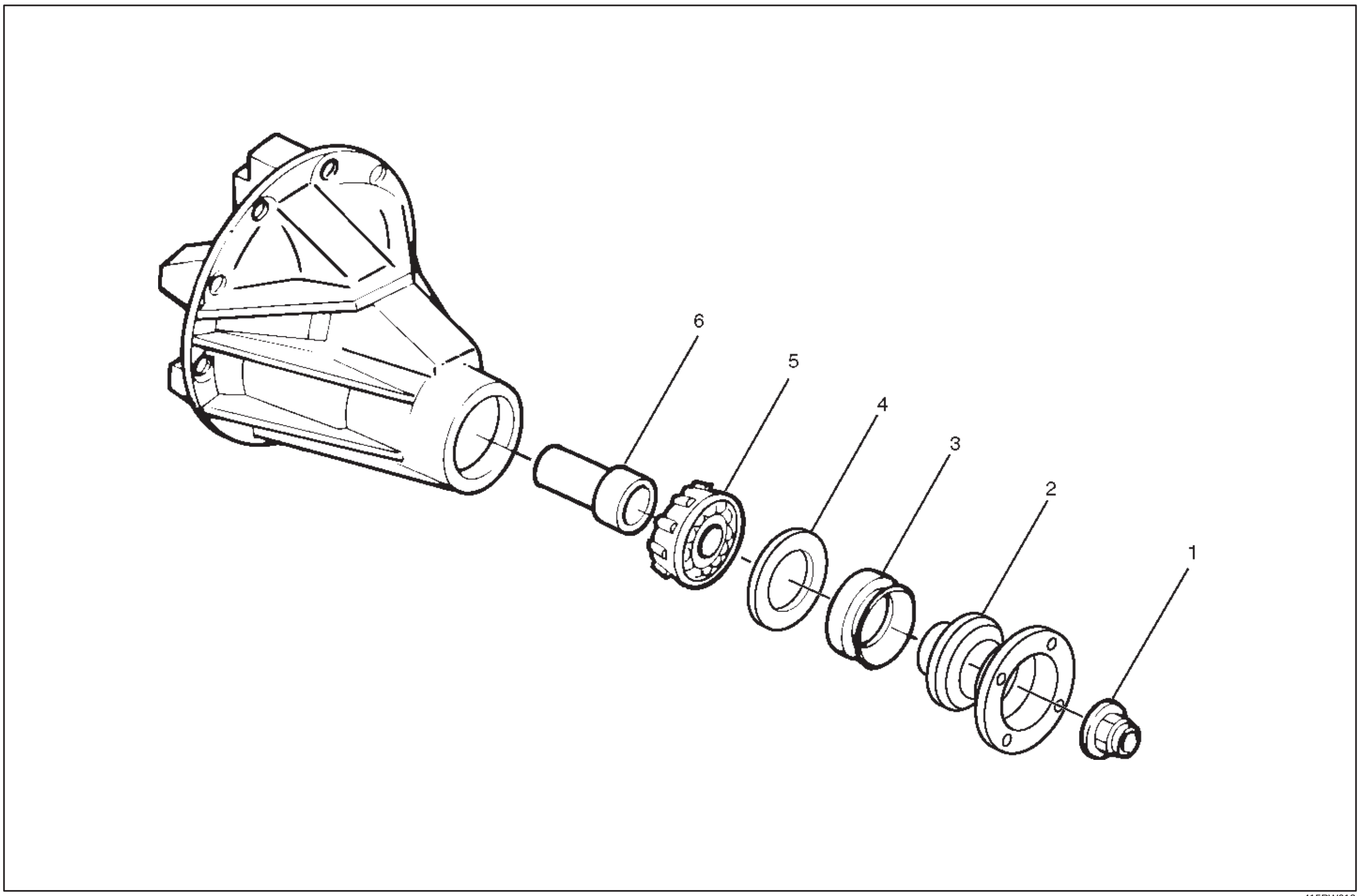
Front Drive Axle

Diagnosis

Condition	Possible cause	Correction
Oil Leak At Front Axle	Worn or defective oil seal.	Replace the oil seal.
	Front axle housing cracked.	Repair or replace.
Oil Leak At Pinion Shaft	Too much gear oil.	Correct the oil level.
	Oil seal worn or defective.	Replace the oil seal.
	Pinion flange loose or damaged.	Tighten or replace.
Noises In Front Axle Drive Shaft Joint	Broken or worn drive shaft joints and bellows (BJ and DOJ).	Replace the drive shaft joints and bellows.
“Clank” When Accelerating From “Coast”	Loose drive shaft joint to output shaft bolts.	Tighten.
	Damaged inner drive shaft joint.	Replace.
Shudder or Vibration During Acceleration	Excessive drive shaft joint angle.	Repair.
	Worn or damaged drive shaft joints.	Replace.
	Sticking spider assembly (inner drive shaft joint).	Lubricate or replace.
	Sticking joint assembly (outer drive shaft joint).	Lubricate or replace.
Vibration At Highway Speeds	Out of balance or out of round tires.	Balance or replace.
	Front end out of alignment.	Align.
Noises in Front Axle	Insufficient gear oil.	Replenish the gear oil.
	Wrong or poor grade gear oil.	Replace the gear oil.
	Drive pinion to ring gear backlash incorrect.	Adjust the backlash.
	Worn or chipped ring gear, pinion gear or side gear.	Replace the ring gear, pinion gear or side gear.
	Pinion shaft bearing worn.	Replace the pinion shaft bearing.
	Wheel bearing worn.	Replace the wheel bearing.
	Differential bearing loose or worn.	Tighten or replace.
Wanders and Pulls	Wheel bearing preload too tight.	Adjust the wheel bearing preload.
	Incorrect front alignment.	Adjust the front alignment.
	Steering unit loose or worn.	Tighten or replace.
	Tire worn or improperly inflated.	Adjust the inflation or replace.
	Front or rear suspension parts loose or broken.	Tighten or replace.
Front Wheel Shimmy	Wheel bearing worn or improperly adjusted.	Adjust or replace.
	Incorrect front alignment.	Adjust the front alignment.
	Worn ball joint or bush.	Replace the ball joint or bush.
	Steering unit loose or worn.	Tighten or replace.
	Tire worn or improperly inflated.	Replace or adjust the inflation.
	Shock absorber worn.	Replace the shock absorber.

Pinion Shaft Oil Seal

Pinion Shaft Oil Seal and Associated Parts



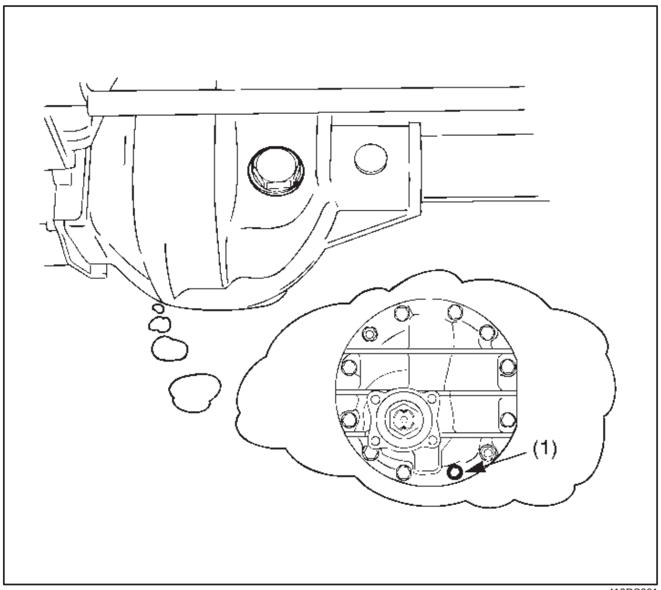
415RW012

Legend

(1) Flange Nut
(2) Flange
(3) Oil Seal
(4) Oil Seal Slinger
(5) Outer Bearing
(6) Collapsible Spacer

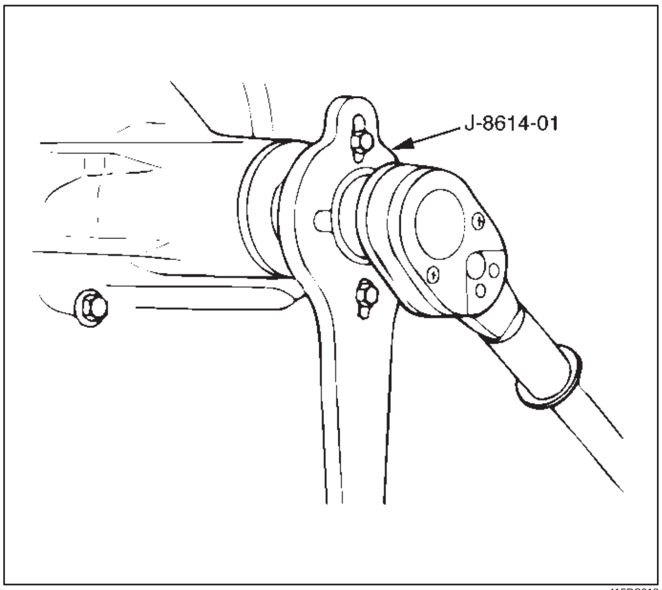
Removal

1. Raise the vehicle and support it at the frame.
   The hoist must remain under the front axle housing.
2. Drain the front axle oil by loosening the drain plug(1).



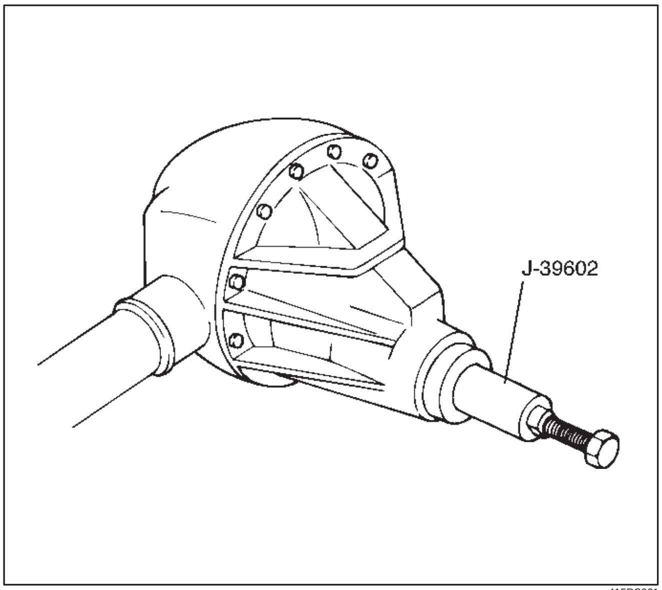
412RS001

3. Remove the front propeller shaft. Refer to Front Propeller Shaft in this section.
4. Remove flange nut by using pinion flange holder J–8614–01.



415RS018

5. Remove flange.
6. Remove oil seal.
7. Remove outer bearing by using remover J–39602.



415RS001

8. Remove collapsible spacer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

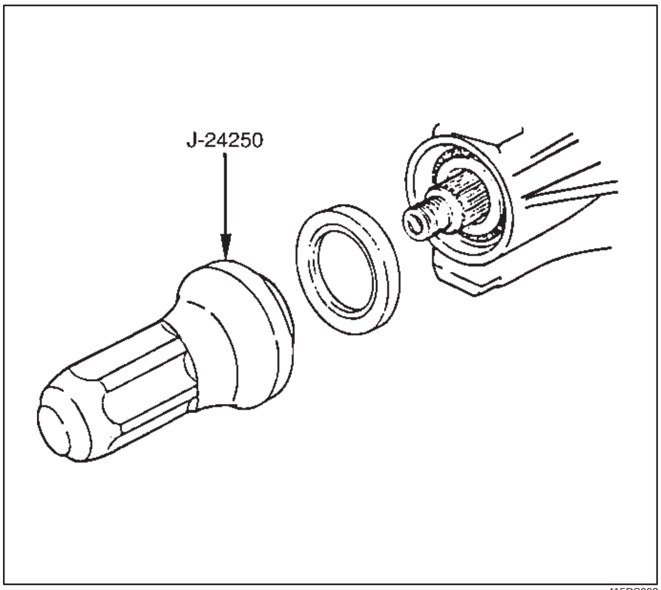
1. Seal surface of the pinion.
2. Cage bore for burns.

Installation

1. Install collapsible spacer. Discard the used collapsible spacer and install a new one.
2. Install outer bearing.

NOTE: Do not drive in, but just temporarily set in the outer bearing by hand, which should be indirectly pressed in finally by tightening the flange nut.

3. Install oil seal, use oil seal installer J–24250 to install a new oil seal that has grease on seal lip.



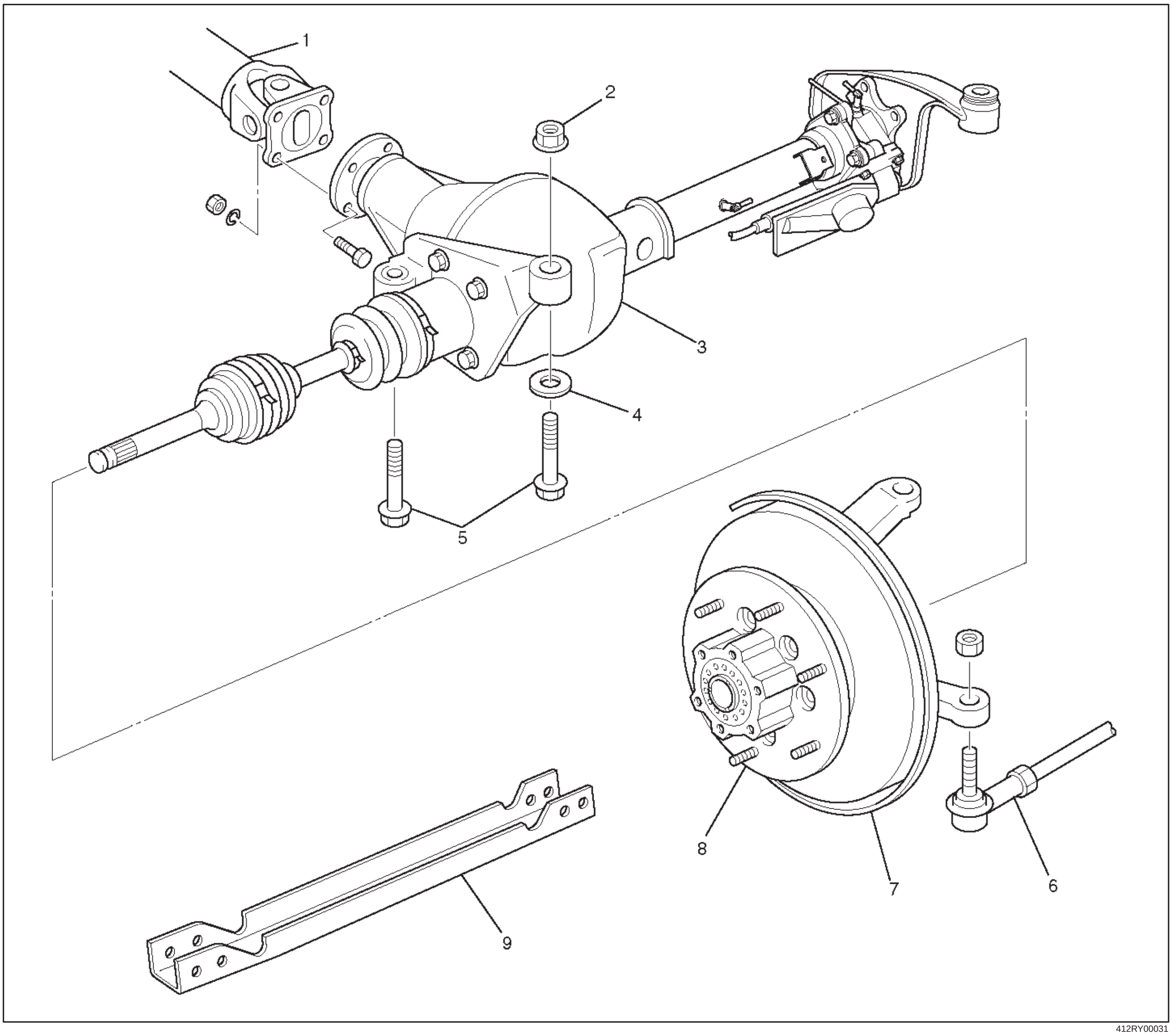
415RS002

4. Install flange.
5. Install flange nut, refer to Differential Assembly Overhaul for flange nut reassembly in this section.

NOTE: Discard the used nut and install a new one.

Front Drive Axle Assembly

Front Drive Axle Assembly and Associated Parts

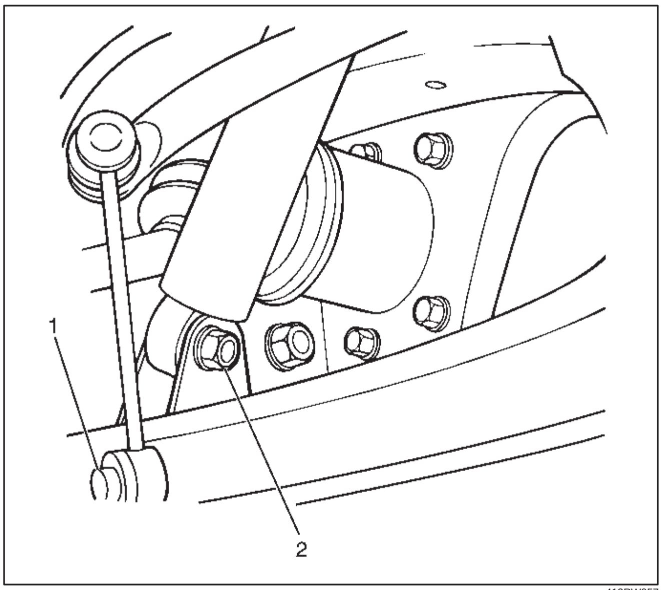


Legend

(1) Propeller Shaft
(2) Mounting Nut
(3) Front Axle Case Assembly and Front Drive Shaft Assembly
(4) Washer
(5) Mounting Bolt
(6) Tie–rod End; Power Steering Unit
(7) Knuckle and Back Plate
(8) Hub and Disc Assembly
(9) Suspension Crossmember

Removal

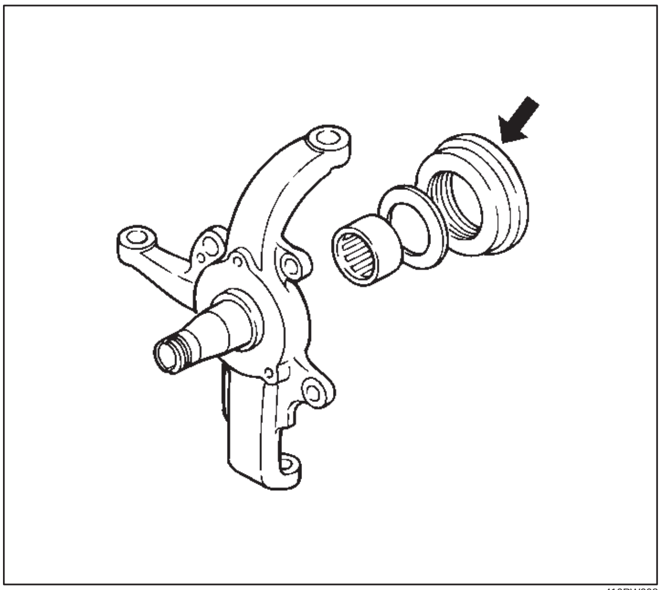
1. Jack up the vehicle and support it using jack stand.
2. Remove the tire and wheel.
3. Remove the stone guard.
4. Remove the brake caliper fixing bolt and hang the caliper. Refer to Disc Brakes in Brake section.
5. Remove the antilock brake system speed sensor. Refer to Front Wheel Speed Sensor in Brake section.
6. Remove the hub and disc assembly. Refer to Front Hub and Disc in this section.
7. Remove the propeller shaft, refer to Front Propeller Shaft in this section.
8. Loosen the height control arm of the torsion bar, then remove the torsion bar from lower control arm. refer to Torsion Bar in Suspension section.
9. Remove the suspension crossmember.
10. Remove the lower nut (1) of the stabilizer link.
11. Remove the lower bolt and nut (2) of the shock absorber.



412RW057

12. Remove the tie-rod end from the knuckle. Refer to Power Steering Unit in Steering Section.
13. Disconnect the hose of the shift on the fly.
14. Disconnect the actuator connector.
15. Remove the bolts and nuts of the lower control arm (Frame side), then disconnect the lower control arm from frame.
16. Disconnect between the right side upper control arm and the knuckle, then remove the knuckle with lower control arm.

CAUTION: When removing the knuckle, be careful not to damage the oil seal inside of the knuckle.



410RW008

17. Support the differential case by the jack.
18. Remove the front axle mounting bolts and nuts, lower the jack slowly. Remove the left side drive shaft end from the knuckle, then lower the axle assembly from the vehicle.

CAUTION:

1. **During the work, be sure that the axle assembly is supported securly.**
2. **Be careful not to damage the bellows of the power steering unit by interference.**
3. **Be careful not to damage the hose bracket of the shift on the fly by interference.**

Installation

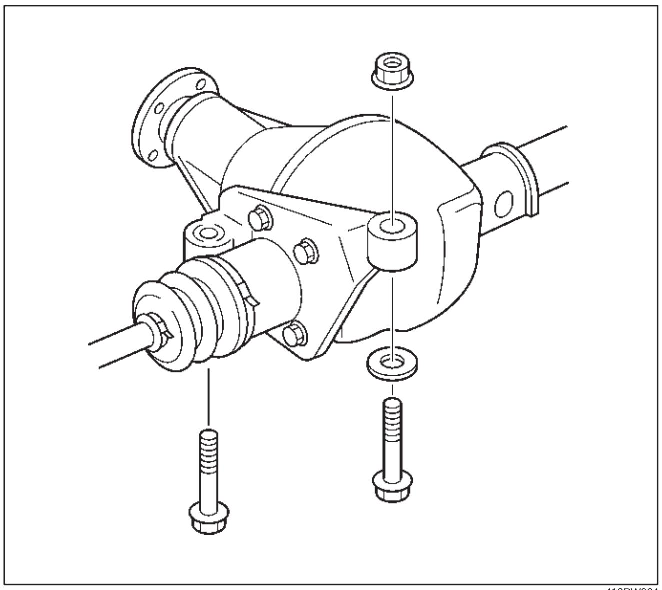
1. Support the differential case by the jack.
2. Jack up the front drive axle assembly, install the left side drive shaft to the knuckle, then install the mount bolts and nuts.

CAUTION:

1. **Be careful not to damage the bellows of the power steering unit by interference.**
2. **Be careful not to damage the hose bracket of the shift on the fly by interference.**
3. **When installing the drive shaft to the knuckle, be careful not to damage the oil seal inside of the knuckle.**

3. Tighten the mounting bolts and nuts to the specified torque.

Torque: 168 N·m (124 lb ft)



412RW064

4. Install the right side knuckle with lower control arm to the upper control arm.
   Refer to Knuckle in Suspension section.

CAUTION: When insert the drive shaft to the knuckle, be careful not to damage the oil seal inside of the knuckle.

5. Align the bolt hole of the lower control arm, install the bolts and nuts.

NOTE: Adjust the buffer clearance before tighten the bolts and nuts of the lower control arm.

6. Install the hose of the shift on the fly.
7. Install the actuator connector of the shift on the fly.
8. Install the tie-rod end of the power steering unit to the knuckle, tighten the nut to the specified torque.

Torque: 118 N·m (87 lb ft)

9. Install lower bolts and nuts of the shock absorber, tighten it to the specified torque.

Torque: 93 N·m (69 lb ft)

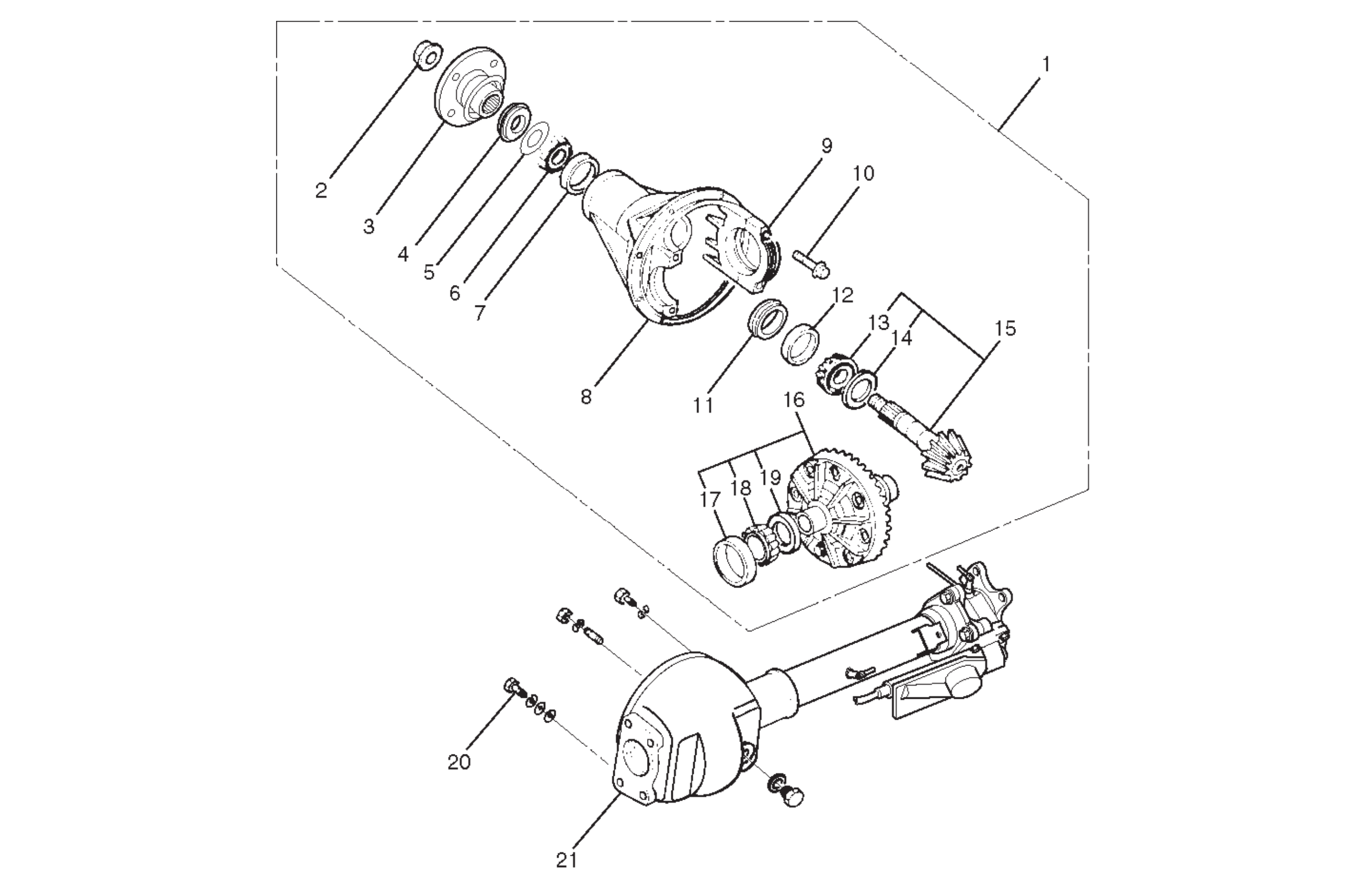
10. Install lower nuts of the stabilizer link, tighten it to the specified torque.
11. Install the suspension crossmember.
12. Install the torsion bar.
    Refer to Torsion Bar in Suspension section.
13. Install the front propeller shaft.
    Refer to Front Propeller Shaft in this section.
14. Install the hub and disc assembly and adjust the bearing preload.
    Refer to Front Hub and Disc in this section.
15. Install the wheel speed sensor of the antilock brake system.
16. Install the brake caliper. Tighten the bolt of the caliper bracket to the specified torque.

Torque: 50 N·m (37 lb ft)

17. Install the stone guard.
18. Install the tire and wheel.
19. Lower the vehicle, adjust the trim height.
    Refer to Trim Height Adjustment in Steering section.
20. Tighten the bolts and nuts of the lower control arm to the specified torque.
    Refer to Lower Control Arm in Suspension section.

Differential Assembly

Disassembled View



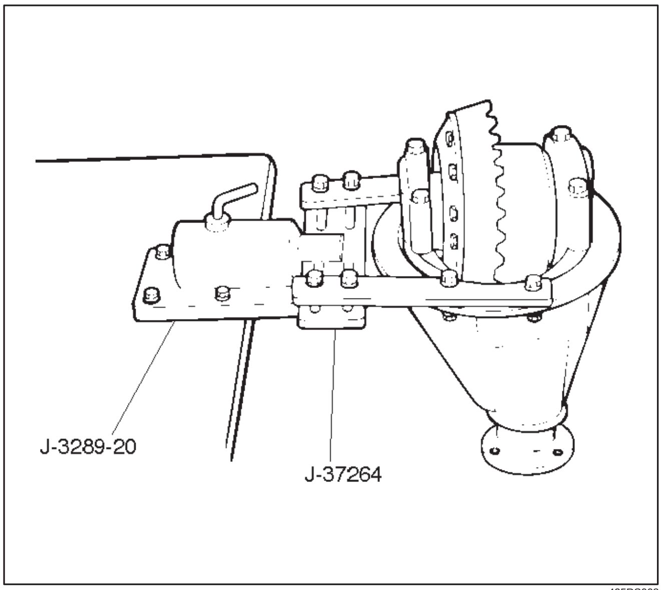
415RY00008

Legend

(1) Differential Assembly
(2) Flange Nut
(3) Flange
(4) Oil Seal
(5) Oil Seal Slinger
(6) Outer Bearing
(7) Outer Bearing Outer Race
(8) Differential Carrier
(9) Bearing Cap
(10) Bolt
(11) Collapsible Spacer
(12) Inner Bearing Outer Race
(13) Inner Bearing
(14) Adjust Shim
(15) Pinion Gear
(16) Diff Cage Assembly
(17) Side Bearing Outer Race
(18) Side Bearing
(19) Adjust Shim
(20) Bolt
(21) Axle Case

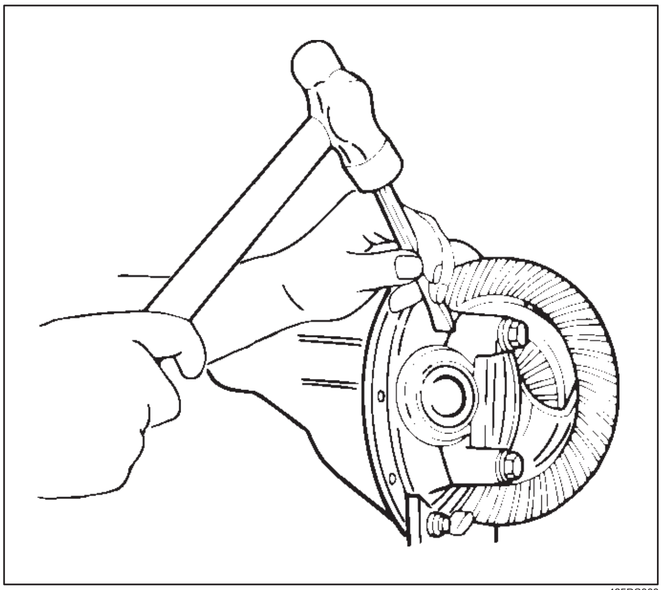
Disassembly

1. Remove differential carrier fixing bolt.
2. Remove differential assembly.
3. Using holding fixture J–37264 and holding fixture base J–3289–20, fix the differential assembly to the bench.



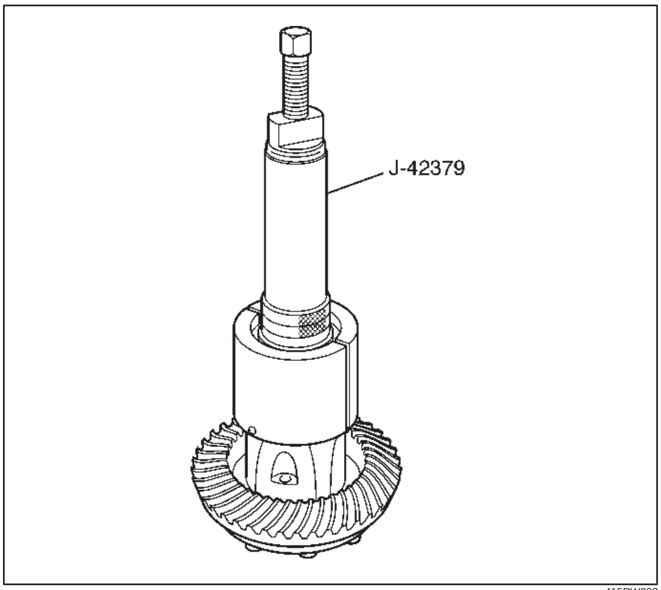
425RS008

4. Remove bearing cap bolt.
5. Apply a setting mark to the side bearing cap and the differential carrier then remove bearing cap.



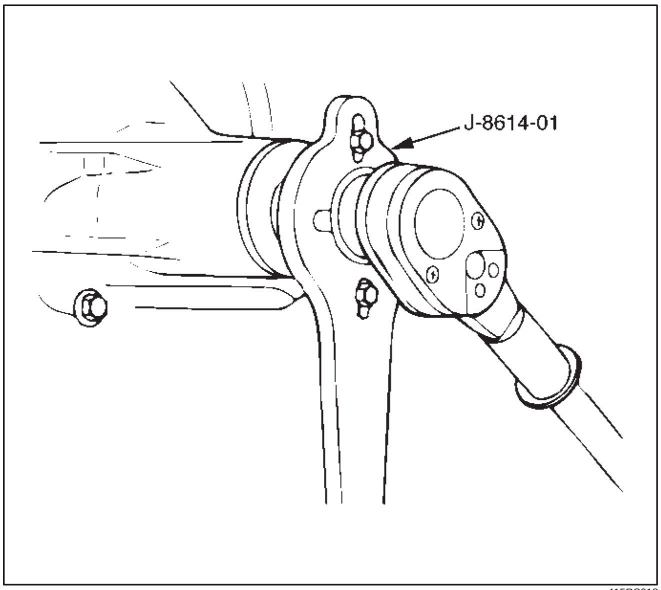
425RS009

6. Remove differential cage assembly.
7. Remove side bearing outer race, after removal, keep the right and left hand side bearing assemblies separate to maintain inner and outer race combinations.
8. Remove side bearing, using remover J–42379 and adapter J–8107–2.
   - Select insert; 303173 and collet halves; 44801 in remover kit J–42379.



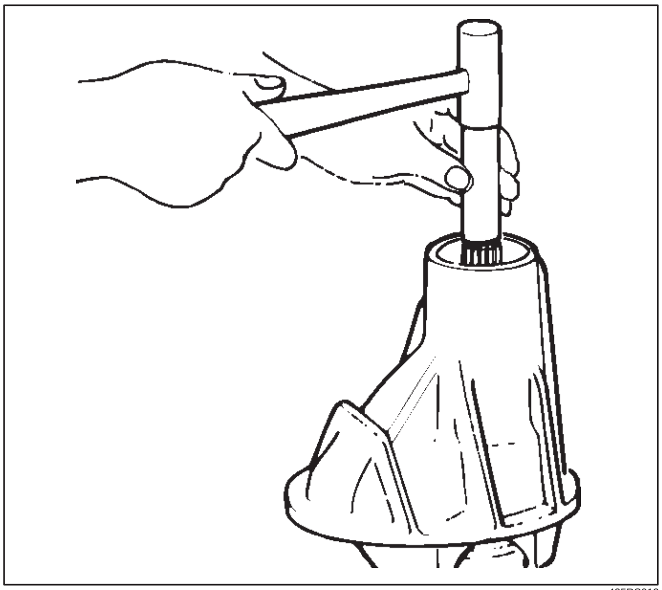
415RW003

9. Remove adjust shim, note the thickness and position of the shims removed.
10. Remove the flange nut using holding wrench J–8614–01.



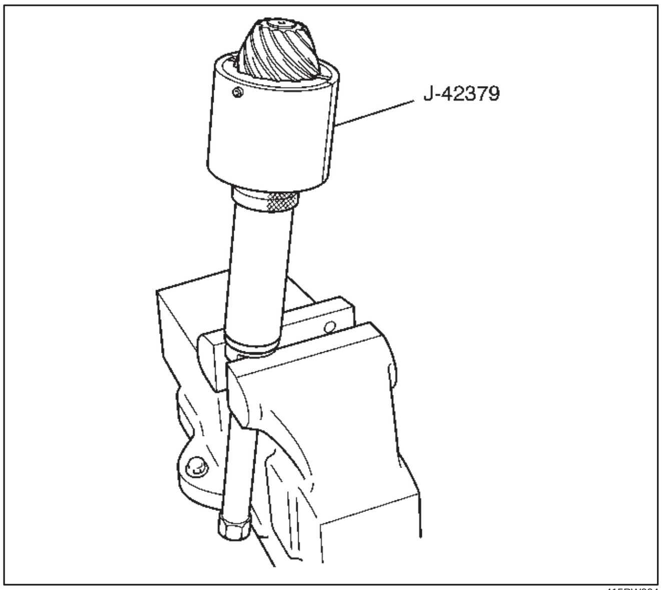
415RS018

11. Remove flange using an universal puller.
12. Remove the drive pinion assembly using a soft metal rod and a hammer.



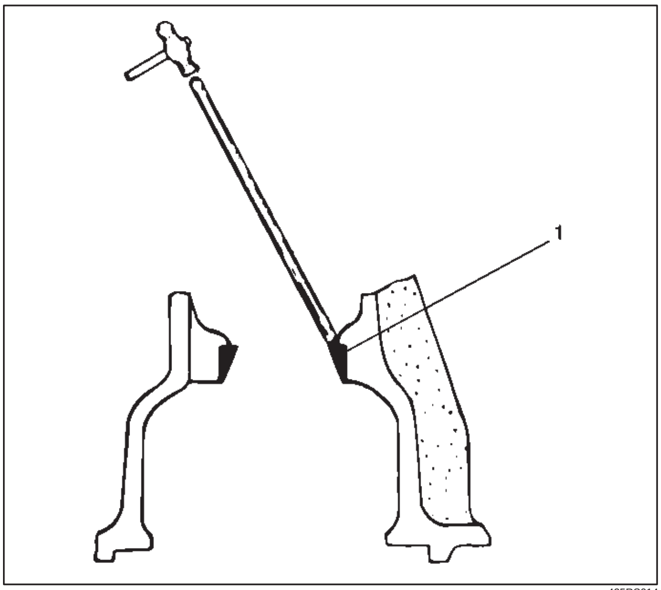
425RS012

13. Remove collapsible spacer.
14. Remove the inner bearing using remover J–42379.
    - Select insert; 303173 and collet halves; 44801 in remover kit J–42379.

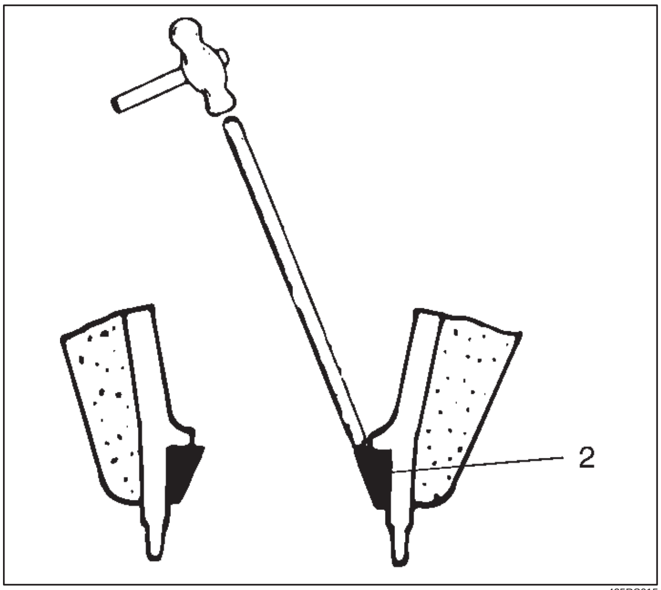


415RW004

15. Remove adjust shim.
16. Remove oil seal.
17. Remove oil seal slinger.
18. Remove outer bearing.
19. Remove the inner bearing outer race (1) and the outer bearing outer race (2) by using a brass bar and a hammer.



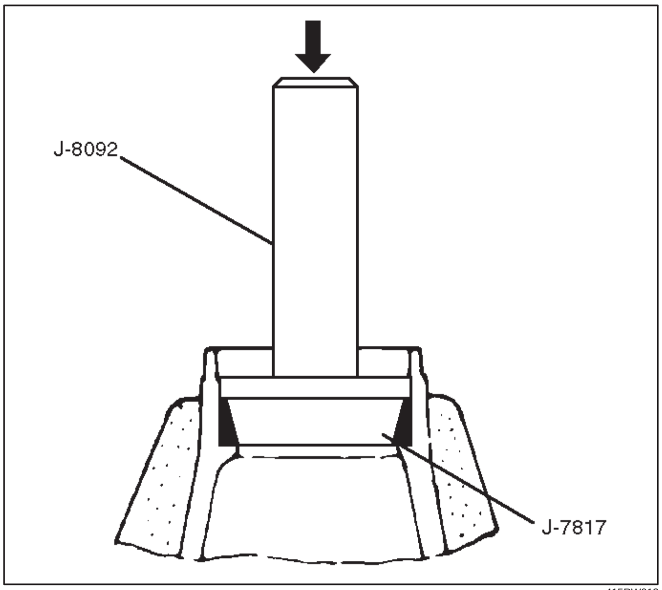
425RS014



425RS015

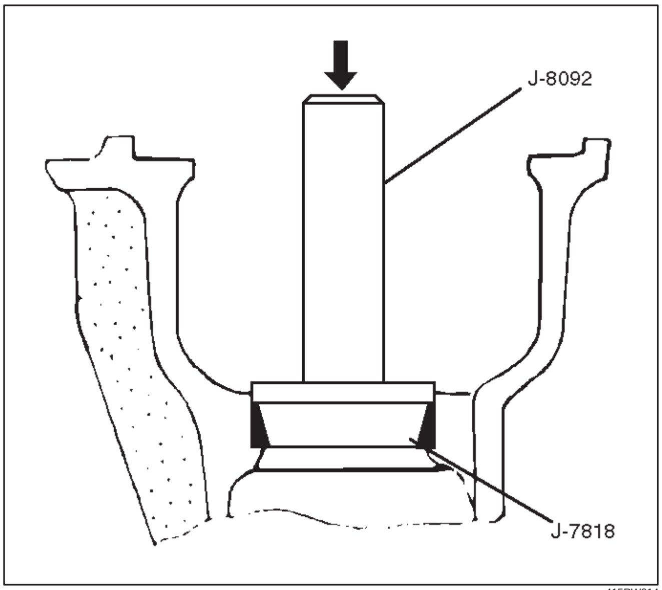
Reassembly

1. Using installer J–7817 and grip J–8092, install outer bearing outer race.



415RW013

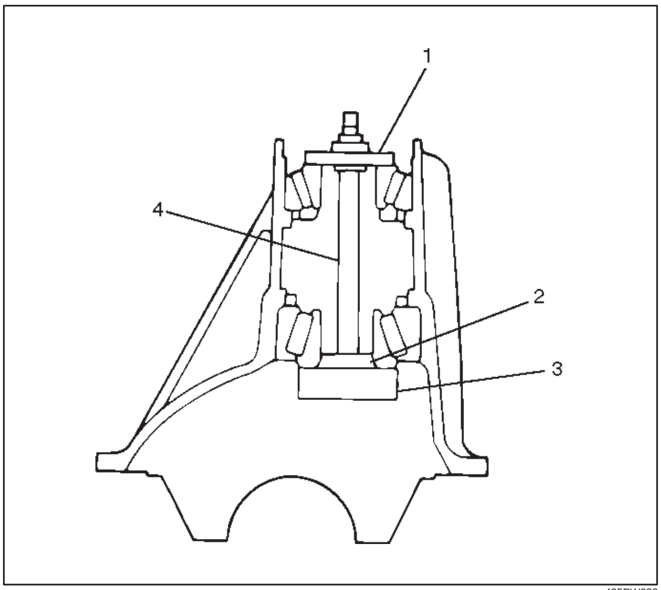
2. Using installer J–7818 and grip J–8092, install Inner bearing outer race.



415RW014

3. Install adjust shim and adjust drive pinion mounting distance:
   1. Apply gear oil to the inner and outer drive pinion bearing.
      Clean the pinion setting gauge set.
      Then install the gauge set together with the inner and outer bearings.
   2. Tighten the nut to the specified torque.

Torque: 2.3 N·m (20 lb in)

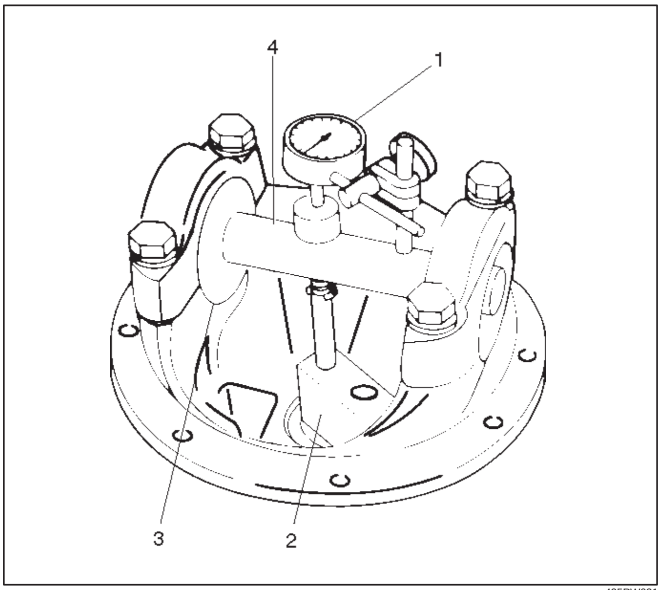


425RW030

Legend
(1) Pilot : J–21777–42
(2) Pilot : J–42479–2
(3) Gauge Plate : J–42479–1
(4) Nut and Stud : J–21777–43

3. Clean the side bearing bores. Install the dial indicator with the discs and arbor. Install and tighten the bearing caps to the specified torque.

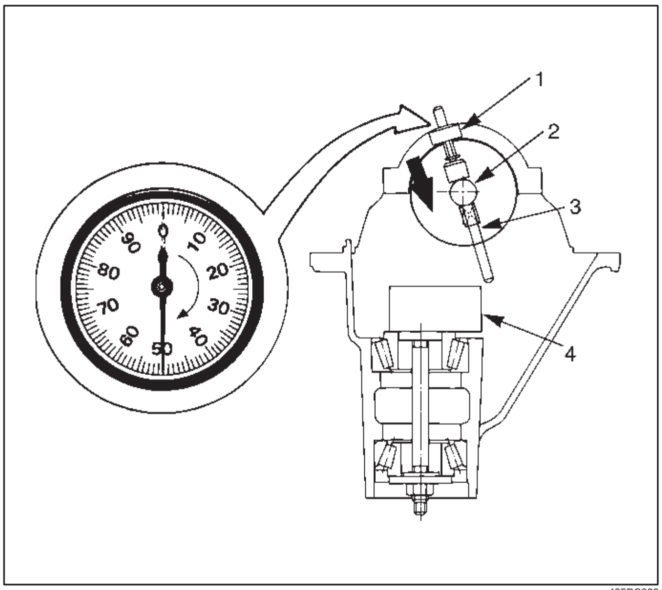
Torque: 97 N·m (72 lb ft)



425RW031

Legend
(1) Dial Indicator: J–8001
(2) Gauge Plate: J–42479–1
(3) Disc (2 pcs.): J–23597–8
(4) Arbor: J–23597–1

4. Set the dial indicator to “0”. Place it on the mounting post of the gauging arbor with the contact button touching the indicator pad. Force the dial indicator downward until the needle has made a half turn clockwise. Tighten down the dial indicator in this position.



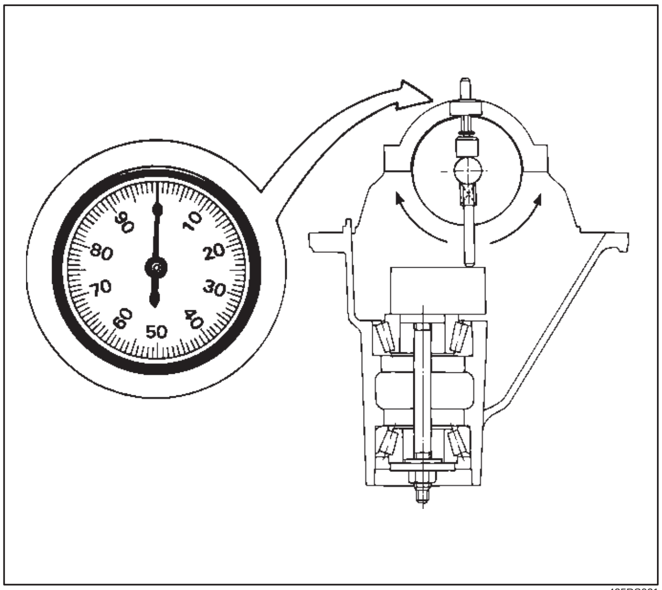
425RS020

Legend

(1) Dial Indicator
(2) Ganging Arbor
(3) Plunger
(4) Gauge Plate

5. Position the plunger on the gauge plate. Move the gauging arbor slowly back and forth and locate the position at which the dial indicator shows the greatest defection. At this point, once again set the dial indicator to “0”.

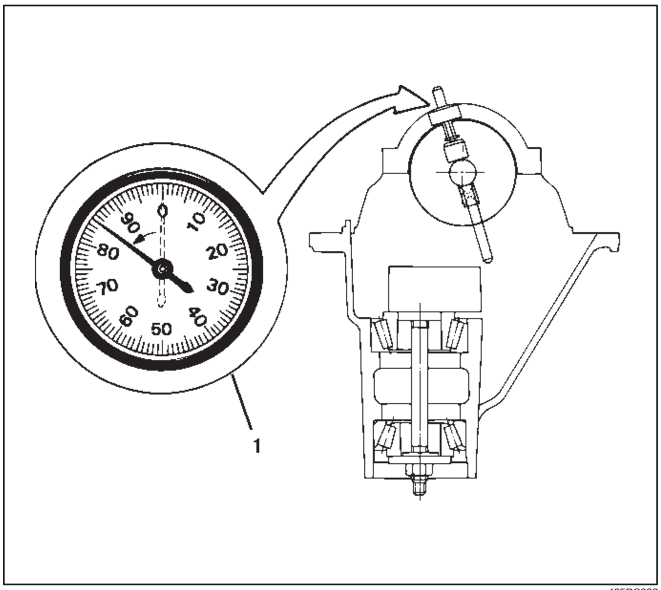
   Repeat the procedure to verify the “0” setting.



425RS021

6. After the ZERO setting is obtained, rotate the gauging arbor until the dial indicator rod does not touch the gauging plate.

   Record the number the dial indicator needle points to.



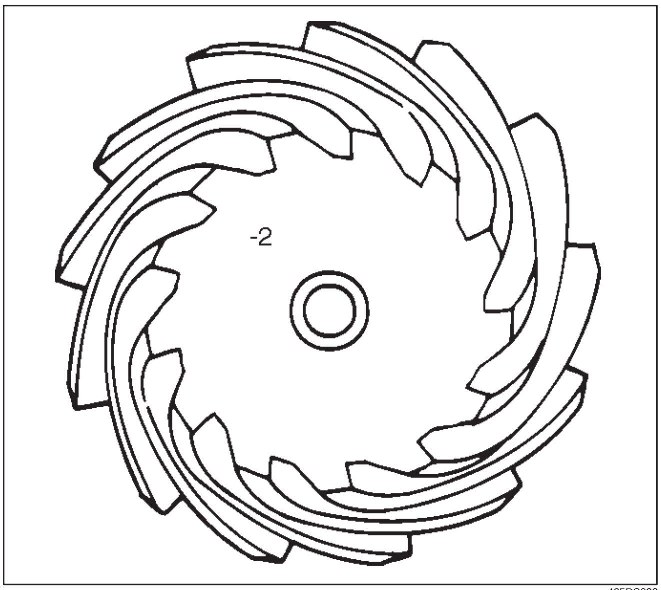
425RS022

Legend

(1) Example=Dial indicator reading of 0.085

7. Record the pinion depth code on the head of the drive pinion.

   The number indicates a necessary change in the pinion mounting distance. A plus number indicates the need for a greater mounting distance (which can be achieved by decreasing the shim thickness). A minus number indicates the need for a smaller mounting distance (which can be achieved by increasing the shim thickness). If examination reveals pinion depth code “0”, the pinion is “nominal”.



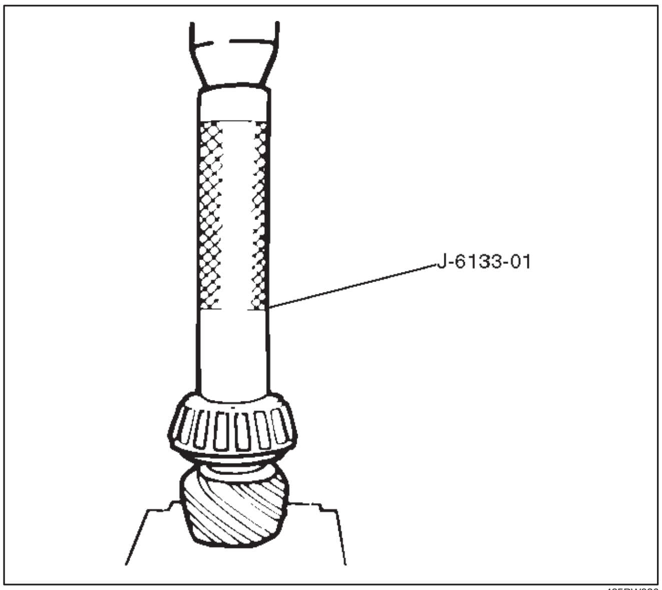
425RS023

8. Select the shim using chart;

Pinion marking / Dial indicator reading (Inches)	+7	+6	+5	+4	+3	+2	+1	0	–1	–2	–3	–4	–5	–6	–7
0.023															0.030
0.024														0.030	0.030
0.025													0.030	0.030	0.032
0.026												0.030	0.030	0.032	0.032
0.027											0.030	0.030	0.032	0.032	0.034
0.028										0.030	0.030	0.032	0.032	0.034	0.034
0.029									0.030	0.030	0.032	0.032	0.034	0.034	0.036
0.030								0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036
0.031							0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038
0.032						0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038
0.033					0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040
0.034				0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040
0.035			0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042
0.036		0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042
0.037	0.030	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044
0.038	0.030	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044
0.039	0.032	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046
0.040	0.032	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046
0.041	0.034	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048
0.042	0.034	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048
0.043	0.036	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050
0.044	0.036	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050
0.045	0.038	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052
0.046	0.038	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052
0.047	0.040	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052	
0.048	0.040	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052		
0.049	0.042	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052			
0.050	0.042	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052				
0.051	0.044	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052					
0.052	0.044	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052						
0.053	0.046	0.046	0.048	0.048	0.050	0.050	0.052	0.052							
0.054	0.046	0.048	0.048	0.050	0.050	0.052	0.052								
0.055	0.048	0.048	0.050	0.050	0.052	0.052									
0.056	0.048	0.050	0.050	0.052	0.052										
0.057	0.050	0.050	0.052	0.052											
0.058	0.050	0.052	0.052												
0.059	0.052	0.052													
0.060	0.052														

4. Place the shim on the drive pinion. Install the inner bearing onto the pinion using an installer J–6133–01 and a press.

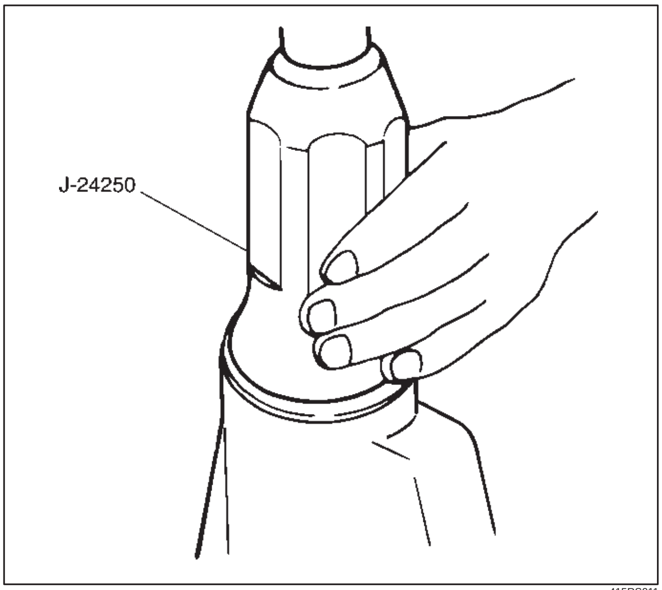
NOTE: Do not apply pressure to the roller cage and apply pressure only to the inner race.



425RW036

5. Discard the used collapsible spacer and install a new one.
6. Install pinion gear.
7. Install outer bearing.
8. Install oil seal slinger.
9. Use oil seal installer J–24250 to install a new oil seal that has been soaked in front axle lubricant.

NOTE: Take care to use a front differential oil seal, NOT the rear differential oil seal.

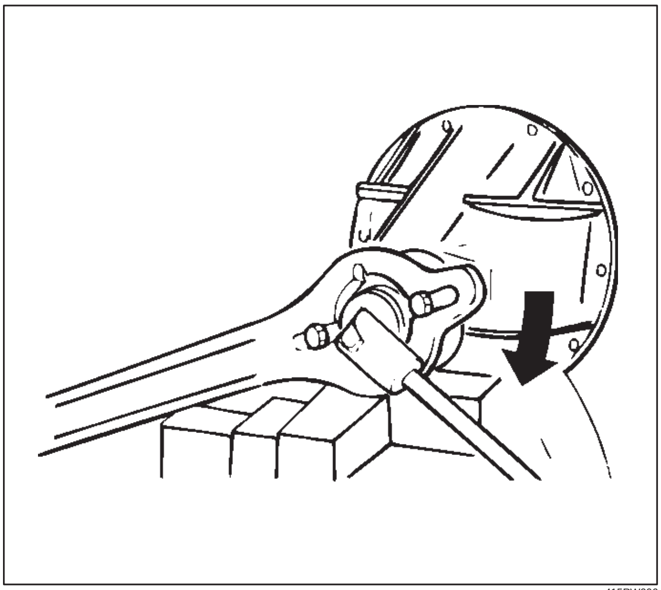


415RS011

10. Install flange.
11. Install flange nut.
    1. Apply lubricant to the pinion threads.
    2. Tighten the nut to the specified torque using the pinion flange holder J–8614–01.

Torque: 217N·m (160 lb ft)

NOTE: Discard used flange nut and install new one and do not over tighten the flange nut.

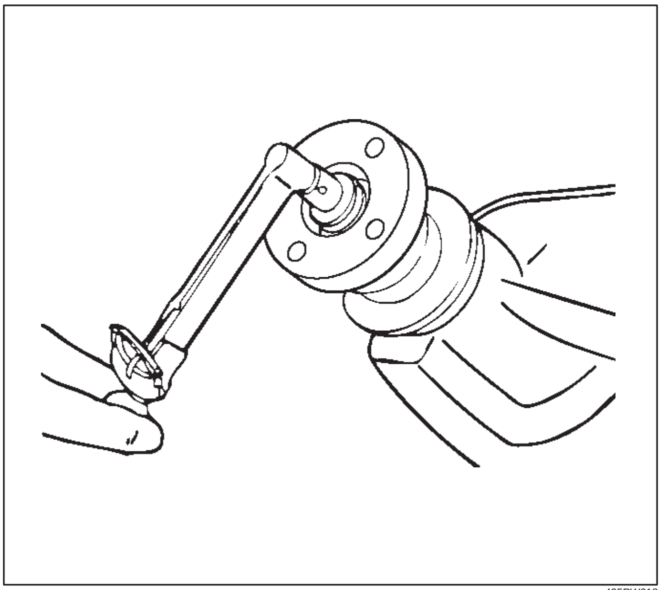


415RW006

    3. Adjust pinion bearing preload.
        a. Measure the bearing preload by using a torque meter. Note the scale reading required to rotate the flange.
        b. Continue tightening flange nut until the specified starting torque is obtained.

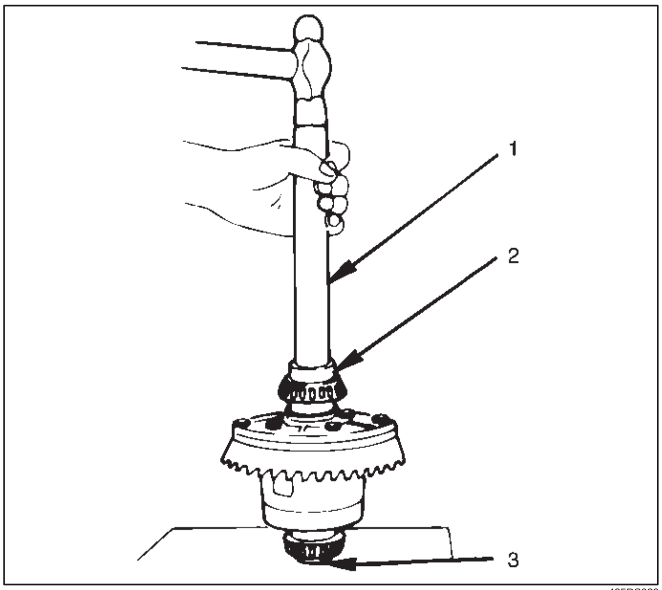
Starting torque: 0.6–1.1 N·m(5.6–10.0 lb in)

NOTE: Do not tighten the flange nut more than 678 N·m(500 lb ft).



425RW018

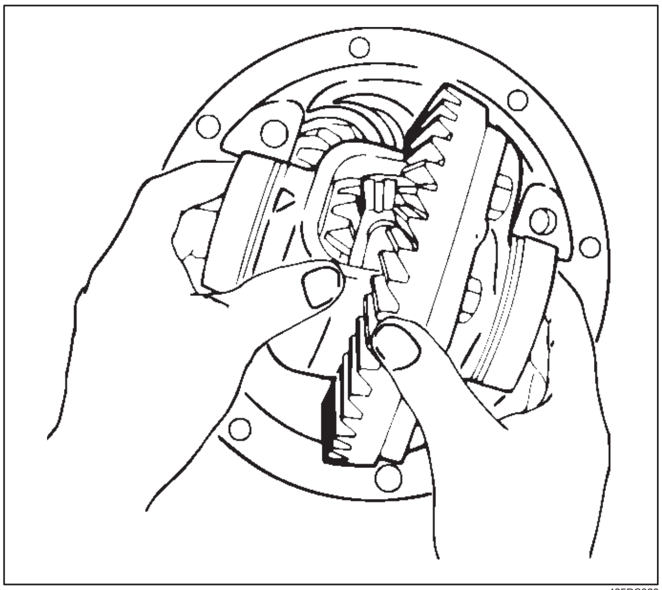
12. Install adjust shim.
    1. Attach the side bearing to the differential assembly without shims. Support the opposite side using a pilot to prevent bearing damage.



425RS029

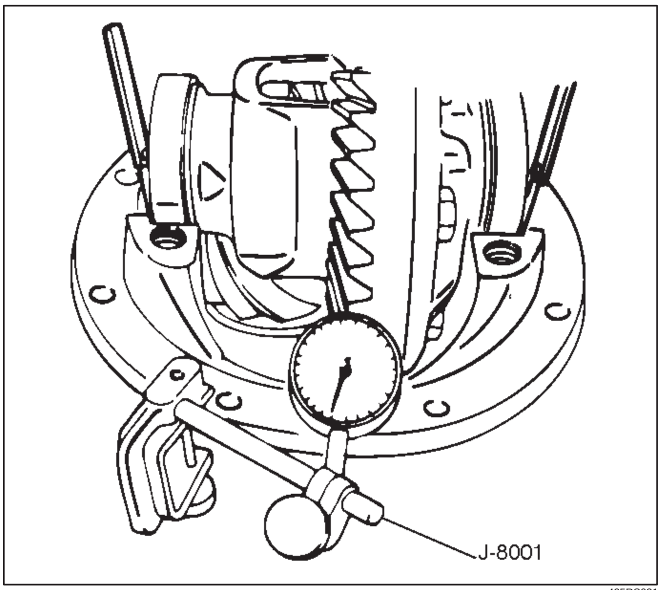
Legend
(1) Drive handle:J–8092
(2) Installer:J–24244
(3) Pilot:J–8107–2

2. Insert the differential cage assembly with bearing outer races into the side bearing bores of the carrier.


425RS030

3. Using two sets of feeler gauges, insert a feeler stock of sufficient thickness between each bearing outer race and the carrier to remove all end play. Make certain the feeler stock is pushed to the bottom of the bearing bores.

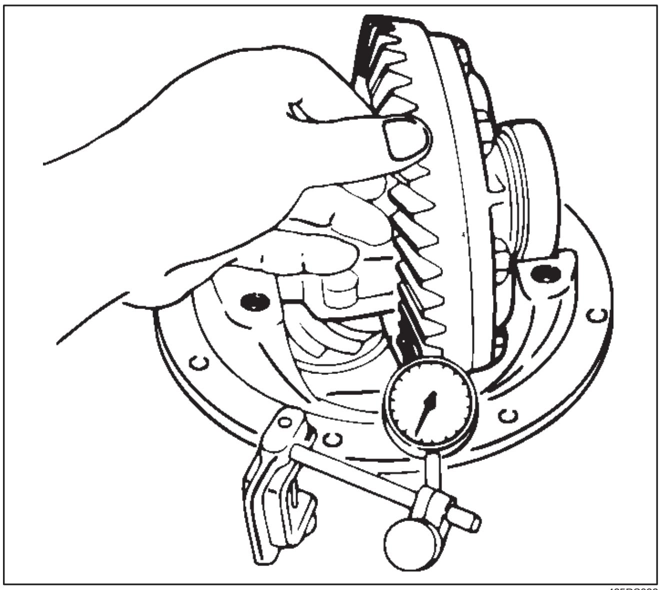
   Mount the dial indicator J–8001 on the carrier so that the indicator stem is at right angles to a tooth on the ring gear.



425RS031

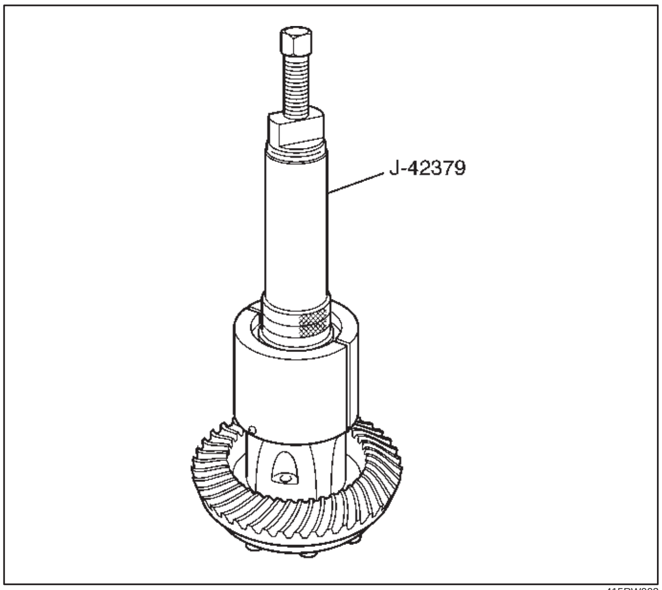
4. Adjust feeler gauge thickness from side to side until ring gear backlash is in the specified range.

Backlash: 0.13–0.20 mm(0.005 –0.008 in)


425RS032

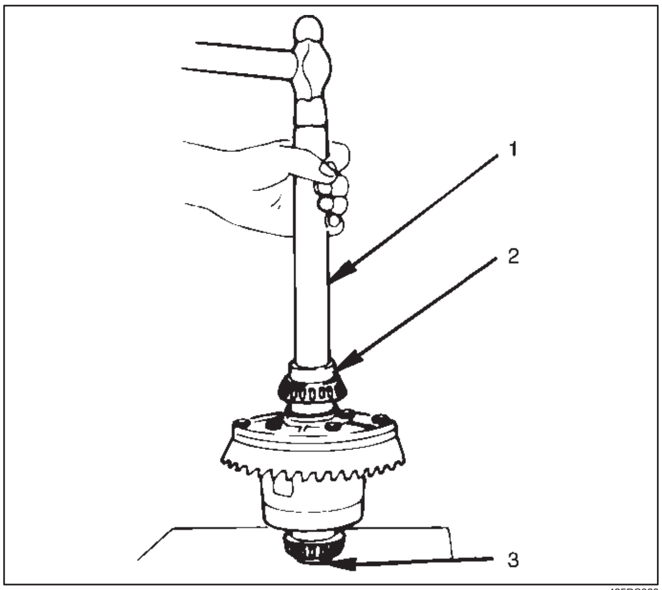
With zero end play and correct backlash established, remove the feeler gauge packs, determine the thickness of the shims required and add 0.025 mm (0.001 in) to each shim pack to provide side bearing preload. Always use new shims.

5. Use bearing remover J–42379 and pilot J–8107–2 to remove side bearing.
   - Select insert; 303173 and collet halves;44801 in remover kit J–42379.



415RW003

13. Install the side bearings together with the selected shims.

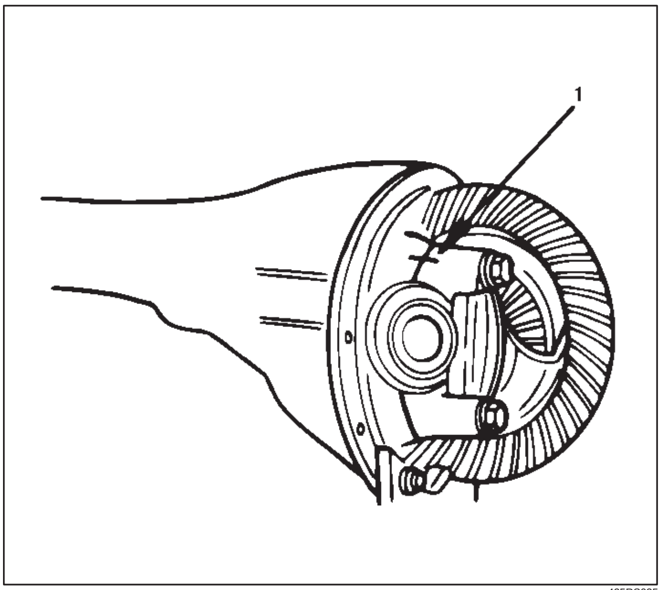


425RS029

Legend

(1) Drive Handle:J–8092
(2) Installer: J–24244
(3) Pilot: J–8107–2

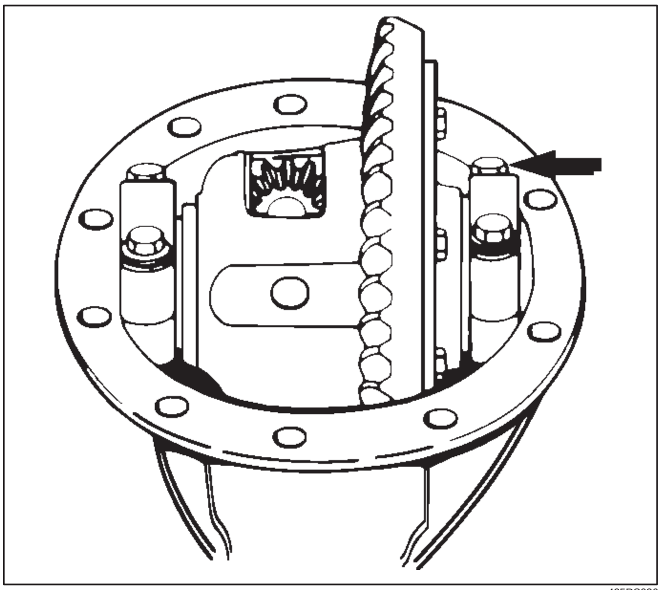
14. Install side bearing outer race.
15. Install differential cage assembly.
16. Install bearing cap then align the setting marks(1) applied at disassembly.



425RS035

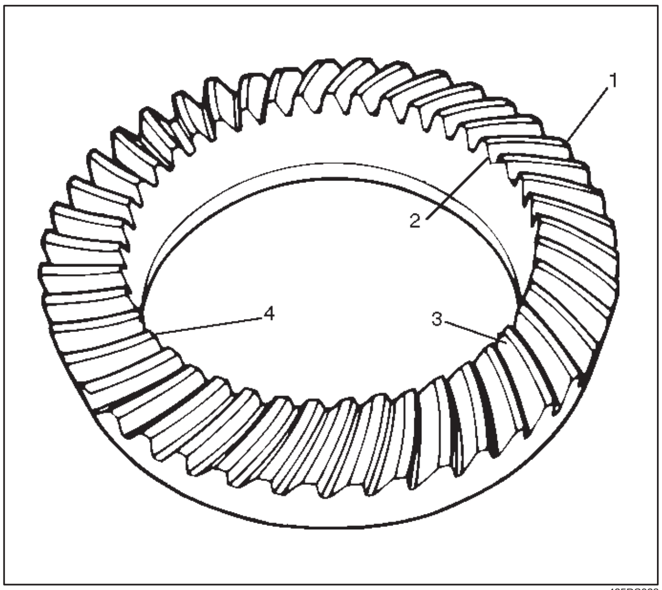
17. Tighten the cap bolt to the specified torque.

Torque: 97 N·m (72 lb ft)


425RS036

Gear Tooth Contact Pattern Check and Adjustment

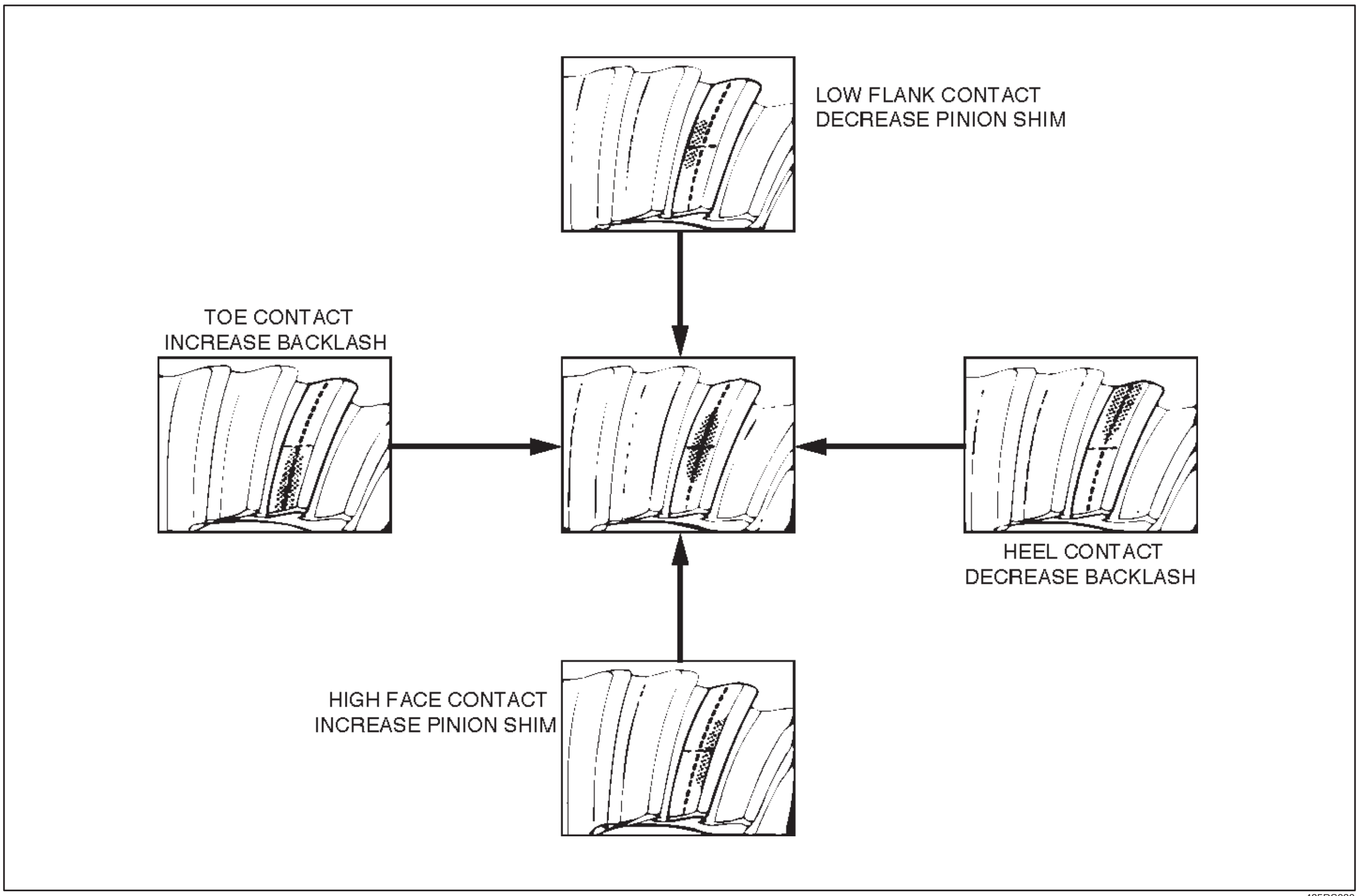
1. Apply a thin coat of prussian blue or equivalent to the faces of the 7–8 teeth of the ring gear. Check the impression of contact on the ring gear teeth and make necessary adjustment as described in illustration if the contact is abnormal.



425RS038

Legend

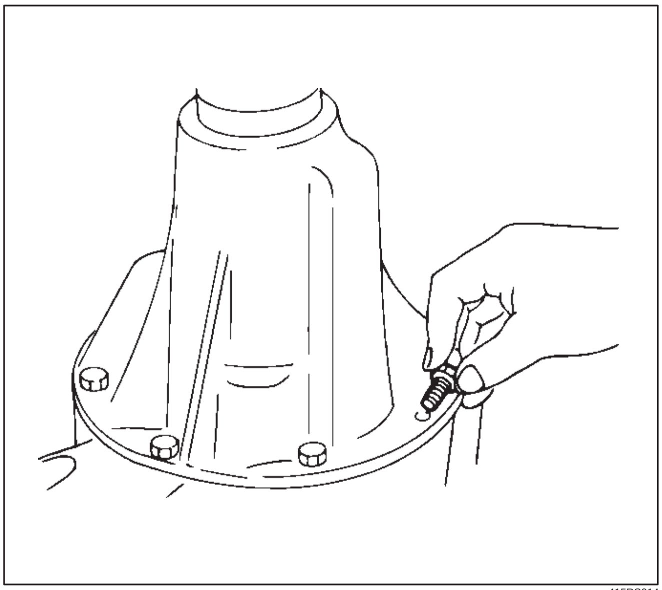
(1) Heel
(2) Toe
(3) Concave Side(Coast)
(4) Convex Side(Drive)



425RS039

18. Install differential assembly.
    1. Clean the faces of the front axle case and differential carrier.
       Apply Three Bond TB1215 or equivalent to the sealing side of the axle case and the carrier.
    2. Attach the differential case and the carrier assembly to the front axle case and tighten the nuts and bolts.

Torque: 25 N·m (19 lb ft)



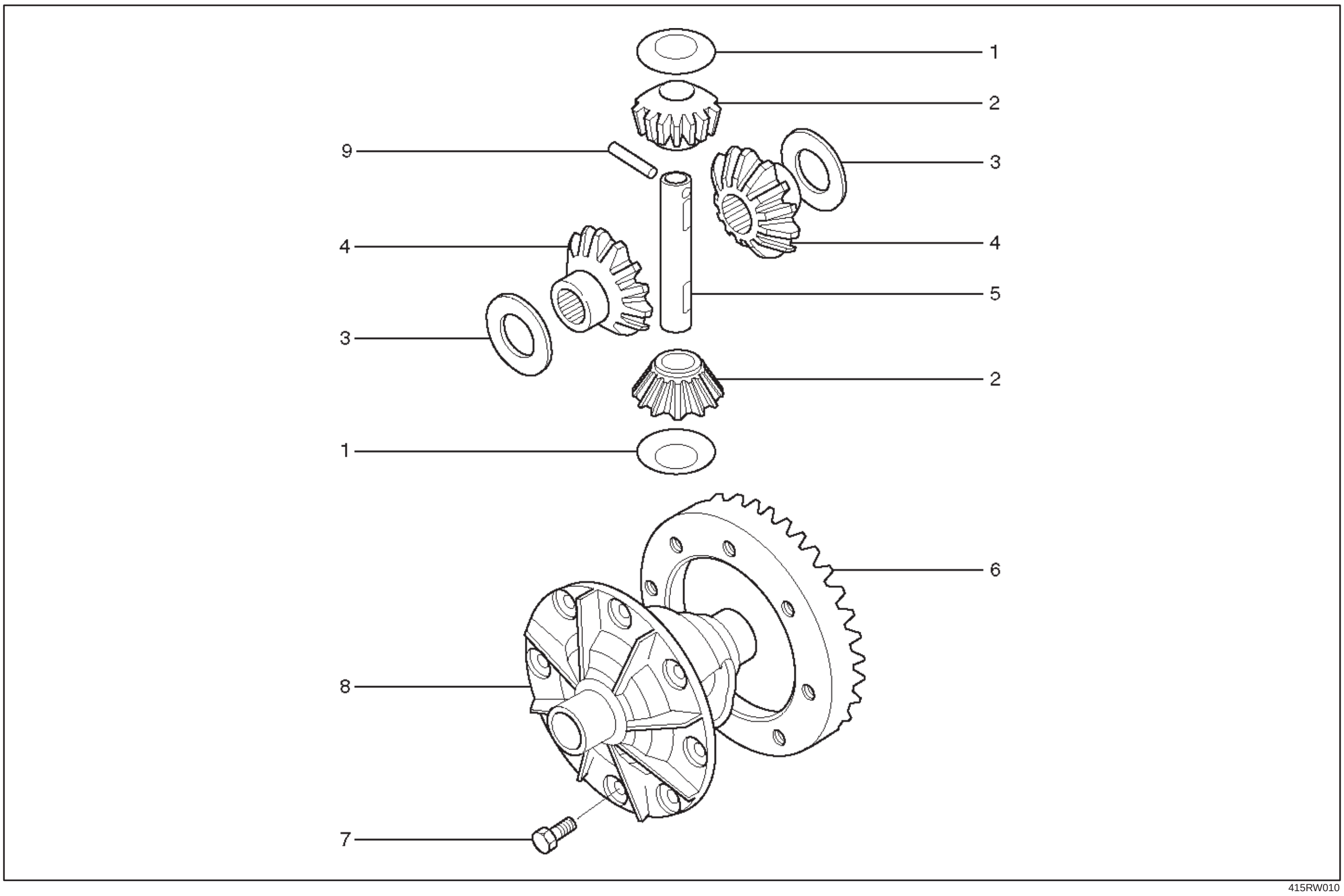
415RS014

    3. Fill the axle case with hypoid gear lubricant, to just below the filler hole.

Lubricant capacity: 1.4 liter(1.48 US qt)

Differential Cage Assembly

Disassembled View

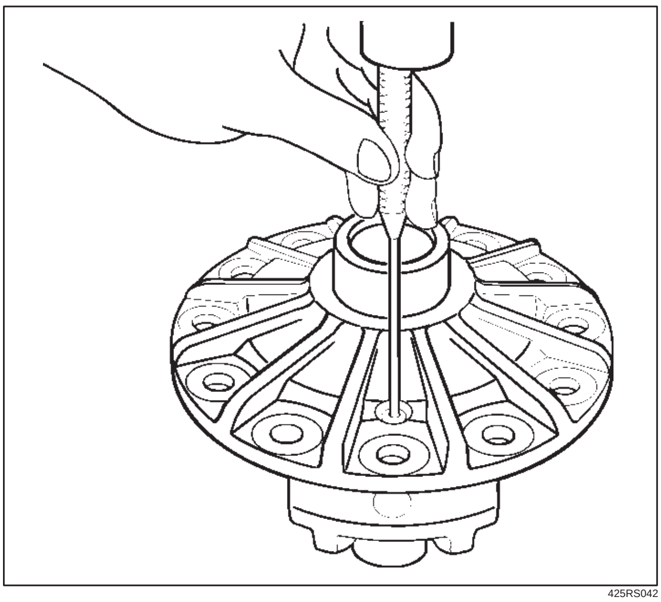


Legend

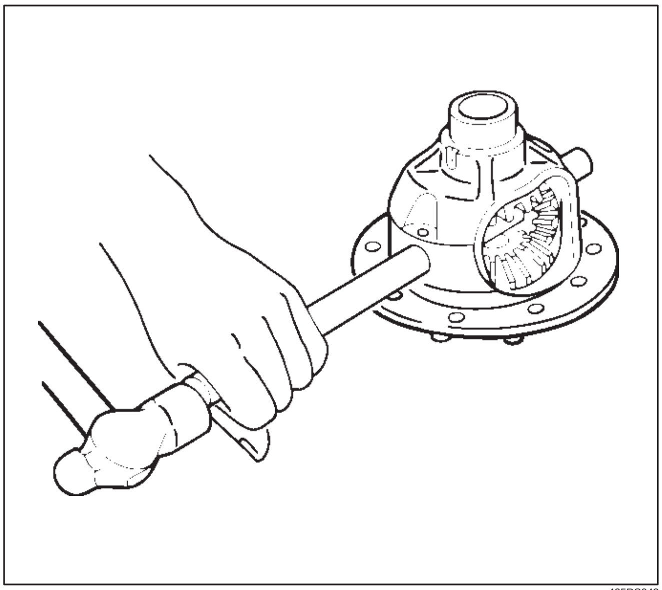
(1) Thrust Washer
(2) Pinion Gear
(3) Thrust Washer
(4) Side Gear
(5) Cross Pin
(6) Ring Gear
(7) Bolt
(8) Differential Cage
(9) Lock Pin

Disassembly

1. Remove bolt.
2. Remove ring gear.
3. Remove lock pin.



4. Remove the cross pin, using a soft metal rod and a hammer.



425RS043

5. Remove pinion gear and thrust washer.
6. Remove side gear.
7. Remove thrust washer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

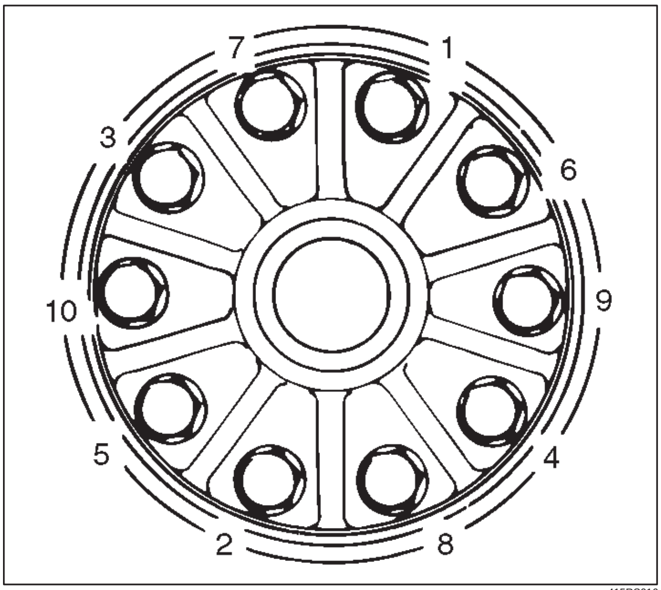
1. Ring gear, pinion gear
2. Bearing
3. Side gear, pinion gear, cross pin
4. Differential cage, carrier
5. Thrust washer
6. Oil seal

Ring gear replacement:

1. The ring gear should always be replaced with the drive pinion as a set.
2. Discard used bolts and install new ones.

Torque: 108 N·m (80 lb ft)

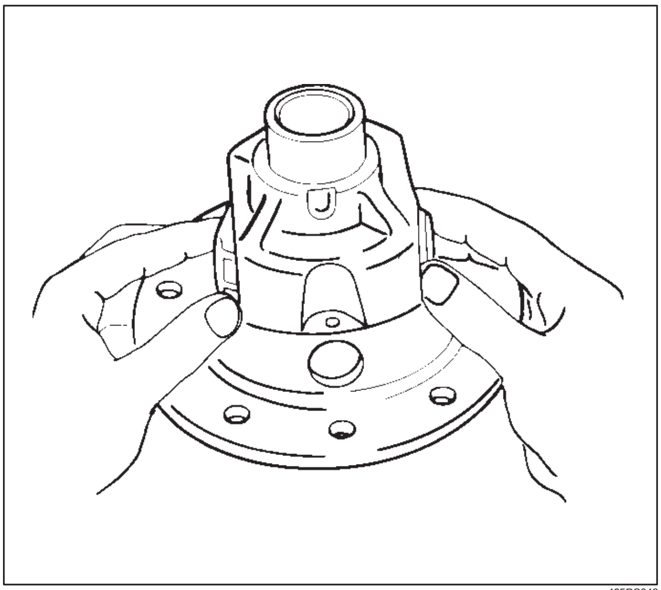
3. Tighten the fixing bolts in a diagonal sequence as illustrated.



415RS016

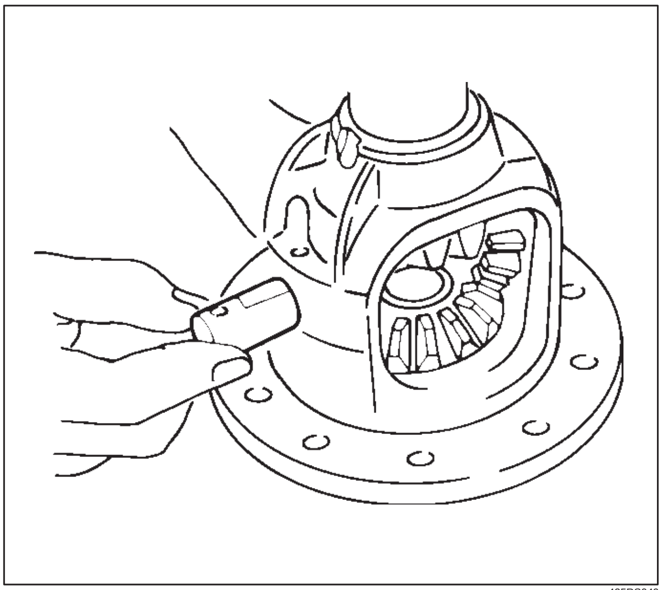
Reassembly

1. Install thrust washer.
2. Install side gear.
3. Install the pinion gear with thrust washer by engaging it with the side gears while turning both pinion gears simultaneously in the same direction.



425RS048

4. Install cross pin.
   - Be sure to install the cross pin so that it is in alignment with the lock pin hole in the differential cage.

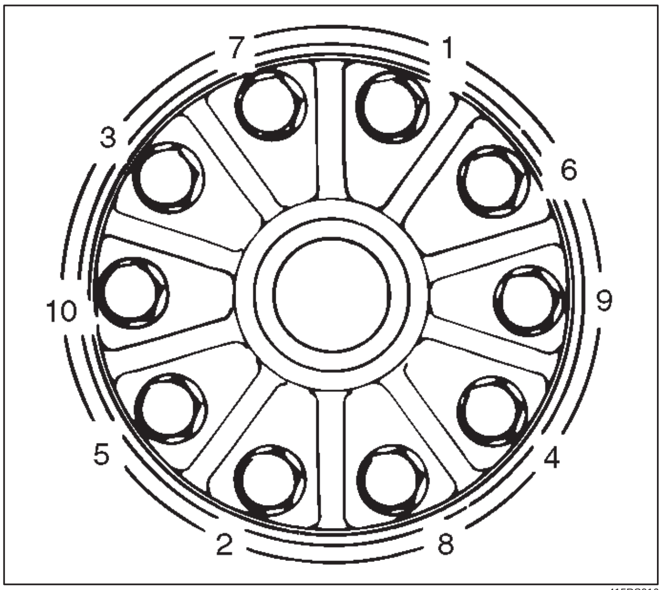


425RS049

5. Install lock pin. After lock pin installation, stake the cage to secure the lock pin.
6. Install ring gear and tighten the bolts in diagonal sequence as illustrated.

Torque: 108 N·m (80 lb ft)

NOTE: Discard used bolts and install new ones.



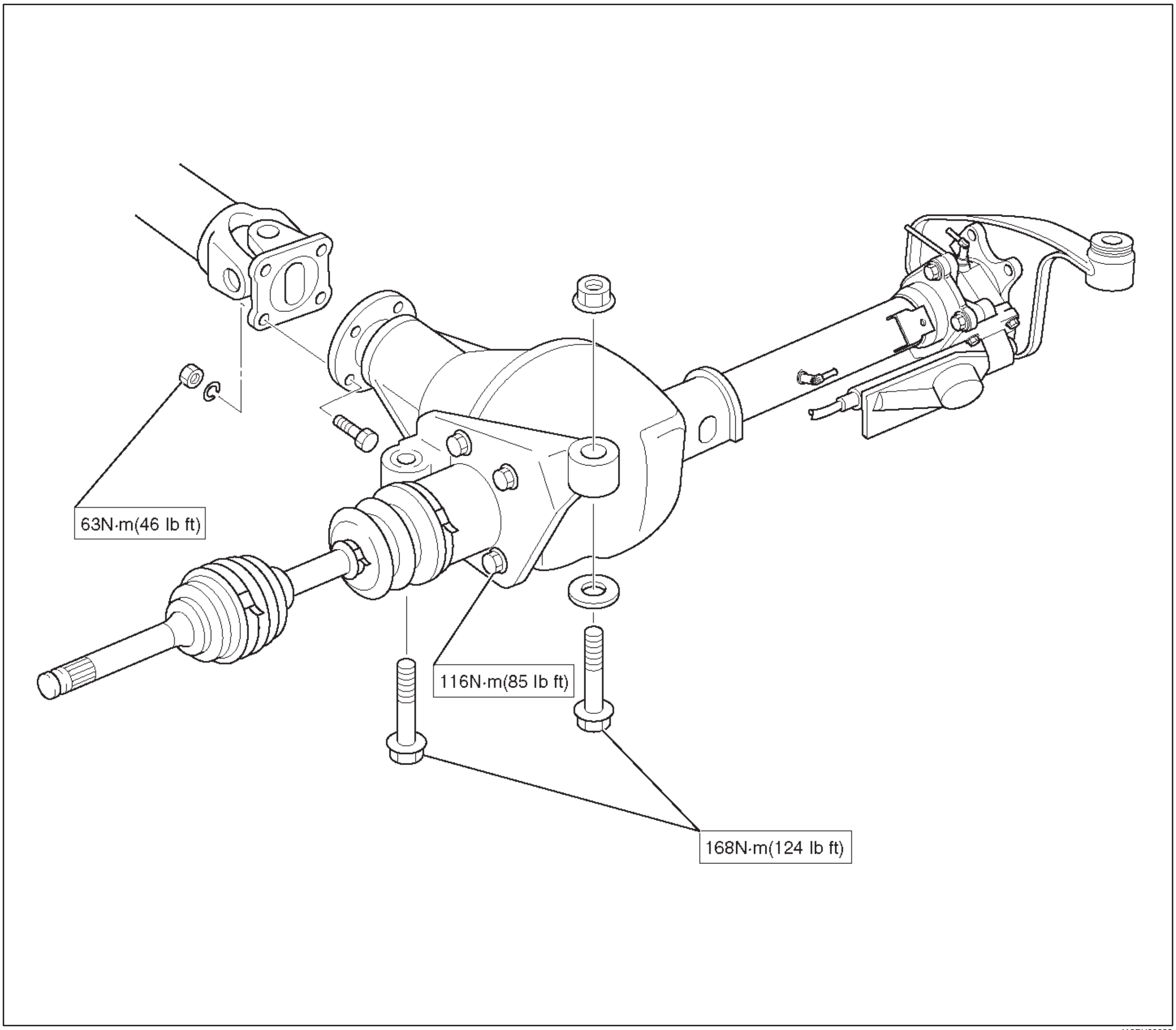
415RS016

Main Data and Specifications

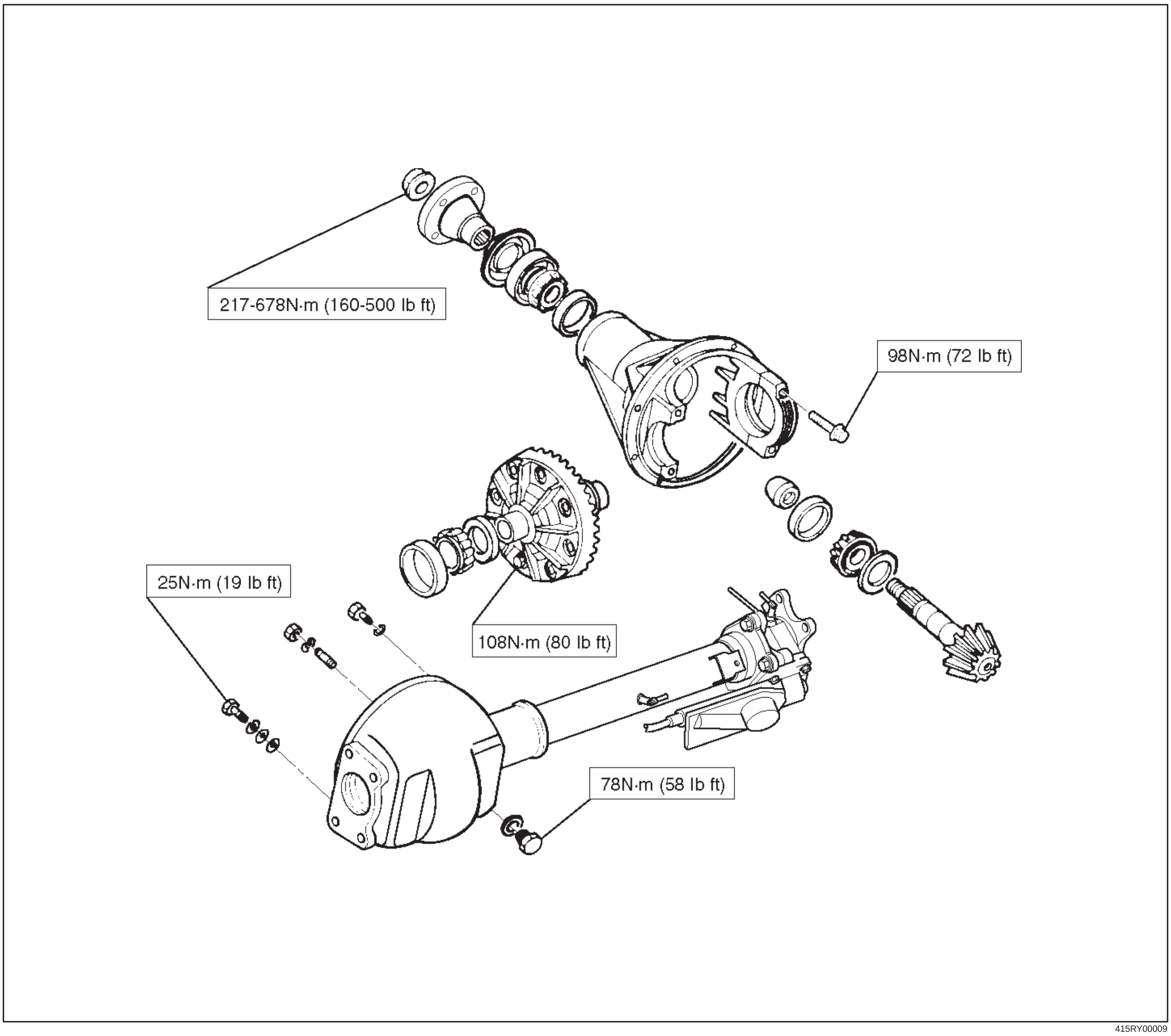
General Specifications

Axle tube Type		It consists of the duct, a cast iron housing and the axle tube.
Gear type		Hypoid
Gear ratio	(to 1)	4.100 (6VD1 with A/T) 4.300 (6VD1 with M/T)
Differential type		Two pinion
Oil capacity	liter (US qt)	1.25 (1.32) (Differential) 0.12 (0.13) (Actuator Housing: Shift on the fly)
Type of lubricant		GL–5 (75W–90)
Axle shaft type		Constant velocity joint (Birfield joint type and double offset joint)
Hub locking Type		Rigid

Torque Specifications



412RY00032


217-678N·m (160-500 lb ft)
98N·m (72 lb ft)
25N·m (19 lb ft)
108N·m (80 lb ft)
78N·m (58 lb ft)
415RY00009

Special Tools

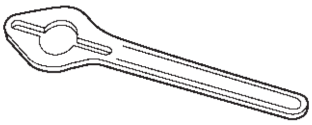
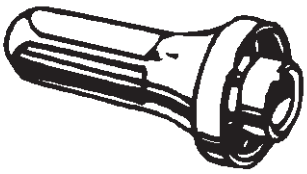
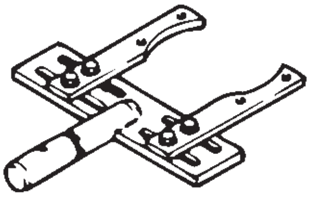
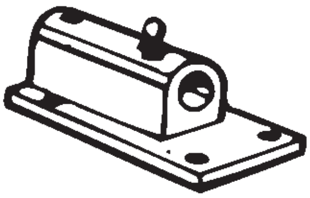
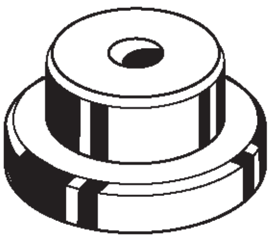
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–8614–01** Holder; Pinion flange
	**J–24250** Installer; Oil seal
	**J–37264** Differential holding fixture (Use with J–3289–20 base)
	**J–3289–20** Holding fixture base
	**J–42379** Remover; Side/Pinion bearing
	**J–8107–2** Adapter; Side bearing plug

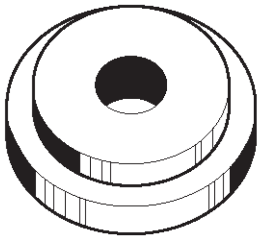
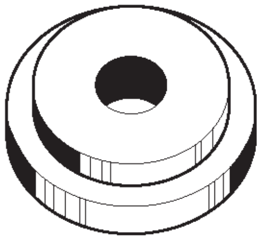
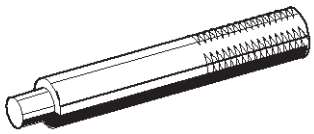
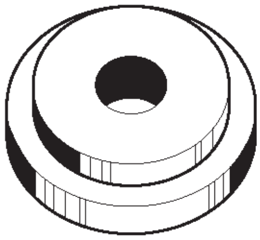
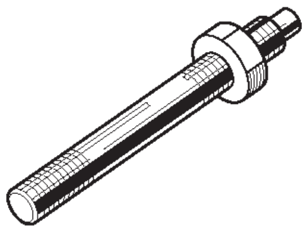
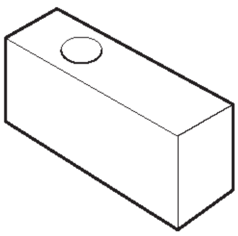
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–7817** Installer; Outer bearing outer race
	**J–7818** Installer; Inner bearing outer race
	**J–8092** Driver handle
	**J–21777–42** Pilot
	**J–21777–43** Nut and stud
	**J–42479–1** Gauge plate

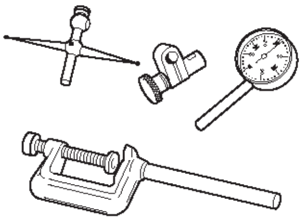
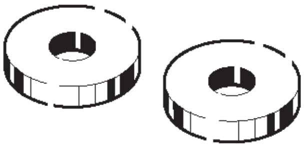
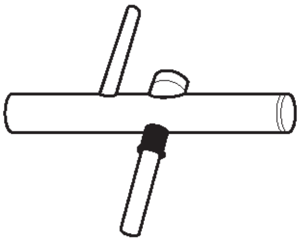
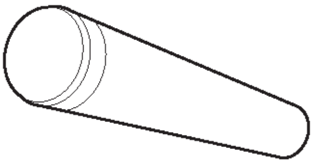
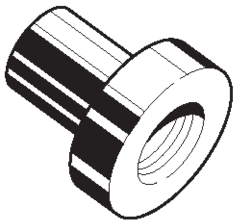
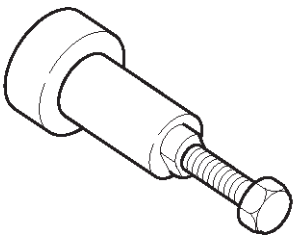
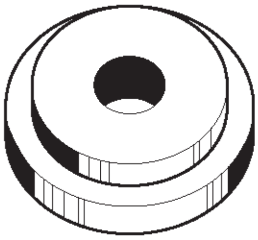
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–8001** Dial indicator
	**J–23597–8** Disc
	**J–23597–1** Arbor
	**J–6133–01** Installer; Pinion bearing
	**J–24244** Installer; Side bearing
	**J–39602** Remover; Outer bearing

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–42479–2** Pilot

RODEO

DRIVELINE/AXLE

Differential (Rear)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM(SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE REFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFOMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED , do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally,such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specification. Following these instructions can help you avoid damage to parts and systems.

General Description

The rear axle assembly is of the semi–floating type in which the vehicle weight is carried on the axle housing . The center line of the pinion gear is below the center line of the ring gear (hypoid drive).

All parts necessary to transmit power from the propeller shaft to the rear wheels are enclosed in a salisbury type axle housing (a carrier casting with tubes pressed and welded into the carrier). A removable aluminum cover at the rear of the axle housing permits rear axle service without removal of the entire assembly from the vehicle.

The 8.9 inch ring gear rear axle uses a conventional ring and pinion gear set to transmit the driving force of the engine to the rear wheels. This gear set transfers this driving force at a 90 degree angle from the propeller shaft to the drive shafts.

The axle shafts are supported at the wheel end of the shaft by a roller bearing.

The pinion gear is supported by two tapered roller bearings. The pinion depth is set by a shim pack located between the gear end of the pinion and the roller bearing that is pressed onto the pinion. The pinion bearing preload is set by crushing a collapsible spacer between the bearings in the axle housing.

The ring gear is bolted onto the differential case with 10 bolts.

The differential case is supported in the axle housing by two tapered roller bearings. The differential and ring gear are located in relationship to the pinion by using selective shims and spacers between the bearing and the differential case. To move the ring gear, shims are deleted from one side and an equal amount are added to the other side. These shims are also used to preload the bearings which are pressed onto the differential case. Two bearing caps are used to hold the differential into the rear axle housing.

The differential is used to allow the wheels to turn at different rates of speed while the rear axle continues to transmit the driving force. This prevents tire scuffing when going around corners and prevents premature wear on internal axle parts.

The rear axle is sealed with a pinion seal, a seal at each axle shaft end, and by a liquid gasket between the rear cover and the axle housing.

Limited Slip Differential (LSD)

The axle assembly may be equipped with an limited slip differential (LSD). It is similar to the standard differential except that part of the torque from the ring gear is transmitted through clutch packs between the side gears and differential case.

The LSD construction permits differential action when required for turning corners and transmits equal torque to both wheels when driving straight ahead. However, when one wheel tries to spin due to a patch of ice, etc., the clutch packs automatically provide more torque to the wheel which is not trying to spin.

In diagnosing customer complaints, it is important to recognize two things:

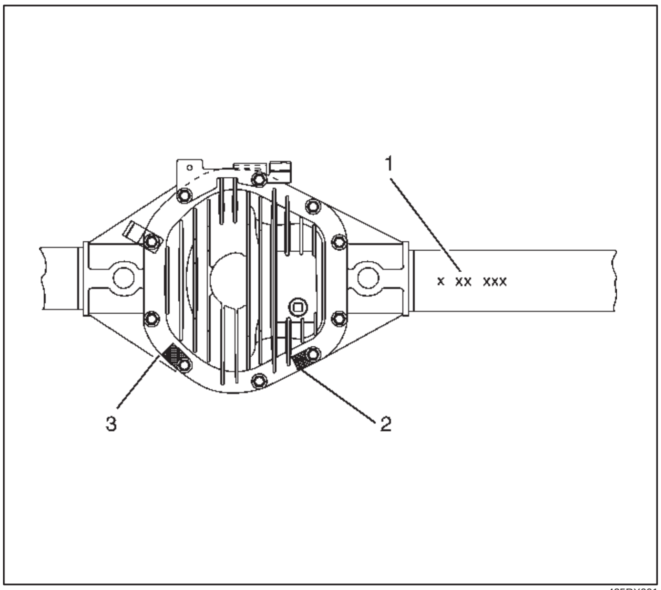
1. If, both wheels slip, with unequal traction, the LSD has done all it can possibly do.
2. In extreame cases of differences in traction, the wheel with the least traction may spin after the LSD has transferred as much torque as possible to the non-slipping wheel.

Limited Slip Differntials impose additional requirements on lubricants, and require a special lubricant or lubricant additive. Use 80W90 GL–5 LSD lubricant.

Rear Axle Identification

The Bill of Material and build date information(1) is stamped on the right axle tube on the rearward side.

The axle ratio is identified by a tag(3) which is secured by a cover bolt. If the axle has limited-slip differntial, it also will be identified with a tag(2) secured by a cover bolt.



425RX001

Diagnosis

Many noises that seem to come from the rear axle actually originate from other sources such as tires, road surface, wheel bearings, engine, transmission, muffler, or body drumming. Investigate to find the source of the noise before disassembling the rear axle. Rear axles, like any other mechanical device, are not absolutely quiet but should be considered quiet unless some abnormal noise is present.

To make a systematic check for axle noise, observe the following:

1. Select a level asphalt road to reduce tire noise and body drumming.
2. Check rear axle lubricant level to assure correct level, and then drive the vehicle far enough to thoroughly warm up the rear axle lubricant.
3. Note the speed at which noise occurs. Stop the vehicle and put the transmission in neutral. Run the engine speed slowly up and down to determine if the noise is caused by exhaust, muffler noise, or other engine conditions.
4. Tire noise changes with different road surfaces; axle noises do not. Temporarily inflate all tires to 344 kPa (50 psi) (for test purposes only). This will change noise caused by tires but will not affect noise caused by the rear axle.

   Rear axle nose usually stops when coasting at speeds under 48 km/h (30 mph); however, tire noise continues with a lower tone. Rear axle noise usually changes when comparing pull and coast, but tire noise stays about the same.

   Distinguish between tire noise and rear axle noise by noting if the noise changes with various speeds or sudden acceleration and deceleration. Exhaust and axle noise vary under these conditions, while tire noise remains constant and is more pronounced at speeds of 32 to 48 km/h (20 to 30 mph). Further check for tire noise by driving the vehicle over smooth pavements or dirt roads (not gravel) with the tires at normal pressure. If the noise is caused by tires, it will change noticeably with changes in road surface.
5. Loose or rough front wheel bearings will cause noise which may be confused with rear axle noise; however, front wheel bearing noise does not change when comparing drive and coast. Light application of the brake while holding vehicle speed steady will often cause wheel bearing noise to diminish. Front wheel bearings may be checked for noise by jacking up the wheels and spinning them or by shaking the wheels to determine if bearings are loose.
6. Rear suspension rubber bushings and spring insulators dampen out rear axle noise when correctly installed. Check to see that there is no link or rod loosened or metal–to–metal contact.
7. Make sure that there is no metal–to–metal contact between the floor and the frame.

After the noise has been determined to be in the axle, the type of axle noise should be determined, in order to make any necessary repairs.

Gear Noise

Gear noise (whine) is audible from 32 to 89 km/h (20 to 55 mph) under four driving conditions.

1. In drive under acceleration or heavy pull.
2. Driving under load or under constant speed.
3. When using enough throttle to keep the vehicle from driving the engine while the vehicle slows down gradually (engine still pulls slightly).
4. When coasting with the vehicle in gear and the throttle closed. The gear noise is usually more noticeable between 48 and 64 km/h (30 and 40 mph) and 80 and 89 km/h (50 and 55 mph).

Bearing Noise

Bad bearings generally produce a rough growl or grating sound, rather than the whine typical of gear noise. Bearing noise frequently “wow–wows” at bearing rpm, indicating a bad pinion or rear axle side bearing. This noise can be confused with rear wheel bearing noise.

Rear Wheel Bearing Noise

Rear wheel bearing noise continues to be heard while coasting at low speed with transmission in the neutral. Noise may diminish by gentle braking. Jack up the rear wheels, spin them by hand and listen for noise at the hubs. Replace any faulty wheel bearings.

Knock At Low Speeds

Low speed knock can be caused by worn universal joints or a side gear hub counter bore in the cage that is worn oversize. Inspect and replace universal joints or cage and side gears as required.

Backlash Clunk

Excessive clunk on acceleration and deceleration can be caused by a worn rear axle pinion shaft, a worn cage, excessive clearance between the axle and the side gear splines, excessive clearance between the side gear hub and the counterbore in the cage, worn pinion and side gear teeth, worn thrust washers, or excessive drive pinion and ring gear backlash. Remove worn parts and replace as required. Select close–fitting parts when possible. Adjust pinion and ring gear backlash.

Rear Axle Noise

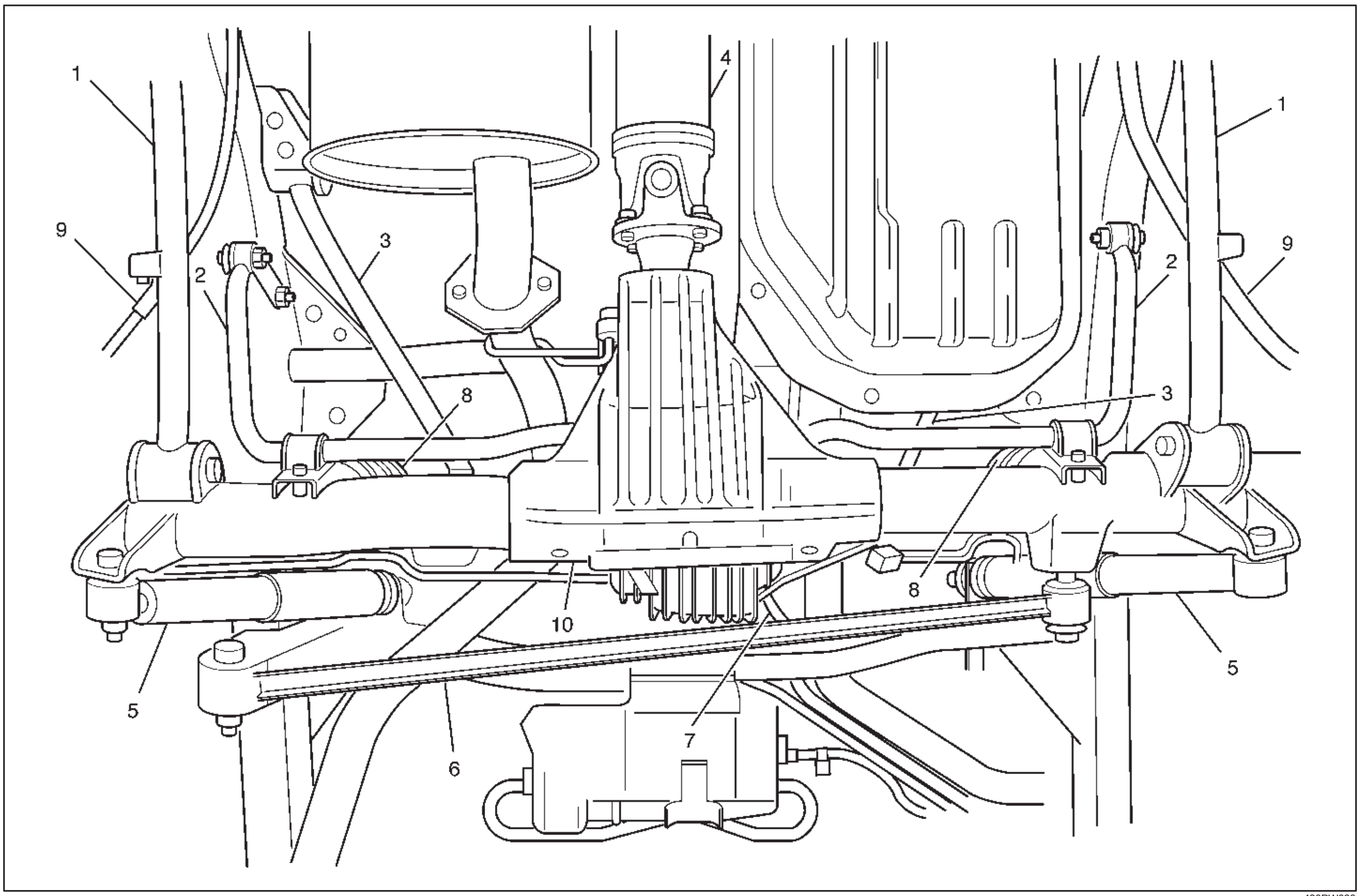
Condition	Possible cause	Correction
Noise in Drive	Excessive pinion to ring gear backlash.	Adjust.
	Worn pinion and ring gear.	Replace
	Worn pinion .bearings.	Replace.
	Loose pinion bearings.	Adjust.
	Excessive pinion end play.	Adjust.
	Worn side bearings.	Replace.
	Loose side bearings.	Adjust.
	Excessive ring gear run-out.	Replace.
	Low oil level.	Replenish.
	Wrong or poor grade oil.	Replace.
	Bent axle housing.	Replace.
Noisy when coasting	Axle noise heard when driving will usually be heard also on coasting, although not as loud.	Adjust or replace.
	Pinion and ring gear too tight (audible when slowing down and disappears when driving).	Adjust.
Intermittent noise	Warped bevel ring.	Replace.
	Loose differential case bolts.	Tighten.
Constant noise	Flat spot on pinion or ring gear teeth.	Replace.
	Flat spot on bearing.	Replace.
	Worn pinion splines.	Replace.
	Worn axle shaft dowel holes.	Replace.
	Worn hub studs.	Replace.
	Bent axle shaft.	Replace.
Noisy on turns	Worn differential side gears and pinions.	Replace.
	Worn differential shaft.	Replace.
	Worn axle shaft splines.	Replace.

Limited Slip Differential

Condition	Possible cause	Correction
Does not lock	Broken clutch plates.	Replace the clutch plates.
Chatters in turns	Lubricant contaminated.	Drain lube when hot. Wipe carrier clean. Refill with lube specified in Main Data and Specifications at the end of this section.
	Clutch plates dateriorated.	Replace clutch plates.
Noise (in addition to normal clutch engagement)	Broken clutch plates.	Replace clutch plates.
	Damaged case.	Replace unit.
	Broken differential gears.	Replace gears.

Axle Housing

Axle Housing and Associated Parts



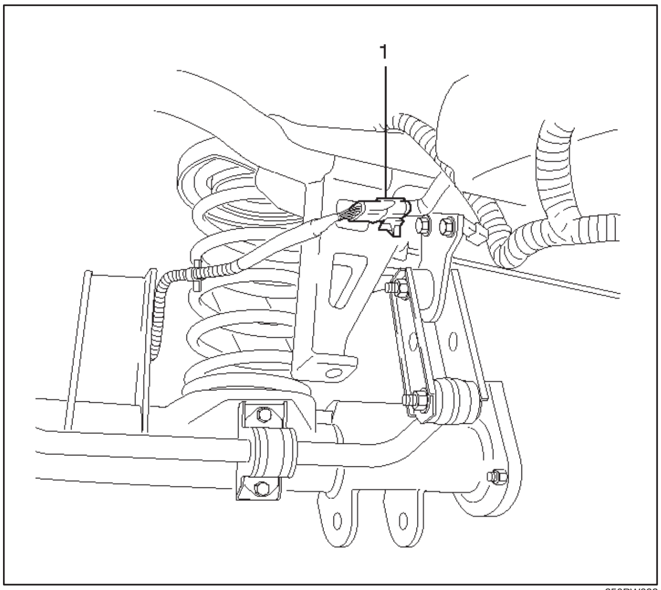
420RW030

Legend

(1) Lower Link
(2) Stabilizer
(3) Upper Link
(4) Rear Propeller shaft
(5) Shock Absorber
(6) Lateral Rod
(7) Brake Hose
(8) Coil Spring
(9) Parking Cable
(10) Axle Assembly

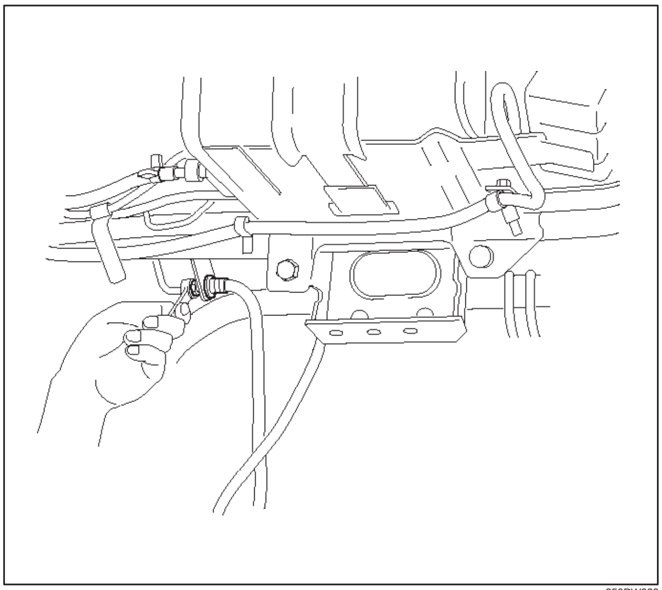
Removal

1. Raise the vehicle and support it with suitable safety stands.
   The hoist must remain under the rear axle housing.
2. Take out brake fluid. Refer to Hydraulic Brakes in Brake section.
3. Remove rear wheels and tires. Refer to Wheel Replacement in Suspension section.
4. Remove propeller shaft. Refer to Rear Propeller Shaft in this section.
5. Drain the rear axle oil into a proper container.
6. Remove parking brake cable, release the connection between the cable fixing clip equalizer. Refer to Parking Brakes in Brake section.
7. Move the clip aside and pull out the breather hose.
8. Disconnect the ABS connectors (1) and remove the brackets attached to the frame and center link.



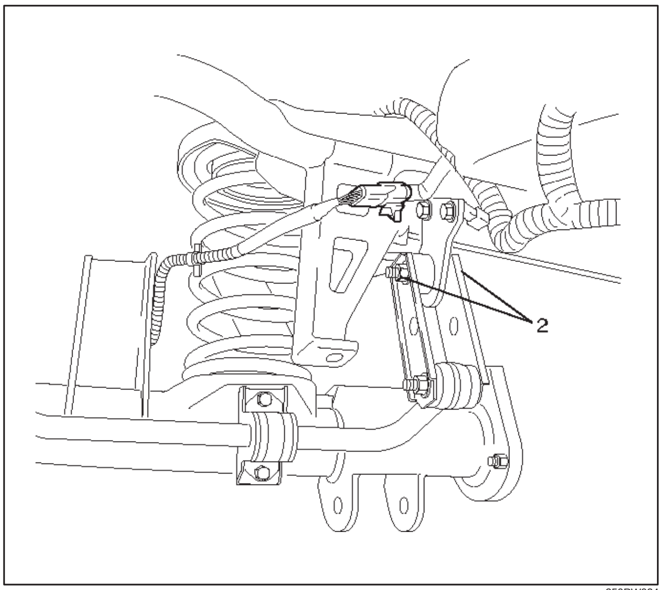
350RW023

9. Loosen the brake tube flare nut, remove the clip and take out the brake tube.



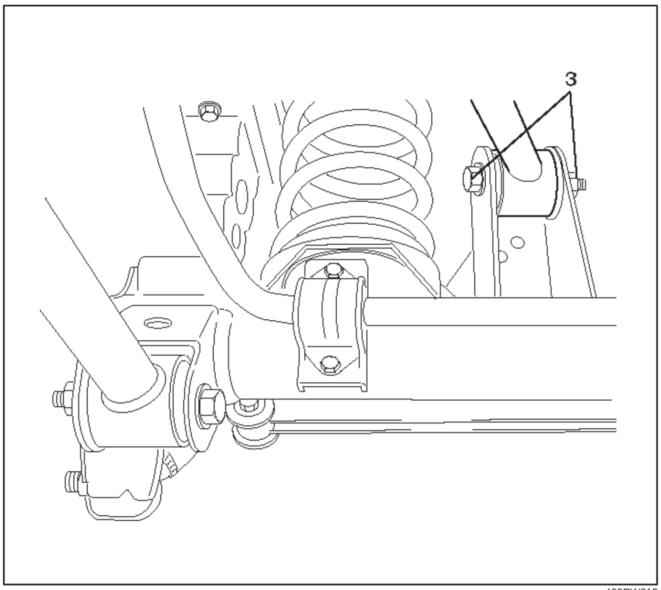
350RW020

10. Remove the shock absorber.
11. Remove the stabilizer linkage mounting bolts and nuts (2) from the frame side.



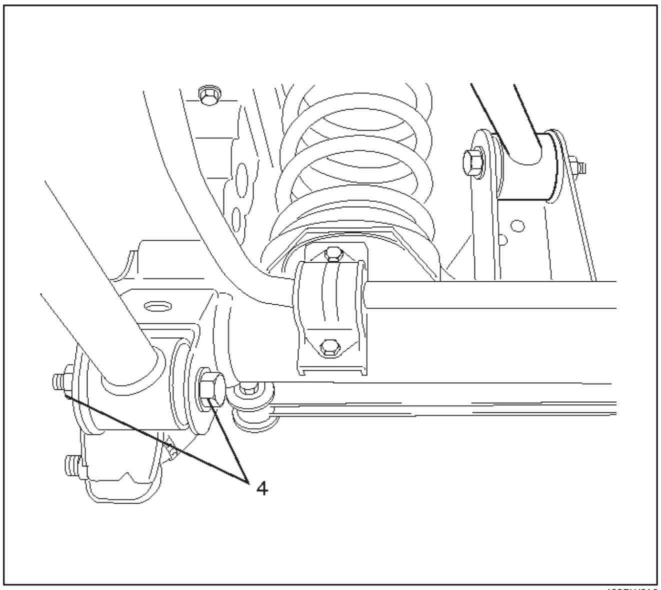
350RW024

12. Remove the lateral rod fixing bolt and nut from the frame.
13. Remove the upper link mounting bolt and nut (3) from the axle housing.



460RW015

14. Remove the lower link fixing bolt and nut (4) from the axle housing.



460RW016

15. Jack down and remove the coil spring and insulator.
16. Axle housing assembly can be separated from the vehicle on completion of steps 1 – 15.
17. Remove the brake caliper fixing bolt, loosen the flare nut, release the clip and take out the brake caliper together with the flexible hose.
18. Remove brake disc.
19. Remove antilock brake system speed sensor fixing bolt and the clip and bracket on the axle housing.
20. Remove the brake pipe clip and fixing bolt on the axle housing and take out the brake pipe.

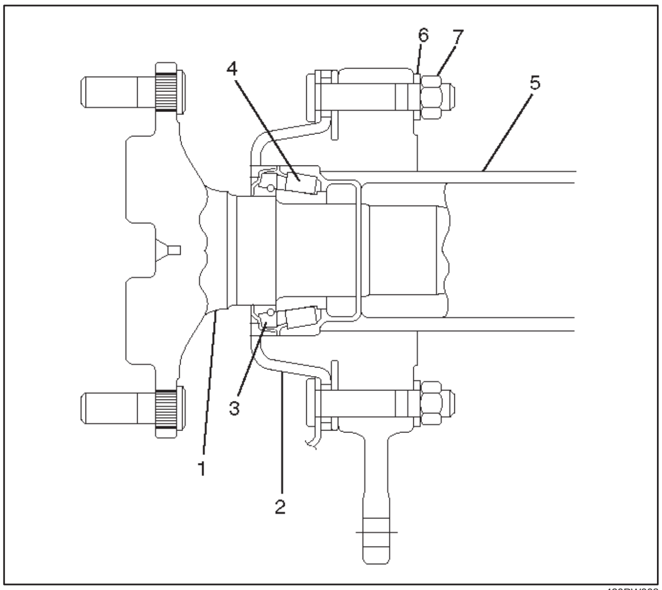
Installation

1. Install brake pipe.
2. Connect Antilock brake system (ABS) speed sensor and harness, refer to 4–Wheel Anti–Lock Brake System (ABS) in Brake section.
3. Install brake disc.
4. Install brake caliper. Refer to Disk Brakes in Brake section.
5. Install axle housing assembly.
6. Install coil spring and insulator.
7. Install the lower link fixing bolt and nut to the axle housing. For the procedures in items 7–11, refer to Suspension section.
8. Install the upper link bolt and nut to the axle housing.
9. Install the lateral rod fixing nut and bolt to the frame side.
10. Install the stabilizer linkage mounting nut and bolt to the frame side.
11. Install the shock absorber.
12. Install brake tube flare nut, Refer to Disk Brakes in Brake section.
13. Install ABS connector and bracket.
14. Connect breather hose.
15. Install parking brake cable, Refer to Parking Brakes in Brake section.
16. Bleed brakes. Refer to Hydraulic Brakes in Brake section.

Axle Shaft, Oil Seal and Bearing

Axle Shaft and Associated Parts

Disc Brake Model

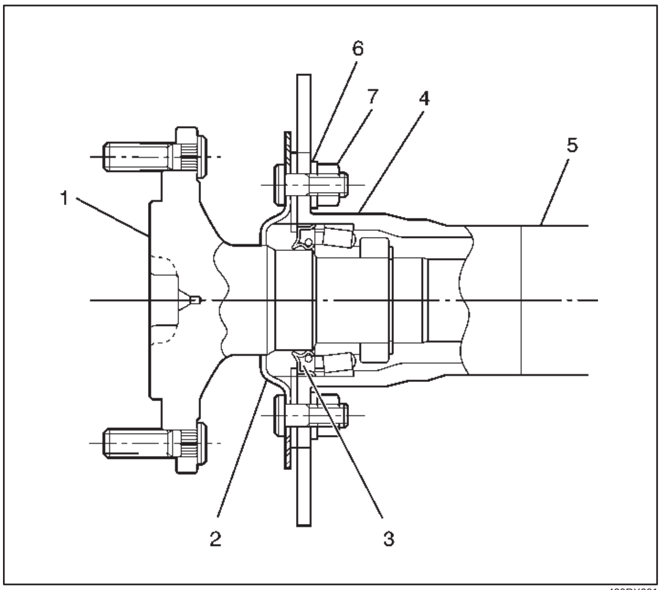


420RW008

Legend

(1) Axle Shaft
(2) Backing Plate
(3) Oil Seal
(4) Bearing
(5) Axle Housing
(6) Lock Washer
(7) Nut

Drum Brake Model



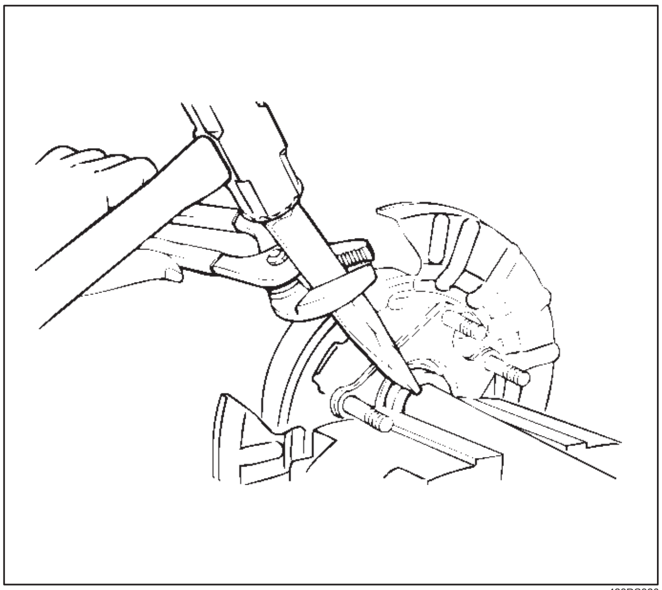
420RX001

Legend

(1) Axle Shaft
(2) Backing Plate
(3) Oil Seal
(4) Bearing
(5) Axle Housing
(6) Lock Washer
(7) Nut

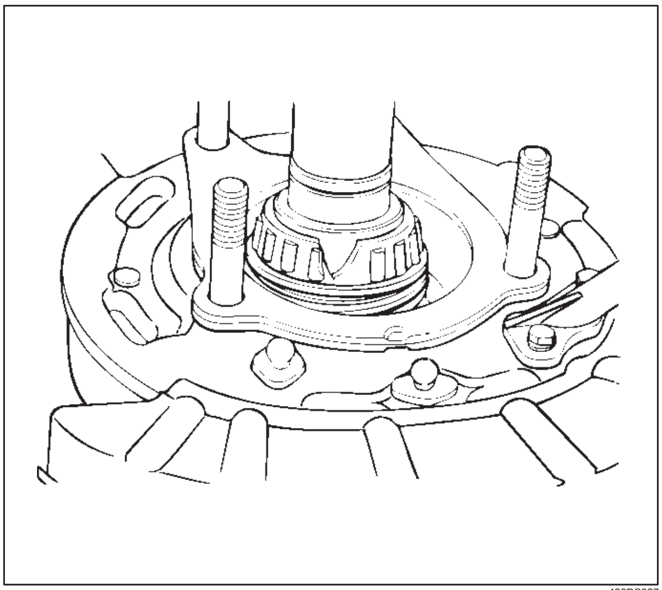
Removal

1. Raise the vehicle.
2. Remove rear wheels and brake calipers or drums. Do not let calipers hang from the vehicle by the brake line or hose. Wire them to frame of vehicle to prevent damage.
3. Remove four nuts and lockwashers.
4. Remove shaft assembly from the axle housing.
5. Remove snap ring and bearing cup.
6. Break retainer ring with hammer and chisel.



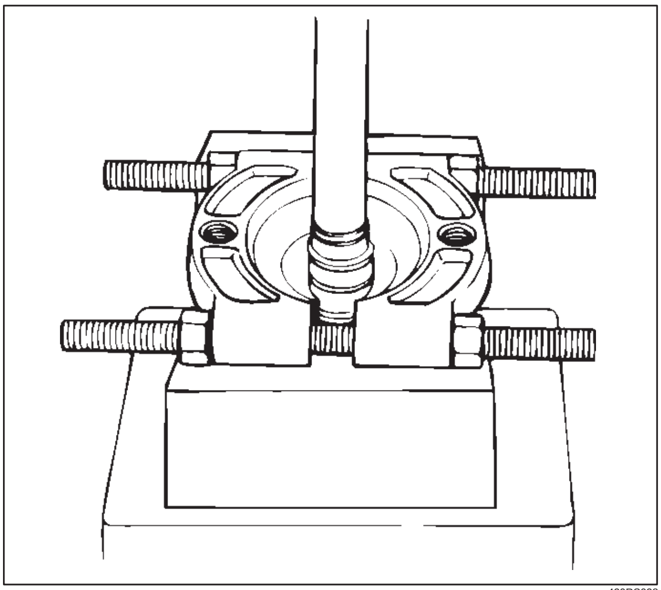
420RS026

7. Break bearing cage with hammer and chisel.



420RS027

8. Remove oil seal, retainer, and emergency brake assembly.
9. Remove inner race from shaft with OTC–1126 bearing splitter and press.



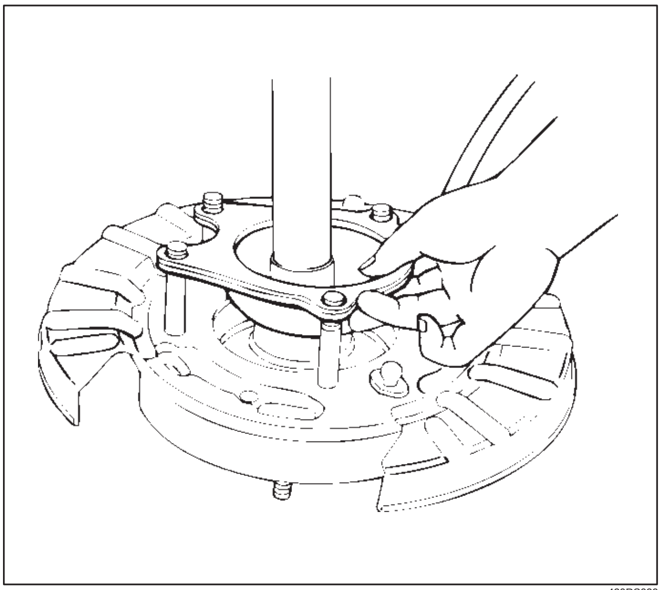
420RS028

Inspection

- Shaft for spalling or grooves from seal wear.
- Retainer – bent or damaged.
- Replace items if required.

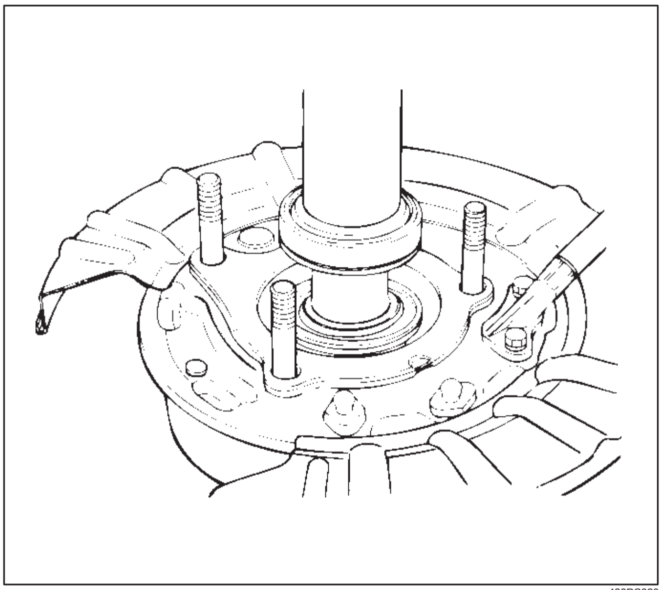
Installation

1. Emergency brake assembly.
2. Install retainer. Note direction – do not install backwards.



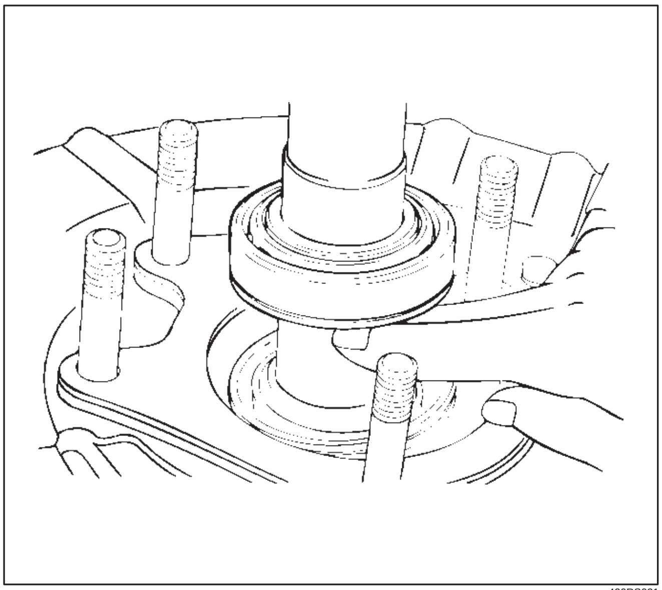
420RS029

3. Install oil seal. Note direction.
4. Install bearing assembly, using installer and press.



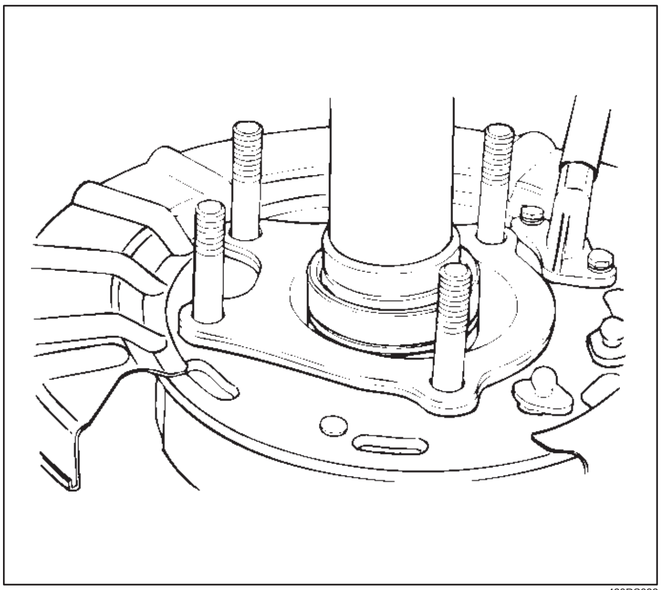
420RS030

NOTE: Install bearing with cup towards inboard side.



420RS031

5. Install retainer ring, using installer and press.



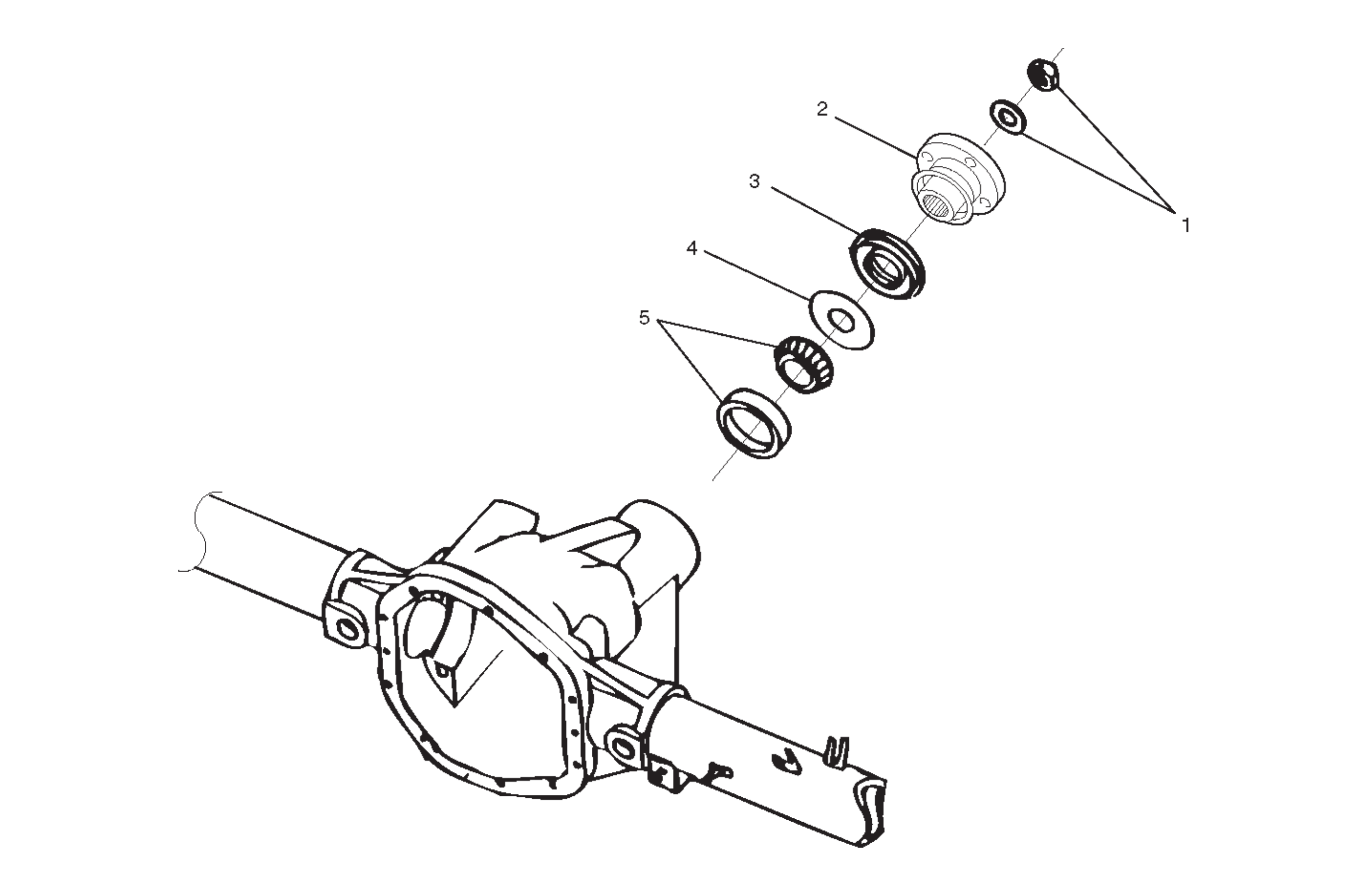
420RS033

6. Install snap ring.
7. Install axle shaft assembly into housing.
8. Install bolts, lockwashers, and nuts.
   Tighten the retainer nuts to the specified torque.

Torque : 75 N·m (55 lb ft)

Pinion Oil Seal

Pinion Oil Seal and Associated Parts

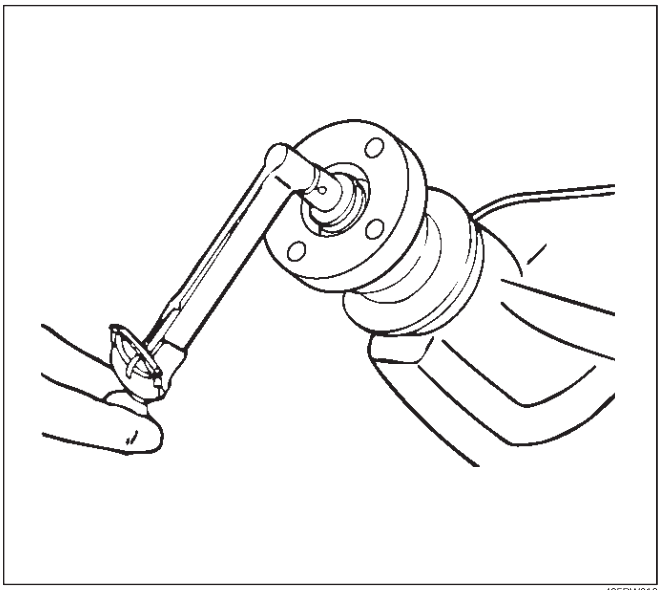


420RW013

Legend
(1) Flange Nut and Washer
(2) Flange
(3) Oil Seal
(4) Outer Oil Seal Slinger
(5) Outer Pinion Bearing (Cup and Cone)

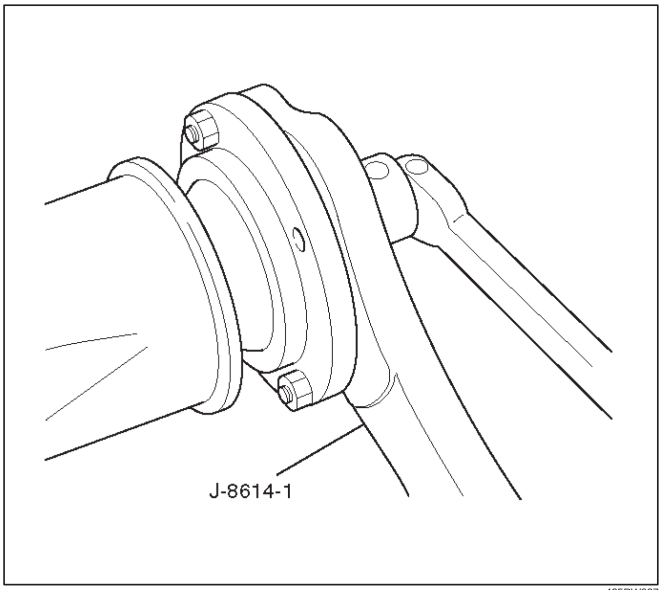
Removal

1. Remove the rear propeller shaft. Refer to Rear Propeller Shaft in this section.
2. Drain the rear axle oil.
3. Check and record preload with an inch pound torque wrench. This will give combined pinion bearing, seal, carrier bearing, axle bearing and seal preload.



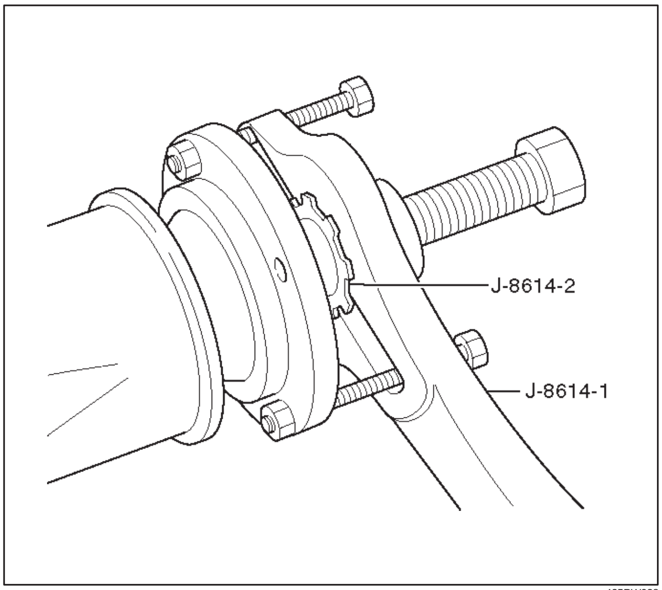
425RW018

4. Remove flange nut and washer by using pinion flange holder J–8614–01 after raising up its staked parts completely.



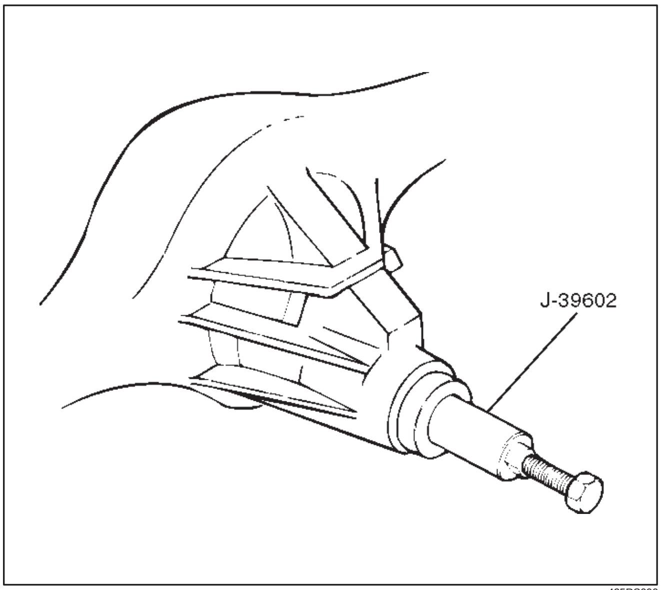
425RW037

5. Remove flange by using SST J–8614–1 ~ 3.
   - Have a suitable container in place to catch lubricant.



425RW038

6. Remove oil seal.
7. Remove pinion oil seal slinger.
8. Remove outer bearing by using remover J–39602.



425RS090

9. Remove collapsible spacer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

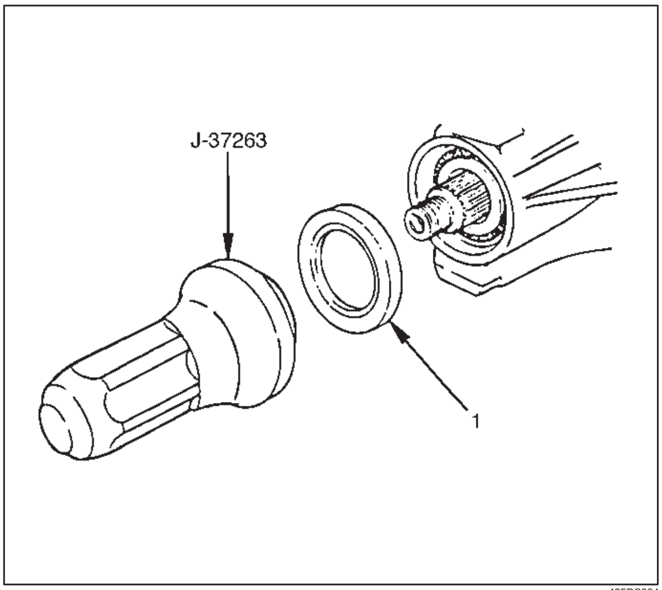
1. Seal surface of the flange.
2. Cage bore for burns.

Installation

1. Install collapsible spacer, discard the used collapsible spacer and install a new one.
2. Install outer bearing.

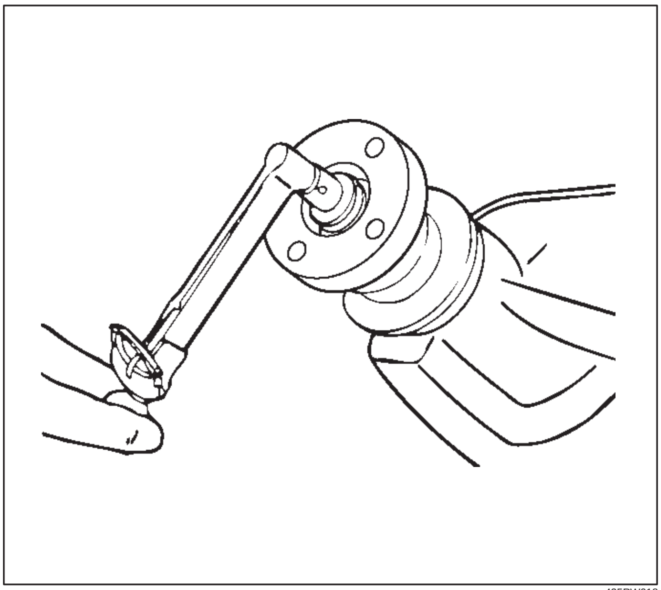
NOTE: Do not drive in, but just temporarily set in the outer bearing by hand, which should be indirectly pressed in finally by tightening the flange nut.

3. By using the seal installer J–37263, install a new oil seal (1) that has grease on seal lip.



425RS004

4. Install flange.
5. The pinion washer and a new nut while holding the pinion flange with J–8614–01.
   - Tighten the nut until the pinion end play is just taken up. Rotate the pinion while tightening the nut to seat the bearings. Once there is not end play in the pinion, the preload torque should be checked.
   - Remove J–8614–01. Using an inch-pound torque wrench, check to make sure the pinion preload is equal to or slightly over the reading recorded during removal.



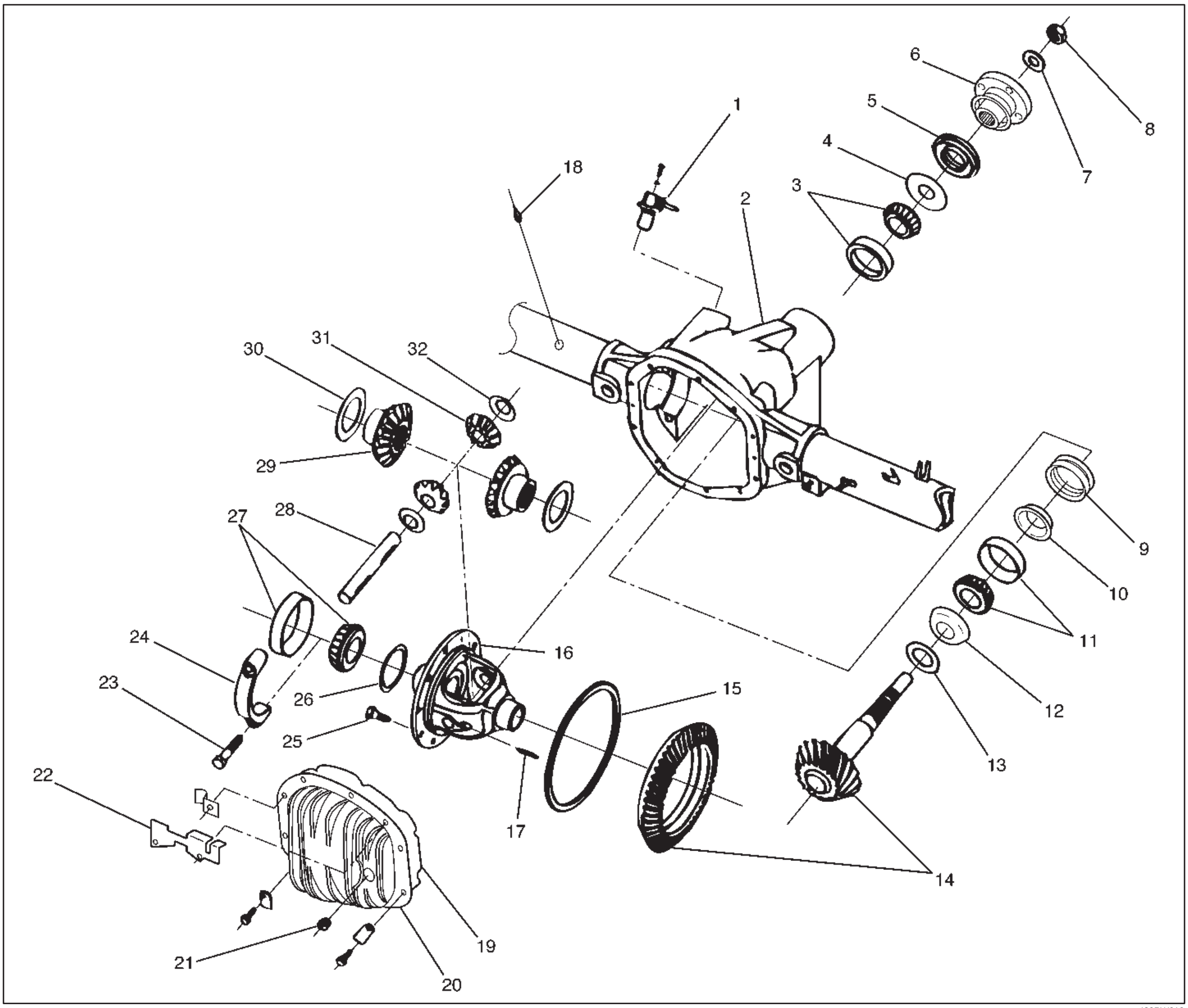
425RW018

6. Install propeller shaft to the frange.
7. Install bolt and nut. Tighten the bolt and nut to the specified torque.

Torque: 63 N·m (46 lb ft)

Differential Assembly

Disassembled View



Legend

(1) ABS Speed Sensor
(2) Housing
(3) Outer Pinion Bearing (Cup and Cone)
(4) Outer Oil Slinger
(5) Oil Seal
(6) Companion Flange Assembly
(7) Pinion Nut Washer
(8) Pinion Nut
(9) Collapsible Spacer
(10) Baffle Plate
(11) Inner Pinion Bearing (Cup and Cone)
(12) Inner Oil Slinger
(13) Pinion gear adj. Shim-Selective (Position)
(14) Ring gear and Pinion Gear Assembly
(15) Exciter Ring
(16) Differential Case
(17) Lock Pin
(18) Axle Vent
(19) Gasket
(20) Cover and Clip Assembly
(21) Fill Plug (with Magnet)
(22) Mounting Bracket
(23) Side Bearing Cap Bolt
(24) Side Bearing Cap
(25) Drive Gear Bolts
(26) Differential Adjustment Shims (Side Bearing Preload and Ring Gear/Pinion Backlash)
(27) Side Bearing (Cup and Cone)
(28) Differential Shaft
(29) Differential Side Gears
(30) Side Gear Thrust Washer
(31) Pinion Mate Gears
(32) Thrustwasher-Differential Pinion Mate Gear

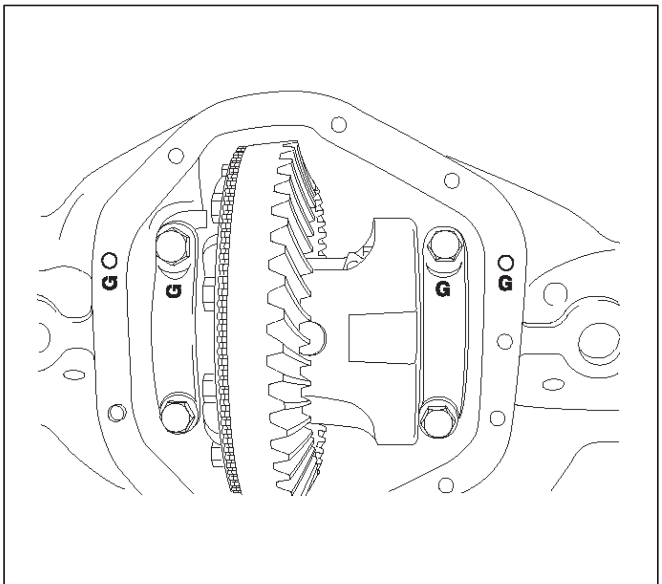
Inspecting the Axle Before Disassembly

1. Remove the axle cover from the rear axle and drain the axle lubricant into a suitable container.
2. Check ring gear backlash. Refer to "BACKLASH ADJUSTMENT" in this section. This information can be used to determine the cause of the axle problem. It will also help when setting up the shim packs for locating and preloading the differential cage.
3. Check case for metal chips and shavings. Determine where these ships and shavings come from, such as a broken gear or bearing cage.
   - If possible, determine the cause of the axle problem before disassembly.

Disassembly

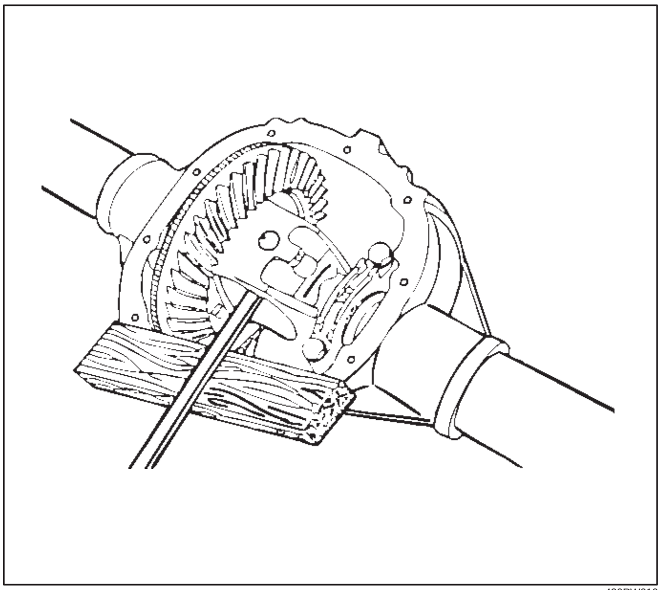
1. Remove axle shafts.
   - Refer to axle shaft replacement in this section.
2. Remove ABS sensor.
3. Remove bearing caps and bolts.
   - Mark the caps and the housing as left and right.

CAUTION: Bearing caps are machined with the housing and must be assembled in the same position as removed. Note the matched letter stamped on the caps and carrier. When assembled, the letters on the caps must agree in both the hosizontal and vertical position with the letters on the carrier.



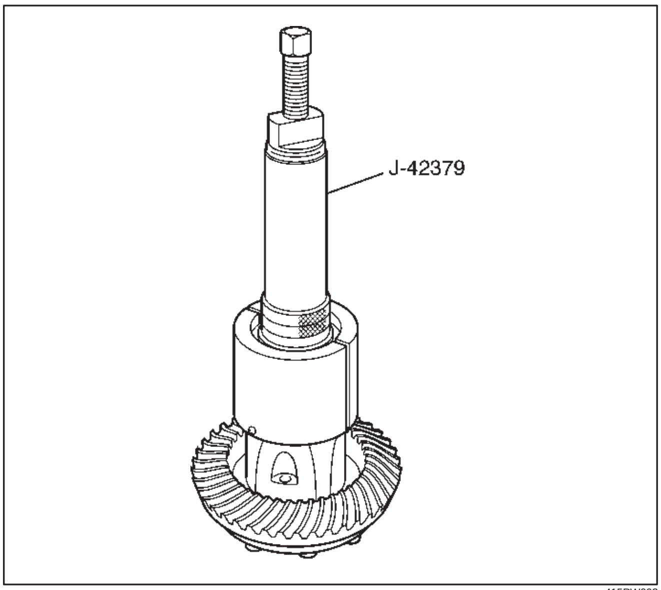
420RW003

4. Remove Differential case.
   - Pry the case from the axle housing at the differential "window".



420RW010

5. Remove side bearing outer races and shims.
   - Mark the races and shims as left and right, and place them with the bearing cups.
6. Remove differential side bearings using remover J–42379 and plug J–39830.
   - Select insert ; 303174 and collet halves ; 44801 in remover kit J–42379.

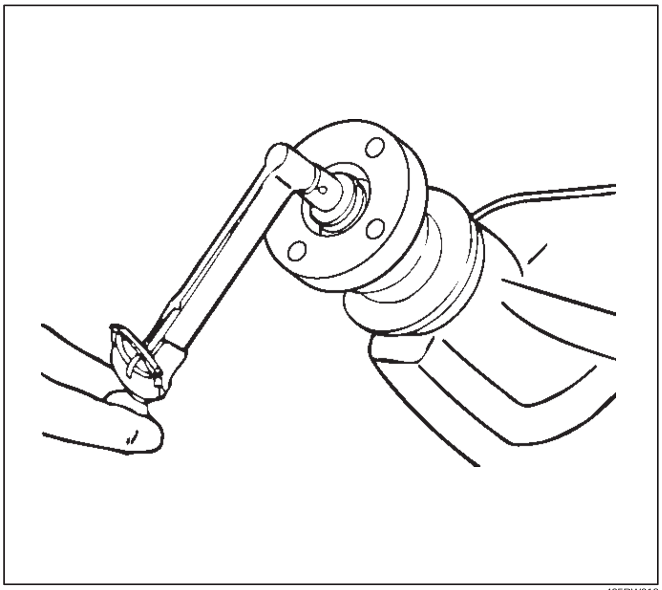


415RW003

7. Remove ring gear bolts.
   - Ring gear bolts use right handed threads.

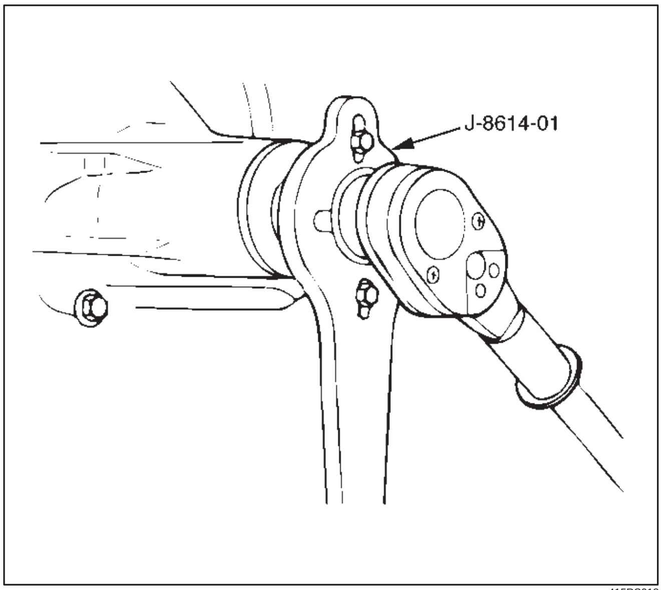
CAUTION: DO not pry the ring gear from the case. This will damage the ring and the differential case.

8. Remove ring gear from the differential.
   - Drive the ring gear off with a brass drift if necessary.
   - Check drive pinion bearing preload.



425RW018

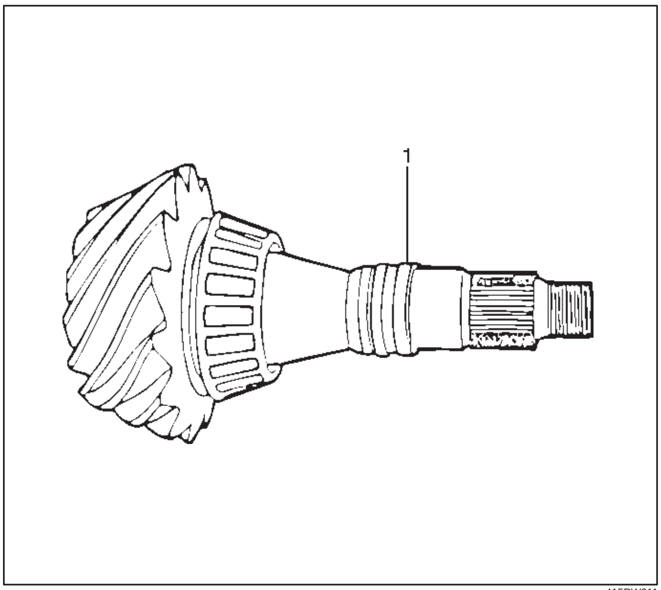
   - Check the pinion assembly for looseness by moving it back and forth. (Looseness indicates excessive bearing wear.)
9. Remove pinion flange nut and washer.
   - Use flange holder J–8614–01 to hold the pinion flange.
10. Remove pinion flange.
   - Use flange holder J–8614–01 to remove the pinion flange.



415RS018

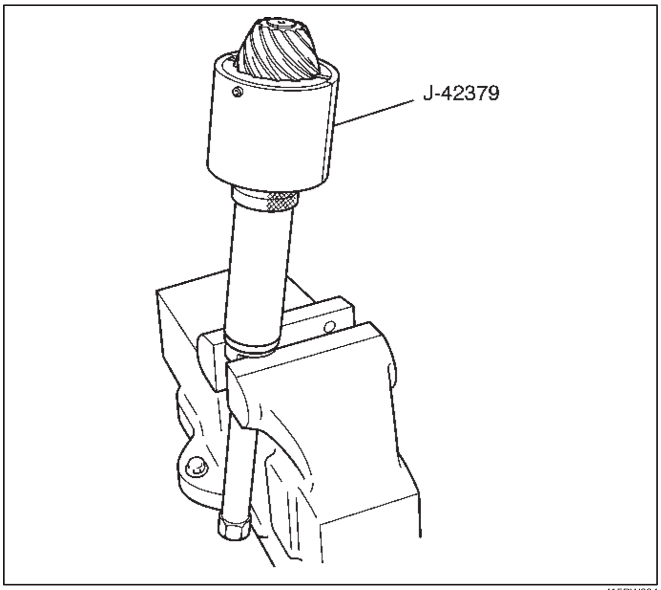
11. Remove pinion from the axle housing.
   - Thread the pinion nut halfway onto the pinion.
   - Drive the pinion out of the housing with a hammer and a soft drift.
   - Remove the nut and then remove the pinion.

12. Remove collapsible spacer(1).



415RW011

13. Remove outer seal, outer oil slinger and outer pinion bearing.
14. Remove inner bearing, inner oil slinger and shim from the pinion.
   - Press the bearing off the pinion using remover J–42379.

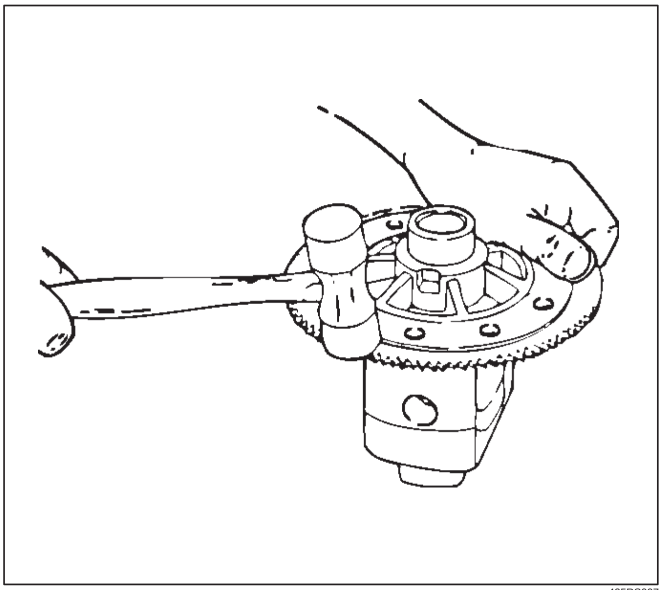


415RW004

   - Select insert ; 303174 and collet halves ; 44801 in remover kit J–42379.
   - Remove the shim.
15. Remove bearing cups and baffle plate from the axle housing using a hammer and a punch.
   - Work the cups out of the housing evenly, moving the punch back and forth between one side of the cup and the other.
   - The baffle plate will be destroyed and should be replaced with a new one.

16. Remove exciter ring.
    - Remove the exciter ring from the differential using a mallet or a brass hammer if it is required.

NOTE: Discard the exciter ring after removal.



Cleaning

Do not steam clean drive parts which have ground and polished surfaces such as gears, bearings, and shafts. These parts should be cleaned in a suitable solvent. All parts should be disassembled before cleaning.
Parts should be thoroughly dried immediately after cleaning. Use soft, clean, lintless rags. Parts may be dried with cimpressed air. Do not allow the bearings to spin while drying them with compressed air.

Inspection and Repair

It is very important to carefully and thoroughly inspect all drive unit parts before reassembly.
Thorough inspection of the drive parts for wear or stress and subsequent replacement of worn parts will eliminate costly drive component repair after reassembly.

Axle Housing

- The carrier bore for nicks or burrs that would prevent the outer diameter of the pinion seal from sealing, Remove any burrs that are found.
- The bearing cap bores for nicks or burrs.
  Remove any burrs that are found.
- The housing for cracks. Replace the housing if any cracks are found.
- The housing for foreign material such as metal chips, dirt, or rust.

Pinion and Ring Gear

- Pinion and ring gear teeth for cracking, chipping, scoring, or excessive wear.
- Pinion splines for wear.
- Pinion flange splines for wear.
- The sealing surface of the pinion flange for nicks, burrs, or rough tool marks which would cause damage to the seal's inside diameter and result in an oil leak.
- Replace all worn or broken parts.
- Ring and pinion gears are matched sets and are both replaced anytime a replacement of either is necessary.

Bearings

- Bearings visually and by feel.
- The bearings should feel smooth when oiled and rotated while applying as much hand pressure as possible.
  The large end of the bearing rollers for wear.
  This is where tapered roller bearing wear is most evident.
- Bearing cups for wear, cracks, brinelling and scoring.
- Bearing and cups are only replaced as sets.
- If the rear axle was operated for an extended period of time with very loose bearings, the ring gear and drive pinion will also require replacement.
- Low mileage bearings may have minute scratches and pits on the rollers and the bearing cups from the initial pre-load. Do not replace a bearing for this reason.
- Bearing cups for cracks or chips.

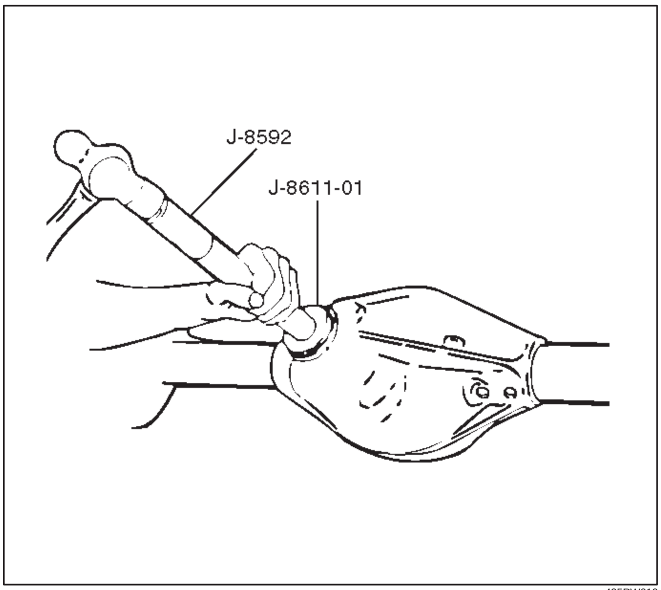
Shims

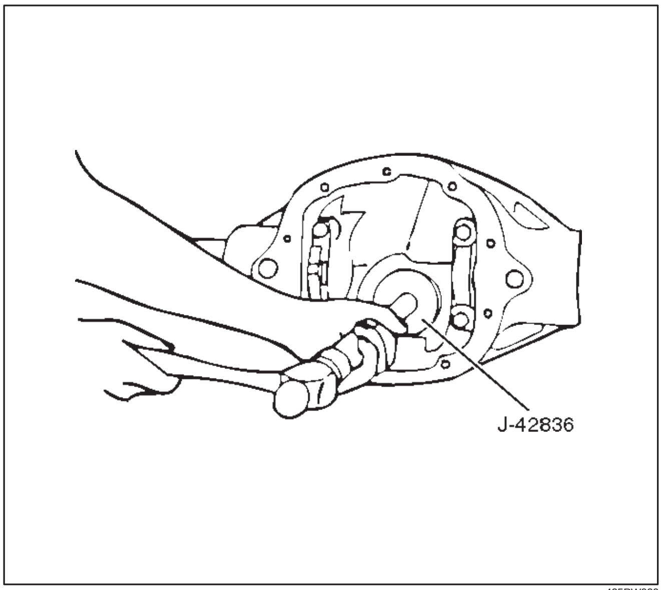
- Shims for cracks and chips. Damaged shims should be replaced with an equally sized service shim.

Reassembly

1. Install pinion bearing races and baffle plate using outer bearing race installer J–8611–01 / inner bearing race installer J–42836 and drive handle J–8592.

NOTE: Baffle plate must be installed, when install the inner pinion bearing race.



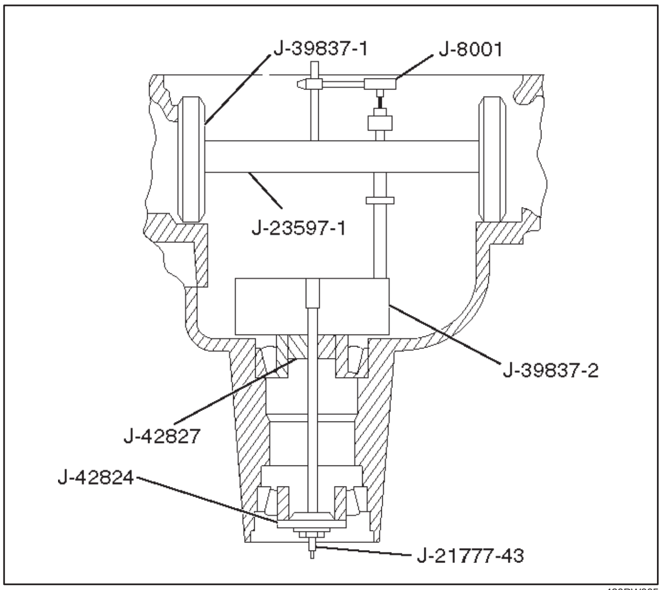


425RW020

2. Clean all the gauge parts.
3. Lubricate the outer and inner bearings with axle lubricant.
4. Place the bearings into the pinion bearing races.
5. Place the inner oil slinger onto the inner pinion bearing.

NOTE: The inner oil slinger must be placed between gauge plate and inner pinion bearing when measuring the pinion depth.

6. Install gauge plate J–39837–2, inner J–42827 stud and nut J–21777–43 and outer pilot J–42824 to the pinion bore.



420RW005

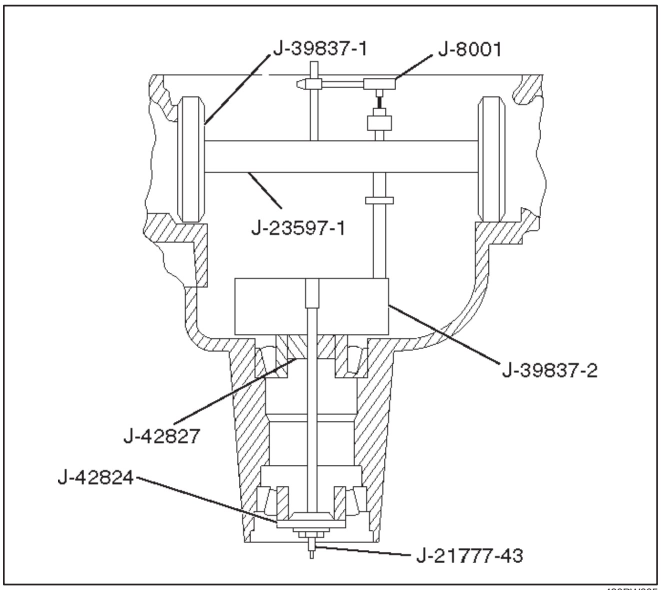
7. Hold the stud stationary at the flats of the stud (and).

Tighten the stud nut

Torque: 2.2 N·m (1.6 lb ft)

8. Rotate the gauge plate and bearings several complete revolutions to seat the bearings.
9. Tighten the stud nut until a torque of 1.6 to 2.2 N·m (1.2 to 1.6 lb ft.) is required to keep the gauge plate in rotation.
10. Assemble discs J–39837–1, arbor J–23597–1 and dial indicator J–8001 to the side bearing bores.

NOTE: The bearing bores must be clean and burr-free.



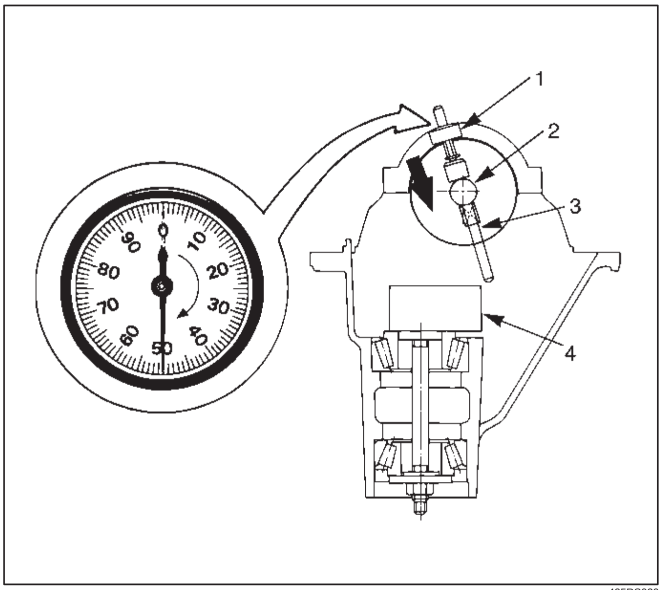
420RW005

11. Install the side bearing caps and tighten the bolts to the specified torque.

Torque: 108 N·m (80 lb ft)

12. Rotate the gauge plate until the gauging area is parallel with the discs.
13. Position the arbor assembly in the carrier so that the plunger is centered on the gauge area of the gauge plate.

14. Set the dial indicator to “0”. Place it on the mounting post of the gauging arbor with the contact button touching the indicator pad.
    Force the dial indicator downward until the needle has made a half turn clockwise. Tighten down the dial indicator in this position.

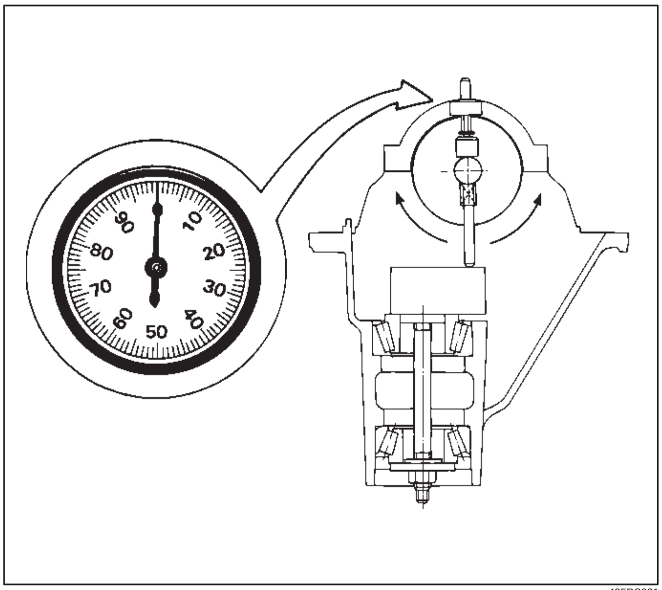


425RS020

Legend

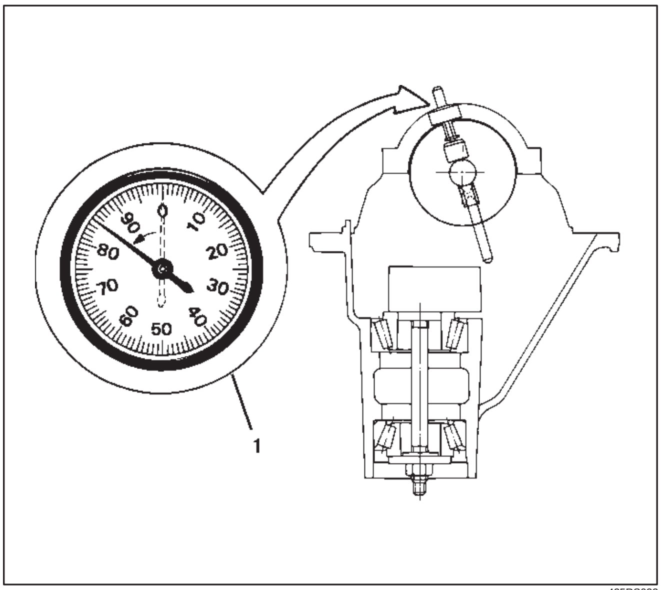
(1) Dial Indicator
(2) Ganging Arbor
(3) Plunger
(4) Gaug Plate

15. Position the plunger on the gauge plate. Move the gauging arbor slowly back and forth and locate the position at which the dial indicator shows the greatest defection. At this point, once again set the dial indicator to “0”.
    Repeat the procedure to verify the “0” setting.



425RS021

16. After the ZERO setting is obtained, rotate the gauging arbor until the dial indicator rod does not touch the gauging plate.
    Record the number the dial indicator needle points to.

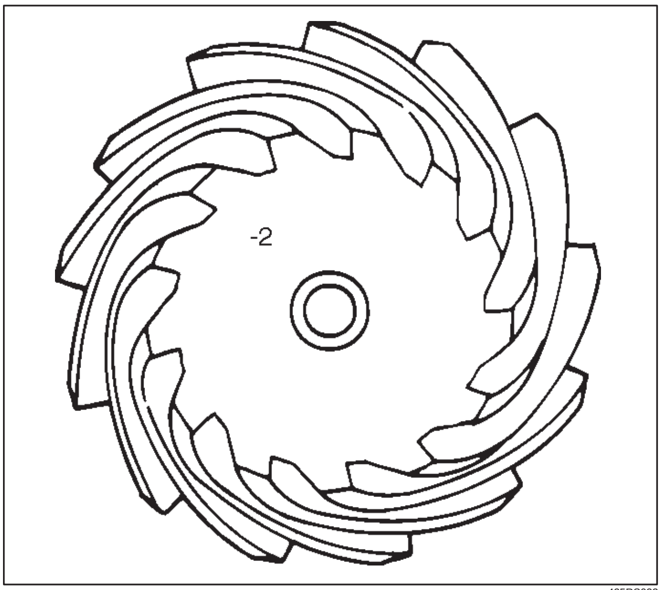


425RS022

Legend

(1) Example=Dial indicator reading of 0.085

17. Record the pinion depth code on the head of the drive pinion.
    The number indicates a necessary change in the pinion mounting distance. A plus number indicates the need for a greater mounting distance (which can be achieved by decreasing the shim thickness). A minus number indicates the need for a smaller mounting distance (which can be achieved by increasing the shim thickness). If examination reveals pinion depth code “0”, the pinion is “nominal”.



425RS023

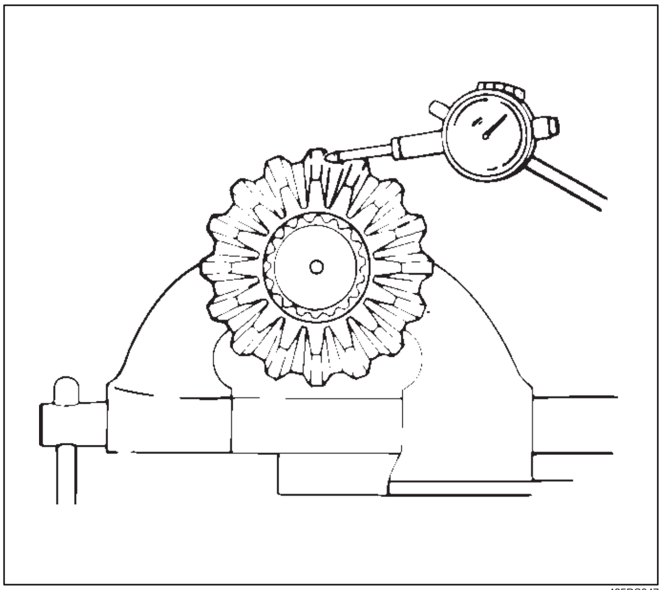
18. Select the shim using the chart;

Dial Indicator Reading (inches)	Marking (inches)						
	+3	**+2**	**+1**	**0**	**–1**	**–2**	**–3**
0.027							0.030
0.028						0.030	0.031
0.029					0.030	0.031	0.032
0.030				0.030	0.031	0.032	0.033
0.031			0.030	0.031	0.032	0.033	0.034
0.032		0.030	0.031	0.032	0.033	0.034	0.035
0.033	0.030	0.031	0.032	0.033	0.034	0.035	0.036
0.034	0.031	0.032	0.033	0.034	0.035	0.036	0.037
0.035	0.032	0.033	0.034	0.035	0.036	0.037	0.038
0.036	0.033	0.034	0.035	0.036	0.037	0.038	0.039
0.037	0.034	0.035	0.036	0.037	0.038	0.039	0.040
0.038	0.035	0.036	0.037	0.038	0.039	0.040	0.041
0.039	0.036	0.037	0.038	0.039	0.040	0.041	0.042
0.040	0.037	0.038	0.039	0.040	0.041	0.042	0.043
0.041	0.038	0.039	0.040	0.041	0.042	0.043	0.044
0.042	0.039	0.040	0.041	0.042	0.043	0.044	0.045
0.043	0.040	0.041	0.042	0.043	0.044	0.045	0.046
0.044	0.041	0.042	0.043	0.044	0.045	0.046	0.047
0.045	0.042	0.043	0.044	0.045	0.046	0.047	0.048
0.046	0.043	0.044	0.045	0.046	0.047	0.048	0.049
0.047	0.044	0.045	0.046	0.047	0.048	0.049	0.050
0.048	0.045	0.046	0.047	0.048	0.049	0.050	0.051
0.049	0.046	0.047	0.048	0.049	0.050	0.051	0.052
0.050	0.047	0.048	0.049	0.050	0.051	0.052	0.053
0.051	0.048	0.049	0.050	0.051	0.052	0.053	
0.052	0.049	0.050	0.051	0.052	0.053		
0.053	0.050	0.051	0.052	0.053			
0.054	0.051	0.052	0.053				
0.055	0.052	0.053					
0.056	0.053						

19. Remove bearing caps and depth gauging tools.
20. Install the correct pinion shim and inner oil slinger onto pinion.

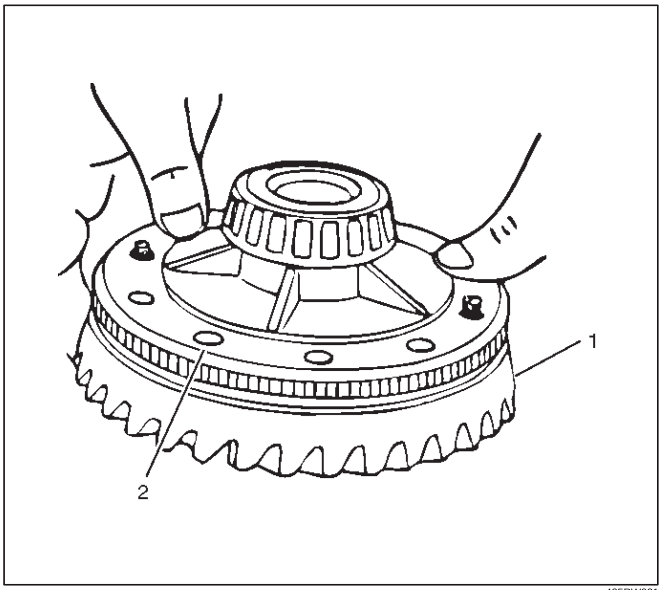
NOTE: Do not install pinion gear into housing at this time.

21. If the exciter ring was removed, install the new exciter ring onto the differential case by pressing using the ring gear as a pilot.



425RS047

22. Install ring gear(1) to the differential case(2)

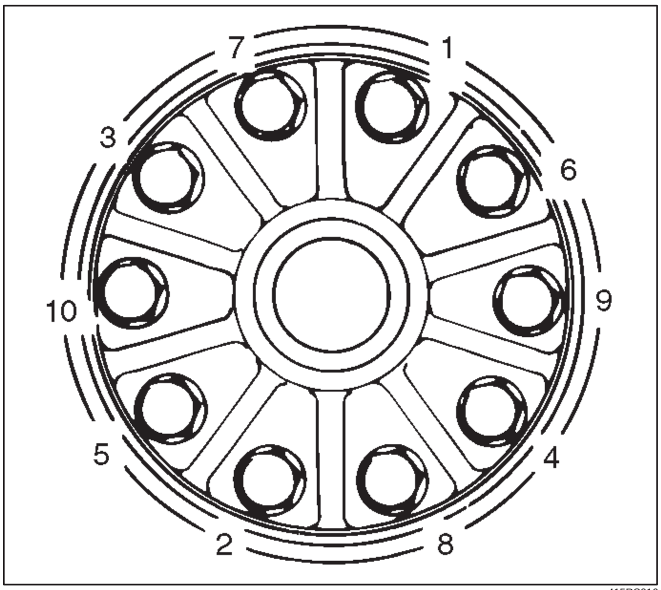


425RW021

23. Install new ring gear bolts.
    - Tighten the ring gear bolts alternately in stages, gradually pulling the ring gear onto the differential case.

Tighten the ring gear bolts in sequence
Torque: 108 N·m (80 lb ft)

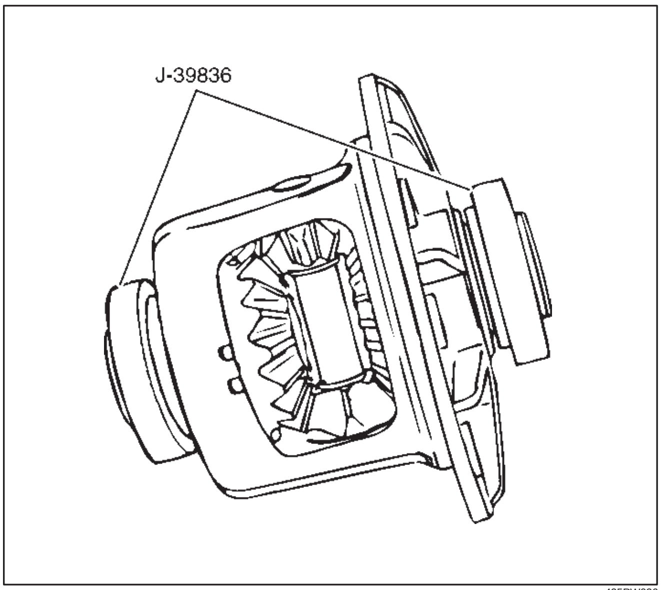
NOTE: Discard used bolts and install new ones.



415RS016

Side Bearing Preload Adjustment

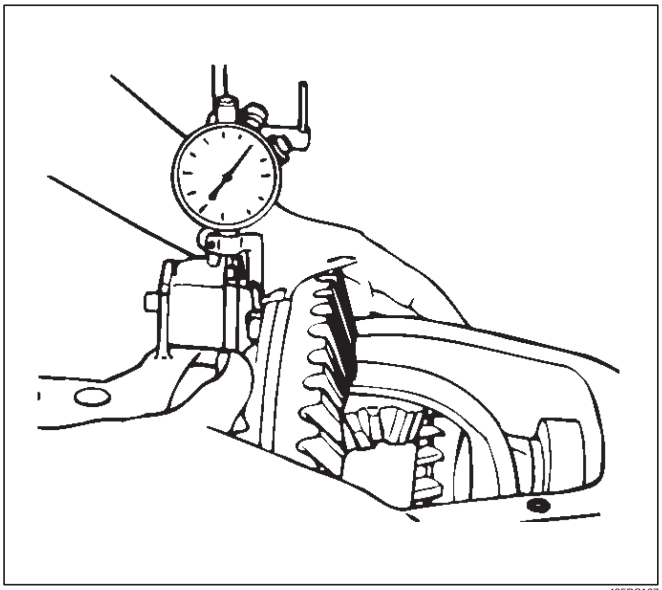
1. The side bearing preload adjustment must be made before installing the pinion.
2. The side bearing preload is adjusted by changing the thickness of both hte left and right shims equally. This maintain the original backlash.
3. Install master side bearings J–39836 onto the case. Remove all nicks, burrs, dirt etc., from the hubs to allow the master bearings to rotate freely.



425RW026

4. Assemble the differential case into the housing (less pinion). Install bearing caps and finger tight bolts. Mount a dial indicator with a magnetic base to the housing and indicate on the flange or head of screw.
   Force the differential assembly as far as possible in the dirction towards the indicator.
   With force still applied, set indicator at zero(0).

NOTE: Dial indicator set should be capable of a minimum travel of 5.08 mm (0.2 in).



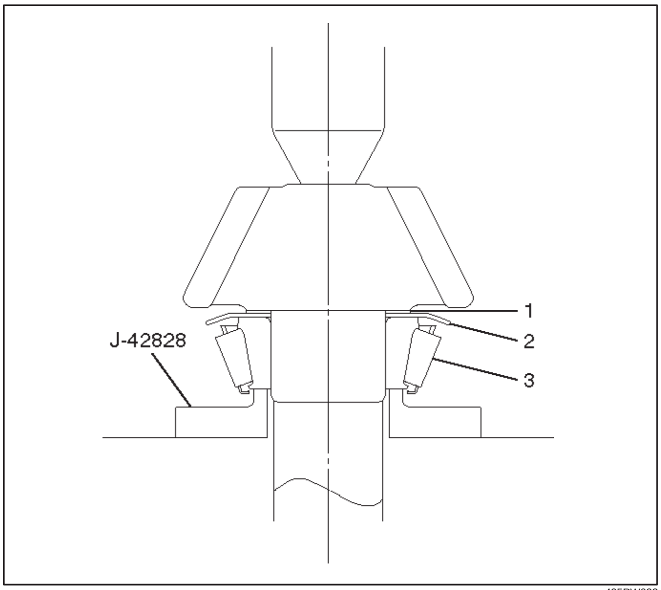
425RS107

5. Force the differetial assembly as far as it will go in the opposite direction. Repeat these steps until the same reading is obtained.
6. RECORD THE READING OF THE INDICATOR.
   This amount, in shims, will be included in the final assembly shim stack to establish side bearing preload and ring gear and pinion backlash.
7. After marking sure the readings are correct, remove the indicator and differetial assembly from the housing.

Pinion Installation

- The bearing cups should have been installed in Pinion Depth Adjustment in this section.

1. Place the shim(1) and inner oil slinger(2) on the pinion gear, then install the pinion inner bearing(3) using installer J–42828.



425RW023

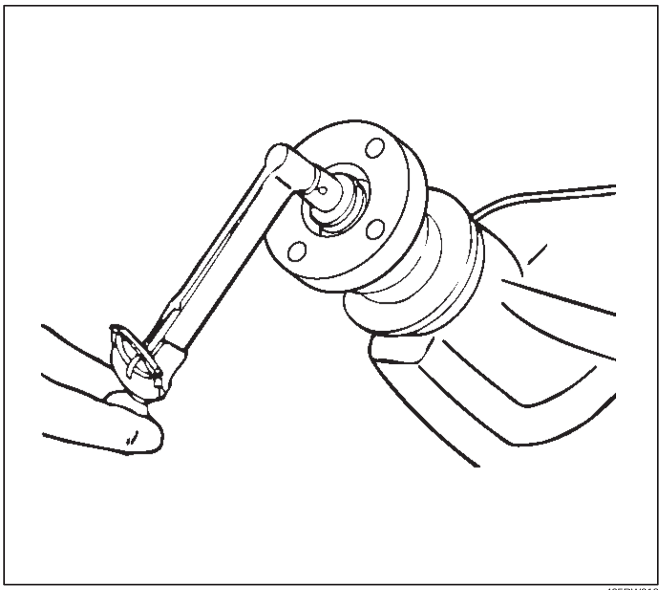
- Drive the bearing until the bearing cone seats on the pinion shims.

2. Install a new collpsible spacer.
   - Lubracate the pinion bearings with axle lublicant.
3. Install pinion to the axle housing.
4. Install outer pinion bearing onto the pinion.
   - Hold the pinion forward from inside the case while driving the bearing onto the pinion.
5. Install oil seal slinger.
6. Install pinion oil seal using installer J–37263.
7. Install the pinion flange to the pinion by tapping it with a rawhide hammer until a few threads show through the pinion flange.
8. Install pinion washer and a new nut while holding the pinion flange with flange holder J–8614–01.
   - Tighten the nut until the pinion end play is just taken up. Rotate the pinion while tightening the nut to seat the bearings.

Torque:217-678 N·m (160-500 lb ft)

Once there is no end play in the pinion, the preload torque should be checked.

- Remove flange holder J–8614–01. Using an inch-pound torque wrench, check the pinion preload by rotating the pinion with the wrench.



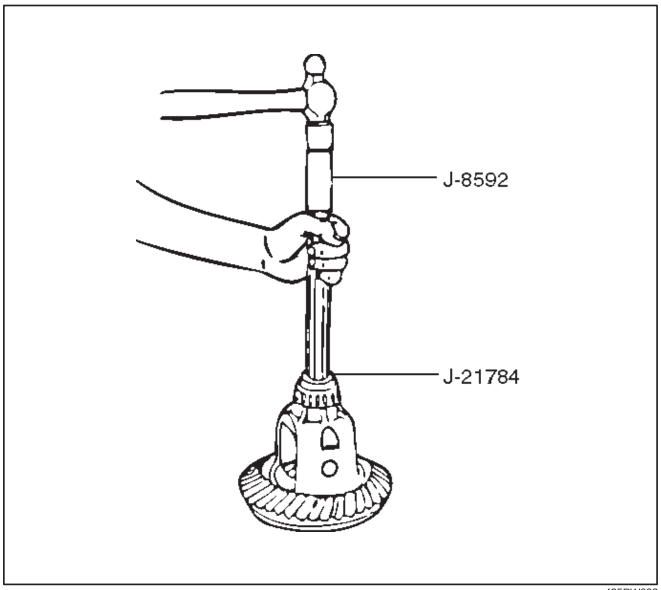
425RW018

Preload should be at 1.0 to 1.6 N·m (8 to 14 in lbs.) on new bearings, or 0.46 to 0.69 N·m (4 to 6 in lbs.) for used bearings.

- If the preload torque is below the preloads given above, continue torquing the nut in small increments. Check the preload after each tightening. Each tightening increases the bearing preload by several pounds. If the bearing preload is exceeded, the pinion will have to be removed, and a new collapsible spacer installed.
- Once a preload of 1.0 to 1.4 N·m (8 to 12 in lbs.) has been obtained, rotate the pinion several times to assure that the bearings have seated. Recheck the preload, and adjust if necessary.

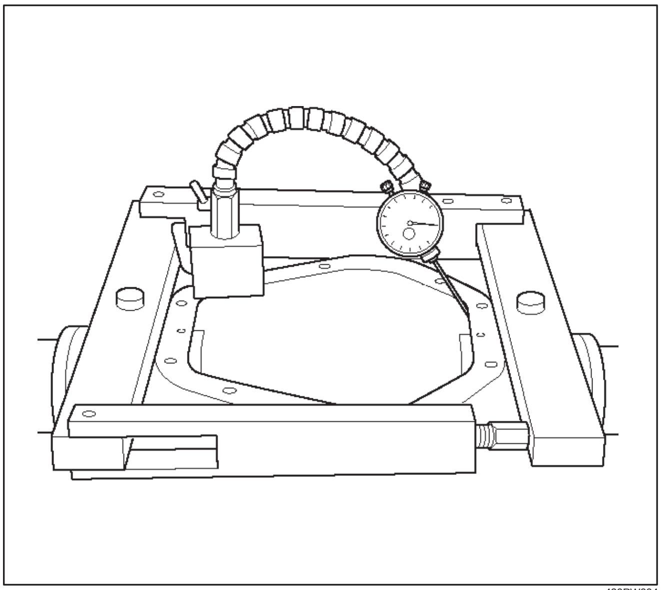
Determination of Backlash & Preload Shims

1. Install master side bearings onto the case.
2. Install differential assembly into the carrier.
3. Install the bearing cap and finger tight bolts.
4. Set up the dial indicator.
5. Force the differential assembly away from the pinion gear until it is completely seated against the cross bore face of the carrier.
6. With force still applied to the differential case, place the tip of dial indicator on a machined surface of the differential case, if available, or on the head of a ring gear screw, and set the indicator at zero(0).
7. Force the ring gear to mesh with the pinion gear. Rock the ring gear slightly to make sure the gear teeth are meshed. Repeat this procedure several times until the same reading is obtained each time. Be sure the indicator reads zero(0) each time the ring gear is forced back into contact with the cross bore face. This reading will be the necessary amount of thims to be placed between the differential case and side bearing cone on the ring gear side.
8. The remaining amount of shims, which is the difference between the overall found in step 6 of Side Bearing Pre-load Adjustment and step(7) above, should be placed on the other side of the differential case, plus additional 0.38 mm (0.015 in) for obtaining preload and backlash.
9. Place the required amount of shims on each hub as determined in the previous steps and assemble side bearing cone by using installer J–21784 and handle J–8592.



425RW022

10. Total torque to rotate — Increase of pinion torque to rotate due to differential case assembly shall not exceed 3.4 N·m (30 in lbs.) divided by the gear ratio.
11. Assembly the spreader J–24385–B and indicator to the carrier as shown in figure. Spread the carrier 0.5 mm (0.02 in) for differential installation.



420RW004

CAUTION: Do not spread the carrier over 0.5 mm (0.02 in).

12. Remove the indicator.

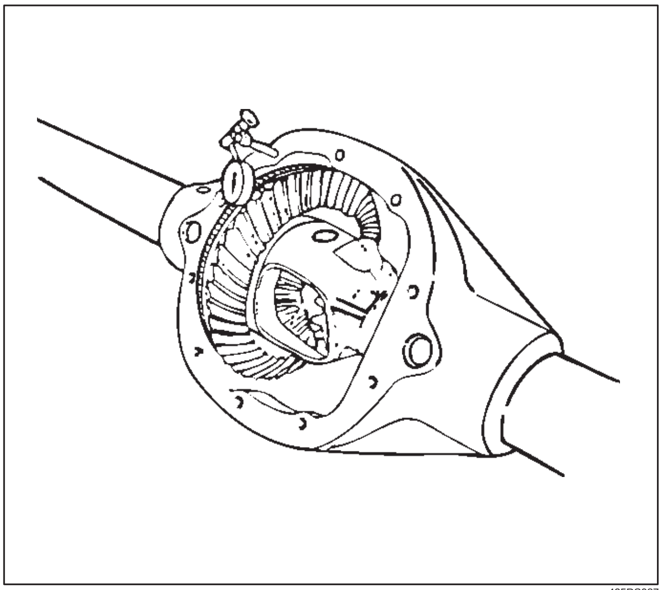
Backlash Adjustment

1. Install the differential case assembly and bearing caps.
2. Rotate the case several times to seat the bearings.
3. Remove the spreader.
4. Install the side bearing cap bolts.

Tighten side bearing cap bolts

Torque: 108 N·m (80 lb ft)

5. Install a dial indicator to the case using a magnetic base.
6. Place the indicator stem at the heel end of a tooth.
   - Set the dial indicator so that the stem is in line with the gear rotation and perpendicular to the tooth angle.



425RS087

7. Check and record the backlash at three points around the ring gear.
   - The pinion must be held stationary when checking backlash.
   - The backlash should be the same at each point within 0.07 mm (0.003 in). If the backlash varies more than 0.07 mm (0.003 in), check for burrs, a distorted case flange, or uneven bolting conditions.
8. Backlash at the minimum lash point measured should be between 0.13 and 0.20 mm (0.005 and 0.008 in) for all new gear sets.
9. If the backlash is not within specifications, move the ring gear in or out from the pinion by increasing the thickness of one shims, and decreasing the thickness of the other shim by the same amount.

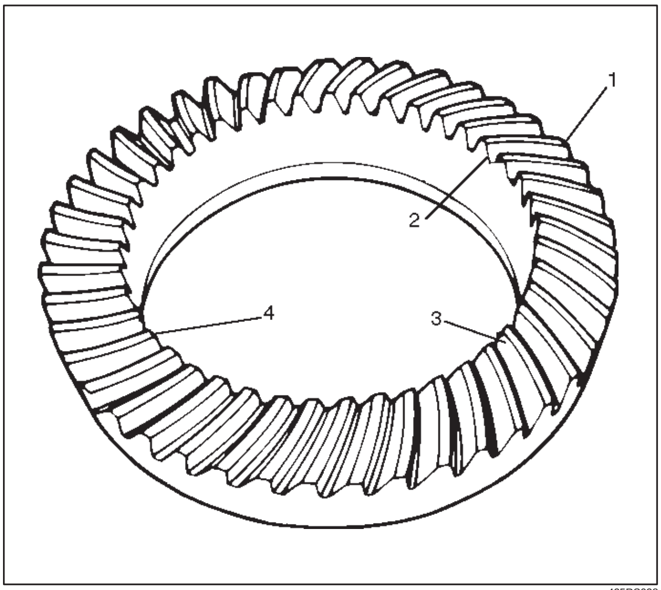
   This will maintain the correct rear axls side bearing preload.
   - Moving 0.05 mm (0.002 in) worth of shim from one side of the differential to the other will change the backlash adjustment by 0.03 mm (0.001 in).
10. After obtaining correct tooth contact described in later, install ABS speed sensor.
11. Install the cover with sealant.

Torque: 40 N·m (30 lb ft)

12. Fill the axle lubricant.

Gear Tooth Pattern Check

Checking the ring gear to pinion tooth pattern is to be done only after setting up the axle according to the methods in this section. The pattern check is NEVER to be used as an initial check, or instead of checking pinion depth and backlash adjustments.
This check is only to be verify the correct adjustment of the gear set after set up.

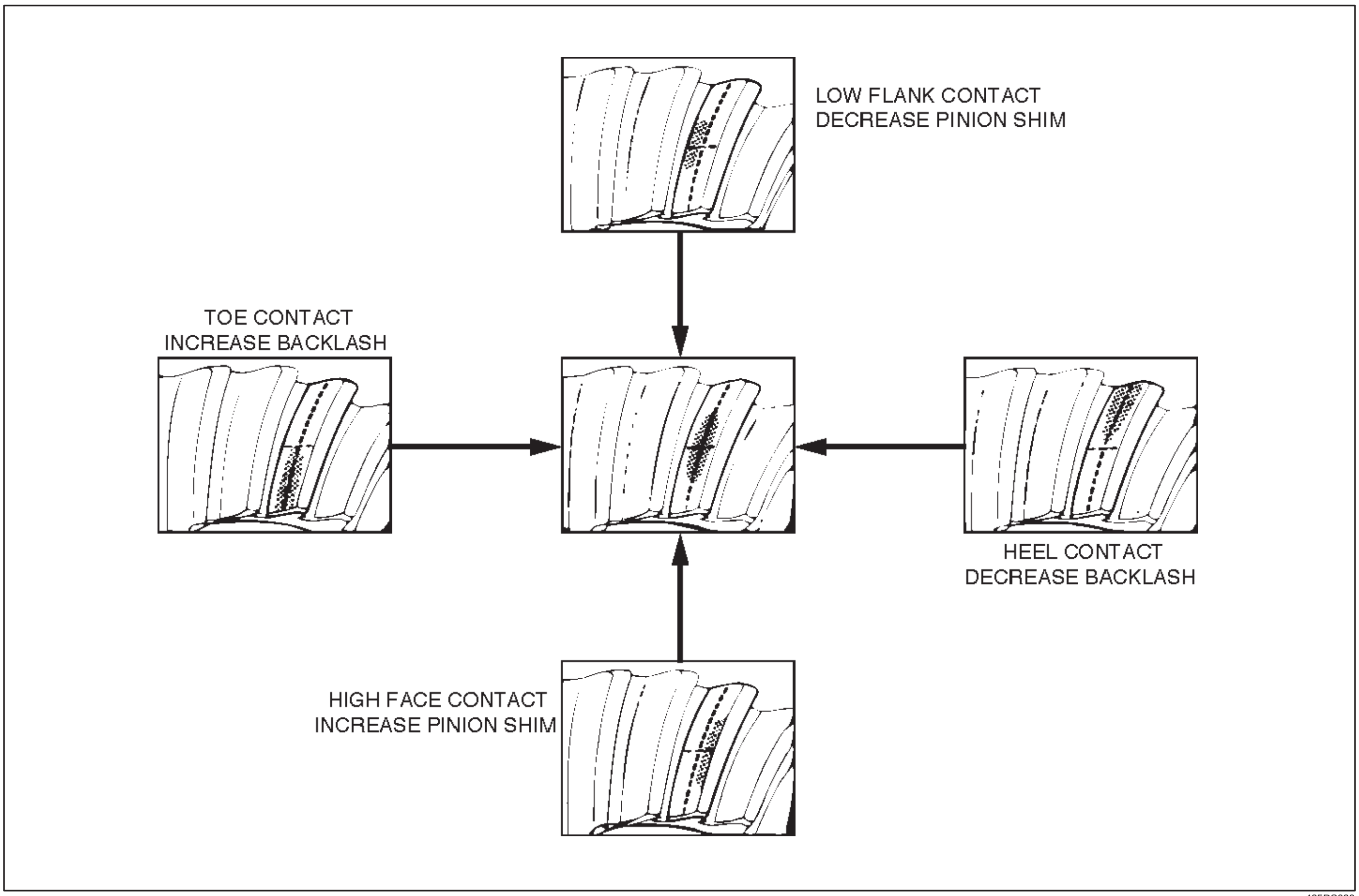


425RS038

Legend

(1) Heel
(2) Toe
(3) Concave Side (Coast)
(4) Convex Side (Drive)

1. Wipe all oil out of the carrier, and carefully clean each tooth of the ring gear.
2. Use gear marking compound 1052351 or equivalent and apply this mixture sparingly to all ring gear teeth, using a medium-stiff brush. When properly used, the area of pinion tooth contact will be visible when hand load is applied.
3. Tighten the bearing cap bolts to the specified torque.
4. Expand the brake shoes until a torque of 54 to 68 N·m (40 to 50 lb ft.) is required to turn the pinion. A test made without loading the gears will not give a satisfactory pattern. Turn the pinion flange with a wrench so that the ring gear rotates one full revolution, then reverse the rotation so that the ring gear rotates one revolution in the opposite direction.
5. Observe the pattern on the ring gear teeth and compare this with figure.



Adjustments Affecting Tooth Contact

Two adjustments can be made which will affect tooth contact pattern: backlash, and the position of the drive pinion in the case. The effects of bearing preloads are not readily apparent on head loaded tooth contact pattern tests; however, these adjustments shuld be within specifications before proceeding with backlash and drive pinion adjustments.

The position of the drive pinion is adjusted by increasing or decreasing the distance between the pinion head and the centerline of the ring gear.

Decreasing the distance will move the pinion closer to the centerline of the ring gear. Increasing the distance will move the pinion farther away from the centerline of the ring gear.

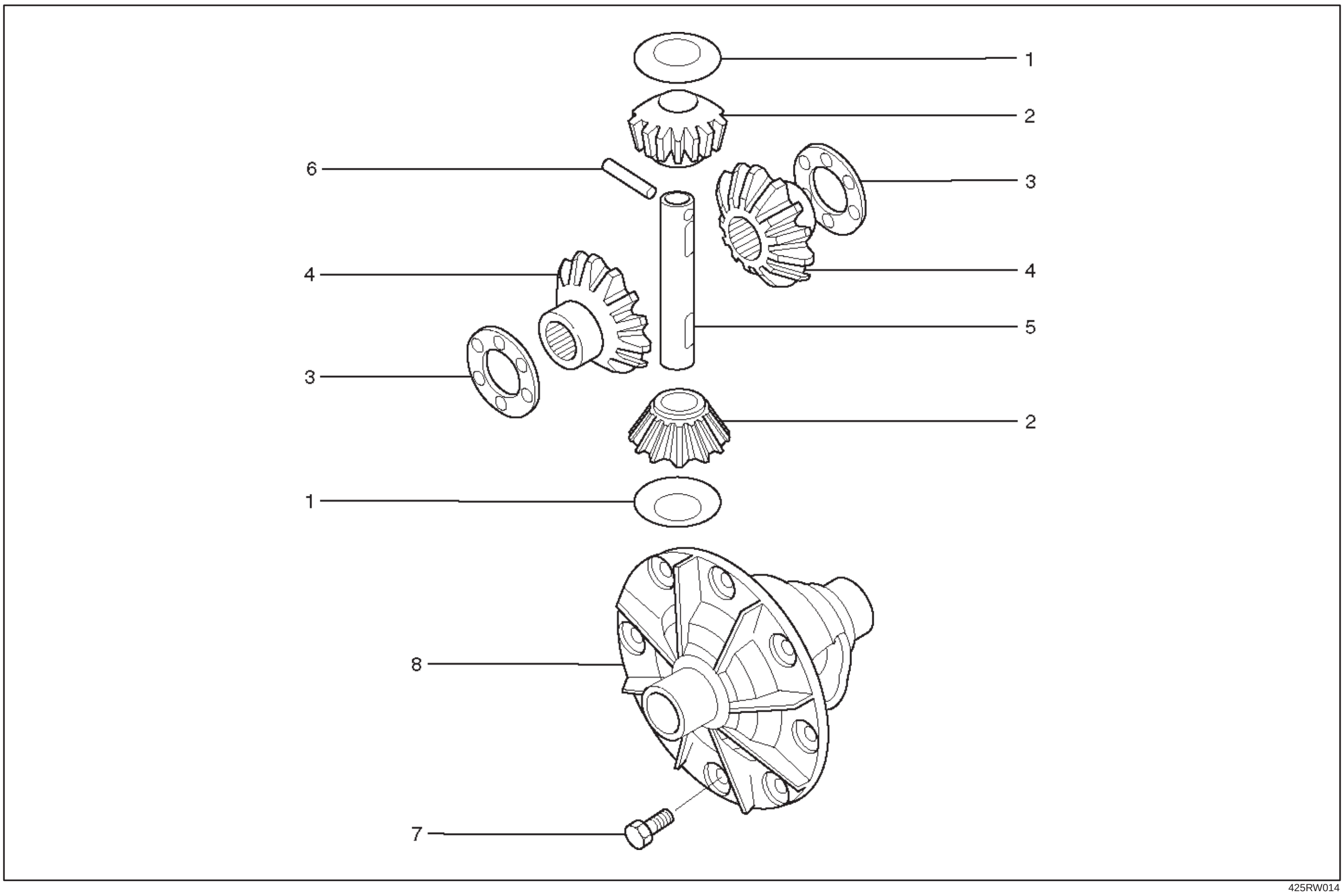
Backlash is adjusted by means of the side bearing adjusting shims which move the entire case and ring gear assembly closer to, or farther from, the drive pinion. (The adjusting shims are also used to set side bearing preload.)

If the thickness of the right shim is increased (along with decreasing the left shim thickness), backlash will increase.

The backlash will decrease if the left shim thickness is increased (along with a decrease in right shim thickness).

Differential Case Assembly

Disassembled View

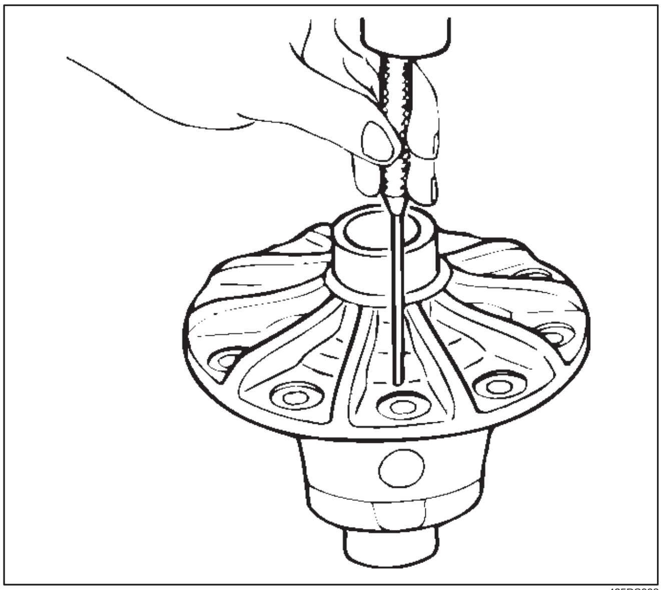


Legend

(1) Thrust Washer (for Pinion Gear)
(2) Pinion Mate Gear
(3) Thrust Washer(for Side Gear)
(4) Side Gear
(5) Differential Shaft
(6) Lock Pin
(7) Bolt
(8) Differential Case

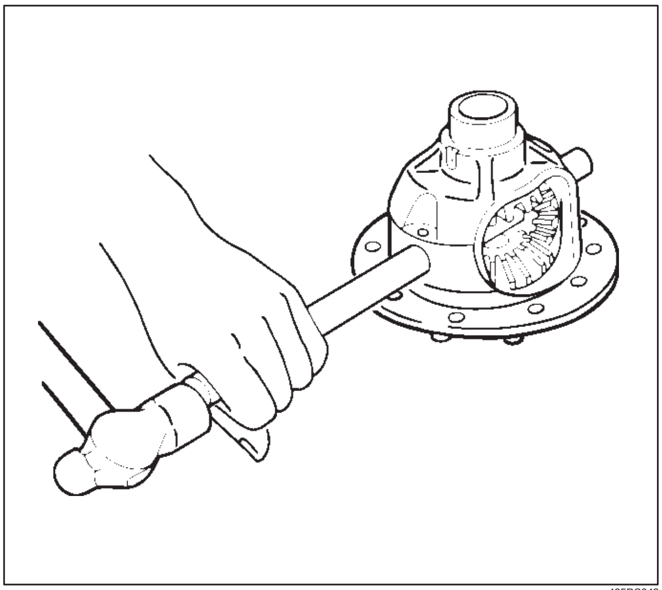
Disassembly

1. Remove lock pin using a small drift.



425RS098

2. Remove the differential shaft by using a soft metal rod and a hammer.



425RS043

3. Remove pinion mate gear and thrust washer.
4. Remove side gear and thrust washer.

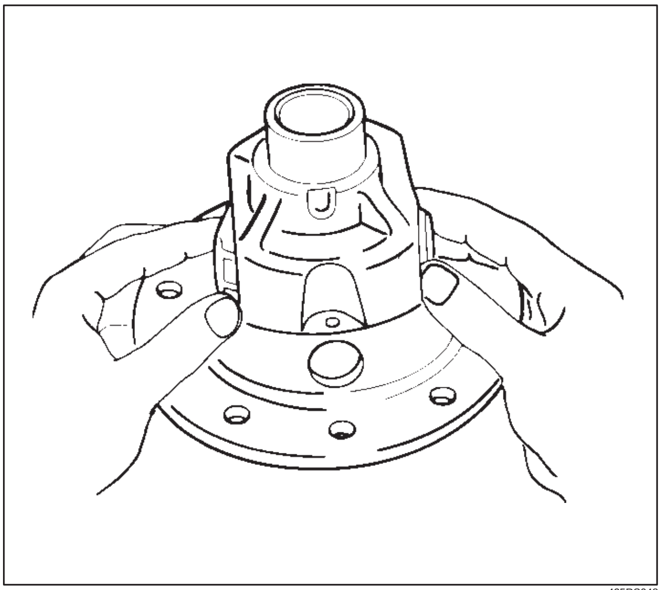
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

- Ring gear, pinion gear
- Bearing
- Side gear, pinion mate gear, differential shaft
- Differential case, carrier
- Thrust washer
- Oil seal

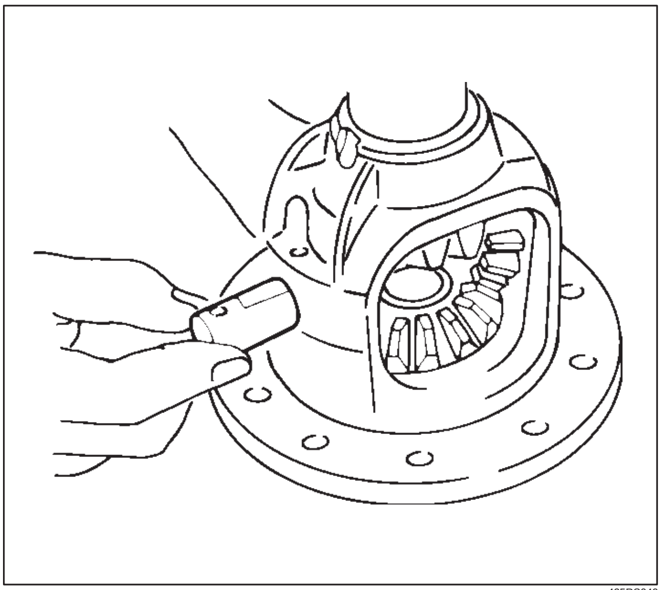
Reassembly

1. Install side gear with thrust washer.
2. Install the pinion mate gear with thrust washer by engaging it with the side gears while turning both pinion mate gears simultaneously in the same direction.



425RS048

3. Install differential shaft.
   1. Be sure to install the differential shaft so that it is in alignment with the lock pin hole in the differential case.

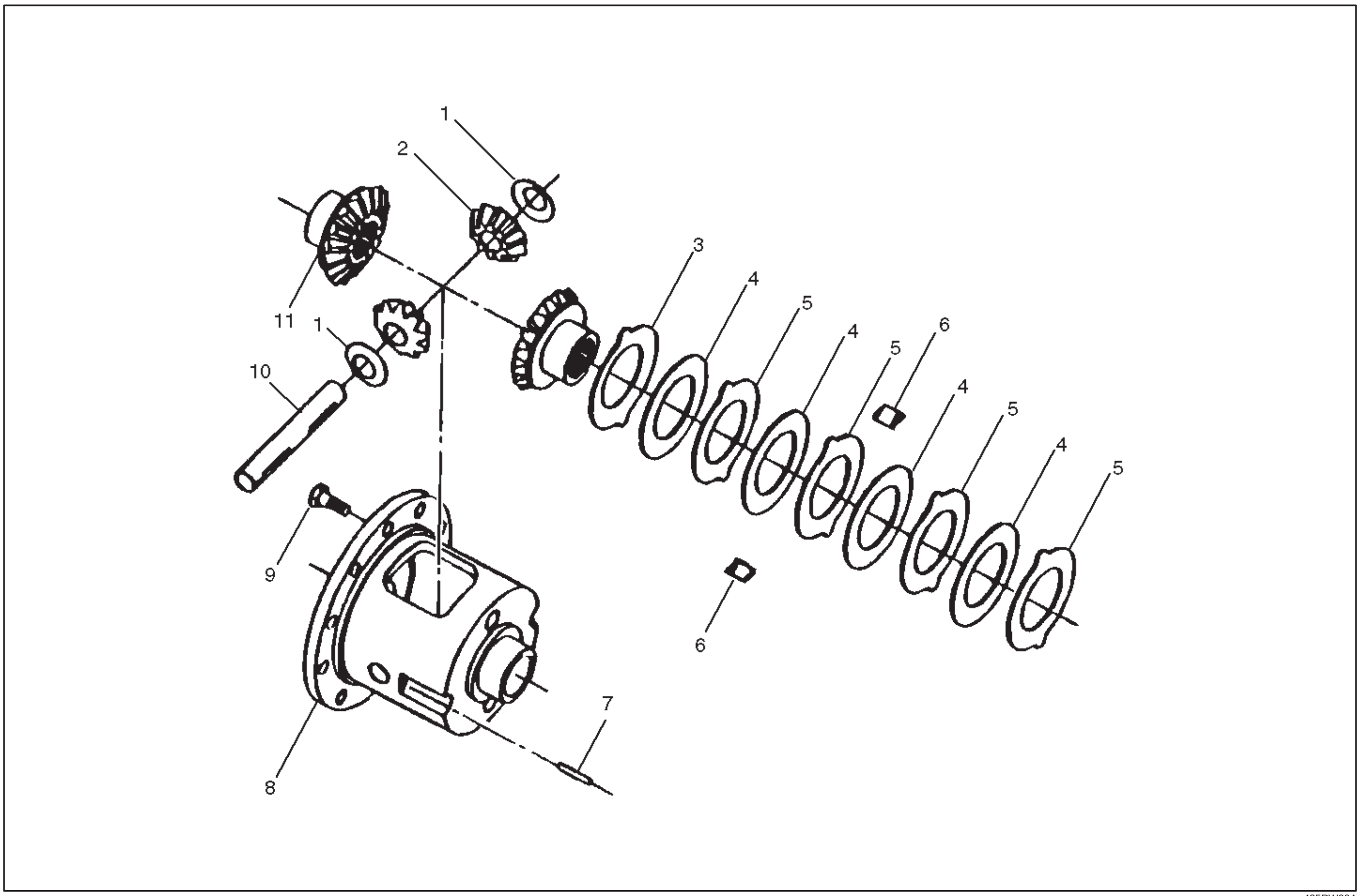


425RS049

4. Install lock pin.
   After lock pin installation, stake the case to secure the lock pin.

Limited Slip Differential Assembly

Disassembled View



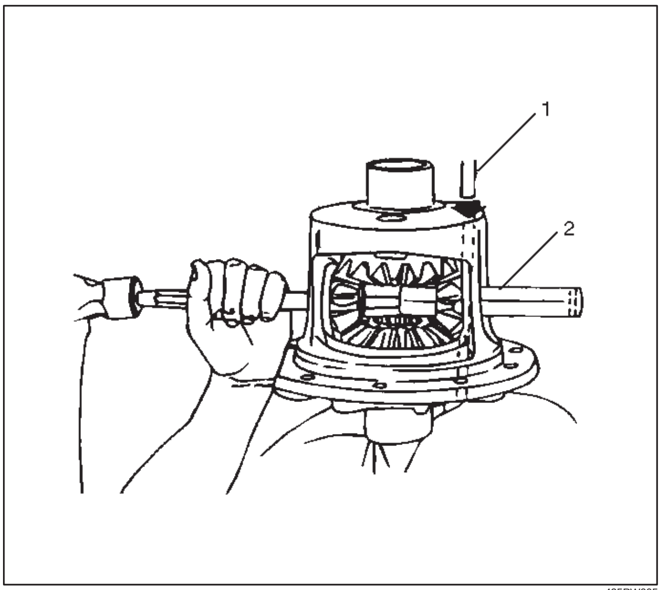
425RW004

Legend

(1) Thrust Washer–Differential Pinion Mate Gear
(2) Pinion Mate Gear
(3) Dished Spacer
(4) Disc
(5) Plate
(6) Differential Plate Retainer
(7) Lock Pin
(8) Differential Case
(9) Ring Gear Bolts
(10) Differential Shaft
(11) Differential Side Gear

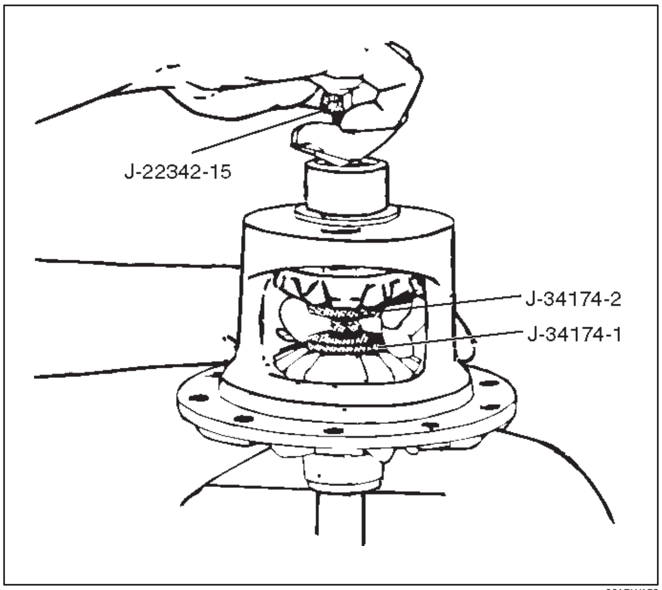
Disassembly

1. Place the holder J–39824 into a vise.
   Position the differential on the holder with the ring gear side down.
2. Remove Lock pin (1) from differential shaft using a punch.
3. Remove Differential shaft (2) using hammer and punch.
   Place shop towel behind case to prevent differential shaft from dropping out of case.



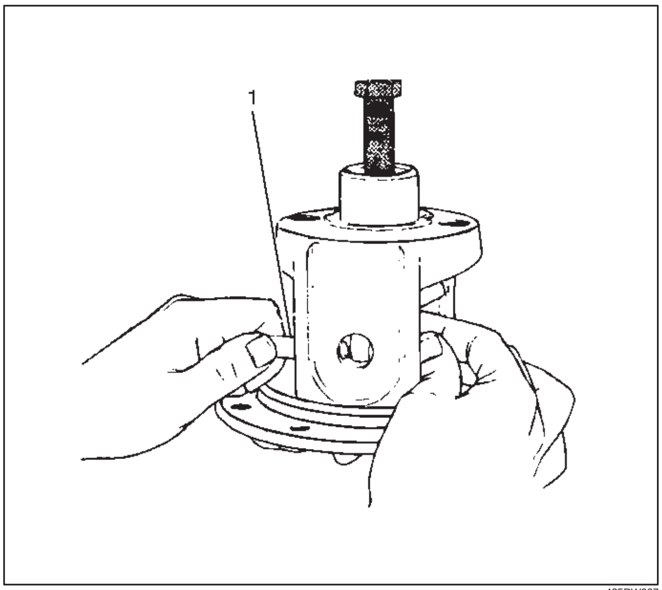
425RW005

4. Assemble clutch pack unloading tool .
   a. Install cap J–34174–1 to the bottom differential side gear.
   b. Install threaded screw cap J–34174–2 to top differential side gear. Thread forcing screws J–22342–15 into threaded screw cap until it becomes centered into the bottom cap.



901RW153

   c. Tighten forcing screw until tight enough to collapse dished spacers and and allow looseness between side and pinion mate gears.
5. Both pinion mate gear thrust washers using a shim stock (1) of 0.51 mm (0.020 in.) or equivalent tool to push out washers.



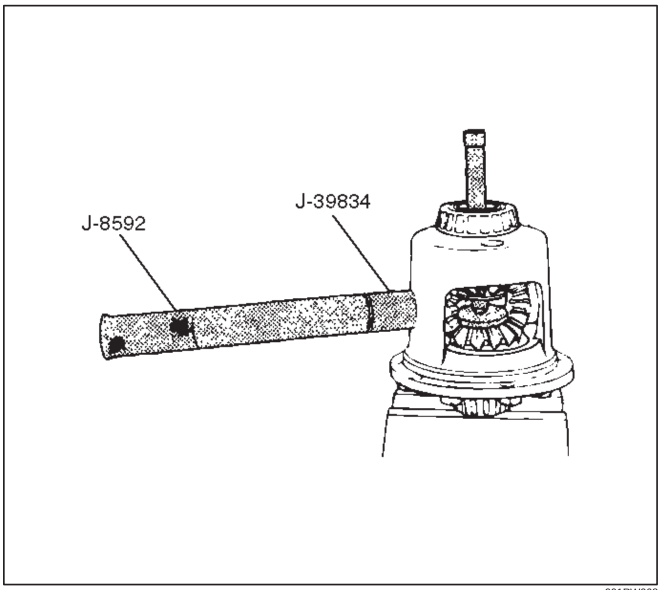
425RW007

6. Relieve tension of dished spacers by loosening forcing screw.

NOTE:

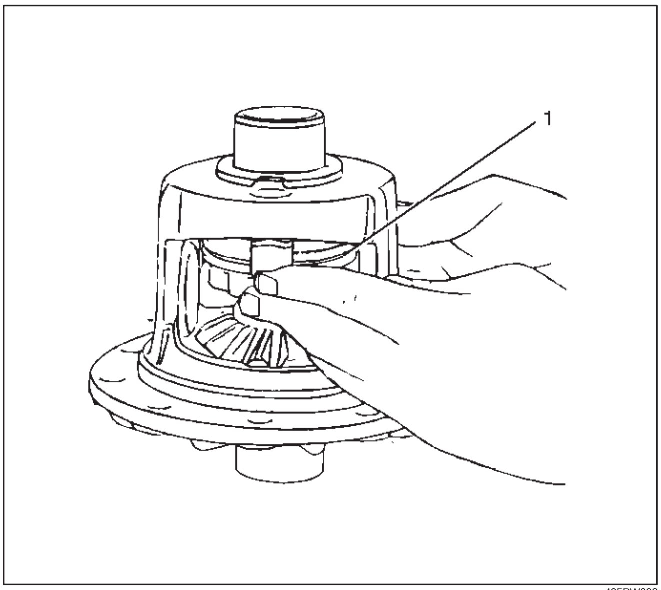
- You may have to adjust the forcing screw slightly to allow the case to rotate.

7. Assemble LSD service adapter J–39834 onto long drive handle J–8592.Insert it into differential shaft hole of case. Pull on handle and rotate case until pinion mate gears can be removed.



901RW068

8. Remove pinion mate gears.
9. Hold side gear top clutch pack (1) with one hand and remove positraction unloading tools.



425RW008

10. Remove top side gear and clutch pack.

NOTE:

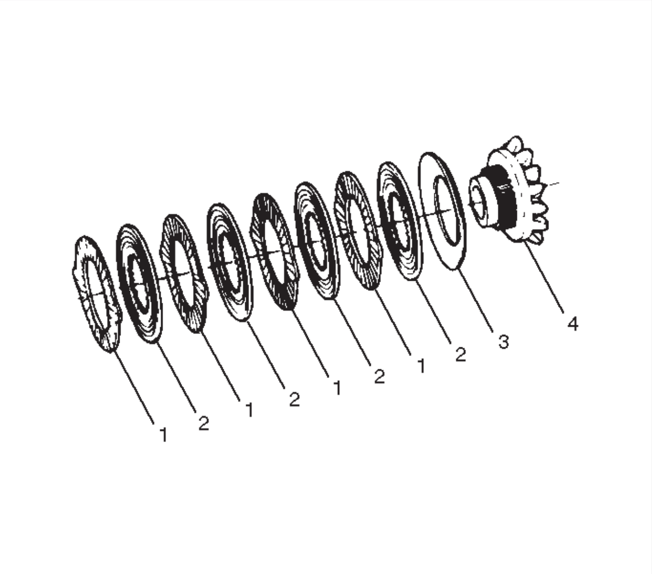
- Keep the stack of plates and discs intact and in exactly the same position while they are being removed.

11. Remove case from holder. Turn case with flange or ring gear side up to allow side gear and clutch pack to be removed from case.

12. Remove differential plate retainer from both clutch packs to allow separation of the plates and discs.

NOTE:

- Keep the discs and plates in the same order as they were removed.



425RW009

Legend

(1) Differential Plate
(2) Differential Disc
(3) Dished Spacer
(4) Side Gear

Inspection and Repair

Cleaning

- All parts with solvent.

Visual Inspection

- Clean all parts with solvent.
- Plates and Discs. If any one disc or plate in either stack shows evidence of excessive wear or scoring, the complete stack is to be replaced on both sides.
- Side Gears and Pinion Mate Gears. The gear teeth of these parts should be checked for extreme wear and possible cracks. The external teeth of the side gear, which retain the concentric groove discs, should also be checked for wear or cracks.
- If replacement of one gear is required due to wear, etc., then both side gears, pinion mate gears, and thrust washers are to be replaced.
- Differential Shaft. If excessive wear is evident, the differential shaft should be replaced.
- Differential Plate Retainers. If wear is evident on any one of the differential plate retainers, all four retainers must be replaced.
- Differential Case. If scoring, wear or metal pickup is evident on the machined surfaces, replacement of the case is necessary.

Reassembly

1. Lubricate thrust face of side gears, plates and discs with the proper limited slip rear axle lubricant.
2. Assemble plates and discs in exactly in the same position as they were removed, regardless of whether they are new or original.
3. Install differential plate retainer to ears of plates.

NOTE:

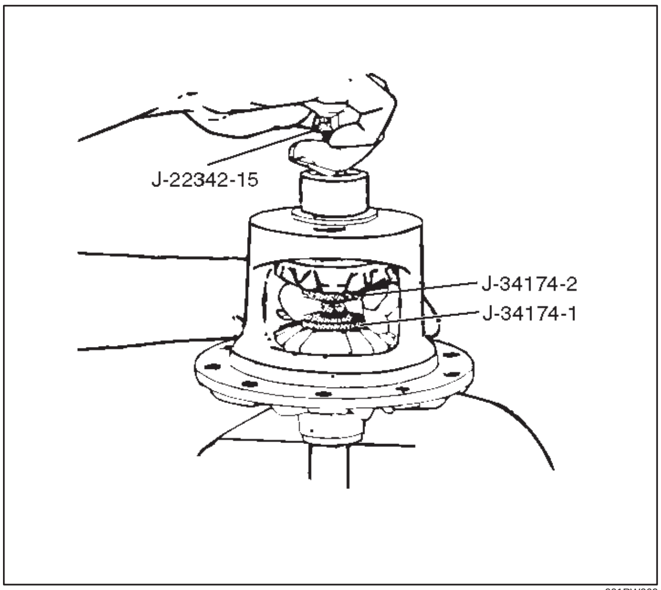
- Make sure both retainers are Completely seated on ears of plates.

4. Install clutch pack and side gear into bottom side gear bore. Make sure clutch pack stays assembled to side gear splines, and that retainers are completely seated into pockets of case.

NOTE:

- To prevent clutch pack from falling out of case, hold clutch pack in place by hand while repositioning case on bench.

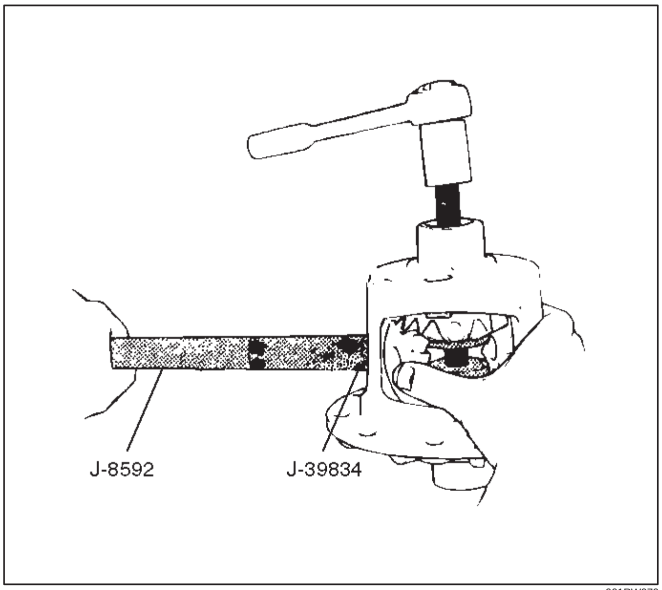
5. Install other side gear and clutch pack. Make sure clutch pack stays assembled to side gear splines, and retainers are completely seated into pockets of case.
6. Hold clutch pack in position and assemble screw cap J–34174–2, cap J–34174–1 and forcing screw J–22342–15. Tighten forcing screw into bottom cap to hold both clutch packs in position.
7. With tools assembled to case, position case on holder J–39824 by aligning splines of side gear with those of shaft. Tighten forcing screw to compress clutch packs in order to provide clearance for pinion mate gears.



901RW069

8. Install pinion mate gears.
   - Place the pinion mate gears into the differential 180 degrees apart.

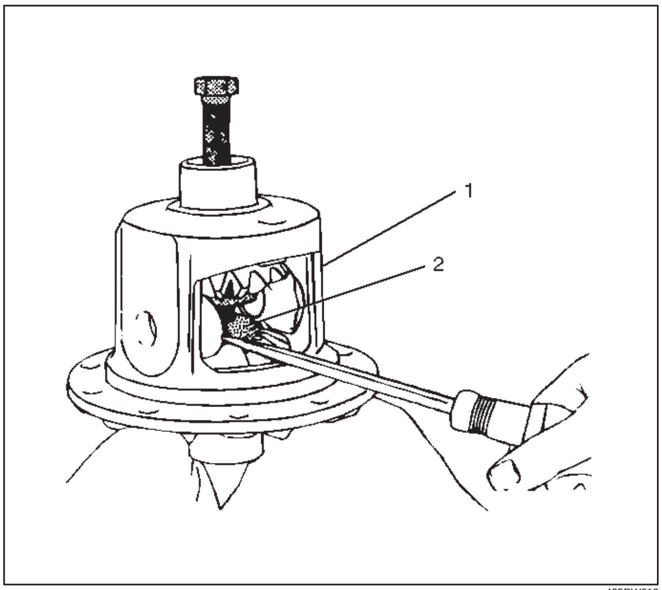
9. While holding gears in place, insert LSD service adapter J–39834 with long drive handle J–8592 in differential shaft hole of case. Pull on long drive handle J–8592 and rotate case, allowing gears to turn. Make sure that holes in pinion mate gears align with holes in case.



901RW070

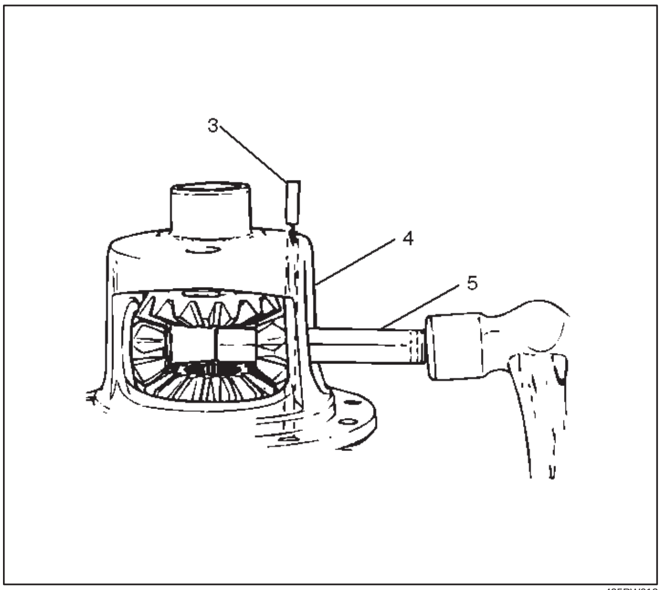
- It may be necessary to adjust tension on forcing screw to rotate case.

10. Tighten forcing screw to compress the clutch packs, to allow installation of spherical thrust washers.
11. Lubricate spherical thrust washers (2), and assemble into case (1). Use a small screw driver to push washers into place. Remove tools.



425RW012

12. Position differential shaft in case and drive in with hammer. Be sure lock pin hole of differential shaft (5) is properly aligned to allow installation of lock pin (3). Be sure that thrust washers and differential pinion mate gears are aligned with the differential case (4). Install new lock pin to proper depth using a punch.
    Stake metal of case over pin in two places, 180 degrees apart.



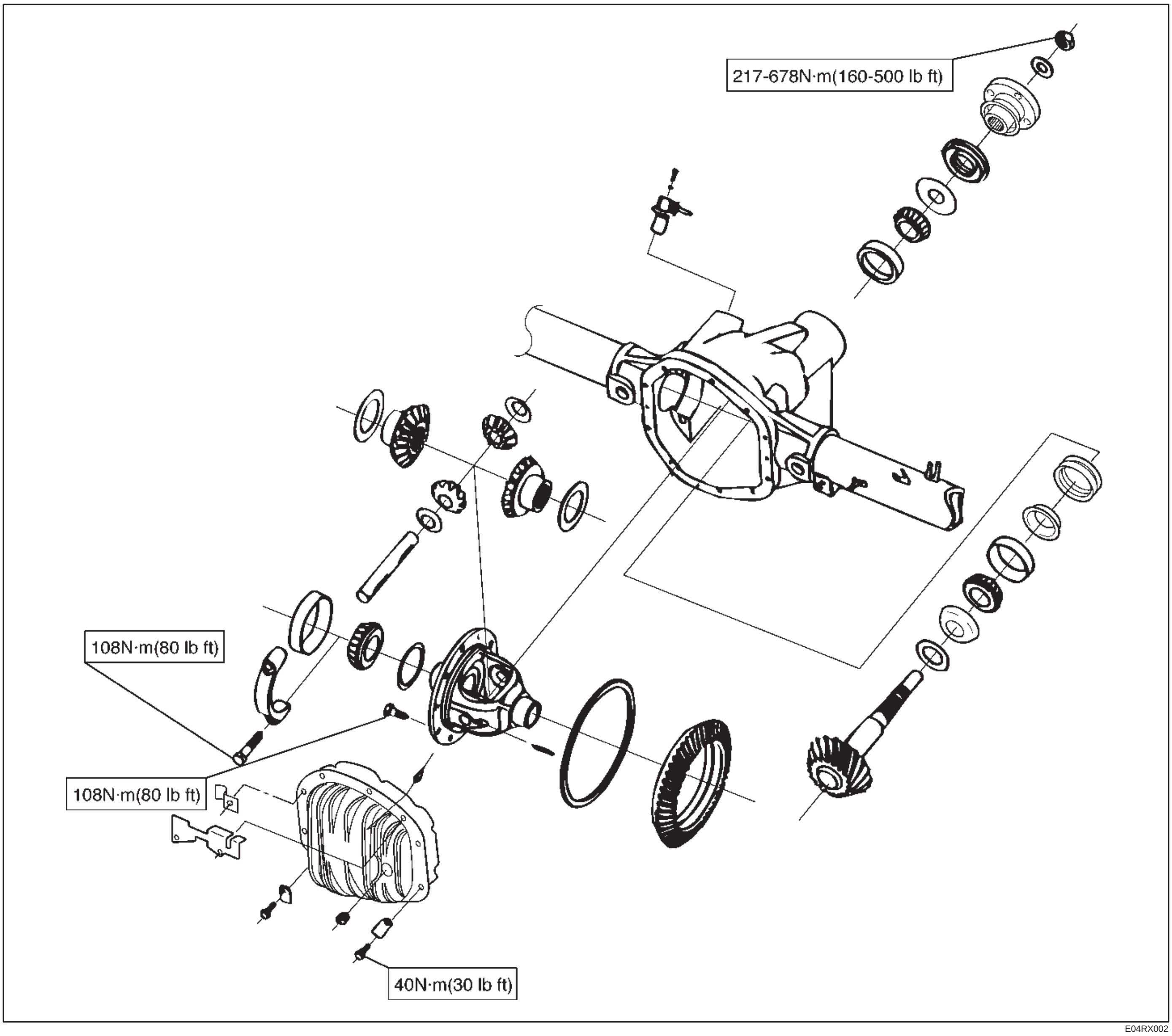
425RW013

Main Data And Specifications

General Specifications

Rear axle	
Type	Salisbury, Semi–floating
Rear axle Size	226 mm (8.9 in)
Gear type	Hypoid
Gear ratio (to 1)	4.100 (6VD1 with A/T) 4.300 (6VD1 with M/T) 4.777 (X22SE with M/T)
Differential type	Two pinion
Lubricant Grade	GL–5: (Standard differential)
	GL–5, LSD: (Limited slip differential)
Locking Differential Lubricant	80W90 GL–5 (USE Limited Slip Differential Gear Lubricant or Friction Modifier Organic Additive)
Capacity	1.77 liter (1.87 US qt)

Torque Specifications



Special Tools

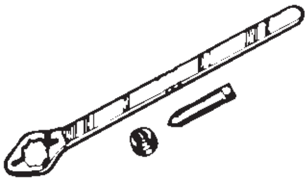
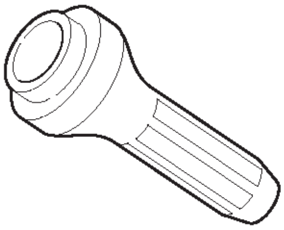
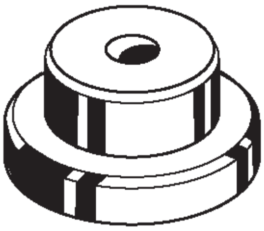
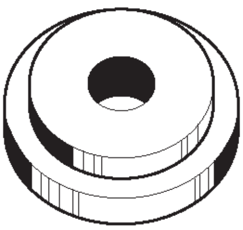
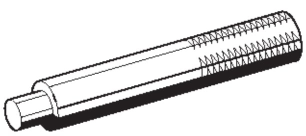
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RW037	**J–8614–01** Pinion flange holder
 901RS211	**J–37263** Installer; Pinion oil seal
 901RW039	**J–42379** Remover; Bearing
 901RS215	**J–39830** Adapter; Side bearing plug
 901RS217	**J–8611–01** Installer; Outer bearing outer race
 901RS218	**J–8592** Grip

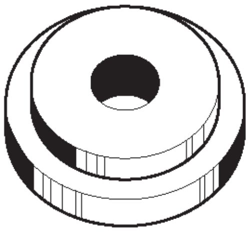
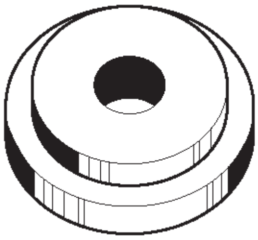
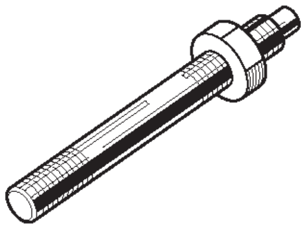
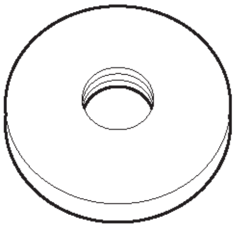
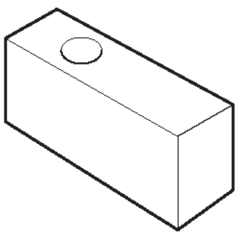
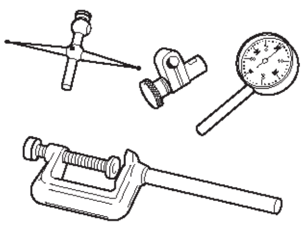
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS219	**J–42836** Installer; Inner bearing outer race
 901RS220	**J–42824** Pilot;Outer
 901RS221	**J–21777–43** Nut & Stud
 901RS222	**J–42827** Pilot;Inner
 901RS223	**J–39837–2** Gauge plate
 901RS224	**J–8001** Dial indicator

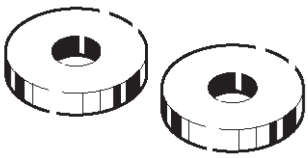
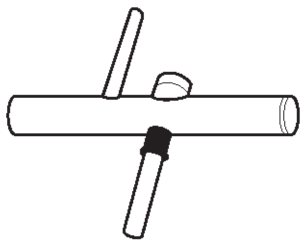
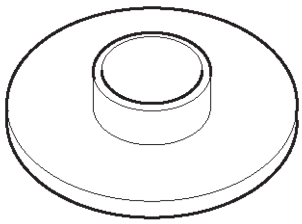
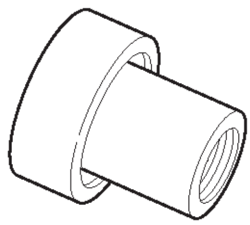
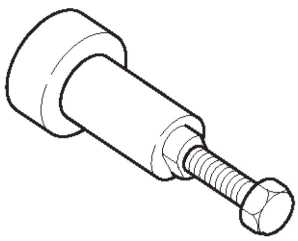
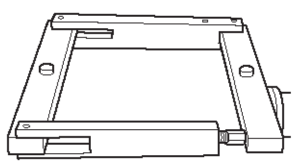
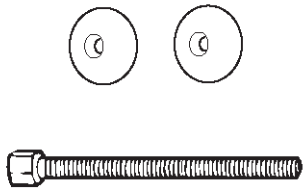
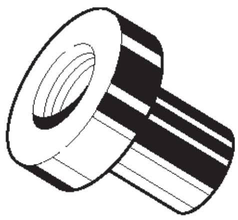
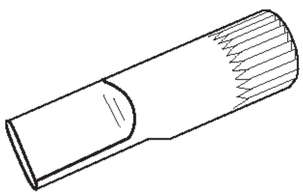
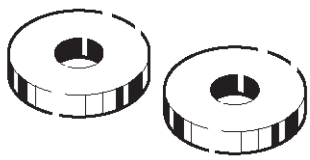
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–39837–1** Disc (2 required)
	**J–23597–1** Arbor
	**J–42828** Installer; Pinion bearing
	**J–21784** Installer; Side bearing
	**J–39602** Remover; Outer bearing
	**J–24385–B** Spreader

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–39858** Clutch pack unloading tool kit Includes **J–34174–1/J–34174–2** Screw cap and Cap **J–22342–15** Forcing screw
	**J–39834** Limited–slip differential (LSD) service adapter
	**J–39824** Holder
	**J–39836** Side bearing preload master bearings

RODEO

DRIVELINE/AXLE

DRIVELINE CONTROL SYSTEM

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Shift On The Fly System

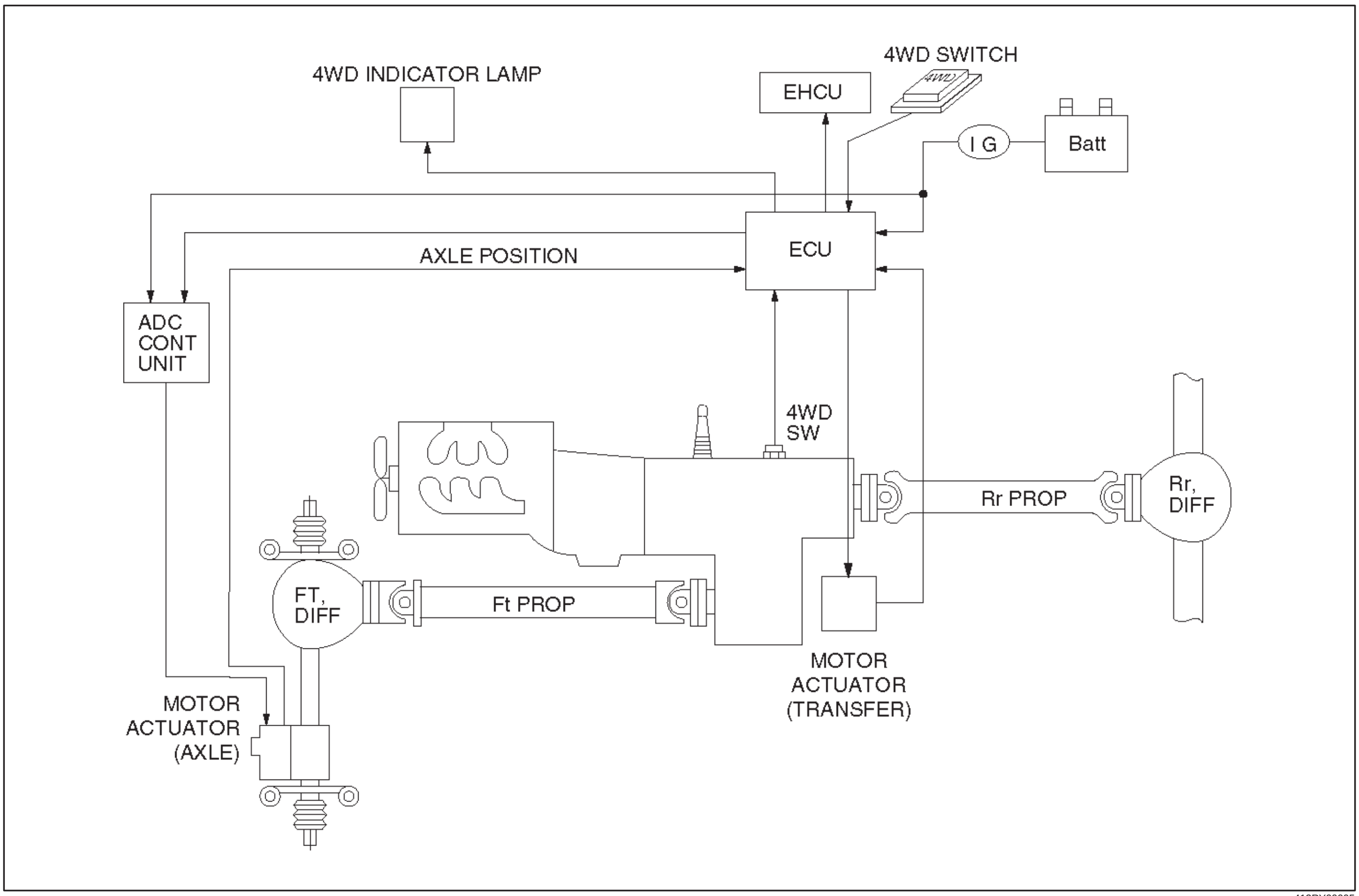
Outline of Shift on The Fly System

The shift on the fly system switches between 2 wheel drive (2WD) and 4 wheel drive (4WD) electrically by driver's pressing the 4WD switch (push button type) on instrument panel.

This system controls below operations. (Shifting between "4H" and "4L" must be performed by transfer control lever on the floor.)

1. Shifting the transfer front output gear (Connecting to, and disconnecting from, front propeller shaft by motor actuator).
2. Retrial of shifting the transfer front output gear.
3. Connecting front wheels to, and disconnecting them from, the front axles by axle motor actuator.
4. Indicator on instrument panel.
5. 4WD out signal to other Electronic Hydraulic Control Unit.

System Diagrams

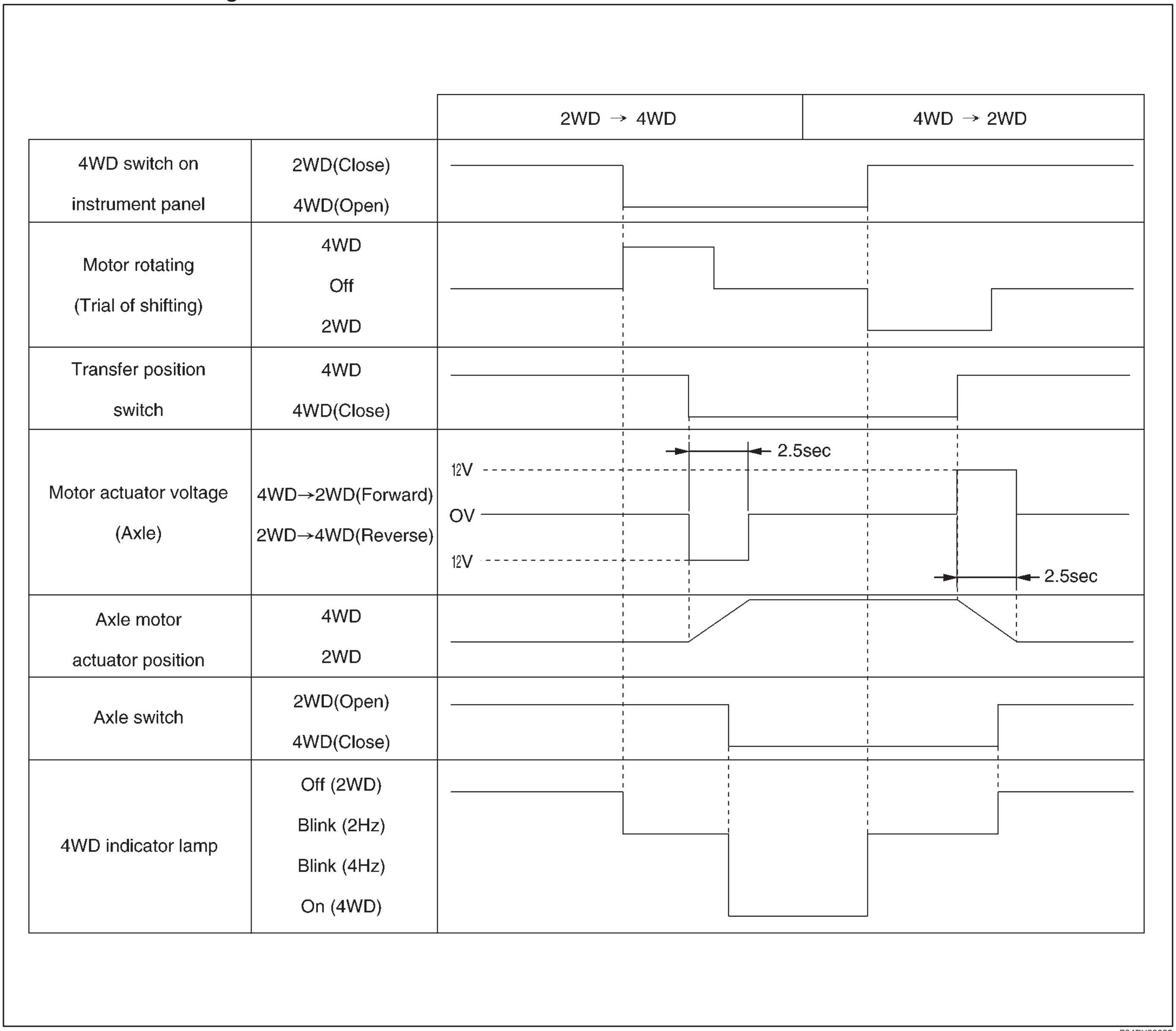


412RY00005

Normal Operation

The motor actuator mounted on transfer rear case is driven by signal from 4WD switch on instrument panel. After complete the connecting transfer front output gear to, or disconnecting it from, front propeller shaft, condition of the transfer position switch changes. The axle disconnect controller is driven by the signal from transfer position switch and axle the motor actuator connects front wheels to, or disconnect them from, front axles.

Time Chart of Shifting Under Normal Condition

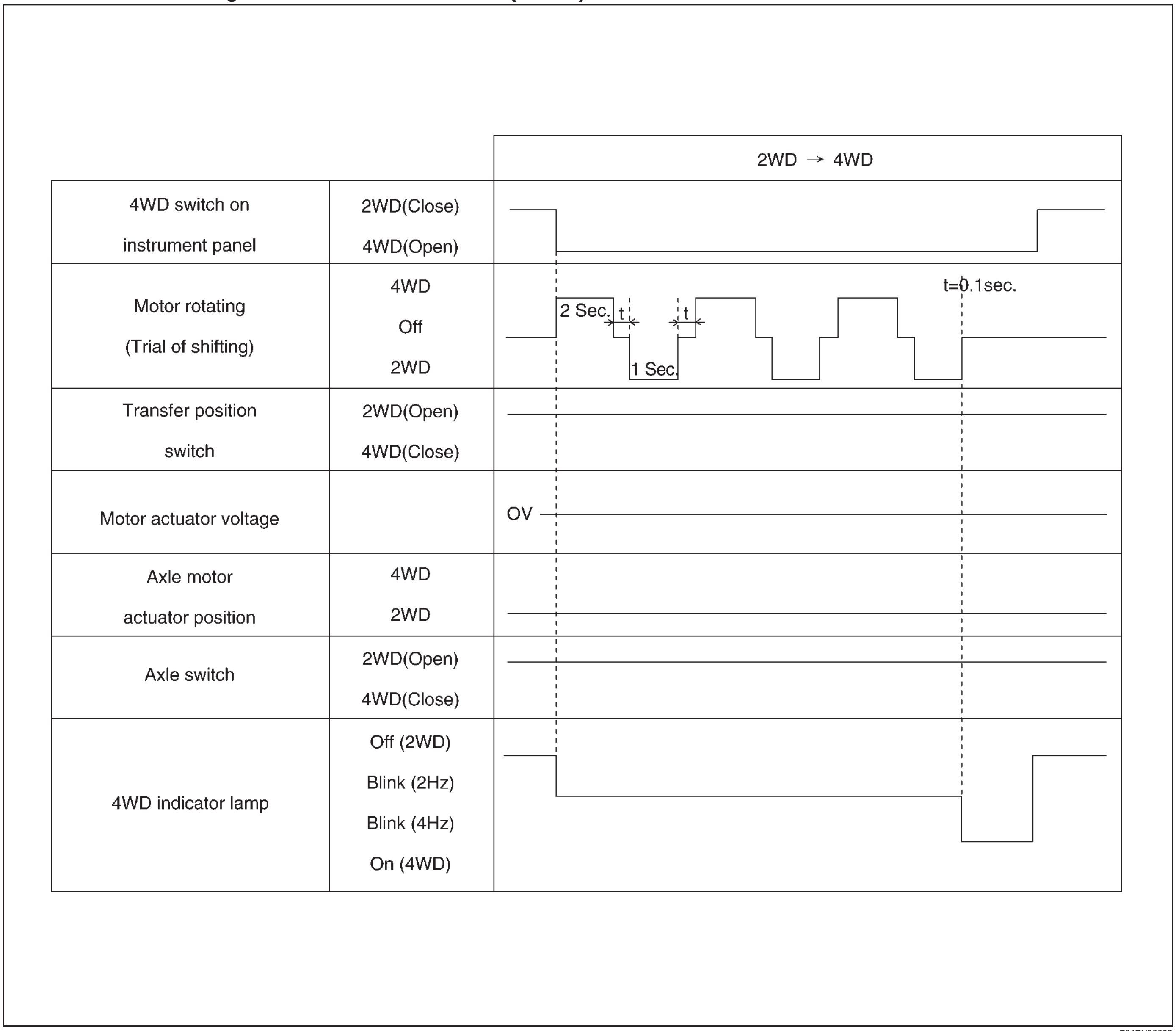


F04RY00002

Retrial

The transfer motor actuator starts transfer gear shifting after signal from 4WD switch on instrument panel has been received. But the shifting may be impossible in cold weather or under high speed condition. When 2 seconds have passed since transfer gear shifting started and the transfer position switch dose not turn on (the gear engagement is not completed), the motor reverses its rotation for 1.2 seconds and tries again to shift transfer gear. This procedure is repeated 3 times in maximum. While this procedure, 4WD indicator lamp blinks by 2 Hz. If the transfer position switch does not turn on after aforementioned procedure has been repeated 3 times, the gear shifting is stopped and 4WD indicator lamp's blinking changes from 2Hz to 4Hz to notify driver that the gear shifting is stopped. This blinking of indicator lamp continues until 4WD switch is returned from 4WD to 2WD.

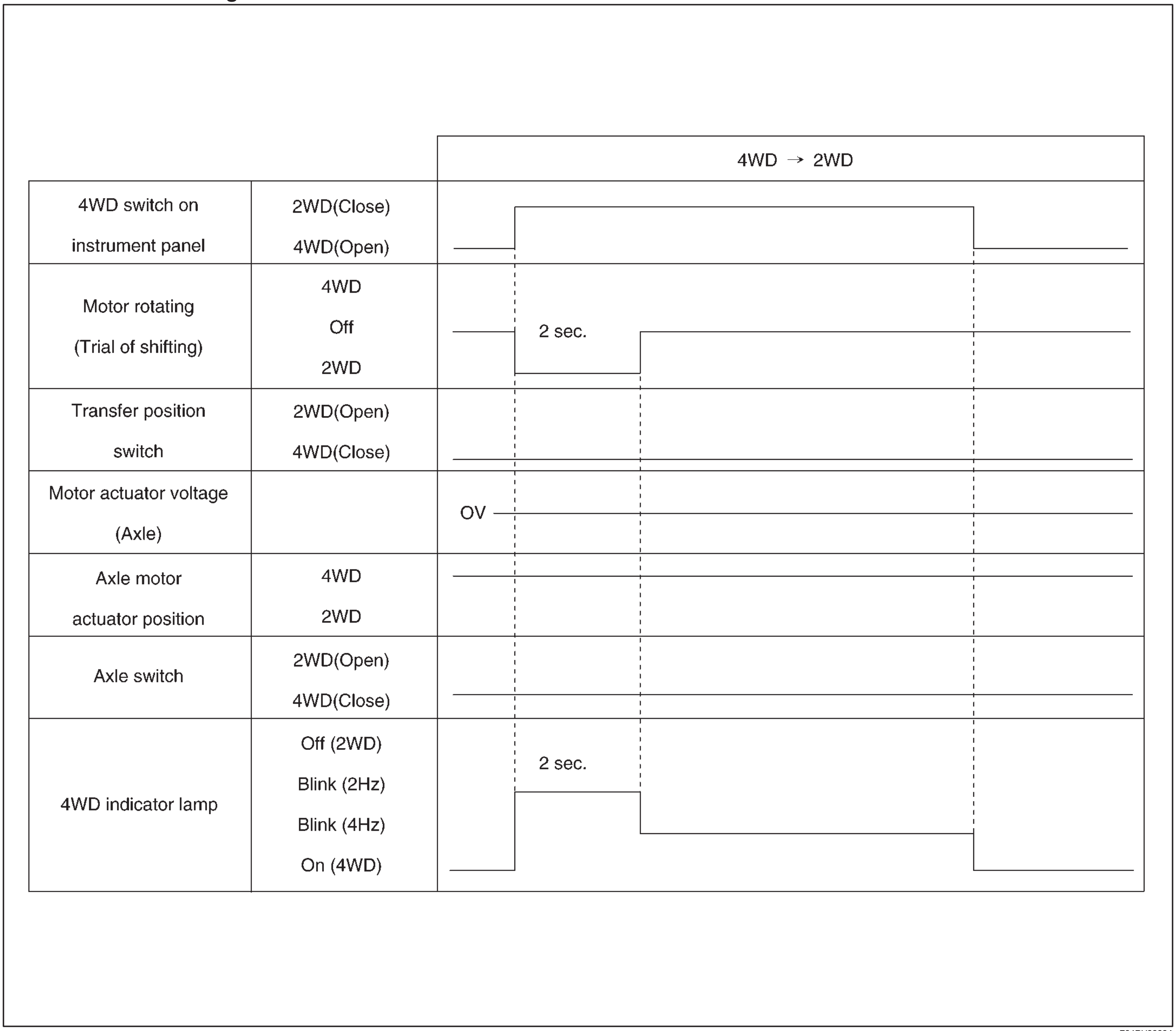
Time Chart of Shifting Under Severe Condition (retrial)



F04RY00003

Warning at “4L” position : In view of the shifting mechanism of transfer, the gear shifting from 4WD to 2WD at “4L” condition is impossible. Therefore, the transfer position switch can not be turned off by 4WD switch when vehicle is in “4L” condition. In the case this condition continues for 2 seconds, the shifting to 2WD is stopped and the indicator lamp’s blinking changes from 2Hz to 4Hz to notify driver of wrong operation.

Time Chart of Shifting from 4WD to 2WD at “4L” Condition



F04RY00004

4WD out signal to other Electronic Hydraulic Control Unit : ECU of shift on the fly sends 4WD out signal to other Electronic Hydraulic Control Unit as below.

4WD out signal (Period)	Vehicle Condition	Transfer position switch	Front axle switch
120 ms	2WD	2WD (Open)	2WD (Open)
240 ms	4WD	4WD (Close)	4WD (Close)

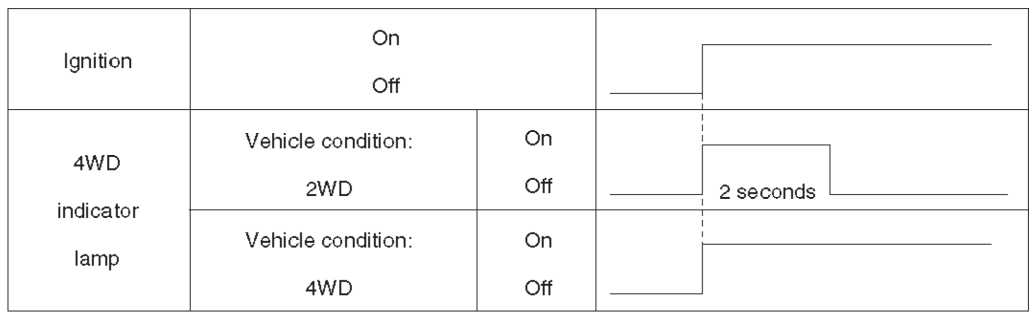
Functions of Indicator Lamp

Indication of vehicle condition : Indicator lamp is controlled by transfer ECU of shift on the fly and shows vehicle conditions as below.

Indicator	Vehicle condition	4WD switch	Transfer position switch	Front axle switch
Off	2WD	Off (Close)	2WD (Open)	2WD (Open)
On	4WD	On (Open)	4WD (Close)	4WD (Close)
Blink (2Hz)	Operating	On (Open)	4WD (Close)	2WD (Open)
		Off (Close)	2WD (Open)	4WD (Close)
Blink (4Hz)	Stop operating	On (Open)	2WD (Open)	2WD (Open)
		Off (Close)	4WD (Close)	4WD (Close)

Bulb check : The bulb of indicator lamp is checked for 2 seconds when ignition key is turned on.

Time Chart of Bulb Checking



F04RW004

Retrials from 2WD to 4WD : In cold weather or under high speed condition, the gear shifting (engagement) sometimes dose not complete by 3 trials. In such case, the indicator lamp informs driver of this incident as aforementioned chart (shown at Retrial in Outline of shift on the fly system.)

Diagnosis

Before Judging That Troubles Occur (Unfaulty mode)

When Switching from 2WD to 4WD

1. **In case that blinking frequency of the 4WD indicator changes from 2Hz to 4Hz.**

   When heavy synchronization load is needed, the motor actuator tries the shifting transfer gear three times. While the motor actuator tries shifting, the indicator blinks by 2Hz. If the third shifting fails, the indicator's blinking changes from 2Hz to 4Hz at the same time that the motor actuator shifted back to 2WD.

   Heavy synchronization load occurs by

   - extremely lower temperature.
   - higher speed rotation difference of wheels during cornering.

   Solution 1: Operate again after stop the vehicle or slow down.

2. **In case that the 4WD indicator continues blinking by 2Hz for more than 11.5 seconds.**

   When there is rotation difference of wheels or there is phase difference between front wheels and axles, it is difficult to connect front wheels to front axles. The blinking by 2Hz shows that shifting the transfer gear or connecting the front wheels is in the middle of operating. In above case, the indicator's blinking by 2Hz shows that connecting the front wheels is not completed (because the indicator's blinking changes to 4Hz when the shifting transfer gear is impossible.). And removal of rotation or phase difference makes connecting the front wheels possible.

   Solution 2: When vehicle is running, drive straight ahead while accelerating and decelerating. When vehicle is at a stop, move the vehicle forward and backward from 2 to 3 meters.

When Switching from 4WD to 2WD

1. **In case that the 4WD indicator continues blinking by 2Hz .**

   The 4WD indicator continues blinking by 2Hz until both shifting the transfer gear and disconnecting the front wheels are completed when switching 4WD to 2WD. When drive line is loaded with torsional torque, the shifting transfer gear and disconnecting front wheels are impossible. In this case, removal of torsional torque on drive line makes the shifting transfer gear and disconnecting front wheels possible.

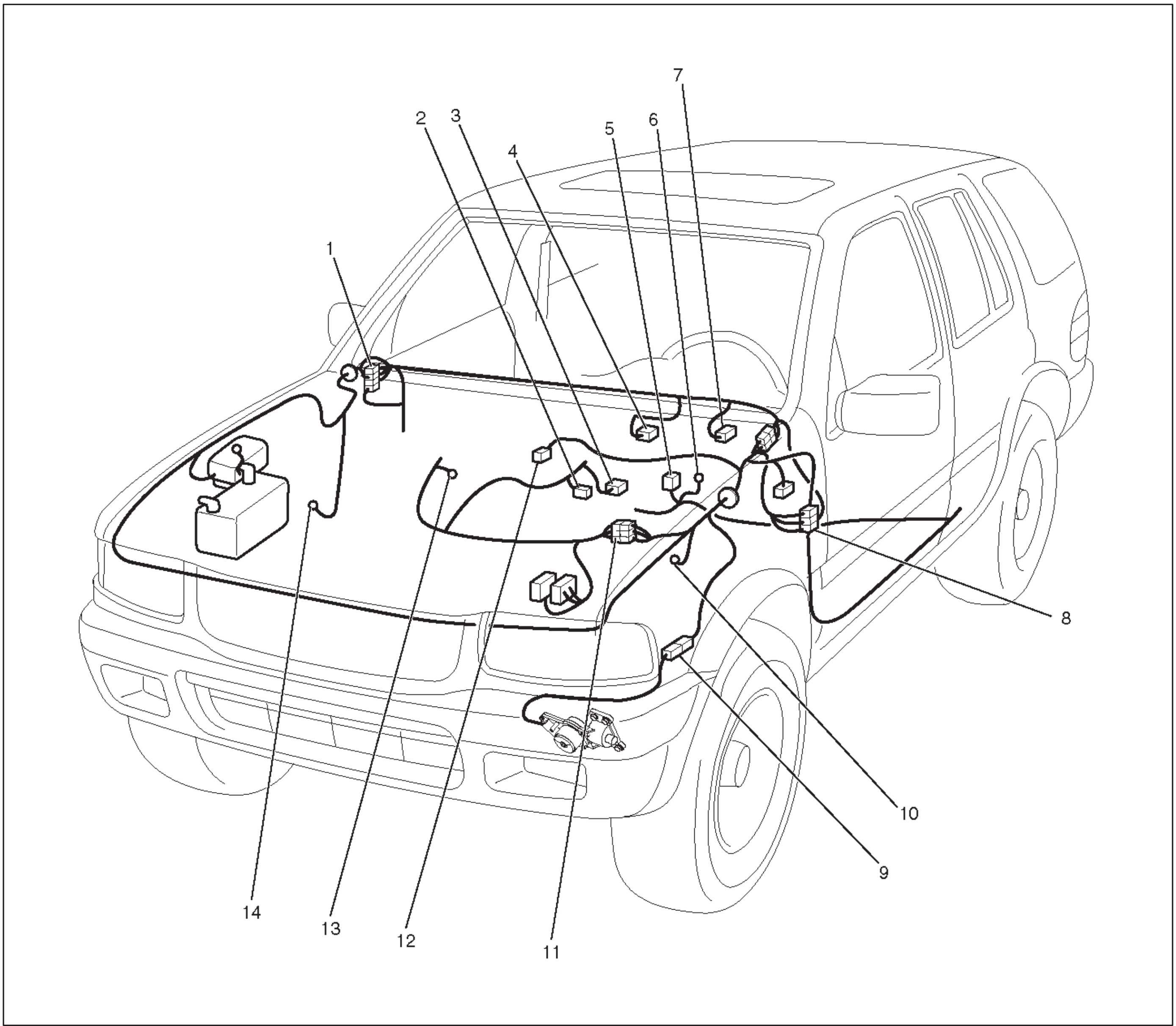
   Solution 3: When vehicle is running, drive straight ahead while accelerating and decelerating. When vehicle is at a stop, move the vehicle forward and backward from 2 to 3 meters.

2. **In case that the 4WD indicator's blinking changes from 2Hz to 4Hz.**

   Check the position of transfer lever. Is it at "4L" position? In view of the shifting mechanism of transfer, the gear shifting from 4WD to 2WD at "4L" condition is impossible.

   Solution 4: Push the 4WD switch to 4WD, shift the transfer lever to "High" position and re–operate the 4WD switch to 2WD.

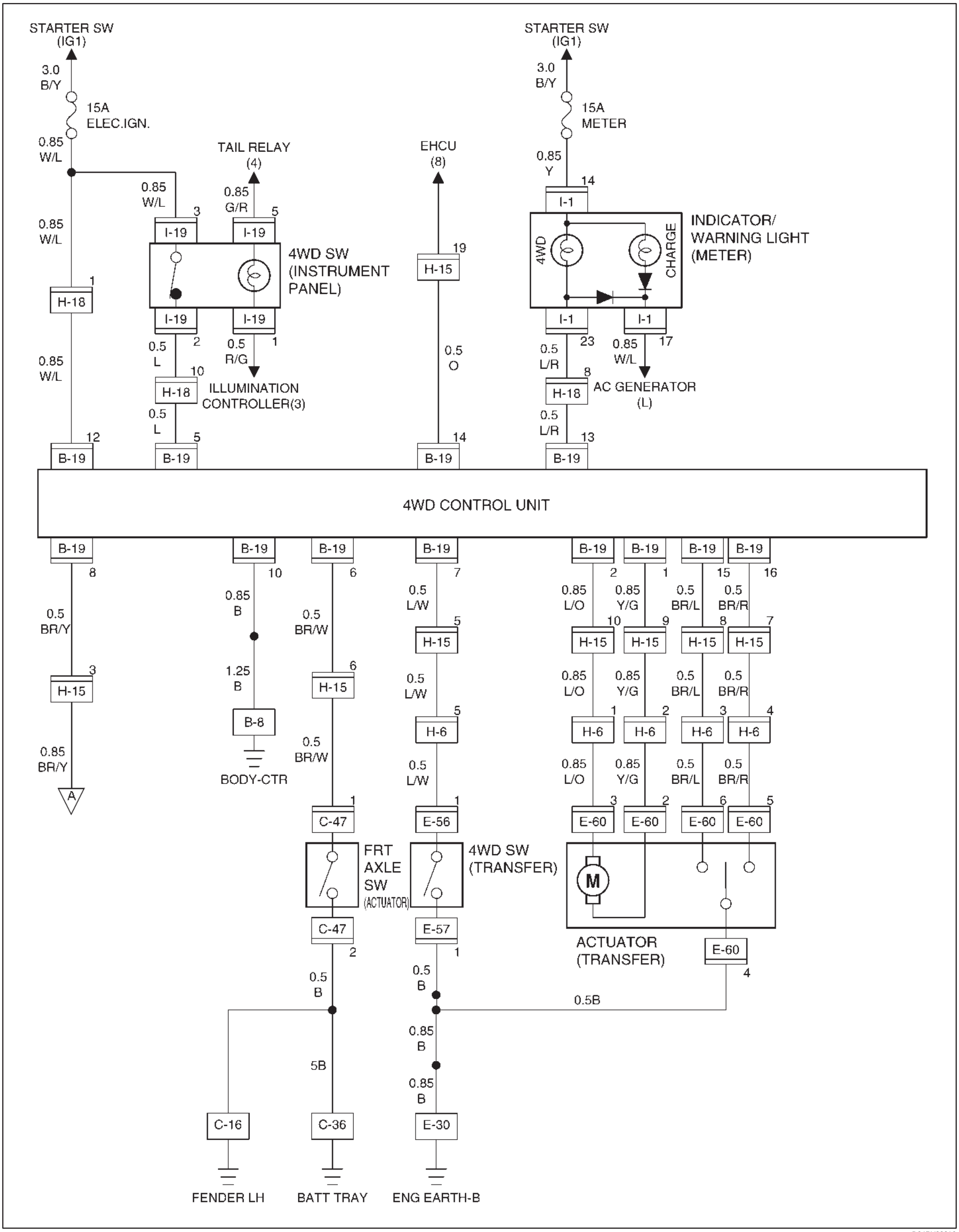
Parts Location



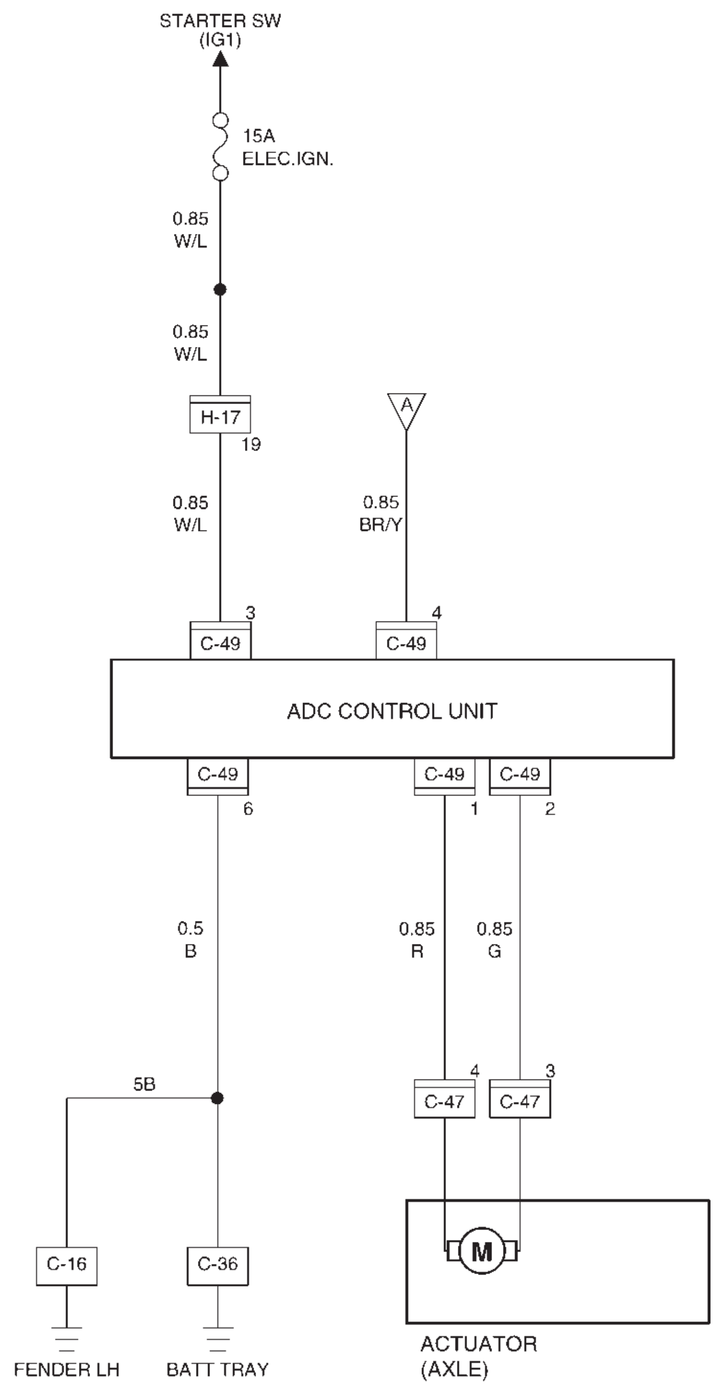
Legend

(1) H–18
(2) E–56, E–57
(3) E–60
(4) I–1
(5) B–19
(6) B–8
(7) I–19
(8) H–15, H–17
(9) C–47
(10) C–16
(11) H–6
(12) C–49 (ADC CONTROL UNIT)
(13) E–30
(14) C–36

Wiring Diagram



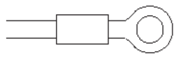
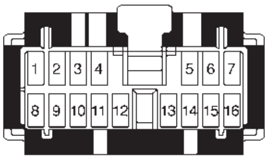
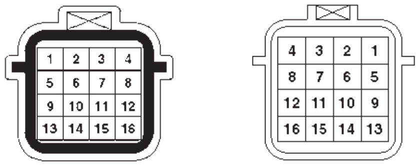
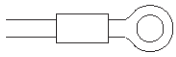
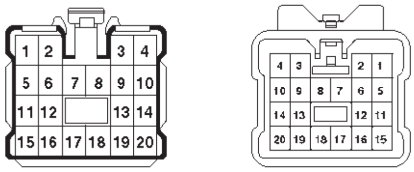
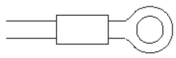
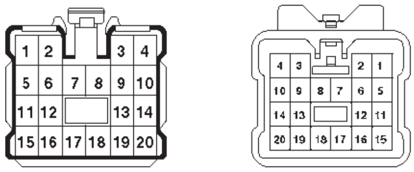
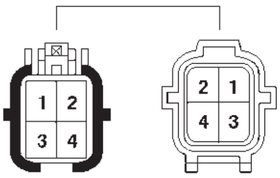
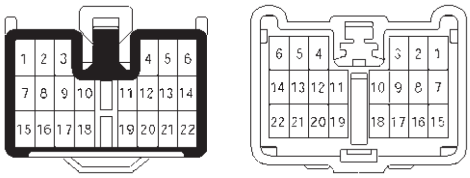
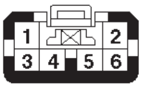
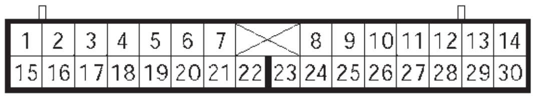
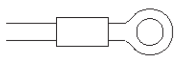
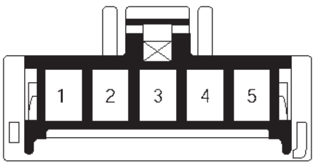
D04RY00016



STARTER SW
(IG1)
15A
ELEC.IGN.
0.85
W/L
0.85
W/L
H-17
19
A
0.85
W/L
0.85
BR/Y
3
C-49
4
C-49
ADC CONTROL UNIT
C-49
6
C-49
1
C-49
2
0.5
B
0.85
R
0.85
G
5B
4
C-47
3
C-47
M
C-16
C-36
FENDER LH
BATT TRAY
ACTUATOR
(AXLE)

D04RY00017

Connector List

No.	Connector face	No.	Connector face
B-8		E-60	
B-19		H-6	
C-16		H-15	
C-36		H-17	
C-47		H-18	
C-49		I-1	
E-30		I-19	
E-56			
E-57			

Diagnosis of The Faults Based on the Status of 4WD Indicator Lamp, 4WD Switch and T/F Change Lever

Diagnosis charts are shown on below. If troubles can not be solved after every chart was traced, troubles may occur in the ECU. In this case, replace the ECU and trace every chart again.

Fault on Switching from 2WD to 4WD

1. **In case that 4WD indicator's blinking changes from 2Hz to 4Hz after Solution 1 is carried out.**

   Faults occur in the motor actuator or the transfer case assembly. Remove the motor actuator and check function. If problem was found and it was repaired, try **Solution 1** again. After that, disassemble the transfer case assembly for check and repair or replace. If incident is not improved after above mentioned actions were taken, replace the ECU.

2. **In case that 4WD indicator dose not blink nor light, when switching from 2WD to 4WD.**

Step	Action	Yes	No
1	Is ignition turned on?	Go to Step 2	Turn on the ignition and trace this chart from start.
2	Dose the indicator light during two seconds initialization after ignition is turned on?	Go to Step 3	Burning out of indicator lamp or disconnection of harness wire. Trace this chart from the start after repair or replace.
3	Is the 4WD switch turned from 2WD to 4WD?	Short-circuit (body short) on harness of the 4WD switch. Fault of the 4WD switch (holding the closed condition). Trace this chart from the start after repair or replace.	Push the 4WD switch to 4WD.

3. **Case that the indicator keeps blinking by 2Hz after aforementioned Solution 2 is carried out.**

Step	Action	Yes	No
1	Check the air pressure and wear of all tires. Were problems found?	Try **Solution 2** after adjust the air pressure and replace worn tires.	Go to Step 2
2	Can the transfer lever be operated from High to 4L or vice versa?	Go to Step 3	Disconnection of the motor actuator harness wiring. Trace this chart from the start after repair or replace. Faults on the motor actuator. Trace this chart from the start after replace. Internal faults of transfer case. Disassemble the transfer case for check. Trace this chart from the start after repair or replace.
3	Confirm that transfer switch is normal. If abnormal, replace it.	Go to Step 4	—
4	1. Disconnect the connector C–47. 2. Turn on the starter switch 3. Measure voltage between the connector C–47 terminals 4 and 3, when 4WD switch on instrument panel is switched on 2WD and 4WD position. Is the motor actuator voltage on the axle as “Time Chart of Shifting Under Normal Condition” aforementioned?	Go to Step 8	Go to Step 5
5	1. Inspect the wiring for poor electrical connections, open or short to ground between the connector-terminal E56–1 and B19–7, E57–1 and ground, C47–1 and B19–6, C47–2 and ground, H18–1 and B19–12, B19–8 and C49–3, H17–19 and C49–3, C49–1 and C47–4, C49–2 and C47–3, and C49–6 and ground. 2. Repair the circuit. Is the motor actuator voltage on the axle as “Time Chart of Shifting Under Normal Condition” aforementioned?	Go to Step 8	Go to Step 6
6	Check the axle switch continuity between the connector C–47 terminals 1 and 2. Is the axle switch open or close as “Time Chart of Shifting Under Normal Condition” aforementioned?	Go to Step 8	Go to Step 7
7	Replace the axle motor actuator.	Go to Step 8	—
8	Reconnect all components, ensure all components are properly mounted. Was this step finished	Trace this chart from the start.	Go to Step 8

Fault on Switching from 4WD to 2WD

1. **Case that indicator dose not blink nor turn out.**

Step	Action	Yes	No
1	Dose the indicator turn out by ignition off?	Go to Step 2	Short circuit of the indicator harness.
2	Is the 4WD switch on 2WD position?	Disconnection on the 4WD switch harness or breakdown of the 4WD switch in open state. Trace this chart from the start after repair or replace.	Turn the 4WD switch to 2WD position. Trace this chart from the start.

2. **Case that indicator keeps 2Hz blinking after aforementioned Solution 3 is carried out.**

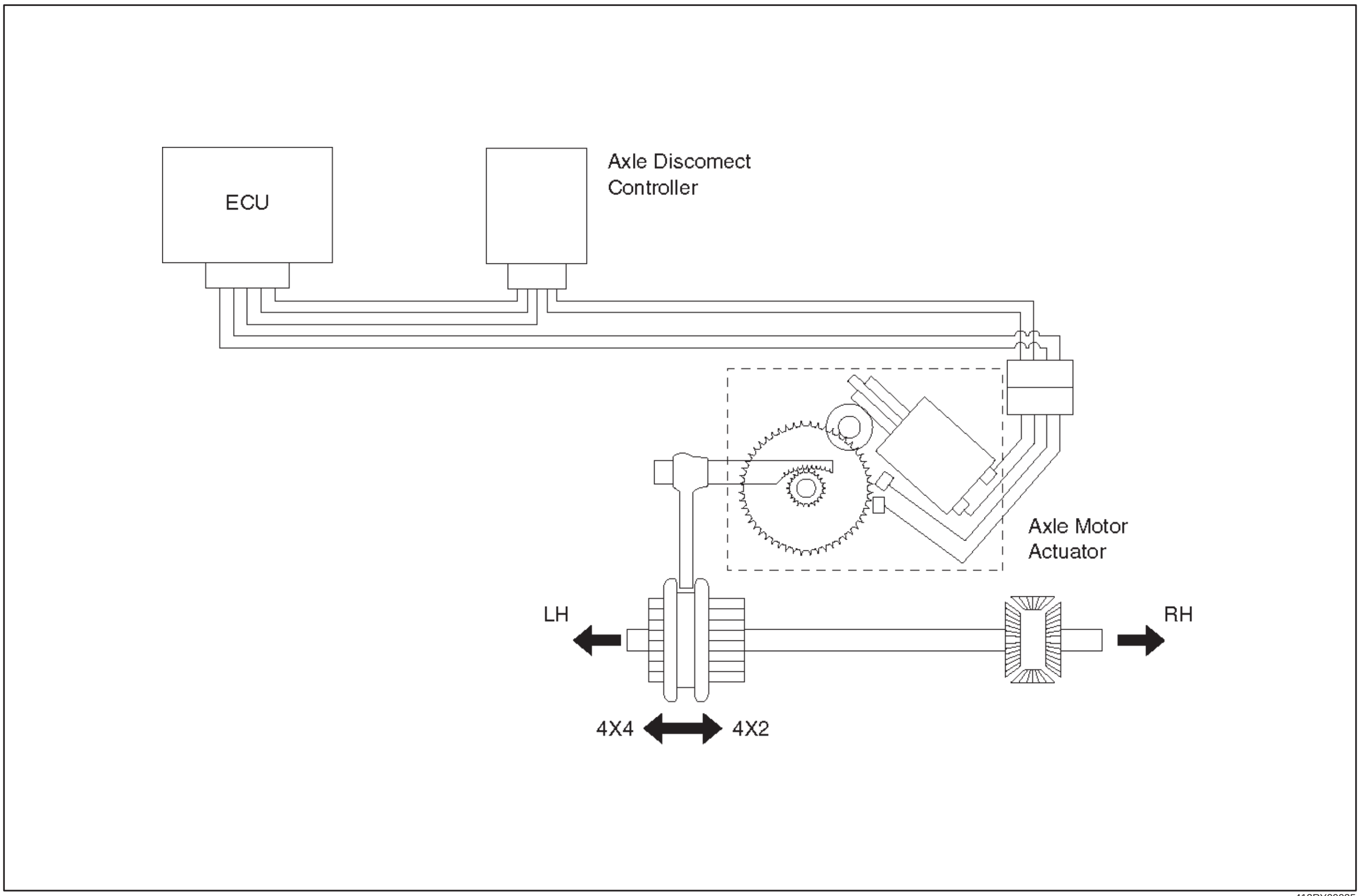
Step	Action	Yes	No
1	Check the air pressure and wear of all tires. Were problems found?	Try **Solution 3** after adjust the air pressure and replace worn tires.	Go to Step 2
2	Can the transfer lever be operated from High to 4L or vice versa?	Faults on the harness wiring of motor actuator. Trace this chart from the start after repair or replace. Internal faults on transfer case. Disassemble the transfer case for check. Trace this chart from the start after repair or replace. Faults on the motor actuator. Trace this chart from the start after or replace.	Go to Step 3
3	1. Disconnect the connector C–47. 2. Turn on the starter switch 3. Measure voltage between the connector C–47 terminals 4 and 3, when 4WD switch on instrument panel is switched on 2WD and 4WD position. Is the motor actuator voltage on the axle as “Time Chart of Shifting Under Normal Condition” aforementioned?	Go to Step 7	Go to Step 4
4	1. Inspect the wiring for poor electrical connections, open or short to ground between the connector-terminal C47–1 and B19–6, C47–2 and ground, H18–1 and B19–12, B19–8 and C49–3, H17–19 and C49–3, C49–1 and C47–4, C49–2 and C47–3, and C49–6 and ground. 2. Repair the circuit. Is the motor actuator voltage on the axle as “Time Chart of Shifting Under Normal Condition” aforementioned?	Go to Step 7	Go to Step 5
5	Check the axle switch continuity between the connector C–47 terminals 1 and 2. Is the axle switch open or close as “Time Chart of Shifting Under Normal Condition” aforementioned?	Go to Step 7	Go to Step 6
6	Replace the axle motor actuator.	Go to Step 7	—
7	Reconnect all components, ensure all components are properly mounted. Was this step finished	Trace this chart from the start.	Go to Step 7

3. **Case that indicator's blinking changes to 4Hz after aforementioned Solution 4 is carried out.**

Step	Action	Yes	No
1	Can the transfer lever be operated from High to 4L or vice versa?	Faults on the harness wiring of motor actuator. Trace this chart from the start after repair or replace. Faults on the motor actuator. Trace this chart from the start after replace. Internal faults on transfer case. Disassemble the transfer case for check. Trace this chart from the start after repair or replace.	Faults on the ECU. Trace this chart from the start after replace.

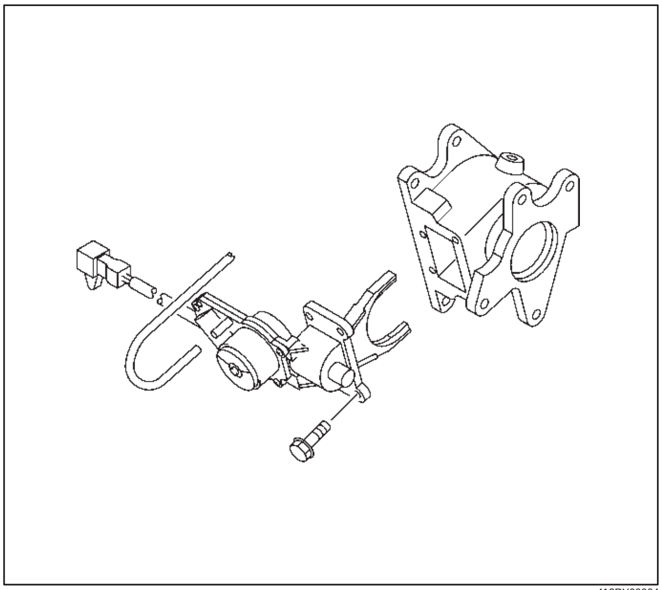
Shift On The Fly Electrical Equipment

Axle Shaft Connection and Disconnection



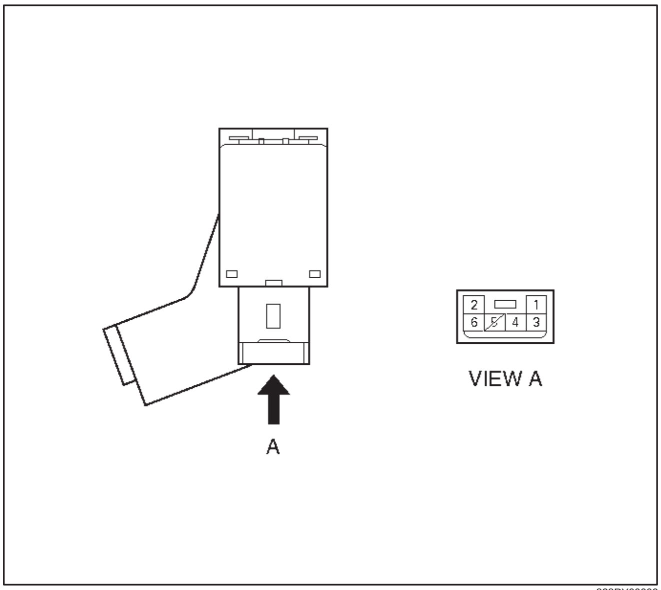
412RY00035

Actuator Assembly

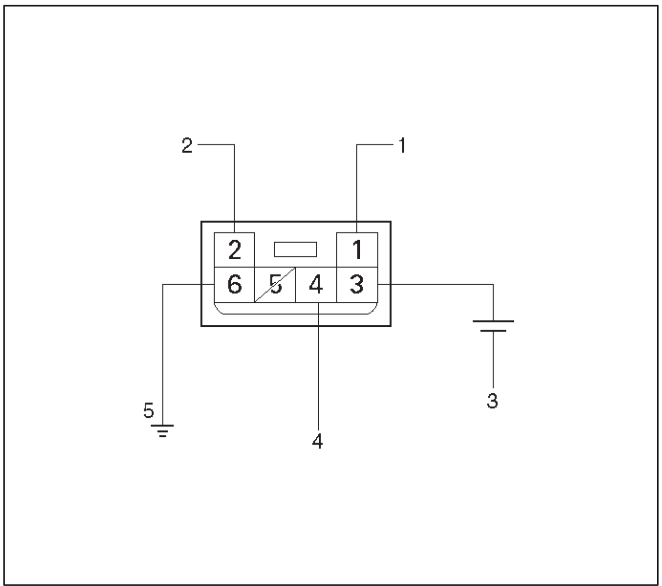


412RY00004

Axle Disconnect Controller



828RY00009



828RY00010

Legend
- (1) Output Signal
- (2) Output Signal
- (3) 12V
- (4) Input Signal
- (5) GND

1. Connect 12V with terminal (3) and the ground with the terminal (6).
2. Send the signal to the terminal (4)
   2WD → 4WD less than 2.4V
   4WD → 2WD more than 9.0V
3. Confirm the output signal from the terminals (1) & (2) (2 seconds output)

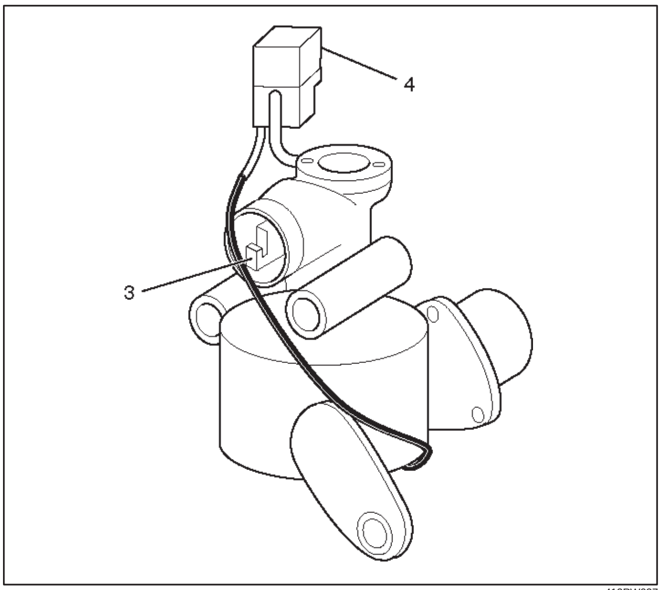
	INPUT SIGNAL	OUTPUT SIGNAL (2 seconds)	
	4	1	2
2WD → 4WD	Less than 2.4V	0V	12V
4WD → 2WD	More than 9.0V	12V	0V

4. If the trouble occurs afther above test, charge the Axle Disvonnect Controller to the new one.

Motor Actuator Assembly (Transfer)

Inspect the function of the motor actuator assembly as follows:

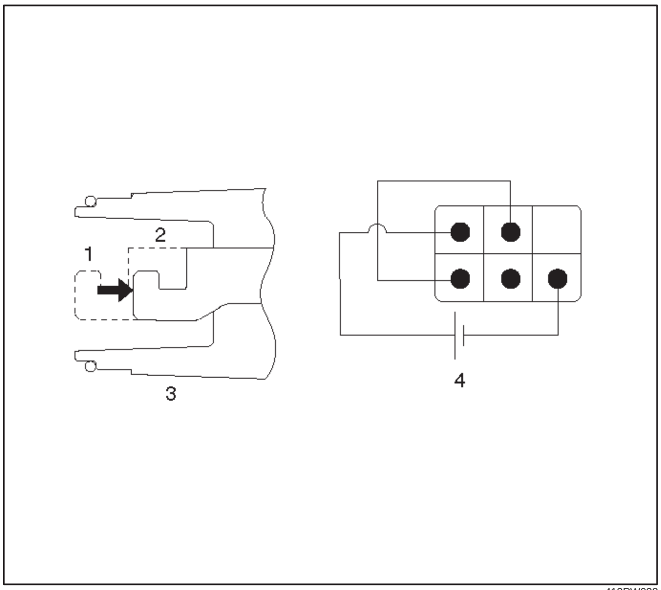
1. Disassemble the motor actuator from transfer rear case.



412RW037

Legend
- (3) Shift Rod
- (4) Connector

2. Connect the terminals as shown in figure.
   Shift rod of the motor actuator moves and stops at 4WD position.

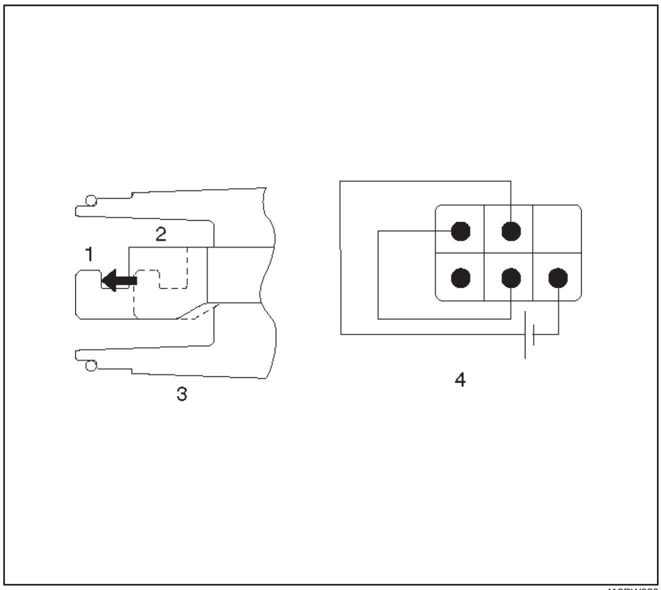


412RW038

Legend
- (1) 2WD
- (2) 4WD
- (3) Shift Rod
- (4) Connector

3. Connect the terminals as shown in figure.

   Shift rod of the motor actuator moves and stops at 2WD position.

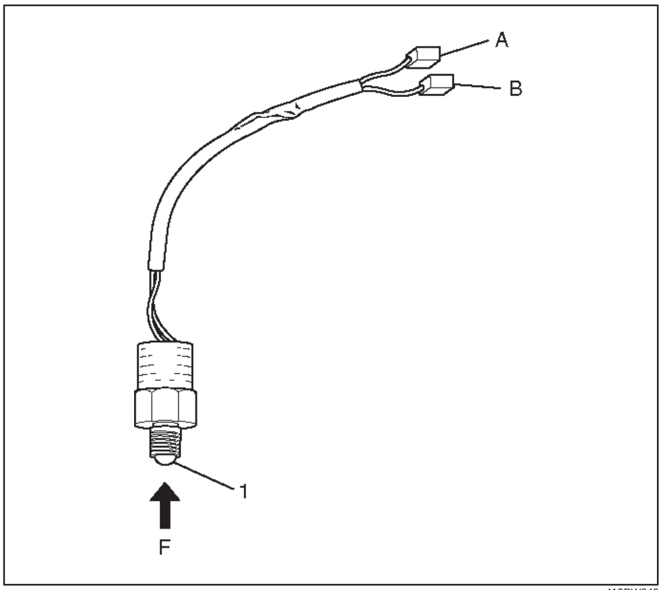


412RW039

Legend
(1) 2WD
(2) 4WD
(3) Shift Rod
(4) Connector

4. If 2) and 3) fail, replace with a new motor actuator.

Transfer Position Switch



412RW040

Legend
(1) Ball

1. With ball being free.

   A–B : There is continuity.

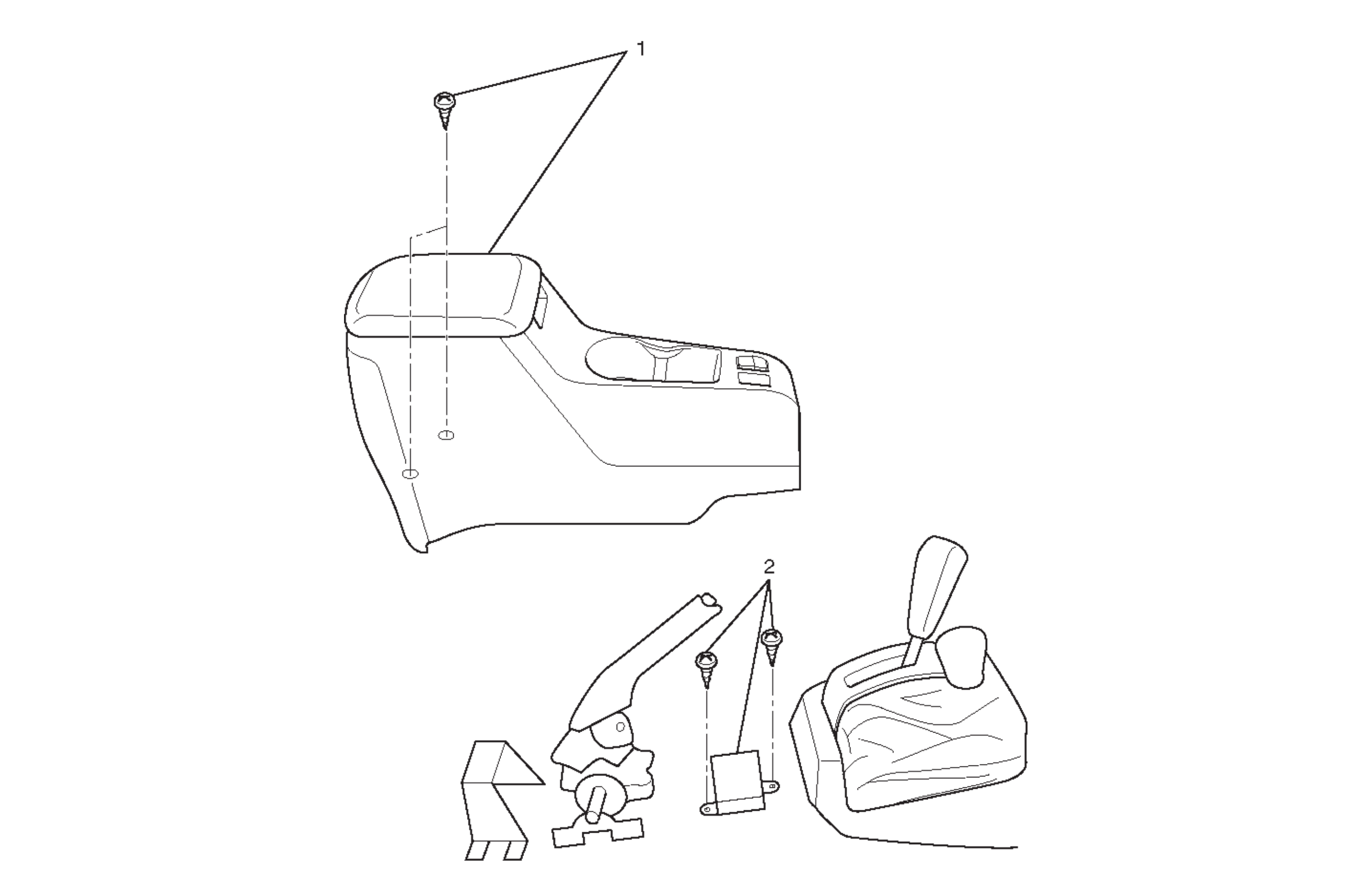
2. With ball forced into the switch.

   A–B : No continuity.

3. If 1) and 2) fail, replace with a new switch.

4WD Control Unit

4WD Control Unit Associated Parts



412RW042

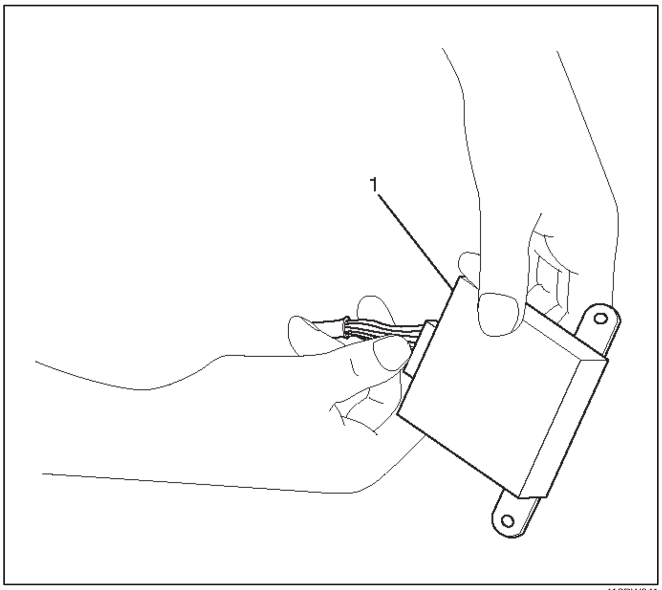
Legend

(1) Center Console Assembly
(2) 4WD Control Unit

Removal

1. Remove center console assembly.
   Refer to Interior Trim in Body and Accessories section.

2. Remove two screws and harness connector (1) from 4WD control unit.



Legend

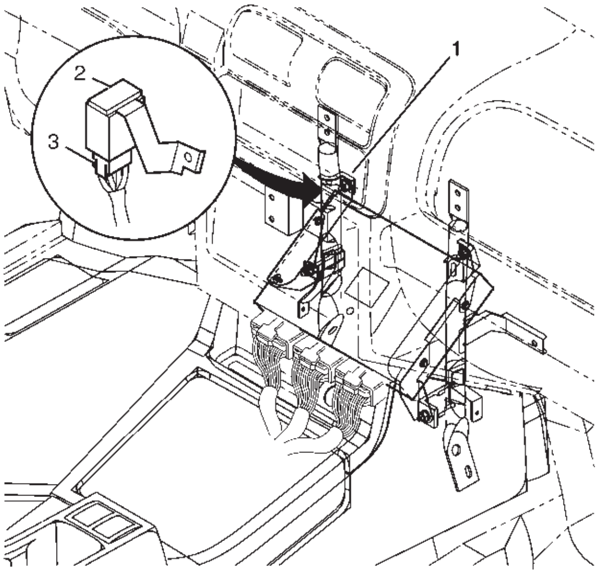
(1) Harness Connector

Installation

1. Connect harness connector, then install 4WD control unit.
2. Install center console assembly.

Shift On The Fly Controller

Shift On The Fly Controller and Associated Parts



828RY00003

Legend

(1) Nut

(2) SOF Controller

(3) Connector

Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly.
   Refer to Consoles in Body and Accessories section.
3. Disconnect the connector from the controller.
4. Remove the nut.
5. Remove the controller.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

Torque: Nut (1) 8 N·m (69 lb in)

RODEO

DRIVELINE/AXLE

DRIVE SHAFT SYSTEM

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM(SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED , do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

This publication contains essential removal, installation, adjustment and maintenance procedures.
The front axle utilizes a central disconnect type front axle/transfer case system.

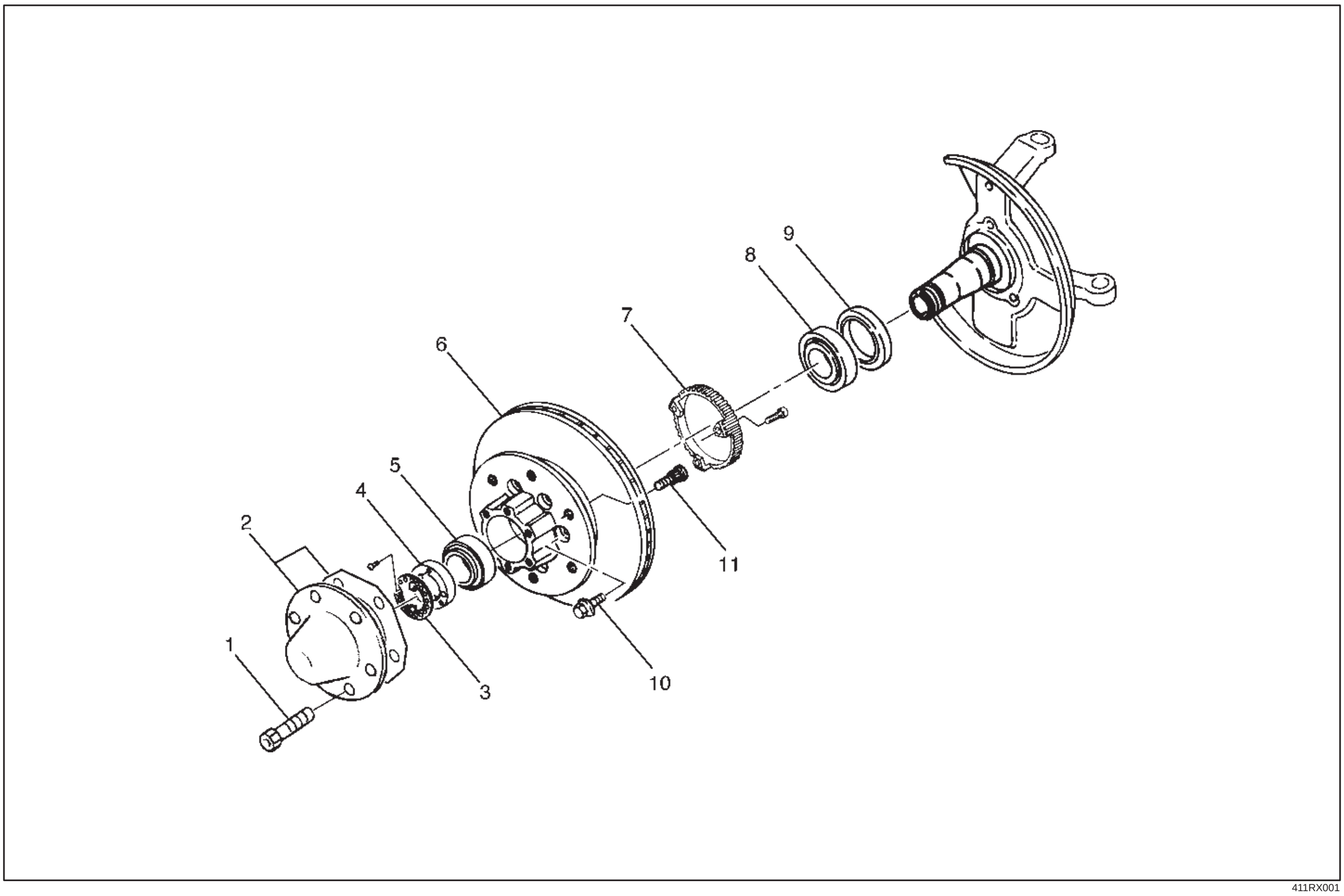
The drive axles are completely flexible assemblies, consisting of inner and outer constant velocity (CV) drive shaft joints connected by an axle shaft.
For description of front propeller shaft and universal joint, refer to Front Propeller Shaft in this section.

Diagnosis

Condition	Possible cause	Correction
Oil Leak At Front Axle	Worn or defective oil seal.	Replace the oil seal.
	Front axle housing cracked.	Repair or replace.
Oil Leak At Pinion Shaft	Too much gear oil.	Correct the oil level.
	Oil seal worn or defective.	Replace the oil seal.
	Pinion flange loose or damaged.	Tighten or replace.
Noises In Front Axle Drive Shaft Joint	Broken or worn drive shaft joints and bellows (BJ and DOJ).	Replace the drive shaft joints and bellows.
“Clank” When Accelerating From “Coast”	Loose drive shaft joint to output shaft bolts.	Tighten.
	Damaged inner drive shaft joint.	Replace.
Shudder or Vibration During Acceleration	Excessive drive shaft joint angle.	Repair.
	Worn or damaged drive shaft joints.	Replace.
	Sticking spider assembly (inner drive shaft joint).	Lubricate or replace.
	Sticking joint assembly (outer drive shaft joint).	Lubricate or replace.
Vibration At Highway Speeds	Out of balance or out of round tires.	Balance or replace.
	Front end out of alignment.	Align.
Noises in Front Axle	Insufficient gear oil.	Replenish the gear oil.
	Wrong or poor grade gear oil.	Replace the gear oil.
	Drive pinion to ring gear backlash incorrect.	Adjust the backlash.
	Worn or chipped ring gear, pinion gear or side gear.	Replace the ring gear, pinion gear or side gear.
	Pinion shaft bearing worn.	Replace the pinion shaft bearing.
	Wheel bearing worn.	Replace the wheel bearing.
	Differential bearing loose or worn.	Tighten or replace.
Wanders and Pulls	Wheel bearing preload too tight.	Adjust the wheel bearing preload.
	Incorrect front alignment.	Adjust the front alignment.
	Steering unit loose or worn.	Tighten or replace.
	Tire worn or improperly inflated.	Adjust the inflation or replace.
	Front or rear suspension parts loose or broken.	Tighten or replace.
Front Wheel Shimmy	Wheel bearing worn or improperly adjusted.	Adjust or replace.
	Incorrect front alignment.	Adjust the front alignment.
	Worn ball joint or bush.	Replace the ball joint or bush.
	Steering unit loose or worn.	Tighten or replace.
	Tire worn or improperly inflated.	Replace or adjust the inflation.
	Shock absorber worn.	Replace the shock absorber.

Front Hub and Disc (2WD Model)

Disassembled View

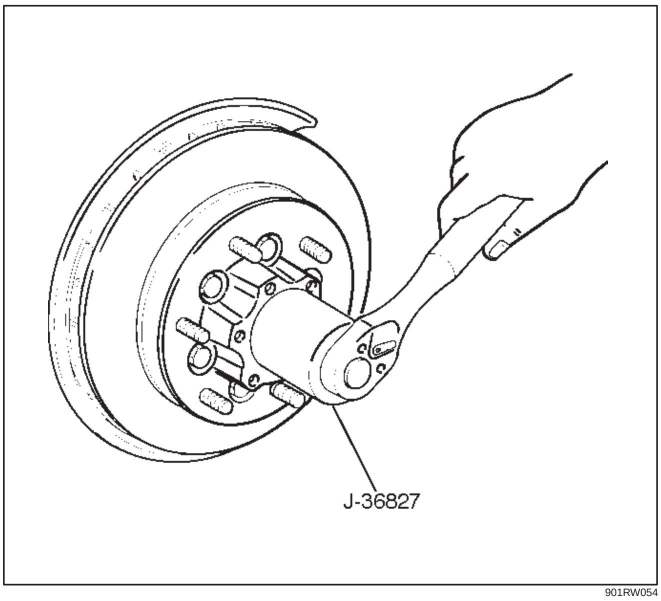


Legend

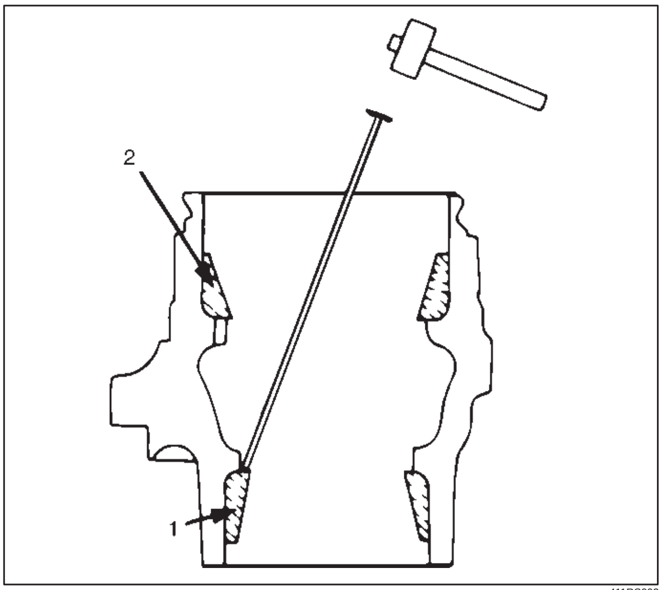
(1) Bolt
(2) Cover and Gasket
(3) Lock Washer
(4) Hub Nut
(5) Outer Bearing
(6) Hub and Disc Assembly
(7) ABS Sensor Ring
(8) Inner Bearing
(9) Oil Seal
(10) Bolt
(11) Wheel Pin

Disassembly

1. Before disassembly, jack up the front of vehicle and support frame with jack stands.
2. Remove the two bolts from the rear side of the knuckle arm, then remove the brake caliper, with the brake hose attached.
   Use a wire to attach the brake caliper to the upper link. Refer to Disk Brakes in Brake section.
3. Remove cover bolt.
4. Remove cover and gasket.
5. Remove lock washer.
6. Remove hub nut, using front hub nut wrench J–36827.

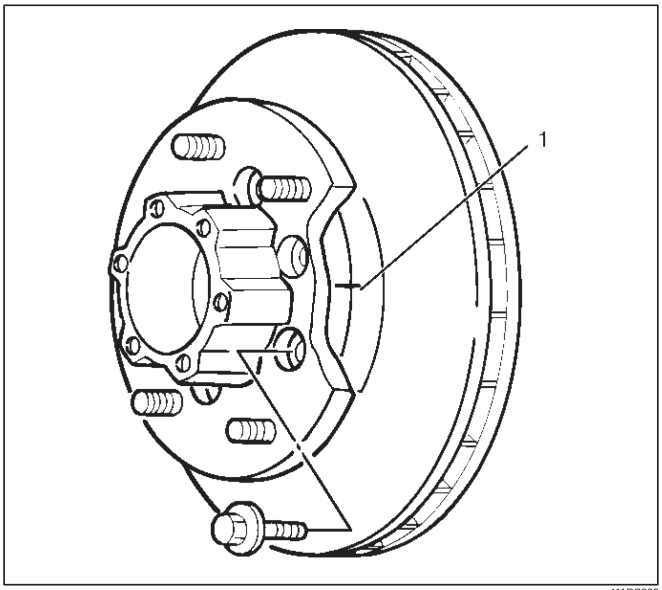


7. Remove outer bearing.
8. Remove oil seal.
9. Remove inner bearing.
10. Use a brass bar to remove the outer bearing outer race(1), oil seal, inner bearing and inner bearing outer race(2) from the hub.



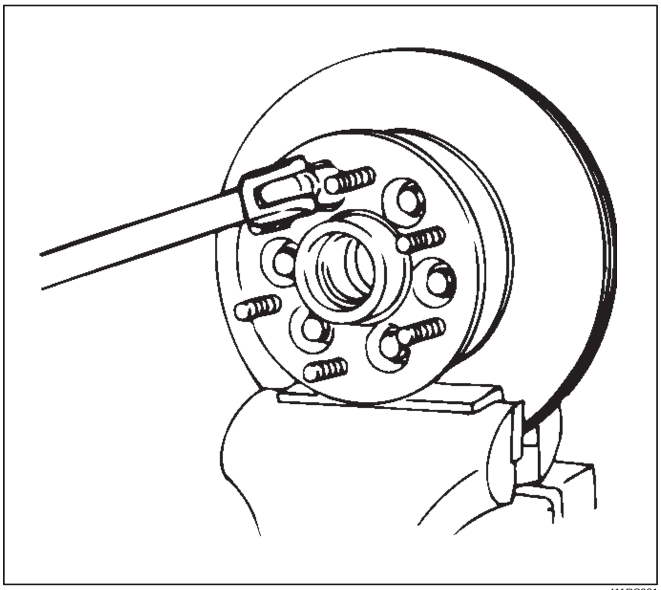
411RS002

11. Remove bolt.
12. If necessary, replace the wheel pin in the following manner.
    - Scribe mark(1) on hub to disc before disassembly to insure proper assembly.



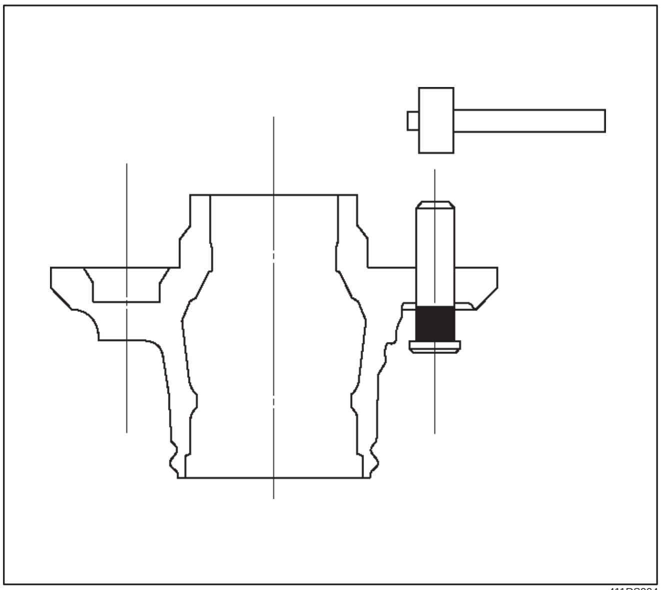
411RS003

- Clamp hub and disc assembly in vise, using protective pads. Remove six(6) disc-to-hub retaining bolts.



411RS021

- Place hub on a suitable work surface and remove wheel studs, as required, using a hammer.



411RS004

Inspection and Repair

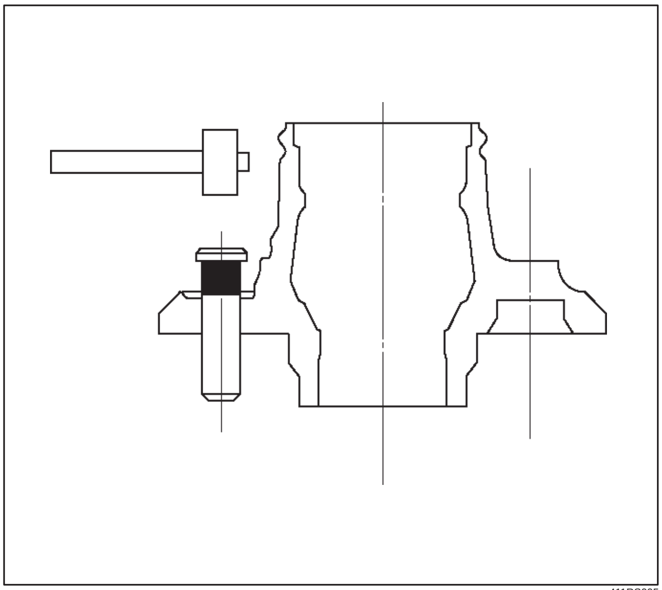
Check the following parts for wear, damage or other abnormal conditions.

- Hub
- Hub bearing
- Bearing outer race
- Disc
- Oil seal

Reassembly

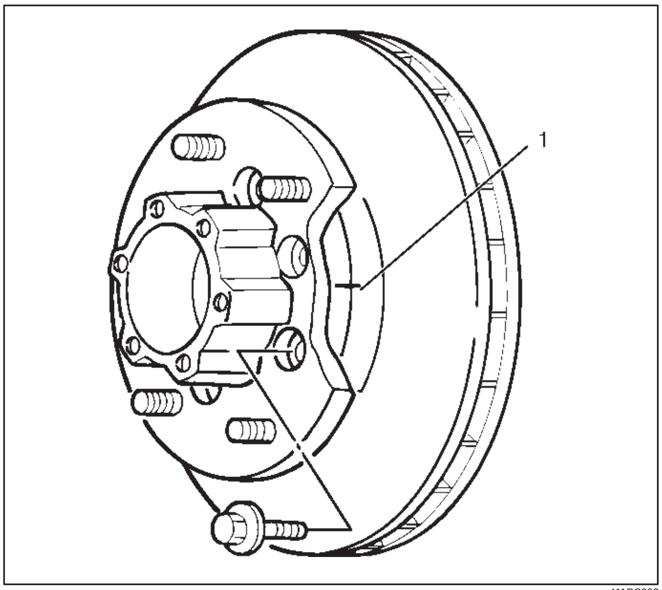
1. Install wheel pin.
   - Place hub on a wood workbench or a block of wood approx. 6” by 6” to protect the wheel stud ends and threads.
   - Install wheel stud, using a hammer.

NOTE: Be sure wheel stud is started squarely and seats completely.



411RS005

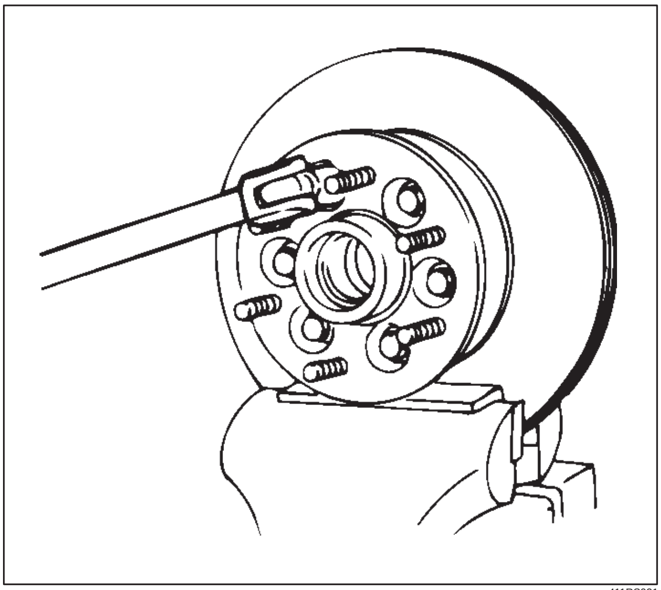
2. Align index marks(1) and install hub to disc.



411RS003

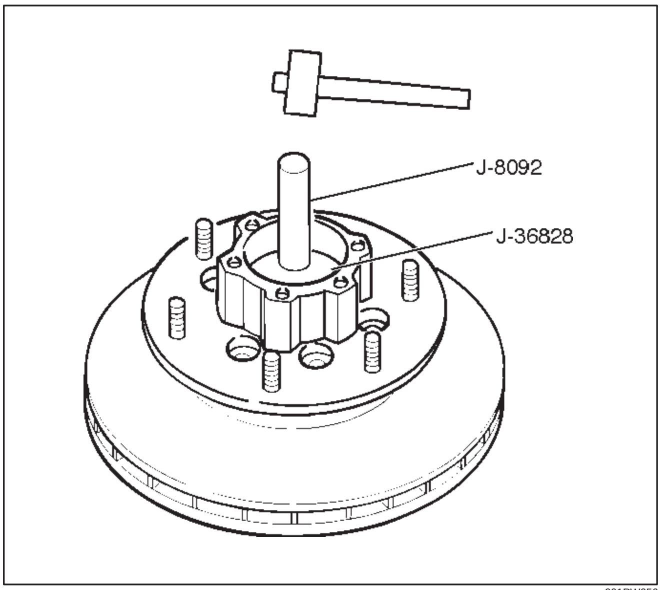
3. Install bolt.
   Tighten the bolts to the specified torque.

Torque: 103 N·m (76 lb ft)



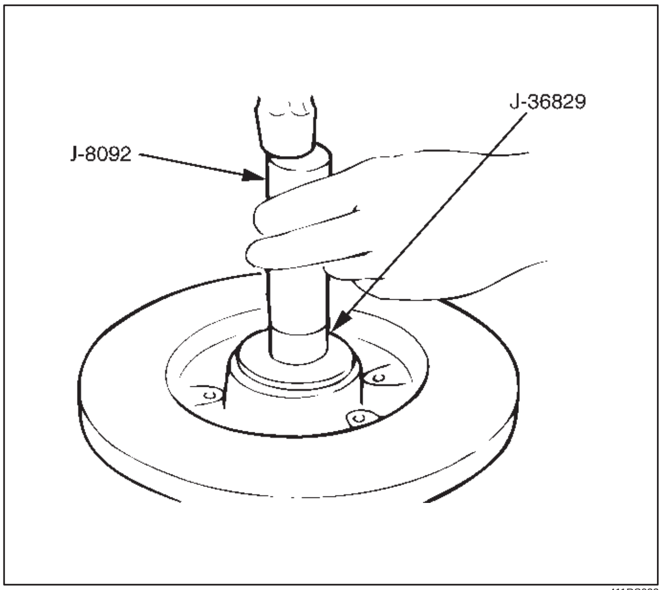
411RS021

4. Install outer bearing.
   Install the outer race by driving it into the hub by using installer J–36828 and grip J-8092.



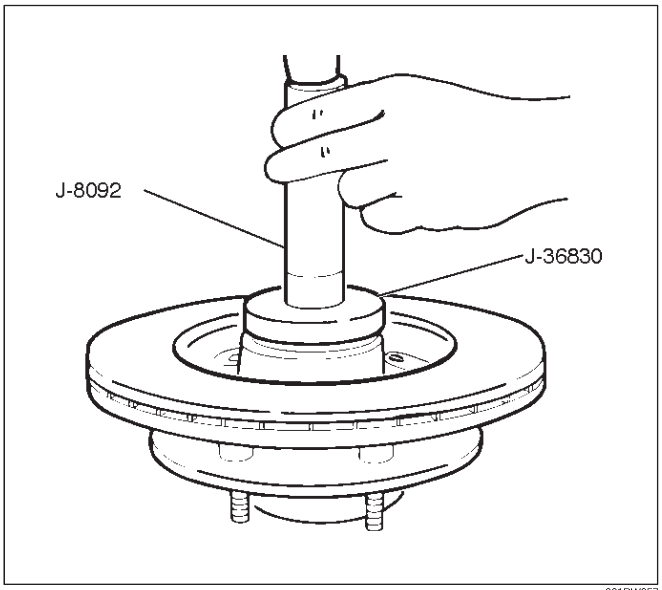
901RW056

5. Install inner bearing.
   Install the outer race by driving it into the hub by using installer J–36829 and grip J–8092.



411RS023

6. Install oil seal by using installer J–36830 and grip J–8092.
   Apply Multipurpose grease NLGI No. 2 or equivalent to the lip portion.

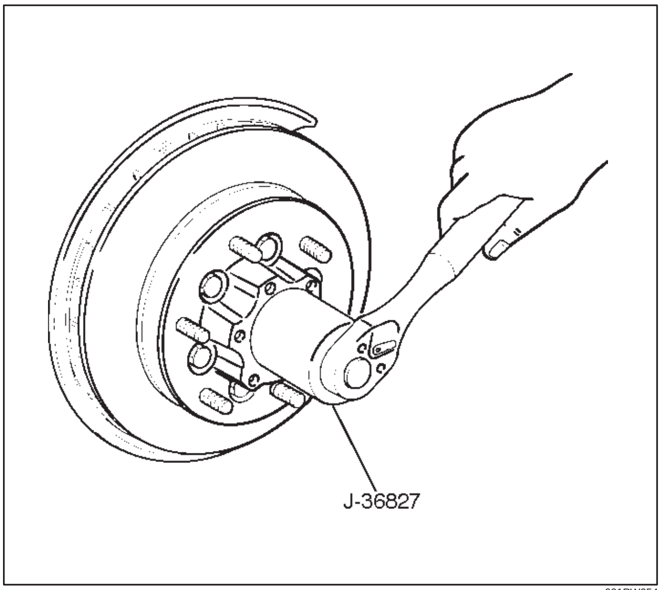


901RW057

7. Apply Multipurpose grease NLGI No.2 in the hub and bearing.

Hub	35 g (1.23 oz)
Outer bearing	10 g (0.35 oz)
Inner bearing	15 g (0.53 oz)

8. Install hub nut by using wrench J–36827.
   Turn the place where there is a chamfer in the tapped hole to the outer side, and attach the nut.



901RW054

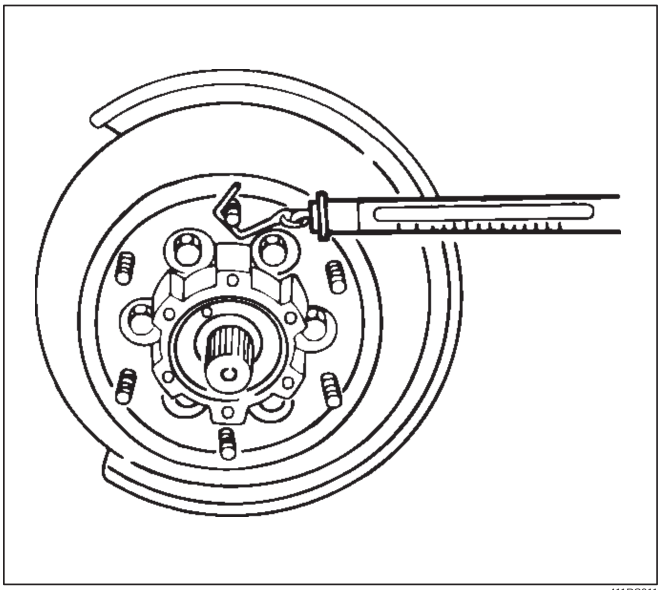
Preload Adjustment

1. Tighten the hub nut to 29.4 N·m (21.7 lb ft), then loosen the nut to the full.
2. Tighten the hub nut to the value given below, using a spring scale on the wheel pin.

Bearing Preload

New bearing and New oil seal	19.6 – 24.5 N (4.4 – 5.5 lb)
Used bearing and New oil seal	11.8 – 17.7 N (2.6 – 4.0 lb)

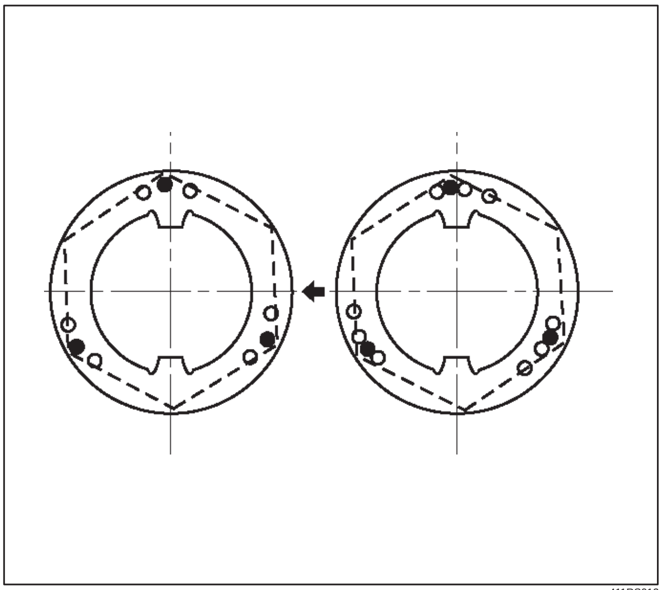
If the measured bearing preload is outside the specifications, adjust it by loosening or tightening the bearing nut.



411RS011

9. Install lock washer.
   - Turn the side with larger diameter of the tapered bore to the vehicle outer side, then attach the washer.

     If the bolt holes in the lock plate are not aligned with the corresponding holes in the nut, reverse the lock plate. If the bolt holes are still out of alignment, turn in the nut just enough to obtain alignment. Screw is to be fastened tightly so its head may come lower than the surface of the washer.

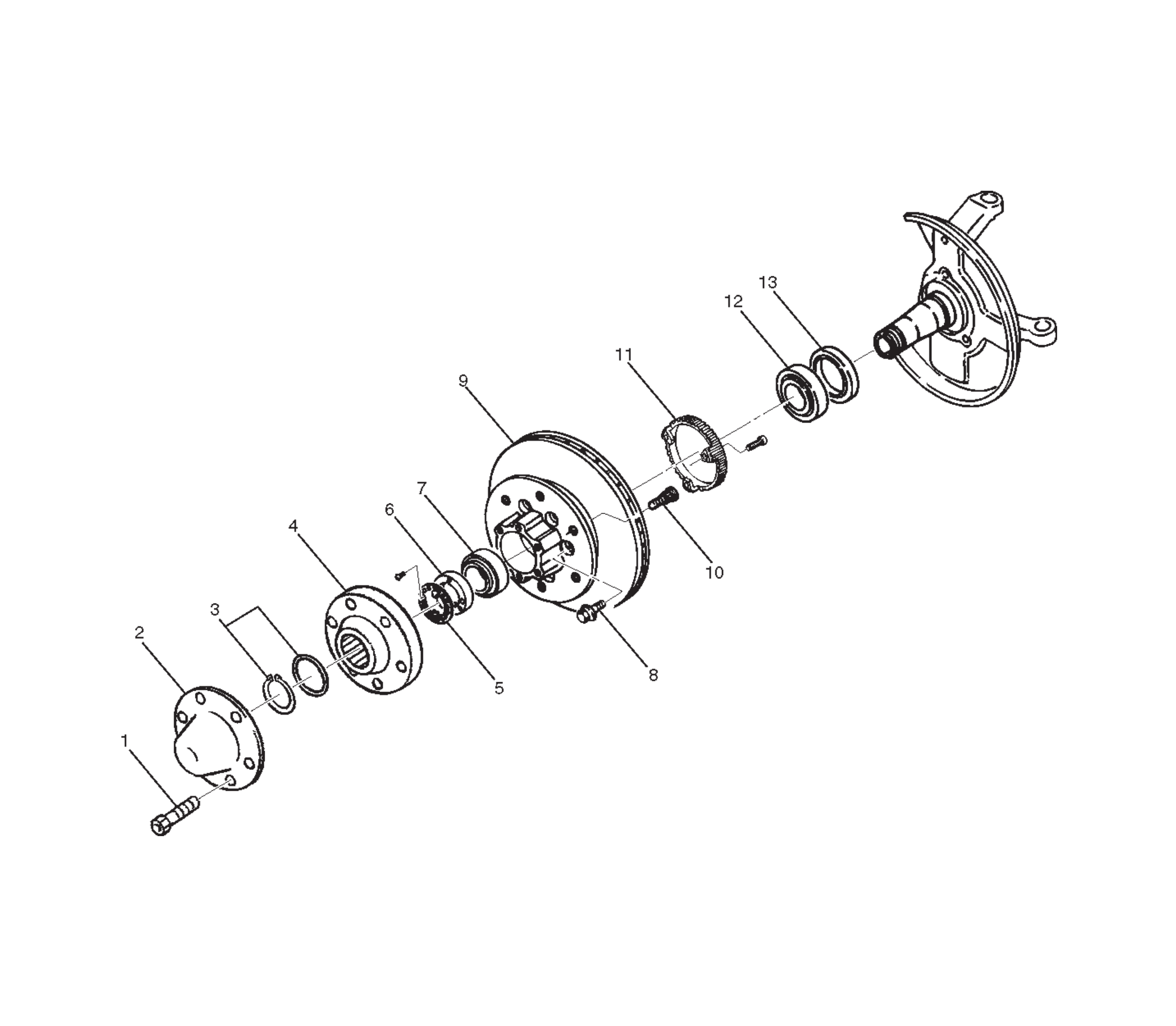


411RS012

10. Install cover and tighten the cover bolt.
11. Install brake caliper and tighten fixing bolt.

Front Hub and Disc (4WD Model)

Disassembled View



411RW001

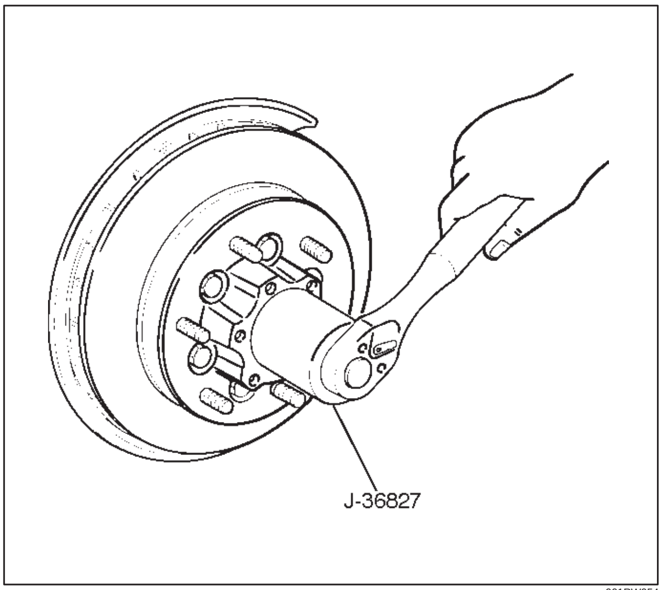
Legend

(1) Bolt
(2) Cap
(3) Snap Ring and Shim
(4) Hub Flange
(5) Lock Washer and Lock Screw
(6) Hub Nut
(7) Outer Bearing
(8) Bolt
(9) Hub and Disc Assembly
(10) Wheel Pin
(11) ABS Sensor Ring
(12) Inner Bearing
(13) Oil Seal

Disassembly

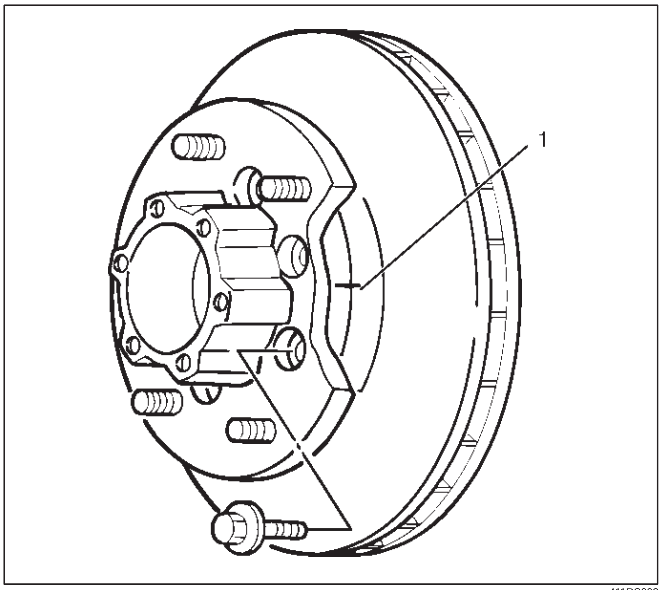
1. Before disassembly, select the 2WD position with the 4WD switch.
2. Jack up the front of vehicle and support frame with jack stands.
3. Remove the disc brake caliper assembly and hang it on the frame with wires. Refer to Disk Brakes in Brake section.
4. Remove Bolt.
5. Remove cap.
6. Remove snap ring and shim.
7. Remove hub flange.

8. Remove lock washer and lock screw.
9. Use wrench J–36827, remove hub nut.



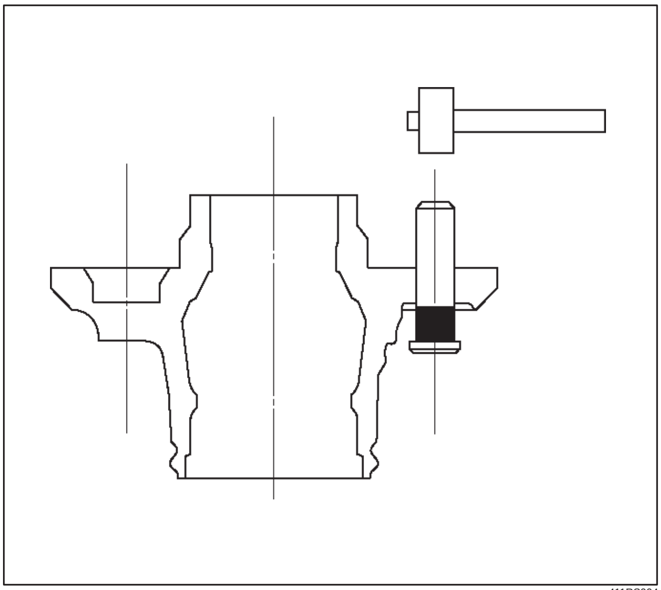
901RW054

10. Remove hub and disc assembly.
11. Remove ABS sensor ring.
12. Remove outer bearing.
13. Remove oil seal.
14. Remove inner bearing.
15. Remove bolt , if necessary, replace the wheel pin in the following manner.
    - Apply a scribe mark(1) to disc to hub.
    - Clamp the hub and disc assembly in a vise, using protective pads. Remove the 6 disc–to–hub retaining bolts.



411RS003

- Place hub on a suitable work surface and remove the studs by using a hammer.



411RS004

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

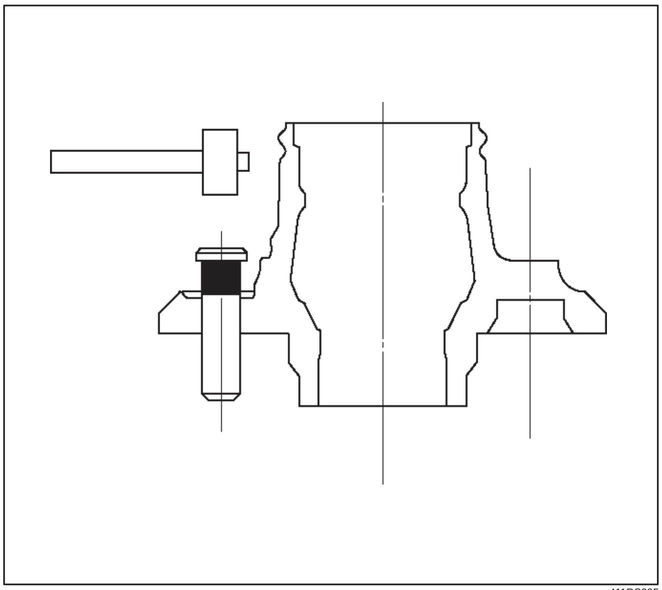
- Hub
- Hub bearing oil seal
- Knuckle spindle
- Disc
- Caliper
- Shift on the fly system parts (Cap, Hub flange, Shim, Snap ring)
- ABS sensor ring

For inspection and servicing of disc caliper and related parts, refer to Disc Brakes in Brake section.

Reassembly

1. Install wheel pin.
   - Place the hub on a wood workbench or a block of wood approx. 6” by 6” to protect the wheel stud ends and threads.
   - Insert a wheel stud using a hammer.

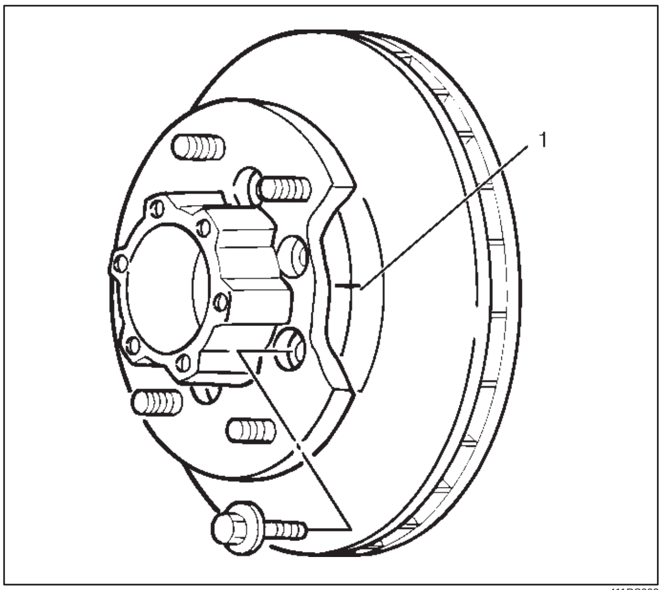
     Be sure the wheel stud is started squarely and seats completely.



411RS005

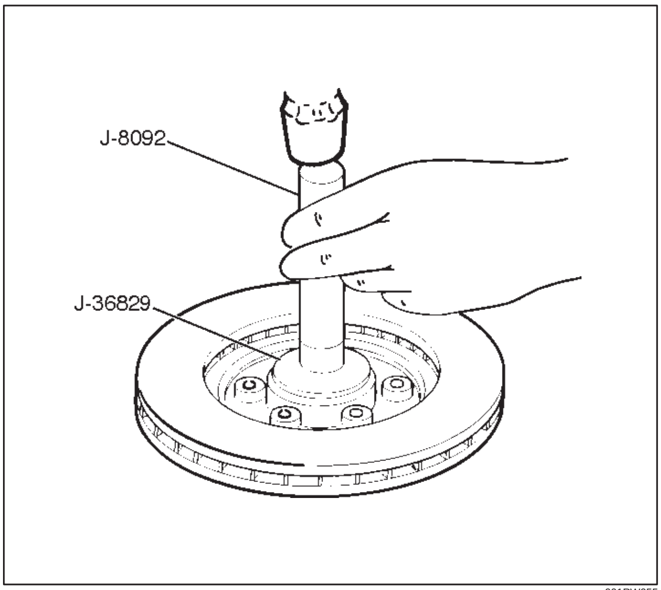
2. Align scribe marks(1) and attach the hub to the disc, then tighten the bolts to the specified torque.

Torque: 103 N·m (76 lb ft)



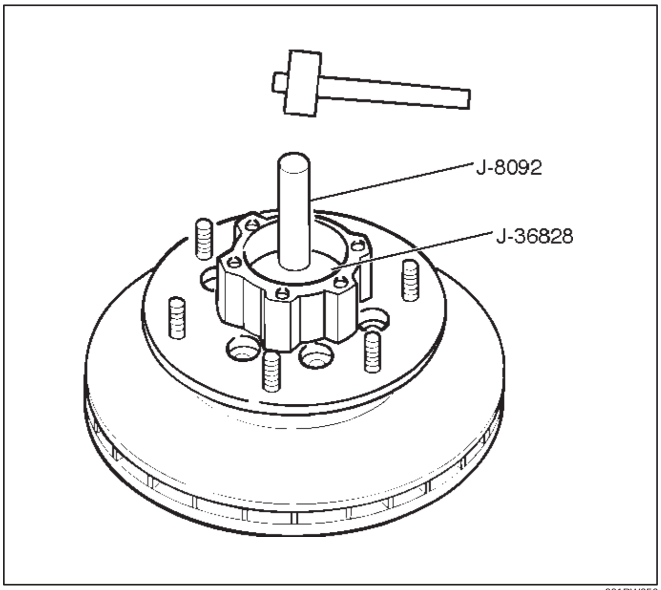
411RS003

3. Use installer J–36829 and grip J–8092, then install the inner bearing by driving it into the hub.



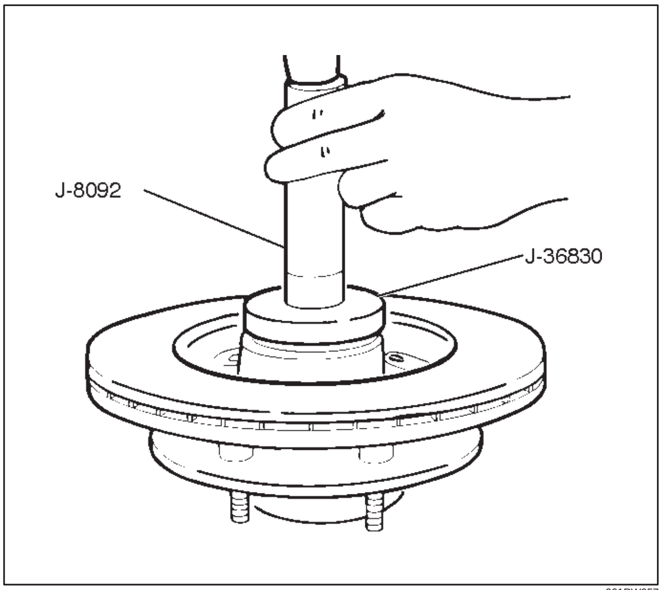
901RW055

4. Use installer J–36828 and grip J–8092 then install the outer bearing by driving it into the hub.



901RW056

5. Apply grease (NLGI No.2 or equivalent) to the lip portion, then install oil seal by using installer J–36830 and grip J–8092.

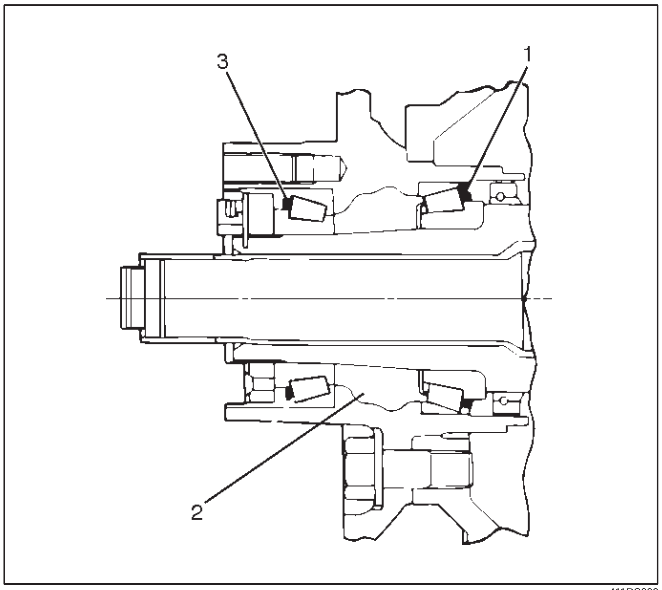


6. Install ABS sensor ring, then tighten the bolts to the specified torque.

Torque: 18 N·m (13 lb ft)

7. Install hub and disc assembly.
   - Apply grease in the hub.
   - Apply wheel bearing type grease NLGI No. 2 or equivalent to the outer and inner bearing.

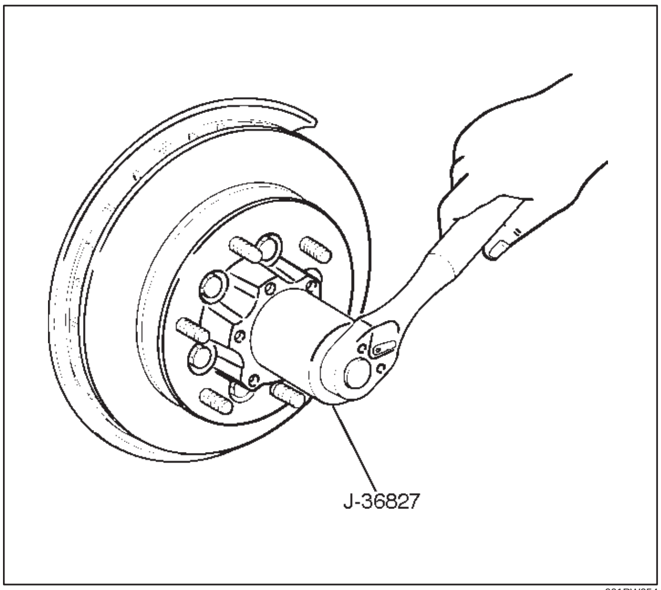
Grease Amount
- **Hub: 35 g (1.23 oz)**
- **Outer bearing: 10 g (0.35 oz)**
- **Inner bearing: 15 g (0.53 oz)**



Legend
- (1) Inner Bearing
- (2) Hub
- (3) Outer Bearing

8. Install hub nut.

   Turn to the place where there is a chamfer in the tapped hole to the outer side, then attach the nut by using front hub nut wrench J–36827.



Preload Adjustment

1. Tighten the hub nut to 29 N·m (22 lb ft), then fully loosen the nut.
2. Tighten the hub nut to the value given below, using a spring scale on the wheel pin.

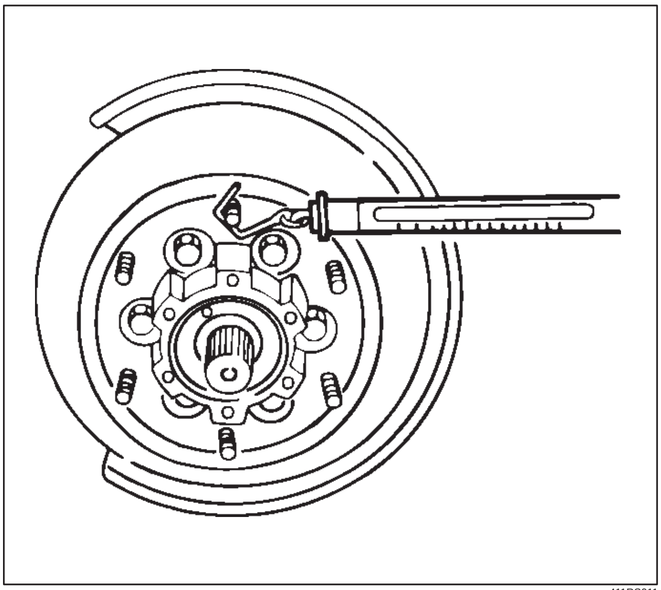
New bearing and New oil seal

Bearing Preload: 20 N – 25 N (4.4 lb – 5.5 lb)

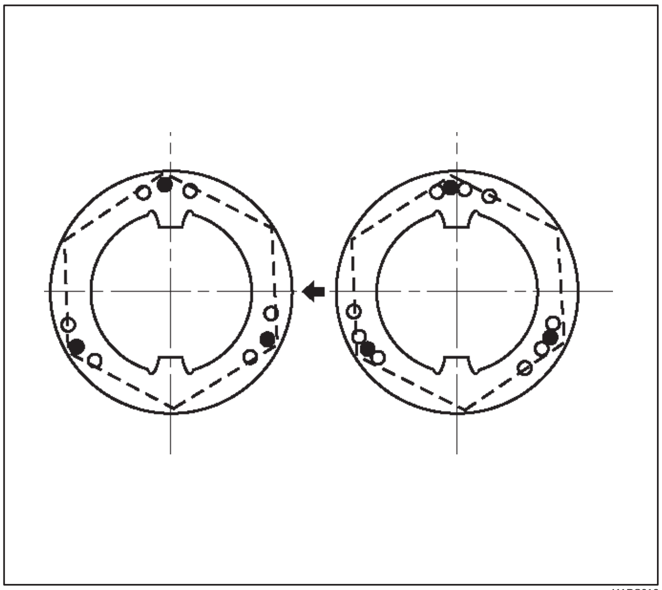
Used bearing and New oil seal

Bearing Preload: 12 N – 18 N (2.6 lb – 4.0 lb)

If the measured bearing preload is outside the specifications, adjust it by loosening or tightening the bearing nut.



9. Install lock washer and lock screw in the following manner.
   - Turn the side with larger diameter of the tapered bore to the vehicle outer side, then attach the washer.
   - If the bolt holes in the lock plate are not aligned with the corresponding holes in the nut, reverse the lock plate.
   - If the bolt holes are still out of alignment, turn in the nut just enough to obtain alignment.
   - Screw is to be fastened tightly so its head may come lower than the surface of the washer.

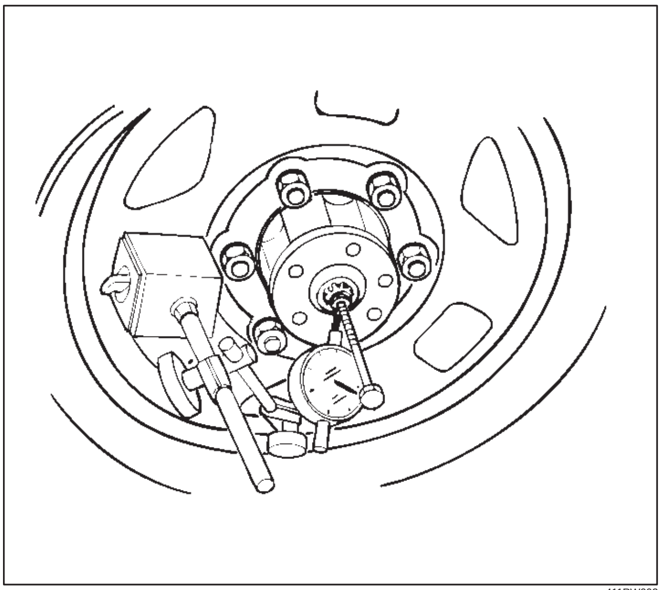


411RS012

10. Apply adhesive (LOCTITE 515 or equivalent) to both joining flange faces then install hub flange.
11. Install snap ring and shim.
    - Adjust the clearance between the free wheeling hub body and the snap ring.

Clearance: 0 mm–0.3 mm (0 in–0.012 in)

Shims Available: 0.2 mm, 0.3 mm, 0.5 mm, 1.0 mm (0.008 in, 0.012 in, 0.020 in, 0.039 in)



411RW002

12. Install hub cap.
13. Tighten the bolts to the specified torque.

Torque: 59 N·m (43 lb ft)

Front Drive Shaft Joint

Front Drive Shaft Joints Replacement

- Refer to Front Drive Axle Assembly Replacement in this section, and refer to Front Hub and Disc Overhaul in Suspension section.

Front Hub Bearing Preload Check

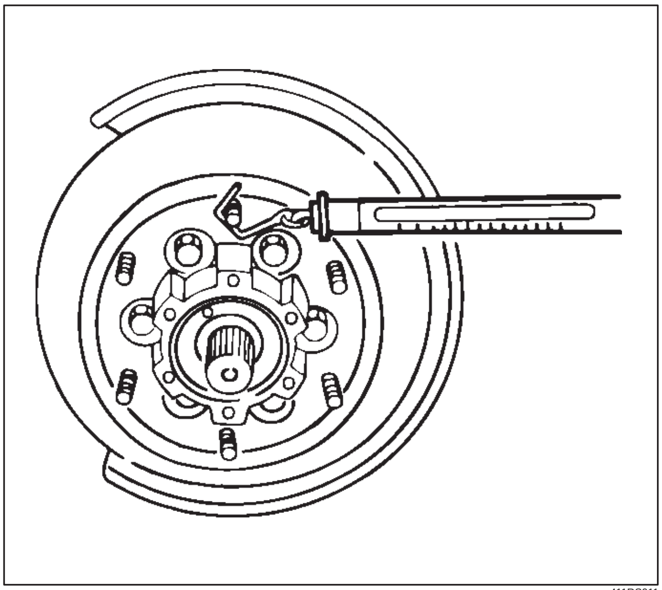
Check the hub bearing preload at the wheel pin.

New bearing and New oil seal:

24.5 N (4.4 – 5.5 lb)

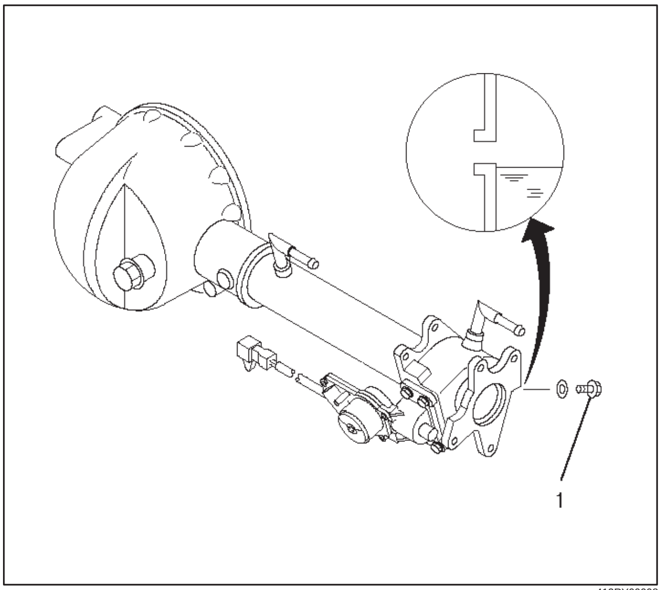
Used bearing and New oil seal:

11.8– 17.7 N(2.6 – 4.0 lb)



411RS011

Inspection Of Shift On The Fly System Gear Oil



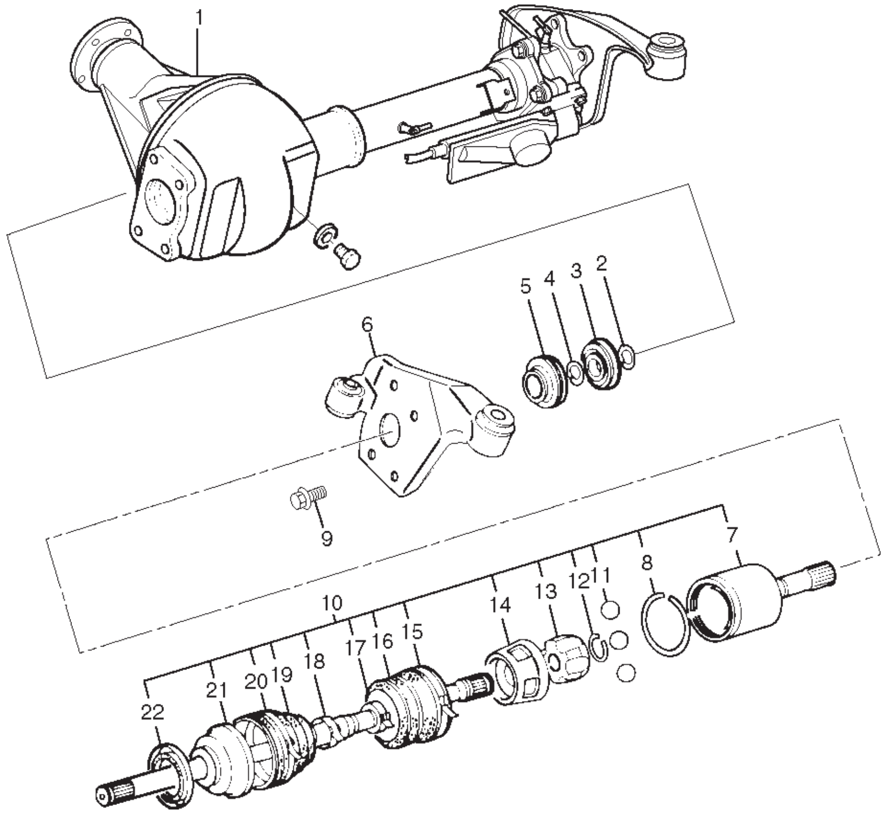
412RY00008

1. Open filler plug and make sure that the oil up to the plug port.
   If the oil is short, replenish with gear oil GL–5 grade.
2. Tighten the filler plug to specified torque.

Torque: 78 N·m (58 lb in)

Front Axle Drive Shaft

Front Axle Drive Shaft and Associated Parts



412RY00036

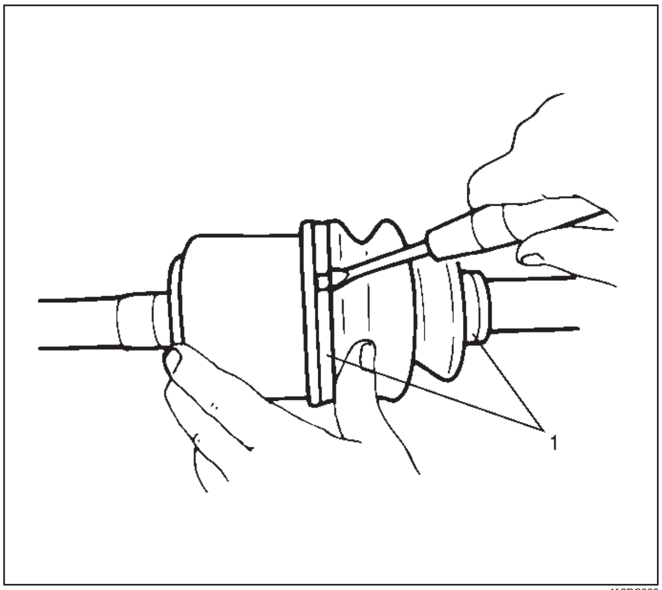
Legend

(1) Axle Case and Differential
(2) Snap Ring
(3) Bearing
(4) Snap Ring
(5) Oil Seal
(6) Bracket
(7) DOJ Case
(8) Circlip
(9) Bolt
(10) Drive Shaft Joint Assembly
(11) Ball
(12) Snap Ring
(13) Ball Retainer
(14) Ball Guide
(15) Band
(16) Bellows
(17) Band
(18) Band
(19) Bellows
(20) Band
(21) BJ Shaft
(22) Dust Seal

Disassembly

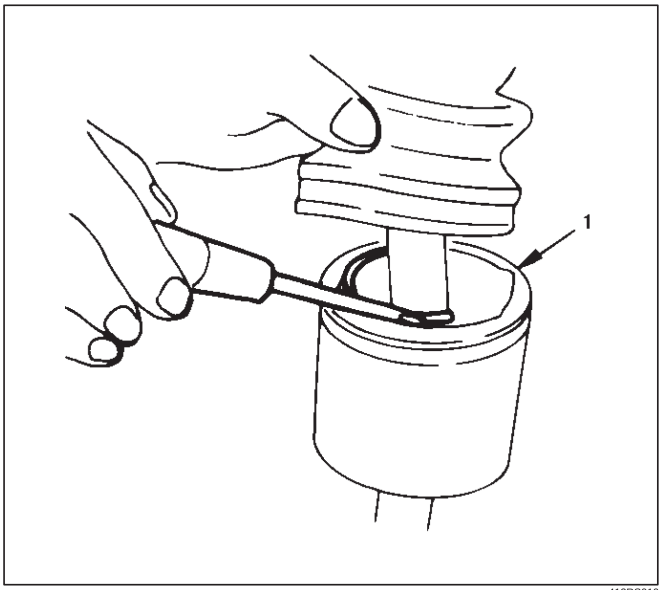
NOTE: For the left side, follow the same steps as right side.

1. Raise the hooked end of the band with a screwdriver or equivalent.



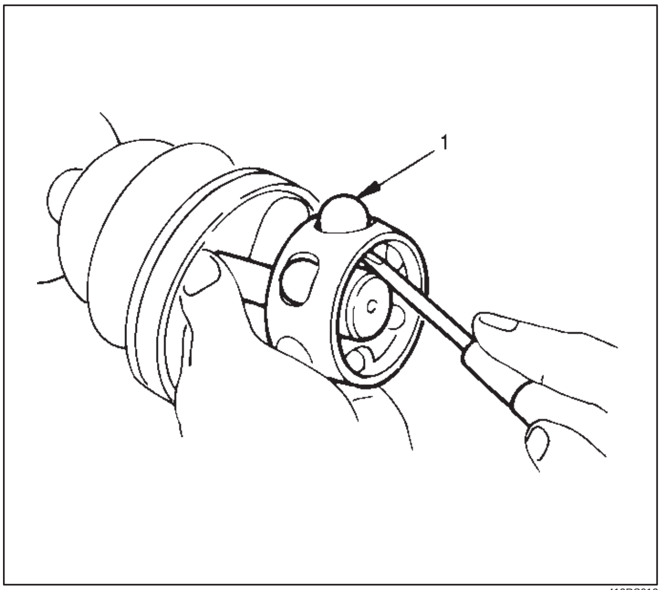
412RS009

2. Remove band(1).
3. Pry off circlip (1) with a screwdriver or equivalent.



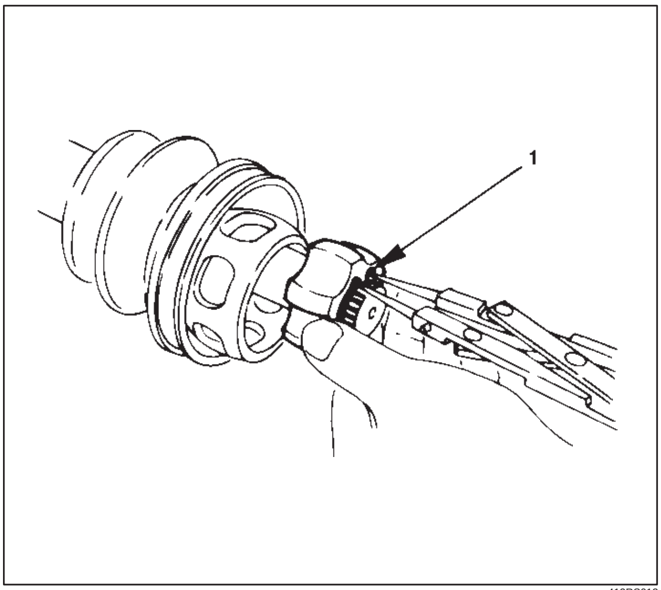
412RS010

4. Remove drive shaft joint assembly.
5. Remove the six balls (1) with a screwdriver or equivalent.



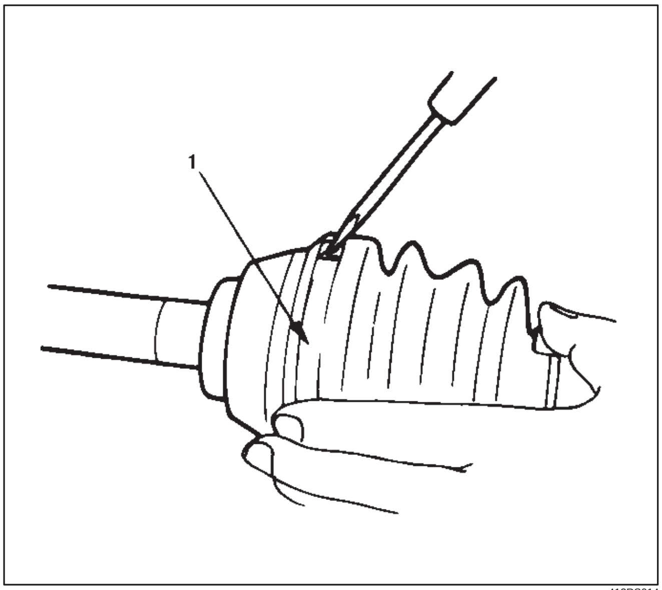
412RS012

6. Using snap ring pliers, remove the snap ring (1) fastening the ball retainer to the center shaft.



412RS013

7. Remove ball retainer, ball guide and bellows.
8. Raise the hooked end of the band with a screwdriver or equivalent.



412RS014

9. Remove band(1).
10. Remove bellows.
11. Remove dust seal.
12. Remove BJ shaft assembly.
13. Remove the mounting bracket fixing bolts, and then remove DOJ case assembly from the axle case.
14. Remove snap ring and bearing.
15. Remove snap ring and oil seal.
16. Remove bracket.

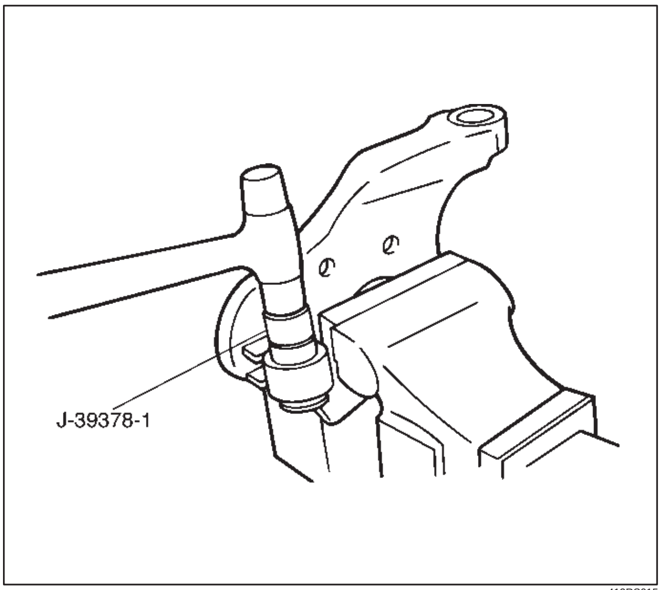
Inspection And Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts.

1. Drive shaft joint assembly
2. DOJ case, ball, ball guide, ball retainer
3. Bellows
4. Bearing
5. Dust seal, oil seal

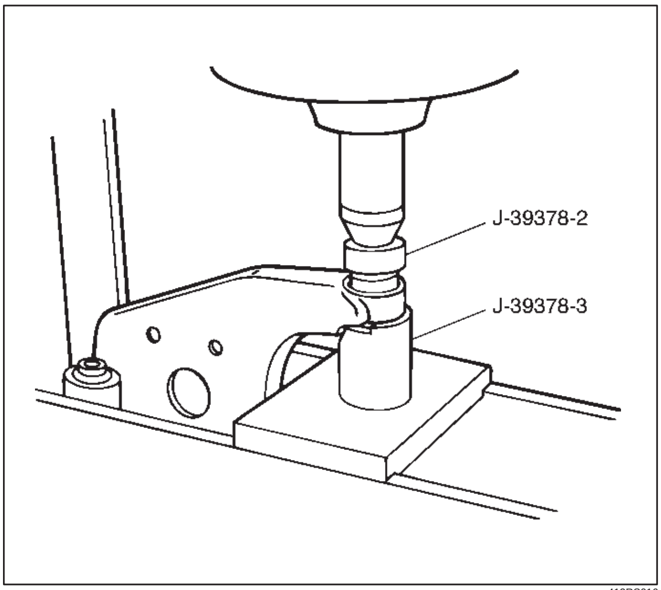
Bushing Replacement

- Remove the bushings using a remover J–39378–1 and hammer.



412RS015

- By using installer J–39378–2 and base J–39378–3, press fit the bushings into the bracket.



412RS016

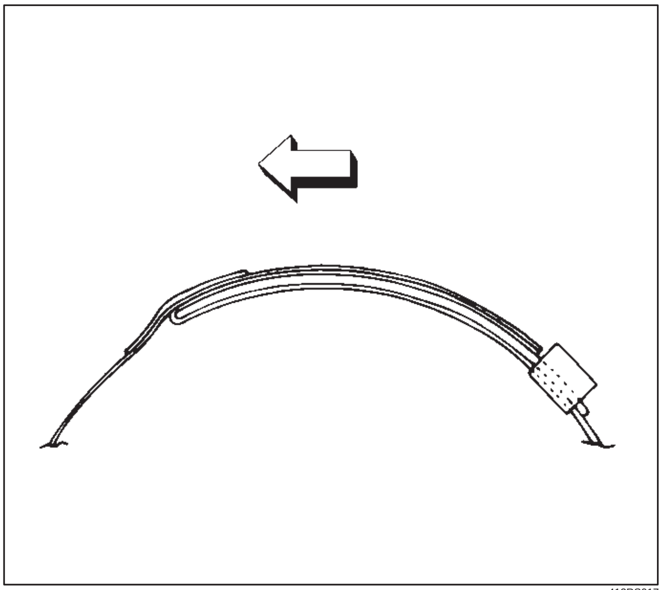
Reassembly

1. Install DOJ case to bracket.
2. Install oil seal and fix snap ring.
3. Install bearing and fix snap ring.
4. Install bracket to axle case. Tighten the bracket bolt to the specified torque.

Torque: 116 N·m (85 lb ft)

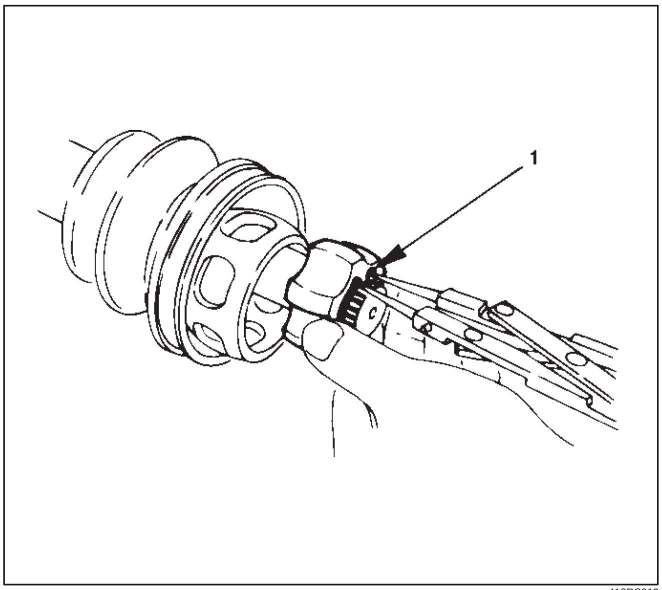
5. Apply 150g of the specified grease in BJ.
6. Install dust seal.
7. Apply a thin coat of grease to the shaft for smooth installation then install bellows.

8. Install band. Note the setting direction. After installation, check that the bellows is free from distortion.



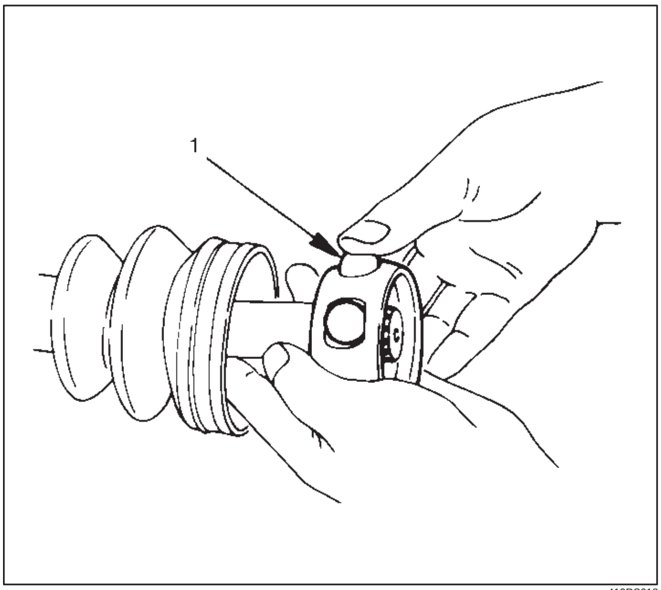
412RS017

9. Install another bellows and fix band.
10. Install the ball guide with the smaller diameter side ahead onto the shaft.
11. Install ball retainer.
12. Using snap ring pliers, install the snap ring (1) securing the ball retainer to the shaft.



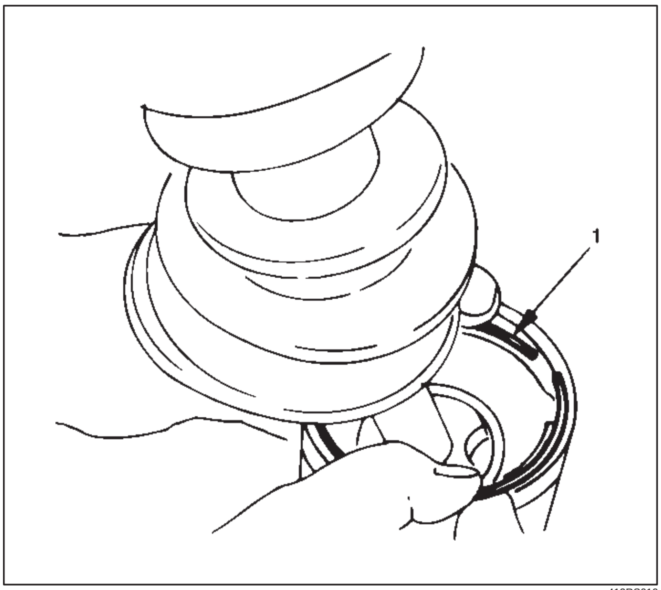
412RS013

13. Align the track on the ball (1) retainer with the window in the cage, and install the six balls into position.

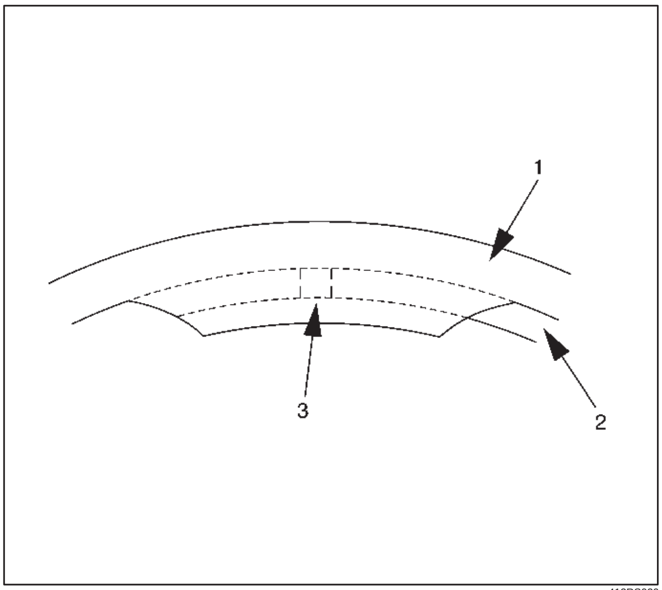


412RS018

14. Pack 150g of the specified grease in DOJ case, then install drive shaft joint assembly. After reassembly, move the DOJ longitudinally several times to get to fit.
15. Install the circlip (1) so that open ends are positioned away from the ball groove.



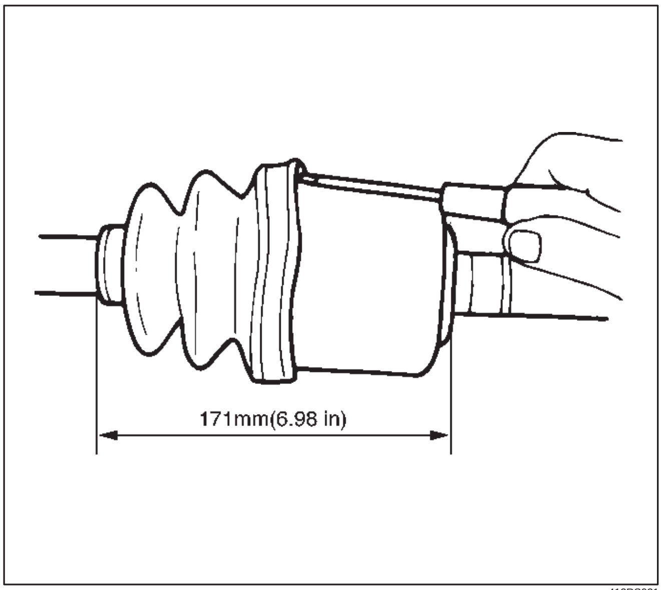
412RS019



Legend

(1) Outer Case
(2) Circlip
(3) Open Ends

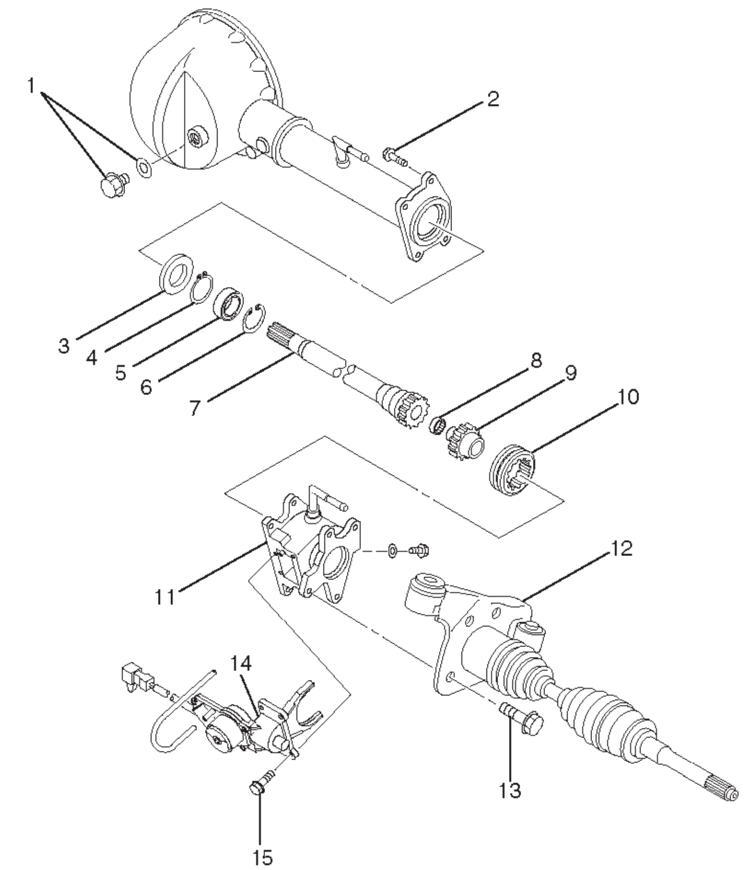
16. Install bellows. Adjust the air pressure within the bellows by inserting a screwdriver or equivalent, so that it equals atmospheric pressure.



17. Install band. After installation, check that the bellows is free from distortion.

Shift On The Fly System

Shift On The Fly System and Associated Parts



412RY00007

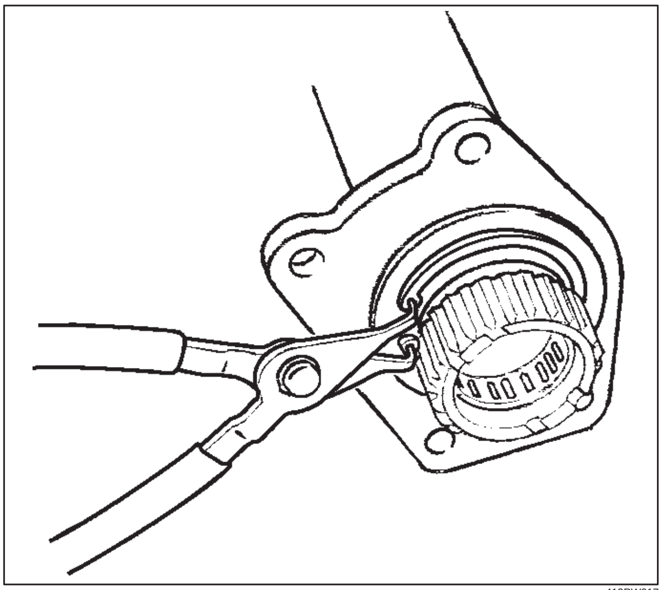
Legend

(1) Filler Plug
(2) Bolt
(3) Oil Seal
(4) Snap Ring(External)
(5) Inner Shaft Bearing
(6) Snap Ring(Internal)
(7) Inner Shaft
(8) Needle Bearing
(9) Clutch Gear
(10) Sleeve
(11) Housing
(12) Front Axle Drive Shaft(LH side) with Bracket
(13) Bolt
(14) Actuator Assembly
(15) Bolt

Disassembly

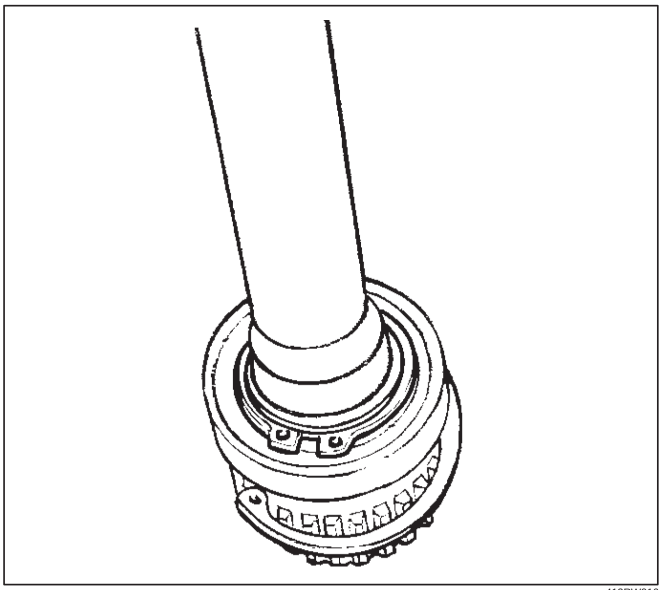
1. Remove filler plug and gasket, drain oil.
2. Loosen mounting bracket fitting bolts and remove front axle drive shaft from front axle case.
3. Remove actuator assembly and draw out actuator ASM.
4. Remove housing.
5. Remove sleeve.
6. Remove clutch gear.

7. Remove snap ring from front axle case by using snap ring pliers.



412RW017

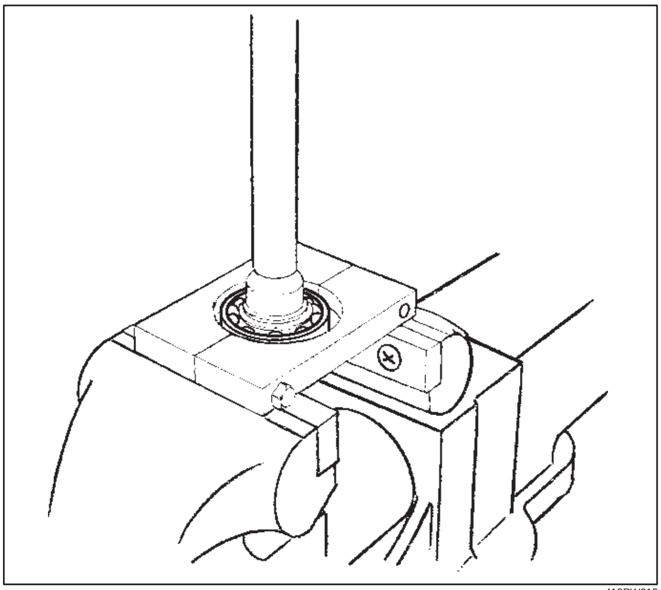
8. Take out inner shaft from front axle case.
9. Remove snap ring from inner shaft by using snap ring pliers.



412RW016

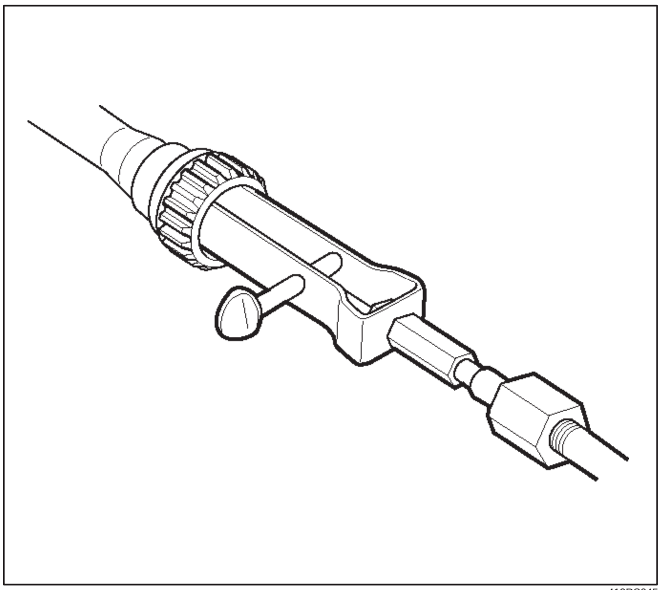
10. Remove inner shaft bearing.

NOTE: Be careful not to damage the shaft.



412RW015

11. Remove needle bearing from inner shaft by using a remover J–26941 and sliding hammer J–2619–01.



412RS045

12. Remove oil seal from front axle case.

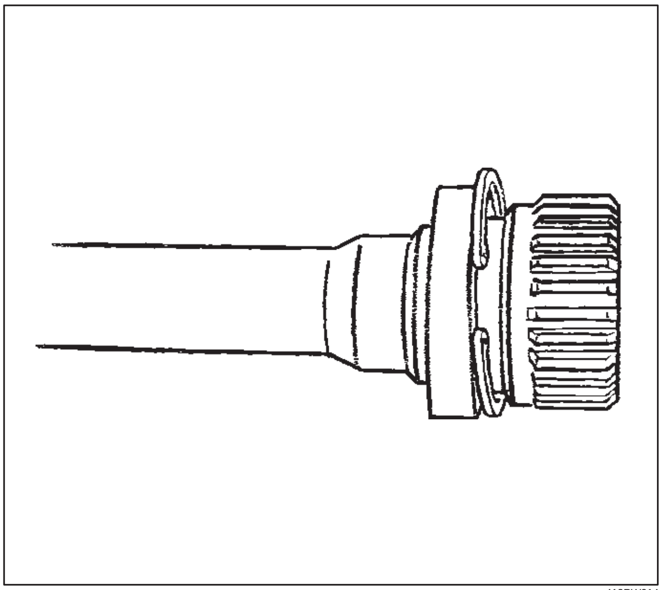
NOTE: Be careful not to damage the front axle case.

Inspection And Repair

Inspect the removed parts. If there are abnormalities such as wear and damage, take corrective action or replace.

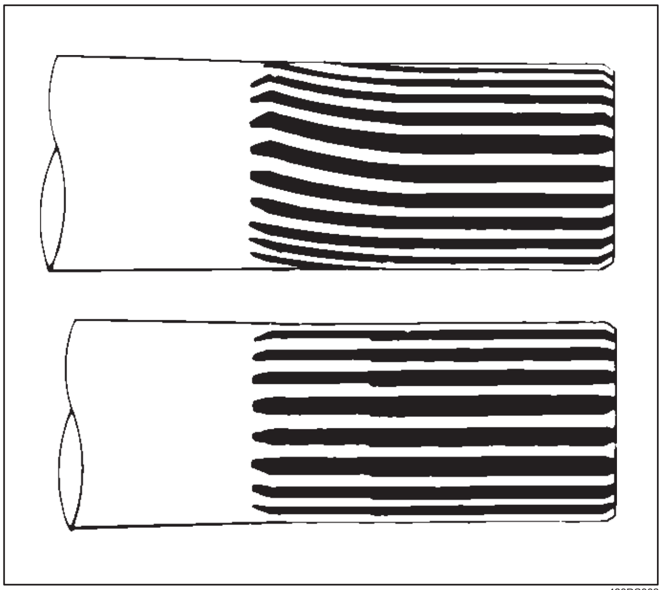
Visual Check

1. Check and see if the inner shaft has such abnormalities as wear and damage.



412RW014

2. When inspecting the inner shaft, be sure to check and see if its splined part is twisted, worn, or cracked. If so, replace with a new shaft. In case such an abnormality in its gear part (a slide with sleeve), replace the shaft.



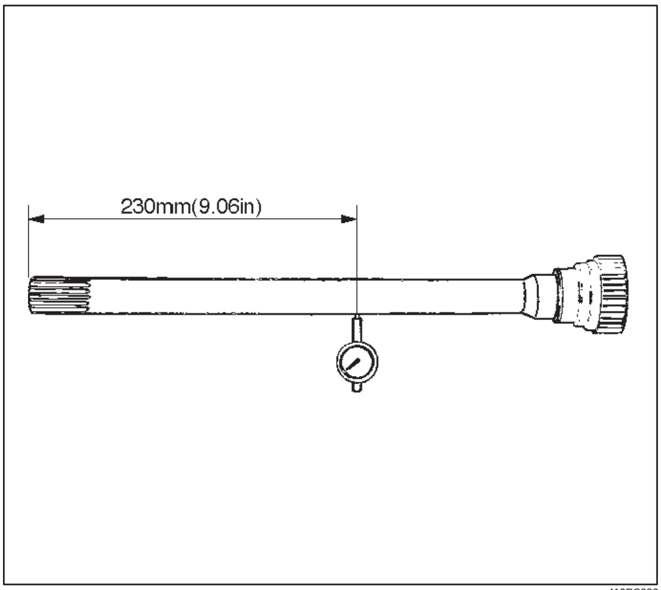
420RS008

Inner Shaft Run–Out

With both end centers supported, rotate the shaft slowly and measure deflection with a dial gauge.

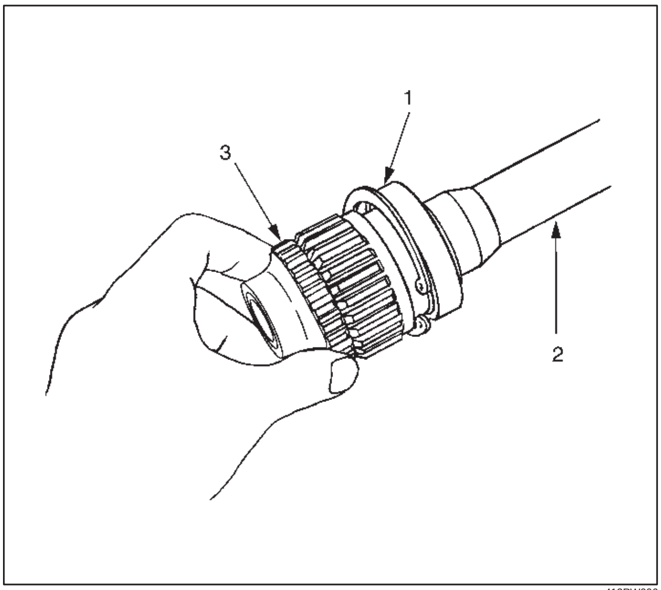
Limit: 0.5 mm (0.02 in)

NOTE: Do not heat the shaft to correct its bend.



412RS026

Inner Shaft Bearing



412RW006

Legend

(1) Inner Shaft Bearing
(2) Inner Shaft
(3) Clutch Gear

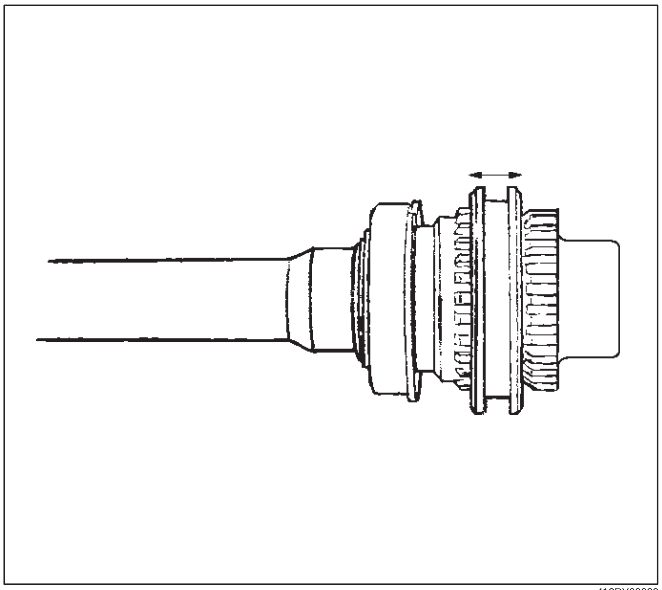
1. Inspect the state of inner shaft bearing. If any abnormality such as smoothlessness is found, replace with a new inner shaft bearing.
2. Insert a clutch gear and check the state of needle bearing.
3. If there is an abnormality such as smoothlessness, replace the needle bearing.

Sleeve Condition

Check and see that there is not wear damage, or cracking in the sleeve.

NOTE: Close inspection of the groove and inner gear are required because those are important parts.

Sleeve Function



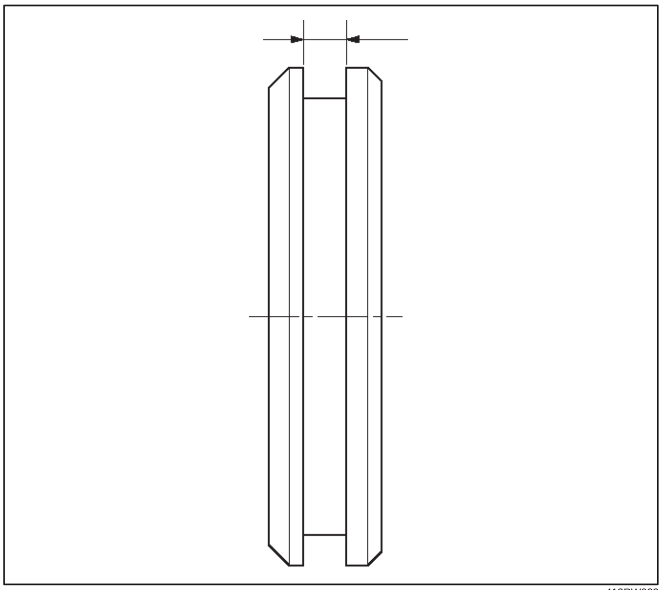
412RY00039

Operate the sleeve with the inner shaft combined with the clutch gear and if smoothlessness is felt, replace the sleeve.

NOTE: Gear oil should be applied to the contact surface of gear.

Check the width of sleeve center groove.

Limit: 7.1 mm (1.28 in)

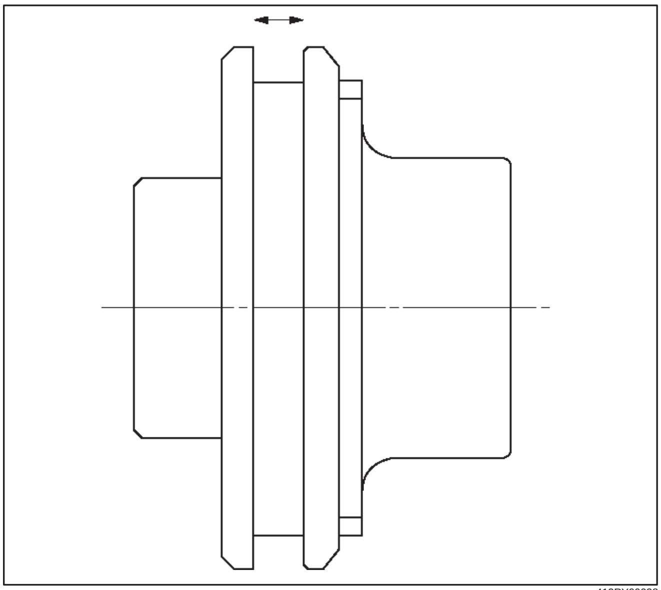


412RW022

Clutch Gear Condition

Check and see that there is not wear, damage, crack, or any other abnormality in the clutch gear.

Clutch Gear Function



412RY00038

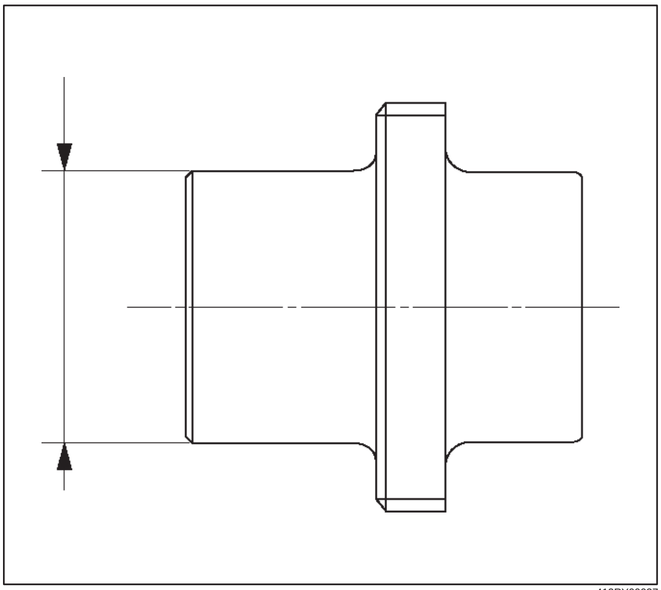
If there is an abnormality such as roughness when operated in combination with sleeve, replace the clutch gear.

NOTE: When inspecting, gear oil should be applied to the contact surface of gear.

Clutch Gear Journal Diameter

Make sure of the size illustrated.

Limit: 36.98 mm (1.456 in)

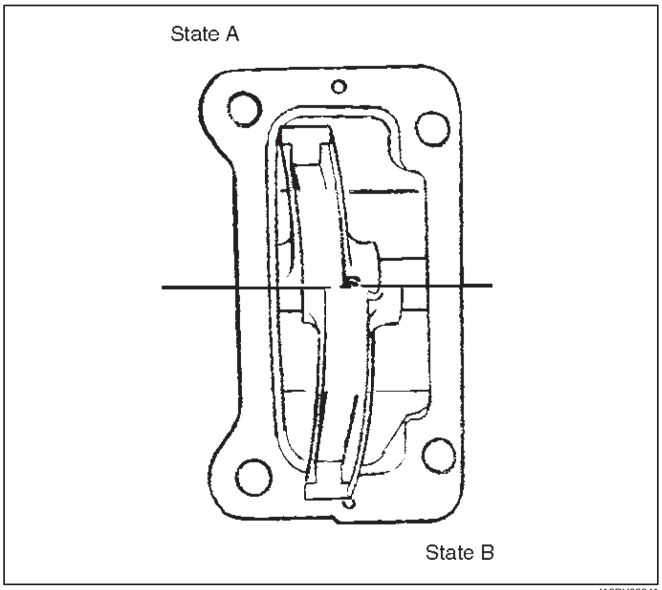


412RY00037

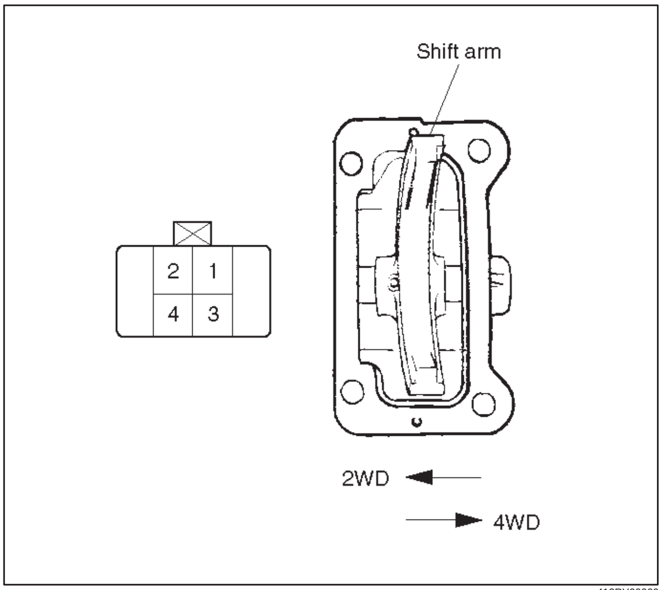
Actuator

Check and see that there is no damage, cracking, or other abnormality.

Functional Check



412RY00041



412RY00009

Wake sure of function with boltage (12V) applied to terminal 3, 4 and set the tester to terminal 1, 2 in accordance with the table below.

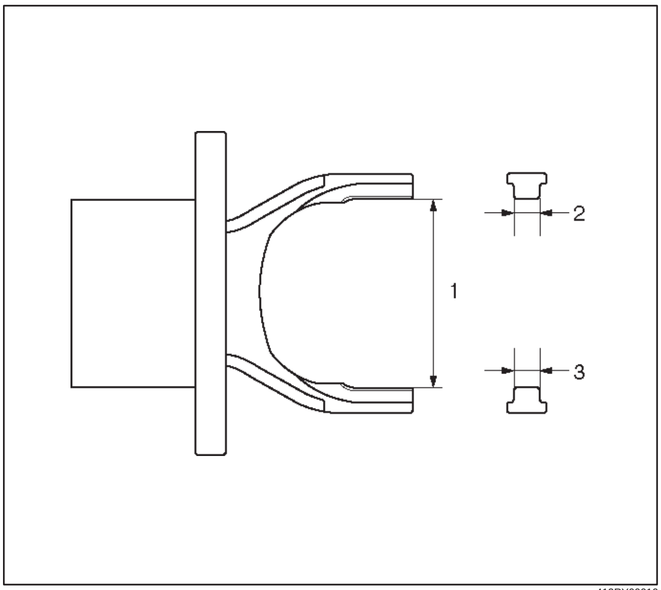
State	Trminal 3	Trminal 4	Electric circuit between terminal 1 & 2	Function
A	+12V	Ground	OK	2WD
B	Ground	+12V	NONE	4WD

If there is an abnormality, replace the actuator as an assembly.

NOTE: Be careful not to permit the entry of water or dust into of the actuator.

Dimentional Check

Measure illustrated sizes 1, 2, and 3.



412RY00010

Limit

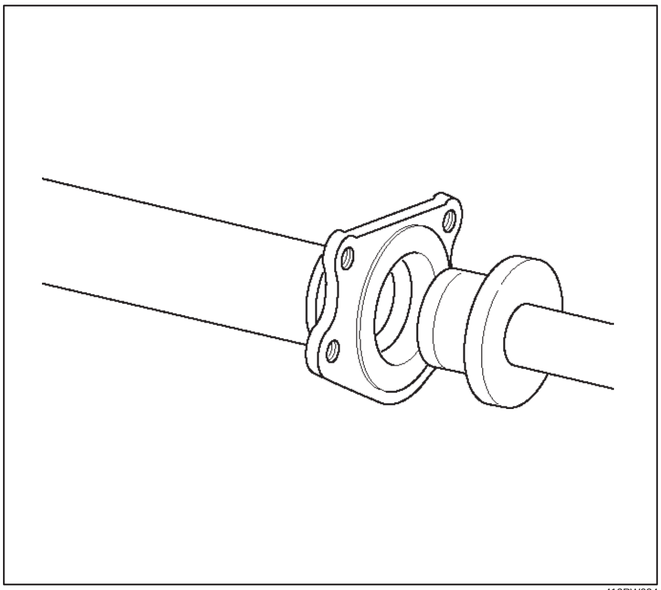
1=64.1 mm (2.52 in)

2=6.7 mm (0.26 in)

3=6.7 mm (0.26 in)

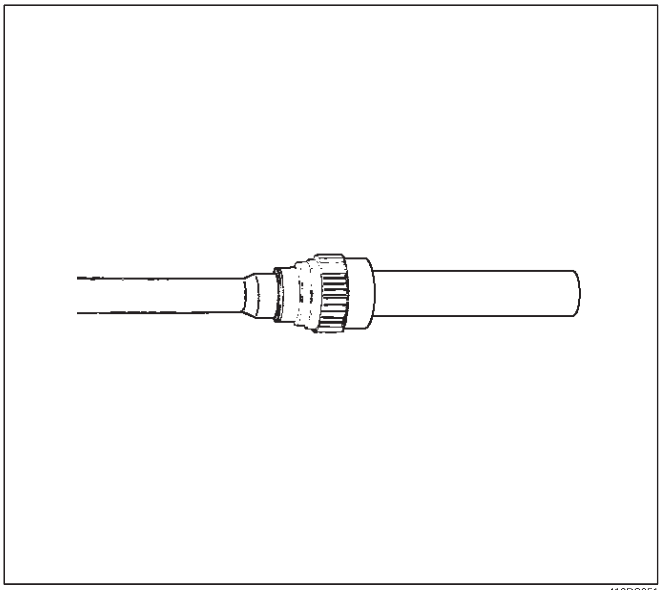
Reassembly

1. Install the new oil seal which has been immersed in differential gear oil, by using an oil seal installer J–41693 and grip J–8092.



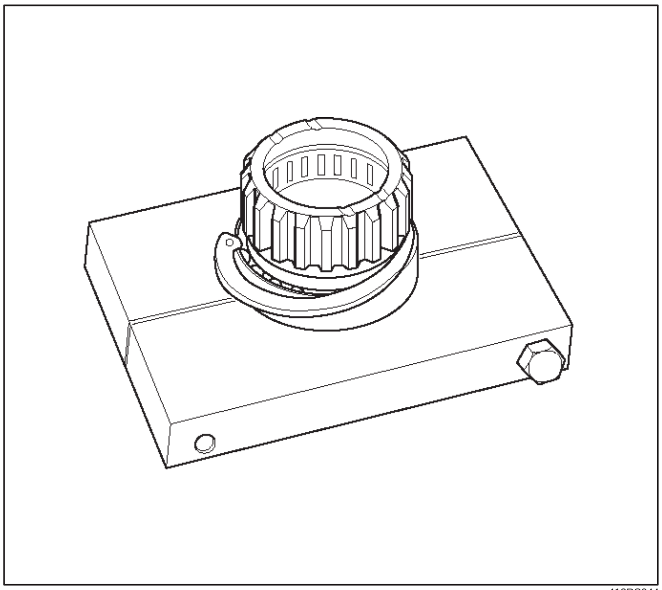
412RW034

2. Force a new needle bearing into inner shaft by using a Installer J–41694 and grip J–8092.



412RS051

3. Place a new snap ring(internal) in inner shaft.
   Force a new inner shaft bearing into the inner shaft.



412RS044

4. Install snap ring(external).

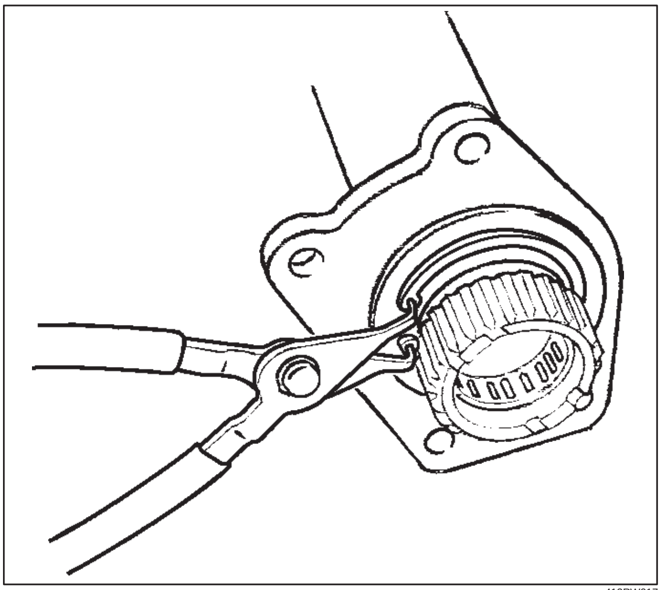
NOTE: Be careful not to damage the inner shaft.

5. Clean the housing contact surface of the front axle case and insert inner shaft assembly into the front axle case.

NOTE: Be careful not to damage seal.

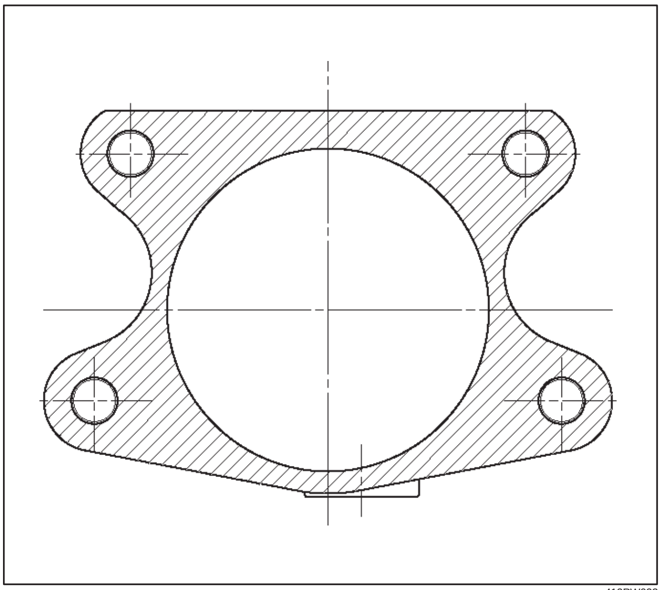
6. Install snap ring internal in the groove of front axle case.

NOTE: Be sure to install the snap ring properly.



412RW017

7. Apply differential gear oil to clutch gear, then install clutch gear.
8. Apply differential gear oil to sleeve, then install sleeve.
9. Clean contact surface with the front axle and actuator mounting surface. Apply liquid gasket to the contact surface on the front axle case, then install in the housing.



412RW023

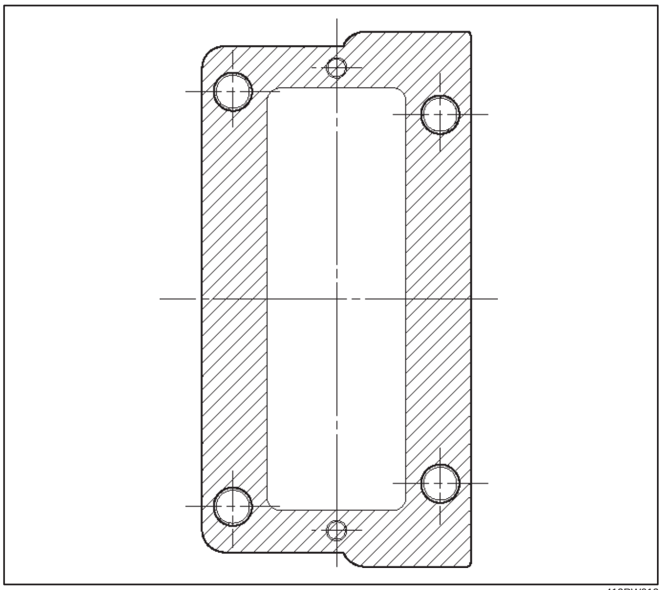
10. Tighten bolts to specified torque.

    Torque: 75N·m(55 lb ft)

11. Clean the actuator contact surface with the housing then Install and tighten shift position switch to specified torque.

    Torque: 39N·m (29 lb ft)

12. Apply liquid gasket to the contact surface on the actuator side.



412RW012

13. Align shift arm with the groove of sleeve and install the actuator.
14. Tighten bolts to specified torque.

    Torque: 9N·m(78 lb in)

15. Install front axle drive shaft and mounting bracket. Tighten fitting bolts to specified torque.

    Torque: 116N·m (85 lb ft)

16. Pour specified amount of differential gear oil to filler plug.

    Front Differential

    Oil Capacity: 1.4lit (1.48US qt)

    Actuator Housing

    Oil Capacity: 0.12lit(0.13US qt)

17. Install filler plug through gasket and tighten to specified torque.

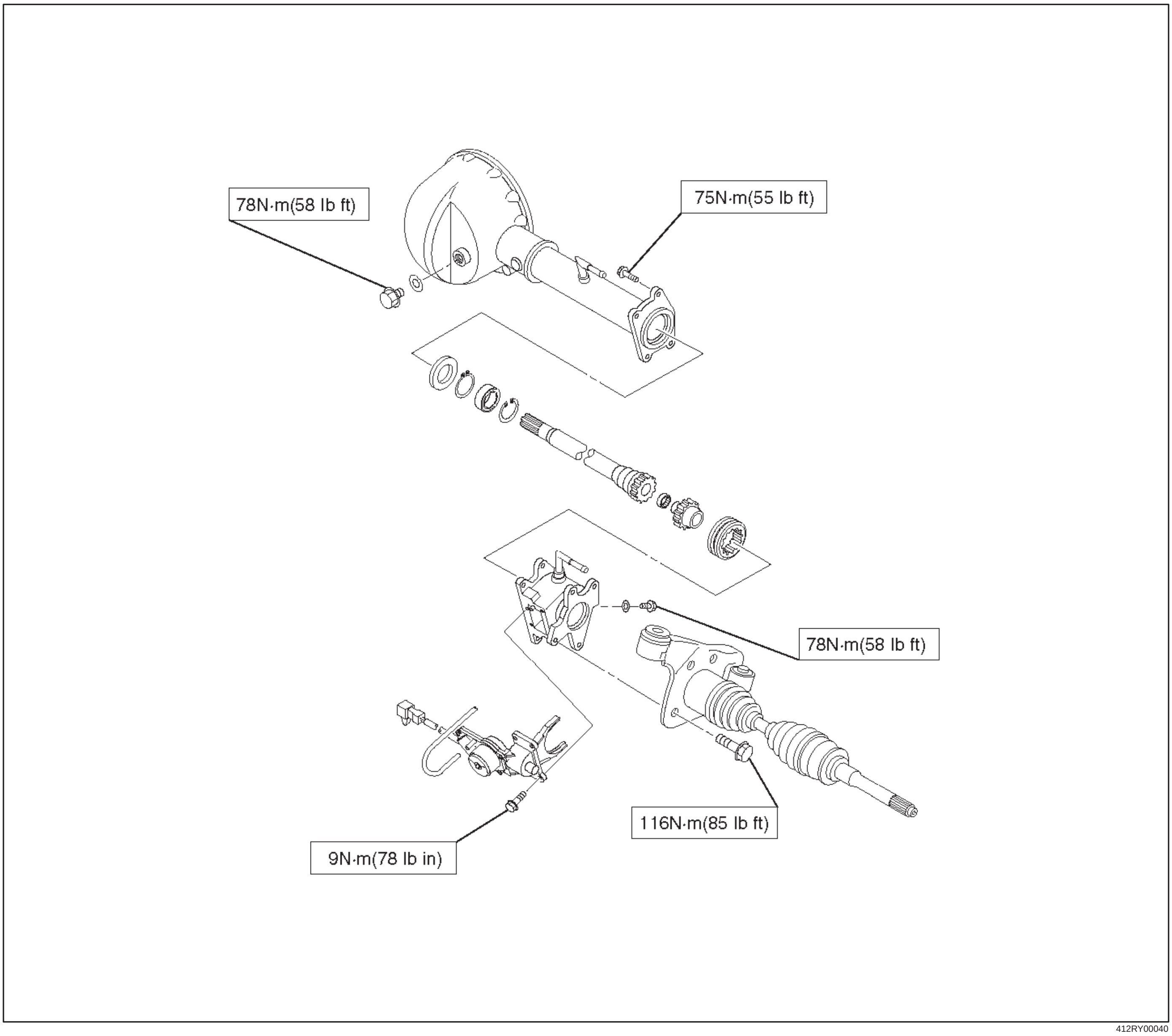
    Torque: 78N·m (58lb ft)

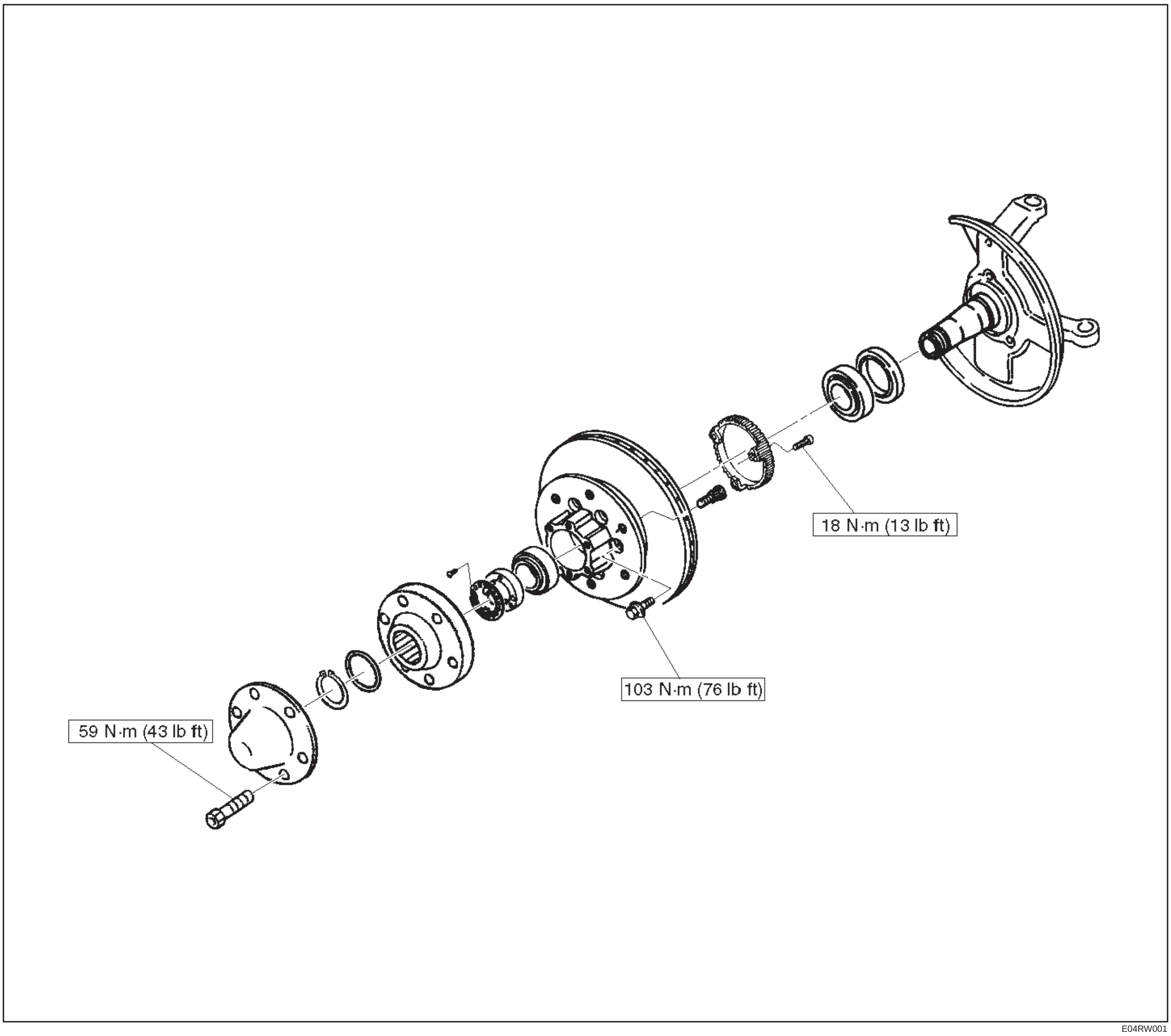
Main Data and Specifications

General Specifications

Front drive axle oil capacity	1.25 liter (1.32 US qt)(Differential)
	0.12 liter (0.13 US qt)(Actuator Housing:Shift on the fly)
Type of lubricant	GL–5 (75W–90) Refer to chart in General Information
Axle shaft type	Constant velocity joint(Birfield joint type and double offset joint)

Torque Specifications




18 N·m (13 lb ft)
103 N·m (76 lb ft)
59 N·m (43 lb ft)
E04RW001

Special Tools

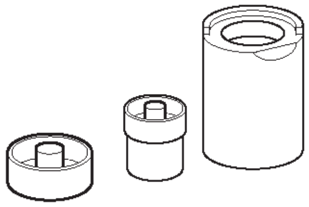
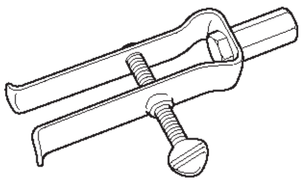
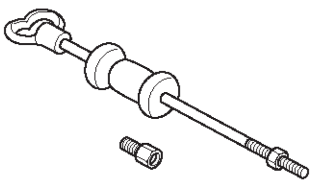
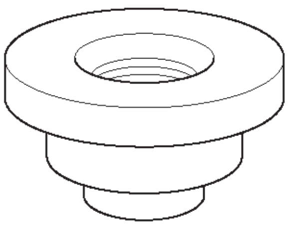
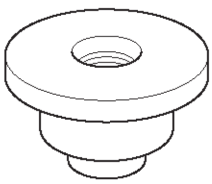
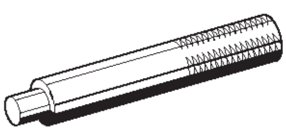
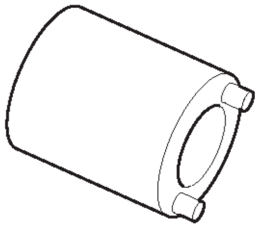
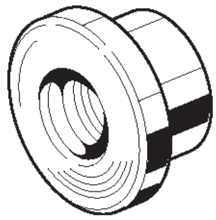
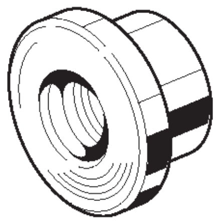
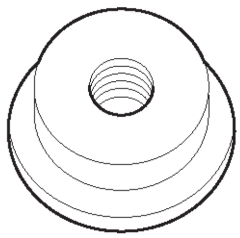
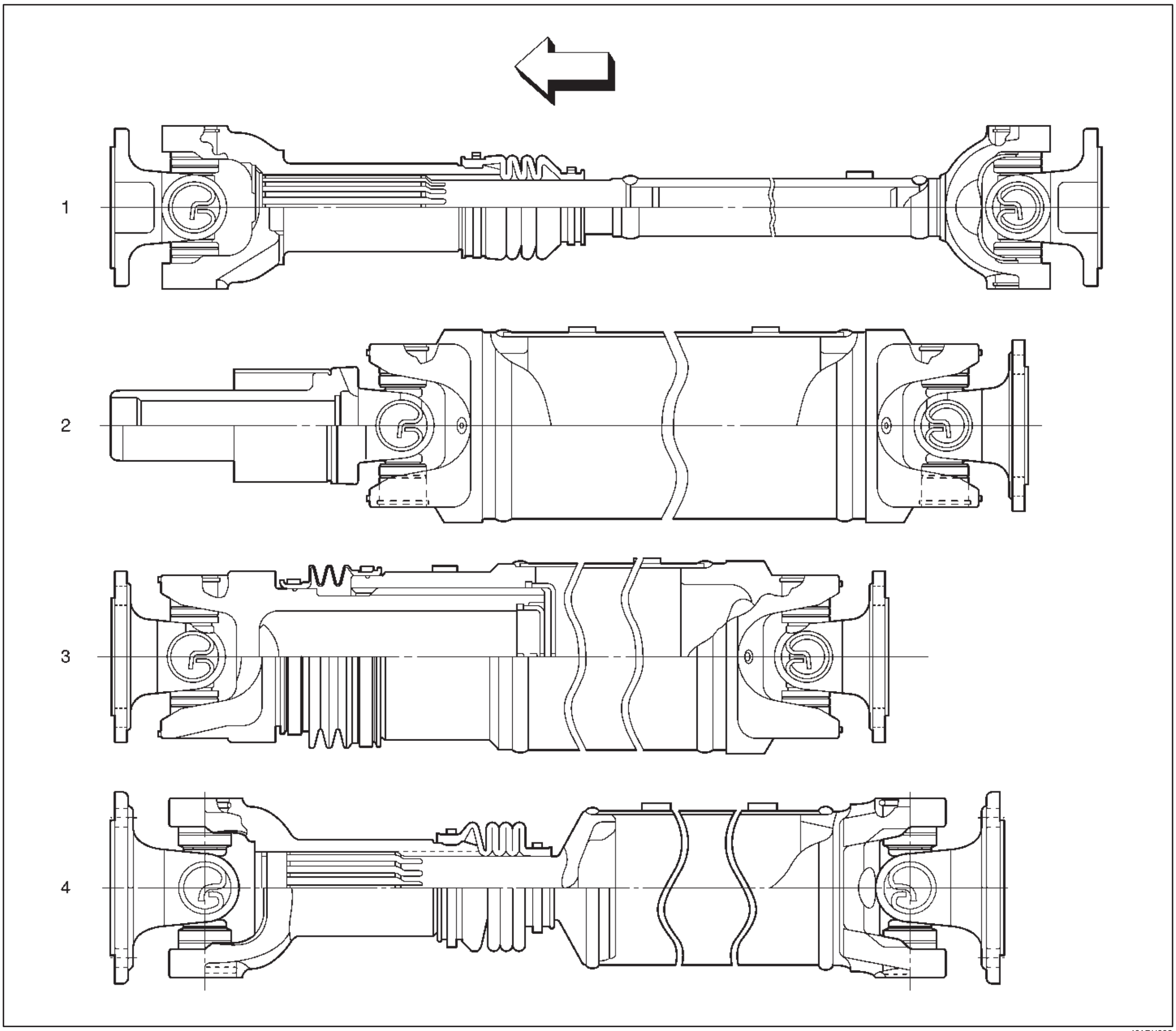
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS233	**J–39378** Remover and Installer; Front Axle mount bushing
 901RS234	**J– 26941** Remover; Bearing needle
 901RS235	**J–2619–01** Hammer; Sliding
 901RS236	**J–41693** Installer; Oil seal
 901RS177	**J–41694** Installer; Bearing needle
 901RS285	**J–8092** Grip

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS246	**J–36827** Wrench; Hub nut
 901RS247	**J–36829** Installer; Inner bearing
 901RS248	**J–36828** Installer; Outer bearing
 901RS249	**J–36830** Installer; Oil seal

Propeller Shaft

General Description



Legend

(1) Front Propeller Shaft
(2) Rear Propeller Shaft;
Aluminum Tube with Spline Yoke Type
(3) Rear Propeller Shaft;
Aluminum Tube with Flange Yoke Type
(4) Rear Propeller Shaft;
Steel Tube Type (for 4×4, 6VD1, A/T model)

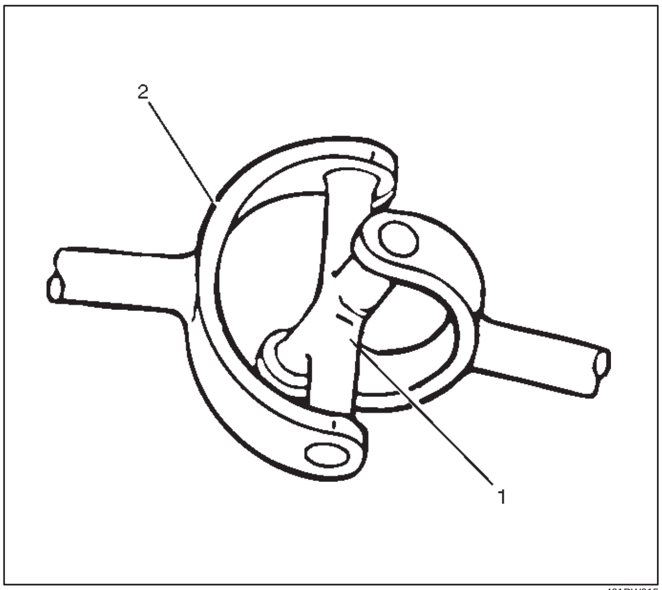
Torque is transmitted from the transmission to the axle through propeller shaft and universal joint assembles. All propeller shafts are the balanced tubular type. A splined slip joint is provided in some drivelines.

- Since the propeller shaft is total balanced carefully, welding or any other modification are not permitted.
- Alignment marks should be applied to each propeller shaft before removal.
- Be sure vehicle is stopped, engine is not running, brake is secured and vehicle is secured to prevent injury.
- Be careful not to grip the propeller shaft tube too tightly in the bise as this will be cause deformation.

Phasing

The propeller shaft is designed and built with the yoke lugs (ears) in line with each other. This design produces the smoothest running shaft possible, called phasing.Vibration can be caused by an out–of–phase propeller shaft.The propeller shaft will absorb vibrations from speeding up and slowing down each time the universal joint goes around.This vibration would be the same as a person snapping rope and watching the ”wave” reaction flow to the end.A propeller shaft working in phase would be similar to two persons snapping a rope at the same time, and watching the ”waves” meet and cancel each other out.In comparison, this would be the same as the universal joints on a propeller shaft.A total cancellation of vibration produces a smooth flow of power in the driveline.It is very important to apply a reference mark to the propeller shaft before removal, to assure installation alignment.

Universal Joint



401RW015

Legend

(1) Spider
(2) Yoke

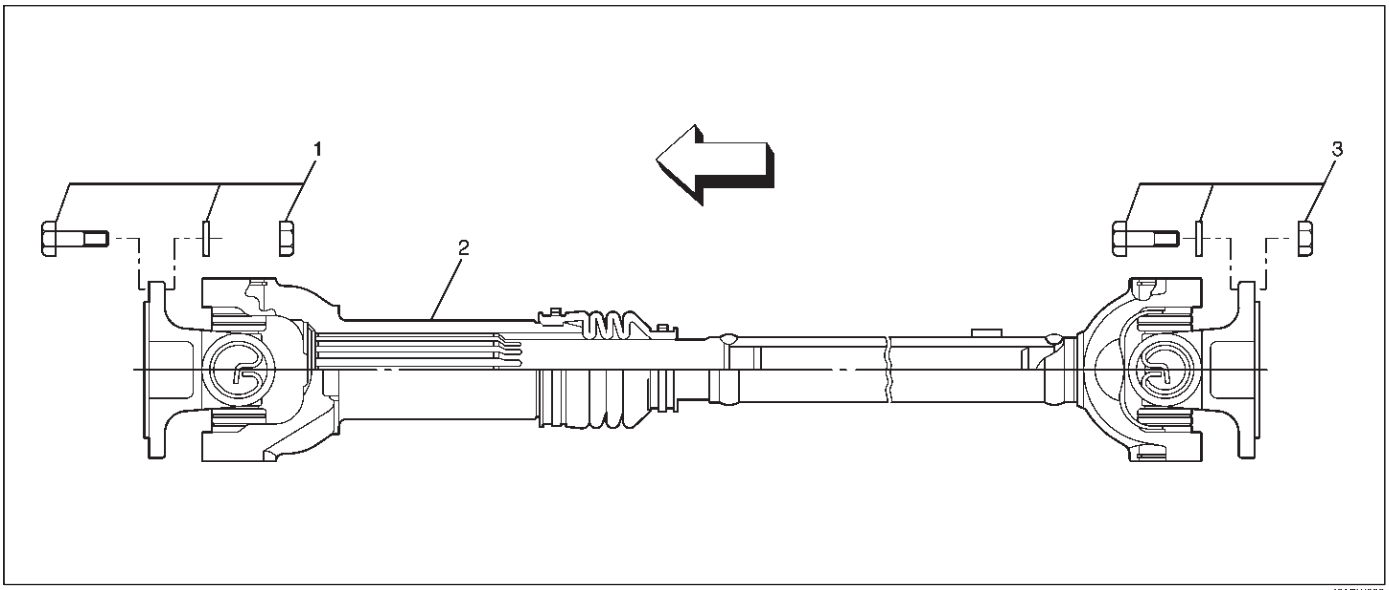
A universal joint consists of two Y-shaped yokes connected by a crossmember called a spider.
The spider is shaped like a cross. Universal joints are designed to handle the effects of various loadings and front or rear axle windup during acceleration. Within the designed angle variations, the universal joint will operate efficiently and safely. When the design angle is changed or exceeded the operationallife of the joint may decrease.
The bearings used in universal joints are of the needle roller type. The needle rollers are held in place on the trunnions by round bearing cups. The bearing cups are held in the yokes by snap rings.

Diagnosis of Propeller Shaft and Universal Joint

Condition	Possible cause	Correction
Universal Joint Noise.	Worn universal joint bearings.	Replace.
	Improper lubrication.	Lubricate as directed.
	Loose flange bolts.	Tighten to specifications.
Ping, Snap, or Click in Drive Line (Usually Heard on Initial Load after the Transmission is in Forward or Reverse Gear)	Loose bushing bolts on the rear springs or upper and lower control arms.	Tighten the bolts to specified torque.
	Loose or out-of-phase end yoke.	Remove end yoke, turn 180 degrees from its original position, lubricate the splines and reinstall. Tighten the bolts and pinion nut to specified torque.
Knocking or Clanking Noise in the Driveline when in High or Neutral Gear at 16km/h(10mph)	Worn or damaged universal joint	Replace the universal joint.
Squeak	Lack of lubricant.	Lubricate joints and splines. Also check for worn or brinelled parts.
Shudder on Acceleration (Low Speed)	Loose or missing bolts at the flanges.	Replace or tighten bolts to specified torque.
	Incorrectly set front joint angle.	Install shim under the transmission support mount to change the front joint angle.
	Worn universal joint.	Replace.
Vibration	Incorrect shaft runout.	Replace.
	Shaft out of balance.	Adjust.
	Transmission rear housing bushing, transfer case housing bushing worn.	Replace.
	Yoke spline jammed.	Replace.
Excessive Leak at the Front Spline Yoke of Rear Propeller Shaft	Rough surface on splined yoke; burred nicked or worn.	Replace the seal. Minor burrs can be Smoothed by careful use of crocus cloth or fine stone honing. Replace the yoke if badly burred.
	Defective transmission rear oil seal.	Replace the transmission rear oil seal and replenish the transmission oil.

Front Propeller Shaft

Front Propeller Shaft and Associated Parts



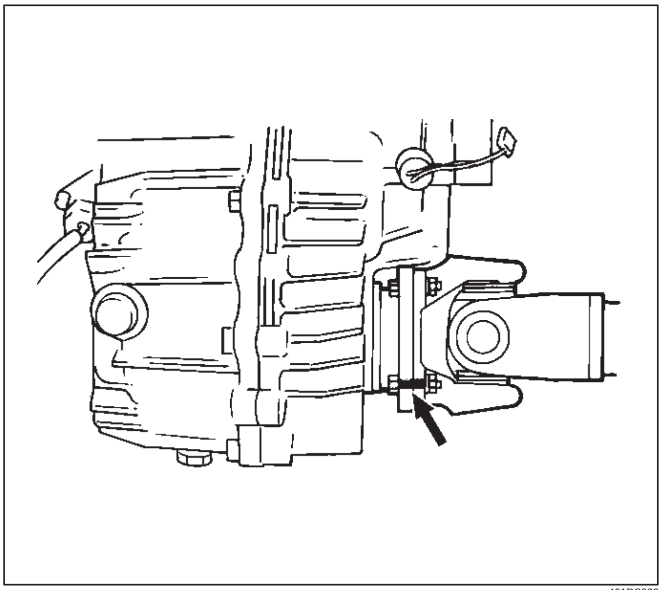
401RW093

Legend
(1) Bolt, Nut and Washer (Front Axle Side)
(2) Front Propeller Shaft
(3) Bolt, Nut and Washer (Transfer Side)

Removal

1. Raise the vehicle on a hoist.

NOTE: Apply alignment marks on the flange at the front propeller shaft both front and rear side.



401RS020

2. Remove bolt, nut and washer (Front axle side).
3. Remove bolt, nut and washer (Transfer side).
4. Remove front propeller shaft.

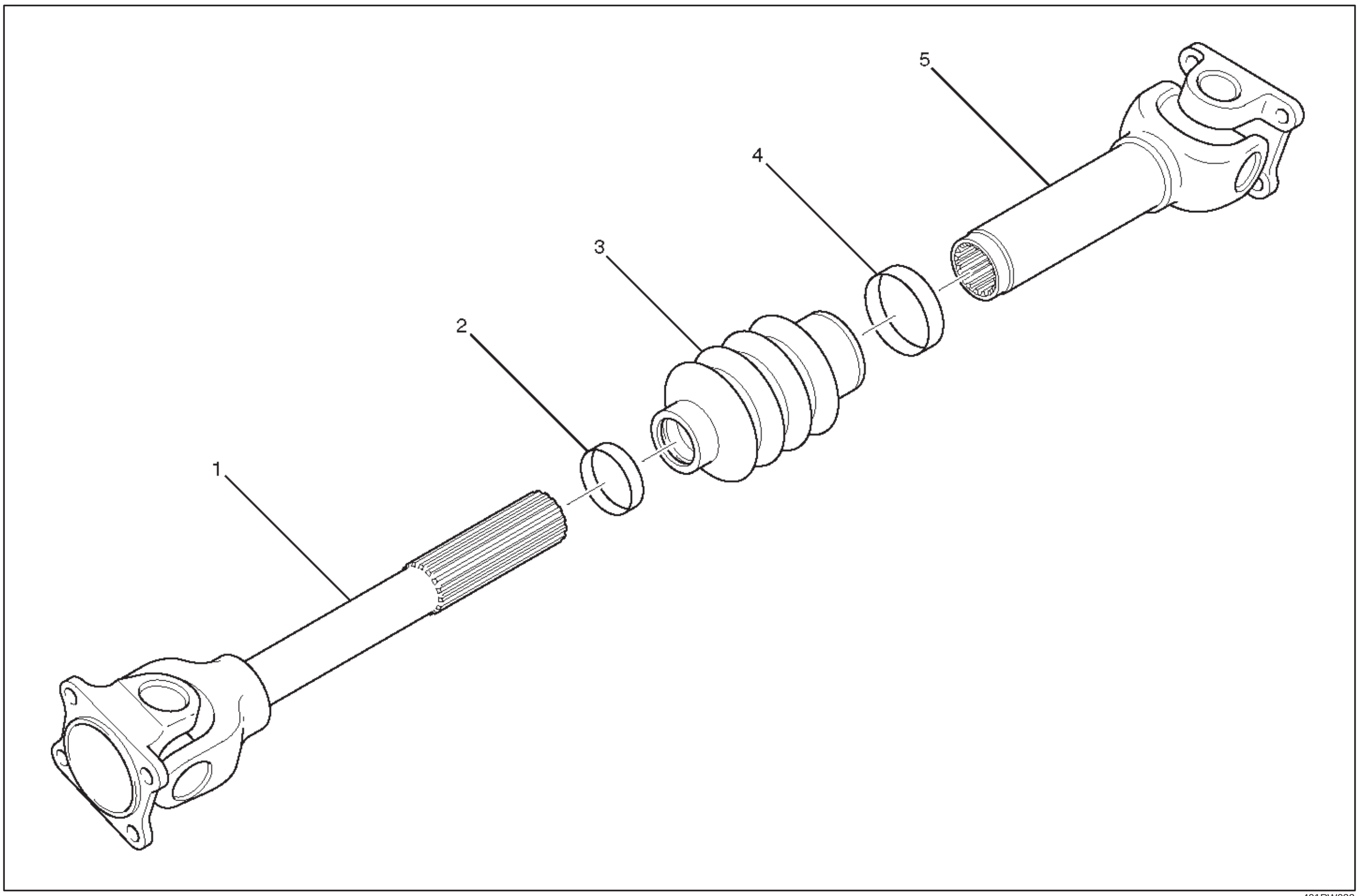
Installation

NOTE: Never install the shaft assembly backwards. Never insert bar between yoke lugs when tightening or removing bolts. Completely remove the black paint from the connecting surface of flange coupling on each end of propeller shaft. Clean so that no foreign matter will be caught in between.

1. Align the mark which is applied at removal. Install front propeller shaft and tighten the bolts to the specified torque.

   Torque: 63 N·m (46 lb ft)

Disassembly

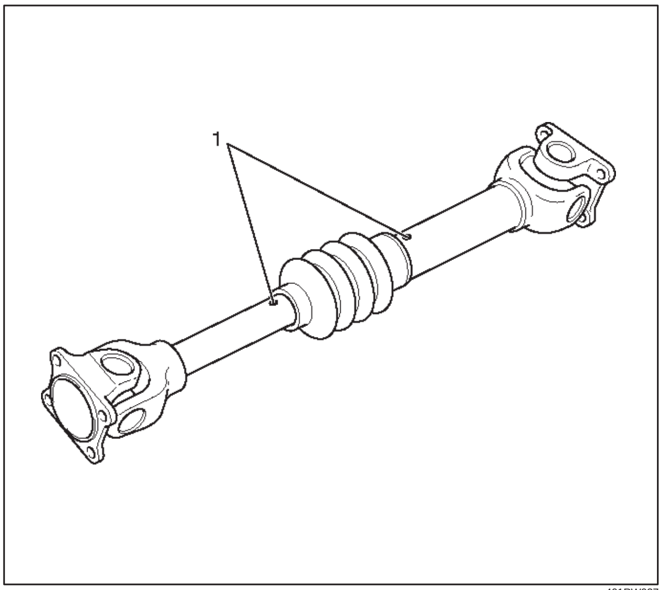


401RW032

Legend

(1) Sleeve Yoke
(2) Clamp
(3) Boot
(4) Clamp
(5) Tube Assembly

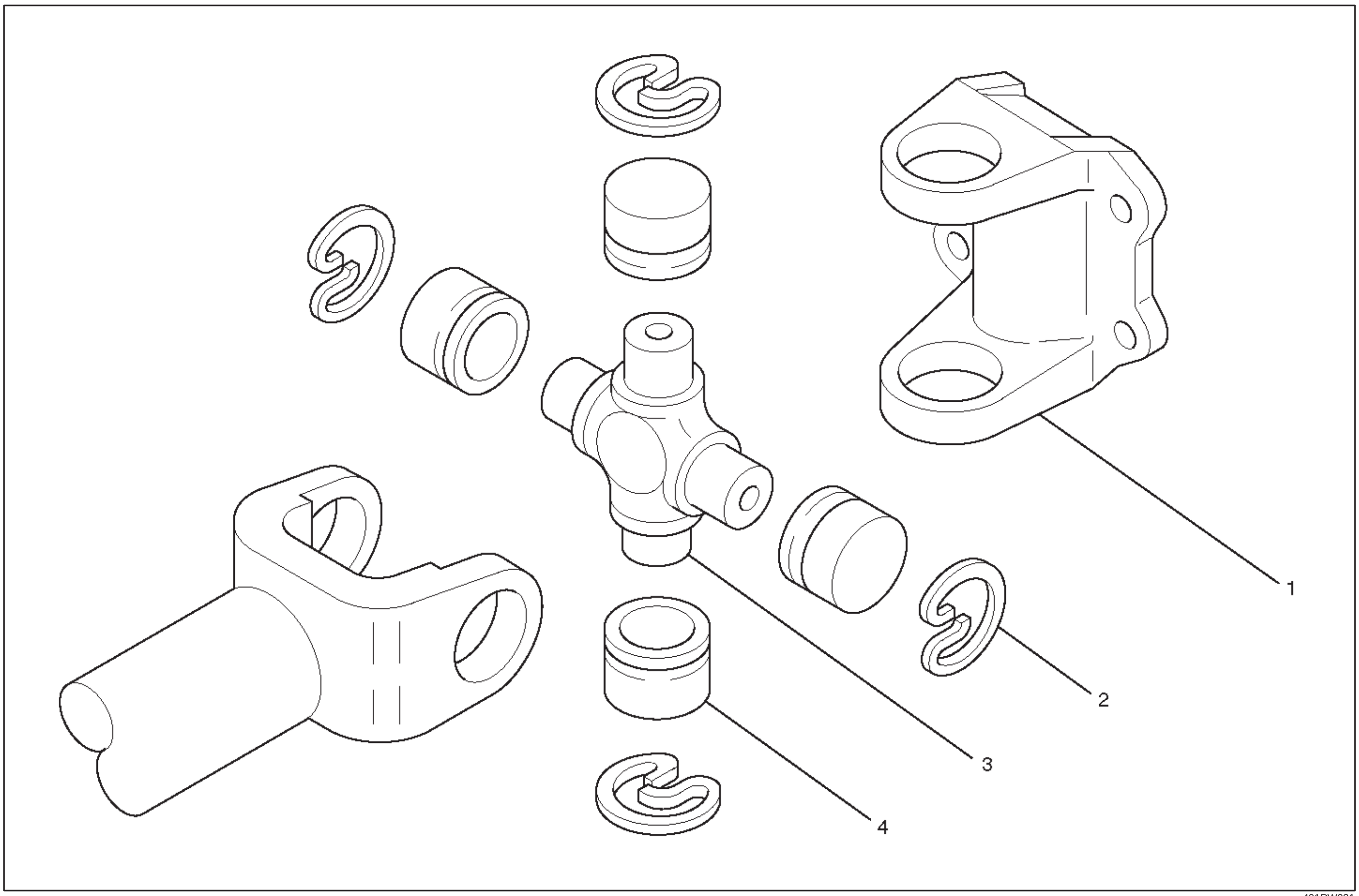
1. Lay the shaft horizontally on a bench and secure.
2. Indicate the original assembled position (1) by marking the phasing of the shaft prior to disassembly.



401RW037

3. Using the flat blade of a screwdriver, pry the loose end of the boot clamp upwards and away from the propeller shaft boot. Be careful not to damage the boot.
4. When boot clamps becomes loose, remove by hand.
5. Repeat for the other boot clamp.
6. Remove the slip yoke assembly from the driveshaft, by securing the boot with one hand and pulling on the slip yoke.
7. Remove the boot from the shaft assembly.

Universal Joint Disassembly



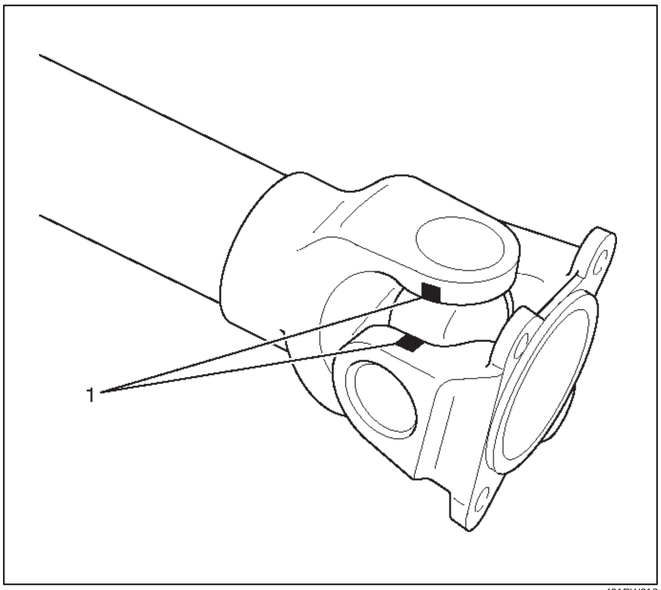
Legend

(1) Flange Yoke
(2) Snap Ring
(3) Spider
(4) Needle Roller Bearing

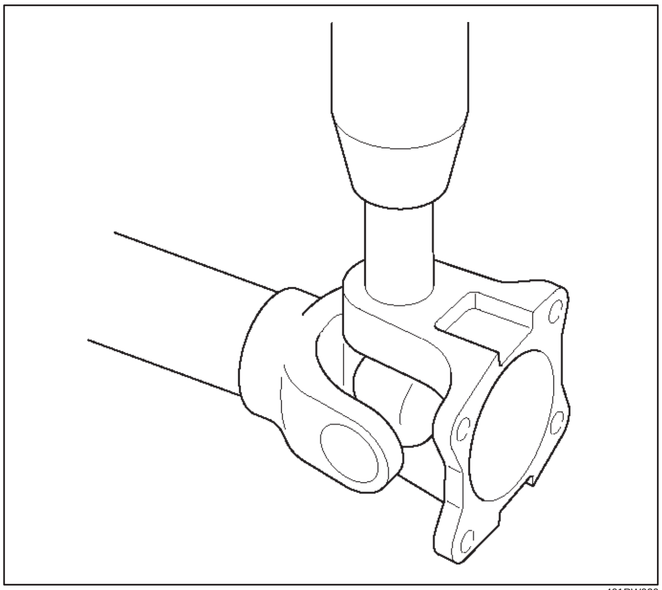
1. Using a soft drift, tap the outside of the bearing cup assembly to loosen snap ring. Tap bearing only hard enough to break assembly away from snap ring.

   Remove snap ring from yoke. Turn joint over, tap bearing away from snap ring, then remove opposite snap ring.

   Apply alignment marks (1) on the yokes of the universal joint, then remove snap ring.



2. Set the yoke in the arbor press with a piece of tube stock beneath it.
   Place a solid plug on the upper bearing assembly and press it through to release the lower bearing assembly.



401RW020

3. If the bearing assembly will not pull out by hand after pressing, tap the base of the lug near the bearing assembly to dislodge it.
4. To remove the opposite bearing, turn the yoke over and straighten the spider in the open hole. Then carefully press on the end of the spider so the remaining bearing moves straight out of the bearing spider hole. If the spider or bearing are cocked, the bearing will score the walls of the spider hole and ruin the yoke.
5. Repeat this procedure on the remaining bearing to remove the spider from the yoke.
6. Make sure of proper position for reinstallation by applying setting marks, then remove spider .

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition is found through inspection.

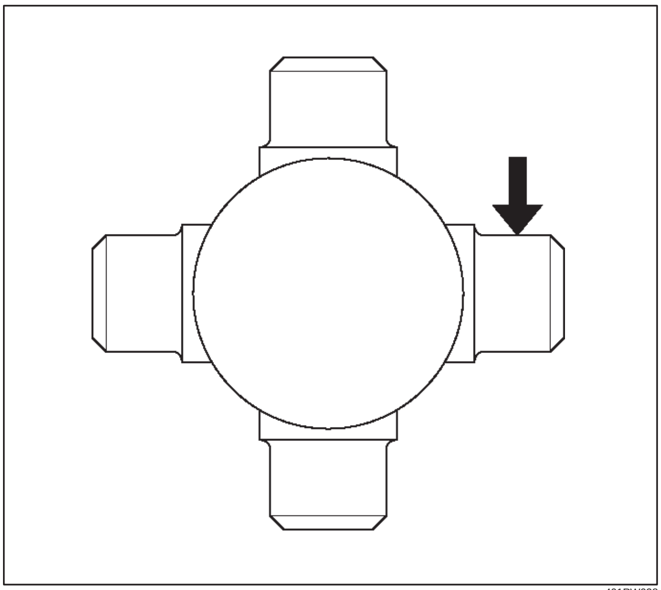
NOTE: When any part of the journal assembly (spider, needle roller bearing) requires replacement, be sure to replace the entire assembly.

Check the following parts for wear, damage, noise or any other abnormal conditions.

1. Spider
2. Needle roller bearing
3. Yoke
4. Flange
5. Boot

Spider pin for wear

Spider pin should be smooth and free from fretting or galling. Visible signs of needle presence is normal, but wear should not be felt.



401RW038

Propeller shaft run–out

Support the propeller shaft on V-blocks (2) and check for run-out by holding the probe of a dial indicator (1) in contact with the shaft.

Static run-out limit:

0.13 mm (0.005 in)

TIR on the neck of the slip tube shaft (with a boot).

0.25 mm (0.010 in)

TIR on the ends of the tubing 3 inch from the welds.

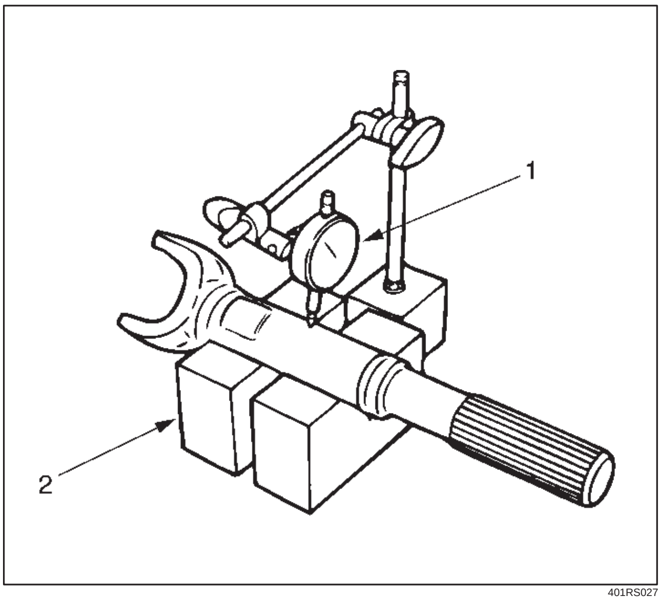
0.38 mm (0.015 in)

TIR at the linear center of the tube.

0.38 mm (0.015 in)

TIR for the full length of tube with 30” or less of tubing.

(TIR : Total Indicator Reading)



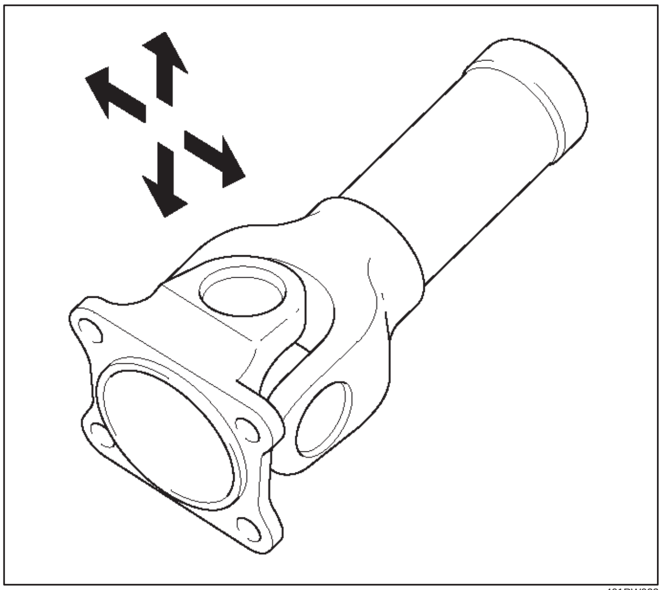
401RS027

Spline

The nylon-coated spline should be free from nicks and dings and the underlying steel spline should not be visible. After cleaning the nylon coating spline, the coating should exhibit only slight indicator of wear.
Grease volume is approximately 10 grams of grease in total. Grease should be evenly applied to both the female and the male slip splines using a small brush. After assembly of the slip joint, the sliding joint should be fully worked from the full collapsed to the full extended position.

Play in the universal joint

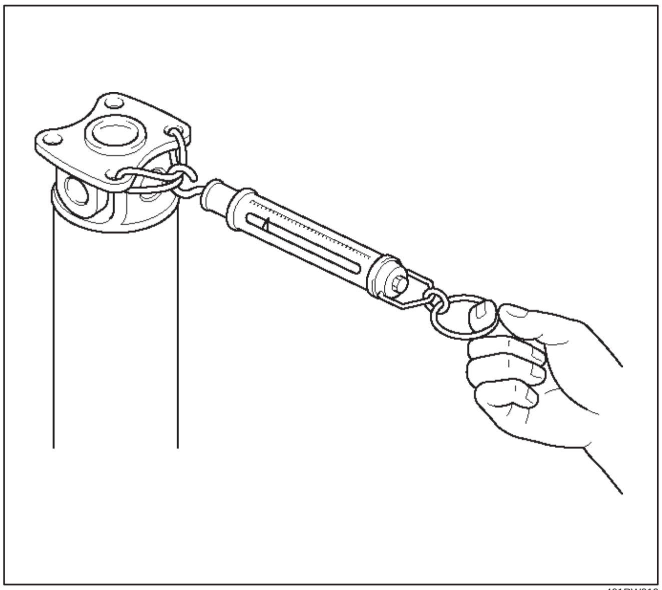
Limit: Less than 0.15 mm (0.006 in)



401RW023

Preload of the universal joint

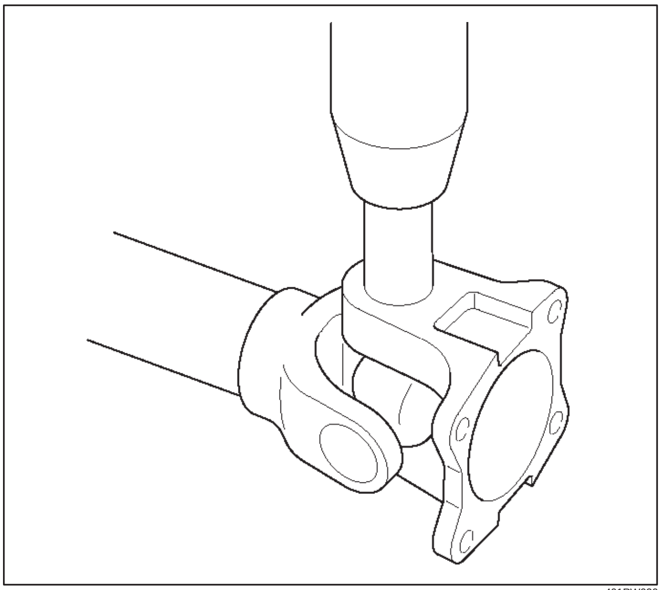
Preload should be 0 to 49 N(0 to11.0 lb). Joints should rotate smoothly and freely and should exhibit no rough or ratchety movement.



401RW019

Universal Joint Reassembly

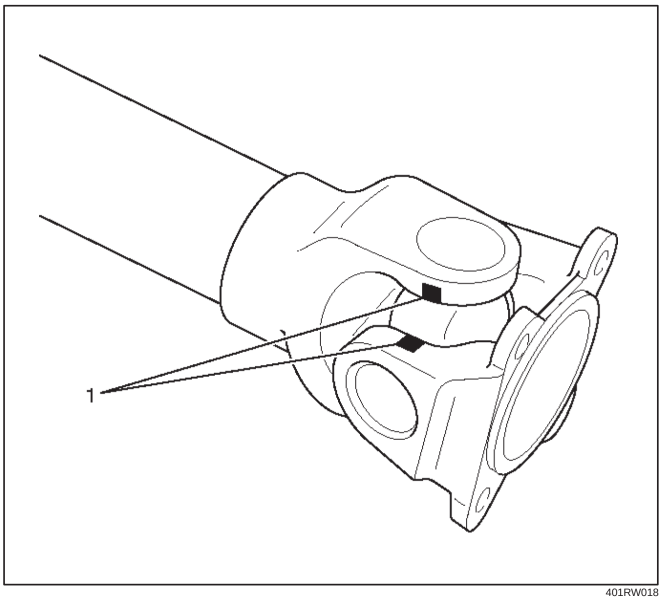
1. Install spider to flange yoke. Be sure to install the spider by aligning the setting marks made during disassembly.
2. Pack the four grease cavities of the spider with a high quality, extreme pressure N.L.G.I. Grade 2 grease. Do not add additional grease to the bearing cup assembly.
3. Move one end of the spider to cause a trunnion to project through the spider hole beyond the outer machined face of the yoke lug. Place a bearing over the trunnion diameter and align it to the spider hole. Using an arbor press, hold the trunnion in alignment with the spider hole and place a solid plug on the upper bearing. Press the bearing into the spider hole enough to install a snap ring.



401RW020

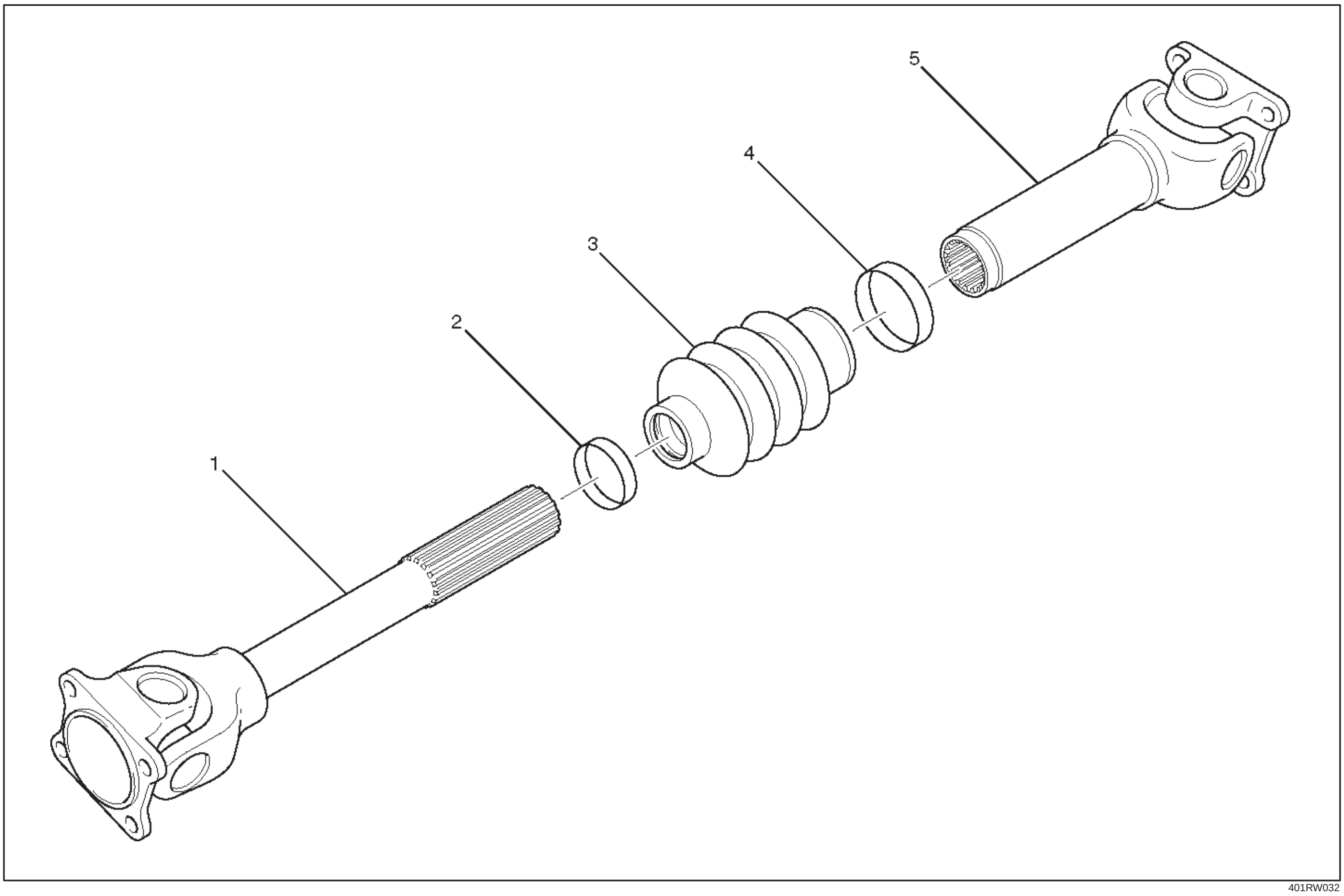
4. Install a snap ring.
   Be sure the snap rings are properly seated in the grooves.
5. Repeat steps 3 and 4 to install the opposite bearing. If the joint is stiff, strike the yoke ears with a soft hammer to seat needle bearings.

6. Align setting marks (1) and join the yokes.



7. Install snap ring.

Reassembly



Legend

- (1) Sleeve Yoke
- (2) Clamp
- (3) Boot
- (4) Clamp
- (5) Tube Assembly

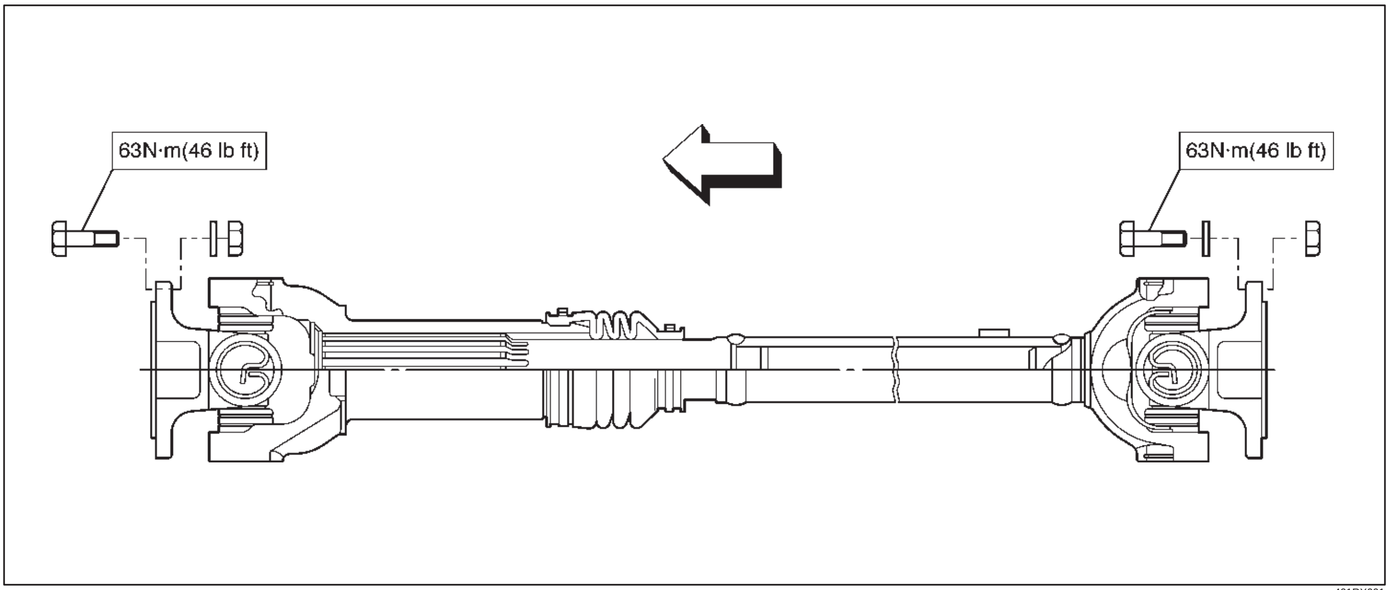
1. Apply grease evenly to both the female and male splines.
2. Apply a small amount of grease by finger to the outer lips of the boot.
3. Slide the boot onto the yoke shaft being careful not to damage the spline coating or boot.
4. Insert the yoke shaft spline into the sleeve being careful to maintain proper phasing. The spider holes should be in line and as per originally marked prior to disassembly.
5. Position boot onto sleeve and yoke shaft in final position over boot grooves.
6. Attach boot clamps and secure using pliers.
7. Be sure clamp is properly seated and secure.

Main Data and Specifications

General Specifications

Transmission	M/T	A/T
Length (between two spiders center)	367.2 mm (14.81 in)	542.2 mm (21.35 in)

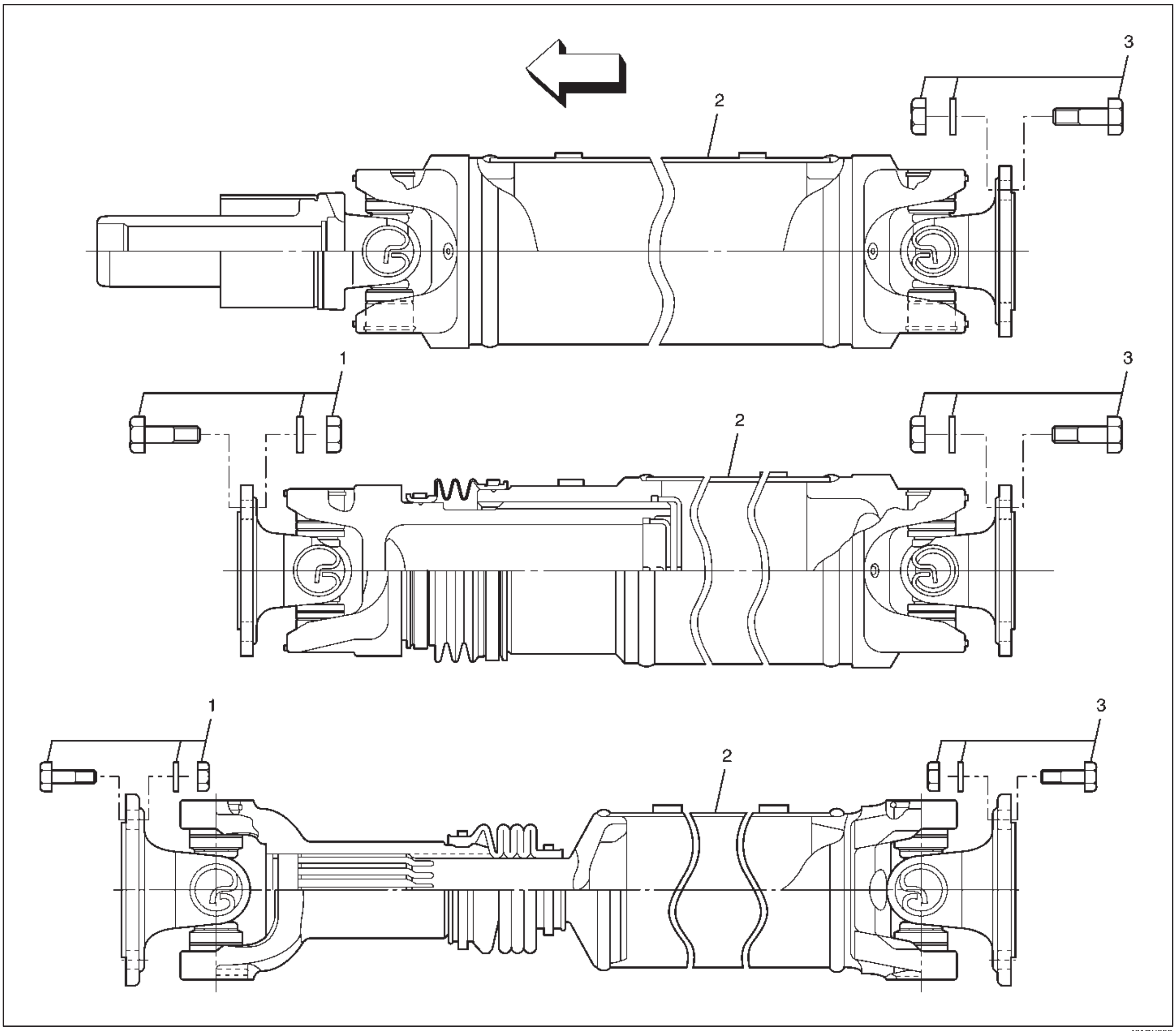
Torque Specifications



401RX001

Rear Propeller Shaft

Rear Propeller Shaft and Associated Parts



Legend

(1) Bolt, Nut and Washer (Transfer Side)

(2) Rear Propeller Shaft

(3) Bolt, Nut and Washer (Rear Axle Side)

Removal

1. Raise the vehicle on a hoist.

NOTE: Apply alignment marks on the flange at the rear propeller shaft both front and rear side.

2. Remove transfer side bolt, nut and washer (except spline yoke type).
3. Remove rear axle side bolt, nut and washer.
4. Remove rear propeller shaft.

NOTE: Plug the hole of the transmission rear end to prevent oil leakage (spline yoke type only).

Installation

NOTE: Never install the shaft assembly backwards.

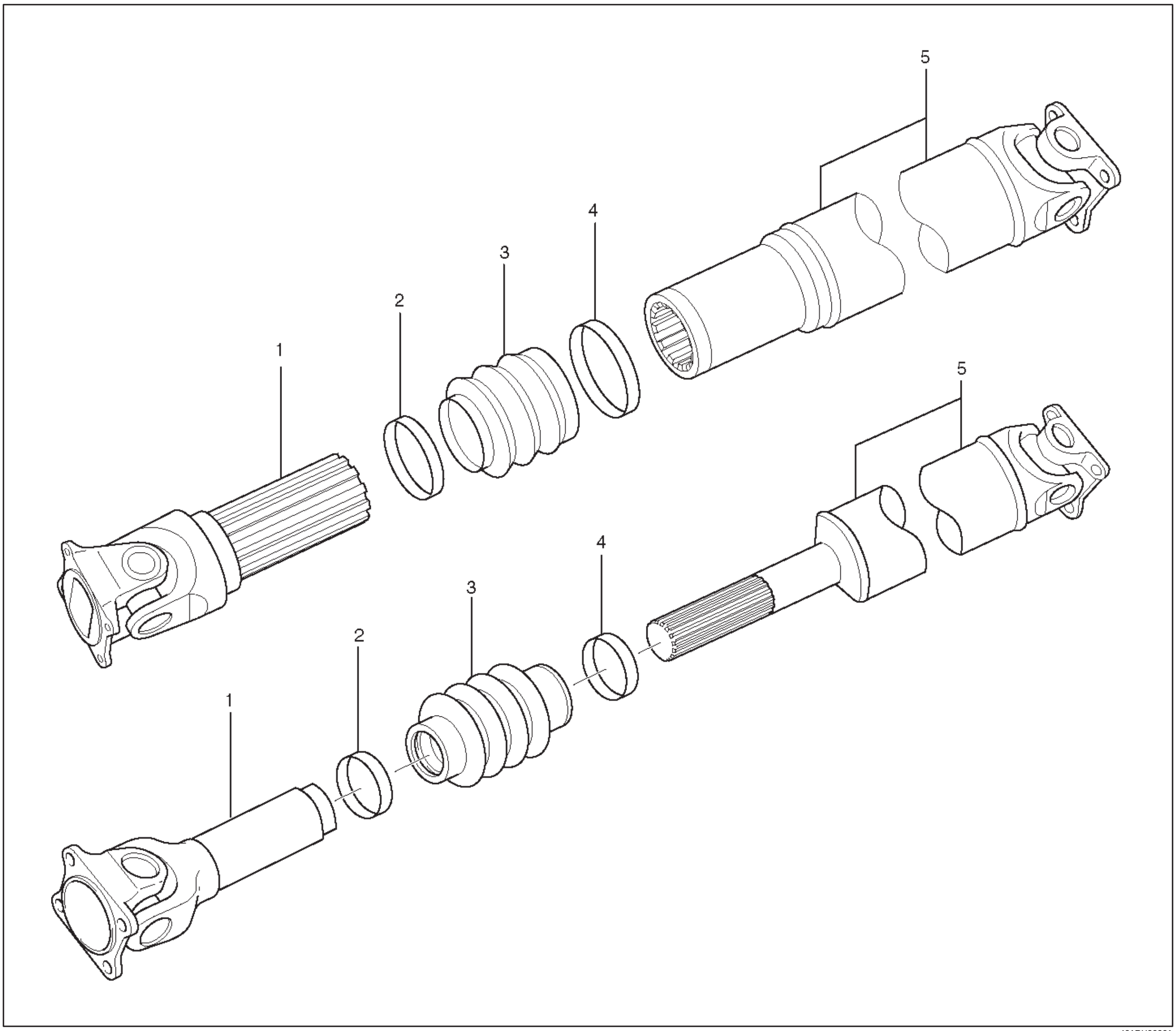
Never insert bar between yoke lugs when tightening or removing bolts.

Completely remove the dust or foreign matter from the connecting surface of flange coupling on each end of the propeller shaft.

1. Align the mark which is applied at removal.
2. Install rear propeller shaft and tighten the bolts to the specified torque.

Torque: 63 N·m(46 lb ft)

Slip Joint Disassembly

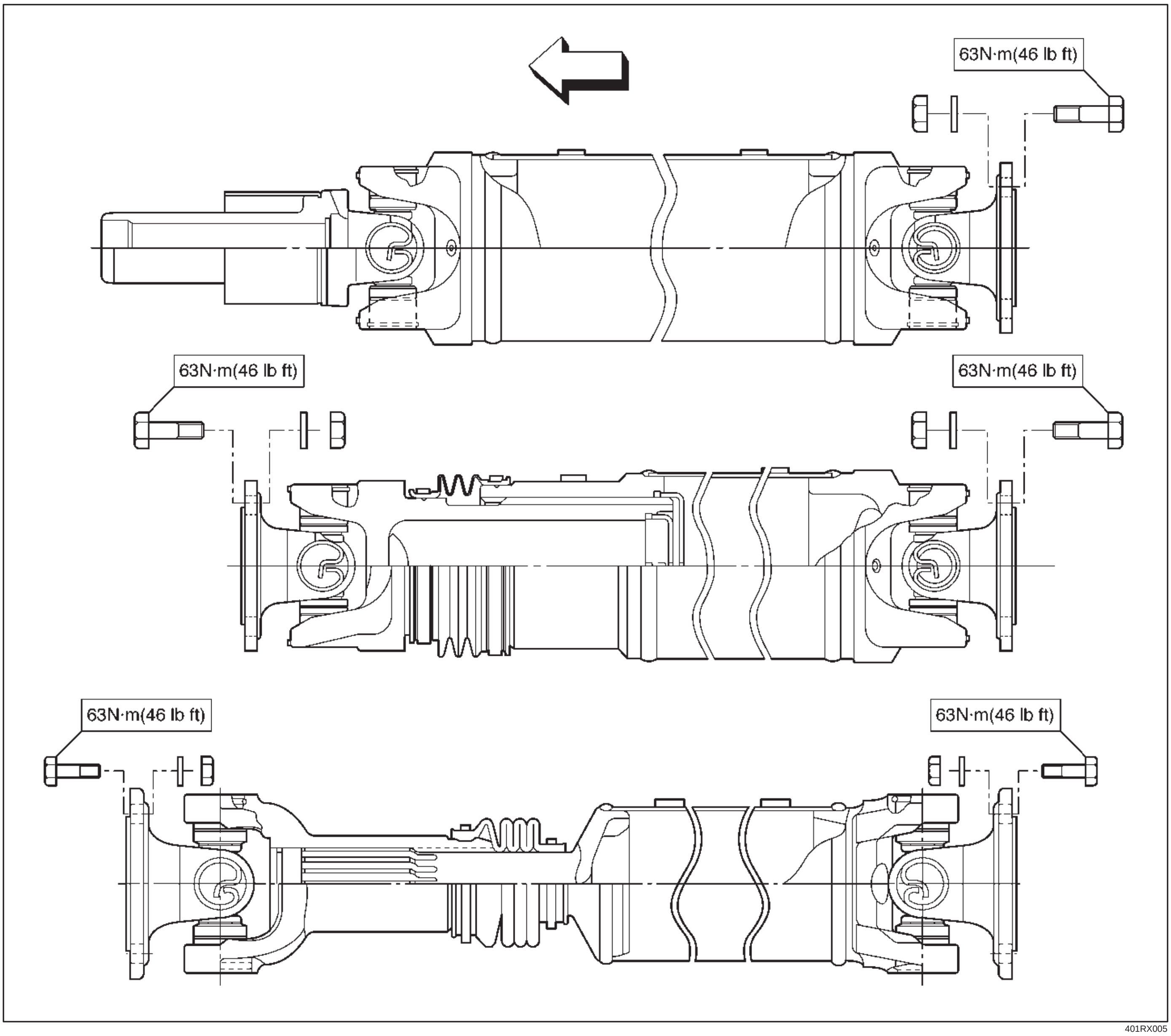


Legend

(1) Spline Yoke and Universal Joint Assembly
(2) Clamp
(3) Boot
(4) Clamp
(5) Tube and Universal Joint Assembly

1. Lay the shaft horizontally on a bench and secure.
2. Indicate the original assembled position by marking the phasing of the shaft prior to disassembly.
3. Using the flat blade of a screwdriver, pry the loose end of the boot clamp upwards and away from the propeller shaft boot. Be careful not to damage the boot.
4. When boot clamps becomes loose, remove by hand.
5. Repeat for the other boot clamp.
6. Remove the slip yoke assembly from the driveshaft, by securing the boot with one hand and pulling on the slip yoke.
7. Remove the boot from the shaft assembly.

Universal Joint Disassembly



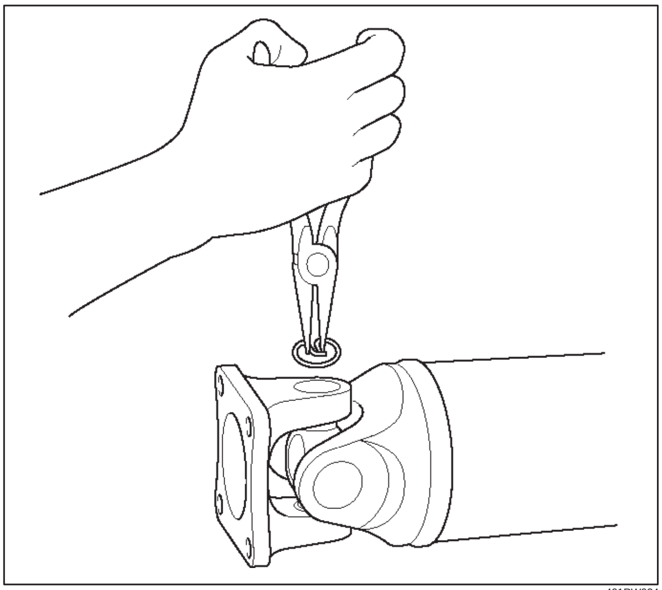
Legend

(1) Spline Yoke
(2) Spider
(3) Propeller Shaft Assembly
(4) Spider
(5) Flange Yoke
(6) Bearing
(7) Snap Ring
(8) Flange Yoke

NOTE: Aluminum is softer than steel. Care must be taken not to remove excessive material or damage bearing holes.

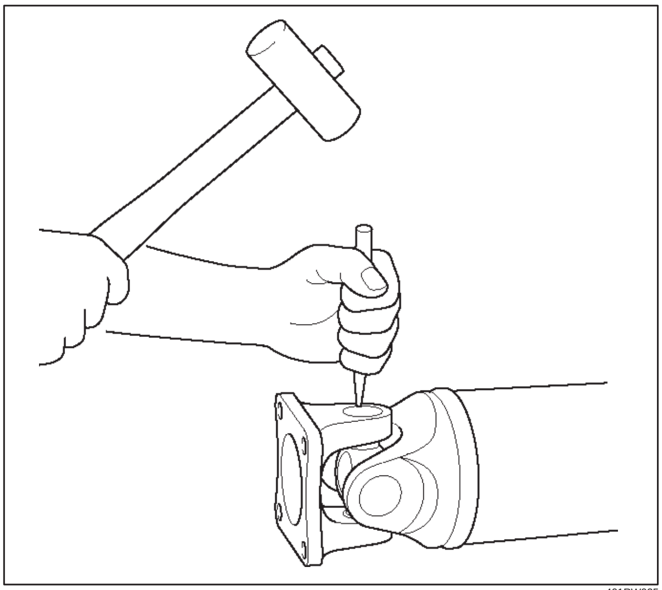
If the vehicle has aluminum tube type propeller shaft, flange yoke, boot kit, journal kit can be replaced. If other parts are damaged, replace propeller shaft as assembly.

1. Apply alignment marks on the yokes of the universal joint, then remove the snap ring.



401RW024

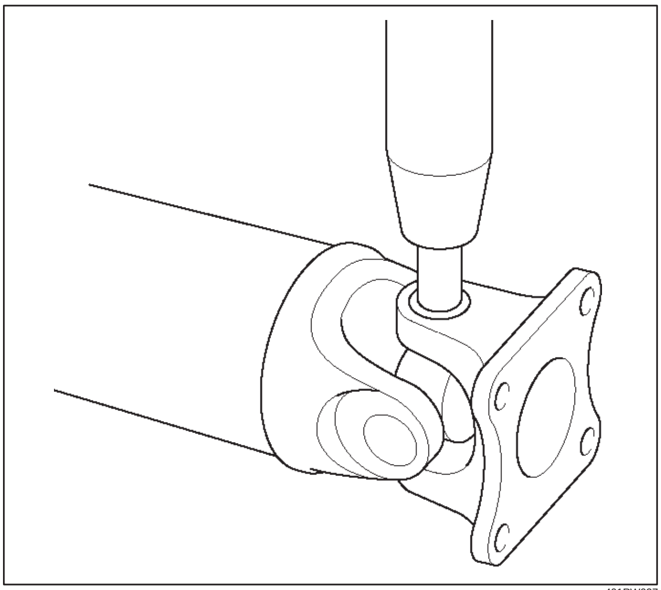
If the snap ring is stuck in position, remove paint from the hole in the yoke or tap around the edge of the bearing lightly with a soft drift.



401RW025

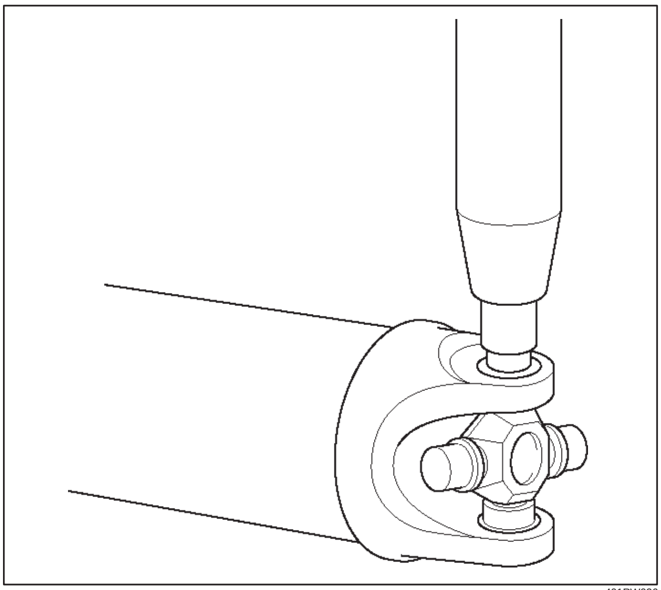
2. Set the yoke in the arbor press with a piece of tube stock beneath it.

   Place a solid plug on the upper bearing and press it through to release the lower bearing.



401RW027

3. If the bearing will not pull out by hand after pressing, tap the base of the lug near the bearing to dislodge it.
4. To remove the opposite bearing, turn the yoke over and straighten the spider in the open spider hole. Then carefully press on the end of the spider so the remaining bearing moves straight out of the bearing spider hole. If the spider or bearing are cocked, the bearing will score the walls of the spider hole and ruin it.



401RW026

5. Repeat this procedure on the remaining bearing to remove the spider from the yoke.

Inspection

- Propeller shaft for run-out Aluminum tube type.

  Static run-out limit : 1.0 mm(0.04 in)

  TIR full length of tubing maximum.

  (TIR : Total Indicator Reading)

- Propeller shaft for runout (Steel tube type).

  Static runout limit : 0.13 mm(0.005 in)

  TIR on the neck of the slip tube shaft (with a boot).

  0.25 mm(0.010 in)

  TIR on the ends of the tubing 3 inch from the welds.

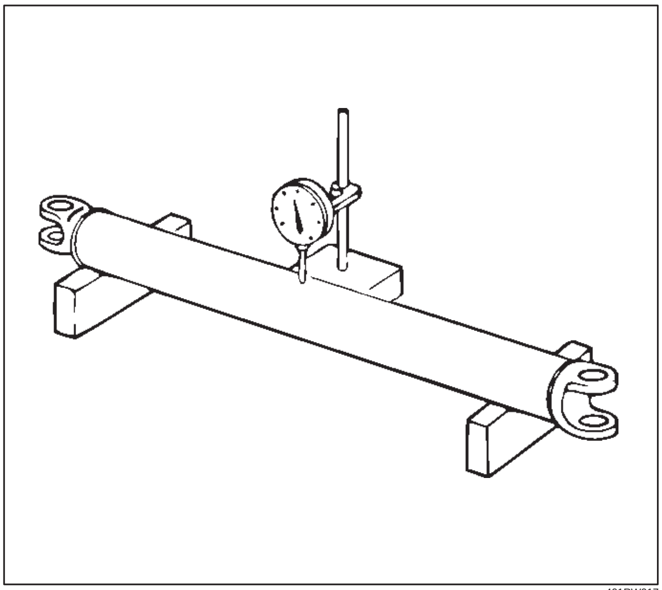
  0.38 mm(0.015 in)

  TIR at the linear center of the tube.

  0.38 mm(0.015 in)

  TIR for the full length of tube with 30” or less of tubing.

  (TIR: Total Indicator Reading)



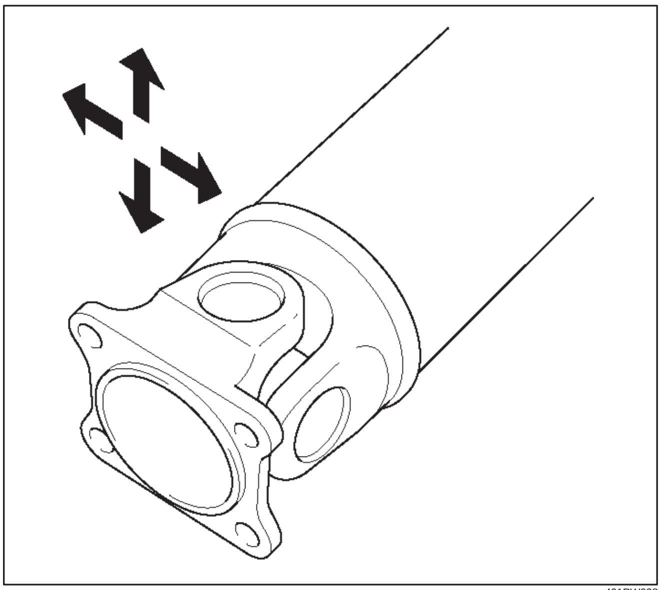
401RW017

- Play in universal joint.

  Limit: Less than 0.15 mm(0.006 in)

- Spider pin should be smooth and free from fretting or galling.

  Visible signs of needle presence is normal, but wear should not be felt.

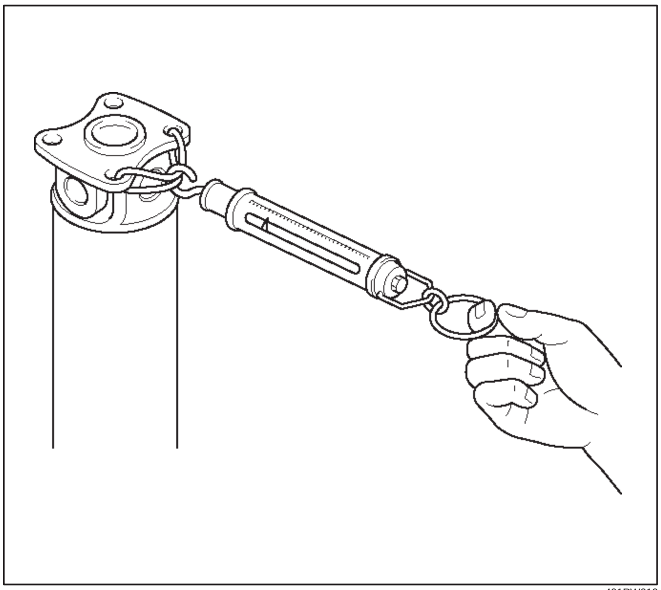


401RW028

- Preload of the universal joint.

  Preload should be 0 to 49 N (0 to 11.0 lb).

  Joints should rotate smoothly and freely and should exhibit no rough or ratchety movement.



401RW019

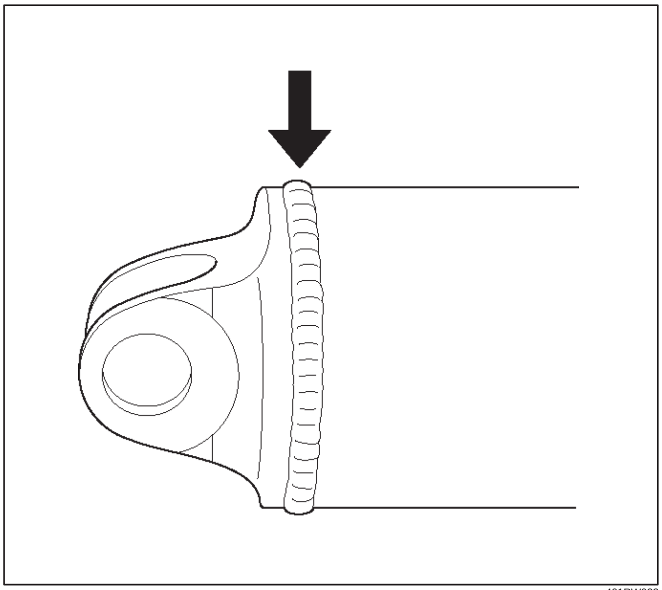
- Inspect splines of slip joint for wear.

  The nylon-coated spline should be free from nicks and dings and the underlying steel spline should not be visible.

  After cleaning the nylon coating spline, the coating should exhibit only slight indicator of wear.

  Grease volume is approximately 10 grams of grease in total. Grease should be evenly applied to both the female and the male slip splines using a small brush. After assembly of the slip joint, the sliding joint should be fully worked from the full collapsed to the full extended position.

- Aluminum tube type only: Inspect the aluminum tubing for surface scratches and dents. These scratches may not exceed 0.2 mm (0.008 in) in depth.



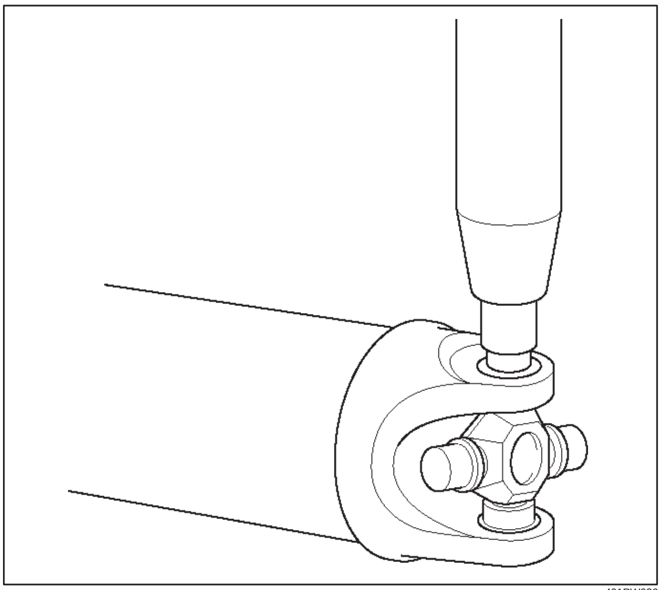
401RW022

- Aluminum tube type only: Visually inspect the circle welds and fittings for any signs of cracks or signs of deterioration. If there are any cracks that exceed 0.2 mm (0.008 in) in depth, the assembly must be replaced.
- Aluminum tube type only: Check to be sure there are no missing balance weights. If balance weights are missing and void has occurred in the aluminum tubing greater than 0.2 mm (0.008 in), the assembly must be replaced.

Universal Joint Reassembly

1. Pack the four grease cavities of the spider with a high quality, extreme pressure N.L.G.I. Grade 2 grease. Do not add additional grease to bearing cup assembly.
2. Move one end of the spider to cause a trunnion to project through the spider hole beyond the outer machined face of the yoke lug. Place a bearing over the trunnion diameter and align it to the spider hole.

   Using an arbor press, hold the trunnion in alignment with the spider hole and place a solid plug on the upper bearing. Press the bearing into the spider hole enough to install snap ring.



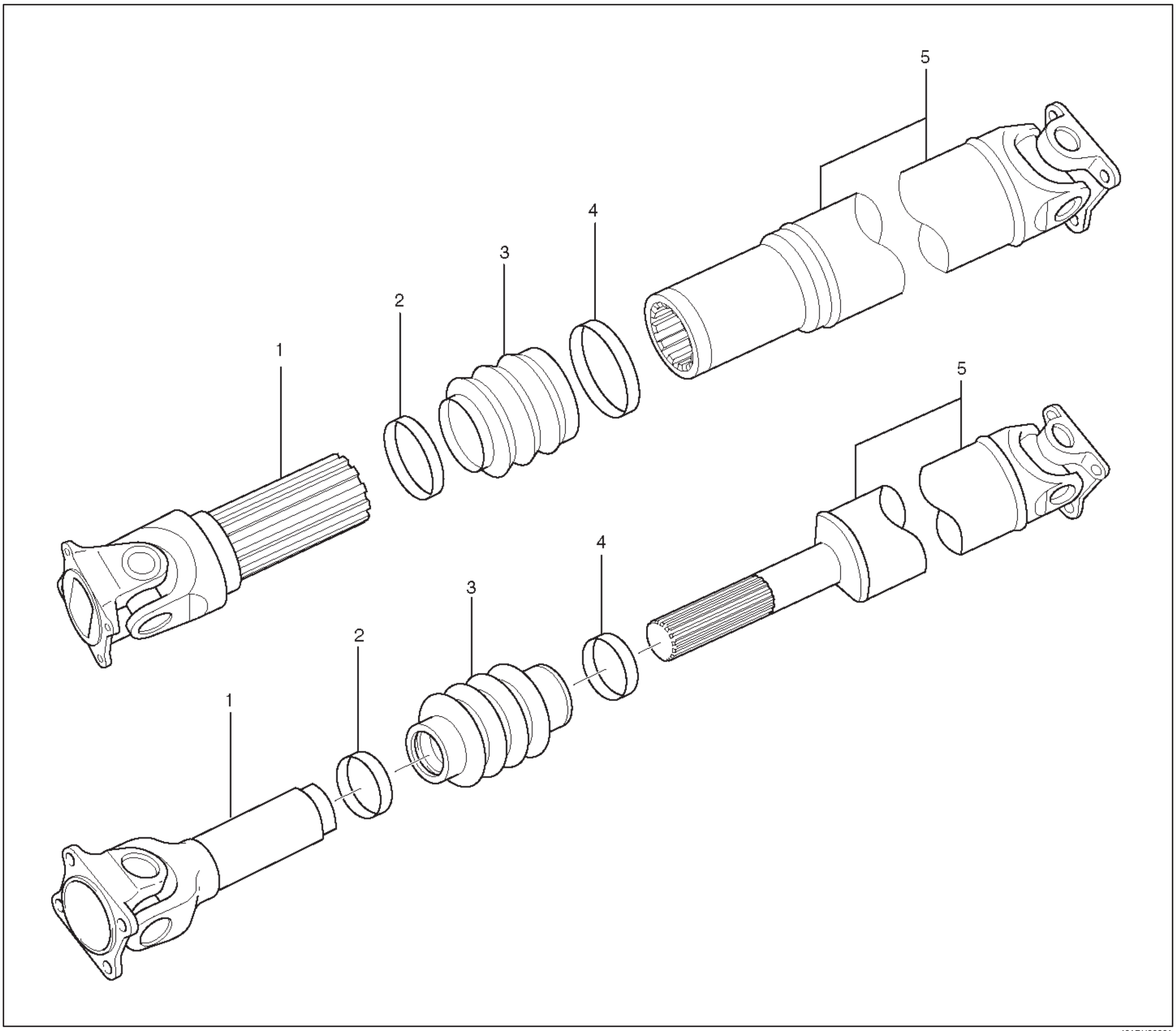
401RW026

3. Install a snap ring.

NOTE: Be sure the snap rings are properly seated in the grooves.

4. Repeat steps 2 and 3 to install the opposite bearing. If the joint is stiff, strike the yoke ears with a soft hammer to seat the bearing.
5. Align the setting marks and join the yokes.

Slip Joint Reassembly



Legend

(1) Spline Yoke and Universal Joint Assembly
(2) Clamp
(3) Boot
(4) Clamp
(5) Tube and Universal Joint Assembly

1. Apply grease evenly to both the female and male splines.
2. Apply a small amount of grease by finger to the outer lips of the boot.
3. Slide the boot (smaller diameter side) onto the spline yoke shaft being careful not to damage the spline coating or boot.
4. Insert the spline yoke shaft spline into the tube assembly being careful to maintain proper phasing. The spider holes should be in line and as per originally marked prior to disassembly.
5. Position boot onto tube and yoke shaft in final position.
6. Attach boot clamps and secure using pliers.
7. Be sure clamp is properly seated and secure.

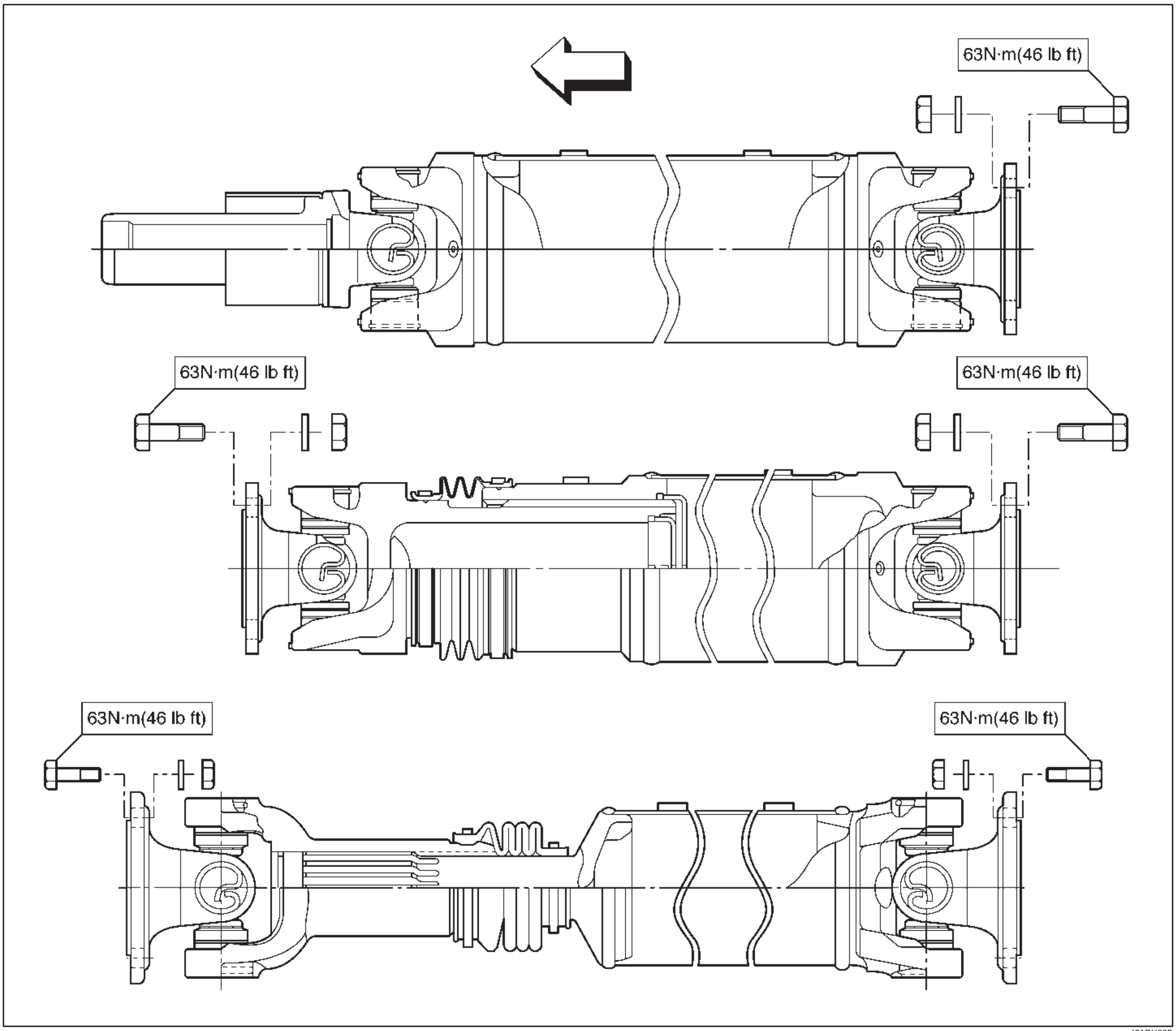
CAUTION: Use new clamp which is the same parts as original. Do not use other clamp to avoid bad balancing of shaft or the grease leakage.

Main Data and Specifications

General Specifications

	2WD Model			4WD Model	
Engine	X22SE	6VD1 (M/T)	6VD1 (A/T)	6VD1 (M/T)	6VD1 (A/T)
Length (between two spiders center)	1314.5 mm (51.75 in)	1298.5 mm (51.12 in)	1343.8 mm (52.91 in)	1212.5 mm (47.73 in)	1043.0 mm (41.06 in)
Universal joint type	Cardan type				

Torque Specifications



401RX005

RODEO

DRIVELINE/AXLE

TRANSFER CASE

CONTENTS

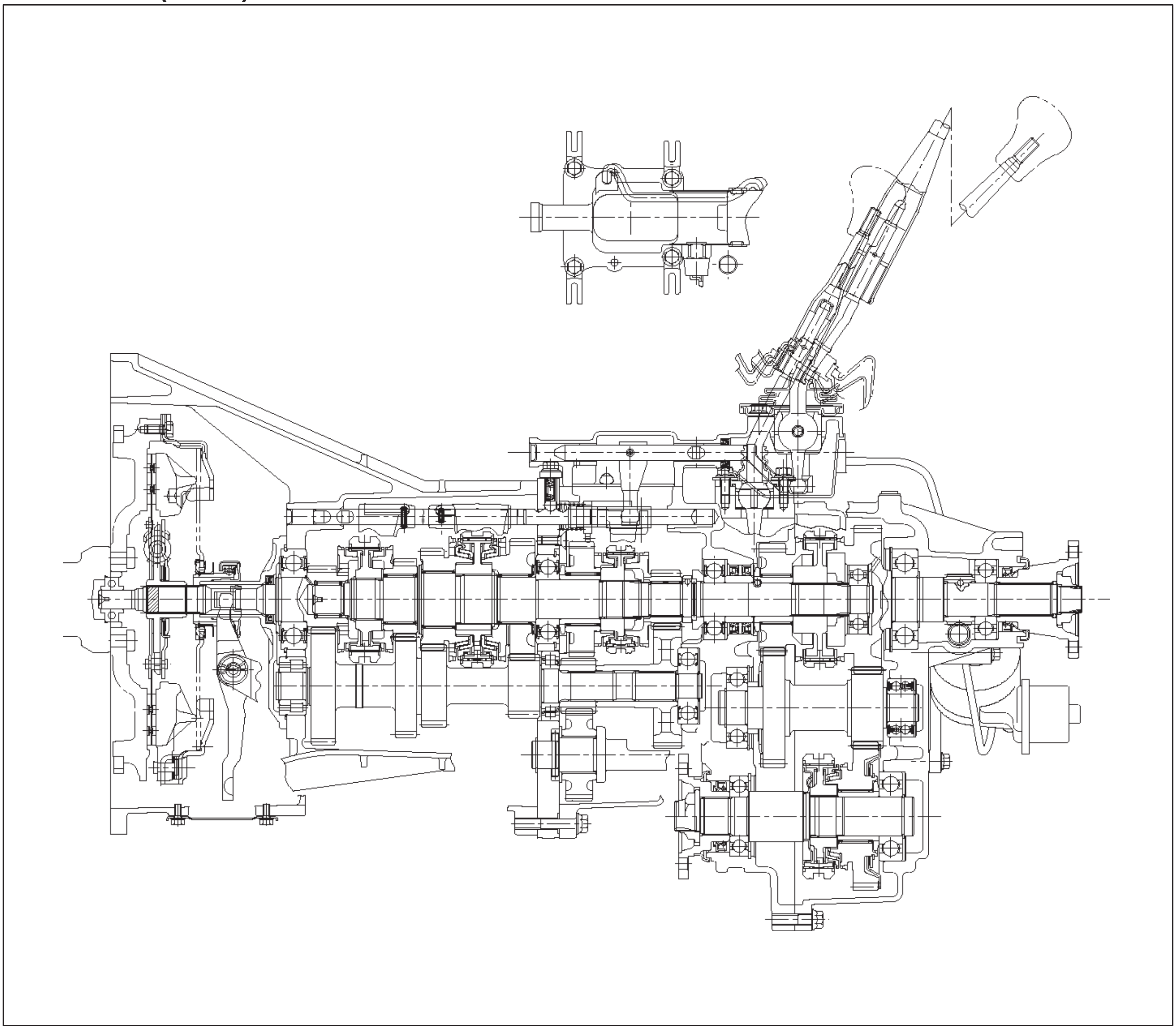
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

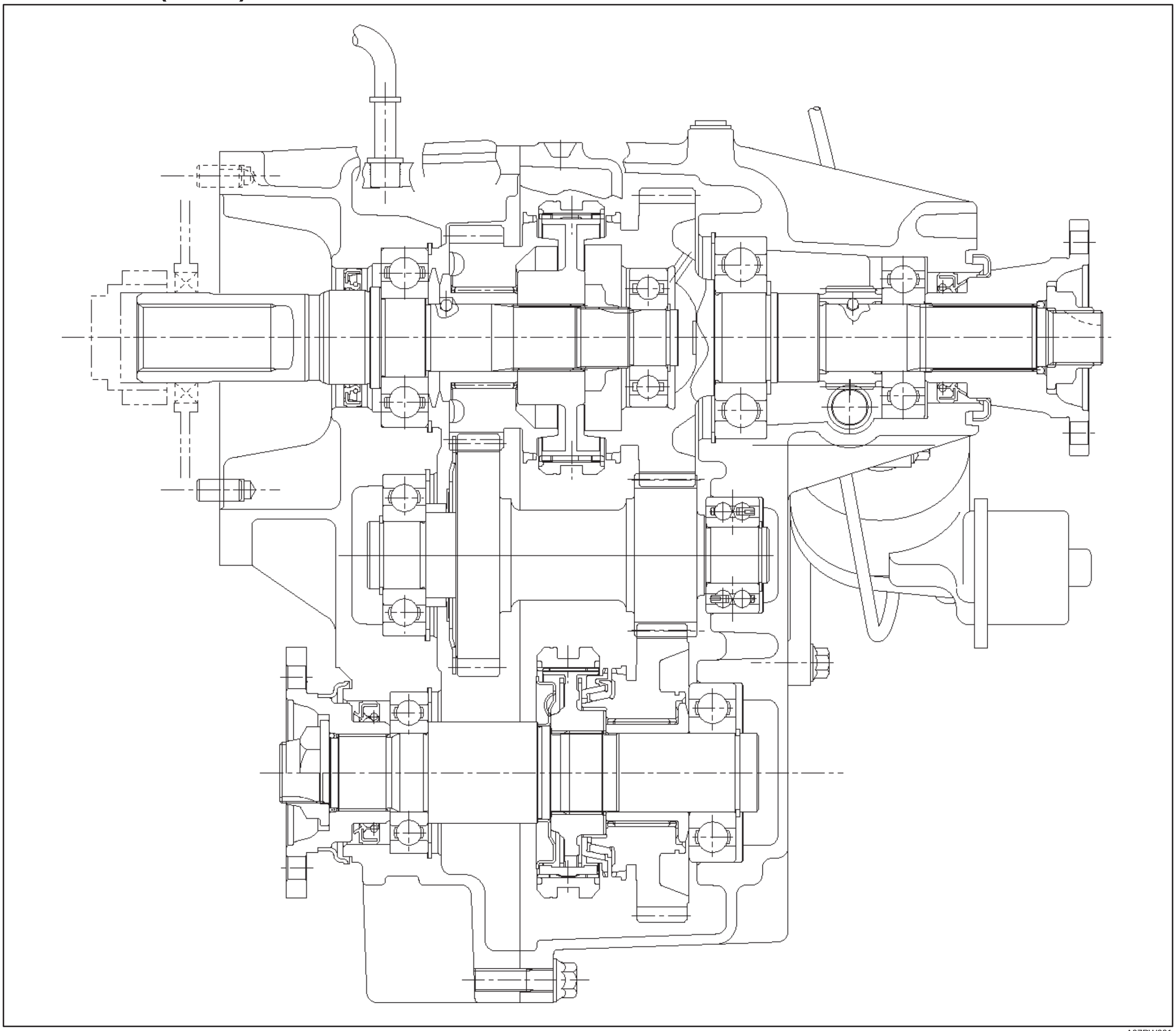
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Transfer Case (for M/T)


A07RW002

Transfer Case (for A/T)



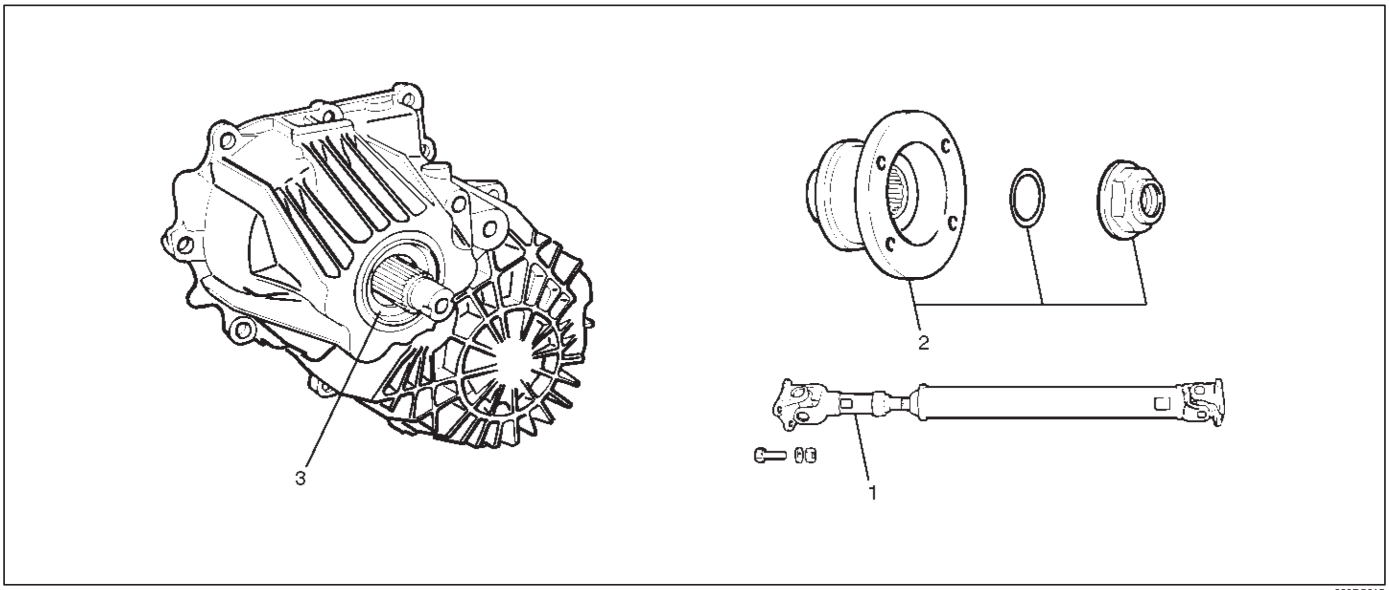
A07RW001

The transfer case is used to provide a means of providing power flow to the front axle. The transfer case also provides a means of disconnecting the front axle, providing better fuel economy and quieter operation when the vehicle is driven on improved roads where four wheel drive is not required. In addition, the transfer case provides an additional gear reduction when placed in low range, which is useful when difficult off–road conditions are encountered.

A floor mounted shift lever is used to select the high–low range. When four wheel drive switch has been turned on, the four wheel drive indicator light is designed to come on and the front axle has been engaged.

Transfer Rear Oil Seal

Transfer Rear Oil Seal and Associated Parts



220RS015

Legend

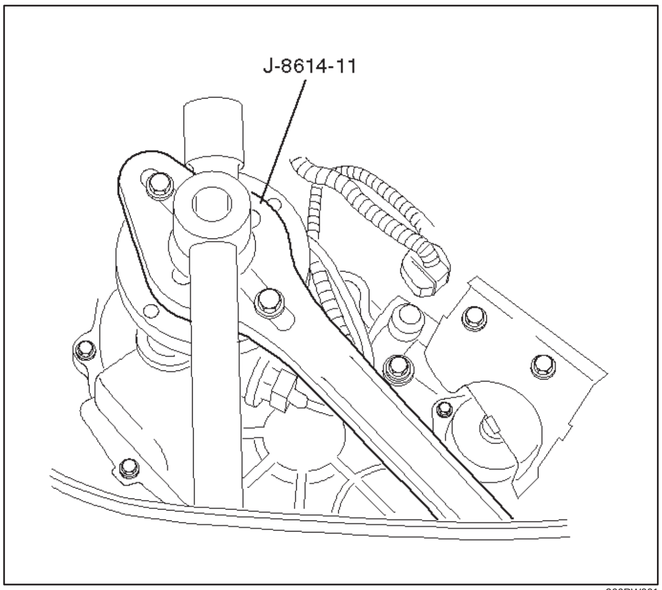
(1) Rear Propeller Shaft

(2) End Nut and Rear Companion Flange

(3) Oil Seal

Removal

1. Disconnect the rear propeller shaft (1) from the transfer case side.
2. Remove end nut and rear companion flange (2), using the companion flange holder J–8614–11.

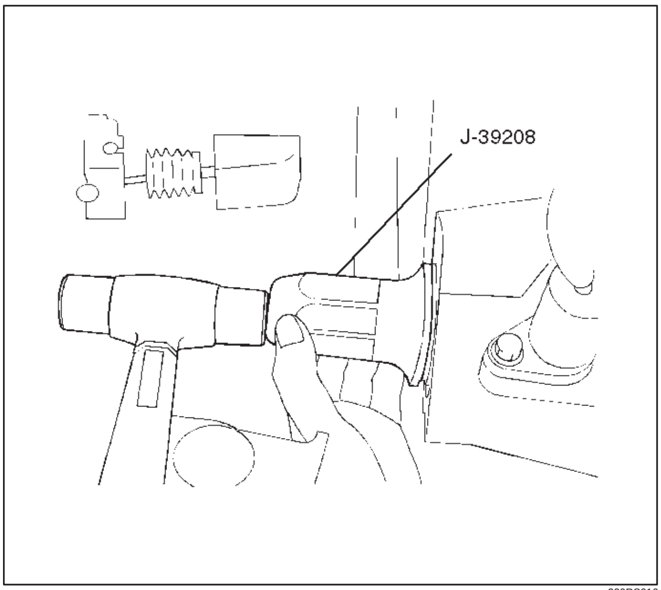


266RW001

3. Use the universal puller to remove the rear companion flange and O–ring.
4. Remove the oil seal from the transfer case.

Installation

1. Install oil seal and apply engine oil to the oil seal outer surfaces.
2. Apply the recommended grease (BESCO L2) or equivalent to the oil seal lip.
3. Use the oil seal installer J–39208 to install the rear seal (3) to the transfer rear case.



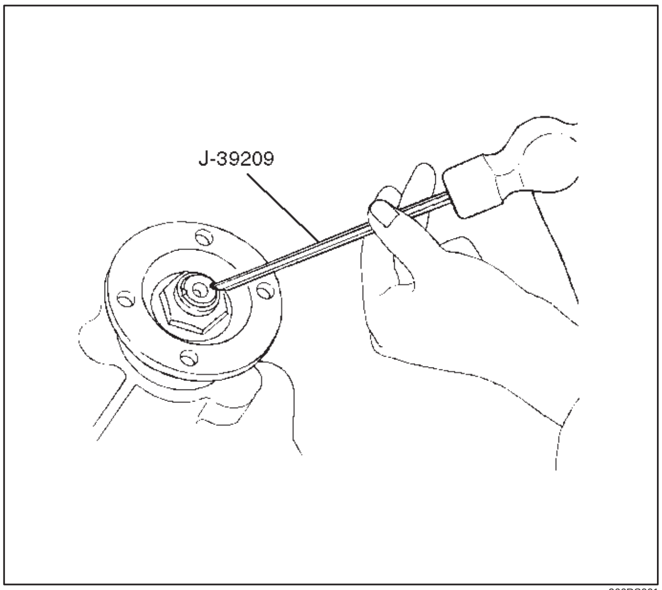
220RS016

4. Install the rear companion flange (2) and O–ring (2).
5. Use the companion flange holder J–8614–11 to install a new end nut (2) and tighten to the specified torque.

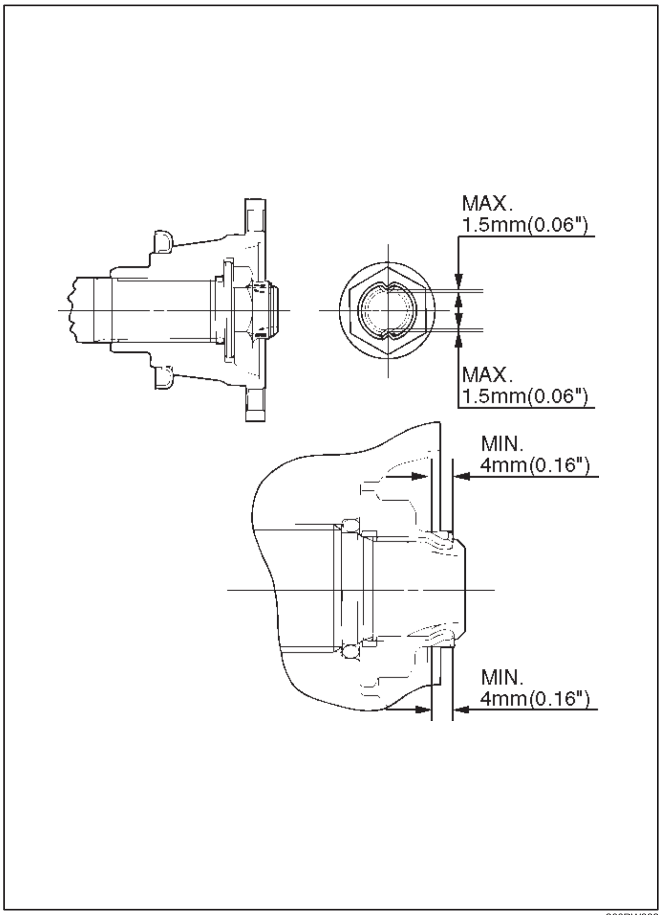
Torque: 167 N·m (123 lb ft)

6. Use the punch J–39209 to stake the end nut at two spots.

NOTE: Be sure to confirm that there is no crack at the staked portion of the end nut (2) after staking.



266RS001



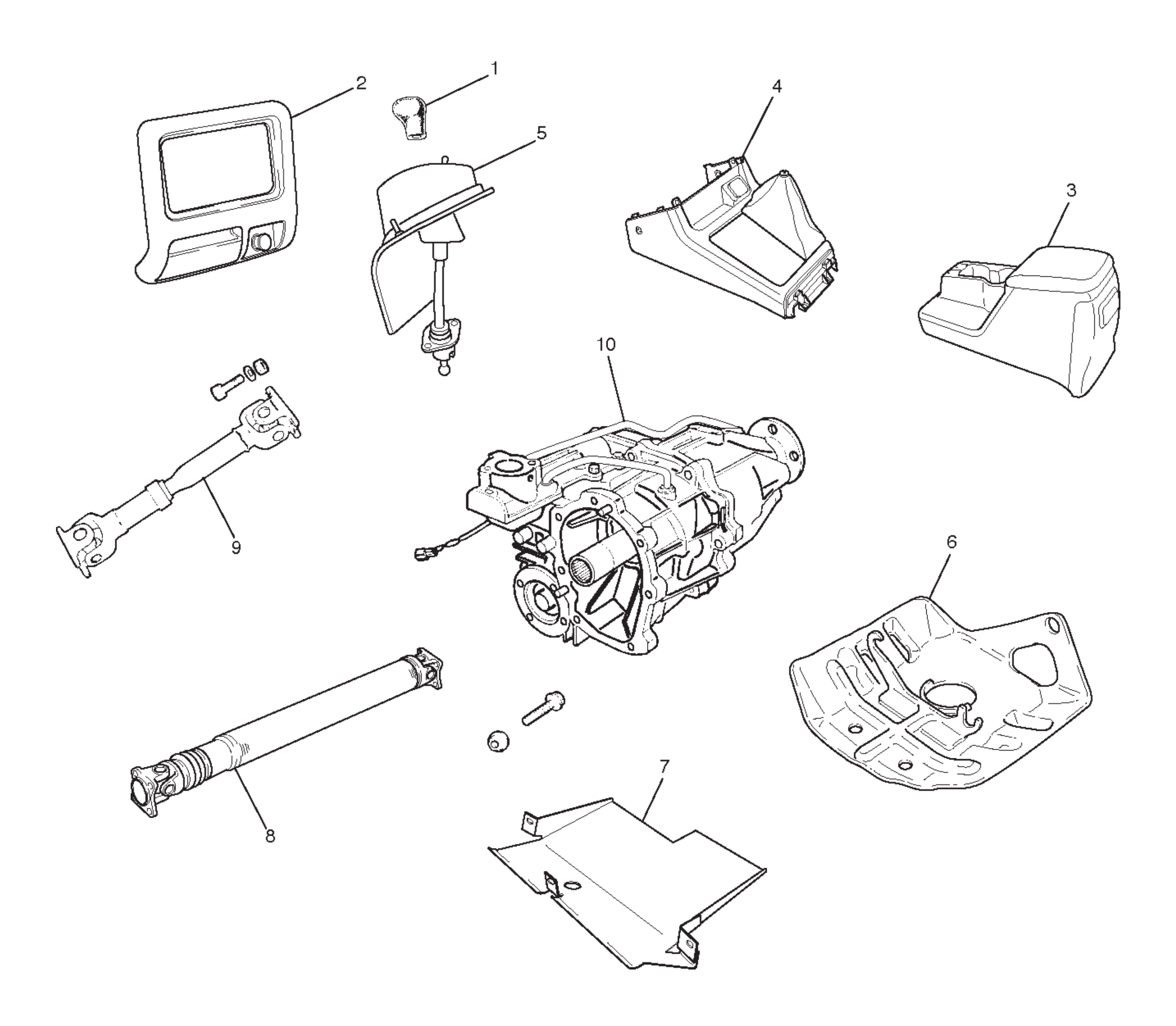
266RW002

7. Connect the rear propeller shaft to the transfer case and tighten to the specified torque.

Torque: 63 N·m 46 (lb ft)

Transfer Case Assembly (A/T)

Transfer Case Assembly (A/T) and Associated Parts



260RW008

Legend

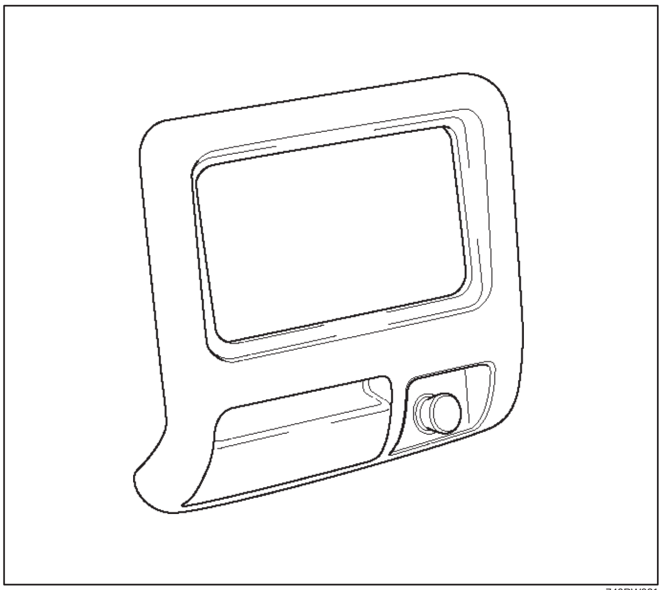
(1) Transfer Control Lever Knob
(2) Lower Cluster Assembly
(3) Rear Console
(4) Center Console
(5) Grommet Assembly and Transfer Control Lever
(6) Transfer Protector
(7) Fairing Plate
(8) Rear Propeller Shaft
(9) Front Propeller Shaft
(10) Transfer Case Assembly

Removal

NOTE: Before removing transmission and transfer assembly from vehicle, change the transfer mode to 2WD using the 4WD push button switch on dash panel.

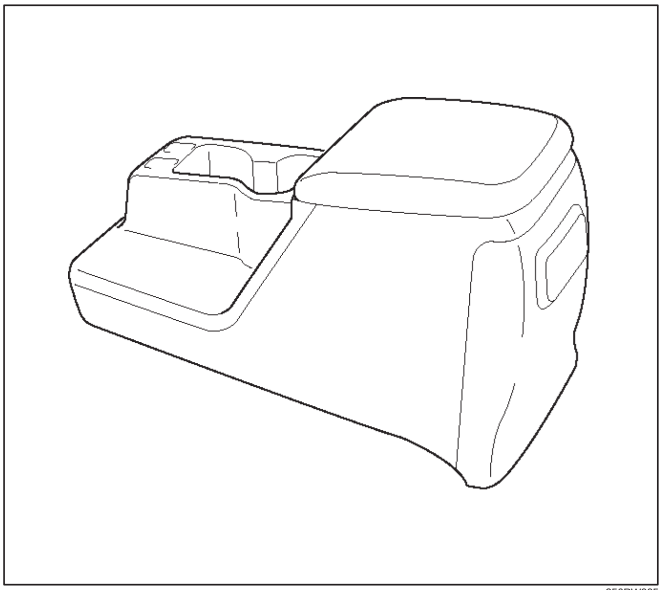
1. Disconnect battery ground cable.
2. Remove transfer control lever knob (1).

3. Remove lower cluster assembly (2).



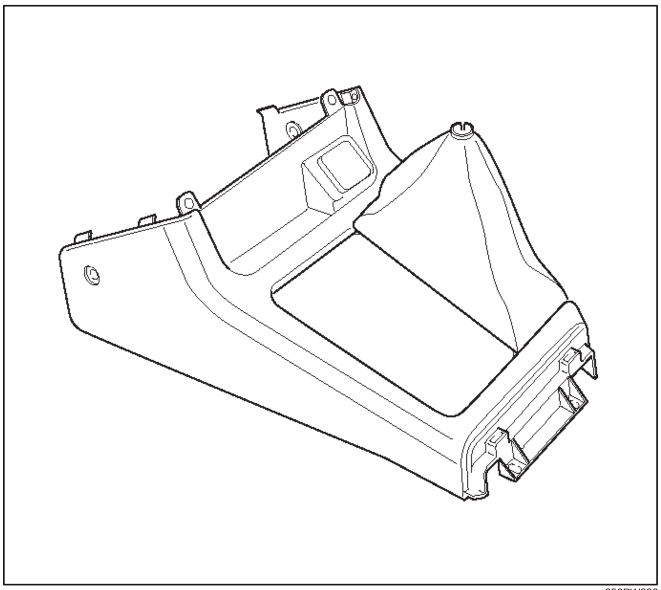
740RW021

4. Remove rear console (3).



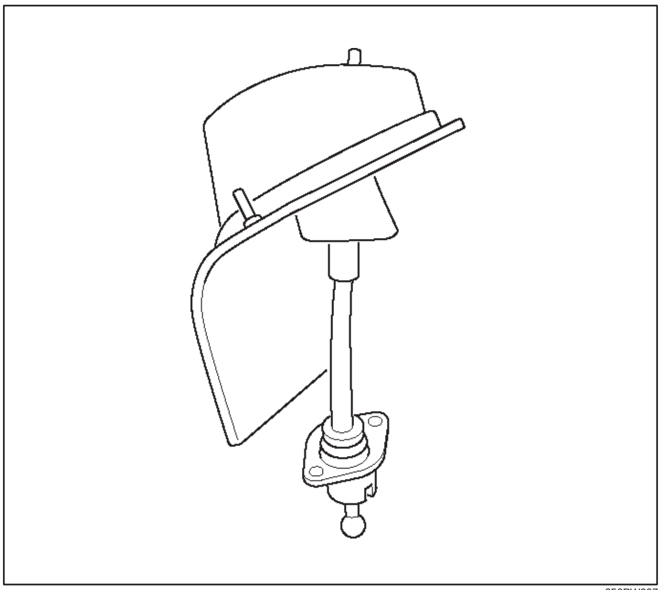
256RW005

5. Remove center console (4).



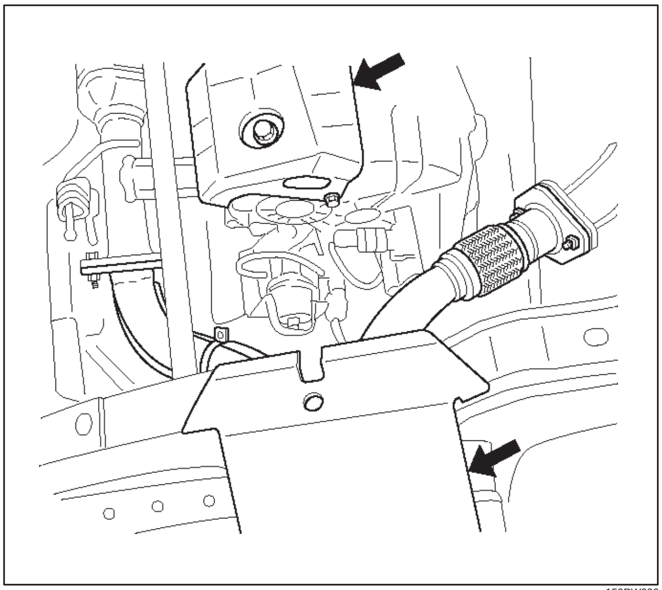
256RW006

6. Remove grommet assembly and transfer control lever (5).



256RW007

7. Raise and support vehicle with suitable stands. Drain transfer case fluid.
8. Remove transfer protector (6) and fairing plate (7).



150RW006

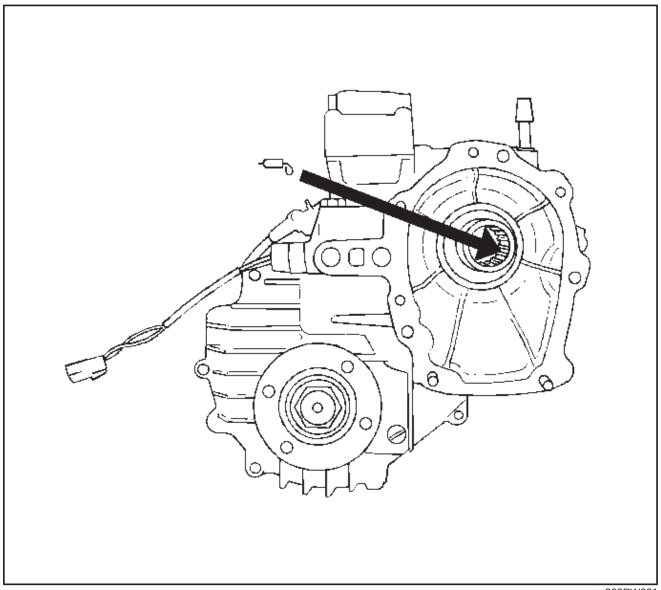
9. Remove rear propeller shaft (8) and front propeller shaft (9).

NOTE: Apply alignment marks on the flange at both front and rear sides.

10. Disconnect harness connectors and clip.
    Connector: transfer switch, 2WD–4WD actuator, speed sensor.
11. Support transmission case with a transmission jack.
12. Remove the top position bolt from transfer control lever hole and others under the floor.
    Remove transfer case (10) from the vehicle.

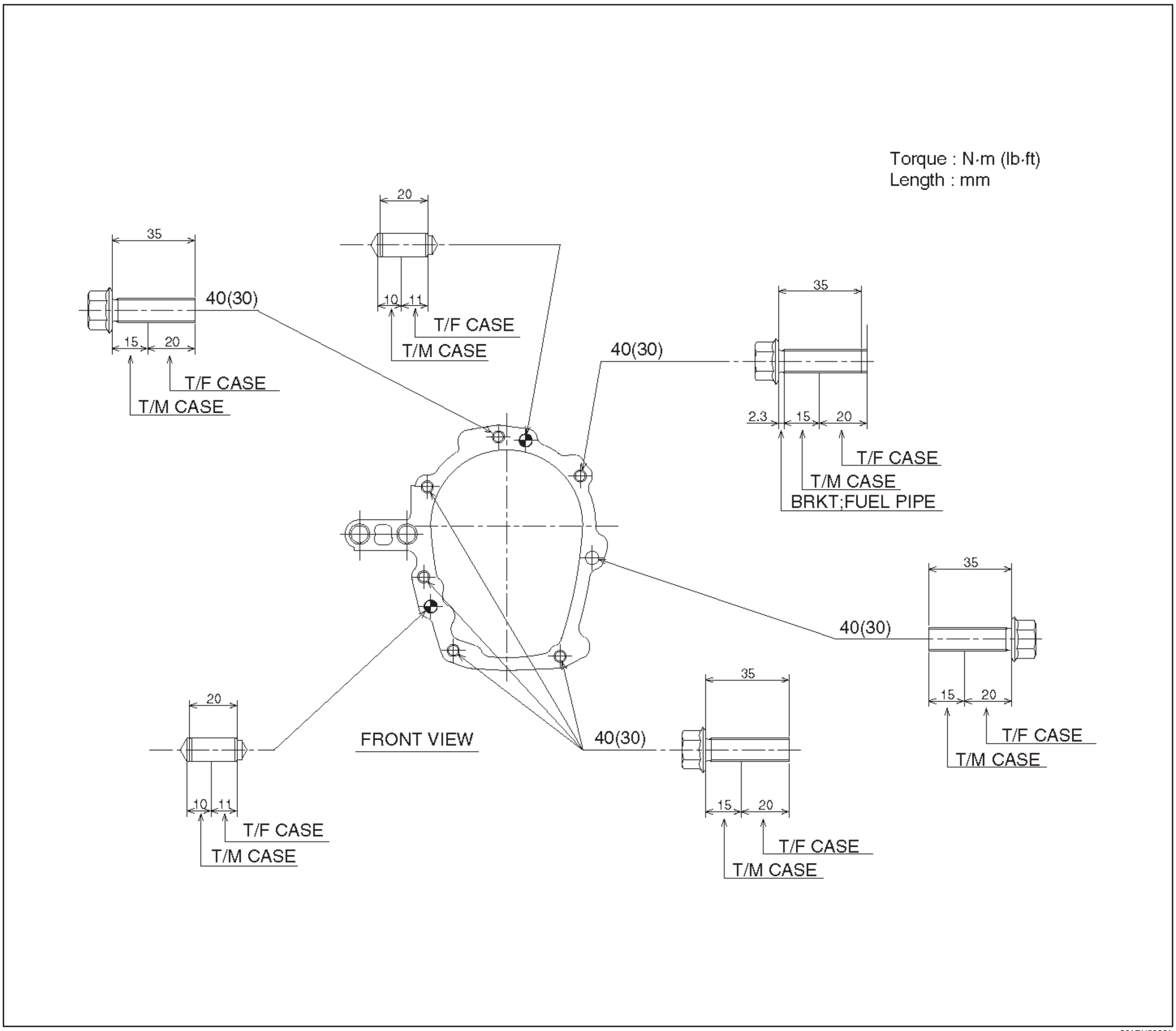
Installation

1. Apply a thin coat of molybdenum disulfide grease to the input shaft spline as shown in the figure.



260RW001

2. Install transfer case (10) to the transmission. Tighten transfer bolts as shown in the figure.

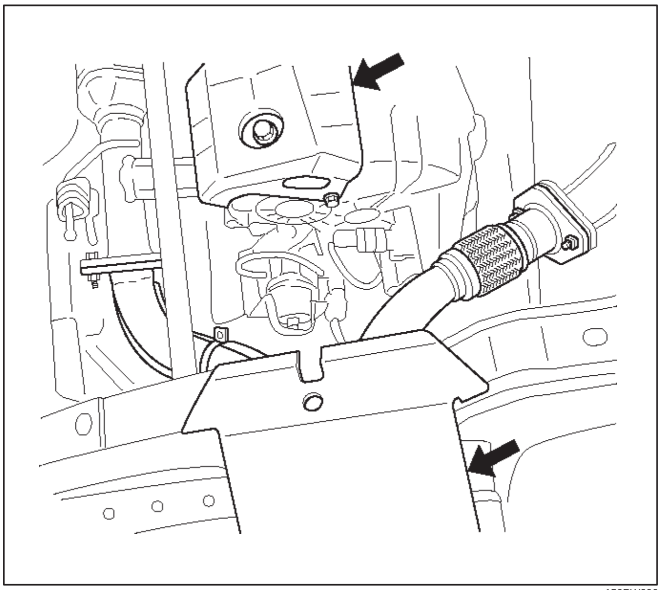


261RX00001

3. Remove the transmission jack from transmission side.
4. Connect harness connectors and clip.
   Connector: transfer switch, 2WD–4WD actuator, speed sensor.
5. Install rear propeller shaft (8) and front propeller shaft (9).

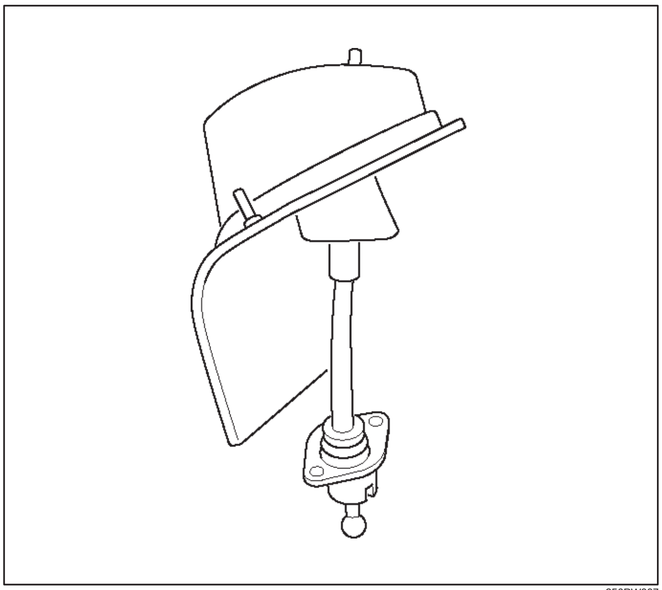
Torque: 63 N·m (46 lb ft)

6. Install transfer protector (6) and fairing plate (7).



150RW006

7. Fill transfer case fluid.
8. Lower the vehicle.
   Install grommet assembly and transfer control lever (5).

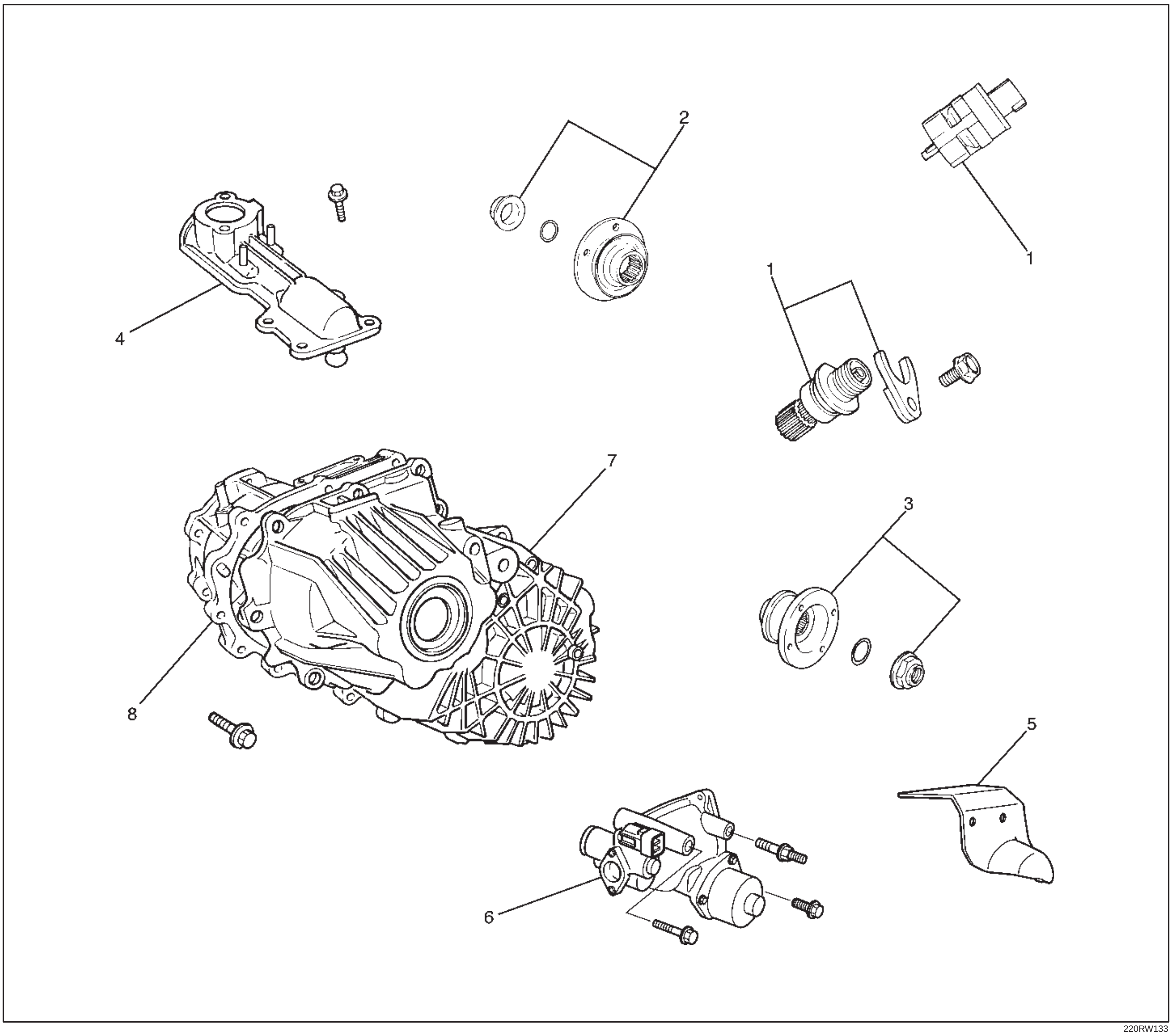


256RW007

9. Install center console (4), rear console (3) and lower cluster assembly (2).
10. Install transfer control lever knob (1).

Transfer Rear Case Assembly (A/T)

Transfer Rear Case Assembly (A/T) and Associated Parts



Legend

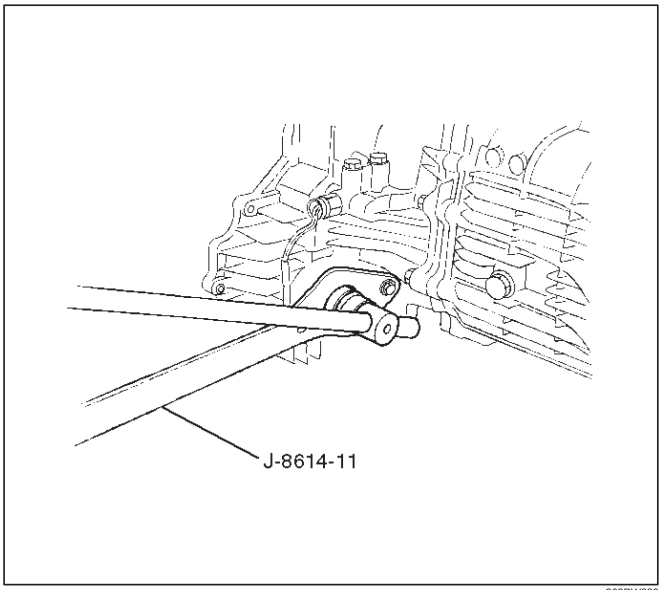
(1) Speedometer Sensor, Speedometer Driven Gear and Plate
(2) Front Companion Flange
(3) Rear Companion Flange
(4) Control Box Assembly
(5) 2WD–4WD Actuator Heat Protector
(6) 2WD–4WD Actuator Assembly
(7) Transfer Rear Cover Assembly
(8) Transfer Case Assembly

Removal

1. Remove the speedometer sensor (1).
2. Remove the plate (1).
3. Remove the speedometer driven gear bushing and driven gear (1).

NOTE: Apply a reference mark to the driven gear bushing before removal.

4. Remove front companion flange (2) and rear companion flange (3), using the flange companion holder J–8614–11 to remove the end nut..

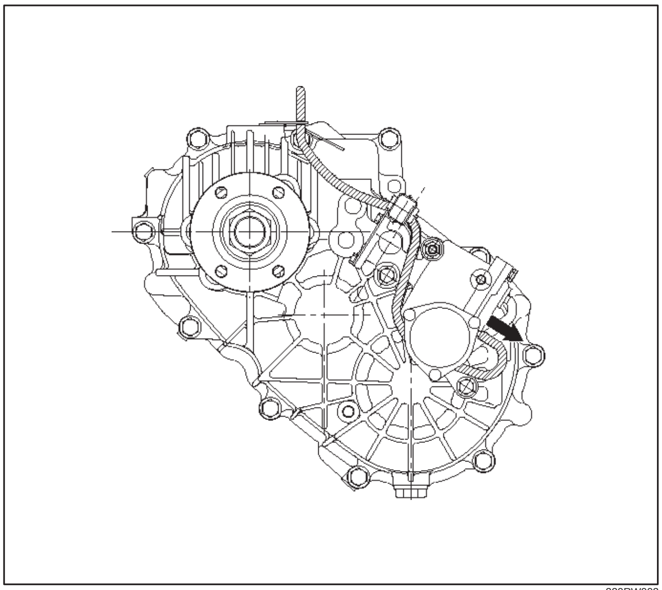


262RW009

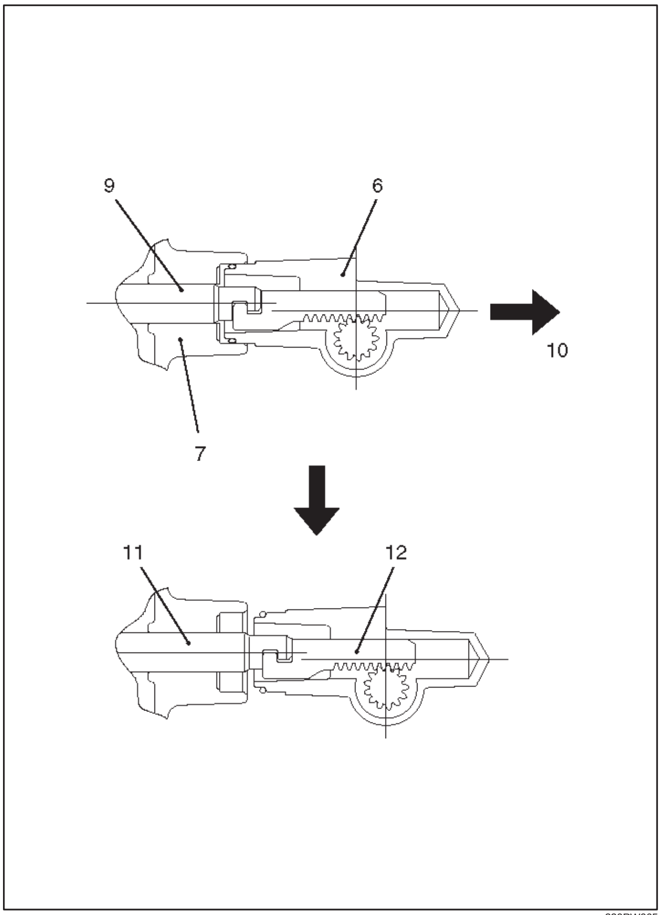
5. Remove the front and rear companion flange.

NOTE: Use the universal puller to remove the rear companion flange.

6. Disconnect the actuator breather hose and transfer breather hose from control box (4).
7. Remove control box assembly (4).
8. Disconnect the actuator breather hose and 2WD–4WD actuator heat protector (5) from the 2WD–4WD actuator assembly (6).


220RW002

9. Remove the 2WD–4WD actuator assembly bolts.
10. Pull the 2WD–4WD actuator assembly (6) with 2WD–4WD shift rod.

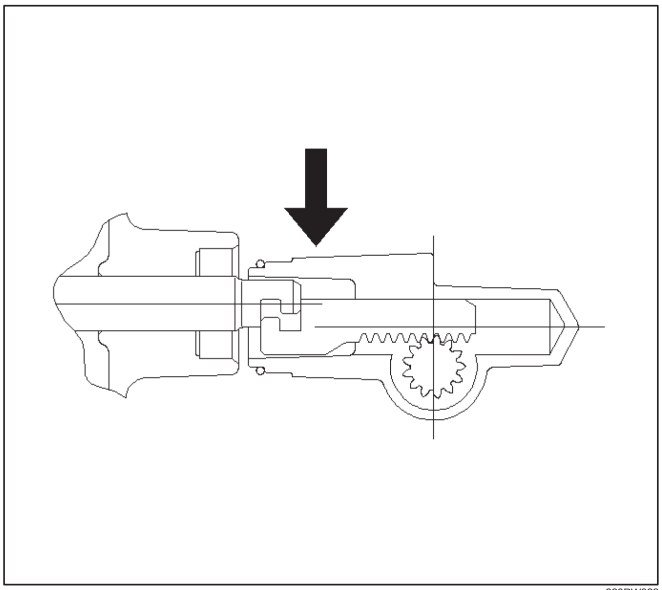


220RW065

Legend

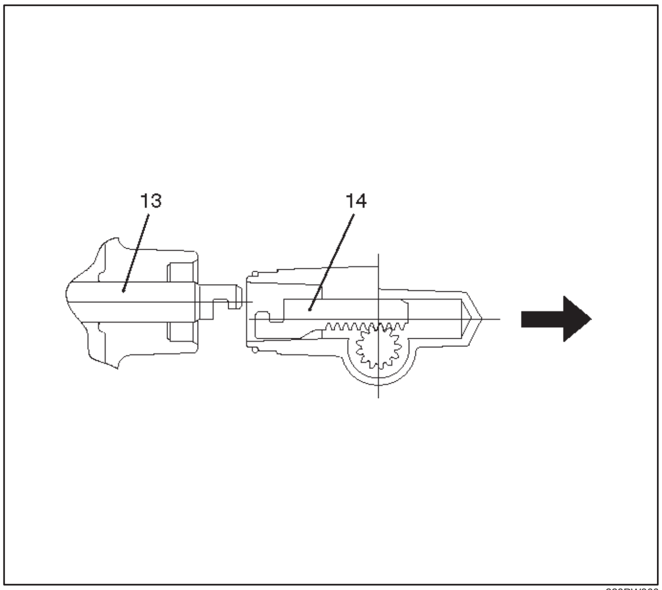
- (6) 2WD–4WD Actuator Assembly
- (7) Rear Cover Assembly
- (9) Shift Rod: 2WD–4WD (Position: 2WD)
- (10) Pull
- (11) Position: 4WD
- (12) Mode: 2WD

11. Off set the actuator assembly.



220RW028

12. Remove the actuator assembly (6).



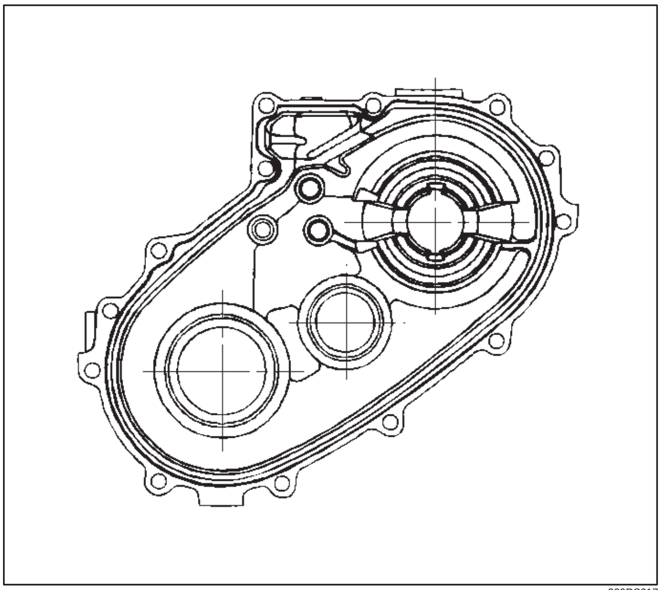
220RW066

Legend
(13) Position: 4WD
(14) Mode: 2WD

13. Remove transfer rear cover assembly (7) from transfer case assembly.

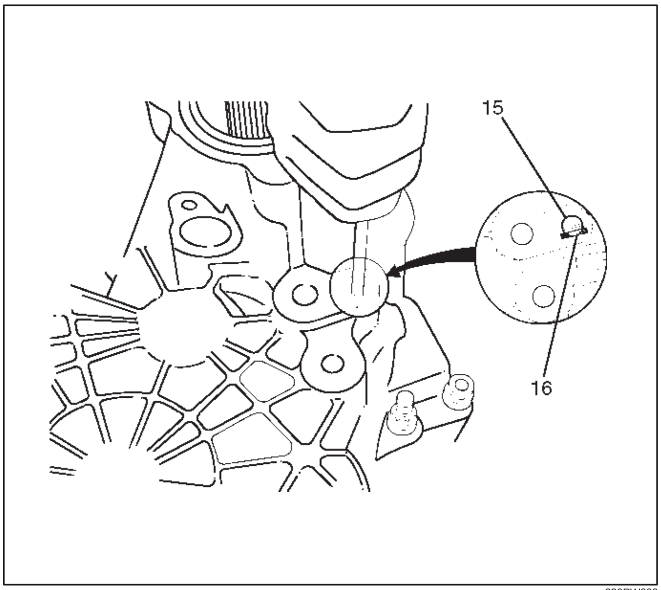
Installation

1. Apply the recommended liquid gasket (LOCTITE 17430) or its equivalent to the transfer rear cover fitting faces.



220RS017

2. Install transfer rear cover assembly (7) to transfer case assembly (8).
3. Perform the following steps before fitting the transfer rear case.
   1. Shift the high–low shift rod to the 4H side.
   2. The cut–away portion of the select rod head (15) should align with that of the rear case hole's stopper (16).

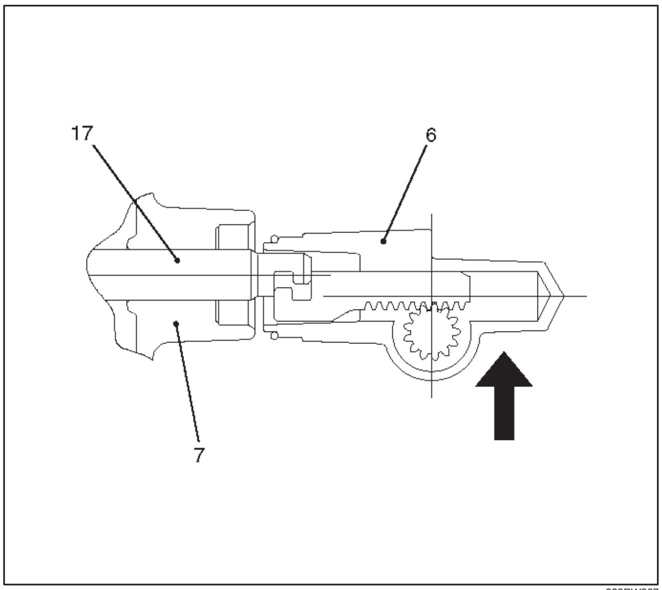


230RW009

4. Tighten the transfer rear case bolts to the specified torque.

Torque: 37 N·m (27 lb ft)

5. Shift the 2WD–4WD shift rod (17) to the 4WD side.
6. Join the rod grooves of 2WD–4WD actuator assembly (6) and shift rod (17).

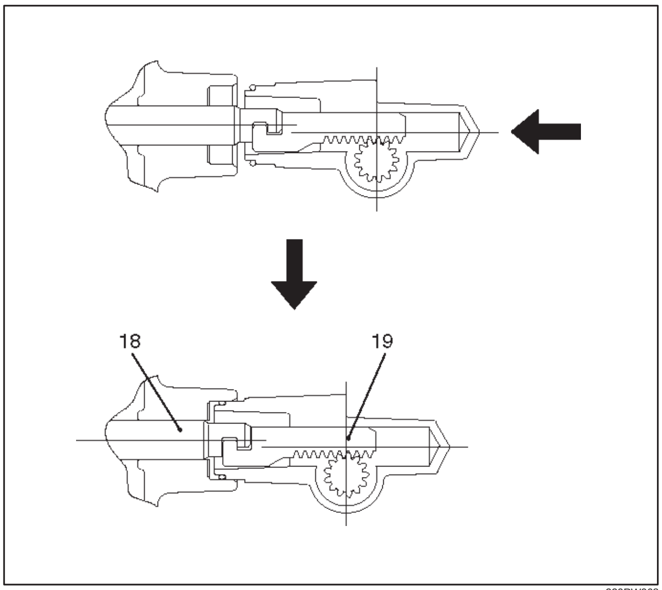


220RW067

Legend

(6) 2WD–4WD Actuator Assembly (Mode: 2WD)
(7) Rear Cover Assembly
(17) Shift Rod: 2WD–4WD (Position: 4WD)

7. Push the 2WD–4WD actuator assembly (6) with 2WD–4WD shift rod (17) till the shift rod (17) reaches the 2WD position.



220RW068

Legend

(18) Position: 2WD
(19) Mode: 2WD

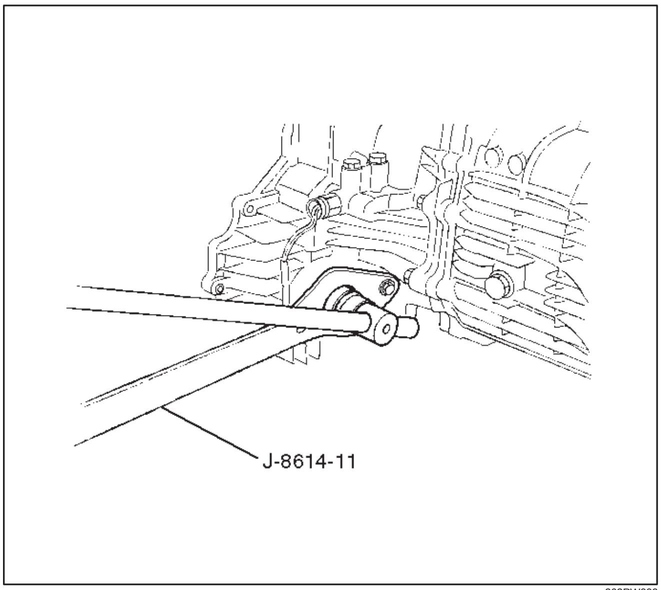
8. Tighten the 2WD–4WD actuator bolts to the specified torque.

Torque: 19 N·m (14 lb ft)

9. Connect the actuator breather hose to actuator.
10. Install actuator heat protector (5).
11. Install control box assembly (4).

Torque: 19 N·m (14 lb ft)

12. Connect breather hoses to control box (4).
13. Install rear companion flange (3) and front companion flange (2), using the companion flange holder J–8614–11 to tighten the flange nuts to the transfer case.



262RW009

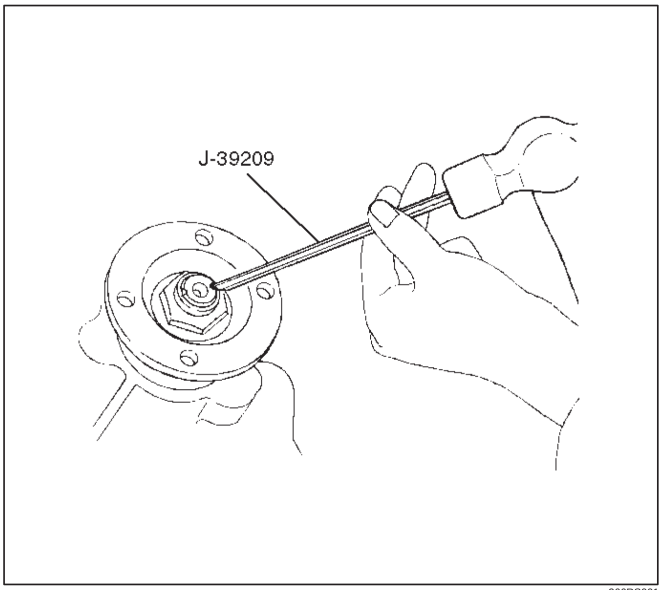
14. Tighten the new transfer flange nuts to the specified torque.

Torque

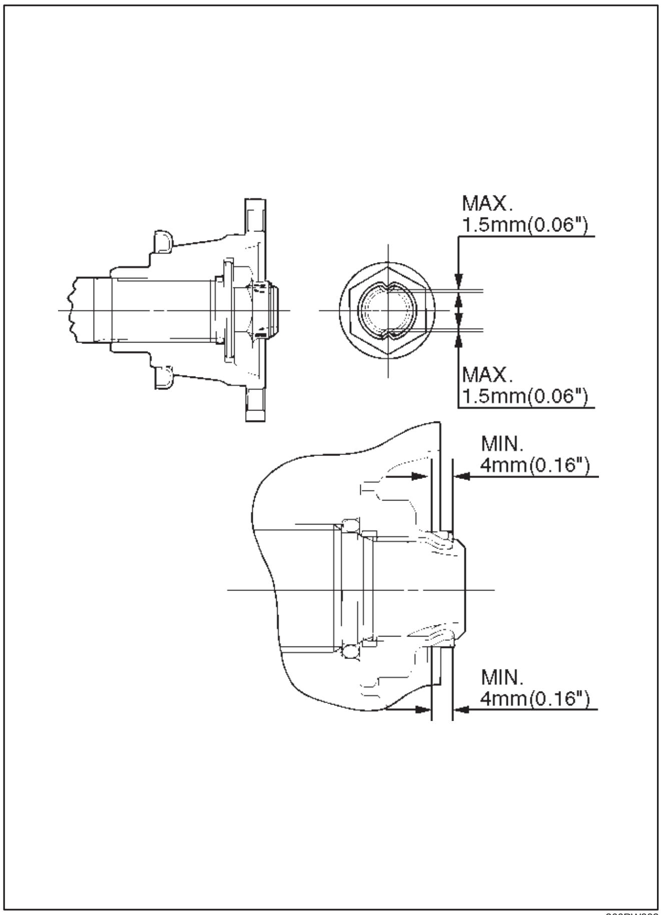
Rear companion flange: 167 N·m (123 lb ft)

Front companion flange: 137 N·m (101 lb ft)

15. Use the punch J–39209 to stake the rear companion flange nut (3) at two spots.



266RS001



266RW002

16. Stake the front companion flange nut (2) at one spot.

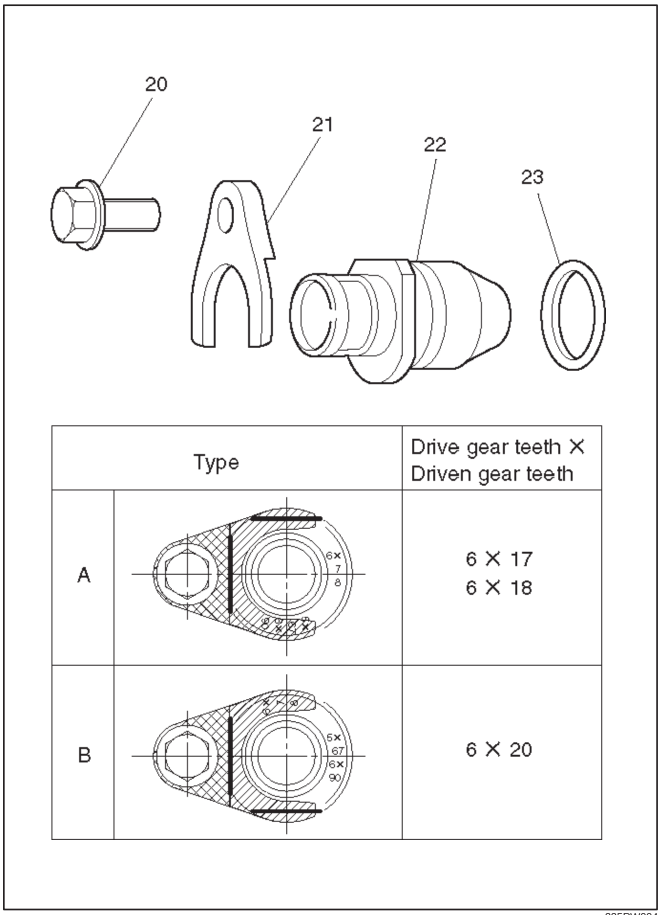
NOTE: Be sure to confirm that there is no crack at the staked portion of the flange nut after staking.

17. Install the O–ring (23) to the speedometer driven gear bushing (22).
18. Install the driven gear to the speedometer driven gear bushing (22).
19. Install the speedometer driven gear assembly to the transfer rear cover.
20. Install the plate (21) to the transfer rear case and tighten to the specified torque.

Torque: 15 N·m (11 lb ft)

21. Install the speedometer sensor and tighten to the specified torque.

Torque: 27 N·m (20 lb ft)

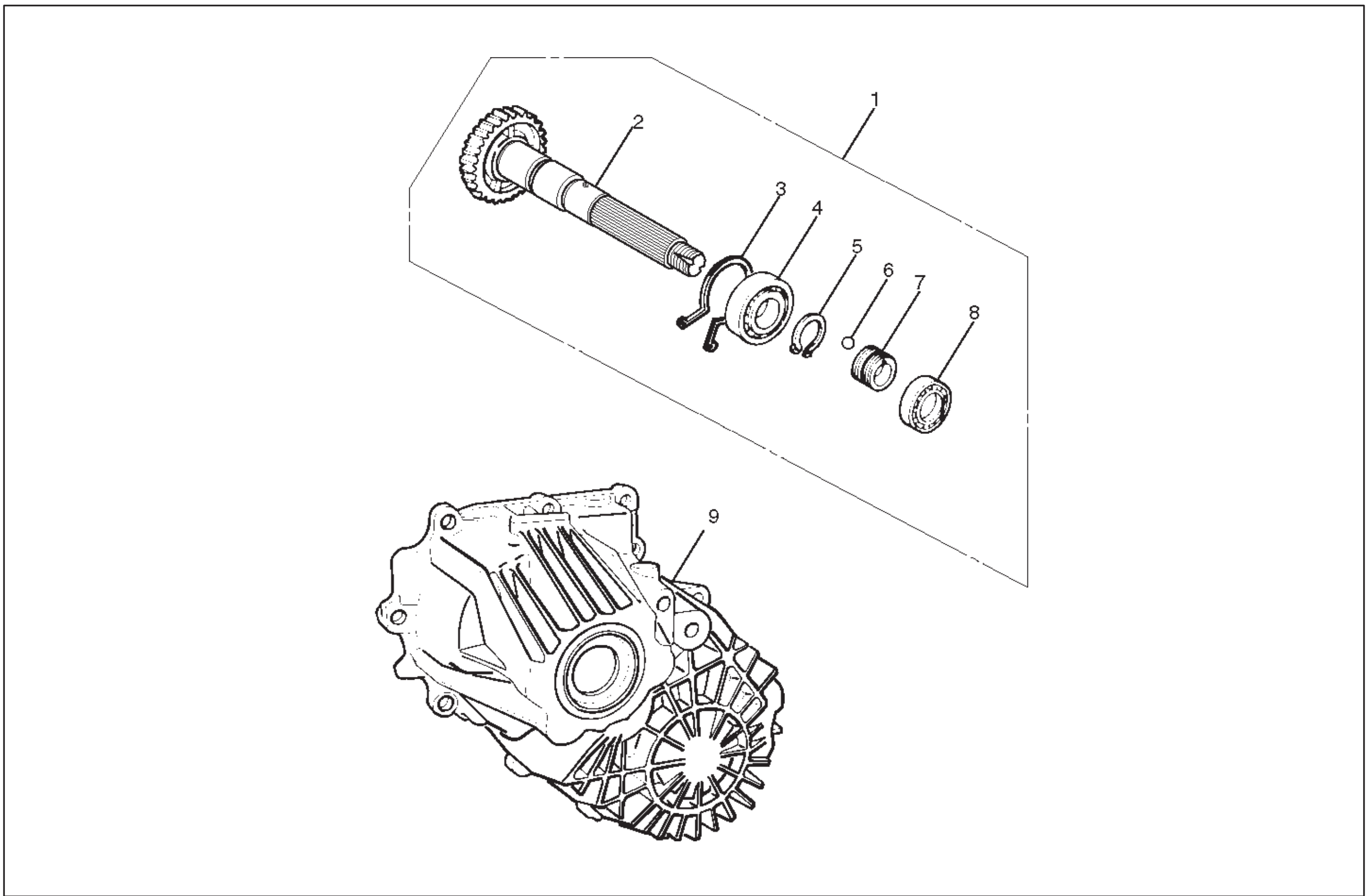


225RW004

Legend

(20) Bolt
(21) Plate
(22) Bushing
(23) O–ring

Transfer Rear Cover Assembly



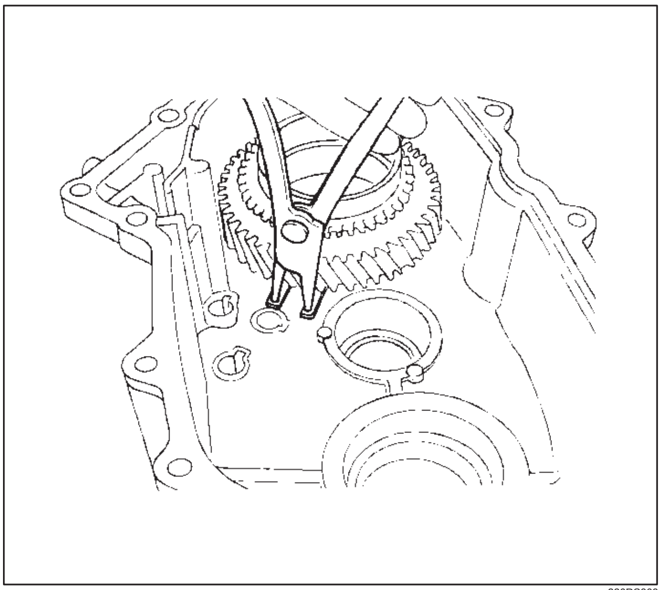
226RW154

Legend

(1) Rear Output Shaft Assembly
(2) Rear Output Shaft
(3) Bearing Snap Ring
(4) Ball Bearing
(5) Bearing Snap Ring
(6) Ball
(7) Speedometer Drive Gear
(8) Ball Bearing
(9) Transfer Rear Cover (with oil seal)

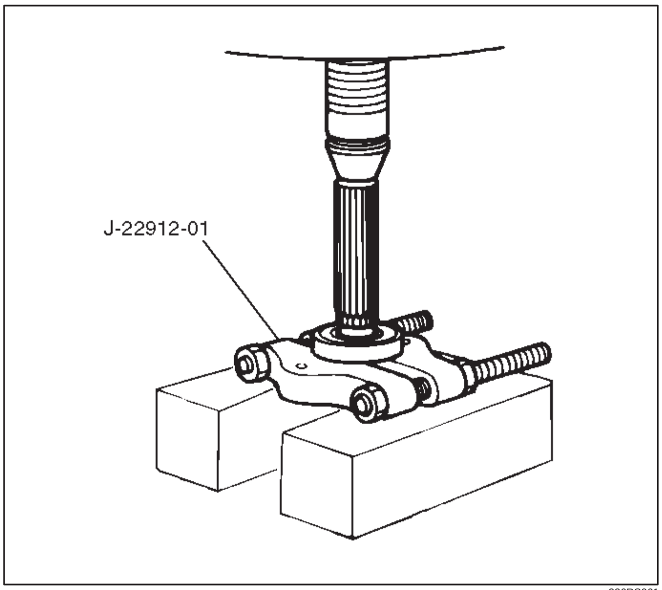
Disassembly

1. Remove bearing snap ring, use a pair of snap ring pliers to remove the snap ring (3).



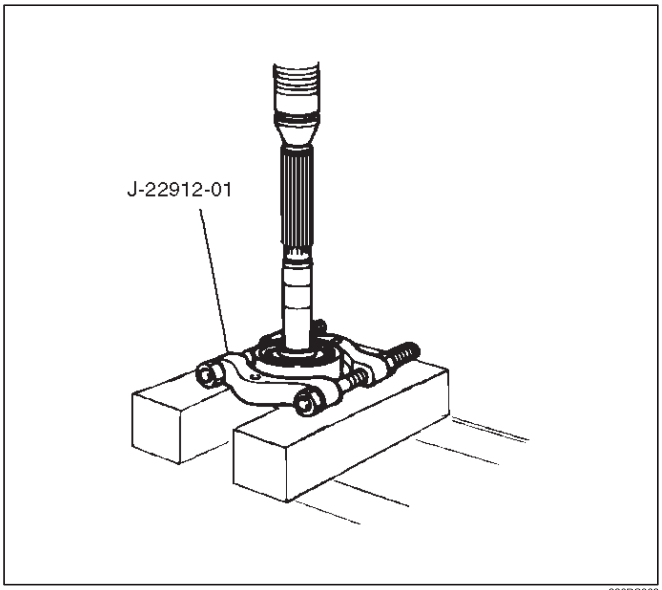
226RS060

2. Remove the rear output shaft assembly (1) from the transfer rear cover (with oil seal) (9).
3. Remove ball bearing (8), using a bench press and the bearing remover J–22912–01.



226RS061

4. Remove speedometer drive gear (7).
5. Remove ball (6).
6. Remove bearing snap ring (5), using a pair of snap ring pliers.
7. Remove rear output shaft (2) from the ball bearing (4), using a bench press and the bearing remover J–22912–01.



226RS062

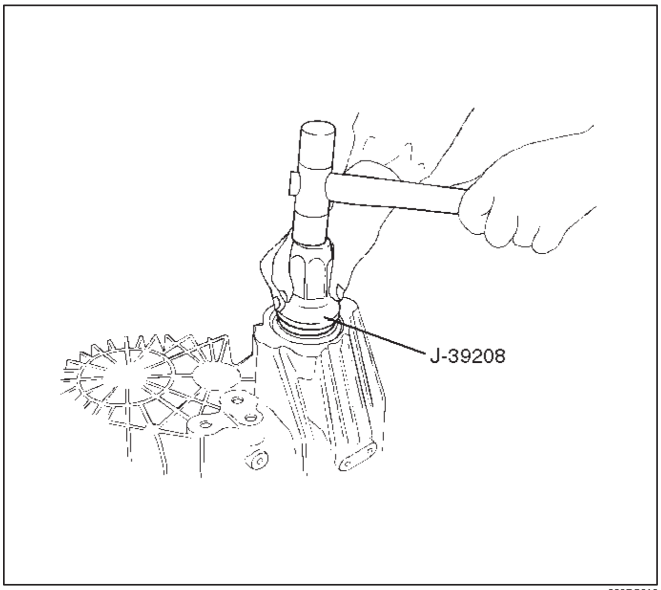
Inspection and Repair

Refer to “TRANSFER CASE ASSEMBLY” in this section for inspection and repair.

Reassembly

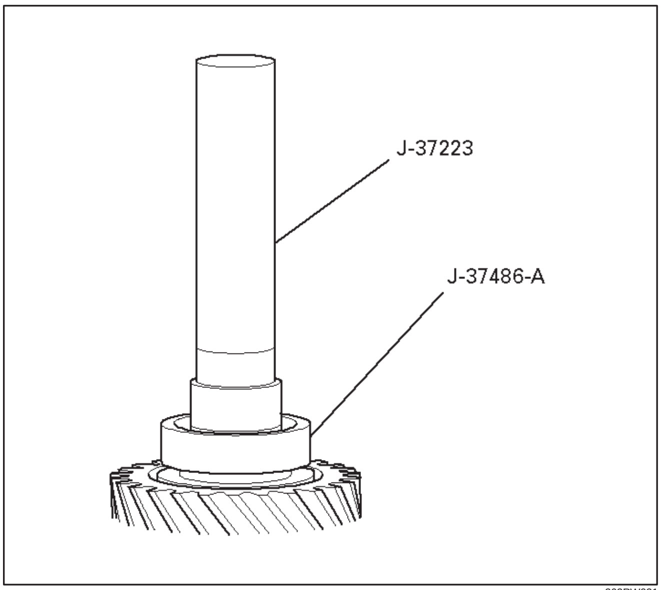
Transfer rear cover (with oil seal) (9). Oil seal replacement.

- Remove the oil seal from the transfer rear cover.
- Apply engine oil to the oil seal outer surfaces.
- Fill in recommended grease (BESCO L2) or equivalent in the oil seal lip.
- Use the oil seal installer J–39208 to install the rear oil seal to the transfer rear cover.



220RS019

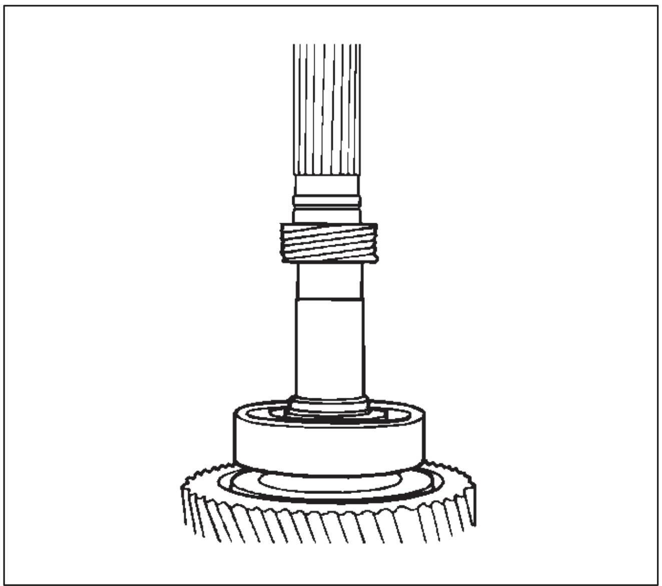
1. Install ball bearing (4) to the rear output shaft (2), using the ball bearing installer J–37223 and the adapter J–37486–A.



262RW021

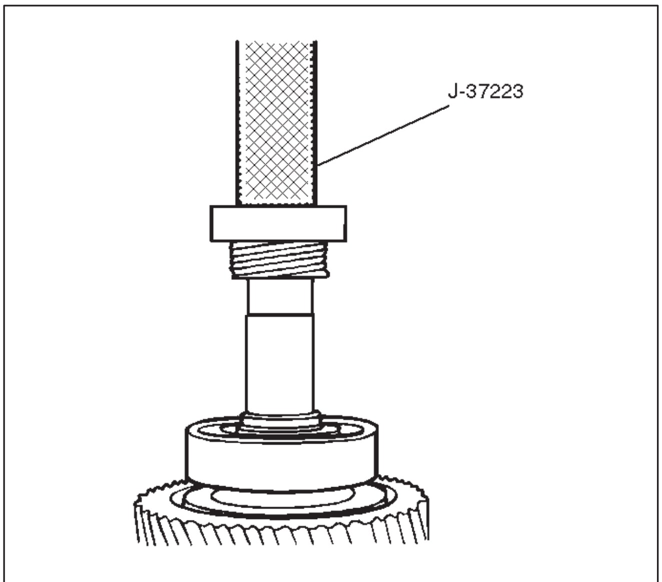
2. Install bearing snap ring (5), using a pair of snap ring pliers.
3. Install ball (6).

4. Install speedometer drive gear (7).



226RS064

5. Use the ball bearing installer J–37223 to install the ball bearing (8).



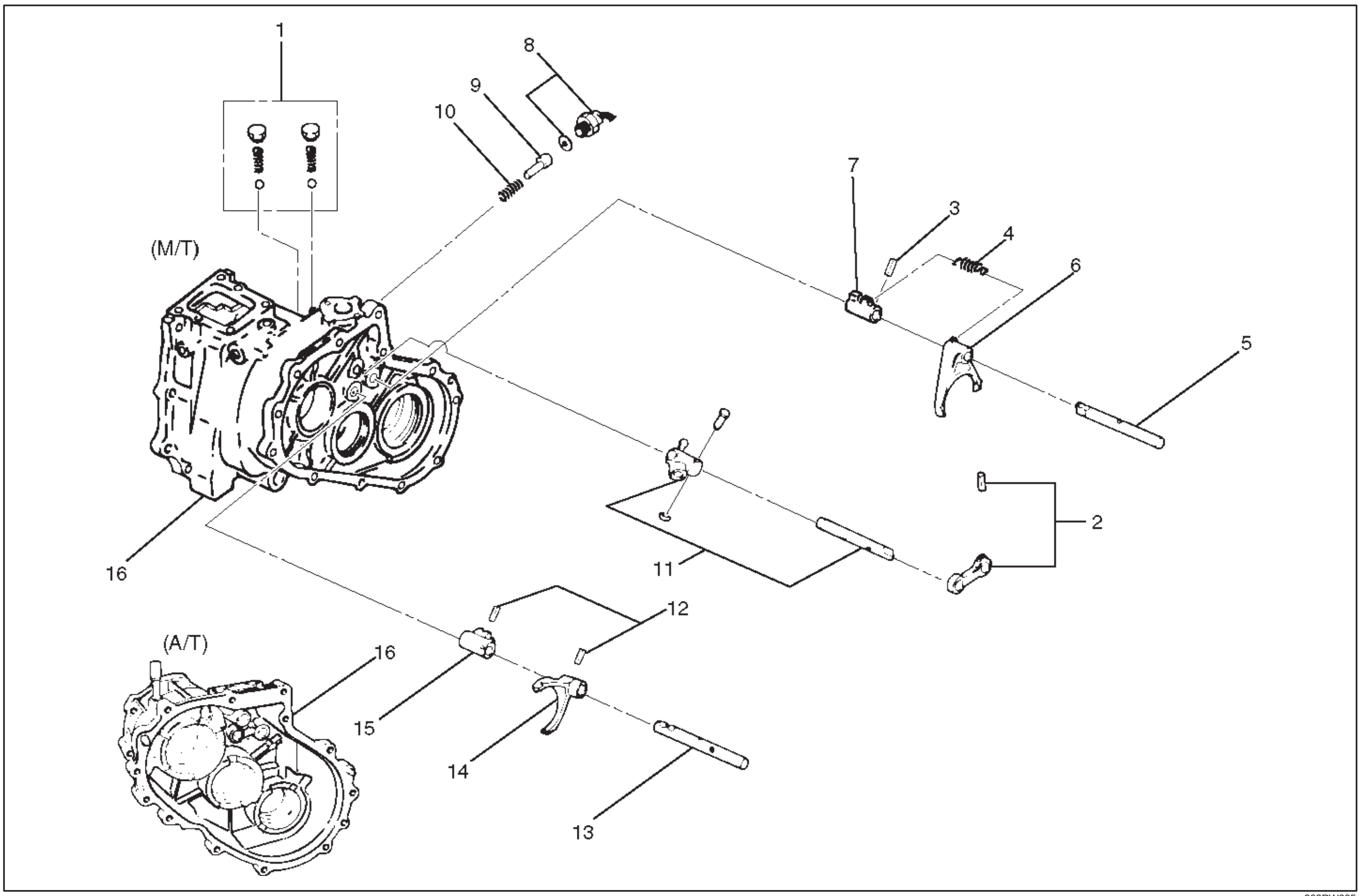
226RS065

6. Install the rear output shaft assembly (1) to the transfer rear cover (9).
7. Install bearing snap ring (3).

NOTE: The snap ring must be fully inserted into the transfer rear cover snap ring groove.

Detent, Shift Arm, and Interlock Pin (Transfer Case Assembly)

Disassembled View



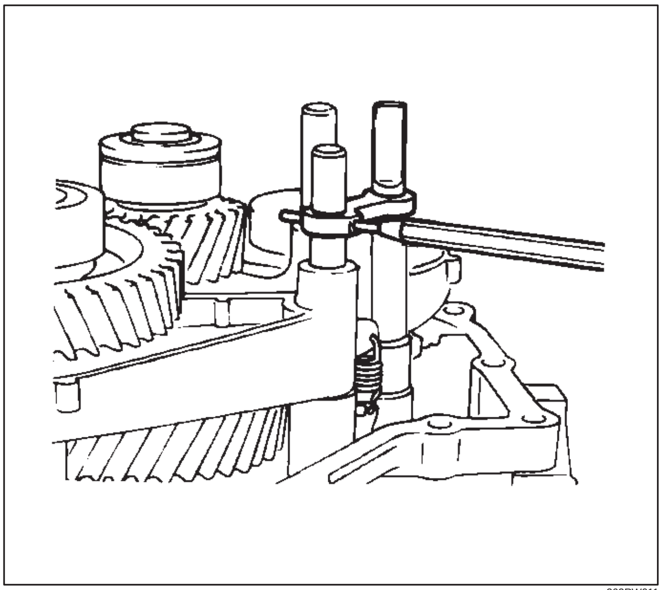
262RW005

Legend

- (1) Detent Ball, Spring and Plug
- (2) Spring Pin and Bridge
- (3) Spring Pin
- (4) Spring
- (5) 2WD–4WD Shift Rod
- (6) Shift Arm
- (7) Shift Block
- (8) 4WD Indicator Switch
- (9) Interlock Pin
- (10) Spring
- (11) Select Rod Assembly
- (12) Spring Pin
- (13) High–Low Shift Rod
- (14) Shift Arm
- (15) Shift Block
- (16) Transfer Case

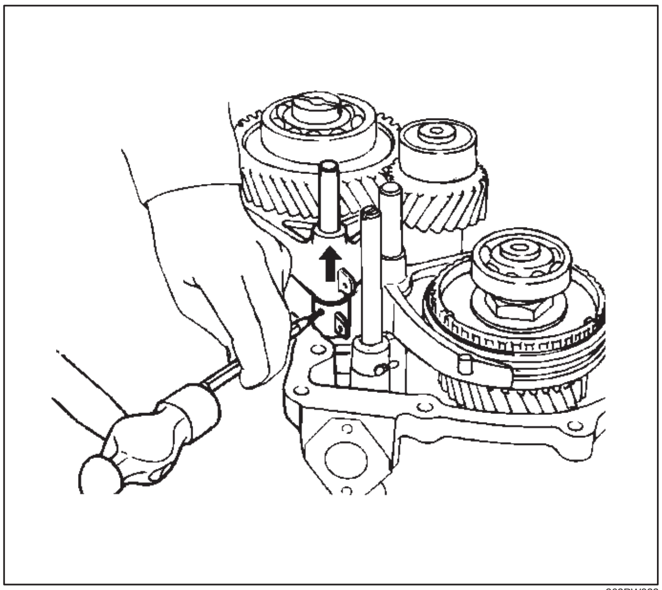
Disassembly

1. Remove detent ball, spring and plug (1).
2. Use a spring pin remover to remove the spring pin (2) from the bridge (6).



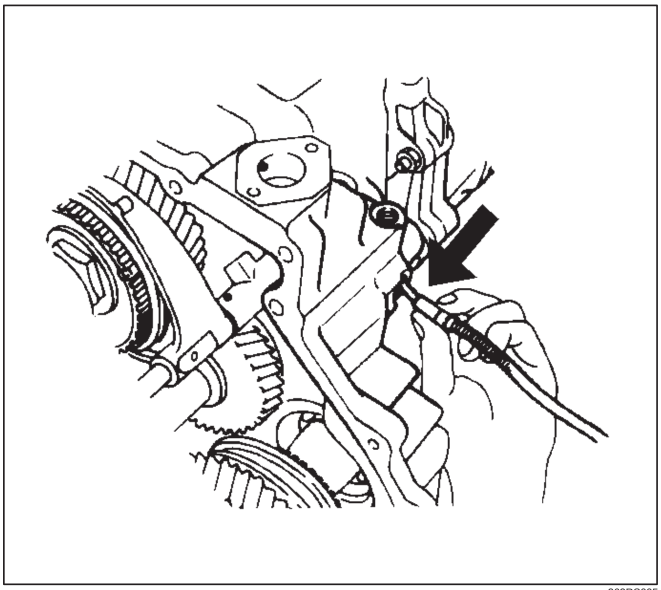
262RW011

3. Remove spring (4).
4. Engage the 2WD–4WD sleeve with front output gear. Remove the spring pin (3) from the block (7). Remove the shift rod (5).



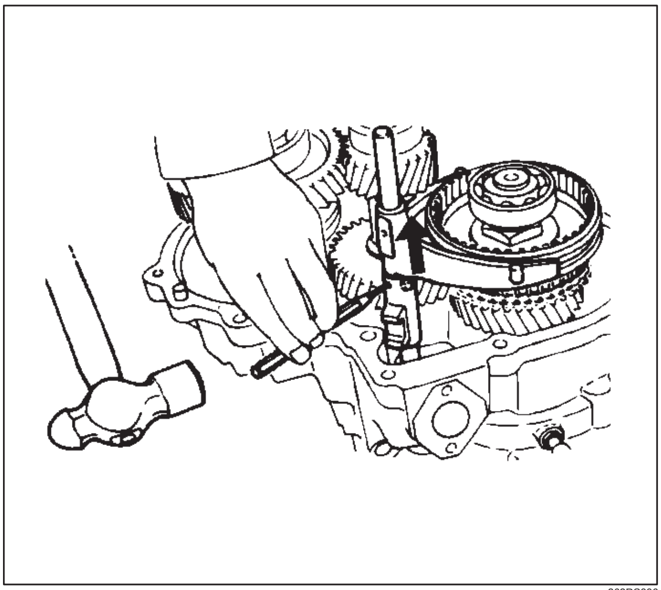
262RW022

5. Remove shift arm (6).
6. Remove shift block (7).
7. Remove 4WD indicator switch (8).
8. Use a magnetic tool to remove the interlock pin (9) and spring (10) from the transfer case (16).



262RS005

9. Remove select rod assembly (11).
10. Use a spring pin remover to remove the shift arm spring pin (12) from the shift arm (14) and shift block (15). Remove the high–low shift rod (13) from transfer case (16).



262RS006

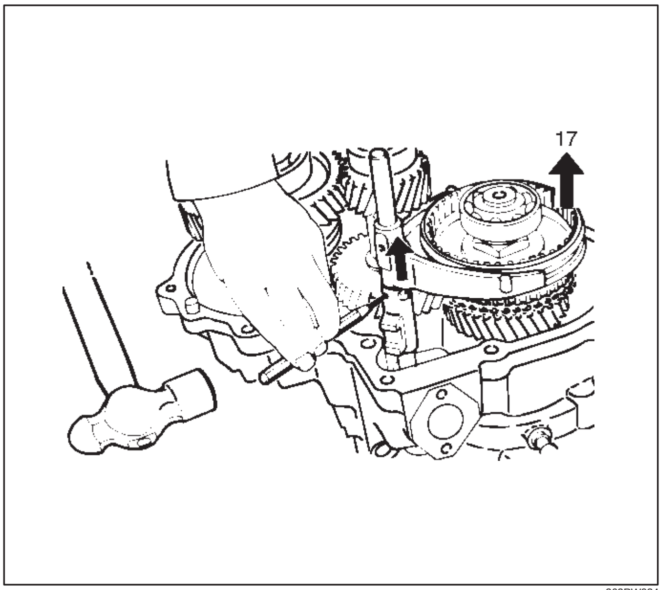
11. Remove shift arm (14).
12. Remove shift block (15) from transfer case (16).

Inspection and Repair

Refer to “TRANSFER CASE ASSEMBLY” in this section for inspection and repair.

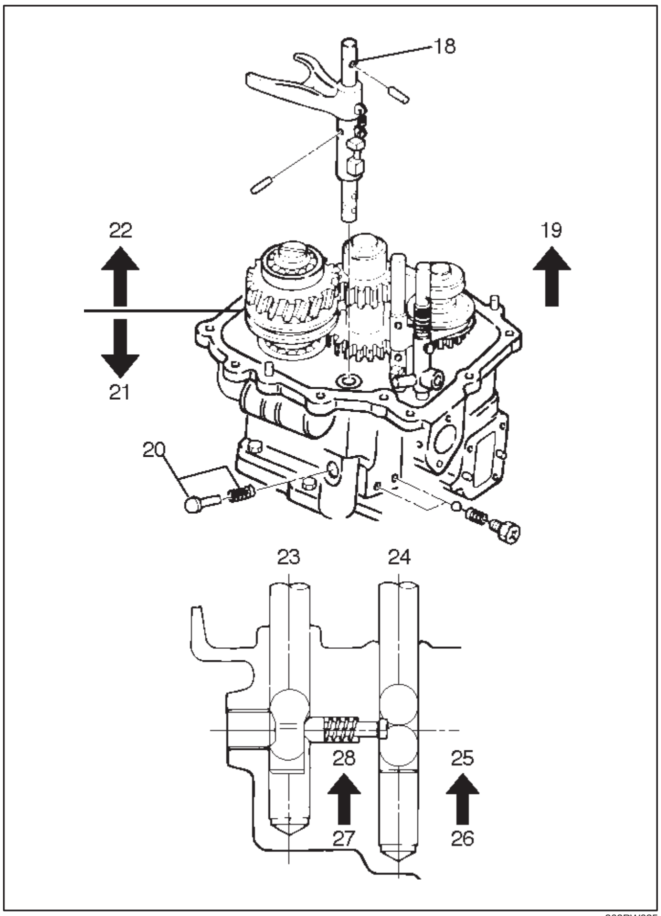
Reassembly

1. Place shift block (15) in transfer case (16).
2. Set shift arm (14) on the High–Low sleeve.
3. Push High–Low shift rod (13) through shift arm (14) and block (14).
4. Engage the High–Low sleeve with the 4H (1) side.
5. Install the spring pin (12) to the shift block (15) and shift arm (14).



262RW034

6. Install select rod assembly (11), joining its lever to shift block groove.
7. Engage the High–Low sleeve with the 4H side and install the interlock pin and spring (10) in the proper direction.
8. Place 2WD–4WD shift block in the transfer case (16).
9. Set 2WD–4WD shift arm on the 2WD–4WD sleeve.
10. Puh 2WD–4WD shift rod through 2WD–4WD shift arm and 2WD–4WD shift block.
11. Install the shift rod: 2WD–4WD (5) with interlock pin pushed in.



262RW035

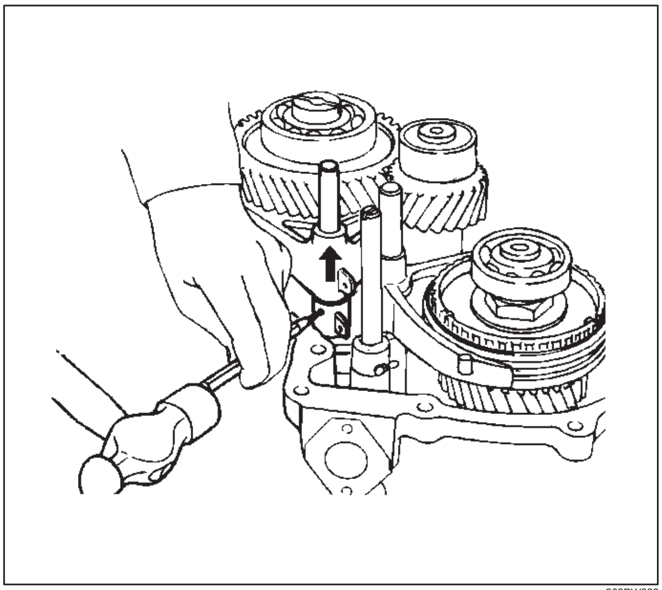
Legend
(18) 2WD–4WD
(19) 4H Side
(20) Interlock pin
(21) 2WD
(22) 4WD
(23) Rod: 2–4
(24) Rod: H–L
(25) 4H
(26) 4L
(27) 4×2
(28) 4×4

12. Install 4WD indicator switch and gasket (8).
    Tighten to the specified torque.

    Torque: 39 N·m (29 lb ft)

13. Install spring (4).

14. Engage the 2WD–4WD sleeve with the 4WD side and install the spring pin (3).



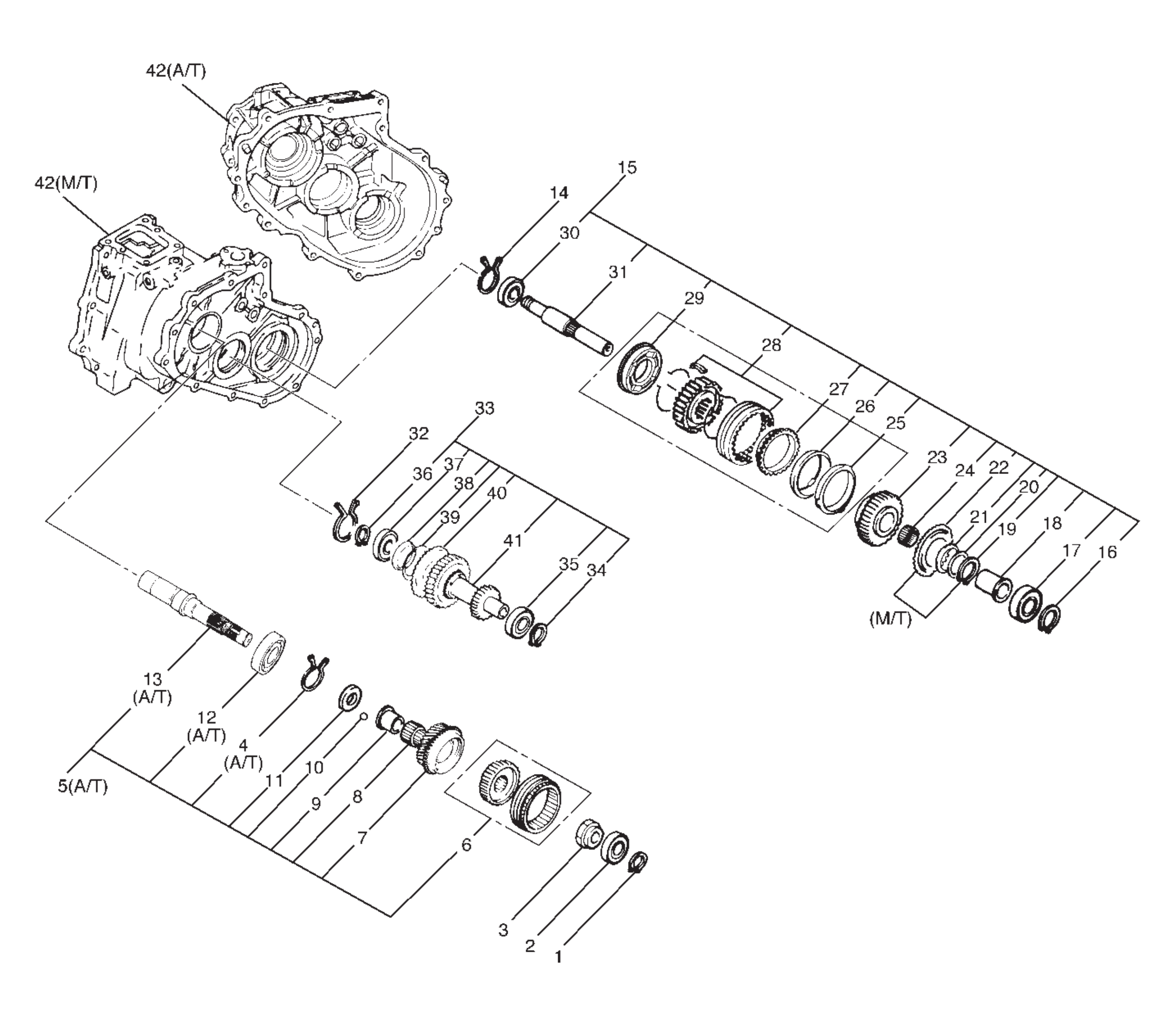
262RW022

15. Install spring pin (2) and bridge (2).
16. Install detent ball, spring and plug and tighten the plug to the specified torque.

Torque: 25 N·m (18 lb ft)

Transfer Case Assembly

Disassembled View



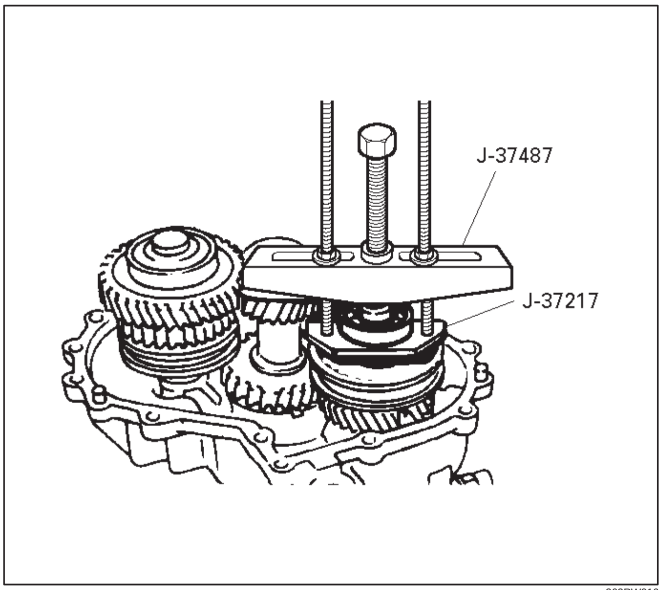
Legend

(1) Bearing Snap Ring
(2) Ball Bearing
(3) Lock Nut
(4) Snap Ring (A/T)
(5) Input Shaft Assembly (A/T)
(6) High–Low Clutch Hub and Sleeve
(7) Transfer Input Gear
(8) Needle Bearing
(9) Bearing Collar
(10) Ball
(11) Plate
(12) Ball Bearing (A/T)
(13) Input Shaft (A/T)
(14) Bearing Snap Ring
(15) Front Output Gear Assembly
(16) Bearing Snap Ring
(17) Ball Bearing
(18) Bearing Collar
(19) Sub–Gear Snap Ring (M/T)
(20) Spacer (M/T)
(21) Belleville Spring (M/T)
(22) Sub–Gear (anti–lash plate) (M/T)
(23) Front Output Gear
(24) Needle Bearing
(25) Inside Ring
(26) Outside Ring
(27) Block Ring
(28) 2WD–4WD Clutch Hub and Sleeve Assembly
(29) Stopper Plate
(30) Ball Bearing
(31) Front Output Shaft

(32) Bearing Snap Ring
(33) Counter Gear Assembly
(34) Snap Ring
(35) Ball Bearing
(36) Snap Ring
(37) Ball Bearing
(38) Spacer
(39) Belleville Spring
(40) Sub–Gear (anti–lash plate)
(41) Counter Gear
(42) Transfer Case (with oil seal)

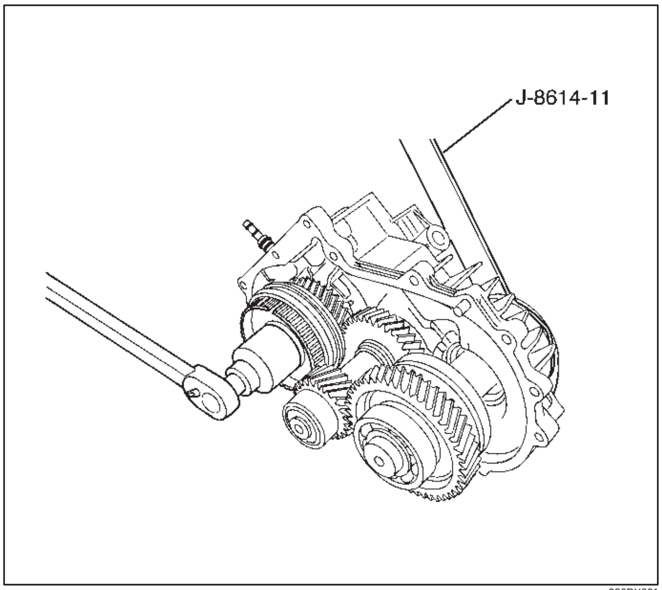
Disassembly

1. Use a pair of snap ring pliers to remove the snap ring (1).
2. Use a bearing remover J–37217 and puller J–37487 to remove the ball bearing (2).



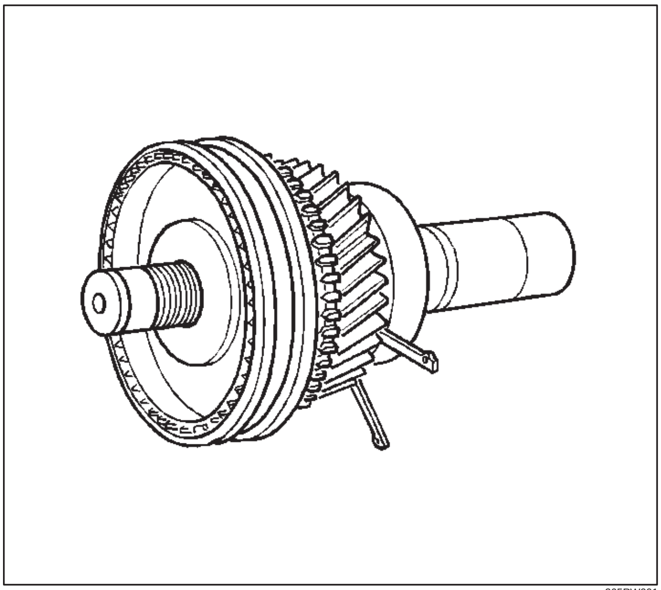
262RW016

3. Install the front companion flange temporarily.
4. Use the Companion flange holder J–8614–11 and lock nut wrench J–37219 to remove the lock nut (3).



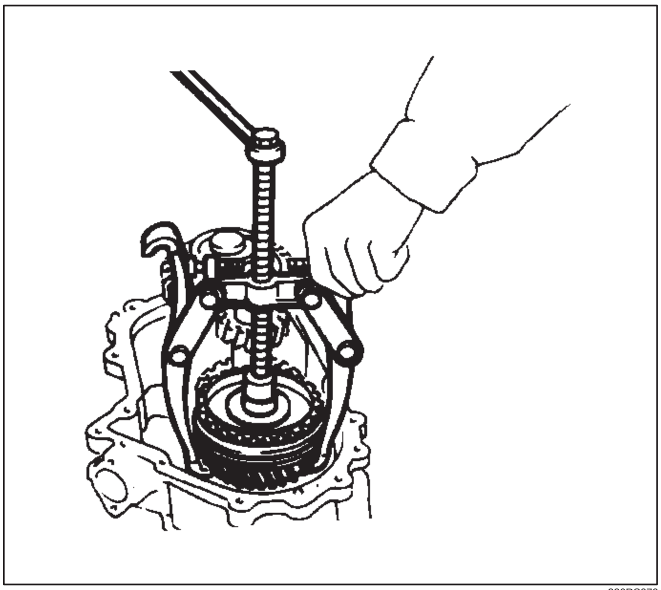
226RX001

5. Remove the front companion flange.
6. Remove snap ring (4). (A/T)
7. Remove the input shaft assembly (5) from the transfer case (42). (A/T)



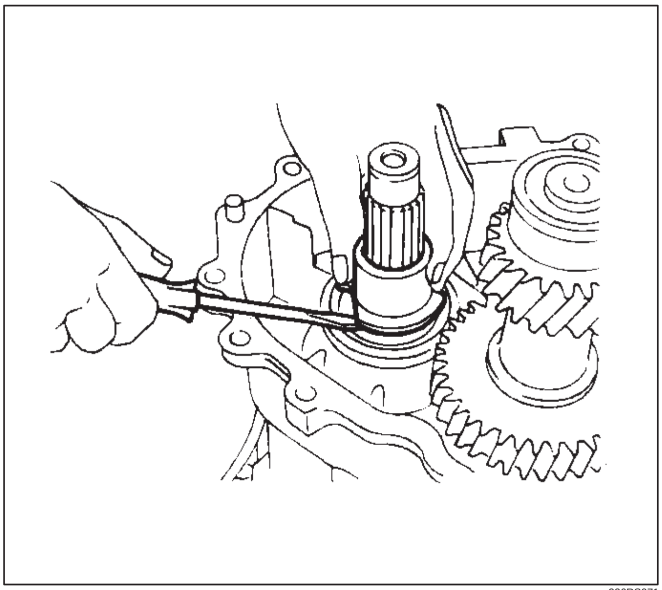
265RW001

8. Use the universal puller to remove the high–low clutch hub and sleeve (6), and transfer input gear (7).



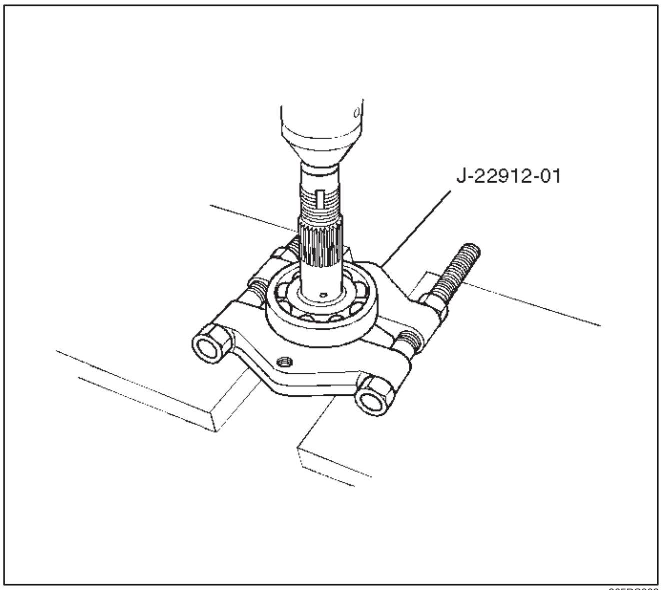
226RS070

9. Remove needle bearing (8).
10. Remove bearing collar (9).



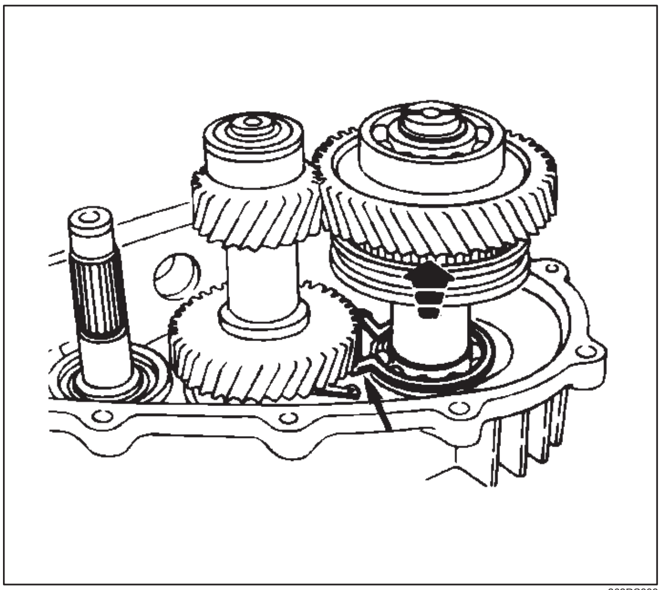
226RS071

11. Remove ball (10).
12. Remove plate (11).
13. Use a bench press and the ball bearing remover J–22912–01 to remove the ball bearing (12) from the input shaft (13). (A/T)



265RS002

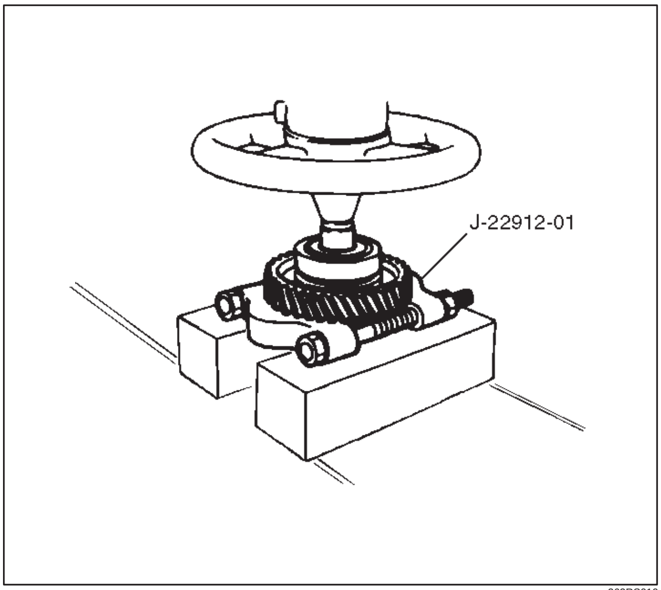
14. Use a pair of snap ring pliers to remove the bearing snap ring (14).
15. Use a plastic hammer to tap the front output gear assembly (15) free.



262RS009

16. Remove bearing snap ring (16).
17. Use a bench press and the bearing remover J–22912–01 to remove the following parts.
18. Remove ball bearing (17), and bearing collar (18). Remove sub–gear snap ring (19), spacer (20), belleville spring (21), and sub–gear (anti–lash plate) (22). (M/T)

    Remove front output gear (23) and needle bearing (24).



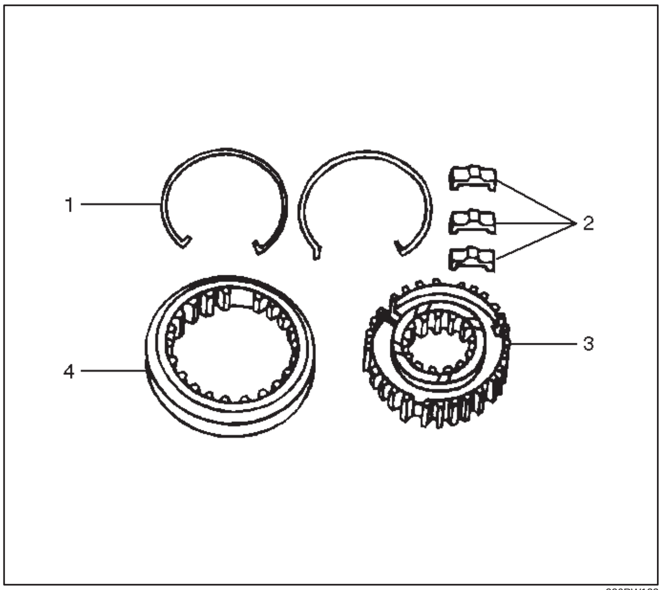
262RS010

19. Remove inside ring (25).
20. Remove outside ring (26).
21. Remove block ring (27).

22. Use a bench press and bearing remover J–22912–01 to remove 2WD–4WD clutch hub and sleeve assembly (28) and stopper plate (29).

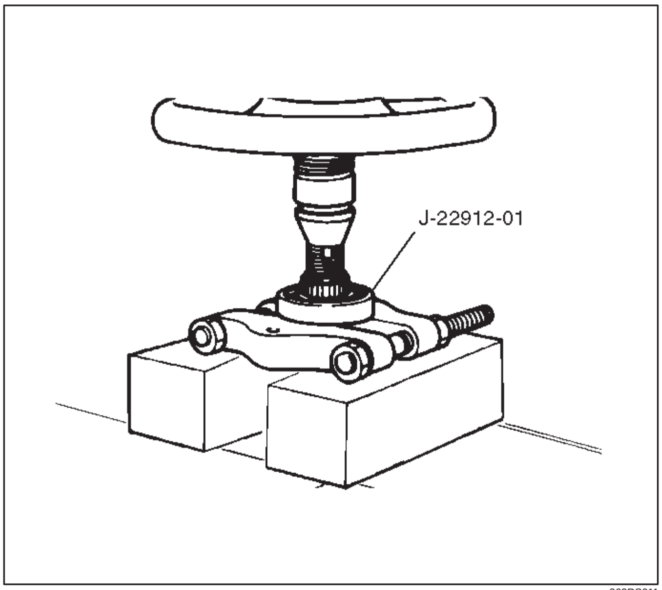
NOTE: Do not reuse the stopper plate.

23. Disassemble the 2WD–4WD clutch hub and sleeve assembly (28).
    - Springs (1)
    - Inserts (2)
    - Clutch Hub (3)
    - Sleeve (4)



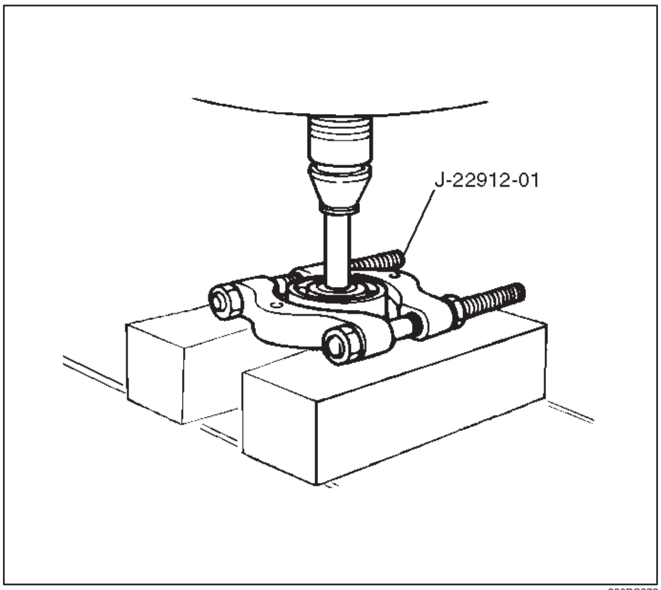
226RW133

24. Use a bench press and the ball bearing remover J–22912–01 to remove the ball bearing (30) from front output shaft (31).



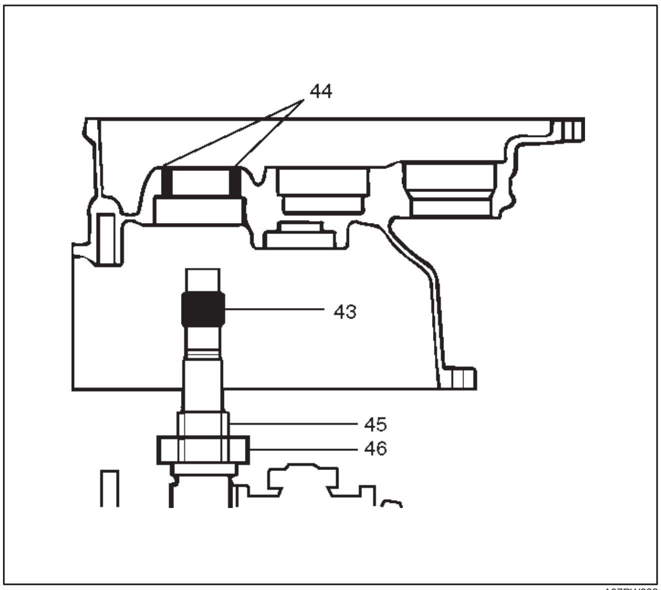
262RS011

25. Remove bearing snap ring (32).
26. Remove the counter gear assembly (33) from the transfer case (42).
27. Use a pair of snap ring pliers to remove the snap ring (34).
28. Use a bench press and the bearing remover J–22912–01 to remove the ball bearing (35).
29. Use a pair of snap ring pliers to remove the snap ring (36).
30. Use a bench press and the bearing remover J–22912–01 to remove the ball bearing (37).



226RS073

31. Remove spacer (38).
32. Remove belleville spring (39).
33. Remove sub–gear (anti–lash plate) (40).
34. Remove counter gear (41).
35. Remove transfer case (with oil seal) (42), performing the following steps (M/T)
    - Cover the shaft splines with adhesive tape (43).



A07RW022

Legend

(43) Adhesive Tape
(44) Oil Seal Lip
(45) Oil Seal Collar
(46) Bearing

- Remove the transfer case together with intermediate plate with gear assembly from the transmission case (M/T).
- Remove the transfer case from the intermediate plat with gear assembly (M/T).

Inspection and Repair

1. Make the necessary repair or parts replacement if wear, damage or any other abnormal conditions are found during inspection.
2. Wash all parts thoroughly in clean solvent. Be sure all old lubricant, metallic particles, dirt, or foreign material are removed from the surfaces of every part. Apply compressed air to each oil feed port and channel in each case half to remove any obstructions or cleaning solvent residue.

Gears

1. Inspect all the gear teeth for signs of excessive wear or damage and check all the gear splines for burrs, nicks, wear or damage. Remove the minor nicks or scratches on an oil stone. Replace any part exhibiting excessive wear or damage.

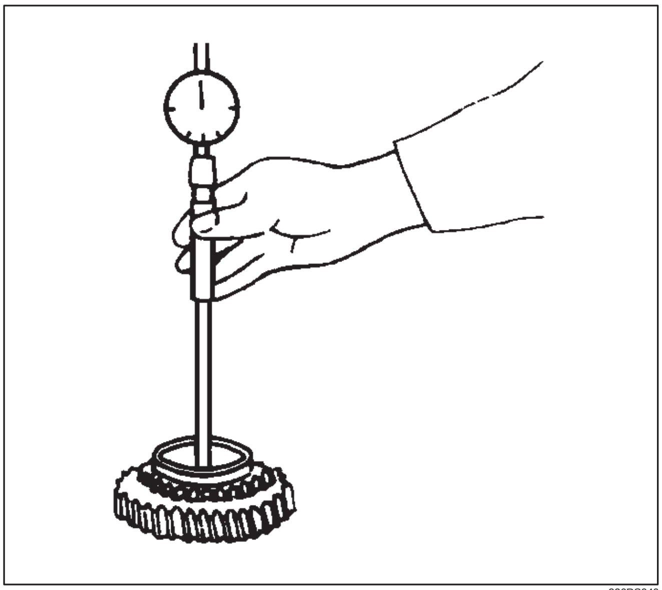
Front Output Gear Inside Diameter

1. Use an inside dial indicator to measure the gear inside diameter.
2. If the measured value exceeds the specified limit, the gear must be replaced.

Gear inside diameter

Standard : 48.000–48.013 mm (1.8898–1.8903 in)

Limit : 48.10 mm (1.894 in)



226RS040

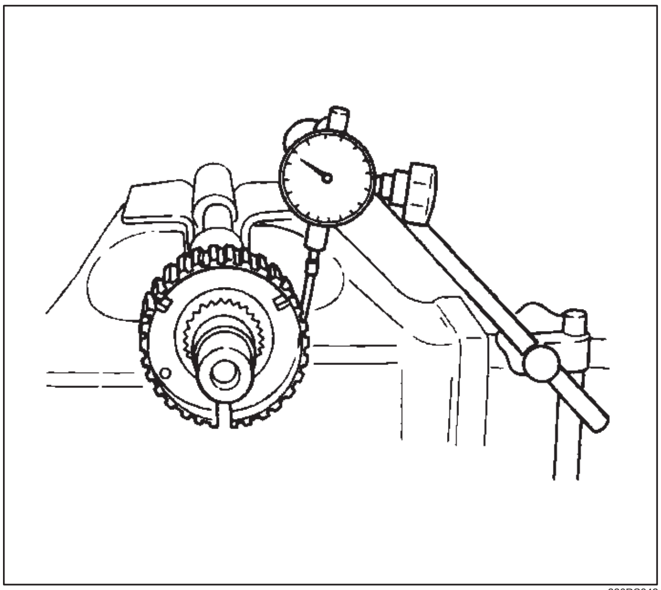
Clutch Hub Spline Play

1. Set a dial indicator to the clutch hub to be measured.
2. Move the clutch hub as far as possible to both the right and the left.
   Note the dial indicator reading.
3. If the measured value exceeds the specified limit, the clutch hub must be replaced.

Clutch hub spline play

Standard : 0–0.1 mm (0–0.004 in)

Limit : 0.2 mm (0.008 in)



226RS042

Bearings

1. Inspect the condition of all the needles and ball bearings. Wash bearings thoroughly in a cleaning solvent. Apply compressed air to the bearings.

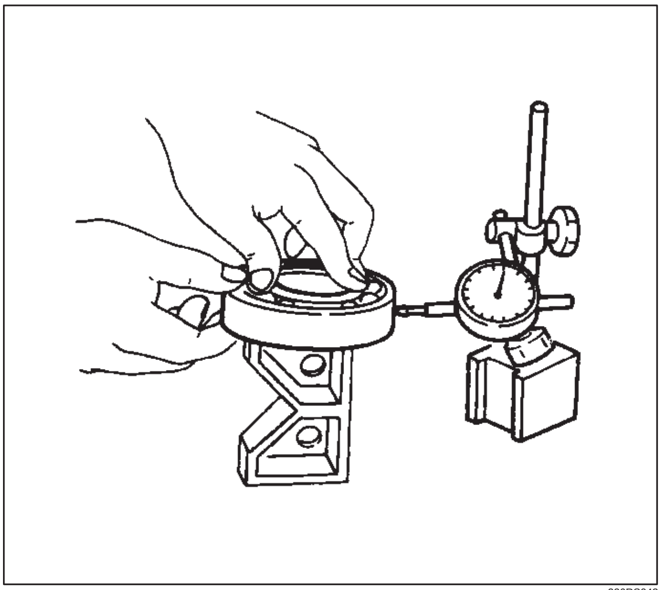
NOTE: Do not allow the bearings to spin. Turn them slowly by hand. Spinning bearings may damage the rollers.

2. Lubricate the bearings with a light oil and check them for roughness by slowly turning the race by hand.

Ball Bearing Play

1. Use a dial indicator to measure the ball bearing play.
2. If the measured value exceeds the specified limit, the ball bearing must be replaced.

Limit : 0.2 mm (0.008 in)



226RS043

Synchronizers

The synchronizer hubs and sliding sleeves are a selected assembly and should be kept together as originally assembled.
Clean synchronizer components with clean solvent and air dry.
Inspect the components for the following:

- Teeth for wear, scuffs, nicks, burrs or breaks.
- Keys and springs for wear, cracks or distortion, replace if these conditions are present.
- If scuffed, nicked or burred conditions cannot be corrected with a soft stone or crocus cloth, replace the component.

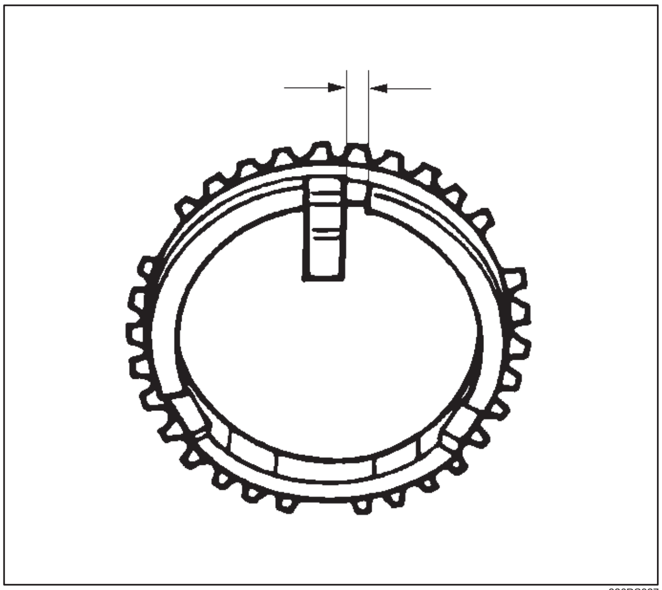
Block Ring and Insert Clearance

1. Use a vernier caliper to measure the clearance between the block ring and the insert.
2. If the measured value exceeds the specified limit, the block ring and the insert must be replaced.

Block ring and insert clearance

Standard : 2.46–2.74 mm (0.097–0.108 in)

Limit : 3.0 mm (0.118 in)



226RS037

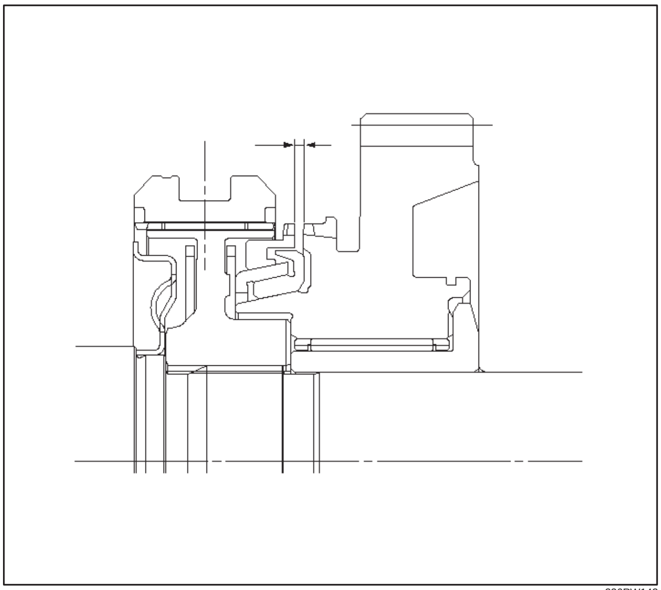
2WD–4WD Synchronizer (3–Cone)

1. Use a thickness gauge to measure the clearance between the block ring and the dog teeth.
2. If the measured value exceeds the specified limit, the 2WD–4WD synchronizer assembly must be replaced.

Block ring and insert clearance

Standard : 1.5 mm (0.059 in)

Limit : 0.8 mm (0.031 in)



226RW142

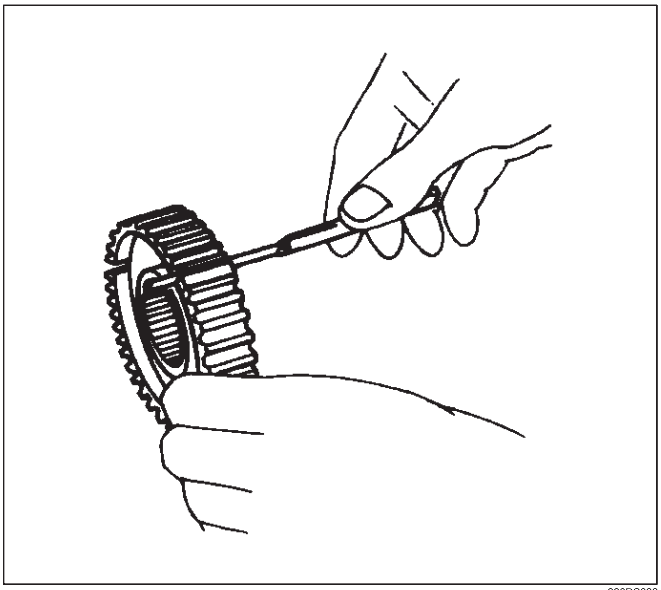
Clutch Hub and Insert Clearance

1. Use a thickness gauge to measure the clearance between the clutch hub and the insert.
2. If the measured value exceeds the specified limit, the clutch hub and the insert must be replaced.

Clutch hub and insert clearance

Standard : 0.01–0.19 mm (0.0004–0.0075 in)

Limit : 0.3 mm (0.012 in)



226RS038

Detent Springs

1. Inspect the springs for distortion, cracks or wear. Replace if these conditions are present.

Detent Spring Free Length

1. Use a vernier caliper to measure the detent spring free length.
2. If the measured value is less than the specified limit, the detent spring must be replaced.

Detent spring free length

Detent ball

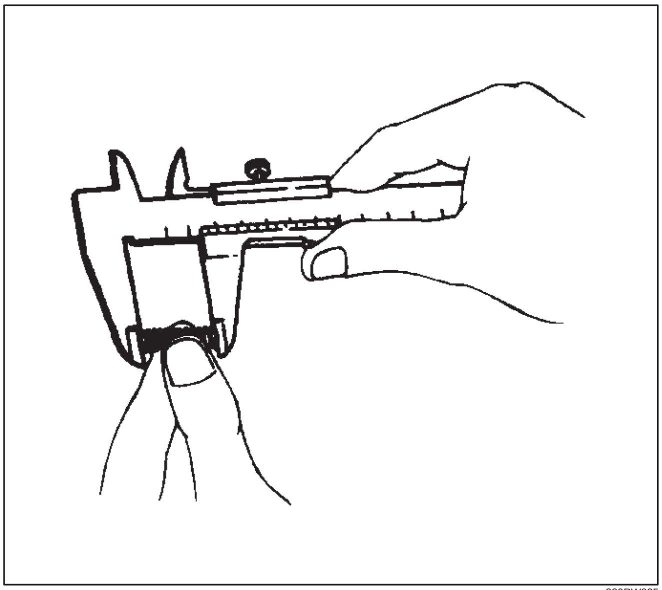
Standard : 23.4 mm (0.921 in)

Limit : 22.8 mm (0.898 in)

Interlock pin

Standard : 15.9 mm (0.626 in)

Limit : 15.3 mm (0.602 in)



220RW035

Detent Spring Tension

1. Use a spring tester to measure the detent spring tension.
2. If the measured value is less than the specified limit, the detent spring must be replaced.

Detent ball

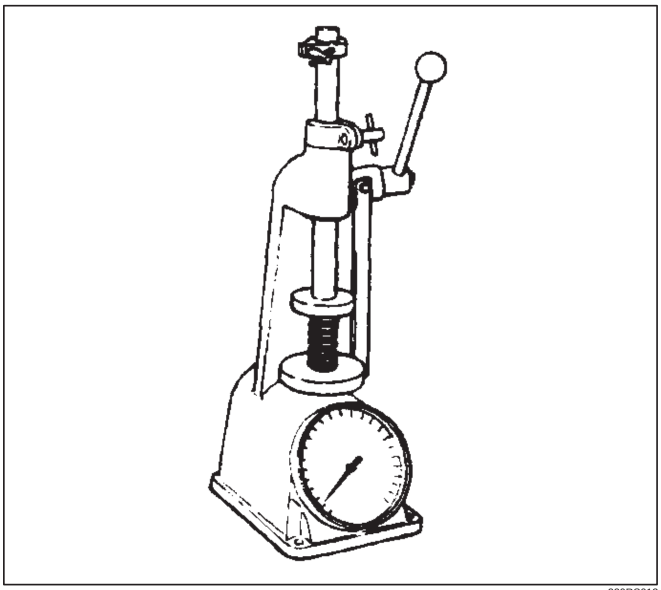
Compressed height : 18.7 mm (0.736 in)

Standard : 68.6–88.2 N (15.4–19.8 lb)

Interlock pin

Compressed height : 11.5 mm (0.453 in)

Standard : 9.8 N (2.2 lb)



220RS013

Shift Arm

1. Inspect the shift arms for wear, distortion or scoring. Replace if these conditions are present.

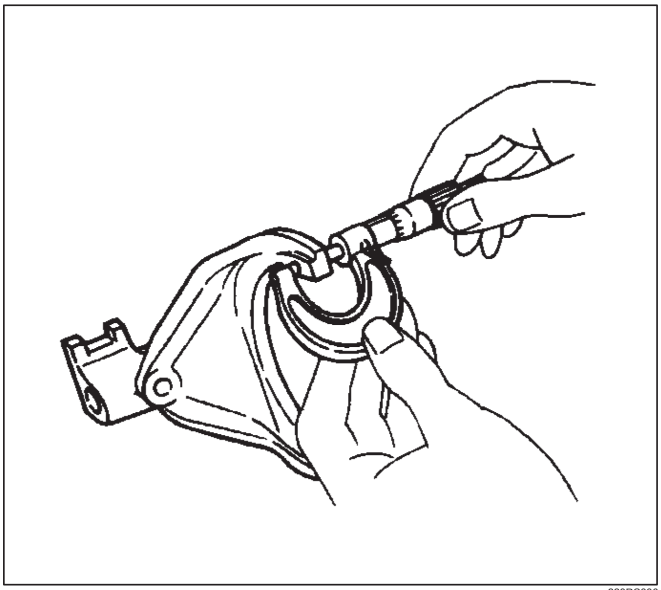
Shift Arm Thickness

1. Use a micrometer to measure the shift arm thickness.
2. If the measured value is less than the specified limit, the shift arm must be replaced.

Shift arm thickness

Standard : 9.60–9.85 mm (0.378–0.388 in)

Limit : 9.0 mm (0.354 in)



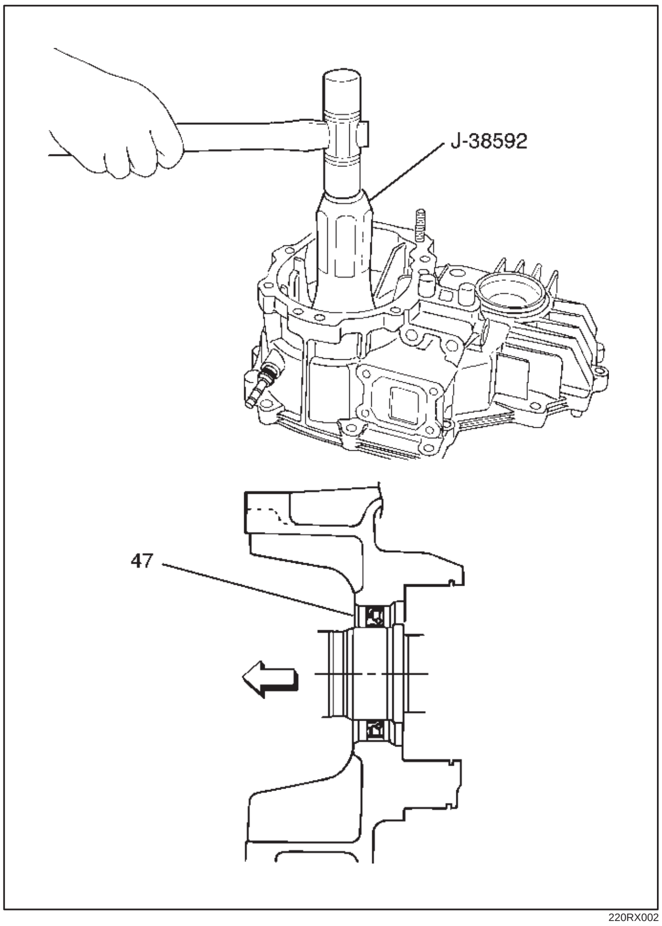
230RS006

Reassembly

Input Shaft Oil Seal Replacement

1. Remove the oil seal from the transfer case.
2. Apply the engine oil to the oil seal outer surfaces.
3. Apply recommended grease (BESCO L2) or equivalent to the oil seal lip.
4. Use the oil seal installer J–38592 (A/T) J–37488 (M/T) and driver handle J–8092 to install the oil seal to the transfer case.

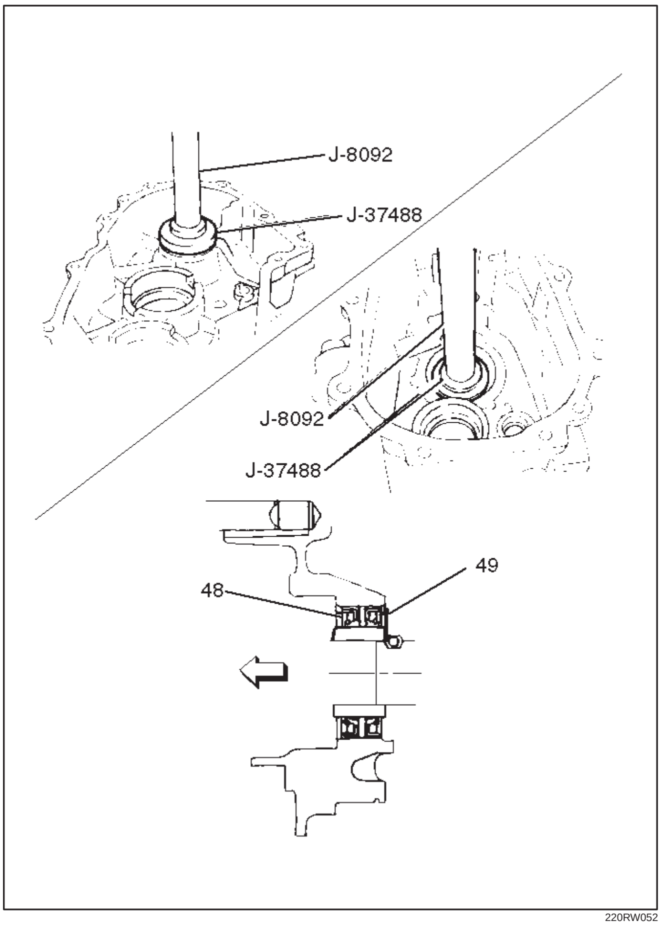
A/T



Legend

(47) Oil Seal

M/T

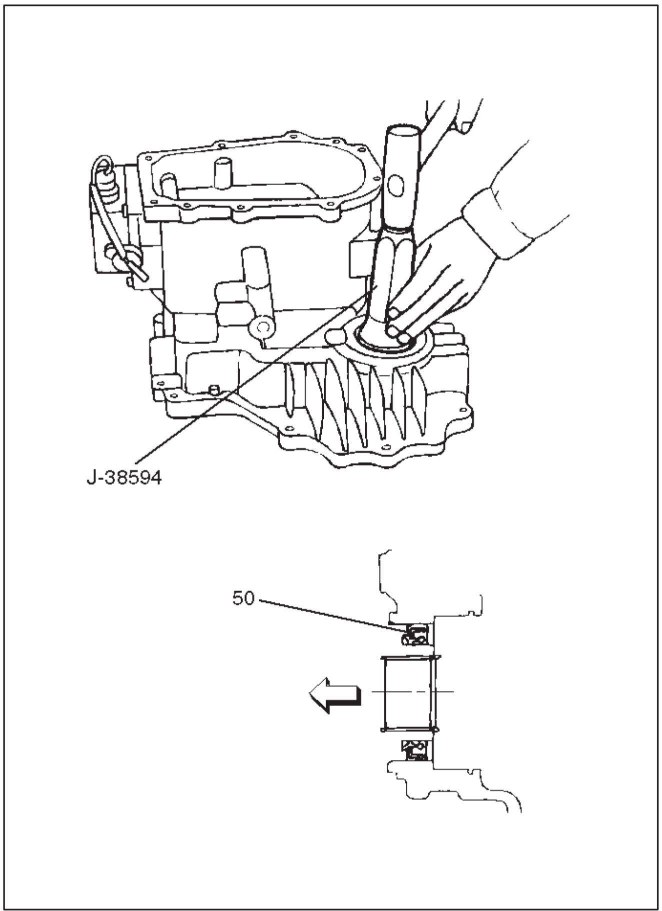


Legend

(48) Transmission Side Oil Seal
(49) Transfer Side Oil Seal

Front Output Shaft Oil Seal Replacement

1. Remove the oil seal from the transfer case.
2. Apply engine oil to the oil seal outer surfaces.
3. Apply recommended grease (BESCO L2) or equivalent to the oil seal lip.
4. Use the oil seal installer J–38594 to install the oil seal to the transfer case.

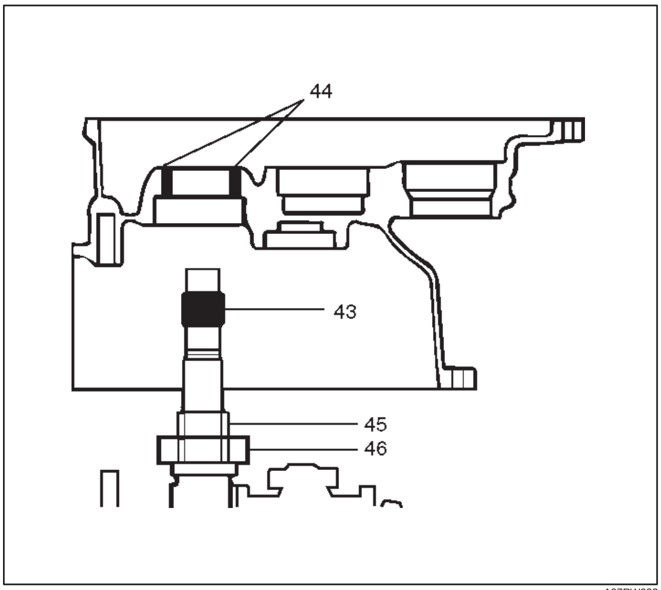


220RW070

Legend

(50) Front Output Shaft Oil Seal

1. Install the transfer case (with oil seal) (42), performing the following steps. (M/T)
   - Cover the shaft splines with adhesive tape (43). This will prevent damage to the oil seal lip (44).

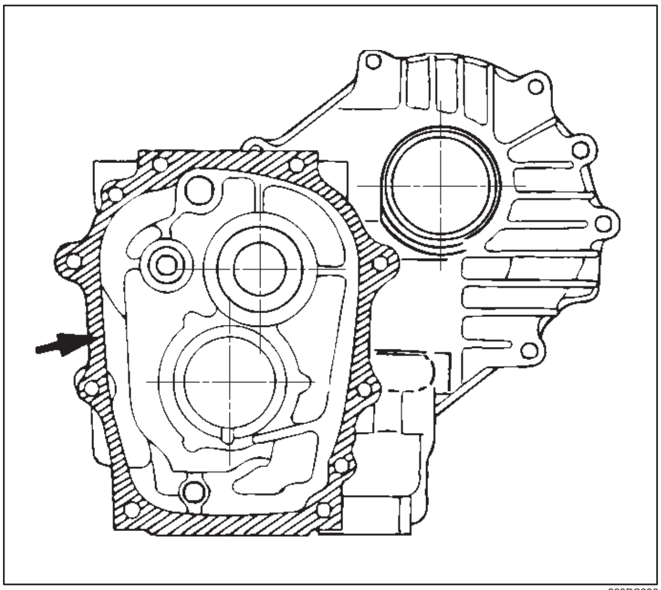


A07RW022

Legend

(43) Adhesive Tape
(44) Oil Seal Lip
(45) Oil Seal Collar
(46) Bearing

- Apply recommended liquid gasket (LOCTITE FMD 127) or its equivalent to the transmission, intermediate plate and transfer case fitting surfaces (M/T).



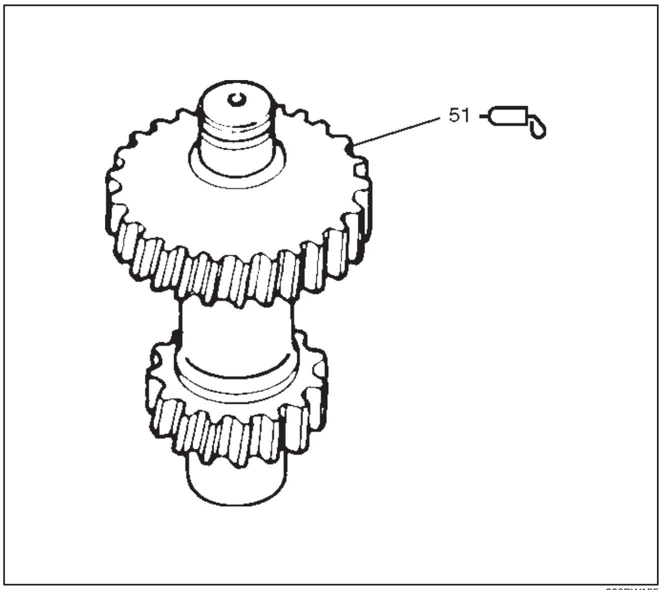
220RS026

Install the transfer case together with intermediate plate with gear assembly to transmission case (M/T).

Tighten the transfer case bolts to the specified torque a little at a time (M/T).

Torque : 37 N·m (27 lb ft)

2. Apply chassis grease (51) to the sub–gear (40) and the counter gear (41) thrust surfaces.

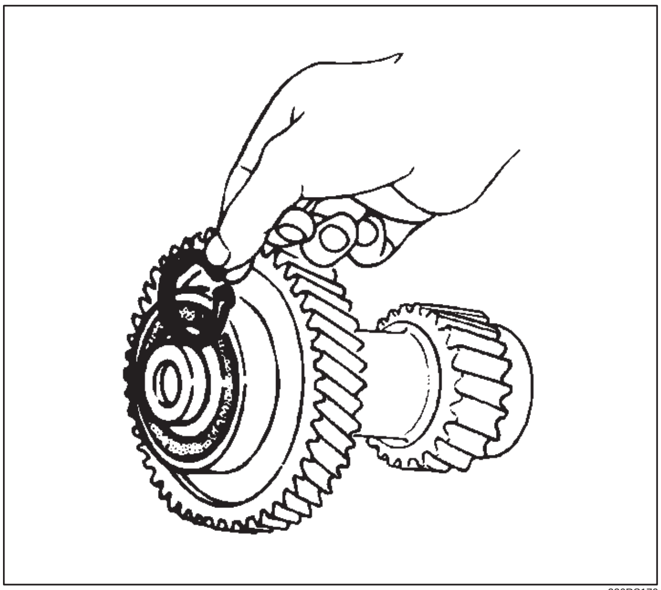


226RW155

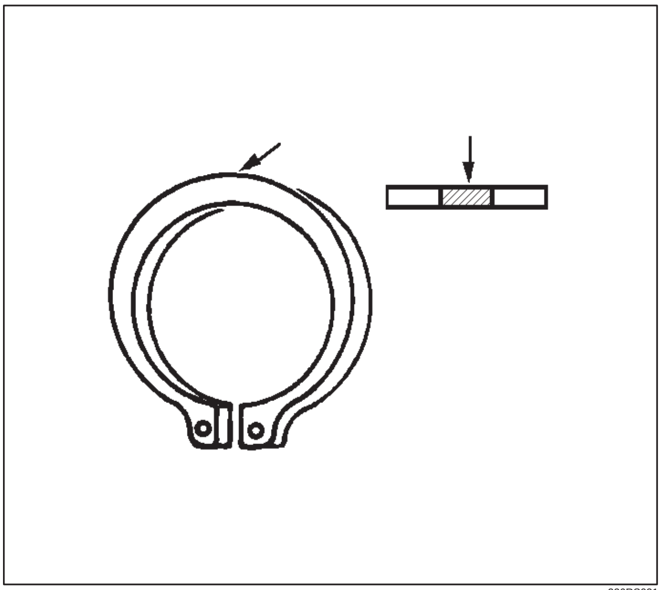
3. Install sub–gear (40) to counter gear (41).
4. Install belleville spring (39).
5. Install spacer.
6. Install ball bearing, using a bench press.
7. Select a snap ring that will allow the minimum axial play.

Clearance : 0–0.1 mm (0–0.004 in)

Snap ring availability:	
Thickness	Color–coding
1.50 mm (0.059 in)	White
1.55 mm (0.061 in)	Yellow
1.60 mm (0.063 in)	Blue



226RS170



226RS021

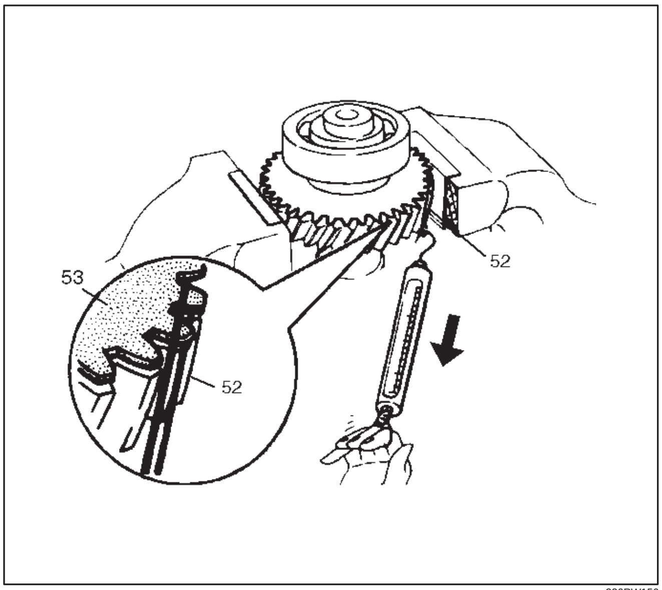
8. Use a pair of snap ring pliers to install the snap ring (36) to the counter gear (41).

Sub–Gear (anti–lash plate) Preload

1. Hook a length of piano wire (52) over one of the sub–gear (53) teeth.
2. Attach the other end of the piano wire (52) to a spring balancer.

3. Measure the sub–gear preload.

Preload : 59–98 N (13–22 lb)

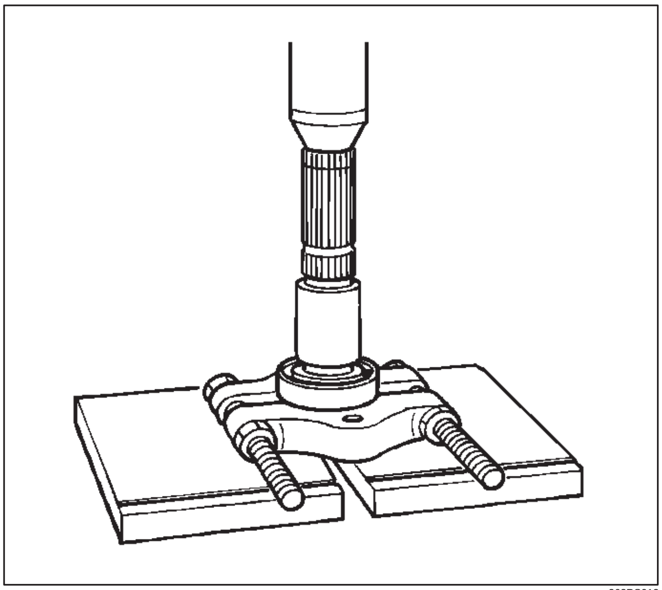


226RW156

9. Install ball bearing (35), using a bench press.
10. Install snap ring (34).
11. Install the counter gear assembly (33) to the transfer case (42).
12. Use a pair of snap ring pliers to install the snap ring (32) to the transfer case (42).

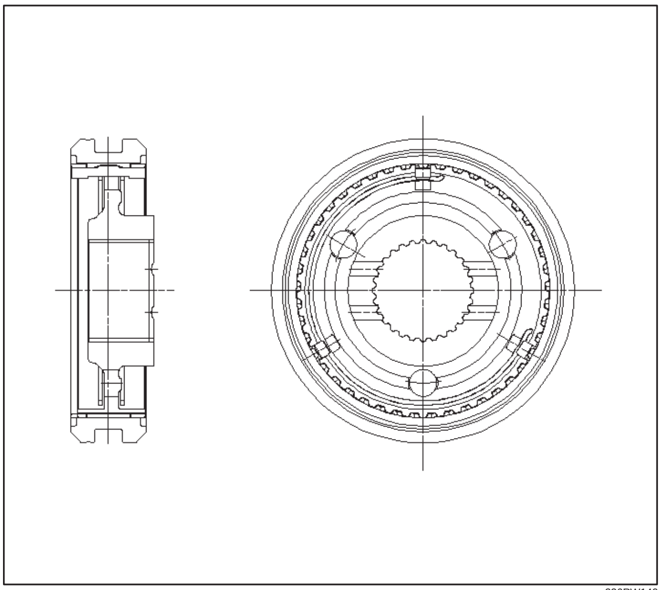
NOTE: The snap ring must be fully inserted into the transfer case snap ring groove.

13. Use a bench press to install the ball bearing (30) to the front output shaft (31).



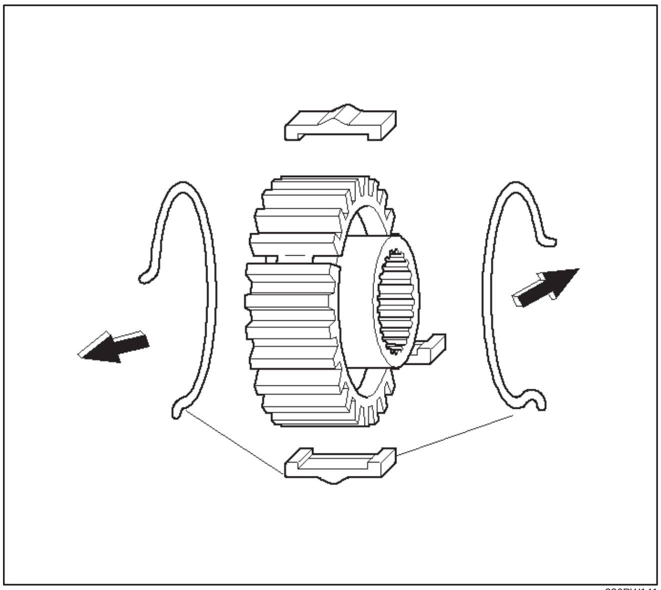
262RS012

14. Assemble the 2WD–4WD clutch hub and sleeve assembly (28).



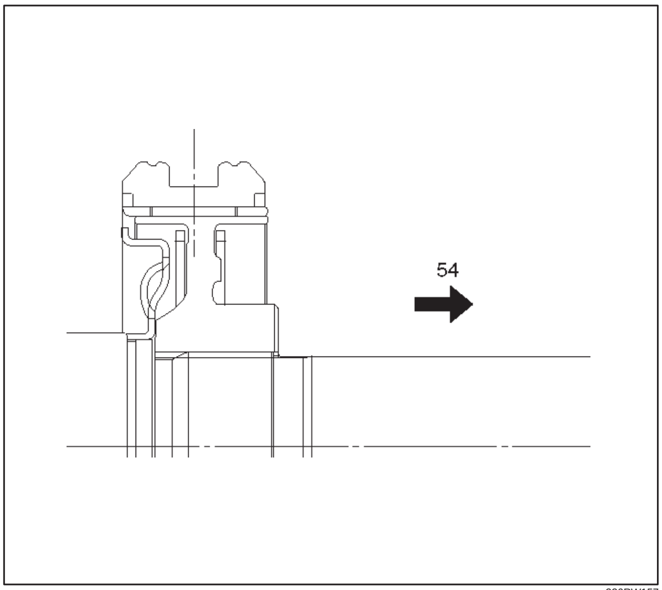
226RW140

15. Engage the springs in the same insert with the open ends away from each other.



226RW141

16. Install a new stopper plate (29) and the clutch hub and sleeve assembly (28) to the front output shaft (31).



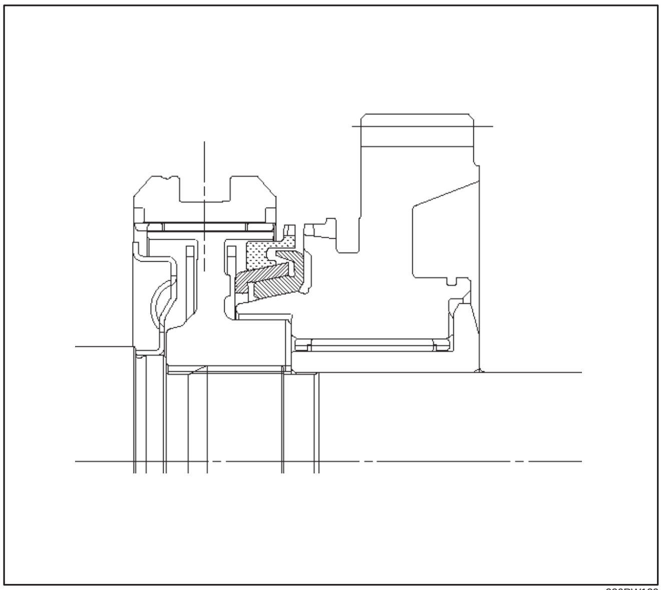
226RW157

Legend

(54) Front Output Gear

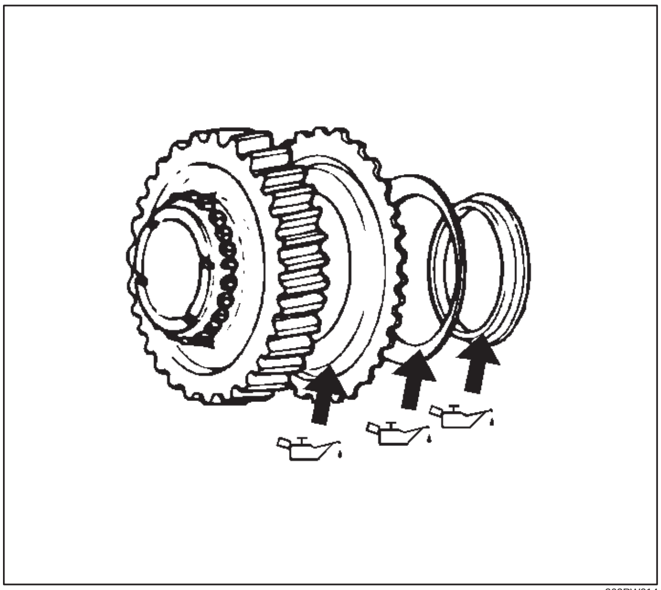
17. The clutch hub face (with the heavy boss) must be facing the front output gear side.
18. Use a bench press to slowly force the clutch hub and sleeve assembly (28) together with the stopper plate (29) into place.
19. Align the inserts with the block ring insert grooves. Install the block ring (27) to the clutch sleeve and hub assembly (28).
20. Install the outside ring (26), inside ring (25) and needle bearing (24) to the front output gear (23) and bearing collar (18).

NOTE: Coat all parts with transmission oil before installing them.



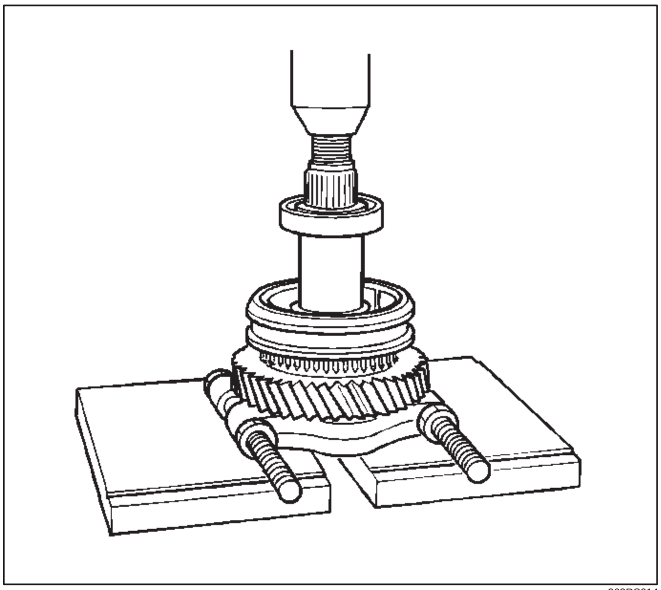
226RW139

21. Apply engine oil to the thrust surfaces of the sub–gear, the belleville spring, and the spacer.



262RW014

22. Install sub–gear (anti–lash plate) (22), belleville spring (21) and spacer (20). (M/T)
23. Install sub–gear snap ring (19). (M/T)
24. Use a bench press to install the needle bearing collar together with the front output gear assembly, aligning inside ring claw with block ring groove.

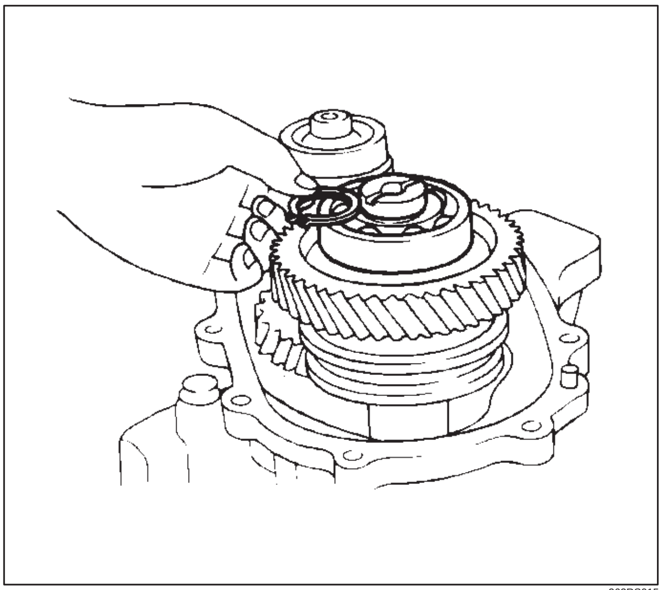


262RS014

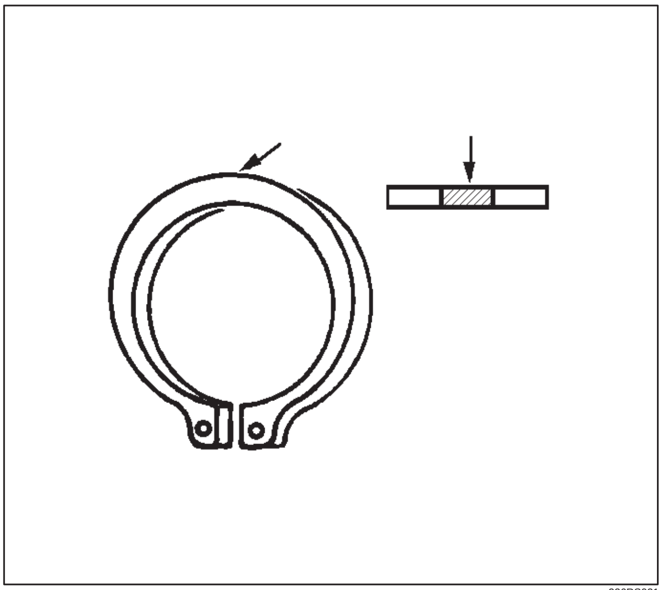
25. Install ball bearing (17), using a bench press.
26. Select a snap ring (16) that will allow the minimum axial play.

Clearance : 0–0.1 mm (0–0.004 in)

Snap ring availability:	
Snap ring thickness	Color coding
1.55 mm (0.061 in)	White
1.60 mm (0.063 in)	Yellow
1.65 mm (0.065 in)	Blue
1.70 mm (0.067 in)	Pink
1.75 mm (0.069 in)	Green
1.80 mm (0.071 in)	Brown
1.85 mm (0.073 in)	Red
1.90 mm (0.075 in)	Orange



262RS015



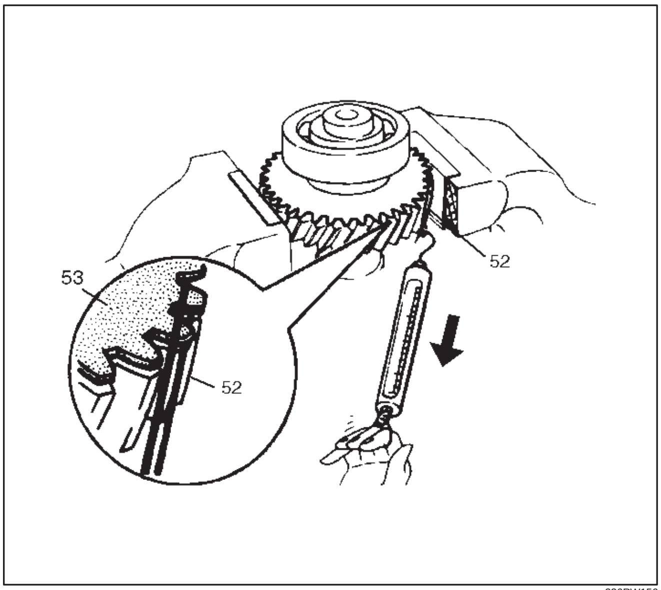
226RS021

27. Use a pair of snap ring pliers to install the snap ring (16) to the output shaft (31).

Sub-gear (anti-lash plate) preload

1. Hook a length of piano wire (52) over one of the sub–gear (53) teeth.
2. Attach the other end of the piano wire to (52) a spring balancer.
3. Measure the sub–gear preload.

Preload: 59–98 N (13–22 lb)

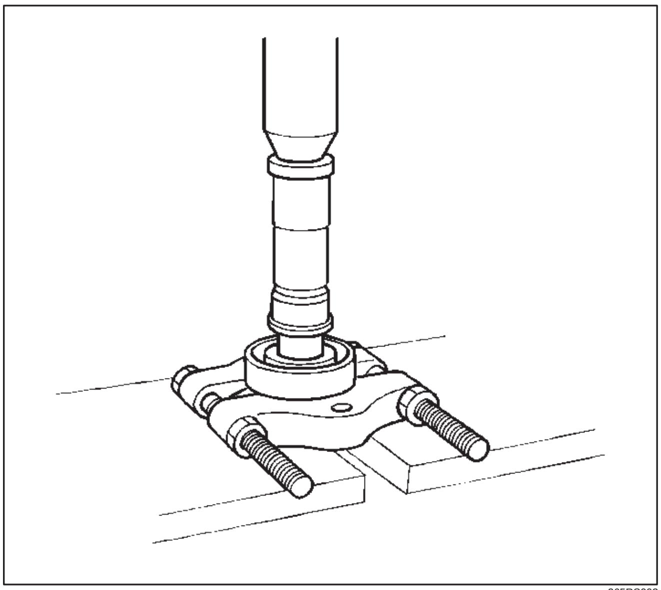


226RW156

28. Install front output gear assembly (15) to transfer case (42).
29. Use a pair of snap ring pliers to install the snap ring (14) to the transfer case (42).

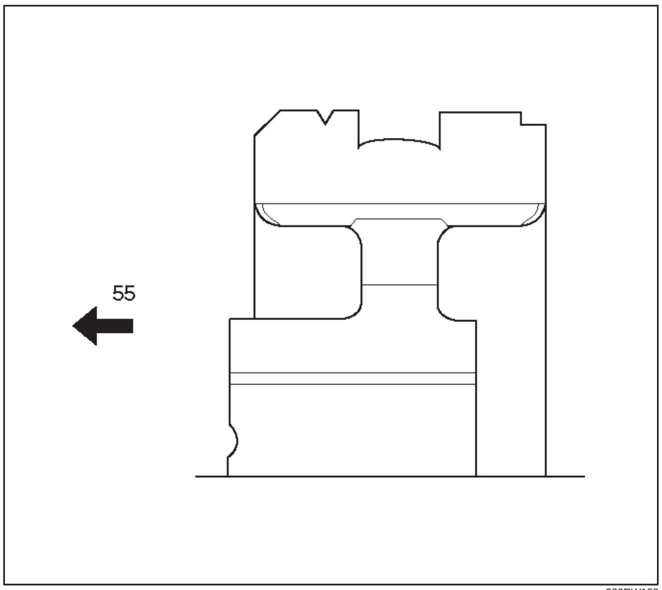
NOTE: The snap ring must be fully inserted into the transfer case snap ring groove.

30. Use a bench press to install the ball bearing (12) to the input shaft (13). (A/T)



265RS003

31. Install plate (11), ball (10) and bearing collar (9).
32. Install needle bearing (8) and input gear (7).
33. The clutch hub face (with the heavy boss) must be facing the transfer input gear side (55).



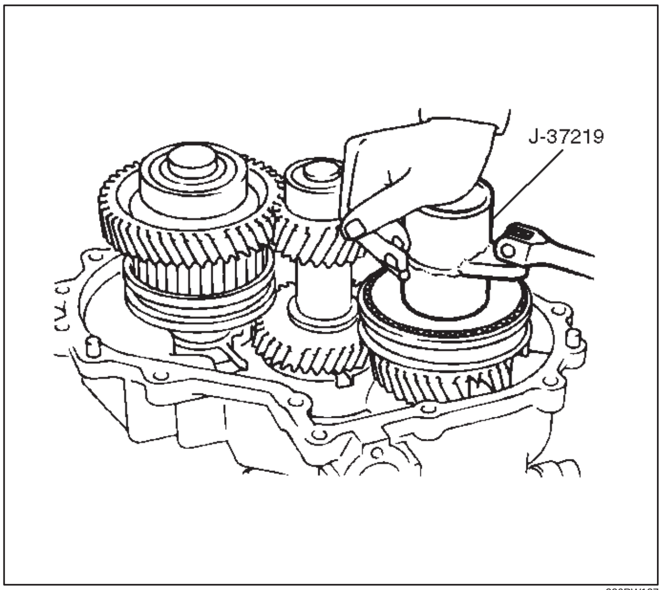
226RW158

34. Install high–low clutch hub and sleeve (6), using a bench press.
35. Install input shaft assembly (5) to transfer case (42). (A/T)
36. Install the snap ring (4) to the transfer case (42). (A/T)

NOTE: The snap ring must be fully inserted into the transfer case snap ring groove.

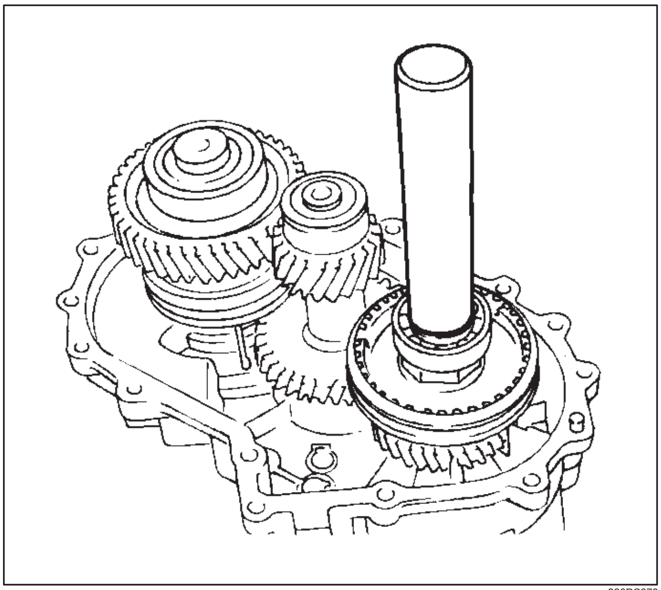
37. Install the front companion flange temporarily and use the flange holder J–8614–11 and lock nut wrench J–37219 to install the lock nut (3).

Torque: 137 N·m (101 lb ft)



226RW137

38. Use the punch to stake the lock nut (3) at one spot.
39. Use a suitable drift and hammer to install the ball bearing (2).



226RS079

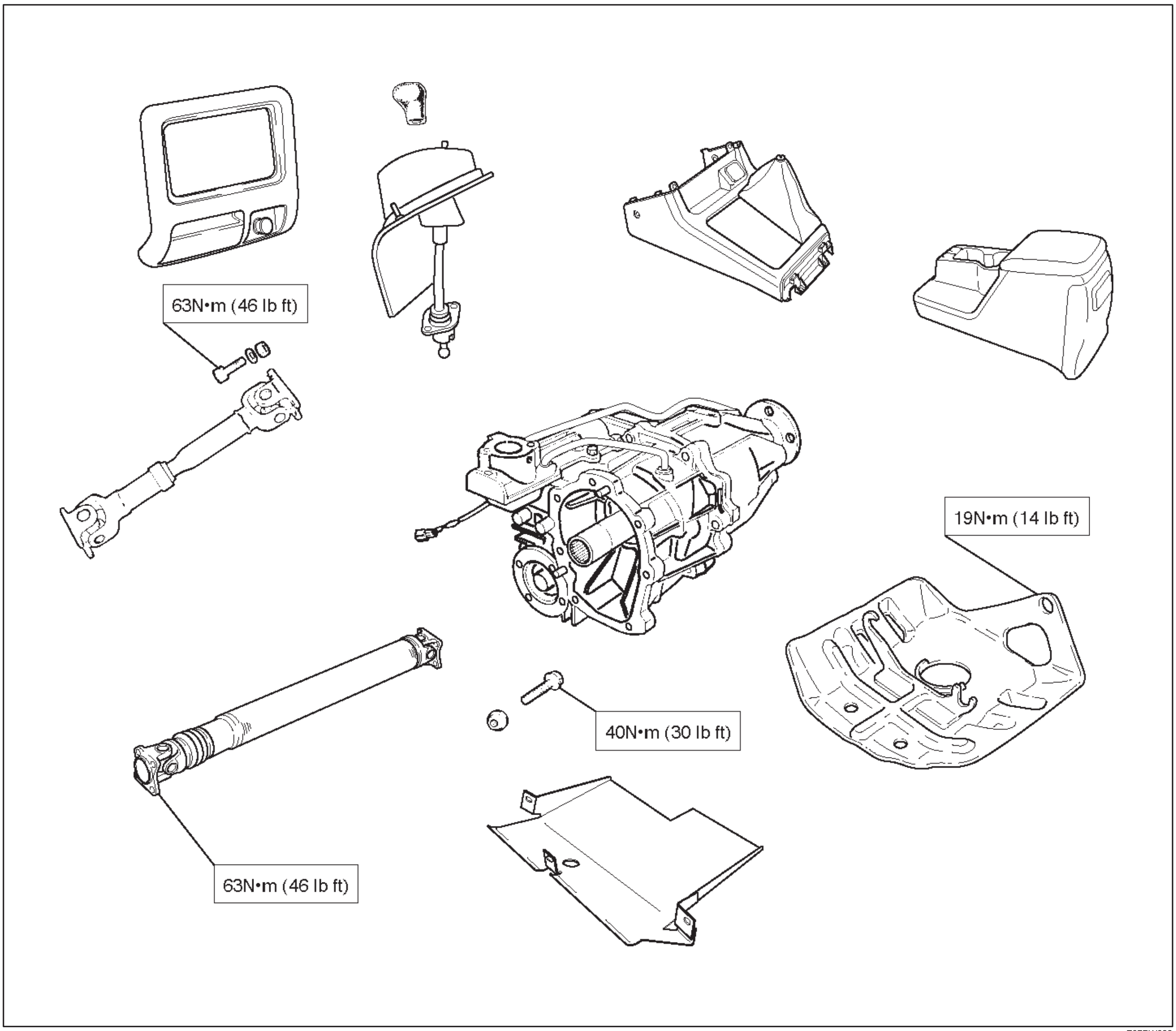
40. Install bearing snap ring (1).

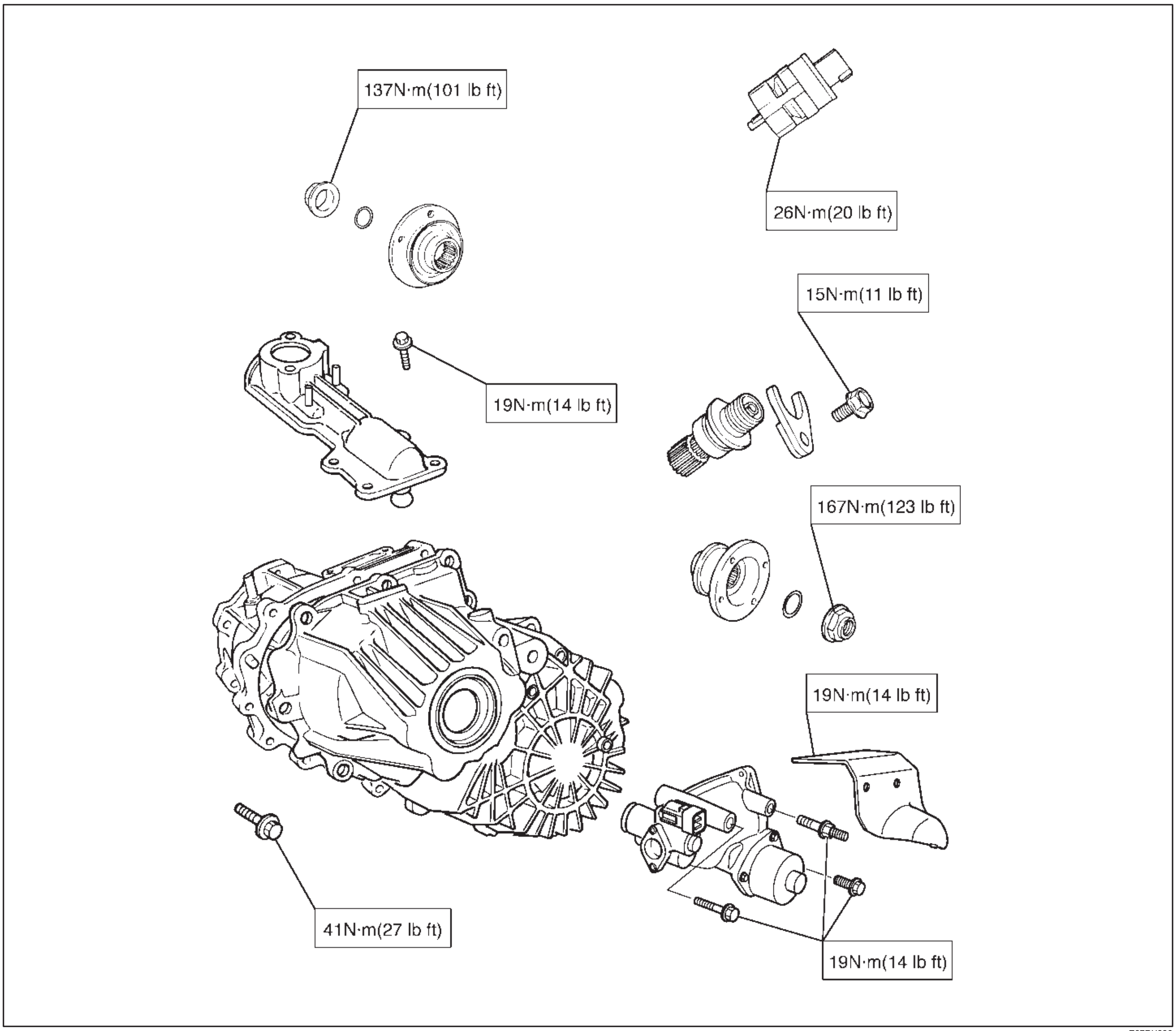
Main Data and Specifications

General Specifications

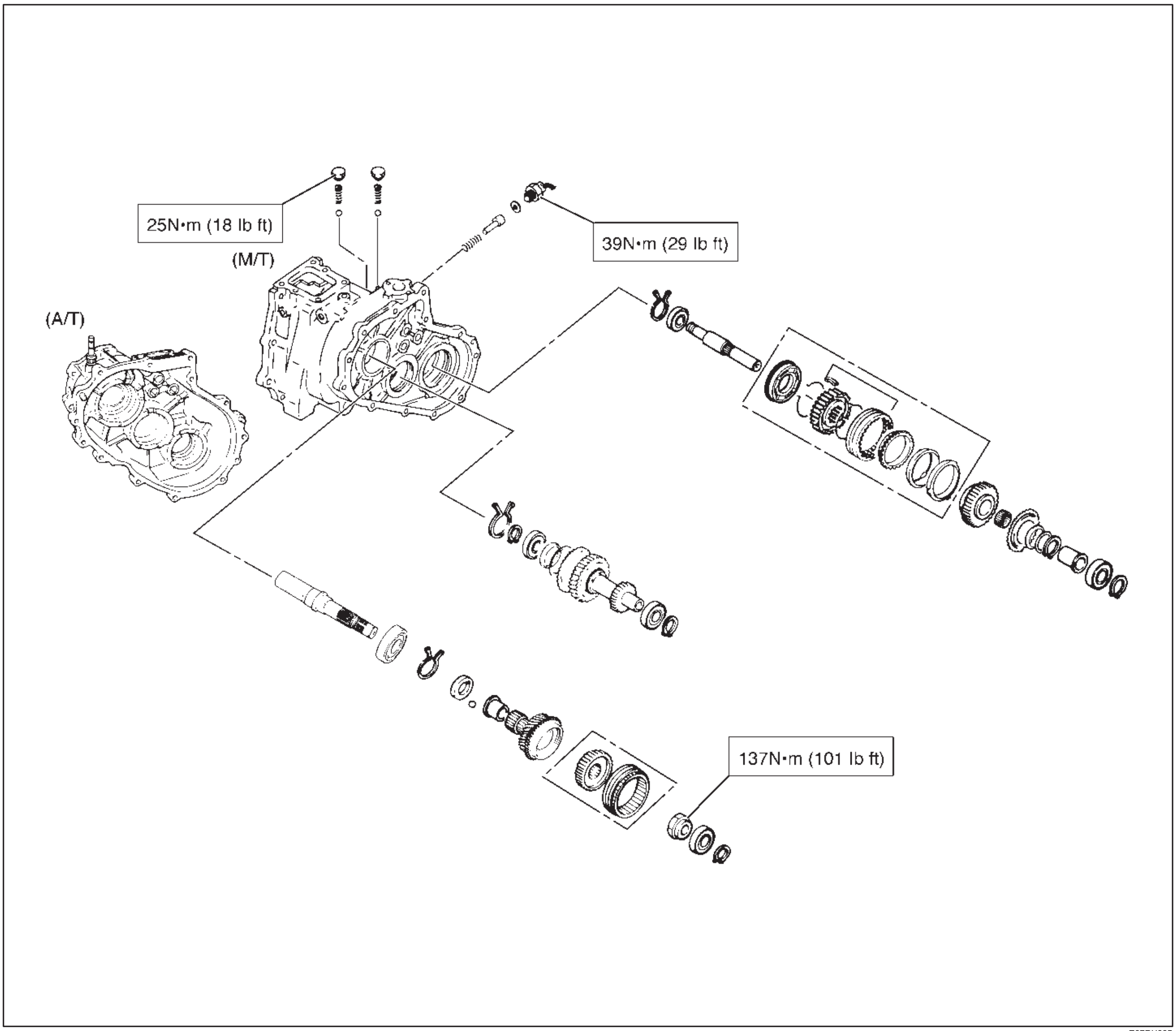
Type	Synchronized type gears shifting between the 2 and 4 wheel drive mode. Constant mesh type gears shifting between “low” and “high”.
Control method	Remote (A/T) and direct (M/T) control with the gear shift lever on the floor for gears shifting between “low” and “high”. Electric control with the button switch on the instrument panel for gears shifting between the 2 and 4 wheel driver mode.
Gear ratio	High; 1.000 Low; 2.050
Oil capacity	1.45 lit. (1.53 U.S. quart)
Type of lubricant	Engine oil Refer to chart in Section 0

Torque Specifications




137N·m(101 lb ft)
26N·m(20 lb ft)
15N·m(11 lb ft)
19N·m(14 lb ft)
167N·m(123 lb ft)
19N·m(14 lb ft)
41N·m(27 lb ft)
19N·m(14 lb ft)

E07RX006



E07RX005

Special Tools

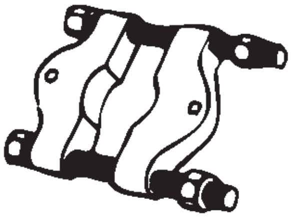
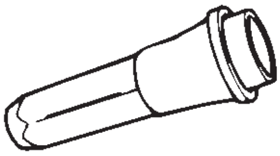
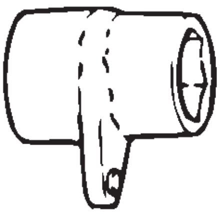
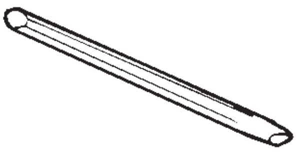
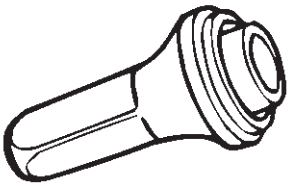
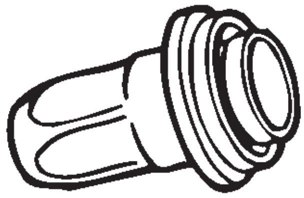
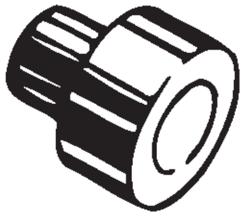
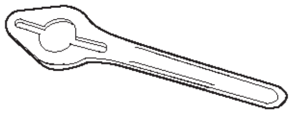
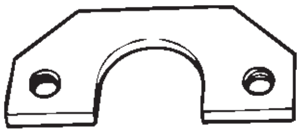
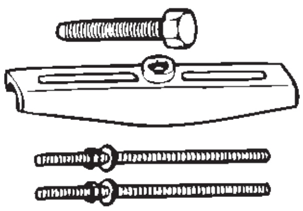
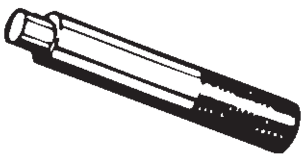
ILLUSTRATION	**PART NO.** PART NAME
 901RS258	**J–22912–01** Bearing remover/installer
 901RS269	**J–38592** Transfer case oil seal installer
 901RS255	**J–37219** Mainshaft nut wrench
 901RS257	**J–37223** Rear output shaft and bearing installer
 901RS263	**J–39209** Punch; end nut
 901RS271	**J–38594** Front output shaft oil seal installer

ILLUSTRATION	**PART NO.** PART NAME
 901RS272	**J–39208** Rear oil seal installer
 901RS273	**J–37486–A** Bearing installer adapter
 901RW071	**J–8614–11** Flange holder
 901RS274	**J–37217** Mainshaft end bearing remover
 901RS252	**J–37487** Puller
 901RS268	**J–8092** Driver handle

RODEO

BRAKES

CONTENTS

Brake Control System

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

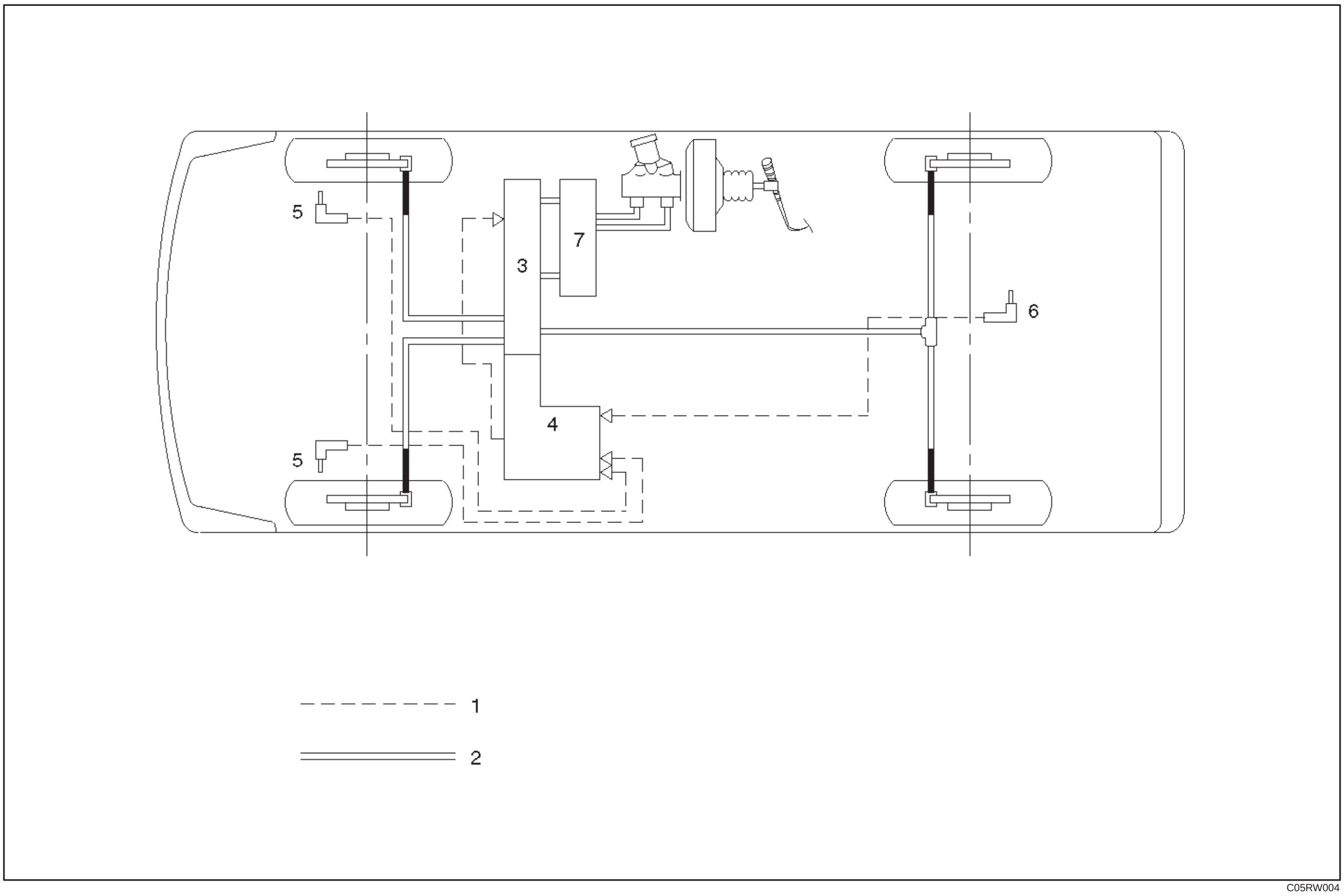
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The Anti-lock Brake System (ABS) works on all four wheels. A combination of wheel speed sensor and Electronic Hydraulic Control Unit (EHCU) can determine when a wheel is about to stop turning and adjust brake pressure to maintain best braking.

This system helps the driver maintain greater control of the vehicle under heavy braking conditions.

NOTE: The Electronic Hydraulic Control Unit (EHCU) comprises the Hydraulic Unit (H/U) and the coil Integrated Module.



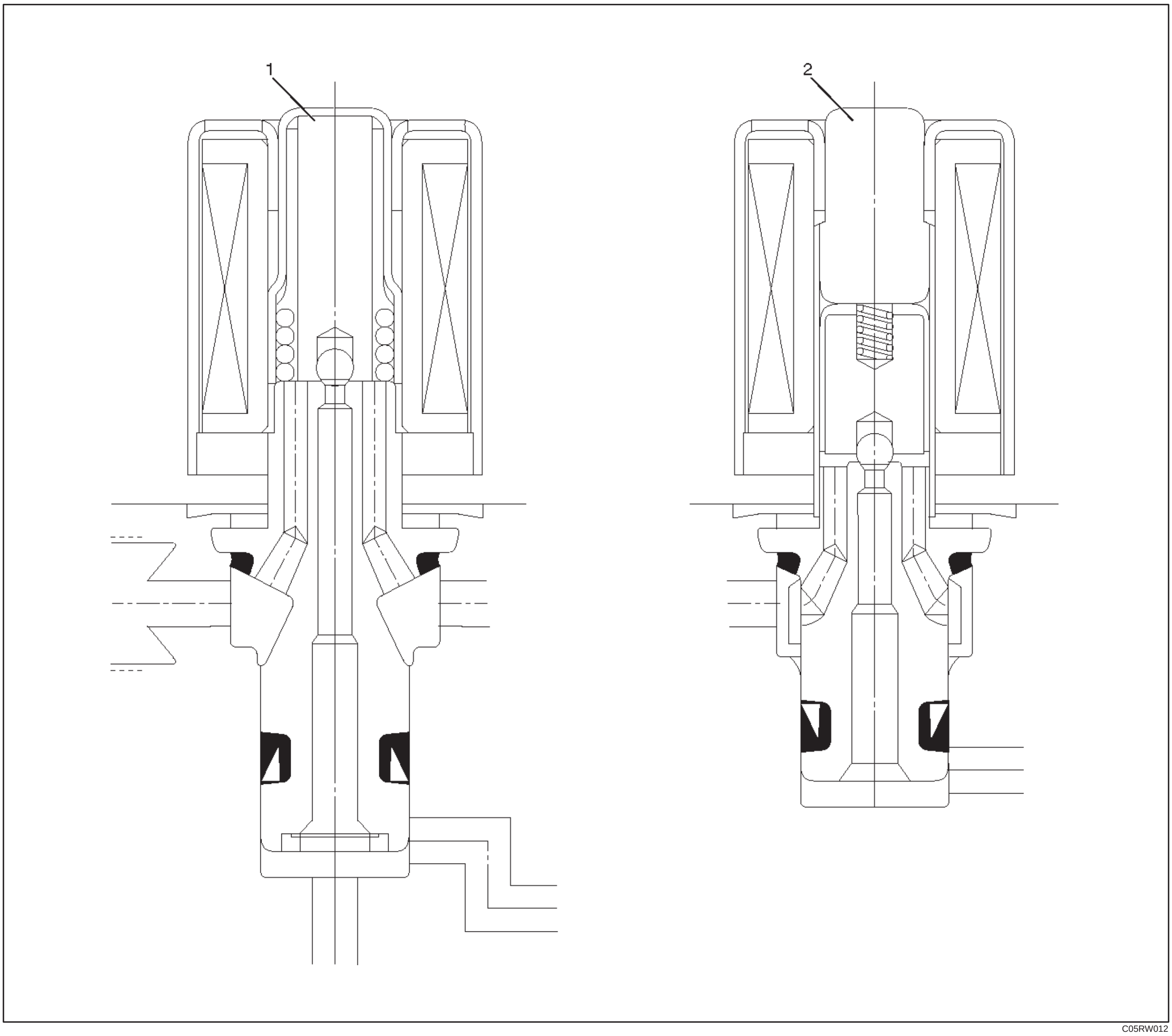
Legend

(1) Electronic
(2) Hydraulic
(3) Hydraulic Unit (H/U)
(4) Coil Integrated Module
(5) Front Wheel Speed Sensor
(6) Rear Wheel Speed Sensor
(7) Proportioning and Bypass (P&B) Valve

Functional Description

Hydraulic Unit (H/U)

Solenoid Valve



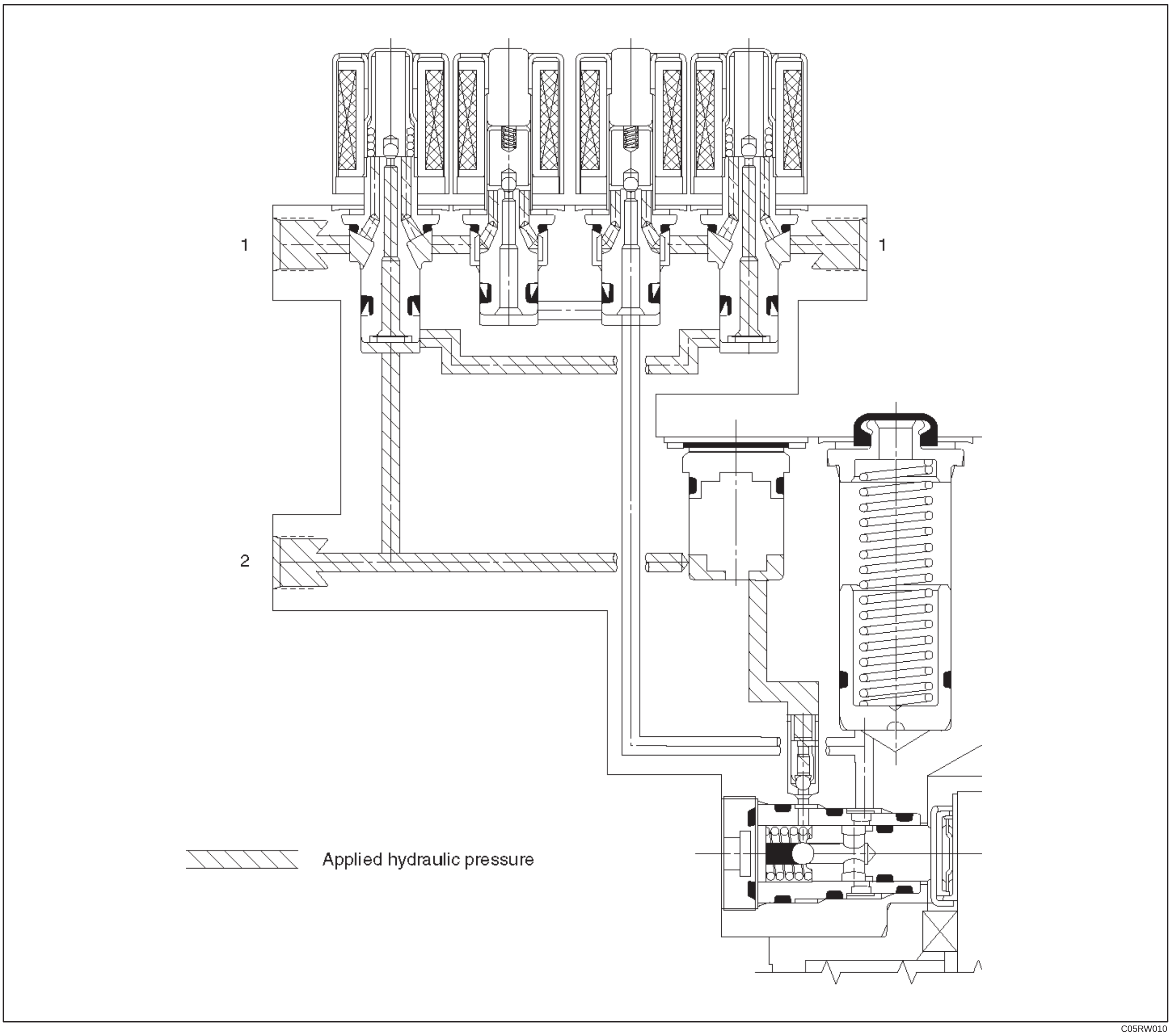
Legend

(1) Isolation Valve
(2) Dump valve

Normal Braking

During normal (non anti-lock) braking, the solenoid valves are without current and closed due to spring force.

Brake fluid travels through the centre of the normally open isolation valve around the normally closed dump valve and on to the brake pistons.



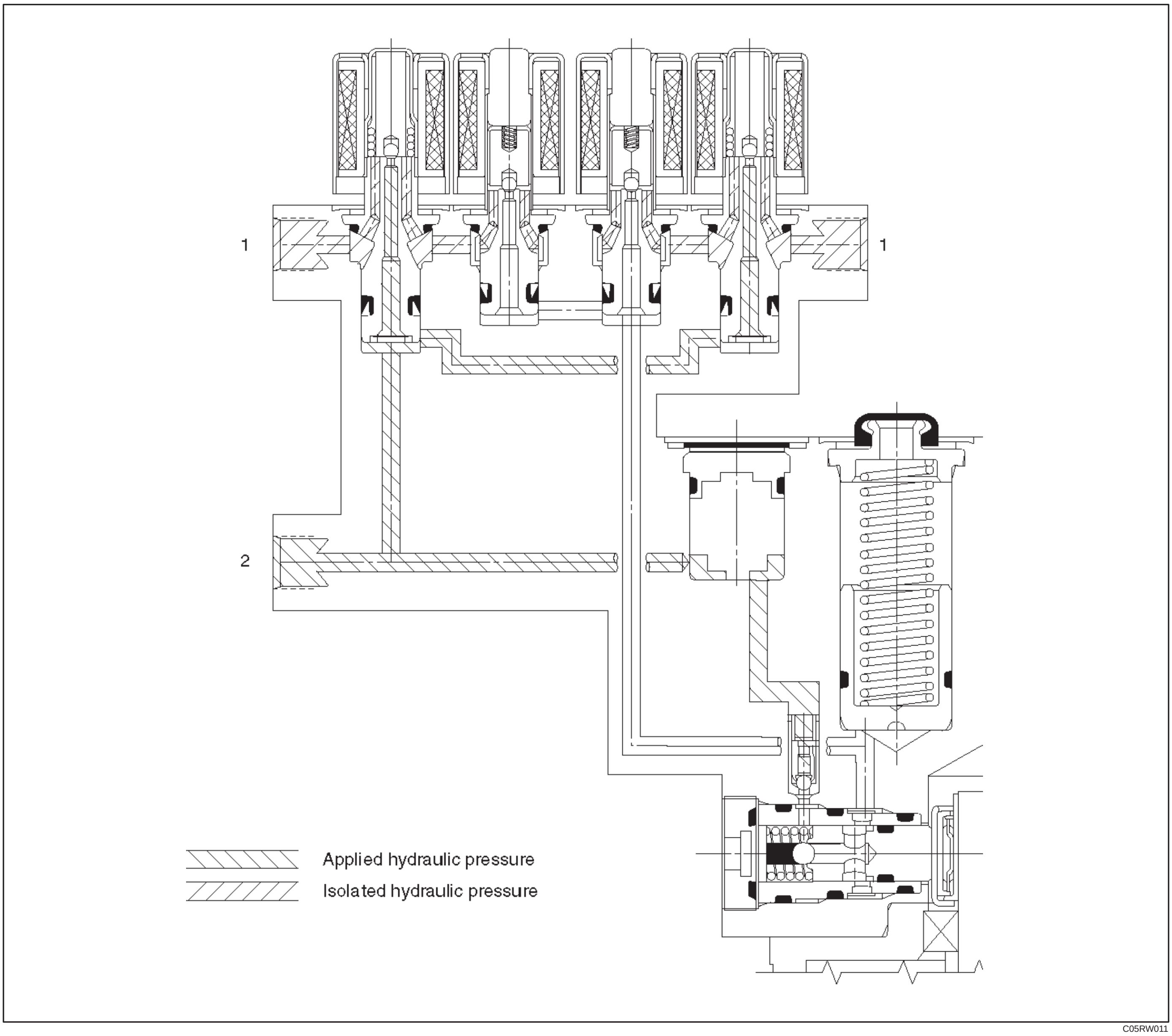
Legend

(1) Brake
(2) Master Cylinder

Pressure Isolation (Pressure Maintain)

The electro-hydraulic control unit is activated when the brakes are applied which sends a signal to the coil integrated module to prepare for a possible anti-lock stop. If the information from the wheel speed sensors indicates excessive wheel deceleration (imminent lockup), the first step in the anti-lock sequence is to isolate the brake pressure being applied by the brake pedal.

The microprocessor in the coil integrated module sends a voltage to the coil to energize and close the isolation valve. This prevents any additional fluid pressure applied by the brake pedal from reaching the wheel. With the isolation valves closed, further unnecessary increase in the brake pressure is therefore prevented.



Legend

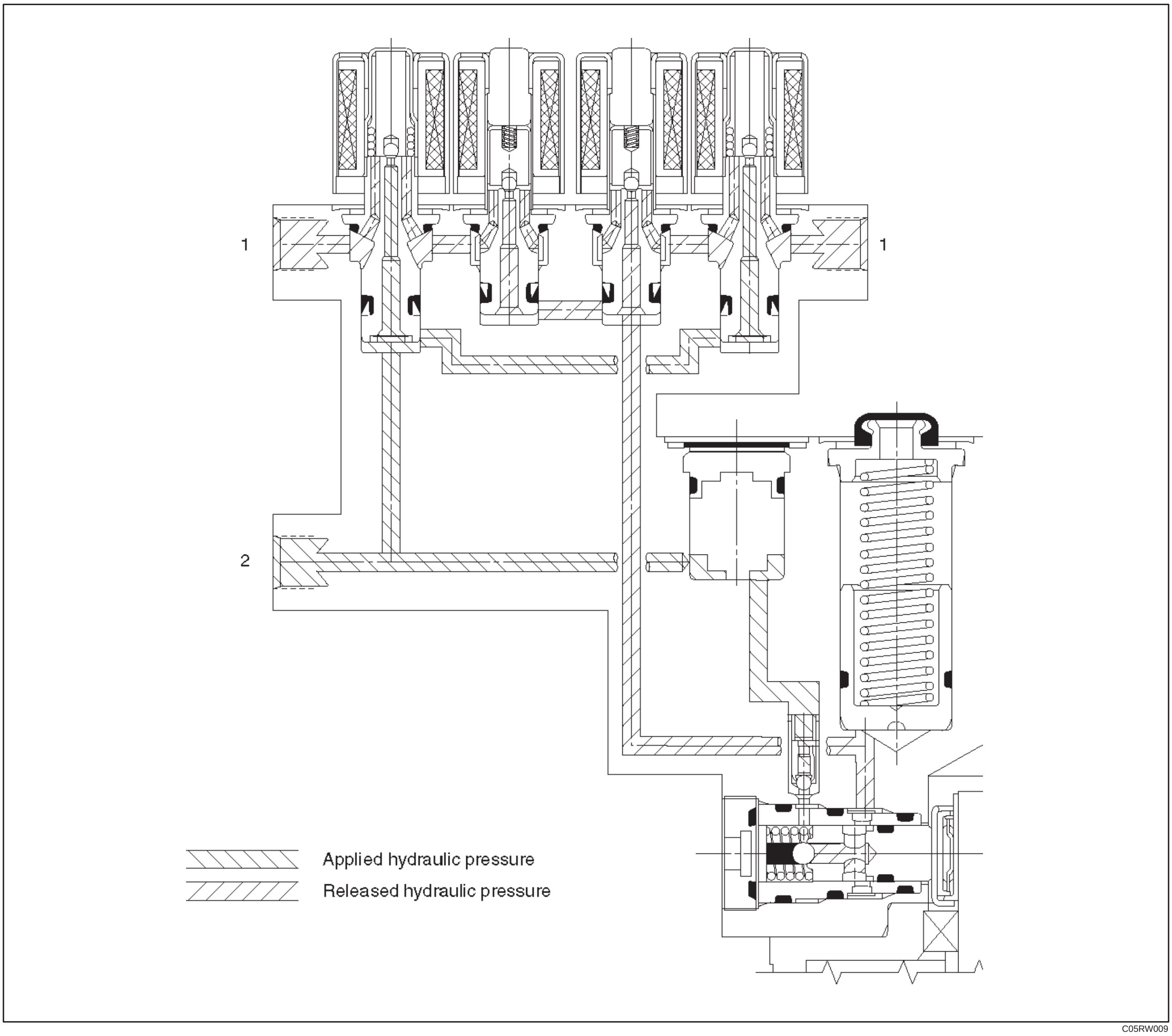
(1) Brake
(2) Master Cylinder

Pressure Reduction

Once the brake pressure is isolated, it must be reduced to allow the wheels to unlock. This is accomplished by dumping a portion of the brake fluid pressure into a low pressure accumulator.

The microprocessor activates the normally closed dump valve to open, allowing fluid from the wheels to be dumped into the accumulator. This is done with very short activation pulses opening and closing the dump valve passageway. Brake pressure is reduced at the wheel and allows the wheel to begin rotating again. The fluid from the brake piston is stored in the accumulator against spring pressure and a portion of this fluid also primes the pump.

The dump valves are operated independently to control the deceleration of the wheel. At this point, the brake pedal is isolated from the base brake system, the hydraulic control unit pumps are primed and the attenuators are ready to pump fluid.



Legend

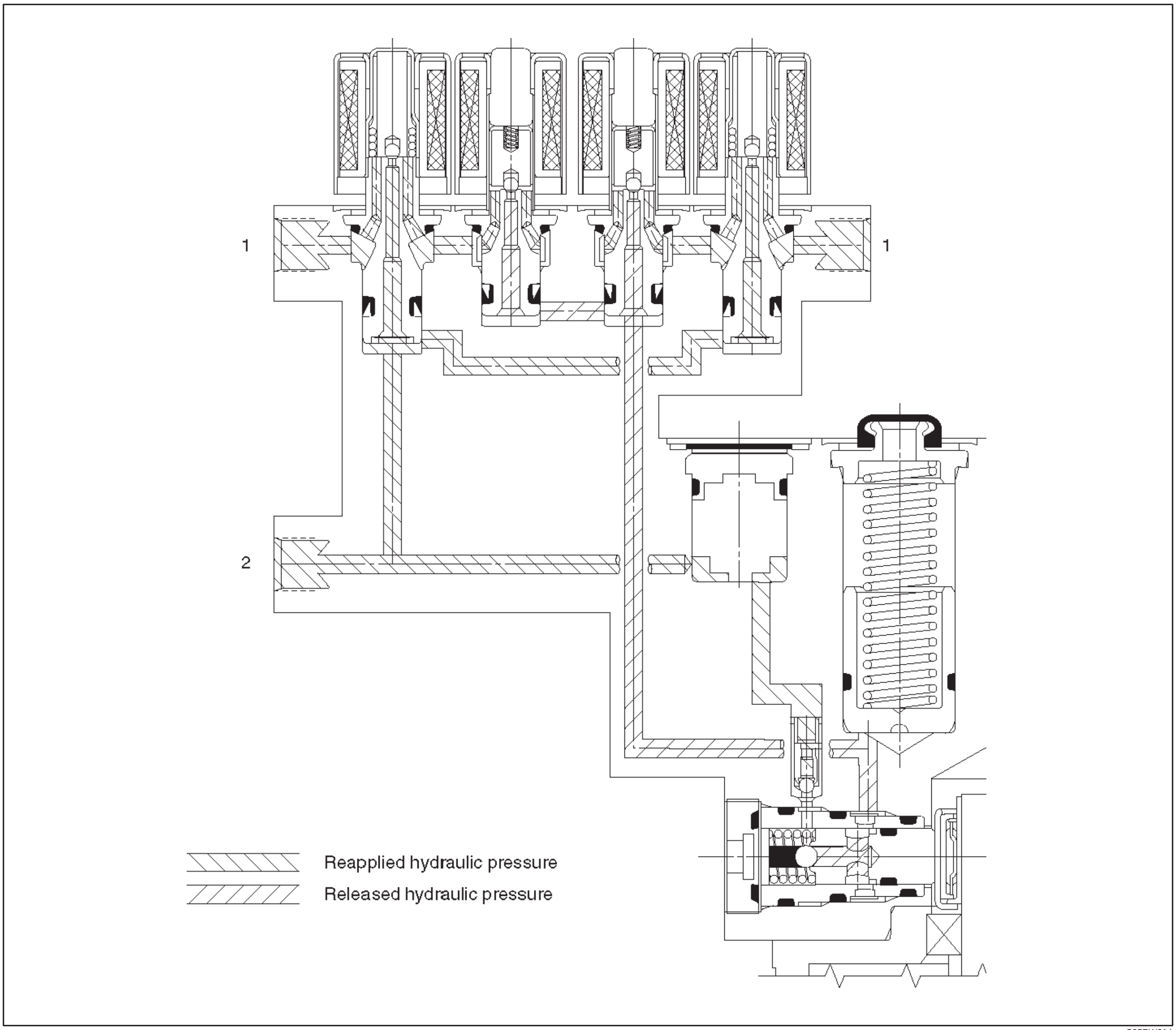
(1) Brake
(2) Master Cylinder

Pressure Increase (Re-apply)

The re-apply sequence is initiated to achieve optimum braking. The isolation valve is momentarily opened to allow master cylinder and pump pressure to reach the brakes. This controlled pressure rise continues until the wheel is at optimum brake output or until the brake pressure is brought up to the master cylinder output pressure.

If more pressure is required, more fluid is drawn from the master cylinder and applied to the brakes. The driver may feel slight pedal pulsations, or pedal drop, this is normal and expected.

As fluid is re-applied to the brakes, the wheel speed will reduce. If the wheels approach imminent lockup again, the module will isolate, dump and re-apply again. This cycle occurs in millisecond intervals, allowing several cycles to occur each second. It is a much faster and more controlled way of “pumping the pedal”.



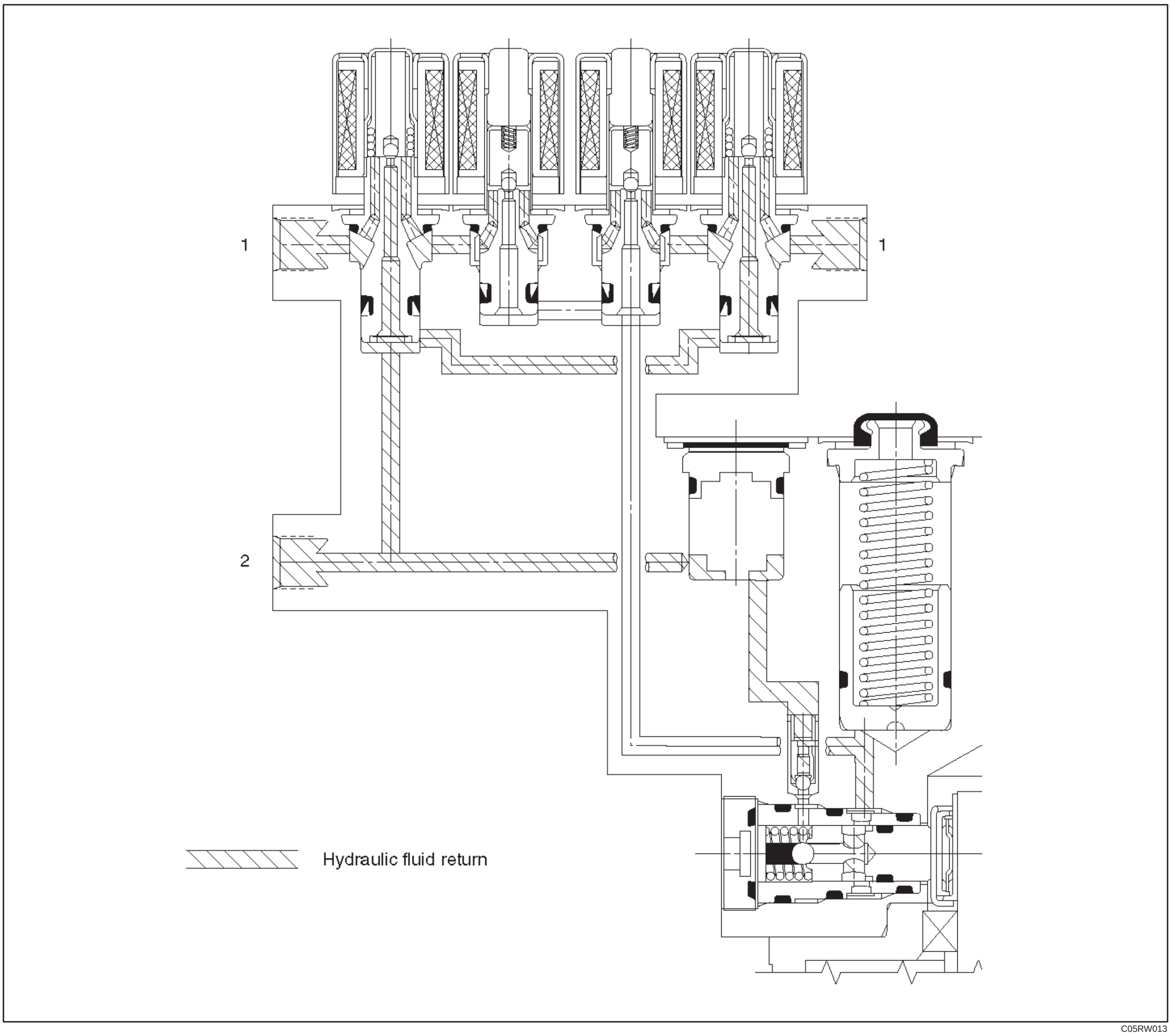
Legend

(1) Brake
(2) Master Cylinder

Brake Release

At the end of the anti-lock stop, when the brake pedal is released, the pump will remain running for a short time to help drain any fluid from the accumulators. As this fluid returns into the system, the spring forces the piston back to its original position.

The isolation valve opens and fluid may return to the master cylinder. Conventional braking is then resumed.



Legend

(1) Brake
(2) Master Cylinder

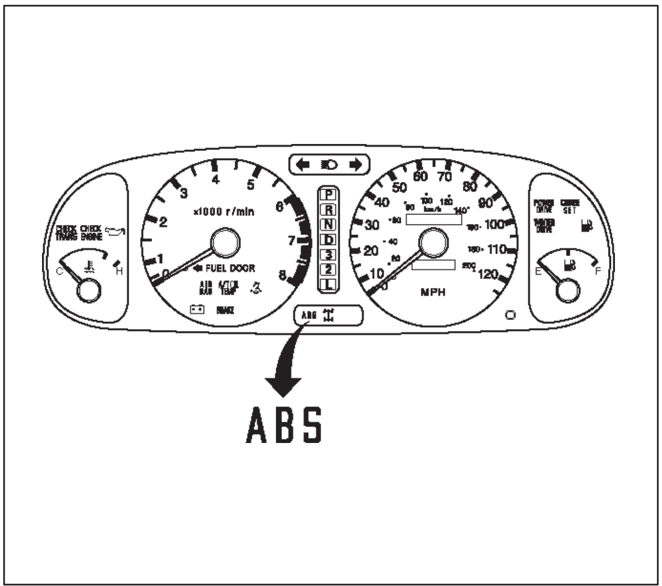
System Components

Electronic Hydraulic Control Unit (EHCU), three Wheel Speed Sensors, Warning Light, and G-sensor.

Electronic Hydraulic Control Unit (EHCU)

The EHCU consists of ABS control circuits, fault detector, and a fail-safe. It drives the hydraulic unit according to the signal from each sensor, cancelling ABS to return to normal braking when a malfunction has occurred in the ABS.
The EHCU has a self-diagnosing function which can indicate faulty circuits during diagnosis.
The EHCU is mounted on the engine compartment rear right side. It consists of a Motor, Plunger Pump, Solenoid Valves.
Solenoid Valves: Reduces or holds the caliper fluid pressure for each front disc brake or both rear disc brakes according to the signal sent from the EHCU.
Reservoir: Temporarily holds the brake fluid that returns from the front and rear disc brake caliper so that pressure of front disc brake caliper can be reduced smoothly.
Plunger Pump: Feeds the brake fluid held in the reservoir to the master cylinder.
Motor: Drives the pump according to the signal from EHCU.
Check Valve: Controls the brake fluid flow.

ABS Warning Light



Vehicles equipped with the Anti-lock Brake System have an amber “ABS” warning light in the instrument panel. The “ABS” warning light will illuminate if a malfunction in the Anti-lock Brake System is detected by the Electronic Hydraulic Control Unit (EHCU). In case of an electronic malfunction, the EHCU will turn “ON” the “ABS” warning light and disable the Anti-lock braking function.
The “ABS” light will turn “ON” for approximately three seconds after the ignition switch is to the “ON” position.
If the “ABS” light stays “ON” after the ignition switch is the “ON” position, or comes “ON” and stays “ON” while driving, the Anti-lock Brake System should be inspected for a malfunction according to the diagnosis procedure.

Wheel Speed Sensor

It consists of a sensor and a rotor. The sensor is attached to the knuckle on the front wheels and to the rear axle case on the rear differential.
The rotor is press-fit in the axle shaft.
The flux generated from electrodes magnetized by a magnet in the sensor varies due to rotation of the rotor, and the electromagnetic induction generates alternating voltage in the coil. This voltage draws a “sine curve” with the frequency proportional to rotor speed and it allows detection of wheel speed.

G-Sensor

The G-sensor installed inside the EHCU detects the vehicle deceleration speed and sends a signal to the EHCU. In 4WD operation, all four wheels may be decelerated in almost the same phase, since all wheels are connected mechanically.
This tendency is noticeable particularly on roads with low friction coefficient, and the ABS control is adversely affected.
The G-sensor judges whether the friction coefficient of road surface is low or high, and changes the EHCU’s operating system to ensure ABS control.

Normal and Anti-lock Braking

Under normal driving conditions, the Anti-lock Brake System functions the same as a standard power assisted brake system. However, with the detection of wheel lock-up, a slight bump or kick-back will be felt in the brake pedal. This pedal “bump” will be followed by a series of short pedal pulsations which occurs in rapid succession. The brake pedal pulsation will continue until there is no longer a need for the anti-lock function or until the vehicle is stopped. A slight ticking or popping noise may be heard during brake applications when the Anti-lock features is being used.
When the Anti-lock feature is being used, the brake pedal may rise even as the brakes are being applied. This is also normal. Maintaining a constant force on the pedal will provide the shortest stopping distance.

Brake Pedal Travel

Vehicles equipped with the Anti-lock Brake System may be stopped by applying normal force to the brake pedal. Although there is no need to push the pedal beyond the point where it stops or holds the vehicle, by applying more force the pedal will continue to travel toward the floor.
This extra brake pedal travel is normal.

Acronyms and Abbreviations

Several acronyms and abbreviations are commonly used throughout this section:

ABS
Anti-lock Brake System

CIM
Coil Integrated Module

CKT
Circuit

DLC
Data Link Connector

EHCU
Electronic Hydraulic Control Unit

FL
Front Left

FR
Front Right

GEN
Generator

H/U
Hydraulic Unit

MV
Millivolts

RR
Rear

RPS
Revolution per Second

VDC
DC Volts

VAC
AC Volts

W/L
Warning Light

WSS
Wheel Speed Sensor

General Diagnosis

General Information

ABS troubles can be classified into two types, those which can be detected by the ABS warning light and those which can be detected as a vehicle abnormality by the driver.

In either case, locate the fault in accordance with the "BASIC DIAGNOSTIC FLOWCHART" and repair.

Please refer to Section 5C for the diagnosis of mechanical troubles such as brake noise, brake judder (brake pedal or vehicle vibration felt when braking), uneven braking, and parking brake trouble.

ABS Service Precautions

Required Tools and Items:

- Box Wrench
- Brake Fluid
- Special Tool

Some diagnosis procedures in this section require the installation of a special tool.

J-39200 High Impedance Multimeter

When circuit measurements are requested, use a circuit tester with high impedance.

Computer System Service Precautions

The Anti-lock Brake System interfaces directly with the Electronic Hydraulic Control Unit (EHCU) which is a control computer that is similar in some regards to the Powertrain Control Module. These modules are designed to withstand normal current draws associated with vehicle operation. However, care must be taken to avoid overloading any of the EHCU circuits. In testing for opens or shorts, do not ground or apply voltage to any of the circuits unless instructed to do so by the appropriate diagnostic procedure. These circuits should only be tested with a high impedance multimeter (J-39200) or special tools as described in this section. Power should never be removed or applied to any control module with the ignition in the "ON" position.

Before removing or connecting battery cables, fuses or connectors, always turn the ignition switch to the "OFF" position.

General Service Precautions

The following are general precautions which should be observed when servicing and diagnosing the Anti-lock Brake System and/or other vehicle systems. Failure to observe these precautions may result in Anti-lock Brake System damage.

- If welding work is to be performed on the vehicle using an electric arc welder, the EHCU and valve block connectors should be disconnected before the welding operation begins.
- The EHCU and valve block connectors should never be connected or disconnected with the ignition "ON" .
- If only rear wheels are rotated using jacks or drum tester, the system will diagnose a speed sensor malfunction and the "ABS" warning light will illuminate. But actually no trouble exists. After inspection stop the engine once and re-start it, then make sure that the "ABS" warning light does not illuminate.

If the battery has been discharged

The engine may stall if the battery has been completely discharged and the engine is started via jumper cables. This is because the Anti-lock Brake System (ABS) requires a large quantity of electricity. In this case, wait until the battery is recharged, or set the ABS to a non-operative state by removing the fuse for the ABS (60A). After the battery has been recharged, stop the engine and install the ABS fuse. Start the engine again, and confirm that the ABS warning light does not light.

Note on Intermittents

As with virtually any electronic system, it is difficult to identify an intermittent failure. In such a case duplicating the system malfunction during a test drive or a good description of vehicle behavior from the customer may be helpful in locating a "most likely" failed component or circuit. The symptom diagnosis chart may also be useful in isolating the failure. Most intermittent problems are caused by faulty electrical connections or wiring. When an intermittent failure is encountered, check suspect circuits for:

- Suspected harness damage.
- Poor mating of connector halves or terminals not fully seated in the connector body (backed out).
- Improperly formed or damaged terminals.

Test Driving ABS Complaint Vehicles

In case that there has been an abnormality in the lighting pattern of “ABS” warning light, the fault can be located in accordance with the “DIAGNOSIS BY “ABS” WARNING LIGHT ILLUMINATION PATTERN” . In case of such trouble as can be detected by the driver as a vehicle symptom, however, it is necessary to give a test drive following the test procedure mentioned below, thereby reproducing the symptom for trouble diagnosis on a symptom basis:

1. Start the engine and make sure that the “ABS” W/L goes OFF. If the W/L remains ON, it means that the Diagnostic Trouble Code (DTC) is stored. Therefore, read the code and locate the fault.

NOTE: The DTC cannot be cleared if the vehicle speed does not exceed 12 km/h (8 mph) at DTC, even though the repair operation is completed.

2. Start the vehicle and accelerate to about 30 km/h (19 mph) or more.
3. Slowly brake and stop the vehicle completely.
4. Then restart the vehicle and accelerate to about 40 km/h (25 mph) or more.
5. Brake at a time so as to actuate the ABS and stop the vehicle.
6. Be cautious of abnormality during the test. If the W/L is actuated while driving, read the DTC and locate the fault.
7. If the abnormality is not reproduced by the test, make best efforts to reproduce the situation reported by the customer.
8. If the abnormality has been detected, repair in accordance with the “SYMPTOM DIAGNOSIS” .

NOTE:

- Be sure to give a test drive on a wide, even road with a small traffic.
- If an abnormality is detected, be sure to suspend the test and start trouble diagnosis at once.

“ABS” Warning Light

When ABS trouble occurs to actuate “ABS” warning light, the trouble code corresponding to the trouble is stored in the EHCU. Only ordinary brake is available with ABS being unactuated. Even when “ABS” warning light is actuated, if the starter switch is set ON after setting it OFF once, the EHCU checks up on the entire system and, if there is no abnormality, judges ABS to work currently and the warning light is lit normally even though the trouble code is stored.

NOTE: Illumination of the “ABS” warning light indicates that anti-lock braking is no longer available. Power assisted braking without anti-lock control is still available.

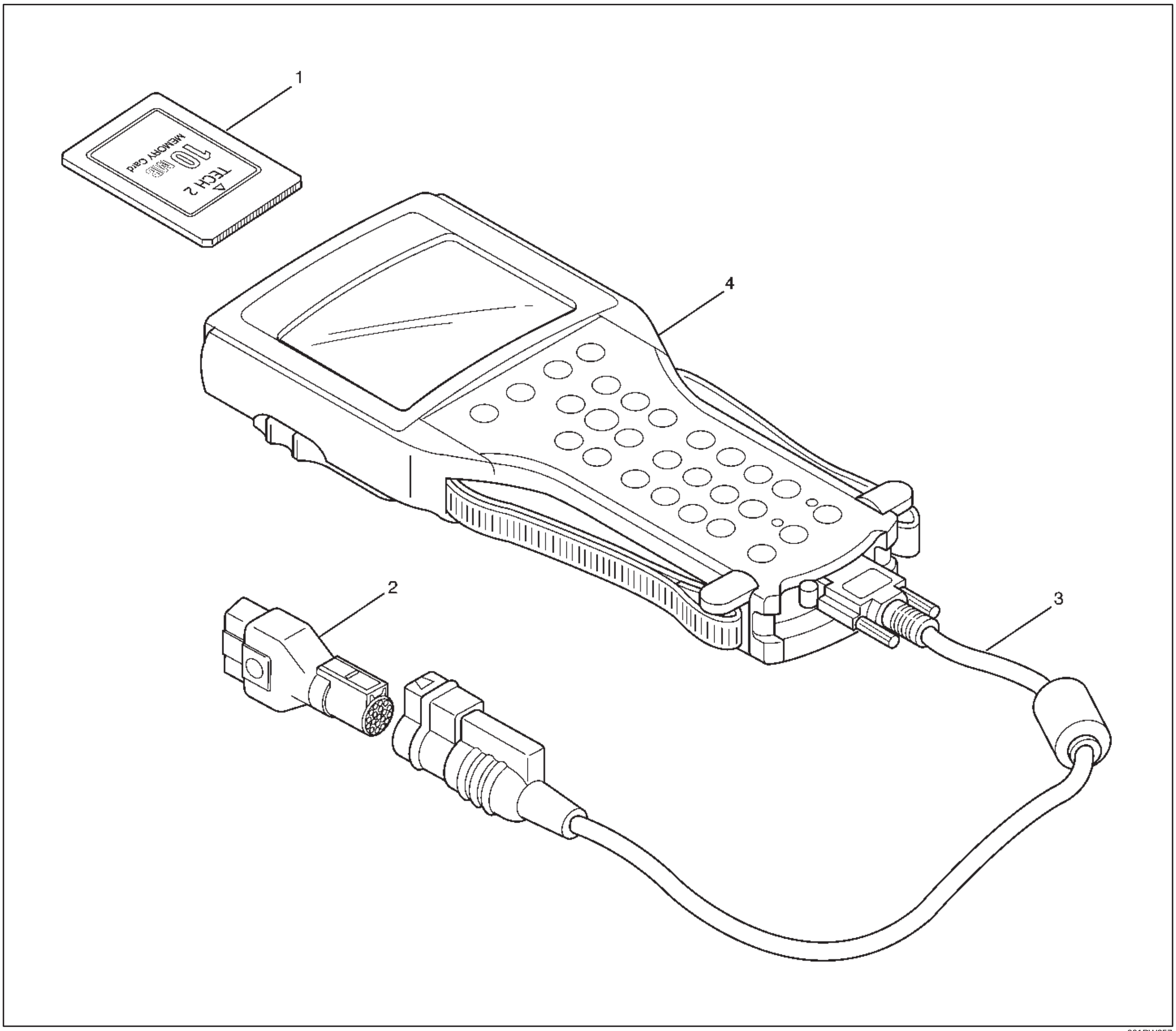
Normal Operation

“ABS” Warning Light

When the ignition is first moved from “OFF” to “RUN” , the amber “ABS” warning light will turn “ON” . The “ABS” warning light will turn “ON” during engine starting and will usually stay “ON” for approximately three seconds after the ignition switch is returned to the “ON” position. The warning light should remain “OFF” at all other times.

Tech 2 Scan Tool

From 98 MY, Isuzu dealer service departments are recommended to use Tech 2. Please refer to Tech 2 scan tool user guide.



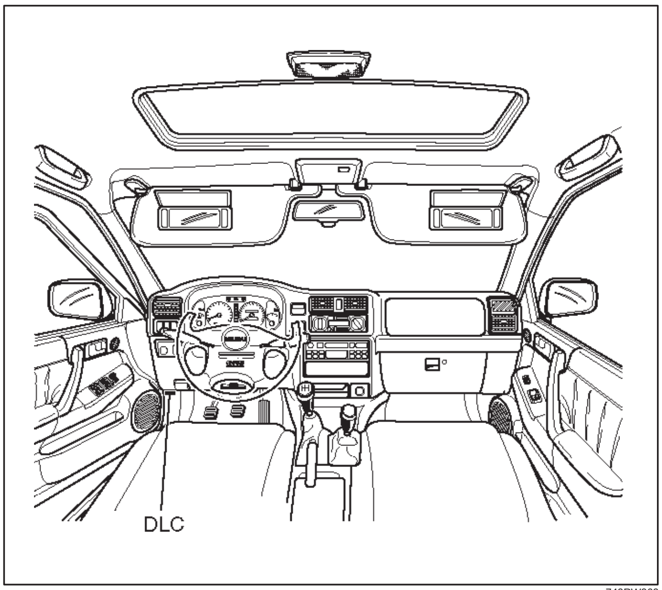
Legend

(1) PCMCIA Card
(2) SAE 16/19 Adaptor
(3) DLC Cable
(4) Tech–2

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 98 System PCMCIA card (1) inserts into the Tech 2 (4).
2. Connect the SAE 16/19 adapter (2) to the DLC cable (3).
3. Connect the DLC cable to the Tech 2 (4).
4. Make sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.



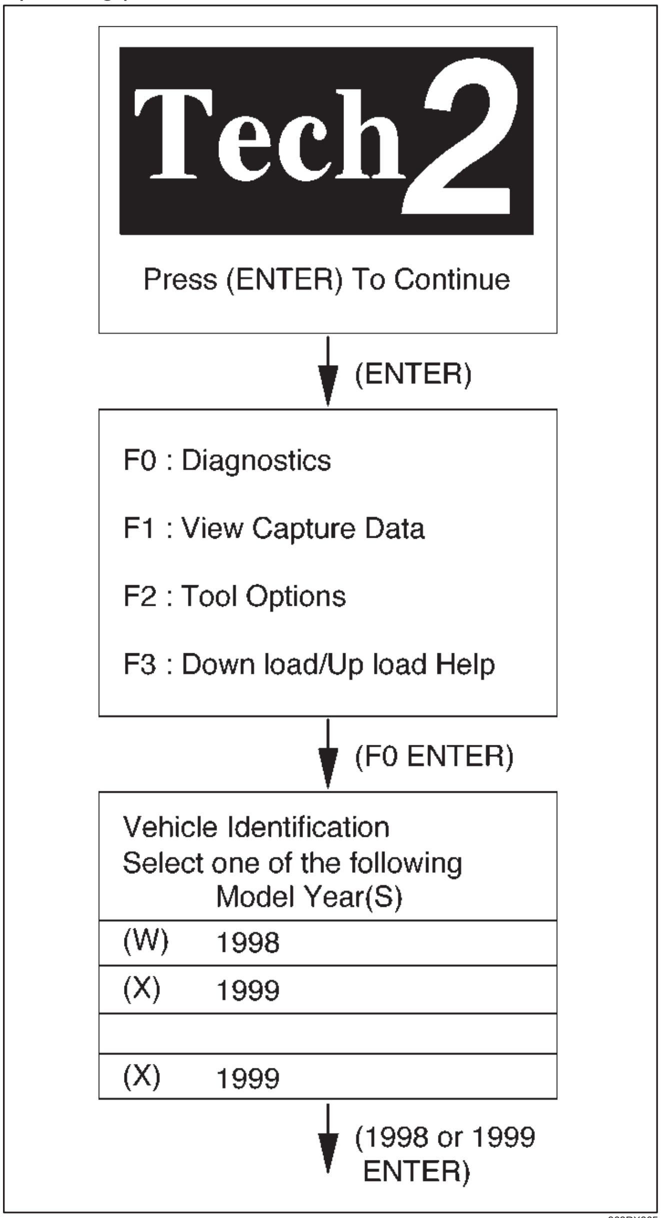
740RW060

6. The vehicle ignition turns on.
7. Power up the Tech 2.
8. Verify the Tech 2 power up display.

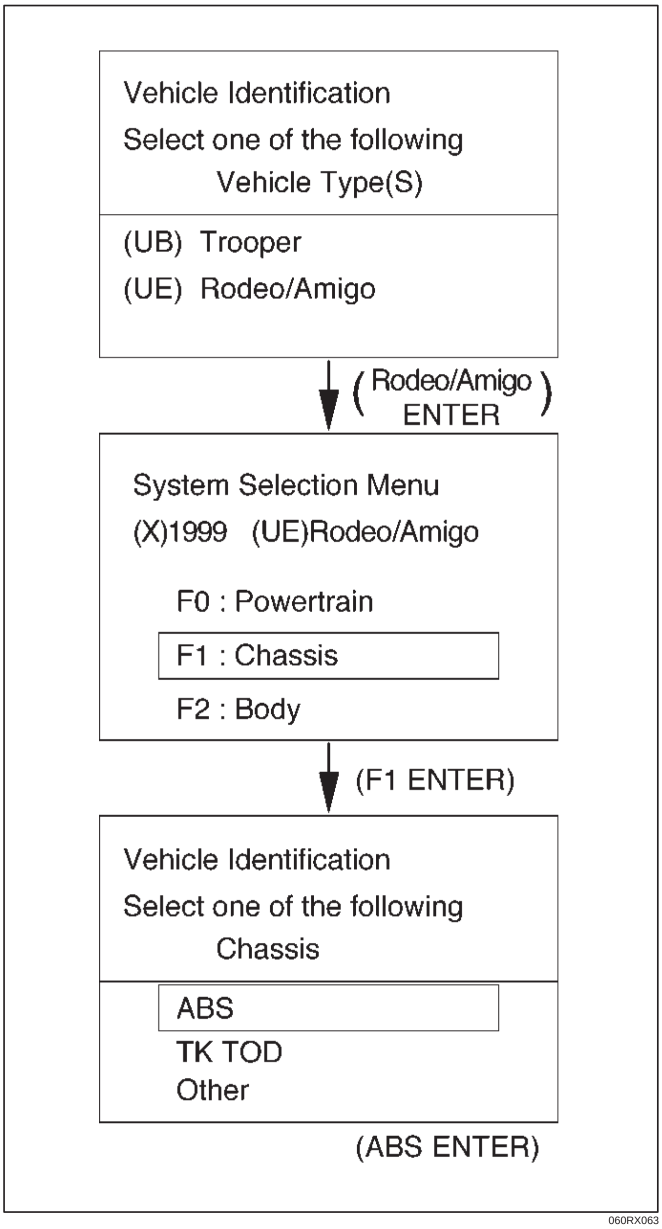
060RW009

Operating Procedure

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



060RX065


Vehicle Identification
Select one of the following
Vehicle Type(S)
(UB) Trooper
(UE) Rodeo/Amigo
(Rodeo/Amigo ENTER)
System Selection Menu
(X)1999 (UE)Rodeo/Amigo
F0 : Powertrain
F1 : Chassis
F2 : Body
(F1 ENTER)
Vehicle Identification
Select one of the following
Chassis
ABS
TK TOD
Other
(ABS ENTER)
060RX063

DATA LIST

The data displayed by DATA LIST are as follows:

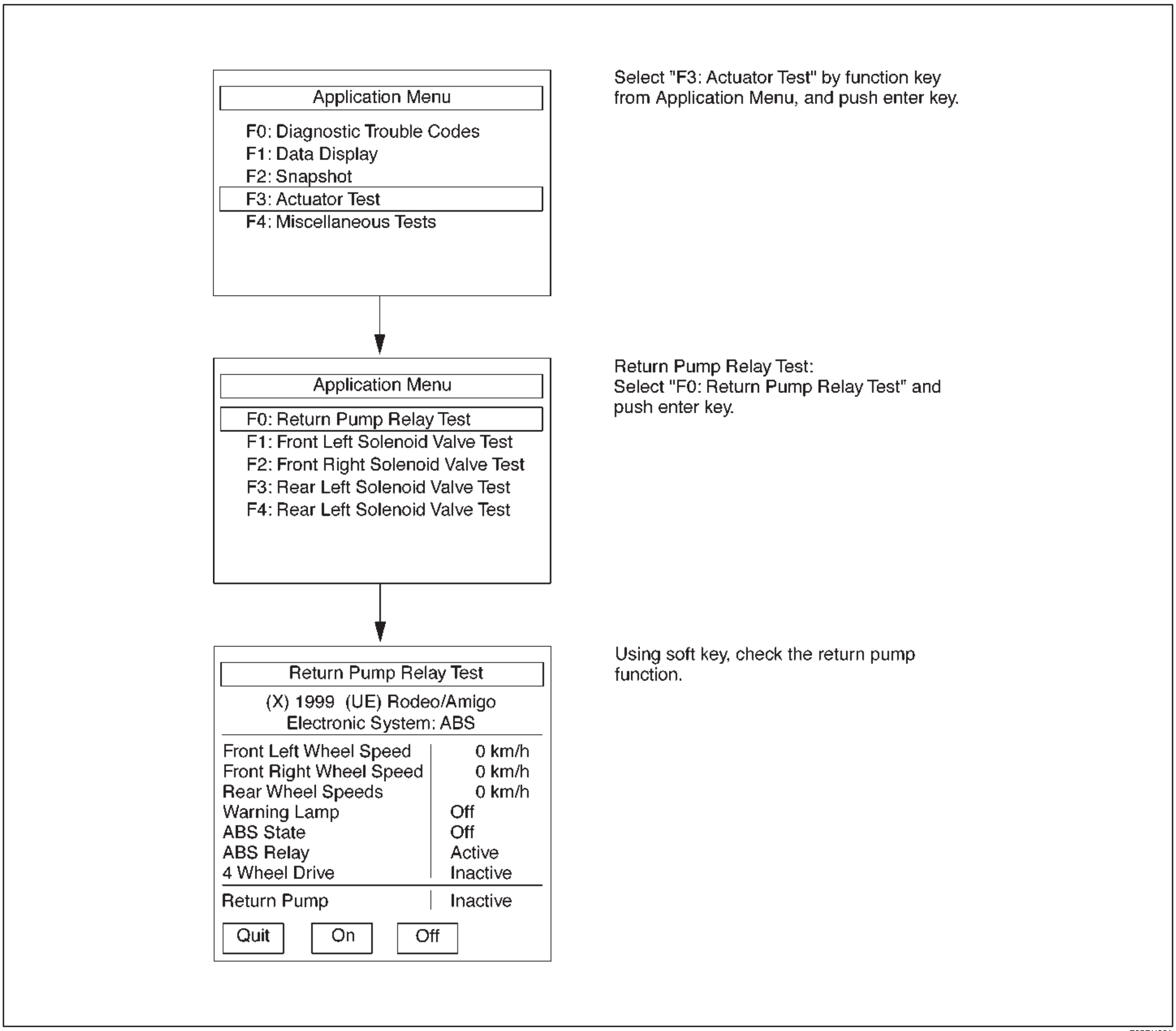
Display	Content	OK/NG Criteria for Data
Front Left Wheel Speed Front Right Wheel Speed Rear Wheel Speeds	km/h (MPH)	• Start the vehicle and make sure of linear change in each wheel speed. • Turn each wheel by hand and make sure that each speed data change.
Warning Lamp	ON/OFF	• To be OFF usually
ABS State	ON/OFF	• To be OFF usually
ABS Relay	Active/Inactive	• To be Active usually
4 Wheel Drive	Active/Inactive	• 2WD: Inactive • 4WD: Active
Brake Switch	Active/Inactive	• Inactive (Released) • Active (Pressed)
Brake Fluid Level	Normal or not	• To be Normal usually
Return Pump	Active/Inactive	• To be Inactive usually
DRP (Dynamic Rear Proportioning)	Active/Inactive	• To be Inactive usually
Rear Dump Valve Commanded	Active/Inactive	• To be Inactive usually
Rear Dump Valve Feedback		
Rear Isolation Valve Commanded		
Rear Isolation Valve Feedback		
FL Dump Valve Commanded	Active/Inactive	• To be Inactive usually
FL Dump Valve Feedback		
FL Isolation Valve Commanded		
FL Isolation Valve Feedback		
FR Dump Valve Commanded	Active/Inactive	• To be Inactive usually
FR Dump Valve Feedback		
FR Isolation Valve Commanded		
FR Isolation Valve Feedback		
G–Sensor	Voltage	• 0.00V when vehicle is stopped
Battery Voltage	Voltage	• Between 10–16.9V

ACTUATOR TEST

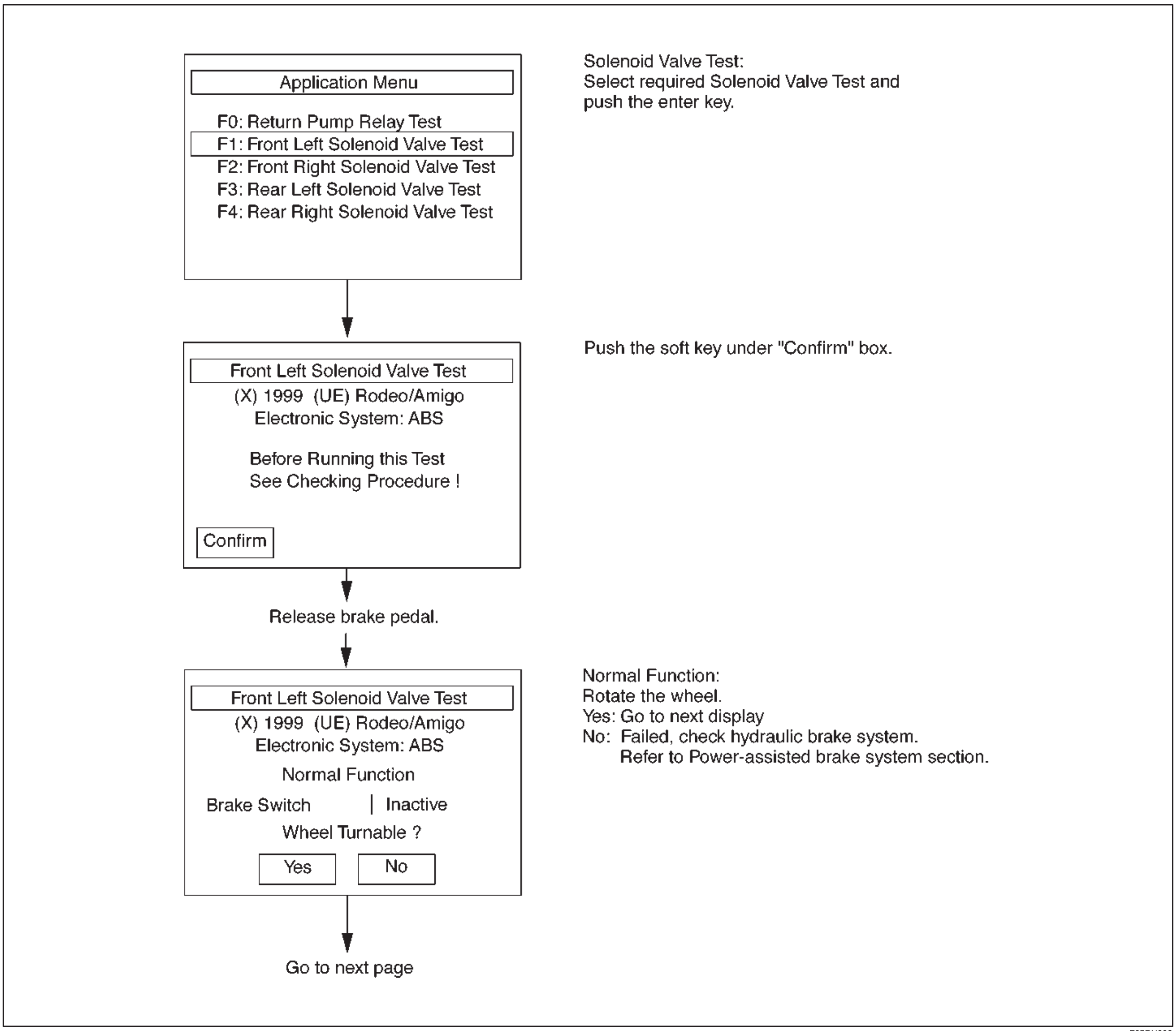
This mode is used to exercise the ABS actuators and make sure they operate normally. Prior to the test, pay attention to the cautions below. (When checking the solenoid valve system, be sure to jack up the vehicle.)

CAUTION:

- Before testing, be sure that the brakes work normally.
- Make sure that the battery is fully charged.Conduct the test by two persons (A TECH 2 operator and a vehicle checker).
- Be sure to start ACTUATOR TEST with the engine stopped.
- Before testing, make sure that electrical trouble, if any, has been completely repaired. Conducting tests of ABS solenoid with electrical circuit problem remaining uncorrected could damage the control unit.



F05RX001


Application Menu
F0: Return Pump Relay Test
F1: Front Left Solenoid Valve Test
F2: Front Right Solenoid Valve Test
F3: Rear Left Solenoid Valve Test
F4: Rear Right Solenoid Valve Test
Solenoid Valve Test:
Select required Solenoid Valve Test and
push the enter key.
Front Left Solenoid Valve Test
(X) 1999 (UE) Rodeo/Amigo
Electronic System: ABS
Before Running this Test
See Checking Procedure !
Confirm
Push the soft key under "Confirm" box.
Release brake pedal.
Front Left Solenoid Valve Test
(X) 1999 (UE) Rodeo/Amigo
Electronic System: ABS
Normal Function
Brake Switch | Inactive
Wheel Turnable ?
Yes
No
Normal Function:
Rotate the wheel.
Yes: Go to next display
No: Failed, check hydraulic brake system.
Refer to Power-assisted brake system section.
Go to next page

F05RX002

Depress and hold brake pedal.

Front Left Solenoid Valve Test
(X) 1999 (UE) Rodeo/Amigo
Electronic System: ABS
Normal Function
Brake Switch | Active
Wheel Blocked ?
Yes No

Rotate the wheel.
Yes: Go to next display
No: Failed, check brake line and bleed air.
Refer to Power-assisted brake system section.

Release brake pedal.

Front Left Solenoid Valve Test
(X) 1999 (UE) Rodeo/Amigo
Electronic System: ABS
Normal Function
Brake Switch | Inactive
Wheel Turnable ?
Yes No

Rotate the wheel.
Yes: Go to next display
No: Failed, check brake disc, caliper or drum.
Refer to Power-assisted brake system section.

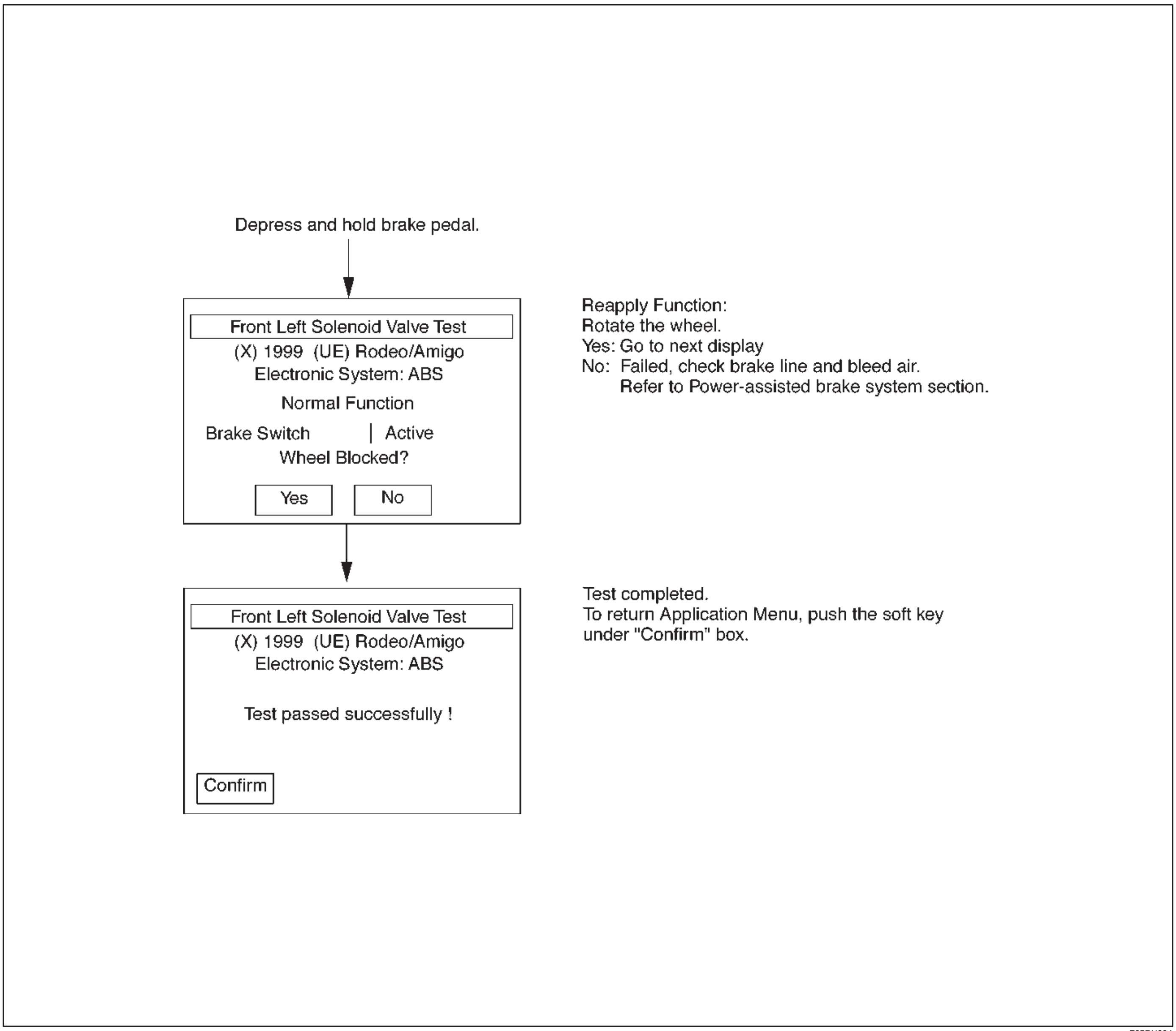
Depress and hold brake pedal.

Front Left Solenoid Valve Test
(X) 1999 (UE) Rodeo/Amigo
Electronic System: ABS
Release Function
Brake Switch | Active
Return Pump | Inactive
Wheel Turnable ?
Yes No

Release Function:
Rotate the wheel.
Yes: Go to next display
No: Failed, check brake disc, caliper or drum.
Refer to Power-assisted brake system section.

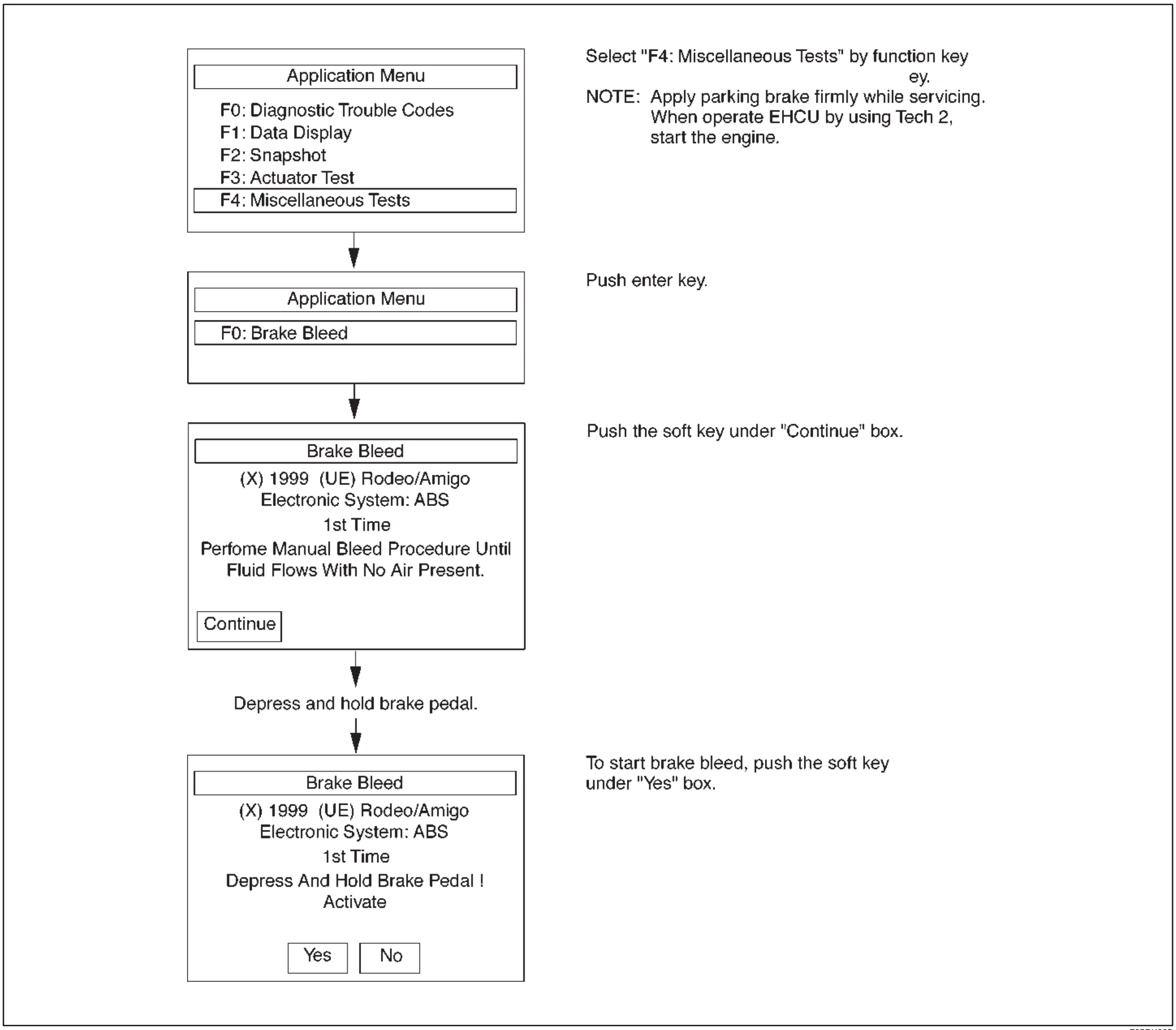
Go to next page

F05RX003

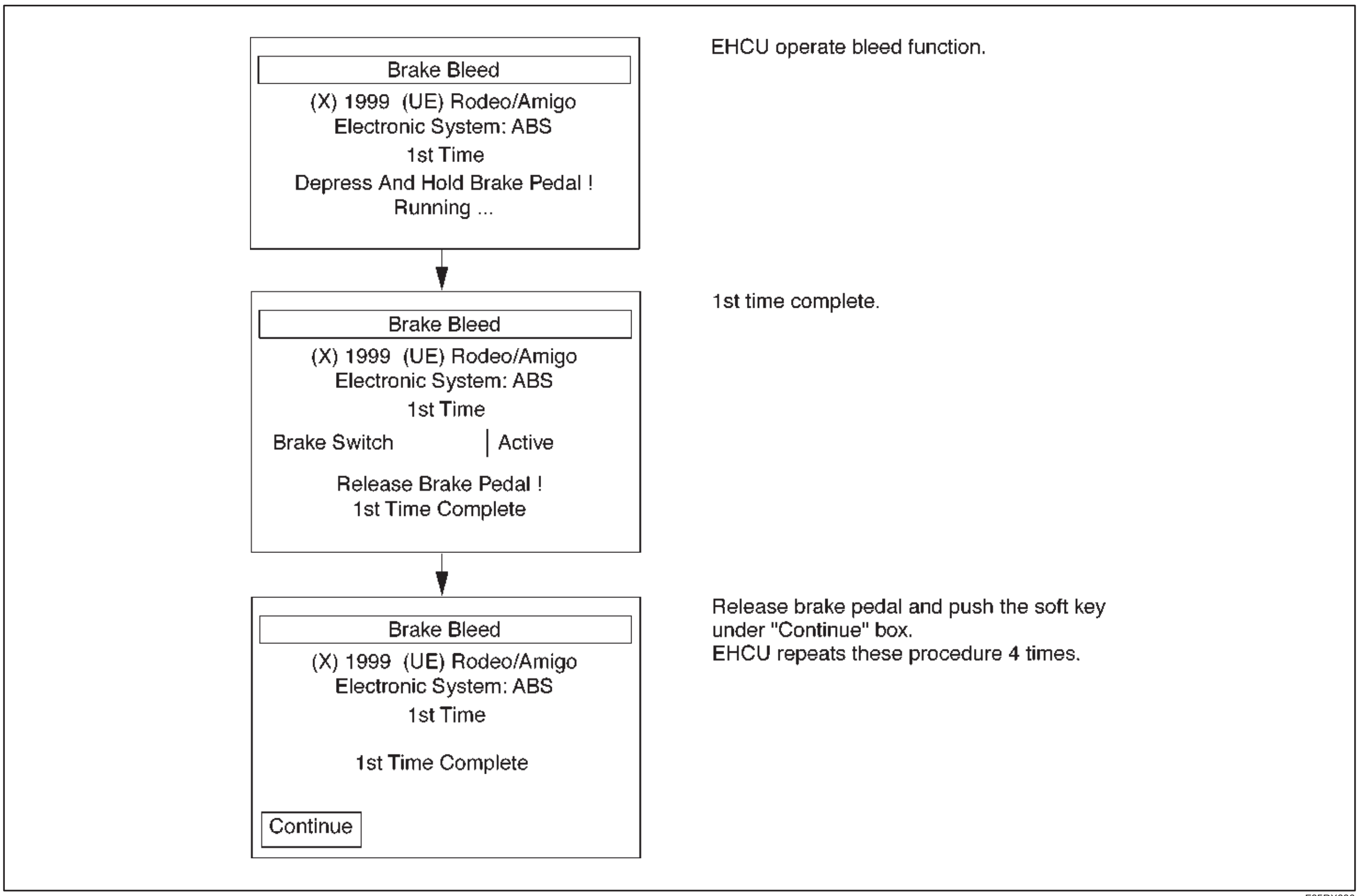

Depress and hold brake pedal.
Front Left Solenoid Valve Test
(X) 1999 (UE) Rodeo/Amigo
Electronic System: ABS
Normal Function
Brake Switch | Active
Wheel Blocked?
Yes
No
Reapply Function:
Rotate the wheel.
Yes: Go to next display
No: Failed, check brake line and bleed air.
Refer to Power-assisted brake system section.
Front Left Solenoid Valve Test
(X) 1999 (UE) Rodeo/Amigo
Electronic System: ABS
Test passed successfully !
Confirm
Test completed.
To return Application Menu, push the soft key
under "Confirm" box.

F05RX004

Tech 2 Service Bleed



F05RX005



F05RX006

Basic Diagnostic Flow Chart

Step	Action	Yes	No
1	1. Customer complaint. 2. Questioning to customer. 3. Basic inspection (Refer to “Basic inspection procedure”) Using TECH 2?	Go to Step 2	Go to Step 4
2	Make sure of DTC by mode “F0: Diagnostic Trouble Codes”. Is EHCU including DTC?	Clear code and check for repeatability. Go to Step 3	Go to Step 5
3	1. Repair of faulty part. 2. Elimination of DTC. 3. Inspection of “ABS” W/L Illumination pattern with ignition SW “ON”. 4. Test drive. Does trouble repeat?	Repeat the diagnosis it the symptom or DTC appears again Go to Step 1	Go to Step 5
4	Check if the DTC is stored or not. Is EHCU including DTC?	Clear code and check for repeatability Go to Step 3	Trouble diagnosis based on symptom (Refer to “SYMPTOM DIAGNOSIS”) Go to Step 3
5	1. Reconnect all components. Ensure all component are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Finished	Go to Step 5

Basic Inspection Procedure

1. Basic Inspection of Service Brake

Step	Action	Yes	No
1	Is the fluid level normal?	Go to Step 2	Replenish with fluid Go to Step 2
2	Does fluid leak?	Repair Go to Step 3	Go to Step 3
3	Is the booster function normal?	Go to Step 4	Repair Go to Step 4
4	Is the pad and rotor normal?	Go to Step 5	Repair Go to Step 5
5	Reconnect all components. Ensure all component are properly mounted. Was this step finished?	Finished	Go to Step 5

2. Ground Inspection

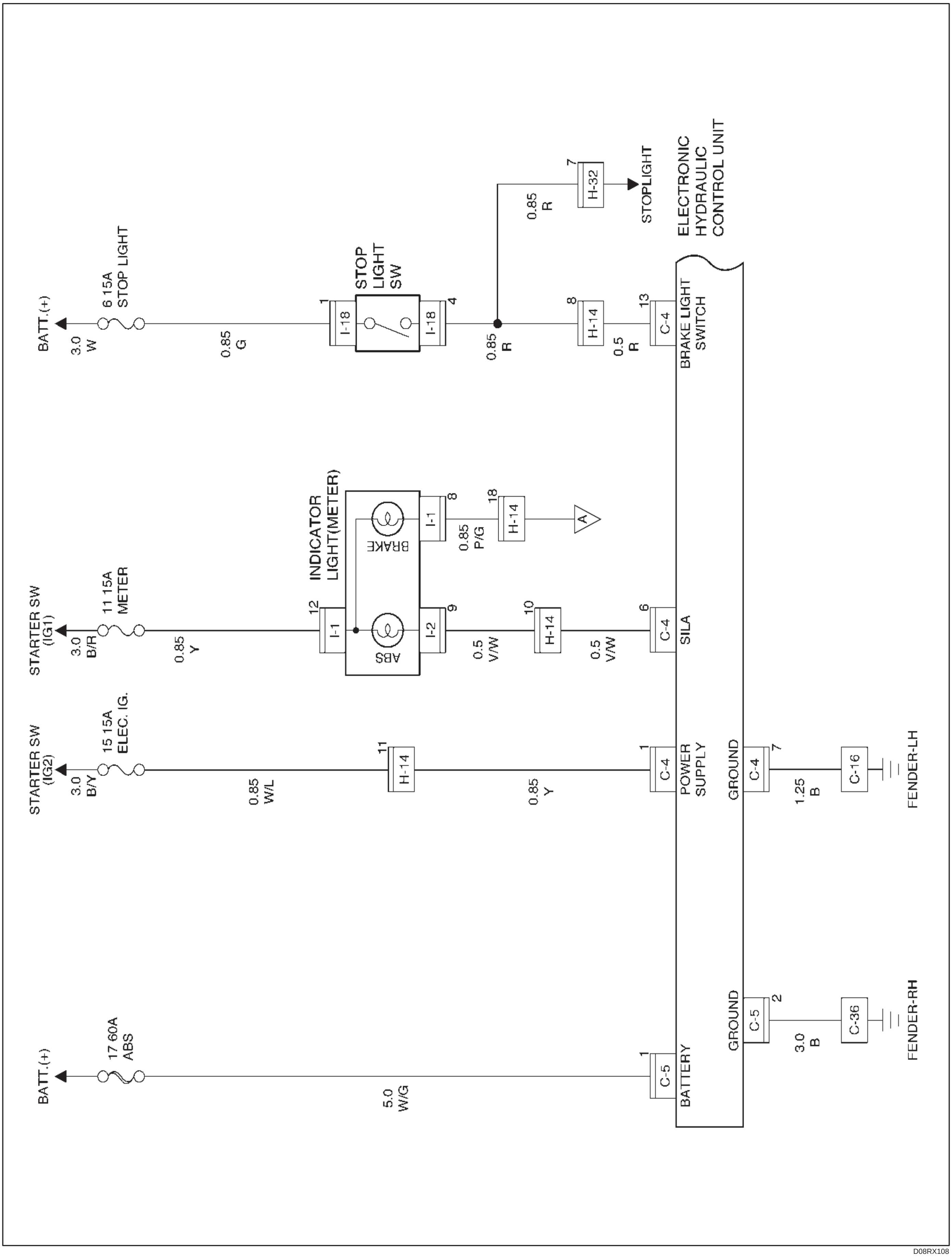
Step	Action	Yes	No
1	Does ABS—related ground points normally?	Go to Step 2	Repair Go to Step 2
2	Reconnect all components. Ensure all component are properly mounted. Was this step finished?	Finished	Go to Step 2

EHCU Connector Pin-out Checks

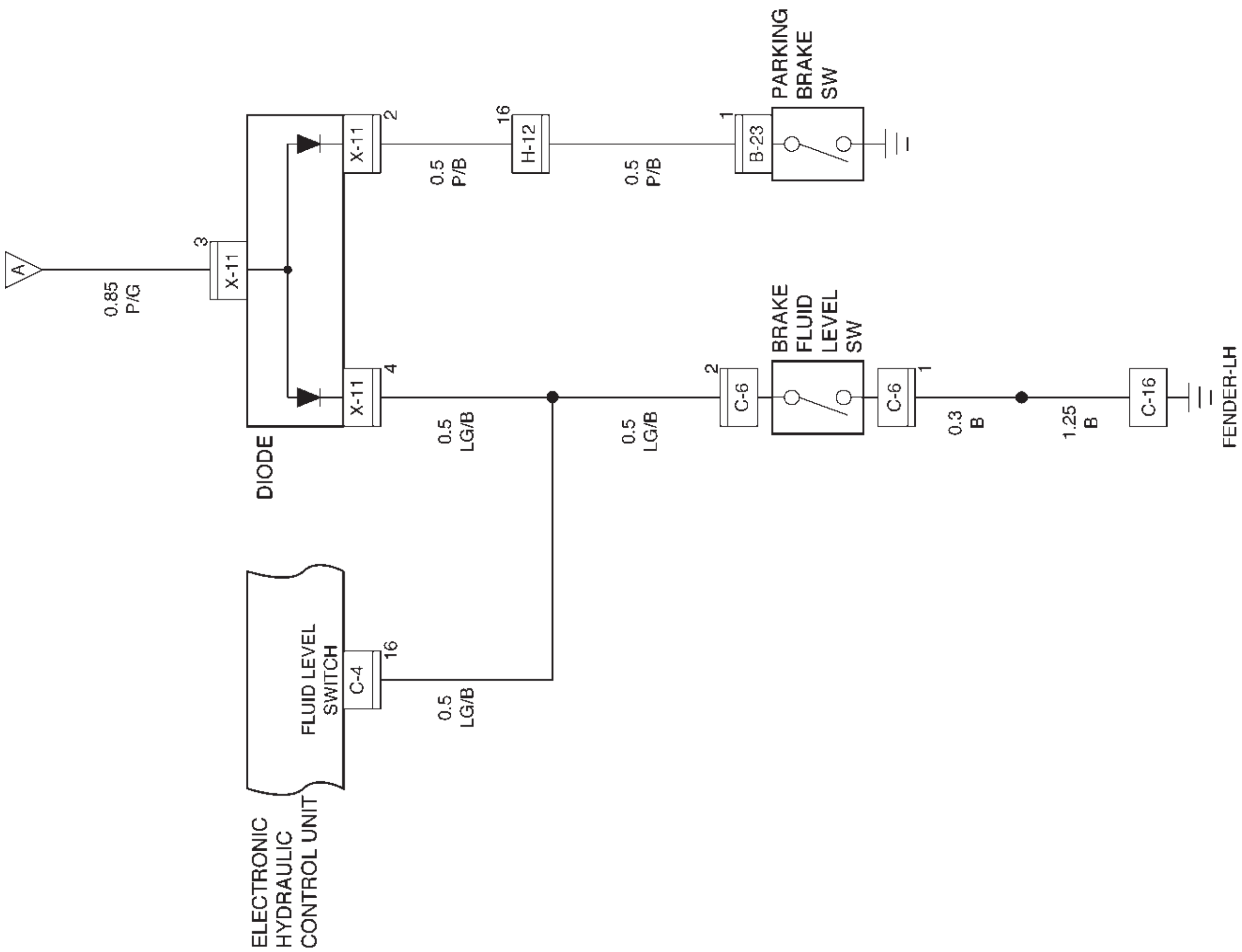
- Disconnect Electronic Hydraulic Control Module.
- Perform checks with high impedance digital multimeter J-39200 or equivalent.

No.	Circuit to be Tested	Ignition Switch Position	Multimeter Scale/Range	Measure between Pin Number	Nominal Value	Note
1	Power supply	OFF	20DCV	1 (C–5) 2 (C–5)	11.5V to 14.5V	
2	Ignition enable	OFF	20DCV	1 (C–4) 7 (C–4)	0V to 0.1V	
		ON	20DCV	1 (C–4) 7 (C–4)	11.5V to 14.5V	
3	Stoplight switch	OFF	20DCV	13 (C–4) 7 (C–4)	10.5V to 14.5V	Press brake pedal
4	Ground connection	OFF	200Ω	7 (C–4) Ground	Less than 2Ω	
		OFF	1Ω	2 (C–5) Ground	Less than 0.2Ω	
5	FL speed sensor	OFF	2kΩ	2 (C–4) 10 (C–4)	2.0kΩ to 2.8kΩ	Internal Resistance
		OFF	200kΩ	2 (C–4) 7 (C–4)	more than 100kΩ	Insulation Resistance
		OFF	200mACV	2 (C–4) 10 (C–4)	more than 200mV	Turn wheel at 1RPS
6	FR speed sensor	OFF	2kΩ	3 (C–4) 11 (C–4)	2.0kΩ to 2.8kΩ	Internal Resistance
		OFF	200kΩ	3 (C–4) 7 (C–4)	more than 100kΩ	Insulation Resistance
		OFF	200mACV	3 (C–4) 11 (C–4)	more than 200mV	Turn wheel at 1RPS
7	RR speed sensor	OFF	2kΩ	4 (C–4) 12 (C–4)	1.2kΩ to 2.0kΩ	Internal Resistance
		OFF	200kΩ	4 (C–4) 7 (C–4)	more than 100kΩ	Insulation Resistance
		OFF	200mACV	4 (C–4) 12 (C–4)	more than 200mV	Turn wheel at 1RPS

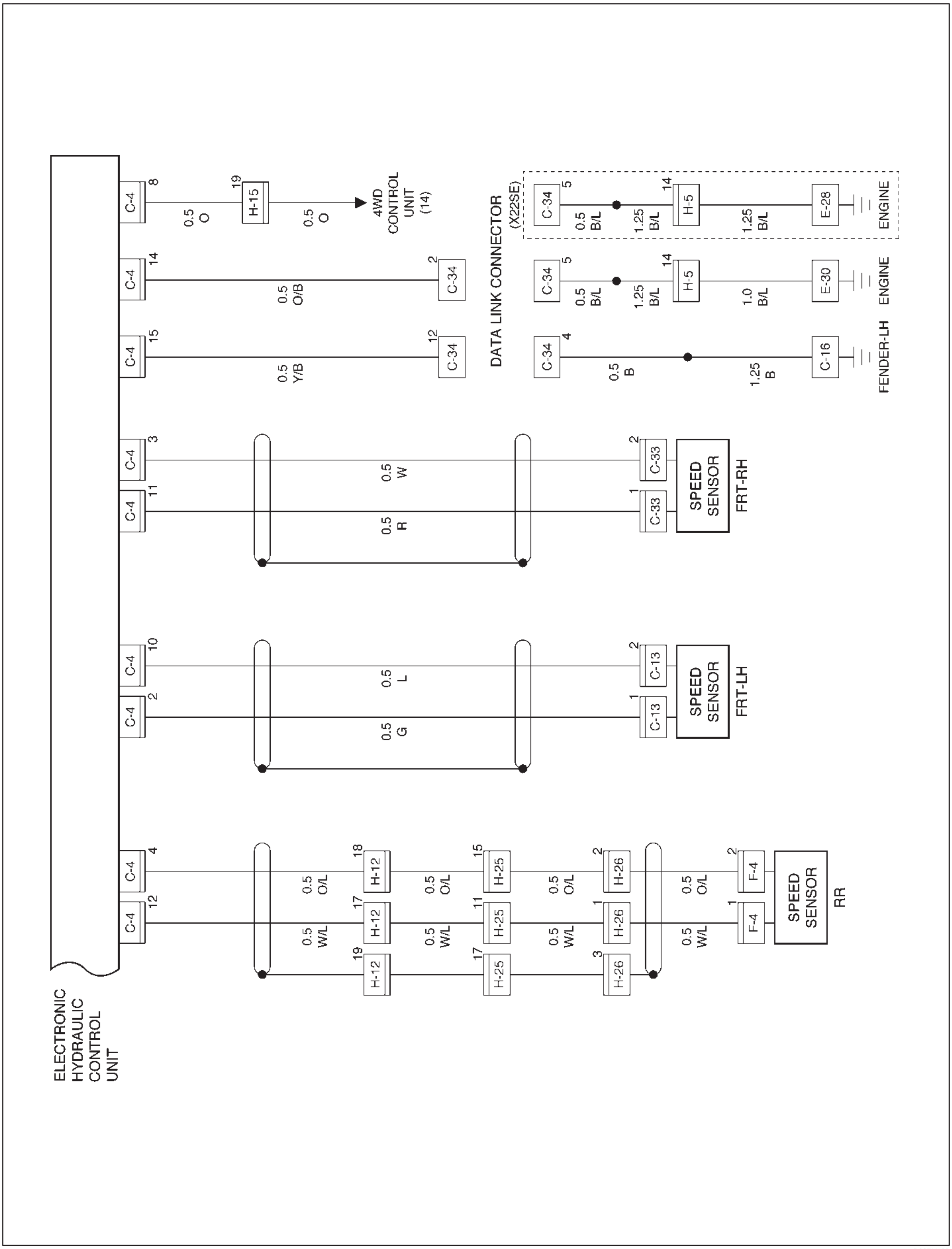
Circuit Diagram



D08RX108

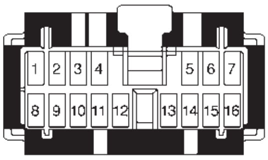
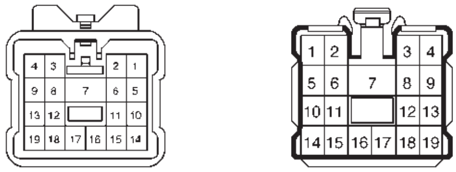
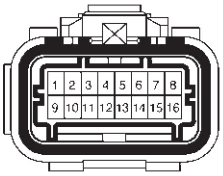
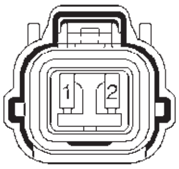
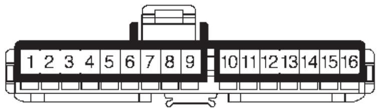
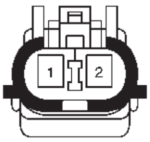
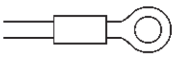
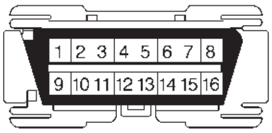
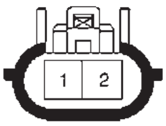
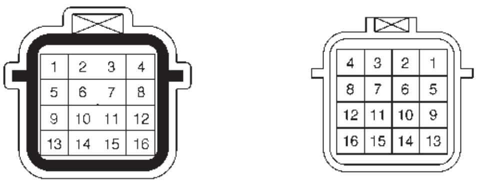
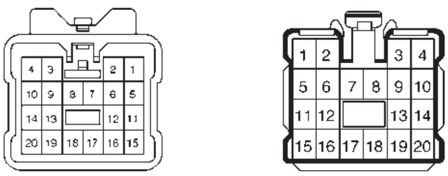

A
0.85
P/G
3
X-11
X-11
2
0.5
P/B
16
H-12
0.5
P/B
1
B-23
PARKING
BRAKE
SW
X-11
4
DIODE
0.5
LG/B
0.5
LG/B
2
C-6
BRAKE
FLUID
LEVEL
SW
C-6
1
0.3
B
1.25
B
C-16
FENDER-LH
FLUID LEVEL
SWITCH
C-4
16
0.5
LG/B
ELECTRONIC
HYDRAULIC
CONTROL UNIT

D08RX110

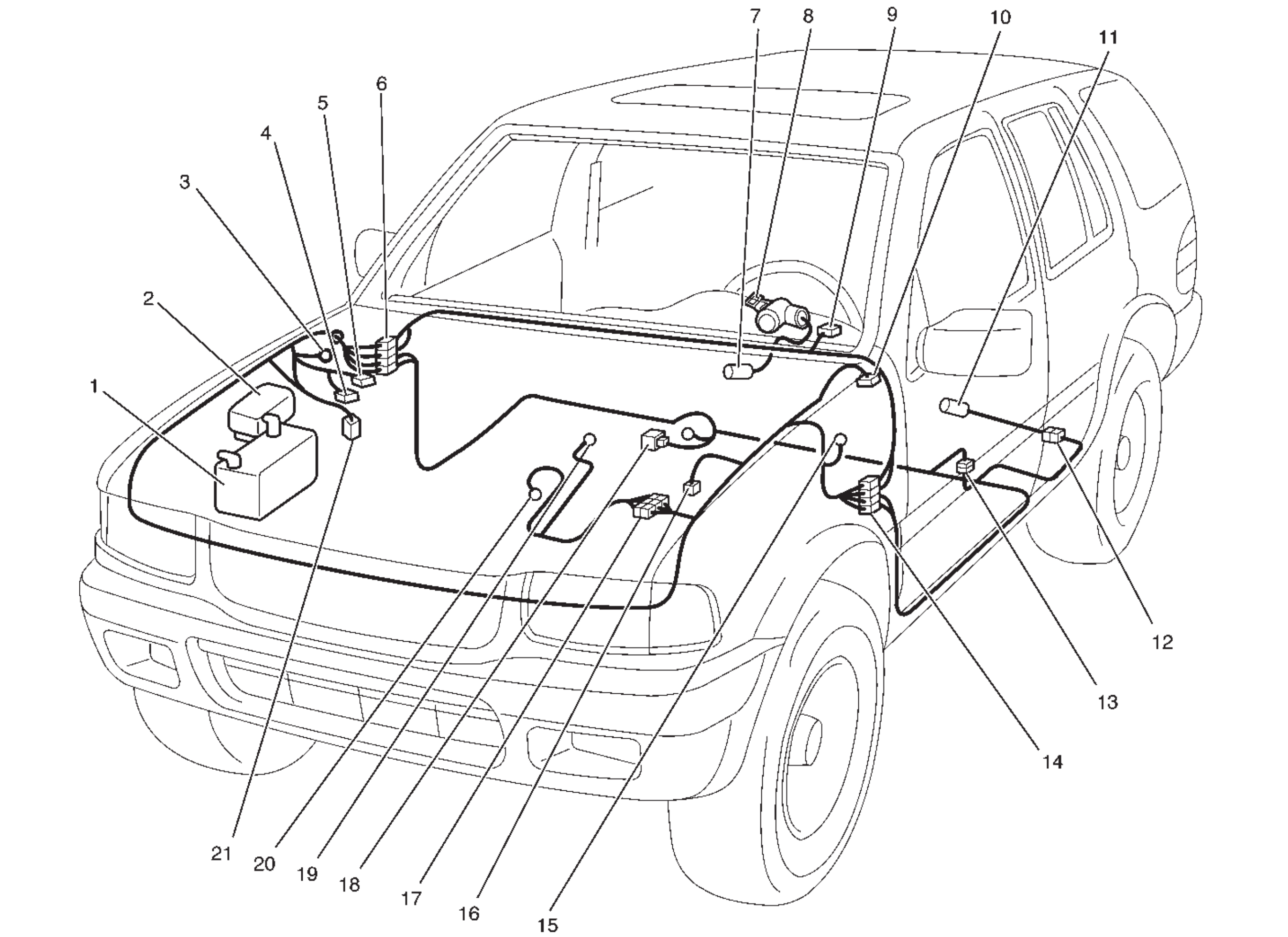

ELECTRONIC HYDRAULIC CONTROL UNIT
C-4
4WD CONTROL UNIT (14)
H-15
0.5 O
0.5 O/B
0.5 Y/B
C-34
DATA LINK CONNECTOR
(X22SE)
0.5 B/L
1.25 B/L
1.0 B/L
0.5 B
1.25 B
H-5
E-28
E-30
C-16
ENGINE
FENDER-LH
0.5 W
0.5 R
C-33
SPEED SENSOR
FRT-RH
0.5 L
0.5 G
C-13
FRT-LH
0.5 O/L
0.5 W/L
H-12
H-25
H-26
F-4
RR

D08RX109

Connector List

No.	Connector face	No.	Connector face
B-19		H-13 H-14	
C-4		H-26	
C-5		I-1	
C-13 C-33		I-18	
C-16 C-36 E-28 E-30			
C-34			
F-4			
H-5			
H-12 H-15 H-25			

Part Location



D08RX107

Legend

(1) Battery
(2) Fuse & Relay Box
(3) C–36
(4) C–5
(5) C–4
(6) H–12, 13, 14
(7) I–18
(8) Starter Switch
(9) I–1
(10) C–34
(11) F–4
(12) H–26
(13) H–25
(14) H–15
(15) C–16
(16) C–13
(17) H–5
(18) B–19
(19) E–30 (6VD1)
(20) E–28 (X22SE)
(21) C–33

Symptom Diagnosis

The symptoms that cannot be indicated by warning light can be divided in the following five categories:

1. ABS works frequently but vehicle does not decelerate.
2. Uneven braking occurs while ABS works.
3. The wheels lock during braking.
4. Brake pedal feel is abnormal.
5. Braking sound (from EHCU) is heard while not braking.

These are all attributable to problems which cannot be detected by EHCU self-diagnosis. Use the customer complaint and a test to determine which symptom is present. Then follow the appropriate flow chart listed below.

No.	Symptom	Diagnostic Flow Charts	
		Without TECH 2	With TECH 2
1	ABS works frequently but vehicle does not decelerate.	Chart A-1	Chart TA-1
2	Uneven braking occurs while ABS works.	Chart A-2	Chart TA-2
3	The wheels are locked.	Chart A-3	Chart TA-3
4	Brake pedal feel is abnormal.	Chart A-4	—
5	Braking sound (from EHCU) is heard while not braking.	Chart A-5	Chart TA-5

Chart A-1 ABS Works Frequently But Vehicle Does Not Decelerate

Step	Action	Yes	No
1	Is braking force distribution normal between front and rear of vehicle?	Go to Step 2	Repair brake parts. Go to Step 8
2	Are axle parts installed normally?	Go to Step 3	Repair axle parts. Go to Step 8
3	Is there play in each or any wheel speed sensor?	Repair wheel speed sensor. Go to Step 8	Go to Step 4
4	Is there damage, or powered iron sticking to each or any wheel speed sensor/sensor ring?	Replace sensor or sensor ring. Go to Step 8	Go to Step 5
5	Is the output of each wheel speed sensor normal? (Refer to chart C-1 or TC-1)	Go to Step 6	Replace wheel speed sensor or repair harness. Go to Step 7
6	Is the input of 4WD controller normal?	Go to Step 7	Replace controller or repair harness. Go to Step 7
7	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 7

Chart TA-1 ABS Works Frequently But Vehicle Does Not Decelerate (Use TECH 2)

Step	Action	Yes	No
1	1. Connect TECH 2. 2. Make sure of the output conditions of each sensor. Is the output of each sensor normal?	Go to Step 2	Replace wheel speed sensor. Go to Step 3
2	Return to Chart A-1. Was the Chart A-1 finished?	Go to Step 3	Go to Step 2
3	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 3

Chart A-2 Uneven Braking Occurs While ABS Works

Step	Action	Yes	No
1	Is there play in each or any sensor?	Repair. Go to Step 5	Go to Step 2
2	Damage or powdered iron sticking to each or any sensor/sensor ring?	Repair. Go to Step 5	Go to Step 3
3	Is the output of each sensor normal? (Refer to chart C-1 or TC-1)	Go to Step 4	Replace sensor or repair harness. Go to Step 5
4	Is brake pipe connecting order correct?	Replace H/U. Go to Step 5	Reconnect brake pipe correctly. Go to Step 5
5	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 5

Chart TA-2 Uneven Braking Occurs While ABS Works (Use TECH 2)

Step	Action	Yes	No
1	1. Connect TECH 2. 2. Make sure of the output conditions of each sensor. Is the output of each sensor normal?	Go to Step 2	Go to Step 3
2	Check piping by TECH 2 ACTUATOR TEST Is the piping normal?	Replace EHCU. Go to Step 4	Repair the pipe. Go to Step 4
3	Repair and check the wheel speed sensor (Refer to chart B-20 to B-23 , C-1 or TC-1). Was the each chart finished?	Go to Step 4	Go to Step 3
4	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 4

Chart A-3, TA-3 The Wheels Are Locked

Step	Action	Yes	No
1	Is ABS working?	Go to Step 2	Go to Step 6
2	Is vehicle speed under 10 km/h (6mph)?	Normal.	Go to Step 3
3	Is sensor output normal? (Chart C-1 or TC-1)	Go to Step 4	Replace sensor or repair harness. Go to Step 6
4	Is front 4WD controller normal?	Go to Step 5	Replace 4WD controller or repair harness. Go to Step 6
5	Is hydraulic unit grounded properly?	Replace EHCU. Go to Step 6	Correct. Go to Step 6
6	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 6

Chart A-4 Brake Pedal Feed Is Abnormal

Step	Action	Yes	No
1	Is the stop light actuated when the brake pedal is depressed?	Go to Step 2	Go to Step 3
2	1. Turn the ignition switch off. 2. Disconnected EHCU connector. Is the check voltage EHCU connector terminals 13 to 7 when brake pedal is depressed than battery voltage?	Go to Step 4	Harness NG between brake SW and EHCU. Go to Step 6
3	Is stop light fuse normal?	Go to Step 5	Replace stop light fuse. Go to Step 6
4	Is the check continuity between EHCU connector terminals, 7 to body grounded?	Go to Step 6	Repair body grounded harness. Go to Step 6
5	Is brake SW normal?	Repair stop light harness. Go to Step 6	Replace brake SW. Go to Step 6
6	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 6

Chart A-5, TA-5 Braking Sound (From EHCU) Is Heard While Not Braking

Step	Action	Yes	No
1	Is this the first vehicle start after engine start?	It is self checking sound Normal.	Go to Step 2
2	Is vehicle speed under 10 km/h (6 mph)?	It is self checking sound Normal.	Go to Step 3
3	Check for the following condition: ● At the time of shift down or clutch operation. ● At the time of low road friction drive (ice or snow road) or rough road drive. ● At the time of high-speed turn. ● At the time of passing curb. ● At the time of operating electrical equipment switches. ● At the time of racing the engine (over 5000 rpm). Did it occur under any one condition above?	ABS may sometime be actuated even when brake pedal is not applied.	Go to Step 4
4	Is there play in each or any sensor/wheel speed sensor rings?	Repair. Go to Step 7	Go to Step 5
5	Damage or powdered iron sticking to each or any sensor/wheel speed sensor ring?	Repair. Go to Step 7	Go to Step 6
6	Is each sensor output normal? (Refer to chart C-1 or TC-1).	Check harness/ connector for suspected disconnection If no disconnection is found, replace Coil integrated module. Go to Step 7	Repair. Go to Step 7
7	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 7

Diagnostic Trouble Codes

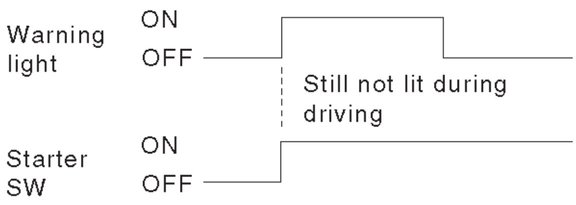
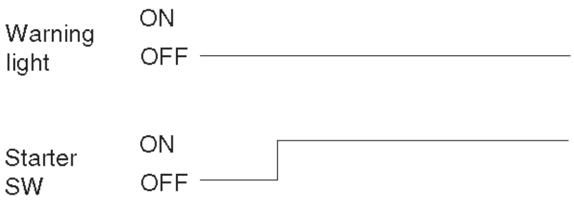
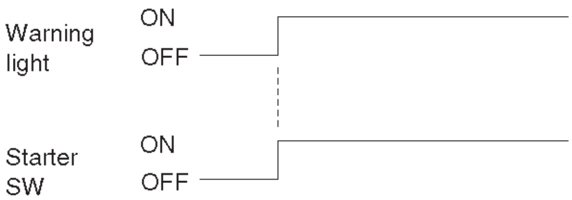
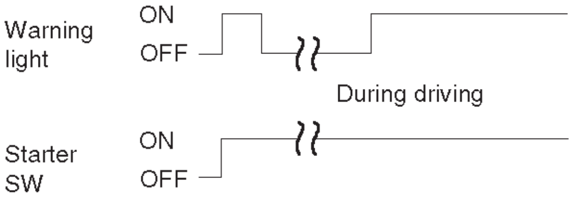
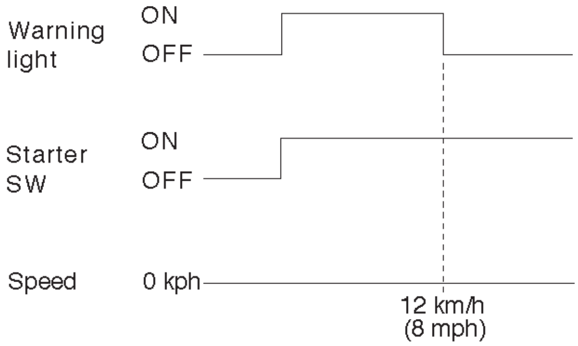
Choose and trace an appropriate flowchart by the numbers listed below to find fault and repair.

Code		Diagnosis	Item	Chart No.
Flash out	Serial Communications			
12	—	—	—	—
13	C0285	2 WD Controller in 4WD Vehicle Controller	Wiring	B-8
14	C0271	RAM read/write error	Coil Integrated Module	B-2
	C0272	ROM checksum error		
	C0270	ALU function error		
	C0273	Inoperative isolation item		
	C0284	Loop time overrun		
15	C0277	Low ignition voltage	Wiring	B-3
	C0278	High ignition voltage		
17	C0269	Excessive dump time	Coil Integrated Module	B-4
18	C0274	Excessive isolation time		B-5
21	C0276	G-Sensor Failure		B-6
22	C0281	Brake switch Failure		B-7
24	C0282	Open or shorted 4×4 input signal (4WD only)	Wiring	B-8
32	C0267	Open motor circuit or shorted ECU output	Motor	B-9
	C0268	Stalled motor or open ECU output		
35	C0265	Open relay circuit	Relay	B-10
	C0266	Shorted relay circuit		
41	C0245	FL Open isolation solenoid or shorted ECU output	Solenoid	B-11
	C0247	FL Shorted isolation solenoid or open ECU output		
42	C0246	FL Open dump solenoid or shorted ECU output		B-12
	C0248	FL Shorted dump solenoid or open ECU output		
43	C0241	FR Open isolation solenoid or shorted ECU output		B-13
	C0243	FR Shorted isolation solenoid or open ECU output		
44	C0242	FR Open dump solenoid or shorted ECU output		B-14
	C0244	FR Shorted dump solenoid or open ECU output		
45	C0251	Rear Open isolation solenoid or shorted ECU output		B-15
	C0253	Rear Shorted isolation solenoid or open ECU output		
46	C0252	Rear Open dump solenoid or shorted ECU output		B-16
	C0254	Rear Shorted dump solenoid or open ECU output		

Code		Diagnosis	Item	Chart No.
Flash out	Serial Communications			
51	C0225	FL Open or shorted sensor	Sensor or Wiring	B-17
52	C0221	FR Open or shorted sensor		B-18
53	C0235	Rear Open or shorted sensor		B-19
61	C0226	FL Missing sensor signal		B-20
	C0227	FL Sensor signal dropout		
62	C0222	FR Missing sensor signal		B-21
	C0223	FR Sensor signal dropout		
63	C0236	Rear Missing sensor signal		B-22
	C0237	Rear Sensor signal dropout		
64	C0229	Simultaneous dropout of front sensor signal		B-23
65	C0238	Wheel speed error	Vehicle or Sensor	B-24
—	C0286	Shorted indicator lamp	Wiring	—

Diagnosis By “ABS” Warning Light Illumination Pattern

In the event that there is abnormality in the “ABS” warning light illumination pattern while the key is in the ON position or if the warning light is actuated during driving, trouble should be diagnosed on a illumination pattern basis as follows:

No.	Condition	“ABS” Warning Light Illumination Pattern	Diagnostic
1	Warning light is actuated normally		Normal
2	Warning light is not lit		Warning light lighting circuit trouble→Go to Chart B-1
3	Warning light remains ON		Diagnostic trouble codes are stored. Display diagnostic trouble codes and diagnose on a code basis according to the flow charts.
4	Warning light is actuated while driving		Diagnostic trouble codes are stored. Display diagnostic trouble codes and diagnose on a code basis according to the flow charts.
5	Warning light goes at 12 km/h (8 mph) or higher (After repairing the faulty part)		Even after repairing the faulty part the warning light (W/L) dose not go out it vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h (8 mph) or higher to make sure that the warning light goes out.

Diagnostic Trouble Codes (DTCs)

When the warning light in the meter remains ON, the EHCU stores the fault identification and disables the ABS.

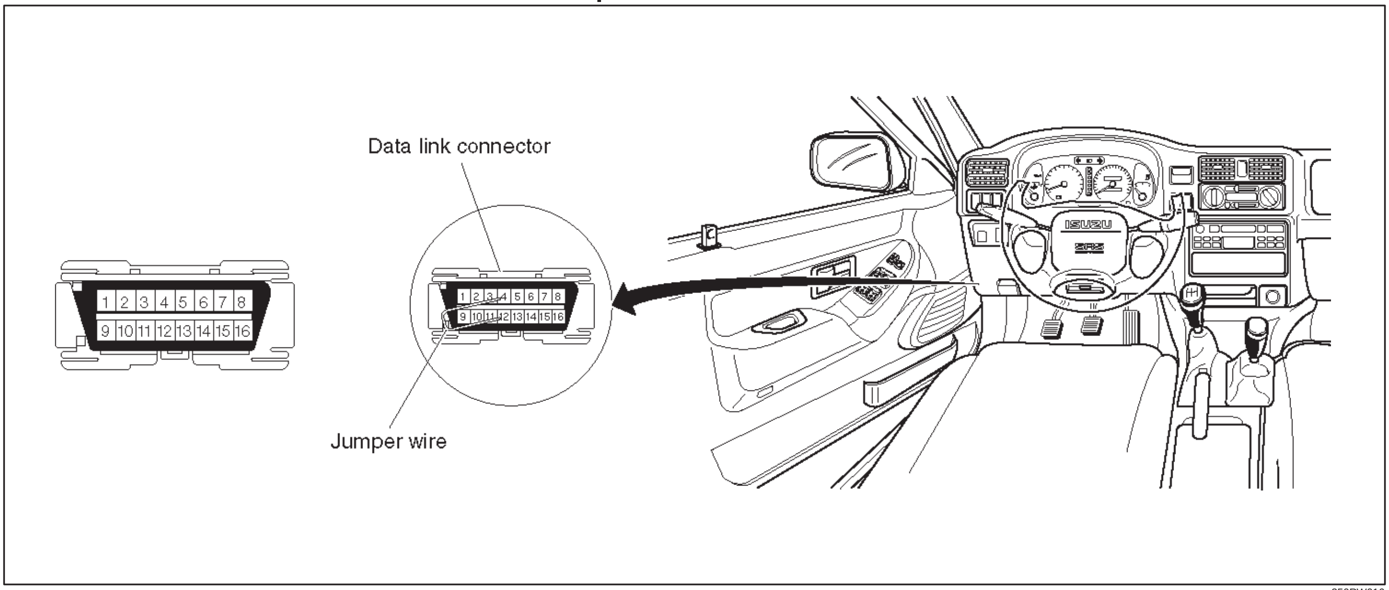
How to display and erase DTCs:

NOTE:

- DTCs can be displayed also by TECH 2. Use "Diagnostic Trouble Codes" mode.

1. How to start DTC display:
   - Confirm that the vehicle has come to a complete stop (with the wheels standing still) and that the brake pedal is not depressed. (Unless these two condition are satisfied, DTC display cannot be started.)
   - With IGN OFF, connect #12 terminal with #4 terminal or # 5 terminal (GND) . Then turn IGN ON.

The DLC is located behind the driver side kick panel



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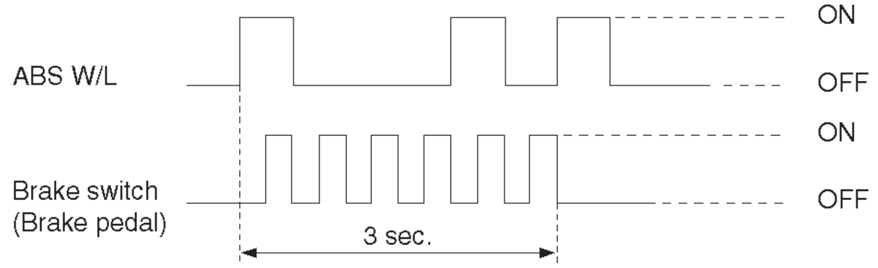
- Keep #12 terminal connected with #4 terminal or # 5 terminal (GND) during DTC display. (If #12 terminal is separated from #4 terminal or # 5 terminal (GND) during display, display will stop.)

2. DTC display:
   - DTC is displayed by blinking warning light.
   - Double-digit display.
   - First, normal DTC 12 is displayed three times and then any other DTCs are displayed three times. (If no other DTCs have been stored, the display of DTC 12 will be repeated.)
3. How to erase code:
   - Conduct brake switch ON/OFF operation 6 or more times within 3 seconds of self-diagnosis startup.
   - The code cannot be erased if more than 3 seconds have passed since self-diagnosis startup, or if self-diagnosis has started with brake switched on (brake pedaled).



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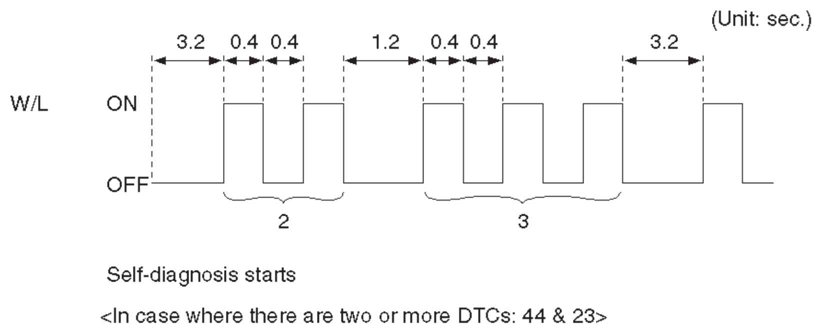
4. Notes
- If the following should occurs during Diagnostic Trouble Code (DTC) display the display will be discontinued. After initial check, the status that is under the control of ABS will be returned :
  – The vehicle starts (The wheels turn) or the brake pedal is depressed.
- Up to 3 different codes can be stored.
- If the ABS should turn OFF due to an intermittent defect, the system will be restored at the next key cycle, if the initial check finds no abnormality (when IGN is switched from OFF to ON).

5. An example of DTC display

Display of DTC 23



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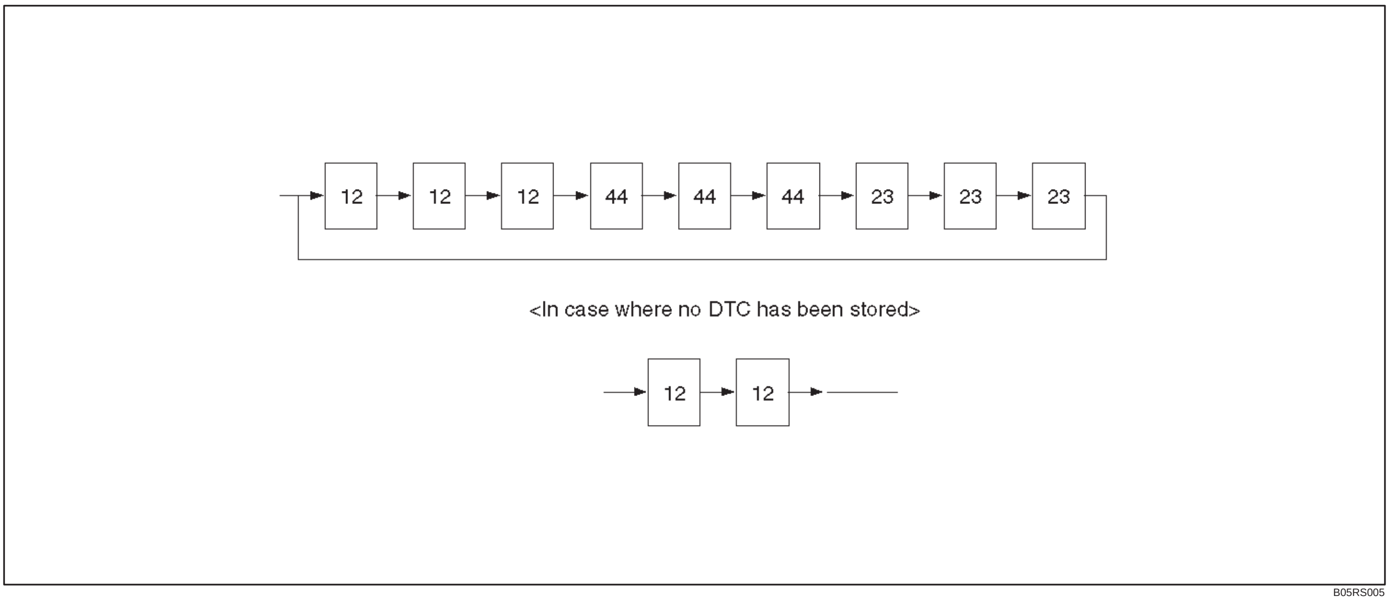
After displaying DTC 12 three times, one DTC after another is displayed, starting with the most recent one. (However, display is discontinued after about 5 minutes.)



The DTC 12 is displayed repeatedly. (display is discontinued after about 5 minutes after)

Chart B-1 With the key in the ON position (Before starting the engine). Warning light (W/L) is not activated.

Step	Action	Yes	No
1	Is W/L fuse disconnected?	Replace fuse. Go to Step 5	Go to Step 2
2	Is W/L burnt out?	Replace W/L bulb. Go to Step 5	Go to Step 3
3	1. Turn the key off. 2. Disconnect coil integrated module connector (C-4). 3. Turn the key ON. Is the check voltage between coil integrated module connector (C-4) terminals 6 and 7 than battery voltage?	Go to Step 4	Repair harness and connector. Go to Step 5
4	Is the check continuity coil integrated module connector (C-4) terminals, 1 and 7 and body ground.	Check harness for suspected disconnection No fault found: Replace EHCU. Go to Step 5	Repair harness and connector. Go to Step 5
5	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 5

Chart B-2 CPU Error (DTC 14 (Flash out) / C0271, C0272, C0273, C0284 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnected coil integrated module connector. 3. Inspect coil integrated module ground. Is the check resistance between the coil integrated module connector terminals, 2 (C-5) and 7 (C-4) and body ground?	Go to Step 2	Repair the body ground harness. Go to Step 3
2	1. Turn the key off, connect the coil integrated module connector. 2. Erase the trouble code. 3. Turn Ignition off, then on, to perform system self-check. 4. If warning light remains on, display trouble codes once again. Is the check trouble code 14 (Flash out) / C0271, C0272, C0273, C0284 (Serial communications)?	Replace EHCU. Go to Step 3	Inspect in accordance with the DTC displayed.
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 3

Chart B-3 Low or High Ignition Voltage (DTC 15 (Flash out) / C0277, 0278 (Serial communications))

Step	Action	Yes	No
1	Is the check battery voltage normal? (Battery capacity check)	Go to Step 2	Charge or replace battery. Go to Step 2
2	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Turn the key on. Is the check voltage between coil integrated module connector (C-4) terminals 1 and 7, higher than 10V?	Check harness connector for suspected disconnection Fault found: Repair, and perform system self-check No fault found: replace EHCU. Go to Step 3	Repair harness or connector. Go to Step 3
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 3

Chart B-4 Excessive Dump Time (DTC 17 (Flash out) / C0269 (Serial communications))

Step	Action	Yes	No
1	Check for anything causing extended ABS activation, such as locked brakes or an erratic speed sensor signal. Was a problem found?	Repair or Replace	Go to Step 2
2	1. The key turned off. 2. Replace EHCU. 3. Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 2

Chart B-5 Excessive Isolation Time (DTC 18 (Flash out) / C0274 (Serial communications))

Step	Action	Yes	No
1	Check for anything causing extended ABS activation, such as locked brakes or an erratic speed sensor signal. Was a problem found?	Repair or Replace	Go to Step 2
2	1. The key turned off. 2. Replace EHCU. 3. Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 2

Chart B-6 G-Sensor Output Failure (DTC 21 (Flash out) / C0276 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Replace EHCU. 3. Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 1

Chart B-7 Brake Switch Failure (DTC 22 (Flash out) / C0281 (Serial communications))

Step	Action	Yes	No
1	Is the stop light actuated when the brake pedal is depressed?	Go to Step 2	Go to Step 4
2	1. Turn the key off. 2. Disconnected coil integrated module connector. Is the check voltage coil integrated module connector (C-4) terminals 13 to 7 when brake pedal is depressed than battery voltage?	Go to Step 3	Harness between brake SW and coil integrated module is faulty. Go to Step 6
3	Is the check that pins C-5 connector 2, and C-4 connector 7 have good ground?	Check harness / connector for disconnection Fault found: Repair, and perform system self-check. No fault found: replace EHCU. Go to Step 6	Repair. Go to Step 6
4	Is stop light fuse normal?	Go to Step 5	Replace. Go to Step 6
5	Is brake SW normal?	Abnormal harness in stop light circuit. Repair the harness. Go to Step 6	Replace. Go to Step 6
6	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 6

Chart B-8 2WD Controller in 4WD Vehicle Controller (DTC 13 (Flash out) / C0285 (Serial communications)), 4WD State Input Signal Failure (DTC 24 (Flash out) / C0282 (Serial communications))

Step	Action	Yes	No
1	Remove coil integrated module connector. Is the coil integrated module connector (C-4) terminal 8 line normally?	Go to Step 2	Repair. Go to Step 3
2	Is the 4WD controller normally?	Replace EHCU. Go to Step 3	Replace 4WD controller. Go to Step 3
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 3

Chart B-9 Pump Motor Failure (DTC 32 (Flash out) / C0267, C0268 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the voltage between terminal 1 of the coil integrated module connector (C-5) and body ground. Is the voltage equal to the battery voltage?	Go to Step 2	Repair fuse/harness between battery and coil integrated module connector (C-5) terminal 1. Go to Step 5
2	Is the harness from the hydraulic unit connected to the coil integrated module connector?	Go to Step 3	Connect to the connector. Go to Step 3
3	Is the harness from the hydraulic unit normally?	Go to Step 4	Replace EHCU. Go to Step 5
4	Is the check resistance of hydraulic unit connector terminals 1 and 2 between 0.2 and 1.0 ohms?	Replace EHCU. Go to Step 5	Replace EHCU. Go to Step 5
5	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 5

Chart B-10 EHCU Valve Relay Failure (DTC 35 (Flash out) / C0265, C0266 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the voltage between terminal 1 of the coil integrated module connector (C-5) and body ground. Is the voltage equal to the battery voltage?	Replace EHCU. Go to Step 2	Repair fuse and harness coil integrated module connector (C-5) terminal 1 and battery. Go to Step 2
2	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 2

Chart B-11 FL Isolation Solenoid Coil Failure (DTC 41 (Flash out) / C0245, C0247 (Serial communications))

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” performed?	Go to Step 2	Go to “EHCU Connector Pin–out Checks.”
2	1. Turn the key switch to off. 2. Disconnect the 2–way EHCU connector (C–5) from the EHCU. 3. Inspect the connector for damage or corrosion. Is the connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the “Basic Diagnostic Flow Chart.”
3	1. Replace the Coil Integrated Module. 2. Reconnect all component, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 3

Chart B-12 FL Dump Solenoid Coil Failure (DTC 42 (Flash out) / C0246, C0248 (Serial communications))

Step	Action	Yes	No
1	Was the “EHCU Connector Pin–out Checks” performed?	Go to Step 2	Go to “EHCU Connector Pin–out Checks.”
2	1. Turn the key switch to off. 2. Disconnect the 2–way EHCU connector (C–5) from the EHCU. 3. Inspect the connector for damage or corrosion. Is the connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the “Basic Diagnostic Flow Chart.”
3	1. Replace the Coil Integrated Module. 2. Reconnect all component, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 3

Chart B-13 FR Isolation Solenoid Coil Failure (DTC 43 (Flash out) / C0241, C0243 (Serial communications))

Step	Action	Yes	No
1	Was the "EHCU Connector Pin–out Checks" performed?	Go to Step 2	Go to "EHCU Connector Pin–out Checks."
2	1. Turn the key switch to off. 2. Disconnect the 2–way EHCU connector (C–5) from the EHCU. 3. Inspect the connector for damage or corrosion. Is the connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the "Basic Diagnostic Flow Chart."
3	1. Replace the Coil Integrated Module. 2. Reconnect all component, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart"	Go to Step 3

Chart B-14 FR Dump Solenoid Coil Failure (DTC 44(Flash out) / C0242, C0244 (Serial communications))

Step	Action	Yes	No
1	Was the "EHCU Connector Pin–out Checks" performed?	Go to Step 2	Go to "EHCU Connector Pin–out Checks."
2	1. Turn the key switch to off. 2. Disconnect the 2–way EHCU connector (C–5) from the EHCU. 3. Inspect the connector for damage or corrosion. Is the connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the "Basic Diagnostic Flow Chart."
3	1. Replace the Coil Integrated Module. 2. Reconnect all component, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart"	Go to Step 3

Chart B-15 Rear Isolation Solenoid Coil Failure (DTC 45 (Flash out) / C0251, C0253 (Serial communications))

Step	Action	Yes	No
1	Was the "EHCU Connector Pin–out Checks" performed?	Go to Step 2	Go to "EHCU Connector Pin–out Checks."
2	1. Turn the key switch to off. 2. Disconnect the 2–way EHCU connector (C–5) from the EHCU. 3. Inspect the connector for damage or corrosion. Is the connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the "Basic Diagnostic Flow Chart."
3	1. Replace the Coil Integrated Module. 2. Reconnect all component, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart"	Go to Step 3

Chart B-16 Rear Dump Solenoid Coil Failure (DTC 46 (Flash out) / C0252, C0254 (Serial communications))

Step	Action	Yes	No
1	Was the "EHCU Connector Pin–out Checks" performed?	Go to Step 2	Go to "EHCU Connector Pin–out Checks."
2	1. Turn the key switch to off. 2. Disconnect the 2–way EHCU connector (C–5) from the EHCU. 3. Inspect the connector for damage or corrosion. Is the connector free from damage or corrosion?	Go to Step 3	Repair the connector. Repeat the "Basic Diagnostic Flow Chart."
3	1. Replace the Coil Integrated Module. 2. Reconnect all component, ensure all components are properly mounted. Was this step finished?	Repeat the "Basic diagnostic flow chart"	Go to Step 3

Chart B-17 FL Speed Sensor Open or Shorted (DTC 51 (Flash out) / C0225 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the resistance between coil integrated module connector (C-4) terminals 2 and 10. Is the resistance between 2.0k and 2.8k ohms?	Check for faults in harness between speed sensor and coil integrated module. Fault found: Repair, and perform system self-check. No fault found: Replace coil integrated module. Go to Step 3	Go to Step 2
2	Measure the FL speed sensor resistance at the sensor connector. Is the resistance between 2.0k and 2.8k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to Step 3	Replace sensor. Go to Step 3
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart"	Go to Step 3

Chart B-18 FR Speed Sensor Open or Shorted (DTC 52 (Flash out) / C0221 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the resistance between coil integrated module connector (C-4) terminals 3 and 11. Is the resistance between 2.0k and 2.8k ohms?	Check for faults in harness between speed sensor and coil integrated module. Fault found: Repair, and perform system self-check. No fault found: Replace coil integrated module. Go to Step 3	Go to Step 2
2	Measure the FR speed sensor resistance at the sensor connector. Is the resistance between 2.0k and 2.8k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to Step 3	Replace sensor. Go to Step 3
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 3

Chart B-19 Rear Speed Sensor Open or Shorted (DTC 53 (Flash out) / C0235 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the resistance between coil integrated module connector (C-4) terminals 4 and 12. Is the resistance between 1.2k and 2.0k ohms?	Check for faults in harness between speed sensor and coil integrated module. Fault found: Repair, and perform system self-check. No fault found: Replace EHCU. Go to Step 3	Go to Step 2
2	Measure the Rear speed sensor resistance at the sensor connector. Is the resistance between 1.2k and 2.0k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to Step 3	Replace sensor. Go to Step 3
3	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the "Basic diagnostic flow chart"	Go to Step 3

Chart B-20 FL Speed Sensor Missing (DTC 61 (Flash out) / C0226, C0227 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the FL speed sensor resistance between coil integrated module connector (C-4) terminals 2 and 10. Is the resistance between 2.0k and 2.8k ohms?	Go to Step 2	Go to Step 3
2	Is there play sensor/sensor rotor?	Repair. Go to Step 6	Go to Step 4
3	Measure the FL speed sensor resistance at the sensor connector. Is the resistance between 2.0k and 2.8k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to Step 6	Replace sensor. Go to Step 6
4	Damage and powered iron sticking to sensor/sensor ring?	Repair. Go to Step 6	Go to Step 5
5	Is sensor output normal? (Chart C-1-1 or TC-1)	Check for faults in harness between speed sensor and coil integrated module. Fault found: repair, and perform system self-check. No fault found: replace EHCU. Go to Step 6	Replace sensor. Go to Step 6
6	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 6

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h (8 mph) or higher to make sure that the warning light goes out.

Chart B-21 FR Speed Sensor Missing (DTC 62 (Flash out) / C0222, C0223 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the FR speed sensor resistance between coil integrated module connector (C-4) terminals 3 and 11. Is the resistance between 2.0k and 2.8k ohms?	Go to Step 2	Go to Step 3
2	Is there play sensor/sensor rotor?	Repair. Go to Step 6	Go to Step 4
3	Measure the FR speed sensor resistance at the sensor connector. Is the resistance between 2.0k and 2.8k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to Step 6	Replace sensor. Go to Step 6
4	Damage and powered iron sticking to sensor/sensor ring?	Repair. Go to Step 6	Go to Step 5
5	Is sensor output normal? (Chart C-1-2 or TC-1)	Check for faults in harness between speed sensor and coil integrated module. Fault found: repair, and perform system self-check. No fault found: replace EHCU. Go to Step 6	Replace sensor. Go to Step 6
6	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 6

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h (8 mph) or higher to make sure that the warning light goes out.

Chart B-22 Rear Speed Sensor Missing (DTC 63 (Flash out) / C0236, C0237 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the Rear speed sensor resistance between coil integrated module connector (C-4) terminals 4 and 12. Is the resistance between 1.2k and 2.0k ohms?	Go to Step 2	Go to Step 3
2	Is there play sensor/sensor rotor?	Repair. Go to Step 6	Go to Step 4
3	Measure the rear speed sensor resistance at the sensor connector. Is the resistance between 1.2k and 2.0k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to Step 6	Replace sensor. Go to Step 6
4	Damage and powered iron sticking to sensor/sensor ring?	Repair. Go to Step 6	Go to Step 5
5	Is sensor output normal? (Chart C-1-3 or TC-1)	Check for faults in harness between speed sensor and coil integrated module. Fault found: repair, and perform system self-check. No fault found: replace EHCU. Go to Step 6	Replace sensor. Go to Step 6
6	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 6

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h (8 mph) or higher to make sure that the warning light goes out.

Chart B-23 Simultaneous Drop-out of Front Speed Sensor Signal (DTC 64 (Flash out) / C0229 (Serial communications))

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Measure the FL speed sensor resistance between coil integrated module connector (C-4) terminals 2 and 10. Is the resistance between 2.0k and 2.8k ohms?	Go to Step 2	Go to Step 3
2	Measure the FR speed sensor resistance between coil integrated module connector (C-4) terminals 3 and 11. Is the resistance between 2.0k and 2.8 k ohms?	Go to Step 5	Go to Step 4
3	Measure the FL speed sensor resistance at the sensor connector. Is the resistance between 2.0k and 2.8k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to Step 2	Replace sensor. Go to Step 2
4	Measure the FR speed sensor resistance at the sensor connector. Is the resistance between 2.0k and 2.8k ohms?	Repair harness abnormality between sensors and coil integrated module. Go to Step 5	Replace sensor. Go to Step 5
5	Damage and powered iron sticking to sensor/sensor ring?	Repair. Go to Step 6	Go to Step 6
6	Is there play sensor/sensor rotor?	Repair. Go to Step 7	Go to Step 7
7	Is sensor output normal? (Chart C-1-1&C-1-2 or TC-1)	Check for faults in harness between speed sensor and coil integrated module. Fault found: repair, and perform system self-check. No fault found: replace EHCU. Go to Step 8	Replace sensor. Go to Step 8
8	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat “Basic diagnostic flow chart”	Go to Step 8

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop. Turn the ignition switch to the ON position and drive the vehicle at 12 km/h (8 mph) or higher to make sure that the warning light goes out.

Chart B-24 Wheel Speed Input Abnormality (DTC 65 (Flash out) / C0238 (Serial communications))

Step	Action	Yes	No
1	Using TECH 2?	Go to Step 2	Go to Step 3
2	1. Connect TECH 2. 2. Select Snap shot manual trigger. 3. With wheel speed data displayed, run the vehicle when speed has arrived at 30 km/h (18 mph). 4. Check speed data on each wheel (refer to the criterion given below). * 1 Is the abnormal sensor condition found?	Replace. Go to Step 8	Go to Step 3 All the sensors should follow the following flowchart (without using TECH 2).
3	Is there play in sensor/sensor ring?	Repair. Go to Step 8	Go to Step 4
4	Is there powdered iron sticking to sensor/sensor ring?	Repair. Go to Step 8	Go to Step 5
5	Is there a broken tooth or indentation in sensor ring?	Replace sensor ring. Go to Step 8	Go to Step 6
6	Is there play in wheel bearing?	Adjust or repair. Go to Step 8	Go to Step 7
7	Is the check wiring between sensor and coil integrated module normal?	Replace EHCU. Go to Step 8	Repair, and perform system self-check. Go to Step 8
8	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble code. Was this step finished?	Repeat ‘Basic diagnostic flow chart”	Go to Step 8

Sensor Signal Abnormality Criteria using TECH 2

1. While driving, the speed of one or two wheels is 25% or more higher or lower than that of the other wheels.
2. The speed of one or two wheels is 10 km/h (6 mph) or more higher or lower than that of the other wheels.
3. During steady driving, wheel speed changes abruptly.

*1 The vehicle must run on a level paved road.

NOTE: Even after repairing the faulty part the warning light (W/L) does not go out if the vehicle is at a stop.

Turn the ignition switch to the ON position and drive the vehicle at 12 km/h (8 mph) or higher to make sure that the warning light goes out.

It is important to verify that the correct tires are installed on vehicle.

Unit Inspection Procedure

This section describes the following inspection procedures referred to during “SYMPTOM DIAGNOSIS” and “DIAGNOSIS BY ‘ABS’ WARNING LIGHT ILLUMINATION PATTERN” :

	without TECH 2	with TECH 2
Sensor Output Inspection	Chart C-1-1 to C-1-3	Chart TC-1

Chart C-1-1 FL Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Jack up the vehicle with all four wheels off the ground. Measure the AC voltage between coil integrated module connector terminals while turning FL wheel at a speed of 1 RPS: Is the check between coil integrated module connector (C-4) terminals 2 and 10 than under 200 mV?	Go to Step 2	OK. Go to Step 3
2	1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2. Is the check between connector (C-13) terminals 1 and 2 within 2.0k - 2.8k ohms?	Connector is faulty, or open or short circuit of harness between wheel speed sensor connector and coil integrated module. Inspect and correct the connector or harness. Go to Step 3	Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to Step 3
3	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 3

Chart C-1-2 FR Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Jack up the vehicle with all four wheels off the ground. Measure the AC voltage between coil integrated module connector terminals while turning FR wheel at a speed of 1 RPS: Is the check between coil integrated module connector (C-4) terminals 3 and 11 than under 200 mV?	Go to Step 2	OK. Go to Step 3
2	1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2. Is the check between connector (C-33) terminals 1 and 2 within 2.0k - 2.8k ohms?	Connector is faulty, or open or short circuit of harness between wheel speed sensor connector and coil integrated module. Inspect and correct the connector or harness. Go to Step 3	Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to Step 3
3	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 3

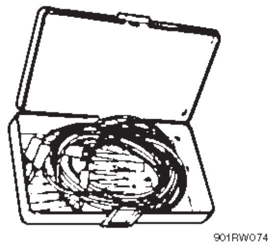
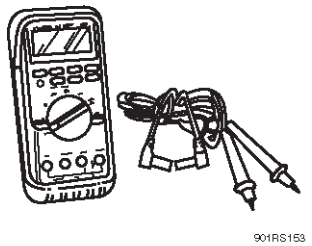
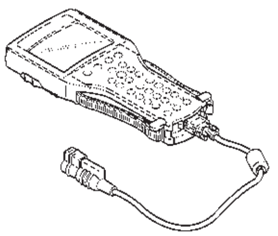
Chart C-1-3 Rear Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Turn the key off. 2. Disconnect coil integrated module connector. 3. Jack up the vehicle with all four wheels off the ground measure the AC voltage between coil integrated module connector terminals while turning Rear wheel at a speed of 1 RPS: Is the check between coil integrated module connector (C-4) terminals 4 and 12 than under 200 mV?	Go to Step 2	OK. Go to Step 3
2	1. Disconnect the wheel speed sensor. 2. Measure resistance between the wheel speed sensor connector terminals 1 and 2. Is the check between connector (F-4) terminals 1 and 2 within 1.2k - 2.0k ohms?	Connector is faulty, or open or short circuit of harness between wheel speed sensor connector and coil integrated module. Inspect and correct the connector or harness. Go to Step 3	Wheel speed sensor is faulty. Replace the wheel speed sensor. Go to Step 3
3	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 3

Chart TC-1 Sensor Output Inspection Procedure

Step	Action	Yes	No
1	1. Connect TECH 2. 2. Check the wheel speed of each sensor by Data List. Is the vehicle speed normal?	Go to Step 6	Go to Step 2
2	Check the sensor harness for suspected disconnection (check while shaking harness/connector). Is the sensor harness connection normal?	Replace speed sensor. Go to Step 4	Repair. Go to Step 3
3	Check the wheel speed of each sensor by Data List. Is the vehicle speed normal?	Go to Step 6	Go to Step 4
4	Check the sensor rotor. Is the sensor rotor normal?	Replace speed sensor. Go to Step 5	Replace sensor rotor. Go to Step 5
5	Check the harness between coil integrated module and speed sensor. Is the harness connection normal?	Go to Step 6	Repair harness or connector between coil integrated module and speed sensor. Go to Step 6
6	Reconnect all components, ensure all components are properly mounted. Was this step finished?	Repeat the “Basic diagnostic flow chart”	Go to Step 6

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–35616** Connector test adapter kit
	**J–39200** High impedance multimeter
	**7000086–ISU** Tech 2 Set (1) PCMCIA Card (2) SAE 16/19 Adapter (3) DLC Cable (4) Tech 2

RODEO

BRAKES

ANTI-LOCK BRAKE SYSTEM

CONTENTS

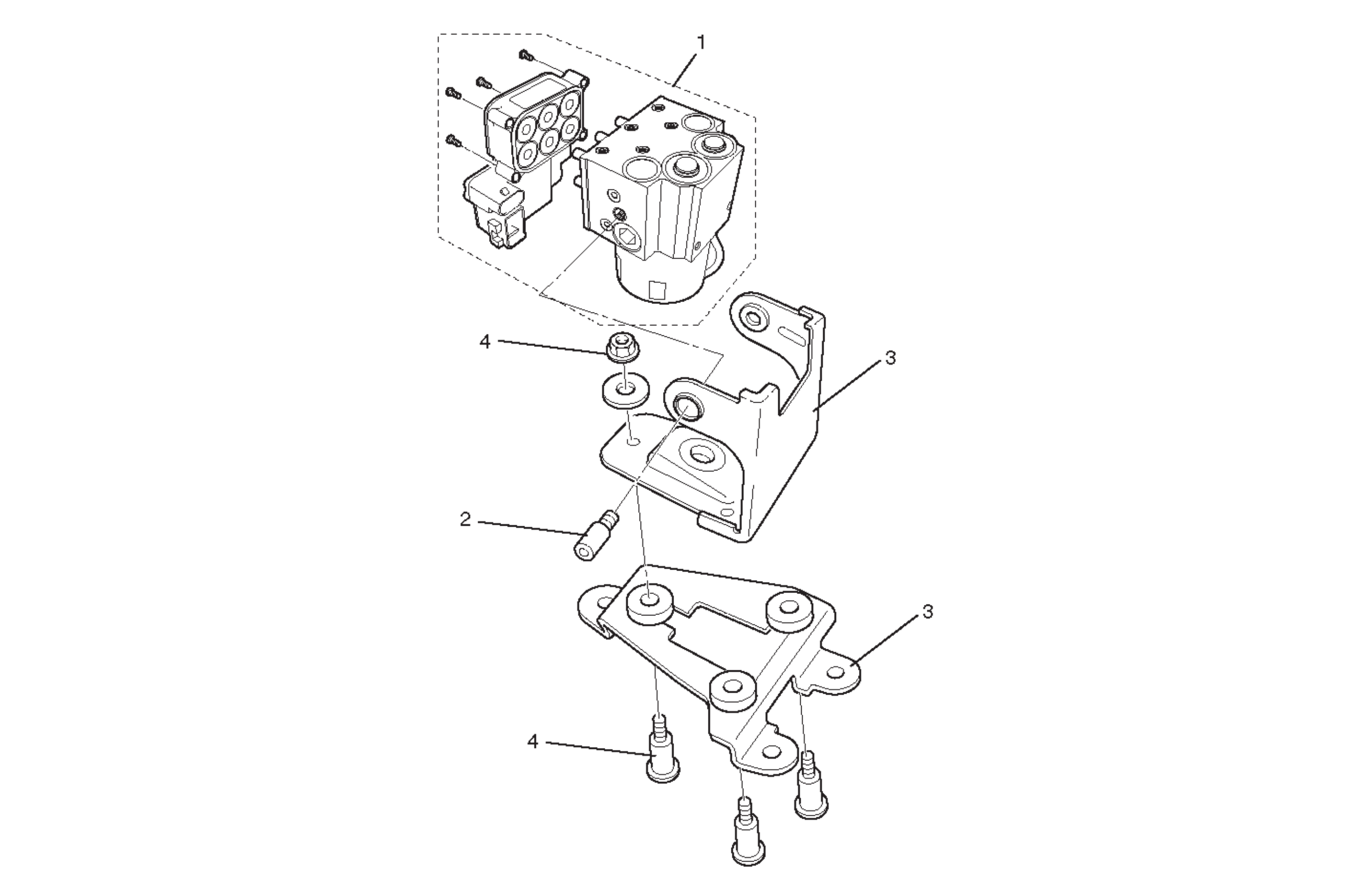
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Electronic Hydraulic Control Unit

Electronic Hydraulic Control Unit and Associated Parts



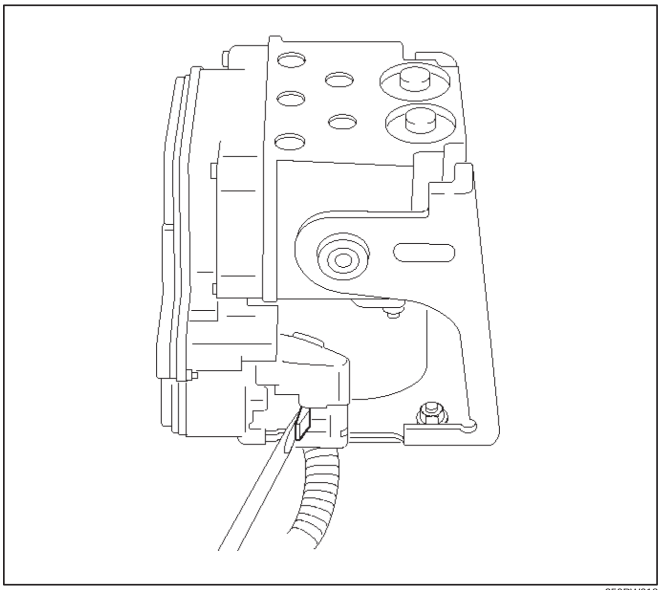
350RW017

Legend

(1) EHCU
(2) Bolt
(3) Bracket
(4) Bolt and Nut

Removal

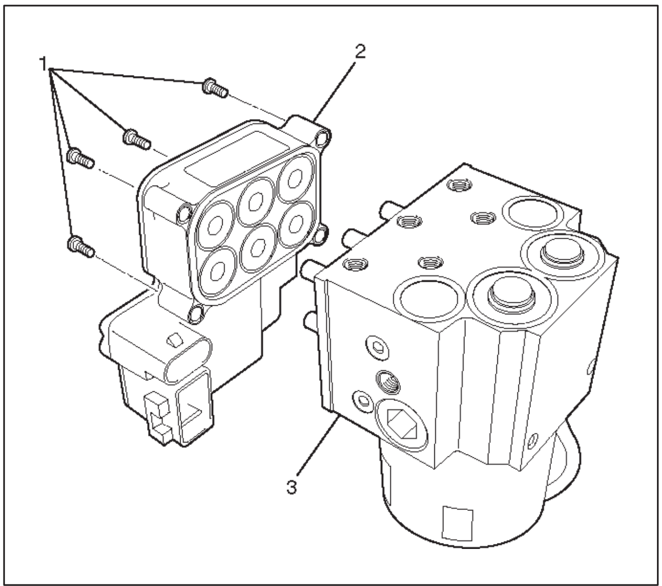
1. Remove brake pipes.
   - After disconnecting brake pipe, cap or tape the openings of the brake pipe to prevent the entry of foreign matter.
2. Remove three bracke fixing bolts.
3. Disconnect red clip from harness connector.



350RW018

4. Remove harness connector.
5. Remove EHCU ASM.
6. Remove EHCU.

Disassembled View



350RW025

Legend

(1) Fixing Bolts
(2) Coil Integrated Module
(3) Hydraulic Unit (H/U)

Disassembly

1. Remove fixing bolts from EHCU.
2. Remove coil integrated module from hydraulic unit.

Reassembly

To reassembly, follow the disassembly steps in the reverse order, noting the following points:

Torque:

Fixing bolts: 4.4 N·m (39 lb in)

Installation

To install, follow the removal steps in the reverse order, noting the following points:

Torque:

Hydraulic unit fixing nuts : 22 N·m (16 lb ft)

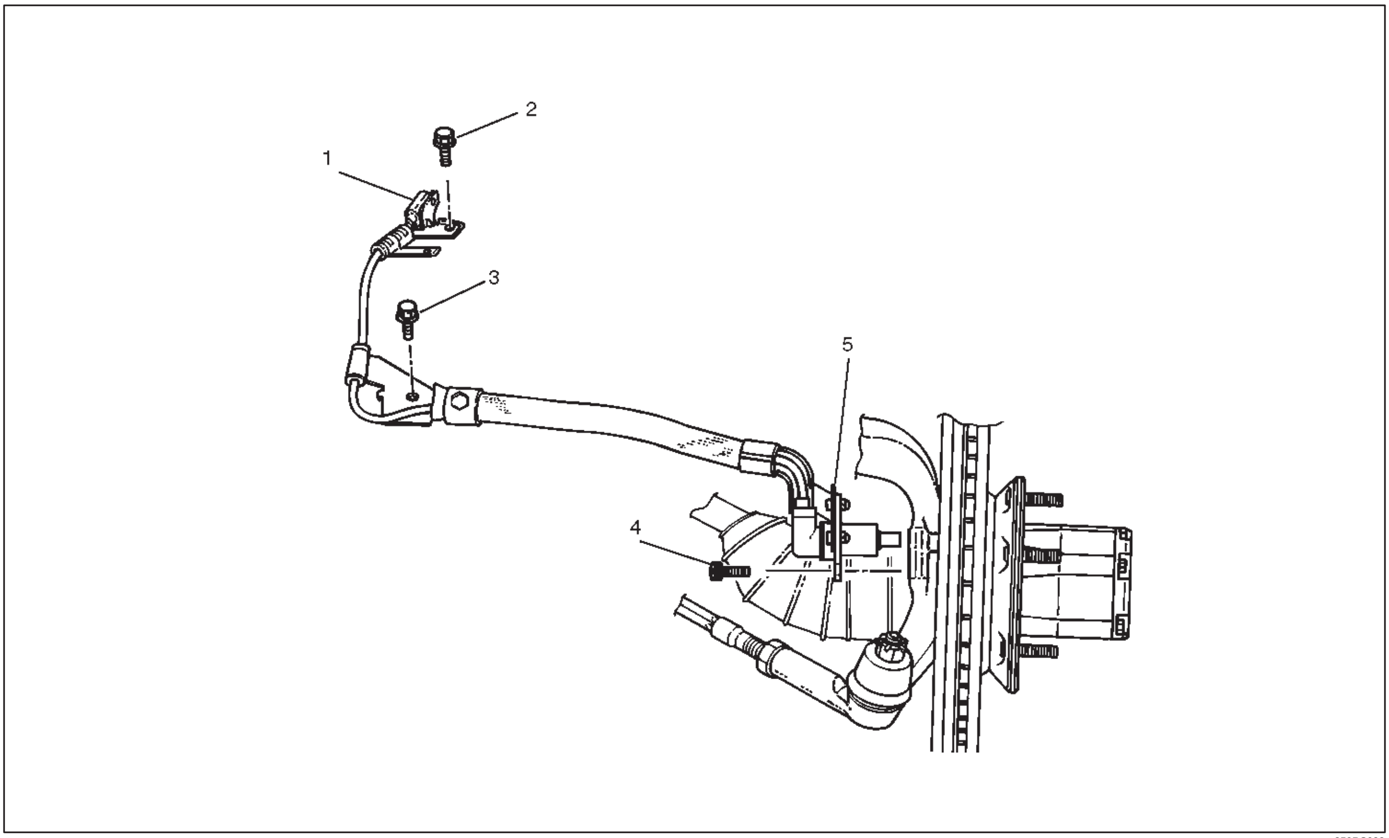
Ground cable : 14 N·m (10 lb ft)

Brake pipe (joint bolts) : 16 N·m (12 lb ft)

- After installing the hydraulic unit, bleed brakes completely. See Section 5A “Hydraulic Brakes”.

Front Wheel Speed Sensor

Front Wheel Speed Sensor and Associated Parts



350RS033

Legend

(1) Speed Sensor Connector
(2) Sensor Cable Fixing Bolt (Upper side)
(3) Sensor Cable Fixing Bolt (Lower side)
(4) Sensor Cable Fixing Bolt (Sensor side)
(5) Speed Sensor

Removal

1. Remove speed sensor connector.
2. Remove sensor cable fixing bolt (Upper side).
3. Remove sensor cable fixing bolt (Lower side).
4. Remove the speed sensor cable fixing bolt.
5. Remove speed sensor.

Inspection and Repair

1. Check the speed sensor pole piece for presence of foreign materials; remove any dirt, etc.
2. Check the pole piece for damage; replace speed sensor if necessary.
3. Check the speed sensor cable for short or open circuit, and replace with a new one if necessary.
   To check for cable short or open, bend or stretch the cable while checking for continuity.
4. Check the sensor ring for damage including tooth chipping, and if damaged, replace the sensor ring assembly. Refer to removal of the sensor ring in Section 4D "Front hub and disc".

Installation

1. Install speed sensor and take care not to hit the speed sensor pole piece during installation.
2. Install speed sensor fixing bolt and tighten the fixing bolt to the specified torque.

   Torque: 11 N·m (95 lb in)
3. Install speed sensor cable fixing bolt (Lower side) and tighten the fixing bolt to the specified torque.

   Torque : 24 N·m (18 lb ft)
4. Install speed sensor cable fixing bolt (Upper side) and tighten the fixing bolt to the specified torque.

   Torque : 6 N·m (52 lb ft)

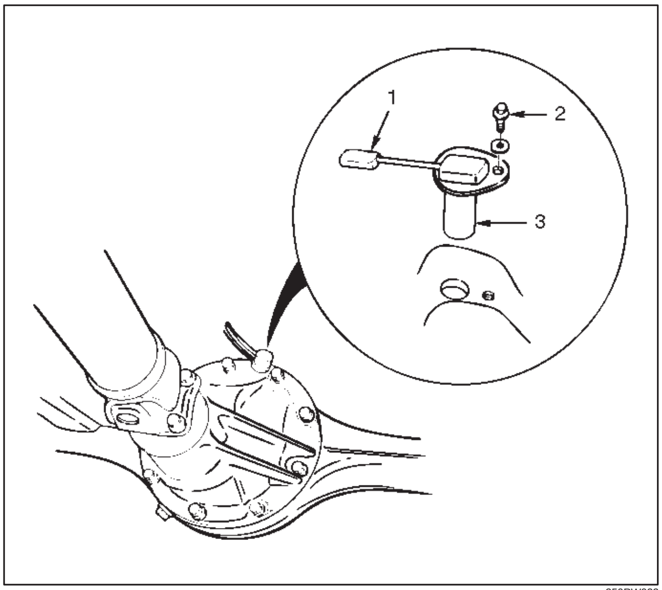
NOTE: Confirm that a white line marked on the cable is not twisted when connecting the speed sensor cable.

5. Install speed sensor connector.

Rear Wheel Speed Sensor

Removal

1. Disconnect harness connector (1).
2. Remove sensor fixing bolt (2) .
3. Remove speed sensor (3).



350RW022

Inspection and Repair

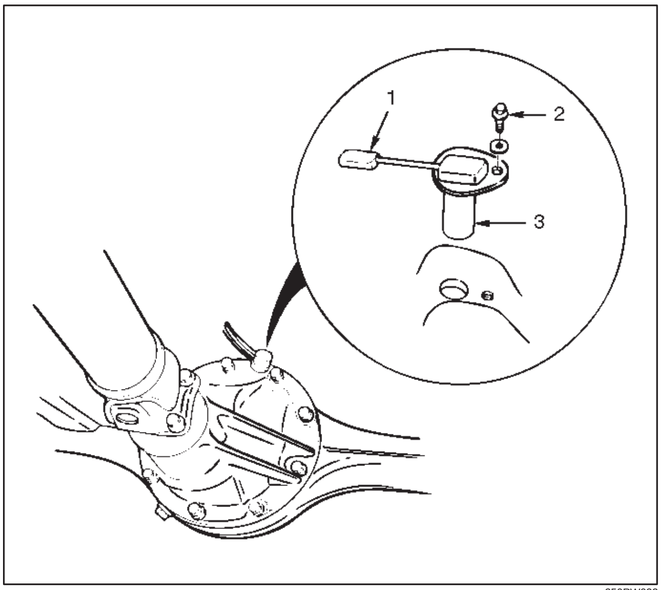
1. Check speed sensor pole piece for presence of foreign materials; remove any dirt, etc.
2. Check the pole piece for damage, and replace speed sensor if necessary.
3. Check speed sensor cable for short or open, and replace with a new one if necessary. To check for cable short or open, bend or stretch the cable while checking for continuity.
4. Check the sensor ring for damage including tooth chipping, and if damaged, replace the axle shaft assembly. Refer to removal of the sensor ring in Section 4A2 “Differential (Rear)”.

Installation

1. Install speed sensor (3).
2. Tighten the sensor fixing bolt (2) to the specified torque.

Torque : 11 N·m (95 lb in)

3. Connect harness connector (1).



350RW022

RODEO

BRAKES

POWER-ASSISTED BRAKE SYSTEM

CONTENTS

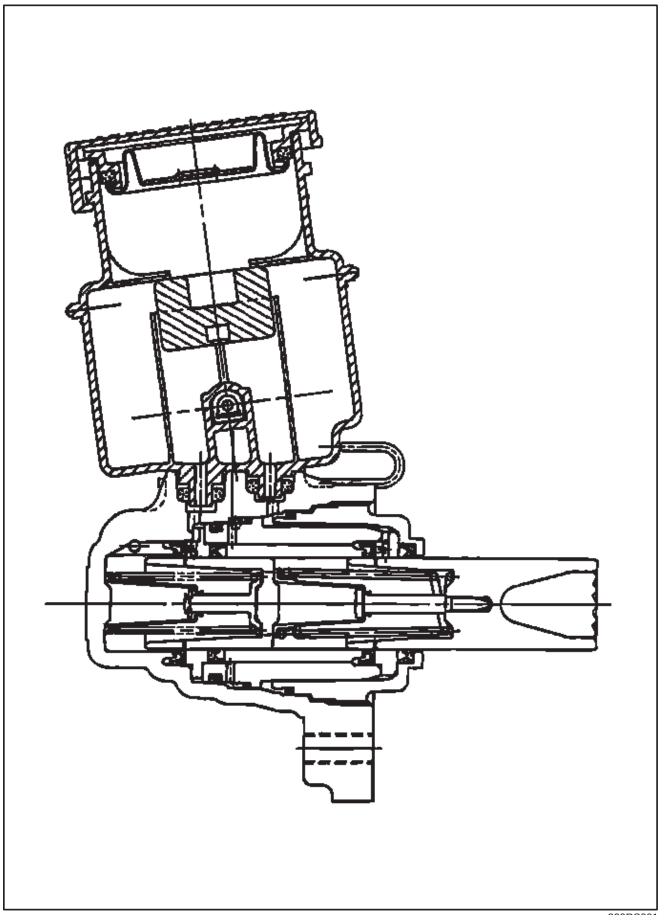
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Master Cylinder Assembly



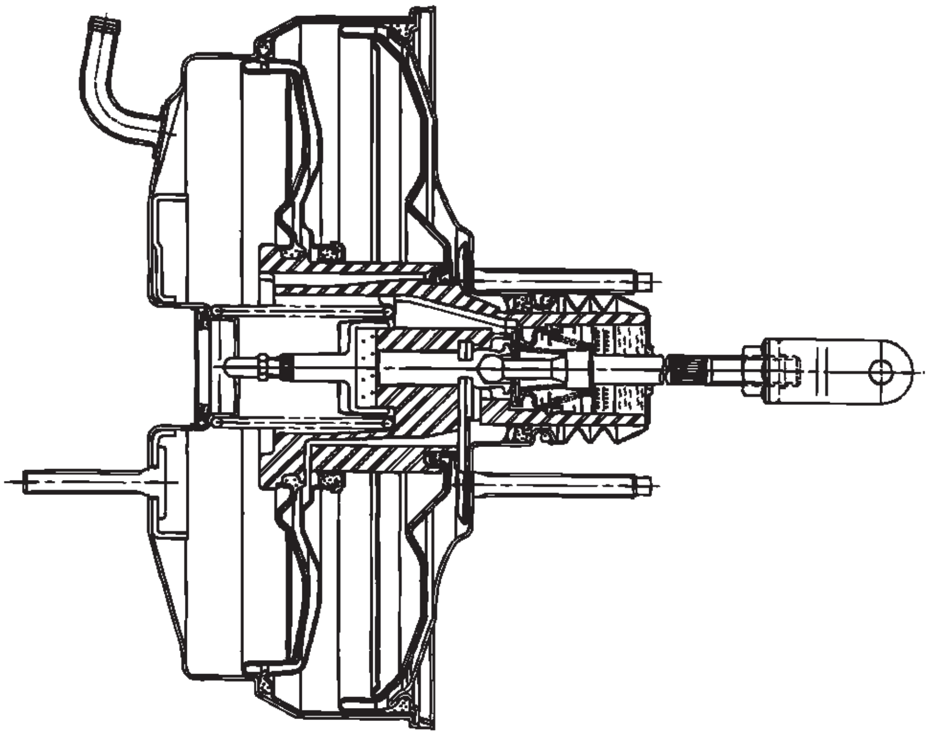
330RS001

The master cylinder contains two pistons that supply the hydraulic pressure for a dual–circuit braking system. The primary piston provides the fluid pressure to the front brakes, while the secondary piston provides the fluid pressure to the rear brakes. If the pressure is lost from either system, the remaining system will function to stop the vehicle.

CAUTION:

1. **The master cylinder is not repairable. If found defective, it must be replaced as a complete assembly.**
2. **If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system. (Refer to "Bleeding Brake Hydraulic System" in this section.)**
3. **The torque values specified are for dry, unlubricated fasteners.**
4. **Perform service operations on a clean bench free from all mineral oil materials.**

Brake Booster



331RS001

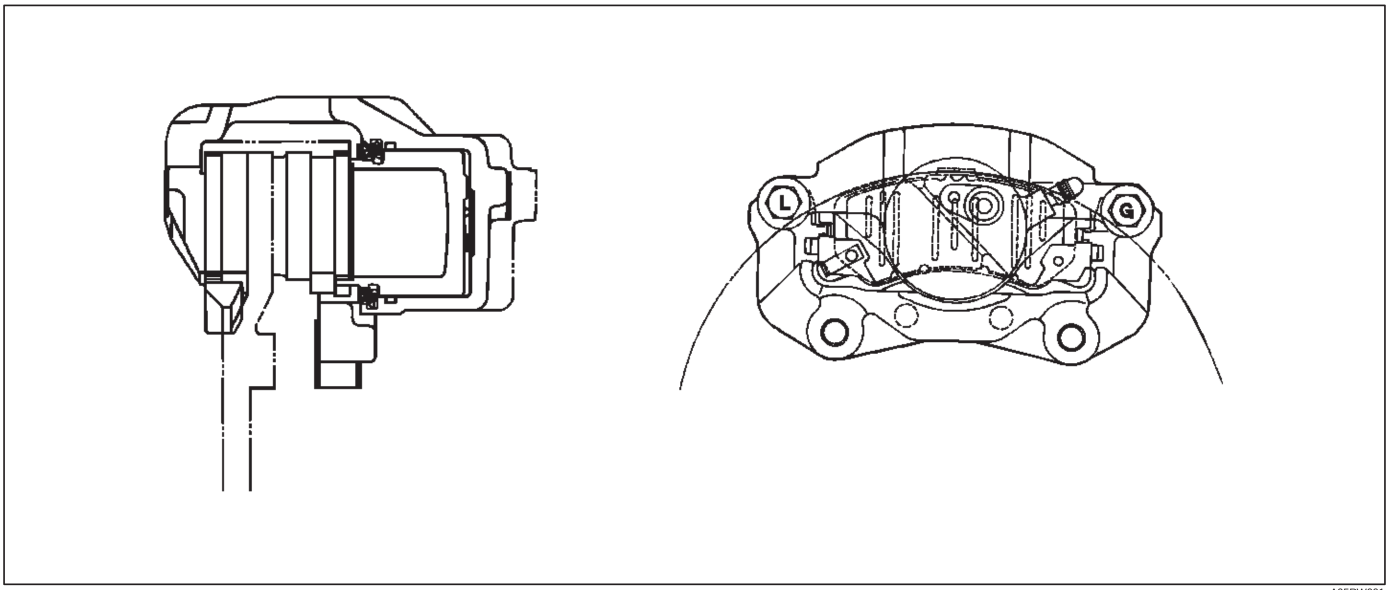
This booster is a tandem vacuum unit with a diaphragm effective diameter 205mm + 230mm. In normal operating mode, with the service brakes in the released position, the tandem vacuum booster operates with vacuum on both sides of its diaphragms. When the brakes are applied, air at atmospheric pressure is admitted to one side of each diaphragm to provide the power assist. When the service brake is released, the atmospheric air is shut off from the one side of each diaphragm. The air is then drawn from the booster through the vacuum check valve to the vacuum source.

CAUTION:

1. **If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.**
2. **The torque values specified are for dry, unlubricated fasteners.**
3. **The vacuum booster is not repairable and must be replaced as complete assembly.**

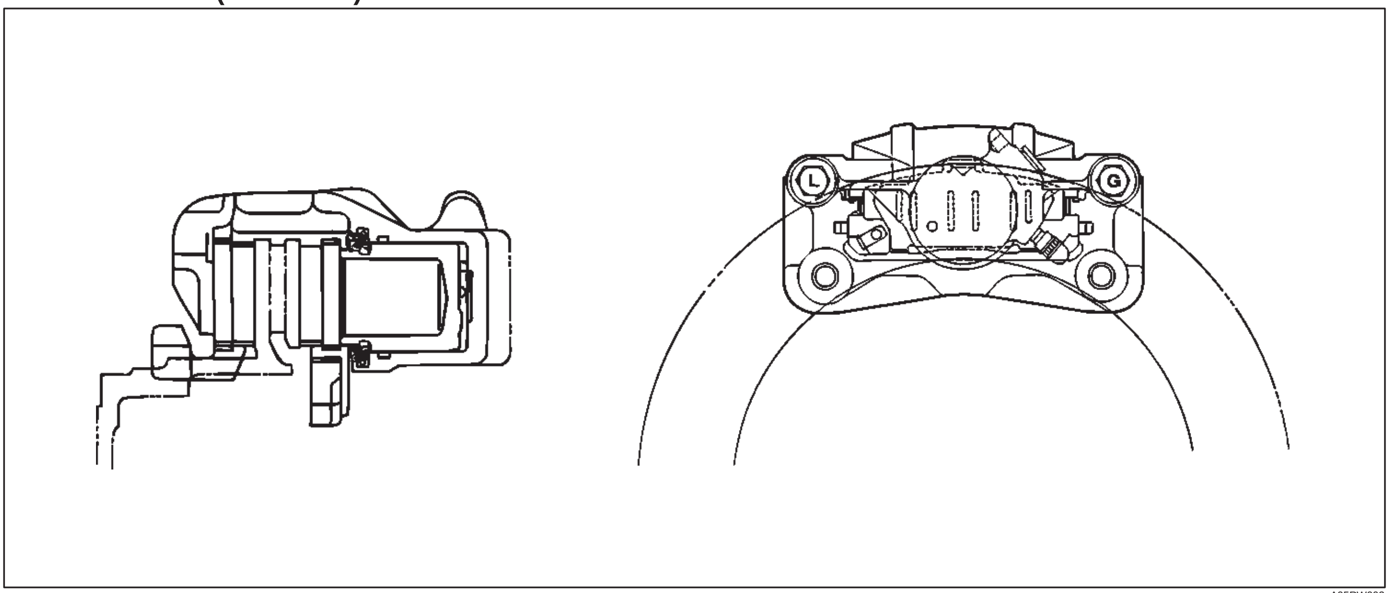
Disc Brake

Front Disc Brake



A05RW001

Rear Disc Brake (4×4 Model)



A05RW002

The disc brake assembly consists of a caliper, piston, rotor, pad assembly and support bracket. The caliper assembly has a single bore and is mounted to the support bracket with two mounting bolts. The support bracket allows the caliper to move laterally against the rotor. The caliper is a one–piece casting with the inboard side containing the piston bore. A square cut rubber seal is located in a groove in the piston bore which provides the hydraulic seal between the piston and the cylinder wall.

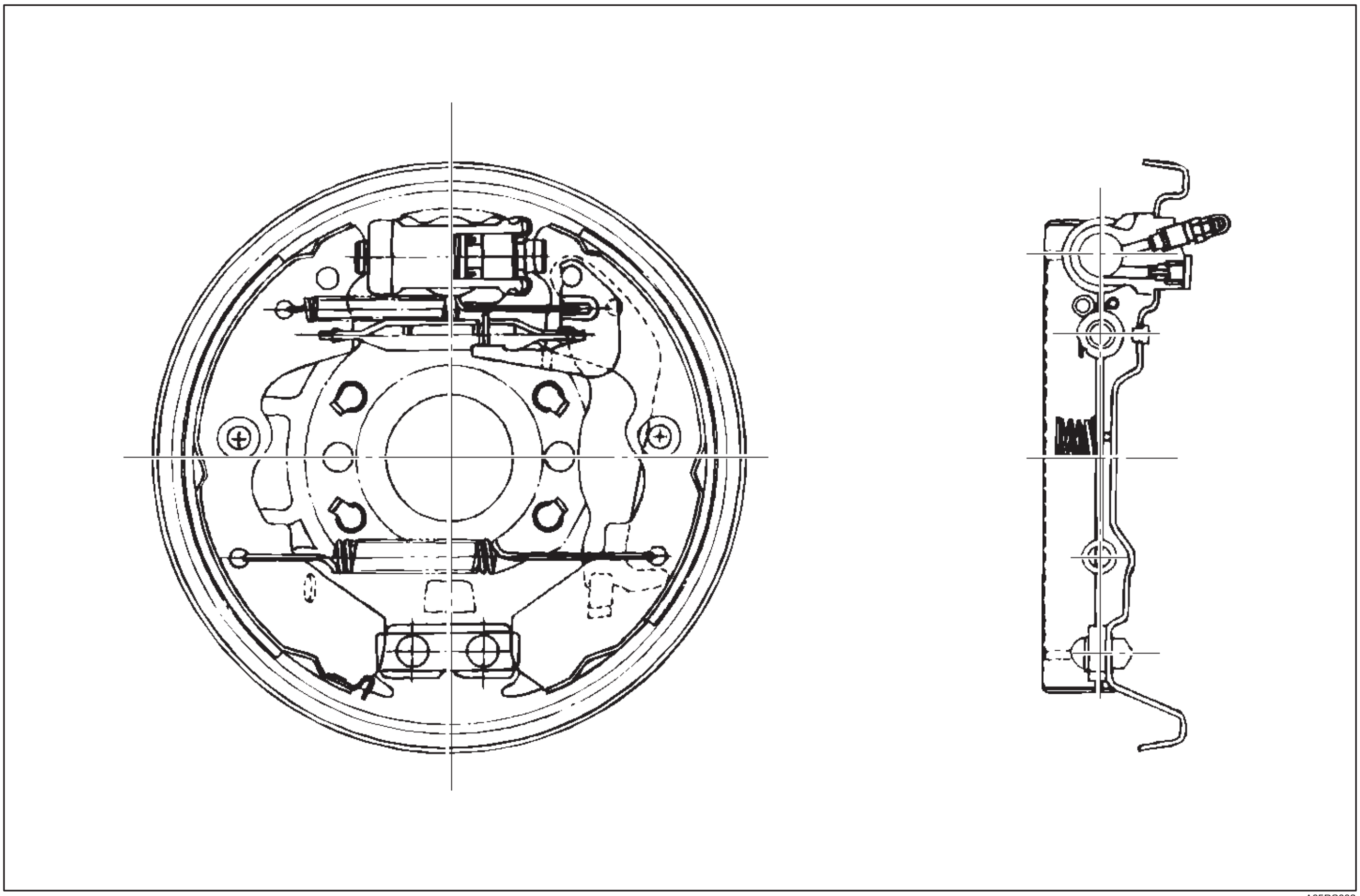
NOTE:

1. Replace all components included in repair kits used to service this caliper.
2. Lubricate rubber parts with clean brake fluid to ease assembly.
3. If any hydraulic component is removed or disconnected, it may be necessary to bleed all or part of the brake system.
4. Replace pads in axle sets only.
5. The torque values specified are for dry, unlubricated fasteners.
6. Perform the service operation on a clean bench free from all mineral oil materials.

Operation

Hydraulic pressure, created by applying the brake pedal, is converted by the caliper to a stopping force. This force acts equally against the piston and the bottom of the caliper bore to move the piston outward and to move (slide) the caliper inward resulting in a clamping action on the rotor. This clamping action forces the linings against the rotor, creating friction to stop the vehicle.

Leading/Trailing Drum Brakes (4×2 Model)



A05RS003

This drum brake assembly is a leading/trailing shoe design. Both brake shoes are held against the wheel cylinder pistons by the upper return spring and to the fixed anchor plate by the lower return spring. When the brakes are applied, the wheel cylinder pistons move both shoes out contact the drum.

With forward wheel rotation, the forward brake shoe will wrap into the drum and became self-energized.

With reverse wheel rotation, the rear brake shoe is self-energized. Force from the brake shoes is transferred to the anchor plate through the braking plate to the axle flange. Adjustment is automatic and occurs on any service brake application. Also, with leading/trailing brakes, it is normal for the front shoe to wear at a faster rate than the rear shoe.

Diagnosis

Road Testing The Brakes

Brake Test

Brakes should be tested on a dry, clean, reasonably smooth and level roadway. A true test of brake performance cannot be made if the roadway is wet, greasy or covered with loose dirt so that all tires do not grip the road equally. Testing will also be adversely affected if the roadway is crowned so as to throw the weight of the vehicle toward wheels on one side or if the roadway is so rough that wheels tend to bounce. Test the brakes at different vehicle speeds with both light and heavy pedal pressure; however, avoid locking the wheels and sliding the tires. Locked wheels and sliding tires do not indicate brake efficiency, since heavily braked but turning wheels will stop the vehicle in less distance than locked wheels. More tire–to–road friction is present with a heavily braked turning tire then with a sliding tire.

The standard brake system is designed and balanced to avoid locking the wheels except at very high deceleration levels.

It is designed this way because the shortest stopping distance and best control is achieved without brake lock–up.

Because of high deceleration capability, a firmer pedal may be felt at higher deceleration levels.

External Conditions That Affect Brake Performance

1. Tires: Tires having unequal contact and grip on the road will cause unequal braking. Tires must be equally inflated, identical in size, and the thread pattern of right and left tires must be approximately equal.
2. Vehicle Loading: A heavily loaded vehicle requires more braking effort.
3. Wheel Alignment: Misalignment of the wheels, particularly in regard to excessive camber and caster, will cause the brakes to pull to one side.

Brake Fluid Leaks

With engine running at idle and the transmission in "Neutral", depress the brake pedal and hold a constant foot pressure on the pedal. If pedal gradually falls away with the constant pressure, the hydraulic system may be leaking.

Check the master cylinder fluid level. While a slight drop in the reservoir level will result from normal lining wear, an abnormally low level in reservoir indicates a leak in the system. The hydraulic system may be leaking internally as well as externally. Refer to "Master Cylinder Inspection". Also, the system may appear to pass this test but still have slight leakage. If fluid level is normal, check the vacuum booster push rod length. If an incorrect length push rod is found, adjust or replace the push rod. Check the brake pedal travel and the parking brake adjustment.

When checking the fluid level, the master cylinder fluid level may be low from the "MAX" mark if the front and rear linings are worn. This is not abnormal.

Warning Light Operation

When the ignition switch is in the START position, the "BRAKE" warning light should turn on and go off when the ignition switch returns to the ON position.

The following conditions will activate the "BRAKE" light:

1. Parking brake applied. The light should be on whenever the parking brake is applied and the ignition switch is on.
2. Low fluid level. A low fluid level in the master cylinder will turn the "BRAKE" light on.
3. During engine cranking the "BRAKE" light should remain on. This notifies the driver that the warning circuit is operating properly.

General Diagnosis

Condition	Possible cause	Correction
Brake Pull	Tire inflation pressure is unequal.	Adjust
	Front wheel alignment is incorrect.	Adjust
	Unmatched tires on same axle.	Tires with approx. the same amount of tread should be used on the same axle.
	Restricted brake pipes or hoses.	Check for soft hoses and damaged lines. Replace with new hoses and new double“walled steel brake piping.
	Water or oil on the brake pads.	Clean or replace.
	Brake pads hardened.	Replace
	Brake pads worn excessively.	Replace
	Brake rotor worn or scored.	Grind or replace.
	Disc brake caliper malfunctioning.	Clean or replace.
	Front hub bearing preload incorrect.	Adjust or replace.
	Loose suspension parts.	Check all suspension mountings.
	Loose calipers.	Check and tighten the bolts to specifications.
Brake Roughness or Chatter (Pulsates)	Excessive lateral runout.	Check per instructions. If not within specifications, replace or machine the rotor.
	Parallelism not within specifications.	Check per instructions. If not within specifications, replace or machine the rotor.
	Wheel bearings not adjusted.	Adjust wheel bearings to correct specifications
	Pad reversed (steel against iron).	Replace the brake pad and machine rotor to within specifications.
Excessive Pedal Effort	Malfunctioning vacuum booster.	Check the vacuum booster operation and repair, if necessary.
	Partial system failure.	Check the front and rear brake system for failure and repair. Also, check the brake warning light. If a failed system is found, the light should indicate failure.
	Excessively worn pad.	Check and replace pads in sets.
	Piston in caliper stuck or sluggish.	Remove caliper and rebuild.
	Fading brakes due to incorrect pad.	Remove and replace with original equipment pad or equivalent.
	Vacuum leak to vacuum booster.	Check for ruptured or loose hose.
	Check the direction of check valve within vacuum hose.	Correct vacuum hose direction.
	Grease on the brake pads.	Replace or clean.

Condition	Possible cause	Correction
Excessive Brake Pedal Travel	Air in hydraulic circuit.	Bleed the hydraulic circuit.
	Level of brake fluid in the reservoir too low.	Replenish brake fluid reservoir to specified level and bleed hydraulic circuit as necessary.
	Master cylinder push rod clearance excessive.	Adjust
	Leakage in hydraulic system.	Correct or replace defective parts.
Brake Drag	Master cylinder pistons not returning correctly.	Adjust the stop light switch and vacuum booster push rod. If necessary, rebuild.
	Restricted brake pipes or hoses.	Check for soft hoses or damaged pipes, and replace with new hoses and new double–walled steel brake piping.
	Parking brake maladjusted.	Adjust
	Parking brake lining clearance insufficient.	Adjust
	Brake pedal free play insufficient.	Adjust the brake pedal height or power cylinder operating rod.
	Piston in the master cylinder sticking.	Replace
	Piston in the disc brake caliper sticking.	Replace piston seals.
	Brake pads sticking in caliper.	Clean
	Return spring weakened.	Replace
	Parking brake binding.	Overhaul the parking brakes and correct.
	Front hub bearing preload incorrect.	Adjust or replace.
	Parking brake shoes not returning.	Correct or replace the brake back plate and brake shoe as necessary.
	Obstructions in hydraulic circuit.	Clean
	Rotor warped excessively.	Grind or replace.
	Rear brake drum distorted.	Grind or replace.
	Parking cable sticking.	Grind or replace.
Grabbing or Uneven Braking Action (All conditions listed under “Pulls”)	Malfunctioning vacuum booster.	Check operation and correct as necessary.
	Binding brake pedal mechanism.	Check and lubricate, if necessary.
	Corroded caliper assembly.	Clean and lubricate.
Brake Noisy	Brake pads are worn.	Replace
	Brake pads are hardened.	Replace
	Brake pads are in poor contact with rotor.	Correct
	Brake disc(s) warped, worn or damaged.	Grind or replace.
	Disc brake anti–squeak shims fatigued.	Replace
	Front hub bearings are loose or preload is incorrect.	Adjust or replace.
	Brake disc is rusted.	Grind or replace.

Condition	Possible cause	Correction
Poor Brake Action	Master cylinder faulty.	Correct or replace.
	Vacuum booster faulty.	Correct or replace.
	Level of brake fluid in reservoir too low.	Replenish and bleed.
	Air in hydraulic circuit.	Bleed
	Disc brake caliper faulty.	Clean or replace.
	Water or oil on brake pads.	Clean or replace.
	Brake pads in poor contact with the rotor.	Correct
	Brake pads worn.	Replace
	Brake disc rusted.	Grind or replace.
	Check valve in vacuum hose faulty.	Correct or replace.

Hydraulic Brakes

Filling Master Cylinder Reservoir

CAUTION: Use only specified brake fluid. Do not use any fluid which contains a petroleum base. Do not use a container which has been used for petroleum based fluids or a container which is wet with water. Petroleum based fluid will cause swelling and distortion of rubber parts in the hydraulic brake system. Water mixed with brake fluid lowers the fluid boiling point. Keep all fluid containers capped to prevent contamination.

Always fill the master cylinder reservoir when the engine is cold.

Never allow the brake fluid to come in contact with the painted surfaces.

The master cylinder reservoir must be kept properly filled to ensure adequate reserve and to prevent air and moisture from entering the hydraulic system. However, because of expansion due to heat absorbed from the brakes and the engine, the reservoir must not be overfilled. The brake fluid reservoir is on the master cylinder, which is located under the hood on the left side of the cowl. Thoroughly clean reservoir cap before removal to avoid getting dirt into reservoir. Remove the diaphragm. Add fluid as required to bring level to the "MAX" mark on the reservoir tank. Use "DOT 3" Hydraulic Brake Fluid. If the fluid cap diaphragm is stretched, return it to the original position before installing.

Deterioration of Brake Fluid

Using any other brake fluid than specified or brake fluid with mineral oil or water mixed in will drop the boiling point of brake fluid. It may, in turn, result in vapor lock or deteriorated rubber parts of the hydraulic system. Be sure to change the brake fluid at specified intervals.

If the rubber parts are deteriorated, remove all the system parts and clean them with alcohol. Prior to reassembly, dry the cleaned parts with air to remove the alcohol. Replace all the hoses and rubber parts of the system.

Leakage of Brake Fluid

With engine idling, set shift lever in the neutral position and continue to depress brake pedal at a constant pedal application force.

Should the pedal stroke become deeper gradually, leakage from the hydraulic pressure system is possible. Make sure by visual check that there is no leak.

Bleeding Brake Hydraulic System

A bleeding operation is necessary to remove air from the hydraulic brake system whenever air is introduced into the hydraulic system. It may be necessary to bleed the hydraulic system at all four brakes if air has been introduced through a low fluid level or by disconnecting brake pipes at the master cylinder. If a brake pipe is disconnected at one wheel, only that wheel cylinder/caliper needs to be bled. If the pipes are disconnected at any fitting located between the master cylinder and brakes, then the brake system served by the disconnected pipe must be bled.

1. For 4–Wheel Antilock Brake System (ABS) equipped vehicle, be sure to remove the ABS main fuse 60A located at the relay and fuse box before bleeding air. If you attempt to bleed air without removing the main fuse, air cannot be let out thoroughly, and this may cause damage to the hydraulic unit. After bleeding air, be sure to replace the ABS main fuse back to its original position.
2. Set the parking brake completely, then start the engine.

NOTE: The vacuum booster will be damaged if the bleeding operation is performed with the engine off.

3. Remove the master cylinder reservoir cap.
4. Fill the master cylinder reservoir with brake fluid. Keep the reservoir at least half full during the air bleeding operation
5. Always use new brake fluid for replenishment.
6. In replenishing brake fluid, take care that air bubbles do not enter the brake fluid.

   When the master cylinder is replaced or overhauled, first bleed the air from the master cylinder, then from each wheel cylinder and caliper following the procedures described below.

Bleeding the Master Cylinder

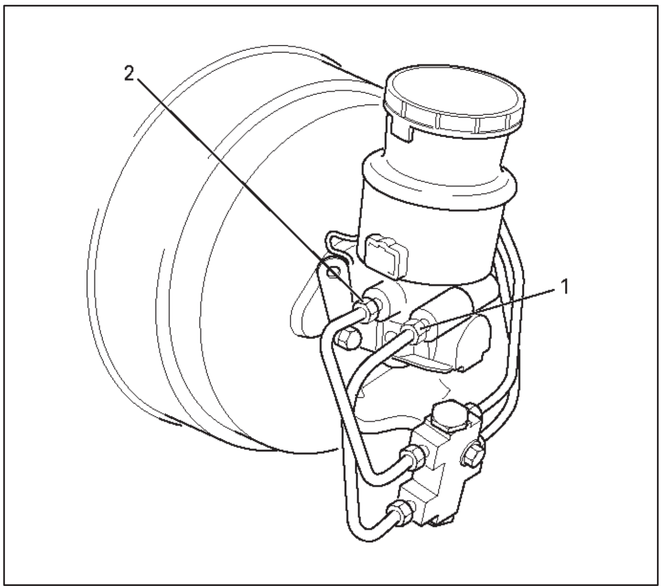
7. Disconnect the rear wheel brake pipe (1) from the master cylinder.

   Check the fluid level and replenish as necessary. If replenished, leave the system for at least one minute.
8. Depress the brake pedal slowly once and hold it depressed.
9. Completely seal the delivery port of the master cylinder with your finger, where the pipe was disconnected then release the brake pedal slowly.
10. Release your finger from the delivery port when the brake pedal returns completely.
11. Repeat steps 8 through 10 until the brake fluid comes out of the delivery port during step 8.

NOTE: Do not allow the fluid level in the reservoir to go below the half–way mark.

12. Reconnect the brake pipe (1) to the master cylinder and tighten the pipe.
13. Depress the brake pedal slowly once and hold it depressed.
14. Loosen the rear wheel brake pipe (1) at the master cylinder.
15. Retighten the brake pipe, then release the brake pedal slowly.
16. Repeat steps 13 through 15 until no air comes out of the port when the brake pipe is loosened

NOTE: Be very careful not to allow the brake fluid to come in contact with painted surfaces.



330RW012

17. Bleed the air from the front wheel brake pipe connection (2) by repeating steps 7 through 16.

Bleeding the Caliper

18. Bleed the air from each wheel in the order listed below:
    - Right rear caliper or wheel cylinder
    - Left rear caliper or wheel cylinder
    - Right front caliper
    - Left front caliper

    Conduct air bleeding from the wheels in the above order. If no brake fluid comes out, it suggests that air is mixed in the master cylinder. In this case, bleed air from the master cylinder. In this case, bleed air from the master cylinder in accordance with steps 7 through 17, and then bleed air from the caliper or wheel cylinder.
19. Place the proper size box end wrench over the bleeder screw.
20. Cover the bleeder screw with a transparent tube, and submerge the free end of the transparent tube in a transparent container containing brake fluid.
21. Pump the brake pedal slowly three (3) times (once/sec), then hold it depressed.
22. Loosen the bleeder screw until fluid flows through the tube.
23. Retighten the bleeder screw.
24. Release the brake pedal slowly.
25. Repeat steps 21 through 24 until the air is completely removed.

    It may be necessary to repeat the bleeding procedure 10 or more times for front wheels and 15 or more times for rear wheels.
26. Go to the next wheel in the sequence after each wheel is bled.

    Be sure to monitor reservoir fluid level.
27. Depress the brake pedal to check if you feel “sponginess” after the air has been removed from all wheel cylinders and calipers.

    If the pedal feels “spongy”, the entire bleeding procedure must be repeated.
28. After the bleeding operation is completed on the each individual wheel, check the level of the brake fluid in the reservoir and replenish up to the “MAX” level as necessary.
29. Attach the reservoir cap.

    If the diaphragm inside the cap is deformed, reform it and install.
30. Stop the engine.

Flushing Brake Hydraulic System

It is recommended that the entire hydraulic system be thoroughly flushed with clean brake fluid whenever new parts are installed in the hydraulic system. Approximately one quart of fluid is required to flush the hydraulic system. The system must be flushed if there is any doubt as to the grade of fluid in the system or if fluid has been used which contains the slightest trace of mineral oil. All rubber parts that have been subjected to a contaminated fluid must be replaced.

Brake Pipes and Hoses

The hydraulic brake system components are interconnected by special steel piping and flexible hoses. Flexible hoses are used between the frame and the front calipers, the frame and rear axle case and the rear axle and the rear calipers.

When the hydraulic pipes have been disconnected for any reason, the brake system must be bled after reconnecting the pipe. Refer to “Bleeding the Brake Hydraulic System” in this section.

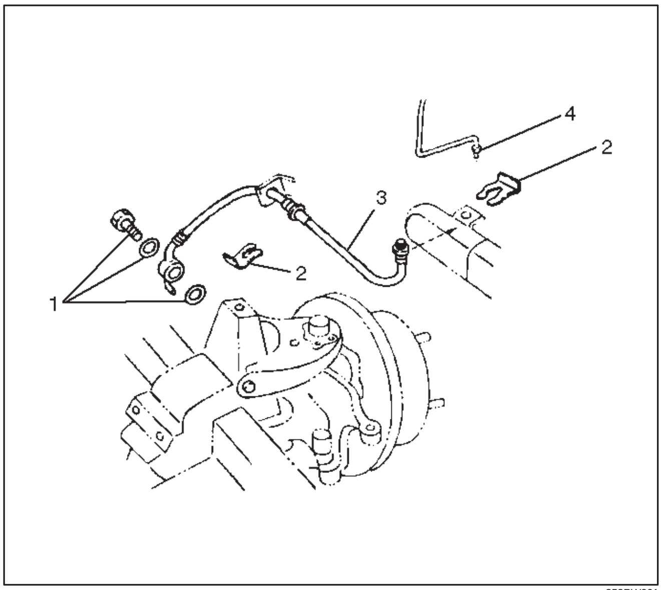
Brake Hose Inspection

The brake hose should be inspected at least twice a year. The brake hose assembly should be checked for road hazard, cracks and chafing of the outer cover, and for leaks and blisters. Inspect for proper routing and mounting of the hose. A brake hose that rubs on suspension components will wear and eventually fail. A light and mirror may be needed for an adequate inspection. If any of the above conditions are observed on the brake hose, adjust or replace the hose as necessary.

CAUTION: Never allow brake components such as calipers to hang from the brake hoses, as damage to the hoses may occur.

Front Caliper Brake Hose

Front Caliper Brake Hose and Associated Parts



352RW001

Legend

(1) Bolt and Gasket
(2) Clip
(3) Hose
(4) Brake Pipe

Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove the wheel and tire assembly.
3. Clean dirt, grease, and other foreign material off the hose fittings at both ends.
4. Disconnect brake pipe.
5. Remove clip.
6. Remove bolt and gasket.
7. Remove hose.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Tighten the brake pipes to the specified torque

   Torque: 16 N·m (12 lb ft)

2. Tighten the bolt to the specified torque.

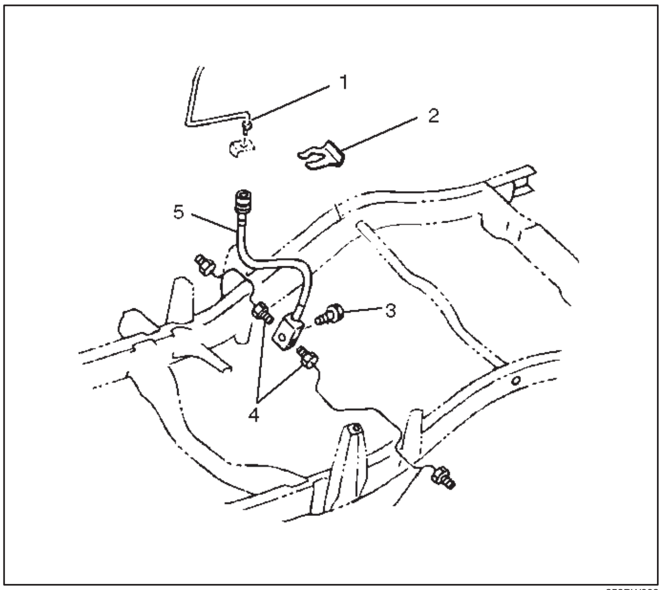
   Torque: 35 N·m (26 lb ft)

NOTE: Always use new gaskets and be sure to put the hooked edge of the flexible hose end into the anti–rotation cavity.

After installing the brake hoses, bleed the brakes as described in this section.

Rear Axle Brake Hose

Rear Axle Brake Hose and Associated Parts



352RW002

Legend
- (1) Brake Pipe
- (2) Clip
- (3) Bolt
- (4) Brake Pipe
- (5) Hose

Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove wheel and tire assembly.
3. Clean dirt, grease, and other foreign material off the hose fittings at both ends.
4. Disconnect brake pipe.
5. Remove clip.
6. Remove brake pipe.
7. Remove bolt.
8. Remove hose.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Tighten the brake pipes to the specified torque

   Torque: 16 N·m (12 lb ft)
2. Tighten the bolt to the specified torque.

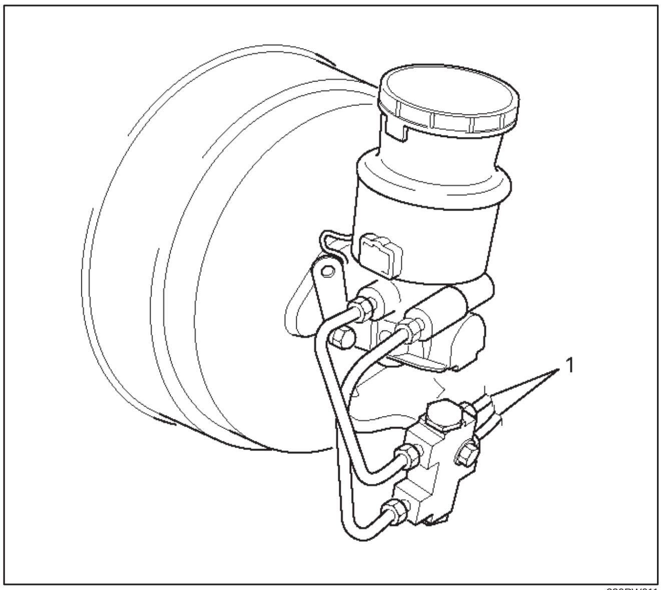
   Torque: 15 N·m (11 lb ft)

After installing the brake hoses, bleed the brakes as described in this section.

Brake Pipe

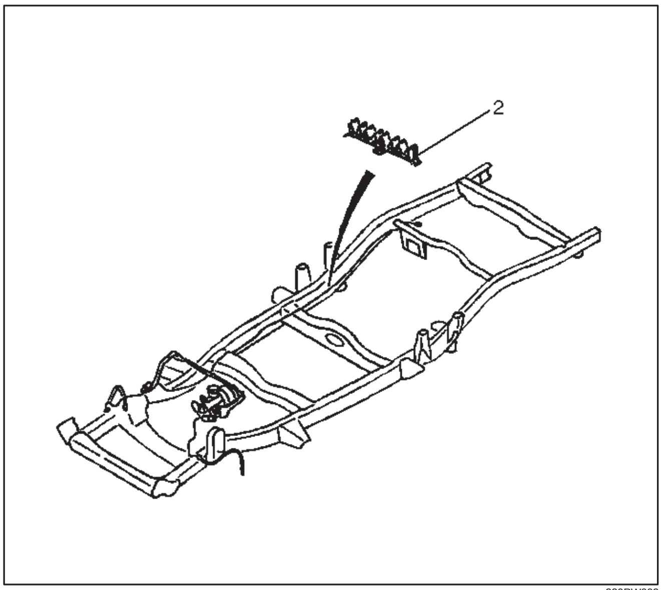
Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove wheel and tire assembly as necessary.
3. Clean dirt, grease, and other foreign material off the pipe fittings at both ends.
4. Remove brake pipe (1).



330RW011

5. Remove plastic clip (2).



330RW002

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Tighten the brake pipes to the specified torque.

Master cylinder and P&B valve sides

Torque: 12 N·m (104 lb in)

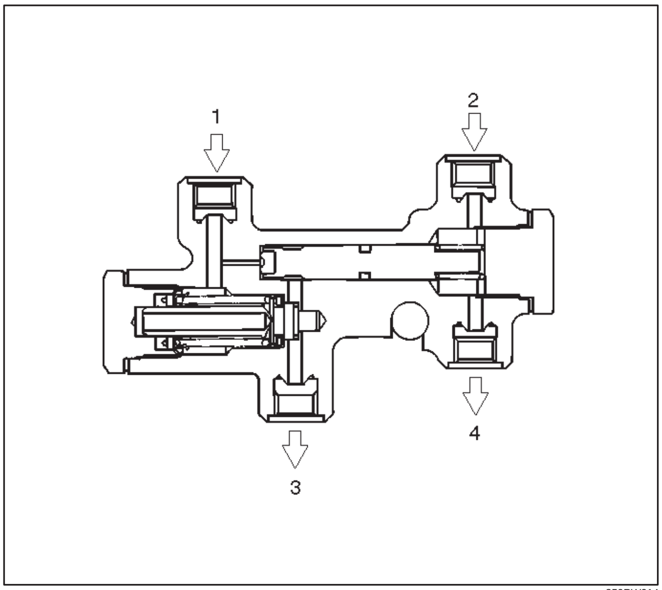
Others

Torque: 16 N·m (12 lb ft)

After installing the brake pipes, bleed the brakes as described in this section.

P & B (Proportioning and Bypass) Valve

P & B (Proportioning and Bypass) Valve Sectional View



350RW014

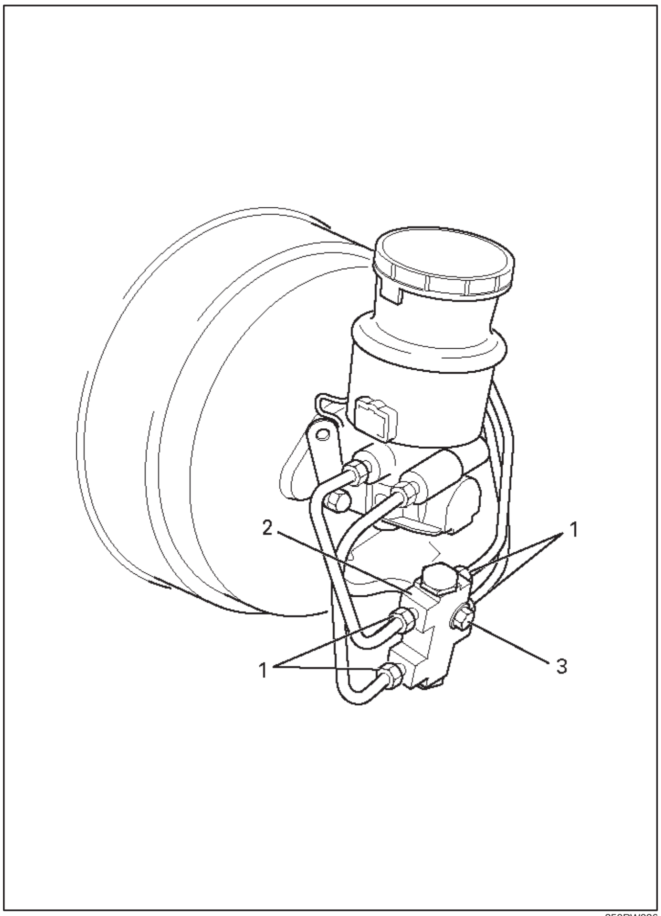
Legend

(1) Master Cylinder (Secondary)
(2) Master Cylinder (Primary)
(3) Rear Brake
(4) Front Brake

The P&B valve contains two sections, each serving a different function.
The proportioning section of the P&B valve proportions outlet pressure to the rear brakes after a predetermined rear input pressure has been reached. This is done to prevent rear wheel lock up on the vehicles with light rear wheel loads. The valve has a by–pass feature which assures full system pressure to the rear brakes in the event of front brake system malfunction. Also full front pressure is retained in the event of rear brake malfunction.
The P&B valve is not repairable and must be replaced as complete assembly.

Removal

1. The P&B valve is not repairable and must be replaced as a complete assembly. Care must be taken to prevent brake fluid from contacting any painted surface.
2. Remove hydraulic pipes (1) and plug the pipes (1) to prevent the loss of fluid or the entrance of dirt.
3. Remove bolt (3).
4. Remove P&B valve (2).



350RW026

Installation

1. Install P&B valve (2).
2. Install bolt (3) and tighten the bolt to the specified torque.

   Torque: 22 N·m (16 lb ft)

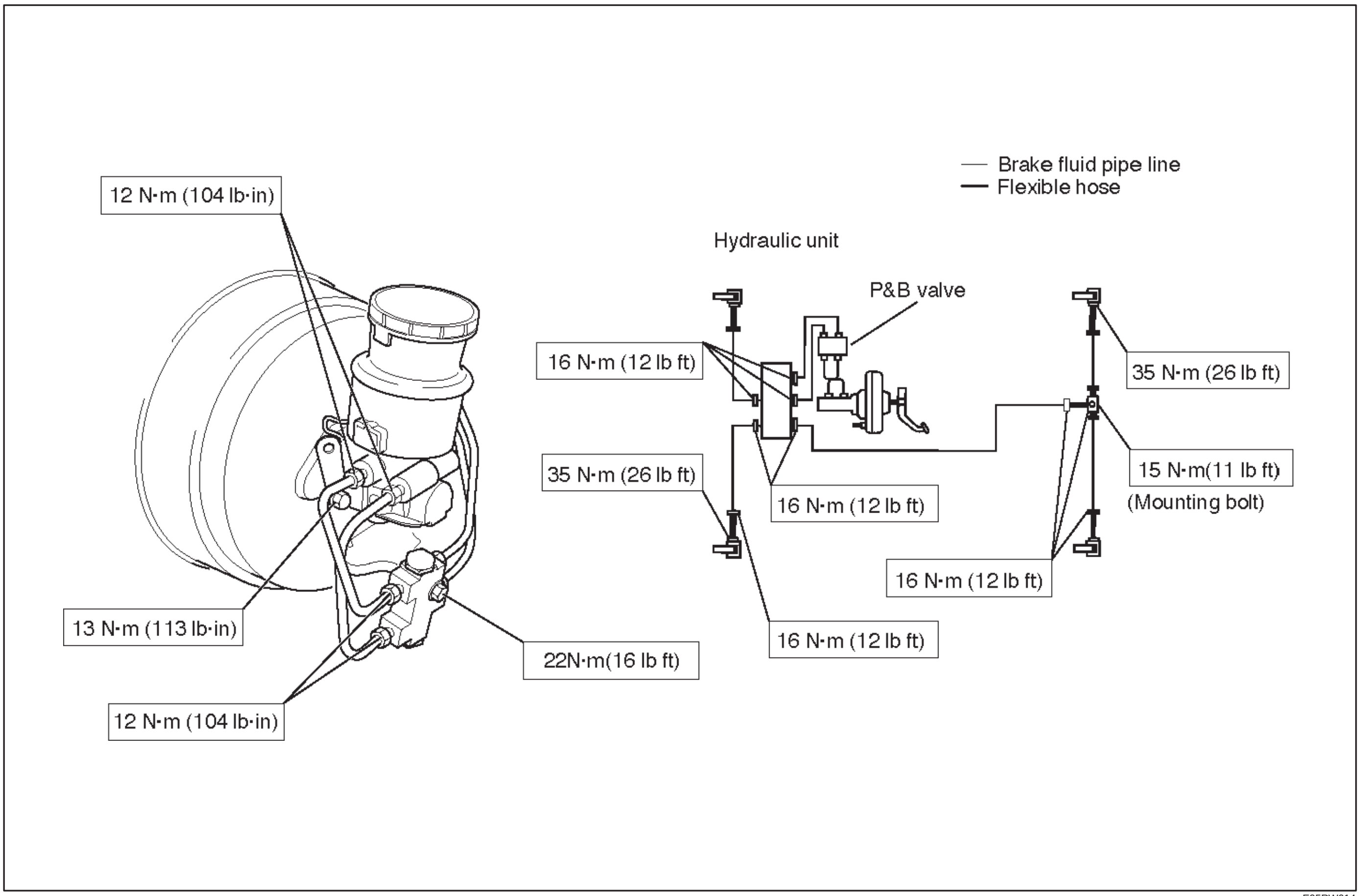
3. Install hydraulic pipes (1) and tighten the bolt to the specified torque.

   Torque: 12 N·m (104 lb in)

4. After installing the brake pipes, bleed the brakes as refer to Bleeding Brake Hydraulic System in this section.

Main Data and Specifications

Torque Specifications



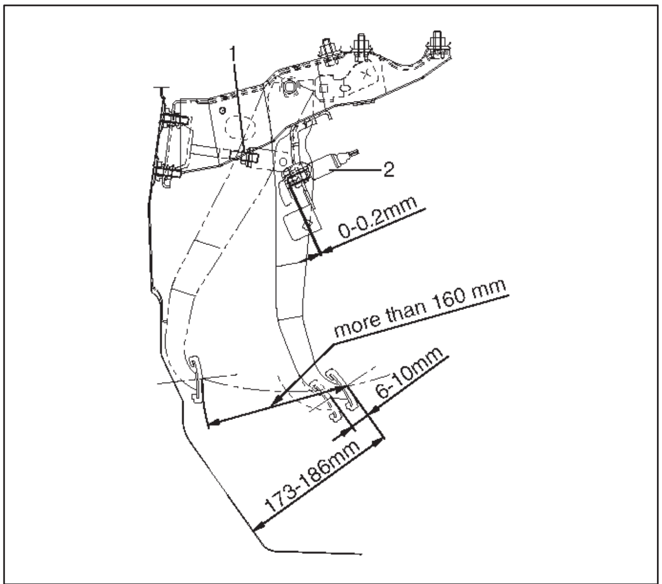
E05RW014

Brake Pedal

Checking Pedal Height

The push rod serves as the brake pedal stopper when the pedal is fully released. Brake pedal height adjustment should be performed as follows:

Adjust Brake Pedal



310RY00004

1. Measure the brake pedal height after making sure the pedal is fully returned by the pedal return spring.
   Pedal height must be measured after starting the engine and receiving it several times.

   Pedal Free Play: 6-10 mm (0.23-0.39 in)

   Pedal Free Play: 173-185 mm (6.81-7.28 in)

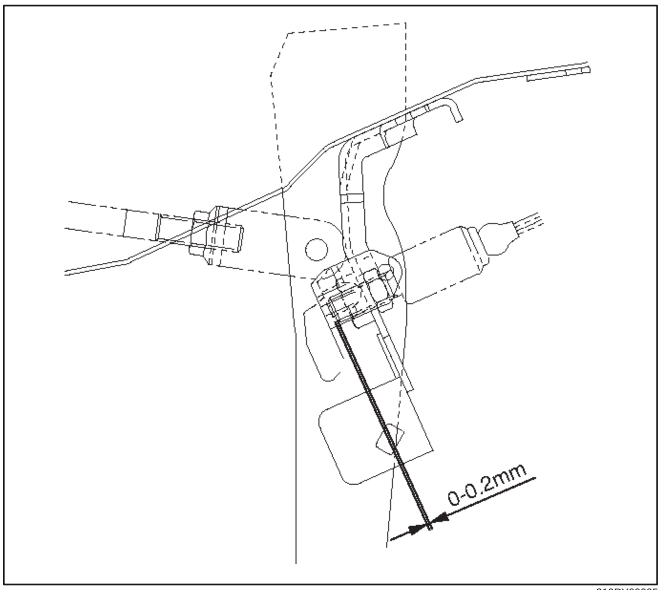
NOTE: Pedal free play must be measured after turning off the engine and stepping on the brake pedal firmly five times or more.

2. If the measured value is not within the above range, adjust the brake pedal as follows:
   a. Disconnect the stoplight switch connector.
   b. Loosen the stoplight switch lock nut.
   c. Rotate the stoplight switch so that it moves away from the brake pedal.
   d. Loosen the lock nut (1) on the push rod.
   e. Adjust the brake pedal to the specified height by rotating the push rod in the appropriate direction.
   f. Tighten the lock nut to the specified torque.

   Torque: 20 N·m (15 lb ft)

   g. Adjust the stoplight switch (2) to the specified clearance (between the switch housing and the brake pedal) by rotating the switch housing.

   Clearance: 0.5–1.0 mm (0.02–0.04 in)

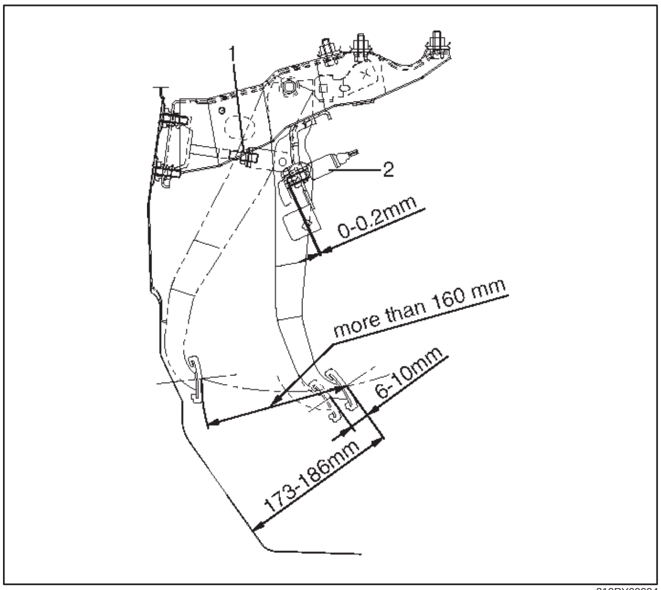


310RY00005

NOTE: While adjusting the stoplight switch, make sure that the threaded part of the stoplight switch does not push the brake pedal.

   h. Tighten the stoplight switch lock nut.
   i. Connect the stoplight switch connector.

Checking Pedal Travel



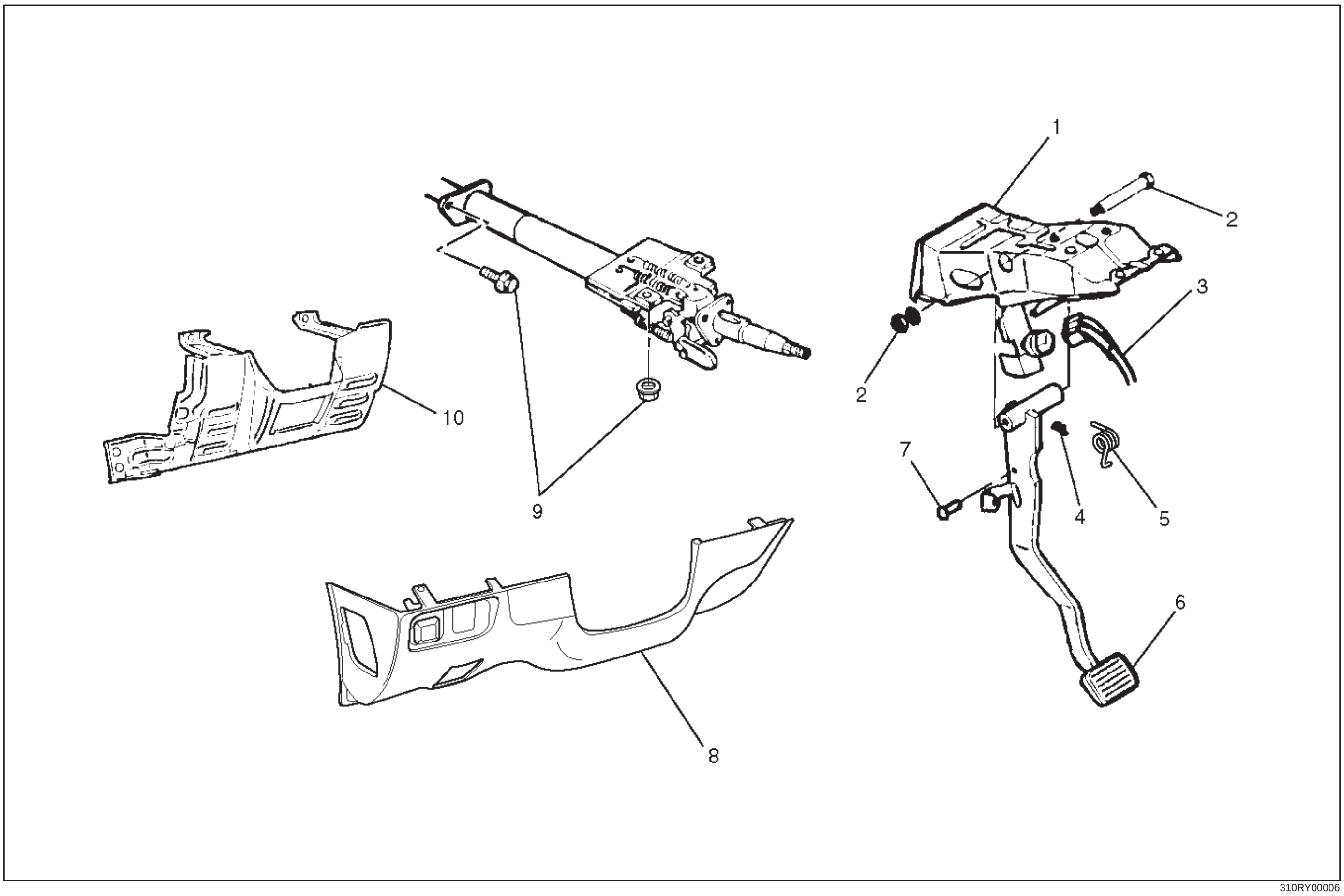
310RY00004

1. Pedal height must be measured after starting the engine and revving it several times to apply vacuum to the vacuum booster fully.

NOTE: Pedal height must be 95 mm (3.7 in) or more when about 50 kg (110.25 lb) of stepping force is applied.

2. If the measured value is lower than the above range, air existing in the hydraulic system is suspected. Perform the bleeding procedure.

Brake Pedal and Associated Parts



Legend

(1) Brake Pedal Bracket Assembly
(2) Fulcrum Pin and Nut
(3) Connector
(4) Snap Pin
(5) Return Spring
(6) Peadl Assembly
(7) Push Rod Pin
(8) Lower Cover
(9) Bolts and Nut
(10) Driver Knee Bolster

Removal

1. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
2. Disconnect the yellow 3 way SRS connector located under the steering column.
3. Remove the engine hood opening lever.
4. Remove lower cover (8).
5. Remove driver knee bolster (10).
6. Disconnect the stop light switch connector (3).
   Disconnect the anti-theft control module connector. Refer to Body and Accessories section.
7. Remove snap pin (4) and push rod pin (7).
8. Remove the steering column shaft fixing bolt and nut (9) on the steering wheel side, and lower the steering column shaft.
9. Remove the brake pedal bracket assembly (1).
10. Remove return spring (5).
11. Remove fulcrum pin and nut (2).
12. Remove pedal assembly (6).

Installation

1. Apply grease to the entire circumference of the fulcrum pin.
2. Install pedal assembly (6) and fulcrum pin and nut (2).
   Tighten the nut (2) to the specified torque.

   Torque: 35 N·m (26 lb ft)
3. Install the brake pedal bracket assembly (1).
   Tighten the bolts and nuts soecified torque.

   Torque: 15 N·m (11 lb ft)
4. Install return spring (5).
5. Adjust pedal free travel.
   Refer to Brake Pedal Adjustment in this section.
6. Tighten the steering column fixing bolt (9) (dash panel) to the specified torque.

   Torque: 19 N·m (14 lb ft)

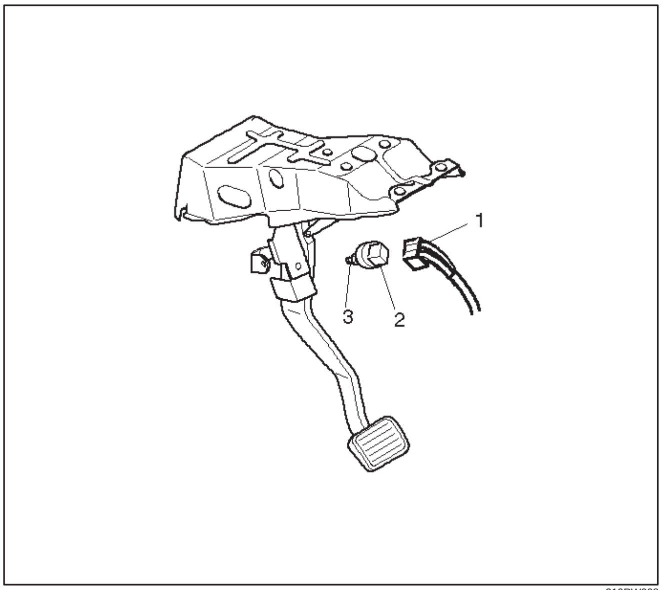
7. Tighten the steering column fixing nut (9) (Cross Beam) to the specified torque.

   Torque: 20 N·m (14 lb ft)

8. Apply grease to the entire circumference of the Push rod pin (7).
9. Install push rod pin (7).
10. Install snap pin (4).
11. Connect the anti-theft control module connector. Refer to Body and Accessories section.
12. Connect the stop light switch connector (3).
13. Install driver knee bolster (10) and lower cover (8).
14. Install the engine hood opening lever.
15. Connect the yellow 3 way SRS connector located under the steering column.
16. Connect the battery "–" terminal cable.

Stoplight Switch

Parts Location



310RW008

Legend

(1) Connector
(2) Switch
(3) Lock Nut

Removal

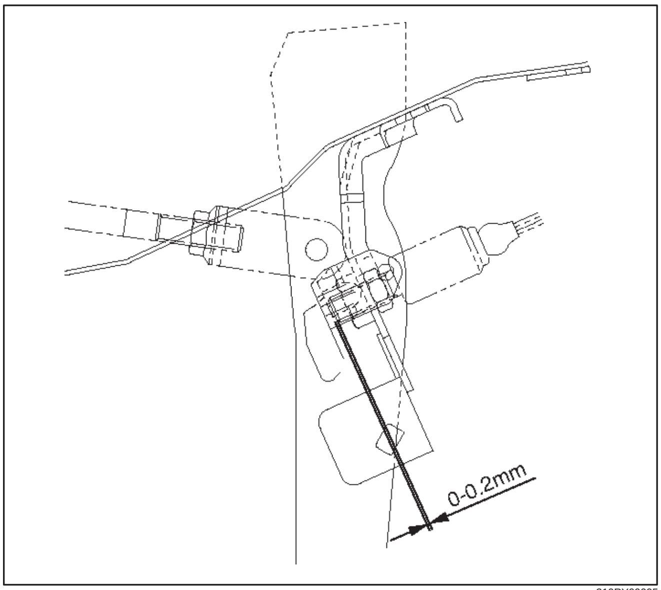
1. Disconnect connector (1)
2. Remove lock nut (3).
3. Remove switch (2).

Installation

1. Adjust the stop light switch to the specified clearance (between switch housing and brake pedal) by rotating the switch housing.

   Clearance : 0-0.2 mm (0-0.08 in)

NOTE: Do not attempt to force the push rod into position during the stop light switch installation and adjustment procedure.



310RY00005

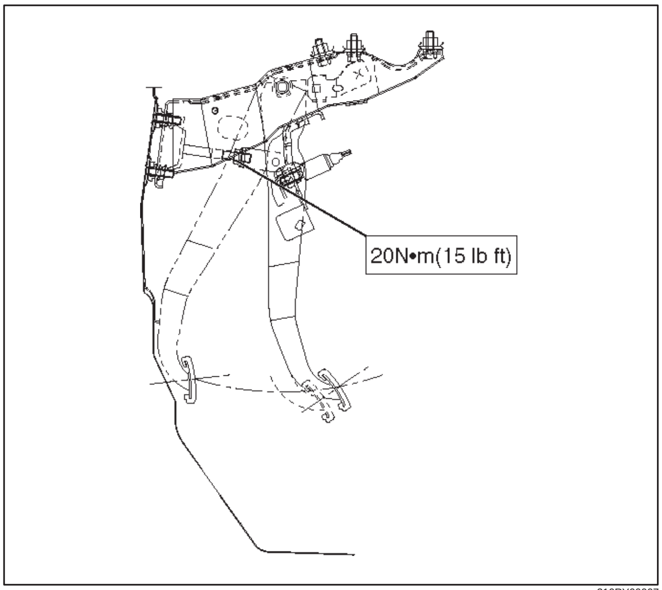
2. Connect connector (1).
3. Install lock nut (3).

Main Data and Specifications

General Specifications

Pedal free play	6–10 mm (0.23 –0.39 in)
Pedal Height	173–185 mm (6.81–7.28 in)

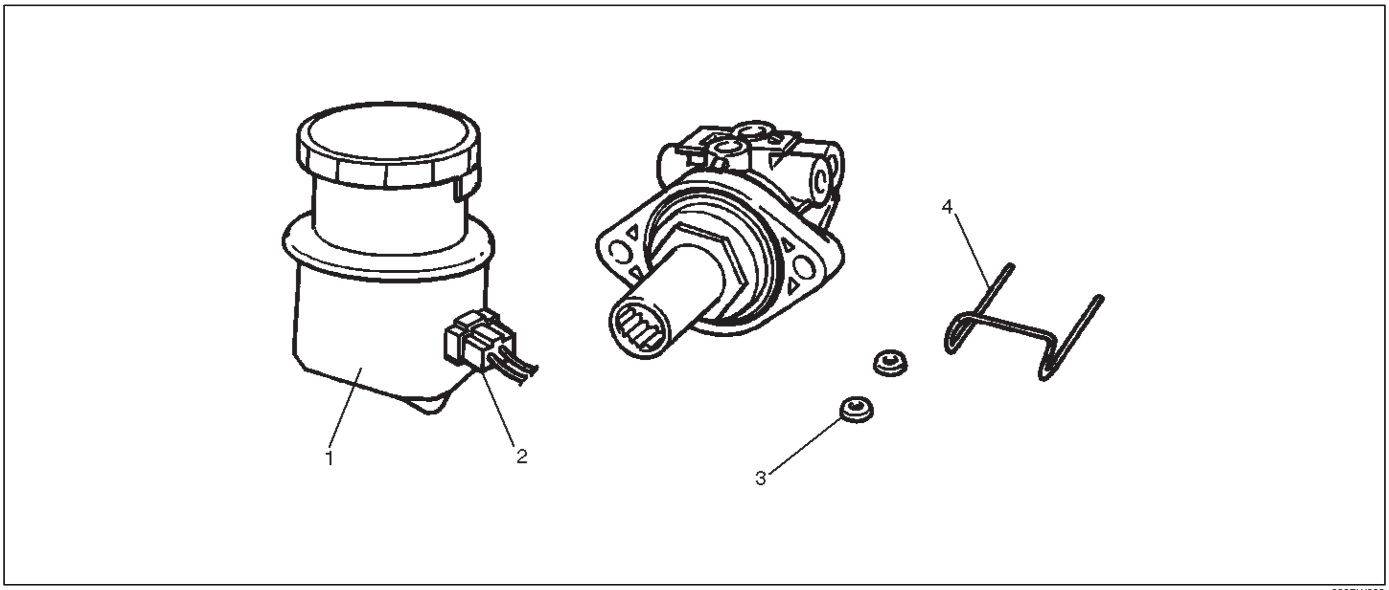
Torque Specifications



310RY00007

Fluid Reservoir Tank

Fluid Reservoir Tank and Associated Parts



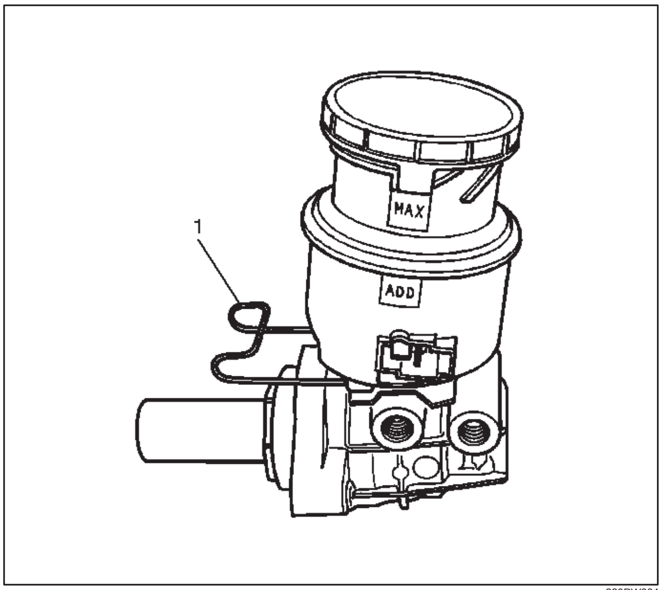
330RW003

Legend
(1) Fluid Reservoir
(2) Electrical Connector
(3) O–ring
(4) Retainer

Removal

NOTE: Before removing the fluid reservoir, remove the brake fluid from the fluid reservoir.

1. Disconnect electrical connector.
2. Remove retainer (1).



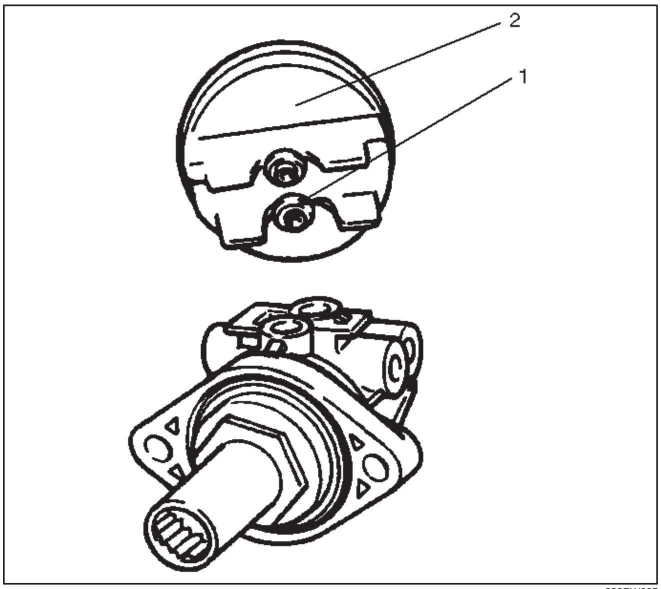
330RW004

3. Remove fluid reservoir and the fluid level sensor built into the fluid reservoir. The fluid level sensor cannot be removed for servicing.
4. Remove O–ring.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

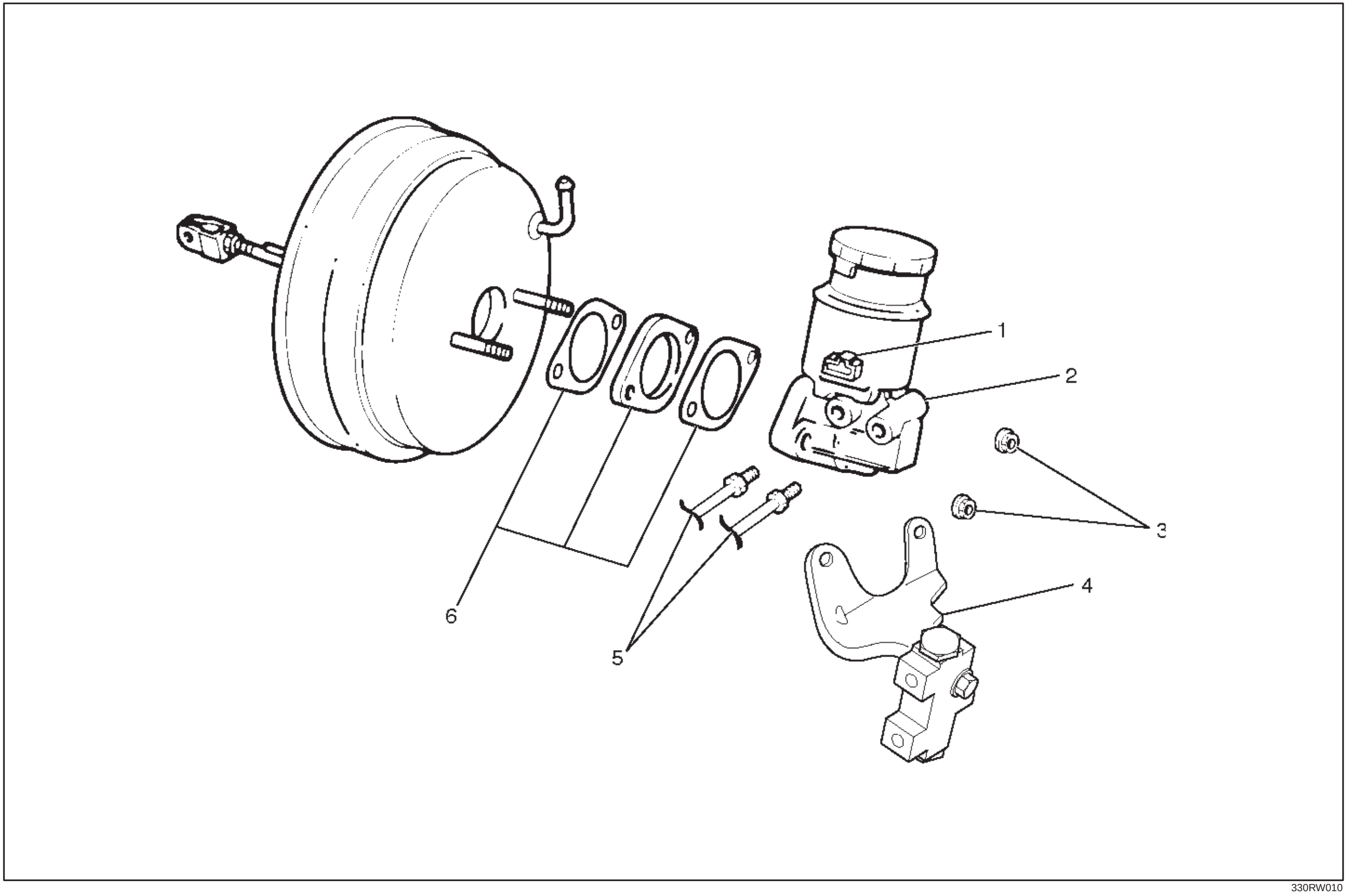
1. O–ring (1) must be set onto the fluid reservoir (2), before installing fluid reservoir.



330RW005

Master Cylinder Assembly

Master Cylinder Assembly and Associated Parts



Legend

(1) Electrical Connector
(2) Master Cylinder
(3) 2 attaching Nuts
(4) P&B Valve and Bracket
(5) Brake Pipes
(6) Spacer and 2 gaskets

Removal

CAUTION: When removing the master cylinder from the vacuum booster, be sure to get rid of the internal negative pressure of the vacuum booster (by, for instance, disconnecting the vacuum hose) in advance.

If any negative pressure remains in the vacuum booster, the piston may possibly come out when the master cylinder is being removed, letting the brake fluid run out.

While removing the master cylinder, further, do not hold the piston as it can be easily pulled out.

Outside surface of the piston is the surface on which seals are to slide. Care should be taken to keep the surface free of cuts and dents.

1. Disconnect electrical connector.
2. Remove brake pipes and after disconnecting the brake pipe, cap or tape the openings of the brake pipe to prevent the entry of foreign matter.
3. Remove 2 attaching nuts.
4. Remove P&B valve and bracket.
5. Remove master cylinder.
6. Remove spacer and the 2 gaskets.

Inspection and Repair

Master Cylinder

The master cylinder is not repairable and must be replaced as a complete assembly if found defective.

Inspection

Excessive brake pedal travel, malfunction or dragging brake suggests that the master cylinder is defective. In such cases perform the following visual check:

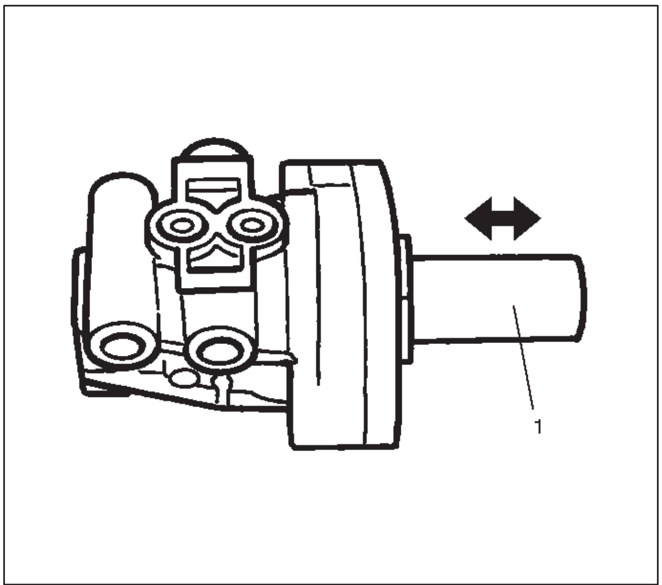
Visual Check

Make parts replacement as required if wear, distortion, nicks, cuts, corrosion, or other abnormal conditions are found through the following parts inspection:

- Master cylinder body
- Fluid reservoir
- O–ring

Functional Inspection of Master Cylinder Piston

Push the primary piston (1) with your fingers to check that it travels smoothly. If the motion is questionable, replace the master cylinder as a complete assembly.

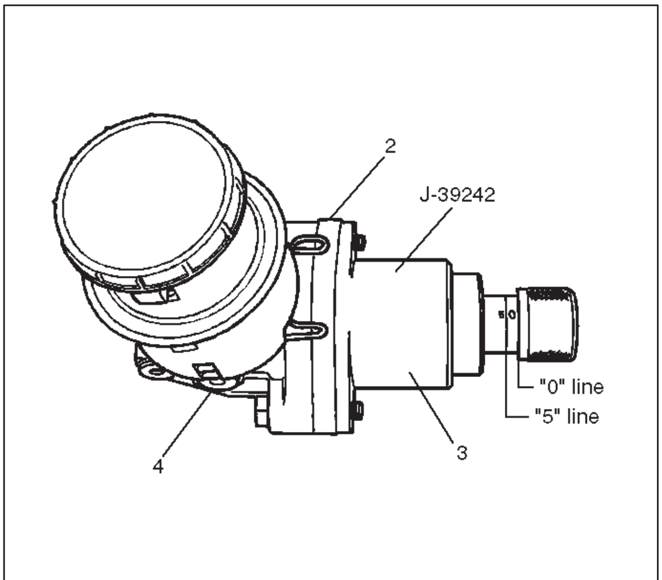


330RW007

Functional Inspection of Master Cylinder

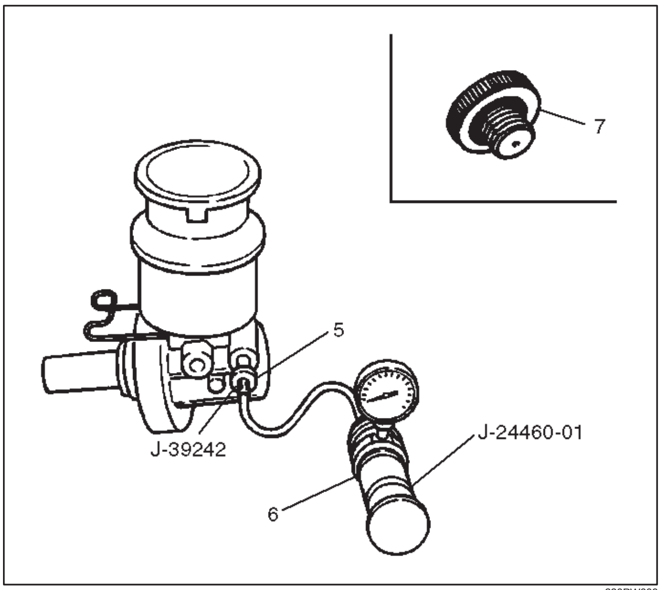
Inspect the master cylinder for function as follows. If any abnormal function is found, replace with a new one.

Install the primary piston holder (3) J–39242 (including the master cylinder attachment (5) and master cylinder plug (7)) onto the master cylinder (4). Make sure the spacer (2) (2 bolts) with its adjusting bolt is screwed in up to the “0” line



330RW008

Connect the master cylinder attachment (5) J–39242 with the end of the radiator cap tester (6) J–24460–01, and apply air pressure with the cap tester. Make sure there is no rise in pressure and that with the adjusting bolt further screwed in 5 mm (align the adjusting bolt to the “5” line). There should be a pressure increase of 0.5 kg/cm^2 or more.



330RW009

NOTE: When checking the front (or primary) side, be sure to mount the master cylinder plug in the rear (or secondary) port.

	“0” Line	“5” Line
Apply air pressure to the front and rear ports	No pressure rise.	Pressure increase of 0.5 kg/cm^2 or more
Remarks	Checks port into the atmospheric pressure chamber	Checks air tightness of the pressure chamber

NOTE:

1. Do not use an air compressor, as the air from the compressor is mixed with compressor oil.
2. When installing the master cylinder onto the vacuum booster, always adjust the vacuum booster push rod. (Refer to “Vacuum Booster” in this section).
3. After the master cylinder is installed onto the vehicle, check for leakage, pedal travel and pedal free play.

Installation

1. Install spacer and the 2 gaskets.
2. Install master cylinder.
   When replacing the master cylinder or vacuum booster or both, always measure the vacuum booster push rod protrusion and adjust it as necessary (Refer to “Vacuum Booster” in section).
3. Install P&B valve and bracket.
4. Install 2 attaching nuts and tighten the attaching nuts to the specified torque.

Torque: 13 N·m (113 lb in)

5. Install brake pipes and tighten the brake pipe to the specified torque.

Master cylinder and P&B valve sides

Torque: 12 N·m (104 lb in)

Others

Torque: 16 N·m (12 lb in)

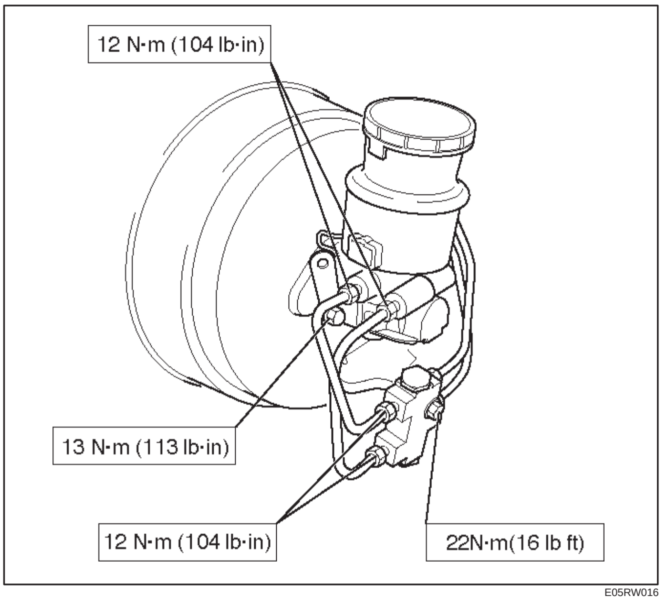
6. Connect electrical connector.

Main Data and Specifications

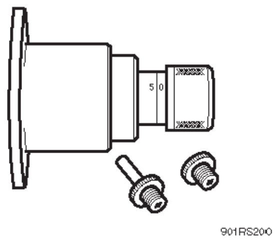
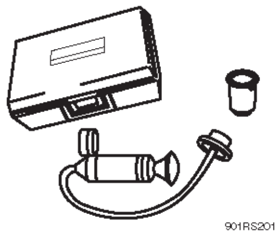
General Specifications

Type	Dual–circuit
Piston bore diameter	25.4 mm (1.000 in)

Torque Specifications

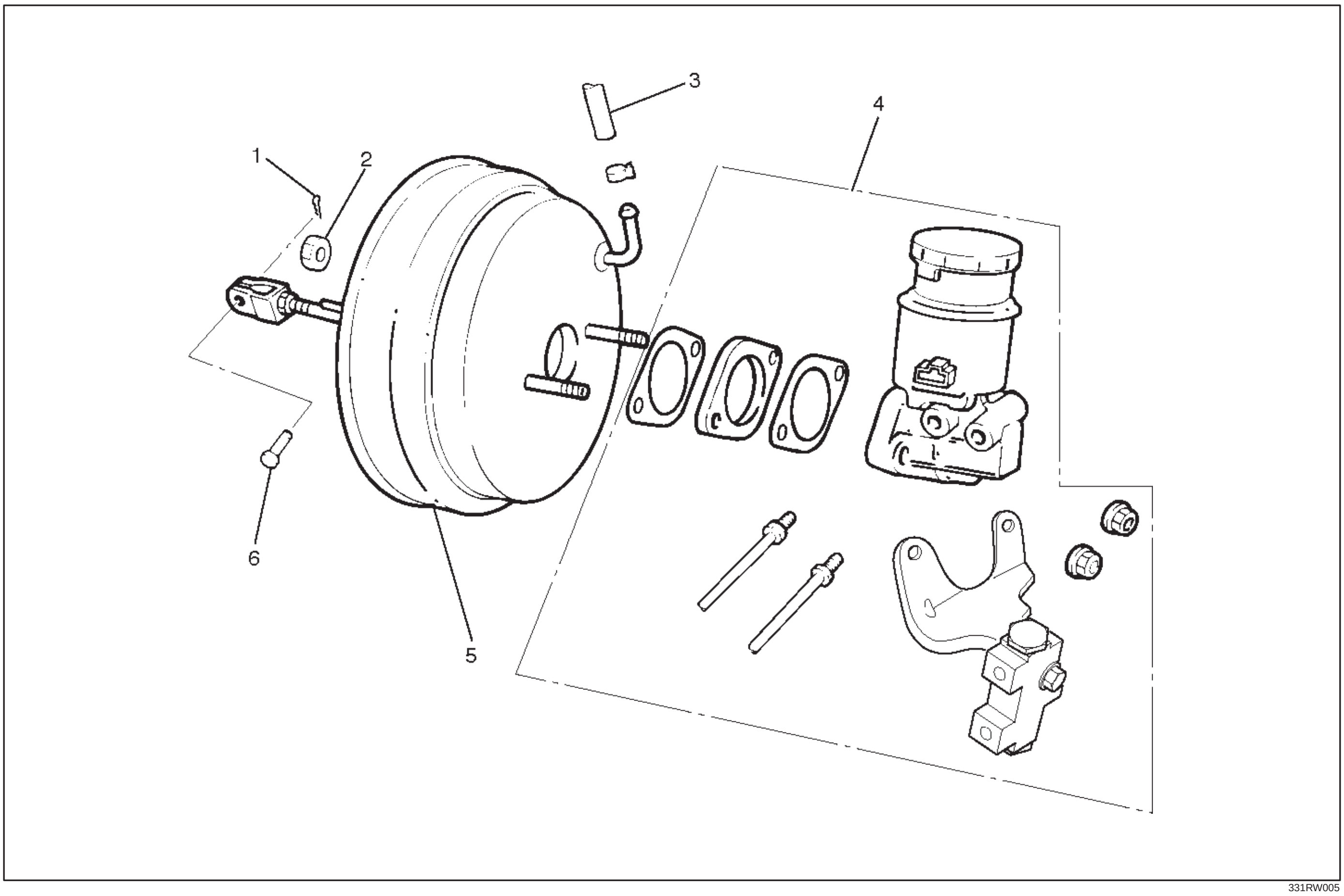


Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J-39242** Primary Piston Holder (including master cylinder attachment and master cylinder plug
	**J-24460-01** Radiator Cap Tester

Vacuum Booster Assembly

Vacuum Booster Assembly and Associated Parts



Legend
(1) Pin
(2) Vacuum Booster Fixing Nut
(3) Vacuum Hose
(4) Master Cylinder
(5) Vacuum Booster
(6) Snap Pin

Removal

1. Before removing the vacuum booster assembly, disconnect and remove the brake pipes.
2. Remove master cylinder, refer to “Master Cylinder Removal” in this section.

CAUTION: When removing the master cylinder from the vacuum booster, be sure to get rid of the internal negative pressure of the vacuum booster (by, for instance, disconnecting the vacuum hose) in advance.

If any negative pressure remains in the vacuum booster, the piston may possibly come out when the master cylinder is being removed, letting the brake fluid run out.

While removing the master cylinder, further, do not hold the piston as it can be easily pulled out.

Outside surface of the piston is the surface on which seals are to slide. Care should be taken to keep the surface free of cuts and dents.

3. Remove vacuum hose.
4. Disconnect the yoke clevis from the brake pedal.
5. Remove vacuum booster fixing nut.
6. Remove vacuum booster.

Inspection and Repair

Vacuum Hose (The built in check valve)

1. Inspect the check valve (2), which is installed inside the vacuum hose.
2. Air should pass freely from the vacuum booster (3) to the engine (1).

3. Air should not pass from the engine (1) to the vacuum booster (3). If it does, the check valve is inoperative and the vacuum hose built in check valve must be replaced.

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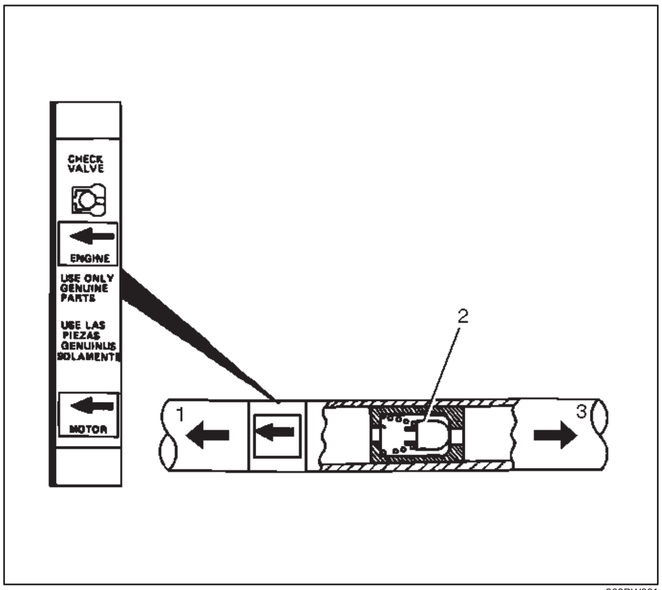
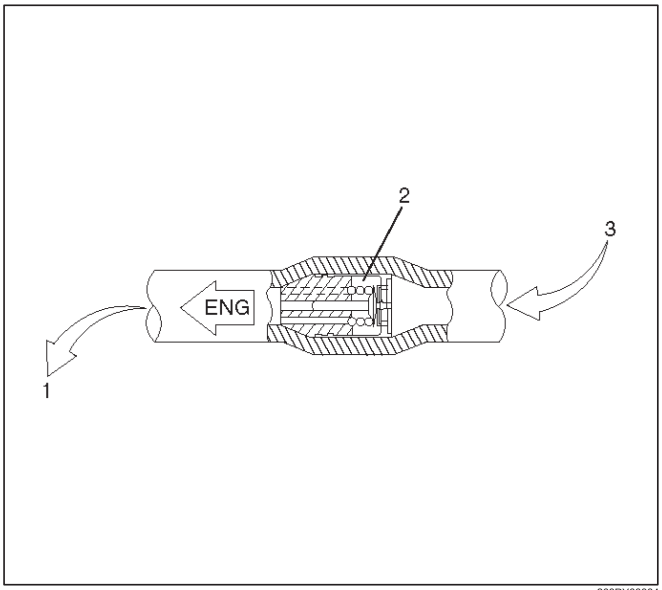


360RW001

6VD1 ENGINE



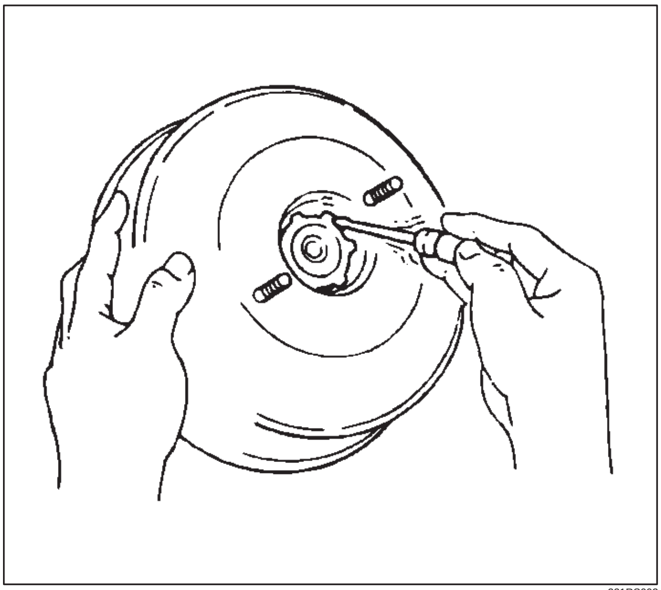
360RY00004

Installation

1. Perform vacuum booster and vacuum booster push rod adjustment.

NOTE: When replacing either the master cylinder or vacuum booster, be sure to measure push rod, and adjust if required.

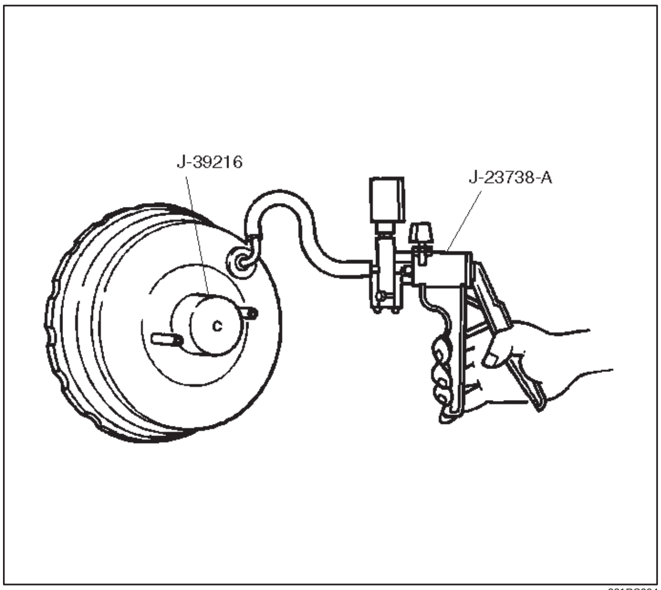
2. Remove retainer from vacuum booster front shell using a small screwdriver. Then gently draw plate and seal assembly out of the shell inside.



331RS003

3. Set push rod gauge J–39216 on vacuum booster, and apply negative pressure by means of vacuum pump J–23738–A so that the pressure in the vacuum booster becomes 500 mm Hg.

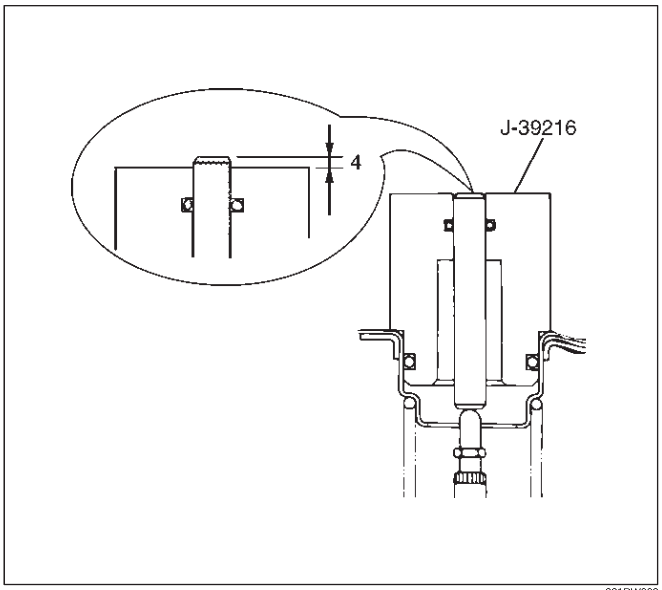
NOTE: Be sure to apply NEGATIVE pressure after installing a push rod gauge on the vacuum booster.



331RS004

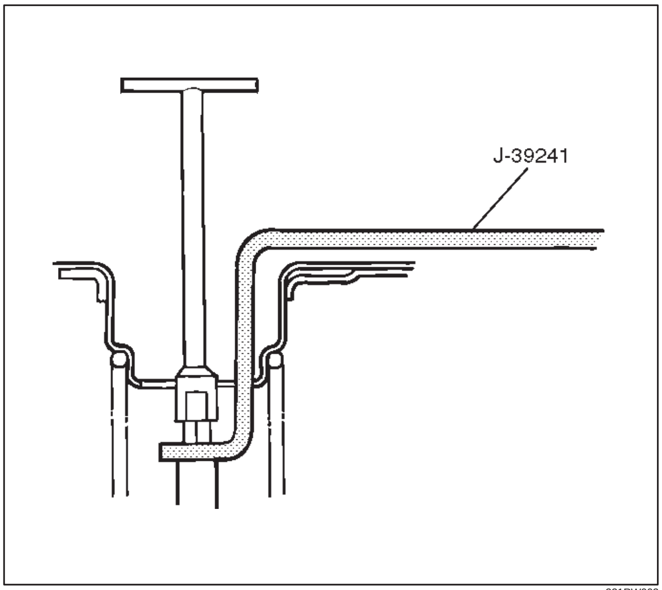
4. Measure dimension (4).

Dimension (4) (Standard): –0.1–0.1 mm (–0.0039–0.0039 in)



331RW002

5. If dimension (4) is out of the standard range, adjust push rod using the Push Rod Support J–39241.



331RW003

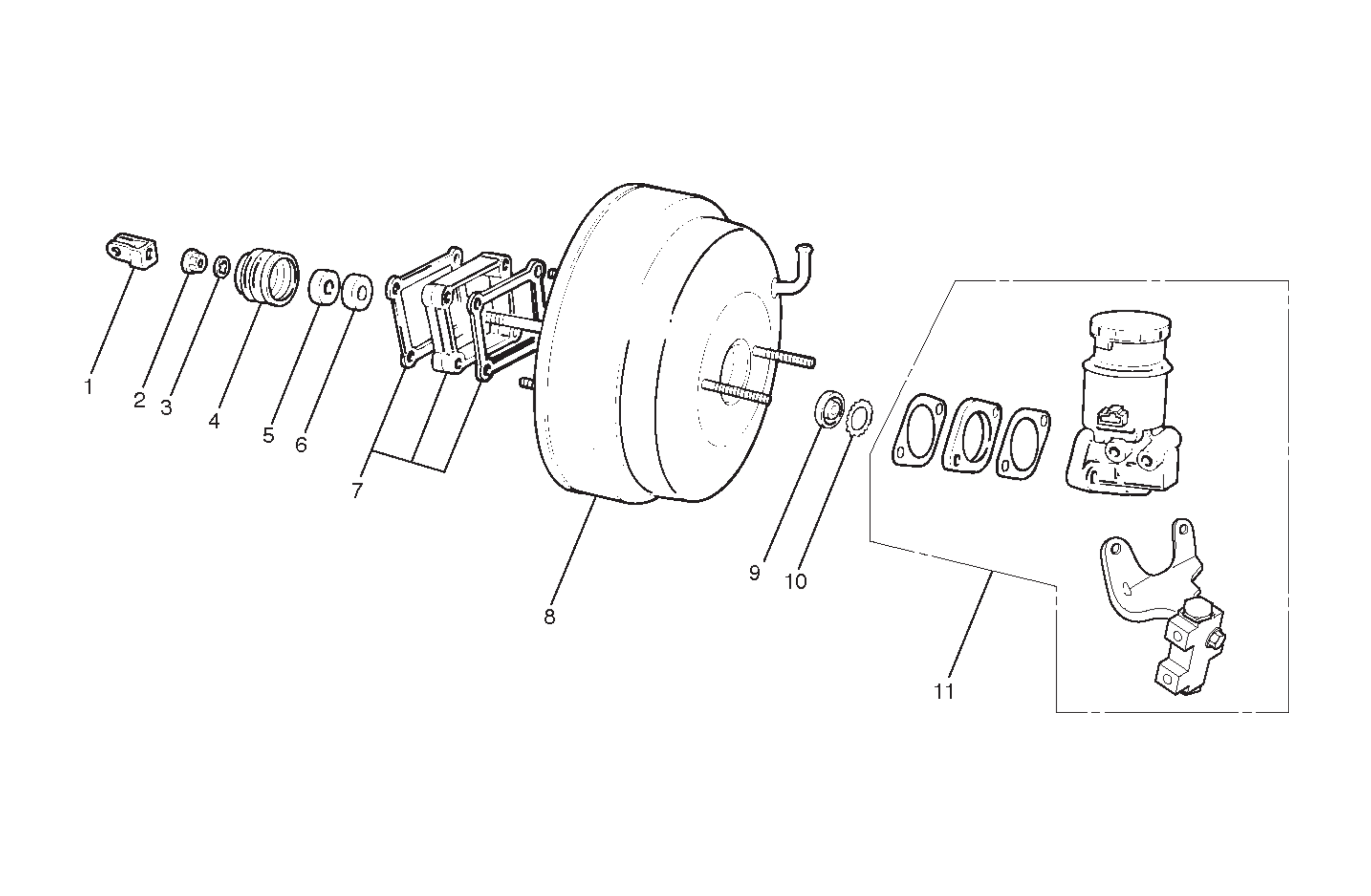
6. Mount plate and seal assembly in vacuum booster front shell. Then install the retainer.
7. Install vacuum booster fixing nut and tighten the specified torque.

Torque: 15 N·m (11 lb ft)

8. Install yoke clevis.
9. Connect vacuum hose and make sure that the arrow on the hose points in the direction of the engine.
10. Install master cylinder, refer to “Master Cylinder Installation” in this section.

Exterior Components

Exterior Components and Associated Parts



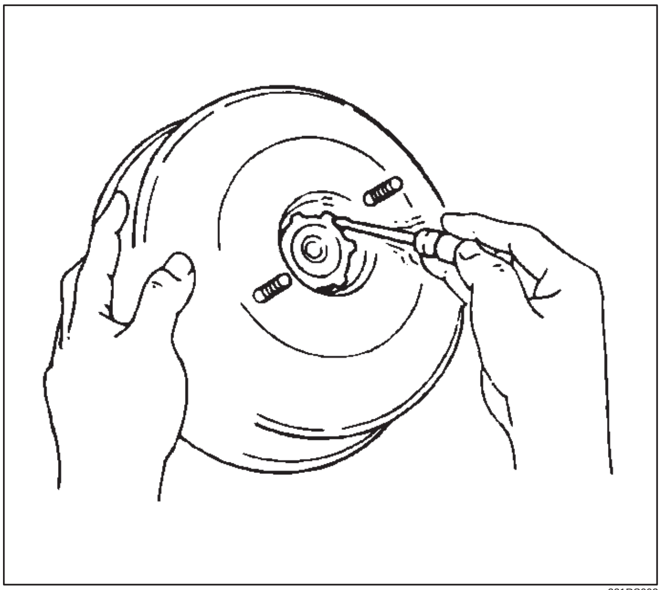
331RW006

Legend

(1) Yoke Clevis
(2) Lock Nut
(3) Retaining Clip
(4) Valve Body Guard
(5) Silencer
(6) Filter
(7) 2 Gaskets and Spacer
(8) Vacuum Booster
(9) Retainer
(10) Plate and Seal Assembly
(11) Master Cylinder

Removal

1. Remove master cylinder. Refer to "Master Cylinder" in this section.
2. Remove vacuum booster. Refer to "Vacuum Booster" in this section.
3. Remove yoke clevis.
4. Remove lock nut.
5. Remove retaining clip.
6. Remove valve body guard.
7. Remove silencer.
8. Remove filter.
9. Remove 2 gaskets and spacer.
10. Remove retainer, using a small screwdriver to pry out the retainer. Gently pull out the plate and seal assembly from the shell.



331RS003

Inspection and Repair

Visual Check

Make necessary parts replacement if cuts, nicks, excessive wear, or other abnormal conditions are found through inspection. Check the following parts:

- Yoke clevis
- Valve body guard
- Silencer
- Filter plate and seal assembly

Installation

1. Install plate and seal assembly.
2. Install retainer.
3. Install 2 gaskets and spacer.
4. Install filter.
5. Install silencer.
6. Install valve body guard.
7. Install retainer.
8. Install lock nut and yoke clevis and tighten to the specified torque.

   Torque: 20 N·m (15 lb ft)

9. Install vacuum booster, refer to “Vacuum Booster” in this section.
10. Install master cylinder, refer to “Master Cylinder” in this section and after installation, perform brake pedal check and adjustment. Refer to “Brake Pedal” in this section.

Vacuum Booster Overhaul

Vacuum Booster

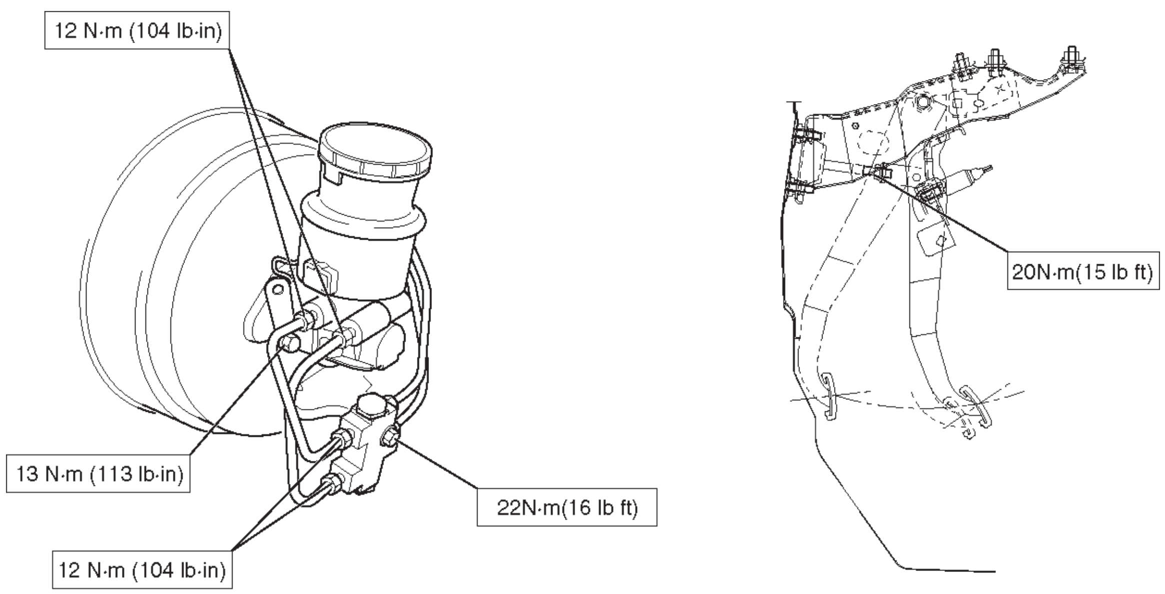
The vacuum booster cannot be disassembled for repair.
Replace a defective vacuum booster with a new one.

Main Data and Specifications

General Specifications

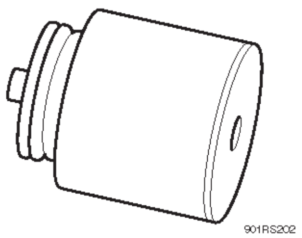
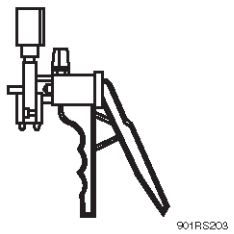
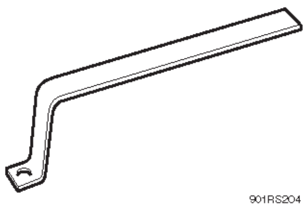
Vacuum booster diaphragm diameter (Front)	205 mm (8.07 in)
Vacuum booster diaphragm diameter (Rear)	230 mm (9.06 in)
Push rod stroke	More than 32.0 mm (1.26 in)
Plunger diameter	10.25 mm (0.40 in)
Push rod diameter	27.4 mm (1.08 in)

Torque Specifications



330RY00005

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J-39216** Push Rod Gauge
	**J-23738-A** Vacuum Pump
	**J-39241** Push Rod Support

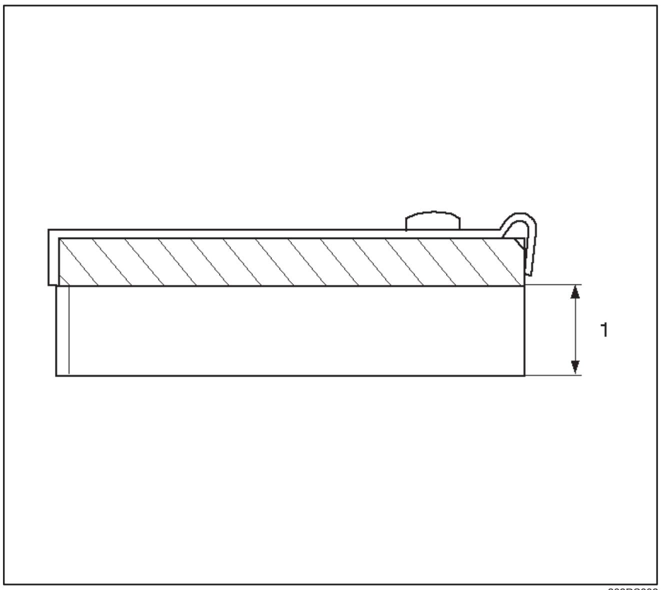
Front Disc Brake Pads

Front Disc Brake Pads Inspection

Check the outer pad by looking at each caliper from above. Check the thickness on the inner pad by looking down through the inspection hole in the top of the caliper. Whenever the pad is worn to about the thickness of the pad base, the pad should be removed for further measurements. The pad should be replaced anytime the pad thickness (1) is worn to within 1.00 mm (0.039 in) of the pad itself.

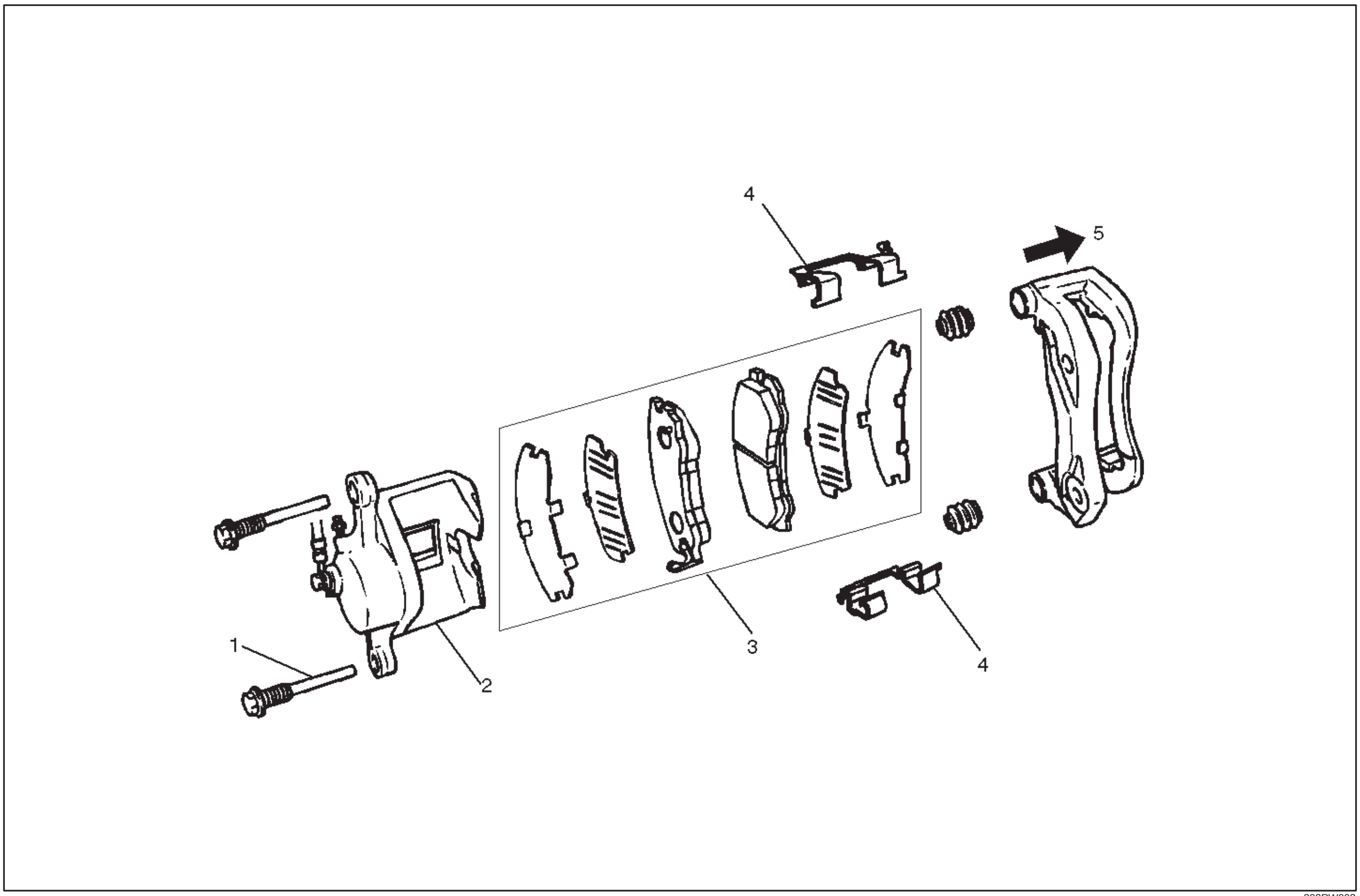
The disc pads have a wear indicator that makes a noise when the pad wears to where the replacement is required.

Minimum limit (1): 1.0 mm (0.039 in)



302RS002

Front Disc Brake Pads and Associated Parts



302RW003

Legend

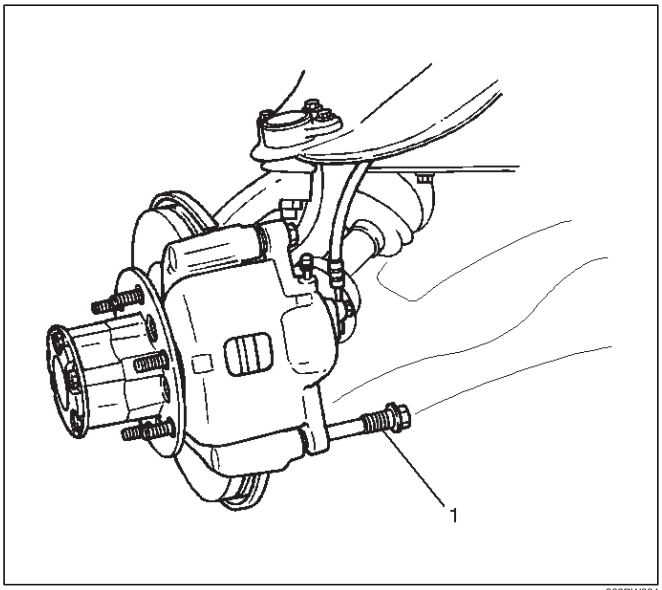
(1) Lock Bolt
(2) Caliper Assembly
(3) Pad Assembly
(4) Clip
(5) Outer Side

Removal

NOTE: If a squealing noise occurs from the front brake while driving, check the pad wear indicator plate. If the indicator plate contacts the rotor, the disc pad assembly should be replaced.

- Draw out two–thirds of the brake fluid from the reservoir.
- Raise the vehicle and support it with suitable safety stands.

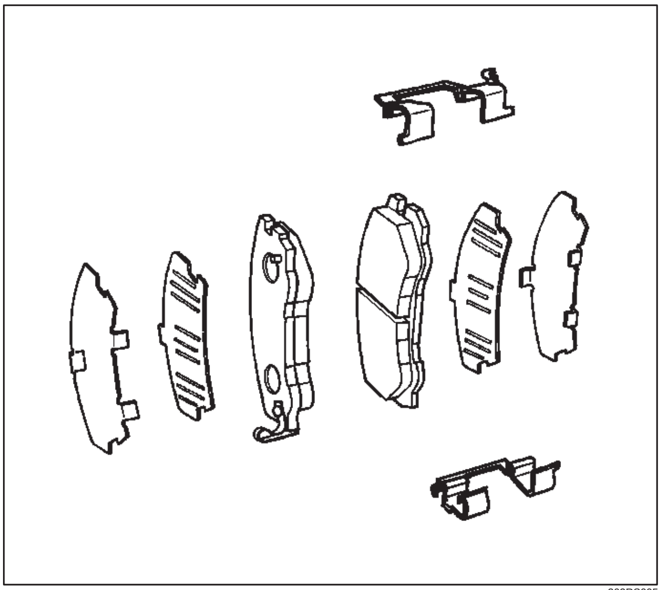
1. Remove wheel and tire assembly, refer to “Wheels and Tires System” in Section 3E.
2. Remove lock bolt (1).



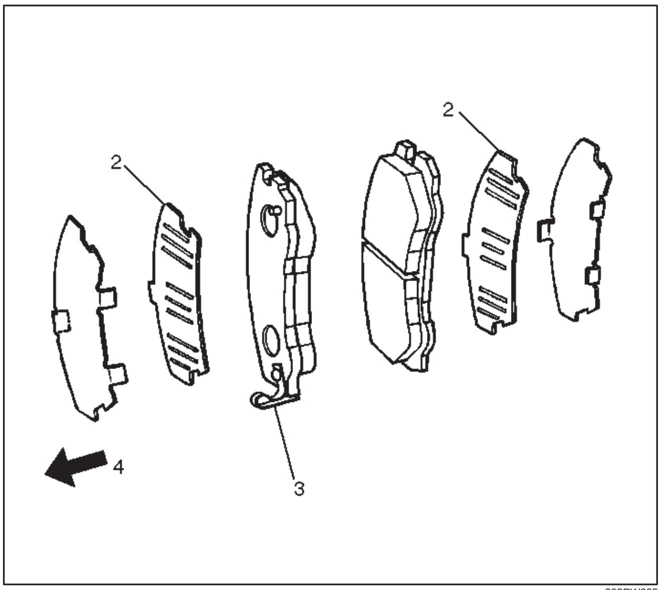
3. Rotate caliper assembly and support the caliper assembly so that the brake hose is not stretched or damaged.
4. Remove pad assembly with shim.
5. Remove Clip.

Installation

1. Install clip.

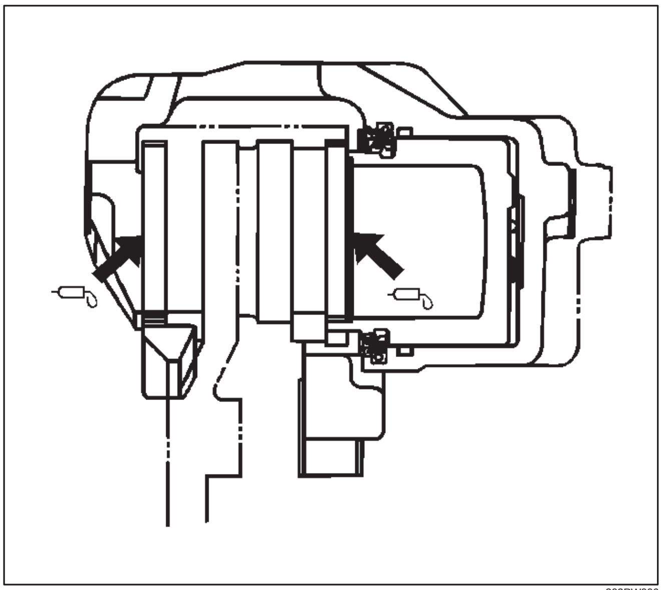


2. Apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims (2). Wipe off extruded grease after installing. Install pad assembly with shim.



Legend

(2) Inner Shim
(3) Wear Indicator
(4) Inner Side

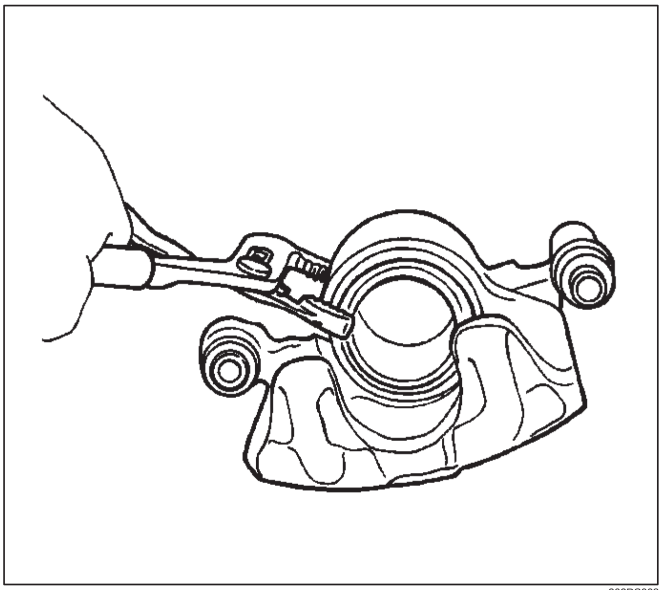


302RW006

3. Use adjustable pliers to bottom the piston into the caliper bore. Be careful do not damage the piston boot and do not damage the flexible hose by twisting or pulling it.

   Install caliper assembly.

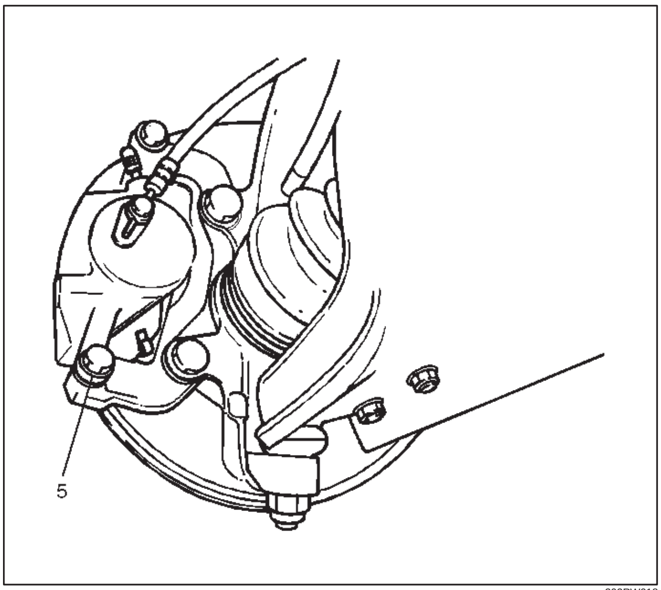
   Set caliper assembly in place.



302RS008

4. Install lock bolt (5) and tighten the bolt to the specified torque.

Torque: 74 N·m (54 lb ft)



302RW018

5. Install wheel and tire assembly, refer to "Wheels and Tires System" in Section 3E.
6. Pump the brake pedal several times to make sure that the pedal is firm. Check the brake fluid level in the reservoir after pumping the brakes.

Front Disc Brake Rotor

Inspection

In the manufacturing of the brake rotor, all the tolerances regarding surface finish, parallelism and lateral runout are held very closely. Maintaining these tolerances provides the surface necessary to assure smooth brake operation.

Lateral Runout

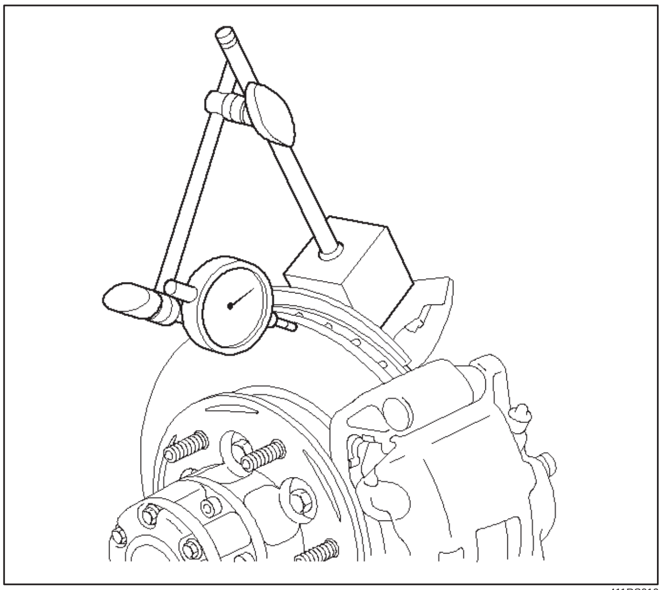
Lateral runout is the movement of the rotor from side to side as it rotates on the spindle. This could also be referred to as “rotor wobble”.

This movement causes the piston to be knocked back into its bore. This results in additional pedal travel and a vibration during braking.

Checking Lateral Runout

1. Adjust the wheel bearing correctly, refer to “Differential” in Section 4A.
2. Attach a dial indicator to some portion of the suspension so that the stem contacts the rotor face about 29 mm (1.14 in) from the rotor edge.
3. Move the rotor one complete rotation and the lateral runout should not exceed 0.13 mm (0.005 in).

Maximum runout: 0.13 mm (0.005 in)



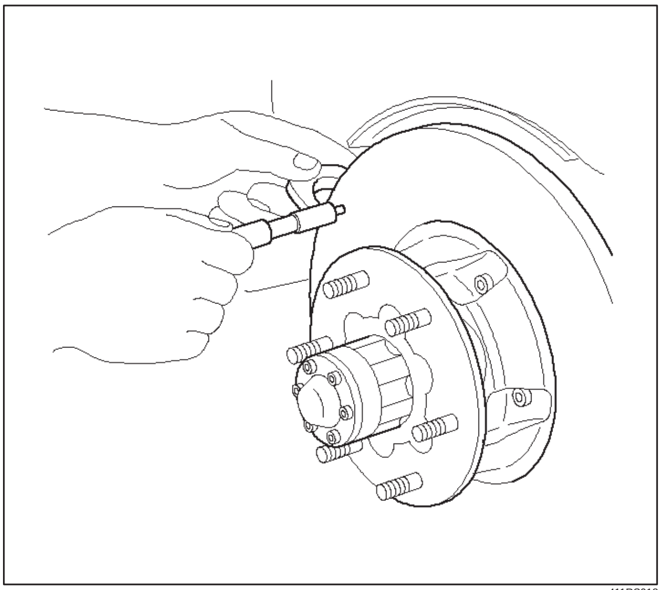
411RS019

Parallelism

Parallelism is the measurement of thickness of the rotor at four or more points around the circumference of the rotor. All measurement must be made at 29 mm (1.14 in) from the edge of the rotor.

The rotor thickness must not vary more than 0.010 mm (0.0004 in) from point to point.

Maximum runout: 0.010 mm (0.0004 in)



411RS018

Replacing Brake Rotors

When installing new brake rotors, do not refinish the surfaces. These parts are at the correct level of surface finish.

Refinishing Brake Rotors

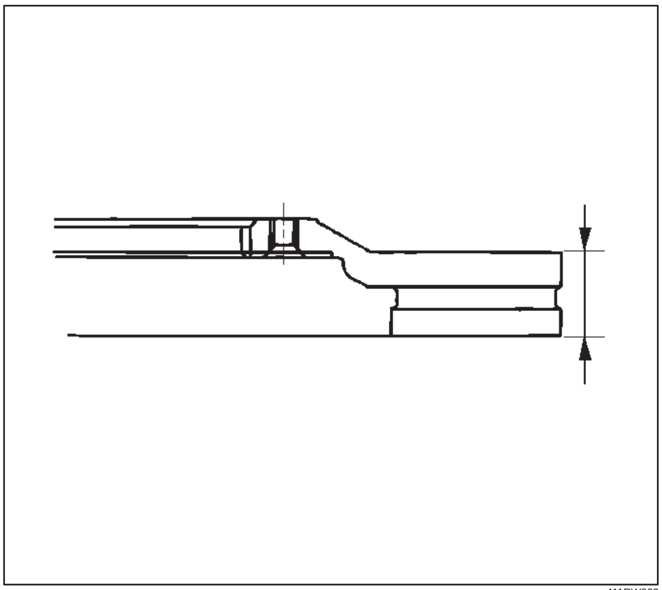
Accurate control of the rotor tolerances is necessary for proper performance of the disc brakes. Machining of the rotor should be done only with precision equipment. All brake rotors have a minimum thickness dimension cast into them. This dimension is the minimum wear dimension and not a refinish dimension. The minimum wear dimension is 24.60 mm (0.969 in). The minimum refinish dimension is 24.97 mm (0.983 in).

When refinishing rotors, always use sharp cutting tools or bits. Dull or worn tools leave a poor surface finish which will affect initial braking performance. Vibration dampening attachments should always be used when refinishing braking surfaces. These attachments eliminate tool chatter and will result in better surface finish.

After refinishing, replace any rotor that does not meet the minimum thickness of 24.97 mm (0.983 in). Do not use a brake rotor that will not meet the specification.

Minimum wear dimension: 24.60 mm (0.969 in)

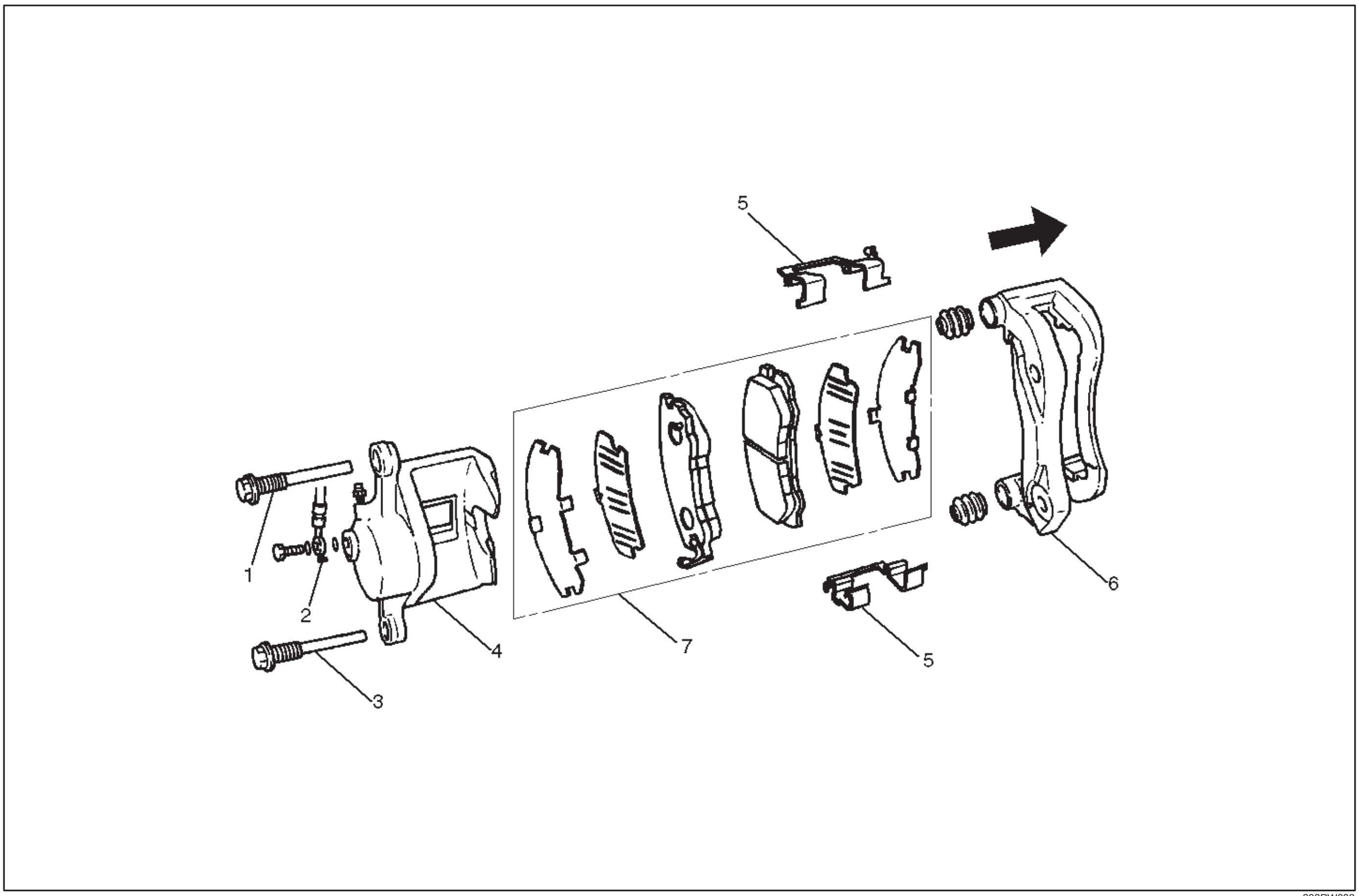
Refinish dimension: 24.97 mm (0.983 in)



411RW003

Front Disc Brake Caliper Assembly

Front Disc Brake Caliper Assembly and Associated Parts



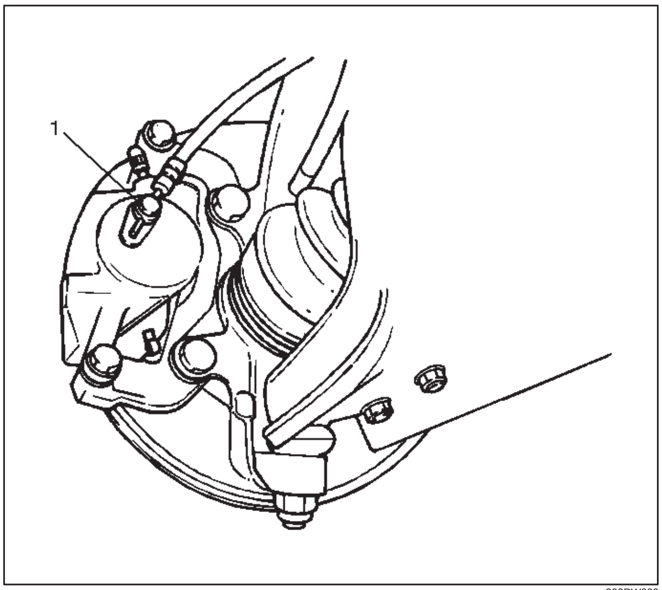
302RW008

Legend

(1) Guide Bolt
(2) Brake Flexible Hose
(3) Lock Bolt
(4) Caliper Assembly
(5) Clip
(6) Support Bracket with Pad Assembly
(7) Pad Assembly

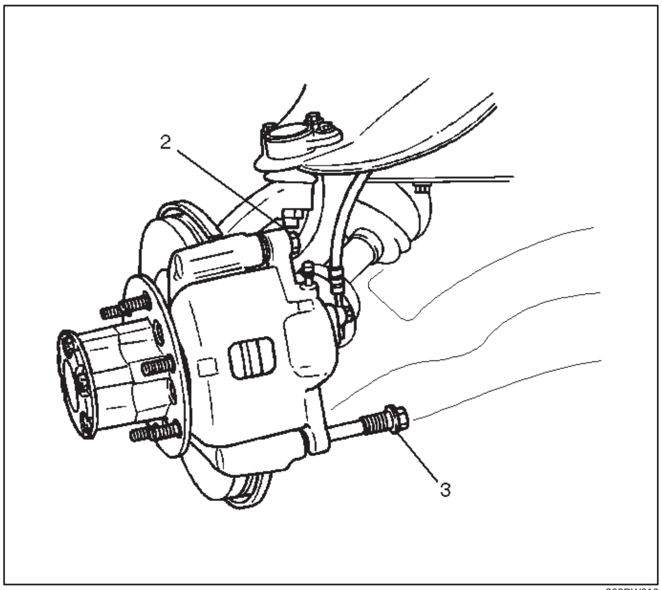
Removal

1. Raise the vehicle and support with suitable safety stands.
2. Concernig wheel and tire assembly, refer to “Wheels and Tires System” in Section 3E.
3. Remove the bolt and gaskets, then disconnect the flexible hose from the caliper and after disconnecting the flexible hose (1), cap or tape the openings to prevent entry of foreign material.



302RW009

4. Since the brake fluid flows out from the connecting coupler, place a drain pan under the vehicle.
5. Remove guide bolt (2).
6. Remove lock bolt (3).

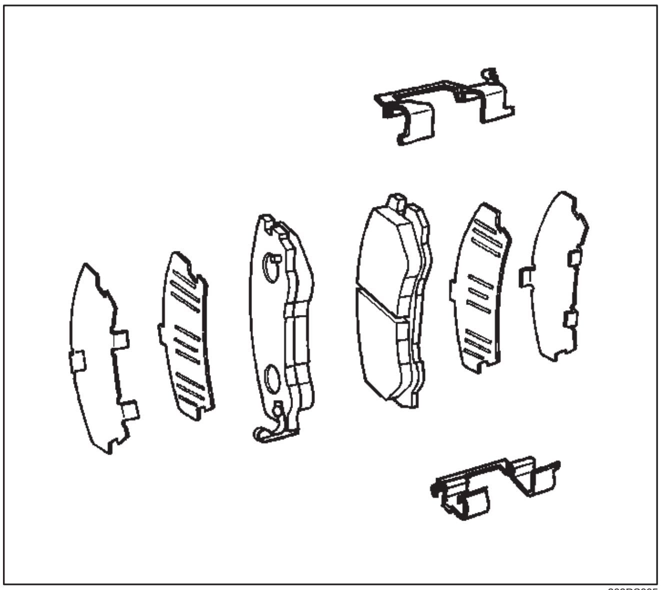


302RW010

7. Remove caliper assembly.
8. Remove support bracket with pad assembly and take care not to damage the flexible brake hose when removing the support bracket.
9. Remove pad assembly with shim and mark the lining locations if they are to be reinstalled.
10. Remove clip.

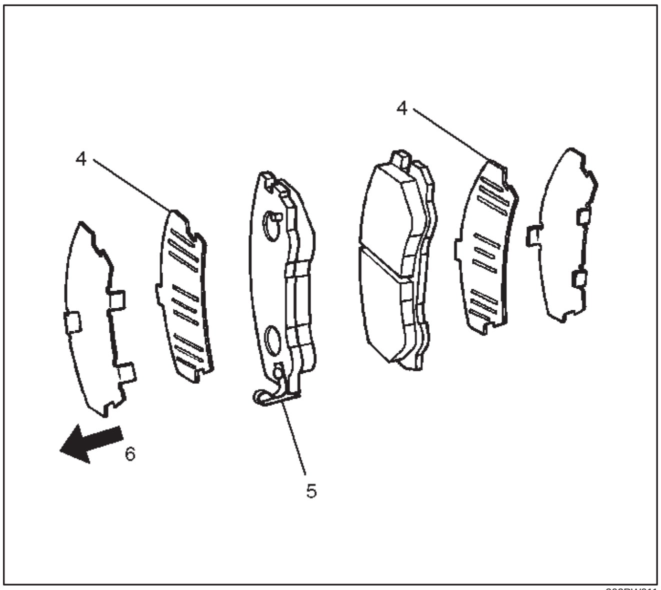
Installation

1. Install clip.



302RS005

2. Apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims (4). Wipe off extruded grease after installing. Install pad assembly with shim.



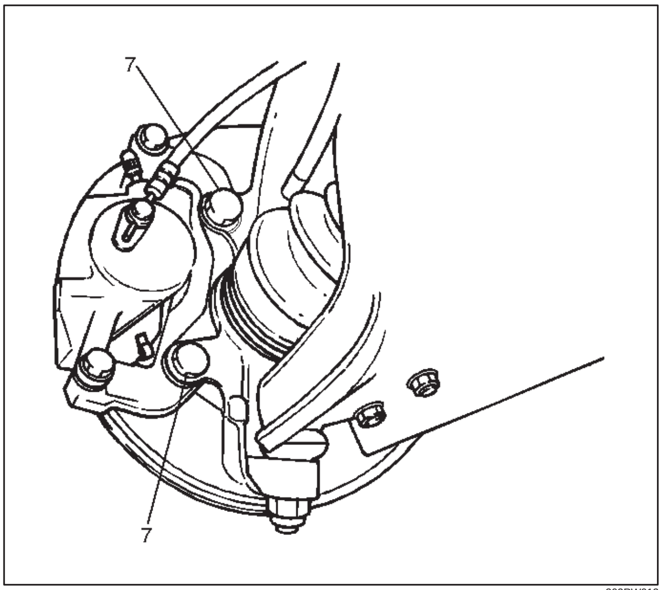
302RW011

Legend

(4) Inner Shim
(5) Wear Indicator
(6) Inner Side

3. Install support bracket and tighten the bolt (7) to the specified torque.

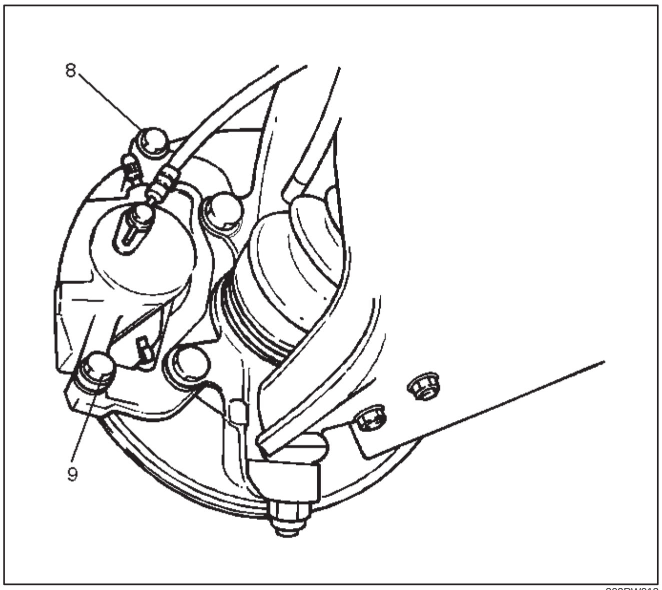
Torque: 155 N·m (115 lb ft)



302RW012

4. Install caliper assembly.
5. Install lock bolt (9) and guide bolt (8) and tighten the bolt to the specified torque.

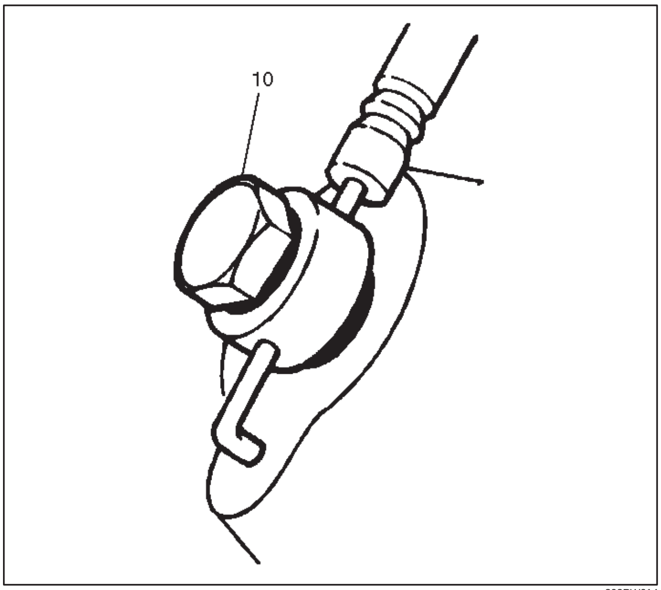
Torque: 74 N·m (54 lb ft)



302RW013

6. Install brake flexible hose, always use new gaskets and be sure to put the hooked edge of the flexible hose end into the anti–rotation cavity then tighten the I–bolt (10) to the specified torque.

Torque: 35 N·m (26 lb ft)

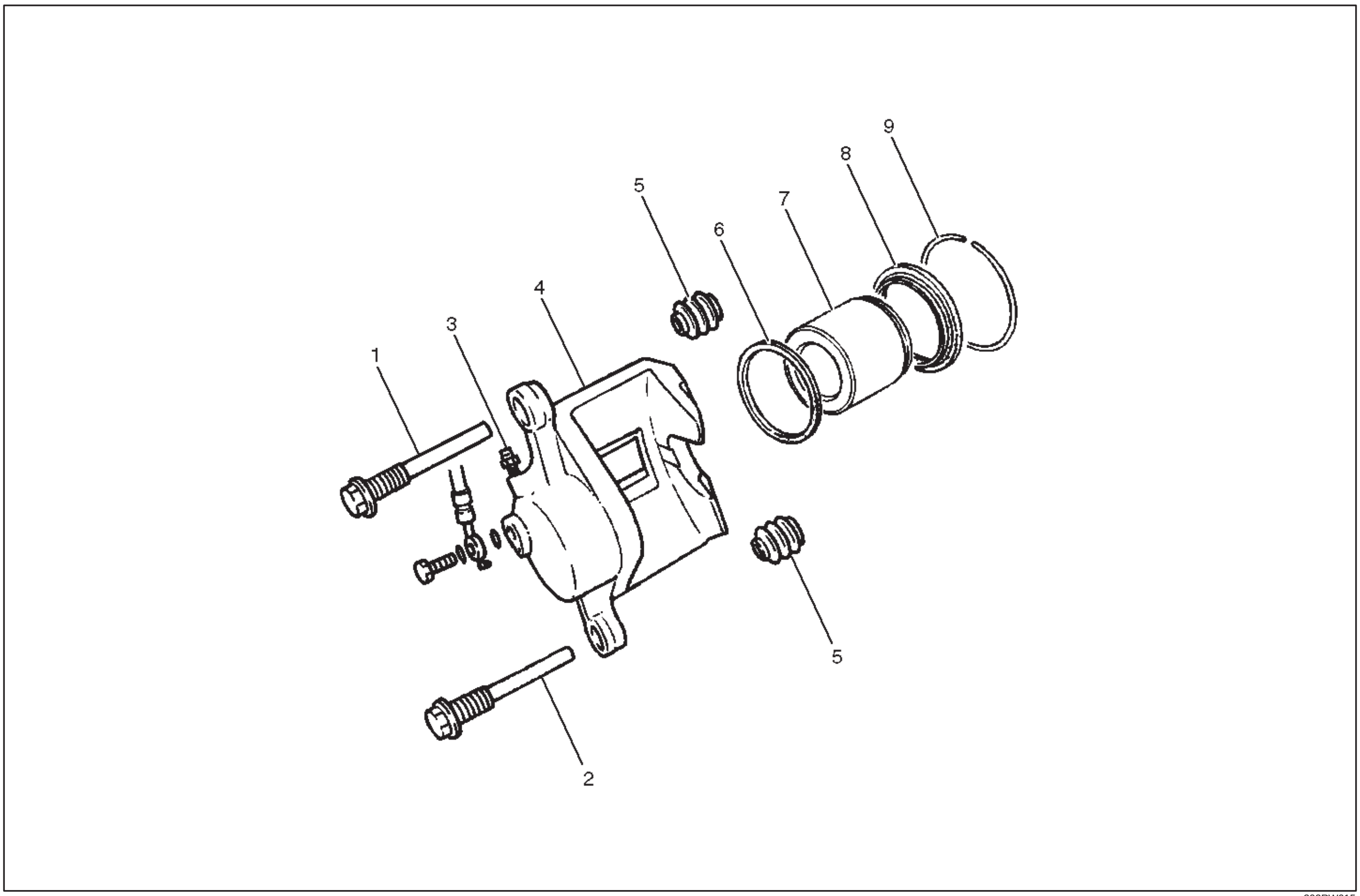


302RW014

7. Install wheel and tire assembly, referring to “Wheels and Tires System” in Section 3E.
8. Bleed brakes. Refer to “Hydraulic Brakes” in this section.

Front Disc Brake Caliper

Front Disc Brake Caliper Disassembled View



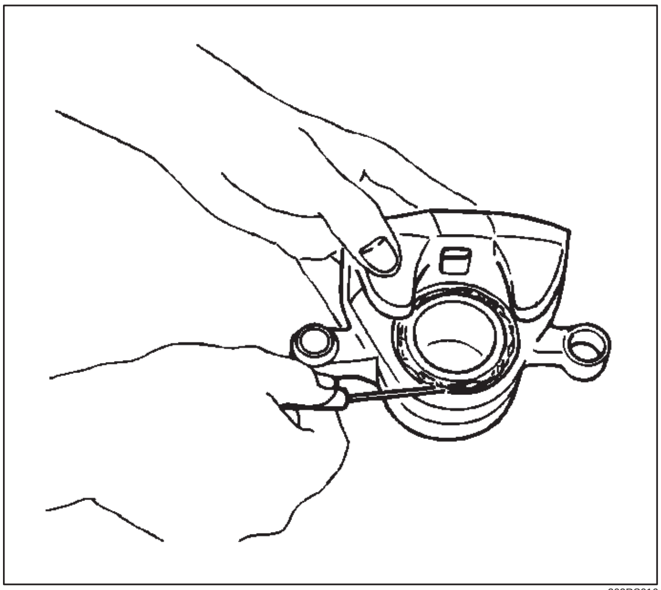
302RW015

Legend

(1) Guide Bolt
(2) Lock Bolt
(3) Bleeder with Cap
(4) Caliper Body
(5) Dust Boot: Guide Bolt and Lock Bolt
(6) Piston Seal
(7) Piston
(8) Dust Boot: Piston
(9) Dust Boot Ring

Disassembly

1. Remove guide bolt.
2. Remove lock bolt.
3. Remove dust boot: guide bolt and lock bolt.
4. Remove dust boot ring, using a small screwdriver.

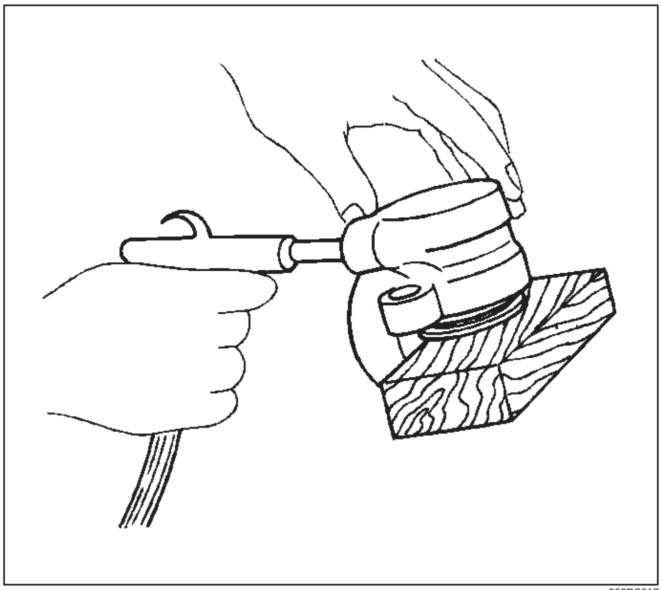


302RS016

5. Insert a block of wood into the caliper and force out the piston by blowing compressed air into the caliper at the flexible hose attachment. This procedure must be done prior to removal of the dust boot.
   Remove piston.

WARNING: DO NOT PLACE YOUR FINGERS IN FRONT OF THE PISTON IN AN ATTEMPT TO CATCH OR PROTECT IT WHEN APPLYING COMPRESSED AIR. THIS COULD RESULT IN PERSONAL INJURY.

CAUTION: Use just enough air to ease the piston out of the bore. If the piston is blown out, it may be damaged.



302RS017

6. Remove dust boot: piston.
7. Remove piston seal.
8. Remove bleeder with cap.
9. Remove caliper body.

Inspection and Repair

Make necessary parts replacement, if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

- Rotor
- Cylinder body
- Cylinder bore
- Piston
- Guide bolt, lock bolt
- Support bracket

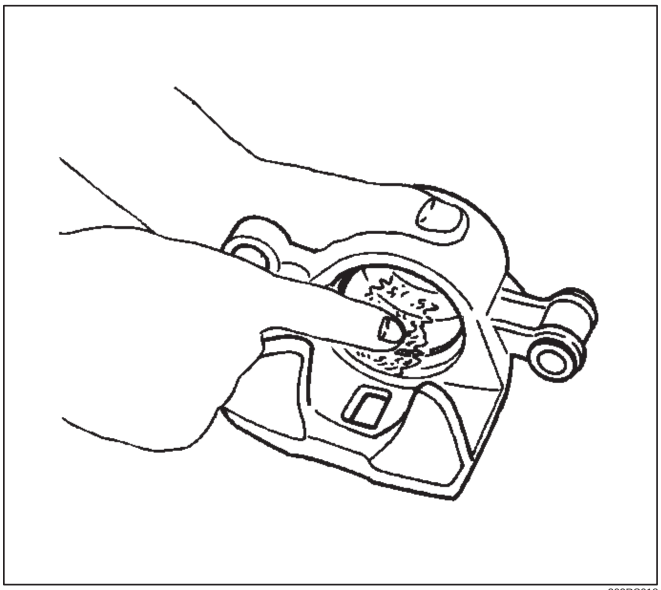
NOTE: The piston seal, boot ring and dust boot are to be replaced each time the caliper is overhauled. Discard these used rubber parts and replace them with new ones.

Reassembly

1. Install caliper body.
2. Install bleeder with cap and tighten the cap to the specified torque.

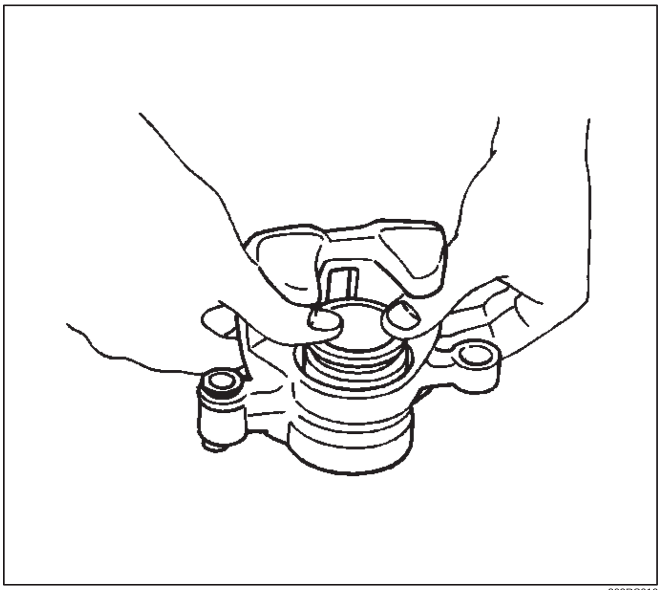
Torque: 8 N·m (69 lb in)

3. Apply special rubber grease to the piston seal and cylinder wall, then insert the piston seal into the cylinder. The special rubber grease is included in the repair kit.



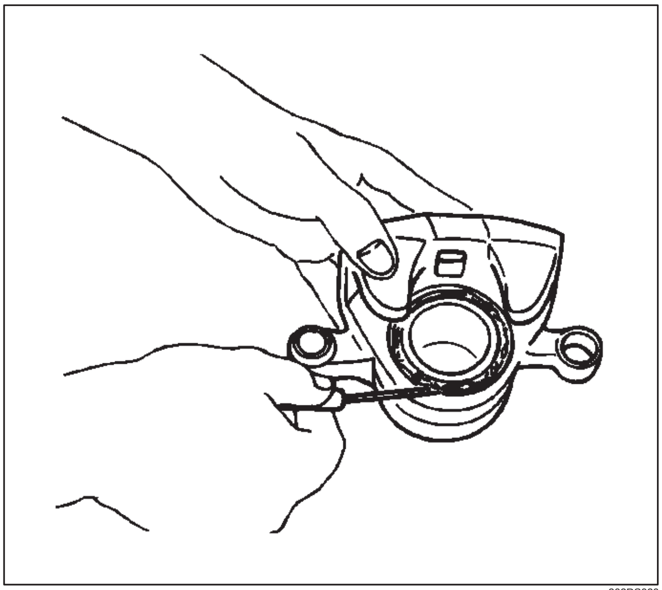
302RS018

4. When inserting the piston into the cylinder, use finger pressure only and do not use a mallet or other impact tool, since damage to the cylinder wall or piston seal can result.
   Install piston.



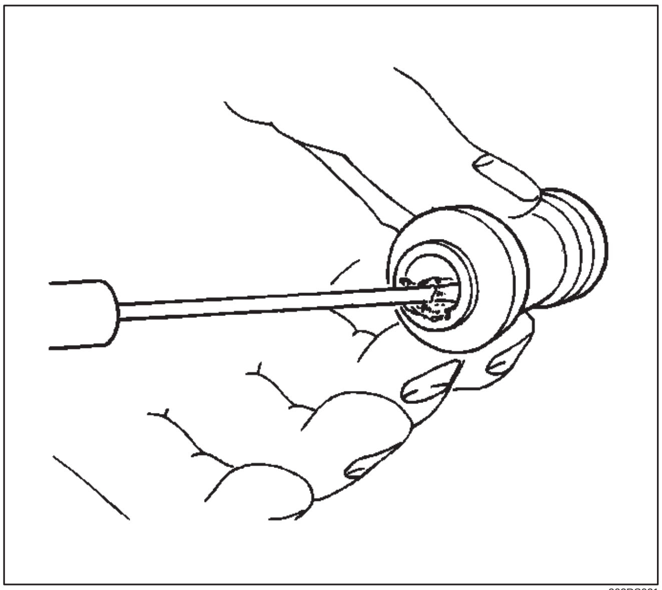
302RS019

5. Apply special grease (approximately 1 g) to the piston and attach the dust boot to the piston and caliper. Insert the dust boot ring into the dust boot.



302RS020

6. Install guide bolt and lock bolt dust boot.
7. Install the dust boot on the support bracket after applying special grease (approximately 1 g) onto the dust boot inner surface. Apply special grease onto the lock bolt and guide bolt setting hole of the support bracket.



302RS021

8. Install lock bolt and guide bolt and tighten the bolt to the specified torque.

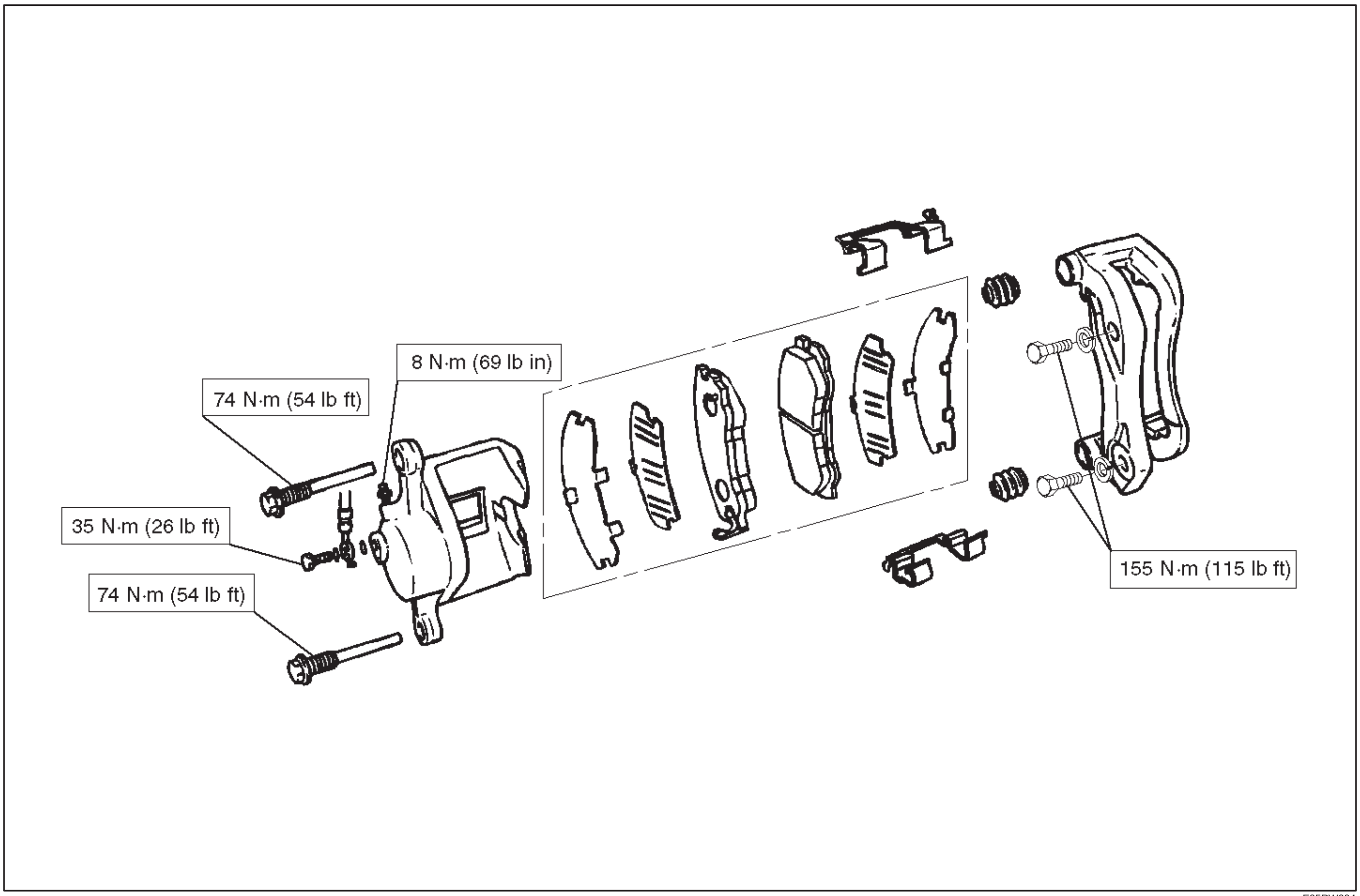
Torque: 74 N·m (54 lb ft)

Main Data and Specifications

General Specifications

Type	Floating, pin slide
Pad dimension	55 cm^2 (8.52 in^2)
Adjusting method	Self–adjusting
Piston diameter	60.33 mm (2.38 in)
Disc type	Ventilated
Disc thickness	26 mm (1.02 in)
Disc effective diameter	222 mm (8.74 in)

Torque Specifications



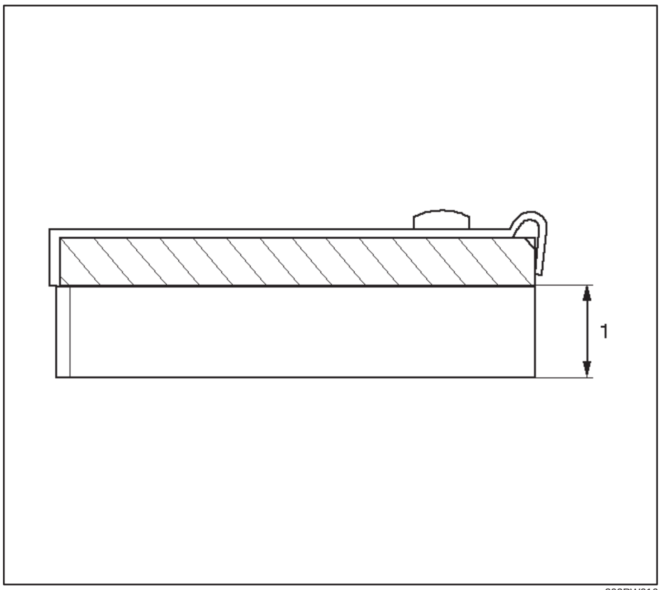
E05RW004

Rear Disc Brake Pads (4×4 Model)

Brake Pads Inspection

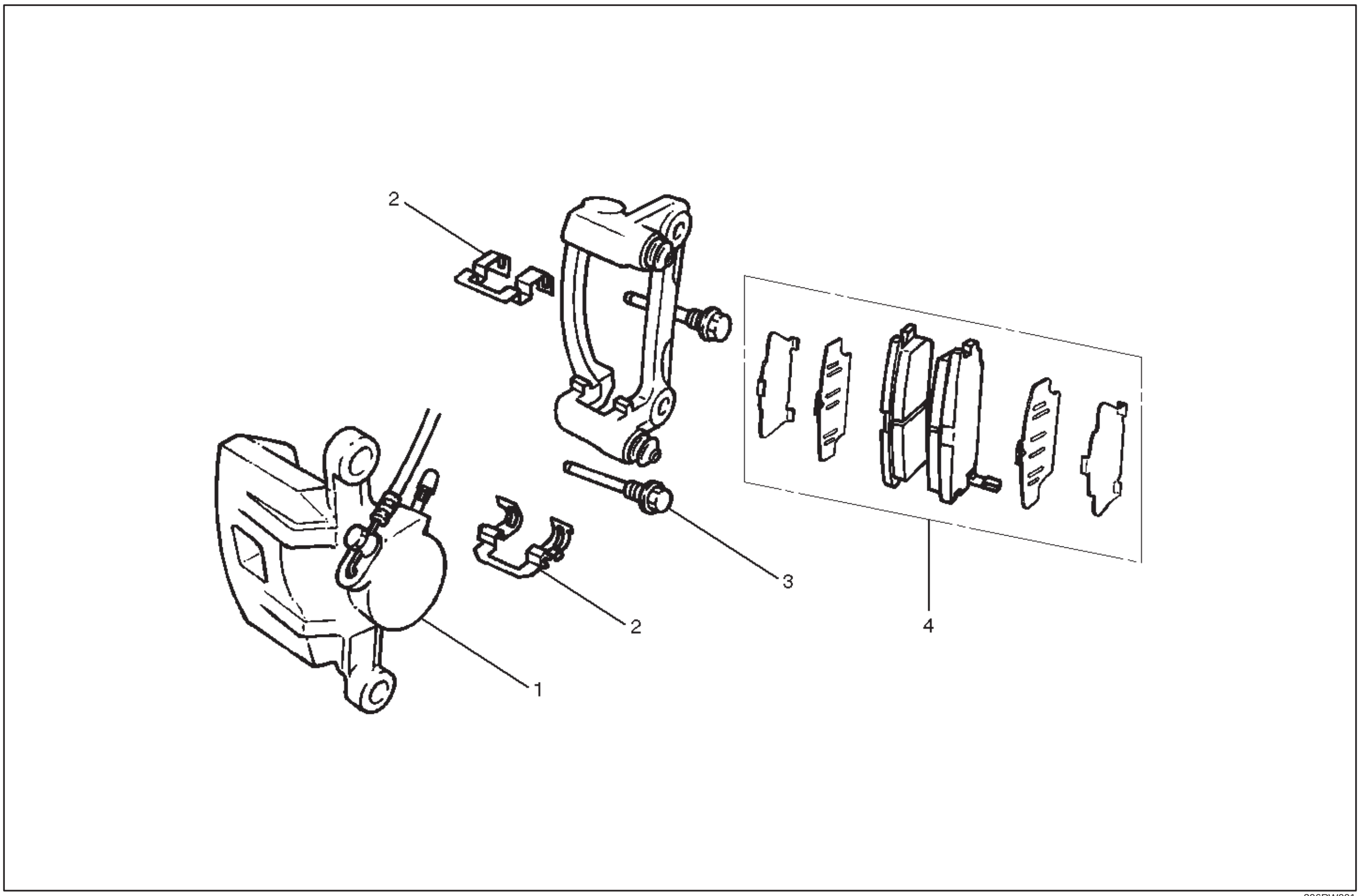
Check the outer pads by looking at each caliper from above. Check the thickness on the inner pad by looking down through the inspection hole in the top of the caliper. Whenever the pad is worn to about the thickness of the pad base, the pad should be removed for further measurements. The pad should be replaced anytime the pad thickness (1) is worn to within 1.0 mm (0.039 in) of the pad itself.
The disc pads have a wear indicator that makes a noise when the pad wears to where replacement is required.

Minimum limit (1): 1.0 mm (0.039 in)



302RW016

Brake Pads and Associated Parts



306RW001

Legend

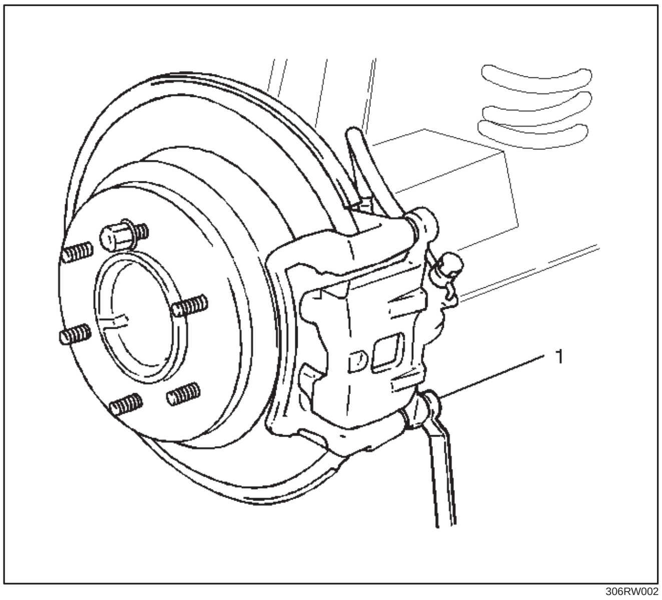
(1) Caliper Assembly
(2) Clip
(3) Lock Bolt
(4) Pad Assembly

Removal

NOTE: If a squealing noise occurs from the rear brake while driving, check the pad wear indicator plate. If the indicator plate contacts the rotor, the disc pad assembly should be replaced.

- Draw out two–thirds of the brake fluid from the reservoir.
- Raise the vehicle and support it with suitable safety stands.

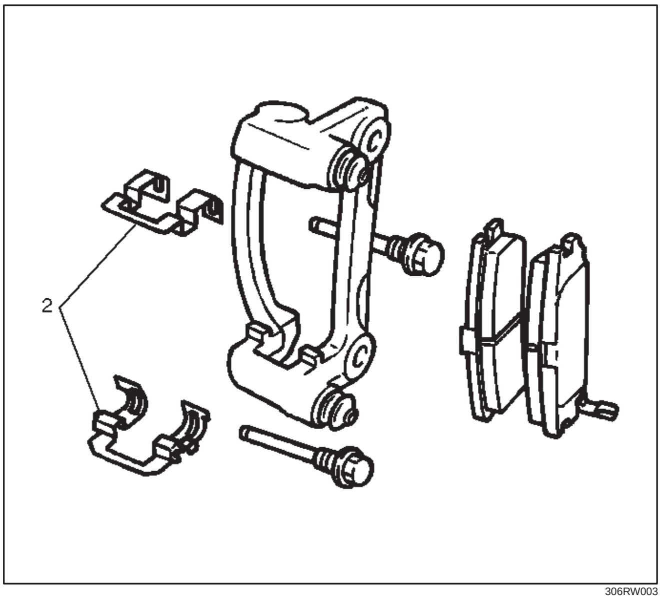
1. Remove wheel and tire assembly, referring to “Wheels and Tires System” in Section 3E.
2. Remove lock bolt (1)



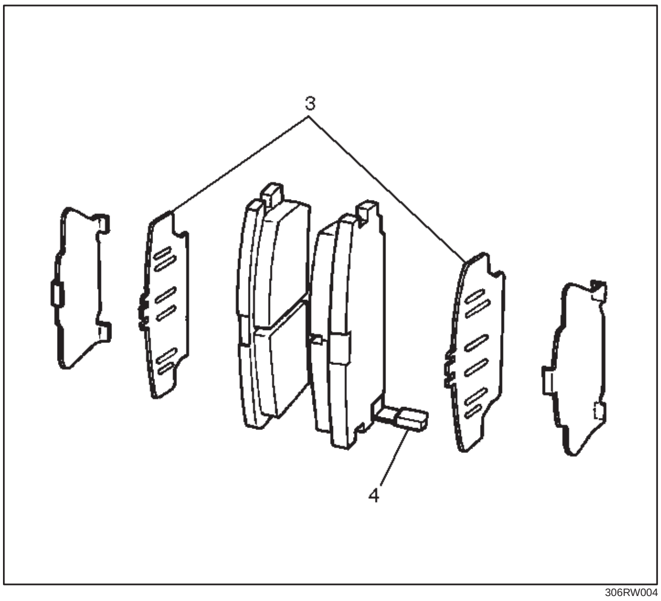
3. Rotate caliper assembly and support the caliper assembly so that the brake hose is not stretched or damaged.
4. Remove pad assembly with shim.
5. Remove clip.

Installation

1. Install clip (2).

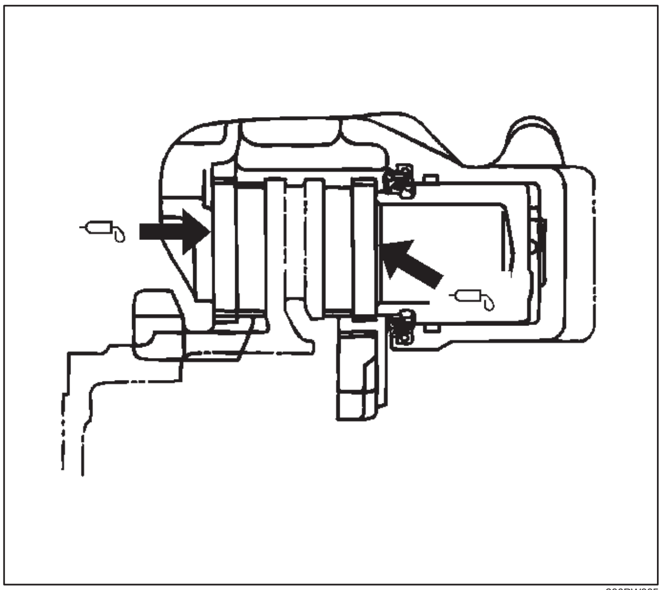


2. Apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims. Wipe off extruded grease after installing. Install pad assembly with shim.



Legend

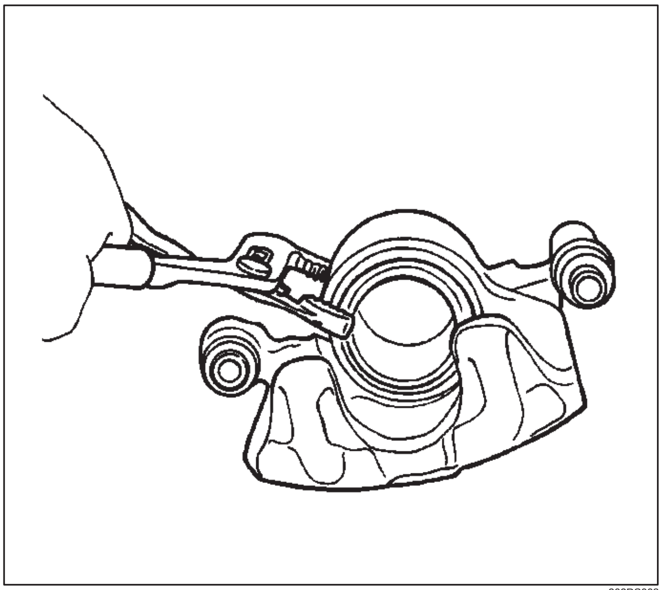
(3) Inner Shim
(4) Wear Indicator



306RW005

3. Use adjustable pliers to bottom the piston into the caliper bore. Be careful not to damage the piston dust boot and do not damage the flexible hose by twisting or pulling it. Install caliper assembly.

   Set caliper assembly in place.

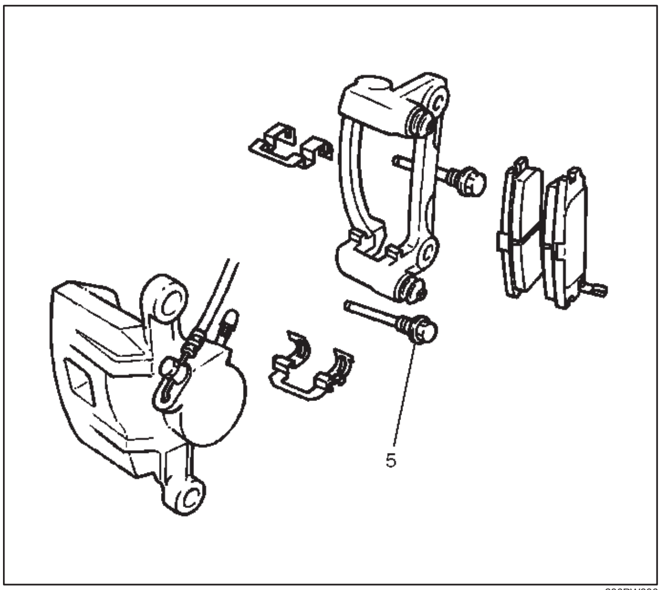


302RS008

4. Install lock bolt (5) and tighten the bolt to the specified torque.

Torque: 44 N·m (32 lb ft)

5. Install wheel and tire assembly, referring to “Wheels and Tires System” in Section 3E.
6. Pump the brake pedal several times to make sure that the pedal is firm. Check the brake fluid level in the reservoir after pumping the brakes.



306RW006

Rear Disc Brake Rotor (4×4 Model)

Inspection

In the manufacturing of the brake rotor, all the tolerances regarding surface finish, parallelism and lateral runout are held very closely. Maintaining these tolerances provides the surface necessary to assure smooth brake operation.

Lateral Runout

Lateral runout is the movement of the rotor from side to side as it rotates on the spindle. This could also be referred to as “rotor wobble”.

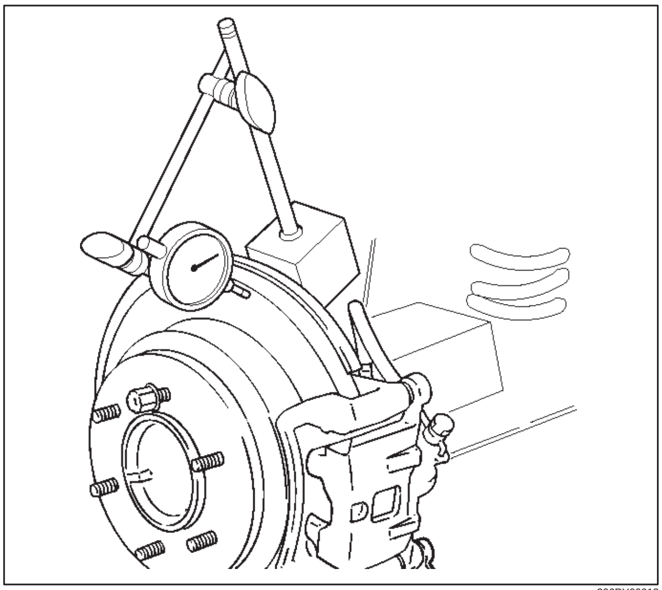
This movement causes the piston to be knocked back into its bore. This results in additional pedal travel and a vibration during braking.

Checking Lateral Runout

1. Adjust the wheel bearing correctly, referring to “Differential” in Section 4A.
2. Attach a dial indicator to some portion of the suspension so that the stem contacts the rotor face about 29 mm (1.14 in) from the rotor edge.
3. Move the rotor one complete rotation.

1. The lateral runout should not exceed 0.13 mm (0.005 in)

Maximum runout: 0.13 mm (0.005 in)



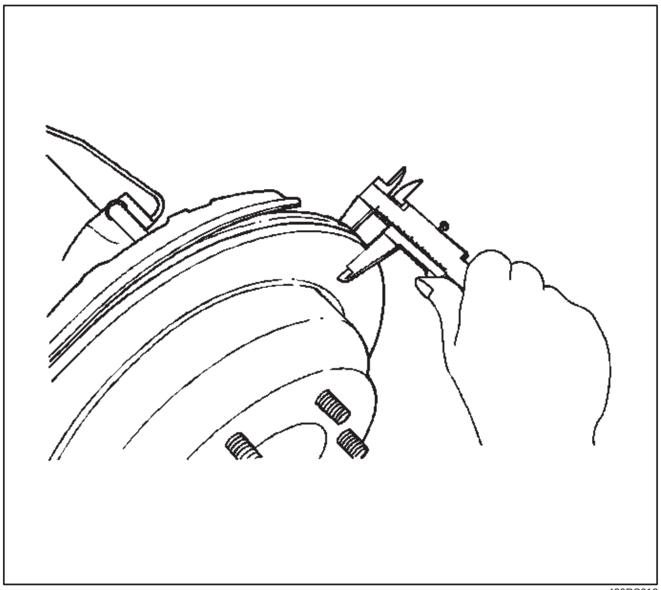
306RY00013

Parallelism

Parallelism is the measurement of thickness of the rotor at four or more points around the circumference of the rotor. All measurement must be made at 22 mm (0.87 in) from the edge of the rotor.

The rotor thickness must not vary more than 0.010 mm (0.0004 in) from point to point.

Maximum parallelism: 0.010 mm (0.0004 in)



420RS013

Replacing Brake Rotors

When installing new brake rotors, do not refinish the surfaces. These parts are at the correct level of surface finish.

Refinishing Brake Rotors

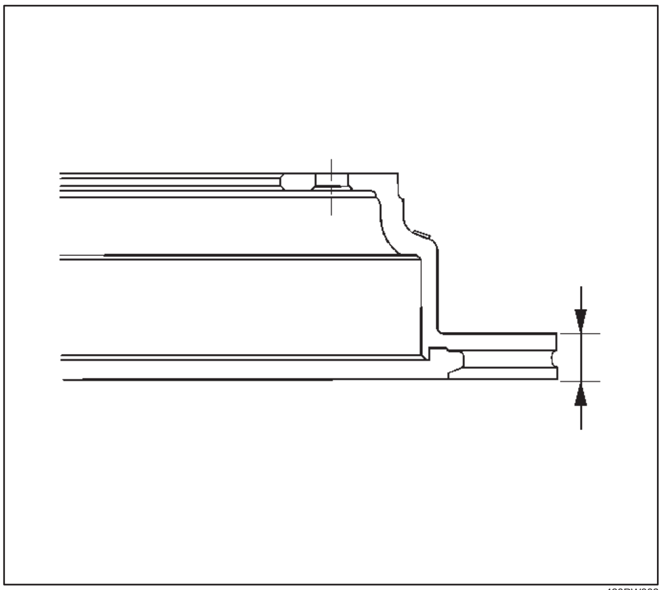
Accurate control of the rotor tolerances is necessary for proper performance of the disc brakes. Machining of the rotor should be done only with precision equipment. All brake rotors have a minimum thickness dimension cast into them. This dimension is the minimum wear dimension and not a refinish dimension. The minimum wear dimension is 16.6 mm (0.654 in). The minimum refinish dimension is 16.97 mm (0.668 in).

When refinishing rotors, always use sharp cutting tools or bits. Dull or worn tools leave a poor surface finish which will affect initial braking performance. Vibration dampening attachments should always be used when refinishing braking surfaces. These attachments eliminate tool chatter and will result in better surface finish.

After refinishing, replace any rotor that does not meet the minimum thickness of 16.97 mm (0.668 in). Do not use a brake rotor that will not meet the specification.

Minimum wear dimension: 16.6 mm (0.654 in)

Refinish dimension: 16.97 mm (0.668 in)



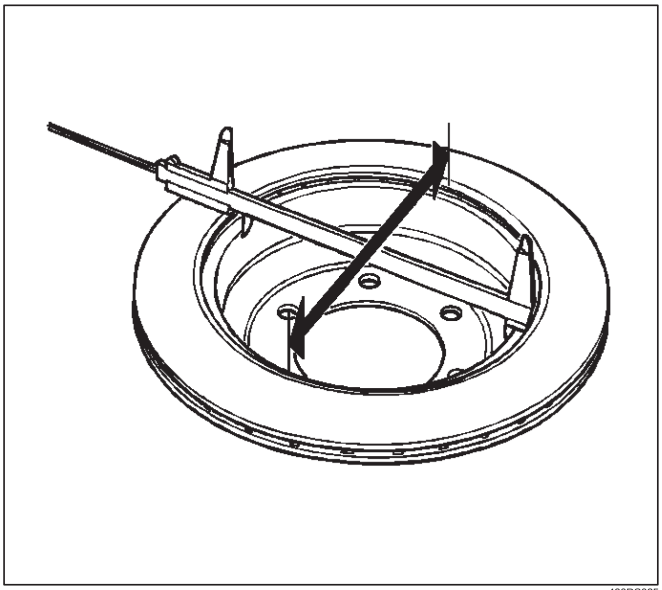
420RW002

Rear Drum (In Disc) Inside Diameter Check

Check the rear drum inside diameter by measuring at more than two portions as shown in the illustration.
If the inside diameter is greater than the limit, replace the rear rotor.

Standard: 210.0 mm (8.27 in)

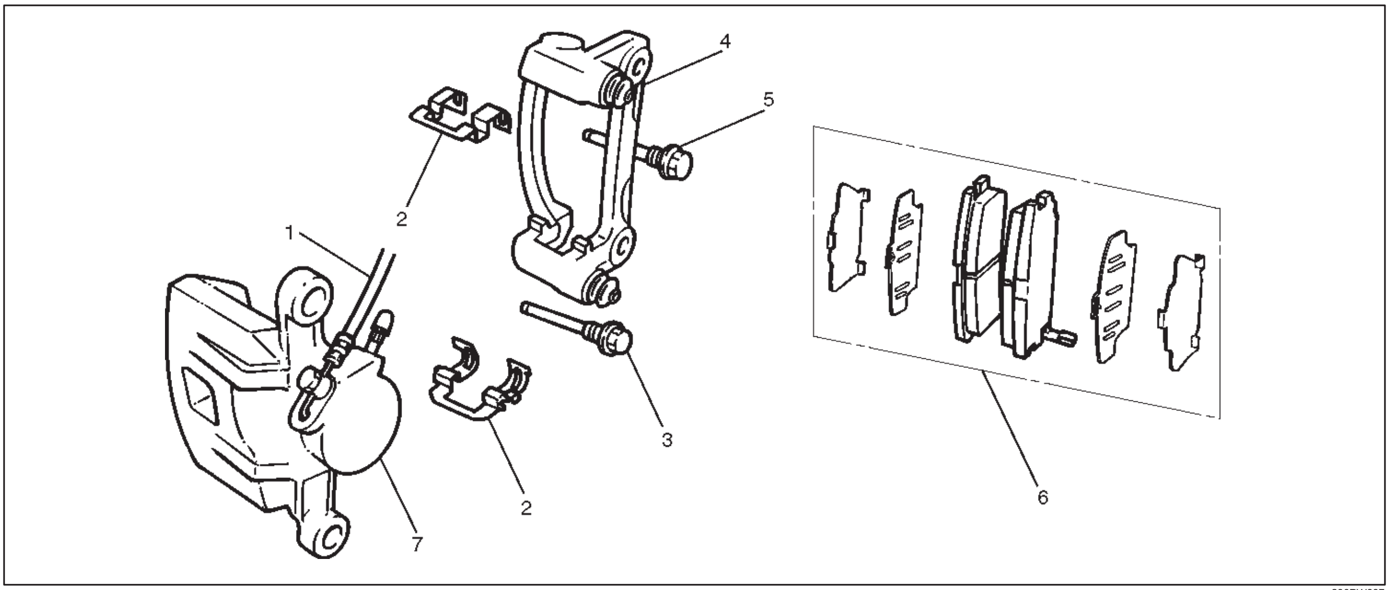
Limit: 211.4 mm (8.32 in)



420RS035

Rear Disc Brake Caliper Assembly (4×4 Model)

Rear Disc Brake Caliper Assembly and Associated Parts



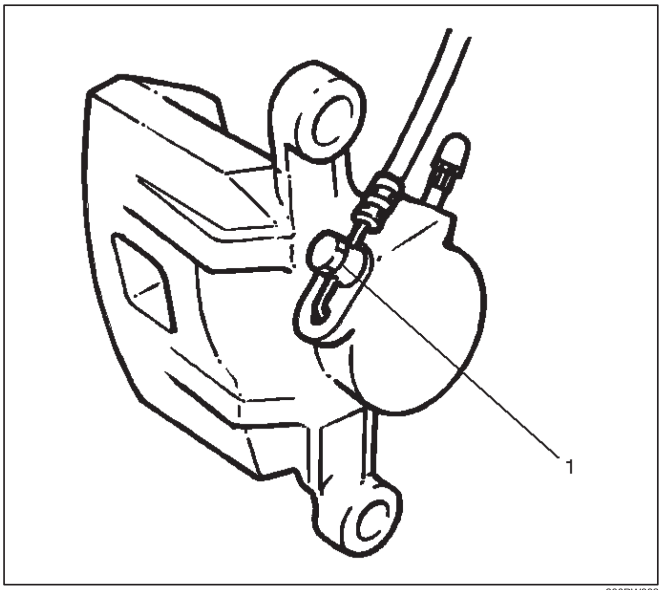
306RW007

Legend

(1) Brake Flexible Hose
(2) Clip
(3) Lock Bolt
(4) Support Bracket
(5) Guide Bolt
(6) Pad Assembly with Shim
(7) Caliper Assembly

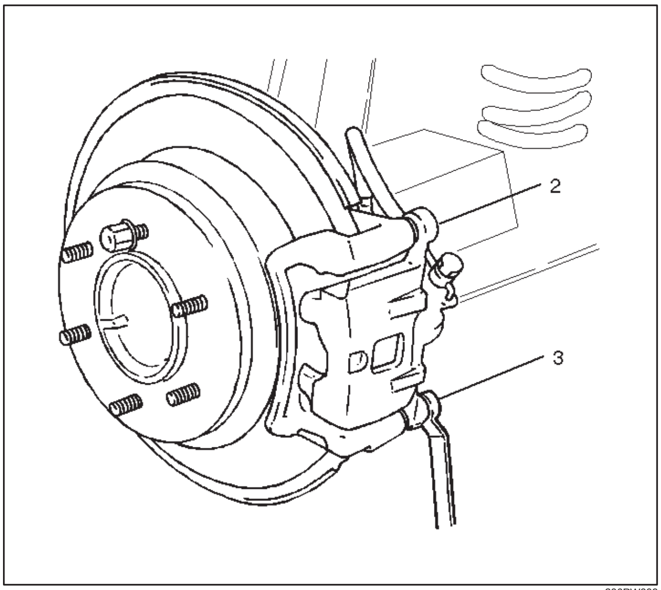
Removal

1. Raise the vehicle and support with suitable safety stands.
2. Remove wheel and tire assembly, referring to “Wheels and Tires System” in Section 3E.
3. Remove the bolt and gaskets, then disconnect the flexible hose from the caliper and after disconnecting the flexible hose (1), cap or tape the openings to prevent entry of foreign material.



306RW008

4. Since the brake fluid flows out from the connecting coupler, place a drain pan under the vehicle.
5. Remove lock bolt (3).
6. Remove guide bolt (2).



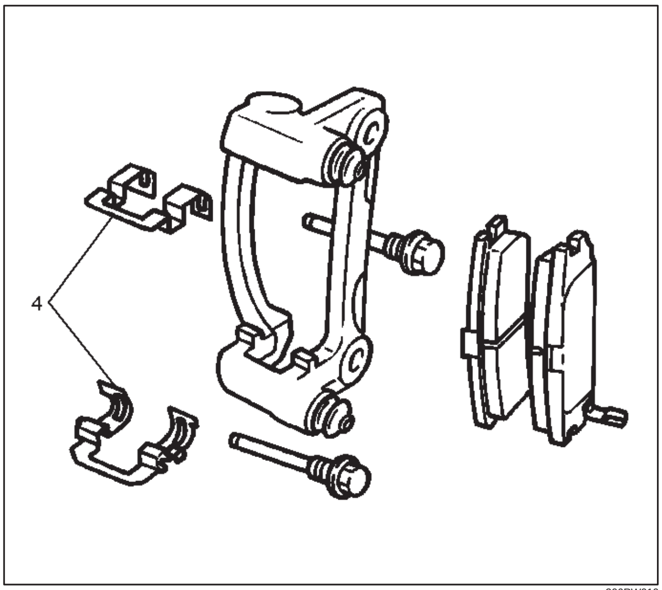
306RW009

7. Remove caliper assembly.
8. Remove support bracket with pad assembly and take care not to damage the flexible brake hose when removing the support bracket.
9. Remove pad assembly with shim and mark the lining locations if they are to be reinstalled.

10. Remove clip.

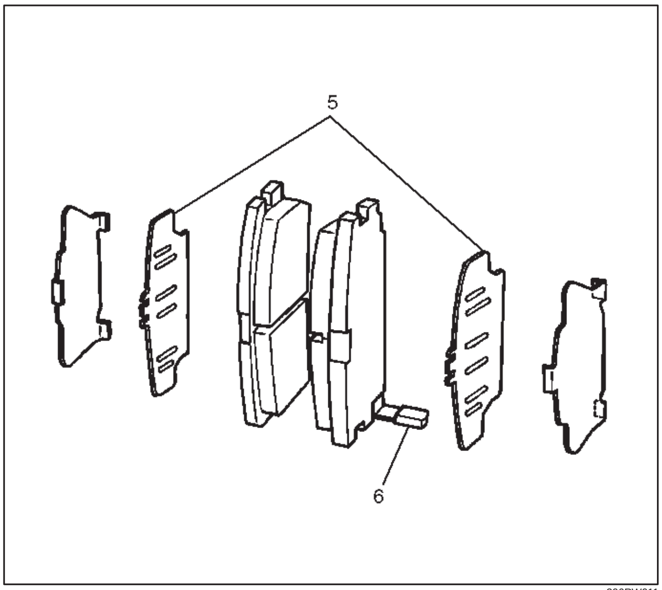
Installation

1. Install clip (4).



306RW010

2. Apply special grease (approximately 0.2 g) to both contacting surfaces of the inner shims (5). Wipe off extruded grease after installing. Install pad assembly with shim.



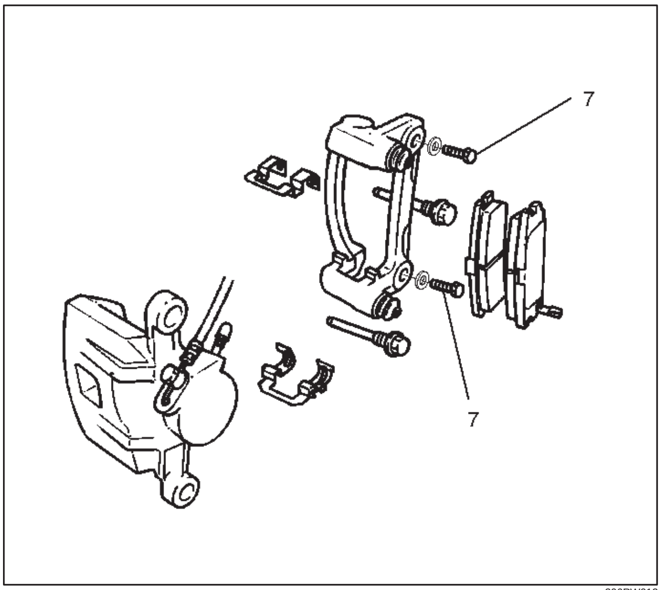
306RW011

Legend

(5) Inner Shim
(6) Wear indicator

3. Install support bracket and tighten the bolt (7) to the specified torque.

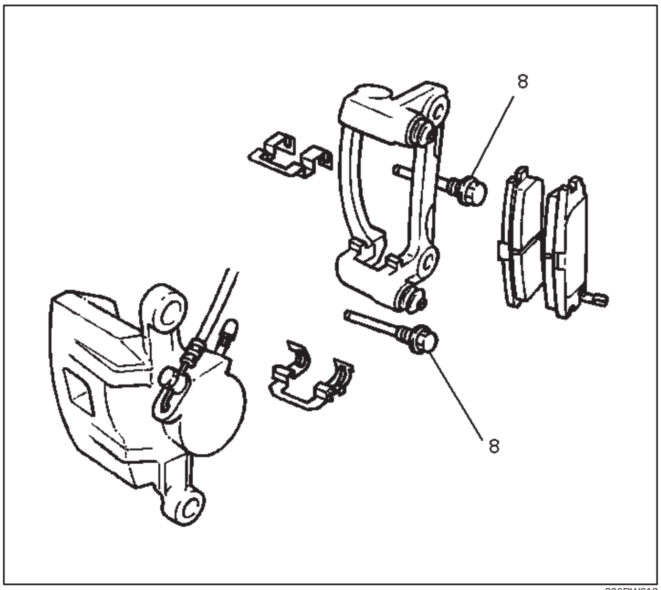
Torque: 103 N·m (76 lb ft)



306RW012

4. Install caliper assembly.
5. Install lock bolt and guide bolt (8) and tighten the bolt to the specified torque.

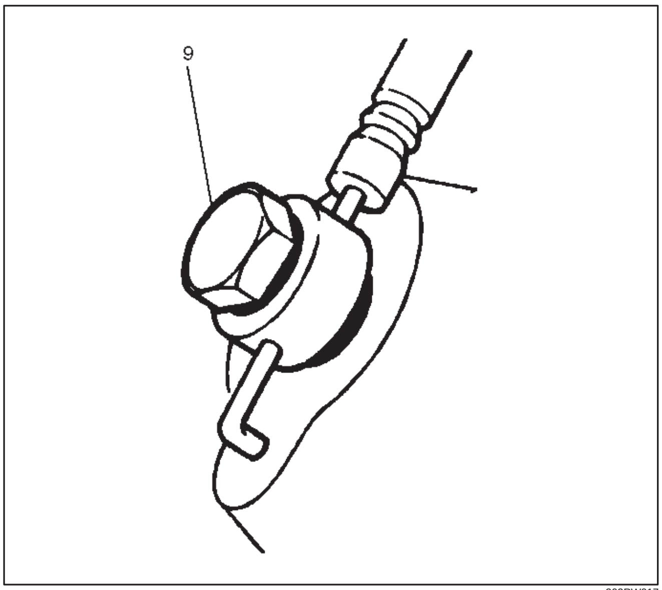
Torque: 44 N·m (32 lb ft)



306RW013

6. Install brake flexible hose, always use new gaskets and be sure to put the hooked edge of the flexible hose end into the anti–rotation cavity then tighten the eye–bolt (9) to the specified torque.

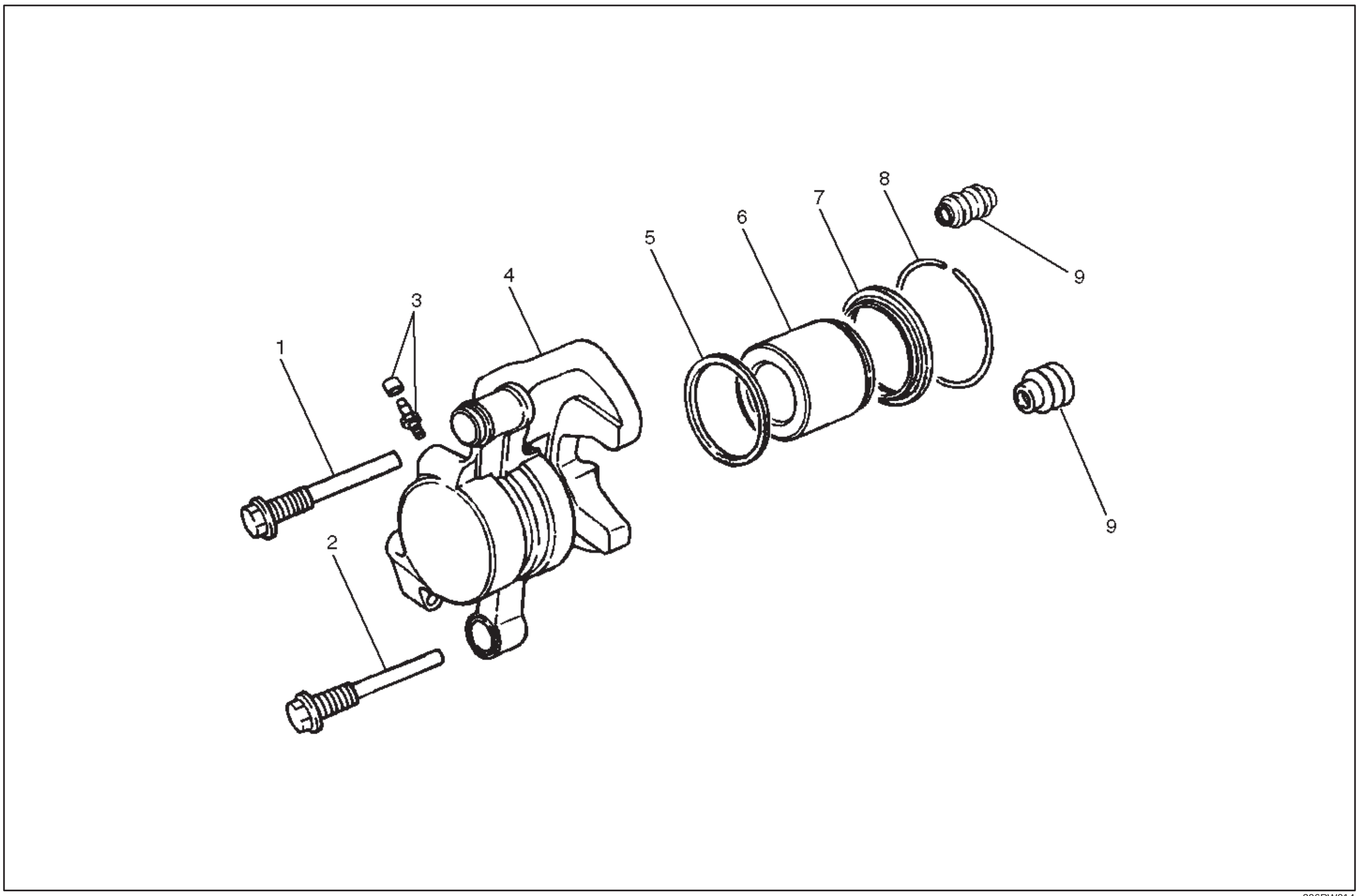
Torque: 35 N·m (26 lb ft)



7. Install the wheel and tire assembly, referring to “Wheels and Tires System” in Section 3E.
8. Bleed brakes. Refer to “Hydraulic Brakes” in this section.

Rear Disc Brake Caliper (4×4 Model)

Rear Disc Brake Caliper Disassembled View

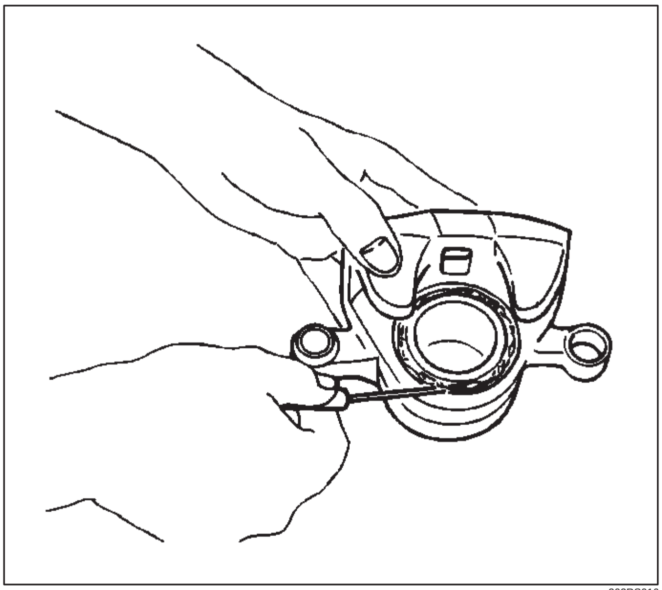


Legend

(1) Guide Bolt
(2) Lock Bolt
(3) Bleeder with Cap
(4) Caliper Body
(5) Piston Seal
(6) Piston
(7) Dust Boot: Piston
(8) Dust Boot Ring
(9) Dust Boot: Guide Bolt and Lock Bolt

Disassembly

1. Remove guide bolt.
2. Remove lock bolt.
3. Remove dust boot; guide bolt and lock bolt.
4. Remove dust boot ring, using a small screwdriver.

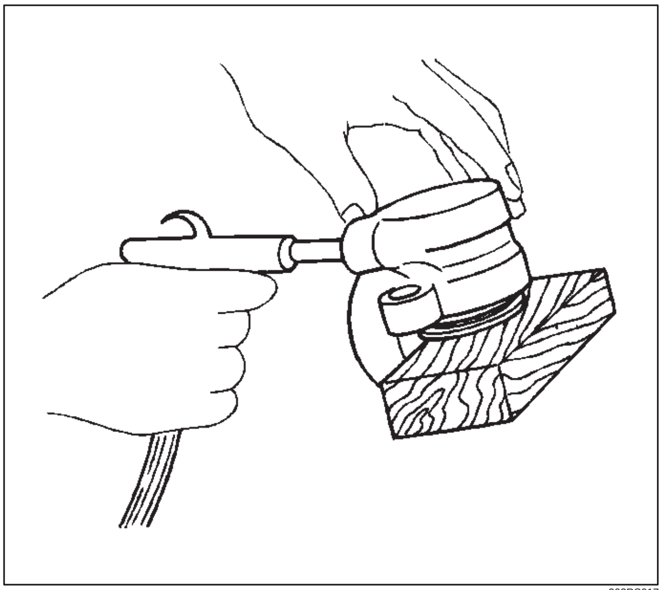


302RS016

5. Insert a block of wood into the caliper and force out the piston by blowing compressed air into the caliper at the flexible hose attachment. This procedure must be done prior to removal of the dust boot.
   Remove piston.

WARNING: DO NOT PLACE YOUR FINGERS IN FRONT OF THE PISTON IN AN ATTEMPT TO CATCH OR PROTECT IT WHEN APPLYING COMPRESSED AIR. THIS COULD RESULT IN PERSONAL INJURY.

CAUTION: Use just enough air to ease the piston out of the bore. If the piston is blown out, it may be damaged.



302RS017

6. Remove dust boot: piston.
7. Remove piston seal.
8. Remove bleeder with cap.
9. Remove caliper body.

Inspection and Repair

Make necessary parts replacement, if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

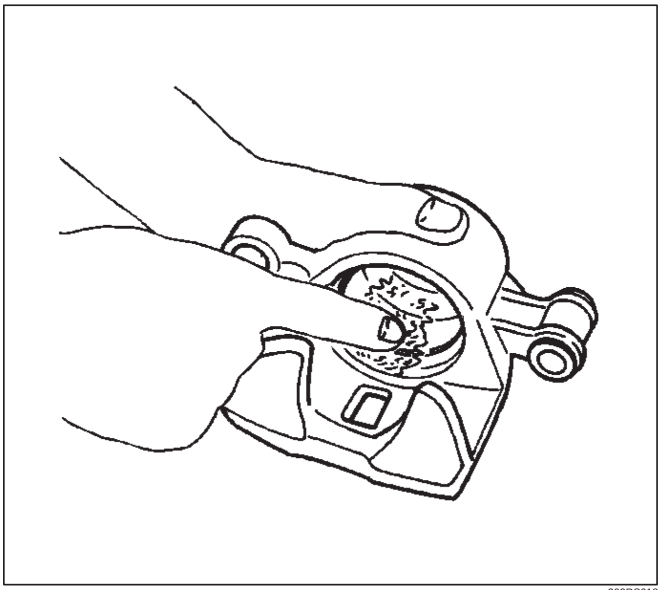
- Rotor
- Cylinder body
- Cylinder bore
- Piston
- Guide bolt, lock bolt
- Support bracket

NOTE: The piston dust seal and dust boot are to be replaced each time the caliper is overhauled. Discard these used rubber parts and replace with new ones.

Reassembly

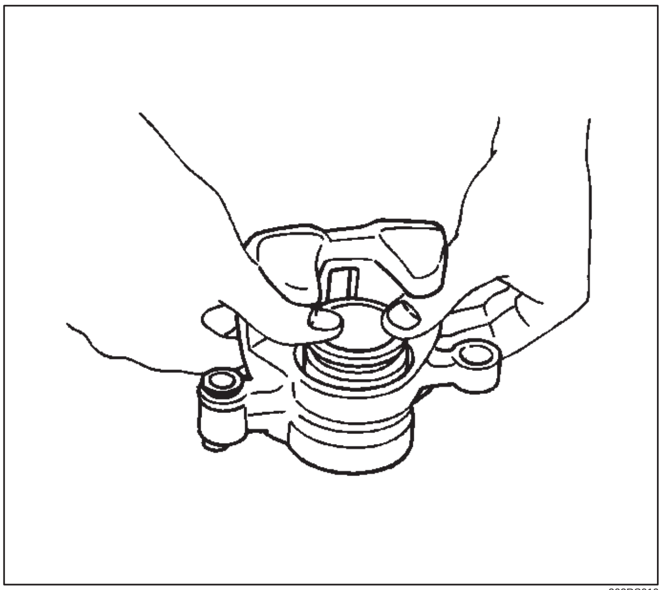
1. Install caliper body.
2. Install bleeder with cap and tighten the cap to the specified torque.

   Torque: 8 N·m (69 lb ft)
3. Install piston seal and apply special rubber grease to the piston seal and cylinder wall, then insert the piston seal into the cylinder. The special rubber grease is included in the repair kit.



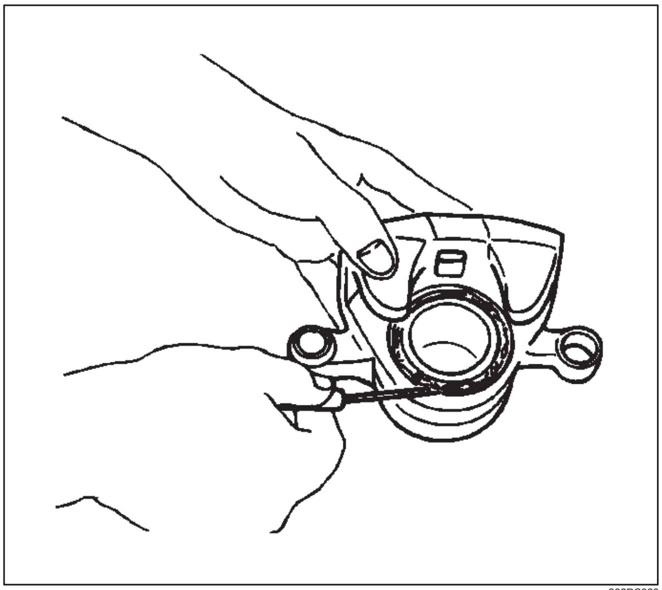
302RS018

4. When inserting the piston into the cylinder, use finger pressure only and do not use a mallet or other impact tool, since damage to the cylinder wall or piston seal can result.
   Install piston.



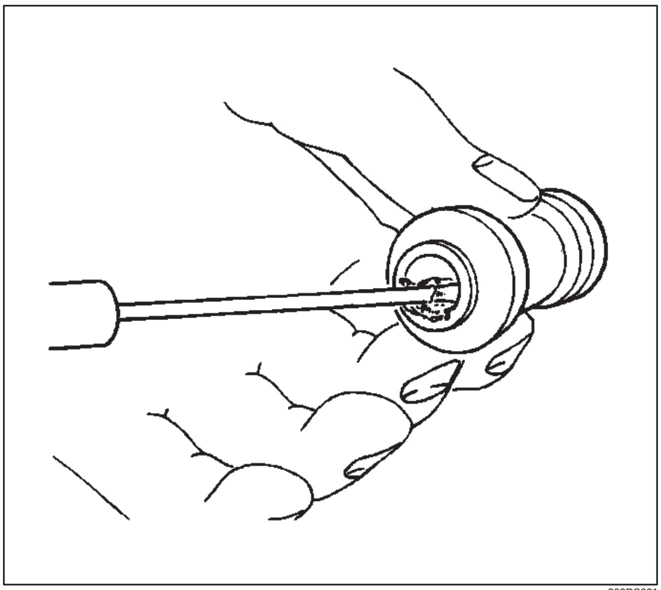
302RS019

5. Apply special grease (approximately 1g) to the piston and attach the dust boot to the piston and caliper. Insert the dust boot ring into the dust boot.



302RS020

6. Install guide bolt and lock bolt dust boot.
7. Install the dust boot on the support bracket after applying special grease (Approx. 1g) onto the dust boot inner surface. Also apply special grease onto the lock bolt and guide bolt setting hole of the support bracket.



302RS021

8. Install lock bolt and guide bolt and tighten the bolt to the specified torque.

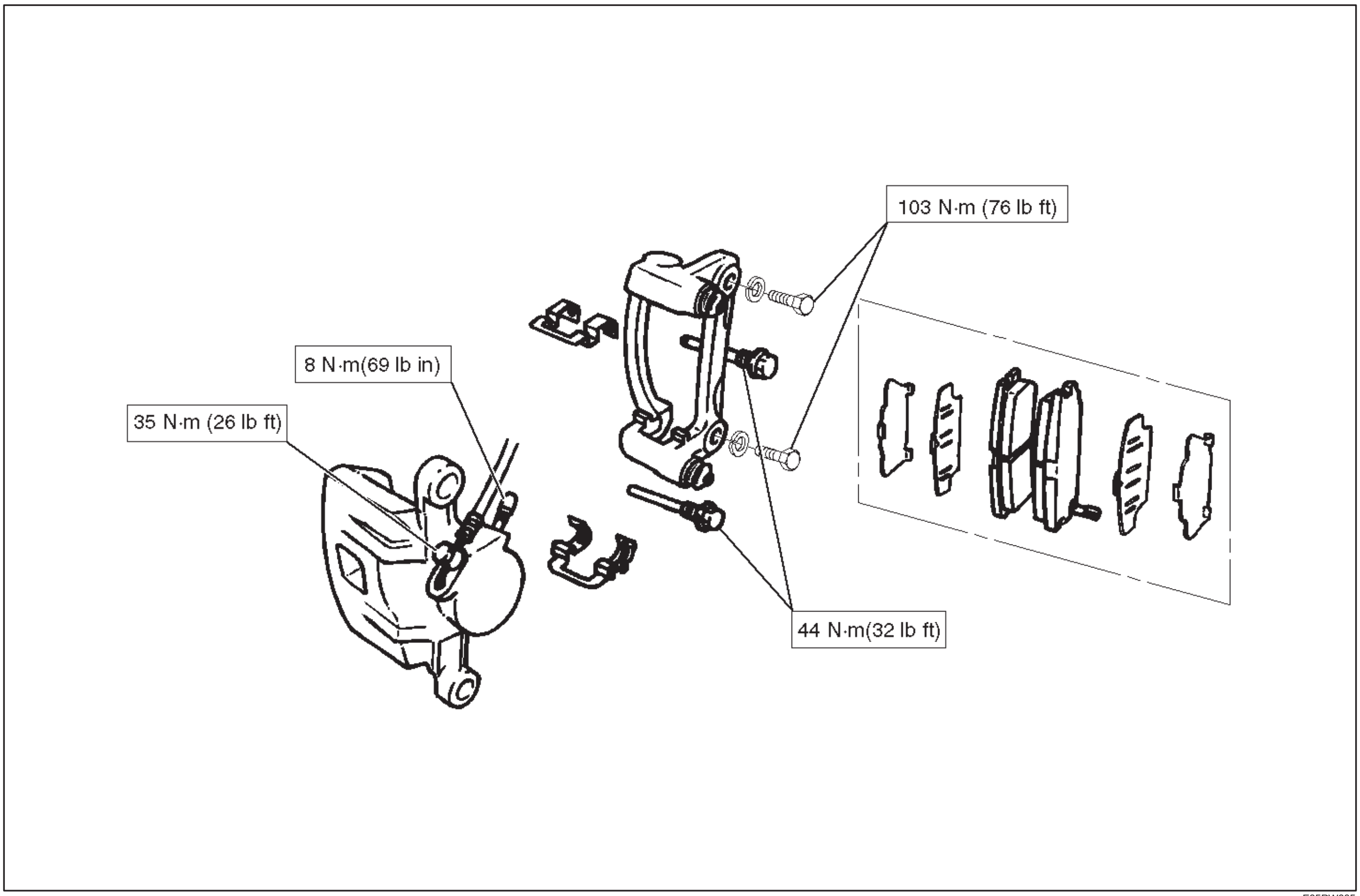
Torque: 44 N·m (32 lb ft)

Main Data and Specifications (4×4 Model)

General Specifications

Type	Floating, pin slide
Pad dimension	33 cm^2 (5.11 in^2)
Adjusting method	Self–adjusting
Piston diameter	41.3 mm (1.63 in)
Disc type	Ventilated
Disc thickness	18 mm (0.71 in)
Disc effective diameter	269.2 mm (10.60 in)

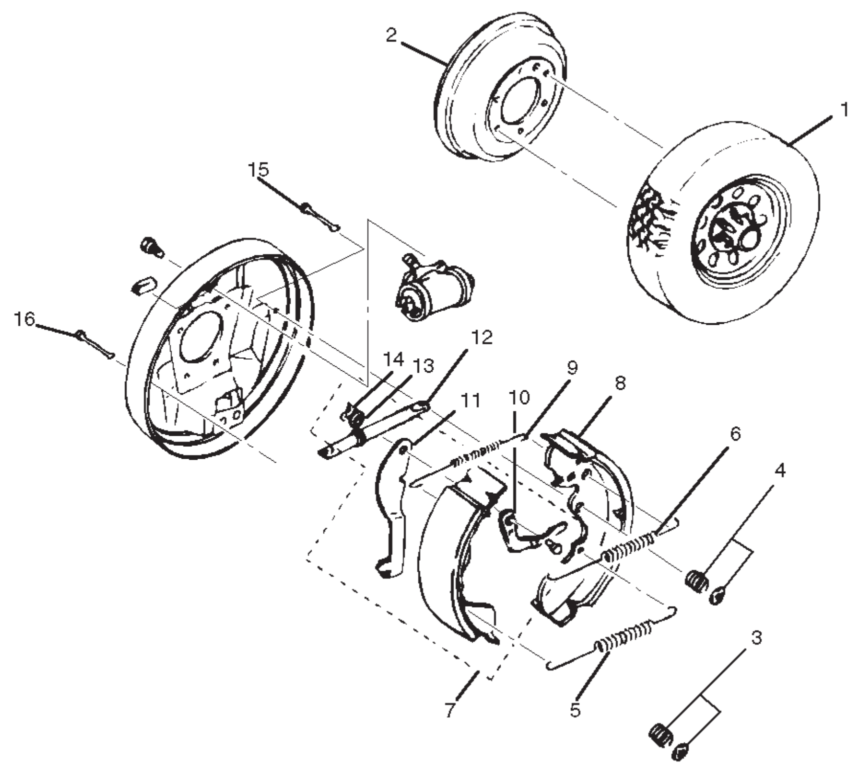
Torque Specifications



E05RW005

Brake Lining

Brake Lining and Associated Parts



305RW001

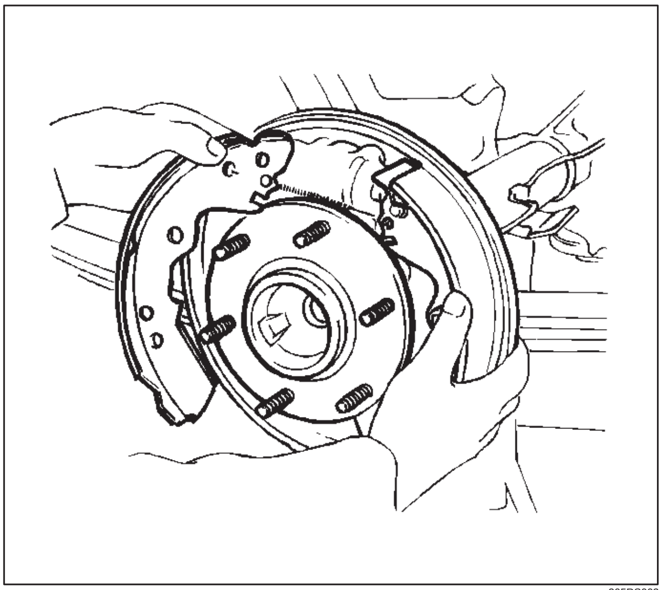
Legend

(1) Wheel and Tire Assembly
(2) Drum
(3) Hold-down Spring and Cup
(4) Hold-down Spring and Cups
(5) Lower Return Spring
(6) Upper (other) Return Spring
(7) Trailing Shoe Assembly with Parking Brake Lever
(8) Leading Shoe Assembly with Upper (inner) Return Spring
(9) Upper (inner) Return Spring
(10) Auto Adjuster Lever
(11) Parking Brake Lever
(12) Adjuster Assembly
(13) Wave Washer
(14) Retainer
(15) Hold-down Pin
(16) Hold-down Pin

Removal

1. Raise the vehicle and support with suitable safety stands.
2. Remove wheel and tire assembly (1).
   - Refer to “Wheel and Tires” in Wheel and Tire System section.
3. Remove Drum (2).
   - If difficulty is encountered in removing the drum:
   – Mark the position of the drum to the axle.
   – Make sure the parking brake is released.
   – Use a rubber mallet to tap gently on the outer rim of the drum and/or around the inner drum. Be careful to avoid damaging the drum.
4. Remove upper (other) return spring (6) and auto adjuster lever.
5. Remove lower return spring (5).
6. Remove hold-down spring and cups (4) and hold-down pin (15).
7. Remove adjuster assembly (12)
8. Remove leading shoe assembly (8) with upper (inner) return spring (9).

NOTE: Do not over stretch the return spring.



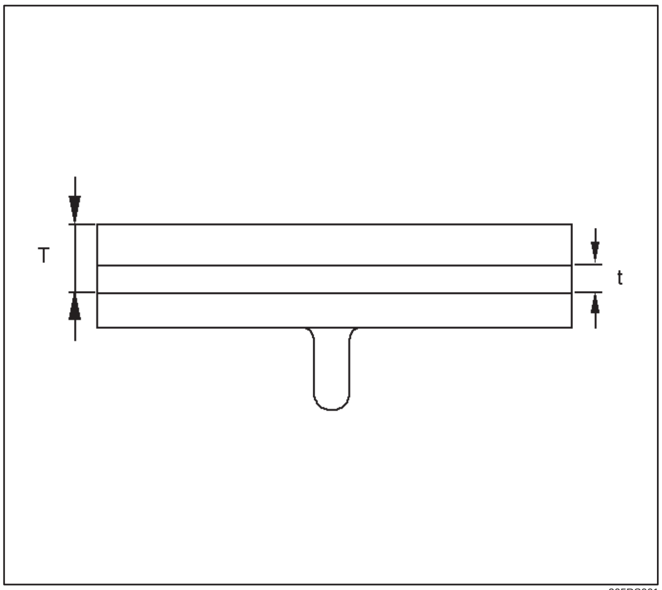
305RS003

9. Remove upper (inner) return spring (9).
10. Remove hold-down spring and cup (3) and hold-down pin (16).
11. Remove Trailing shoe assembly (7) with parking brake lever (16).
12. Remove parking brake cable from parking brake lever (11).
13. Remove retainer (14), wave washer (13), and parking brake lever (11).

Brake Lining Inspection

Check the shoe assemblies for wear by removing brake drum.
Replace the shoe assemblies, if lining thickness is less than 1.0 mm (0.039 in).
The shoe assemblies have a wear indicator that makes a noise when the linings wear to a degree where replacement required.

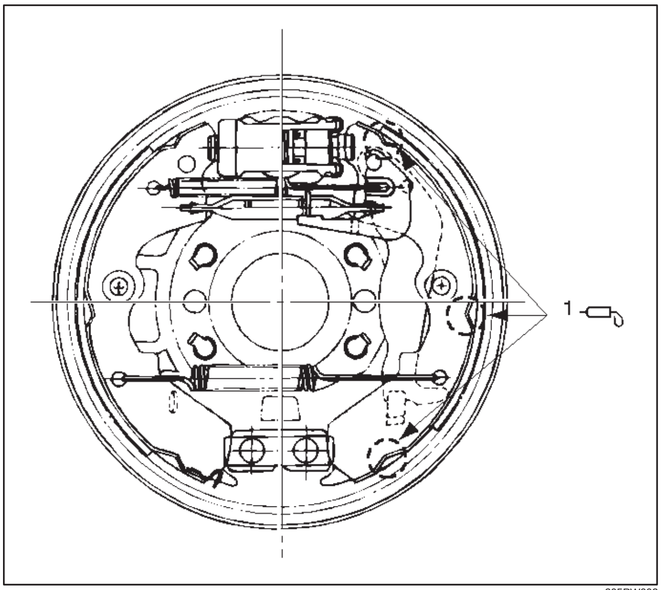
Minimum limit: 1.0 mm (0.039 in)



305RS001

Installation

1. Apply grease lightly to back place A.



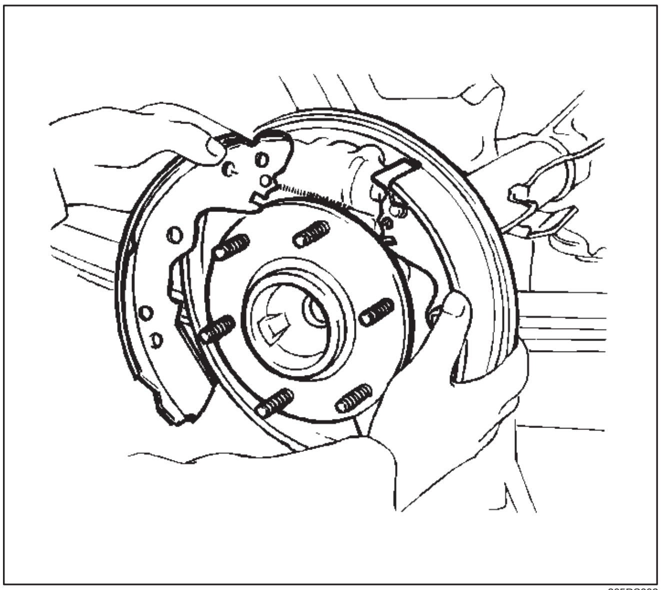
305RW002

Legend

(1) Place A (3 portions for each side)

2. Install parking brake lever (11), wave washer (13), and retainer (14).
3. Install trailing shoe assembly (7) with parking brake lever (16).
4. Install the parking brake cable to parking brake lever (11).
5. Install hold-down pin (16) and hold-down spring and cup (3).
6. Install upper (inner) return spring (9).
7. Install leading shoe assembly (8) with upper (inner) return spring (9).

NOTE: Do not over stretch the return spring.



305RS003

8. Install adjuster assembly (12).
9. Install hold-down pin (15) and hold-down spring and cups (4).

10. Install lower return spring (5).
    - Use brake spring tool.
11. Install auto adjuster lever (10).
12. Install upper (outer) return spring (6).
    - Use brake spring tool.
13. Install brake drum (2).
    - Adjust the brakes, refer to the “Drum Brake Adjustment” in this section.
14. Install wheel and tire assembly (1).
    - Refer to “Wheels and Tires ” in wheel and Tire System section.

Drum Brake Adjustment (4×2 Model)

NOTE: All brakes are self-adjusting. Brakes are adjusted by repeated stepping on the brake pedal. (After stepping on the pedal and releasing it, the rear auto adjuster, in the rear brake, produces a clicking sound.

The same operation should be repeated until the sound disappears.)

Take the following steps after overhauling the rear brake assembly.

1. Move the parking brake handle to its fully released position.
2. Parking cable must be loosened sufficiently. (Loosen the adjust nut and the lock nut.)
3. Repeat stepping on the brake pedal firmly, and releasing it until the clicking sound can no longer be heard.
   If the difference between the brake drum inside diameter and diameter of the brake shoes is adjusted to be 0,5 mm, the number of times for depressing the brake pedal can be reduced.
4. Remove the drum. Measure the brake drum inside diameter and diameter of the brake shoes.
   Shoe clearance: 0.25-0.4 mm (0.0098-0.0157 in)
   If incorrect, check the brake auto-adjusting system.
5. Rotate the adjust nut until all slack disappears from the cable. Set the adjust nut.
6. Applying about 30 kg (66 lb) of force, pull the parking brake handle to its fully set position three or four times.
7. If the parking brake is properly adjusted, the travel between the fully disengaged position and the fully engaged position will be between 9 and 11 notches.
   If the traveling range is not within these limits, again repeat steps 1 through 5.
   After adjusting has been done, check to see if the rear wheel rotates smoothly without drag when turned by hand.

Servicing The Brake Drum

Whenever the brake drums are removed, they should be thoroughly cleaned and inspected for cracks, scores, deep grooves and out-of-round.

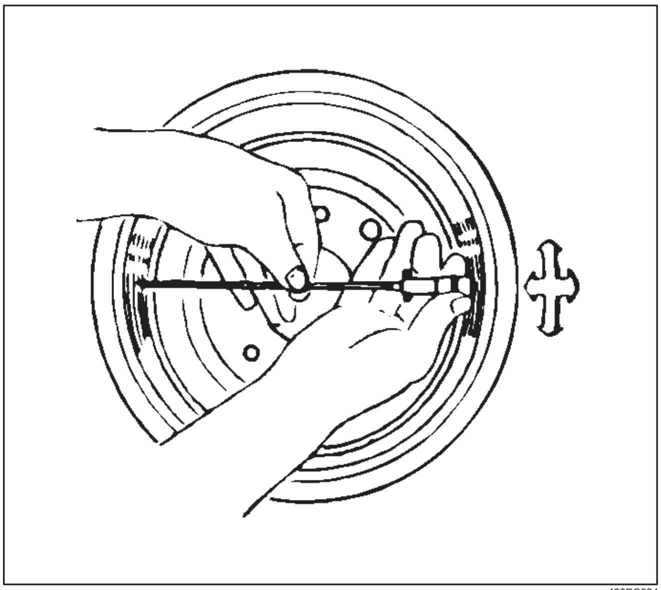
Cracked, Scored or Grooved Drum

A cracked drum is unsafe for further service and must be replaced.
Do not attempt to weld a cracked drum.
Smooth any slight scores. Heavy or extensive scoring will cause excessive brake lining wear, and it will probably be necessary to machine the drum braking surface.
If the brake linings are slightly worn and the drum is grooved, the drum should be polished with fine emery cloth but should not be machined. At this stage, eliminating all the grooves in the drum and smoothing the ridges on the lining would require the removal of too much metal and lining. If left alone, the grooves and ridges match and satisfactory service can be obtained. If brake linings are to be replaced, a grooved drum should be machined. A grooved drum, if used with a new lining, will not only wear the lining, but will make it difficult, it not impossible, to obtain efficient brake performance.

Out-Of-Round Drum

An out-of-round drum makes accurate brake shoe adjustment impossible and is likely to cause excessive wear to other parts of the brake mechanism due to its eccentric action. An out-of-round drum can also cause severe and irregular tire tread wear as well as a pulsing brake pedal. When the braking surface of a brake drum exceeds the specification limit of 0.15 mm (0.006 in) in out-of-round, the drum should be machined to true up the braking surface. Out-of-round can be accurately measured with an inside micrometer fitted with proper extension rods. When measuring a drum for out-of-round and wear, take measurements at the open and closed edges of machines surfaces and at right angles to each other.

Maximum out-of-round: 0.15 mm (0.006 in)



420RS034

Machining The Drum

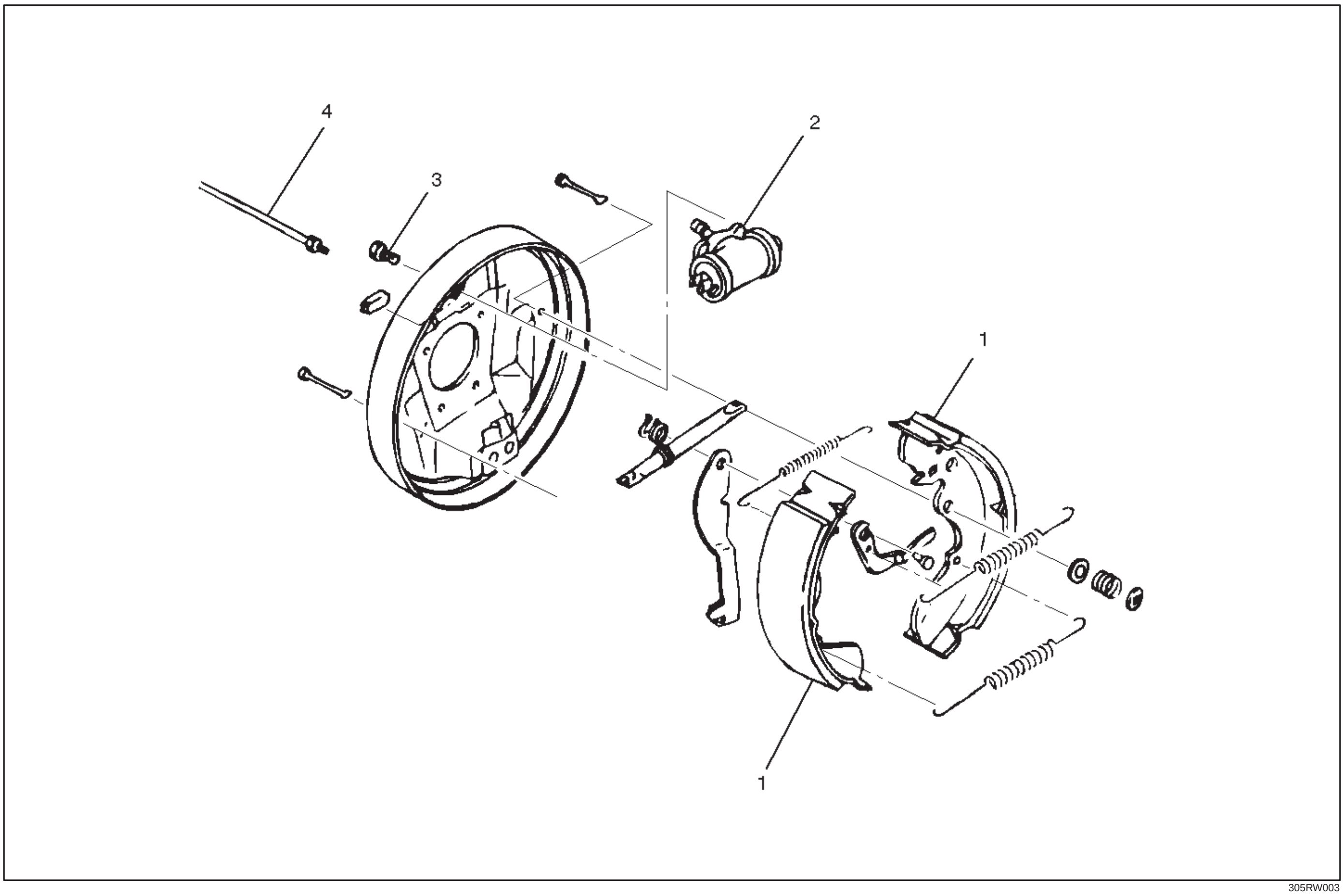
If a drum is to be machined, only enough metal should be removed to obtain a true, smooth braking surface. If a drum does not clean-up when machined to a maximum diameter, it must be replaced. Removal of more metal will affect dissipation of heat and may cause distortion of the drum.

After refinishing, replace any drum that exceeds a maximum inside diameter of 296.5 mm (11.673 in). Do not use a brake drum that is not within the specification.

Maximum inside diameter: 296.5 mm (11.673 in)

Wheel Cylinder Assembly (4×2 Model)

Wheel Cylinder Assembly and Associated Parts



Legend

(1) Brake Linings
(2) Wheel Cylinder
(3) Bolts
(4) Brake Pipe

Removal

1. Remove brake linings (1).
   - Refer to “Brake Lining and Associated Parts ” in this section.
2. Remove brake pipe (4).
   - Plug the opening in the line to prevent fluid loss and contamination.
3. Remove bolts (3) and wheel cylinder (2).

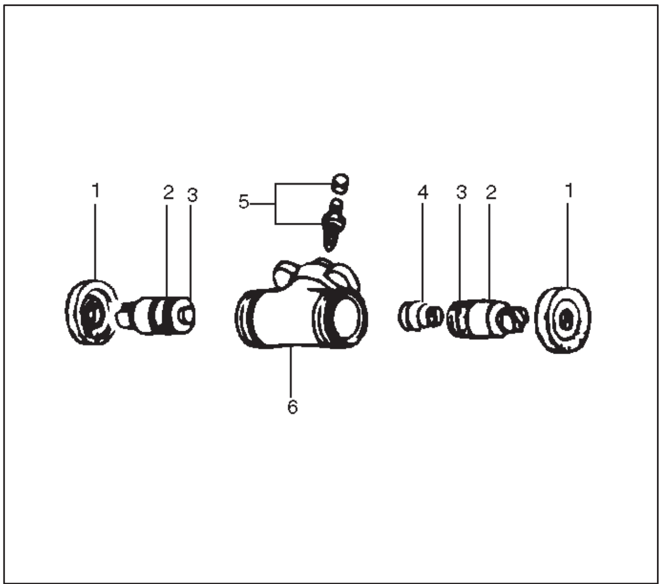
Installation

1. Install wheel cylinder (2) and tighten bolts (3) to the specified torque.

   Torque: 10 N·m (8 lb ft)
2. Install brake pipe (4) and tighten the nut to the specified torque.

   Torque: 16 N·m (12 lb ft)
3. Install brake linings (1).
   - Refer to “Brake Lining Replacement” in this section.
   - Bleed brake system. Refer to “Hydraulic Brake” in this section.

Disassembled View



305RS006

Legend

(1) Boot
(2) Piston Assembly
(3) Piston Cup
(4) Return Spring
(5) Bleeder
(6) Wheel Cylinder

Disassembly

1. Remove boot (1) and piston assembly (2).
2. Remove piston cup (3) from piston assembly (2).
3. Remove return spring (4) and bleeder (5) from wheel cylinder (6).

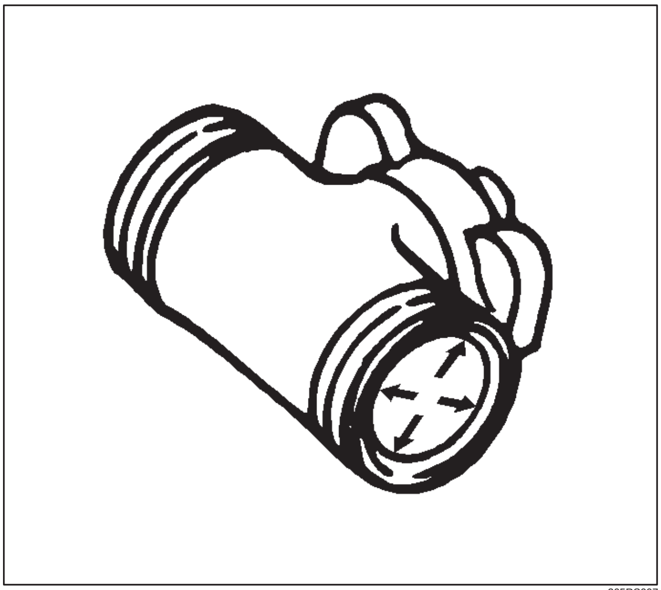
Inspection and Repair

1. Make necessary parts replacement if wear, damage, corrosion or any other abnormal condition are fond through inspection.
   Check the following parts;
   - Wheel cylinder body
   - Cylinder bore
   - Piston
   - Return spring
   - Bleeder

NOTE: Replace the piston cups and boots each time the wheel cylinder is overhauled. Discard these used rubber parts and replace with new ones.

Reassembly

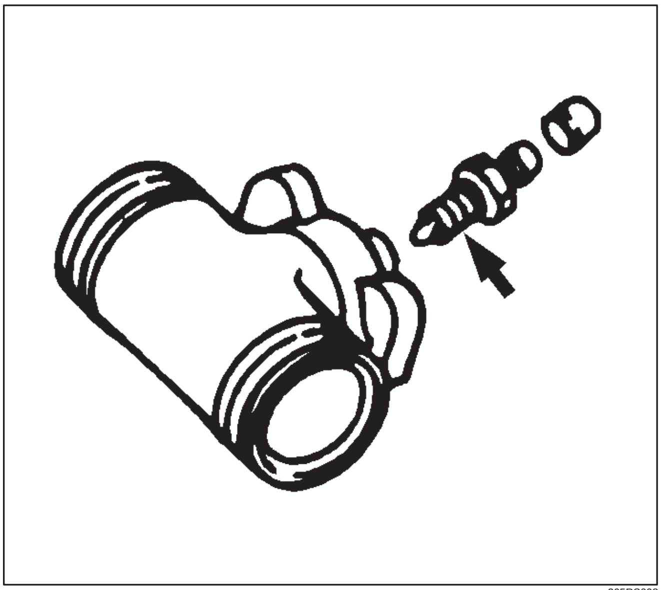
1. Lubricate the cylinder bore with clean rubber grease.



305RS007

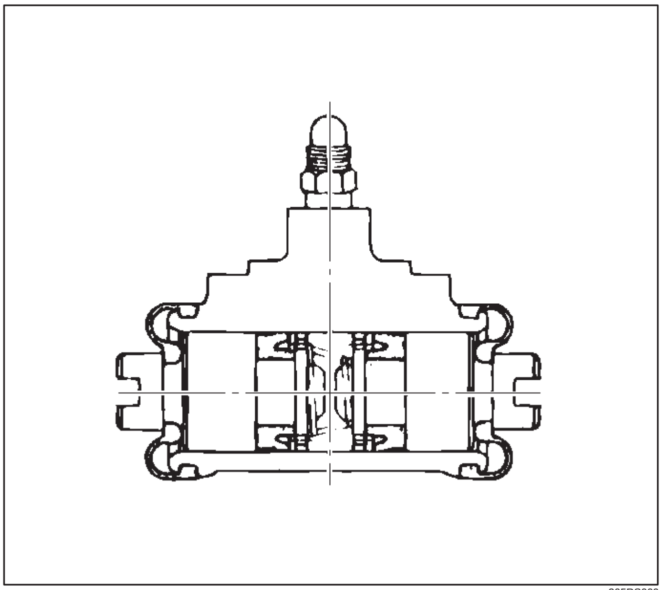
2. Install bleeder (5) to wheel cylinder (6).

   Torque: 10 N·m (8 lb ft)



305RS008

3. Install new piston cups (3) on each piston so that the flared end of the cups are turned to the inboard side of the pistons.
   Attach the return spring (4) and the boot (1) to the piston.



305RS009

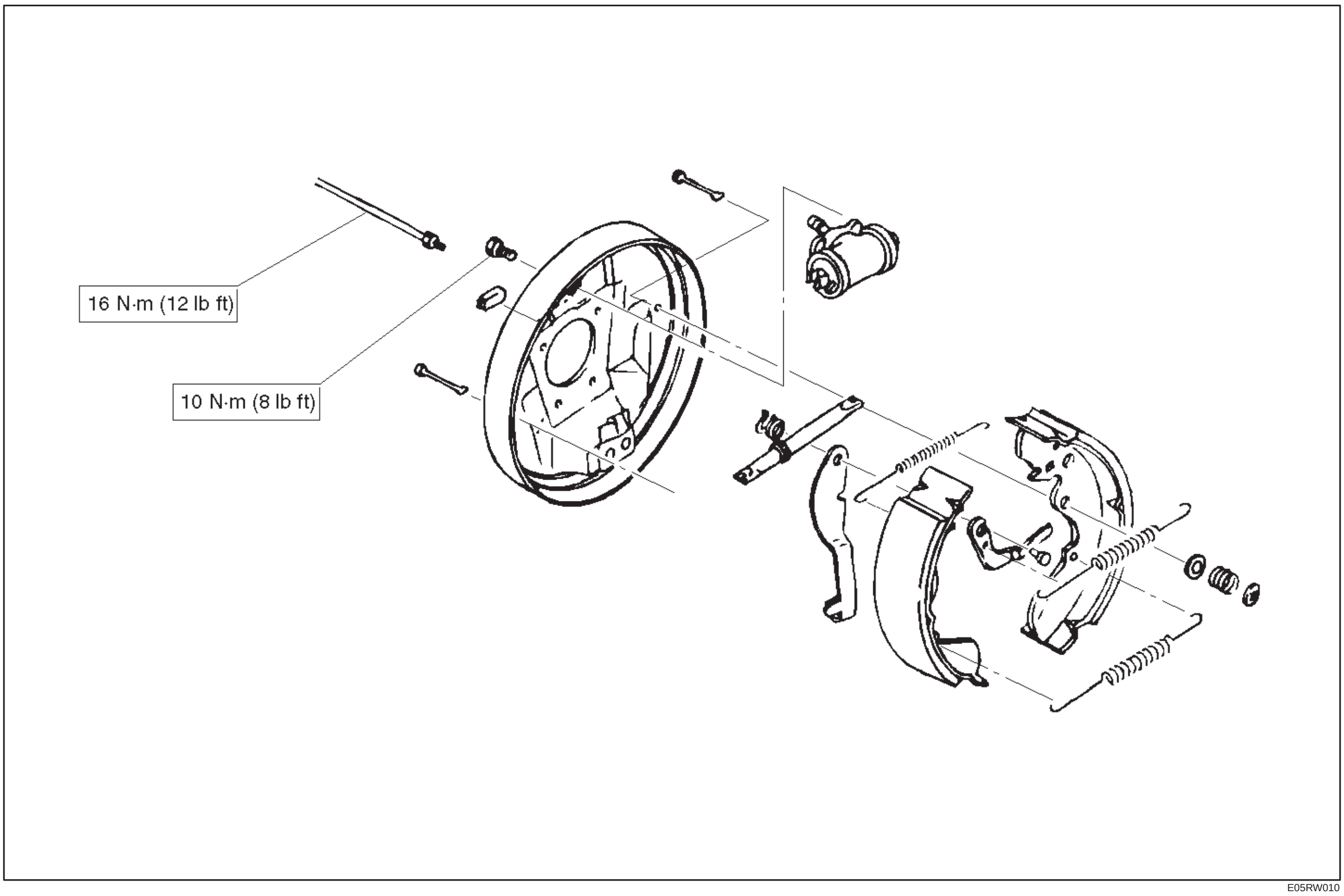
4. Apply DELCO silicone lube No. 5459912 (or equivalgmlent) to the piston and the inner face of the boots.
5. Install piston assembly (2) to wheel cylinder (6).

Main Data and Specifications

General Specifications

Rear drum brake	
Type	Leading-trailing, non-servo
Drum inside diameter	295 mm (11.6 in)
Wheel cylinder diameter	22.22 mm (7/8 in)

Torque Specifications



RODEO

BRAKES

PARKING BRAKE SYSTEM (4×4 Model)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

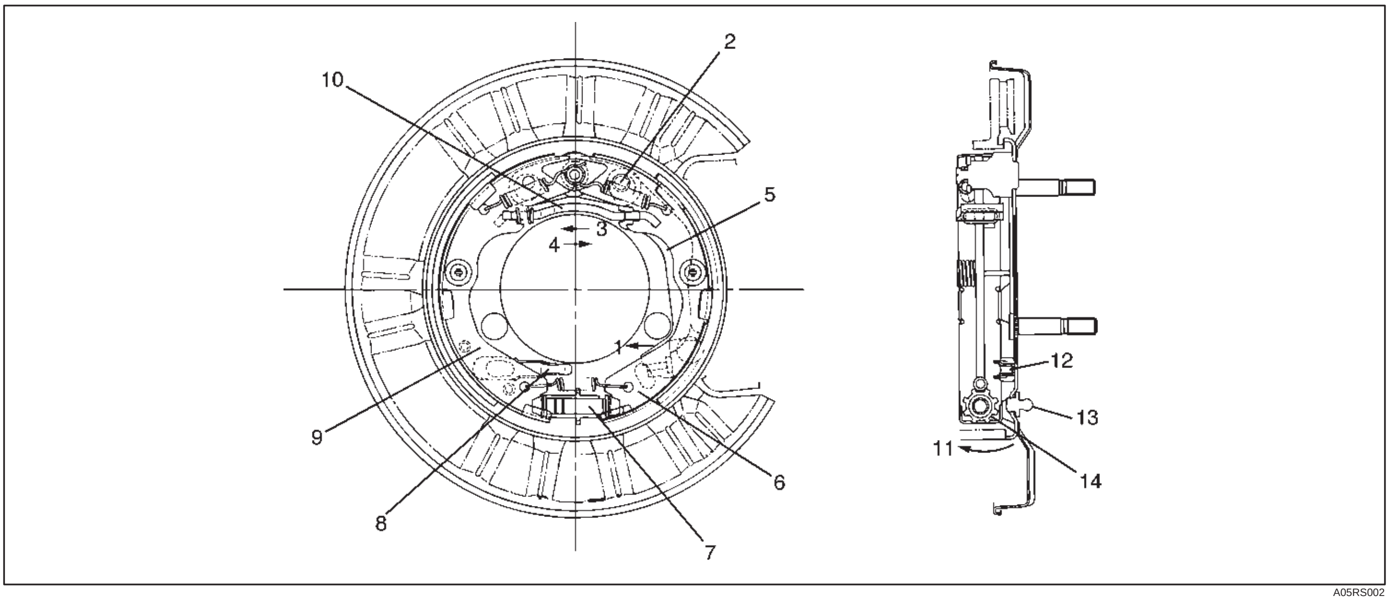
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fasteners joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fasteners. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Pulling up the parking brake lever by hand will set the parking brake. By means of a ratchet type lock, the lever can be held in that position until it is released. The position of the lever is transmitted through cable/lever systems to the rear wheels. These parts are designed to obtain sufficient braking force even when parking on slopes. When the parking brake is set, or when the ignition SW is in the“ON” position, the brake warning light illuminates. The rear wheel parking brake is a duo–servo brake (mechanical inside expansion type) built in the rear disc brake. Parking brake adjustment is made through the adjusting hole (bored through back plate). Parking brake lever stroke should be adjusted to 6–8 notches. Refer to “Parking Brake Adjustment” in this section.

Operation

When pulled in the direction “A”, the parking lever presses the secondary shoe against the brake drum using the lever/shoe joint “B” as a fulcrum and pushes the strut in the direction “C”. The strut ,in turn, presses the primary shoe against the brake drum. Counter force “D” to the primary shoe is transmitted again to the secondary shoe through the fulcrum “B”. The secondary shoe contacts the drum thereby producing braking effect. Clearance which may result from worn parking brake shoe lining can be adjusted by turning the adjusting screw. Refer to “Parking Brake Adjustment” in this Section.

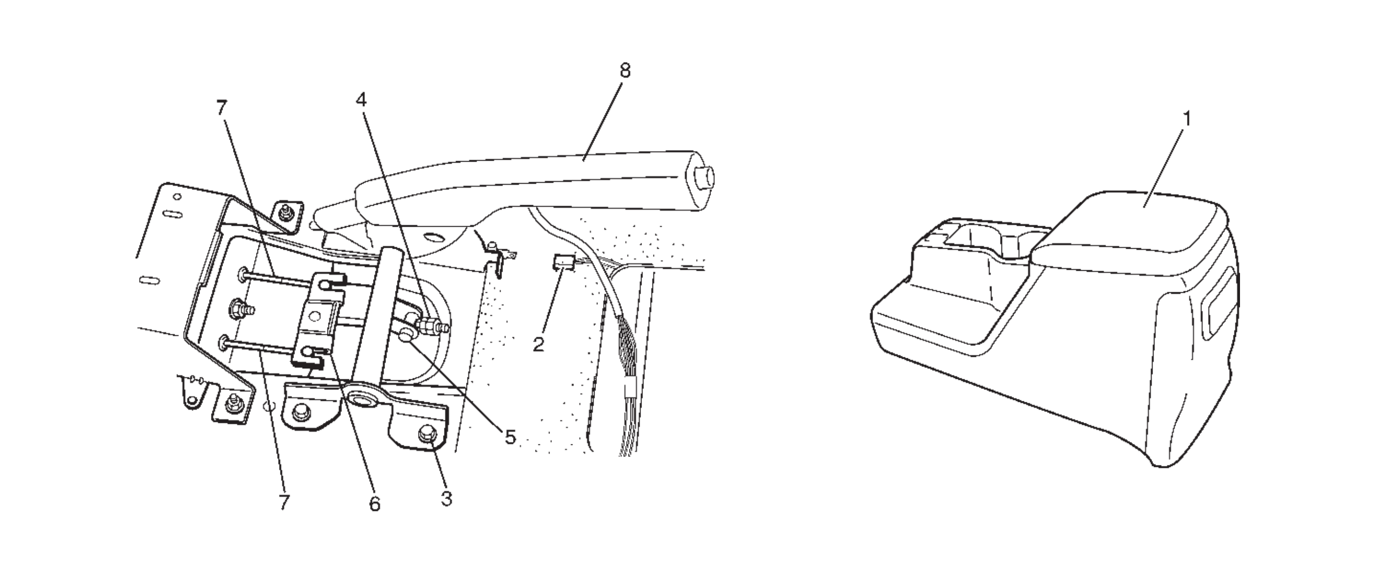


Legend

(1) Direction “A”
(2) Lever/Shoe Joint “B” as a fulcrum
(3) Direction “C”
(4) Counter Force “D”
(5) Parking Lever
(6) Secondary Shoe
(7) Adjusting Screw Notch
(8) Parking Cable Guide
(9) Primary Shoe
(10) Strut
(11) Shoe Expanding Direction
(12) Parking Brake Cable Guide
(13) Adjusting Hole Plug
(14) Adjusting Screw Notch

Parking Brake Lever and Front Cable

Parking Brake Lever Assembly and Associated Parts



311RW008

Legend

(1) Rear Console
(2) Switch Connector
(3) Bolt
(4) Adjust Nut and Lock Nut
(5) Trunnion Pin
(6) Equalizer
(7) Parking Brake Rear Cable
(8) Parking Brake Lever

Removal

1. Remove rear console (1).
   - Refer to Body and Accessories section.
2. Disconnect switch connector (2).
3. Remove bolt (3).
4. Remove adjust nut and lock nut (4).
5. Pull out equalizer (6) from trunnion pin (5).
6. Disconnect trunnion pin (5) from Parking brake lever (8).
7. Disconnect parking brake rear cable (7).

Installation

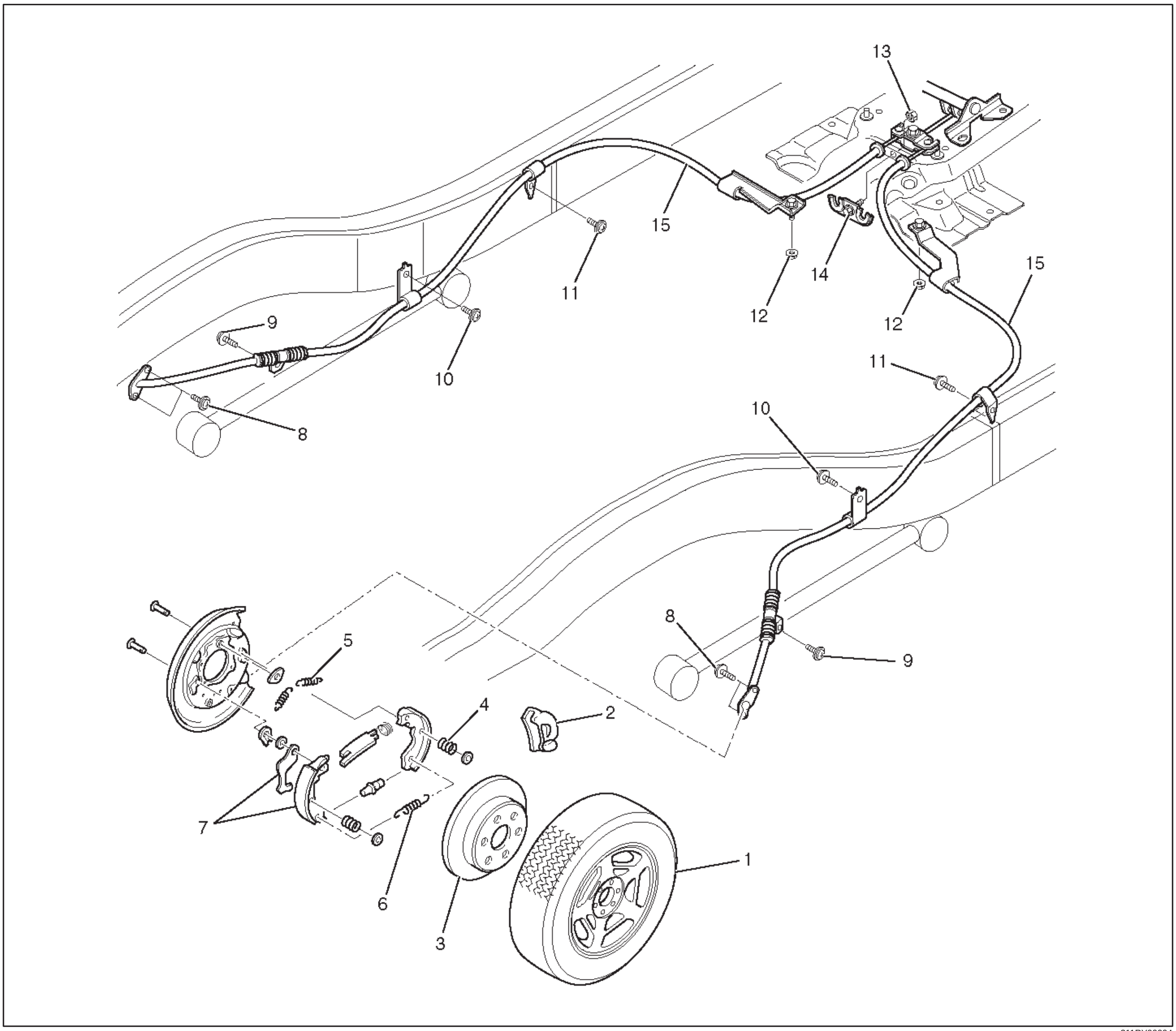
1. Apply grease (BESCO L–2 or equivalent) to the connecting portion of the rear cable (7) and equalizer (6).
2. Connect parking brake rear cable (7) to equalizer
3. Install trunnion pin (5) to parking brake lever (8).
4. Insert equalizer (6) into trunnion pin (5) and tighten adjust nut and lock nut (4).
   - To adjust the parking brake lever, see “Parking Brake Adjustment” in this section.

   Lock Nut Torque: 13 N·m (113 lb in)
5. Tighten the parking brake lever fixing bolt (3) to the specified torque.

   Torque: 15 N·m (11 lb ft)
6. Connect switch connector (2).
7. Install rear console (1).
   - Refer to Body and Accessories section.

Parking Brake Rear Cable

Parking Brake Rear Cable and Associated Parts

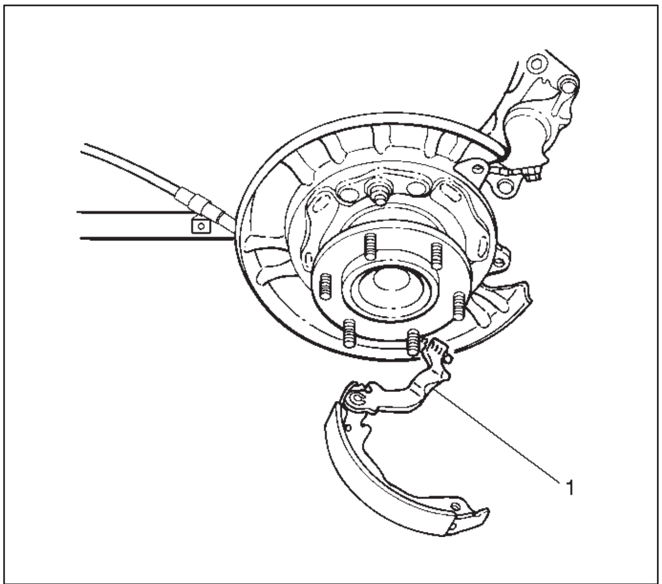


Legend

(1) Rear Wheels
(2) Caliper Assembly
(3) Rotor (Drum)
(4) Holding Spring
(5) Upper Return Spring
(6) Lower Return Spring
(7) Shoe Assembly
(8) Cable Fixing Bolt
(9) Bolt
(10) Bolt
(11) Bolt (Only Long Wheel Base Model)
(12) Nut
(13) Nut
(14) Retainer
(15) Rear Cable

Removal

1. Remove rear wheels (1).
2. Remove 2 bolts to remove the caliper assembly (2) from the support bracket. Refer to “Rear Disc Brakes” in Power Assisted Brake System section. Temporarily hang the caliper with wire etc.
3. Remove rotor (drum) (3).
4. Remove holding spring (4), upper return spring (5) and lower return spring (6).
5. Previously remove the rear cable from the parking brake lever, then remove the brake shoe assembly (7).



308RW004

Legend

(1) Parking Brake Lever

6. Remove cable fixing bolt (8) and bolt (9) (10) (11).
7. Remove nut (12).
8. Remove nut (13) and retainer (14).
9. Remove rear cable (15).

Installation

1. Apply grease (BESCO L–2 or equivalent) to the connecting portion of the rear cable and equalizer. Install rear cable (15).
2. Install retainer (14).
   - Tighten nut (13) to the specified torque.

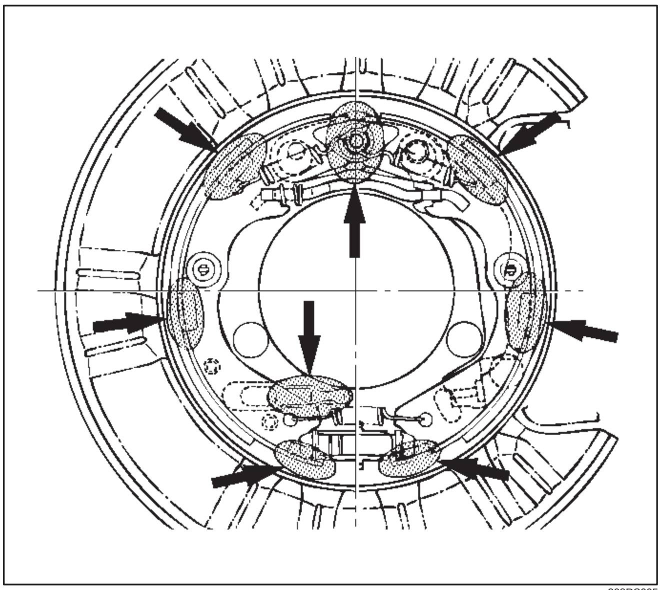
   Torque: 41N·m (30lb ft)
3. Tighten nut (12) to the specified torque.

   Torque: 15N·m (11lb ft)
4. Tighten bolt (11) (10) (9) to the specified torque.

   Torque: 6.5N·m (57lb in)
   - To adjust the parking brake, refer to “Parking Brake Adjustment” in this section.
5. Tighten the cable fixing bolt (8) to the specified

   Torque: 6.5N·m (57lb in)
6. Install shoe assembly (7).

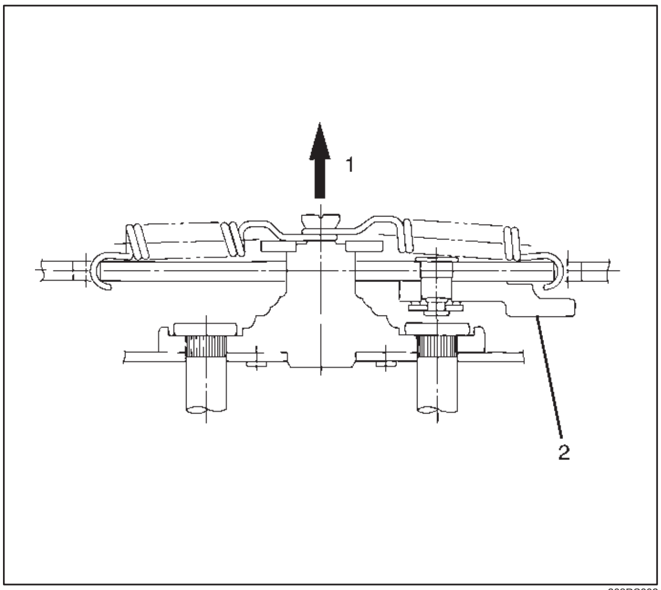
   After installation of the shoe and cable assembly, apply special grease (included in the repair kit) to the following portions indicated in the figure.



308RS005

7. Install lower return spring (6) and upper return spring (5).

   The parking brake lever side (secondary side) return spring must be installed on the outer side of the primary side return spring.



308RS003

Legend

(1) Outer Side

(2) Parking Lever

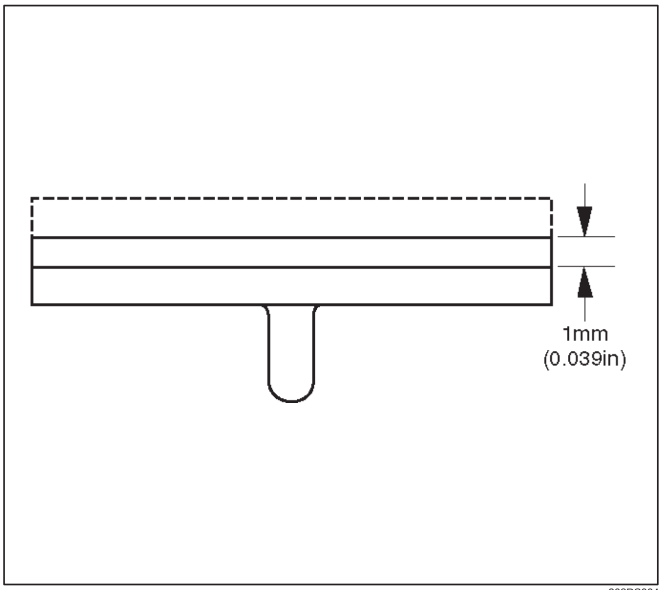
8. Install holding spring (4).
9. Install rotor (drum) (3).
10. Install caliper assembly (2).
11. Install rear wheels (1).

Inspection and Repair

Parking Brake Lining Inspection

Check the shoe assemblies for wear by removing the brake drum.
Replace the shoe assemblies if the lining thickness is less than 1.0 mm (0.039 in).

Minimum limit: 1.0 m (0.039 in)



308RS004

Parking Brake Rotor (Drum) Inspection

Refer to“Rear Disc Brakes” in Power-Assisted Brake System section for inspection procedure of the rotor (drum).

Parking Brake Adjustment

1. Prior to lever stroke adjustment, adjust rear brake shoe/rotor (drum) gap. Perform this procedure with loosening the adjust nut of the hand brake lever.
2. Remove the adjusting hole plug (rubber) and turn the shoe adjusting screw downward with a small screwdriver so that shoes will expand until they get into close touch with the rotor. (Turn down the adjusting screw notch by notch until the rotor does not turn.)
3. Turn the adjusting screw in the opposite direction (upward) until the rotor can be turned lightly. Standard number of notches to turn upward: 7 or 8

   Turn the rotor and make sure that there is no brake dragging.
4. After the rear brake shoe/rotor (drum) gap has been adjusted, perform parking brake cable adjustment.
5. Turn the adjusting nut so that the parking brake lever travels 6–8 notches when pulled up with a force of 30 kg (66 lb).
6. Make sure there is no brake dragging. Then tighten the cable lock nut

Torque : 13 N·m (113 lb in)

7. When poor braking effect possibly resulting from insufficient break–in is felt, or just after replacement of parking brake shoe, be sure to conduct break–in as follows:
8. Forward 50 km/h (30 mph) × 400 m (About 30 seconds) with a lever pull force of 15 kg (33 lb).
9. Backward 10 km/h (6 mph) × 50 m (About 18 seconds) with a lever pull force of 15 kg (33 lb).

NOTE: Break–in procedures must be performed under safe conditions and traffic rules.

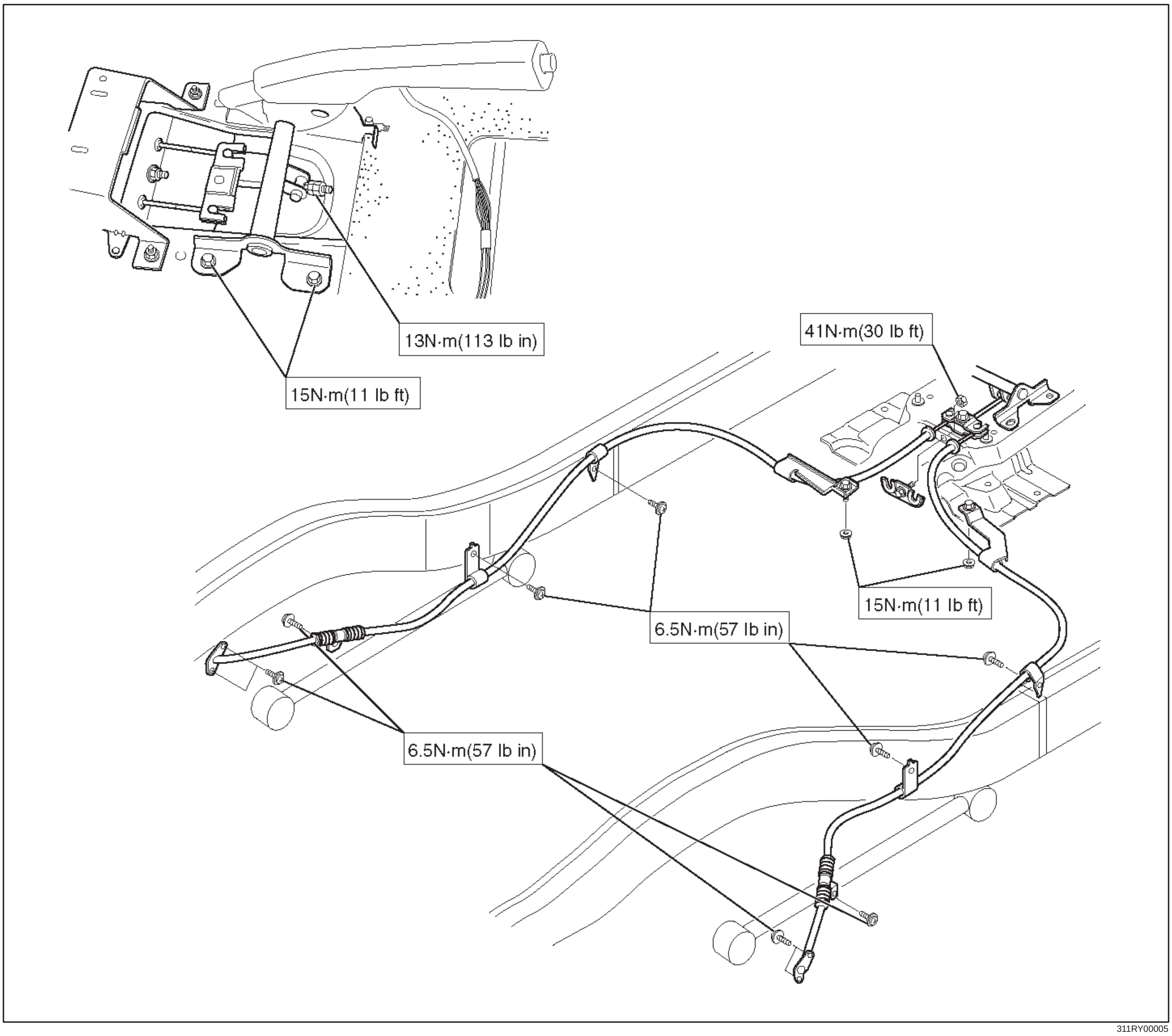
- If braking effect still remains poor after the above break–in, wait for some time until parking brake shoe cools down and repeat the procedures 8. and 9. noted above.
- On completion of break–in, inspect parking brake lever stroke, and if the lever does not come within the specified number of notches when pulled up, readjust.
- Excessive break–in may cause premature wear of the parking brake lining.

Main Data and Specifications

General Specifications

	Model
Type	Duo–servo
Drum inside diameter	210 mm(8.27 in)
Parking brake lever stroke	6–8 notches When pulled with a force of 30 kg (66 lb)

Torque Specifications



RODEO

BRAKES

PARKING BRAKE SYSTEM (4×2 Model)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

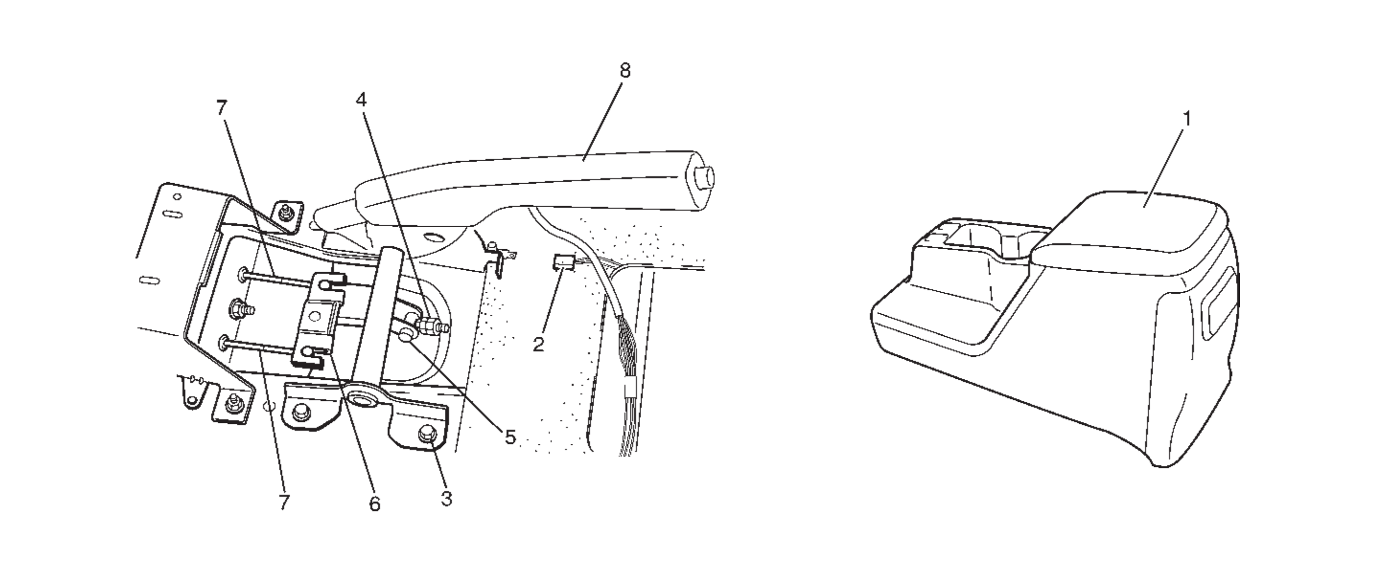
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Pulling up the parking brake lever by hand will set the parking brake. By means of a ratchet type lock, the lever can be held in that position until it is released. The position of the lever is transmitted through cable/lever systems to the rear wheels. These parts are designed to obtain sufficient braking force even when parking on slopes. When the parking brake is set, or when the ignition SW is in the“ON” position, the brake warning light illuminates. The rear wheel parking brake is a leading/trailing brake (mechanical inside expansion type). Parking brake adjustment is made through the adjusting hole (bored through back plate). Parking brake lever stroke should be adjusted to 6 notches. Refer to “Parking Brake Adjustment” in this section.

Parking Brake Lever

Parking Brake Lever Assembly and Associated Parts



311RW008

Legend

(1) Rear Console
(2) Switch Connector
(3) Bolt
(4) Adjust Nut and Lock Nut
(5) Trunnion Pin
(6) Equalizer
(7) Parking Brake Rear Cable
(8) Parking Brake Lever

Removal

1. Remove rear console (1).
   - Refer to Body and Accessories section.
2. Disconnect switch connector (2).
3. Remove bolt (3).
4. Remove adjust nut and lock nut (4).
5. Pull out equalizer (6) from trunnion pin (5).
6. Disconnect trunnion pin (5) from parking brake lever (8).
7. Disconnect parking brake rear cable (7).

Installation

1. Apply grease (BESCO L–2 or equivalent) to the connecting portion of the rear cable (7) and equalizer (8).
2. Connect parking brake rear cable (7) to equalizer (6).
3. Install trunnion pin (5) to parking brake lever (8).
4. Insert equalizer (6) into trunnion pin (5) and tighten adjust nut and lock nut (4).
   - To adjust the parking brake lever, see “Parking Brake Adjustment” in this section.

Lock Nut Torque: 13 N·m (113 lb in)

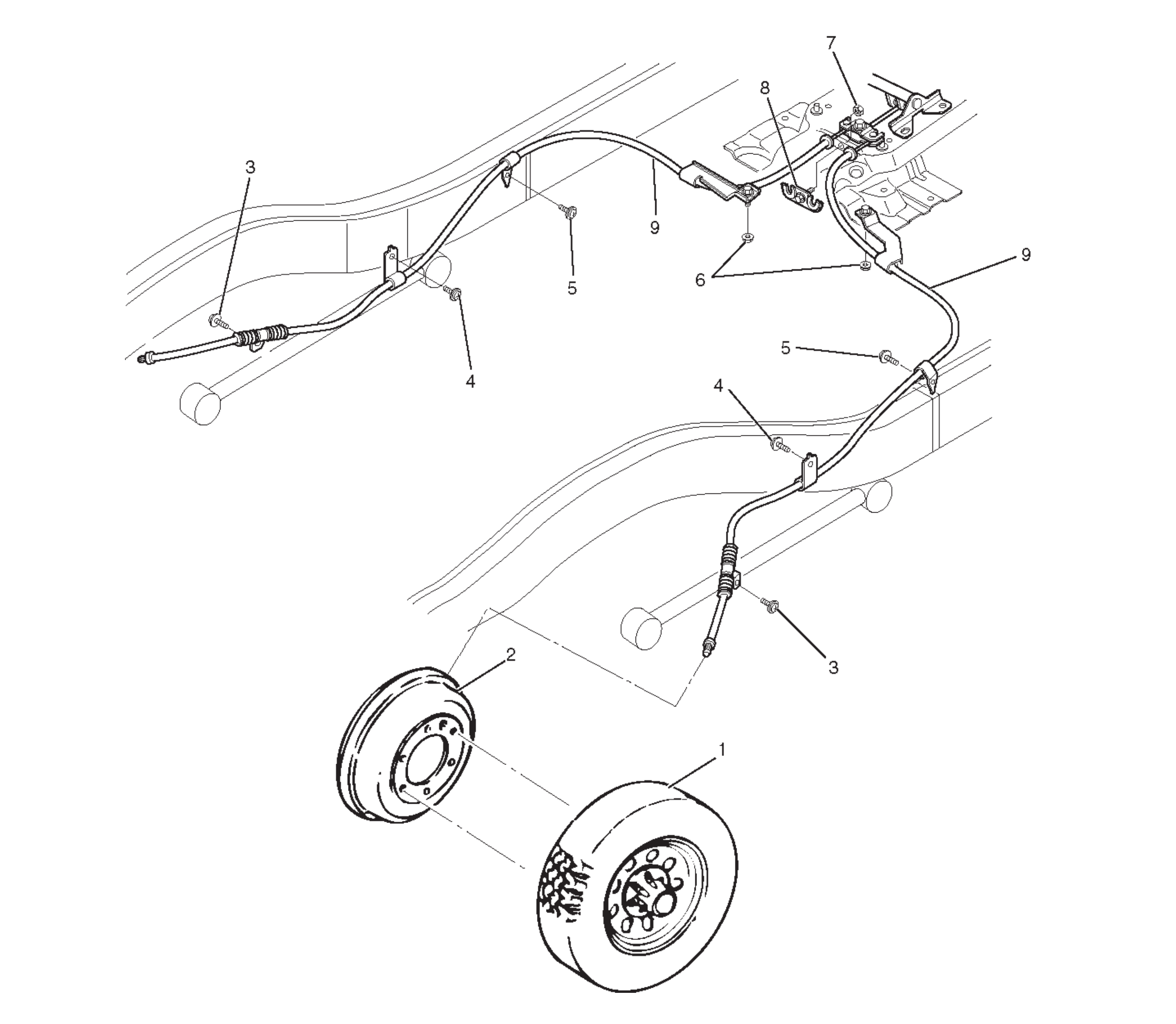
5. Tighten parking lever fixing bolt (3) to the specified torque.

Torque: 15 N·m (11 lb ft)

6. Connect switch connector (2).
7. Install rear console (1).
   - Refer to Body and Accessories section.

Parking Brake Rear Cable

Parking Brake Rear Cable and Associated Parts



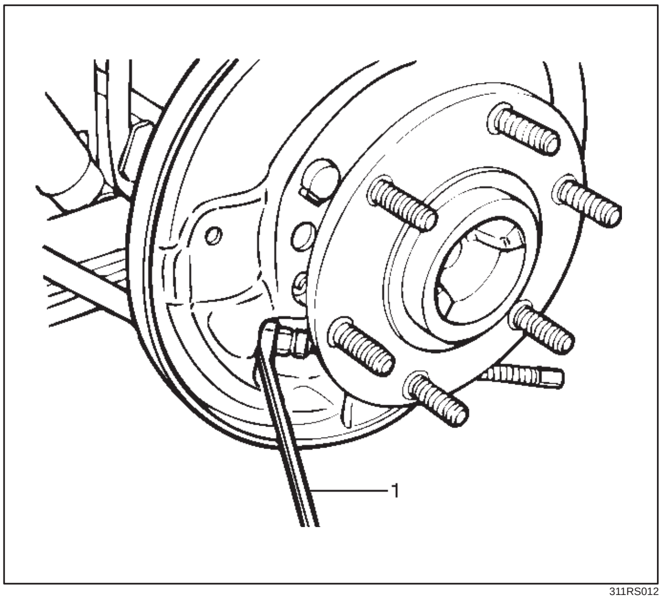
311RY00006

Legend

(1) Rear Wheels
(2) Drums
(3) Clip and Bolt
(4) Clip and Bolt
(5) Clip and Bolt (Only Long Wheel Base Model)
(6) Nut
(7) Nut
(8) Retainer
(9) Rear Cable

Removal

1. Remove rear wheels (1) and drums (2).
2. Remove bolt (3) (4) (5).
3. Remove nut (6).
4. Remove nut (7) and retainer (8).
5. Remove rear brake shoe assemblies. Refer to “Brake Lining Assembly and Associated Parts” in Power Assisted Brake System section.
6. Use offset box wrench (13 mm hex.) to compress the locking lugs on the cable, then remove the rear cable (9) from the Backing plate.



Legend

(1) Offset Box Wrench

Installation

1. Install rear cable (9).
2. Install retainer (8).
3. Tighten nut (7) to the specified torque.

   Torque : 41 N·m (30 lb ft)

   - To adjust the parking brake, refer to“Parking Brake Adjustment” in this section.
4. Tighten nut (6) to the specified torque.

   Torque : 15 N·m (11 lb ft)
5. Tighten bolt (5) (4) (3) to the specified torque.

   Torque : 6.5 N·m (57 lb in)
6. Install rear drums (2) and wheels (1).

Parking Brake Adjustment

NOTE: All brakes are self adjusting. Brakes are adjusted by repeated stepping on the brake pedal. (After stepping on the pedal and releasing it, the rear auto–adjuster, in the rear brake, produces a clicking sound. The same operation should be repeated until the sound disappears.)

Take the following steps after overhauling the rear brake assembly.

1. Move the parking brake lever to its fully released position.
2. Parking cable must be loosened sufficiently. (Loosen the adjust nut and the lock nut.).
3. Repeat stepping on the brake pedal firmly, and releasing it until the clicking sound can no longer be heard.

   If the difference between the brake drum inside diameter and diameter of the brake shoes is adjusted to be 0.5 mm, the number of times for depressing the brake pedal can be reduced.
4. Remove the drum. Measure the brake drum inside diameter and diameter of the brake shoes.

   Shoe clearance: 0.25 mm to 0.40 mm

   (0.0098 in to 0.0157 in)

   If incorrect, check the brake auto–adjusting system.
5. Rotate the adjust nut of hand brake lever until all slack disappears from the cable. Set the adjust nut.
6. Applying about 30 kg (66 lb) of force, pull the parking brake lever to its fully set position three or four times.
7. If the parking brake is properly adjusted, the travel between the fully disengaged position and the fully engaged position will be 6 notches.

   If the traveling range is not within these limits, repeat steps 1 through 5 again .

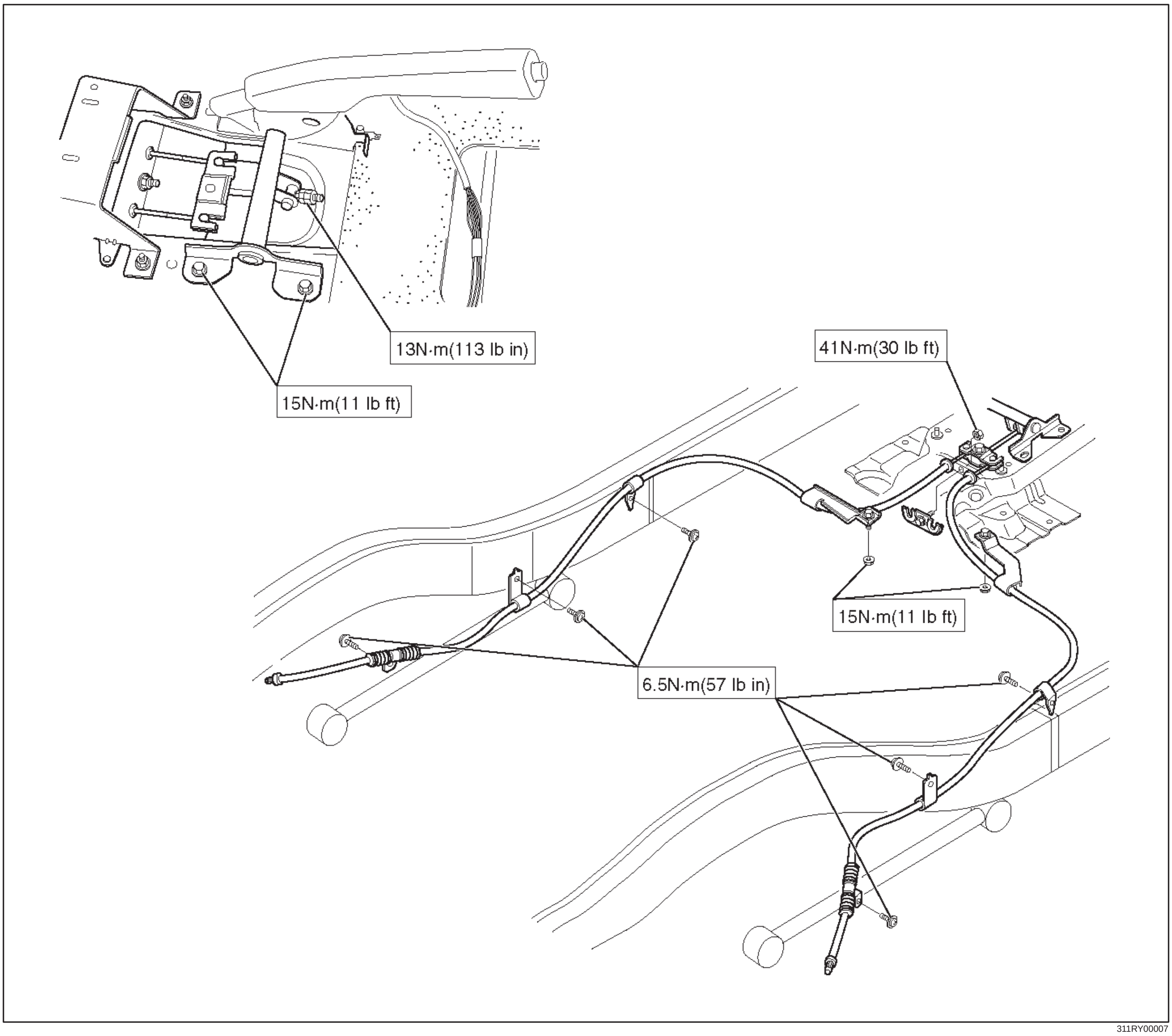
   After adjusting has been done, check to see if the rear wheel rotates smoothly without drag when turned by hand.

Main Data and Specifications

General Specifications

	Model
Type	Leading–Trailing
Drum inside diameter	295 mm (11.6 in)
Parking brake lever stroke	6–8 notches When pulled with a force of 30 kg (66 lb)

Torque Specifications



RODEO

ENGINE

CONTENTS

ENGINE MECHANICAL (X22SE 2.2L)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Engine Cleanliness And Care

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousandths of a millimeter (ten thousandths of an inch). Accordingly, when any internal engine parts are serviced, care and cleanliness are important. Throughout this section, it should be understood that proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to all friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order.
- At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables may result in damage to wire harness or other electrical parts.
- The four cylinders of this engine are identified by numbers; cylinders 1, 2, 3 and 4, as counted from crankshaft pulley.

General Information on Engine Service

The following information on engine service should be noted carefully, as it is important in preventing damage and contributing to reliable engine performance:

- When raising or supporting the engine for any reason, do not use a jack under the oil pan. Due to the small clearance between the oil pan and the oil pump strainer, jacking against the oil pan may cause damage to the oil pick up unit.
- The 12–volt electrical system is capable of damaging circuits. When performing any work where electrical terminals could possibly be grounded, the ground cable of the battery should be disconnected at the battery.
- Any time the intake air duct or air cleaner is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material into the cylinder which could cause extensive damage when the engine is started.

Cylinder Block

The cylinder block is made of cast iron. The crankshaft is supported by five bearings. The bearing cap is made of nodular cast iron.

Cylinder Head

The cylinder head is made of aluminum alloy casting with a spark plug in the center.

Valve Train

Valve system is direct–acting invertered bucket tappet.
The valves clearance adjustment are hydraulic.
Hydraulic valve lash adjustment, no adjustment necessary.

Intake Manifold

The intake manifold is made of aluminum alloy.

Exhaust Manifold

The exhaust manifold is made of high Si–Mo nodular iron.

Pistons and Connecting Rods

Aluminum pistons are used after selecting the grade that meets the cylinder bore diameter. Each piston has two compression rings and one oil ring. The piston pin is made of case–harded steel. The connecting rods are made of cast iron. The connecting rod bearings are made of steel backed with babbitt metal.

Crankshaft and Bearings

The crankshaft is made of nodular cast iron. Pins and journals are graded for correct size selection for their bearing.

Balance Shaft

Type is lanchester (twin counter–rotating shafts). The balance shafts are made of cast iron and gears are hard faced. The housing is made of cast iron. Backlash adjustment method is shim–balancer housing to block (selective fit).

Engine Diagnosis

Hard Starting

1. Starting Motor Does Not Turn Over

Trouble Shooting Procedure

Turn on headlights and starter switch.

Condition	Possible cause	Correction
Headlights go out or dim considerably	Battery run down or under charged	Recharge or replace battery
	Terminals poorly connected	Clean battery posts and terminals and connect properly
	Starting motor coil circuit shorted	Overhaul or replace
	Starting motor defective	Overhaul or replace

2. Ignition Trouble — Starting Motor Turns Over But Engine Does Not Start

Spark Test

Disconnect a high tension cable from any spark plug. Connect the spark plug tester J–26792 (ST–125), crank the engine, and check if a spark is generated in the spark plug tester. Before cranking the engine, make sure that the spark plug tester is properly grounded. To avoid electrical shock, do not touch the high tension cable while the engine is running.

Condition	Possible cause	Correction
Spark jumps across gap	Spark plug defective	Clean, adjust spark gap or replace
	Ignition timing incorrect	Refer to Ignition System
	Fuel not reaching fuel injector(s) or engine	Refer to item 3 (Trouble in fuel system)
	Valve timing incorrect	Adjust
	Engine lacks compression	Refer to item 4 (Engine lacks compression)
No sparking takes place	Ignition coil disconnected or broken	Connect properly or replace
	Electronic Ignition System with module	Replace
	Poor connections in engine harness	Correct
	Powertrain Control Module cable disconnected or defective	Correct or replace

3. Trouble In Fuel System

Condition	Possible cause	Correction
Starting motor turns over and spark occurs but engine does not start.	Fuel tank empty	Fill
	Water in fuel system	Clean
	Fuel filter clogged	Replace filter
	Fuel pipe clogged	Clean or replace
	Fuel pump defective	Replace
	Fuel pump circuit open	Correct or replace
	Evaporative Emission Control System circuit clogged	Correct or replace
	Multiport Fuel Injection System faulty	Refer to “Electronic Fuel Injection” section

4. Engine Lacks Compression

Condition	Possible cause	Correction
Engine lacks compression	Spark plug loosely fitted or spark plug gasket defective	Tighten to specified torque or replace gasket
	Valve timing incorrect	Adjust
	Cylinder head gasket defective	Replace gasket
	Valve incorrectly seated	Lap valve
	Valve stem seized	Replace valve and valve guide
	Valve spring weakened	Replace
	Cylinder or piston rings worn	Overhaul engine
	Piston ring seized	Overhaul engine.

Engine Compression Test Procedure

1. Start and run the engine until the engine reaches normal operating temperature.
2. Turn the engine off.
3. Remove all the spark plugs.
4. Remove ignition coil fuse (15A) and disable the ignition system.
5. Remove the fuel pump relay from the relay and fuse box.
6. Engage the starter and check that the cranking speed is approximately 300 rpm.
7. Install cylinder compression gauge into spark plug hole.
8. With the throttle valve opened fully, keep the starter engaged until the compression gage needle reaches the maximum level. Note the reading.
9. Repeat the test with each cylinder.
   The pressure difference between the individual cylinders should not exceed 100 kPa (14.5 psi).

Rough Engine Idling or Engine Stalling

Condition	Possible cause	Correction
Trouble in fuel injection system	Idle air control valve defective	Replace
	Throttle shutting off incomplete	Correct or replace
	Throttle position sensor circuit open or shorted	Correct or replace
	Fuel injector circuits open or shorted	Correct or replace
	Fuel injectors damaged	Replace
	Fuel pump relay defective	Replace
	Manifold Absolute Pressure Sensor cable disconnected or broken	Correct or replace
	Manifold Absolute Pressure Sensor defective	Replace
	Engine Coolant Temperature Sensor cable disconnected or broken	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	Intake Air Temperature sensor cable disconnected or broken	Correct or replace
	Intake Air Temperature sensor defective	Replace
	Knock Sensor (KS) circuits open or shorted	Correct or replace
	KS defective	Replace
	KS Module circuits open or ground	Correct or replace
	KS Module defective	Replace
	Vehicle Speed Sensor circuit open or shorted	Correct or replace
	Vehicle Speed Sensor defective	Replace
Trouble in emission control system	Powertrain Control Module defective	Replace
	Exhaust Gas Recirculation Valve faulty	Replace
	Canister purge solenoid circuit open	Correct
	Canister purge solenoid defective	Replace
	Evaporative Emission Canister Purge control valve defective	Replace
	Trouble in ignition system	Refer to Hard Start Troubleshooting Guide
Others	Engine lacks compression	Refer to Hard Start Troubleshooting Guide
	Valve incorrectly seated	Lap valve
	Air Cleaner Filter clogged	Replace filter element
	Valve timing incorrect	Readjust
	Idle air control valve broken	Replace

Rough Engine Running

Condition	Possible cause	Correction
Engine misfires regularly	Ignition coil layer shorted	Replace
	Spark plugs fouling	Clean or install hotter type plug
	Spark plug(s) insulator nose leaking	Replace
	Fuel injector(s) defective	Replace
	Engine control module faulty	Replace
Engine knocks regularly	Spark plugs running too hot	Install colder type spark plugs
	Powertrain control module faulty	Replace
Engine lacks power	Spark plugs fouled	Clean
	Fuel injectors defective	Replace
	Manifold Absolute Pressure (MAP) Sensor or Manifold Absolute Pressure Sensor circuit defective	Correct or replace
	Engine Coolant Temperature Sensor or Engine Coolant Temperature Sensor circuit defective	Correct or replace
	Engine Control Module faulty	Replace
	Intake Air Temperature Sensor or Intake Air Temperature Sensor circuit defective	Correct or replace
	Throttle Position Sensor or Throttle Position Sensor circuit defective	Correct or replace
	Knock Sensor or Knock Sensor circuits defective	Correct or replace
	Knock Sensor Module or Knock Sensor Module circuits defective	Correct or replace

Hesitation

Condition	Possible cause	Correction
Hesitation on acceleration	Throttle Position Sensor adjustment incorrect	Replace throttle valve assembly
	Throttle Position Sensor circuit open or shorted	Correct or replace
	Excessive play in accelerator linkage	Adjust or replace
	Manifold Absolute Pressure (MAP) Sensor circuit open or shorted	Correct or replace
	MAP Sensor defective	Replace
	Intake Air Temperature (IAT) Sensor circuit open or shorted	Correct or replace
	Knock Sensor (KS) Circuit open or shorted	Correct or replace
	KS defective	Replace
	KS Module circuits open or shorted	Correct or replace
	KS Module defective	Replace
	IAT Sensor defective	Replace
Hesitation at high speeds (Fuel pressure too low)	Fuel tank strainer clogged	Clean or replace
	Fuel pipe clogged	Clean or replace
	Fuel filter clogged	Replace
	Defective fuel pump system	Check and replace
	Fuel Pressure Control Valve leaking	Replace
Hesitation at high speeds (Fuel injector not working normally)	Power supply or ground circuit for Multiport Fuel Injection System shorted or open	Check and correct or replace
	Cable of Multiport Fuel Injection System disconnected or defective	Correct or replace
Hesitation at high speeds	Engine Control Module defective	Replace
	Throttle Position Sensor circuit open or shorted	Correct or replace
	Throttle Position Sensor defective	Replace
	Engine Coolant Temperature Sensor circuit open or shorted	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	MAP Sensor cable open or shorted	Correct or replace
	MAP Sensor defective	Replace
	IAT Sensor circuit open or shorted	Correct or replace
	IAT Sensor defective	Replace
	KS Circuit open or shorted	Correct or replace
	KS defective	Replace
	KS Module circuit open or shorted	Correct or replace
	KS Module defective	Replace
	Throttle valve not wide opened	Check and correct or replace
	Air Cleaner Filter clogged	Replace filter element
	Power supply voltage too low	Check and correct or replace

Engine Lacks Power

Condition	Possible cause	Correction
Trouble in fuel system	Fuel Pressure Control Valve not working normally	Replace
	Fuel injector clogged	Clean or replace
	Fuel pipe clogged	Clean
	Fuel filter clogged or fouled	Replace
	Fuel pump drive circuit not working normally	Correct or replace
	Fuel tank not sufficiently breathing due to clogged Evaporative Emission Control System circuit	Clean or replace
	Water in fuel system	Clean
	Inferior quality fuel in fuel system	Use fuel of specified octane rating
	Engine Control Module supplied poor voltage	Correct circuit
	Throttle Position Sensor cable disconnected or broken	Correct or replace
	Throttle Position Sensor defective	Replace
	Manifold Absolute Pressure Sensor not working normally	Replace
	Intake Air Temperature Sensor not working normally	Replace
	Engine Coolant Temperature Sensor circuit open or shorted	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	Engine Control Module defective	Replace
Trouble in intake or exhaust system	Air Cleaner Filter clogged	Replace filter element
	Air duct kinked or flattened	Correct or replace
Ignition failure	————	Refer to Hard Start Troubleshooting Guide
	Heat range of spark plug inadequate	Install spark plugs of adequate heat range
	Electronic Ignition System with module	Replace

Condition	Possible cause	Correction
Engine overheating	Level of Engine Coolant too low	Replenish
	Thermo switch or fan motor defective	Replace
	Thermostat defective	Replace
	Engine Coolant pump defective	Correct or replace
	Radiator clogged	Clean or replace
	Radiator filler cap defective	Replace
	Level of oil in engine crankcase too low or wrong oil in engine	Change or replenish
	Resistance in exhaust system increased	Clean exhaust system or replace defective parts
	Throttle Position Sensor adjustment incorrect	Adjust Wide Open Throttle switch setting
	Throttle Position Sensor circuit open or shorted	Correct or replace
	Cylinder head gasket damaged	Replace
Engine overcooling	Thermostat defective	Replace (Use a thermostat set to open at 92˚C (197.6˚F))
Engine lacks compression	————	Refer to Hard Start
Others	Tire inflation pressure abnormal	Adjust to recommend pressures
	Brake drag	Adjust
	Clutch slipping	Adjust or replace
	Level of oil in engine crankcase too high	Correct level of engine oil
	Exhaust Gas Recirculation Valve defective	Replace

Engine Noisy

Abnormal engine noise often consists of various noises originating in rotating parts, sliding parts and other moving parts of the engine. It is, therefore, advisable to locate the source of noise systematically.

Condition	Possible cause	Correction
Noise from crank journals or from crank bearings (Faulty crank journals and crank bearings usually make dull noise that becomes more evident when accelerating)	Oil clearance increased due to worn crank journals or crank bearings	Replace crank bearings and crankshaft or regrind crankshaft and install the over size bearing
	Crankshaft out of round	Replace crank bearings and crankshaft or regrind crankshaft and install the over size bearing
	Crank bearing seized	Crank bearing seized Replace crank bearings and crankshaft or regrind crankshaft and install the over size bearing

Troubleshooting Procedure

Short out each spark plug in sequence using insulated spark plug wire removers. Locate cylinder with defective bearing by listening for abnormal noise that stops when spark plug is shorted out.

Condition	Possible cause	Correction
Noise from connecting rods or from connecting rod bearings (Faulty connecting rods or connecting rod bearings usually make an abnormal noise slightly higher than the crank bearing noise, which becomes more evident when engine is accelerated)	Bearing or crankshaft pin worn	Replace connecting rod bearings and crankshaft or regrind crankshaft and install the under size bearing
	Crankpin out of round	Replace connecting rod bearings and crankshaft or regrind crankshaft and install the under size bearing
	Connecting rod bent	Correct or replace
	Connecting rod bearing seized	Replace connecting rod bearings and crankshaft or regrind crankshaft and install the under size bearing

Troubleshooting Procedure

Abnormal noise stops when the spark plug on the cylinder with defective part is shorted out.

Condition	Possible cause	Correction
Piston and cylinder (Faulty piston or cylinder usually makes a combined mechanical thumping noise which increases when engine is suddenly accelerated but diminishes gradually as the engine warms up)	Piston clearance increased due to cylinder wear	Replace piston and cylinder body
	Piston seized	Replace piston and cylinder body
	Piston ring broken	Replace piston and cylinder body
	Piston defective	Replace pistons and others

Troubleshooting Procedure

Short out each spark plug and listen for change in engine noise.

Condition	Possible cause	Correction
Piston pin noise (Piston makes noise each time it goes up and down)	Piston pin or piston pin hole worn	Replace piston, piston pin and connecting rod assy

Troubleshooting Procedure

The slapping sound stops when spark plug on bad cylinder is shorted out.

Condition	Possible cause	Correction
Timing belt noise	Timing belt tension is incorrect	Replace pusher or adjust the tension pulley or replace timing belt
	Tensioner bearing defective	Replace
	Timing belt defective	Replace
	Timing wheels defective	Replace
	Timing belt comes in contact with timing cover	Replace timing belt and timing cover
Valve noise	Valve and valve guide seized	Replace valve and valve guide
	Valve spring broken	Replace
	Valve seat off–positioned	Correct
Crankshaft noise	Crankshaft end play excessive (noise occurs when clutch is engaged)	Replace thrust bearing
Engine knocking	Preignition due to use of spark plugs of inadequate heat range	Install Spark Plugs of adequate heat range
	Fuel too low in octane rating	Replace fuel
	Wide Open Throttle enrichment system failure	Refer to Section 6E
	Selection of transmission gear incorrect	Caution operator of incorrect gear selection
	Engine overheating	Refer to “Engine Lacks Power”
Others	Water pump defective	Replace
	Drive belt slipping	Adjust tension of drive belt or replace drive belt

Abnormal Combustion

Condition	Possible cause	Correction
Trouble in fuel injection system	Fuel pressure control valve defective	Replace
	Fuel filter clogged	Replace
	Fuel pump clogged	Clean or replace
	Fuel tank or fuel pipe clogged	Clean or replace
	Fuel injector clogged	Clean or replace
	Fuel pump relay defective	Replace
	Power supply cable for fuel pump loosely connected or defective	Reconnect, correct or replace
	Manifold Absolute Pressure Sensor circuit open or shorted	Correct or replace
	Manifold Absolute Pressure Sensor defective	Replace
	Engine Coolant Temperature (ECT) Sensor circuit open or shorted	Correct or replace
	ECT Sensor defective	Replace
	Throttle Position Sensor adjustment incorrect	Reconnect
	Throttle Position Sensor defective	Replace
	Throttle Position Sensor connector loosely connected	Reconnect
	Vehicle Speed Sensor cable loosely connected or defective	Correct or replace
	Vehicle Speed Sensor loosely fixed	Fix tightly
	Vehicle Speed Sensor in wrong contact or defective	Replace
	Engine Control Module cable loosely connected or defective	Correct or replace
Trouble in emission control system	Heated Oxygen Sensor circuit open	Correct or replace
	Heated Oxygen Sensor defective	Replace
	Signal vacuum hose loosely fitted or defective	Correct or replace
	Exhaust Gas Recirculation Valve defective	Replace
	ECT Sensor circuit open or shorted	Correct or replace
	ECT Sensor defective	Replace
	Evaporator system	Refer to Section 6E
Trouble in ignition system	————	Refer to “Engine Lacks Power”
Trouble in cylinder head parts	Carbon deposits in combustion chamber	Remove carbon
	Carbon deposit on valve, valve seat and valve guide	Remove carbon

Engine Oil Consumption Excessive

Condition	Possible cause	Correction
Oil leaking	Oil pan drain plug loose	Retighten or replace gasket
	Oil pan setting bolts loosened	Retighten
	Oil pan gasket broken	Replace gasket
	Front cover retaining bolts loose or gasket broken	Retighten or replace gasket
	Head cover retaining bolts loose or gasket broken	Retighten or replace gasket
	Oil filter adapter cracked	Replace
	Oil filter attachings bolt loose or rubber gasket broken	Retighten or replace oil filter
	Crankshaft front or rear oil seal defective	Replace oil seal
	Oil pressure unit loose or broken	Retighten or replace
	Blow–by gas hose broken	Replace hose
	Engine/Transmission coupling area	Replace oil seal
Oil leaking into combustion chambers due to poor seal in valve system	Valve stem oil seal defective	Replace
	Valve stem or valve guide worn	Replace valve and valve guide
Oil leaking into combustion chambers due to poor seal in cylinder parts	Cylinders and pistons worn excessively	Rebore cylinder and replace pistons and others
	Piston ring gaps incorrectly positioned	Correct
	Piston rings set with wrong side up	Correct
	Piston ring sticking	Rebore cylinder and replace pistons and others
	Piston ring and ring groove worn	Replace pistons and others
	Return ports in oil rings clogged	Clean piston and replace rings
Crank case ventilation, Positive Crankcase Ventilation System malfunctioning	Positive Crankcase Ventilation Hose clogged	Clean
Others	Improper oil viscosity	Use oil of recommended S.A.E. viscosity
	Continuous high speed driving and/or severe usage such as trailer towing	Continuous high speed operation and/or severe usage will normally cause increased oil consumption

Fuel Consumption Excessive

Condition	Possible cause	Correction
Trouble in fuel system	Mixture too rich or too lean due to trouble in fuel injection system	Refer to “Abnormal Combustion”
	Fuel cut function does not act	Refer to “Abnormal Combustion”
Trouble in ignition system	Misfiring or abnormal combustion due to trouble in ignition system	Refer to Hard Start or Abnormal Combustion Troubleshooting Guide
Others	Engine idle speed too high	Reset Idle Air Control Valve
	Returning of accelerator control sluggish	Correct
	Fuel system leakage	Correct or replace
	Clutch slipping	Correct
	Brake drag	Correct
	Selection of transmission gear incorrect	Caution operator of incorrect gear selection
	Excessive Exhaust Gas Recirculation flow due to trouble in Exhaust Gas Recirculation system	Refer to Abnormal Combustion

Oil Problems

Condition	Possible cause	Correction
Oil pressure too low	Wrong oil in use	Replace with correct engine oil
	Relief valve sticking	Replace
	Oil pump not operating properly	Correct or replace
	Oil pump strainer clogged	Clean or replace strainer
	Oil pump worn	Replace
	Oil pressure gauge defective	Correct or replace
	Crankshaft bearing or connecting rod bearing worn	Replace
Oil contamination	Wrong oil in use	Replace with new engine oil
	Oil filter clogged	Replace oil filter
	Cylinder head gasket damage	Replace gasket
	Burned gases leaking	Replace piston and piston rings or rebore cylinders
Oil not reaching valve system	Oil passage in cylinder head or cylinder body clogged	Clean or correct

Engine Oil Pressure Check

1. Check for dirt, gasoline or water in the engine oil.
   a. Check the viscosity of the oil.
   b. Change the oil if the viscosity is outside the specified standard.
   c. Refer to the “Maintenance and Lubrication” section of this manual.
2. Check the engine oil level.
   The level should fall somewhere between the “ADD” and the “FULL” marks on the oil level dipstick.
   If the oil level does not reach the “ADD” mark on the oil level dipstick, engine oil must be added.
3. Remove the oil pressure unit.
4. Install an oil pressure gauge.
5. Start the engine and allow the engine to reach normal operating temperature (About 80˚C).
6. Measure the oil pressure.

   Oil pressure should be:

   150 kPa (21.8 psi) at idle speed.
7. Stop the engine.
8. Remove the oil pressure gauge.
9. Install the oil pressure unit.
10. Start the engine and check for leaks.

Malfunction Indicator Lamp

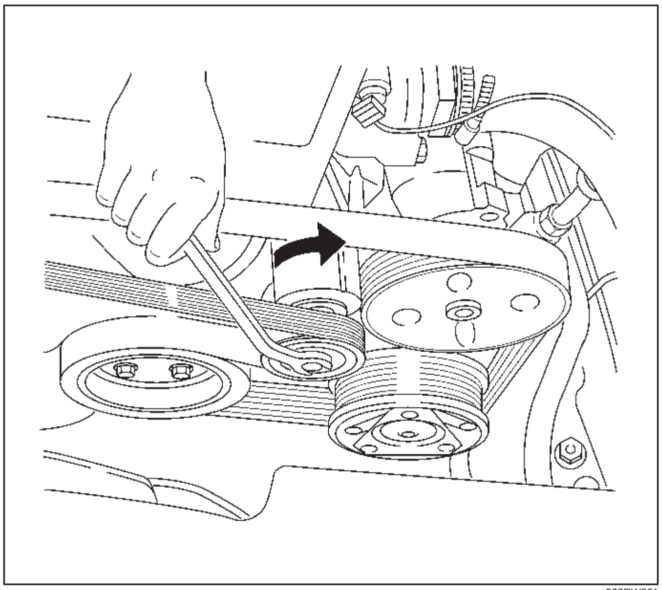
The instrument panel "CHECK ENGINE" Malfunction Indicator Lamp (MIL) illuminates by self diagnostic system when the system checks the starting of engine, or senses malfunctions.

Condition	Possible cause	Correction
"CHECK ENGINE" MIL does not illuminate at the starting of engine	Bulb defective	Replace
	MIL circuit open	Correct or replace
	Command signal circuit to operate self diagnostic system shorted	Correct or replace
	Powertrain Control Module (PCM) cable loosely connected, disconnected or defective	Correct or replace
	PCM defective	Replace
"CHECK ENGINE" MIL illuminates, and stays on	Deterioration heated oxygen sensor of internal element	Replace
	Heated oxygen sensor connector terminal improper contact	Reconnect properly
	Heated oxygen sensor lead wire shorted	Correct
	Heated oxygen sensor circuit open	Correct or replace
	Deterioration engine coolant temperature sensor of internal element	Replace
	Engine coolant temperature sensor connector terminal improper contact	Reconnect properly
	Engine coolant temperature sensor lead wire shorted	Correct
	Engine coolant temperature sensor circuit open	Correct or replace
	Throttle position sensor open or shorted circuits	Correct or replace
	Deterioration of crankshaft position sensor	Replace
	Crankshaft position sensor circuit open or shorted	Correct or replace
	Vehicle speed sensor circuit open	Correct or replace
	Manifold absolute pressure sensor circuit open or shorted	Correct or replace
	Intake air temperature sensor circuit open or shorted	Correct or replace
	Fuel injector circuit open or shorted	Correct or replace
	PCM driver transistor defective	Replace PCM
	Malfunctioning of PCM RAM (Random Access Memory) or ROM (Read Only Memory)	Replace PCM

Cylinder Head Cover

Removal

1. Disconnect battery ground cable.
2. Disconnect PCV hose from cylinder head cover.
3. Remove intake duct.
4. Remove left side ground cable from cylinder head cover and disconnect ground cable connector on the left side wheel arch. Remove right side ground cable from generator stay and disconnect ground cable connector on the right side wheel arch.
5. Disconnect three(black, green and blue colors) engine wire harness connectors from chassis harness of left rear side of compartment.
6. Disconnect cooling fan wire harness connector from cooling fan on left side top of fan shroud.
7. Move drive belt tensioner to loose side using wrench then remove drive belt.



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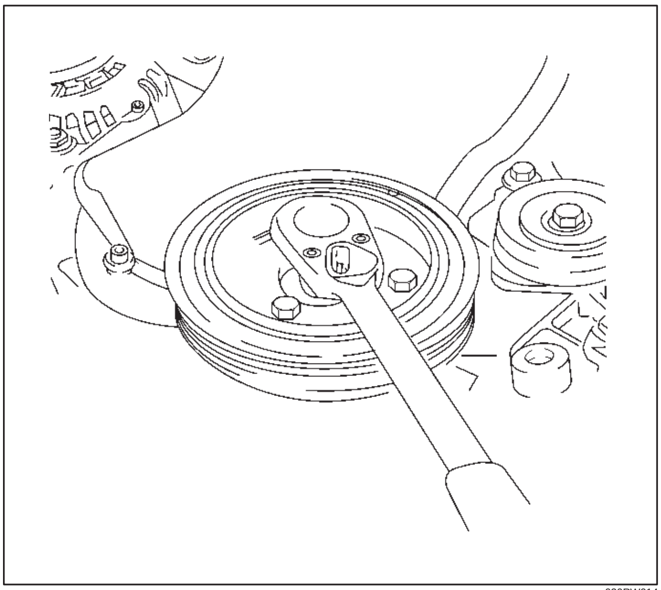
8. Remove PCV hose from cylinder block.
9. Remove intake duct stay from cylinder head.
10. Remove two bolts for remove ignition cable cover from cylinder head cover.
11. Disconnect ignition cable from ignition plug.
12. Disconnect camshaft position sensor harness and crankshaft angle sensor harness from behind generator.
13. Remove four bolts and remove the crankshaft pulley



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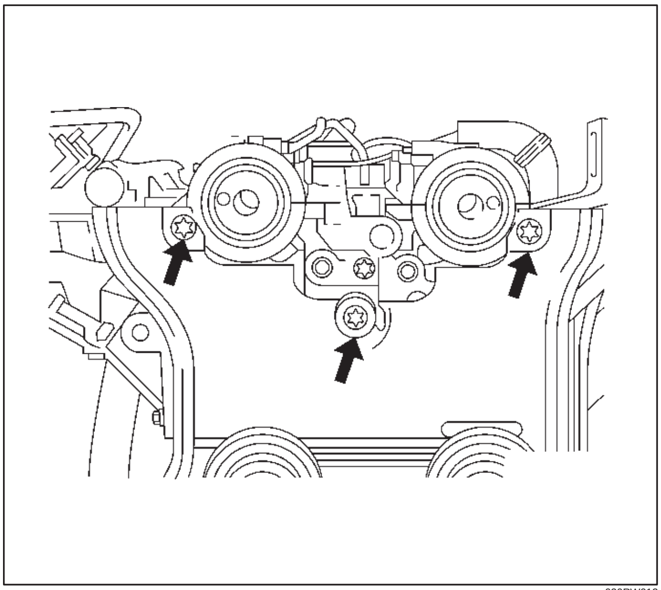
14. Remove timing belt front cover.
15. Loose fixing bolt of timing belt rear cover then remove the camshaft angle sensor.



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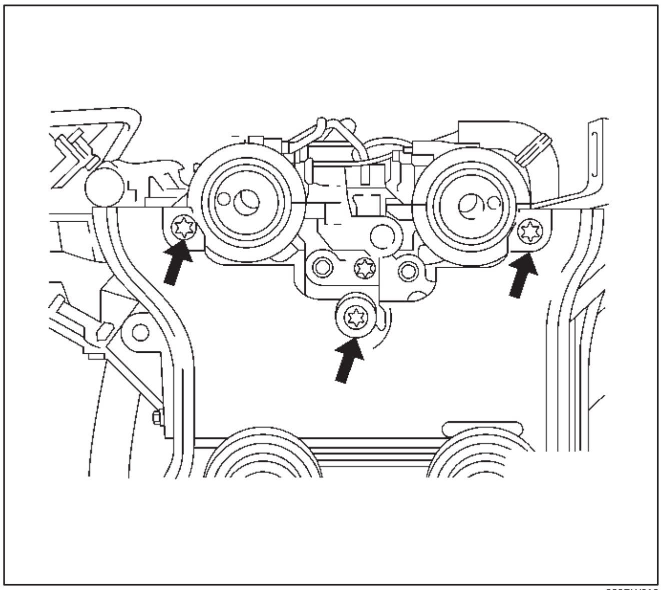
16. Remove ten cylinder head cover fixing bolts and remove the cylinder head cover.

Installation

1. Install the camshaft position sensor and tighten timing rear cover bolt.

Torque: 8 N·m (5.9 lb ft)



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2. Install the cylinder head cover and tighten bolts to the specified torque.

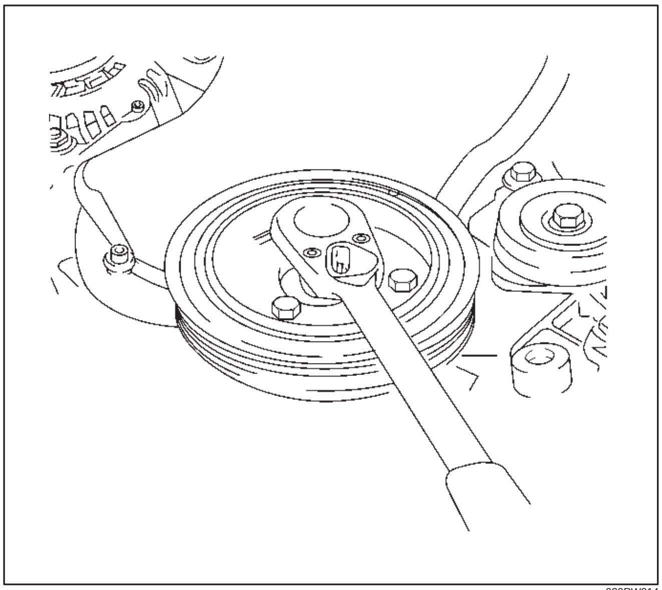
Torque: 8 N·m (5.9 lb ft)

3. Install the timing belt front cover then tighten fixing bolts to the specified torque.

Torque: 6 N·m (4.4 lb ft)

4. Install the crankshaft pulley, tighten fixing bolts to the specified torque.

Torque: 20 N·m (14 lb ft)



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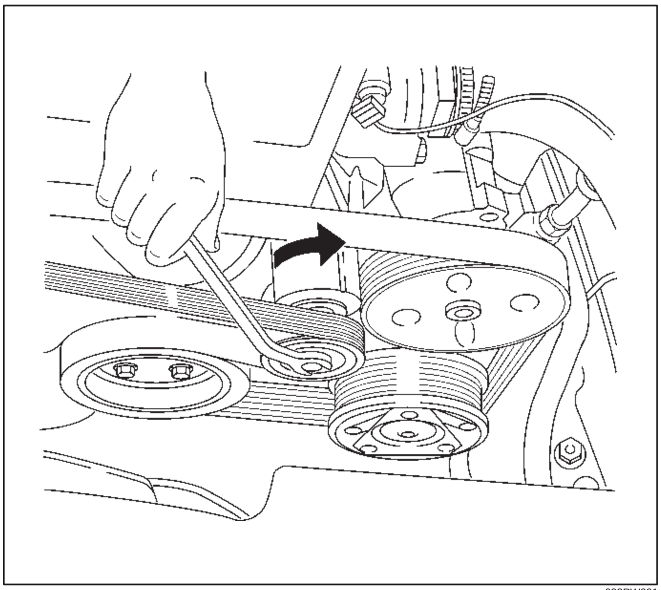
5. Move drive belt tensioner to loose side using wrench then install the drive belt to normal position.



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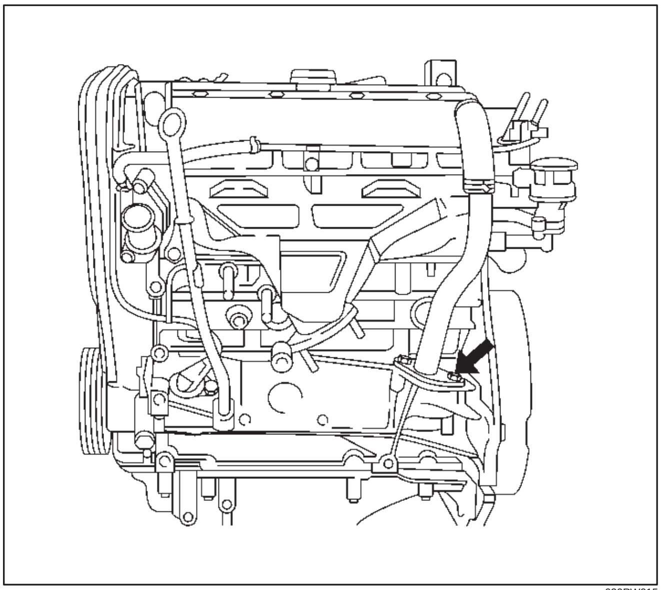
6. Connect ignition cable to ignition plug.
7. Install ignition cable cover to cylinder head cover and tighten two bolt to the specified torque.

Torque: 3 N·m (2 lb ft)

8. Install intake duct bracket to cylinder block.
9. Install PCV hose flange to cylinder block to the specified torque.

Torque: 25 N·m (18 lb ft)



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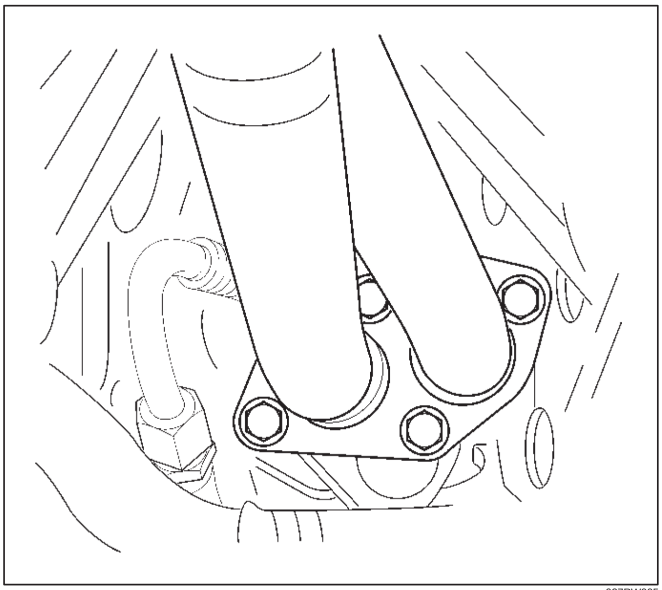
10. Connect cooling fan wire harness connector to cooling fan on left side top of fan shroud.
11. Connect left side ground cable to cylinder head cover and connect other side connector to left side wheel arch terminal.
    Connect right side ground cable to generator stay and connect other side connector to right side wheel arch terminal.
12. Connect three(black, green and blue colors) engine wire harness connector to chassis harness of left rear side of engine compartment.
13. Install intake duct.
14. Connect PCV hose to cylinder head cover.
15. Connect battery ground cable.

Exhaust Manifold

Removal

1. Disconnect battery ground cable.
2. Disconnect PCV hose from air intake duct.
3. Remove a nut from air intake duct bracket and loosen hose clamp on throttle body. Remove air intake duct assembly with air cleaner cover.
4. Remove air intake duct bracket with ground cable.
5. Remove four fixing bolts on exhaust manifold heat protector.
6. Remove fixing four nuts from flange of front exhaust pipe and remove fixing bolts from silencer side.



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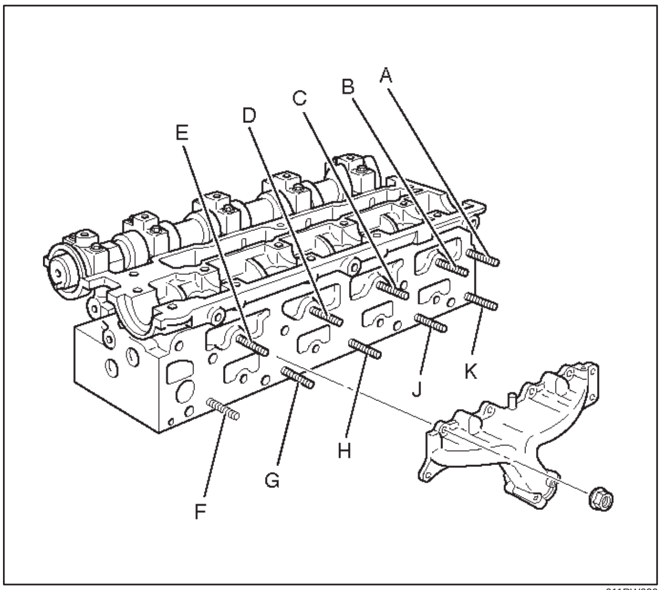
7. Remove ten exhaust manifold fixing nuts then remove exhaust manifold.

Installation

1. Install exhaust manifold and tighten fixing nuts to be tightened in three steps.
- **Tightening sequence:**
  - **Step1: J G H B D C J G B D**
  - **Step2: A B C D E F G H J K**
  - **Step3: A B C D E F G H J K**
- **Tightening torque:**
  - **Step1: 14 N·m (10 lb ft)**
  - **Step2: 20 N·m (14 lb ft)**
  - **Step3: 20 N·m (14 lb ft)**



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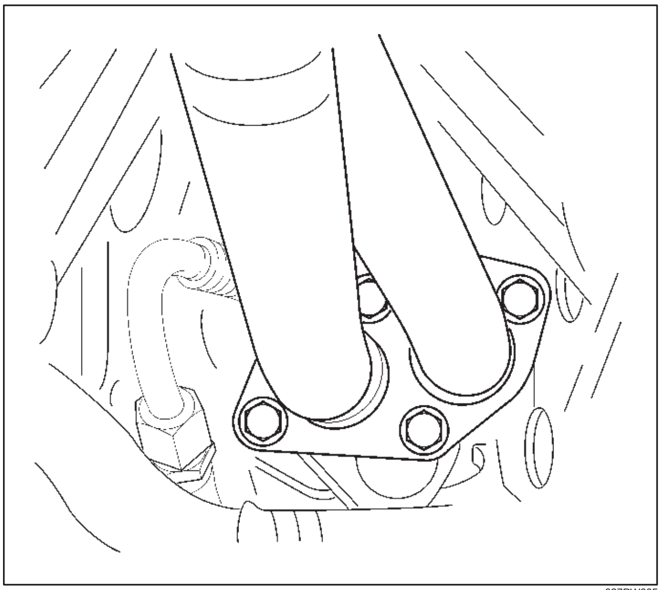
2. Install front exhaust pipe to exhaust manifold and tighten fixing nut to the specified torque.

Torque: 25 N·m (18 lb ft)



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3. Tighten silencer side bolt to the specified torque.

Torque: 68 N·m (50 lb ft)

4. Install exhaust manifold heat protector and tighten bolt.

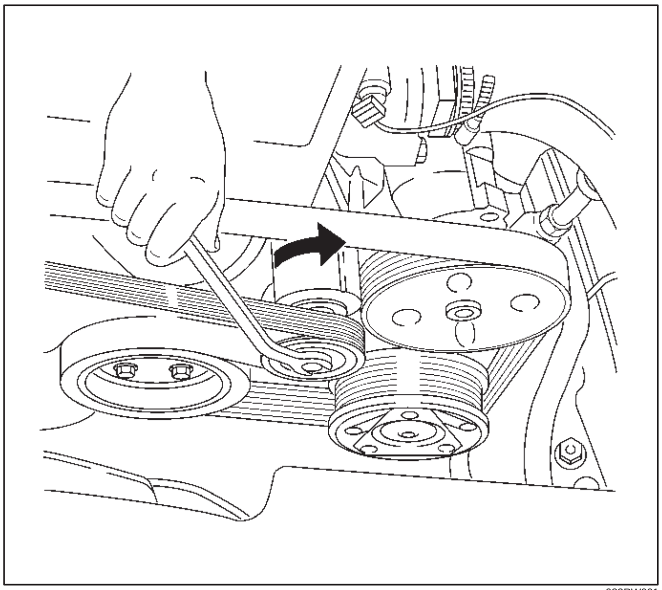
Torque: 8 N·m (5.9 lb ft)

5. Install intake duct bracket with ground cable.
6. Install intake duct assembly to throttle body and air cleaner then tighten nut to the intake duct bracket and clamp on the throttle body side, also clamp air cleaner cover.
7. Connect PCV hose to air intake duct.
8. Connect battery ground cable.

Crankshaft Pulley

Removal

1. Disconnect battery ground cable.
2. Move drive belt tensioner to loose side by using wrench then remove drive belt.



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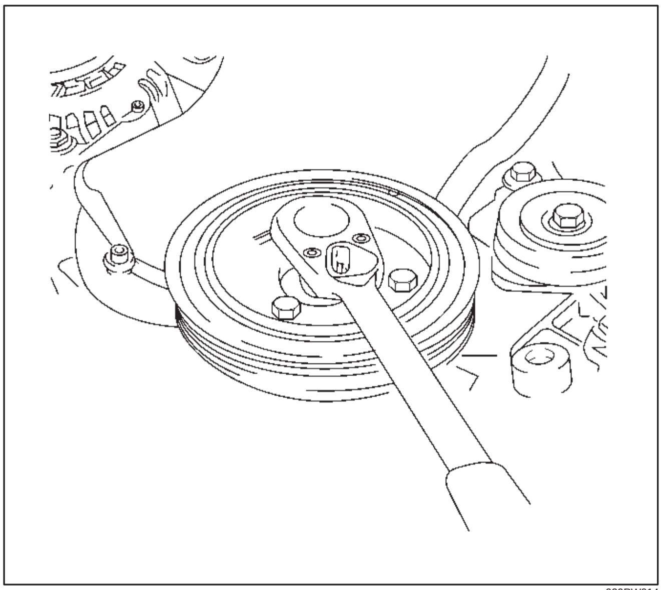
3. Remove four crankshaft pulley fixing bolts, remove crankshaft pulley.



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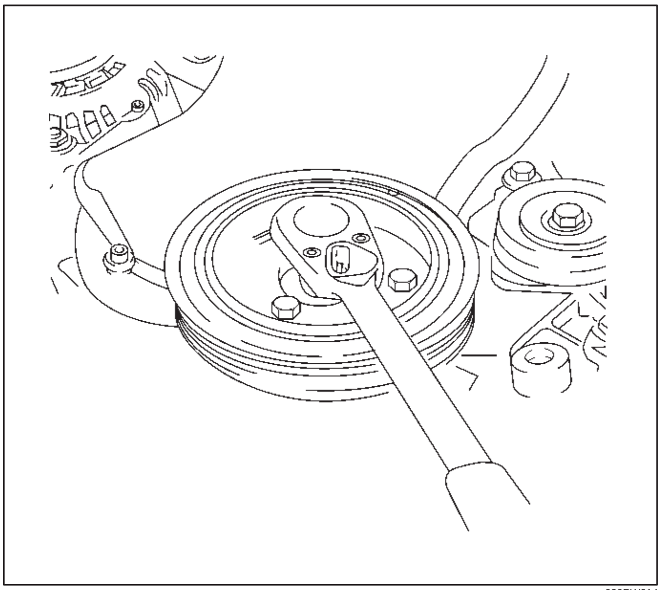
Installation

1. Install the crankshaft pulley to crankshaft flange.
2. Tighten four bolt to the specified torque.

Torque: 20 N·m (14 lb ft)



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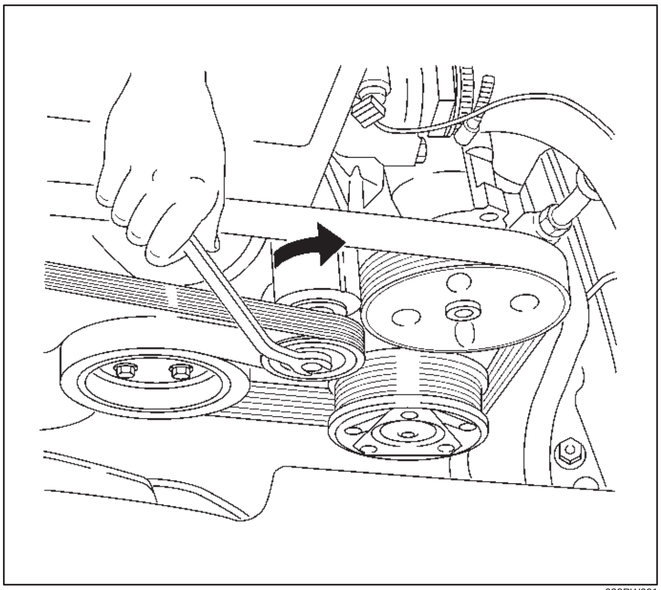
3. Move drive belt tensioner to loose side by using wrench, then install drive belt to normal position.



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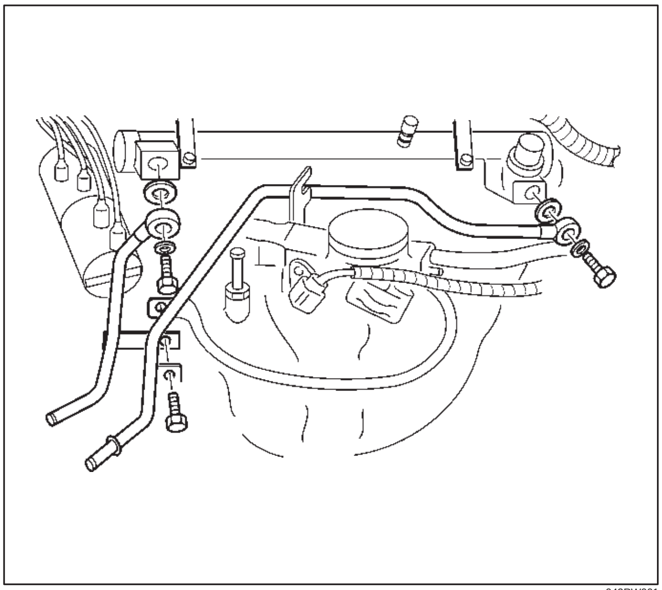
4. Connect battery ground cable.

Intake Manifold

Removal

1. Disconnect battery ground cable.
2. Remove PCV hose from air intake duct.
3. Remove a nut from air intake duct bracket and loosen hose clamp on throttle body. Remove air intake duct assembly with air cleaner cover.
4. Drain engine coolant.
5. Remove water hoses from throttle body.
6. Disconnect the connector for throttle position sensor, idle air control valve sensor from throttle body.
7. Remove fuel pipe joint eye bolts from fuel rail and disconnect wire harness from fuel injector.



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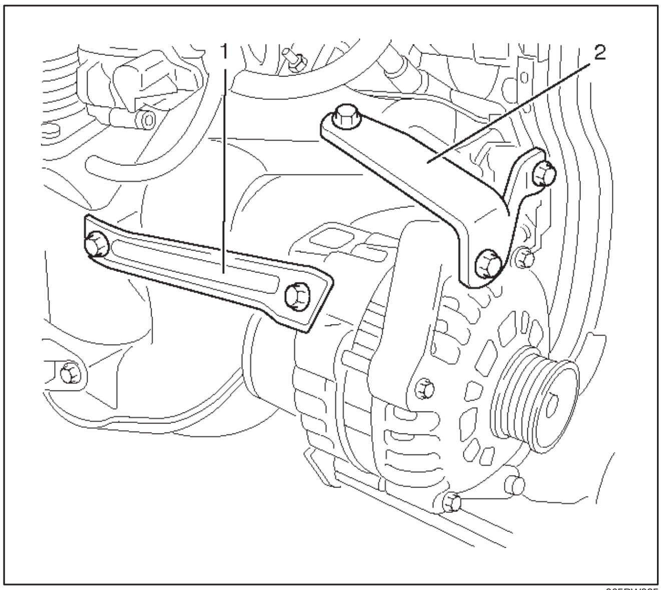
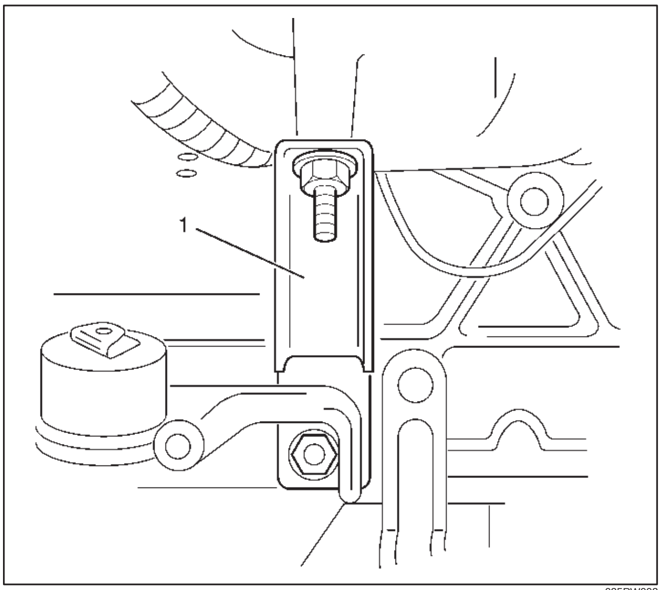
8. Disconnect hose from fuel pressure regulator then remove fuel rail assembly.
9. Remove throttle valve control cable from throttle body.
10. Remove fixing bolts for generator bracket.



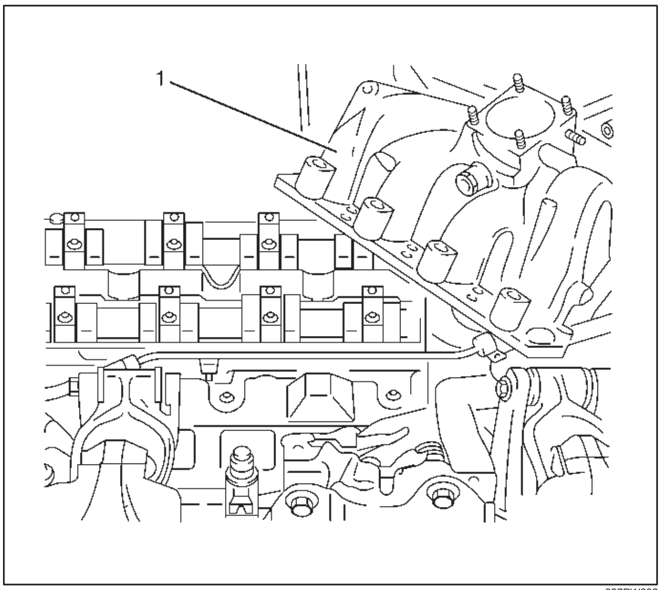
065RW025

11. Remove water pipe fixing bolt then remove water pipe.
12. Remove fixing bolt from bracket (Between cylinder block and intake manifold) of intake manifold side.



025RW002

13. Remove ignition coil bracket fixing bolt.
14. Remove bolt and seven nuts, and remove intake manifold.

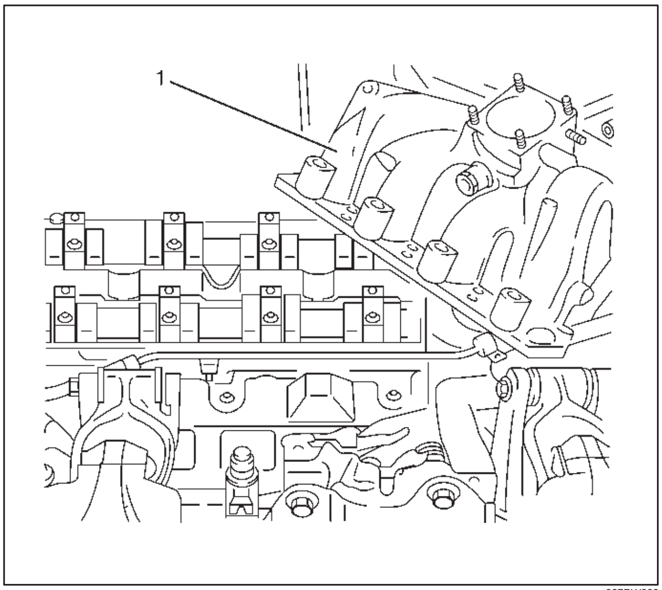


027RW002

Installation

1. Install intake manifold with gasket to cylinder head, tighten bolt and nuts to the specified torque.

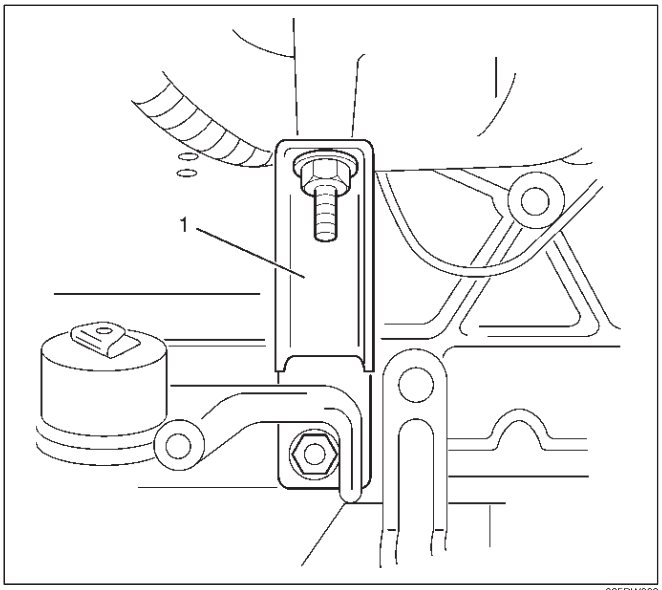
Torque: 22 N·m (16 lb ft)



027RW002

2. Install ignition coil bracket fixing bolt.
3. Install intake manifold bracket, tighten bolt.

Torque: 22 N·m (16 lb ft)



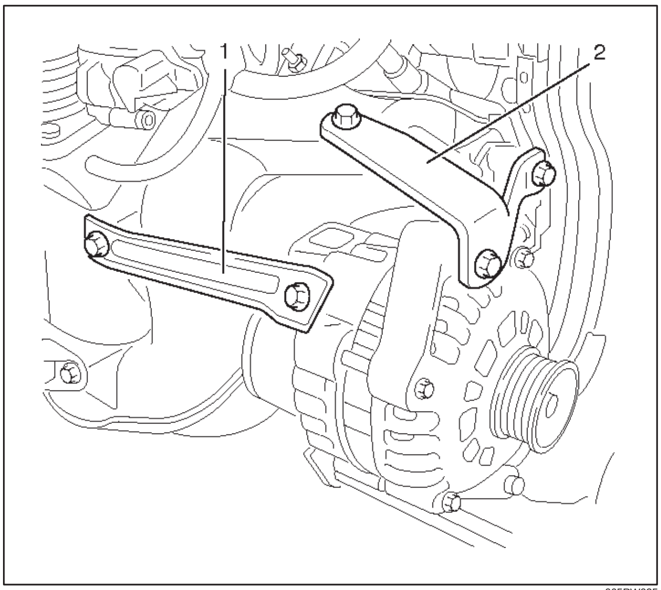
025RW002

4. Install water pipe to intake manifold.
5. Install generator bracket and tighten generator bracket bolts.

Torque

Long bolts: 35 N·m (25 lb ft)

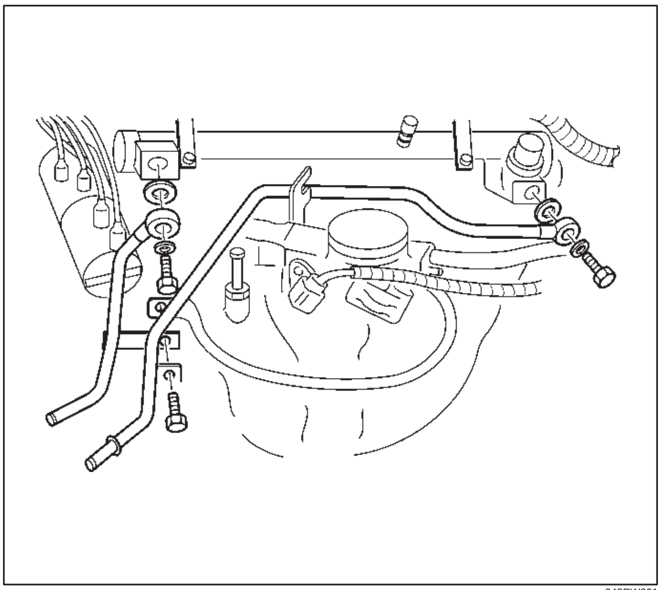
Short bolts: 20 N·m (14 lb ft)



065RW025

6. Install fuel rail assembly to intake manifold and connect hose between fuel pressure regulator and throttle body.
7. Install fuel pipe and tighten joint eye bolt and connect fuel injector harness.

Torque: 25 N·m (18 lb ft)



042RW001

8. Connect the connector for throttle position sensor and idle air control valve sensor to throttle body.
9. Install water hoses to throttle body.
10. Install intake duct assembly to throttle body and air cleaner then tighten nut to the intake duct bracket and clamp on the throttle body side and air cleaner side.

Torque: 7 N·m (5.1 lb ft)

11. Install PCV hose to air intake duct.
12. Install throttle valve control cable to throttle body.
13. Confirm the free play of throttle valve control cable.

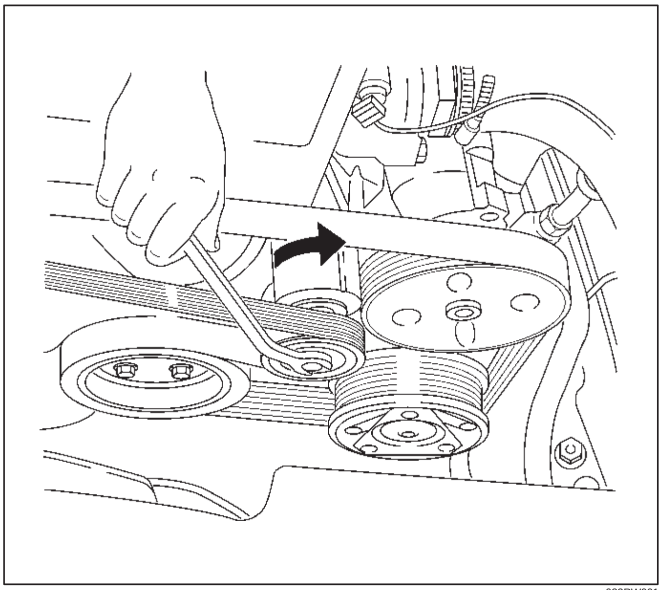
Free play: 5.7 to 6.3 mm

14. Fill engine coolant to full level from radiator filler neck.
15. Connect battery ground cable.

Cylinder Head Assembly

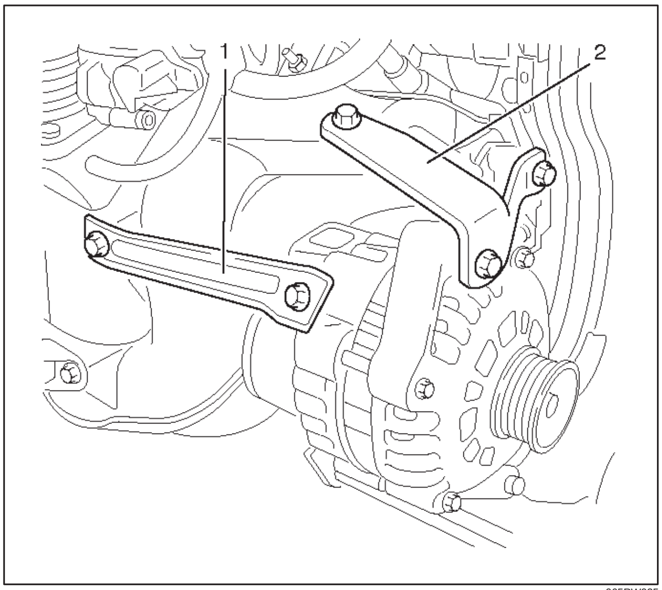
Removal

1. Disconnect battery ground cable.
2. Disconnect connector of intake air temperature sensor from intake air duct.
3. Remove PCV hose from air intake duct.
4. Remove nut from air intake duct bracket and loosen hose clamp on throttle body. Remove air intake duct assembly with air cleaner cover.
5. Remove intake air duct bracket from cylinder head.
6. Drain engine coolant.
7. Move drive belt tensioner to loose side using wrench then remove drive belt.



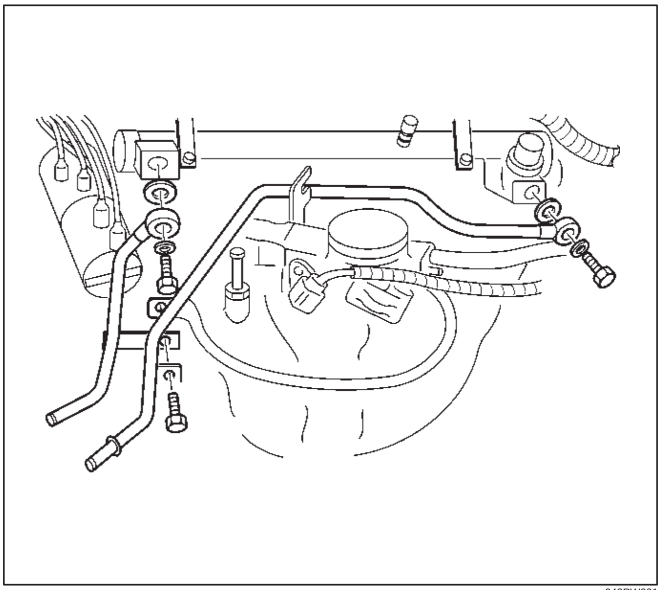
033RW001

8. Remove radiator upper hose from engine side.
9. Remove four nuts of exhaust front pipe.
10. Remove three bolts from generator bracket then remove the generator with brackets.



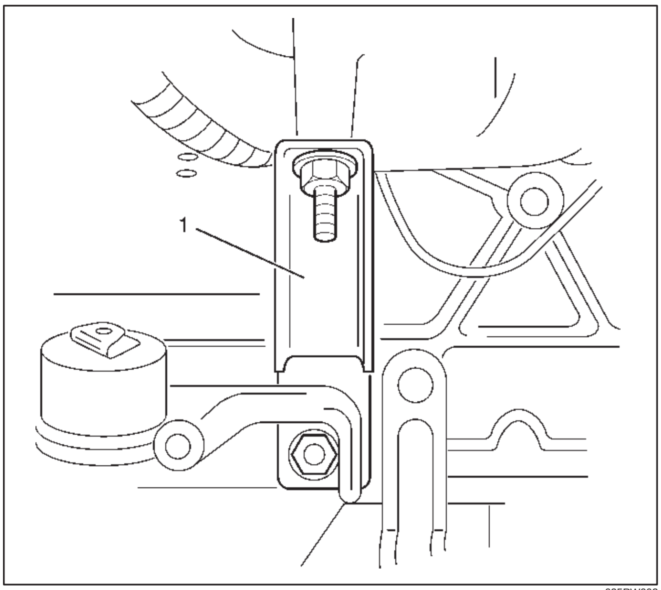
065RW025

11. Disconnect crankshaft angle sensor connector.
12. Disconnect knock sensor connector.
13. Remove heater hose from adapter side.
14. Remove heater hose from water pipe side.
15. Remove water hose between water pipe and throttle body.
16. Remove fuel pipe joint eye bolts from fuel rail assembly and remove fuel pipe bracket with electric ground cable.



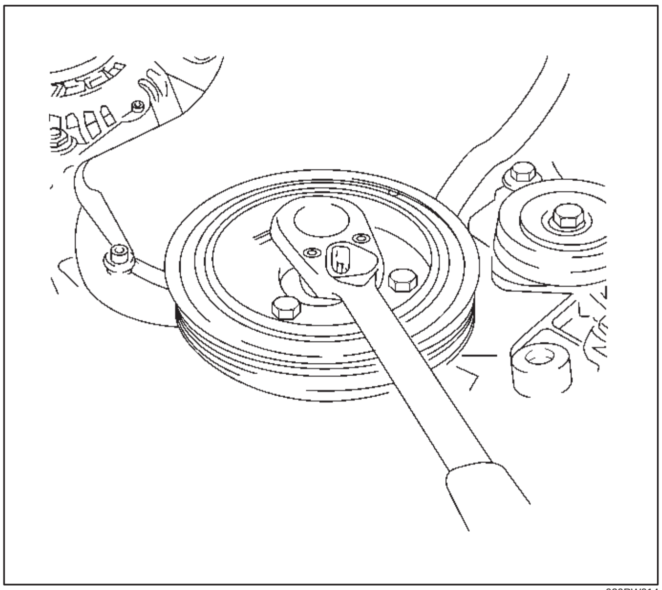
042RW001

17. Disconnect connector for evaporation valve.
18. Remove canister hose.
19. Remove fixing nut of intake manifold stay from cylinder block side.



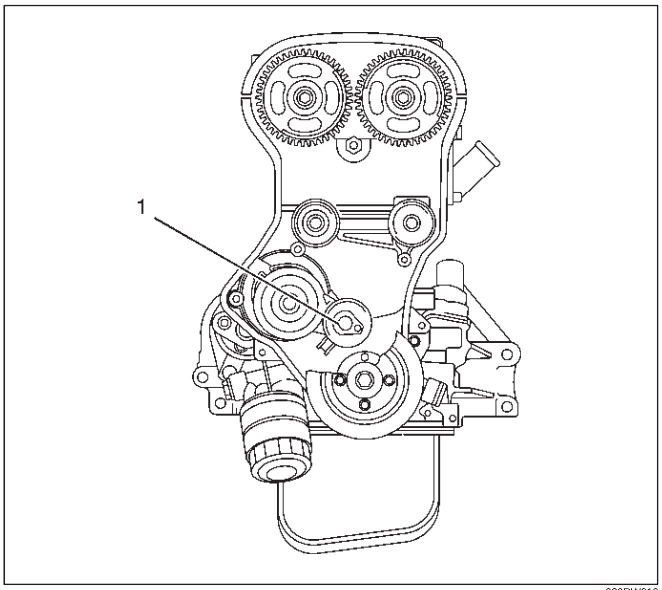
025RW002

20. Remove two bolts from intake manifold for water pipe support and remove cylinder head assembly.
21. Remove engine harness cover and disconnect three connectors from chassis harness on left rear side engine compartment.
22. Disconnect connector for power steering pump pressure switch.
23. Remove four bolts and remove crankshaft pulley.



020RW014

24. Remove two bolts and nut then remove timing belt front cover.
25. Remove ventilation hose from cylinder block side and from cylinder head side.
26. Remove two bolts, ignition cable cover and remove ignition cables from spark plug.
27. Disconnect camshaft angle sensor connector.
28. Remove ten bolts and remove cylinder head cover.
29. Remove fixing bolt of timing belt tensioner then remove timing belt tensioner.



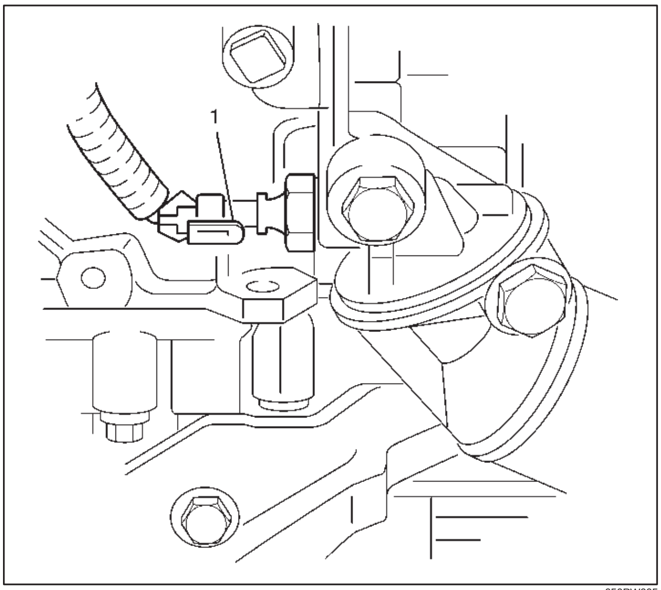
020RW010

30. Remove timing belt.

CAUTION:

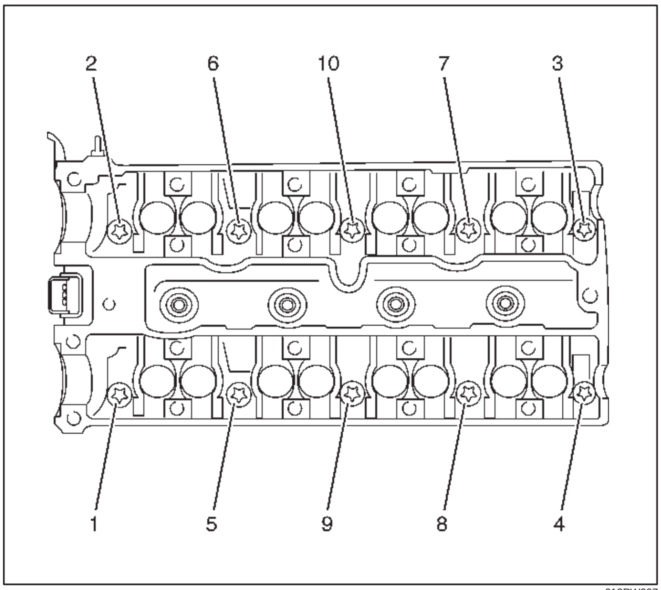
- **Do not bend or twist belt, otherwise its core could be damaged. The belt should not be bent at a radius less than 30 mm.**
- **Timing belt drive gear counterhold with J–42620.**
- **Do not allow oil or other chemical substances to come in contact with the belt. They will shorten the life.**
- **Do not attempt to pry or stretch the belt with a screw driver or any other tool during installation.**
- **Store timing belt in cool and dark place. Never expose the belt direct sunlight or heat.**

31. Remove two idle pulleys, the left side with idle pulley bracket.
32. Remove two bolts and stud bolt and remove timing belt rear cover.
33. Remove camshaft angle sensor
34. Disconnect engine oil pressure switch connector.



050RW005

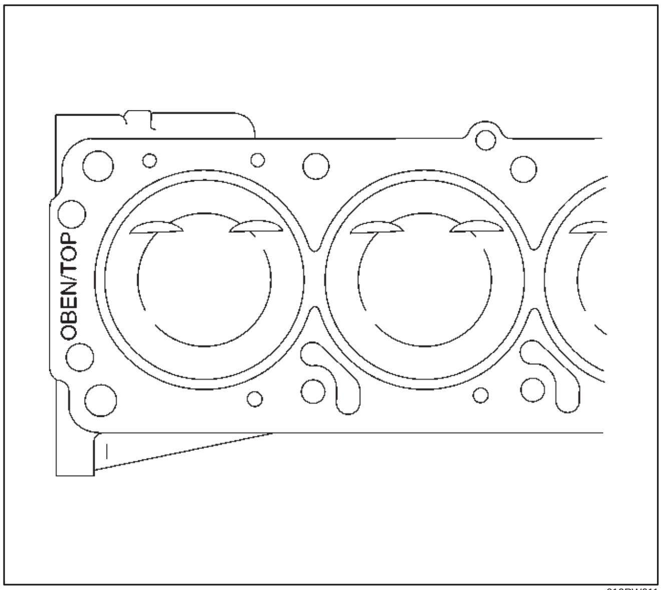
35. Remove camshaft assembly exhaust side.
36. Use J–42623 to remove ten cylinder head fixing bolts



012RW007

Installation

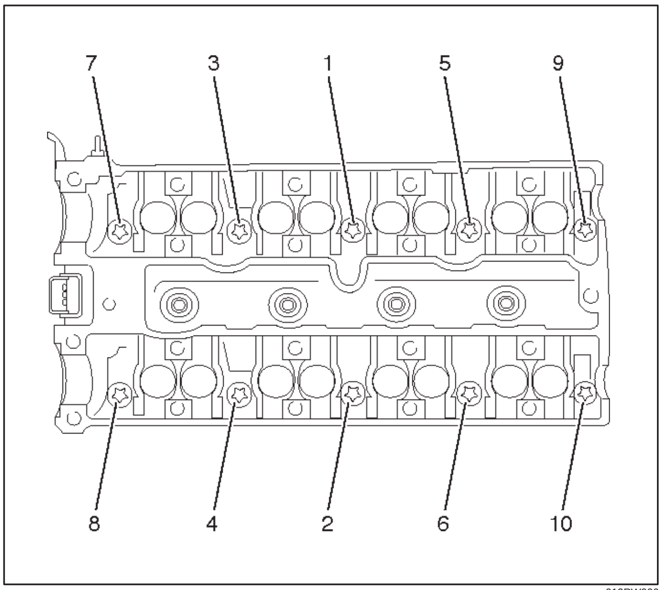
1. Put cylinder head gasket on the cylinder block.



012RW011

2. Install the cylinder head assembly, tighten cylinder head bolts by four steps tightening method in the following sequence to the specified torque.(use J–42623)

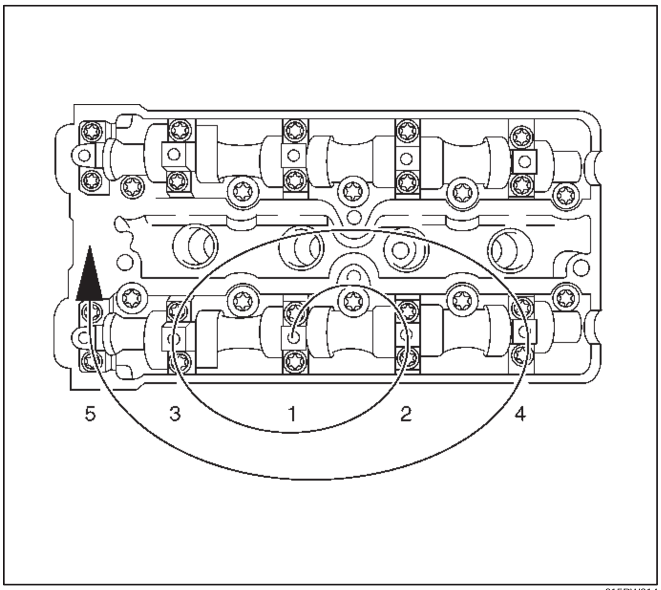
Torque: 25 N·m (18 lb ft) + 90° + 90° + 90°



012RW006

3. Install camshaft assembly exhaust side and tighten camshaft bracket bolts in the sequence to the specified torque.

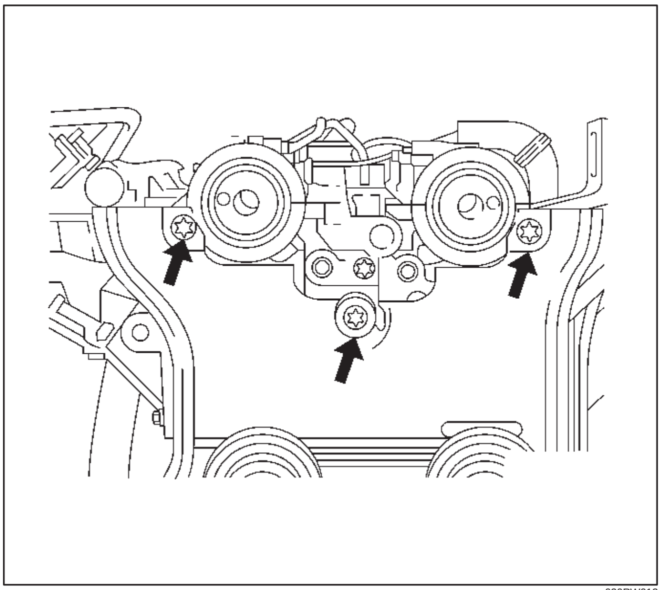
Torque: 8 N·m (5.9 lb ft)



015RW014

4. Connect engine oil pressure switch connector.
5. Install camshaft angle sensor.
6. Install the timing belt rear cover and tighten three bolts to the specified torque.

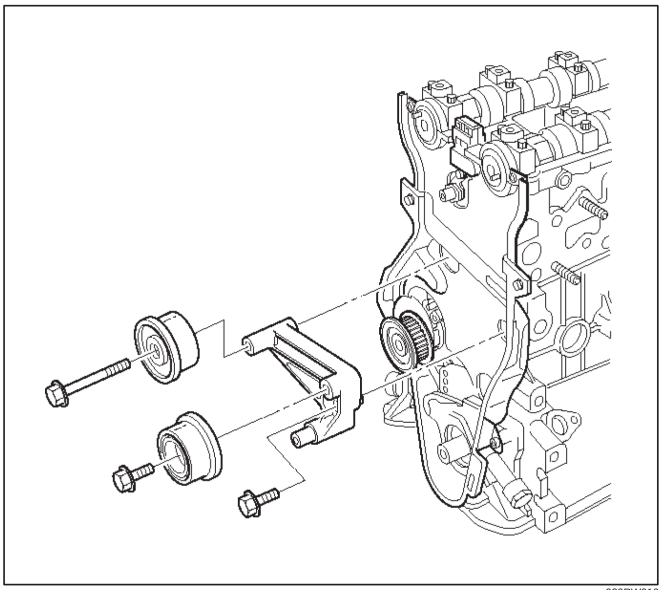
Torque
M6 bolt: 6 N·m (4.4 lb ft)
M8 bolt: 8 N·m (5.8 lb ft)



020RW012

7. Install left side idle pulley with idle pulley bracket, tighten to the specified torque and install right side idle pulley and tighten to the specified torque.

Torque: 25 N·m (18 lb ft)

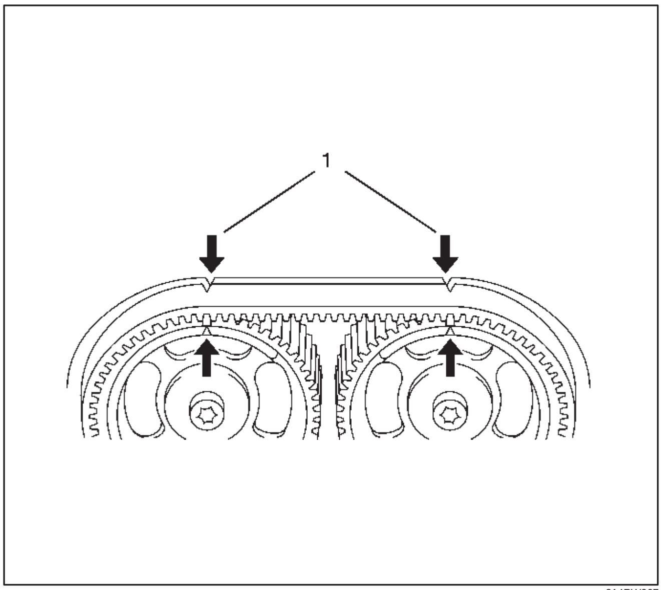


020RW016

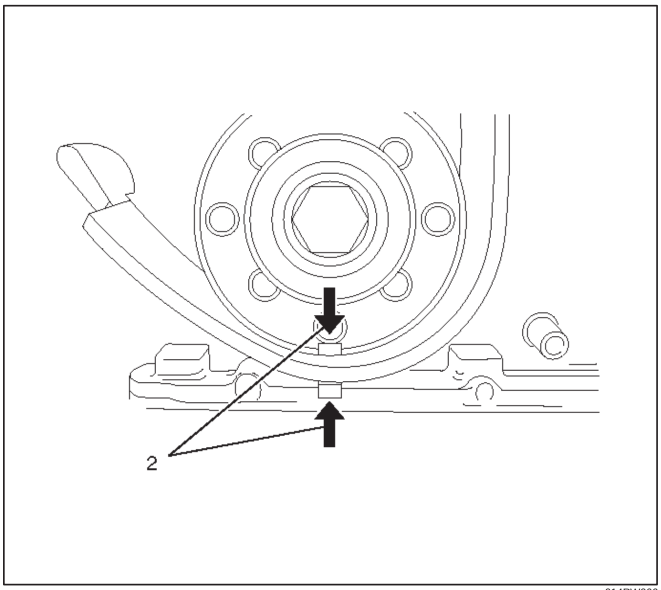
8. Install timing belt tensioner then tighten it temporarily until make alignment timing belt.
9. Install the cylinder head cover and tighten fixing bolt temporally.
10. Install the timing belt and perform timing belt setting procedure as follows.
    1. Bring the engine top dead center No.1 cylinder compression stroke by rotating the engine in the direction of normal operation.

       The engine is in this position when the notches on the camshaft pulleys align with the marks on the cylinder head cover(1), Check the crankshaft pulley timing mark is aligned (2) also check for water pump positioning ensure tabs are aligned (3).

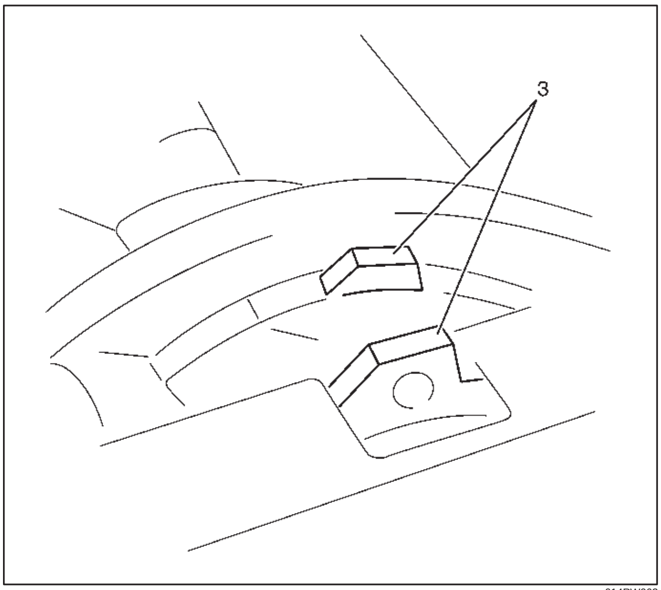
       - Rotate the engine two full turns in the direction of normal operation until the engine is again at top dead centre, No.1 cylinder firing being careful that all movement is in a clockwise direction.
       - If the engine is turned too far, do not turn backwards, but continue to turn in the same direction until the marks are again in line.



014RW067

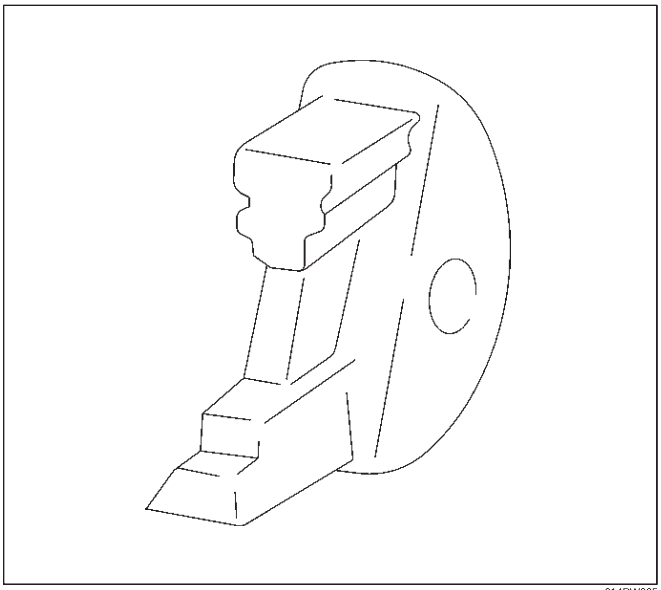


014RW066



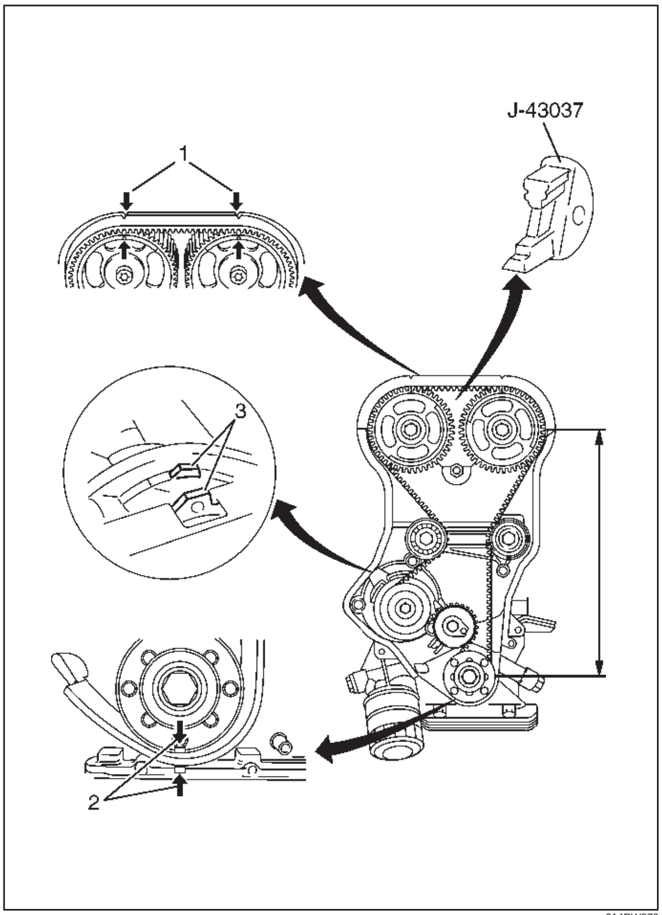
014RW063

2. Place J–43037 to between intake and exhaust of camshaft drive gear to prevent camshaft drive gear movement during timing belt setting.



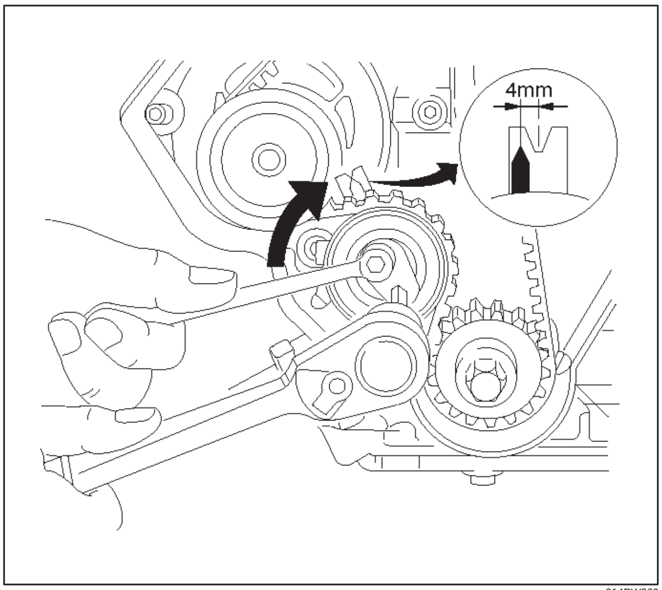
014RW065

3. Set the timing belt shown in the illustration, ensure that tension side of the timing belt is taut and move the timing belt tension adjustment lever clockwise, until the pointer of the tensioner is flowing.



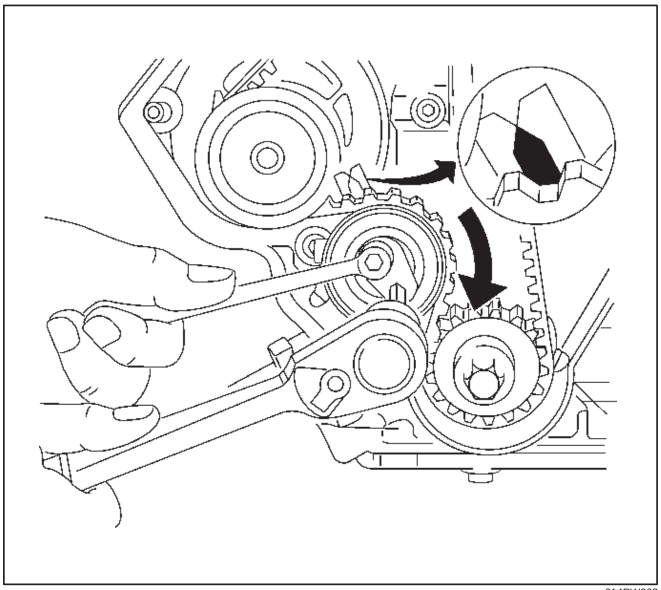
014RW070

For used timing belt(over 60 minutes from new): the pointer will be approx. 4 mm(0.16 in) to the left of the center of the “V” notch when viewed from the front of the engine.



014RW069

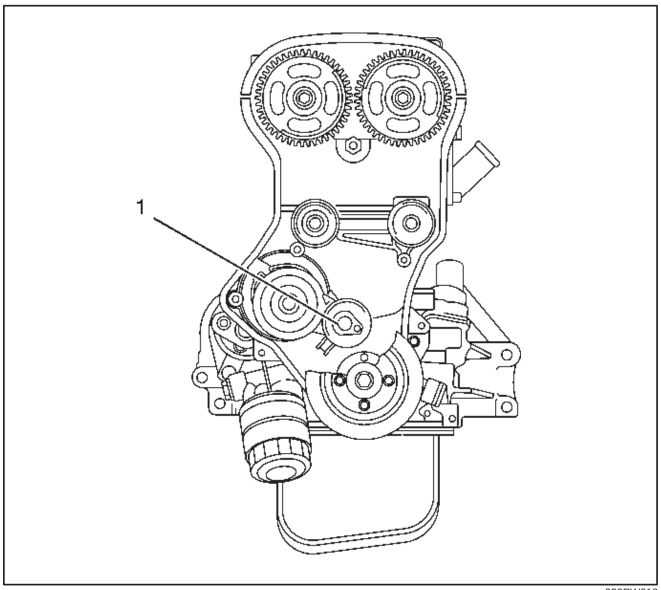
For new timing belt: The pointer must be at the center of “V” notch when viewed from the front of the engine.



014RW062

4. Tighten fixing bolt of timing belt tensioner to the specified torque.

Torque: 25 N·m (18 lb ft)



020RW010

11. Tighten cylinder head cover to the specified torque.

Torque: 8 N·m (5.9 lb ft)

12. Connect camshaft angle sensor connector.
13. Install the ignition cable to spark plug.
14. Install ignition cable cover and tighten two bolts.

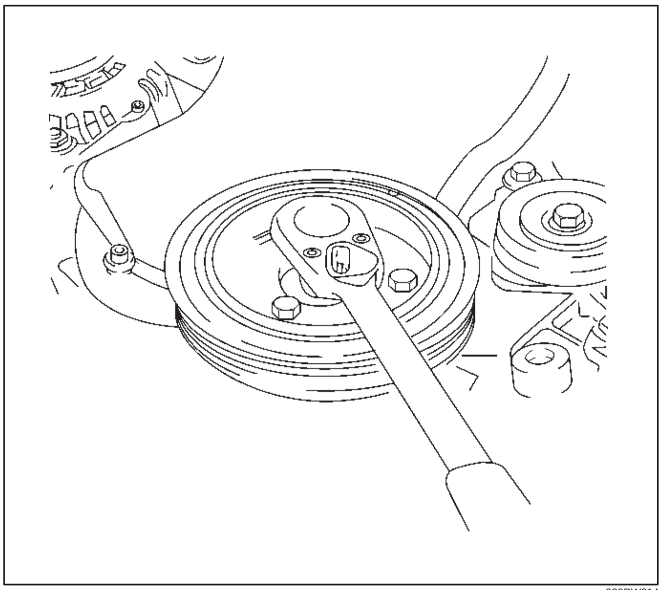
Torque: 3 N·m (2 lb ft)

15. Install ventilation hoses to cylinder block side and cylinder head side.
16. Install timing belt front cover and tighten two bolts to the specified torque.

Torque: 6 N·m (4.4 lb ft)

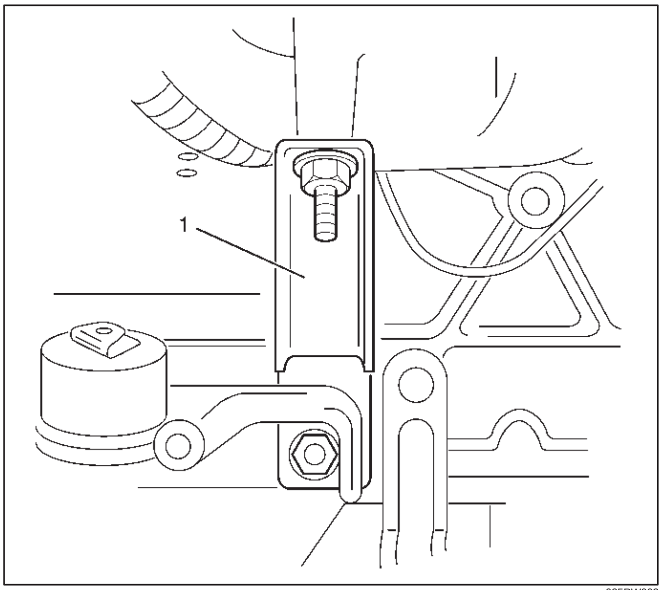
17. Install crankshaft pulley and tighten four bolts.

    Torque: 20 N·m (14 lb ft)



020RW014

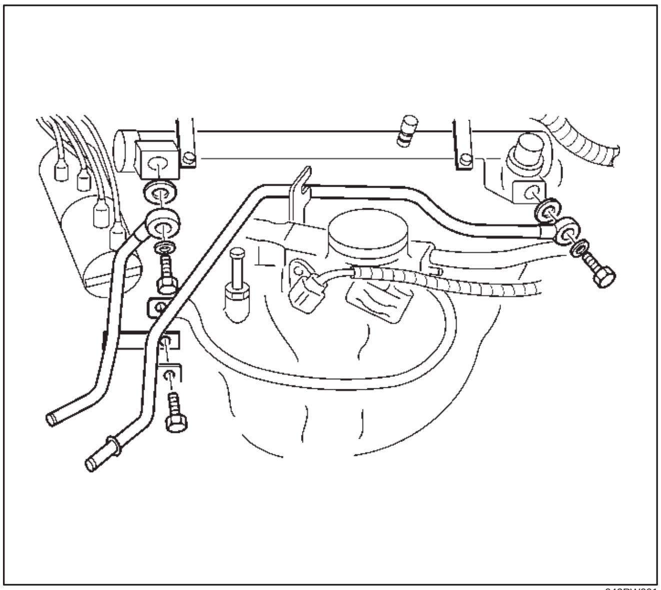
18. Connect connector for power steering pump pressure switch.
19. Connect engine harness connector to chassis harness of the left rear of engine compartment and install engine harness cover.
20. Install two bolts to intake manifold for water pipe support.
21. Install fixing nut of intake manifold stay to cylinder block.



025RW002

22. Install canister hose.
23. Connect connector for evaporation valve.
24. Install fuel pipe joint eye bolts to fuel rail assembly and install fuel pipe bracket with electric ground cable.

    Torque: 25 N·m (18 lb ft)



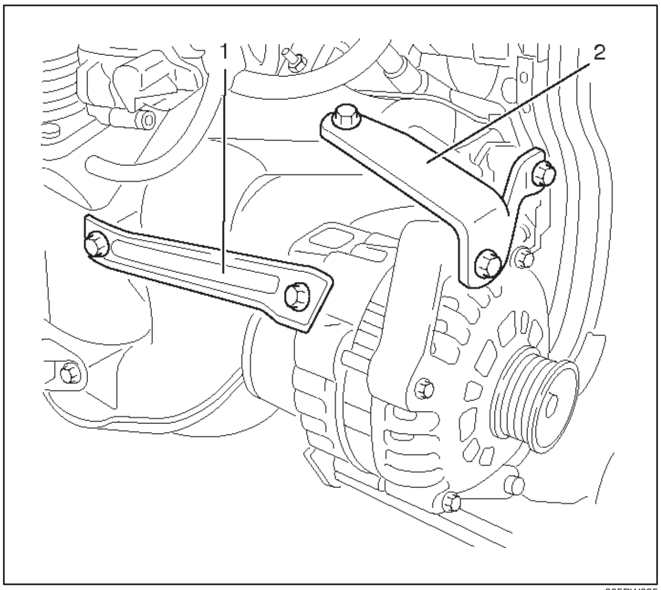
042RW001

25. Install water hose between water pipe and throttle body.
26. Install heater hose to water pipe side.
27. Install heater hose to adapter side.
28. Connect knock sensor connector.
29. Connect crankshaft angle sensor connector.
30. Install generator with bracket and tighten three bolts.

    Torque

    35 N·m (25 lb ft) for Long bolt

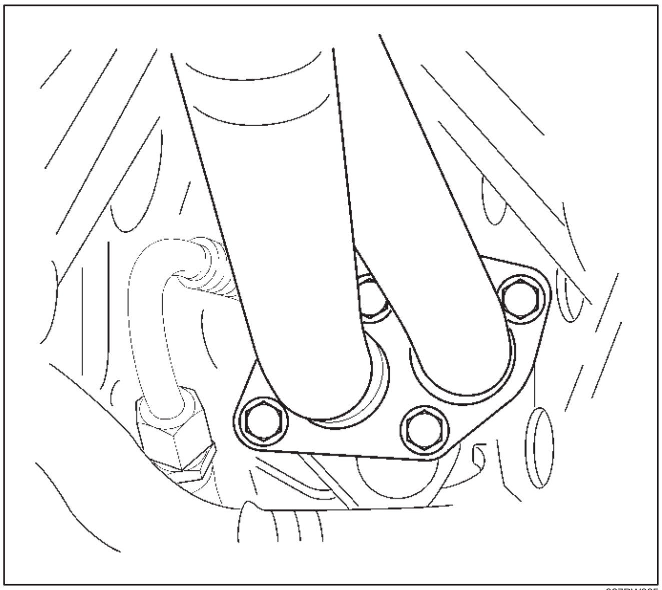
    20 N·m (14 lb ft) for Short bolt



065RW025

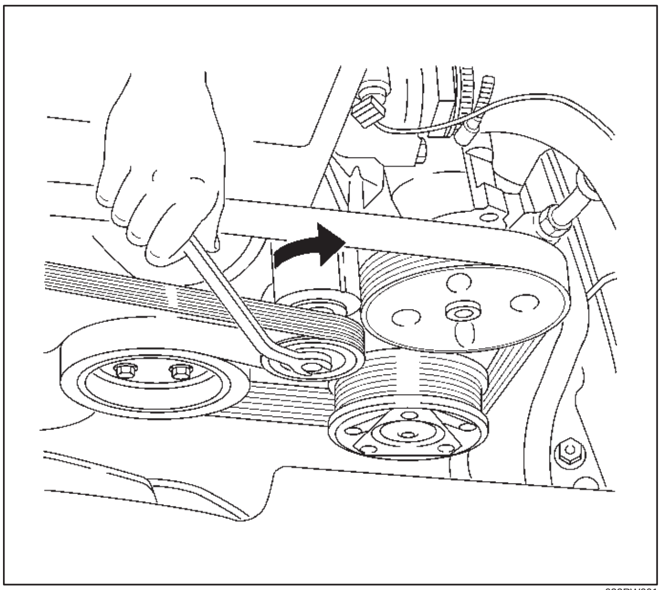
31. Install exhaust front pipe to exhaust manifold and tighten four nuts to the specified torque.

Torque: 25 N·m (18 lb ft)



027RW005

32. Install radiator upper hose to engine.
33. Move drive belt tensioner to loose side using wrench then install the drive belt to normal position.



033RW001

34. Install intake air duct bracket to cylinder head.
35. Install air intake duct assembly with air cleaner cover to throttle body and tighten nut to the air intake duct bracket then tighten hose clamp.

Torque

7 N·m (5.1 lb ft) for nut

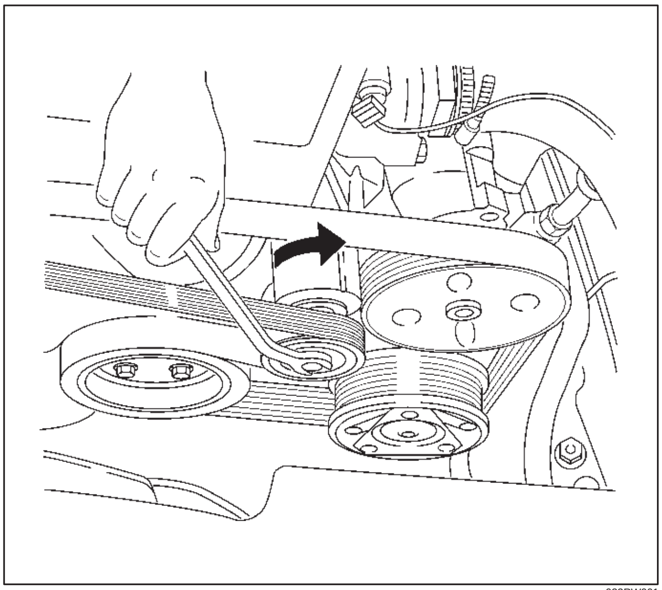
3 N·m (2.2 lb ft) for hose clamp bolt

36. Install PCV hose to air intake duct.
37. Connect connector of intake air temperature sensor on intake air duct.
38. Connect battery ground cable.
39. Fill engine coolant to full level in the engine coolant reservoir tank.

Timing Belt

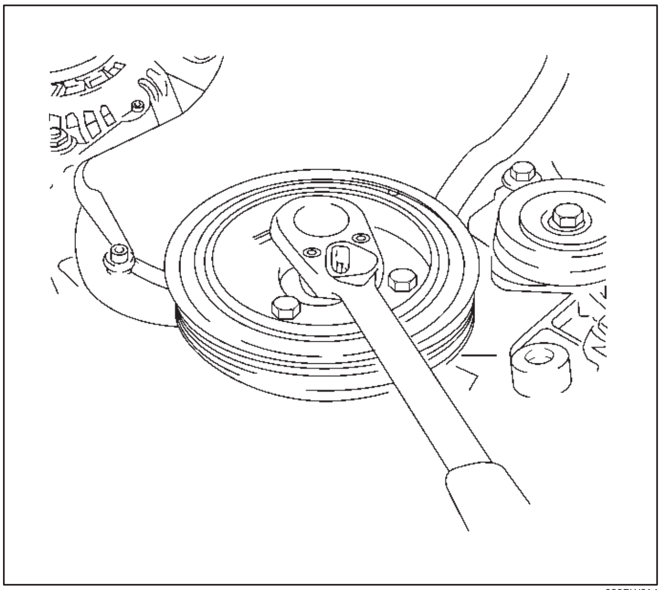
Removal

1. Disconnect battery ground cable.
2. Move drive belt tensioner to loose side using wrench then remove drive belt.



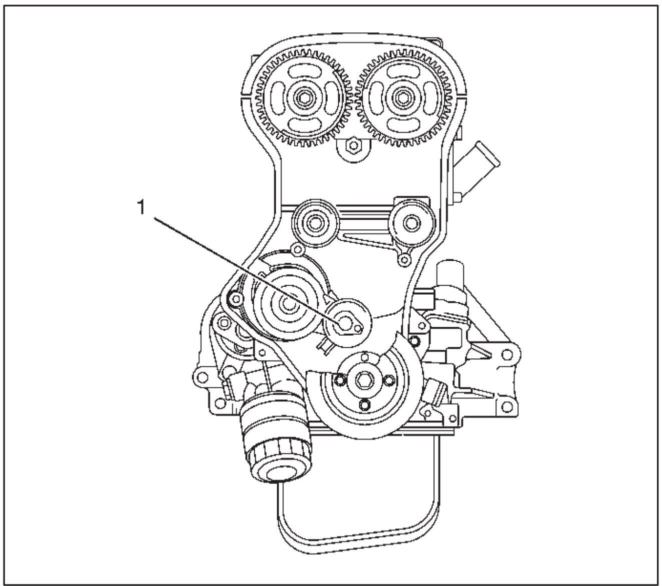
033RW001

3. Remove engine harness cover and disconnect three connectors from left rear side of engine compartment.
4. Remove four bolts and remove crankshaft pulley.



020RW014

5. Disconnect three connectors of engine harness from chassis harness of left rear side of engine compartment.
6. Remove nut and remove engine harness cover from front of engine.
7. Remove two bolts then remove timing belt front cover.
8. Remove fixing bolt of timing belt tensioner then remove timing belt tensioner (1).



020RW010

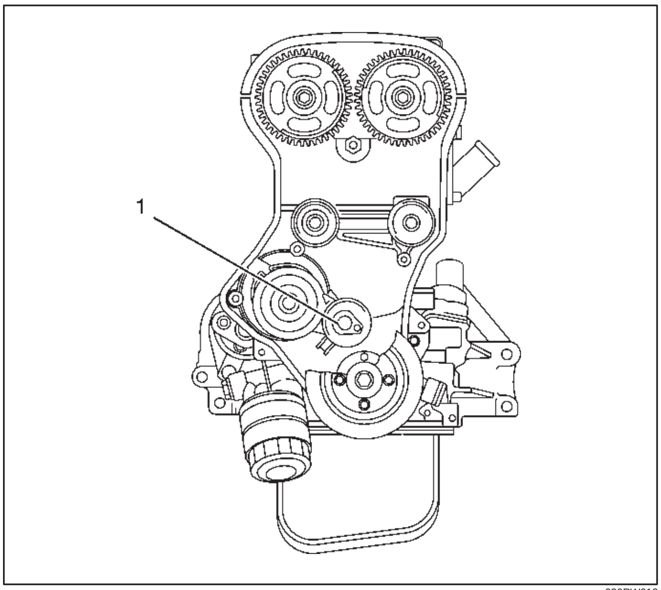
9. Remove timing belt.

CAUTION:

- **Do not bend or twist belt, otherwise its core could be damaged. The belt should not be bent at a radius less than 30 mm.**
- **Timing belt drive gear counterhold with J–42620.**
- **Do not allow oil or other chemical substances to come in contact with the belt. They will shorten the life.**
- **Do not attempt to pry or stretch the belt with a screw driver or any other tool during installation.**
- **Store timing belt in cool and dark place. Never expose the belt direct sunlight or heat.**

Installation

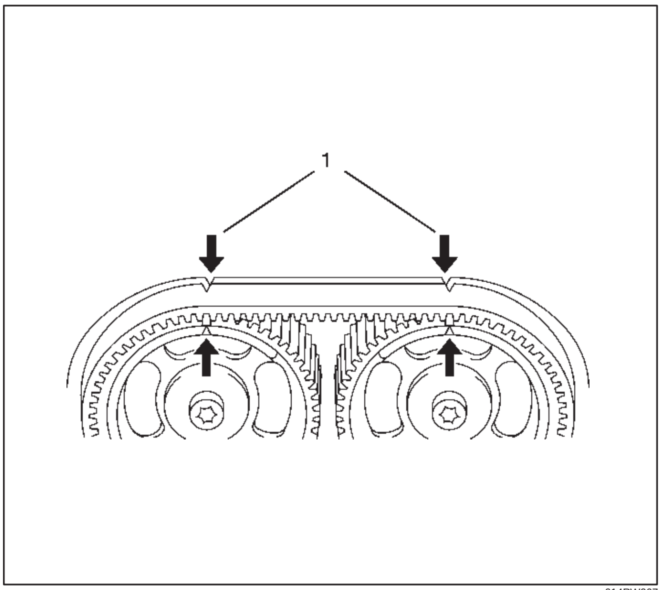
1. Install timing belt tensioner then tighten it temporarily until make alignment timing belt.



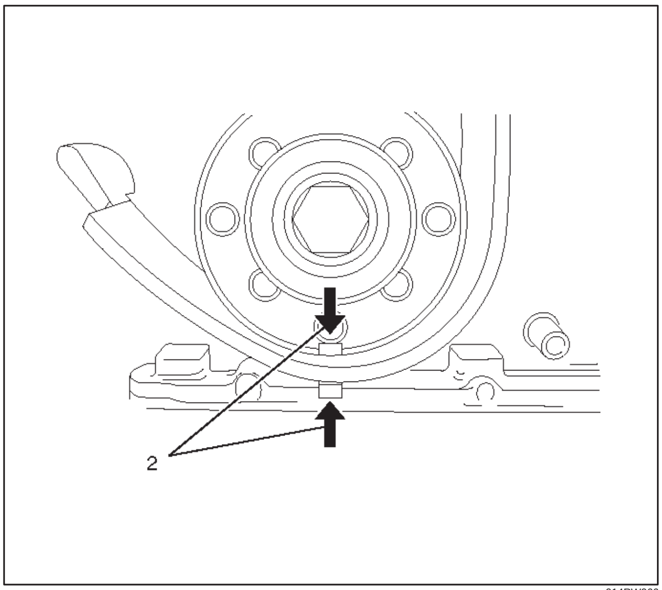
020RW010

2. Install the timing belt and perform timing belt setting procedure as follows:
   1. Bring the engine top dead center No.1 cylinder compression stroke by rotating the engine in the direction of normal operation.

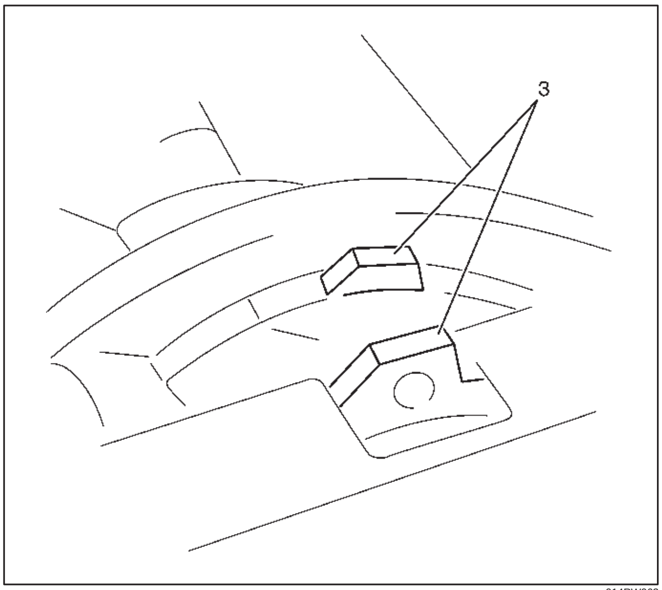
      The engine is in this position when the notches on the camshaft pulleys align with the marks on the cylinder head cover(1), Check the crankshaft pulley timing mark is aligned (2) also check for water pump positioning ensure tabs are aligned (3).



014RW067

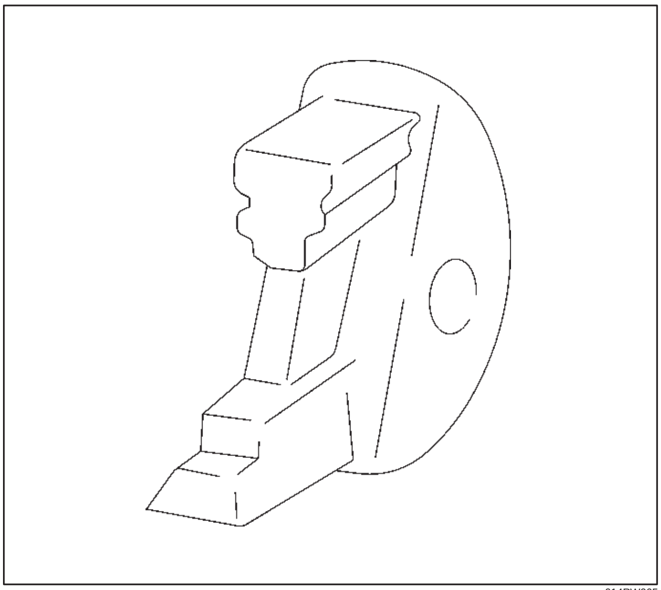


014RW066



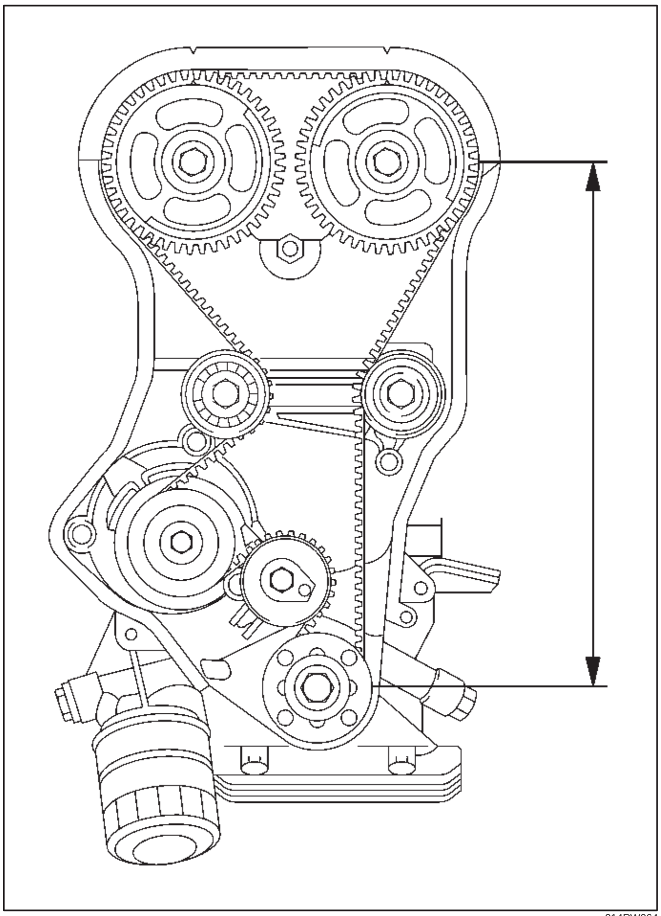
014RW063

2. Place J–43037 between intake and exhaust of camshaft drive gear for prevent to camshaft drive gear movement during timing belt setting.

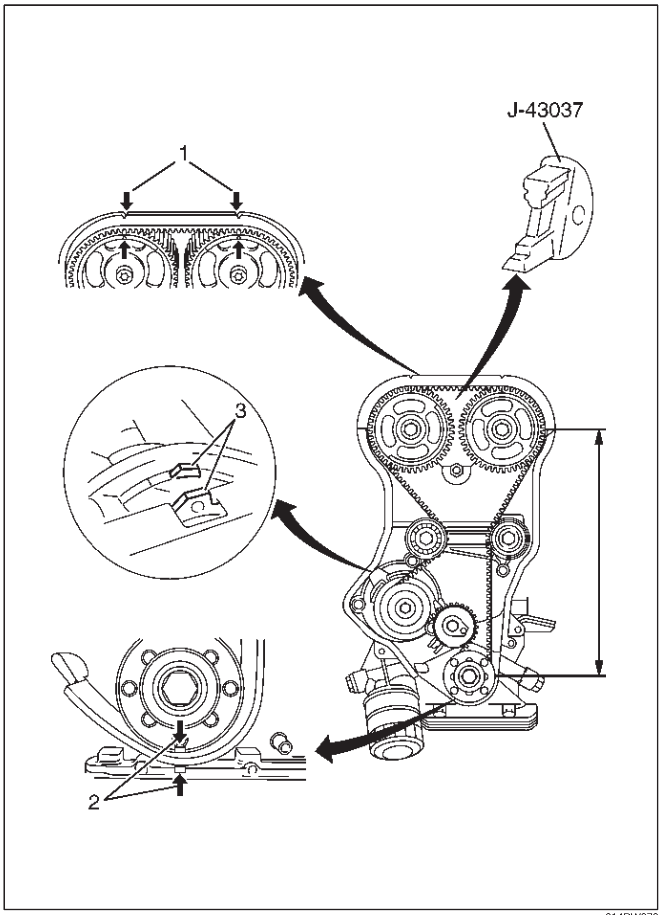


014RW065

3. Set the timing belt shown in the illustration, ensure that tension side of the timing belt is taut and move the timing belt tension adjustment lever clockwise, until the pointer of the tensioner is flowing.

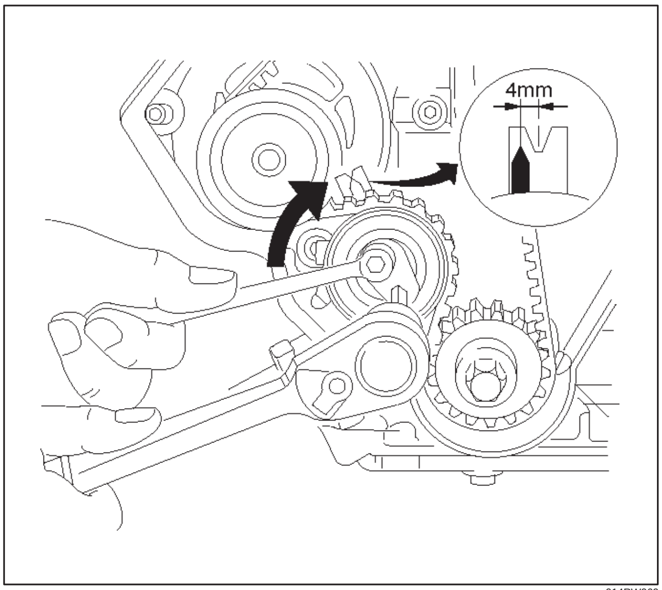


014RW064



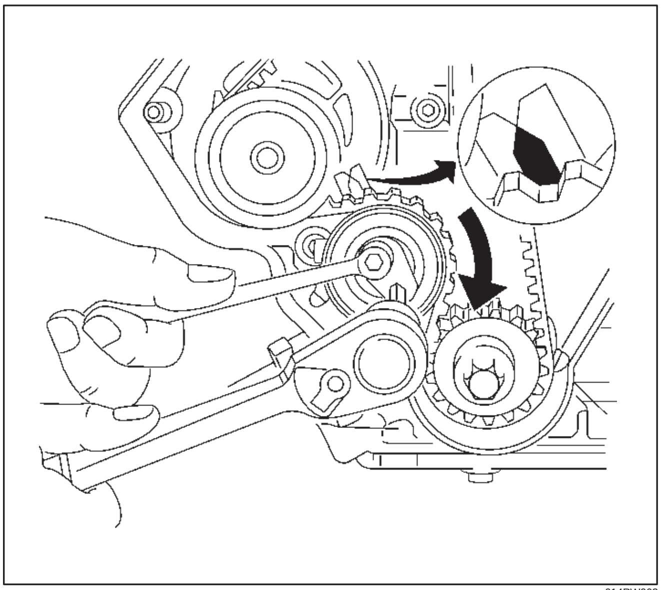
014RW070

For used timing belt(over 60 minutes from new): The pointer will be approx. 4 mm(0.16 in) to the left of the center of the “V” notch when viewed from the front of the engine.



014RW069

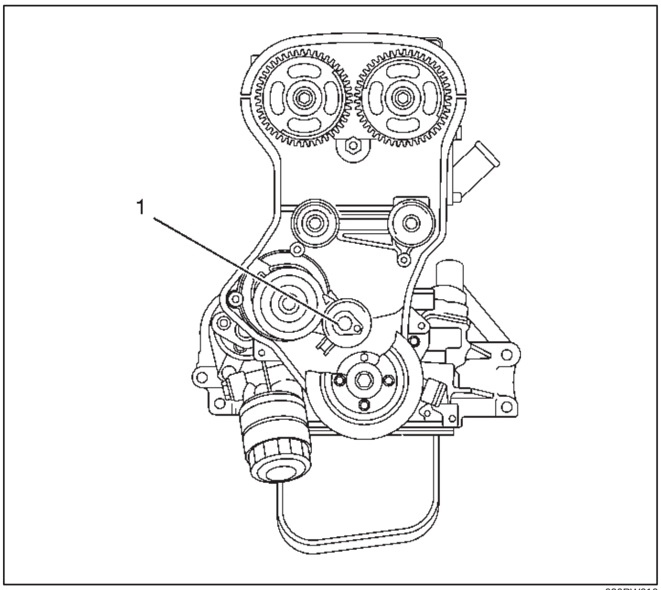
For new timing belt: The pointer must be at the center of “V” notch when viewed from the front of the engine.



014RW062

3. Tighten fixing bolt (1) of timing belt tensioner to the specified torque.

Torque: 25 N·m (18 lb ft)



020RW010

4. Install timing belt front cover and tighten two bolts to the specified torque.

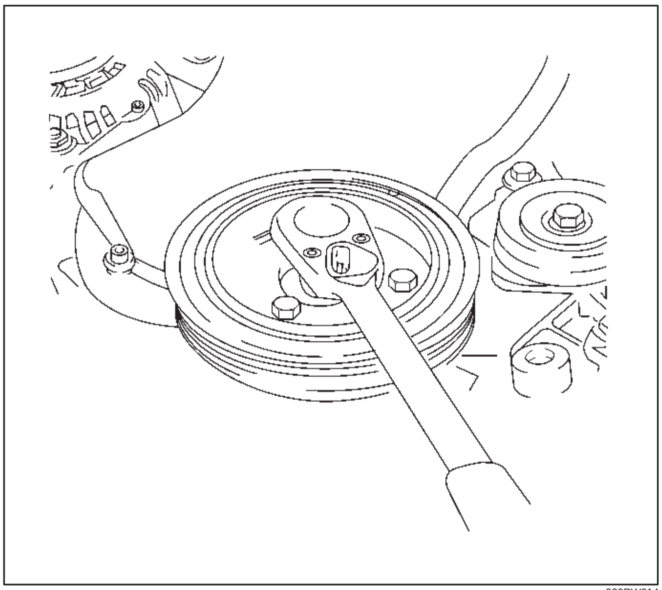
Torque: 6 N·m (4.4 lb ft)

5. Install engine harness cover to front top of engine and tighten nut to the specified torque.

Torque: 6 N·m (4.4 lb ft)

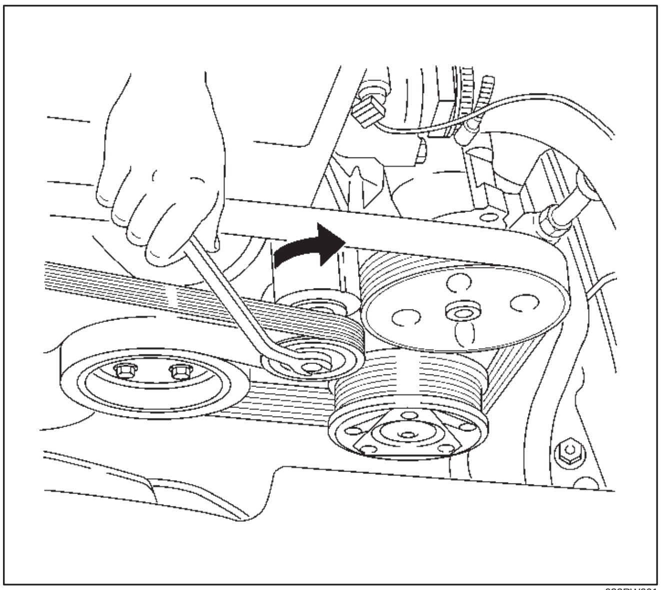
6. Install crankshaft pulley and tighten four bolts.

Torque: 20 N·m (14 lb ft)



020RW014

7. Move drive belt tensioner to loose side using wrench then install drive belt to normal position.



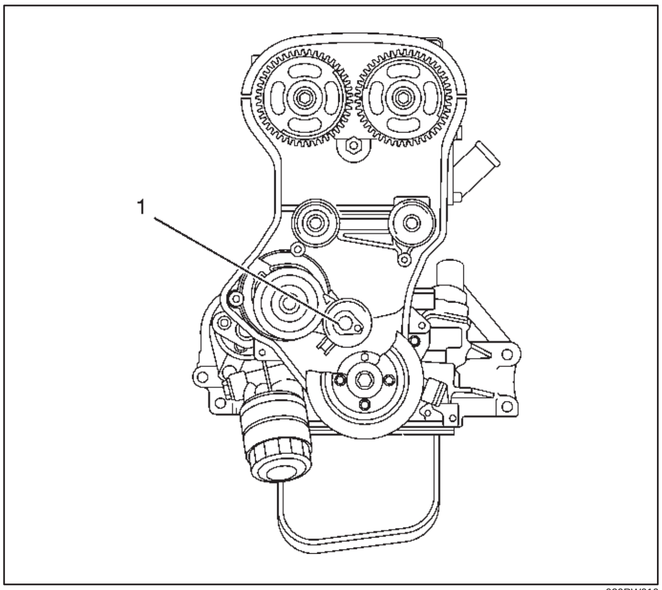
033RW001

8. Connect engine harness three connector to chassis harness of left rear side of engine compartment.
9. Connect battery ground cable.

Camshaft

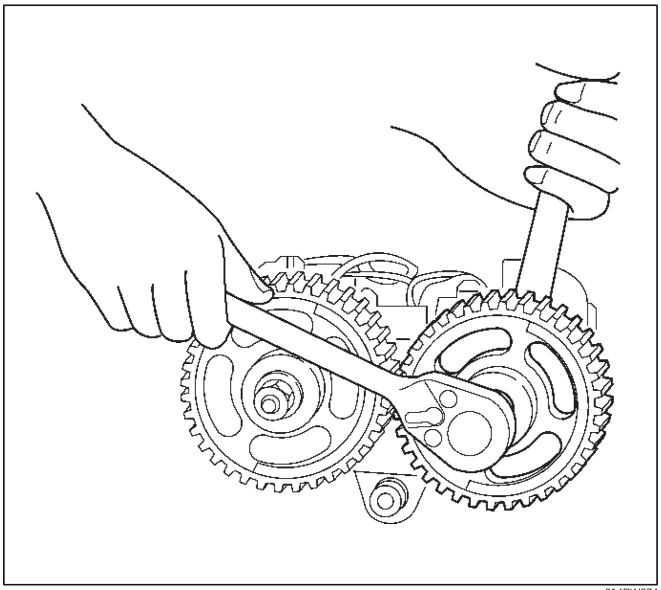
Removal

1. Disconnect battery ground cable.
2. Remove cylinder head cover.
   Refer to removal procedure for Cylinder Head Cover in this manual.
3. Remove timing belt tensioner and remove timing belt.



020RW010

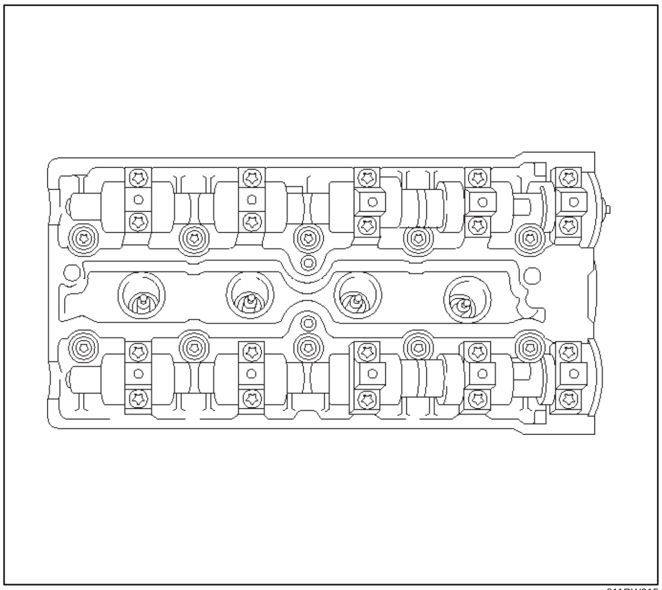
4. Use adjustable wrench to hexagonal portion of camshaft, and remove fixing bolt from front end of camshaft.



014RW074

5. Remove camshaft drive gear from intake and exhaust camshaft.

6. Remove twenty fixing bolts from intake and exhaust camshaft bracket on the cylinder head, then remove camshafts.

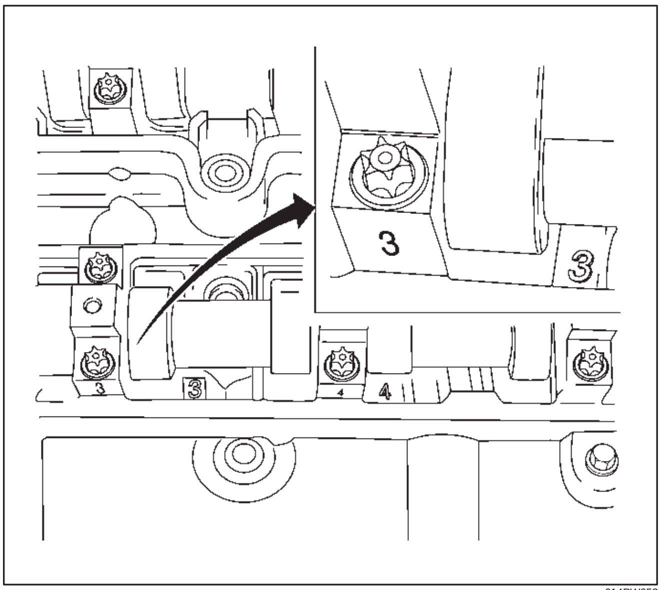


011RW015

CAUTION:

- **Do not damage camshaft lobe and journal.**
- **Do not damage hydraulic lash adjuster(HLA) and do not allow into foreign materials into cylinder head.**

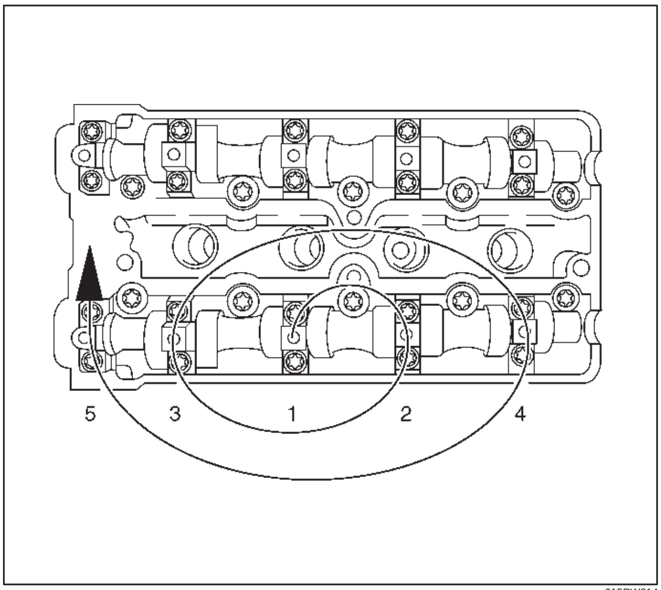
7. Remove oil seal from camshaft.



014RW052

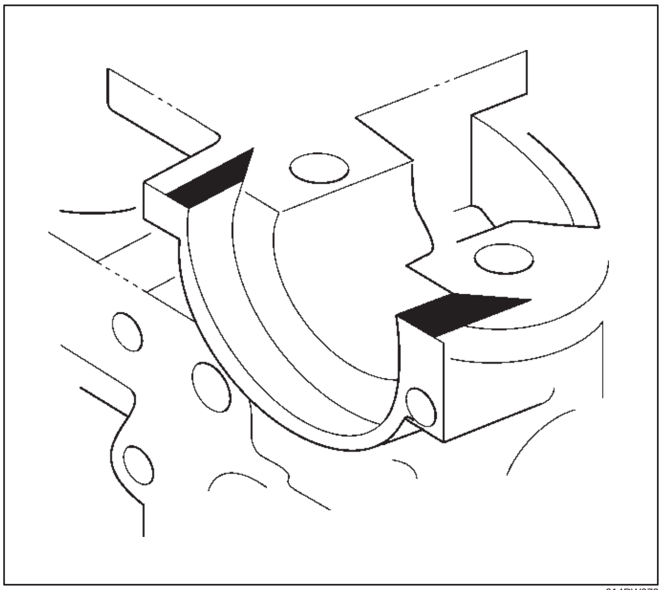
Installation

1. Clean surface of camshaft bracket and HLA.
2. Apply engine oil to journal surface of camshaft bracket and HLA.
3. Install camshaft to cylinder head.
4. Install camshaft bracket according to numerical as shown in the illustration.
   The bracket number is:
   - Exhaust: 1 to 5 from front
   - Intake: 6 to 10 from front.



015RW014

Camshaft oil seal installation area on the cylinder body of No.1, No.6 and camshaft bracket rear side plug portion must be applied HN1023 or equivalent as in the illustration.

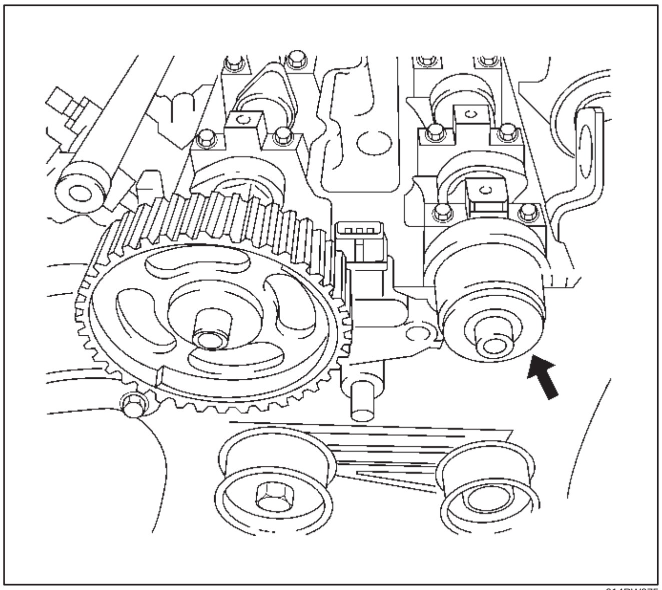


014RW073

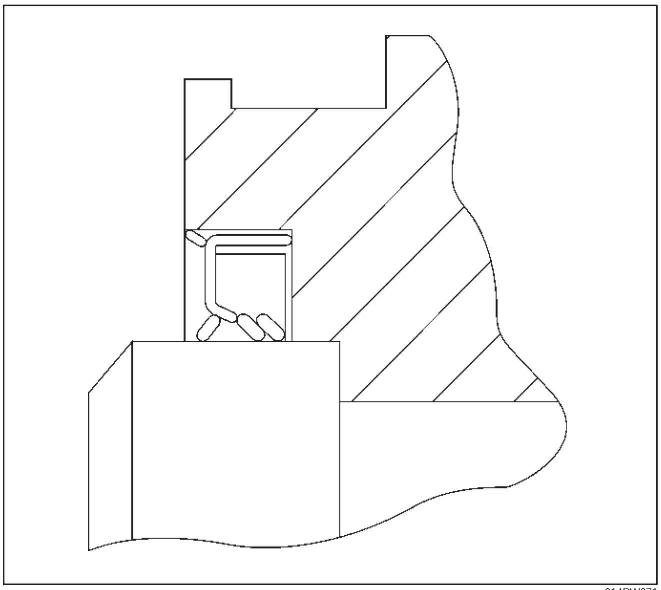
5. Tighten camshaft bracket bolts to the specified torque by sequence in the illustration.

Torque: 8 N·m (5.9 lb ft)

6. Use J–42609 for installation camshaft oil seal.

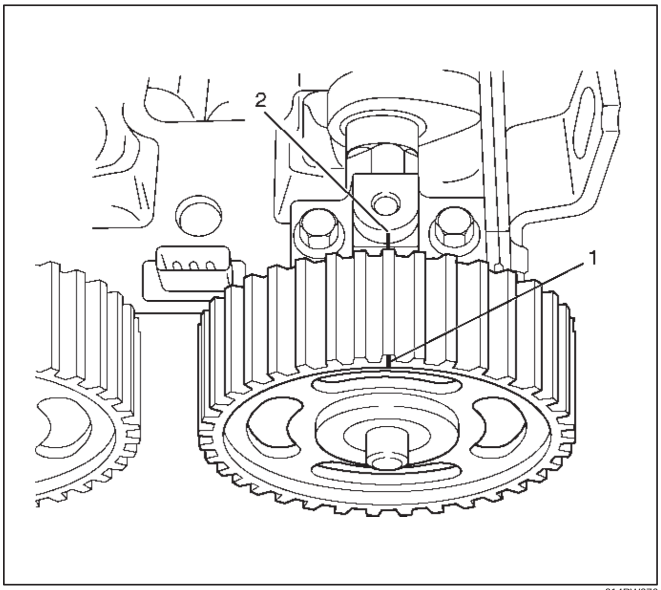


014RW075



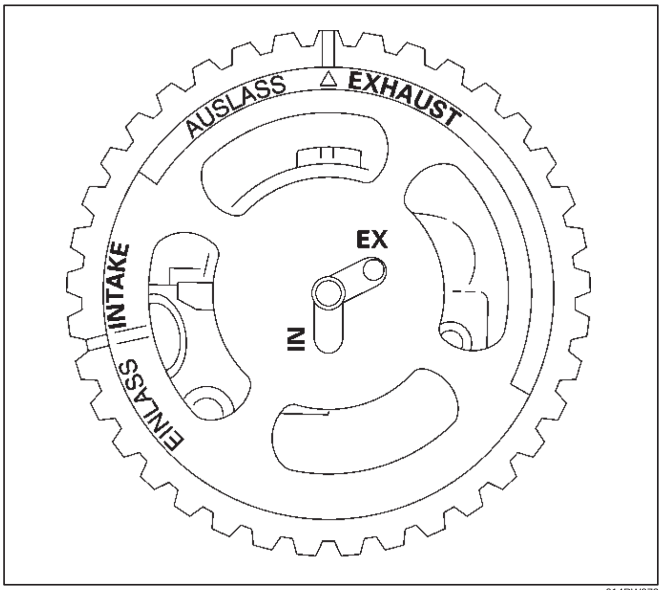
014RW071

7. Install the camshaft drive gear. Align the timing mark between notch on the camshaft drive gear(1) and lug on the camshaft bracket(2).



014RW076

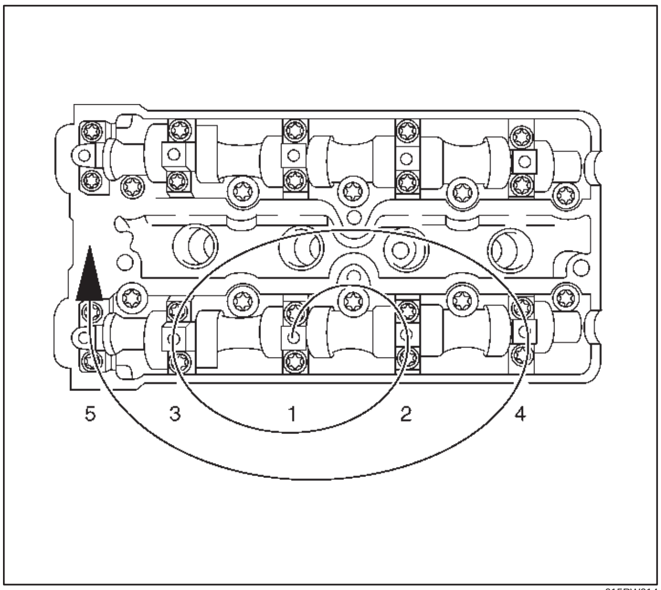
Also align a guide hole on the camshaft drive gear marked “IN” for intake and “EX” for exhaust to guide pin on the camshaft when instaling the camshaft drive gear.



014RW072

8. Tighten camshaft bracket fixing bolt to the specified torque.

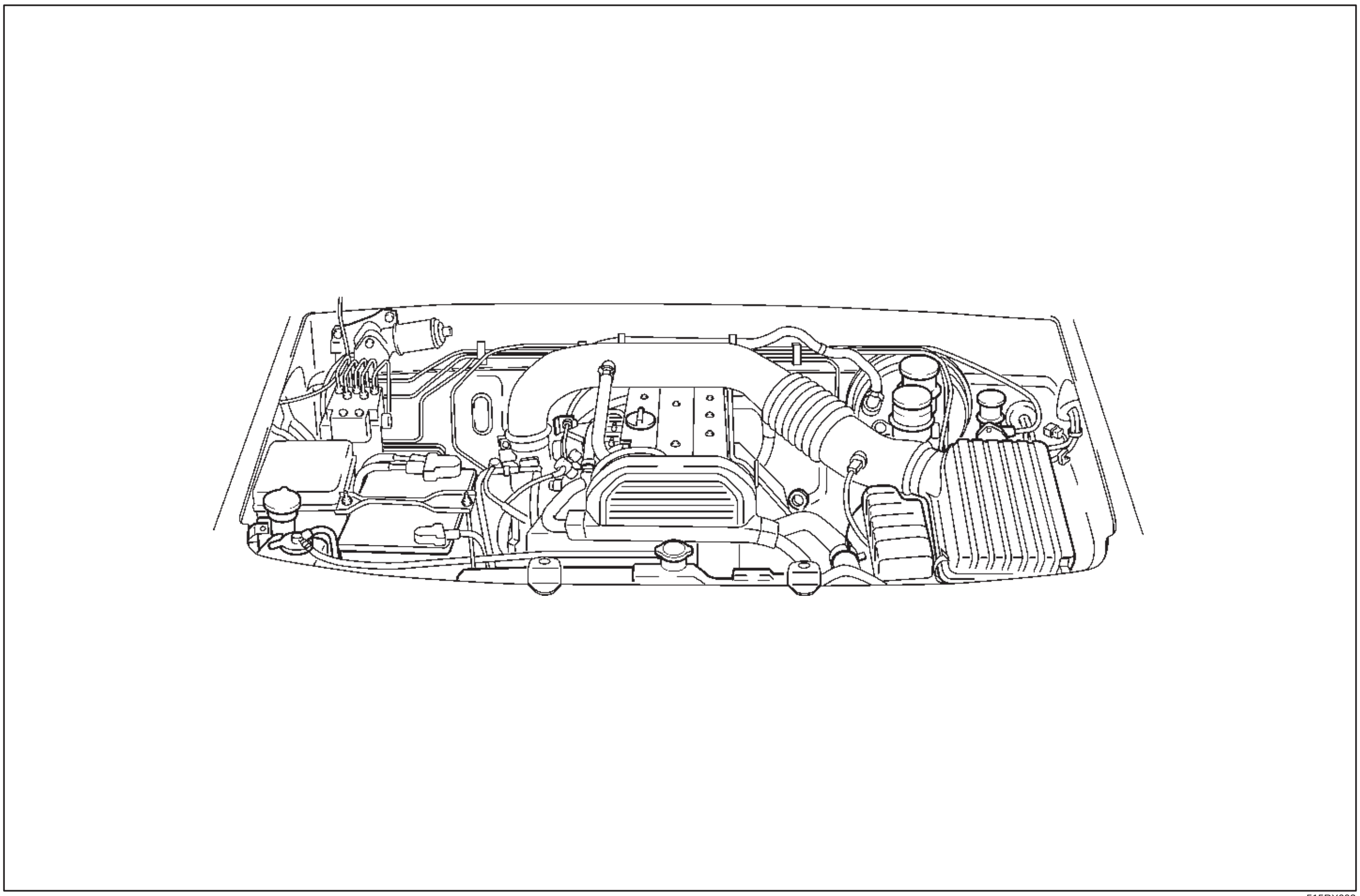
Torque: 50 N·m (36 lb ft)



015RW014

9. Install timing belt.
   Refer to installation procedure for Timing Belt in this manual.
10. Install cylinder head cover.
    Refer to installation procedure for Cylinder Head Cover in this manual.
11. Connect battery ground cable.

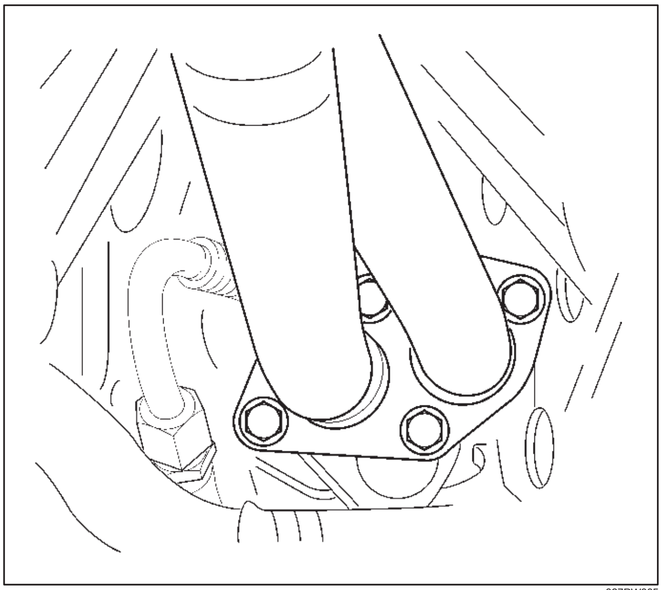
Engine Assembly



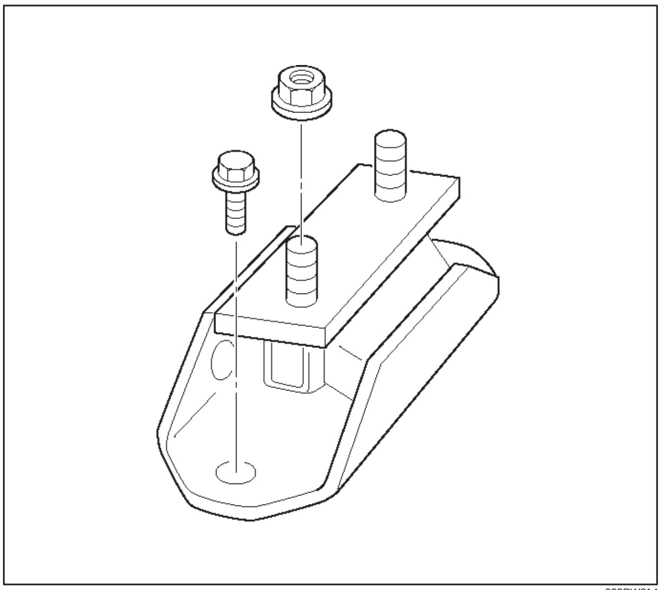
515RX002

Removal

1. Disconnect battery ground and positive cable.
2. Remove battery.
3. Make alignment mark on the engine hood and hinges before removal in order to return the hood to original position exactly.
4. Remove engine hood.
5. Drain engine coolant from radiator.
6. Disconnect throttle valve control cable from throttle valve on intake manifold.
7. Remove air duct with air cleaner cover.
8. Remove air cleaner assembly.
9. Disconnect three engine harness connectors from chassis harness of left rear side engine compartment.
10. Disconnect vacuum hose on the brake booster.
11. Disconnect cooling fan harness connector on the left of fan shroud.
12. Disconnect ground cable connector from left and right of front wheel arch upper side.
13. Remove clutch piping bracket from right side of clutch housing.
14. Remove fuel piping bracket from transmission.
15. Remove four nuts from exhaust front pipe exhaust manifold side and remove two bolts from rear side of exhaust front pipe. Remove exhaust front pipe.


027RW005

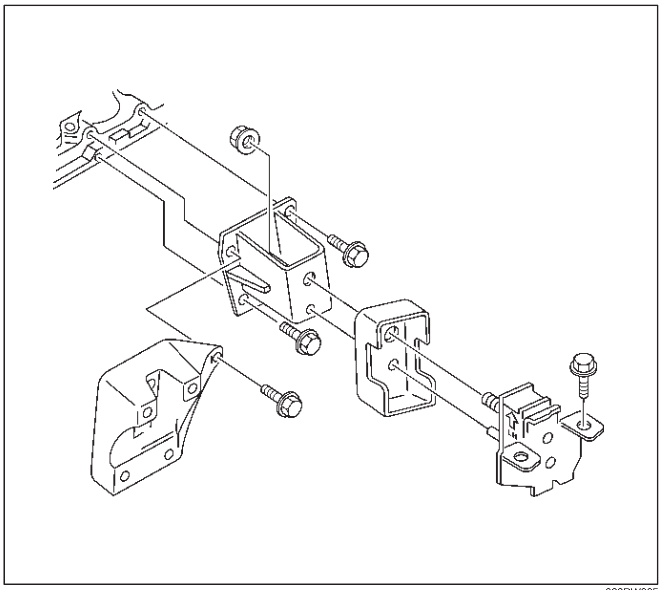
16. Remove transmission mounting fixing bolts and nut from cross member.


022RW014

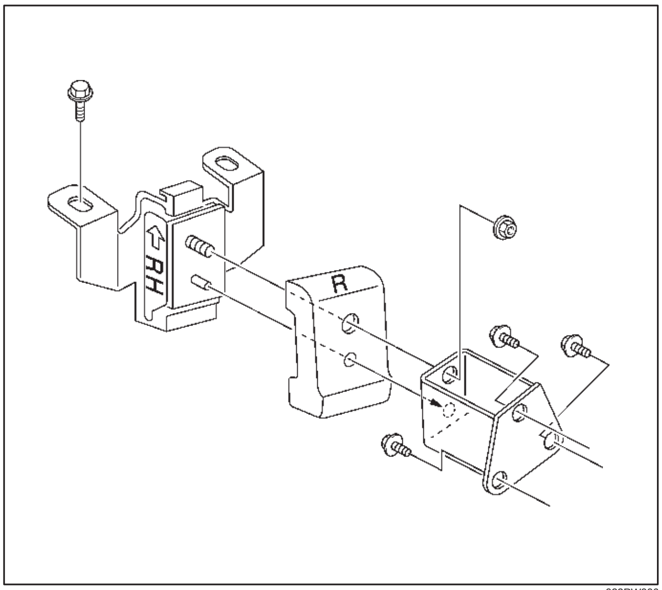
17. Remove transmission front under cover from front portion of clutch housing.
18. Disconnect two fuel pipes at right side of transmission by quick type fuel hose connector.

CAUTION: Plug fuel pipe on engine side and fuel hose from fuel tank.

19. Disconnect canister hose next to fuel piping connector.
20. Remove propeller shaft fixing bolt from rear side transmission.
21. Remove fixing bolts between clutch housing and transmission, then move transmission.
22. Remove power steering pump assembly then place the power steering pump along with piping.
23. Disconnect two chassis harness connectors from right rear side engine compartment (under fuse box) and remove two harness clips.
24. Remove engine ground cable from chassis frame.
25. Remove radiator lower hose from engine side.
26. Remove two heater hoses from right side panel.
27. Remove radiator grille.
28. Remove harness clip from behind right horn.
29. Remove engine mounting bolt from chassis frame side.



022RW005



022RW006

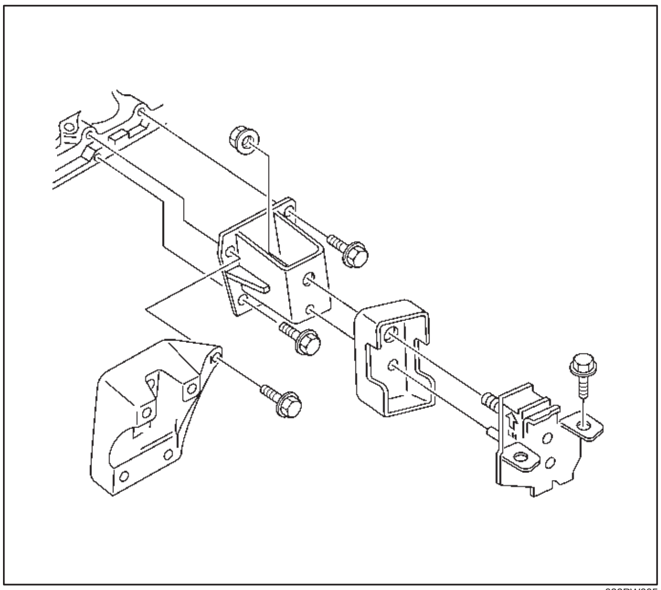
30. Lift up the engine assembly.

Installation

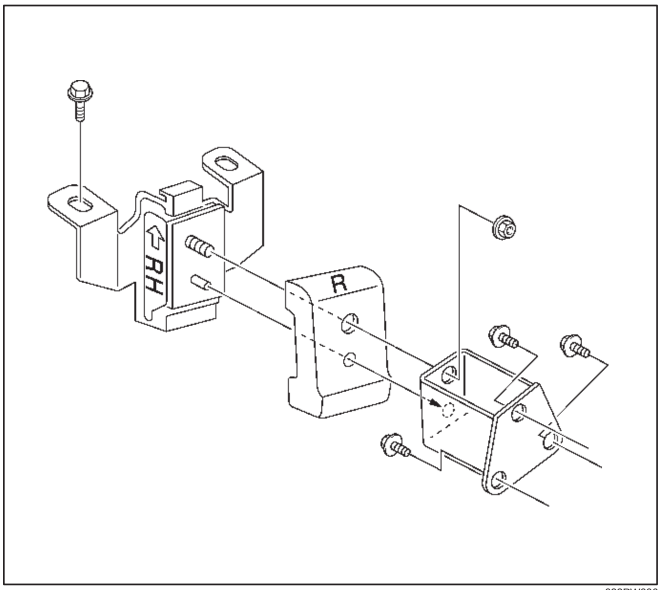
CAUTION: When assembling the engine and transmission, confirm that dowels have been mounted in the specified positions at the engine side. If assembled in the condition that dowels have not been mounted in the specified position, transmission damage can result.

1. position the engine assembly in the engine compartment.
2. Tighten engine mounting bolt to frame side to the specified torque.

Torque: 41 N·m (30 lb ft)



022RW005

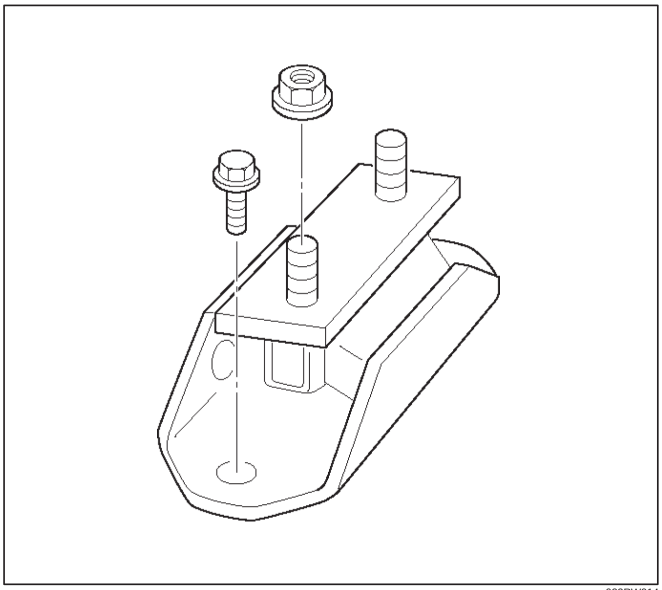


022RW006

3. Install harness clip behind right horn.
4. Install the radiator grille and install flasher lamp assembly.
5. Install two heater hoses to right side panel.
6. Install radiator lower hose to engine.
7. Install engine ground cable to chassis frame.
8. Connect two chassis harness connectors to right rear side engine room(under fuse box) and install two harness clips.
9. Install power steering pump assembly and tighten fixing bolts.
10. Install transmission assembly, refer to installation procedure for Transmission section in this manual.
11. Install propeller shaft, refer to installation procedure for Propeller section in this manual.
12. Connect canister hose next to fuel piping connector.
13. Connect two fuel pipes at right side transmission by quick type connector.

14. Install transmission front under cover to front portion of clutch housing.
15. Install transmission mounting fixing bolts and nuts to cross member.

Torque: 50 N·m (36 lb ft)



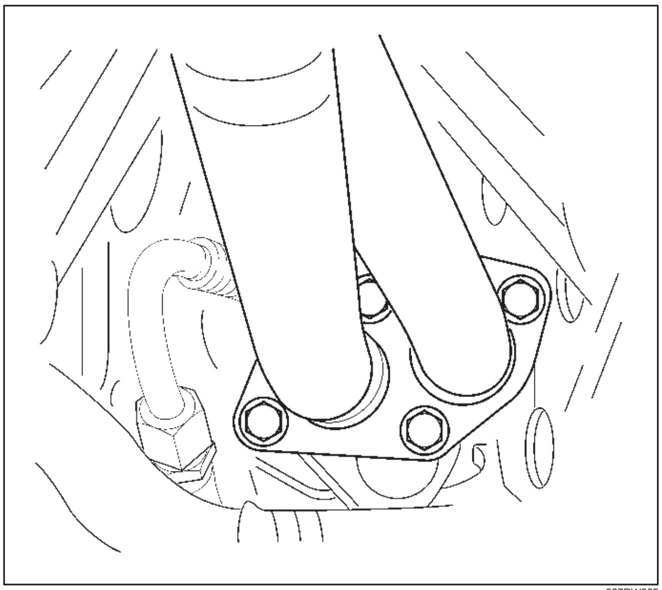
022RW014

16. Install exhaust front pipe to exhaust manifold and silencer, then tighten fixing nuts and bolts to the specified torque.

Torque

25 N·m (18 lb ft) for nut

68 N·m (50 lb ft) for bolt



027RW005

17. Install fuel piping bracket to transmission.
18. Install clutch piping bracket to right side of clutch housing.
19. Connect ground cable connector to left and right of front wheel arch upper side.
20. Connect cooling fan harness connector on the left of fan shroud.
21. Connect vacuum hose to the brake booster.
22. Connect three engine harness connectors to chassis harness of left rear side of engine compartment.
23. Install air cleaner assembly.
24. Install air duct with air cleaner cover to specified torque.

Torque

7 N·m (5.1 lb ft) for air duct fixing

3 N·m (2.2 lb ft) for air duct clamp bolt

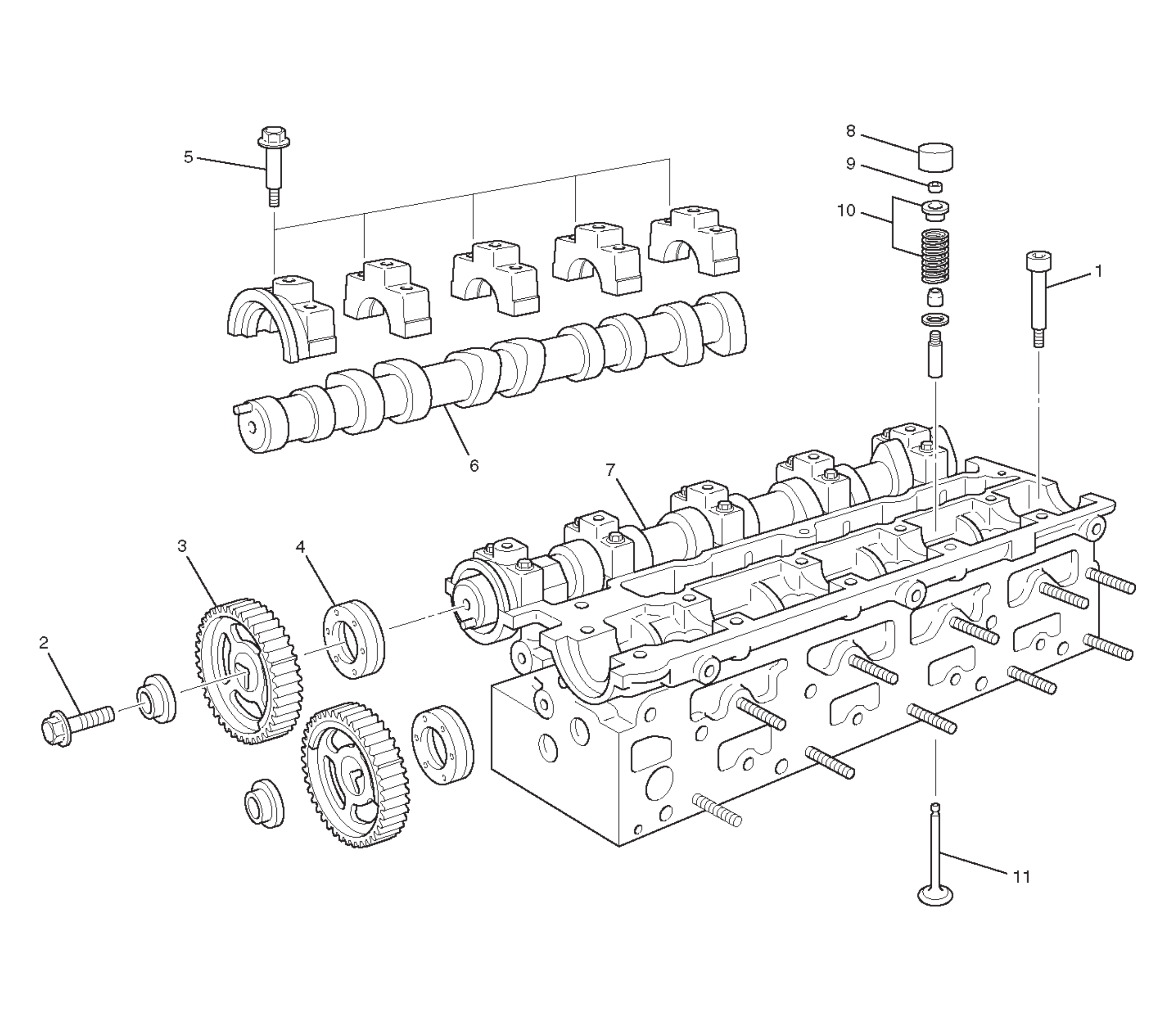
25. Connect throttle valve control cable to throttle valve on the intake manifold.
    Confirm the free play of throttle valve control cable.

Free play: 5.7 to 6.3 mm

26. Install engine hood to original position.
    Refer to installation procedure for Body section in this manual.
27. Install battery, connect positive cable and ground cable.
28. Fill engine coolant to full level in the coolant reservoir tank.

Cylinder Head

Cylinder Head and Associated Parts



Legend

(1) Cylinder Head Bolt
(2) Camshaft Pulley Fixing Bolt
(3) Camshaft Pulley
(4) Camshaft Oil Seal
(5) Camshaft Bracket Bolt
(6) Camshaft Exhaust
(7) Camshaft Intake
(8) Tappet (HLA)
(9) Split Collar
(10) Valve Spring and Spring Upper Seat
(11) Valve

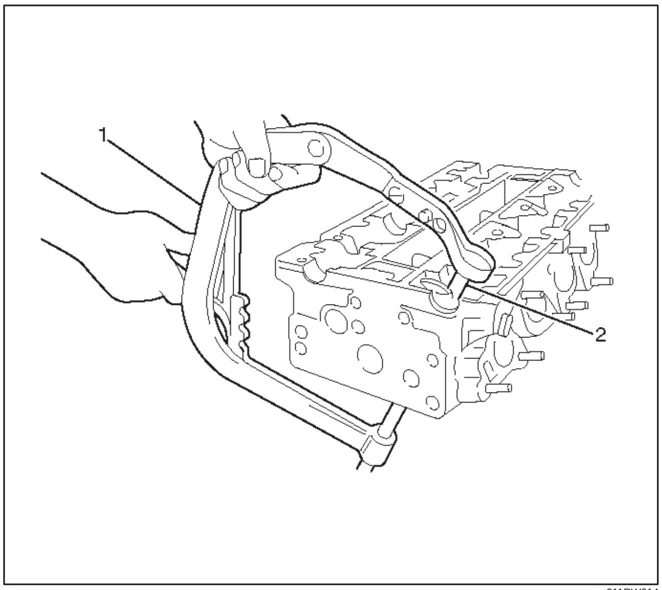
Disassembly

NOTE:

- During disassembly, be sure that the valve train components are kept together and identified so that they can be reinstalled in their original locations.
- Before removing the cylinder head from the engine and before disassembling the valve mechanism, perform a compression test and note the results.

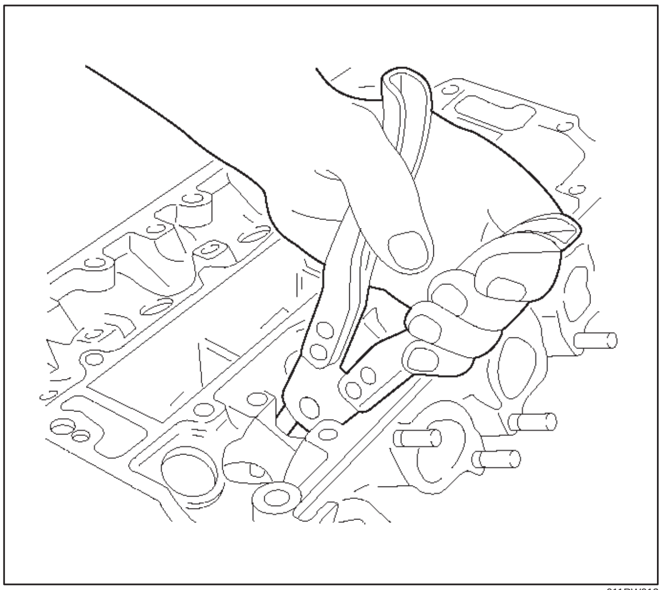
1. Remove camshaft pulley fixing bolt (2), then pulley (3).
2. Remove camshaft bracket fixing bolt (5), camshaft bracket, then camshaft exhaust (6), and intake side (7).

3. Remove cylinder head.
   Use J–42623.
4. Valve spring, valve spring caps, compress valve spring — use J–8062 (1) and Adapter J–42619 (2).
   Valve keepers.



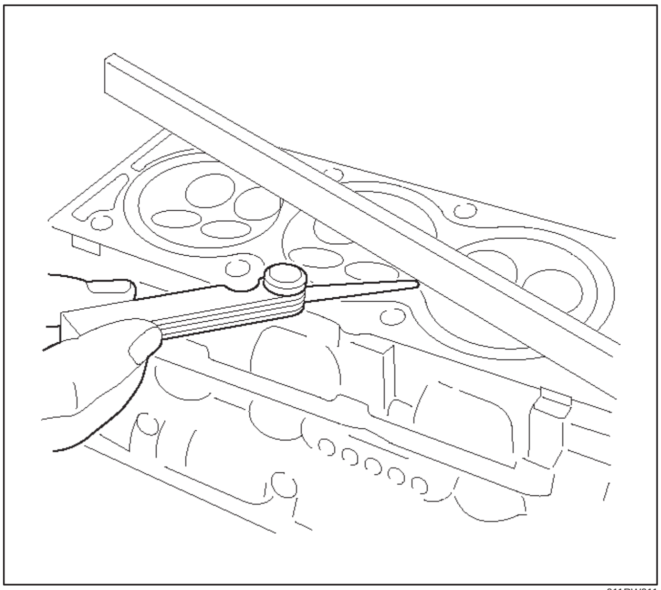
011RW014

5. Valves, valve stem seals — use commercially available remover pliers. Valve spring seats from cylinder head.


011RW013

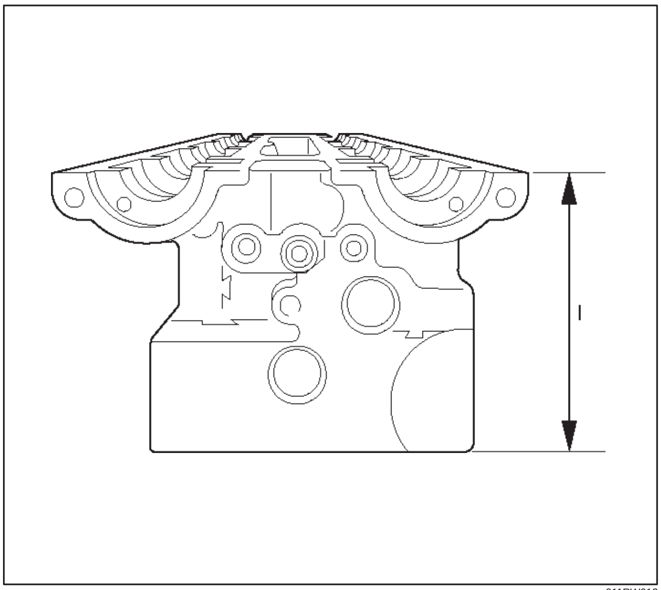
Inspection and Repair

1. Check length and width of cylinder head sealing surfaces for deformation and diagonals for warpage — use straight edge and feeler gauge.


011RW011

2. Height of cylinder head (sealing surface to sealing surface).

Dimension (I) – 134 mm



011RW012

Reassembly

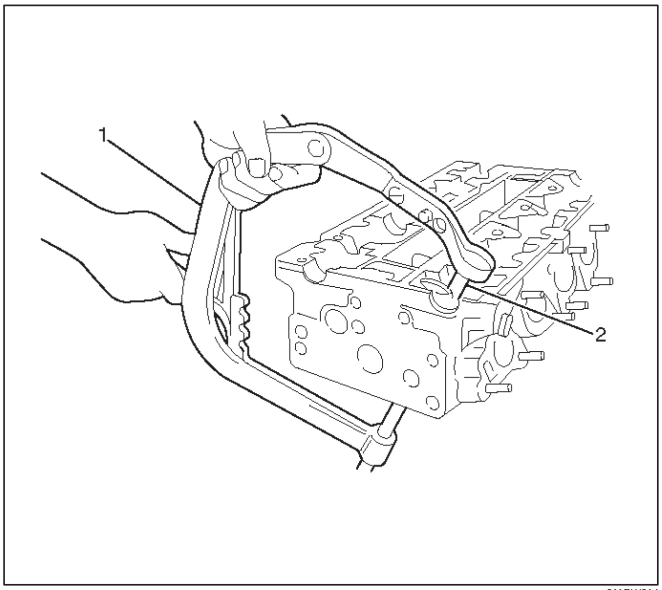
1. Valves, valve stem seals. Refer to Valve Spring, Oil Controller, Valve, Valve Guide in this section.
2. Valve spring, valve spring caps. Refer to Valve Spring, Oil Controller, Valve, Valve Guide in this section.
3. Install tappet (HLA).
4. Cylinder head with new cylinder head bolts to cylinder block.
   Tighten the bolts in 4 steps.

1st step: 25 N·m (18 lb ft)

2nd step: 90°

3rd step: 90°

4th step: 90°

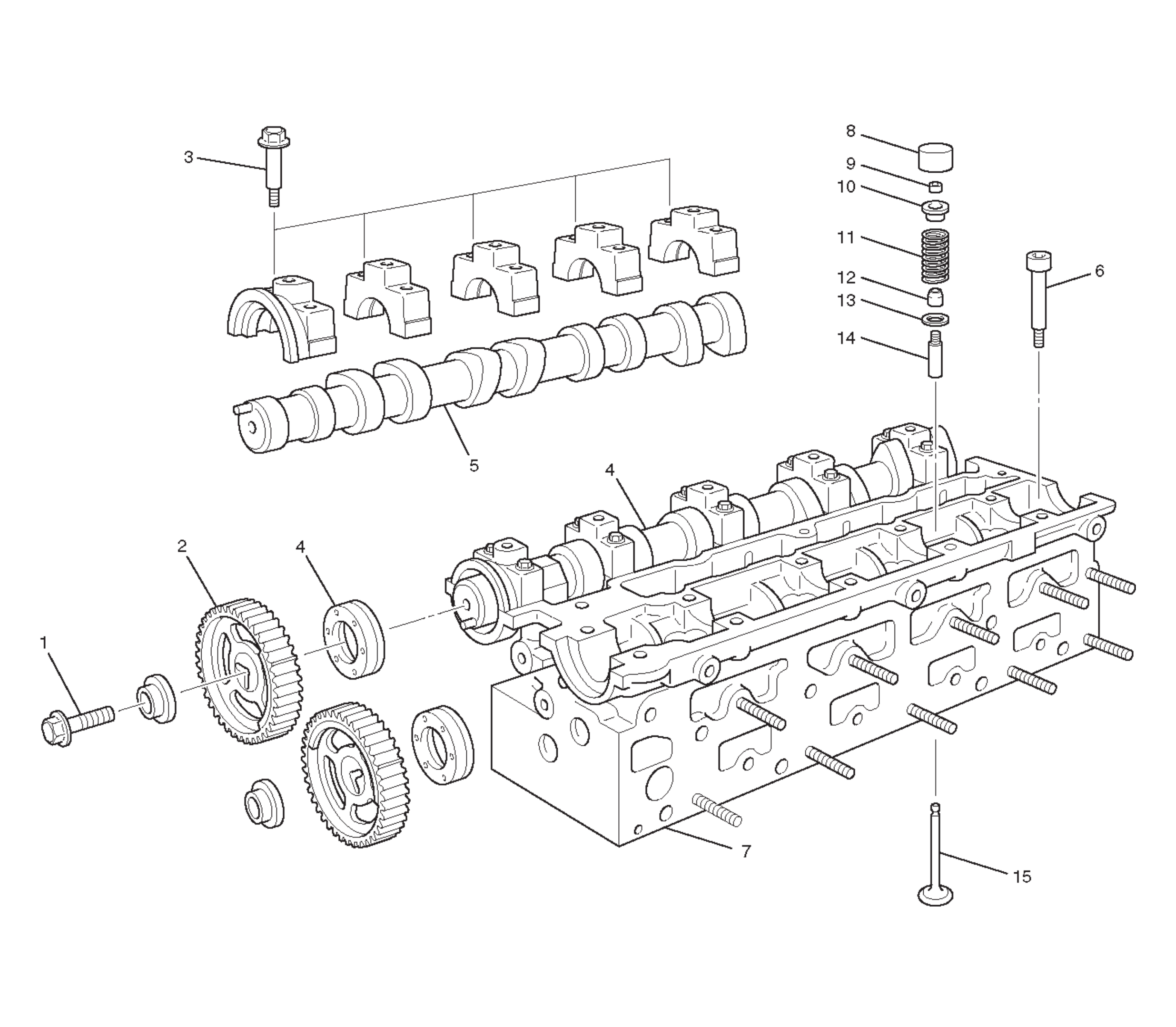


011RW014

5. Camshaft in cylinder head. Refer to Camshaft in this section.
6. Camshaft pulley. Refer to Camshaft in this section.

Valve Spring, Valve, Valve Guide

Valve Spring, Valve, Valve Guide and Associated Parts



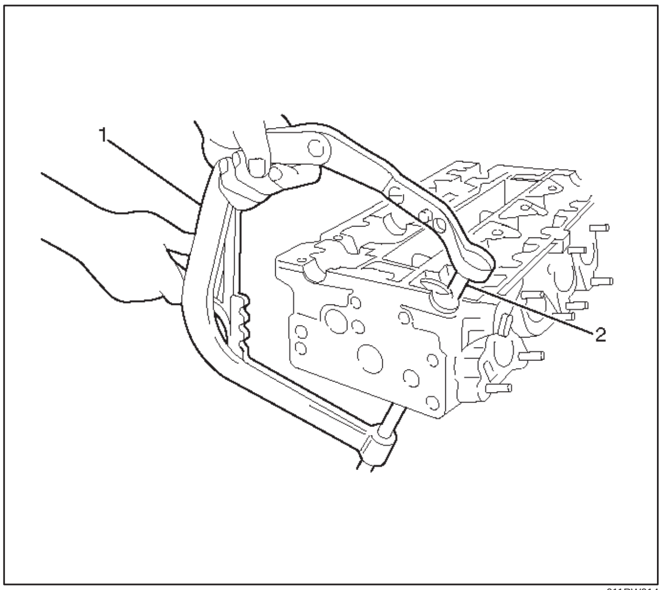
Legend

(1) Camshaft Pulley Fixing Bolts
(2) Camshaft Pulley
(3) Camshaft Bracket Fixing Bolt
(4) Camshaft Assembly Intake
(5) Camshaft Assembly Exhaust
(6) Cylinder Head Bolt
(7) Cylinder Head
(8) Tappet
(9) Split Collar
(10) Spring Upper Seat
(11) Valve Spring
(12) Oil Seal
(13) Spring Lower Seat
(14) Valve Guide
(15) Valve

Disassembly

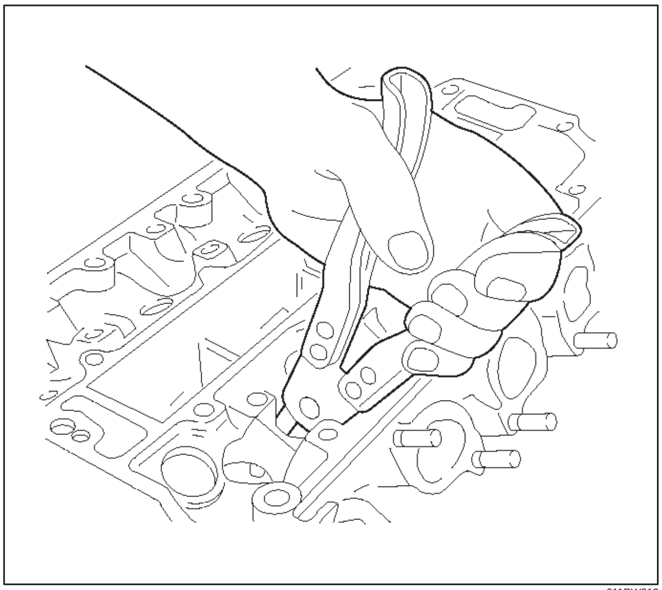
1. Remove camshaft pulley (1), (2).
2. Remove camshaft assembly (Intake) (3), (4).
3. Remove camshaft assembly (Exhaust side) (5).
4. Remove cylinder head (6), (7).
5. Remove tappet (8).

6. Use J–8062 valve spring compressor and J–42619 adapter to remove split collar (9).



011RW014

7. Remove spring upper seat and valve spring (10), (11).
8. Valve, valve guide – use commercially available remover pliers.
   Valve spring lower seat from cylinder head.


011RW013

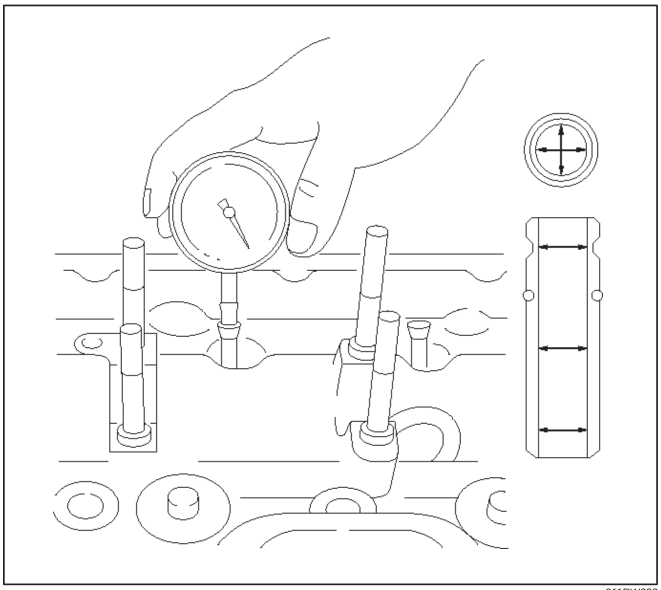
Inspection and Repair

1. Use a internal micrometer to measure the diameter valve guide.

Valve stem play

Intake : 0.03 to 0.057 mm (0.0012 to 0.0022 in)

Exhaust : 0.04 to 0.067 mm (0.0016 to 0.0026 in)


011RW020

Valve Guide

CAUTION: Taking care not to damage the valve seat contact surface, when removing carbon adhering to the valve head. Carefully inspect the valve stem for scratching or abnormal wear. If these conditions are present, the valve and the valve guide must be replaced as a set.

Valve Seat

Valve seat width in cylinder head

Intake: 1.0 to 1.5 mm (0.039 to 0.0585 in)

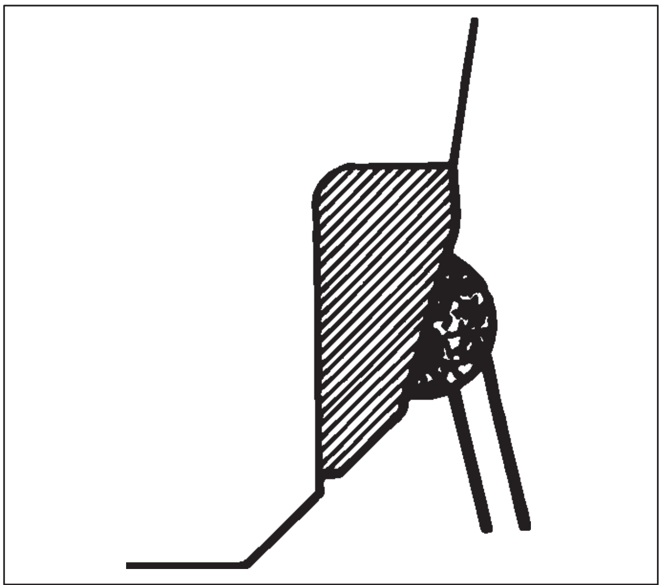
Exhaust: 1.7 to 2.2 mm (0.0663 to 0.0858 in)

Valve Seat Insert Correction

Remove the carbon from the valve seat insert surface.

Valve Seat Insert Replacement

1. Arc weld the rod at several points. Be careful not to damage the aluminum section.
2. Allow the rod to cool for a few minutes. This will cause the valve seat to shrink.
3. Strike the rod and pull it out.

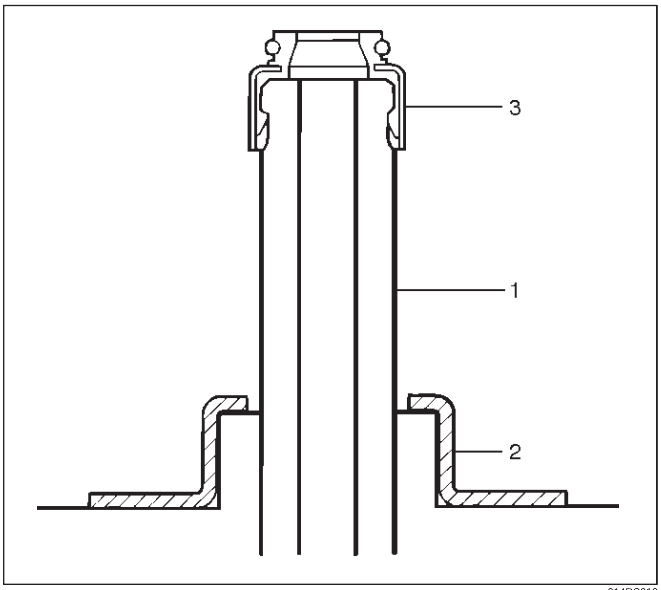


014RS015

4. Carefully clean the valve seat press–fit section on the cylinder head side.
5. Heat the press–fit section with steam or some other means to cause expansion. Cool the valve seat with dry ice or some other means.
6. Insert the press–fit section into the valve seat horizontally.
7. Lap the valve and the seat.

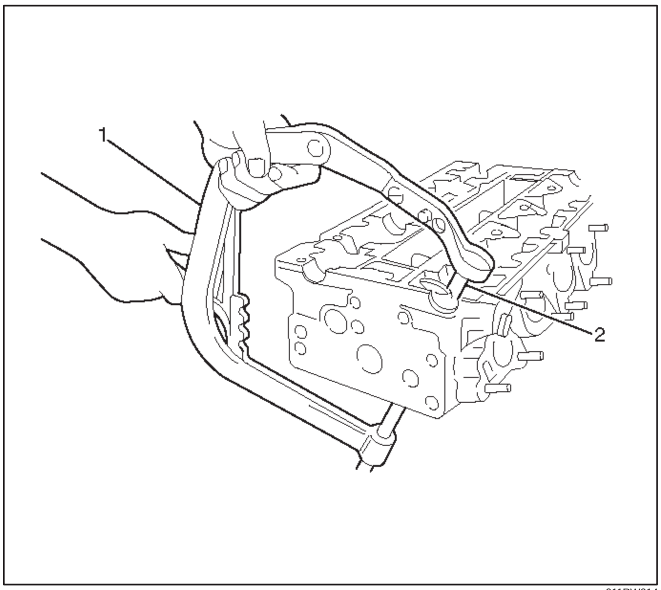
Reassembly

1. Install oil controller (3) and spring lower seat (2). Using oil controller replacer J–42622, drive in a new oil controller.



014RS019

2. Install valve to valve guide. Before install valve guide apply engine oil to the outside of the valve stem.
3. Install valve spring to cylinder head. Attach the valve spring to the lower spring seat.
4. Install lower valve spring seat, valve spring and upper valve spring seat then put split collars on the upper spring seat, using J–8062 valve spring compressor for install the split collars.

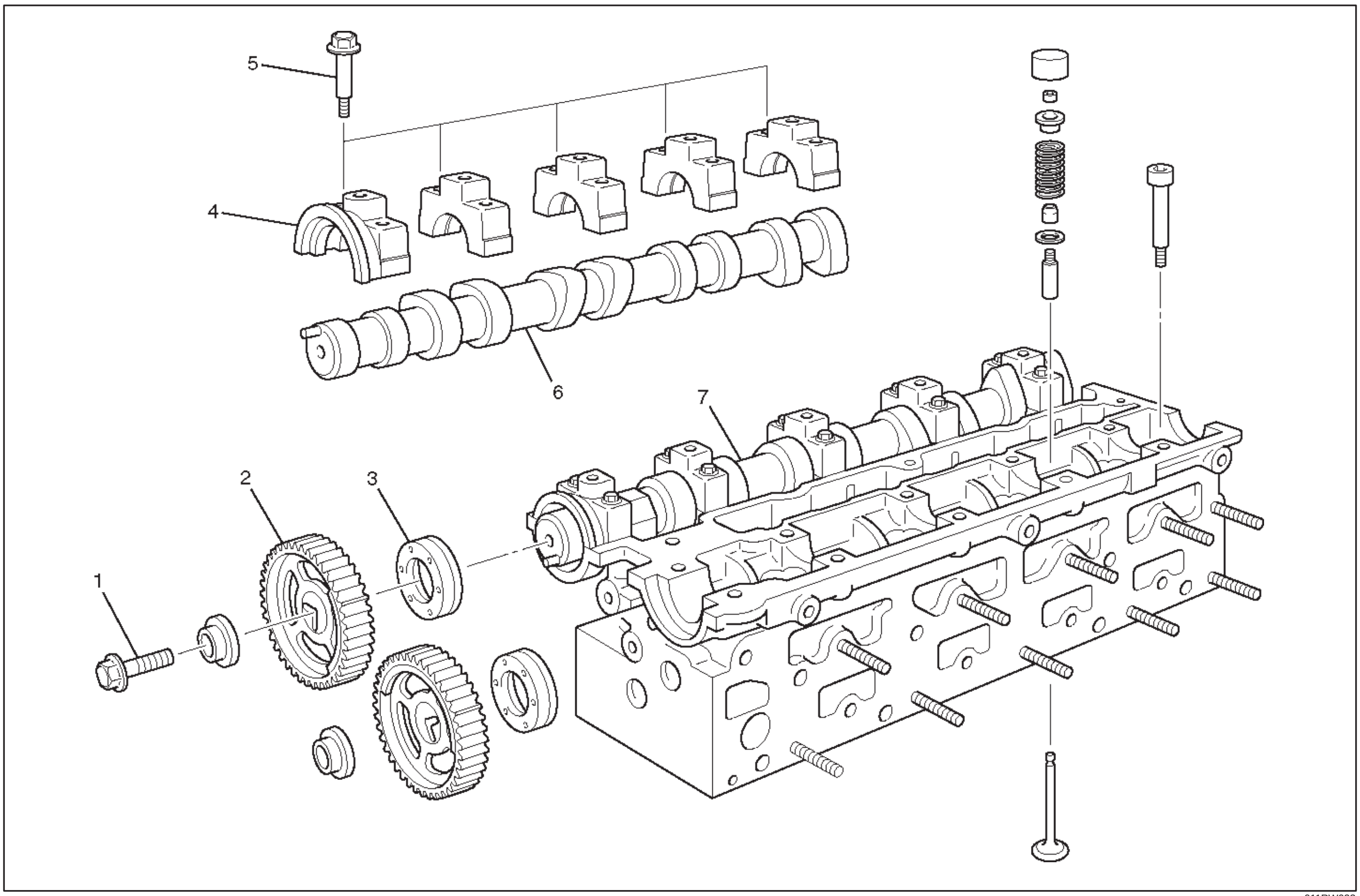


011RW014

5. Install tappet.
6. Install camshaft assembly.
   - Refer to installation procedure for Camshaft in this manual.

Camshaft

Camshaft and Associated Parts



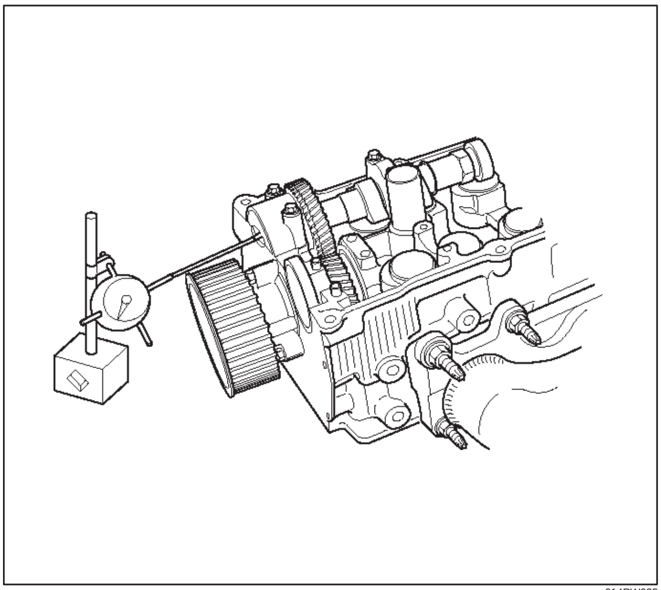
011RW023

Legend

(1) Camshaft Pulley Fixing Bolt
(2) Camshaft Pulley
(3) Oil Seal
(4) Camshaft Bracket
(5) Camshaft Bracket Fixing Bolt
(6) Camshaft Assembly Exhaust
(7) Camshaft Assembly Intake

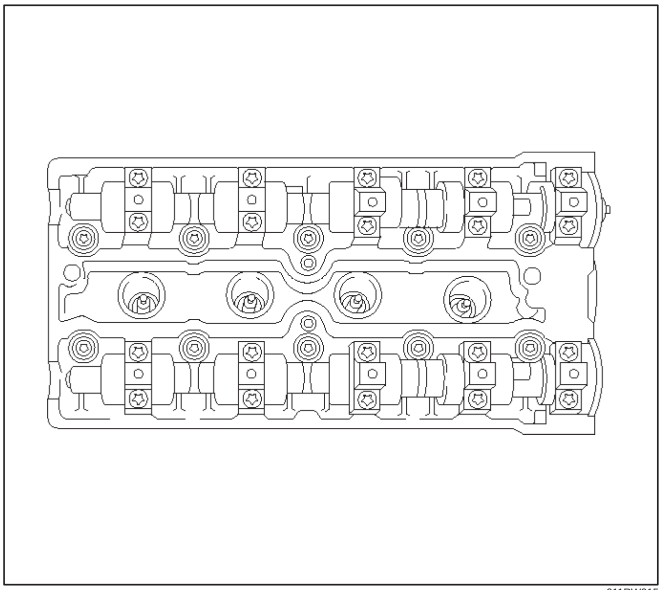
Disassembly

1. Remove fixing bolt (1) for camshaft pulley (2).
2. Remove oil seal (3).



014RW035

3. Remove oil seal (3).
4. Remove twenty fixing bolts (5) from inlet and exhaust camshaft bracket, then camshaft brackets (4).



011RW015

5. Remove camshaft assembly (6), (7).

Reassembly

1. Install camshaft drive gear assembly and tighten three bolts to specified torque.

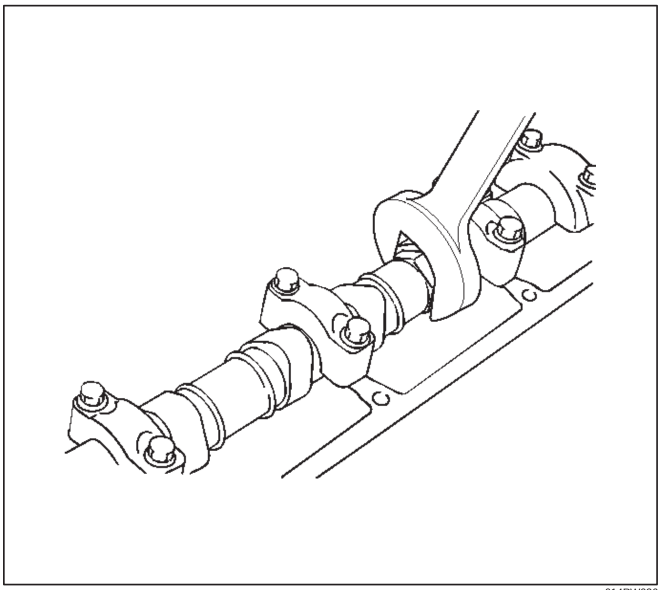
Torque: 50 N·m (37 lb ft) + 60° + 15°

2. Install camshaft assembly and camshaft brackets, tighten twenty bolts on one side bank to the specified torque.
   1. Apply engine oil to camshaft journal and bearing surface of camshaft bracket.
   2. Align timing mark on intake camshaft and exhaust camshaft to timing mark on camshaft drive gear (one dot).
   3. Tighten twenty bolts on numerical order one side bank shown in the illustration.

Torque: 8 N·m (6 lb ft)

   4. If it required to replace oil seal of camshaft drive gear, use J–42609 for install the oil seal.
   5. Tighten bolt for camshaft drive gear assembly pulley to the specified torque.

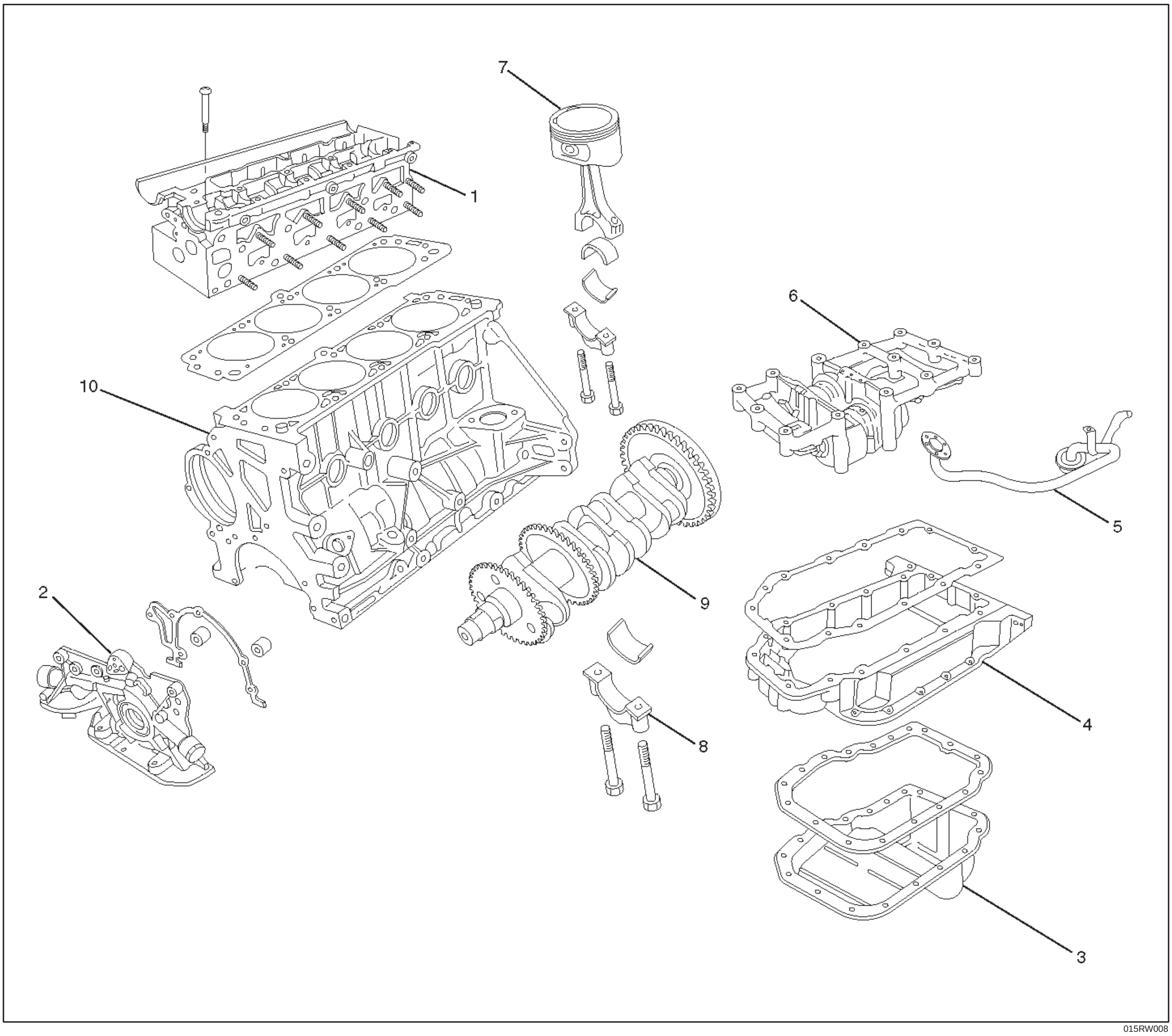
Torque: 50 N·m (37 lb ft) + 60° + 15°



014RW036

Crankshaft

Crankshaft and Associated Parts



Legend

(1) Cylinder Head Assembly
(2) Oil Pump Assembly
(3) Pan
(4) Pan Support
(5) Oil Strainer
(6) Balance Unit Assembly
(7) Piston and Connecting Rod Assembly
(8) Main Bearing Cap
(9) Crankshaft
(10) Cylinder Block Assembly

Disassembly

1. Remove cylinder head assembly (1). Refer to “Cylinder head” in this manual.
2. Remove oil pan (3).

CAUTION: Take care not to damage or deform the sealing flange surface of crankcase.

3. Remove oil pan support (4).
4. Remove oil strainer (5).
5. Remove oil pump assembly (5).
6. Balance unit assembly.
7. Remove piston and connecting rod assembly (7). Refer to “Piston, Piston Ring and Connecting Rod” in this manual.
8. Remove flywheel.
9. Remove rear oil seal and oil baffle plate.

10. Remove main bearing cap (8).
11. Remove crankshaft (9).
12. Remove crankshaft pulse pickup sensor disc.

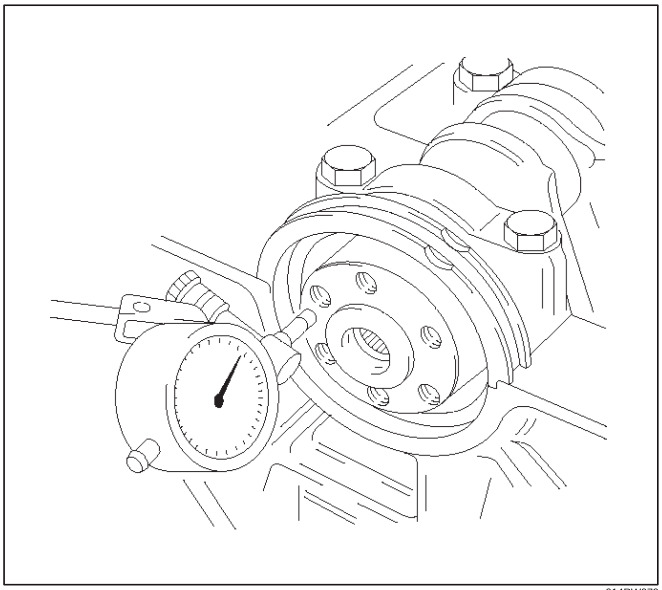
Inspection and Repair

1. Crankshaft
   Set the dial indicator as shown in the illustration and measure the crankshaft thrust clearance. If the thrust clearance exceeds the specified limit, replace the thrust bearings as a set.

Thrust Clearance

Standard : 0.01 mm–0.02 mm (0.0004 in–0.0008 in)

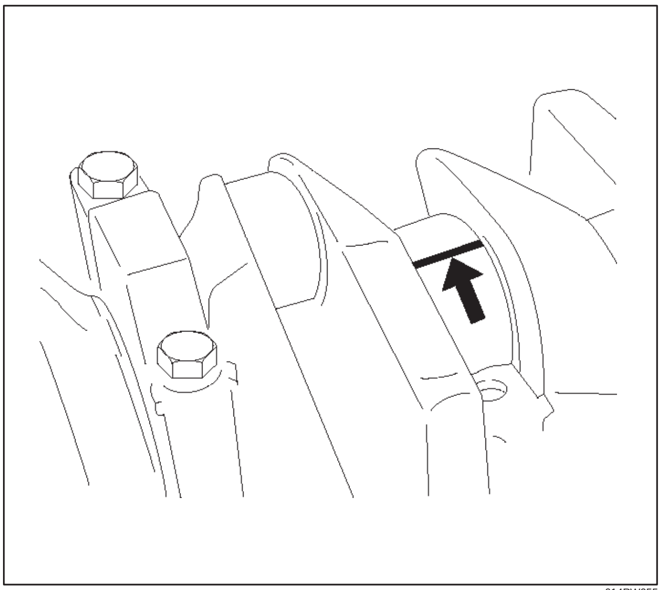
Limit : 0.21 mm (0.0118 in)



014RW079

Main Bearing Clearance

1. Remove the bearing caps and measure the oil clearance.
2. Remove the main bearing cap fixing bolts.
   Arrange the removed main bearing caps in the cylinder number order.
   Remove the main bearings.
3. Remove the crankshaft.
   Remove the main bearings.
4. Clean the upper and lower bearings as well as the crankshaft main journal.
5. Check the bearings for damage or excessive wear.
   The bearings must be replaced as a set if damage or excessive wear is discovered during inspection.
6. Set the upper bearings and the thrust washers to their original positions.
   Carefully install the crankshaft.
7. Set the lower bearings to the bearing cap original position.
8. Apply plastigage to the crankshaft journal unit as shown in the illustration.



014RW055

9. Install main bearing caps, and tighten each bolt to the specified torque.

Main bearing caps bolts.

Torque:

1st step: 50 N·m (37 lb ft)

2nd step: 45˚

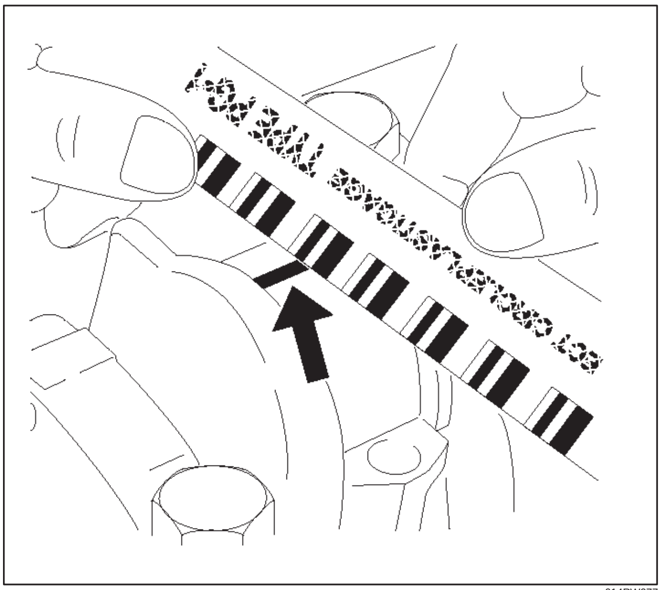
3rd step: 15˚

Torque : 39 N·m (29lb ft)

10. Measure the plastigage width and determine the oil clearance. If the oil clearance exceeds the specified limit, replace the main bearings as a set and/or replace the crankshaft.

Standard : 0.015 mm–0.04 mm (0.0007 in–0.0016 in)

Limit : 0.12 mm (0.0047 in)



014RW077

11. Clean the plastigage from the bearings and the crankshaft.
    Remove the crankshaft and the bearings.

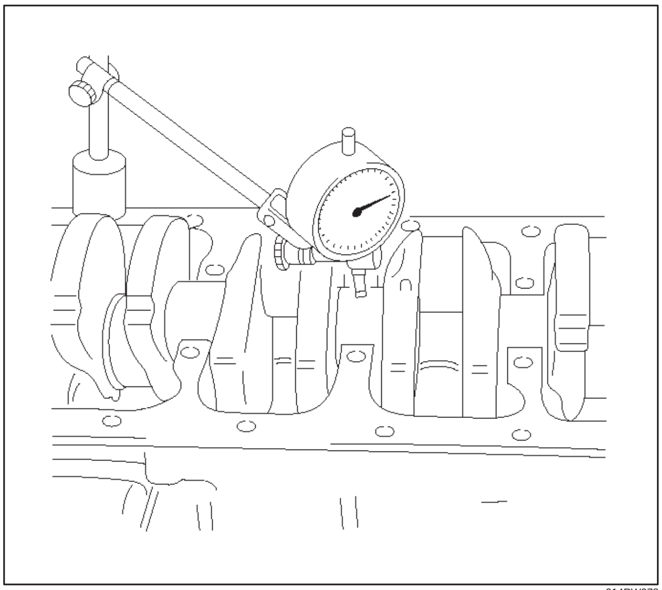
Crankshaft (12) Inspection

Inspect the surface of the crankshaft journal and crank pins for excessive wear and damage. Inspect the oil seal fitting surfaces for excessive wear and damage. Inspect the oil ports for obstructions.

Inspection and Repair

1. Carefully set the crankshaft. Slowly rotate the crankshaft and measure the runout. If the crankshaft runout exceeds the specified limit, the crankshaft must be replaced.

   Runout : 0.03 mm (0.0012 in)

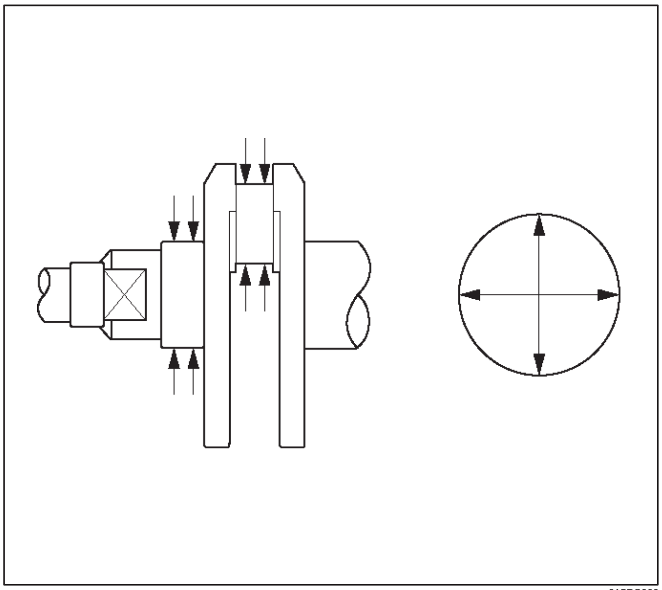


014RW078

2. Measure the diameter and the uneven wear of main journal and crank pin. If the crankshaft wear exceeds the specified limit, crankshaft must be replaced.

   Main journal diameter : 57.934 mm–57.980 mm (2.259 in–2.261 in)

   Crank pin diameter : 48.939 mm–48.982 mm (1.909 in.–1.91 in.)



015RS009

Crankshaft Bearing Selection

When installing new crankshaft bearings or replacing bearings, refer to the selection table below. Select and install the new crankshaft bearings.

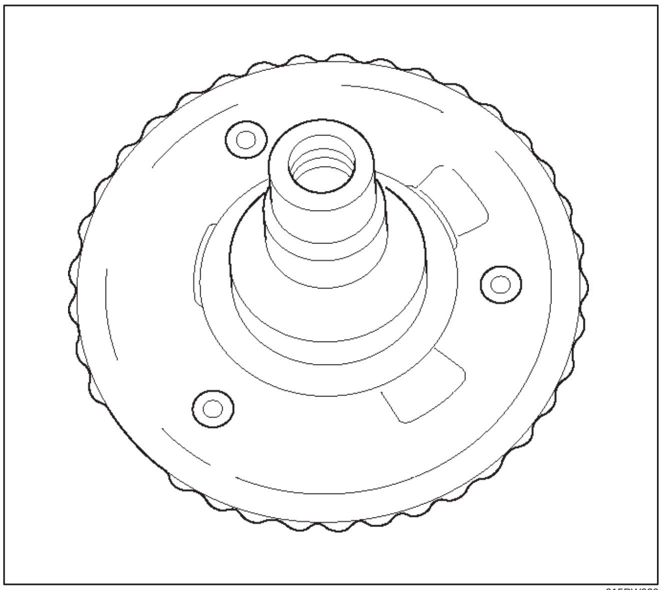
Crankshaft grinding dimensions	mm (in)
Production and Service	
Crankshaft bearing journal dia.	
Standard size	
white	57.974 to 57.981 (2.260–2.261)
green	57.981 to 57.988 (2.261–2.2615)
brown	57.988 to 57.995 (2.2615–2.2618)
Undersize 0.25 (0.0097)	
green/blue	57.732 to 57.738 (2.2515–2.2517)
brown/blue	57.738 to 57.745 (2.2517–2.252)
Undersize 0.5 (0.0195)	
green/white	57.482 to 57.488 (2.2418–2.242)
brown/white	57.488 to 57.495 (2.242–2.2423)
Guide bearing width	
Standard size	25.950 to 26.002 (1.012–1.014)
Undersize 0.25 (0.0097)	26.150 to 26.202 (1.019–1.021)
Undersize 0.5 (0.0195)	26.350 to 26.402 (1.027–1.029)

NOTE: Take care to ensure the bearings are positioned correctly.

Crankshaft pulse pickup sensor disc inspection and repair.

Inspect the crankshaft pulse pickup sensor disc for excessive wear and damage.

Replace the crankshaft pulse pickup sensor disc if the inspection exceeds wear and damage.



015RW039

Reassembly

1. Crankshaft (12).
   - Install the crankshaft pulse pickup sensor disc.

   Torque: 13 N·m (10 lb ft)

   - Install the main bearings to the cylinder block and the main bearing caps.
   - Be sure that they are positioned correctly.
   - Apply new engine oil to the upper and lower main bearing faces.

NOTE: Do not apply engine oil to the main bearing back faces.

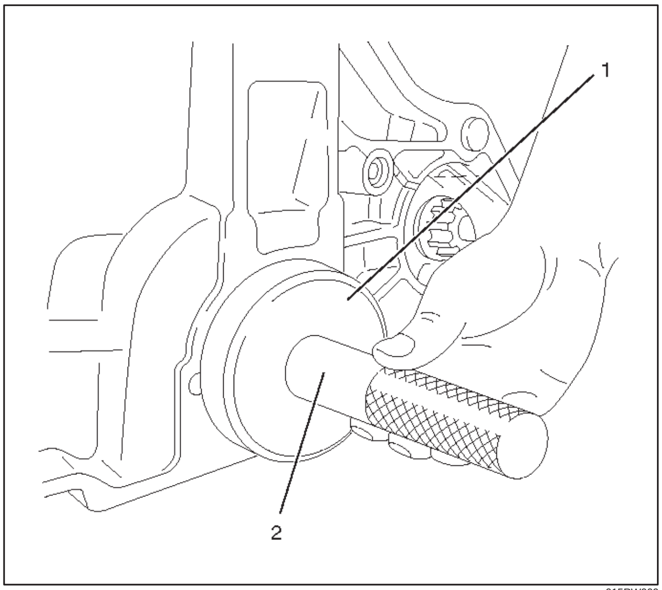
   - Carefully mount the crankshaft.
   - Apply engine oil to the thrust washer.
   - Assemble the thrust washer to the No.3 bearing journal. The oil grooves must face the crankshaft.
   - Tighten the crankshaft baring cap bolts in 3 steps:

   1st step: 50 N·m (36 lb ft)

   2nd step: 45°

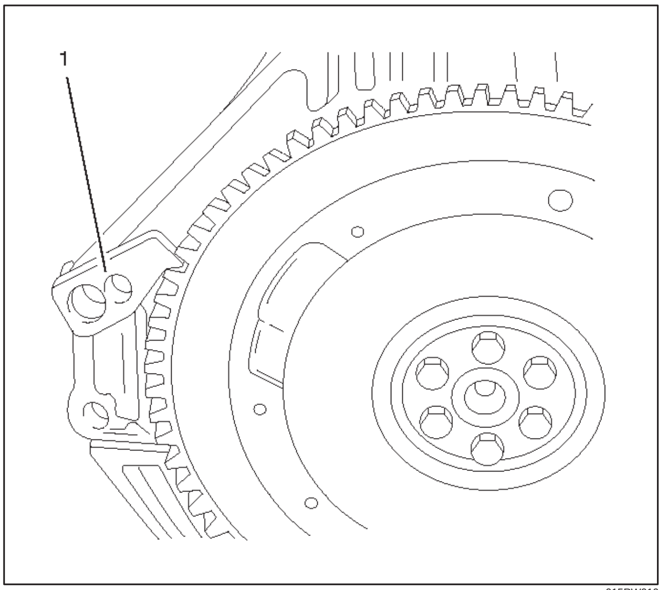
   3rd step: 15°

2. Rear oil seal (10).
   - Coat lip of seal rings thinly with protective grease.
   - Install seal ring into cylinder block, use J–42616 (1) and J–42613 (2).



015RW009

3. Flywheel (9).
   1. Thoroughly clean and remove the oil from the threads of crankshaft.
   2. Remove the oil from the crankshaft and flywheel mounting faces.
   3. Mount the flywheel on the crankshaft and then install the washer.
   4. Use stopper (J–42618) to hold the crankshaft.



015RW010

   5. Prevent from rotating.
      Tighten the flywheel bolts in 3 steps:

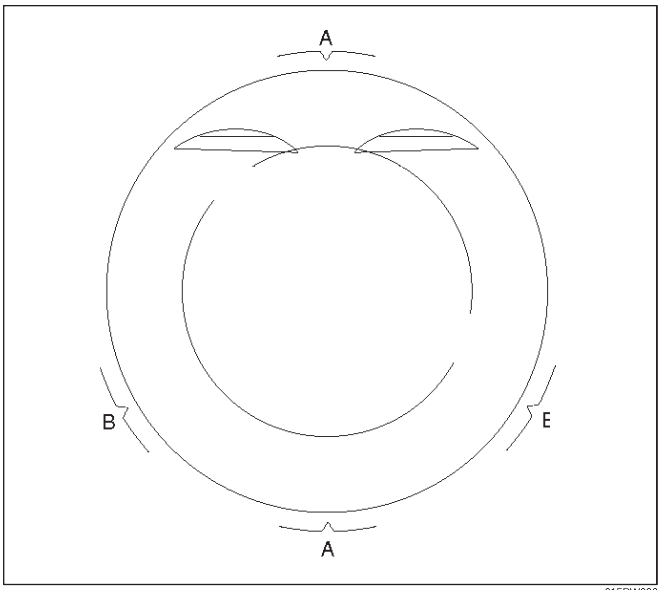
1st step: 65 N·m (48 lb ft)

2nd step: 30°

3rd step: 15°

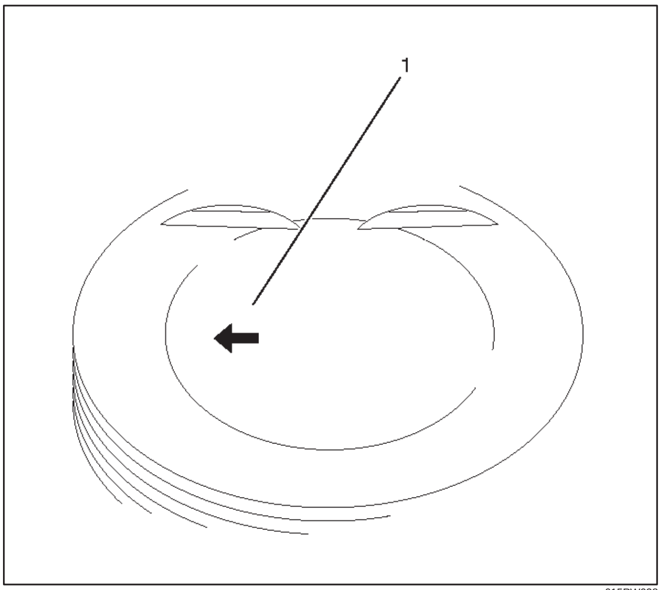
NOTE: Do not reuse the bolt.

4. Piston and connecting rod assembly (8)
   - Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins. Check to see that the piston ring end gaps are correctly positioned.
   - Piston rings position (A) every 180°.
     Oil scraper rings (B) — offset 25 to 50 mm/1 to 2 in. to left and right from gap of intermediate ring.



015RW026

   - Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor. The front marks must be facing the front of the engine.
   - Match the numbered caps with the numbers on the connecting rods. Align the punched marks on the connecting rods and caps.
   - Arrow (1) on piston head points to engine timing side, bead on connecting rod points to flywheel side.



015RW038

- Tighten the bolts in 3 steps:

1st step: 35 N·m (25 lb ft)

2nd step: 45°

3rd step: 15°

5. Install the balance unit assembly and tighten the bolts in 2 steps:

1st step: 20 N·m (14 lb ft)

2nd step: 45°

Refer to the “Balance Unit Assembly” section of this manual.

6. Install oil pump assembly (5), refer to “Oil Pump” in this manual.
7. Install oil strainer.

Torque: 8 N·m (5.8 lb ft)

8. Install oil pan support and tighten the bolts to the specified torque.

Torque: 20 N·m (14 lb ft)

9. Install oil pan.
   1. Completely remove all residual sealant, lubricant and moisture from the sealing surfaces. The surfaces must be perfectly dry.
   2. Apply a correct width bead of sealant (TB–1207C or its equivalent) to the contact surfaces of the oil pan. There must be no gaps in the bead.
   3. The oil pan support must be installed within 5 minutes after sealant application.
   4. Tighten the bolts in to steps.

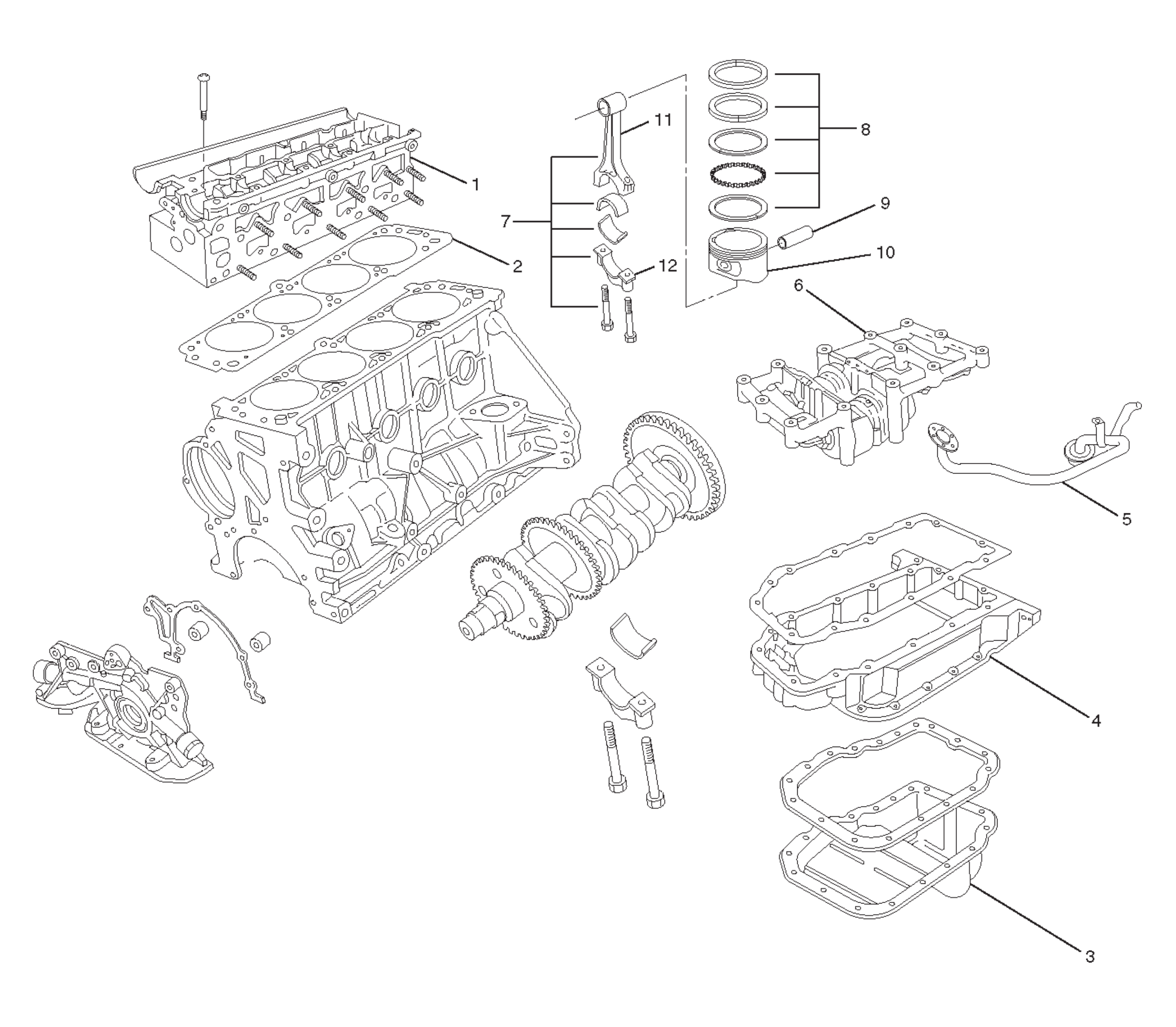
1st step: 8 N·m (5.8 lb ft)

2nd step: 30°

10. Install cylinder head assembly, refer to “Cylinder Head” in this manual.

Piston and Connecting Rod

Piston, Connecting Rod and Associate Parts



Legend

(1) Cylinder Head Assembly
(2) Cylinder Head Gasket
(3) Oil Pan Assembly
(4) Pan Support
(5) Oil Strainer
(6) Balance Unit Assembly
(7) Piston and Connecting Rod Assembly
(8) Piston Ring
(9) Piston Pin
(10) Piston
(11) Connecting Rod
(12) Connecting Rod Cap

Disassembly

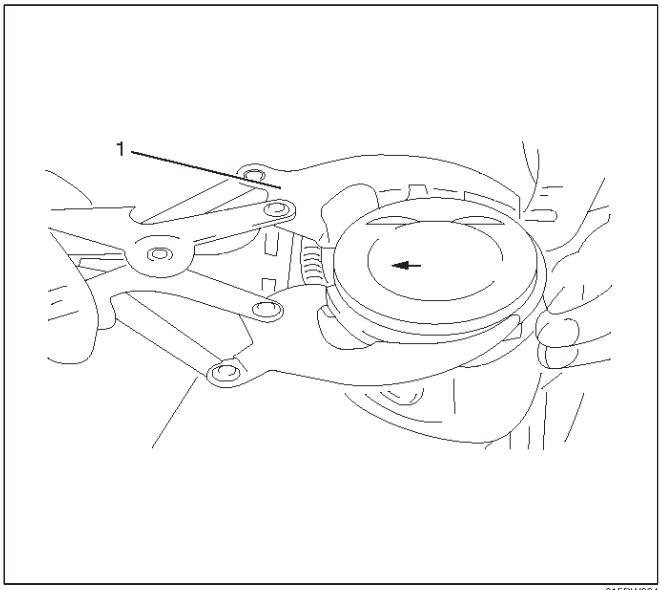
1. Remove cylinder head assembly (1), refer to "Cylinder Head Removal" in this manual.
2. Remove cylinder head gasket (2).
3. Remove oil pan assembly and oil pan support (3) refer to"Oil Pan and Oil Pan Support" in this manual.
4. Remove oil strainer.
5. Remove balance unit assembly.
6. Remove connecting rod cap with connecting rod lower.

7. Remove piston and connecting rod assembly (7).

NOTE: Before removing piston and connecting rod assembly, measure thrust clearance.

- Remove any ridge or carbon build up from the top end of the cylinder.

8. Remove the piston rings (8) with a piston ring expander. Arrange the removed piston rings in the cylinder number order.



015RW024

9. Remove the piston pin (9).
   - Heat the connecting rod and the piston pin with oil heater, when it temperature is keep at 280°C–320°C.
   - Push the piston pin with brass bar.

NOTE: Keep the parts removed from each cylinder separate. All parts must be reinstalled in their original positions.

10. Piston (10).
11. Connecting rod (11).

Inspection and Repair

Pistons (10)

Carefully clean away all the carbon adhering to the piston head and the piston ring grooves.

NOTE: Never use a wire brush to clean the pistons. Damage will result. Visually check each piston for cracking, scoring, and other signs of excessive wear. If any of the above conditions are found, the piston must be replaced.

Piston Rings (8)

Any worn or damaged part discovered during engine overhaul must be replaced with a new one.

1. Ring end gap measurement
   - Insert the piston ring into the bore.
   - Push the ring by the piston, at a right angle to the wall, into the point at which the cylinder bore diameter is the smallest.
   - Measure the ring end gap.

Compression Ring

1st ring

Standard: 0.30 mm–0.50 mm
(0.0118 in–0.0195 in)

2nd ring

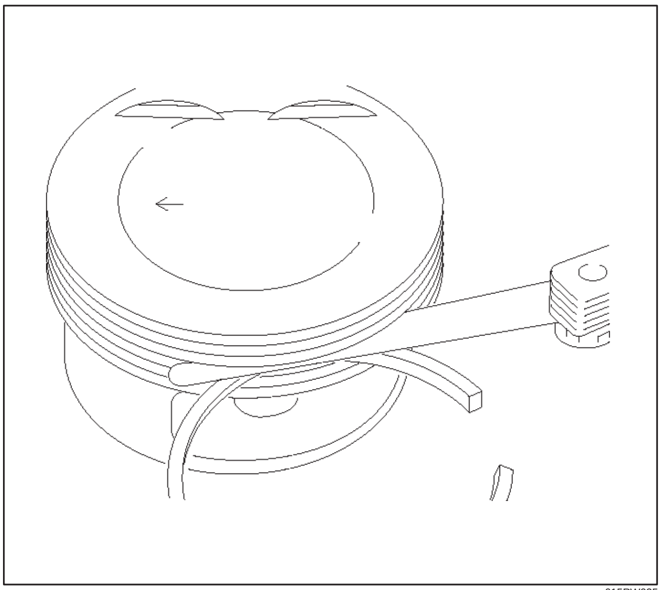
Standard: 0.30 mm–0.50 mm
(0.0118 in–0.0195 in)

Oil ring

Standard: 0.40 mm–1.40 mm
(0.0156 in–0.0546 in)

2. Measure the clearance between the piston ring groove and the piston ring with a feeler gauge. If the piston ring groove / piston ring clearance exceeds the specified limit, the piston must be replaced.

Compression Ring Clearance
Standard : 0.02 mm–0.04 mm
(0.0008 in.–0.0016 in)



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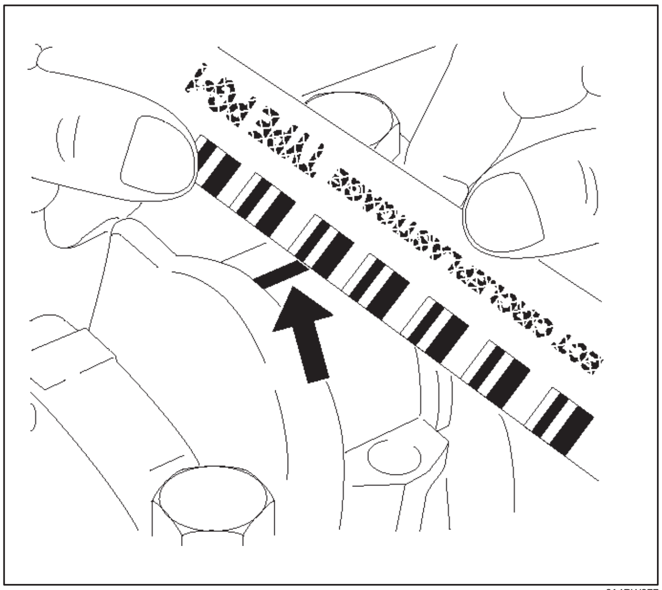
Piston Pin (9)

NOTE: Do not reuse the old piston pin.

1. Use a micrometer to measure the new piston pin outside diameter in both directions at three different positions.
2. Measure the inside diameter of the connecting rod small end. If the fitting interference between the small end and pin does not conform to the specified value, the connecting rod must be replaced.

Standard : 0.02 mm–0.041 mm

(0.0008 in–0.0016 in)



014RW077

3. Insert the new pin into the piston and rotate it. If the pin rotates smoothly with no backlash, the clearance is normal. If there is backlash or roughness, measure the clearance. If the clearance exceeds the specified limit, the piston must be replaced.

Clearance

Standard : 0.011 mm–0.014 mm
(0.0004 in.–0.0005 in)

Connecting Rods (11)

1. Measure the oil clearance between the connecting rod and the crankshaft.
   1. Remove the connecting rod cap nuts and the rod caps (12).
      Arrange the removed rod caps in the cylinder number order.
   2. Clean the rod bearings and the crankshaft pins.
   3. Carefully check the rod bearings. If even one bearing is found to be damaged or badly worn, the entire bearing assembly must be replaced as a set. Reinstall the bearings in their original positions. Apply plastigage to the crank pin.
   4. Reinstall the rod caps (12) to their original positions.
      Tighten the rod cap nuts.

1st step: 35 N·m (26 lb ft)

2nd step: 45°

3rd step: 15°

NOTE: Do not allow the crankshaft to rotate.

5. Remove the rod caps.
6. Measure the width of the plastigage and determine the oil clearance. If the oil clearance exceeds the limit, replace the rod bearing as a set.

Standard : 0.006 mm–0.031 mm
(0.0002 in–0.0012 in)

Limit : 0.12 mm (0.0047 in)

7. Clean the plastigage from the bearings and the crankshaft pins.

Crankshaft grinding dimensions	mm (in)
(continued)	
Production and Service	
Con–rod bearing journal dia.	
Standard size	
(no color code)	48.970 to 48.988 (1.9098–1.9105)
Undersize 0.25 (0.0097)	
blue	48.720 to 48.738 (1.9001–1.9008)
Undersize 0.5 (0.0195)	
white	48.470 to 48.488 (1.8903–1.891)
Con–rod bearing journal width	
Standard size	
(no color code)	26.460 to 26.580 (1.0319–1.036)
Undersize 0.25 (0.0097)	
blue	26.460 to 26.580 (1.0319–1.036)
Undersize 0.5 (0.0195)	
white	26.460 to 26.580 (1.0319–1.036)
Con–rod width	26.338 to 26.390 (1.0271–1.0292)

Reassembly

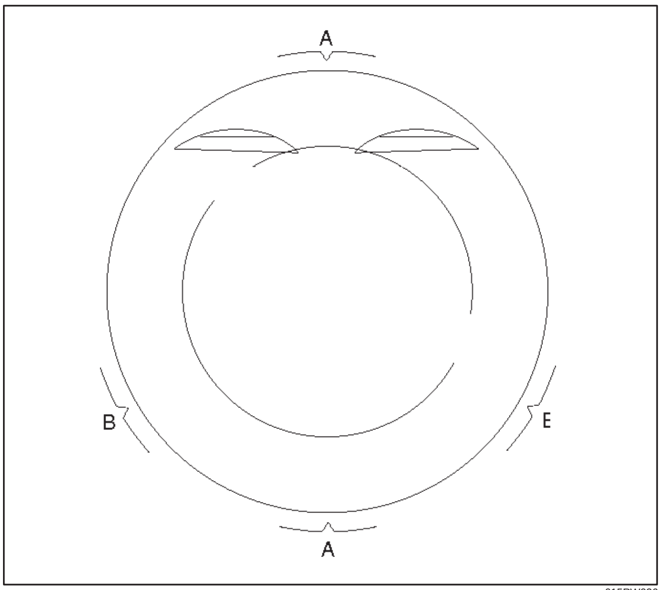
1. Install connecting rod
2. Install piston
3. Install piston pin
   - Apply a thin coat of engine oil to the piston pin. Try to insert the piston pin into the piston pin hole with normal finger pressure.

NOTE: When changing piston / connecting rod combinations, do not change the piston / piston pin combination and do not reuse the old piston pin.

   - Attach the piston to the connecting rod with the piston front mark and the connecting rod front mark on the same side.
   - Heat the connecting rod small end to a suitable temperature to ensure smooth installation.
4. Install piston ring with the piston ring expander.
   - New piston rings with “Top” uppermost — use commercially available pliers.
   - Position ring gaps:

     1 — Compression rings 180° to each other as illustrated.

     2 — Offset oil control rings 25 to 50 mm/1 to 2 in. from gap of second compression ring.



015RW026

   - After installation, apply engine oil to the entire circumference of the piston rings. Check to see that all the rings rotate smoothly.
5. Install piston and connecting rod assembly.
   - Insert the bearings into the connecting rods and caps. Apply new engine oil to the bearing faces and nuts.
   - Tighten the connecting rod cap nuts in 3 steps:

1st step : 35 N·m (26 lb ft)

2nd step: 45°

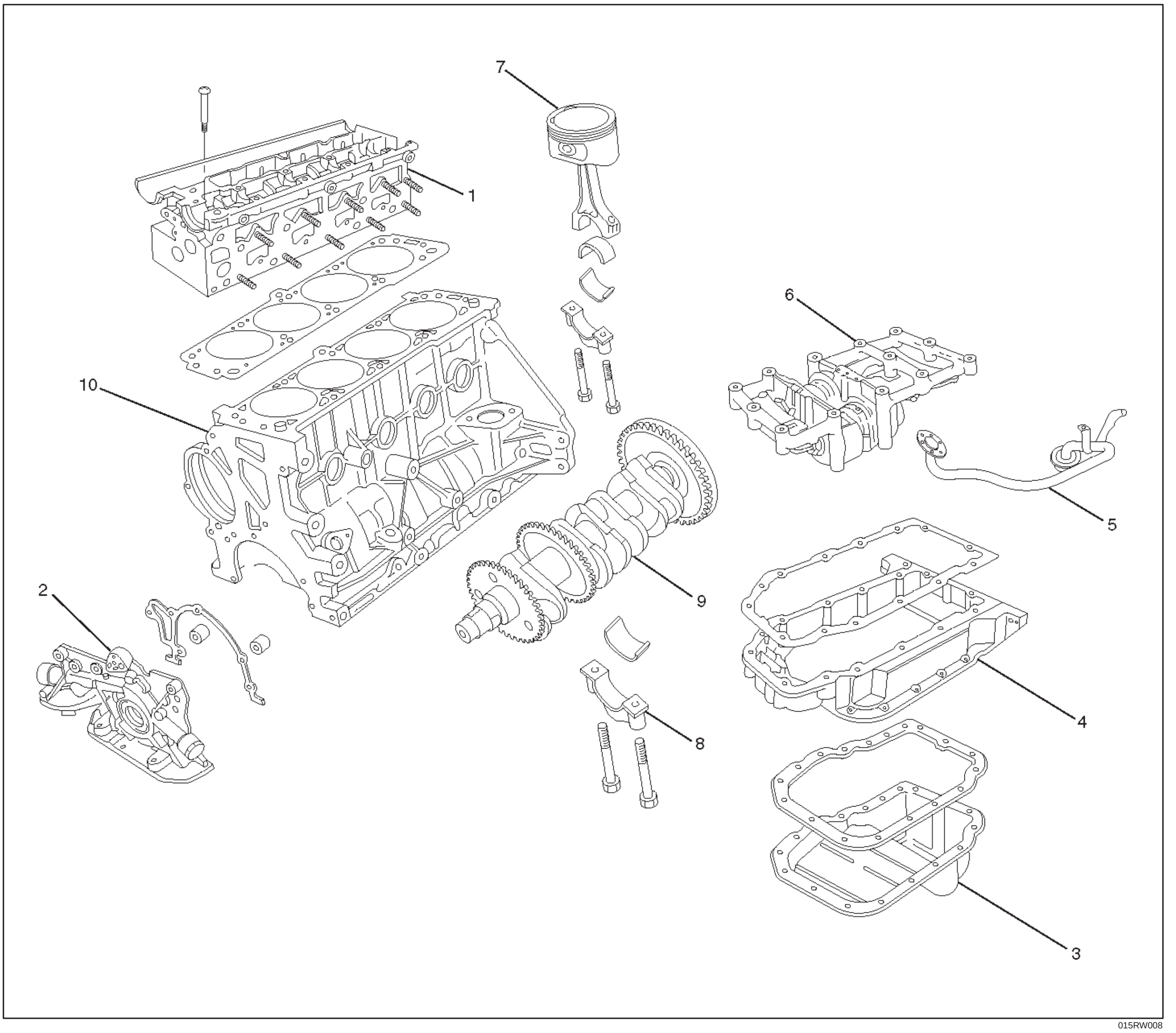
3rd step: 15°

NOTE: Do not apply engine oil to the bearing back faces.

6. Oil gallery, refer to “Crankshaft and Main Bearing” in this manual.
7. Oil strainer and O-ring.
8. Install balance unit assembly, refer to “Balance Unit Assembly: in this manual.
9. Install oil pan support assembly, refer to “Oil Pan and Oil Pan Support” in this manual.
10. Install cylinder head gasket.
11. Install cylinder head assembly.
    - Refer to “Cylinder Head” in this manual.

Cylinder Block

Cylinder Block and Associated Parts



015RW008

Legend

(1) Cylinder Head Assembly
(2) Oil Pump Assembly
(3) Oil Pan
(4) Oil Pan Support
(5) Oil Strainer
(6) Balance Unit Assembly
(7) Piston and Connecting Rod Assembly
(8) Main Bearing Cap
(9) Crankshaft
(10) Cylinder Block

Disassembly

1. Remove cylinder head assembly.
2. Remove cylinder head gasket.
3. Remove oil pan assembly.
4. Remove oil pan support.
5. Remove oil strainer.
6. Remove oil pump assembly.
7. Remove balance unit assembly.
8. Remove piston and connecting rod assembly.
9. Remove flywheel.
10. Remove rear oil seal retainer assembly.
11. Remove main bearing cap.
12. Remove crankshaft.
13. Remove cylinder block.

Inspection and Repair

1. Remove the cylinder head gasket and any other material adhering to the upper surface of the cylinder block. Be very careful not to allow any material to accidentally drop into the cylinder block. Be very careful not to scratch the cylinder block.
2. Carefully remove the oil pump, rear oil seal retainer, and crankcase assembly installation surface seal.
3. Wipe the cylinder block clean.
4. Visually inspect the cylinder block. If necessary, use a flaw detector to perform a dye penetrate and hydraulic (or air pressure) test. If cracking or other damage is discovered, the cylinder block must either be repaired or replaced.

Flatness

1. Using a straight edge and feeler gauge, check that the upper surface of the cylinder block is not warped.

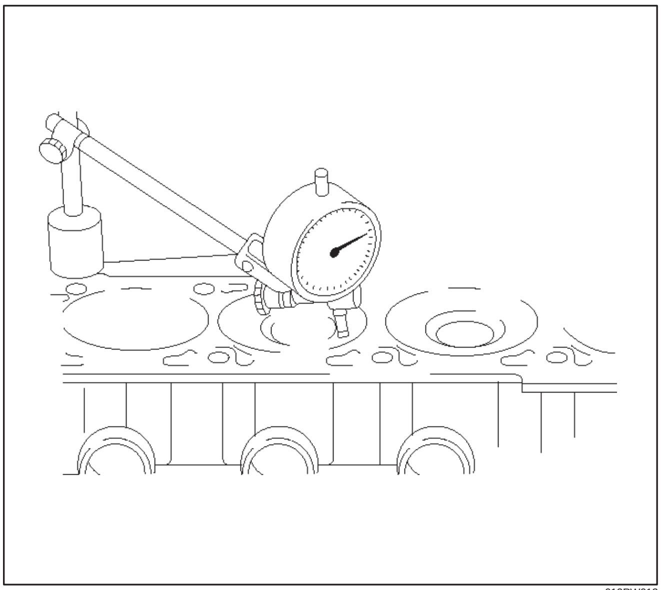
CAUTION: Be very careful not to allow any material to accidentally drop into the upper surface of the cylinder block. Be very careful not to scratch the upper surface of the cylinder block.

2. The cylinder block must be reground or replaced if the warpage exceeds the limit.

Warpage

Limit : 0.40 mm (0.0156 in)

Maximum repairable limit: 0.40 mm (0.0156 in)



012RW013

Cylinder Bore

Use a cylinder gauge to measure the cylinder bore diameter in both the axial and thrust directions. Each measurement should be made at six points.

CAUTION: Be very careful not to allow any material to accidentally drop into the upper surface of the cylinder block. Be very careful not to scratch the upper surface of the cylinder block.

If the measurement exceeds the specified limit, the cylinder block must be replaced.

Diameter

Grade 1 : 85.975 mm–85.985 mm (3.3530 in–3.3534 in)

Grade 2 : 85.985 mm–86.025 mm (3.3534 in–3.3550 in)

Oversize : 0.5 mm (0.0195 in)

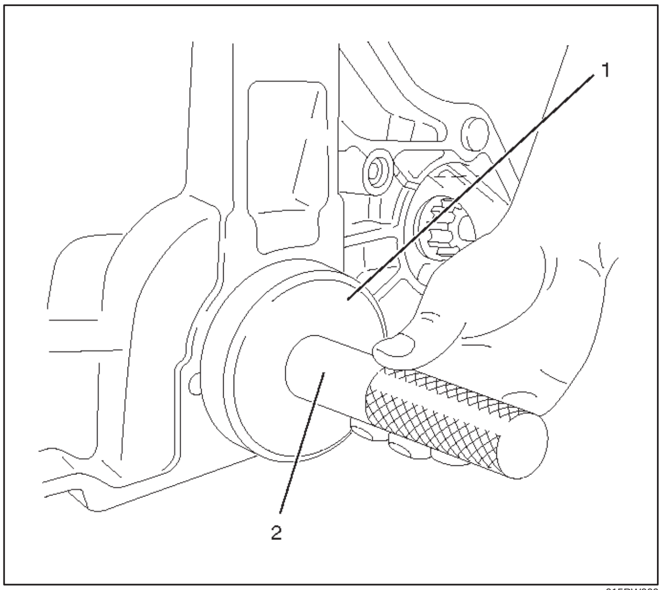
NOTE: For information on piston diameter, please refer to the section “Inspection of the Piston and Connecting Rod Assembly” in this manual.

Reassembly

1. Install cylinder block.
2. Install crankshaft.
   - Install the main bearings to the cylinder block and the main bearing caps.
   - Be sure that they are positioned correctly.
   - Apply new engine oil to the upper and lower main bearing faces.

NOTE: Do not apply engine oil to the bearing back faces.

   - Carefully mount the crankshaft.
   - Apply engine oil to the thrust washer.
3. Install rear oil seal.
   - Coat lip of seal rings thinly with protective grease.
   - Install seal ring into cylinder block, use J–42616 (1) and J–42613 (2).



015RW009

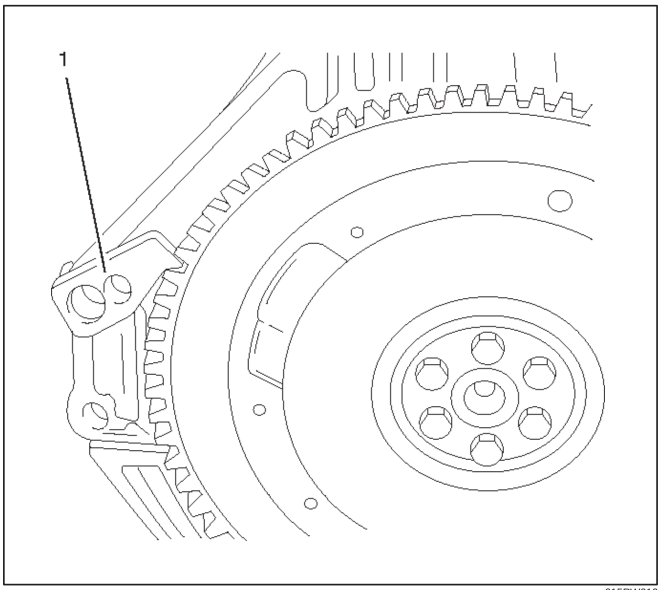
4. Install flywheel
   1. Thoroughly clean and remove the oil from the threads of crankshaft.
   2. Remove the oil from the crankshaft and flywheel mounting faces.
   3. Mount the flywheel on the crankshaft and then install the washer.
   4. Use stopper (J–42618) to hold the crankshaft.
      Prevent from rotating.
      Tighten the flywheel bolts in 3 steps:

1st step: 65 N·m (48 lb ft)

2nd step: 30°

3rd step: 15°

NOTE: Do not reuse the bolt.



015RW010

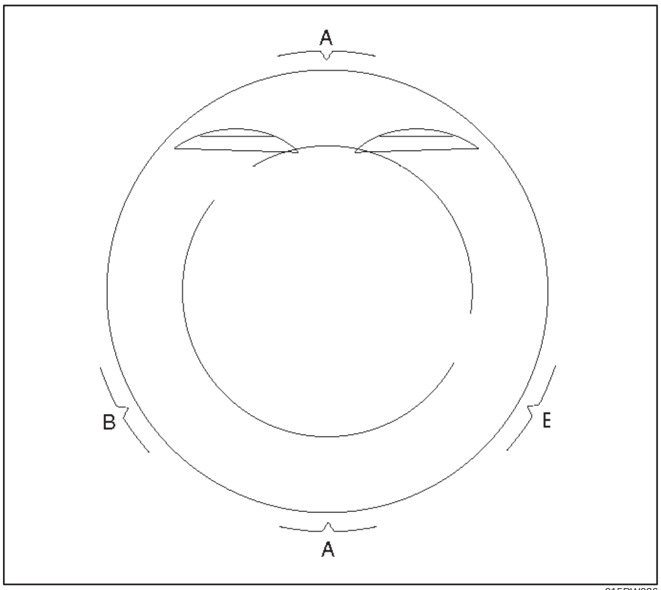
5. Install piston and connecting rod assembly.
   - Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins.

NOTE: Do not apply engine oil to the bearing back faces.

   - Position ring gaps:

     1 — Compression rings 180° to each other as illustrated (A).

     2 — Offset oil control rings 25 to 50 mm/1 to 2 in. from gap of second compression ring (B).



015RW026

6. Install balance unit assembly and tighten the bolts in 2 steps in the order shown:

   1st step : 20 N·m (14 lb ft)

   2nd step : 45°
7. Install oil pump assembly, refer to “Oil Pump” in this manual.
8. Install oil strainer.
9. Install oil pan support.
10. Install oil pan assembly.

1. Completely remove all residual sealant, lubricant and moisture from the sealing surfaces. The surfaces must be perfectly dry.
2. Apply a correct width bead of sealant (TB–1207C or its equivalent) to the contact surfaces of the crankcase. There must be no gaps in the bead.
3. The oil pan must be installed within 5 minutes after sealant application.
4. Tighten the bolts and nuts to the specified torque in 2 steps:

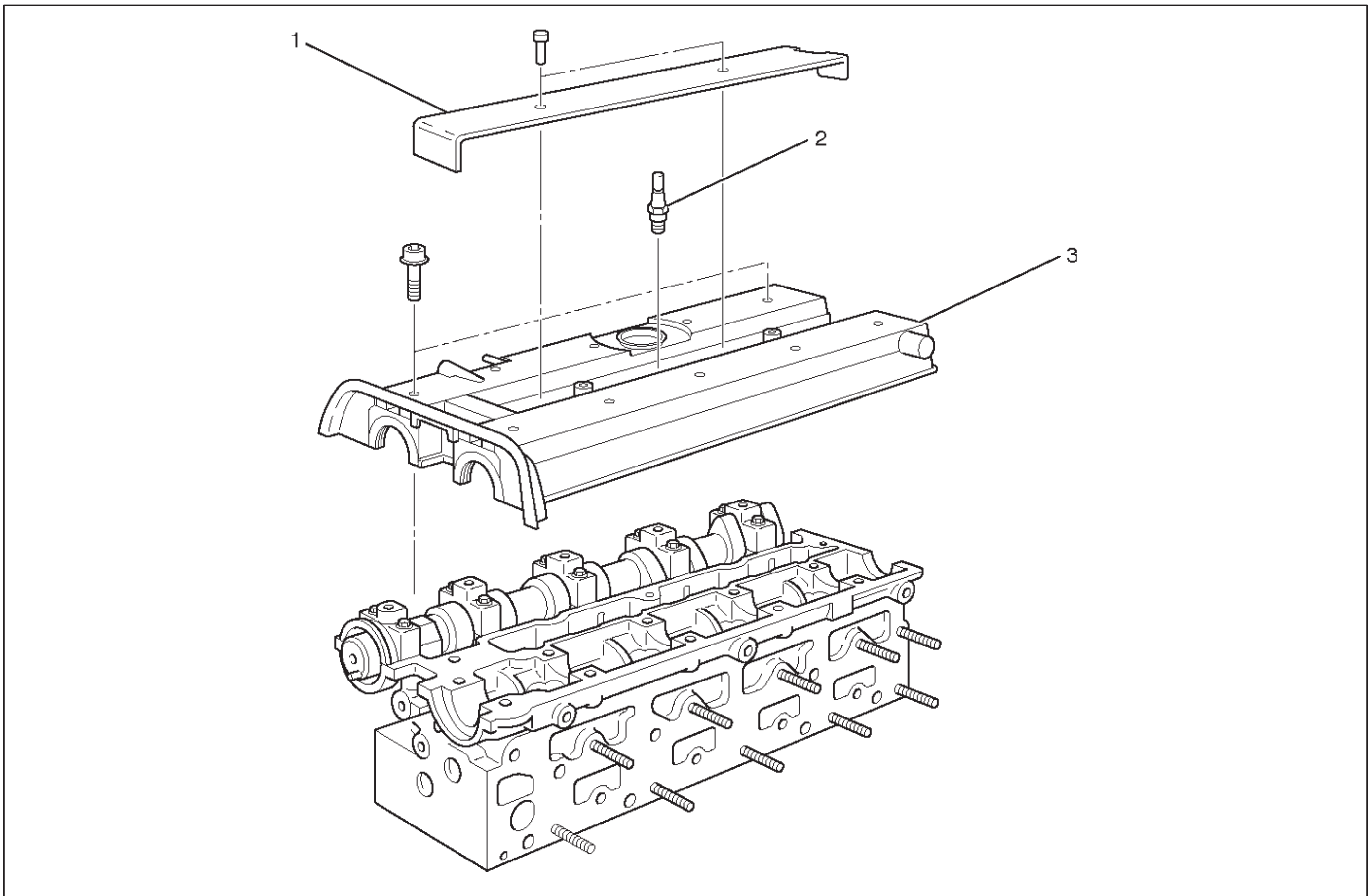
1st step : 8 N·m (5.8 lb ft)

2nd step : 30°

11. Install cylinder head gasket.
12. Install cylinder head assembly, refer to “Cylinder Head” in this manual.

Cylinder Head Cover

Cylinder Head Cover and Associated parts

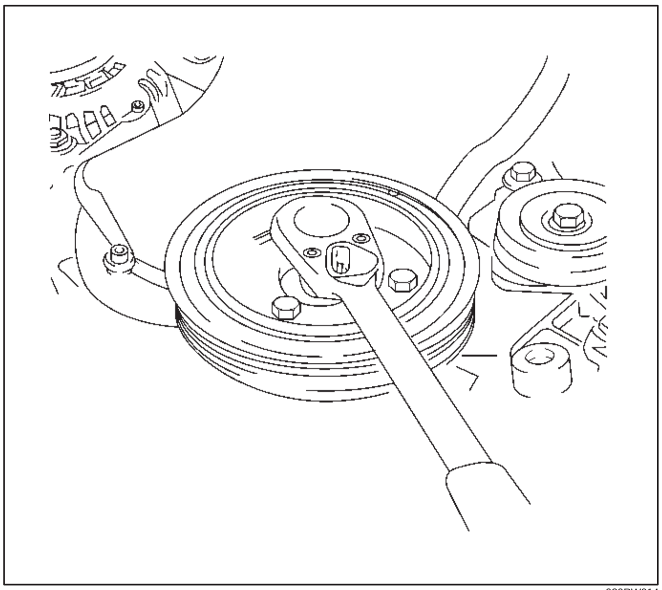


010RW004

Legend
(1) Ignition Cable Cover
(2) Spark Plug
(3) Cylinder Head Cover

Removal

1. Remove two bolts and remove ignition cable cover (1) from cylinder head cover (3).
2. Disconnect ignition cable and remove spark plag (2).
3. Disconnect ignition cable from ignition plug.
4. Disconnect camshaft angle sensor harness and crankshaft angle sensor harness from behind generator.
5. Remove four bolts and remove the crankshaft pulley.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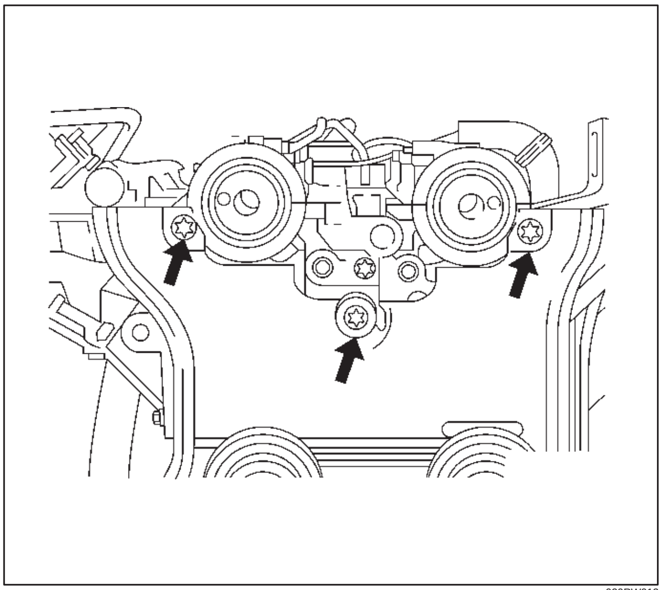
6. Remove timing belt front cover.
7. Loose fixing bolt of timing belt rear cover, then remove the camshaft angle sensor.

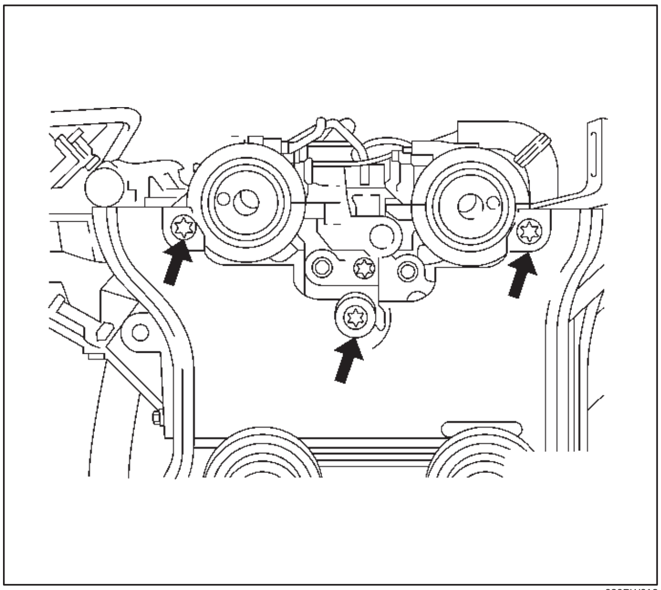

020RW012

8. Remove ten cylinder head cover fixing bolts and remove the cylinder head cover.

Installation

1. Install the camshaft angle sensor and tighten timing rear cover bolt.

Torque: 8 N·m (5.9 lb ft)


020RW012

2. Install the cylinder head cover and tighten bolts to the specified torque.

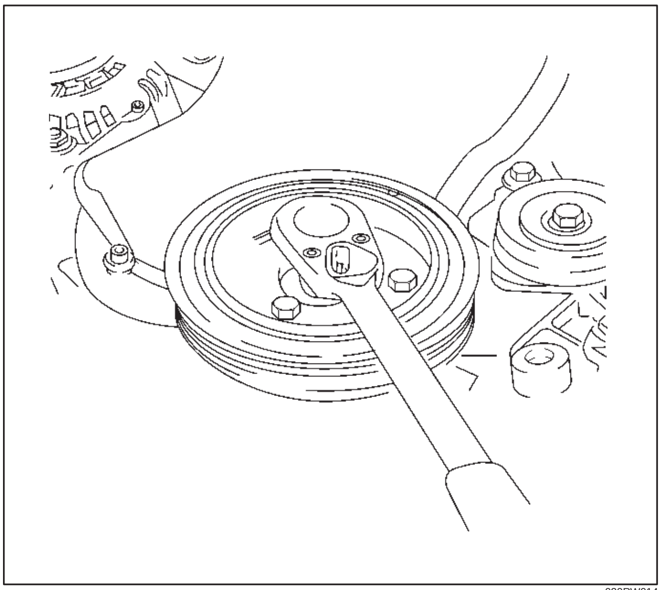
Torque: 8 N·m (5.9 lb ft)

3. Install the timing belt front cover then tighten fixing bolts to the specified torque.

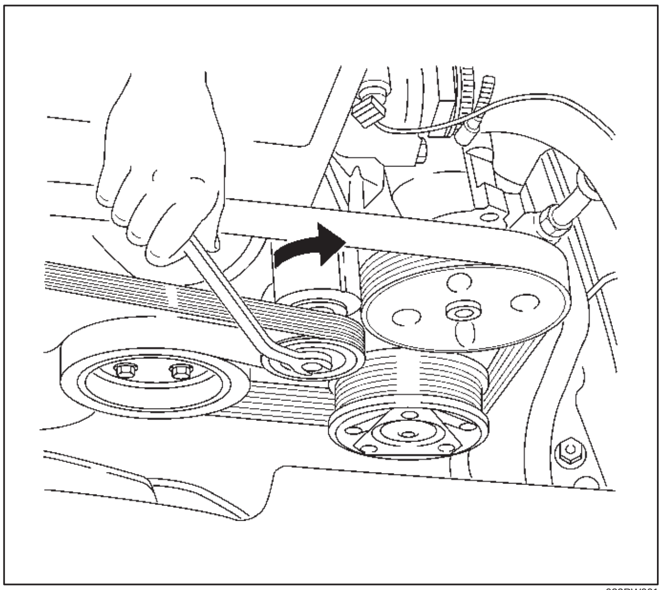
Torque: 6 N·m (4.4 lb ft)

4. Install the crankshaft pulley, tighten fixing bolts to the specified torque.

Torque: 20 N·m (14 lb ft)


020RW014

5. Move drive belt tensioner to loose side using wrench then install the drive belt to normal position.



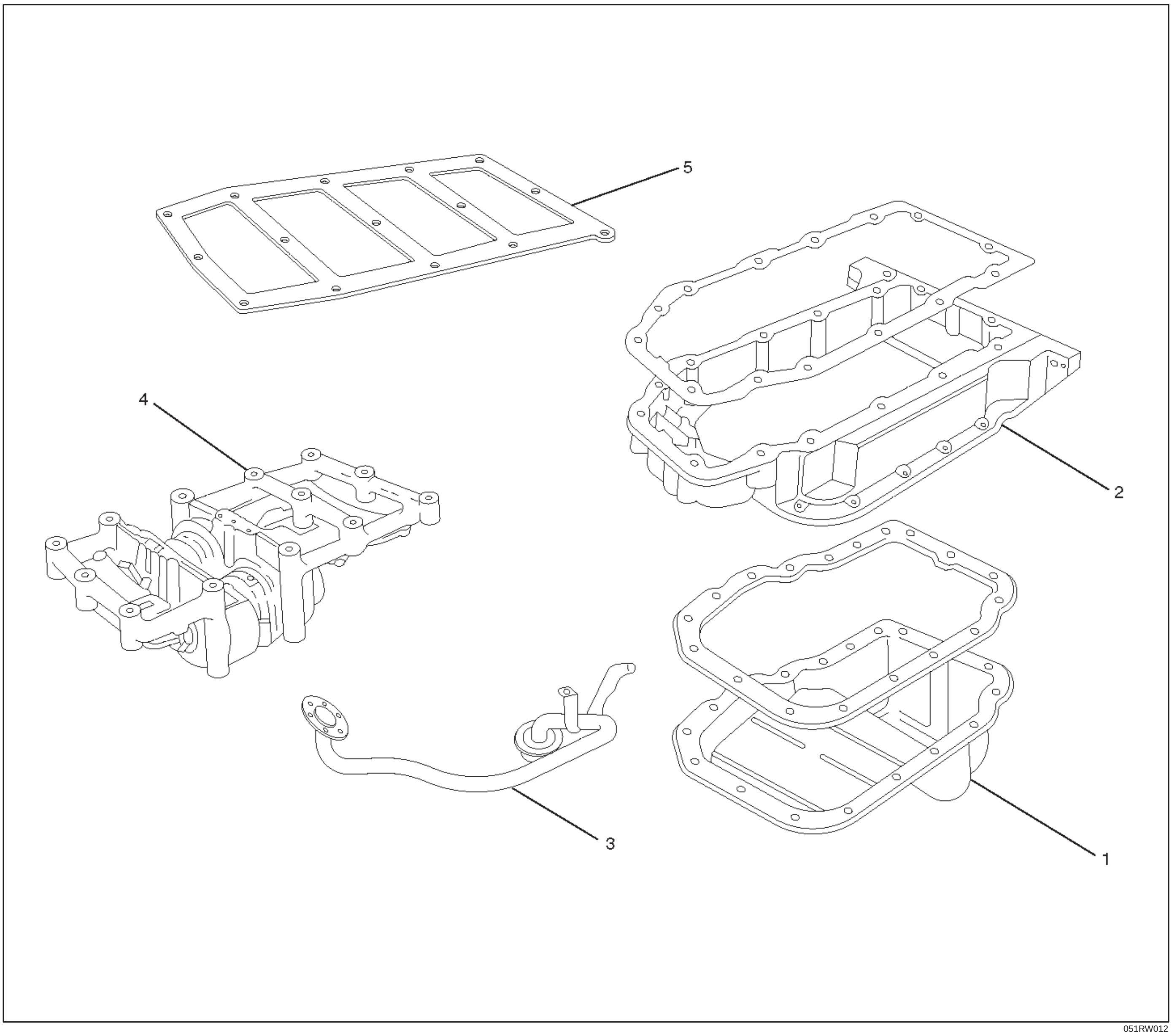
033RW001

6. Connect ignition cable to ignition plug.
7. Install ignition cable cover to cylinder head cover and tighten two bolts to the specified torque.

Torque: 3 N·m (2 lb ft)

Balance Unit Assembly

Balance Unit Assembly Associated Parts

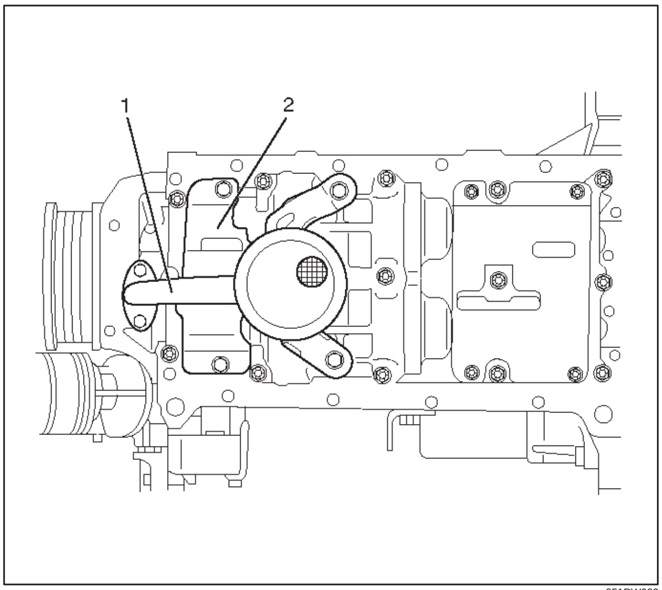


Legend

(1) Oil Pan
(2) Oil Pan Support
(3) Oil Strainer
(4) Balance Unit Assembly
(5) Shim

Disassembly

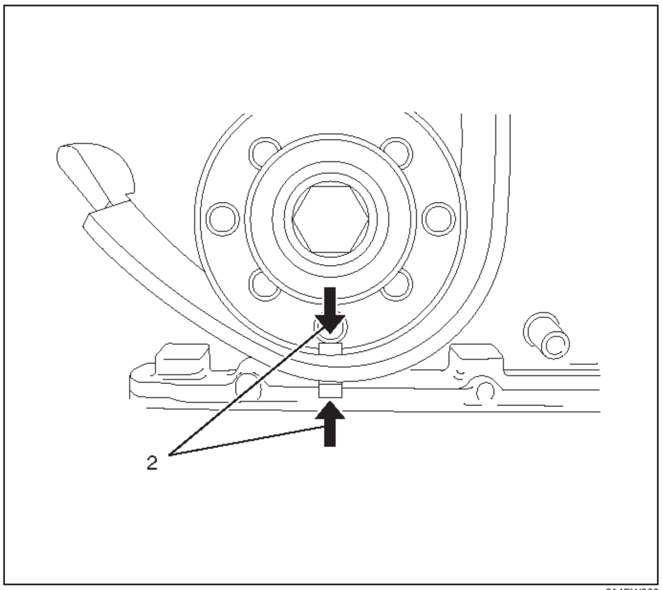
1. Remove the oil pan.
2. Remove the oil pan support.
3. Remove the oil strainer (1) from oil pump and the oil baffle plate (2).



051RW009

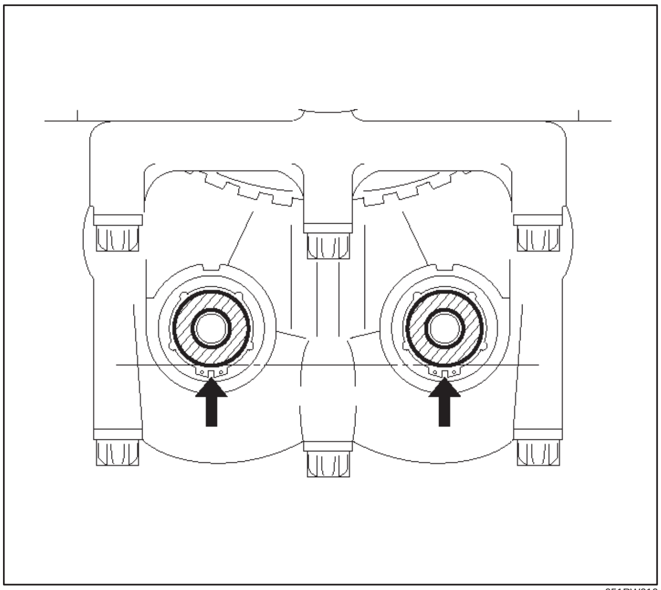
Adjustment

1. Turn crankshaft in engine rotational direction to alignment mark (2) 1st cylinder “TDC”.



014RW066

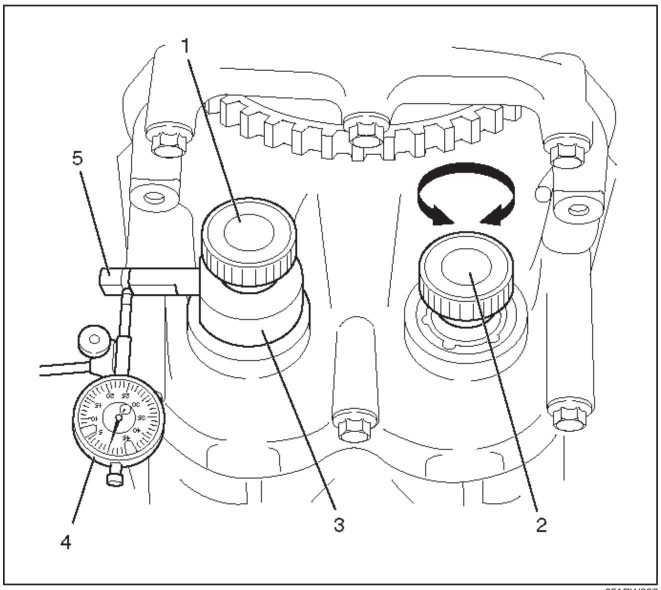
2. In this crankshaft position, the flattened side (arrows) of both balancer shafts must face downward and must be on a horizontal line.



051RW010

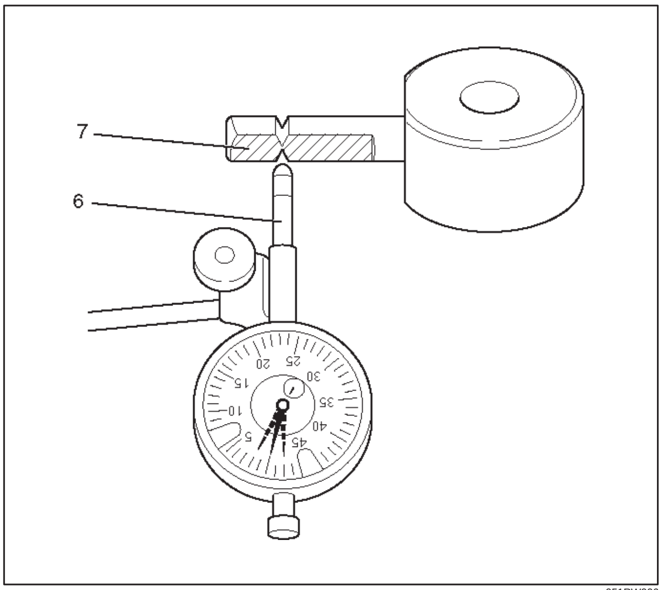
3. Screw measuring device J–43038 (3) with long knurled bolt (1) into 1st balancer shaft (intake side) and tighter hard–tight measuring arm (5) must point in “9 o’clock” direction shown in this illustration.

   Install dial gauge holder with dial gauge (4) on cylinder block.



051RW007

4. Place pre tensioned probe (6) of gauge on measuring arm of measuring device J–43038. The probe must be set precisely between the notch marks, square to the plane surface (7).



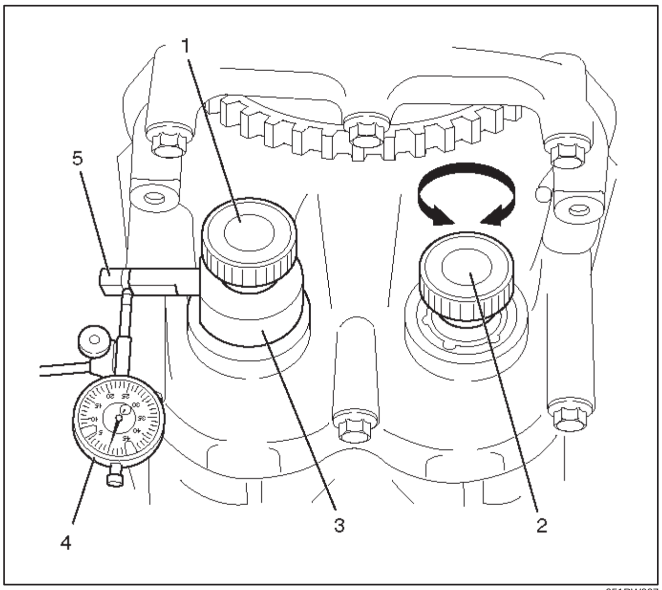
051RW006

5. Determine the left and right stops by turning the knurled bolt (2).

   Set the dial of the gauge to zero.

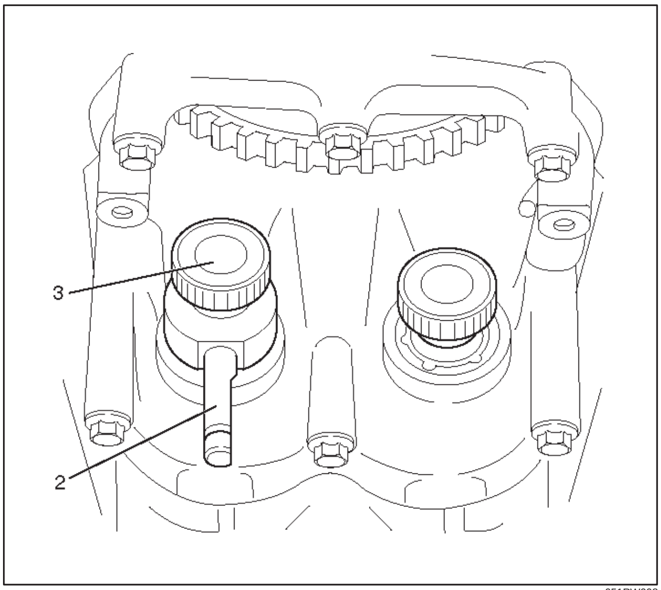
   Use the knurled bolt (2) to move the 2nd balancer shaft (exhaust side) back and forth. Again — simultaneously read off the tooth backlash from the gauge.

   The permissible tooth backlash is: 0.02 mm to 0.06 mm (0.0008 to 0.0024 in).



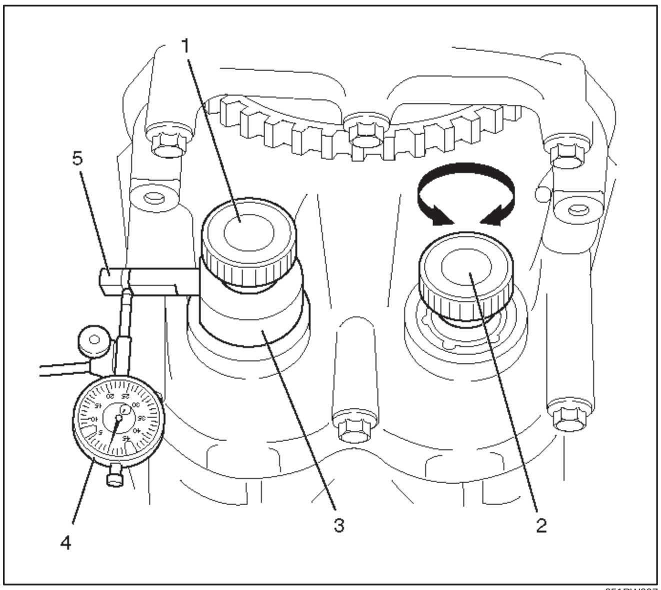
051RW007

6. The tooth backlash must be measured in 4 different positions — turn the crankshaft further at the fastening bolt of the timing belt drive gear by 45° in the engine rotational direction until the measuring arm (2) is at “6 o’clock”.



051RW008

7. Then loosen the knurled bolt (3) fix the measuring arm at “9 o’clock” again and repeat the measurement.



051RW007

8. If the value determined in one of the 4 measurements lies outside the tolerance 0.02 mm to 0.06 mm (0.0008 to 0.0024 in), the tooth backlash must be adjusted.

9. Remove balance unit from cylinder block/crankshaft bearing caps and remove with balancer piece. The balancer piece has a number (code), for easy assignment. The tooth backlash can be adjusted by using a balancer piece with a different thickness.

Code	Thickness of balancer piece in mm
55	0.535 to 0.565
58	0.565 to 0.595
61	0.595 to 0.625
64	0.625 to 0.655
67	0.655 to 0.685
70	0.685 to 0.715
73	0.715 to 0.745
76	0.745 to 0.775
79	0.775 to 0.805
82	0.805 to 0.835
85	0.835 to 0.865

NOTE: The next larger or smaller balancer alters the tooth backlash by 0.02 mm (0.0008 in).

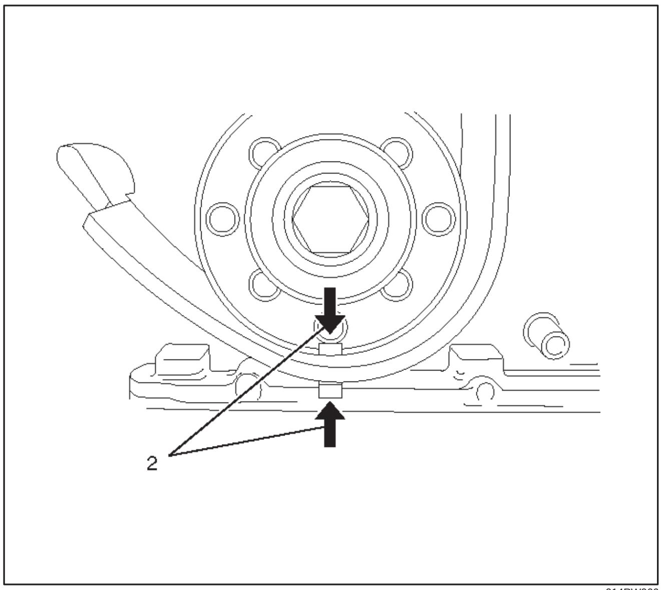
Example of selection of balancer piece: The installed balancer piece with the code "70" gave a tooth backlash of 0.08 mm (0.0031 in).

If a balancer piece with the code "67" is now installed, the tooth backlash will be approx. 0.06 mm (0.0024 in).

CAUTION: Only one balancer piece may be installed.

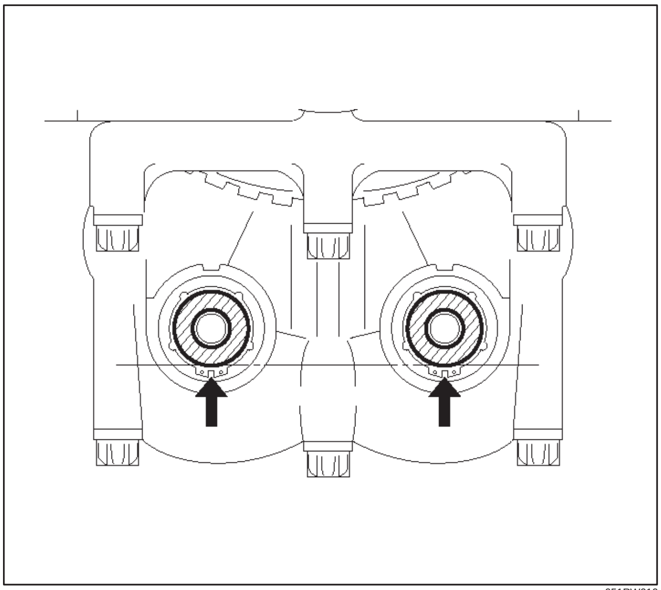
Reassembly

1. Turn crankshaft in engine rotational direction to alignment mark (2) 1st cylinder "TDC".



014RW066

2. Turn balancer shafts until the flattened sides (arrows) of both balancer shafts face downward and are on a horizontal line.



051RW010

3. Install selected balancer piece (2) with balancer shaft unit to cylinder block/crankshaft bearing cap — tighten all fixing bolts to the specified torque.

Torque: 20 N·m (15 lb ft)

4. After installing the balancer shaft unit, recheck the tooth backlash and readjust if necessary.

NOTE: If the balancer shaft unit has to be replaced, use the thickest balancer piece with the code "85" for the initial assembly — this guarantees tooth backlash in all conditions.

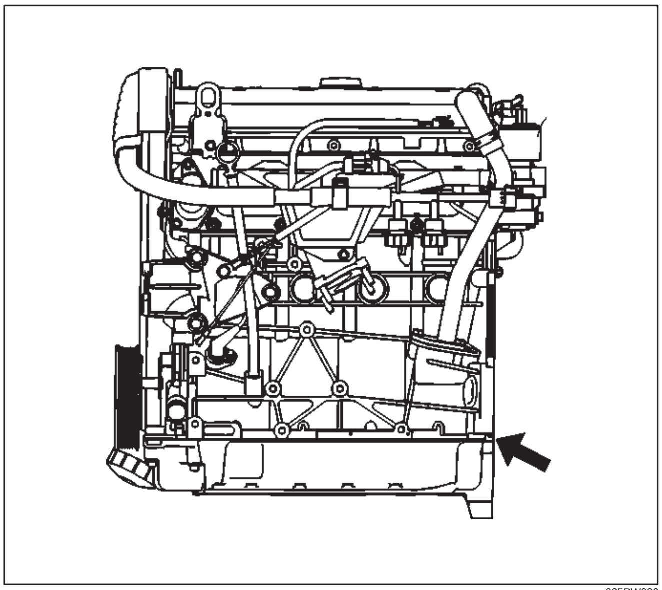
5. Install oil strainer to oil pump with new seal ring and insert fixing bolts with locking agent to the specified torque.

Torque: 8 N·m (6 lb ft)

6. Install oil pan support.

Torque: 20 N·m (14 lb ft)

- Adjust surfaces of the cylinder block and the oil pan support.



035RW026

7. Install oil pan.

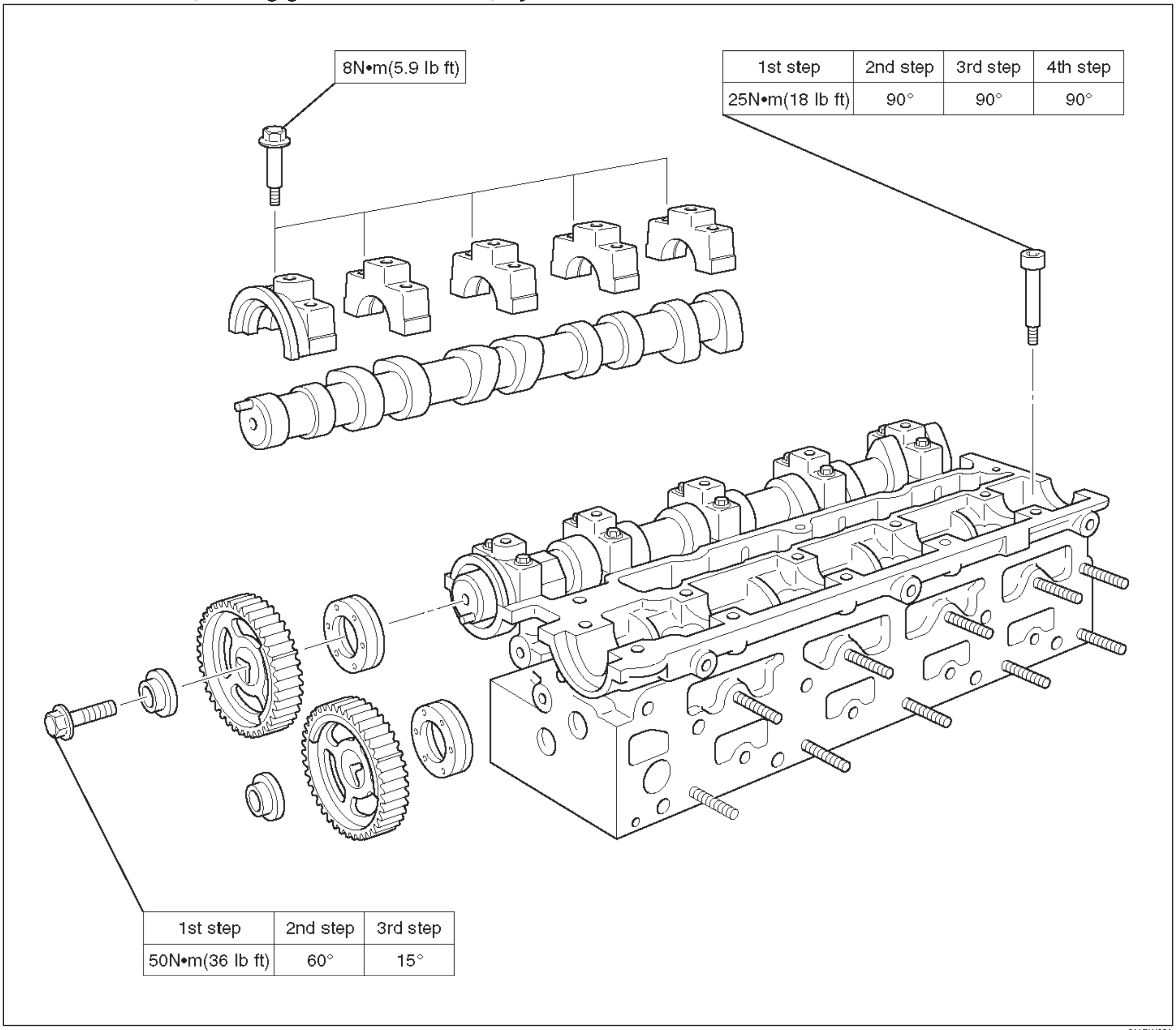
1st step: 8 N·m (5.8 lb ft)

2nd step: 30°

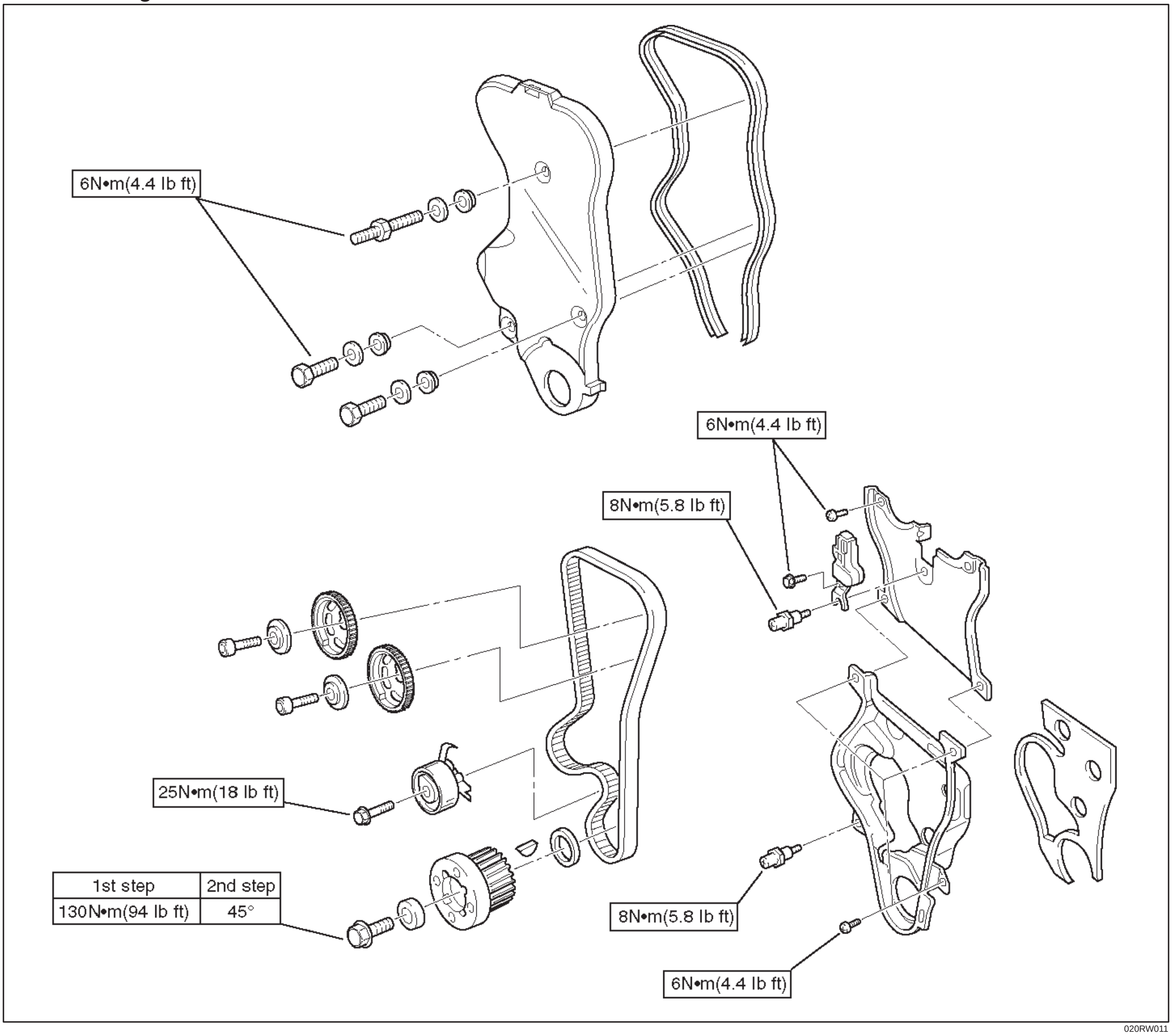
Main Data and Specifications

Torque Specifications

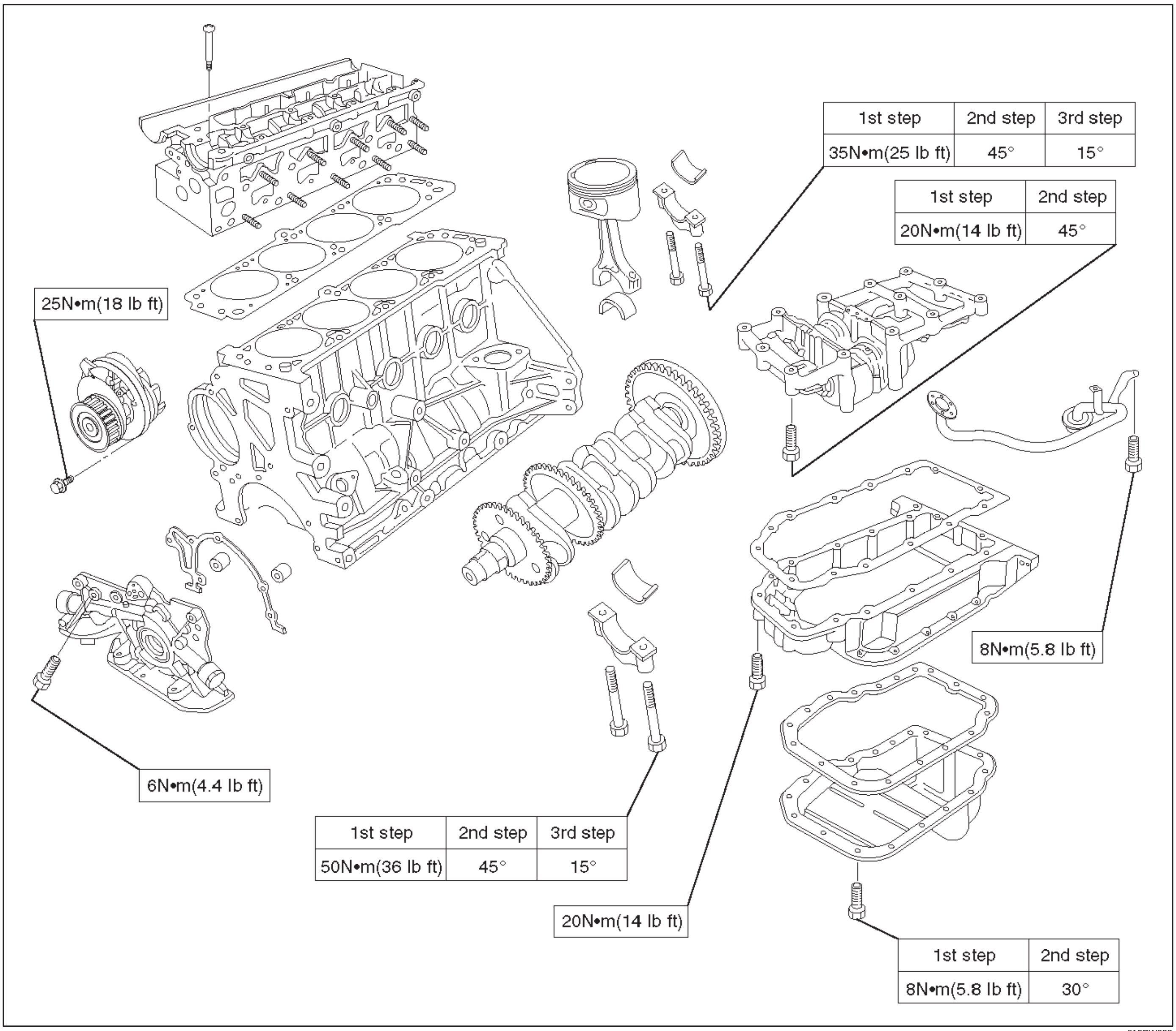
Camshaft bracket, Timing gear camshaft side, Cylinder head



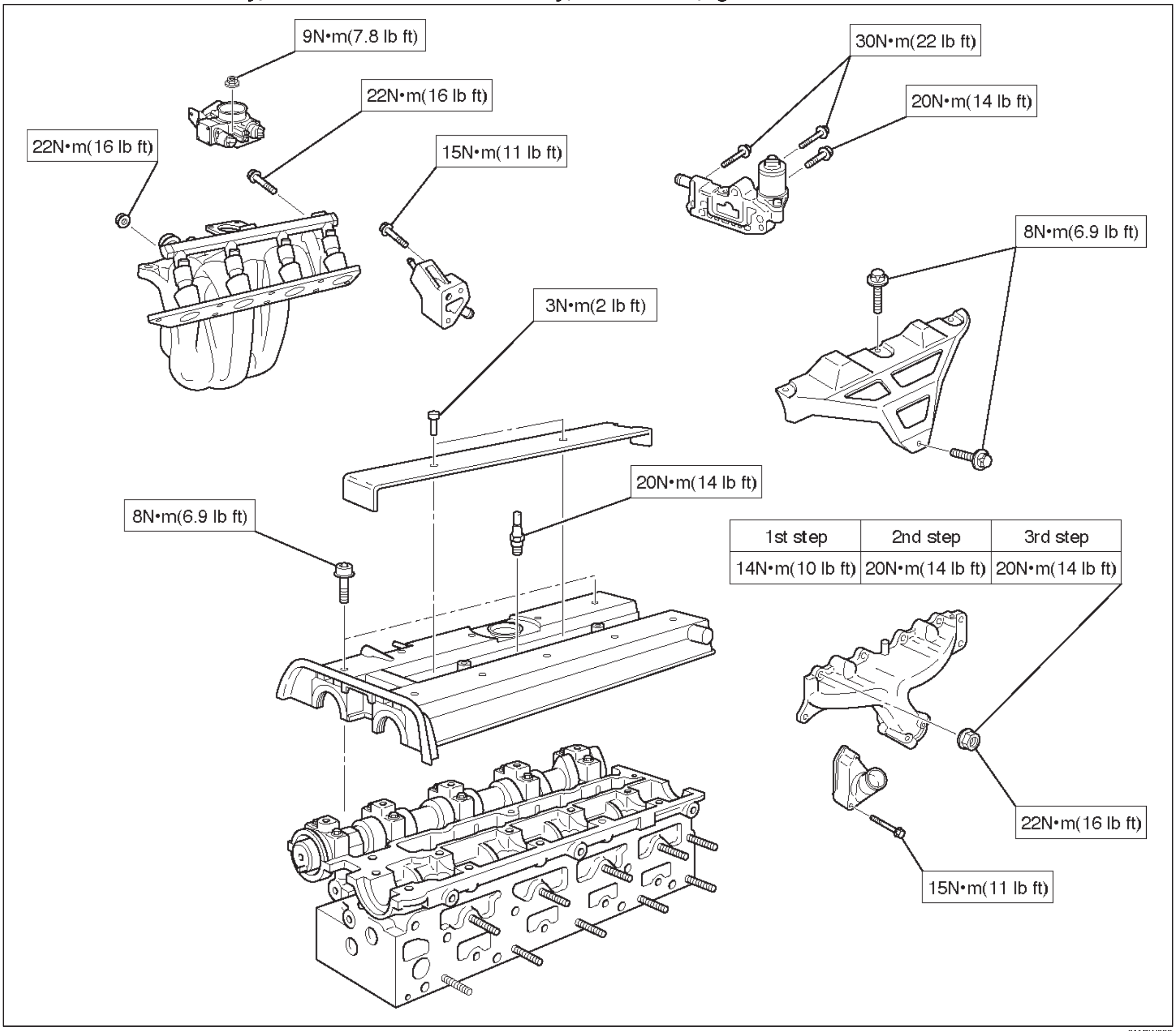
Timing gear crankshaft (center bolt), Timing belt cover front, Timing belt cover rear, Timing belt tensioner, Camshaft angle sensor



Crankshaft main bearing, Oil pan support, Oil pan, Balance unit assembly, Connrod Cap, Oil pump, Oil strainer

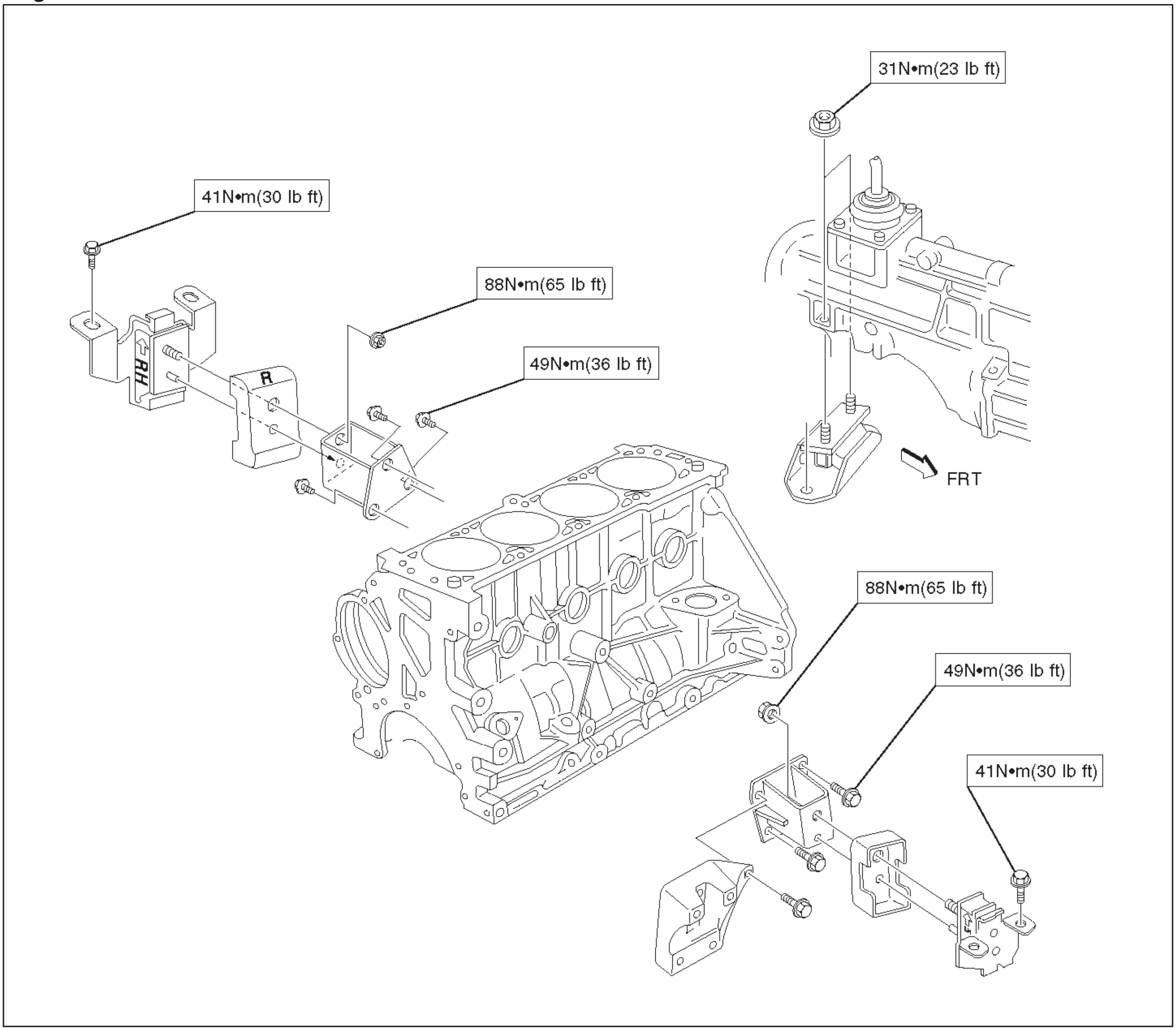


Spark plug, Throttle body, EGR valve adaptor assembly, Bypass housing assembly, Thermostat assembly, inlet manifold assembly, Exhaust manifold assembly, heat shield, Ignition cable cover



011RW022

Engine mount



022RW010

Special Tools

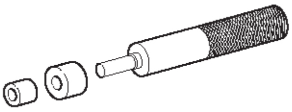
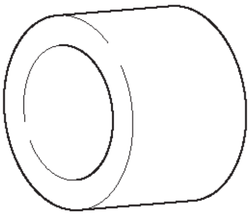
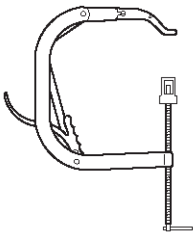
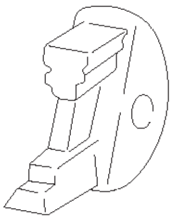
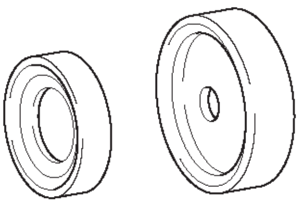
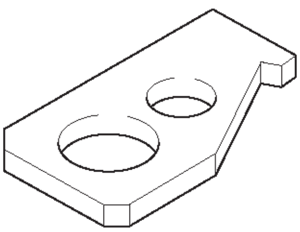
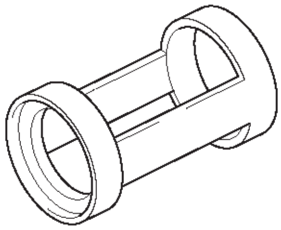
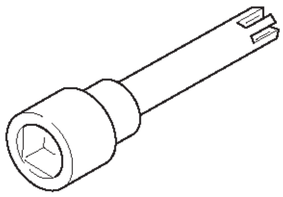
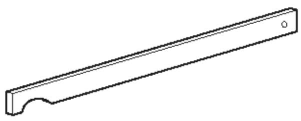
ILLUSTRATION	**TOOL NO.** TOOL NAME
 015RW027	**J–42613** Installer; Rear crankshaft seal ring
 015RW030	**J–42609** Remover/Installer; Crankshaft carrier seal
 901RW108	**J–8062** Compressor; Valve spring (Use with J–3289–20 base)
 901RW185	**J–43037** Locking tool camshaft gear
 015RW031	**J–42616** Installer; Rear crankshaft seal
 015RW035	**J–42618** Locking device; Flywheel

ILLUSTRATION	**TOOL NO.** TOOL NAME
 015RW034	**J–42619** Adapter; Valve spring
 011RW026	**J–42622** Installer sleeve; Valve stem seal
 015RW028	**J–42623** Socket wrench; Cylinder head bolt
 015RW033	**J–42620** Holding wrench; Driven gear fix

RODEO

ENGINE

ENGINE COOLING (X22SE 2.2L)

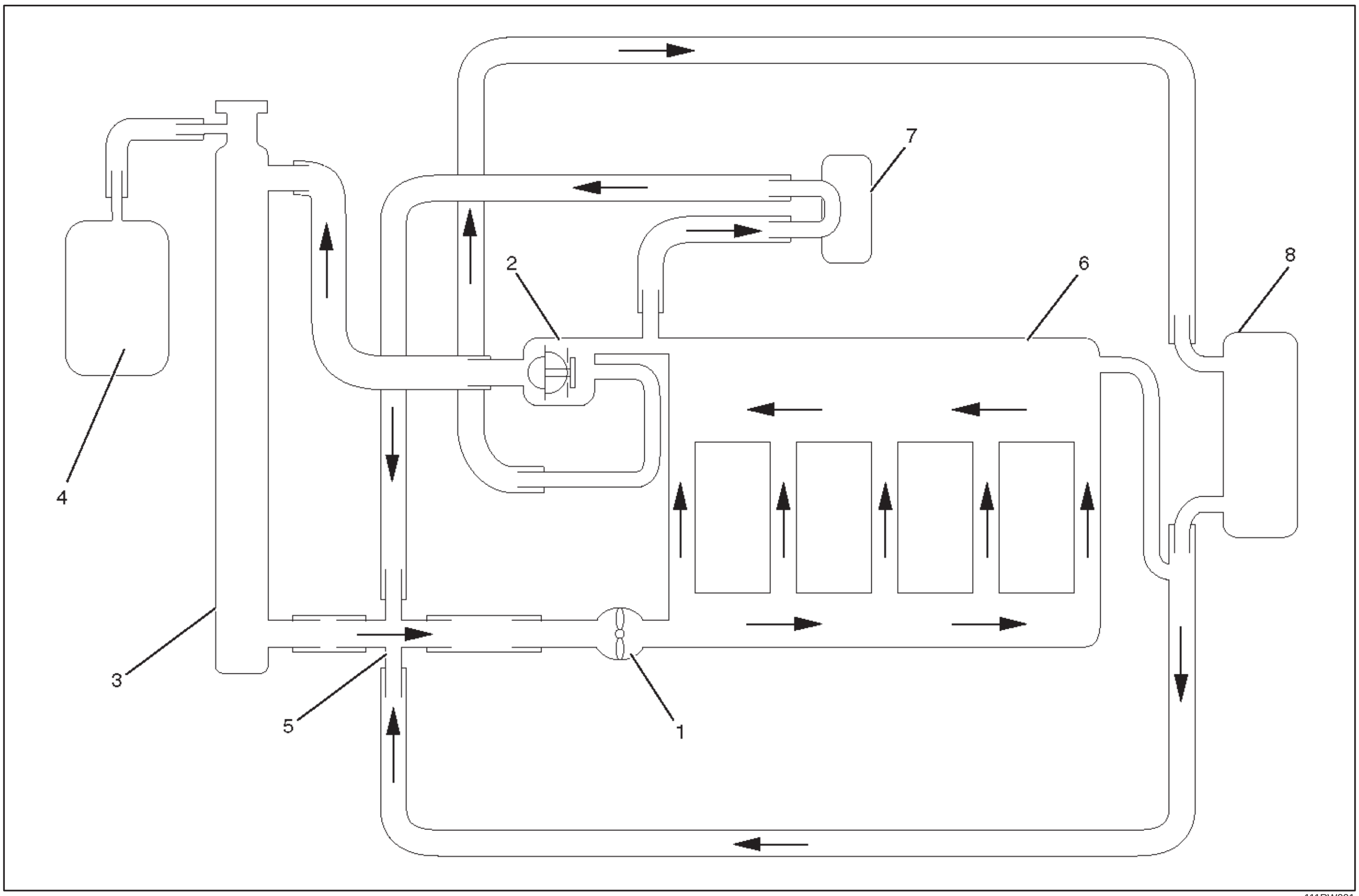
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



111RW001

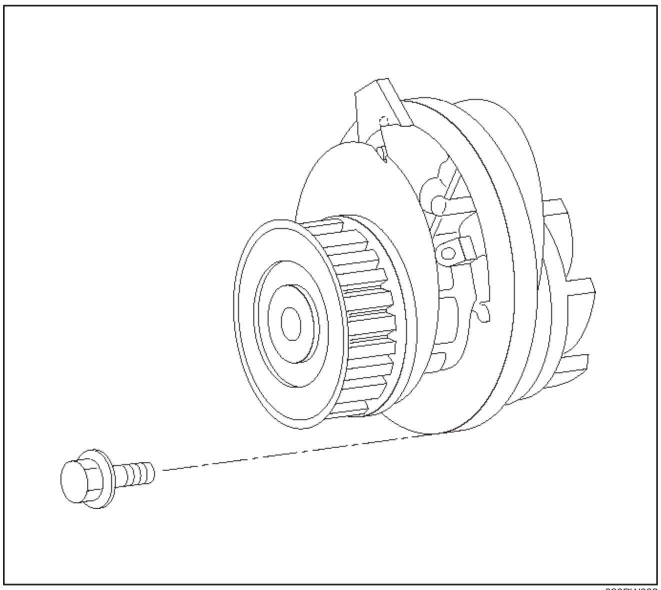
Legend

(1) Water Pump
(2) Thermostat
(3) Radiator
(4) Reserve Tank
(5) Coolant Distributor
(6) Cylinder Block and Head
(7) Throttle Body
(8) Heater

The Cooling System is a pressurized type, where the water pump, which is cambelt driven, forces the circulation of the coolant through the cylinder block and head. The thermostat regulates the flow of coolant between the radiator and the bypass circuit. The heater is part of the bypass circuit. The throttle body pre–heat is a separate circuit which is not regulated by the thermostat. An oil cooler may be fitted as part of this circuit.

Water Pump

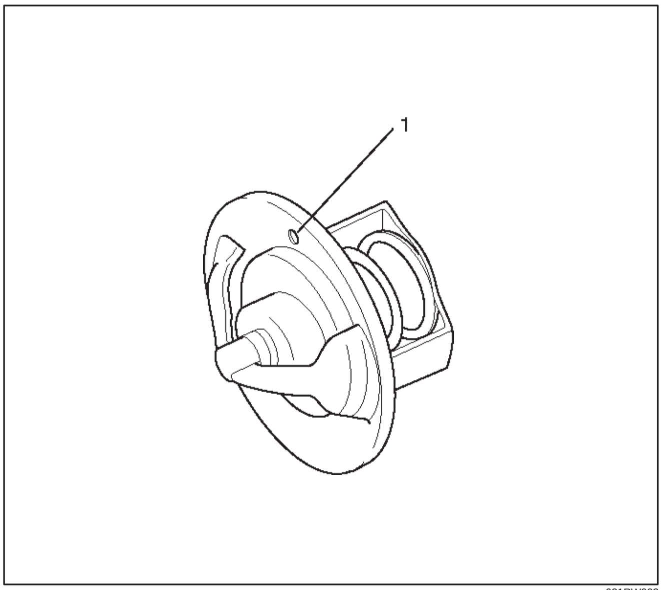
The water pump is centrifugal type and is driven by timing belt.



030RW003

Thermostat

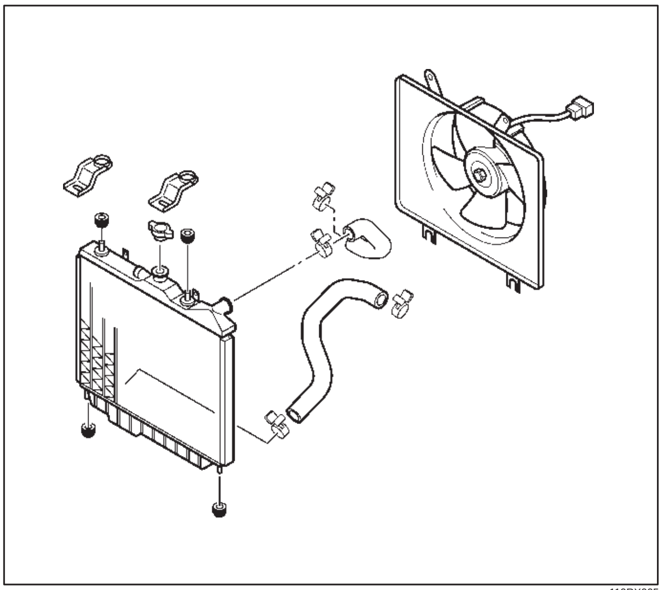
The thermostat is a bypass type and is a wax pellet type with a air hole (1).



031RW003

Radiator

The radiator is a flow type with corrugated fins.



110RX005

Antifreeze Solution

- Relation between Mixing ratio and Freezing temperature of the engine coolant varies with the ratio of antifreeze solution in water. Proper mixing ratio can be determined by referring to the chart. Supplemental inhibitors or additives claiming to increase cooling capability that have not been specifically approved by Isuzu are not recommended for addition to the cooling system.

- Calculating mixing ratio

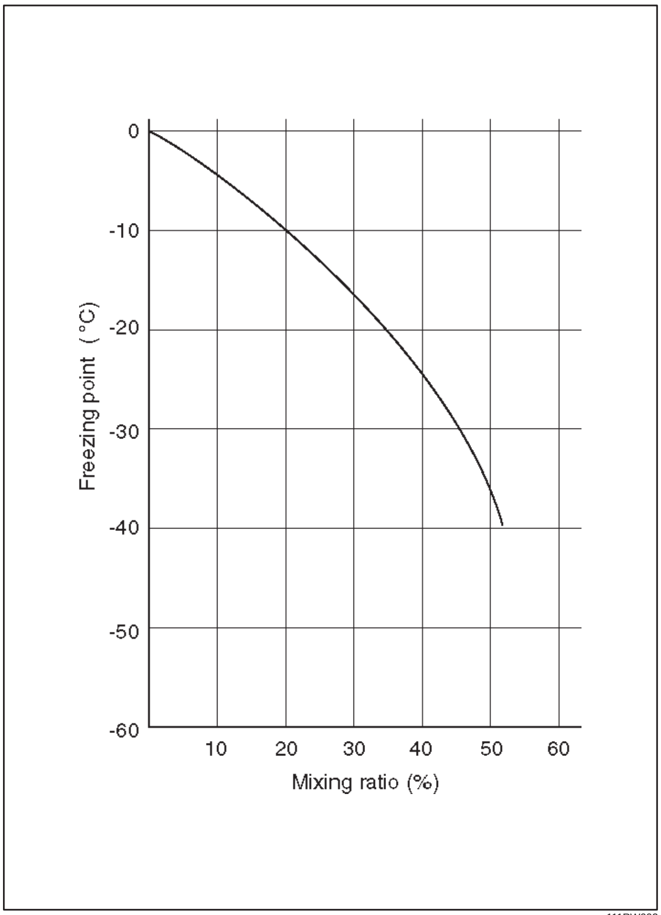
Mixing ratio

$$= \frac{\text{Antifreeze solution (Lit/gal.)}}{\text{Antifreeze solution (Lit/gal.)} + \text{Water (Lit/gal.)}}$$

F06RW005

NOTE: Antifreeze solution + Water = Total cooling system capacity.

- **Total Cooling System Capacity**
  7.2Lit (1.90US gal)



111RW002

- Mixing ratio
  Check the specific gravity of engine coolant in the cooling system temperature ranges from 0°C to 50°C using a suction type hydrometer, then determine the density of the engine coolant by referring to the table.

Diagnosis

Engine Cooling Trouble

Condition	Possible cause	Correction
Engine overheating	Low Engine Coolant level	Replenish
	Thermo mater unit faulty	Replace
	Faulty thermostat	Replace
	Faulty Engine Coolant temperature sensor	Repair or replace
	Clogged radiator	Clean or replace
	Faulty radiator cap	Replace
	Low engine oil level or use of improper engine oil	Replenish or change oil
	Clogged exhaust system	Clean exhaust system or replace faulty parts
	Faulty Throttle Position sensor	Replace throttle valve assembly
	Open or shorted Throttle Position sensor circuit	Repair or replace
	Damaged cylinder head gasket	Replace
Engine overcooling	Faulty thermostat	Replace
Engine slow to warm–up	Faulty thermostat	Replace
	Thermo unit faulty	Replace

Draining and Refilling Cooling System

Before draining the cooling system, inspect the system and perform any necessary service to ensure that it is clean, does not leak and is in proper working order. The engine coolant (EC) level should be between the “MIN” and “MAX” lines of reserve tank when the engine is cold. If low, check for leakage and add EC up to the “MAX” line. There should not be any excessive deposit of rust or scales around the radiator cap or radiator filler hole, and the EC should also be free from oil.
Replace the EC if excessively dirty.

1. Completely drain the cooling system by opening the drain plug at the bottom of the radiator.
2. Remove the radiator cap.

WARNING: TO AVOID THE DANGER OF BEING BURNED, DO NOT REMOVE THE CAP WHILE THE ENGINE AND RADIATOR ARE STILL HOT. SCALDING FLUID AND STEAM CAN BE BLOWN OUT UNDER PRESSURE.

3. Disconnect all hoses from the EC reserve tank.

   Scrub and clean the inside of the reserve tank with soap and water. Flush it well with clean water, then drain it. Install the reserve tank and hoses.4. Refill the cooling system with the EC using a solution that is at least 50 percent antifreeze but no more than 70 percent antifreeze.

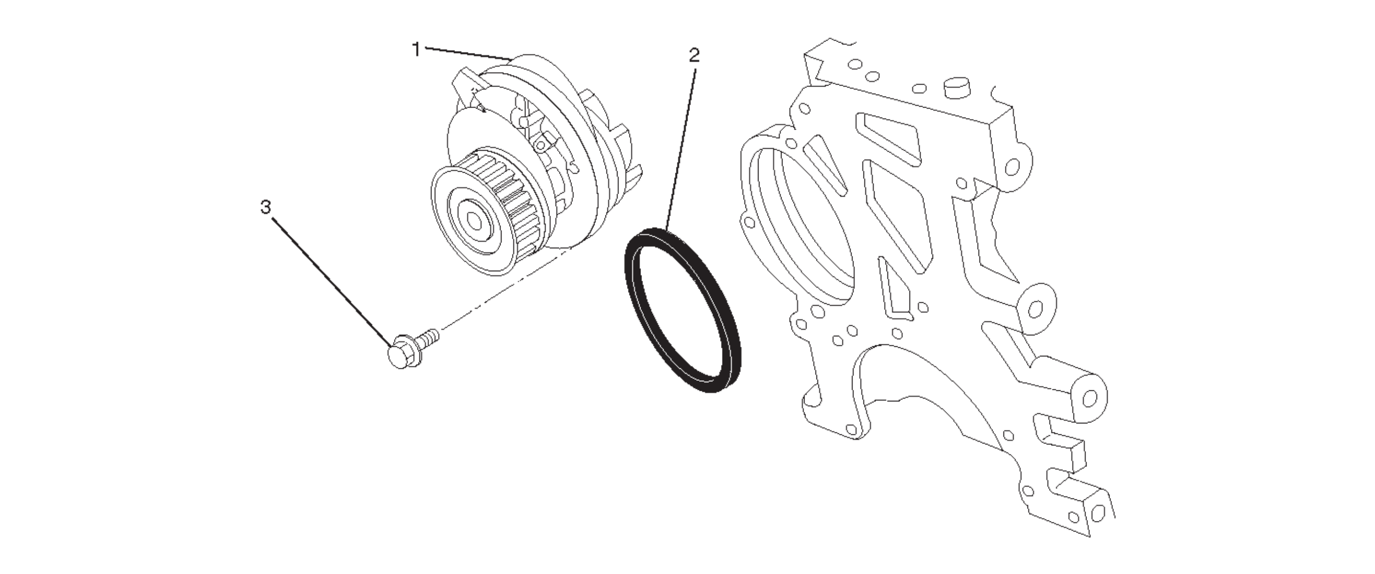
4. Refill the cooling system with the EC using a solution that is at least 50 percent antifreeze but no more than 70 percent antifreeze.
5. Fill the radiator to the base of the filler neck.

   Fill the EC reserve tank to “MAX” line when the engine is cold.

6. Block the drive wheels and firmly apply the parking brake. Shift an automatic transmission to “P” (Park) or a manual transmission to neutral.
7. Remove the radiator cap. Start the engine and warm it up at 2,500 ~ 3,000 rpm for about 30 minutes.
8. When the air comes out from the radiator filler neck and the EC level has gone down, replenish with the EC. Repeat this procedure until the EC level does not go down. Then stop the engine and install the radiator cap. Let the engine cool down.
9. After the engine has cooled, replenish with EC up to the “MAX” line of the reserve tank.
10. Start the engine. With the engine running at 3,000 rpm, make sure there is no running water sound from the heater core (behind the center console).
11. If the running water sound is heard, repeat steps 8 to 10.

Water Pump

Water Pump and Associated Parts



030RW004

Legend
(1) Water Pump Assembly
(2) O Ring
(3) Bolt

Removal

1. Disconnect battery ground cable.
2. Drain coolant.
3. Radiator hose (on inlet pipe side).
4. Remove timing belt, refer to “Timing Belt” in this manual.
5. Remove water pump assembly.

Inspection

Make necessary repair and parts replacement if extreme wear or damage is found during inspection. Should any of the following problems occur, the entire water pump assembly must be replaced:

- Crack in the water pump body
- EC leakage from the seal unit
- Play or abnormal noise in the bearing
- Cracks or corrosion in the impeller

Installation

1. Before installing water pump, coat sealing surface with silicon grease.
2. Install water pump assembly and tighten bolts to the specified torque.

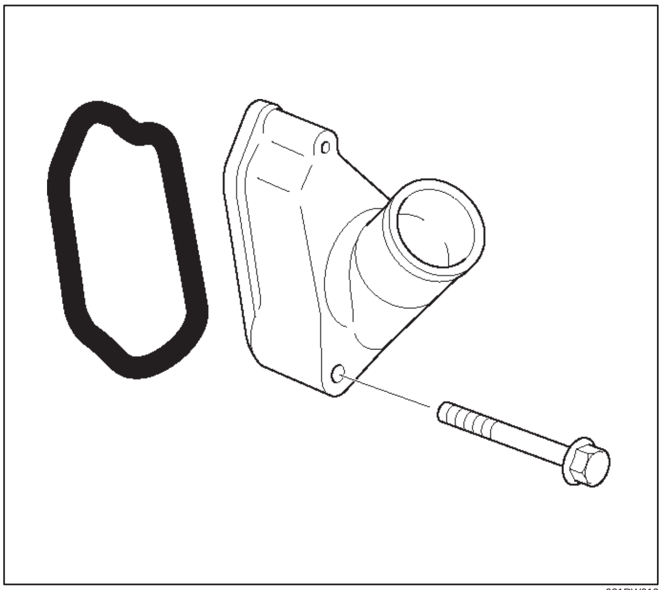
Torque: 25 N·m (18 lb ft)

3. Timing belt
   - Install timing belt, refer to timing belt installation step in “Timing Belt” in this manual.
4. Connect radiator hose and replenish EC.
5. Connect battery ground cable.

Thermostat

Removal

1. Disconnect battery ground cable.
2. Drain engine coolant from the radiator and engine.
3. Disconnect radiator hose from the inlet pipe.
4. Remove thermostat housing.



031RW012

Inspection

Suspend the thermostat in a water–filled container using thin wire. Place a thermometer next to the thermostat. Do not directly heat the thermostat.

Gradually increase the water temperature. Stir the water so that the entire water is same temperature.

Confirm the temperature when the valve first begins to open.

Valve opening temperature 92˚C (197.6˚F)

Confirm the temperature when the valve is fully opened.

Valve full open temperature 107˚C (224.6˚F)

Make necessary repair and parts replacement if extreme wear or damage is found during inspection.

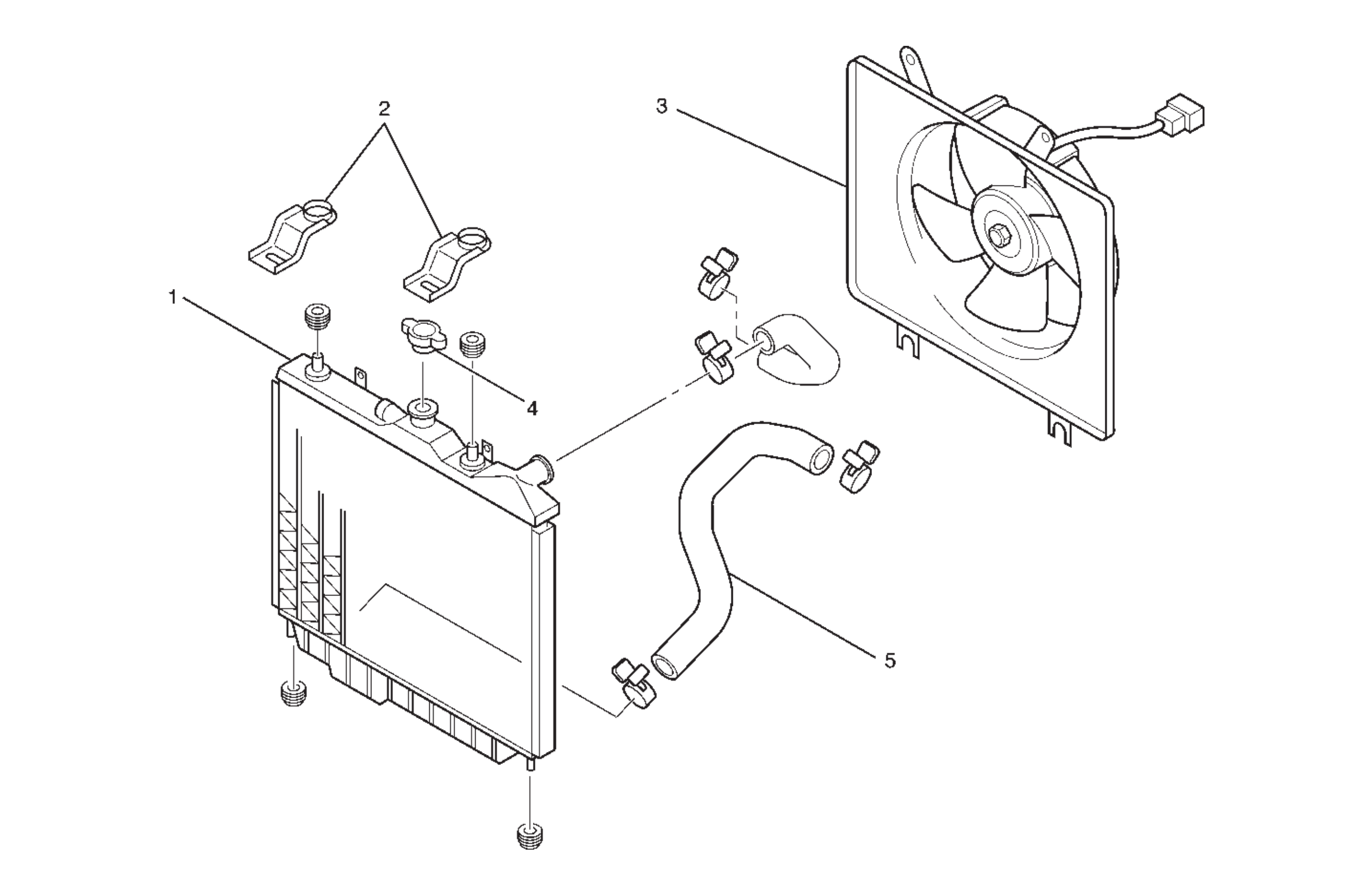
Installation

1. Before installing thermostat, coat sealing surface with silicon grease.
2. Install gasket.
3. Install thermostat housing and tighten bolts to the specified torque.

   Torque: 15 N·m (11 lb ft)
4. Installation rubber hose.
5. Replenish engine coolant (EC).
6. Start engine and check for EC leakage.

Radiator

Radiator and Associated Parts



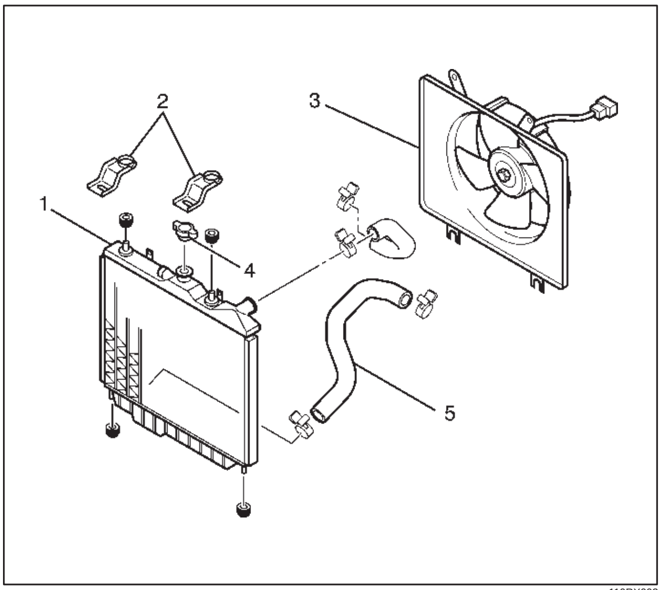
110RX004

Legend

(1) Radiator
(2) Bracket
(3) Cooling Fan Assembly
(4) Radiator Cap
(5) Radiator Hose
(6) Lower Fan Guide

Removal

1. Disconnect battery ground cable.
2. Disconnect cooling fan motor connector.
3. Loosen a drain plug to drain EC.
4. Disconnect radiator inlet hose and outlet hose from the engine.
5. Remove fan guide, clips on both sides and the bottom lower with fan shroud.
6. Disconnect the reserve tank hose from radiator.
7. Remove bracket(2).



110RX003

8. Lift out the radiator assembly with hose, taking care not to damage the radiator core with fan blade.
9. Remove rubber cushions on both sides at the bottom.

Inspection

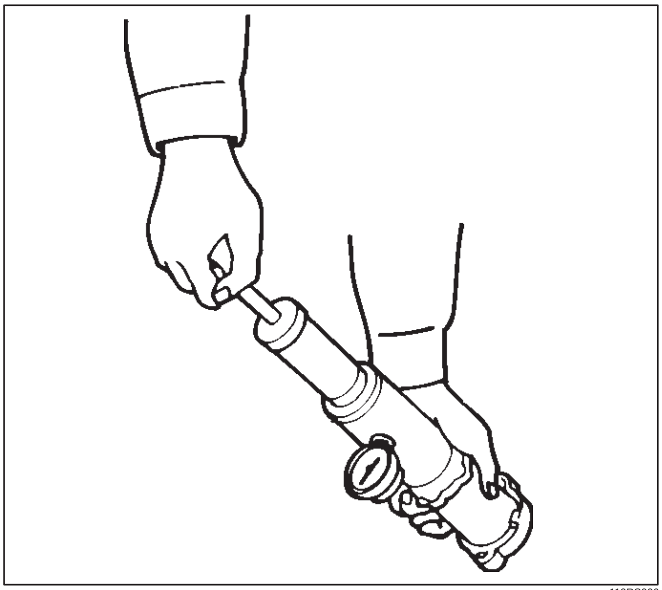
Radiator Cap

Measure the valve opening pressure of the pressurizing valve with a radiator filler cap tester.
Replace the cap if the valve opening pressure is outside the standard range.

Valve opening pressure kPa (psi) 93.3 ~ 122.7 (13.5 ~17.8)

Cap tester: J–24460–01
Adapter: J–33984–A
Check the condition of the vacuum valve in the center of the valve seat side of the cap. If considerable rust or dirt is found, or if the valve seat cannot be moved by hand, clean or replace the cap.

Valve opening vacuum kPa (psi) 1.96 ~ 4.91 (0.28 ~ 0.71)



110RS006

Radiator Core

1. A bent fin may result in reduced ventilation and overheating may occur. All bent fins must be straightened. Pay close attention to the base of the fin when it is being straightened.
2. Remove all dust, bugs and other foreign material.

Flushing the Radiator

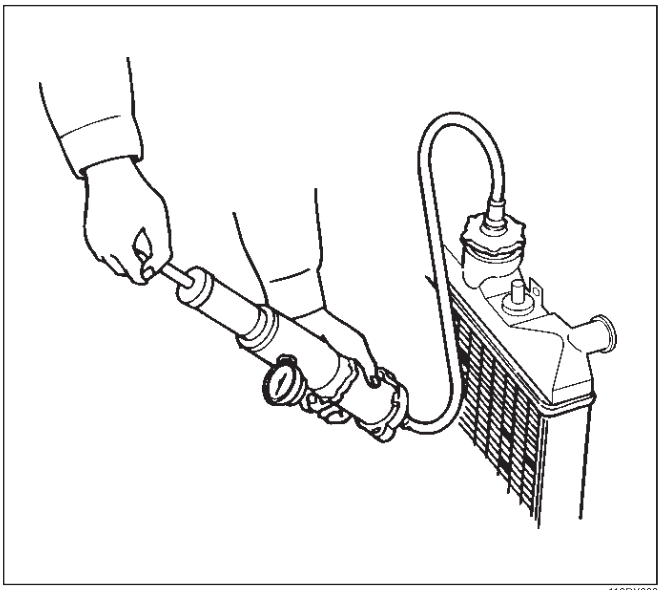
Thoroughly wash the inside of the radiator and the engine coolant passages with cold water and mild detergent. Remove all sign of scale and rust.

Cooling System Leakage Check

Use a radiator cap tester to force air into the radiator through the filler neck at the specified pressure of 196 kPa (28.5 psi) with a cap tester:

- Leakage from the radiator
- Leakage from the coolant pump
- Leakage from the water hoses
- Check the rubber hoses for swelling.

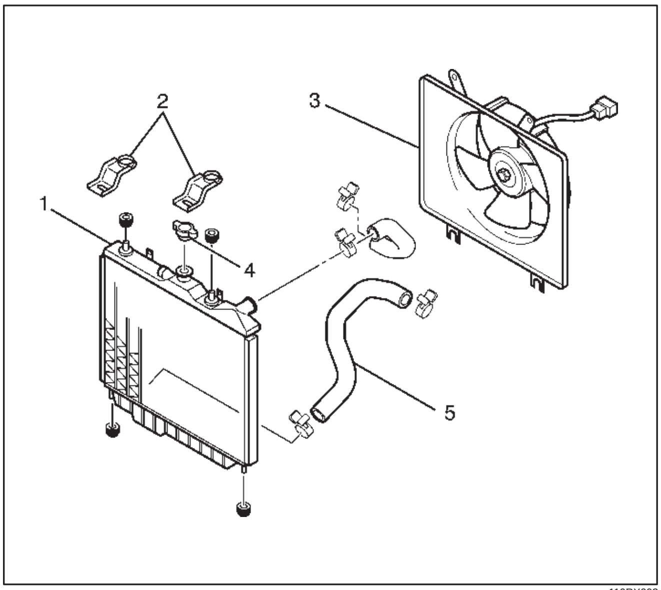
Cap tester: J–24460–01
Adapter: J–33984–A



110RX002

Installation

1. Install rubber cushions on both sides of radiator bottom.
2. Install radiator assembly with hose, taking care not to damage the radiator core with a fan blade.
3. Install bracket and support the radiator upper tank with the bracket and secure the radiator.
4. Connect reserve tank hose.
5. Install lower fan guide (6).
6. Connect radiator inlet hose and outlet hose to the engine.



110RX003

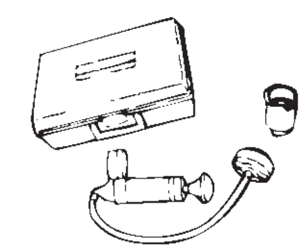
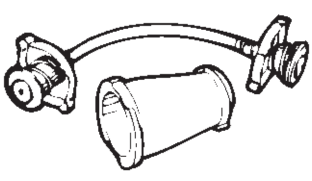
7. Connect battery ground cable.
8. Pour engine coolant up to filler neck of radiator, and up to MAX mark of reserve tank.
   Important operation (in case of 100% engine coolant change) procedure for filling with engine coolant.
   - Remove radiator cap.
   - Fill with engine coolant (EC) to the radiator filler neck.
   - Fill with EC to the “MAX” line on the reservoir.
   - Start the engine with the radiator cap removed and bring to operating temperature by running engine at 2,500 ~ 3,000 rpm for 30 minutes.
   - By EC temperature gauge reading make sure that the thermostat is open.
   - If air bubbles come up to the radiator filler neck, replenish with EC. Repeat until the EC level does not drop any further. Install the radiator cap and stop the engine.
   - Replenish EC to the “MAX” line on the reservoir and leave as it is until the engine gets cool.
   - After the engine gets cool, start the engine and make sure there is no water running noise heard from the heater core while the engine runs at 3000 rpm.
   - Should water running noise be heard, repeat the same procedure from the beginning.

Main Data and Specifications

General Specifications

Cooling system	Engine Coolant forced circulation
Radiator	(1 tube in row) Tube type corrugated
Heat radiation capacity	54,000 kcal/h (62.8 kw)
Heat radiation area	7.677m^2 (0.878ft^2)
Radiator front area	0.264m^2 (0.028ft^2)
Radiator dry weight (with fan)	32N (7.2lb)
Radiator cap valve opening pressure	93.3 ~ 122.7kpa (13.5 ~ 17.8psi)
Engine coolant capacity	1.8lit (0.48 US gal)
Engine coolant pump	Centrifugal type
Thermostat	Bypass type
Engine coolant total capacity	7.2lit (1.9 US gal)

Special Tool

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RW072	**J–24460–01** Tester; radiator cap
 901RW073	**J–33984–A** Adapter; radiator cap

RODEO

ENGINE

ENGINE FUEL (X22SE 2.2L)

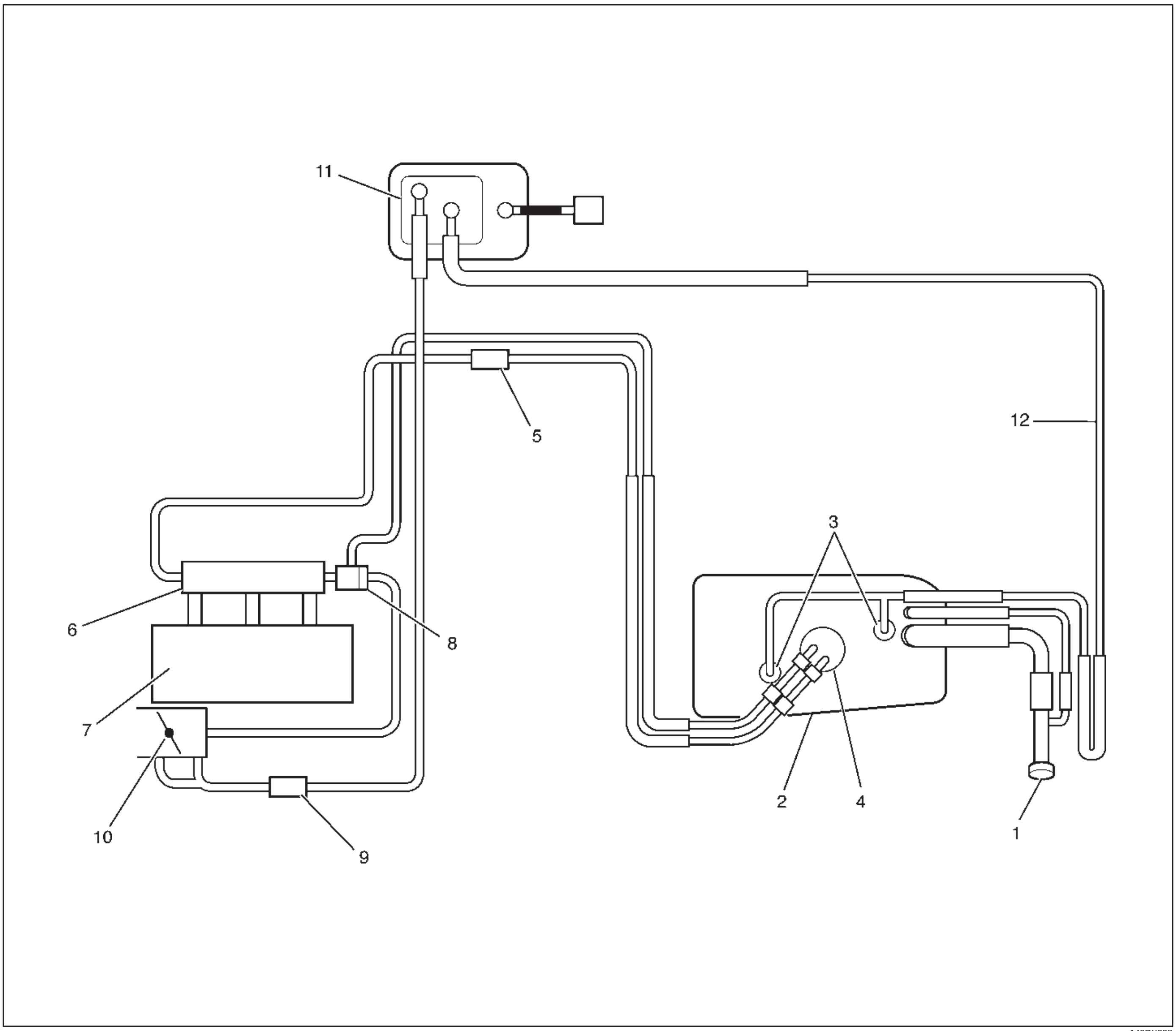
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



140RX008

Legend

(1) Fuel Filter Cap
(2) Fuel Tank
(3) Rollover Valve
(4) Fuel Pump and Sender Assembly
(5) Fuel Filter
(6) Fuel Rail
(7) Intake Manifold
(8) Fuel Pressure Control Valve
(9) Duty Solenoid Valve
(10) Throttle Valve
(11) Canister
(12) Evapo Pipe

When working on the fuel system, there are several things to keep in mind:

- Any time the fuel system is being worked on, disconnect the negative battery cable except for those tests where battery voltage is required.
- Always keep a dry chemical (Class B) fire extinguisher near the work area.
- Replace all pipes with the same pipe and fittings that were removed.
- Clean and inspect “O” rings. Replace if required.
- Always relieve the line pressure before servicing any fuel system components.
- Do not attempt repairs on the fuel system until you have read the instructions and checked the pictures relating to that repair.
- Adhere to all Notices and Cautions.

All gasoline engines are designed to use only unleaded gasoline. Unleaded gasoline must be used for proper emission control system operation.

Its use will also minimize spark plug fouling and extend engine oil life. Using leaded gasoline can damage the emission control system and could result in loss of emission warranty coverage.

All cars are equipped with an Evaporative Emission Control System. The purpose of the system is to minimize the escape of fuel vapors to the atmosphere.

Fuel Metering

The Powertrain Control Module (PCM) is in complete control of this fuel delivery system during normal driving conditions.

The intake manifold function, like that of a diesel, is used only to let air into the engine. The fuel is injected by separate injectors that are mounted over the intake manifold.

The Manifold Absolute Pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load and speed changes, which the MAP sensor converts to a voltage output.

This sensor generates the voltage to change corresponding to the flow of the air drawn into the engine. The changing voltage is transformed into an electric signal and provided to the PCM.

With receipt of the signals sent from the MAP sensor, Intake Air Temperature sensor and others, the PCM determines an appropriate fuel injection pulse width feeding such information to the fuel injector valves to effect an appropriate air/fuel ratio.

The Multiport Fuel Injection system utilizes an injection system where the injectors turn on at every crankshaft revolution. The PCM controls the injector on time so that the correct amount of fuel is metered depending on driving conditions.

Two interchangeable “O” rings are used on the injector that must be replaced when the injectors are removed.

The fuel rail is attached to the top of the intake manifold and supplies fuel to all the injectors.

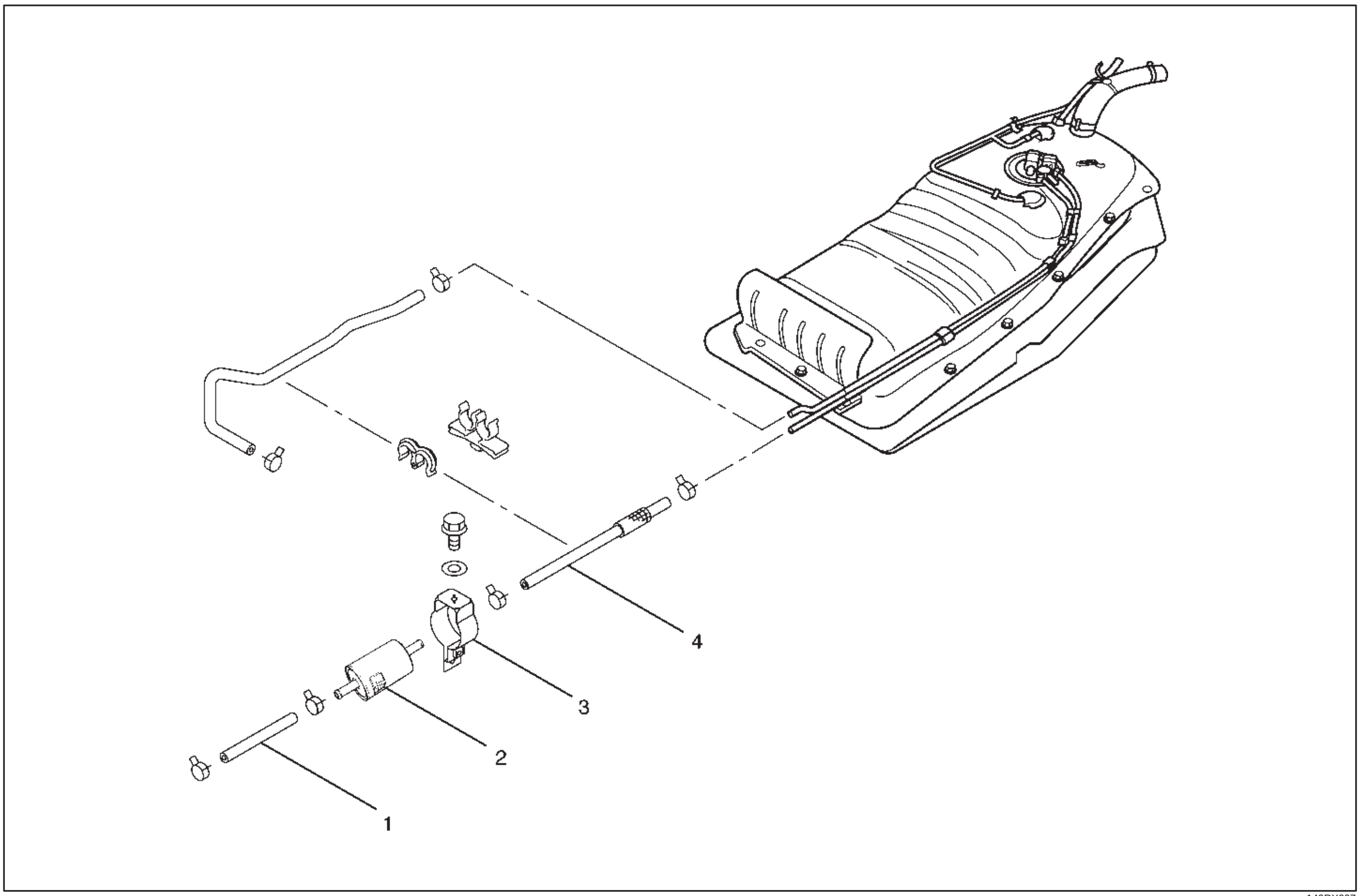
Fuel is recirculated through the rail continually while the engine is running. This removes air and vapors from the fuel as well as keeping the fuel cool during hot weather operation.

The fuel pressure control valve that is mounted on the fuel rail maintains a pressure differential across the injectors under all operating conditions. It is accomplished by controlling the amount of fuel that is recirculated back to the fuel tank based on engine demand.

See Section “Driveability and Emission” for more information and diagnosis.

Fuel Filter

Fuel Filter and Associated Parts



Legend
(1) Fuel Hose
(2) Fuel Filter
(3) Fuel Filter Holder
(4) Fuel Hose

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connections or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".

1. Disconnect battery ground cable.
2. Remove fuel filler cap.
3. Disconnect fuel hoses(1) from fuel filter on both engine side and fuel tank side.
4. Fuel filter fixing bolt.
   - Remove the fuel filter fixing bolt on fuel filter holder(3).
5. Remove fuel filter(2).

Inspection

1. Replace the fuel filter if the fuel leaks from fuel filter body or if the fuel filter body itself is damaged.
2. Replace the filter if it is clogged with dirt or sediment.
3. Check the drain and if it is clogged with dust, clean it out with air.

Installation

1. Install the fuel filter in the proper direction.
2. Install fuel filter holder fixing bolt.
3. Connect fuel hoses on engine side and fuel tank side.
4. Install fuel filler cap
5. Connect the battery ground cable.

Inspection

After installation, start engine and check for fuel leak age.

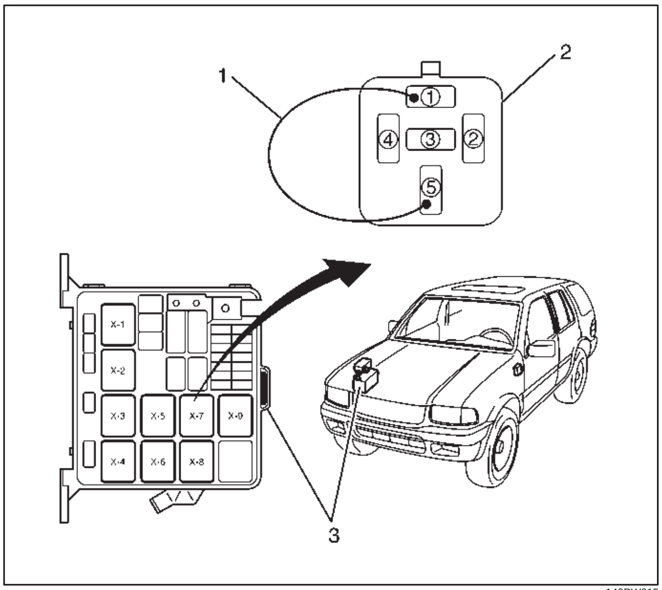
In–Tank Fuel Filter

The filter is located on the lower end of the fuel pickup tube in the fuel tank. It prevents dirt from entering the fuel pipe and also stops water unless the filter is completely submerged in the water. It is a self cleaning type, not requiring scheduled maintenance. Excess water and sediment in the tank restricts fuel supply to the engine, resulting in engine stop. In such a case, the tank must be cleaned throughly.

Fuel Pump Flow Test

If reduction of fuel supply is suspected, perform the following checks.

1. Make sure that there is fuel in the tank.
2. With the engine running, check the fuel feed pipe and hose from fuel tank to injector for evidence of leakage. Retighten, if pipe or hose connection is loose. Also, check pipes and hoses for squashing or clogging.
3. Insert the hose from fuel feed pipe into a clean container, and check for fuel pump flow rate.
4. Connect the pump relay terminals with a jumper wire(1) as shown and start the fuel pump to measure delivery.



140RW015

CAUTION: Never generate sparks when connecting a jumper wire.

Delivery	Delivery
15 seconds	0.38 liters minimum

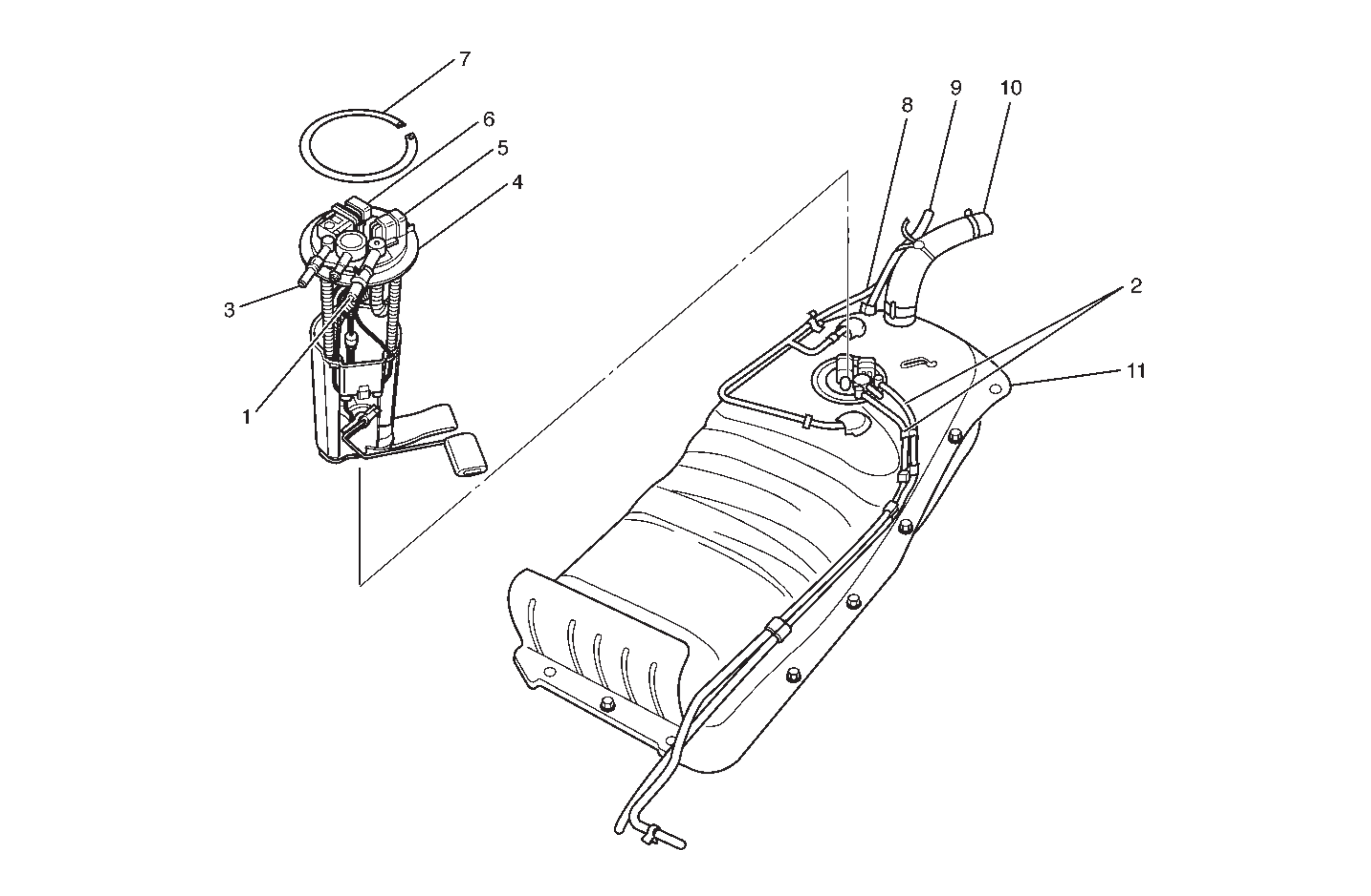
If the measure value is out of standard, conduct the pressure test.

Pressure test

For the pressure test to the fuel system, see Section 6E "Fuel Control System".

Fuel Pump

Fuel Pump and Associated Parts



140RX004

Legend

(1) Fuel Feed Port
(2) Fuel Tube/Quick Connector
(3) Fuel Return Port
(4) Fuel Pump and Sender Assembly
(5) Connector; Fuel Feed Pump
(6) Connector; Fuel Level Sensor
(7) Snap Ring (or Fuel pump lock)
(8) Hose; Evaporative Fuel
(9) Hose; Air Breather
(10) Hose; Fuel Filler
(11) Fuel Tank Assembly

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section "Driveability and Emission".

1. Disconnect battery ground cable.
2. Loosen fuel filler cap.
3. Support underneath of the fuel tank assembly (11) with a lifter.
4. Remove fuel tank assembly(11). Refer to "Fuel Tank Removal" in this section.
5. Remove Fuel Tube/Quick Connector (2).

NOTE: Handling of the fuel tube sure to refer "Fuel Tube/Quick Connector Fittings" in this section.

6. Remove fuel pump and sender (FPAS) assembly(4) fixing snapring and remove the FPAS assembly.

NOTE:

- After removing pump assembly (4), cover fuel tank to prevent any dust entering.
- Remove the fuel pump lock, when using J–39763.

Installation

1. Install FPAS assembly(4).
2. Install Fuel Tube/Quick Connector (2).

NOTE: Handling of the fuel tube sure to refer "Fuel Tube/Quick Connector Fittings" in this section.

3. Install fuel tank assembly(11). Refer to "Fuel Tank Installation".
4. Fill the tank with fuel and tighten fuel filler cap.
5. Connect battery ground cable.

Fuel Tube / Quick – Connector Fittings

Precautions

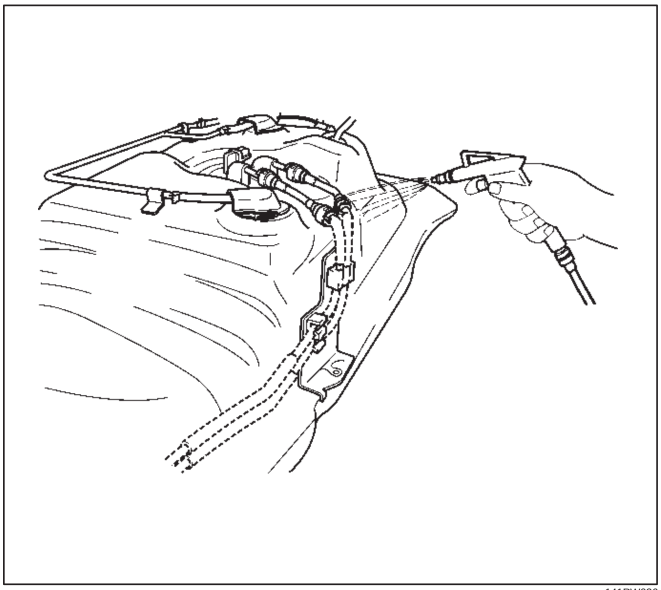
- Lighting of Fires Prohibited.
- Keep flames away from your work area to prevent the inflammable from catching fire.
- Disconnect the battery negative cable to prevent shorting during work.
- When welding or conducting other heat-generating work on other parts, be sure to provide pretreatment to protect the piping system from thermal damage or spattering.

Cautions During Work

Do not expose the assembly to battery electrolyte or do not wipe the assembly with a cloth used to wipe off spilt battery electorolyte.
The piping wet with battery electrolyte cannot be used.
Be careful not to give a bending or twisting force to the piping during the work. If deformed, replace with a new piping.

Removal

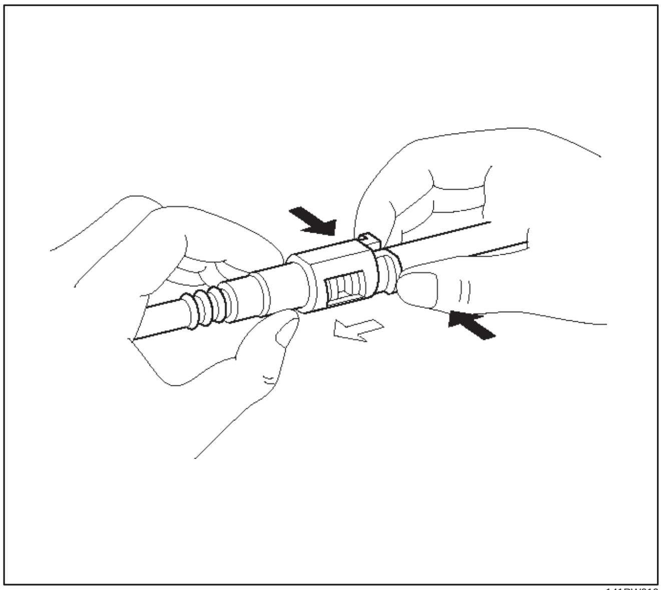
1. Open the fuel cap to relieve the fuel pressure in the tank.
   If the fuel quick-connect fittings are dusty, clean with an air blower, etc. and then remove it.



141RW036

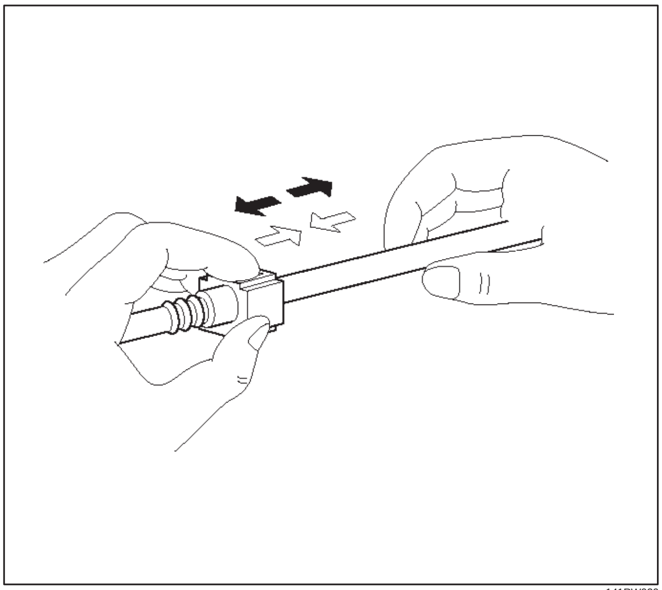
As some pressure may remain in the piping, cover the connector with a cloth, etc. to prevent the splashing of fuel in the first disconnection of the piping.

2. For removal of the delivery pipe (feeding fuel to the engine), hold the connector in one hand, and hold the retainer tab with the other hand and pull out the connector, as illustrated. The pipe can be removed with the retainer attached.



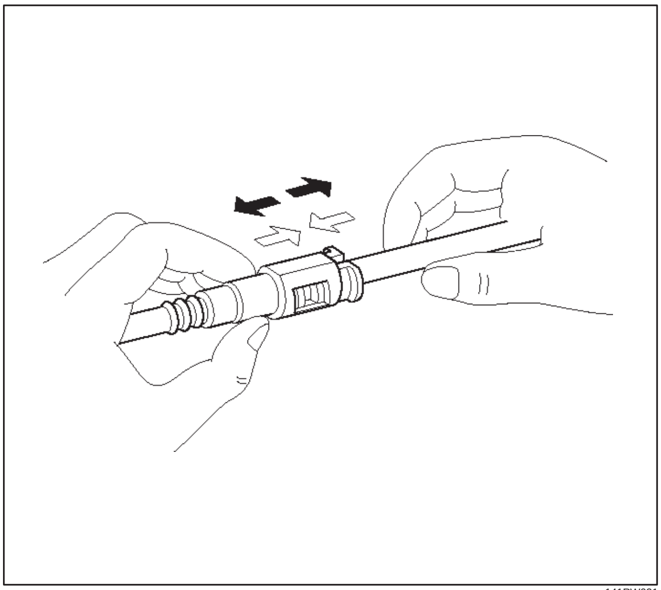
141RW019

3. For removal of the return pipe (returnig fuel to the tank), hold the pipe in one hand, and pull out the connentor with the other hand while pressing the square relieve button of the retainer, as illustrated.



141RW020

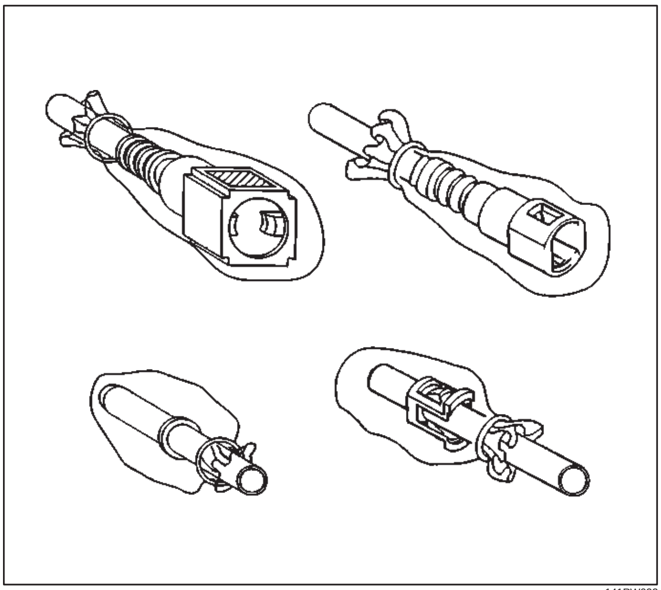
NOTE: This work should be done by hands. Do not use any tools. Should the pipe can hardly be removed from the connector, use a lubricant (light oil) and/or push and pull the connector longitudinally until the pipe is removed.



141RW021

When reusing the delivery pipe retainer, reuse without removing the retainer from the pipe. If the retainer is damaged or deformed, however, replace with a new retainer.

Cover the connectors removed with a plastic bag, etc. to prevent the entry of dust or rain water.



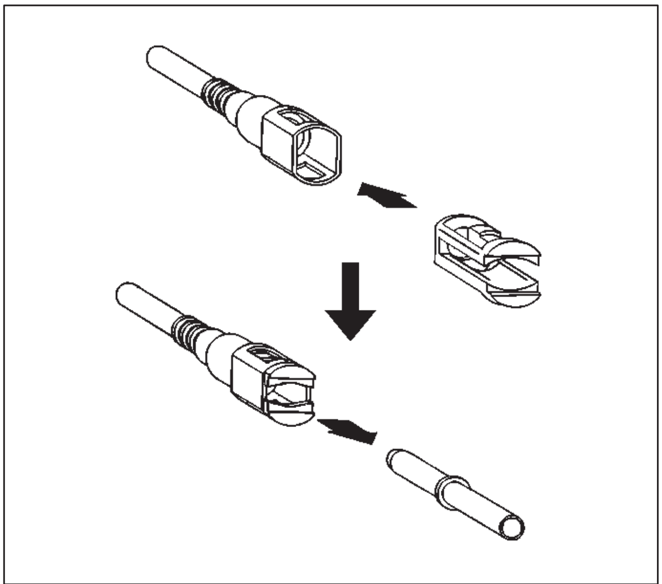
141RW022

Reuse of Quick–Connector

(Delivery Pipe)

- Replace the pipe and connector if scratch, dent or crack is found.
- Remove mud and dust from the pipe and make sure that the end including spool is free of defects, such as scratch, rust, and dent, which may cause poor sealability. If defective, replace with a new pipe.
- If the retainer removed according to the removal step above is attached to the pipe, clean and insert it straight into the quick-connector till it clicks. After it clicks, try pulling it out to make sure that it is not drawn and is securely locked.

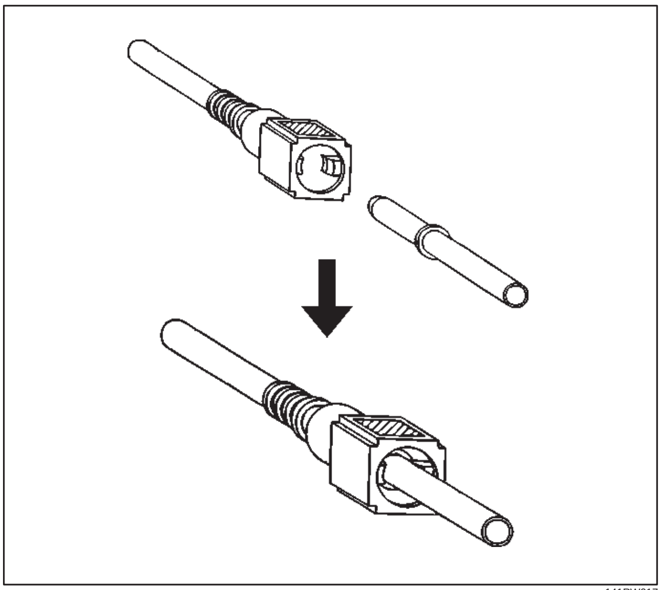
NOTE: The retainer, once removed from the pipe, cannot be reused. Just replace with a new retainer. Insert the new retainer into the connector side until it clicks, and connect the pipe as inserting it into the retainer until it clicks.



141RW018

(Return Pipe)

- Replace the pipe and connector if scratch, dent or crack is found.
- Remove mud or dust from the pipe and make sure that the end including spool is free from defects, such as scratch, rust, and dent, which may cause poor sealability. If defective, replace with a new pipe.
- After cleaning the pipe, insert it straight into the connector until it clicks. After it clicks, try pulling it out to make sure that it is not drawn and is securely locked.



141RW017

Assembling Advice

Application of engine oil or light oil to the pipe facilitates connecting work. The work should be started immediately after lubrication, since dust may stick to the pipe surface to cause poor sealability if a long time passes after lubrication.

Test/Inspection After Assembling

1. Reconnect the battery negative cable.
2. Turn the ignition key to the “ON” position and check pump startup sound. As the pump is actuated to raise fuel pressure, check and see fuel leak from the piping system.
3. Make sure of no fuel leakage by conducting the above fuel leak check a few times.
4. Start the engine and make sure of stable idling speed and normal vehicle run.The entry of dust during the work may sometimes affect the fuel injection system.

Fuel Pump Relay

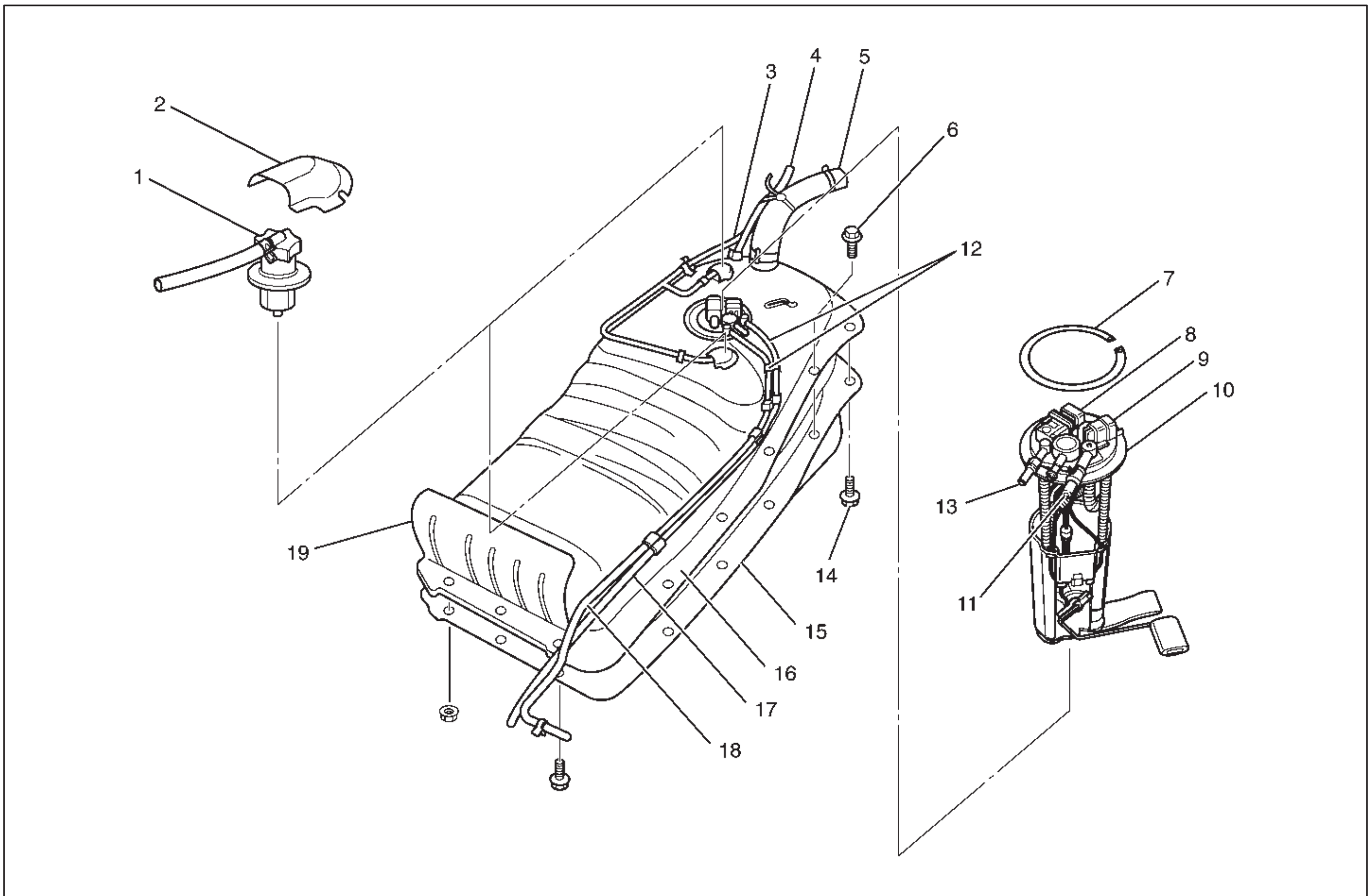
General Description

In order to control the FPAS operation, the FPAS relay is provided. When the starter switch is turned to “ON” position, the FPAS relay operates the FPAS for 2 seconds.

When it is turned to “START” position, the Engine Control Module receives the reference pulse from the Ignition Control Module and it operates the relay, again causing the FPAS to feed fuel.

Fuel Tank

Fuel Tank and Associated Parts



Legend

(1) Roll Over&Float Valve
(2) Retaining Cover
(3) Hose; Evaporative Fuel
(4) Hose; Air Breather
(5) Hose; Fuel Filler
(6) Bolt; Fuel Tank Protecter Fixing
(7) Snap Ring
(8) Connector; Fuel Level Sensor
(9) Connector; Fuel Feed Pump
(10) Fuel Pump and Sender Assembly
(11) Fuel Feed Port
(12) Fuel Tube/Quick Connector
(13) Fuel Return Port
(14) Bolt; Fuel Tank Asm. Fixing
(15) Protector; Fuel Tank
(16) Fuel Tank Assembly
(17) Hose; Fuel Feed
(18) Hose; Fuel Return
(19) Protector; Heat

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section “Driveability and Emission”.

1. Disconnect battery ground cable.
2. Loosen fuel filler cap.
3. Support underneath of the fuel tank protector (15) with a lifter.
4. Disconnect evaporative fuel hose (3) at the canister.
5. Disconnect fuel feed hose (17) and fuel return hose (18) near the fuel filter.

NOTE: Plug both ends of the fuel hoses to prevent fuel leakage.

6. Disconnect air breather hose (4) and fuel filler hose (5) at the fuel filler neck.

NOTE: Cover fuel hose to prevent any dust entering.

7. Remove the four fuel tank assembly fixing bolts (14) at four corners of the tank.
8. Let down the tank and disconnect the wiring connectors (8,9) and the emission hose at the emission port on the fuel pump and sending assembly (10).
9. Remove fuel tank assembly along with protectors (15,19) .
10. Remove retaining cover (2) and roll over&float valve (1) along with the evaporative fuel hose and pipe (3).
11. Remove Fuel Tube/Quick Connector (12).

NOTE: Handling of fuel tube sure to refer “Fuel Tube/Quick Connector Fittings” in this section.

12. Remove fuel pump and sender assembly (10) by removing the snap ring (7) along with the fuel hoses (17,18).
13. Remove protectors (15,19) by removing the six fixing bolts (6).

Installation

1. Install protectors (15,19) and tighten the six fixing bolts to the specified torque.

   Torque: 68 N·m (50 lb ft)

2. Install fuel pump and sender assembly by fitting in the snap ring (7).
3. Install Fuel Tube/Quick Connector (12).

NOTE: Handling of fuel tube sure to refer “Fuel Tube/Quick Connector Fittings” in this section.

4. Install roll over&float valve (1) by fitting in the retaining cover (2).
5. Lift up fuel tank assembly and connect the emission hose to the emission port and the wiring connectors (8,9) on the fuel pump and sending assembly (10).
6. Install fuel tank assembly along with protectors and tighten the four fixing bolts to the specified torque.

   Torque: 68 N·m (50 lb ft)

7. Connect fuel filler hose (5) and air breather hose (4), and clip them firmly.
8. Connect fuel feed hose (17) and fuel return hose (18), and clip them firmly.
9. Connect evaporative fuel hose (3).
10. Tighten fuel filler cap.
11. Connect battery ground cable.

Fuel Gage Unit

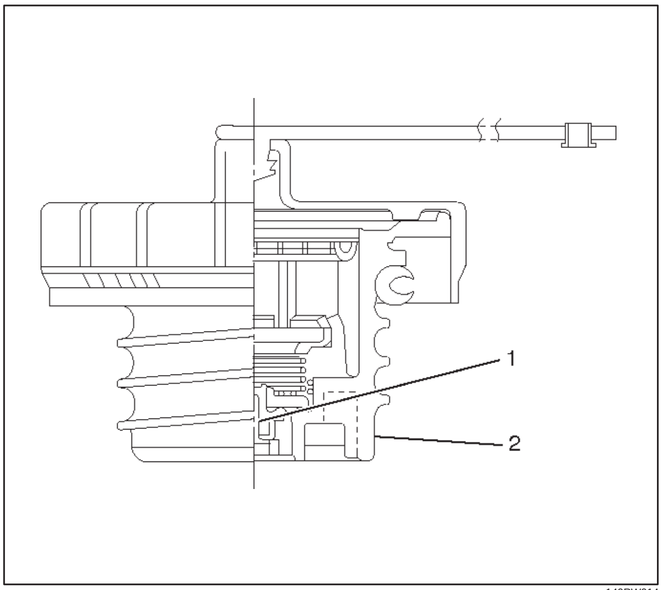
Removal and Installation

As for removal and installation of the Fuel Gauge Unit, refer to “Fuel Tank” of this section 6C as the fuel gauge unit is combined with the fuel pump and sender assembly.

Fuel Filler Cap

General Description

Fuel filler cap includes vacuum valve.
In case any high vacuum happen in tank, the valve works to adjust the pressure to prevent the tank from being damaged.



140RW014

Legend

(1) Vacuum Valve
(2) Fuel Filler Cap

Inspection

Check the seal ring in the filler cap for presence of any abnormality and for seal condition.
Replace the filler cap, if abnormal.

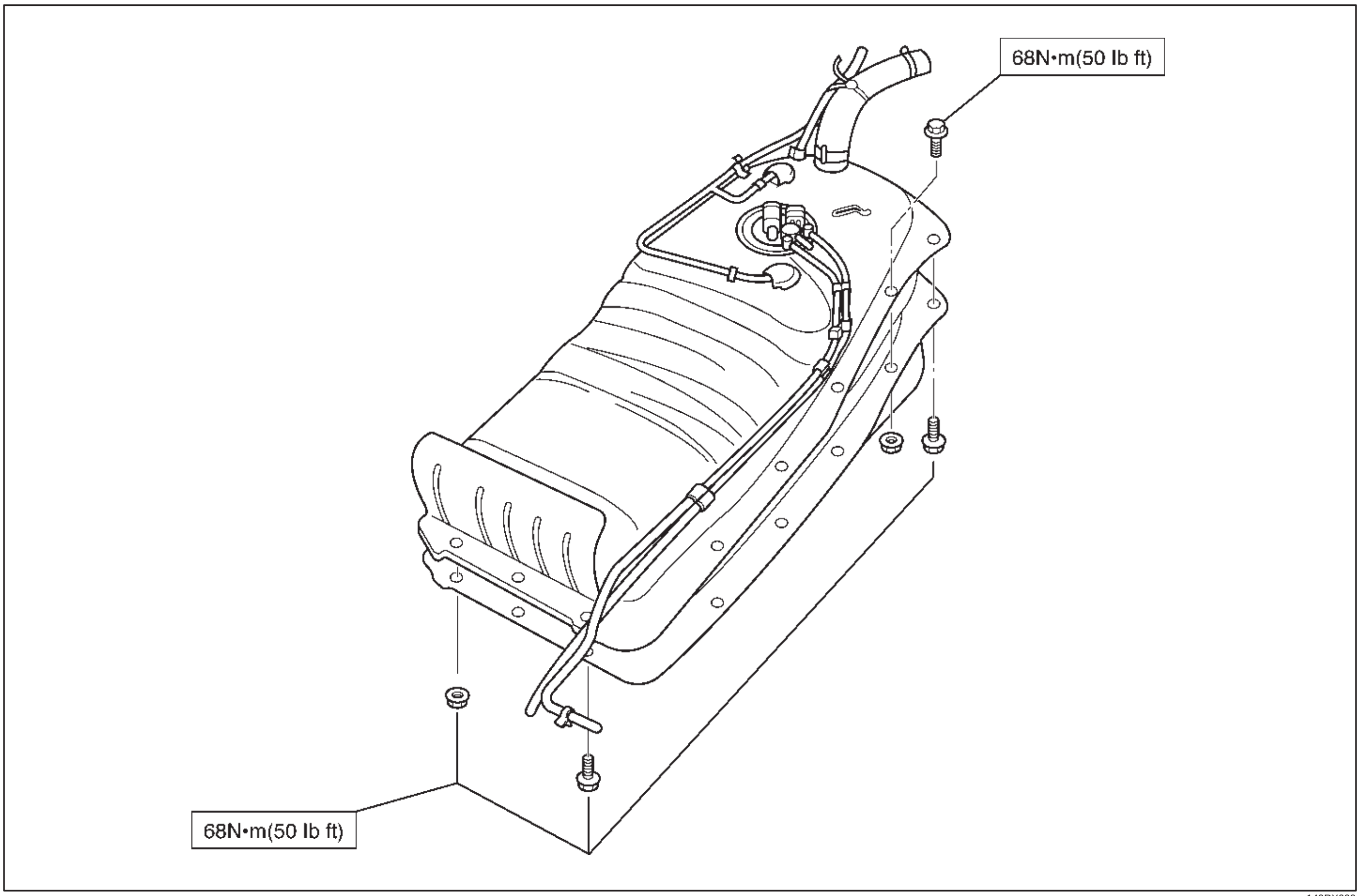
CAUTION:

The fuel filler cap valve has characteristics.

A defective valve, no valve at all or a valve with the wrong characteristics will do a lot of harm to engine operating characteristics; be sure to use the same fuel filler cap as installed in this vehicle.

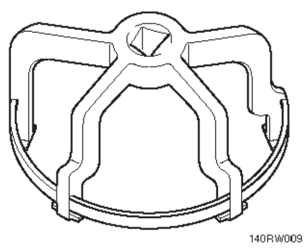
Main Data and Specifications

Torque Specification



140RX009

Special Tool

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–39763** Remover; fuel pump lock (For S/W)

RODEO

ENGINE

ENGINE ELECTRICAL (X22SE 2.2L)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

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Battery

General Description

There are six battery fluid caps on top of the battery. These are covered by a paper label.
The battery is completely sealed except for the six small vent holes on the side. These vent holes permit the escape of small amounts of gas generated by the battery.
This type of battery has the following advantages over conventional batteries:

1. There is no need to add water during the entire service life of the battery.
2. The battery protects itself against overcharging.
   The battery will refuse to accept an extensive charge.
   (A conventional battery will accept an excessive charge, resulting in gassing and loss of battery fluid.)
3. The battery is much less vulnerable to self discharge than a conventional type battery.

Diagnosis

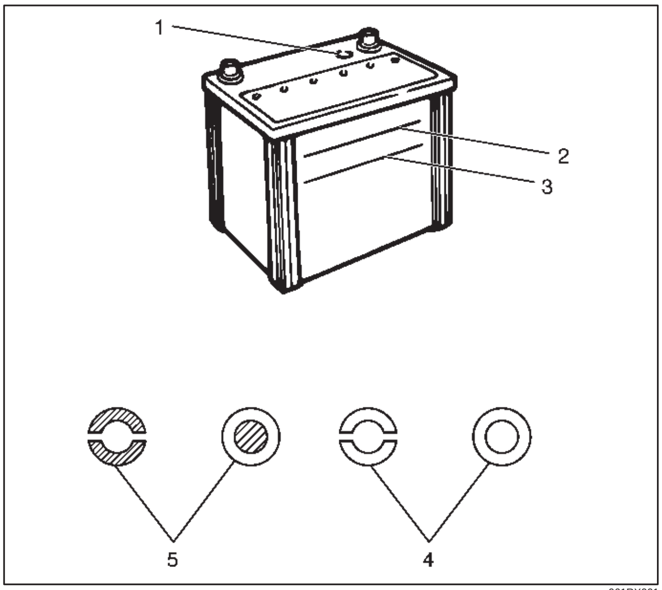
1. Visual Inspection

Inspect the battery for obvious physical damage, such as a cracked or broken case, which would permit electrolyte loss.
Replace the battery if obvious physical damage is discovered during inspection.
Check for any other physical damage and correct it as necessary.

2. Hydrometer Check

There is a built–in hydrometer (Charge test indicator(1)) at the top of the battery. It is designed to be used during diagnostic procedures.
Before trying to read the hydrometer, carefully clean the upper battery surface.
If your work area is poorly lit, additional light may be necessary to read the hydrometer.

a. BLUE RING OR DOT VISIBLE(5) – Go to Step 4.
b. BLUE RING OR DOT NOT VISIBLE(4) – Go to Step 3.

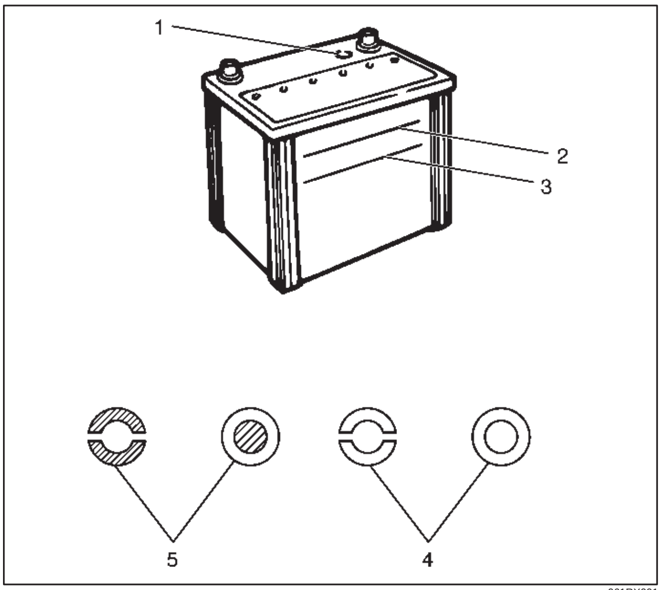


061RX001

3. Fluid Level Check

The fluid level should be between the upper level line(2) and lower level line(3) on side of battery.

a. CORRECT FLUID LEVEL – Charge the battery.
b. BELOW LOWER LEVEL – Replace battery.



061RX001

4. Voltage Check

1. Put voltmeter test leads to battery terminals.
   a. VOLTAGE IS 12.4V OR ABOVE – Go to Step 5.
   b. VOLTAGE IS UNDER 12.4V – Go to procedure (2) below.
2. Determine fast charge amperage from specification. (See Main Data and Specifications in this section).
   Fast charge battery for 30 minutes at amperage rate no higher than specified value.
   Take voltage and amperage readings after charge.
   a. VOLTAGE IS ABOVE 16V AT BELOW 1/3 OF AMPERAGE RATE – Replace battery.
   b. VOLTAGE IS ABOVE 16V AT ABOVE 1/3 OF AMPERAGE RATE – Drop charging voltage to 15V and charge for 10 – 15 hours. Then go to Step 5.
   c. VOLTAGE IS BETWEEN 12V AND 16V – Continue charging at the same rate for an additional 3–1/2 hours. Then go to Step 5.
   d. VOLTAGE BELOW 12V – Replace Battery.

5. Load Test

1. Connect a voltmeter and a battery load tester across the battery terminals.
2. Apply 300 ampere load for 15 seconds to remove surface charge from the battery. Remove load.
3. Wait 15 seconds to let battery recover. Then apply specified load from specifications (See Main Data and Specifications in this section).
   Read voltage after 15 seconds, then remove load.

a. VOLTAGE DOES NOT DROP BELOW THE MINIMUM LISTED IN THE TABLE – The battery is good and should be returned to service.

b. VOLTAGE IS LESS THAN MINIMUM LISTED – Replace battery.

ESTIMATED TEMPERATURE		MINIMUM VOLTAGE
°F	°C	V
70	21	9.6
60	16	9.5
50	10	9.4
40	4	9.3
30	–1	9.1
20	–7	8.9
10	–12	8.7
0	–18	8.5
The battery temperature must be estimated by feel and by the temperature the battery has been exposed to for the preceding few hours.		

Battery Charging

Observe the following safety precautions when charging the battery:

1. Never attempt to charge the battery when the fluid level is below the lower level line on the side of the battery. In this case, the battery must be replaced.
2. Pay close attention to the battery during charging procedure.

   Battery charging should be discontinued or the rate of charge reduced if the battery feels hot to the touch.

   battery charging should be discontinued or the rate of charge reduced if the battery begins to gas or spew electrolyte from the vent holes.
3. In order to more easily view the hydrometer blue dot or ring, it may be necessary to jiggle or tilt the battery.
4. Battery temperature can have a great effect on battery charging capacity.
5. The sealed battery used on this vehicle may be either quick charged or slow charged in the same manner as other batteries.

   Whichever method you decide to use, be sure that you completely charge the battery. Never partially charge the battery.

Jump Starting

Jump Starting with an Auxiliary (Booster) Battery

CAUTION: Never push or tow the vehicle in an attempt to start it. Serious damage to the emission system as well as other vehicle parts will result.

Treat both the discharged battery and the booster battery with great care when using jumper cables. Carefully follow the jump starting procedure, being careful at all times to avoid sparking.

WARNING: FAILURE TO CAREFULLY FOLLOW THE JUMP STARTING PROCEDURE COULD RESULT IN THE FOLLOWING:

1. Serous personal injury, particularly to your eyes.
2. Property damage from a battery explosion, battery acid, or an electrical fire.
3. Damage to the electronic components of one or both vehicles particularly.

Never expose the battery to an open flame or electrical spark. Gas generated by the battery may catch fire or explode.

Remove any rings, watches, or other jewelry before working around the battery. Protect your eyes by wearing an approved set of goggles.

Never allow battery fluid to come in contact with your eyes or skin.

Never allow battery fluid to come in contact with fabrics or painted surfaces.

Battery fluid is a highly corrosive acid.

Should battery fluid come in contact with your eyes, skin, fabric, or a painted surface, immediately and thoroughly rinse the affected area with clean tap water.

Never allow metal tools or jumper cables to come in contact with the positive battery terminal, or any other metal surface of the vehicle. This will protect against a short circuit.

Always keep batteries out of reach of young children.

Jump Starting Procedure

1. Set the vehicle parking brake.

   If the vehicle is equipped with an automatic transmission, place the selector level in the “PARK” position.

   If the vehicle is equipped with a manual transmission place the shift lever in the “NEUTRAL” position.

   Turn “OFF” the ignition.

   Turn “OFF” all lights and any other accessory requiring electrical power.
2. Look at the built–in hydrometer.

   If the indication area of the built–in hydrometer is completely clear, do not try to jump start.

3. Attach the end of one jumper cable to the positive terminal of the booster battery.

   Attach the other end of the same cable to the positive terminal of the discharged battery.

   Do not allow the vehicles to touch each other. This will cause a ground connection, effectively neutralizing the charging procedure.

   Be sure that the booster battery has a 12 volt rating.
4. Attach one end of the remaining cable to the negative terminal of the booster battery.

   Attach the other end of the same cable to a solid engine ground (such as the air conditioning compressor bracket or the generator mounting bracket) of the vehicle with the discharged battery.

   The ground connection must be at least 450 mm (18 in.) from the battery of the vehicle whose battery is being charged.

WARNING: NEVER ATTACH THE END OF THE JUMPER CABLE DIRECTLY TO THE NEGATIVE TERMINAL OF THE DEAD BATTERY.

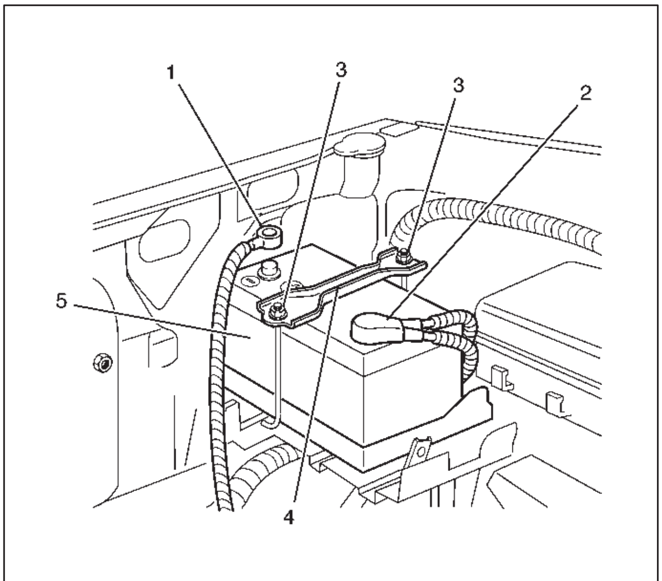
5. Start the engine of the vehicle with the good battery.

   Make sure that all unnecessary electrical accessories have been turned “OFF”.
6. Start the engine of the vehicle with the dead battery.
7. To remove the jumper cables, follow the above directions in reverse order.

   Be sure to first disconnect the negative cable from the vehicle with the discharged battery.

Battery Removal

1. Remove negative cable (1).
2. Remove positive cable (2).
3. Remove retainer screw and rods (3).
4. Remove retainer (4).
5. Remove battery (5).



061RX002

Battery Installation

1. Install battery (5).
2. Install retainer (4).
3. Instal retainer screw and rods (3).

NOTE: Make sure that the rod is hooked on the body side.

4. Install positive cable (2).
5. Install negative cable (1).

Main Data and Specifications

General Specifications

Model	24–600
Voltage (V)	12
Cold Cranking Performance (Amp)	600
Reserve Capacity (Min)	118
Load Test (Amp)	300
BCI Group No.	24

RODEO

ENGINE

IGNITION SYSTEM (X22SE 2.2L)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Ignition is done by the Ignition Module that fires.
Since the cylinder on exhaust stroke requires less energy to fire its spark plug, energy from the ignition coils can be utilized to fire the mating cylinder on compression stroke.
A notch in the timing disc on the crankshaft activates the crank angle sensor which then sends information such as firing order and starting timing of ignition coil to the PCM.
By receiving signals such as crank position,engine speed,water temperature and Manifold Absolute Pressure (MAP),the PCM controls the ignition timing.

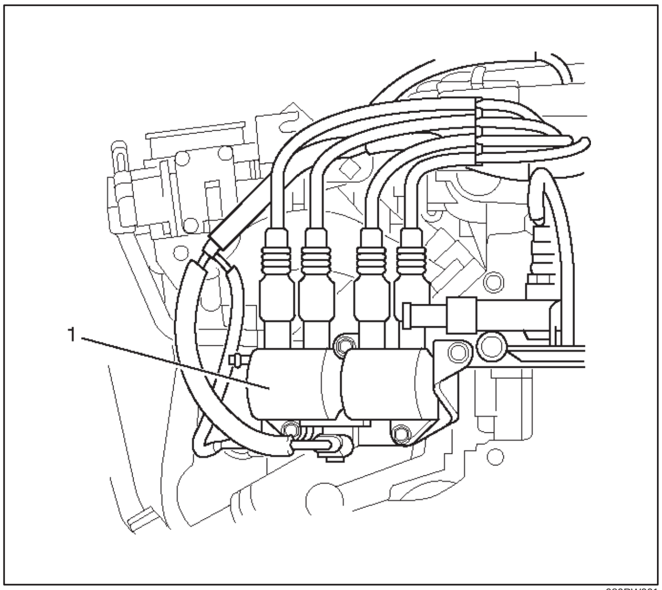
Diagnosis

Refer to Section Drivability and Emissions for the diagnosis to electronic ignition system (EI system).

Ignition Module

Removal

1. Disconnect battery ground cable.
2. Ignition module connector.
3. Removal ignition module (1).

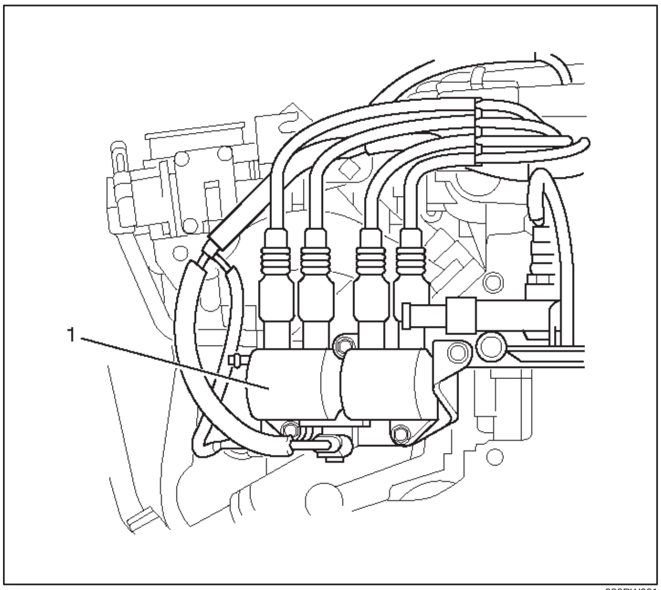


080RW001

Installation

1. Install the ignition module (1).
   Connect ignition module connector and ignition coil,then tighten bolt to the specified torque.

Torque: 20 N·m (15 lb ft)



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2. Connect battery ground cable.

Spark Plug

Removal

1. Remove spark plugs.

Inspection and Repair

The spark plug affects entire engine performance and therefore its inspection is very important.

- Check electrode and insulator for presence of cracks,and replace if any.
- Check electrode for wear,and replace if necessary.
- Check gasket for damage,and replace if necessary.
- Measure insulation resistance with an ohmmeter,and replace if faulty.
- Adjust spark plug gap to 0.7 mm (0.027 in) ~ 0.8 mm (0.031 in).
- Check fuel and electrical systems if spark plug is extremely dirty.
- Use spark plugs having low heat value (hot type plug) if fuel and electrical systems are normal.
- Use spark plugs having high heat value (cold type plug) if insulator and electrode are extremely burned.

Sooty Spark Plugs

Much deposit of carbon or oil on the electrode and insulator of spark plug reduces the engine performance.

Possible causes:

- Too rich mixture
- Presence of oil in combustion chamber
- Incorrectly adjusted spark plug gap

Burning Electrodes

This fault is characterized by scorched or heavily oxidized electrode or blistered insulator nose.

Possible causes:

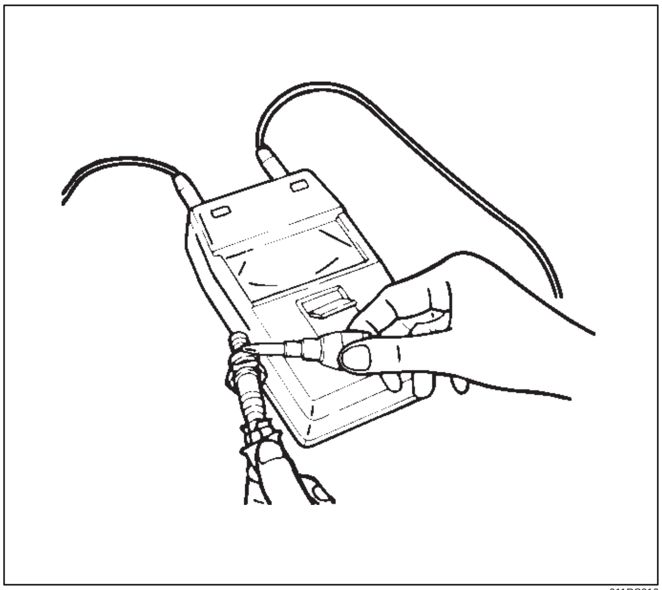
- Too lean mixture
- Improper heat value

Measuring Insulation Resistance

- Measure insulation resistance using a 500 volt megaohm meter.

- Replace spark plugs if measured value is out of standard.

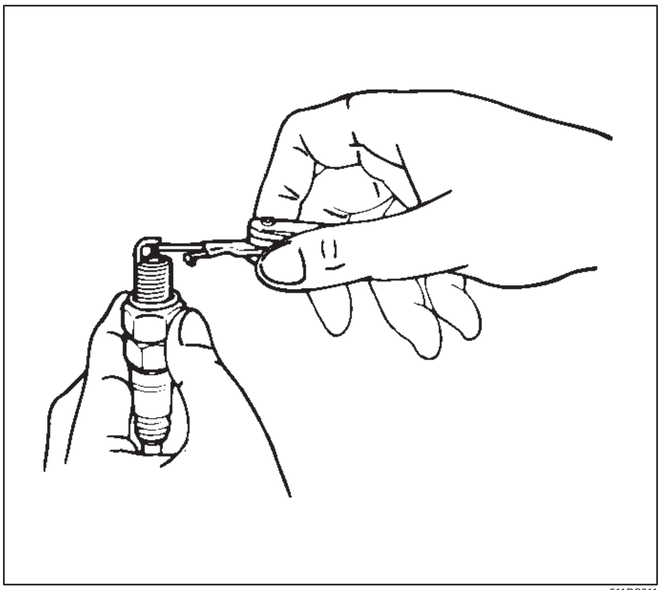
Insulation resistance: 50 MΩ or more



011RS010

Cleaning Spark Plugs

- Clean spark plugs with a spark plug cleaner.
- Raise the ground electrode to an angle of 45 to 60 degrees. if electrode is wet,dry it before cleaning.
- After spark plug is thoroughly cleaned,check insulator for presence of cracks.
- Clean threads and metal body with a wire brush.
- File the electrode tip if electrode is extremely worn.
- Bend the ground electrode to adjust the spark plug gap.



011RS011

Installation

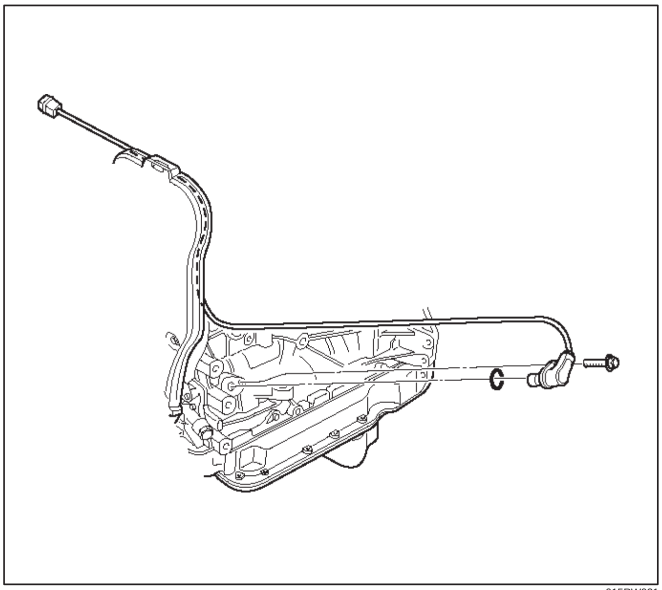
1. Spark plugs
   - Tighten spark plugs to the specified torque.

Torque: 25 N·m (18 lb ft)

Crankshaft Angle Sensor

Removal

1. Disconnect battery ground cable
2. Wiring connector from crankshaft angle sensor.
3. Remove crankshaft angle sensor from cylinder block.



015RW021

Installation

1. Install crankshaft angle sensor into the cylinder block. Before installation,apply small amount of engine oil to the O–ring.

Torque: 6 N·m (4 lb ft)

2. Reconnect wiring connector to crankshaft angle sensor.

Main Data and Specifications

General Specifications

Ignition System	
Ignition Form	Electronic Ignition System (El system) with Crankshaft angle Sensor
Spark Plug	
Type	Electronic Spark Control
No. of Coils and Type	2 Solid State
Coil Location	Engine–mounted
Torque	20 N·m (14 lb ft)

RODEO

ENGINE

STARTING AND CHARGING SYSTEM (X22SE 2.2L)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

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Starting System

General Description

Cranking Circuit

The cranking system consists of a battery, starter, starter switch, starter relay, etc. These main components are connected.

Starter

The cranking system employs a magnetic type reduction starter in which the motor shaft is also used as a pinion shaft. When the starter switch is turned on, the contacts of magnetic switch are closed, and the armature rotates. At the same time, the plunger is attracted, and the pinion is pushed forward by the shift lever to mesh with the ring gear.
Then, the ring gear runs to start the engine. When the engine starts and the starter switch is turned off, the plunger returns, the pinion is disengaged from the ring gear, and the armature stops rotation. When the engine speed is higher than the pinion, the pinion idles, so that the armature is not driven.

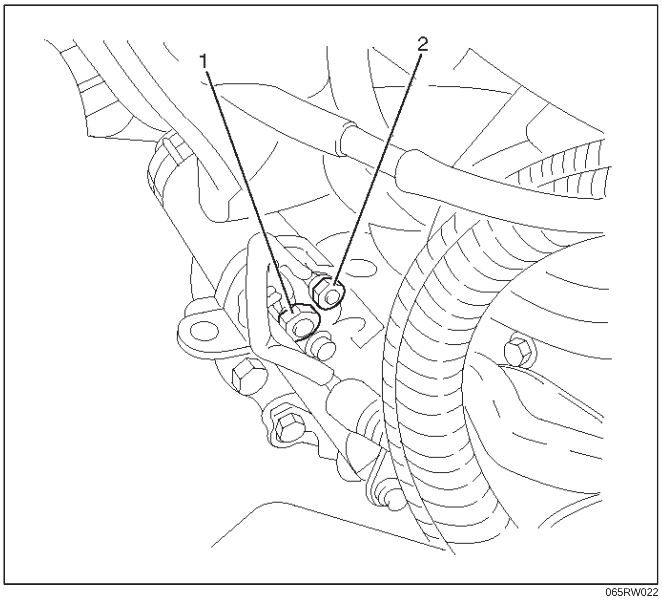
Diagnosis

Condition	Possible cause	Correction
Starter does not run	Charging failure	Repair charging system
	Battery Failure	Replace Battery
	Terminal connection failure	Repair or replace terminal connector and/or wiring harness
	Starter switch failure	Repair or replace starter switch
	Starter failure	Repair or replace starter

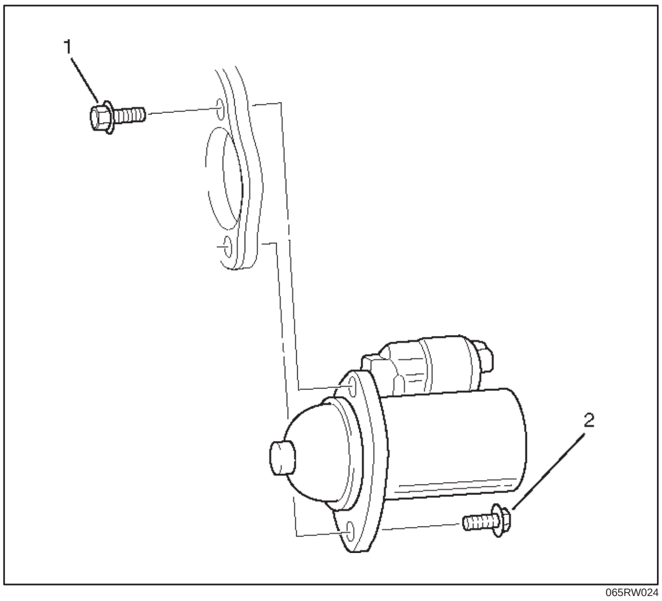
Starter

Removal

1. Battery ground cable.
2. Remove harness connectors (1) and (2).



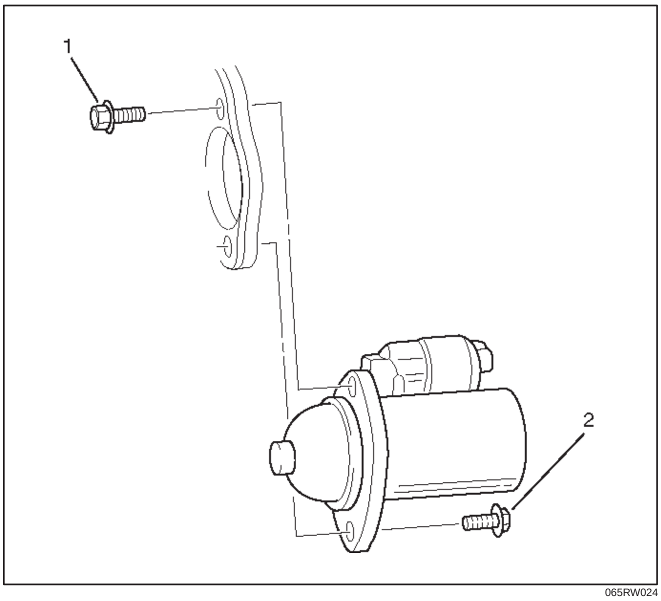
3. Remove bolts from starter (1), (2).



Installation

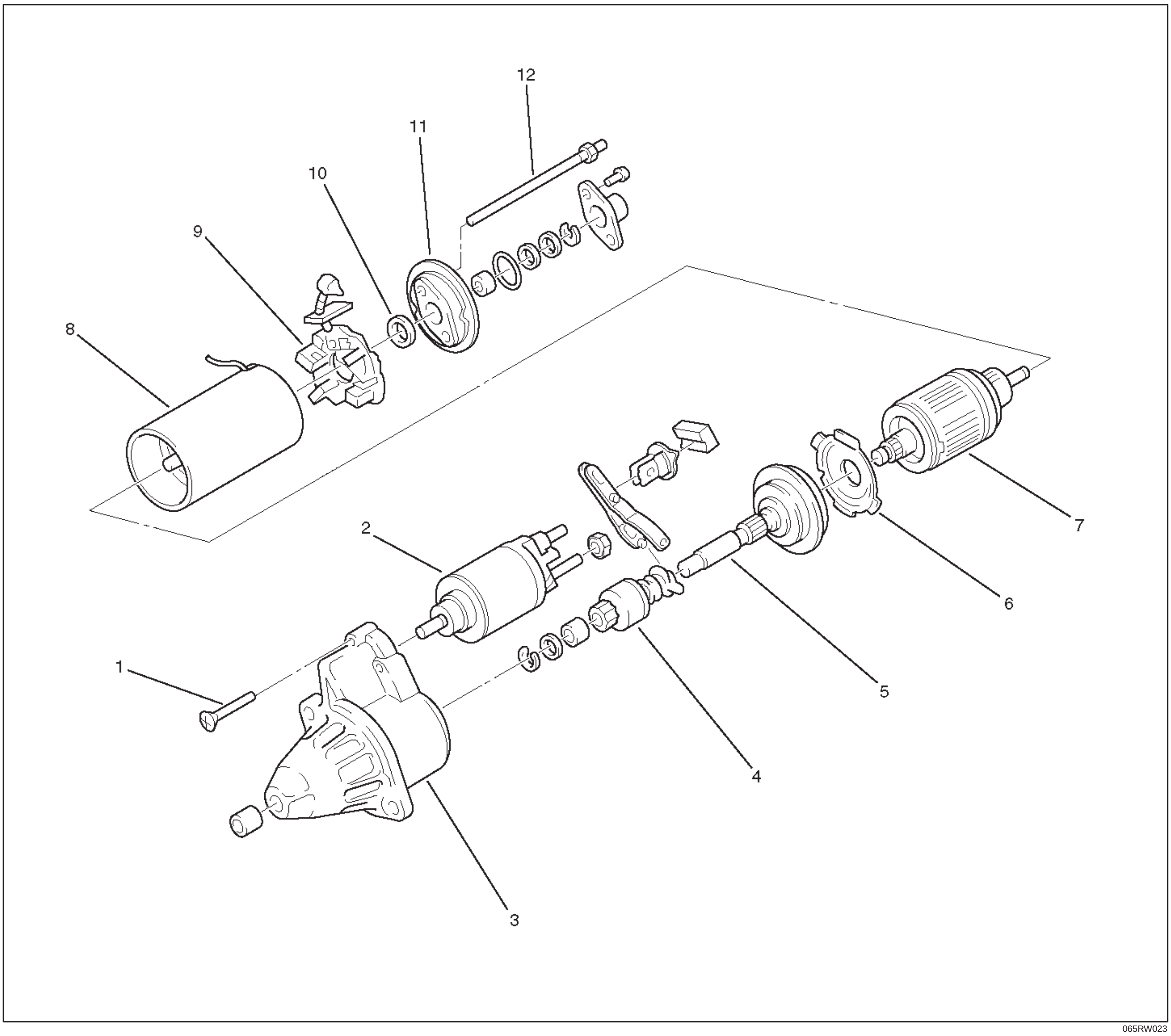
1. Install starter assembly(6).
2. Install mounting bolts and tighten bolts to specified torque (1), (2).

Torque: 25 N·m (18 lb ft)



3. Connect harness.
4. Reconnect the battery ground cable.

Disassembled View



Legend

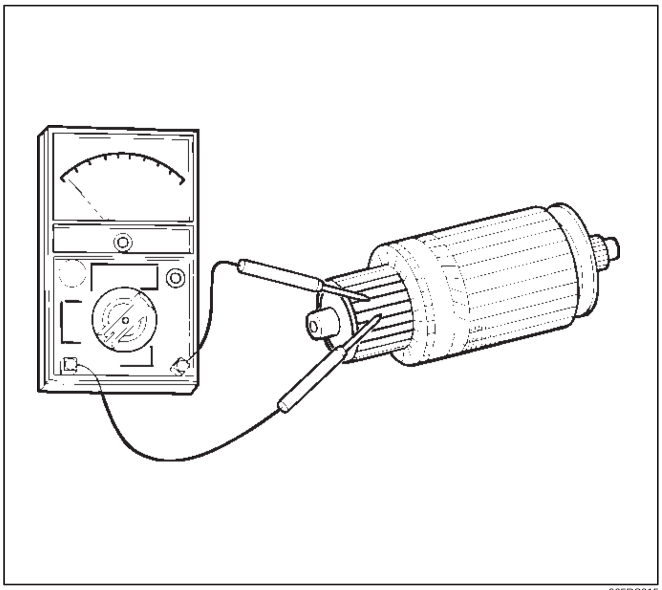
(1) Bolt
(2) Magnetic Switch
(3) Gear Case
(4) Piston
(5) Piston Shaft
(6) Center Bracket
(7) Armature
(8) Yoke Assembly
(9) Brush and Brush Holder
(10) Washer
(11) Rear Cover
(12) Through Bolt

Inspection and Repair

Repair or replace necessary parts if extreme wear or damage is found during inspection.

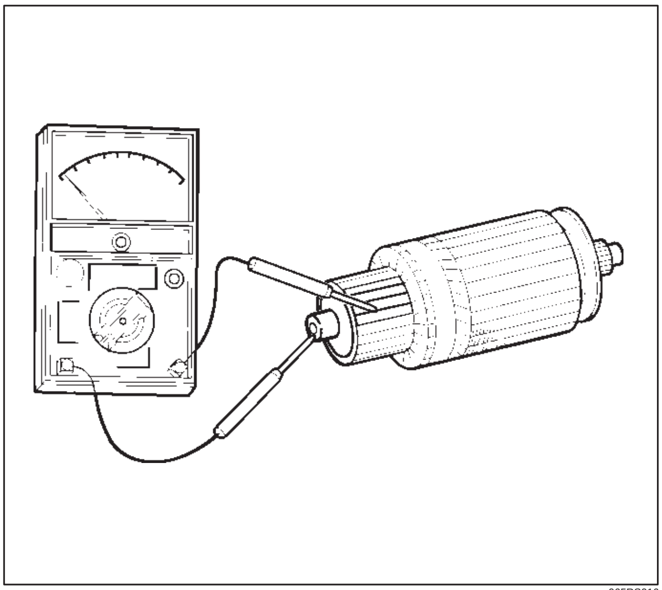
Armature

Check for continuity between commutator and segment. Replace commutator if there is no continuity (i.e., disconnected).



065RS015

Check for continuity between commutator and shaft. Also, check for continuity between commutator and armature core,armature core and shaft. Replace commutator if there is continuity (i.e., internally grounded).



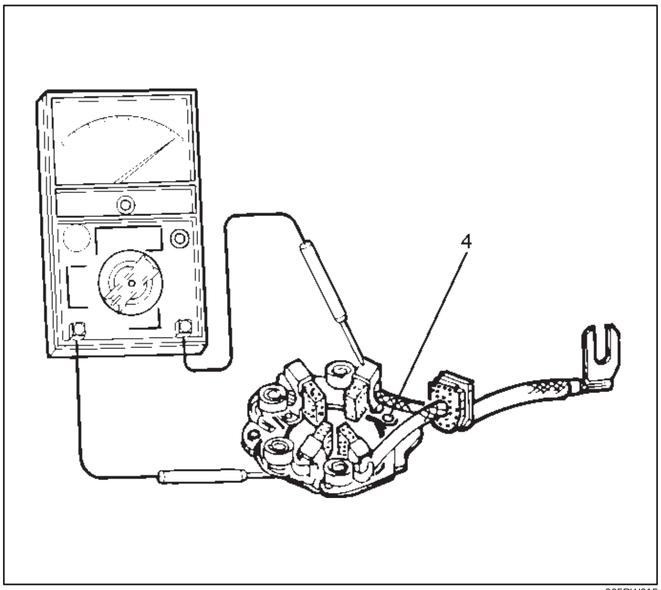
065RS016

Brush

Measure the length of brush.
Replace with a new one, if it is below the limit.

Brush Holder

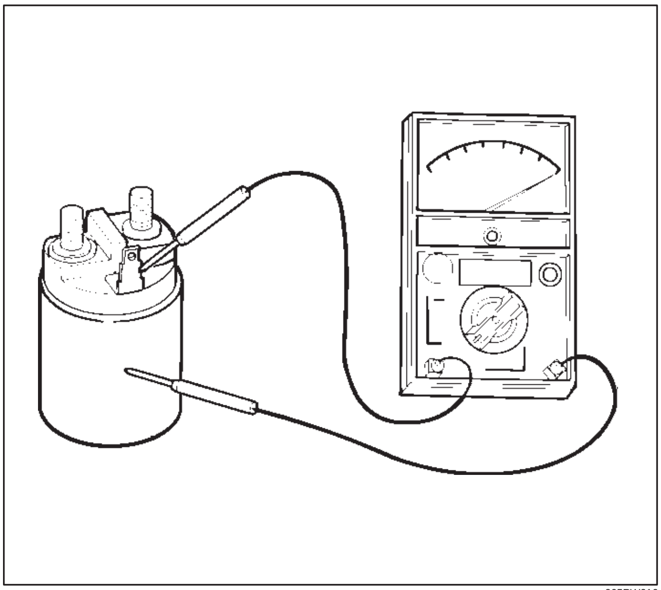
Check for continuity between brush holder (+) (4) and base (–). Replace, if there is continuity (i.e., insulation is broken).



065RW015

Magnetic Switch

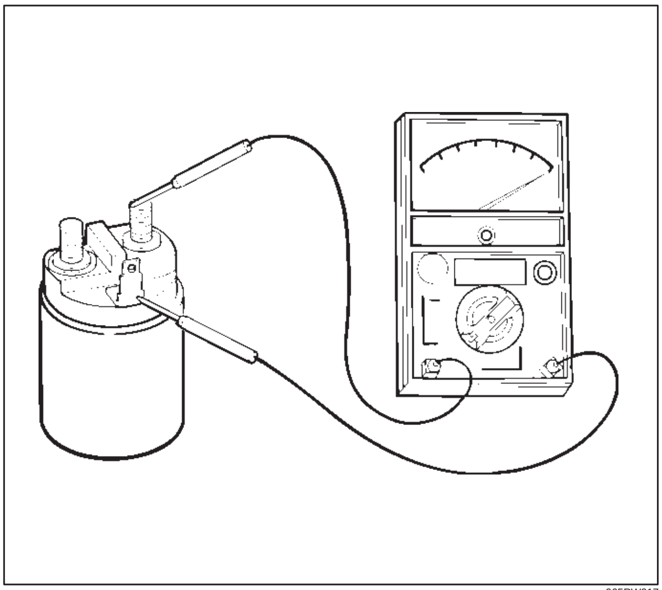
Check for continuity of shunt coil between terminals S and M.
Replace, if there is no continuity (i.e., coil is disconnected).



065RW016

Continuity of Series Coil

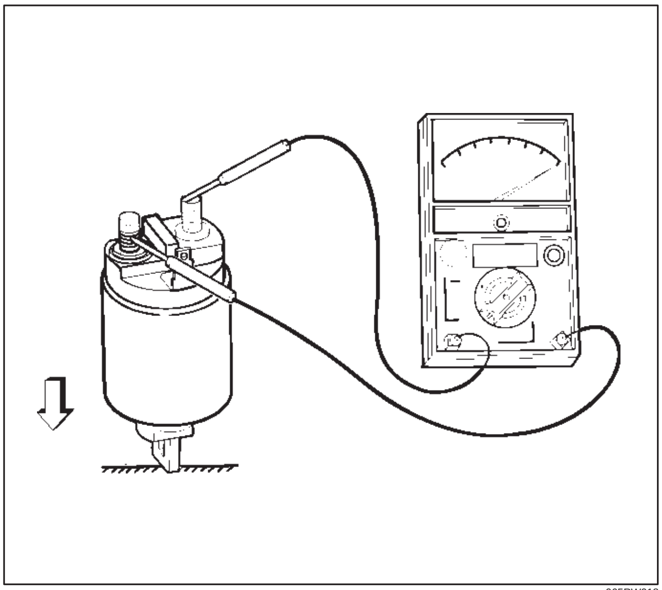
Check for continuity between terminals S and M.
Replace, if there is no continuity (i.e., coil is disconnected).



065RW017

Continuity of Contacts

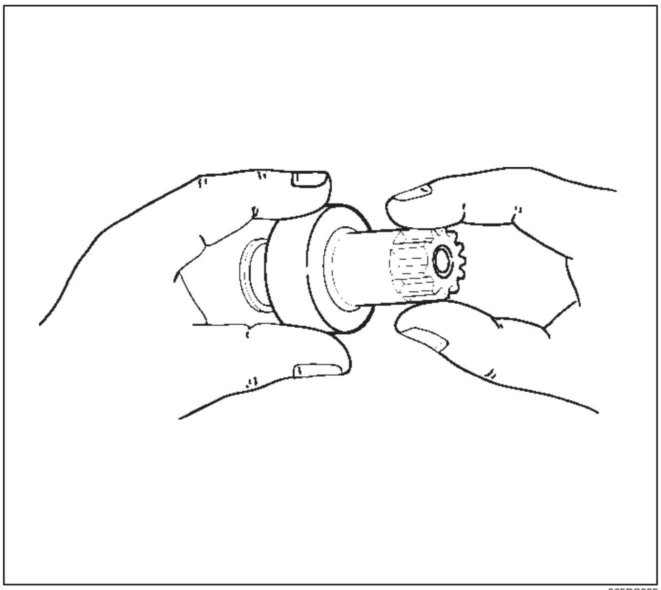
With the plunger faced downward, push down the magnetic switch. In this state, check for continuity between terminals B and M. Replace, if there is no continuity (i.e., contacts are faulty).



065RW018

Pinion

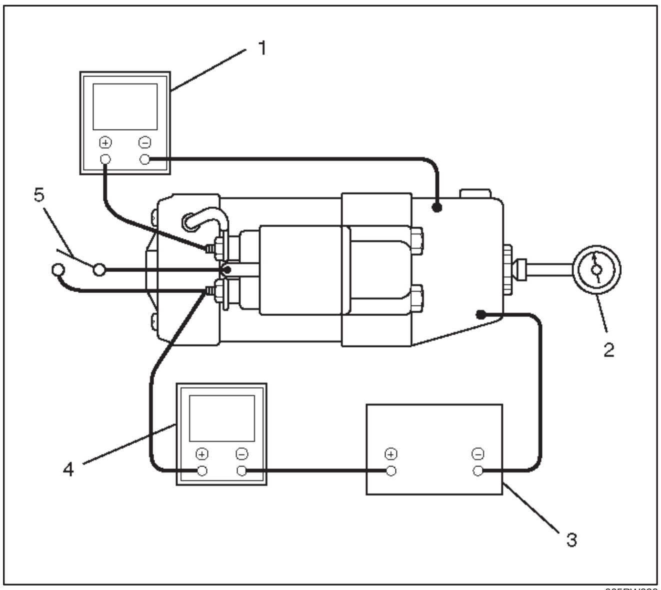
Check if the pinion rotates smoothly in drive direction by hand, or if it is locked when it is rotated in reverse. If not, replace the pinion.



065RS025

Characteristic Test

For easily confirming the characteristics, conduct the noload test as follows:
Rating as short as 30 seconds requires rapid testing.
Fix the starter on the test bench, and wire as shown in illustration. When the switch is closed, the current flows and the starter runs under no load. At this time, measure current, voltage and speed to check if they satisfy the standard.



065RW020

Legend

(1) Volt Meter
(2) Revolution Indicator
(3) Battery
(4) Ammeter
(5) Switch

Charging System

General Description

The charging system is an IC integral regulator charging system and its main components are connected as shown in illustration.

The regulator is a solid state type and it is mounted along with the brush holder assembly inside the generator installed on the rear end cover.

The generator does not require particular maintenance such as voltage adjustment. The rectifier connected to the stator coil has eight diodes to transform AC voltage into DC voltage.

This DC voltage is connected to the output terminal of generator.

General On–Vehicle Inspection

The operating condition of charging system is indicated by the charge warning lamp. The warning lamp comes on when the starter switch is turned to “ON” position. The charging system operates normally if the lamp goes off when the engine starts.

If the warning lamp shows abnormality or if undercharged or overcharged battery condition is suspected, perform diagnosis by checking the charging system as follows:

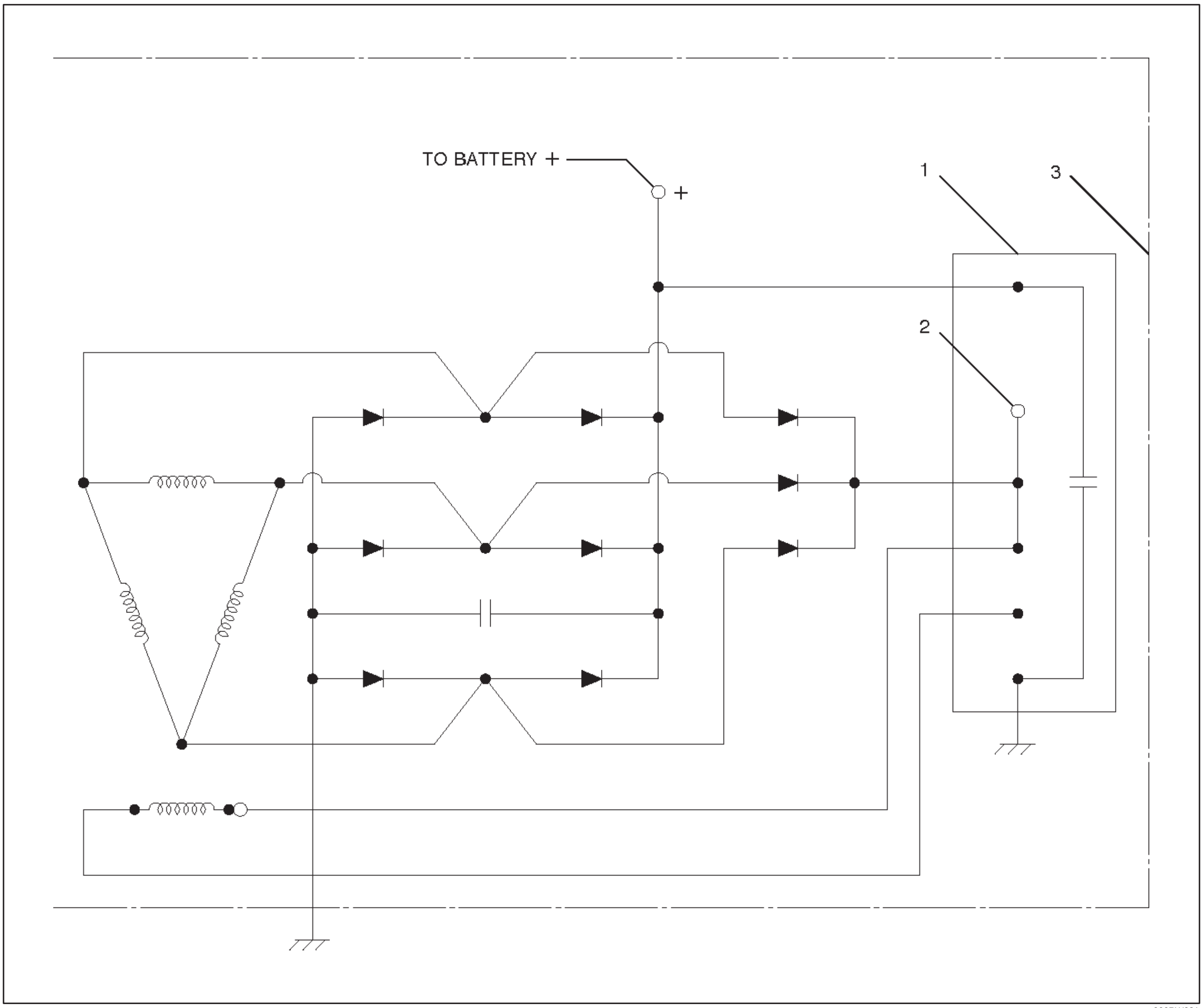
1. Check visually the belt and wiring connector.
2. With the engine stopped, turn the stator switch to “ON” position and observe the warning lamp.

   If lamp does not come on:

   Disconnect wiring connector from generator, and ground the terminal “L” on connector side.

   If lamp comes on:

   Repair or replace the generator.



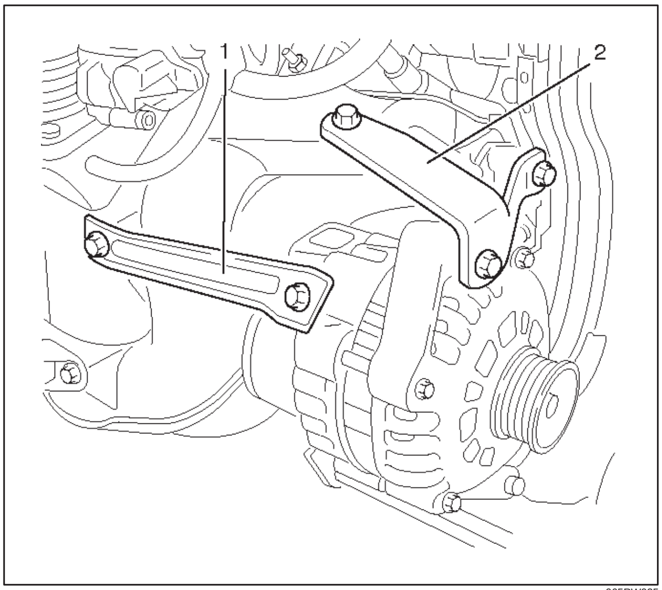
066RW021

Legend
(1) Regulator
(2) Indicator Lamp
(3) Generator Assembly

Generator

Removal

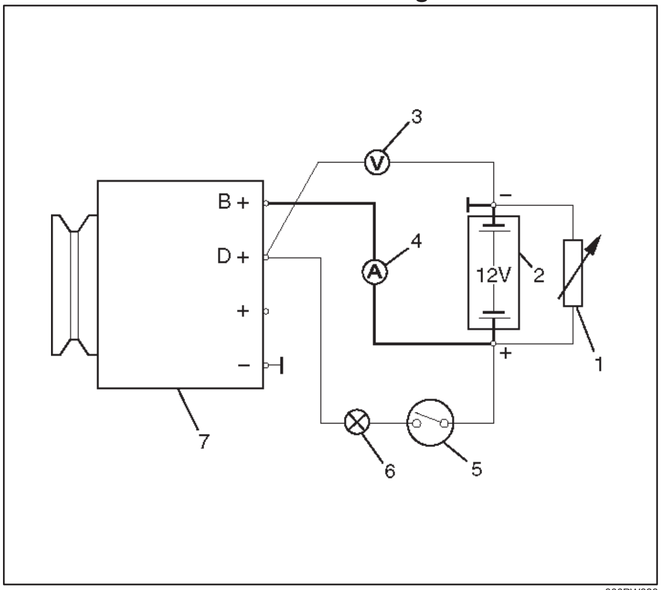
1. Disconnect battery ground cable.
2. Move drive belt tensioner to loose side using wrench then remove drive belt.
3. Disconnect terminal “B” wiring connector and connector.
4. Remove generator bracket (1), (2) and remove generator assembly.



065RW025

Inspection

Generator Power and Circuit Diagram



066RW020

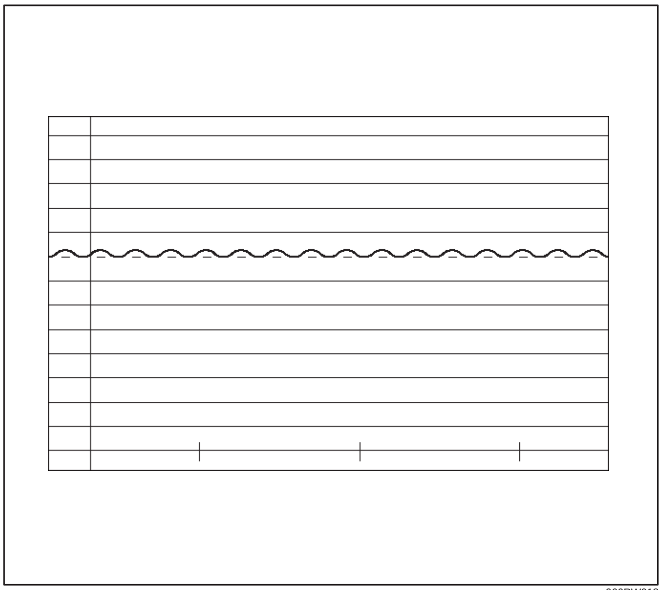
Legend

(1) Load resistor, set parallel to battery
(2) Battery
(3) Voltmeter
(4) Ammeter
(5) Ignition Lock
(6) Charge Telltale
(7) Generator

1. Disconnect battery.
2. Close off connecting cable from alternator terminal “B+”.
3. Set ammeter (measuring range 100A) in disconnected line.
4. Connect controllable load resistor to battery terminal.
5. Set resistor in front of connection to “0”; connect first to battery, then to resistor.
6. Connect tachometer.
7. Connect oscilloscope according to manufacturer’s instructions.
8. Connect battery.
9. Start engine and read off resulting current at various engine speeds.

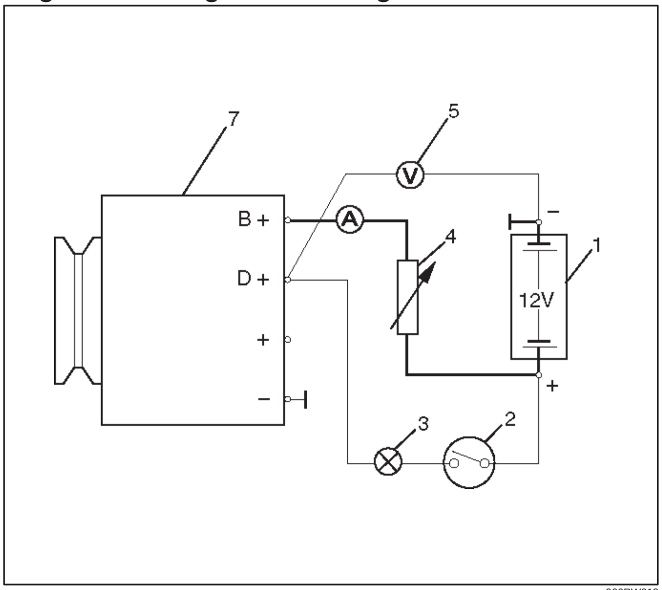
Generator Power

1. Adjust load resistor, if the required load currents are not attained.
2. The shape of the voltage curves on oscilloscope curve should be regular.
3. Test value: 5 to 7A.
4. If the required minimum current intensity is not attained, or if the oscilloscope picture shows variations, the alternator should be overhauled.



066RW018

Regulated Voltage Circuit Diagram



066RW019

Legend

(1) Battery
(2) Ignition Lock
(3) Charge Telltale
(4) Resistor, for attainment of load current with the battery set in series
(5) Voltmeter
(6) Ammeter
(7) Generator

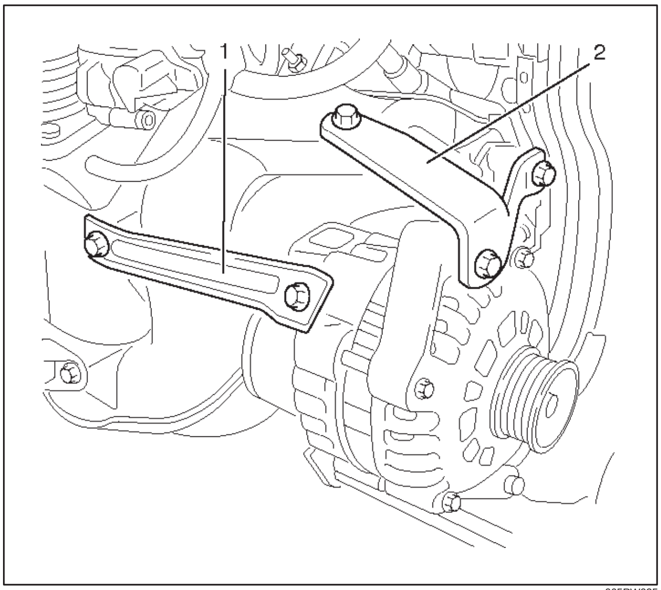
Installation

1. Install generator assembly and bring generator assembly to the position to be installed.
2. Install generator bracket (1), (2) and tighten to the specified torque.

Torque:

Long bolt: 35 N·m (26 lb ft)

Short bolt: 20 N·m (15 lb ft)

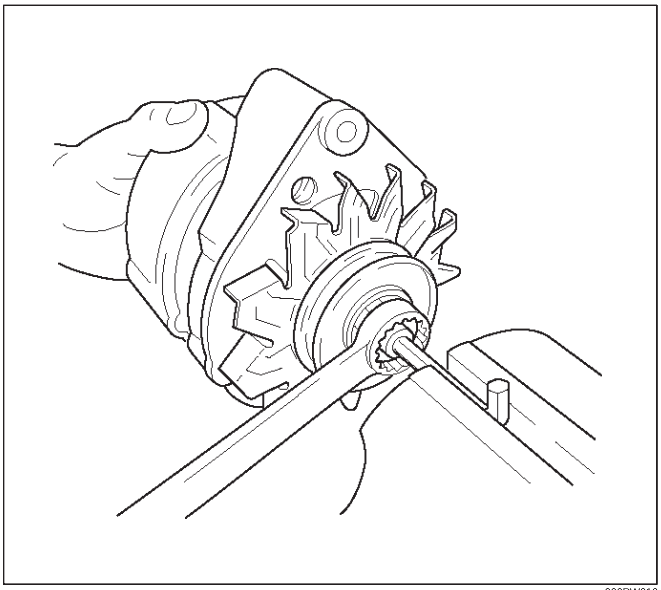


065RW025

3. Connect wiring harness connector.
4. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.
5. Reconnect battery ground cable.

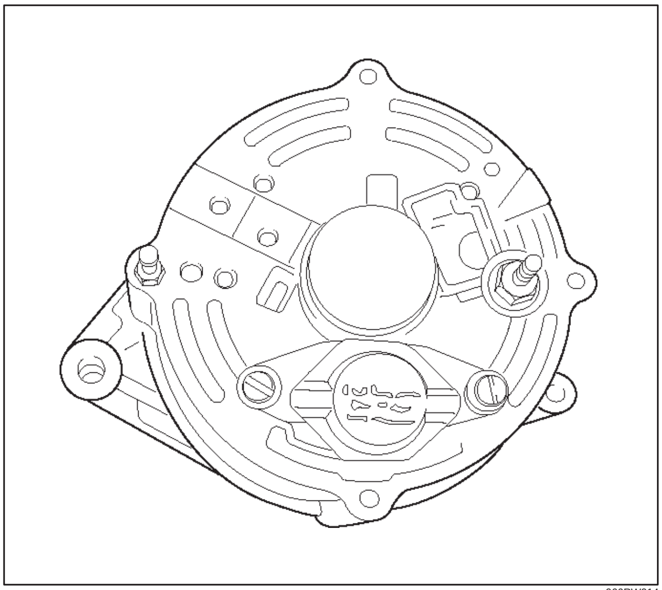
Disassembly

1. Belt pulley nut.



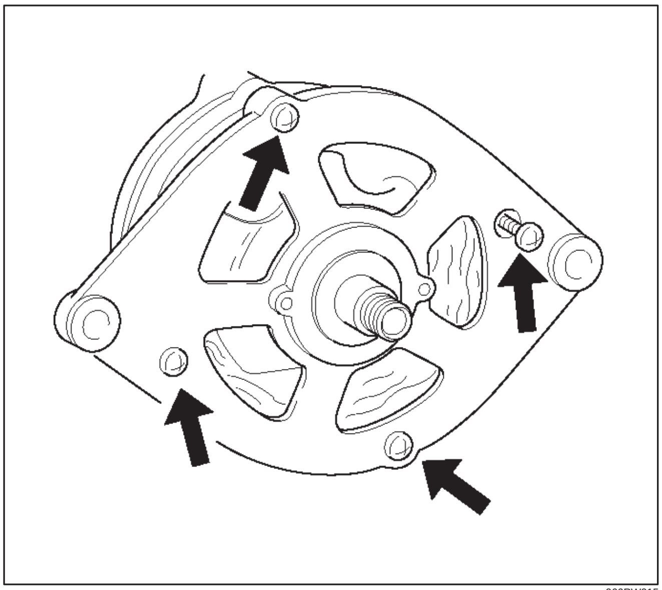
066RW016

2. Spring ring, washer, belt pulley halves, spacing ring, fan pinion, pulley spring.
3. Voltage regulator with brush holder.



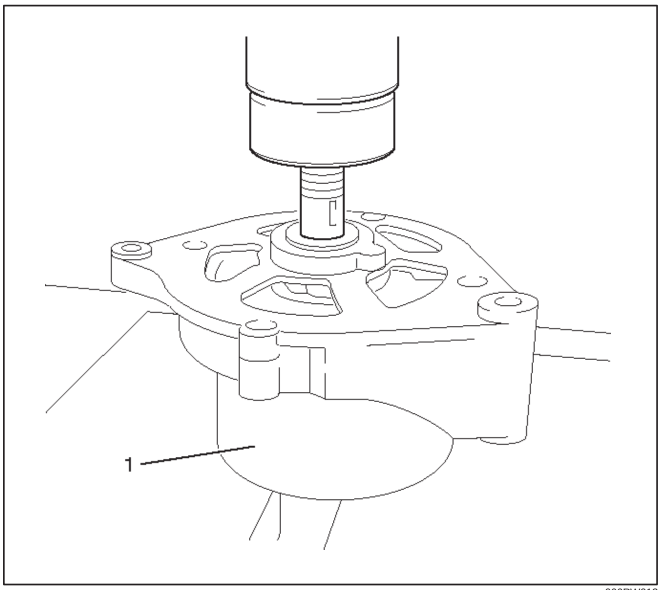
066RW014

4. Drive bearing with clawpole armature.
5. Mark housing halves.
6. 4 fastening bolts.



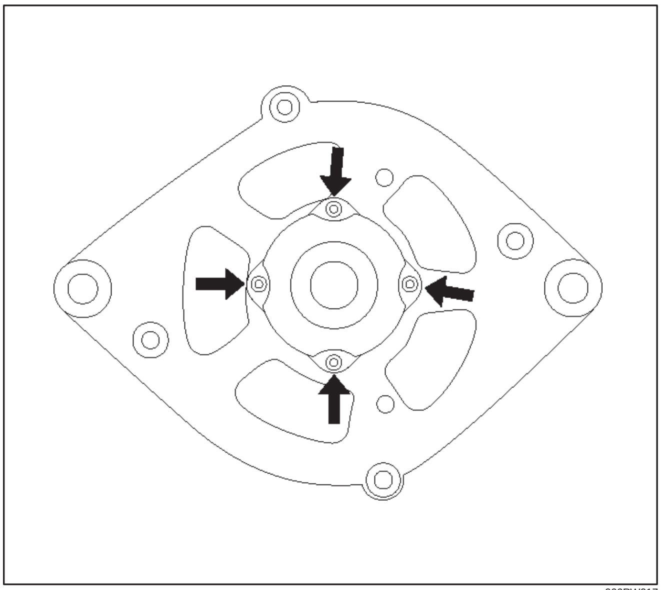
066RW015

7. Clawpole armature from drive bearing.
8. Lay suitable pipe piece (1) underneath.



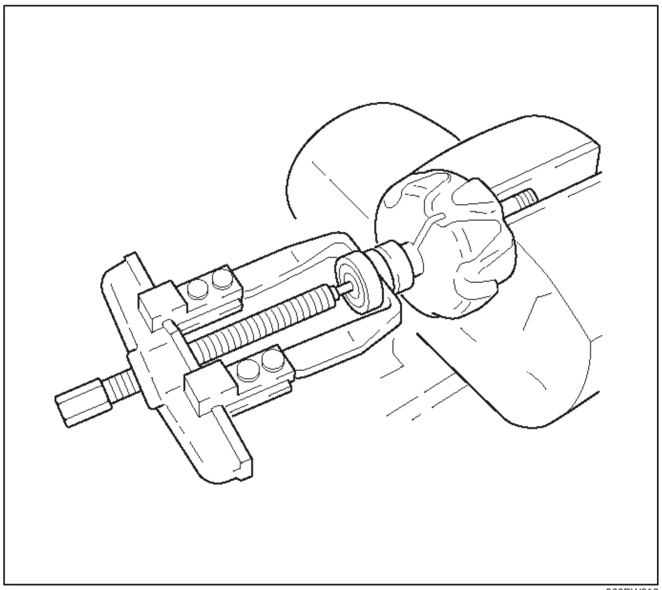
066RW013

9. Bearing cover of drive bearing.
10. Ball bearing from drive bearing.



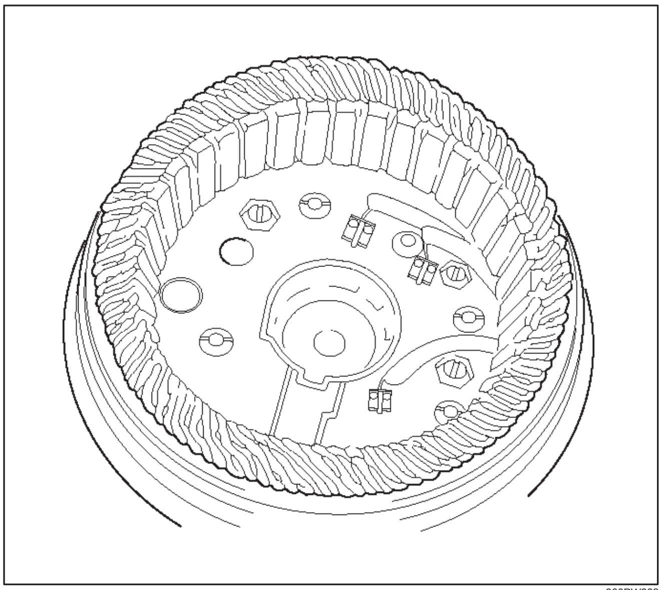
066RW017

11. Ball bearing from armature shaft.



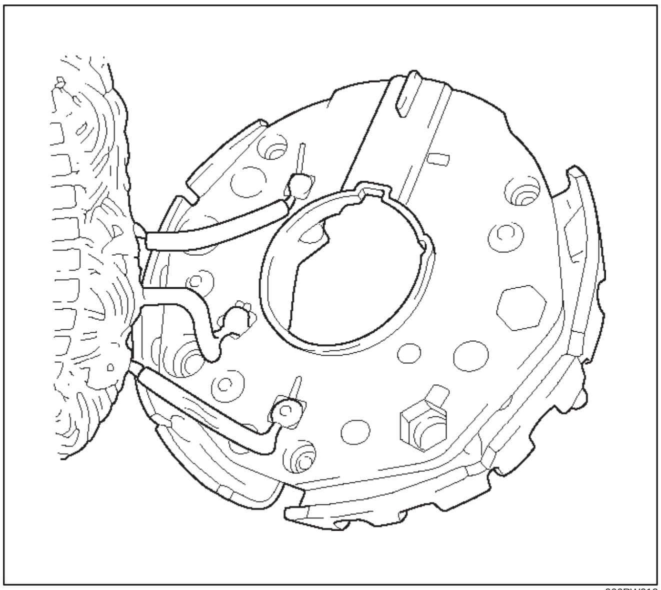
066RW012

12. Nut from connecting pins “B+” and “D+”.
13. Washers and insulating material.
14. Diode plate.
15. Remove together with stator winding from slip ring bearing.



066RW008

16. Spray sleeve (if present).
17. Carefully bend off diode plate.
18. Unsolder stator winding from diode plate.



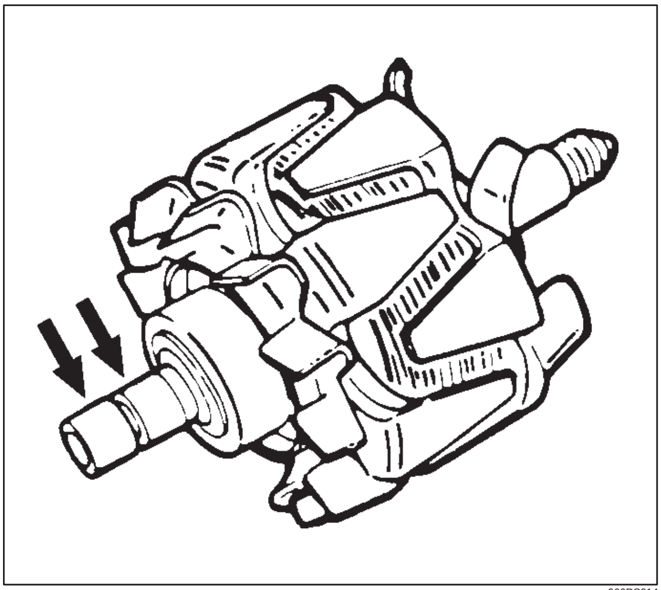
066RW010

Inspection and Repair

Repair or replace necessary parts if extreme wear or damage is found during inspection.

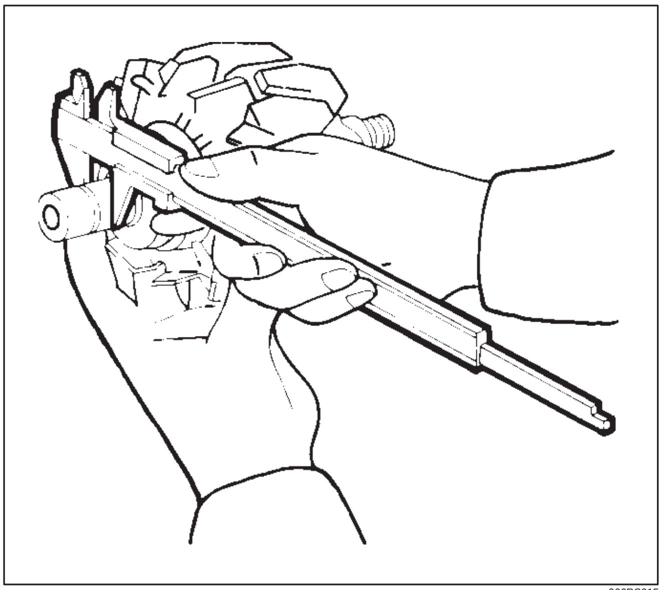
Rotor Assembly

1. Check the rotor slip ring surfaces for contamination and roughness. If rough, polish with #500–600 sandpaper.



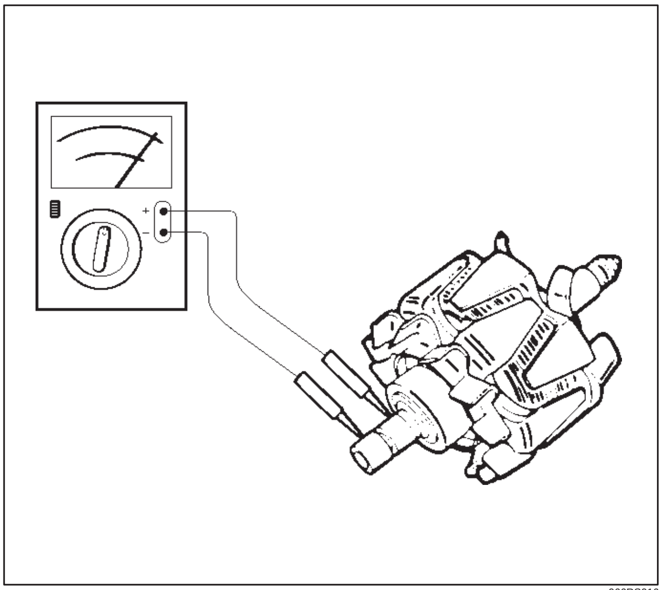
066RS014

2. Measure the slip ring diameter, and replace if it exceeds the limit.



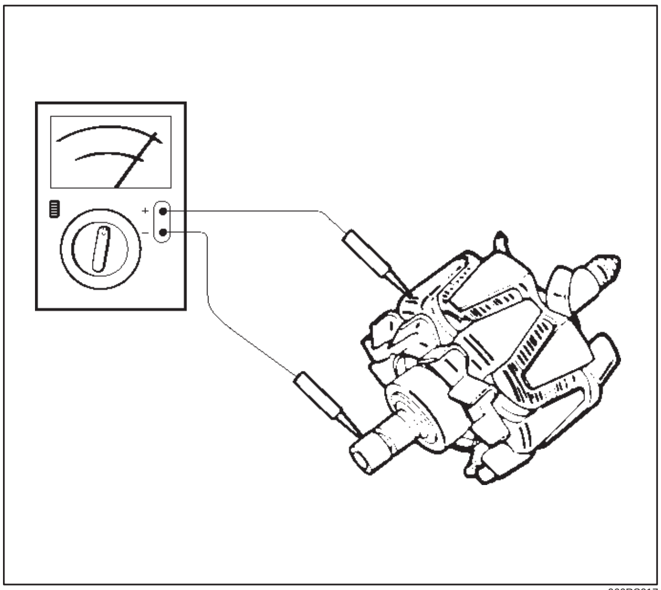
066RS015

3. Check resistance between slip rings, and replace if there is no continuity.



066RS016

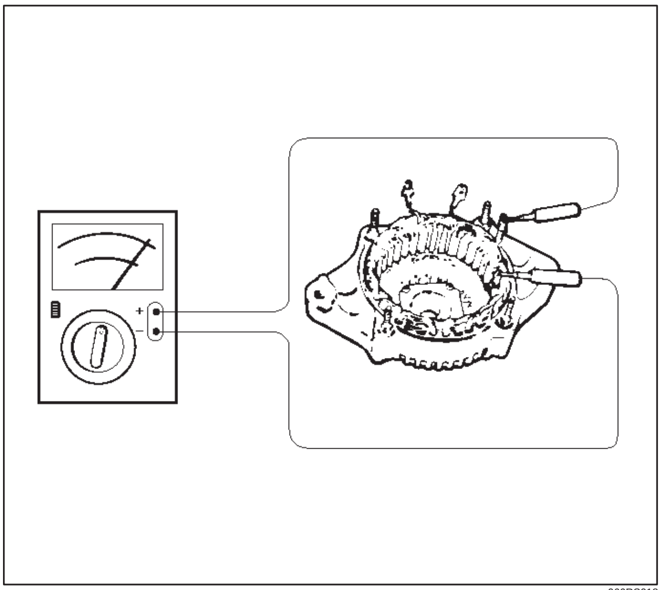
4. Check for continuity between slip ring and rotor core. In case of continuity, replace the rotor assembly.



066RS017

Stator Coil

1. Measure resistance between respective phases.
2. Measure insulation resistance between stator coil and core with a mega–ohmmeter.
   If less than standard, replace the coil.

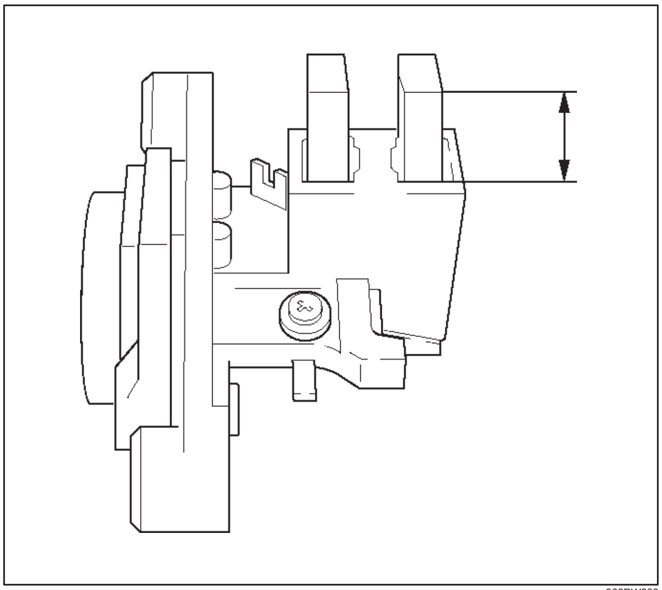


066RS018

Brush

Measure the brush length.
If more than limit, replace the brush.

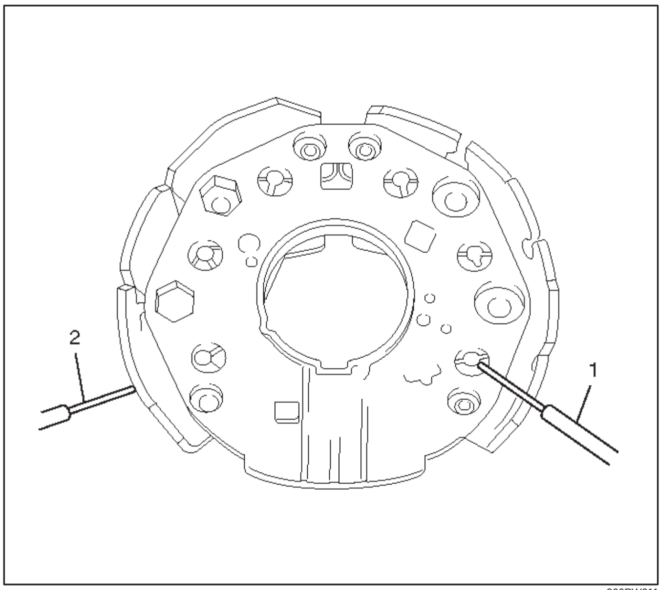
Standard: 5 mm (0.20 in)



066RW009

Rectifier Assembly

Check for continuity across “1” and “2” in the $\times$ 100W range of multimeter.



066RW011

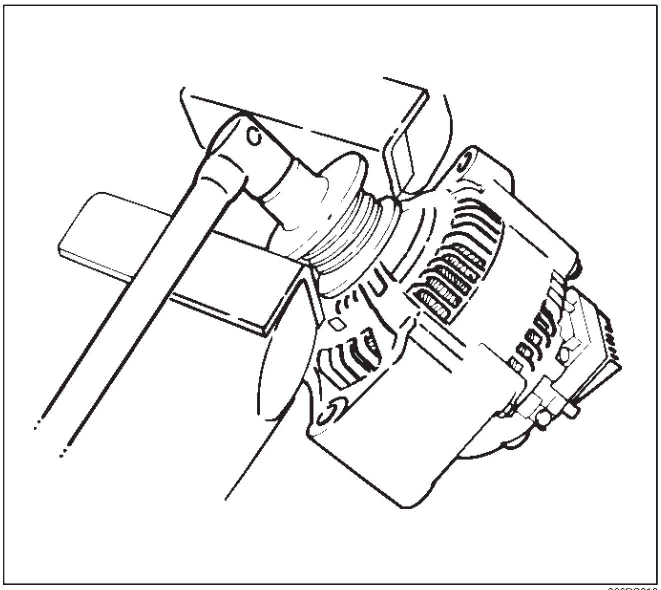
Change polarity, and make sure that there is continuity in one direction, and not in the reverse direction. In case of continuity in both directions, replace the rectifier assembly.

Reassembly

To reassemble, follow the disassembly steps in the reverse order, noting the following points:

1. Install pulley on the rotor.
   Clamp pulley to the vise, and tighten nut to the specified torque.

Torque: 40 N·m (30 lb ft)



066RS010

Main Data and Specifications

General Specifications

Battery voltage	V	12
Rated output	A	100
Direction of rotation (as viewed from pulley side)		Clockwise
Maximum speed	rpm	18000

RODEO

CONTROL SYSTEM

RODEO 2.2L ENGINE DRIVEABILITY AND EMISSIONS

CONTENTS

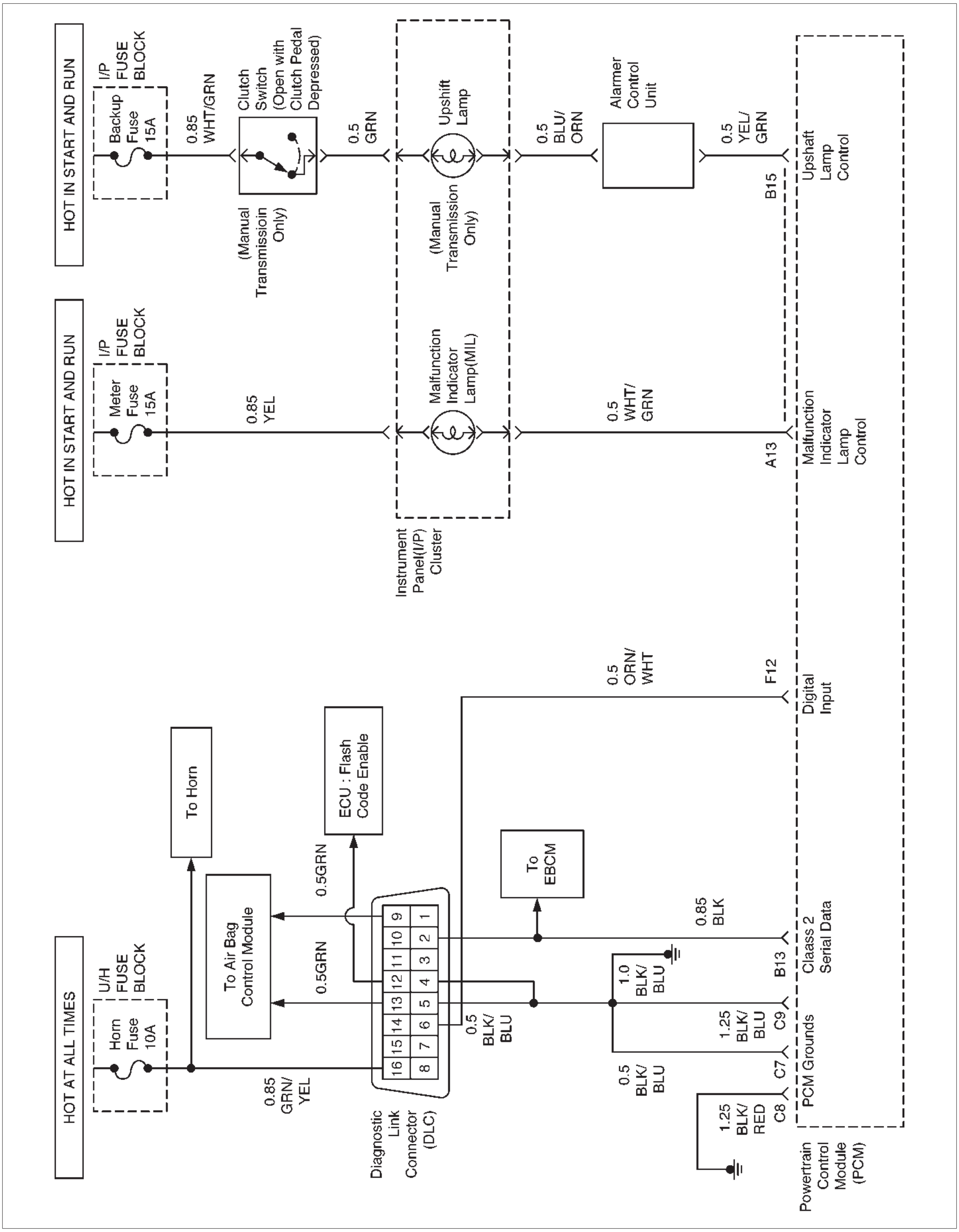
SPECIFICATIONS

TIGHTENING SPECIFICATIONS

Application	N–m	Lb Ft	Lb In
Crankshaft Position Sensor Mounting Bolt	9	—	78
EGR Nut	14	—	130
Engine Coolant Temperature Sensor	30	22	—
Fuel Drain Plug	20	14	—
Fuel Pressure Regulator Attaching Screw	6.5	—	60
Fuel Rail Bolts	7	—	75
Fuel Tank Undercover Retaining Bolts	36	27	—
Heated Oxygen Sensor	5	40	—
Spark Plugs	25	18	—
Throttle Body Mounting Bolts	13	—	120
VSS Retaining Bolt	13	—	120
Camshaft Gear to Camshaft	45	33	—
Camshaft Bearing Cover to Camshaft Housing	8	—	71
Crankshaft Bearing Cover to Cylinder Block	50+45’+15’[1]	37	—
Crankshaft Pulse Pick–up Sensor Disc to Crankshaft	13	—	115
Drive Disc to Crankshaft	60[5]	44	—
Dual–Mass Flywheel to Crankshaft	65+30’+15’[1]	48	—
Engine Bracket to Cylinder Block	60	44	—
Exhaust Manifold to Cylinder Head	22[2]	16	—
Front Toothed Belt Cover to Rear Toothed Belt Cover	4	—	35
Heat Sleeves in Cylinder Head	30[3]	22	—
Intake Manifold to Cylinder Head	22	16	—
Oil Pan Bolt to Oil Pan	55	41	—
Oil Inlet Pipe Bracket to Cylinder Block	6	—	53
Oil Intake Pipe to Oil Pump	8[4,5]	—	71
Rod Bearing Cover to Rod	35+45’+15’[1]	26	—
Spark Plug to Cylinder Head	25	18	—
Thrust Plate Cover to Camshaft Housing	8	—	71
Thrust Plate to Camshaft Housing	8	—	71
Toothed Belt Drive Gear to Crankshaft	130+40’+15’[1]	96	—
Toothed Belt Tension Roller to Oil Pump	25	18	—
Torsional Vibration Damper to Toothed Belt Drive Gear	20	15	—
1. Use new bolt(s). 2. Use new nuts. 3. Insert with Molycote Paste. 4. If not possible to use new bolts, then recut bolts before reuse and insert with locking compound. 5. Maximum installation time including torque check is 10 minutes.	—	—	—

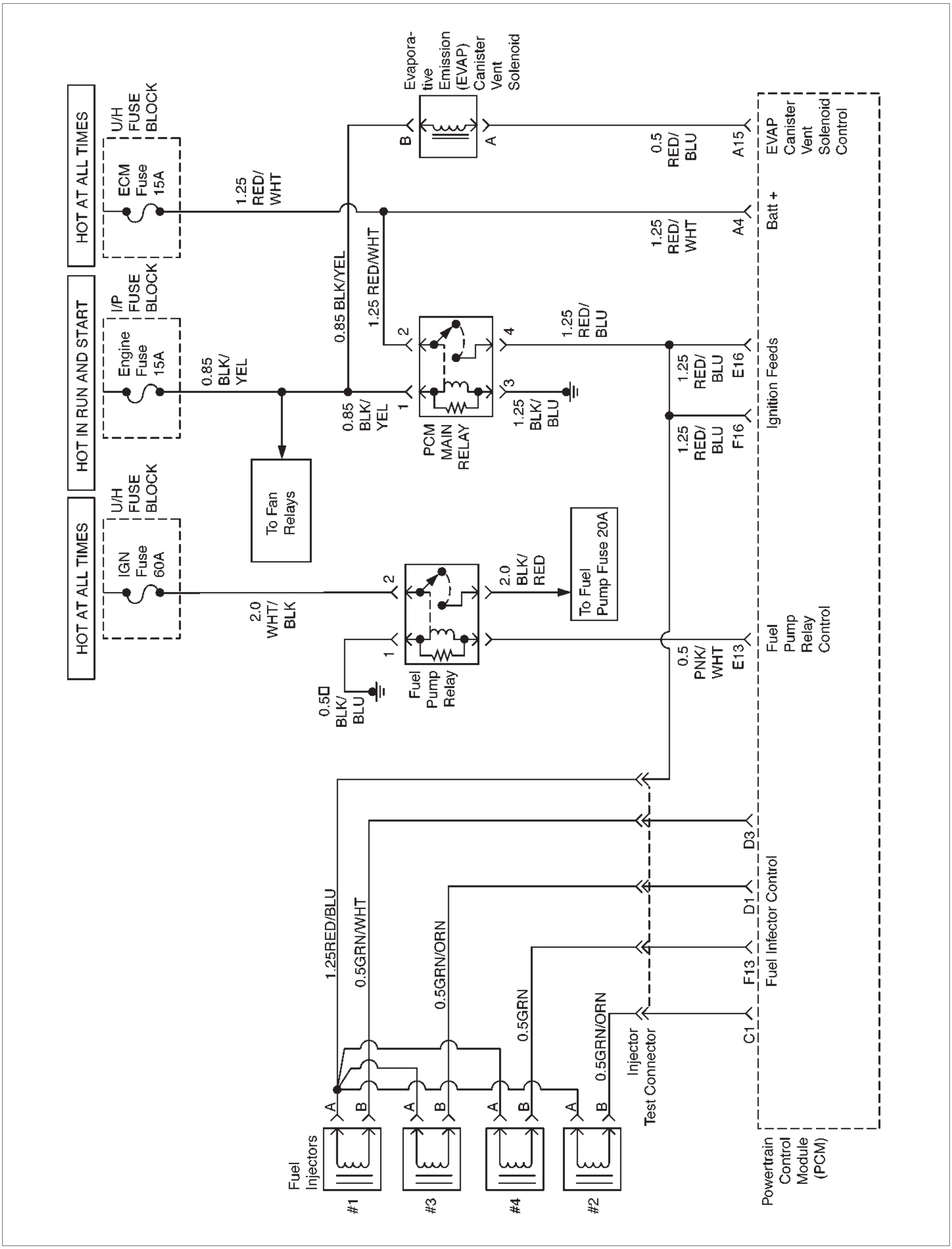
DIAGRAMS AND SCHEMATICS

PCM WIRING DIAGRAM (1 of 10)



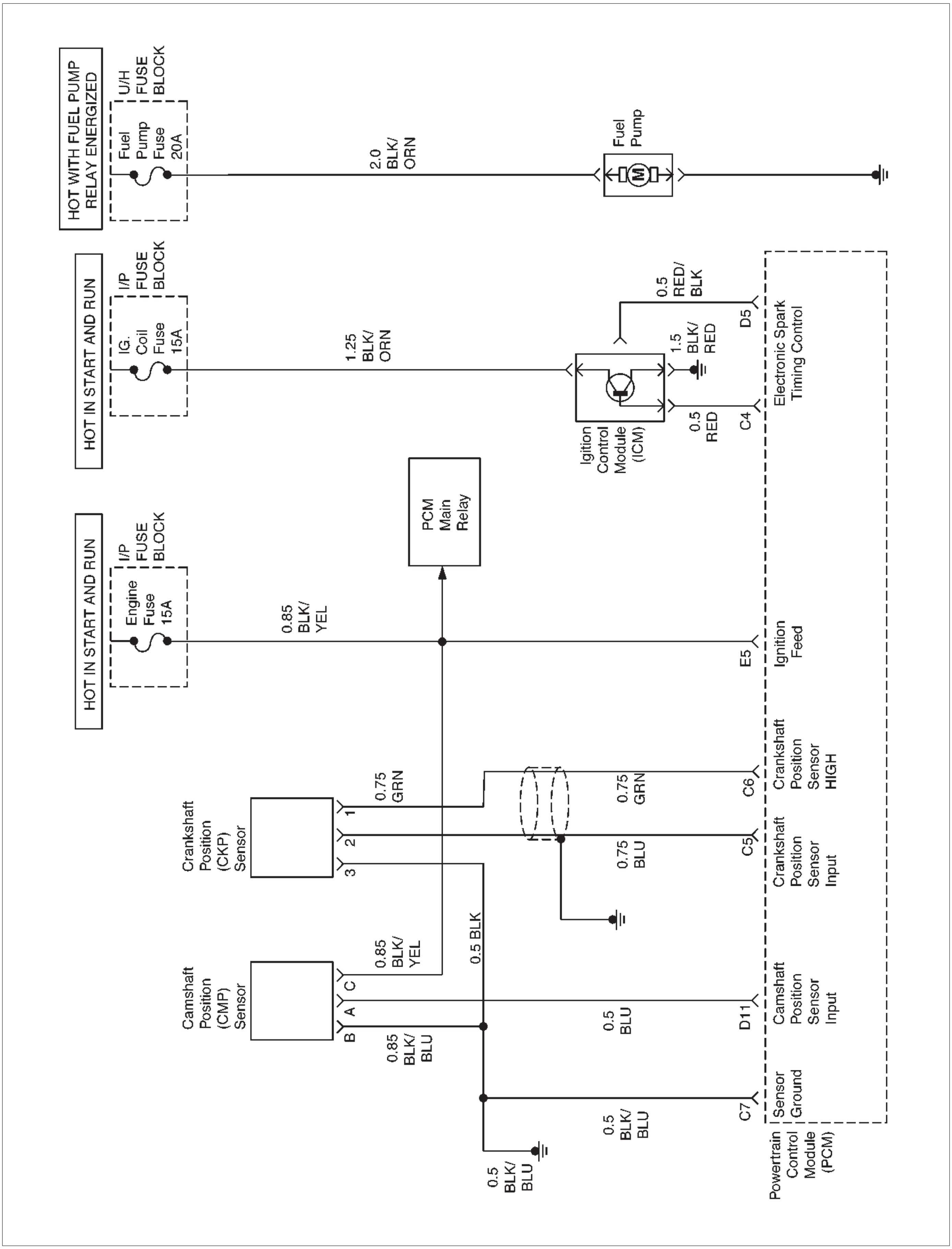
D06RX026

PCM WIRING DIAGRAM (2 of 10)



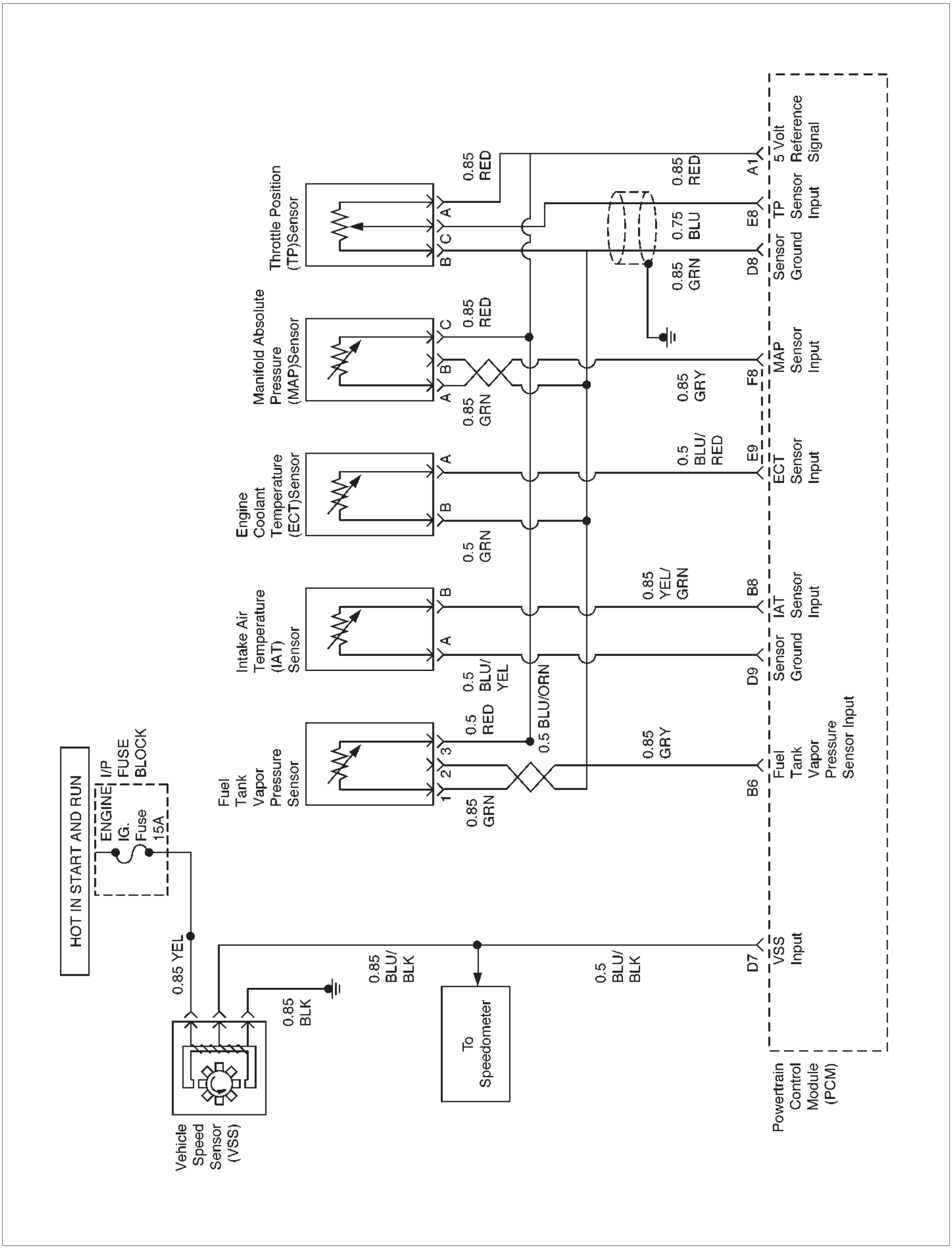
D06RX029

PCM WIRING DIAGRAM (3 of 10)



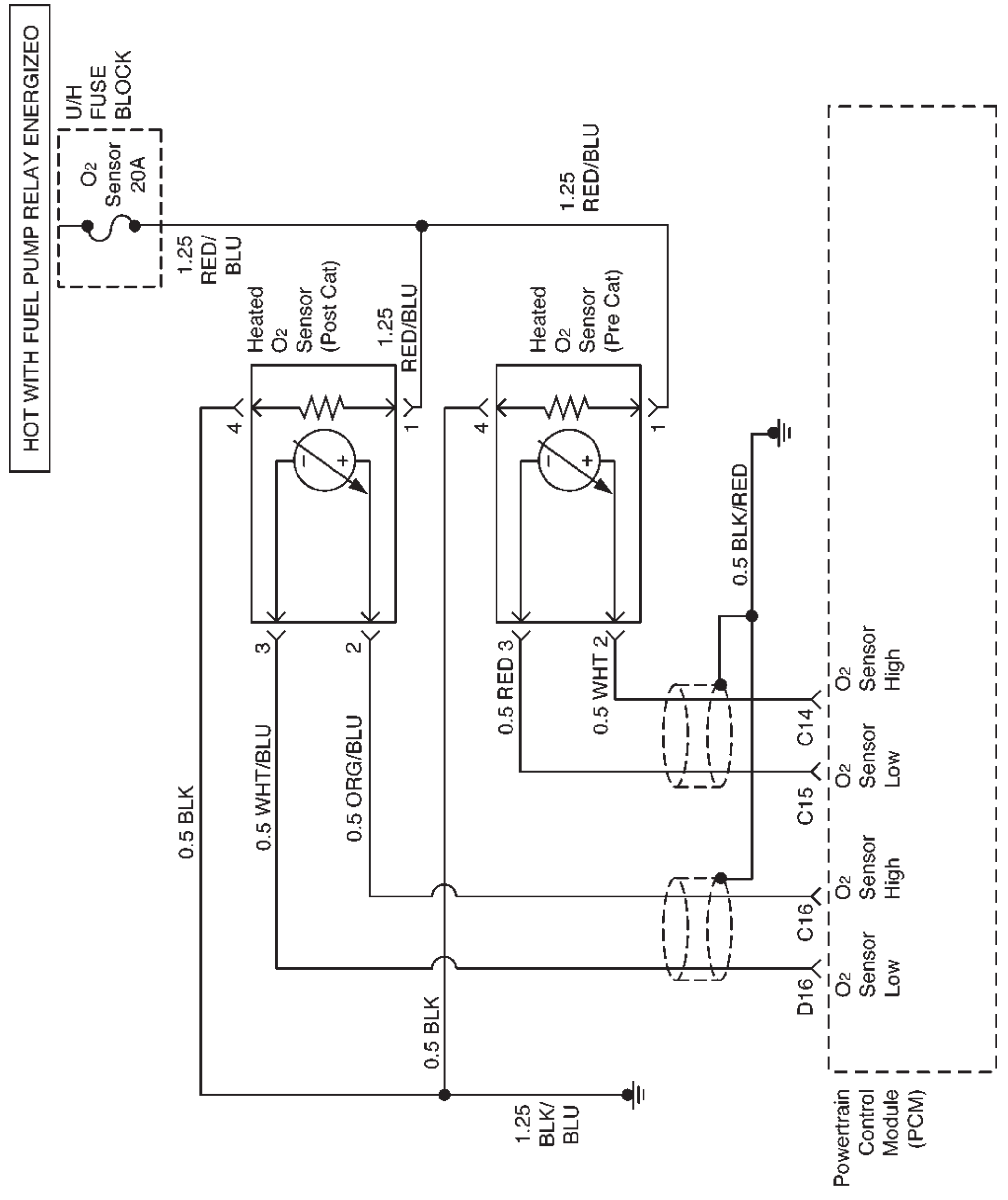
D06RX027

PCM WIRING DIAGRAM (4 of 10)



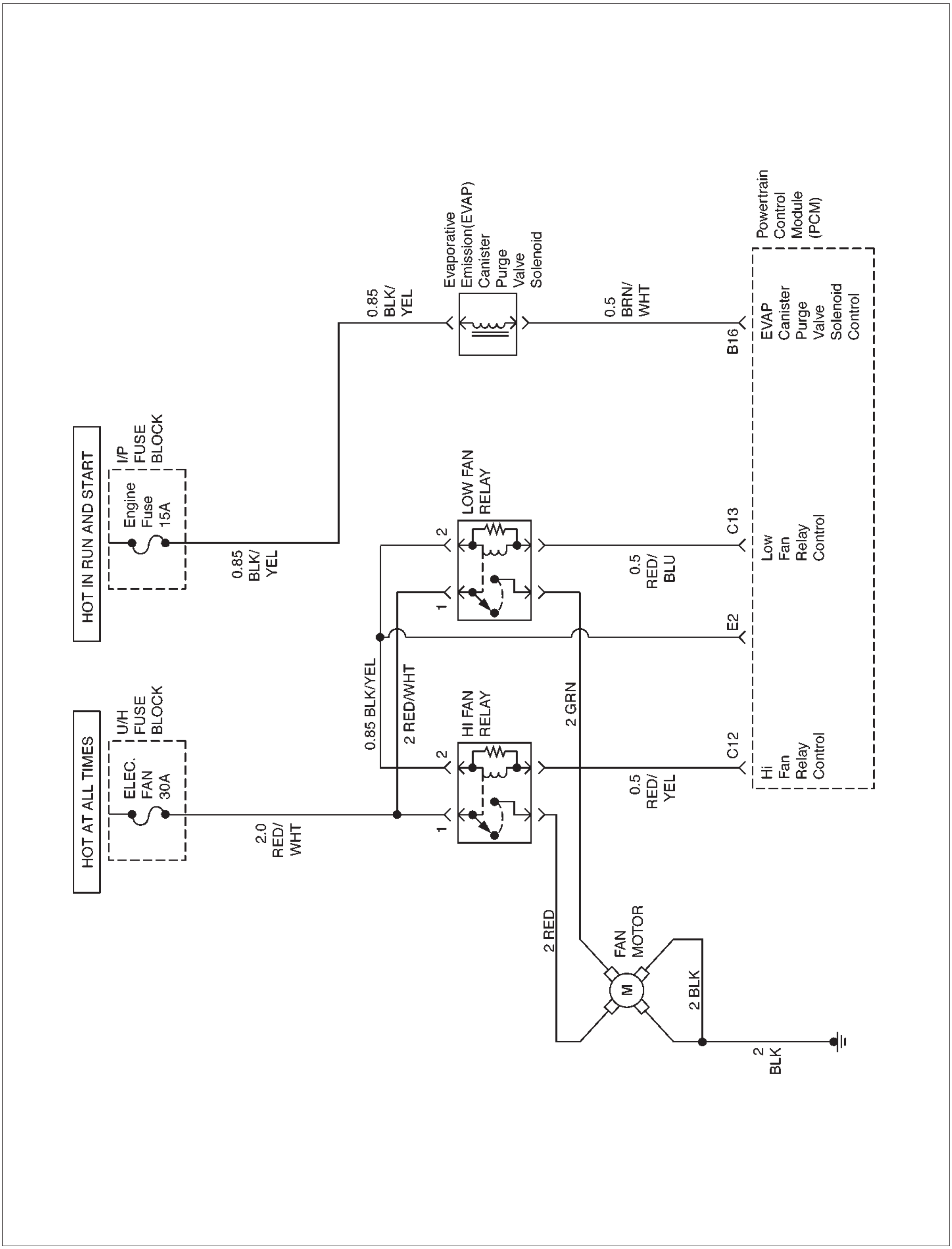
D06RX030

PCM WIRING DIAGRAM (5 of 10)



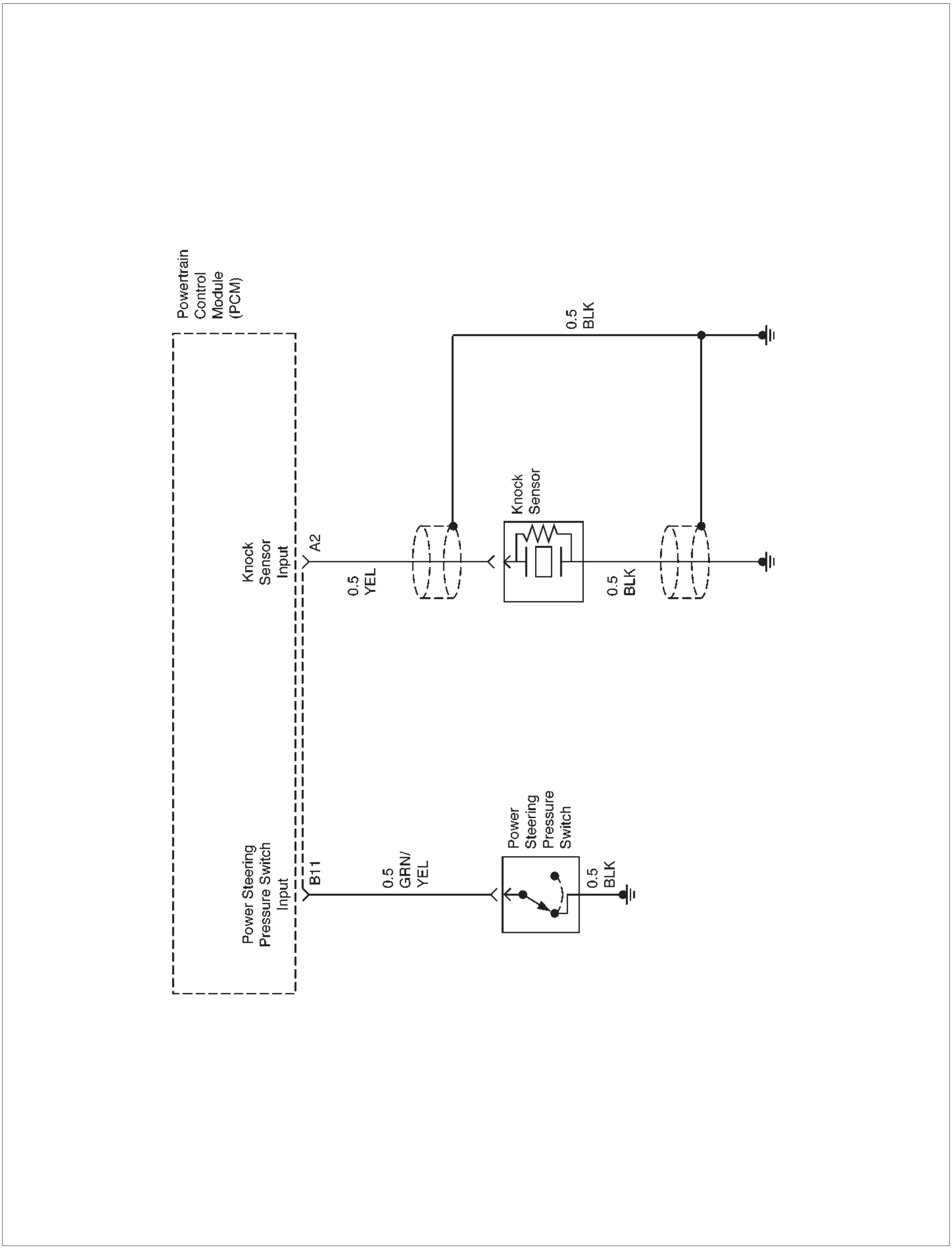
D06RX028

PCM WIRING DIAGRAM (6 of 10)



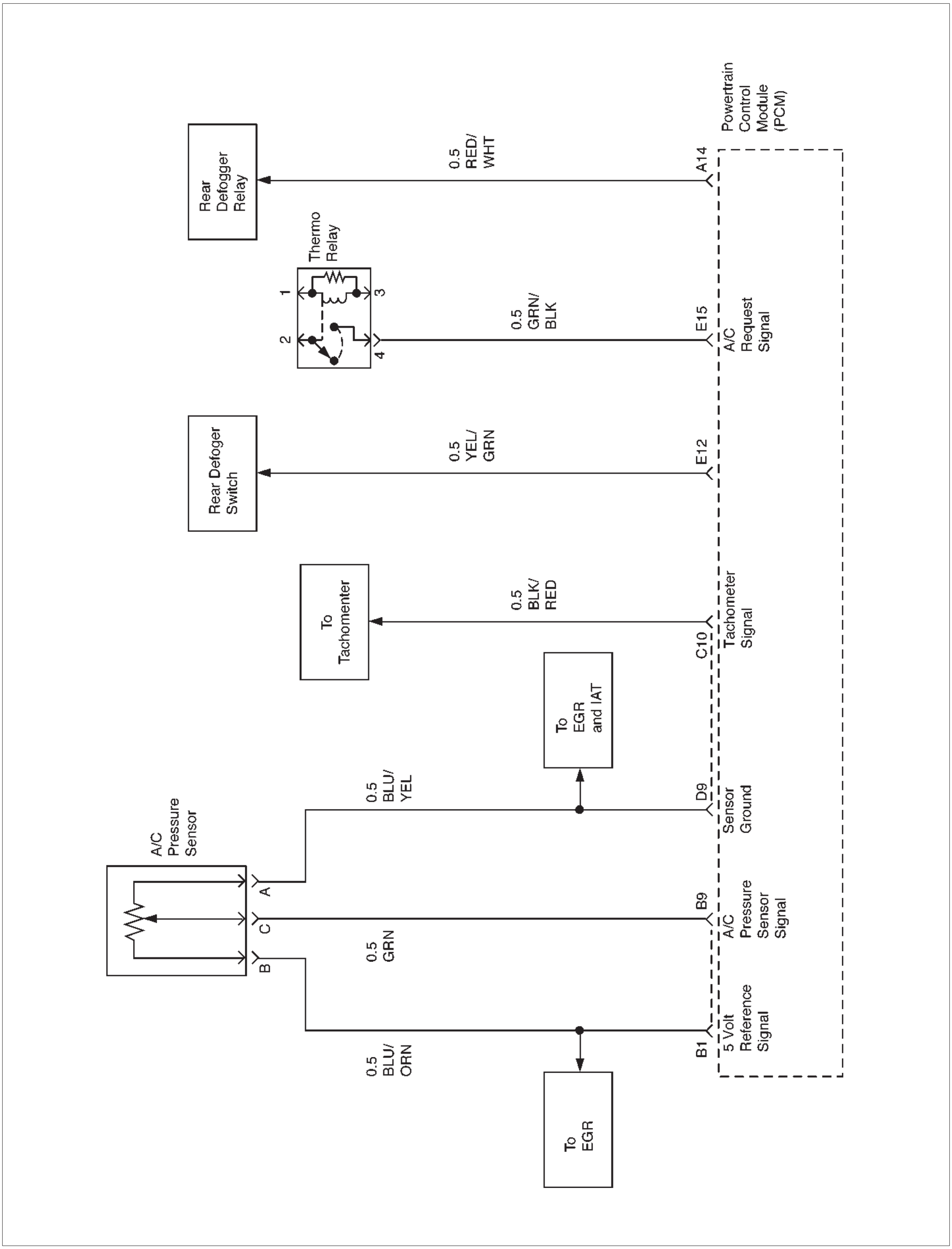
D06RX032

PCM WIRING DIAGRAM (7 of 10)



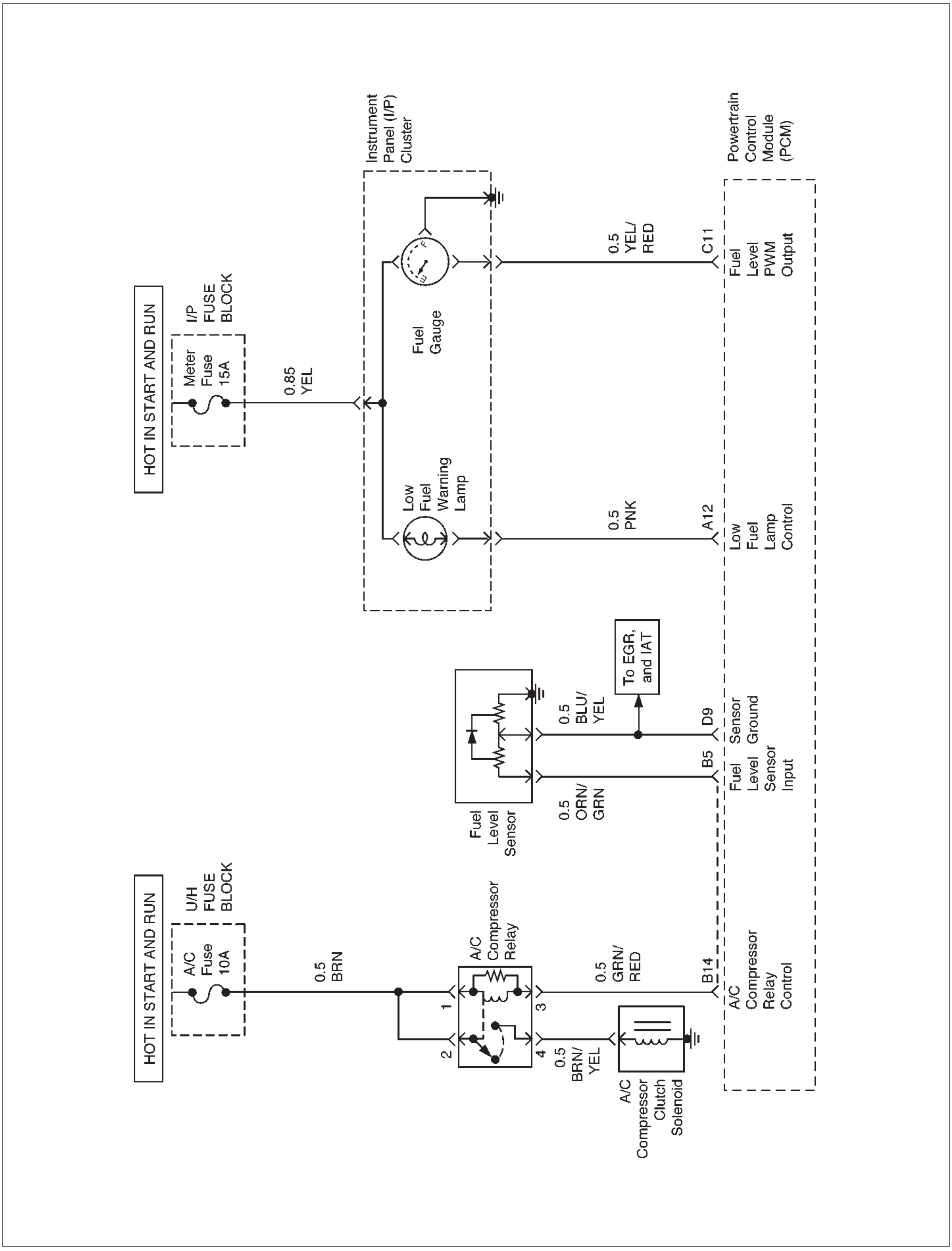
D06RX031

PCM WIRING DIAGRAM (8 of 10)



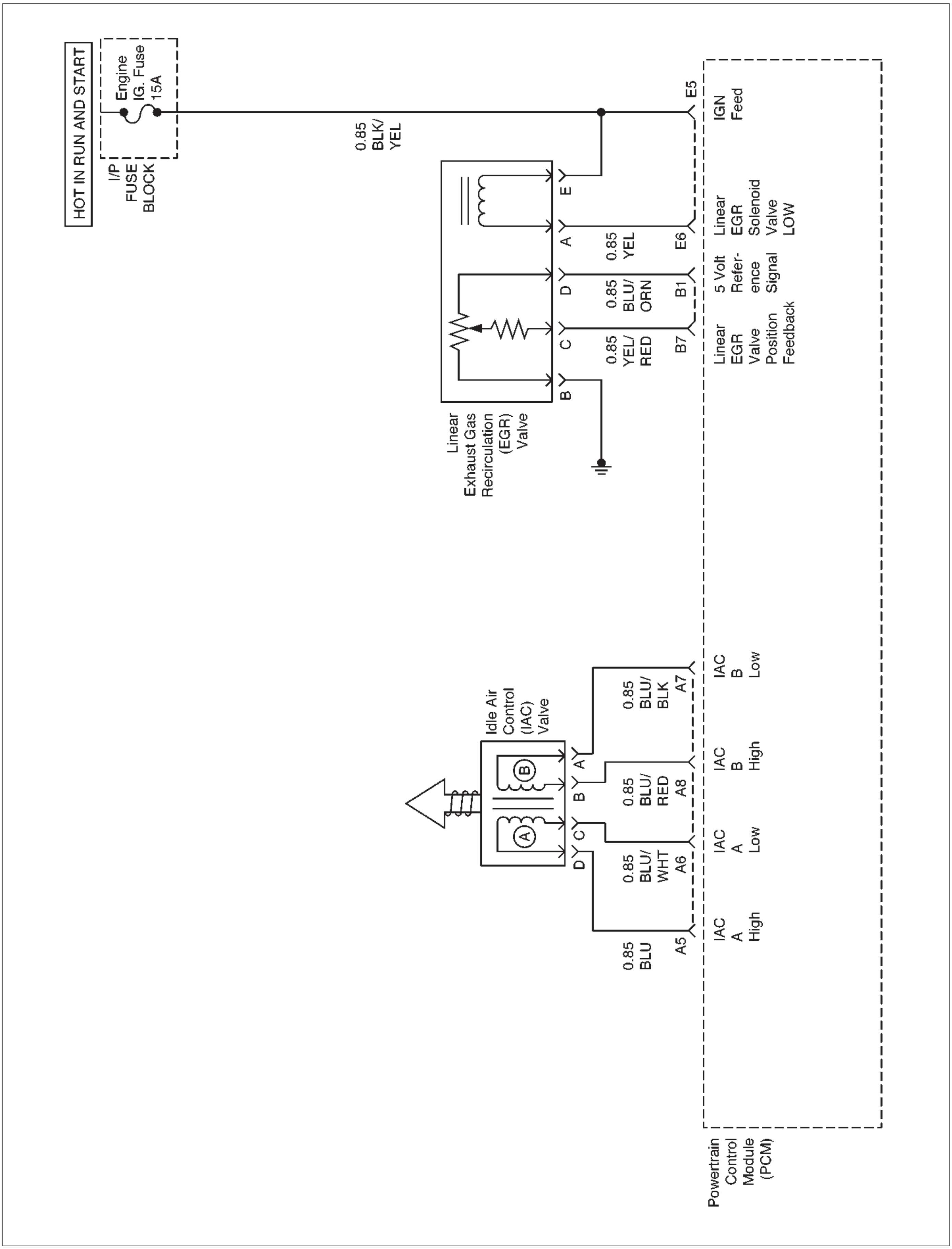
D06RX033

PCM WIRING DIAGRAM (9 of 10)



D06RX034

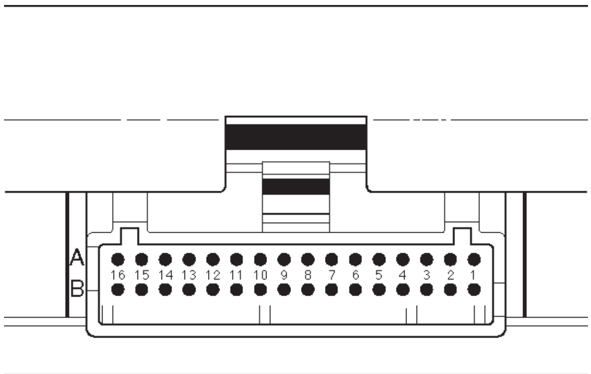
PCM WIRING DIAGRAM (10 of 10)



D06RX035

PCM PINOUTS

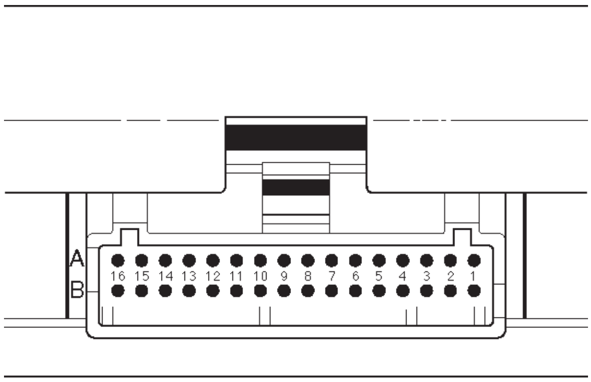
PCM Pinout Table, 32–Pin Red Connector – Row ”A”



TS23344

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
A1	5 Volt Reference Signal	RED	5.0 V	5.0 V	Appropriate Sensor
A2	Knock Sensor Input	YEL	—	3.0 V (MAX)	General Description and Operation, Knock Sensor
A3	Not Used	—			
A4	Battery Feed	RED/WHT	B+	B+	Chassis Electrical
A5	Idle Air Control (IAC) ”A” High	BLU	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A6	IAC ”A” Low	BLU/WHT	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A7	IAC ”B” Low	BLU/BLK	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A8	IAC ”B” High	BLU/RED	B+/0.8 V	B+/0.8 V	General Description and Operation, IAC
A9	Not Used	—	—	—	—
A10	Not Used	—	—	—	—
A11	Not Used	—	—	—	—
A12	Low Fuel Warning Lamp Control	PNK	0.4–0.9 V	B+	Chassis Electrical
A13	Malfunction Indicator Lamp (MIL) Control	WHT/GRN	0.4–0.9 V	B+	Chassis Electrical
A14	Rear Defogger Relay	RED/WHT	B+	B+	Classis Electrical
A15	EVAP Canister Vent Solenoid Control	RED/BLU	B+	0–5 V (varies)	General Description and Operation, EVAP Emission Control System
A16	Not Used	—	—	—	—

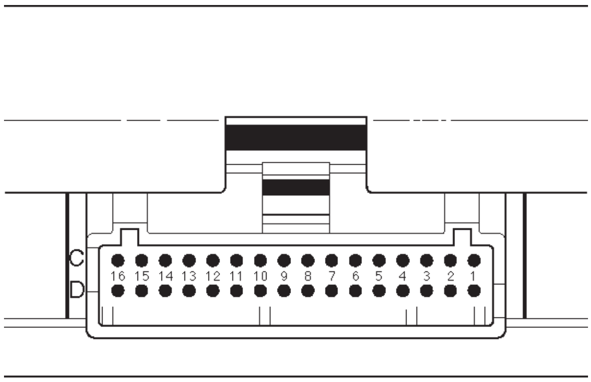
PCM Pinout Table, 32–Pin Red Connector – Row "B"



TS23344

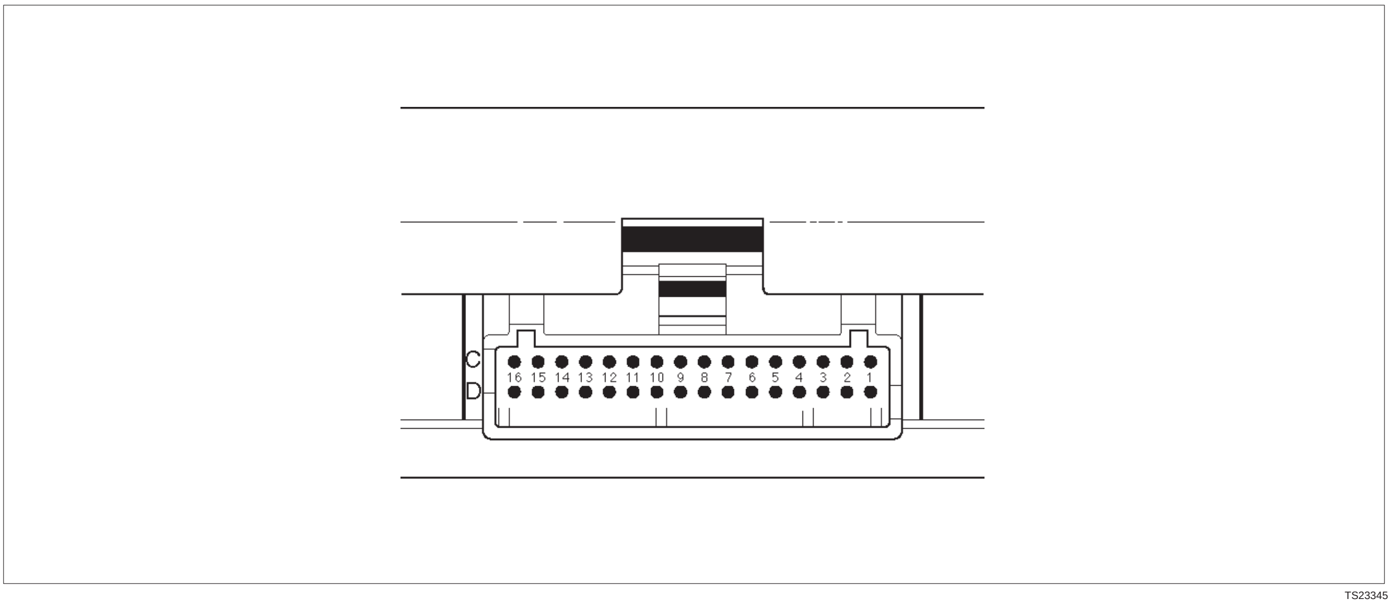
PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
B1	5 Volt Reference Signal	BLU/ORG	5.0 V	5.0 V	Appropriate Sensor
B2	Not Used	—	—	—	—
B3	Not Used	—	—	—	—
B4	Not Used	—	—	—	—
B5	Fuel Tank Level Sensor	ORN/GRN	—	—	General Description and Operation, Fuel Pump
B6	Fuel Tank Vapor Pressure Sensor Input	GRY	0.2 to 4.9 V (0.5V = +5in H2O)	0.2 to 4.9 V (4.5V = –15 in H2O)	General Description and Operation, Fuel Pump
B7	Exhaust Gas Recirculation (EGR) Position Feedback	YEL/RED	0.6 V	0.6 V	General Description and Operation, Linear EGR Control
B8	Intake Air Temperature (IAT) Sensor	YEL/GRN	~3V (0V = 151˚C)	~3 V (5V = –40˚C)	General Description and Operation, IAT
B9	A/C Pressure Sensor Signal	GRN	~1 V	~1 V	A/C System
B10	Not Used	—	—	—	—
B11	Power Steering Pressure (PSP) Switch Input	GRN/YEL	B+	B+	General Description and Operation, PSP
B12	Illumination Switch	GRN/YEL	B+	B+	Chassis Electrical
B13	Class 2 Data	ORN/BLK	0.0 V	0.0 V	Diagnosis, Class 2 Serial Data
B14	A/C Compressor Clutch Relay Control Compressor	GRN/RED	0 (A/C OFF)	B+ (A/C ON)	General Description and Operation, A/C Clutch Circuit Operation
B15	Upshift Lamp Control	YEL/GRN	—	—	—
B16	EVAP Canister Purge Valve Solenoid	BRN/WHT	—	—	General Description and Operation, EVAP

PCM Pinout Table, 32–Pin White Connector – Row "C"



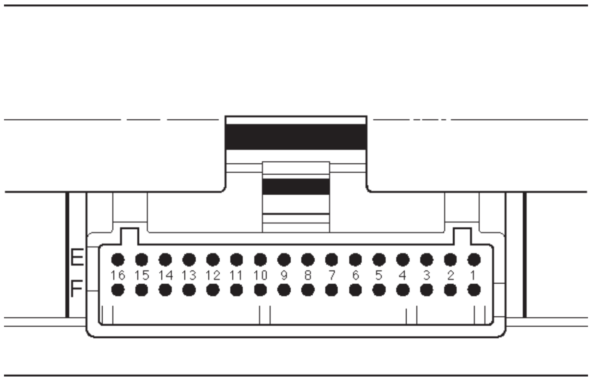
PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
C1	Injector Cylinder #2	GRN/RED	B+ Varies	B+ Varies	General Description and Operation, Fuel Injector
C2	Not Used	—	—	—	—
C3	Not Used	—	—	—	—
C4	Ignition Control Module (ICM) Input	RED	0.0 V	0.1 V	General Description and Operation, Fuel Injector
C5	Crankshaft Position (CKP) Sensor Low	BLUE	4.98 V	0.76 V (at idle)	General Description and Operation, Crankshaft Position Sensor
C6	Crankshaft Position Sensor (CKP) High	GRN	5V	5V	General Description and Operation, Crankshaft Position Sensor
C7	PCM Ground	BLK/BLU	0.0 V	0.0 V	Chassis Electrical
C8	PCM Ground	BLK/BLU	0.0 V	0.0 V	Chassis Electrical
C9	PCM Ground	BLK/BLU	0.0 V	0.0 V	Chassis Electrical
C10	Tachometer Signal	BLK/RED	—	—	General Description and Operation
C11	Fuel Gauge PWM Output	YEL/RED	Varies with Fuel Level	Varies with Fuel Level	General Description and Operation
C12	High Fan Relay Control	RED/YEL	10.5 V	B+	Chassis Electrical
C13	Low Fan Relay Control	RED/BLU	—	—	Chassis Electrical
C14	Bank 1 HO2S 1 High	WHT	0.3 V	–0.1 to 1.1 V	General Description and Operation, Fuel HO2S 1
C15	Bank 1 HO2S 1 Low	RED	0.0 V	0.1 V	General Description and Operation, Fuel HO2S 1
C16	Bank 1 HO2S 2 High	RED	0.3 V	–0.1 to 1.1 V	General Description and Operation, Catalyst HO2S 2

PCM Pinout Table, 32–Pin White Connector – Row ”D”



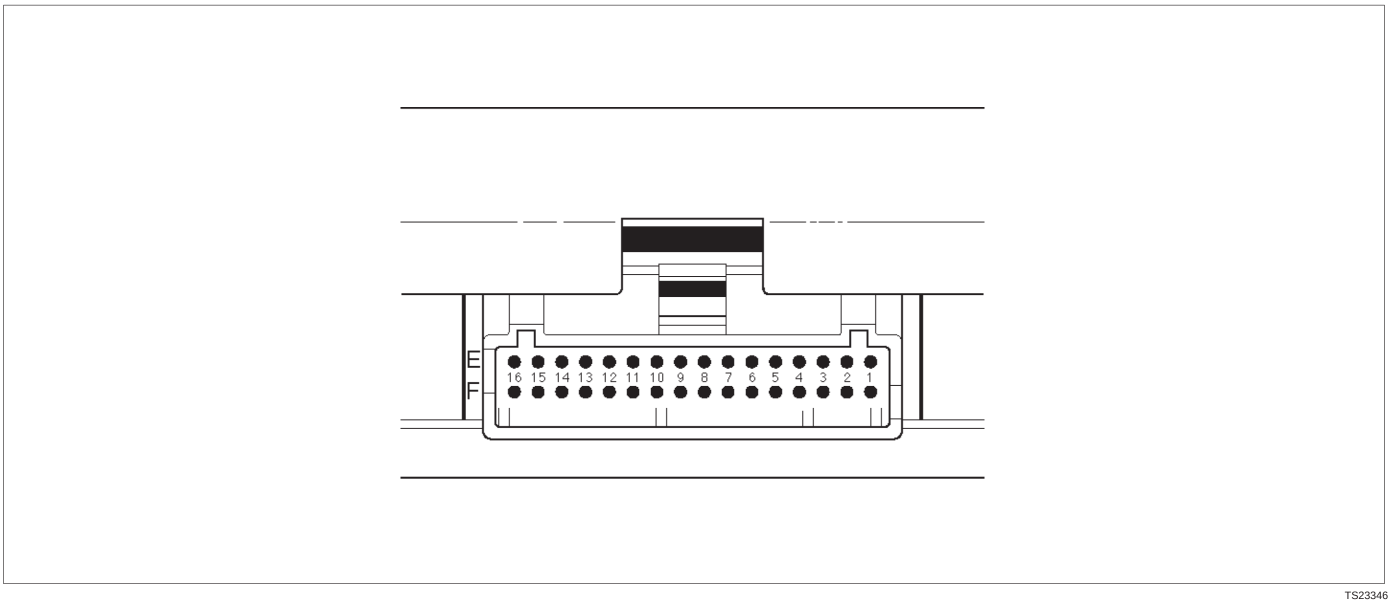
PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
D1	Injector Cylinder #3	GRN/ORN	B+	B+	General Description and Operation, Fuel Injector
D2	Not Used	—	—	—	—
D3	Injector Cylinder #1	GRN/WHT	B+	B+	General Description and Operation, Fuel Injector
D4	Not Used	—	—	—	—
D5	Ignition Control Module (ICM) Input	RED/BLK	—	—	General Description and Operation
D6	Not Used	—	—	—	—
D7	VSS Input	BLU/BLK	—	—	Chassis Electrical
D8	Sensor Ground 5 V Reference A Return	GRN	0.0 V	0.0 V	Appropriate Sensor
D9	Sensor Ground 5 V Reference B Return	BLU/YEL	0.0 V	0.0 V	Appropriate Sensor
D10	Not Used	—	—	—	—
D11	Camshaft Position Sensor Input	BLU	5.0 V	4.6 V	General Description and Operation, Camshaft Position Sensor
D12	Not Used	—	—	—	—
D13	Not Used	—	—	—	—
D14	Not Used	—	—	—	—
D15	Not Used	—	—	—	—
D16	Bank 1 HO2S 2 Low	GRN	0.0 V	0.1 V	General Description and Operation, Catalyst HO2S 2

PCM Pinout Table, 32–Pin White Connector – Row ”E”



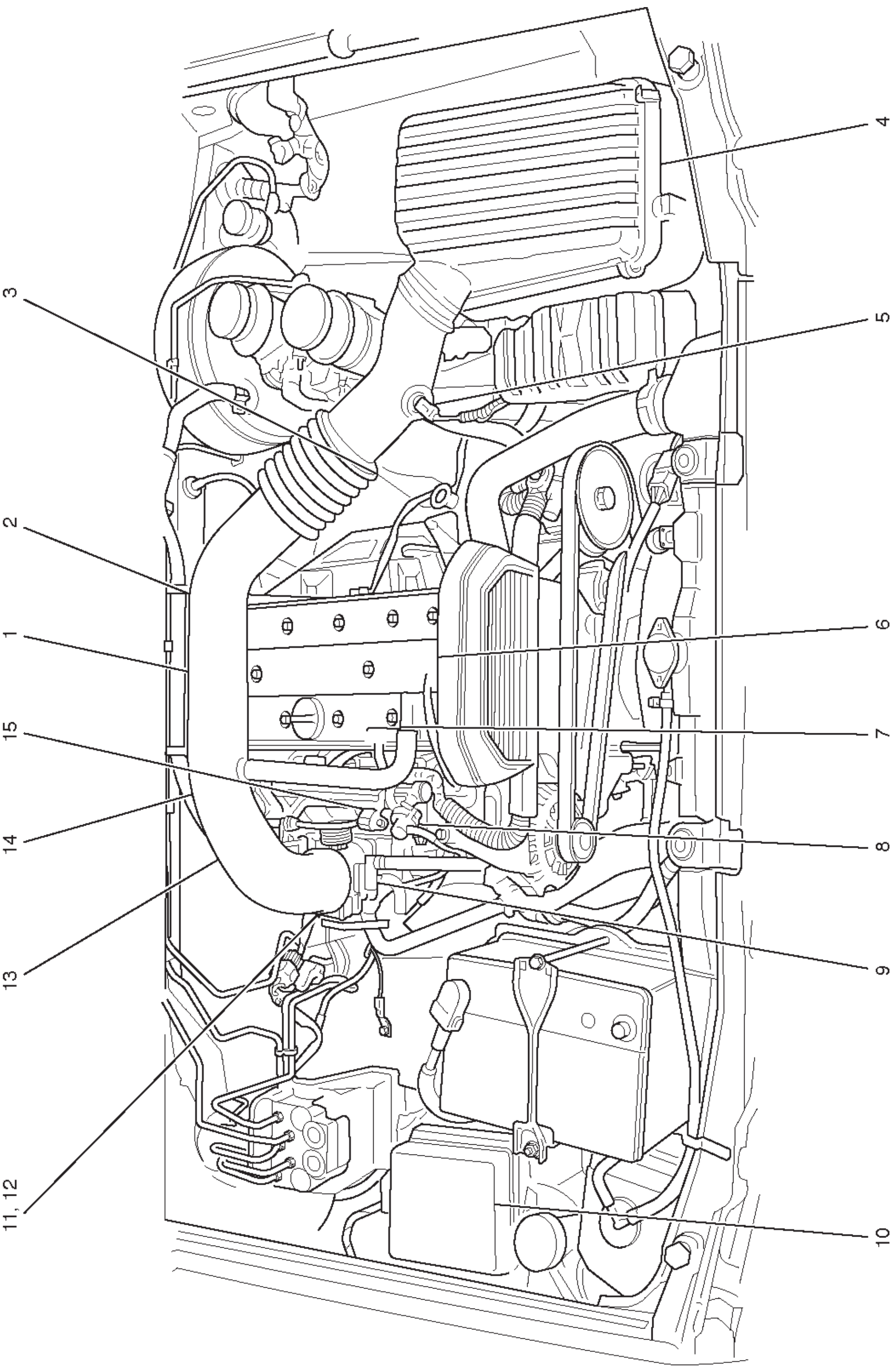
PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
E1	Not Used	—	—	—	—
E2	Fan Control	RED/GRN	0.0V	B+	Chassis Electrical
E3	Not Used	—	—	—	—
E4	Not Used	—	—	—	—
E5	Ignition Feed	BLK/YEL	B+	B+	General Description and Operation
E6	Exhaust Gas Recirculation (EGR) Valve Low	YEL	B+ Varies	B+ Varies	General Description and Operation, EGR Control
E7	Not Used	—	—	—	—
E8	Throttle Position (TP) Sensor Input	BLU	0.25 V (0% = 0.25 V)	0.25 V (at idle) (100% = 4.75 V)	General Description and Operation, Throttle Position Sensor
E9	Engine Coolant Temperature (ECT) Sensor Input	BLU/RED	2.3 V (O V = 151˚C)	2.1 V (5 V = –40˚C)	General Description and Operation, Engine Coolant Temperature (ECT) Sensor
E10	Not Used	—	—	—	—
E11	Not Used	—	—	—	—
E12	Rear Defogger Switch	YEL/GRN	B+	B+	Chassis Electrical
E13	Fuel Pump (FP) Relay Control	PNK/WHT	0.0 V	B+	On–Vehicle Service, Fuel Pump Relay
E14	Not Used	—	—	—	—
E15	A/C Request (Thermo Relay)	GRN/BLK	0.0 V	0.0 V	Electric Cooling Fans
E16	Ignition Feed	RED/BLU	B+	B+	General Description and Operation

PCM Pinout Table, 32–Pin White Connector – Row ”F”

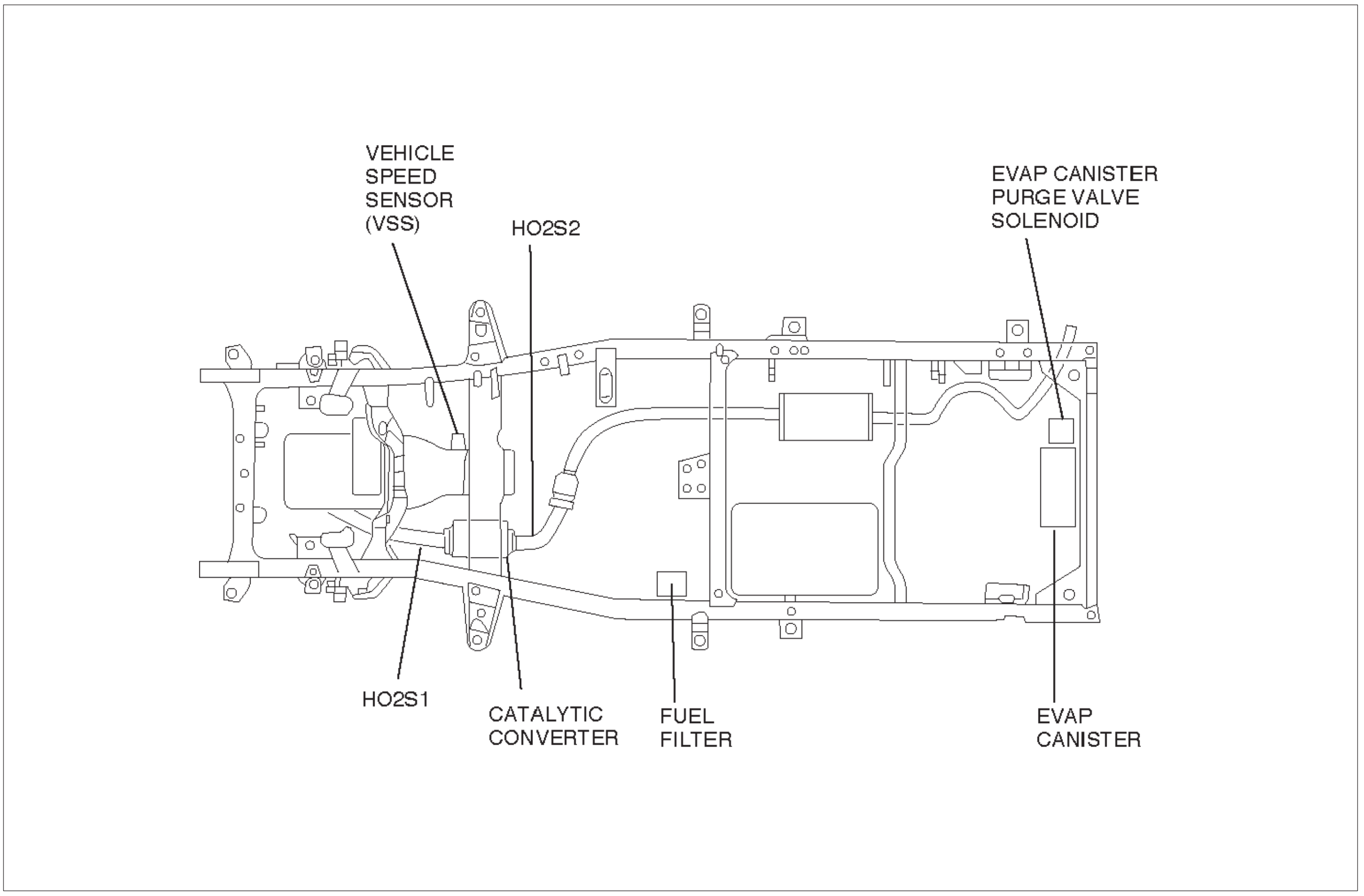


PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F1	Not Used	—	—	—	—
F2	Not Used	—	—	—	—
F3	Not Used	—	—	—	—
F4	Not Used	—	—	—	—
F5	Not Used	—	—	—	—
F6	Not Used	—	—	—	—
F7	Not Used	—	—	—	—
F8	Manifold Absolute Pressure (MAP) Sensor Input	GRY	~4.7 V (0 V = 10kPa)	~1.1 V (5 V = 104kPa)	General Description and Operation, Manifold Absolute Pressure
F9	Not Used	—	—	—	—
F10	Not Used	—	—	—	—
F11	Not Used	—	—	—	—
F12	DLC (Digital Input)	—	—	—	Class 2 Serial Data
F13	Injector ”C” Cylinder #4	GRN	B+	B+	General Description and Operation, Fuel Injector
F14	Not Used	—	—	—	—
F15	Not Used	—	—	—	—
F16	Ignition Feed	RED/BLU	B+	B+	General Description and Operation

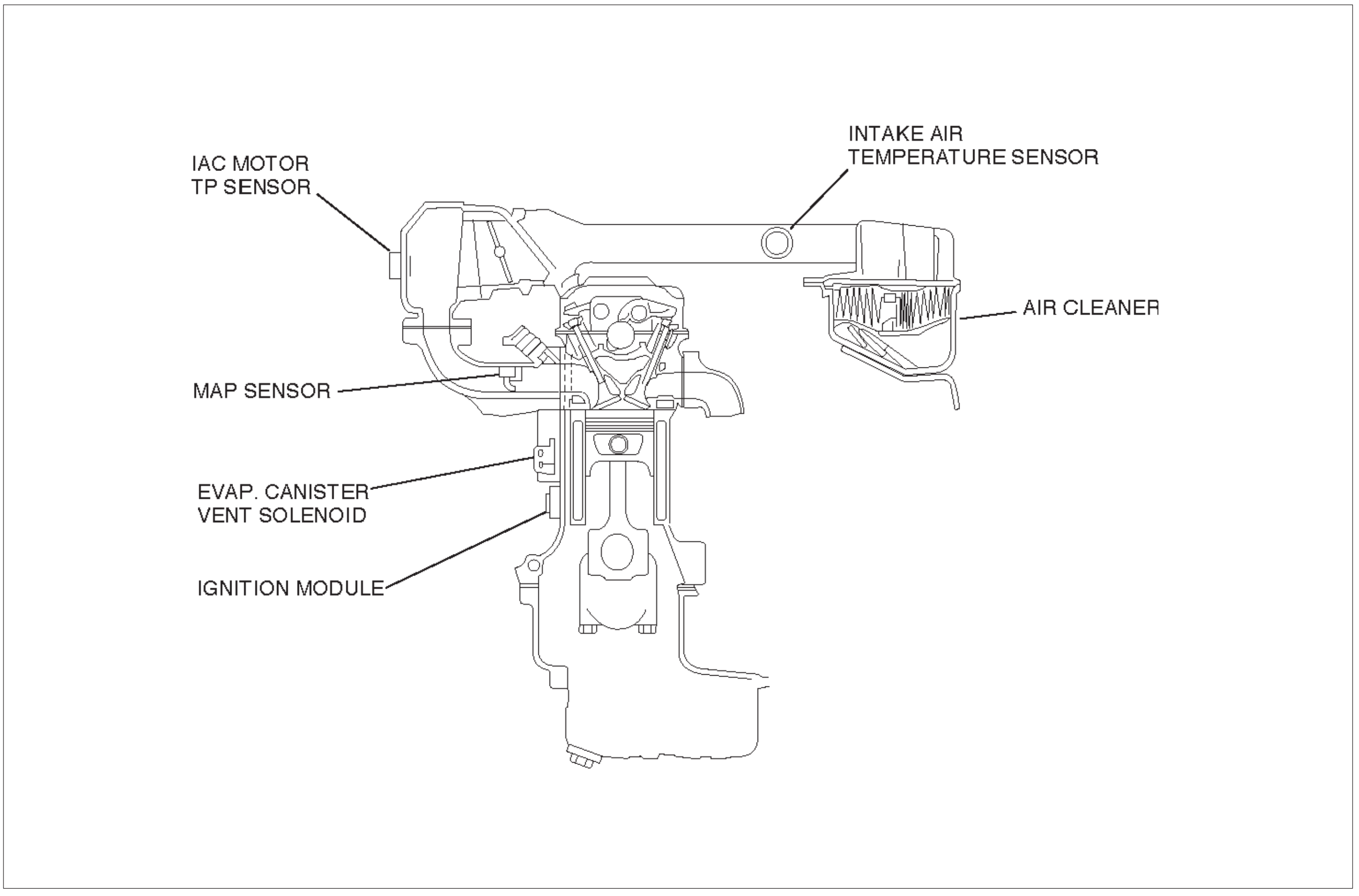
COMPONENT LOCATOR



755RX008



010RX001



028RX001

Engine Component Locator Table

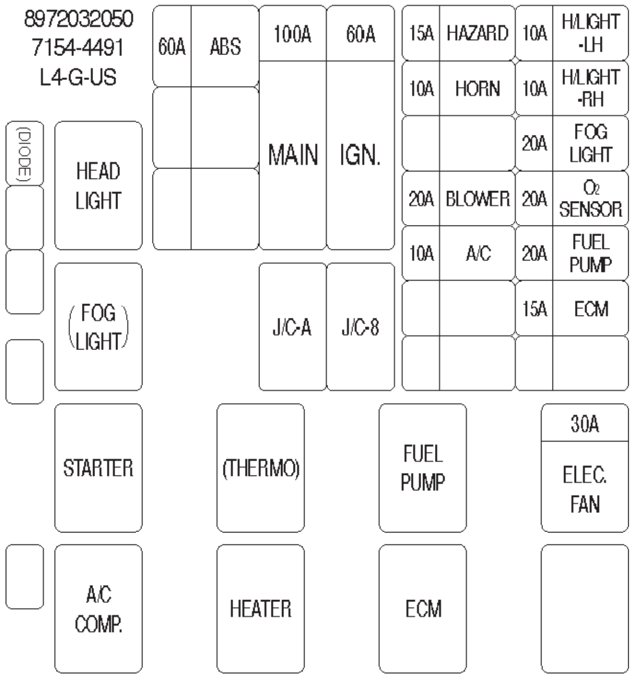
Number	Name	Location
1	Engine Coolant Temperature (ECT) Sensor	Rear of engine, near ignition coils
2	Linear Exhaust Gas Recirculation (EGR) Valve	On the left rear of the engine at the bulkhead
3	Heated Oxygen Sensor (HO2S), Bank 1, Sensor 1	On the exhaust pipe, left side of engine, immediately behind the exhaust manifold
4	Air Cleaner	Left front of the engine bay
5	Intake Air Temperature (IAT) Sensor	On the intake air duct near the air cleaner
6	Camshaft Position (CMP) Sensor	Inside the front cover assembly
7	Positive Crankcase Ventilation (PCV) Port	On the right front corner of the valve cover
8	Fuel Pressure Regulator	On the forward end of the fuel rail, to the right of the PVC port
9	Throttle Body	Between the intake air duct and the intake manifold
10	Fuse/Relay Box	Along the inside of the right fender
11	Throttle Position (TP) Sensor	On the front of the throttle body
12	Idle Air Control (IAC) Valve	On the rear of the throttle body
13	EVAP Canister Vent Solenoid	At the right rear of the engine, behind the Throttle body
14	Ignition Control Module (ICM)	Mounted on a heat sink on the lower right side of the engine block, above the starter motor
15	Manifold Absolute Pressure (MAP) Sensor	Bolted to the front edge of the intake manifold, under the fuel rail

Undercarriage Component Locator Table

Name	Location
Fuel Pump Assembly	Installed in the top of the fuel tank
EVAP Canister	Behind rear axle, near fuel tank filler nozzle
EVAP Canister Purge Valve Solenoid	Behind rear axle, near fuel tank filler nozzle
Heated Oxygen Sensor (HO2S) Bank 1, Sensor 2	Threaded into the exhaust pipe behind the catalytic converter
Vehicle Speed Sensor (VSS)	Protrudes from the right side of the transmission housing, near the output shaft
Crankshaft Position (CKP) Sensor	Lower left hand front of engine, behind power steering pump bracket

Fuse And Relay Panel (Underhood Electrical Center)

Underhood (U/H) Fuse and Relay Panel


8972032050
7154-4491
L4-G-US
60A
ABS
100A
60A
MAIN
IGN.
15A
HAZARD
10A
H/LIGHT -LH
10A
HORN
10A
H/LIGHT -RH
20A
FOG LIGHT
20A
BLOWER
20A
O2 SENSOR
10A
A/C
20A
FUEL PUMP
15A
ECM
(DIODE)
HEAD LIGHT
(FOG LIGHT)
J/C-A
J/C-8
STARTER
(THERMO)
FUEL PUMP
30A
ELEC. FAN
A/C COMP.
HEATER
ECM

755RX009

DIAGNOSIS Strategy–Based Diagnostics

Strategy–Based Diagnostics

The strategy–based diagnostic is a uniform approach to repair all Electrical/Electronic (E/E) systems. The diagnostic flow can always be used to resolve an E/E system problem and is a starting point when repairs are necessary. The following steps will instruct the technician how to proceed with a diagnosis:

1. Verify the customer complaint.
   - To verify the customer complaint, the technician should know the normal operation of the system.
2. Perform preliminary checks.
   - Conduct a thorough visual inspection.
   - Review the service history.
   - Detect unusual sounds or odors.
   - Gather diagnostic trouble code information to achieve an effective repair.
3. Check bulletins and other service information.
   - This includes videos, newsletters, etc.
4. Refer to service information (manual) system check(s).
   - ”System checks” contain information on a system that may not be supported by one or more DTCs. System checks verify proper operation of the system. This will lead the technician in an organized approach to diagnostics.
5. Refer to service diagnostics.

DTC Stored

Follow the designated DTC chart exactly to make an effective repair.

No DTC

Select the symptom from the symptom tables. Follow the diagnostic paths or suggestions to complete the repair. You may refer to the applicable component/system check in the system checks.

No Matching Symptom

1. Analyze the complaint.
2. Develop a plan for diagnostics.
3. Utilize the wiring diagrams and the theory of operation.

Combine technician knowledge with efficient use of the available service information.

Intermittents

Conditions that are not always present are called intermittents. To resolve intermittents, perform the following steps:

1. Observe history DTCs, DTC modes, and freeze–frame data.
2. Evaluate the symptoms and the conditions described by the customer.
3. Use a check sheet or other method to identify the circuit or electrical system component.
4. Follow the suggestions for intermittent diagnosis found in the service documentation.

Most Scan Tools, such as the Tech 2, have data–capturing capabilities that can assist in detecting intermittents.

No Trouble Found

This condition exists when the vehicle is found to operate normally. The condition described by the customer may be normal. Verify the customer complaint against another vehicle that is operating normally. The condition may be intermittent. Verify the complaint under the conditions described by the customer before releasing the vehicle.

1. Re–examine the complaint.

   When the complaint cannot be successfully found or isolated, a re–evaluation is necessary. The complaint should be re–verified and could be intermittent as defined in *Intermittents,* or could be normal.
2. Repair and verify.

   After isolating the cause, the repairs should be made. Validate for proper operation and verify that the symptom has been corrected. This may involve road testing or other methods to verify that the complaint has been resolved under the following conditions:
   - Conditions noted by the customer.
   - If a DTC was diagnosed, verify a repair by duplicating conditions present when the DTC was set as noted in the Failure Records or Freeze Frame data.

Verifying Vehicle Repair

Verification of the vehicle repair will be more comprehensive for vehicles with OBD II system diagnostics. Following a repair, the technician should perform the following steps:

IMPORTANT: Follow the steps below when you verify repairs on OBD II systems. Failure to follow these steps could result in unnecessary repairs.

1. Review and record the Failure Records and the Freeze Frame data for the DTC which has been diagnosed (Freeze Fame data will only be stored for an A or B type diagnostic and only if the MIL (”Check Engine” lamp) has been requested).
2. Clear the DTC(s).
3. Operate the vehicle within conditions noted in the Failure Records and Freeze Frame data.
4. Monitor the DTC status information for the DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

GENERAL SERVICE INFORMATION

OBD II Serviceability Issues

With the introduction of OBD II diagnostics across the entire passenger car and light–duty truck market in 1996, illumination of the MIL (”Check Engine” lamp) due to a non–vehicle fault could lead to misdiagnosis of the vehicle, increased warranty expense and customer dissatisfaction. The following list of non–vehicle faults does not include every possible fault and may not apply equally to all product lines.

Fuel Quality

Fuel quality is not a new issue for the automotive industry, but its potential for turning on the MIL (”Check Engine” lamp) with OBD II systems is new.

Fuel additives such as ”dry gas” and ”octane enhancers” may affect the performance of the fuel. If this results in an incomplete combustion or a partial burn, it will show up as a Misfire DTC P0300. The Reid Vapor Pressure of the fuel can also create problems in the fuel system, especially during the spring and fall months when severe ambient temperature swings occur. A high Reid Vapor Pressure could show up as a Fuel Trim DTC due to excessive canister loading. High vapor pressures generated in the fuel tank can also affect the Evaporative Emission diagnostic as well.

Using fuel with the wrong octane rating for vehicle may cause driveability problems. Many of the major fuel companies advertise that using ”premium” gasoline will improve the performance of vehicle. Most premium fuels use alcohol to increase the octane rating of the fuel. Although alcohol–enhanced fuels may raise the octane rating, the fuel’s ability to turn into vapor in cold temperatures deteriorates. This may affect the starting ability and cold driveability of the engine.

Low fuel levels can lead to fuel starvation, lean engine operation, and eventually engine misfire.

Non–OEM Parts

All of the OBD II diagnostics have been calibrated to run with OEM parts. Something as simple as a high–performance exhaust system that affects exhaust system back pressure could potentially interfere with the operation of the EGR valve and thereby turn on the MIL (”Check Engine” lamp). Small leaks in the exhaust system near the post catalyst oxygen sensor can also cause the MIL (”Check Engine” lamp) to turn on.

Aftermarket electronics, such as transceiver, stereos, and anti–theft devices, may radiate EMI into the control system if they are improperly installed. This may cause a false sensor reading and turn on the MIL (”Check Engine” lamp).

Environment

Temporary environmental conditions, such as localized flooding, will have an effect on the vehicle ignition system. If the ignition system is rain–soaked, it can temporarily cause engine misfire and turn on the MIL (”Check Engine” lamp).

Refueling

A new OBD II diagnostic was introduced in 1996 on some vehicles. This diagnostic checks the integrity of the entire evaporative emission system. If the vehicle is restarted after refueling and the fuel cap is not secured correctly, the on–board diagnostic system will sense this as a system faultand turn on the MIL (”Check Engine” lamp) with a DTC P0440.

Vehicle Marshaling

The transportation of new vehicles from the assembly plant to the dealership can involve as many as 60 key cycles within 2 to 3 miles of driving. This type of operation contributes to the fuel fouling of the spark plugs and will turn on the MIL (”Check Engine” lamp) with a P0300 Misfire DTC.

Poor Vehicle Maintenance

The sensitivity of OBD II diagnostics will cause the MIL (”Check Engine” lamp) to turn ON if the vehicle is not maintained properly. Restricted air filters, fuel filters, and crankcase deposits due to lack of oil changes or improper oil viscosity can trigger actual vehicle faults that were not previously monitored prior to OBD II. Poor vehicle maintenance can’t be classified as a ”non–vehicle fault”, but with the sensitivity of OBD II diagnostics, vehicle maintenance schedules must be more closely followed.

Severe Vibration

The Misfire diagnostic measures small changes in the rotational speed of the crankshaft. Severe driveline vibrations in the vehicle, such as caused by an excessive amount of mud on the wheels, can have the same effect on crankshaft speed as misfire and therefore may set a Misfire DTC P0300.

Related System Faults

Many of the OBD II system diagnostics will not run if the PCM detects a fault on a related system or component. One example would be that if the PCM detected a Misfire fault, the diagnostics on the catalytic converter would be suspended until the Misfire fault was repaired. If the Misfire fault was severe enough, the catalytic converter could be damaged due to overheating and would never set a Catalyst DTC until the Misfire fault was repaired and the Catalyst diagnostic was allowed to run to completion. If this happens, the customer may have to make two trips to the dealership in order to repair the vehicle.

Emissions Control Information Label

The engine compartment ”Vehicle Emissions Control Information Label” contains important emission specifications and setting procedures. In the upper left corner is exhaust emission information. This identifies the emission standard (Federal, California, or Canada) of the engine, the displacement of the engine in liters, the class of the vehicle, and the type of fuel metering system. There is also an illustrated emission components and vacuum hose schematic.

This label is located in the engine compartment of every vehicle. If the label has been removed it should be replaced, it can be ordered from Isuzu Dealer ship.

Maintenance Schedule

Refer to the Maintenance Schedule.

Visual/Physical Engine Compartment Inspection

Perform a careful visual and physical engine compartment inspection when performing any diagnostic procedure or diagnosing the cause of an emission test failure. This can often lead to repairing a problem without further steps. Use the following guidelines when performing a visual/physical inspection:

- Inspect all vacuum hoses for pinches, cuts, disconnection, and Droper routing.
- Inspect hoses that are difficult to see behind other components.
- Inspect all wires in the engine compartment for proper connections, burned or chafed spots, pinched wires, contact with sharp edges or contact with hot exhaust manifolds or pipes.

Basic Knowledge Of Tools Required

NOTE: Lack of basic knowledge of this powertrain when performing diagnostic procedures could result in an incorrect diagnosis or damage to powertrain components. Do not attempt to diagnose a powertrain problem without this basic knowledge.

A basic understanding of hand tools is necessary to effectively use this section of the Service Manual.

SERIAL DATA COMMUNICATIONS

Class II Serial Data Communications

Government regulations require that all vehicle manufacturers establish a common communication system. This vehicle utilizes the ”Class II” communication system. Each bit of information can have one of two lengths: long or short. This allows vehicle wiring to be reduced by transmitting and receiving multiple signals over a single wire. The messages carried on Class II data streams are also prioritized. If two messages attempt to establish communications on the data line at the same time, only the message with higher priority will continue. The device with the lower priority message must wait. The most significant result of this regulation is that it provides Tech 2 manufacturers with the capability to access data from any make or model vehicle that is sold.

The data displayed on the other Tech 2 will appear the same, with some exceptions. Some Scan Tools will only be able to display certain vehicle parameters as values that are a coded representation of the true or actual value. For more information on this system of coding, refer to Decimal/Binary/Hexadecimal Conversions. On this vehicle the Tech 2 displays the actual values for vehicle parameters. It will not be necessary to perform any conversions from coded values to actual values.

ON–BOARD DIAGNOSTIC (OBD II)

On–Board Diagnostic Tests

A diagnostic test is a series of steps, the result of which is a pass or fail reported to the diagnostic executive. When a diagnostic test reports a pass result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The diagnostic test has passed during the current ignition cycle.
- The fault identified by the diagnostic test is not currently active.

When a diagnostic test reports a fail result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The fault identified by the diagnostic test is currently active.
- The fault has been active during this ignition cycle.
- The operating conditions at the time of the failure.

Remember, a fuel trim DTC may be triggered by a list of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Comprehensive Component Monitor Diagnostic Operation

Comprehensive component monitoring diagnostics are required to monitor emissions–related input and output powertrain components. The *CARB OBD II Comprehensive Component Monitoring List Of Components Intended To illuminate The MIL* is a list of components, features or functions that could fall under this requirement.

Input Components:

Input components are monitored for circuit continuity and out–of–range values. This includes rationality checking. Rationality checking refers to indicating a fault when the signal from a sensor does not seem reasonable, i.e. Throttle Position (TP) sensor that indicates high throttle position at low engine loads or MAP voltage). Input components may include, but are not limited to the following sensors:

- Vehicle Speed Sensor (VSS)
- Crankshaft Position (CKP) sensor
- Throttle Position (TP) sensor
- Engine Coolant Temperature (ECT) sensor
- Camshaft Position (CMP) sensor
- Manifold Absolute Pressure (MAP) sensor

In addition to the circuit continuity and rationality check the ECT sensor is monitored for its ability to achieve a steady state temperature to enable ”Closed Loop” fuel control.

Output Components:

Output components are diagnosed for proper response to control module commands. Components where functional monitoring is not feasible will be monitored for circuit continuity and out–of–range values if applicable.

Output components to be monitored include, but are not limited to the following circuit:

- Idle Air Control (IAC) Motor
- EVAP Canister Purge Valve Solenoid
- A/C relays
- Cooling fan relay(s)
- VSS output
- MIL control
- Cruise control inhibit

Refer to PCM and Sensors in General Descriptions.

Passive and Active Diagnostic Tests

A passive test is a diagnostic test which simply monitors a vehicle system or component. Conversely, an active test, actually takes some sort of action when performing diagnostic functions, often in response to a failed passive test. For example, the EGR diagnostic active test will force the EGR valve open during closed throttle decel and/or force the EGR valve closed during a steady state. Either action should result in a change in manifold pressure.

Intrusive Diagnostic Tests

This is any on–board test run by the Diagnostic Management System which may have an effect on vehicle performance or emission levels.

Warm–Up Cycle

A warm–up cycle means that engine at temperature must reach a minimum of 70˚C (160˚F) and rise at least 22˚C (40˚F) over the course of a trip.

Freeze Frame

Freeze Frame is an element of the Diagnostic Management System which stores various vehicle information at the moment an emissions–related fault is stored in memory and when the MIL is commanded on. These data can help to identify the cause of a fault. Refer to Storing And Erasing Freeze Fame Data for more detailed information.

Failure Records

Failure Records data is an enhancement of the OBD II Freeze Frame feature. Failure Records store the same vehicle information as does Freeze Frame, but it will store that information for any fault which is stored in on–board memory, while Freeze Frame stores information only for emission–related faults that command the MIL ON.

System Status And Drive Cycle For Satisfying Federal Inspection/Maintenance (I/M 240) Regulations

I/M Ready Status means a signal or flag for each emission system test that had been set in the PCM. I/M Ready Status indicates that the vehicle on–board emissions diagnostics have been run. I/M Ready Status is not concerned whether the emission system passed or failed the test, only that on–board diagnosis is complete. Not all vehicles use all possible I/M flags.

Common OBD II Terms

Diagnostic

When used as a noun, the word diagnostic refers to any on–board test run by the vehicle’s Diagnostic Management System. A diagnostic is simply a test run on a system or component to determine if the system or component is operating according to specification. There are many diagnostics, shown in the following list:

- Misfire
- Oxygen sensors
- Oxygen sensor heaters
- EGR
- Catalyst monitoring

Enable Criteria

The term ”enable criteria” is engineering language for the conditions necessary for a given diagnostic test to run. Each diagnostic has a specific list of conditions which must be met before the diagnostic will run. ”Enable criteria” is another way of saying ”conditions required”.

The enable criteria for each diagnostic is listed on the first page of the DTC description in Section 6E1 under the heading ”Conditions for Setting the DTC”. Enable criteria varies with each diagnostic, and typically includes, but is not limited to the following items:

- engine speed
- vehicle speed
- ECT
- MAP
- barometric pressure
- IAT
- TP
- high canister purge
- fuel trim
- A/C ON

Trip

Technically, a trip is a key on–run–key off cycle in which all the enable criteria for a given diagnostic are met, allowing the diagnostic to run. Unfortunately, this concept is not quite that simple. A trip is official when all the enable criteria for a given diagnostic are met. But because the enable criteria vary from one diagnostic to another, the definition of trip varies as well. Some diagnostics are run when the vehicle is at operating temperature, some when the vehicle first starts up; some require that the vehicle be cruising at a steady highway speed, some run only when the vehicle is at idle; some diagnostics function with the TCC disabled. Some run only immediately following a cold engine start–up.

A trip then, is defined as a key on–run–key off cycle in which the vehicle was operated in such a way as to satisfy the enabling criteria for a given diagnostic, and this diagnostic will consider this cycle to be one trip. However, another diagnostic with a different set of enable criteria (which were not met) during this driving event, would not consider it a trip. No trip will occur for that particular diagnostic until the vehicle is driven in such a way as to meet all the enable criteria.

The Diagnostic Executive

The Diagnostic Executive is a unique segment of software which is designed to coordinate and prioritize the diagnostic procedures as well as define the protocol for recording and displaying their results. The main responsibilities of the Diagnostic Executive are listed as follows:

- Commanding the MIL (”Check Engine” lamp) ON and OFF
- DTC logging and clearing
- Freeze Frame data for the first emission related DTC recorded
- Non–emission related Service Lamp (future)
- Operating conditions Failure Records buffer, (the number of records will vary)
- Current status information on each diagnostic
- System Status (I/M ready)

The Diagnostic Executive records DTCs and turns ON the MIL when emission–related faults occur. It can also turn OFF the MIL if the conditions cease which caused the DTC to set.

Diagnostic Information

The diagnostic charts and functional checks are designed to locate a faulty circuit or component through a process of logical decisions. The charts are prepared with the requirement that the vehicle functioned correctly at the time of assembly and that there are no multiple faults present.

There is a continuous self–diagnosis on certain control functions. This diagnostic capability is complimented by the diagnostic procedures contained in this manual. The language of communicating the source of the malfunction is a system of diagnostic trouble codes. When a malfunction is detected by the control module, a diagnostic trouble code is set and the Malfunction Indicator Lamp (MIL) (”Check Engine” lamp) is illuminated.

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) looks the same as the MIL you are already familiar with (”Check Engine” lamp). However, OBD II requires that it illuminate under a strict set of guide lines.

Basically, the MIL is turned ON when the PCM detects a DTC that will impact the vehicle emissions.

The MIL is under the control of the Diagnostic Executive. The MIL will be turned ON if an emissions–related diagnostic test indicates a malfunction has occurred. It will stay ON until the system or component passes the same test, for three consecutive trips, with no emissions–related faults.

If the vehicle is experiencing a misfire malfunction which may cause damage to the Three–Way Catalytic Converter (TWC), the MIL will flash once per second. This will continue until the vehicle is outside of speed and load conditions which could cause possible catalyst damage, and the MIL will stop flashing and remain ON steady.

Extinguishing the MIL

When the MIL is ON, the Diagnostic Executive will turn OFF the MIL after *three (3) consecutive* trips that a ”test passed” has been reported for the diagnostic test that originally caused the MIL to illuminate.

Although the MIL has been turned OFF, the DTC will remain in the PCM memory (both Freeze Frame and Failure Records) until *forty(40) warm–up cycles after no faults* have been completed.

If the MIL was set by either a fuel trim or misfire–related DTC, additional requirements must be met. In addition to the requirements stated in the previous paragraph, these requirements are as follows:

- The diagnostic tests that are passed must occur with 375 RPM of the RPM data stored at the time the last test failed.
- Plus or minus ten (10) percent of the engine load that was stored at the time the last test failed.
- Similar engine temperature conditions (warmed up or warming up) as those stored at the time the last test failed.

Meeting these requirements ensures that the fault which turned on the MIL has been corrected.

The MIL (”Check Engine” lamp) is on the instrument panel and has the following functions:

- It informs the driver that a fault that affects vehicle emission levels has occurred and that the vehicle should be taken for service as soon as possible.
- As a bulb and system check, the MIL will come ON with the key ON and the engine not running. When the engine is started, the MIL will turn OFF.

- When the MIL remains ON while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, a Powertrain On–Board Diagnostic (OBD) System Check must be performed. The procedures for these checks are given in On–Board Diagnostic (OBD II) System Check. These checks will expose faults which may not be detected if other diagnostics are performed first.

DTC Types

Each DTC is directly related to a diagnostic test. The Diagnostic Management System sets DTC based on the failure of the tests during a trip or trips. Certain tests must fail two (2) consecutive trips before the DTC is set. The following are the four (4) types of DTCs and the characteristics of those codes:

- Type A
  - Emissions related
  - Requests illumination of the MIL of the first trip with a fail
  - Stores a History DTC on the first trip with a fail
  - Stores a Freeze Frame (if empty)
  - Stores a Fail Record
  - Updates the Fail Record each time the diagnostic test fails
- Type B
  - Emissions related
  - ”Armed” after one (1) trip with a fail
  - ”Disarmed” after one (1) trip with a pass
  - Requests illumination of the MIL on the *second consecutive trip* with a fail
  - Stores a History DTC on the second consecutive trip with a fail (The DTC will be armed after the first fail)
  - Stores a Freeze Frame on the second consecutive trip with a fail (if empty)
  - Stores a Fail Record when the first test fails (not dependent on *consecutive trip* fails)
  - Updates the Fail Record each time the diagnostic test fails

(Some special conditions apply to misfire and fuel trim DTCs)

- Type C (if the vehicle is so equipped)
  - Non–Emissions related
  - Requests illumination of the Service Lamp or the service message on the Drive Information Center (DIC) on the *first trip* with a fail
  - Stores a History DTC on the *first trip* with a fail
  - *Does not* store a Freeze Frame
  - Stores Fail Record when test fails
  - Updates the Fail Record each time the diagnostic test fails
- Type D. (*Type D* non–emissions related are not utilized on certain vehicle applications).
  - Non–Emissions related
  - Does not request illumination of any lamp
  - Stores a History DTC on the *first trip* with a fail
  - *Does not* store a Freeze Frame
  - Stores Fail Record when test fails
  - Updates the Fail Record each time the diagnostic test fails

IMPORTANT: Only four Fail Records can be stored. Each Fail Record is for a different DTC. It is possible that there will not be Fail Records for every DTC if multiple DTCs are set.

Special Cases of Type B Diagnostic Tests

Unique to the misfire diagnostic, the Diagnostic Executive has the capability of alerting the vehicle operator to potentially damaging levels of misfire. If a misfire condition exists that could potentially damage the catalytic converter as a result of high misfire levels, the Diagnostic Executive will command the MIL to “flash” at a rate of once per second during those the time that the catalyst damaging misfire condition is present.

Fuel trim and misfire are special cases of *Type B* diagnostics. Each time a fuel trim or misfire malfunction is detected, engine load, engine speed, and engine coolant temperature are recorded.

When the ignition is turned OFF, the last reported set of conditions remain stored. During subsequent ignition cycles, the stored conditions are used as a reference for similar conditions. If a malfunction occurs during two consecutive trips, the Diagnostic Executive treats the failure as a normal *Type B* diagnostic, and does not use the stored conditions. However, if a malfunction occurs on two non–consecutive trips, the stored conditions are compared with the current conditions. The MIL will then illuminate under the following conditions:

- When the engine load conditions are within 10% of the previous test that failed.
- Engine speed is within 375 rpm, of the previous test that failed.
- Engine coolant temperature is in the same range as the previous test that failed.

Storing and Erasing Freeze Frame Data and Failure Records

Government regulations require that engine operating conditions be captured whenever the MIL is illuminated. The data captured is called Freeze Frame data. The Freeze Frame data is very similar to a single record of operating conditions. Whenever the MIL is illuminated, the corresponding record of operating conditions is recorded to the Freeze Frame buffer.

Freeze Frame data can only be overwritten with data associated with a misfire or fuel trim malfunction. Data from these faults take precedence over data associated with any other fault. The Freeze Frame data will not be erased unless the associated history DTC is cleared.

Each time a diagnostic test reports a failure, the current engine operating conditions are recorded in the *Failure Records* buffer. A subsequent failure will update the recorded operating conditions. The following operating conditions for the diagnostic test which failed *typically* include the following parameters:

- Air Fuel Ratio
- Air Flow Rate

- Fuel Trim
- Engine Speed
- Engine Load
- Engine Coolant Temperature
- Vehicle Speed
- TP Angle
- MAP/BARO
- Injector Base Pulse Width
- Loop Status

Intermittent Malfunction Indicator Lamp

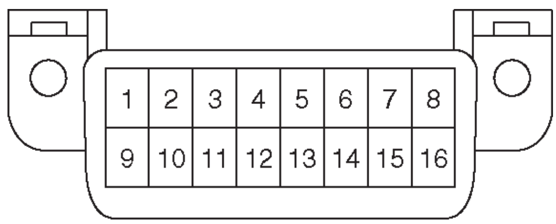
In the case of an ”intermittent” fault, the MIL (”Check Engine” lamp) may illuminate and then (after three trips) go OFF. However, the corresponding diagnostic trouble code will be stored in the memory. When unexpected diagnostic trouble codes appear, check for an intermittent malfunction.

A diagnostic trouble code may reset. Consult the ”Diagnostic Aids” associated with the diagnostic trouble code. A physical inspection of the applicable sub–system most often will resolve the problem.

Data Link Connector (DLC)

The provision for communicating with the control module is the Data Link Connector (DLC). It is located at the lower left of the instrument panel. The DLC is used to connect to the Tech 2 Scan tool. Some common uses of the Tech 2 are listed below:

- Identifying stored Diagnostic Trouble Codes (DTCs)
- Clearing DTCs
- Performing output control tests
- Reading serial data



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Decimal/Binary/Hexadecimal Conversions

Beginning in 1996, Federal Regulations require that all auto manufacturers selling vehicles in the United States provide Scan tool manufacturers with software information to display vehicle operating parameters. All Scan tool manufacturers will display a variety of vehicle information which will aid in repairing the vehicle. Some Scan Tools will display encoded messages which will aid in determining the nature of the concern. The method of encoding involves the use of a two additional numbering systems: Binary and Hexadecimal.

The binary number system has a base of two numbers. Each digit is either a 0 or a 1. A binary number is an eight digit number and is read from right to left. Each digit has a position number with the farthest right being the 0 position and the farthest left being the 7 position. The 0 position, when displayed by a 1, indicates 1 in decimal. Each position to the left is double the previous position and added to any other position values marked as a 1.

A hexadecimal system is composed of 16 different alpha numeric characters. The alpha numeric characters used are numbers 0 through 9 and letters A through F. The hexadecimal system is the most natural and common approach for Scan Tool manufacturers to display data represented by binary numbers and digital code.

Verifying Vehicle Repair

Verification of vehicle repair will be more comprehensive for vehicles with OBD II system diagnostics. Following a repair, the technician should perform the following steps:

1. Review and record the Fail Records and/or Freeze Frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for an A or B type diagnostic and only if the MIL has been requested).
2. Clear DTC(s).
3. Operate the vehicle within conditions noted in the Fail Records and/or Freeze Frame data.
4. Monitor the DTC status information for the DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

Following these steps are very important in verifying repairs on OBD II systems. Failure to follow these steps could result in unnecessary repairs.

Reading Diagnostic Trouble Codes Using A Tech 2 Scan Tool

The procedure for reading diagnostic trouble code(s) is to use a diagnostic Scan tool. When reading DTC(s), follow instructions supplied by tool manufacturer.

Clearing Diagnostic Trouble Codes

IMPORTANT: Do not clear DTCs unless directed to do so by the service information provided for each diagnostic procedure. When DTCs are cleared, the Freeze Frame and Failure Record data which may help diagnose an intermittent fault will also be erased from memory.

If the fault that caused the DTC to be stored into memory has been corrected, the Diagnostic Executive will begin to count the ”warm–up” cycles with no further faults detected, the DTC will automatically be cleared from the PCM memory.

To clear Diagnostic Trouble Codes (DTCs), use the diagnostic Scan tool ”clear DTCs” or ”clear information” function. When clearing DTCs follow instructions supplied by the tool manufacturer.

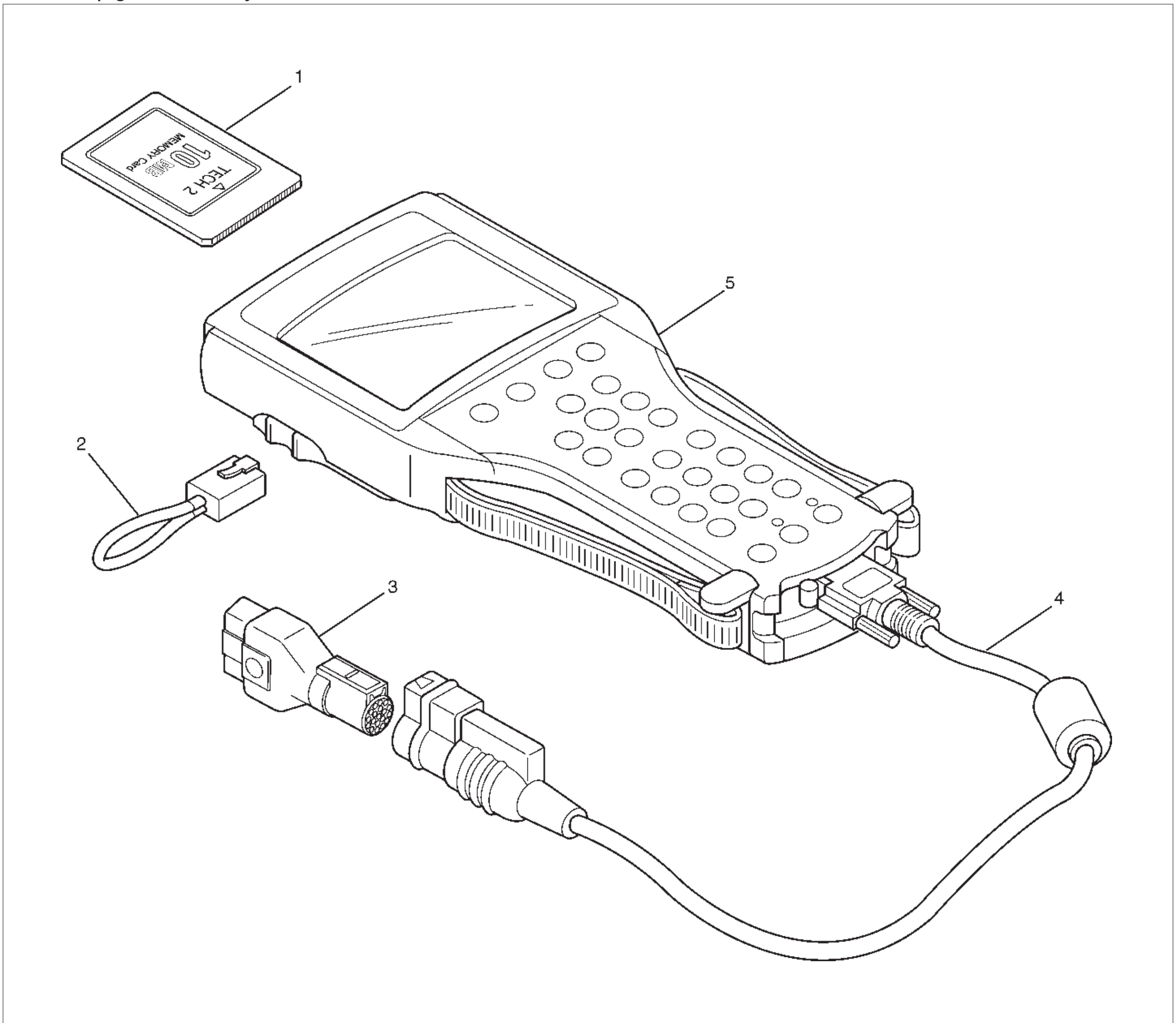
When a Tech 2 is not available, DTCs can also be cleared by disconnecting one of the following sources for at least thirty (30) seconds.

NOTE: To prevent system damage, the ignition key must be OFF when disconnecting or reconnecting battery power.

- The power source to the control module. Examples: fuse, pigtail at battery PCM connectors etc.
- The negative battery cable. (Disconnecting the negative battery cable will result in the loss of other on–board memory data, such as preset radio tuning).

Tech 2

From 98 MY, Isuzu dealer service departments are recommended to use the Tech 2 scan tool. Please refer to the Tech 2 user guide.



901RW180

Legend

(1) PCMCIA Card
(2) R232 Loop Back Connector
(3) SAE 16/19 Adaptor
(4) DLC Cable
(5) Tech 2

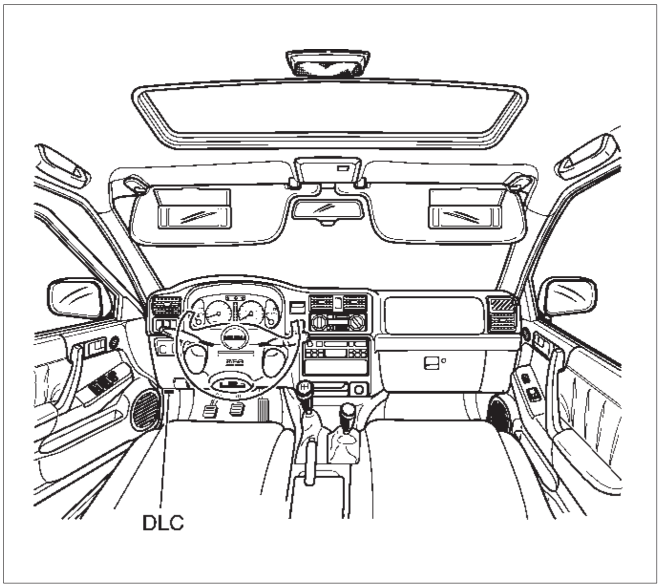
Tech 2 Features

1. Tech 2 is a 12 volt system. Do not apply 24 volt.
2. After connecting and/or installing, the Vehicle Communications Interface (VCI) module, PCMCIA card and DLC connector to the Tech 2, connect the tool to the vehicle DLC.
3. Make sure the Tech 2 is powered OFF when removing or installing the PCMCIA card.
4. The PCMCIA card has a capacity of 10 Megabytes which is 10 times greater than the memory of the Tech 1 Mass Storage Cartridge.
5. The Tech 2 has the capability of two snapshots.
6. The PCMCIA card is sensitive to magnetism and static electricity, so care should be taken in the handling of the card.
7. The Tech 2 can plot a graph when replaying a snapshot.
8. Always return to the Main Menu by pressing the EXIT key several times before shutting down.
9. To clear Diagnostic Trouble Codes (DTCs), open Application Menu and press “F1: Clear DTC Info”.

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 98 System PCMCIA card (1) inserts into the Tech 2 (5).
2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (5)
4. Make sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.



740RW060

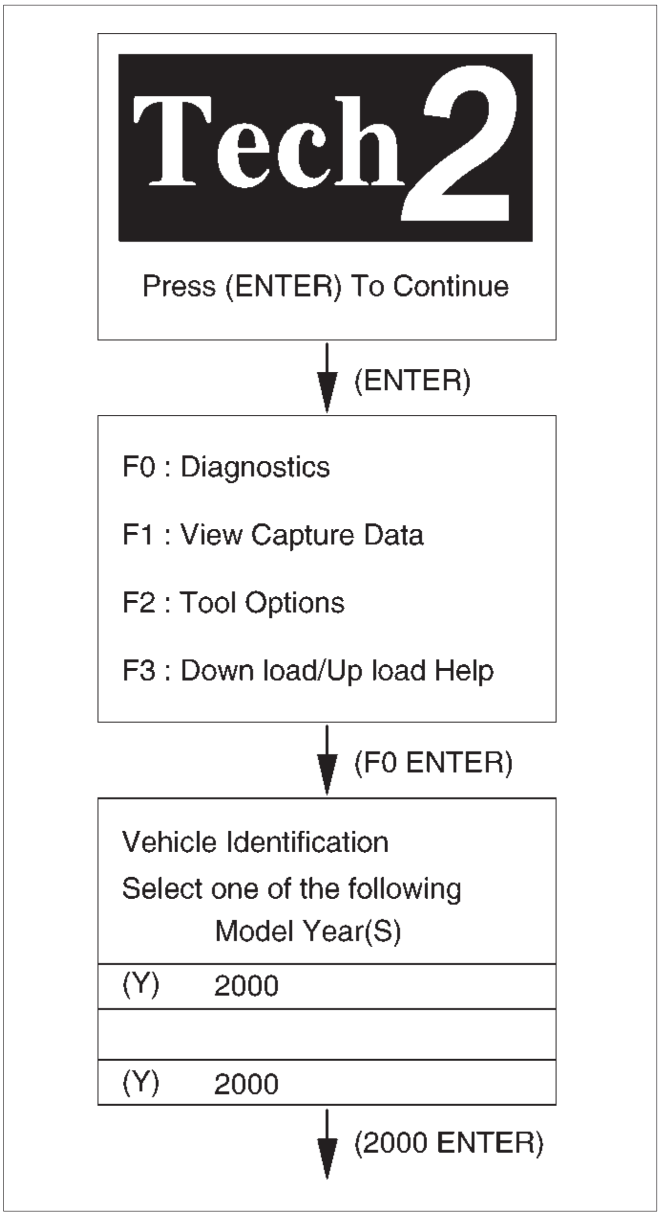
6. Turn on the vehicle ignition.
7. Power the Tech 2 ON and Verify the Tech 2 power up display.

060RW009

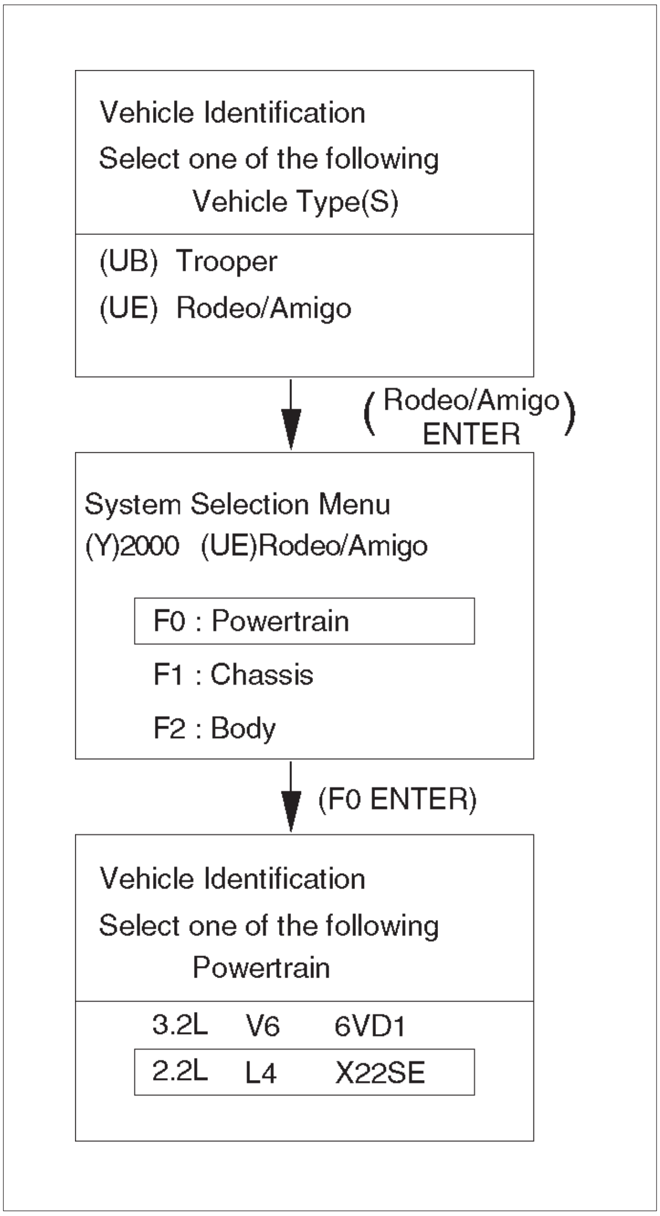
NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2 and refer to user guide of the Tech 2.

Operating Procedure (Example)

The power up screen is displayed when you power up the tester with the Isuzu system PCMCIA card. Follow the operating procedure below.



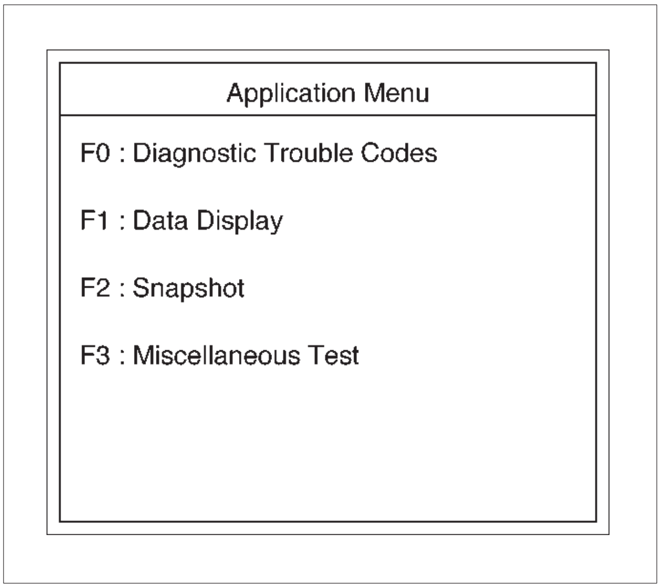
060RY027



060RY00108

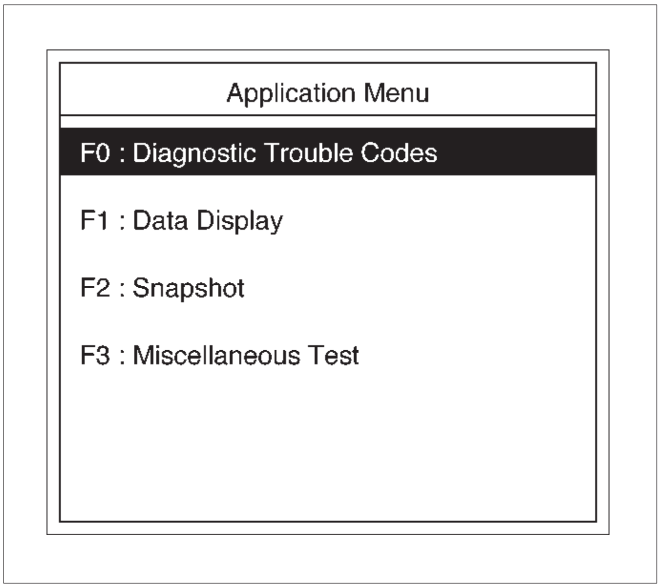
Menu

- The following table shows which functions are used for the available equipment versions.



060RW224

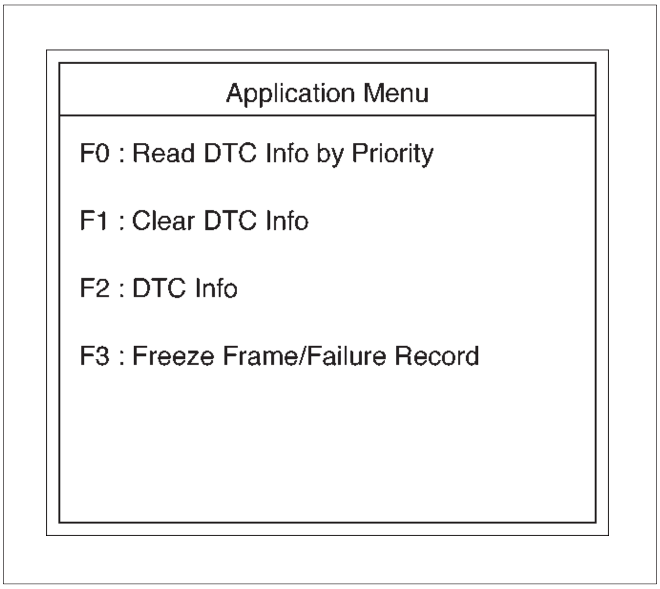
DTC Modes



060RW229

On OBD II vehicles there are five options available in Tech 2 DTC mode to display the enhanced information available. After selecting DTC, the following menu appears:

- DTC Info
- Freeze Frame
- Fail Records (not all applications)
- Clear Info

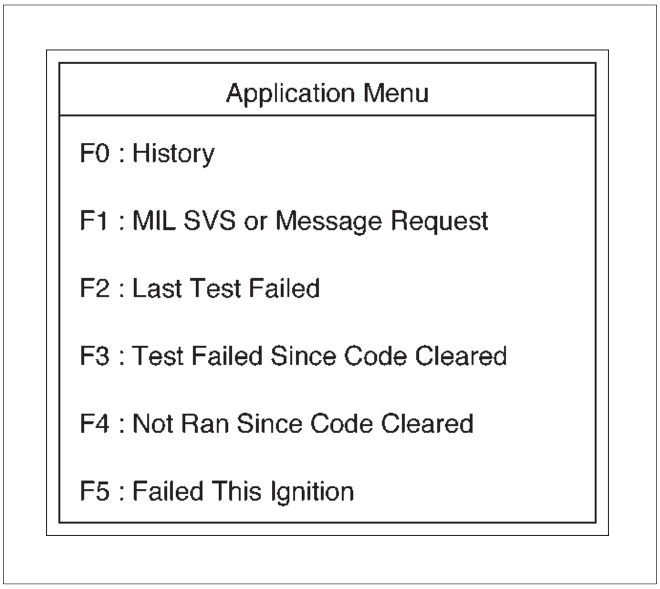


060RW223

The following is a brief description of each of the sub menus in DTC Info and DTC. The order in which they appear here is alphabetical and not necessarily the way they will appear on the Tech 2.

DTC Information Mode

Use the DTC info mode to search for a specific type of stored DTC information. There are six choices. The service manual may instruct the technician to test for DTCs in a certain manner. Always follow published service procedures.



060RW221

DTC Status

This selection will display any DTCs that have not run during the current ignition cycle or have reported a test failure during this ignition up to a maximum of 33 DTCs. DTC tests which run and pass will cause that DTC number to be removed from Tech 2 screen.

Fail This Ignition

This selection will display all DTCs that have failed during the present ignition cycle.

History

This selection will display only DTCs that are stored in the PCM’s history memory. It will display all type A and B DTCs that have requested the MIL and have failed within the last 40 warm-up cycles. In addition, it will display all type C and type D DTCs that have failed within the last 40 warm-up cycles.

Last Test Failed

This selection will display only DTCs that have failed the last time the test run. The last test may have run during a previous ignition cycle if a type A or type B DTC is displayed. For type C and type D DTCs, the last failure must have occurred during the current ignition cycle to appear as Last Test Fail.

MILSVC or Message Request

This selection will display only DTCs that are requesting the MIL. Type C and type D DTCs cannot be displayed using this option. This selection will report type B DTCs only after the MIL has been requested.

Not Run Since Code Cleared

This option will display up to 33 DTCs that have not run since the DTCs were last cleared. Since any displayed DTCs have not run, their condition (passing or failing) is unknown.

Test Failed Since Code Cleared

This selection will display all active and history DTCs that have reported a test failure since the last time DTCs were cleared. DTCs that last failed more than 40 warm-up cycles before this option is selected will not be displayed.

Miscellaneous Test

This test consists of eight menus-Lights, Relays, EVAP, IAC System, Fuel System, EGR Control, Variable Intake Manifold Solenoid, and Injector Balance Tests.

In these tests, Tech 2 sends operating signals to the systems to confirm their operations thereby to judge the normality of electric circuits.

To judge intermittent trouble,

1. Confirm DTC freeze frame data, and match the freeze frame data as test conditions with the data list displayed by Miscellaneous Test.
2. Confirm DTC setting conditions, and match the setting conditions as test conditions with the data list displayed by Miscellaneous Test.
3. Refer to the latest Service Bulletin.
   Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.

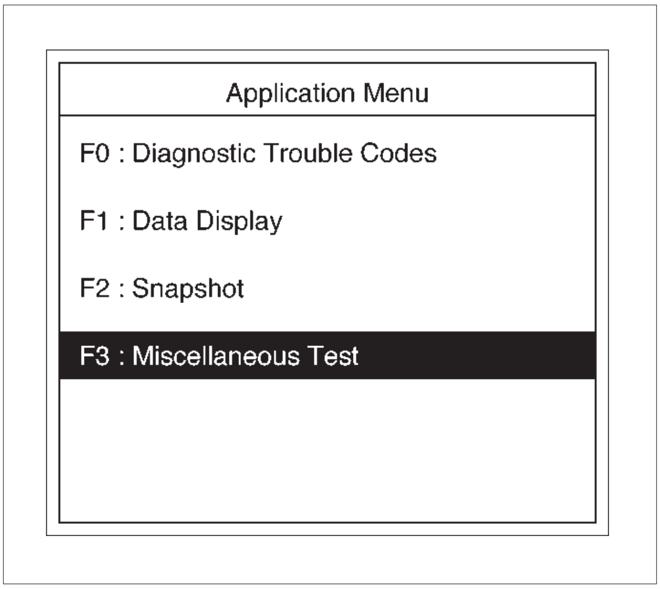
Lamps Test

This test is conducted check MIL and Low Fuel Lamp for its working.

Tech2 must be used for this test.

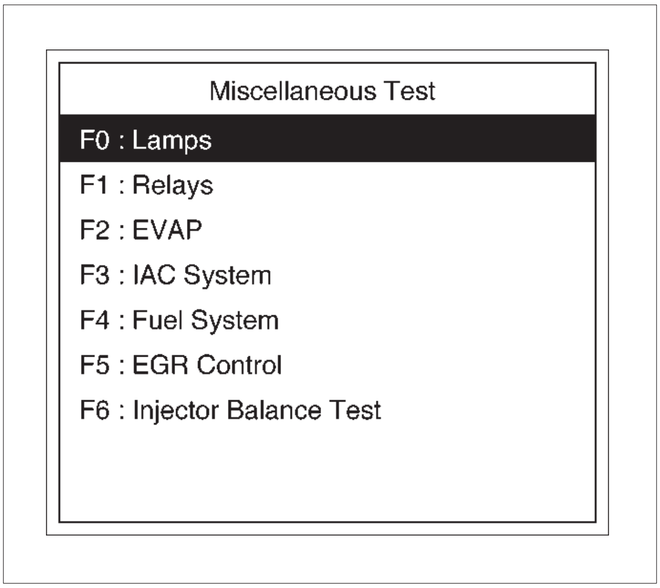
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.

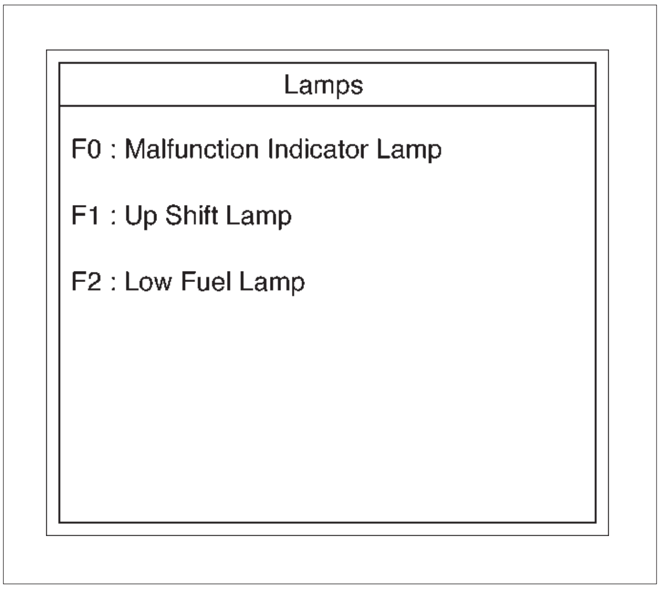


060RW228

4. Select F0:Lamps Test in the Miscellaneous Test.

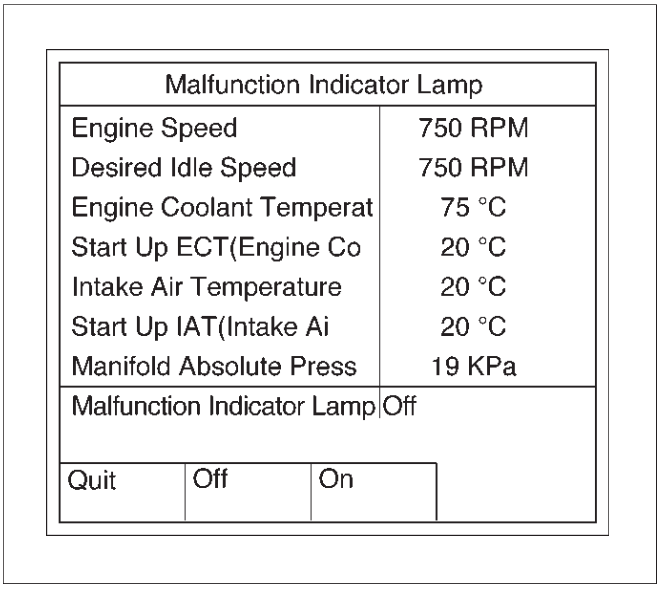


060RX043



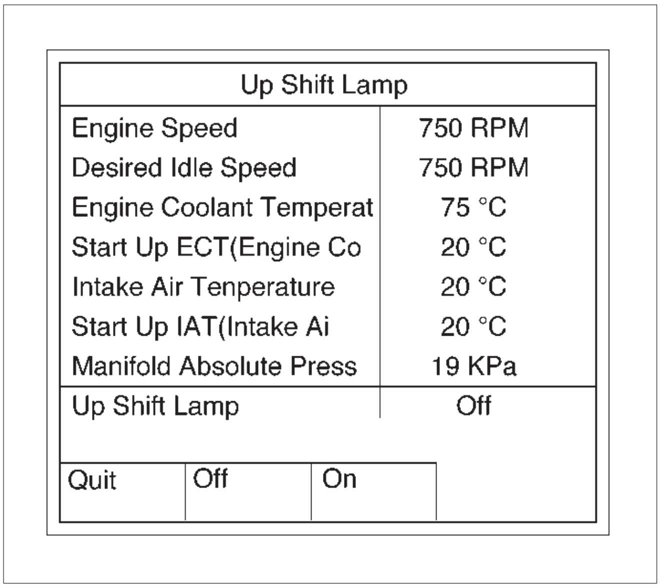
060RX044

5. Select F0:Malfunction Indicator Lamp.



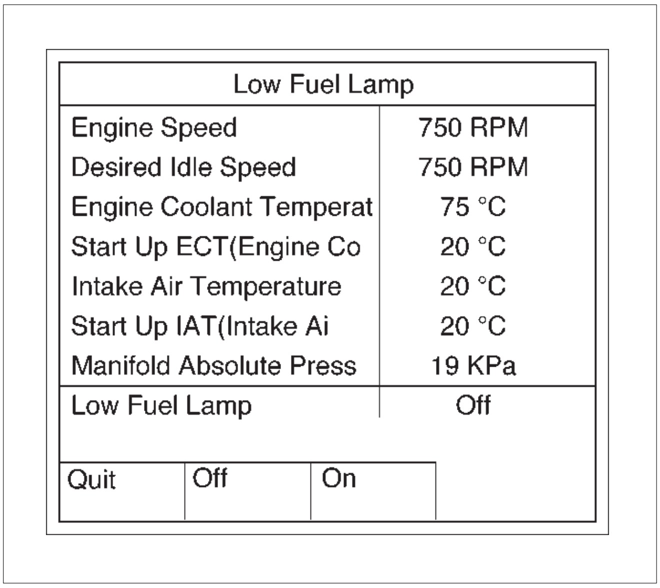
060RX019

6. Push “On” soft key.
7. Make sure Lamp illuminates.
8. If lamp illuminates, the Lamp is operating correctly.
9. Select F1:Up Shift Lamp



060RX045

Select F2:Low Fuel Lamp



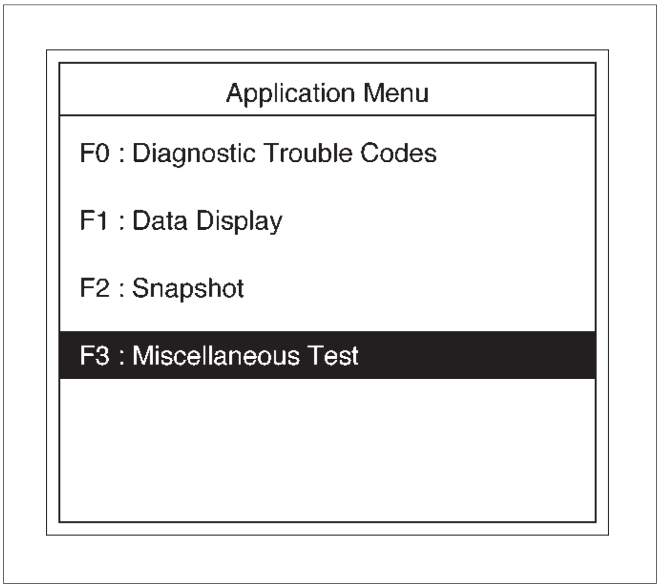
060RX020

10. Push “On” soft key.
11. Make sure Lamp illuminates.
12. If Lamp illuminates, the Lamp is operaing correctly.

Relays Test

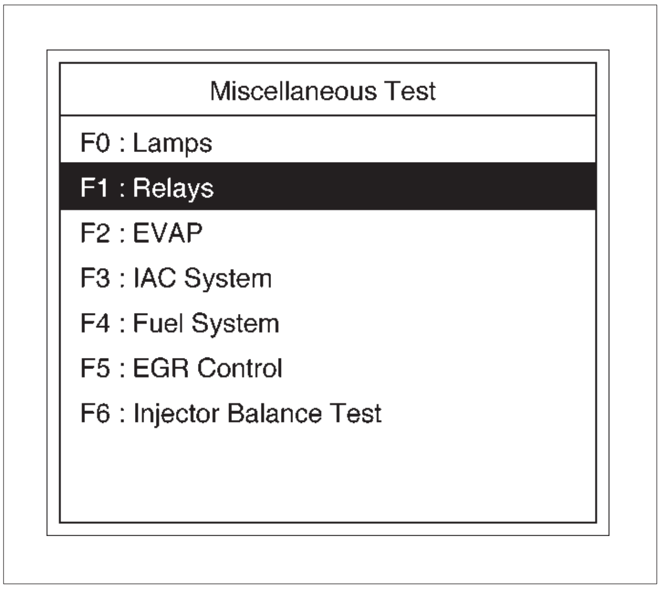
This test is conducted to check Fuel Pump Relay, A/C Clutch Low Fan and High Fan for prepor operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.



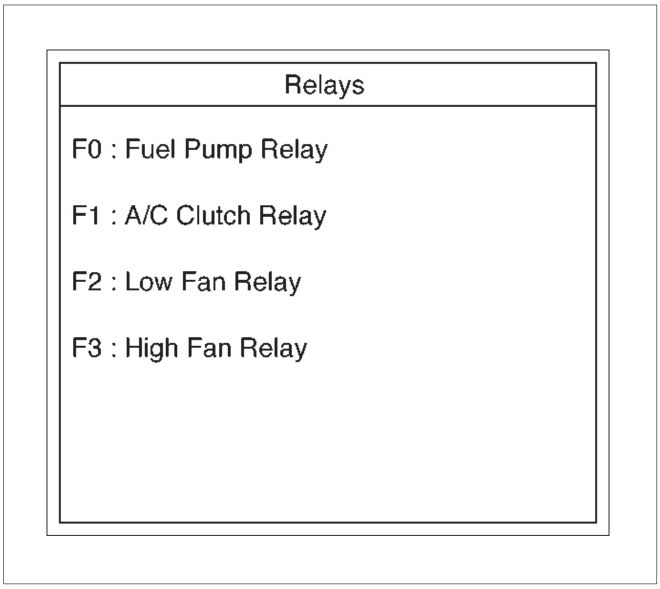
060RW228

4. Select F1:Relay Test in the Miscellaneous Test.



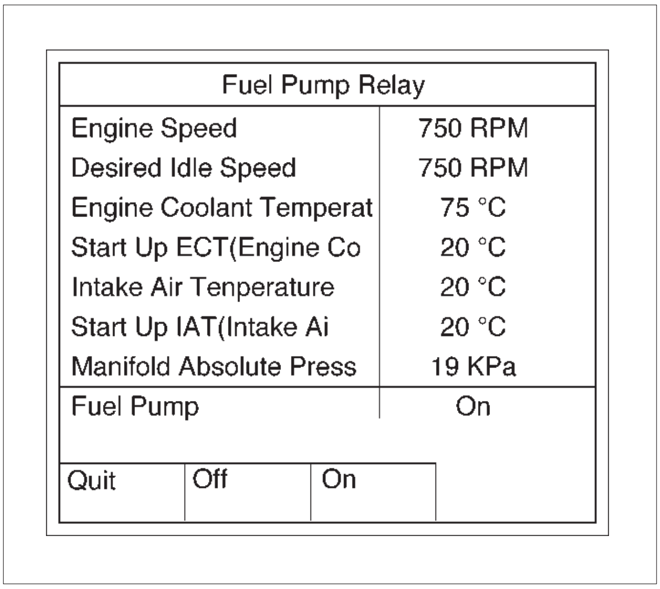
060RX046

5. Select F0:Fuel Pump Relay.



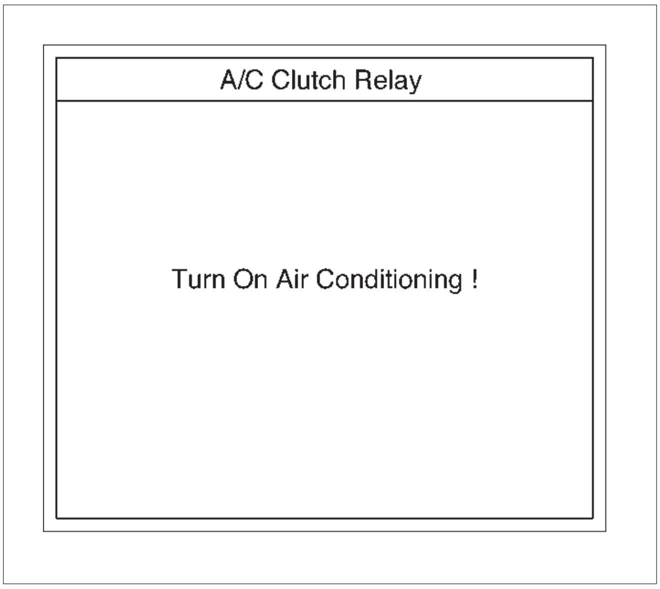
060RX047

6. Push “On” soft key.



060RX022

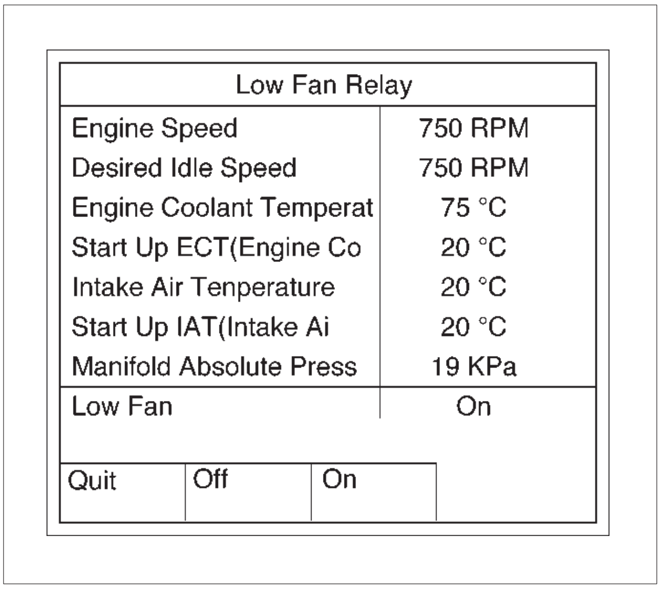
7. Control Fuel Pump Relay and check a data list.
8. If the data list chenges, the Fuel Pump Relay is normal.
9. Select F1:A/C Clutch Relay.
10. *Run the Engine at idle.
11. Turn on Air Condtioning.



060RX023

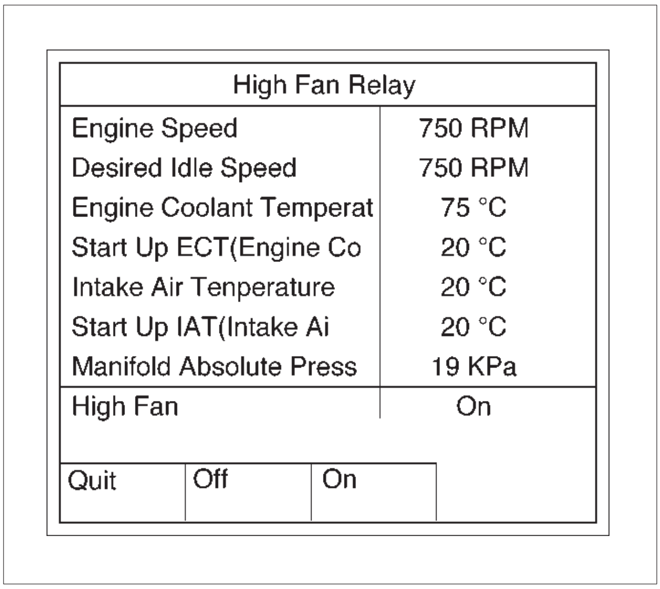
12. Push “On” and “Off” of soft key.
13. Control A/C Clutch Relay and check a data list.
14. If the data list changes, the A/C Clutch Relay is normal.

15. Select F2: Low Fan Relay.



060RX048

16. Push “On” and “Off” of soft key.
17. Control Low Fan Relay and check a data list.
18. If the data list changes, the Low Fan Relay is normal.
19. Run the Fan Motor.
20. Select F3: High Fan Relay.



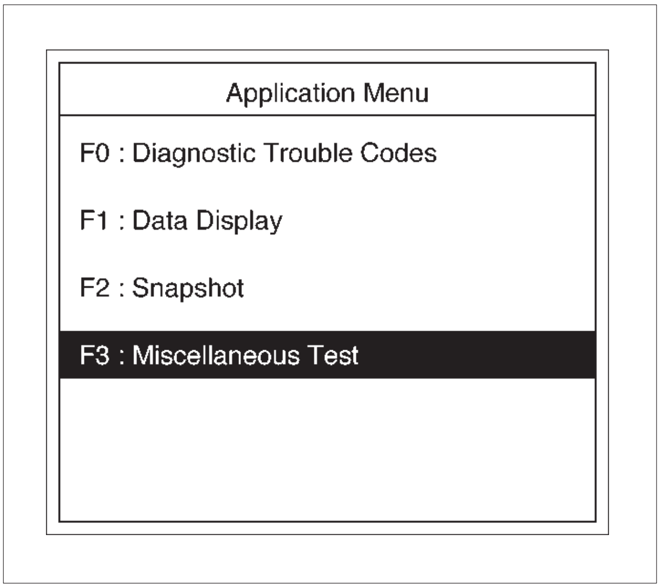
060RX049

21. Push “On” and “Off” of soft key.
22. Control High Fan Relay and check a data list.
    If the data list changes, the High Fan Relay is normal.
23. Run the Fan Motor.

EVAP Test

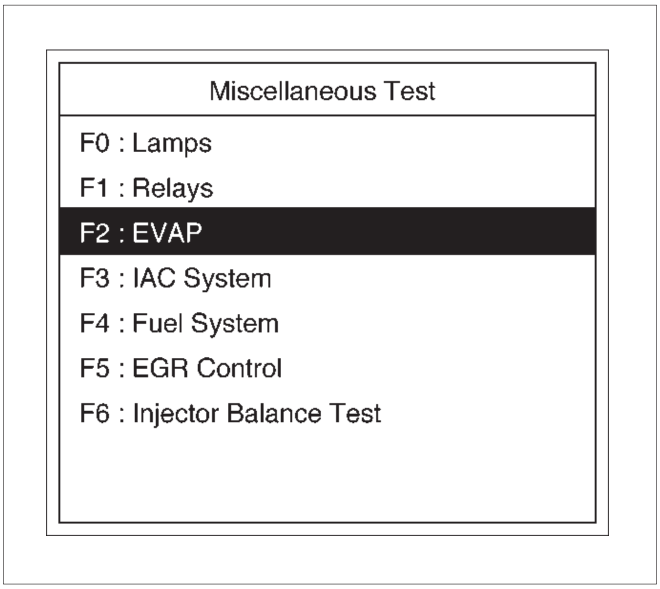
This test is conducted check EVAP system for its working. Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



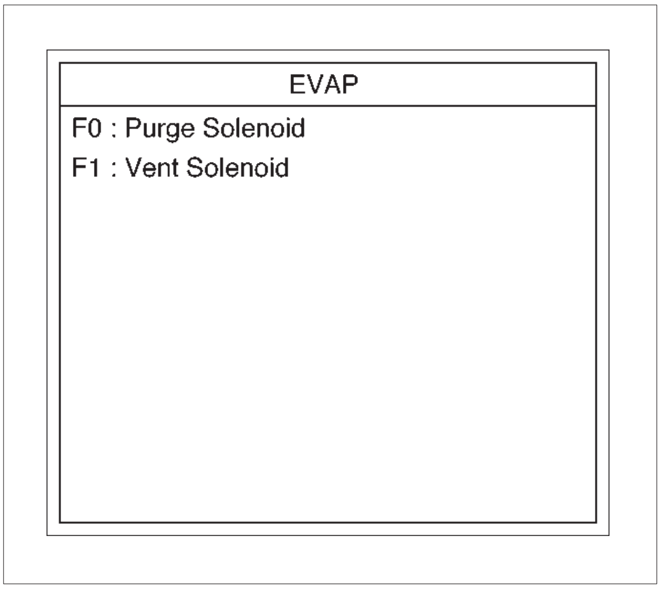
060RW228

4. Select F2:EVAP Test in the Miscellaneous Test.



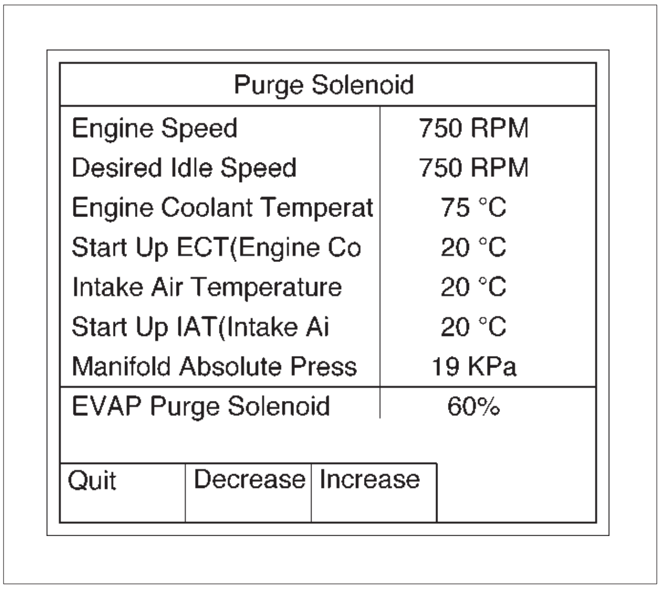
060RX050

5. Select F0: Purge Solenoid.



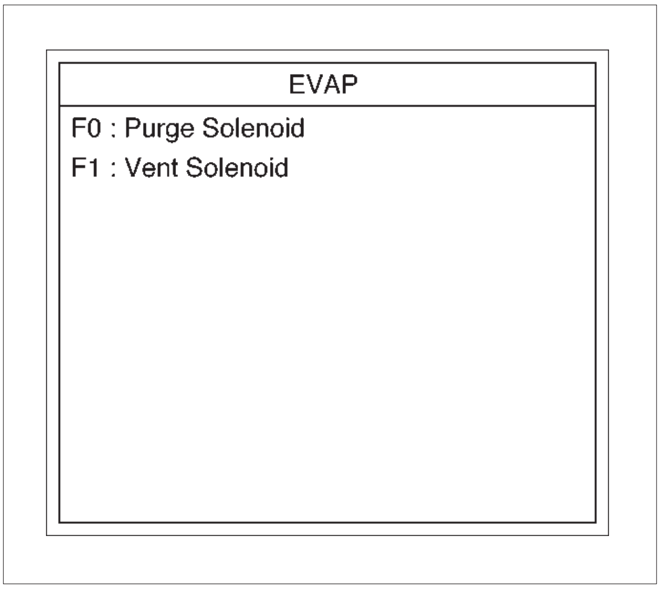
060RX025

6. Push “Decrease” or “Increase” soft key.



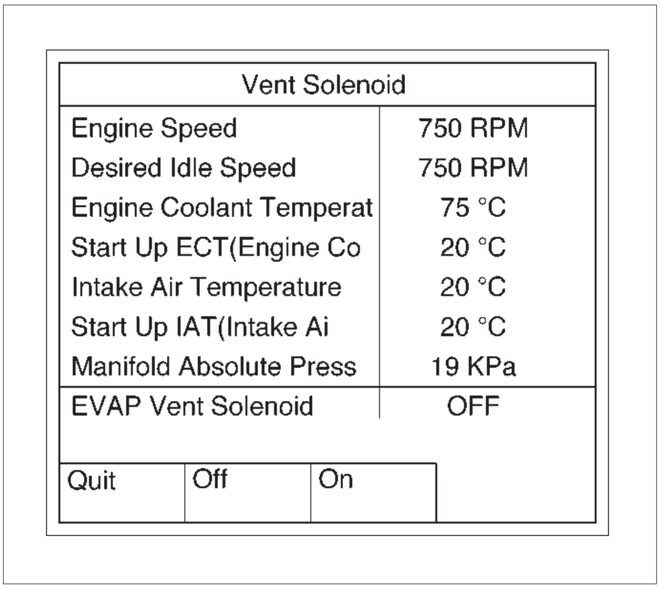
060RX026

7. Control EVAP Purge Solenoid and check a data list.
8. If the data list changes, the purge Solenoid is normal. Ignition SW is “On”.
9. Turn engine off, turn ignition SW “On”.
10. Select F1:EVAP Vent Solenoid.



060RX025

11. Push “On” or “Off” of soft key.



060RX027

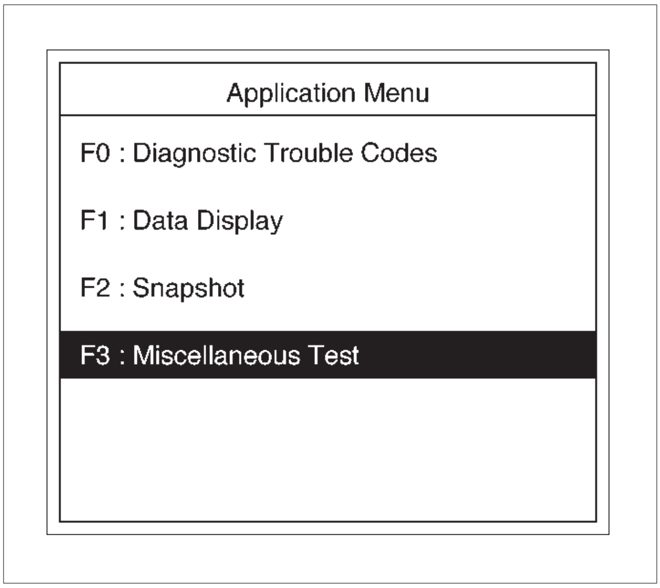
12. Control EVAP Vent Solenoid and check a data list.
13. If the data list changes, the EVAP Vent Solenoid is normal.

Idle Air Control System Test

This test is conducted check to IAC system for proper operation.
Tech 2 must be used for this test.
Test Procedure:

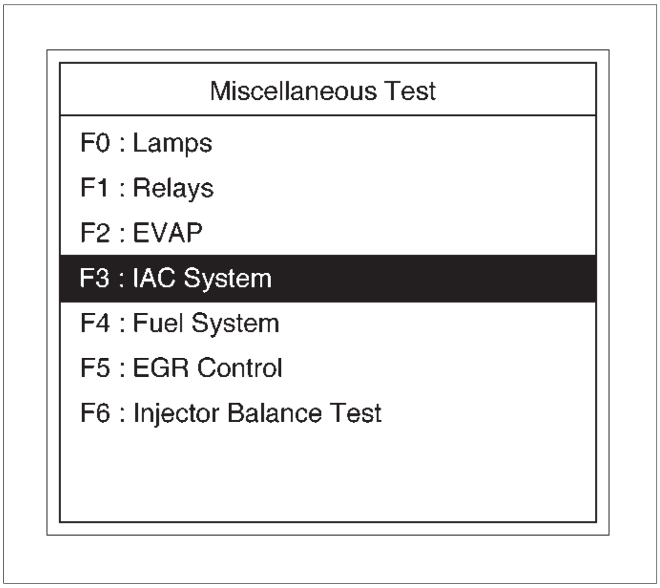
1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.

3. Select F3: Miscellaneous Test in the Application Menu.



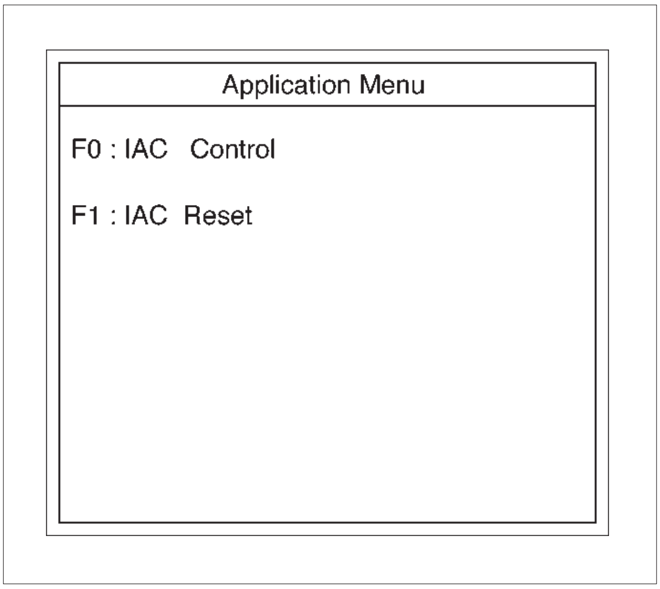
060RW228

4. Select F3: IAC System Test in the Miscellaneous Test.



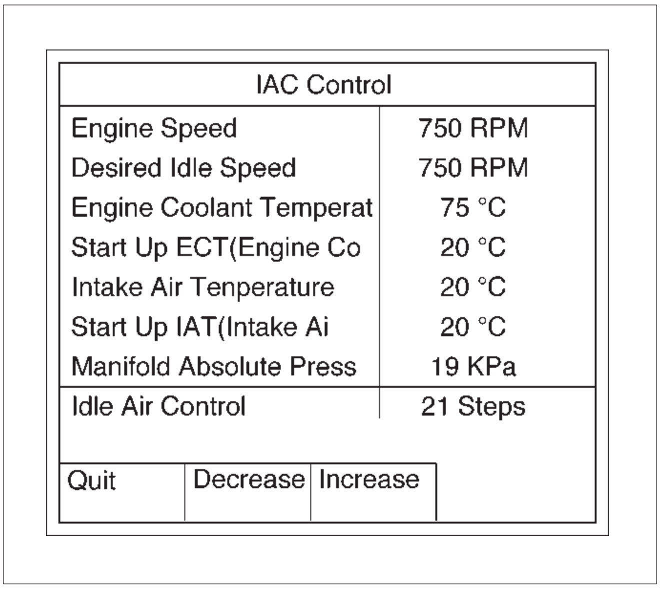
060RX051

5. Select F1: IAC Control Test.



060RX052

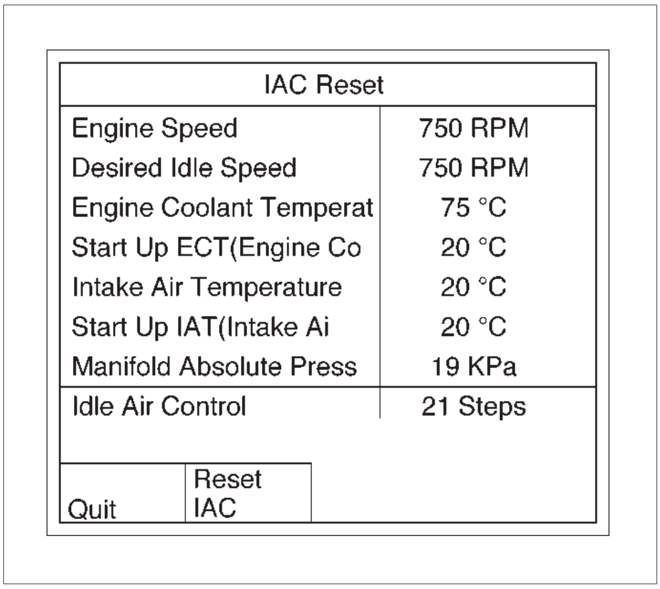
6. Push “Increase” or “Decrease” soft key.
7. Control IAC system and check a data list.
   - F0: IAC Control



060RX015

8. Select F1: IAC Reset.
9. Push “Reset IAC” soft key.
10. Control IAC Reset and check data list.

11. If data list changes, the IAC has been Reset.

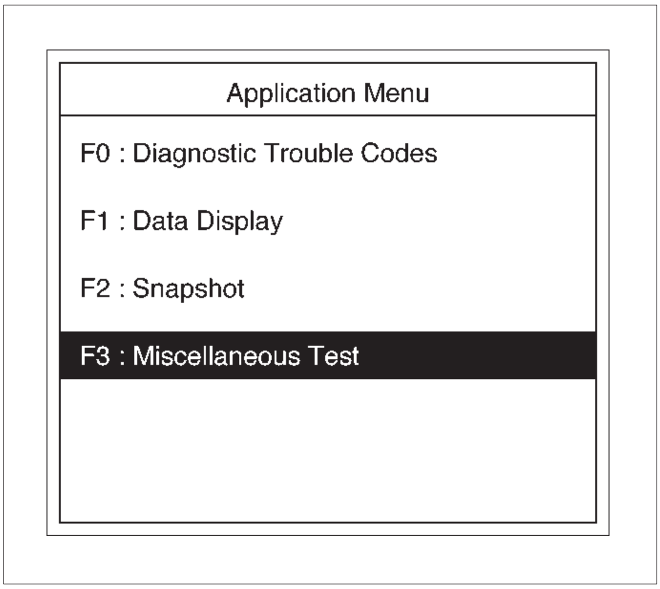


060RW231–1

Fuel System Test

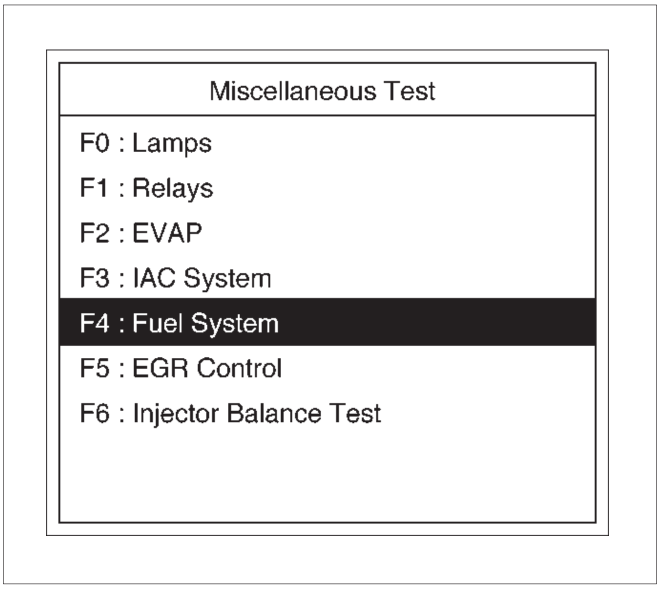
This test is conducted check Fuel Level Gauge for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.



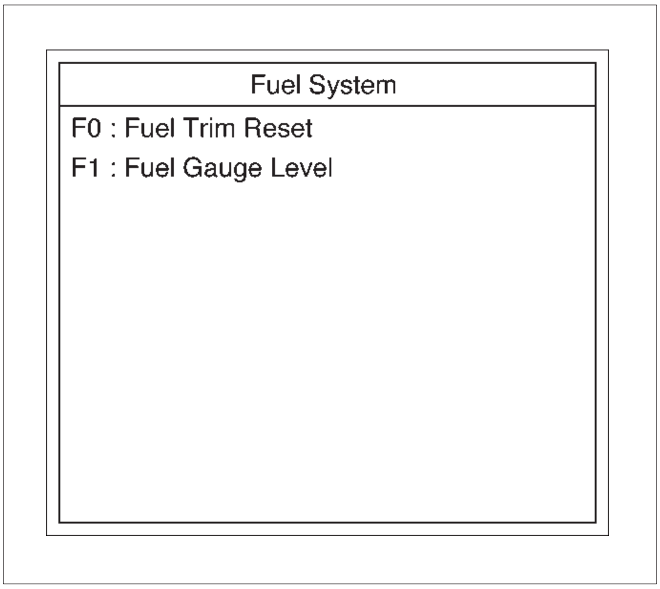
060RW228

4. Select F4: Fuel System in the Miscellaneous Menu.



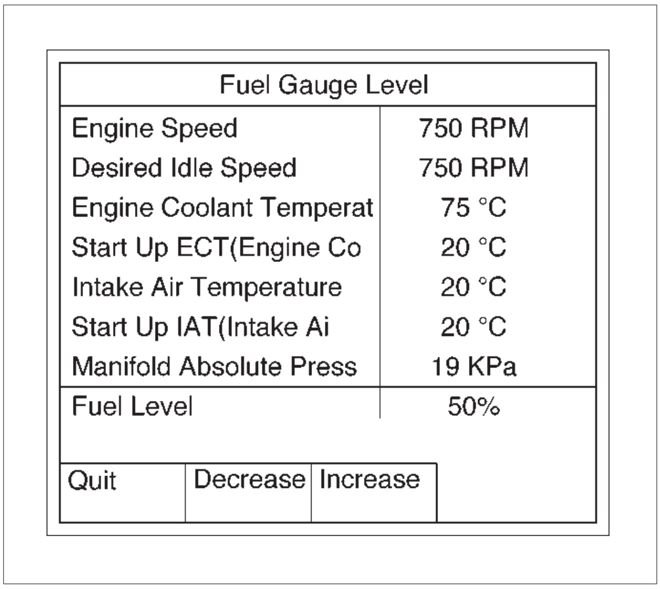
060RX053

5. Select F1: Fuel Gauge Level



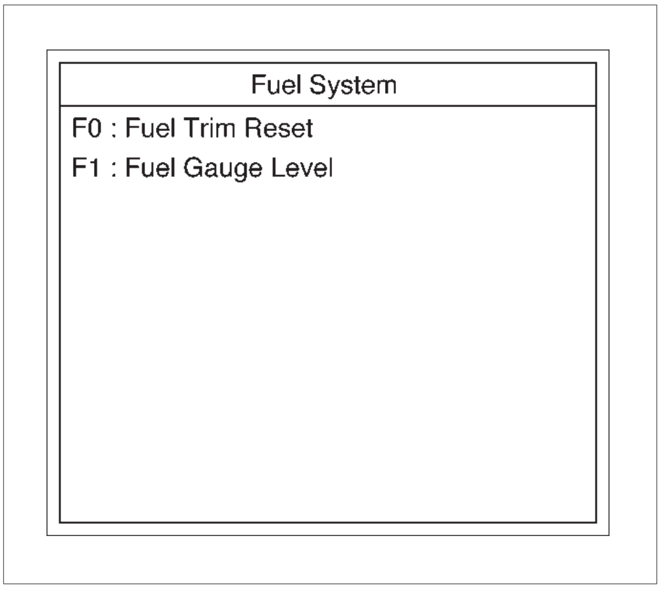
060RX028

6. Push “Decrease” or “Increase” of soft key.



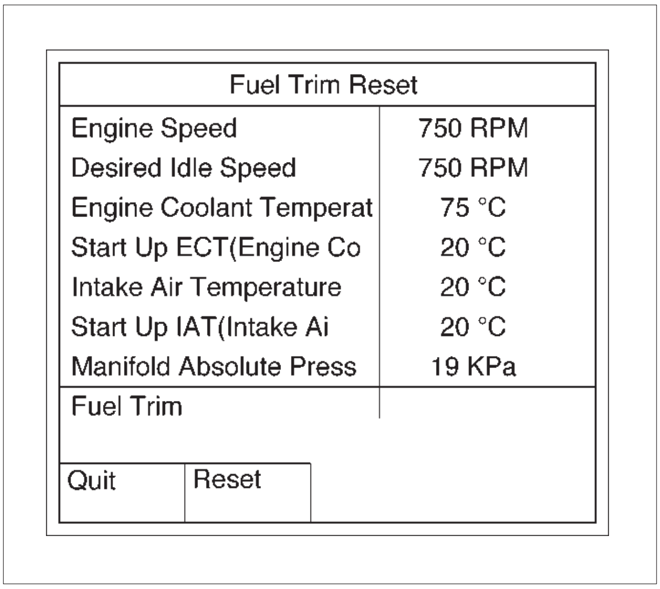
060RX030

7. Control Fuel Level and check data list.
8. If data list changes, the Fuel Gauge Level is normal.
9. Select F0: Fuel Trim Reset.



060RX028

10. Push “Reset” of soft key.



060RX029

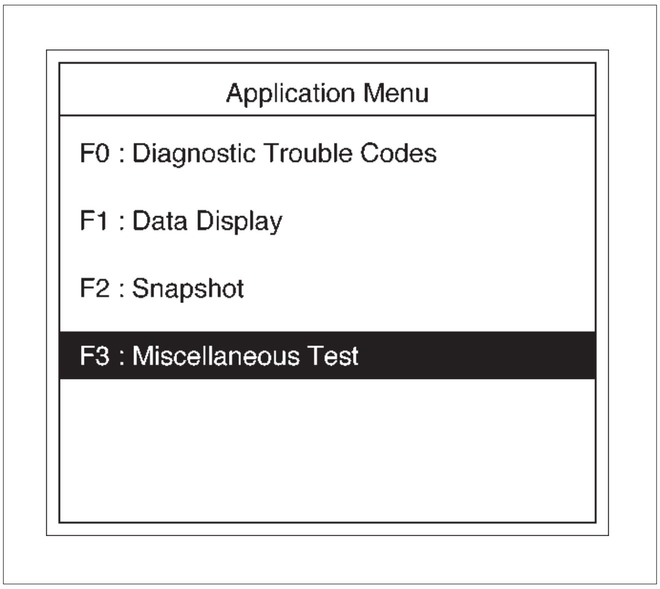
EGR Control Test

This test is conducted check EGR valve for proper operation.

Tech 2 must be used for this test.

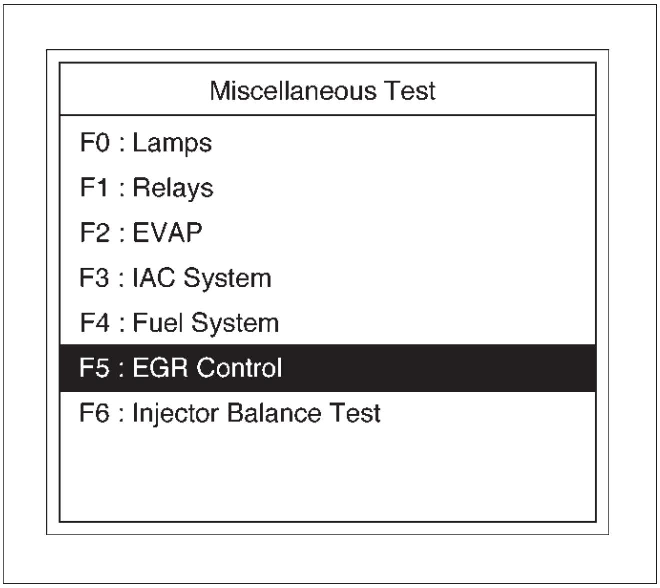
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



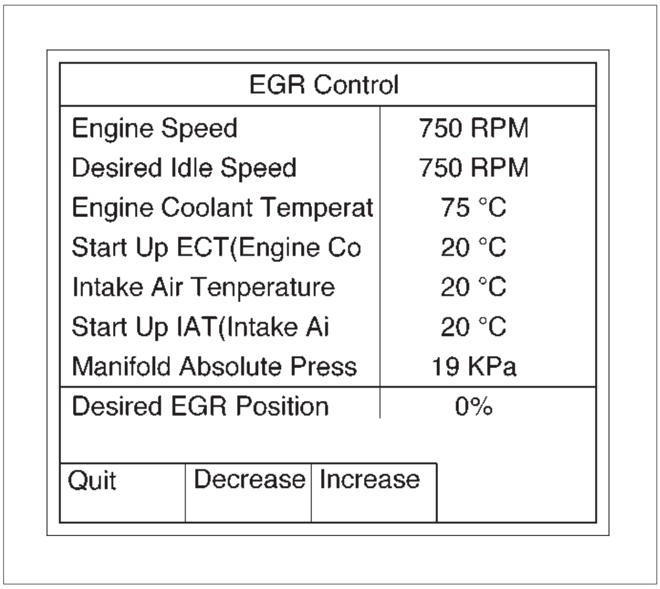
060RW228

4. Select F5: EGR Control Test in the Miscellaneous Test.



060RX054

5. Control EGR Valve and check data list.



060RX017

6. If the change, the EGR Control is normal.

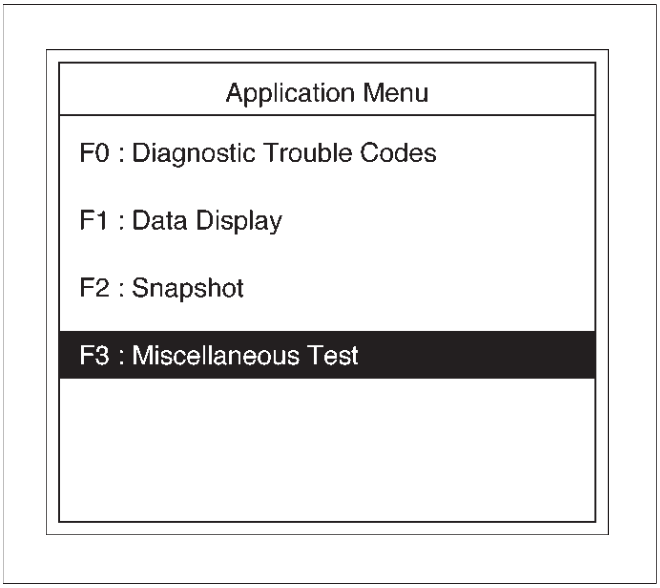
Injector Balance Test

This test is conducted to make sure the appropriate electric signals are being sent to injectors Nos. 1–6.

Tech 2 must be used for this test.

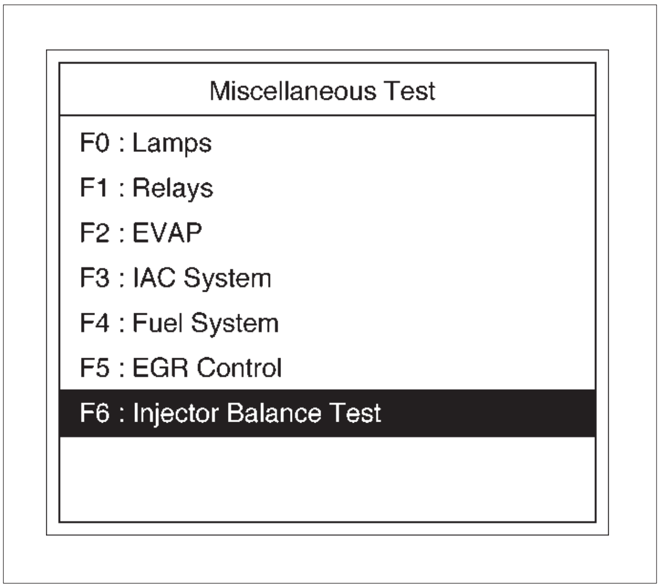
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



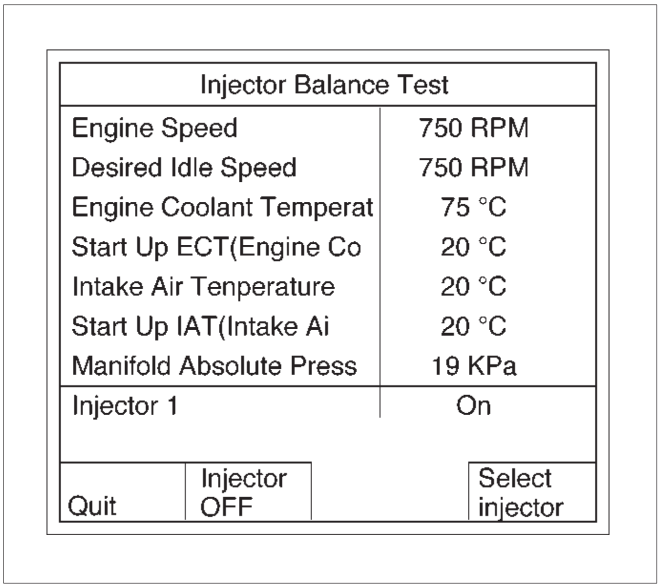
060RW228

4. Select F6: Injector Balance Test in the Miscellaneous Test.



060RX055

5. Select injector number and push “injector off” of soft key.

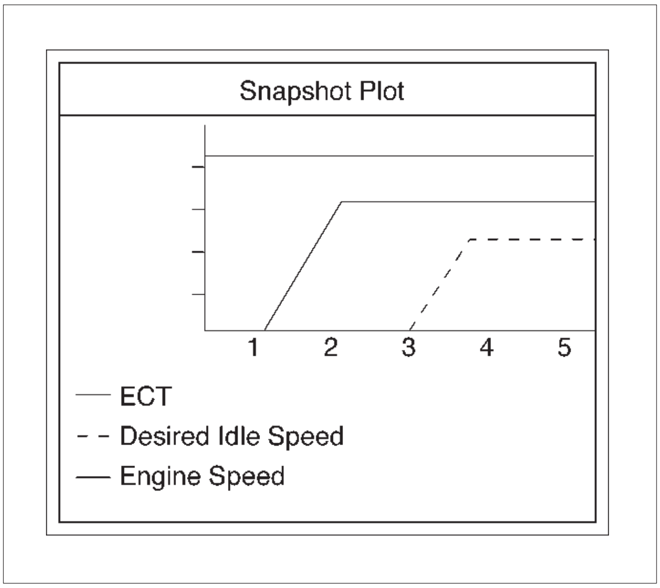


060RW230–1

6. Make sure of engine speed change.
7. If engine speed changes, the injector electric circuit is normal.
   If engine speed does not change, the injector electric circuit or the injector itself is not normal.

Plotting Snapshot Graph

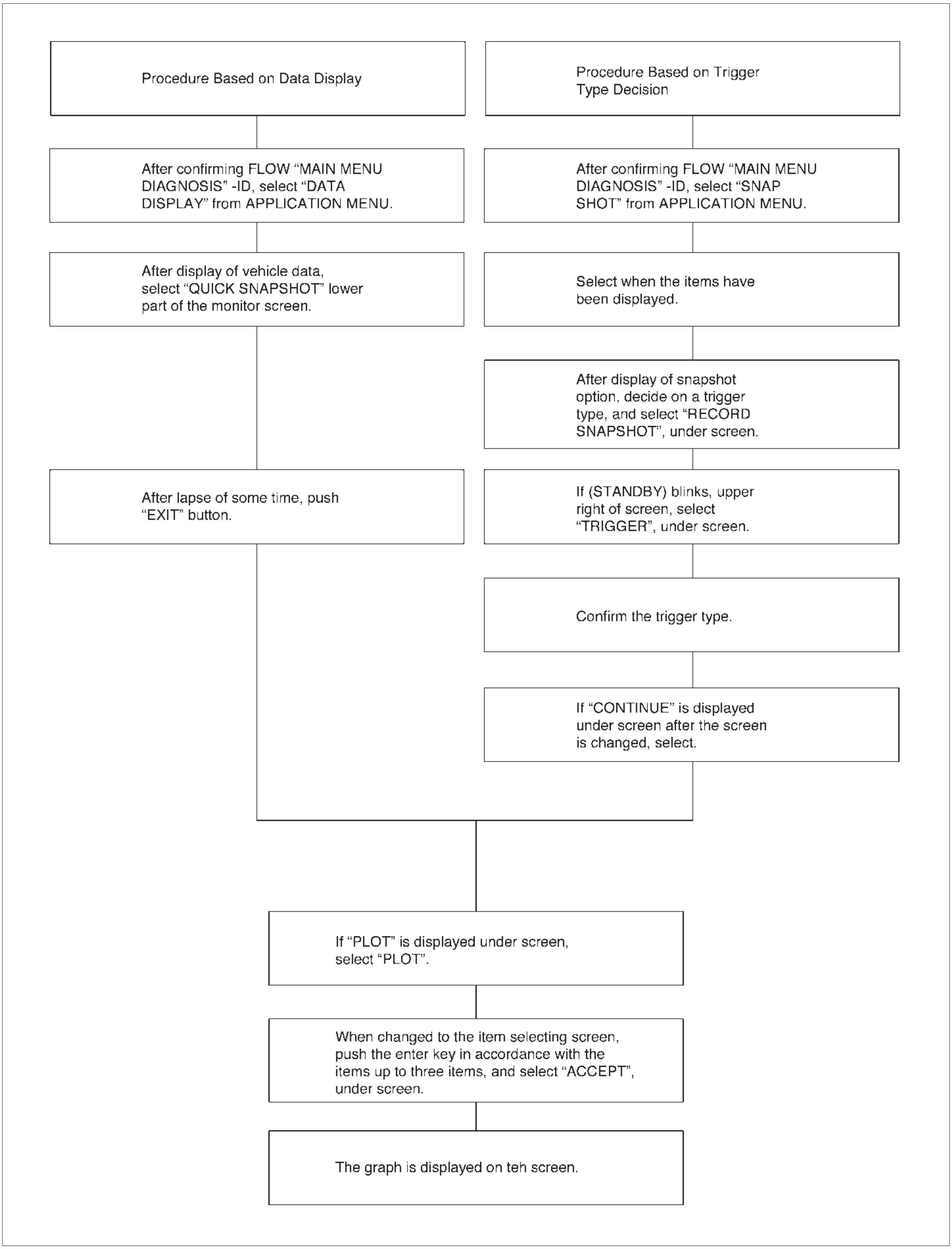
This test selects several necessary items from the data list to plot graphs and makes data comparison on a long term basis. It is an effective test particularly in emission related evaluations.



060RX037

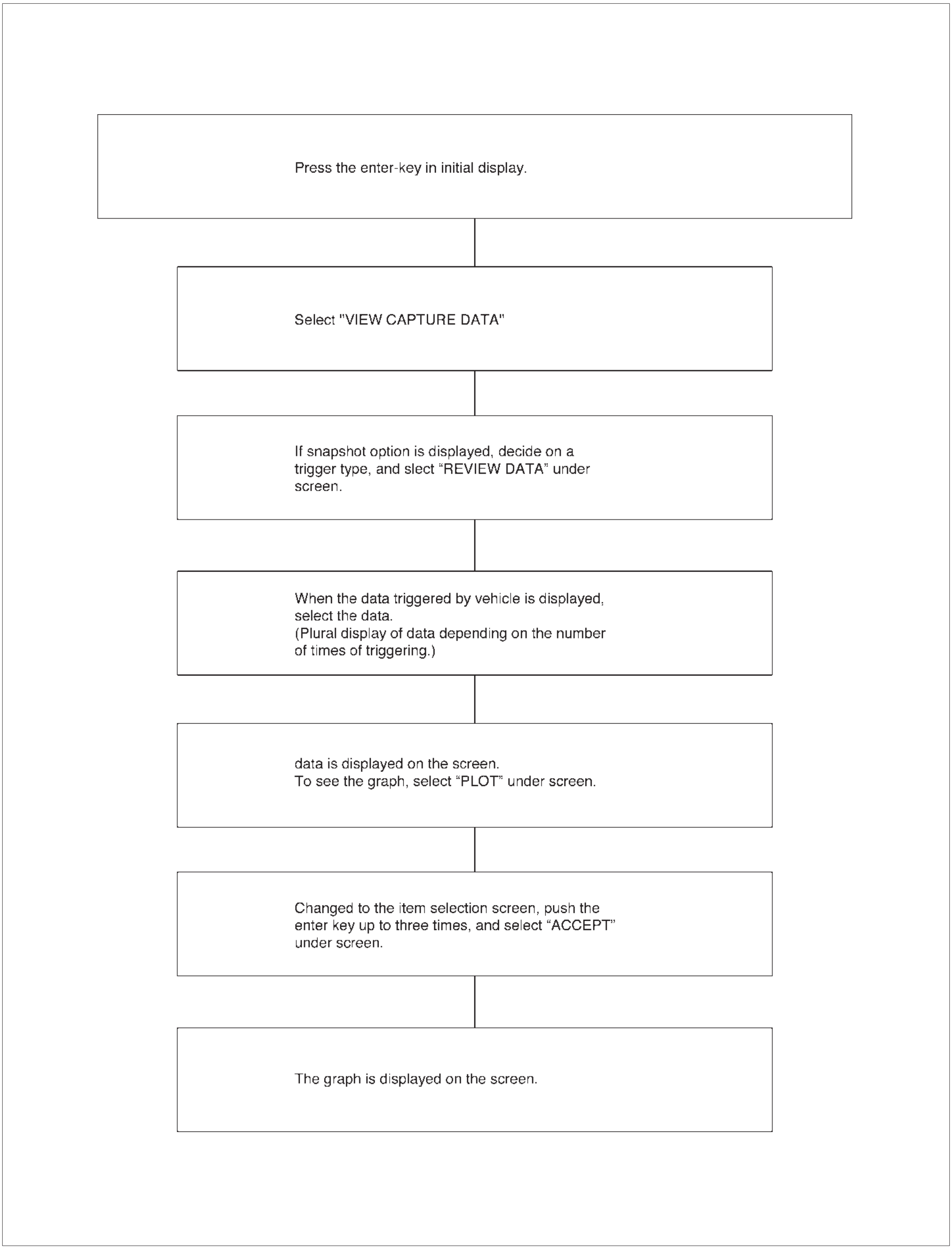
For trouble diagnosis, you can collect graphic data (snap shot) directly from the vehicle. You can replay the snapshot data as needed. There fore, accurate diagnosis is possible, even though the vehicle is not available.

Plotting Graph Flow Chart (Plotting graph after obtaining vehicle information)



060RX041

Flow Chart for Snapshot Replay (Plotting Graph)



060RX040

PRIMARY SYSTEM–BASED DIAGNOSTICS

Primary System–Based Diagnostics

There are primary system–based diagnostics which evaluate system operation and its effect on vehicle emissions. The primary system–based diagnostics are listed below with a brief description of the diagnostic function:

Oxygen Sensor Diagnosis

The fuel control heated oxygen sensor (HO2S 1) is diagnosed for the following conditions:

- Heater performance (time to activity on cold start)
- Slow response
- Response time (time to switch R/L or L/R)
- Inactive signal (output steady at bias voltage – approx. 450 mV)
- Signal fixed high
- Signal fixed low

The catalyst monitor heated oxygen sensor (HO2S 2) is diagnosed for the following conditions:

- Heater performance (time to activity on cold start).
- Signal fixed low during steady state conditions or power enrichment (hard acceleration when a rich mixture should be indicated).
- Signal fixed high during steady state conditions or deceleration mode (deceleration when a lean mixture should be indicated).
- Inactive sensor (output steady at approx. 438 mV).

If the oxygen sensor pigtail wiring, connector or terminal are damaged, the entire oxygen sensor assembly must be replaced. DO NOT attempt to repair the wiring, connector or terminals. In order for the sensor to function properly, it must have clean reference air provided to it. This clean air reference is obtained by way of the oxygen sensor wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the reference air and degrade oxygen sensor performance. Refer to On–Vehicle Service, Heated Oxygen Sensors.

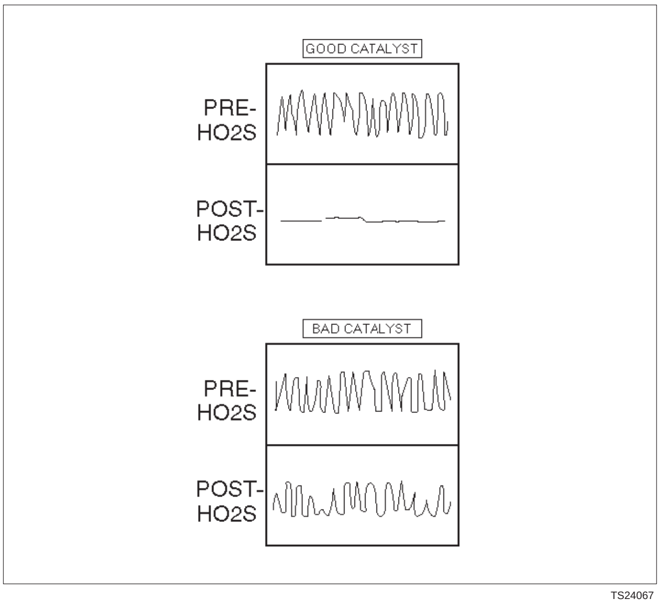
Fuel Control Heated Oxygen Sensors

The main function of the fuel control heated oxygen sensors is to provide the control module with exhaust stream oxygen content information to allow proper fueling and maintain emissions within mandated levels. After it reaches operating temperature, the sensor will generate a voltage, inversely proportional to the amount of oxygen present in the exhaust gases. The control module uses the signal voltage from the fuel control heated oxygen sensors while in ”Closed Loop” to adjust fuel injector pulse width. While in ”Closed Loop”, the PCM can adjust fuel delivery to maintain an air/fuel ratio which allows the best combination of emission control and driveability. The fuel control heated oxygen sensors are also used to determine catalyst efficiency.

HO2S Heater

Heated oxygen sensors are used to minimize the amount of time required for ”Closed Loop” fuel control to begin operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensor (HO2S 1) to become active. Oxygen sensor heaters are required by the catalyst monitor sensor (HO2S 2) to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further away from the engine.

Catalyst Monitor Heated Oxygen Sensors And Diagnostic Operation



To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three–way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The PCM has the ability to monitor this process using the pre–catalyst and post–catalyst heated oxygen sensors. The pre–catalyst sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three–way catalytic converter. The post–catalyst sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst’s ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the pre–catalyst signal will be far more active than that produced by the post–catalyst sensor.

In addition to catalyst monitoring, the heated oxygen sensors have a limited role in controlling fuel delivery. If the sensor signal indicates a high or low oxygen content for an extended period of time while in ”Closed Loop”, the PCM will adjust the fuel delivery slightly to compensate.

- For the 2.2L engine, the pre–catalyst monitor sensor is designated Bank 1 HO2S 1. The post–catalyst sensor is Bank 1 HO2S 2.

Catalyst Monitor Outputs

The catalyst monitor diagnostic is sensitive to the following conditions:

- Exhaust leaks
- HO2S contamination
- Alternate fuels

Exhaust system leaks may cause the following:

- Preventing a degraded catalyst from failing the diagnostic.
- Causing a false failure for a normally functioning catalyst.
- Preventing the diagnostic from running.

Some of the contaminants that may be encountered are phosphorus, lead, silica, and sulfur. The presence of these contaminants will prevent the TWC diagnostic from functioning properly.

Three–Way Catalyst Oxygen Storage Capacity

The Three–Way catalyst (TWC) must be monitored for efficiency. To accomplish this, the control module monitors the pre–catalyst HO2S and post–catalyst HO2S oxygen sensors. When the TWC is operating properly, the post–catalyst oxygen sensor will have significantly less activity than the pre–catalyst oxygen sensor. The TWC stores and releases oxygen as needed during its normal reduction and oxidation process. The control module will calculate the oxygen storage capacity using the difference between the pre–catalyst and post catalyst oxygen sensor's voltage levels. If the activity of the post–catalyst oxygen sensor approaches that of the pre–catalyst oxygen sensor, the catalyst's efficiency is degraded.

Stepped or staged testing level allow the control module to statistically filter test information. This prevents falsely passing or falsely failing the oxygen storage capacity test. The calculations performed by the on–board diagnostic system are very complex. For this reason, post catalyst oxygen sensor activity should not be used to determine oxygen storage capacity unless directed by the service manual.

Two stages are used to monitor catalyst efficiency. Failure of the first stage will indicate that the catalyst requires further testing to determine catalyst efficiency. The second stage then looks at the inputs from the pre and post catalyst HO2S sensors more closely before determining if the catalyst is indeed degraded. This further statistical processing is done to increase the accuracy of oxygen storage capacity type monitoring. Failing the first (stage 1) test DOES NOT indicate a failed catalyst. The catalyst may be marginal or the fuel sulfur content could be very high.

Aftermarket HO2S characteristics may be different from the original equipment manufacturer sensor. This may lead to a false pass or a false fail of the catalyst monitor diagnostic. Similarly, if an aftermarket catalyst does not contain the same amount of cerium as the original part, the correlation between oxygen storage and conversion efficiency may be altered enough to set a false DTC.

MISFIRE MONITOR DIAGNOSTIC OPERATION

Misfire Monitor Diagnostic Operation

The misfire monitor diagnostic is based on crankshaft rotational velocity (reference period) variations. The PCM determines crankshaft rotational velocity using the crankshaft position sensor and camshaft position sensor. When a cylinder misfires, the crankshaft slows down momentarily. By monitoring the crankshaft and camrhaft position sensor signals, the PCM can calculate when a misfire occurs.

For a non–catalyst damaging misfire, the diagnostic will be required to monitor a misfire present for between 1000–3200 engine revolutions.

For catalyst–damaging misfire, the diagnostic will respond to misfire within 200 engine revolutions.

Rough roads may cause false misfire detection. A rough road will cause torque to be applied to the drive wheels and drive train. This torque can intermittently decrease the crankshaft rotational velocity. This may be falsely detected as a misfire.

Misfire Counters

Whenever a cylinder misfires, the misfire diagnostic counts the misfire and notes the crankshaft position at the time the misfire occurred. These ”misfire counters” are basically a file on each engine cylinder. A current and a history misfire counter are maintained for each cylinder. The misfire current counters (Misfire Cur #1–4) indicate the number of firing events out of the last 200 cylinder firing events which were misfires. The misfire current counter will display real time data without a misfire DTC stored. The misfire history counters (Misfire Hist#1–4) indicate the total number of cylinder firing events which were misfires. The misfire history counters will display 0 until the misfire diagnostic has failed and a DTC P0300 is set. Once the misfire DTC P0300 is set, the misfire history counters will be updated every 200 cylinder firing events. A misfire counter is maintained for each cylinder.

If the misfire diagnostic reports a failure, the diagnostic executive reviews all of the misfire counters before reporting a DTC. This way, the diagnostic executive reports the most current information.

When crankshaft rotation is erratic, a misfire condition will be detected. Because of this erratic condition, the data that is collected by the diagnostic can sometimes incorrectly identify which cylinder is misfiring.

Use diagnostic equipment to monitor misfire counter data on OBD II–compliant vehicles. Knowing which specific cylinder(s) misfired can lead to the root cause, even when dealing with a multiple cylinder misfire. Using the information in the misfire counters, identify which cylinders are misfiring. If the counters indicate cylinders numbers 1 and 4 misfired, look for a circuit or component common to both cylinders number 1 and 4.

Misfire counter information is located in the ”Specific Eng.” menu, ”Misfire Data” sub–menu of the data list.

The misfire diagnostic may indicate a fault due to a temporary fault not necessarily caused by a vehicle emission system malfunction. Examples include the following items:

- Contaminated fuel
- Low fuel
- Fuel–fouled spark plugs
- Basic engine fault

FUEL TRIM SYSTEM MONITOR DIAGNOSTIC OPERATION

Fuel Trim System Monitor Diagnostic Operation

This system monitors the averages of short–term and long–term fuel trim values. If these fuel trim values stay at their limits for a calibrated period of time, a malfunction is indicated. The fuel trim diagnostic compares the averages of short–term fuel trim values and long–term fuel trim values to rich and lean thresholds. If either value is within the thresholds, a pass is recorded. If both values are outside their thresholds, a rich or lean DTC will be recorded.

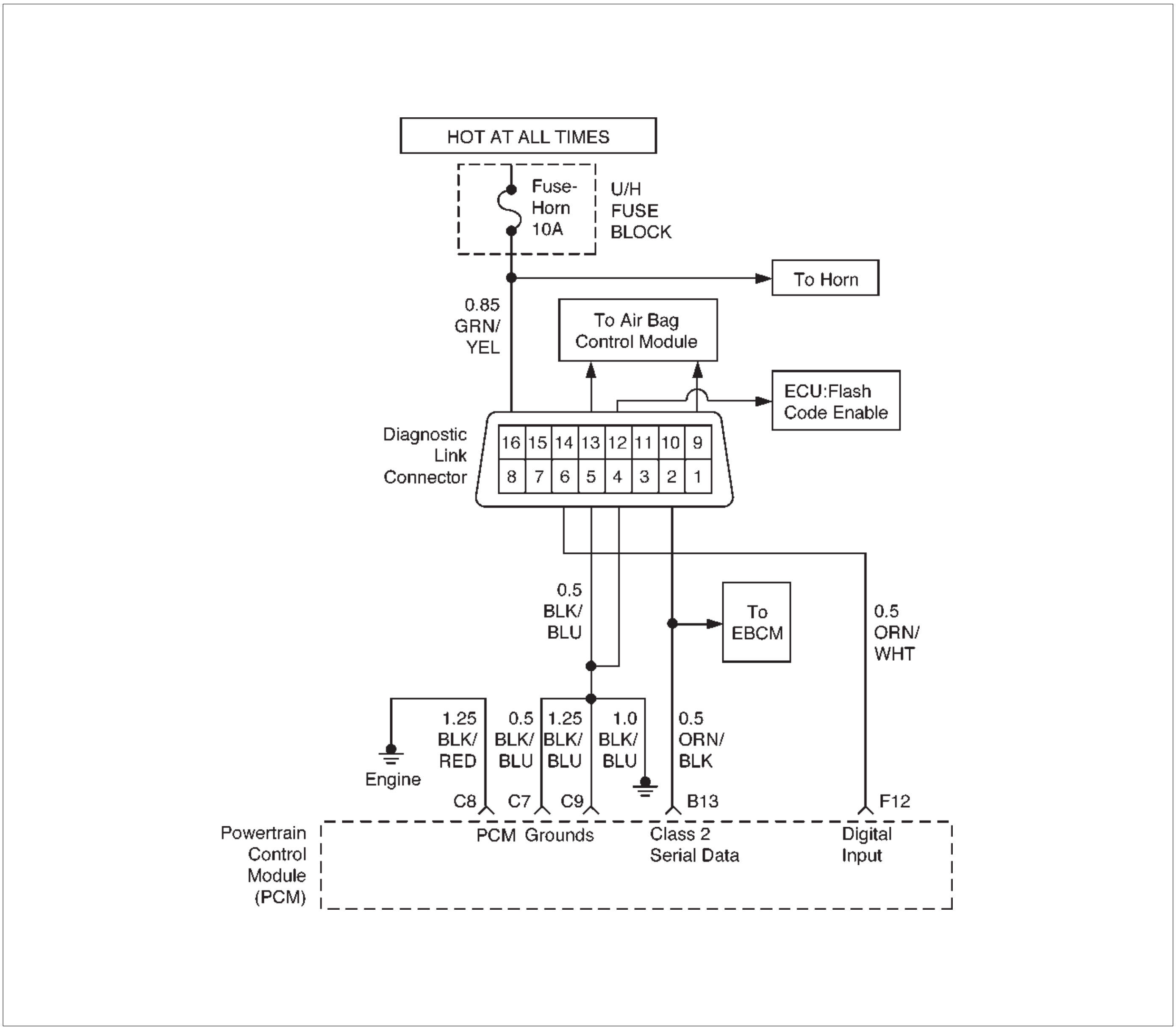
The fuel trim system diagnostic also conducts an intrusive test. This test determines if a rich condition is being caused by excessive fuel vapor from the EVAP canister. In order to meet OBD II requirements, the control module uses weighted fuel trim cells to determine the need to set a fuel trim DTC. A fuel trim DTC can only be set if fuel trim counts in the weighted fuel trim cells exceed specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e., engine idle high due to a small vacuum leak or rough idle due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use the Tech 2 to observe fuel trim counts while the problem is occurring.

A fuel trim DTC may be triggered by a number of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Fuel Trim Cell Diagnostic Weights

No fuel trim DTC will set regardless of the fuel trim counts in cell 0 unless the fuel trim counts in the weighted cells are also outside specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e. engine idle high due to a small vacuum leak or rough due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use the Tech 2 to observe fuel trim counts while the problem is occurring.

ON–BOARD DIAGNOSTIC (OBD II) SYSTEM CHECK



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Circuit Description

The on–board diagnostic system check is the starting point for any driveability complaint diagnosis. Before using this procedure, perform a careful visual/physical check of the PCM and engine grounds for cleanliness and tightness.

The on–board diagnostic system check is an organized approach to identifying a problem created by an electronic engine control system malfunction.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The MIL (”Check Engine” lamp) should be ON steady with the ignition ON/engine OFF. If not, isolate the malfunction in the MIL circuit.
2. Checks the Class 2 data circuit and ensures that the PCM is able to transmit serial data.
3. This test ensures that the PCM is capable of controlling the MIL and the MIL driver circuit is not shorted to ground.
4. If the engine will not start, the Cranks But Will Not Run chart should be used to diagnose the condition.

7. A Tech 2 parameter which is not within the typical range may help to isolate the area which is causing the problem.

10. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.

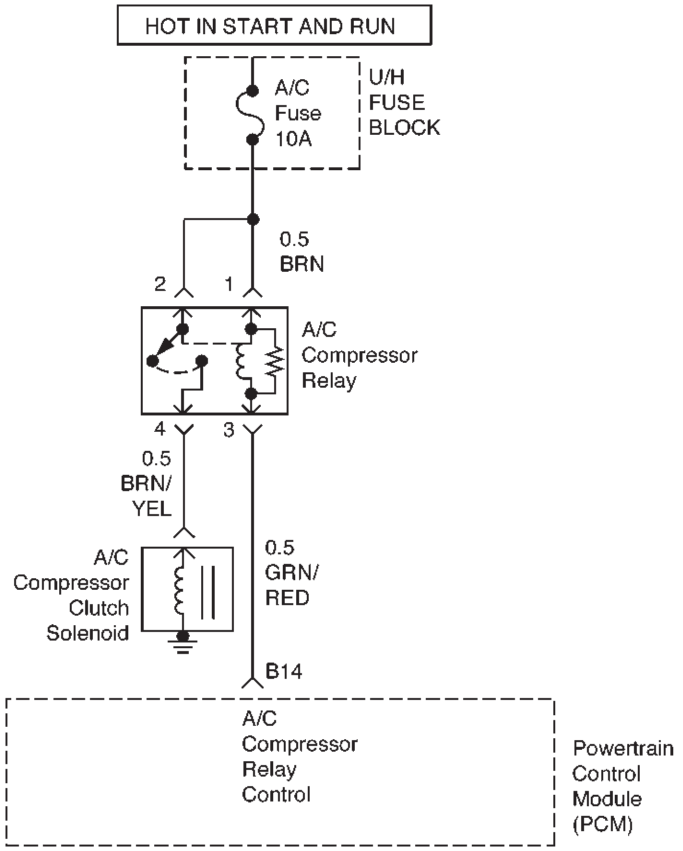
On–Board Diagnostic (OBD II) System Check

Step	Action	Value(s)	Yes	No
1	1. Ignition ON, engine OFF. 2. Observe the malfunction indicator lamp (MIL or ”Check Engine lamp”). Is the MIL (”Check Engine lamp”) ON?	—	Go to *Step 2*	Go to *No MIL*
2	1. Ignition OFF. 2. Install a Tech 2. 3. Ignition ON. 4. Attempt to display PCM engine data with the Tech 2. Does the Tech 2 display PCM data?	—	Go to *Step 3*	Go to *Step 8*
3	1. Using the Tech 2 output tests function, select MIL dash lamp control and command the MIL OFF. 2. Observe the MIL. Did the MIL turn OFF?	—	Go to *Step 4*	Go to MIL *(”Check Engine Lamp”) On Steady*
4	Attempt to start the engine. Did the engine start and continue to run?	—	Go to *Step 5*	Go to *Cranks But Will Not Run*
5	Select ”Display DTCs” with the Tech 2. Are any DTCs stored?	—	Go to *Step 6*	Go to *Step 7*
6	Are two or more of the following DTCs stored? P0107, P0113, P0118, P0122, P0123.	—	Go to *“Multiple PCM Information Sensor DTCs Set”*	Go to *applicable DTC table*
7	Compare PCM data values displayed on the Tech 2 to the typical engine scan data values. Are the displayed values normal or close to the typical values?	—	Go to *“Typial Scan” Data Value*	Go to *indicated Component System Checks*
8	1. Ignition OFF, disconnect the PCM. 2. Ignition ON, engine OFF. 3. Check the Class 2 data circuit for an open, short to ground, or short to voltage. Also, check the DLC ignition feed circuit for an open or short to ground and the DLC ground circuits for an open. 4. If a problem found, repair as necessary. Was a problem found?	—	Go to *Step 2*	Go to *Step 9*

On–Board Diagnostic (OBD II) System Check (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Attempt to reprogram the PCM. Refer to Powertrain Control Module (PCM) in On–Vehicle Service. 2. Attempt to display PCM data with the Tech 2. Does the Tech 2 display PCM engine data?	—	Go to *Step 2*	Go to *Step 10*
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to Powertrain Control Module (PCM) in On–Vehicle Service. And also refer to latest service bulletin Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

A/C CLUTCH CONTROL CIRCUIT DIAGNOSIS



Circuit Description

When air conditioning and blower fan are selected, and if the system has a sufficient refrigerent charge, a 12–volt signal is supplied to the A/C request input of the powertrain control module (PCM). The A/C request signal may be temporarily cancelled during system operation by the electronic thermostat in the evaporator case. The electronic thermostat may intermittently remove the control circuit ground for the A/C thermostat relay to prevent the evaporator from forming ice. When the A/C request signal is received by the PCM, the PCM supplies a ground from the compressor clutch relay if the engine operating conditions are within acceptable ranges. With the A/C compressor relay energized, battery voltage is supplied to the compressor clutch coil.

The PCM will enable the compressor clutch to engage whenever A/C has been selected with the engine running, unless any of the following conditions are present:

- The throttle is greater than 90%.
- The ignition voltage is below 10.5 volts.
- The engine speed is greater than 4500 RPM for 5 seconds or 5400 RPM.
- The engine coolant temperature (ECT) is greater than 125°C (257°F)
- The intake air temperature (IAT) is less than 5°C (41°F).
- The power steering pressure switch signals a high pressure condition position.

Diagnostic Aids

To diagnose an intermittent fault, check for the following conditions:

- Poor connection at the PCM – Inspect harness connections for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.

- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery voltage, and open circuits. If the harness appears to be OK, observe the A/C clutch while moving connnectors and wiring harnesses related to the A/C. A sudden clutch malfunction will indicate the source of the intermittent.

A/C Clutch Diagnosis

This chart should be used for diagnosing the electrical portion of the A/C compressor clutch circuit. A Tech 2 will be used in diagnosing the system. The Tech 2 has the ability to read the A/C request input to the PCM. The Tech 2 can display when the PCM has commended the A/C clutch ON. The Tech 2 should have the ability to override the A/C request signal and energize the A/C compressor relay.

A/C Clutch Control Circuit Diagnosis

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition ON, engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTCs. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P1546. Does the Tech 2 indicate DTC P1546 ”Ran and Passed”?	—	*Refer to Diagnostic Aids*	Go to *Step 3*
3	1. Ignition OFF. 2. Remove the A/C Compressor Relay from the Underhood Electrical Center. 3. Ignition ON, engine OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the Fused pins of the A/C Compressor Clutch Relat connector. Does the DVM read the following value?	12 Volts	Go to *Step 5*	Go to *Step 4*
4	Check the suspect circuit(s) between the A/C Compressor Clutch Relay connector and the Fuse for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	—
5	1. Ignition OFF. 2. Disconnect the Powertrain Controlm Module (PCM) connectors from the PCM. 3. Check the A/C Compressor Clutch Relay control circuit between the PCM and Underhood Electrical Center for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	Go to *Step 6*

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Reinstall the A/C Compressor Clutch Relay. 2. Using a fused jumper, ground the A/C Compressor Clutch Relay control circuit at the PCM connector. 3. Ignition ON, engine OFF. Does the A/C Compressor turn ON?	—	Go to *Step 9*	Go to *Step 7*
7	1. Ignition OFF. 2. Check the A/C Compressor Clutch circuit between the A/C Compressor Clutch Relay and A/C Compressor Clutch for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	Go to *Step 8*
8	Replace the A/C Compressor Clutch Relay. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed.Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest service bulletin Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

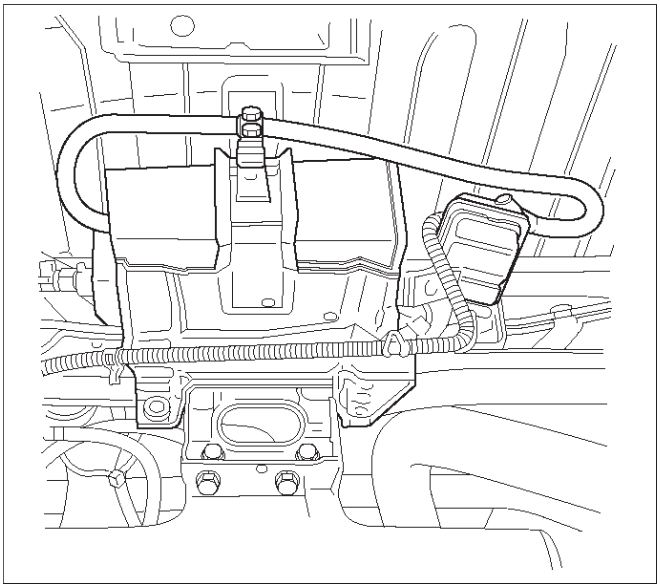
ELECTRONIC IGNITION SYSTEM DIAGNOSIS

If the engine cranks but will not run or immediately stalls, the Engine Cranks But Will Not Start chart must be used to determine if the failure is in the ignition system or the fuel system. If DTC P0300, P0341, P0342, or P0336 is set, the appropriate diagnostic trouble code chart must be used for diagnosis.
If a misfire is being experienced with no DTC set, for diagnosis, refer to the Symptoms section.

EVAP CANISTER PURGE SOLENOID

A continuous purge condition with no purge commanded by the PCM will set a DTC P1441. A fault (small leak) in the EVAP purge vacuum system will set a DTC P0442. Refer to the DTC charts for further information.

VISUAL CHECK OF THE EVAPORATIVE EMISSION CANISTER



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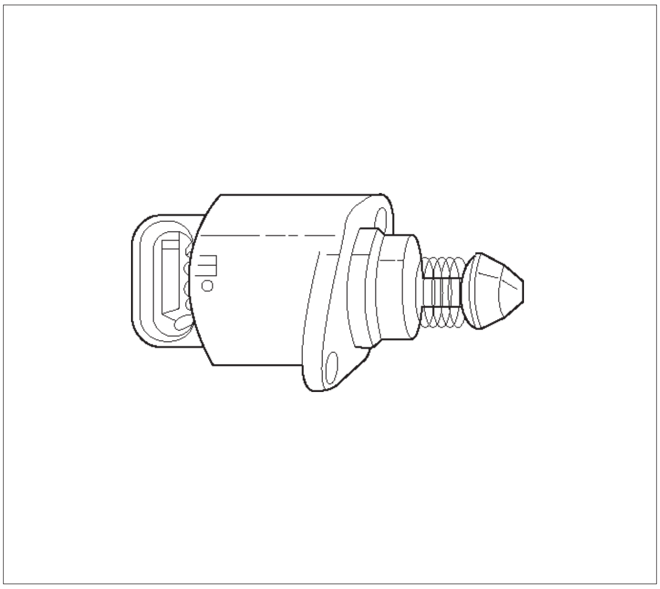
- If the canister is cracked or damaged, replace the canister.
- If fuel is leaking from the canister, replace the canister and check hoses and hose routing.

IDLE AIR CONTROL (IAC) VALVE



0006

The Tech 2 displays the IAC pintle position in counts. A count of ”0” indicates the PCM is commanding the IAC pintle to be driven all the way into a fully–seated position. This is usually caused by a vacuum leak.
The higher the number of counts, the more air is being commanded to bypass the throttle blade. In order to diagnose the IAC system, refer to IAC System Check.
For other possible causes of idle problems, refer to Rough, Unstable, or Incorrect Idle, Stalling in Symptoms.

FUEL SYSTEM PRESSURE TEST

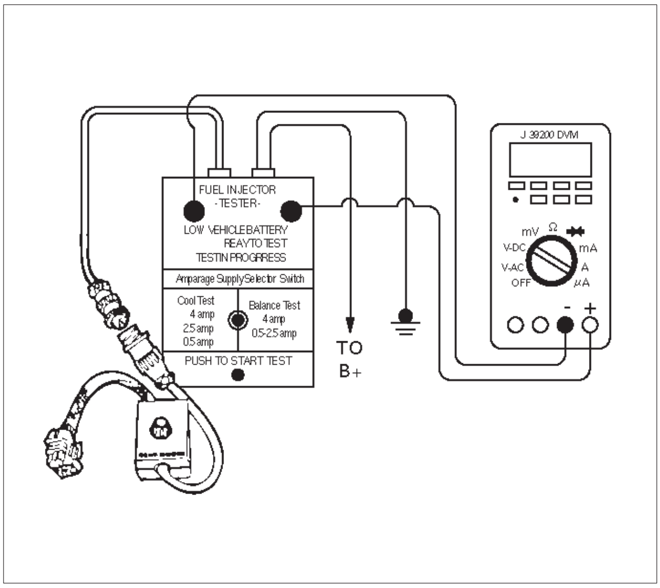
A fuel system pressure test is part of several of the diagnostic charts and symptom checks. To perform this test, refer to Fuel System Diagnosis.

FUEL METERING SYSTEM CHECK

Some failures of the fuel metering system will result in an ”Engine Cranks But Will Not Run” symptom. If this condition exists, refer to the Cranks But Will Not Run chart. This chart will determine if the problem is caused by the ignition system, the PCM, or the fuel pump electrical circuit.
For the fuel system wiring schematic, refer to Fuel System Electrical Test.
If there is a fuel delivery problem, to diagnose the fuel injectors, the fuel pressure regulator, and the fuel pump,refer to Fuel System Diagnosis.
If a malfunction occurs in the fuel metering system, it usually results in either a rich HO2S signal or a lean HO2S signal. This condition is indicated by the HO2S voltage, which causes the PCM to change the fuel calculation (fuel injector pulse width) based on the HO2S reading. Changes made to the fuel calculation will be indicated by a change in the long term fuel trim values which can be

monitored with a Tech 2. Ideal long term fuel trim values are around 0%; for a lean HO2S signal, the PCM will add fuel, resulting in a fuel trim value above 0%. Some variations in fuel trim values are normal because all engines are not exactly the same. If the evaporative emission canister purge is ON, the long term fuel trim may be as low as –38%. If the long term fuel trim values are greater than +23%, for items which can cause a lean HO2S signal, refer to DTC P0131, DTC P0171, and DTC 1171.

FUEL INJECTOR COIL TEST PROCEDURE AND FUEL INJECTOR BALANCE TEST PROCEDURE



T32003

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Relieve the fuel pressure by connecting the J 34730–1 Fuel Pressure Gauge to the fuel pressure connection on the fuel rail.

CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.

Place the fuel pressure gauge bleed hose in an approved gasoline container.

With the ignition switch OFF open the valve on the fuel pressure gauge.

3.Record the lowest voltage displayed by the DVM after the first second of the test. (During the first second, voltage displayed by the DVM may be inaccurate due to the initial current surge.)

Injector Specifications:

Resistance Ohms	Voltage Specification at 10˚C–35˚C (50˚F–95˚F)
11.8 – 12.6	5.7 – 6.6

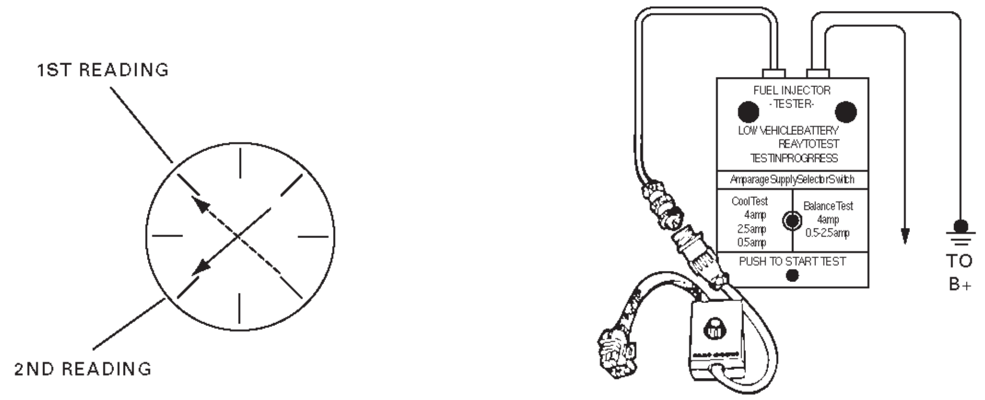
- The voltage displayed by the DVM should be within the specified range.
- The voltage displayed by the DVM may increase throughout the test as the fuel injector windings warm and the resistance of the fuel injector windings changes.
- An erratic voltage reading (large fluctuations in voltage that do not stabilize) indicates an intermittent connection within the fuel injector.

5. Injector Specifications:

Highest Acceptable Voltage Reading Above/Below 35˚C/10˚C (95˚F/50˚F)	Acceptable Subtracted Value
9.5 Volts	0.6 Volt

7. The Fuel Injector Balance Test portion of this chart (Step 7 through Step 11) checks the mechanical (fuel delivery) portion of the fuel injector. An engine cool–down period of 10 minutes is necessary in order to avoid irregular fuel pressure readings due to ”Hot Soak” fuel boiling.

Injector Coil Test Procedure (Steps 1–6) And Injector Balance Test Procedure (Steps 7–11)



R262001

	CYLINDER			
	1	2	3	4
1st Reading	296 kPa (43psi)	296 kPa (43psi)	296 kPa (43psi)	296 kPa (43psi)
2nd Reading	131 kPa (19 psi)	117 kPa (17 psi)	124 kPa (18 psi)	145 kPa (21 psi)
Amount of Drop (1st Reading–2nd Reading	165 kPa (24 psi)	179 kPa (26 psi)	172 kPa (25 psi)	151 kPa (22 psi)
Av. drop = 166 kPa/24 psi +/–10 kPa/1.5 psi = 156 – 176 kPa or 22.5 – 25.5 psi	OK	Faulty, Rich (Too Much Fuel Drop)	OK	Faulty, Lean (Too Little Fuel Drop)

NOTE: These figures are examples only.

Injector Coil Test Procedure (Steps 1–6) And Injector Balance Test Procedure (Steps 7–11)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Turn the engine OFF. NOTE: In order to prevent flooding of a single cylinder and possible engine damage, relieve the fuel pressure before performing the fuel injector coil test procedure. 2. Relieve the fuel pressure. Refer to Test Description Number 2. 3. Connect the J 39021–5V Fuel Injector Tester to B+ and ground, and to the J39021–90 Injector Switch Box. 4. Connect the injector switch box to the grey fuel injector harness connector located at the front of the EVAP canister bracket. 5. Set the amperage supply selector switch on the fuel injector tester to the ”Coil Test” 0.5 amp position. 6. Connect the leads from the J 39200 Digital Voltmeter (DVM) to the fuel injector tester. Refer to the illustrations associated with the test description. 7. Set the DVM to the tenths scale (0.0). 8. Observe the engine coolant temperature. Is the engine coolant temperature within the specified values?	10˚C (50˚F) to 35˚C (95˚F)	Go to *Step 3*	Go to *Step 5*
3	1. Set the injector switch box to injector #1. 2. Press the ”Push to Start Test” button on the fuel injector tester. 3. Observe the voltage reading on the DVM. **IMPORTANT:** The voltage reading may rise during the test. 4. Record the lowest voltage observed after the first second of the test. 5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4. Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading outside of the specified values?	5.7–6.6 V	Go to *Step 4*	Go to *Step 7*
4	Replace the faulty fuel injector(s). Refer to Fuel Injector. Is the action complete?	—	Go to *Step 7*	—

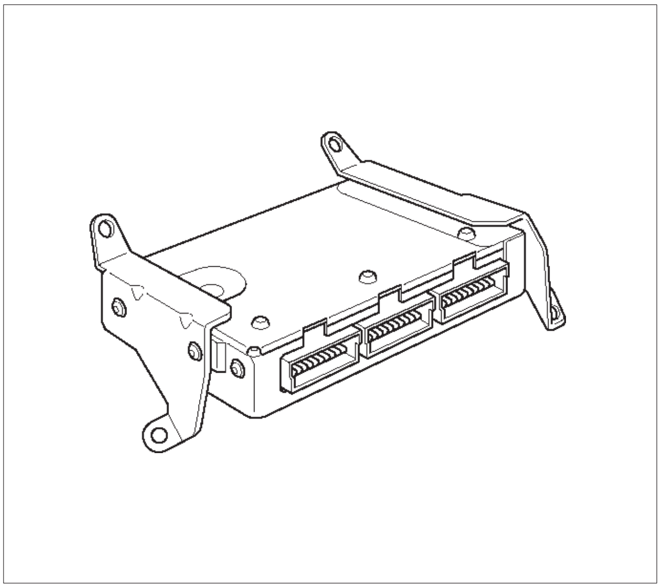
Injector Coil Test Procedure (Steps 1–6) And Injector Balance Test Procedure (Steps 7–11) (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Set the injector switch box to injector #1. 2. Press the "Push to Start Test" button on the fuel injector tester. 3. Observe the voltage reading on the DVM. **IMPORTANT:** The voltage reading may rise during the test. 4. Record the lowest voltage observed after the first second of the test. 5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4. Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading above the specified value?	9.5 V	Go to *Step 4*	Go to *Step 6*
6	1. Identify the highest voltage reading recorded (other than those above 9.5 V). 2. Subtract the voltage reading of each injector from the highest voltage selected in step 1. Repeat until you have a subtracted value for each injector. For any injector, is the subtracted value in step 2 greater than the specified value?	0.6 V	Go to *Step 4*	Go to *Step 7*
7	**CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.** 1. Connect the J 34730–1 Fuel Pressure Gauge to the fuel pressure test port. 2. Energize the fuel pump using the Tech 2. 3. Place the bleed hose of the fuel pressure gauge into an approved gasoline container. 4. Bleed the air out of the fuel pressure gauge. 5. With the fuel pump running, observe the reading on the fuel pressure gauge. Is the fuel pressure within the specified values?	296 kPa– 376 kPa (43–55 psi)	Go to *Step 8*	Go to *Fuel System Diagnosis*
8	Turn the fuel pump OFF. Does the fuel pressure remain constant?	—	Go to *Step 9*	Go to *Fuel System Diagnosis*

Injector Coil Test Procedure (Steps 1–6) And Injector Balance Test Procedure (Steps 7–11) (Cont'd)

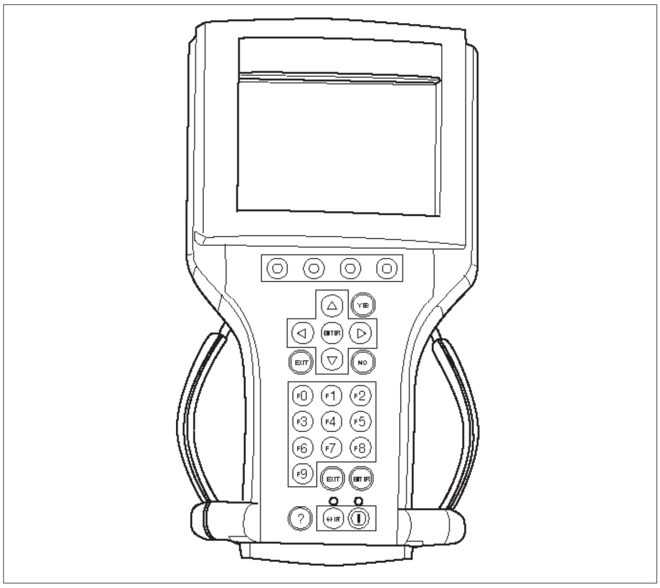
Step	Action	Value(s)	Yes	No
9	1. Connect the J 39021–5V Fuel Injector Tester and J39021–90 Injector Switch Box to the fuel injector harness connector. 2. Set the amperage supply selector switch on the fuel injector tester to the "Balance Test" 0.5–2.5 amp position. 3. Using the Tech 2 turn the fuel pump ON then OFF in order to pressurize the fuel system. 4. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure stabilizes. This is the first pressure reading. 5. Energize the fuel injector by depressing the Push to Start Test button on the fuel injector tester. 6. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure gauge needle has stopped moving. This is the second pressure reading. 7. Repeat steps 1 through 6 for each fuel injector. 8. Subtract the second pressure reading from the first pressure reading for one fuel injector. The result is the pressure drop value. 9. Obtain a pressure drop value for each fuel injector. 10. Add all of the individual pressure drop values. This is the total pressure drop. 11. Divide the total pressure drop by the number of fuel injectors. This is the average pressure drop. Does any fuel injector have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value?	10 kPa (1.5 psi)	Go to *Step 10*	Go to *OBD System Check*
10	Re–test any fuel injector that does not meet the specification. Refer to the procedure in step 11. NOTE: Do not repeat any portion of this test before running the engine in order to prevent the engine from flooding. Does any fuel injector still have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value?	10 kPa (1.5 psi)	Go to *Step 11*	Go to *Symptoms*
11	Replace the faulty fuel injector(s). Refer to Fuel Injector. Is the action complete?	—	Verify repair	—

POWERTRAIN CONTROL MODULE (PCM) DIAGNOSIS



014RX002

To read and clear diagnostic trouble codes, use a Tech 2.



901RX031

IMPORTANT: Use of a Tech 2 is recommended to clear diagnostic trouble codes from the PCM memory. Diagnostic trouble codes can also be cleared by turning the ignition OFF and disconnecting the battery power from the PCM for 30 seconds. Turning off the ignition and disconnecting the battery power from the PCM will cause all diagnostic information in the PCM memory to be cleared. Therefore, all the diagnostic tests will have to be re–run.

Since the PCM can have a failure which may affect only one circuit, following the diagnostic procedures in this section will determine which circuit has a problem and where it is.

If a diagnostic chart indicates that the PCM connections or the PCM is the cause of a problem, and the PCM is replaced, but this does not correct the problem, one of the following may be the reason:

- There is a problem with the PCM terminal connections. The terminals may have to be removed from the connector in order to check them properly.
- EEPROM program is not correct for the application. Incorrect components or reprogramming the PCM with the wrong EEPROM program may cause a malfunction and may or may not set a DTC.
- The problem is intermittent. This means that the problem is not present at the time the system is being checked. In this case, make a careful physical inspection of all components and wiring associated with the affected system and refer to the Symptoms portion of the manual.
- There is a shorted solenoid, relay coil, or harness. Solenoids and relays are turned ON and OFF by the PCM using internal electronic switches called drivers. A shorted solenoid, relay coil, or harness will not damage the PCM but will cause the solenoid or relay to be inoperative.

MULTIPLE PCM INFORMATION SENSOR DTCs SET

Circuit Description

The powertrain control module (PCM) monitors various sensors to determine the engine operating conditions. The PCM controls fuel delivery, spark advance, and emission control device operation based on the sensor inputs.

The PCM provides a sensor ground to all of the sensors. The PCM applies 5 volts through a pull–up resistor, and determines the status of the following sensors by monitoring the voltage present between the 5–volt supply and the resistor:

- The Fuel Tank Vapor Pressure Sensor
- The throttle position (TP) sensor
- The manifold absolute pressure (MAP) sensor

The PCM provides the following sensors with a 5–volt reference and a sensor ground signal:

- The Linear exhaust gas recirculation (EGR) valve
- The A/C Pressure Sensor

The PCM monitors the separate feedback signals from these sensors in order to determine their operating status.

Diagnostic Aids

Be sure to inspect PCM and engine grounds for being secure and clean.

A short to voltage in one of the sensor input circuits may cause one or more of the following DTCs to be set:

- P0108/P1106
- P0113/P1111
- P0118/P1115
- P0123/P1121
- P0463

If a sensor input circuit has been shorted to voltage, ensure that the sensor is not damaged. A damaged sensor will continue to indicate a high or low voltage after the affected circuit has been repaired. If the sensor has been damaged, replace it.

An open in the sensor ground circuit between the PCM and the splice will cause one or more of the following DTCs to be set:

- P0108/P1106
- P0113/P1111
- P0118/P1115
- P0123/P01121
- P0453/P0463

A short to ground in the 5–volt reference A circuit will cause one or more of the following DTCs to be set:

- P0107/P1107
- P0122/P1122
- P0112/P1112
- P0117/P1114
- P0454/P0462
- P0405
- P0532

Check for the following conditions:

- **Poor connection at PCM.** Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and a poor terminal–to–wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness is not damaged, observe an affected sensor's displayed value on the Tech 2 with the ignition ON and the engine OFF while you move the connectors and the wiring harnesses related to the following sensors:
  - IAT
  - ECT
  - TP
  - MAP
  - EGR
  - Fuel Tank Vapor Pressure Sensor
  - A/C Pressure Sensor

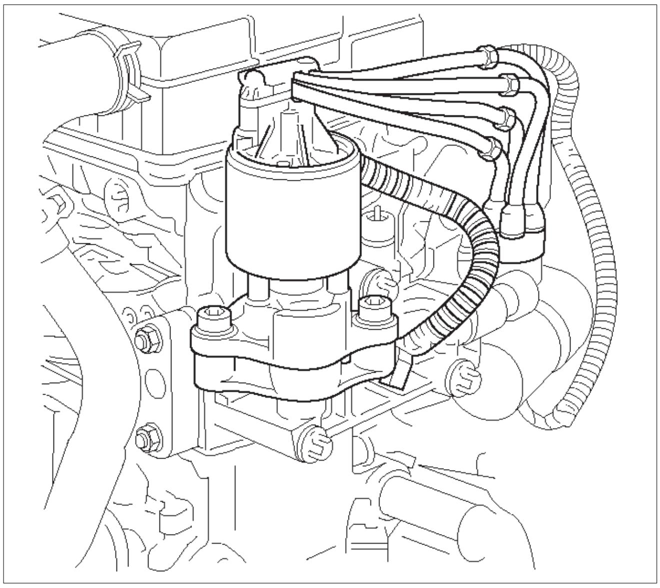
Multiple PCM Information Sensor DTCs Set

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Turn the ignition OFF, disconnect the PCM. 2. Turn the ignition ON, check the 5 volt reference circuits for the following conditions: • A poor connection at the PCM. • An open between the PCM connector and the splice. • A short to ground. • A short to voltage. Is there an open or short?	—	Go to *Step 3*	Go to *Step 4*
3	Repair the open or short. Is the action complete?	—	Verify repair	—
4	Check the sensor ground circuit for the following conditions: • A poor connection at the PCM or the affected sensors. • An open between the PCM connector and the affected sensors. Is there an open or a poor connection?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the open or the poor connection. Is the action complete?	—	Verify repair	—
6	Measure the voltage between the EGR pintle position sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 7*	Go to *Step 13*
7	Measure the voltage between the MAP sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 8*	Go to *Step 14*
8	Measure the voltage between the TP sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 9*	Go to *Step 15*
9	Measure the voltage between the IAT sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 10*	Go to *Step 16*
10	Measure the voltage between the ECT sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 20*	Go to *Step 17*
11	Measure the voltage between the A/C Pressure Sensor circut at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 13*	Go to *Step 19*

Multiple PCM Information Sensor DTCs Set (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Disconnect the EGR valve. 2. Measure the voltage between the EGR pintle position sensor signal circuit at the PCM harness connector and ground. Does the voltage measure near the specified value?	0 V	Go to *Step 12*	Go to *Step 17*
13	Replace the EGR valve. Is the action complete?	—	Verify repair	—
14	Locate and repair the short to voltage in the MAP sensor signal circuit. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to voltage in the TP sensor signal circuit. Is the action complete?	—	Verify repair	—
16	Locate and repair the short to voltage in the IAT sensor signal circuit. Is the action complete?	—	Verify repair	—
17	Locate and repair the short to voltage in the ECT sensor signal circuit. Is the action complete?	—	Verify repair	—
18	Locate and repair the short to voltage in the A/C Pressure Sensor circuit. Is the action complete?	—	Verify repair	—
19	Locate and repair the short to voltage in the EGR pintle position sensor signal circuit. Is the action complete?	—	Verify repair	—
20	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest service bulletin Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to *OBD System Check*	—

EXHAUST GAS RECIRCULATION (EGR) DIAGNOSIS



057RX001

An EGR flow check diagnosis of the linear EGR system is covered by DTC P0401, P0404, and P0405. If EGR diagnostic trouble code P0401 is encountered, refer to the DTC charts.

ENGINE Tech 2 DATA DEFINITIONS AND RANGES

A/C CLUTCH – Tech 2 Displays ON or OFF
Indicates whether the PCM has commanded the A/C clutch ON. Used in A/C system diagnostics.

A/C REQUEST – Tech 2 Displays YES or NO
Indicates the state of the A/C request input circuit from the HVAC controls. The PCM uses the A/C request signal to determine whether A/C compressor operation is being requested.

AIR/FUEL RATIO – Tech 2 Range 0.0–25.5
Air/fuel ratio indicates the PCM commanded value. In ”Closed Loop”, the air/fuel ratio should normally be displayed around ”14.2–14.7.” A lower air/fuel ratio indicates a richer commanded mixture, which may be seen during power enrichment or TWC protection modes. A higher air/fuel ratio indicates a leaner commanded mixture. This can be seen during deceleration fuel mode.

BARO kPa – Tech 2 Range 10–105 kPa/0.00–5.00 Volts
The barometric pressure reading is determined from the MAP sensor signal monitored during key up and wide open throttle (WOT) conditions. The barometric pressure is used to compensate for altitude differences and is normally displayed around ”61–104” depending on altitude and barometric pressure.

CMP ACT. COUNTER – Cam Position Activity

DECEL FUEL MODE – Tech 2 Displays ACTIVE or INACTIVE
”ACTIVE” displayed indicates that the PCM has detected conditions appropriate to operate in deceleration fuel mode. The PCM will command the deceleration fuel mode when it detects a closed throttle position while the vehicle is traveling over 20 mph. While in the deceleration fuel mode, the PCM will decrease the amount of fuel delivered by entering ”Open Loop” and decreasing the injector pulse width.

DESIRED EGR POS. – Tech 2 Range 0%–100%
Represents the EGR pintle position that the PCM is commanding.

DESIRED IDLE – Tech 2 Range 0–3187 RPM
The idle speed that the PCM is commanding. The PCM will compensate for various engine loads based on engine coolant temperature, to keep the engine at the desired speed.

ECT – (Engine Coolant Temperature) Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F)
The engine coolant temperature (ECT) is mounted in the coolant stream and sends engine temperature information to the PCM. The PCM applies 5 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as the temperature changes. When the sensor is cold (high resistance), the PCM monitors a high signal voltage and interprets that as a cold engine. As the sensor warms (decreasing resistance), the voltage signal will decrease and the PCM will interpret the lower voltage as a warm engine.

EGR DUTY CYCLE – Tech 2 Range 0%–100%
Represents the EGR valve driver PWM signal from the PCM. A duty cycle of 0% indicates that no EGR flow is being commanded; a 100% duty cycle indicates maximum EGR flow commanded.

EGR FEEDBACK – Tech 2 Range 0.00–5.00 Volts
Indicates the EGR pintle position sensor signal voltage being monitored by the PCM. A low voltage indicates a fully extended pintle (closed valve); a voltage near 5 volts indicates a retracted pintle (open valve).

EGR TEST COUNT – Tech 2 Range 0–255
Indicates the number of EGR flow test samples collected during the current ignition cycle. Under normal operation, only one sample is allowed during an ignition cycle. If the PCM battery feed has been disconnected or a DTC P0401 has been cleared, 10 EGR flow test samples will be allowed during the ignition cycle. This is to allow repair verification during a single ignition cycle.

ENGINE LOAD – Tech 2 Range 0%–100%
Engine load is calculated by the PCM from engine speed and MAP sensor readings. Engine load should increase with an increase in RPM or air flow.

ENGINE RUN TIME – Tech 2 Range 00:00:00–99:99:99 Hrs:Min:Sec
Indicates the time elapsed since the engine was started. If the engine is stopped, engine run time will be reset to 00:00:00.

ENGINE SPEED – Range 0–9999 RPM
Engine speed is computed by the PCM from the 58X reference input. It should remain close to desired idle under various engine loads with engine idling.

EVAP PURGE PWM – Tech 2 Range 0%–100%
Represents the PCM commanded PWM duty cycle of the EVAP purge solenoid valve. ”0%” displayed indicates no purge; ”100%” displayed indicates full purge.

EVAP VACUUM SWITCH – Tech 2 Displays PURGE or NO PURGE
The EVAP purge vacuum switch is a normally closed switch positioned in the purge line between the canister and the EVAP purge solenoid. The EVAP purge vacuum switch will open when vacuum increases to greater than 5 inches of water in the purge line. The EVAP purge vacuum switch is used by the PCM to monitor EVAP canister purge solenoid operation and purge system integrity. The EVAP purge vacuum switch should be closed to ground with no vacuum present (0% EVAP purge PWM). With EVAP purge PWM at 25% or greater, the EVAP purge vacuum switch should be open and ”PURGE” should be indicated.

FUEL PUMP – Tech 2 Displays ON or OFF
Indicates the PCM commanded state of the fuel pump relay driver circuit.

FUEL TRIM CELL – Tech 2 Range 0–21
The fuel trim cell is dependent upon engine speed and MAF sensor readings. A plot of RPM vs. MAF is divided into 22 cells. Fuel trim cell indicates which cell is currently active.

FUEL TRIM LEARN – Tech 2 Displays NO or YES
When conditions are appropriate for enabling long term fuel trim corrections, fuel trim learn will display YES. This indicates that the long term fuel trim is responding to the short term fuel trim. If the fuel trim learn displays NO, then long term fuel trim will not respond to changes in short term fuel trim.

GENERATOR CONTROL – Tech 2 Displays ACTIVE or INACTIVE.

HO2S BANK 1, SEN. 1 – Tech 2 Range 0–1000 mV
Represents the fuel control exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10 mV (lean exhaust) and 1000 mV (rich exhaust) while operating in ”Closed Loop”.

HO2S BANK 1, SEN. 2 – Tech 2 Range 0–1000 mV
Represents the exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10 mV (lean exhaust) and 1000 mV (rich exhaust) while operating in ”Closed Loop”. This is used along with HO2S Bank 1, Sensor 3 to determine the catalytic converter efficiency in the manual transmission models.

HO2S BANK 1, SEN. 1 – Tech 2 Displays NOT READY or READY
Indicates the status of the exhaust oxygen sensor. The Tech 2 will indicate that the exhaust oxygen sensor is ready when the PCM detects a fluctuating HO2S voltage sufficient to allow ”Closed Loop” operation. This will not occur unless the exhaust sensor is warmed up.

HO2S WARM UP TIME BANK 1, SEN. 1 – Tech 2 Range 00:00:00–99:99:99 HRS:MIN:SEC
Indicates warm–up time for each HO2S. The HO2S warm–up time is used for the HO2S heater test. The PCM will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start–up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start–up. If the PCM determines that too much time was required for the HO2S to become active, a DTC will set. If the engine was warm when started, HO2S warm–up will display ”00:00:00.”

IAC POSITION – Tech 2 Range 0–255 Counts
Displays the commanded position of the idle air control pintle in counts. A larger number of counts means that more air is being commanded through the idle air passage. Idle air control should respond fairly quickly to changes in engine load to maintain desired idle RPM.

IAT (INTAKE AIR TEMPERATURE) – Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F)
The PCM converts the resistance of the intake air temperature sensor to degrees. Intake air temperature (IAT) is used by the PCM to adjust fuel delivery and spark timing according to incoming air density.

IGNITION 1 – Tech 2 Range 0–25.5 Volts
This represents the system voltage measured by the PCM at its ignition feed.

INJ. PULSE BANK 1 – Tech 2 Range 0–1000 msec.
Indicates the amount of time the PCM is commanding each injector ON during each engine cycle. A longer injector pulse width will cause more fuel to be delivered. Injector pulse width should increase with increased engine load.

LONG TERM FUEL TRIM BANK 1
The long term fuel trim is derived from the short term fuel trim values and represents a long term correction of fuel delivery for the bank in question. A value of 0% indicates that the fuel delivery requires no compensation to maintain the PCM commanded air/fuel ratio. A negative value significantly below 0% indicates that the fuel system is rich and fuel delivery is being reduced (decreased injector pulse width). A positive value significantly greater than 0% indicates that a lean condition exists and the PCM is compensating by adding fuel (increased injector pulse width). Because long term fuel trim tends to follow short term fuel trim, a value in the negative range due to canister purge at idle should not be considered unusual. Fuel trim values at maximum authority may indicate an excessively rich or lean system.

LOOP STATUS – Tech 2 Displays OPEN or CLOSED
”CLOSED” indicates that the PCM is controlling fuel delivery according to oxygen sensor voltage. In ”OPEN” the PCM ignores the oxygen sensor voltage and bases the amount of fuel to be delivered on TP sensor, engine coolant, and MAF sensor inputs only.

MAP – Tech 2 Range 10–105 kPa (0.00–4.97 Volts)
The manifold absolute pressure (MAP) sensor measures the change in the intake manifold pressure from engine load, EGR flow, and speed changes. As intake manifold pressure increases, intake vacuum decreases, resulting in a higher MAP sensor voltage and kPa reading. The MAP sensor signal is used to monitor intake manifold pressure changes during the EGR flow test, to update the BARO reading, and as an enabling factor for several of the diagnostics.

MIL – Tech 2 Displays ON or OFF
Indicates the PCM commanded state of the malfunction indicator lamp (”Check Engine Lamp”).

MISFIRE CUR. CYL. #1/#2/#3/#4 – Tech 2 Range 0–255 Counts
The misfire current counters increase at a rate according to the number of possible misfires being detected on each cylinder. The counters may normally display some activity, but the activity should be nearly equal for all the cylinders.

MISFIRE CUR. CYL. #1/#2/#3/#4 – Tech 2 Range 0–65535 Counts
The misfire history counters display the relative level of misfire that has been detected on each cylinder. The misfire history counters will not update or show any activity until a misfire DTC (P0300) has become active.

MISFIRE FAILURES SINCE FIRST FAIL – Tech 2 Range 0–65535 Counts
Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently high to report a fail.

MISFIRE PASSES SINCE FIRST FAIL – Tech 2 Range 0–65535 Counts
Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently low to report a pass.

POWER ENRICHMENT – Tech 2 Displays ACTIVE or INACTIVE
”ACTIVE” displayed indicates that the PCM has detected conditions appropriate to operate in power enrichment mode. The PCM will command power enrichment mode when a large increase in throttle position and load is detected. While in the power enrichment mode, the PCM will increase the amount of fuel delivered by entering ”Open Loop” and increasing the injector pulse width. This is done to prevent a possible sag or hesitation from occurring during acceleration.

RICH/LEAN BANK 1 – Tech 2 Displays RICH or LEAN
Indicates whether oxygen sensor voltage is above a 600 mV threshold voltage (”RICH”) or below a 3000 mV threshold voltage (”LEAN”). Should change constantly while in ”Closed Loop”, indicating that the PCM is controlling the air/fuel mixture properly.

SHORT TERM FT BANK 1
Short term fuel trim to a bank represents a short term correction to the bank fuel delivery by the PCM in response to the amount of time the bank fuel control oxygen sensor voltage spends above or below the 450 mV threshold. If the oxygen sensor voltage has mainly remained less than 450 mV, indicating a lean air/fuel mixture, short term fuel trim will increase into the positive range above 0% and the PCM will pass fuel. If the oxygen sensor voltage stays mainly above the threshold, short term fuel trim will decrease below 0% into the negative range while the PCM reduces fuel delivery to compensate for the indicated rich condition. Under certain conditions such as extended idle and high ambient temperatures, canister purge may cause short term fuel trim to read in the negative range during normal operation. Fuel trim values at maximum authority may indicate an excessively rich or lean system.

SPARK – Tech 2 Range –64° to 64°
Displays the amount of spark advance being commanded by the PCM on the IC circuit.

START–UP ECT – Tech 2 Range –40°C to 151°C (–40°F to 304°F)
Indicates the engine coolant temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start–up was a cold start.

START–UP ECT – Tech 2 Range –40°C to 151°C (–40°F to 304°F)
Indicates the intake air temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start–up was a cold start.

TOTAL MISFIRE CURRENT COUNT – Tech 2 Range 0–255
Indicates the total number of cylinder firing events that were detected as being misfires during the last 200 crankshaft revolution sample period.

TP ANGLE – Tech 2 Range 0%–100%
TP (throttle position) angle is computed by the PCM from the TP sensor voltage. TP angle should display ”0%” at idle and ”100%” at wide open throttle.

TP SENSOR – Tech 2 Range 0.00–5.00 Volts
The voltage being monitored by the PCM on the TP sensor signal circuit.

UPSHIFT LAMP (MANUAL TRANSMISSION)

VEHICLE SPEED – Tech 2 Range 0–255 km/h (0–155 mph)
The vehicle speed sensor signal is converted into km/h and mph for display.

WEAK CYLINDER – Tech 2 Displays Cylinder Number
This indicates that the PCM has detected crankshaft speed variations that indicate 2% or more cylinder firing events are misfires.

TYPICAL SCAN DATA VALUES

Use the Typical Scan Data Values Table only after the On–Board Diagnostic System Check has been completed, no DTC(s) were noted, and you have determined that the on–board diagnostics are functioning properly. Tech 2 values from a properly–running engine may be used for comparison with the engine you are diagnosing. The typical scan data values represent values that would be seen on a normally–running engine.

NOTE: A Tech 2 that displays faulty data should not be used, and the problem should be reported to the Tech 2 manufacturer. Use of a faulty Tech 2 can result in misdiagnosis and unnecessary replacement of parts.

Only the parameters listed below are referred to in this service manual for use in diagnosis. For further information on using the Tech 2 to diagnose the PCM and related sensors, refer to the applicable reference section listed below. If all values are within the typical range described below, for diagnosis, refer to the Symptoms section.

Test Conditions

Engine running, lower radiator hose hot, transmission in park or neutral, ”Closed Loop”, accessories OFF, brake not applied and air conditioning OFF.

2.2L L–4 Engine

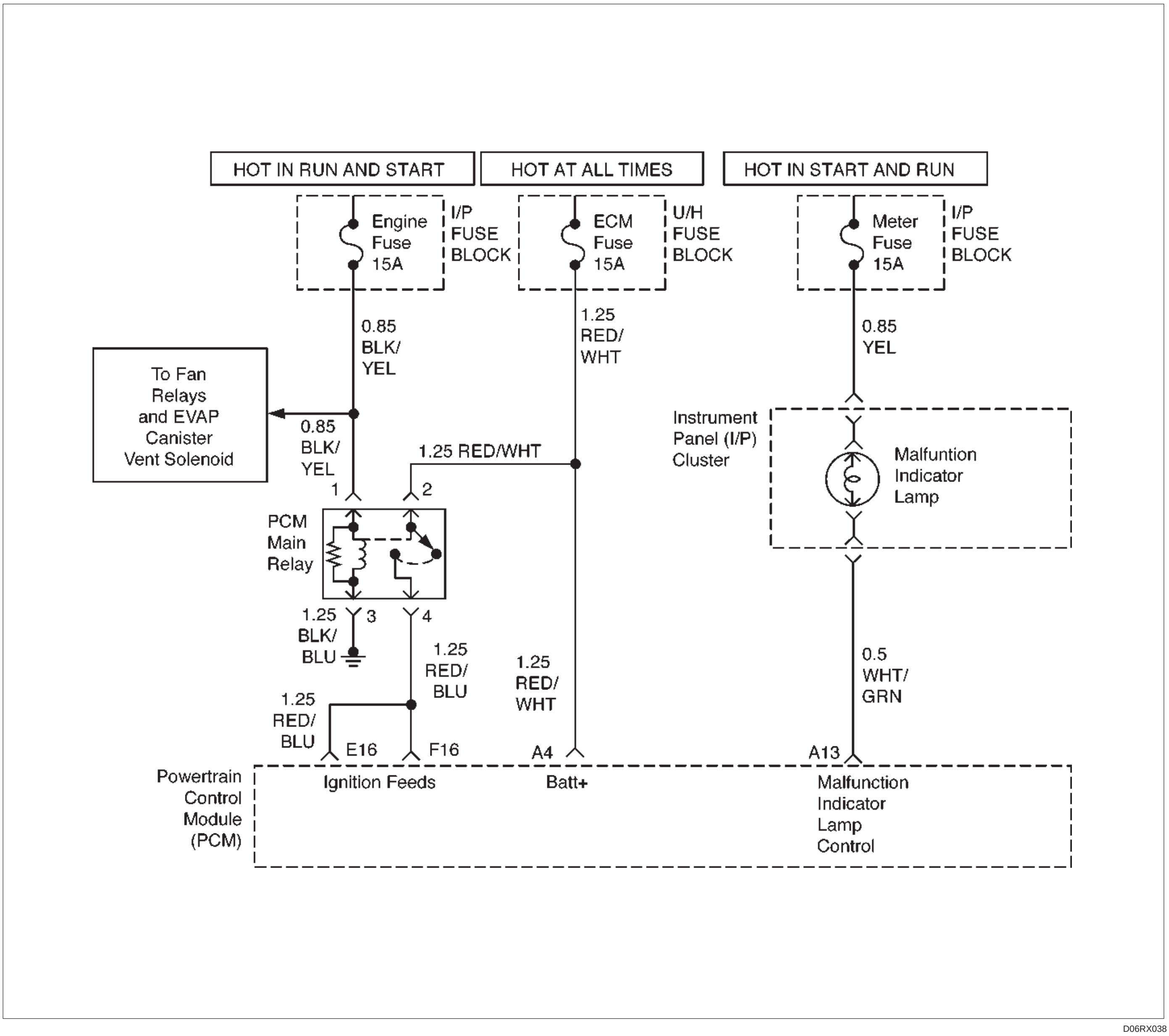
Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
Engine Speed	Engine	RPM	Within -50 to +100 of “Desired Idle”	Actul engine speed	General Discription and Operation
Desired Idle Speed	Engine	RPM	750	800	General Discription and and Operation, Idle Air Control
Engine Coolant Tenpereture	Engine	˚C	80 – 100 (176 – 212 ˚F)	80 – 100 (176 – 212 ˚F)	General Discription and and Operation, Engin coolant tempereture sensor
Start Up ECT	Engine	˚C	–	–	General Discription and and Operation, Engin coolant tempereture sensor
Intake Air Tenpereture	Engine	˚C	0 – 100, depends on underhood	0 – 80, depends on underhood	General Discription and and Operation, Intake Air tempereture sensor
Start Up IAT	Engine	˚C	–	–	General Discription and and Operation, Intake Air tempereture sensor
Manifold Absolute Pressure	Engine	kPa	23 – 40	19 – 32	General Discription and Operation, Manifold Absolute Pressure Sensor. DTC P0106,P0107,P0108,P1106, P1107
Manifold Absolute Pressure	Engine	V	0.65 – 1.32	0.46 – 1.10	General Discription and Operation, Manifold Absolute Pressure Sensor. DTC P0106,P0107,P0108,P1106, P1107
Barometric Pressure	Engine	kPa	61 – 104 (depends pn altitude and barometric)	61 – 104 (depends pn altitude and barometric)	General Discription and Opreration
Throttle Position	Engine	%	0	3 – 5	General Discription and Opreration, Throttle Position Sensor. DTC P0121,P0122,P0123,P1121, P1122

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
Throttle Position Sensor	Engine	V	0.25 – 0.55	0.55 – 0.59	General Discription and Opreration, Throttle Position Sensor. DTC P0121,P0122,P0123,P1121, P1122
Calculated Air Flow	Engine	g/s	2.8 – 3.2	8.5 – 8.7	General Discription and and Operation, Manifold Air Flow sensor
Air Fuel Ratio	Engine	Ratio:_to1	14.6:1	14.6:1	General Discription and Operation, Fuel System Metering Purpose, Fuel Trim
Spark Advance	Engine	˚CA	10 – 12	27 – 29	General Discription and and Operation, Electronic Ignition System
Engine Load	Engine	%	–	–	–
Fuel system Status	Engine	Closed Loop	–	–	EVAP System
EGR Duty Cycle	Engine	%	0	0	General Discription and and Operation, Liner EGR Operation and Results of Incorrect Operation
Desired EGR Position	Engine	%	0	0	General Discription and and Operation, EGR Pintle Position Sensor
EGR Normalized	Engine	%	0	0	–
EGR Feed Back	Engine	V	0.6 – 0.8	0.6 – 0.8	–
EGR Closed Pintle Position	Engine	Steps	20 – 40	20 – 40	General Discription and and Operation, EGR Pintle Position Sensor
Knock Counter	Engine	Yes/No	Yes	Yes	DTC P0325,P0327
Knock Retard	Engine	˚CA	–	–	DTC P0325,P0327
A/C Pressure Sensor	Engine	mV	0	–	DTC P0532,P0533
A/C Clutch Relay	Engine	On/Off	Off	–	General Discription and and Operation, A/C Culutch Circuit Operation
A/C Request	Engine	Yes/No	No	–	General Discription and and Operation, A/C Request Signal
Low Fan Comanded	Engine	Yes/No	–	–	General Discription and and Operation, Cooling Fan Control. DTC P0480,P0481
High Fan Comanded	Engine	Yes/No	–	–	General Discription and and Operation, Cooling Fan Control. DTC P0480,P0481
Camshaft Activity	Engine	Counts	0 – 255	0 – 255	DTC P0341,P0342
EVAP Vent Valve	Engine	On/Off	Off	Off	Diagnosis, EVAP Canister Purge Solenoid And EVAP Vacuum Switch and Visual Check. DTC P1441

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
EVAP Purge Solenoid	Engine	%	17 – 19	35 – 37	Diagnosis, EVAP Emission Canister Purge Valve Check
Low Fuel Lamp	Engine	On/Off	–	–	Engine Fuel. DTC P0461,P0462,P0463
Fuel Level Sensor	Engine	V	–	–	Engine Fuel. DTC P0461,P0462,P0463
Fuel Level	Engine	%	–	–	Engine Fuel. DTC P0461,P0462,P0463
Fuel Pump	Engine	On/Off	On	On	Engine Fuel System
Fuel Tank Pressure Sensor	Engine	V	1.47 – 1.53	1.65 – 1.71	Diagnosis, EVAP Canister Purge Solenoid And EVAP System
Deceleration Fuel Cutoff	Engine	Inactive/Active	Inactive	Inactive	General Discription and and Operation
Idle Air Control	Engine	Steps	–	–	General Discription and and Operation, Intake Air tempereture sensor
Vehicle Speed	Engine	MPH or km/h	0	0	Manual Transmission
Ignition Voltage	Engine	V	12.8 – 14.1	12.8 – 14.1	General Discription and and Operation, Electronic Ignition System
Malfunction Indicator Lamp	Engine	On/Off	Off	Off	On–Board Diagnostic System Check
Up Shift Lamp	Engine	On/Off	Off	Off	Up–Shift Lamp system Check
Time From Start	Engine	_:_:_	_:_:_	_:_:_	–
Misfire Current Cyl.#1	Engine Misfire	Counts	0	0	DTC P0300,P0301
Misfire Current Cyl.#2	Engine Misfire	Counts	0	0	DTC P0300,P0302
Misfire Current Cyl.#3	Engine Misfire	Counts	0	0	DTC P0300,P0303
Misfire Current Cyl.#4	Engine Misfire	Counts	0	0	DTC P0300,P0304
Misfire History Cyl.#1	Engine Misfire	Counts	0	0	DTC P0300,P0301
Misfire History Cyl.#2	Engine Misfire	Counts	0	0	DTC P0300,P0302
Misfire History Cyl.#3	Engine Misfire	Counts	0	0	DTC P0300,P0303
Misfire History Cyl.#4	Engine Misfire	Counts	0	0	DTC P0300,P0304
Misfire Failure Since First Fail	Engine Misfire	Counts	0	0	DTC P0300
Misfire Presses Since First Fail	Engine Misfire	Counts	0	0	DTC P0300
Total Misfire	Engine Misfire	Counts	0	0	DTC P0300

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
Weak Cylinder	Engine Misfire	Cylinder #	–	–	DTC P0300,P0301,P0302,P0303, P0304
Misfire Delay Counter	Engine Misfire	Counts	0	0	DTC P0300,P0301,P0302,P0303, P0304
ABS Rough Road	Engine Misfire	Value	Okey	Okey	DTC P1380,P1381
ABS Rough Road Counts	Engine Misfire	Counts	0	0	DTC P1380,P1381
B1 O2 Sensor Ready	Engine HO2S	Yes/No	Yes	Yes	General Discription and and Operation, Fuel Control HO2S. DTC P0135
B1S1 Status (Bank1,Sensor1)	Engine HO2S	Rich/Lean	–	–	General Discription and and Operation, Fuel Control HO2S
B1S1 O2 Sensor (Bank1,Sensor1)	Engine HO2S	mV	50 – 950 changing quickly	50 – 950 changing quickly	General Discription and and Operation, Fuel Control HO2S
B1S2 O2 Sensor (Bank1,Sensor2)	Engine HO2S	mV	100 – 700 changing slowly	100 – 700 changing slowly	General Discription and and Operation, Fuel Metering System
B1S2 O2S Warm Up Time	Engine HO2S	sec	0	–	General Discription and and Operation, Catalyst Monitor Heated Oxygen Sensor
Fuel Trim Learned	Engine HO2S	Yes/No	Yes	Yes	Diagnosis, Fuel Trim Monitor
Fuel Trim Cell	Engine HO2S	Cell No.	18	2 or 6	Diagnosis, Fuel Trim Cell Diagnostic Weights
B1 Long Fuel Trim	Engine HO2S	%	–	–	DTC P0171,P0172
B2 Short Fuel Trim	Engine HO2S	%	–	–	DTC P0171,P0172
Power Enrichment	Engine HO2S	Yes/No	No	No	General Discription and and Operation, Acceleration Mode
Braodcast Code	–	2.2 letter	–	–	–

NO MALFUNCTION INDICATOR LAMP (MIL)



Circuit Description

The ”Check Engine” lamp (MIL) should always be illuminated and steady with the ignition ON and the engine stopped. Ignition feed voltage is supplied to the MIL bulb through the meter fuse. The powertrain control module (PCM) turns the MIL ON by grounding the MIL driver circuit.

Diagnostic Aids

An intermittent MIL may be caused by a poor connection, rubbed–through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Inspect the PCM harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, and damaged harness.
- If the engine runs OK, check for a faulty light bulb, an open in the MIL driver circuit, or an open in the instrument cluster ignition feed.
- If the engine cranks but will not run, check for an open PCM ignition or battery feed, or a poor PCM to engine ground.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. A ”No MIL” condition accompanied by a no–start condition suggests a faulty PCM ignition feed or battery feed circuit.
9. Using a test light connected to B+, probe each of the PCM ground terminals to ensure that a good ground is present. Refer to PCM Terminal End View for terminal locations of the PCM ground circuits.
12. In this step, temporarily substitute a known good relay for the PCM relay. The horn relay is nearby, and it can be verified as ”good” simply by honking the horn. Replace the horn relay after completing this step.

17. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.

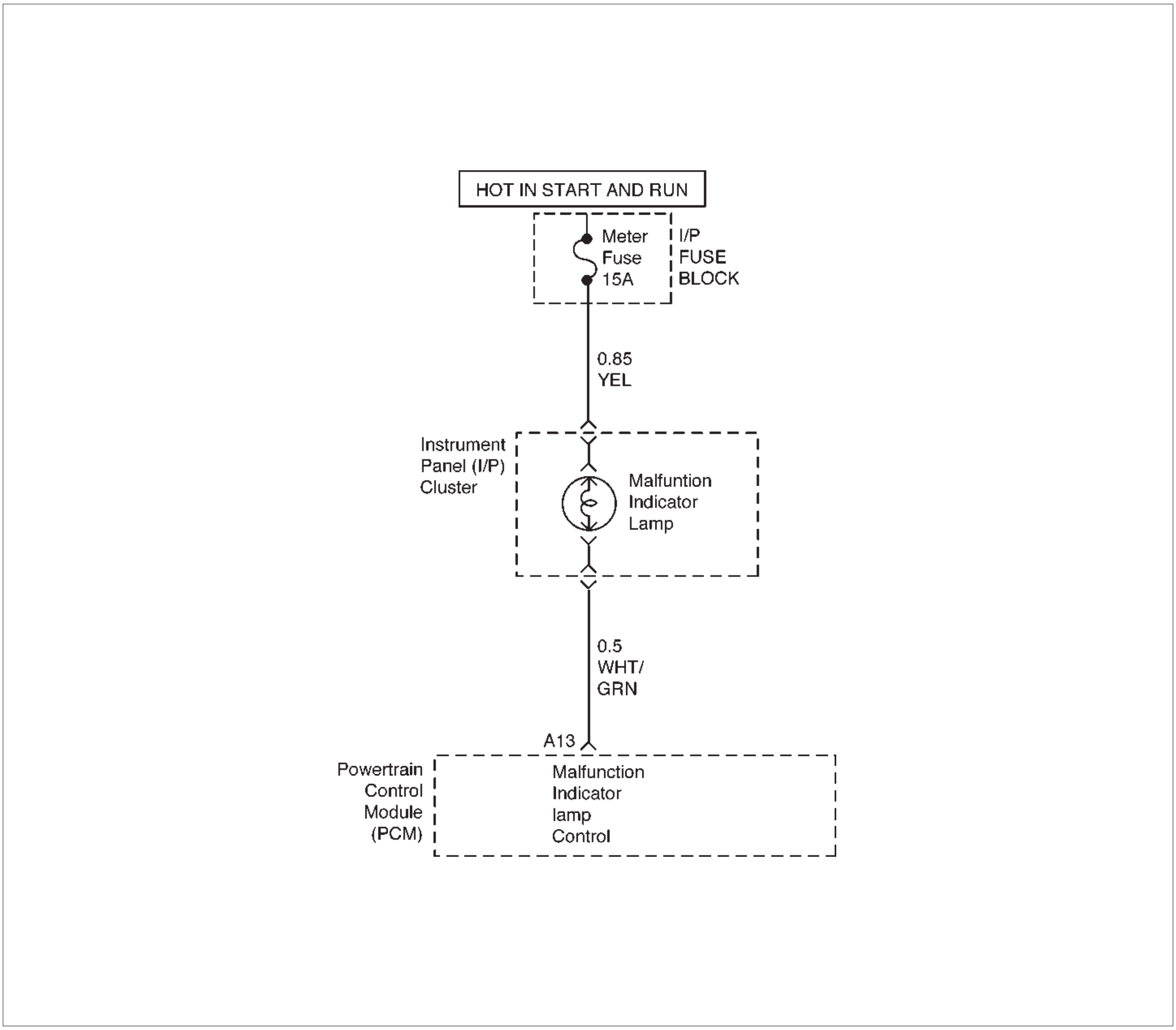
No Malfunction Indicator Lamp (MIL)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Attempt to start the engine. Does the engine start?	—	Go to Step 3	Go to Step 6
3	Check the meter fuse for the instrument cluster ignition feed circuit. Is the fuse OK?	—	Go to Step 4	Go to Step 16
4	1. Ignition ON. 2. Engine OFF. 3. Probe the ignition feed circuit at the cluster connector with a test light to ground. Is the test light ON?	—	Go to Step 5	Go to Step 13
5	1. Ignition OFF. 2. Disconnect the PCM. 3. Jumper the MIL driver circuit at the PCM connector to ground. 4. Ignition ON. Is the MIL ON?	—	Go to Step 10	Go to Step 11
6	Check the PCM ignition feed and battery feed fuses (15A Engine fuse and 15A ECM fuse). Are both fuses OK?	—	Go to Step 7	Go to Step 15
7	1. Ignition OFF. 2. Disconnect the PCM. 3. Ignition ON. 4. Probe the ignition feed circuit at the PCM harness connector with a test light to ground. Is the test light ON?	—	Go to Step 8	Go to Step 12
8	Probe the battery feed circuit at the PCM harness connector with a test light to ground. Is the test light ON?	—	Go to Step 9	Go to Step 14
9	Check for a faulty PCM ground connection. Was a problem found?	—	Verify repair	Go to Step 10
10	Check for damaged terminals at the PCM. Was a problem found?	—	Verify repair	Go to Step 17
11	Check for an open MIL driver circuit between the PCM and the MIL. Was a problem found?	—	Verify repair	Go to Step 18
12	Substitute a known ”good” relay for the PCM main relay. Was the malfunction fixed?	—	Verify repair	Go to Step 13

No Malfunction Indicator Lamp (MIL) (Cont'd)

Step	Action	Value(s)	Yes	No
13	Repair the open in the ignition feed circuit. Is the action complete?	—	Verify repair	—
14	Locate and repair the open PCM battery feed circuit. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in the PCM ignition feed circuit or PCM battery feed circuit. Is the action complete?	—	Verify repair	—
16	Locate and repair the short to ground in the ignition feed circuit to the instrument cluster, and replace the fuse. Is the action complete?	—	Verify repair	—
17	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to PCM in On–Vehicle Service for procedures. and also refer to latest service bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.	—	Verify repair	—
18	Check the MIL driver circuit for a poor connection at the instrument panel connector. Was a problem found?	—	Verify repair	Go to Instrument Panel in Electrical Diagnosis

MALFUNCTION INDICATOR LAMP (MIL) ON STEADY



Circuit Description

The malfunction indicator lamp (MIL) should always be illuminated and steady with the ignition ON and the engine stopped. Ignition feed voltage is supplied directly to the MIL indicator. The powertrain control module (PCM) turns the MIL ON by grounding the MIL driver circuit.

The MIL should not remain ON with the engine running and no DTC(s) set. A steady MIL with the engine running and no DTC(s) suggests a short to ground in the MIL driver circuit.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, and damaged harness.

Test Description

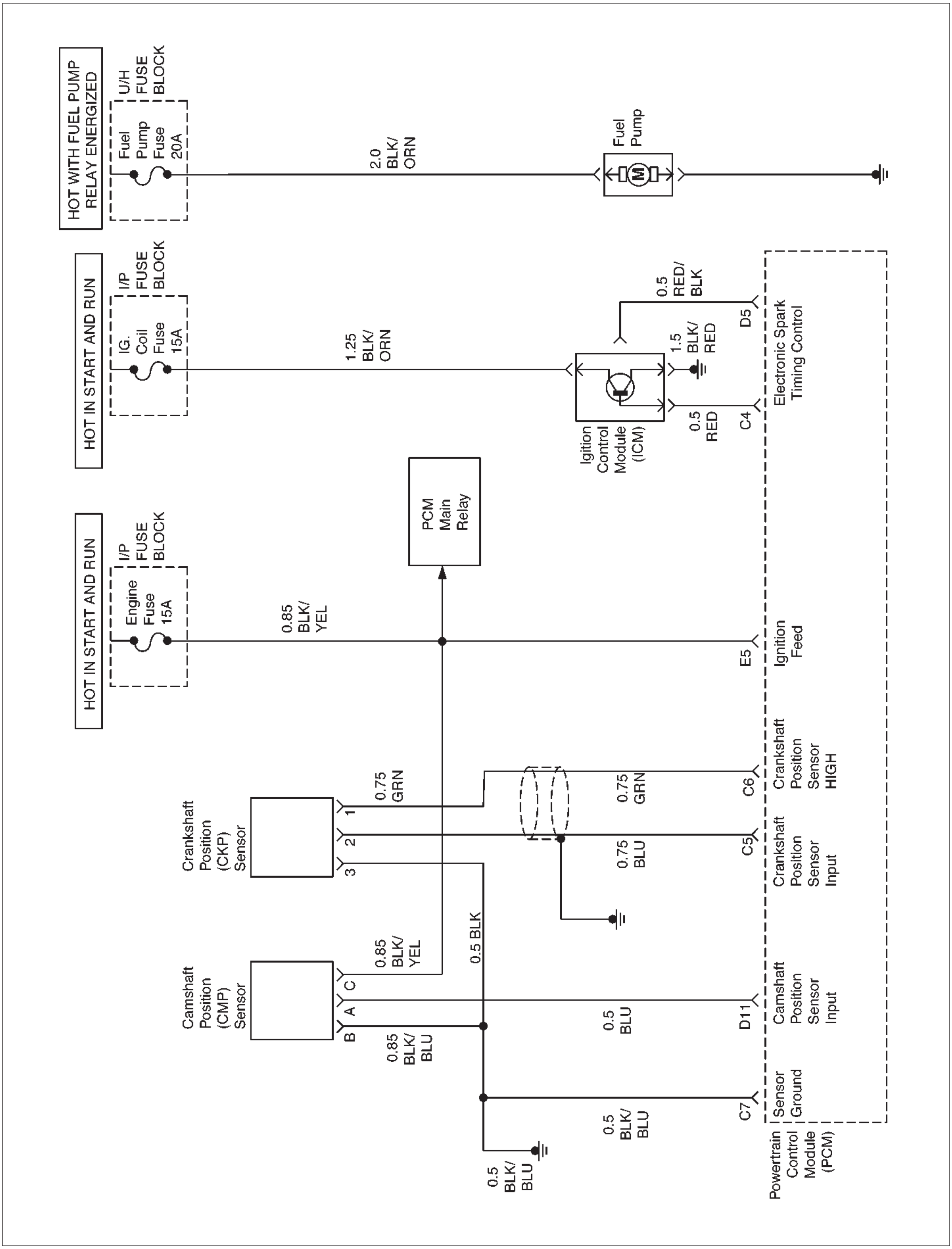
Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. If the MIL does not remain ON when the PCM is disconnected, the MIL driver wiring is not faulty.
3. If the MIL driver circuit is OK, the instrument panel cluster is faulty.
6. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.

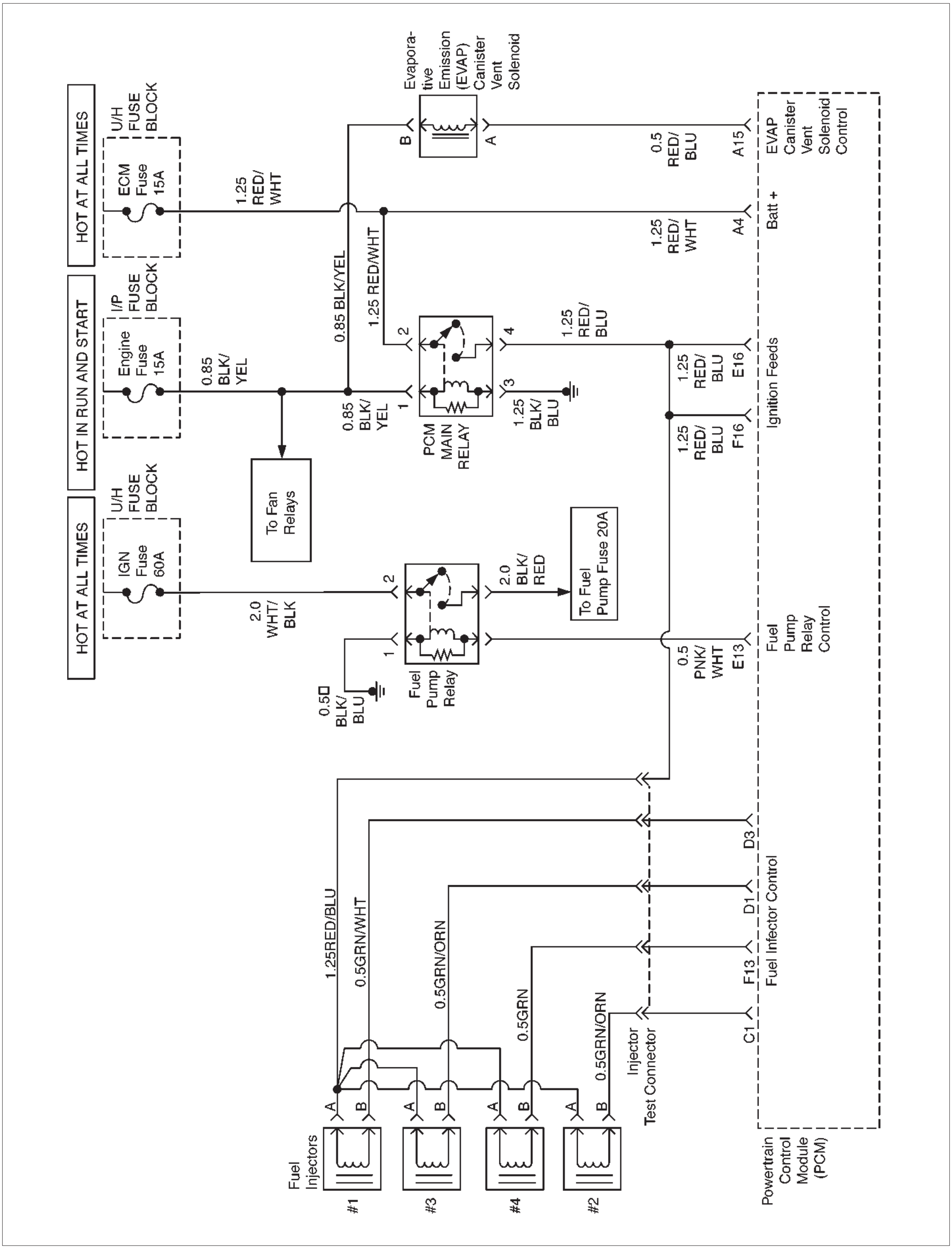
Malfunction Indicator Lamp (MIL) ON Steady

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition OFF, disconnect the PCM. 2. Ignition ON, observe the MIL (Service Engine Soon lamp). Is the MIL ON?	—	Go to Step 3	Go to Step 5
3	1. Ignition OFF, disconnect the instrument panel cluster. 2. Check the MIL driver circuit between the PCM and the instrument panel cluster for a short to ground. 3. If a problem is found, repair as necessary. Was the MIL driver circuit shorted to ground?	—	Go to OBD System Check	Go to Step 4
4	Replace the instrument panel cluster. Is the action complete?	—	Go to OBD System Check	—
5	1. Ignition OFF, reconnect the PCM. 2. Ignition ON, reprogram the PCM. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. 3. Using the Tech 2 output controls function, select MIL dash lamp control and command the MIL OFF. Did the MIL turn OFF?	—	Go to OBD System Check	Go to Step 6
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. and also refer to latest service bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to OBD System Check	—

ENGINE CRANKS BUT WILL NOT RUN



D06RX027



HOT AT ALL TIMES
U/H FUSE BLOCK
ECM Fuse 15A
1.25 RED/WHT
HOT IN RUN AND START
I/P FUSE BLOCK
Engine Fuse 15A
0.85 BLK/YEL
HOT AT ALL TIMES
U/H FUSE BLOCK
IGN Fuse 60A
2.0 WHT/BLK
To Fan Relays
0.85 BLK/YEL
1.25 RED/WHT
Evaporative Emission (EVAP) Canister Vent Solenoid
B
A
0.5 RED/BLU
A15
EVAP Canister Vent Solenoid Control
1.25 RED/WHT
A4
Batt +
2
1
4
3
PCM MAIN RELAY
0.85 BLK/YEL
1.25 RED/BLU
1.25 BLK/BLU
1.25 RED/BLU
E16
1.25 RED/BLU
F16
Ignition Feeds
2
1
Fuel Pump Relay
2.0 BLK/RED
To Fuel Pump Fuse 20A
0.5 BLK/BLU
0.5 PNK/WHT
E13
Fuel Pump Relay Control
1.25RED/BLU
0.5GRN/WHT
0.5GRN/ORN
0.5GRN
0.5GRN/ORN
Injector Test Connector
D3
D1
F13
C1
Fuel Infector Control
A
B
Fuel Injectors
#1
#3
#4
#2
Powertrain Control Module (PCM)

D06RX029

Circuit Description

The electronic ignition system uses a dual coil method of spark distribution. In this type of ignition system, the powertrain control module (PCM) triggers the correct driver inside the ignition control module (ICM), which then triggers the correct ignition coil based on the 58X signal received from the crankshaft position sensor (CKP). The spark plug connected to the coil fires when the ICM opens the ground circuit for the coil's primary circuit.

During crank, the PCM monitors the CKP 58X signal. The CKP signal is used to determine which cylinder will fire first. After the CKP 58X signal has been processed by the PCM, it will command all four injectors to allow a priming shot of fuel for all the cylinders. After the priming, the injectors are left OFF during the next four 58X reference pulses from the CKP. This allows each cylinder a chance to use the fuel from the priming shot. During this waiting period, a camshaft position (CMP) signal pulse will have been received by the PCM. The CMP signal allows the PCM to operate the injectors sequentially based on camshaft position. If the camshaft position signal is not present at start–up, the PCM will begin sequential fuel delivery with a 1–in–4 chance that fuel delivery is correct. The engine will run without a CMP signal, but will set a DTC code.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, and damaged harness.
- Faulty engine coolant temperature sensor – Using a Tech 2, compare engine coolant temperature with intake air temperature on a completely cool engine. Engine coolant temperature should be within 10°C of intake air temperature. If not, replace the ECT sensor.

Engine Cranks But Will Not Run

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Use the Tech 2 and check for any DTC's. Are any DTC's stored?	—	Go to Applicable DTC Table	Go to Step 3
3	Check the 15A ignition coil fuse, the 15A engine device fuse, and the 15A ECM fuse. Was a fuse blown?	—	Go to Step 4	Go to Step 5
4	Check for a short to ground and replace the fuse. Is the action complete?	—	Verify repair	—
5	1. Ignition ON. 2. Use a grounded test lamp to verify that B+ is available at the ignition coil fuse, the engine device fuse, and the ECM fuse. Was B+ available at the fuses?	—	Go to Step 7	Go to Step 6
6	Repair the open ignition feed circuit.	—	Go to Fuel System Electrical Test	Go to Fuel System Diagnosis
7	1. Disconnect the ignition secondary wire at the No.1. 2. Install a spark tester J 26792 at the end of the disconnected ignition coil. 3. Clip the spark tester J 26792 to a good ground (not near the battery). 4. Observe the spark tester while the engine is cranking. Was a crisp blue spark observed? (Only one or two sparks followed by no result is considered the same as "No Spark.")	—	Go to Step 16	Go to Step 8

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Disconnect the ignition module harness connector. 2. Check for an open or short circuit between the ignition control module and the PCM? Was a problem found?	—	Go to Step 9	Go to Step 10
9	Repair the faulty circuit.	—	Verify repair	—
10	1. Ignition ON. 2. Using a Digital Voltmeter (DVM) check the ignition wire coil at the ignition module harness connector? Was the voltage equal to the specified value?	B+	Go to Step 12	Go to Step 11
11	Repair the open circuit.	—	Verify repair	—
12	1. Ignition OFF. 2. With DVM, check for an open in the ground wire at the ignition module harness connector. Was the ground wire OK?	—	Go to Step 14	Go to Step 13
13	Repair the faulty wire.	—	Verify repair	—
14	Replace the ignition module, verify the repair. Attempt to start the engine. Is there still a problem?	—	Go to Step 15	Verify repair
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. and also refer to latest service bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
16	Use an ohmmeter to check the ignition coil primary winding resistance. Was the primary winding resistance approximately equal to the specified value?	0.8–18 Ω	Go to Step 17	Go to Step 18
17	Use an ohmmeter to check the ignition coil secondary winding resistance. Was the secondary winding resistance equal to the specified value?	9,000–12,000 Ω	Go to Step 19	Go to Step 18
18	Replace the ignition coil.	—	Verify repair	—
19	Test the resistance of the coil–to–spark plug secondary ignition wire. Was the resistance greater than the specified value?	10,000 Ω per foot	Go to Step 20	Go to Step 21

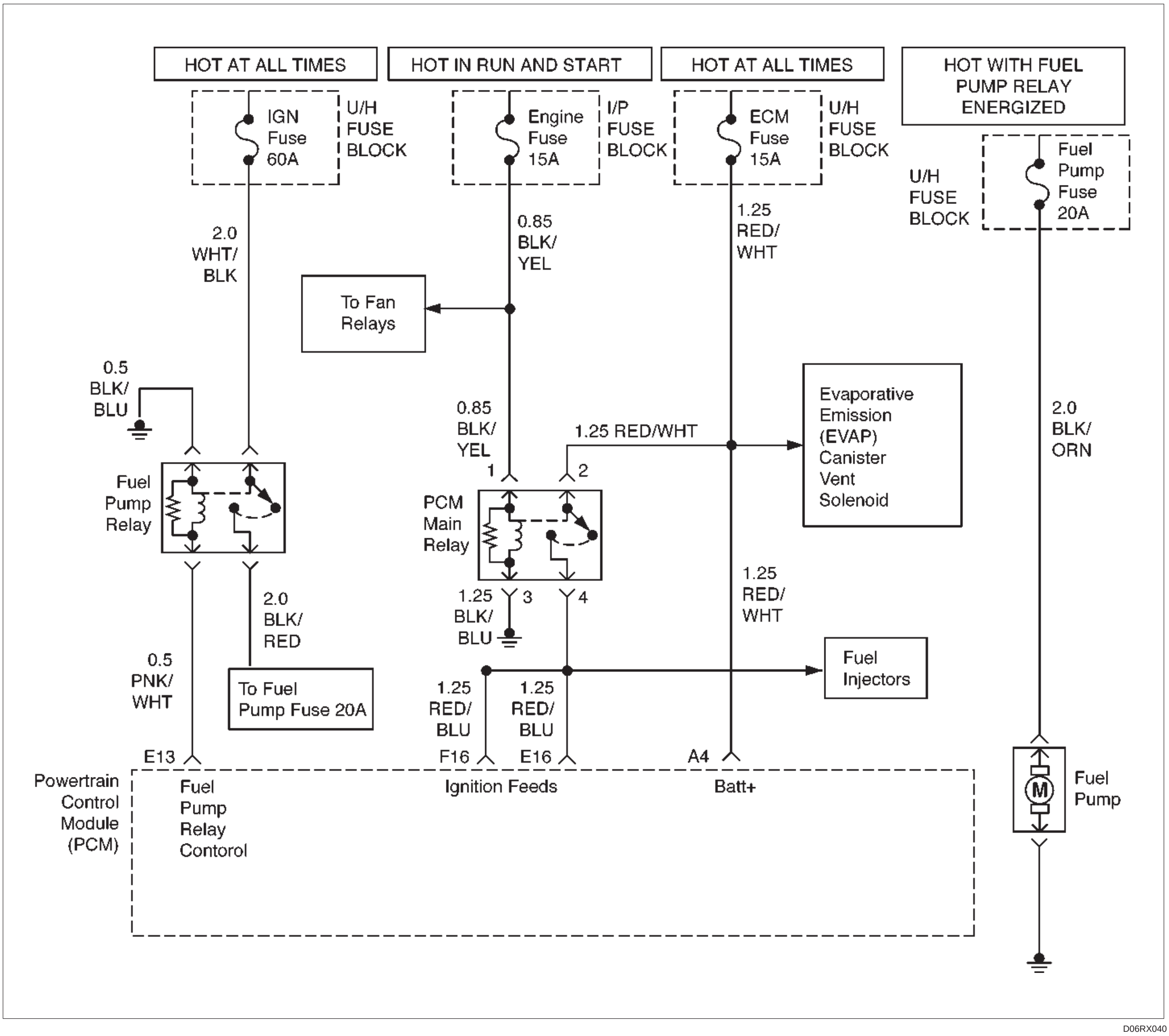
Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
20	Replace the coil–to–spark plug secondary ignition wire and any other secondary wires which exceed the specified value. Is there still a problem?	10,000 Ω per foot	Go to Step 21	Verify repair
21	1. Remove the spark plugs from all cylinders. 2. Visually inspect the spark plug electrodes. 3. Replace any spark plugs with loose or missing electrodes or cracked insulators. Did your inspection reveal any spark plugs exhibiting excessing fouling?	—	Correct the fouling condition	Go to Step 33
22	Verfiy repair. Attempt to start the engine. Is there still a problem?	—	Go to Step 23	Go to Step 22
23	1. Ignition OFF, install a fuel pressure gauge at the test fitting on the fuel supply line in the engine compartment. **CAUTION: Use a shop cloth to absorb any fuel leakage while making the connection.** 2. Check the engine and observe the fuel pressure. Is the fuel pressure within the specified values, and does it hold steady for 2 seconds?	285–375 kPa (43–55 psi)	Go to Step 25	Go to Step 24
24	Is any fuel pressure indicated?	—	Go to Fuel System Electrical Test	Go to Fuel System Diagnosis
25	1. Install switch box J 39021–2 and J 39021–90 at the injector test connector. 2. Activate an injector. Did the fuel pressure drop when the injector was activated?	—	Go to Step 26	Go to Fuel System Diagnosis
26	Pressurize the fuel system using the ignition ON and use the injector switch box to test pressure drop for each injector. Was there a pressure drop when each injector was activated?	—	Go to Step 27	Go to Fuel System Diagnosis
27	1. Remove the switch box and install an injector test light J 39021–45 at the injector test harness connector. 2. Crank the engine. Are any of the lights blinking when the engine is cranked?	—	Go to Step 33	Go to Step 28
28	1. Raise the vehicle and disconnect the CKP sensor harness. 2. Ignition ON. 3. With a test light to ground, probe the CKP ignition feed harness terminal. Did the light illuminate?	—	Go to Step 29	Go to Step 30

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
29	1. Ignition ON. 2. At the CKP harness connector, connect a test lamp between the ignition and ground terminals. Did the lamp illuminate?	—	Go to Step 31	Go to Step 32
30	Check the CKP High circuit between the sensor and the PCM for a short to ground or open circuit. Was a problem found?	—	Verify repair	Go to Step 33
31	Replace the CKP position sensor. Is there still a problem?	—	Go to Step 34	—
32	Check the CKP Low circuit between the sensor and the PCM for: an open circuit, a short to ground, or short to voltage. Was the problem found?	—	Verify repair	Go to Step 33
33	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. and also refer to latest service bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.	—	Verify repair	—
34	1. Test the fuel for contamination. 2. If a problem is found, clean the fuel system and correct the contaminated fuel condition as necessary. Replace the fuel filter and replace any injectors that are not delivering fuel (see Injector Balance Test). Was a problem found?	—	Verify repair	Go to Step 35
35	To diagnose the following conditions, refer to Engine Mechanical: • Slipped camshaft drive belt. • Leaking or sticky valves or rings. • Excessive valve deposits. • Loose or worn rocker arms. • Weak valve springs • Leaking head gasket. Is the action complete?	—	Verify repair	—

FUEL SYSTEM ELECTRICAL TEST



Circuit Description

When the ignition switch is first turned ON, the powertrain control module (PCM) energizes the fuel pump relay which applies power to the in–tank fuel pump. The fuel pump relay will remain ON as long as the engine is running or cranking and the PCM is receiving 58X crankshaft position pulses. If no 58X crankshaft position pulses are present, the PCM de–energizes the fuel pump relay within 2 seconds after the ignition is turned ON or the engine is stopped.

The fuel pump delivers fuel to the fuel rail and injectors, then to the fuel pressure regulator. The fuel pressure regulator controls fuel pressure by allowing excess fuel to be returned to the fuel tank. With the engine stopped and ignition ON, the fuel pump can be turned ON by using a command by the Tech 2.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. If the fuel pump is operating but incorrect pressure is noted, the fuel pump wiring is OK and the ”Fuel System Pressure Test” chart should be used for diagnosis.

CAUTION: To reduce the risk of fire and personal injury:

- **It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.**
- **A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the procedure is completed.**

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge J 34730–1 to the fuel feed line located in front of and above the right side valve cover.
3. Reinstall the fuel pump relay.

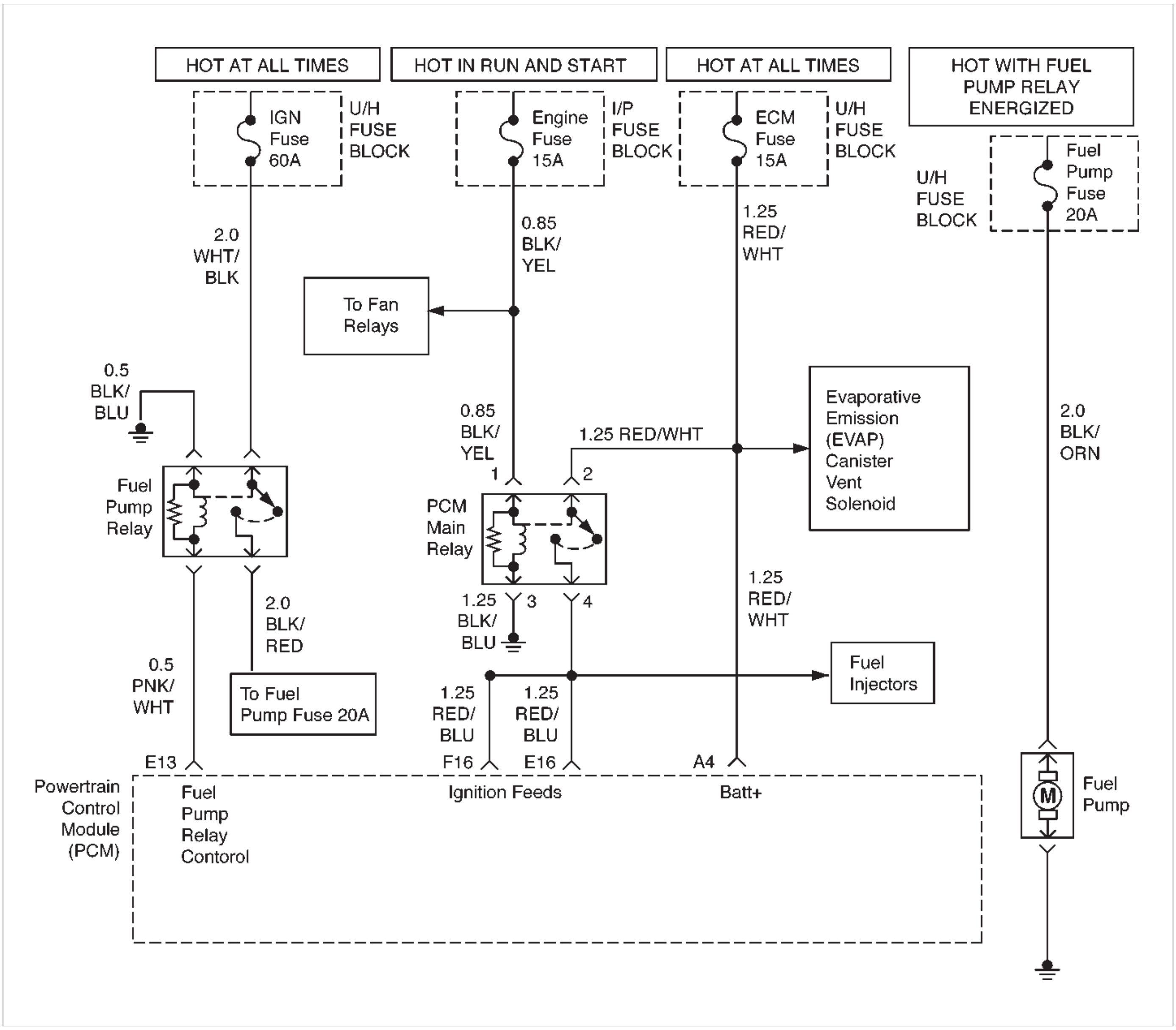
Fuel System Electrical Test

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Read the ”Caution” above. 2. Relieve the fuel system pressure and install the fuel pump pressure gauge to the test fitting. 3. Use a Tech 2 to command the fuel pump ON. Is there an immediate pressure build–up which indicates the pump is running?	—	Go to Step 3	Go to Step 4
3	1. Verify that the pump is not running by removing the fuel filler cap and listening. 2. Command the pump ON with the Tech 2. Did the pump turn OFF after 2 seconds?	—	Test completed	Go to Step 12
4	1. Ignition OFF. 2. Remove the fuel pump relay. 3. Ignition SW “On”, Engin Off. 4. Using a test light connected to ground, probe the battery feed to the relay. Did the light illuminate?	—	Go to Step 6	Go to Step 5
5	Repair short or open battery feed to fuel pump relay. Is the action complete?	—	Verify repair	—
6	1. Connect a test light between the two wires that connect to the fuel pump relay pull–in coil. 2. Ignition ON. Did the test light illuminate for 2 seconds and then turn off?	—	Go to Step 12	Go to Step 7
7	1. With a test light connected to battery (–), probe the fuel pump relay connector at the wire which runs from the relay pull–in coil to the PCM. 2. Ignition ON. Did the test light illuminate for 2 seconds and then turn off?	—	Go to Step 8	Go to Step 9
8	Locate and repair open in the fuel pump relay ground circuit. Is the action complete?	—	Verify repair	—

Fuel System Electrical Test (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check for short or open between the PCM and the fuel pump relay. Was a problem found?	—	Verify repair	Go to Step 10
10	1. Check the fuel pump relay circuit for a poor terminal connection at the PCM. 2. If a problem is found, replace terminal as necessary. Was a problem found?	—	Verify repair	Go to Step 11
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. and also refer to latest service bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
12	1. Reconnect the fuel pump relay. 2. Disconnect the fuel pump electrical connector at the fuel tank. 3. Using a test light connected to ground, probe the fuel pump feed wire (harness side). 4. Command the fuel pump ON with a Tech 2. Did the light illuminate for 2 seconds?	—	Go to Step 15	Go to Step 13
13	1. Honk the horn to verify that the horn relay is functioning. 2. Substitute the horn relay for the fuel pump relay. 3. Leave the test light connected as in step 12. 4. Command the fuel pump ON with the Tech 2. Did the test light illuminate for 2 seconds when the fuel pump was commanded ON?	—	Go to Step 17	Go to Step 14
14	1. Re–connect the horn relay in its proper location. 2. Check for a short circuit, blown fuse or open circuit between the relay and the fuel tank. Is the action complete?	—	Verify repair	—
15	1. With the fuel pump electrical connector at the fuel tank disconnected, connect a test light between the feed wire and the ground wire (harness side). 2. Command the fuel pump ON with a Tech 2. Did the test light illuminate for 2 seconds?	—	Go to Step 18	Go to Step 16
16	Repair the open circuit in the fuel pump ground wire. Is the action complete?	—	Verify repair	—
17	1. Re–connect the horn relay in its proper location. 2. Replace the fuel pump relay. Is the action complete?	—	Verify repair	—
18	Replace the fuel pump. Is the action complete?	—	Verify repair	—

FUEL SYSTEM DIAGNOSIS



D06RX040

Circuit Description

When the ignition switch is turned ON, the powertrain control module (PCM) will turn ON the in–tank fuel pump. The in–tank fuel pump will remain ON as long as the engine is cranking or running and the PCM is receiving 58X crankshaft position pulses. If there are no 58X crankshaft position pulses, the PCM will turn the in–tank fuel pump OFF 2 seconds after the ignition switch is turned ON or 2 seconds after the engine stops running.

The in–tank fuel pump is an electric pump within an integral reservoir. The in–tank fuel pump supplies fuel through an in–line fuel filter to the fuel rail assembly. The fuel pump is designed to provide fuel at a pressure above the pressure needed by the fuel injectors. A fuel pressure regulator, attached to the fuel rail, keeps the fuel available to the fuel injectors at a regulated pressure. Unused fuel is returned to the fuel tank by a separate fuel return line.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Connect the fuel pressure gauge to the fuel feed line as shown in the fuel system illustration. Wrap a shop towel around the fuel pressure connection in order to absorb any fuel leakage that may occur when installing the fuel pressure gauge. With the ignition switch ON and the fuel pump running, the fuel pressure indicated by the fuel pressure gauge should be 283–376 kPa (41–55 psi). This pressure is controlled by the amount of pressure the spring inside the fuel pressure regulator can provide.
3. A fuel system that cannot maintain a constant fuel pressure has a leak in one or more of the following areas:
   - The fuel pump check valve.
   - The fuel pump flex line.

- The valve or valve seat within the fuel pressure regulator.
- The fuel injector(s)

4. Fuel pressure that drops off during acceleration, cruise, or hard cornering may case a lean condition. A lean condition can cause a loss of power, surging, or misfire. A lean condition can be diagnosed using a Tech 2. If an extremely lean condition occurs, the oxygen sensor(s) will stop toggling. The oxygen sensor output voltage(s) will drop below 500 mV. Also, the fuel injector pulse width will increase.

IMPORTANT: Make sure the fuel system is not operating in the ”Fuel Cut–Off Mode.”

When the engine is at idle, the manifold pressure is low (high vacuum). This low pressure (high vacuum) is applied to the fuel pressure regulator diaphragm. The low pressure (high vacuum) will offset the pressure being applied to the fuel pressure regulator diaphragm by the spring inside the fuel pressure regulator. When this happens, the result is lower fuel pressure. The fuel pressure at idle will vary slightly as the barometric pressure changes, but the fuel pressure at idle should always be less than the fuel pressure noted in step 2 with the engine OFF.

16. Check the spark plug associated with a particular fuel injector for fouling or saturation in order to determine if that particular fuel injector is leaking. If checking the spark plug associated with a particular fuel injector for fouling or saturation does not determine that a particular fuel injector is leaking, use the following procedure:
    - Remove the fuel rail, but leave the fuel lines and injectors connected to the fuel rail. Refer to Fuel Rail Assembly in On–Vehicle Service.
    - Lift the fuel rail just enough to leave the fuel injector nozzles in the fuel injector ports.

CAUTION: In order to reduce the risk of fire and personal injury that may result from fuel spraying on the engine, verify that the fuel rail is positioned over the fuel injector ports and verify that the fuel injector retaining clips are intact.

- **Pressurize the fuel system by connecting a 10 amp fused jumper between B+ and the fuel pump relay connector.**
- **Visually and physically inspect the fuel injector nozzles for leaks.**

17. A rich condition may result from the fuel pressure being above 376 kPa (55 psi). A rich condition may cause a DTC P0132 or a DTC P0172 to set. Driveability conditions associated with rich conditions can include hard starting (followed by black smoke) and a strong sulfur smell in the exhaust.

20. This test determines if the high fuel pressure is due to a restricted fuel return line or if the high fuel pressure is due to a faulty fuel pressure regulator.
21. A lean condition may result from fuel pressure below 333 kPa (48 psi). A lean condition may cause a DTC P0131 or a DTC P0171 to set. Driveability conditions associated with lean conditions can include hard starting (when the engine is cold), hesitation, poor driveability, lack of power, surging, and misfiring.
22. Restricting the fuel return line causes the fuel pressure to rise above the regulated fuel pressure. Command the fuel pump ON with the Tech 2. The fuel pressure should rise above 376 kPa (55 psi) as the fuel return line becomes partially closed.

NOTE: Do not allow the fuel pressure to exceed 414 kPa (60 psi). Fuel pressure in excess of 414 kPa (60 psi) may damage the fuel pressure regulator.

CAUTION: To reduce the risk of fire and personal injury:

- **It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.**
- **A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the procedure is completed.**

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge J 34730–1 to the fuel feed line located on the upper right side of the engine near the EGR valve.
3. Reinstall the fuel pump relay.

Fuel System Diagnosis

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Turn the ignition OFF. 2. Turn the air conditioning system OFF. 3. Relieve fuel system pressure and install the fuel pressure gauge. 4. Turn the ignition ON. NOTE: The fuel pump will run for approximately 2 seconds. Use the Tech 2 to command the fuel pump ON. 5. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running. Is the fuel pressure within the specified limits?	283–376 kPa (41–55 psi)	Go to Step 3	Go to Step 17
3	NOTE: The fuel pressure will drop when the fuel pump stops running, then it should stabilize and remain constant. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to Step 4	Go to Step 12
4	1. When the vehicle is at normal operating temperature, turn the ignition ON to build fuel pressure and observe the measurement on the gauge. 2. Start the engine and observe the fuel pressure gauge. Did the reading drop by the amount specified after the engine was started?	21–105 kPa (3–15 psi)	Go to Step 5	Go to Step 9
5	Is fuel pressure dropping off during acceleration, cruise, or hard cornering?	—	Go to Step 6	Check for improper fuel
6	Visually and physically inspect the following items for a restriction: • The in–pipe fuel filter. • The fuel feed line. Was a restrication found?	—	Verify repair	Go to Step 7
7	Remove the fuel tank and visually and physically inspect the following items: • The fuel pump strainer for a restriction. • The fuel line for a leak. • Verify that the correct fuel pump is in the vehicle. Was a problem found in any of these areas?	—	Verify repair	Go to Step 8
8	Replace the fuel pump. Is the action complete?	—	Verify repair	—
9	1. Disconnect the vacuum hose from the fuel pressure regulator. 2. With the engine idling, apply 12–14 inches of vacuum to the fuel pressure regulator. Does the fuel pressure indicated by the fuel pressure gauge drop by the amount specified?	21–105 kPa (3–15 psi)	Go to Step 10	Go to Step 11

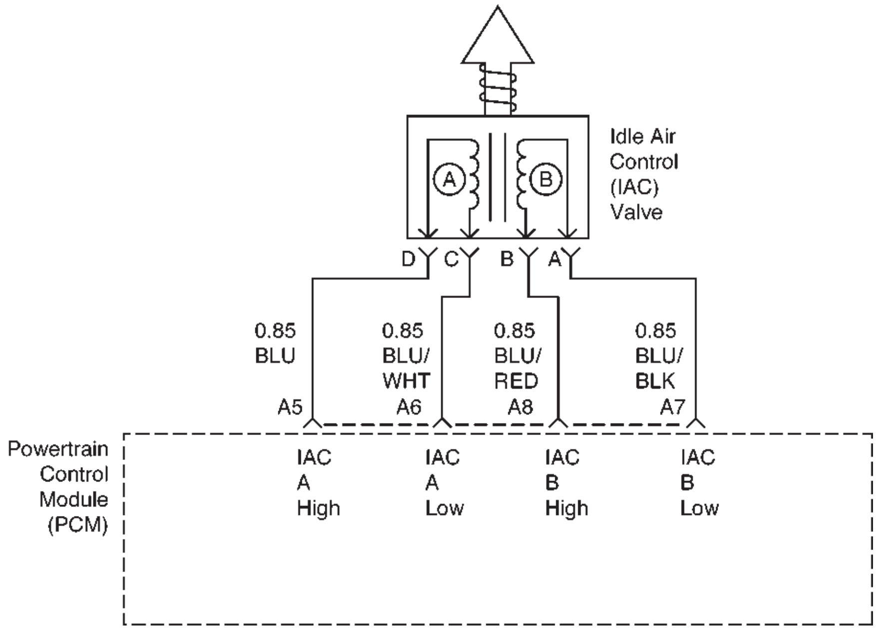
Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
10	Locate and repair the loss of vacuum to the fuel pressure regulator. Is the action complete?	—	Verify repair	—
11	Replace the fuel pressure regulator. Is the action complete?	—	Verify repair	—
12	1. Run the fuel pump with the Tech 2. 2. After pressure has built up, turn off the pump and clamp the supply hose shut with suitable locking pliers which will not damage the hose. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to Step 13	Go to Step 15
13	Visually inspect the fuel supply line and repair any leaks. Was a problem found?	—	Verify repair	Go to Step 14
14	Remove the fuel tank and inspect for leaky hose or in–tank fuel line. Was a problem found?	—	Verify repair	Go to Step 8
15	1. If the pliers are still clamped to the fuel supply hose, remove the locking pliers. 2. With suitable locking pliers which will not damage the hose, clamp the fuel return line to prevent fuel from returning to the fuel tank. 3. Run the fuel pump with the Tech 2. 4. After pressure has built up, remove power to the pump. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to Step 11	Go to Step 16
16	Locate and replace any leaking fuel injector(s). Is the action complete?	—	Verify repair	—
17	Is the fuel pressure indicated by the fuel pressure gauge above the specified limit?	376 kPa (55 psi)	Go to Step 18	Go to Step 21
18	1. Relieve the fuel pressure. Refer to the Fuel Pressure Relief. 2. Disconnect the fuel return line from the fuel rail. 3. Attach a length of flexible hose to the fuel rail return outlet passage. 4. Place the open end of the flexible hose into an approved gasoline container. 5. Run the fuel pump with the Tech 2. 6. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running. Is the fuel pressure within the specified limits?	290–376 kPa (42–55 psi)	Go to Step 19	Go to Step 20
19	Locate and correct the restriction in the fuel return line. Is the action complete?	—	Verify repair	—
20	Visually and physically inspect the fuel rail outlet passages for a restriction. Was a restriction found?	—	Verify repair	Go to Step 11

Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
21	Is the fuel pressure indicated by the fuel pressure gauge above the specified value?	0 kPa (0 psi)	Go to Step 22	Go to Step 23
22	1. Command the fuel pump ON with the Tech 2. 2. Using suitable pliers which will not damage the fuel hose, gradually apply pressure with the pliers to pinch the flexible fuel return hose closed. **CAUTION: Do not let the fuel pressure exceed the second specified value.** Does the fuel pressure indicated by the fuel pressure gauge rise above the first specified value?	414 kPa (60 psi)	Go to Step 11	Go to Step 7
23	1. Command the fuel pump ON with the Tech 2. 2. Remove the fuel filler cap and listen for the sound of the fuel pump running. 3. Turn the pump off. Was the fuel pump running?	—	Go to Step 7	Go to Fuel System Electrical Test Chart

IDLE AIR CONTROL (IAC) SYSTEM CHECK



D06RX041

Circuit Description

The powertrain control module (PCM) controls engine idle speed with the idle air control (IAC) valve. To increase idle speed, the PCM retracts the IAC valve pintle away from its seat, allowing more air to bypass the throttle bore. To decrease idle speed, it extends the IAC valve pintle towards its seat, reducing bypass air flow. A Tech 2 will read the PCM commands to the IAC valve in counts. Higher counts indicate more air bypass (higher idle). Lower counts indicate less air is allowed to bypass (lower idle).

Diagnostic Aids

A slow, unstable, or fast idle may be caused by a non–IAC system problem that cannot be overcome by the IAC valve. Out of control range IAC Tech 2 counts will be above 60 if idle is too low, and zero counts if idle is too high. The following checks should be made to repair a non–IAC system problem:

- Vacuum leak (high idle) – If idle is too high, stop the engine. Fully extend (low) IAC with the IAC motor analyzer J 39027–A. Start the engine. If idle speed is above 800 RPM, locate and correct the vacuum leak, including the PCV system. Check for binding of the throttle blade or linkage.
- Lean heated oxygen sensor signal (high air/fuel ratio) – The idle speed may be too high or too low. Engine speed may vary up and down, and disconnecting the IAC valve does not help. Diagnostic trouble codes P0131, P0151, P0171, or P0174 may be set. Tech 2 oxygen (O2) voltage will be less than 100 mV (0.1 V). Check for low regulated fuel pressure, water in fuel, or a restricted injector.

- Rich heated oxygen sensor signal (low air/fuel ratio) – The idle speed will be too low. Tech 2 IAC counts will usually be above 80. The system is obviously rich and may exhibit black smoke in the exhaust.
- Tech 2 O2 voltage will be fixed at about 750 mV (0.75 V). Check for high fuel pressure, or a leaking or sticking injector. A silicon–contaminated heated oxygen sensor will show an O2 voltage slow to respond on the Tech 2.
- Throttle body – Remove the IAC valve and inspect the bore for foreign material.
- IAC valve electrical connections – IAC valve connections should be carefully checked for proper contact.
- PCV valve – An incorrect or faulty PCV valve may result in an incorrect idle speed. Refer to Diagnosis, Rough Idle, Stalling.

  If intermittent poor driveability or idle symptoms are resolved by disconnecting the IAC, carefully recheck the connections and valve terminal resistance, or replace the IAC.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The IAC motor analyzer J 39027–A is used to extend and retract the IAC valve. Valve movement is verified by an engine speed change. If no change in engine speed occurs, the valve can be resettled when removed from the throttle body.
2. This step checks the quality of the IAC movement in step 1. Between 700 revolutions per minute (RPM) and about 1500 RPM, the engine speed should change smoothly with each flash of the tester light in both extend and retract. If the IAC valve is retracted beyond the control range (about 1500 RPM), it may take many flashes to extend the IAC valve before engine speed will begin to drop. This is normal on certain engines. Fully extending the IAC may cause engine stall. This may be normal.
6. Steps 1 and 2 verified the proper IAC valve operation. This step checks the IAC circuits. Each lamp on the noid light should flash red and green while the IAC valve is cycled. While the sequence of color is not important, if either light is OFF or does not flash red and green, check the circuits for faults, beginning with poor terminal contacts.

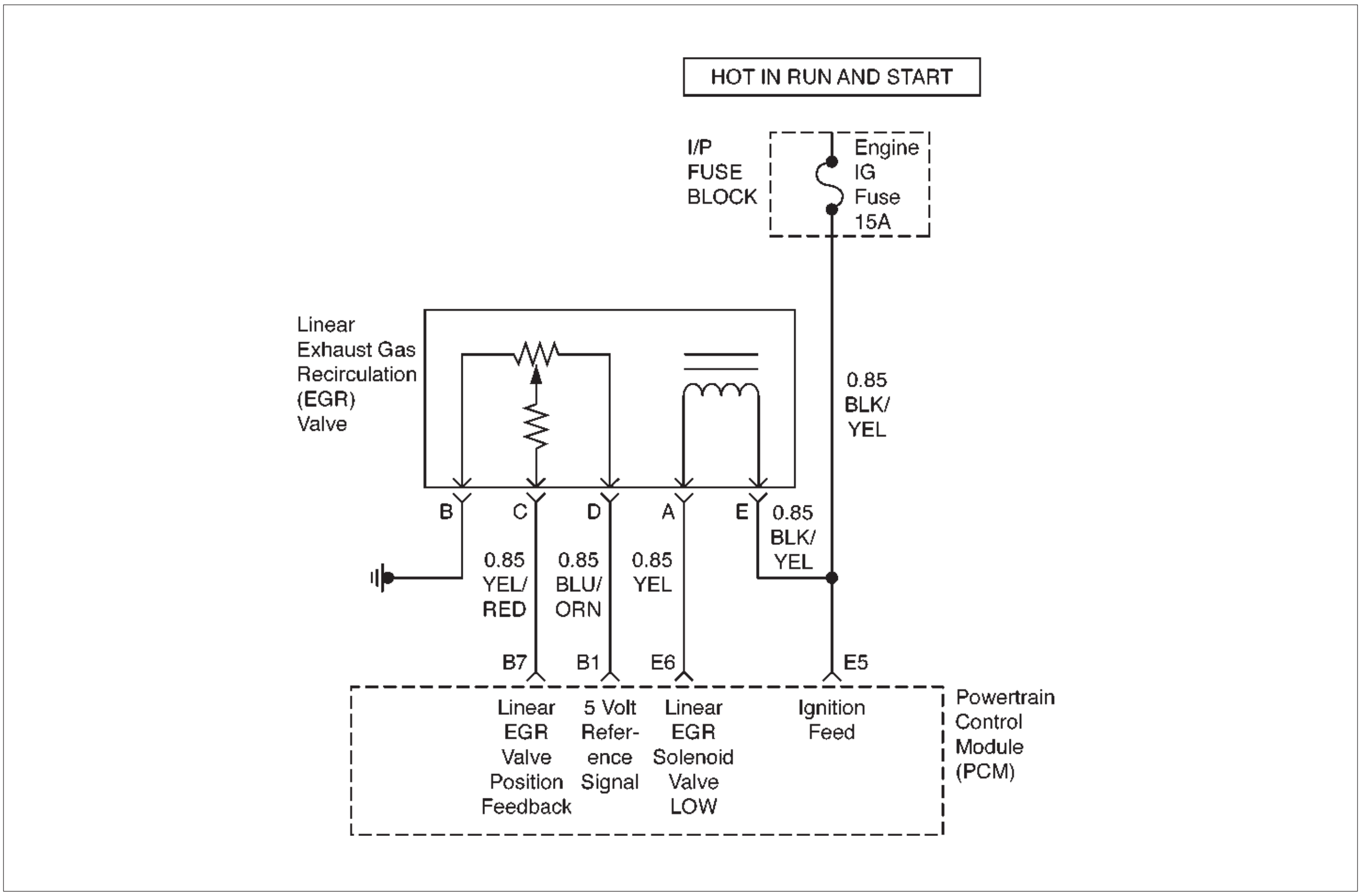
Idle Air Control (IAC) System Check

Step	Action	Value(s)	Yes	No
1	1. Ignition OFF. 2. Connect the IAC motor analyzer J 39027–A to the IAC valve. 3. Set the parking brake. 4. Block the wheels. 5. Turn the air conditioning OFF. 6. Idle the engine in Park (A/T) or Neutral (M/T). 7. Install the Tech 2. Display the RPM. 8. Use the IAC motor analyzer J 39027–A to extend and retract the IAC valve. 9. The engine speed should decrease and increase as the IAC is cycled. Does the RPM change?	—	Go to Step 2	Go to Step 3
2	RPM should change smoothly with each flash of the IAC motor analyzer J 39027–A light. Does the RPM change within the range specified?	700–1500 RPM	Go to Step 6	Go to Step 3
3	Check the IAC passages. Are the IAC passages blocked?	—	Go to Step 4	Go to Step 5
4	Clear any obstruction from the IAC passages. Is the action complete?	—	Verify repair	—
5	Replace the IAC. Refer to On–Vehicle Service, Idle Air Control Valve. Is the action complete?	—	Verify repair	—

Idle Air Control (IAC) System Check (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Install the appropriate IAC noid light from J 39027–A into the powertrain control module harness. 2. Cycle the IAC motor analyzer J 39027–A and observe the noid lights. 3. Both the lights should cycle red and green, but never OFF, as the RPM is changed over its range. Do the noid lights cycle red and green?	—	Go to Step 7	Go to Step 8
7	1. Use the other connector on the IAC motor analyzer J 39027–A pigtail. 2. Check the resistance across the IAC coils. Measure the resistance between terminal A and terminal B. 3. Measure the resistance between terminal C and terminal D. Is the resistance within the specified range?	40–80 Ω	Go to Step 9	Go to Step 10
8	If the circuits did not test green and red, check the following: ● Faulty connector terminal contacts ● Open circuits, including connections ● Circuits shorted to ground or voltage ● Faulty powertrain control module connector(s) or powertrain controlmodule. Are repairs necessary?	—	Go to Step 13	—
9	1. Check the resistance between the IAC terminal B and terminal C. 2. Check the resistance between the IAC terminal A and terminal D. Is the resistance infinite?	—	Go to Step 11	Go to Step 12
10	Replace the IAC. Refer to On–Vehicle Service, Idle Air Control Valve. Is the action complete?	—	Go to Step 7	—
11	Check the IAC valve and circuit. Are the IAC valve and circuit OK?	—	Refer to Diagnostic Aids	Go to Step 12
12	Replace the IAC. Refer to On–Vehicle Service, Idle Air Control Valve. Is the action complete?	—	Go to Step 9	—
13	Repair or replace the faulty component(s). Is the action complete?	—	Go to Step 6	—

EXHAUST GAS RECIRCULATION (EGR) SYSTEM CHECK



D06RX055

Circuit Description

A properly operating exhaust gas recirculation (EGR) system will directly affect the air/fuel requirements of the engine. Since the exhaust gas introduced into the air/fuel mixture is an inert gas (contains very little or no oxygen), less fuel is required to maintain a correct air/fuel ratio.

Introducing exhaust gas into the combustion chamber lowers combustion temperatures and reduces the formation of oxides of nitrogen (NOx) in the exhaust gas. Lower combustion temperatures also prevent detonation. If the EGR pintle were to stay closed, the inert exhaust gas would be replaced with air and the air/fuel mixture would be leaner. The powertrain control module (PCM) would compensate for the lean condition by adding fuel, resulting in higher long term fuel trim values.

Diagnostic Aids

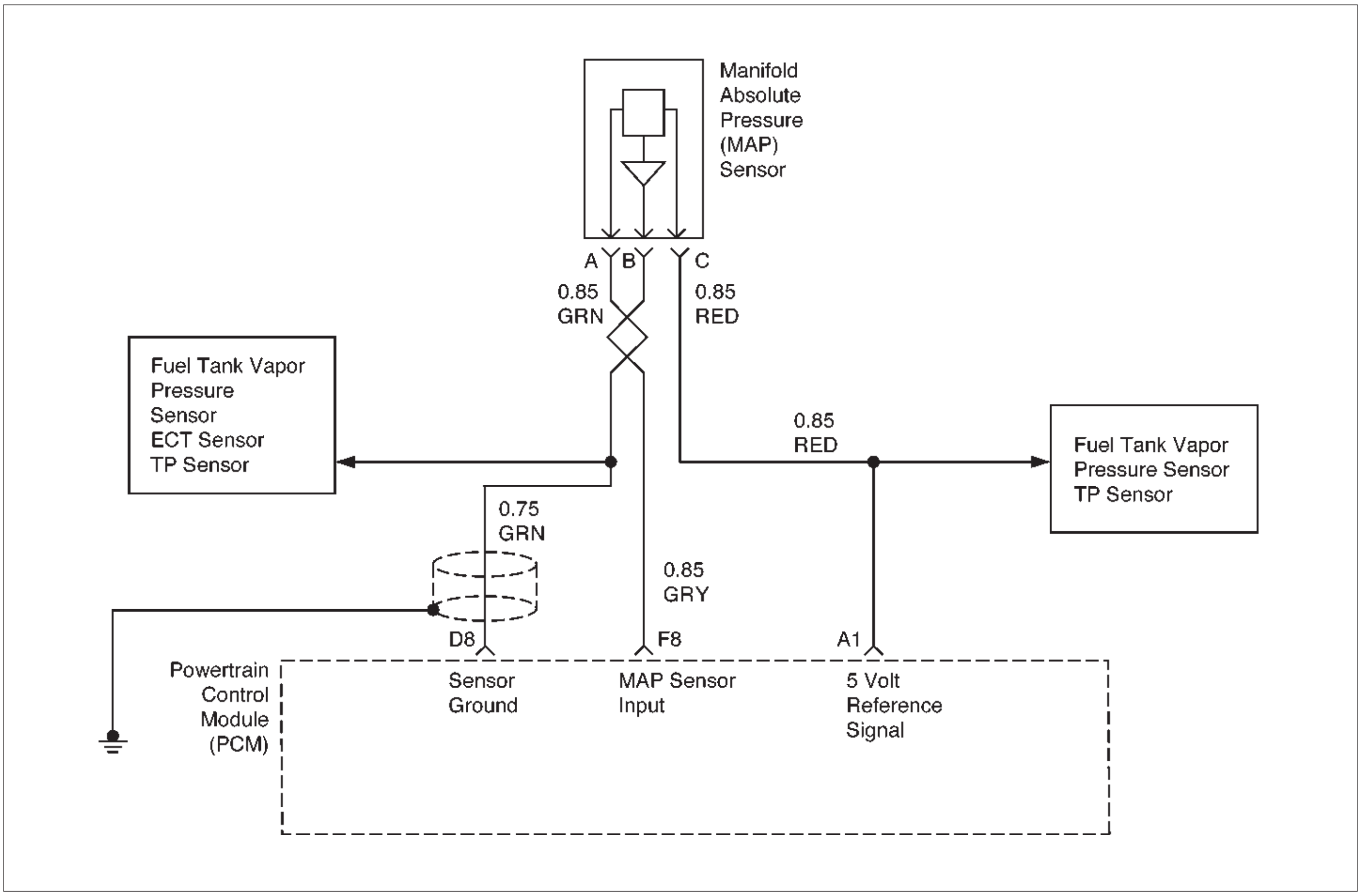
The EGR valve chart is a check of the EGR system. An EGR pintle constantly in the closed position could cause detonation and high emissions of NOx. It could also result in high long term fuel trim values in the open throttle cell, but not in the closed throttle cell. An EGR pintle constantly in the open position would cause rough idle. Also, an EGR valve mounted incorrectly (rotated 180°) could cause a rough idle without setting an EGR DTC. Check for the following items:

- EGR passages – Check for restricted or blocked EGR passages.
- Manifold absolute pressure sensor – A manifold absolute pressure sensor may shift in calibration enough to affect fuel delivery. Refer to Manifold Absolute Pressure Output Check.

Exhaust Gas Recirculation (EGR) System Check

Step	Action	Value(s)	Yes	No
1	Check the EGR valve for looseness. Is the EGR valve loose?	—	Go to Step 2	Go to Step 3
2	Tighten the EGR valve. Is the action complete?	—	Verify repair	—
3	1. Place the transmission selector in Park or Neutral. 2. Start the engine and idle until warm (”Closed Loop”). 3. Using a Tech 2, command EGR ”50% ON.” Does the engine idle rough and lose RPMs?	—	EGR system working properly. No problem found.	Go to Step 4
4	1. Engine OFF. 2. Ignition ON. 3. Using a test light to ground, check the EGR harness between the ignition feed and ground. Does the test light illuminate?	—	Go to Step 6	Go to Step 5
5	Repair the EGR harness ignition feed. Was the problem corrected?	—	Verify repair	Go to Step 6
6	1. Remove the EGR valve. 2. Visually and physically inspect the EGR valve pintle, valve passages and adapter for excessive deposits, obstructions or any restrictions. Does the EGR valve have excessive deposits, obstructions or any restrictions?	—	Go to Step 7	Go to Step 8
7	Clean or replace EGR system components as necessary. Was the problem corrected?	—	Verify repair	Go to Step 8
8	1. Ground the EGR valve metal case to battery (–). 2. Using a Tech 2, command EGR ON and observe the EGR valve pintle for movement. Does the EGR valve pintle move according to command?	—	Go to Step 9	Go to DTC P0404 chart
9	1. Remove the EGR inlet and outlet pipes from the intake and exhaust manifolds. 2. Visually and physically inspect manifold EGR ports and EGR inlet and outlet pipes for blockage or restriction caused by excessive deposits or other damage. Do the manifold EGR ports or inlet and outlet pipes have excessive deposits, obstructions, or any restrictions?	—	Go to Step 10	EGR system working properly. No problem found.
10	Clean or replace EGR system components as necessary. Is the action complete?	—	Verify repair	—

MANIFOLD ABSOLUTE PRESSURE (MAP) OUTPUT CHECK



D06RX042

Circuit Description

The manifold absolute pressure (MAP) sensor measures the changes in the intake MAP which result from engine load (intake manifold vacuum) and engine speed changes; and converts these into a voltage output. The powertrain control module (PCM) sends a 5–volt reference voltage to the MAP sensor. As the MAP changes, the output voltage of the sensor also changes. By monitoring the sensor output voltage, the PCM knows the MAP. A lower pressure (low voltage) output voltage will be about 1–2 volts at idle. Higher pressure (high voltage) output voltage will be about 4–4.8 volts at wide open throttle. The MAP sensor is also used, under certain conditions, to measure barometric pressure, allowing the PCM to make adjustments for different altitudes. The PCM uses the MAP sensor to diagnose proper operation of the EGR system, in addition to other functions.

Test Description

IMPORTANT: Be sure to use the same diagnostic test equipment for all measurements.

The number(s) below refer to the step number(s) on the Diagnostic Chart:

1. When you compare the Tech 2 readings to a known good vehicle, it is important to compare vehicles that use MAP sensors that have the same part number.
2. Applying 34 kPa (10 Hg) vacuum to the MAP sensor should cause the voltage to be 1.5–2.1 volts less than the voltage at step 1. Upon applying vacuum to the sensor, the change in voltage should be instantaneous. A slow voltage change indicates a faulty sensor.
3. Check the vacuum hose to the sensor for leaking or restriction. Be sure that no other vacuum devices are connected to the MAP hose.

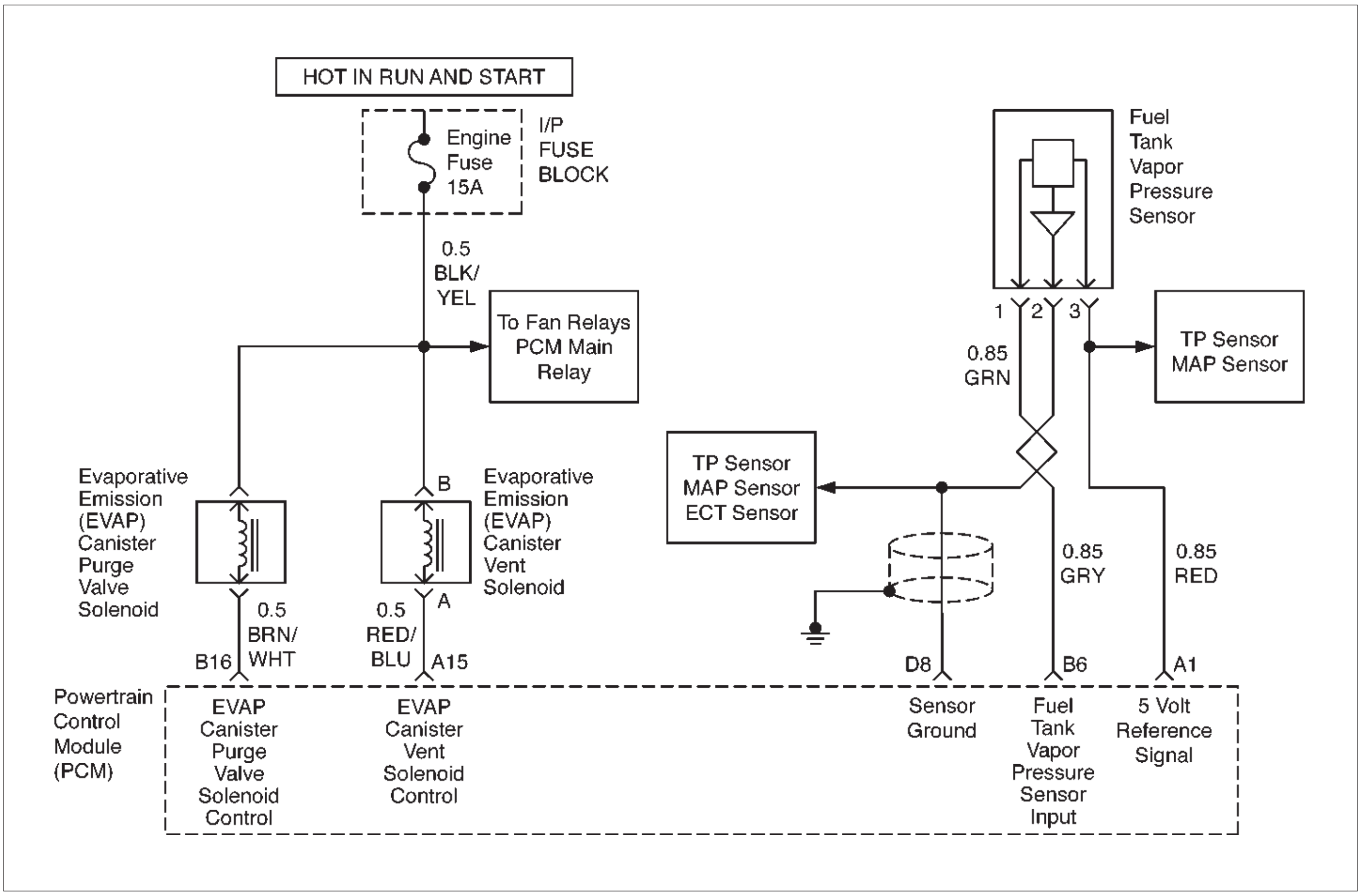
IMPORTANT: Make sure the electrical connector remains securely fastened.

4. Disconnect the sensor from the bracket. Twist the sensor with your hand to check for an intermittent connection. Output changes greater than 0.10 volt indicate a bad sensor.

Manifold Absolute Pressure (MAP) Output Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition OFF and leave it OFF for 15 seconds. 2. Ignition ON. Do not crank engine. 3. The Tech 2 should indicate a manifold absolute pressure (MAP) sensor voltage. 4. Compare this scan reading to the scan reading of a known good vehicle obtained using the exact same procedure as in Steps 1–4. Is the voltage reading the same +/– 0.40 volt?	—	Go to Step 2	Go to Step 5
2	1. Disconnect the vacuum hose at the MAP sensor and plug the hose. 2. Connect a hand vacuum pump to the MAP sensor. 3. Start the engine. 4. Apply 34 kPa (10 Hg) of vacuum and note the voltage change. Is the voltage change 1.5–2.1 volts less than step 1?	—	Go to Step 3	Go to Step 4
3	Check the sensor hose for leakage or restriction. Does the hose supply vacuum to the MAP sensor only?	—	Go to Step 5	Go to Step 4
4	Repair the hose to ensure the hose supplies vacuum to the MAP sensor only. Is the action complete?	—	Verify repair	—
5	Check the sensor connection. Is the sensor connection good?	—	Go to Step 6	Go to Step 7
6	Refer to On–Vehicle Service, MAP Sensor. Is the action complete?	—	Verify repair	—
7	Repair the poor connection. Is the action complete?	—	Verify repair	—

EVAPORATIVE (EVAP) EMISSIONS CANISTER PURGE VALVE SOLENOID CHECK



Circuit Description

Canister purge is controlled by a solenoid valve that allows manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge ON). The EVAP purge solenoid control is turned ON time is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the purge solenoid is enabled when the appropriate conditions have been met:

- The engine run time after start is more than 60 seconds.
- The engine coolant temperature is above 30˚C (86˚F).
- The fuel control system is operating in the Closed–Loop mode.

Diagnostic Aids

- Make a visual check of vacuum hoses.
- Check the throttle body for possible cracked.
- Check the malfunction indicator lamp for a possible mechanical problem.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart:

1. Check to see if the solenoid is open or closed. The solenoid is normally de–energized in this step, so it should be closed.
2. This step checks to determine if the solenoid was open due to an electrical circuit problem or a defective solenoid.
3. This should normally energize the solenoid, opening the valve and allowing the vacuum to drop (purge ON).

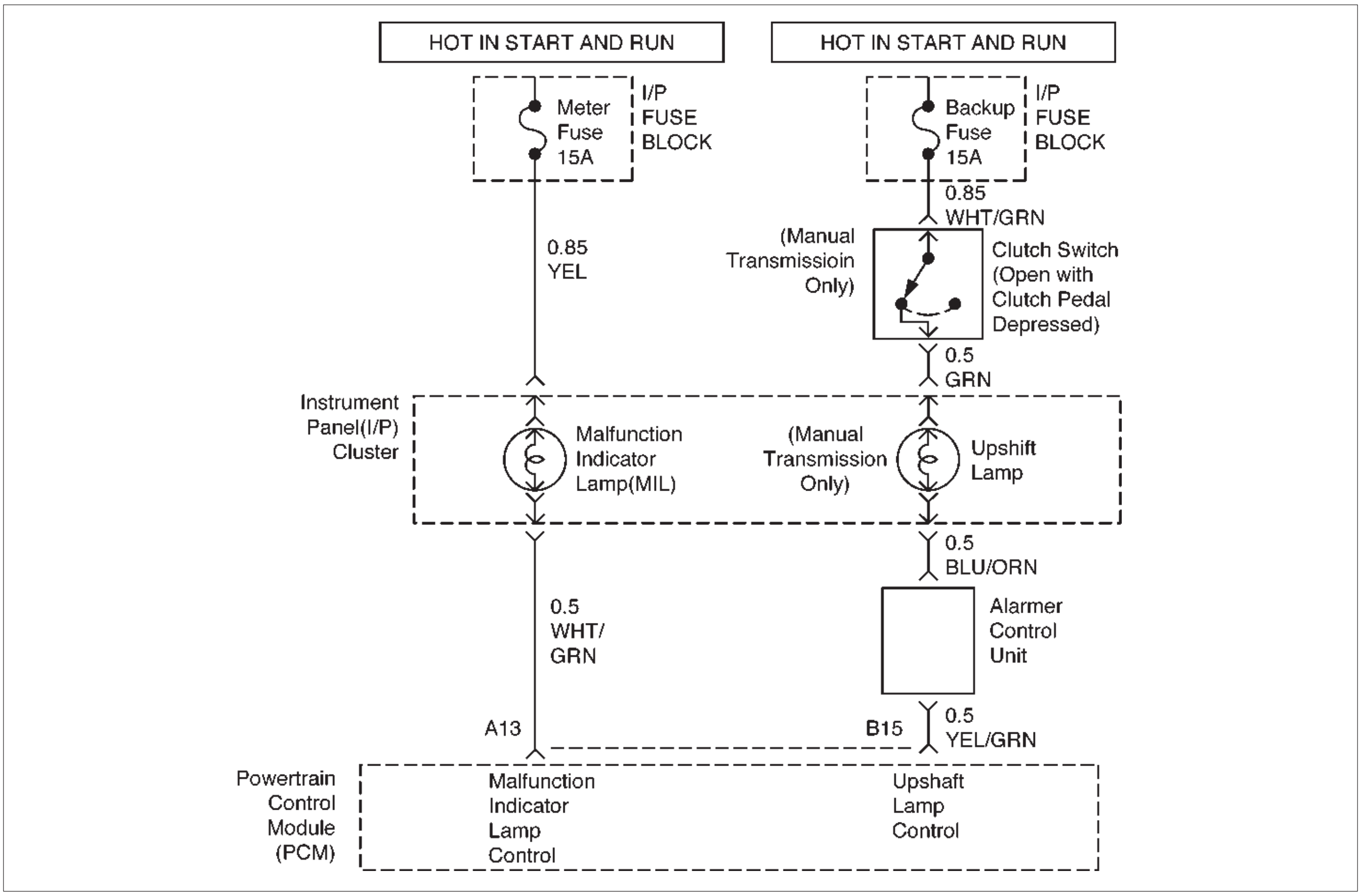
Evaporative (EVAP) Emissions Canister Purge Valve Solenoid Check

Step	Action	Value(s)	Yes	No
1	1. Ignition OFF. 2. Ignition ON, engine OFF. 3. At the throttle body, disconnect the hose that goes to the pump solenoid. 4. Using a hand vacuum pump with an attached vacuum gauge J 23738–A, apply vacuum (10” Hg or 34 kPa) to the solenoid. Does the solenoid hold vacuum?	—	Go to Step 3	Go to Step 2
2	1. Disconnect the solenoid electrical connector. 2. As in Step 1, apply vacuum (10” Hg or 34 kPa) to the solenoid. Does the solenoid hold vacuum?	—	Go to Step 4	Go to Step 7
3	1. At the throttle body, put a cap over the vacuum port where the hose was disconnected for testing. This is to prevent a vacuum leak when the engine is started. 2. Ignition OFF. 3. Install the Tech 2. 4. Apply vacuum to the purge solenoid with the hand vacuum pump. 5. Start the engine, run at 2500 RPM. 6. Using the Tech 2 command the purge solenoid ON. Did the vacuum drop when the purge was turned on?	—	Go to Step 8	Go to Step 9
4	Check for a short to ground or open in the wire between the solenoid and the PCM. Is there a problem?	—	Go to Step 5	Go to Step 6
5	Repair the faulty wire. Is the action complete?	—	Verify repair	—
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. and also refer to latest service bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
7	Replace the faulty purge solenoid. Refer to On–Vehicle Service, EVAP Canister Purge Solenoid. Is the action complete?	—	Verify repair	—

Evaporative (EVAP) Emissions Canister Purge Valve Solenoid Check (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition OFF. 2. At the throttle body, install a vacuum gauge where the hose from the purge solenoid was disconnected for testing. 3. Start the engine. 4. Stabilize the engine speed at about 2500 RPM. 5. Momentarily snap the throttle open and let it return to idle. Is there approximately 10" Hg (34 kPa) of vacuum available at the EVAP emission canister purge solenoid?	—	No problem found in the EVAP emission canister purge valve check.	Refer to Diagnostic Aids
9	1. Turn the Ignition OFF. 2. Disconnect the solenoid's electrical connector. 3. Connect a test lamp between the harness terminals. 4. Turn the Ignition ON. Does the test lamp light?	—	Go to Step 7	Go to Step 10
10	Probe each terminal of the solenoid valve electrical connector with a test lamp to ground. Does the test lamp light on both terminals?	—	Go to Step 11	Go to Step 12
11	Repair the short to voltage in the wire between the solenoid and the PCM. Is the action complete?	—	Verify repair	—
12	Does the ignition feed terminals light the test lamp?	—	Go to Step 13	Go to Step 14
13	Check for an open in the wire between the purge solenoid and the PCM. Was there an open circuit?	—	Go to Step 15	Go to Step 6
14	Repair the open in the ignition feed wire. Is the action complete?	—	Verify repair	—
15	Repair the open wire. Is the action complete?	—	Verify repair	—

Upshift Lamp System Check (Manual Transmission Only)



D06RX063

Circuit Description

The shift lamp indicates the best transmission shift point for maximum fuel economy.

The lamp is controlled by the Power Train Control Module (PCM) and is turned “ON” by grounding the YEL/GRN wire.

The PCM is used information from the following inputs to control the upshift lamp.

- Engine Coolant temperature (ECT) Sensor
- Throttle Position Sensor
- Vehicle Speed Sensor
- Engine Speed

The PCM uses the measured RPM and the vehicle speed to calculate what gear the vehicle is in.

It’s this calculation that determines when the upshift lamp should be turned “ON”.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation. Check for poor connections or a damaged harness.

Inspect the PCM harness and connector for proper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.

Test Description

1. This should not turn “ON” the up-shift lamp. If the lamp is “ON”, there is a short to ground in YEL/GRN or a fault PCM.
2. This checks the upshift lamp circuit up to the PCM connector.

   If the up-shift lamp illuminates, then the PCM connector is faulty or PCM does not have the ability to ground the circuit.

Up-Shift Lamp System Check

Step	Action	Value(s)	Yes	No
1	1. Verify the customer complaints in accordance with mentioned below: Go to the adequate Step Chart first. • At the 1st gear position, the lamp doesn't illuminate: Go to Step Chart • At the 3rd gear position, the lamp doesn't illuminate: Go to Step Chart • Upshift Lamp doesn't illuminate always. 2. Ignition "ON", engine "OFF". 3. Using the Tech 2, check to see if the upshift lamp turn "ON" or "OFF". Does the upshift lamp stay "OFF"?	—	Go to *Step 2*	Go to *Step 12*
2	Check for an open of 15A Turn Backup Fuse. Was a problem found?	—	Go to *Step 3*	Go to *Step 4* Refer to Section 8
3	Replace the fuse. Is the action complete?	Verify Repair	—	—
4	Check for an burned out the Upshift Lamp. Was a problem found?	—	Go to *Step 5*	Go to *Step 6*
5	Replace the Upshift Lamp. Is the action complete?	Verify Repair	—	—
6	1. Check for an Clutch Switch operation and the fixing condition. 2. Check for an open or short of clutch switch. 3. Check for an open or short of WHT/GRN wiring harness between Turn Backup Fuse and Clutch Switch. Was a problem found?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the Clutch Switch. Or, 2. Repair for an open or short of WHT/GRN wiring harness. Is the action complete?	Verify Repair	—	—
8	1. Check for an open or short of 1-2 Transmission Switch. 2. Check for an open or short of 3-4 Transmission Switch. 3. Check for an open or short of GRN wiring harness between Clutch Switch and Transmission Switches. Was a problem found?	—	Go to *Step 9*	Go to *Step 10*
9	1. Replace the applicable Transmission Switch. or, 2. Repair for an open or short of GRN wiring harness. Is the action complete?	Verify Repair	—	—

Up-Shift Lamp System Check (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check for an open or short in the Alarmer and Relay Control Unit. 2. Check for an open of BLU/ORN wiring harness between Transmission Switches and Alarmer Relay Control Unit. Was a problem found?	—	Go to *Step 11*	Go to *Step 12*
11	1. Replace the Alarmer and Relay Control Unit. Or, 2. Repair for an open of BLU/ORN wiring harness between Alarmer and Relay Control Unit and PCM connector. Is the action complete?	Verify Repair	—	Go to *Step 15*
12	1. Ignition "OFF". 2. Disconnect the PCM connectors. 3. Shift the gear to 1st or 4th gear position. 4. Turn ignition "ON", but *don't start the engine*. Does the Upshift Lamp Stay "ON"?	—	Go to *Step 13*	Go to *Step 15*
13	Check for an short to ground of YEL/GRN wiring harness between Alarmer and PCM connector. Was a problem found?	—	Go to *Step 14*	Go to *Step 15*
14	Repair for an open YEL/GRN wiring harness. Is the action complete?	Verify Repair	—	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed refer to ON-Vehicle Service in Power Train Control Module and Sensor for procedure. and also refer to latest service bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	—	—

PCM DIAGNOSTIC TROUBLE CODES

The following table lists the diagnostic trouble codes supported by this vehicle application. If any DTCs not listed here are displayed by a Scan Tool, the Tech 2 data may be faulty; notify the Tech 2 manufacturer of any DTCs displayed that are not included in the following table.

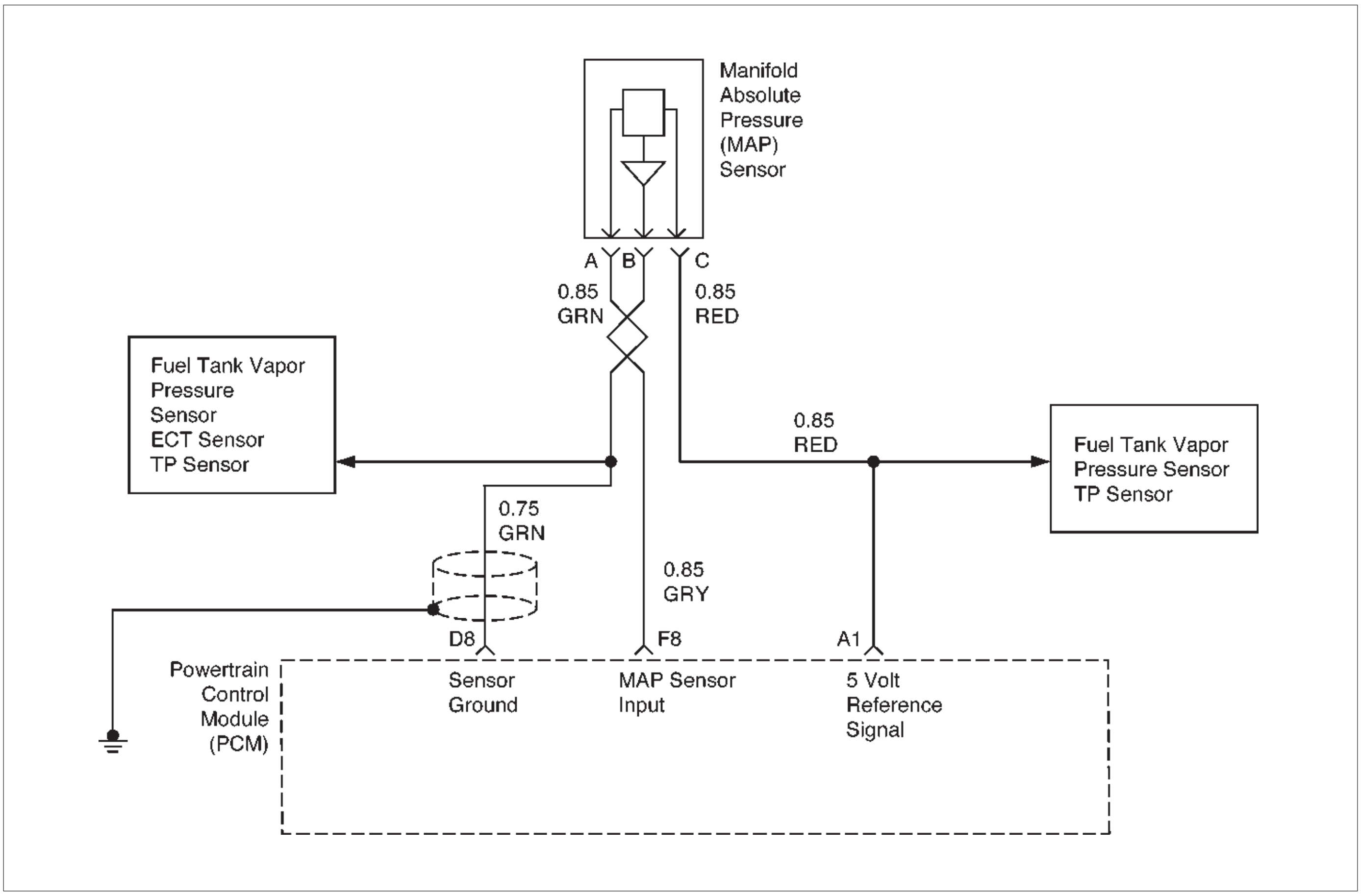
PCM Diagnostic Trouble Codes

DTC	Description	Type	Illuminate MIL
P0106	MAP Circuit/Range Performance Problem	B	Yes
P0107	MAP Sensor Circuit Low Input	A	Yes
P0108	MAP Sensor Circuit High Input	A	Yes
P0112	IAT Sensor Circuit Low Input	A	Yes
P0113	IAT Sensor Circuit High Input	A	Yes
P0117	ECT Sensor Circuit Low Input	A	Yes
P0118	ECT Sensor Circuit High Input	A	Yes
P0121	TP Sensor Circuit Range/Performance Problem	A	Yes
P0122	TP Sensor Circuit Low Input	A	Yes
P0123	TP Sensor Circuit High Input	A	Yes
P0125	Insufficient Coolant Temperature for Closed Loop Fuel Control	B	Yes
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	A	Yes
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	A	Yes
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	B	Yes
P0134	O2 Sensor Circuit No Activity Detected (Bank Sensor 1)	A	Yes
P0135	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)	B	Yes
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	A	Yes
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	A	Yes
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	A	Yes
P0141	O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)	B	Yes
P0171	Fuel Trim System Too Lean (Bank 1)	B	Yes
P0172	Fuel Trim System Too Rich (Bank 1)	B	Yes
P0201	Injector Circuit Malfunction – Cylinder 1	A	Yes
P0202	Injector Circuit Malfunction – Cylinder 2	A	Yes
P0203	Injector Circuit Malfunction – Cylinder 3	A	Yes
P0204	Injector Circuit Malfunction – Cylinder 4	A	Yes
P0300	Random/Multiple Cylinder Misfire Detected	B	Yes
P0301	Cylinder Misfire Detected (#1)	B	Yes
P0302	Cylinder Misfire Detected (#2)	B	Yes
P0303	Cylinder Misfire Detected (#3)	B	Yes
P0304	Cylinder Misfire Detected (#4)	B	Yes
P0325	Knock Sensor Circuit Malfunction	B	Yes
P0327	Knock Sensor Circuit Low Input	B	Yes
P0336	CKP Sensor Circuit Range/Performance	B	Yes
P0337	CKP Sensor Circuit Low Input	B	Yes
P0341	CMP Sensor Circuit Range/Performance	B	Yes
P0342	CMP Sensor Circuit Low Input	B	Yes
P0351	Ignition Coil ”A” Primary/Secondary	A	Yes

DTC	Description	Type	Illuminate MIL
P0352	Ignition Coil ”B” Primary/Secondary	A	Yes
P0401	EGR Flow Insufficient Detected	A	Yes
P0402	EGR Excessive Flow Detected	B	Yes
P0404	EGR Circuit Range/Performance	B	Yes
P0405	EGR Sensor Circuit Low	A	Yes
P0406	EGR Sensor Circuit High	A	Yes
P0420	Catalyst System Efficiency Below Threshold	A	Yes
P0440	EVAP Control System Malfunction	A	Yes
P0442	EVAP Control System Small Leak Detected	A	Yes
P0443	EVAP Control System Purge Control Valve Circuit Malfunction	A	Yes
P0446	EVAP Control System Vent Control Circuit Malfunction	B	Yes
P0449	EVAP Control System Vent Valve/Solenoid Circuit Malfunction	A	Yes
P0461	Fuel Level Sensor Circuit Range/Performance	B	Yes
P0462	Fuel Level Sensor Circuit Low Input	B	Yes
P0463	Fuel Level Sensor Circuit High Input	B	Yes
P0480	Cooling Fan 1 Control Circuit Malfunction	D	No
P0481	Cooling Fan 2 Control Circuit Malfunction	D	No
P0502	VSS Circuit Low Input	B	Yes
P0506	Idle Control System RPM Lower than expected	B	Yes
P0507	Idle Control System RPM Higher than expected	B	Yes
P0532	A/C Refrigerent Pressure Sensor Circuit Low	D	No
P0533	A/C Refrigerent Pressure Sensor Circuit High	D	No
P0562	System Voltage Low	D	No
P0563	System Voltage High	A	Yes
P0601	Internal Control Module Memory Check Sum Error	A	Yes
P1106	MAP Sensor Circuit Intermittent High Voltage	D	No
P1107	MAP Sensor Circuit Intermittent Low Voltage	D	No
P1111	IAT Sensor Circuit Intermittent High Voltage	D	No
P1112	IAT Sensor Circuit Intermittent Low Voltage	D	No
P1114	ECT Sensor Circuit Intermittent Low Voltage	D	No
P1115	ECT Sensor Circuit Intermittent High Voltage	D	No
P1121	TP Sensor Circuit Intermittent High Voltage	D	No
P1122	TP Sensor Circuit Intermittent Low Voltage	D	No
P1133	O2 Sensor Insufficient Switching (Bank 1 Sensor 1)	B	Yes
P1134	O2 Sensor Transition Time Ratio (Bank 1 Sensor1)	B	Yes
P1171	Fuel System Lean During Acceleration	A	Yes
P1336	CKP System Variation Not Learned	A	Yes
P1380	ABS Rough Road System Fault	D	No
P1381	ABS Rough Road Class 2 Serial Data Fault	D	No
P1404	EGR Closed Valve	B	Yes
P1441	EVAP System Flow During Non–Purge	B	Yes
P1546	A/C Compressor Clutch Output Circuit Malfunction	D	No
P1625	PCM Unexpected Reset	D	Yes

DTC	Description	Type	Illuminate MIL
P1627	PCM A/D Conversion Malfunction	A	Yes
P1635	5 Volt Reference Voltage Circuit Malfunction	A	Yes
P1640	ODM Output Circuit Fault	D	No

DIAGNOSTIC TROUBLE CODE (DTC) P0106 MANIFOLD ABSOLUTE PRESSURE (MAP) CIRCUIT/RANGE PERFORMANCE PROBLEM



D06RX042

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure. The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (low manifold pressure) to above 4 volts with the ignition ON engine not running or at wide–open throttle (high manifold pressure).

A "speed density" method of determining engine load is used on the 2.2L engine. This is calculated using inputs from the MAP sensor, RPM, CKP Sensor, and the Intake Air Temperature (IAT) sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function. The MAP sensor is also used to determine manifold pressure changes while the exhaust gas recirculation (EGR) flow test diagnostic is being run, to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). Refer to DTC P0401.

The PCM monitors the MAP signals for voltages outside the normal range (10–104 kpa) of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively low, Diagnostic Trouble Code P0106 will be set. Diagnostic Trouble Code P0106 is a Type B Code.

Conditions for Setting the DTC

- No ECT, CKP, EGR, EVAP, MAP orTP sensor DTC's present.
- Engine speed is steady, changing less than 20 RPM.
- Throttle position is steady, throttle angle changes less than 5%.
- EGR flow rate is steady, changing less than 2%.
- IAC valve counts are steady, changing less than 3 counts.
- Engine speed is between 1000 RPM and 4000 RPM.
- ECT is above –10°C (14°F).
- No change in brake switch, A/C clutch, 3 or power steering pressure switch status.

The above conditions are met for longer than 1.5 seconds and the following condition is met in two consecutive trips:

- Actual MAP value varies more than 10 kPa.
- The MAP value must vary for a total of 10 seconds over a 20–second period of time that the samples were monitored.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0106 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0106 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The MAP sensor shares a 5 Volt Reference with the TP sensor and Fuel Pressure sensor. If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the TP sensor and Fuel Pressure sensor.
- Damaged harness – Inspect the wiring harness for damage; an open circuit, a short to ground, or a short to voltage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If Diagnostic Trouble Code P0106 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set. If it is determined that the Diagnostic Trouble Code occurs intermittently, performing the Diagnostic Trouble Code P1106 or P1107 Diagnostic Chart may isolate the cause of the fault.

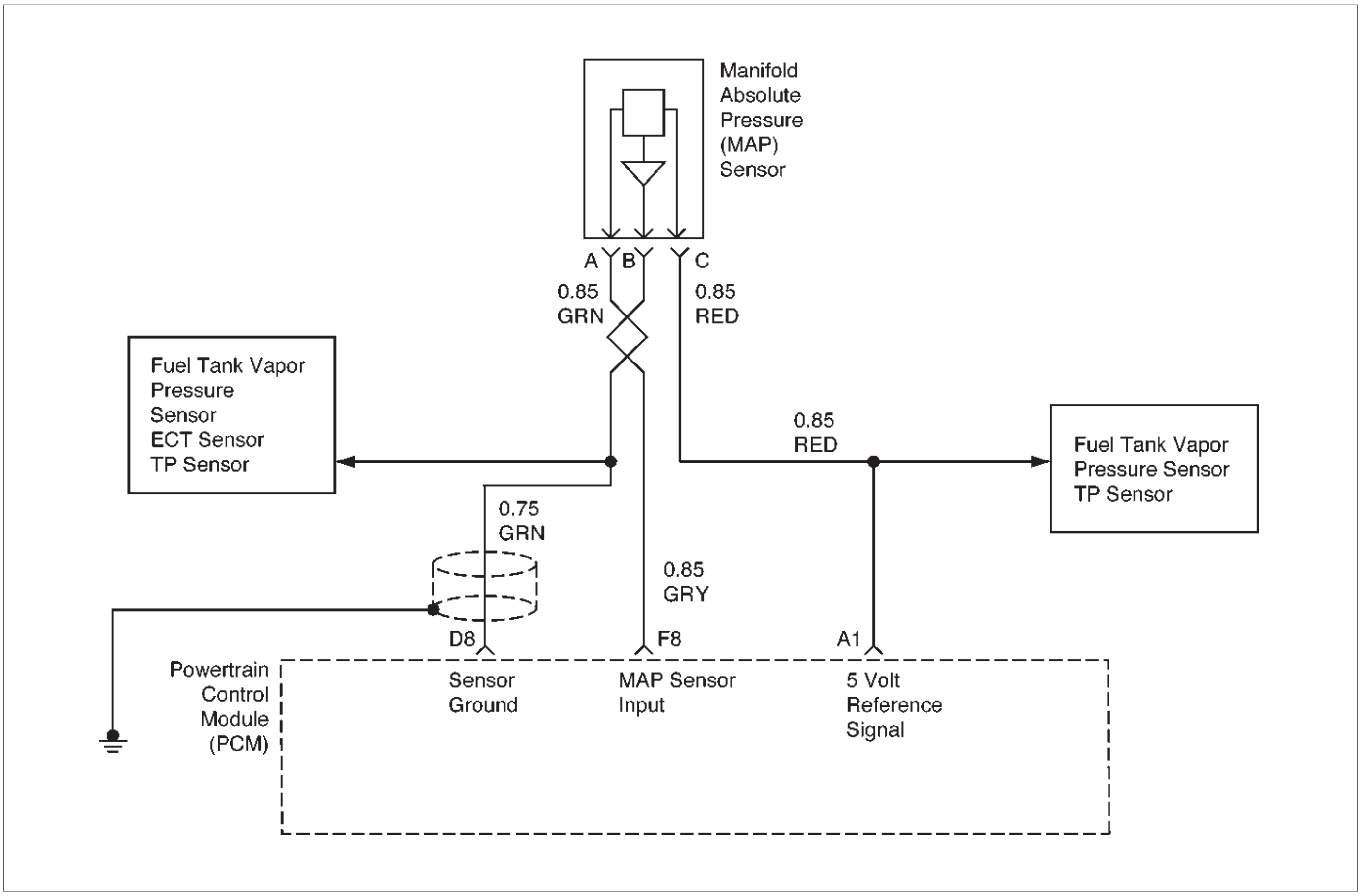
DTC P0106 MAP Circuit/Range Performance Problem

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, engine OFF 2. Review and record Tech 2 Failure Records data, then clear the DTC's. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for Diagnostic Trouble Code P0106. Does the Tech 2 indicate that DTC P0106 ran and passed?	—	Go to Step 3	Go to Step 4
3	1. Check for the following condition: • Vacuum hoses disconnected, damaged, or incorrectly routed? • Intake manifold vacuum leaks; • Vacuum leaks at throttle body; • Vacuum leaks at EGR valve flange and pipes; 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to Diagnostic Aids
4	1. Disconnect the Manifold Absolute Pressure (MAP) sensor electrical connector. 2. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	0 V 10.3 kPa	Go to Step 6	Go to Step 5
5	Check the MAP sensor signal circuit; between the MAP sensor and the Powertrain Control Module (PCM), for a short to voltage?	—	Verify repair	Go to Step 12
6	Check the MAP sensor circuit, between the MAP sensor and the PCM, the following conditions: • A short to ground • An open circuit Was the problem found?	—	Verify repair	Go to Step 7

DTC P0106 MAP Circuit/Range Performance Problem (Cont'd)

Step	Action	Value(s)	Yes	No
7	Check the 5 volt signal circuit, between the MAP sensor and the PCM, for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 8
8	1. Ignition OFF. 2. Place a fused jumper between the MAP sensor circuit and the 5 volt signal circuit, both at the wiring harness' MAP sensor connector. 3. Ignition ON, engine OFF. 4. Observe the MAP value displayed on the Tech 2? Does the Tech 2 read the following value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	5 volts 104 kPa	Go to Step 9	Go to Step 12
9	Check the MAP sensor ground circuit, between the MAP sensor and the PCM, for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 10
10	1. Ignition OFF. 2. Place a Digital Multimeter (DVM), set to measure voltage, between the ground circuit and the 5 volt signal circuit, both at the wiring harness' MAP sensor connector. 3. Ignition ON, engine OFF. 5 volts Does the DVM read the following value?	—	Go to Step 11	Go to Step 12
11	Replace the MAP sensor. Verify repair.	—	—	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P0107 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT LOW INPUT



D06RX042

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure. The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (low manifold pressure) to above 4 volts with the ignition ON, engine not running or at wide–open throttle (high manifold pressure).

A ”speed density” method of determining engine load is used on the 2.2L engine. This is calculated using inputs from the MAP sensor, the CKP Sensor, and the Intake Air Temperature (IAT) sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function. The MAP sensor is also used to determine manifold pressure changes while the exhaust gas recirculation (EGR) flow test diagnostic is being run, to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). Refer to DTC P0401.

The PCM monitors the MAP signals for voltages outside the normal range (10–104 kpa) of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively low, Diagnostic Trouble Code P0107 will be set. DTC P0107 is a Type A Code.

Conditions for Setting the DTC

- No TP sensor Diagnostic Trouble Codes present.
- Engine is running.
- System voltage greater than 11 volts.
- Throttle angle is above 0% if engine speed is less than or equal to 1300 RPM.
- Throttle angle is above 5% if engine speed is above 1300 RPM.
- The MAP sensor indicates manifold absolute pressure below 11 kPa for a total of approximately 10 seconds over a 16–second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will use a MAP value based on speed density calculation.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0107 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0107 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The MAP sensor shares a 5 Volt Reference with the TP sensor and Fuel Pressure sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the TP sensor and Fuel Pressure sensor.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.
- A faulty 5 volt reference circuit could also set a TP Sensor Diagnostic Trouble Code because the two sensors share the same 5 volt reference pin at the PCM.

If Diagnostic Trouble Code P0107 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set. If it is determined that the Diagnostic Trouble Code occurs intermittently, performing the Diagnostic Trouble Code P0107 Diagnostic Chart may isolate the cause of the fault.

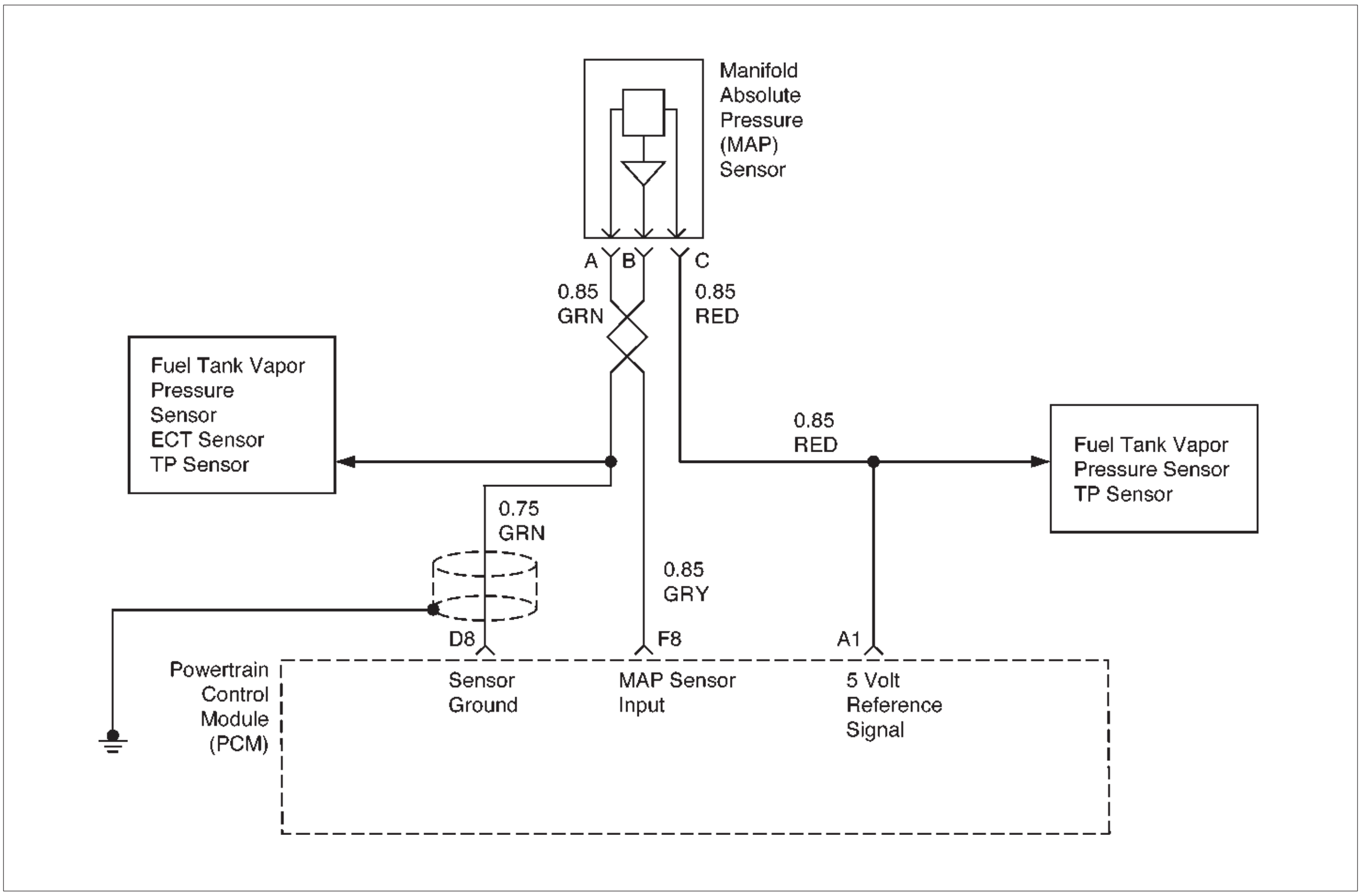
DTC P0107 – MAP Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, engine OFF. 2. With the throttle closed, observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	0V 10.3 kPa at sea level	Go to Step 4	Go to Step 3
3	1. Ignition ON, engine OFF. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor «Diagnostic Trouble Code” info for Diagnostic Trouble Code P0107. Does the Tech 2 indicate Diagnostic Trouble Code P0107 failed?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Ignition OFF. 2. Disconnect the MAP sensor electrical connector. 3. Jumper the 5 volt reference circuit and the MAP signal together at the MAP sensor harness connector. 4. Ignition ON. 5. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	5 V 104 kPa	Go to Step 10	Go to Step 5
5	1. Disconnect the jumper. 2. Connect a fused jumper between the 5 Volt signal circuit and the MAP sensor signal circuit at the MAP sensor harness connector. 3. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	5 V 104 kPa	Go to Step 6	Go to Step 8

DTC P0107 – MAP Sensor Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition OFF. 2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground. 3. If the 5 volt reference circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference circuit open or shorted to ground?	—	Verify repair	Go to Step 7
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 11
8	1. Ignition OFF. 2. Disconnect the PCM, and check the MAP signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. If the MAP sensor signal circuit is open or shorted to ground, repair it as necessary. Was the MAP signal circuit open or shorted to ground?	—	Verify repair	Go to Step 9
9	Check the MAP sensor signal circuit for a poor connection at the PCM and the MAP sensor; replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 11
10	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0108 MANIFOLD ABSOLUTE PRESSURE (MAP) CIRCUIT HIGH INPUT



D06RX042

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure. The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (low manifold pressure) to above 4 volts with the ignition ON, engine not running or at wide–open throttle (high manifold pressure).

A ”speed density” method of determining engine load is used on the 2.2L engine. This is calculated using inputs from the MAP sensor, RPM, CKP Sensor, and the Intake Air Temperature (IAT) sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function. The MAP sensor is also used to determine manifold pressure changes while the exhaust gas recirculation (EGR) flow test diagnostic is being run, to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). Refer to DTC P0401.

The PCM monitors the MAP signals for voltages outside the normal range (10–104 kpa) of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively low, Diagnostic Trouble Code P0108 will be set. DTC P0108 is a Type A Code.

Conditions for Setting the DTC

- No TP sensor Diagnostic Trouble Codes present.
- Engine is running.
- Throttle position is below 2.7% if engine speed is below 1000 RPM.
- Throttle position is below 10% if engine speed is above 1000 RPM.
- The MAP sensor indicates manifold absolute pressure above 90 kPa for a total of approximately 10 seconds over a 16–second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0108 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0108 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The MAP sensor shares a 5 Volt Reference with the TP sensor and Fuel Pressure sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor share a ground with the TP sensor and Fuel Pressure sensor.
- Damaged harness – Inspect the wiring harness for damage; an open circuit, a short to ground, or a short to voltage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If Diagnostic Trouble Code P0108 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set.

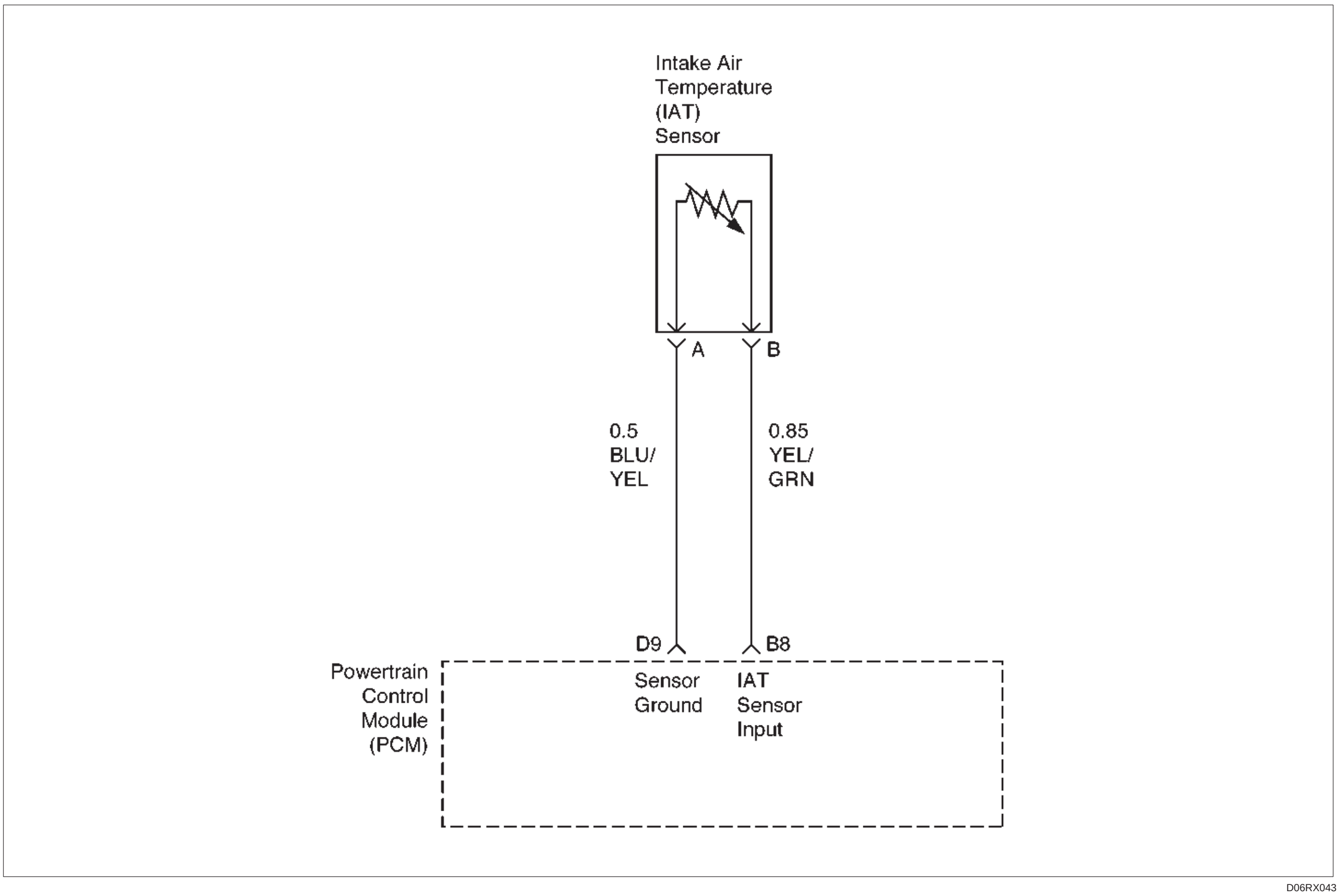
DTC P0108 MAP Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. If the engine idle is rough, unstable or incorrect, repair the idle problem before using this chart. Refer to Symptoms section. 2. With the engine idling, note the MAP value on the Tech 2. Is the MAP reading above the specified value?	About 4V 90 kPa	Go to Step 4	Go to Step 3
3	1. Ignition ON engine OFF 2. Review and record Tech 2 Failure Records data, then clear the DTC’s. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for Diagnostic Trouble Code P0108. Does the Tech 2 indicate that DTC P0108 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Ignition OFF. 2. Disconnect the MAP sensor electrical connector. 3. Ignition ON. 4. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	0 V 10.3 kPa	Go to Step 5	Go to Step 6
5	Check the MAP sensor signal circuit; between the MAP sensor and the Powertrain Control Module (PCM), for a short to voltage. Was the problem found?	—	Verify repair	Go to Step 12
6	Check the MAP sensor circuit, between the MAP sensor and the PCM, the following conditions: • A short to ground • An open circuit Was the problem found?	—	Verify repair	Go to Step 7
7	Check the 5 volt signal circuit, between the MAP sensor and the PCM for the following conditions: • An open circuit • A short to ground • A short to voltage Was the problem found?	—	Verify repair	Go to Step 8

DTC P0108 MAP Sensor Circuit High Input (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition OFF. 2. Place a fused jumper between the MAP sensor circuit and the 5 volt signal circuit, both at the wiring harness' MAP sensor connector. 3. Ignition ON, Engine OFF. 4. Observe the MAP value displayed on the Tech 2? Does the Tech 2 read the following value?	5 volts 104 kPa	Go to Step 9	Go to Step 12
9	Check the MAP sensor ground circuit, between the MAP sensor and the PCM, for the following conditions: • An open circuit • A short to ground • A short to voltage Was the problem found?	—	Verify repair	Go to Step 10
10	1. Ignition OFF. 2. Place a Digital Multimeter (DVM), set to measure voltage, between the ground circuit and the 5 volt signal circuit, both at the wiring harness' MAP sensor connector. 3. Ignition ON, Engine OFF. Does the DVM read the following value?	5 Volts	Go to Step 11	Go to Step 12
11	Replace the MAP sensor. Verify repair.	—	—	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P0112 INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT LOW INPUT



Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull–up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower, causing the PCM to monitor a lower voltage. Diagnostic Trouble Code P0112 will set when the PCM detects an excessively low signal voltage (short to ground) on the intake air temperature sensor signal circuit. DTC P0112 is a Type A Code.

Conditions for Setting the DTC

- The engine has been running for over 2 minutes.
- Vehicle speed is greater than 48 km/h (30 mph).
- IAT signal voltage less than 0.10 volts for a total of 12.5 seconds over a 25–second period of time.

The above conditions are met for at least 2 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will use a default IAT valve based on PCM inputs and engine run time.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0112 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0112 can be cleared by using the Scan Tool's ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery and open circuits. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

If Diagnostic Trouble Code P0112 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.
3. If Diagnostic Trouble Code P0112 can be repeated only by duplicating the Failure Records condition, refer to the Temperature vs. Resistance Value table.

   The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be stored above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to Diagnostic Aids.

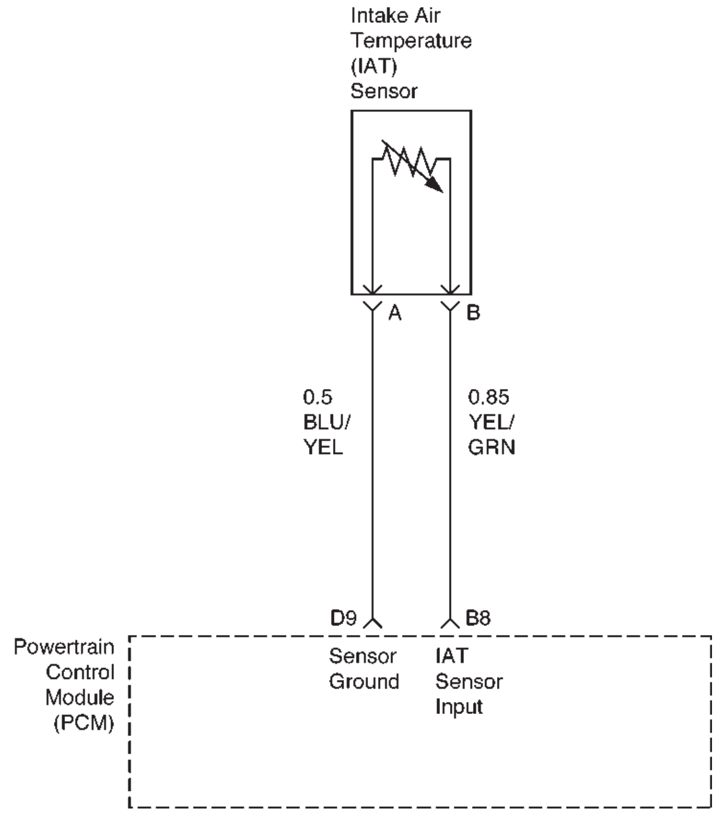
Intake Air Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P0112 Intake Air Temperature (IAT) Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, engine OFF. 2. Using a Tech 2, monitor the intake air temperature (IAT). Is the intake air temperature greater than the specified value?	148°C (283°F)	Go to Step 4	Go to Step 3
3	1. Ignition ON, engine OFF. Review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor the "DTC" info for Diagnostic Trouble Code P0112. Does the Tech 2 indicate DTC P0112 failed this ignition?	—	Refer to Test Description	Refer to Diagnostic Aids
4	1. Ignition OFF. 2. Disconnect the IAT sensor electrical connector. 3. Ignition ON. 4. Observe the intake air temperature on the Tech 2. Is the intake air temperature below the specified value?	–38°C (–36°F)	Go to Step 6	Go to Step 5
5	1. Ignition OFF. 2. Disconnect the PCM electrical connectors. 3. Check the IAT sensor signal circuit for a short to ground. Is the IAT sensor signal circuit shorted to ground?	—	Verify Repair	Go to Step 7
6	Replace the IAT sensor. Is the action complete?	—	Verify Repair	—
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify Repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0113 INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT HIGH INPUT



D06RX043

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull–up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. Diagnostic Trouble Code P0113 will set when the PCM detects an excessively high signal voltage on the intake air temperature sensor signal circuit. DTC P0113 is a Type A Code.

Conditions for Setting the DTC

- The engine has been running for over 4 minutes.
- Vehicle speed is less than 32 km/h (20 mph).
- ECT signal temperature is above 60˚C (140˚F).
- Mass air flow is less than 20g/second.
- IAT signal voltage almost 5 volts which indicates an intake air temperature less than –39˚C (–38˚F) for a total of 12.5 seconds over a 25–second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will use a default IAT valve based on PCM inputs and engine run time.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0113 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0113 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

If Diagnostic Trouble Code P0113 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.

3. If Diagnostic Trouble Code P0113 can be repeated only by duplicating the Failure Records conditions, refer to the ”Temperature vs. Resistance Values” table.

   The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a ”shifted” sensor that may be open above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to Diagnostic Aids.

Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

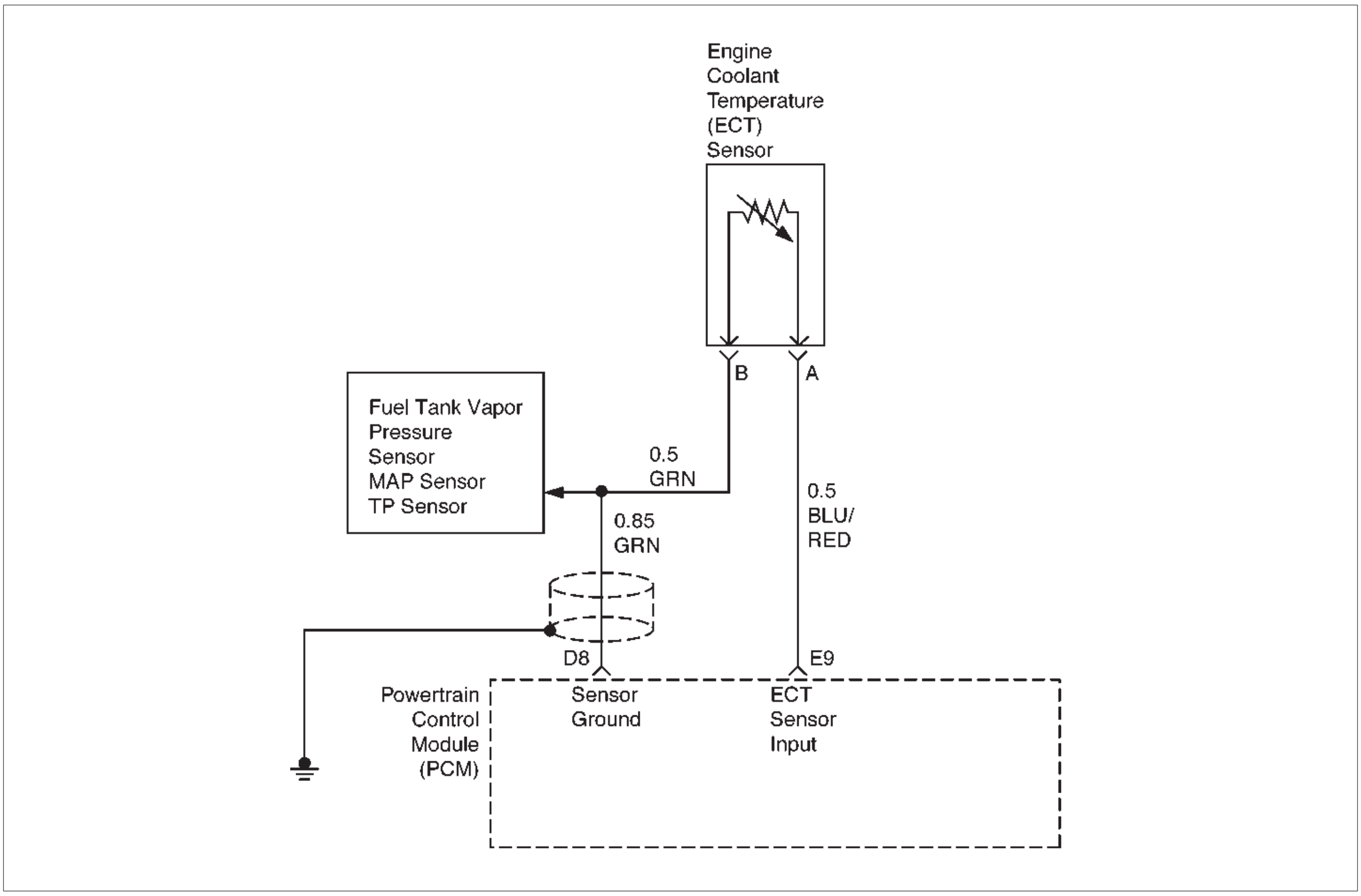
DTC P0113 Intake Air Temperature (IAT) Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Ignition ON, engine OFF. Observe the ”Intake Air Temp” display on the Tech 2. Is the ”Intake Air Temp” below the specified value?	5V –38˚C (–36˚F)	Go to Step 4	Go to Step 3
3	1. Ignition ON, engine OFF. 2. Review and record Tech 2 Failure Records data parameters. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor «Diagnostic Trouble Code” info for Diagnostic Trouble Code P0113. Does the Tech 2 indicate Diagnostic Trouble Code P0113 failed?	—	Refer to Test Description	Refer to Diagnostic Aids
4	1. Ignition OFF. 2. Disconnect the IAT sensor electrical connector. 3. Jumper the IAT signal circuit and the sensor ground circuit together at the IAT sensor harness connector. 4. Ignition ON. 5. Observe the ”Intake Air Temp” display on the Tech 2. Is the ”Intake Air Temp” at the specified value?	0V 140˚C (284˚F)	Go to Step 6	Go to Step 5
5	1. Jumper the IAT signal circuit at the IAT sensor harness connector to chassis ground. 2. Observe the ”Intake Air Temp” display on the Tech 2. Is the ”Intake Air Temp” at the specified value?	0V 140˚C (284˚F)	Go to Step 7	Go to Step 8

DTC P0113 Intake Air Temperature (IAT) Sensor Circuit High Input (Cont'd)

Step	Action	Value(s)	Yes	No
6	Check for poor connections at the IAT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify Repair	Go to Step 10
7	1. Ignition OFF. 2. Disconnect the PCM, and check the IAT sensor ground circuit for an open. 3. If the IAT sensor ground circuit is open, repair it as necessary. Was the IAT sensor ground circuit open?	—	Verify repair	Go to Step 9
8	1. Ignition OFF. 2. Disconnect the PCM, and check the IAT signal circuit for an open. 3. If the IAT sensor signal circuit is open, repair it as necessary. Was the IAT signal circuit open?	—	Verify repair	Go to Step 9
9	Check for a poor sensor ground or IAT signal circuit terminal connection at the PCM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to Step 11
10	Replace the IAT sensor Is the action complete?	—	Verify repair	—
11	Replace the PCM **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0117 ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT LOW INPUT



D06RX044

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull–up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes lower, and the ECT signal voltage measured at the PCM drops. With a fully warmed–up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. DTC P0117 is a Type A Code.

Conditions for Setting the DTC

- Engine running time is longer than two minutes.
- The ECT sensor signal indicates an engine coolant temperature greaterthan 150°C (302°F) (about 0.14 V) for a total of 12.5 seconds overa 25–second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start–up intake air temperature and running time.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0117 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0117 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If Diagnostic Trouble Code P0117 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the

Diagnostic Trouble Code was last set. If it is determined that the Diagnostic Trouble Code occurs intermittently, performing the Diagnostic Trouble Code P1114 Diagnostic Chart may isolate the cause of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.

3. If Diagnostic Trouble Code P0117 can be repeated only by duplicating the Failure Records conditions, refer to the ”Temperature vs. Resistance Values” table.

   The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a ”shifted” sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to Diagnostic Aids.

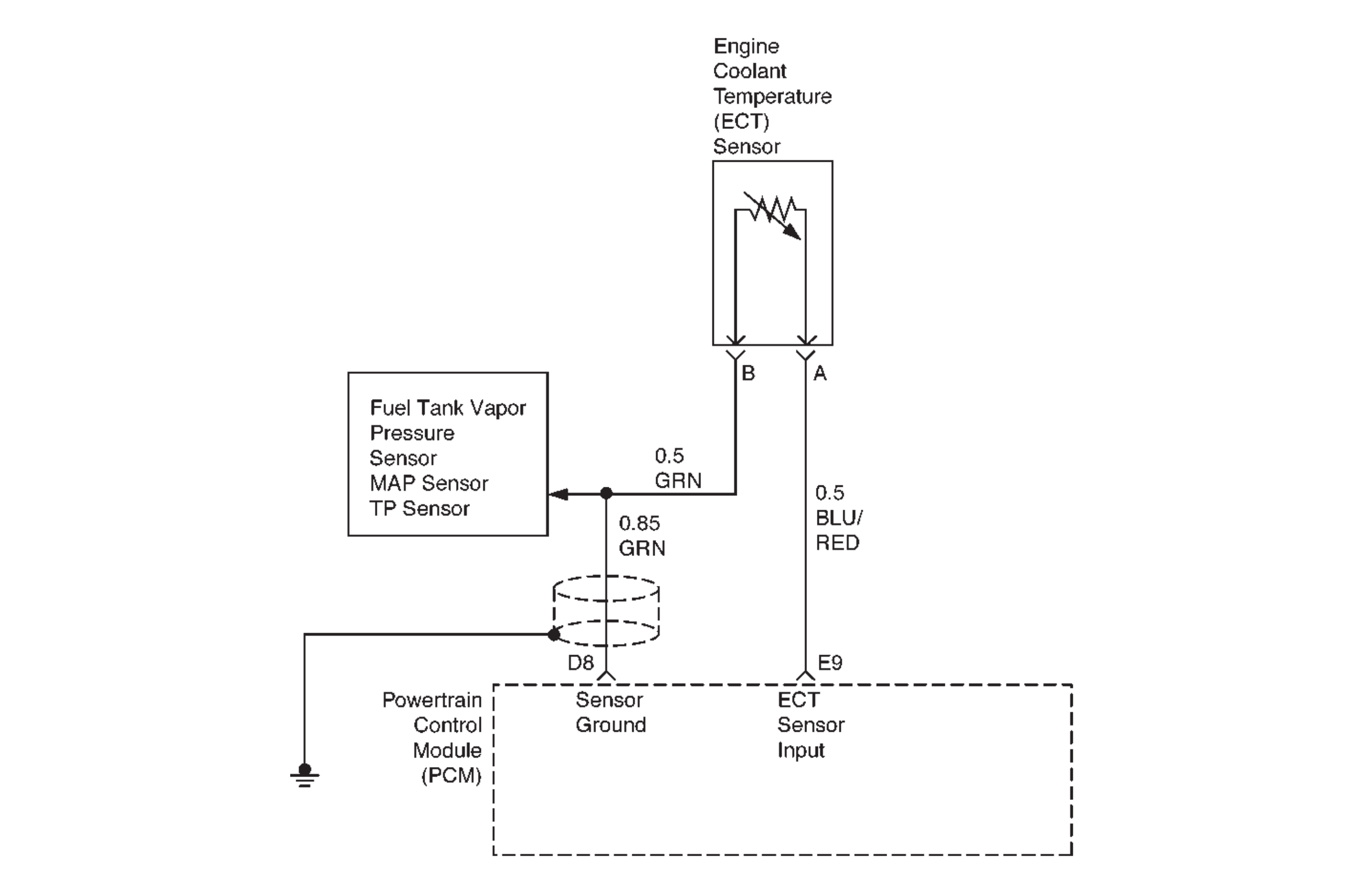
Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P0117 – Engine Coolant Temperature (ECT) Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON engine OFF. 2. Observe the ”Eng Cool Temp” display on the Tech 2. Is the ”Eng Cool Temp” below the specified value?	139°C (282°F)	Go to Step 4	Go to Step 3
3	1. Ignition ON engine OFF. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor ”DTC” info for DTC P0117. Does the Tech 2 indicate DTC P0117 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Disconnect the ECT sensor electrical connector. 2. Observe the ”Eng Cool Temp” display on the Tech 2. Is the ”Eng Cool Temp” at or below the specified value?	–39°C (–38°F)	Go to Step 6	Go to Step 5
5	1. Ignition OFF. 2. Disconnect the PCM and check the ECT signal circuit for a short to ground or a short to the sensor ground circuit. 3. If the ECT signal circuit is shorted, repair it as necessary. Was the ECT signal circuit shorted to ground?	—	Verify repair	Go to Step 7
6	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0118 ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT HIGH INPUT



D06RX044

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull–up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detect a continuous open in the ECT sensor or circuit, then a code P0118 will set. DTC P0118 is a type A code.

Conditions for Setting the DTC

- Engine running time is longer than 2.5 minutes.
- The ECT sensor signal indicates an engine coolant temperature of –39˚C (–38˚F) or less (about 5 volts) for a total of 12.5 seconds over a 25–second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start–up intake air temperature and running time.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0118 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0118 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery positive, and open circuit. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If Diagnostic Trouble Code P0118 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the

Diagnostic Trouble Code was last set. If it is determined that the Diagnostic Trouble Code occurs intermittently, performing the DTC P1115 Diagnostic Chart may isolate the cause of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.
3. If Diagnostic Trouble Code P0118 can be repeated only by duplicating the Failure Records condition, refer to the ”Temperature vs. Resistance Value” table.

   The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a ”shifted” sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to Diagnostic Aids.

Intake Air Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

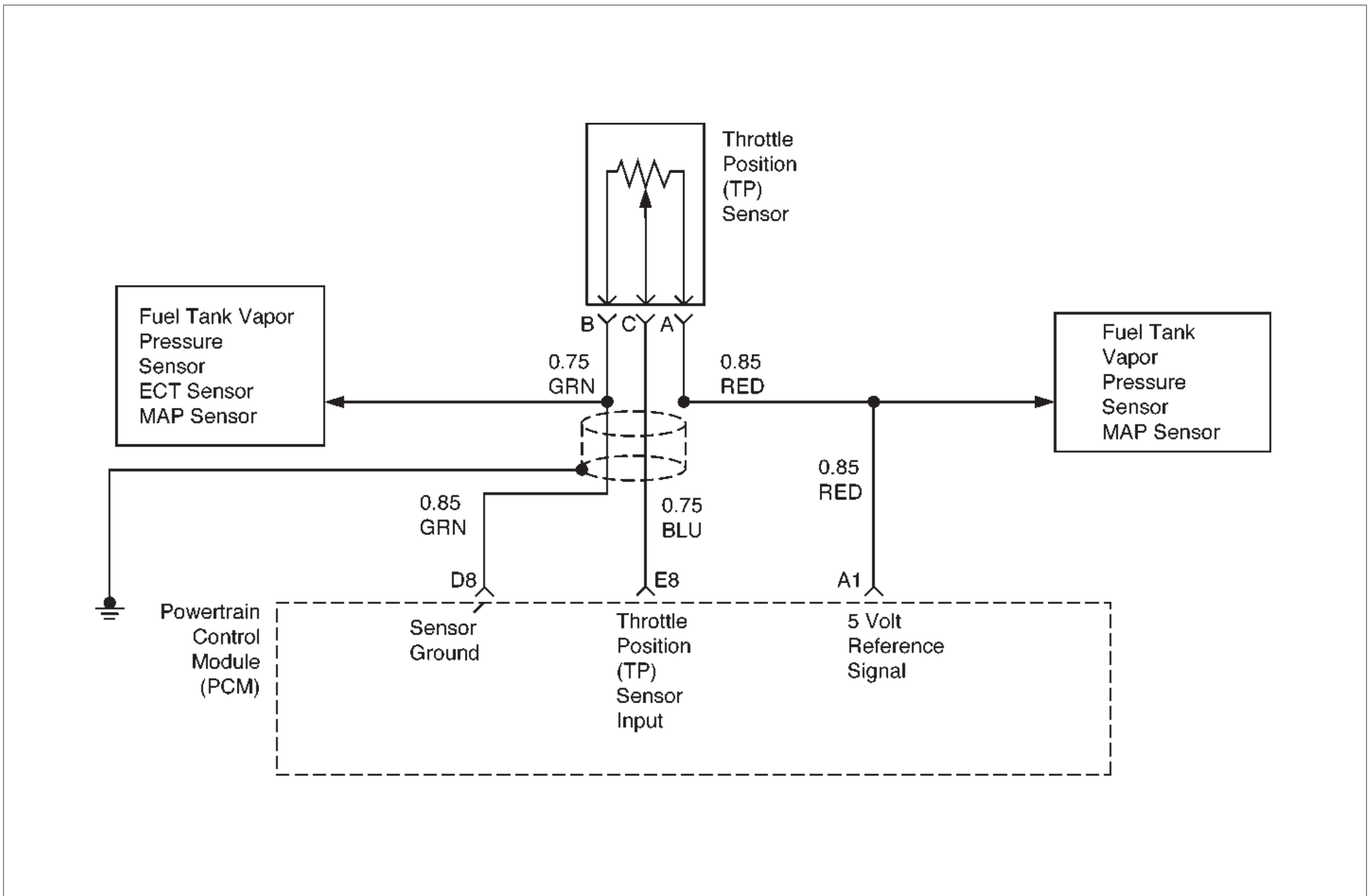
DTC P118 – ECT Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON engine OFF. 2. Observe the ”Eng Cool Temp” display on the Tech 2. Is the ”Eng Cool Temp” below the specified value?	–39°C (–38°F)	Go to Step 4	Go to Step 3
3	1. Ignition ON engine OFF. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the ”DTC” info for Diagnostic Trouble Code P0118. Does the Tech 2 indicate Diagnostic Trouble Code P0118 failed?	—	Refer to Test Description	Refer to Diagnostic Aids
4	1. Disconnect the ECT sensor electrical connector. 2. Jumper the ECT signal circuit and the sensor ground circuit together at the ECT sensor harness connector. 3. Observe the ”Eng Cool Temp” display on the Tech 2. Is the ”Eng Cool Temp” at or above the specified value?	140°C (284°F)	Go to Step 6	Go to Step 5
5	1. Jumper the ECT signal circuit at the ECT sensor harness connector to chassis ground. 2. Observe the ”Eng Cool Temp” display on the Tech 2. Is the ”Eng Cool Temp” at or above the specified value?	140°C (284°F)	Go to Step 7	Go to Step 8
6	Check for poor connections at the ECT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 10

DTC P118 – ECT Sensor Circuit High Input (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition OFF. 2. Disconnect the PCM, and check the ECT sensor ground circuit for an open. 3. If the ECT sensor ground circuit is open, repair it as necessary. Was the ECT sensor ground circuit open?	—	Verify repair	Go to Step 9
8	1. Ignition OFF. 2. Disconnect the PCM, and check the ECT signal circuit for an open. 3. If the ECT sensor signal circuit is open, repair it as necessary. Was the ECT signal circuit open?	—	Verify repair	Go to Step 9
9	Check for a poor sensor ground or ECT signal circuit terminal connection at the PCM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to Step 11
10	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0121 THROTTLE POSITION (TP) SENSOR CIRCUIT RANGE/PERFORMANCE PROBLEM



D06RX045

Circuit Description

The throttle position (Throttle Position) sensor circuit provides a voltage signal that changes relative to throttle blade angle. The signal voltage will vary from about 0.25 volts at closed throttle to about 4.75 volts at wide open throttle (WOT).

The Throttle Position (TP) signal is used by the powertrain control module (PCM) for fuel control and most of the PCM–controlled outputs. The PCM monitors throttle position and compares actual throttle positions from the TP sensor to a predicted TP value calculated from engine speed. If the PCM detects an out–of–range condition, then a DTC code P0121 will set. DTC P0121 is type A code.

Conditions for Setting the DTC

- The Engine is running.
- No MAP, ECT, TP, CKP, EGR, EVAP or DTC's are set.
- IAC is between 10 and 160 counts.
- ECT is above –10˚C (14˚F).
- The MAP value changes by less than 2 kPa.

All the above mentioned conditions are met, and one of the following conditions occurs for a total of 12.5 seconds over a 25–second period of time.

Stuck High–

- MAP value is below 55 kPa.
- Actual TP value is greater than the PCM's estimated TP value (Estimated TP value is based on MAP and RPM).

Stuck Low–

- MAP value is below 50 kPa.
- Actual TP value is less than the PCM's estimated TP value (Estimated TP value is based on MAP and RPM).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.
- The PCM will use a default throttle position based on MAP and RPM.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0121 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0121 can be cleared by using the Scan Tool's ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Skewed MAP signal or faulty MAP sensor – An incorrect MAP signal may cause the PCM to incorrectly calculate the predicted TP sensor value during high engine load situations. Check for an unusually low MAP reading. This condition can cause DTC P0121 to be set.
- The TP sensor shares a 5 Volt reference with the MAP sensor and Fuel Pressure sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The TP sensor shares a ground with the MAP sensor and the Fuel Pressure sensor.
- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; an open circuit, a short to ground, or a short to voltage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0121 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1122 or P1121 Diagnostic Chart may isolate the cause of the fault.

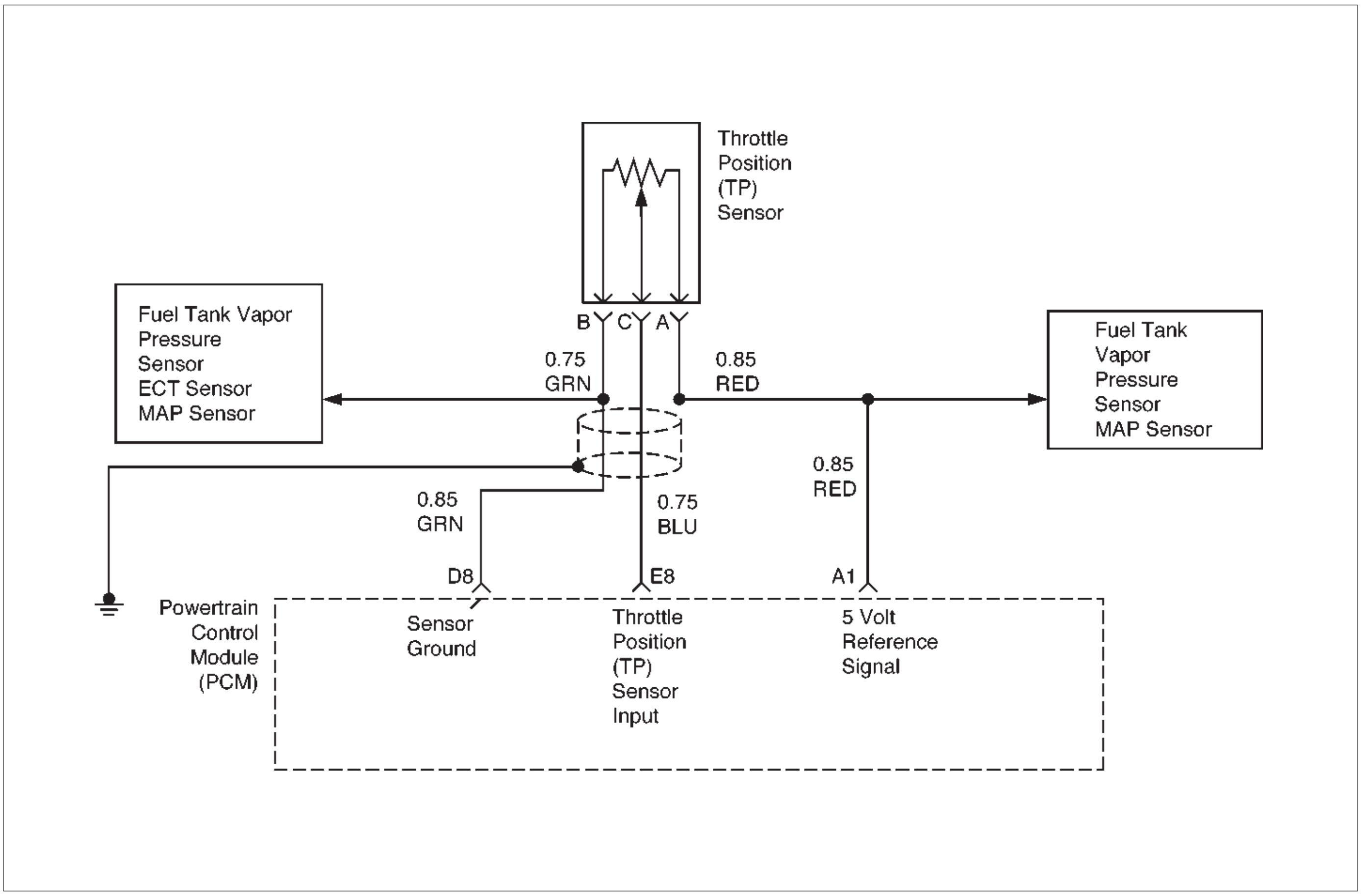
DTC P0121 TP Sensor/Range Performance Problem

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON engine OFF 2. Review and record Tech 2 Failure Records data, then clear the DTC’s. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor ”DTC” info for DTC P0121. Does the Tech 2 indicate that DTC P0121 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition ON, engine OFF. 2. Monitor the TP value on the Tech 2 while moving the throttle between 0% and 100%. Does the TP value on the Tech 2 move smoothly from 0% (0.25 volts) to 100% (4.75 volts)? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to Step 4	Go to Step 11
4	1. Ignition OFF. 2. Disconnect the Throttle Position (TP) Sensor electrical connector, located on the RH side of the Throttle body. 3. Start the vehicle, and monitor the TP value with the Tech 2. Does the TP value on the Tech 2 hold steadily within the given range?	0–0.25 volts 0%	Go to Step 6	Go to Step 5
5	Check the TP sensor signal circuit; between the TP sensor and the Powertrain Control Module (PCM), for a short to voltage. Was the problem found?	—	Verify repair	Go to Step 12
6	Check the TP sensor circuit, between the TP sensor and the PCM, the following conditions: • A short to ground • An open circuit Was the problem found?	—	Verify repair	Go to Step 7

DTC P0121 TP Sensor/Range Performance Problem (Cont'd)

Step	Action	Value(s)	Yes	No
7	Check the 5 volt signal circuit, between the TP sensor and the PCM, for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 8
8	1. Ignition OFF. 2. Place a fused jumper between the TP sensor circuit and the 5 volt signal circuit both at the wiring harness' TP sensor connector. 3. Ignition ON, Engine OFF. 4. Observe the TP value displayed on the Tech 2? Does the Tech 2 read the following value?	about 5 volts 100%	Go to Step 9	Go to Step 12
9	Check the TP sensor ground circuit, between the TP sensor and the PCM, for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 10
10	1. Ignition OFF. 2. Place a Digital Multimeter (DVM), set to measure voltage, between the ground circuit and the 5 volt signal circuit, both at the wiring harness' TP sensor connector. 3. Ignition ON, Engine OFF. Does the DVM read the following value?	about 5 volts	Go to Step 11	Go to Step 12
11	Replace the TP sensor. Verify repair.	—	—	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P0122 THROTTLE POSITION (TP) SENSOR CIRCUITLOW INPUT



Circuit Description

The throttle position (TP) sensor circuit provides a voltage signal that changes relative to throttle blade angle. The signal voltage will vary from below 1 volt at closed throttle to about 4 volts at wide open throttle(WOT).

The TP signal is used by the powertrain control module (PCM) for fuel control and most of the PCM–controlled outputs. If the PCM detect a continuous short to ground in the TP sensor or circuit, then a code P0122 will set. Diagnostic Trouble Code P0122 is type A code.

Conditions for Setting the DTC

- The ignition is ON.
- Throttle Position sensor signal voltage is less than 0.235 volt for a total of 0.78 second over a 1.5–second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.
- The PCM will use a default throttle position based on MAP and RPM.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0122 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0122 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The TP sensor shares a 5 Volt reference with the MAP sensor and Fuel Pressure sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The TP sensor share a ground with the MAP and the Fuel Pressure sensor.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the throttle position display on the Tech 2 while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.

If Diagnostic Trouble Code P0122 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set. If it is determined that the Diagnostic Trouble Code occurs intermittently, performing the Diagnostic Trouble Code P1122 Diagnostic Chart may isolate the cause of the fault.

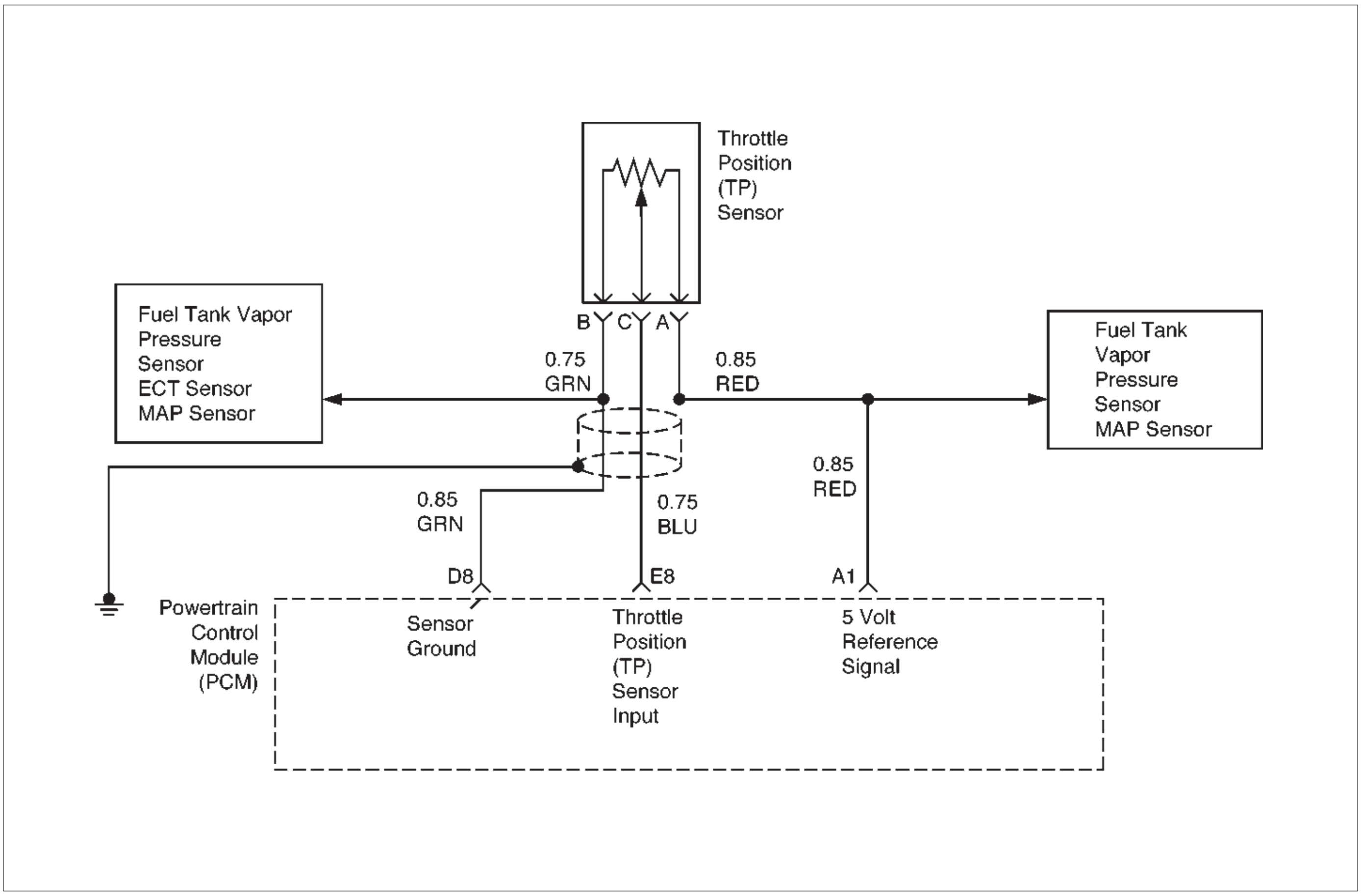
DTC P0122 – TP Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON engine OFF. 2. With the throttle closed, observe the ”Throttle Position Sensor” display on the Tech 2. Is the ”Throttle Position Sensor” below the specified value?	0.235 V	Go to Step 4	Go to Step 3
3	1. Ignition ON engine OFF. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0122. Does the Tech 2 indicate DTC P0122 failed?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Ignition OFF. 2. Disconnect the TP sensor electrical connector. 3. Jumper the 5 volt reference circuit and the Throttle Position signal together at the Throttle Position sensor harness connector. 4. Ignition ON. Observe the ”Throtle Position Sensor” display on the Tech 2. Is the ”Throttle Position Sensor” at the specified value?	5 V	Go to Step 10	Go to Step 5
5	1. Disconnect jumper. 2. Connect a test light between B+ and the Throttle Position sensor signal circuit at the Throttle Position sensor harness connector. Observe the ”Throttle Position Sensor” display on the Tech 2. Is the ”Throttle Position Sensor” at the specified value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	5 V	Go to Step 6	Go to Step 8
6	1. Ignition OFF. 2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground. 3. If the 5 volt reference circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference circuit open or shorted to ground?	—	Verify repair	Go to Step 7
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 12

DTC P0122 – TP Sensor Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition OFF. 2. Disconnect the PCM, and check the TP signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. If the TP sensor signal circuit is open or shorted to ground, repair it as necessary. Was the TP signal circuit open or shorted to ground?	—	Verify repair	Go to Step 9
9	Check the TP sensor signal circuit for a poor connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 12
10	Check the TP sensor signal circuit for a poor connection at the TP sensor and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 11
11	Replace the TP sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0123 THROTTLE POSITION (TP) SENSOR CIRCUIT HIGH INPUT



D06RX045

Circuit Description

The throttle position (TP) sensor circuit provides a voltage signal that changes relative to throttle blade angle. The signal voltage will vary from below 1 volt at closed throttle to about 4 volts at wide open throttle (WOT).

The TP signal is used by the powertrain control module (PCM) for fuel control and most of the PCM–controlled outputs. If the PCM detect a continuous open in the TP sensor or circuit, then a code P0123 will set. DTC P0123 is a type A code.

Conditions for Setting the DTC

- The ignition is ON.
- Throttle Position sensor signal voltage is greater than 4.78 volts for a total of 0.78 second over a 1.5–second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- The PCM will use a default throttle position based on MAP and RPM.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0123 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0123 can be cleared by using the Scan Tool's ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The TP sensor shares a 5 Volt reference with the MAP sensor and Fuel Pressure sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The TP sensor share a ground with the MAP and the Fuel Pressure sensor.
- Damaged harness – Inspect the wiring harness for damage, shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, observe the Throttle Position sensor display on the Tech 2 while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.

- Faulty Throttle Position sensor – With the ignition key ON engine OFF observe the TP sensor display on the Tech 2 while slowly depressing the accelerator to wide open throttle. If a voltage over 4.88 volts is seen at any point in normal accelerator travel, replace the TP sensor.

If Diagnostic Trouble Code P0123 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the Diagnostic Trouble Code was last set. If it is determined that the Diagnostic Trouble Code occurs intermittently, performing theDiagnostic Trouble Code P1121 Diagnostic Chart may isolate the cause of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

7. Components that share the TP sensor 5 volt reference circuit include the following devices:
   - EGR valve
   - Fuel Tank Pressure sensor
   - MAP sensor

   Disconnect the component while observing the Throttle Position sensor display on the Tech 2. If the reading changes drastically when this component is disconnected, replace the component that affected the reading.

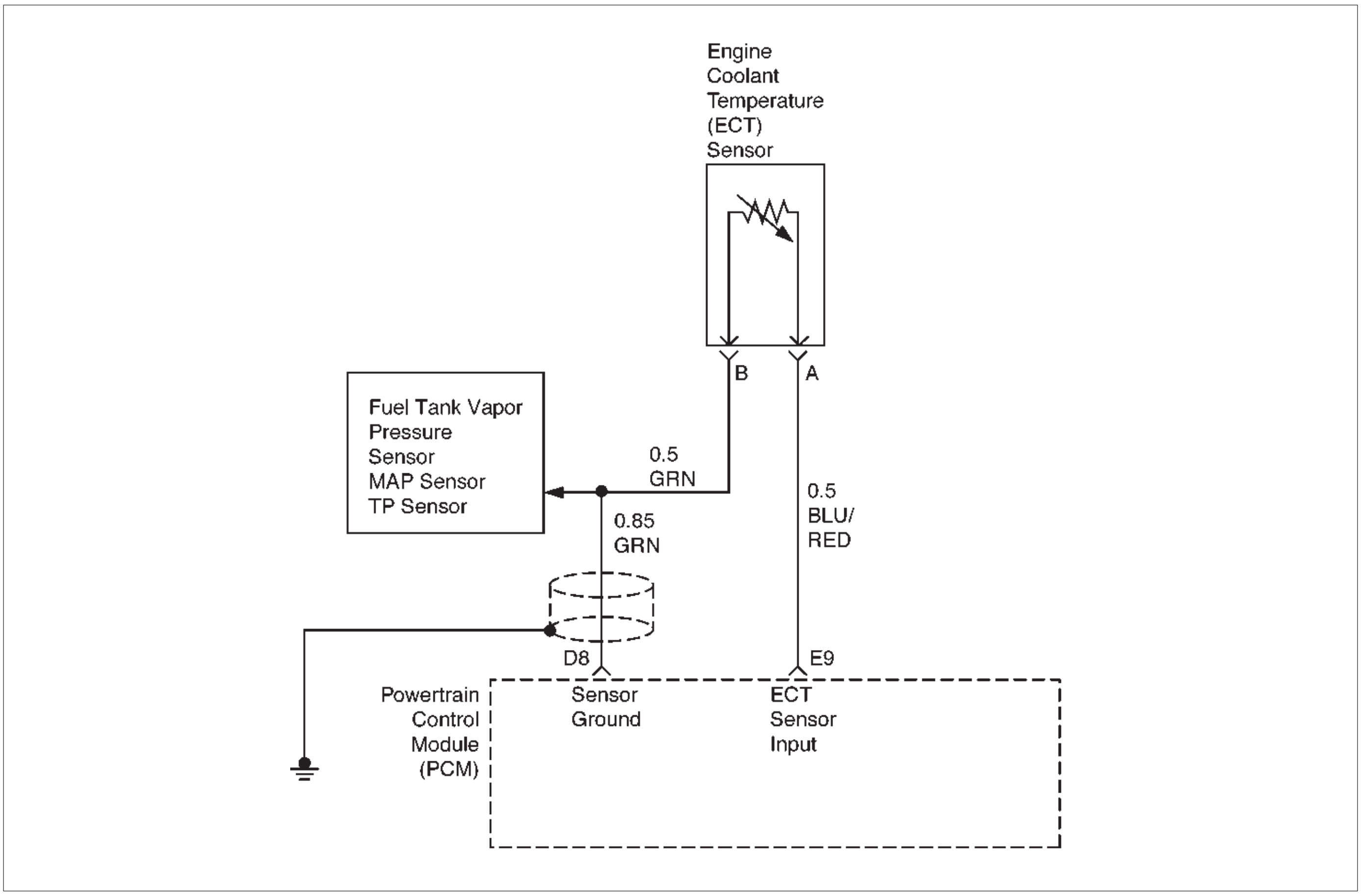
DTC P0123 – TP Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, engine OFF. 2. With the throttle closed, observe the ”Throttle Position Sensor” display on the Tech 2. Is the ”Throttle Position Sensor” above the specified value?	4.78 V	Go to Step 4	Go to Step 3
3	1. Ignition ON, engine OFF. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0123. Does the Tech 2 indicate Diagnostic Trouble Code P0123 failed.	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Disconnect the Throttle Position sensor electrical connector. 2. Observe the ”Throttle Position Sensor” display on the Tech 2. Is the ”Throttle Position Sensor” near the specified value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	0 V	Go to Step 5	Go to Step 6
5	Probe the sensor ground circuit at the Throttle Position sensor harness connector with a test light connected to B+. Is the test light ON?	—	Go to Step 7	Go to Step 10
6	1. Ignition OFF disconnect the PCM. 2. Ignition ON engine OFF. 3. Check for a short to voltage on the TP sensor signal circuit. 4. If the TP sensor signal circuit is shorted, repair it as necessary. Was the TP sensor signal circuit shorted?	—	Verify repair	Go to Step 12

DTC P0123 – TP Sensor Circuit High Input (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition ON. 2. Monitor the "Throttle Position Sensor" Tech 2 display while disconnecting each of the components that share the 5 volt reference circuit (one at a time). 3. If the "Throttle Position Sensor" Tech 2 display changes, service the component(s) that caused the display to change when disconnected. Does disconnecting any of these components cause the "Throttle Position Sensor" display to change?	—	Verify repair	Go to Step 8
8	1. Ignition OFF disconnect the PCM. 2. Ignition ON, engine OFF. 3. Check for a short to B+ on the 5 volt reference circuit. 4. If the 5 volt reference circuit is shorted, repair it as necessary. Was the 5 volt reference circuit shorted?	—	Verify repair	Go to Step 9
9	Check for poor electrical connections at the Throttle Position sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 11
10	1. Ignition OFF. 2. Disconnect the PCM, and check for an open sensor ground circuit to the Throttle Position sensor. 3. If a problem is found, repair it as necessary. Was the sensor ground circuit to the Throttle Position sensor open?	—	Verify repair	Go to Step 12
11	Replace the Throttle Position sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0125 INSUFFICIENT COOLANT TEMPERATURE FOR CLOSED LOOP FUEL CONTROL



Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a "Closed Loop" air/fuel metering system is used. When the vehicle is first started, the powertrain control module (PCM) controls fuel delivery in "Open Loop" ignoring the heated oxygen sensor (HO2S) signals and calculating air/fuel ratio based on inputs from the engine coolant temperature, throttle position, and mass air flow sensors.

If the PCM detects that the ECT sensor has not reached a sufficient reading to achieve "Closed Loop" within a specified amount of time, DTC P0125 will set. DTC P0125 is a type B code.

Conditions for Setting the DTC

- No MAP, IAT, ECT, TP, Misfire, Injector, or VSS DTC codes set.

All the above mentioned conditions are true and any combination of the following three tests fail three times in two consecutive ignition cycles (for a total of six failures):

Warm Case Test

- Start–up ECT value is less than 29°C (84°F).
- IAT is greater than 10°C (50°F).
- Accumulated airflow is greater than 1500 grams.
- Engine run time is greater than 90 seconds.
- Time for coolant to reach stabilized "Closed Loop" value is less than 120 seconds.

Cold Case Test

- IAT is between –7°C (20°F) and 10°C (50°F)
- Accumulated airflow is greater than 2000 grams.
- Engine run time is less than 225 seconds.
- Time for coolant to reach stabilized "Closed Loop" value is less than 300 seconds.

Other Case Test

- IAT is between –30°C (–22°F) and –7°C (20°F).
- Accumulated airflow is greater than 3600 grams.
- Engine run time is less than 450 seconds.
- Time for coolant to reach stabilized "Closed Loop" value is less than 600 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history Diagnostic Trouble Code P0125 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0125 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

DTC P0125 set indicates a faulty ECT sensor. Comparing the engine coolant temperature displayed on a Tech 2 with actual coolant temperature measured with a thermometer may isolate this condition. If the displayed engine coolant temperature is not close to the actual coolant temperature, replace the ECT sensor.

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for back–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged Harness – Inspect the wiring harness for damage; open circuits, shorts to ground, or shorts to voltage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0125 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Comparing the engine coolant temperature displayed on a Tech 2 with actual coolant temperature measured with a thermometer may isolate this condition. If the displayed engine coolant temperature is not close to the actual coolant temperature, replace the ECT sensor. If the temperatures are closed, the fault is intermittent; refer to Diagnostic Aids.
7. Engine Coolant Temperature

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

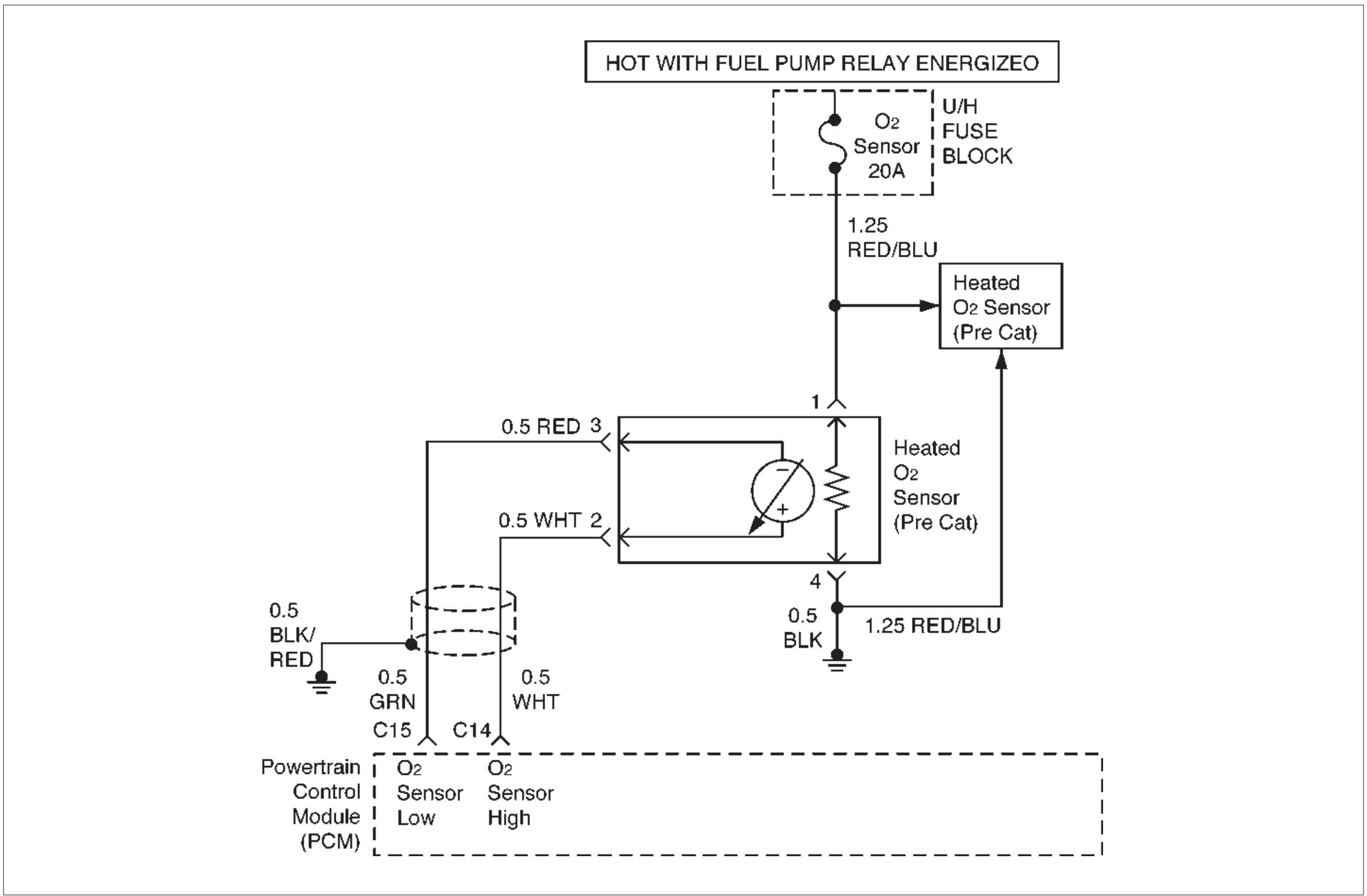
DTC P0125 Insufficient Coolant Temperature for Closed Loop Fuel Control

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Are any ECT sensor DTC's set?	—	Go to applicable ECT sensor DTC chart	Go to Step 3
3	1. Allow the engine to cool completely. 2. Check the cooling system coolant level (refer to Cooling and Radiator). Is the coolant level OK?	—	Go to Step 4	Go to Step 9
4	1. Start the engine. 2. With the engine idling, monitor "ENG COOL TEMP" display on the Tech 2. Does "ENG COOL TEMP" increase to above the specified value within 2 minutes?	21˚C (70˚F)	Refer to Diagnsotic Aids	Go to Step 5
5	Check for proper operation of the thermostat (refer to Cooling and Radiator). Is the thermostat operating correctly?	—	Go to Step 6	Go to Step 9

DTC P0125 Insufficient Coolant Temperature for Closed Loop Fuel Control (Cont'd)

Step	Action	Value(s)	Yes	No
6	Compare engine coolant temperature displayed on the Tech 2 to the actual coolant temperature measured with a thermometer. (Observe normal precautions when opening the cooling system.) Is the Tech 2 engine coolant temperature indication close to the measured temperature?	—	Go to Step 9	Go to Step 7
7	1. Ignition OFF. 2. Disconnect the PCM. 3. Using a DVM, measure the resistance of the ECT at the PCM connector. 4. Compare the DVM reading with the chart in "Test Description." Is the chart value approximately equal to the thermometer reading?	—	Go to Step 12	Go to Step 8
8	Check for the following conditions in the wiring between the ECT and the PCM: • An open circuit • A short to ground • A short to voltage	—	Go to Step 10	Go to Step 11
9	Refer to Cooling and Radiator for cooling system diagnosis and repair condition as necessary. Is the action complete?	—	Verify Repair	—
10	Replace the faulty terminal(s) or repair faulty wiring as necessary. Is the action complete?	—	Verify Repair	—
11	Replace the ECT sensor. Is the action complete?	—	Verify Repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify Repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0131 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 1)



D06RX046

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal and low circuits. When measured with a 10 megaΩ digital voltmeter, this may display as low as 350 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "Closed Loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively low for an extended period of time, Diagnostic Trouble Code P0131 will be set. DTC P0131 is a type A code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Vehicle is operating in "Closed Loop".
- Engine coolant temperature is above 60°C (140°F)
- "Closed Loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.

All above conditions met for 0.3 seconds and the following condition is met:

- Bank 1 HO2S 1 signal voltage remains below 22 mV during normal "Closed Loop" operation for a total of 76.5 seconds over a 90–second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open Loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0131 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0131 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be routed incorrectly and/or contacting the exhaust system. Also, check for shorts to ground, shorts to battery positive and open circuits.
- Poor PCM to engine block grounds.
- Fuel pressure – The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a Diagnostic

Trouble Code P0131 may be set. Refer to Fuel System Diagnosis.

- Lean injector(s) – Perform ”Injector Balance Test.”
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Check for exhaust leaks that may cause a false lean condition to be indicated.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. For the procedure to check for fuel contamination, Refer to Fuel System Diagnosis.

If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. Diagnostic Trouble Code P0131 failing during operation may indicate a condition described in the ”Diagnostic Aids” above. If the Diagnostic Trouble Code P0131 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

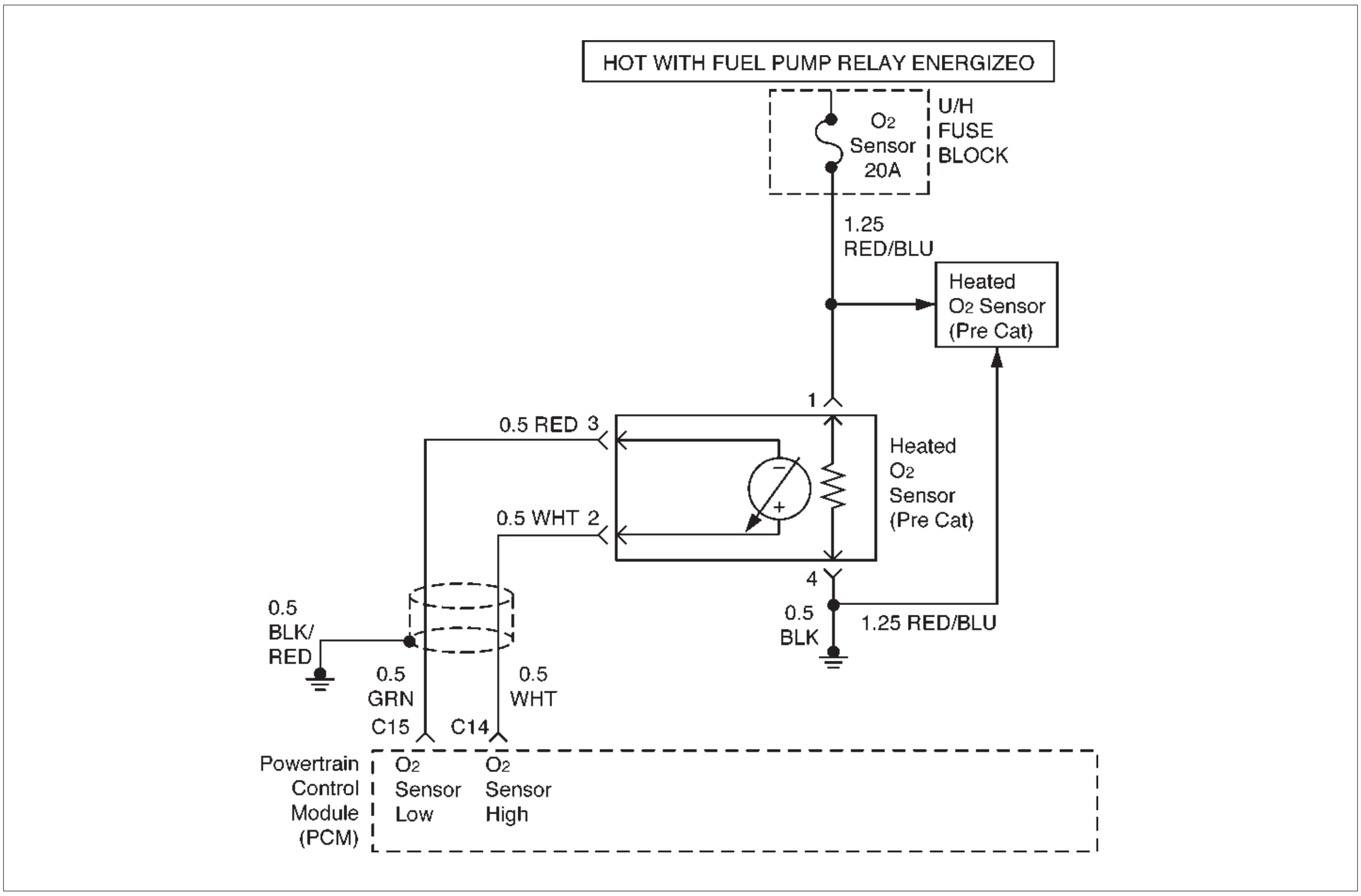
DTC P0131 – O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under ”Conditions for Setting the Diagnostic Trouble Code” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 1 voltage remain below the specified value?	300 mV	Go to Step 4	Go to Step 3
3	1. Ignition ON engine OFF review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0131 until the Diagnostic Trouble Code P0131 test runs. Note test result. Does Tech 2 indicate DTC P0131 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Turn the ignition OFF. 2. Disconnect the PCM. 3. Check the Bank 1 HO2S 1 high and low circuits for a short to ground or a short to the heater ground circuit. Are the Bank 1 HO2S 1 signal circuits shorted to ground?	—	Go to Step 5	Go to Step 6
5	Repair the Bank 1 HO2S 1 signal circuit. Is the action complete?	—	Verify repair	—

DTC P0131 – O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Turn the ignition OFF HO2S 1 and PCM disconnected. 2. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to Step 7	Go to Step 8
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition OFF. 2. Reconnect the PCM, leave the sensor disconnected. 3. Ignition ON. Does the Tech 2 indicate Bank 1 HO2S 1 voltage near the specified value?	430–450 mV	Refer to Diagnostic Aids	Go to Step 9
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0132 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 1)



D06RX046

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal and low circuits. When measured with a 10 megaΩ digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "Closed Loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively high for an extended period of time, Diagnostic Trouble Code P0132 will be set. DTC P0132 is a type A code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine coolant temperature is above 60°C (140°F).
- "Closed Loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.

All above conditions met for 0.3 seconds or vehicle in Decelleration Fuel Cut–Off (DFCO) mode for 3 seconds, and one of the following two conditions met:

- Bank 1 HO2S 1 signal voltage remains above 952 mV during normal "Closed Loop" operation for a total of 76.5 seconds over a 90–second period.

OR

- Bank 1 HO2S 1 signal voltage remains above 500 mV during "deceleration fuel cutoff mode" (DFCO) operation for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open Loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0132 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0132 can be cleared by using the Scan Tool's "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check the following items:

- Fuel pressure – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a

Diagnostic Trouble Code P0132 may be set. Refer to Fuel System Diagnosis.

- Perform ”Injector Balance Test” – Refer to Fuel System Diagnosis.
- Check the EVAP canister for fuel saturation – If full of fuel, check canister control and hoses. Refer to Evaporative (EVAP) Emission Control System.
- Check for a leak in the fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel.
- An intermittent TP sensor output will cause the system to go rich due to a false indication of the engine accelerating.
- Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery white deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S high and low circuit wiring and associated terminal connections. If the wiring and connections are OK, replace the HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. Diagnostic Trouble Code P0132 failing during ”deceleration fuel cutoff mode” operation may indicate a condition described in the ”Diagnostic Aids” above. If the Diagnostic Trouble Code P0132 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated. Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

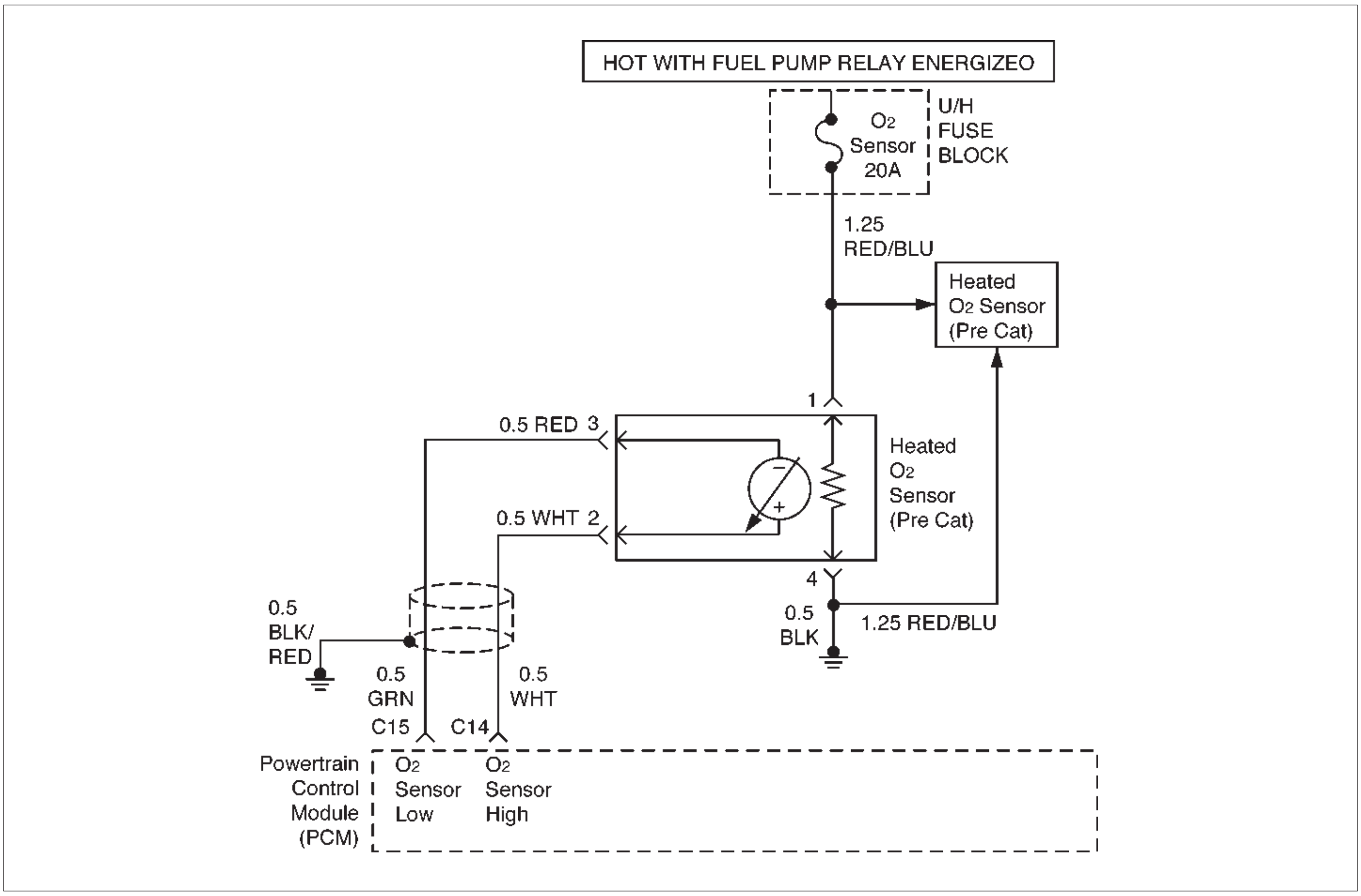
DTC P0132 – O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within parameters specified under ”Conditions for Setting the DTC” included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 1 voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cutoff mode)	Go to Step 4	Go to Step 3
3	1. Ignition ON review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0132 until the Diagnostic Trouble Code P0132 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0132 failed this ignition?	—	Refer to Diagnostic Aids	Go to Step 4
4	1. Ignition OFF. 2. Disconnect Bank 1 HO2S 1. 3. Ignition ON. 4. At HO2S 1 connector (PCM side) use a Digital Voltmeter (DVM) to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	5–14 V	Go to Step 5	Go to Step 6
5	Repair short to voltage in signal circuit.	—	Verify repair	—

DTC P0132 – O2 Sensor Circuit High Voltage (Bank 1 Sensor 1) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition OFF. 2. Disconnect the PCM connector. 3. Check for damage to the PCM pins and terminals. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Ignition ON, engine OFF. 2. Disconnect Bank 1 HO2S 1 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage below the specified value?	10 mV	Go to Step 8	Go to Step 9
8	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0133 O2 SENSOR CIRCUIT SLOW RESPONSE (BANK 1 SENSOR 1)



D06RX046

Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after ”Closed Loop” has been enabled. During the monitoring period the PCM counts the number of times that a rich–to–lean and lean–to–rich response is indicated and adds the amount of time it took to complete all transitions. With this information, an average time for each transition can be determined. If the average response time is too slow, a Diagnostic Trouble Code P0133 will be set. A DTC P0133 is a type B code.

A lean–to–rich transition is indicated when the HO2S voltage changes from less than 300 mV to greater than 600 mV. A rich–to–lean transition is indicated when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is likely to be faulty and should be replaced.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine coolant temperature is greater than 60°C (140°F).
- Engine is operating in ”Closed Loop”.
- Engine has been running for at least 2 minutes.
- Engine speed is between 1500 RPM and 3500 RPM.
- Canister purge solenoid duty cycle is greater than 2%.
- Calculated air flow is between 17 and 32 g/second.

All above conditions are met for 1 second and the following condition is met:

- 90 seconds after ”Closed Loop” has been enabled, Bank 1 HO2S 1 average transition time between 300 mV and 600 mV is too slow. The lean–to–rich average transition response time was longer than 100 milliseconds or rich–to–lean average transition response time was longer than 105 milliseconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator Lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.
- ”Open Loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0133 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0133 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If Diagnostic Trouble Code P0133 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is currently present.
3. HO2S transition time, ratio mean volts and switching Diagnostic Trouble Codes set for multiple sensors indicate probable contamination. Before replacing the sensors, isolate and correct the source of the contamination to avoid damaging the replacement sensors.

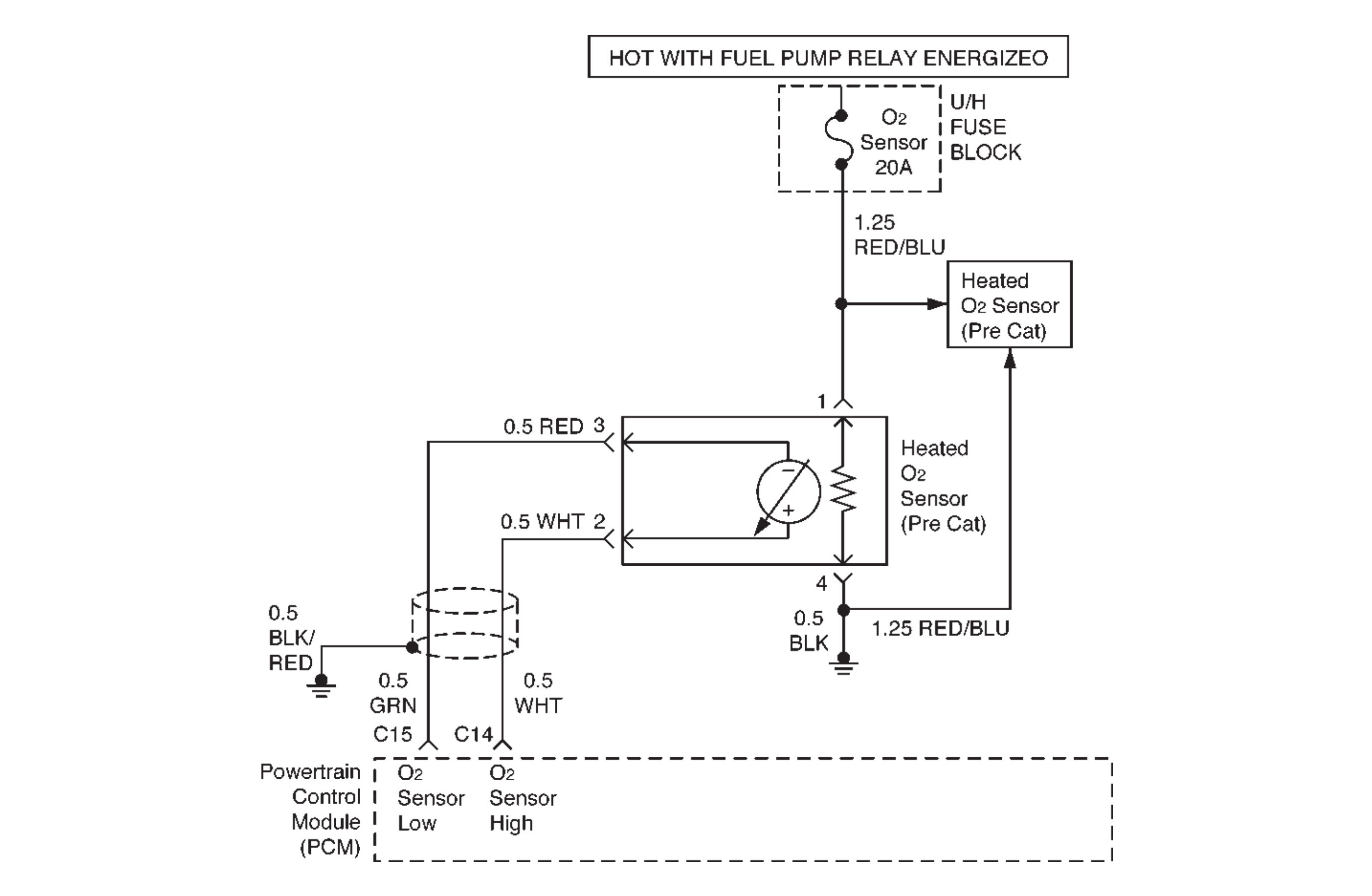
DTC P0133 – O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	NOTE: If any DTCs are set (except P1133 and/or P1134), refer to those DTCs before proceeding with this diagnostic chart. 1. Install the Tech 2. 2. Idle the engine at operating temperature. 3. Operate the vehicle within parameters specified under ”Conditions for Setting the Diagnostic Trouble Code” included in Diagnostic Support. 4. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0133 until the Diagnostic Trouble Code P0133 test runs. 5. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0133 failed this ignition?	—	Go to Step 3	Refer to Diagnostic Aids
3	Did the Tech 2 also indicate Diagnostic Trouble Code P1133 and/or P1134 failed this ignition?	—	Go to Step 8	Go to Step 4
4	1. Perform ”Exhaust System Leak Test” (refer to Exhaust System). After ”Exhaust System Leak Test” has been performed, return to this diagnostic 2. If an exhaust leak is found, repair as necessary. Was an exhaust leak isolated?	—	Go to Step 2	Go to Step 5
5	Visually/physically inspect the following items: • Ensure that the Bank 1 HO2S 1 is securely installed. • Check for corrosion on terminals. • Check terminal tension (at Bank 1 HO2S 1 and at the PCM). • Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to Step 9	Go to Step 6

DTC P0133 – O2 Sensor Circuit Slow Response (Bank 1 Sensor 1) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Disconnect Bank 1 HO2S 1. 2. Ignition ON. 3. Using a Digital Voltmeter (DVM) at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. Also measure the voltage between the low signal circuit and ground. Are both voltages in the specified range?	3–4 V	Go to Step 7	Go to Step 10
7	1. With Bank 1 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition ON. 3. Using a Tech 2, monitor the Bank 1 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to Step 12	Go to Step 13
8	Replace the affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. • Fuel contamination. • Use of improper RTV sealant. • Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
9	Repair condition as necessary. Is the action complete?	—	Verify repair	—
10	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to Step 11
11	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	—
12	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0134 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 1)



D06RX046

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) high and low circuits. When measured with a 10 MΩ digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during ”Closed Loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains at or near the 450 mV bias for an extended period of time, Diagnostic Trouble Code P0134 will be set, indicating an open sensor signal or sensor low circuit. DTC P0134 is a type B code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine run time is longer than 120 seconds.
- Oxygen sensor heater has been determined to be functioning properly, and the oxygen sensor has warmed to operating temperature.

All the above conditions are met and the following condition is met:

- Bank 1 HO2S 1 signal voltage remains between 400 mV and 500 mV for a total of 76.5 seconds over a 90–second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the second time the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.
- ”Open Loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0134 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0134 can be cleared by using the Scan Tool's ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, and damaged harness.
- Faulty HO2S heater or heater circuit – With the ignition ON engine OFF after a cooldown period, the HO2S 1 voltage displayed on the Tech 2 is normally 455–460 mV. A reading over 1000 mV indicates a signal line shorted to voltage. A reading under 5 mV indicates a

signal line shorted to ground or signal lines shorted together. Disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light for 2 seconds when the ignition is turned on, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.

- Intermittent test – With the ignition ON monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

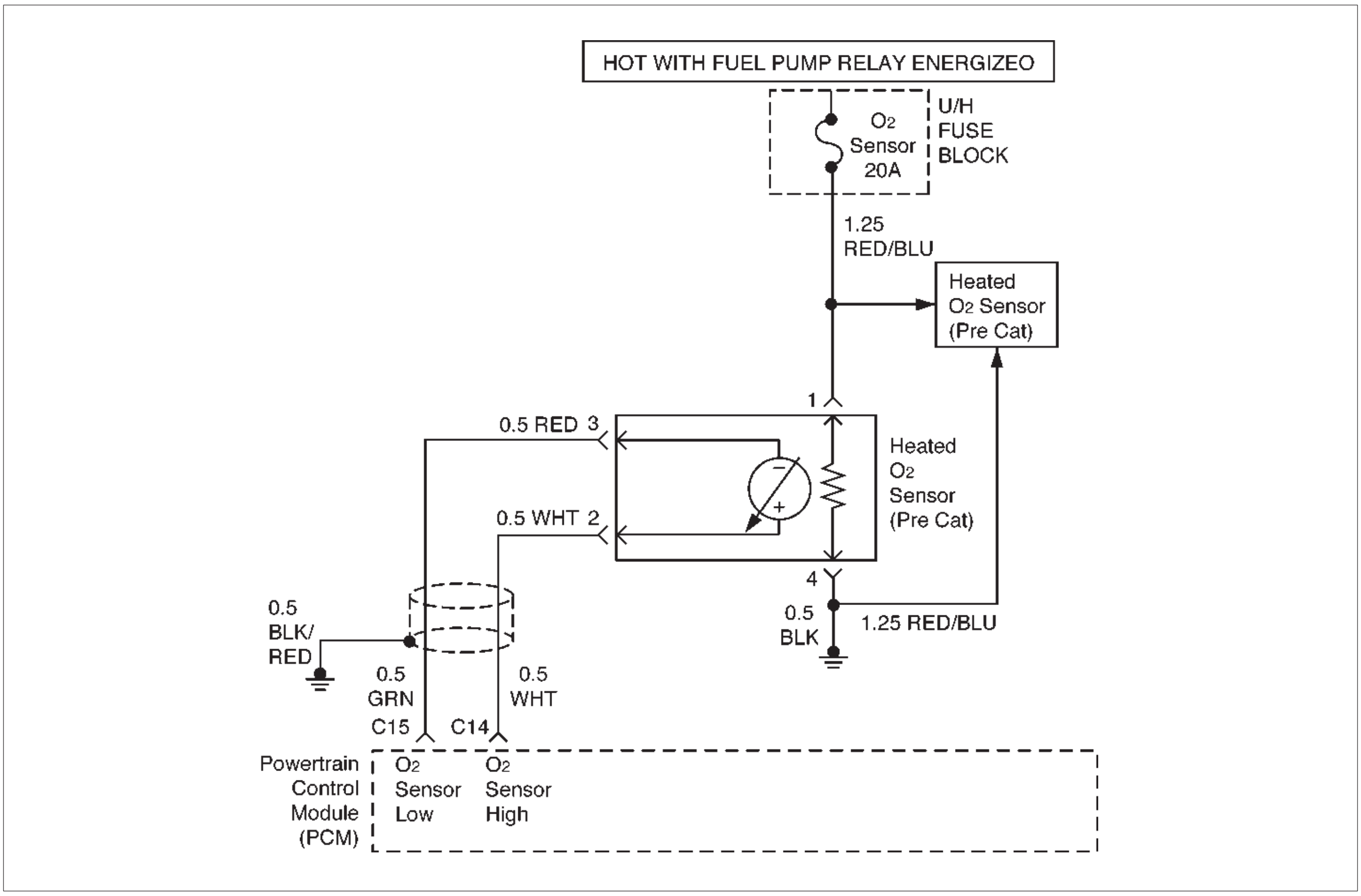
DTC P0134 – O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for three minutes. Does the Tech 2 indicate Bank 1 HO2S 1 voltage varying outside the specified values?	400–500 mV	Go to Step 3	Go to Step 4
3	1. Ignition ON, engine OFF review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "Diagnostic Trouble Code" info for Diagnostic Trouble Code P0134 until the Diagnostic Trouble Code P0134 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0134 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids
4	Check for a damaged harness. Was a problem found?	—	Verify repair	Go to Step 5
5	Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the Bank 1 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 6
6	Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the PCM and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 7
7	1. Ignition OFF. 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 high circuit. 3. If the Bank 1 HO2S 1 high circuit measures over 0.5 Ω, repair open or poor connection as necessary. Was a Bank 1 HO2S 1 high circuit problem found and corrected?	—	Verify repair	Go to Step 8

DTC P0134 – O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1) (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition OFF. 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 low circuit measures over 5 Ω, repair open or poor connection as necessary. Was a Bank 1 HO2S 1 low circuit problem found and corrected?	—	Verify repair	Go to Step 9
9	1. Ignition ON, engine OFF. 2. Disconnect Bank 1 HO2S 1 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage approximately equal to the specified value?	10 mV	Go to Step 10	Go to Step 11
10	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0135 O2 SENSOR HEATER CIRCUIT MALFUNCTION (BANK 1 SENSOR 1)



Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for ”Closed Loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by catalyst monitor sensors Bank 1 HO2S 2 and Bank 2 HO2S 2 to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine.

The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start–up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start–up. If the PCM determines that too much time was required for the Bank 1 HO2S 1 to become active, a Diagnostic Trouble Code P0135 will set. DTC P0135 is a type B code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Intake air temperature (IAT) is less than 32°C (90°F) at start–up.
- Engine coolant temperature (ECT) is less than 32°C (90°F) at start–up.
- IAT and ECT are within 5°C (9°F) of each other at start–up.
- Ignition voltage is between 11 and 16.6 V.
- Average calculated air flow is less than 18 g/second during sample period.
- Throttle angle is less than 40%.
- Bank 1 HO2S 1 voltage does not change more than 148 mV from the bias voltage (between 400 mV and 500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 240 seconds. This warm–up time depends on the engine coolant temperature at start–up and intake air temperature at start–up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history Diagnostic Trouble Code P0135 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0135 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. Ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2s heater ground circuit is faulty.
5. Checks the HO2S heater ground circuit.
6. Checks for an open or shorted HO2S heater element.
10. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

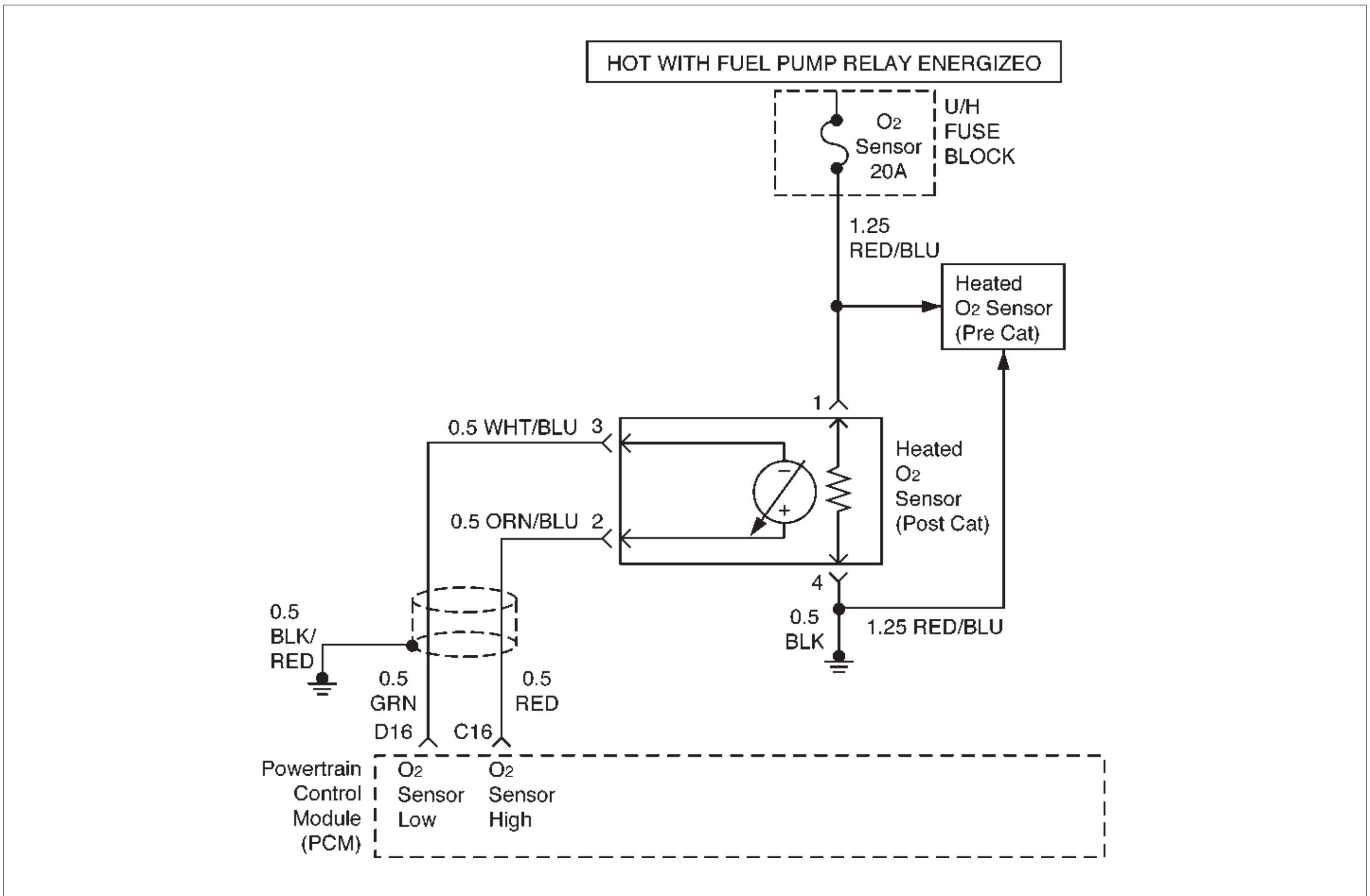
DTC P0135 – O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	NOTE: If the engine has just been operating, allow engine to cool for about one half hour before proceeding. 1. Ignition OFF, engine OFF. 2. Install a Tech 2. 3. Ignition ON engine OFF monitor the Bank 1 HO2S 1 voltage. Does the HO2S voltage go from bias voltage to above and below the specified values?	Above 650 mV or below 250 mV	Refer to Diagnostic Aids	Go to Step 3
3	Inspect the fuse for the Bank 1 HO2S 1 ignition feed. Is the fuse open?	—	Go to Step 15	Go to Step 4
4	1. Ignition OFF. 2. Raise the vehicle. 3. Disconnect the Bank 1 HO2S 1 electrical connector. 4. Using a test light connected to a good ground (do not use Bank 1 HO2S 1 heater ground or Bank 1 HO2S 1 low), probe the ignition feed circuit at the Bank 1 HO2S 1 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to Step 5	Go to Step 7
5	Connect the test light between the Bank 1 HO2S 1 ignition feed and the Bank 1 HO2S 1 heater ground. Does the test light illuminate?	—	Go to Step 6	Go to Step 8

DTC P0135 – O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 1) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Allow the HO2S to cool for at least 10 minutes. 2. Using a Digital Voltmeter (DVM), measure the resistance between the Bank 1 HO2S 1 ignition feed and the Bank 1 HO2S 1 heater ground at the Bank 1 HO2S 1 pigtail. Is the HO2S heater resistance within the specified values?	3–6 ohms	Go to Step 9	Go to Step 10
7	Repair the open Bank 1 HO2S 1 ignition feed circuit to Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 1 HO2S 1 heater ground circuit to Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 1 HO2S 1 harness terminals. 2. If a poor connection is found, replace terminals. Was a poor connection found?	—	Verify repair	Go to Step 10
10	Check for a poor Bank 1 HO2S 1 high or low circuit terminal connection at the Bank 1 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 11
11	1. Ignition OFF. 2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 1 signal circuit and the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 high circuit or HO2S low circuit measures over 5 Ω, repair open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to Step 12
12	Check for a poor Bank 1 HO2S 1 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 13
13	Check for a poor Bank 1 HO2S 1 high circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 14
14	Replace the Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in Bank 1 HO2S 1 ignition feed circuit and replace the fault fuse. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0137 O2 SENSOR CIRCUIT LOW VOLTAGE (BANK 1 SENSOR 2)



D06RX047

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three–way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three–way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the Bank 1 HO2S 2 signal voltage remains excessively low for an extended period of time, Diagnostic Trouble Code P0137 will be set. DTC P0137 is a type A code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine is operating in ”Closed Loop”.
- Engine coolant temperature is above 60˚C (140˚F).
- ”Closed Loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.

  All above conditions met for 0.3 seconds or for 3.0 seconds, if in ”Decelleration Fuel Cut–Off” (DFCO) mode, and the following two conditions are met:
- Bank 1 HO2S 2 signal voltage remains below 22 mV during normal ”Closed Loop” operation for a total of 106.25 seconds over a 125–second period of time.

OR
- Bank 1 HO2S 2 signal voltage remains below 426 mV during power enrichment (P.E.) mode fuel control operation for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history Diagnostic Trouble Code P0137 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0137 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and/or contacting the exhaust system.
- Poor PCM to engine grounds.
- Fuel pressure – A condition which causes a lean exhaust can cause Diagnostic Trouble Code P0137 to set. The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a Diagnostic Trouble Code P0137 may be set. Refer to Fuel System Diagnosis.
- Lean injector(s) – Perform "Injector Balance Test."
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the Diagnostic Trouble Code P0137 to set. Check for exhaust leaks near the Bank 1 HO2S 2 sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. For procedure to check for fuel contamination, refer to Fuel System Diagnosis.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. Diagnostic Trouble Code P0137 being set in power enrichment mode conditions may indicate a condition described in the "Diagnostic Aids" above. If the Diagnostic Trouble Code P0137 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated. Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

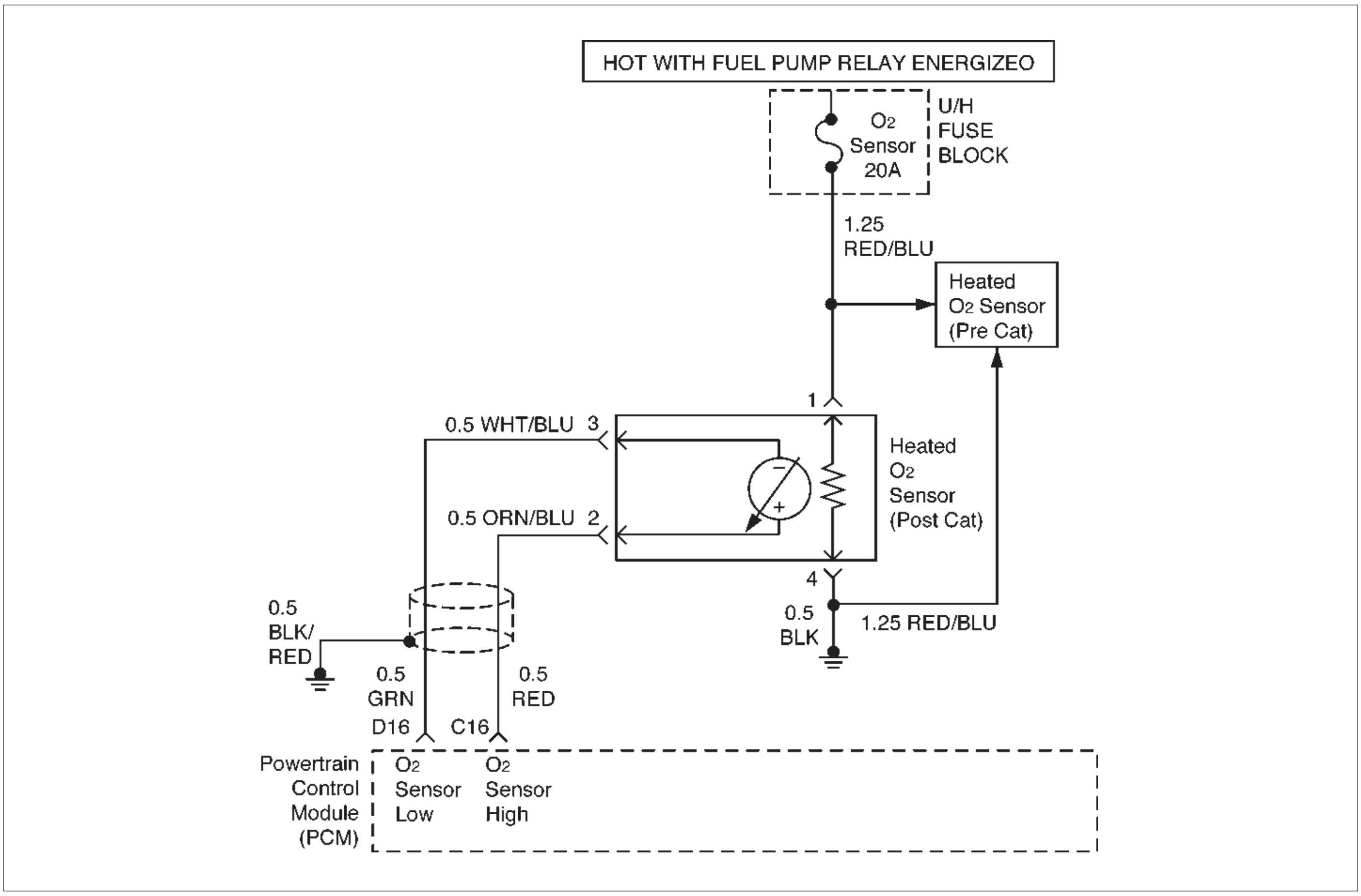
DTC P0137 – O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under "Conditions for Setting the Diagnostic Trouble Code" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Does the Bank 1 HO2S 2 voltage remain below the specified value?	26 mV	Go to Step 4	Go to Step 3
3	1. Ignition ON, engine OFF review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "Diagnostic Trouble Code" info for Diagnostic Trouble Code P0137 until the Diagnostic Trouble Code P0137 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0137 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Turn ignition OFF. 2. Disconnect the PCM. 3. Check the Bank 1 HO2S 2 high and low signal circuits for a short to ground or a short to the heater ground circuit. Were Bank 1 HO2S 2 signal circuits shorted?	—	Go to Step 5	Go to Step 6
5	Repair the Bank 1 HO2S 2 signal circuit. Is the action complete?	—	Verify repair	—

DTC P0137 – O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition OFF. 2. Leave the PCM and HO2S 2 disconnected. 3. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to Step 7	Go to Step 8
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition OFF. 2. Reconnect the PCM, leave HO2S 2 disconnected. 3. Ignition ON. Does the Tech 2 indicate Bank 1 HO2S 2 voltage near the specified value?	430–450 mV	Refer to Diagnostic Aids	Go to Step 9
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0138 O2 SENSOR CIRCUIT HIGH VOLTAGE (BANK 1 SENSOR 2)



D06RX047

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three–way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three–way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the Bank 1 HO2S 2 signal voltage remains excessively high for an extended period of time, Diagnostic Trouble Code P0138 will be set. DTC P0138 is a type A code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine is operating in ”Closed Loop”.
- ”Closed Loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Engine coolant temperature is above 60˚C (140˚F).
- Throttle angle is between 3% and 19%.

  All above conditions met for 3.0 seconds or in ”Deceleration Fuel Cutoff” DFCO mode, and one of the following two conditions are met:

- Bank 1 HO2S 2 signal voltage remains above 952 mV during normal ”Closed Loop” operation for a total of 106.25 seconds over a 125–second period of time.

OR

- Bank 1 HO2S 2 signal voltage remains above 474 mV during deceleration fuel cutoff mode operation for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0138 will clear after 40 consecutive warm–up cycles have occurred without a fault.

- Diagnostic Trouble Code P0138 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check the following items:

- Fuel pressure – An excessively rich fuel mixture can cause a Diagnostic Trouble Code P0138 to be set. Refer to Fuel System Diagnosis.
- Rich injector(s) – Perform "Injector Balance Test."
- Leaking injector – Refer to Fuel System Diagnosis.
- Evaporative emissions (EVAP) canister purge – Check for fuel saturation. If full of fuel, check the canister control and hoses. Refer to Evaporative Emission (EVAP) Control System.
- Check for a leaking fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S) – If the HO2S is internally shorted the HO2S voltage displayed on the Tech 2 will be over 1 volt. Silicon contamination of the HO2S can also cause a high HO2S voltage. This condition is indicated by a powdery white deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is evident, replace the affected HO2S.
- Open HO2S Signal, Low Circuit or Faulty HO2S – A poor connection or open in the HO2S signal or low circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal and low circuit wiring and associated terminal connections. If the wiring and connections are OK, replace the HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. Diagnostic Trouble Code P0138 being set during deceleration fuel mode operation may indicate a condition described in the "Diagnostic Aids" above. If the Diagnostic Trouble Code P0138 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated. Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

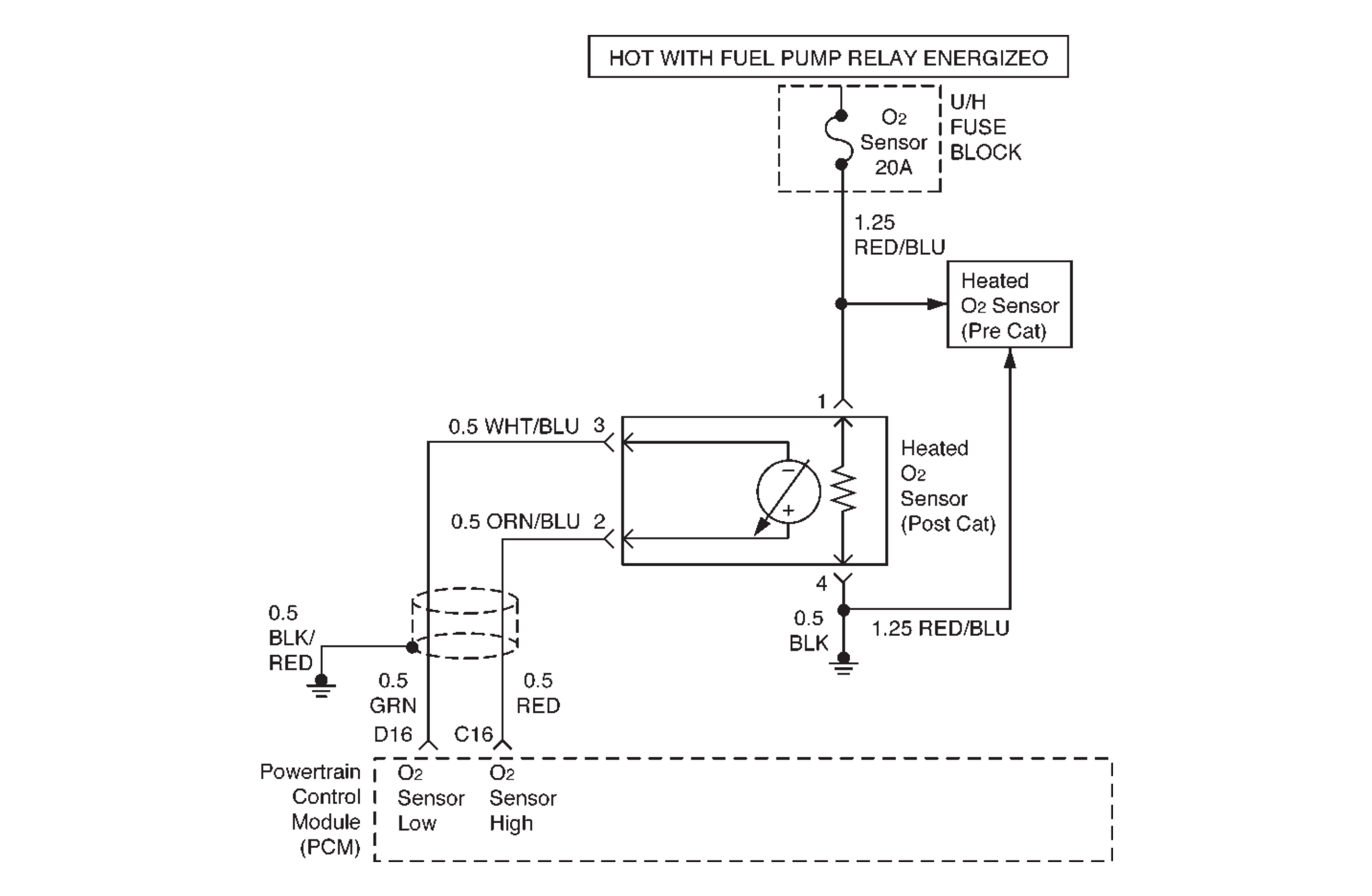
DTC P0138 – O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within parameters specified under "Conditions for Setting the Diagnostic Trouble Code" included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 2 voltage remain above the specified value?	952 mV	Go to Step 4	Go to Step 3
3	1. Ignition ON review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "Diagnostic Trouble Code" info for Diagnostic Trouble Code P0138 until the Diagnostic Trouble Code P0138 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0138 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids

DTC P0138 – O2 Sensor Circuit High Voltage (Bank 1 Sensor 2) (Cont'd)

Step	Action	Value(s)	Yes	No
4	1. Ignition OFF. 2. Disconnect Bank 1 HO2S 2. 3. Ignition ON. 4. At HO2S 2 connector (PCM side) use a DVM to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	5–14 V	Go to Step 5	Go to Step 6
5	Repair short to voltage in signal circuit.	—	Verify repair	—
6	1. Ignition OFF. 2. Disconnect the PCM connector. 3. Check for damage to the PCM pins and terminals. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Ignition ON, engine OFF. 2. Disconnect Bank 1 HO2S 2 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 2 voltage below the specified value?	10 mV	Go to Step 8	Go to Step 9
8	Replace Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0140 O2 SENSOR CIRCUIT NO ACTIVITY DETECTED (BANK 1 SENSOR 2)



D06RX047

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three–way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 2 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three–way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the Bank 1 HO2S 2 signal voltage remains between 400 mV and 500 mV for an extended period of time, Diagnostic Trouble Code P0140 will be set. DTC P0140 is a type A code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine run time is longer than 120 seconds.
- Oxygen sensor heater is functioning properly, and the oxygen sensor has reached operating temperature.
- Engine is operating in "Closed Loop".
- Bank 1 HO2S 2 signal voltage remains between 426 mV and 474 mV for a total of 106.25 seconds over a 125–second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0140 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0140 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal–to–wire connection, shorts to ground, shorts to battery positive and open circuits.

- Faulty HO2S heater or heater circuit – With the ignition ON engine OFF the HO2S voltage displayed on a Tech 2 should gradually drop to below 250 mV. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test – With the ignition ON monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. If the Diagnostic Trouble Code P0140 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated. Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

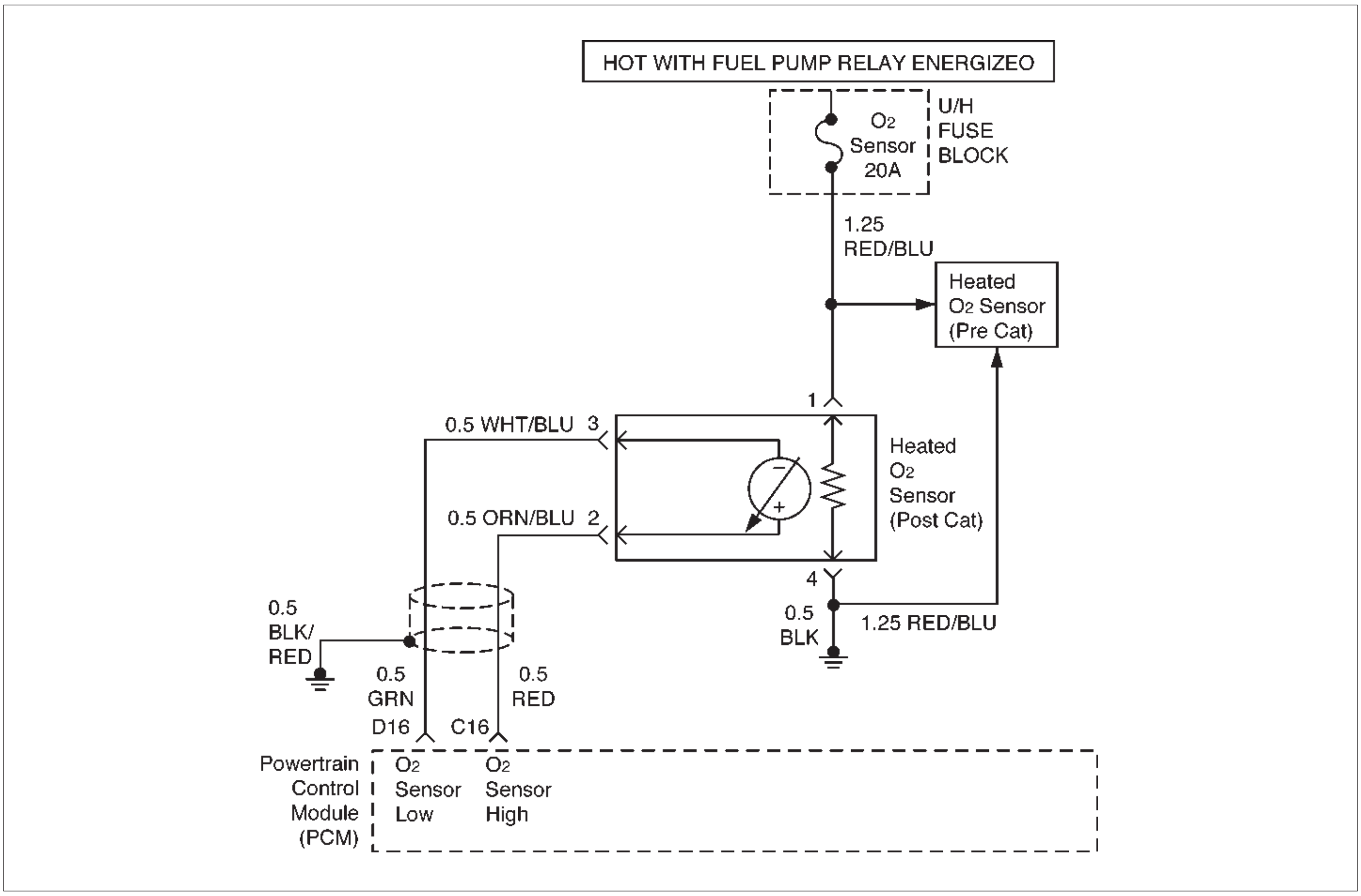
DTC P0140 – O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 1 HO2S 2 voltage vary outside the specified value?	425–475 mV	Go to Step 3	Go to Step 4
3	1. Ignition ON engine OFF review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "Diagnostic Trouble Code" info for Diagnostic Trouble Code P0140 until the Diagnostic Trouble Code P0140 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0140 failed this ignition?	—	Go to Step 4	Refer to Diagnostic Aids
4	Check for a poor Bank 1 HO2S 2 high or low signal circuit terminal connection at the Bank 1 HO2S 2 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 5
5	1. Ignition OFF. 2. Disconnect the PCM. 3. Check for poor Bank 1 HO2S 2 high or low signal circuit terminal connection at the PCM and replace the terminal if necessary. Did either terminal require replacement?	—	Verify repair	Go to Step 6
6	Check continuity of the Bank 1 HO2S 2 signal circuits. If either Bank 1 HO2S 2 signal circuit measures over 5 Ω, repair open or poor connection as necessary. Was a Bank 1 HO2S 2 signal circuit problem found and corrected?	—	Verify repair	Go to Step 7

DTC P0140 – O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2) (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Reconnect the PCM harness. 2. Ignition ON. 3. With the Bank 1 HO2S 2 sensor harness disconnected, use a Digital Voltmeter (DVM) to measure the voltage between the HO2S heater ground wire and each signal circuit wire. Does each signal circuit measure in the specified range?	3–4 V	Go to Step 9	Go to Step 8
8	Check for a short to ground or voltage in both signal circuits. Was a problem found?	—	Verify repair	Go to Step 11
9	1. Jumper the high and low signal wires to the heater ground wire. 2. Ignition ON. Using a Tech 2, is the Bank 1 HO2S 2 voltage in the specified range?	0–10 mV	Go to Step 10	Go to Step 11
10	Replace Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0141 O2 SENSOR HEATER CIRCUIT MALFUNCTION (BANK 1 SENSOR 2)



D06RX047

Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for ”Closed Loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by catalyst monitor sensors Bank 1 HO2S 2 and Bank 2 HO2S 2 to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine.

The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start–up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the Bank HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start–up. If the PCM determines that too much time was required for the Bank 1 HO2S 2 to become active, a Diagnostic Trouble Code P0141 will set. DTC P0141 is a type B code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Intake air temperature (IAT) is less than 32°C (90°F) at start–up.
- Engine coolant temperature (ECT) is less than 32°C (90°F) at start–up.
- IAT and ECT are within 5°C (9°F) of each other at start–up.
- Ignition voltage is between 11 volts and 16.6 volts.
- Throttle angle is less than 40%.
- Average calculated airflow is less than 18 g/second during the sample period.
- Bank 1 HO2S 2 voltage does not change more than 148 mV from the bias voltage (between 400 mV–500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 405 seconds. This warm–up time depends on the engine coolant temperature at start–up and intake air temperature at start–up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle duringwhich the diagnostic has been run and the fault condition is no longer present.

- A history Diagnostic Trouble Code P0141 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0141 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. This ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. This checks the HO2S heater ground circuit.
6. This checks for an open or shorted HO2S heater element.
11. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

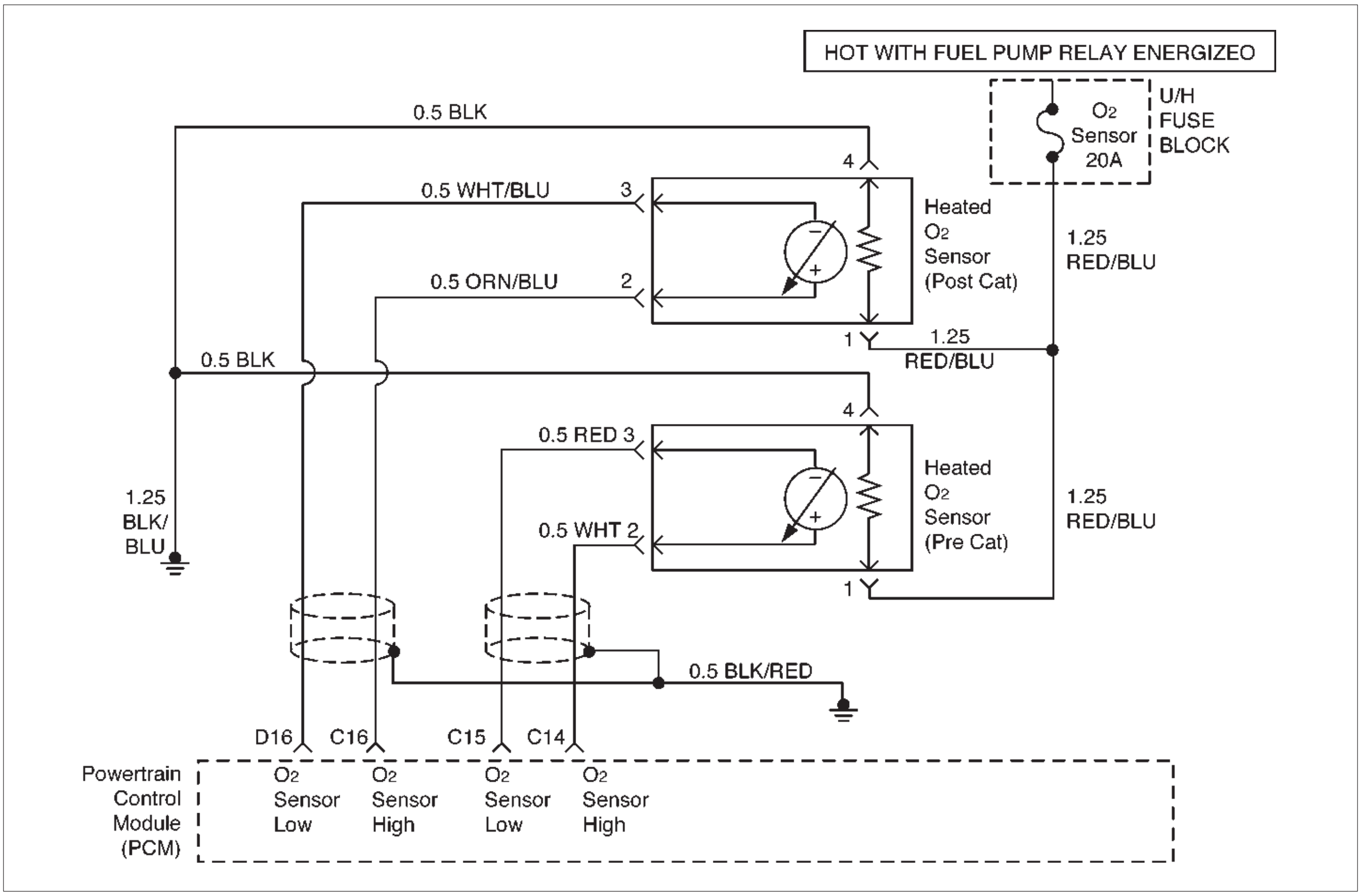
DTC P0141 – O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2)

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	NOTE: If the engine has just been operating, allow the engine to cool for about one half hour before proceeding. 1. Ignition OFF, engine OFF. 2. Install the Tech 2. 3. Ignition ON, engine OFF monitor the Bank 1 HO2S 2 voltage. Does the HO2S voltage go from bias voltage to above or below the specified values?	Above 650 mV or below 250 mV	Refer to Diagnostic Aids	Go to Step 3
3	Inspect the fuse for Bank 1 HO2S 2 ignition feed. Is the fuse open?	—	Go to Step 15	Go to Step 4
4	1. Ignition OFF. 2. Raise the vehicle. 3. Disconnect the Bank 1 HO2S 2 electrical connector. 4. Using a test light connected to a good ground (do not use Bank 1 HO2S 2 heater ground or Bank 1 HO2S 2 low), probe the ignition feed circuit at the Bank 1 HO2S 2 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to Step 5	Go to Step 7
5	Connect the test light between the Bank 1 HO2S 2 ignition feed and the Bank 1 HO2S 2 heater ground. Does the test light illuminate?	—	Go to Step 6	Go to Step 8

DTC P0141 – O2 Sensor Heater Circuit Malfunction (Bank 1 Sensor 2) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Allow the HO2S to cool for at least 10 minutes. 2. Using a Digital Voltmeter (DVM), measure the resistance between the Bank 1 HO2S 2 ignition feed and the Bank 1 HO2S 2 heater ground at the Bank 1 HO2S 2 pigtail. Is the HO2S resistance within the specified values?	3–6 Ω	Go to Step 9	Go to Step 10
7	Repair the open Bank 1 HO2S 2 ignition feed circuit to Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 1 HO2S 2 heater ground circuit. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 1 HO2S 2 harness terminals. 2. If a poor connection is found, replace the terminals. Was a poor connection found?	—	Verify repair	Go to Step 10
10	1. Ignition OFF. 2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 2 signal circuit and the Bank 1 HO2S 2 low circuit. 3. If the Bank 1 HO2S 2 signal circuit or the HO2S low circuit measures over 5 Ω, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to Step 11
11	Check for a poor Bank 1 HO2S 2 high or low circuit terminal connection at the Bank 1 HO2S 2 harness connector and replace the terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 12
12	Check for a poor Bank 1 HO2S 2 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 13
13	Check for a poor Bank 1 HO2S 2 high circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to Step 14
14	Replace Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in Bank 1 HO2S 2 ignition feed circuit and replace the faulty fuse. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0171 SYSTEM TOO LEAN (BANK 1)



D06RX048

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a "Closed Loop" air/fuel metering system is used. While in "Closed Loop", the powertrain control module (PCM) monitors the Bank 1 HO2S 1 signal and adjusts fuel delivery based upon the HO2S signal voltage. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signal indicates a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected on Bank 1, the PCM will set Diagnostic Trouble Code P0171. DTC P0171 is a type B code.

The PCM's maximum authority to control long term fuel trim allows a range between –14% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following: EGR Diagnostic Trouble Codes, HO2S Diagnostic Trouble Codes, (response, transition, open, low volts, no activity), TP sensor Diagnostic Trouble Codes, MAP Diagnostic Trouble Codes, IAT Diagnostic Trouble Codes, canister purge Diagnostic Trouble Codes, EVAP Diagnostic Trouble Codes, injector circuit Diagnostic Trouble Codes, or misfire Diagnostic Trouble Codes.
- Engine coolant temperature is between 65˚C (149˚F) and 104˚C (219˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 23.75 kPa and 99 kPa.
- Engine speed is between 400 and 6000 RPM.
- Barometric pressure is greater than 72.3 kPa.
- System voltage is greater than 9.5v.
- Engine is operating in "Closed Loop".
- The average of the short term fuel trim samples is greater than 0.97 and the average of adaptive index multiplier samples is greater than 1.21.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0171 will clear after 40 consecutivewarm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0171 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Diagnostic Trouble Codes other than P0171 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other Diagnostic Trouble Code will most likely correct the Diagnostic Trouble Code P0171.
4. If the Diagnostic Trouble Code P0171 test passes while the Failure Records conditions are being duplicated, the lean condition is intermittent. Refer to Diagnostic Aids or Symptoms for additional information on diagnosing intermittent problems.

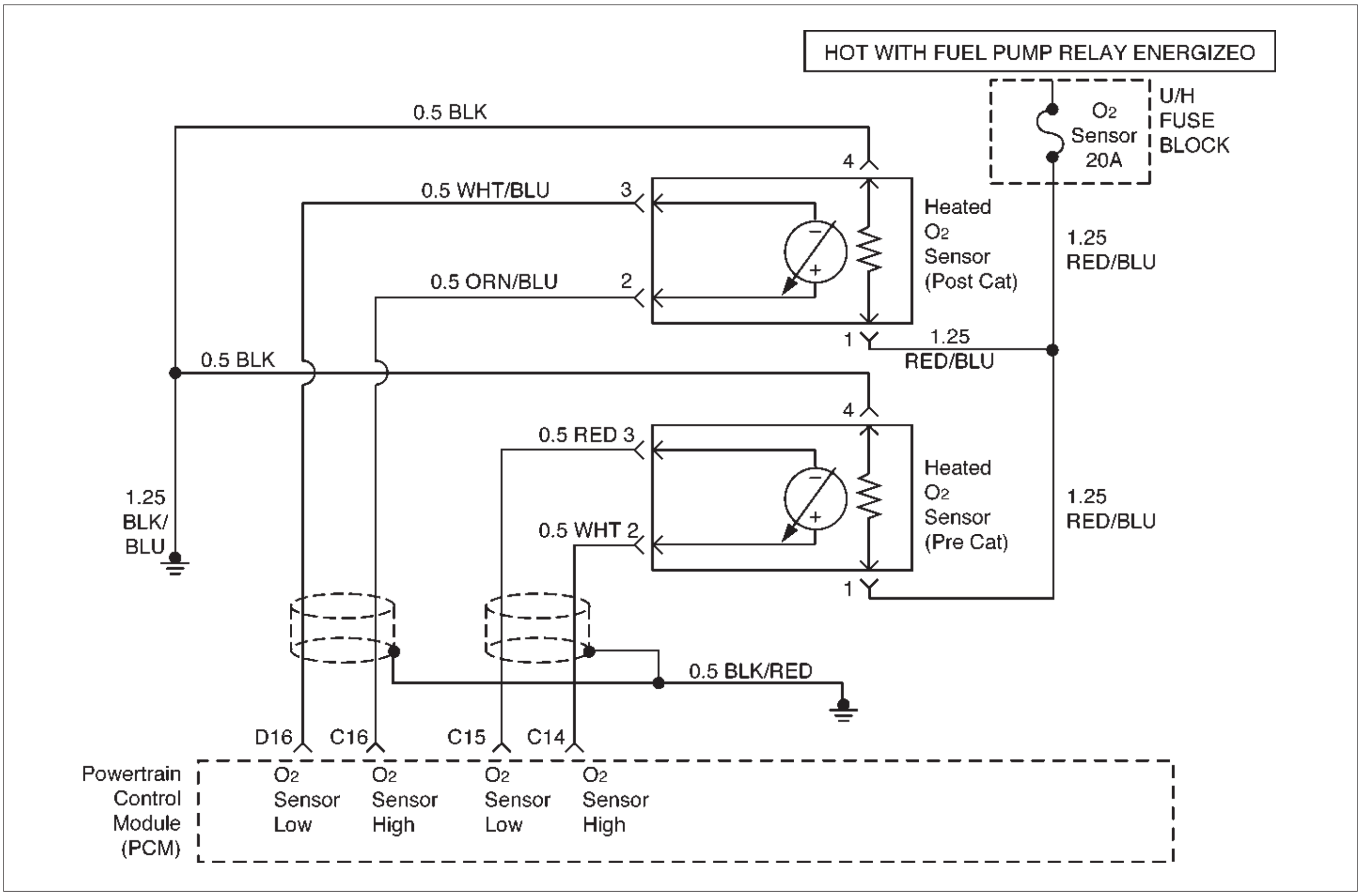
DTC P0171 – System Too Lean (Bank 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Are any DTCs set other than P0171?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart.	Go to Step 3
3	1. Start the engine and operate the vehicle in ”Closed Loop”. 2. Observe the ”BANK 1 L.T. FUEL TRIM” and display on the Tech 2. Are the displayed values greater than the specified values?	L.T. Fuel Trim: 20%	Go to Step 5	Go to Step 4
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the Diagnostic Trouble Code P0171 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0171 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the Diagnostic Trouble Code P0171 test runs and note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0171 failed this ignition?	—	Go to Step 5	The lean condition is not present. If a driveability symptom still exists, refer to Symptoms section.
5	Visually and physically inspect the vacuum hoses for disconnects, splits, kinks, improper routing and improper connections and repair any problem found. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to Step 6
6	Visually and physically inspect the crankcase ventilation valve for proper installation and repair any problem found (refer to Crankcase Ventilation System). Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to Step 7
7	Start the engine and note the idle quality. Is a high or unsteady idle being experienced?	—	Go to Step 8	Go to Step 10
8	With the engine idling, observe the ”IDLE AIR CONTROL” display on the Tech 2. Is the displayed value above the specified value?	Above 5 counts	Go to Step 10	Go to Step 9
9	1. Visually and physically inspect the throttle body, intake manifold, EGR valve and the EGR feed pipe for vacuum leaks. 2. Repair any vacuum leaks as necessary. Did your inspection reveal a vacuum leak?	—	Verify repair	Go to Step 10

DTC P0171 – System Too Lean (Bank 1) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Perform the "Idle Air Control (IAC) Valve Check" and correct any IAC problem as necessary. Did this test isolate a problem requiring repair?	—	Verify repair	Go to Step 11
11	Check the fuel for excessive water, alcohol, or other contaminants (see Diagnosis in Engine Fuel for the procedure) and correct the contaminated fuel condition if present (see Engine Fuel). Was the fuel contaminated?	—	Verify repair	Go to Step 12
12	1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight, and in their proper locations. 2. If a faulty ground condition is present, correct it as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to Step 13
13	Perform the procedure in "Fuel System Pressure Test" and repair fuel system problem if necessary. Did the test isolate a condition requiring repair?	—	Verify repair	Go to Step 14
14	Perform the "Evaporative Emissions Control (EVAP) Canister Purge Valve Check" and repair EVAP system problem if necessary. Did the test isolate a problem?	—	Verify repair	Go to Step 15
15	1. Visually and physically inspect the intake manifold, injector O–rings, EGR adapter, EGR valve and the EGR feed pipes for vacuum leaks. 2. Repair any problem that is found. Did your inspection reveal a problem?	—	Verify repair	Go to Step 16
16	Visually and physically inspect the Bank 1 exhaust manifold for leaks and loose or missing hardware and correct any problem found. Did your inspection reveal a problem?	—	Verify repair	Go to Step 17
17	Perform the "Injector Balance Test," and correct any problem found (refer to Fuel Metering System). Did the test isolate a problem?	—	Verify repair	Go to Step 18
18	1. Visually and physically inspect the Bank 1 HO2S 1 to ensure that it is installed securely and that the Bank 1 HO2S 1 pigtail and wiring harness are not contacting the exhaust or otherwise damaged. 2. If a problem is found, correct it as necessary. Did your inspection reveal a problem?	—	Verify repair	Refer to Diagnostic Aids

DIAGNOSTIC TROUBLE CODE (DTC) P0172 SYSTEM TOO RICH (BANK 1)



D06RX048

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a "Closed Loop" air/fuel metering system is used. While in "Closed Loop", the powertrain control module (PCM) monitors the Bank 1 heated oxygen sensor (HO2S) 1 and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected on Bank 1, the PCM will set Diagnostic Trouble Code P0172. DTC P0172 is a type B code.

The PCM's maximum authority to control long term fuel trim allows a range between –14% and +20%. The PCM's maximum authority to control short term fuel trim allows a range between –11% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following was set: EGR Diagnostic Trouble Codes, HO2S Diagnostic Trouble Codes, (response, transition, open, low volts, no activity), TPS Diagnostic Trouble Codes, MAP Diagnostic Trouble Codes, IAT Diagnostic Trouble Codes, canister purge Diagnostic Trouble Codes, EVAP Diagnostic Trouble Codes, injector circuit Diagnostic Trouble Codes, or misfire Diagnostic Trouble Codes.
- Engine coolant temperature is between 65°C (149°F) and 104°C (219°F).
- Intake air temperature is between –40°C (–40°F) and 120°C(248°F).
- Manifold absolute pressure is between 23.75 kPa and 99 kPa.
- System voltage is greater than 9.5 volts.
- Engine speed is between 400 and 6000 RPM.
- Barometric pressure is greater than 72.3 kPa.
- Engine is operating in "Closed Loop".
- The average of the long term full trim samples is less than 1.03 and the average of the adaptive index multiplier samples is less than or equal to 0.82.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history Diagnostic Trouble Code P0172 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0172 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Diagnostic Trouble Codes other than P0172 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0172.
4. If the Diagnostic Trouble Code P0172 test passes while the Failure Records conditions are being duplicated, the rich condition is intermittent. Refer to Diagnostic Aids or Symptoms for additional information on diagnosing intermittent problems.

—

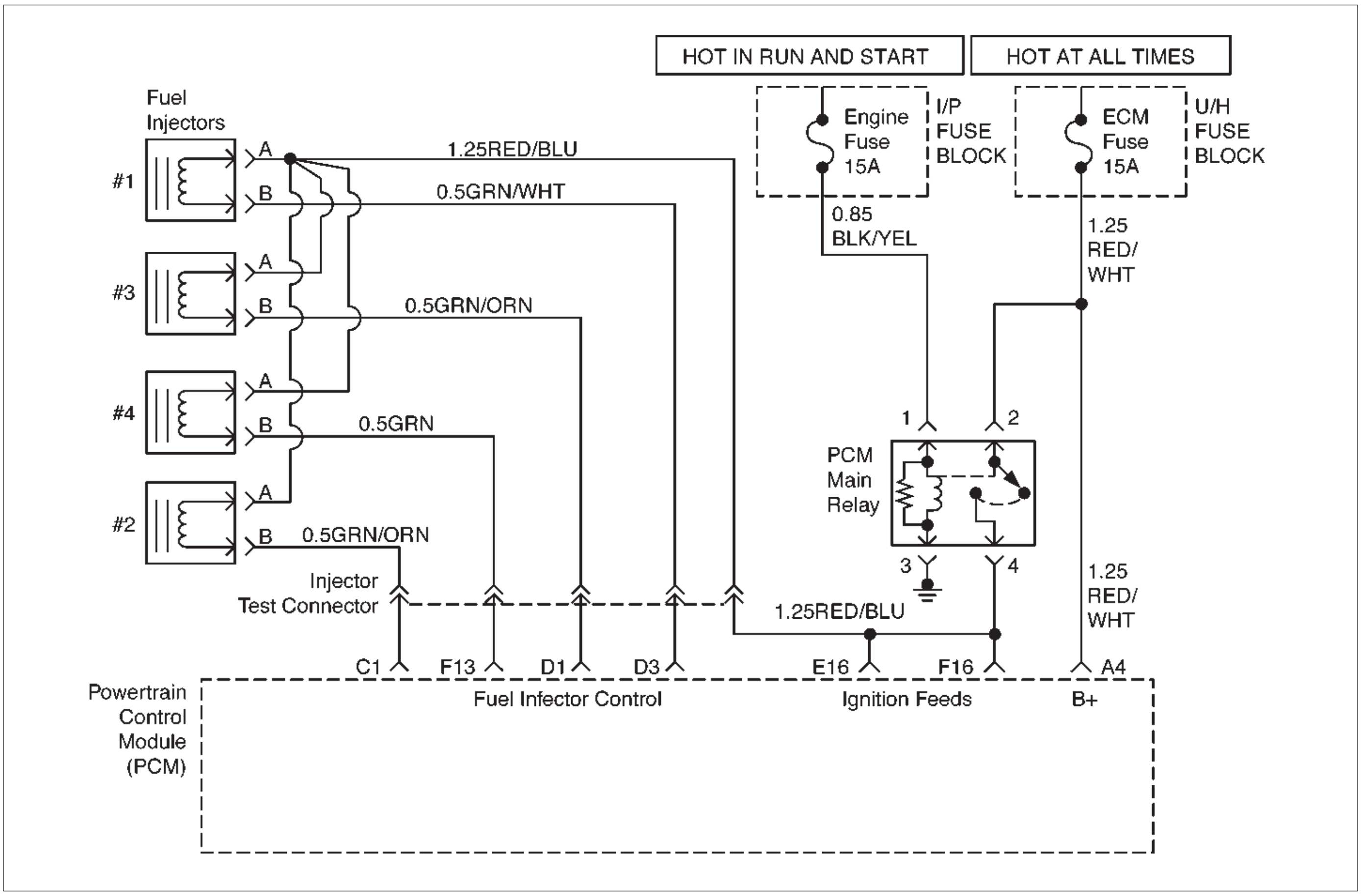
DTC P0172 – System Too Rich (Bank 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Are any Diagnostic Trouble Codes set other than P0172?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart.	Go to Step 3
3	1. Start the engine and operate the vehicle in ”Closed Loop”. 2. Observe ”BANK 1 L.T. FUEL TRIM” display on the Tech 2. Are the displayed values more negative than the specified values?	L.T. Fuel Trim: –14%	Go to Step 5	Go to Step 4
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the Diagnostic Trouble Code P0172 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 “Diagnostic Trouble Code” info for Diagnostic Trouble Code P0172 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the Diagnostic Trouble Code P0172 test runs and note test result. Does the Tech 2 indicate Diagnostic Trouble Code P0172 failed this ignition?	—	Go to Step 5	The rich condition is not present. If a driveability symptom still exists, refer to Symptoms.
5	Visually and physically inspect the air filter element and replace it if necessary. Did the air filter require replacement?	—	Verify repair	Go to Step 6
6	Visually and physically inspect the air intake duct for collapse or restriction and repair if necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to Step 7
7	Start the engine and note the idle quality. Is a low or unsteady idle being experienced?	—	Go to Step 8	Go to Step 10
8	With the engine idling, observe the ”IDLE AIR CONTROL” display on the Tech 2. Is the ”IDLE AIR CONTROL” value below the specified value?	Below 100 counts	Go to Step 10	Go to Step 9
9	1. Ignition OFF. 2. Physically inspect the throttle body bore, throttle plate, and IAC passages for coking and foreign objects. 3. If a problem was found, repair as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to Step 10

DTC P0172 – System Too Rich (Bank 1) (Cont’d)

Step	Action	Value(s)	Yes	No
10	1. Perform the ”Idle Air Control (IAC) Valve Check.” 2. If a problem is found, repair as necessary. Did the test isolate a problem requiring repair?	—	Verify repair	Go to Step 11
11	1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is present in the vacuum hose, replace the fuel pressure regulator (refer to Fuel Metering System). Did the fuel pressure regulator require replacement?	—	Verify repair	Go to Step 12
12	Ignition ON engine OFF monitor the TP Angle display on the Tech 2 while slowly depressing the accelerator pedal. Does the TP Angle display increase steadily and evenly from minimum value at closed throttle to maximum value at wide–open throttle?	Minimum 0% Maximum 100%	Go to Step 13	Go to Step 17
13	1. Perform the ”Fuel System Pressure Test.” 2. If the test isolates a problem, repair as necessary (refer to Engine Fuel or Fuel Metering System). Did the test isolate a problem requiring repair?	—	Verify repair	Go to Step 14
14	1. Perform the ”Evaporative Emissions Control (EVAP) Canister Purge Valve Check.” 2. If the test isolates a problem, repair as necessary. Did the test isolate a problem requiring repair?	—	Verify repair	Go to Step 15
15	1. Perform the ”Injector Balance Test.” 2. If the test isolates a problem, repair as necessary (refer to Fuel Metering System). Did the test isolate a problem requiring repair?	—	Verify repair	Go to Step 16
16	1. Remove and visually/physically inspect the Bank 1 HO2S 1 for silicon contamination. This will be indicated by a powdery white deposit on the portion of the HO2S that is exposed to the exhaust stream. 2. If contamination is evident on the Bank 1 HO2S 1, replace the contaminated sensors. Did the sensor require replacement?	—	Verify repair	Refer to Diagnostic Aids
17	1. Check the TP sensor mounting screws and tighten or replace them as necessary if they are loose or missing. 2. If the screws are OK, replace the TP sensor. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0201 INJECTOR CIRCUIT MALFUNCTION – CYLINDER 1



D06RX049

Circuit Description

The powertrain control module (PCM) has four individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The PCM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a Diagnostic Trouble Code is set. This Diagnostic Trouble Code is also set if an injector driver is shorted to voltage. DTC P0201 is a type A code.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- Engine is running.
- Fuel pump is ON.
- The injector voltage does not equal the ignition voltage when the injector is commanded OFF or the injector voltage does not equal 0 volts when the injector is commanded ON.
- The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history Diagnostic Trouble Code P0201 will clear after 40 consecutive warm–up cycles occur without a fault.
- Diagnostic Trouble Code P0201 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a Diagnostic Trouble Code P0201 to set. It will also cause a misfire due to an inoperative injector. A misfire Diagnostic Trouble Code will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

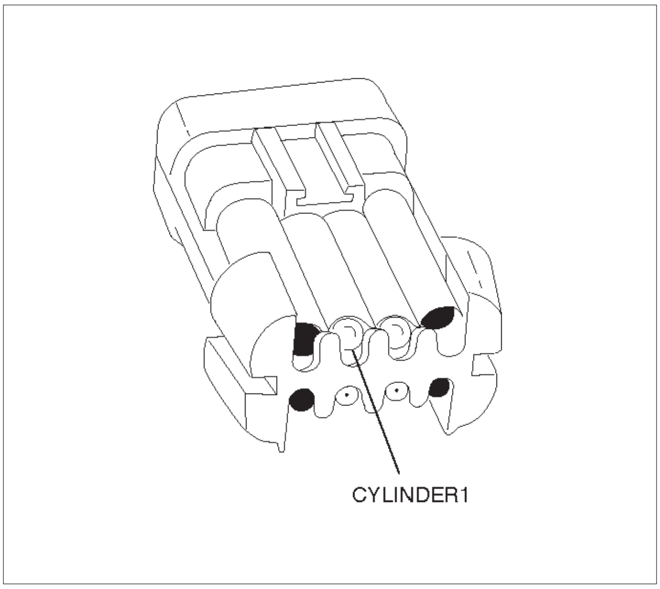
3. This step determines if Diagnostic Trouble Code P0201 is the result of a hard failure or an intermittent condition.
5. This step tests the harness wiring and PCM control of the injectors using a test light.

   The fuel injector test connector is a gray 5 pin connector at the right rear of the valve cover. It can be identified by a blue connector lock which is tethered to the harness.

   J 39021–45 is a test light with one light for each cylinder. The test light fits on the injector test connector.

   If the test light is ON steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to voltage.

   If the test light blinks, the PCM and the wiring to the injectors are OK. Fuel Injector Coil Test Procedure will check if the injectors are faulty.
7. Because the test light was ON steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.



901RX032

13. Normal injector resistance is slightly more than if tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5 Ω.

—

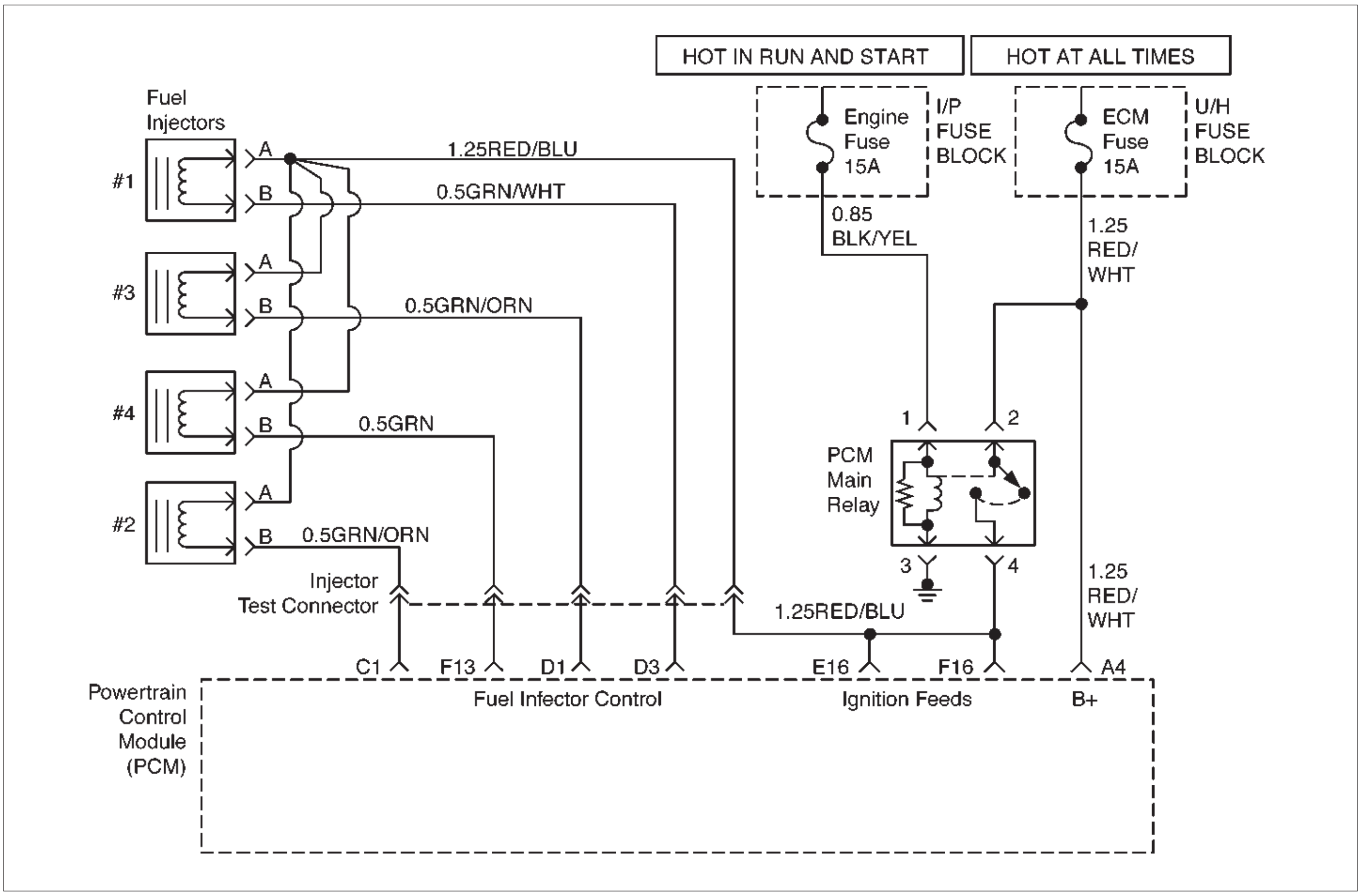
DTC P0201 – Injector Circuit Malfunction – Cylinder 1

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Will the engine start?	—	Go to Step 3	Go to Engine Cranks But Will Not Run Chart
3	1. Install the Tech 2. Clear the Diagnostic Trouble Code. 2. Idle the engine for one minute. Does Diagnostic Trouble Code P0201 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0201 reset?	—	Go to Step 5	Go to Diagnostic Aids
5	1. Ignition OFF. 2. Disconnect the injector test connector. 3. Install the injector test light J 39021–45 on the injector test connector. 4. Crank the engine while observing the light for cylinder 1. Does the injector test light blink?	—	Go to Fuel Injector Coil Test Procedure	Go to Step 6
6	Note whether the injector test light was OFF or ON steady in step 5. Was the test light ON steady while cranking the engine?	—	Go to Step 7	Go to Step 10

DTC P0201 – Injector Circuit Malfunction – Cylinder 1 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to Step 8	Go to Step 9
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to OBD System Check	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to OBD System Check	—
10	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each terminal on the PCM side of the injector test connector. Only the Ign+ terminal should illuminate the test light. Besides the Ign+, did any other terminal illuminate the test light?	—	Go to Step 11	Go to Step 12
11	Repair the short to voltage in the injector driver circuit.	—	Verify repair	—
12	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each pin on the injector side of the connector. Did any terminal illuminate the test light?	—	Go to Step 11	Go to Step 13
13	1. Disconnect the injector test connector. 2. Ignition OFF. 3. Clip one lead of an ohmmeter to the ignition pin on the injector side of the test connector. 4. Touch the other lead to each of the other four pins in the test connector, one pin at a time. Instead of normal injector resistance, did the ohmmeter indicate an open in one of the injector circuits?	—	Go to Step 14	Go to Step 15
14	Repair the open circuit or open injector.	—	Verify repair	—
15	Check for an open circuit between the injector test connector and the PCM connector for the Injector 1 control circuit. Was there an open circuit?	—	Go to Step 16	Go to Step 9
16	Repair the open circuit.	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0202 INJECTOR CIRCUIT MALFUNCTION – CYLINDER 2



D06RX049

Circuit Description

The powertrain control module (PCM) has four individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The PCM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a Diagnostic Trouble Code is set. This Diagnostic Trouble Code is also set if an injector driver is shorted to voltage. DTC P0202 is a type A code.

Conditions for Setting the DTC

- The battery voltage is greater than 9 volts.
- Engine is running.
- Fuel pump is ON.
- The injector voltage does not equal the ignition voltage when the injector is commanded OFF or the injector voltage does not equal 0 volts when the injector is commanded ON.
- The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history Diagnostic Trouble Code P0202 will clear after 40 consecutive warm–up cycles occur without a fault.
- Diagnostic Trouble Code P0202 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a Diagnostic Trouble Code P0202 to set. It will also cause a misfire due to an inoperative injector. A misfire Diagnostic Trouble Code will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. This step determines if Diagnostic Trouble Code P0202 is the result of a hard failure or an intermittent condition.

5. This step tests the harness wiring and PCM control of the injectors using a test light.

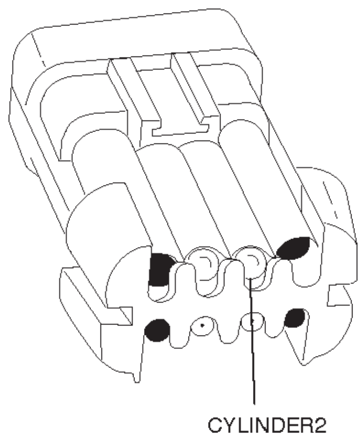
   The fuel injector test connector is a gray 5 pin connector at the right rear of the valve cover. It can be identified by a blue connector lock which is tethered to the harness.

   J 39021–45 is a test light with one light for each cylinder. The test light fits on the injector test connector.

   If the test light is ON steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to voltage.

   If the test light blinks, the PCM and the wiring to the injectors are OK. Fuel Injector Coil Test Procedure will check if the injectors are faulty.

7. Because the test light was ON steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.



901RX033

13. Normal injector resistance is slightly more than if tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5 Ω.

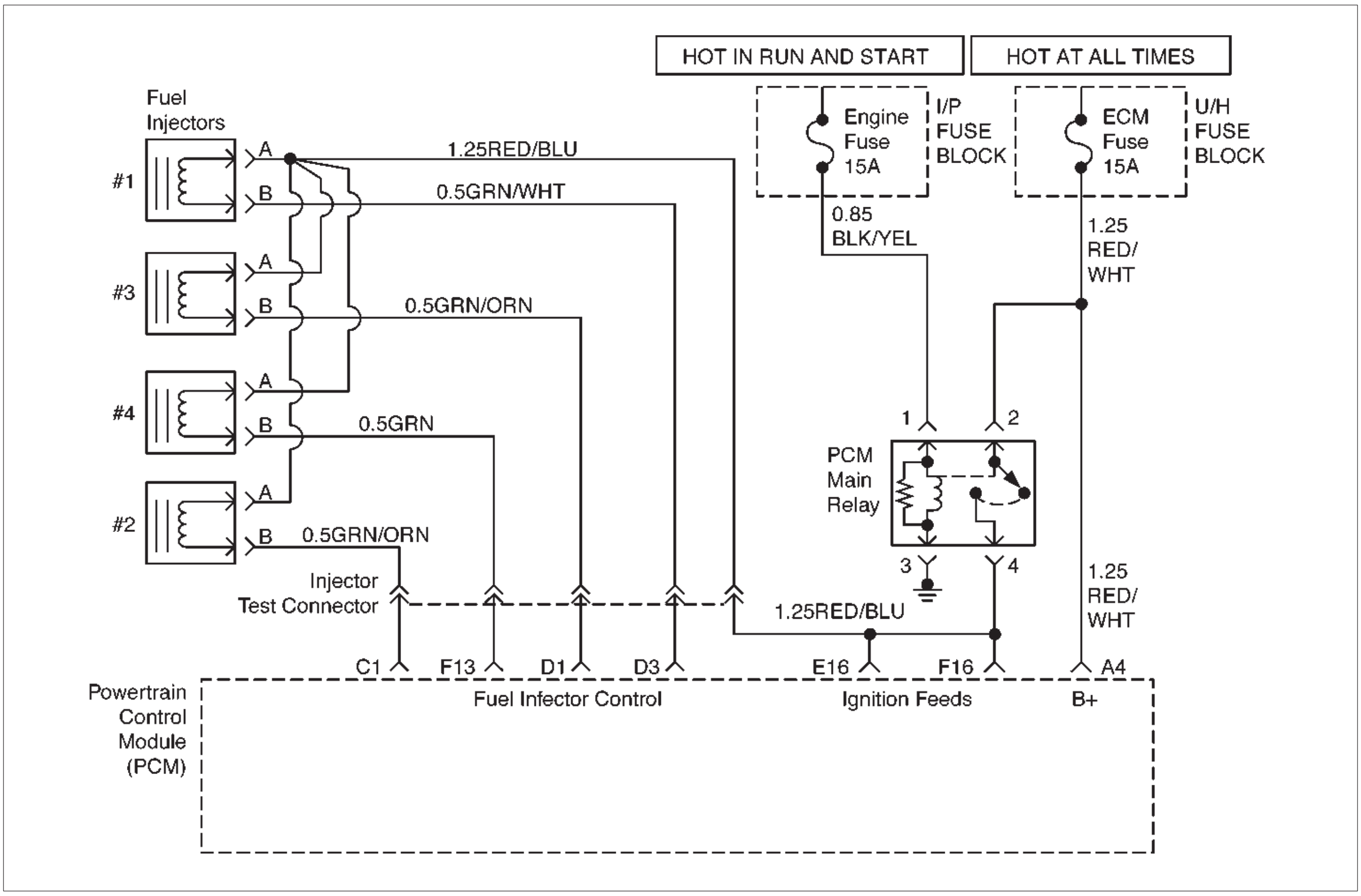
DTC P0202 – Injector Circuit Malfunction – Cylinder 2

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Will the engine start?	—	Go to Step 3	Go to Engine Cranks But Will Not Run Chart
3	1. Install the Tech 2. Clear the Diagnostic Trouble Code. 2. Idle the engine for one minute. Does Diagnostic Trouble Code P0202 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0202 reset?	—	Go to Step 5	Go to Diagnostic Aids
5	1. Ignition OFF. 2. Disconnect the injector test connector. 3. Install the injector test light J 39021–45 on the injector connector. 4. Crank the engine while observing the light for cylinder 2. Does the injector test light blink?	—	Go to Fuel Injector Coil Test Procedure	Go to Step 6
6	Note whether the injector test light was OFF or ON steady in step 5. Was the test light ON steady while cranking the engine?	—	Go to Step 7	Go to Step 10

DTC P0202 – Injector Circuit Malfunction – Cylinder 2 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to Step 8	Go to Step 9
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to OBD System Check	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to OBD System Check	—
10	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each terminal on the PCM side of the injector test connector. Only the Ign+ terminal should illuminate the test light. Besides the Ign+, did any other terminal illuminate the test light?	—	Go to Step 11	Go to Step 12
11	Repair the short to voltage in the injector driver circuit.	—	Verify repair	—
12	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each pin on the injector side of the connector. Did any terminal illuminate the test light?	—	Go to Step 11	Go to Step 13
13	1. Disconnect the injector test connector. 2. Ignition OFF. 3. Clip one lead of an ohmmeter to the ignition pin on the injector side of the test connector. 4. Touch the other lead to each of the other four pins in the test connector, one pin at a time. Instead of normal injector resistance, did the ohmmeter indicate an open in one of the injector circuits?	—	Go to Step 14	Go to Step 15
14	Repair the open circuit or open injector.	—	Verify repair	—
15	Check for an open circuit between the injector test connector and the PCM connector for the Injector 2 control circuit. Was there an open circuit?	—	Go to Step 16	Go to Step 9
16	Repair the open circuit.	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0203 INJECTOR CIRCUIT MALFUNCTION – CYLINDER 3



Circuit Description

The powertrain control module (PCM) has four individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The PCM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a Diagnostic Trouble Code is set. This Diagnostic Trouble Code is also set if an injector driver is shorted to voltage. DTC P0203 is a type A code.

Conditions for Setting the DTC

- The battery voltage is greater than 9 volts.
- Engine is running.
- Fuel pump is ON.
- The injector voltage does not equal the ignition voltage when the injector is commanded OFF or the injector voltage does not equal 0 volts when the injector is commanded ON.
- The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was setas Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history Diagnostic Trouble Code P0203 will clear after 40 consecutive warm–up cycles occur without a fault.
- Diagnostic Trouble Code P0203 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a Diagnostic Trouble Code P0203 to set. It will also cause a misfire due to an inoperative injector. A misfire Diagnostic Trouble Code will also be set indicating which cylinder is inoperative.
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

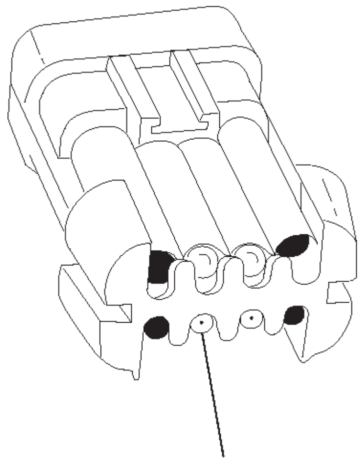
3. This step determines if Diagnostic Trouble Code P0203 is the result of a hard failure or an intermittent condition.
5. This step tests the harness wiring and PCM control of the injectors using a test light.

   The fuel injector test connector is a gray 5 pin connector at the right rear of the valve cover. It can be identified by a blue connector lock which is tethered to the harness.

   J 39021–45 is a test light with one light for each cylinder. The test light fits on the injector test connector.

   If the test light is ON steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to voltage.

   If the test light blinks, the PCM and the wiring to the injectors are OK. Fuel Injector Coil Test Procedure will check if the injectors are faulty.
7. Because the test light was ON steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.



901RX034

13. Normal injector resistance is slightly more than if tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5 Ω.

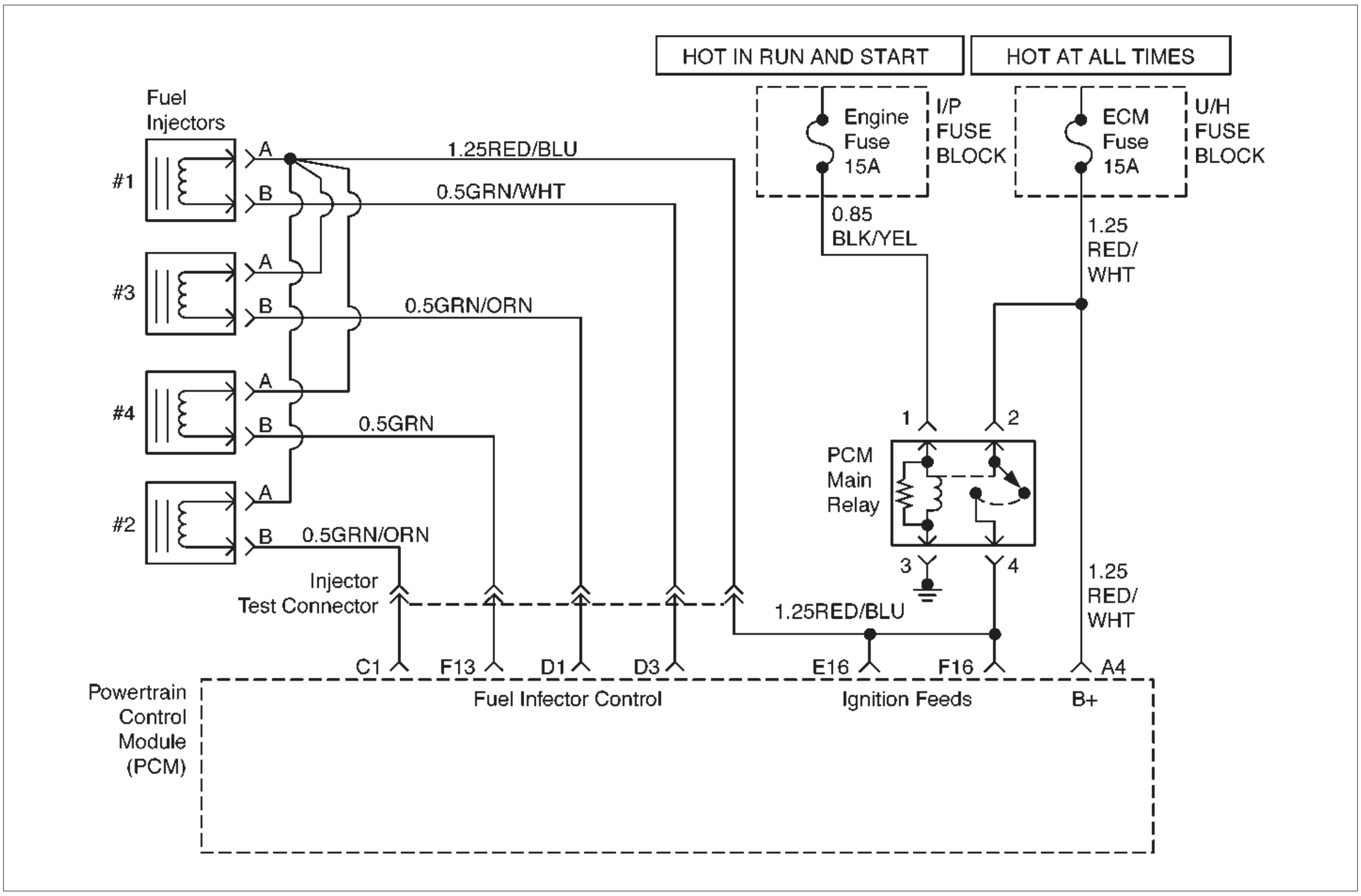
DTC P0203 – Injector Circuit Malfunction – Cylinder 3

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Will the engine start?	—	Go to Step 3	Go to Engine Cranks But Will Not Run Chart
3	1. Install the Tech 2. Clear the Diagnostic Trouble Code. 2. Idle the engine for one minute. Does Diagnostic Trouble Code P0203 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0203 reset?	—	Go to Step 5	Go to Diagnostic Aids
5	1. Ignition OFF. 2. Disconnect the injector test connector. 3. Install the injector test light J 39021–45 on the injector connector. 4. Crank the engine while observing the light for cylinder 3. Does the injector test light blink?	—	Go to Fuel Injector Coil Test Procedure	Go to Step 6
6	Note whether the injector test light was OFF or ON steady in step 5. Was the test light ON steady while cranking the engine?	—	Go to Step 7	Go to Step 10

DTC P0203 – Injector Circuit Malfunction – Cylinder 3 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to Step 8	Go to Step 9
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to OBD System Check	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to OBD System Check	—
10	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each terminal on the PCM side of the injector test connector. Only the Ign+ terminal should illuminate the test light. Besides the Ign+, did any other terminal illuminate the test light?	—	Go to Step 11	Go to Step 12
11	Repair the short to voltage in the injector driver circuit.	—	Verify repair	—
12	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each pin on the injector side of the connector. Did any terminal illuminate the test light?	—	Go to Step 11	Go to Step 13
13	1. Disconnect the injector test connector. 2. Ignition OFF. 3. Clip one lead of an ohmmeter to the ignition pin on the injector side of the test connector. 4. Touch the other lead to each of the other four pins in the test connector, one pin at a time. Instead of normal injector resistance, did the ohmmeter indicate an open in one of the injector circuits?	—	Go to Step 14	Go to Step 15
14	Repair the open circuit or open injector.	—	Verify repair	—
15	Check for an open circuit between the injector test connector and the PCM connector for the Injector 3 control circuit. Was there an open circuit?	—	Go to Step 16	Go to Step 9
16	Repair the open circuit.	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0204 INJECTOR CIRCUIT MALFUNCTION – CYLINDER 4



D06RX049

Circuit Description

The powertrain control module (PCM) has four individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The PCM measures a voltage drop through a fixed resistor and controls it. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a Diagnostic Trouble Code is set. This Diagnostic Trouble Code is also set if an injector driver is shorted to voltage. DTC P0204 is a type A code.

Conditions for Setting the DTC

- The battery voltage is greater than 9 volts.
- Engine is running.
- Fuel pump is ON.
- The injector voltage does not equal the ignition voltage when the injector is commanded OFF or the injector voltage does not equal 0 volts when the injector is commanded ON.
- The above conditions are met for 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history Diagnostic Trouble Code P0204 will clear after 40 consecutive warm–up cycles occur without a fault.
- Diagnostic Trouble Code P0204 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a Diagnostic Trouble Code P0204 to set. It will also cause a misfire due to an inoperative injector. A misfire Diagnostic Trouble Code will also be set indicating which cylinder is inoperative.
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

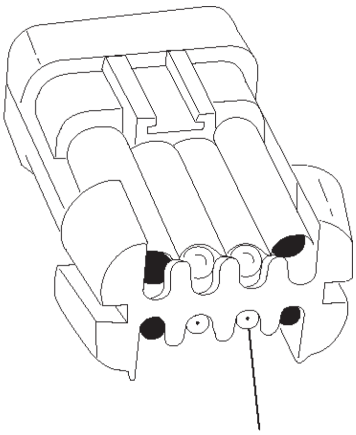
3. This step determines if Diagnostic Trouble Code P0204 is the result of a hard failure or an intermittent condition.
5. This step tests the harness wiring and PCM control of the injectors using a test light.

   The fuel injector test connector is a gray 5 pin connector at the right rear of the valve cover. It can be identified by a blue connector lock which is tethered to the harness.

   J 39021–45 is a test light with one light for each cylinder. The test light fits on the injector test connector.

   If the test light is ON steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to voltage.

   If the test light blinks, the PCM and the wiring to the injectors are OK. Fuel Injector Coil Test Procedure will check if the injectors are faulty.
7. Because the test light was ON steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.



901RX035

13. Normal injector resistance is slightly more than if tested directly at the injector because it includes resistance of the harness wires. The normal value is about 13.5 Ω.

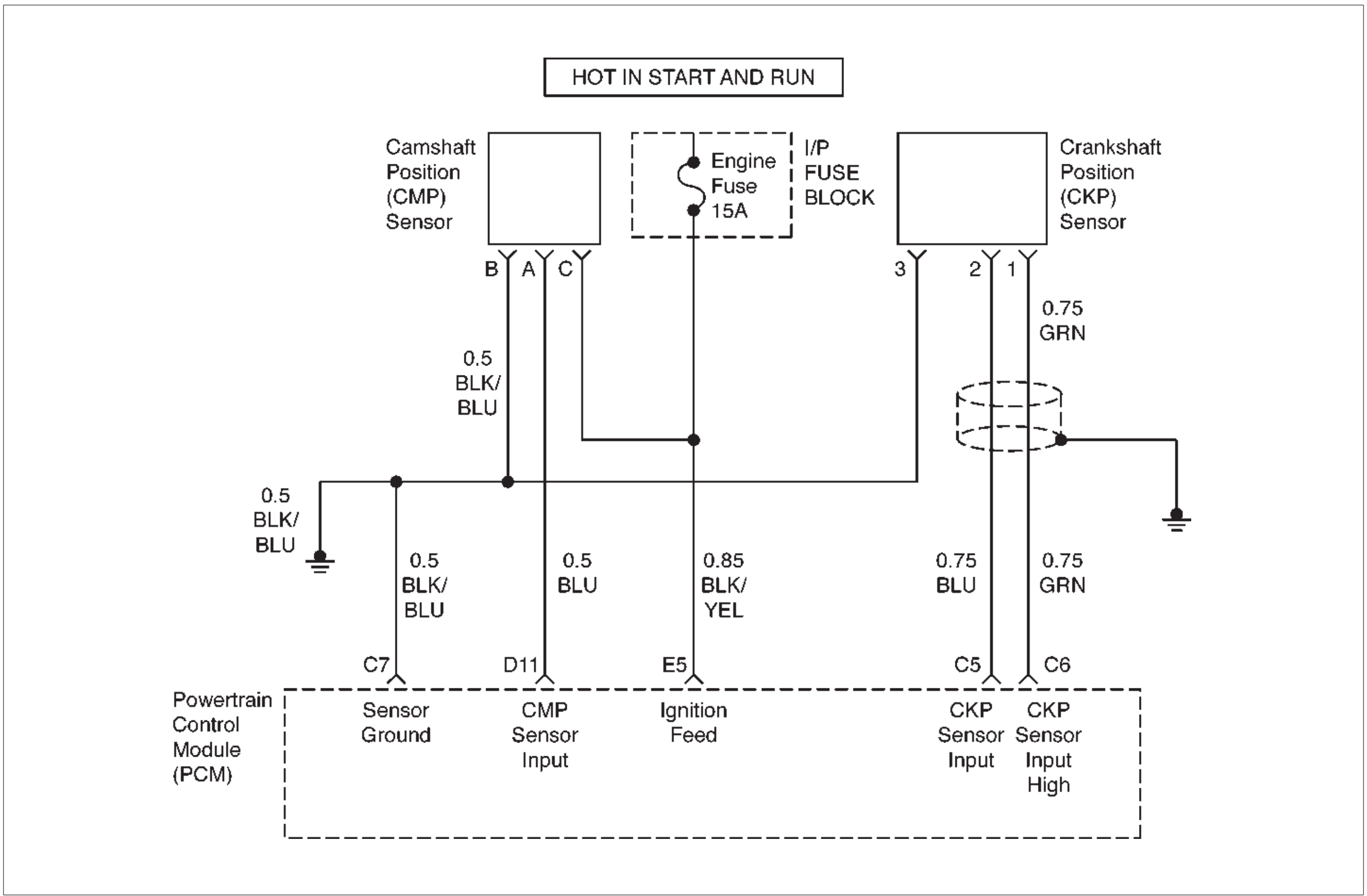
DTC P0204 – Injector Circuit Malfunction – Cylinder 4

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Will the engine start?	—	Go to Step 3	Go to Engine Cranks But Will Not Run Chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0204 reset?	—	Go to Step 5	Go to Step 4
4	1. Review the Freeze Frame data with the ignition ON and the engine OFF and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0204 reset?	—	Go to Step 5	Go to Diagnostic Aids
5	1. Ignition OFF. 2. Disconnect the injector test connector. 3. Install the injector test light J 39021–45 on the injector connector. 4. Crank the engine while observing the light for cylinder 4. Does the injector test light blink?	—	Go to Fuel Injector Coil Test Procedure	Go to Step 6
6	Note whether the injector test light was OFF or ON steady in step 5. Was the test light ON steady while cranking the engine?	—	Go to Step 7	Go to Step 10

DTC P0204 – Injector Circuit Malfunction – Cylinder 4 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to Step 8	Go to Step 9
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to OBD System Check	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to OBD System Check	—
10	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each terminal on the PCM side of the injector test connector. Only the Ign+ terminal should illuminate the test light. Besides the Ign+, did any other terminal illuminate the test light?	—	Go to Step 11	Go to Step 12
11	Repair the short to voltage in the injector driver circuit.	—	Verify repair	—
12	1. Disconnect the injector test connector. 2. Ignition ON. 3. Use a test light connected to ground to probe each pin on the injector side of the connector. Did any terminal illuminate the test light?	—	Go to Step 11	Go to Step 13
13	1. Disconnect the injector test connector. 2. Ignition OFF. 3. Clip one lead of an ohmmeter to the ignition pin on the injector side of the test connector. 4. Touch the other lead to each of the other four pins in the test connector, one pin at a time. Instead of normal injector resistance, did the ohmmeter indicate an open in one of the injector circuits?	—	Go to Step 14	Go to Step 15
14	Repair the open circuit or open injector.	—	Verify repair	—
15	Check for an open circuit between the injector test connector and the PCM connector for the Injector 3 control circuit. Was there an open circuit?	—	Go to Step 16	Go to Step 9
16	Repair the open circuit.	—	—	Verify repair

DIAGNOSTIC TROUBLE CODE (DTC) P0300 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED



D06RX050

Circuit Description

If the PCM determines that the engine is misfiring and cannot determine the actual cylinder that is misfiring then it will log the trouble code P0300. This is normally the case shere the misfire is caused by the ignition coil(s) which would then cause a misfire to happen in more than one cylinder.

Conditions for Setting the DTC

- None of the following Diagnostic Trouble Codes are present: TP sensor, MAP sensor, CMP sensor, VSS, ECT, CKP sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine coolant temperature sensor (ECT) indicates an engine temperature between –6.75˚C (20˚F) and 120˚C (248˚F).
- Throttle angle is steady and throttle angle changes less than 2.73% per 100 milliseconds.
- The PCM detects a crankshaft RPM variation indicating a misfire that is sufficient to cause catalytic converter damage or emissions levels to exceed the mandated standard.
- TP sensor reads less than 3.125%.
- Vehicle speed is greater than 33km/h (20mph).
- Engine under load.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0300 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0300 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

The Tech 2 displays ”Misfire Cur. # 1 through #4” can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coils – Check for cracks or other damage.

- Substitute a known good coil – Swap the ignition coils and retest. If misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Air induction system – Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Excessive engine vibration – This may falsely set a P0300. Refer to Engine Mechanical Diagnosis to check for a falsely Mechanical condition or component.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O–rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

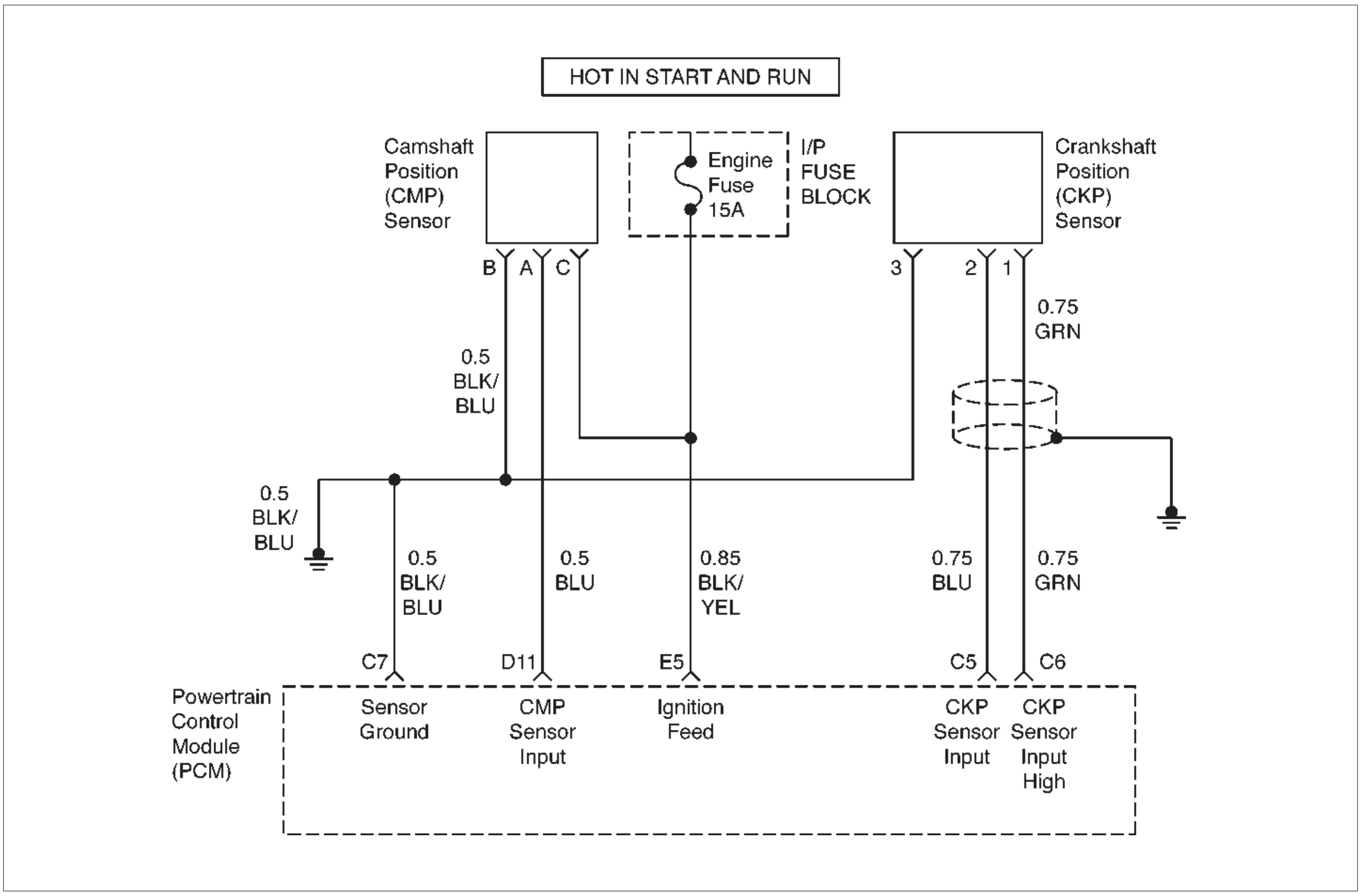
DTC P0300 – Random/Multiple Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Start and idle the engine. 2. Review and record the Tech 2 Freeze Frame data. 3. Operate the vehicle to duplicate the conditions present when the Diagnostic Trouble Code was set (as defined by the Freeze Frame data). 4. Monitor the Tech 2 ”Misfire Cur. #” display for each cylinder. Is ”Misfire Cur. #” display increasing for any cylinder (indicating a misfire currently occurring)?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. 2. If a problem is found, repair or replace the vacuum hoses as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 4
4	1. Visually and physically inspect the following areas for vacuum leaks: • Intake manifold • Injector O–rings • EGR valve • EGR feed pipes Did your inspection reveal a vacuum leak?	—	Verify repair	Go to Step 5
5	Inspect the crankcase ventilation valve for proper installation or a cracked hose. Did your inspection reveal a problem?	—	Verify repair	Go to Step 6
6	1. Remove and visually/physically inspect the ignition coils. Ensure that the coils are free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coils. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Remove the EGR valve and visually/physically inspect the pintle to ensure that it is not sticking partially open. Also, inspect the EGR valve pintle and seat for carbon deposits or burrs that may interfere with the pintle closing completely. 2. If a problem is found, clean the EGR valve pintle and seat or replace the EGR valve as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 8
8	1. Install a spark tester at the spark plug end of the ignition wire for the cylinder that is indicated by the ”Misfire Cur. Counters” or ”Misfire Hist. Counters” as having the most severe misfire (largest number of counts). 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to Step 13	Go to Step 9

DTC P0300 – Random/Multiple Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Remove the spark plugs from the cylinders that were indicated as misfiring. 2. Visually inspect the spark plug electrodes. Does your inspection reveal any spark plugs exhibiting excessive fouling?	—	Go to Engine Mechanical Diagnosis	Go to Step 10
10	1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage. 2. If a problem is found, replace the faulty spark plug(s) as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 11
11	Replace the ignition control module.	—	Verify repair	—
12	1. Inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations. 2. If a problem is found, correct the faulty ground condition as necessary. Did your inspection reveal a poor ground?	—	Verify repair	Go to Step 13
13	1. Perform the "Fuel System Pressure Test" procedure. 2. If a problem is found, repair as necessary (refer to Engine Fuel or Fuel Metering System). Was a fuel system problem found?	—	Verify repair	Go to Step 14
14	1. Check the fuel for excessive water, alcohol, or other contaminants (refer to Diagnosis in Engine Fuel for procedure). Was the fuel contaminated?	—	Verify repair	Go to Step 15
15	1. Perform the "Injector Coil/Balance Test." 2. If a problem is found, replace the faulty injector(s) as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to Step 16
16	Check for an engine mechanical problem. Refer to Engine Mechanical Diagnosis to diagnose the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or piston rings • Excessive valve deposits • Loose or worn rocker arms • Weak valve springs • Incorrect valve timing • A leaking head gasket • A loose or broken motor mount	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0301 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED



D06RX050

Circuit Description

If the PCM determines that the engine is misfiring and can determine the actual cylinder that is misfiring then it will log the individual trouble code for that cylinder P0301. This is normally the situation in the case of a failed fuel injector, spark plug or ignition lead.

Conditions for Setting the DTC

- None of the following Diagnostic Trouble Codes are present: TP sensor, MAP sensor, CMP sensor, VSS, ECT, CKP sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine coolant temperature sensor (ECT) indicates an engine temperature between –6.75˚C (20˚F) and 120˚C (248˚F).
- Throttle angle is steady and throttle angle changes less than 2.73% per 100 milliseconds.
- The PCM detects a crankshaft RPM variation indicating a misfire that is sufficient to cause catalytic converter damage or emissions levels to exceed the mandated standard.
- TP sensor reads less than 3.125%.
- Vehicle speed is greater than 33km/h (20mph).
- Engine under load.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0301 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0301 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

The Tech 2 displays ”Misfire Cur. # 1 through #4” can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coils – Check for cracks or other damage.

- Substitute a known good coil – Swap the ignition coils and retest. If misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Air induction system – Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Excessive engine vibration – This may falsely set a P0301. Refer to Engine Mechanical Diagnosis to check for a falsely Mechanical condition or component.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O–rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

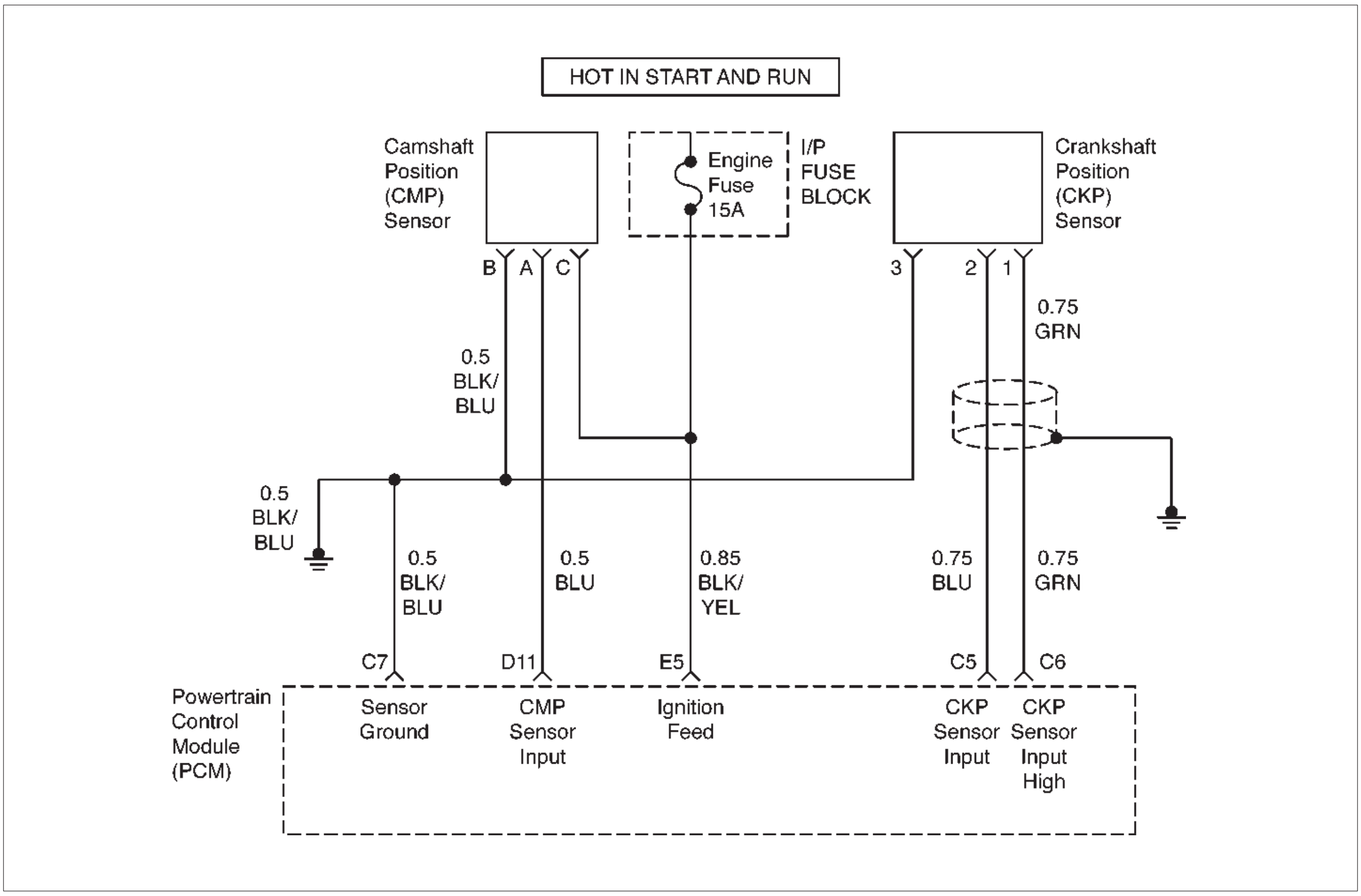
DTC P0301 – Random/Multiple Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Start and idle the engine. 2. Review and record the Tech 2 Freeze Frame data. 3. Operate the vehicle to duplicate the conditions present when the Diagnostic Trouble Code was set (as defined by the Freeze Frame data). 4. Monitor the Tech 2 "Misfire Cur. #" display for each cylinder. Is "Misfire Cur. #" display increasing for any cylinder (indicating a misfire currently occurring)?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. 2. If a problem is found, repair or replace the vacuum hoses as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 4
4	1. Visually and physically inspect the following areas for vacuum leaks: • Intake manifold • Injector O–rings • EGR valve • EGR feed pipes Did your inspection reveal a vacuum leak?	—	Verify repair	Go to Step 5
5	Inspect the crankcase ventilation valve for proper installation or a cracked hose. Did your inspection reveal a problem?	—	Verify repair	Go to Step 6
6	1. Remove and visually/physically inspect the ignition coils. Ensure that the coils are free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coils. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Install a spark tester at the spark plug end of the ignition wire for the cylinder that is indicated by the "Misfire Cur. Counters" or "Misfire Hist. Counters" as having the most severe misfire (largest number of counts). 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to Step 12	Go to Step 8
8	1. Remove the spark plugs from the cylinders that were indicated as misfiring. 2. Visually inspect the spark plug electrodes. Does your inspection reveal any spark plugs exhibiting excessive fouling?	—	Go to Engine Mechanical Diagnosis	Go to Step 9

DTC P0301 – Random/Multiple Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage. 2. If a problem is found, replace the faulty spark plug(s) as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 10
10	Replace the ignition control module.	—	Verify repair	—
11	1. Inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations. 2. If a problem is found, correct the faulty ground condition as necessary. Did your inspection reveal a poor ground?	—	Verify repair	Go to Step 12
12	1. Perform the "Fuel System Pressure Test" procedure. 2. If a problem is found, repair as necessary (refer to Engine Fuel or Fuel Metering System). Was a fuel system problem found?	—	Verify repair	Go to Step 13
13	1. Check the fuel for excessive water, alcohol, or other contaminants (refer to Diagnosis in Engine Fuel for procedure). Was the fuel contaminated?	—	Verify repair	Go to Step 14
14	1. Perform the "Injector Coil/Balance Test." 2. If a problem is found, replace the faulty injector(s) as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to Step 15
15	Check for an engine mechanical problem. Refer to Engine Mechanical Diagnosis to diagnose the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or piston rings • Excessive valve deposits • Loose or worn rocker arms • Weak valve springs • Incorrect valve timing • A leaking head gasket • A loose or broken motor mount	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0302 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED



D06RX050

Circuit Description

If the PCM determines that the engine is misfiring and can determine the actual cylinder that is misfiring then it will log the individual trouble code for that cylinder P0302. This is normally the situation in the case of a failed fuel injector, spark plug or ignition lead.

Conditions for Setting the DTC

- None of the following Diagnostic Trouble Codes are present: TP sensor, MAP sensor, CMP sensor, VSS, ECT, CKP sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine coolant temperature sensor (ECT) indicates an engine temperature between –6.75°C (20°F) and 120°C (248°F).
- Throttle angle is steady and throttle angle changes less than 2.73% per 100 milliseconds.
- The PCM detects a crankshaft RPM variation indicating a misfire that is sufficient to cause catalytic converter damage or emissions levels to exceed the mandated standard.
- TP sensor reads less than 3.125%.
- Vehicle speed is greater than 33km/h (20mph).
- Engine under load.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DiagnosticTrouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0302 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0302 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

The Tech 2 displays ”Misfire Cur. # 1 through #4” can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coils – Check for cracks or other damage.

- Substitute a known good coil – Swap the ignition coils and retest. If misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Air induction system – Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Excessive engine vibration – This may falsely set a P0302. Refer to Engine Mechanical Diagnosis to check for a falsely Mechanical condition or component.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O–rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

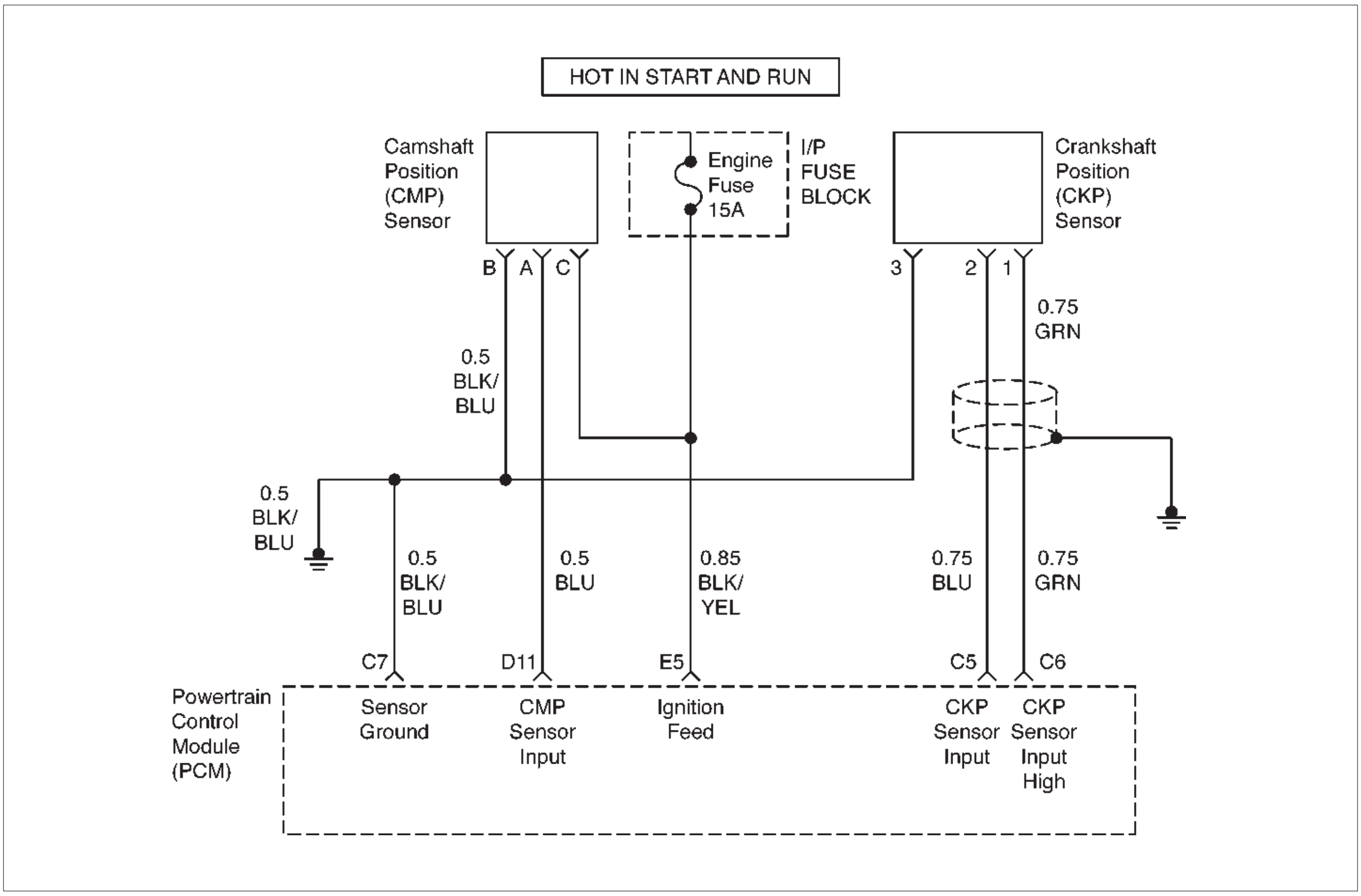
DTC P0302 – Random/Multiple Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Start and idle the engine. 2. Review and record the Tech 2 Freeze Frame data. 3. Operate the vehicle to duplicate the conditions present when the Diagnostic Trouble Code was set (as defined by the Freeze Frame data). 4. Monitor the Tech 2 "Misfire Cur. #" display for each cylinder. Is "Misfire Cur. #" display increasing for any cylinder (indicating a misfire currently occurring)?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. 2. If a problem is found, repair or replace the vacuum hoses as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 4
4	1. Visually and physically inspect the following areas for vacuum leaks: • Intake manifold • Injector O–rings • EGR valve • EGR feed pipes Did your inspection reveal a vacuum leak?	—	Verify repair	Go to Step 5
5	Inspect the crankcase ventilation valve for proper installation or a cracked hose. Did your inspection reveal a problem?	—	Verify repair	Go to Step 6
6	1. Remove and visually/physically inspect the ignition coils. Ensure that the coils are free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coils. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Install a spark tester at the spark plug end of the ignition wire for the cylinder that is indicated by the "Misfire Cur. Counters" or "Misfire Hist. Counters" as having the most severe misfire (largest number of counts). 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to Step 12	Go to Step 8
8	1. Remove the spark plugs from the cylinders that were indicated as misfiring. 2. Visually inspect the spark plug electrodes. Does your inspection reveal any spark plugs exhibiting excessive fouling?	—	Go to Engine Mechanical Diagnosis	Go to Step 9

DTC P0302 – Random/Multiple Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage. 2. If a problem is found, replace the faulty spark plug(s) as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 10
10	Replace the ignition control module.	—	Verify repair	—
11	1. Inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations. 2. If a problem is found, correct the faulty ground condition as necessary. Did your inspection reveal a poor ground?	—	Verify repair	Go to Step 12
12	1. Perform the "Fuel System Pressure Test" procedure. 2. If a problem is found, repair as necessary (refer to Engine Fuel or Fuel Metering System). Was a fuel system problem found?	—	Verify repair	Go to Step 13
13	1. Check the fuel for excessive water, alcohol, or other contaminants (refer to Diagnosis in Engine Fuel for procedure). Was the fuel contaminated?	—	Verify repair	Go to Step 14
14	1. Perform the "Injector Coil/Balance Test." 2. If a problem is found, replace the faulty injector(s) as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to Step 15
15	Check for an engine mechanical problem. Refer to Engine Mechanical Diagnosis to diagnose the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or piston rings • Excessive valve deposits • Loose or worn rocker arms • Weak valve springs • Incorrect valve timing • A leaking head gasket • A loose or broken motor mount	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0303 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED



D06RX050

Circuit Description

If the PCM determines that the engine is misfiring and can determine the actual cylinder that is misfiring then it will log the individual trouble code for that cylinder P0303. This is normally the situation in the case of a failed fuel injector, spark plug or ignition lead.

Conditions for Setting the DTC

- None of the following Diagnostic Trouble Codes are present: TP sensor, MAP sensor, CMP sensor, VSS, ECT, CKP sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine coolant temperature sensor (ECT) indicates an engine temperature between –6.75˚C (20˚F) and 120˚C (248˚F).
- Throttle angle is steady and throttle angle changes less than 2.73% per 100 milliseconds.
- The PCM detects a crankshaft RPM variation indicating a misfire that is sufficient to cause catalytic converter damage or emissions levels to exceed the mandated standard.
- TP sensor reads less than 3.125%.
- Vehicle speed is greater than 33km/h (20mph).
- Engine under load.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0303 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0303 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

The Tech 2 displays ”Misfire Cur. # 1 through #4” can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coils – Check for cracks or other damage.

- Substitute a known good coil – Swap the ignition coils and retest. If misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Air induction system – Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Excessive engine vibration – This may falsely set a P0303. Refer to Engine Mechanical Diagnosis to check for a falsely Mechanical condition or component.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O–rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

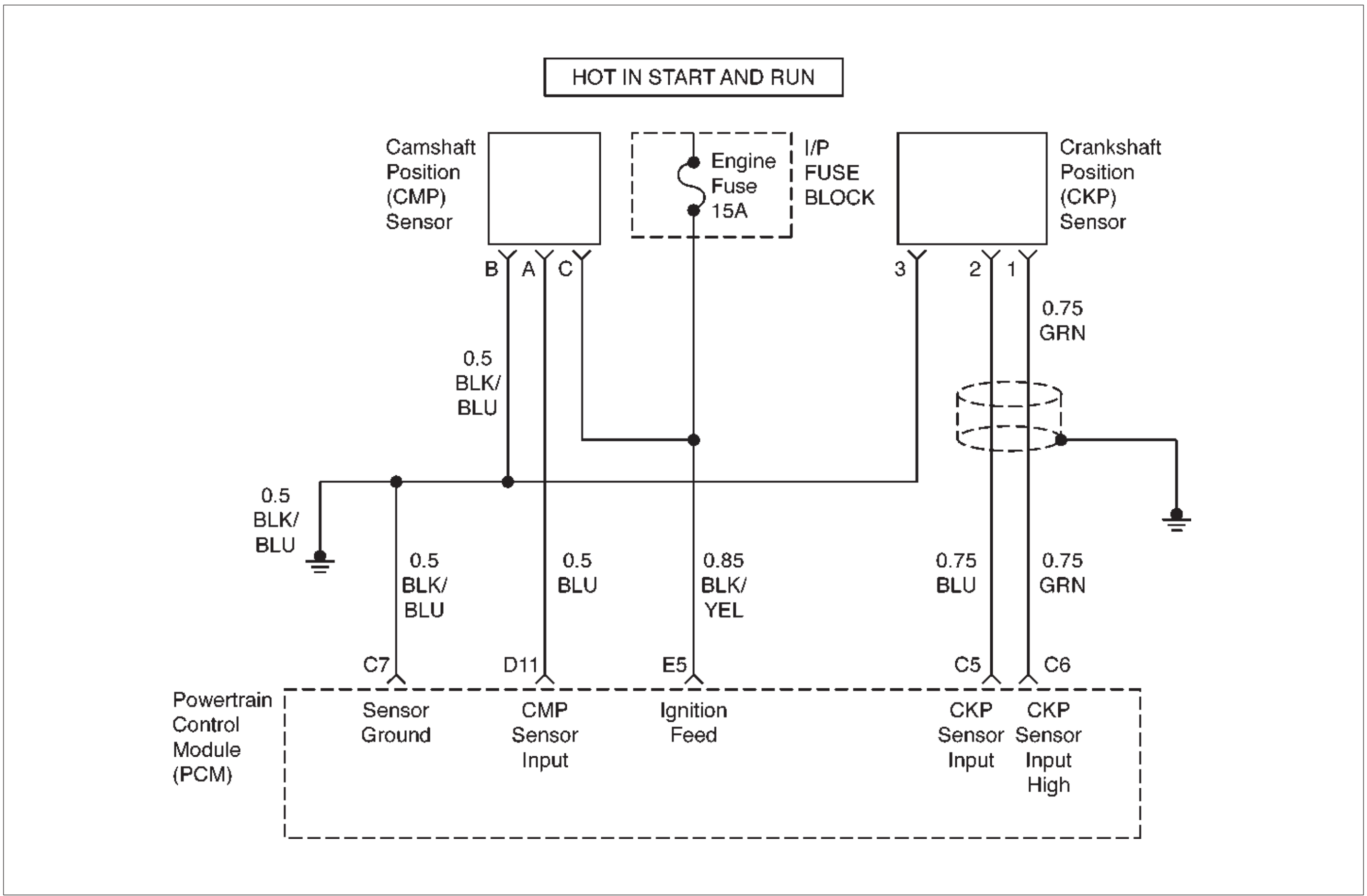
DTC P0303 – Random/Multiple Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Start and idle the engine. 2. Review and record the Tech 2 Freeze Frame data. 3. Operate the vehicle to duplicate the conditions present when the Diagnostic Trouble Code was set (as defined by the Freeze Frame data). 4. Monitor the Tech 2 "Misfire Cur. #" display for each cylinder. Is "Misfire Cur. #" display increasing for any cylinder (indicating a misfire currently occurring)?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. 2. If a problem is found, repair or replace the vacuum hoses as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 4
4	1. Visually and physically inspect the following areas for vacuum leaks: • Intake manifold • Injector O–rings • EGR valve • EGR feed pipes Did your inspection reveal a vacuum leak?	—	Verify repair	Go to Step 5
5	Inspect the crankcase ventilation valve for proper installation or a cracked hose. Did your inspection reveal a problem?	—	Verify repair	Go to Step 6
6	1. Remove and visually/physically inspect the ignition coils. Ensure that the coils are free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coils. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Install a spark tester at the spark plug end of the ignition wire for the cylinder that is indicated by the "Misfire Cur. Counters" or "Misfire Hist. Counters" as having the most severe misfire (largest number of counts). 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to Step 12	Go to Step 8
8	1. Remove the spark plugs from the cylinders that were indicated as misfiring. 2. Visually inspect the spark plug electrodes. Does your inspection reveal any spark plugs exhibiting excessive fouling?	—	Go to Engine Mechanical Diagnosis	Go to Step 9

DTC P0303 – Random/Multiple Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage. 2. If a problem is found, replace the faulty spark plug(s) as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 10
10	Replace the ignition control module.	—	Verify repair	—
11	1. Inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations. 2. If a problem is found, correct the faulty ground condition as necessary. Did your inspection reveal a poor ground?	—	Verify repair	Go to Step 12
12	1. Perform the "Fuel System Pressure Test" procedure. 2. If a problem is found, repair as necessary (refer to Engine Fuel or Fuel Metering System). Was a fuel system problem found?	—	Verify repair	Go to Step 13
13	1. Check the fuel for excessive water, alcohol, or other contaminants (refer to Diagnosis in Engine Fuel for procedure). Was the fuel contaminated?	—	Verify repair	Go to Step 14
14	1. Perform the "Injector Coil/Balance Test." 2. If a problem is found, replace the faulty injector(s) as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to Step 15
15	Check for an engine mechanical problem. Refer to Engine Mechanical Diagnosis to diagnose the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or piston rings • Excessive valve deposits • Loose or worn rocker arms • Weak valve springs • Incorrect valve timing • A leaking head gasket • A loose or broken motor mount	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0304 RANDOM/MULTIPLE CYLINDER MISFIRE DETECTED



D06RX050

Circuit Description

If the PCM determines that the engine is misfiring and can determine the actual cylinder that is misfiring then it will log the individual trouble code for that cylinder P0304. This is normally the situation in the case of a failed fuel injector, spark plug or ignition lead.

Conditions for Setting the DTC

- None of the following Diagnostic Trouble Codes are present: TP sensor, MAP sensor, CMP sensor, VSS, ECT, CKP sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine coolant temperature sensor (ECT) indicates an engine temperature between –6.75˚C (20˚F) and 120˚C (248˚F).
- Throttle angle is steady and throttle angle changes less than 2.73% per 100 milliseconds.
- The PCM detects a crankshaft RPM variation indicating a misfire that is sufficient to cause catalytic converter damage or emissions levels to exceed the mandated standard.
- TP sensor reads less than 3.125%.
- Vehicle speed is greater than 33km/h (20mph).
- Engine under load.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0304 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0304 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

The Tech 2 displays ”Misfire Cur. # 1 through #4” can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coils – Check for cracks or other damage.

- Substitute a known good coil – Swap the ignition coils and retest. If misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Air induction system – Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Excessive engine vibration – This may falsely set a P0304. Refer to Engine Mechanical Diagnosis to check for a falsely Mechanical condition or component.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O–rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

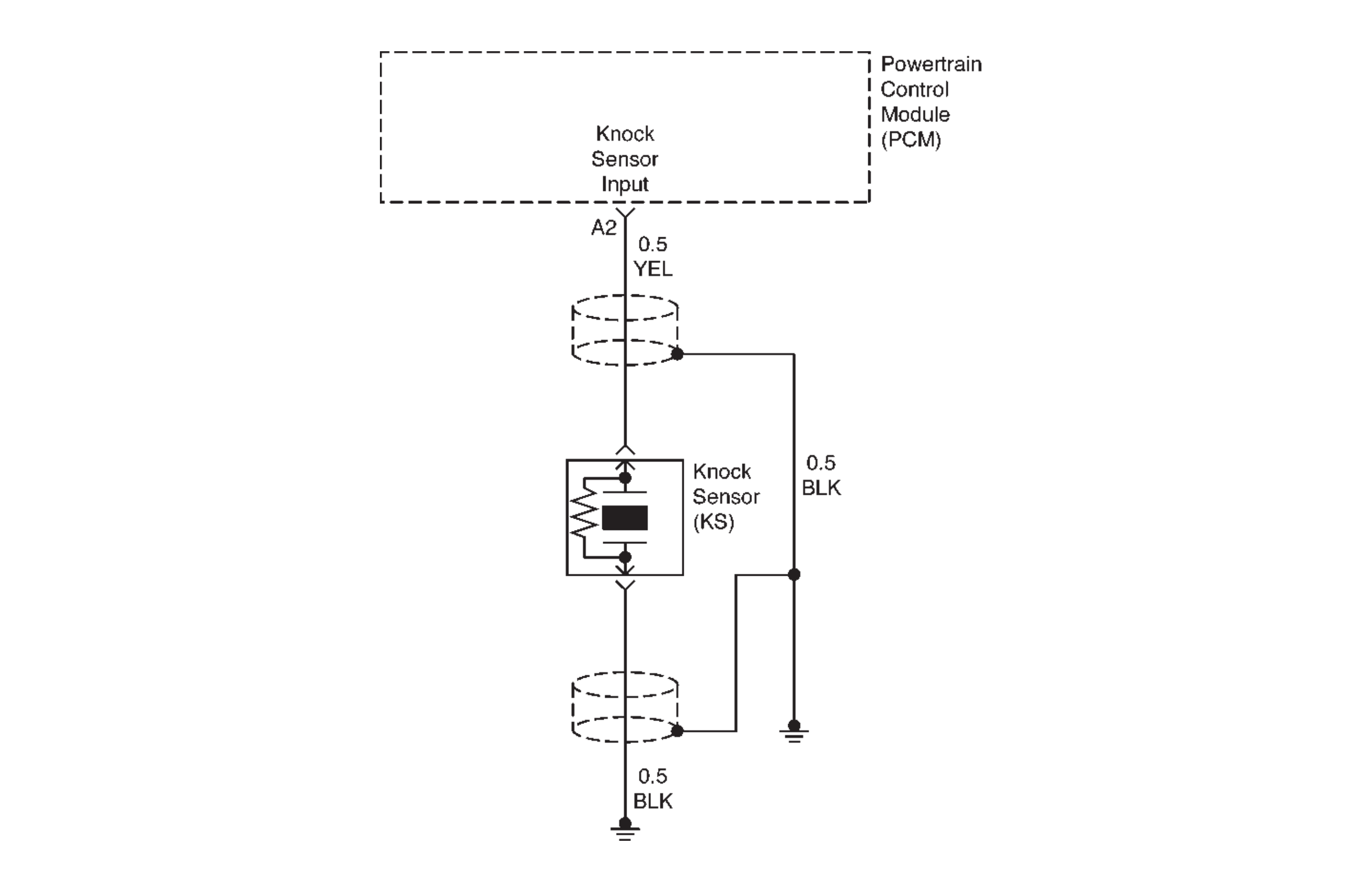
DTC P0304 – Random/Multiple Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Start and idle the engine. 2. Review and record the Tech 2 Freeze Frame data. 3. Operate the vehicle to duplicate the conditions present when the Diagnostic Trouble Code was set (as defined by the Freeze Frame data). 4. Monitor the Tech 2 ”Misfire Cur. #” display for each cylinder. Is ”Misfire Cur. #” display increasing for any cylinder (indicating a misfire currently occurring)?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. 2. If a problem is found, repair or replace the vacuum hoses as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 4
4	1. Visually and physically inspect the following areas for vacuum leaks: • Intake manifold • Injector O–rings • EGR valve • EGR feed pipes Did your inspection reveal a vacuum leak?	—	Verify repair	Go to Step 5
5	Inspect the crankcase ventilation valve for proper installation or a cracked hose. Did your inspection reveal a problem?	—	Verify repair	Go to Step 6
6	1. Remove and visually/physically inspect the ignition coils. Ensure that the coils are free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coils. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Install a spark tester at the spark plug end of the ignition wire for the cylinder that is indicated by the ”Misfire Cur. Counters” or ”Misfire Hist. Counters” as having the most severe misfire (largest number of counts). 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to Step 12	Go to Step 8
8	1. Remove the spark plugs from the cylinders that were indicated as misfiring. 2. Visually inspect the spark plug electrodes. Does your inspection reveal any spark plugs exhibiting excessive fouling?	—	Go to Engine Mechanical Diagnosis	Go to Step 9

DTC P0304 – Random/Multiple Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage. 2. If a problem is found, replace the faulty spark plug(s) as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to Step 10
10	Replace the ignition control module.	—	Verify repair	—
11	1. Inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations. 2. If a problem is found, correct the faulty ground condition as necessary. Did your inspection reveal a poor ground?	—	Verify repair	Go to Step 12
12	1. Perform the "Fuel System Pressure Test" procedure. 2. If a problem is found, repair as necessary (refer to Engine Fuel or Fuel Metering System). Was a fuel system problem found?	—	Verify repair	Go to Step 13
13	1. Check the fuel for excessive water, alcohol, or other contaminants (refer to Diagnosis in Engine Fuel for procedure). Was the fuel contaminated?	—	Verify repair	Go to Step 14
14	1. Perform the "Injector Coil/Balance Test." 2. If a problem is found, replace the faulty injector(s) as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to Step 15
15	Check for an engine mechanical problem. Refer to Engine Mechanical Diagnosis to diagnose the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or piston rings • Excessive valve deposits • Loose or worn rocker arms • Weak valve springs • Incorrect valve timing • A leaking head gasket • A loose or broken motor mount	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0325 KNOCK SENSOR (KS) CIRCUIT MALFUNCTION



D06RX051

Circuit Description

The knock sensor (KS) system is used to detect engine detonation. The knock sensor produced an AC voltage signal. The knock sensor sends this signal to the PCM. The amplitude and the frequency of the AC voltage signal depends upon the knock level being detected. The PCM will then retard the spark timing based on the signals from the Knock Sensor. DTC P0325 is a type B code.

Conditions for Setting the DTC

- Engine run time is greater than 10 seconds.
- No P0327 Diagnostic Trouble Code set.
- Engine speed is above 2500 rpm.

All the above mentioned conditions are met, and the following conditions are met for 8.75 seconds within a 10 second monitoring period:

- Any of the four A/D voltages exceeds 1.5625 Volts.
- Instantaneous A/D delta Voltage falls below 0.019531 Volts.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate the second time the fault is detected.
- The PCM will record operating conditions at the time the diagnostic fails.
- A history Diagnostic Trouble Code is stored.
- The PCM will use a calculated spark retard value in order to minimize the knock during the conditions when the knock is likely to occur. The calculated value will vary based on the engine speed and load.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after 3 consecutive ignition cycles in which the diagnostic runs without a fault.
- A history Diagnostic Trouble Code will clear after 40 consecutive warm up cycles without a fault.
- A Tech 2 can clear the Diagnostic Trouble Codes.

Diagnostic Aids

Correct any abnormal engine noise before using the diagnostic table.

Check for an open ignition feed circuit.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame data and failure records data on the Tech 2 if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the Tech 2 for later reference.

2. If the conditions for the test as described above are met, a Diagnostic Trouble Code P0325 will set and MIL will illuminate.
4. If the engine has an internal knock or audible noise that causes a knocking type noise on the engine block, the knock sensor may be responding to the noise.
6. The Tech 2 displays knock sensor activity in counts, approximately 20–50 at idle. The counts should increase when engine speed is increased and the counts should decrease when engine speed is decreased.
7. Any circuitry, that is suspected as causing the complaint, should be thoroughly checked for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wiring connections or physical damage to the wiring harness.
8. If the KS module was previously replaced and the Diagnostic Trouble Code resets, a malfunctioning PCM is indicated.

NOTE: Replacement PCMs must be reprogrammed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures.

9. Checking the internal resistance of the knock sensor verifies if the knock sensor or the wiring to the knock sensor is OK.

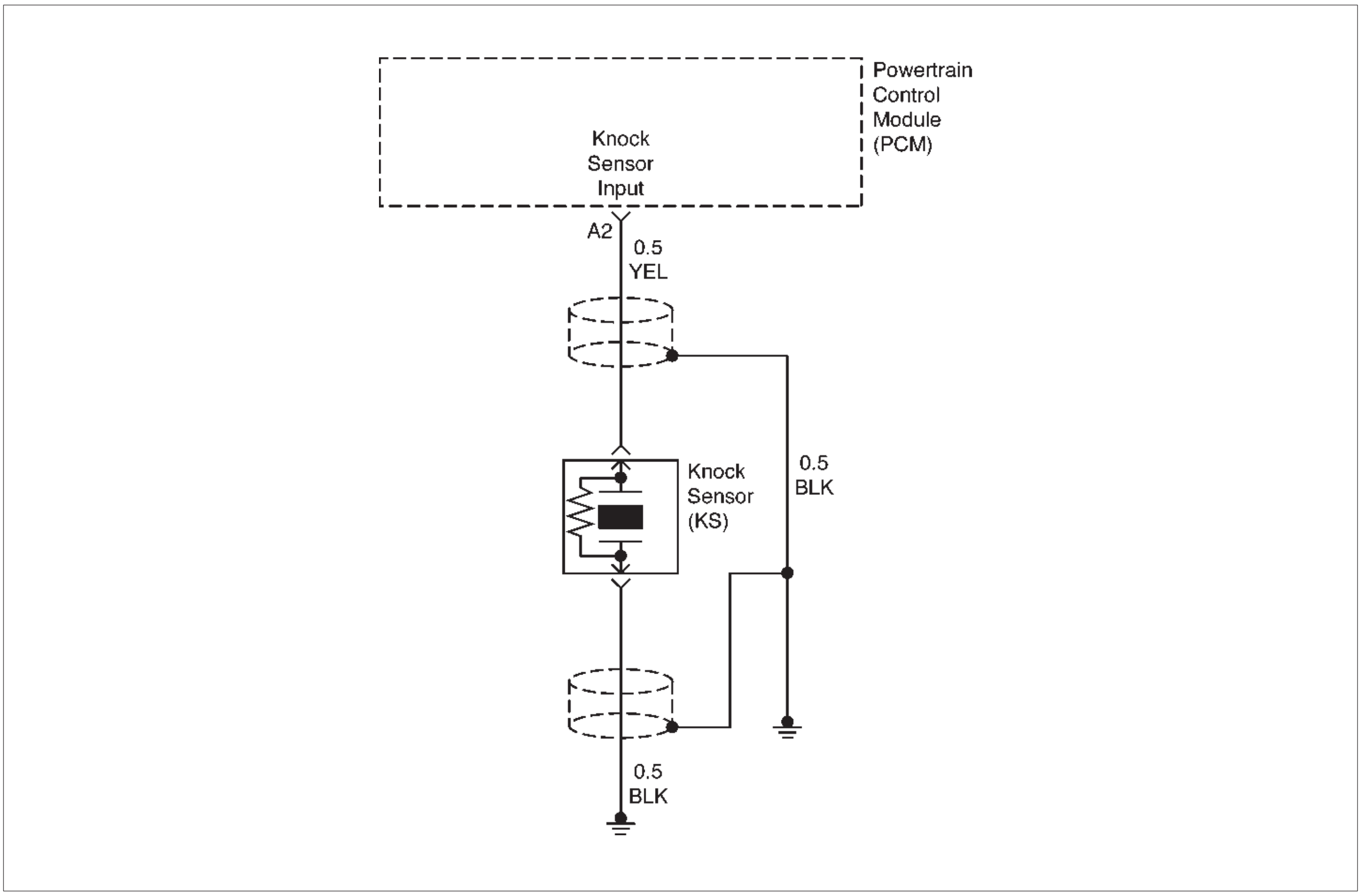
DTC P0325 KS Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the Powertrain "On–Board Diagnostic (OBD) System Check" performed? —	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Start the engine. 2. Install a Tech 2. 3. Clear the Diagnostic Trouble Codes. 4. Run the engine at slightly more than 10% throttle angle. Does the Malfunction Indicator Lamp (MIL) illuminate?	—	Go to Step 4	Go to Step 3
3	1. Turn the ignition switch ON, with engine OFF. 2. Review the Freeze Frame data and note the parameters. 3. Operate the vehicle within the Conditions and Conditions for Setting the DTC as noted. Does the Malfunction Indicator Lamp (MIL) illuminate?	—	Go to Step 4	Go to Step 13
4	Listen to the engine while raising and lowering the engine speed. Is a knock or audible noise present?	—	Go to Step 5	Go to Step 6
5	Repair the mechanical engine problem or a loose bracket or component. Is the action complete?	—	Go to Step 13	—
6	Slowly increase the engine speed to the specified value. Does the KS Activity increase with the engine speed?	2500 RPM	Go to Step 7	Go to Step 11
7	Check for a poor connection at the PCM connector, Knock sensor signal circuit and repair as necessary. Was a repair necessary?	—	Go to Step 13	Go to Step 8

DTC P0325 KS Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to Step 13	—
9	1. Turn the ignition switch OFF. 2. Disconnect the PCM connectors at the PCM. 3. With a Digital Voltmeter (DVM) connected to ground, measure the resistance of the knock sensor through the knock sensor signal circuit. Is the measured value within the specified value?	90K – 110K Ω	Go to Step 7	Go to Step 10
10	Check the knock sensor electrical connector for a poor connection and repair as necessary. Was a repair necessary?	—	Go to Step 13	Go to Step 11
11	Check the knock sensor signal circuit for an open or a short to ground or to voltage and repair as necessary. Was a repair necessary?	—	Go to Step 13	Go to Step 12
12	Replace the Knock Sensor (KS). Is the action complete?	—	Go to Step 13	—
13	1. Using the Tech 2, clear the Diagnostic Trouble Codes. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this Diagnostic Trouble Code as specified in the supporting text. Does the Tech 2 indicate that this diagnostic has ran and passed?	—	Go to Step 14	Go to Step 2
14	Check is any additional Diagnostic Trouble Codes are set. Are any Diagnostic Trouble Codes displayed that have not been diagnosed?	—	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P0327 KNOCK SENSOR (KS) CIRCUIT LOW INPUT



D06RX051

Circuit Description

The PCM uses the Knock Sensor (KS) in order to detect engine detonation. This allows the PCM to retard the Ignition Control (IC) spark timing based on the KS signal the PCM receives. The circuitry within the knock sensor pulls down the PCM–supplied 5 volt signal, so that under a no knock condition the signal on the KS circuit measures about 1.3 volts. The knock sensors produce an AC signal that rides on the 1.3 volts DC. The signal's amplitude and frequency are dependent upon the amount of the knock being experienced.

The PCM determines whether the knock is occurring by comparing the signal level on the KS circuit with a voltage level on the noise channel. The noise channel allows the CM to reject any false knock signal by indicating the amount of normal engine mechanical noise present. The normal engine noise varies depending on the engine speed and load. Then the ECM determines that an abnormally high noise channel voltage level is being experienced, a Diagnostic Trouble Code P0327 sets. This DTC is a type B DTC.

Conditions for Setting the DTC

A/D Test

The following conditions are met for 7.5 seconds within a 10 second monitoring period:

- Engine speed is equal to or greater than 2000 RPM.
- A/D Voltage is less than or equal to 0.0977 Volts.

Gain Test

The following conditions are met for 7.5 seconds within a 10 second monitoring period:

- Engine speed is greater than 2500 RPM.
- Gain is equal to or greater than 23.875 dB.

Action Taken When the DTC Sets

- The PCM will illuminate the MIL the second time the fault is detected.
- The PCM will store the conditions which were present then the Diagnostic Trouble Code set.
- The PCM will use a calculated spark retard value in order to minimize the knock during the conditions when the knock is likely to occur. The calculated value will vary based on the engine speed and load.

Conditions for Clearing the MIL/DTC

- A history Diagnostic Trouble Code will clear after 40 consecutive warm–up cycles have occurred without a fault.
- The Tech 2 ”Clear Info” will clear the Diagnostic Trouble Code.

Diagnostic Aids

Check for the following conditions:

A poor connection at the PCM. Inspect the knock sensor and the PCM connectors for: , broken locks, improperly formed or damaged terminals.

- Backed out terminals
- Broken locks
- Improperly formed or damaged terminals

Also, check the wiring harness for: shorts to ground, shorts to battery positive, and open circuits.

- A misrouted harness. Inspect the knock sensor harness in order to ensure that it is not routed too close to high voltage wires such as spark plug leads.
- Improper Knock Sensor torque specification. Torque the Knock Sensor to 19N·m (14 lbs·ft). Refer to Fastener Notice.

Review the Fail Records vehicle mileage since the diagnostic test last failed in order to help determine how often the conditions that caused the DTC to set occur. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Ensures that the fault is present.
6. Ensures that the knock sensor is capable of detecting detonation.

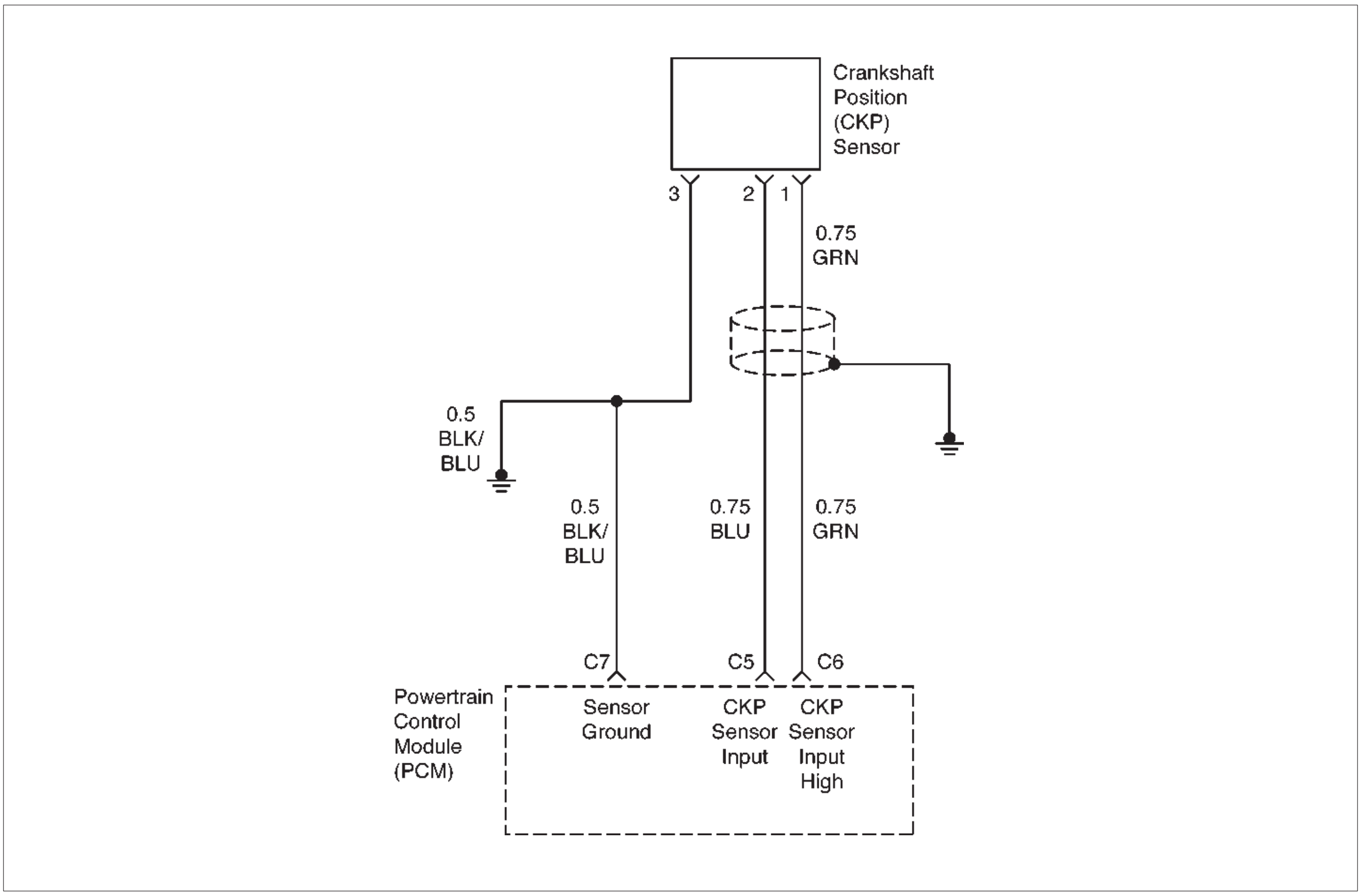
DTC P0327 KS Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the Powertrain ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Operate the engine within the conditions specified in the diagnostic support Conditions for Setting the DTC. 2. Using a Tech 2, monitor theDiagnostic Trouble Code information for Diagnostic Trouble Code P0327 until the Diagnostic Trouble Code P0327 test runs. 3. Observe the test results. Does the Tech 2 indicate the DTC P0327 failed this ignition?	—	Go to Step 4	Go to Step 3
3	1. Turn ON the Ignition leaving the engine OFF. 2. Review the Tech 2 Fail Records data. 3. **IMPORTANT:** Before clearing the DTCs, use the Tech 2 to record the Freeze Frame and the Failure Records for reference. This data will be lost when the Clear Info function is used. 4. Record the Tech 2 Fail Records data. 5. Operate the vehicle within the Fail Records conditions. 6. Using a Tech 2, monitor the DTC info for the DTC P0327 until the DTC P0327 test runs. 7. Observe the test results. Does the Tech 2 indicate the DTC P0327 Failed This Ignition?	—	Go to Step 4	Go to Diagnostic Aids
4	1. Disconnect the KS Sensor electrical connector. 2. Using a Digital Voltmeter (DVM), measure the voltage between the KS signal circuit at the knock sensor harness connectors and ground. Is the voltage at the specified value?	Approx. 5.0 V	Go to Step 5	Go to Step 8
5	Measure the resistance of the KS sensor by connecting the between the KS sensor terminal and the engine block. Is the resistance of the KS sensor near the specified value?	100K Ω	Go to Step 6	Go to Step 9

DTC P0327 KS Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Check the KS signal circuit for a poor terminal connection at the knock sensor. 2. If a problem is found, repair as necessary. Refer to Wiring Repairs in Engine Electrical. Was a problem found?	—	Go to Step 7	Go to Step 9
7	1. Re–Connect the KS Sensor in order to monitor the voltage between the KS sensor terminal and the engine ground. 2. Tap on the engine lift bracket, near the KS Sensor, while observing the signal indicated on the Tech 2. Is any signal indicated on the while tapping on the engine lift bracket?	—	Go to Step 11	Go to Step 8
8	1. Turn OFF the ignition. 2. Disconnect the PCM. 3. Turn ON the ignition. 4. Check the KS signal circuit between the PCM and the KS sensor connector for an open, a short to voltage, or a short to ground. 5. If a wiring problem is found, repair as necessary. Was a problem found?	—	Go to Step 11	Go to Step 10
9	Replace the KS Sensor. Refer to Knock Sensor. Is the action complete?	—	Go to Step 11	—
10	Replace the PCM. **IMPORTANT:** If the PCM is faulty, reprogram the PCM. Refer to PCM Replacement/Programming. Is the action complete?	—	Go to Step 11	—
11	1. Using the Tech 2, select the DTC and the Clear Info. 2. Start the engine. 3. Idle at the normal operating temperature. 4. Select the DTC and the Specific. 5. Enter the DTC number which was set. 6. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Tech 2 indicate that this diagnostic ran and passed?	—	Go to Step 12	Go to Step 2
12	Using the Tech 2, select the Capture Info and the Review Info. Are any DTCs displayed that have not been diagnosed?	—	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P0336 CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT RANGE/PERFORMANCE



D06RX052

Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft pulses will be produced. The powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CMP) signal pulses being received. If the PCM receives an incorrect number of pulses on the 58X reference circuit, Diagnostic Trouble Code P0336 will set. Diagnostic Trouble Code P0336 is a type B code.

Conditions for Setting the DTC

- Engine is running.
- Extra or missing pulse is detected between consecutive 58X reference pulses.
- Above condition is detected in 10 of 100 crankshaft rotations.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0336 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0336 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM. A change in voltage will indicate the location of the fault.

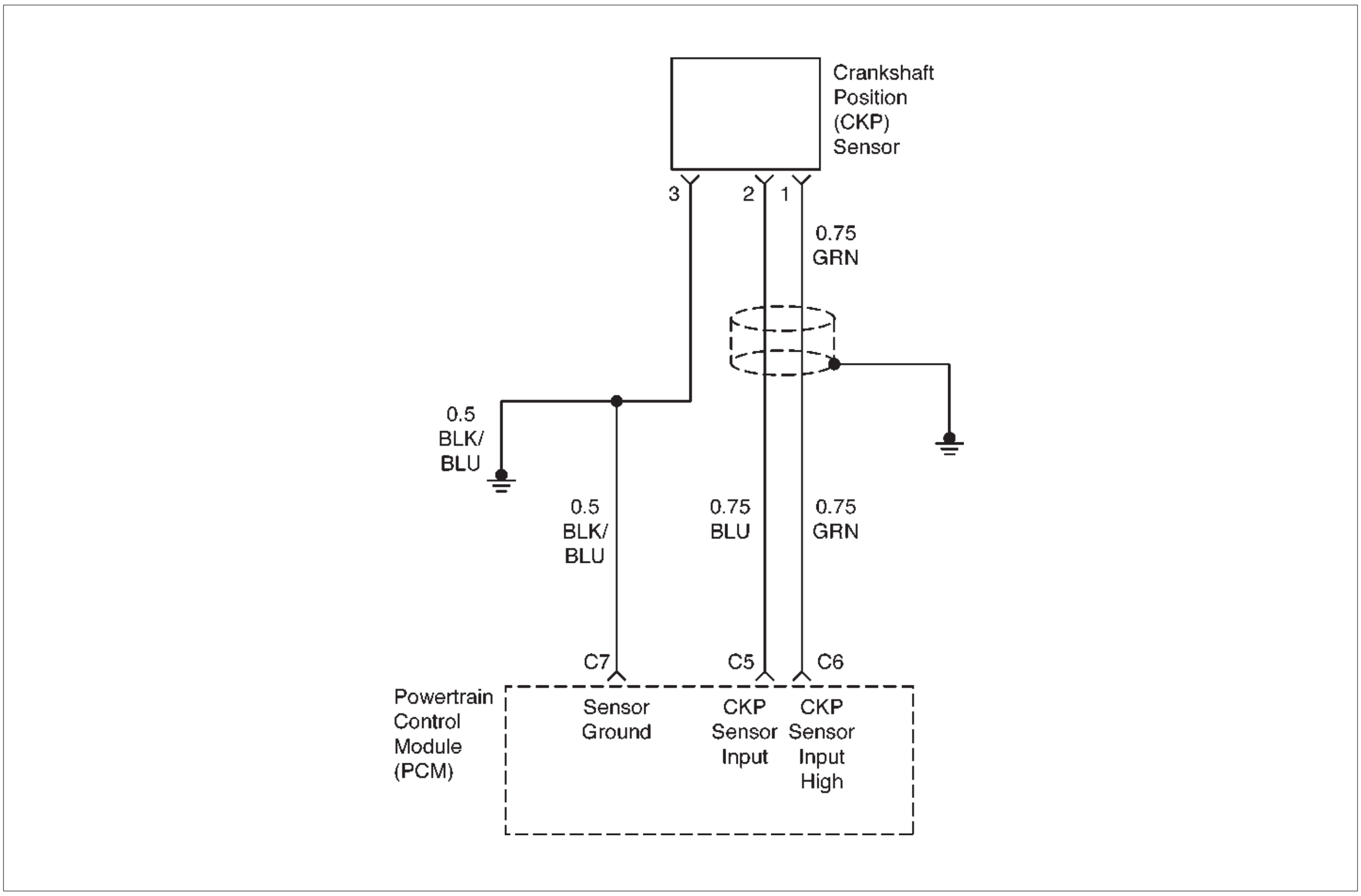
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to

be set occurs. This may assist in diagnosing the condition.

DTC P0336 – CKP Sensor Circuit Range/Performance

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Attempt to start the engine. Does the engine start?	—	Go to Step 3	Refer to Engine Cranks But Will Not Run chart
3	1. Review and record Failure Records information. 2. Clear Diagnostic Trouble Code P0336. 3. Start the engine and idle for 1 minute. 4. Observe Diagnostic Trouble Codes. Is Diagnostic Trouble Code P0336 set?	—	Go to Step 4	Refer to Diagnostic Aids
4	1. Disconnect the PCM and CKP sensor. 2. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Reconnect the PCM and CKP sensor. 2. Connect a Digital Voltmeter (DVM) to measure voltage on the 58X reference circuit at the PCM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to Step 8	Go to Step 6
6	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 7
7	Replace the CKP sensor. **IMPORTANT:** The PCM must go through the Scan Tool's Tooth Error Correction (TEC) procedure after CKP Sensor replacement. Refer to the Tooth Error Correction procedure. Is the action complete?	—	Verify repair	—
8	Check connections at the PCM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 9
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0337 CRANKSHAFT POSITION (CKP) SENSOR CIRCUIT LOW INPUT



D06RX052

Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft reference pulses will be produced. The powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CMP) signal pulses being received. If the PCM does not receive pulses on the 58X reference circuit, Diagnostic Trouble Code P0337 will set. Diagnostic Trouble Code P0337 is a type B code.

Conditions for Setting the DTC

- No camshaft position (CMP) sensor DTCs are set.
- Engine cranking.
- Crankshaft position (CKP) sensor signal is not present between two cam pulses.
- CKP reference pulse is not detected within 24 CMP pulses.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0337 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0337 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to

be set occurs. This may assist in diagnosing the condition.

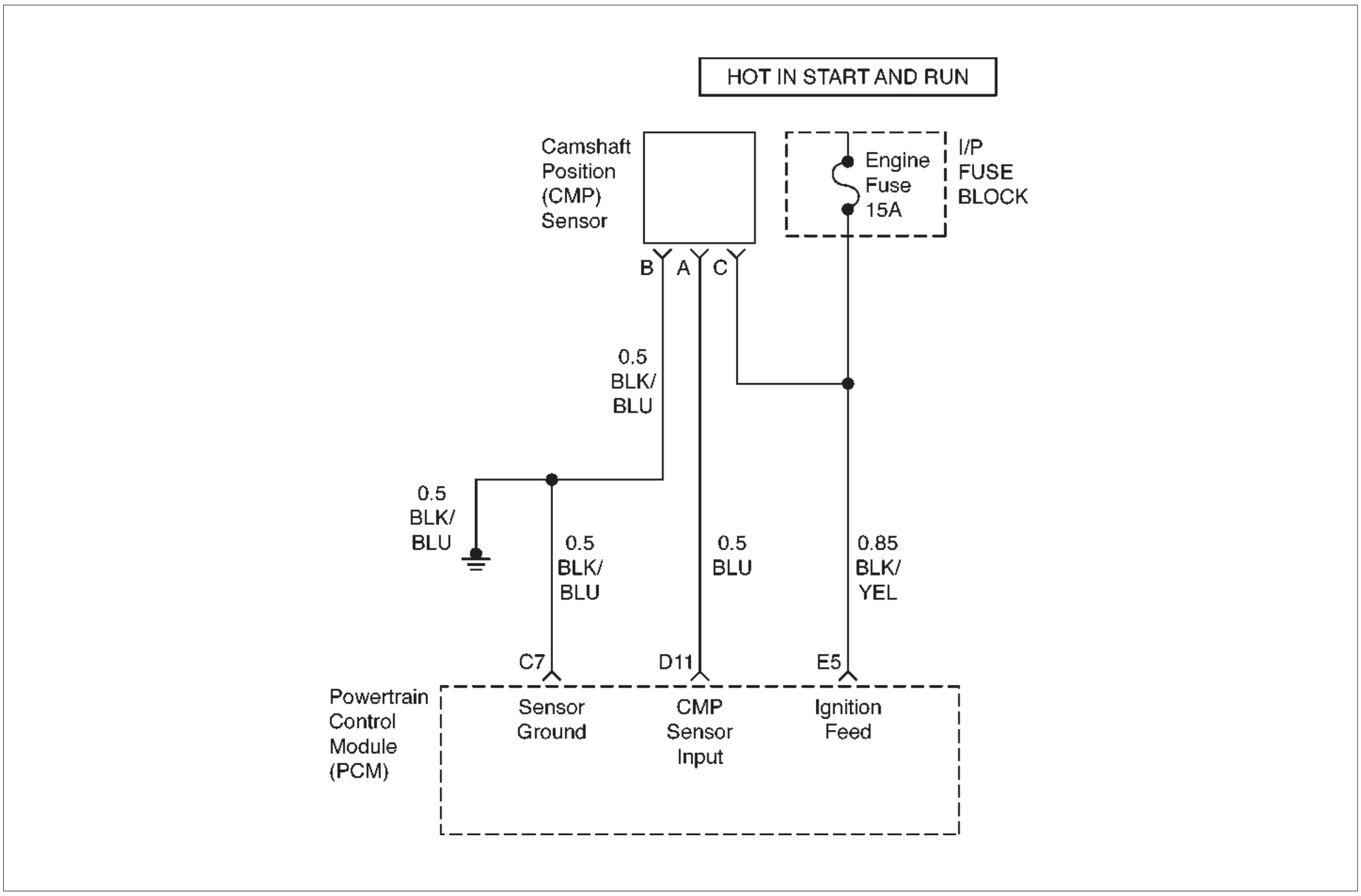
DTC P0337 – CKP Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Disconnect the CKP sensor. 2. Ignition ON. 3. Using a Digital Voltmeter (DVM), verify that 5 V reference and ground are being supplied at the sensor connector (PCM side). Are 5 V and ground being supplied to the sensor?	—	Go to Step 5	Go to Step 3
3	1. Ignition ON. 2. With a DVM, backprobe the PCM connector 5 V reference and ground connections. Are 5 V reference and ground available at the PCM?	—	Go to Step 4	Go to Step 9
4	Check 5 V reference or ground between the CKP sensor and PCM and repair the open circuit, short to ground or short to voltage. Is the action complete?	—	Verify repair	—
5	1. Ignition OFF. 2. Disconnect the PCM and CKP sensor. 3. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector. 4. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 6
6	1. Reconnect the PCM and CKP sensor. 2. Connect a DVM to measure voltage on the 58X reference circuit at the PCM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to Step 9	Go to Step 7
7	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 8
8	Replace the CKP sensor. **IMPORTANT:** The PCM must go through the Scan Tool's Tooth Error Correction (TEC) procedure after a CKP Sensor replacement. Refer to Tooth Error Correction (TEC) procedure. Is the action complete?	—	Verify repair	—

DTC P0337 – CKP Sensor Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the connections at the PCM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to Step 10
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0341 CAMSHAFT POSITION (CMP) SENSOR CIRCUIT RANGE/PERFORMANCE



D06RX053

Circuit Description

The camshaft position (CMP) sensor signal is produced by the CMP sensor pulses when the engine is running and crankshaft position (CKP) sync pulses are also being received. The powertrain control module (PCM) uses the CMP signal pulses to initiate sequential fuel injection. The PCM constantly monitors the number of pulses on the CMP signal circuit and compares the number of CMP pulses to the number of 58X reference pulses received. If the PCM receives an incorrect number of pulses on the CMP reference circuit, Diagnostic Trouble Code P0341 will set and the PCM will initiate injector sequence without the CMP signal with a one in four chance that injector sequence is correct. The engine will continue to start and run normally, although the misfire diagnostic will be affected if a misfiring condition occurs. DTC P0341 is a type B code.

Conditions for Setting the DTC

- The engine is running (CMP reference pulses are being received).
- Above condition fails for 10 occurrences within 100 test samples (15.6 m/s).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will initiate injector sequence without the CMP signal with a one in four chance that injector sequence is correct.
- The PCM will store conditions which were present when the Diagnostic Trouble Code (DTC) was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code (DTC) P0341 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code (DTC) P0341 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- If a CKP Diagnostic Trouble Code (DTC) is also indicated, there may be a problem with the ground circuit because the CMP ground is spliced to the CKP ground wire.
- If a fuel injector Diagnostic Trouble Code (DTC) is also indicated, there may be a problem with the power supply to the CMP. The wire supplying CMP power is spliced to the wire supplying power to the fuel injectors.

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for the following conditions:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, disconnect the PCM, turn the ignition ON and observe a voltmeter connected to the CMP signal circuit at the PCM harness connector while moving connectors and wiring harnesses related to the CMP sensor. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code (DTC) to be set occurs. This may assist in diagnosing the condition.

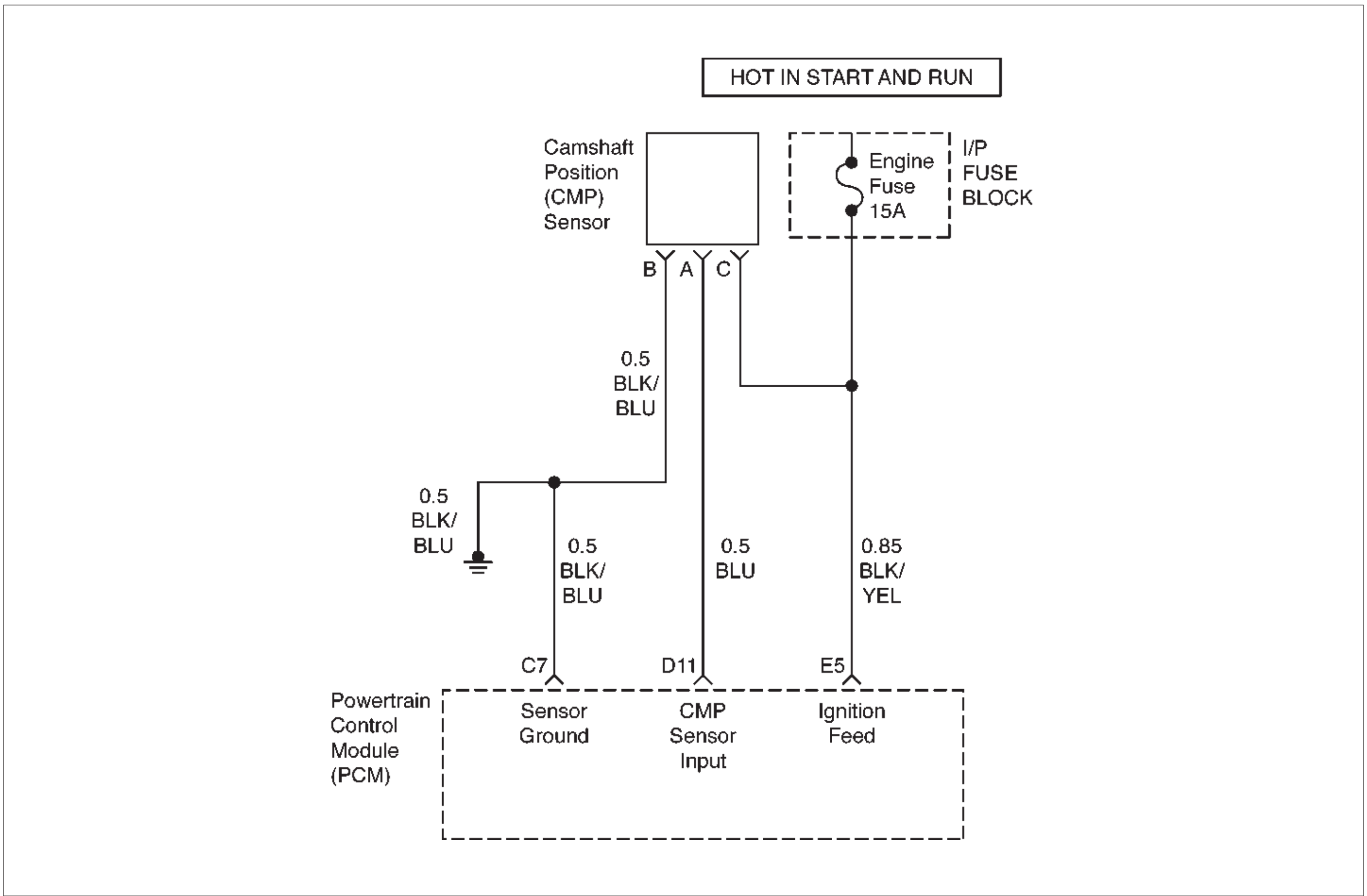
DTC P0341 – CMP Sensor Circuit Range/Performance

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using a Tech 2, monitor ”DTC” information for DTC P0341 until the DTC P0341 test runs. Does the Tech 2 indicate DTC P0341 failed this ignition cycle?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Monitor voltage on the CMP signal circuit while cranking the engine. Does the voltage toggle between the specified values?	0–4 V	Go to Step 4	Go to Step 7
4	Check for a poor connection of the CMP signal wire at the PCM terminal. Was a poor connection found?	—	Go to Step 5	Go to Step 6
5	Repair the damaged pin or terminal at the PCM.	—	Verify repair	—
6	Replace the PCM **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the repair complete?	—	—	Verify repair
7	1. Disconnect the CMP connector from the CMP Sensor. 2. Ignition ON. 3. At the CMP connector, use a Digital Voltmeter (DVM) to check the voltage between the voltage signal wire and sensor ground. Does the DVM indicate the specified value?	B+	Go to Step 12	Go to Step 8
8	1. Ignition ON. 2. Use a DVM to measure between the ground and the CMP positive connector. Does the DVM indicate the specified value?	B+	Go to Step 10	Go to Step 9

DTC P0341 – CMP Sensor Circuit Range/Performance (Cont'd)

Step	Action	Value(s)	Yes	No
9	Repair the open circuit. Is the repair complete?	—	Verify repair	—
10	1. Ignition ON. 2. Use a DVM to measure at the CMP connector between the battery + and the CMP ground wire. Does the DVM indicate the specified value?	B+	Go to Step 12	Go to Step 11
11	Repair the open ground wire. Is the repair complete?	—	Verify repair	—
12	Use an ohmmeter to check continuity of the signal wire between the CMP and the PCM. Was there an open circuit?	—	Go to Step 13	Go to Step 14
13	Repair the open signal wire. Is the action complete?	—	Verify repair	—
14	1. Ignition ON. 2. Check the signal wire for a short to ground or a short to voltage. Was a problem found?	—	Go to Step 15	Go to Step 16
15	Repair the signal circuit problem. Is the action complete?	—	Verify repair	—
16	Replace the CMP Sensor. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0342 CAMSHAFT POSITION (CMP) SENSOR CIRCUIT LOW INPUT



D06RX053

Circuit Description

The camshaft position (CMP) sensor signal is produced by the CMP sensor pulses when the engine is running and crankshaft position (CKP) sync pulses are also being received. The PCM uses the CMP signal pulses to initiate sequential fuel injection. The PCM constantly monitors the number of pulses on the CMP signal circuit and compares the number of CMP pulses to the number of 58X reference pulses received. If the PCM does not receive pulses on the CMP reference circuit, Diagnostic Trouble Code (DTC) P0342 will set and the PCM will initiate injector sequence without the CMP signal with a one in four chance that injector sequence is correct. The engine will continue to start and run normally, although the misfire diagnostic will be affected if a misfiring condition occurs. Diagnostic Trouble Code (DTC) P0342 is a type B code.

Conditions for Setting the DTC

- The engine is running.
- The CMP sensor signal is not received by the PCM once every 4 cylinders.
- The above condition occurs for 10 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will initiate injector sequence without the CMP signal with a one in four chance that injector sequence is correct.
- The PCM will store conditions which were present when the Diagnostic Trouble Code (DTC) was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code (DTC) P0342 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code (DTC) P0342 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- If a CKP Diagnostic Trouble Code (DTC) is also indicated, there may be a problem with the ground circuit because the CMP ground is spliced to the CKP ground wire.
- If a fuel injector Diagnostic Trouble Code (DTC) is also indicated, there may be a problem with the power supply to the CMP. The wire supplying CMP power is spliced to the wire supplying power to the fuel injectors.

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for the following:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, disconnect the PCM, turn the ignition ON and observe a voltmeter connected to the CMP signal circuit at the PCM harness connector while moving connectors and wiring harnesses related to the CMP sensor. A change in voltage will indicate the location of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Ensures that the fault is present.

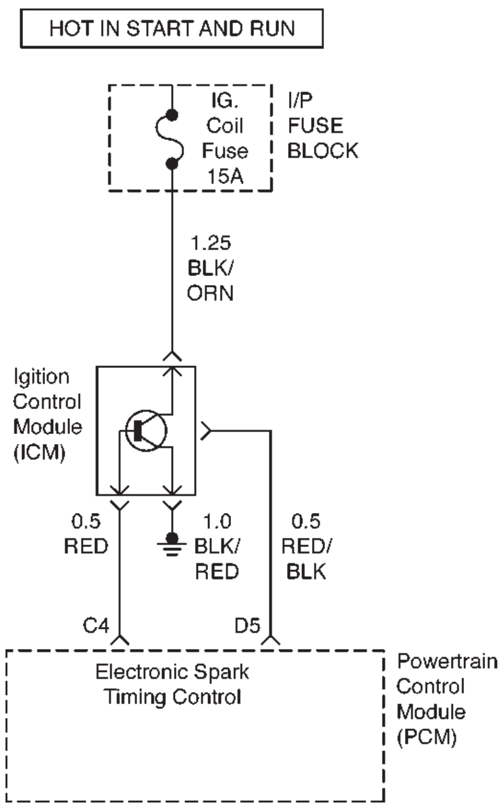
DTC P0342 – Camshaft Position Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON. 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" information for DTC P0342 until the DTC P0342 test runs. Did the Tech 2 indicate DTC P0342 failed this ignition cycle?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Use a Digital Voltmeter (DVM) to monitor voltage on the CMP signal circuit while cranking the engine. Does the voltage toggle between the specified values?	0–4 V	Go to Step 4	Go to Step 7
4	Check for a poor connection of the CMP signal wire at the PCM terminal. Was a poor connection found?	—	Go to Step 5	Go to Step 6
5	Repair the damaged pin or terminal at the PCM.	—	Verify repair	—
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the repair complete?	—	Verify repair	—
7	1. Disconnect the CMP connector from the CMP Sensor. 2. Ignition ON. 3. At the CMP connector, check the voltage between the voltage signal wire and sensor ground. Does the DVM indicate the specified value?	B+	Go to Step 12	Go to Step 8
8	1. Ignition ON. 2. Use a DVM to measure between the ground and the CMP positive connector. Does the DVM indicate the specified value?	B+	Go to Step 10	Go to Step 9
9	Repair the open circuit. Is the repair complete?	—	Verify repair	—

DTC P0342 – Camshaft Position Sensor Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Ignition ON. 2. Use a DVM to measure at the CMP connector between the battery + and the CMP ground wire. Does the DVM indicate the specified value?	B+	Go to Step 12	Go to Step 11
11	Repair the open ground wire. Is the repair complete?	—	Verify repair	—
12	Use an ohmmeter to check continuity of the signal wire between the CMP and the PCM. Was there an open circuit?	—	Go to Step 13	Go to Step 14
13	Repair the open signal wire. Is the action complete?	—	Verify repair	—
14	1. Ignition ON. 2. Check the signal wire for a short to ground or a short to voltage. Was a problem found?	—	Go to Step 15	Go to Step 16
15	Repair the signal circuit problem. Is the action complete?	—	Verify repair	—
16	Replace the CMP Sensor. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0351 IGNITION COIL ”A” PRIMARY/ SECONDARY CIRCUIT MALFUNCTION



D06RX054

Circuit Description

The ignition control circuit provides a zero volt or a 5 volt signal to the ignition control module. The normal circuit voltage is zero volts. When the module receives the 5 volt signal from the powertrain control module (PCM), it provides a ground path for the B+ voltage supplied to the ignition primary coil. When the PCM turns off the 5 volts to the module, the module will remove the ground path of the ignition primary coils; causing the magnetic field produces a voltage in the secondary coils which fires the spark plug.

The circuit between the PCM and the ignition control module is monitored for an open circuit, short to voltage, and short to ground. When the PCM detects a problem in the ignition control circuit, it will set DTC P0351. DTC P0351 is a type A code.

Conditions for Setting the DTC

- Ignition ON.
- Output voltage is not equal to 5 volts when output is ON.
- Output voltage is not equal to 0 volt when output is OFF.
- Twenty test failures within 40 samples of continuous circuit monitoring.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0351 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0351 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

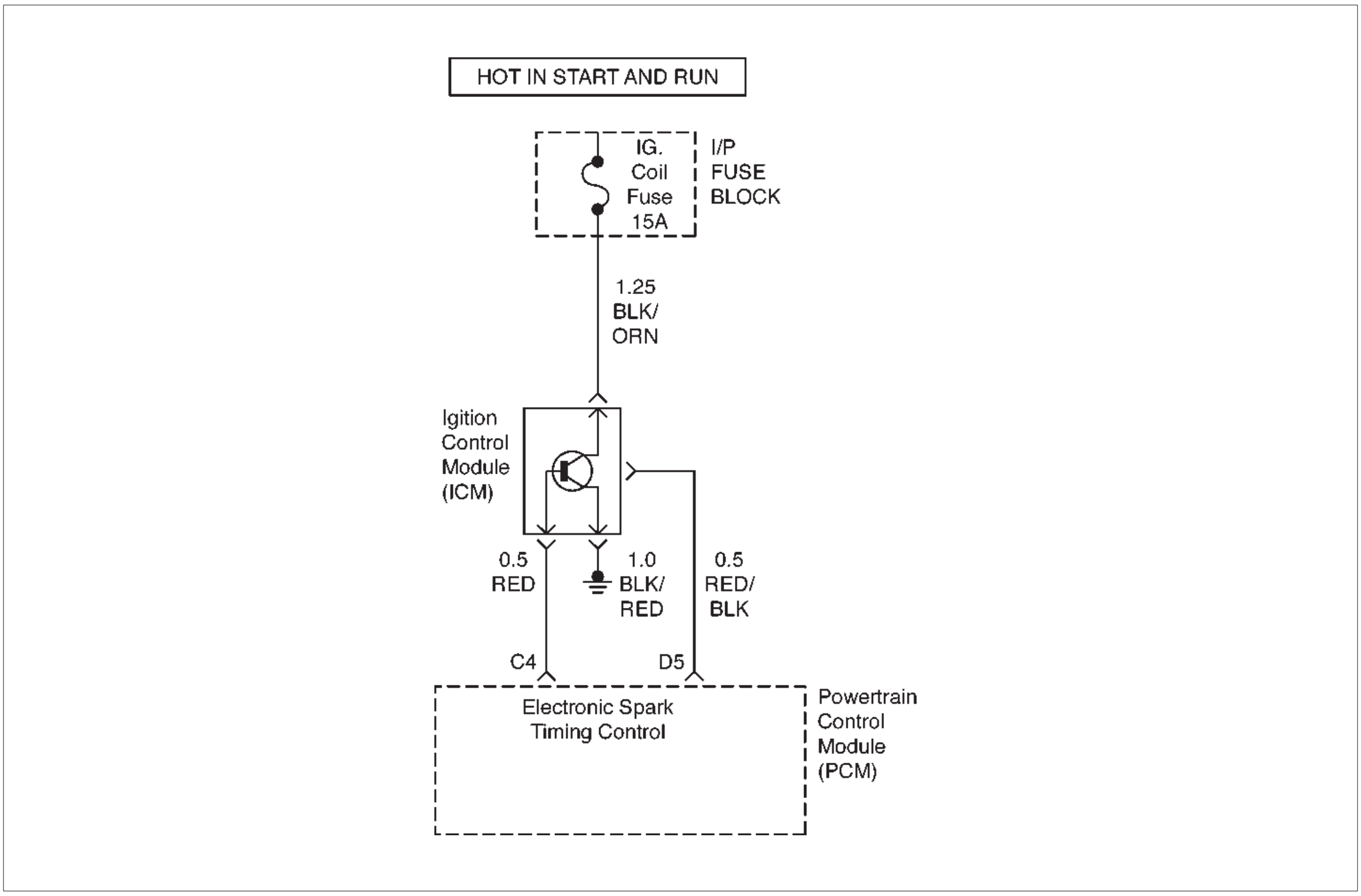
- Poor connection at the PCM – Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connections.
- Damaged harness – Inspect the wiring harness for damage; Open circuits, shorts to ground, or shorts to Voltage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0351 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0351 Ignition Coil ”A” Primary/Secondary Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Check for a faulty connection or damaged terminals at the ignition control module. Was a problem found?	—	Verify Repair	Go to Step 3
3	Check for a faulty connection or damaged terminals at the PCM connector. Was a problem found?	—	Verify Repair	Go to Step 4
4	1. Ignition OFF. 2. Disconnect the PCM and the ignition control module. 3. Check the ignition control circuit for a short to voltage. Was a problem found?	—	Verify Repair	Go to Step 5
5	Check the ignition control circuit for a short to voltage. Was a problem found?	—	Verify Repair	Go to Step 6
6	Check for an open in the ignition control circuit. Was a problem found?	—	Verify Repair	Go to Step 7
7	Replace the ignition control module. Verify repair. Is there still a problem?	—	Go to Step 8	—
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the repair complete?	—	Verify Repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0352 IGNITION COIL ”B” PRIMARY/ SECONDARY CIRCUIT MALFUNCTION



D06RX054

Circuit Description

The ignition control circuit provides a zero volt or a 5 volt signal to the ignition control module. The normal circuit voltage is zero volts. When the module receives the 5 volt signal from the powertrain control module (PCM), it provides a ground path for the B+ voltage supplied to the ignition primary coil. When the PCM turns off the 5 volts to the module, the module will remove the ground path of the ignition primary coils; causing the magnetic field produces a voltage in the secondary coils which fires the spark plug.

The circuit between the PCM and the ignition control module is monitored for an open circuit, short to voltage, and short to ground. When the PCM detects a problem in the ignition control circuit, it will set DTC P0352. DTC P0352 is a type A code.

Conditions for Setting the DTC

- Ignition ON.
- Output voltage is not equal to 5 volts when output is ON.
- Output voltage is not equal to 0 volt when output is OFF.
- Twenty test failures within 40 samples of continuous circuit monitoring.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0352 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0352 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

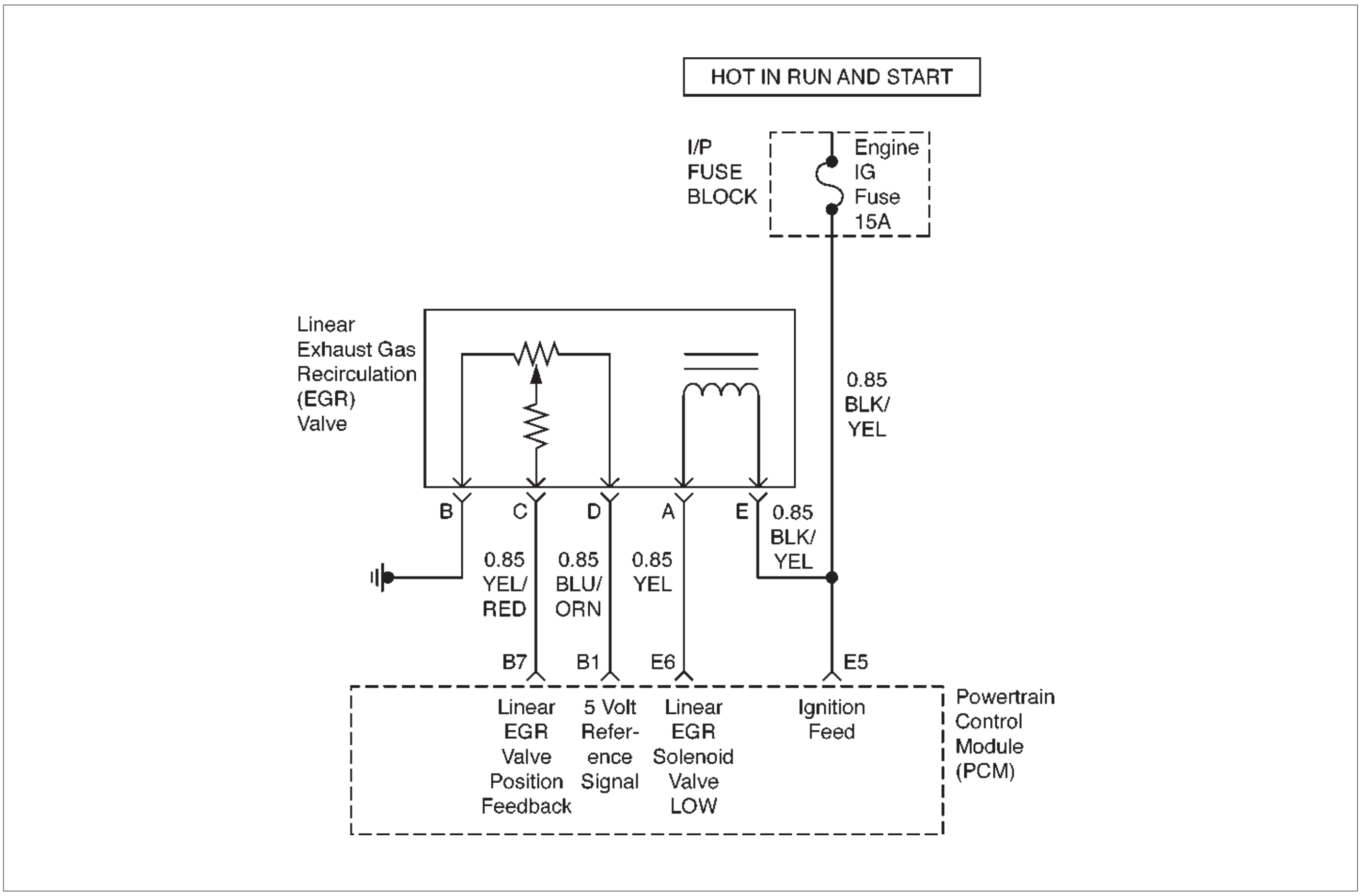
- Poor connection at the PCM – Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connections.
- Damaged harness – Inspect the wiring harness for damage; Open circuits, shorts to ground, or shorts to Voltage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0351 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0352 Ignition Coil "B" Primary/Secondary Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Check for a faulty connection or damaged terminals at the ignition control module. Was a problem found?	—	Verify Repair	Go to Step 3
3	Check for a faulty connection or damaged terminals at the PCM connector. Was a problem found?	—	Verify Repair	Go to Step 4
4	1. Ignition OFF. 2. Disconnect the PCM and the ignition control module. 3. Check the ignition control circuit for a short to voltage. Was a problem found?	—	Verify Repair	Go to Step 5
5	Check the ignition control circuit for a short to voltage. Was a problem found?	—	Verify Repair	Go to Step 6
6	Check for an open in the ignition control circuit. Was a problem found?	—	Verify Repair	Go to Step 7
7	Replace the ignition control module. Verify repair. Is there still a problem?	—	Go to Step 8	—
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the repair complete?	—	Verify Repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0401 EXHAUST GAS RECIRCULATION (EGR) FLOW INSUFFICIENT DETECTED



D06RX055

Circuit Description

The powertrain control module (PCM) tests the exhaust gas recirculation (EGR) system during deceleration by momentarily commanding the EGR valve to open while monitoring the manifold absolute pressure (MAP) sensor signal. When the EGR valve is opened, the PCM monitors the change in MAP input signal. The PCM compares the MAP change to a RPM vs. BARO table. When the PCM interprets the change in MAP to be out of limits, the PCM will set DTC P0401. The number of test samples required to accomplish this may vary according to the severity of the detected flow error.

Normally, the PCM will only allow one EGR flow test sample to be taken during an ignition cycle. To aid in verifying a repair, the PCM allows twelve test samples during the first ignition cycle following a Tech 2 ”Clear Info” or a battery disconnect. Between nine and twelve samples should be sufficient for the PCM to determine adequate EGR flow and pass the EGR test. DTC P0401 is a type A code.

Conditions for Setting the DTC

- No TP sensor, VSS, EVAP Purge, IAC, IAT sensor, MAP sensor, EGR Pintle Position sensor, ECT sensor, misfire DTCs set.
- Barometric pressure is above 72 kPa.
- Engine coolant temperature is greater than 60°C (140°F).
- System voltage is between 11.5 and 16 volts.
- Vehicle speed is greater than 23 km/h (14 mph).
- IAC position is steady, changing less than 5 counts.
- A/C clutch status is unchanged.

Start Test

- TP angle is less than 0.8%.
- EGR duty cycle is less than 1%.
- MAP is steady, changing less than 1 kPa.
- Engine speed is between 1200 RPM and 2000 RPM.
- Compensated MAP between 10.3 kPa and 49.8 kPa.

Run Test

- Delta MAP is recorded during valve open conditions.
- EGR valve is ramped over a time interval.

Run Test will be aborted if any of the following are true:

- Vehicle speed changes by greater than 16 km/h (10mph).
- Engine RPM changes by greater than 100 rpm.
- EGR is opened less than 95% of the commanded amount.

During the Start Test and the Run Test, the EGR is closed then opened. The associated change in MAP is compared with the PCM’s expected change value. If the difference between the two values exceeds the PCM's internal limit, a Diagnostic Trouble Code P0401 will set. DTC P0401 is a type A code.

NOTE: Several deceleration cycles will be necessary to run a sufficient number of EGR flow tests to determine a "pass" or "fail" condition.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate the first time the fault is detected.
- A history Diagnostic Trouble Code is stored.
- A history Diagnostic Trouble Code will clear after 40 consecutive warm up cycles without a fault.
- The MIL will turn OFF after three consecutive ignition cycles in which the diagnostic runs without a fault.

Conditions for Clearing the DTC

- The MIL will turn OFF after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history Diagnostic Trouble Code will clear after 40 consecutive warm up cycles without a fault.
- Diagnostic Trouble Codes can be cleared by using the Tech 2.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Actual EGR Position display on the Tech 2 while moving connectors and wiring harnesses related to the EGR valve. A change in the display will indicate the location of the fault.
- Ensure EGR valve is correctly mounted. See On–Vehicle Service.

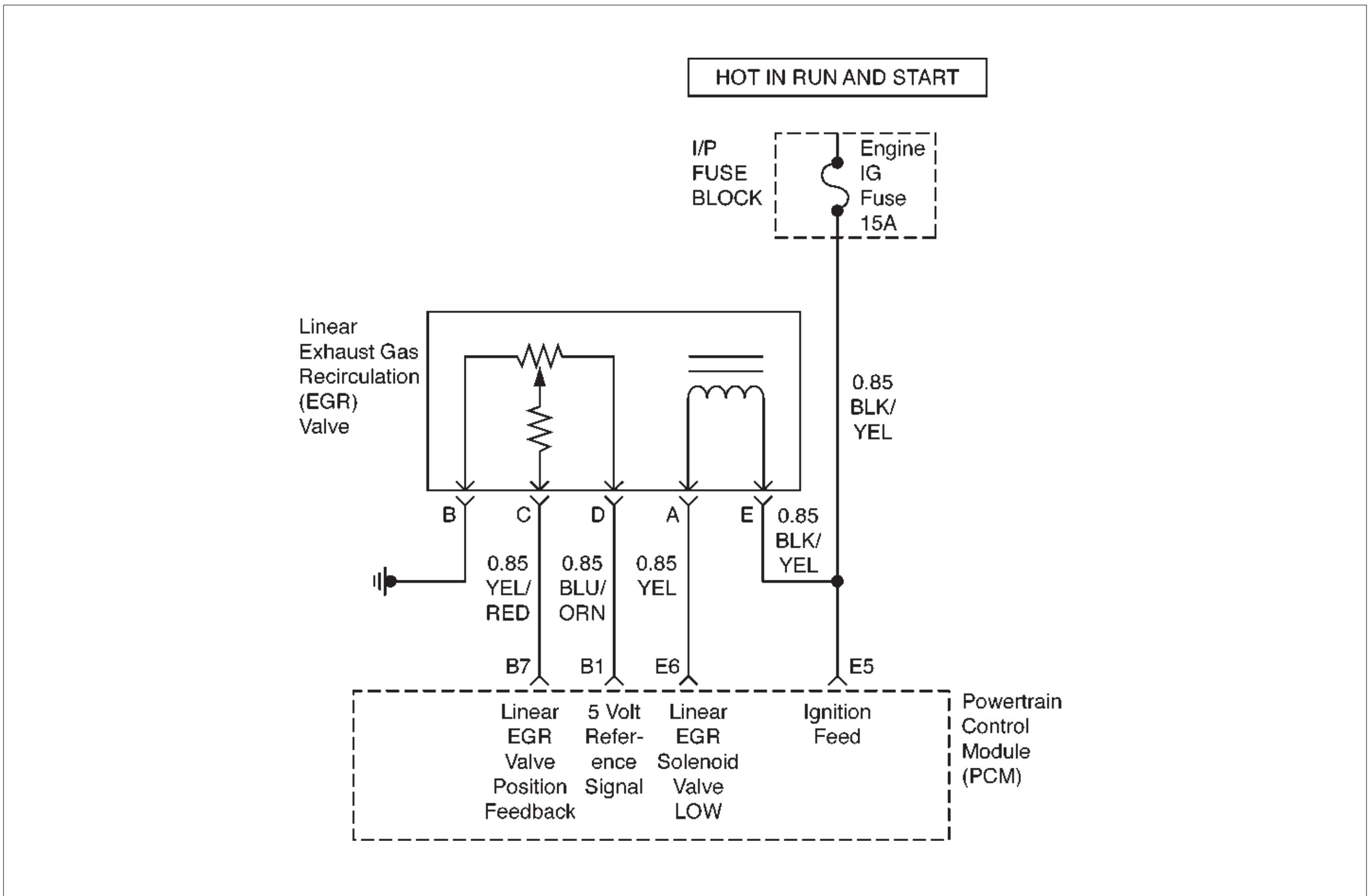
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

NOTE: If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possibly a plugged catalytic converter) using the "Restricted Exhaust System Check."

DTC P0401 – Exhaust Gas Recirculation Flow Insufficient Detected

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Start the engine. 2. Monitor the MAP signal with a Tech 2 while idling. 3. While idling, depress the accelerator pedal about halfway down and immediately let the engine return to idle. Did the MAP value on the Tech 2 show an immediate large change?	—	Go to Step 4	Go to Step 3
3	Replace the MAP sensor.	—	Verify repair	—
4	1. Inspect the exhaust system for modification of original installed parts or leaks. 2. If a problem was found, repair exhaust system as necessary. Was a condition present that required repair?	—	Go to Step 7	Go to Step 5
5	1. Remove the EGR valve. 2. Visually and physically inspect the pintle, valve passages and the adapter for excessive deposits or any kind of a restriction. 3. If a problem if found, clean or replace EGR system components as necessary. Was a condition present that required repair?	—	Go to Step 7	Go to Step 6
6	1. Remove the EGR inlet and outlet pipes from the exhaust manifold and the intake manifold. 2. Inspect the manifold EGR ports and the EGR inlet and outlet pipes for a blockage caused by excessive deposits or other damage. 3. If a problem is found, correct the condition as necessary. Was a condition present that required repair?	—	Go to Step 7	Refer to Diagnostic Aids
7	1. Review and record the Tech 2 Failure Records data. 2. Clear Diagnostic Trouble Code and monitor the Tech 2 System Info Screen while operating the vehicle as specified in "Diagnostic Aids." 3. Using a Tech 2, monitor "Diagnostic Trouble Code" info for Diagnostic Trouble Code P0401 until the Diagnostic Trouble Code P0401 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0401 failed this ignition?	—	—	Repair complete

DIAGNOSTIC TROUBLE CODE (DTC) P0402 EXHAUST GAS RECIRCULATION (EGR) EXCESSIVE FLOW DETECTED



D06RX055

Circuit Description

The Powertrain Control Module (PCM) closes the Exhaust Gas Recirculation (EGR) system on engine start–up to test for excessive (any) flow. If the PCM determines that EGR flow occurred on start–up, in two consecutive trips, then DTC P0402 will set. DTC P0402 is a type B code.

Conditions for Setting the DTC

- Intake Air Temperature (IAT) is above 5°C (41°F).
- Engine RPM is less than 500 RPM.
- EGR Pintle Position if greater than 55 counts.

The above mentioned conditions must be met for 0.6 seconds during engine start–up on two consecutive trips.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Actual EGR Position display on the Tech 2 while moving connectors and wiring harnesses related to the EGR valve. A change in the display will indicate the location of the fault.
- Ensure EGR valve is correctly mounted. See On–Vehicle Service.

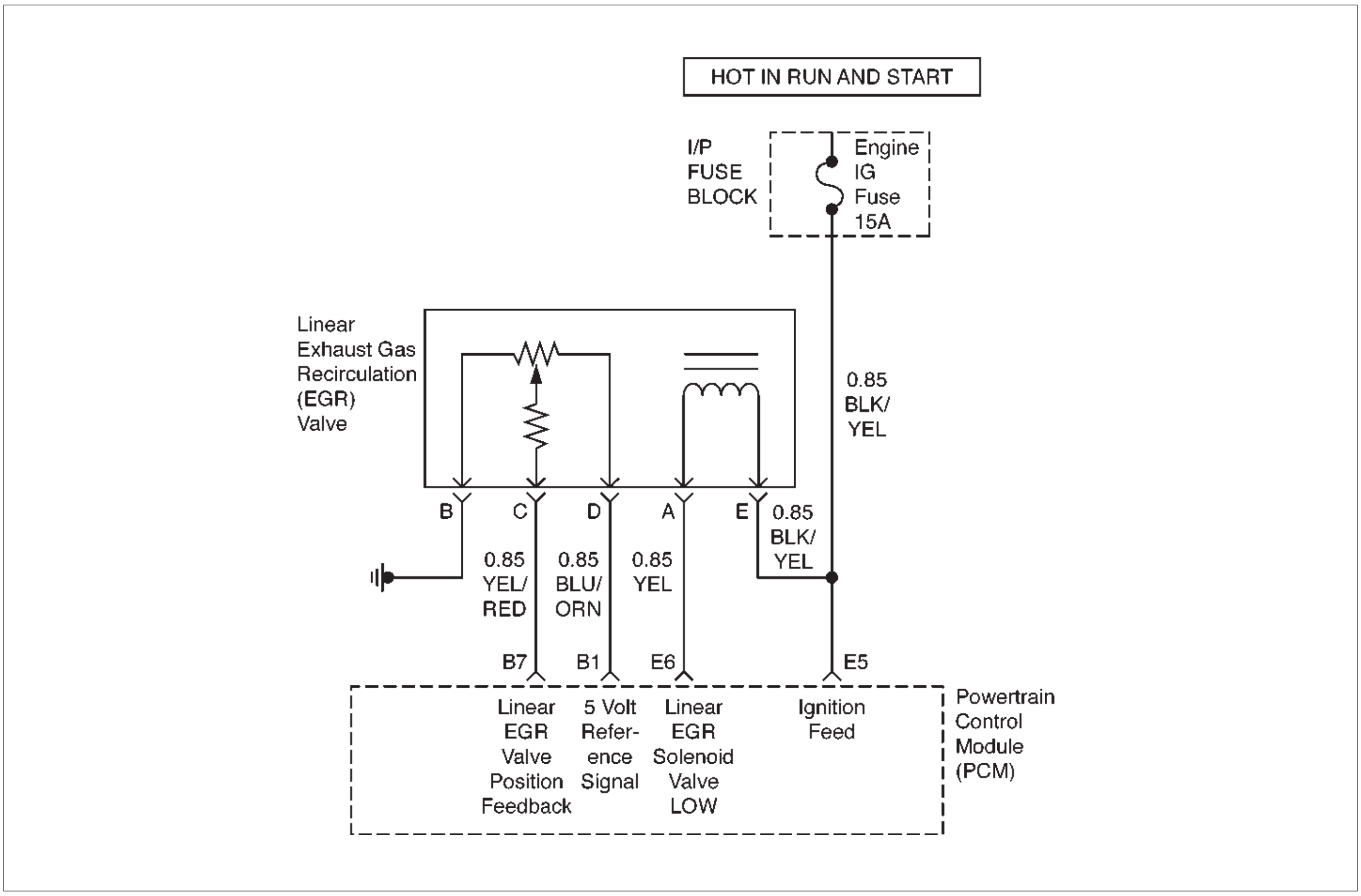
Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

NOTE: If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possible a plugged catalytic converter) using the ”Restricted Exhaust System Check.”

DTC P0402 EGR Excessive Flow Detected

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Review and record the Tech 2 Failure Records data. 2. Clear Diagnostic Trouble Code and monitor the Tech 2 System Info Screen while operating the vehicle as specified in "Diagnostic Aids." 3. Using a Tech 2, monitor "Diagnostic Trouble Code" info for Diagnostic Trouble Code P0401 until the Diagnostic Trouble Code P0401 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P0401 failed this ignition?	—	Go to Diagnostic Aids	Go to Step 3
3	1. Inspect the exhaust system for modification of original installed parts or leaks. 2. If a problem was found, repair exhaust system as necessary. Was a condition present that required repair?	—	Verify repair	Go to Step 4
4	1. Remove the EGR valve. 2. Visually and physically inspect the pintle, valve passages and the adapter for excessive deposits or any kind of a restriction. 3. If a problem if found, clean or replace EGR system components as necessary. Was a condition present that required repair?	—	Verify repair	Go to Step 5
5	1. Remove the EGR inlet and outlet pipes from the exhaust manifold and the intake manifold. 2. Inspect the manifold EGR ports and the EGR inlet and outlet pipes for a blockage caused by excessive deposits or other damage. 3. If a problem is found, correct the condition as necessary. Was a condition present that required repair?	—	Verify repair	Refer to Diagnostic Aids

DIAGNOSTIC TROUBLE CODE (DTC) P0404 EXHAUST GAS RECIRCULATION (EGR) CIRCUIT RANGE/PERFORMANCE



D06RX055

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Oxides of Nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold from the exhaust manifold through an orifice with a PCM controlled pintle. The PCM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The PCM then commands the EGR valve to operate when necessary by controlling an ignition signal through the PCM. This can be monitored on a Tech 2 as the Desired EGR Position.

The PCM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the PCM. This feedback signal can also be monitored on a Tech 2 and is the actual position of the EGR pintle. The Actual EGR position should always be near the commanded or Desired EGR Position.

If the PCM detects a large difference between the desired EGR position and actual EGR position, then Diagnostic Trouble Code P0404 will set. DTC P0404 is a type B code.

Conditions for Setting the DTC

- IAT is greater than 5°C (41°F).
- EGR commanded ON (Desired EGR Position is greater than 0%).
- Actual EGR Position differs from Desired EGR Position by more than 15% for 5 seconds.

Action Taken When the DTC Sets

- Malfunction Indicator Lamp (MIL) will illuminate the second time the fault is detected.
- The PCM will record operating conditions at the time the diagnostic fails.
- A history Diagnostic Trouble Code is stored.
- The EGR Valve is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after three consecutive ignition cycles in which the diagnostic runs without a fault.
- Diagnostic Trouble Code(s) can be cleared by using a Tech 2.

Diagnostic Aids

Due to the moisture associated with exhaust systems, the EGR valve may freeze and stick in colder weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a Tech 2, the fault can be verified easily. Check the freeze frame data to determine if the Diagnostic Trouble Code was set when the vehicle was cold by viewing the Engine Coolant Temperature (ECT).

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 if applicable. This created an electronic copy of the data taken when the fault occurred. The information is then stored on the Tech 2 for later reference.
2. Commanding the EGR valve open determines whether the EGR system can control the EGR valve accurately and if the fault if present.
3. When the EGR valve electrical connector is disconnected, the Tech 2 should display the Actual EGR Position as 0%. If is does not, the fault lies either in the EGR signal circuit or the PCM.
4. A test light, when connected to ground, will glow dimly when the EGR valve is commanded to 25%, and brighter as the EGR valve is commanded to 100%. If the test light flashes, check the sensor ground for an open.
5. An open or poor connection condition may have caused this Diagnostic Trouble Code to set. Be sure to check the terminals for being backed out, improperly formed or damaged, and for poor tension.
7. The test light will have glowed brightly in the previous step if the EGR control circuit was shorted to B+ and the Actual EGR Position on the Tech 2 will display 100%. A test light that did not illuminate, indicates that the circuit may be open or shorted to ground.
9. If the EGR valve 5 volt reference is shorted to voltage, the DVM will read battery voltage and additional Diagnostic Trouble Codes may be set and engine performance will be poor.
12. The replacement PCM must be reprogrammed and the Tooth Error Correction (TEC) procedure must be performed. Refer to the latest procedures for PCM reprogramming and Powertrain Control Module for the Tooth Error Correction (TEC) Procedure.
13. Although the circuitry acted correctly when checked, a problem may still lie within the terminals which would not show up in probe type testing. Be sure to check the terminals for being backed out, improperly formed or damaged, and for poor tension.
17. All circuits to the EGR valve are OK at this point. The fault lies internally in the EGR valve and therefore must be replaced. Be sure all gasket material is removed from the EGR mounting surface. Even a small amount of material may cause a Diagnostic Trouble Code P0401 to set. For on vehicle service of the EGR Valve, refer to EGR Valve.
18. Check the terminals for being backed out, improperly formed or damaged, and for poor tension.
19. Clearing the Diagnostic Trouble Codes is a very important step for this diagnostic. The clearing function allows the EGR valve to relearn a new pintle position as the old position was inaccurate due to the malfunction that caused the Diagnostic Trouble Code. The Diagnostic Trouble Code must be cleared with the ignition switch ON, with the engine OFF or when the engine is idling. If the PCM sees a EGR command, the new pintle position will not be learned.

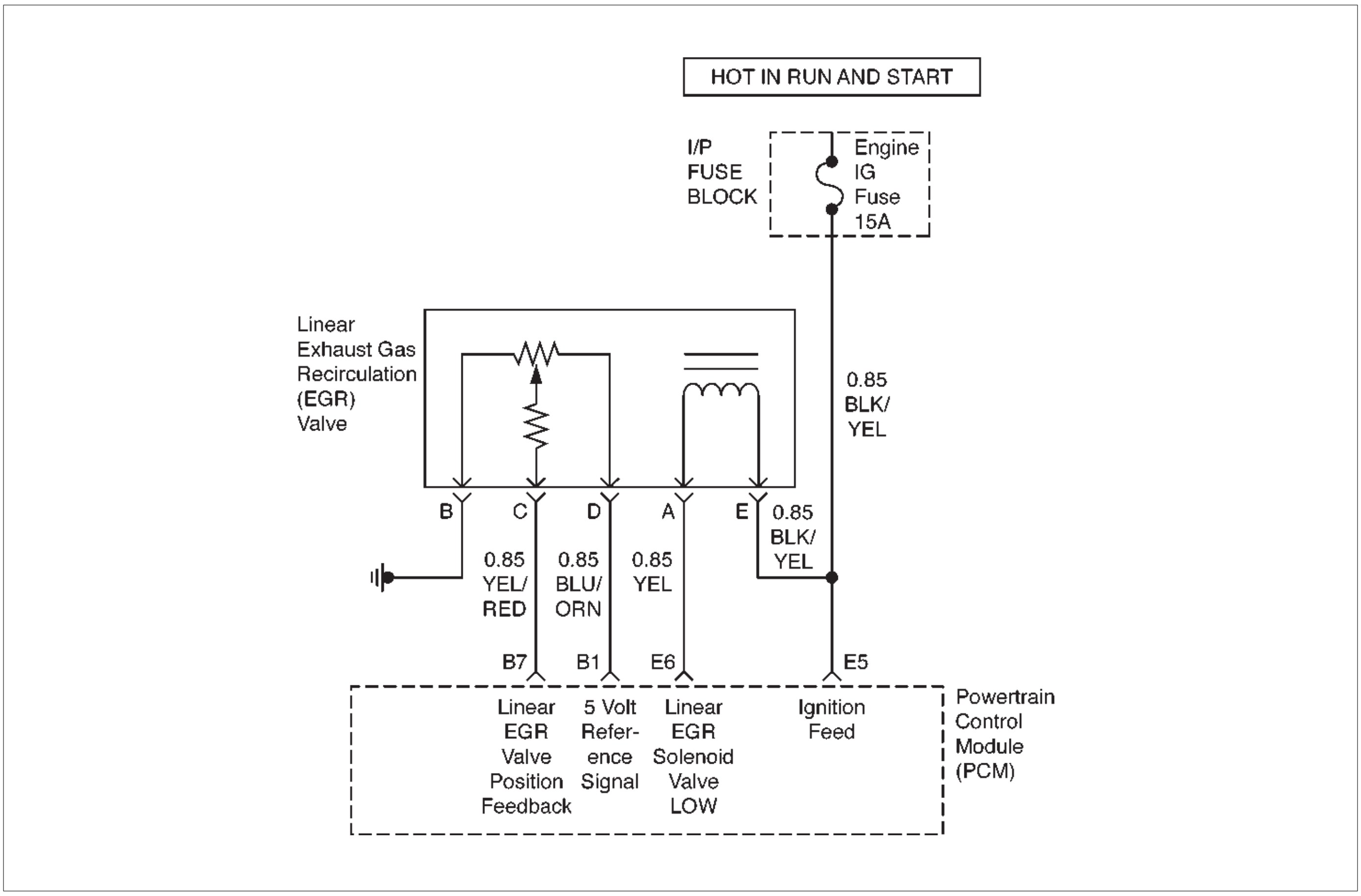
DTC P0404 EGR Circuit Range/Performance

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install a Tech 2. 3. Command the EGR valve to the specified values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to Step 19	Go to Step 3
3	1. Turn the ignition switch ON, with the engine OFF. 2. Disconnect the EGR valve electrical connector. 3. With a test light connected to B+, probe the ground circuit to the EGR valve. Does the light illuminate?	—	Go to Step 4	Go to Step 5
4	1. Connect the test light to ground. 2. Probe the EGR control circuit to the EGR valve. 3. Command the EGR valve to the specified values using a Tech 2. As the command is raised, does the test light glow brighter, flash or maintain a steady glow?	25%, 50%, 75%, 100%	Go to Step 6	Go to Step 7
5	Repair the open or poor connection in the EGR ground circuit. Is the action complete?	—	Go to Step 19	—
6	With the test light still connected to ground, probe the signal circuit. Is the action complete?	—	Go to Step 8	Go to Step 9
7	With the test light still connected to ground, again probe the control circuit without commanding the EGR valve with the Tech 2. Does the test light illuminate?	—	Go to Step 10	Go to Step 11
8	Check the signal circuit for a short to voltage and repair as necessary. Was a repair necessary?	—	Go to Step 19	Go to Step 12
9	With a Digital Voltmeter (DVM) connected to ground, probe the 5 V reference circuit. Is the voltage measured near the specified value?	5 V	Go to Step 13	Go to Step 14
10	Check the control circuit for a short to voltage and repair as necessary. Was a repair necessary?	—	Go to Step 19	Go to Step 12
11	Connect the test light to B+ and again probe the control circuit. Does the light illuminate?	—	Go to Step 15	Go to Step 16

DTC P0404 EGR Circuit Range/Performance (Cont'd)

Step	Action	Value(s)	Yes	No
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to Step 19	—
13	Check the EGR ground circuit for a poor connection or proper terminal tension at the PCM and repair as necessary. Was a repair necessary?	—	Go to Step 19	Go to Step 17
14	Check the 5 V reference circuit for a short to voltage and repair as necessary. Was a repair necessary?	—	Go to Step 19	Go to Step 12
15	Check the control circuit for a short to ground and repair as necessary? Was a repair necessary?	—	Go to Step 19	Go to Step 12
16	Check the control circuit for an open or poor connection at the EGR valve electrical connector and repair as necessary. Was a repair necessary?	—	Go to Step 19	Go to Step 18
17	Replace the EGR valve. Is the action complete?	—	Go to Step 19	—
18	Check the PCM electrical connector for a poor connection and repair as necessary. Was a repair necessary?	—	Go to Step 19	Go to Step 12
19	1. Using the Tech 2, clear Diagnostic Trouble Codes. 2. Start engine and idle at normal operating temperature. 3. Operate vehicle within the conditions for setting this Diagnostic Trouble Code as specified in the supporting text. Does the Tech 2 indicate that this diagnostic "Ran and Passed?"	—	Verify repair	Go to Step 2

DIAGNOSTIC TROUBLE CODE (DTC) P0405 EXHAUST GAS RECIRCULATION (EGR) SENSOR CIRCUIT LOW



D06RX055

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Oxides of Nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold form the exhaust manifold through an orifice with a PCM controlled pintle. The PCM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The PCM then commands the EGR valve to operate when necessary by controlling an ignition signal through the PCM. This can be monitored on a Tech 2 as the Desired EGR Position.

The PCM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the PCM. This feedback signal can also be monitored on a Tech 2 and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

If the PCM detects a continuous short to ground in the signal circuit or the sensor, then Diagnostic Trouble Code P0405 will set. DTC P0405 is a type A code.

Conditions for Setting the DTC

- IAT is greater than 5°C (41°F).
- The PCM sees less than 0.10 voltage from the EGR valve sensor.
- A malfunction is present for 10 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate the first time the malfunction is detected.
- The PCM will record operating conditions at the time the diagnostic fails.
- A history Diagnostic Trouble Code is stored.
- The EGR Valve is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history Diagnostic Trouble Code will clear after 40 consecutive warm up cycles without a fault.
- Diagnostic Trouble Codes can be cleared by using the Tech 2.

Diagnostic Aids

Due to the moisture associated with exhaust systems, the EGR valve may freeze and stick in colder weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a Tech 2, the fault can be verified easily. Check the freeze frame data to determine if the Diagnostic Trouble Code set when the vehicle was cold by viewing the Engine Coolant Temperature (EGR).

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 if applicable. This creates an electronic copy of the data taken when the fault occurred. The information is then stored on the Tech 2 for later reference.
2. Commanding the EGR valve open determines whether the EGR system can control the EGR valve accurately and if the fault is present.
3. If the EGR valve 5 volt reference is shorted to ground, the DVM will read no voltage and an additional Diagnostic Trouble Code will be set and engine performance will be poor. When this circuit is open, only a Diagnostic Trouble Code P0405 will be set.
4. Jumping the 5 volt reference circuit to the signal circuit checks the signal circuit and PCM. The Tech 2 should display the Actual EGR Position as 100% if the signal circuit and PCM are OK.
6. Although the PCM and circuitry acted correctly in the previous step, a problem may still lie within the terminals which would not show up in probe type testing. Check the terminals for being backed out, improperly formed or damaged, and for poor tension.
10. All circuits to the EGR valve are OK at this point. The fault lies internally in the EGR valve and therefore must be replaced. Be sure all gasket material is removed from the EGR mounting surface. Even a small amount of material may cause a Diagnostic Trouble Code P0405 to set. Refer the EGR Valve for on vehicle service of the EGR valve.
13. The replacement PCM must be reprogrammed and the crankshaft position system variation procedure must be performed. Refer to the latest procedures for PCM reprogramming and Powertrain Control Module for the Tooth Error Correction Variation Procedure.
14. Check the terminals for being backed out, improperly formed or damaged, and for poor tension.

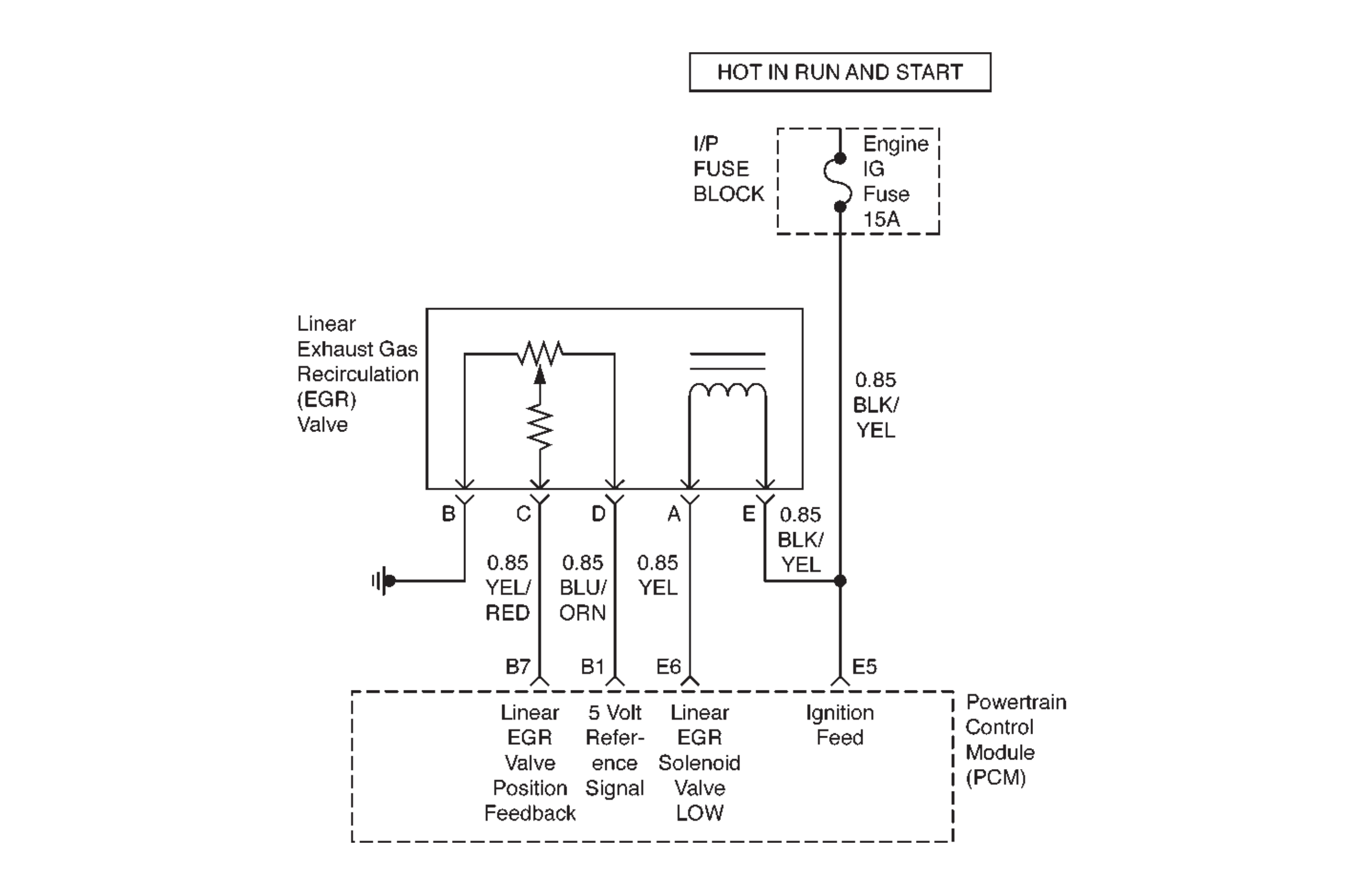
DTC P0405 – EGR Sensor Circuit Low

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install a Tech 2. 3. Command the EGR valve to the specified values. Does the Actual EGR Position follow the Desired EGR Position?	25%, 50%, 75%, 100%	Go to Step 15	Go to Step 3
3	1. Turn the ignition switch ON, with the engine OFF. 2. Disconnect the EGR valve electrical connector. 3. With a Digital Voltmeter (DVM) connected to ground, probe the 5 V reference circuit to the EGR valve. Does the DVM read near the specified value?	5 V	Go to Step 4	Go to Step 5
4	Jumper the EGR valve 5 volt reference circuit to the signal circuit. Does the Actual EGR Position display the specified value?	100%	Go to Step 6	Go to Step 7
5	1. Connect the test light to B+. 2. Probe the 5 V reference circuit to the EGR valve. Does the test light illuminate?	—	Go to Step 8	Go to Step 9

DTC P0405 – EGR Sensor Circuit Low (Cont'd)

Step	Action	Value(s)	Yes	No
6	Check the 5 V reference and signal circuit's for a poor connection or proper terminal tension and repair as necessary. Was a repair necessary?	—	Go to Step 15	Go to Step 10
7	1. Connect the test light to B+. 2. Probe the signal circuit to the EGR valve. Does the light illuminate?	—	Go to Step 11	Go to Step 12
8	Check for a short to ground in the EGR valve 5 V reference circuit and repair as necessary. Was a repair necessary?	—	Go to Step 15	Go to Step 13
9	Check for an open in the EGR valve 5 V reference circuit and repair as necessary. Was a repair necessary?	—	Go to Step 15	Go to Step 14
10	Replace the EGR valve. Is the action complete?	—	Go to Step 15	—
11	Check for a short to ground in the EGR valve signal circuit and repair as necessary. Was a repair necessary?	—	Go to Step 15	Go to Step 13
12	Check for an open in the EGR valve signal circuit and repair as necessary. Was a repair necessary?	—	Go to Step 15	Go to Step 14
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to Step 15	—
14	Check the affected circuit for a poor connection or proper terminal at the PCM and repair as necessary. Was a repair necessary?	—	Go to Step 15	Go to Step 13
15	1. Using the Tech 2, clear the Diagnostic Trouble Codes. 2. Start engine and idle at normal operating temperature. 3. Operate vehicle within the conditions for setting this Diagnostic Trouble Code as specified in the supporting text. Does the Tech 2 indicate that this diagnostic ran and passed?	—	Verify repair	Go to Step 2

DIAGNOSTIC TROUBLE CODE (DTC) P0406 EXHAUST GAS RECIRCULATION (EGR) SENSOR CIRCUIT HIGH



D06RX055

Circuit Description

An Exhaust Gas Recirculation (EGR) system is used to lower Oxides of Nitrogen (NOx) emission levels caused by high combustion temperatures. It accomplishes this by feeding small amounts of exhaust gases back into the combustion chamber. When the air/fuel mixture is diluted with the exhaust gases, combustion temperatures are reduced.

A linear EGR valve is used on this system. The linear EGR valve is designed to accurately supply exhaust gases to the engine without the use of intake manifold vacuum. The valve controls exhaust flow going into the intake manifold form the exhaust manifold through an orifice with a PCM controlled pintle. The PCM controls the pintle position using inputs from the Throttle Position (TP) and Manifold Absolute Pressure (MAP) sensors. The PCM then commands the EGR valve to operate when necessary by controlling an ignition signal through the PCM. This can be monitored on a Tech 2 as the Desired EGR Position.

The PCM monitors the results of its command through a feedback signal. By sending a 5 volt reference and a ground to the EGR valve, a voltage signal representing the EGR valve pintle position is sent to the PCM. This feedback signal can also be monitored on a Tech 2 and is the actual position of the EGR pintle. The Actual EGR Position should always be near the commanded or Desired EGR Position.

If the PCM detects a continuous short to ground in the signal circuit or the sensor, then DTC P0406 will set. Diagnostic Trouble Code P0406 is a type A code.

Conditions for Setting the DTC

- IAT is greater than 5°C (41°F).
- The PCM sees less than 0.10 voltage from the EGR valve sensor.
- A malfunction is present for 10 seconds.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The PCM will record operating conditions at the time the diagnostic fails.
- A history Diagnostic Trouble Code is stored.
- The EGR Valve is disabled.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history Diagnostic Trouble Code will clear after 40 consecutive warm–up cycles without a fault.
- Diagnostic Trouble Code(s) can be cleared by using the Tech 2.

Diagnostic Aids

Due to the moisture associated with exhaust systems, the EGR valve may freeze and stick in colder weather at times. After the vehicle is brought into a warm shop for repairs, the valve warms and the problem disappears. By watching the Actual EGR and Desired EGR Positions on a cold vehicle with a Tech 2, the fault can be verified easily. Check the freeze frame data to determine if the Diagnostic Trouble Code set when the vehicle was cold by viewing the Engine Coolant Temperature (EGR).

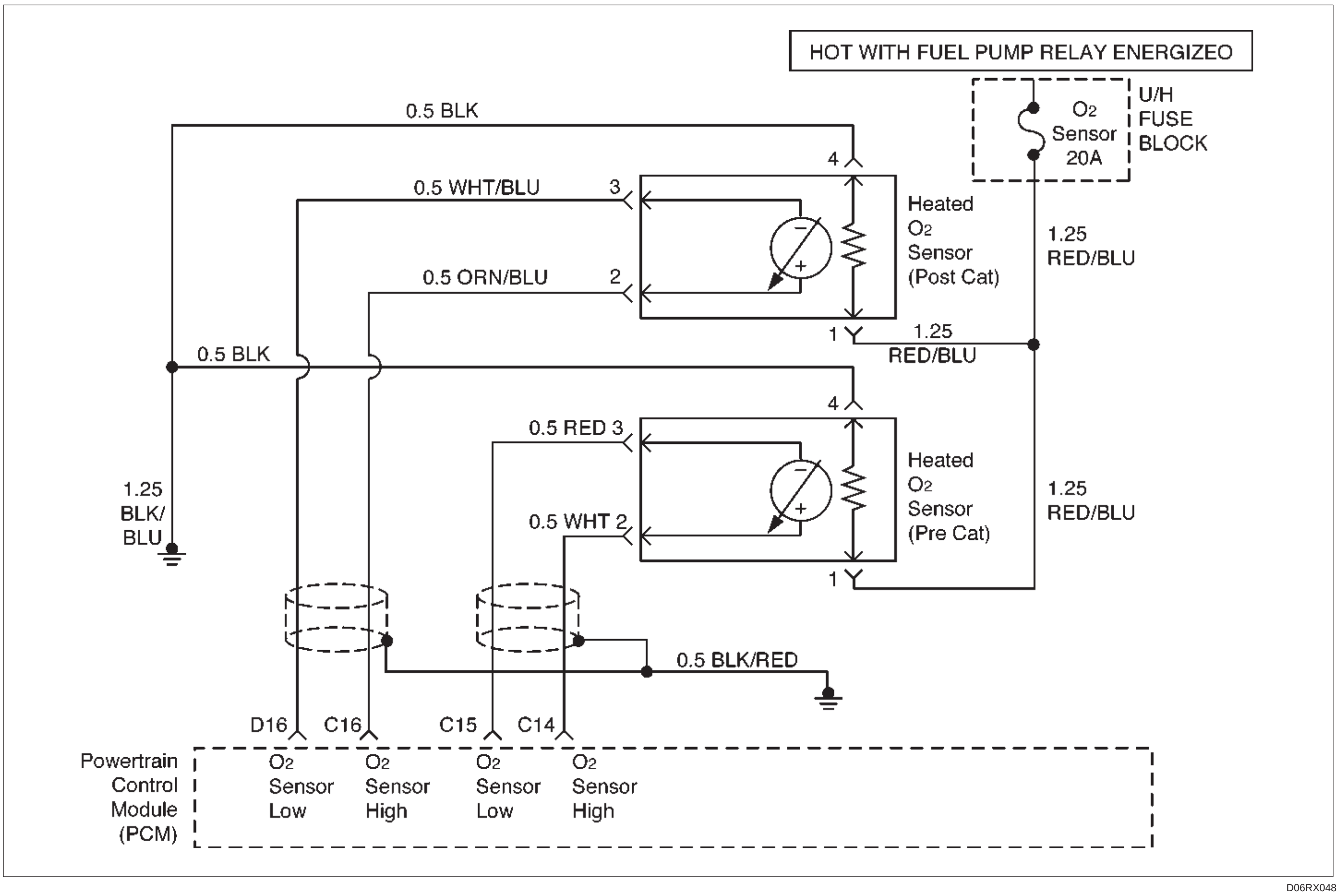
DTC P0406 EGR Sensor Circuit High

Step	Action	Value(s)	Yes	No
1	Was the Powertrain ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Turn the ignition switch ON, with the engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTC's. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P0406. Does the Tech 2 indicate DTC P0406 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Disconnect the Linear Exhaust Gas Recirculation (EGR) Valve from the wiring harness. 3. Ignition ON, Engine OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the ignition feed circuit at the Linear Exhaust Gas Recirculation (EGR) Valve wiring harness connector. Does the DVM read the following value?	12 Volts	Go to Step 6	Go to Step 4
4	Check the ignition feed circuit, between the EGR sensor and the ”Engine IG.” fuse, for the following conditions: • An open circuit • A short to ground Was the problem found?	—	Verify repair	—
5	Using a DVM, check the resistance of the EGR solenoid. Does the DVM read the following value?	less then 5 Ω	Go to Step 6	Go to Step 14
6	Check the EGR solenoid valve Low circuit, between the EGR sensor and the PCM, for the following conditions: • An open circuit • A short to ground • A short to voltage Was the problem found?	—	Verify repair	Go to Step 15
7	1. Ignition OFF. 2. Disconnect the Linear Gas Recirculation (EGR) Valve from the wiring harness. 3. Ignition ON, Engine OFF. 4. Observe the EGR value on the Tech 2. Does the Tech 2 display the following value(s)?	0 Volts 0%	Go to Step 9	Go to Step 8
8	Check the EGR position feedback circuit, between the EGR sensor and the PCM, for the following conditions: • An open circuit • A short to ground • A short to voltage Was the problem found?	—	Verify repair	Go to Step 15

DTC P0406 EGR Sensor Circuit High (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Ignition ON, Engine OFF. 2. Using a Digital Voltmeter (DVM), check for voltage on the 5 volt Reference signal circuit at the Linear Exhaust Gas Recirculation (EGR) Valve wiring harness connector. Does the DVM read the following value?	about 5 volts	Go to Step 11	Go to Step 10
10	Check the 5 volt Reference signal circuit, between the EGR and the PCM, for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 11
11	1. Ignition OFF. 2. Place a DVM between the 5 volt Reference signal circuit and the 5 volt signal return (ground) circuit at the EGR wiring harness connector. 3. Ignition ON, Engine OFF. Does the DVM read the following value?	about 5 volts	Go to Step 13	Go to Step 12
12	Check the 5 volt signal return (ground) circuit, between the EGR and the PCM, for the following conditions: ● An open circuit ● A short to ground ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 15
13	1. Ignition OFF. 2. Place a fused jumper wire between the 5 volt Reference signal circuit and the EGR valve position feedback circuit at the EGR wiring harness connector. 3. Ignition ON, Engine OFF. 4. Observe the EGR value on the Tech 2. Does the Tech 2 display the following value(s)?	5 volts 100%	Go to Step 14	Go to Step 15
14	Replace the Linear Exhaust Gas Recirculation (EGR) Valve. Verify Repair.	—	—	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P0420 CATALYST SYSTEM EFFICIENCY BELOW THRESHOLD



Circuit Description

The PCM uses the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three–way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the PCM detects a level of Bank 1 HO2S 2 activity that indicates the catalyst is no longer operating efficiently, Diagnostic Trouble Code P0420 will be set. DTC P0420 is a type A code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- The engine is operating in "Closed Loop".
- Engine air load is below 99.6%.
- Engine coolant temperature is above 60˚C (140˚F).
- Calculated air flow is between 10 g/second and 32 g/second.
- Change in engine load is below 3.91%.
- Engine speed is below 3500 RPM.
- Vehicle speed is between 24 km/h and 123 km/h (15 mph and 75 mph).
- Catalyst temperature is above 399˚C (750˚F).
- The PCM determines that the catalyst's oxygen storage capacity is below the acceptable threshold.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0420 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0420 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive and open circuits. If the harness appears to be OK, observe the display on the Tech 2 while moving

connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

- Bank 1 HO2S 1/Bank 1 HO2S 2 Activity Test:

  Ensure that the engine is fully warmed up.

  Using a Tech 2, monitor Bank 1 HO2S 1 and Bank 1 HO2S 2 displays in "Neutral" while using the Tech 2 IAC RPM control function to maintain a mass air flow of 10 g/second. Compare the amount of activity (frequency and amplitude) on Bank 1 HO2S 1 to the activity on Bank 1 HO2S 2 over a 30 second period.

If the amount of activity on Bank 1 HO2S 2 is nearly as great as the activity on Bank 1 HO2S 1, a problem exists. Use the Diagnostic Trouble Code P0420 diagnostic chart. If much less activity is noted on Bank 1 HO2S 2, the system is functioning properly.

The "TWC Monitor Test Counter" displayed on the Tech 2 may be used to monitor the progress of the TWC diagnostic. To complete the TWC diagnostic with a good catalyst, the counter must be allowed to increment to 49 samples and roll over to 0 at least twice. A failed catalyst will require three or more 50–sample tests to report a failure.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

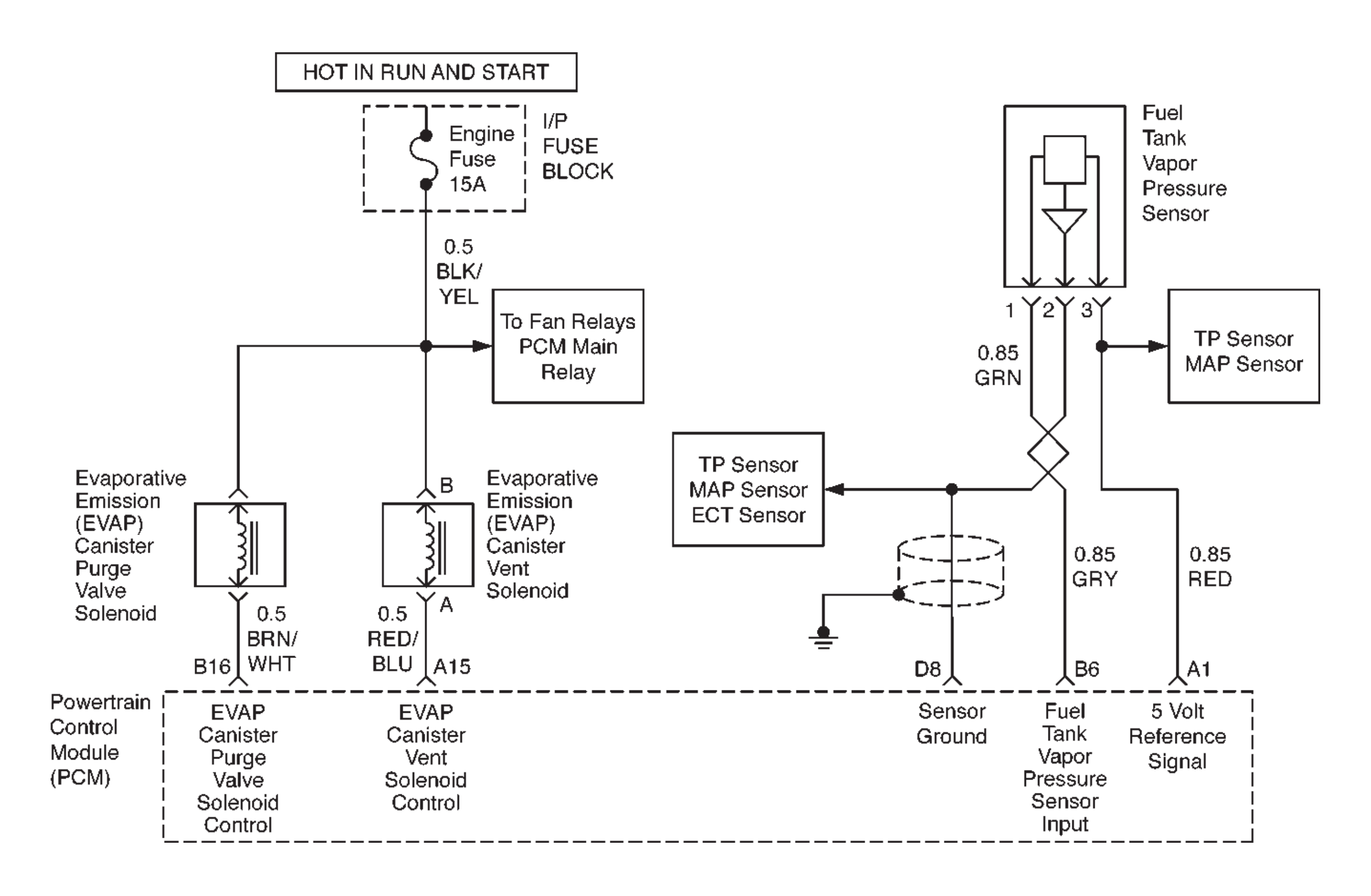
7. Difficulty completing the Diagnostic Trouble Code P0420 "Status This Ign." test may be encountered in areas where test conditions cannot be maintained easily, especially in urban areas. To minimize the amount of driving required to complete the Diagnostic Trouble Code P0420 "Status This Ign." test, use the following procedure:
   - Allow the engine to warm completely.
   - With the vehicle in "Neutral," monitor the calculated air flow on the Tech 2 and hold part throttle to maintain a reading of over 12 g/second for at least 2 minutes. This will achieve the "warm catalyst" required for running the test.
   - Operate the vehicle in second or third gear to remain in the Diagnostic Trouble Code P0420 test conditions described in "Conditions for Setting the Diagnostic Trouble Code" as much as possible. If you must stop the vehicle, maintain the "warm catalyst" criteria as follows:
     – Place the vehicle in "Neutral."
     – Hold part throttle to maintain a calculated air flow reading of over 15 g/second for the duration of the stop.

The "TWC Monitor Test Counter" displayed on the Tech 2 may be used to monitor the progress of the TWC diagnostic. To complete the TWC diagnostic with a good catalyst, the counter must be allowed to increment to 49 samples and roll over to 0 at least twice.

DTC P0420 – Catalyst System Efficiency Below Threshold

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Are any other O2 Sensor Diagnostic Trouble Codes set?	—	Diagnose other Diagnostic Trouble Code(s) first	Go to Step 3
3	1. Visually and physically inspect the three–way catalytic converter for damage. Check for the following: • dents • severe discoloration caused by excessive temperatures • holes • internal rattle caused by damaged catalyst 2. Also, ensure that the three–way catalytic converter is a proper original equipment manufacturer part. Did your inspection reveal a problem?	—	Go to Step 6	Go to Step 4
4	1. Visually and physically inspect the exhaust system between the three–way catalytic converter and the rear converter flange for leaks, damage, and loose or missing hardware. 2. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to Step 7 to verify repair	Go to Step 5
5	1. Visually and physically inspect the Bank 1 HO2S 2. 2. Ensure that the Bank 1 HO2S 2 is secure and that the pigtail and wiring harness is not contacting the exhaust pipe or is not other wise damaged. 3. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to Step 7 to verify repair	Go to Step 6
6	Replace the three–way catalytic converter. NOTE: Check for conditions which may cause catalyst damage (refer to Diagnostic Aids). Is the action complete?	—	Go to Step 7 to verify repair	—
7	1. Review and record the Tech 2 Failure Records data. 2. Clear Diagnostic Trouble Code P0420. 3. Start the engine and allow it to warm up until the engine coolant temperature monitored on the Tech 2 is above the specified value. 4. Run the engine to maintain the specified mass air flow range for at least 2 minutes. 5. Operate the vehicle to maintain Diagnostic Trouble Code P0420 test conditions (for detailed instructions, refer to Diagnostic Trouble Code Test Description in Diagnostic Support). 6. Using a Tech 2, monitor “Diagnostic Trouble Code” info for DTC P0420 until the DTC P0420 test runs. 7. Note the test result. Does the Tech 2 indicate DTC P0420 passed this ignition?	Engine coolant temp: greater than 60°C (140°F) Calculated air flow: between 7 g/second and 41 g/second	Verify repair	Go to Diagnostic Aids

DIAGNOSTIC TROUBLE CODE (DTC) P0440 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM MALFUNCTION



D06RX056

Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP vent solenoid
- Fuel tank pressure sensor
- Fuel pipes and hoses
- Fuel vapor lines
- Fuel cap
- EVAP canister
- Purge lines
- EVAP canister purge valve
- EVAP service port

The evaporative emission system is checked by applying vacuum to the EVAP system and monitoring for a vacuum decay. The PCM monitors the vacuum level through the fuel tank pressure sensor signal.

At an appropriate time, the EVAP canister purge valve and the EVAP vent solenoid are turned ON, allowing the engine to draw a small vacuum on the entire evaporative emission system. After the desired vacuum level has been achieved, the EVAP canister purge valve is turned OFF, sealing the system. If a sufficient vacuum level cannot be achieved, a large leak is indicated. This can be caused by the following conditions:

- Missing or faulty fuel cap
- Disconnected or faulty fuel tank pressure sensor
- Disconnected, damaged, pinched, or blocked fuel tank vapor line
- Disconnected or faulty EVAP canister purge valve
- Disconnected or faulty EVAP vent solenoid
- Open ignition feed circuit to the EVAP vent or purge solenoid
- Damaged EVAP canister
- Leaking fuel sender assembly O–ring
- Leaking fuel tank or fuel filler neck

Any of the above conditions can set a Diagnostic Trouble Code P0440. DTC P0440 is a type A code.

Conditions for Setting the DTC

- Diagnostic Trouble Codes P0106, P0107, P0108, P0112, P0113, P0117, P0118, P0121, P0122, P0123, P0125, P0131, P0132, P0133, P0134 and P1133 not set.
- The BARO is greater than 72.3 kPa.
- IAT and ECT are between 3.5˚C (38.5˚F) and 90.5˚F at engine start up.
- The difference between IAT and ECT at start up is less than 6.75˚C (12.2˚F).
- The Vehicle Speed is less than 98 km/h (60 mph).
- The Fuel Tank Level Sensor reads between 10% and 90%.
- Fuel Level counts vary by less than 15 counts in a 0.125 second time frame.
- Maximum Engine Run time is at least 540 seconds.

- The difference between the actual Fuel Tank Pressure and the expected Fuel Tank Pressure is less than the PCM's expectations.

The above conditions are met, and the following condition is met once:

- The EVAP system is unable to achieve or maintain vacuum during the diagnostic test. The amount of decay will vary with the fuel level.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The PCM will disable the EVAP purge vale solenoid.
- The PCM will record operating conditions at the time the diagnostic fails. The Freeze Frame and Failure Records buffers will store this information.
- A history Diagnostic Trouble Code is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after one ignition cycle in which the diagnostic runs without a fault.
- Freeze Frame information and the history Diagnostic Trouble Code will clear after one ignition cycle in which the diagnostic runs without a fault.
- Diagnostic Trouble Codes can be cleared with the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- A missing, loose, or damaged fuel cap.
- Missing or damaged O–rings at the EVAP canister fuel vapor fittings and the purge line fittings.
- A cracked EVAP canister.
- Damaged or disconnected source vacuum line. EVAP purge line, vent hose or fuel tank vapor line.
- The Fuel Pressure Sensor shares a 5 Volt reference with the MAP sensor and TP sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The Fuel Pressure Sensor share a ground with the MAP sensor and the TP sensor.
- A poor connection at the PCM: Inspect the harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals.
- Damaged harness: Inspect the wiring harness to the EVAP vent solenoid, the EVAP purge solenoid, and the fuel tank pressure sensor for shorts to ground, shorts to battery positive and open circuits.
- A kinked, pinched or plugged vacuum source, EVAP purge, or fuel tank vapor line. Verify that the lines are not restricted.

Check for charcoal particles. Refer to Carbon Particles Removal from EVAP System before starting repairs.

Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the Tech 2 for later reference.
4. If a vent solenoid or EVAP canister purge valve electrical malfunction is present, the purge system will not operate correctly. Repairing the electrical malfunction will very likely correct the condition that set Diagnostic Trouble Code P0440.
5. Check the fuel tank pressure sensor at ambient pressure.
7. Forces the fuel tank pressure sensor to re–zero.
8. Determines whether or not the EVAP system is sealed sufficiently to be pressurized. If not, the large leak must be located and corrected before continuing with diagnosis.
9. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.
12. Ensures that sufficient source vacuum is present at the EVAP canister purge valve.
13. Check for a stuck closed EVAP canister purge valve.
20. Insures proper system integrity.

DTC P0440 EVAP Control System Malfunction

Step	Action	Value(s)	Yes	No
1	Was the Powertrain On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Is Diagnostic Trouble Code P0461, P0462 or P0463 also set?	—	Go to Applicable DTC Chart	Go to Step 3
3	1. Visually/Physically check the fuel cap for missing or loose conditions. 2. Replace or tighten the fuel cap is necessary. Was a loose or missing fuel cap found?	—	Go to Step 20	Go to Step 4
4	1. Install a Tech 2. 2. Command the EVAP canister purge valve and vent solenoid ON and OFF with the Tech 2. Does the purge valve and sent solenoid click when commanded ON and OFF?	—	Go to Step 5	Go to PCM Outputs Diagnosis
5	1. Turn the ignition switch OFF. 2. Remove the fuel cap. 3. Turn the ignition switch ON. Is the Fuel Tank Pressure at the specified value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	1.51V	Go to Step 8	Go to Step 6
6	Has the battery been disconnected?	—	Go to EVAP Control System Diagnosis	Go to Step 7
7	Disconnect the battery, wait 20 seconds then reconnect the battery. Is the action complete?	—	Go to Step 5	—
8	**IMPORTANT:** Before continuing with this diagnosis, zero the EVAP Pressure and Vacuum gauges on the EVAP pressure/purge cart J41413. Also, read the temperature variation instruction card. (refer to tool operating instructions). 1. Reinstall the fuel cap. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Connect the EVAP pressure/purge cart J41413 to the EVAP service port. 4. Attempt to pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor the pressure using the gauges on the cart with the switch in the HOLD position). Can the specified value be achieved?	5 in. H2O	Go to Step 9	Go to Step 10
9	1. Maintain the fuel tank pressure at the specified value? 2. Observe the Fuel Tank Pressure on the Tech 2. Is the Fuel Tank Pressure at the specified value?	1.47~1.51V	Go to Step 12	Go to Step 11

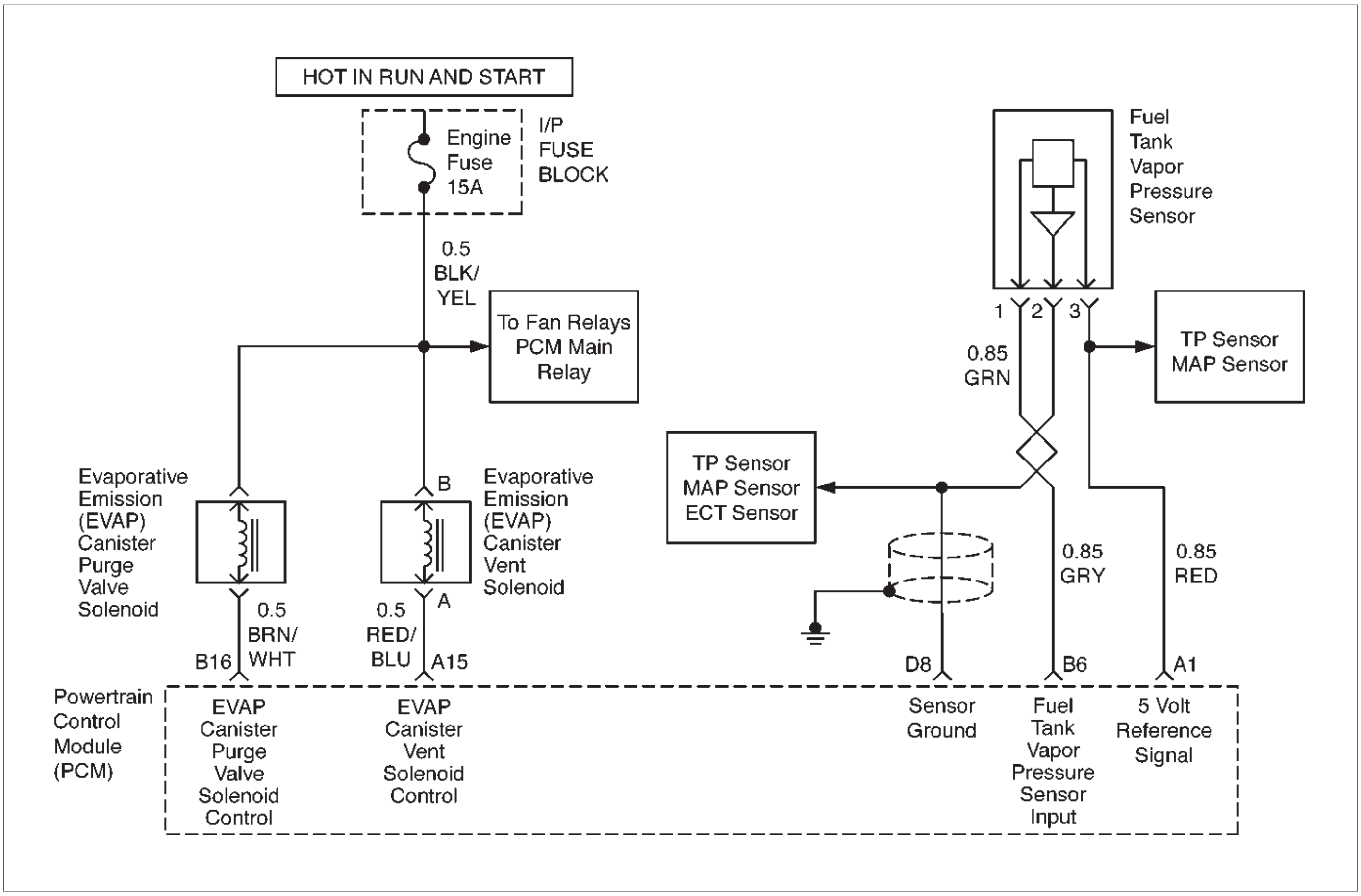
DTC P0440 EVAP Control System Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister. 2. Block the canister fitting for the fuel tank vapor line. 3. Connect a hand vacuum pump to the canister fitting for the EVAP purge line. 4. Ensure that the EVAP vent solenoid is still commanded ON (closed). 5. Attempt to apply the specified vacuum to the EVAP canister. Can vacuum be maintained at the specified value?	5 in. Hg (17 kPa)	Go to Step 15	Go to Step 14
11	1. Visually/physically check for the following conditions: ● Restricted fuel tank vapor line. ● Restricted EVAP purge line. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 20	Go to EVAP Control System Diagnosis
12	1. Disconnect the throttle body to EVAP emission canister purge vale vacuum hose from the EVAP canister purge valve. 2. Connect a hand vacuum pump to the EVAP canister purge vale vacuum source fitting. 3. Apply the specified amount of vacuum to the EVAP canister purge valve. 4. Command the EVAP purge valve ON, using the Tech 2. Does the EVAP canister purge vale release the vacuum?	10in. of Hg (34 kPa)	Go to Step 13	Go to Step 17
13	1. Connect the in. Hg vacuum gauge on the EVAP pressure/purge cart J41413 of the vacuum source line. 2. Start the engine. 3. Stabilize the engine rpm near the specified value. 4. Momentarily depress the throttle open and then immediately let the throttle return to idle. Did the vacuum gauge read greater than the specified value when the throttle was opened then closed?	2500 RPM 10 in. Hg	Go to Diagnostic Aids	Go to Step 18
14	1. Visually/physically check for the following conditions: ● Vent hose disconnected or damaged. ● EVAP canister damaged. 2. If a problem is found, repair as necessary. Was a repair necessary?	—	Go to Step 20	Go to Step 19
15	1. Visually/physically check for the following conditions: ● Missing or malfunctioning fuel cap. ● Disconnected or leaking fuel tank vapor line. ● Disconnected or damaged EVAP purge line. 2. If a problem is found, repair as necessary. Was a repair necessary?	—	Go to Step 20	Go to Step 16

DTC P0440 EVAP Control System Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
16	1. Using the Tech 2, command the EVAP vent solenoid ON. 2. With the cart connected to the EVAP service port continuously attempt to pressurize the EVAP system by leaving the cart control knob in the pressurized position. 3. Using the ultrasonic leak detector J41416, locate and repair any leaks in the EVAP system (it may be necessary to partially lower the fuel tank to examine the top tank connections). Is the action complete?	—	Go to Step 20	—
17	Replace the EVAP canister purge valve. Refer to Diagnostic Aids Is the action complete?	—	Go to Step 20	—
18	Locate and repair the cause of no source or vacuum to the EVAP canister purge valve. Is the action complete?	—	Go to Step 20	—
19	Replace the EVAP vent solenoid. Refer to Diagnostic Aids Is the action complete?	—	Go to Step 20	—
20	**IMPORTANT:** Review the temperature variation instructions included with J41413 before performing this step. 1. Turn the ignition switch ON, with the engine OFF. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor pressure using the gauge on the cart). 4. Switch the rotary switch on the cart to HOLD and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	2.14V	System OK	Go to Step 3

DIAGNOSTIC TROUBLE CODE (DTC) P0442 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM SMALL LEAK DETECTED



D06RX056

Circuit Description

The evaporative system includes the following components:

- Fuel tank.
- EVAP vent solenoid.
- Fuel tank pressure sensor.
- Fuel pipes and hoses.
- Fuel vapor lines.
- Fuel cap.
- EVAP canister.
- Purge lines.
- EVAP canister purge valve.
- EVAP service port.

The evaporative emission system is checked by applying vacuum to the EVAP system and monitoring for a vacuum decay. The PCM monitors the vacuum level through the fuel tank pressure sensor signal. At an appropriate time, the EVAP canister purge valve and the EVAP vent solenoid are turned ON, allowing the engine to draw a small vacuum on the entire evaporative emission system. After the desired vacuum level has been achieved, the EVAP canister purge valve is turned OFF, sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, when all other variables remain constant. A small leak in the system will cause Diagnostic Trouble Code P0442 to be set. DTC P0442 is a type A code.

Conditions for Setting the DTC

- The BARO is greater the 72.3 kPa.
- No: MAP, TPS, IAT, ECT, EGR, EVAP, VSS, or System Voltage Diagnostic Trouble Codes.
- IAT and ECT at startup are between 3.5°C(38°F) and 32°C (90°F).
- The difference between IAT and ECT at startup is less than 6.75°C (12.2°F).
- Vehicle Speed is less than or equal to 98 km/h (60 mph).
- Fuel Level counts vary by less than 8 counts in a 0.125 second time frame.
- The Fuel Tank Level Sensor reads between 10% and 90%.
- Maximum Engine Run time is at least 540 seconds.
- The difference between the actual Fuel Tank Pressure and the expected Fuel Tank Pressure is less than the PCM's expectation.
- Fuel Tank Pressure slope is less than or equal to 1mm (0.03 inches) of water.

The above conditions are met, and the following condition is met once:

- A single 15 second vacuum decay slope and three 5 second vacuum slopes are all greater than or equal to the PCM's upper threshold.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.

- The PCM will record operating conditions at the time the diagnostic fails. The Freeze Frame and Failure Records buffers will store this information.
- A history Diagnostic Trouble Code is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after 3 consecutive ignition cycles in which the diagnostic runs without a fault.
- A history Diagnostic Trouble Code will clear after 40 consecutive warm up cycles without a fault.
- A Tech 2 can clear the Diagnostic Trouble Codes.

Diagnostic Aids

- A loose, missing, or damaged fuel cap.
- Missing or damaged O–rings at the fuel vapor fittings and the EVAP purge line canister fittings.
- Cracked EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel vapor line.
- The Fuel Pressure Sensor shares a 5 Volt reference with the MAP sensor and TP sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The Fuel Pressure Sensor share a ground with the MAP sensor and the TP sensor.
- Poor connection at PCM: Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness: Inspect the wiring harness to the EVAP vent solenoid, the EVAP purge solenoid, and the fuel tank pressure sensor for an intermittent open or intermittent short circuit.

Check for charcoal particles. Refer to Carbon Particle Removal from EVAP System before starting repairs.

Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that causes the Diagnostic Trouble Code to set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 if applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the Tech 2 for later reference.
3. If a vent solenoid or EVAP canister purge valve electrical malfunction is present, the purge system will not operate correctly. Repairing the electrical malfunction will very likely correct the condition that set Diagnostic Trouble Code P0442.
4. Checks the fuel tank pressure sensor at ambient pressure.
6. Forces the fuel tank pressure sensor to re–zero.
7. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.

DTC P0442 EVAP Control System Small Leak Detected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Is Diagnostic Trouble Code P0461, P0462, or P0463 also set?	—	Go to Applicable DTC Table	Go to Step 3
3	1. Install a Tech 2. 2. Command the EVAP canister purge valve and vent solenoid ON and OFF with the Tech 2? Does the purge valve and vent solenoid click ON and OFF?	—	Go to Step 4	Go to PCM Outputs Diagnosis
4	1. Turn the ignition switch OFF. 2. Remove the fuel cap. 3. Turn the ignition switch ON. Is the Fuel Tank Pressure at the specified value? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	1.51V	Go to Step 7	Go to Step 5
5	Has the battery been disconnected?	—	Go to EVAP Control System Diagnosis	Go to Step 6

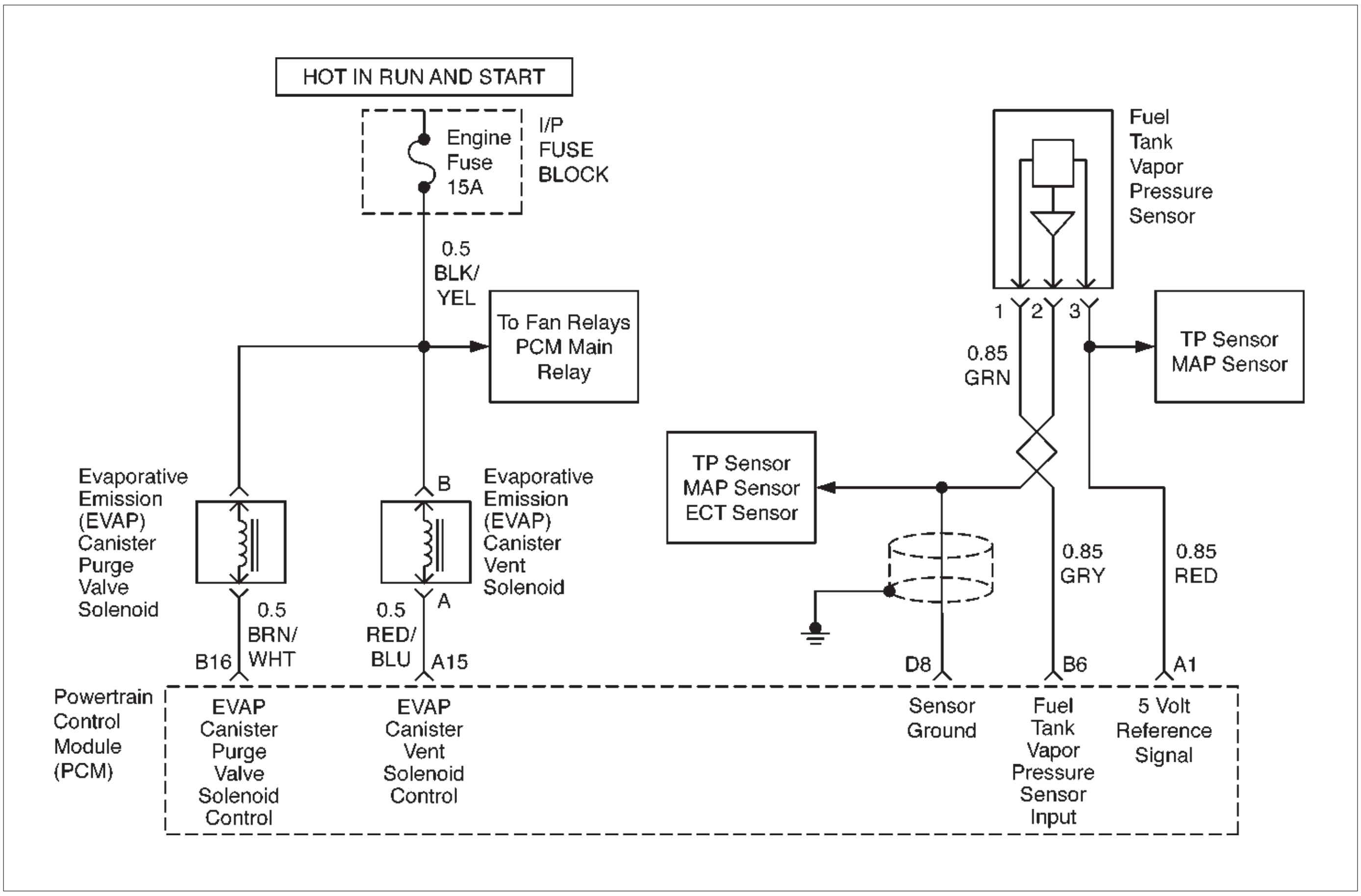
DTC P0442 EVAP Control System Small Leak Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	Disconnect the battery, wait 20 seconds then reconnect the battery. Is the action complete?	—	Go to Step 4	—
7	**IMPORTANT:** Before continuing with this diagnosis, zero the EVAP Pressure and Vacuum Gauges on the EVAP pressure/purge cart J41413. Also read the temperature variation instruction card. (Refer to tool operating instructions). 1. Reinstall the fuel cap. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Connect the EVAP pressure/purge cart J41413 to the EVAP service port. 4. Pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor the pressure using the gauge on the cart with the switch in the HOLD position. 5. Observe the Fuel Tank Pressure on the Tech 2. Is the Fuel Tank Pressure at the specified value?	5 in. H2O (±2 in. H2O)	Go to Step 8	Go to EVAP Control System Diagnosis
8	**IMPORTANT:** Review the temperature variation instructions included with the J41413 before performing this step. 1. Turn the ignition switch ON, with the engine OFF. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor the pressure using the gauge on the cart). 4. Switch the rotary switch on the cart to HOLD and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	1.47 – 1.51V	Go to Step 9	Refer to Diagnostic Aids
9	1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister. 2. Block the fuel tank vapor line fitting on the canister. 3. Connect a hand vacuum pump to the EVAP purge line fitting on the canister. 4. Ensure that the EVAP vent solenoid is still commanded ON (closed). 5. Attempt to apply vacuum to the canister. Can the specified vacuum be maintained?	5 in. Hg	Go to Step 12	Go to Step 10
10	1. Visually/physically check for the following conditions: • Vent hose disconnected or damaged. • EVAP canister damaged 2. If a problem is found, repair as necessary Was a repair necessary?	—	Go to Step 14	Go to Step 11
11	Replace the EVAP vent solenoid. Refer to Diagnostic Aids Is the action complete?	—	Go to Step 14	—

DTC P0442 EVAP Control System Small Leak Detected (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Visually/physically check for the following conditions: ● Malfunctioning fuel cap. ● Leaking fuel tank vapor line. ● Damaged EVAP purge line. 2. If a problem is found, repair as necessary Was a repair necessary?	—	Go to Step 14	Go to Step 13
13	1. Using the Tech 2, command the EVAP vent solenoid ON (closed). 2. With the EVAP pressure/purge cart J41413 connected to the EVAP system by leaving the cart control knob in the pressurized position. 3. Using the ultrasonic leak detector J41416, locate and repair the leak in the EVAP system (it may be necessary to partially lower the fuel tank to examine the top tank connections). Is the action complete?	—	Go to Step 14	—
14	**IMPORTANT:** Review the temperature variation instructions included with the J41413 before performing this step. 1. Turn the ignition switch ON, with engine OFF. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor the pressure using the gauge on the cart). 4. Switch the rotary switch on the cart to HOLD and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	2.14V	System OK	Go to Step 3

DIAGNOSTIC TROUBLE CODE (DTC) P0443 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM PURGE CONTROL VALVE CIRCUIT MALFUNCTION



Circuit Description

The Powertrain Control Module (PCM) controls the Evaporative Emission (EVAP) Canister Purge Solenoid Valve through the use of a control (ground) circuit. If the PCM commands the Purge solenoid to maximum duty cycle (100%) but the voltage remains High (12 Volts); or, if the PCM commands the Purge solenoid to minimum duty cycle (0%) but the voltage remains Low (0 volts), then DTC P0443 will set. DTC P0443 is a type A code.

Conditions for Setting the DTC

- Ignition voltage is greater than 10 volts
- Engine run time is greater than 32 seconds

The above mentioned conditions are met and one of the following two conditions are met for 25 seconds within a 50 seconds test sample:

- PCM senses voltage is High with the EVAP Canister Purge Solenoid commanded ON.
- PCM senses voltage is Low with the EVAP Canister Purge Solenoid commanded OFF.

Action Taken When the DTC Sets

- The PCM will illuminate the Malfunction Indicator Lamp (MIL) the first time the fault is detected.
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL after three consecutive trips without a reported failure.
- A History DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- Poor connections , or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also check for open circuits, shorts to ground, and shorts to voltage.
- The Fuel Pressure Sensor shares a 5 Volt reference with the MAP sensor and TP sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The Fuel Pressure Sensor share a ground with the MAP sensor and the TP sensor.

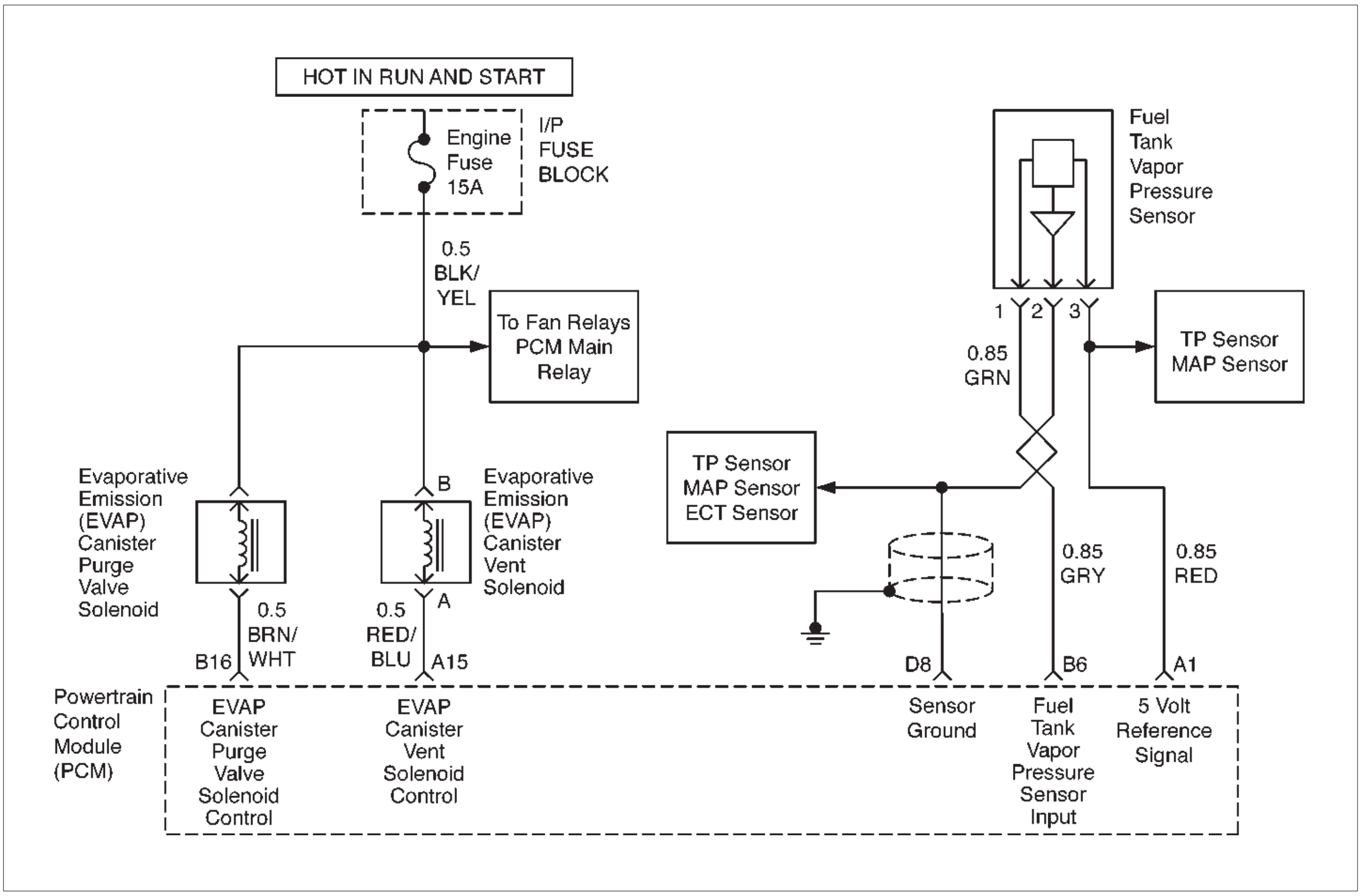
DTC P0443 EVAP Control System Purge Control Valve Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTC’s. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P0443. Does the Tech 2 indicate DTC P0443 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Disconnect the EVAP Canister Purge Solenoid from the wiring harness connector from the EVAP Canister Purge Solenoid. 3. Ignition ON, Engine OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the ”Engine IG.” Fuse pin of the EVAP Canister Purge Solenoid wiring harness connector. Does the DVM read the following value?	12 Volts	Go to Step 5	Go to Step 4
4	Check the suspect circuit between the EVAP Canister Purge Solenoid connector and the ”Engine IG.” Fuse for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	—
5	Using a DVM, check the resistance of the EVAP Canister Purge Solenoid. Does the DVM read the following value?	less than 5 Ω	Go to Step 6	Go to Step 7
6	1. Ignition OFF. 2. Disconnect the Powertrain Control Module (PCM) connectors from the PCM. 3. Check the EVAP Canister Purge Solenoid control circuit between the PCM and EVAP Canister Purge Solenoid for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	Go to Step 8

DTC P0443 EVAP Control System Purge Control Valve Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
7	Replace the EVAP Canister Purge Solenoid. Verify Repair.	—	—	—
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P0446 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM VENT CONTROL CIRCUIT MALFUNCTION



D06RX056

Circuit Description

The evaporative system includes the following components:

- Fuel tank.
- EVAP vent solenoid.
- Fuel tank pressure sensor.
- Fuel pipes and hoses.
- Fuel vapor lines.
- Fuel cap.
- EVAP canister.
- Purge lines.
- EVAP canister purge valve.
- EVAP service port.

The evaporative emission system is checked by applying vacuum to the EVAP system and monitoring for a vacuum decay. The PCM monitors the vacuum level through the fuel tank pressure sensor signal.

At an appropriate time, the EVAP canister purge valve and the EVAP vent solenoid are turned ON, allowing the engine to draw a small vacuum on the entire evaporative emission system. After the desired vacuum level has been achieved, the EVAP canister purge valve is turned OFF, sealing the system.

A restricted or blocked EVAP canister vent path is detected by drawing a vacuum on the EVAP system, turning OFF the EVAP vent solenoid and the EVAP canister purge valve (EVAP vent solenoid Open, EVAP purge PWM 0%) and monitoring the fuel tank vacuum sensor input. With the EVAP vent solenoid open, any vacuum in the system should decrease quickly unless the vent path is blocked. A blockage can be caused by the following conditions:

- Faulty EVAP vent solenoid (stuck closed).
- Plugged, kinked or pinched vent hose.
- Shorted EVAP vent solenoid driver circuit.
- Plugged evaporative canister.

If any of these conditions are present, Diagnostic Trouble Code P0446 will set. DTC P0446 is a type B code.

Conditions for Setting the DTC

- The BARO is greater than 72.3 kPa.
- No: MAP, TPS, IAT, ECT, EGR, EVAP, VSS or System Voltage Diagnostic Trouble Codes.
- IAT and ECT at startup are between 3.5°C(38°F) and 32°C (90°F).
- The difference between IAT and ECT at startup is less than 6.75°C (12.2°F).
- The Fuel Tank Level Sensor reads between 10% and 90%.
- The difference between the actual Fuel Tank Pressure and the expected Fuel Tank Pressure is less than the PCM's expectation.
- Fuel Tank Pressure slope is less than or equal to 1mm (0.03 inches) of water.

The above conditions are met, and the following condition is met once:

- Fuel Tank vacuum is greater than 39 cm (15.35 inches) of water.

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate.
- The PCM will records operating conditions at the time the diagnostic fails. The Freeze Frame and Failure Records buffers will store this information.
- A history Diagnostic Trouble Code is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn off after 3 consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- A Tech 2 can clear the DTC's.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM: Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- The Fuel Pressure Sensor shares a 5 Volt reference with the MAP sensor and TP sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The Fuel Pressure Sensor share a ground with the MAP sensor and the TP sensor.
- Damaged harness: Inspect the wiring harness to the EVAP vent solenoid and the fuel tank pressure sensor for shorts to ground, shorts to battery positive, and open circuits.
- Kinked, pinched or plugged vent hose: Verify that the vent hose between the canister and the EVAP vent solenoid is not restricted.

Check for charcoal particles. Refer to Carbon Particles Removal from EVAP System before starting repairs.

Reviewing the Fail Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that causes the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 if applicable. This creates an electronic copy of the data taken when the malfunction occurs. This may assist in diagnosing the condition.
3. If a vent solenoid electrical malfunction is present, the purge system will not operate correctly. Repairing the electrical malfunction will very likely correct the condition that set Diagnostic Trouble Code P0446.
4. Checks the fuel tank pressure sensor at ambient pressure.
6. Forces the fuel tank pressure sensor to re–zero.
7. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.
9. Checks for a blocked EVAP canister.
13. Duplicates the Powertrain On–Board Diagnostic test.

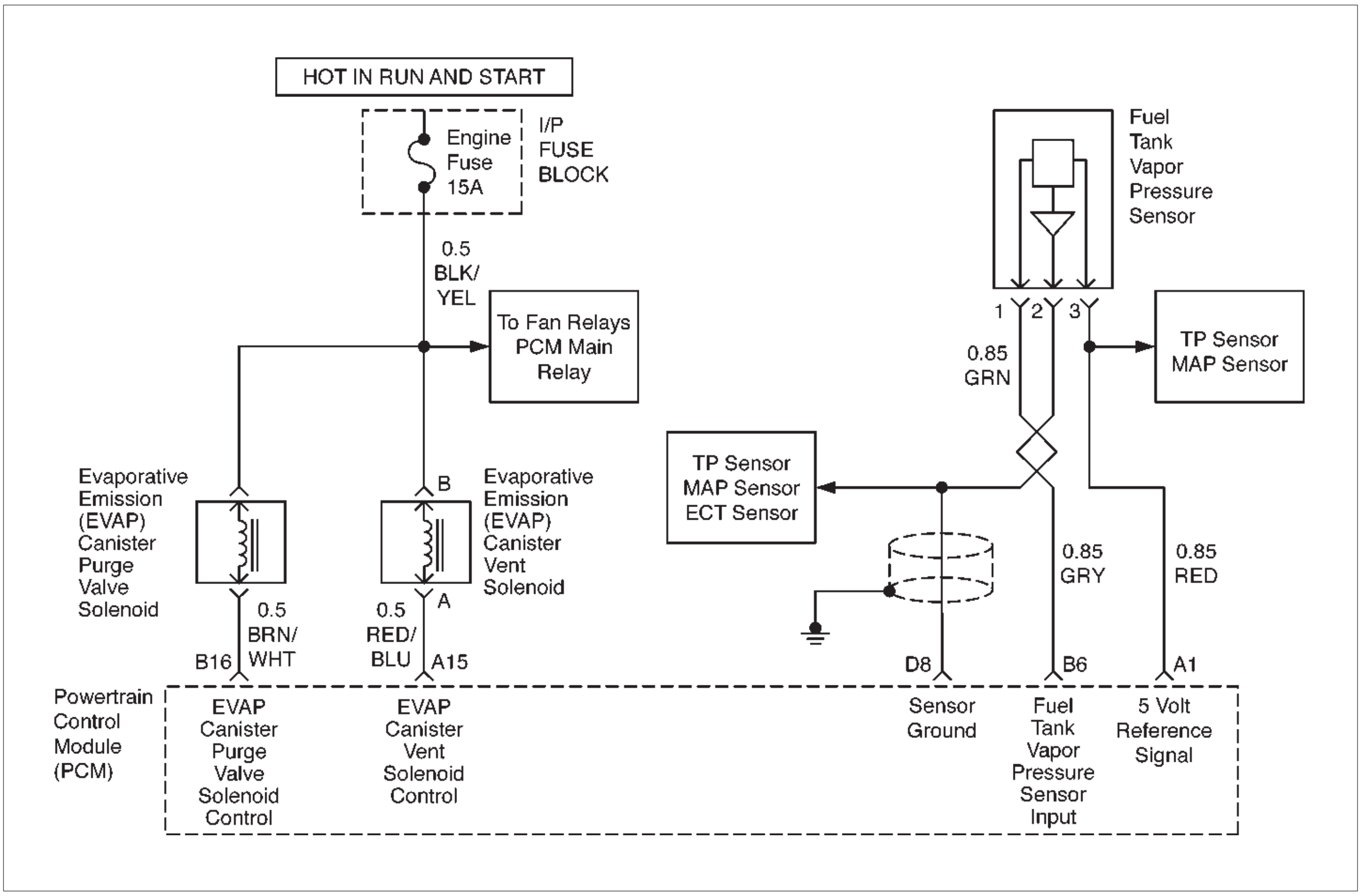
DTC P0446 EVAP Control System Vent Control Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Is Diagnostic Trouble Code P0461, P0462, or P0463 also set?	—	Go to Applicable DTC chart	Go to Step 3
3	1. Install a Tech 2. 2. Command the EVAP canister purge valve and vent solenoid ON and OFF with the Tech 2? Does the purge valve and vent solenoid click ON and OFF? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	–	Go to Step 4	Go to PCM Outputs Diagnosis
4	1. Turn the ignition switch OFF. 2. Remove the fuel cap. 3. Turn the ignition switch ON. Is the Fuel Tank Pressure at the specified value?	1.51V	Go to Step 7	Go to Step 5
5	Has the battery been disconnected?	—	Go to EVAP Control System Diagnosis	Go to Step 6
6	Disconnect the battery, wait 30 seconds, then reconnect the battery. Is the action complete?	—	Go to Step 4	—
7	**IMPORTANT:** Before continuing with this diagnosis, zero the EVAP Pressure and Vacuum Gauges on the EVAP pressure/purge cart J41413. Also read the temperature variation instruction card. (Refer to tool operating instructions). 1. Reinstall the fuel cap. 2. Using the Tech 2, command the EVAP vent solenoid ON (closed). 3. Connect the EVAP pressure/purge cart J41413 to the EVAP service port. 4. Pressurize the EVAP system to the specified value using the EVAP pressure/purge cart J41413 (monitor the pressure using the gauge on the cart with the switch in the "HOLD" position. 5. Observe the Fuel Tank Pressure on the Tech 2. Is the Fuel Tank Pressure at the specified value?	1.52 – 1.69V	Go to Step 8	Go to EVAP Control System Diagnosis
8	1. Maintain the specified EVAP pressure. 2. Using the Tech 2, command the EVAP vent solenoid OFF (open) while observing the EVAP pressure gauge on the cart J41413. Does the EVAP pressure return to the specified value within 5 seconds?	0 in. H2O	Refer to Diagnostic Aids	Go to Step 9

DTC P0446 EVAP Control System Vent Control Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Disconnect the large vent hose (marked air) from the EVAP canister. 2. Switch the rotary switch on the cart J41413 to PURGE. 3. Start the engine and allow the engine to reach operating temperature. 4. Observe the vacuum gauge for 5 seconds while holding the engine speed at the specified value. Does the vacuum remain below the specified value?	30 in. H_2O 2500 RPM	Go to Step 10	Go to Step 12
10	1. Inspect the EVAP vent hose between the EVAP canister and the EVAP vent solenoid for being kinked, pinched, or other wise blocked. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to Step 13	Go to Step 11
11	Replace the EVAP vent solenoid. Refer to Diagnostic Aids Is the action complete?	—	Go to Step 13	—
12	Replace the EVAP canister. Refer to EVAP Canister Replacement. Is the action complete?	—	Go to Step 13	—
13	1. Using the Tech 2, command the EVAP vent solenoid ON (closed). 2. Pressurize the EVAP system to the specified value. 3. Switch the rotary switch on the cart J41413 to HOLD. 4. Using the Tech 2, command the EVAP vent solenoid OFF (open) while observing the EVAP pressure gauge on the cart J41413. Does the EVAP pressure return to the specified value within 5 seconds?	1.51V	System OK	Go to Step 3

DIAGNOSTIC TROUBLE CODE (DTC) P0449 EVAPORATIVE EMISSION (EVAP) CONTROL SYSTEM VENT VALVE/SOLENOID CIRCUIT MALFUNCTION



D06RX056

Circuit Description

The Powertrain Control Module (PCM) controls the Evaporative Emission (EVAP) Canister Vent Solenoid Valve through the use of a control (ground) circuit. If the PCM commands the Vent solenoid but the voltage remains High (12 Volts); or, if the PCM commands the Vent solenoid OFF but the voltage remains Low (0 volts), then DTC P0449 will set. DTC P0449 is a type A code.

Conditions for Setting the DTC

- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 32 seconds.

The above mentioned conditions are met and one of the following two conditions are met for 25 seconds within a 50 seconds test sample:

- PCM senses voltage is High with the EVAP Canister Vent Solenoid commanded ON.
- PCM senses voltage is Low with the EVAP Canister Vent Solenoid commanded OFF.

Action Taken When the DTC Sets

- The PCM will illuminate the Malfunction Indicator Lamp (MIL).
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL after three consecutive trips without a reported failure.
- A History DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- Poor connections , or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also check for open circuits, shorts to ground, and shorts to voltage.
- The Fuel Pressure Sensor shares a 5 Volt reference with the MAP sensor and TP sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The Fuel Pressure Sensor share a ground with the MAP sensor and the TP sensor.

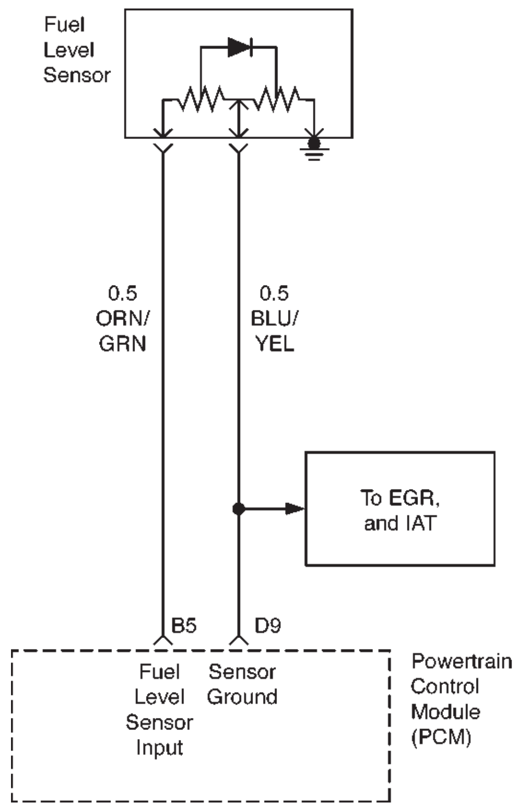
DTC P0449 EVAP Control System Vent Valve/Solenoid Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTC’s. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P0449. Does the Tech 2 indicate DTC P0449 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Disconnect the EVAP Canister Purge Solenoid from the wiring harness connector from the EVAP Canister Purge Solenoid. 3. Ignition ON, Engine OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the ”Engine IG.” Fuse pin of the EVAP Canister Purge Solenoid wiring harness connector. Does the DVM read the following value?	12 Volts	Go to Step 5	Go to Step 4
4	Check the suspect circuit between the EVAP Canister Purge Solenoid connector and the ”Engine IG.” Fuse for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	—
5	Using a DVM, check the resistance of the EVAP Canister Purge Solenoid. Does the DVM read the following value?	less than 5 Ω	Go to Step 6	Go to Step 4
6	1. Ignition OFF. 2. Disconnect the Powertrain Control Module (PCM) connectors from the PCM. 3. Check the EVAP Canister Purge Solenoid control circuit between the PCM and EVAP Canister Purge Solenoid for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	—

DTC P0449 EVAP Control System Vent Valve/Solenoid Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
7	Replace the EVAP Canister Purge Solenoid.	—	Verify repair.	Go to Step 7
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.	—	Verify repair.	Go to Step 8

DIAGNOSTIC TROUBLE CODE (DTC) P0461 FUEL LEVEL SENSOR CIRCUIT RANGE/PERFORMANCE



D06RX057

Circuit Description

The Fuel Level sensor is an important input to the PCM for the Enhanced Evaporative System Diagnostic. The PCM needs the fuel level information in order to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the EVAP system. Several of the Enhanced Evaporative System Diagnostic sub–test are dependent upon correct fuel level information. The diagnostic will not run when the tank is greater than 85% or less than 15% full. (This sensor signal disables the misfire when the fuel levels are less than 15%). DTC P0461 is a type D Code.

Conditions for Setting the DTC

- The Fuel Tank Level Slosh Test is completed.
- The Tank Level Main Test is completed.
- The Fuel Tank Level Data is Valid.
- The Fuel Level signal changes by less than 7 counts (0.14 volts) over a distance of 240 km (146 miles).

Action Taken When the DTC Sets

- The PCM will not turn on the MIL.

Conditions for Clearing the DTC

- The PCM turns the MIL off after 3 consecutive driving trips withouta fault condition present.
- A history DTC will clear if no fault conditions have been detected for 40 warm–up cycles (coolant temperature has risen 40°F from the start–up coolant temperature and the engine coolant temperature exceeds 160°F during that same ignition cycle) or the Tech 2 clearing feature has been used.

Test Description

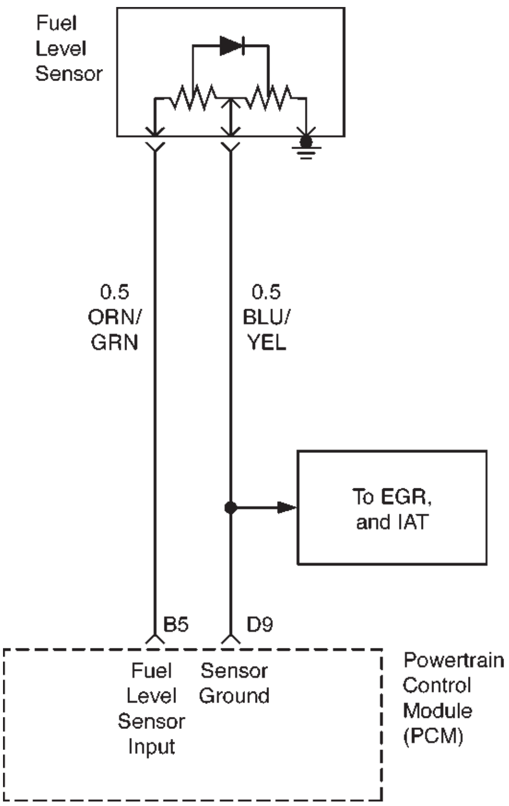
Number(s) below refer to the step number(s) on the Diagnostic Chart:

4. This step determines if the fuel gauge and fuel level sender module are operating correctly.

DTC P0461 Fuel Level Sensor Circuit Range/Performance

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Install the Tech 2. 2. Turn ON the ignition. 3. Compare the fuel level on the Tech 2 with the vehicle fuel gauge. Are the levels approximately the same?	—	Go to Step 3	Go to Step 5
3	1. Record the vehicle fuel gauge reading. 2. Turn OFF the ignition. 3. Disconnect the PCM's connector. 4. Turn ON the ignition. Did the vehicle fuel gauge reading change?	—	Go to Step 4	Go to Step 5
4	1. Turn the ignition OFF. 2. Disconnect the fuel tank level sensor connector. 3. Using a fused jumper wire, jump the fuel level input to the fuel level sensor ground. 4. Turn the ignition ON. Does the Tech 2 and the fuel gauge indicate the specified value?	0% (Empty)	Go to Step 5	Go to Step 6
5	Replace the Fuel tank level sensor.	—	Go to Step 7	—
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to Step 7	—
7	1. Using the Tech 2, select the Diagnostic Trouble Code, and Clear Info. 2. Start the engine. 3. Idle at the normal operating temperature. 4. Select the DTC and the Specific 5. Enter the DTC number which was set. 6. Operate the vehicle within the conditions for setting this DTC. Does the Tech 2 indicate that this diagnostic Ran and Passed?	—	System OK	Go to Step 2

DIAGNOSTIC TROUBLE CODE (DTC) P0462 FUEL LEVEL SENSOR CIRCUIT LOW INPUT



D06RX057

Circuit Description

The Fuel Level Sensor is an important input to the PCM for the Enhanced Evaporative System Diagnostic. The PCM needs the fuel level information in order to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the EVAP system. Several of the Enhanced Evaporative System Diagnostic sub–test are dependent upon correct fuel level information. The diagnostic will not run when the tank is greater than 85% or less than 15% full. (This sensor signal disables the misfire when the fuel levels are less than 15%). If the PCM detects a continuous short to ground in the Fuel Level sensor or circuit, then a code P0462 will set. DTC P0462 is a type D code.

Conditions for Setting the DTC

- The Fuel Tank Slosh Test is completed.
- The Fuel Tank Main Level Test is completed.
- The Fuel Tank Level Data is valid.
- The Fuel Level signal voltage is less than 0.06 volts for a period greater than 20 seconds.

Action Taken When the DTC Sets

- The PCM will not turn on the MIL.

Conditions for Clearing the DTC

- The PCM turns the MIL OFF after 3 consecutive driving trips without a fault condition present.
- A history Diagnostic Trouble Code will clear if no fault conditions have been detected for 40 warm–up cycles (coolant temperature has risen 40°F from the start–up coolant temperature and the engine coolant temperature exceeds 160°F during that same ignition cycle) or the Tech 2 clearing feature has been used.

Test Description

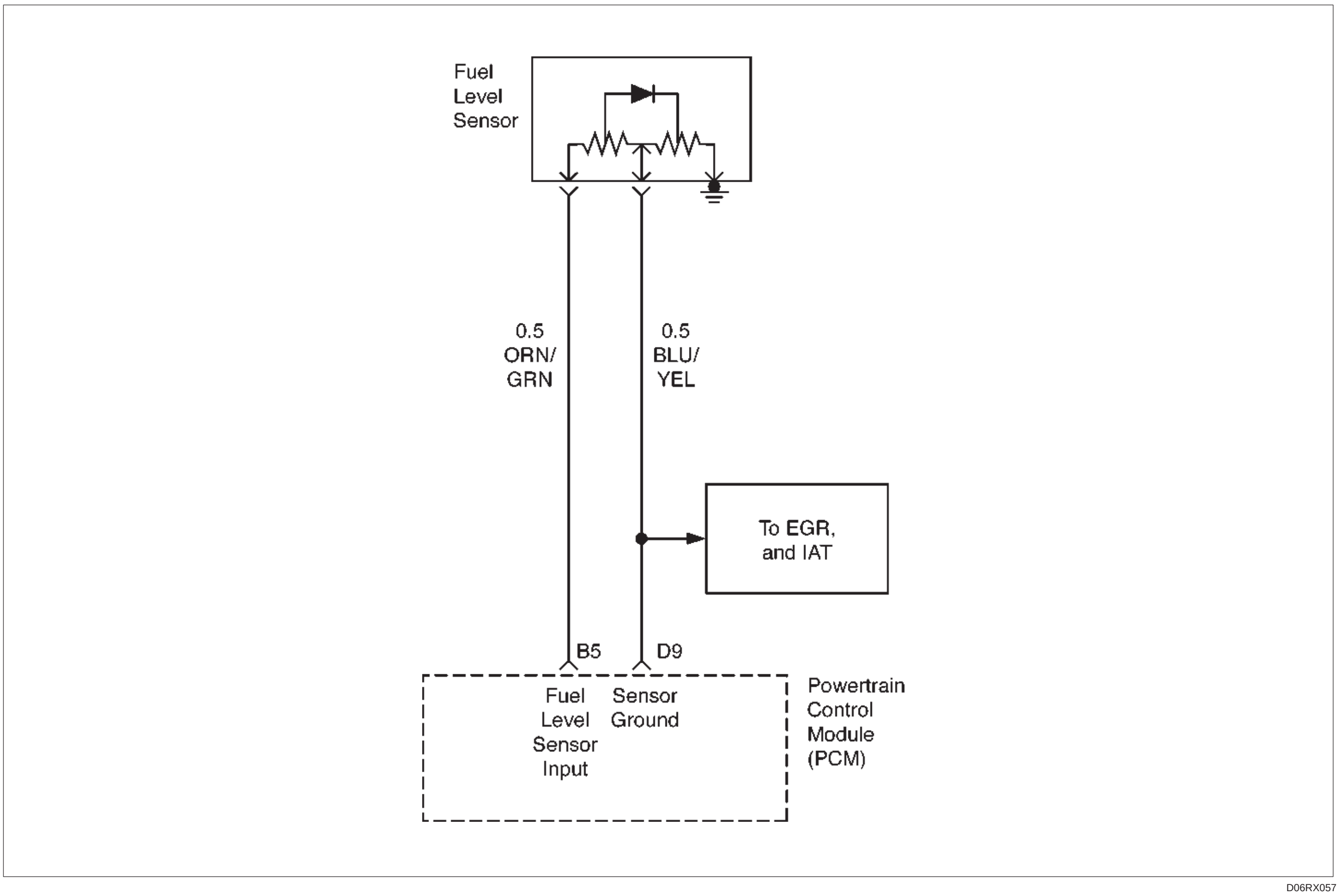
Number(s) below refer to the step number(s) on the Diagnostic Chart:

4. This step checks the wiring, connections, and the PCM.
6. This step checks the wiring, connections, and the PCM.

DTC P0462 Fuel Level Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Install the Tech 2. 2. Ignition ON. 3. Observe the fuel level on the Tech 2. Does the Tech 2 display the specified value?	0%–1%	Go to Step 4	Go to Step 3
3	Refer to Fuel Gauge Diagnosis.	—	—	—
4	With a Digital Voltmeter (DVM) to ground, probe the fuel level sensor input at the Fuel Level sensor. Is the voltage less than the specified value?	0.13 V	Go to Step 5	Go to Step 6
5	Check for a open in the fuel level sensor input circuit. Was a problem found?	—	Go to Step 7	Go to Step 6
6	With a DVM to ground, probe the fuel level module output at the Fuel Level sensor. Is the voltage greater than the specified value?	2.9 V	Go to Step 9	Go to Step 10
7	Repair the open in the fuel level sensor input circuit. Is the action complete?	—	Go to Step 11	—
8	Repair the open in the fuel level output circuit. Is the action complete?	—	Go to Step 11	—
9	Repair the short to voltage in the fuel level output circuit. Is the action complete?	—	Go to Step 11	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to Step 11	—
11	1. Using the Tech 2, select the DTC and the Clear Info. 2. Start the engine. 3. Idle at the normal operating temperature. 4. Select the Diagnostic Trouble Code and the Specific. 5. Enter the number which was set. 6. Operate the vehicle within the conditions for setting this Diagnostic Trouble Code as specified in the supporting text. Does the Tech 2 indicate that this diagnostic Ran and Passed?	—	System OK	Go to Step 2

DIAGNOSTIC TROUBLE CODE (DTC) P0463 FUEL LEVEL SENSOR CIRCUIT HIGH INPUT



Circuit Description

The Fuel Level sensor is an important input to the PCM for the Enhanced Evaporative System Diagnostic. The PCM needs the fuel level information in order to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the EVAP system. Several of the Enhanced Evaporative System Diagnostic sub–tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is greater than 85% or less than 15% full. (This sensor signal disables the misfire when the fuel levels are less than 15%). If the PCM detects a continuous short to voltage in the Fuel Level sensor or circuit, then a DTC P0463 will set. DTC P0463 is a type D code.

Conditions for Setting the DTC

- The Fuel Tank Level Slosh Test is completed.
- The Fuel Tank Level Main Test is completed.
- The Fuel Tank Level Data is valid.
- The Fuel Level signal voltage is greater than 4.9 volts for a period greater than 20 seconds.

Action Taken When the DTC Sets

- The PCM will not turn on the MIL.

Conditions for Clearing the DTC

- The PCM turns the MIL off after 3 consecutive driving trips without a fault condition present.
- A history DTC will clear if no fault conditions have been detected for 40 warm–up cycles (coolant temperature has risen 40°F from the start–up coolant temperature and the engine coolant temperature exceeds 160°F during that same ignition cycle) or the Tech 2 clearing feature has been used.

Test Description

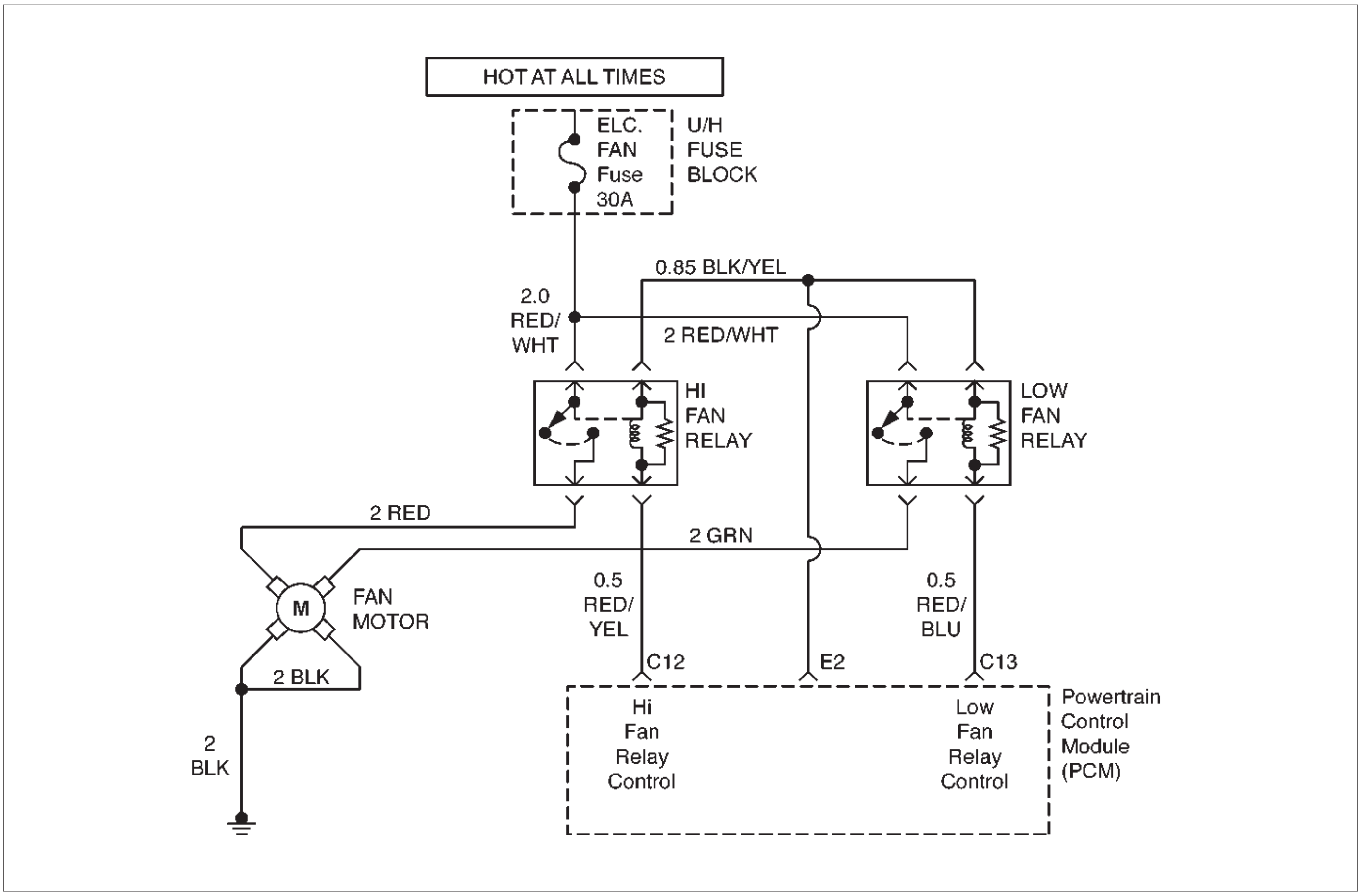
Number(s) below refer to the step number(s) on the Diagnostic Chart:

5. This step checks the wiring, connections, and the PCM.
7. This step checks the wiring, connections, and the PCM.

DTC P0463 Fuel Level Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Install the Tech 2. Observe the fuel level on the Tech 2. Does the Tech 2 display the specified value?	99% – 100%	Go to Step 4	Go to Step 3
3	Refer to Fuel Gauge Diagnosis.	—	—	—
4	With a Digital Voltmeter (DVM) to ground, probe the Fuel Level sensor input at the Sensor Input cavity. Is the voltage greater than the specified value?	2.9 V	Go to Step 5	Go to Step 6
5	Check for a open in the Fuel Level sensor ground. Was a problem found?	—	Go to Step 7	Go to Step 6
6	Check for an open in the Fuel Level sensor ground. Was a problem found?	—	Go to Step 9	Go to Step 10
7	Repair the short to voltage in the fuel level input circuit. Is the repair complete?	—	Go to Step 11	—
8	Repair the short to voltage in the fuel level output circuit. Is the repair complete?	—	Go to Step 11	—
9	Repair the open in the fuel level sensor ground. Is the repair complete?	—	Go to Step 11	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be reprogrammed. Refer to PCM Replacement/Programming. Is the action complete?	—	Go to Step 11	—
11	1. Using the Tech 2, select the DTC and the Clear Info. 2. Start the engine. 3. Idle at the normal operating temperature. 4. Select the Diagnostic Trouble Code and the Specific. 5. Enter the Diagnostic Trouble Code number which was set. 6. Operate the vehicle within the conditions for setting this Diagnostic Trouble Code as specified in the supporting text. Does the Tech 2 indicate that this diagnostic Ran and Passed?	—	System OK	Go to Step 2

DIAGNOSTIC TROUBLE CODE (DTC) P0480 COOLING FAN 1 CONTROL CIRCUIT MALFUNCTION



D06RX058

Circuit Description

The Powertrain Control Module (PCM) controls the engagement of the cooling fan Low speed through the use of a relay and a control circuit. If the PCM commands the fan to Low speed and then senses that the fan did not turn ON, or if the PCM commands the fan OFF from Low speed and then senses that the fan did not turn OFF, the PCM will set a DTC P0480. DTC P0480 is a type D code.

Conditions for Setting the DTC

- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 32 seconds.

The above conditions are met and one of the following conditions are met for 25 seconds within a 50 second test sample:

- PCM sensed voltage is High with the Low Speed Fan OFF.

OR

- PCM sensed voltage is Low with the Low Speed Fan ON.

Action Taken When the DTC Sets

- The PCM will not turn on the Malfunction Indicator Lamp.
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the DTC

- A history DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's Clear Info" function.

Diagnostic Aids

- Poor connections or a damaged harness – Inspect the harness connectors for: backed out terminals, improper mating or damaged terminals. Also check for open circuits, shorts to ground, and shorts to voltage.

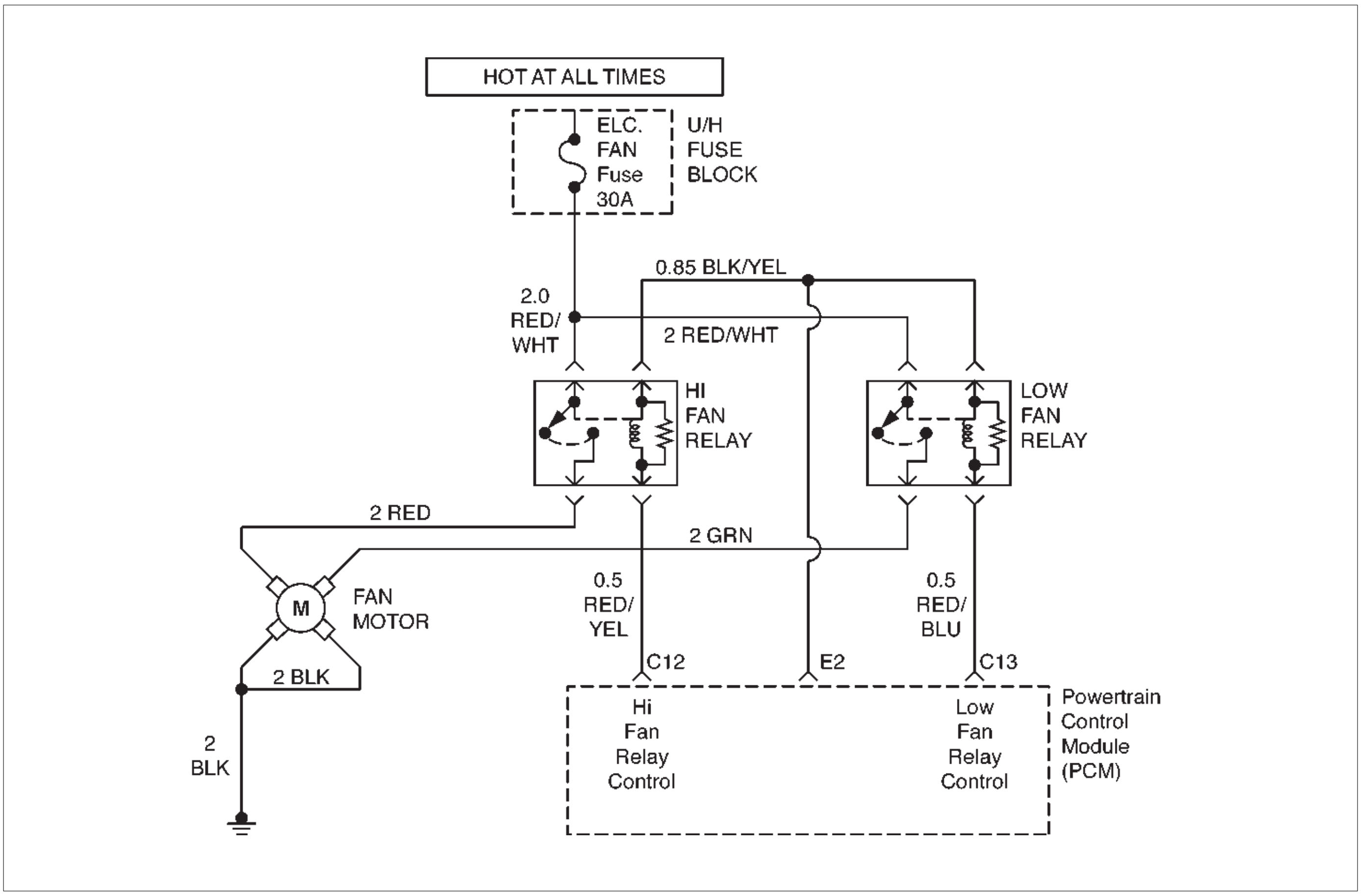
DTC P0480 Cooling Fan 1 Control Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTCs. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P0480. Does the Tech 2 indicate that DTC P0480 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Remove the Low Fan Relay from the Underhood Electrical Center. 3. Ignition OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the ”ELEC. FAN” Fuse pin of the Low fan Relay connector. Does the DVM read the following value?	12 Volts	Go to Step 4	Go to Step 3
4	1. Ignition ON. 2. Using a DVM, check for voltage on the ”ENGINE FAN” Fuse pin of the Low Fan Relay connector. Does the DVM read the following value?	12 Volts	Go to Step 6	Go to Step 5
5	Check the suspect circuit between the Low Fan Relay connector and Fuse for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	—
6	1. Ignition OFF. 2. Disconnect the Powertrain Control Module (PCM) connectors from the PCM. 3. Check the Low Fan Relay control circuit between the PCM and Underhood Electrical Center for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	Go to Step 7
7	1. Reinstall the Low Fan Relay. 2. Using a fused jumper, ground the Low Fan Relay control circuit at the PCM connector. 3. Ignition ON, Engine OFF. Does the fan run at low speed?	—	Go to Step 9	Go to Step 8

DTC P0480 Cooling Fan 1 Control Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the Low Fan Relay. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P0481 COOLING FAN 2 CONTROL CIRCUIT MALFUNCTION



D06RX058

Circuit Description

The Powertrain Control Module (PCM) controls the engagement of the cooling fan Low speed through the use of a relay and a control circuit. If the PCM commands the fan to Low speed and then senses that the fan did not turn ON, or if the PCM commands the fan OFF from Low speed and then senses that the fan did not turn OFF, the PCM will set a DTC P0481. DTC P0481 is a type D code.

Conditions for Setting the DTC

- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 32 seconds.

The above conditions are met and one of the following conditions are met for 25 seconds within a 50 second test sample:

- PCM sensed voltage is High with the High Speed Fan OFF.

OR

- PCM sensed voltage is High with the High Speed Fan ON.

Action Taken When the DTC Sets

- The PCM will not turn on the Malfunction Indicator Lamp.
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the DTC

- A history DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- Poor connections or a damaged harness – Inspect the harness connectors for: backed out terminals, improper mating or damaged terminals. Also check for open circuits, shorts to ground, and shorts to voltage.

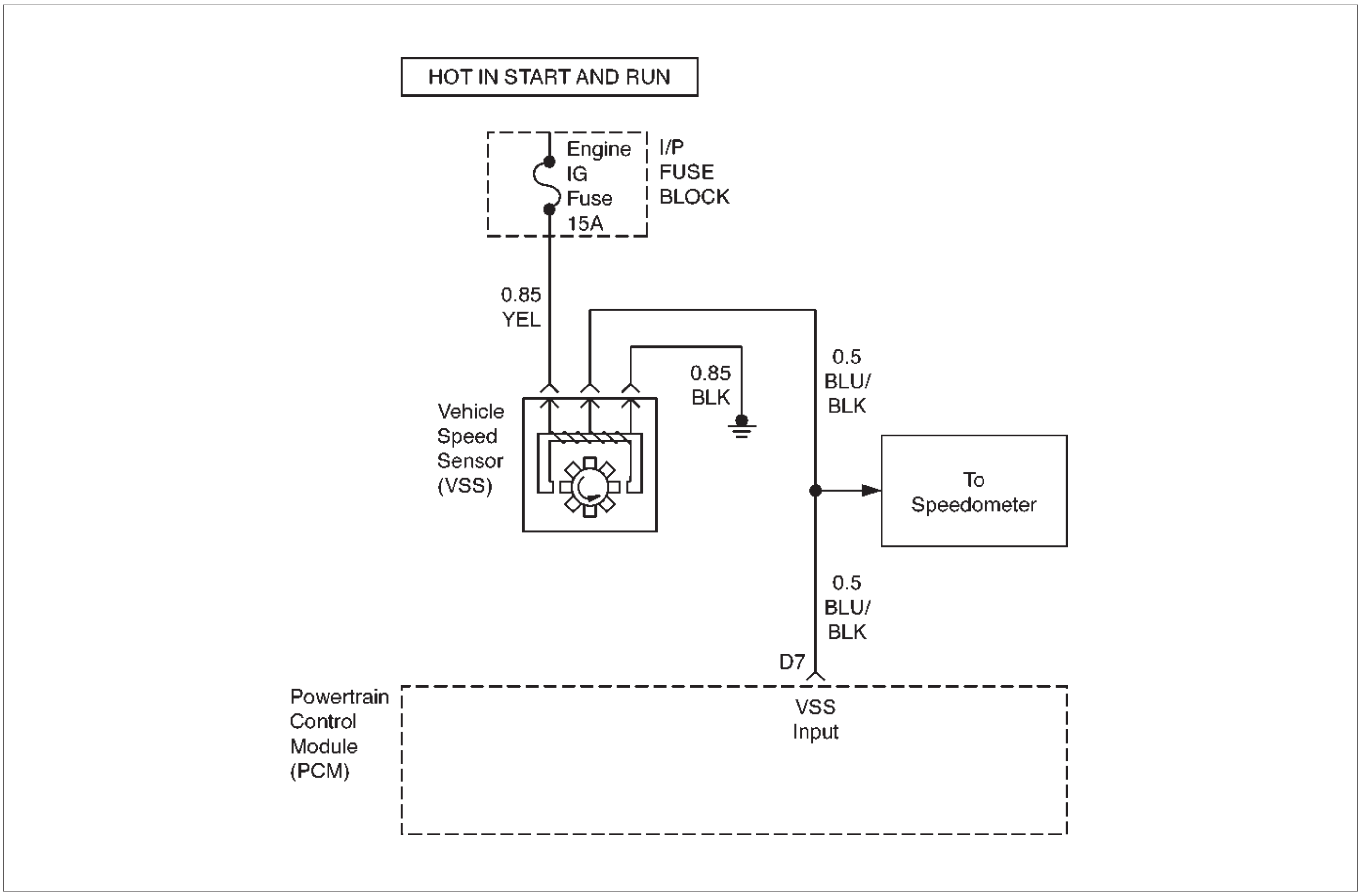
DTC P0481 Cooling Fan 2 Control Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTCs. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P0480. Does the Tech 2 indicate that DTC P0480 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Remove the Low Fan Relay from the Underhood Electrical Center. 3. Ignition OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the ”ELEC. FAN” Fuse pin of the Low fan Relay connector. Does the DVM read the following value?	12 Volts	Go to Step 4	Go to Step 3
4	1. Ignition ON. 2. Using a DVM, check for voltage on the ”ENGINE FAN” Fuse pin of the Low Fan Relay connector. Does the DVM read the following value?	12 Volts	Go to Step 6	Go to Step 5
5	Check the suspect circuit between the Low Fan Relay connector and Fuse for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	—
6	1. Ignition OFF. 2. Disconnect the Powertrain Control Module (PCM) connectors from the PCM. 3. Check the Low Fan Relay control circuit between the PCM and Underhood Electrical Center for the following conditions: ● A short to ground ● An open circuit ● A short to voltage Was the problem found?	—	Verify repair	Go to Step 7
7	1. Reinstall the High Fan Relay. 2. Using a fused jumper, ground the High Fan Relay control circuit at the PCM connector. 3. Ignition ON, Engine OFF. Does the fan run at High speed?	—	Go to Step 9	Go to Step 8

DTC P0481 Cooling Fan 2 Control Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the High Fan Relay. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P0502 VEHICLE SPEED SENSOR (VSS) CIRCUIT LOW INPUT



D06RX059

Circuit Description

The vehicle speed sensor has a magnet rotated by the transmission output shaft. Attached to the sensor is a hall effect circuit that interacts with the magnetic field created by the rotating magnet. A 12–volt operating supply for the speed sensor hall circuit is supplied from the meter fuse. The VSS pulses to ground the 5–volt signal sent from the powertrain control module (PCM) on the reference circuit. The PCM interprets vehicle speed by the number of pulses to ground per second on the reference circuit. DTC P0502 is a type B code.

Conditions for Setting the DTC

- Engine is running.
- Engine coolant temperature is above 60°C (140°F).
- System voltage is between 10 and 16 volts.

When the above conditions are met, one of the following tests will run:

Decel Test

- MAP is less than 35 kPa.
- Throttle Position is less than 0.8%.
- Engine Speed is between 1500 RPM and 3500 RPM.

The Decel Test will fail if vehicle speed is less than 8 km/h (5mph).

The Decel Test will pass if vehicle speed is greater than 24 km/h (15mph).

Power Test

- MAP is greater than 50 kPa.
- Throttle Position is between 25% and 70%.
- Engine Speed is between 2700 RPM and 4400 RPM.

The Power Test will fail if vehicle speed is less than 8 km/h (5 mph).

The Power Test will pass if vehicle speed is greater than 8km/h (5mph) without any VSS DTC's present, or if vehicle speed is greater than 49 km/h (30mph) with VSS Diagnostic Trouble Codes present.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the second time the fault is detected.
- Base shift logic on RPM only.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0502 will clear after 40 consecutive warm–up cycles have occurred without a fault.

- Diagnostic Trouble Code P0502 can be cleared by using the Scan Tool's "Clear Info" function.

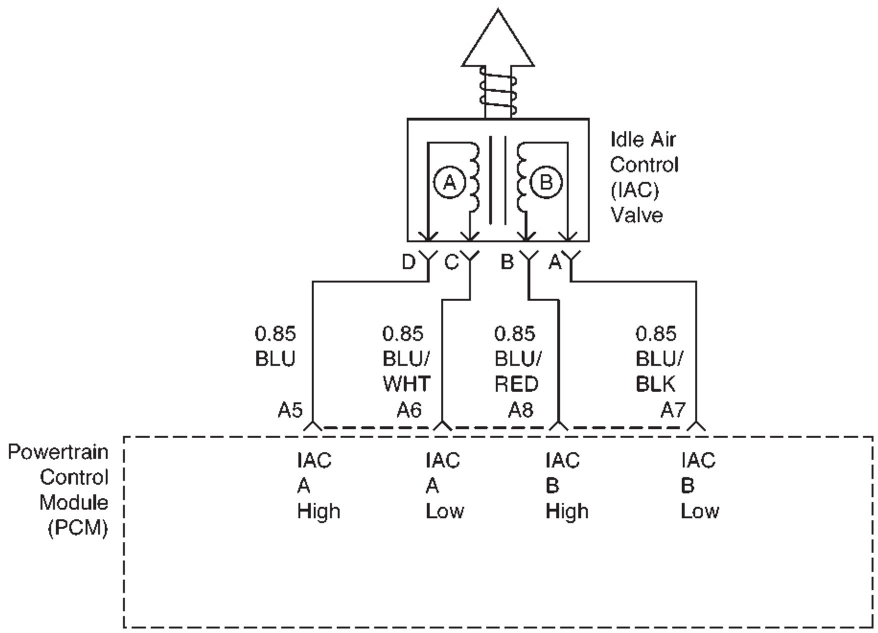
Diagnostic Aids

- Poor connection at PCM: Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness: Inspect the wiring harness to the EVAP vent solenoid, the EVAP purge solenoid, and the fuel tank pressure sensor for an intermittent open or intermittent short circuit.

DTC P0502 – VSS Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition OFF. 2. Disconnect the VSS connector. 3. Using a test light to battery +, probe the connector ground wire. Did the light illuminate?	—	Go to Step 4	Go to Step 3
3	Repair the open in the sensor ground circuit.	—	Verify repair	—
4	1. Ignition ON, sensor disconnected. 2. Using a Digital Voltmeter (DVM), measure at the VSS connector between ground and voltage supply. Was the measurement near the specified value?	Battery voltage	Go to Step 6	Go to Step 5
5	Repair the open or short to ground in the VSS sensor circuit.	—	Verify repair	—
6	1. Ignition OFF. 2. Check the BLU/BLK wire between the VSS sensor connector and the PCM for the following conditions: • An open circuit • A short to ground Was the faulty condition located?	—	Verify repair	Go to Step 9
7	Using a DVM, measure the resistance between the VSS sensor body and transmission case (ground). Is the resistance above the specified value?	10 K Ω	Verify repair	Go to Step 9
8	1. Remove the VSS from the transmission case. 2. Visually inspect the VSS for damage. Does the VSS appear to be OK?	—	Verify repair	—
9	Replace the VSS.	—	Verify repair	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0506 IDLE CONTROL SYSTEM RPM LOWER THAN EXPECTED



D06RX041

Circuit Description

The powertrain control module (PCM) controls engine idle speed by adjusting the position of the idle air control (IAC) motor pintle. The IAC is a bi–directional stepper motor driven by two coils. The PCM applies current to the IAC coils in steps (counts) to extend the IAC pintle into a passage in the throttle body to decrease air flow. The PCM reverses the current to retract the pintle, increasing air flow. This method allows highly accurate control of idle speed and quick response to changes in engine load. If the PCM detects a condition where too low of an idle speed is present and the PCM is unable to adjust idle speed by increasing the IAC counts, DTC P0506 will set, indicating a problem with the idle control system. DTC O0506 is a type B code.

Conditions for Setting the DTC

- No intrusive tests being run.
- Engine run time is more than 125 seconds.
- No TPS, VSS, ECT, EGR, MAP, IAT, misfire, low voltage, fuel system or canister purge Diagnostic Trouble Codes are set.
- Barometric pressure is greater than 72.7 kPa.
- Canister purge duty cycle is above 0%.
- Engine coolant temperature (ECT) is above 50˚C (122˚F).
- Intake air temperature above –40˚C (–40˚F).
- MAP is less than 60 kPa.
- Ignition voltage is between 9.5 volts and 16 volts.
- The throttle is closed.
- All conditions are met for 10 seconds.
- Engine speed is at least 100 RPM lower than desired idle, based upon PCM expectations.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- Diagnostic Trouble Code P0506 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or IAC motor – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.

- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits.
- Restricted air intake system – Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system.
- Throttle body – Check for objects blocking the IAC passage or throttle bore, excessive deposits in the IAC passage and on the IAC pintle, and excessive deposits in the throttle bore and on the throttle plate.
- Large vacuum leak – Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty PCV valve or brake booster hose disconnected.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

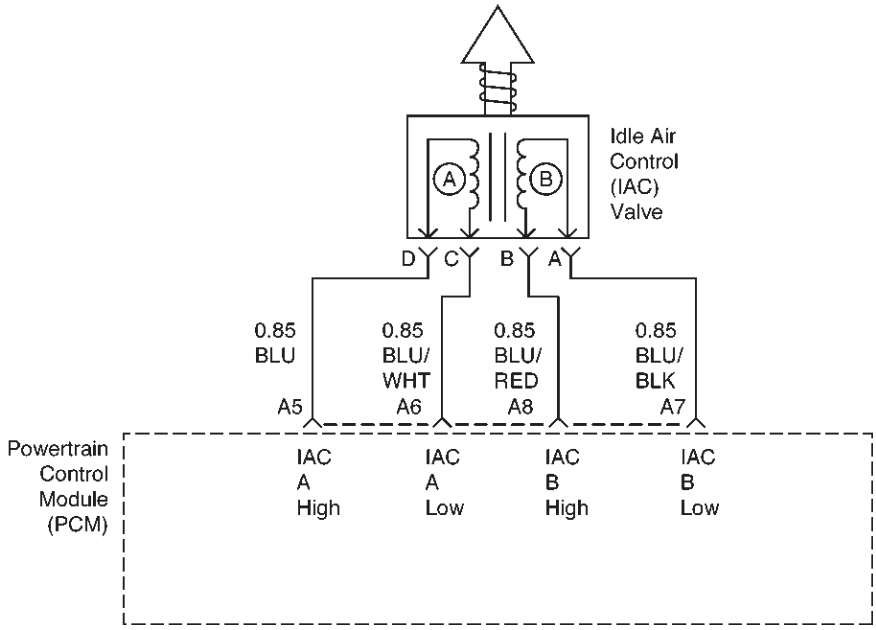
DTC P0506 – Idle Control System RPM Lower Than Expected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Are any other Diagnostic Trouble Codes set?	—	Go to other Diagnostic Trouble Code first	Go to Step 3
3	1. Start the engine. 2. Turn all accessories OFF (A/C, rear defroster, etc.) 3. Using a Tech 2, command RPM up to 1500, down to 500, and then up to 1500 while monitoring ”Engine Speed” on the Tech 2. Does the ”Engine Speed” remain within the specified value of ”Desired Idle” for each RPM command?	+/–50 RPM	No trouble found. Go to Diagnostic Aids	Go to Step 4
4	1. Disconnect the IAC. 2. Install IAC Noid Light J 37027A or equivalent. 3. With the engine running, command RPM up to 1500, down to 500, and then up to 1500 while observing the noid light. Does each noid light cycle red and green (never OFF)?	—	Go to Step 6	Go to Step 5
5	1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: • IAC ”A” low • IAC ”A” high • IAC ”B” low • IAC ”B” high 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 8
6	Visually/physically inspect for the following conditions: • Throttle body tampering (adjustment screw plug removed). • Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. • Throttle body. Check for objects blocking the IAC passage or throttle bore, excessive deposits in the IAC passage and on the IAC pintle, and excessive deposits in the throttle bore and on the throttle plate. Do any of the above require a repair?	—	Refer to appropriate section for on–vehicle service	Go to Step 7

DTC P0506 – Idle Control System RPM Lower Than Expected (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Check for a poor connection at the IAC harness connector. 2. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to Step 8
8	Using a Digital Voltmeter (DVM), check the IAC valve solenoids (A and B) for the following conditions: ● An open circuit ● A short to ground (the IAC body) ● A short together Was the problem found?	—	—	—
9	Replace the IAC valve. Is the action complete?	—	Verify repair	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0507 IDLE CONTROL SYSTEM RPM HIGHER THAN EXPECTED



D06RX041

Circuit Description

The powertrain control module (PCM) controls engine idle speed by adjusting the position of the idle air control (IAC) motor pintle. The IAC is a bi–directional stepper motor driven by two coils. The PCM applies current to the IAC coils in steps (counts) to extend the IAC pintle into a passage in the throttle body to decrease air flow. The PCM reverses the current to retract the pintle, increasing air flow. This method allows highly accurate control of idle speed and quick response to changes in engine load. If the PCM detects a condition where too high of an idle speed is present and the PCM is unable to adjust idle speed by increasing the IAC counts, Diagnostic Trouble Code P0507 will set, indicating a problem with the idle control system. DTC P0507 is a type B code.

Conditions for Setting the DTC

- No intrusive tests being run.
- Engine run time is more than 125 seconds.
- No TPS, VSS, ECT, EGR, MAP, IAT, misfire, low voltage, fuel system or canister purge DTCs are set.
- Barometric pressure is greater than 72.7 kPa.
- Canister purge duty cycle is above 0%.
- Intake air temperature above –40˚C (–40˚F).
- Engine coolant temperature (ECT) is above 50˚C (122˚F).
- Ignition voltage is between 9.5 volts and 16 volts.
- The throttle is closed.
- All conditions are met for 10 seconds.
- MAP is less than 60 kPa.
- Engine speed is at least 200 RPM lower than desired idle, based upon PCM's expectations.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0507 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0507 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or IAC motor – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.

- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits.
- Vacuum leak – Check for a condition that causes a vacuum leak, such as disconnected or damaged hoses, leaks at EGR valve and EGR pipe to intake manifold, leak at the throttle body, a faulty or incorrectly installed PCV valve, leaks at the intake manifold, etc.
- Throttle body – Check for sticking throttle plate. Also inspect the IAC passage for deposits or objects which will not allow the IAC pintle to fully extend or properly seat.

If Diagnostic Trouble Code P0507 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

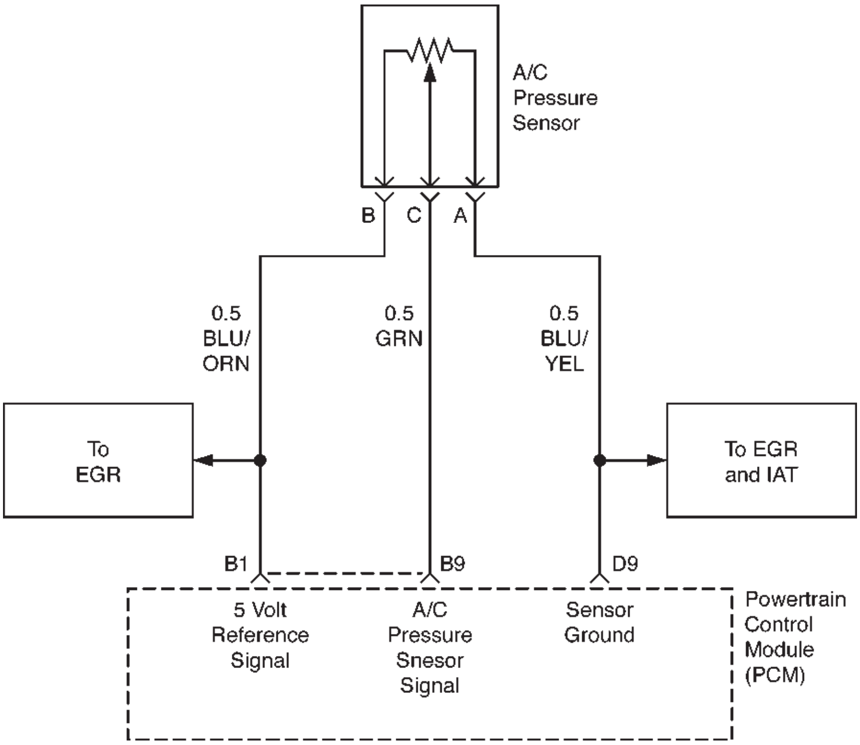
DTC P0507 – Idle Control System RPM Higher Than Expected

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Are any other Diagnostic Trouble Codes set?	—	Go to other Diagnostic Trouble Code first	Go to Step 3
3	1. Start the engine. 2. Turn all accessories OFF (A/C, rear defroster, etc.) 3. Using a Tech 2, command RPM up to 1500, down to 500, and then up to 1500 while monitoring ”Engine Speed” on the Tech 2. Does the ”Engine Speed” remain within the specified value of ”Desired Idle” for each RPM command?	+/–50 RPM	No trouble found. Go to Diagnostic Aids	Go to Step 4
4	1. Disconnect the IAC. 2. Install IAC Noid Light J 37027A or equivalent. 3. With the engine running, command RPM up to 1500, down to 500, and then up to 1500 while observing the noid light. Does each noid light cycle red and green (never OFF)?	—	Go to Step 6	Go to Step 5
5	1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: • IAC ”A” low • IAC ”A” high • IAC ”B” low • IAC ”B” high 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 9
6	Visually/physically inspect for the following conditions: • Vacuum leaks • Throttle body tampering (adjustment screw plug removed). • Throttle plate or throttle shaft for binding. • Accelerator and cruise control cables for being mis–adjusted or for binding. • Faulty, missing, or incorrectly installed PCV valve. Do any of the above require a repair?	—	Refer to appropriate section for on–vehicle service	Go to Step 7

DTC P0507 – Idle Control System RPM Higher Than Expected (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Check for a poor connection at the IAC harness connector. 2. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to Step 8
8	Using a Digital Voltmeter (DVM), check the IAC valve solenoids (A and B) for the following conditions: ● An open circuit ● A short to ground (the IAC body) ● A short together Was the problem found?	—	Go to Step 9	Go to Step 10
9	Replace the IAC valve. Is the action complete?	—	Verify repair	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0532 A/C REFRIGERANT PRESSURE SENSOR CIRCUIT LOW INPUT



D06RX060

Circuit Description

The Powertrain Control Module (PCM) monitors the A/C refigerant pressure through the use of a three wire sensor. If the PCM senses the pressure falls below a threshold value, then DTC P0532 will set. DTC P0532 is a type D code.

Conditions for Setting the DTC

- A/C pressure sensor is below 5 counts (0.1 volt) for 125 seconds within a 250 seconds test sample.

Action Taken When the DTC Sets

- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the DTC

- A History DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using a Scan Tool's "Clear Info" function.

Diagnostic Aids

Poor Conditions, or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also, check for open circuits, shorts to ground, and shorts to voltage.

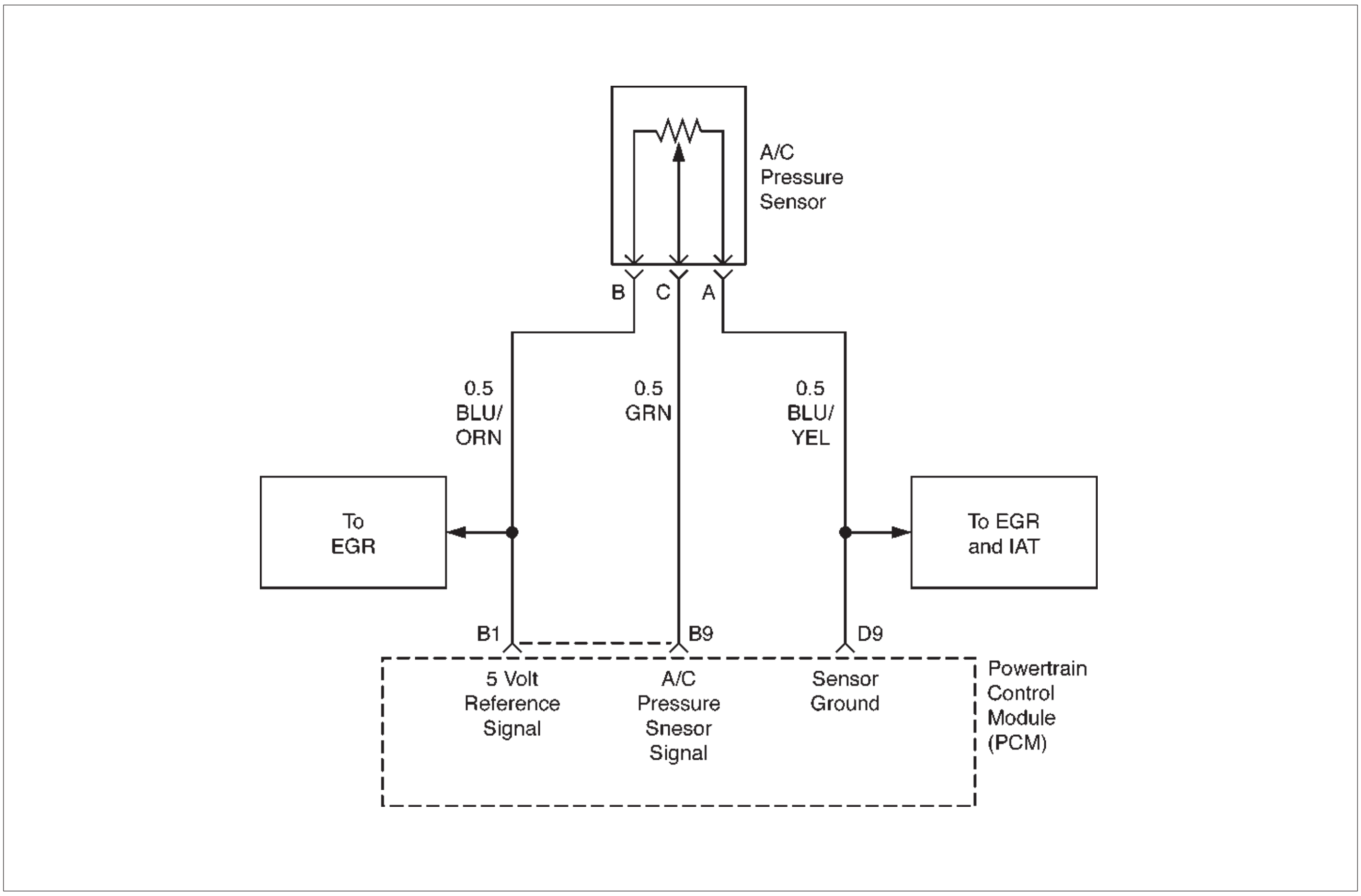
DTC P0532 A/C Refigerant Pressure Sensor Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Scan Tool's Failure Records data, then clear the DTC's. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor "DTC" info for DTC P0532. Does the Tech 2 indicate DTC P0532 "Ran and Passed?"	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Disconnect the A/C refrigerant pressure sensor wiring harness connector from the A/C refrigerant pressure sensor. 3. Start the vehicle, and monitor the A/C refrigerant pressure value with the Tech 2. Does the A/C refrigerant pressure sensor value on the Tech 2 hold steadily at the given value?	less than 0.1 volts	Go to Step 5	Go to Step 4
4	Check the A/C refrigerant pressure sensor signal circuit, between the A/C refrigerant pressure sensor and the Powertrain Control Module (PCM), for a short to voltage. Was the problem found?	—	Verify repair	Go to Step 12
5	Check the A/C refrigerant pressure sensor signal circuit, between the A/C refrigerant pressure sensor and the PCM for the following conditions: ● A short to ground ● An open circuit Was the problem found?	—	Verify repair	Go to Step 6
6	Check the 5 volt signal circuit, between the A/C refrigerant pressure sensor and the PCM, for the following conditions: ● An open circuit ● A short to voltage ● A short to ground Was the problem found?	—	Verify repair	Go to Step 7
7	1. Ignition OFF. 2. Place a Digital Voltmeter (DVM), set to measure voltage between the 5 volt signal circuit and ground. 3. Ignition ON, Engine OFF. Does the DVM indicate the following value?	about 5 volts	Go to Step 8	Go to Step 12

DTC P0532 A/C Refigerant Pressure Sensor Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition OFF. 2. Place a fused jumper between the A/C refrigerant pressure sensor and the 5 volt signal circuit, both at the wiring harnesses A/C refrigerant pressure sensor connector. 3. Ignition ON, Engine OFF. 4. Observe the A/C refrigerant pressure sensor value displayed on the Tech 2. Does the Tech 2 read the following value?	about 5 volts	Go to Step 9	Go to Step 12
9	Check the A/C refrigerant pressure sensor and the PCM, for the following conditions: • An open circuit • A short to ground • A short to voltage Was the problem found?	—	Verify repair	Go to Step 10
10	1. Ignition OFF. 2. Place a Digital Voltmeter (DVM), set to measure voltage between the ground circuit and the 5 volt signal circuit, both at the wiring harnesses A/C refigerant pressure sensor connector. 3. Ignition ON, Engine OFF. Does the DVM indicate the following value?	about 5 volts	Go to Step 11	Go to Step 12
11	Replace the A/C refrigerant pressure sensor. Verify Repair.	—	—	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P0533 A/C REFRIGERANT PRESSURE SENSOR CIRCUIT HIGH INPUT



D06RX060

Circuit Description

The Powertrain Control Module (PCM) monitors the A/C refigerant pressure through the use of a three wire sensor. If the PCM senses the pressure falls below a threshold value, then DTC P0533 will set. DTC P0533 is a type D code.

Conditions for Setting the DTC

- A/C pressure sensor is above 250 counts (4.88 volts) for 125 seconds within a 250 seconds test sample.

Action Taken When the DTC Sets

- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the DTC

- A history DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using a Scan Tool's "Clear Info" function.

Diagnostic Aids

- Poor Conditions, or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also, check for open circuits, shorts to ground, and shorts to voltage.

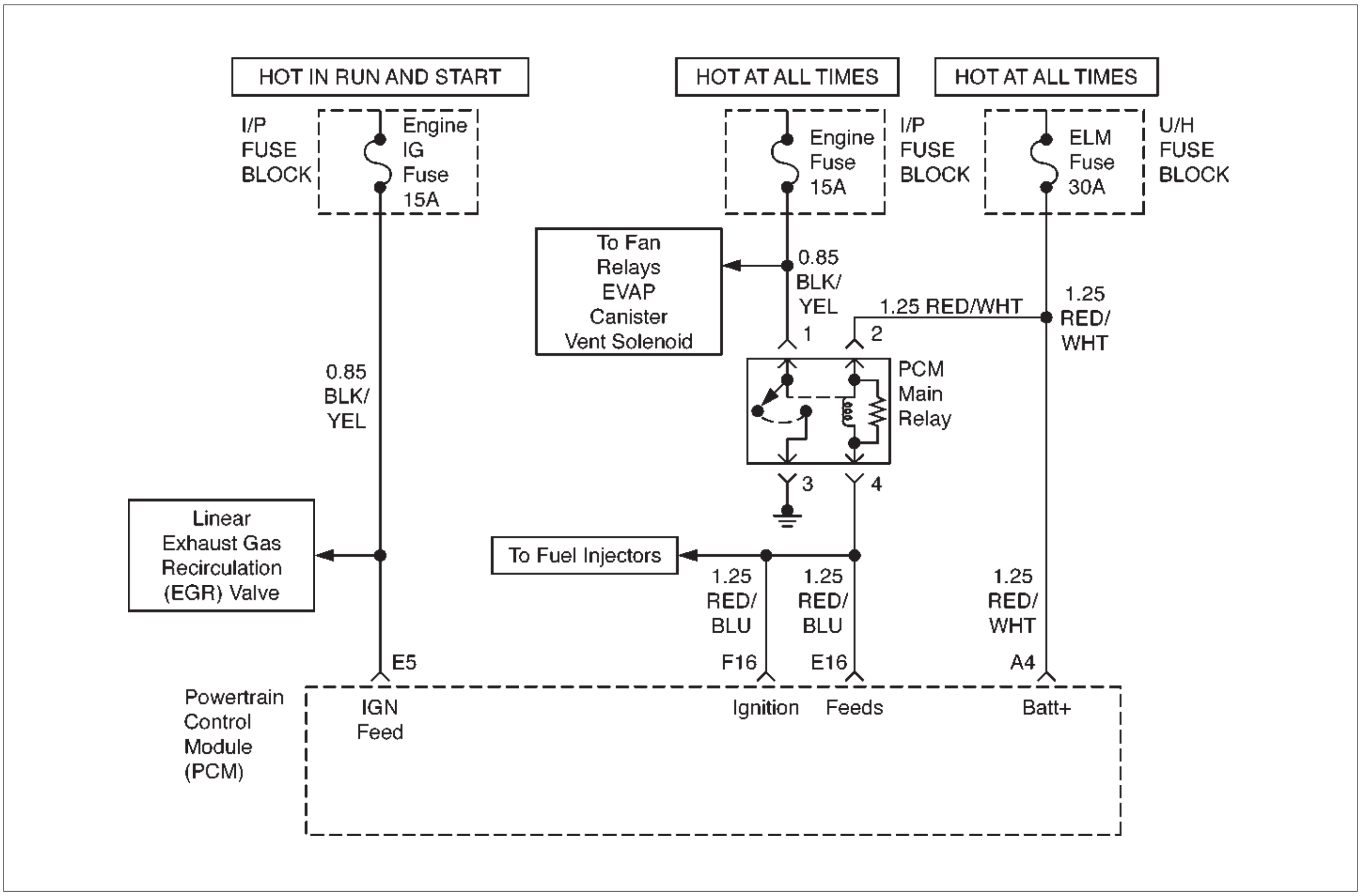
DTC P0533 A/C Refigerant Pressure Sensor Circuit High Input

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Scan Tool's Failure Records data, then clear the DTC's. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor "DTC" info for DTC P0533. Does the Tech 2 indicate DTC P0533 "Ran and Passed?"	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Disconnect the A/C refrigerant pressure sensor wiring harness connector from the A/C refrigerant pressure sensor. 3. Start the vehicle, and monitor the A/C refrigerant pressure value with the Tech 2. Does the A/C refrigerant pressure sensor value on the Tech 2 hold steadily at the given value?	less than 0.1 volts	Go to Step 5	Go to Step 4
4	Check the A/C refrigerant pressure sensor signal circuit, between the A/C refrigerant pressure sensor and the Powertrain Control Module (PCM), for a short to voltage. Was the problem found?	—	Verify repair	Go to Step 12
5	Check the A/C refrigerant pressure sensor signal circuit, between the A/C refrigerant pressure sensor and the PCM for the following conditions: • A short to ground • An open circuit Was the problem found?	—	Verify repair	Go to Step 6
6	Check the 5 volt signal circuit, between the A/C refrigerant pressure sensor and the PCM, for the following conditions: • An open circuit • A short to voltage • A short to ground Was the problem found?	—	Verify repair	Go to Step 7
7	1. Ignition OFF. 2. Place a Digital Voltmeter (DVM), set to measure voltage between the 5 volt signal circuit and ground. 3. Ignition ON, Engine OFF. Does the DVM indicate the following value?	about 5 volts	Go to Step 8	Go to Step 12

DTC P0533 A/C Refigerant Pressure Sensor Circuit High Input (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition OFF. 2. Place a fused jumper between the A/C refrigerant pressure sensor and the 5 volt signal circuit, both at the wiring harnesses A/C refrigerant pressure sensor connector. 3. Ignition ON, Engine OFF. 4. Observe the A/C refrigerant pressure sensor value displayed on the Tech 2. Does the Tech 2 read the following value?	about 5 volts	Go to Step 9	Go to Step 12
9	Check the A/C refrigerant pressure sensor and the PCM, for the following conditions: • An open circuit • A short to ground • A short to voltage Was the problem found?	—	Verify repair	Go to Step 10
10	1. Ignition OFF. 2. Place a Digital Voltmeter (DVM), set to measure voltage between the ground circuit and the 5 volt signal circuit, both at the wiring harnesses A/C refigerant pressure sensor connector. 3. Ignition ON, Engine OFF. Does the DVM indicate the following value?	about 5 volts	Go to Step 11	Go to Step 12
11	Replace the A/C refrigerant pressure sensor. Verify Repair.	—	—	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P0562 SYSTEM VOLTAGE LOW



D06RX061

Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminal to the PCM. A system voltage Diagnostic Trouble Code will set whenever the voltage is below a calibrated value. DTC P0562 is a type D code.

Conditions for Setting the DTC

- Ignition ON.
- System voltage is below 11.5 volts for 4 minutes.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store as Failure Records conditions which were present when the Diagnostic Trouble Code was set. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P0562 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0562 can be cleared by using the Scan Tool's "Clear Info" function.

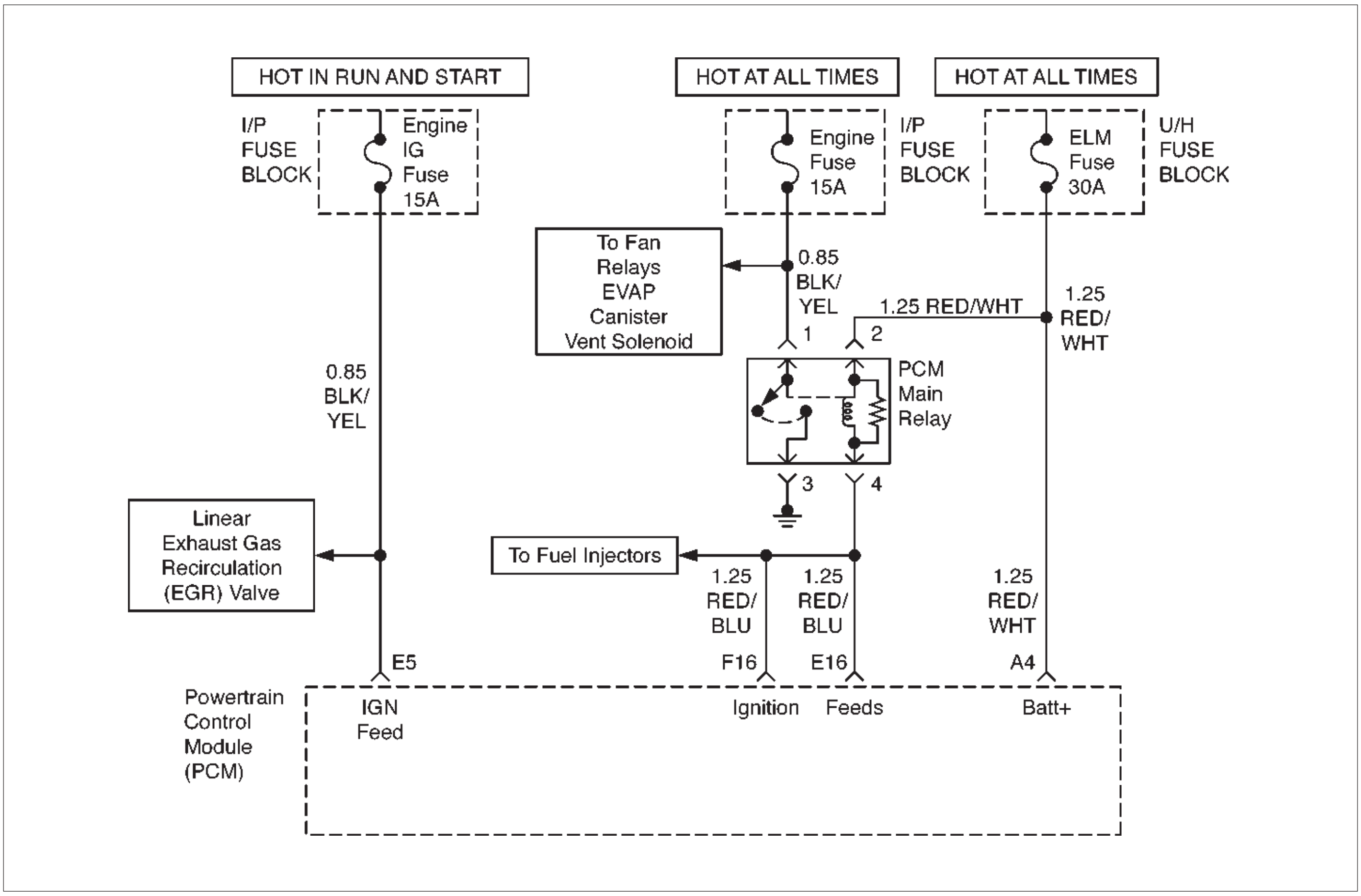
Diagnostic Aids

- If the Diagnostic Trouble Code sets when an accessory is operated, check for a poor connection or excessive current draw.
- Check for an open circuit in the PCM main relay's control (ground) circuit.
- Check for open circuits or shorts to ground on the PCM's battery or ignition inputs.
- Check for a faulty PCM main relay.

DTC P0562 System Voltage Low

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Using a Digital Voltmeter (DVM), measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	11.5 V	Go to Step 3	Charge battery, then go to Step 3
3	1. Install the Tech 2. 2. Select "Ignition Volts" on the Tech 2. 3. Start the engine and raise the engine speed to 2000 RPM. 4. Load the electrical system by turning on the headlights, high blower, etc. Is the ignition voltage approximately equal to the specified value?	13.2 V	Go to Step 4	Go to Starting/Charging
4	1. Ignition OFF. 2. Disconnect the PCM connector at the PCM. 3. Ignition ON, Engine OFF 4. Using a DVM, measure the voltage at the PCM Main Relay's two power inputs to the PCM. Is it approximately equal to battery voltage?	—	Check for excessive current draw with ignition OFF, engine OFF.	Go to Step 5
5	1. Check for faulty connections at the PCM harness terminals. 2. Repair as necessary. Was a repair necessary?	—	Verify repair	Go to Step 6
6	Check for an open battery feed circuit to the PCM. Is the action complete?	—	Verify repair	Go to Step 7
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0563 SYSTEM VOLTAGE HIGH



D06RX061

Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminals to the PCM. A system voltage Diagnostic Trouble Code will set whenever the voltage is above a calibrated value. DTC P0563 is a type A code.

Conditions for Setting the DTC

- Ignition ON.
- System voltage is above 16.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL) for the first time the malfunction is detected.
- The PCM will store as Failure Records conditions which were present when the Diagnostic Trouble Code was set. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history Diagnostic Trouble Code P0563 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0563 can be cleared by using the Scan Tool's "Clear Info" function.

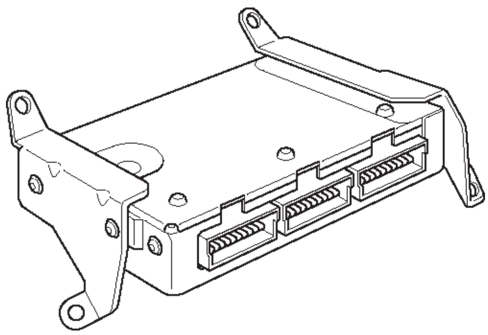
Diagnostic Aids

Check for a faulty charging system components.

DTC P0563 System Voltage High

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition OFF, engine OFF. 2. Using a Digital Voltmeter (DVM), measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	16 V	Go to Step 3	Go to Step 4
3	1. Charge the battery and clean the battery terminals. 2. Clean the battery ground cable connection if corrosion is indicated. Is the battery voltage greater than the specified value?	16 V	Replace battery	Go to Step 4
4	1. Turn OFF all the accessories. 2. Install the Tech 2. 3. Select the ignition voltage parameter on the data list. 4. Start the engine and raise the engine speed to 2000 RPM. Is the voltage above the specified value?	16 V	Go to Step 5	Go to Step 6
5	Replace or repair the generator (see Charging System). Is a malfunction present?	—	Verify repair	—
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P0601 INTERNAL CONTROL MODULE MEMORY CHECK SUM ERROR



014RX002

Circuit Description

The powertrain control module (PCM) used in this vehicle utilizes an electrically erasable programmable read–only memory (EEPROM). The EEPROM contains program information and the calibrations required for engine, transmission, and powertrain diagnostics operation.

Unlike the PROM used in past applications, the EEPROM is not replaceable. When the PCM is replaced or a calibration update is required, the PCM must be programmed using a Tech 2. For the EEPROM programming procedure, Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. If the PCM detects a check sum error then DTC P0601 will set. DTC P0601 is a type A code.

Conditions for Setting the DTC

- The PCM detects an internal program fault (check sum error).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the malfunction is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P0601 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P0601 can be cleared by using the Scan Tool's "Clear Info" function.

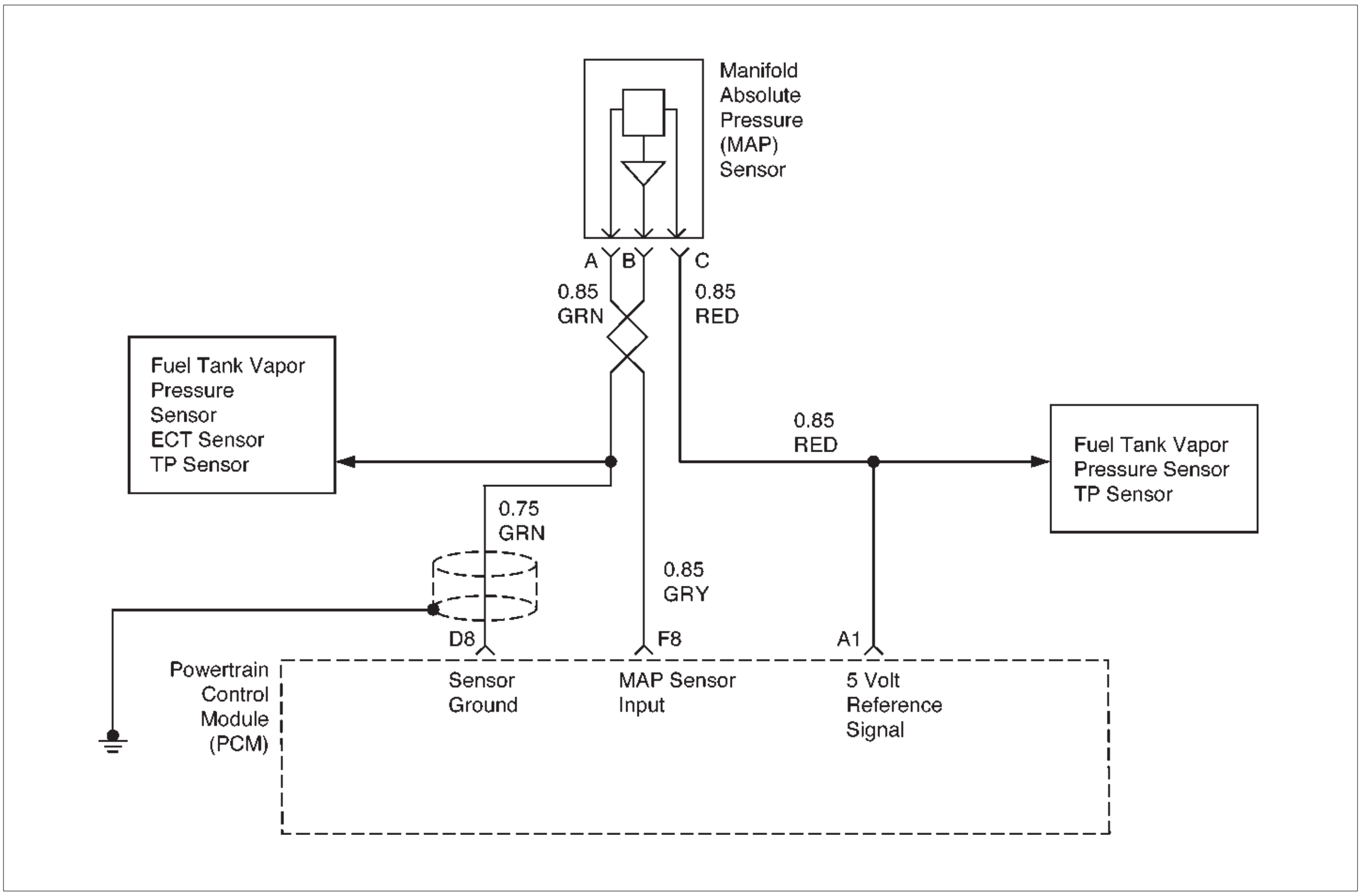
Diagnostic Aids

- Diagnostic Trouble Code P0601 indicates that the contents of the EEPROM have changed since the PCM was programmed. The only possible repair is PCM reprogramming or replacement. Check service bulletins to program the replacement PCM with the correct software and calibration for the vehicle.

DTC P0601 Internal Control Module Memory Check Sum Error

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Reprogram PCM with most recent calibrations. Refer to Service Bulletins and PCM Reprogramming. Is there still a problem?	—	Go to Step 3	Verify repair
3	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1106 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE



D06RX042

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure. The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (low manifold pressure) to above 4 volts with the ignition ON, engine not running or at wide–open throttle (high manifold pressure).

A ”speed density” method of determining engine load is used on the 2.2L engine. This is calculated using inputs from the MAP sensor, RPM, the CKP sensor, and the Intake Air Temperature (IAT) sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function.

The MAP sensor is also used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run, to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). Refer to Diagnostic Trouble Code 401.

The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various other engine load factors. If the PCM detects a MAP signal that is intermittently above the calculated value, Diagnostic Trouble Code P1106 will set. DTC P1106 is a type D code.

Conditions for Setting the DTC

- No TP sensor Diagnostic Trouble Codes are present.
- Engine is running.
- Throttle angle is below 2.7% if engine speed is below 1000 RPM.
- Throttle angle is below 10% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure above 90 kPa for a total of approximately 5 seconds over a 16–second period of time.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1106 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1106 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Leaking or plugged vacuum supply line to the MAP sensor.
- Inspect PCM harness connectors for backed–out terminals, improper mating, broken locks, improperly

formed or damaged terminals, and poor terminal–to–wire connection.

- The MAP sensor shares a 5 Volt Reference with the TP sensor and Fuel Pressure sensor.

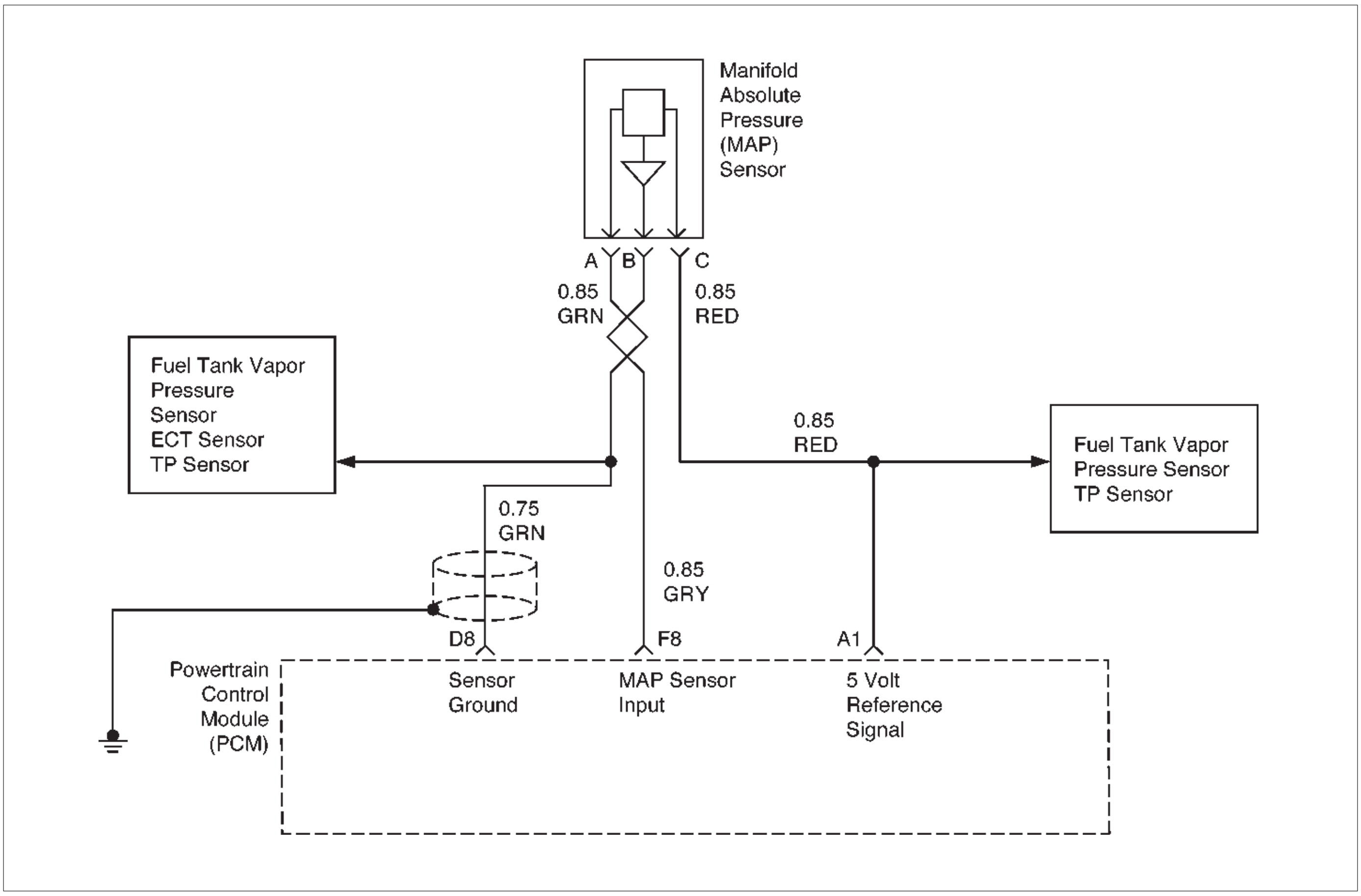
  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the TP sensor and Fuel Pressure sensor.
- Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

DTC P1106 – MAP Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0108 also set?	—	Go to DTC P0108 chart first	Go to Step 3
3	Are Diagnostic Trouble Code P0463, and/or P1121 also set?	—	Go to Step 6	Go to Step 4
4	Check for a poor sensor ground circuit terminal connection at the MAP sensor. Was a problem found?	—	Go to Step 9	Go to Step 5
5	Check the MAP signal circuit between the MAP sensor connector and the PCM for an intermittent short to voltage. Was a problem found?	—	Go to Step 10	Go to Step 8
6	Check for an intermittent short to voltage on the 5 volt reference circuit between the PCM and the following components: • Fuel Tank Vapor Pressure Sensor • TP sensor Was a problem found?	—	Go to Step 10	Go to Step 7
7	Check for a poor sensor ground circuit terminal connection at the PCM. Was a problem found?	—	Go to Step 9	Go to Step 8
8	Check for an intermittent open or a faulty splice in the sensor ground circuit. Was a problem found? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to Step 10	Refer to Diagnostic Aids
9	Replace the faulty harness connector terminal for the sensor ground circuit. Is the action complete?	—	Verify repair	—
10	Locate and repair the intermittent open/short circuit in the wiring harness as necessary. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1107 MANIFOLD ABSOLUTE PRESSURE (MAP) SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE



D06RX042

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure. The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (low manifold pressure) to above 4 volts with the ignition ON, engine not running or at wide–open throttle (high manifold pressure).

A ”speed density” method of determining engine load is used on the 2.2l engine. This is calculated using inputs from the MAP sensor, the CKP sensor, and the Intake Air Temperature (IAT) sensor. The MAP sensor is the main sensor used in this calculation, and measuring engine load is its main function.

The MAP sensor is also used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run, to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). Refer to DTC P0401.

The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various other engine load factors. If the PCM detects a MAP signal that is intermittently below the calculated value, DTC P1107 will set. DTC P1107 is a type D code.

Conditions for Setting the DTC

- No TP sensor Diagnostic Trouble Codes are present.
- Engine is running.
- Throttle angle is below 0% if engine speed is less than 1300 RPM.
- Throttle angle is below 5% if engine speed is above 1300 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure above 11 kPa for a total of approximately 5 seconds over a 16–second period of time.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1107 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1107 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.

- The MAP sensor shares a 5 Volt Reference with the TP sensor and Fuel Pressure sensor.

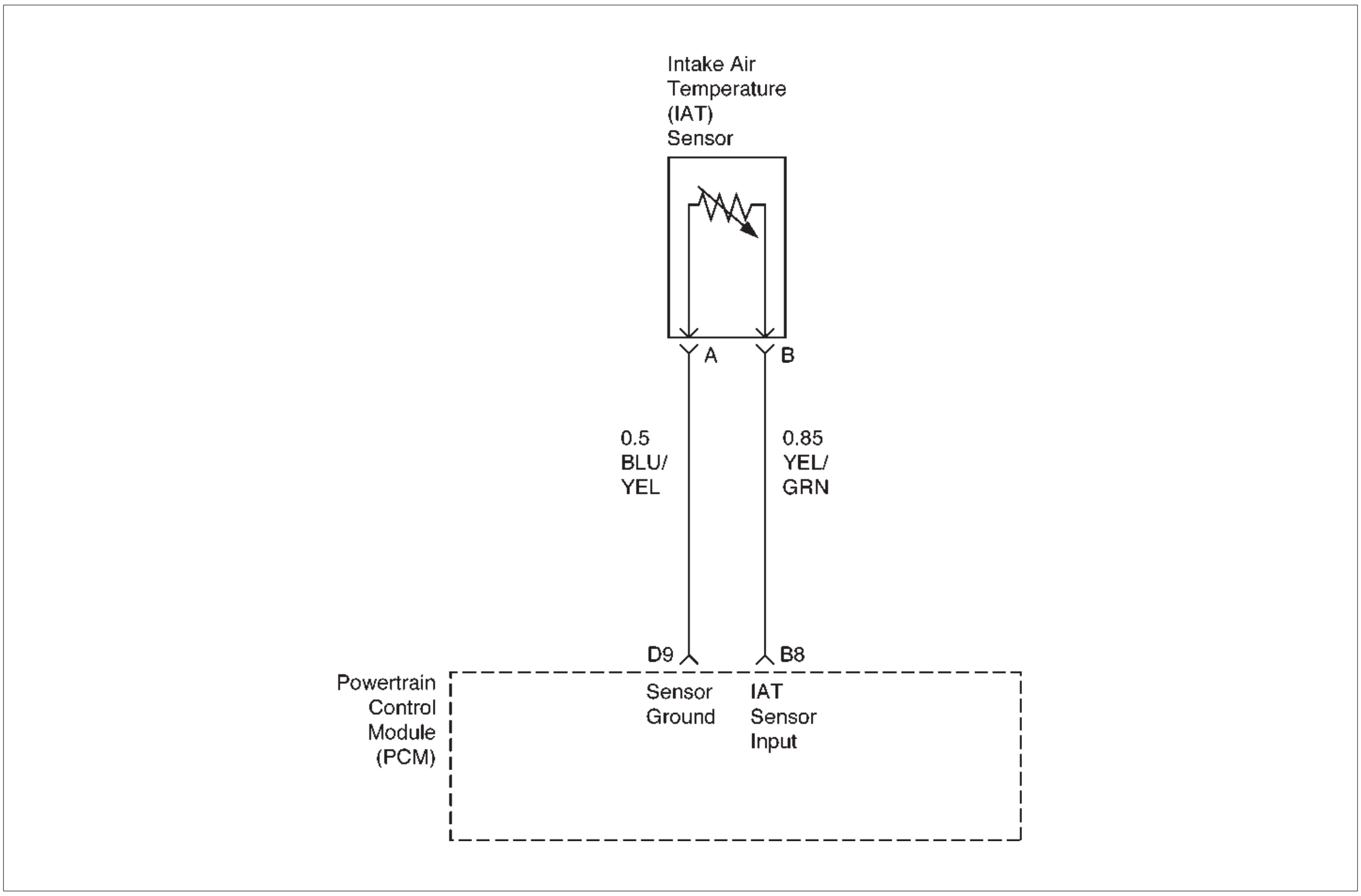
  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the TP sensor and Fuel Pressure sensor.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

DTC P1107 – MAP Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0107 also set?	—	Go to DTC P0107 chart first	Go to Step 3
3	Is DTC P1122 and/or P0462 also set?	—	Go to Step 6	Go to Step 4
4	Check for a poor 5 volt reference circuit terminal connection at the MAP sensor. Was a problem found?	—	Go to Step 9	Go to Step 5
5	Check the MAP signal circuit between the MAP sensor connector and the PCM for an intermittent open or short to ground. Was a problem found?	—	Go to Step 10	Go to Step 8
6	Check for an intermittent short to ground on the 5 volt reference circuit between the PCM and the following components: • Fuel Tank Vapor Pressure Sensor • TP sensor Was a problem found?	—	Go to Step 10	Go to Step 7
7	Check for a poor 5 volt reference terminal connection at the PCM. Was a problem found?	—	Go to Step 9	Go to Step 8
8	Check for an intermittent open or a faulty splice in the 5 volt reference circuit. Was a problem found? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to Step 10	Refer to Diagnostic Aids
9	Replace the faulty harness connector terminal for the 5 volt reference circuit and/or the MAP signal circuit as necessary. Is the action complete?	—	Verify repair	—
10	Repair the intermittent open/short circuit in the wiring harness as necessary. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1111 INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE



D06RX043

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull–up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. Diagnostic Trouble Code P1111 will set when the PCM intermittently detects an excessively high signal voltage on the intake air temperature sensor signal circuit. DTC P1111 is a type D code.

Conditions for Setting the DTC

- The engine has been running for over 4 minutes.
- Vehicle speed is less than 32 km/h (20 mph).
- Engine coolant temperature is above 60˚C (140˚F).
- Calculated air flow is less than 20g/second.
- IAT signal voltage indicates an intake air temperature intermittently less than –39˚C (–38˚F) (4.94 volts) for approximately 2.5 seconds over a 25–second period of time.

Action Taken When the DTC Sets

- The PCM will substitute a default value for intake air temperature.
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Failure Records data only. This information will not be stored as Freeze Frame data.
- Diagnostic Trouble Code P1111 does not illuminate the MIL.

Conditions for Clearing the DTC

- A history DTC P1111 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1111 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to

be set occurs. This may assist in diagnosing the condition.

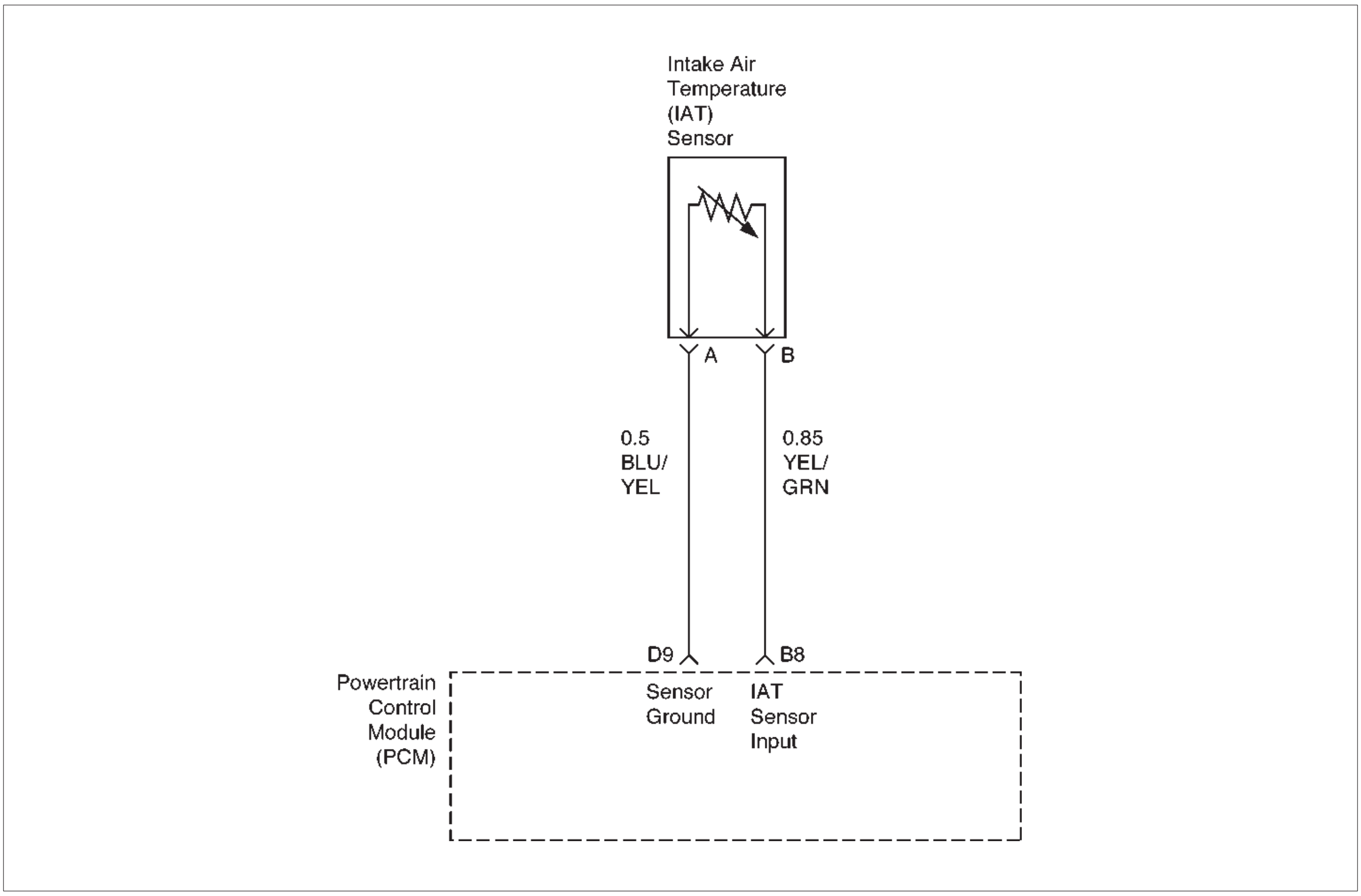
Intake Air Temperature Sensor

°C	°F	Ω
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1111 – IAT Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0113 also set?	—	Go to DTC P0113 chart first	Go to Step 3
3	1. Check for a poor sensor ground circuit terminal connection at the IAT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 4
4	1. Check for a poor IAT signal circuit terminal connection at the IAT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent open. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 6
6	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent short to voltage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Check for a poor sensor ground circuit terminal connection at the PCM. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 8
8	1. Check for an intermittent open or a faulty splice in the sensor ground circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to Diagnostic Aids

DIAGNOSTIC TROUBLE CODE (DTC) P1112 INTAKE AIR TEMPERATURE (IAT) SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE



D06RX043

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull–up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance becomes lower, causing the PCM to monitor a lower voltage. Diagnostic Trouble Code P1112 will set when the PCM intermittently detects an excessively low signal voltage on the intake air temperature sensor signal circuit. DTC P1112 is a type D code.

Conditions for Setting the DTC

- The engine has been running for over 2 minutes.
- Vehicle speed is greater than 48 km/h (30 mph).
- IAT signal voltage is greater than 148˚C (298˚F) (about 0.10 volt) for a total of 2.5 seconds over a 25–second period of time.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Failure Records data only. This information will not be stored as Freeze Frame data.
- The PCM will substitute a default value for intake air temperature.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1112 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1112 can be cleared by using the Scan Tool's ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to

be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.
3. If DTC P1112 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Value Chart."

   The chart may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the IAT sensor.

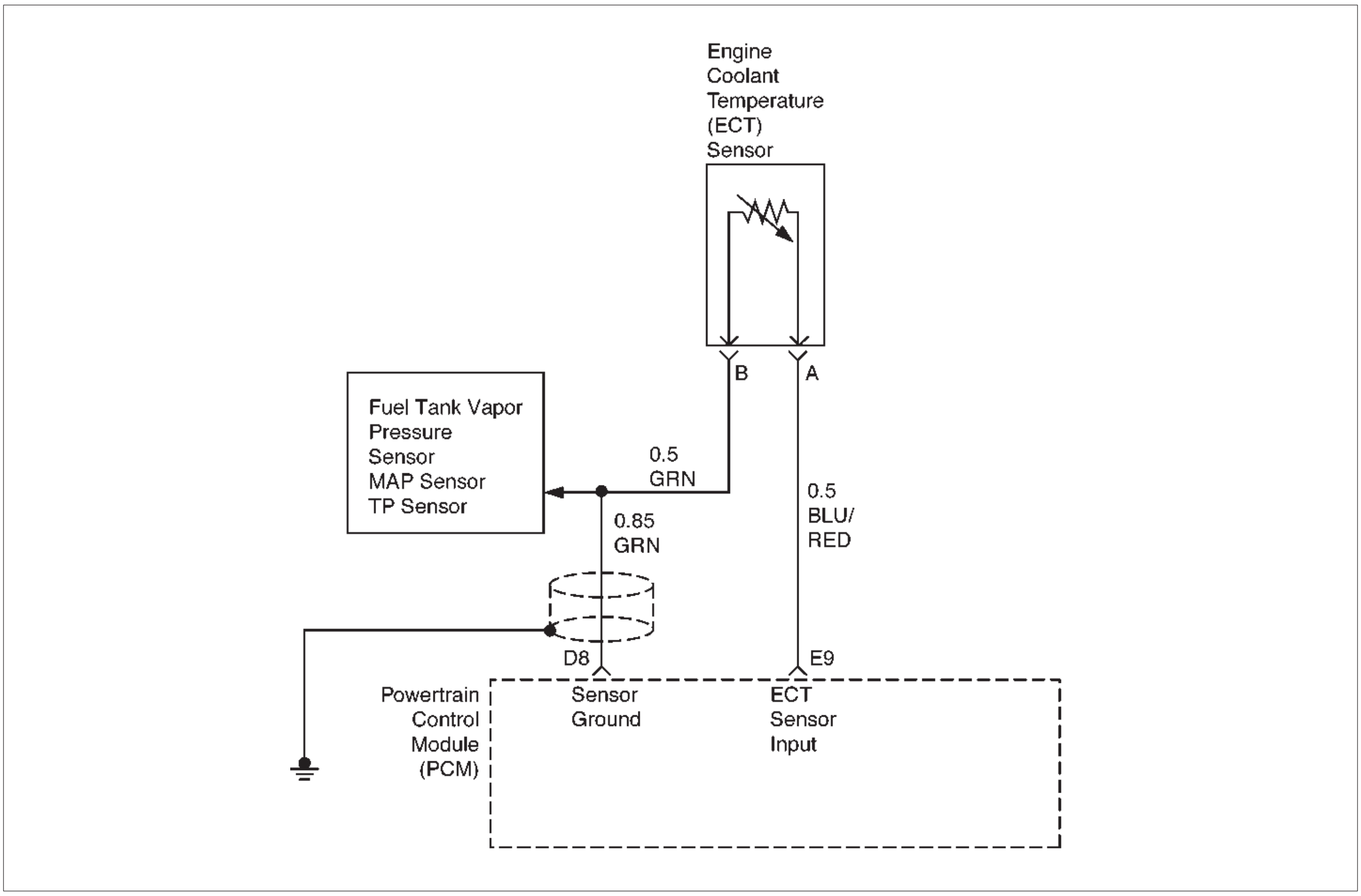
Intake Air Temperature Sensor

°C	°F	Ω
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1112 – IAT Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0112 also set?	—	Go to DTC P0112 chart first	Go to Step 3
3	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent short to ground. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to Diagnostic Aids

DIAGNOSTIC TROUBLE CODE (DTC) P1114 ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE



D06RX044

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5.0 volts) through a pull–up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently below the range of the ECT sensor, Diagnostic Trouble Code P1114 will set. DTC P1114 is a type D code.

Conditions for Setting the DTC

- Engine run time longer than 2 minutes.
- The ECT sensor signal is intermittently greater than 150˚C (302˚F) (about 0.10 volt) for a total of 10 seconds over a 100–second period.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1114 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1114 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

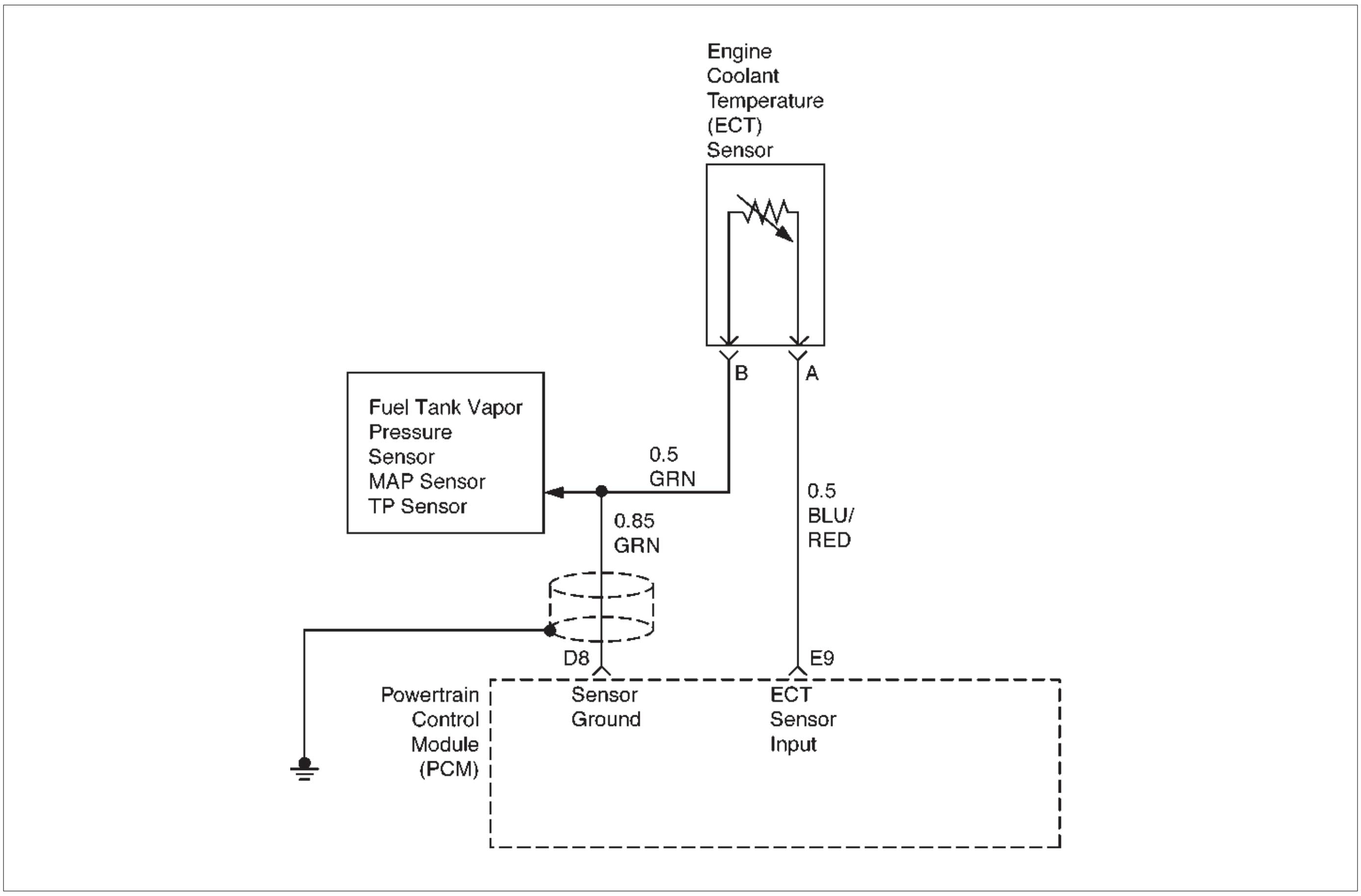
Engine Coolant Temperature Sensor

°C	°F	Ω
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1114 – ECT Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0117 also set?	—	Go to DTC P0117 first	Go to Step 3
3	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent short to ground. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to Diagnostic Aids

DIAGNOSTIC TROUBLE CODE (DTC) P1115 ENGINE COOLANT TEMPERATURE (ECT) SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE



D06RX044

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5.0 volts) through a pull–up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently above the range of the ECT sensor, Diagnostic Trouble Code P1115 will set. Diagnostic Trouble Code P1115 is a type D code.

Conditions for Setting the DTC

- Engine run time longer than 180 seconds.
- The ECT sensor signal is intermittently greater than –39°C (–38°F) (4.94 volts) for a total of 10 seconds over a 100–second period.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1115 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1115 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

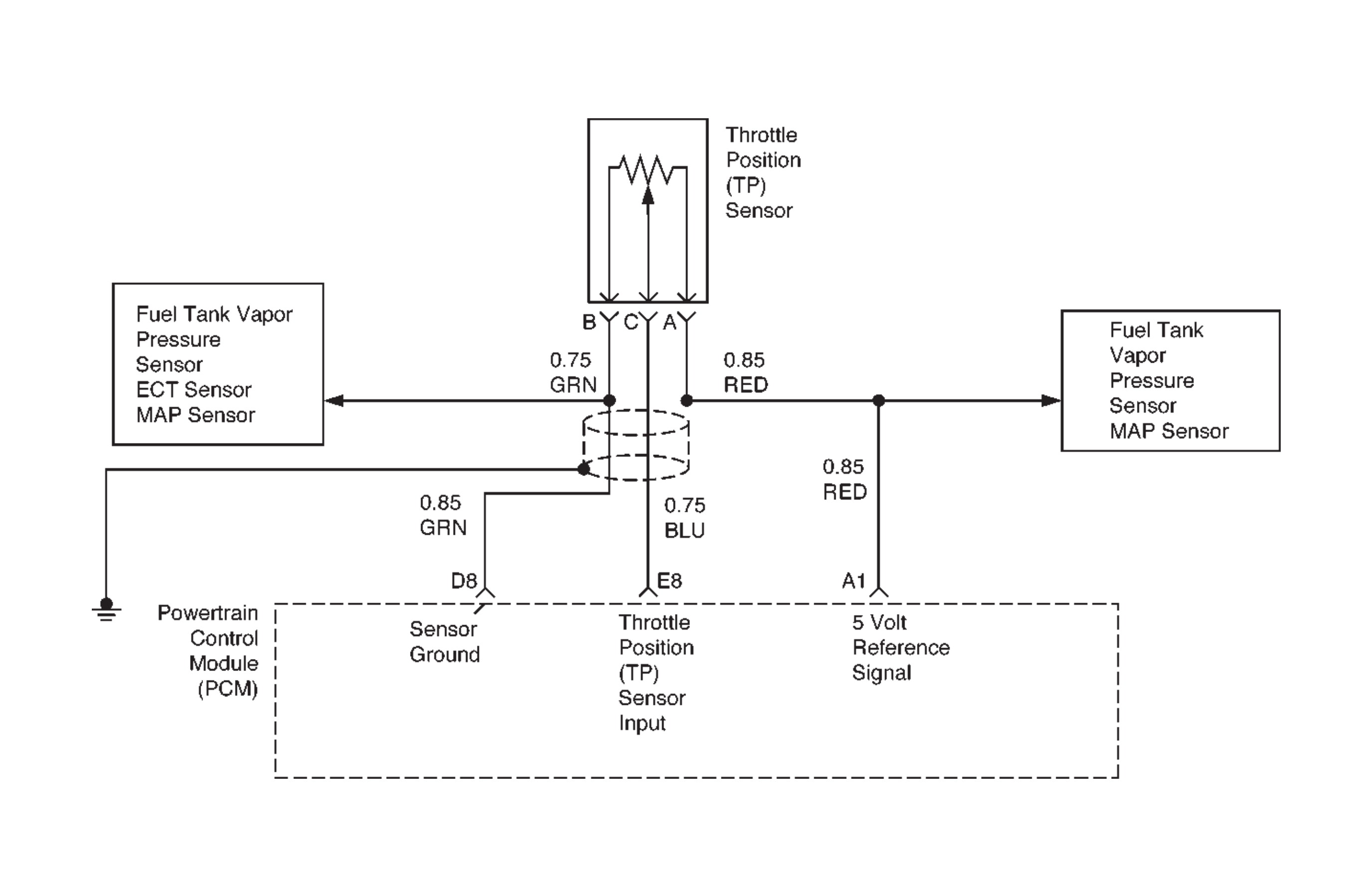
Engine Coolant Temperature Sensor

°C	°F	Ω
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1115 ECT Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0118 also set?	—	Go to DTC P0118 first	Go to Step 3
3	1. Check for a poor sensor ground circuit terminal connection at the ECT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 4
4	1. Check for a poor ECT signal circuit terminal connection at the ECT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent open. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 6
6	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent short to voltage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Check for a poor sensor ground circuit terminal connection at the PCM. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 8
8	1. Check for an intermittent open or a faulty splice in the sensor ground circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to Diagnostic Aids

DIAGNOSTIC TROUBLE CODE (DTC) P1121 THROTTLE POSITION (TP) SENSOR CIRCUIT INTERMITTENT HIGH VOLTAGE



D06RX045

Circuit Description

The throttle position (TP) sensor circuit provides a voltage signal that changes relative to the throttle blade angle. The signal voltage will vary from less than 1 volt at closed throttle to more than 4 volts at wide open throttle (WOT). The TP signal is used by the powertrain control module (PCM) for fuel control and for most of the PCM controlled outputs. If the PCM detects a TP signal that is intermittently above the range of the TP sensor, Diagnostic Trouble Code P1121 will be set. DTC P1121 is a type D code.

Conditions for Setting the DTC

- The ignition is ON.
- TP sensor indicates a throttle position voltage intermittently greater than 4.88 volts for a total of 0.15 seconds over a 1.5–second period.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1121 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1121 can be cleared by using the Scan Tool's "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The TP sensor shares a 5 Volt reference with the MAP sensor and Fuel Pressure sensor.

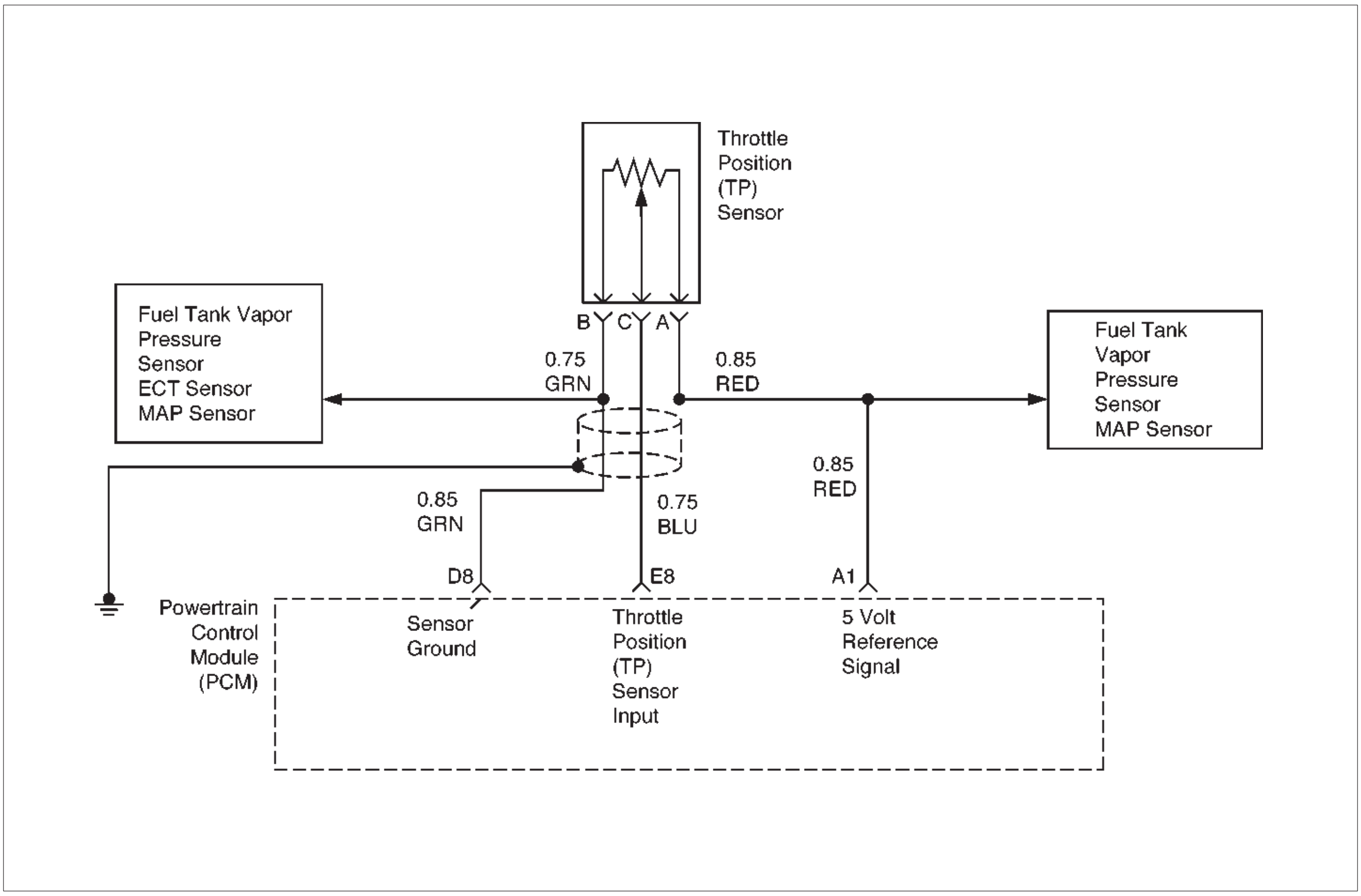
  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The TP sensor share a ground with the MAP and the Fuel Pressure sensor.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the throttle position display on the Tech 2 while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.

If Diagnostic Trouble Code P1121 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help to determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

DTC P1121 – TP Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	Is Diagnostic Trouble Code P0123 also set?	—	Go to DTC P0123 first	Go to Step 3
3	Is Diagnostic Trouble Code P0463 and/or P1106 also set?	—	Go to Step 6	Go to Step 4
4	Check for a poor sensor ground circuit terminal connection at the TP sensor. Was a problem found?	—	Go to Step 9	Go to Step 5
5	Check the TP signal circuit between the TP sensor connector and the PCM for an intermittent short to voltage. Was a problem found?	—	Go to Step 10	Go to Step 8
6	Check for an intermittent short to voltage on the 5 volt reference circuit between the PCM and the following components: • MAP Sensor • Fuel Tank Vapor Pressure Sensor Was a problem found?	—	Go to Step 10	Go to Step 7
7	Check for a poor sensor ground terminal connection at the PCM. Was a problem found?	—	Go to Step 9	Go to Step 8
8	Check for an intermittent open or a faulty splice in the sensor ground circuit. Was a problem found? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to Step 10	Refer to Diagnostic Aids
9	Replace the faulty harness connector terminal for the sensor ground circuit. Is the action complete?	—	Verify repair	—
10	Repair intermittent open/short circuit in wiring harness as necessary. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1122 THROTTLE POSITION (TP) SENSOR CIRCUIT INTERMITTENT LOW VOLTAGE



D06RX045

Circuit Description

The throttle position (TP) sensor circuit provides a voltage signal that changes relative to the throttle blade angle. The signal voltage will vary from less than 1 volt at closed throttle to more than 4 volts at wide open throttle (WOT). The TP signal is used by the powertrain control module (PCM) for fuel control and for most of the PCM controlled outputs. If the PCM detects a TP signal that is intermittently above the range of the TP sensor, Diagnostic Trouble Code P1122 will be set. DTC P1122 is a type D code.

Conditions for Setting the DTC

- The ignition is ON.
- TP sensor indicates a throttle position signal intermittently less than 0.235 volt for a total of 0.15 seconds over a 1.5–second period.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the Diagnostic Trouble Code set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history Diagnostic Trouble Code P1122 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1122 can be cleared by using the Scan Tool’s ”Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the throttle position display on the Tech 2 while moving connectors and wiring harnesses related to the TP sensor. A change in the display will indicate the location of the fault.
- The TP sensor shares a 5 Volt reference with the MAP sensor and Fuel Pressure sensor.

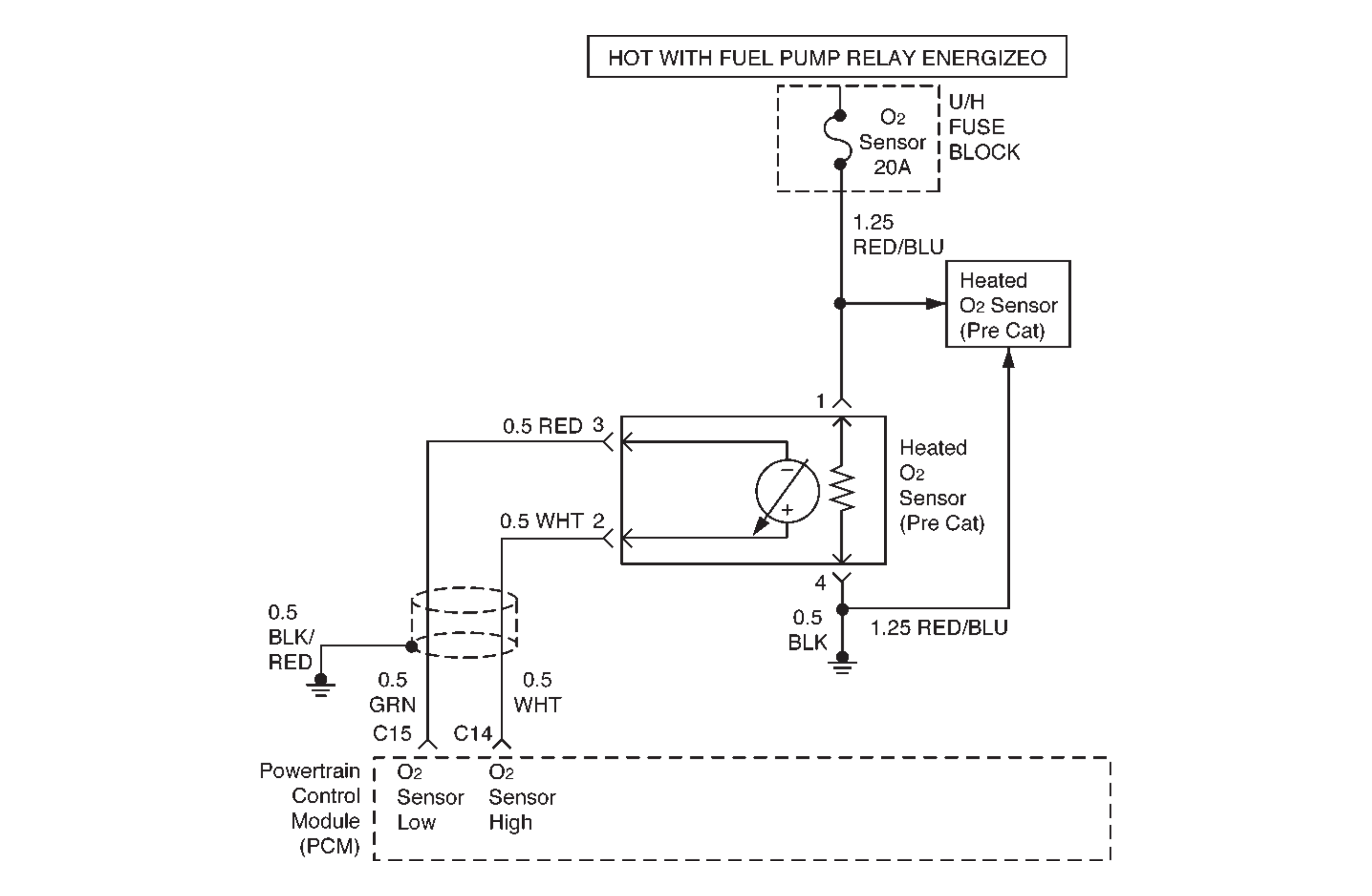
  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The TP sensor share a ground with the MAP and the Fuel Pressure sensor.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help to determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

DTC P1122 – TP Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Is DTC P0122 also set?	—	Go to DTC P0122 first	Go to Step 3
3	Is DTC P1107 and/or P0462 also set?	—	Go to Step 6	Go to Step 4
4	Check for a poor 5 volt reference circuit or TP signal circuit terminal connection at the TP sensor. Was a problem found?	—	Go to Step 9	Go to Step 5
5	Check the TP signal circuit between the TP sensor connector and the PCM for an intermittent short to ground. Was a problem found?	—	Go to Step 10	Go to Step 8
6	Check for an intermittent short to ground on the 5 volt reference circuit between the PCM and the following components: ● Fuel Tank Vapor Pressure Sensor ● MAP Sensor Was a problem found?	—	Go to Step 9	Go to Step 8
7	Check for a poor 5 volt reference circuit terminal connection at the PCM. Was a problem found?	—	Go to Step 9	Go to Step 8
8	Check for an intermittent open or a faulty splice in the 5 volt reference circuit. Was a problem found? (if no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to Step 10	Refer to Diagnostic Aids
9	Replace the faulty harness connector terminal(s) for the 5 volt reference circuit and/or the TP signal circuit as necessary. Is the action complete?	—	Repair complete. If a driveability symptom still exists, refer to Symptoms.	—
10	Repair intermittent open/short circuit in wiring harness as necessary. Is the action complete?	—	Repair complete. If a driveability symptom still exists, refer to Symptoms.	—

DIAGNOSTIC TROUBLE CODE (DTC) P1133 O2 SENSOR INSUFFICIENT SWITCHING (BANK 1 SENSOR 1)



D06RX046

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after ”Closed Loop” has been enabled. During this test period the PCM counts the number of times that the HO2S signal voltage crosses the rich–to–lean and lean–to–rich threshold. If the PCM determines that the HO2S did not switch enough times, Diagnostic Trouble Code P1133 will be set.

A lean–to–rich switch is determined when the HO2S voltage changes above and below 450 mV. DTC P1133 is a type B code.

Conditions for Setting the DTC

- Engine coolant temperature (ECT) is above 60°C (140°F).
- Engine is operating in ”Closed Loop”.
- The engine has been running at least two minutes.
- Canister purge duty cycle is greater than 2%.
- Calculated air flow between 17 and 32 grams/sec.
- Engine speed is between 1500 RPM and 3500 RPM.
- Above conditions are present for 1 second.
- 90 seconds after ”Closed Loop” and has been achieved, the PCM monitors the oxygen sensor as it switches above and below 450 mV. If fewer than 12 rich–to–lean and 12 lean–to–rich switches are detected, Diagnostic Trouble Code P1133 will be set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- ”Open Loop” fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P1133 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1133 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a Diagnostic Trouble Code P1133 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and Diagnostic Trouble Code P1133 continues to set, replace the Bank 1 HO2S 1.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help to determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging the replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
11. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

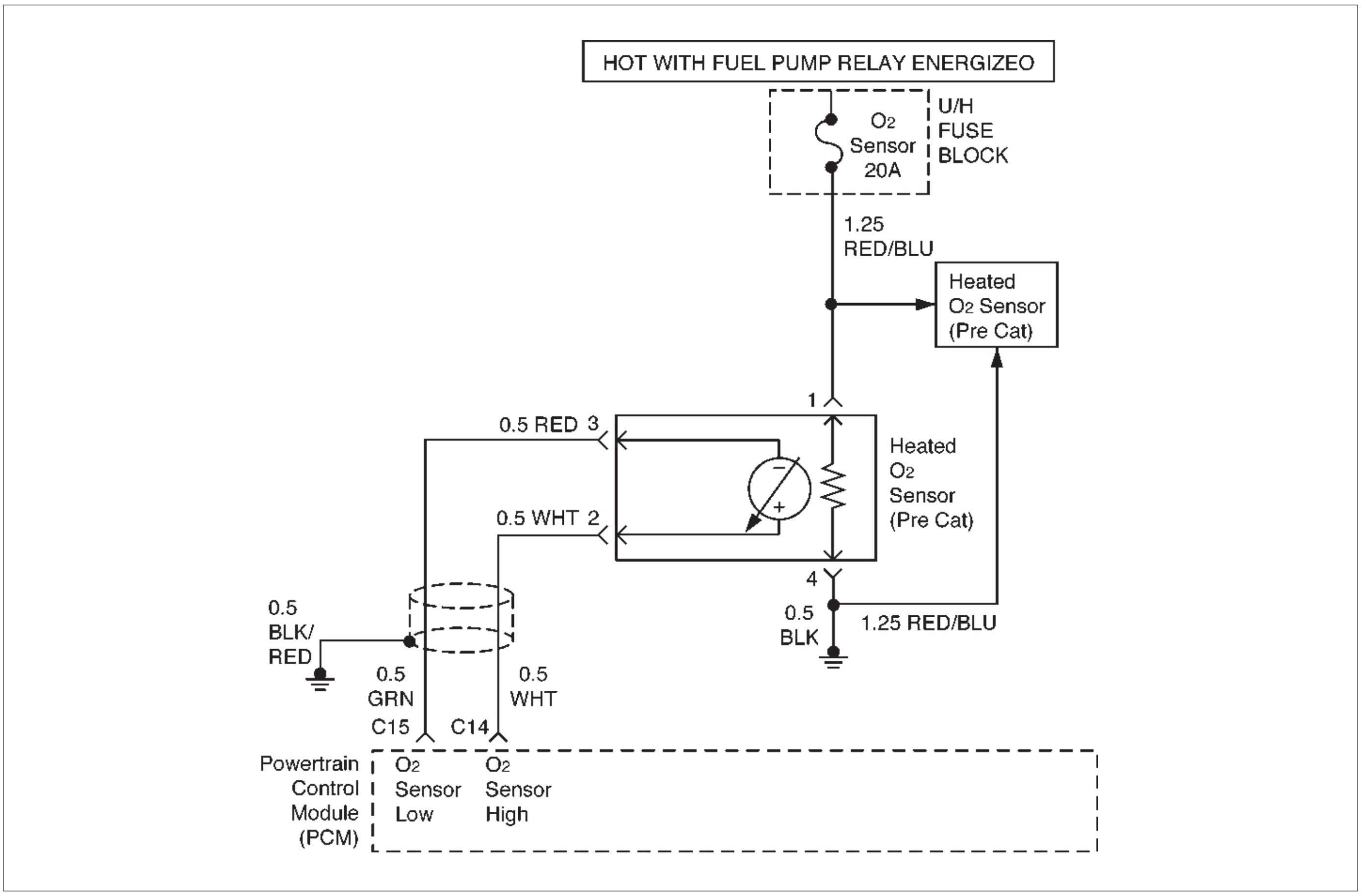
DTC P1133 – O2 Sensor Insufficient Switching (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	**IMPORTANT:** If any Diagnostic Trouble Codes are set refer to those Diagnostic Trouble Codes before proceeding with this diagnostic chart. 1. Engine idling at operating temperature. 2. Operate the vehicle within parameters specified under ”Conditions for Setting the Diagnostic Trouble Code” criteria. 3. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P1133 until the Diagnostic Trouble Code P1133 test runs. 4. Note the test result. Does the Tech 2 indicate Diagnostic Trouble Code P1133 failed this ignition?	—	Go to Step 3	Refer to Diagnostic Aids
3	Did the Tech 2 also indicate that the P1153 or P1154 tests failed?	—	Go to Step 11	Go to Step 4
4	1. Perform the ”Exhaust System Leak Test” (refer to Exhaust System). After the ”Exhaust System Leak Test” has been performed, return to this diagnostic. 2. If an exhaust leak is found, repair as necessary. Was an exhaust leak isolated?	—	Go to Step 2	Go to Step 5
5	Visually/physically inspect the following items: • Ensure that the Bank 1 HO2S 1 is securely installed. • Check for corrosion on the terminals. • Check the terminals at Bank 1 HO2S 1 and at the PCM. • Check for damaged wiring; shorts to ground, shorts to battery positive, and open circuits. Was a problem found in any of the above areas?	—	Verify repair	Go to Step 6
6	1. Disconnect Bank 1 HO2S 1. 2. Ignition ON. 3. Using a Digital Voltmeter (DVM) at the PCM side of the connector, check the voltage between the high signal circuit and ground. Also measure between the low signal circuit and ground. Are both voltages in the specified range?	3–4 mV	Go to Step 9	Go to Step 7

DTC P1133 – O2 Sensor Insufficient Switching (Bank 1 Sensor 1) (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition OFF. 2. Check for damage to PCM pins or terminals. Was a problem found?	—	Verify repair	Go to Step 8
8	Check for a short to voltage or ground or an open in the signal circuit. Was a problem found?	—	Verify repair	Go to Step 9
9	1. Ignition OFF. 2. Disconnect the PCM connector. 3. With the HO2S disconnected, check for high and low signal circuits shorted together between the PCM and HO2S. Was a problem found?	—	Verify repair	Go to Step 10
10	With the PCM connected and Bank 1 HO2S 1 disconnected from the harness, check Bank 1 HO2S 1 with a Tech 2. Is the voltage in the specified range?	430–470 mV	Go to Step 11	Go to Step 12
11	Replace the affected heated oxygen sensors. NOTE: Before replacing the sensors, the cause of the contamination must be determined and corrected. ● Fuel contamination. ● Use of improper RTV sealant. ● Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1134 O2 SENSOR TRANSITION TIME RATIO (BANK 1 SENSOR 1)



D06RX046

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after "Closed Loop" has been established. During the monitoring period the PCM counts the number of times that the HO2S responds from rich–to–lean and from lean–to–rich and adds the amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. The PCM then divides the rich–to–lean average by the lean–to–rich average to obtain a ratio. If the HO2S transition time ratio is not within this range, Diagnostic Trouble Code P1134 will be set, indicating that the oxygen sensor is not responding as expected to changes in exhaust oxygen content. DTC P1134 is a type B code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine coolant temperature (ECT) is above 60°C (140°F).
- Engine is operating in "Closed Loop".
- The engine has been running at least two minutes.
- Calculated air flow between 17 and 32 grams/sec.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3500 RPM.
- Above conditions are present for a 1–second monitoring period.
- 90 seconds after "Closed Loop" has been enabled, Bank 1 HO2S 1 transition ratio between lean–to–rich and rich–to–lean is less than 0.4 or greater than 3.8.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- "Open Loop" fuel control will be in effect.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P1134 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1134 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a Diagnostic Trouble Code P1133 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and

Diagnostic Trouble Code P1134 continues to set, replace the Bank 1 HO2S 1.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the Diagnostic Trouble Code to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging the replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
11. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

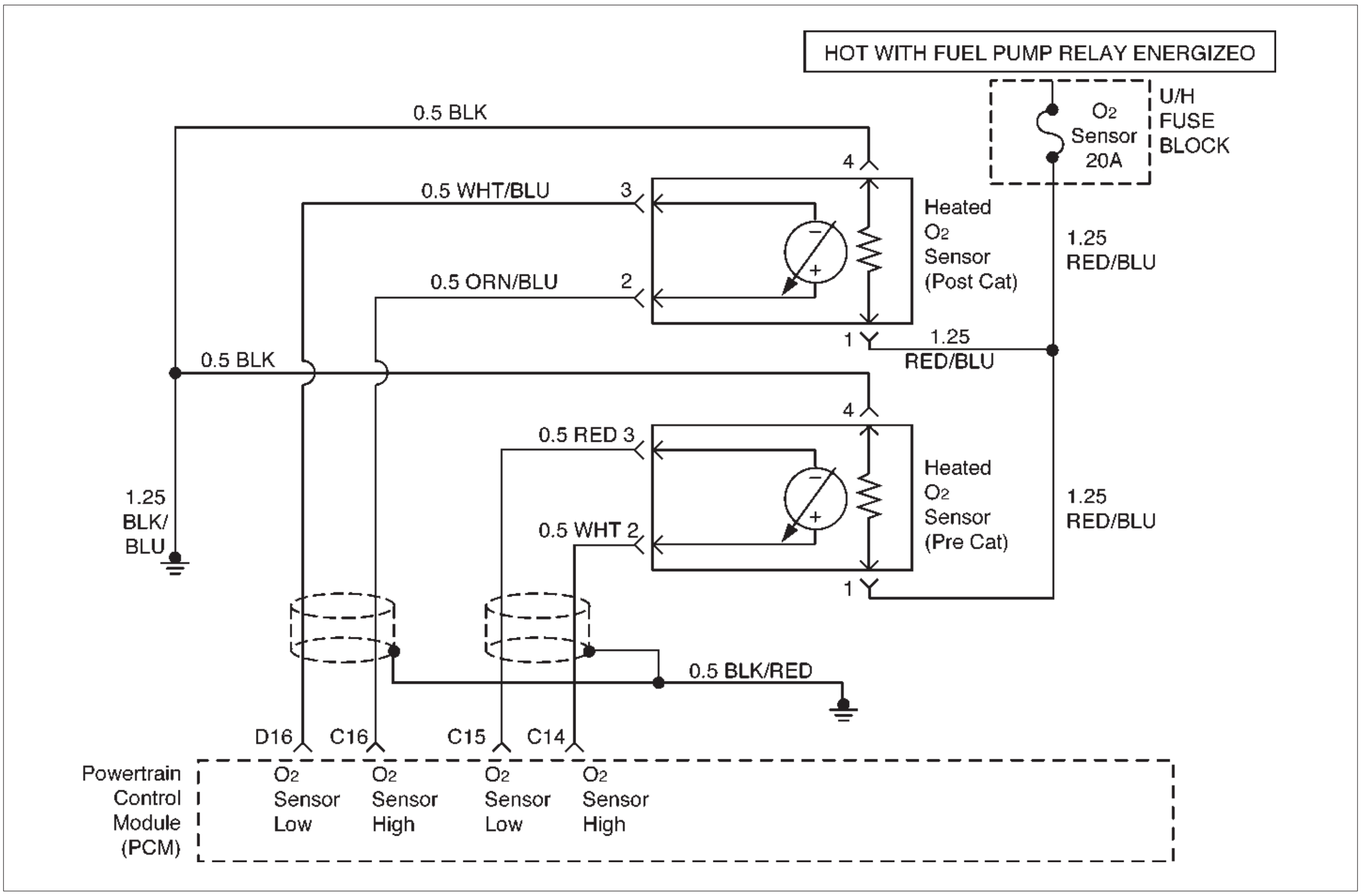
DTC P1134 – O2 Sensor Transition Time Ratio (Bank 1 Sensor 1)

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	**IMPORTANT:** If any DTCs are set refer to those DTCs before proceeding with this diagnostic chart. 1. Idle the engine at operating temperature. 2. Operate the vehicle within parameters specified under ”Conditions for Setting the Diagnostic Trouble Code” criteria included in Diagnostic Support. 3. Using a Tech 2, monitor “Diagnostic Trouble Code” info for Diagnostic Trouble Code P1134 until the Diagnostic Trouble Code P1134 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P1134 failed this ignition?	—	Go to Step 3	Refer to Diagnostic Aids
3	1. Perform the ”Exhaust System Leak Test” (refer to Exhaust System). After the ”Exhaust System Leak Test” has been performed, return to this diagnostic. 2. If an exhaust leak is found, repair as necessary. Was an exhaust leak isolated?	—	Verify repair	Go to Step 4
4	Visually/physically inspect the following items: • Ensure that the Bank 1 HO2S 1 is securely installed. • Check for corrosion on the terminals. • Check the terminals at Bank 1 HO2S 1 and at the PCM. • Check for damaged wiring; shorts to ground, shorts to battery positive, and open circuits. Was a problem found in any of the above areas?	—	Go to Step 7	Go to Step 5
5	1. Disconnect Bank 1 HO2S 1. 2. Ignition ON. 3. Using a Digital Voltmeter (DVM) at the PCM side of the connector, check the voltage between the high signal circuit and ground. Also measure between the low signal circuit and ground. Are both voltages in the specified range?	3–4 V	Go to Step 6	Go to Step 8

DTC P1134 – O2 Sensor Transition Time Ratio (Bank 1 Sensor 1) (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. With Bank 1 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition ON. 3. Using a Tech 2, monitor the Bank 1 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to Step 10	Go to Step 11
7	Repair condition as necessary. Is the action complete?	—	Verify repair	—
8	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to Step 9
9	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	Go to Step 6
10	Remove the Bank 1 H02S 1 and examine it for signs of: • Fuel contamination; • Improper RTV sealant (white powdery coating on sensor); • Engine oil/coolant consumption. Were signs of contamination observed?	—	Go to Step 13	Go to Step 12
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the repair complete?	—	Verify repair	—
12	Replace the Bank 1 H02S 1. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1171 FUEL SYSTEM LEAN DURING ACCELERATION



D06RX048

Circuit Description

The powertrain control module (PCM) internal circuitry can identify if the vehicle fuel system is capable of supplying adequate amounts of fuel during heavy acceleration (power enrichment). The PCM monitors the voltage of the oxygen sensor during power enrichment. When a power enrichment mode of operation is requested during ”Closed Loop” operation (by heavy acceleration), the PCM will provide more fuel to the engine. Under these conditions the PCM should detect a ”rich” condition (high oxygen sensor voltage). If this ”rich” exhaust is not detected at this time, a Diagnostic Trouble Code P1171 will set. A plugged fuel filter or restricted fuel line can prevent adequate amounts of fuel from being supplied during power enrichment mode. DTC P1171 is a type A code.

Conditions for Setting the DTC

- No related Diagnostic Trouble Codes.
- Engine is operating in ”Closed Loop”.
- Engine coolant temperature is above 60˚C (140˚F).
- While in ”power enrichment” mode the oxygen sensor voltage remains below 400 mV for 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the Diagnostic Trouble Code was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history Diagnostic Trouble Code P1171 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- Diagnostic Trouble Code P1171 can be cleared by using the Scan Tool’s ”Clear Info” function.

Diagnostic Aids

- A restricted fuel filter or fuel line can supply adequate amounts of fuel at idle, but may not be able to supply enough fuel during heavy acceleration.
- Water or alcohol in the fuel may cause low HO2S voltage during acceleration.
- Check for faulty or plugged fuel injector(s).
- Check for low fuel.

Test Description

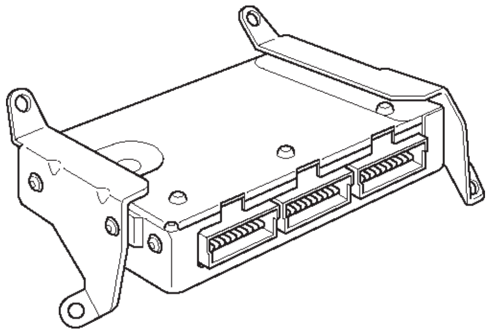
Number(s) below refer to the step number(s) on the Diagnostic Chart:

4. When the engine is idling or at steady cruise, the HO2S voltage should vary from between approximately 100 mV to 900 mV. During ”power enrichment” mode, more fuel is needed and the HO2S voltage should rise above 447 mV. This step checks to see if the HO2S is operating properly.
5. Wrap a shop towel around the fuel pressure connector to absorb any small amount of fuel leakage that may occur when installing the gauge. Ignition ON, pump pressure should be 235–320 kPa.
7. Add Caution: Use correct pliers so damage to fuel lines will not occur.

DTC P1171 – Fuel System Lean During Acceleration

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	Are any component–related Diagnostic Trouble Codes set?	—	Go to component DTC charts	Go to Step 3
3	1. Check the vehicle’s fuel tank for an adequate amount of fuel. 2. Add fuel to the vehicle’s fuel tank if the tank is almost empty. Was fuel added to the vehicle’s fuel tank?	—	Go to Step 4	Go to Step 5
4	1. Using a Tech 2, observe HO2S 1 voltage while running warm engine(75°C–95°C [167°F–203°F]) at 1200 RPM. 2. HO2S 1 voltage should vary within the specified range. Does the voltage toggle back and forth within the specified range?	100– 900 mV	Go to Diagnostic Aids	Go to Step 5
5	1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure. 2. Install the fuel pressure gauge. 3. Start the engine and idle at normal operating temperature. 4. Disconnect the vacuum line going to the fuel pressure regulator. With the engine running, is the fuel pressure within the specified range?	284– 325 kPa	Go to OBD System Check	Go to Step 6
6	Check for restricted fuel lines or restricted in–line filter. Was a problem found?	—	Verify repair	Go to Step 7
7	1. Ignition OFF. 2. Ignition ON, engine OFF. 3. Using a Tech 2, enable the fuel pump to operate. 4. Using pliers, slowly close the return line (do not exceed the first specified value). Using the pliers, can the fuel pressure be manipulated to exceed the second specified value?	414 kPa 325 kPa	Go to Diagnostic Aids	Go to Step 8
8	Check for: • Faulty fuel pump • Restricted fuel pump strainer (sock) • Incorrect fuel pump • Incorrect fuel being used • Hot fuel	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1336 CRANKSHAFT POSITION SENSOR (CKP) SYSTEM VARIATION NOT LEARNED



014RX002

Circuit Description

In order to detect engine misfire at higher engine speeds, the Powertrain Control Module (PCM) must know of any variation between the crankshaft sensor pulse. Most variations are due to the machining of the crankshaft reluctor wheel, however, other sources of variation are also possible. A Crankshaft Position Sensor Tooth Error Correction (TEC) procedure must be performed any time a change is made to the crankshaft sensor, crankshaft, or if the PCM measures the variations and then calculates compensation factors needed to enable the PCM to accurately detect engine misfire at all speeds and loads. The Tech 2 must be used to command the PCM to learn these variations. If for any reason the PCM is unable to learn these variations or they are out of an acceptable range, the PCM will set a DTC P1336. A PCM that has not had the Crankshaft Position Sensor Tooth Error Correction (TEC) Procedure performed due to replacement or reprogramming will also set a DTC P1336. DTC P1336 is a type A code.

Conditions for Setting the DTC

- No ECT, Knock, CKP, CMP or injector sensor DTCs.
- PCM has not successfully learned crankshaft position Tooth Error Correction(TEC) within 5 attempts or 5 Km (3 miles).

Action Taken When the DTC Sets

- The Malfunction Indicator Lamp (MIL) will illuminate the first time the error is detected.
- The PCM will record operating conditions at the time the diagnostic fails. This information will be stored in the Freeze Frame and Failure Records buffers.
- A history DTC is stored.

Conditions for Clearing the MIL/DTC

- The MIL will turn OFF after three consecutive ignition cycles in which the diagnostic runs without a fault.
- A history DTC will clear after 40 consecutive warm up cycles without a fault.
- DTC(s) can be cleared by using the Tech 2.

Diagnostic Aids

- Refer to ”TEC Learn Procedure”

CAUTION: When performing the Crankshaft Position Sensor Tooth Error Correction (TEC) Procedure always set the vehicle parking brake and block the drive wheels. Release the throttle immediately when the engine starts to decelerate. Once the learn procedure is completed, engine control will be returned to the operator and the engine will respond to throttle position.

DTC P1336 will only set if the PCM has not learned the crankshaft position sensor Tooth Error Correction (TEC). The PCM only needs to learn this variation once per life cycle of the vehicle unless the crank sensor to crankshaft relationship is disturbed. Removing a part for inspection and then reinstalling the same part is considered a disturbance. A fully warmed up engine is critical to learning the variation correctly. If a valid learn occurs, no other learns can be completed that ignition cycle. If the engine cuts out before the specified learn procedure engine speed or at normal fuel cut–off RPM. The PCM is not in the learn procedure mode. Review the Crankshaft Position Sensor Tooth Error Correction (TEC) Procedure and re–enable the learn procedure. Verify that the Tech 2 says "Test in Progress."

Excessive Crankshaft Variation Symptom

Tech 2 Display	Possible Causes
Factors out of range	Reluctor wheel–matching quality, run out, incorrect air gap
Opposing factors out of range	Disturbance–noise on crank sensor circuit, reattempt the Learn procedure
Sum out of range	Engine too cold, reattempt the Learn Procedure
Crank pulse count error	Crank or Cam sensor DTCs set–Repair first

Test Description

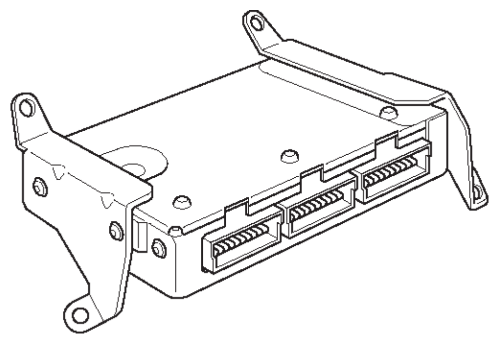
Number(s) below refer to the step number(s) on the Diagnostic Chart:

1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 if applicable. This created an electronic copy of the data taken when the fault occurred. The information is then stored on the Tech 2 for later reference.
2. Engine temperature if critical to properly learn the Crankshaft Position Sensor Tooth Error Correction (TEC). Failure to properly warm the engine before performing this procedure will result in an inaccurate measurement of the Crankshaft Position Sensor Tooth Error Correction (TEC). The PCM learns this variation as the engine is decelerating and then allows engine control to be returned to the operator. All accessories must be turned OFF when learning the Crankshaft Position System angle variation. If the A/C is not disabled when the learn procedure is enable, the PCM will disable the A/C. When the PCM is ready to allow the learn procedure to run, the Tech 2 will display "Test in Progress."
3. If after the specified number attempts the PCM cannot learn the crankshaft position Sensor Tooth Error Correction (TEC) then the variation is too large and no variation problem is corrected.
4. Being unable to learn the Crankshaft Position Sensor Tooth Error Correction (TEC) indicates that the variation is out of range. Using the Excessive Crankshaft Variation Trouble shooting will help to diagnose the area where the problem lies.

DTC P1336 CKP System Variation Not Learned

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	Perform the Crankshaft Position Sensor Tooth Error Correction(TEC) Learning Procedure as follows: When performing the Crankshaft Position Sensor Tooth Error Correction (TEC) Learning Procedure always set the vehicle parking brake and block the drive wheels. Release the throttle immediately when the engine starts to decelerate. Once the learn procedure is completed, engine control will be returned to the operator and the engine will respond to throttle position. 1. Install a Tech 2. 2. Put vehicle in Park or Neutral. 3. Run the engine until it is above the specified temperature. 4. Set the vehicle parking brake and block the drive wheels. 5. Turn all accessories OFF. 6. Enable the Crankshaft Position Sensor Tooth Error Correction (TEC) Learning Procedure with the Tech 2. 7. Raise the engine RPM to the specified value RELEASING the throttle as soon as the engine shuts out. Does the Tech 2 indicate that Crankshaft Position System variation has been learned?	70˚C (158˚F) 3920 RPM	Go to Step 5	Go to Step 3
3	Attempt Crankshaft Position System Variation Learning Procedures many times as the specified value. Does the Tech 2 indicate that Crankshaft Position System variation has been learned?	5	Go to Step 5	Go to Step 4
4	Repair Check for a problem with the a Crank Sensor to Crankshaft relationship and repair as necessary? Refer to the Excessive Crankshaft Variation Symptom Table.	—	Go to Step 5	—
5	1. Using the Tech 2, clear DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Tech 2 indicate that this diagnostic "Ran and Passed?"	—	Go to Step 6	Go to Step 2
6	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	—	Go to applicable DTC table	System OK

DIAGNOSTIC TROUBLE CODE (DTC) P1380 ABS ROUGH ROAD SYSTEM FAULT



014RX002

Circuit Description

The PCM identifies an engine misfire by detecting the variations in crankshaft speed. The crankshaft speed variations can also occur when a vehicle is operated over a rough surface. The ABS (Anti–Lock Brake System) can detect when the vehicle is on a rough surface based on the wheel acceleration/deceleration data supplied by each wheel speed sensor. The EBCM (Electronic Brake Control Module) over the Class 2 serial data line sends this information to the PCM. The OCM then uses this information in order to determine if the crankshaft variations are being caused by an actual engine misfire or from being driven on a rough surface.

This Diagnostic determines if the ABS system is not capable of detecting a rough road situation. DTC P1380 is a type D code.

Conditions for Setting the DTC

- 20 unusable ABS data values within a 50 value sample.

Conditions for Clearing the DTC

- A history DTC clears after 40 consecutive warm–up cycles without a fault.
- The Tech 2 can clear the DTC.

Diagnostic Aids

The setting of this DTC indicates that a misfire was detected and that the PCM could not determine if the detected misfire was true or due to operating the vehicle on a rough surface. A misfire can be a true misfire with or without setting this DTC. Check the EBCM for poor connections at the Class 2 serial data terminals. Be sure no true misfire exists after repairing the cause of this DTC.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

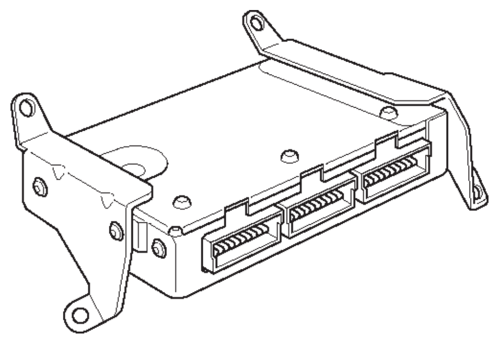
1. The Powertrain OBD System Check prompts the technician to complete some basic checks and store the freeze frame and failure records data on the Tech 2 is applicable. This creates an electronic copy of the data taken when the malfunction occurred. The information is then stored on the Tech 2 for later reference.
2. ABS DTCs are found by selecting Chassis on the Tech 2.
3. Be careful to clear only DTCs and not the captured information stored on the Tech 2. The Tech 2 will issue a warning if this is about to happen.
4. A DTC P1380 being reset indicated that the PCM is not receiving the correct information from the EBCM due to an ABS DTC.
5. When DTC P1380 is set, and ABS DTC should also be set.
6. Refer to Section 5E of the service manual for ABS DTCs and repairs.

8. Repair any condition that remains and is causing a misfire by following the table for any DTC that has set.
9. Replacement PCMs must be reprogrammed. Refer to the latest Isuzu Technical Communication System information for programming procedures.

DTC P1380 ABS Rough Road System Fault

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install the Tech 2. 3. Check for any ABS DTCs. Were any ABS DTCs set?	—	Go to Step 6	Go to Step 3
3	1. Turn the ignition switch ON, with the engine OFF. 2. Review the Freeze Frame data and note the parameters. Did a misfire DTC set?	—	Go to Step 4	Go to Step 10
4	Was a DTC P1380 also set?	—	Go to Step 5	Go to Step 8
5	Did a ABS DTC also set?	—	Go to Step 6	Go to Step 9
6	Repair the condition causing the ABS DTC. Is the action complete?	—	Go to Step 7	—
7	Check if any additional DTCs are set. Are any DTCs displayed that has not been diagnosed?	—	Go to applicable DTC table	System OK
8	Repair the condition causing the misfire. Is the action complete?	—	Go to Step 10	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed.Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to Step 10	—
10	1. Using the Tech 2, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Tech 2 indicate that this diagnostic has ”Ran and Passed?”	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1381 ABS ROUGH ROAD CLASS 2 SERIAL DATA FAULT



014RX002

Circuit Description

The PCM identifies an engine misfire by detecting the variations in crankshaft speed. The crankshaft speed variations can also occur when a vehicle is operated over a rough surface. The ABS (Anti–Lock Brake System) can detect when the vehicle is on a rough surface based on the wheel acceleration/deceleration data supplied by each wheel speed sensor. The EBCM (Electronic Brake Control Module) over the Class 2 serial data line sends this information to the PCM. The PCM then uses this information in order to determine if the crankshaft variations are being caused by an actual engine misfire or from being driven on a rough surface. DTC P1381 is a type D code.

Conditions for Setting the DTC

- A DTC P0300–P0304 has been set.
- The vehicle speed is greater than 1 mph (2 km/h).
- The Manifold Absolute Pressure (MAP) is below 99.7 kPa.
- The engine speed is below 3406 RPM.
- The PCM has not received any ABS information for 2.5 seconds.

Action Taken When the DTC Sets

- The PCM records the operating conditions at the time the diagnostic fails. The Failure Records buffers stores this information.
- A history DTC is stored.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions for Clearing the DTC

- A history DTC clears after 40 consecutive warm up cycles without a fault.
- The Tech 2 can clear the DTC.

Diagnostic Aids

The setting of this DTC indicates that a misfire was detected and that the PCM could not determine if the detected misfire was true or due to operating the vehicle on a rough surface. A misfire can be a true misfire with or without setting this DTC. Check the EBCM for poor connections at the Class 2 serial data terminals. Be sure no true misfire exists after repairing the cause of this DTC.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

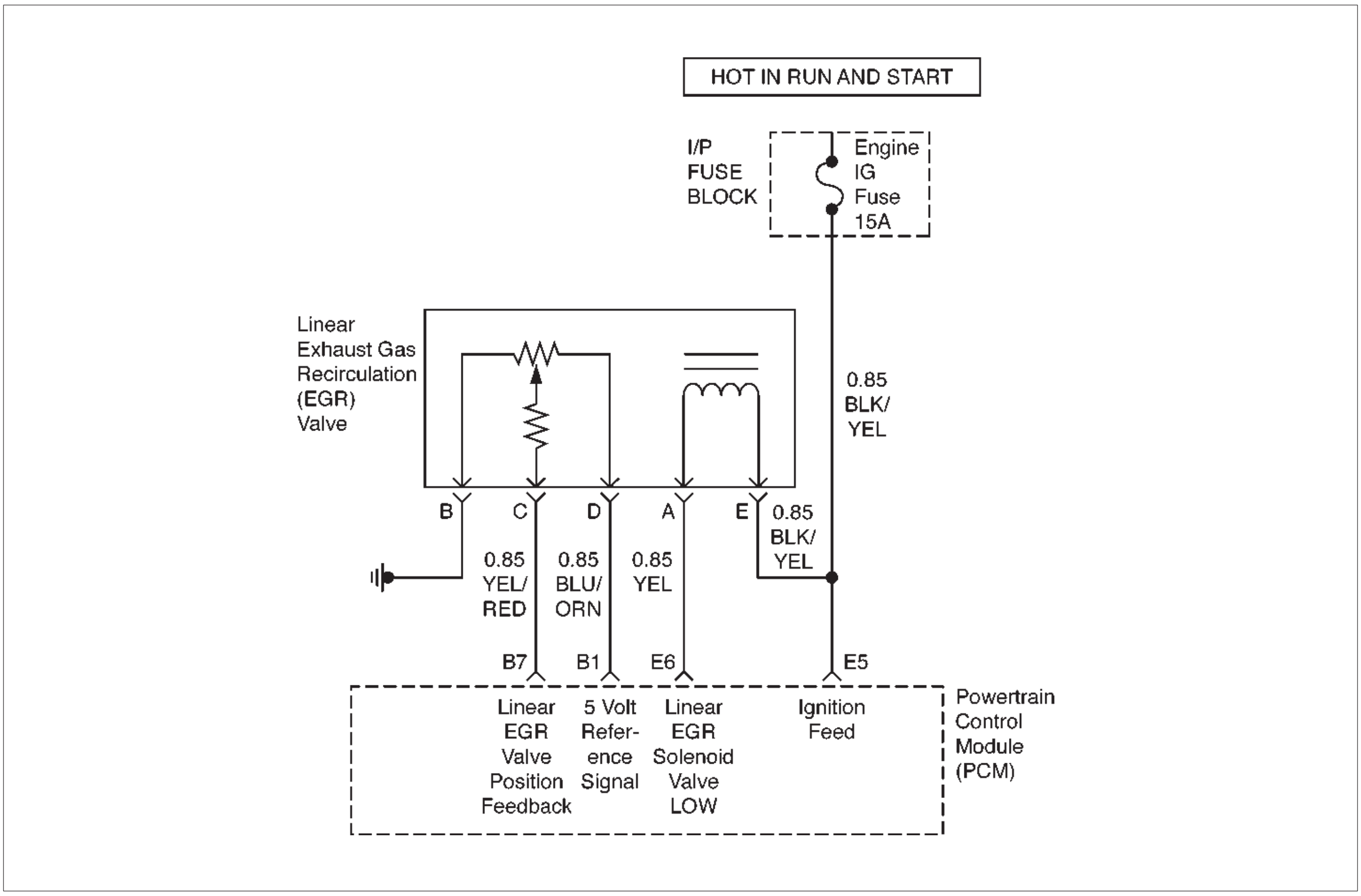
1. The Powertrain OBD System Check indicates that a misfire was detected and that the PCM could not determine if the detected misfire was true or due to operating the vehicle on a rough surface. A misfire can be a true misfire with or without setting this DTC. Check the EBCM for poop connections at the Class 2 serial data terminals. Be sure no true misfire exists after repairing the cause of this DTC.

3. Refer to the ABS portion of the service manual for ABS DTCs and repairs. Performing the ABS Diagnostic System Check is the first step in diagnosing a serial data problem.
4. Be careful to clear only DTCs and not the captured information stored on the Tech 2. The Tech 2 will issue a warning if this is about to happen.
5. A DTC P1381 being reset indicates that the PCM is not receiving serial data from the EBCM due to a EBCM problem.
6. When DTC P1381 is set, ABS serial data should not be able to be displayed.
7. Repair any condition that is causing a misfire by following the table for any DTC that has set.
10. Replacement PCMs must be reprogrammed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures.

DTC P1381 ABS Rough Road Class 2 Serial Data Fault

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to Powertrain OBD System Check
2	1. Turn the ignition switch ON, with the engine OFF. 2. Install the Tech 2. 3. Attempt to display the ABS data on the Tech 2. Can the ABS be displayed?	—	Go to Step 4	Go to Step 3
3	Repair the condition causing the ABS data not to be displayed. Is the action complete?	—	Go to Step 4	Go to Step 10
4	1. Clear the DTCs. 2. Operate the vehicle within the same conditions as indicated within the Freeze Frame data and Conditions for Setting the DTC as noted while driving on rough surfaces. Did a misfire DTC set?	—	Go to Step 5	Go to Step 8
5	Was a DTC P1380 also set?	—	Go to Step 6	Go to Step 7
6	Can the ABS data be displayed?	—	Go to Step 10	Go to Step 4
7	Repair the condition causing the misfire. Is the action complete?	—	Go to Step 8	—
8	1. Using the Tech 2, clear the DTCs. 2. Start the engine and idle at normal operating temperature. 3. Operate the vehicle within the conditions for setting this DTC as specified in the supporting text. Does the Tech 2 indicate that this diagnostic has "Ran and Passed?"	—	Go to Step 9	Go to Step 2
9	Check if any additional DTCs are set. Are any DTCs displayed that have not been diagnosed?	—	Go to applicable DTC table	System OK
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) 1404 EXHAUST GAS RECIRCULATION (EGR) CLOSED VALVE



D06RX055

Circuit Description

The powertrain control module (PCM) monitors the exhaust gas recirculation(EGR) valve pintle position input to ensure that the valve responds properly to commands from the PCM to detect a fault if the pintle position sensor and control circuits are open or shorted. If the PCM detects a pintle position signal voltage below the normal range of the pintle position sensor, or a signal voltage that is not within a tolerance considered acceptable for proper EGR control system operation, the PCM will set a DTC P1404.

Conditions for Setting the DTC

- IAT is above 5˚C (41˚)
- EGR actual position is 16 counts below the EGR low threshold for at least 6.3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the Malfunction Indicator Lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1404 will clear after 40 consecutive warm up cylcles without a fault.
- DTC P1404 can be cleared by using the Scan Tool's ”Clear Info” function.

Diagnostic Aids

Check for the following conditions:

- Excessive deposits on EGR valve pintle or seat – Check for deposits that may interfere with the EGR valve pintle extending completely or cause the pintle to stick.
- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to the EGR valve. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

NOTE: If the EGR valve show signs of excessive heat, check the exhaust system for blockage (possible a plugged catalytic converter) using the ”Restricted Exhaust System Check”.

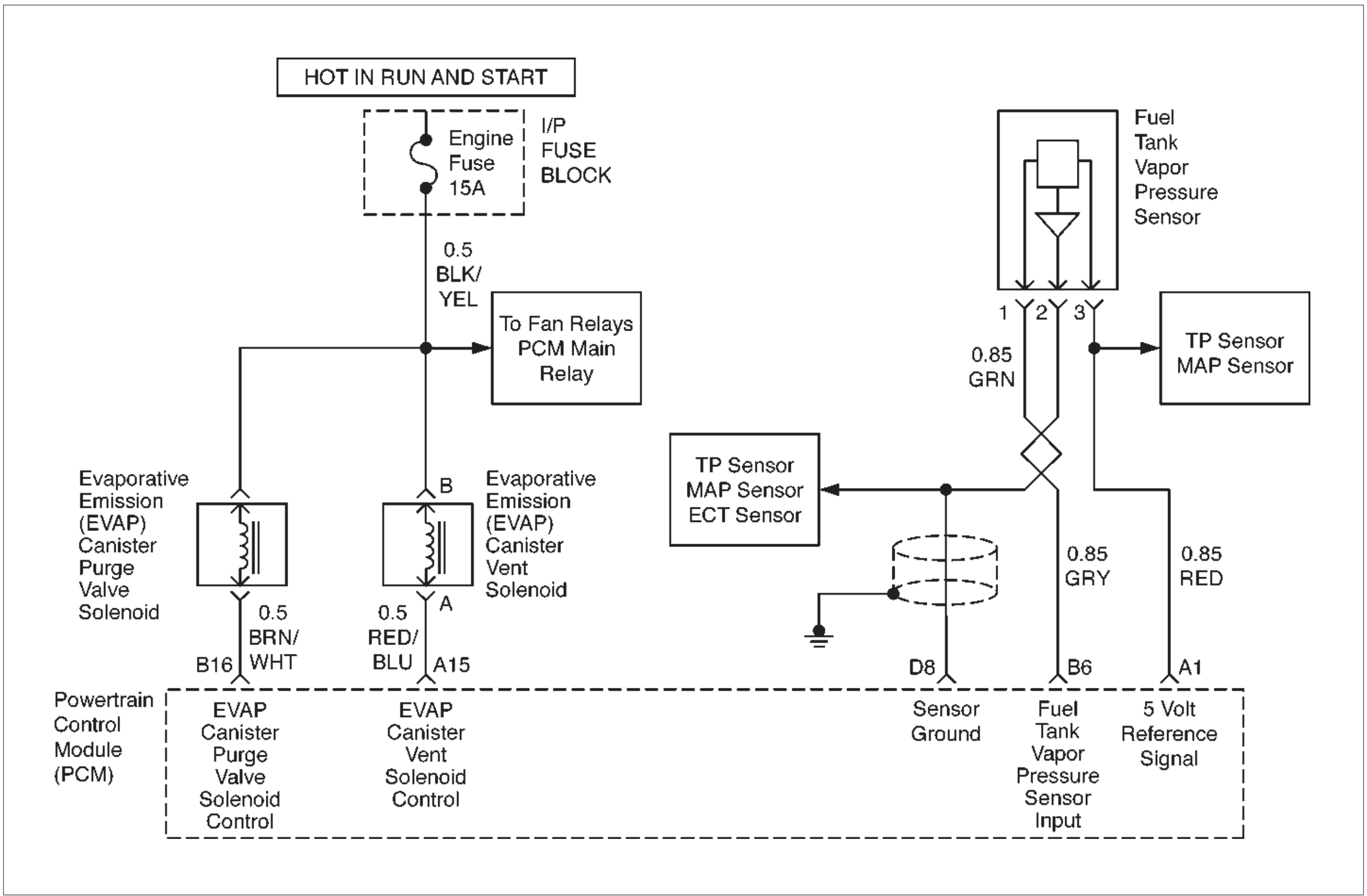
DTC P1404 EGR Closed Valve

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Turn the ignition switch ON, with the engine OFF. 2. Review and record the Tech 2 Failure Records data, the clear the DTCs. 3. Operate the vehicle within the Failure Records conditions noted. 4. Using the Tech 2, monitor "DTC" info for DTC P1404. Does the Tech 2 indicate DTC P1404 "Ran and Passed"	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Disconnect the Linear Exhaust Gas Recirculation (EGR) Valve from the wiring harness. 3. Ignition ON, Engine OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the Ignition feed circuit at the Linear Exhaust Gas Recirculation (EGR) Valve wiring harness connector. Does the DVM read the following value?	12 volts	Go to Step 6	Go to Step 4
4	Check the Ignition feed circuit, between the EGR sensor and the "Engine IG." fuse, for the following conditions: • An Open circuit • A short to ground Was the problem found?	—	Verify repair	—
5	Using a DVM, check the resistance of the EGR solenoid. Does the DVM read the following value?	less than 5 Ω	Go to Step 6	Go to Step 14
6	Check the EGR solenoid valve Low circuit, between the EGR sensor and the PCM, for the following conditions: • An Open circuit • A short to ground Was the problem found?	—	Verify repair	Go to Step 15
7	1. Ignition OFF. 2. Disconnect the Linear Exhaust Gas Recirculation (EGR) Valve from the wiring harness. 3. Ignition ON, Engine OFF. 4. Observe the EGR value on the Tech 2. Does the Tech 2 display the following value(s)?	0 volts 0%	Go to Step 9	Go to Step 8
8	Check the EGR position feedback circuit, between the EGR sensor and the PCM, for the following conditions: • An Open circuit • A short to ground Was the problem found?	—	Verify repair	Go to Step 15

DTC P1404 EGR Closed Valve (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Ignition ON, engine OFF. 2. Using a Digital Voltmeter (DVM), check for voltage on the 5 volt Reference signal circuit at the Linear Exhaust Gas Recirculation (EGR) Valve wiring harness connector. Does the DVM read the following value?	about 5 volts	Go to Step 11	Go to Step 10
10	Check the 5 volt reference signal circuit, between the EGR and the PCM, for the following conditions: • An Open circuit • A short to ground Was the problem found?	—	Verify repair	Go to Step 11
11	1. Ignition OFF. 2. Place a DVM between the 5 volt reference signal circuit and the 5 volt signal return (ground) circuit at the EGR wiring harness connector. 3. Ignition ON, Engine OFF. Does the DVM read the following value?	about 5 volts	Go to Step 13	Go to Step 12
12	Check the 5 volt signal return (ground) circuit, between the EGR and the PCM, for the following conditions: • An Open circuit • A short to ground Was the problem found?	—	Verify repair	Go to Step 15
13	1. Ignition OFF. 2. Place a fused jumper wire between the 5 volt reference signal circuit and the EGR valve position feedback circuit at the EGR wiring harness connector. 3. Ignition ON, Engine OFF. 4. Observe the EGR value on the Tech 2. Does the Tech 2 display the following value?	5 volts 100%	Go to Step 14	Go to Step 15
14	Replace the Linear Exhaust Gas Recirculation (EGR) Value. Verify repair.	—	—	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P1441 EVAPORATIVE EMISSION (EVAP) SYSTEM FLOW DURING NON–PURGE



D06RX056

Circuit Description

Canister purge is controlled by a solenoid valve that allows manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge ON). The EVAP purge solenoid control is pulse–width modulated (PWM) and is turned ON and OFF several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met.

The EVAP purge vacuum switch is a normally closed switch positioned in the purge line between the canister and the EVAP purge solenoid. The EVAP purge vacuum switch will open when vacuum increases to greater than 5 inches of water pressure in the purge line. The PCM monitors the EVAP purge vacuum switch signal to determine if the evaporative emission control system is working properly. If the switch is open (purge flow detected) when the PCM is not commanding the EVAP purge solenoid ON, DTC P1441 will be set. DTC P1441 is a type A code.

Conditions for Setting the DTC

- No active system voltage, ECT sensor, IAT sensor, VS sensor, MAP sensor, vacuum switch, or TP sensor DTCs set.
- BARO reading is above 72.3 kPa.
- Start–up intake air temperature (IAT) and start–up engine coolant temperature(ECT) are both between 3.5˚C (38˚F) and 32˚C (90˚F).
- The difference between start–up ECT and start–up IAT is less than 6.75˚C(12.2˚F).
- The Fuel Tank Level Sensor reads between 10% and 90%.
- The vehicle speed is less than 98 km/h (60mph).
- Fuel thank vacuum is greater than 15.25 cm (6 inches) of water for 0.5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL OFF on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1441 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P1441 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal–to–wire connection.
- The Fuel Pressure Sensor shares a 5 Volt reference with the MAP sensor and TP sensor.

  If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The Fuel Pressure Sensor share a ground with the MAP sensor and the TP sensor.
- Damaged harness – Inspect the wiring harness for damage; shorts to ground, shorts to battery positive, and open circuits. If the harness appears to be OK, observe the EVAP vacuum switch display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. The canister purge vacuum switch is normally closed when no vacuum (purge) is present. With the ignition ON and the engine OFF, there shouldn't be any vacuum (purge) present in the EVAP system.
3. Determines if the PCM is able to control the EVAP purge solenoid valve.
4. Determines if the DTC will set under the conditions present when the DTC was originally stored. If not, the fault is intermittent.
5. Checks for a grounded EVAP purge solenoid driver circuit, a faulty EVAP vacuum switch, or a leaking EVAP purge solenoid valve.

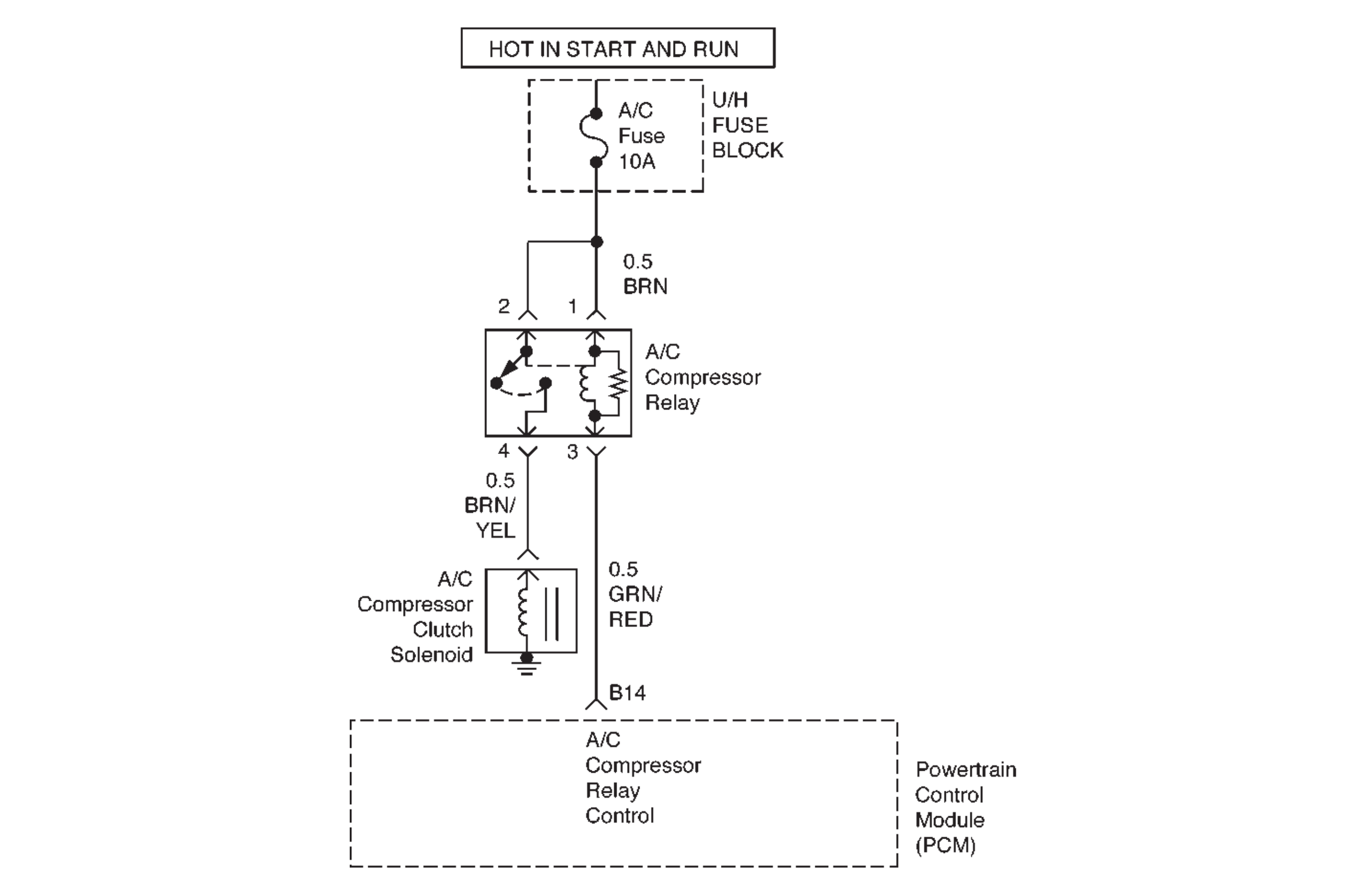
DTC P1441 – EVAP System Flow During Non-Purge

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "OFF." 2. Remove the fuel filler cap. 3. Ignition "ON." Observe "Fuel Tank Pressure" on the Tech 2. Is "Fuel Tank Pressure" at the specified value?	1.51 V	Go to *Step 3*	Go to *P0452 or P0453*
3	1. Re–install the fuel filler cap. 2. Using the Tech 2, command the EVAP Vent Solenoid Valve "ON" (Closed). 3. Disconnect the canister side rubber hose end that hose is connected between the Purge Solenoid Valve and Canister. **IMPORTANT:** Before continuing with the diagnosis, zero the EVAP pressure and vacuum gauges on EVAP pressure / purge cart J41413 (refer to the tool operating instructions). And then monitor the fuel tank inner pressure using the Tech 2. Does the fuel tank pressure hold the specified value?	1.52 - 1.60 V	Go to *Step 4*	Go to *Step 6*

DTC P1441 – EVAP System Flow During Non-Purge (Cont'd)

Step	Action	Value(s)	Yes	No
4	1. Disconnect the EVAP pressure / purge cart J41413, and then plug the hose end. 2. Disconnect the rubber hose end of engine vacuum source side, (the hose connected between Purge Solenoid Valve and engine). 3. Connect a vacuum hand pump to this rubber hose end. 4. Then apply -15 in H2O vacuum by the vacuum pump. 5. Monitor the fuel tank inner pressure using the Tech 2. Does the fuel tank inner pressure hold the specified value?	1.47 - 1.51 V	Go to *Step 6*	Go to *Step 5*
5	Replace the Purge Solenoid Valve.	—	Verify repair	—
6	1. Check for leaks, kinks or pinched hoses at the EVAP system rubber hose line, and also check if the rubber hoses are correctly connected or not. 2. Check for a leak from Vent Solenoid Valve and EVAP system rubber hoses, and also check for clogged Filter of air separator which is located near the vent solenoid valve. Was a problem found? Using the Vacuum Hose Routing Diagram, repair or re-connect the rubber hoses correctly.	—	Verify repair	Go to *Step 7*
7	1. Start engine. 2. Remove the Fuel Filler Cap. 3. Using the Tech 2, command the EVAP Vent Solenoid Valve "ON" (closed) and Purge Solenoid Valve "OFF" (0%). 4. Replace the Fuel Filler Cap. 5. Run the engine at 2500RPM constant while monitoring "Fuel Tank Vacuum" on the Tech 2. Does the fuel tank vacuum remain at the specified value while the EVAP Vent Solenoid Valve "ON" (closed) and Purge Solenoid Valve "OFF" (o%)?	30 - 40%	Verify repair	Go to *Diagnostic Aids*

DIAGNOSTIC TROUBLE CODE (DTC) P1546 A/C COMPRESSOR CLUTCH OUTPUT CIRCUIT MALFUNCTION



D06RX037

Circuit Description

The Powertrain Control Module (PCM) controls the A/C Compressor Clutch Solenoid through the use of a relay and a control (ground) circuit. If the PCM commands the A/C Compressor Clutch Solenoid ON but the voltage remains High (12 volts) or, if the PCM commands the A/C Compressor Clutch Solenoid OFF but the voltage remains Low (0 volts), then DTC P1546 will set. DTC P1546 is a type D code.

Conditions for Setting the DTC

- Ignition voltage is greater than 10 volts.
- Engine run time is greater than 32 seconds.

The above mentioned conditions are met and one of the following two conditions are met for 25 seconds within a 50 second test sample.

- PCM senses voltage is High with the A/C Compressor Clutch Solenoid commanded ON.

OR

- PCM senses voltage is Low with the A/C Compressor Clutch Solenoid commanded OFF.

Action Taken When the DTC Sets

- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the DTC

- A history DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's "Clear Info" function.

Diagnostic Aids

- Poor connections, or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also check for open circuits, shorts to ground, and shorts to voltage.

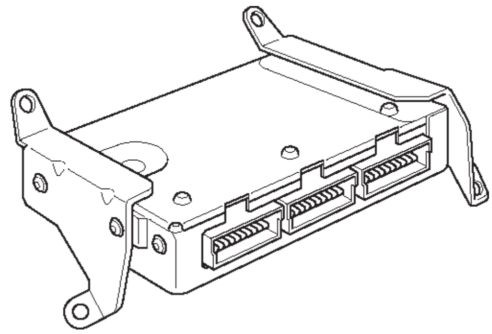
DTC P1546 A/C Compressor Clutch Output Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the "On–Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTCs. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor "DTC" info for DTC P1546. Does the Tech 2 indicate DTC P1546 "Ran and Passed?"	—	Refer to Diagnostic Aids	Go to Step 3
3	1. Ignition OFF. 2. Remove the A/C Compressor Clutch Relay from the Underhood Electrical Center. 3. Ignition ON, Engine OFF. 4. Using a Digital Voltmeter (DVM), check for voltage on the Fused pins of the A/C Compressor Clutch Relay connector. Does the DVM read the following value?	12 Volts	Go to Step 5	Go to Step 4
4	Check the suspect circuit(s) between the A/C Compressor Clutch Relay connector and the Fuse for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	—
5	1. Ignition OFF. 2. Disconnect the Powertrain Control Module (PCM) connectors from the PCM. 3. Check the A/C Compressor Clutch Relay control circuit between the PCM and Underhood Electrical Center for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	Go to Step 6
6	1. Reinstall the A/C Compressor Clutch Relay. 2. Using a fused jumper, ground the A/C Compressor Clutch Relay control circuit at the PCM connector. 3. Ignition ON, Engine OFF. Does the A/C Compressor turn ON?	—	Go to Step 9	Go to Step 7
7	1. Ignition OFF. 2. Check the A/C Compressor Clutch circuit between the A/C Compressor Clutch Relay and A/C Compressor Clutch for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	Go to Step 8

DTC P1546 A/C Compressor Clutch Output Circuit Malfunction (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the A/C Compressor Clutch Relay. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

Diagnostic Trouble Code (DTC) P1625 PCM Unexpected Reset



014RX002

Circuit Description

The powertrain control module (PCM) monitors unexpected PCM reset. This will not turn on MIL light on, only records code DTC P1625.

Conditions for Setting the DTC

- Clock or COP (Computer Operating Properly) reset.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1625 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1625 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

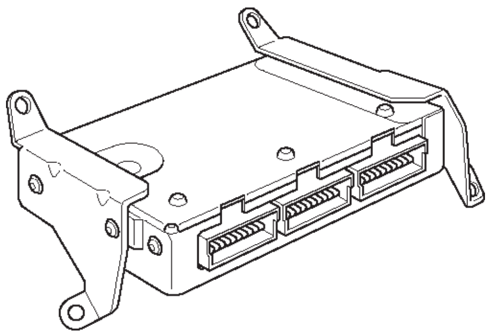
- P1625 alone stored does not need diagnosis. Clear DTC code.

NOTE: DTC P1625 is a DTC to record a PCM reset history. If DTC P1625 is not reset and no engine abnormality is found after clearance of DTC, it is not necessary to do any farther processing.

DTC P1625–PCM Unexpected Reset

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition is "On". 2. Install the Tech 2. 3. Start the engine at let it Idle. 4. On the Tech 2, select "DTC info". Does the Tech 2 indicate DTC P1625 failed?	—	Go to Step 3	Go to *Diagnostic Aids*
3	1. Ignition is "On". 2. Clear DTC P1625 by using the Tech 2 "Clear Info". 3. Start the engine at let it Idle. 4. On the Tech 2, select "DTC info". Does the Tech 2 indicate DTC P1625 failed?	—	Go to Step 4	Go to *Diagnostic Aids*
4	1. Check for aftermarket electronics, such as transceiver stereos, and anti theft devices, they may radiate EMI into the control system if they are improperly installed. (This may cause a false sensor reading and turn on the MIL.) 2. If a problem is found, repair as necessary. Was the problem found?	—	Verify repair	—

DIAGNOSTIC TROUBLE CODE (DTC) P1627 PCM A/D CONVERSION MALFUNCTION



014RX002

Circuit Description

The Powertrain Control Module (PCM) monitors the 5 volt reference signal when the Ignition is ON. If the PCM senses an Analog to Digital (A/D) conversion error within the PCM, then DTC P1627 will set. DTC P1627 is a type A code.

Conditions for Setting the DTC

- Engine is running.
- Any A/D DTC's set.

Action Taken When the DTC Sets

- The PCM will illuminate the Malfunction Indicator Lamp (MIL) the first time the fault is detected.
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL on the third consecutive trip without a reported failure.
- A History DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's "Clear Info" function.

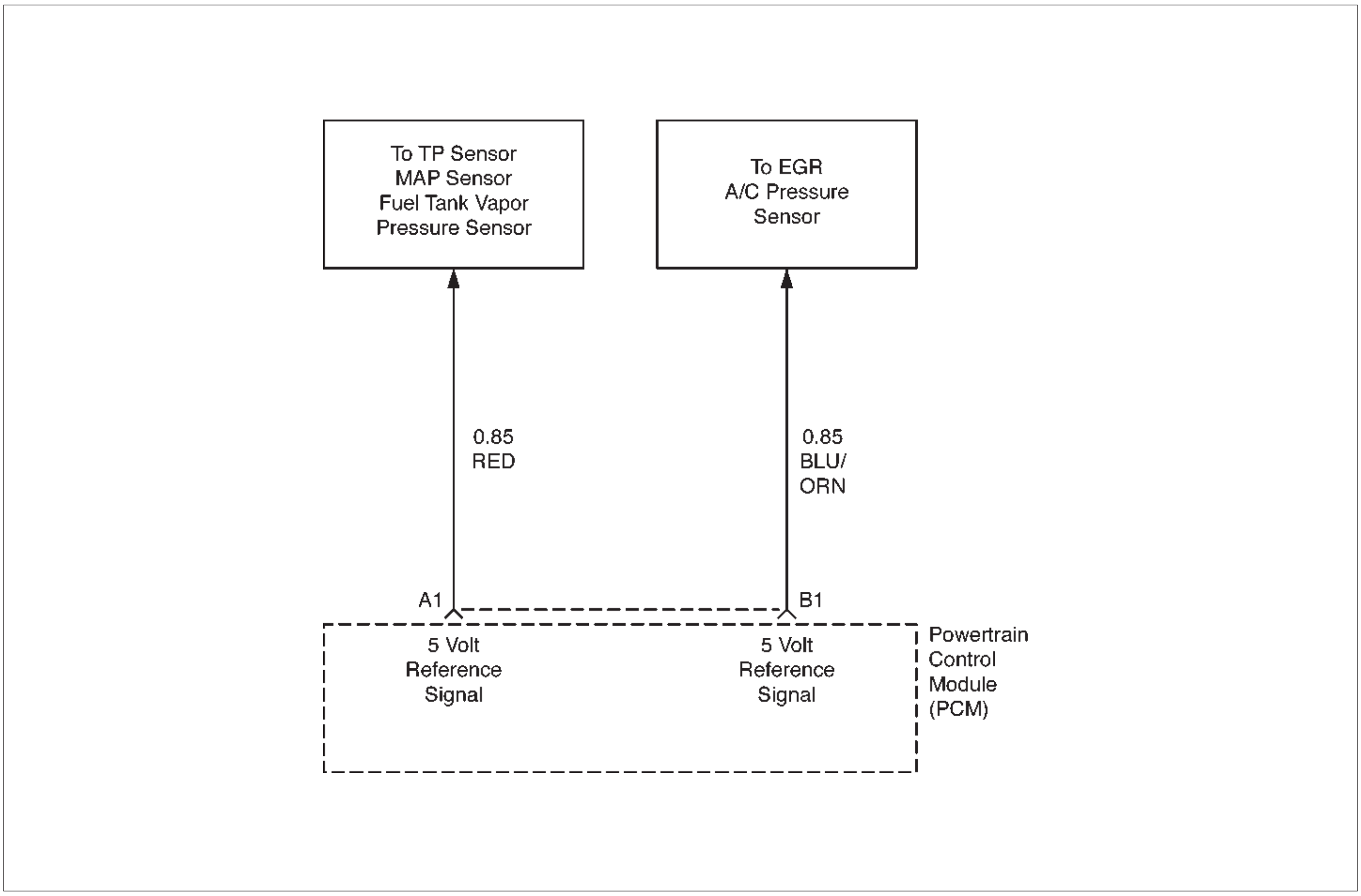
Diagnostic Aids

- Poor connections, or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also, check for open circuits, shorts to ground, and shorts to voltage.

DTC P1627 PCM A/D Conversion Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTCs. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P1627. Does the Tech 2 indicate DTC P1627 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	Check the suspect 5 volt reference circuit(s) for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	Go to Step 4
4	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P1635 5 VOLT REFERENCE VOLTAGE CIRCUIT MALFUNCTION



Circuit Description

The Powertrain Control Module (PCM) monitors the 5 volt reference signal when the Ignition is ON. If the PCM senses the 5 volt reference signal circuit is above 5.12 volts or below 4.88 volts, then DTC P1635 will set. DTC P1635 is a type A code.

Conditions for Setting the DTC

- Ignition voltage is greater than 6.3 volts.
- Engine is running.

The above mentioned conditions are met and one of the following two conditions are met for 5 seconds within a 10 second test sample:

- PCM senses the 5 volt reference signal circuit is above 5.12 volts.

OR

- PCM senses the 5 volt reference signal circuit is below 4.88 volts.

Action Taken When the DTC Sets

- The PCM will illuminate the Malfunction Indicator Lamp (MIL) the first time the fault is detected.
- The PCM will store the conditions that were present when the DTC was set as Freeze Frame and in Failure Records.

Conditions for Clearing the MIL/DTC

- The PCM will turn OFF the MIL on the third consecutive trip without a reported failure.
- A History DTC will clear after 40 consecutive trips without a reported failure.
- The DTC can be cleared using the Scan Tool's "Clear Info" function.

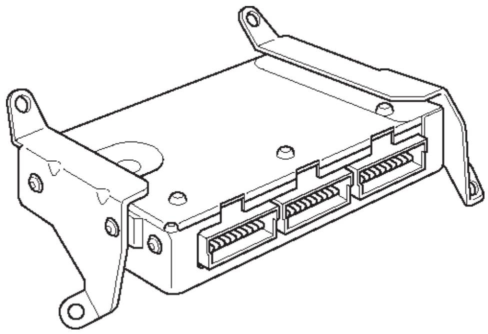
Diagnostic Aids

Poor connections, or a damaged harness – Inspect the harness connectors for: backed–out terminals, improper mating or damaged terminals. Also, check for open circuits, shorts to ground, and shorts to voltage.

DTC P1635 5 Volt Reference Voltage Circuit Malfunction

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Ignition ON, Engine OFF. 2. Review and record Tech 2 Failure Records data, then clear the DTCs. 3. Operate the vehicle within the Failure Records conditions as noted. 4. Using the Tech 2, monitor ”DTC” info for DTC P1635. Does the Tech 2 indicate DTC P1635 ”Ran and Passed?”	—	Refer to Diagnostic Aids	Go to Step 3
3	Check the suspect 5 volt reference circuit(s) for the following conditions: • A short to ground • An open circuit • A short to voltage Was the problem found?	—	Verify repair	Go to Step 4
4	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to On–Vehicle Service in Powertrain Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Verify repair.	—	—	—

DIAGNOSTIC TROUBLE CODE (DTC) P1640 ODM OUTPUT CIRCUIT FAULT



014RX002

Circuit Description

Output driver modules (ODMs) are used by the powertrain control module(PCM) to turn ON many of the current driven devices that are needed to control various engine and transmission functions. Each ODM is capable of controlling up to 11 separate outputs by applying ground to the device which the PCM is commanding ON. ODMs have the capability of diagnosing each output circuit individually. DTC P1640 set indicates an improper voltage level has been detected on an ODM output.

If the PCM detects an open circuit condition and a shorted to voltage circuit condition on the same circuit at the same time, then DTC P1640 will set. DTC P1640 is a type D code.

Conditions for Setting the DTC

- Ignition ON.
- Above conditions occur for at least 2.5 seconds.
- The PCM detects an open circuit condition and a shorted to voltage circuit condition on the same circuit at the same time.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- A history DTC P1640 will clear after 40 consecutive warm up cycles occur without a fault.
- DTC P1640 can be cleared by using the Scan Tool's "Clear Info" function.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition ON and observe a voltmeter connected to the MIL driver circuit at the PCM harness connector while moving connectors and wiring harnesses relates to the MIL. A change in voltage will indicate the location of the fault.
- Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

The following PCM pins are controlled by output driver modules (ODMs):

- A13 MIL LAMP
- A14 Rear Defogger
- B15 Up Shift
- B14 A/C Clutch

- A15 EVAP Canister Vent Solenoid
- B16 EVAP Canister Parge Solenoid
- A1 2 Low Fuel
- C10 Tacho Meter
- C11 Fuel Gauge
- C13 Fan Low
- C12 Fan High

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The Tech 2 Driver Module Status indicates the PCM pin that is affected.

9. The Tech 2 may indicate "short circuit" even when the problem is an open circuit. The cause of an open circuit may be in the component itself.

11. A short to ground on the ignition side of the component will blow the fuse. Since the fuse was checked in Step 2, a short to ground would be between the affected component and the PCM.

DTC P1640 –Output Driver Module (ODM) "A" Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Check the fuse for the driver circuit that was shown as faulty. Was the fuse blown?	—	Go to *Step 3*	Go to *Step 4*
3	1. Check for a short to ground between the fuse and the affected component. 2. Replace the fuse after making any necessary repairs. Is the action complete?	—	Verify repair	—
4	1. Disconnect the PCM connector for the affected driver circuit. Is there any damage to the PCM pin or connector?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
6	Was the Lamp of circuit for "Check Engine"?	—	Go to *Step 7*	Go to *Step 13*
7	1. Leave the PCM connector for the lamp driver circuit disconnected. 2. Ignition "ON." 3. Using a DVM, check the voltage at the PCM connector for the affected lamp driver circuit. Was the voltage equal to the specified value?	B+	Go to *Step 15*	Go to *Step 8*
8	1. Ignition "ON." 2. Check for battery voltage at the fuse for the affected lamp circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
9	Repair the open circuit between the ignition switch and the fuse. Is the action complete?	—	Verify repair	—
10	1. Ignition "OFF." 2. Disconnect the PCM connector for the affected driver terminal. 3. Connect an ohmmeter between a good ground and the PCM connector for the affected driver. Did the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 12*

DTC P1640 –Output Driver Module (ODM) “A” Fault (Cont’d)

Step	Action	Value(s)	Yes	No
11	Repair the short to ground between the affected component and its PCM driver terminal. Is the action complete?	—	Verify repair	—
12	Repair the open circuit between the fuse and the PCM driver terminal for the affected circuit. Is the action complete?	—	Verify repair	—
13	1. Connect the PCM. 2. Start the engine and let it idle. 3. Backprobe the affected terminal at the PCM with a DVM. Was the voltage equal to the specified value?	B+	Go to *Step 15*	Go to *Step 14*
14	1. Run the engine at idle. 2. Check for battery voltage at the fuse for the affected circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

SYMPTOM DIAGNOSIS

PRELIMINARY CHECKS

Before using this section, perform the "On–Board Diagnostic (OBD) System Check" and verify all of the following items:

- The powertrain control module (PCM) and malfunction indicator lamp (MIL)(Check Engine lamp) are operating correctly.
- There are no DTC(s) stored.
- Tech 2 data is within normal operating range. Refer to Typical Scan Data Values.
- Verify the customer complaint and locate the correct symptom in the table of contents. Perform the procedure included in the symptom chart.

VISUAL/PHYSICAL CHECK

Several of the symptom procedures call for a careful visual/physical check. This can lead to correcting a problem without further checks and can save valuable time. This check should include the following items:

- PCM grounds for cleanliness, tightness and proper location.
- Vacuum hoses for splits, kinks, and proper connections, as shown on the "Vehicle Emission Control Information" label. Check thoroughly for any type of leak or restriction.
- Air intake ducts for collapsed or damaged areas.
- Air leaks at throttle body mounting area, manifold absolute pressure (MAP) sensor and intake manifold sealing surfaces.
- Ignition component for cracking, hardness, and carbon tracking.
- Wiring for proper connections, pinches and cuts.

INTERMITTENTS

An intermittent problem may or may not turn on the malfunction indicator lamp (MIL) or store a Diagnostic Trouble Code. DO NOT use the Diagnostic Trouble Code (DTC) charts for intermittent problems. The fault must be present to locate the problem.

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful visual/physical check for the following conditions:

- Poor mating of the connector halves or a terminal not fully seated in the connector (backed out).
- Improperly formed or damaged terminal.
- All connector terminals in the problem circuit should be carefully checked for proper contact tension.
- Poor terminal–to–wire connection. This requires removing the terminal from the connector body to check.

Road test the vehicle with a J 39200 Digital Multimeter connected to a suspected circuit. An abnormal voltage when the malfunction occurs is a good indication that there is a fault in the circuit being monitored.

Use a Tech 2 to help detect intermittent conditions.

The Scan Tools have several features that can be used to locate an intermittent condition. Use the following feature to find intermittent faults:

- Using a Scan Tool's "Freeze Frame" buffer or "Failure Records" buffer can aid in locating an intermittent condition. Review and record the information in the freeze frame or failure record associated with the intermittent DTC being diagnosed. The vehicle can be driven within the conditions that were present when the DTC originally set.

To check for loss of diagnostic code memory, disconnect the MAP sensor and idle the engine until the MIL (Check Engine lamp) comes on. Diagnostic Trouble Code P0107 should be stored and kept in memory when the ignition is turned OFF. If not, the PCM is faulty. When this test is completed, make sure that you clear the Diagnostic Trouble Code P0107 from memory.

An intermittent MIL (Check Engine lamp) with no stored Diagnostic Trouble Code may be caused by the following:

- Ignition coil shorted to ground and arcing at ignition wires or plugs.
- MIL (Check Engine lamp) wire to PCM shorted to ground.
- Poor PCM grounds. Refer to the PCM wiring diagrams.

Check for improper installation of electrical options such as lights, cellular phones, etc. Check all wires from the PCM to the ignition coils for poor connections.

Check for an open diode across the A/C compressor clutch and check for other open diodes (refer to wiring diagrams in Electrical Diagnosis).

If problem has not been found, refer to PCM Connector Symptom tables.

- Check the "Broadcast Code" of the PCM, and compare it with the latest Isuzu service bulletins and/or Isuzu EEPROM reprogramming equipment to determine if an update to the PCM's reprogrammable memory has been released. To check the "Broadcast Code," connect the Tech 2, then look for "ID info," then select "Broadcast Code." This should display a 4 character code, such as "XBYA" (example only). This identifies the contents of the reprogrammable software and calibration contained in the PCM. If the Broadcast code is not the most current available, it is advisable to reprogram the PCM's EEPROM memory, which may either help identify a hard–to–find problem or may fix the problem.

HARD START SYMPTOM

DEFINITION:

Engine cranks, but does not start for a long time. Does eventually run, or may start but immediately stalls.

Step	Action	Value(s)	Yes	No
1	Was the ”On–Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	Check engine coolant temperature (ECT) sensor for shift in value. 1. After 8 hours with the hood up and the engine not running, connect the Tech 2. 2. Ignition ON, engine not running. 3. Using the Tech 2, compare Engine Coolant Temperature to Intake Air Temperature. Are ECT and IAT within the specified value of each other?	± 5°C (± 9°F)	Go to Step 8	Go to Step 5
5	1. Using a Tech 2, display the engine coolant temperature and note the value. 2. Check the resistance of the engine coolant temperature sensor. 3. For resistance specifications, refer to Temperature vs. Resistance chart in DTC P0118. Is the actual resistance near the resistance value in the chart for the temperature that was noted?	—	Go to Step 7	Go to Step 6
6	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
7	Locate and repair high resistance or connection in the ECT signal circuit or the ECT signal circuit or the PCM sensor ground.	—	Verify repair	—
8	Check for a faulty, plugged, or incorrectly installed PCV valve. Was a problem found?	—	Verify repair	Go to Step 9
9	Visually/Physically inspect the secondary ignition wires. Check for the following conditions: • Verify that all ignition wire resistance are less than the specified value. • Verify that ignition wires are correctly routed to eliminate cross–firing. • Verify that ignition wires are not arcing to ground. Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Was a problem found?	22.4 k Ω	Verify repair	Go to Step 10
10	Check for proper ignition voltage output with a spark testerJ 26792. Was a problem found?	—	Verify repair	Go to Step 11

Step	Action	Value(s)	Yes	No
11	1. Remove the spark plugs and check for gas or oil fouling cracks, wear, improper gap, burned electrodes, heavy deposits, or improper heat range. 2. If spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 12
12	Check for a loose ignition control module ground. Was a problem found?	—	Verify repair	Go to Step 13
13	1. Check the ignition coil secondary resistance. 2. Replace the coil if it is not within the specified range of resistance. Did the coil require replacement?	9 kΩ–12 kΩ	Verify repair	Go to Step 14
14	Check IAC operation. Perform the procedure in the diagnostic chart DTC P0506, Step 6. Was a problem found?	—	Verify repair	Go to Step 15
15	Check for water or alcohol contaminated fuel. Was a problem found?	—	Verify repair	Go to Step 16
16	Perform the procedure in Fuel System Pressure Test to determine if there is a problem with fuel delivery. Was a problem found?	—	Verify repair	Go to Step 17
17	Check for the following engine mechanical problems (refer to Engine Mechanical): • Low compression • Leaking cylinder head gaskets • Worn camshaft • Camshaft drive belt slipped or stripped Was a problem found?	—	Verify repair	Go to Step 18
18	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system Was a problem found?	—	Verify repair	Contact Technical Assistance

SURGES AND/or CHUGGLES SYMPTOM

DEFINITION:
Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	Be sure that the driver understands A/C compressor operation as explained in the owner's manual. Inform the customer how the A/C clutch operate. Is the customer experiencing a normal condition?	—	System OK	Go to Step 5
5	Check the fuel control Heated Oxygen Sensor (HO2S1). When monitored on the Tech 2, the H02S1 should respond quickly to different throttle positions. If it doesn't check for silicon or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating. Silicone contamination sends a rich exhaust signal which causes the PCM to command an excessively lean air/fuel mixture. Was a problem found?	—	Verify repair	Go to Step 6
6	Check the fuel pressure. Refer to Fuel System Pressure Test. Was a problem found?	—	Verify repair	Go to Step 7
7	Monitor "Long Term Fuel Trim" on the Tech 2. Is "Long Term Fuel Trim" in the negative range (rich condition)?	—	Go to Step 8	Go to Step 9
8	Check items that can cause the engine to run rich. Refer to Diagnostic Aids in DTC P0172. Was a problem found?	—	Verify repair	Go to Step 10
9	Check items that can cause the engine to run lean. Refer to Diagnostic Aids in DTC P0171. Was a problem found?	—	Verify repair	Go to Step 10
10	Check for proper ignition voltage output with the spark tester J 26792. Was a problem found?	—	Verify repair	Go to Step 11
11	Check for a loose ignition control module ground. Was a problem found?	—	Verify repair	Go to Step 12

Step	Action	Value(s)	Yes	No
12	Visually/Physically inspect the secondary ignition wires. Check for the following conditions. • Verify that all ignition wire resistance are less than the specified value. • Verify that ignition wires are correctly routed to eliminated cross–firing. • Verify that ignition wires are not arcing to ground. Spraying the secondary ignition wires with a light mist of water may help to locate an intermittent problem. Was a problem found?	22.4 Ω	Verify repair	Go to Step 13
13	1. Check ignition coil secondary resistance. 2. Replace the coil if it is not within the specified range of resistance. Did the coil require replacement?	9 kΩ– 12 kΩ	Verify repair	Go to Step 14
14	1. Remove the spark plugs and check for gas or oil fouling, cracks, wear, improper gap, burned electrodes, heavy deposits or improper heat range. 2. If spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 15
15	1. Check the injector connectors. 2. If any of the connectors are connected at an improper cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to Step 16
16	Check the PCM grounds to verify that they are clean and tight. Refer to the PCM wiring diagrams in Electrical Diagnosis. Was a problem found?	—	Verify repair	Go to Step 17
17	Visually/physically check the vacuum hoses for splits, kinks and proper connections and routing as shown on the ”Vehicle Emission Control Information” label. Was a problem found?	—	Verify repair	Go to Step 18
18	Check the exhaust system for a possible restriction: • damaged or collapsed pipes • internal muffler failure • Refer to Restricted Exhaust System Check to measure back pressure and determine if the catalytic converter is plugged.	—	Verify repair	Go to Step 19
19	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection. • Tech 2 data. • Freeze Frame data/Failure Records buffer. • All electrical connections within a suspected circuit and/or system. Was a problem found?	—	Verify repair	Contact Technical Assistance

LACK OF POWER, SLUGGISH OR SPONGY SYMPTOM

DEFINITION:
Engine delivers less than expected power. Little or no increase in speed when accelerator pedal is pushed down part–way.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	1. Remove and check the air filter element for dirt or restrictions. Refer to Air Intake System in On–Vehicle Service. 2. Replace the air filter element if necessary. Was a problem found?	—	Verify repair	Go to Step 5
5	Check for proper ignition voltage output with the spark tester J 26792. Was a problem found?	—	Verify repair	Go to Step 6
6	1. Remove the spark plugs and check gas or oil fouling, cracks, wear, improper gap, burned electrodes, heavy deposits or improper heat range. 2. If spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 7
7	Check the fuel pressure. Refer to Fuel System Test. Was a problem found?	—	Verify repair	Go to Step 8
8	1. Install the Tech 2. 2. Run the engine at idle. 3. On the Tech 2, select F3: Miscellaneous Test, F6: Variable Intake Manifold. 4. Repeat Switch ON or OFF of VIM solenoid valve by using the Tech 2. 5. Check the solenoid working sound. 6. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 9
9	Check for water or alcohol contaminated fuel. Was a problem found?	—	Verify repair	Go to Step 10
10	Check the PCM grounds to verify that they are clean and tight. Refer to the PCM wiring diagrams in Electrical Diagnosis. Was a problem found?	—	Verify repair	Go to Step 11

Step	Action	Value(s)	Yes	No
11	Check the exhaust system for a possible restriction: • Damaged or collapsed pipes • Internal muffler failure • Refer to Restricted Exhaust System Check to measure backpressure and determine if the catalytic converter is plugged. Was a problem found?	—	Verify repair	Go to Step 12
12	Check for the following engine mechanical problems: • Low compression • Leaking cylinder head gasket • Worn or incorrect camshaft • Loose timing belt Was a problem found?	—	Verify repair	Go to Step 13
13	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection. • Tech 2 data • Freeze Frame data/Failure Records buffer. • All electrical connections within suspected circuit and/or system. Was a problem found?	—	Verify repair	Contact Technical Assistance

DETONATION/SPARK KNOCK SYMPTOM

DEFINITION:
A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	1. If Tech 2 readings are normal and there are no engine mechanical faults, fill the fuel tank with a known quality gasoline that has a minimum octane rating of 87. Refer to Typical Scan Values. 2. Re–evaluate the vehicle performance. Is detonation present?	—	Go to Step 5	Verify repair
5	1. Check for obvious overheating problems: • Low engine coolant. • Restricted air flow to radiator, or restricted water flow through radiator. • Incorrect coolant solution. It should be a 50/50 mix of approved antifreeze/water. • Incorrect EGR operation. Refer to DTC P0401. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 6
6	Check fuel pressure. Refer to Fuel System Pressure Test. Was a problem found?	—	Verify repair	Go to Step 7
7	Check items that can cause an engine to run lean. Refer to Diagnostic Aids in DTC P0171. Was a problem found?	—	Verify repair	Go to Step 8
8	Check spark plugs for proper heat range. Refer to General Information. Were incorrect spark plugs installed?	—	Verify repair	Go to Step 9
9	1. Remove excessive carbon buildup with a top engine cleaner. Refer to instructions on the top engine cleaner can. 2. Re–evaluate vehicle performance. Is detonation still present?	—	Go to Step 10	Verify repair

Step	Action	Value(s)	Yes	No
10	Check for an engine mechanical problem. Perform a cylinder compression check. Refer to Engine Mechanical. Was a problem found?	—	Verify repair	Go to Step 11
11	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system Was a problem found?	—	Verify repair	Contact Technical Assistance

ROUGH, UNSTABLE, OR INCORRECT IDLE, STALLING SYMPTOM

DEFINITION:
Engine runs unevenly at idle. If severe, the engine or vehicle may shake. Engine idle speed may vary in RPM. Either condition may be severe enough to stall the engine.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed, including the rotor, ignition coil and secondary ignition wires?	—	Go to Step 4	Go to Visual / Physical Check
4	Verify that the EGR valve is not mounted backwards. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Check for incorrect idle speed. Ensure that the following conditions are present: • Engine fully warm. • Accessories are OFF. 2. Using a Tech 2, monitor IAC position. Is the IAC position within the specified values?	Between 10 and 50 counts	Go to Step 8	Go to Step 7
6	1. Visually/physically inspect for the following conditions: • Restricted air intake system. Check for a restricted air filter element, or foreign objects blocking the air intake system. • Check for objects blocking the IAC passage or throttle bore, excessive deposits in the IAC passage and on the IAC pintle, and excessive deposits in the throttle bore and on the throttle plate. • Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty crankcase ventilation valve brake booster hose. Was a problem found?	—	Verify repair	Go to Step 7
7	Using a Tech 2, monitor TP angle with the engine idling. Is the TP angle at the specified value and steady?	0%	Go to Step 8	For further diagnosis, refer to DTC P0123
8	Check for proper ignition voltage output with the spark tester J 26792. Was a problem found?	—	Verify repair	Go to Step 9
9	1. Remove the spark plugs and check for gas or oil fouling, cracks, wear, improper gap, burned electrodes, heavy deposits or improper heat range. 2. If spark plugs are fouled, the cause of the fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 10

Step	Action	Value(s)	Yes	No
10	Check for a loose ignition control module ground. Refer to Electrical Ignition System. Was a problem found?	—	Verify repair	Go to Step 11
11	Monitor ”Long Term Fuel Trim” on the Tech 2. Is ”Long Term Fuel Trim” in the negative range (rich condition)?	—	Go to Step 12	Go to Step 13
12	Check the items that can cause the engine to run rich. Refer to Diagnostic Aids in DTC P0172. Was a problem found?	—	Verify repair	Go to Step 13
13	Is ”Long Term Fuel Trim” significantly in the positive range (lean condition)? —	—	Go to Step 14	Go to Step 15
14	Check items that can cause the engine to run leading. Refer to ”Diagnostic Aids” in DTC P0171. Was a problem found?	—	Verify repair	Go to Step 14
15	Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to Step 16
16	Perform the Injector Coil/Balance Test. Was a problem found?	—	Verify repair	Go to Step 17
17	1. Check the following engine mechanical problems: • Low compression • Leaking cylinder head gasket • Worn or incorrect camshaft • Sticking or leaking valves • Valve timing • Broken valve springs • Camshaft drive belt slipped or stripped. Was a problem found?	—	Verify repair	Go to Step 18
18	1. Check for faulty motor mounts. Refer to Engine Mechanical for inspection of mounts. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to Step 19
19	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system Was a problem found?	—	Verify repair	Contact Technical Assistance

POOR FUEL ECONOMY SYMPTOM

DEFINITION:
Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	Check owner's driving habits. • Is the A/C ON full time (defroster mode ON)? • Are tires at the correct pressure? • Are excessively heavy loads being carried? • Is acceleration too much, too often?	—	Go to Step 5	Go to Step 6
5	Review the items in Step 4 with the customer and advise as necessary. Is the action complete?	—	System OK	—
6	1. Visually/physically check: Vacuum hoses for splits, kinks, and improper connections and routing as shown on the "Vehicle Emission Control Information" label. Was a problem found?	—	Verify repair	Go to Step 7
7	Remove and check the air filter element for dirt or for restrictions. Was a problem found?	—	Verify repair	Go to Step 8
8	1. Remove the spark plugs and check for gas or oil fouling, cracks, wear, improper gap, burned electrodes of heavy deposits. 2. Is spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 9
9	Check for low engine coolant level. Was a problem found?	—	Verify repair	Go to Step 10
10	Check for an incorrect or faulty engine thermostat. Refer to Engine Cooling. Was a problem found?	—	Verify repair	Go to Step 11
11	Check for low engine compression. Refer to Engine Mechanical. Was a problem found?	—	Verify repair	Go to Step 12

Step	Action	Value(s)	Yes	No
12	Check for excessive exhaust system back–pressure. Refer to Restricted Exhaust System Check. Possible problems could be: • Damaged or collapsed pipes. • Internal muffler failure. • Plugged catalytic converter. Was a problem found?	—	Verify repair	Go to Step 13
13	Check for proper calibration of the speedometer. Does the speed indicated on the speedometer closely match the vehicle speed displayed on the Tech 2?	—	Go to Step 15	Go to Step 14
14	Diagnose and repair the inaccurate speedometer condition as necessary. Refer to Vehicle Speed Sensor in Electrical Diagnosis.	—	Verify repair	—
15	Check the air intake system and the crankcase for air leaks. Was a problem found?	—	Verify repair	Go to Step 16
16	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All connections within a suspected circuit and/or system Was a problem found?	—	Verify repair	Go to Step 17
17	Perform the procedure in Fuel System Pressure Test. Was the fuel pressure normal?	—	Contact Technical Assistance	Verify repair

EXCESSIVE EXHAUST EMISSIONS OR ODORS SYMPTOM

DEFINITION:
Vehicle fails an emission test. There is excessive ”rotten egg” smell. (Excessive odors do not necessarily indicate excessive emissions.)

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Go to Step 13	Go to Step 3
3	Was visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	Check for vacuum leaks (vacuum lines, intake manifold, throttle body, etc.) Were any vacuum leaks found?	—	Go to Step 13	Go to Step 5
5	1. Check fuel cap for proper installation. 2. Secure the fuel cap if necessary. Was a problem found?	—	Go to Step 13	Go to Step 6
6	1. Check the fuel pressure. Refer to Fuel System Pressure Test. Was a problem found?	—	Go to Step 13	Go to Step 7
7	1. Check for faulty, plugged or incorrectly installed PCV valve. 2. Verify that the PCV system is not plugged. Was a problem found?	—	Go to Step 13	Go to Step 8
8	Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Go to Step 13	Go to Step 9
9	Perform the Injector Coil/Balance Test. Was a problem found?	—	Go to Step 13	Go to Step 10
10	Check for a problem with the engine cooling system. Was a problem found?	—	Go to Step 13	Go to Step 11
11	Check the EVAP canister for fuel loading. Refer to Evaporative Emission Control System. Was a problem found?	—	Go to Step 13	Go to Step 12
12	1. Remove excessive carbon build-up with a top engine cleaner. Refer to the instructions on the top engine cleaner can. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to Step 14
13	Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to Step 14
14	Does the exhaust emission test indicate excessive HC levels, or is ”Long Term Fuel Trim” significantly in the negative range (rich condition)?	—	Go to Step 15	Go to Step 16

Step	Action	Value(s)	Yes	No
15	1. Check items that can cause the engine to run rich. Refer to Diagnostic Aids in DTC P0172 Diagnostic Support. Make any necessary repairs. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to Step 17
16	1. Check items that can cause the engine to run lean. Refer to Diagnostic Aids in DTC P0171. Make any necessary repairs. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to Step 17
17	Check the EGR system (refer to DTC P0401). Was a problem found?	—	Verify repair	Go to Step 18
18	Check for the following engine mechanical problems. • Low compression • Leaking cylinder head gasket • Worn or incorrect camshaft • Sticking or leaking valves • Valve timing • Broken Valve springs Was a problem found?	—	Verify repair	Go to Step 19
19	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system Was a problem found?	—	Verify repair	Contact Technical Assistance

DIESELING, RUN–ON SYMPTOM

DEFINITION:

Engine continues to run after key is turned OFF, but runs very rough. If engine runs smoothly, check the ignition switch and adjustment.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	1. Check for a short between B+ and the ignition feed circuit. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All connections within a suspected circuit and/or system Was a problem found?	—	Verify repair	Contact Technical Assistance

BACKFIRE SYMPTOM

DEFINITION:
Fuel ignites in the intake manifold, or in the exhaust system, making a loud popping noise.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	Check for proper ignition voltage output with spark tester J 26792. Was a problem found?	—	Verify repair	Go to Step 5
5	1. Remove the spark plugs and check for gas or oil fouling, cracks, wear, improper gap, burned electrodes of heavy deposits. 2. If spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 6
6	1. Visually/physically inspect the secondary ignition wires. Check for the following conditions: • Verify that all ignition wire resistances are less than the specified value. • Verify that ignition wires are correctly routed to eliminate cross–firing. • Verify that ignition wires are not arcing to ground. Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Was a problem found?	—	Verify repair	Go to Step 7
7	Check for an intermittent ignition system malfunction: • Intermittent CKP 58X signal. • Intermittent ignition feed circuit or sensor ground circuit to the crankshaft position sensor. Was a problem found?	—	Verify repair	Go to Step 8
8	To determine if there is a problem with fuel delivery, refer to Fuel System Diagnosis. Was a problem found?	—	Verify repair	Go to Step 9
9	1. Check for the following engine mechanical problems: • Low compression • Leaking cylinder head gasket • Worn or incorrect camshaft • Incorrect valve timing • Sticking or leaking valves • Camshaft drive belt slipped or stripped. Was a problem found?	—	Verify repair	Go to Step 10

Step	Action	Value(s)	Yes	No
10	Check the intake and exhaust manifold(s) for casting flash. Refer to Engine Mechanical. Was a problem found?	—	Verify repair	Go to Step 11
11	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system Was a problem found?	—	Verify repair	Contact Technical Assistance

CUTS OUT, MISSES SYMPTOM

DEFINITION:
Steady pulsation or jerking that follows engine speed; usually more pronounced as engine load increases.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	Check the PCM grounds to verify that they are clean and tight. Refer to the PCM wiring diagrams in Electrical Diagnosis. Was a problem found?	—	Verify repair	Go to Step 5
5	Monitor ”Long Term Fuel Trim” on the Tech 2. Is the ”Long Term Fuel Trim” in the negative range (rich condition)?	—	Go to Step 6	Go to Step 7
6	Check items that can cause the engine to run rich. Refer to ”Diagnostic Aids” in DTC P0172. Was a problem found?	—	Verify repair	Go to Step 9
7	Is the long term fuel trim significantly in the positive range (lean condition)?	—	Go to Step 8	Go to Step 9
8	Check items that can cause the engine to run lean. Refer to Diagnostic Aids in DTC P0171. Was a problem found?	—	Verify repair	Go to Step 9
9	1. Check for incorrect idle speed. Ensure that the following conditions are present: • Engine fully warm. • Accessories are OFF. 2. Using a Tech 2, monitor the IAC position. Is the IAC position within the specified values?	Between 5 and 50 counts	Go to Step 11	Go to Step 10
10	1. Visually/physically inspect for the following conditions: • Restricted air intake system. Check for a restricted air filter element, or foreign objects blocking the air intake system. • Check for objects blocking the IAC passage or throttle bore, excessive deposits in the IAC passage and on the IAC pintle, and excessive deposits in the throttle bore and on the throttle plate. • Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty crankcase ventilation valve or brake booster hose disconnected. Was a problem found?	—	Verify repair	Go to Step 11

Step	Action	Value(s)	Yes	No
11	Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to Step 12
12	1. Perform the Injector Coil/Balance Test. Was a problem found?	—	Verify repair	Go to Step 13
13	1. Check for fuel in the pressure regulator vacuum hose. 2. If fuel is present, replace the fuel pressure regulator assembly. Was a problem found?	—	Verify repair	Go to Step 14
14	Check for proper ignition voltage output with spark tester J 26792. Was a problem found?	—	Verify repair	Go to Step 15
15	1. Remove spark plugs and check for gas or oil fouling, cracks, wear, improper gap, burned electrodes of heavy deposits. 2. If spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 16
16	Check for a loose ignition control module ground. Was a problem found?	—	Verify repair	Go to Step 17
17	Using a Tech 2, monitor the TP angle with the engine idling. Is the TP angle at the specified value and steady?	0%	Go to Step 18	For further diagnosis, refer to DTC P0123
18	Check the PCV valve for proper operation. Was a problem found?	—	Verify repair	Go to Step 19
19	Check for the following engine mechanical problems: ● Low compression ● Leaking cylinder head gasket ● Worn or incorrect camshaft ● Incorrect valve timing ● Sticking or leaking valves ● Camshaft drive belt slipped or stripped. Was a problem found?	—	Verify repair	Go to Step 20
20	Check for faulty motor mounts. Refer to Engine Mechanical for inspection of the mounts. Was a problem found?	—	Verify repair	Go to Step 21
21	1. Review all the diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system Was a problem found?	—	Verify repair	Contact Technical Assistance

HESITATION, SAG, STUMBLE SYMPTOM

DEFINITION:

Momentary lack of response as the accelerator is pushed down. Can occur at any vehicle speed. Usually most pronounced when first trying to make the vehicle move, as from a stop sign. May cause the engine to stall if severe enough.

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to Step 3
3	Was a visual/physical check performed?	—	Go to Step 4	Go to Visual / Physical Check
4	1. Check the fuel control heated oxygen sensor (HO2S1). The HO2S1 should respond quickly to different to throttle positions. If it doesn't, check for silicon or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating. Silicon contamination sends a rich exhaust signal which causes the PCM to command an excessively lean air/fuel mixture. Was a problem found?	—	Verify repair	Go to Step 5
5	Check the fuel pressure. Refer to Fuel System Pressure Test. Was a problem found?	—	Verify repair	Go to Step 6
6	Observe the "TP angle" display on the Tech 2 while slowly increasing throttle pedal. Does the TP angle display steadily increase from 0% at closed throttle to 100% at WOT?	—	Go to Step 7	Go to Step 13
7	Monitor "Long Term Fuel Trim" on the Tech 2. Is the "Long Term Fuel Trim" in the negative range (rich condition)?	—	Go to Step 8	Go to Step 9
8	Check items that can cause the engine to run rich. Refer to Diagnostic Aids in DTC P0172. Was a problem found?	—	Verify repair	Go to Step 10
9	Check items that can cause the engine to run lean. Refer to Diagnostic Aids in DTC P0171. Was a problem found?	—	Verify repair	Go to Step 10
10	Check for proper ignition voltage output with spark tester J 26792 (ST–125). For the procedure, refer to Electronic Ignition System. Was a problem found?	—	Verify repair	Go to Step 11
11	Check for a loose ignition control module ground. Was a problem found?	—	Verify repair	Go to Step 12

Step	Action	Value(s)	Yes	No
12	Visually/physically inspect the secondary ignition wires. Check for the following conditions: • Verify that all ignition wire resistances are less than the specified value. • Value that ignition wires are correctly routed to eliminate cross–firing. • Verify that ignition wires are not arcing to ground. Spraying the secondary ignition wires with a light mist of water may help locate an intermittent problem. Was a problem found?	30,000 Ω	Verify repair	Go to Step 14
13	Replace the TP sensor.	—	Verify repair	—
14	1. Check the ignition coil secondary resistance. 2. Replace the coil if it is not within the specified value. Was a problem found?	9 kΩ– 12kΩ	Verify repair	Go to Step 15
15	1. Remove the spark plugs and check for gas or oil fouling, cracks, wear, improper gap, burned electrodes of heavy deposits. 2. If spark plugs are fouled, the cause of fouling must be determined before replacing the spark plugs. Was a problem found?	—	Verify repair	Go to Step 16
16	Check the PCM grounds to verify that they are clean and tight. Refer to the PCM wiring diagrams in Electrical Diagnosis. Was a problem found?	—	Verify repair	Go to Step 17
17	Visually/physically check vacuum hoses for splits, kinks, and proper connections and routing as shown on the Vehicle Emission Control Information label. Was a problem found?	—	Verify repair	Go to Step 18
18	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

RESTRICTED EXHAUST SYSTEM CHECK

Step	Action	Value(s)	Yes	No
1	Was the On–Board Diagnostic (OBD) System Check performed?	—	Go to Step 2	Go to OBD System Check
2	1. Remove the HO2S2. • For removal procedures, refer to Heated Oxygen Sensors in On–Vehicle Service. 2. Install the Exhaust Backpressure Tester in place of the Bank 1 HO2S. 3. Idle the engine at normal operating temperature. Does the reading on the gauge exceed the specified value?	8.62 kPa (1.25 psi)	Go to Step 5	Go to Step 3
3	With the exhaust back–pressure tester in place of HO2S, and the engine at normal operating temperature: Increase the engine speed to 2000 RPM while observing the gauge. Does the reading exceed the amount of the value column?	8.62 kPa (1.25 psi)	Go to Step 5	Go to Step 4
4	1. Re–install the HO2S2. (Refer to Heated Oxygen Sensors in On–Vehicle Service for installation procedure.) 2. Remove the HO2S1. 3. Install the Exhaust Back–Pressure Tester BT8515V or equivalent in place of the HO2S1. 4. Bring the engine to normal operating temperature while observing the gauge. 5. Increase the engine speed to 2000 RPM (allow 10 seconds for pressure build) and observe the gauge. Did the reading exceed the specified value?	8.62 kPa (1.25 psi)	Go to Step 6	System OK
5	Repair a restiction in the exhaust system after the catalytic converter. Possible faults include: • Collapsed pipe • Internal muffler failure	—	Verify repair	—
6	Replace the restricted catalytic converter.	—	Verify repair	—

NOTE: Diagnostic Trouble Codes will be set by running the vehicle to normal operating temperature after a cold start with the O2 sensor disconnected. After performing these tests, use the Tech 2 to erase the Diagnostic Trouble Codes that were set by the lack of O2 sensor activity.

DEFAULT MATRIX TABLE

SERVICE PROCEDURE DEFAULT STRATEGY

A referral strategy has been established to assist the technician with additional information when the cause of the failure cannot be determined. If no problem is found after performing diagnostics, then for further diagnostic information, refer to the default matrix table.

DEFAULT MATRIX TABLE

Strategy Based Diagnostic Charts	Initial Diagnosis	Default Section(s)
On–Board Diagnostic (OBD) System Check	Vehicle does not enter diagnostics.	Chassis Electrical
On–Board Diagnostic (OBD) System Check	Vehicle enters diagnostics and communicates with the Tech 2. MIL is ON in diagnostics. Engine does not start and run.	Ignition System Check
On–Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of vibration.	—
PCM Power and Ground Check	On–Board Diagnostic (OBD) System Check.	Chassis Electrical
PCM Power and Ground Check	On–Board Diagnostic (OBD) System Check. PCM power and ground circuits OK. Data link voltage incorrect.	Chassis Electrical

Symptoms	Initial Diagnosis	Default Section(s)
Intermittents	1. On–board diagnostic (OBD) system check. 2. Careful visual/physical inspections.	Chassis Electrical
Hard Starts	1. OBD system check. 2. Sensors (ECT, MAP, TP); MAP output chart. 3. Fuel system electrical test, fuel system diagnosis. 4. Ignition system. 5. IAC system check.	Engine Mechanical Ignition System Check Exhaust System Diagnosis
Surges and/or Chuggles	1. OBD system check. 2. Heated oxygen sensors. 3. Fuel system diagnosis. 4. Ignition system.	Calibration ID ”Broadcast Code”/Service Bulletins Ignition System Check Generator Output Exhaust System Diagnosis
Lack of Power, Sluggish or Spongy	1. OBD system check. 2. Fuel system diagnosis. 3. Ignition system. 4. EGR operation. 5. EGR system check.	Refer to Exhaust System in Engine Exhaust TCC Operation Calibration ID/Service Bulletins
Detonation / Spark Knock	1. OBD system check. 2. EGR operation. 3. EGR system check. 4. Fuel system diagnosis. 5. Ignition system.	Cooling System Ignition System Check Calibration ID/Service Bulletins

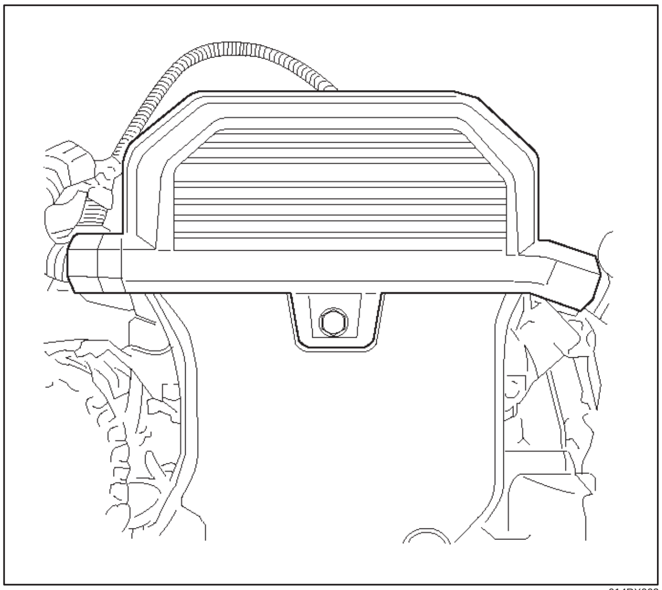
Hesitation, Sag, Stumble	1. OBD system check. 2. TP. 3. MAP output check. 4. Fuel system diagnosis. 5. Fuel injector and fuel injector balance test. 6. EVAP emission canister purge valve. 7. Ignition system.	EGR Operation EGR System Check Generator Output Voltage (refer to Chassis Electrical) Calibration ID/Service Bulletins Ignition System Check
Cuts Out, Misses	1. OBD system check. 2. Cylinder balance test.	Ignition System Check
Rough, Unstable, or Incorrect Idle, Stalling	1. OBD system check. 2. Fuel injector and fuel injector balance test. 3. EVAP emission canister purge valve check. 4. Ignition system. 5. IAC operation. 6. EGR operation.	MAP Output Check Throttle Linkage IAC System Check EGR System Check A/C Clutch Control Circuit Diagnosis Crankcase Ventilation System Calibration ID/Service Bulletins Generator Output Voltage (refer to Chassis Electrical) Exhaust Diagnosis
Poor Fuel Economy	1. OBD system check. 2. Careful visual/physical inspection. 3. Ignition system. 4. Cooling system.	TCC Operation Exhaust System (refer to Engine Exhaust)
Engine Cranks But Will Not Run	1. OBD system check.	Fuel System Electrical Diagnosis Fuel System Diagnosis Fuel Injector Fuel Injector Balance Test
Excessive Exhaust Emissions or Odors	1. OBD system check. 2. Emission test. 3. Cooling system. 4. Fuel system diagnosis. 5. Fuel injector and fuel injector balance test. 6. EVAP emission canister purge valve. 7. Crankcase ventilation system. 8. Ignition system. 9. MAP output check.	EGR System Check Exhaust Diagnosis Calibration ID/Service Bulletins
Dieseling, Run–On	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis.	—
Backfire	1. OBD system check. 2. Ignition system. 3. Fuel system diagnosis. 4. Fuel injector and fuel injector balance test. 5. EGR operation, EGR system check.	Exhaust System Diagnosis, Intake Casting Flash, Ignition System Check

Misfire	1. OBD system check. 2. Ignition system. 3. Fuel system diagnosis. 4. Fuel injector and fuel injector balance test.	Vibrations, Transmission, Driveshaft and Axle
Catalyst Monitor	1. OBD system check. 2. Careful visual/physical inspection. 3. Heated oxygen sensors.	Exhaust System
Fuel Trim	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis. 4. Heated oxygen sensors.	Exhaust System Intake Air System
Evaporative Emissions	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis.	—
Heated Oxygen Sensors	1. OBD system check. 2. Careful visual/physical inspection.	Exhaust System

Camshaft Position (CMP) Sensor

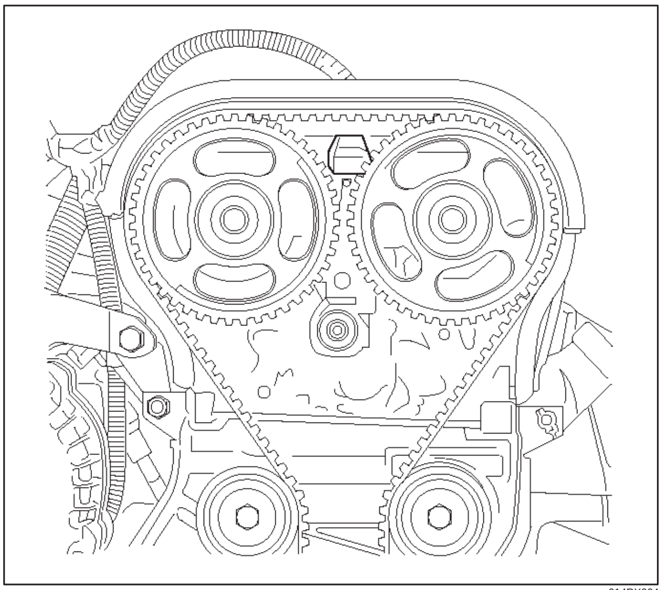
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove spark plug cover on top of valve cover by removing four retaining bolts.
3. Disconnect electrical connector from the sensor.



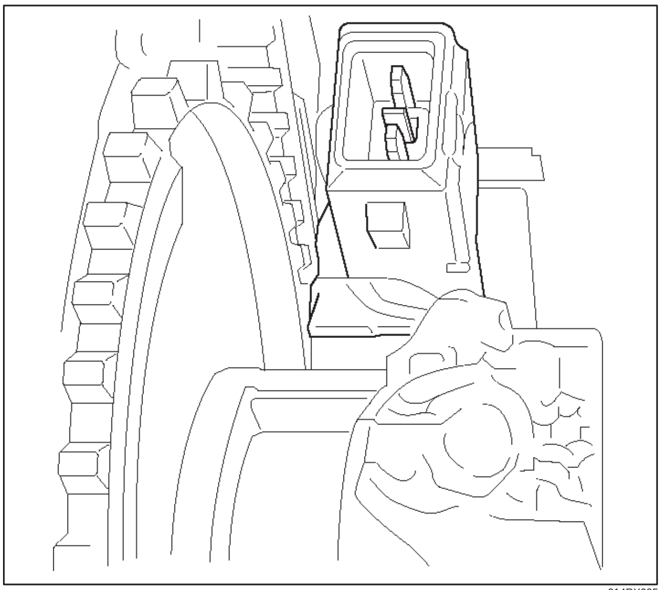
014RX003

4. Remove drive belt. Refer to Engine Mechanical Section.
5. Remove top harness cover installed on timing belt cover by removing a retaining screw.
6. Remove the retaining bolts holding crankshaft pulley, and pull crankshaft pulley while wiggling. Refer to Engine Mechanical Section.
7. Remove the retaining screws for timing belt cover and timing belt cover.



014RX004

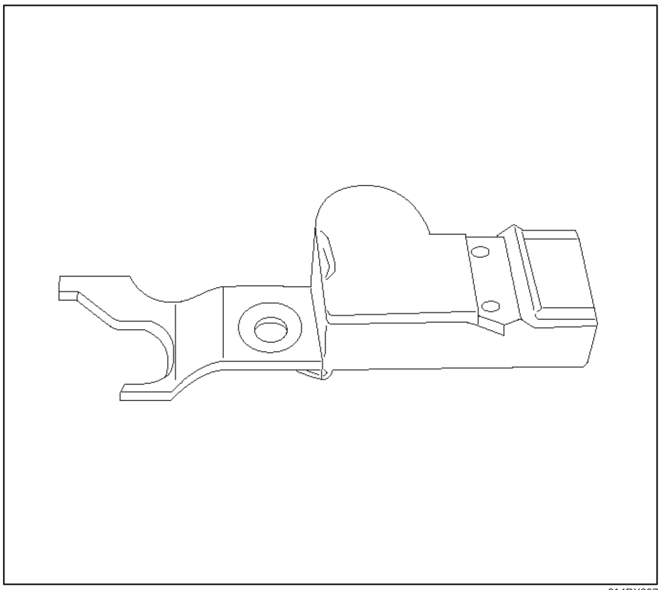
8. Remove the retaining bolt for the sensor and pull up camshaft position sensor.



014RX005

Installation Procedure

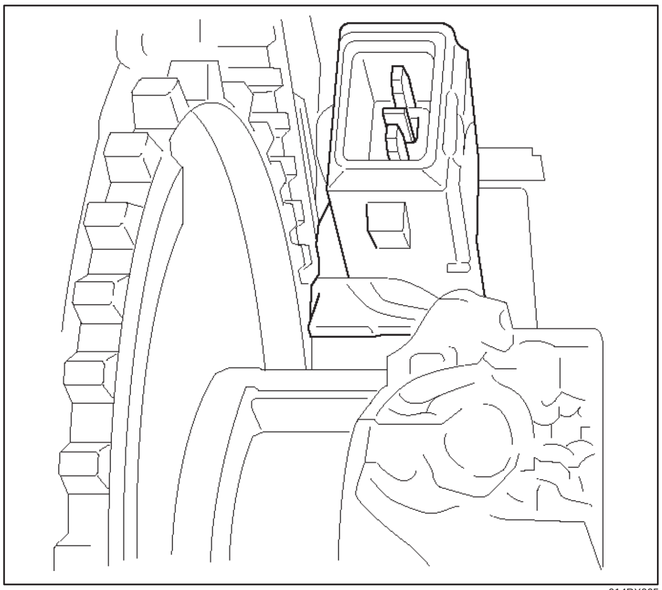
1. Insert camshaft position sensor in position.
2. Install retaining bolt.



014RX007

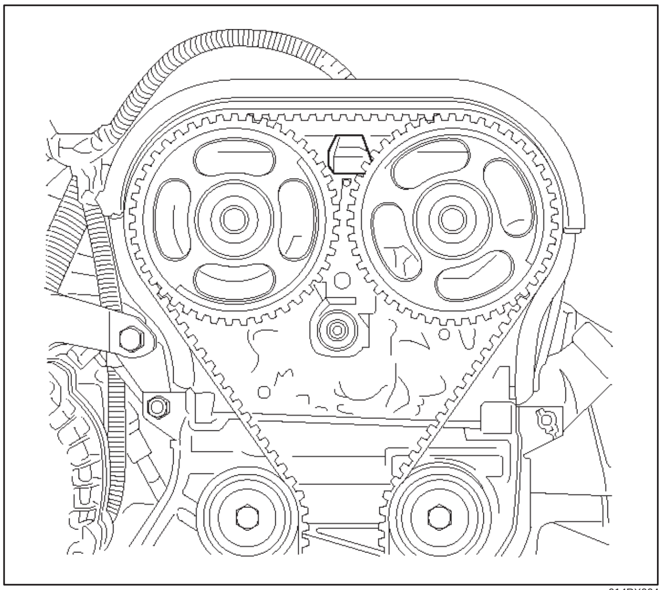
3. Install the timing belt cover and the retaining screws.
4. Install the crank shaft pulley and the mounting bolts. Holes for mounting bolts are off the pitch. The pulley can be mounted only one way to install all mounting bolts. Tighten the bolts. Refer to Engine Mechanical section.

5. Install the drive belt. Refer to Engine Mechanical Section.



014RX005

6. Install the top harness cover onto timing belt cover.
7. Connect electrical connector to the sensor and securely lock it.
8. Install the spark plug cover.
9. Connect the negative battery cable.

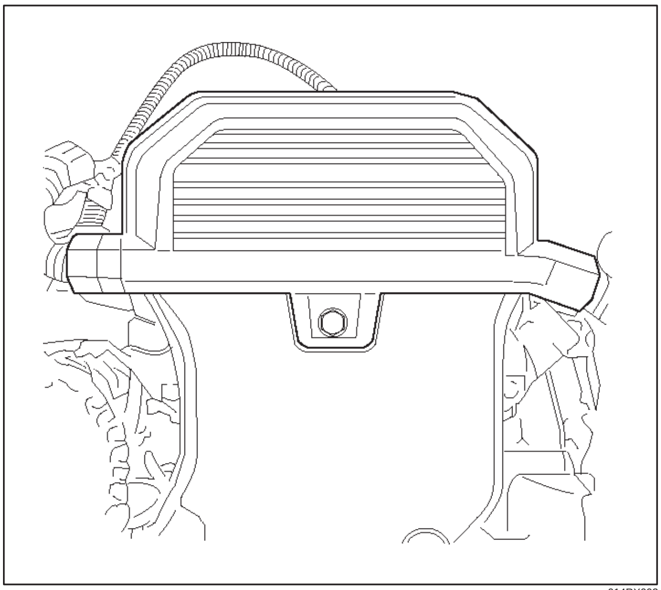


014RX004

Crankshaft Position (CKP) Sensor

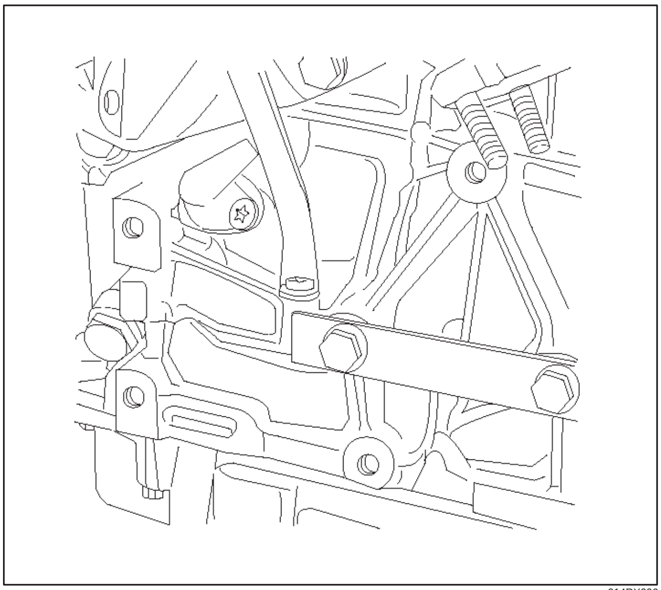
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the drive belt. Refer to Engine Mechanical Section.



014RX003

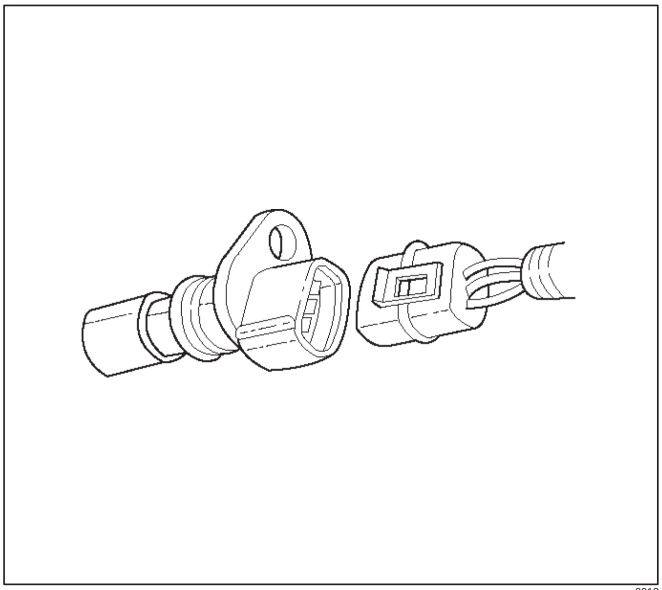
3. Remove the pwer steering pump and mounting–bracket from engine. Refer to Engine Mechanical Section.
4. Disconnect electrical connector from the sensor.



014RX006

5. Remove the retaining bolt and sensor from the engine block.

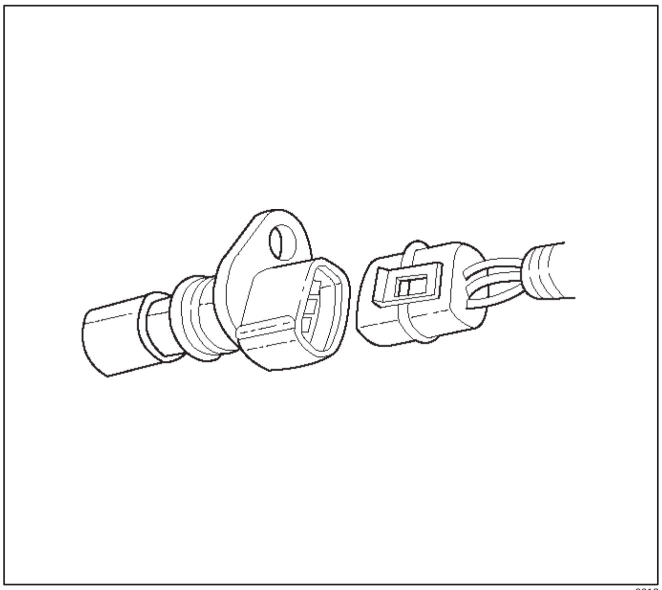
NOTE: Use caution to avoid any hot oil that might drip out.



0013

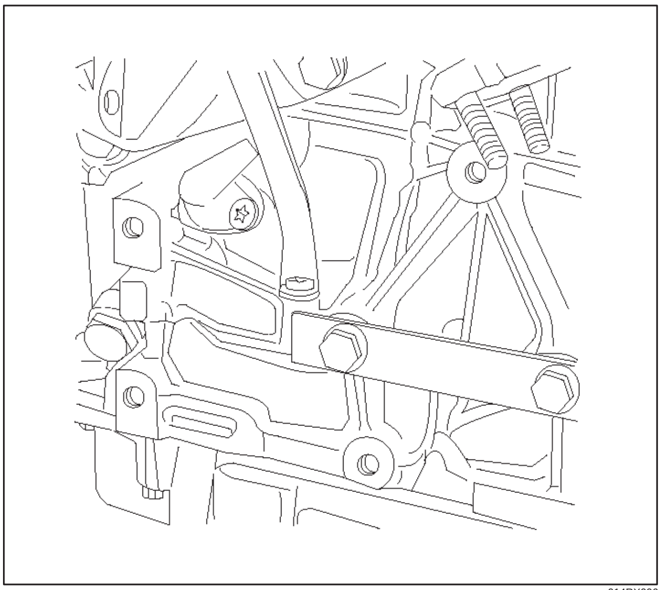
Installation Procedure

1. Install the crank shaft position sensor to its position.
2. Install and tighten the mounting bolt. Refer to Engine Mechanical Section.



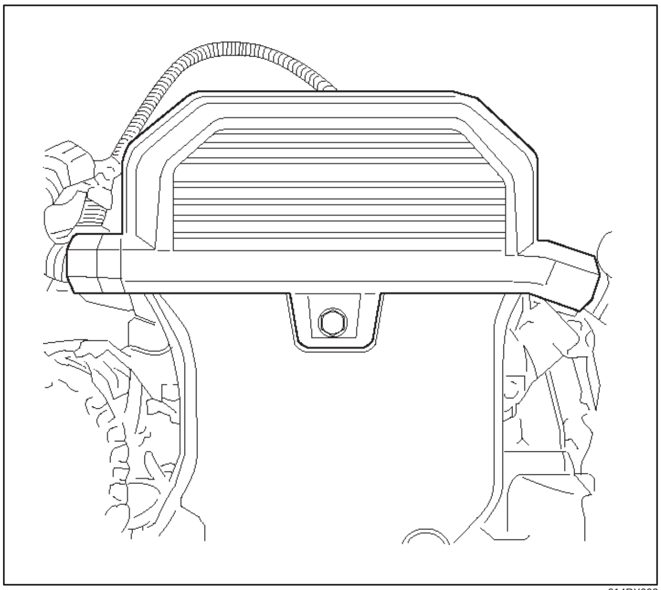
0013

3. Reinstall the power steering pump and bracket to the engine.



014RX006

4. Reinstall the accessory drive belt.
5. Connect the negative battery cable.



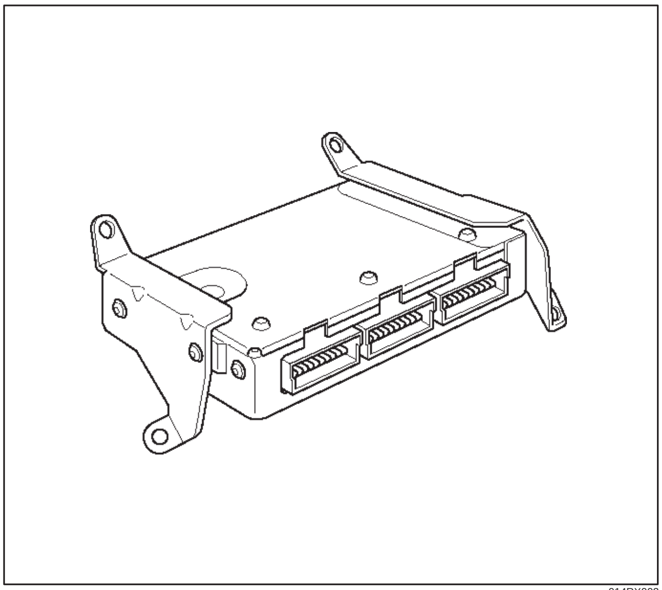
014RX003

IMPORTANT: PCM must re–learn Crankshaft Position when the CKP sensor is replaced. Refer to CKP sensor learn mode on the Tech 2, or Tooth Error Correction in the Service Manual.

EEPROM

EEPROM

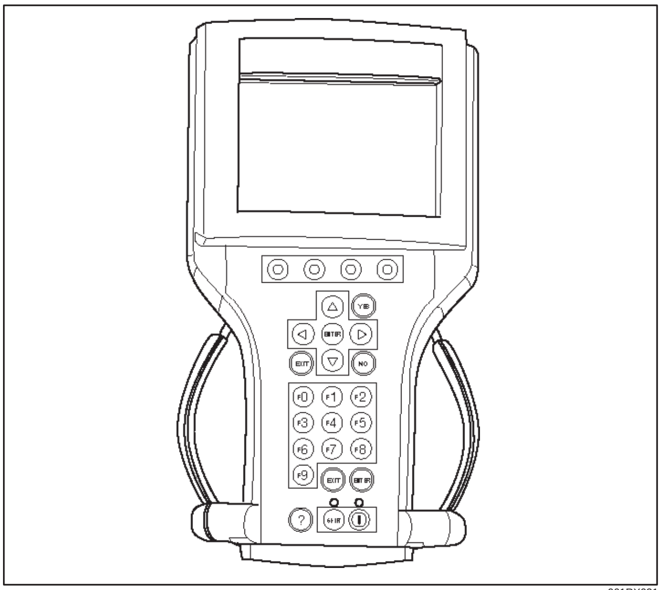
The Electronically Erasable Programmable Read Only Memory (EEPROM) is a permanent memory that is physically soldered within the PCM. The EEPROM contains program and calibration information that the PCM needs to control Powertrain operation.



014RX002

EEPROM Programming

1. Connect Tech 2 to the vehicle DLC and retrieve information from the PCM. Ensure that the following condition have been met:
   - Battery is fully charged.
   - The Ignition is in ON position.
   - Tech 2 cable is securely connected to DLC.
2. Download latest program and calibration from ITCS. Always use latest ITCS software to program PCM. Refer to Up–to–date ITCS user’s guide.
3. Reconnect Tech 2 to the DLC and program PCM.
   - Make sure the ignition is recycled after information is retrieved.
   - Ensure the ignition is stay in ON position after programming is started.



901RX031

Functional Check

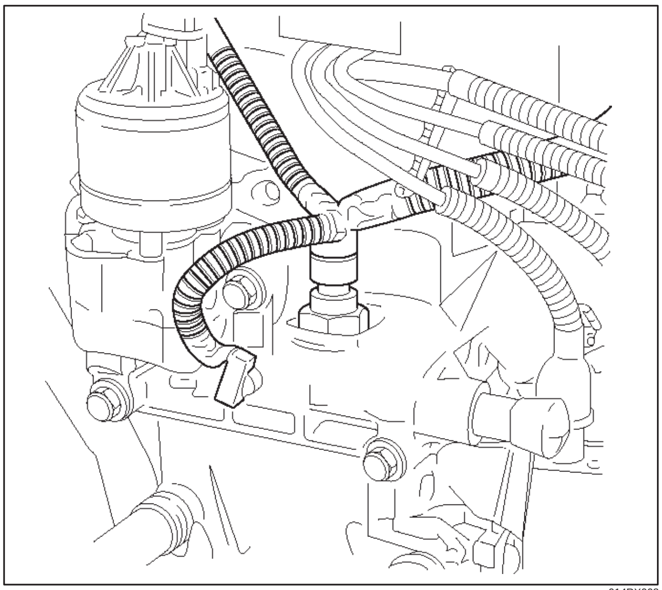
1. Perform the On–Board Diagnostic System Check.
2. Start the engine and run for least one minute.
3. Check for DTCs using Tech 2.
4. If the PCM fails to program, proceed as follow:
   - Ensure that all PCM connections are OK.
   - Check the ITCS for latest version software.
   - Attempt to program PCM again. If PCM still cannot be programmed properly, replace PCM. The replacement PCM must be programmed.

Engine Coolant Temperature (ECT) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Drain enough engine coolant so that the coolant level will be below the ECT sensor.
3. Remove electrical connector from the sensor located on the intake manifold above the ignition coil.

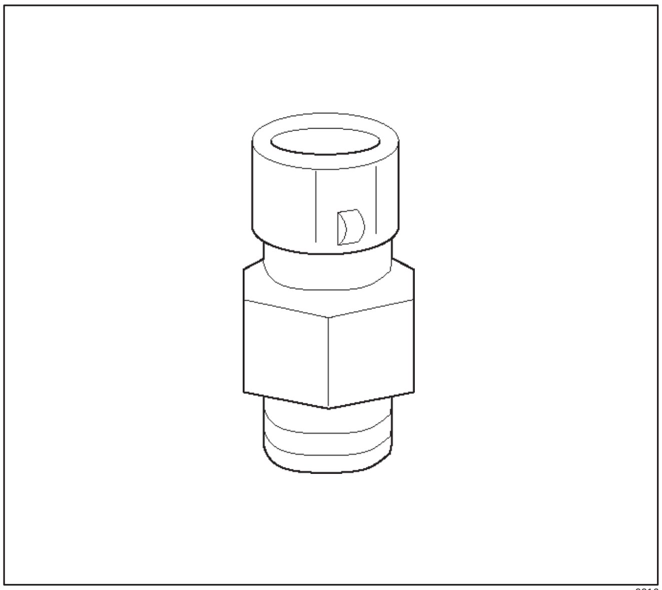
4. Unscrew the sensor from the manifold.



014RX008

Installation Procedure

1. Install the sensor into the intake manifold. Do not over tighten.
2. Connect electrical connector.
3. Add engine coolant to required level. Refer to Engine Cooling System Section.
4. Connect the negative battery cable.



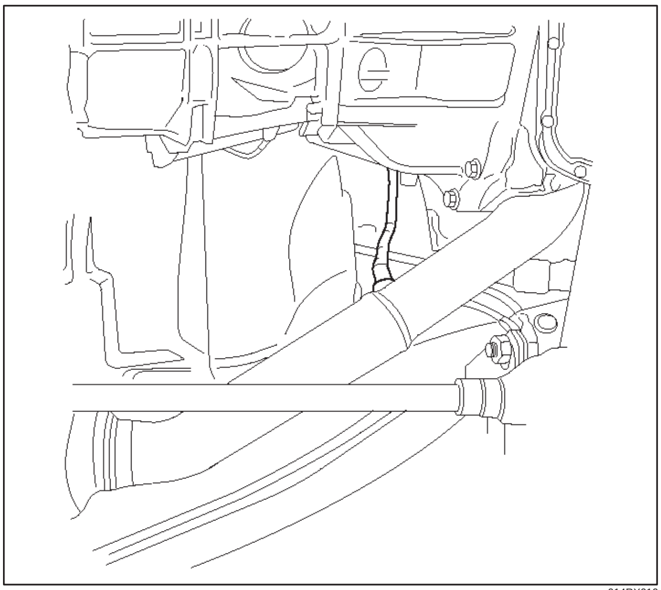
0016

Heated Oxygen Sensor (HO2S)

Removal Procedure

1. Disconnect the negative battery cable.
2. Locate the two oxygen sensors.
   - Bank 1 sensor 1 is mounted on the exhaust pipe ahead of the catalytic converter.
   - Bank 1 sensor 2 is mounted on the exhaust pipe behind the catalytic converter.
3. Disconnect pig tail electrical connector.

IMPORTANT: The pigtail is permanently attached to the sensor. Be careful not to pull the wires out.



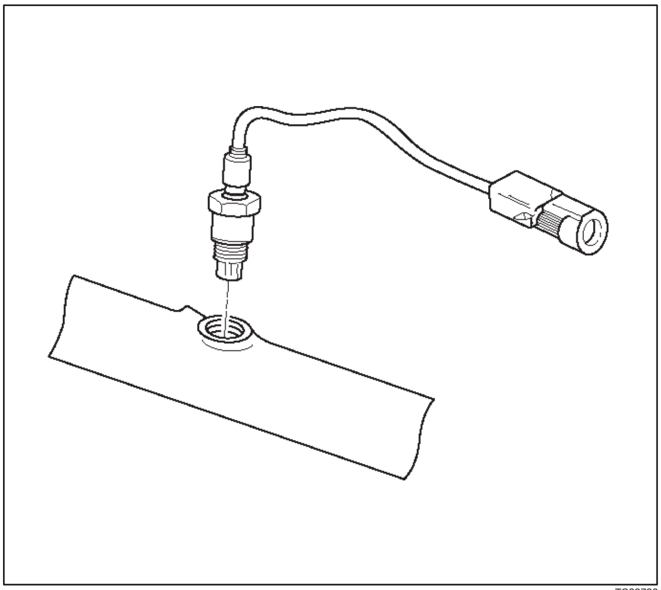
014RX010

4. Unscrew sensors form the exhaust pipe. Because of the expansion and contraction of the metal in the exhaust system over time, this may be difficult if the engine temperature is below 48 degree C.

Inspection Procedure

NOTE: Both sensors are identical. Inspect each inthe same way.

1. Inspect the pigtail and the electrical connector for grease, dirt, corrosion and bare wire or worn insulation.
2. Inspect the louvered end of the sensor for grease, dirt, excessive carbon build up or other contaminants.

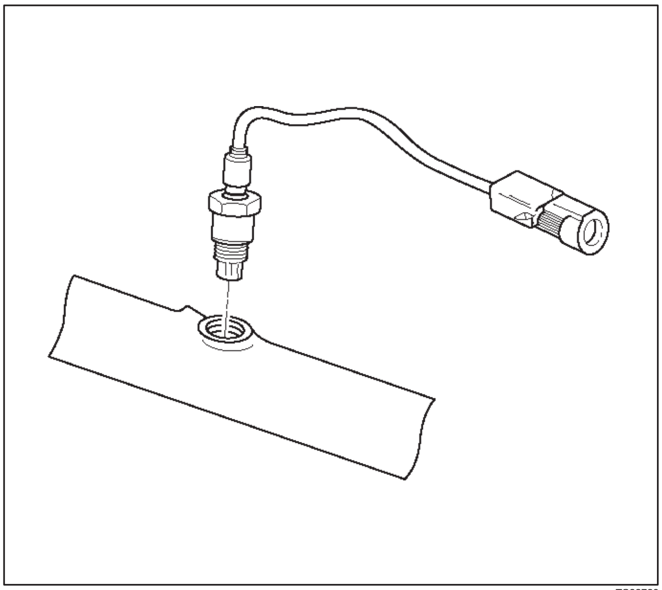


TS23739

Installation Procedure

NOTE: If HO2S is reinstalled after removal, special anti–seize compound or the equivalent should be applied to the threads. Special anti–seize compound, (P/N 5613695), is used on the HO2S threads. This compound consists of glass beads suspended in a liquid graphite solution. The graphite burns away with exhaust heat, but the glass beads will remain, making the sensor easier to remove.

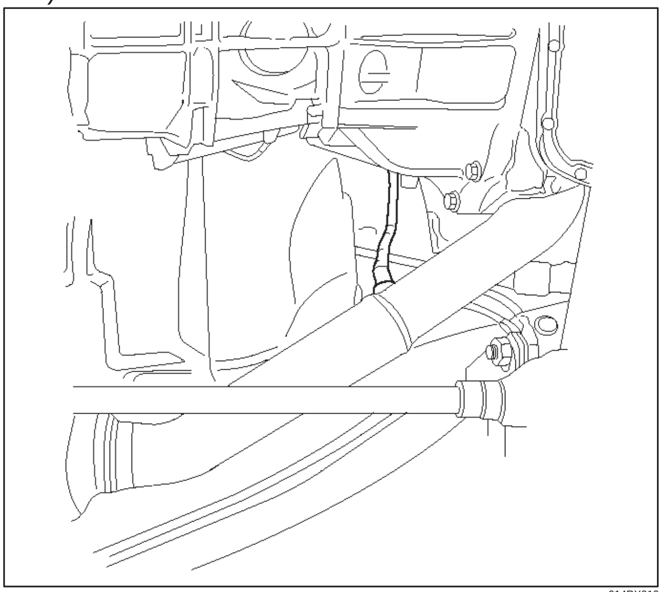
1. Apply anti–seize compound or the equivalent to the thread.



TS23739

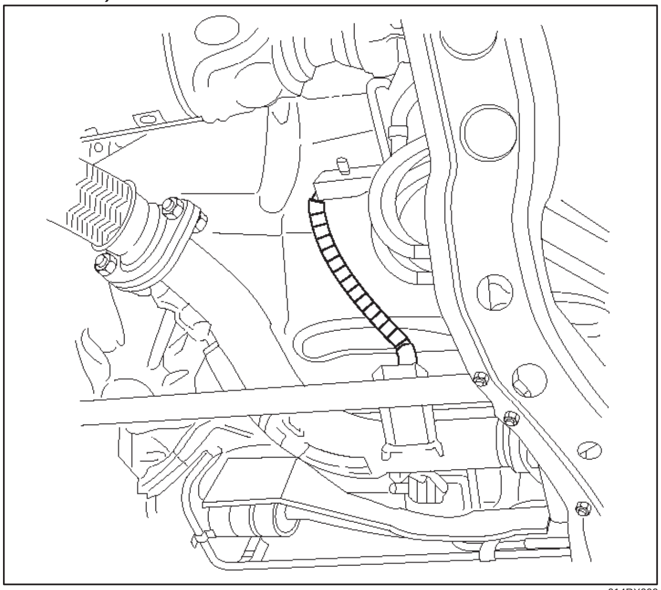
2. Install HO2S on the exhaust pipe.
3. Tighten the sensor to 55 Nm (40 lb ft)
4. Connect the pig tail to the wiring harness.
5. Connect the negative battery cable.

(Pre–Catalytic Converter Heater Oxygen Sensor Location)



014RX010

(Post–Catalytic Converter Heater Oxygen Sensor Location)

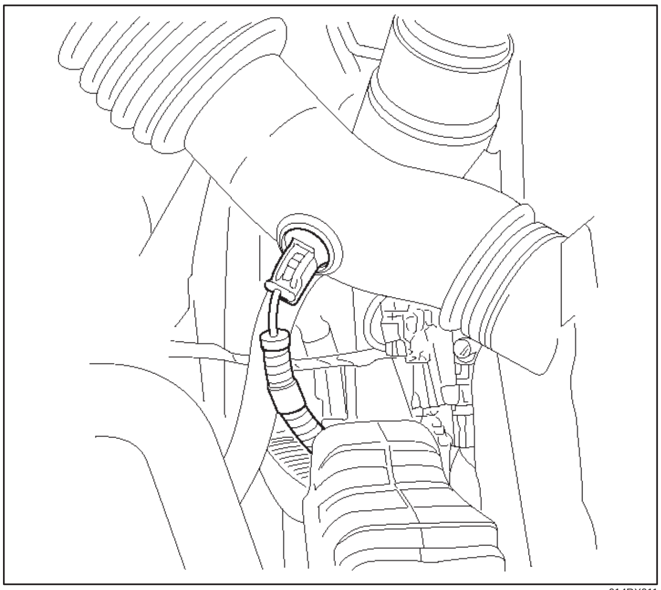


014RX009

Intake Air Temperature (IAT) Sensor

Removal Procedure

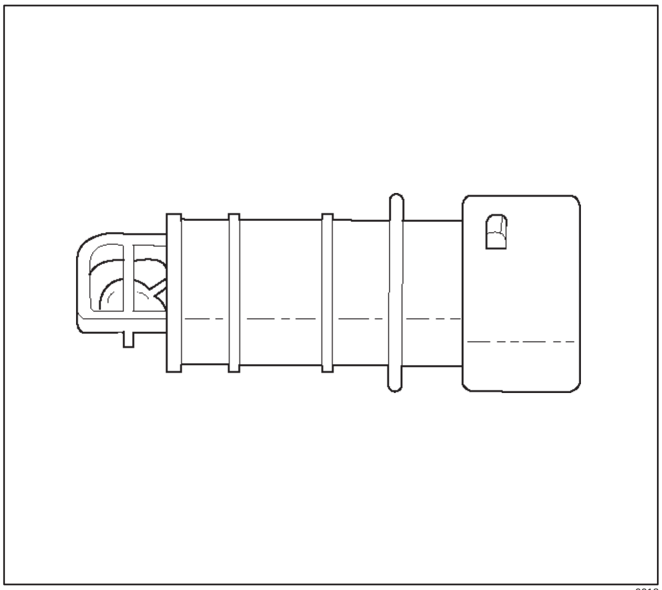
1. Disconnect the negative battery cable.
2. The IAT sensor is located in the intake air duct between the air filter and the throttle body.



014RX011

3. Disconnect the electrical connector from the sensor.

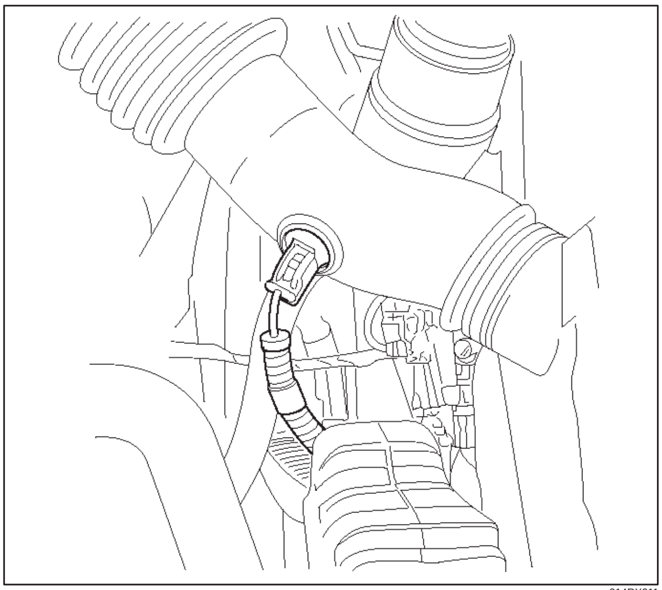
4. Remove the sensor from intake air duct by using a rocking motion while pulling the sensor.



0018

Installation Procedure

1. Install the IAT sensor into intake air duct. Make sure the sensoris pushed all the way into the intake air duct.
2. Connect electrical connector.
3. Connect the negative battery cable.

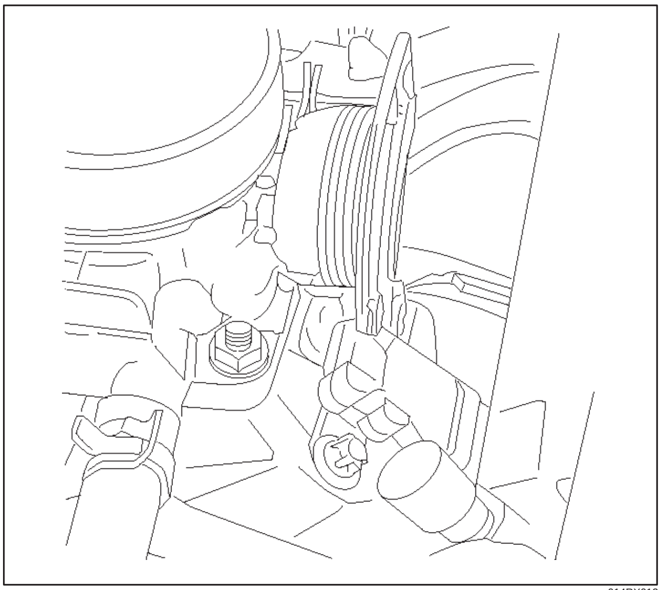


014RX011

Manifold Absolute Pressure (MAP) Sensor

Removal Procedure

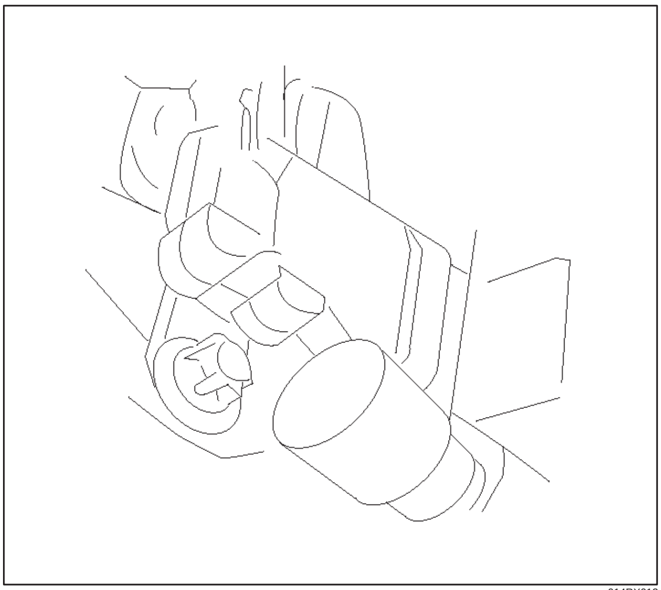
1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the sensor. (The MAP sensoris located on the intake manifold behind throttle body.)
3. Remove a mounting bolt securing the sensor to the manifold.
4. Remove the sensor from the intake manifold using rocking motion while pulling the sensor.



014RX012

Installation Procedure

1. Push MAP sensor into the manifold. Make sure the sensor is pushed always into its position.
2. Install a mounting bolts and tighten.
3. Connect electrical connector.
4. Connect the negative battery cable.



014RX013

Malfunction Indicator Lamp (MIL)

Malfunction Indicator Lamp (MIL)

Refer to Instrument Panel Removal Procedure.

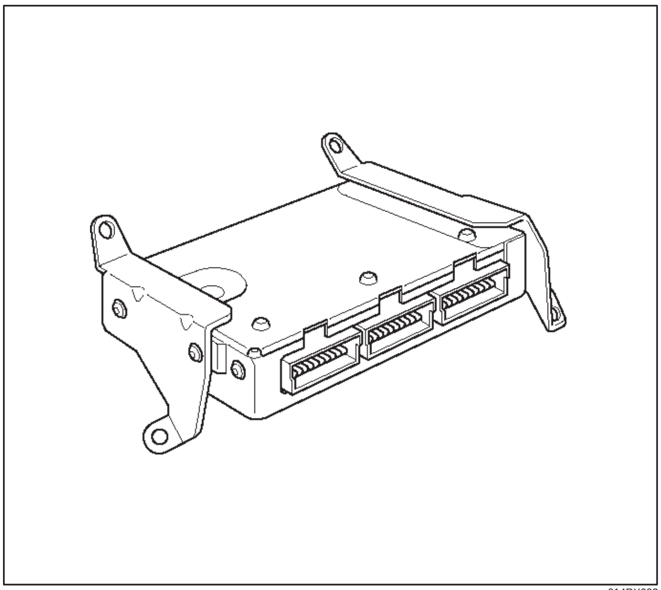
Powertrain Control Module (PCM)

Electrostatic Discharge (ESD) Damage

Electronic components used in the control system are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to same electronic components. By comparison, it takes as much as 4000 volts for a person to even feel the zap of a static discharge. There are several way for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat. Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charge of the same polarity are drained off leaving the person highly charged with opposite polarity. Static charge can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTE: To prevent possible Electrostatic Discharge damage, follow these guidelines:

- Do not touch the control module connector pins or soldered components on the control module circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the parts from the package, ground the package to a known good ground on the vehicle.
- If the parts been handled while sliding across the seat, or while sitting from standing position, or walking a distance, touch a known good ground before installing the parts.



014RX002

NOTE: To prevent internal PCM damage, the ignition must be OFF position in order to disconnect or reconnect power to the PCM (for example: battery cable. pig tail, PCM fuse, jumper cable, etc.).

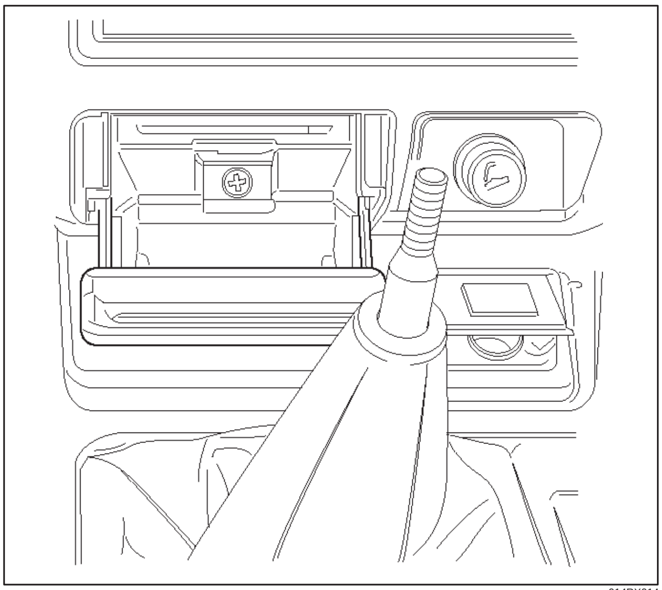
IMPORTANT: When replacing the production PCM with a service PCM, it is important to transfer the broadcast code and production PCM number to the service PCM label. This will allow positive identification of PCM parts throughout the service life of the vehicle. Do not record this information on PCM metal cover.

IMPORTANT: The ignition should always be in the OFF position in order to install or remove the PCM connectors. Service of the PCM should normally consist of either replacement of the PCM or EEPROM reprogramming. If the diagnostic procedure call for the PCM to be replaced, the replacement PCM should be checked first to ensure it has the correct part number. If it is, remove the faulty PCM and install the new service PCM. The service PCM EEPROM will need to be programmed. Additionally, after programming, the CKP Sensor Tooth Error Correction (TEC) Learn procedure will need to be performed.

Removal Procedure

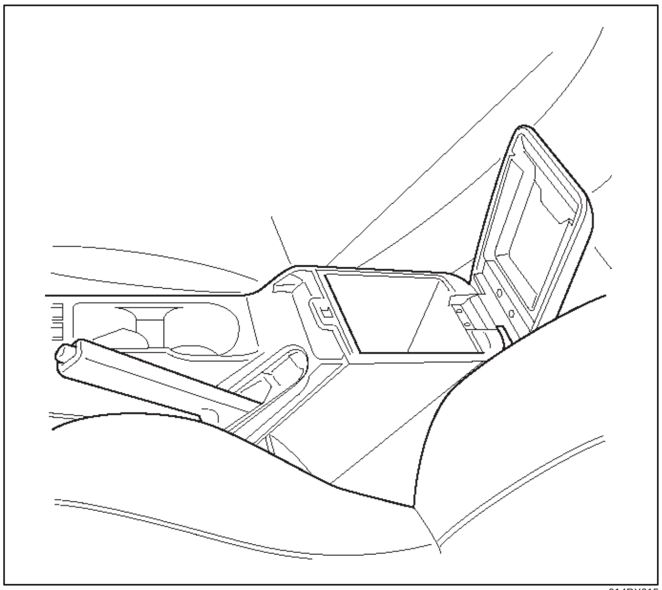
1. Disconnect the negative battery cable.
2. Block the wheels.
3. Remove ashtray inner.

4. Remove a screw located behind ashtray.



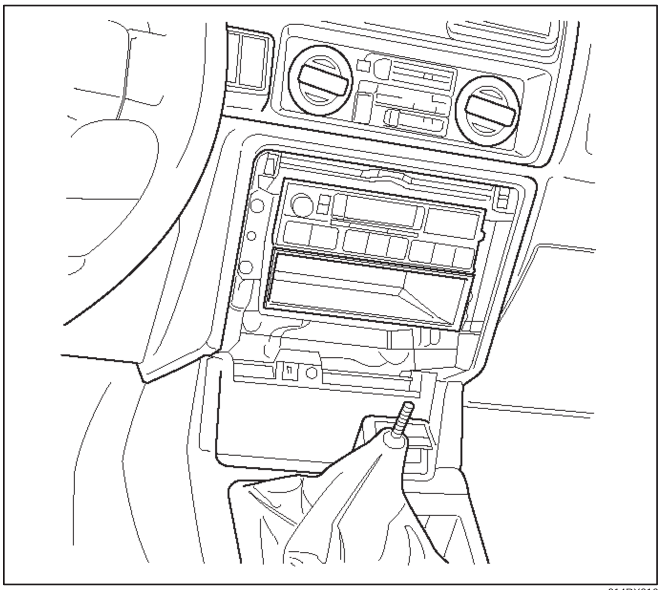
014RX014

5. Pull out Face trim of console.
6. Remove two screws located inside of center console storage box and pull up rear part of center console.



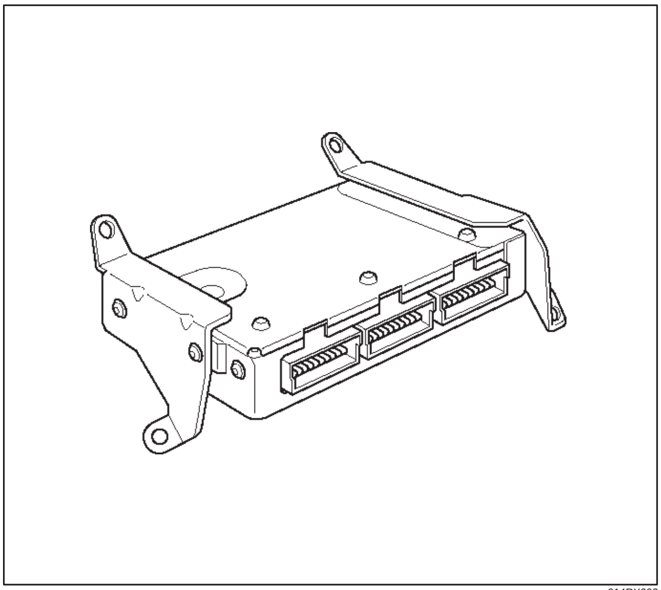
014RX015

7. Unscrew the shift knob.
8. Remove four screw holding front part of the console and pull the console up.
9. Disconnect the red, white and blue electrical connector at the PCM.



014RX016

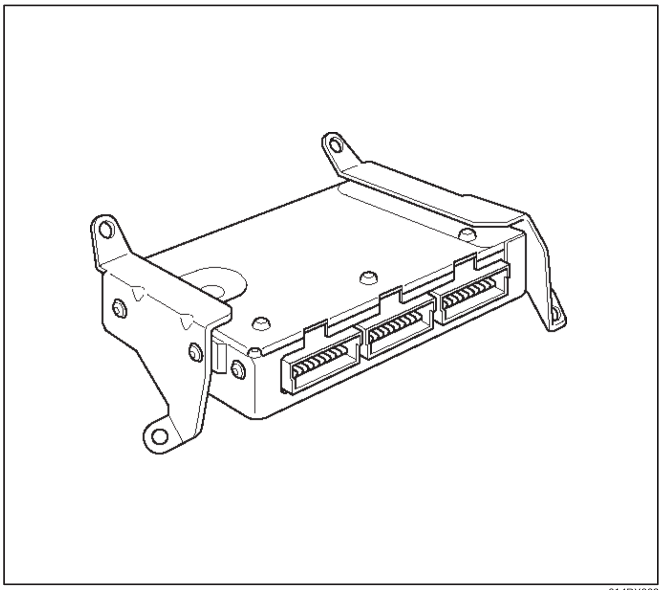
10. Remove two nuts in the front of PCM.
11. Remove two nuts in the rear of PCM.
12. Pull the PCM out from dashboard.



014RX002

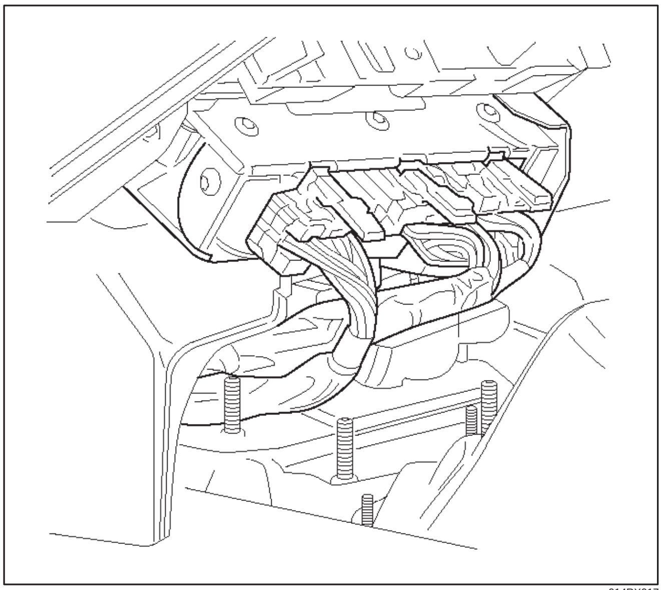
Installation Procedure

1. Place PCM into its position and secure by four mounting screws.



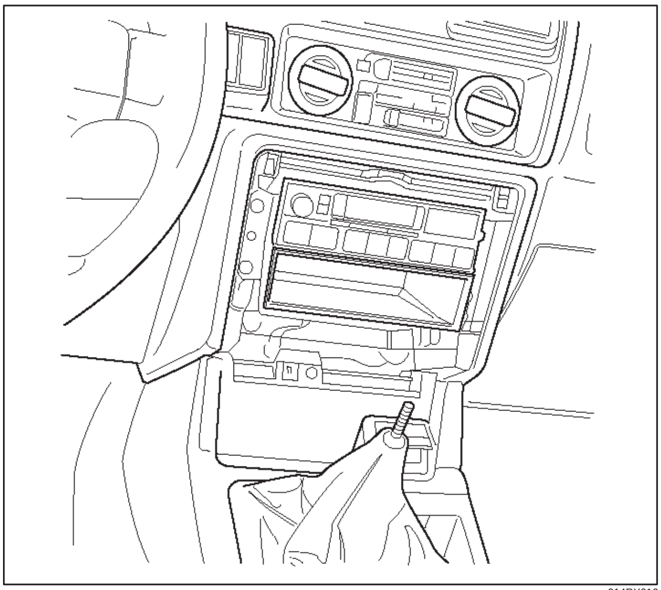
014RX002

2. Connect all three connectors to PCM. All connectors are color keyed. Same color male and female connectors join together.



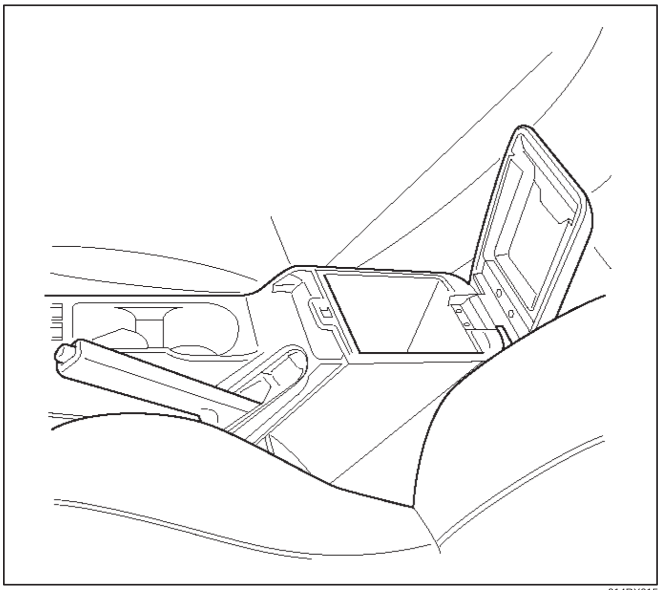
014RX017

3. Install the front center console and secure by four retaining screws.



014RX016

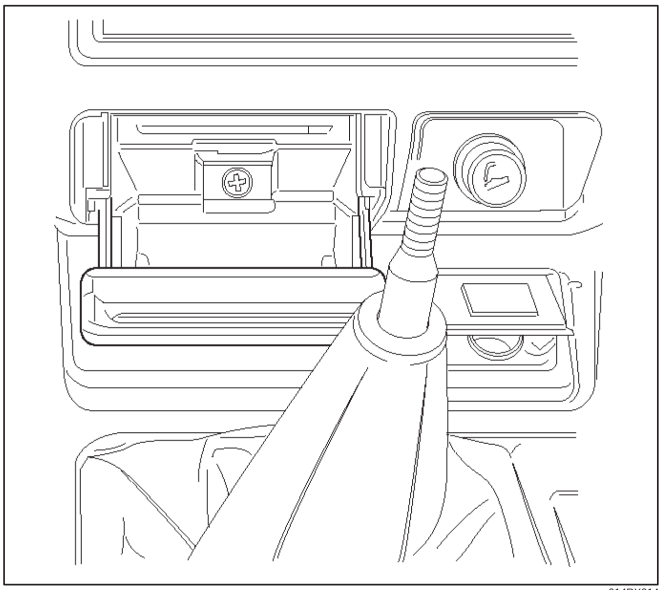
4. Install the rear center console and secure it by two retaining screw into storage box.



014RX015

5. Snap face plate into its position and secure it by a screw.
6. Insert ashtray inner.
7. Insert the shift knob.
8. Connect the negative battery cable.

9. Remove wheel blocks.



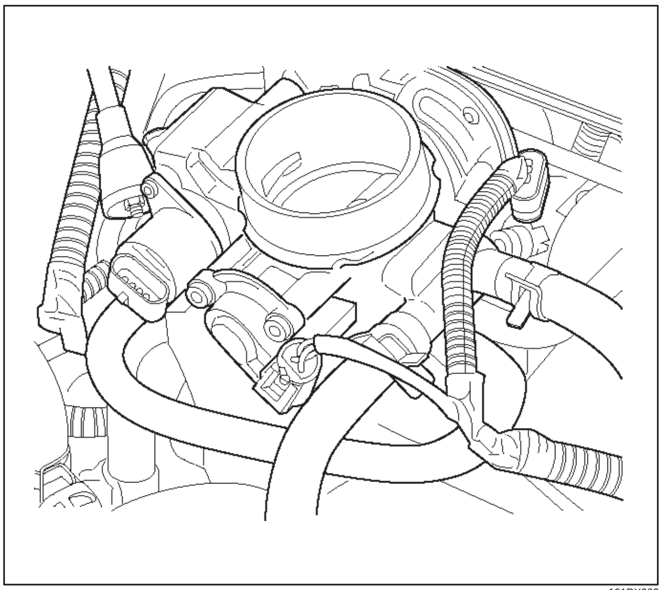
014RX014

Throttle Position (TP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the TPS electrical connector.
3. Remove the two screws and TP sensor from the throttle body.

NOTE: Do not clean the TP sensor by soaking it in solvent. The sensor will be damaged as a result.

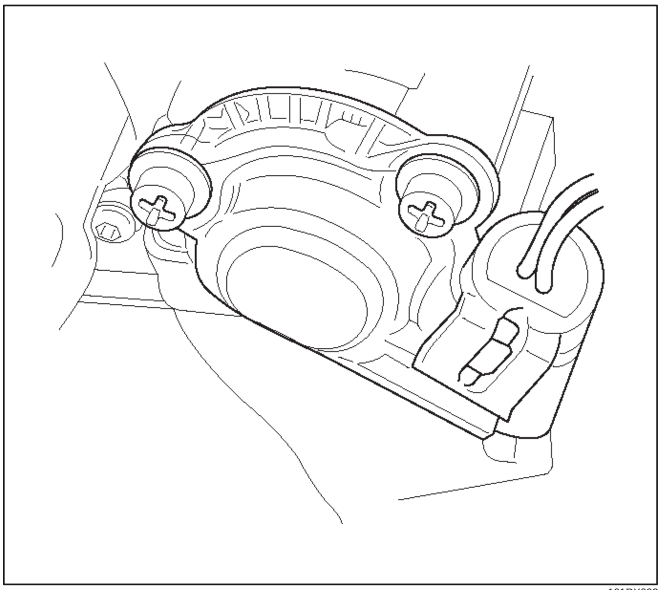


101RX002

Function Check

Use a Tech 2 to check the TP sensor output voltage at closed throttle.

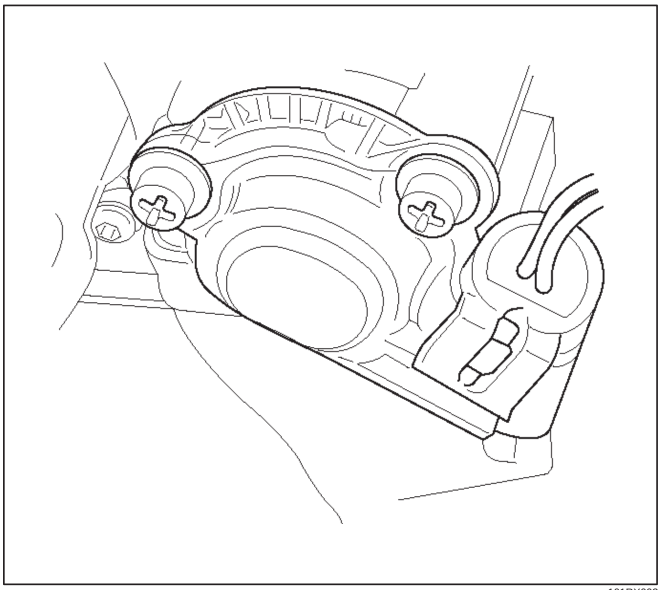
- The voltage should be under 0.25 volts.
- If the reading is greater than 0.25 volts, check the throttle shaft to see if it is binding. Check that the throttle cable is properly adjusted, also. Refer to Throttle Cable Adjustment.
- If the throttle shaft is not binding and the throttle cable is properly adjusted, install a new TP sensor.



101RX003

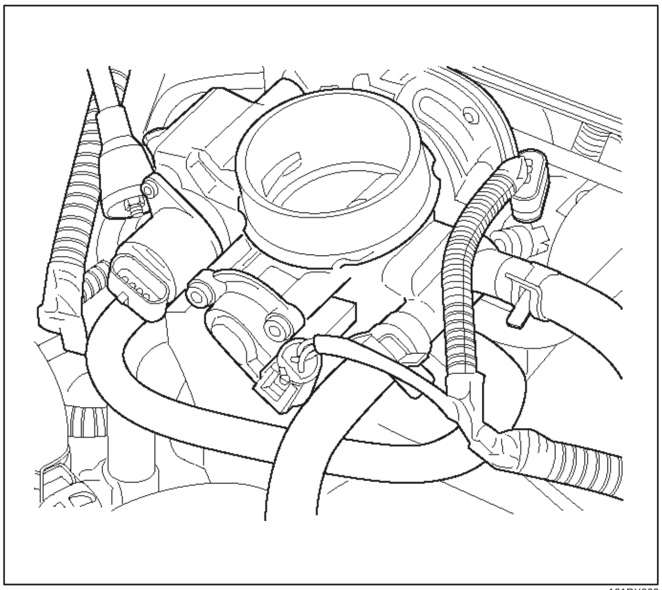
Installation Procedure

1. Install the TP sensor on the throttle body with two screws.



101RX003

2. Connect the electrical connector.
3. Connect the negative battery cable.



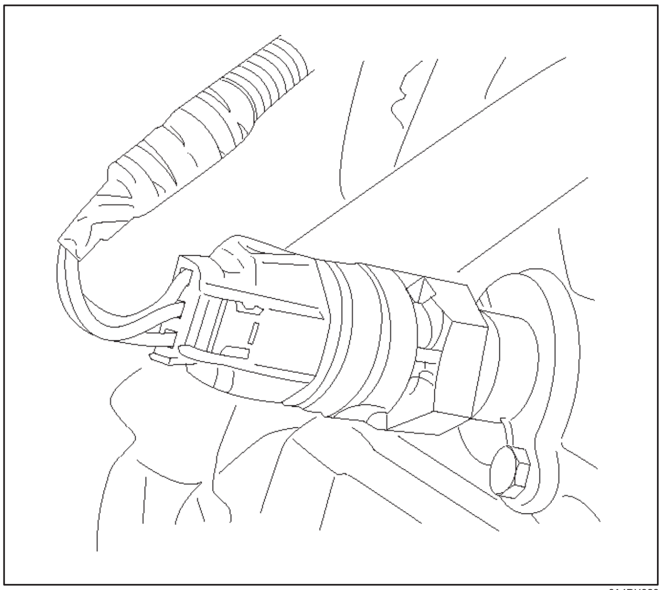
101RX002

Vehicle Speed Sensor (VSS)

Removal Procedure

1. Disconnect the negative battery cable.
2. VSS is located on the right side of the transmission case just ahead of the rear propeller shaft. Disconnect the VSS electrical connector.
3. Remove the bolt and the VSS from the transmission case by wiggling it slightly and pulling it straight out.

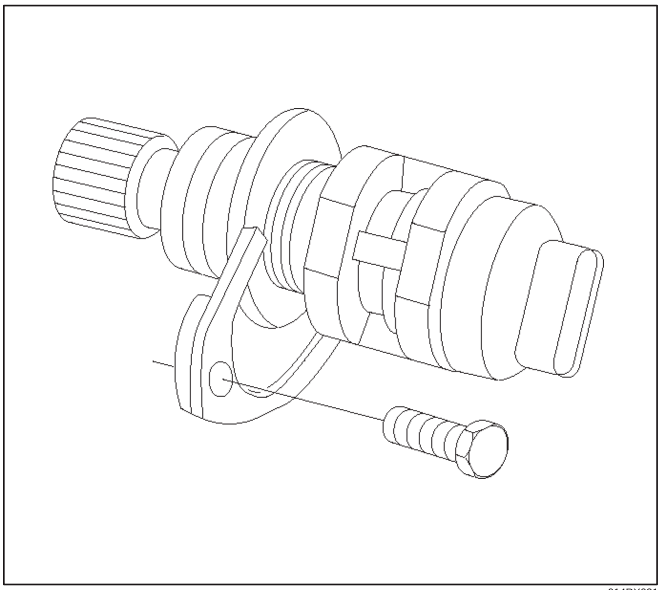
IMPORTANT: Have a container ready to catch any fluid that leaks out when the VSS is removed from the transfer case.



014RX020

Inspection Procedure

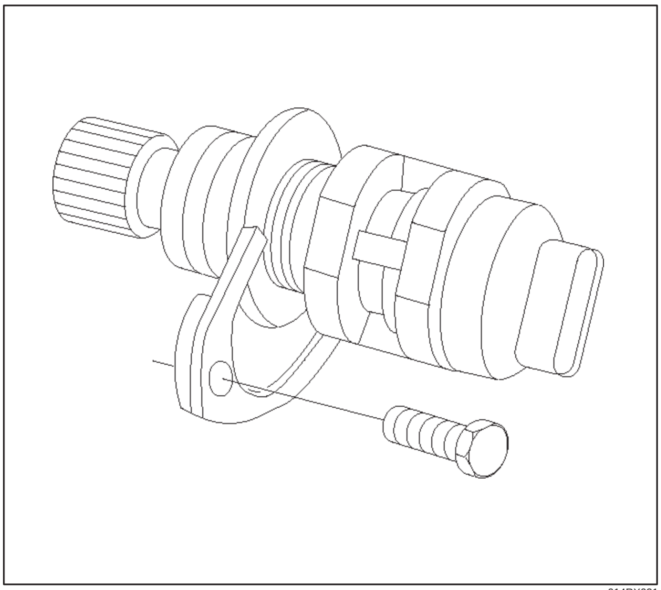
1. Inspect the electrical connector for signs of corrosion or warping. Replace the VSS if the electrical connector is corroded or warped.
2. Inspect the VSS driven gear for chips, breaks, or worn condition. Replace the VSS if the driven gear is chipped, broken or worn.
3. Inspect the O–ring for wear, nicks, tears, or looseness. Replace the O–ring if necessary.



014RX021

Installation Procedure

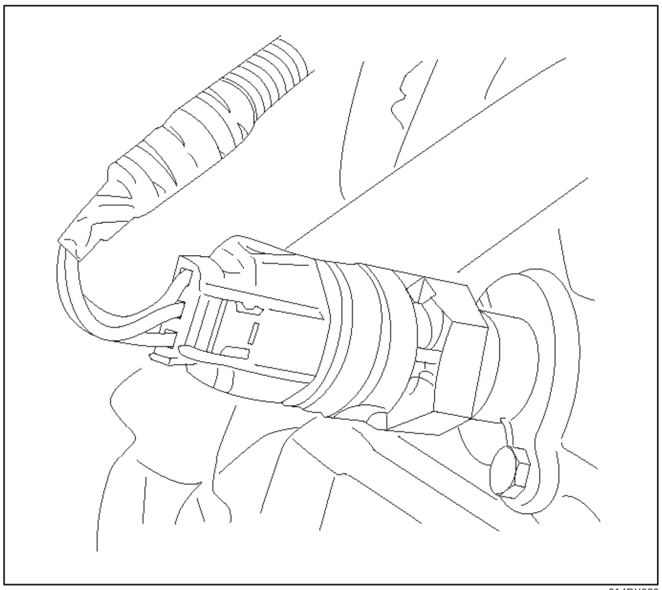
1. Install the VSS in the transmission case with the notch for the connector facing the rear.
2. Secure the VSS with mounting bolt. Tighten the bolt to 16 Nm (12 lb ft).



014RX021

3. Connect electrical connector to the VSS.
4. Check the transmission oil level. Add oil if necessary.

5. Connect the negative battery cable.

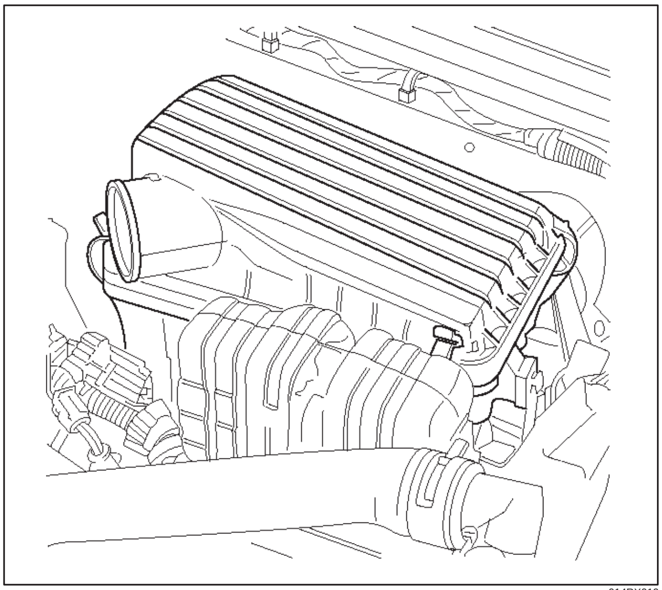


014RX020

Air Filter

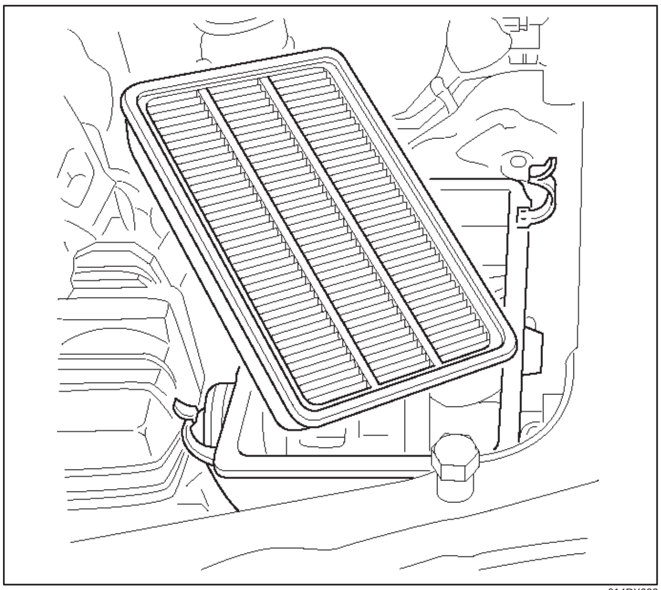
Removal Procedure

1. Disconnect electrical connector at the IAT sensor.
2. Release the four latches securing the lid to the air cleaner housing.
3. Remove the air cleaner lid.



014RX019

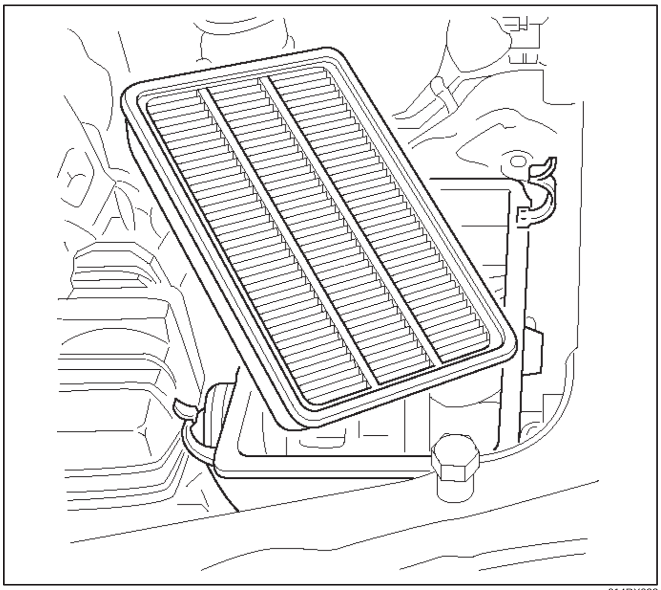
4. Remove the air filter element.



014RX023

Installation Procedure

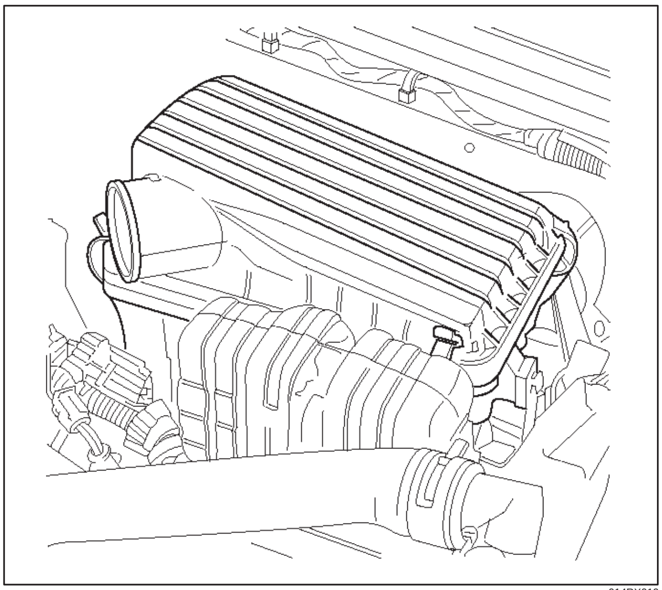
1. Install the air filter element in the air cleaner housing.



014RX023

2. Install the air cleaner lids.
3. Secure the three latches, holding the lid on the air cleaner housing.

4. Connect the electrical connector to the IAT sensor.

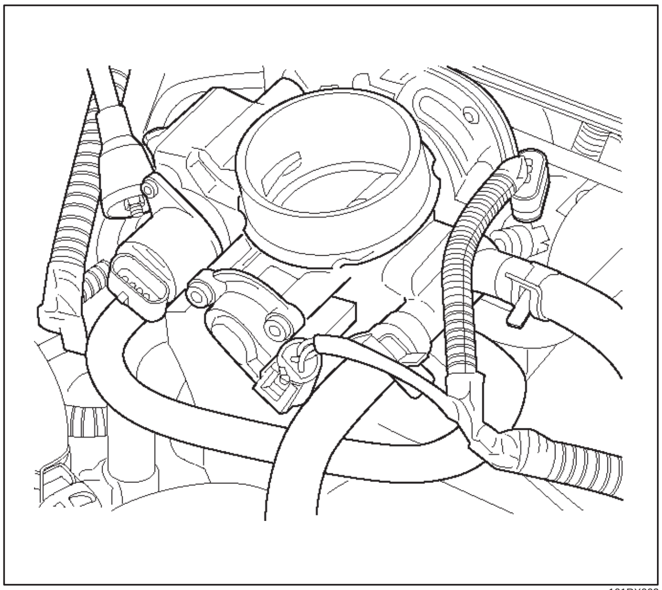


014RX019

Idle Air Control (IAC) Valve

Removal Procedure

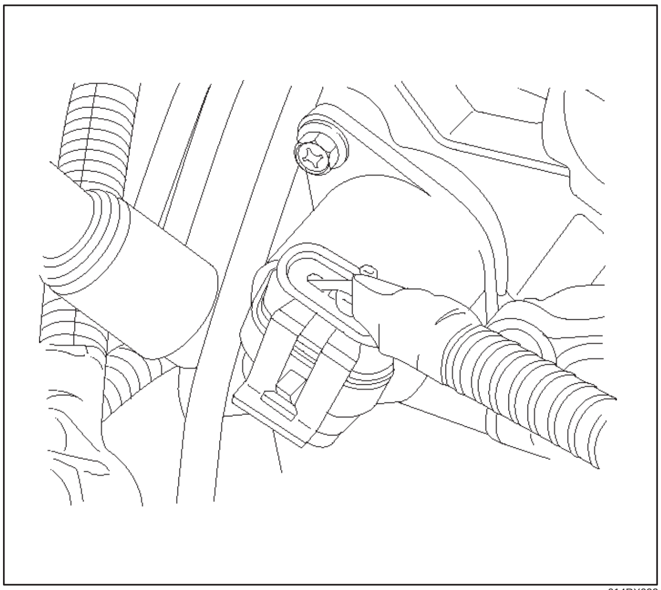
1. Disconnect the negative battery cable.



101RX002

2. Disconnect the IAC electrical connector.
3. Remove the two screws and IAC valve from the throttle body.

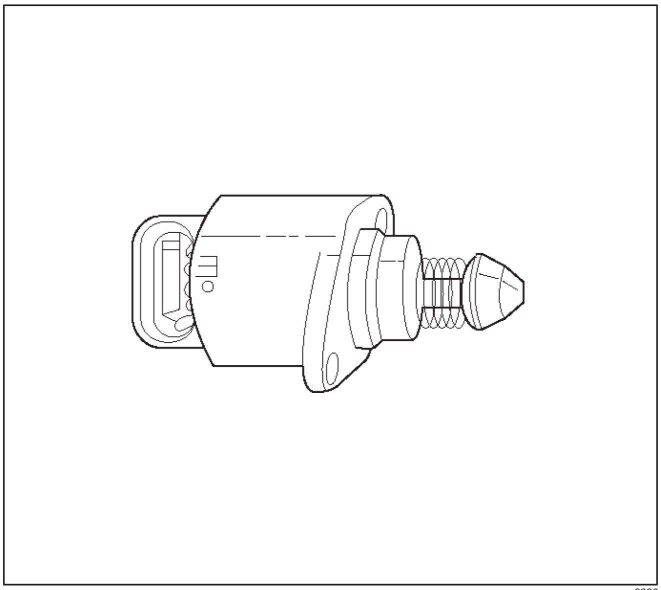
NOTE: Do not clean the IAC valve by soaking it in solvent. The valve will be damaged as a result.



014RX022

Cleaning and Inspection Procedure

- Clean the IAC valve O–ring sealing surface, pintle valve seat and air passage.
- Use carburetor cleaner and a parts cleaning brush to remove carbon deposit. Do not use a cleaner that contain methyl ethyl ketone. This is an extremely strong solvent and not necessary for this type of deposit.
- Shiny spots on the pintle are normal and do not indicate misalignment or a bent pintle shaft.
- Inspect the IAC valve O–ring for cuts, cracks or distortion. Replace the O–ring if damaged.



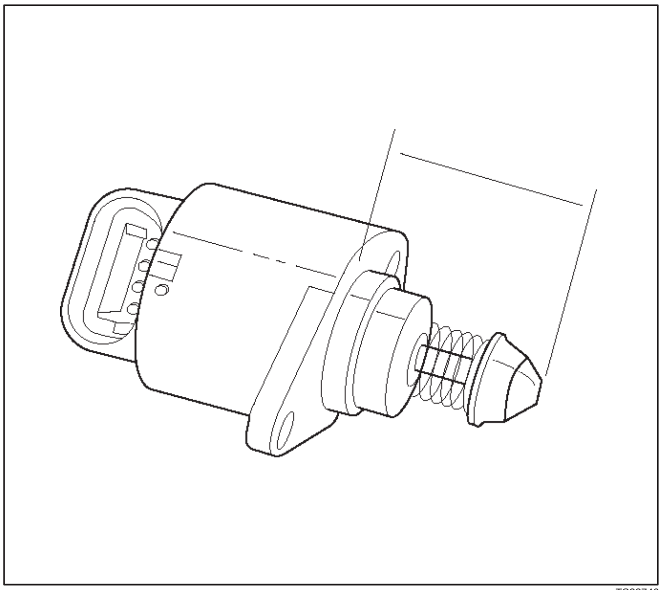
0006

Measurement Procedure

- In order to install a new IAC valve, measure the distance between the tip of the pintle and the mounting flange. If that measurement is 28 mm or less, the valve need no adjustment. If the measurement is greater than 28 mm, apply finger pressure and retract the valve. The force required to retract the pintle on a new valve will not damage the valve, shaft or pintle.

NOTE: Do not push or pull on the IAC valve pintle on IAC valve that have been in service. The force required to move the pintle may damage it.

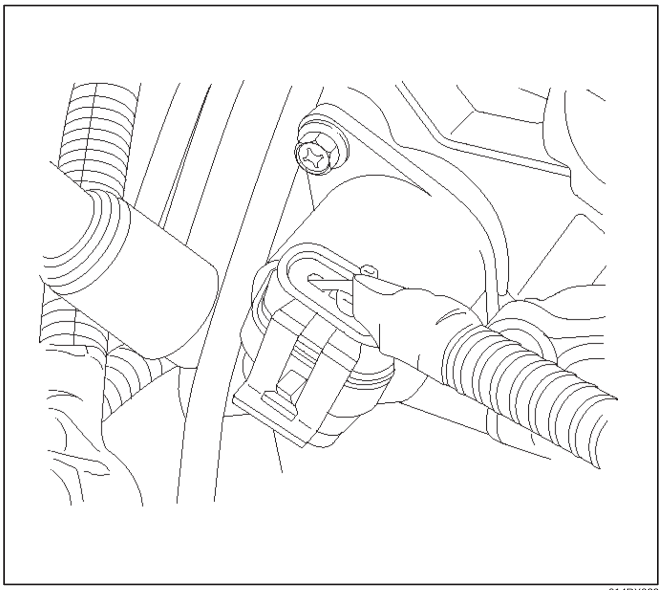
IMPORTANT: Use an identical replacement part in order to replace a valve. IAC valve pintle shape and diameter are designed for the specific application.



TS23746

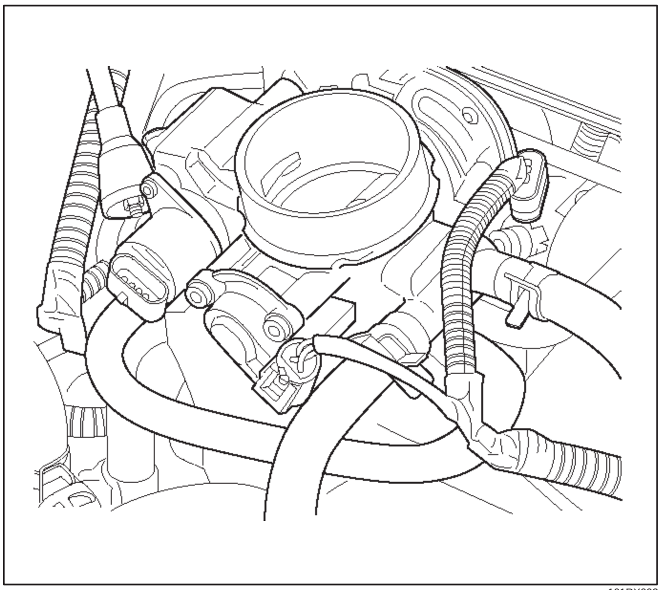
Installation Procedure

1. Install IAC valve on the throttle valve body with the two screws. Tighten the screw to 1 Nm (9 lb in).



014RX022

2. Connect electrical connector to IAC valve.
3. Connect the negative battery cable.

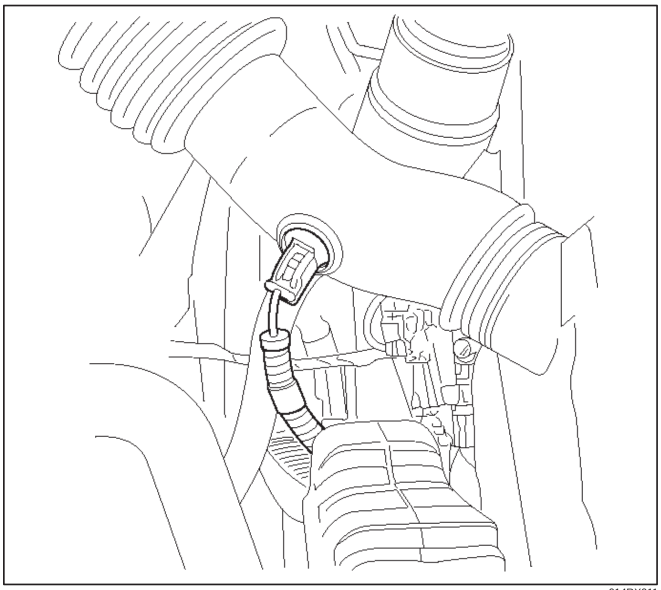


101RX002

Intake Air Duct

Removal Procedure

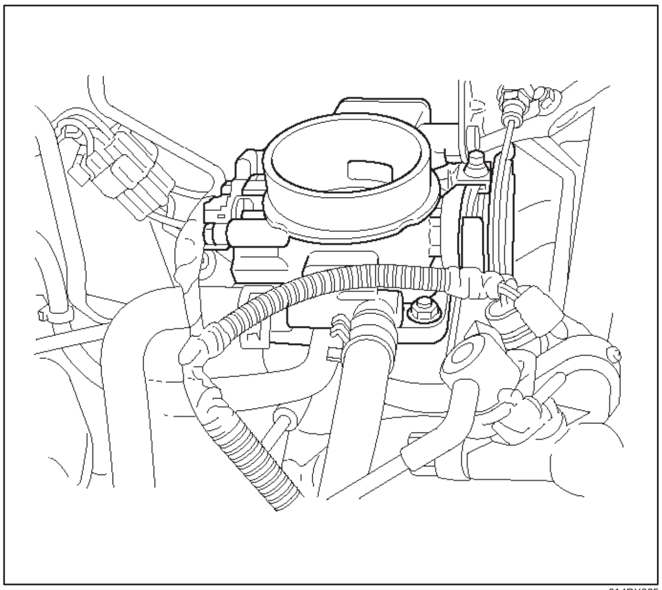
1. Disconnect the negative battery cable.
2. Disconnect electrical connector at IAT sensor.
3. Remove the IAT sensor if necessary. Refer to Intake Air Temperature Sensor Removal.



014RX011

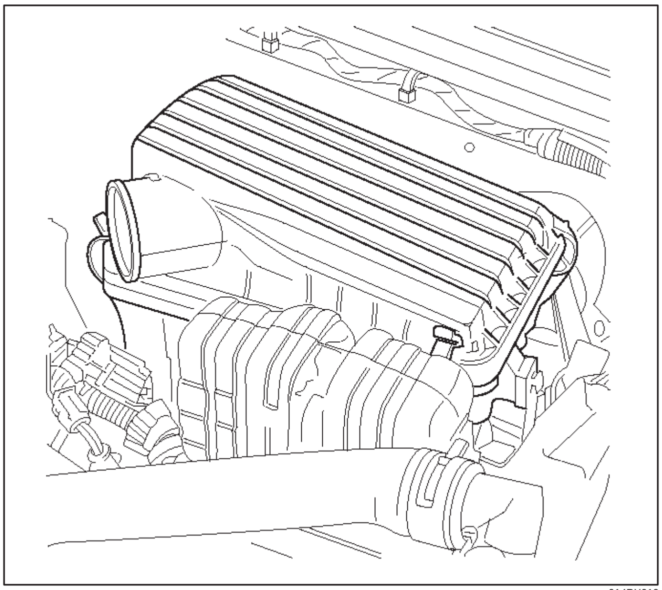
4. Loosen retaining clamps at the throttle body and at the air filter box.

5. Disconnect brake booster vacuum hose at intake manifold and at brake booster.



014RX025

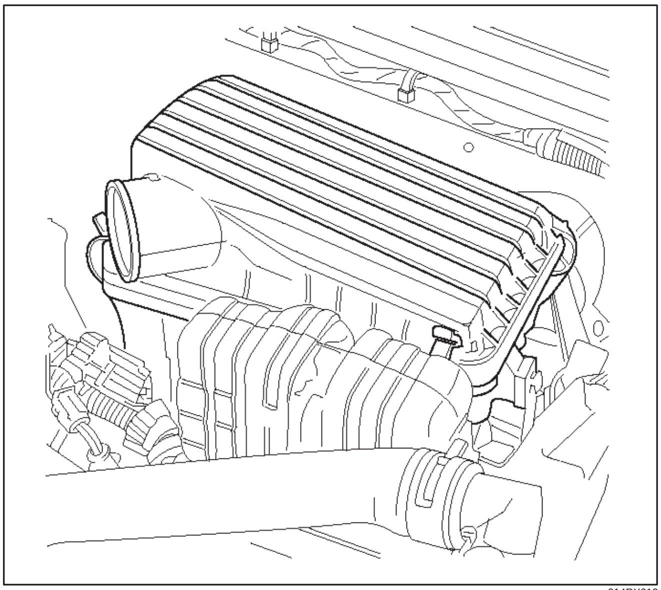
6. Remove retaining nut at the intake air duct bracket at top of valve cover.
7. Disconnect the intake air duct from the throttle body and at the air filter box.



014RX019

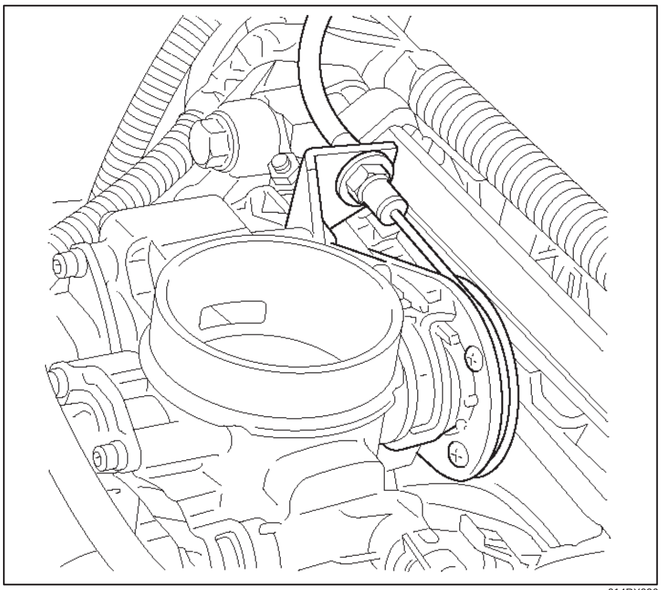
Installation Procedure

1. Connect the intake air duct at the throttle body and at the air filter box. Make sure retaining hole is inserted to the intake air duct bracket.



014RX019

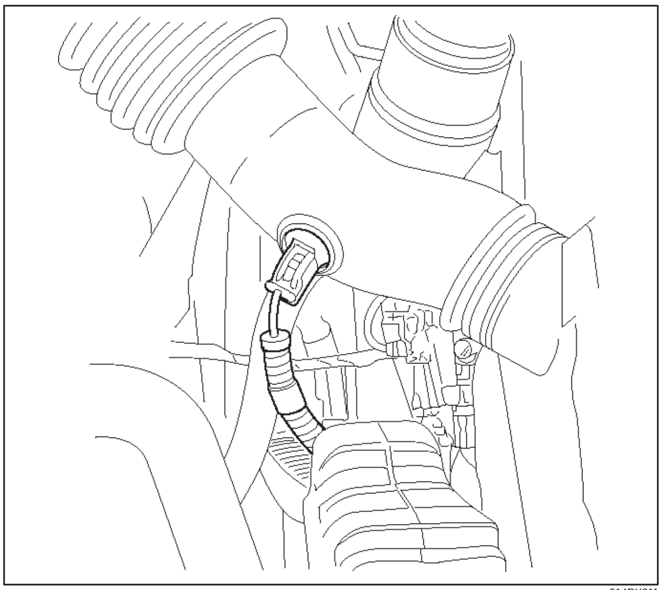
2. Tighten retaining clamp at the throttle body and at the air filter box.
3. Install a nut to the intake air duct bracket and tighten.
4. Connect brake booster vacuum hose to intake manifold and to brake booster and secure them with clamps.



014RX026

5. Install IAT sensor if necessary. Refer to Intake Air Temperature Sensor Installation.
6. Connect electrical connector at IAT sensor.

7. Connect the negative battery cable.



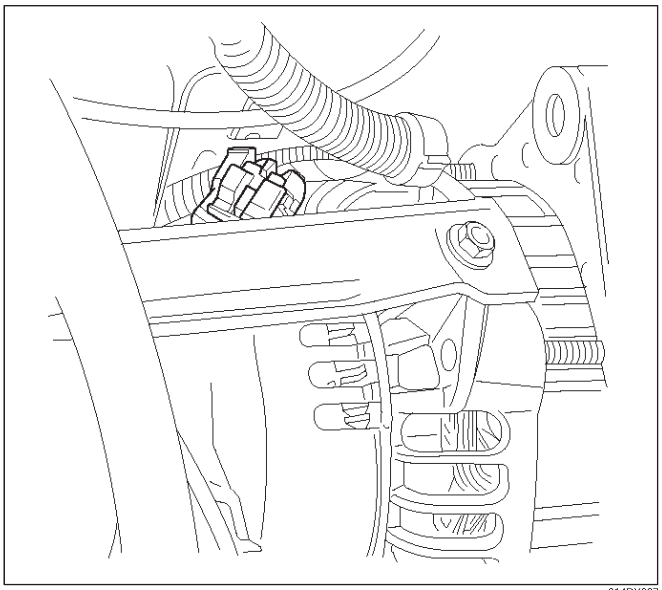
014RX011

IMPORTANT: Use an identical replacement part in order to replace a valve. IAC valve pintle shape and diameter are designed for the specific application.

Knock Sensor

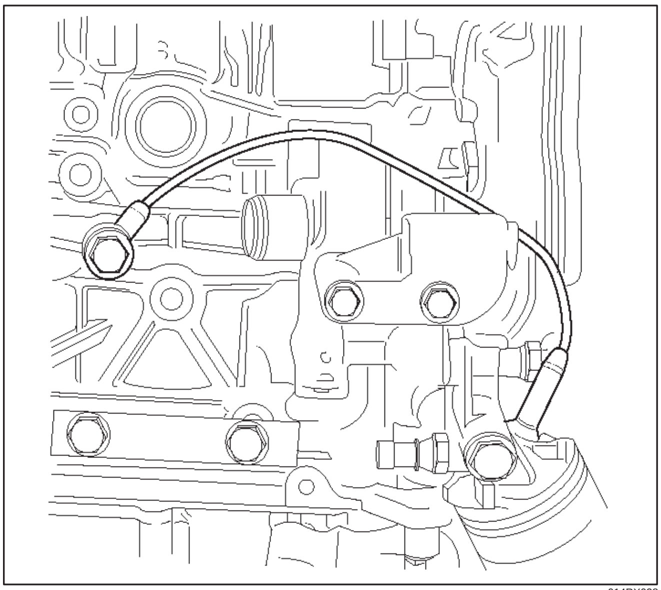
Removal Procedure

1. Disconnect negative battery cable.
2. Disconnect pig tail electrical connector at near the top of generator.



014RX027

3. Unscrew retaining bolt from Knock Sensor located passenger side of engine block just front of starter.

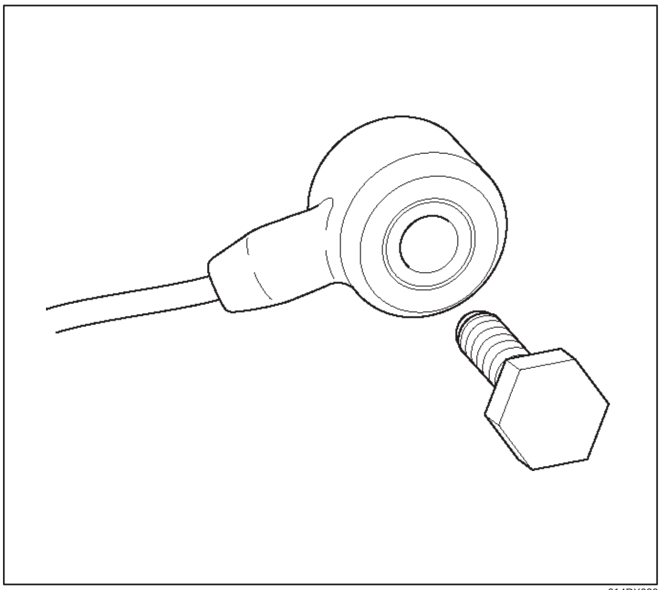


014RX028

4. Remove Knock Sensor with retaining bolt.

Installation Procedure

1. Install Knock Sensor with retaining bolt.
2. Connect pig tail electrical connector.
3. Connect battery negative cable.

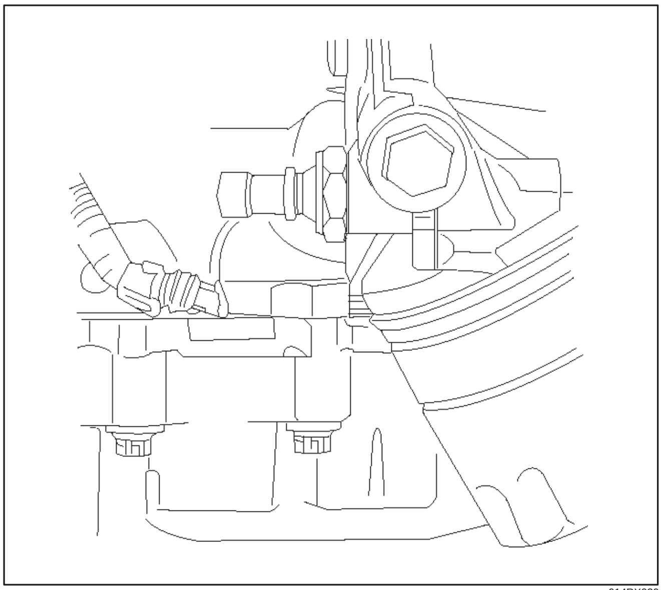


014RX029

Oil Pressure Switch

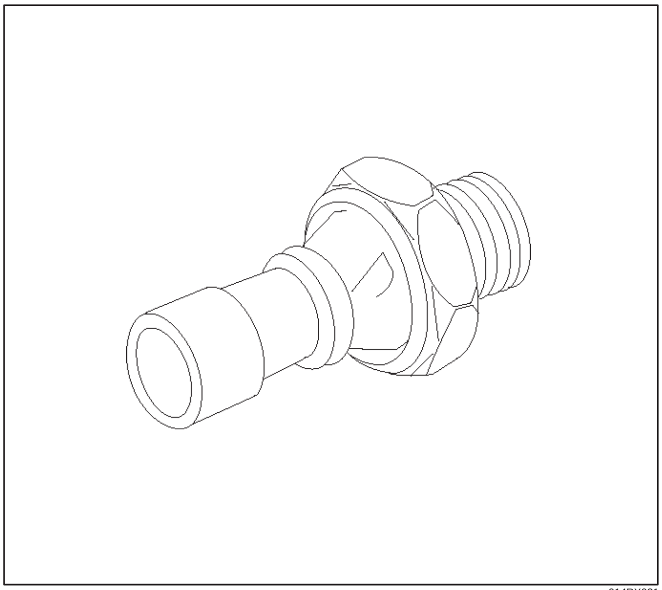
Removal Procedure

1. Disconnect battery negative cable.
2. Disconnect electrical connector at Oil Pressure Switch.



014RX030

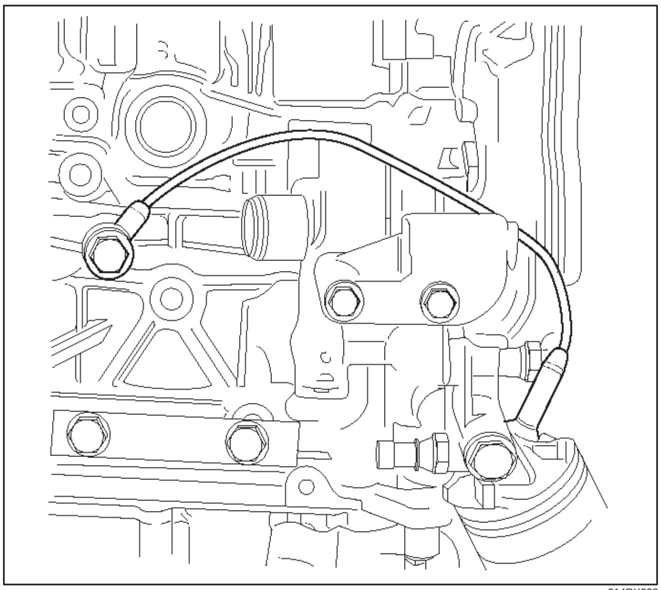
3. Unscrew Oil Pressure Switch from Oil Filter Mounting Housing.



014RX031

Installation Procedure

1. Install Oil Pressure Switch into Oil Filter Mounting Housing and tighten.
2. Connect electrical connector.
3. Connect battery negative cable.

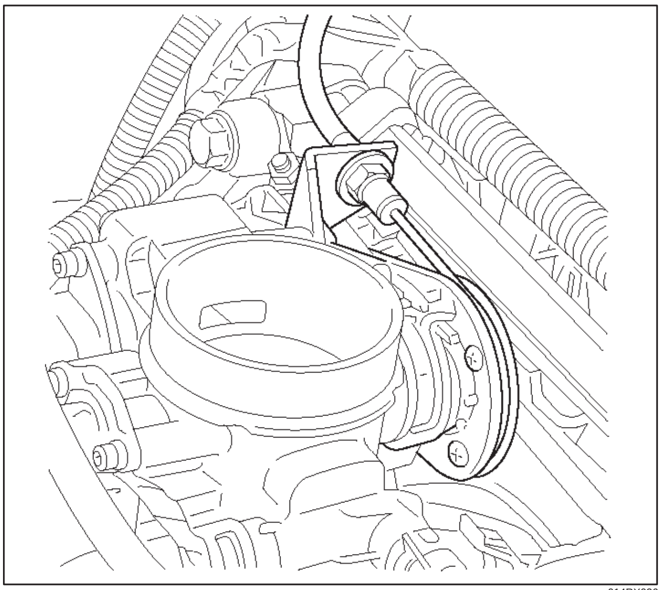


014RX028

FUEL METERING SYSTEM Accelerator Cable Assembly

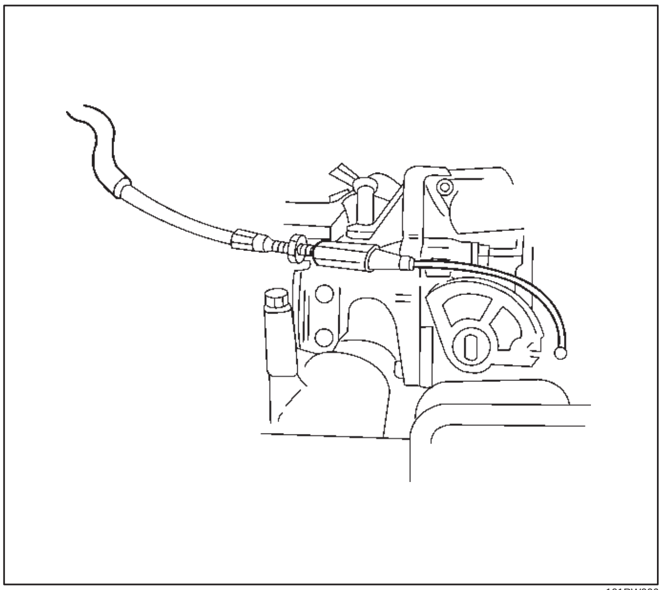
Removal Procedure

1. Loosen the adjusting nut on the cable bracket mounting on the throttle body.
2. Remove the cable clip from holding bracket.



014RX026

3. Remove accelerator control cable (on the throttle valve end).



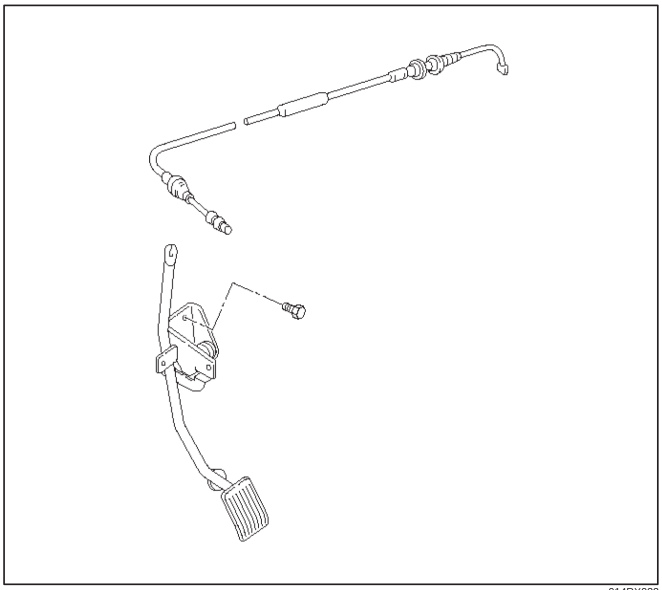
101RW006

4. Remove the accelerator control cable (on the accelerator pedal end).
5. Remove the grommet.
6. Remove the accelerator control cable.

Inspection Procedure

Check the following items, and replace the control cable if any abnormality is found:

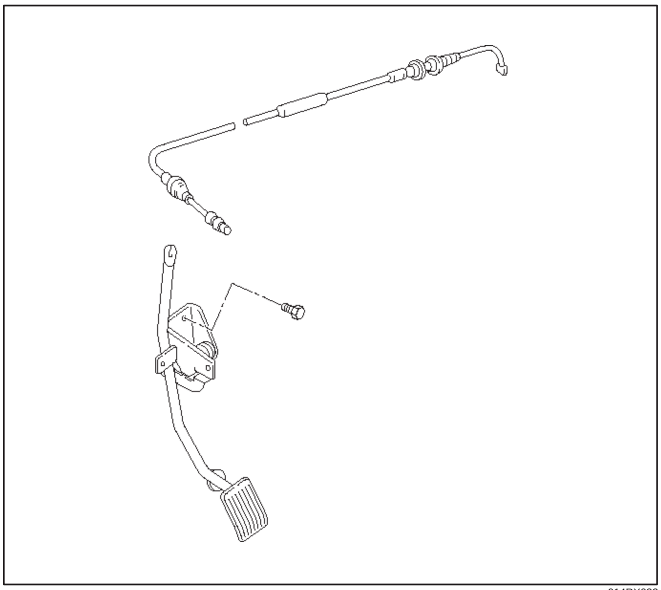
- The control cable should move smoothly.
- The control cable should not be bent or kinked.
- The control cable should be free of damage and corrosion.



014RX032

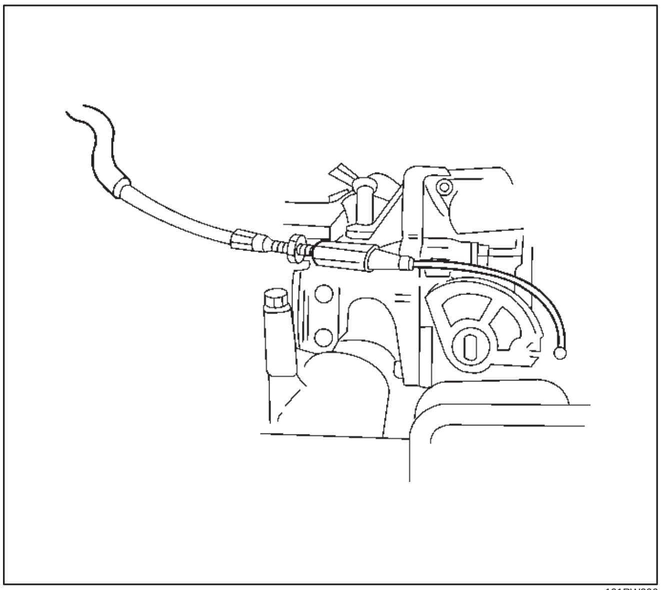
Installation Procedure

1. Install the accelerator control cable.
2. Install the grommet.
3. Install the accelerator control cable on the accelerator pedal.



014RX032

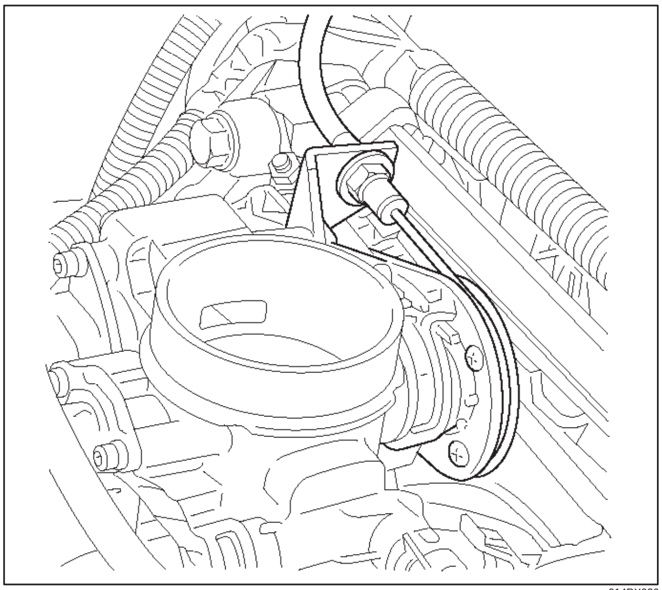
4. Install the accelerator control cable on the throttle valve.



101RW006

5. Install the cable clip to the holding bracket.

6. Adjust the accelerator cable. Refer to Accelerator Cable Adjustment Section.



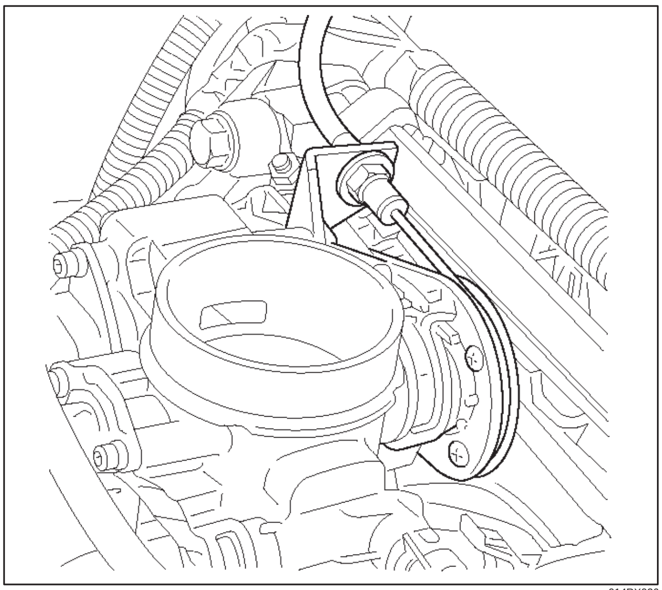
014RX026

Accelerator Cable Adjustment

Adjustment Procedure

1. Loosen the adjusting nut.
2. Loosen the jam nut.
3. Pull the outer cable while fully closing the throttle valve.
4. Tighten the adjusting nut.
5. Tighten the jam nut.
6. Loosen the adjusting nut by three turns.
7. Tighten the jam nut again.
8. Manually operate valve.

IMPORTANT: The valve lever must return up to the stopper screw. If the valve lever does not reach the stopper screw, repeat the procedure again from Step 1.

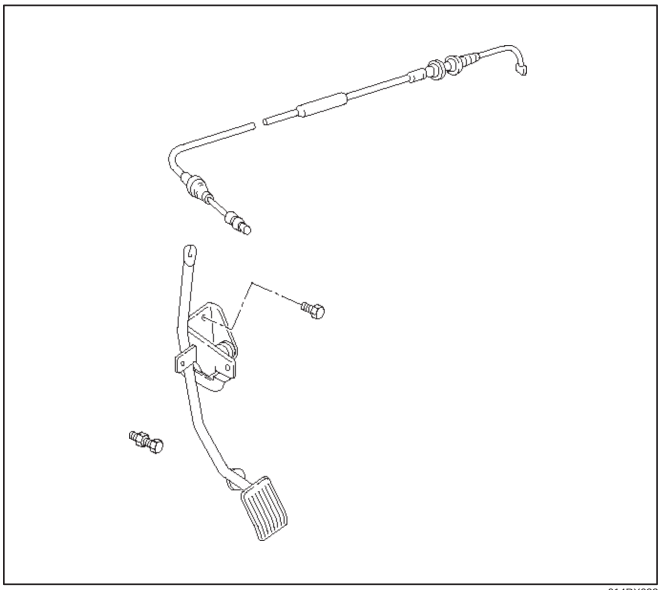


014RX026

Accelerator Pedal Replacement

Removal Procedure

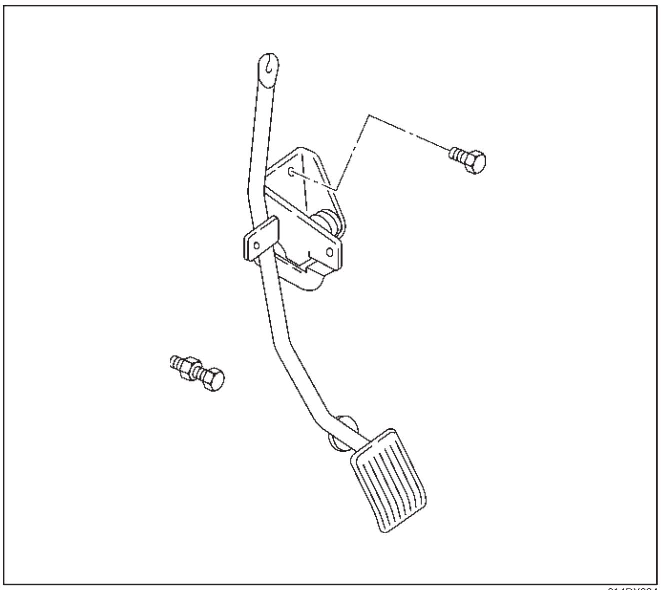
1. Disconnect the accelerator pedal control cable from the acceleratorpedal assembly.
2. Remove the two screws retaining the accelerator pedal to the bulkhead.
3. Remove the accelerator pedal from the bulkhead.



014RX033

Installation Procedure

1. Install the accelerator pedal assembly to the bulkhead with two screws.
2. Connect the accelerator control cable to the accelerator pedal assembly.
3. Adjust accelerator cable if necessary. Refer to Accelerator Cable Adjustment Section.



014RX034

Fuel Filler Cap

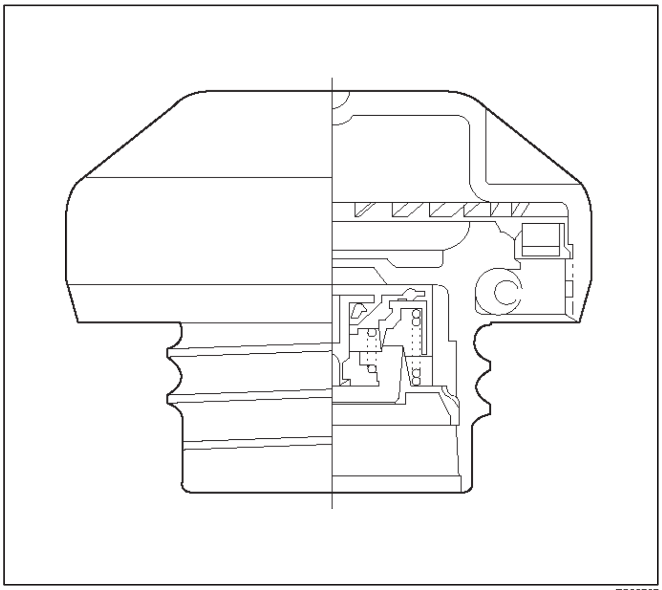
Fuel Filler Cap

The Fuel filter cap includes a vacuum valve and a pressure valve. If high vacuum or pressure occurs in the fuel tank, each valve works to adjust the pressure in order to prevent damage to the tank at the EGR valve.

Inspection Procedure

NOTE: Replace the fuel filler cap with the same typeof filler cap that was originally installed on the vehicle.

- Check the seal ring in the filler cap for any abnormality and for seal condition.
- Replace the filler cap if any abnormality is found.

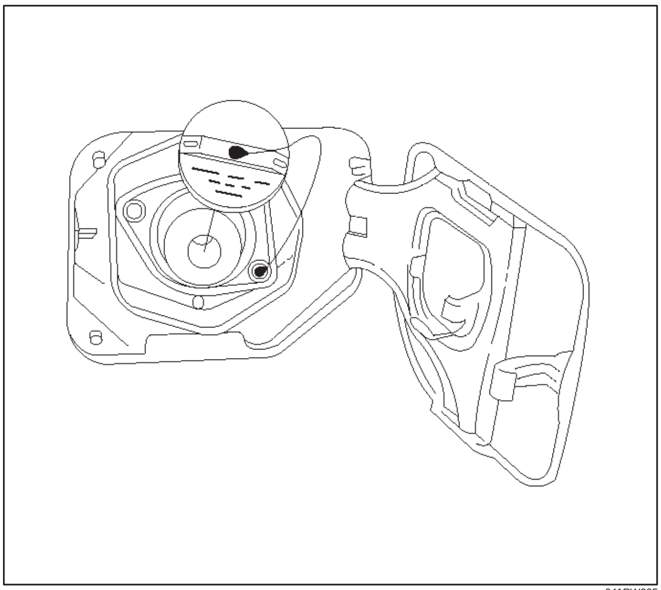


TS23767

Fuel Filter

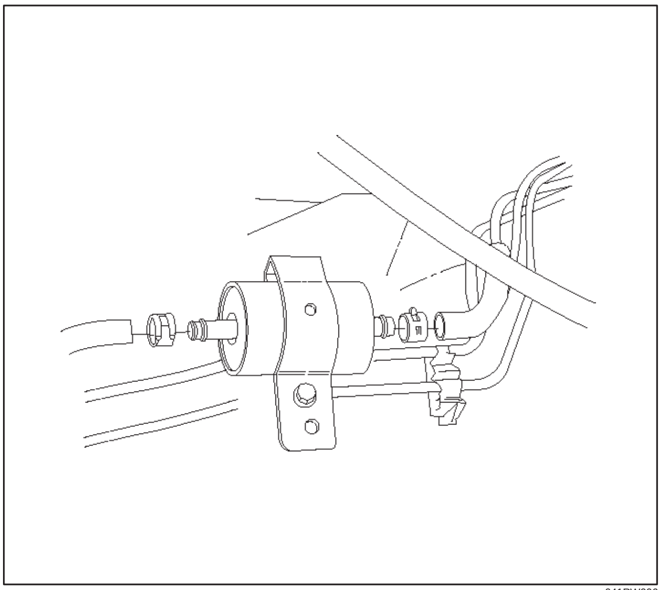
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the fuel filler cap.



041RW005

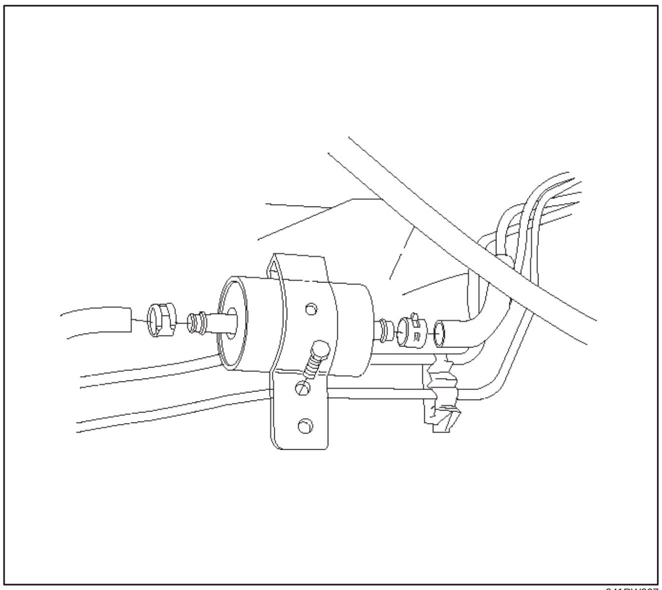
3. Disconnect the fuel lines from the fuel filter on the engine side.
4. Disconnect the fuel line from the fuel filter on the fuel tank side.



041RW006

5. Remove the bolt on the fuel filter holder.

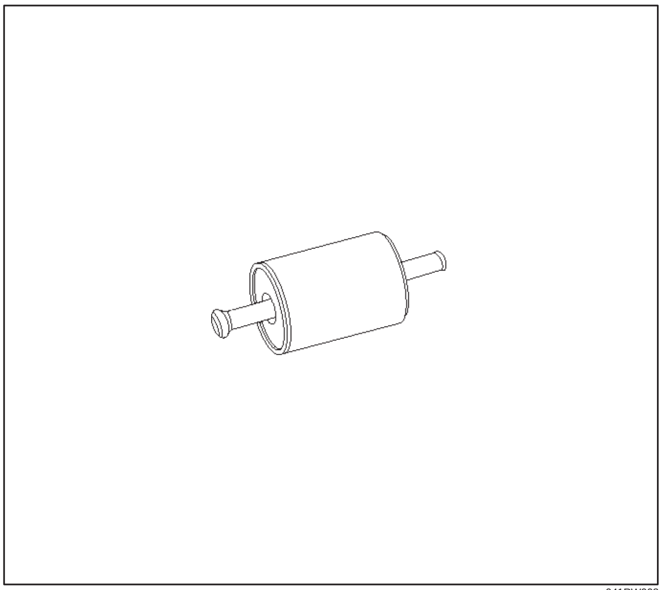
6. Remove the fuel filter.



041RW007

Inspection Procedure

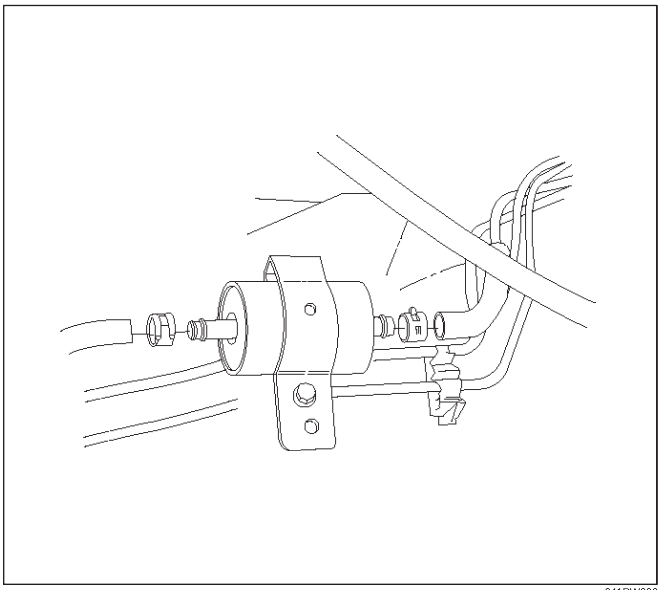
1. Replace the fuel filter when the following occur:
   - Fuel leaks from the fuel filter body
   - The fuel filter body is damaged
   - The fuel filter is clogged with dust or sediment
2. If the drain hole is clogged at filler neck is clogged with dust, clean the drain hole with air.



041RW008

Installation Procedure

1. Install the fuel filter in the correct direction.
2. Install the bolt on the fuel filter holder.
3. Connect the fuel line on the engine side.
4. Connect the fuel line on the fuel tank side.
5. Install the fuel filler cap.
6. Connect the negative battery cable.



041RW006

Fuel Injectors

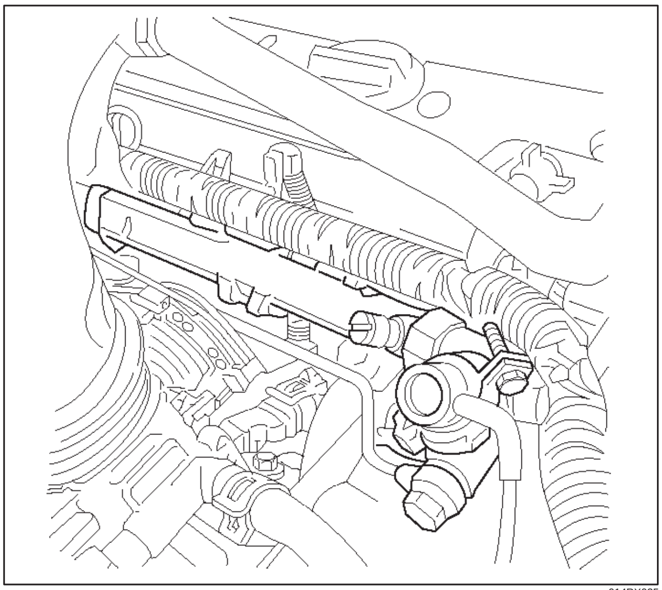
Removal Procedure

NOTE: If the fuel injectors are leaking, the engine oil may be contaminated with fuel. Check the oil for signs of contamination and change the oil and filter if necessary.

NOTE: Use care in removing the fuel injector in order to prevent damage to the fuel injector electrical connector pins or fuel injector nozzles. The fuel injector is an electrical component and should not be immersed in any type of cleaner as this may damage the fuel injector.

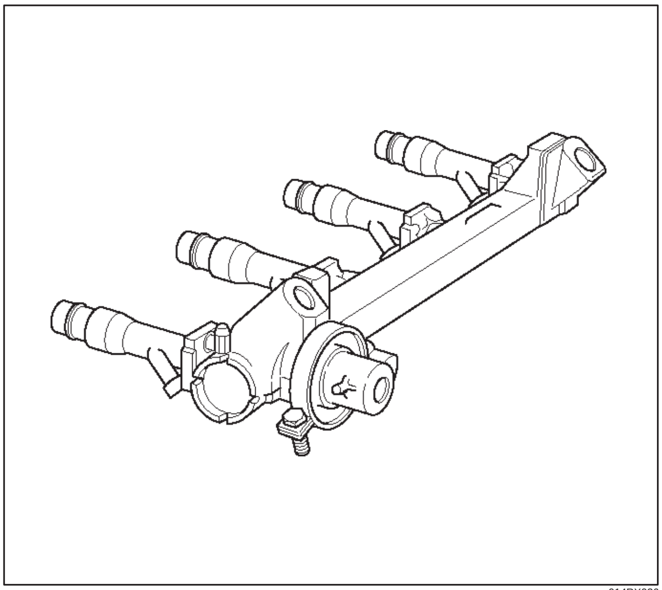
IMPORTANT: Fuel injectors are serviced as complete assembly only.

1. Disconnect the negative battery cable.



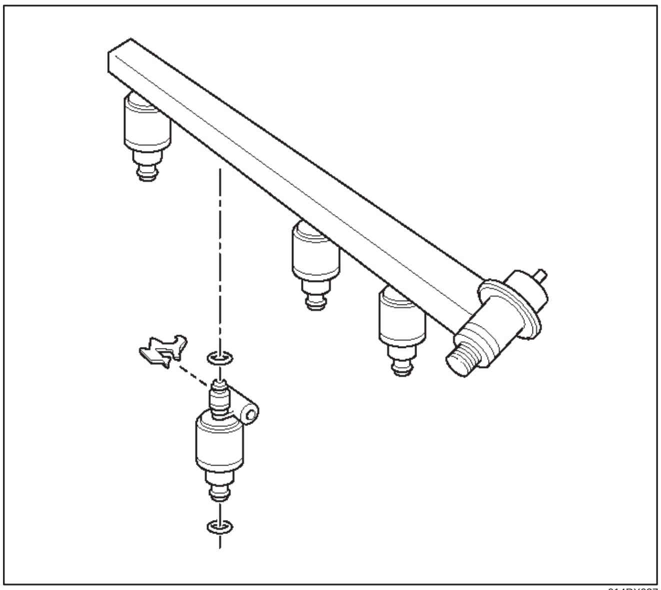
014RX035

2. Disconnect electrical connector from fuel injector.
3. Remove the fuel rail. Refer to Fuel Rail Removal Procedure.



014RX036

4. Remove the fuel injector retainer clip.
5. Remove fuel injector assembly from fuel rail.
6. Remove O–ring from the fuel injector.
7. Remove O–ring backup from fuel injector.



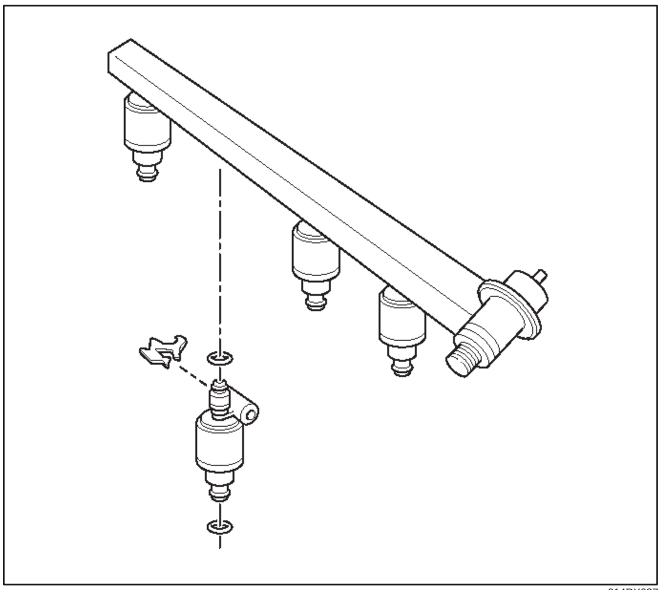
014RX037

Inspection Procedure

1. Inspect O–ring for crack, damage or leaks.
2. Replace worn or damaged O–ring.
3. Lubricate the new O–rings with engine oil before installation.

Installation Procedure

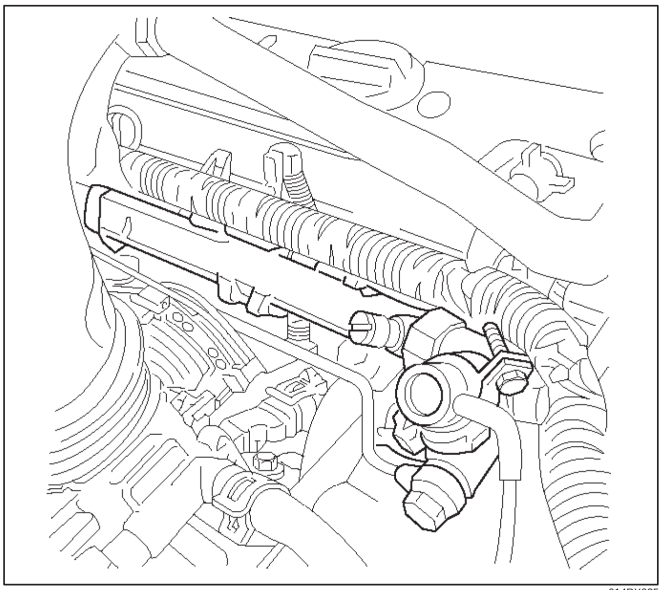
1. Lubricate the new O–ring with engine oil.
2. Install the O–ring backup on the fuel injector.
3. Install new O–ring on the fuel injector.
4. Install all four injector on the fuel rail.
5. Use new injector retainer clip to retain the injector to the fuel rail.
6. Coat the end of the fuel injector with engine oil.



014RX037

7. Install fuel rail assembly. Refer to Fuel Rail Installation Procedure.

8. Connect the negative battery cable.



014RX035

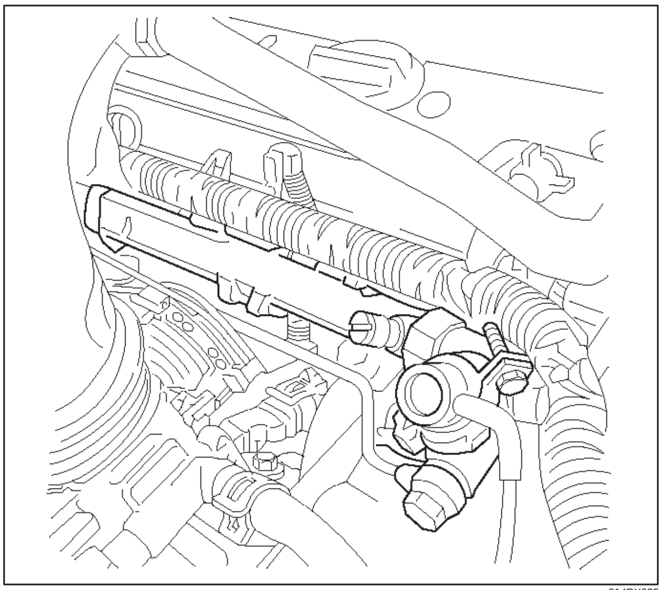
Fuel Pressure Regulator

Removal Procedure

CAUTION: To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing the fuel system components.

CAUTION: After relieving the fuel system pressure, a small amount of fuel may be released when servicing fuel lines or connections. Reduce the chance of personal injury by covering the fuel line fitting with a shop towel before disconnecting the fittings. The towel will absorb any fuel that may leak out. When the disconnect is completed, place the towel in an approved container.

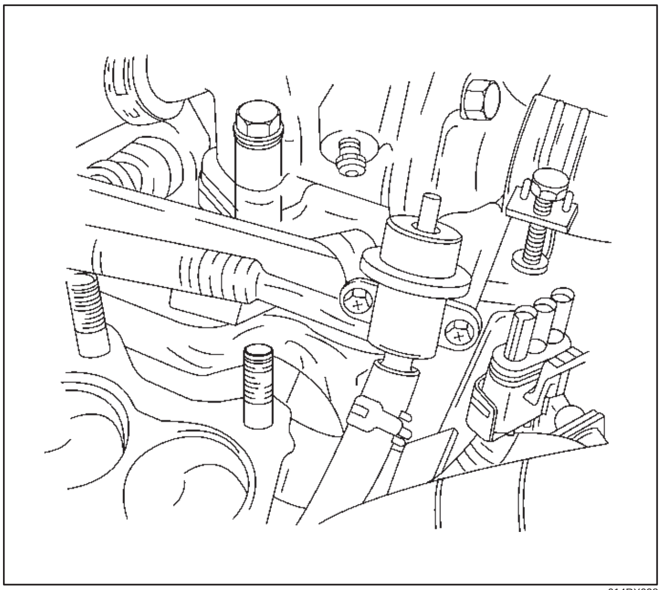
NOTE: Compressed air must never used to test or clean a fuel pressure regulator, as damage to the fuel pressure regulator may occur.



014RX035

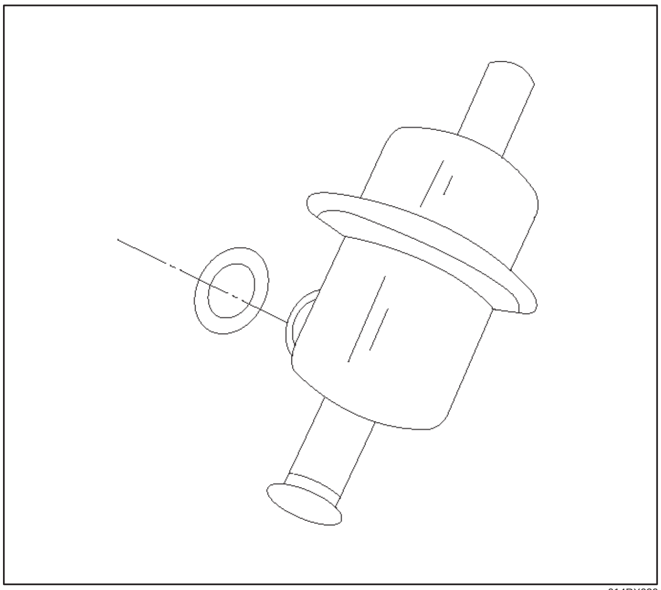
NOTE: To prevent damage to the fuel pressure regulator, do not immerse the pressure regulator in solvent.

1. Depressurize the fuel system. Referto Fuel Pressure Relief Procedure.
2. Disconnect the negative battery cable.
3. Remove the fuel pump relay.
4. Disconnect the vacuum line form fuel pressure regulator.



014RX038

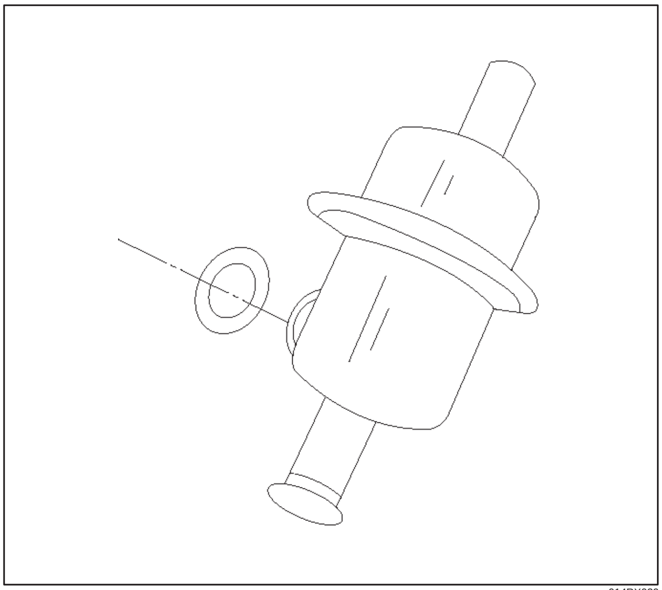
5. Remove the fuel pressure regulator retaining screw.
6. Remove the fuel pressure regulator retaining bracket.
7. Remove the fuel pressure regulator from fuel rail.



014RX039

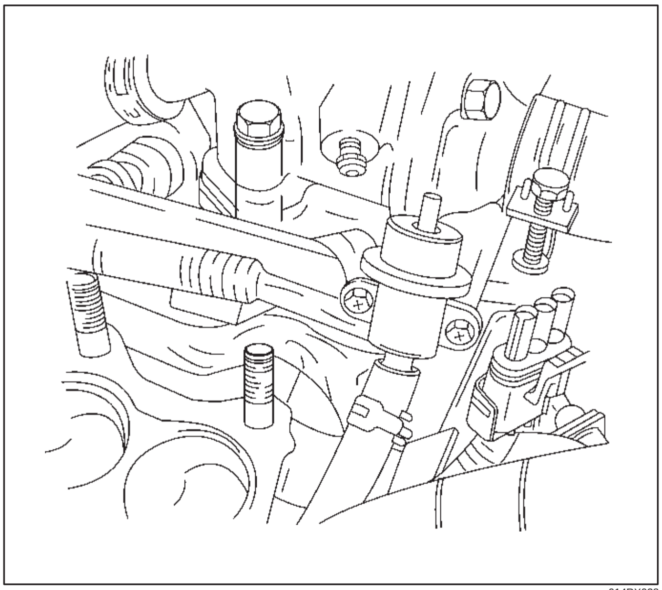
Installation Procedure

1. Insert the fuel pressure regulator into the fuel rail.



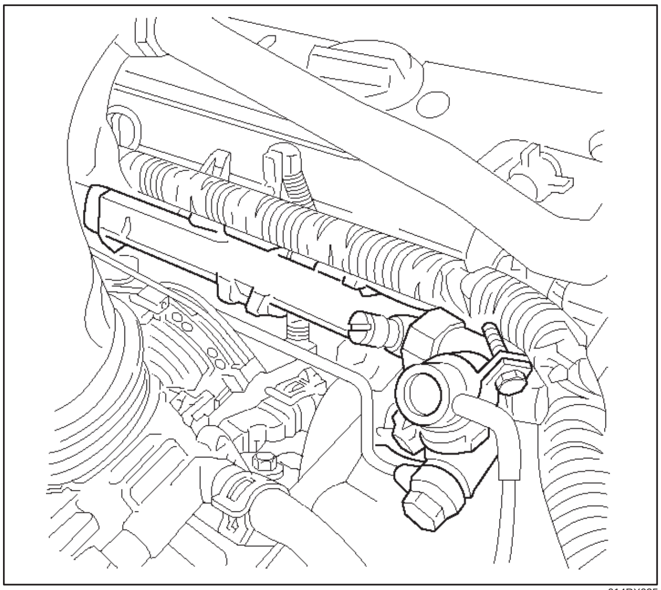
014RX039

2. Install the fuel pressure regulator retaining bracket ant tighten with a screw.
3. Connect vacuum line onto the fuel pressure regulator.



014RX038

4. Install the fuel pump relay.
5. Connect the negative battery cable.
6. Crank the engine until it starts. Cranking the engine may take longer than usual due to trapped air in the fuel line.



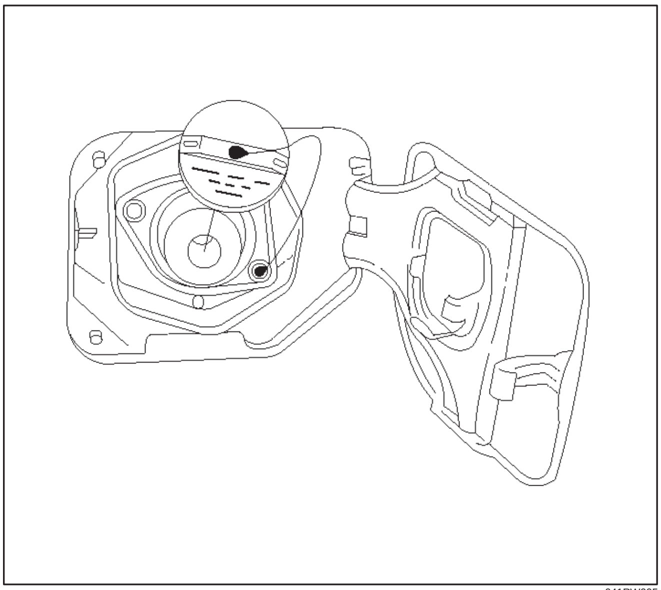
014RX035

Fuel Pressure Relief Procedure

CAUTION: To reduce the risk of fire and personal injury, it is necessary to relieve the fuel system pressure before servicing the fuel system components.

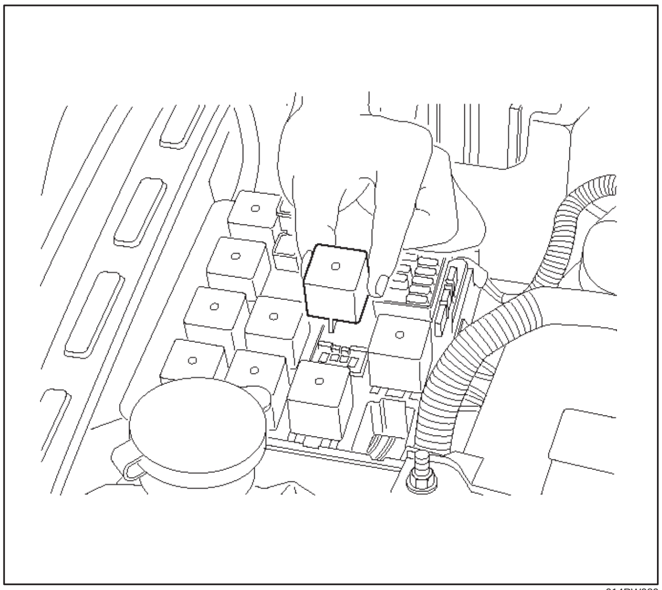
CAUTION: After relieving the fuel system pressure, a small amount of fuel may be released when servicing fuel lines or connections. Reduce the chance of personal injury by covering the fuel line fitting with a shop towel before disconnecting the fittings. The towel will absorb any fuel that may leak out. When the disconnect is completed, place the towel in an approved container.

1. Remove the fuel filler cap.



041RW005

2. Remove the fuel pump relay from the underhood relay box.
3. Start the engine and allow it to stall.
4. Crank the engine for about 30 seconds.
5. Disconnect the negative battery cable.

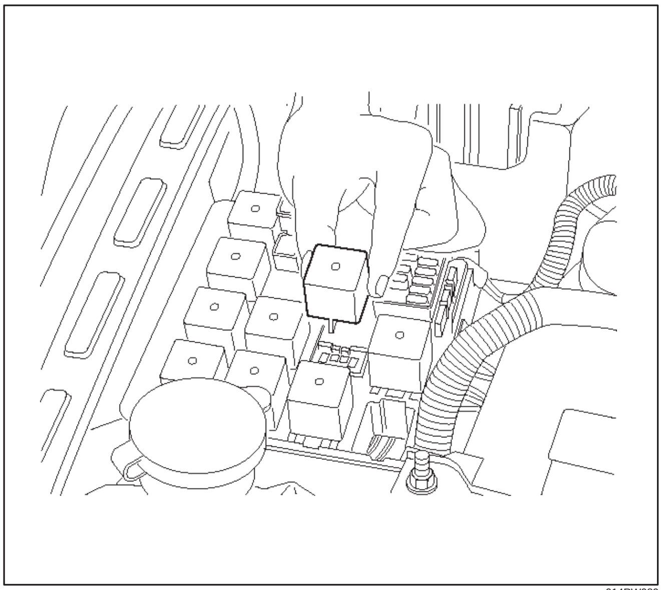


014RW089

Fuel Pump Assembly

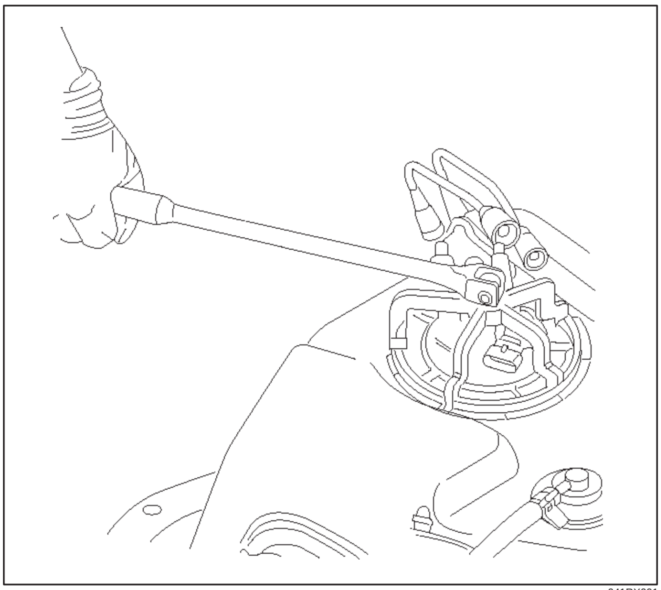
Removal Procedure

1. Disconnect the negative battery cable.
2. Drain all fuel from fuel tank from filler neck.
3. Remove the fuel pump relay from the fuse and relay box at right side of engine room.



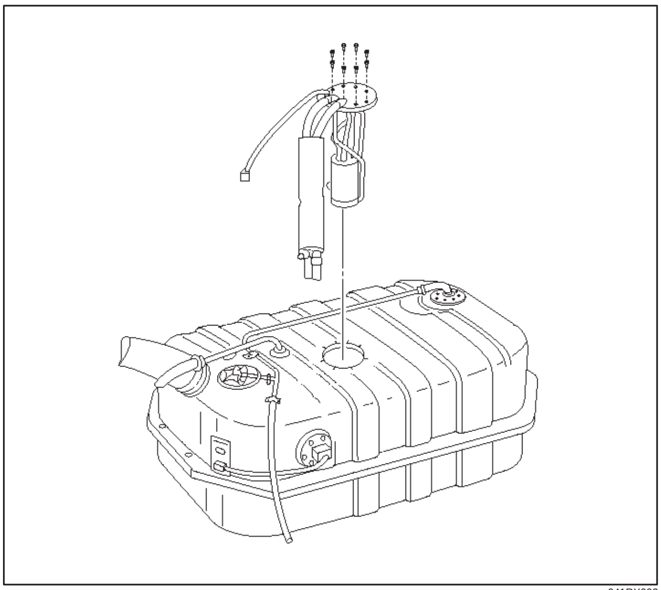
014RW089

4. Remove fuel tank. Refer to Fuel Tank Removal Procedure.
5. Using J–39763, twist the fuel pump counter–clock wise to release from fuel tank.



041RX001

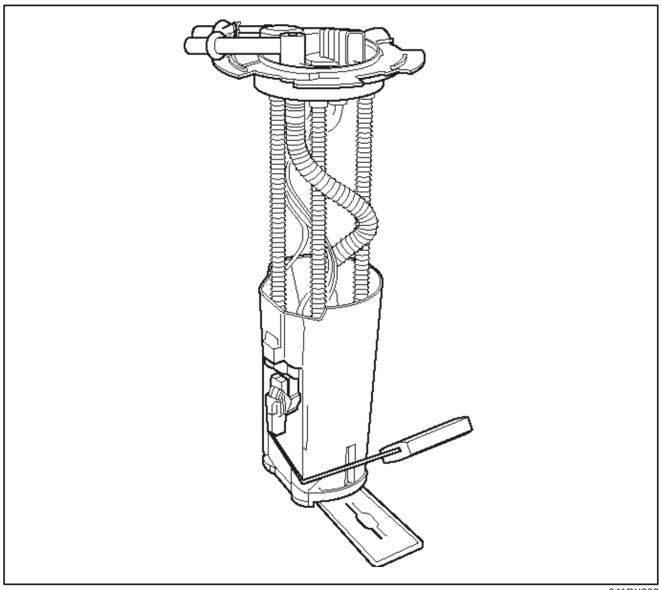
6. Lift fuel pump to remove from fuel tank.



041RX002

Inspection Procedure

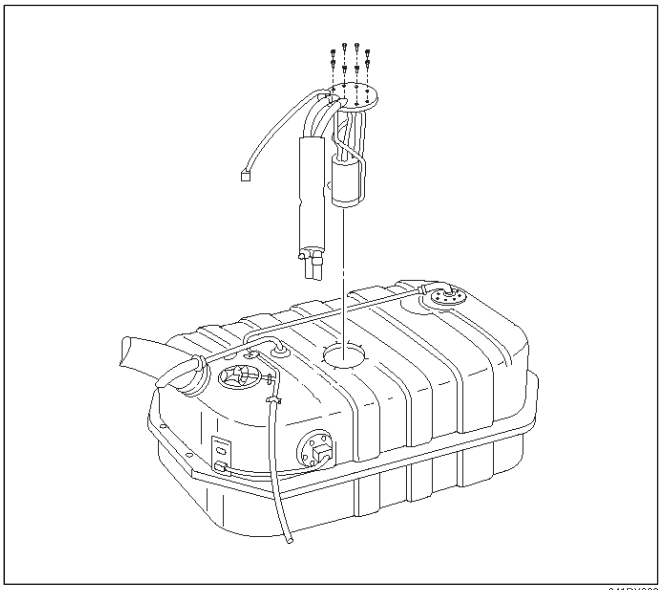
Inspect in–tank fuel filter for tears, damage or evidence of dirt derbies or water in the fuel. If any of these condition exist, replace the in–tank fuel filter.



041RX003

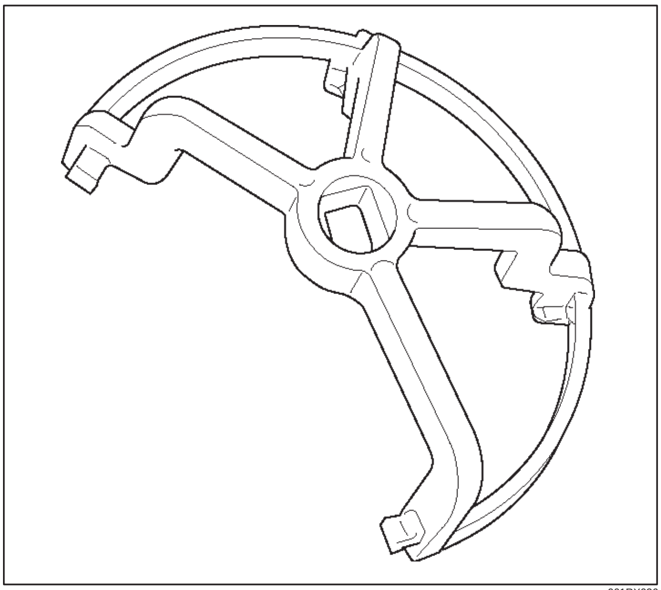
Installation Procedure

1. Insert the fuel pump assembly into fuel tank and place them at its position.



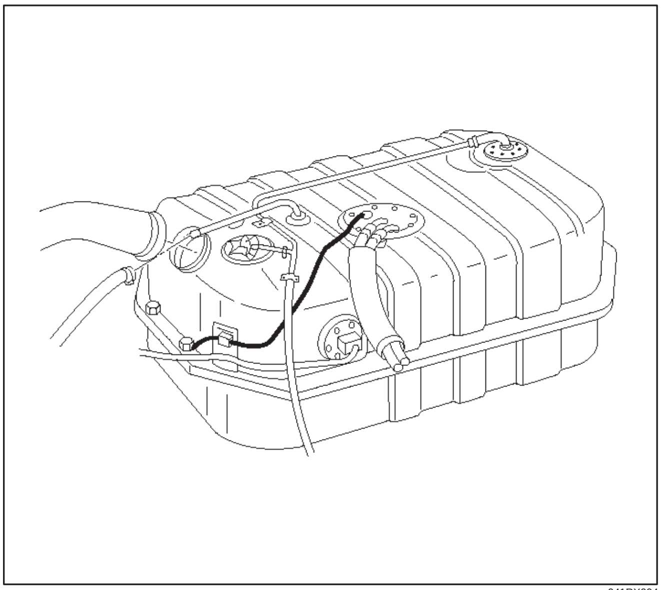
041RX002

2. Using J–39763, twist fuel pump assembly clock wise into the lock.



901RX036

3. Install the fuel tank. Refer to Fuel Tank Installation Procedure.
4. Install the fuel pump relay.
5. Connect the negative battery cable.



041RX004

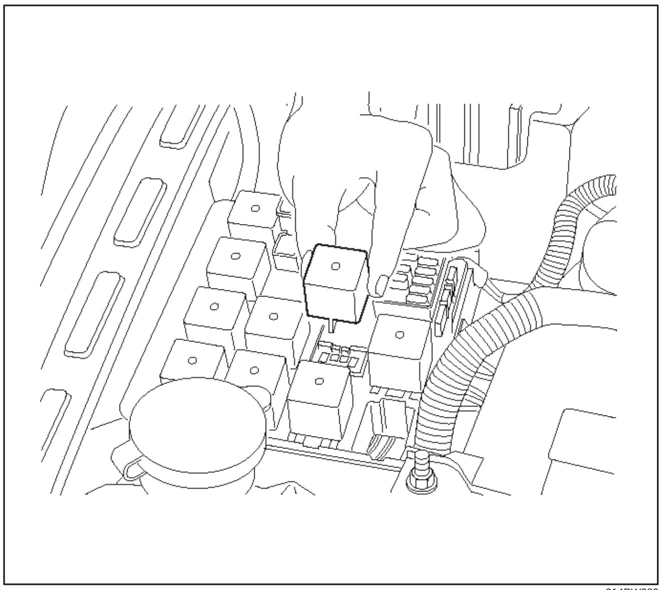
Fuel Pump Relay

Removal Procedure

1. Remove the fuse and relay box cover located right side of engine room.
2. Determine correct relay by consulting to the diagram on the cover.
3. Insert a small screwdriver or use thumb pressure to release the retainer of the relay.
4. Pull the relay straight up and out of the fuse and relay box.

Installation Procedure

1. Inserts the relay into the correct place in the fuse and relay box with the catch slot aligned to retainer.
2. Press down until the catch of retainer engages.
3. Install fuse and relay box cover.



014RW089

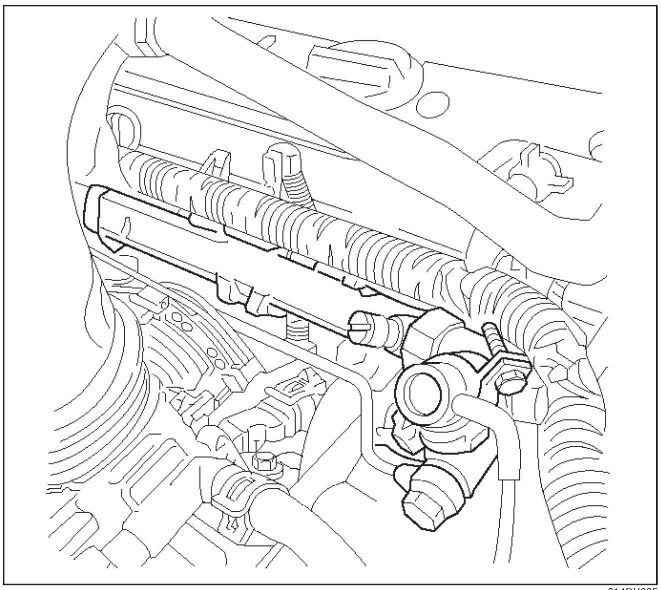
Fuel Rail Assembly

Removal Procedure

NOTE:

- Use care when removing the fuel rail assembly in order to prevent damage to the injector electrical connector terminal and the injector spray tips.
- Fitting should be capped and holes plugged during servicing to prevent dirt and other contaminants from entering open lines and passage.

IMPORTANT: An eight–digit identification number is stamped on side of the fuel rail. Refer to this number when you service the fuel rail or when a replacement part is required.



014RX035

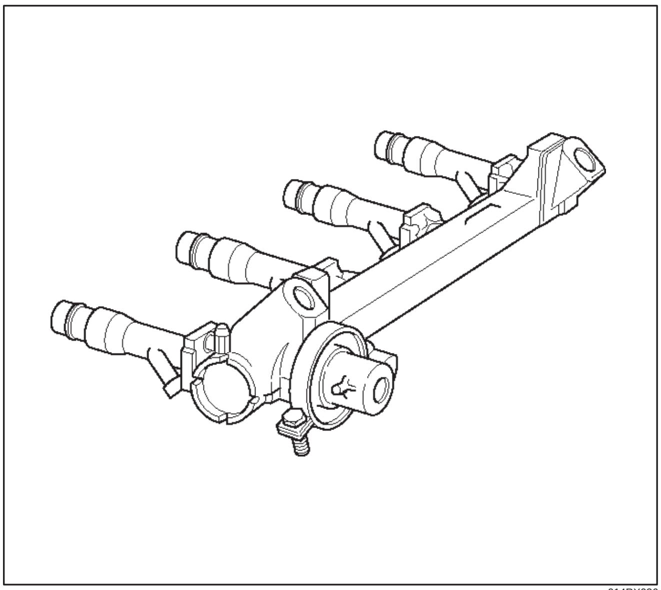
1. Depressurize the fuel system. Refer to Fuel Pressure Relief Procedure.
2. Disconnect the fuel inlet at the rear of the engine.
3. Disconnect the fuel return line at front of the engine.
4. Disconnect the injector electrical connectors.
5. Remove the nuts holding wiring harness onto fuel rail.
6. Remove the bolts retaining fuel rail to the intake manifold.

Lift up the injectors carefully to separate them from intake manifold.

Lift up the fuel rail with injectors as assembly. Do not separate the fuel injectors from fuel rail.

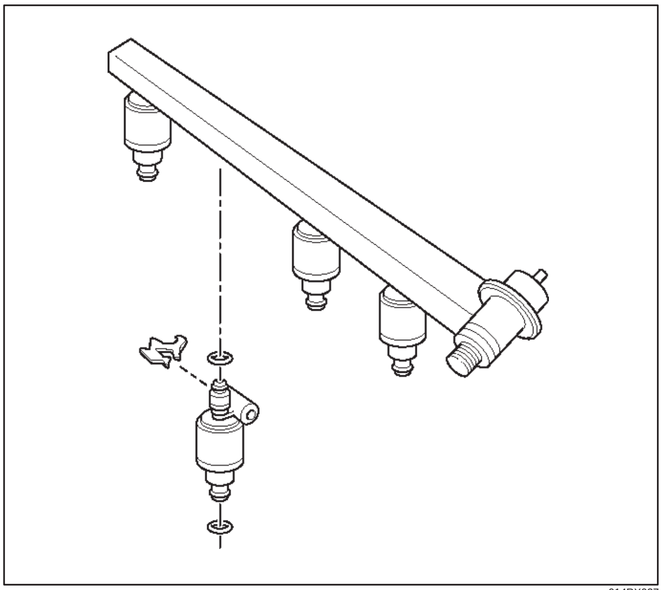
If an injector become separated from fuel rail, injector backup O–ring and injector retainer clip must be replaced.

Drain residual fuel from fuel rail into an approved container.



014RX036

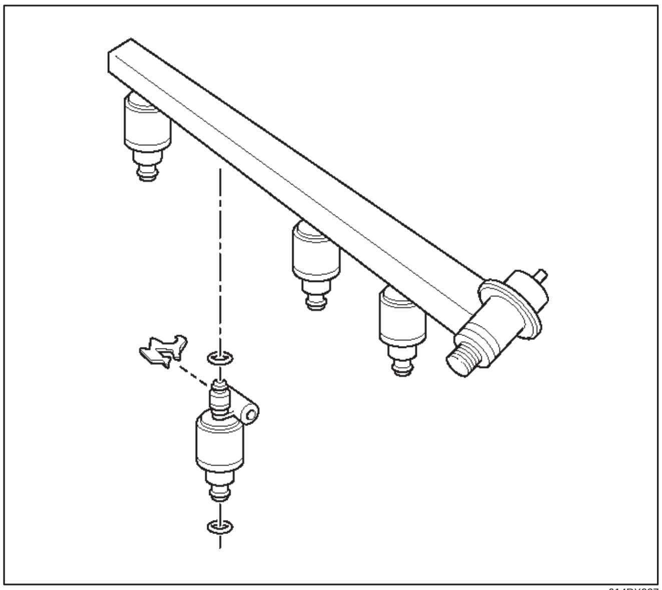
7. If removal of fuel pressure regulator is necessary. Refer to Fuel Pressure Regulator Removal Procedure.
8. If removal of fuel injector is necessary. Refer to Fuel Injectors Removal Procedure.



014RX037

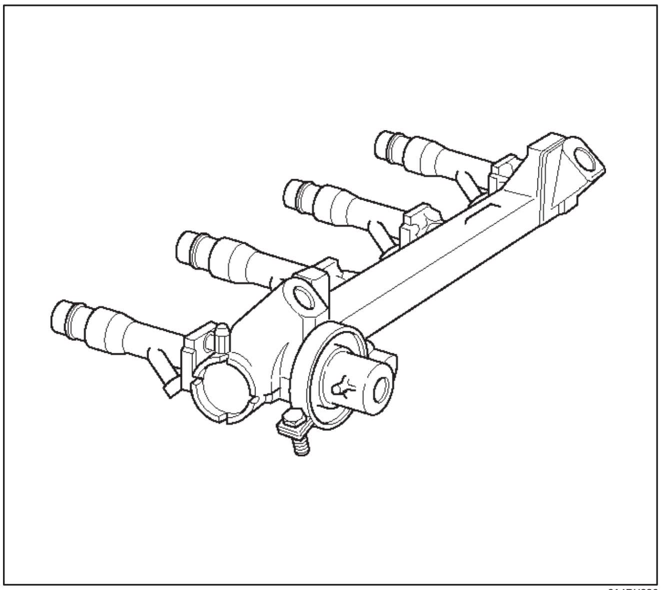
Installation Procedure

1. Install the fuel injectors if necessary. Refer to Fuel Injector Installation Procedure.
2. Install the fuel pressure regulator if necessary. Refer to Fuel Pressure Regulator Installation Procedure.
3. Place the fuel injector rail assembly on the manifold and insert the injectors into each port by pushing fuel rail.



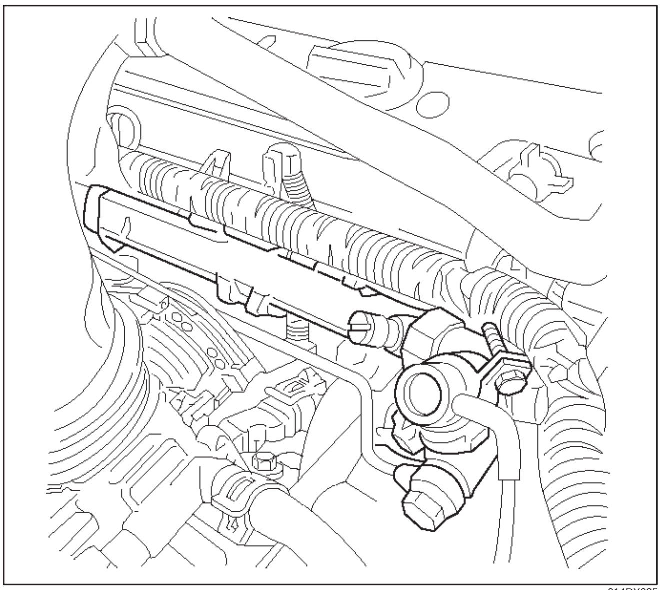
014RX037

4. Install two fuel rail retaining bolts. Tighten fuel rail retaining bolts to 19 Nm (14 lb ft)
5. Place wiring harness in its place and secure it with two nuts.
6. Connect electrical connector to each fuel injector.



014RX036

7. Connect the fuel supply line securely. Do not over tighten.
8. Connect the fuel return line securely. Do not over tighten.
9. Connect the negative battery cable.
10. Crank the engine until it start. Cranking the engine may take longer than usual due to trapped air in the fuel system. Check for leak. If fuel leak is observed, stop engine immediately. Before correct fuel leak, be sure to depressurize system again.

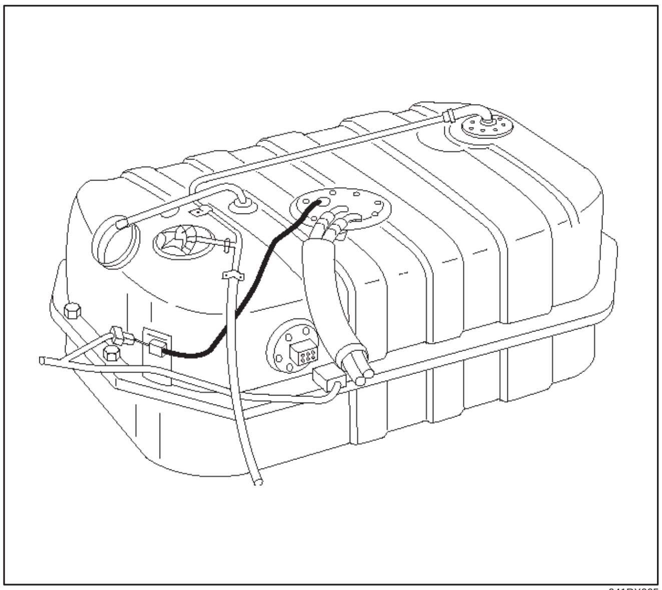


014RX035

Fuel Tank

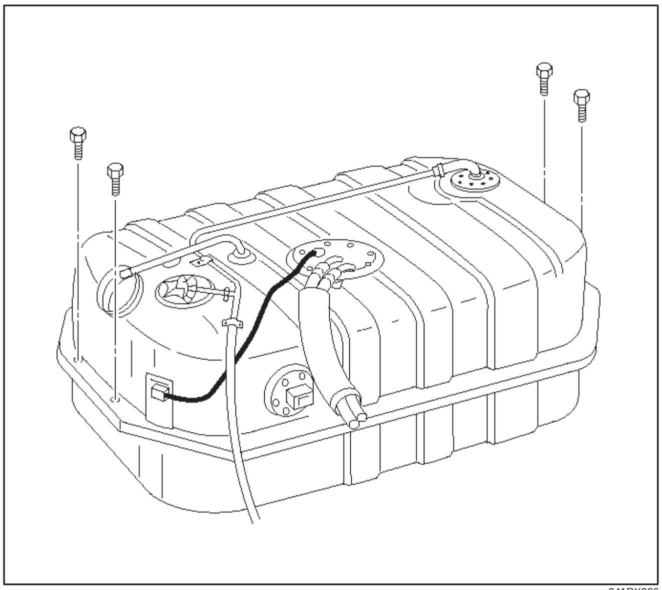
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove fuel filer cap.
3. Drain the fuel from fuel filler neck.
4. Disconnect the fuel filler hose at fuel tank.
5. Disconnect the air breather hose at the fuel tank.
6. Disconnect the evaporator hose at the fuel tank.
7. Hold entire fuel tank at the bottom with stands.
8. Disconnect fuel supply lines and fuel return line at near the fuel filter inside of body frame.



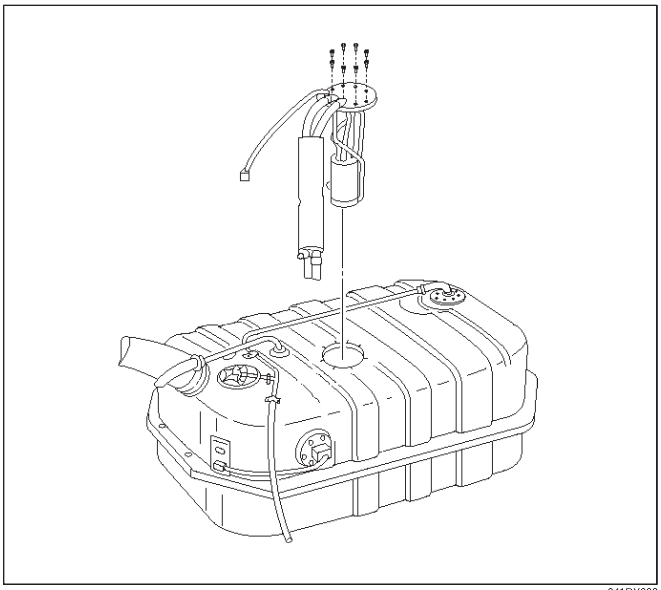
041RX005

9. Remove four bolts (two in front and two in rear) holding fuel tank to the frame.
10. Lower tank assembly from the vehicle a little to make access space on top.
11. Disconnect two electrical connectors at fuel pump.



041RX006

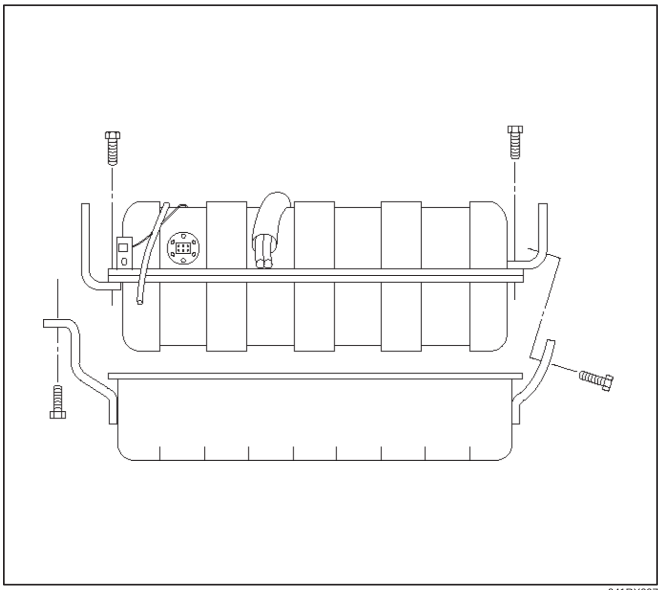
12. Remove fuel tank assembly from the vehicle.
13. Remove four nuts retaining tank under guard to the tank.
14. Remove the tank from the guard.



041RX002

Installation Procedure

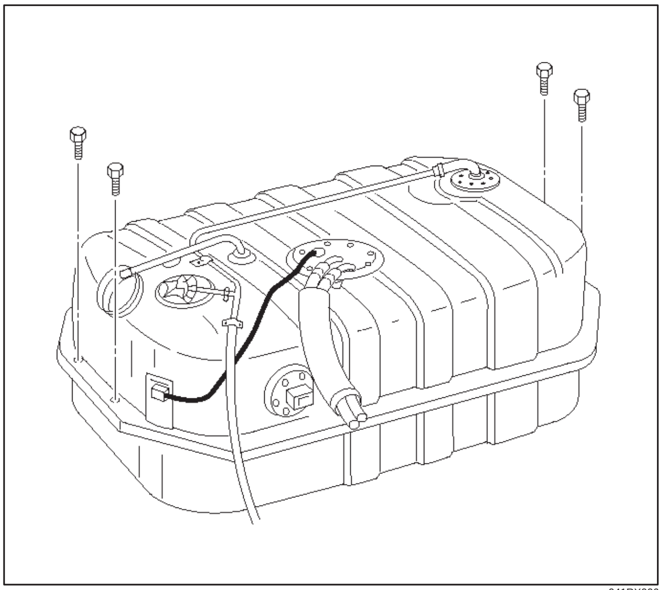
1. Secure fuel tank into under guard with four retaining bolts, if necessary.
2. Place the fuel tank assembly onto stands.
3. Lift the fuel tank assembly near the position.
4. Connect two electrical connectors at fuel pump.
5. Lift the fuel pump to its position and secure it with four mounting bolts. Make sure that all hoses and fuel lines are out of way between the fuel tank and the fuel tank bracket. Tighten the fuel tank retaining bolts to 36 Nm (27 lb ft).



041RX007

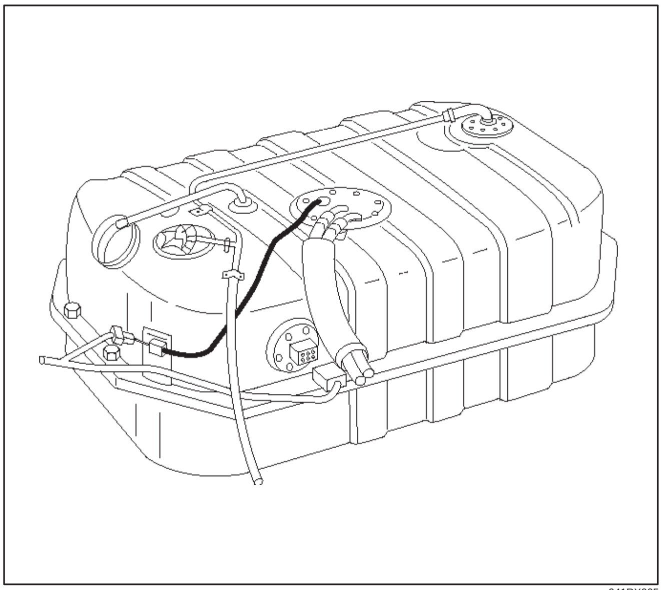
6. Connect fuel supply and return lines.

7. Connect the fuel filler hose, the air breather hose and EVAP hose onto fuel tank and secure them with clamps.



041RX006

8. Pour fuel into fuel tank.
9. Install fuel filler cap securely.
10. Connect the battery negative cable.

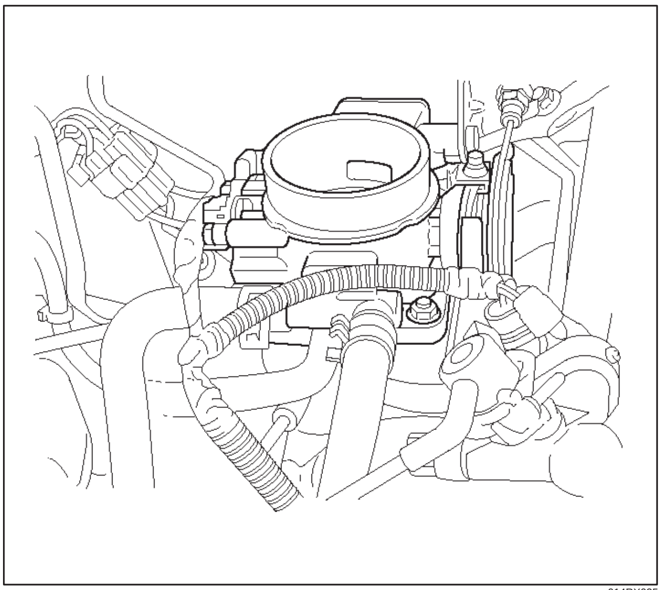


041RX005

Throttle body (TB)

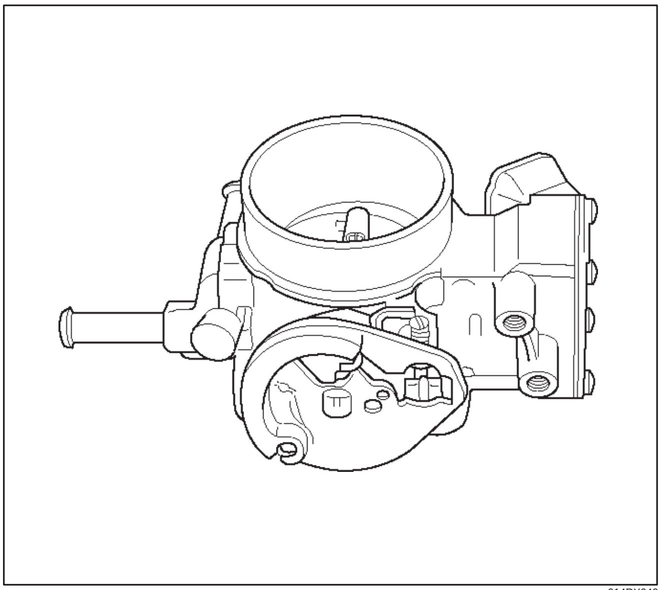
Removal Procedure

1. Disconnect the negative battery cable.
2. Drain the cooling system. Refer to Cooling System.
3. Remove the air intake duct. Refer to Air Intake Duct Removal Procedure.
4. Remove the accelerator cable from throttle. Refer to Accelerator Cable Assembly Removal Procedure.
5. Disconnect the electrical connectors from the throttle position sensor and the idle air control valve solenoid.
6. Disconnect all vacuum hoses below air horn.
7. Disconnect coolant lines.



014RX025

8. Remove the mounting bolts retaining the throttle body the intake manifold.
9. Lift up the throttle body from the intake manifolds.



014RX040

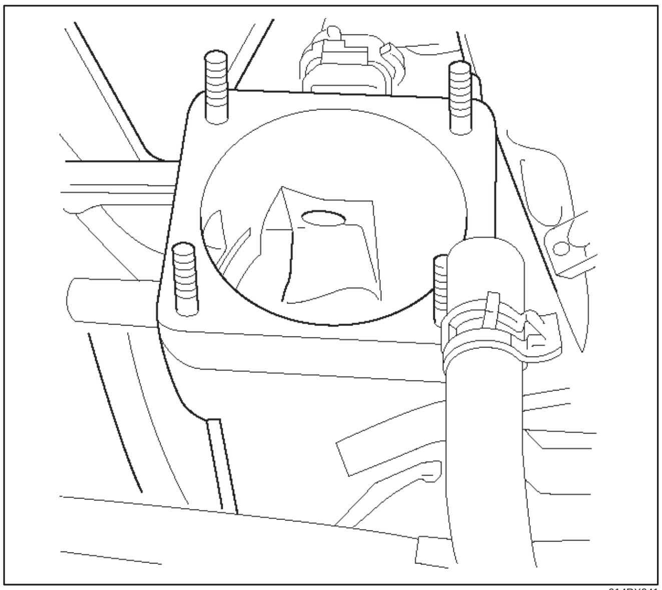
10. Remove the gaskets from the intake manifolds.
11. Remove the IAC. Refer to Idle Air Control Valve Solenoid Removal Procedure.
12. Remove TPS. Refer to Throttle Position Sensor Removal Procedure.

Inspection Procedure

NOTE: Do not use solvent of any type when you clean the gasket surfaces on the intake manifold and the throttle body assembly. The gasket surface and the throttle body assembly may be damaged as results.

1. If the throttle body gasket needs to be released, remove any gasket material that may be stuck to the mating surfaces of the manifold.

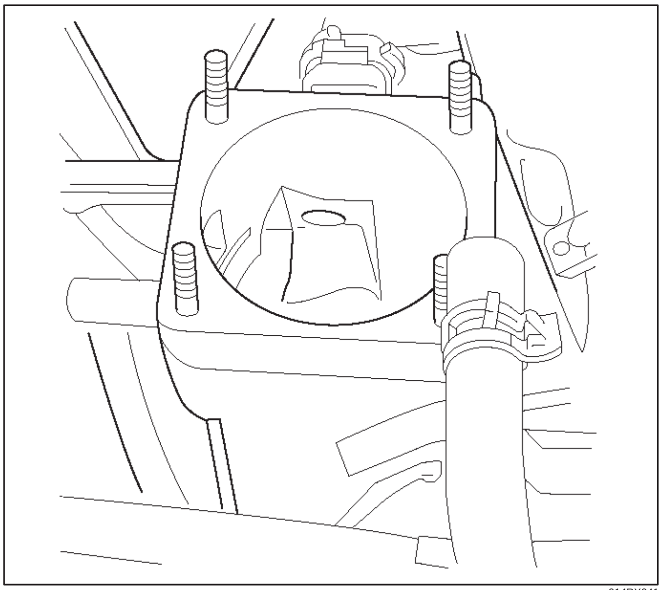
2. Do not leave any scratches in the aluminum casting.



014RX041

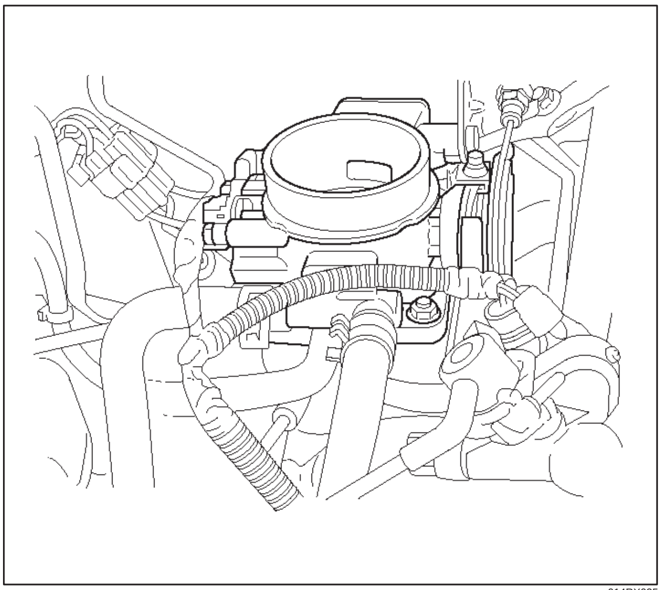
Installation Procedure

1. Install IAC valve onto the throttle body. Refer to Idle Air Control Valve Solenoid Installation Procedure.
2. Install TPS onto the throttle body if necessary. Refer to TPS Installation Procedure.
3. Place the gasket then the throttle body on the manifold.
4. Install four mounting bolt. Tighten the throttle body mounting bolt to 13.5 Nm (10 lb ft).



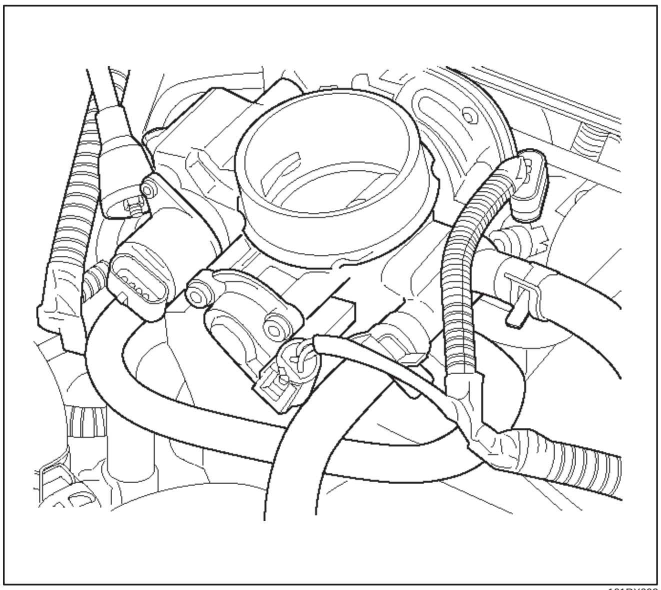
014RX041

5. Connect coolant line and secure them with clamps.
6. Connect all vacuum hoses and secure them with clamps if necessary.
7. Install accelerator control cable bracket onto the throttle body.
8. Connect accelerator control cable to throttle plate.



014RX025

9. Connect electrical connector at IAC valve and TPS.
10. Install the air intake duct. Refer to Air Intake Duct Installation Procedure.
11. Fill the cooling system with required coolant. Refer to Engine Cooling System.
12. Connect the negative battery cable.



101RX002

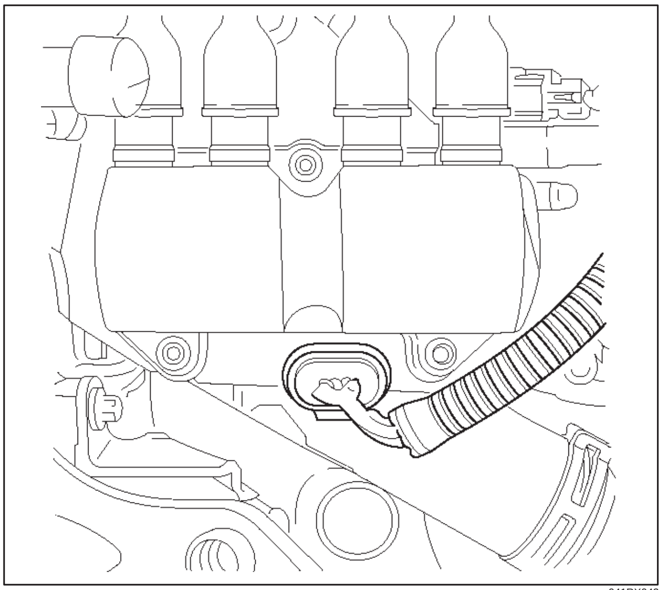
ELECTRONIC IGNITION SYSTEM Ignition Control Module (ICM)

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the ignition control module.
3. Remove the two attaching screws.
4. Remove the ignition control module from the engine block.

Installation Procedure

1. Fasten the module to the engine block with two screws.
2. Reconnect the electrical connector.
3. Reconnect the negative battery terminal.

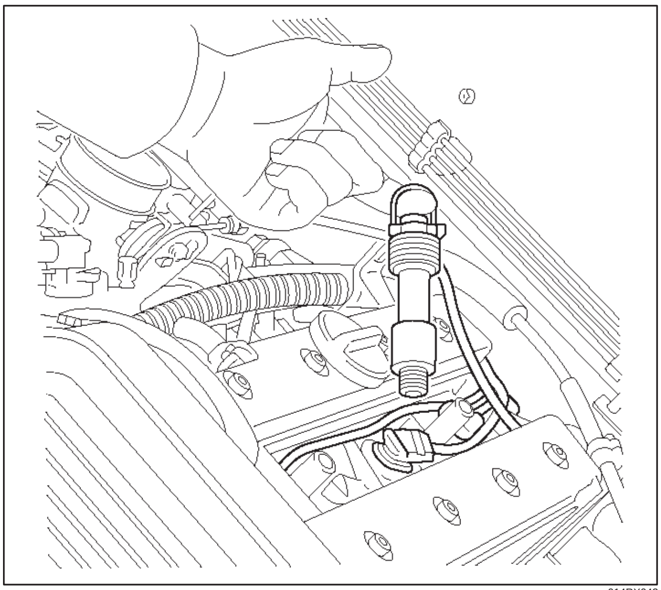


041RX042

Ignition Coil

Removal Procedure

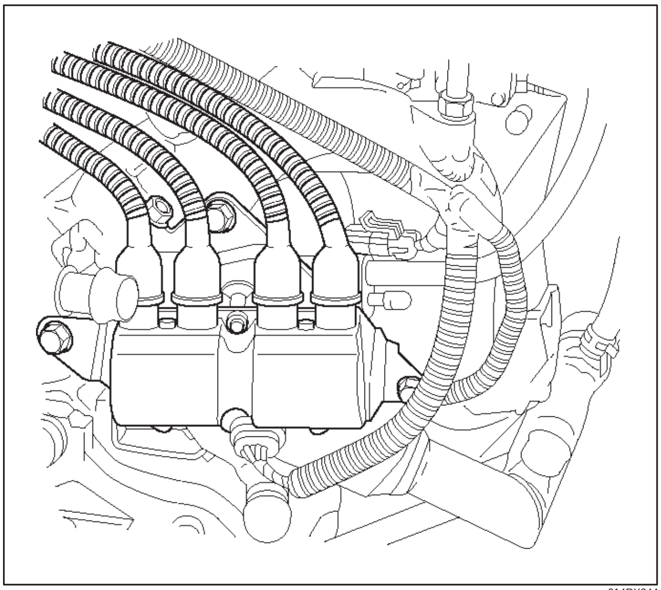
1. Disconnect the negative battery cable.
2. Drain the cooling system. Refer to Engine Cooling System.
3. Remove the heater supply and return hose.
4. Remove the coolant return hose.
5. Disconnect all four spark plug cables from the coil.
6. Disconnect electrical connector from the ignition coil.
7. Remove three mounting bolt from the ignition coil.
8. Remove the ignition coil from the bracket.



014RX043

Installation Procedure

1. Install the ignition coil onto the bracket with three mounting bolts.
2. Connect electrical connector at the ignition coil.
3. Connect spark plug cable to the ignition coil.
4. Connect heater supply and return hose and secure them with clamps.
5. Connect coolant return line and secure them with clamps.
6. Fill the cooling system with required coolant. Refer to Engine Cooling System.
7. Connect the negative battery cable.



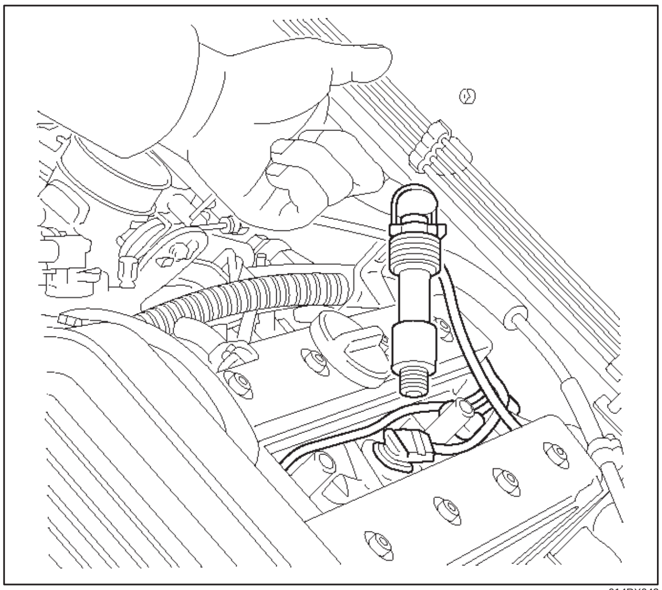
014RX044

Spark Plugs

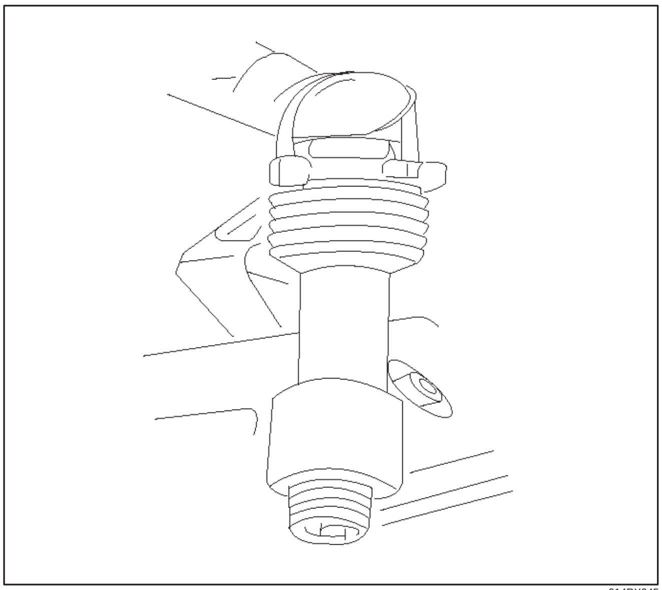
Removal Procedure

Type: NGK BPR6ES–11
Spark Gap : 1.05 MM (0.040”)
Spark Plug Torque : 25 Nm (18 lb ft)

1. Disconnect the negative battery cable.
2. Remove four bolt holding spark plug cover plate to top of valve cover, and remove the cover plate.
3. Pull ignition wire using hocks attached to end of spark plug cable.

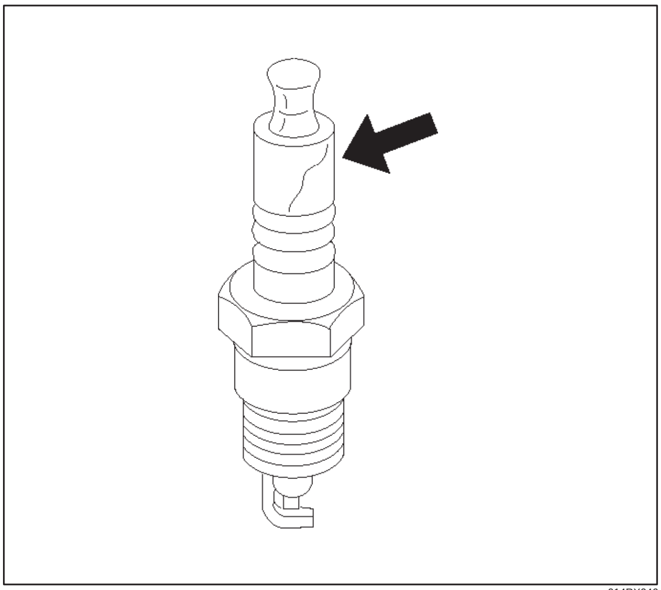

014RX043

4. Remove the spark plug.


014RX045

Inspection Procedure

1. Check the insulator for cracks. Replace the spark plug if crack are present.
2. Check the electrode condition and replace the spark plug if necessary.

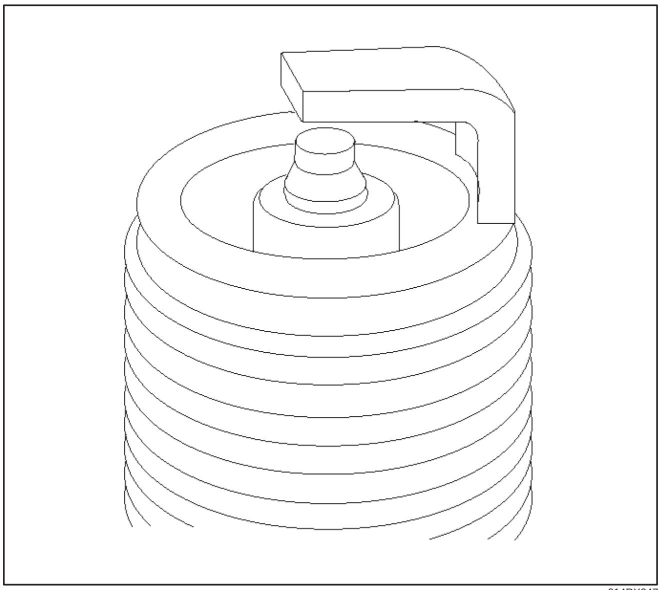

014RX046

If the spark plug electrodes and insulators are fouled with carbon or oil, the engine will not operate efficiently.
There are number of possible causes:

- Fuel mixture is too rich.
- Oil in the combustion chamber.
- The spark plug gap is not set correctly.

If spark plug fouling is excessive, check the fuel and electrical system for possible causes of trouble. If fuel and electrical system are normal, install spark plug of a higher heat range which have the same physical dimensions as the original equipment spark plug.
The following symptoms are characteristics of spark plugs that are running too hot:

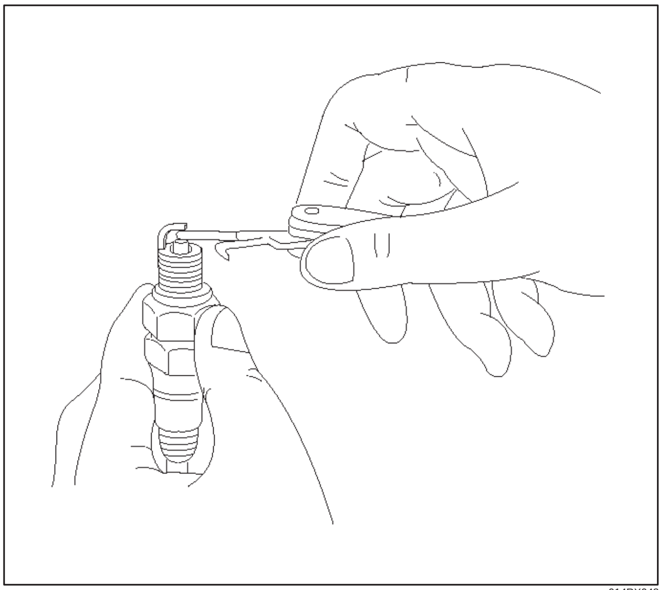
- Fuel mixture is too lean.
- Heat range is incorrect.


014RX047

If vehicle usage does not conform to normal driving conditions, a more suitable spark plug may be substituted.
If fuel and electrical system are normal, in most cases of this sort, the problem can be corrected by using a colder

type spark plug with the same physical dimensions as the original equipment spark plug.

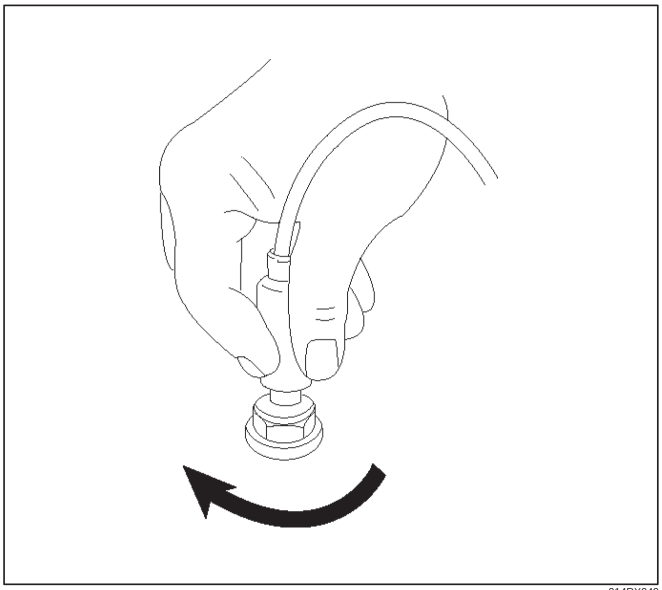
3. Check the gaskets for damage and replace if necessary.
4. Measure the spark plug gap. The specification is 1.05 mm (0.040”).
5. Adjust the spark gap by bending the grounded electrode.



014RX048

Installation Procedure

1. Tighten the spark plug to the 25 Nm (18 lb ft).
2. Push the spark plug cable in until it snaps in.
3. Install spark plug cover onto valve cover and secure it with four retaining bolts.



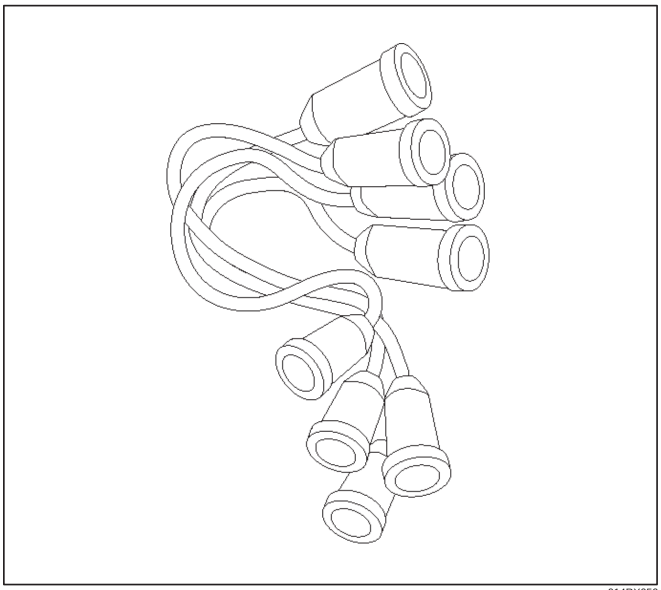
014RX049

Spark Plug Cables

Spark Plug Cables

The cable contains a synthetic conductor which is easily damaged. Never stretch or kink the cable. Disconnect the cable from spark plug and the ignition coil.

The original equipment cables and the ignition coil are marked to show correct location of the cables. If spark plug cables or the ignition coil are replaced previously, before cables are removed from the ignition coil, mark the cables and the coil so they can be reconnected in the same position.

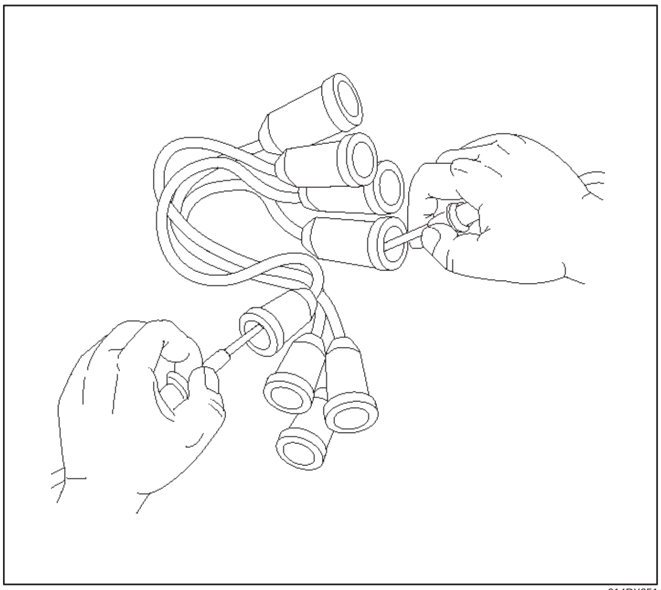


014RX050

Inspection Procedure

NOTE: Never puncture the spark plug cable’s insulation with a needle or the pointed end of a probe into the cable. An increase in resistance would be created which would cause the cable to become defective.

1. If the cable has broken or cracked insulation, it must be replaced.
2. If the terminals are corroded or loose, the cable must be replaced.
3. Check that the cable resistance does not exceed 10 k Ω per foot.



014RX051

EMISSIONS Catalytic Converter

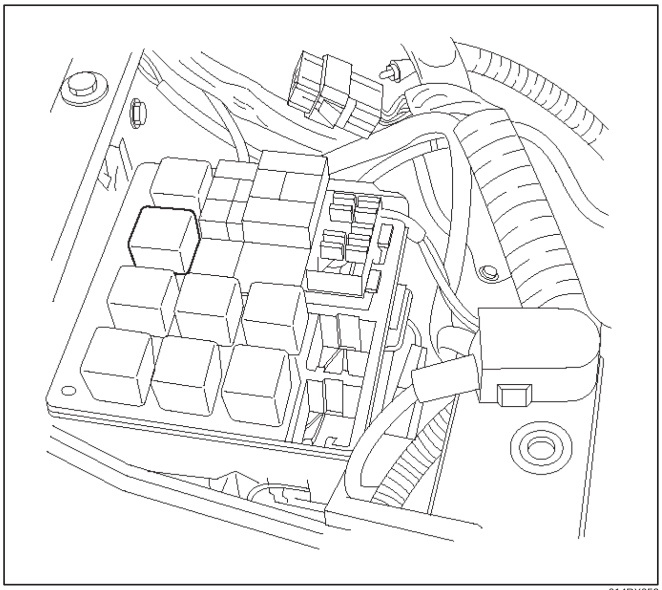
Catalytic Converter

Refer to Engine Exhaust.

Air Conditioning Relay

Removal Procedure

1. Remove the fuse and relay box cover at right side of engine room.
2. Refer to the diagram on the cover to determine which is the correct relay.
3. Insert small screwdriver or use thumb pressure to release the retainer of the relay.
4. Pull the relay straight up and out of the fuse and relay box.



014RX052

Installation Procedure

1. Insert the relay into the correct place in the fuse and relay box with the catch slot aligned to retainer.
2. Press down until the catch of retainer engages.
3. Install fuse and relay box cover.

Ignition Timing Adjustment

Ignition Timing Adjustment

There is no timing adjustment. The timing signal is furnished by the CKP and the CMP signal. PCM control the ignition timing.

EVAP Canister Hoses

EVAP Canister Hoses

To see the routing of the EVAP canister hoses, refer to Vehicle Emission Control Information in Diagnosis or Emission Label located bottom side ofthe hood. Use 6148M or equivalent when you replace the EVAP canister hoses.

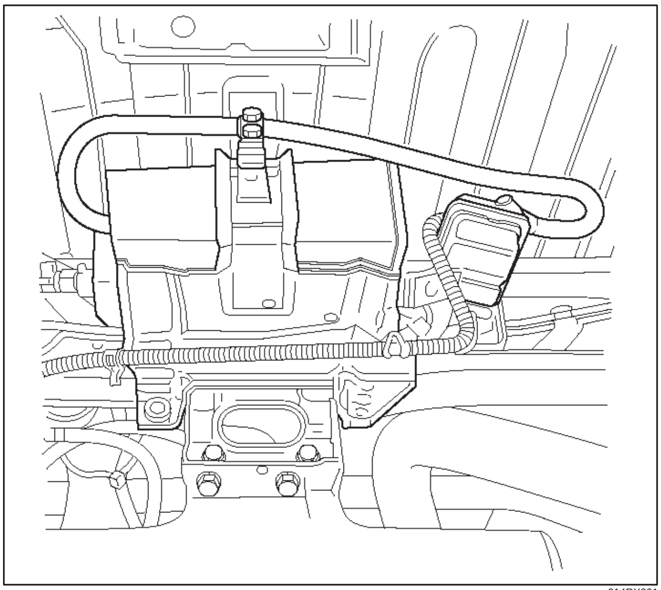
EVAP Canister

Removal Procedure

1. Disconnect all hoses.
2. Remove two mounting bracket nuts.

Inspection Procedure

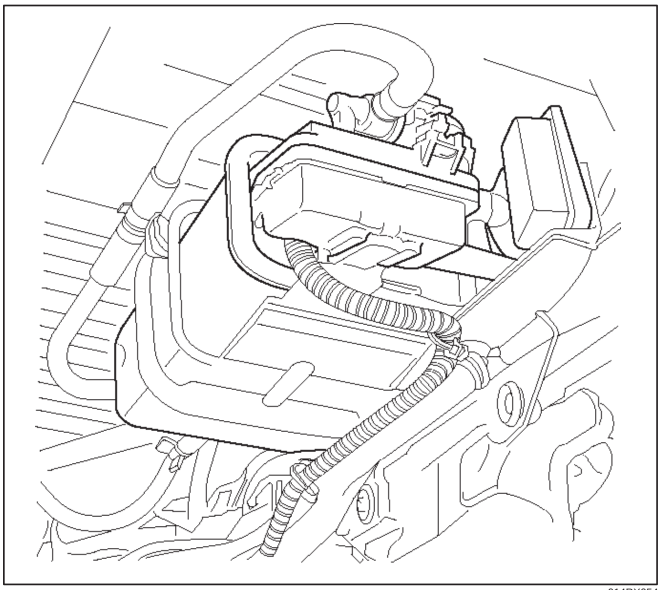
1. Inspect the hoses for cracks, damage and leaks.
2. Inspect the canister for damages.



014RX001

Installation Procedure

1. Install EVAP canister onto crossmember with two mounting bolts.
2. Connect all hoses and secure them with clamps.

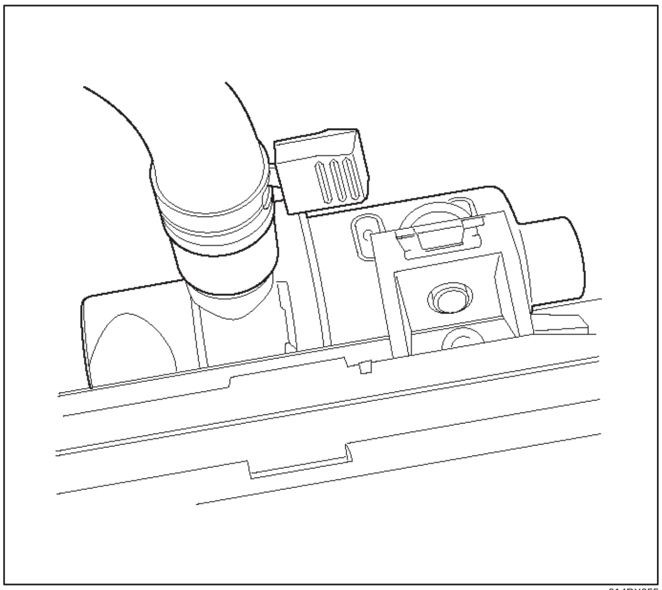


014RX054

EVAP Canister Vent Solenoid

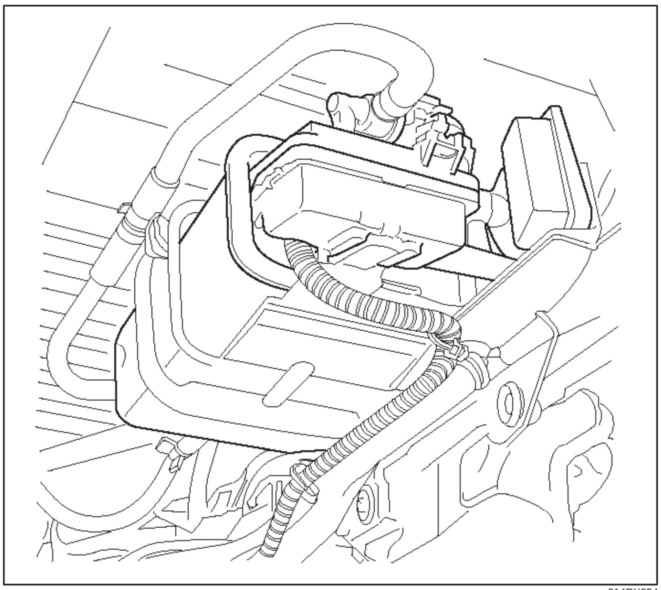
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect electrical connector at the vent valve.
3. Disconnect vent hoses from the solenoid valve.
4. Remove the filter and vent valve solenoid assembly by pulling it out from bracket.
5. Remove a screw holding the solenoid.
6. Remove vent valve solenoid from filter.


014RX055

Installation Procedure

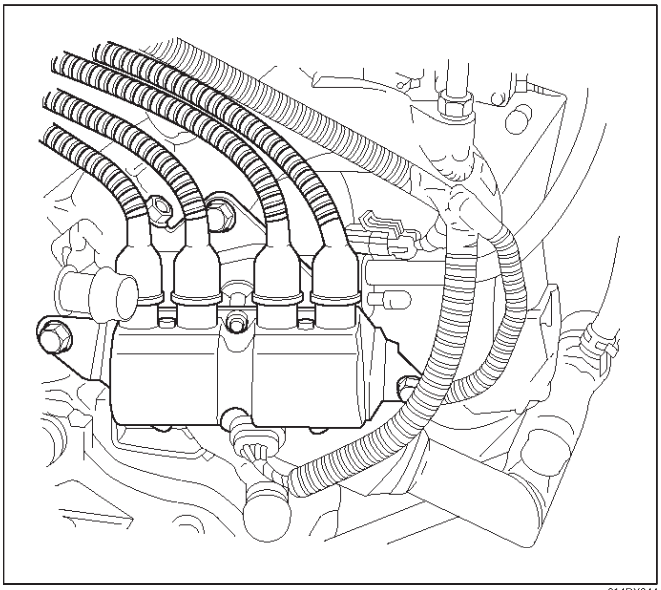
1. Install the vent valve solenoid to the filter and secure it witha screw.
2. Insert the vent valve assembly onto EVAP canister bracket.
3. Connect all hoses and secure them with clamps.
4. Connect electrical connector at vent valve solenoid.
5. Connect the negative battery cable.


014RX054

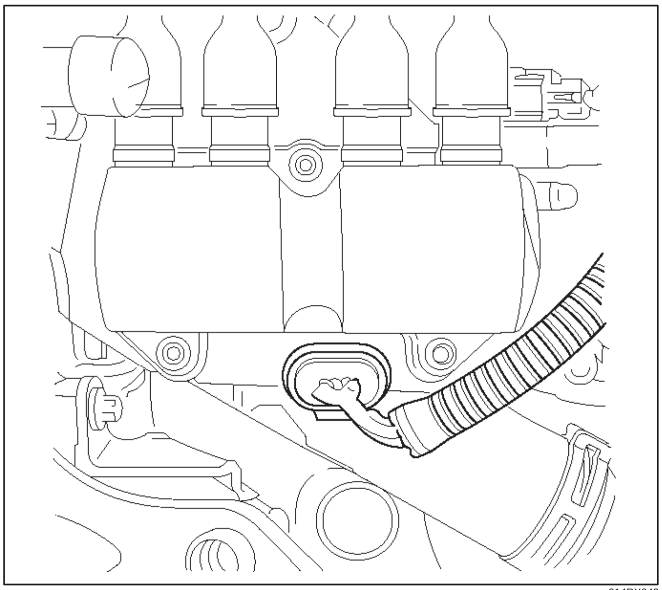
EVAP Canister Purge Valve Solenoid

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect electrical connector from EVAP purge solenoid located just front of the ignition coil.
3. Disconnect the vacuum hoses from the solenoid.
4. Remove the ignition coil. Refer toIgnition Coil Removal Procedure.


014RX044

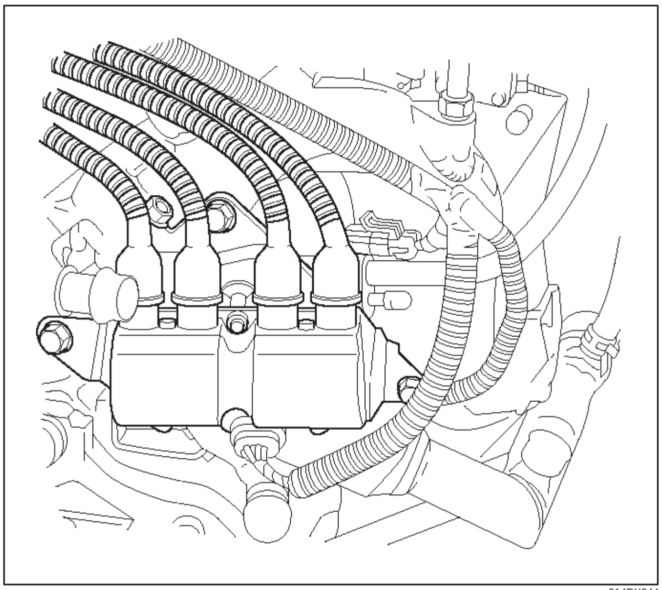
5. Remove the three bolts holding the ignition coil bracket.
6. Remove the ignition coil bracket with the purge solenoid still attached to it.
7. Insert small screw driver into the catch from the bottom hole to release the catch.
8. Slide EVAP purge solenoid out form the ignition bracket.



014RX042

Installation Procedure

1. Insert EVAP purge solenoid valve onto the ignition coil bracket.
2. Install the ignition coil bracket to back of intake manifold.
3. Install the ignition coil. Refer to Ignition Coil Installation Procedure.
4. Connect vacuum hoses and electrical connector at the purge valve.

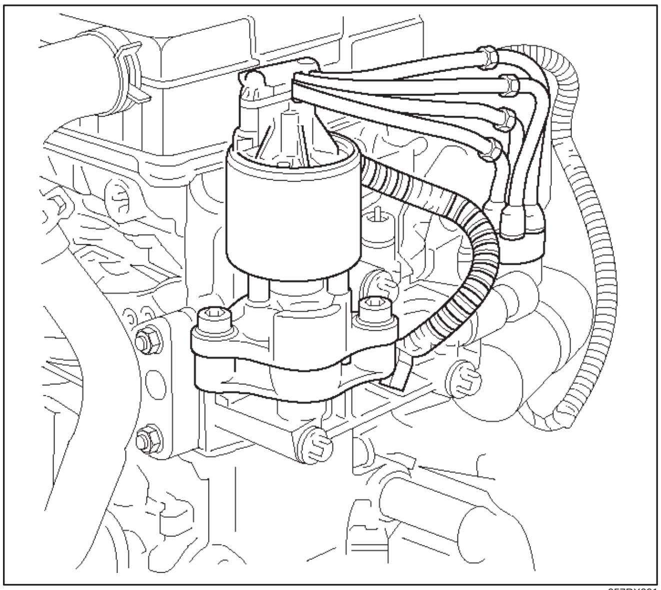


014RX044

Linear Exhaust Gas Recirculation (EGR) Valve

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect electrical connector at EGR valve.
3. Disconnect the electrical connector at Intake Air Temperature Sensor.
4. Remove air intake duct. Refer to Air Intake Duct Removal Procedure.
5. Remove crankshaft breather hose.
6. Remove two bolts holding EGR valve.
7. Remove EGR valve and gasket from the manifold.

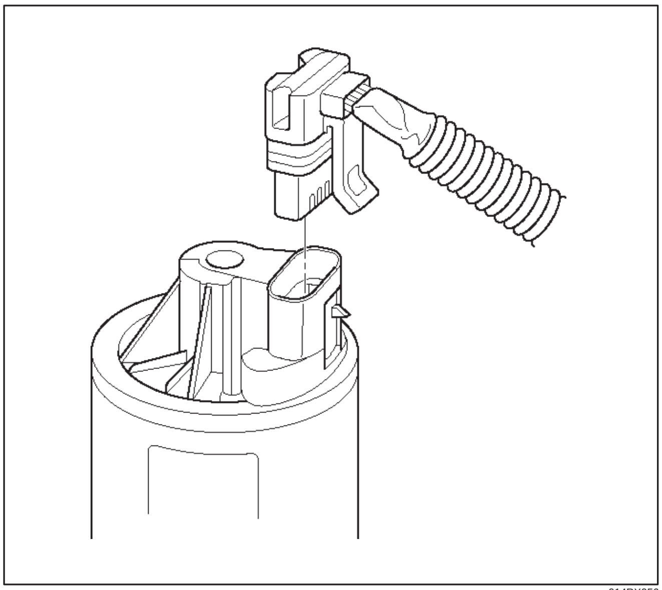


057RX001

Inspection Procedure

1. Inspect the air passage for a restrtiction. If there is restriction, remove the object. Do not use any type of solvent, it may damage electrical system of EGR valve.

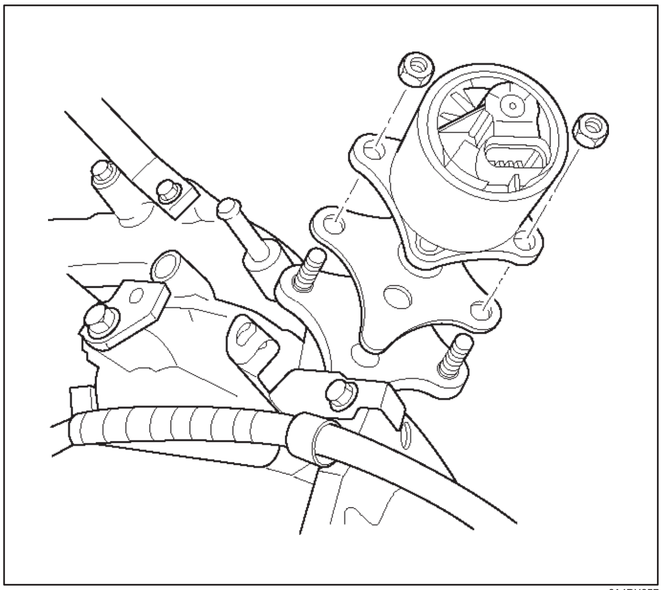
2. Inspect restriction for valve movement. If there is restriction remove the object.



014RX056

Installation Procedure

1. Place the gasket and EGR valve on to the intake manifold.
2. Install mounting bolts and tighten.
3. Connect electrical connector at EGR valve
4. Connect the crankshaft breather hose and secure it with clamps.
5. Install the air intake duct. Refer to Air Intake Duct Installation Procedure.
6. Connect the negative battery cable.



014RX057

Wiring and Connectors

Wiring Harness Service

The control module harness electrically connects the control module to the various solenoids, switches and sensors in the vehicle engine compartment and passenger compartment.
Replace wire harnesses with the proper part number replacement.
Because of the low amperage and voltage levels utilized in powertrain control systems, it is essential that all wiring in environmentally exposed areas be repaired with crimp and seal splice sleeves.
The following wire harness repair information is intended as a general guideline only. Refer to Chassis Electrical for all wire harness repair procedures.

PCM Connectors And Terminals

Removal Procedure

1. Remove the connector terminal retainer.
2. Push the wire connected to the affected terminal through the connector face so that the terminal is exposed.
3. Service the terminal as necessary.

Installation Procedure

1. Bend the tab on the connector to allow the terminal to be pulledinto position within the connector.
2. Pull carefully on the wire to install the connector terminal retainer.

Connectors And Terminals

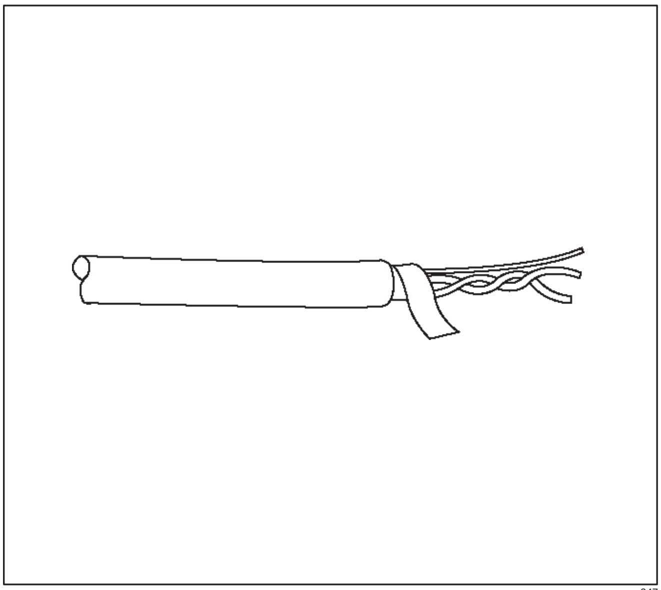
Connectors And Terminals

Use care when probing a connector and when replacing terminals. It is possible to short between opposite terminals. Damage to components could result. Always use jumper wires between connectors for circuit checking. NEVER probe through Weather–Pack seals. Use an appropriate connector test adapter kit which contains an assortment of flexible connectors used to probe terminals during diagnosis. Use an appropriate fuse remover and test tool for removing a fuse and to adapt the fuse holder to a meter for diagnosis.
Open circuits are often difficult to locate by sight because oxidation or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor, or in the wiring harness, may temporarily correct the open circuit. Intermittent problems may also be caused by oxidized or loose connections.
Be certain of the type of connector/terminal before making any connector or terminal repair. Weather–Pack and Com–Pack III terminals look similar, but are serviced differently.

Wire Harness Repair: Twisted Shielded Cable

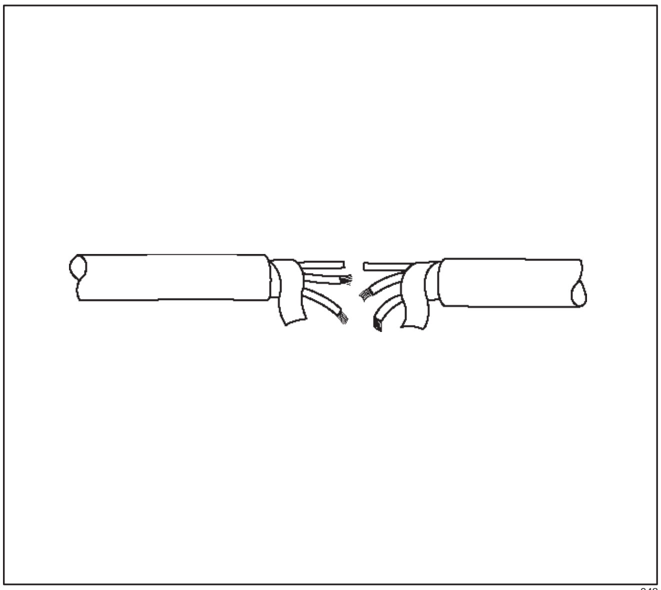
Removal Procedure

1. Remove the outer jacket.
2. Unwrap the aluminum/mylar tape. Do not remove the mylar.



047

3. Untwist the conductors.
4. Strip the insulation as necessary.

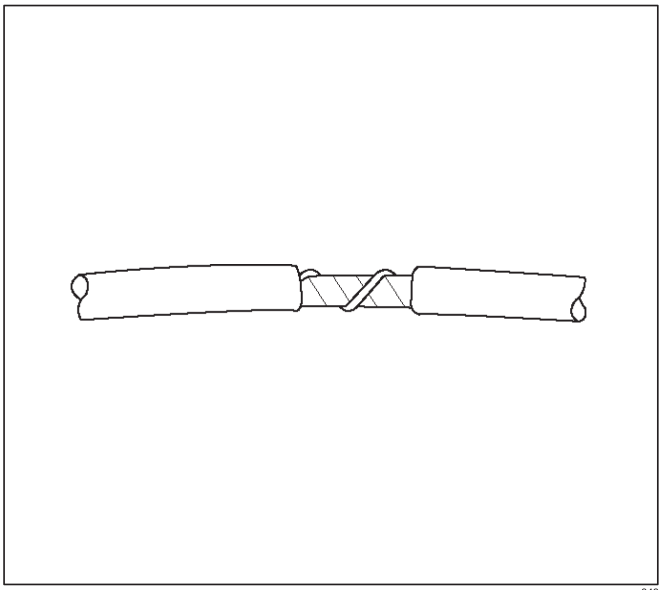


048

Installation Procedure

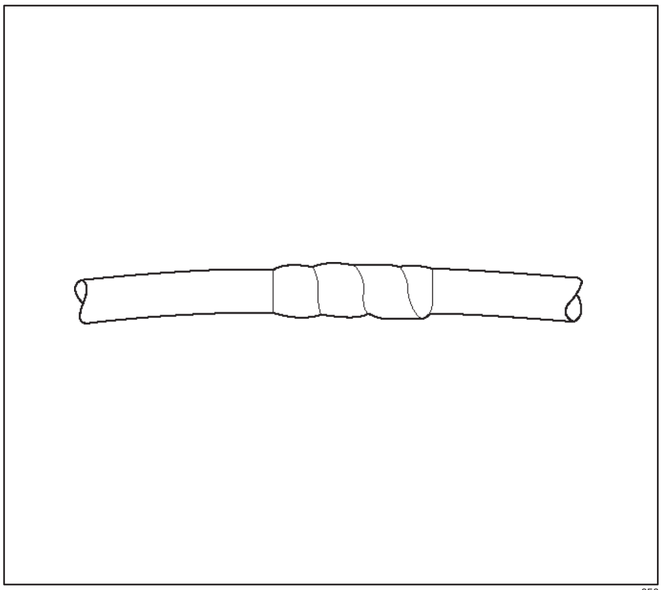
1. Splice the wires using splice clips and rosin core solder.
2. Wrap each splice to insulate.

3. Wrap the splice with mylar and with the drain (uninsulated) wire.



049

4. Tape over the whole bundle to secure.

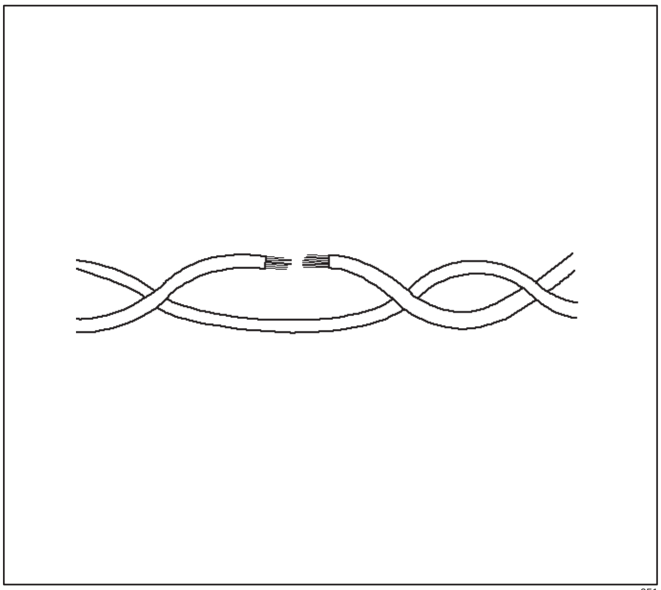


050

Twisted Leads

Removal Procedure

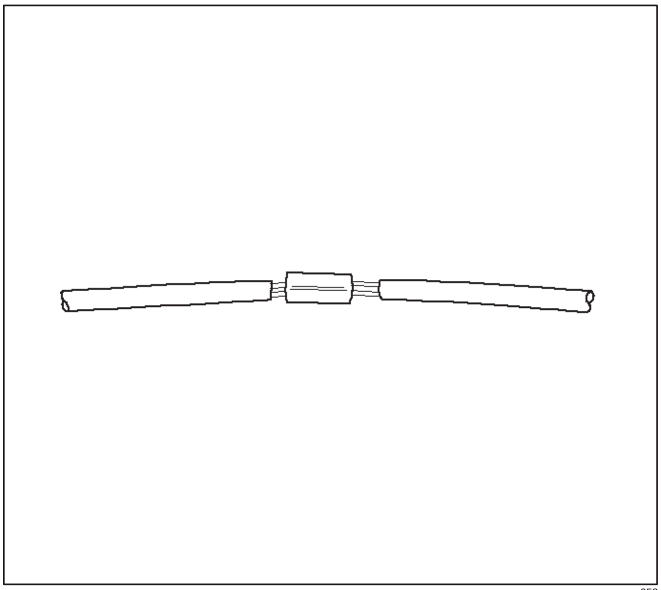
1. Locate the damaged wire.
2. Remove the insulation as required.



051

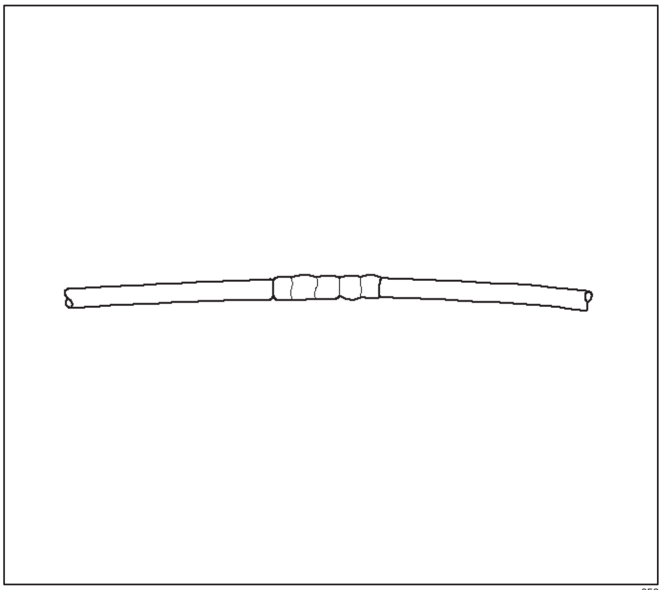
Installation Procedure

1. Use splice clips and rosin core solder in order to splice the two wires together.



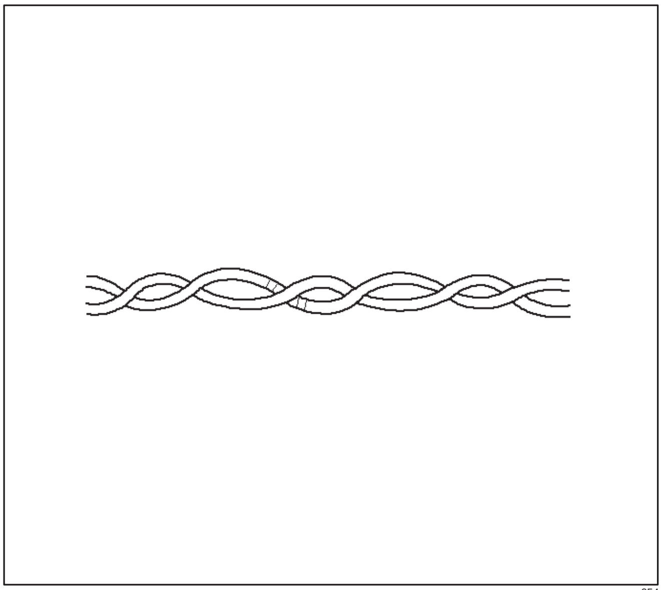
052

2. Cover the splice with tape in order to insulate it from the other wires.



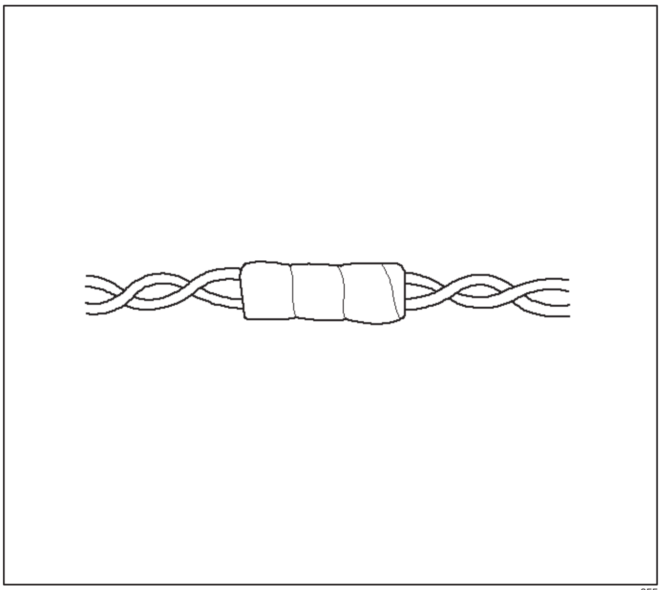
053

3. Twist the wires as they were before starting this procedure.



054

4. Tape the wires with electrical tape.



055

Weather–Pack Connector

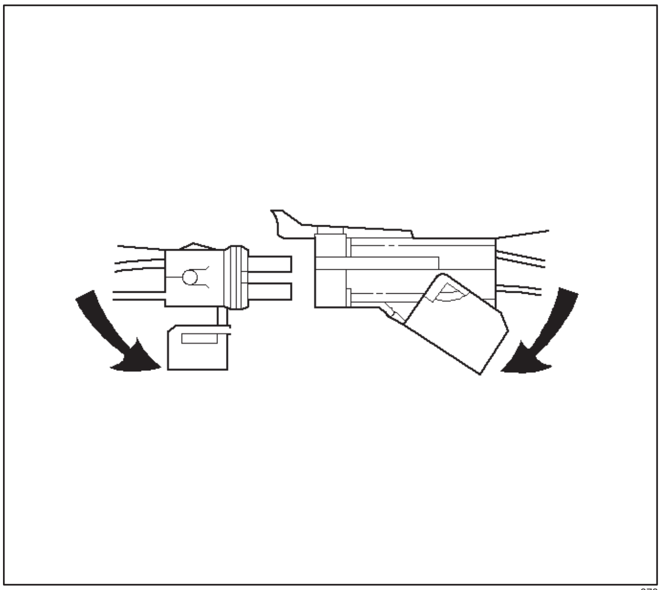
Tools Required

J 28742–A Weather–Pack II Terminal Remover

Removal Procedure

A Weather–Pack connector can be identified by a rubber seal at the rear of the connector. This engine room connector protects against moisture and dirt, which could form oxidation and deposits on the terminals. This protection is important, because of the low voltage and the low amperage found in the electronic systems.

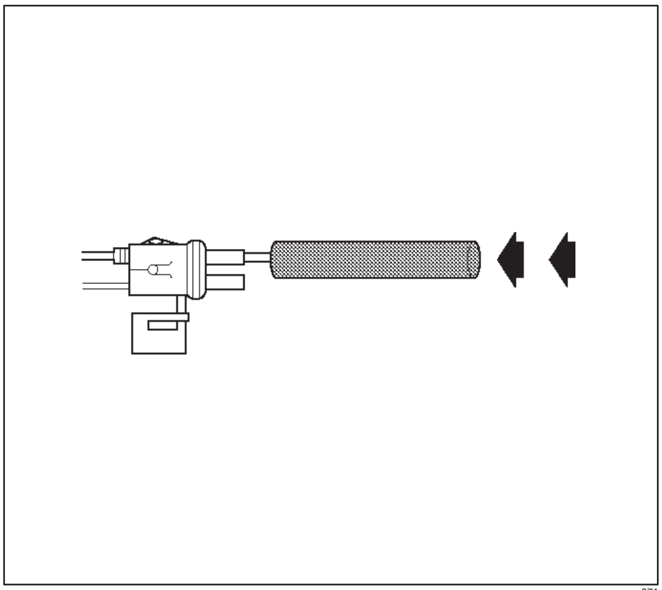
1. Open the secondary lock hinge on the connector.



070

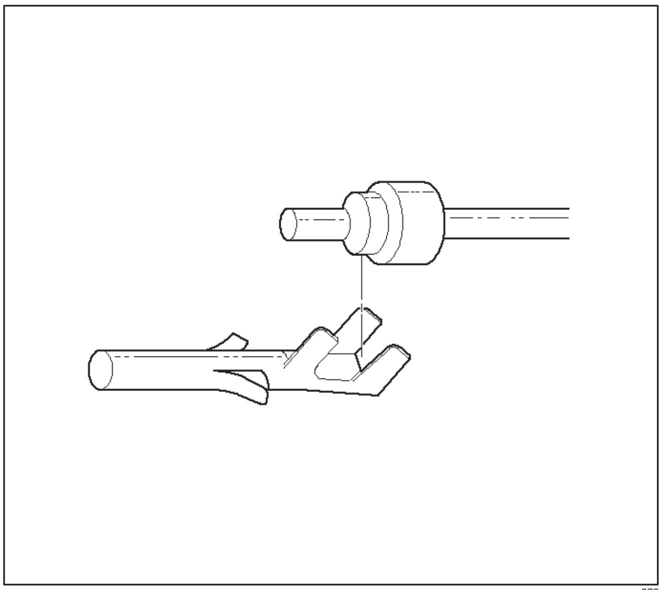
2. Use tool J 28742–A or the equivalent to remove the pin and the sleeve terminals. Push on J 28742–A to release.

NOTE: Do not use an ordinary pick or the terminal may be bent or deformed. Unlike standard blade terminals, these terminals cannot be straightened after they have been improperly bent.



071

3. Cut the wire immediately behind the cable seal.



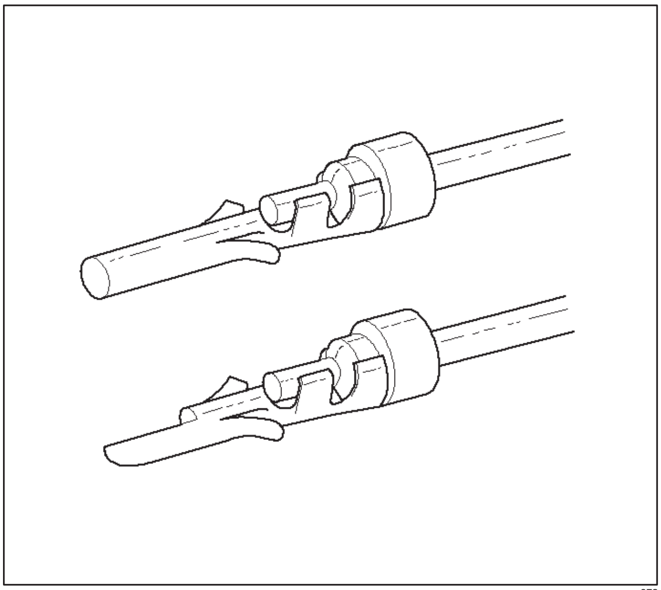
072

Installation Procedure

Make certain the connectors are properly seated and all of the sealing rings are in place when you reconnect the leads. The secondary lock hinge provides a backup locking feature for the connector. The secondary lock hinge is used for added reliability. This flap should retain the terminals even if the small terminal lock tangs are not positioned properly.

Do not replace the Weather–Pack connections with standard connections. Read the instructions provided with the Weather–Pack connector and terminal packages.

1. Replace the terminal.
2. Slip the new seal onto the wire.
3. Strip 5 mm (0.2”) of insulation from the wire.
4. Crimp the terminal over the wire and the seal.



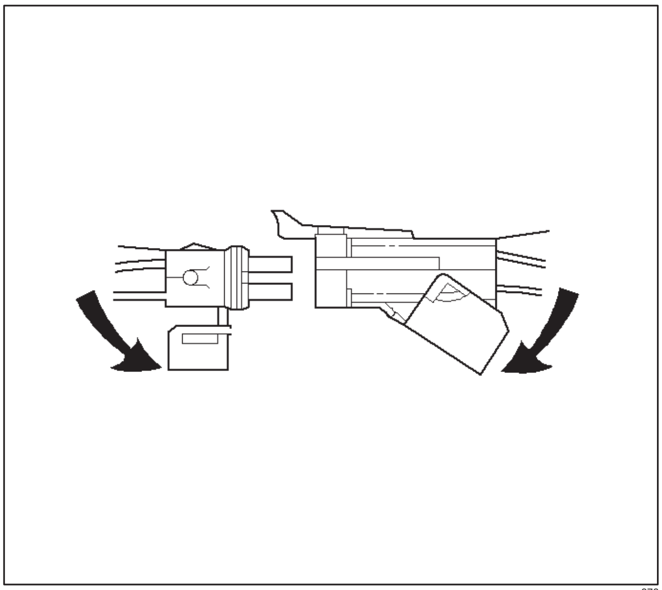
073

5. Push the terminal and the connector to engage the locking tangs.
6. Close the secondary locking hinge.

Com–Pack III

Com–Pack III

The Com–Pack III terminal looks similar to some Weather–Pack terminals. This terminal is not sealed and is used where resistance to the environment is not required. Use the standard method when repairing a terminal. Do not use the Weather–Pack terminal tool J 28742–A or equivalent. These will damage the terminals.



070

Metri–Pack

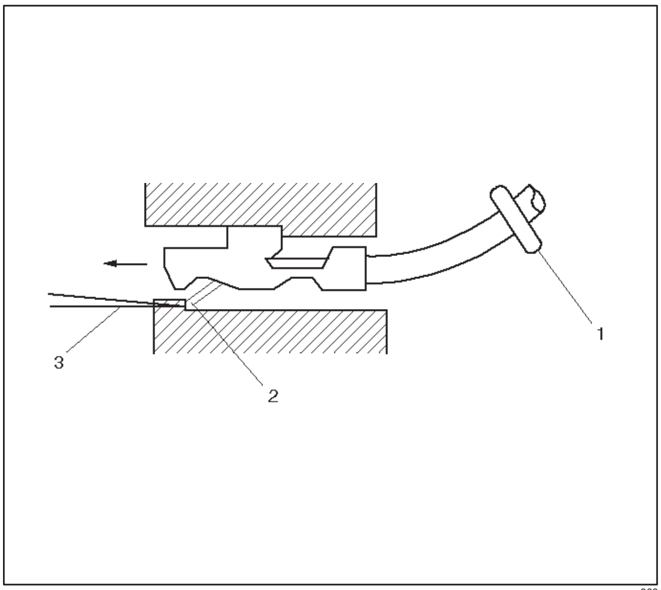
Tools Required

J 35689 Terminal Remover

Removal Procedure

Some connectors use terminals called Metri–Pack Series 150. These may be used at the engine coolant temperature (ECT) sensor.

1. Slide the seal (1) back on the wire.
2. Insert the J 35689 tool or equivalent (3) in order to release the terminal locking tang (2).
3. Push the wire and the terminal out through the connector. If you reuse the terminal, reshape the locking tang.

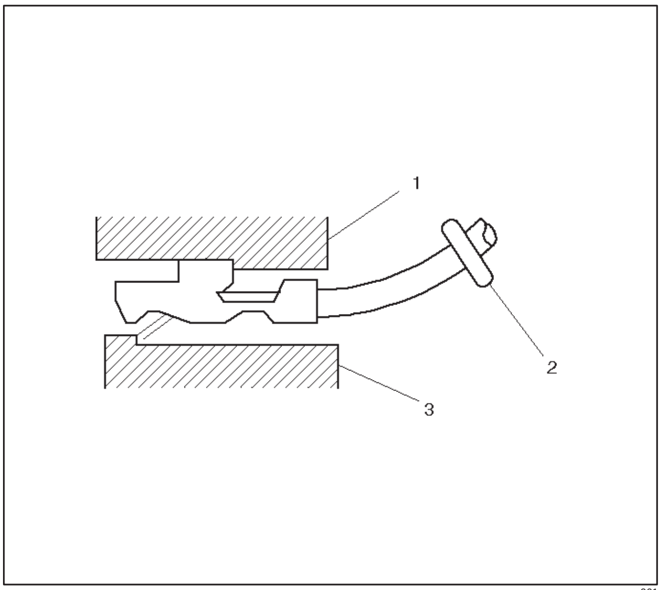


060

Installation Procedure

Metri–Pack terminals are also referred to as ”pull–to–seat” terminals.

1. In order to install a terminal on a wire, the wire must be inserted through the seal (2) and through the connector (3).
2. The terminal (1) is then crimped onto the wire.
3. Then the terminal is pulled back into the connector to seat it in place.



061

GENERAL DESCRIPTION — PCM AND SENSORS

58X Reference PCM Input

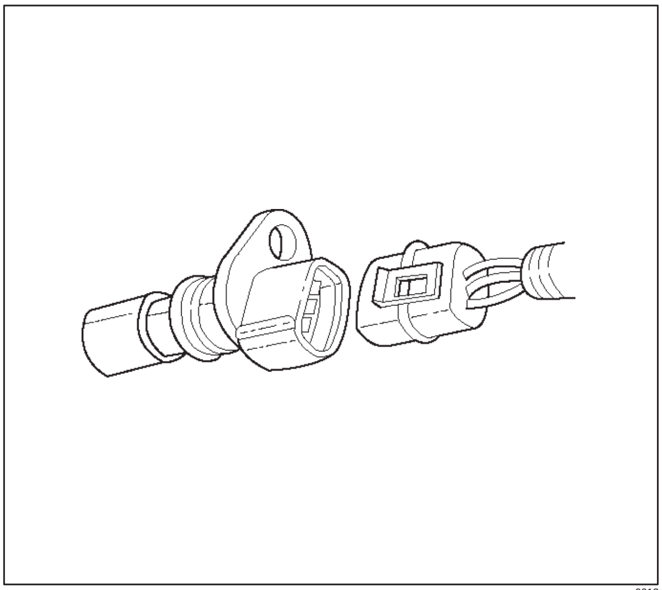
The powertrain control module (PCM) uses this signal from the crankshaft position (CKP) sensor to calculate engine RPM and crankshaft position at all speeds. The PCM also uses the pulses on this circuit to initiate injector pulses. If the PCM receives no pulses on this circuit, DTC P0337 will set. If the PCM receives a number of pulses other than the expected amount, DTC P0336 will set. The engine will not start and run without using the 58X reference signal.

A/C Request Signal

This signal tells the PCM when the A/C mode is selected at the A/C control switch. The PCM uses this signal to adjust the idle speed before turning ON the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.
For A/C wiring diagrams and diagnosis for the A/C electrical system, refer to A/C Clutch Circuit Diagnosis.

Crankshaft Position (CKP) Sensor

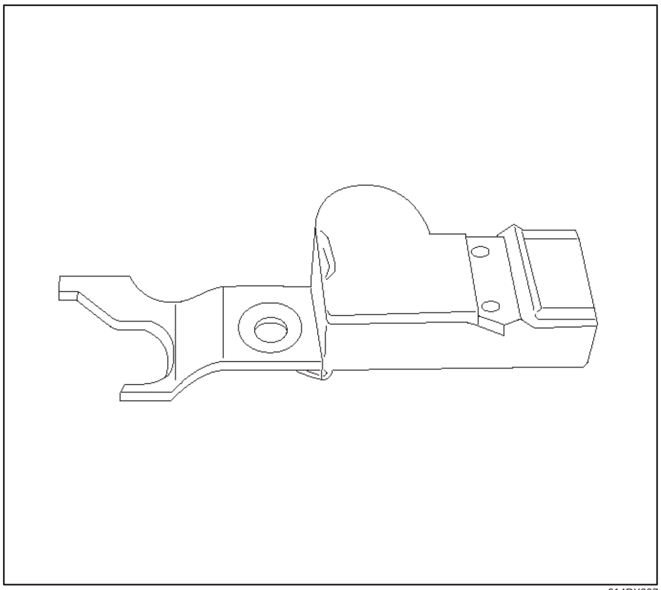
The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The CKP sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position. For additional information, refer to Electronic Ignition System.



0013

Camshaft Position (CMP) Sensor And Signal

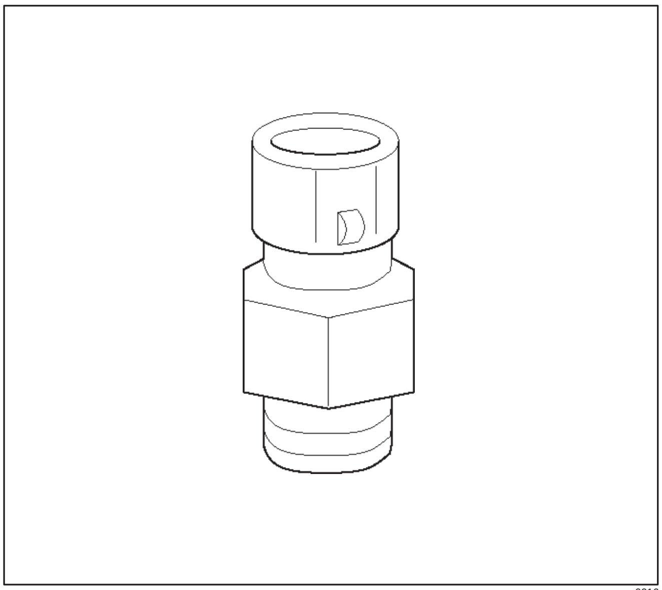
The camshaft position (CMP) sensor sends a signal to the PCM. The PCM uses this signal as a ”sync pulse” to trigger the injectors in the proper sequence. The PCM uses the CMP signal to indicate the position of the #1 piston during its power stroke. The CMP allows the PCM to calculate true sequential fuel injection (SFI) mode of operation. If the PCM detects an incorrect CMP signal while the engine is running, DTC P0341 will set.
If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection mode based on the last fuel injection pulse, and the engine will continue to run. It will run in the calculated sequential mode with a 1–in–4 chance of the injector sequence being correct.
For further information, refer to
DTC P0341
DTC P0342.



014RX007

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. Low coolant temperature produces a high resistance of about 100,000 Ω at –40°C (–40°F). High temperature causes a low resistance of about 70 Ω at 130°C (266°F).
The PCM supplies a 5–volt signal to the ECT sensor through resistors internal to the PCM and then measures the voltage after the internal resistor. This signal voltage will be high when the engine is cold and low when the engine is hot. By measuring the voltage, the PCM calculates the engine coolant temperature. Engine coolant temperature affects most of the systems that the PCM controls.
The Tech 2 displays engine coolant temperature in degrees. After engine start–up, the temperature should rise steadily to about 85°C (185°F). It then stabilizes when the thermostat opens. If the engine has not been run for several hours (overnight), the engine coolant temperature and intake air temperature displays should be close to each other. A hard fault in the engine coolant sensor circuit will set DTC P0117 or DTC P0118. An intermittent fault will set a DTC P1114 or P1115.



0016

Electrically Erasable Programmable Read Only Memory (EEPROM)

The electrically erasable programmable read only memory (EEPROM) is a permanent memory chip that is physically soldered within the PCM. The EEPROM contains the program and the calibration information that the PCM needs to control powertrain operation.

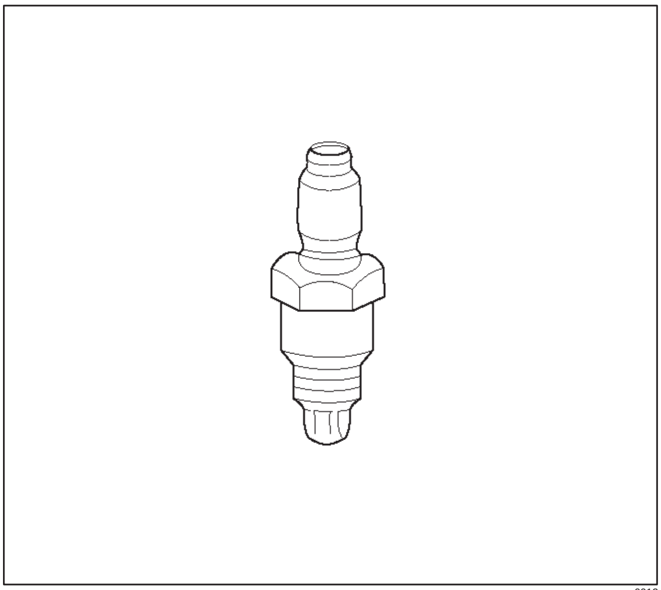
Unlike the PROM used in past applications, the EEPROM is not replaceable. If the PCM is replaced, the new PCM will need to be programmed. Equipment containing the correct program and calibration for the vehicle is required to program the PCM.

Fuel Control Heated Oxygen Sensor (Pre Catalyst)

The fuel control heated oxygen sensor (Bank 1 HO2S 1) is mounted in the exhaust stream where it can monitor the oxygen content of the exhaust gas. The oxygen present in the exhaust gas reacts with the sensor to produce a voltage output. This voltage should constantly fluctuate from approximately 100 mV to 900 mV. The heated oxygen sensor voltage can be monitored with a Tech 2. By monitoring the voltage output of the oxygen sensor, the PCM calculates the pulse width command for the injectors to produce the proper combustion chamber mixture.

- Low HO2S voltage is a lean mixture which will result in a rich command to compensate.
- High HO2S voltage is a rich mixture which will result in a lean command to compensate.

An open Bank 1 HO2S 1 signal circuit will set a DTC P0134 and the Tech 2 will display a constant voltage between 400–500 mV. A constant voltage below 300 mV in the sensor circuit (circuit grounded) will set DTC P0131. A constant voltage above 800 mV in the circuit will set DTC P0132. A slow transition between 300mV and 800mV will cause a DTC P0133 to set. A fault in the Bank 1 HO2S 1 heater circuit will cause DTC P0135 to set. The PCM can also detect HO2S response problems. If the response time of an HO2S is determined to be too slow, the PCM will store a DTC that indicates degraded HO2S performance.



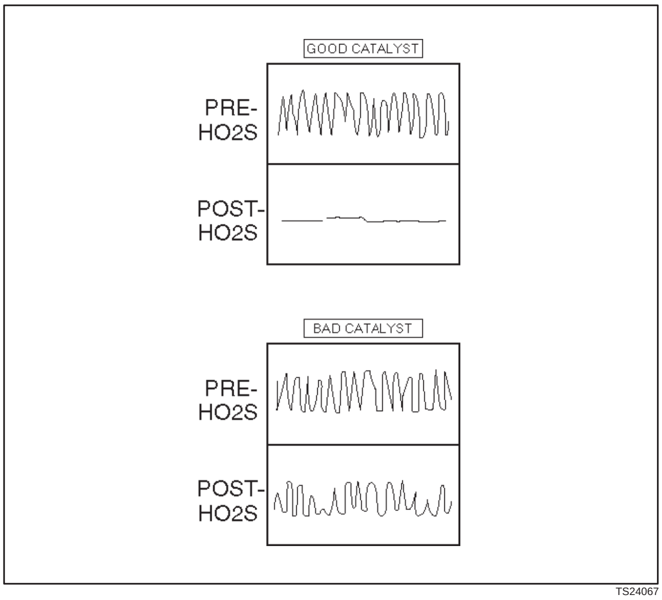
0012

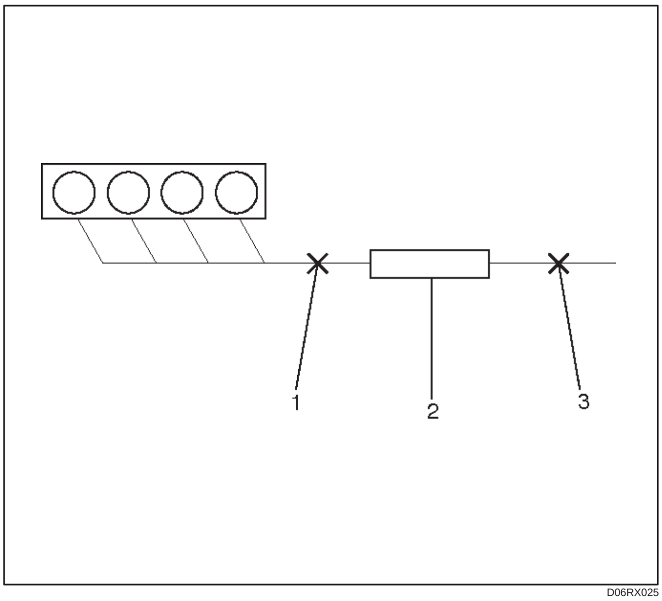
Catalyst Monitor Heated Oxygen Sensor (Post Catalyst)

Three–way catalytic converters are used to control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx). The catalyst within the converters promotes a chemical reaction. This reaction oxidizes the HC and CO present in the exhaust gas and converts them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx by converting it to nitrogen. The PCM can monitor this process using the Bank 1 HO2S 2 heated oxygen sensor. The Bank 1 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three–way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst. This indicates the catalyst's ability to efficiently convert exhaust gases. If the catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be more active than the signal produced by the Bank 1 HO2S 2 sensor.

The catalyst monitor sensors operate the same as the fuel control sensors. The Bank 1 HO2S 2 sensor's main function is catalyst monitoring, but it also has a limited role in fuel control. If a sensor output indicates a voltage either above or below the 450 mV bias voltage for an extended period of time, the PCM will make a slight adjustment to fuel trim to ensure that fuel delivery is correct for catalyst monitoring.

A problem with the Bank 1 HO2S 2 signal circuit will set DTC P0137, P0138, P0140, OR P0141, depending on the specific condition. A fault in the heated oxygen sensor heater element or its ignition feed or ground will result in lower oxygen sensor response. This may cause incorrect catalyst monitor diagnostic results.





Legend

(1) Bank 1 Sensor 1 (Fuel Control)
(2) Catalytic Converter
(3) Bank 1 Sensor 2 (Catalyst Monitor)

Intake Air Temperature (IAT) Sensor

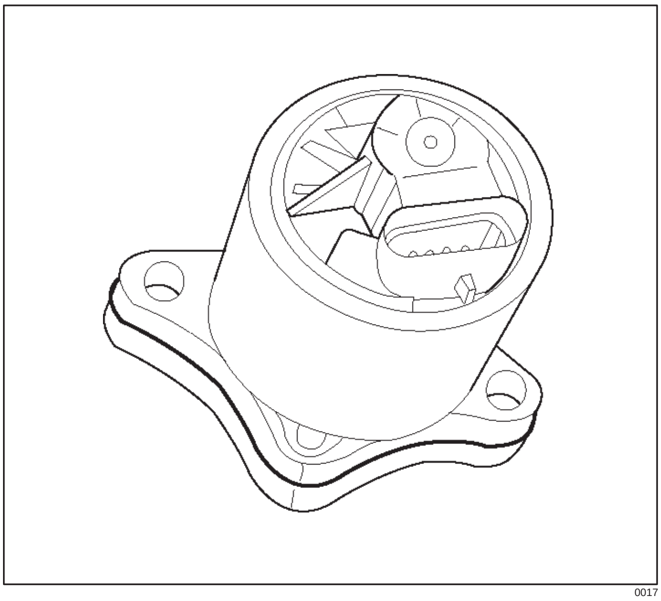
The intake air temperature (IAT) sensor is a thermistor which changes its resistance based on the temperature of air entering the engine. Low temperature produces a high resistance of about 100,000 Ω at –40˚C (–104˚F). High temperature causes low resistance of about 70 Ω at 130˚C (266˚F). The PCM supplies a 5–volt signal to the sensor through a resistor internal to the PCM, and then monitors the signal voltage. The voltage will be high when the incoming air is cold. The voltage will be low when the incoming air is hot. By measuring the voltage, the PCM calculates the incoming air temperature. The IAT sensor signal is used to adjust spark timing according to the incoming air density.

The Tech 2 displays the temperature of the air entering the engine. The temperature should read close to the ambient air temperature when the engine is cold and rise as underhood temperature increases. If the engine has not been run for several hours (overnight), the IAT sensor temperature and engine coolant temperature should read close to each other. A failure in the IAT sensor circuit will set DTC P0112, DTC P1111, DTC P1112, or DTC P0113.

Linear Exhaust Gas Recirculation (EGR) Control

The PCM monitors the exhaust gas recirculation (EGR) actual position and adjusts the pintle position accordingly. The PCM uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Manifold Absolute Pressure (MAP) sensor.



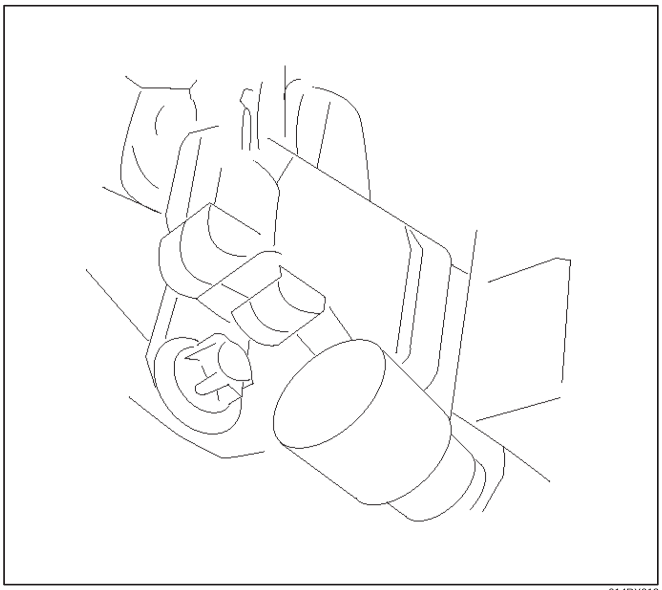
Manifold Absolute Pressure (MAP) Sensor

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition ON, engine not running or at wide–open throttle (low vacuum).

The MAP sensor is used to determine the following:

- Manifold pressure changes while the linear EGR flow test diagnostic is being run. Refer to DTC P0401.
- Engine vacuum level for other diagnostics.
- Barometric pressure (BARO).

If the PCM detects a voltage that is lower than the possible range of the MAP sensor, DTC P0107 will be set. A signal voltage higher than the possible range of the sensor will set DTC P0108. An intermittent low or high voltage will set DTC P1107 or P1106, respectively. The PCM can detect a shifted MAP sensor. The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that varies excessively above or below the calculated value, DTC P0106 will set.



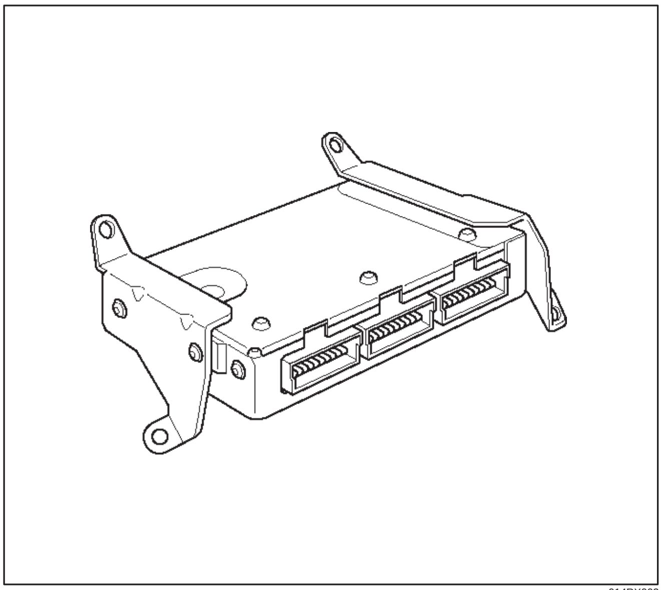
014RX013

Powertrain Control Module (PCM)

The powertrain control module (PCM) is located in the passenger compartment below the center console. The PCM controls the following:

- Fuel metering system.
- Ignition timing.
- On–board diagnostics for powertrain functions.

The PCM constantly observes the information from various sensors. The PCM controls the systems that affect vehicle performance. The PCM performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the Check Engine lamp, and store diagnostic trouble codes (DTCs). DTCs identify the problem areas to aid the technician in making repairs.



014RX002

PCM Function

The PCM supplies either 5 or 12 volts to power various sensors or switches. The power is supplied through resistors in the PCM which are so high in value that a test light will not light when connected to the circuit. In some cases, even an ordinary shop voltmeter will not give an accurate reading because its resistance is too low. Therefore, a digital voltmeter with at least 10 megΩ input impedance is required to ensure accurate voltage readings. Tool J 39200 meets this requirement.

The PCM controls output circuits such as the injectors, IAC, cooling fan relays, etc., by controlling the ground or the power feed circuit through transistors or through either of the following two devices:

- Output Driver Module (ODM)
- Quad Driver Module (QDM)

PCM Components

The PCM is designed to maintain exhaust emission levels to government mandated standards while providing excellent driveability and fuel efficiency. The PCM monitors numerous engine and vehicle functions via electronic sensors such as the throttle position (TP) sensor, heated oxygen sensor (HO2S), and vehicle speed sensor (VSS). The PCM also controls certain engine operations through the following:

- Fuel injector control
- Ignition control module
- Evaporative emission (EVAP) purge
- A/C clutch control

PCM Voltage Description

The PCM supplies a buffered voltage to various switches and sensors. It can do this because resistors in the PCM which are so high in value that a test light may not illuminate when connected to the circuit. An ordinary shop voltmeter may not give an accurate reading because the voltmeter input impedance is too low. Use a 10–megohm input impedance digital voltmeter (such as J 39200) to assure accurate voltage readings.

The input/output devices in the PCM include analog–to–digital converters, signal buffers, counters, and special drivers. The PCM controls most components with electronic switches which complete a ground circuit when turned ON. These switches are arranged in groups of 4 and 7, called either a quad driver module (QDM), which can independently control up to 4 output terminals, or Output Driver Module (ODM) which can independently control up to 7 outputs. Not all outputs are always used.

PCM Inputs/Outputs

Inputs – Operating Conditions Read

- Air Conditioning Compressor Clutch ON or OFF
- Engine Coolant Temperature
- Crankshaft Position
- Exhaust Oxygen Content
- Manifold Absolute Pressure
- Battery Voltage
- Throttle Position
- Fuel Tank Vapor Pressure
- Fuel Tank Level
- Exhaust Gas Recirculation (EGR) Feedback
- Knock

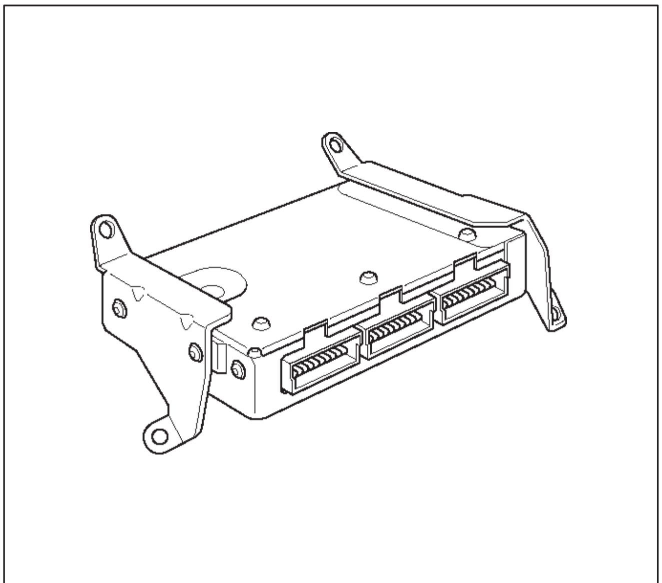
- Vehicle Speed
- Fuel Pump Voltage
- Power Steering Pressure
- Intake Air Temperature
- Camshaft Position

Outputs – Systems Controlled

- EVAP Canister Purge Solenoid
- Exhaust Gas Recirculation (EGR)
- Ignition Control
- Fuel Injector Control
- Idle Air Control
- Coolant Fan Relays
- Electric Fuel Pump Relay Compressor Clutch Relay
- Air Conditioning
- Diagnostics
  - OBD II Malfunction Indicator Lamp (Check Engine lamp)
  - Data Link Connector (DLC)
  - Data Output
- Tachometer Signal

PCM Service Precautions

The PCM is designed to withstand normal current draws associated with vehicle operation. Avoid over loading any circuit. When testing for opens and shorts, do not ground or apply voltage to any of the PCM's circuits unless instructed to do so. These circuits should only be tested using digital voltmeter J 39200. The PCM should remain connected to the PCM or to a recommended breakout box.



014RX002

Reprogramming the PCM

The Rodeo allows reprogramming of the PCM without removing it from the vehicle. This provides a flexible and cost–effective method of making changes in software calibrations.

Refer to the latest Isuzu Technical Communication System information for reprogramming or flashing procedures.

Tooth Error Correction (TEC) Service Bay Guidelines

Deceleration Fuel Cut–Off

This procedure is very convenient because it can be done in the service bay.

CAUTION: Appropriate safety measures should be taken to assure the safest conditions possible for all those people in the nearby vicinity of where the tooth error learn procedure is being performed.

Vehicle Preparation Requirements and Safety Issues

The vehicle needs sufficient engine oil, automatic transmission fluid, manual transmission gear box oil, power steering fluid, coolant, and brake fluid. Engine noise and exhaust should be considered by each assembly plant when deciding the location to perform the tooth error learn. Proper safety precautions should be taken. Anticipate unusual events such as a manual transmission accidentally being bumped into gear or a foot slipping off a clutch at high engine speed. The vehicle may cause other vehicles to be hit. If the transmission is in Park during the high engine speeds, the transmission Park Ratchet experiences excessive vibration and may momentarily slip. The vehicle is typically then in a Neutral type state and may roll, especially if the vehicle is on an incline. Under this condition the transmission should not slip into gear.

The following summarizes the engine preparation requirements for a tooth error learn.

Requirements:

1. At least 4 minutes of engine run time is required to have occurred at lest once during the life of the vehicle to insure that all of the oil passages are flushed of debris from machining, casting, and assembly.
2. At least 5 seconds of engine run time is required during the same key cycle as the tooth error learn to fill the oil passages and provide proper lubrication. 10 seconds is the preferred guideline.
3. At least 65 degrees Celsius Coolant temperature. Engine oil temperature of 38 degrees Celsius is required for lubrication, which correlates (in most engines) to 65 degrees Celsius Coolant temperature. This is a recommendation to insure a sufficiently lubricated engine 65 degrees Celsius Coolant temperature correlates to an engine oil temperature of 38 degrees Celsius.
4. Vehicle must be in Park or Neutral. For a manual transmission vehicle, the clutch does not need to be depressed. The tooth error learn may be performed with either:
   1. Gear box in Neutral, it does not matter if the clutch is depressed or not.
   2. Gear Box in a gear and clutch depressed.

NOTE: The first option is the recommended option due to safety concerns. The second option has the risk of the operators foot slipping off of the clutch with the vehicle being revved up and in gear.

5. A/C should always be turned OFF before performing the TEC learn procedure.
6. A Class II command from the Tech 2 is required to invoke the TEC learn procedure.
7. No Camshaft and/or Crankshaft Sensor DTC Codes present.

Tooth Error Learn Procedures

The following steps are required to learn the tooth error once the above mentioned vehicle preparation requirements are met:

1. Make sure that the tooth error learn procedure has been invoked with the Tech 2, other wise when the throttle is depressed, the RPM would go to the high RPM fuel cutoff and not be cutoff at the lower tooth error learning fuel cutoff limit.
2. Depress the brake pedal for safety reasons.
3. Depress the throttle pedal to Wide Open Throttle (WOT) and keep the throttle at 100% for the duration of the Tooth Error Correction (TEC) learning process until the TEC is learned or the number of attempts to learn has been exceeded. The RPM will be limited to the upper TEC RPM limit until one of the two above mentioned conditions are met and the throttle is released to less than 5% Throttle Position Sensor (TPS). After this, the RPM limit will be the normal redline RPM limit.
4. The tooth error learning diagnostic will learn the tooth error as the engine decelerates in fuel cutoff.
5. During the tooth error learning procedure. TEC specific information is available which will indicate that the tooth error was properly learned and completed.

Considerations For Locating The Tooth Error Learning Procedure

The area that the tooth error learn is done should be well ventilated or have vehicle exhaust elimination system which attaches to the tail pipe and draws the vehicle exhaust out of the building.

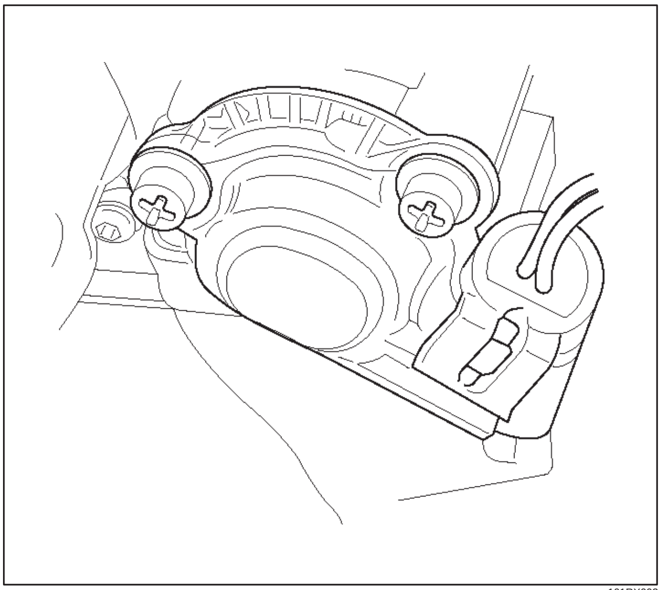
CAUTION: Appropriate safety measures should be taken to assure the safest conditions possible for all those people in the nearby vicinity of where the tooth error learn procedure is being performed. If possible, anchored or secured safety barriers should be in place in at least the front of the vehicle and in the back of the vehicle if possible to reduce the possibility of accidents. The figure below shows the proper placement of a frontal safety barrier.

The area that the tooth error learn is done should be well ventilated or have vehicle exhaust elimination system which attaches to the tail pipe and draws the vehicle exhaust out of the building.

Throttle Position (TP) Sensor

The throttle position (TP) sensor is a potentiometer connected to the throttle shaft on the throttle body. The PCM monitors the voltage on the signal line and calculates throttle position. As the throttle valve angle is changed (accelerator pedal moved), the TP sensor signal also changes. At a closed throttle position, the output of the TP sensor is about 0.25 volts. As the throttle valve opens, the output increases so that at wide open throttle (WOT), the output voltage should be about 4.75 volts.

The PCM calculates fuel delivery based on throttle valve angle (driver demand). A broken or loose TP sensor may cause intermittent bursts of fuel from an injector and unstable idle because the PCM thinks the throttle is moving. A hard failure in the TP sensor 5–volt reference or signal circuits will set either a DTC P0122 or DTC P0123. A hard failure with the TP sensor ground circuit may set DTC P0123 and DTC P0122. Once a DTC is set, the PCM will use an artificial default value based on engine RPM and mass air flow for the throttle position, and some vehicle performance will return. A high idle may result when either DTC P0122 or DTC P0123 is set. The PCM can detect intermittent TP sensor faults. DTC P1121 or DTC P1122 will set if an intermittent high or low circuit failure is being detected.



101RX003

Transmission Range Switch

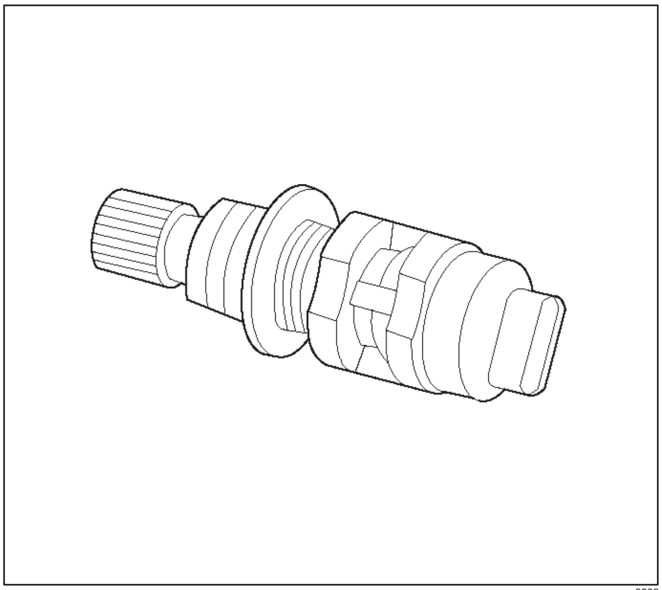
IMPORTANT: The vehicle should not be driven with the transmission range switch disconnected; idle quality will be affected.

The four inputs from the transmission range switch indicate to the PCM which position is selected by the transmission selector lever. This information is used for ignition timing, EVAP canister purge, EGR and IAC valve operation.

For more information on the transmission range switch, refer to 4L30–E Automatic Transmission.

Vehicle Speed Sensor (VSS)

The PCM determines the speed of the vehicle by converting a pulsing voltage signal from the vehicle speed sensor (VSS) into miles per hour. The PCM uses this signal to operate the speedometer.



0008

Use of Circuit Testing Tools

Do not use a test light to diagnose the powertrain electrical systems unless specifically instructed by the diagnostic procedures. Use Connector Test Adapter Kit J 35616 whenever diagnostic procedures call for probing connectors.

Aftermarket Electrical And Vacuum Equipment

Aftermarket (add–on) electrical and vacuum equipment is defined as any equipment which connects to the vehicle's electrical or vacuum systems that is installed on a vehicle after it leaves the factory. No allowances have been made in the vehicle design for this type of equipment.

NOTE: No add–on vacuum equipment should be added to this vehicle.

NOTE: Add–on electrical equipment must only be connected to the vehicle's electrical system at the battery (power and ground).

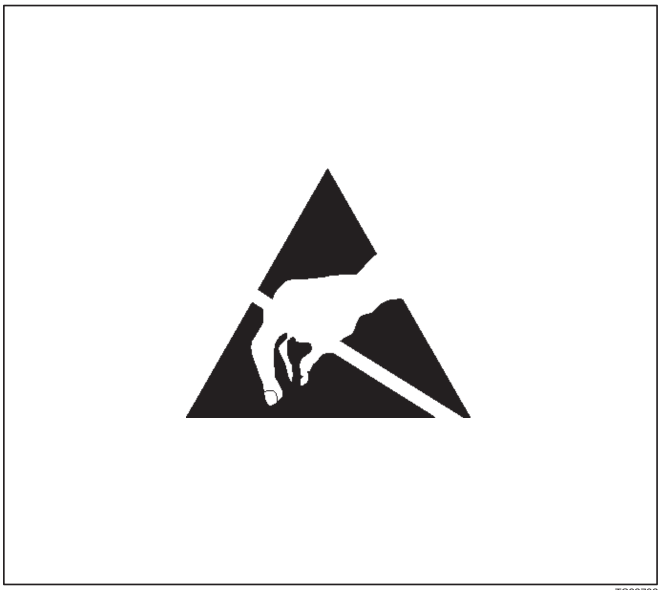
Add–on electrical equipment, even when installed to these guidelines, may still cause the powertrain system to malfunction. This may also include equipment not connected to the vehicle electrical system such as portable telephones and radios. Therefore, the first step in diagnosing any powertrain problem is to eliminate all aftermarket electrical equipment from the vehicle. After this is done, if the problem still exists, it may be diagnosed in the normal manner.

Electrostatic Discharge Damage

Electronic components used in the PCM are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4000 volts for a person to feel even the zap of a static discharge.

There are several ways for a person to become statically charged. The most common methods of charging are by friction and induction.

- An example of charging by friction is a person sliding across a vehicle seat.
- Charge by induction occurs when a person with well–insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore it is important to use care when handling and testing electronic components.



TS23793

NOTE: To prevent possible electrostatic discharge damage, follow these guidelines:

- Do not touch the PCM connector pins or soldered components on the PCM circuit board.
- Do not touch any electronic sensor module component leads.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

Upshift Lamp

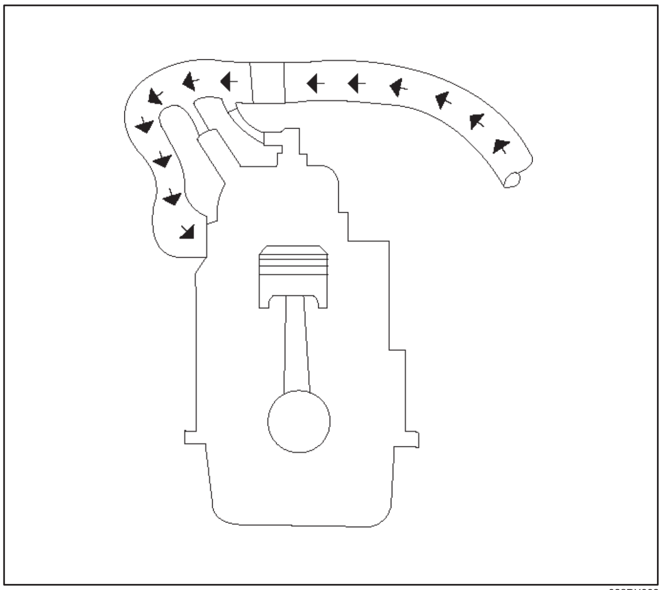
Refer to Up shift lamp diagnosis.

GENERAL DESCRIPTION — AIR INDUCTION

Air Induction System

The air induction system filters contaminants from the outside air, and directs the progress of the air as it is drawn into the engine. A remote–mounted air cleaner prevents dirt and debris in the air from entering the engine. The air duct assembly routes filtered air to the throttle body. Air enters the engine by the following steps:

1. Through the throttle body.
2. Into the intake manifold.
3. Through the cylinder head intake ports.
4. Into the cylinders.



028RX002

GENERAL DESCRIPTION — FUEL METERING

Acceleration Mode

The PCM provides extra fuel when it detects a rapid increase in the throttle position and the air flow.

Accelerator Controls

The accelerator control system is a cable–type system with specific linkage adjustments.
Refer to Cable Adjustment.

Battery Voltage Correction Mode

When battery voltage is low, the PCM will compensate for the weak spark by increasing the following:

- The amount of fuel delivered.
- The idle RPM.

CMP Signal

The PCM uses the camshaft position (CMP) sensor signal to determine the position of the number 1 piston during its power stroke, allowing the PCM to calculate true sequential multiport fuel injection (SFI). Loss of this signal will set a DTC P0341 or DTC P0342. If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection based on the last fuel injection pulse, and the engine will continue to run. The engine can be restarted and will run in the calculated sequential mode with the fault is present, with a 1–in–4 chance of being correct.

Clear Flood Mode

Clear a flooded engine by pushing the accelerator pedal down all the way. The PCM then de–energizes the fuel injectors. The PCM holds the fuel injectors de–energized as long as the throttle remains above 80% and the engine speed is below 800 RPM. If the throttle position becomes less than 80%, the PCM again begins to pulse the injectors ON and OFF, allowing fuel into the cylinders.

Deceleration Fuel Cutoff (DFCO) Mode

The PCM reduces the amount of fuel injected when it detects a decrease in the throttle position and the air flow. When deceleration is very fast, the PCM may cut off fuel completely for short periods.

Engine Speed/Vehicle Speed/ Fuel Disable Mode

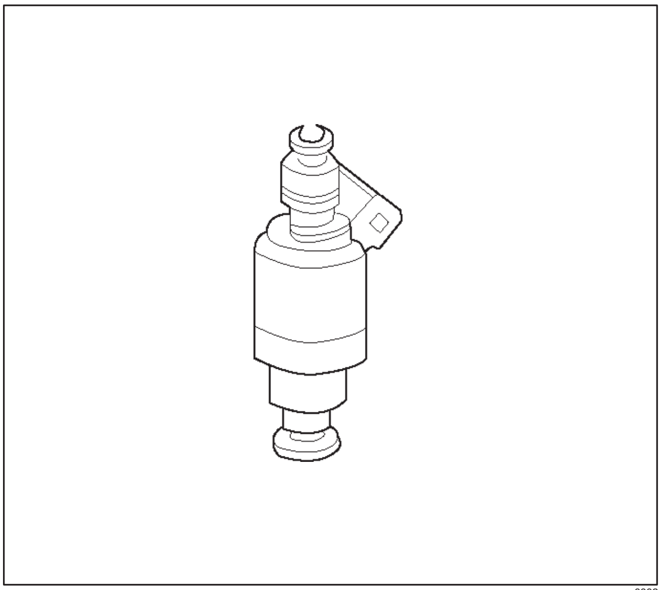
The PCM monitors engine speed. It turns off the fuel injectors when the engine speed increases above 6000 RPM. The fuel injectors are turned back on when engine speed decreases below 5750 RPM.

Fuel Cutoff Mode

No fuel is delivered by the fuel injectors when the ignition is OFF. This prevents engine run–on. In addition, the PCM suspends fuel delivery if no reference pulses are detected (engine not running) to prevent engine flooding.

Fuel Injector

The sequential multiport fuel injection (SFI) fuel injector is a solenoid–operated device controlled by the PCM. The PCM energizes the solenoid, which opens a valve to allow fuel delivery.
The fuel is injected under pressure in a conical spray pattern at the opening of the intake valve. Excess fuel not used by the injectors passes through the fuel pressure regulator before being returned to the fuel tank.
A fuel injector which is stuck partly open will cause a loss of fuel pressure after engine shut down, causing long crank times.



0003

Fuel Metering System Components

The fuel metering system is made up of the following parts:

- The fuel injectors.
- The throttle body.
- The fuel rail.
- The fuel pressure regulator.
- The PCM.
- The crankshaft position (CKP) sensor.
- The camshaft position (CMP) sensor.
- The idle air control (IAC) valve.
- The fuel pump.
- The fuel pump relay.
- The fuel tank vapor pressure sensor.

Basic System Operation

The fuel metering system starts with the fuel in the fuel tank. An electric fuel pump, located in the fuel tank, pumps fuel to the fuel rail through an in–line fuel filter. The pump is designed to provide fuel at a pressure above the pressure needed by the injectors. A fuel pressure regulator in the fuel rail keeps fuel available to the fuel injectors at a constant pressure. A return line delivers unused fuel back to the fuel tank. Refer to Section 6C for further information on the fuel tank, line filter, and fuel pipes.

Fuel Metering System Purpose

The basic function of the air/fuel metering system is to control the air/fuel delivery to the engine. Fuel is delivered to the engine by individual fuel injectors mounted in the intake manifold near each intake valve.

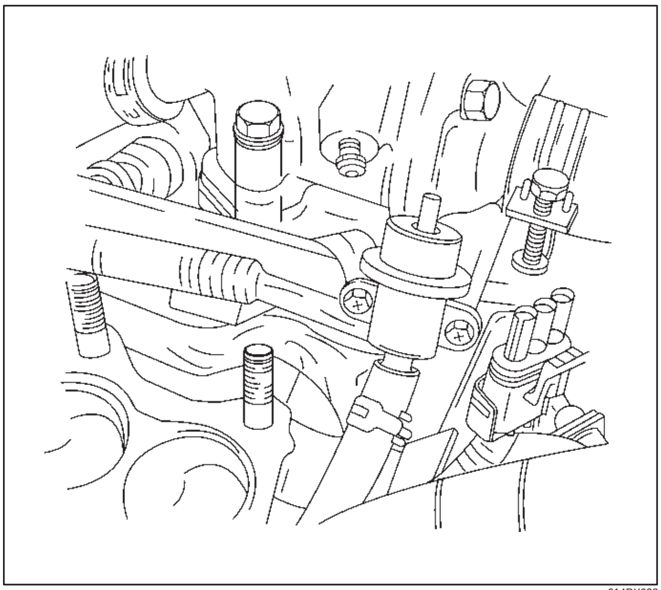
The main control sensor is the heated oxygen sensor (HO2S) located in the exhaust system. The HO2S tells the PCM how much oxygen is in the exhaust gas. The PCM changes the air/fuel ratio to the engine by controlling the amount of time that the fuel injector is ON. The best mixture to minimize exhaust emissions is 14.7 parts of air to 1 part of gasoline by weight, which allows the catalytic converter to operate most efficiently. Because of the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a ”Closed Loop” system.

The PCM monitors signals from several sensors in order to determine the fuel needs of the engine. Fuel is delivered under one of several conditions called ”modes.” All modes are controlled by the PCM.

Fuel Pressure Regulator

The fuel pressure regulator is a diaphragm–operated relief valve mounted on the fuel rail with fuel pump pressure on one side and manifold pressure on the other side. The fuel pressure regulator maintains the fuel pressure available to the injector at three times barometric pressure adjusted for engine load. It may be serviced separately.

If the pressure is too low, poor performance and a DTC P0171, or DTC P1171 will be the result. If the pressure is too high, a DTC P0172 will be the result. For information on diagnosing fuel pressure conditions, refer to Fuel System Diagnosis.



014RX038

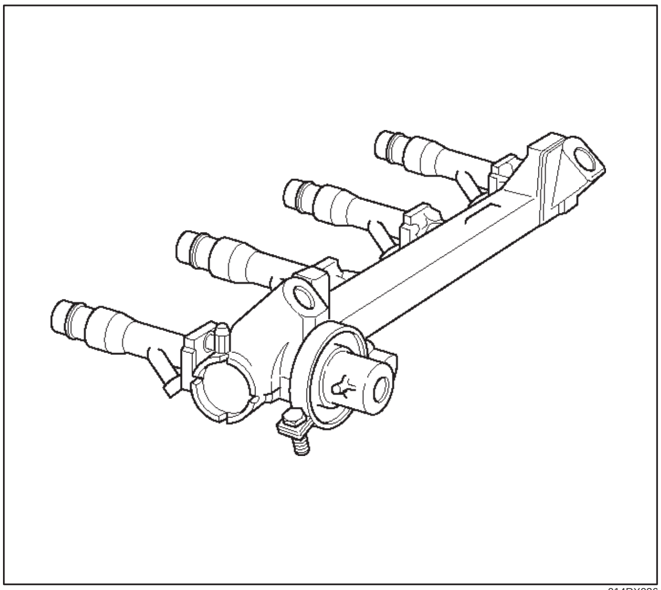
Fuel Pump Electrical Circuit

When the key is first turned ON, the PCM energizes the fuel pump relay for two seconds to build-up the fuel pressure quickly. If the engine is not started within two seconds, the PCM shuts the fuel pump off and waits until the engine is cranked. When the engine is cranked and the 58X crankshaft position signal has been detected by the PCM, the PCM supplies 12 volts to the fuel pump relay to energize the electric in–tank fuel pump.

An inoperative fuel pump will cause a ”no–start” condition. A fuel pump which does not provide enough pressure will result in poor performance.

Fuel Rail

The fuel rail is mounted to the top of the engine and distributes fuel to the individual injectors. Fuel is delivered to the fuel inlet tube of the fuel rail by the fuel lines. The fuel goes through the fuel rail to the fuel pressure regulator. The fuel pressure regulator maintains a constant fuel pressure at the injectors. Remaining fuel is then returned to the fuel tank.



014RX036

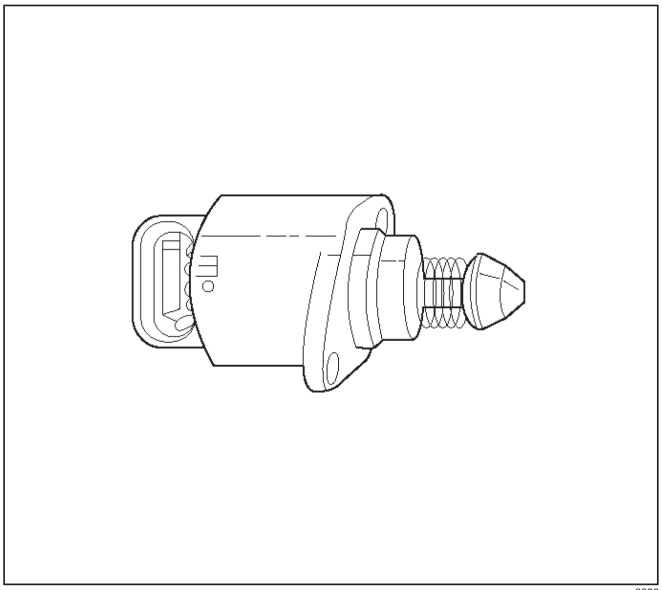
Idle Air Control (IAC) Valve

The purpose of the idle air control (IAC) valve is to control engine idle speed, while preventing stalls due to changes in engine load. The IAC valve, mounted in the throttle body, controls bypass air around the throttle plate. By moving the conical valve (pintle) in (to decrease air flow) or out (to increase air flow), a controlled amount of air can move around the throttle plate. If the RPM is too low, the PCM will retract the IAC pintle, resulting in more air moving past the throttle plate to increase the RPM. If the RPM is too high, the PCM will extend the IAC pintle, allowing less air to move past the throttle plate, decreasing the RPM.

The IAC pintle valve moves in small steps called counts. During idle, the proper position of the IAC pintle is calculated by the PCM based on battery voltage, coolant temperature, engine load, and engine RPM. If the RPM drops below a specified value, and the throttle plate is closed, the PCM senses a near–stall condition. The PCM will then calculate a new IAC pintle valve position to prevent stalls.

If the IAC valve is disconnected and reconnected with the engine running, the idle RPM will be wrong. In this case, the IAC must be reset. The IAC resets when the key is cycled ON then OFF. When servicing the IAC, it should only be disconnected or connected with the ignition OFF.

The position of the IAC pintle valve affects engine start–up and the idle characteristics of the vehicle. If the IAC pintle is fully open, too much air will be allowed into the manifold. This results in high idle speed, along with possible hard starting and a lean air/fuel ratio. DTC P0507 may set. If the IAC pintle is stuck closed, too little air will be allowed in the manifold. This results in a low idle speed, along with possible hard starting and a rich air/fuel ratio. DTC P0506 may set. If the IAC pintle is stuck part–way open, the idle may be high or low and will not respond to changes in the engine load.



0006

Run Mode

The run mode has the following two conditions:

- Open Loop
- Closed Loop

When the engine is first started, the system is in ”Open Loop” operation. In ”Open Loop,” the PCM ignores the signal from the heated oxygen sensor (HO2S). It calculates the air/fuel ratio based on inputs from the TP, ECT, and MAP sensors.

The system remains in ”Open Loop” until the following conditions are met:

- The HO2S has a varying voltage output showing that it is hot enough to operate properly (this depends on temperature).
- The ECT has reached a specified temperature.
- A specific amount of time has elapsed since starting the engine.
- Engine speed has been greater than a specified RPM since start–up.

The specific values for the above conditions vary with different engines and are stored in the programmable read only memory (PROM). When these conditions are met, the system enters ”Closed Loop” operation. In ”Closed Loop”, the PCM calculates the air/fuel ratio (injector on–time) based on the signal from the HO2S. This allows the air/fuel ratio to stay very close to 14.7:1.

Starting Mode

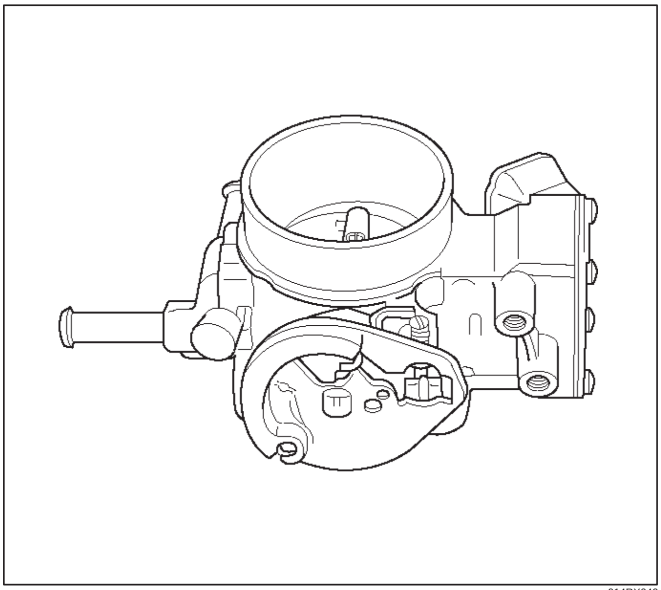
When the ignition is first turned ON, the PCM energizes the fuel pump relay for two seconds to allow the fuel pump to build up pressure. The PCM then checks the engine coolant temperature (ECT) sensor and the throttle position (TP) sensor to determine the proper air/fuel ratio for starting.

The PCM controls the amount of fuel delivered in the starting mode by adjusting how long the fuel injectors are energized by pulsing the injectors for very short times.

Throttle Body Unit

The throttle body has a throttle plate to control the amount of air delivered to the engine. The TP sensor and IAC valve are also mounted on the throttle body.

Vacuum ports located behind the throttle plate provide the vacuum signals needed by various components. Engine coolant is directed through a coolant cavity in the throttle body to warm the throttle valve and to prevent icing.

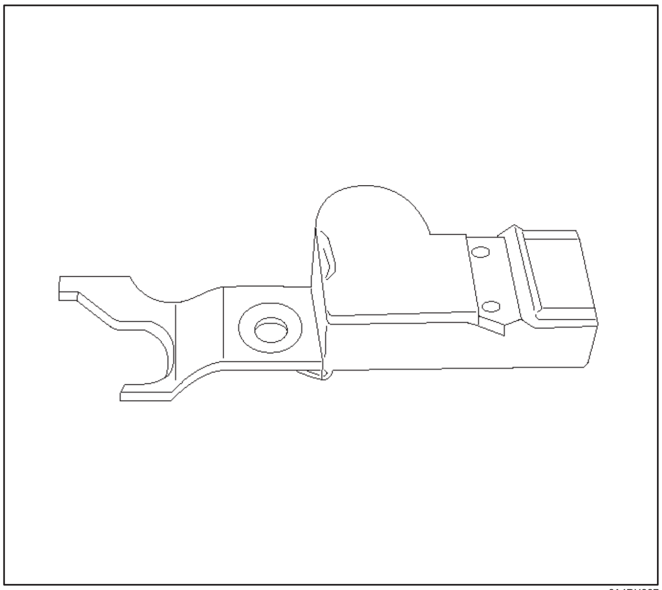


014RX040

GENERAL DESCRIPTION — ELECTRONIC IGNITION SYSTEM

Camshaft Position (CMP) Sensor

The camshaft position (CMP) sensor sends a signal to the PCM. The PCM uses this signal as a ”sync pulse” to trigger the injectors in the proper sequence. The PCM uses the CMP signal to indicate the position of the #1 piston during its power stroke. The CMP allows the PCM to calculate true sequential fuel injection (SFI) mode of operation. If the PCM detects an incorrect CMP signal while the engine is running, DTC P0341 will set.
If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection mode based on the last fuel injection pulse, and the engine will continue to run. It will run in the calculated sequential mode with a 1–in–4 chance of the injector being correct.
For additional information, refer to DTC P0342.



014RX007

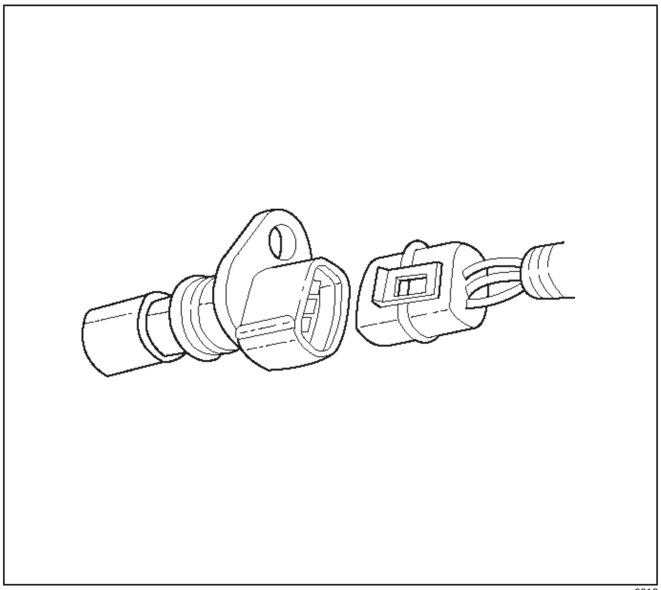
Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position. For additional information, refer to Electronic Ignition System.

Electronic Ignition

The electronic ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide optimum engine performance, fuel economy, and control of exhaust emissions, the PCM controls the spark advance of the ignition system. Electronic ignition has the following advantages over a mechanical distributor system:

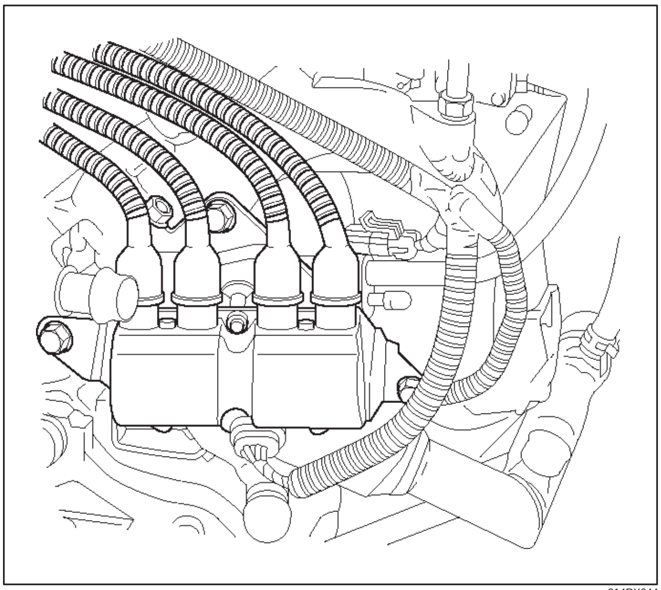
- No moving parts.
- Less maintenance.
- Remote mounting capability.
- No mechanical load on the engine.
- More coil cooldown time between firing events.
- Elimination of mechanical timing adjustments.
- Increased available ignition coil saturation time.



0013

Ignition Coils

The 2.2L engine uses 2 ignition coils, 1 per 2 cylinders. A two–wire connector provides a 12–volt primary supply through the 15–amp ignition coil fuse, and the ground wire is connected to a ground–switching ignition module. Radio frequency interference produced by the coil is controlled by a condenser which is mounted near the ignition coil.



014RX044

Ignition Control

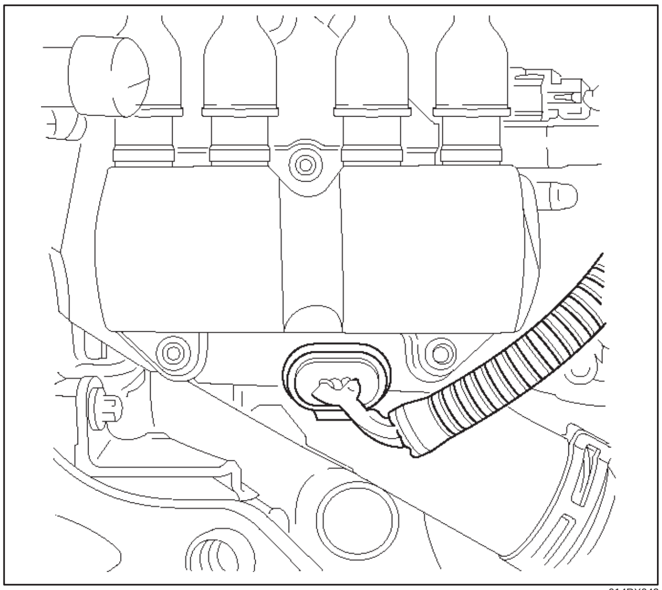
The ignition control (IC) spark timing is the PCM’s method of controlling the spark advance and the ignition dwell.
The IC spark advance and the ignition dwell are calculated by the PCM using the following inputs:

- Engine speed.
- Crankshaft position (58X reference).
- Camshaft position (CMP) sensor.

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Vehicle speed (vehicle speed sensor).
- PCM and ignition system supply voltage.

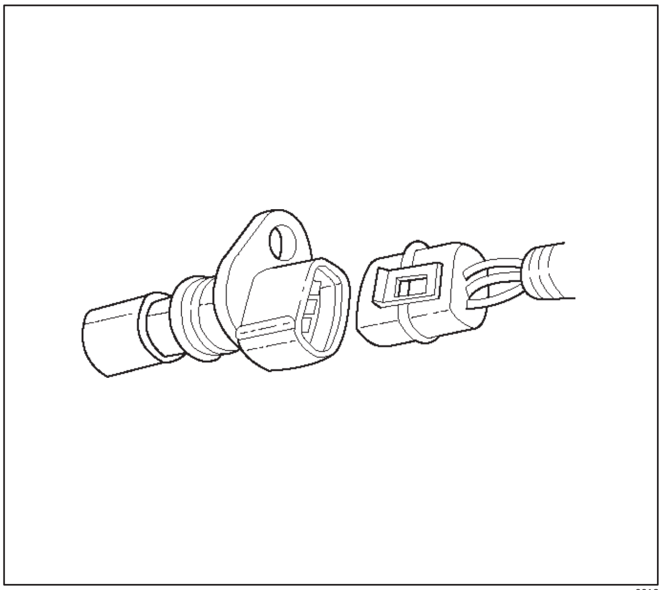
Ignition Control Module (ICM)

The powertrain control module (PCM) controls engine ignition through a solid–state switching unit called the ignition control module (ICM). The software in the PCM uses input from several sensors to determine the timing, duration, and strength of the spark.



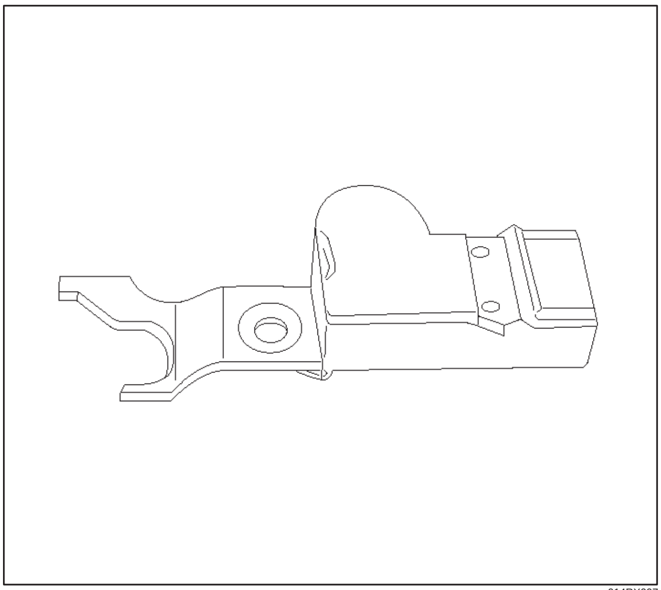
014RX042

- The crankshaft position (CKP) sensor sends the PCM a 58X signal related to the exact position of the crankshaft.



0013

- The camshaft position (CMP) sensor sends a signal related to the position of the camshaft.



014RX007

Based on these sensor signals, as well as engine load and engine coolant temperature information, the PCM controls the switching function of the ICM by sending it a 5V signal. As long as the ICM receives the signal, it allows battery voltage to the ignition coil. That voltage allows a magnetic field to build in the coil.

When the PCM requires a spark plug to fire, it shuts off the 5V signal to the ICM grounding it internally. This triggers the ICM to switch off the battery voltage to the ignition coil, which causes the field to collapse. The lines of magnetic force pass through the secondary portion of the coil as they collapse. As they intersect the coil, they induce high voltage in the secondary ignition circuit which travels toward ground through the spark plug.

Ignition Control PCM Output

The PCM provides a zero volt (actually about 100 mV to 200 mV) or a 5–volt output signal to the ignition control (IC) module. When the ignition control (IC) module receives the 5–volt signal from the PCM, it provides a ground path for the B+ supply to the primary side of the coil and creates a magnetic field in the coil. When the PCM shuts off the 5–volt signal to the ignition control module, the ground path for the primary coil is broken. The magnetic field collapses and induces a high voltage secondary impulse which fires the spark plug and ignites the air/fuel mixture.

Powertrain Control Module (PCM)

The PCM is responsible for maintaining proper spark and fuel injection timing for all driving conditions. To provide optimum driveability and emissions, the PCM monitors the input signals from the following components in order to calculate spark timing:

- Engine coolant temperature (ECT) sensor.
- Intake air temperature (IAT) sensor.
- Throttle position (TP) sensor.
- Vehicle speed sensor (VSS).
- Crankshaft position (CKP) sensor.

Spark Plug

Although worn or dirty spark plugs may give satisfactory operation at idling speed, they frequently fail at higher engine speeds. Faulty spark plugs may cause poor fuel economy, power loss, loss of speed, hard starting and generally poor engine performance. Follow the scheduled maintenance service recommendations to ensure satisfactory spark plug performance. Refer to Maintenance and Lubrication.

Normal spark plug operation will result in brown to grayish–tan deposits appearing on the insulator portion of the spark plug. A small amount of red–brown, yellow, and white powdery material may also be present on the insulator tip around the center electrode. These deposits are normal combustion by–products of fuels and lubricating oils with additives. Some electrode wear will also occur.

Engines which are not running properly are often referred to as "misfiring." This means the ignition spark is not igniting the air/fuel mixture at the proper time. While other ignition and fuel system causes must also be considered, possible causes include ignition system conditions which allow the spark voltage to reach ground in some other manner than by jumping across the air gap at the tip of the spark plug, leaving the air/fuel mixture unburned. Refer to DTC P0300.

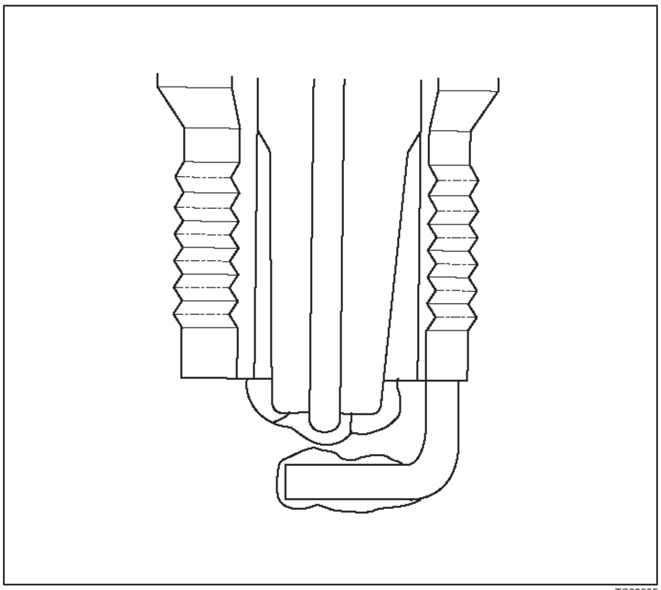
Misfiring may also occur when the tip of the spark plug becomes overheated and ignites the mixture before the spark jumps. This is referred to as "pre–ignition."

Spark plugs may also misfire due to fouling, excessive gap, or a cracked or broken insulator. If misfiring occurs before the recommended replacement interval, locate and correct the cause.

Carbon fouling of the spark plug is indicated by dry, black carbon (soot) deposits on the portion of the spark plug in the cylinder. Excessive idling and slow speeds under light engine loads can keep the spark plug temperatures so low that these deposits are not burned off. Very rich fuel mixtures or poor ignition system output may also be the cause.Refer to DTC P0172.

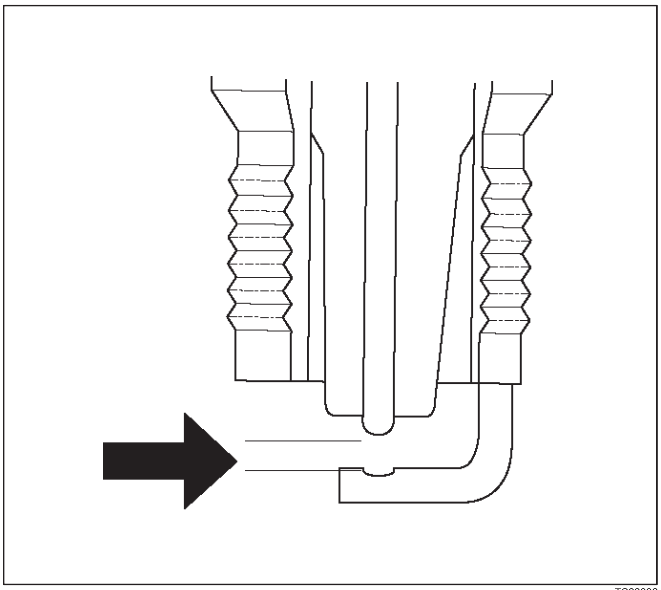
Oil fouling of the spark plug is indicated by wet oily deposits on the portion of the spark plug in the cylinder, usually with little electrode wear. This may be caused by oil during break–in of new or newly overhauled engines.

Deposit fouling of the spark plug occurs when the normal red–brown, yellow or white deposits of combustion by–products become sufficient to cause misfiring. In some cases, these deposits may melt and form a shiny glaze on the insulator around the center electrode. If the fouling is found in only one or two cylinders, valve stem clearances or intake valve seals may be allowing excess lubricating oil to enter the cylinder, particularly if the deposits are heavier on the side of the spark plug facing the intake valve.



TS23995

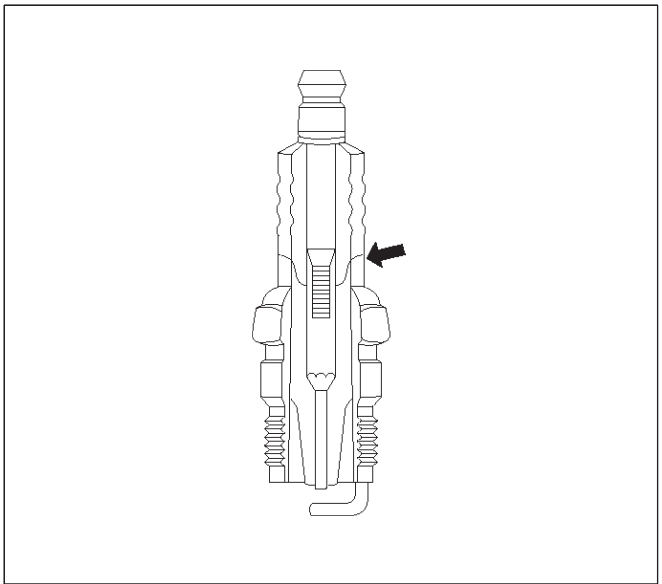
Excessive gap means that the air space between the center and the side electrodes at the bottom of the spark plug is too wide for consistent firing. This may be due to improper gap adjustment or to excessive wear of the electrode during use. A check of the gap size and comparison to the gap specified for the vehicle in Maintenance and Lubrication will tell if the gap is too wide. A spark plug gap that is too small may cause an unstable idle condition. Excessive gap wear can be an indication of continuous operation at high speeds or with engine loads, causing the spark to run too hot. Another possible cause is an excessively lean fuel mixture.



TS23992

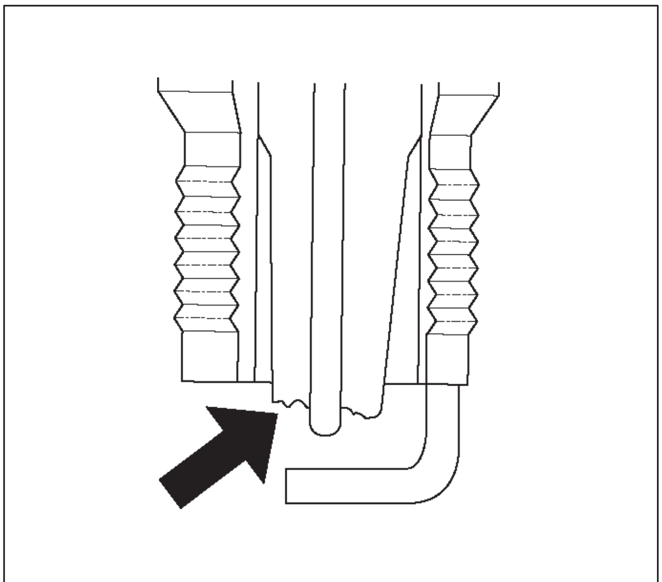
Low or high spark plug installation torque or improper seating can result in the spark plug running too hot and can cause excessive center electrode wear. The plug and the cylinder head seats must be in good contact for proper heat transfer and spark plug cooling. Dirty or damaged threads in the head or on the spark plug can keep it from seating even though the proper torque is applied. Once spark plugs are properly seated, tighten them to the torque shown in the Specifications Table. Low torque may result in poor contact of the seats due to a loose spark plug. Overtightening may cause the spark plug shell to be stretched and will result in poor contact between the seats. In extreme cases, exhaust blow–by and damage beyond simple gap wear may occur.

Cracked or broken insulators may be the result of improper installation, damage during spark plug re–gapping, or heat shock to the insulator material. Upper insulators can be broken when a poorly fitting tool is used during installation or removal, when the spark plug is hit from the outside, or is dropped on a hard surface. Cracks in the upper insulator may be inside the shell and not visible. Also, the breakage may not cause problems until oil or moisture penetrates the crack later.



TS23994

A broken or cracked lower insulator tip (around the center electrode) may result from damage during re–gapping or from ”heat shock” (spark plug suddenly operating too hot).



TS23993

- Damage during re–gapping can happen if the gapping tool is pushed against the center electrode or the insulator around it, causing the insulator to crack. When re–gapping a spark plug, make the adjustment by bending only the ground side terminal, keeping the tool clear of other parts.
- ”Heat shock” breakage in the lower insulator tip generally occurs during several engine operating conditions (high speeds or heavy loading) and may be caused by over–advanced timing or low grade fuels. Heat shock refers to a rapid increase in the tip temperature that causes the insulator material to crack.

Spark plugs with less than the recommended amount of service can sometimes be cleaned and re–gapped, then returned to service. However, if there is any doubt about the serviceability of a spark plug, replace it. Spark plugs with cracked or broken insulators should always be replaced.

A/C CLUTCH DIAGNOSIS

A/C Clutch Circuit Operation

A 12–volt signal is supplied to the A/C request input of the PCM when the A/C is selected through the A/C control switch.

The A/C compressor clutch relay is controlled through the PCM. This allows the PCM to modify the idle air control position prior to the A/C clutch engagement for better idle quality. If the engine operating conditions are within their specified calibrated acceptable ranges, the PCM will enable the A/C compressor relay. This is done by providing a ground path for the A/C relay coil within the PCM. When the A/C compressor relay is enabled, battery voltage is supplied to the compressor clutch coil. The PCM will enable the A/C compressor clutch whenever the engine is running and the A/C has been requested. The PCM will not enable the A/C compressor clutch if any of the following conditions are met:

- The engine speed is greater than 6315 RPM.
- The ECT is greater than 119˚C (246˚F).
- The throttle is more than 80% open.

A/C Clutch Circuit Purpose

The A/C compressor operation is controlled by the powertrain control module (PCM) for the following reasons:

- It improves idle quality during compressor clutch engagement.
- It improves wide open throttle (WOT) performance.
- It provides A/C compressor protection from operation with incorrect refrigerant pressures.

The A/C electrical system consists of the following components:

1. The A/C control switch.
2. The A/C refrigerant pressure switches.
3. The A/C compressor clutch.
4. The A/C compressor clutch relay.
5. The PCM.

A/C Request Signal

This signal tells the PCM when the A/C mode is selected at the A/C control switch. The PCM uses this input to adjust the idle speed before turning on the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.

For A/C wiring diagrams and diagnosis for the A/C electrical system, refer to A/C Clutch Circuit Diagnosis.

GENERAL DESCRIPTION — EVAPORATIVE EMISSION (EVAP) SYSTEM

EVAP Emission Control System Purpose

The basic evaporative emission (EVAP) control system used on all vehicles is the charcoal canister storage method. Gasoline vapors from the fuel tank flow into the canister through the inlet labeled ”TANK.” These vapors are absorbed into the activated carbon (charcoal) storage device (canister) in order to hold the vapors when the vehicle is not operating. The canister is purged by PCM control when the engine coolant temperature is over 60˚C (140˚F), the IAT reading is over 10˚C (50˚F), and the engine has been running. Air is drawn canister through the air inlet grid. The air mixes with the vapor and the mixture is drawn into the intake manifold.

EVAP Emission Control System Operation

The EVAP canister purge is controlled by a solenoid valve that allows the manifold vacuum to purge the canister. The Powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge on). The EVAP purge solenoid control is pulse–width modulated (PWM) (turned on and off several times a second). The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM. The output is commanded when the appropriate conditions have been met. These conditions are:

- The engine is fully warmed up.
- The engine has been running for a specified time.
- The IAT reading is above 10˚C (50˚F).
- A continuous purge condition with no purge commanded by the PCM willset a DTC P1441.

Poor idle, stalling and Poor driveability can be caused by:

- A malfunctioning purge solenoid.
- A damaged canister.
- Hoses that are split, cracked, or not connected properly.

Enhanced Evaporative Emission Control System

The basic purpose of the Enhanced Evaporative Emissions control system is the same as other EVAP systems. A charcoal–filled canister captures and stores gasoline fumes. When the PCM determines that the time is right, it opens a purge valve which allows engine vacuum to draw the fumes into the intake manifold. The difference between this and other systems is that the PCM monitors the vacuum and/or pressure in the system to determine if there is any leakage. If the PCM determines that the EVAP system is leaking or not functioning properly, it sets a Diagnostic Trouble Code (DTC) in the PCM memory.

The enhanced EVAP system is required to detect evaporative fuel system leaks as small as 0.040 in. (1.0 mm) between the fuel filler cap and purge solenoid. The system can test the evaporative system integrity by applying a vacuum signal (ported or manifold) to the fuel tank to create a small vacuum. The PCM then monitors the ability of the system to maintain the vacuum. If the vacuum remains for a specified period of time, there are no evaporative leaks and a PASS report is sent to the diagnostic executive. If there is a leak, the system either will not achieve a vacuum, or a vacuum cannot be maintained. Usually, a failure can only be detected after a cold start with a trip of sufficient length and driving conditions to run the needed tests. The enhanced EVAP system diagnostic will conduct up to eight specific sub–tests to detect fault conditions. If the diagnostic fails a sub–test, the PCM will store a Diagnostic Trouble Code (DTC) to indicate the type of fault detected.

Electrical Components

The electrical components that make up the enhanced EVAP system are:

Fuel Tank Pressure Sensor – The fuel tank pressure sensor is a three–wire strain gauge sensor similar to a common MAP sensor. However, the fuel tank pressure sensor has very different electrical characteristics due to its pressure differential design. The sensor measures the difference between the air pressure (or vacuum) in the fuel tank and the outside air pressure.

The sensor mounts at the top of the fuel pump assembly. A three–wire electrical harness connects it to the PCM. The PCM supplies a five–volt reference voltage and a ground to the sensor. The sensor will return a voltage between 0.1 and 4.9 volts. When the air pressure in the fuel tank is equal to the outside air pressure, such as when the fuel cap is removed, the output voltage of the sensor will be 1.3 to 1.7 volts.

When the air pressure in the fuel tank is 4.5 in. H2O (1.25 kPa), the sensor output voltage will be 0.5 +/– 0.2 V. When there is neither vacuum nor pressure in the fuel tank, the sensor voltage will be 1.5 V. At –14 in. H2O (–3.75 kPa), the sensor voltage will be 4.5 +/– 0.2 V.

EVAP Canister Purge Solenoid – Normally closed, the purge solenoid opens upon the PCM's signal to allow engine vacuum to purge gasoline fumes from the canister. Mounted on top of the upper intake manifold assembly.

EVAP Canister Vent Solenoid – Located next to the canister, the vent solenoid opens to allow air into the EVAP system. Fresh air is necessary to completely remove gasoline fumes from the canister during purge. The EVAP vent solenoid closes to seal off the evaporative emissions system for leak testing.

Fuel Level Sensor – The fuel level sensor is an important input to the PCM for the enhanced EVAP system diagnostic. The PCM needs fuel level information to know the volume of fuel in the tank. The fuel level affects the rate of change of air pressure in the EVAP system. Several of the enhanced EVAP system diagnostic sub–tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is less than 15% or more than 85% full. Be sure to diagnose any Fuel Level Sensor DTCs first, as they can cause other DTCs to set.

Manifold Absolute Pressure (MAP) Sensor – The PCM compares the signals from the fuel tank pressure sensor and the MAP sensor to ensure that a relative vacuum is maintained in the EVAP system.

Non–Electrical Components

Purge/Vacuum Hoses – Made of rubber compounds, these hoses route the gasoline fumes from their sources to the canister and from the canister to the intake air flow.

EVAP Canister – Mounted on a bracket ahead of the fuel tank, the canister stores fuel vapors until the PCM determines that engine conditions are right for them to be removed and burned.

Fuel Tank – The tank has a built–in air space designed for the collection of gasoline fumes.

Vacuum Source – The vacuum source is split between two ports, one on either side of the throttle body.

Fuel Cap – The fuel cap is designed to be an integral part of the EVAP system.

System Fault Detection

The EVAP leak detection strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The PCM monitors vacuum level via the fuel tank pressure sensor. At an appropriate time, the EVAP purge solenoid and the EVAP vent solenoid are turned ON, allowing the engine vacuum to draw a small vacuum on the entire evaporative emission system.

After the desired vacuum level has been achieved, the EVAP purge solenoid is turned OFF, sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant. A small leak in the system will cause DTC P0442 to be set.

If the desired vacuum level cannot be achieved in the test described above, a large leak or a faulty EVAP purge solenoid is indicated.

Leaks can be caused by the following conditions:

- Disconnected or faulty fuel tank pressure sensor
- Missing or faulty fuel cap
- Disconnected, damaged, pinched, or blocked EVAP purge line
- Disconnected or damaged EVAP vent hose
- Disconnected, damaged, pinched, or blocked fuel tank vapor line
- Disconnected or faulty EVAP purge solenoid
- Disconnected or faulty EVAP vent solenoid
- Open ignition feed circuit to the EVAP vent or purge solenoid
- Damaged EVAP canister
- Leaking fuel sender assembly 0–ring
- Leaking fuel tank or fuel filler neck

A restricted or blocked EVAP vent path is detected by drawing vacuum into the EVAP system, turning OFF the EVAP vent solenoid and the EVAP purge solenoid (EVAP vent solenoid OPEN, EVAP purge Pulse Width Modulate (PWM) ”0%”) and monitoring the fuel tank vacuum sensor input. With the EVAP vent solenoid open, any vacuum in the system should decrease quickly unless the vent path is blocked. A blockage like this will set DTC P0446 and can be caused by the following conditions:

- Faulty EVAP vent solenoid (stuck closed)
- Plugged, kinked or pinched vent hose
- Shorted EVAP vent solenoid driver circuit
- Plugged EVAP canister

The PCM supplies a ground to energize the purge solenoid (purge ON). The EVAP purge control is PWM, or turned ON and OFF, several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met.

The system checks for conditions that cause the EVAP system to purge continuously by commanding the EVAP vent solenoid ON and the EVAP purge solenoid OFF (EVAP vent solenoid CLOSED, EVAP purge PWM ”0%”). If fuel tank vacuum level increases during the test, a continuous purge flow condition is indicated, which will set a DTC P1441. This can be caused by the following conditions:

- EVAP purge solenoid leaking
- EVAP purge and engine vacuum lines switched at the EVAP purge solenoid
- EVAP purge solenoid driver circuit grounded

GENERAL DESCRIPTION — EXHAUST GAS RECIRCULATION (EGR) SYSTEM

EGR Purpose

The exhaust gas recirculation (EGR) system is used to reduce emission levels of oxides of nitrogen (NOx). NOx emission levels are caused by a high combustion temperature. The EGR system lowers the NOx emission levels by decreasing the combustion temperature.

Linear EGR Valve

The main element of the system is the linear EGR valve. The EGR valve feeds small amounts of exhaust gas back into the combustion chamber. The fuel/air mixture will be diluted and combustion temperatures reduced.

Linear EGR Control

The PCM monitors the EGR actual position and adjusts the pintle position accordingly. The PCM uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.

Linear EGR Valve Operation And Results Of Incorrect Operation

The linear EGR valve is designed to accurately supply EGR to the engine independent of intake manifold vacuum. The valve controls EGR flow from the exhaust to the intake manifold through an orifice with a PCM–controlled pintle. During operation, the PCM controls pintle position by monitoring the pintle position feedback signal. The feedback signal can be monitored with a Tech 2 as ”Actual EGR Pos.” ”Actual EGR Pos.” should always be near the commanded EGR position (”Desired EGR Pos.”). The PCM also tests for EGR flow. If incorrect flow is detected, DTC P0401 will set. If DTC P0401 is set, refer to the DTC charts.

The linear EGR valve is usually activated under the following conditions:

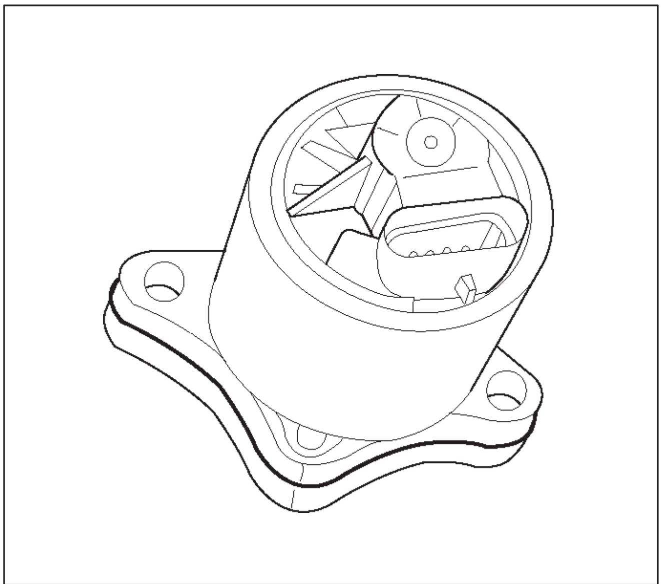
- Warm engine operation.
- Above–idle speed.

Too much EGR flow at idle, cruise or cold operation may cause any of the following conditions to occur:

- Engine stalls after a cold start.
- Engine stalls at idle after deceleration.
- Vehicle surges during cruise.
- Rough idle.
- DTC P0300 (misfire detected).

Too little or no EGR flow may allow combustion temperatures to get too high. This could cause:

- Spark knock (detonation).
- Engine overheating.
- Emission test failure.
- DTC P0401 (EGR Flow Insufficient detected).
- Poor fuel economy.



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EGR Pintle Position Sensor

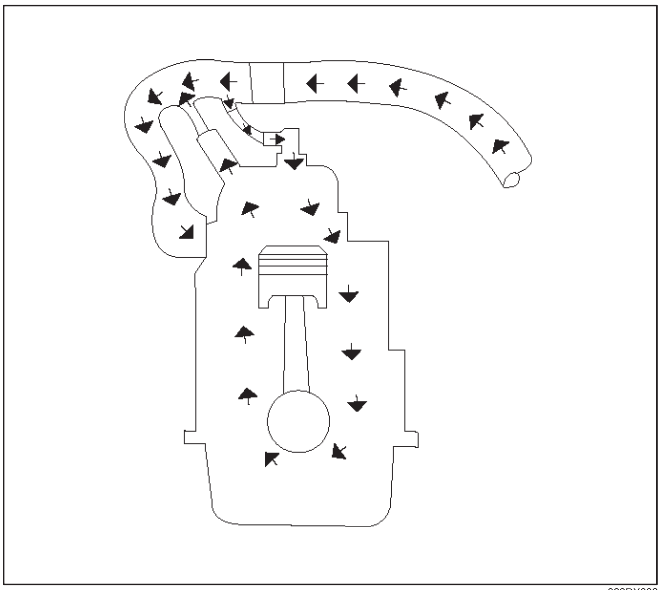
The PCM monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM and to detect a fault if the pintle position sensor and control circuits are open or shorted. If the PCM detects a pintle position signal voltage outside the normal range of the pintle position sensor, or a signal voltage that is not within a tolerance considered acceptable for proper EGR system operation, the PCM will set DTC P0404.

GENERAL DESCRIPTION — POSITIVE CRANKCASE VENTILATION (PCV) SYSTEM

Crankcase Ventilation System Purpose

The crankcase ventilation system is used to consume crankcase vapors in the combustion process instead of venting them to the atmosphere. Fresh air from the throttle body is supplied to the crankcase and mixed with blow–by gases. This mixture is then passed through the positive crankcase ventilation (PCV) port into the intake manifold.

While the engine is running, exhaust gases and small amounts of the fuel/air mixture escape past the piston rings and enter the crankcase. These gases are mixed with clean air entering through a tube from the air intake duct.



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During normal, part–throttle operation, the system is designed to allow crankcase gases to flow through the PCV valve into the throttle body to be consumed by normal combustion.

A plugged valve or PCV hose may cause the following conditions:

- Rough idle.
- Stalling or slow idle speed.
- Oil leaks.
- Sludge in the engine.

A leaking PCV hose would cause:

- Rough idle.
- Stalling.
- High idle speed.

SPECIAL TOOLS

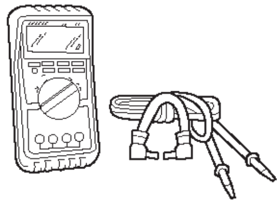
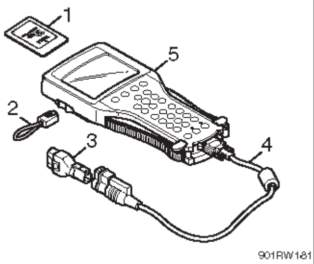
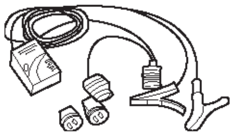
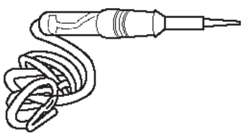
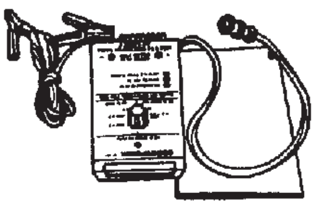
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 39200** High Impedance Multimeter (Digital Voltmeter – DVM)
	(1) PCMCIA Card (2) RS232 Loop Back Connector (3) SAE 16/19 Adapter (4) DLC Cable (5) TECH–2
	**J 37027–A** IAC Motor Analyzer
	**J 34142–B** Unpowered Test Light
	**J 39021–5V** Port Fuel Injector Tester
	**J 35616–A/BT–8637** Connector Test Adapter Kit

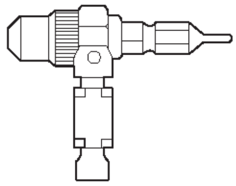
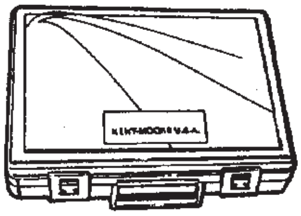
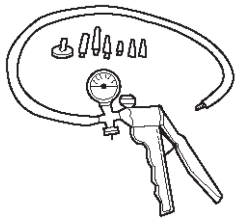
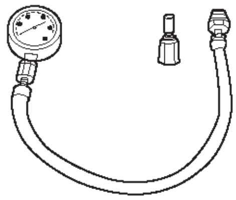
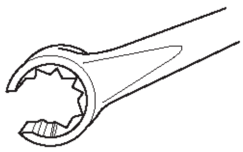
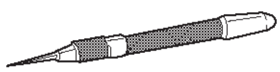
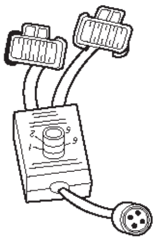
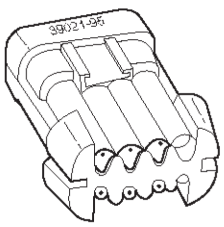
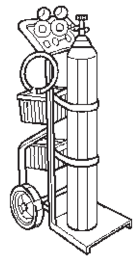
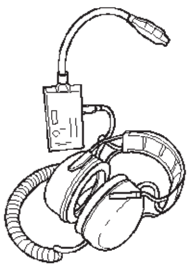
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 26792/BT–7220–1** Spark Tester
	**J 39021–Box** Port Fuel Injection Diagnostic Kit
	**J 23738–A** Vacuum Pump with Gauge
	**BT–8515–V** Exhaust Back Pressure Tester
	**J 39194–B** Heated Oxygen Sensor Wrench
	**J 35689–A** Terminal Remover

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 28742–A** Weather Pack II Terminal Remover
	**J 39021–90** Injector Switch Box
	**J 39021–45** Injector Test Light
	**J 41413**[1] EVAP Pressure/Purge Diagnostic Station
	**J 41416**[2] Ultrasonic Leak Detector

1. J 41413 EVAP Pressure/Purge Diagnostic Station is a multipurpose tool which is used to perform several diagnostic procedures for enhanced emission testing. The station will accommodate a nitrogen gas filled cylinder which is used to pressurize the vehicle EVAP system for a leakdown test and leak location test when a vehicle is repaired for leakage in the enhanced evaporative emission control system. It also has two additional gauges (inches of mercury and inches of water) which are used to measure both source vacuum and EVAP canister purge vacuum to verify correct operation and vapor flow within the canister purge circuit.
2. J 41416 Ultrasonic Leak Detector is a microprocessor–based device used to detect leaks in the enhanced evaporative emission control system. The evaporative system is pressurized to 30 inches of water using the J 41413 EVAP Pressure/Purge Diagnostic System. Small leaks in the EVAP system will emit sound at a high frequency undetectable by a human ear but detectable with the J 41416. The technician traces along the evaporative system and can pinpoint leaks due to corroded lines, cracked hoses, or a damaged EVAP component. The detector includes a high quality set of headphones to block out surrounding shop noise and the LED sensitivity meter allows a visual reference for locating leaks in conjunction with the audio output heard through the headphones. Powered by (1) nine volt battery.

RODEO

ENGINE

ENGINE EXHAUST (X22SE 2.2L)

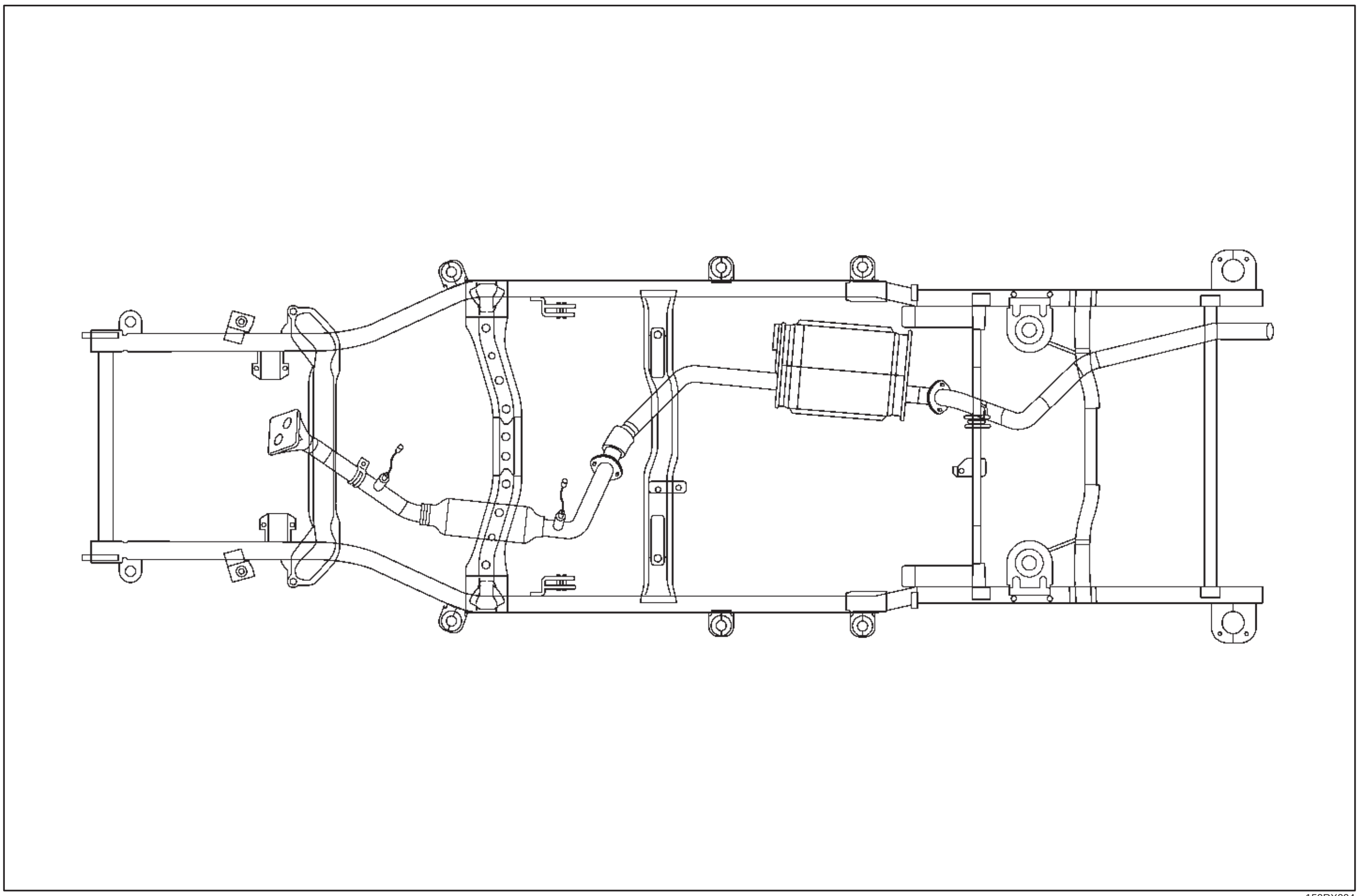
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description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When inspecting or replacing exhaust system components, make sure there is adequate clearance from all points on the underbody to prevent overheating the floor pan and possible damage to the passenger compartment insulation and trim materials.

Check complete exhaust system and nearby body areas and rear compartment lid for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections or other deterioration which could permit exhaust fumes to seep into the rear compartment or passenger compartment. Dust or water in the rear compartment may be an indication of a problem in one of these areas. Any faulty areas should be corrected immediately.

Hangers

Various types of hangers are used to support exhaust system(s). These include conventional rubber straps, rubber rings, and rubber blocks.

The installation of exhaust system supports is very important, as improperly installed supports can cause annoying vibrations which can be difficult to diagnose.

Three Way Catalytic Converter

The three way catalytic converter is an emission control device added to the exhaust system to reduce pollutants from the exhaust gas stream.

CAUTION: The catalytic converter requires the use of unleaded fuel only.

Periodic maintenance of the exhaust system is not required. If the vehicle is raised for other service, it is advisable to check the condition of the complete exhaust system.

A dual bed monolith catalytic converter is used in combination with three way catalytic converter.

Catalytic Types:

Three way (Reduction/Oxidation) catalyst

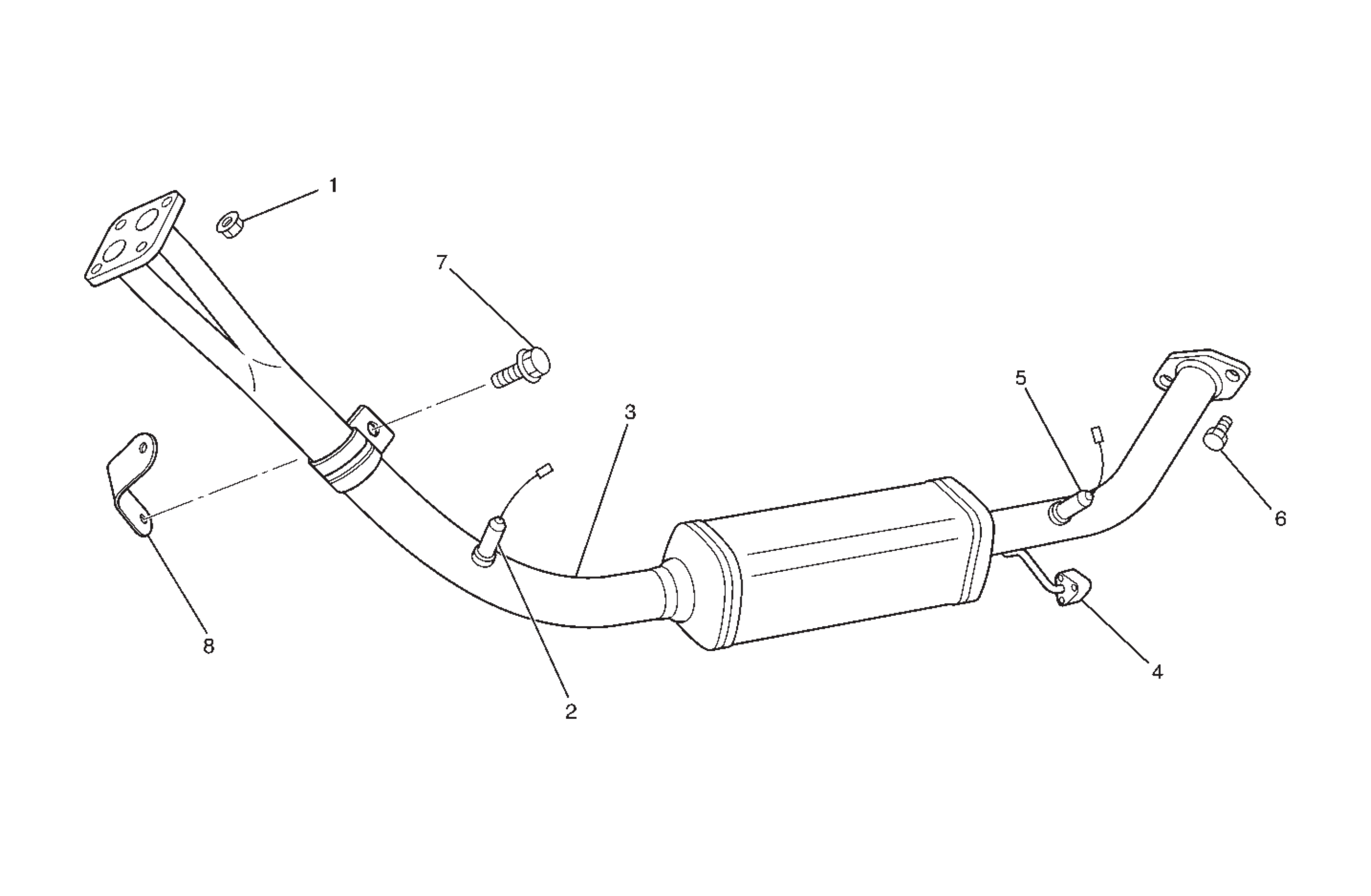
The catalyst coating on the three way (reduction) converter contains platinum and rhodium which lowers the levels of nitrous oxide (NOx) as well as hydrocarbons (HC) and carbon monoxide (Co).

Gasket

The gasket must be replaced whenever a new exhaust pipe, muffler or catalytic converter is installed.

Front Exhaust Pipe

Front Exhaust Pipe and Associated Parts



150RX001

Legend

(1) Front Exhaust Pipe Fixing Nuts
(2) O2 Sensor
(3) Front Exhaust Pipe with Three Way Catalytic Converter
(4) Front Exhaust Pipe Mounting Rubber
(5) O2 Sensor
(6) Front Exhaust Pipe Fixing Bolt
(7) Front Exhaust Pipe Fixing Bolt (Clamp)
(8) Front Exhaust Pipe Mounting Bracket

Removal

1. Disconnect battery ground cable.
2. Raise the vehicle and support with suitable safety stands.
3. Disconnect O2 sensor harness connector and remove front side O2 sensor (2),(5).
4. Remove front exhaust pipe fixing bolts (6),(7).
5. Remove front exhaust pipe fixing four stud nuts from exhaust manifold (1).
6. Remove front exhaust pipe (3).

Installation

1. Install front exhaust pipe (3) and tighten four stud nuts (1) and two bolts (6) to the specified torque:

   Torque:

   Stud Nuts : 28 N·m (21 lb ft)

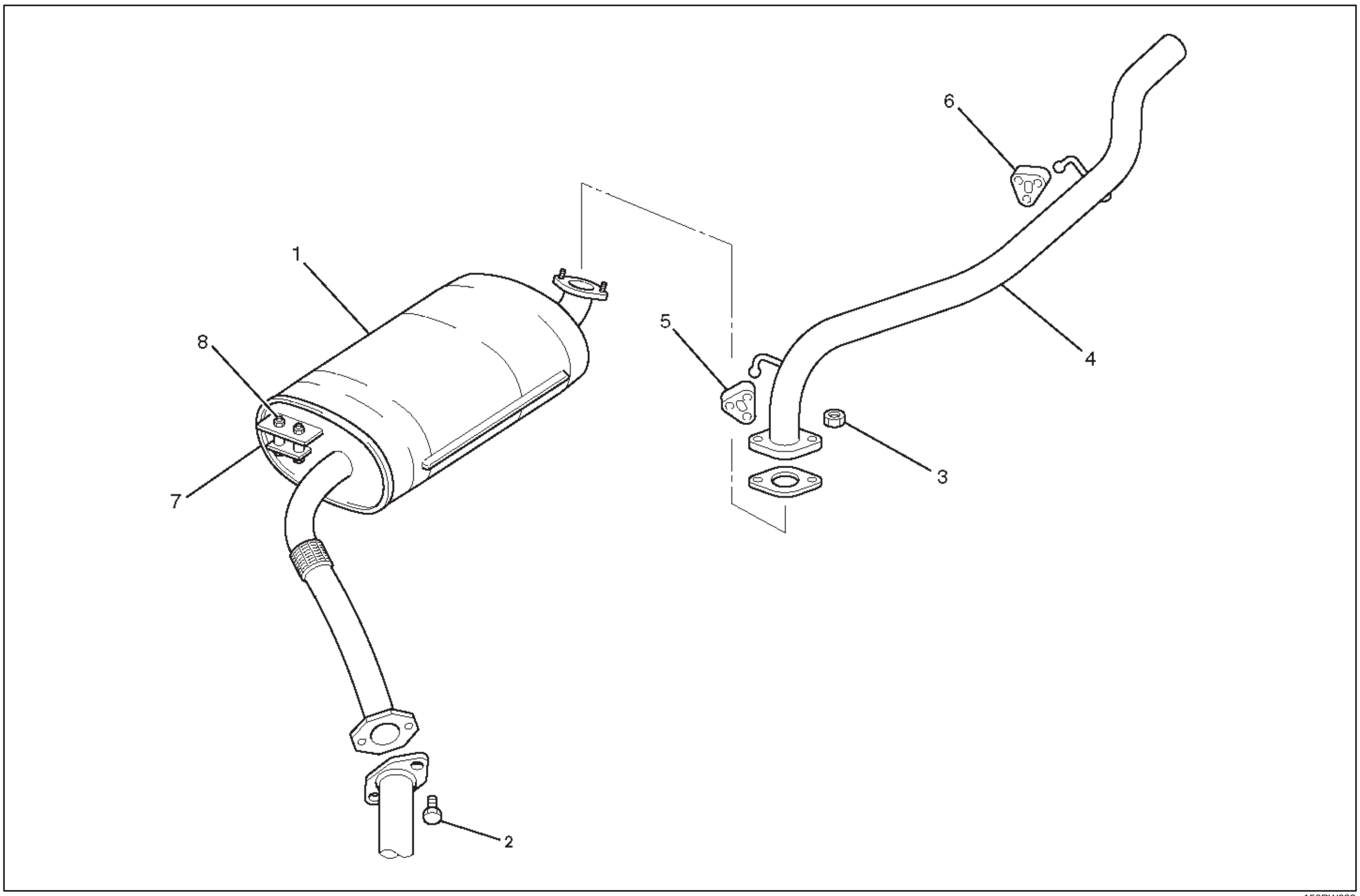
   Bolts (6) : 43 N·m (32 lb ft)

   Bolts (7) : 23 N·m (17 lb ft)
2. Tighten front side O2 sensor and reconnect O2 sensor harness connector.

   Torque : 55 N·m (41 lb ft)

Exhaust Silencer

Exhaust Silencer and Associated Parts



Legend

(1) Exhaust Silencer
(2) Front Exhaust Pipe Fixing Bolt
(3) Exhaust Silencer Fixing Nuts
(4) Exhaust Rear Pipe
(5) Mounting Rubber
(6) Mounting Rubber
(7) Mounting Rubber
(8) Exhaust Silencer Fixing Nuts

Removal

1. Disconnect battery ground cable.
2. Raise the vehicle and support with suitable safety stands.
3. Remove exhaust silencer fixing nuts (3) then disconnect rear exhaust pipe from exhaust silencer.
4. Remove exhaust silencer fixing nuts (2) then disconnect exhaust silencer from front exhaust pipe (5).
5. Remove exhaust silencer mounting nuts (8) from chassis side then remove exhaust silencer (1).

Installation

1. Install the exhaust silencer (1) chassis side and tighten two nuts (8) to the specified torque.

   Nuts: 15 N·m (11 lb ft)

2. Install the exhaust silencer and tighten two Bolts (2) on front exhaust pipe to specified torque.

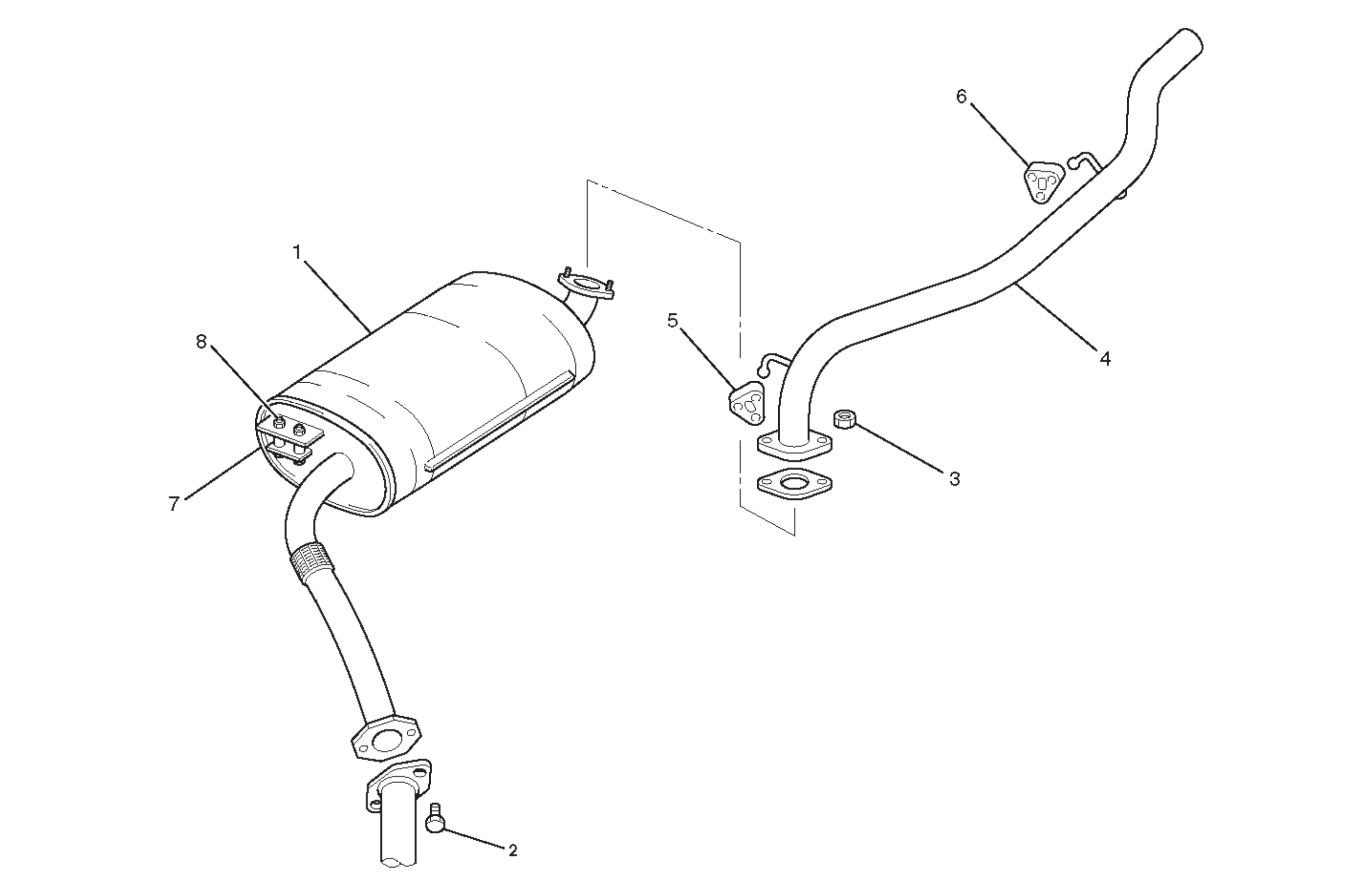
   Bolts: 43 N·m (32 lb ft)

3. Install the rear exhaust pipe and tighten two nuts (3) on exhaust silencer to specified torque.

   Nuts: 43 N·m (32 lb ft)

Rear Exhaust pipe

Rear Exhaust pipe and Associated Parts



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Legend

(1) Exhaust Silencer
(2) Front Exhaust Pipe Fixing Bolt
(3) Exhaust Silencer Fixing Nuts
(4) Exhaust Rear Pipe
(5) Mounting Rubber
(6) Mounting Rubber
(7) Mounting Rubber
(8) Exhaust Silencer Fixing Nuts

Removal

1. Disconnect battery ground cable.
2. Raise the vehicle and support with suitable safety stands.
3. Remove rear exhaust pipe fixing nuts (3), then disconnect rear exhaust pipe from exhaust silencer.
4. Remove mounting rubber (5), (6).
5. Remove rear exhaust pipe (4).

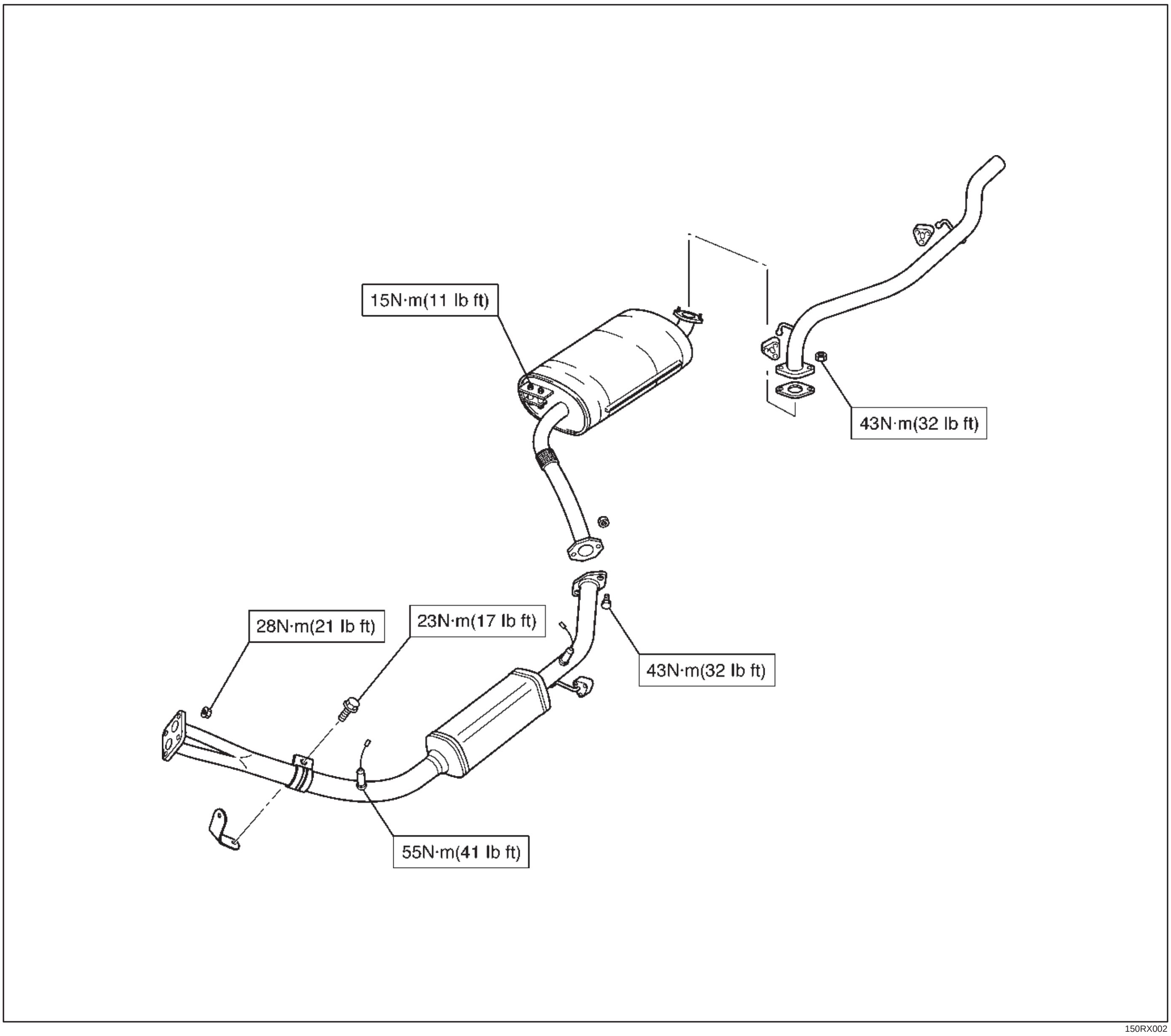
Installation

1. Install the mounting rubber (5), (6).
2. Install the exhaust pipe (4) and tighten two nuts (3) on exhaust silencer to specified torque.

Nuts: 43 N·m (32 lb ft)

Main Data and Specifications

Torque Specifications



RODEO

ENGINE

ENGINE LUBRICATION (X22SE 2.2L)

CONTENTS

Service Precaution

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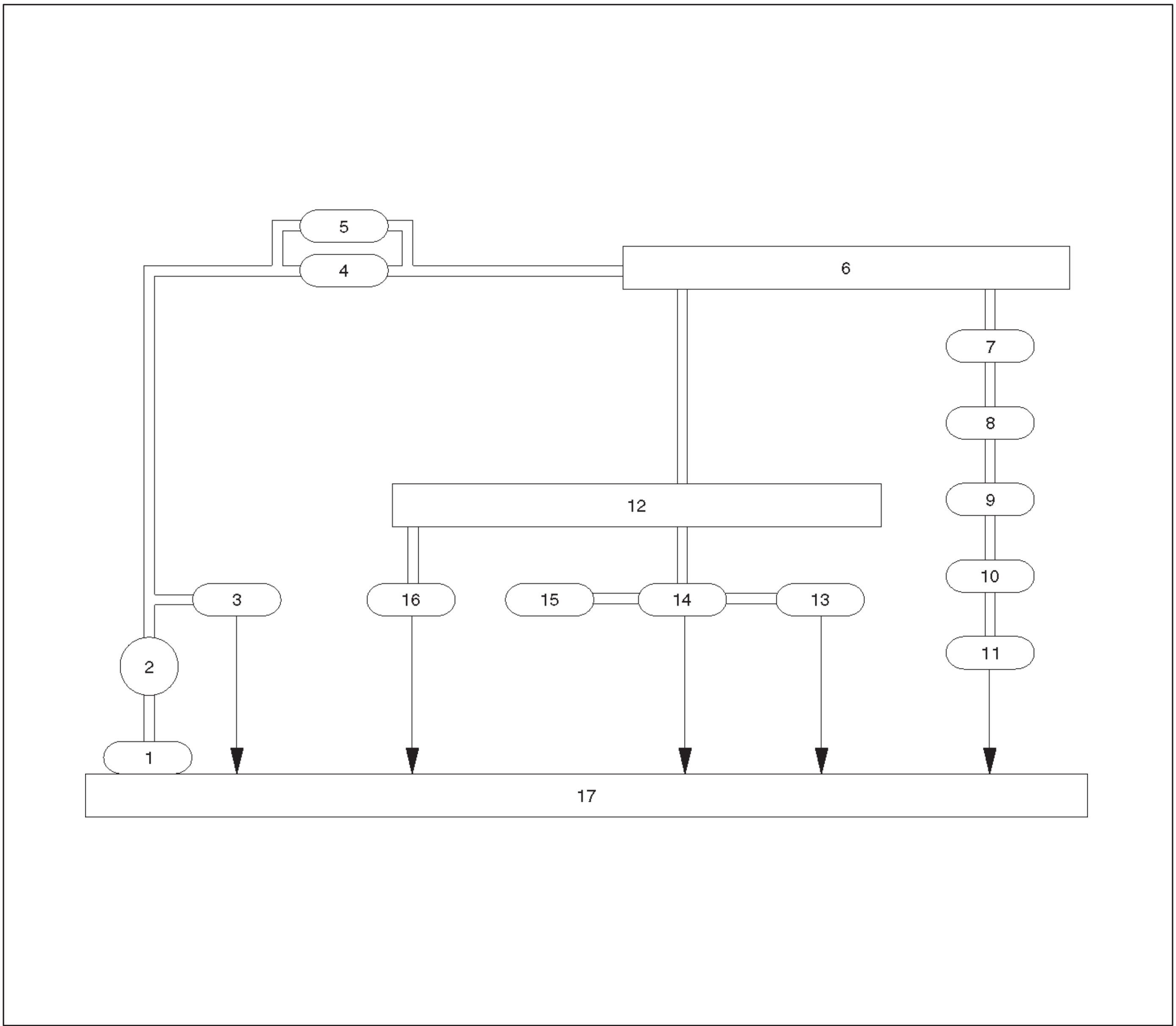
General Description

A gear-type oil pump is directly driven by the crankshaft and draws oil from the oil pan, via the suction pipe. If then passes the pressured oil through a full-flow disposable oil filter, to the main oil gallery in the cylinder Block. An oil pump pressure relief valve and oil filter bypass valve are incorporated in the system.

From the main oil gallery in the cylinder block, the cylinder head and crankshaft main bearings are supplied with oil.

The camshaft bearings and hydraulic tappets are supplied through the main feed galleries in the cylinder head. Vent valves allow air to be expelled from the oil galleries in the cylinder head. The balance shaft journals are directly fed from the crankshaft main bearings. The connecting rod bearings are fed via passages in the crankshaft. the oil returns to the oil pan via passages in the cylinder block.



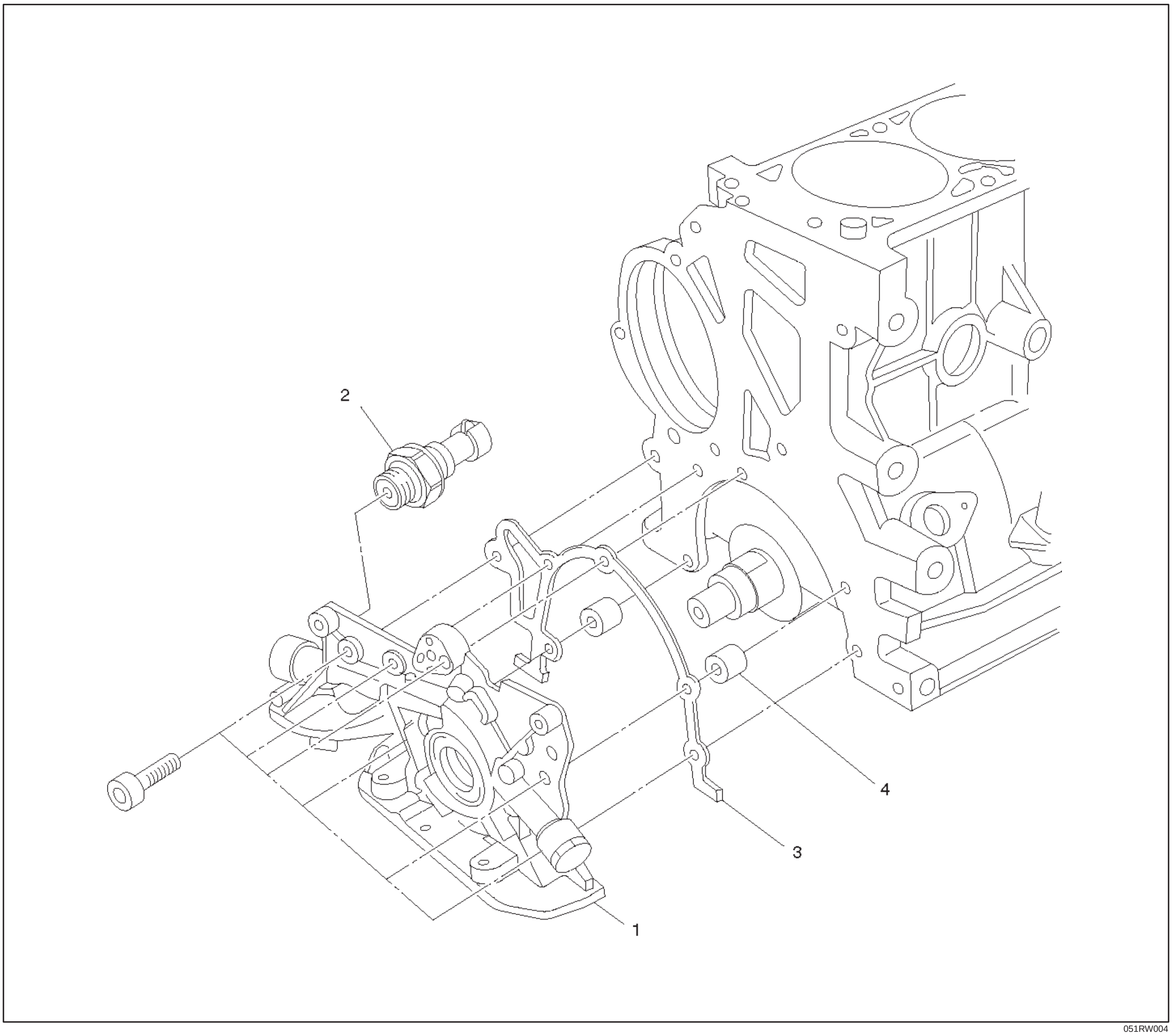
C06RW004

Legend

(1) Oil Strainer
(2) Oil Pump
(3) Relief Valve
(4) Oil Filter
(5) Safety Valve
(6) Oil Gallery
(7) Crankshaft Bearing
(8) Crankshaft
(9) Connecting Rod Bearing
(10) Connecting Rod
(11) Piston
(12) Oil Gallery; Cylinder Head
(13) Camshaft
(14) Camshaft Journal
(15) HLV
(16) Vent Valve
(17) Oil Pan

Oil Pump

Oil Pump and Associated Parts



Legend

(1) Oil Pump Assembly
(2) Oil Pressure Switch
(3) Gasket
(4) Sleeve

Disassembly

1. Remove crankshaft timing pulley.
2. Remove oil pan.
3. Remove oil pan support.
4. Remove oil strainer.
5. Remove oil pump assembly.
6. Remove oil pressure switch.
7. Remove gasket.
8. Remove sleeve.

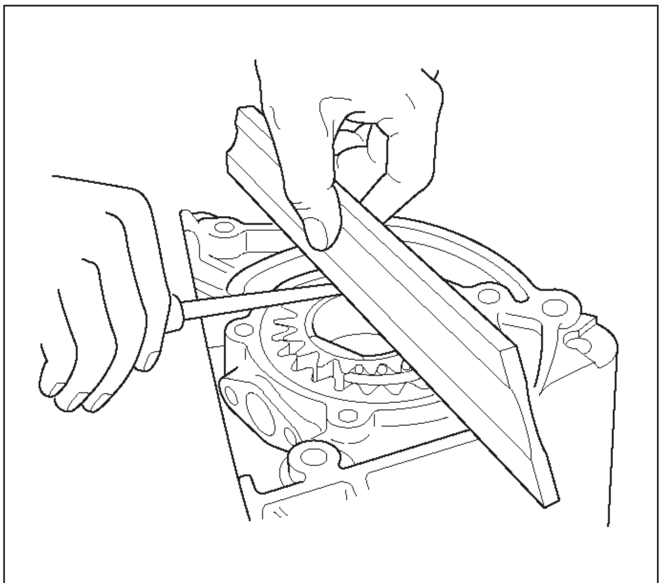
Inspection and Repair

CAUTION: Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found through inspection.

Body and Gears

The pump assembly must be replaced if one or more of the conditions below is discovered during inspection: Indentation of gear pair — use feeler strip and straight edge.

Dimension : 0.03 mm to 0.10 mm
(0.0012 to 0.0039 in)



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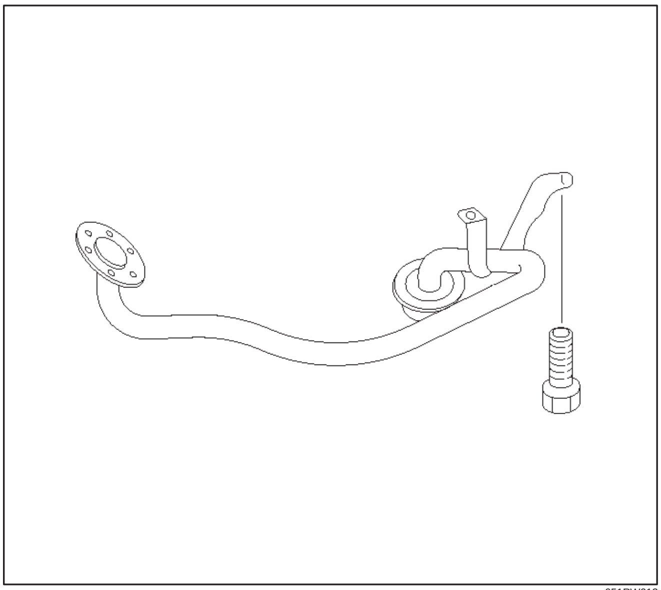
Oil Strainer

Check the oil strainer for cracking and scoring. If cracking and scoring are found, the oil strainer must be replaced.



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Reassembly

1. Install oil pressure switch to the oil pump.
   Torque : 40 N·m (37 lb ft)
2. Install the oil pump with the sleeve and the gasket.
   Torque : 6 N·m (4.4 lb ft)
3. Install oil strainer.
   Torque : 8 N·m (5.8 lb ft)
4. Install Oil pan support.
   Torque : 20 N·m (14 lb ft)
5. Install the oil pan.
   Tighten the bolts in 2 steps:
   1st step: 8 N·m (5.8 lb ft)
   2nd step: 30°
6. Install crankshaft timing pulley.
   Tighten the bolts in 2 steps:
   1st step: 130 N·m (94 lb ft)
   2nd step: 45°

RODEO

ENGINE

ENGINE SPEED CONTROL SYSTEM (X22SE 2.2L)

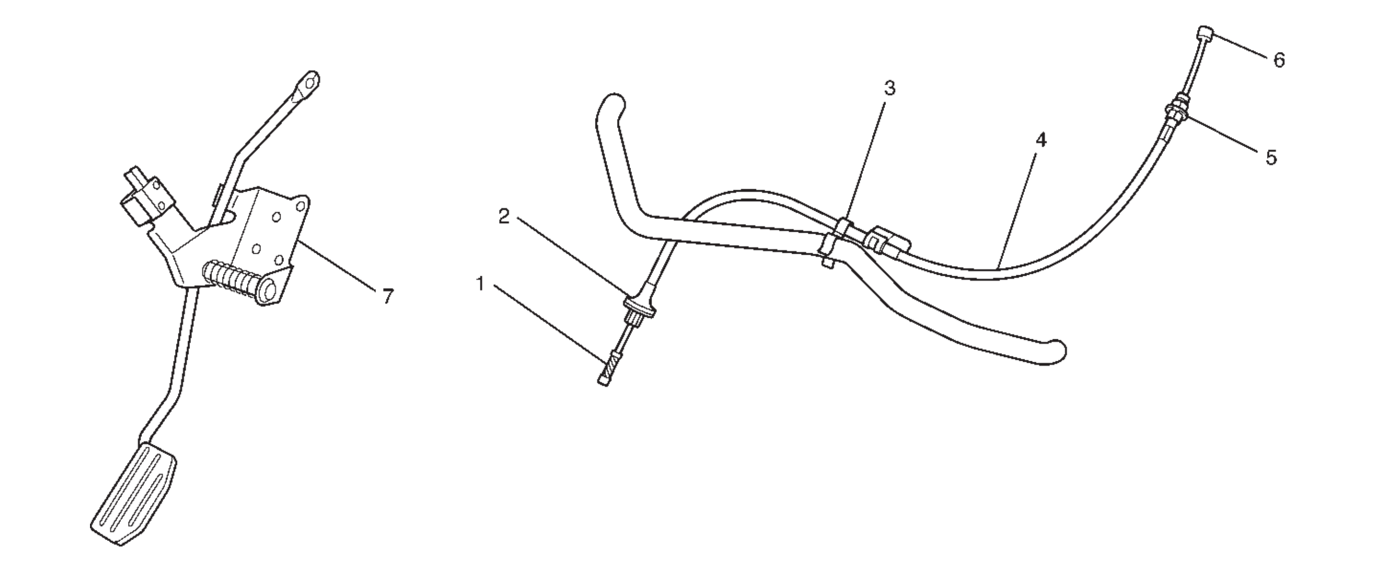
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Accelerator Pedal Control Cable



035RX004

Removal

1. Loosen the nut(5) on the cable bracket mounted.
2. Remove cable clip(3).
3. Disconnect accelerator pedal (AP) control cable(6). (on throttle valve side)
4. Disconnect AP control cable(1). (on AP pedal(7) side)
5. Remove grommet(2).
6. Remove AP control cable(4).

Inspection

Check the following items, and replace the control cable if any abnormality is found:

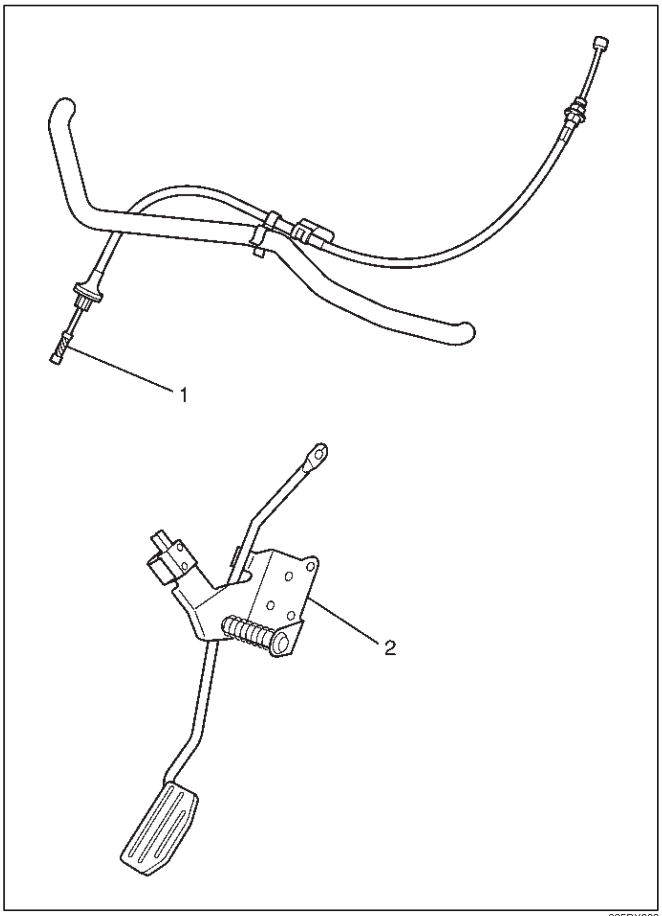
- The control cable should move smoothly.
- The control cable should not be bent or kinked.
- The control cable should be free of damage and corrosion.

Installation

1. Install AP control cable(4).
2. Install grommet(2).
3. Connect AP control cable(1). (on AP pedal(7) side)
4. Connect AP control cable(6). (on throttle valve side)
5. Install cable clip(3).
6. Install nut(5).

Accelerator Pedal

Accelerator Pedal and Associated Parts



035RX002

Legend

(1) Accelerator Pedal Control Cable
(2) Accelerator Pedal Assembly

Removal

1. Accelerator pedal control cable(1).
2. Accelerator pedal assembly(2).

Installation

1. Accelerator pedal assembly (2).
2. Accelerator pedal control cable (1).

RODEO

ENGINE

INDUCTION (X22SE 2.2L)

CONTENTS

Service Precaution

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Air Cleaner Filter

Removal

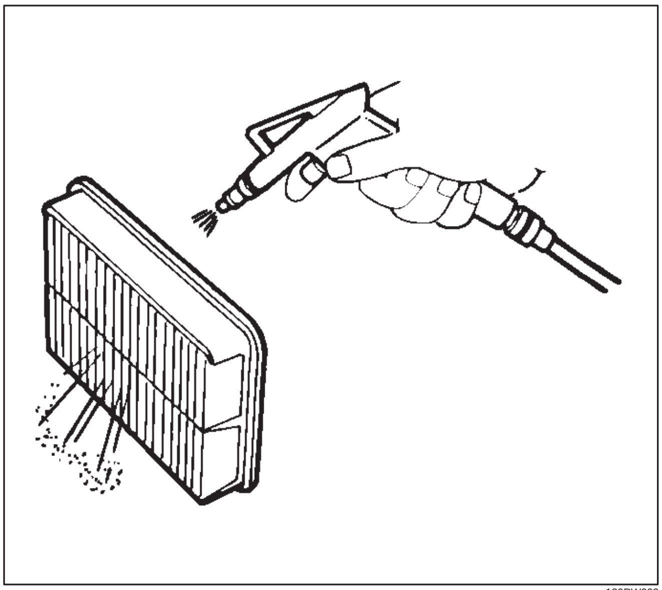
1. Remove positive ventilation hose connector.
2. Remove intake air temperature sensor.
3. Remove mass air flow sensor.
4. Remove air cleaner duct assembly.
5. Remove air cleaner element.

Inspection

Check the air cleaner filter for damage or dust clogging. Replace if it is damaged, or clean if it is clogged.

Cleaning Method

Tap the air cleaner filter gently so as not to damage the paper filter, or clean the element by blowing with compressed air of about 490 kPa (71 psi) from the clean side if it is extremely dirty.



130RW002

Installation

1. Install air cleaner element.
2. Attach the air cleaner duct cover to the body completely, then clamp it with the clip.
3. Install mass air flow sensor.
4. Install mass air temperature sensor.
5. Install positive crankcase ventilation hose connector.

RODEO

ENGINE

CONTENTS

ENGINE MECHANICAL (6VD1 3.2L)

CONTENTS

Service Precaution

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General Description

Engine Cleanliness And Care

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the thousandths of a millimeter (ten thousandths of an inch). Accordingly, when any internal engine parts are serviced, care and cleanliness are important. Throughout this section, it should be understood that proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

- A liberal coating of engine oil should be applied to all friction areas during assembly to protect and lubricate the surfaces on initial operation.
- Whenever valve train components, pistons, piston rings, connecting rods, rod bearings, and crankshaft journal bearings are removed for service, they should be retained in order.
- At the time of installation, they should be installed in the same locations and with the same mating surfaces as when removed.
- Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables may result in damage to wire harness or other electrical parts.
- The six cylinders of this engine are identified by numbers; Right side cylinders 1, 3 and 5, Left side cylinders 2, 4 and 6, as counted from crankshaft pulley side to flywheel side.

General Information on Engine Service

The following information on engine service should be noted carefully, as it is important in preventing damage and contributing to reliable engine performance.

- When raising or supporting the engine for any reason, do not use a jack under the oil pan. Due to the small clearance between the oil pan and the oil pump strainer, jacking against the oil pan may cause damage to the oil pick–up unit.
- The 12–volt electrical system is capable of damaging circuits. When performing any work where electrical terminals could possibly be grounded, the ground cable of the battery should be disconnected at the battery.
- Any time the intake air duct or air cleaner is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material into the cylinder which could cause extensive damage when the engine is started.

Cylinder Block

The cylinder block is made of aluminum die–cast casting for 75° V–type six cylinders. It has a rear plate integrated structure and employs a deep skirt. The cylinder liner is cast and the liner inner diameter and crankshaft journal diameter are classified into grades. The crankshaft is supported by four bearings of which width is different between No.2, No.3 and No.1, No.4; the width of No.3 bearing on the body side is different in order to support the thrust bearing. The bearing cap is made of nodular cast iron and each bearing cap uses four bolts and two side bolts.

Cylinder Head

The cylinder head, made of aluminum alloy casting employs a pent–roof type combustion chamber with a spark plug in the center. The intake and exhaust valves are placed in V–type design. The ports are cross–flow type.

Valve Train

Intake and exhaust camshaft on the both side of banks are driven through an camshaft drive gear by timing belt. The valves are operated by the camshaft and the valve clearance is adjusted to select suitable thickness shim.

Intake Manifold

The intake manifold system is composed of the aluminum cast common chamber and intake manifold attached with six fuel injectors.

Exhaust Manifold

The exhaust manifold is made of nodular cast iron.

Pistons and Connecting Rods

Aluminum pistons are used after selecting the grade that meets the cylinder bore diameter. Each piston has two compression rings and one oil ring. The piston pin made of chromium steel is offset 1mm toward the thrust side, and the thrust pressure of piston to the cylinder wall varies gradually as the piston travels. The connecting rods are made of forged steel. The connecting rod bearings are graded for correct size selection.

Crankshaft and Bearings

The crankshaft is made of Ductile cast–iron. Pins and journals are graded for correct size selection for their bearing.

Engine Diagnosis

Hard Starting

1. Starting Motor Does Not Turn Over

Troubleshooting Procedure

Turn on headlights and starter switch.

Condition	Possible cause	Correction
Headlights go out or dim considerably	Battery run down or under charged	Recharge or replace battery
	Terminals poorly connected	Clean battery posts and terminals and connect properly
	Starting motor coil circuit shorted	Overhaul or replace
	Starting motor defective	Overhaul or replace

2. Ignition Trouble — Starting Motor Turns Over But Engine Does Not Start

Spark Test

Disconnect an ignition coil from any spark plug. Connect the spark plug tester J–26792 (ST–125), start the engine, and check if a spark is generated in the spark plug tester.

Before starting the engine, make sure that the spark plug tester is properly grounded. To avoid electrical shock, do not touch the part where insulation of the ignition coil is broken while the engine is running.

Condition	Possible cause	Correction
Spark jumps across gap	Spark plug defective	Clean, adjust spark gap or replace
	Ignition timing incorrect	Refer to Ignition System
	Fuel not reaching fuel injector(s) or engine	Refer to item 3 (Trouble in fuel system)
	Valve timing incorrect	Adjust
	Engine lacks compression	Refer to item 4 (Engine lacks compression)
No sparking takes place	Ignition coil disconnected or broken	Connect properly or replace
	Electronic Ignition System with module	Replace
	Poor connections in engine harness	Correct
	Powertrain Control Module cable disconnected or defective	Correct or replace

3. Trouble In Fuel System

Condition	Possible cause	Correction
Starting motor turns over and spark occurs but engine does not start.	Fuel tank empty	Fill
	Water in fuel system	Clean
	Fuel filter clogged	Replace filter
	Fuel pipe clogged	Clean or replace
	Fuel pump defective	Replace
	Fuel pump circuit open	Correct or replace
	Evaporative Emission Control System circuit clogged	Correct or replace
	Multiport Fuel Injection System faulty	Refer to “Electronic Fuel Injection” section

4. Engine Lacks Compression

Condition	Possible cause	Correction
Engine lacks compression	Spark plug loosely fitted or spark plug gasket defective	Tighten to specified torque or replace gasket
	Valve timing incorrect	Adjust
	Cylinder head gasket defective	Replace gasket
	Valve incorrectly seated	Lap valve
	Valve stem seized	Replace valve and valve guide
	Valve spring weakened or broken	Replace
	Cylinder or piston rings worn	Overhaul engine
	Piston ring seized	Overhaul engine.

Engine Compression Test Procedure

1. Start and run the engine until the engine reaches normal operating temperature.
2. Turn the engine off.
3. Remove all the spark plugs.
4. Remove ignition coil fuse (15A) and disable the ignition system.
5. Remove the fuel pump relay from the relay and fuse box.
6. Engage the starter and check that the cranking speed is approximately 300 rpm.
7. Install cylinder compression gauge into spark plug hole.
8. With the throttle valve opened fully, keep the starter engaged until the compression gage needle reaches the maximum level. Note the reading.
9. Repeat the test with each cylinder.

   If the compression pressure obtained falls below the limit, engine overhaul is necessary.

Limit; 1000 kPa (145 psi)

Rough Engine Idling or Engine Stalling

Condition	Possible cause	Correction
Trouble in fuel injection system	Throttle shutting off incomplete	Correct or replace
	Throttle position sensor circuit open or shorted	Correct or replace
	Fuel injector circuits open or shorted	Correct or replace
	Fuel injectors damaged	Replace
	Fuel pump relay defective	Replace
	Mass Airflow Sensor circuit open or poor connections	Correct or replace
	Mass Airflow Sensor defective	Replace
	Manifold Absolute Pressure Sensor circuit open or poor connections	Correct or replace
	Manifold Absolute Pressure Sensor defective	Replace
	Engine Coolant Temperature Sensor circuit open or poor connections	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	Intake Air Temperature sensor circuit open or poor connections	Correct or replace
	Intake Air Temperature sensor defective	Replace
	Ion Sensing Module cable broken or poor connections	Correct or replace
	Ion Sensing Module defective	Replace
	Vehicle Speed Sensor circuit open or shorted	Correct or replace
	Vehicle Speed Sensor defective	Replace
Trouble in emission control system	Powertrain Control Module defective	Replace
	Exhaust Gas Recirculation Valve circuit open or poor connections	Correct or replace
	Exhaust Gas Recirculation Valve faulty	Replace
	Canister purge valve circuit open or poor connections	Correct or replace
	Canister purge valve defective	Replace
	Evaporative Emission Canister Purge control valve defective	Replace
	Trouble in ignition system	Refer to “Hard Start”
Others	Engine lacks compression	Refer to “Hard Start”
	Valve incorrectly seated	Lap valve
	Air Cleaner Filter clogged	Replace filter element
	Valve timing incorrect	Readjust
	Idle air control valve broken	Replace
	Fast idle solenoid defective	Replace
	Positive Crankcase Ventilation valve defective or clogged	Replace

Rough Engine Running

Condition	Possible cause	Correction
Engine misfires periodically	Ignition coil layer shorted	Replace
	Spark plugs fouling	Clean or install hotter type plug
	Spark plug(s) insulator nose leaking	Replace
	Fuel injector(s) defective	Replace
	Powertrain control module faulty	Replace
Engine knocks periodically	Spark plugs running too hot	Install colder type spark plugs
	Powertrain control module faulty	Replace
	Ion Sensing module faulty	Refer or replace
Engine lacks power	Spark plugs fouled	Clean
	Fuel injectors defective	Replace
	Mass Airflow Sensor or Intake Airflow Sensor circuit defective	Correct or replace
	Manifold Absolute Pressure (MAP) Sensor or Manifold Absolute Pressure Sensor circuit defective	Correct or replace
	Engine Coolant Temperature Sensor or Engine Coolant Temperature Sensor circuit defective	Correct or replace
	Powertrain Control Module faulty	Replace
	Intake Air Temperature Sensor or Intake Air Temperature Sensor circuit defective	Correct or replace
	Throttle Position Sensor or Throttle Position Sensor circuit defective	Correct or replace
	ION Sensing Module or ION Sensing Module circuits defective	Correct or replace

Hesitation

Condition	Possible cause	Correction
Hesitation on acceleration	Throttle Position Sensor adjustment incorrect	Replace throttle valve assembly
	Throttle Position Sensor circuit open or shorted	Correct or replace
	Mass Airflow Sensor circuit open or poor connections	Correct or replace
	Mass Airflow Sensor defective	Replace
	Manifold Absolute Pressure (MAP) Sensor circuit open or shorted	Correct or replace
	MAP Sensor defective	Replace
	Intake Air Temperature (IAT) Sensor circuit open or poor connections	Correct or replace
	Ion Sensing Module circuit open or poor connections	Correct or replace
	Ion Sensing Module defective	Replace
	IAT Sensor defective	Replace
Hesitation at high speeds (Fuel pressure too low)	Fuel tank strainer clogged	Clean or replace
	Fuel pipe clogged	Clean or replace
	Fuel filter clogged	Replace
	Defective fuel pump system	Check and replace
	Fuel Pressure Control Valve leaking	Replace
Hesitation at high speeds (Fuel injector not working normally)	Power supply or ground circuit for Multiport Fuel Injection System shorted or open	Check and correct or replace
	Fuel Injector defective	Replace
	Cable of Multiport Fuel Injection System circuit open or poor connections	Correct or replace

Condition	Possible cause	Correction
Hesitation at high speeds	Powertrain Control Module defective	Replace
	Throttle Position Sensor cable broken or poor connections	Correct or replace
	Throttle Position Sensor defective	Replace
	Engine Coolant Temperature Sensor circuit open or shorted	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	Mass Airflow Sensor circuit open or poor connections	Correct or replace
	Mass Airflow Sensor defective	Replace
	MAP Sensor cable broken or poor connections	Correct or replace
	MAP Sensor defective	Replace
	IAT Sensor circuit open or poor connections	Correct or replace
	IAT Sensor defective	Replace
	Ion Sensing Module circuit open or poor connections	Correct or replace
	Ion Sensing Module defective	Replace
	Throttle valve not fully opened	Check and correct or replace
	Air Cleaner Filter clogged	Replace filter element
	Power supply voltage too low	Check and correct or replace

Engine Lacks Power

Condition	Possible cause	Correction
Trouble in fuel system	Fuel Pressure Control Valve not working normally	Replace
	Fuel injector clogged	Clean or replace
	Fuel pipe clogged	Clean
	Fuel filter clogged or fouled	Replace
	Fuel pump drive circuit not working normally	Correct or replace
	Fuel tank not sufficiently breathing due to clogged Evaporative Emission Control System circuit	Clean or replace
	Water in fuel system	Clean
	Inferior quality fuel in fuel system	Use fuel of specified octane rating
	Powertrain Control Module supplied poor voltage	Correct circuit
	Throttle Position Sensor cable broken or poor connections	Correct or replace
	Throttle Position Sensor defective	Replace
	Mass Airflow Sensor not working normally	Replace
	Manifold Absolute Pressure Sensor not working normally	Replace
	Intake Air Temperature Sensor not working normally	Replace
	Engine Coolant Temperature Sensor circuit open or shorted	Correct or replace
	Engine Coolant Temperature Sensor defective	Replace
	Powertrain Control Module defective	Replace
Trouble in intake or exhaust system	Air Cleaner Filter clogged	Replace filter element
	Air duct kinked or flattened	Correct or replace
	TWC defective	Repair
Ignition failure	————	Refer to Hard Start Troubleshooting Guide
	Heat range of spark plug inadequate	Install spark plugs of adequate heat range
	Ignition coil defective	Replace

Condition	Possible cause	Correction
Engine overheating	Level of Engine Coolant too low	Replenish
	Fan clutch defective	Replace
	Incorrect fan installed	Replace
	Thermostat defective	Replace
	Engine Coolant pump defective	Correct or replace
	Radiator clogged	Clean or replace
	Radiator filler cap defective	Replace
	Level of oil in engine crankcase too low or wrong engine oil	Change or replenish
	Resistance in exhaust system increased	Clean exhaust system or replace defective parts
	Throttle Position Sensor adjustment incorrect	Replace with Throttle Valve ASM
	Throttle Position Sensor circuit open or shorted	Correct or replace
	Cylinder head gasket damaged	Replace
Engine overcooling	Thermostat defective	Replace (Use a thermostat set to open at 82˚C (180˚F))
Engine lacks compression	————	Refer to Hard Start
Others	Tire inflation pressure abnormal	Adjust to recommended pressures
	Brake drag	Adjust
	Clutch slipping	Adjust or replace
	Level of oil in engine crankcase too high	Correct level of engine oil
	Exhaust Gas Recirculation Valve defective	Replace

Engine Noisy

Abnormal engine noise often consists of various noises originating in rotating parts, sliding parts and other moving parts of the engine. It is, therefore, advisable to locate the source of noise systematically.

Condition	Possible cause	Correction
Noise from crank journals or from crank bearings (Faulty crank journals and crank bearings usually make dull noise that becomes more evident when accelerating)	Oil clearance increased due to worn crank journals or crank bearings	Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing
	Crankshaft out of round	Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing
	Crank bearing seized	Crank bearing seized Replace crank bearings and crankshaft or regrind crankshaft and install the undersize bearing

Troubleshooting Procedure

Short out each spark plug in sequence using insulated spark plug wire removers. Locate cylinder with defective bearing by listening for abnormal noise that stops when spark plug is shorted out.

Condition	Possible cause	Correction
Noise from connecting rods or from connecting rod bearings (Faulty connecting rods or connecting rod bearings usually make an abnormal noise slightly higher than the crank bearing noise, which becomes more evident when engine is accelerated)	Bearing or crankshaft pin worn	Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing
	Crankpin out of round	Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing
	Connecting rod bent	Correct or replace
	Connecting rod bearing seized	Replace connecting rod bearings and crankshaft or regrind crankshaft pin and install the undersize bearing

Troubleshooting Procedure

Abnormal noise stops when the spark plug on the cylinder with defective part is shorted out.

Condition	Possible cause	Correction
Piston and cylinder noise (Faulty piston or cylinder usually makes a combined mechanical thumping noise which increases when engine is suddenly accelerated but diminishes gradually as the engine warms up)	Piston clearance increased due to cylinder wear	Replace piston and cylinder body
	Piston seized	Replace piston and cylinder body
	Piston ring broken	Replace piston and cylinder body
	Piston defective	Replace pistons and others

Troubleshooting Procedure

Short out each spark plug and listen for change in engine noise.

Condition	Possible cause	Correction
Piston pin noise (Piston makes noise each time it goes up and down)	Piston pin or piston pin hole worn	Replace piston, piston pin and connecting rod assy

Troubleshooting Procedure

The slapping sound stops when spark plug on bad cylinder is shorted out.

Condition	Possible cause	Correction
Timing belt noise	Timing belt tension is incorrect	Replace pusher or adjust the tension pulley or replace timing belt
	Tensioner bearing defective	Replace
	Timing belt defective	Replace
	Timing pulley defective	Replace
	Timing belt comes in contact with timing cover	Replace timing belt and timing cover
Valve noise	Valve clearance incorrect	Replace adjusting shim
	Valve and valve guide seized	Replace valve and valve guide
	Valve spring broken or weakened	Replace
	Valve seat off–positioned	Correct
	Camshaft worn out	Replace
Crankshaft noise	Crankshaft end play excessive (noise occurs when clutch is engaged)	Replace thrust bearing
Engine knocking	Preignition due to use of spark plugs of inadequate heat range	Install Spark Plugs of adequate heat range
	Carbon deposits in combustion chambers	Clean
	Fuel too low in octane rating	Replace fuel
	Wide Open Throttle enrichment system failure	Refer to Section 6E
	Selection of transmission gear incorrect	Caution operator of incorrect gear selection
	Engine overheating	Refer to “Engine Lacks Power”
Others	Water pump defective	Replace
	Drive belt slipping	Replace auto tentioner or drive belt

Abnormal Combustion

Condition	Possible cause	Correction
Trouble in fuel system	Fuel pressure control valve defective	Replace
	Fuel filter clogged	Replace
	Fuel pump clogged	Clean or replace
	Fuel tank or fuel pipe clogged	Clean or replace
	Fuel injector clogged	Clean or replace
	Fuel pump relay defective	Replace
	Power supply cable for fuel pump broken or poor connections	Reconnect, correct or replace
	Mass Airflow (MAF) Sensor circuit open or defective	Correct or replace
	MAF Sensor defective	Replace
	Manifold Absolute Pressure Sensor circuit open or shorted	Correct or replace
	Manifold Absolute Pressure Sensor defective	Replace
	Engine Coolant Temperature (ECT) Sensor circuit open or shorted	Correct or replace
	ECT Sensor defective	Replace
	Throttle Position Sensor adjustment incorrect	Readjust
	Throttle Position Sensor defective	Replace
	Throttle Position Sensor connector poor connections	Reconnect
	Vehicle Speed Sensor cable poor connections or defective	Correct or replace
	Vehicle Speed Sensor loosely fixed	Fix tightly
	Vehicle Speed Sensor in wrong contact or defective	Replace
	Powertrain Control Module cable poor connections or defective	Correct or replace
Trouble in emission control system	Heated Oxygen Sensor circuit open	Correct or replace
	Heated Oxygen Sensor defective	Replace
	Signal vacuum hose loosely fitted or defective	Correct or replace
	EGR Valve circuit open or shorted	Correct or replace
	Exhaust Gas Recirculation Valve defective	Replace
	ECT Sensor circuit open or shorted	Correct or replace
	Canister Purge Valve circuit open or shorted	Correct or replace
	Canister Purge Valve defective	Replace
	ECT Sensor defective	Replace
	Positive Crankcase Ventilation (PCV) valve and hose clogged	Correct or replace
	Evaporator system	Refer to Section 6E
Trouble in ignition system	————	Refer to “Engine Lacks Power”

Condition	Possible cause	Correction
Trouble in cylinder head parts	Carbon deposits in combustion chamber	Remove carbon
	Carbon deposit on valve, valve seat and valve guide	Remove carbon

Engine Oil Consumption Excessive

Condition	Possible cause	Correction
Oil leaking	Oil pan drain plug loose	Retighten or replace gasket
	Crankcase fixing bolts loosened	Retighten
	Oil pan setting bolts loosened	Retighten
	Oil pan gasket broken	Replace gasket
	Front cover retaining bolts loose or gasket broken	Retighten or replace gasket
	Head cover fixing bolts loose or gasket broken	Retighten or replace gasket
	Oil filter adapter cracked	Replace
	Oil filter attachings bolt loose or rubber gasket broken	Retighten or replace oil filter
	Crankshaft front or rear oil seal defective	Replace oil seal
	Oil pressure unit loose or broken	Retighten or replace
	Blow–by gas hose broken	Replace hose
	Positive Crankcase Ventilation Valve clogged	Clean
	Engine/Transmission coupling failed	Replace oil seal
Oil leaking into combustion chambers due to poor seal in valve system	Valve stem oil seal defective	Replace
	Valve stem or valve guide worn	Replace valve and valve guide
Oil leaking into combustion chambers due to poor seal in cylinder parts	Cylinders and pistons worn excessively	Replace cylinder body assembly and pistons
	Piston ring gaps incorrectly positioned	Correct
	Piston rings set with wrong side up	Correct
	Piston ring sticking	Replace cylinder body assembly and pistons
	Piston ring and ring groove worn	Replace pistons and others
	Return ports in oil rings clogged	Clean piston and replace rings
Positive Crankcase Ventilation System malfunctioning	Positive Crankcase Ventilation Valve clogged	Clean
Others	Improper oil viscosity	Use oil of recommended S.A.E. viscosity
	Continuous high speed driving and/or severe usage such as trailer towing	Continuous high speed operation and/or severe usage will normally cause increased oil consumption

Fuel Consumption Excessive

Condition	Possible cause	Correction
Trouble in fuel system	Mixture too rich or too lean due to trouble in fuel injection system	Refer to “Abnormal Combustion”
	Fuel cut function does not work	Refer to “Abnormal Combustion”
Trouble in ignition system	Misfiring or abnormal combustion due to trouble in ignition system	Refer to “Hard Start” or “Abnormal Combustion”
Others	Engine idle speed too high	Reset Idle Air Control Valve
	Fuel system leakage	Correct or replace
	Clutch slipping	Correct
	Brake drag	Correct
	Selection of transmission gear incorrect	Caution operator of incorrect gear selection
	Excessive Exhaust Gas Recirculation flow due to trouble in Exhaust Gas Recirculation system	Refer to “Abnormal Combustion”

Lubrication Problems

Condition	Possible cause	Correction
Oil pressure too low	Wrong oil in use	Replace with correct engine oil
	Relief valve sticking	Replace
	Oil pump not operating properly	Correct or replace
	Oil pump strainer clogged	Clean or replace strainer
	Oil pump worn	Replace
	Oil pressure gauge defective	Correct or replace
	Crankshaft bearing or connecting rod bearing worn	Replace
Oil contamination	Wrong oil in use	Replace with correct engine oil
	Oil filter clogged	Replace oil filter
	Cylinder head gasket damage	Replace gasket
	Burned gases leaking	Replace piston and piston rings or cylinder body assembly
Oil not reaching valve system	Oil passage in cylinder head or cylinder body clogged	Clean or correct

Engine Oil Pressure Check

1. Check for dirt, gasoline or water in the engine oil.
   a. Check the viscosity of the oil.
   b. Check the viscosity of the oil.
   c. Change the oil if the viscosity is outside the specified standard.
   d. Refer to the “Maintenance and Lubrication” section of this manual.
2. Check the engine oil level.
   The level should fall somewhere between the “ADD” and the “FULL” marks on the oil level dipstick.
   If the oil level does not reach the “ADD” mark on the oil level dipstick, engine oil must be added.
3. Remove the oil pressure unit.
4. Install an oil pressure gauge.
5. Start the engine and allow the engine to reach normal operating temperature (About 80°C).
6. Measure the oil pressure.
   Oil pressure should be:
   392–550 kPa (56.9–80.4 psi) at 3000 rpm.
7. Stop the engine.
8. Remove the oil pressure gauge.
9. Install the oil pressure unit.
10. Start the engine and check for leaks.

Malfunction Indicator Lamp

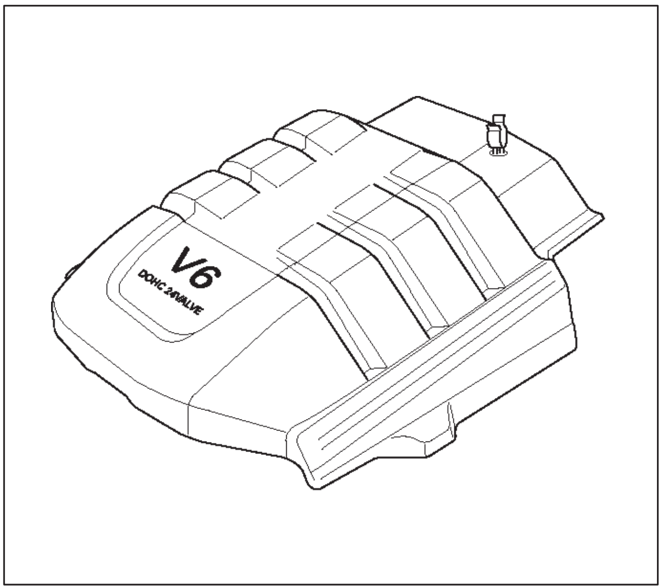
The instrument panel “CHECK ENGINE” Malfunction Indicator Lamp (MIL) illuminates by self diagnostic system when the system checks the starting of engine, or senses malfunctions.

Condition	Possible cause	Correction
“CHECK ENGINE” MIL does not illuminate at the starting of engine	Bulb defective	Replace
	MIL circuit open	Correct or replace
	Command signal circuit to operate self diagnostic system shorted	Correct or replace
	Powertrain Control Module (PCM) cable loosely connected, disconnected or defective	Correct or replace
	PCM defective	Replace
“CHECK ENGINE” MIL illuminates, and stays on	Deterioration of heated oxygen sensor internal element	Replace
	Heated oxygen sensor connector terminal improper contact	Reconnect properly
	Heated oxygen sensor lead wire shorted	Correct
	Heated oxygen sensor circuit open	Correct or replace
	Deterioration of engine coolant temperature sensor internal element	Replace
	Engine coolant temperature sensor connector terminal improper contact	Reconnect properly
	Engine coolant temperature sensor lead wire shorted	Correct
	Engine coolant temperature sensor circuit open	Correct or replace
	Throttle position sensor open or shorted circuits	Correct or replace
	Deterioration of crankshaft position sensor	Replace
	Crankshaft position sensor circuit open or shorted	Correct or replace
	Vehicle speed sensor circuit open	Correct or replace
	Manifold absolute pressure sensor circuit open or shorted	Correct or replace
	Intake air temperature sensor circuit open or shorted	Correct or replace
	Fuel injector circuit open or shorted	Correct or replace
	PCM driver transistor defective	Replace PCM
	Malfunctioning of PCM RAM (Random Access Memory) or ROM (Read Only Memory)	Replace PCM

Cylinder Head Cover LH

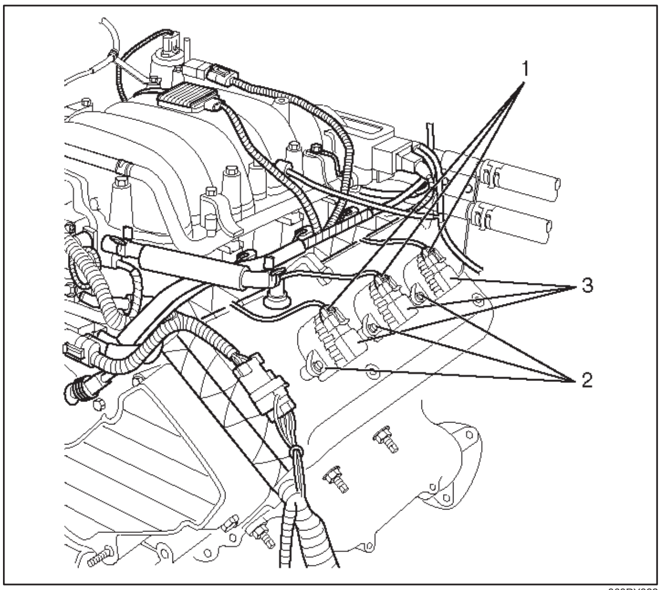
Removal

1. Disconnect battery ground cable.
2. Remove engine cover from the dowels on the common chamber.



F06RY001

3. Disconnect positive crankcase ventilation hose.
4. Remove ground cable fixing bolt on cylinder head cover.
5. Ignition coil connector and ignition coil.
   - Disconnect the three connectors from the ignition coils.
   - Remove harness bracket bolt on cylinder head cover.
   - Remove fixing bolts on ignition coils.

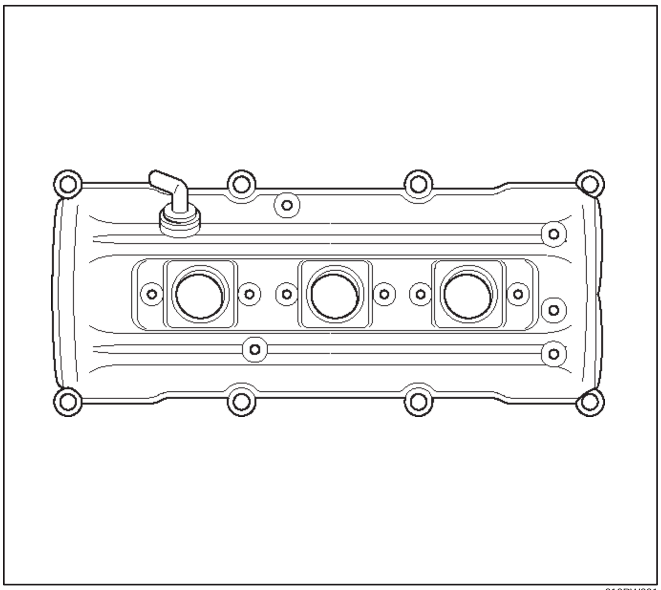


060RY022

Legend

(1) Ignition Coil Connector
(2) Bolt
(3) Ignition Coil Assemblies

6. Disconnect fuel injector harness connector then remove fuel injector harness bracket bolt.
7. Remove eight fixing bolts, then the cylinder head cover.



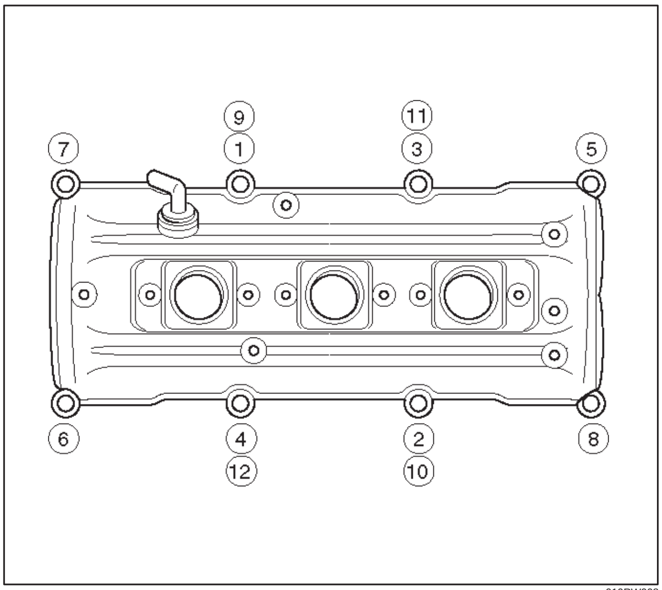
010RW001

NOTE: As the inmost left side bolt in the cylinder head cover is not easy to remove, follow the undermentioned procedure for removing the bolt.

Installation

1. Install cylinder head cover.
   - Clean the sealing surface of cylinder head and cylinder head cover to remove oil and sealing materials completely.
   - Apply sealant (TB-1207B or equivalent) of bead diameter 2-3 mm at eight place of arched area of camshaft bearing cap on front and rear sides.
   - The cylinder head cover must be installed with in 5 minutes after sealant application to prevent hardning of sealant.
   - Tighten bolts to the specified torque.

Torque : 9 N·m (80 lb in)



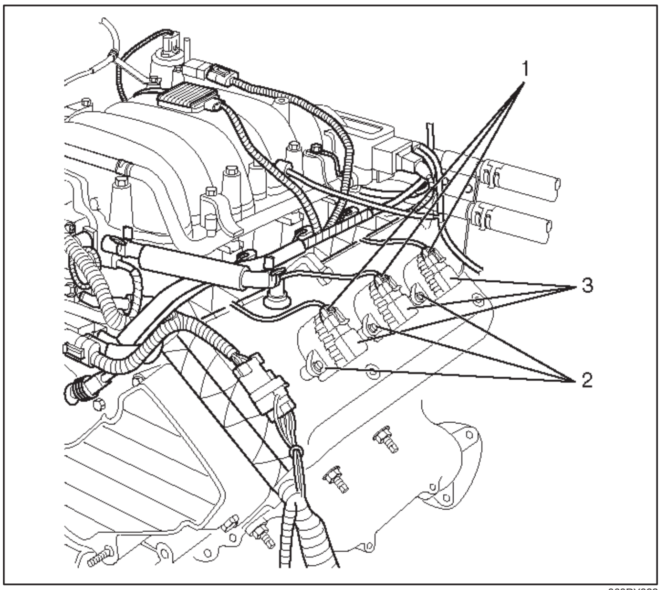
010RW008

2. Install fuel injection harness bracket and tighten bolt to the specified torque.

Torque : 9 N·m (80 lb in)

3. Connect ignition coil connector and ignition coil, then tighten bolt to the specified torque.

Torque : 4 N·m (35 lb in)

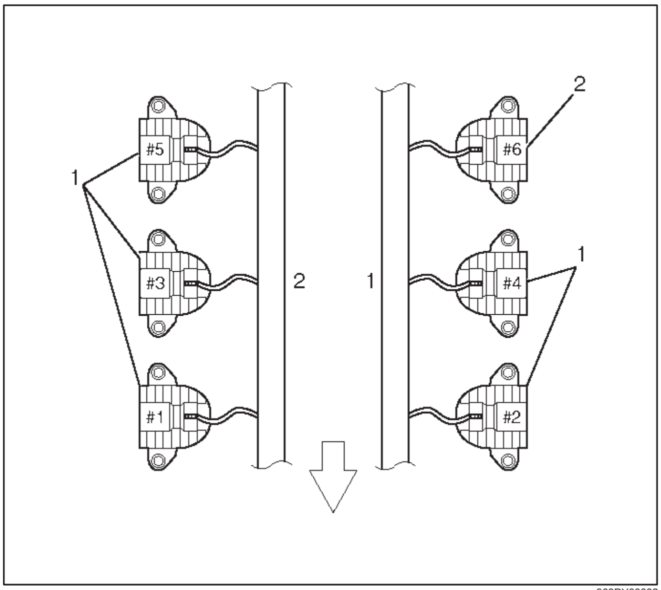


060RY022

Legend

(1) Ignition Coil Connector
(2) Bolt
(3) Ignition Coil Assembly

CAUTION: Ignition coil assembly #6 is different from ignition coil assembly from #1 to #5. Ignition coil assembly #6 is short type. So, note it when installing ignition coil assembly of #6.



060RY00002

Legend

(1) Long Type Ignition Coil Assemblies (# 1 ~ # 5)
(2) Short Type Ignition Coil Assembly (# 6)

4. Connect ground cable and tighten bolts to the specified torque.

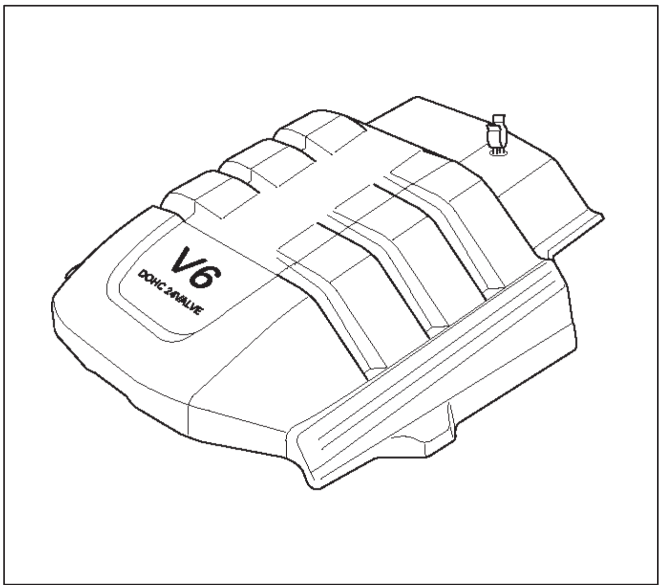
Torque : 9 N·m (80 lb in)

5. Install positive crankcase ventilation hose.
6. Install engine cover mating with the dowels.

Cylinder Head Cover RH

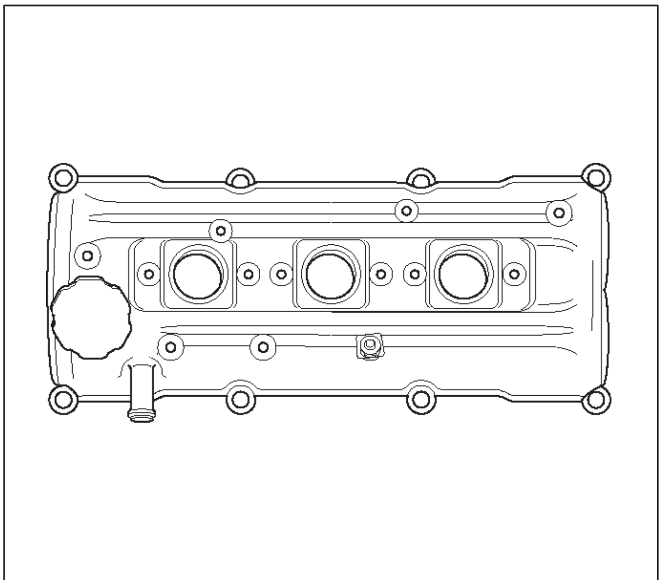
Removal

1. Disconnect battery ground cable.
2. Remove engine cover from the dowele on the common chamber.



F06RY001

3. Disconnect ventilation hose from cylinder head cover.
4. Disconnect three ignition coil connectors from ignition coils and remove harness bracket bolts on cylinder head cover then remove ignition coil fixing bolts on ignition coils and remove ignition coils.
5. Disconnect fuel injector harness connector then remove fuel injector harness bracket bolt.
6. Remove eight fixing bolts then the cylinder head cover.



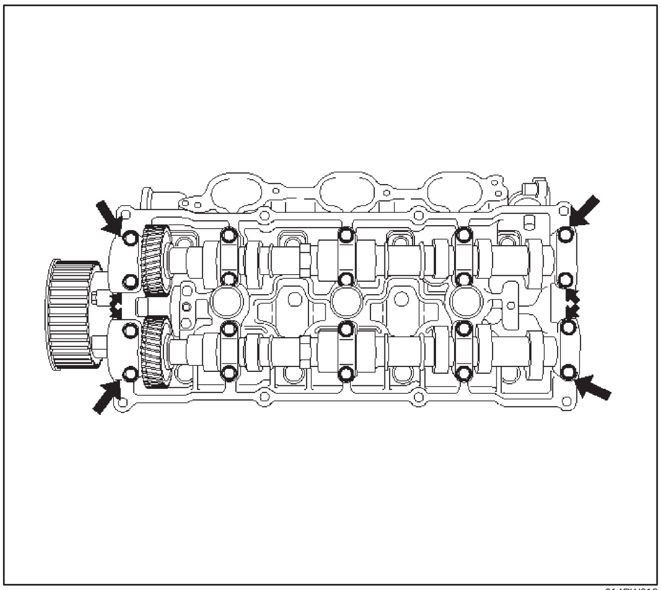
010RW002

Installation

1. Install cylinder head cover.
   - Clean the sealing surface of cylinder head and cylinder head cover to remove oil and sealing materials completely.

     Apply sealant (TB-1207B or equivalent) bead (diameter 2-3 mm) at eight places of arched areas of camshaft bracket on front and rear sides.
   - The cylinder head cover must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.
   - Tighten bolts to the specified torque.

   Torque : 9 N·m (80 lb in)



014RW019

2. Tighten fuel injector harness bracket bolts to specified torque then reconnect fuel injector harness connector.

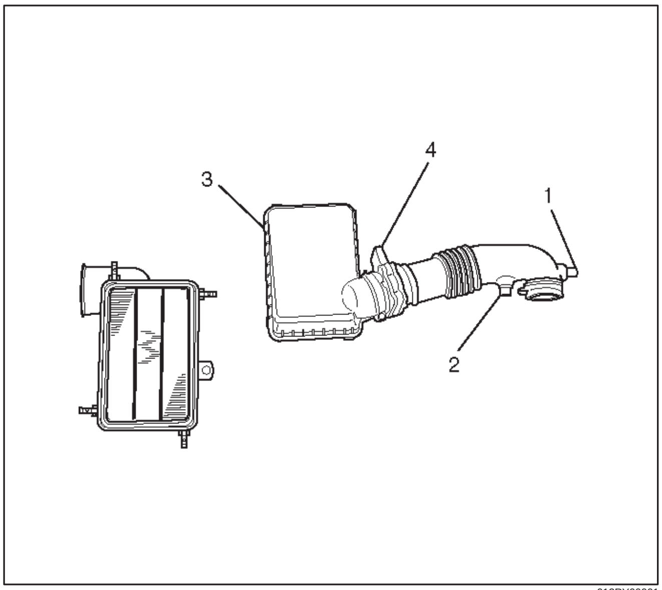
   Torque : 7.8 N·m (5.7 lb ft)
3. Connect ignition coil connector and tighten ignition coil fixing bolts to specified torque.

   Torque : 4 N·m (35 lb in)
4. Connect ventilation hose to cylinder head.
5. Install engine cover mating with the dowels.

Common Chamber

Removal

1. Disconnect battery ground cable.
2. Remove air cleaner duct assembly.

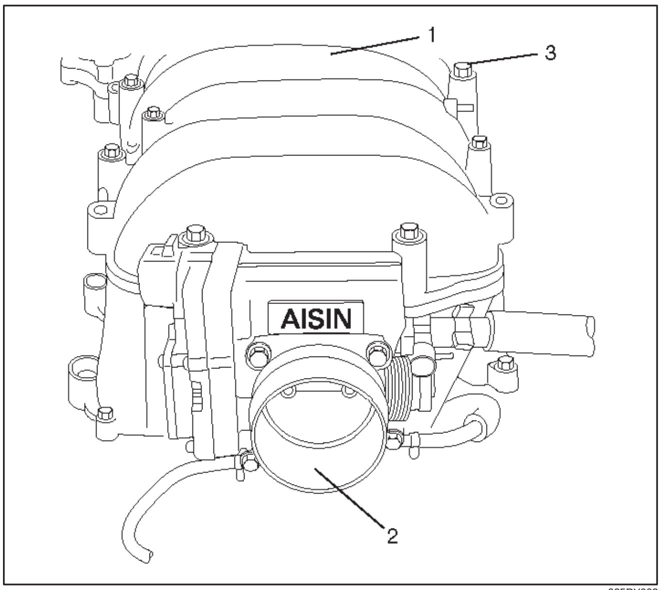


013RY00001

Legend

(1) Positive Crankcase Ventilation Hose Connector
(2) Intake Air Temperature Sensor
(3) Air Cleaner Duct Assembly
(4) Air Flow Sensor

3. Disconnect vacuum booster hose from common chamber.
4. Disconnect connector from manifold absolute pressure sensor, Ion sensing module, throttle position sensor, solenoid valve, electric vacuum sensing valve, and EGR valve.
5. Disconnect vacuum hose on canister VSV and positive crankcase ventilation hose, fuel rail assembly with pressure control valve bracket.
6. Remove ventilation hose from throttle valve and intake duct and remove water hose.
7. Remove the four throttle body fixing bolts.
8. Remove exhaust gas recirculation valve assembly fixing bolt and nut on common chamber and remove EGR valve assembly.
9. Remove two bolts from common chamber rear side for remove fuel hose bracket.
10. Remove common chamber four bolts and four nuts then remove the common chamber.



025RY002

Legend

(1) Common Chamber
(2) Throttle Valve Assembly
(3) Bolt

Installation

1. Install common chamber and tighten bolts and nuts to the specified torque.

   Torque :

   Bolt : 25 N·m (18 lb ft)

   Nut : 25 N·m (18 lb ft)

2. Install fuel hose bracket and tighten bolts to specified torque.

   Torque : 10 N·m (89 lb in)

3. Install exhaust gas recirculation valve assembly and tighten bolt and nut to the specified torque.

   Torque : 25 N·m (18 lb ft)

4. Install throttle body and tighten bolts to the specified torque.

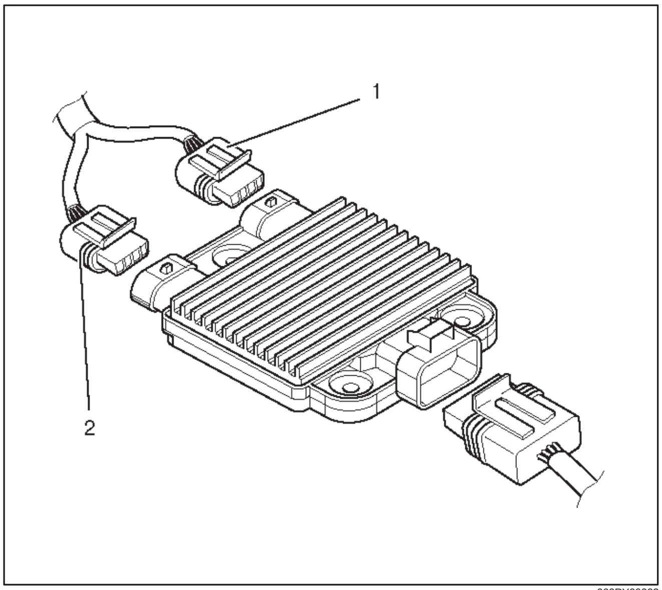
   Torque : 25 N·m (18 lb ft)

5. Install ventilating hose to throttle valve and intake duct.
6. Connect vacuum hoses on canister VSV and positive crankcase ventilation hose. Tighten bolts for fuel rail assembly with pressure control valve bracket.

   Torque : 25 N·m (18 lb ft)

7. Connect each connector without fail.

8. Connect vacuum booster hose.
9. Connect the Ion sensing module connectors as shown in the illustration.

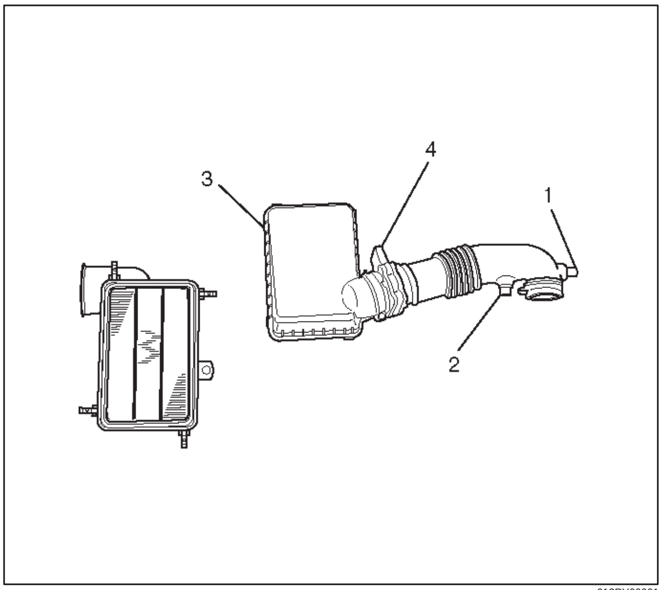


060RY00003

Legend

(1) Green Connector
(2) Blue Connector

10. Install air cleaner duct assembly.



013RY00001

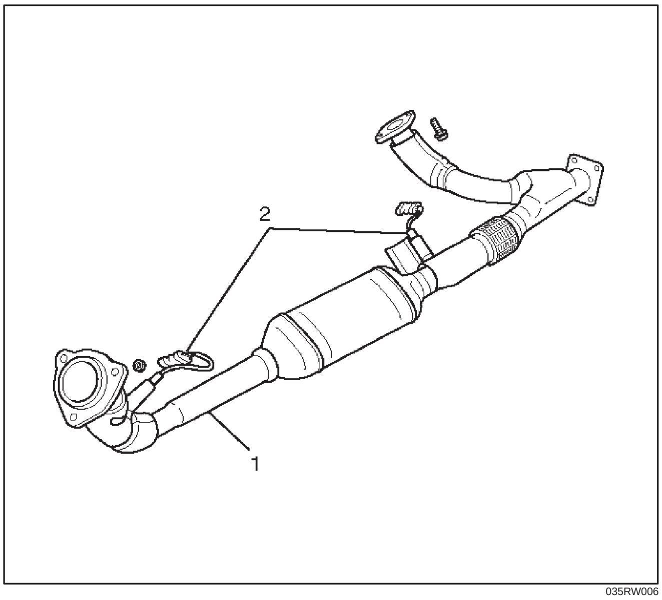
Legend

(1) Positive Crankcase Ventilation Hose Connector
(2) Intake Air Temperature Sensor
(3) Air Cleaner Duct Assembly
(4) Mass Air Flow Sensor

Exhaust Manifold LH

Removal

1. Disconnect battery ground cable.
2. Disconnect O_2 sensor connector.
3. Remove exhaust front pipe three stud nuts from exhaust side and two nuts from rear end of exhaust front pipe.



Legend

(1) Exhaust Front Pipe LH
(2) O_2 Sensor

4. Remove exhaust manifold eight fixing nuts and remove exhaust manifold from the engine.

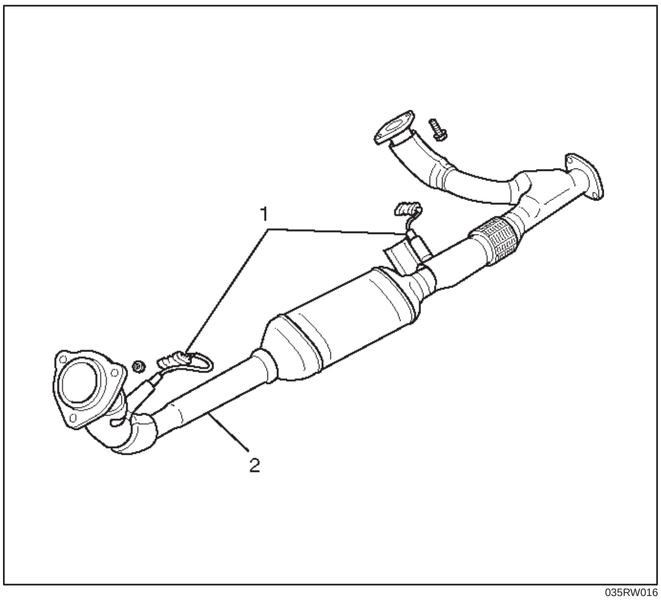
Installation

1. Install exhaust manifold and tighten exhaust manifold fixing nuts to the specified torque with new nuts.

Torque: 57 N·m (42 lb ft)

2. Install exhaust front pipe and tighten three stud nuts and two nuts to the specified torque.

Torque :
Stud nuts: 67 N·m (49 lb ft)
Nuts: 43 N·m (32 lb ft)



Legend

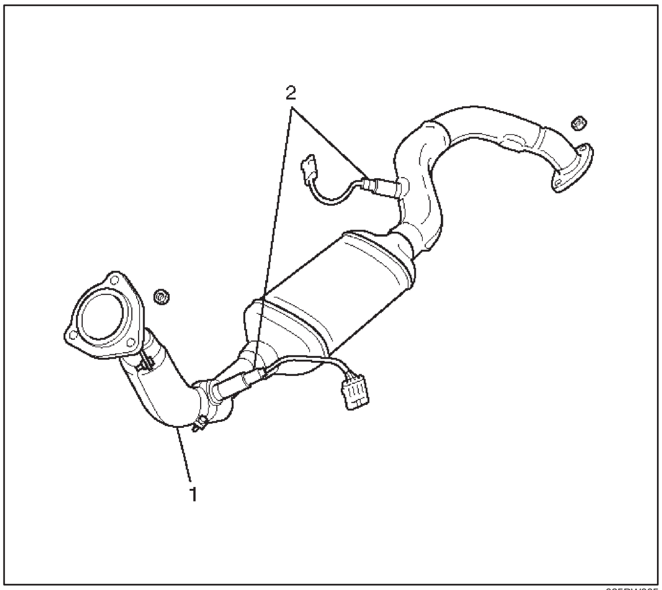
(1) O_2 Sensor
(2) Exhaust Front Pipe LH

3. Reconnect O_2 sensor connector.

Exhaust Manifold RH

Removal

1. Disconnect battery ground cable.
2. Remove torsion bar. Refer to removal procedure in Front Suspension section.
3. Remove exhaust front pipe three stud nuts and two nuts then disconnect exhaust front pipe.



035RW005

Legend

(1) Exhaust Front Pipe RH
(2) O_2 Sensor

4. Remove exhaust manifold eight fixing nuts then the exhaust manifold.

Installation

1. Install exhaust manifold and tighten bolts to the specified torque.

Torque : 57 N·m (42 lb ft)

2. Install exhaust front pipe and tighten three stud nuts and two nuts to the specified torque.

Torque:

Stud nuts: 67 N·m (49 lb ft)

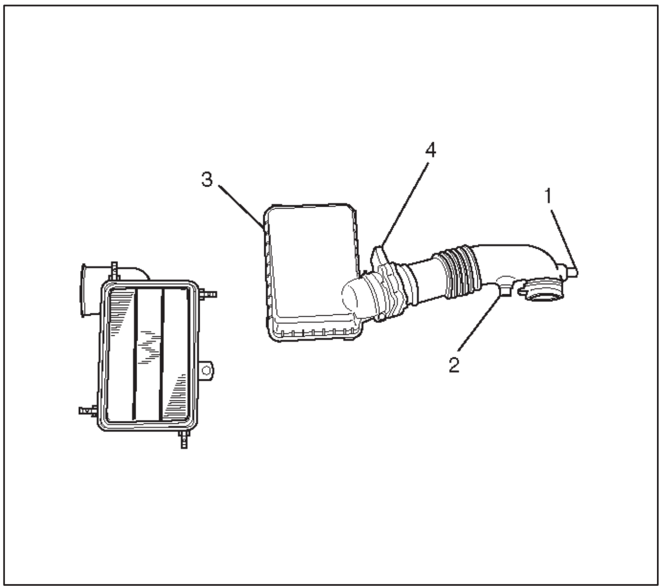
Nuts: 43 N·m (32 lb ft)

3. Install the torsion bar and readjust the vehicle height. Refer to installation and vehicle height adjustment procedure for front suspension.

Crankshaft Pulley

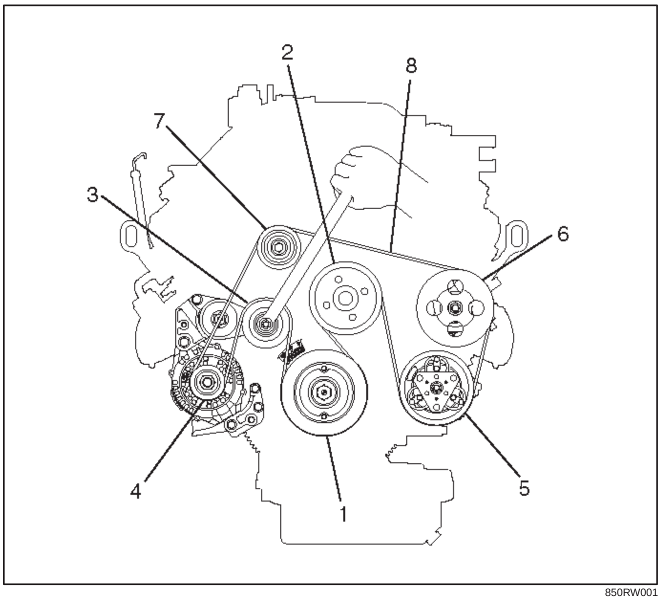
Removal

1. Disconnect battery ground cable.
2. Remove air cleaner assembly.



Legend
- (1) Positive Crankcase Ventilation Hose Connector
- (2) Intake Air Temperature Sensor
- (3) Air Cleaner Duct Assembly
- (4) Air Flow Sensor

3. Remove radiator upper fan shroud from radiator.
4. Move serpentine belt tensioner to loose side using wrench then remove serpentine belt.



Legend
- (1) Crankshaft Pulley
- (2) Cooling Fan Pulley
- (3) Tensioner
- (4) Generator
- (5) Air Conditioner Compressor
- (6) Power Steering Oil Pump
- (7) Idle Pulley
- (8) Driver Belt

5. Remove cooling fan assembly four fixing nuts, then the cooling fan assembly.
6. Remove crankshaft pulley assembly using J-8614-01 crankshaft holder, hold crankshaft pulley then remove center bolt and pulley.

Installation

1. Install crankshaft pulley using J-8614-01 crankshaft holder, hold the crankshaft pulley and tighten center bolt to the specified torque.

   Torque : 167 N·m (123 lb ft)

2. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

   Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.

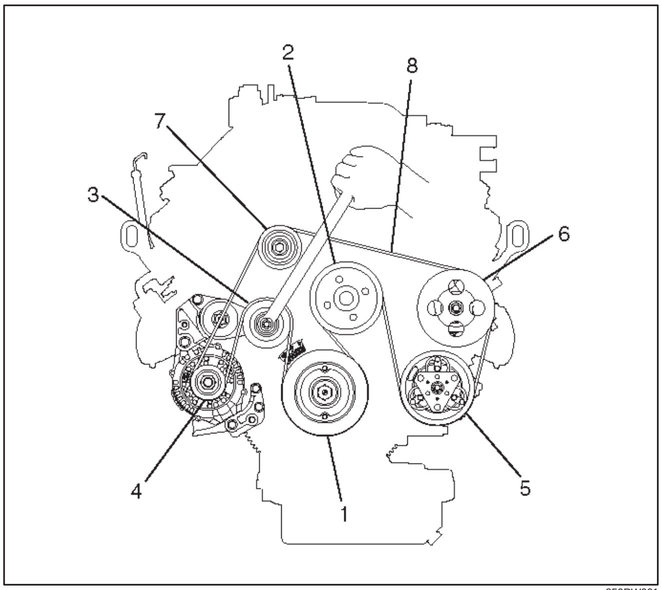
   Torque : 7.5 N·m (66.4 lb in) for fan and clutch assembly.

3. Move serpentine belt tensioner to loose side using wrench, then install serpentine belt to normal position.
4. Install radiator upper fan shroud.
5. Install air cleaner assembly.

Timing Belt

Removal

1. Disconnect battery ground cable.
2. Remove air cleaner assembly.
3. Remove radiator upper fan shroud from radiator.
4. Move drive belt tensioner to loose side using wrench then remove drive belt.

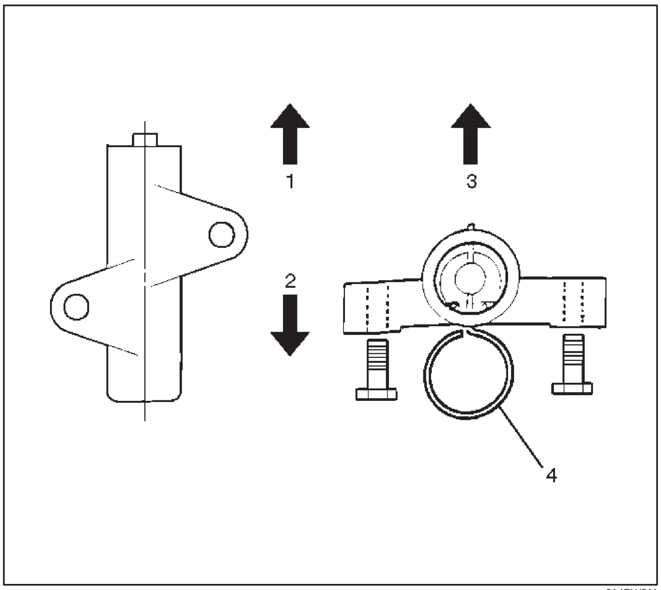


Legend

- (1) Crankshaft Pulley
- (2) Cooling Fan Pulley
- (3) Tensioner
- (4) Generator
- (5) Air Conditioner Compressor
- (6) Power Steering Oil Pump
- (7) Idle Pulley
- (8) Drive Belt

5. Remove cooling fan assembly four nuts, then the cooling fan assembly.
6. Remove cooling fan drive pulley assembly.
7. Remove idle pulley assembly.
8. Remove serpentine belt tensioner assembly.
9. Remove power steering pump assembly.
10. Remove crankshaft pulley assembly using J-8614-01 crankshaft holder, hold crankshaft pulley remove center bolt, then the pulley.
11. Remove right side timing belt cover then left side timing belt cover.
12. Remove lower timing belt cover
13. Remove pusher.

CAUTION: The pusher prevents air from entering the oil chamber. Its rod must always be facing upward.



Legend

- (1) Up Side
- (2) Down Side
- (3) Direction For Installation
- (4) Locking Pin

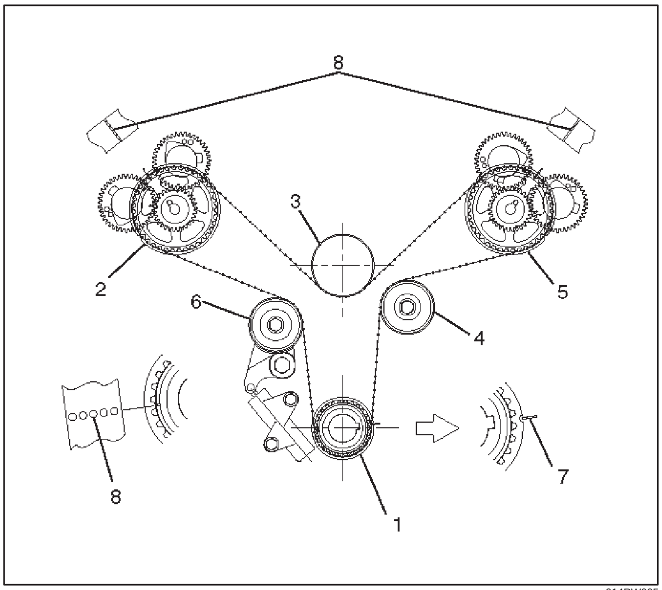
14. Remove timing belt.

CAUTION:

1. **Do not bend or twist the belt, otherwise its core could be damaged. The belt should not be bent at a radius less than 30 mm.**
2. **Do not allow oil or other chemical substances to come in contact with the belt. They will shorten the life.**
3. **Do not attempt to pry or stretch the belt with a screw driver or any other tool during installation.**
4. **Store timing belt in a cool and dark place. Never expose the belt direct sunlight or heat.**

Installation

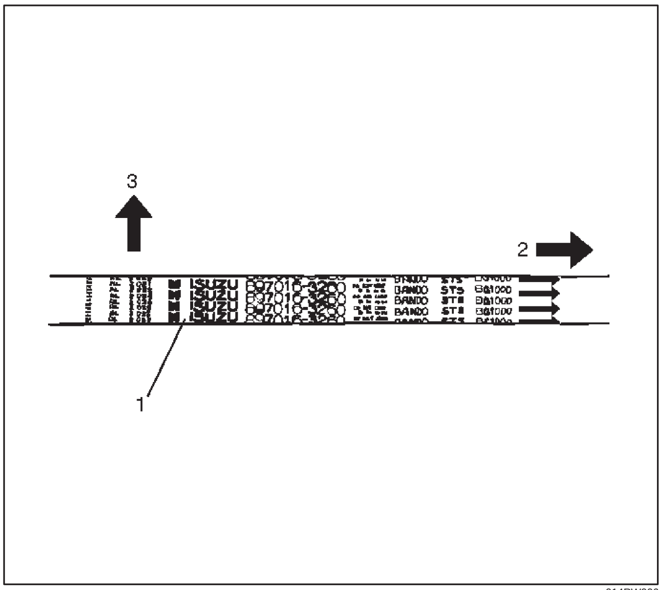
NOTE: For correct belt installation, the letter on the belt must be able to be read as viewed from the front of the vehicle.



014RW005

Legend

(1) Crankshaft Timing Pulley
(2) RH Bank Camshaft Drive Gear Pulley
(3) Water Pump Pulley
(4) Idle Pulley
(5) LH Bank Camshaft Drive Gear Pulley
(6) Tension Pulley
(7) Alignment Mark on Oil Pump.
(8) Alignment Mark on Timing Belt



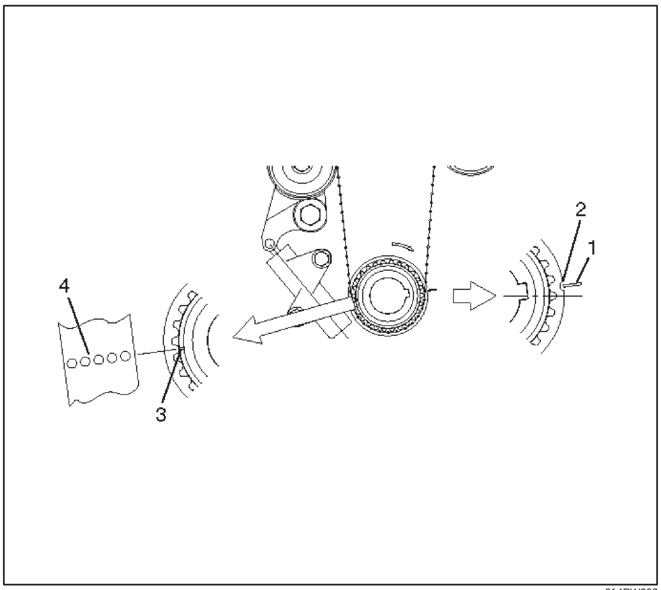
014RW006

Legend

(1) Timing Belt
(2) Engine Rotation Direction
(3) Cylinder Head Side

1. Install timing belt.
   1. Align groove of crankshaft timing pulley with mark on oil pump.
      Align the mark on the crankshaft timing pulley with alignment mark (white dotted line) on the timing belt.
      Secure the belt with a double clip.

NOTE: When timing marks are aligned, No.2 piston will be on Top Dead Center.

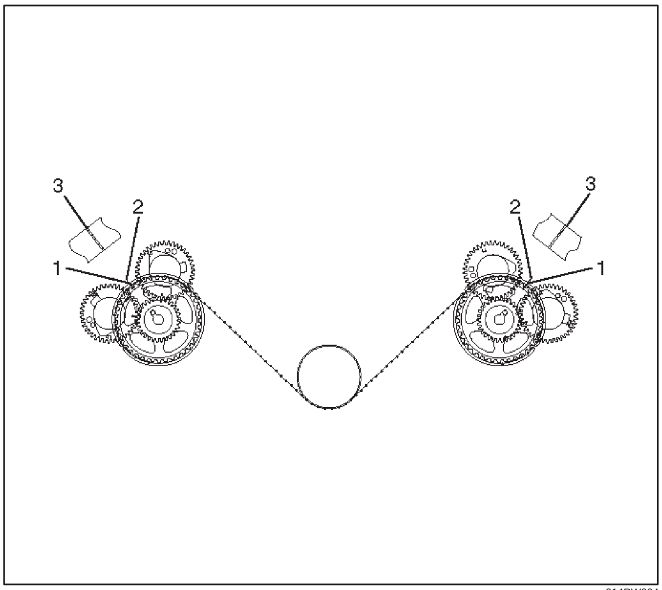


014RW003

Legend

(1) Alignment Mark on Oil Pump
(2) Groove on Crankshaft Timing Pulley
(3) Alignment Mark on Crankshaft Timing Pulley
(4) Alignment Mark on Timing Belt

2. Align the marks on the camshaft drive gear pulleys with the corresponding alignment marks on the cylinder head covers.



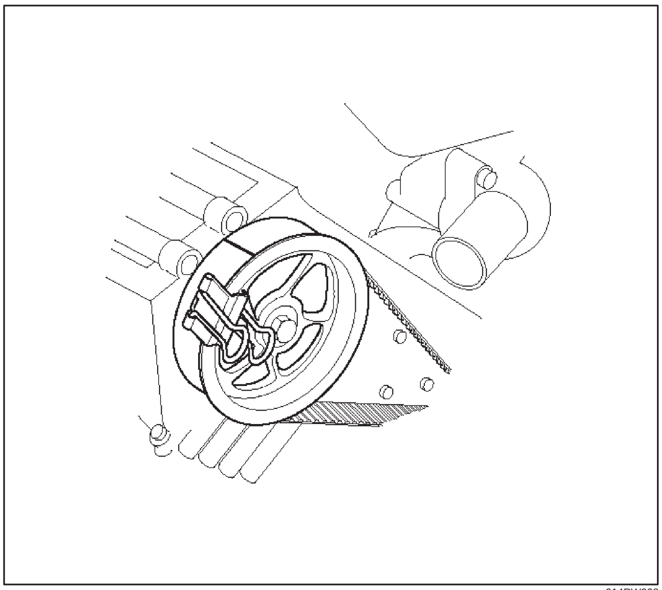
014RW004

Legend

(1) Alignment Mark on Camshaft Drive Gear Pulley
(2) Alignment Mark on Cylinder Head Cover.
(3) Alignment Mark on Timing Belt (White Line)

3. Align the alignment mark (white line) on the timing belt with alignment mark on the RH bank camshaft drive gear pulley (on the left side as viewed from the front of the vehicle).

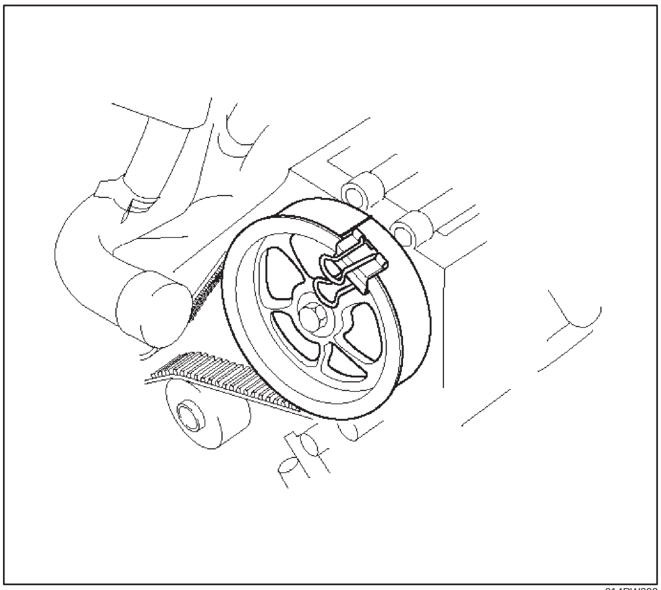
   Secure the belt with a double clip.


014RW008

4. Align the alignment mark (white line) on the timing belt with the alignment mark on the LH bank camshaft drive gear pulley.

   When aligning the timing marks, use a wrench to turn the camshaft drive gear pulley, then set the timing mark between timing belt and camshaft drive gear pulley.
   Secure the belt with a double clip.

NOTE: It is recommended for easy installation that the belt be secured with a double clip after it is installed to each pulley.

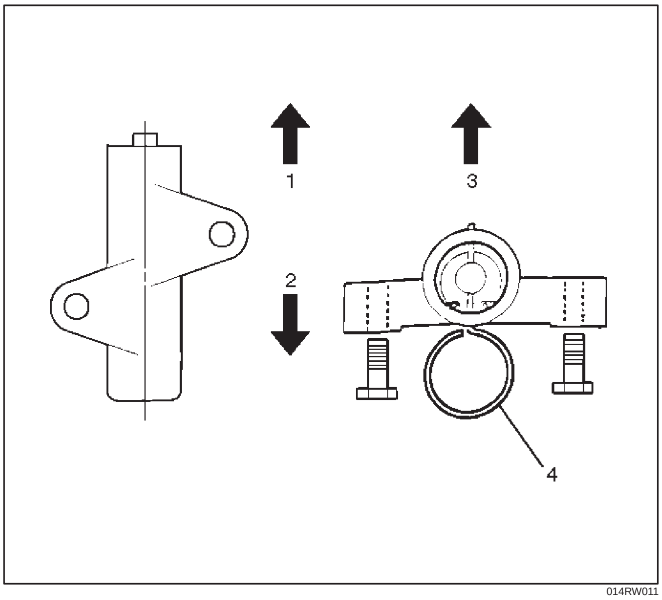

014RW009

5. Install crankshaft pulley temporarily and tighten center bolt by hand (do not use a wrench).

   Turn the crankshaft pulley clockwise to give some belt slack between the crankshaft timing pulley and the RH bank camshaft drive gear pulley.

2. Install pusher and tighten bolt to the specified torque.
   1. Install the pusher while pushing the tension pulley to the belt.
   2. Pull out pin from the pusher.

NOTE: When reusing the pusher, press the pusher with approximately 100Kg to retract the rod, and insert a pin (1.4 mm piano wire).



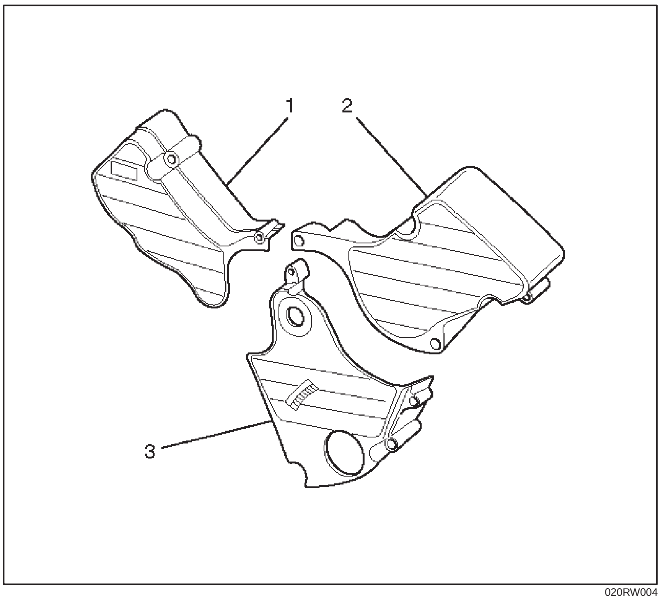
Legend
(1) Up Side
(2) Down Side
(3) Direction for Installation
(4) Locking Pin

3. Remove double clips from timing belt pulleys.
   Turn the crankshaft pulley clockwise by two turns.

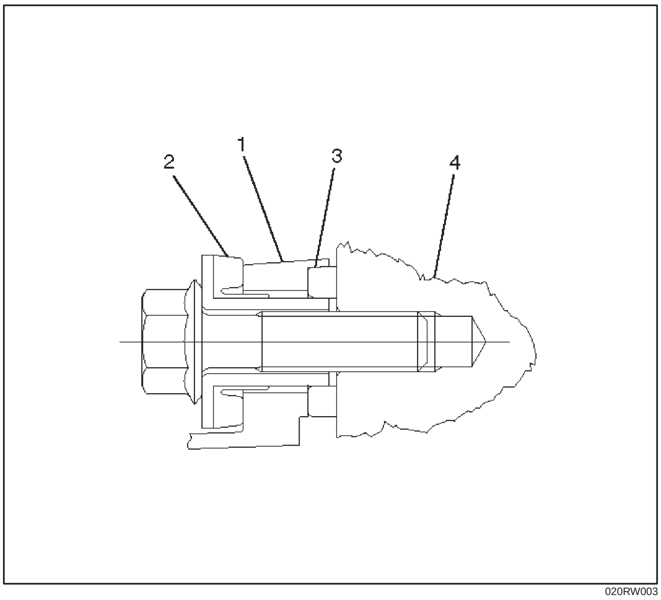
Torque : 25 N·m (18 lb ft)

3. Install timing belt cover.
   Remove crankshaft pulley that was installed in step 1 item 5.
   Tighten bolts to the specified torque.

Torque: 19 N·m (14 lb ft)



Legend
(1) Timing Belt Cover RH
(2) Timing Belt Cover LH
(3) Timing Belt Cover Lower



Legend
(1) Timing Belt Cover
(2) Rubber Bushing
(3) Sealing Rubber
(4) Cylinder Body

4. Install crankshaft pulley using J-8614-01, hold the crankshaft pulley and tighten center bolt to the specified torque.

Torque : 167 N·m (123 lb ft)

5. Install fan pulley bracket and tighten fixing bolts to the specified torque.

Torque : 22 N·m (16 lb ft)

6. Install power steering pump assembly and tighten to the specified torque.

Torque :

M8 bolt : 22 N·m (16 lb ft)

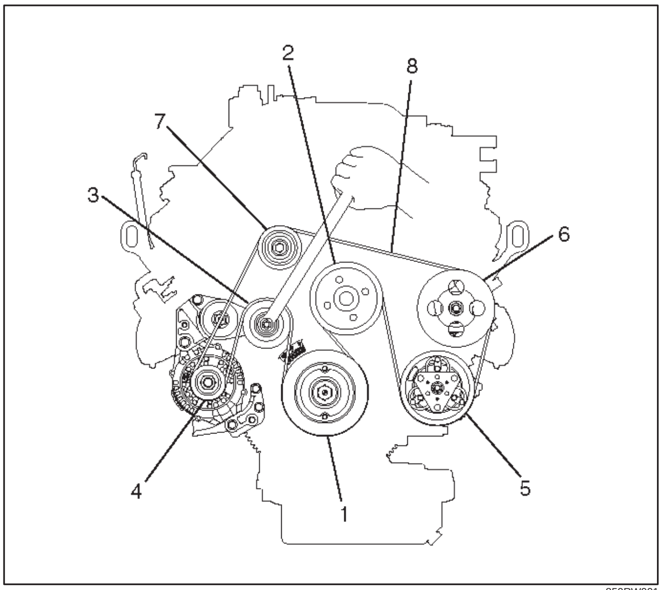
M10 bolt : 46 N·m (34 lb ft)

7. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.

Torque : 7.5 N·m (66.4 lb in) for fan and clutch assembly.

8. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.



850RW001

Legend

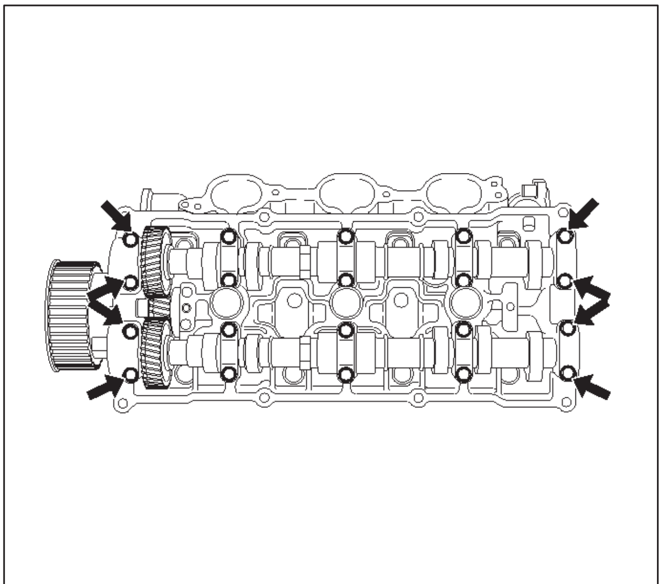
(1) Crankshaft Pulley
(2) Cooling Fan Pulley
(3) Tensioner
(4) Generator
(5) Air Conditioner Compressor
(6) Power Steering Oil Pump
(7) Idle Pulley
(8) Drive Belt

9. Install radiator upper fan shroud.
10. Install air cleaner assembly.

Camshaft

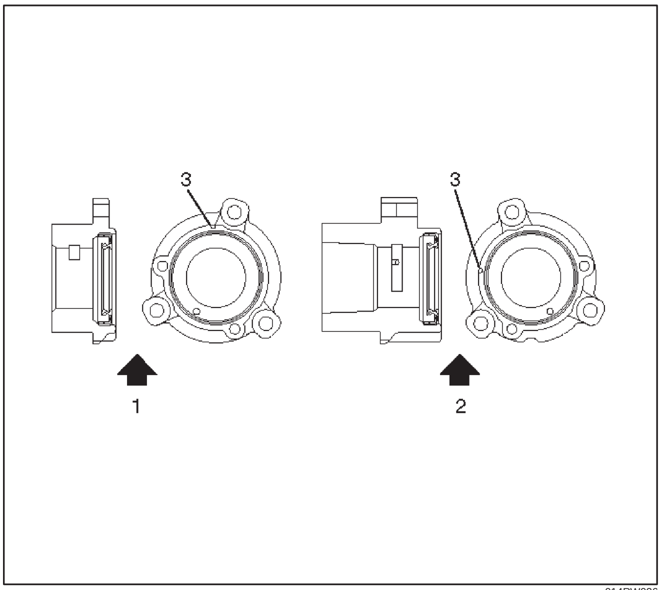
Removal

1. Disconnect battery ground cable.
2. Remove crankshaft pulley.
   - Refer to removal procedure for Crankshaft Pulley in this manual.
3. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
4. Remove cylinder head cover LH.
   - Refer to removal procedure for Cylinder Head Cover LH in this manual.
5. Remove cylinder head cover RH.
   - Refer to removal procedure for Cylinder Head Cover RH in this manual.
6. Remove twenty fixing bolts from inlet and exhaust camshaft bearing cap on one side bank, then camshaft bearing cap.



014RW027

7. Remove camshaft assembly.
8. Remove fixing bolt for camshaft drive gear pulley.
9. Remove three fixing bolts from camshaft drive gear retainer, then camshaft drive gear assembly.



014RW026

Legend

(1) Right Bank
(2) Left Bank
(3) Timing Mark on Retainer

Installation

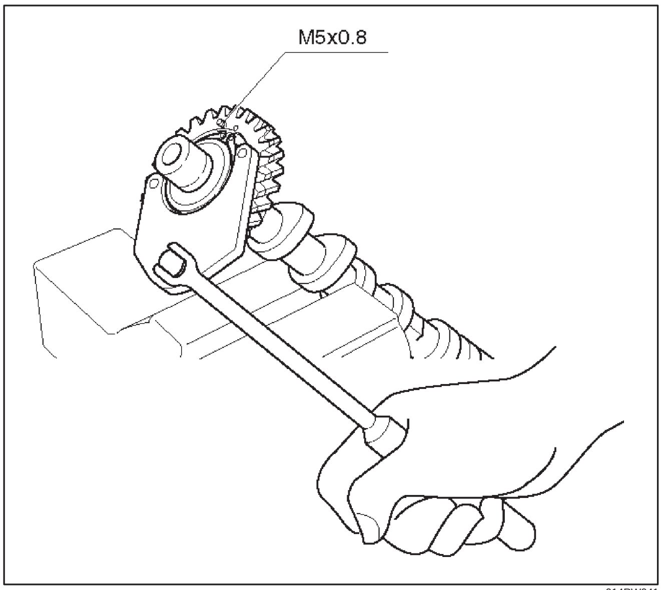
1. Install camshaft drive gear assembly and tighten three bolts to the specified torque.

   Torque : 10 N·m (89 lb in)

2. Tighten bolt for camshaft drive gear assembly pulley to the specified torque.

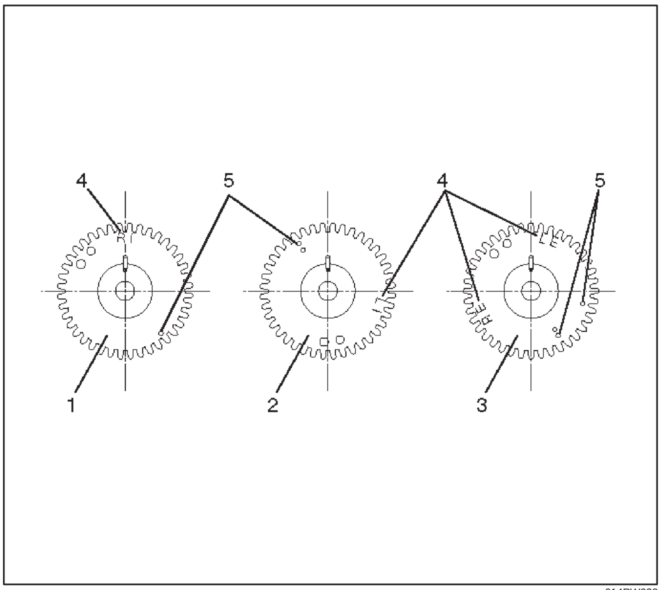
   Torque : 98 N·m (72 lb ft)

3. Tighten sub gear setting bolt.
   1. Use J-42686 to turn sub gear to right direction until it aligns with the M5 bolt hole between camshaft driven gear and sub gear.
   2. Tighten the M5 bolt to a suitable torque to prevent the sub gear from moving.



014RW041

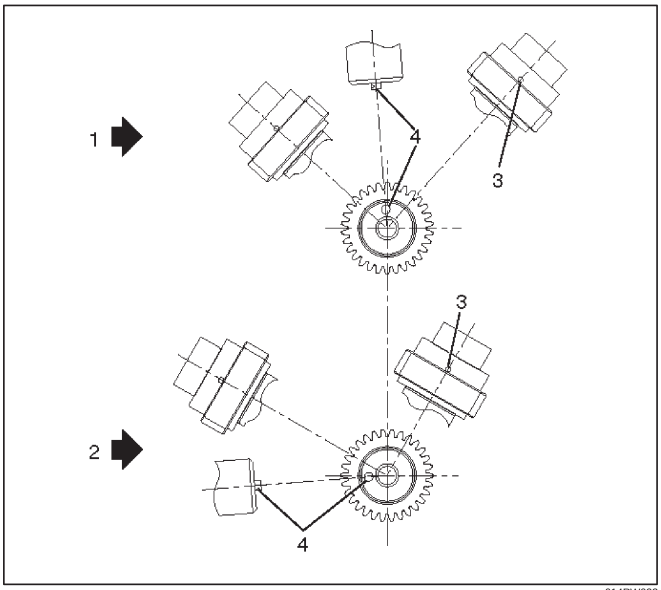
4. Install camshaft assembly and camshaft bearing caps, tighten twenty bolts on one side bank to the specified torque.
   1. Apply engine oil to camshaft journal and bearing surface of camshaft bearing caps.
   2. Align timing mark on intake camshaft (one dot for right bank, two dot for left bank) and exhaust camshaft (one dots for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



014RW020

Legend

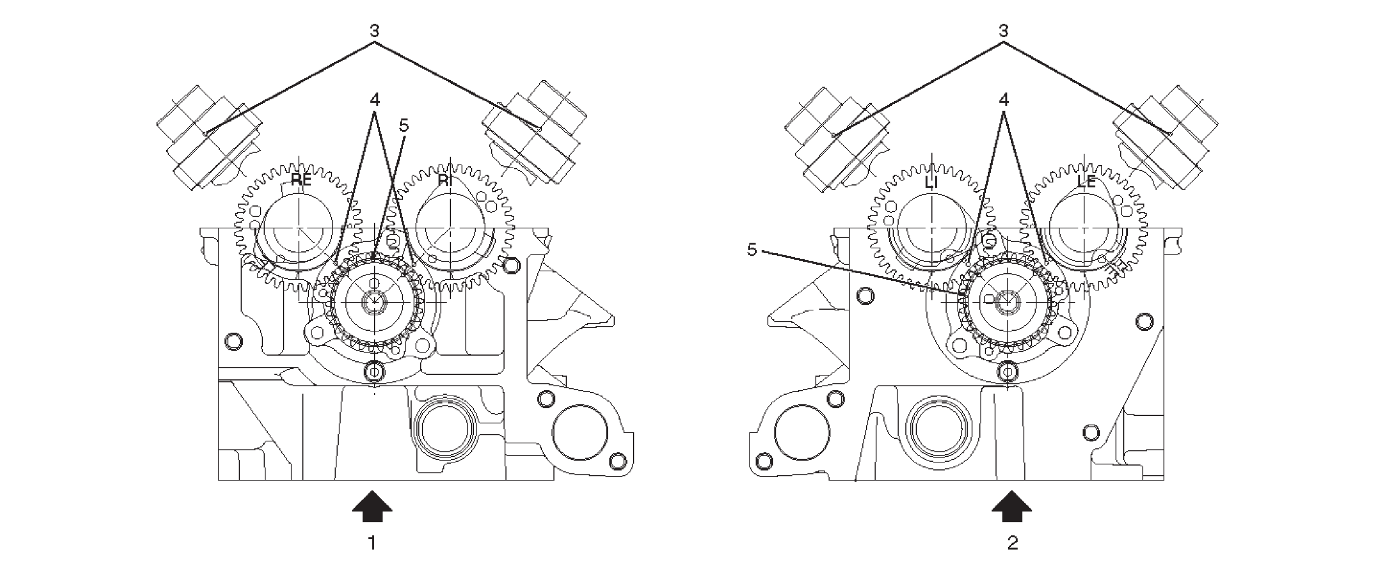
(1) Intake Camshaft Timing Gear for Right Bank
(2) Intake Camshaft Timing Gear for Left Bank
(3) Exhaust Camshaft Timing Gear
(4) Discrimination Mark
(LI: Left bank intake, RI: Right bank intake)
(LE: Left bank exhaust, RE: Right bank exhaust)



014RW023

Legend

(1) Right Bank Camshaft Drive Gear
(2) Left Bank Camshaft Drive Gear
(3) Timing Mark on Drive Gear
(4) Dowel Pin



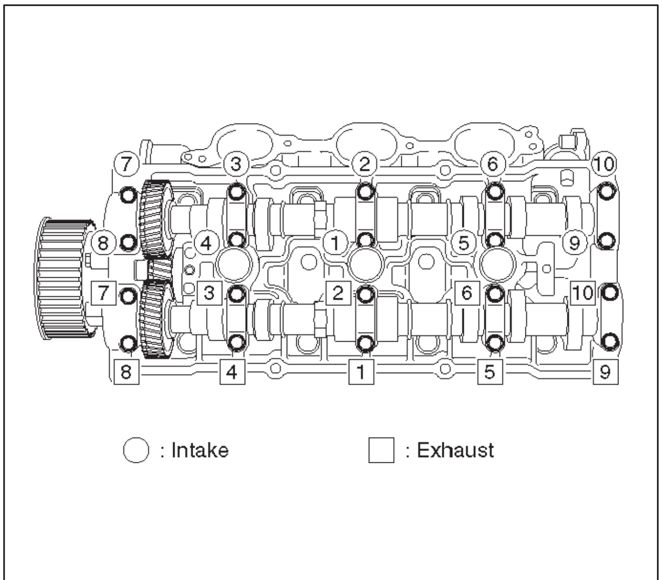
014RW024

Legend

(1) Right Bank
(2) Left Bank
(3) Alignment Mark on Camshaft Drive Gear
(4) Alignment Mark on Camshaft
(5) Alignment Mark on Retainer

3. Tighten twenty bolts on numerical order an one side bank as shown in the illustration.

Torque : 10 N·m (89 lb in)



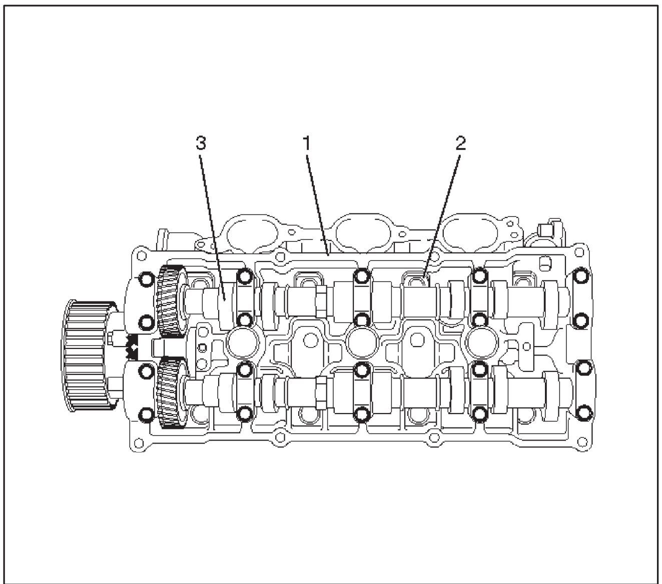
014RW031

5. Install cylinder head cover RH.
   - Refer to installation procedure for CYLINDER HEAD COVER RH in this manual.
6. Install cylinder head cover LH.
   - Refer to installation procedure for CYLINDER HEAD COVER LH in this manual.
7. Install timing belt.
   - Refer to installation procedure for TIMING BELT in this manual.
8. Install crankshaft pulley.
   - Refer to installation procedure for CRANKSHAFT PULLEY in this manual.

Cylinder Head

Removal

1. Remove engine hood.
2. Disconnect battery ground cable.
3. Drain radiator coolant.
4. Drain engine oil.
5. Remove crankshaft pulley.
   - Refer to removal procedure for Crankshaft Pulley in this manual.
6. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
7. Remove cylinder head cover LH.
   - Refer to removal procedure for Cylinder Head Cover LH in this manual.
8. Remove cylinder head cover RH.
   - Refer to removal procedure for Cylinder Head Cover RH in this manual.
9. Remove common chamber.
   - Refer to removal procedure for Common Chamber in this manual.
10. Remove cylinder head assembly.
    1. Loosen head bolts in reverse of tightening sequence.
    2. Remove cylinder head assembly.



014RW028

Legend

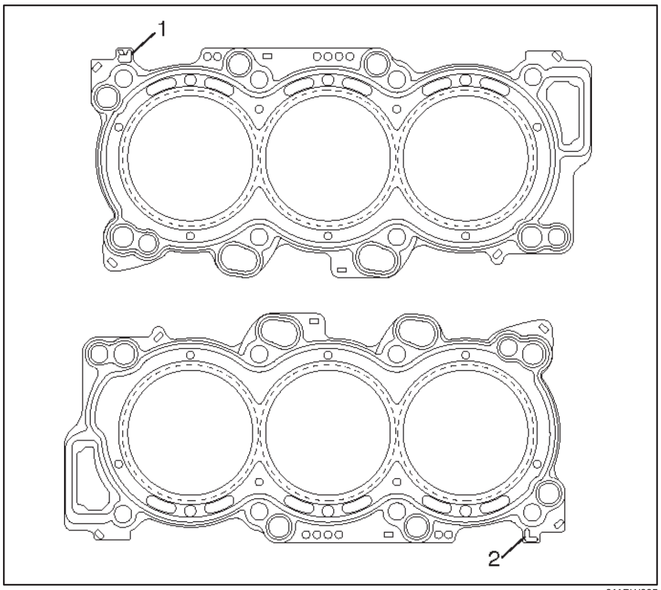
(1) Cylinder Head
(2) Cylinder Head Bolt
(3) Camshaft

Installation

1. Install cylinder head assembly to cylinder block.
   A. Put cylinder head gasket on the cylinder block.

NOTE: There is discrimination mark “R” for right bank and “L” for left bank on the cylinder head gasket as shown in the illustration.

Do not reuse cylinder head gasket.



011RW005

B. Align dowel pin hole to dowel pin on the cylinder block.
C. Position cylinder head on the cylinder bolock.
D. Tighten two bolts temporarily by hand to prevent the cylinder head assembly from moving.
E. Using J-24239-01 cylinder head bolt wrench, tighten bolts in numerical order as shown in the illustration to the specified torque.

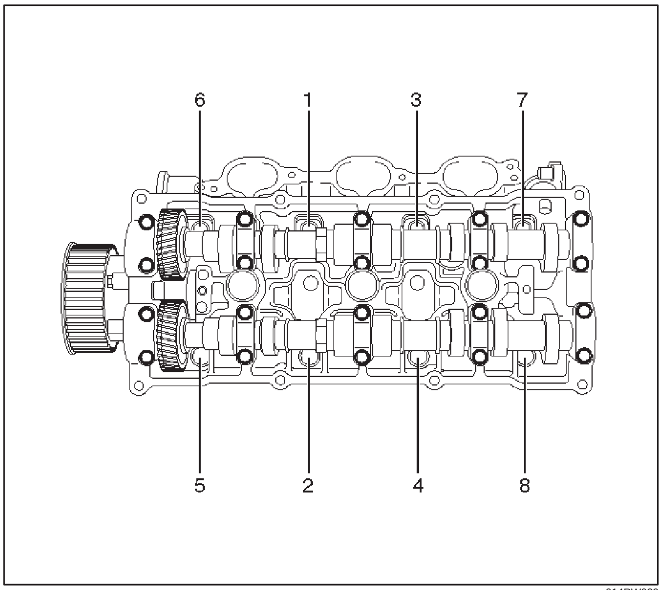
NOTE: Do not reuse cylinder head bolts.

Do not apply any lubricant to the cylinder head bolts.

Torque :

Temporary : 29 N·m (21 lb ft)

Final : 64 N·m (47 lb ft)



014RW029

2. Install common chamber.
   - Refer to installation procedure for Common Chamber in this manual.
3. Install cylinder head cover RH.
   - Refer to installation procedure for Cylinder Head Cover RH in this manual.
4. Install cylinder head cover LH.
   - Refer to installation procedure for Cylinder Head Cover LH in this manual.
5. Install timing belt.
   - Refer to installation procedure for Timing Belt in this manual.
6. Install crankshaft pulley.
   - Refer to installation procedure for Crankshaft Pulley in this manual.

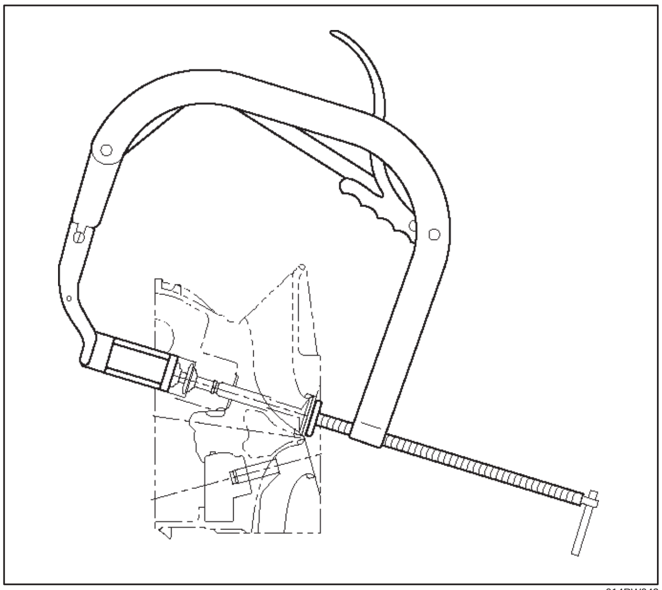
Valve Stem Oil Controller , Valve Spring and Valve Guide

Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
   - Drain engine coolant.
3. Remove cylinder head assembly.
   - Refer to removal procedure for Cylinder Head in this manual.
4. Remove camshaft.
   - Refer to removal procedure for Camshaft in this manual.
5. Remove tappets with shim.

NOTE: Do not damage shim surface.

6. Remove valve springs using J-8062 valve spring compressor and J-42898 valve spring compressor adapter then remove upper valve spring seat and lower seat.

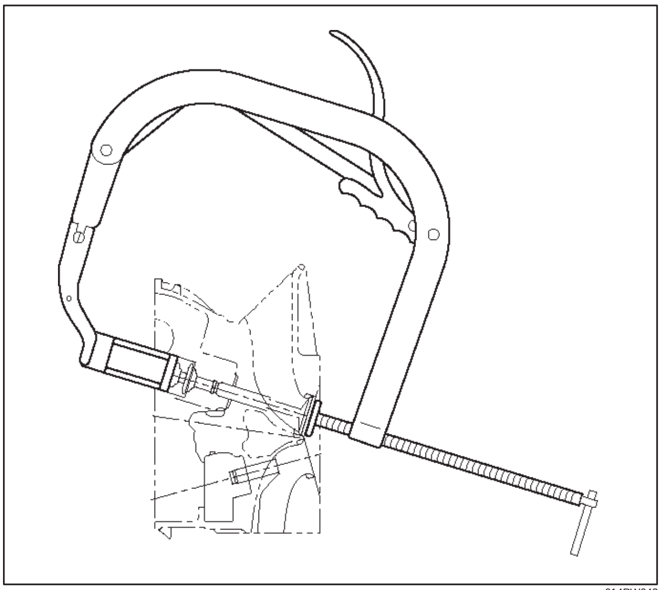


014RW042

7. Remove oil controller using J-37281 oil controller remover, remove each valve stem oil controller.
8. Remove valve guide using J-37985 valve guide replacer.

Installation

1. Install valve guide using J-42899 valve guide installer.
2. Install oil controller using J-38537 oil controller installer.
3. Install lower valve spring seat, valve spring and upper valve spring seat then put split collars on the upper spring seat, using J-8062 valve spring compressor and J-42898 valve spring compressor adapter to install the split collars.

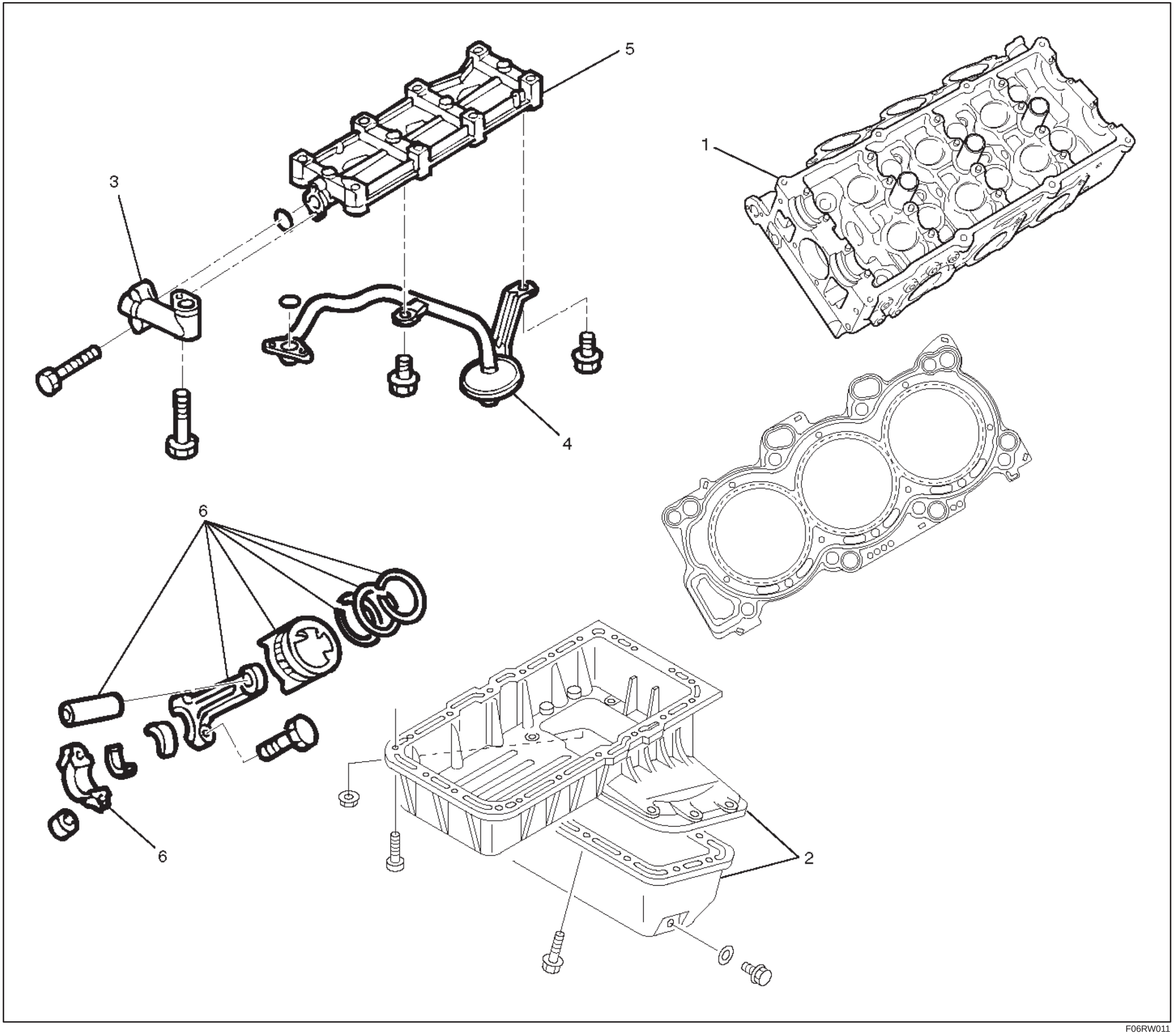


014RW042

4. Install tappet with shim.
5. Install camshaft assembly.
   - Refer to installation procedure for Camshaft in this manual.
6. Install cylinder head assembly.
   - Refer to installation procedure for Cylinder Head in this manual.
7. Fill engine oil until full level.
8. Fill engine coolant.

Piston, Piston Ring and Connecting Rod

Removal

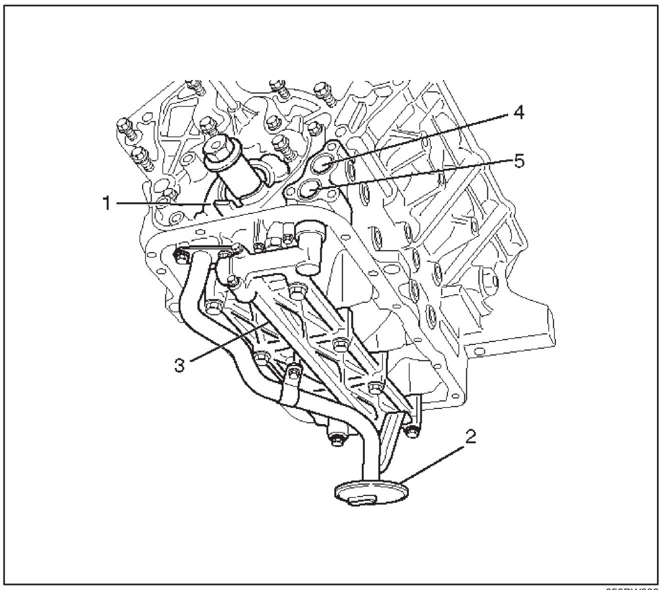


Legend

(1) Cylinder Head
(2) Crankcase with Oil Pan
(3) Oil Pipe
(4) Oil Strainer
(5) Oil Gallery
(6) Piston with Connecting Rod Assembly

1. Remove cylinder head assembly.
   - Refer to removal procedure for Cylinder Head in this manual.
2. Remove crankcase with oil pan.
   - Refer to removal procedure for Oil Pan and Crankcase in this manual.

3. Remove oil strainer fixing bolts, remove oil strainer assembly with O-ring.



050RW002

Legend

(1) Oil Pump
(2) Oil Strainer
(3) Oil Gallery
(4) From Oil Filter
(5) To Oil Filter

4. Remove three fixing bolts, oil pipe with O-ring.
5. Remove eight fixing bolts, oil gallery.
6. Remove piston with connecting rod assembly. (before removing the bearing cap, remove carbon on the top of cylinder bore and push piston with connecting rod out from the top of cylinder bore.)

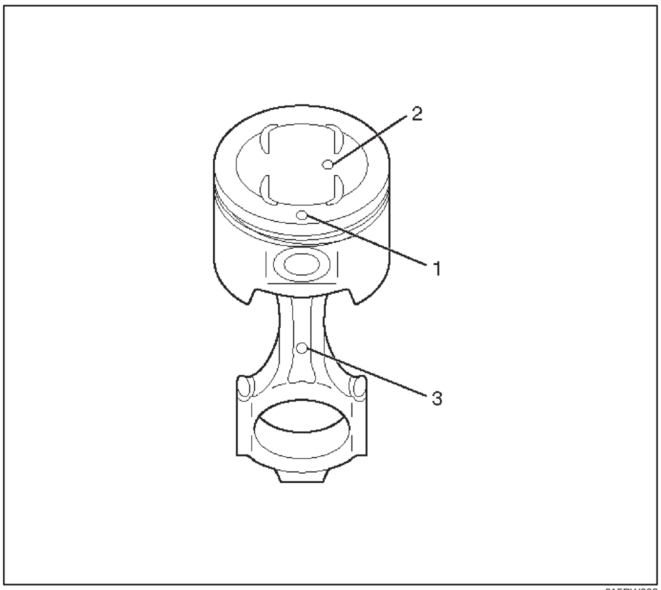
Installation

1. Install piston with connecting rod assembly.
   - Apply engine oil to cylinder bore, connecting rod bearing and crank pin.
     When installing the piston, its front mark must face the engine front side.
   - The bearing cap number must be the same as connecting rod number.
   - Apply engine oil to the thread and seating surface of each nut.
   - Tighten nuts to the specified torque.

   Torque : 54 N·m (40 lb ft)

   - After tightening the nuts, make sure that the crankshaft rotates smoothly.

NOTE: Do not apply engine oil to the bearing back faces and connecting rod bearing fitting surfaces.



015RW003

Legend

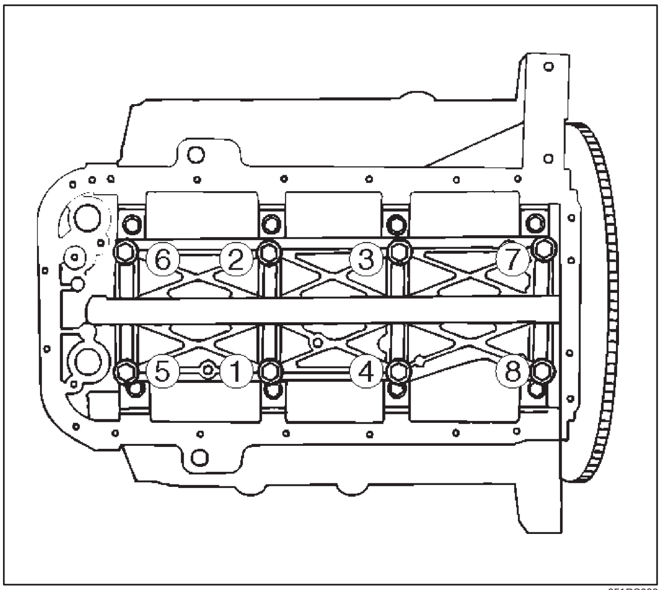
(1) Piston Front Mark
(2) Piston Grade
(3) Connecting Rod Front Mark

2. Install oil gallery and tighten the bolts in two steps, in the order shown in illustration.

   Torque :

   1st step : 29 N·m (21 lb ft)

   2nd step : 55°–65°



051RS009

3. Install oil pipe with O-ring.

   Torque : 10 N·m (89 lb in)

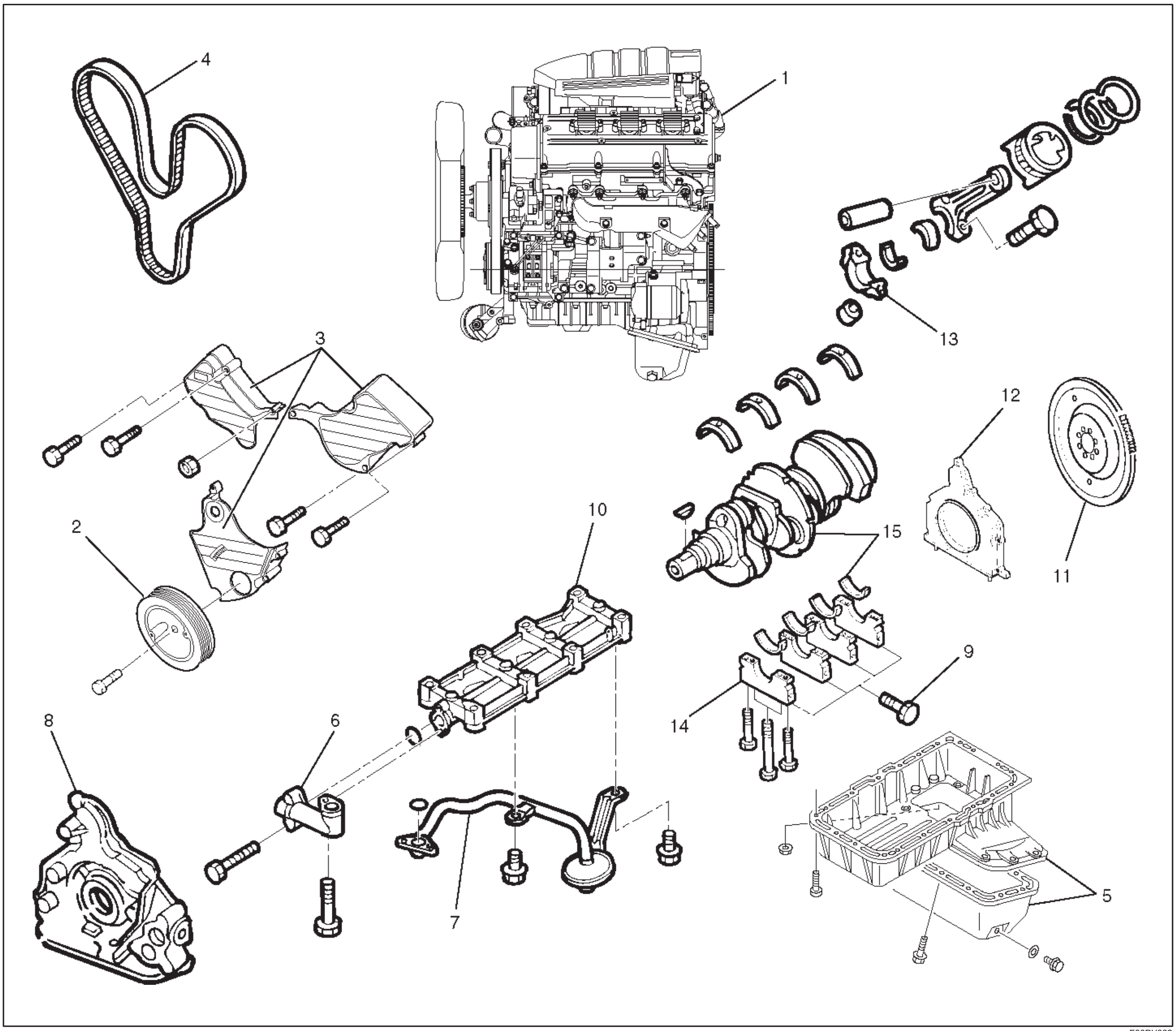
4. Install oil strainer assembly with O-ring.

   Torque : 25 N·m (18 lb ft)

5. Install crankcase with oil pan.
   - Refer to installation procedure for Oil Pan and Crankcase in this manual.
6. Install cylinder head assembly.
   - Refer to installation procedure for Cylinder Head in this manual.

Crankshaft and Main Bearings

Removal



F06RY002

Legend

- (1) Engine Assembly
- (2) Crankshaft Pulley
- (3) Timing Belt Cover
- (4) Timing Belt
- (5) Crankcase with Oil Pan
- (6) Oil Pipe
- (7) Oil Strainer
- (8) Oil Pump Assembly
- (9) Cylinder Body Side Bolt
- (10) Oil Gallery
- (11) Flywheel
- (12) Rear Oil Seal Retainer
- (13) Connecting Rod Cap
- (14) Crankshaft Main Bearing Cap
- (15) Crankshaft and Main Bearing

1. Remove engine assembly.
   - Refer to removal procedure for Engine Assembly in this manual.
2. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
3. Remove oil pan and crankcase.
   - Refer to removal procedure for Oil Pan and Crankcase in this manual.
4. Remove oil pipe with O-ring.
5. Remove oil strainer assembly with O-ring.

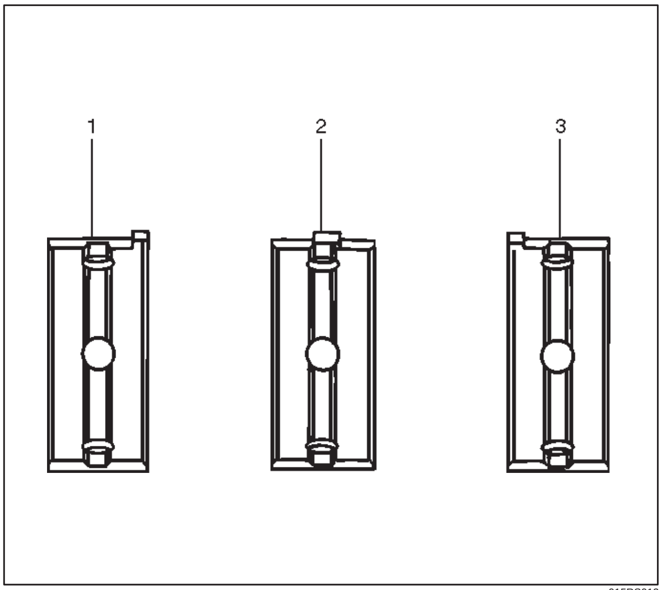
6. Remove oil pump assembly.
   - Refer to removal procedure for Oil Pump in this manual.
7. Remove cylinder body side bolts.
8. Remove oil gallery.
9. Remove flywheel.
10. Remove rear oil seal retainer.
    - Refer to removal procedure for Rear Oil Seal in this manual.
11. Remove connecting rod caps.
12. Remove crankshaft main bearing caps.
13. Remove crankshaft and main bearings.

Installation

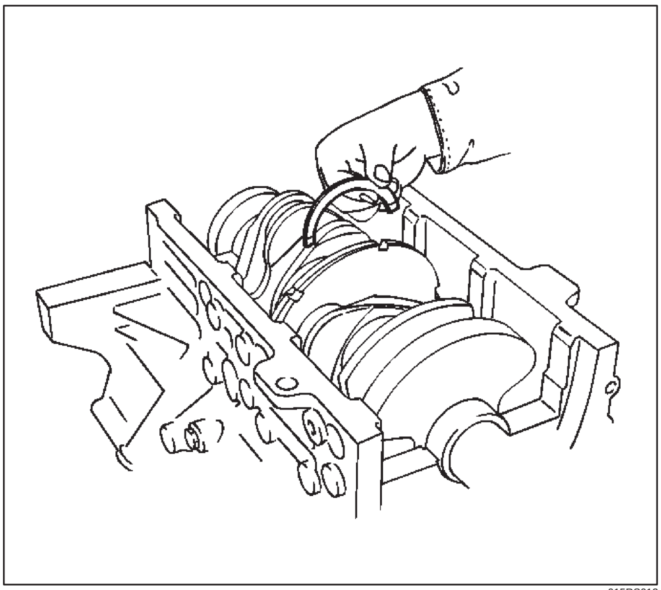
1. Install crankshaft and main bearings.
   - Install main bearing in the cylinder block and main bearing cap respectively.
     Apply new engine oil to upper and lower main bearings.

NOTE:

- Do not apply engine oil to the bearing back faces.
- Make sure that main bearings are in correct position.
- Install crankshaft with care.
- Apply engine oil to the thrust washer.
- Install thrust washer on No.3 journal.
- Oil grooves in thrust washer must face the crankshaft.



015RS012



015RS013

2. Install crankshaft main bearing caps.
   - Apply engine oil to the thread and seating surface of each bearing cap fixing bolt.

NOTE:

- Do not apply engine oil to the bearing back faces.
- Install bearing caps, starting with cylinder block front side.
- Tighten main bearing fixing bolts to the specified torque.

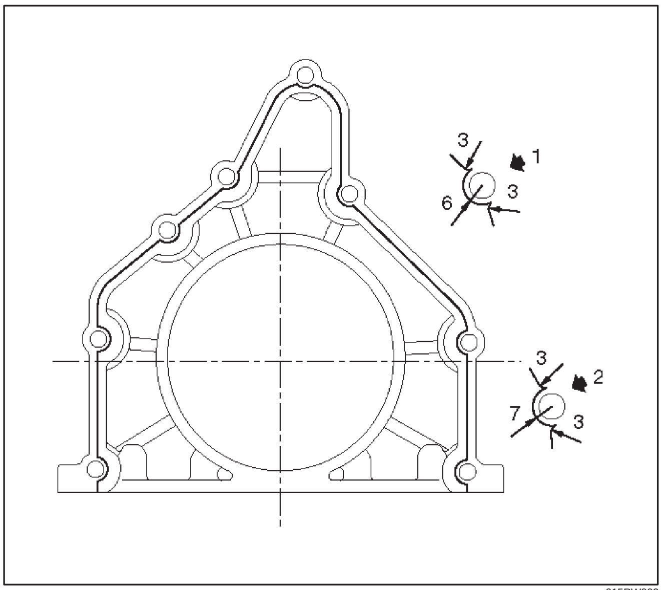
Torque : 39 N·m (29 lb ft)

- After tightening the bolts, make sure that the crankshaft rotates smoothly.

3. Install connecting rod caps.
   - The cap number must be same as connecting rod number.
   - Apply engine oil to the thread and seating surface of each nut.
   - Tighten nuts to the specified torque.

Torque : 54 N·m (40 lb ft)

   - After tightening the nuts, make sure that the crankshaft rotates smoothly.
4. Install rear oil seal retainer.
   - Remove oil on cylinder block and retainer fitting surface.
   - Apply sealant (TB1207B or equivalent) to retainer fitting surface as shown in illustration.
   - The oil seal retainer must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.



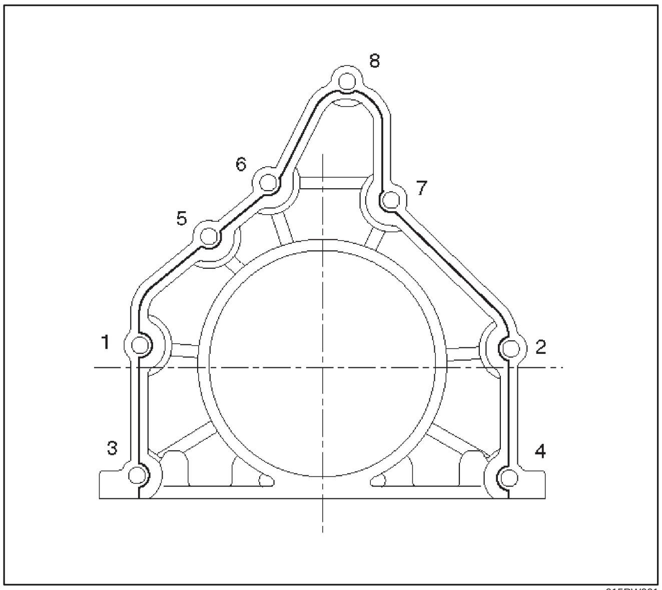
015RW002

Legend

(1) Around Bolt Holes
(2) Around Dowel Pin

- Apply engine oil to oil seal lip and align a dowel pin hole in the cylinder block with that in the retainer.
- Tighten retainer fixing bolts to the specified torque.

Torque : 18 N·m (13 lb ft)



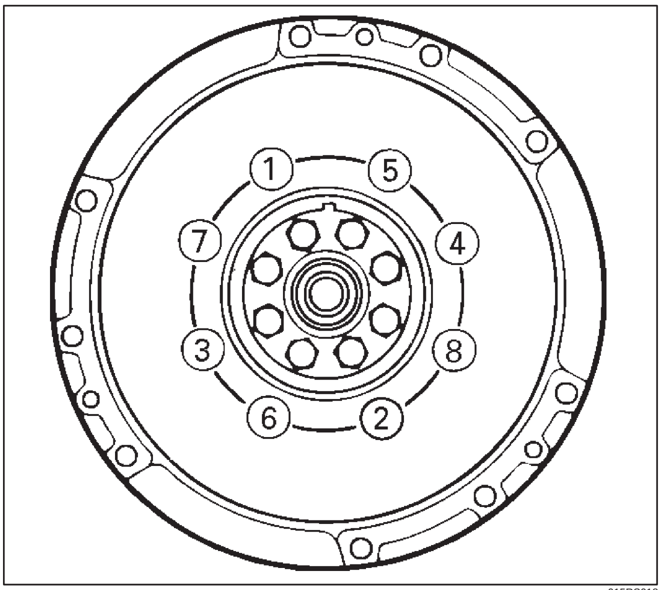
015RW001

5. Install flywheel.
   - Clean tapped holes in the crankshaft.
   - Remove oil on crankshaft and flywheel fitting surface.

NOTE:

- Do not reuse the bolts.
- Do not apply oil or thread lock to the bolts.
- Tighten fixing bolts to the specified torque.

Torque : 54 N·m (40 lb ft)



015RS018

6. Install oil gallery.
   - Clean contact surface of oil gallery and main bearing cap.
     Apply engine oil to oil gallery fixing bolts and tighten the bolts in two steps, in the order shown.

Torque :

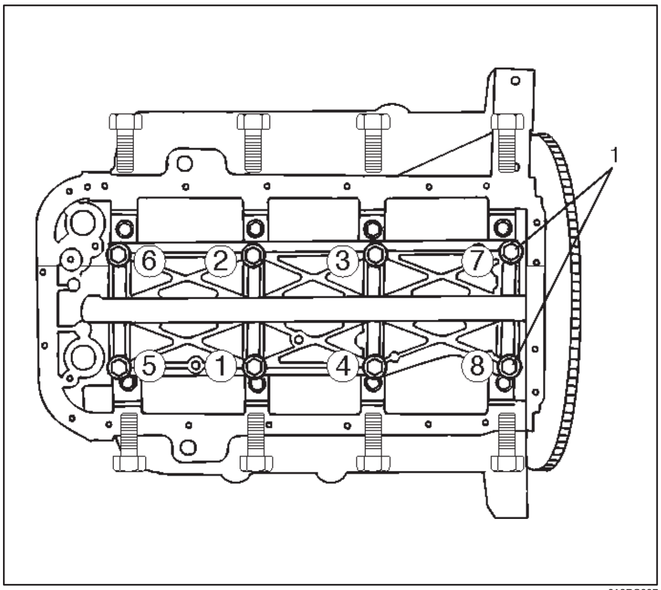
1st step : 29 N·m (21 lb ft)

2nd step : 55°–65°

7. Install cylinder body side bolts and tighten bolts in order to the specified torque.

Torque : 39 N·m (29 lb ft)

NOTE: Do not apply the oil to the bolts.

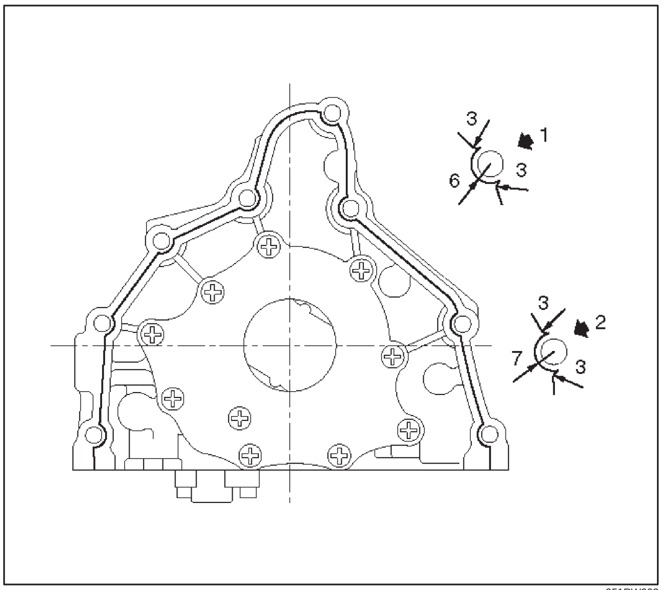


012RS007

8. Install oil pump assembly.
   - Remove oil on cylinder block and oil pump mounting surface.
   - Apply sealant (TB1207B or equivalent) to the oil pump mounting surface.
   - The oil pump assembly must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

- Apply engine oil to oil seal lip.
- Install oil pump in the cylinder block and tighten fixing bolts to the specified torque.

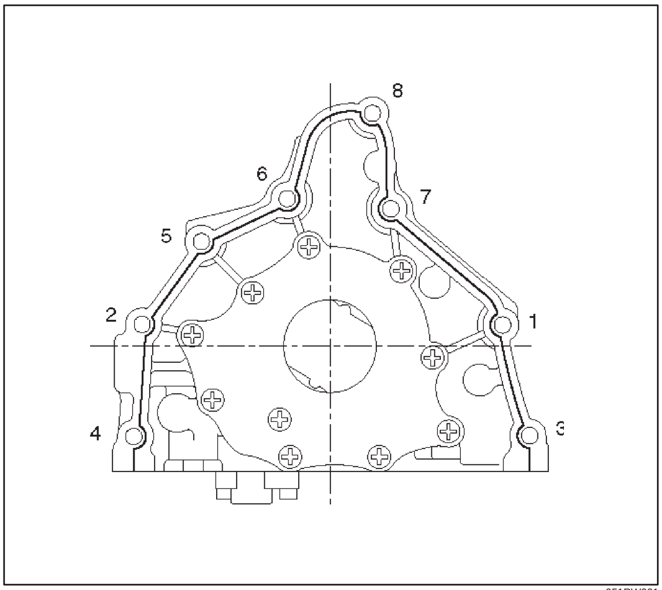
Torque : 25 N·m (18 lb ft)



051RW002

Legend

(1) Around Bolt Holes
(2) Around Dowel Pin



051RW001

9. Install oil strainer with O-ring, tighten to the specified torque.

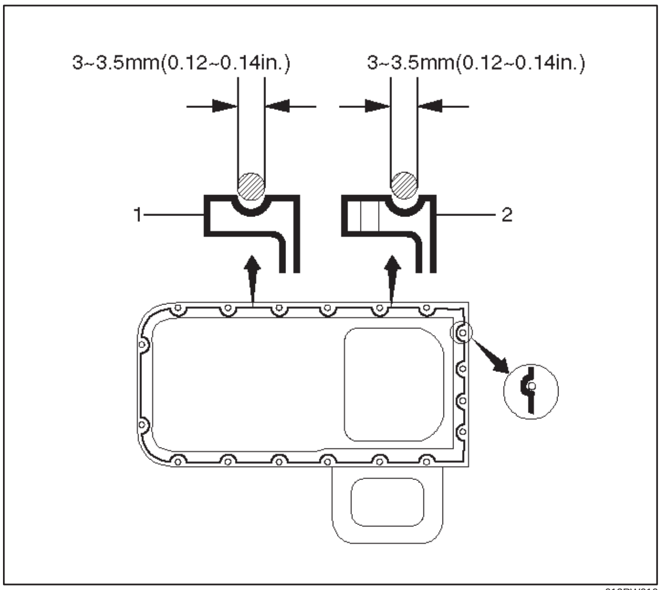
Torque : 25 N·m (18 lb ft)

10. Install oil pipe with O-ring, tighten fixing bolts to the specified torque.

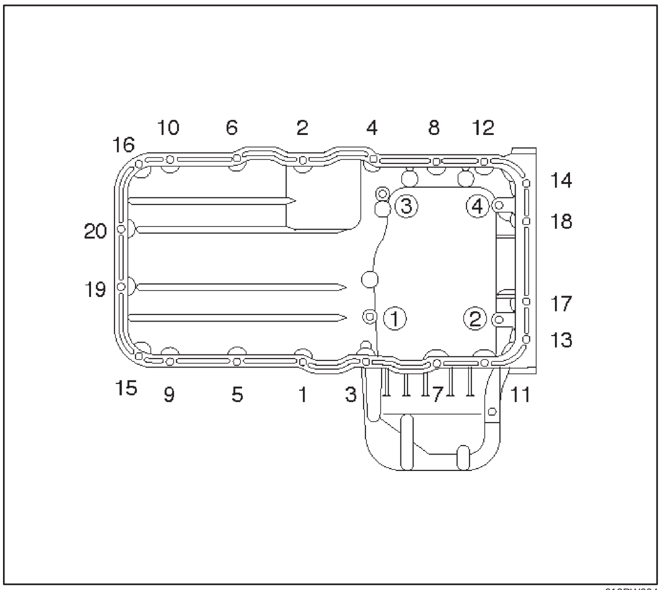
Torque : 25 N·m (18 lb ft)

11. Install crankcase.
    - Remove oil on crankcase mounting surface and dry the surface.
    - Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the crankcase mounting surface. The bead must be continuous.
    - The crankcase must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.
    - Tighten fixing bolts to the specified torque.

Torque : 10 N·m (89 lb in)



013RW010

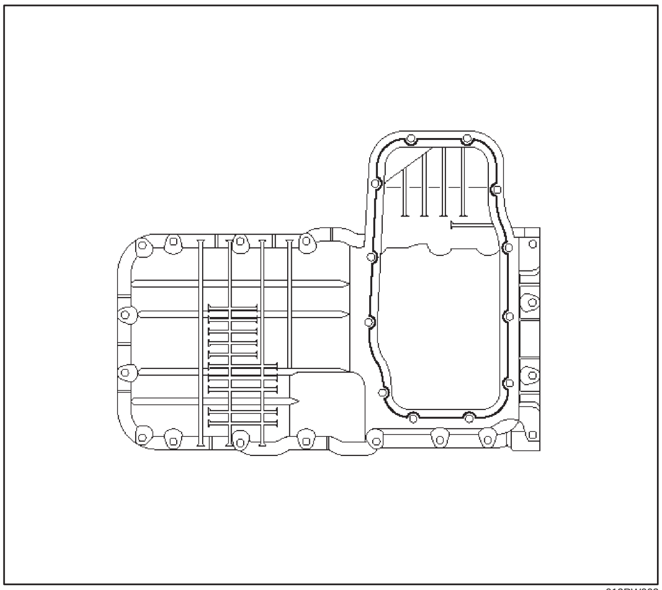


013RW004

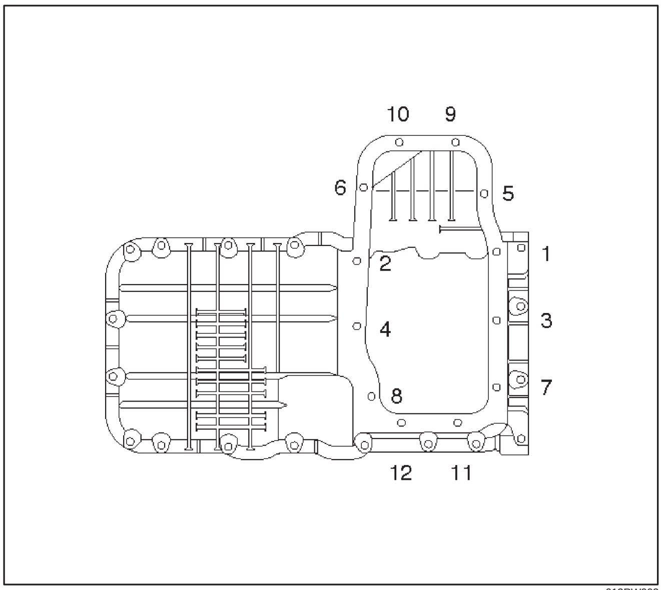
12. Install oil pan
    - Remove oil on oil pan mounting surface and dry the surface.
    - Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the oil pan mounting surface. The bead must be continuous.
    - The oil pan must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

- Tighten fixing bolts to the specified torque.

Torque : 25 N·m (18 lb ft)



013RW003



013RW002

13. Install timing belt.
    - Refer to installation procedure for Timing Belt in this manual.
14. Install engine assembly.
    - Refer to installation procedure for Engine Assembly in this manual.

Rear Oil Seal

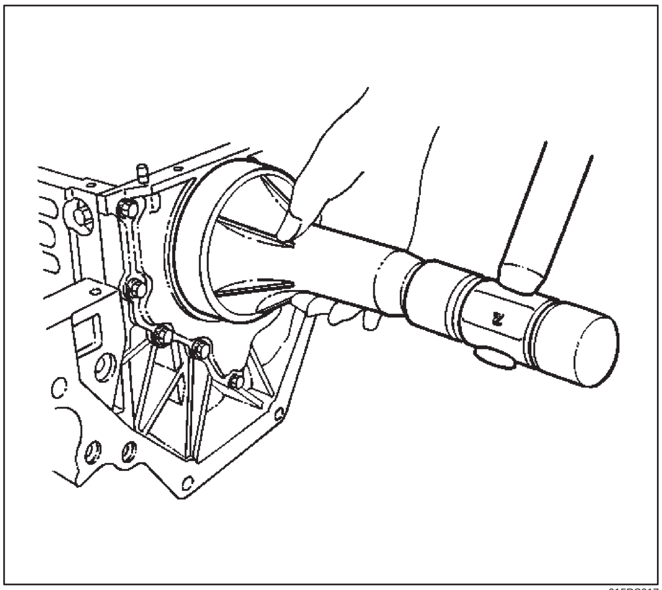
Removal

1. Remove transmission assembly.
   - See Transmission section in this manual.
2. Remove flywheel.
3. Remove rear oil seal using a seal remover.

NOTE: Take care not to damage the crankshaft or oil seal retainer when removing oil seal.

Installation

1. Apply engine oil to oil seal lip and install oil seal using J-39201.

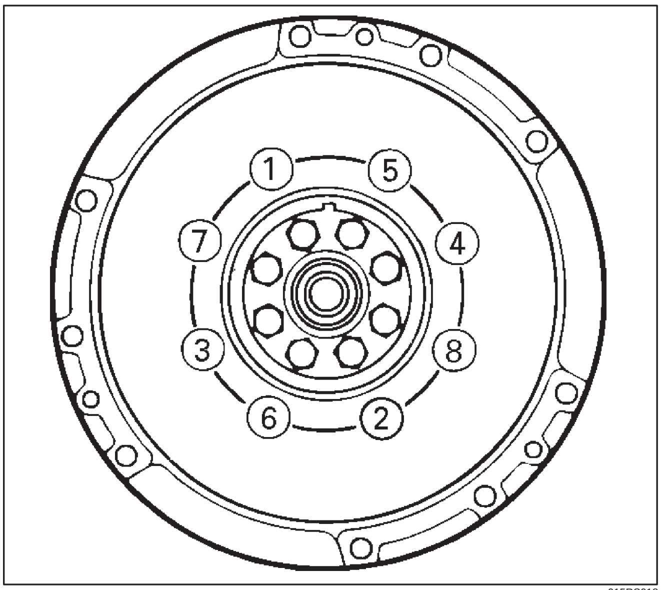


015RS017

2. Install flywheel.
   - Clean tapped holes in the crankshaft.
   - Remove oil on the crankshaft and flywheel mounting surface.
   - Tighten fixing bolts to the specified torque.

NOTE: Do not reuse the bolts and do not apply oil or thread lock to the bolts.

Torque : 54 N·m (40 lb ft)



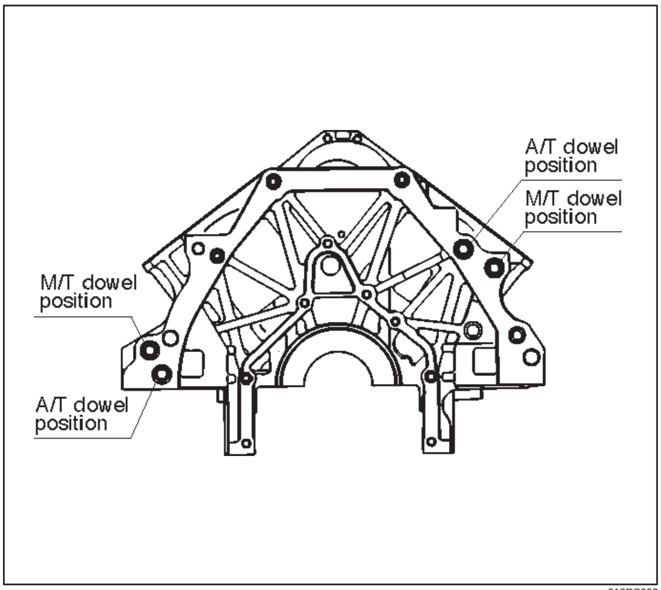
015RS018

3. Install transmission.
   - See Transmission section in this manual.

CAUTION: When assembling the engine and transmission, confirm that dowels have been mounted in the specified positions at the engine side.

NOTE: Take care that dowel positions are different between the manual transmission and the automatic transmission.

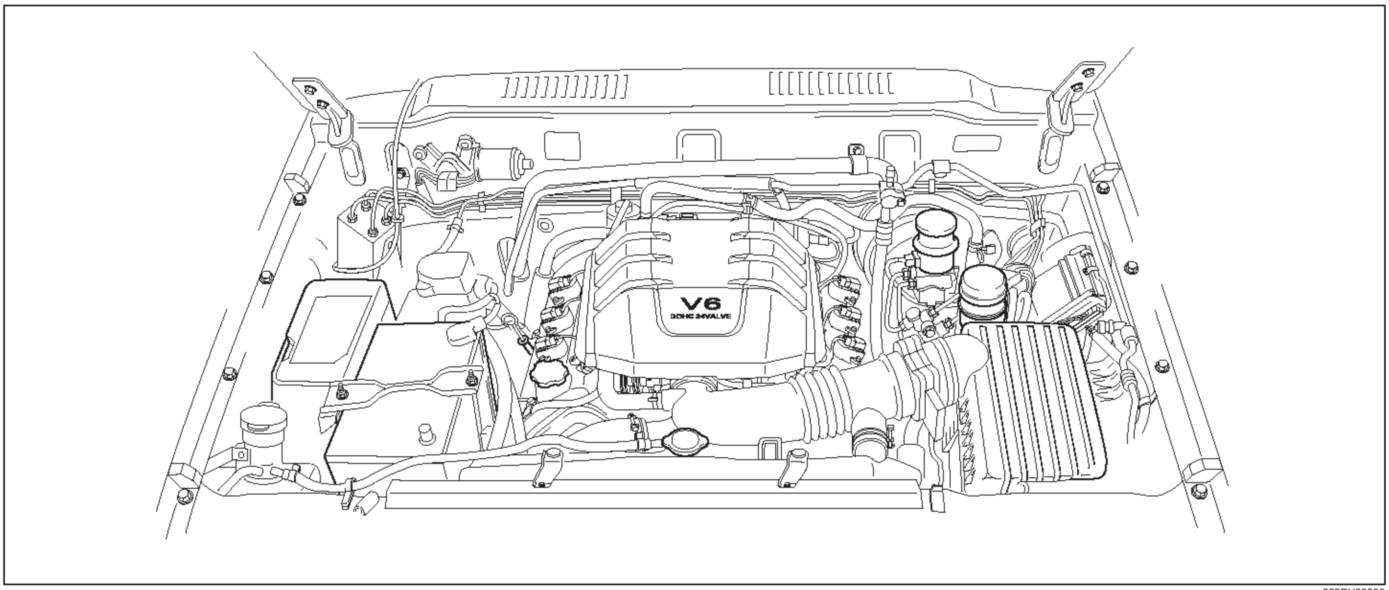
Otherwise, the transmission may be damaged.



012RS009

Engine Assembly

Removal



1. Disconnect battery ground and positive cable.
2. Remove battery.
3. Make alignment mark on the engine hood and hinges before removal in order to return the hood to original position exactly.
4. Remove engine hood.
5. Drain radiator coolant.
6. Disconnect Ion sensing module harness connectors, and manifold absolute pressure sensor harness connectors from sensor on common chamber.
7. Disconnect throttle position sensor harness connectors from throttle body.
8. Disconnect air duct with air cleaner cover.
9. Remove air cleaner assembly.
10. Disconnect canister vacuum hose.
11. Disconnect vacuum booster hose.
12. Disconnect three engine harness connectors.
13. Disconnect harness connector to transmission (left front side of engine compartment), disconnect shift on the fly harness connector from front side of front axle and remove transmission harness bracket from engine left side.
14. Disconnect ground cable between engine and frame.
15. Disconnect bonding cable connector on the back of right dash panel.
16. Disconnect bonding cable terminal on the left bank.
17. Disconnect starter harness connector from starter.
18. Disconnect generator harness connector from generator.
19. Disconnect coolant reserve tank hose from radiator.
20. Remove radiator upper and lower hoses.
21. Remove upper fan shroud.
22. Remove cooling fan assembly four fixing nuts, then the cooling fan assembly.
23. Move drive belt tensioner to loose side using wrench then remove drive belt.
24. Remove power steering pump fixing bolts, then power steering pump. Place the power steering pump along with piping on the body side.
25. Remove air conditioning compressor fixing bolts from bracket and place the compressor along with piping on the body side.
26. Remove four O_2 sensor harness connectors (two each bank) from exhaust front pipe.
27. Remove three exhaust pipe fixing nuts from each bank.
28. Remove two exhaust pipe fixing nuts from each exhaust pipe, then move exhaust pipe to rear side of vehicle.
29. Remove flywheel dust covers.
30. Disconnect two heater hoses from engine.
31. Disconnect fuel hoses from right side of transmission.

CAUTION: Plug fuel pipes on engine side and fuel hoses from fuel tank.

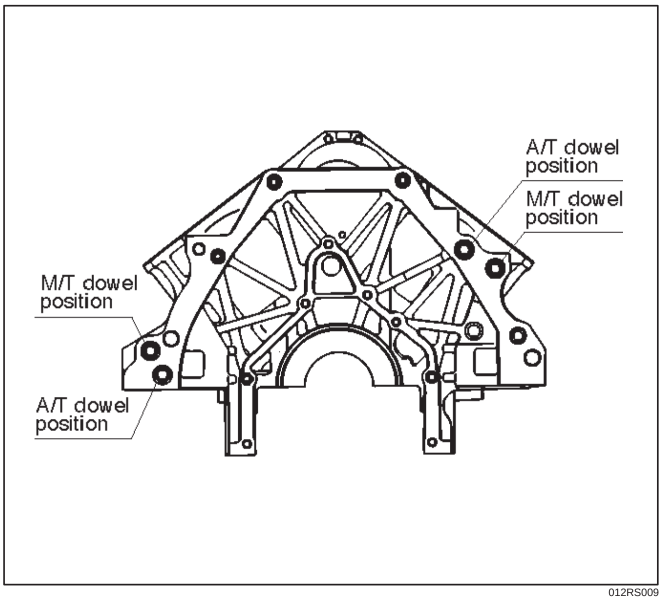
32. Remove transmission assembly. Refer to Transmission section in this manual.
33. Support the engine by engine hoist.
34. Remove two left side engine mount fixing bolts from engine mount on chassis side.
35. Remove two right side engine mount fixing bolts from engine mount on chassis side.
36. Remove engine assembly.

Installation

CAUTION: When assembling the engine and transmission, confirm that dowels have been mounted in the specified positions at the engine side.

NOTE: Take care that dowel positions are different between the manual transmission and the automatic transmission.

If the engine is assembled in the condition that the dowels have not been mounted in the specified positions, the transmission may be damaged the transmission.



1. Install engine assembly. Tighten engine mount fixing bolts to frame to the specified torque.

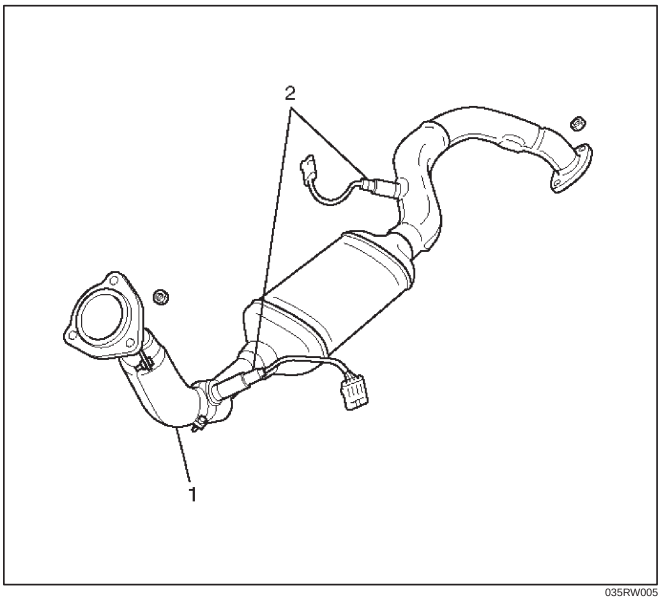
   Torque: 41 N·m (30 lb ft)

2. Reconnect fuel hose to fuel pipe on engine.
3. Install transmission assembly. Refer to Transmission section in this manual.
4. Reconnect two heater hoses to engine.
5. Install flywheel dust covers.
6. Install exhaust pipe and temporally tighten two (each bank) rear exhaust flange nuts then tighten three stud nuts (each bank) between exhaust manifold and exhaust pipe, finally tighten rear side nuts to the specified torque.

   Torque:

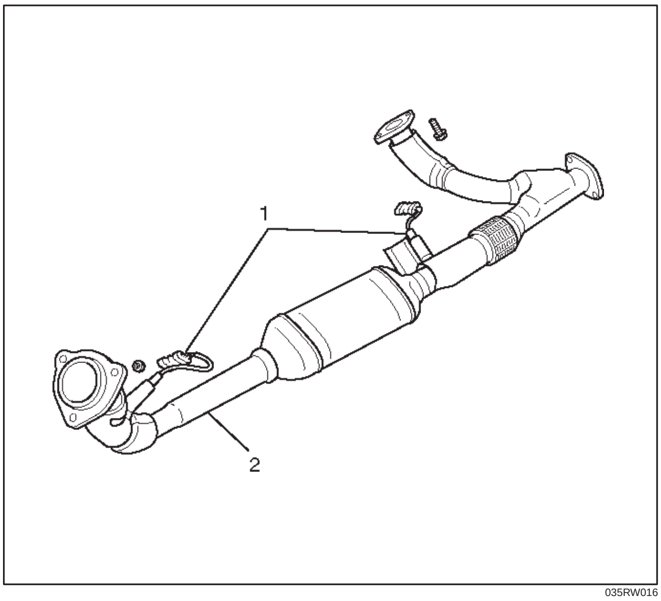
   Nuts: 43 N·m (32 lb ft)

   Stud nuts: 67 N·m (49 lb ft)



Legend

(1) Exhaust Front Pipe RH
(2) O_2 Sensor



Legend

(1) O_2 Sensor
(2) Exhaust Front Pipe LH

7. Reconnect O_2 sensor connector.
8. Install cooling fan assembly and tighten bolts/nuts to the specified torque.

   Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.

   Torque : 10 N·m (88.5 lb in) for fan and clutch assembly.

9. Install air conditioner compressor to engine and tighten to the specified torque.

6VE1

Torque :

M8 bolts : 22 N·m (16 lb ft)

M10 bolts : 43 N·m (32 lb ft)

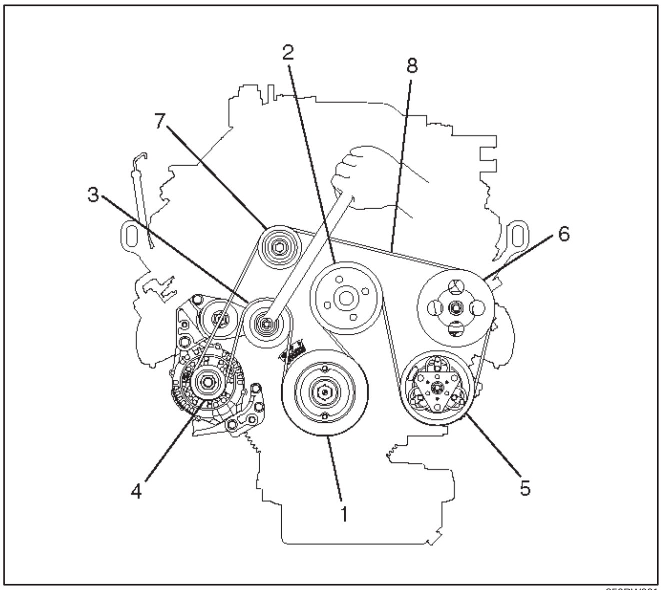
10. Install power steering pump, tighten fixing bolt to the specified torque.

Torque :

M8 bolts : 22N·m (16 lb ft)

M10 bolts : 46 N·m (34 lb ft)

11. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.

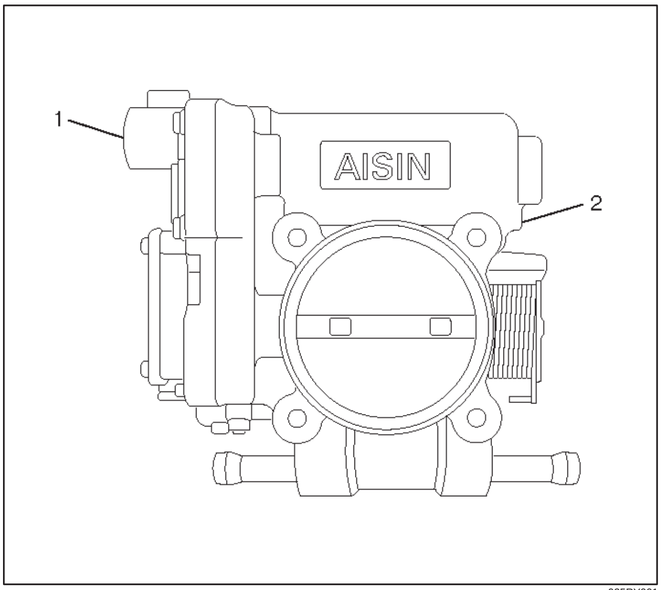


850RW001

Legend

(1) Crankshaft Pulley
(2) Cooling Fan Pulley
(3) Tensioner
(4) Generator
(5) Air Conditioner Compressor
(6) Power Steering Oil Pump
(7) Idle Pulley
(8) Drive Belt

12. Install upper fan shroud.
13. Reconnect radiator upper and lower hoses.
14. Reconnect coolant reserve tank hose to radiator.
15. Reconnect generator harness connector.
16. Reconnect starter harness connector.
17. Reconnect bonding cable terminal on left bank
18. Reconnect bonding cable terminal on the back of right dash panel.
19. Reconnect ground cable between engine and chassis.
20. Reconnect harness connector to transmission and install transmission harness bracket on engine left side.
21. Reconnect three engine harness connectors.
22. Reconnect vacuum booster hose.
23. Reconnect canister vacuum hose.
24. Install air cleaner assembly.
25. Reconnect air duct.
26. Reconnect throttle position sensor harness connector.

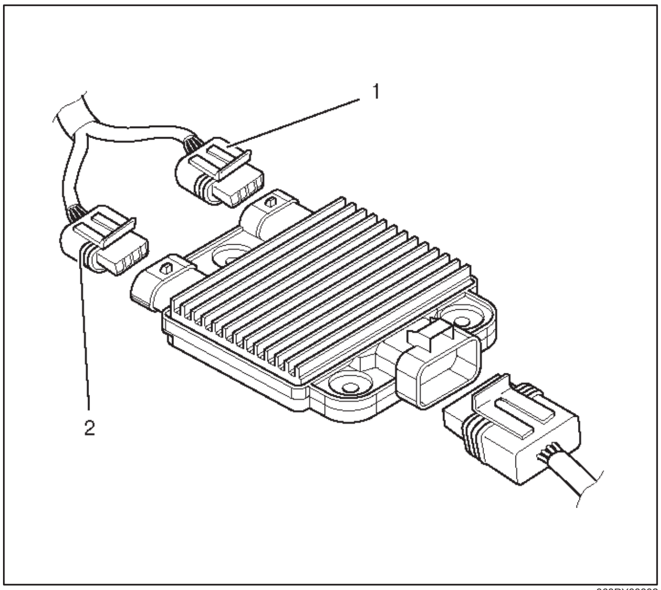


025RY001

Legend

(1) Throttle Position Sensor Connector
(2) Throttle Valve Assembly

27. Reconnect manifold absolute pressure sensor harness connectors.
28. Reconnect ion sensing module connectors as shown in the illustration.



060RY00003

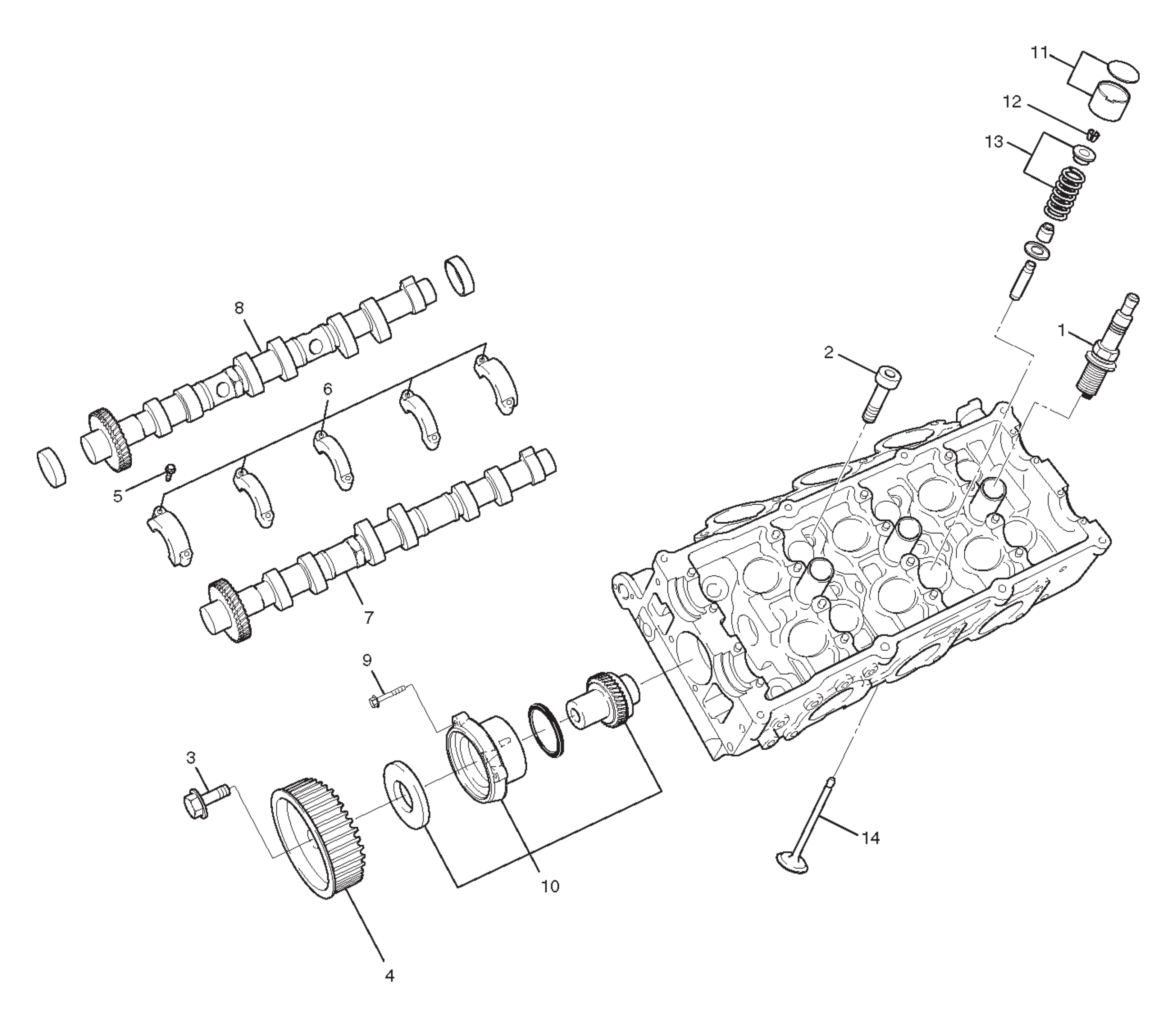
Legend

(1) Green Connector
(2) Blue Connector

29. Install engine hood to the original position.
   - Refer to installation procedure for Body section in this manual.

Cylinder Head

Cylinder Head and Associated Parts



Legend

(1) Spark Plug
(2) Cylinder Head Bolt
(3) Camshaft Drive Gear Pulley Fixing Bolt
(4) Camshaft Drive Gear Pulley
(5) Camshaft Bearing Cap Fixing Bolt
(6) Camshaft Bearing Cap
(7) Camshaft Exhaust
(8) Camshaft Intake
(9) Retainer Fixing Bolt
(10) Retainer Assembly
(11) Tappet with Shim
(12) Split Collar
(13) Valve Spring and Spring Upper Seat
(14) Valve

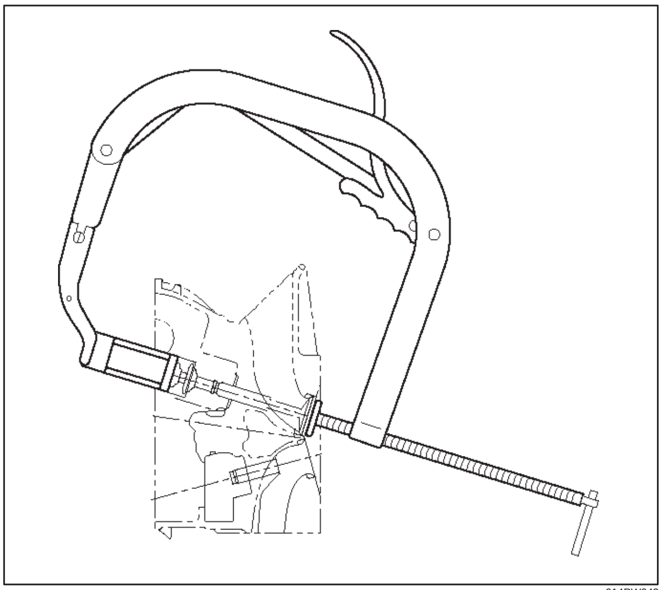
Disassembly

NOTE:

- During disassembly, be sure that the valve train components are kept together and identified so that they can be reinstalled in their original locations.
- Before removing the cylinder head from the engine and before disassembling the valve mechanism, perform a compression test and note the results.

1. Remove camshaft drive gear pulley fixing bolt (3), then pulley (4).

2. Remove camshaft bearing cap fixing bolt (5), camshaft bearing cap (6), then camshaft exhaust (7), and intake side (8).
3. Remove tappet with shim (11).
4. Use the J–8062 valve spring compressor and J–42898 valve spring compressor adapter to remove the split collar (12), valve spring with upper seat (13) and valve (14).


014RW042

5. Remove spark plug (1).

CAUTION: Do not remove the spark plugs when the head and plugs are hot. Clean dirt and debris from spark plug recess areas before removal.

Clean

Cylinder head

Carefully remove all varnish, soot and carbon from the bare metal. Do not use a motorized wire brush on any gasket sealing surface.

Inspection and Repair

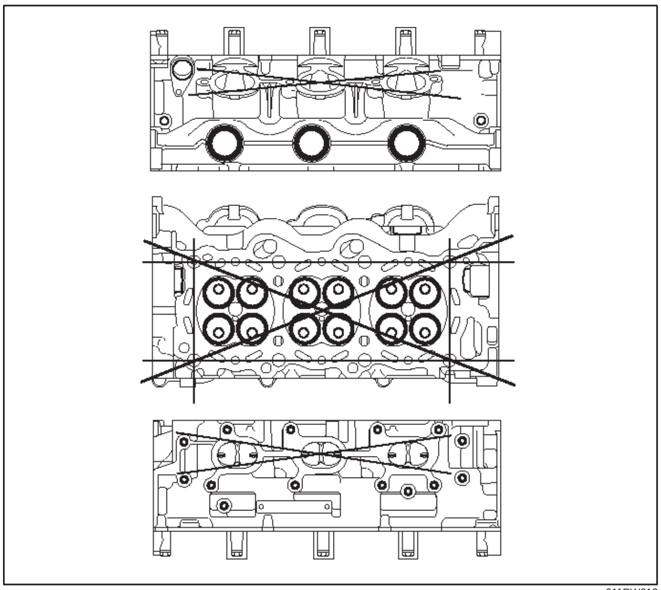
1. Cylinder head gasket and mating surfaces for leaks, corrosion and blow–by. If the gasket has failed, determine the cause.
   – Insufficient torque on head bolts
   – Improper installation
   – Loose or warped cylinder head
   – Missing dowel pins
   – Warped case surface
2. Cylinder head for cracks, especially between valve seats and in the exhaust ports.
3. Cylinder head deck for corrosion, sand particles in head and porosity.

CAUTION:

- **Do not attempt to weld the cylinder head. Replace it.**
- **Do not reuse cylinder head bolts.**

4. Cylinder head deck, common chamber and exhaust manifold mating surfaces for flatness. These surfaces may be reconditioned by milling. If the surfaces are “out of flat” by more than specification, the surface should be ground to within specifications. Replace the head if it requires machining beyound the repairable limit.

Head surface and manifold surface
Standard: 0.05 mm (0.002 in) or less
Warpage limit: 0.2 mm (0.0079 in)
Maximum Repairable limit: 0.2 mm (0.0079 in)
Head height
Standard height : 133.2 mm (5.2441 in)
Warpage limit : 0.2 mm (0.0079 in)
Maximum Repairable limit : 133.0 mm (5.2362 in)


011RW019

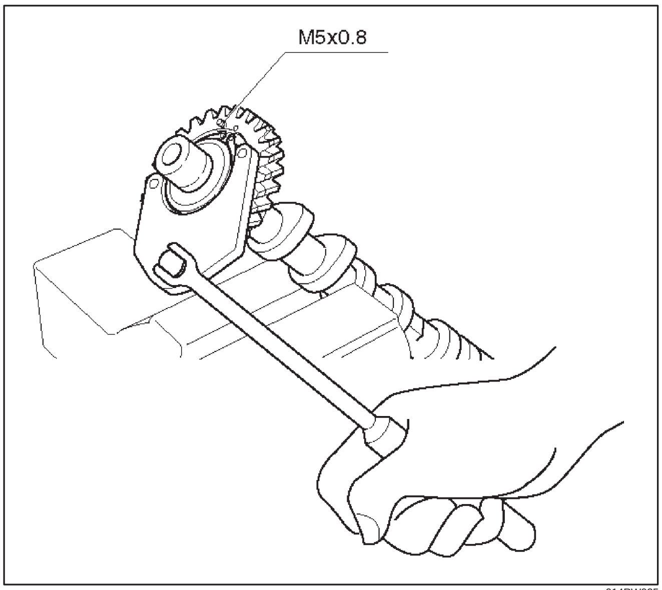
5. Water jacket sealing plugs seating surfaces.

Reassembly

1. Install Spark plug and tighten all the spark plugs to specified torque.

   Torque: 18 N·m (13 lb ft)

2. Tighten sub gear setting bolt.
   1. Use J–42686 gear spring lever to turn sub gear to right direction until the M5 bolt aligns with the hole between camshaft driven gear and sub gear.
   2. Tighten the M5 bolt to a suitable torque to prevent the sub gear from moving.

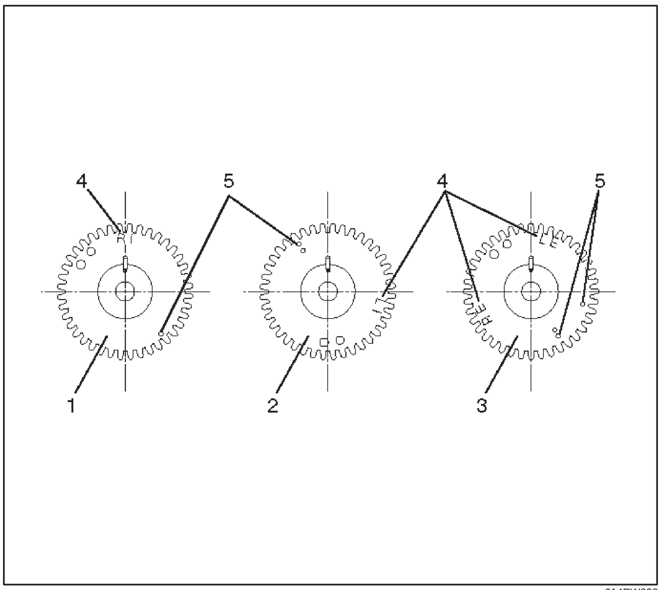


014RW025

3. Install camshaft drive gear assembly and tighten three bolts to the specified torque.

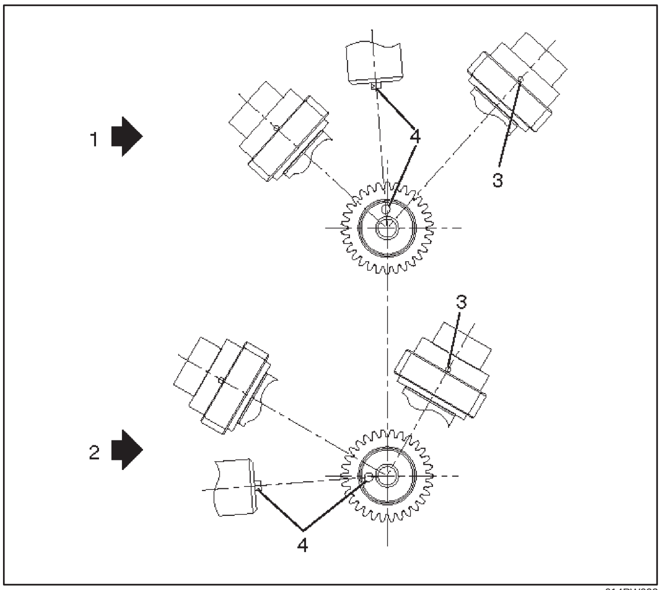
   Torque: 10 N·m (89 lb in)

4. Install camshaft assembly and camshaft bearing cap, tighten twenty bolts on one side bank to the specified torque.
   1. Apply engine oil to camshaft journal and bearing surface of camshaft bearing cap.
   2. Align timing mark on intake camshaft (one dot for right bank, two dots for left bank) and exhaust camshaft (one dot for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



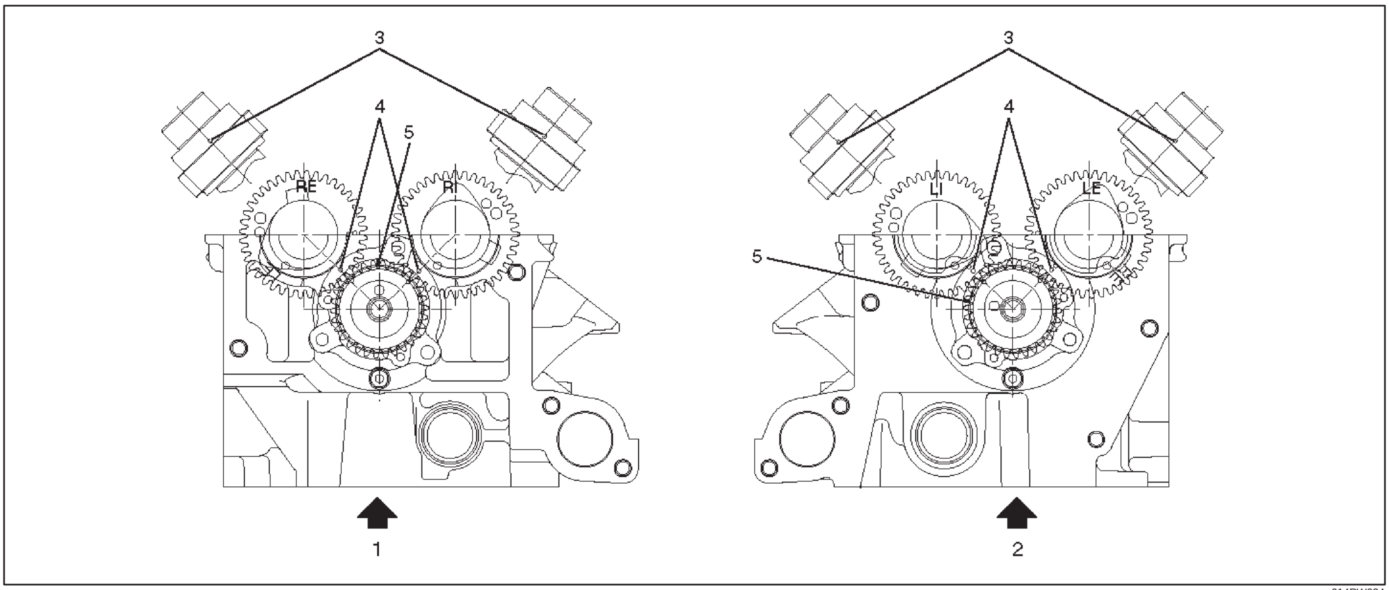
014RW020

Legend
- (1) Intake Camshaft Timing Gear for Right Bank
- (2) Intake Camshaft Timing Gear for Left Bank
- (3) Exhaust Camshaft Timing Gear
- (4) Discrimination Mark
- LI: Left Bank Intake
- RI: Right Bank Intake
- LE: Left Bank Exhaust
- RE: Right Bank Exhaust



014RW023

Legend
- (1) Right Bank Camshaft Drive Gear
- (2) Left Bank Camshaft Drive Gear
- (3) Timing Mark on Drive Gear
- (4) Dowel Pin

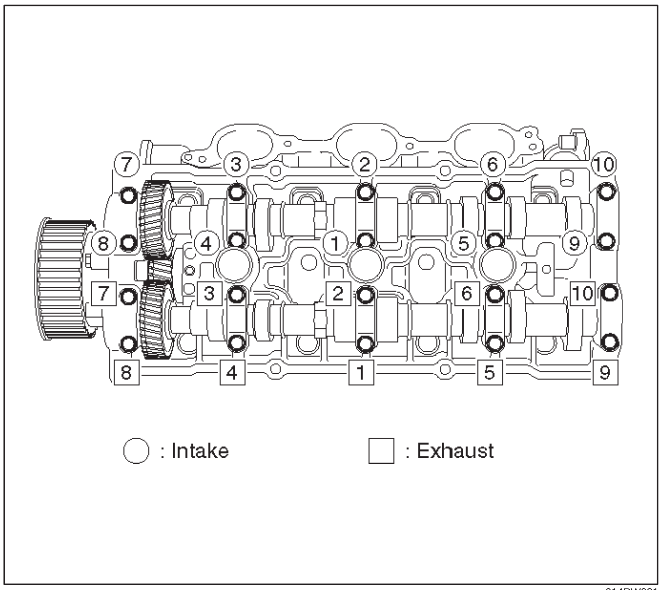


Legend

(1) Right Bank
(2) Left Bank
(3) Alignment Mark on Camshaft Drive Gear
(4) Alignment Mark on Camshaft
(5) Alignment Mark on Retainer

3. Tighten twenty bolts in numerical order on each bank as shown in the illustration.

Torque: 10 N·m (89 lb in)

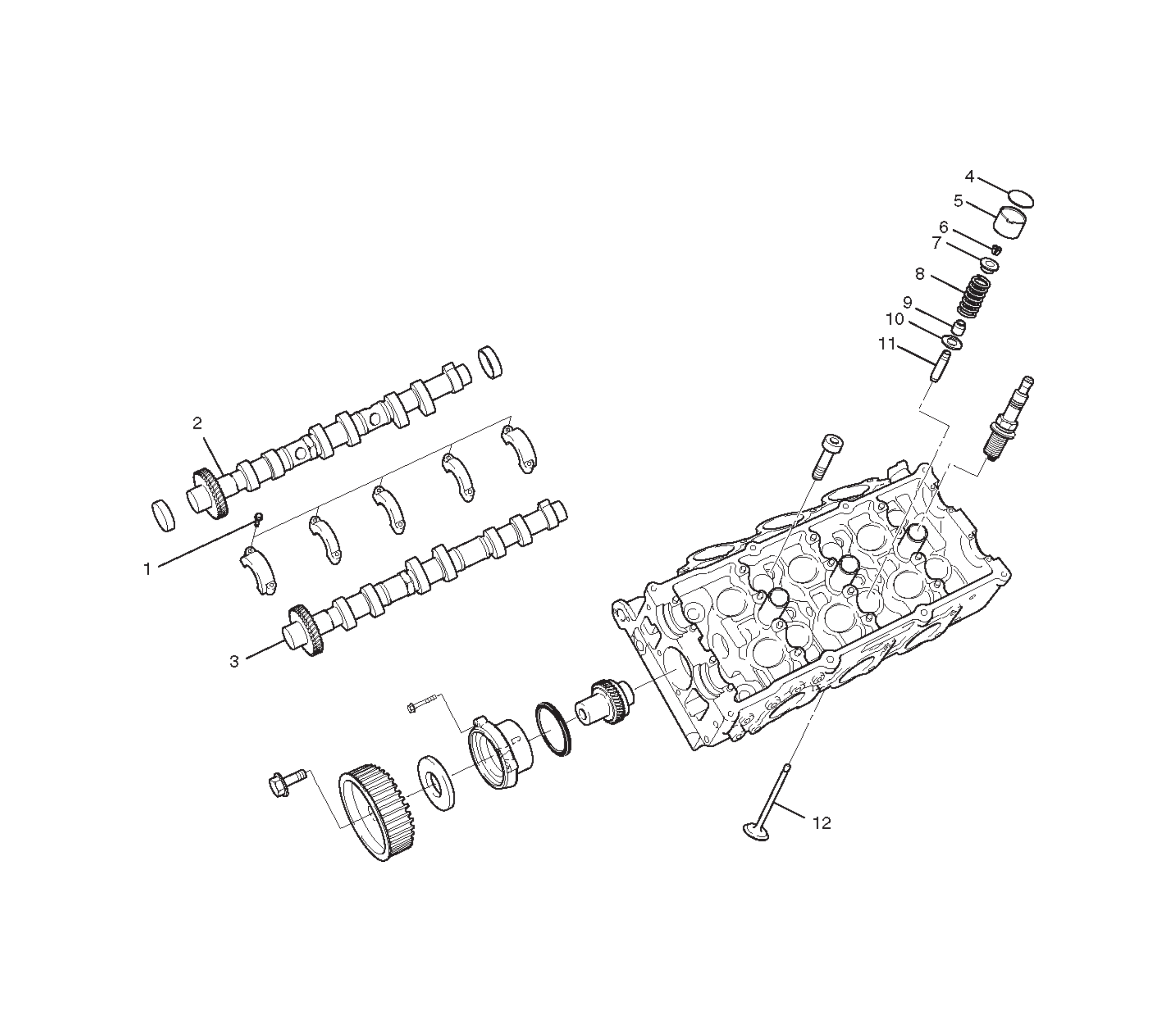


5. Tighten bolt for camshaft drive gear assembly pulley to the specified torque.

Torque: 98 N·m (72 lb ft)

Valve Spring, Oil Controller, Valve, Valve Guide

Valve Spring, Oil Controller, Valve, Valve Guide and Associated Parts



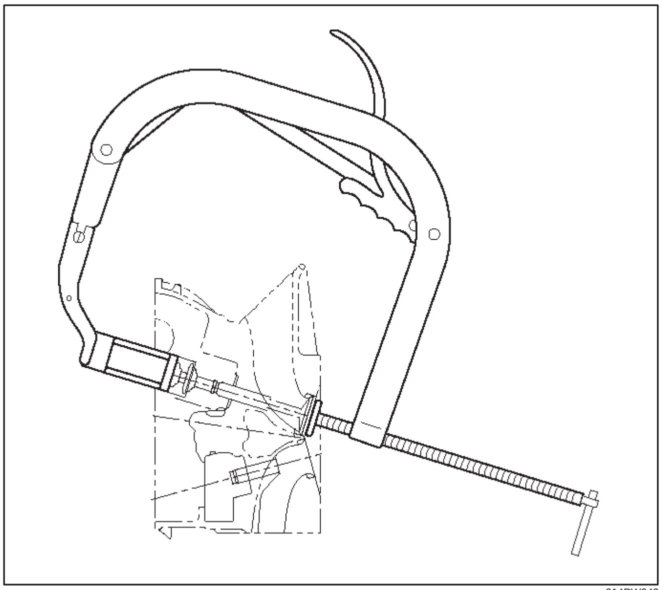
Legend

(1) Camshaft Bearing Cap Fixing Bolts
(2) Camshaft Assembly Inlet
(3) Camshaft Assembly Exhaust
(4) Shim
(5) Tappet
(6) Split Collar
(7) Spring Upper Seat
(8) Valve Spring
(9) Oil Controller
(10) Spring Lower Seat
(11) Valve Guide
(12) Valve

Disassembly

1. Remove camshaft bearing cap fixing bolts (1).
2. Remove camshaft assembly (intake).
3. Remove camshaft assembly (Exhaust side).
4. Remove shim (4) and tappet (5).

5. Use the J–8062 valve spring compressor and J–42898 valve spring compressor adapter to remove split collar.


014RW042

6. Remove valve spring.
7. Remove valve.
8. Remove oil controller and spring lower seat.
9. Remove the valve guide using the J–42899 valve guide replacer.

Inspection and Repair

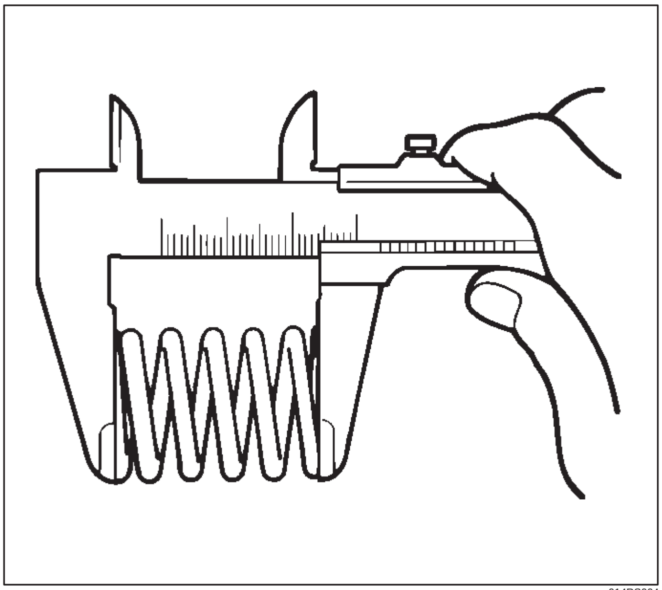
Valve Spring

CAUTION: Visually inspect the valve springs and replace them if damage or abnormal wear is evident.

1. Measure the free height of the springs. The springs must be replaced if the free height is below the specified limit.

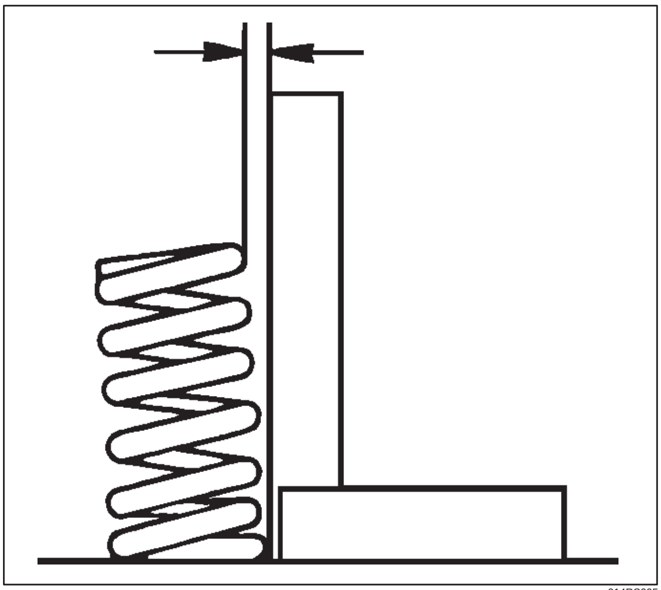
Standard : 44.6 mm (1.756 in)

Limit : 43.6 mm (1.717 in)


014RS004

2. Measure the valve spring squareness with a steel square and replace the valve springs if the measured value exceeds the specified limit.

Limit : 2 mm (0.079 in)

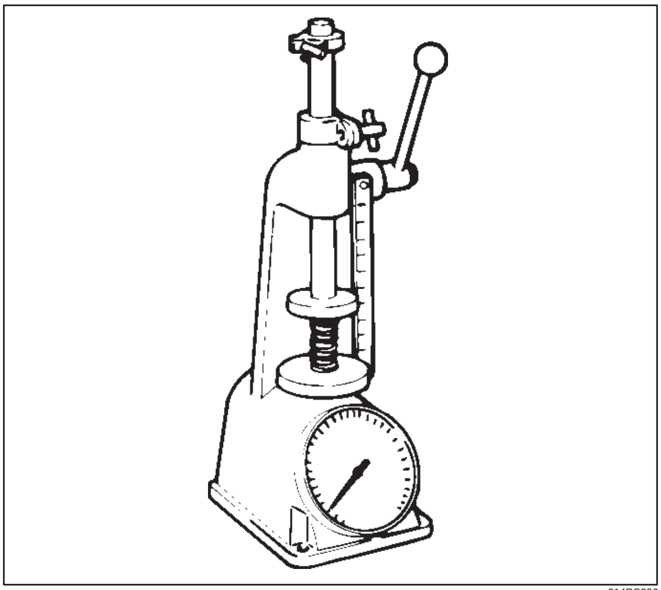

014RS005

3. Using a spring tester to compress the springs to the installed height, measure the compressed spring tension, and replace the springs if the measured tension is below the specified limit.

At installed height: 35.0 mm (1.38 in)

Standard: 196 N (44 lb)

Limit: Less than 181 N (41 lb)


014RS006

Valve Guide

CAUTION: Take care not to damage the valve seat contact surface, when removing carbon adhering to the valve head. Carefully inspect the valve stem for scratchs or abnormal wear. If these conditions are present, the valve and the valve guide must be replaced as a set.

1. Measure the valve stem diameter with a micrometer. If the valve stem diameter is less than the specified limit, the valve and the valve guide must be replaced as a set.

Diameter of Valve Stem

Intake

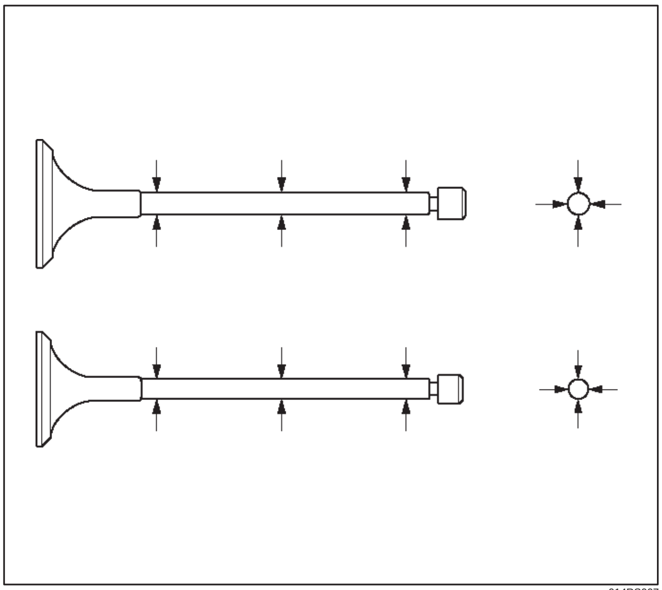
Standard : 5.977 mm–5.959 mm (0.2353 in–0.2346 in)

Limit : 5.90 mm (0.2323 in)

Exhaust

Standard : 5.952 mm–5.970 mm (0.2343 in–0.2350 in)

Limit : 5.90 mm (0.2323 in)



014RS007

2. Measure the inside diameter of the valve guide with a micrometer. Subtract the measured outer diameter of the valve stem from the measured inner diameter of the valve guide. If the value exceeds the specified limit, the valve and the valve guide must be replaced as a set.

Inside Diameter of the Vale Guide

Inlet clearance

Standard : 0.023 mm–0.056 mm (0.0009 in–0.0002 in)

Limit : 0.20 mm (0.00787 in)

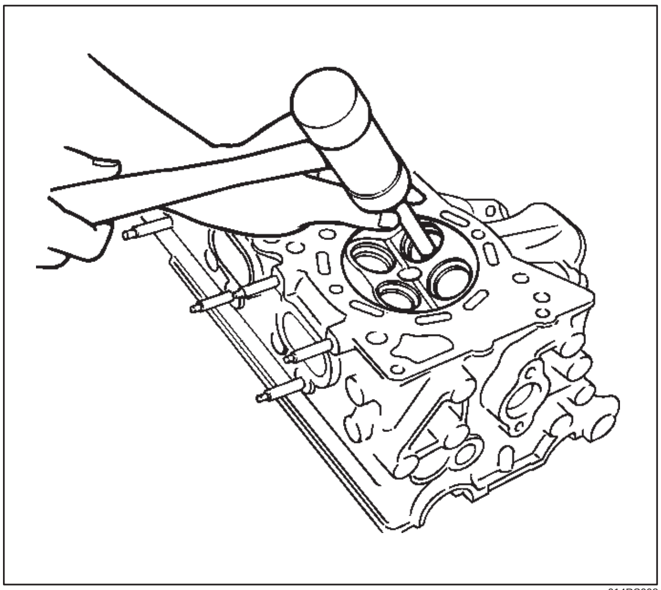
Exhaust clearance

Standard : 0.030 mm–0.063 mm (0.0012 in–0.0025 in)

Limit : 0.20 mm (0.00787 in)

Valve Guide Replacement

1. Using Valve guide replacer: J–42899, drive out the valve guide from the combustion chamber side.

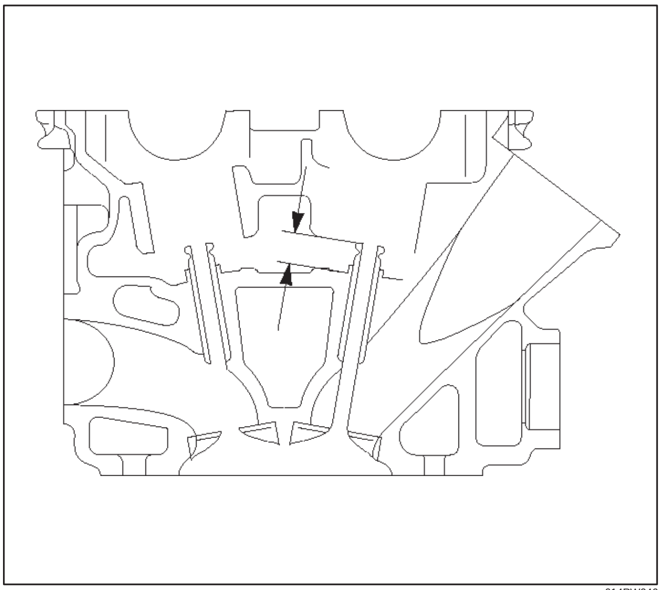


014RS008

2. Apply engine oil to the outside of the valve guide. Using valve guide replacer J–42899, drive in a new valve guide from the camshaft side, and check the valve guide height.

Valve guide upper end height: 13.0 mm (0.5118 in)

(Measured from the cylinder head upper face)



014RW046

3. Check the clearance. If the clearance is less than the specified value, ream the inside diameter of valve guide. Using a sharp 6 mm reamer, ream the valve guide to obtain the specified clearance.

Valve Seat

1. Measure the protrusion of the valve stem when a new valve is installed in the cylinder head. If the protrusion of the valve stem exceeds the limit, replace the valve seat insert or the cylinder head assembly.

Protrusion of valve stem

Intake

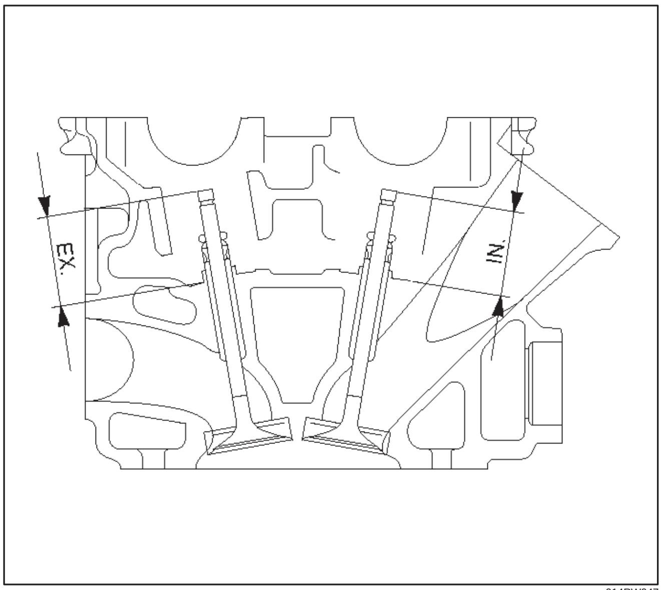
Standard: 39.32 mm (1.5480 in)

Limit: 39.47 mm (1.5539 in)

Exhaust

Standard: 39.3 mm (1.5472 in)

Limit: 39.45 mm (1.5531 in)



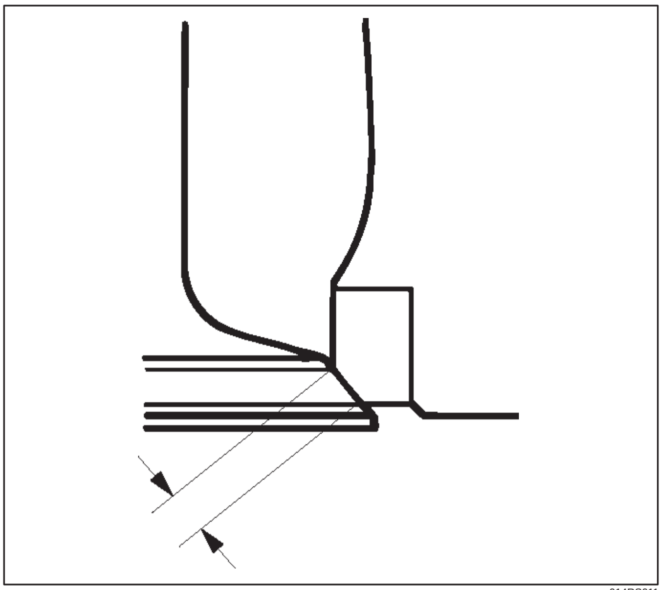
014RW047

2. Measure the valve seat contact width. Make the necessary corrections if the seat contact surface is damaged or rough or if the contact width wear exceeds the limit.

Valve seat contact width

Standard: 1.1 mm (0.0433 in)

Limit: 1.7 mm (0.0669 in)

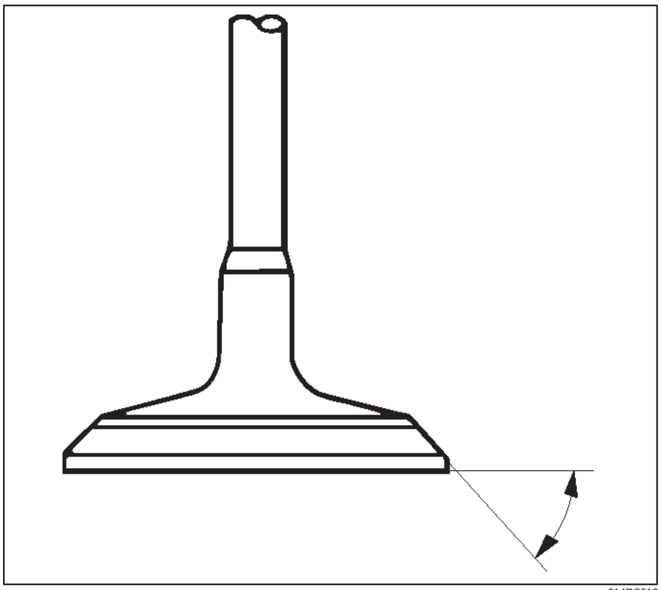


014RS011

Contact Surface Angle on Valve Seat on Valve

1. Measure contact surface angle on valve seat.
2. If the measured value exceeds the limit, replace valve, valve guide and valve seat as a set.

Valve contact surface angle: 45°

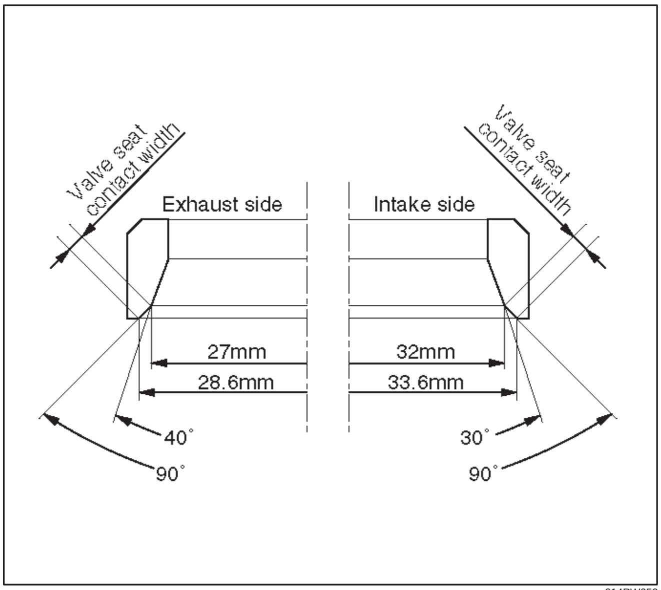


014RS012

Valve Seat Insert Correction

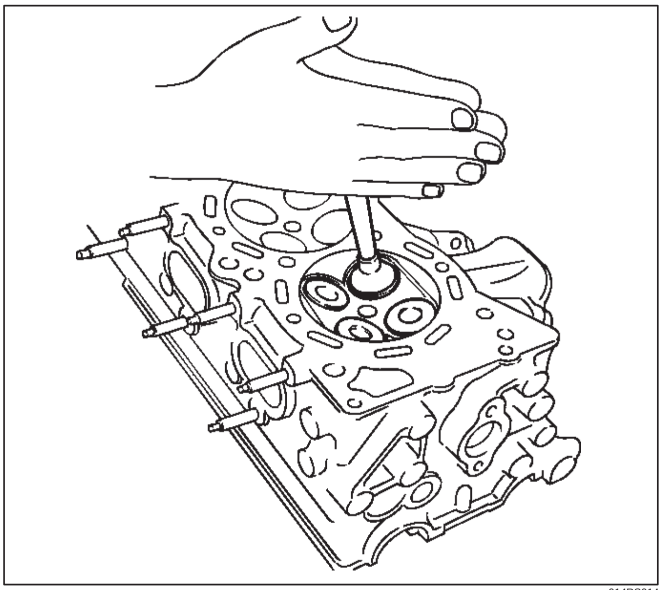
1. Remove the carbon from the valve seat insert surface.
2. Use a valve cutter to minimize scratches and other rough areas. This will bring the contact width back to the standard value. Remove only the scratches and rough areas. Do not cut away too much. Take care not to cut away unblemished areas of the valve seat surface.

Valve seat angle degree: 90°



014RW059

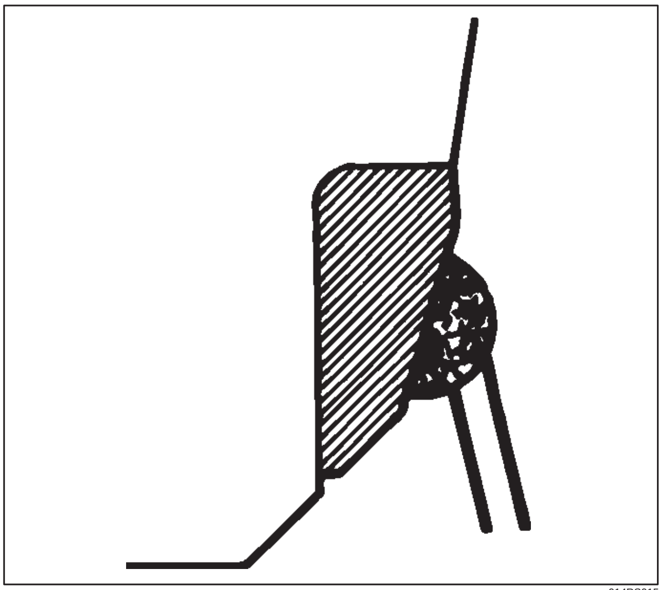
3. Apply abrasive compound to the valve seat insert surface.
4. Insert the valve into the valve guide.
5. Turn the valve while lapping it to fit the valve seat insert.
6. Check that the valve contact width is correct.
7. Check that the valve seat insert surface is in contact with the entire circumference of the valve.



014RS014

Valve Seat Insert Replacement

1. Arc weld the rod at several points. Be careful not to damage the aluminum section.
2. Allow the rod to cool for a few minutes. This will cause the valve seat to shrink.
3. Strike the rod and pull it out.



014RS015

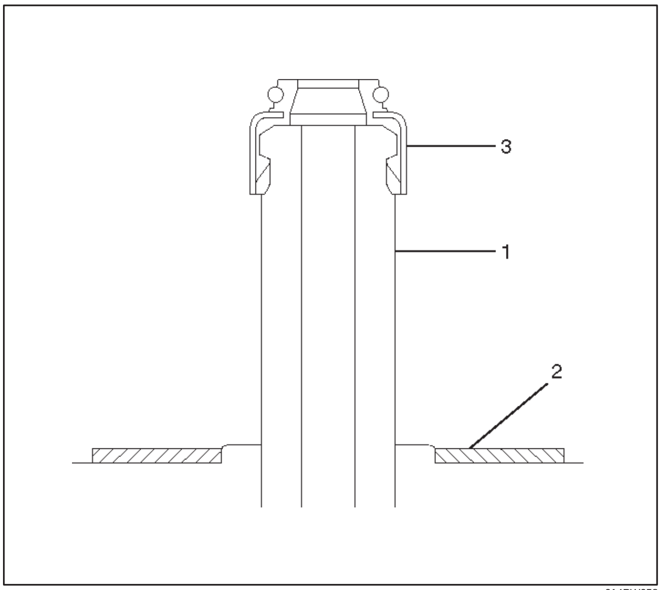
4. Carefully clean the valve seat press–fit section on the cylinder head side.
5. Heat the press–fit section with steam or some other means to cause expansion. Cool the valve seat with dry ice or some other means.
6. Insert the press–fit section into the valve seat horizontally.

Standard fitting interference: 0.14 mm–0.09 mm (0.0055 in–0.0035 in)

7. After insertion, use a seat grinder to grind finish the seating face. Carefully note the seating angle, the contact width, and the depression.
8. Lap the valve and the seat.

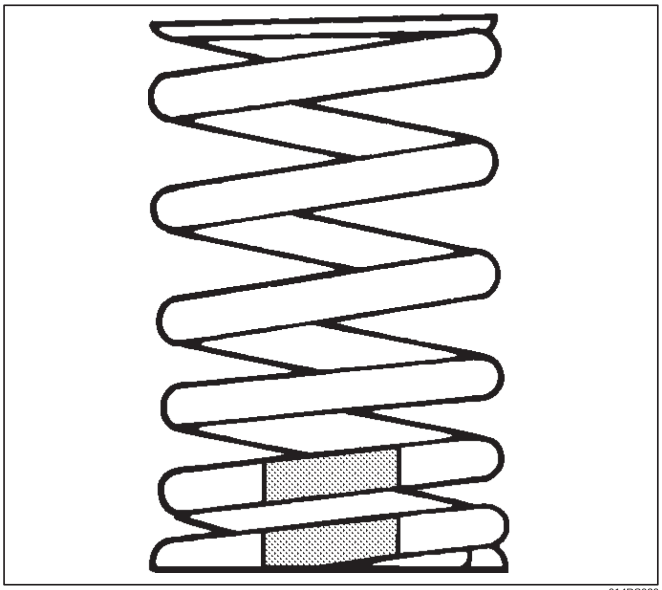
Reassembly

1. Install valve guide (1) to cylinder head. Apply engine oil to the outside of the valve guide. Using valve guide replacer J–42899, drive in a new valve guide from the camshaft side.
2. Install oil controller (3) and spring lower seat (2). Using oil controller replacer J–37281, drive in a new oil controller.



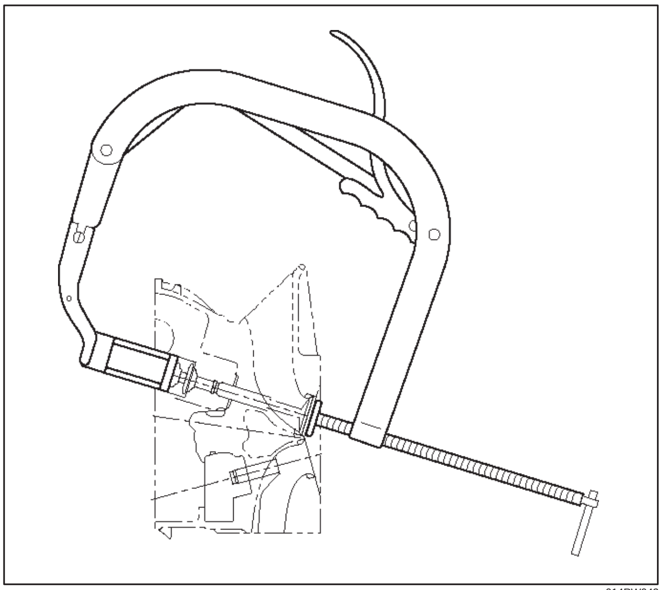
014RW058

3. Install valve to valve guide. Before install valve guide apply engine oil to the outside of the valve stem.
4. Install valve spring to cylinder head. Attach the valve spring to the lower spring seat. The painted area of the valve spring should be facing downward.



014RS020

5. Install lower valve spring seat, valve spring and upper valve spring seat then put split collars on the upper spring seat, using the J–8062 valve spring compresor and J–42898 valve spring compressor adapter to install the split collars.

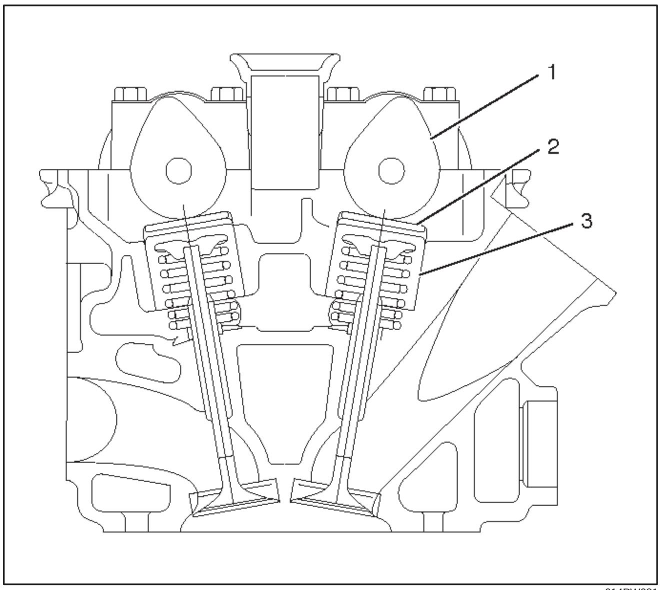


014RW042

6. Install tappet with shim.
7. Install camshaft assembly.
   - Refer to installation procedure for Camshaft in this manual.

Valve Clearance Adjustments

NOTE: To adjust valve clearance, apply engine oil to the cam as well as to the adjusting shim (2) with the cylinder head built on the cylinder block, give a few turns to the camshaft by means of timing pulley tightening bolt, and measure valve clearance when the nose of cam is just opposite to maximum cam lift (1) as shown in illustration below.



014RW081

Legend

(1) Cam
(2) Shim
(3) Tappet

Valve Clearance Standard Value (cold)

Intake: 0.23 mm–0.33 mm (0.0091 in–0.0130 in)

Exhaust: 0.25 mm–0.35 mm (0.0098 in–0.0138 in)

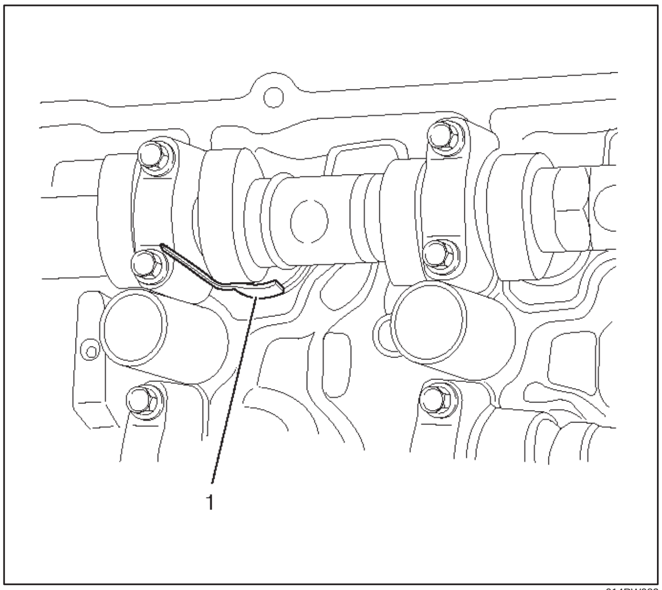
Selection of Adjusting Shim

Shim to be selected = (Thickness of removed shim) + (Valve clearance measurement – Standard valu)

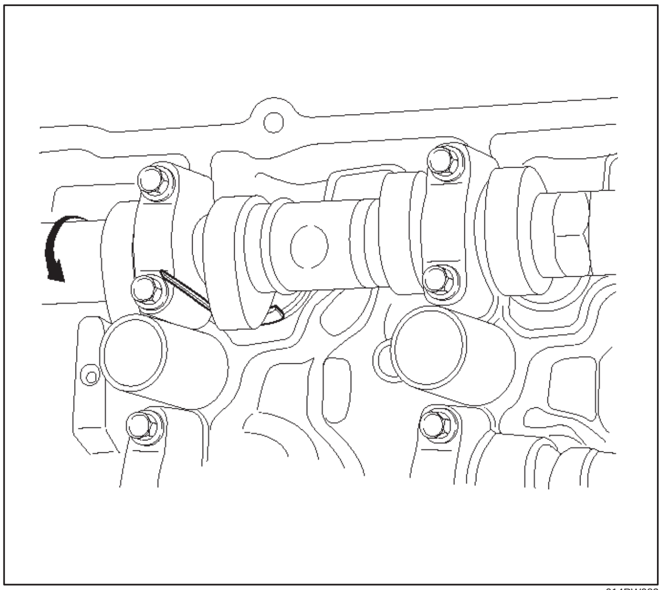
Based on the above formula, the best suited shim should be selected from 41 sorts of shim (differently thick at 0.02mm (0.0008 in) intervals from 2.40mm (0.0945 in) through 3.2mm (0.1260 in) thick). Install the shim and check valve clearance.

Replacement of Shim

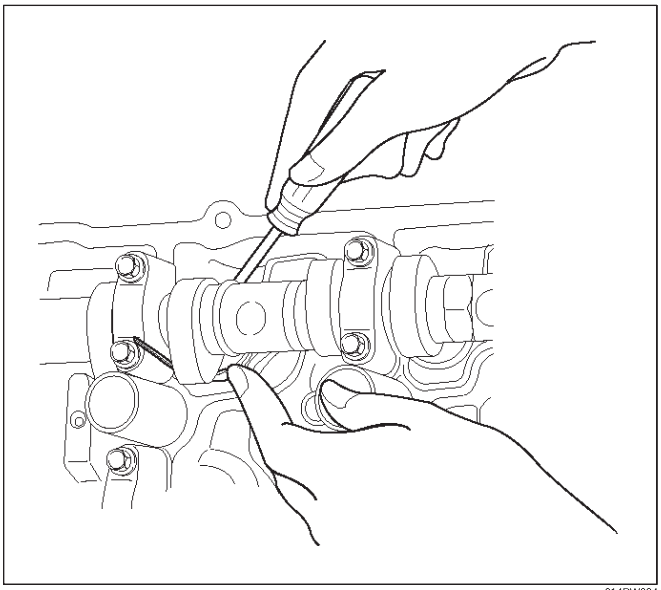
Let the cam push down the edge of tappet by using J–42689 valve clearance adjusting tool and push out the shim with a flat blade screw driver as shown in illustrations below.



014RW082



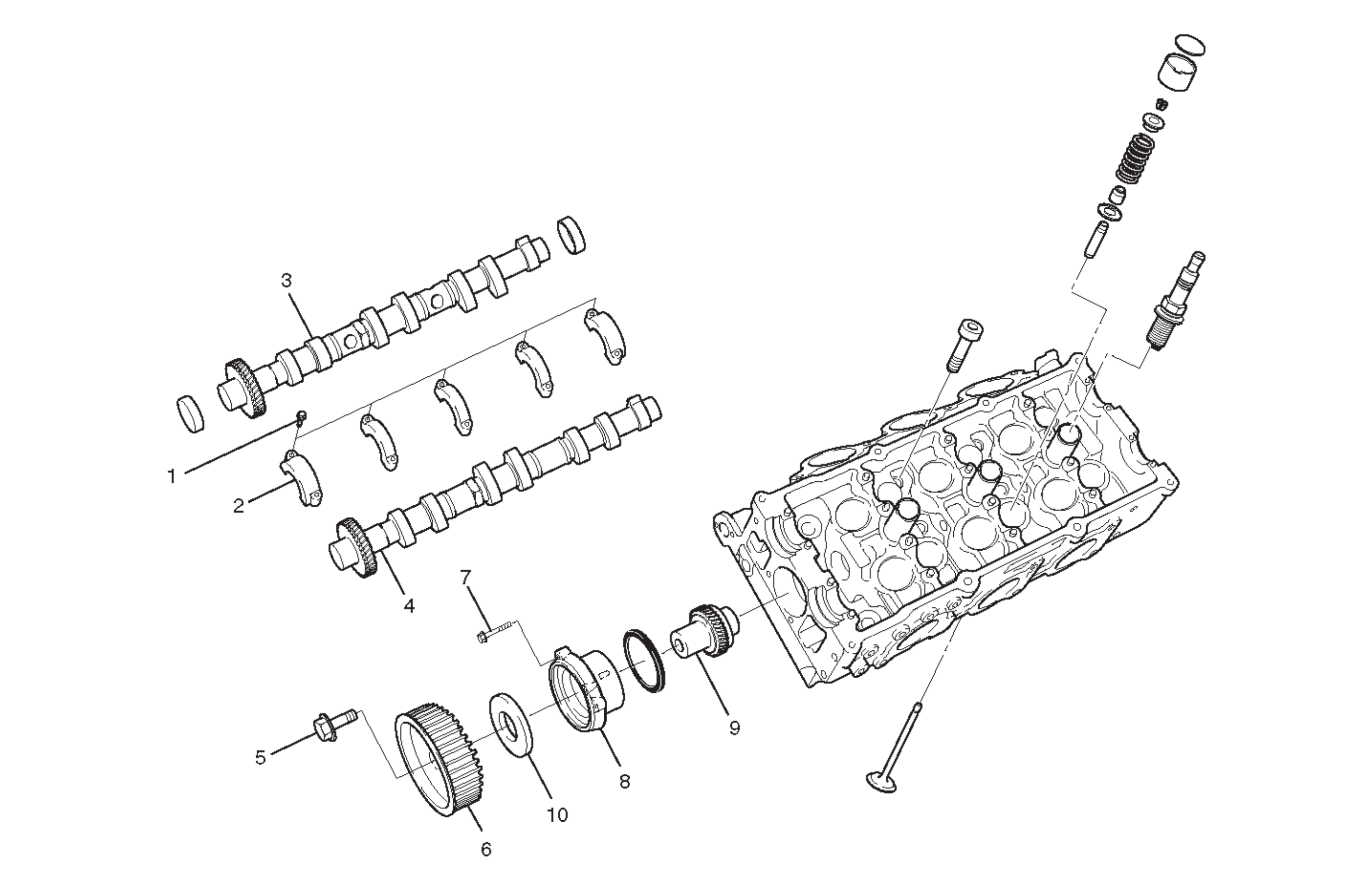
014RW083



014RW084

Camshaft

Camshaft and Associated Parts



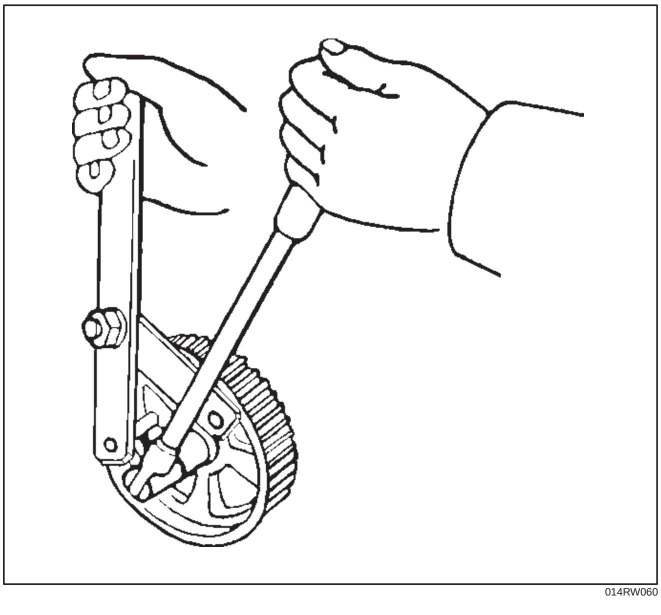
014RW040

Legend

(1) Camshaft Bearing Cap Fixing Bolt
(2) Camshaft Bearing Cap
(3) Camshaft Assembly Intake
(4) Camshaft Assembly Exhaust
(5) Pulley Fixing Bolt
(6) Camshaft Drive Gear Pulley
(7) Retainer Fixing Bolt
(8) Retainer
(9) Camshaft Drive Gear
(10) Oil Seal

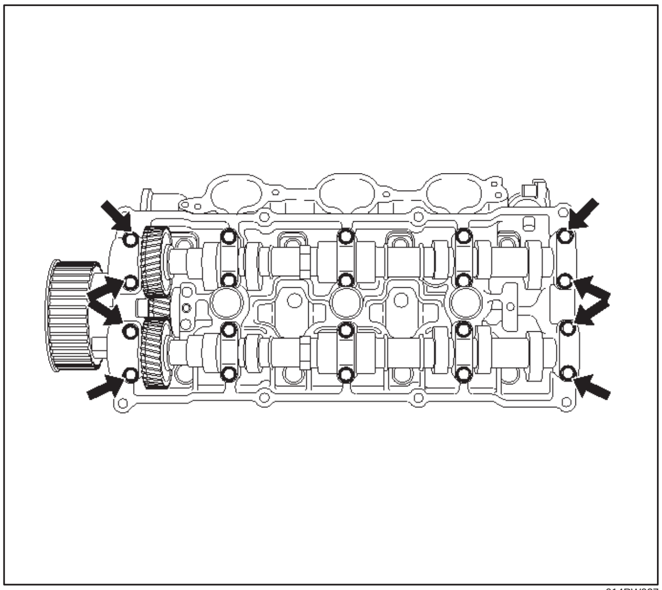
Disassembly

1. Remove fixing bolt (5) for camshaft drive gear pulley using J–43041 universal holder.



014RW060

2. Remove twenty fixing bolts from inlet and exhaust camshaft bearing cap on one side bank, then camshaft bearing cap (2).



014RW027

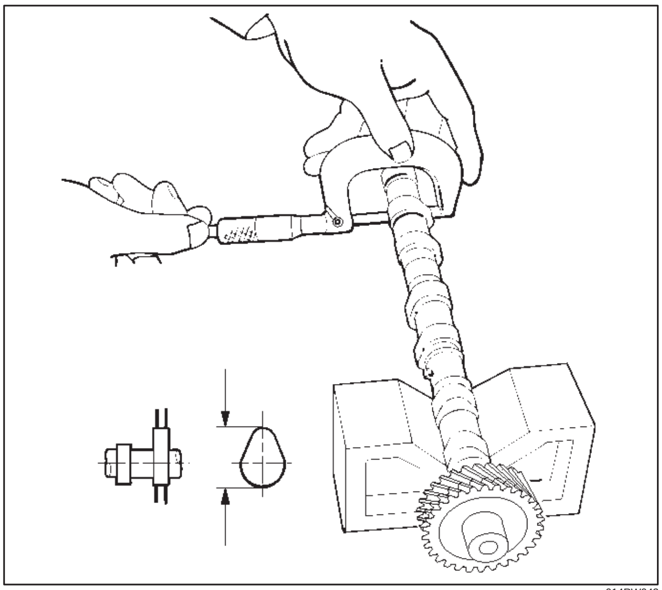
3. Remove camshaft assembly (3), (4).
4. Remove three fixing bolts (7) from camshaft drive gear retainer (8), then camshaft drive gear assembly.

Inspection and Repair

1. Use a micrometer to measure the cam lobe height and uneven wear. Replace the camshaft if either the lobe height or the uneven wear exceeds the specified limit.

Lobe height : 44.709 mm (1.7602 in)

Uneven wear : 0.05 mm (0.0020 in)



014RW043

2. Use a micrometer to measure the diameter and the uneven wear of the camshaft journals.

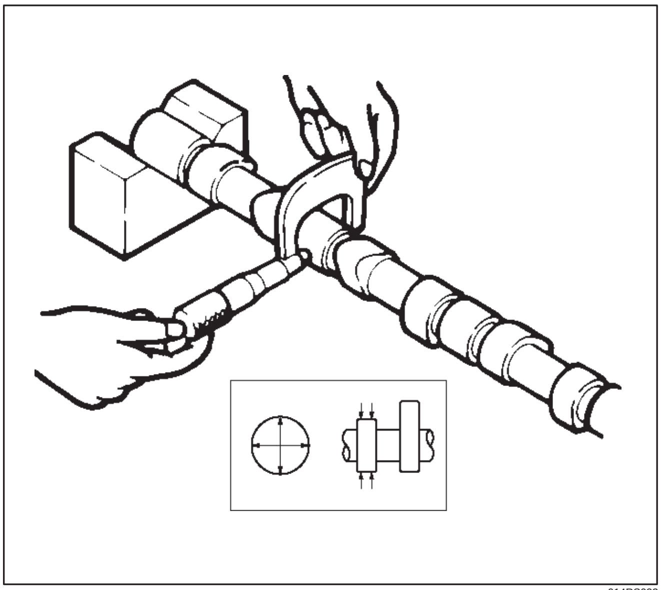
   Replace the camshaft if the diameter or the uneven wear exceeds the specified limit.

Journal Diameter

Standard : 25.972 mm–25.993 mm (1.0225 in–1.0233 in)

Limit : 25.8 mm (1.0157 in)

Uneven wear : 0.05 mm (0.0020 in)



014RS023

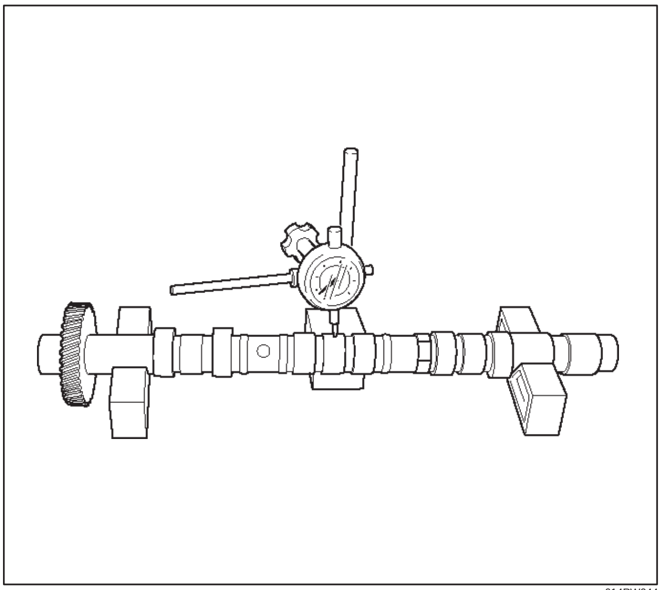
3. Place the camshaft on V–blocks.

   Slowly rotate the camshaft and measure the runout with a dial indicator.

   Replace the camshaft if the runout exceeds the specified limit.

Run out

Limit : 0.1 mm (0.0039 in)

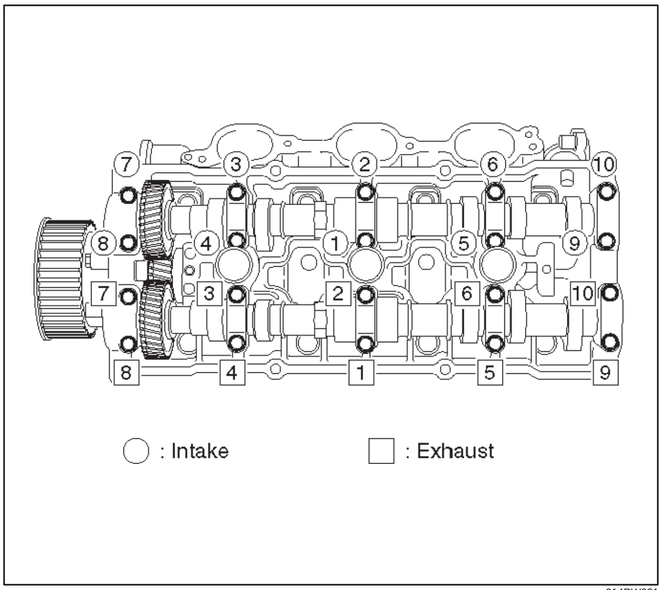


014RW044

4. Measure the camshaft journal oil clearance.
   1. Measure the camshaft bearing cap housing inside diameter.

NOTE: Tighten camshaft bearing cap (2) to specified torque before measuring the camshaft bearing cap inside diameter.

Torque : 10 N·m (89 lb in)



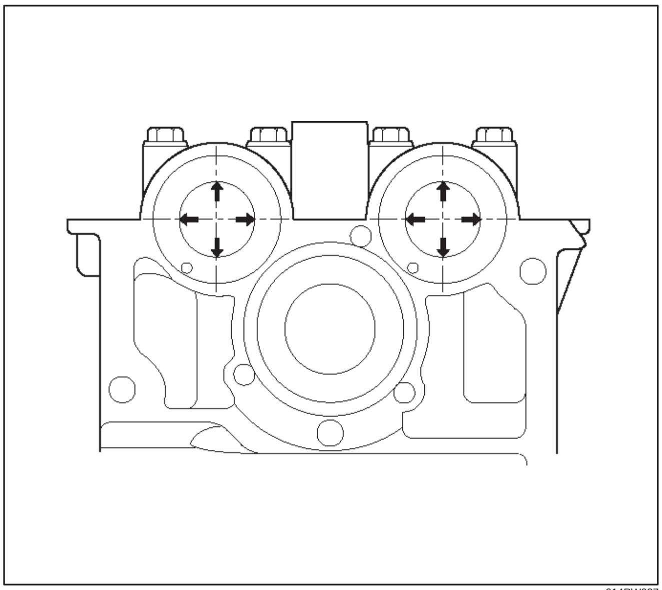
014RW031

2. Subtract the camshaft outside diameter from the camshaft bearing cap housing inside diameter.

Oil Clearance

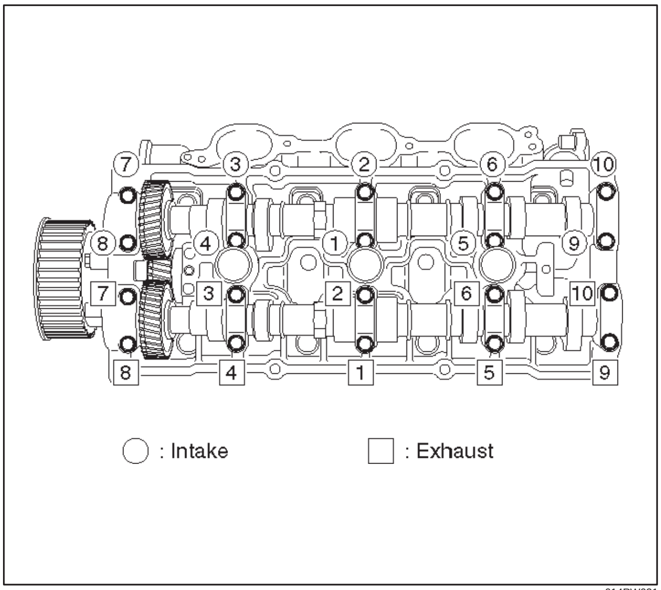
Standard : 0.027 mm–0.078 mm (0.0011 in–0.0031 in)

Limit : 0.11 mm (0.0043 in)


014RW037

5. Replace the cylinder head and/or camshaft if the measured oil clearance exceeds the specified limit.
   1. Carefully clean the camshaft journal, the camshaft bearing cap, and the cylinder head.
   2. Install camshaft assembly and camshaft bearing cap (2), tighten twenty bolts (1) on one side bank to the specified torque.

Torque: 10 N·m (89 lb in)



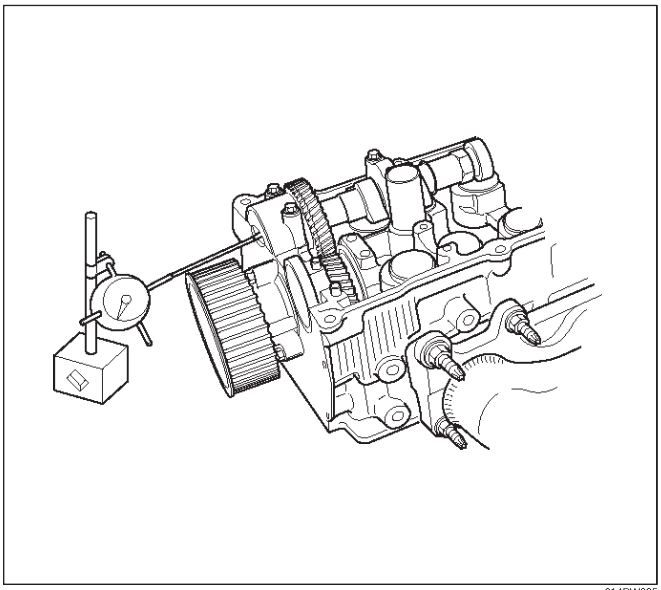
014RW031

3. Measure the camshaft thrust clearance with a dial indicator. Replace the camshaft and/or the cylinder head if the camshaft thrust clearance exceeds the specified limit.

Camshaft thrust Clearance

Standard : 0.03 mm–0.08 mm (0.0012 in.–0.0031 in.)

Limit : 0.12 mm (0.0047 mm)

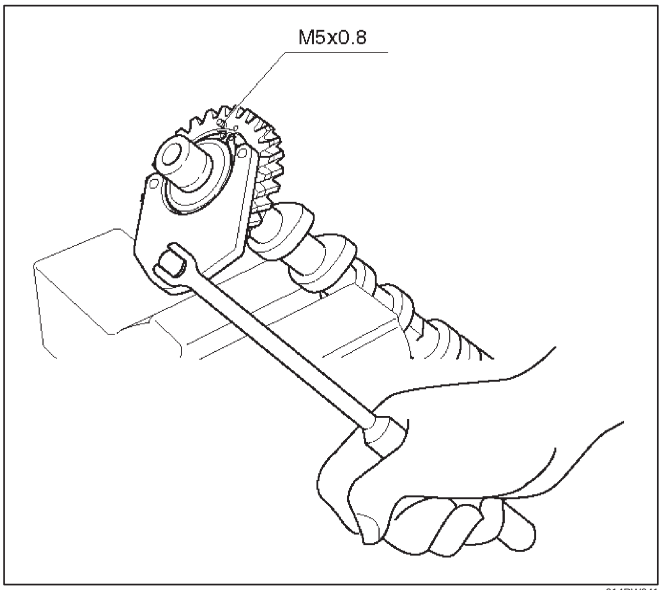

014RW035

Reassembly

1. Install camshaft drive gear assembly and tighten three bolts to specified torque.

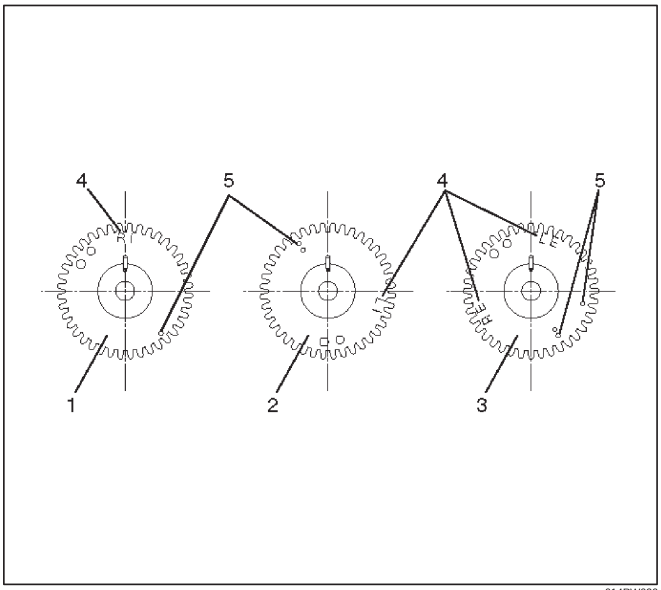
Torque: 10 N·m (89 lb in)

2. Tighten sub gear setting bolt.
   1. Use J–42686 to turn sub gear to right direction until the M5 bolt hole aligns between camshaft driven gear and sub gear.
   2. Tighten M5 bolt suitable torque for prevent moving the sub gear.



014RW041

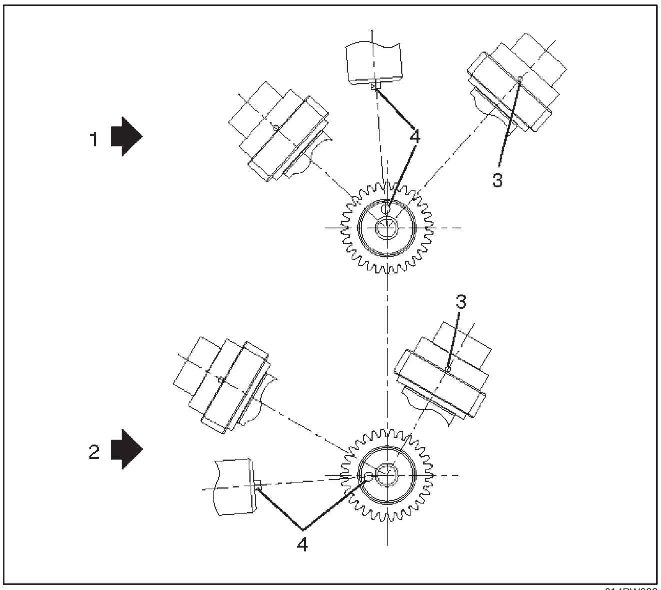
3. Install camshaft assembly and camshaft bearing caps, tighten twenty bolts on one side bank to the specified torque.
   1. Apply engine oil to camshaft journal and bearing surface of camshaft bearing cap.
   2. Align timing mark on intake camshaft (one dot for right bank, two dots for left bank) and exhaust camshaft (one dot for right bank, two dots for left bank) to timing mark on camshaft drive gear (one dot).



014RW020

Legend

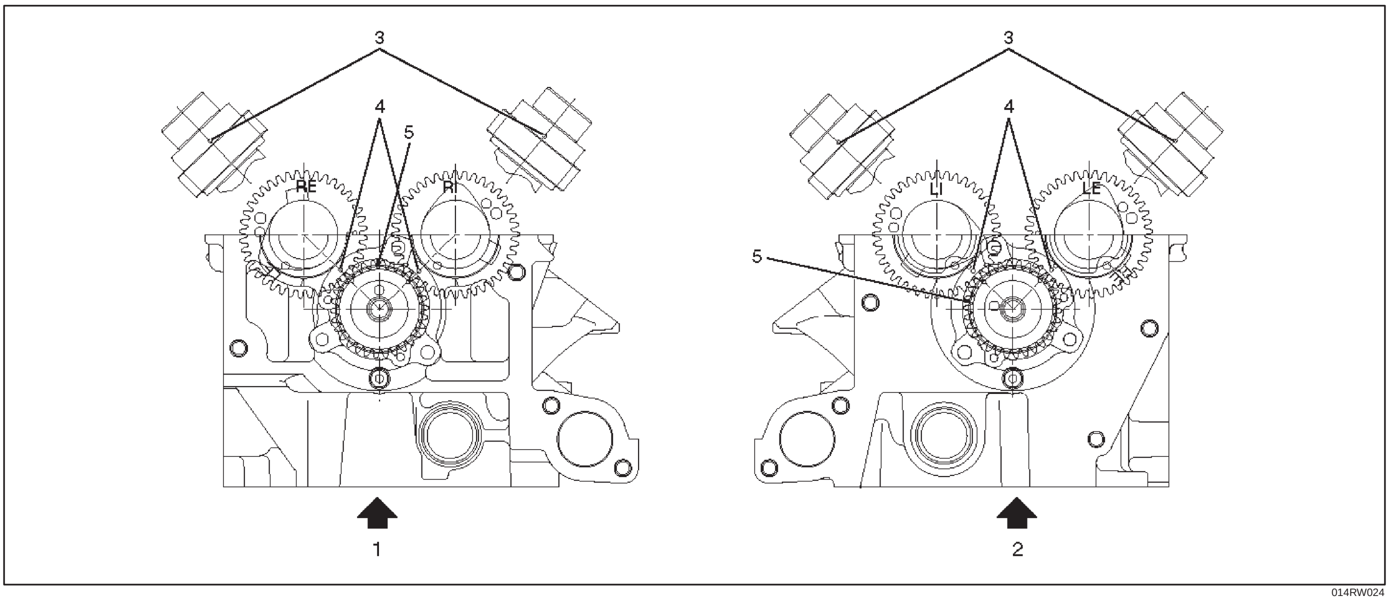
- (1) Intake Camshaft Timing Gear for Right Bank
- (2) Intake Camshaft Timing Gear for Left Bank
- (3) Exhaust Camshaft Timing Gear
- (4) Discerning Mark
- LI: Left Bank Intake
- RI: Right Bank Intake
- LE: Left Bank Exhaust
- RE: Right Bank Exhaust



014RW023

Legend

- (1) Right Bank Camshaft Drive Gear
- (2) Left Bank Camshaft Drive Gear
- (3) Timing Mark on Drive Gear
- (4) Dowel Pin

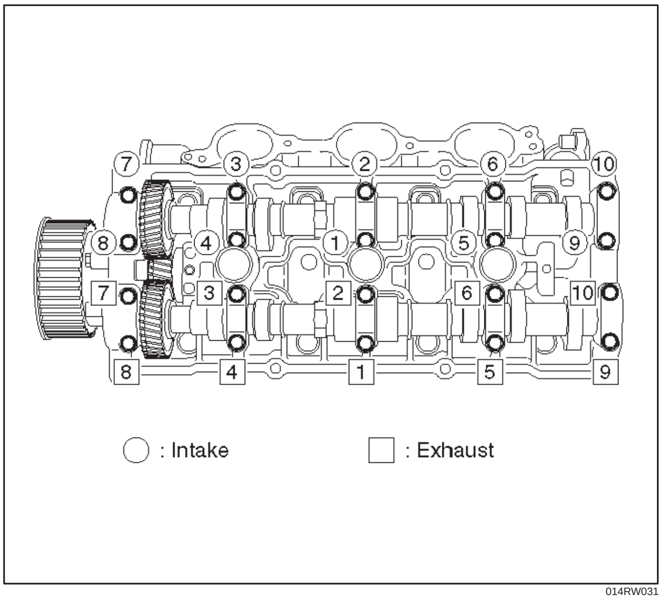


Legend

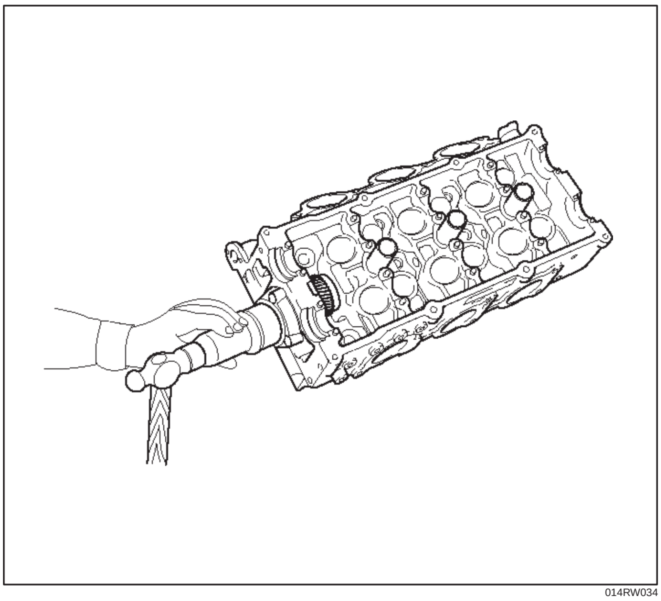
(1) Right Bank
(2) Left Bank
(3) Alignment Mark on Camshaft Drive Gear
(4) Alignment Mark on Camshaft
(5) Alignment Mark on Retainer

3. Tighten twenty bolts in numerical order on one side bank as shown in the illustration.

Torque: 10 N·m (89 lb in)

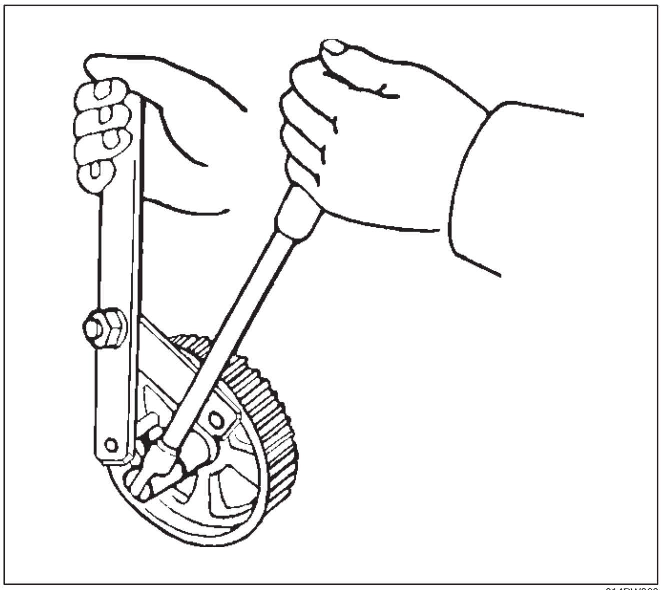


4. If the oil seal requires replacement, use the J–42985 to install the oil seal.



5. Tighten bolt for camshaft drive gear assembly pulley to the specified torque using the J–43041 universal holder.

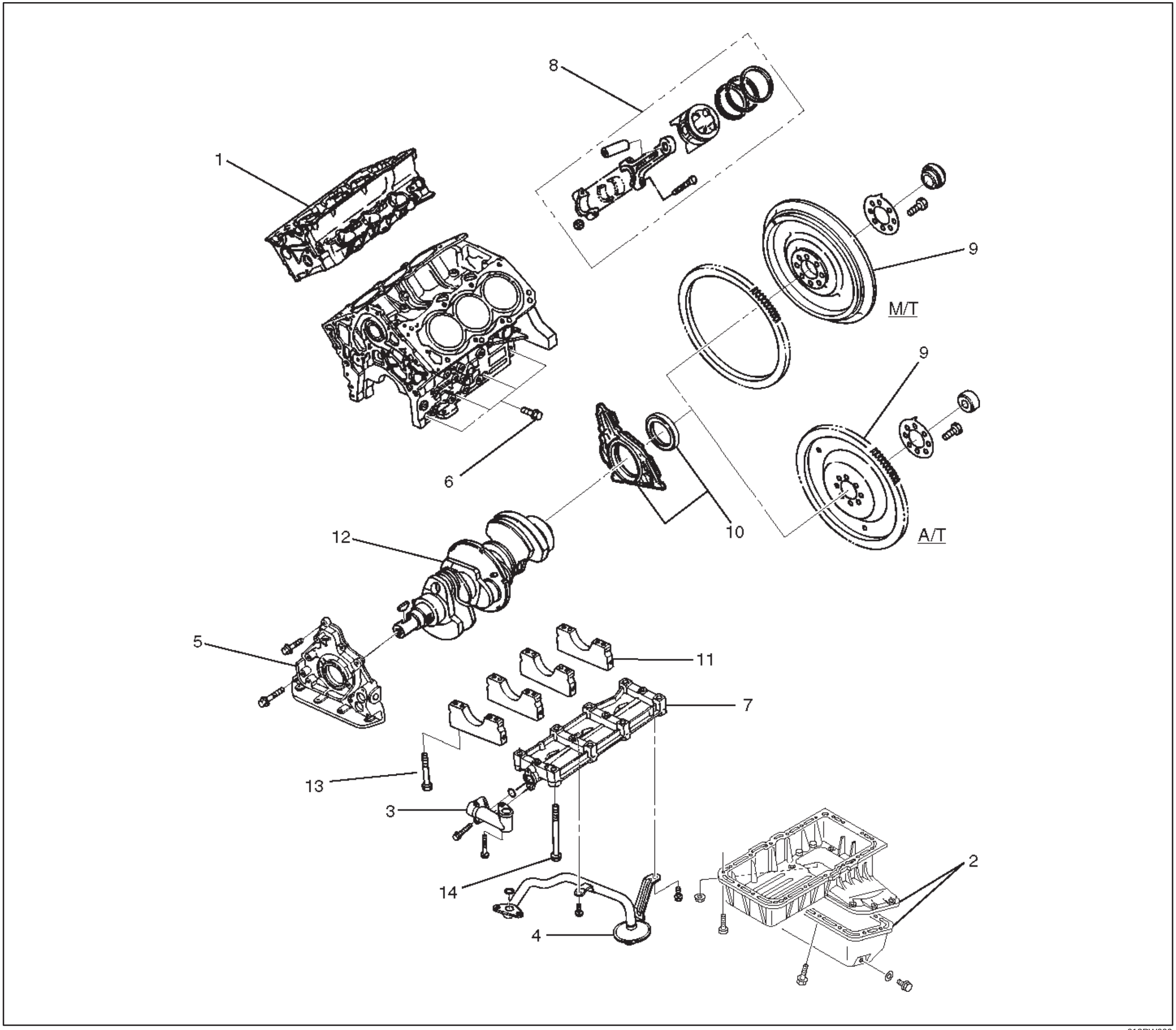
Torque: 98 N·m (72 lb ft)



014RW060

Crankshaft

Crankshaft and Associated Parts



Legend

(1) Cylinder Head Assembly
(2) Crankcase with Oil Pan
(3) Oil Pipe and O-ring
(4) Oil Strainer and O-ring
(5) Oil Pump Assembly
(6) Cylinder Block Side Bolts
(7) Oil Gallery
(8) Piston and Connecting Rod Assembly
(9) Flywheel
(10) Rear Oil Seal Retainer and Oil Seal
(11) Main Bearing Cap
(12) Crankshaft
(13) Main Bearing Cap Fixing Bolts
(14) Oil Gallery Fixing Bolts

Disassembly

1. Remove cylinder head assembly (1). Refer to “Cylinder Head” in this manual.
2. Remove crankcase with oil pan (2). Refer to “Oil Pan and Crankcase” in this manual.

CAUTION: Take care not to damage or deform the sealing flange surface of crankcase.

3. Remove oil pipe and O-ring (3).
4. Remove oil strainer and O-ring (4).
5. Remove oil pump assembly (5).
6. Remove crankcase side bolts (6).

7. Remove oil gallery (7).
8. Remove piston and connecting rod assembly (8). Refer to “Piston, Piston Ring and Connecting Rod” in this manual.
9. Remove flywheel (9).
10. Remove rear oil seal retainer (10).
11. Remove main bearing cap (11).
12. Remove crankshaft (12).

Inspection and Repair

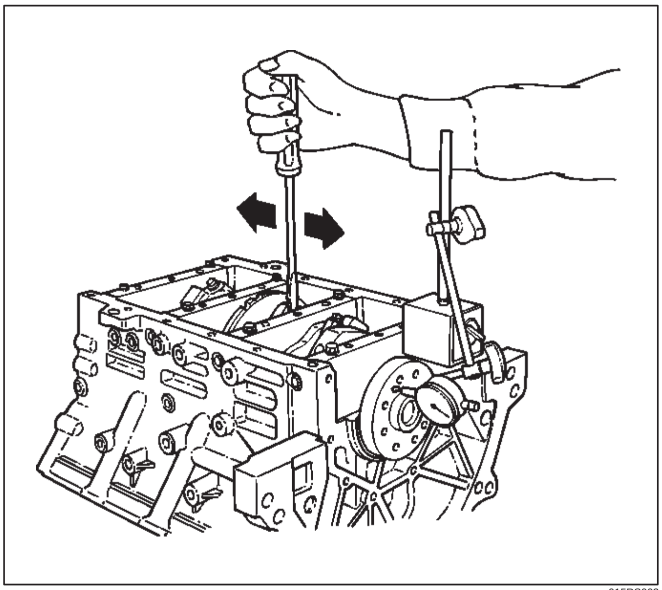
1. Crankshaft

   Set the dial indicator as shown in the illustration and measure the crankshaft thrust clearance. If the thrust clearance exceeds the specified limit, replace the thrust bearings as a set.

   Thrust Clearance

   Standard : 0.06 mm–0.24 mm (0.0024 in–0.0094 in)

   Limit : 0.30 mm (0.0118 in)



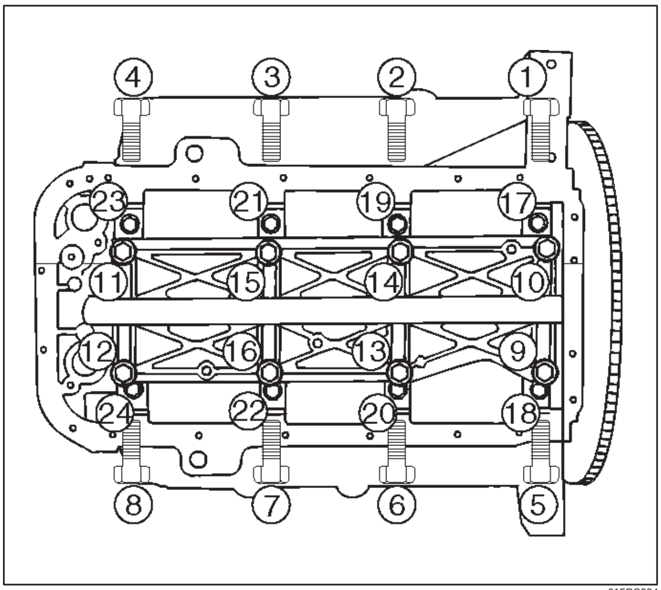
015RS003

Main Bearing Clearance

1. Remove the bearing caps and measure the oil clearance.
2. Remove the main bearing cap fixing bolts in the sequence shown in the illustration.

   Arrange the removed main bearing caps in the cylinder number order.

   Remove the main bearings.



015RS004

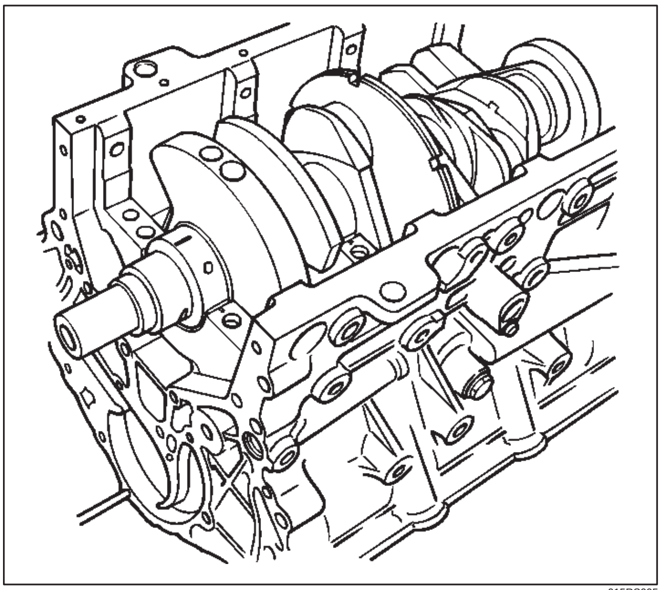
3. Remove the crankshaft.

   Remove the main bearings.
4. Clean the upper and lower bearings as well as the crankshaft main journal.
5. Check the bearings for damage or excessive wear.

   The bearings must be replaced as a set if damage or excessive wear is discovered during inspection.
6. Set the upper bearings and the thrust washers to their original positions.

   Carefully install the crankshaft.
7. Set the lower bearings to the bearing cap original position.
8. Apply plastigage to the crankshaft journal unit as shown in the illustration.

NOTE: Do not set the plastigage on the oil hole.



015RS005

9. Install main bearing caps, oil gallery and crank case bolts in the order shown, and tighten each bolt to the specified torque.

NOTE: Do not apply engine oil to the crank case side bolts.

Main bearing cap bolts.

Torque: 39 N·m (29lb ft)

Oil gallery fixing bolts.

Torque:

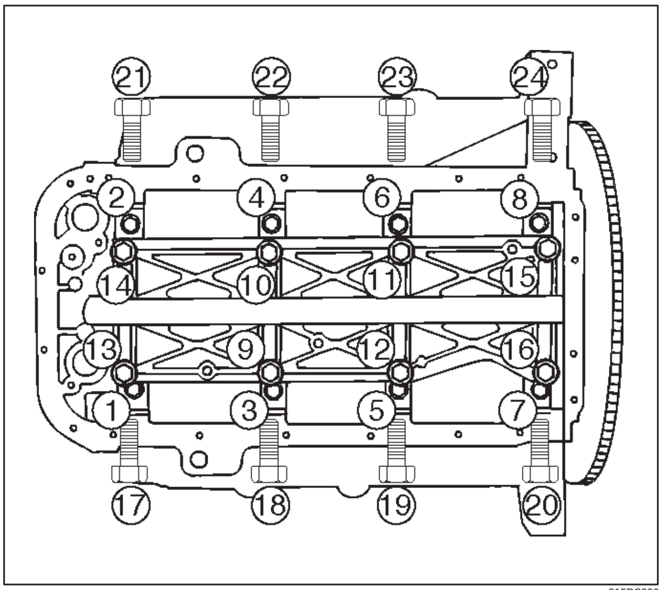
1st step: 29 N·m (21 lb ft)

2nd step 55°～65°

Crank case side bolts

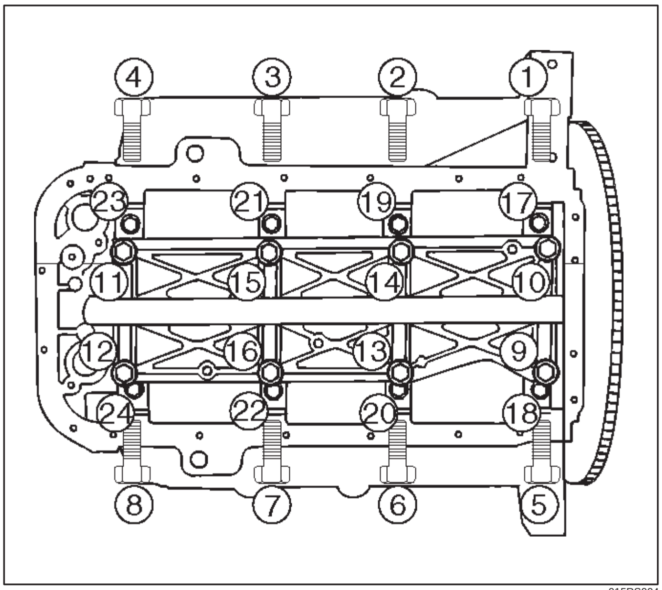
Torque : 39 N·m (29lb ft)

NOTE: Do not allow the crankshaft to rotate.



015RS006

10. Remove the main bearing caps in the sequence shown in the illustration.

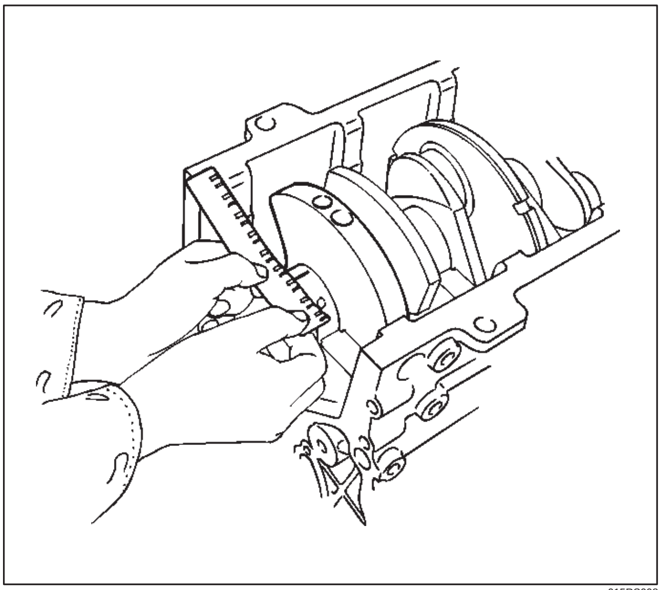


015RS004

11. Measure the plastigage width and determine the oil clearance. If the oil clearance exceeds the specified limit, replace the main bearings as a set and/or replace the crankshaft.

Standard : 0.019 mm–0.043 mm (0.0007 in–0.0017 in)

Limit : 0.08 mm (0.0031 in)



015RS008

12. Clean the plastigage from the bearings and the crankshaft.
   Remove the crankshaft and the bearings.

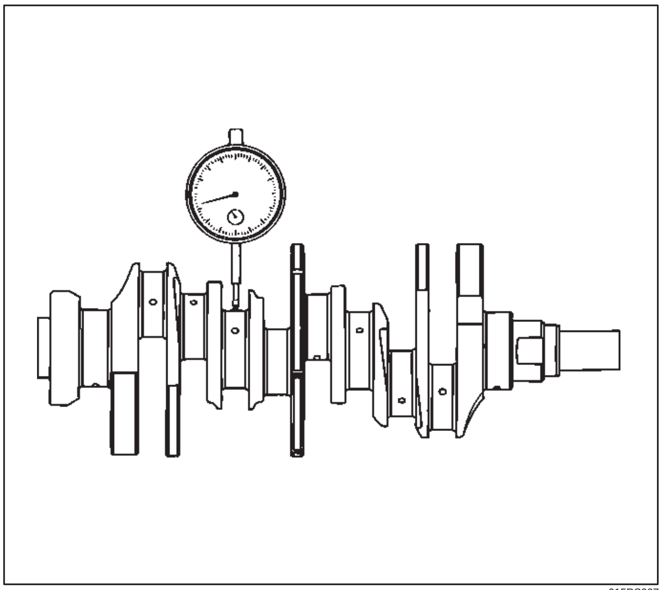
Crankshaft (12) Inspection

Inspect the surface of the crankshaft journal and crank pins for excessive wear and damage. Inspect the oil seal fitting surfaces for excessive wear and damage. Inspect the oil ports for obstructions.

Inspection and Repair

1. Carefully set the crankshaft on the V–blocks. Slowly rotate the crankshaft and measure the runout. If the crankshaft runout exceeds the specified limit, the crankshaft must be replaced.

Runout : 0.04 mm (0.0016 in)

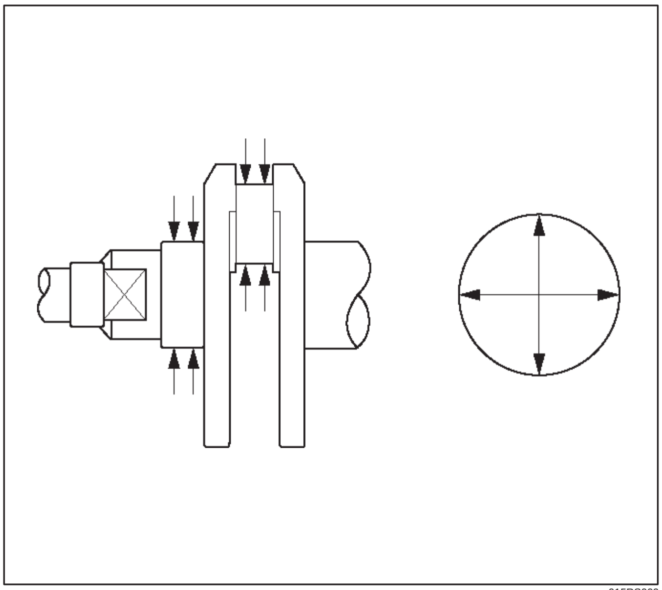

015RS007

2. Measure the diameter and the uneven wear of main journal and crank pin. If the crankshaft wear exceeds the specified limit, crankshaft must be replaced.

Main journal diameter : 63.918 mm–63.933 mm (2.5165 in–2.5170 in)

Crank pin diameter : 53.922 mm–53.937 mm (2.1229 in.–2.1235 in.)

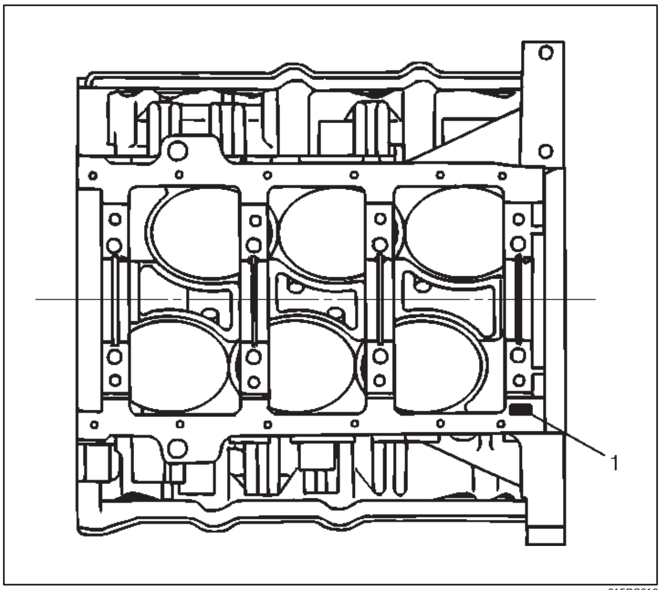
Uneven wear limit : 0.005 mm (0.0002 in)


015RS009

Crankshaft Bearing Selection

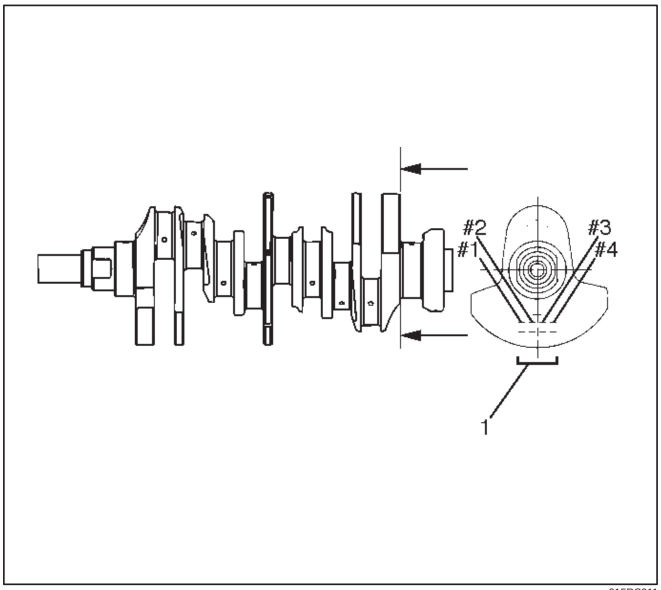
When installing new crankshaft bearings or replacing bearings, refer to the selection table below. Select and install the new crankshaft bearings, paying close attention to the cylinder block journal hole.

1. Diameter size mark (1) and the crankshaft journal.



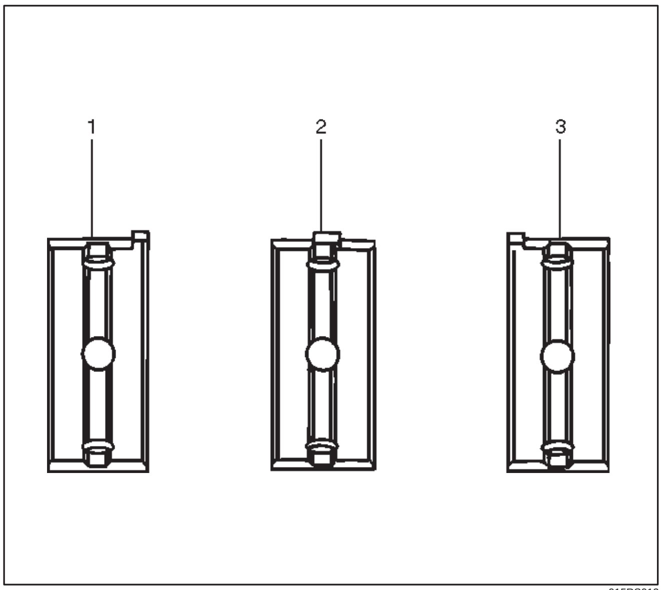
015RS010

2. Diameter size mark (1).
   The diameter size marks are stamped on the No.1 crankshaft balancer as shown in the illustration.



015RS011

NOTE: Take care to ensure the bearings are positioned correctly.



015RS012

Legend

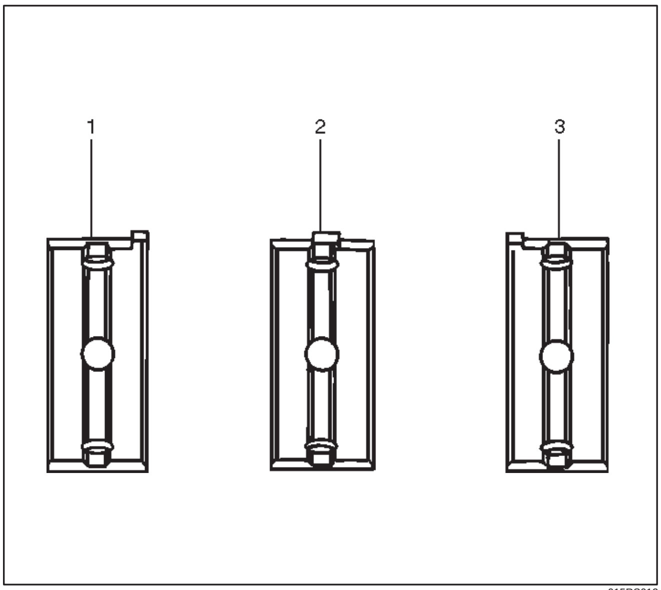
(1) Number 1 and 4 main bearing upper and lower
(2) Number 2 and 3 main bearing upper
(3) Number 2 and 3 main bearing lower

1 Size Mark	Main Bearing Bore Diameter	Crank Shaft Main Journal Diameter	2 Size Mark	Crank Shaft Bearing Size Mark (Upper Side)	Crank Shaft Bearing Size Mark (Lower Side)	Oil Clearance (Reference)
1	68.994-69.000 (2.7163-2.7165)	63.918-63.925 (2.5165-2.5167)	2	Blue	Blue	0.030-0.049 (0.0012-0.0019)
		63.926-63.933 (2.5168-2.5170)	1	Brown	Brown	0.028-0.047 (0.0011-0.0019)
2	68.987-68.993 (2.7160-2.7163)	63.918-63.925 (2.5165-2.5167)	2			0.029-0.048 (0.0011-0.0019)
		63.926-63.933 (2.5168-2.5170)	1	Green	Green	0.027-0.046 (0.0011-0.0018)
3	68.980-68.986 (2.7157-2.7160)	63.918-63.925 (2.5165-2.5167)	2			0.028-0.047 (0.0011-0.0019)
		63.926-63.933 (2.5168-2.5170)	1	Yellow	Yellow	0.026-0.045 (0.0010-0.0018)

Reassembly

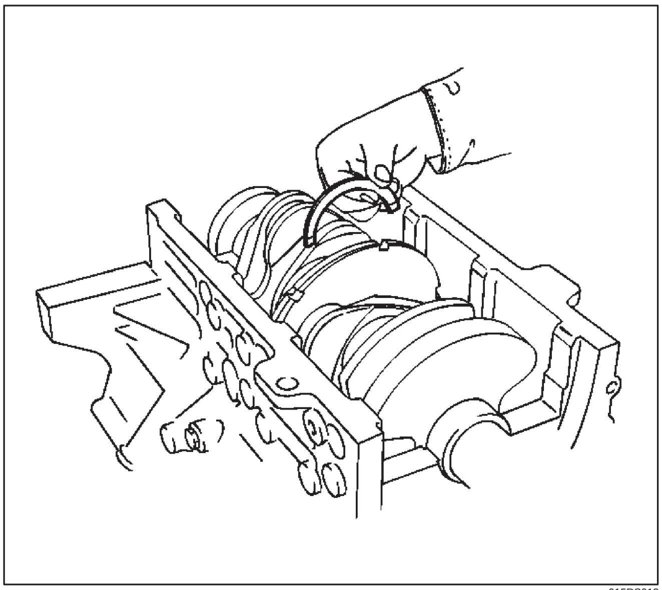
1. Crankshaft (12)
   - Install the main bearings to the cylinder block and the main bearing caps.
   - Be sure that they are positioned correctly.
   - Apply new engine oil to the upper and lower main bearing faces.

NOTE: Do not apply engine oil to the main bearing back faces.



015RS012

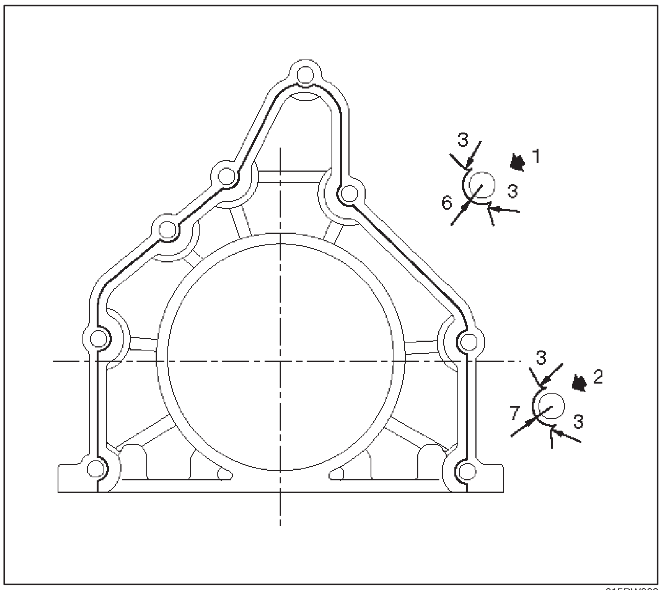
- Carefully mount the crankshaft.
- Apply engine oil to the thrust washer.
- Assemble the thrust washer to the No.3 bearing journal. The oil grooves must face the crankshaft.



015RS013

2. Rear oil seal (10)
   - Remove the oil from the cylinder block and the retainer mounting surface.
   - Apply sealant (TB–1207B or equivalent) to the retainer mounting surface, following the pattern shown in the illustration.

     The retainer must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.



015RW002

Legend

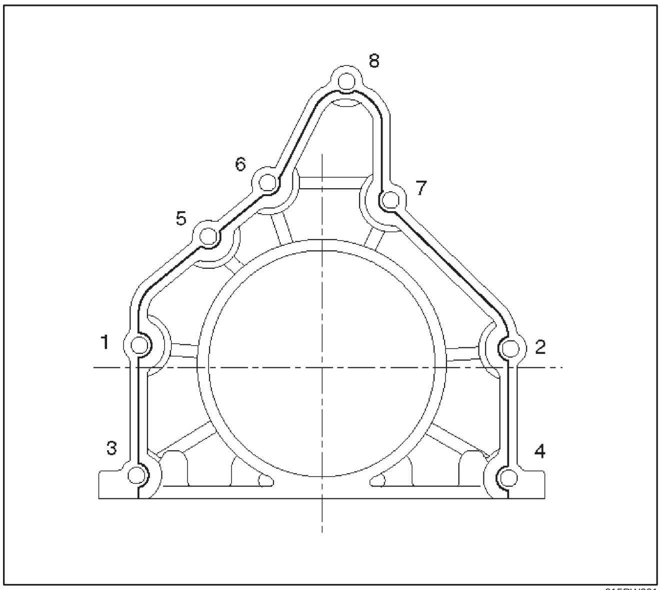
(1) Around Bolt Holes
(2) Around Dowel Pin

- Apply engine oil to the oil seal lip.
- Align the cylinder block dowel pin holes with the rear retainer dowel pins.
- Tighten the rear retainer fixing bolts. New bolts should be used when installing rear retainer.

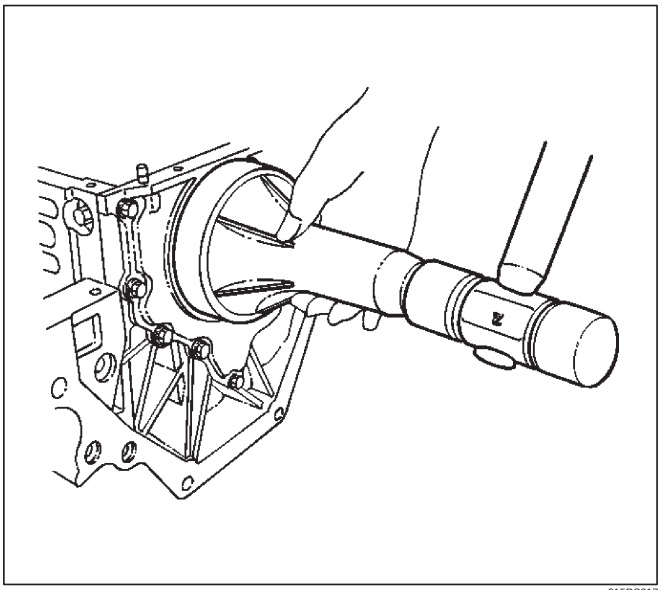
Torque: 18 N·m (13 lb ft)

NOTE: Be very careful not to disengage the oil seal garter spring during installation of the rear retainer.

If the seal was removed from retainer for replacement, apply engine oil to the oil seal lip and install the oil seal using J–39201 oil seal installer.



015RW001



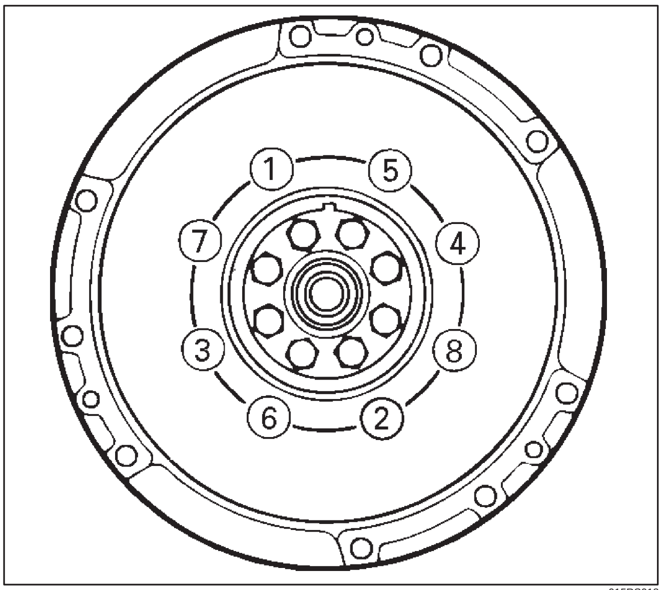
015RS017

3. Flywheel (9)
   1. Thoroughly clean and remove the oil from the threads of crankshaft.
   2. Remove the oil from the crankshaft and flywheel mounting faces.
   3. Mount the flywheel on the crankshaft and then install the washer.

4. Hold the crankshaft to prevent from rotating then install the bolts in the order shown to the specified torque.

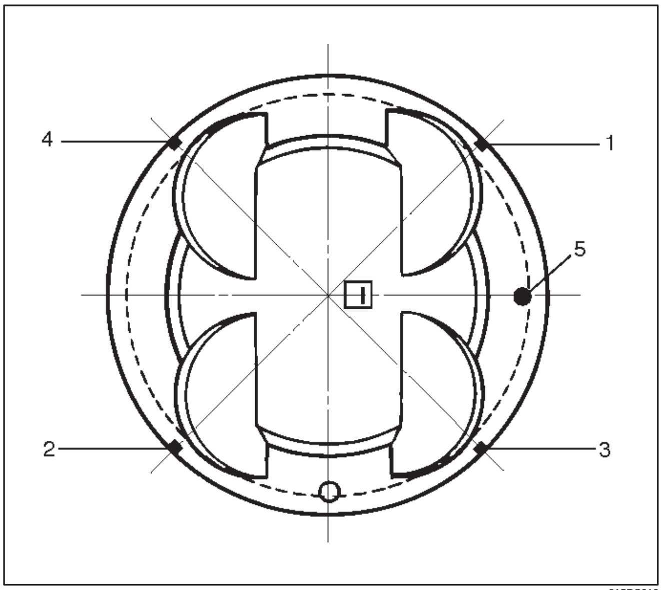
Torque: 54 N·m (40 lb ft)

NOTE: Do not reuse the bolt and do not apply oil or thread lock to the bolt.



015RS018

4. Piston and connecting rod assembly (8)
   - Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins. Check to see that the piston ring end gaps are correctly positioned.



015RS019

Legend

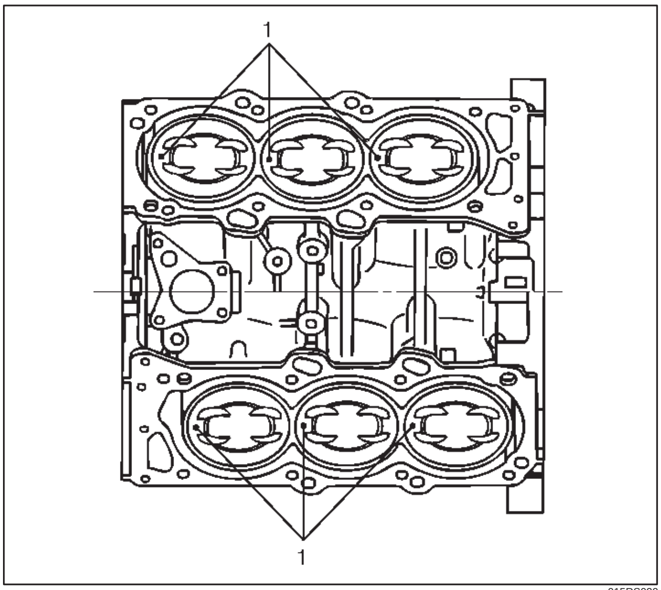
(1) No.1 Compression Ring
(2) No.2 Compression Ring
(3) Oil Ring Side Rail Upper
(4) Oil Ring Side Rail Lower
(5) Piston Front Mark

- Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor. The front marks must be facing the front of the engine.
- Match the numbered caps with the numbers on the connecting rods. Align the punched marks on the connecting rods and caps.
- Apply engine oil to the threads and seating faces of the nuts.
- Tighten the nuts.

Torque: 54 N·m (40 lb ft)

After tightening the cap nuts, check to see that the crankshaft rotates smoothly.

NOTE: Do not apply engine oil to the bearing back faces.

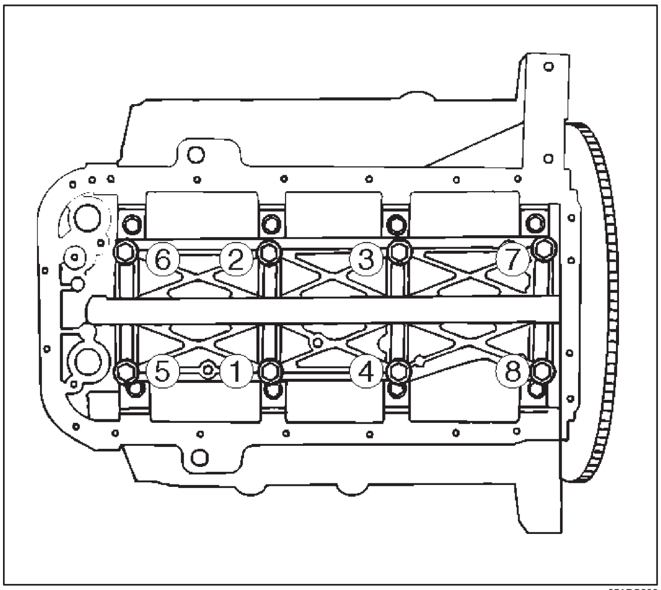


015RS020

5. Install oil gallery (7) and tighten the bolts in 2 steps, in the order shown.

1st step: 29 N·m (22 lb ft)

2nd step: 55°~ 65°

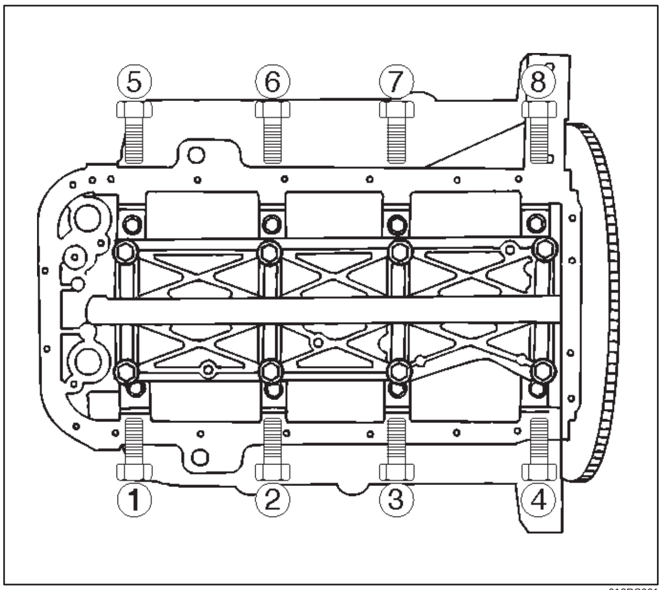


051RS009

6. Cylinder block side bolts (6)
   - Tighten all the bolts to the specified torque in the order shown.

NOTE: Do not apply engine oil to the crank case side bolts.

Torque: 39 N·m (29 lb ft)



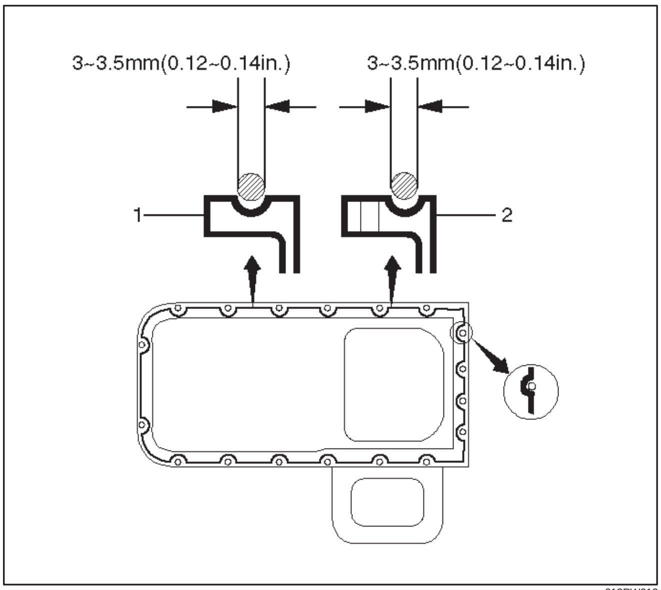
012RS001

7. Install oil pump assembly (5), refer to “Oil pump” in this manual.
8. Install oil strainer and O-ring (4).
9. Install oil pipe and O-ring (3) and tighten the bolts.

Torque: 25 N·m (18 lb ft)

10. Install crankcase with oil pan (2).
    1. Completely remove all residual sealant, lubricant and moisture from the sealing surfaces. The surfaces must be perfectly dry.
    2. Apply a correct width bead of sealant (TB—1207C or its equivalent) to the contact surfaces of the oil pan. There must be no gaps in the bead.
    3. The crankcase assembly must be installed within 5 minutes after sealant application.
    4. Tighten the bolts and nuts to the specified torque.

Torque : 10 N·m (89 lb in)



013RW010

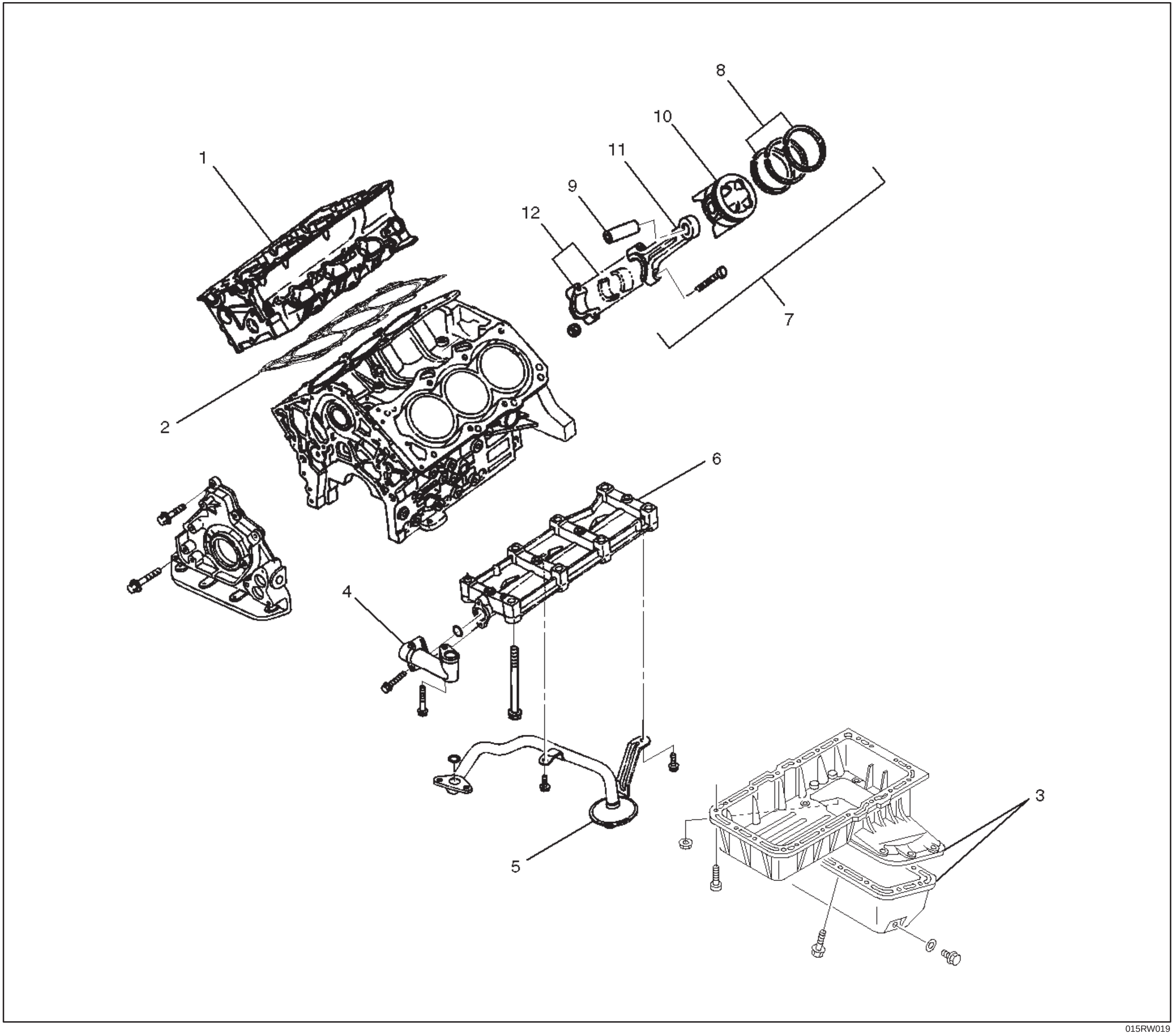
Legend

(1) Portion Between Bolt Holes
(2) Bolt Hole Portion

11. Install cylinder head assembly, refer to “Cylinder head” in this manual.

Piston and Connecting Rod

Piston, Connecting Rod and Associate Parts



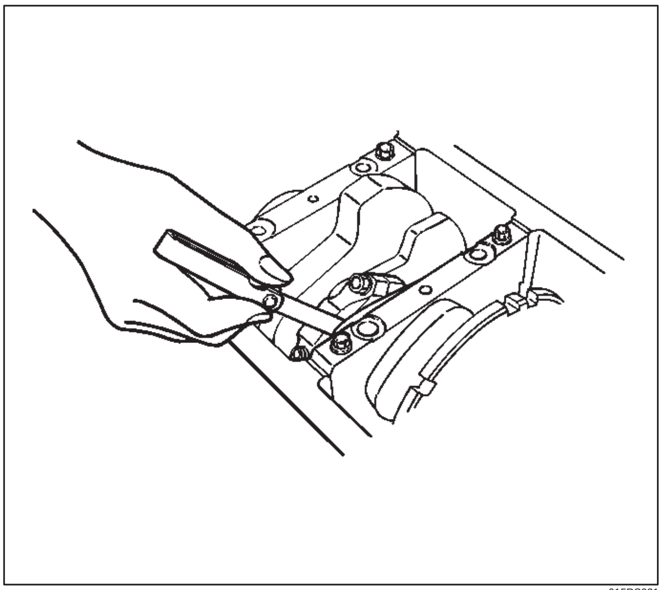
Legend

(1) Cylinder Head Assembly
(2) Cylinder Head Gasket
(3) Crankcase with Oil Pan
(4) Oil Pipe and O-ring
(5) Oil Strainer and O-ring
(6) Oil Gallery
(7) Piston and Connecting Rod Assembly
(8) Piston Ring
(9) Piston Pin
(10) Piston
(11) Connecting Rod
(12) Connecting Rod Cap

Disassembly

1. Remove cylinder head assembly (1). Refer to “Cylinder Head Removal” in this manual.
2. Remove cylinder head gasket (2).
3. Remove crankcase with oil pan (3). Refer to“Oil Pan and Crankcase” in this manual.
4. Remove oil pipe and O-ring (4).
5. Remove oil strainer and O-ring (5).
6. Remove oil gallery (6).
7. Remove connecting rod cap with connecting rod lower bearing (12).
8. Remove piston and connecting rod assembly (7).

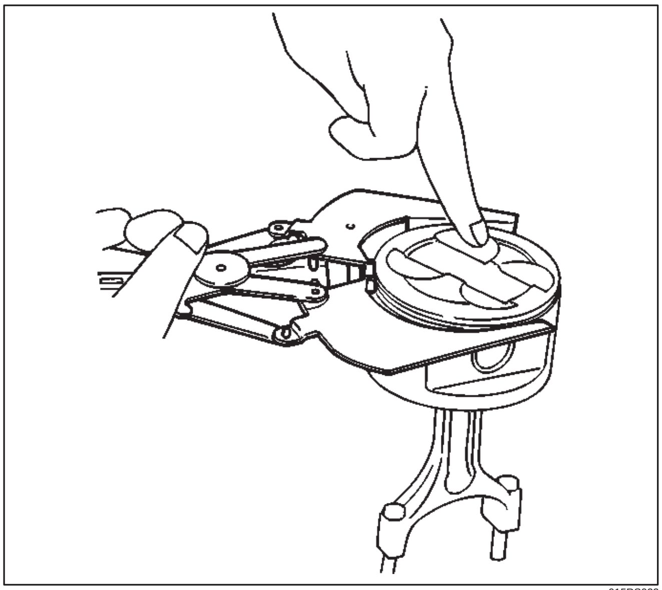
NOTE: Before removing piston and connecting rod assembly, measure thrust clearance.



015RS031

- Remove any ridge or carbon build up from the top end of the cylinder.

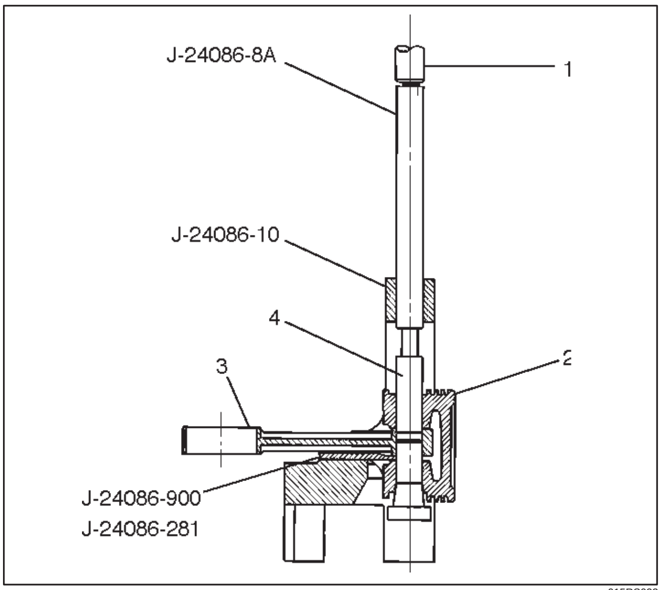
9. Remove the piston rings (8) with a piston ring expander. Arrange the removed piston rings in the cylinder number order.



015RS022

10. Remove the piston pin (9) using J–24086–C piston pin service set and piston support with a press.

NOTE: Keep the parts removed from each cylinder separate. All parts must be reinstalled in their original positions. Heating the connecting rod will permit easy removal of the piston pin.



015RS023

Legend

(1) Press Ram
(2) Piston
(3) Connecting Rod
(4) Piston Pin

11. Piston (10)
12. Connecting rod (11)

Inspection and Repair

Pistons (10)

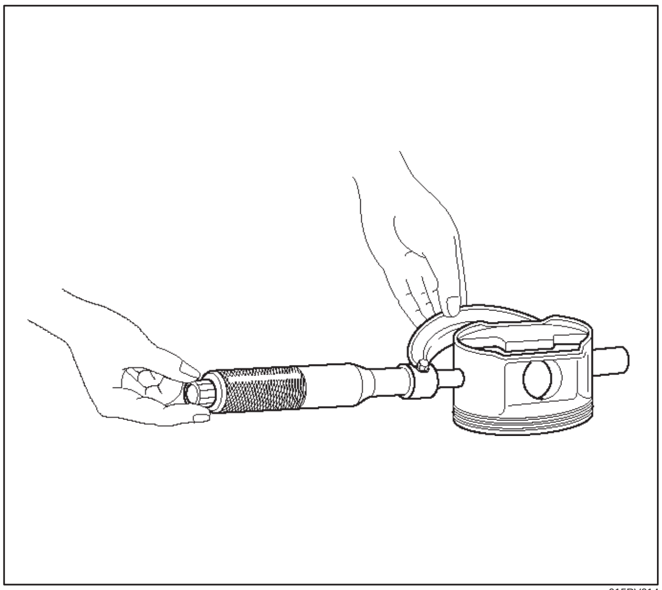
Carefully clean away all the carbon adhering to the piston head and the piston ring grooves.

NOTE: Never use a wire brush to clean the pistons. Damage will result. Visually check each piston for cracking, scoring, and other signs of excessive wear. If any of the above conditions are found, the piston must be replaced.

Piston Diameter

1. Measure the piston outside diameter with micrometer at the piston grading position and a right angle to the piston pin.
   Piston grading position (from piston head)

Piston grading position : 43.0 mm (1.6929 in)


015RV014

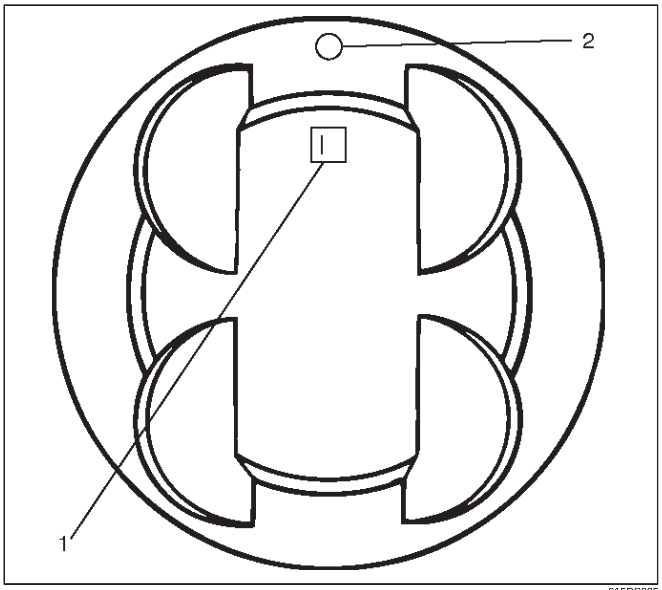
The size mark (1) for piston outside diameter is represented as shown in Figure.

Outside Diameter

Size Mark A : 93.360 mm–93.370 mm (3.6756 in–3.6760 in)

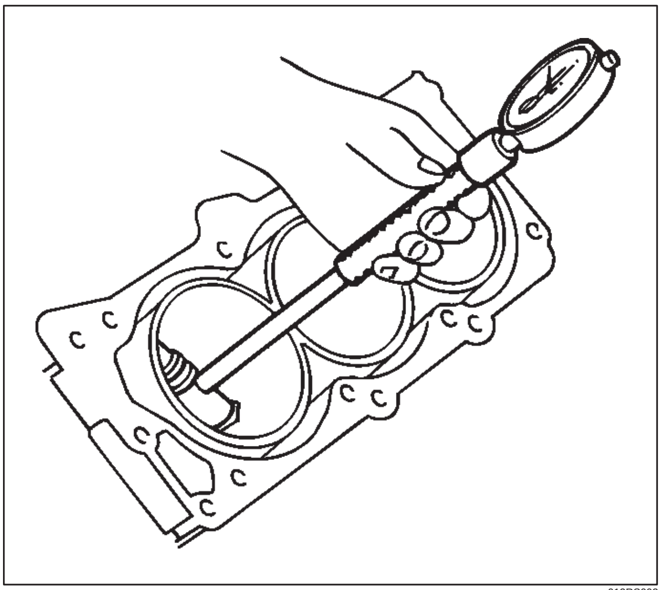
Size Mark B : 93.371 mm–93.380 mm (3.6760 in–3.6764 in)

Size Mark C : 93.381 mm–93.390 mm (3.6764 in–3.6768 in)



015RS025

Measure the cylinder bore inside diameter (refer to “Cylinder Block” in this manual).


012RS002

Piston Rings (8)

Any worn or damaged part discovered during engine overhaul must be replaced with a new one.

1. Ring end gap measurement
   - Insert the piston ring into the bore.
   - Push the ring by the piston, at a right angle to the wall, into the point at which the cylinder bore diameter is the smallest.
   - Measure the ring end gap.

Compression Ring

1st ring

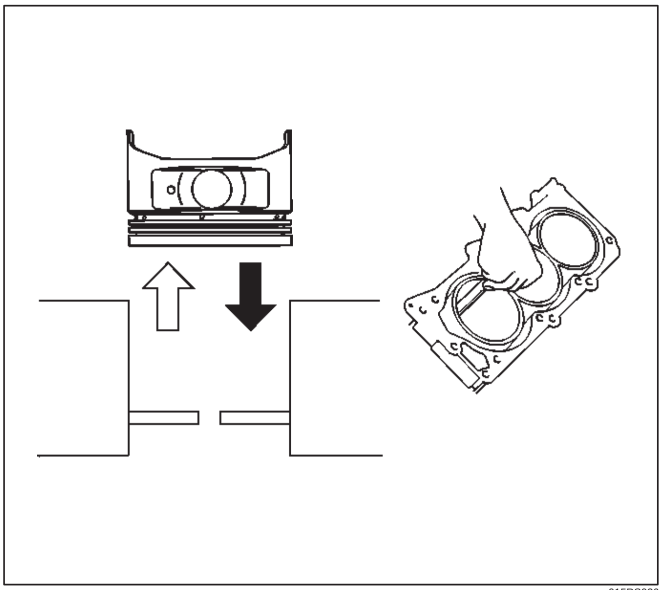
Standard:	**0.300 mm–0.400 mm (0.0118 in–0.0157 in)**
Limit:	**1.0 mm (0.0394 in)**

2nd ring

Standard:	**0.450 mm–0.600 mm (0.0177 in–0.0236 in)**
Limit:	**1.2 mm (0.0472 in)**

Oil ring

Standard:	**0.150 mm–0.450 mm (0.0059 in–0.0177 in)**
Limit:	**1.05 mm (0.0413 in)**

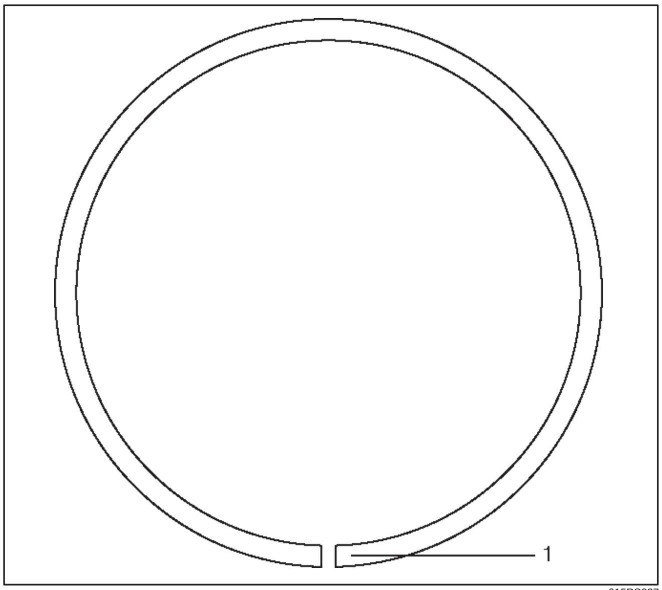


015RS026

- Positioning mark (1) is painted as shown in the illustration.

Marked T : No.1 Compression ring

Marked T2 : No.2 Compression ring



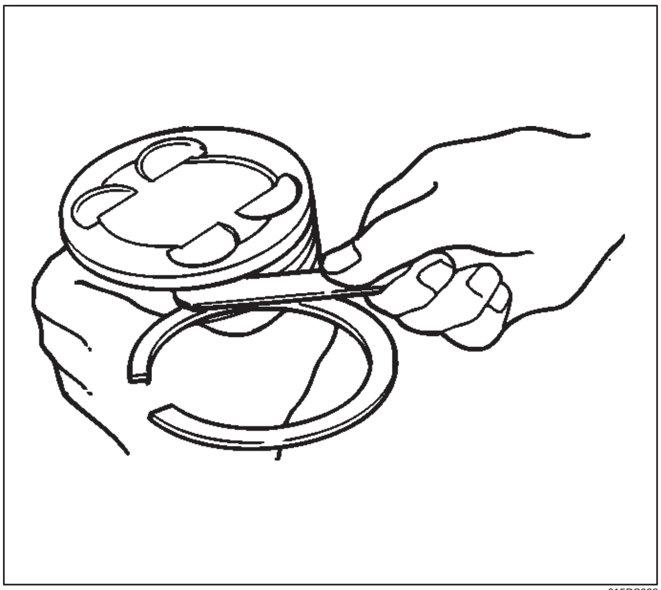
015RS027

2. Measure the clearance between the piston ring groove and the piston ring with a feeler gauge. If the piston ring groove / piston ring clearance exceeds the specified limit, the piston must be replaced.

Compression Ring Clearance

Standard : 0.025 mm–0.065 mm (0.0006 in.–0.0015 in)

Limit : 0.1mm (0.0059 in)



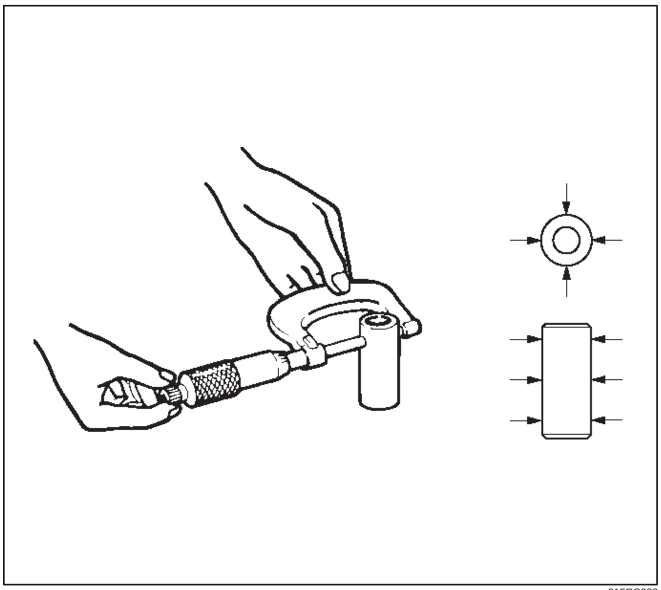
015RS028

Piston Pin (9)

NOTE: Do not reuse the old piston pin.

1. Use a micrometer to measure the new piston pin outside diameter in both directions at three different positions.
2. Measure the inside diameter of the connecting rod small end. If the fitting interference between the small end and pin does not conform to the specified value, the connecting rod must be replaced.

Standard : 0.023 mm–0.038 mm (0.0009 in–0.0015 in)



015RS029

3. Insert the new pin into the piston and rotate it. If the pin rotates smoothly with no backlash, the clearance is normal. If there is backlash or roughness, measure the clearance. If the clearance exceeds the specified limit, the piston must be replaced.

Clearance

Standard : 0.010 mm–0.017 mm (0.0004 in.–0.0007 in)

Limit : 0.040 mm (0.0016 in)

Connecting Rods (11)

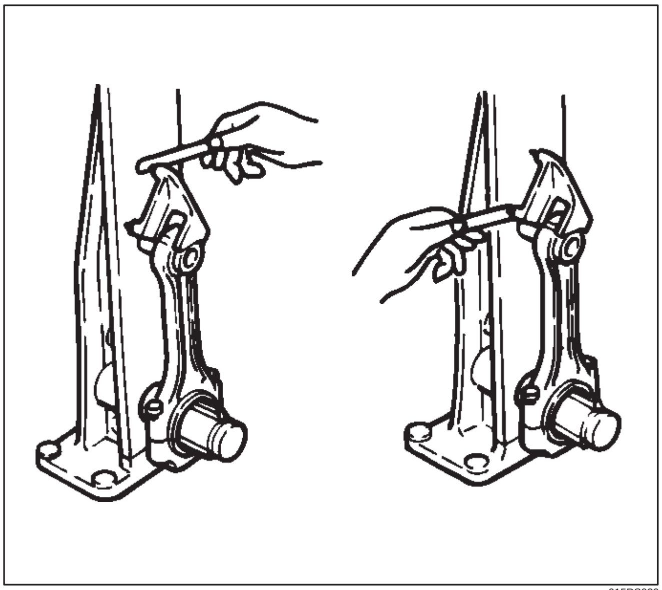
1. Check the connecting rod alignment If either the bend or the twist exceeds the specified limit, the connecting rod must be replaced.

Bend per 100 mm (3.937 in)

Limit: 0.15 (0.0059)

Twist per 100 mm (3.937 in)

Limit: 0.20 (0.0078)

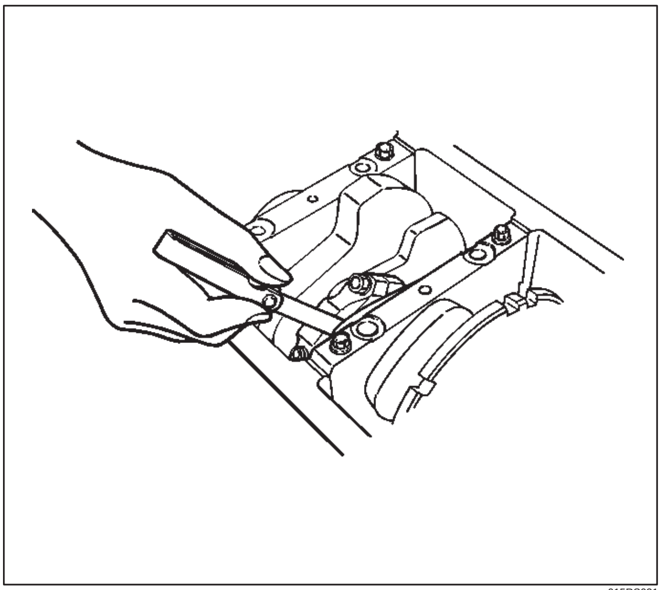


015RS030

2. Measure the connecting rod thrust clearance. Use a feeler gauge to measure the thrust clearance at the large end of the connecting rod If the clearance exceeds the specified limit, the connecting rod must be replaced.

Standard : 0.16 mm–0.35 mm (0.0063 in.–0.0138 in)

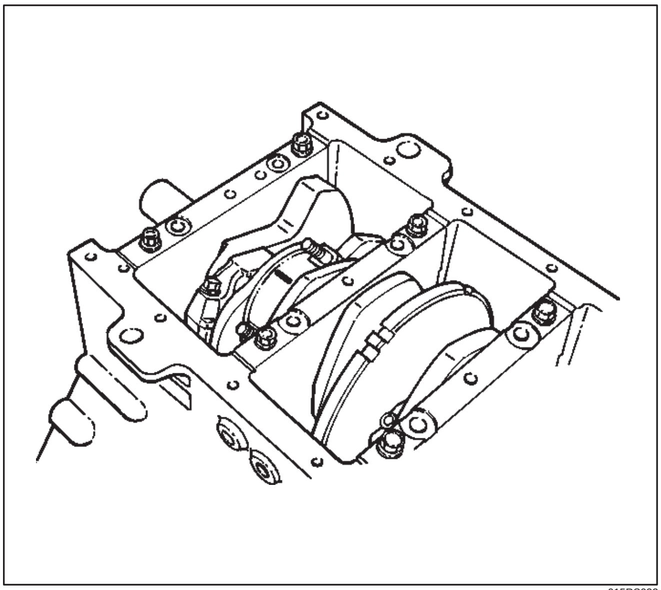
Limit : 0.40 mm (0.0157 in)



015RS031

3. Measure the oil clearance between the connecting rod and the crankshaft.
   1. Remove the connecting rod cap nuts and the rod caps (12).

      Arrange the removed rod caps in the cylinder number order.
   2. Clean the rod bearings and the crankshaft pins.
   3. Carefully check the rod bearings. If even one bearing is found to be damaged or badly worn, the entire bearing assembly must be replaced as a set. Reinstall the bearings in their original positions. Apply plastigage to the crank pin.



015RS032

   4. Reinstall the rod caps (12) to their original positions.

      Tighten the rod cap nuts.

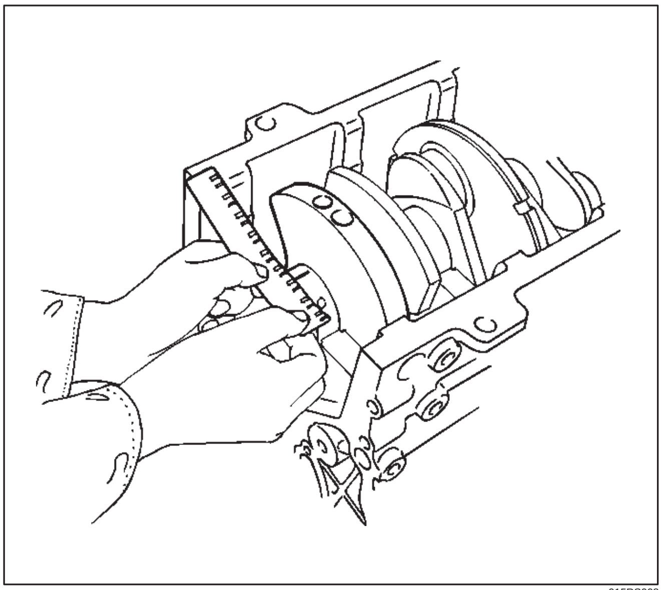
Torque: 54 N·m (40 lb ft)

NOTE: Do not allow the crankshaft to rotate.

5. Remove the rod caps.
6. Measure the width of the plastigage and determine the oil clearance. If the oil clearance exceeds the limit, replace the rod bearing as a set.

Standard : 0.019 mm–0.043 mm (0.0007 in–0.0017 in)

Limit : 0.08 mm (0.0031 in)



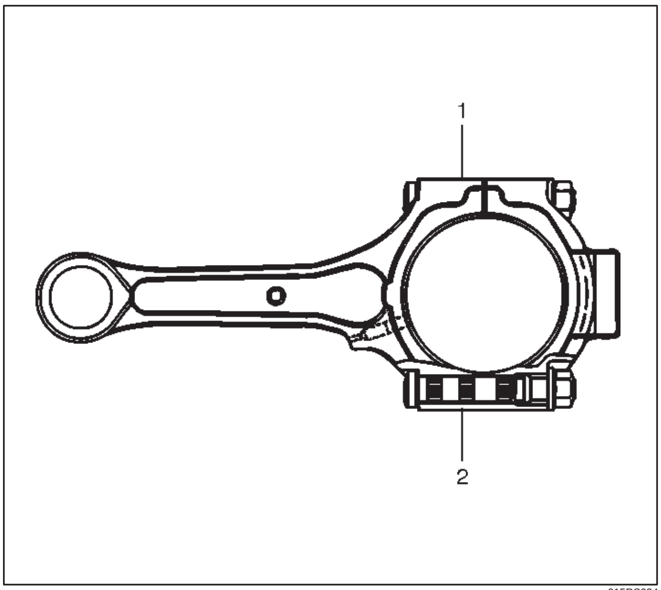
015RS008

7. Clean the plastigage from the bearings and the crankshaft pins.

Con–rod Bearing Selection

Select and install the new connecting rod bearings, paying close attention to the connecting rod big end diameter size mark (1).

NOTE: Take care not to confuse the alignment mark (2) and the size mark (1) during the installation procedure.



015RS034

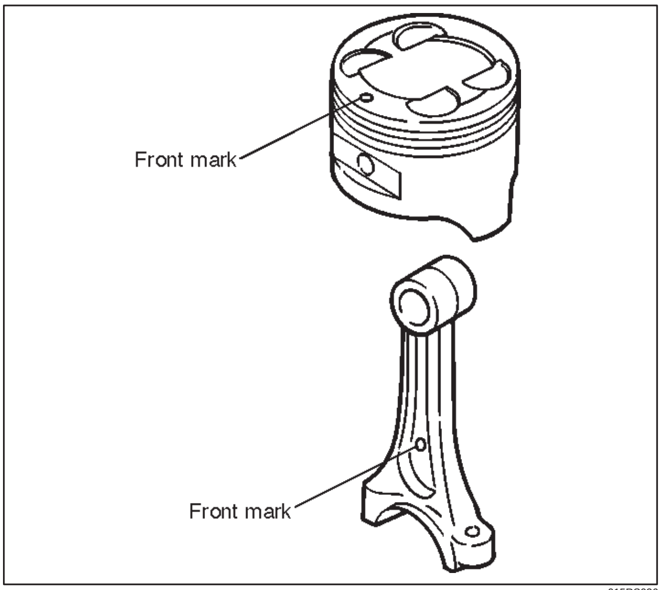
1 Size Mark	Big end Bore Diameter	Crankshaft Pin Diameter	Connecting Rod Bearing Thickness (Reference)	Color of Size Mark	Oil Clearance (Reference)
A	56.994-57.000 (2.2439-2.2441)	53.922-53.937 (2.1229-2.1235)	1.512-1.516 (0.0595-0.0597)	Yellow	0.025-0.054 (0.0010-0.0021)
B	56.988-56.994 (2.2436-2.2439)		1.508-1.512 (0.0594-0.0595)	Green	0.027-0.056 (0.0011-0.0022)
C	56.982-56.988 (2.2434-2.2436)		1.504-1.508 (0.0592-0.0594)	Pink	0.029-0.058 (0.0011-0.0023)

Reassembly

1. Install connecting rod
2. Install piston
3. Install piston pin
   - Apply a thin coat of engine oil to the piston pin. Try to insert the piston pin into the piston pin hole with normal finger pressure.

NOTE: When changing piston / connecting rod combinations, do not change the piston / piston pin combination and do not reuse the old piston pin.

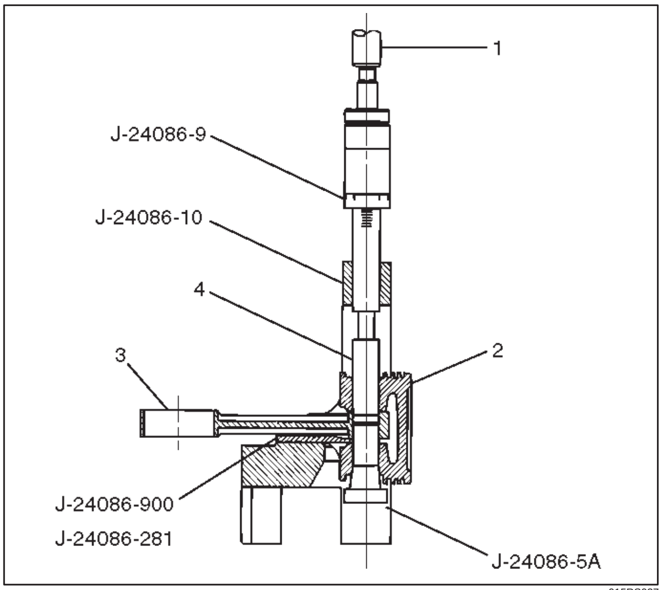
- Attach the piston to the connecting rod with the piston front mark and the connecting rod front mark on the same side.



015RS036

- With J–24086–C Piston pin service set and a press, press fit the piston pin.

NOTE: Heat the connecting rod small end to a suitable temperature to ensure smooth installation.



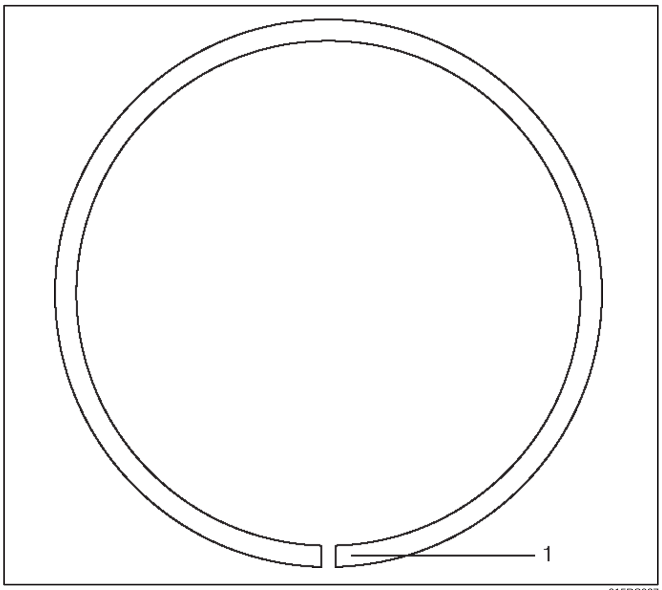
015RS037

Legend
(1) Press Ram
(2) Piston
(3) Connecting Rod
(4) Piston Pin

4. Install piston ring with the piston ring expander.
   The compression ring must be set with the T mark (1) facing up.

   Marked T : No.1 Compression ring

   Marked T2 : No.2 Compression ring



015RS027

- Install piston rings in the following sequence.

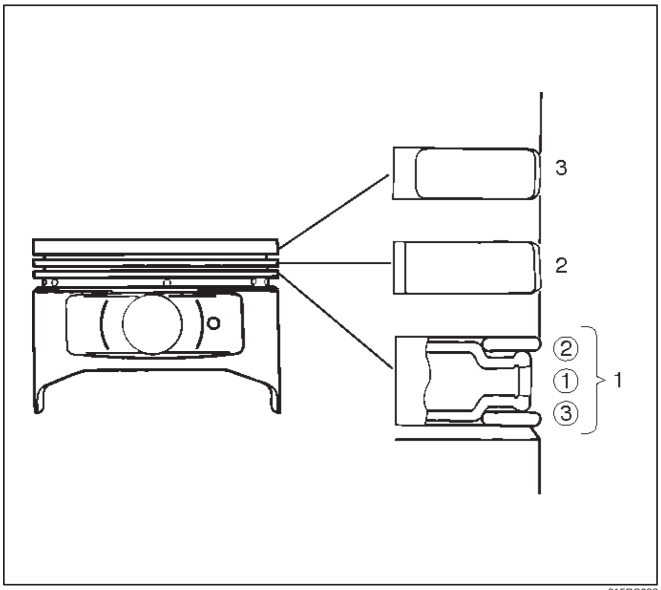
1. Oil ring
   1. Expander ring
   2. Upper side rail
   3. Lower side rail
2. 2nd compression ring
3. 1st compression ring

- The compression rings must be set with the T or T2 mark facing up.

Marked T : No.1 Compression ring

Marked T2 : No.2 Compression ring

- After installation, apply engine oil to the entire circumference of the piston rings. Check to see that all the rings rotate smoothly.



015RS038

5. Install piston and connecting rod assembly.
   - Insert the bearings into the connecting rods and caps. Apply new engine oil to the bearing faces and nuts.
   - Tighten the connecting rod cap nuts

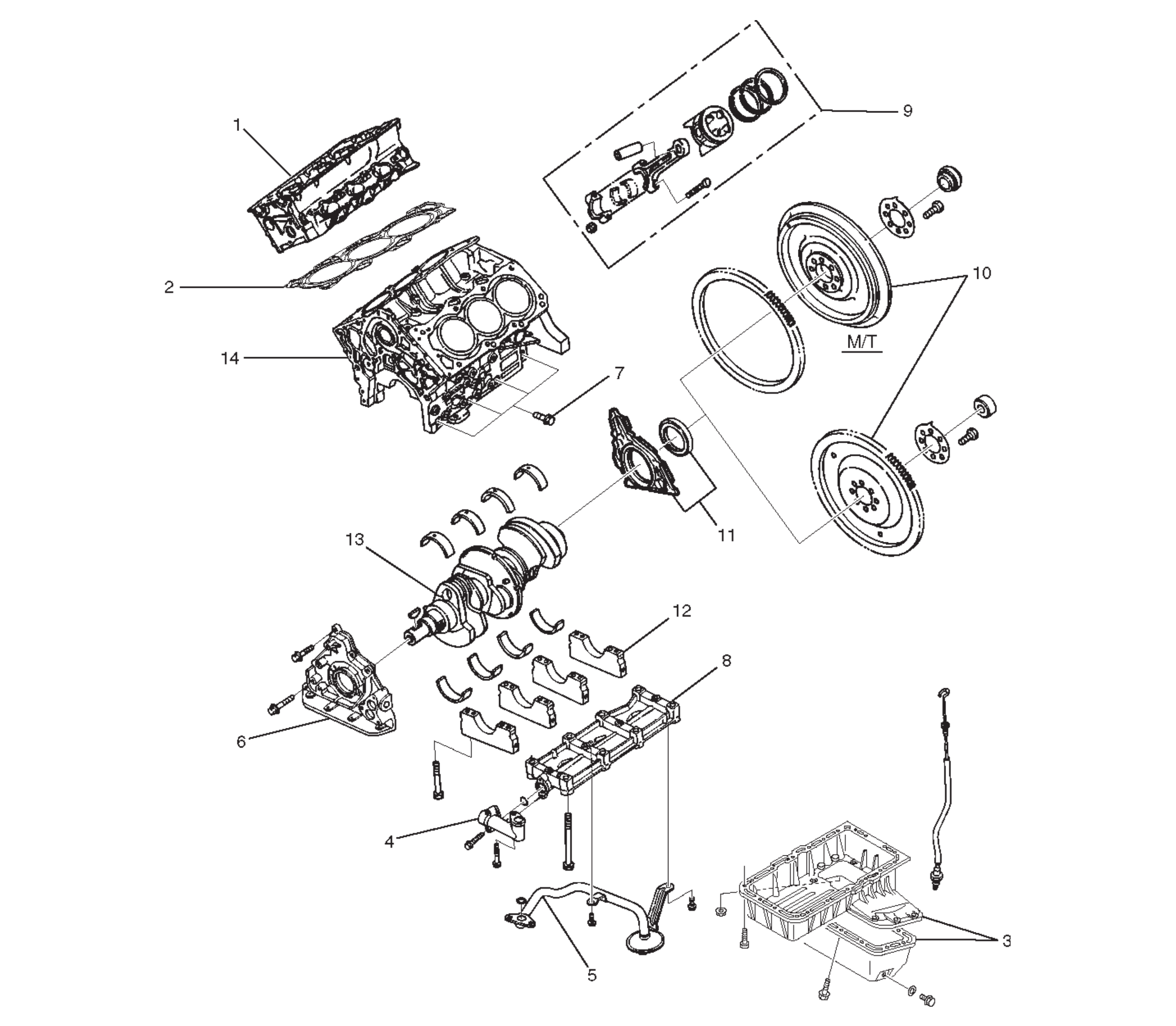
   Torque : 54 N·m (40 lb ft)

NOTE: Do not apply engine oil to the bearing back faces.

6. Oil gallery, refer to “Crankshaft and main bearing” in this manual.
7. Oil strainer and O-ring.
8. Oil pipe and O-ring.
9. Install crankcase with oil pan, refer to “Oil pan and Crankcase” in this manual.
10. Install cylinder head gasket.
11. Install Cylinder head assembly.
    - Refer to “Cylinder head” in this manual.

Cylinder Block

Cylinder Block and Associated Parts



Legend

(1) Cylinder Head Assembly
(2) Cylinder Head Gasket
(3) Crankcase with Oil Pan
(4) Oil Pipe and O-ring
(5) Oil Strainer and O-ring
(6) Oil Pump Assembly
(7) Cylinder Block Side Bolts
(8) Oil Gallery
(9) Piston and Connecting Rod Assembly
(10) Flywheel
(11) Rear Oil Seal Retainer Assembly
(12) Main Bearing Cap
(13) Crankshaft
(14) Cylinder Block

Disassembly

1. Remove cylinder head assembly.
2. Remove cylinder head gasket.
3. Remove crankcase with oil pan.
4. Remove oil pipe and O-ring.
5. Remove oil strainer and O-ring.
6. Remove oil pump assembly.
7. Remove crankcase side bolts.
8. Remove oil gallery.
9. Remove piston and connecting rod assembly.
10. Remove flywheel.

11. Remove rear oil seal retainer assembly.
12. Remove main bearing cap.
13. Remove crankshaft.
14. Remove cylinder block.

Inspection and Repair

1. Remove the cylinder head gasket and any other material adhering to the upper surface of the cylinder block. Be very careful not to allow any material to accidentally drop into the cylinder block. Be very careful not to scratch the cylinder block.
2. Carefully remove the oil pump, rear oil seal retainer, and crankcase assembly installation surface seal.
3. Wipe the cylinder block clean.
4. Visually inspect the cylinder block. If necessary, use a flaw detector to perform a dye penetrate and hydraulic (or air pressure) test. If cracking or other damage is discovered, the cylinder block must either be repaired or replaced.

Flatness

1. Using a straight–edge and feeler gauge, check that the upper surface of the cylinder block is not warped.

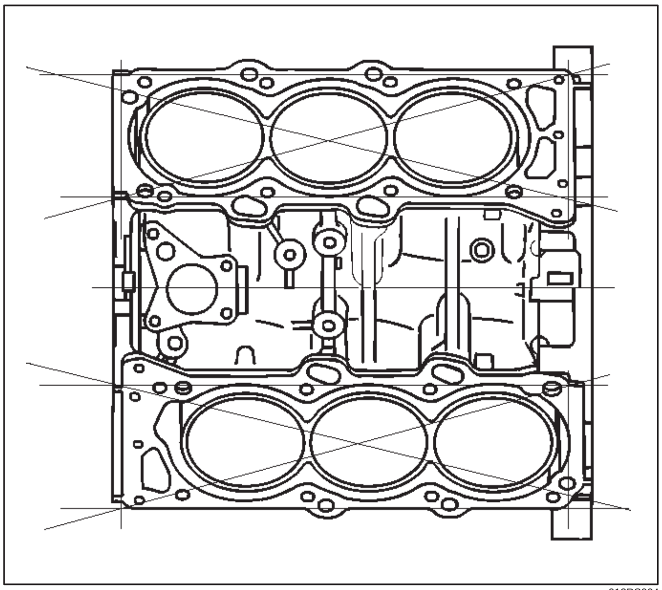
CAUTION: Be very careful not to allow any material to accidentally drop into the upper surface of the cylinder block. Be very careful not to scratch the upper surface of the cylinder block.

2. The cylinder block must be reground or replaced if the warpage exceeds the limit.

Warpage

Limit : 0.15 mm (0.0059 in)

Maximum repairable limit: 0.15 mm (0.0059 in)



012RS004

Cylinder Bore

Use a cylinder gauge to measure the cylinder bore diameter in both the axial and thrust directions. Each measurement should be made at six points.

CAUTION: Be very careful not to allow any material to accidentally drop into the upper surface of the cylinder block. Be very careful not to scratch the upper surface of the cylinder block.

Cylinder Bore Inside Diameter

Limit : 93.530 (3.6823)

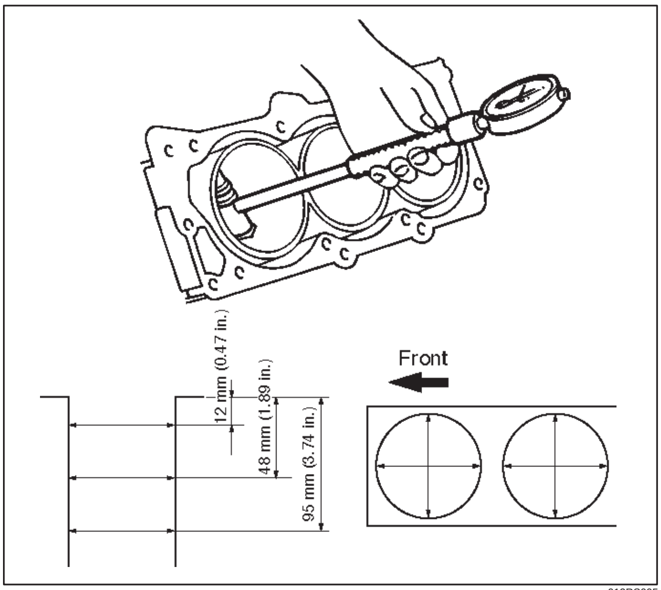
If the measurement exceed the specified limit, the cylinder block must be replaced.

Diameter

Grade A : 93.400 mm–93.410 mm (3.6772 in–3.6776 in)

Grade B : 93.411 mm–93.420 mm (3.6776 in–3.6779 in)

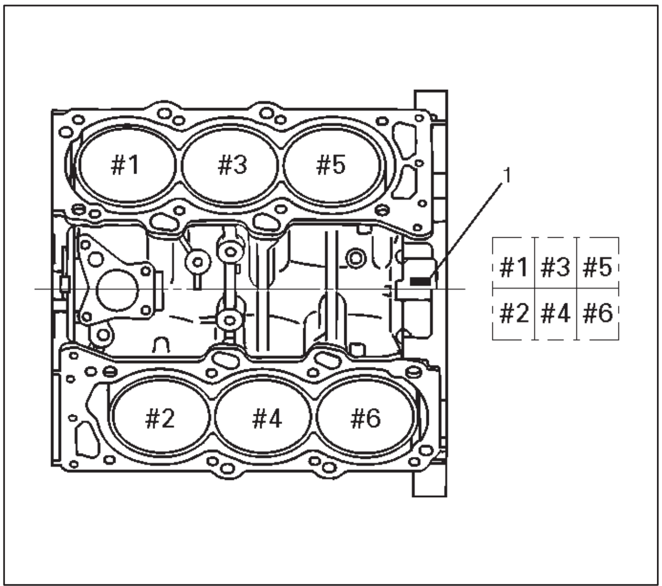
Grade C : 93.421 mm–93.430 mm (3.6780 in–3.6783 in)



012RS005

NOTE: For information on piston diameter, please refer to the section ”Inspection of the Piston and Connecting Rod Assembly” in this manual.

- The ”Grade” mark (1) is stamped at the position illustrated.

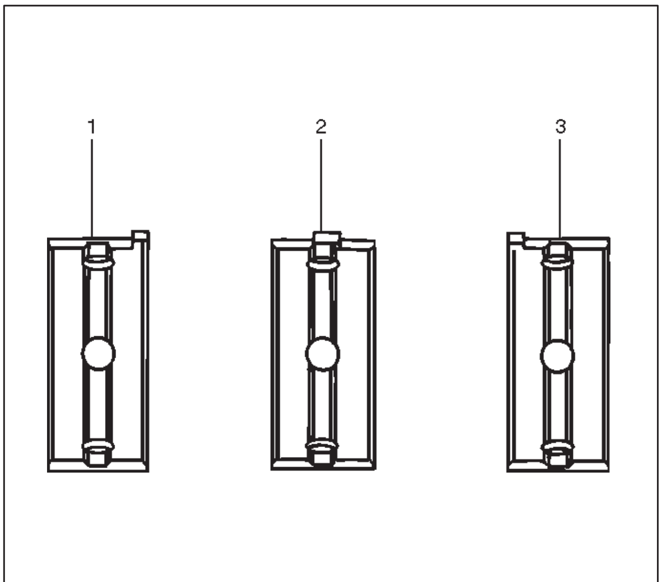


012RS006

Reassembly

1. Install cylinder block.
2. Install crankshaft.
   - Install the main bearings to the cylinder block and the main bearing caps.
   - Be sure that they are positioned correctly.
   - Apply new engine oil to the upper and lower main bearing faces.

NOTE: Do not apply engine oil to the bearing back faces.

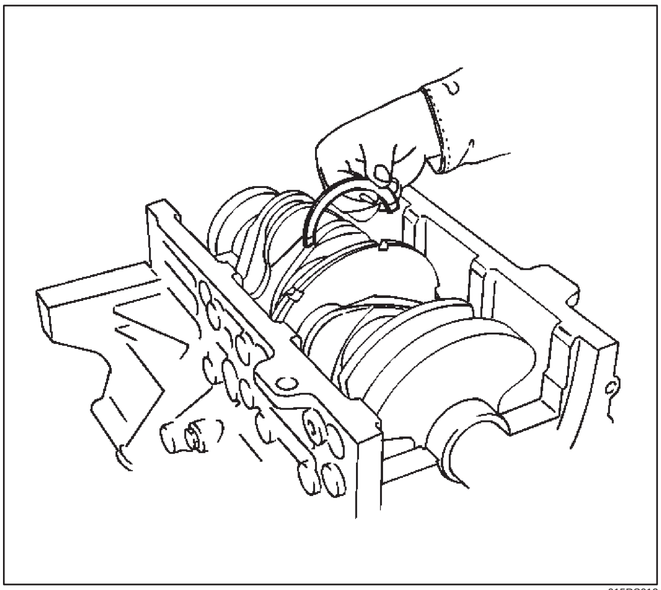


015RS012

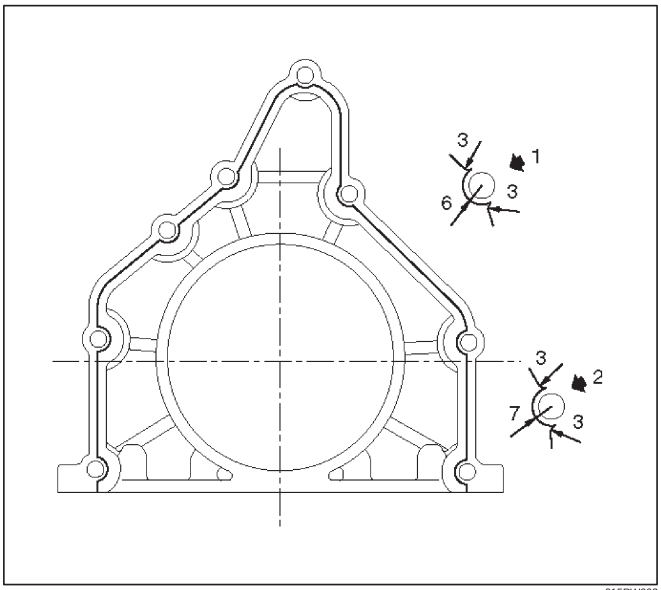
Legend

(1) Number 1 and 4 main bearing upper and lower.
(2) Number 2 and 3 main bearing upper.
(3) Number 2 and 3 main bearing lower.

- Carefully mount the crankshaft.
- Apply engine oil to the thrust washer.
- Assemble the thrust washer to the No. 3 bearing journal. The oil grooves must face the crankshaft.


015RS013

3. Install rear oil seal retainer.
   - Remove oil on cylinder block and retainer fitting surface.
   - Apply sealant (TB1207B or equivalent) to retainer fitting surface as shown in illustration.
   - The oil seal retainer must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.



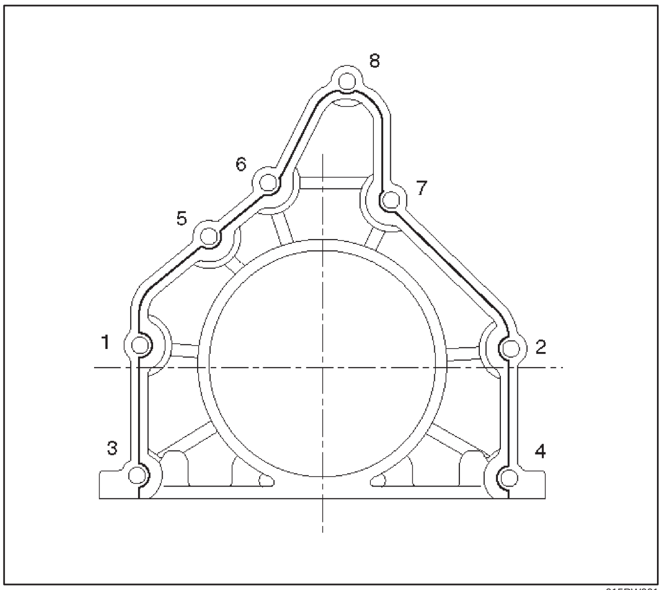
015RW002

Legend

(1) Around Bolt Holes
(2) Around Dowel Pin

- Apply engine oil to oil seal lip and align a dowel pin hole in the cylinder block with that in the retainer.
- Tighten retainer fixing bolts to the specified torque.

Torque: 25 N·m (18.4 lb ft)

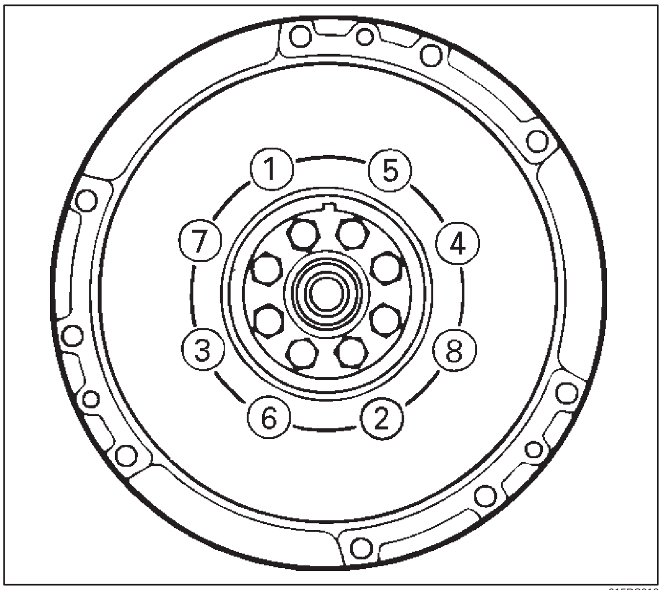


015RW001

4. Install flywheel
   1. Thoroughly clean and remove the oil from the threads of crankshaft.
   2. Remove the oil from the crankshaft and flywheel mounting faces.
   3. Mount the flywheel on the crankshaft and then install the washer.
   4. Holding the crankshaft stationary, tighten the flywheel bolts in the order shown.

Torque: 54 N·m (40 lb ft)

NOTE: Do not reuse the bolts and do not apply oil or thread lock to the bolts.

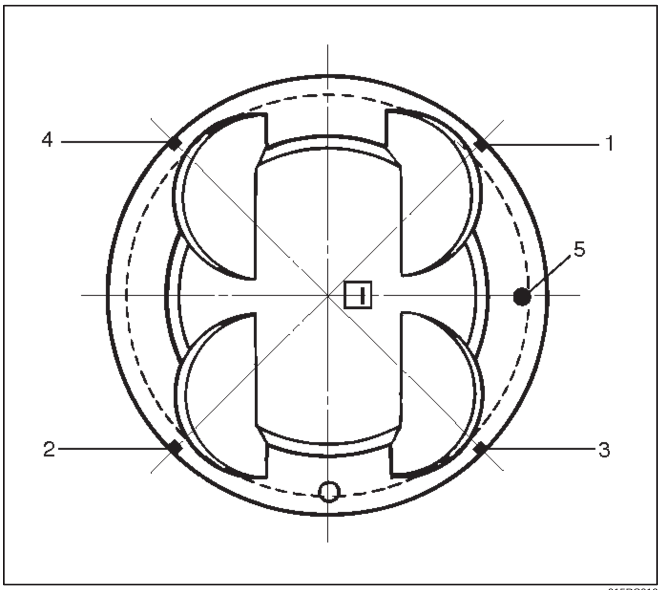


015RS018

5. Install piston and connecting rod assembly.
   - Apply engine oil to the cylinder bores, the connecting rod bearings and the crankshaft pins.

NOTE: Do not apply engine oil to the bearing back faces.

- Check to see that the piston ring end gaps are correctly positioned.

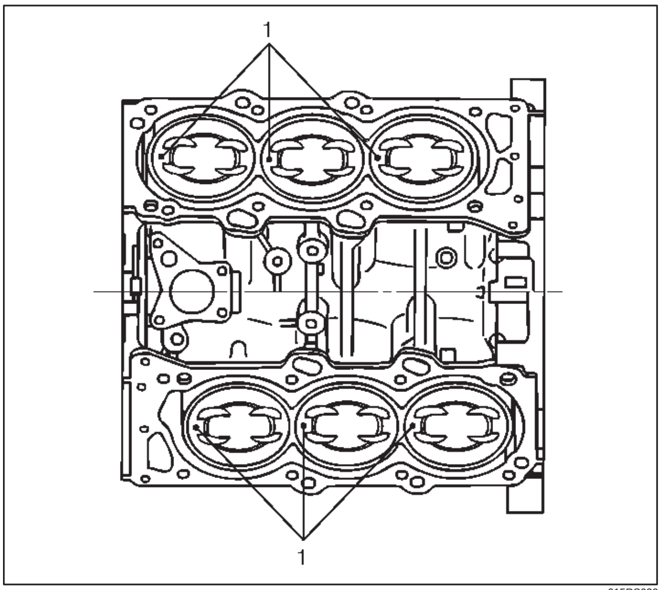


015RS019

Legend

(1) No.1 Compression Ring
(2) No.2 Compression Ring
(3) Oil Ring Side Rail Upper
(4) Oil Ring Side Rail Lower
(5) Piston Front Mark

- Insert the piston/connecting rod assemblies into each cylinder with the piston ring compressor.
- The front marks (1) must be facing the front of the engine.

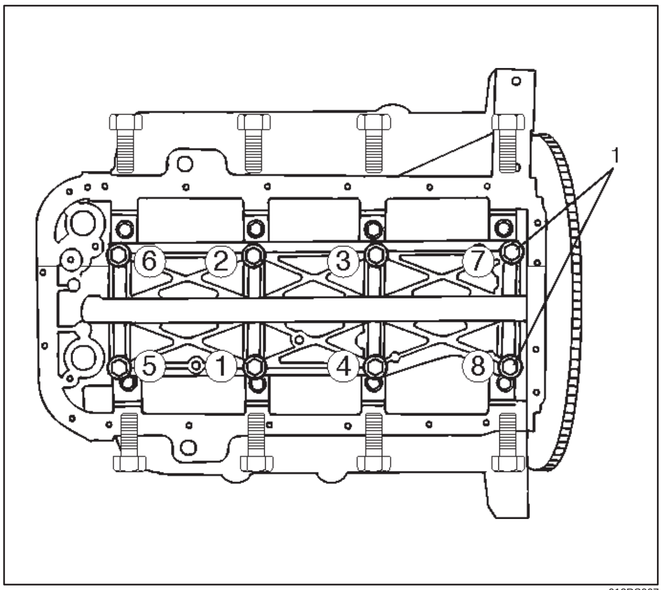


015RS020

6. Install oil gallery and tighten the bolts in 2 steps in the order shown.

1st step : 29 N·m (22 lb ft)

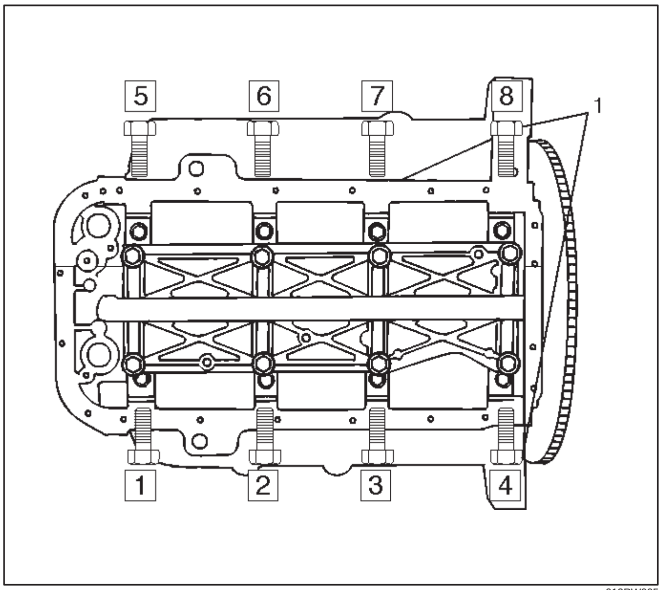
2nd step : 55° ~ 65°



012RS007

7. Install cylinder block side bolts (1) and tighten crankcase bolts in sequence shown in the illustration.

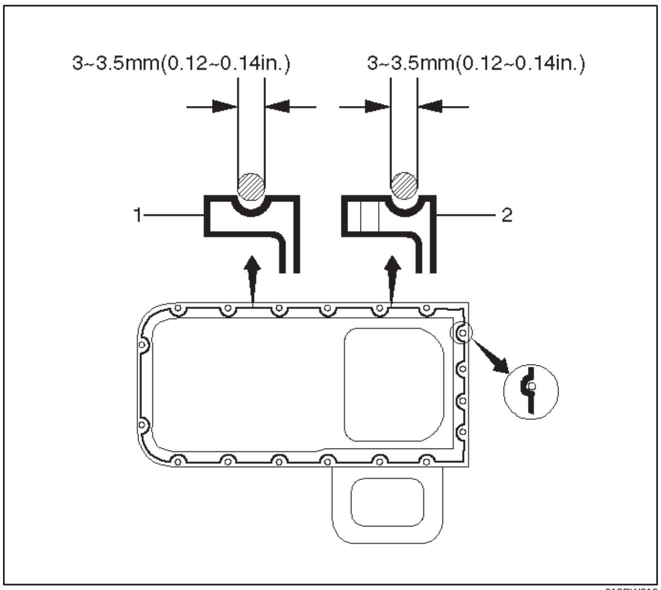
Torque : 39 N·m (29 lb ft)



012RW005

8. Install oil pump assembly. Refer to “Oil Pump” in this manual.
9. Install oil strainer and O-ring.
10. Install oil pipe and O-ring.
11. Install crankcase with oil pan.
    1. Completely remove all residual sealant, lubricant and moisture from the sealing surfaces. The surfaces must be perfectly dry.
    2. Apply a correct width bead of sealant (TB– 1207C or its equivalent) to the contact surfaces of the crankcase. There must be no gaps in the bead.
    3. The oil pan must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.
    4. Tighten the bolts and nuts to the specified torque.

Torque : 10 N·m (89 lb in)



013RW010

Legend

(1) Portion Between Both Holes
(2) Bolt Hole Portions

12. Install cylinder head gasket.
13. Install cylinder head assembly. Refer to “Cylinder Head” in this manual.

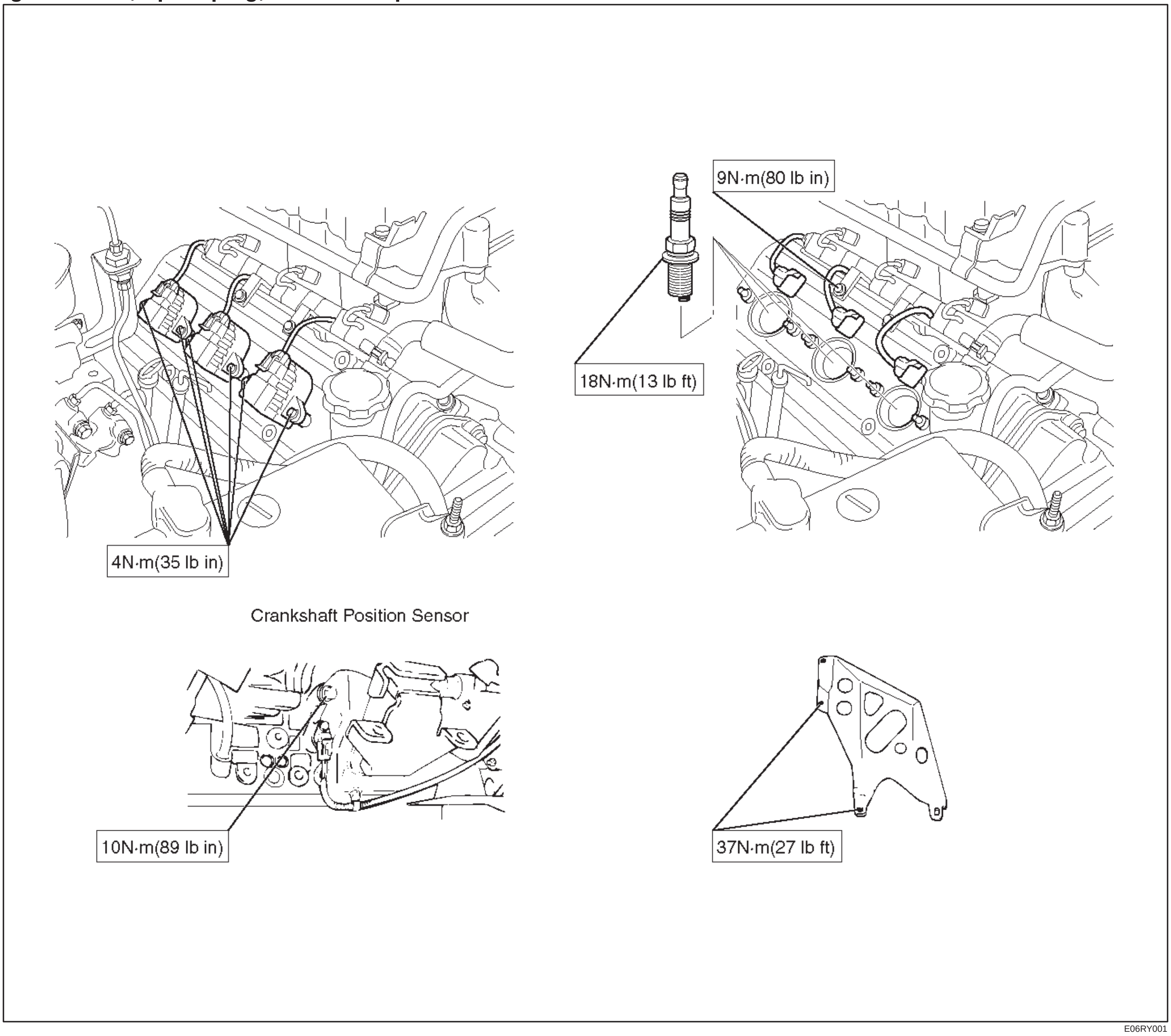
Main Data and Specification

General Specification

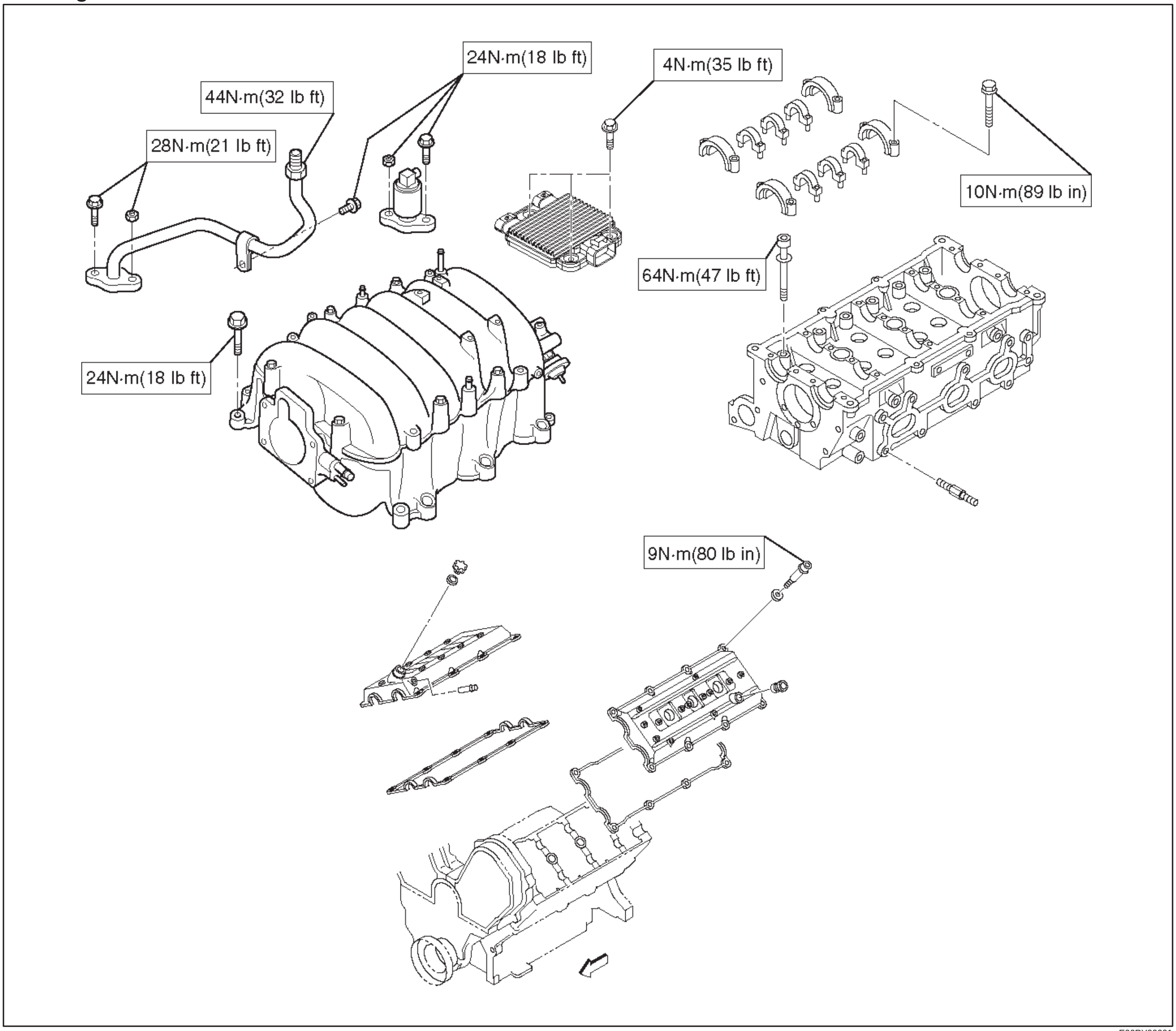
Item	Specifications
	6VD1
Engine type, number of cylinders and arrangement	Water cooled, four cycle V6
Form of combustion chamber	Pent-roof type
Valve mechanism	4-Cams, 4-Valves, DOHC Gear & Belt Drive
Cylinder liner type	Casted in cylinder drive
Total piston displacement	3165 cc
Cylinder bore x stroke	93.4mm x 77mm (3.677 in x 3.031 in)
Compression ratio	9.1
Compression pressure at 300rpm	1.37 MPa (14.0 Kg/cm^2)
Engine idling speed rpm	Non adjustable (750)
Valve clearance	Intake: 0.28 mm (0.11 in)
	Exhaust: 0.30mm (0.12in)
Oil capacity	5.3 liters
Ignition timing	Non adjustable (16° BTDC at idle rpm)
Spark plug	PK16PR11, RC10PYP4, K16PR-P11
Plug gap	1.0 mm–1.1 mm(0.0394 in – 0.0433 in)

Torque Specifications

Ignition coil, Spark plug, Crankshaft position sensor and Under cover

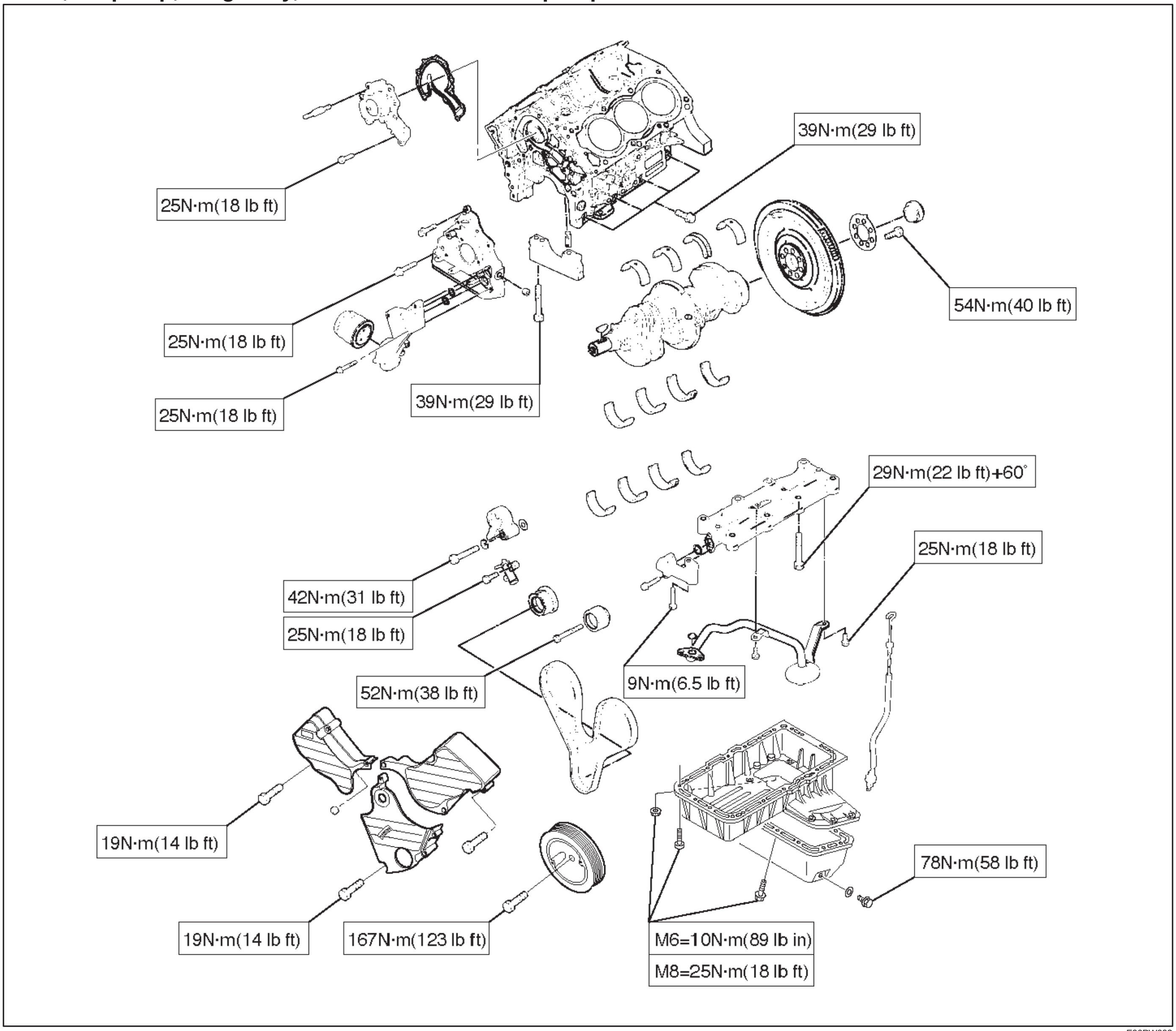


Cylinder head cover, Cylinder head, Camshaft bearing cap, Common chamber, EGR valve and EGR pipe, Ion sensing module



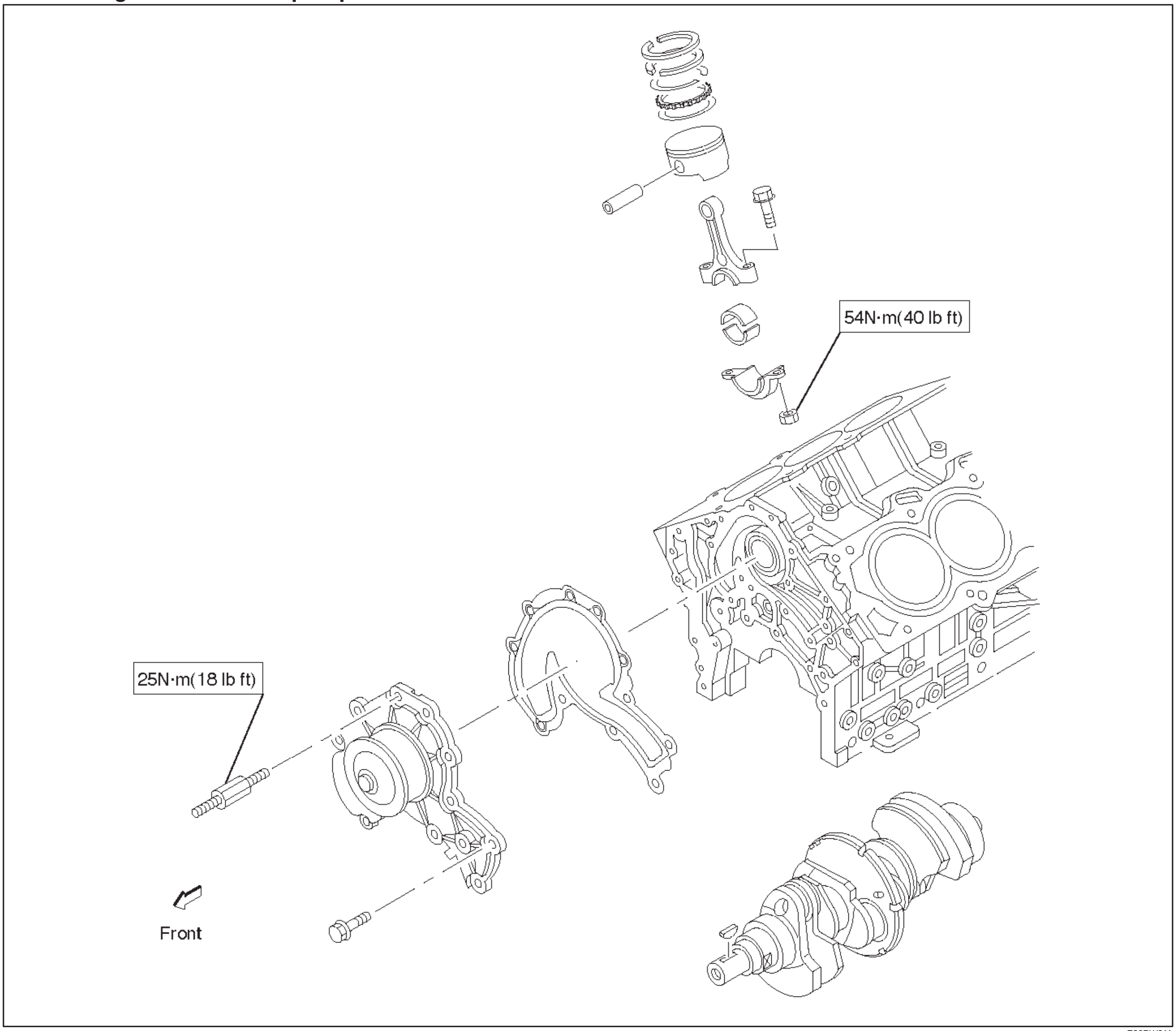
E06RY00001

Crankshaft main bearing, Flywheel, Crankcase, Oil pan, Timing belt tensioner, Timing pulley, timing belt cover, Oil pump, Oil gallery, Oil strainer and water pump

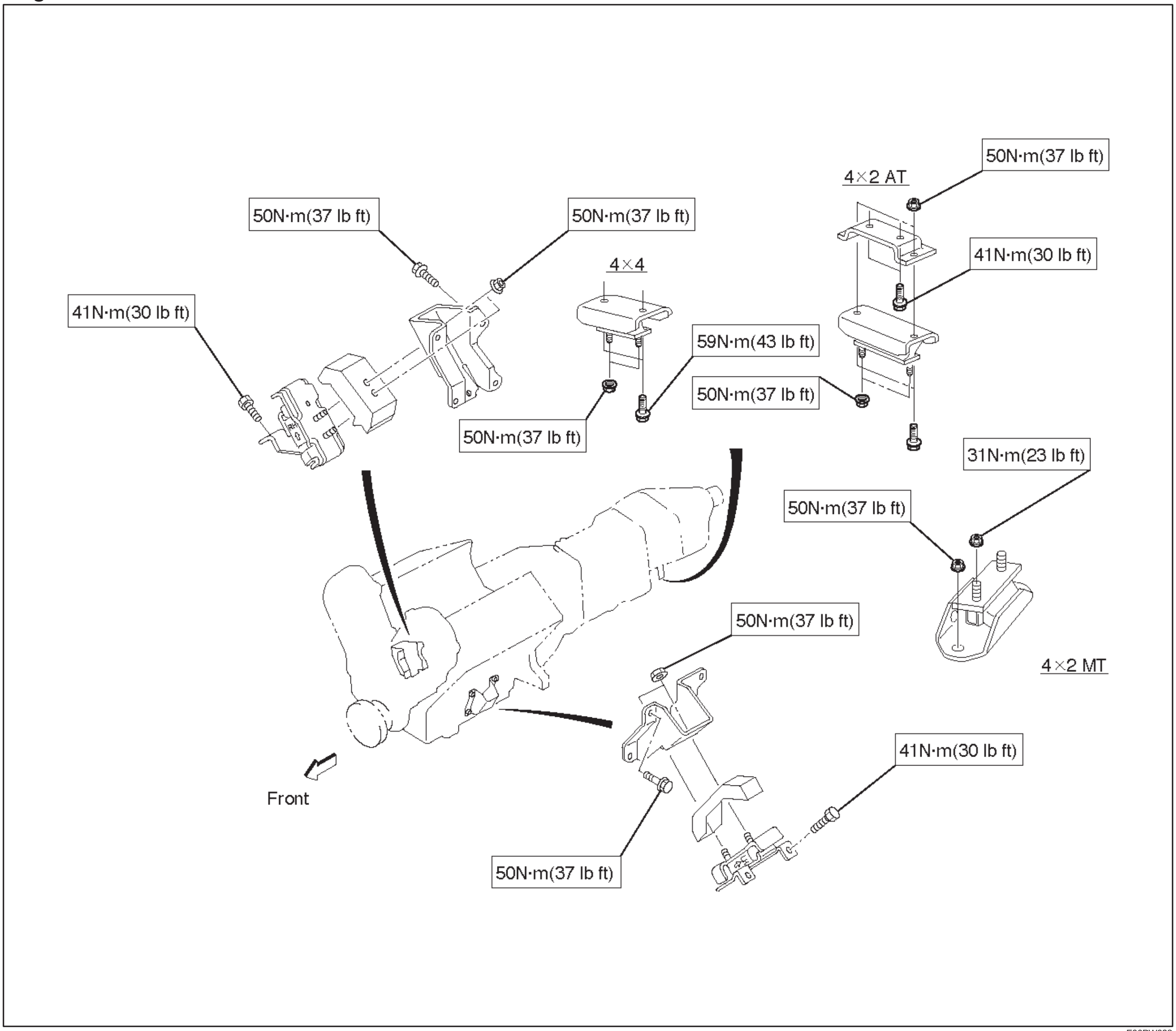


E06RW002

Connecting rod and Water pump



Engine mount



E06RW028

Special Tool

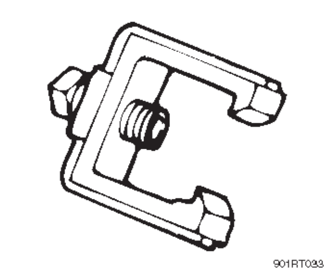
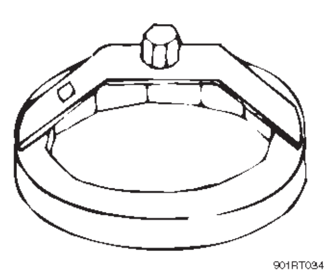
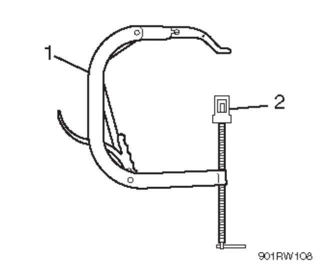
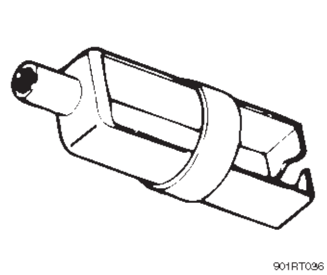
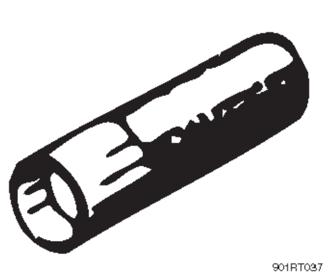
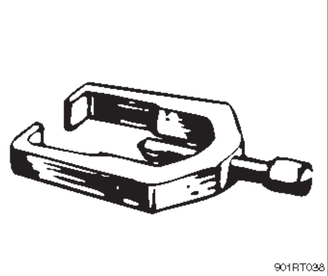
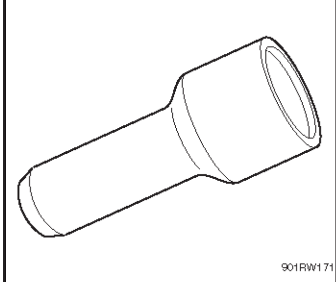
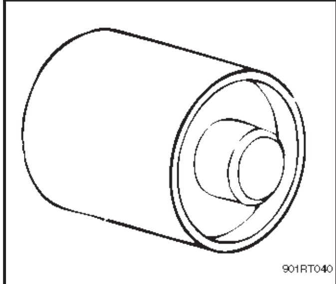
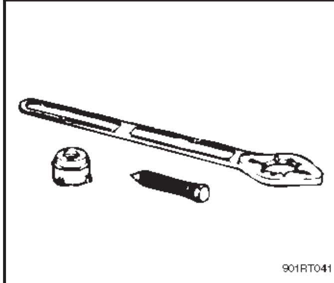
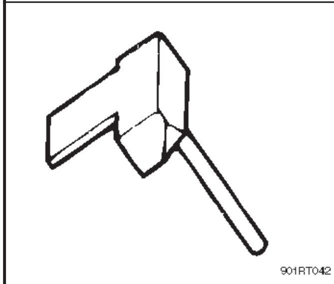
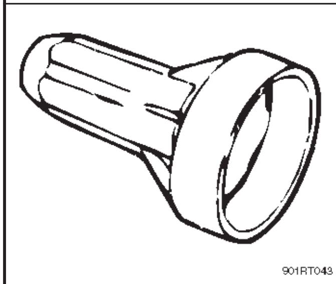
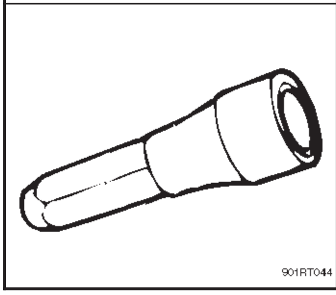
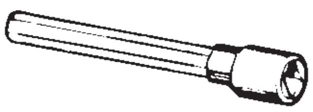
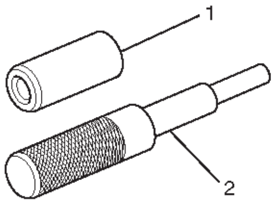
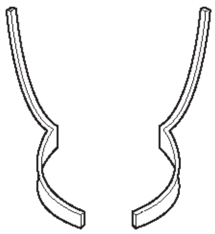
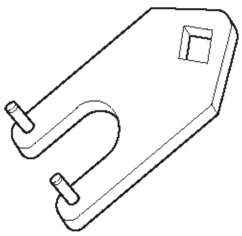
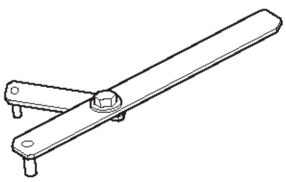
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–21687–02** Remover; tie rod end
	**J–36390** Wrench; Oil filter
	**J–8062** Compressor; Valve spring (1) **J–42898** Adapter; Compressor, Valve spring (2)
	**J–37281** Remover; Oil controller
	**J–38537** Installer; Oil controller
	**J–29107** Universal pitman arm puller
	**J–42985** Installer; Camshaft oil seal
	**J–39206** Installer; Pilot bearing
	**J–8614–01** Holder; Crankshaft
	**J–37228** Seal cutter
	**J–39201** Installer; Real oil seal
	**J–39202** Installer; Oil pump oil seal

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–24239–1** Cylinder head bolt wrench
	**J–42899** Replacer; Valve guide (1,2) **J–42687** Installer; Valve guide (1) **J–37985–1** Remover; Valve guide (2)
	**J–42689** Adjusting Tool; Valve clearance
	**J–42686** Lever; Gear spring
	**J–43041** Holder; Universal

RODEO

ENGINE

ENGINE COOLING (6VD1 3.2L)

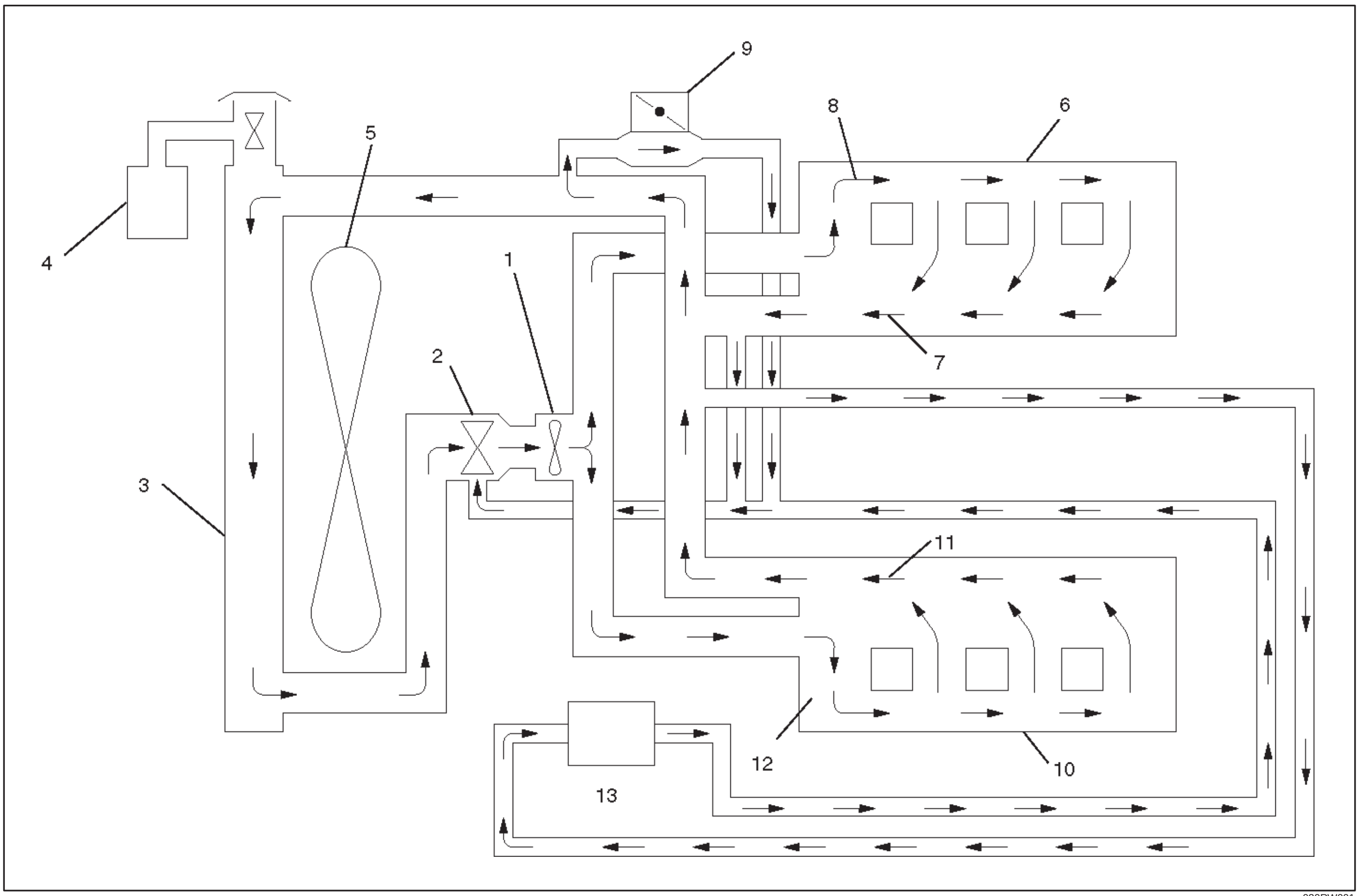
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



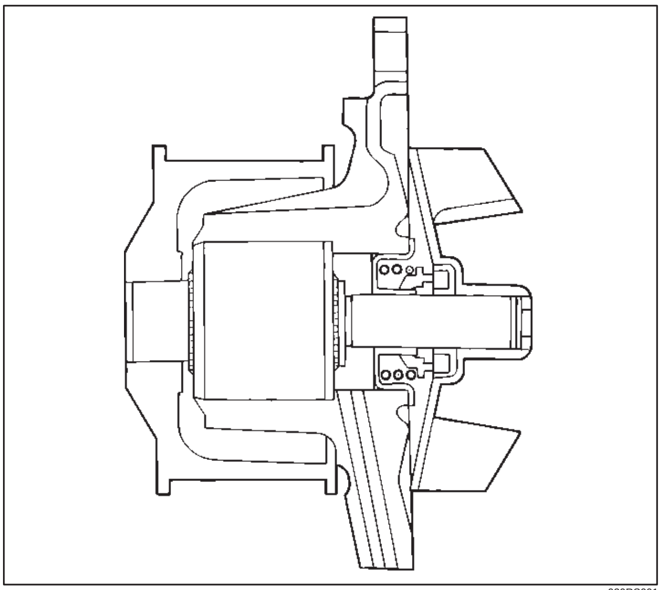
Legend

(1) Water Pump
(2) Thermostat
(3) Radiator
(4) Reserve Tank
(5) Cooling Fan
(6) Cylinder Block
(7) Cylinder Head
(8) Right Bank
(9) Throttle Body
(10) Cylinder Block
(11) Cylinder Head
(12) Left Bank
(13) Heater

The cooling system is a pressurized Engine Coolant (EC) forced circulation type which consists of a water pump, thermostat cooling fan, radiator and other components. The automatic transmission fluid is cooled by the EC in radiator.

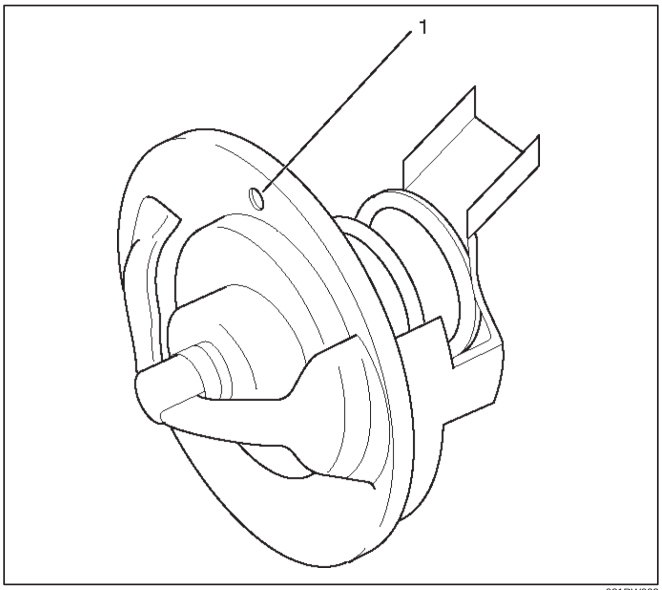
Water Pump

The EC pump is a centrifugal impeller type and is driven by a timing belt.



Thermostat

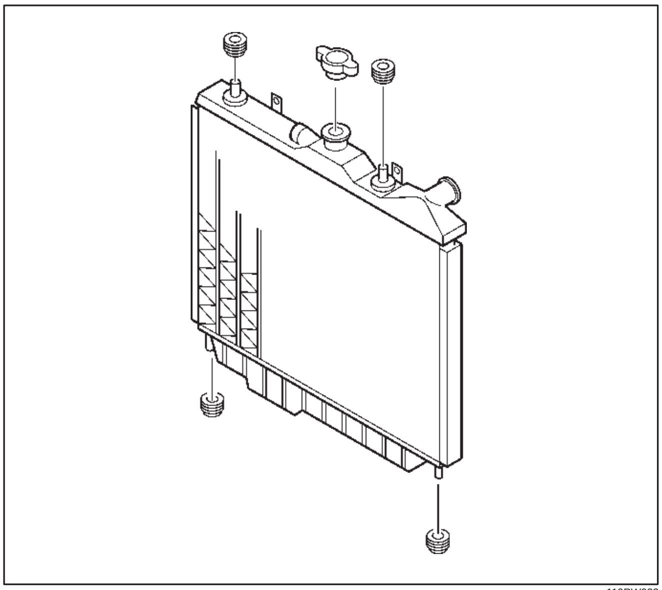
The thermostat is a wax pellet type with a air hole(1) and is installed in the thermostat housing.



031RW002

Radiator

The radiator is a tube type with corrugated fins. In order to raise the boiling point of the coolant, the radiator is fitted with a cap in which the valve is operated at 88.2 ~ 117.6 kPa (12.8 ~ 17.0 psi) pressure. (No oil cooler provided for M/T)



110RW023

Antifreeze Solution

- Relation between the mixing ratio and freezing temperature of the EC varies with the ratio of anti–freeze solution in water. Proper mixing ratio can be determined by referring to the chart. Supplemental inhibitors or additives claiming to increase cooling capability that have not been specifically approved by Isuzu are not recommended for addition to the cooling system.

- Calculating mixing ratio

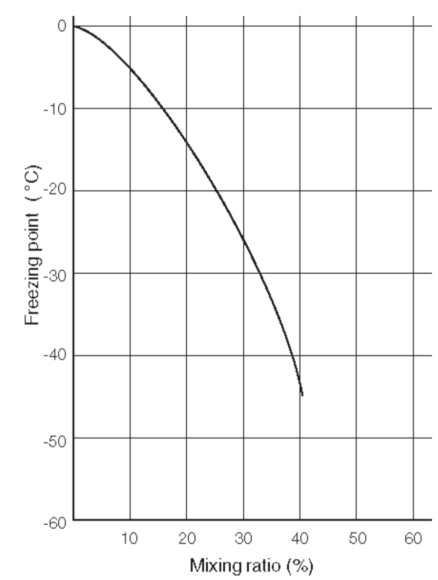
Mixing ratio

$$= \frac{\text{Anti freeze solution (Lit/gal.)}}{\text{Anti freeze solution (Lit/gal.)} + \text{Water (Lit/gal.)}}$$

F06RW005

NOTE: Antifreeze solution + Water = Total cooling system capacity.

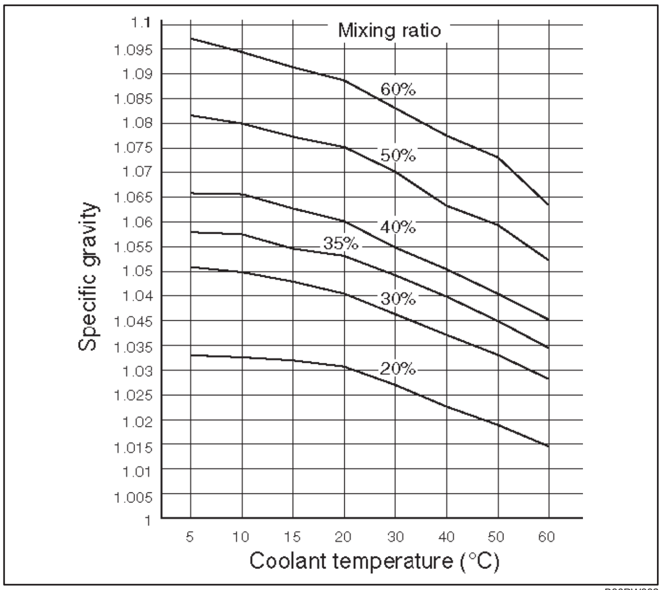
- **Total Cooling System Capacity**
- **M/T 11.1Lit (2.93Us gal)**
- **A/T 10.0Lit (2.64Us gal)**



B06RW002

- Mixing ratio

  Check the specific gravity of engine coolant in the cooling system temperature ranges from 0˚C to 50˚C using a suction type hydrometer, then determine the density of the engine coolant by referring to the table.



B06RW003

Diagnosis

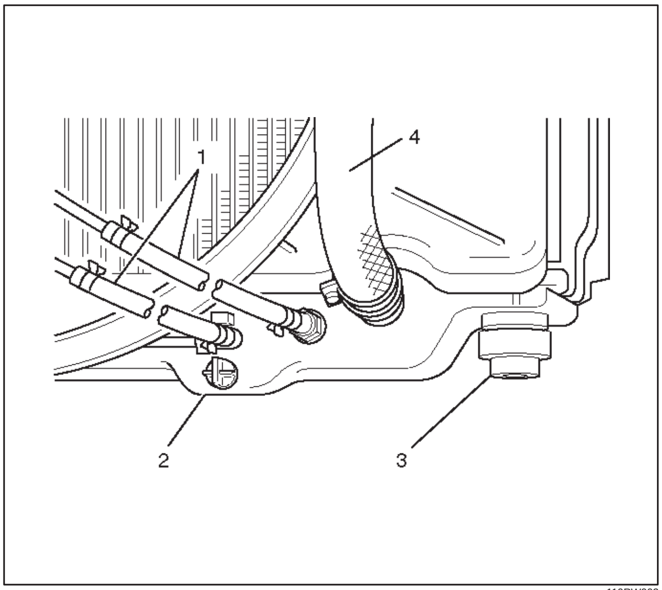
Engine Cooling Trouble

Condition	Possible cause	Correction
Engine overheating	Low Engine Coolant level	Replenish
	Incorrect fan installed	Replace
	Thermo meter unit faulty	Replace
	Faulty thermostat	Replace
	Faulty Engine Coolant temperature sensor	Repair or replace
	Clogged radiator	Clean or replace
	Faulty radiator cap	Replace
	Low engine oil level or use of improper engine oil	Replenish or change oil
	Clogged exhaust system	Clean exhaust system or replace faulty parts
	Faulty Throttle Position sensor	Replace throttle valve assembly
	Open or shorted Throttle Position sensor circuit	Repair or replace
	Damaged cylinder head gasket	Replace
Engine overcooling	Faulty thermostat	Replace
Engine slow to warm–up	Faulty thermostat	Replace
	Thermo unit faulty	Replace

Draining and Refilling Cooling System

Before draining the cooling system, inspect the system and perform any necessary service to ensure that it is clean, does not leak and is in proper working order. The engine coolant (EC) level should be between the “MIN” and “MAX” lines of reserve tank when the engine is cold. If low, check for leakage and add EC up to the “MAX” line. There should not be any excessive deposit of rust or scales around the radiator cap or radiator filler hole, and the EC should also be free from oil.
Replace the EC if excessively dirty.

1. Completely drain the cooling system by opening the drain plug (2) at the bottom of the radiator.



110RW002

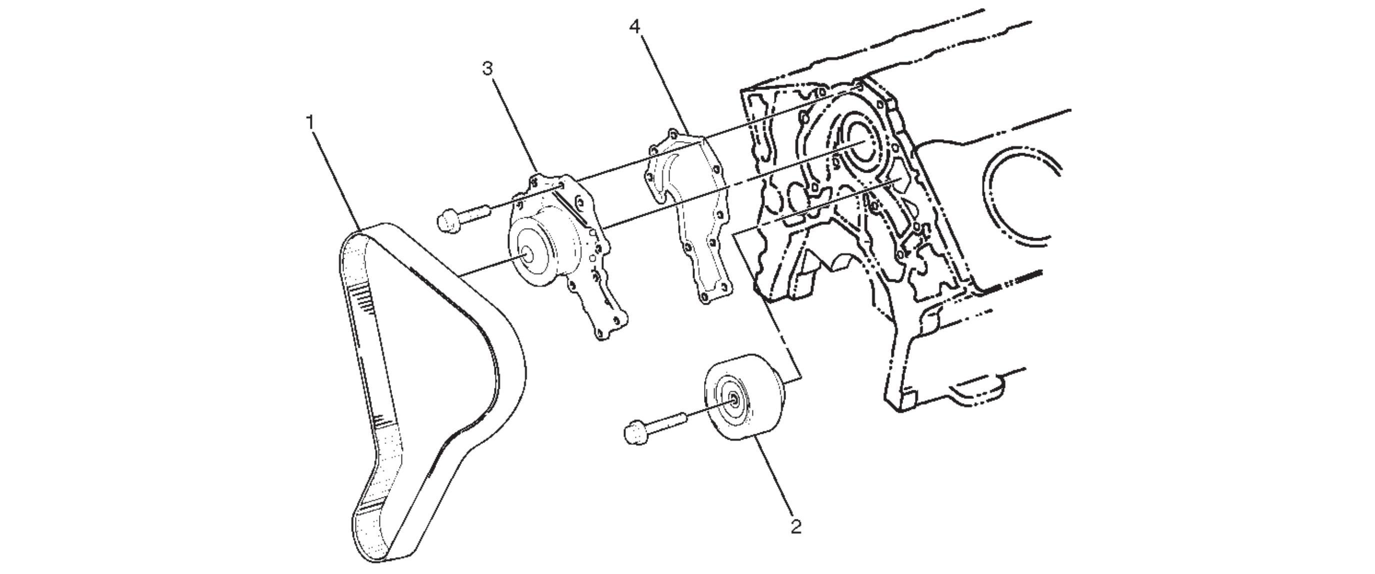
2. Remove the radiator cap.

WARNING: TO AVOID THE DANGER OF BEING BURNED, DO NOT REMOVE THE CAP WHILE THE ENGINE AND RADIATOR ARE STILL HOT. SCALDING FLUID AND STEAM CAN BE BLOWN OUT UNDER PRESSURE.

3. Disconnect all hoses from the EC reserve tank.
   Scrub and clean the inside of the reserve tank with soap and water. Flush it well with clean water, then drain it. Install the reserve tank and hoses.
4. Refill the cooling system with the EC using a solution that is at least 50 percent antifreeze but no more than 70 percent antifreeze.
5. Fill the radiator to the base of the filler neck.
   Fill the EC reserve tank to “MAX” line when the engine is cold.
6. Block the drive wheels and firmly apply the parking brake. Shift an automatic transmission to “P” (Park) or a manual transmission to neutral.
7. Remove the radiator cap. Start the engine and warm it up at 2,500 ~ 3,000 rpm for about 30 minutes.
8. When the air comes out from the radiator filler neck and the EC level has gone down, replenish with the EC. Repeat this procedure until the EC level does not go down. Then stop the engine and install the radiator cap. Let the engine cool down.
9. After the engine has cooled, replenish with EC up to the “MAX” line of the reserve tank.
10. Start the engine. With the engine running at 3,000 rpm, make sure there is no running water sound from the heater core (behind the center console).
11. If the running water sound is heard, repeat steps 8 to 10.

Water Pump

Water Pump and Associated Parts



030RS002

Legend
(1) Timing Belt
(2) Idle Pulley
(3) Water Pump Assembly
(4) Gasket

Removal

1. Disconnect battery ground cable.
2. Drain coolant.
3. Radiator hose (on inlet pipe side).
4. Remove timing belt. Refer to “Timing Belt” in this manual.
5. Remove Idle pulley.
6. Remove water pump assembly.
7. Remove gasket.

Inspection

Make necessary repair and parts replacement if extreme wear or damage is found during inspection. Should any of the following problems occur, the entire water pump assembly must be replaced.

- Crack in the water pump body
- EC leakage from the seal unit
- Play or abnormal noise in the bearing
- Cracks or corrosion in the impeller

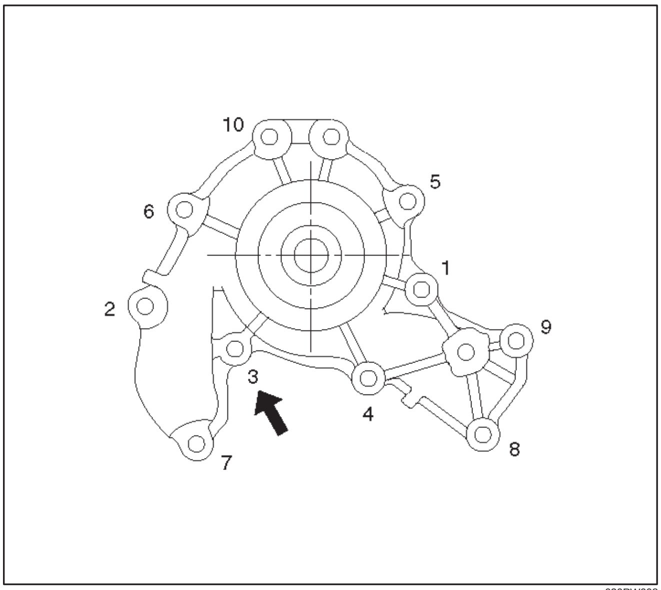
Installation

1. Install gasket, clean the mating surface of gasket before installation.
2. Install water pump assembly and tighten bolts to the specified torque.

   Torque: 25 N·m (18 lb ft)

   - Tightening order
     The tightening order are in the illustrate.

NOTE: To prevent the oil leakage, apply the LOCTITE 262 or an equivalent, to the arrow marked fixing bolt thread.



030RW008

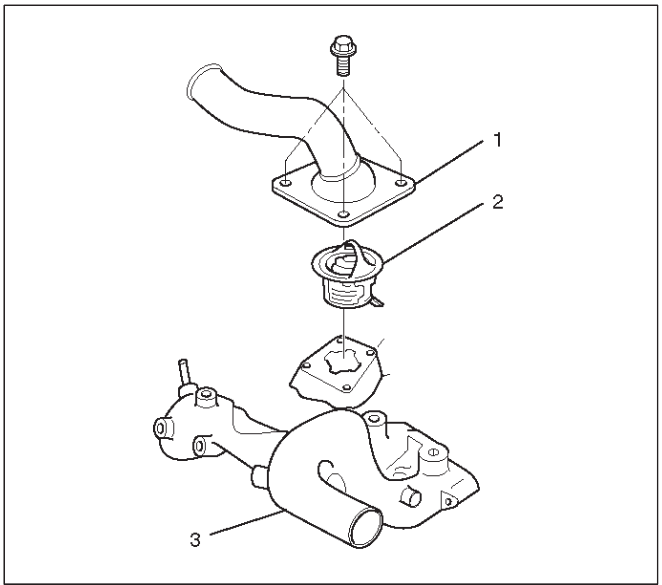
3. Idle pulley
   - Install idle pulley and tighten bolt to the specified torque.

   Torque: 52 N·m (38 lb ft)

4. Timing belt
   - Install timing belt. Refer to timing belt installation step in “Timing Belt” in this manual.
5. Connect radiator inlet hose and replenish EC.
6. Connect battery ground cable.

Thermostat

Thermostat and Associated Parts



031RW001

Legend

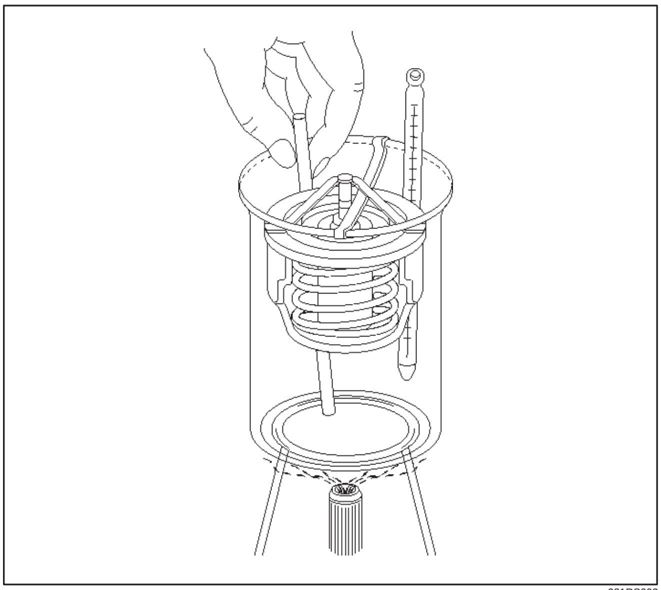
(1) Thermostat Housing
(2) Thermostat
(3) Outlet Pipe

Removal

1. Disconnect battery ground cable.
2. Drain engine coolant from the radiator and engine.
3. Disconnect radiator hose from the inlet pipe.
4. Remove thermostat housing.
5. Remove thermostat(2).

Inspection

Suspend the thermostat in a water–filled container using thin wire. Place a thermometer next to the thermostat. Do not directly heat the thermostat.
Gradually increase the water temperature. Stir the water so that the entire water is same temperature.



031RS003

Confirm the temperature when the valve first begins to open.

Valve opening temperature 74.5C ~ 78.5˚C (166.1˚F ~ 173.3˚F)

Confirm the temperature when the valve is fully opened.

Valve full open temperature and lift More than 8.5mm (0.33 in) at 90˚C (194˚F)

Make necessary repair and parts replacement if extreme wear or damage is found during inspection.

Installation

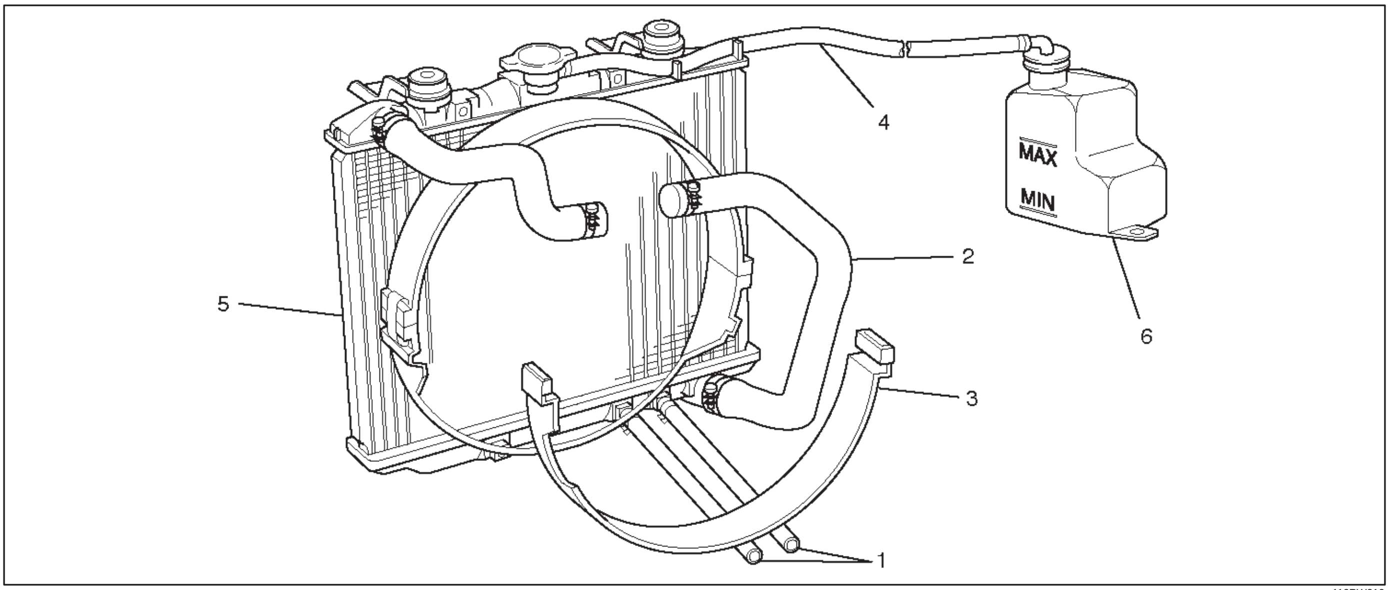
1. Install thermostat into the outlet pipe(4) making sure that the air hole is in the up position.
2. Install thermostat housing and tighten bolts to the specified torque.

Torque: 25 N·m (18 lb ft)

3. Installation rubber hose.
4. Replenish engine coolant (EC).
5. Start engine and check for EC leakage.

Radiator

Radiator and Associated Parts



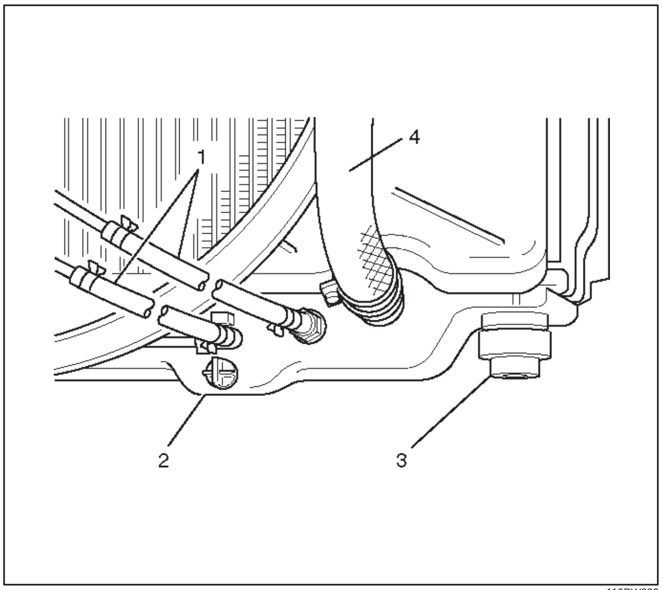
110RW010

Legend

(1) Oil Cooler Hose For Automatic Transmission
(2) Radiator Hose
(3) Fan Guide, Lower
(4) Reserve Tank Hose
(5) Radiator Assembly
(6) Reserve Tank

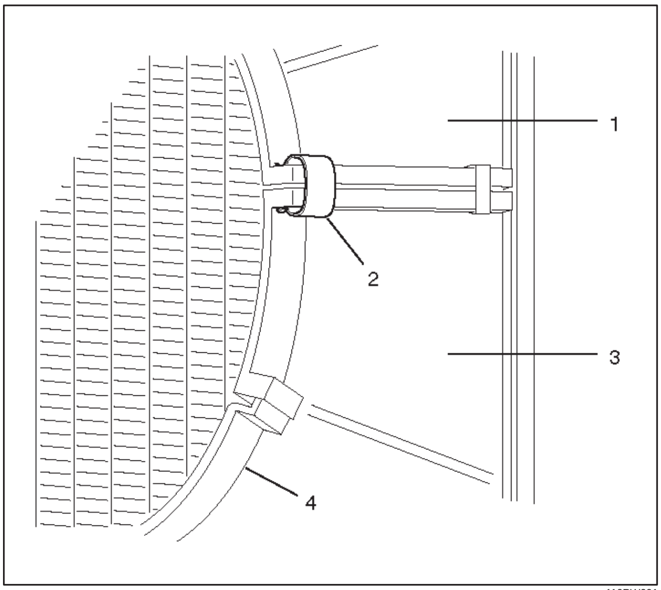
Removal

1. Disconnect battery ground cable.
2. Loosen a drain plug(2) to drain EC.
3. Disconnect oil cooler hose(1) on automatic transmission (A/T).
4. Disconnect radiator inlet hose and outlet hose from the engine.



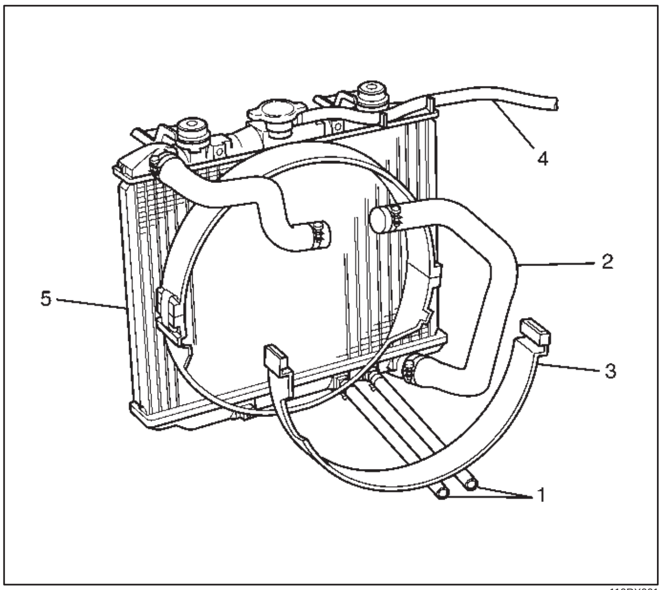
110RW002

5. Remove fan guide(1), clips(3) on both sides and the bottom lock, then remove fan guide lower(3) with fan shroud(4).



110RW001

6. Disconnect the reserve tank hose(4) from radiator.



110RX001

7. Lift up and remove the radiator assembly with hose, taking care not to damage the radiator core with a fan blade.
8. Remove rubber cushions on both sides at the bottom.

Inspection

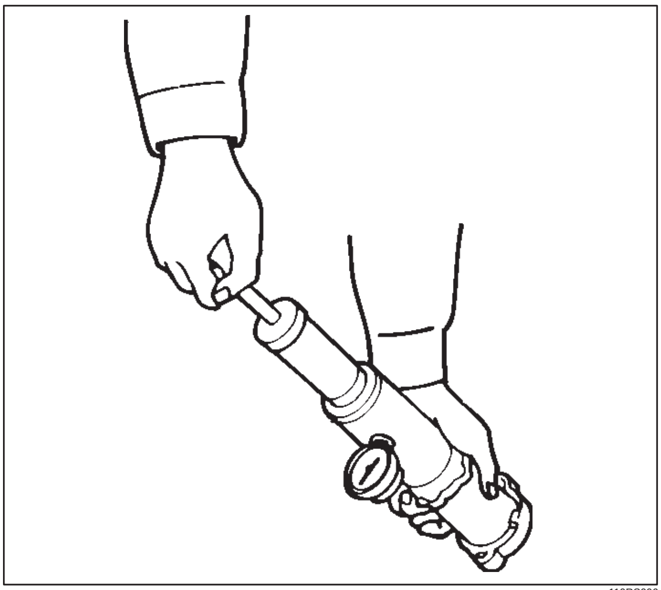
Radiator Cap

Measure the valve opening pressure of the pressurizing valve with a radiator filler cap tester.
Replace the cap if the valve opening pressure is outside the standard range.

Valve opening pressure kPa (psi) 93.3 ~ 122.7 (13.5 ~17.8)

Cap tester: J–24460–01
Adapter: J–33984–A
Check the condition of the vacuum valve in the center of the valve seat side of the cap. If considerable rust or dirt is found, or if the valve seat cannot be moved by hand, clean or replace the cap.

Valve opening vacuum kPa (psi) 0 ~ 6.9 (0 ~ 1.0)



110RS006

Radiator Core

1. A bent fin may result in reduced ventilation and overheating may occur. All bent fins must be straightened. Pay close attention to the base of the fin when it is being straightened.
2. Remove all dust, bugs and other foreign material.

Flushing the Radiator

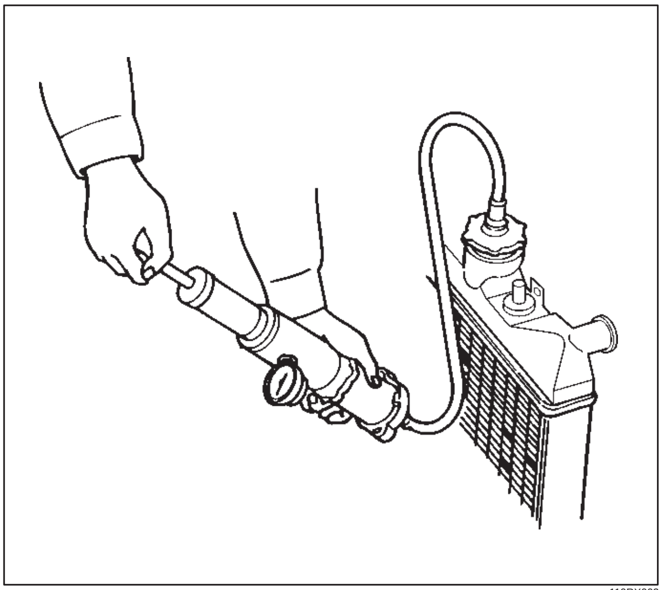
Thoroughly wash the inside of the radiator and the engine coolant passages with cold water and mild detergent. Remove all signs of scale and rust.

Cooling System Leakage Check

Use a radiator cap tester to force air into the radiator through the filler neck at the specified pressure of 196 kPa (28.5 psi) with a cap tester:

- Leakage from the radiator
- Leakage from the coolant pump
- Leakage from the water hoses
- Check the rubber hoses for swelling.

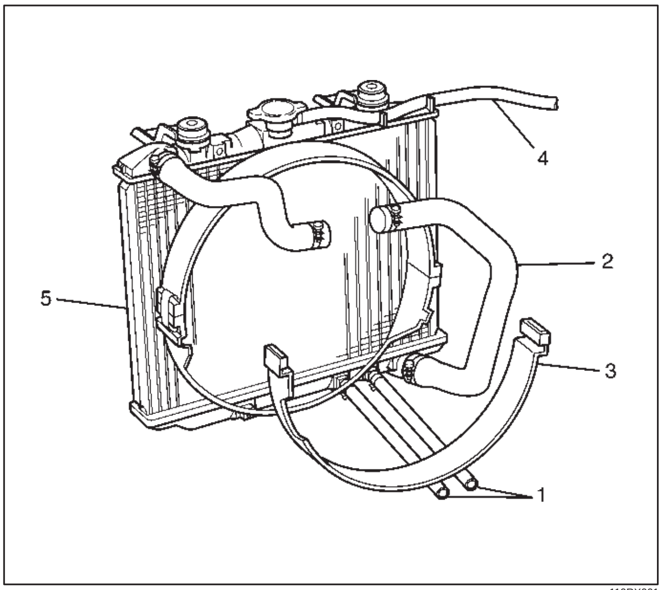
Cap tester: J–24460–01
Adapter: J–33984–A



110RX002

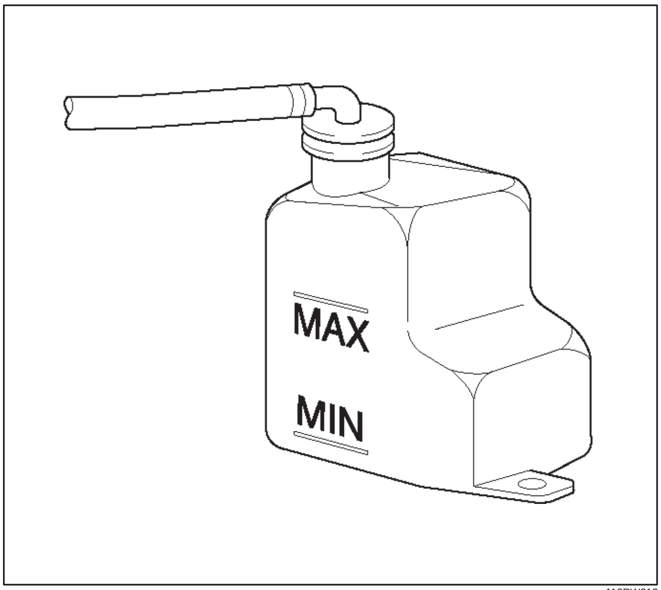
Installation

1. Install rubber cushions on both sides of radiator bottom.
2. Install radiator assembly with hose, taking care not to damage the radiator core with a fan blade.
3. Connect reserve tank hose (4).
4. Install lower fan guide (3).
5. Connect radiator inlet hose and outlet hose to the engine.
6. Connect oil cooler hose (1) to automatic transmission.



110RX001

7. Connect battery ground cable.
8. Pour engine coolant up to filler neck of radiator, and up to MAX mark of reserve tank.



110RW012

Important operation (in case of 100% engine coolant change) procedure for filling with engine coolant.

Engine Coolant Filling Up Procedure

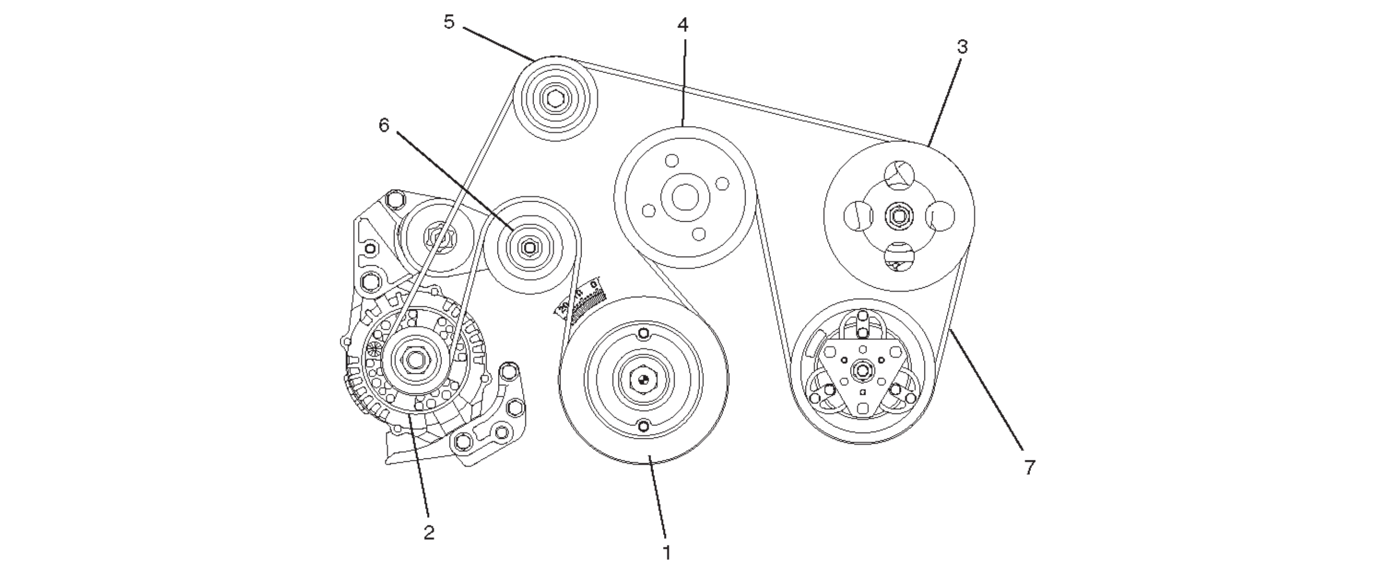
1. Make sure that the engine is cool.

WARNING: WHEN THE COOLANT IS HEATED TO A HIGH TEMPERATURE, BE SURE NOT TO LOOSEN OR REMOVE THE RADIATOR CAP. OTHERWISE YOU MIGHT GET SCALDED BY HOT VAPOR OR BOILING WATER. TO OPEN THE RADIATOR CAP, PUT A PIECE OF THICK CLOTH ON THE CAP AND LOOSEN THE CAP SLOWLY TO REDUCE THE PRESSURE WHEN THE COOLANT HAS BECOME COOLER.

2. Open radiator cap pour coolant up to filler neck.
3. Pour coolant into reservoir tank up to “MAX” line.
4. Tighten radiator cap and start the engine. After idling for 2 to 3 minutes, stop the engine and reopen radiator cap. If the water level is lower, replenish.
5. After replenish the coolant tighten radiator cap, warm up the engine at about 2000 rpm. Set heater adjustment to the highest temperature position, and let the coolant circulate also into heater water system.
6. Check to see the thermometer, continuously idling 5 minutes and stop the engine.
7. When the engine has been cooled, check filler neck for water level and replenish if required. Should extreme shortage of coolant is found, check the coolant system and reservoir tank hose for leakage.
8. Pour coolant into the reservoir tank up to “MAX” line.

Drive Belt and Cooling Fan

Drive Belt and Associated Parts



015RW005

Legend

(1) Crankshaft Pulley
(2) Generator
(3) Power Steering Pump
(4) Water Pump and Cooling Fan Pulley
(5) Idle Pulley
(6) Tension Pulley
(7) Drive Belt

The drive belt adjustment is not required as automatic drive belt tensioner is equipped.

Inspection

Check drive belt for wear or damage, and replace with a new one as necessary.

Installation

Install cooling fan assembly and tighten bolts/nuts to the specified torque.

Torque : 22 N·m (16 lb ft) for fan pulley and fan bracket.

Torque : 7.5 N·m (66.4 lb in) for fan and clutch assembly.

NOTE: Fan belts for 6VD1 Gasoline Engine mounted on 98MY Rodeo(UE) have been brought into one. As a result, the rotating direction of a fan belt is opposite to the direction of cooling fan for 93 to 97MY 6VD1 with no interchangeability.

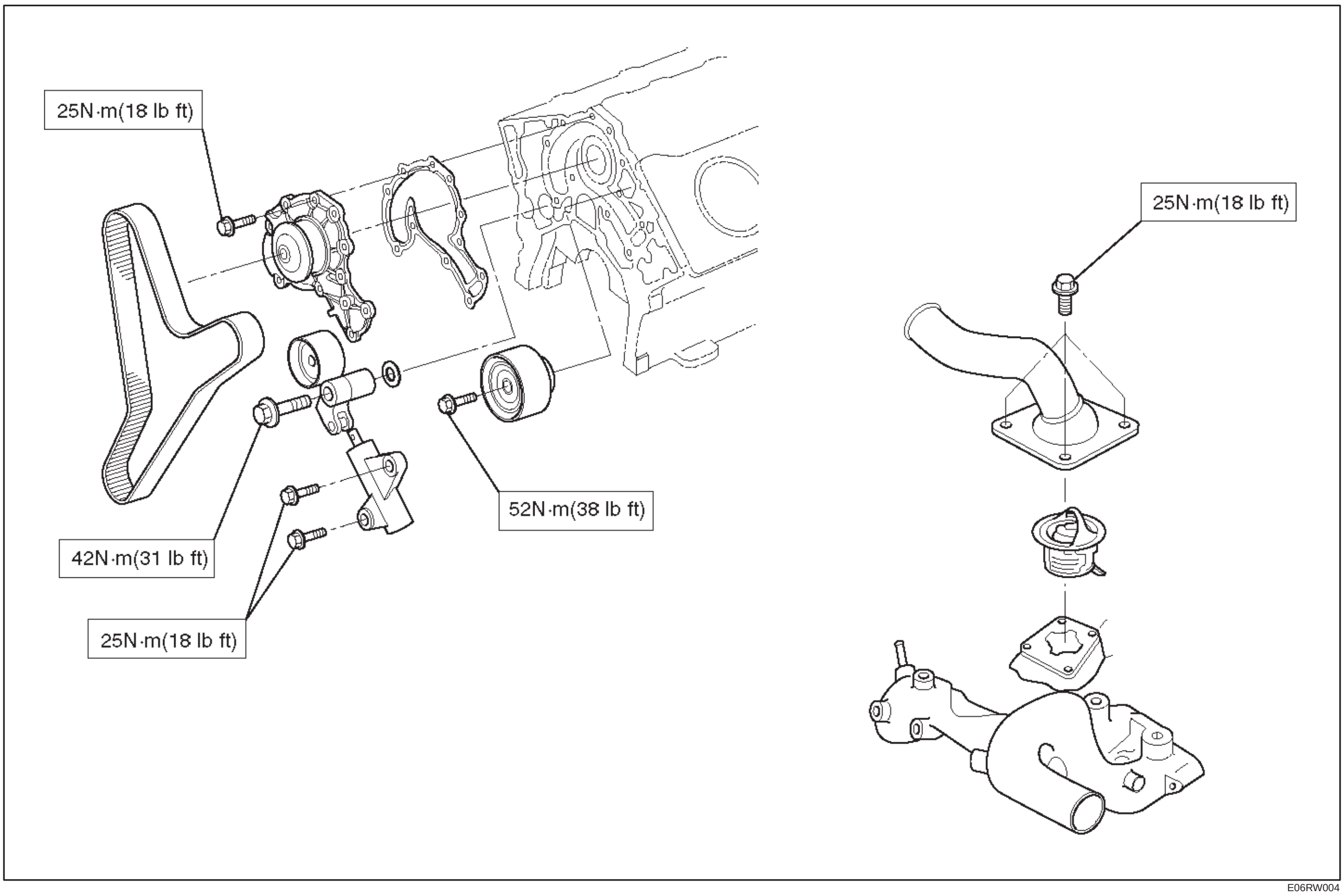
Therefore, incorrect installation of a fan may cause the air for cooling to flow in the opposite direction, this resulting in the poor performance of the air-conditioner and a rise temperature in engine cooling water.

Main Data and Specifications

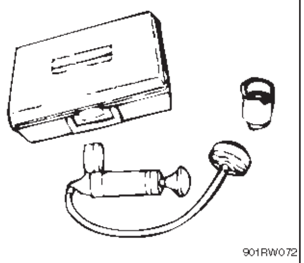
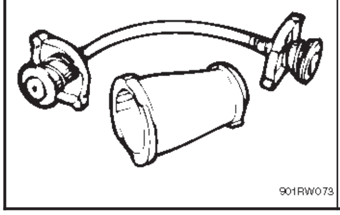
General Specifications

	M/T	A/T
Cooling system	Engine coolant forced circulation	
Radiator	Tube type corrugated (2 tube in row)	
Heat radiation capacity	70,000 kcal/h	77,800 kcal/h
Heat radiation area	9.74m^2 (104.8ft^2)	11.74m^2 (126.4ft^2)
Radiator front area	0.263m^2 (2.83ft^2)	
Radiator dry weight	42N (9.4lb)	45N (10.1lb)
Radiator cap valve opening pressure	93.3 ~ 122.7kpa (13.5 ~ 17.8psi)	
Engine coolant capacity	2.5lit (0.6 US gal)	2.4lit (0.6 US gal)
Engine coolant pump	Centrifugal impeller type	
Delivery	300 (317) or more	
Pump speed	5000 ± 50 rpm	
Thermostat	Wax pellet type with air hole	
Valve opening temperature	74.5 ~ 78.5˚C (166.1 ~ 173.3˚F)	
Engine coolant total capacity	11.1lit (2.93 US gal)	10.0lit (2.64 US gal)

Torque Specifications



Special Tool

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–24460–01** Tester; radiator cap
	**J–33984–A** Adapter; radiator cap

RODEO

ENGINE

ENGINE FUEL

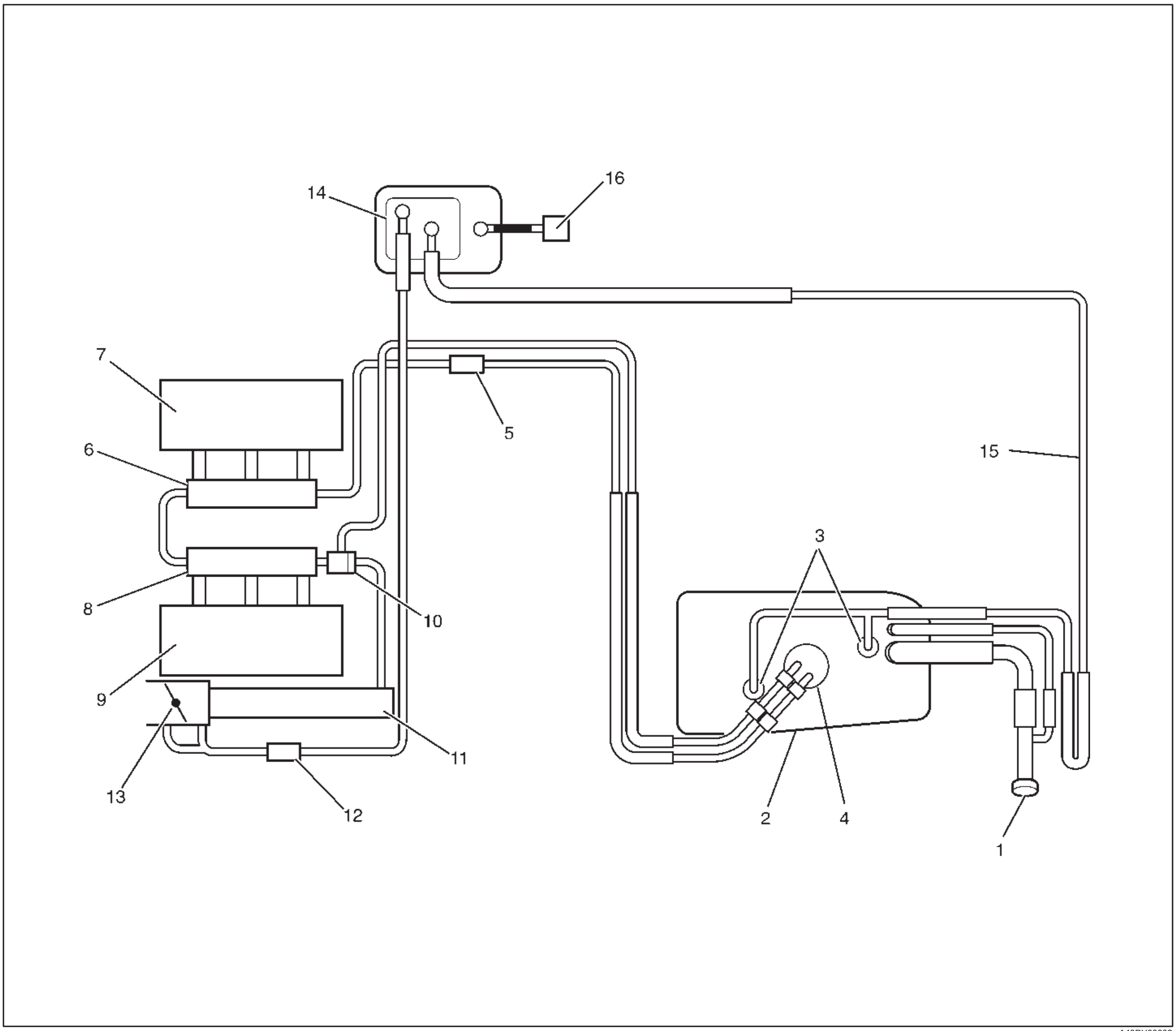
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



Legend

- (1) Fuel Filler Cap
- (2) Fuel Tank
- (3) Rollover Valve
- (4) Fuel Pump and Sender Assembly
- (5) Fuel Filter
- (6) Fuel Rail Right
- (7) Right Bank
- (8) Fuel Rail Left
- (9) Left Bank
- (10) Fuel Pressure Control Valve
- (11) Common Chamber
- (12) Duty Solenoid Valve
- (13) Throttle Valve
- (14) Canister
- (15) Evapo Pipe
- (16) Vent Solenoid Cut Valve

When working on the fuel system, there are several things to keep in mind:

- Any time the fuel system is being worked on, disconnect the negative battery cable except for those tests where battery voltage is required.
- Always keep a dry chemical (Class B) fire extinguisher near the work area.
- Replace all pipes with the same pipe and fittings that were removed.
- Clean and inspect “O” rings. Replace if required.
- Always relieve the line pressure before servicing any fuel system components.
- Do not attempt repairs on the fuel system until you have read the instructions and checked the pictures relating to that repair.
- Adhere to all Notices and Cautions.

All gasoline engines are designed to use only unleaded gasoline. Unleaded gasoline must be used for proper emission control system operation.

Its use will also minimize spark plug fouling and extend engine oil life. Using leaded gasoline can damage the emission control system and could result in loss of emission warranty coverage.

All cars are equipped with an Evaporative Emission Control System. The purpose of the system is to minimize the escape of fuel vapors to the atmosphere.

Fuel Metering

The Powertrain Control Module (PCM) is in complete control of this fuel delivery system during normal driving conditions.

The intake manifold function, like that of a diesel, is used only to let air into the engine. The fuel is injected by separate injectors that are mounted over the intake manifold.

The Manifold Absolute Pressure (MAP) sensor measures the changes in the intake manifold pressure which result from engine load and speed changes, which the MAP sensor converts to a voltage output.

This sensor generates the voltage to change corresponding to the flow of the air drawn into the engine. The changing voltage is transformed into an electric signal and provided to the PCM.

With receipt of the signals sent from the MAP sensor, Intake Air Temperature sensor and others, the PCM determines an appropriate fuel injection pulse width feeding such information to the fuel injector valves to effect an appropriate air/fuel ratio.

The Multiport Fuel Injection system utilizes an injection system where the injectors turn on at every crankshaft revolution. The PCM controls the injector on time so that the correct amount of fuel is metered depending on driving conditions.

Two interchangeable “O” rings are used on the injector that must be replaced when the injectors are removed.

The fuel rail is attached to the top of the intake manifold and supplies fuel to all the injectors.

Fuel is recirculated through the rail continually while the engine is running. This removes air and vapors from the fuel as well as keeping the fuel cool during hot weather operation.

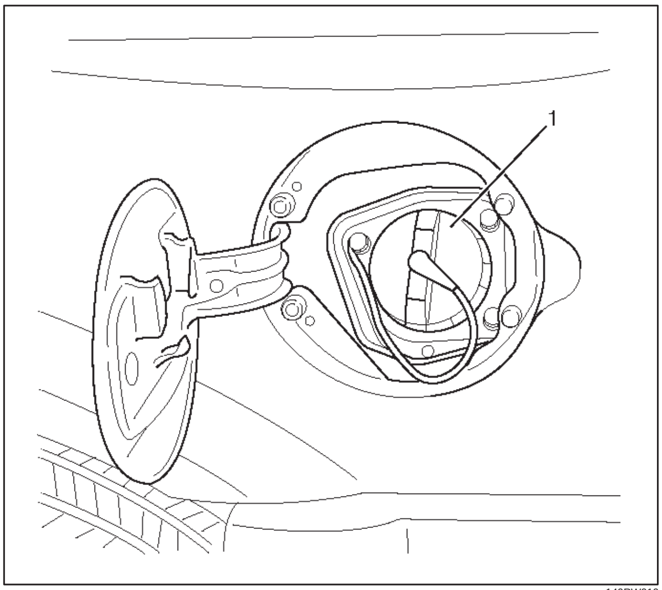
The fuel pressure control valve that is mounted on the fuel rail maintains a pressure differential across the injectors under all operating conditions. It is accomplished by controlling the amount of fuel that is recirculated back to the fuel tank based on engine demand.

See Section “Driveability and Emission” for more information and diagnosis.

Fuel Filter

Removal

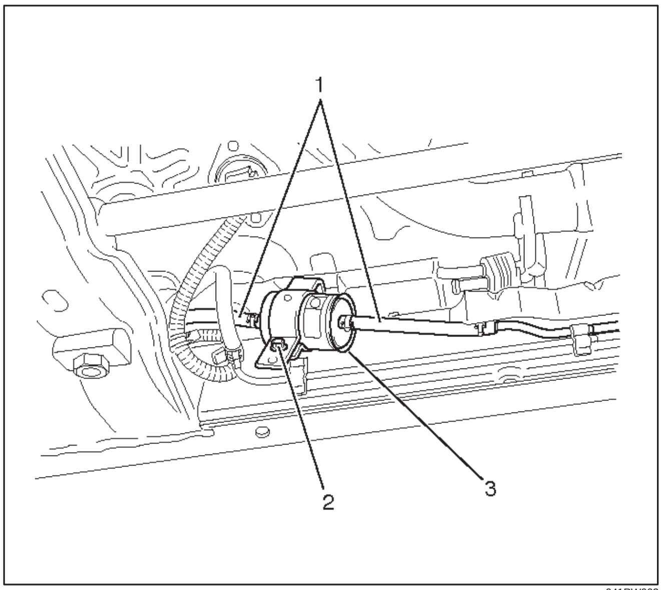
CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section “Driveability and Emission”.



140RW010

Legend
(1) Fuel Filler Cap

1. Disconnect battery ground cable.
2. Remove Fuel filler cap(1).



041RW003

Legend
(1) Fuel Hose
(2) Fuel Filter Fixing Bolt
(3) Fuel Filter

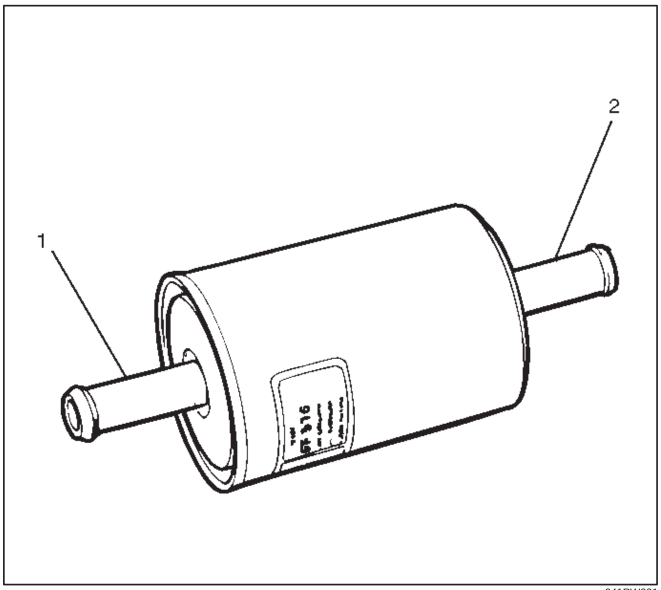
3. Disconnect fuel hoses(1) from fuel filter on both engine side and fuel tank side.
4. Fuel filter fixing bolt(2).
   - Remove the fuel filter fixing bolt(2) on fuel filter holder.
5. Remove fuel filter(3).

Inspection

1. Replace the fuel filter if the fuel leaks from fuel filter body or if the fuel filter body itself is damaged.
2. Replace the filter if it is clogged with dirt or sediment.
3. Check the drain of receive rubber and if it is clogged with dust, clean it up with air.

Installation

1. Install the fuel filter in the proper direction.
2. Install fuel filter holder fixing bolt.
3. Connect fuel hoses on engine side(1) and fuel tank side(2).



041RW001

4. Install fuel filler cap
5. Connect the battery ground cable.

Inspection

After installation, start engine and check for fuel leakage.

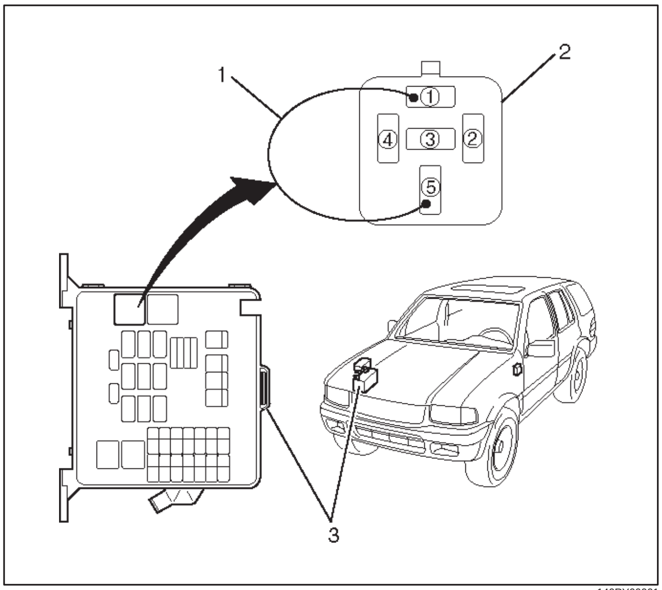
In–Tank Fuel Filter

The filter is located on the lower end of fuel pickup tube in the fuel tank. It prevents dirt from entering the fuel pipe and also stops water unless the filter is completely submerged in the water. It is a selfcleaning type, not requiring scheduled maintenance. Excess water and sediment in the tank restricts fuel supply to the engine, resulting in engine stoppage. In such a case, the tank must be cleaned thoroughly.

Fuel Pump Flow Test

If reduction of fuel supply is suspected, perform the following checks.

1. Make sure that there is fuel in the tank.
2. With the engine running, check the fuel feed pipe and hose from fuel tank to injector for evidence of leakage. Retighten, if pipe or hose connection is loose. Also, check pipes and hoses for squashing or clogging.
3. Insert the hose from fuel feed pipe into a clean container, and check for fuel pump flow rate.
4. Connect the pump relay terminals with a jumper wire(1) as shown and start the fuel pump to measure delivery.



140RY00001

CAUTION: Never generate sparks when connecting a jumper wire.

Delivery	Delivery
15 seconds	0.38 liters minimum

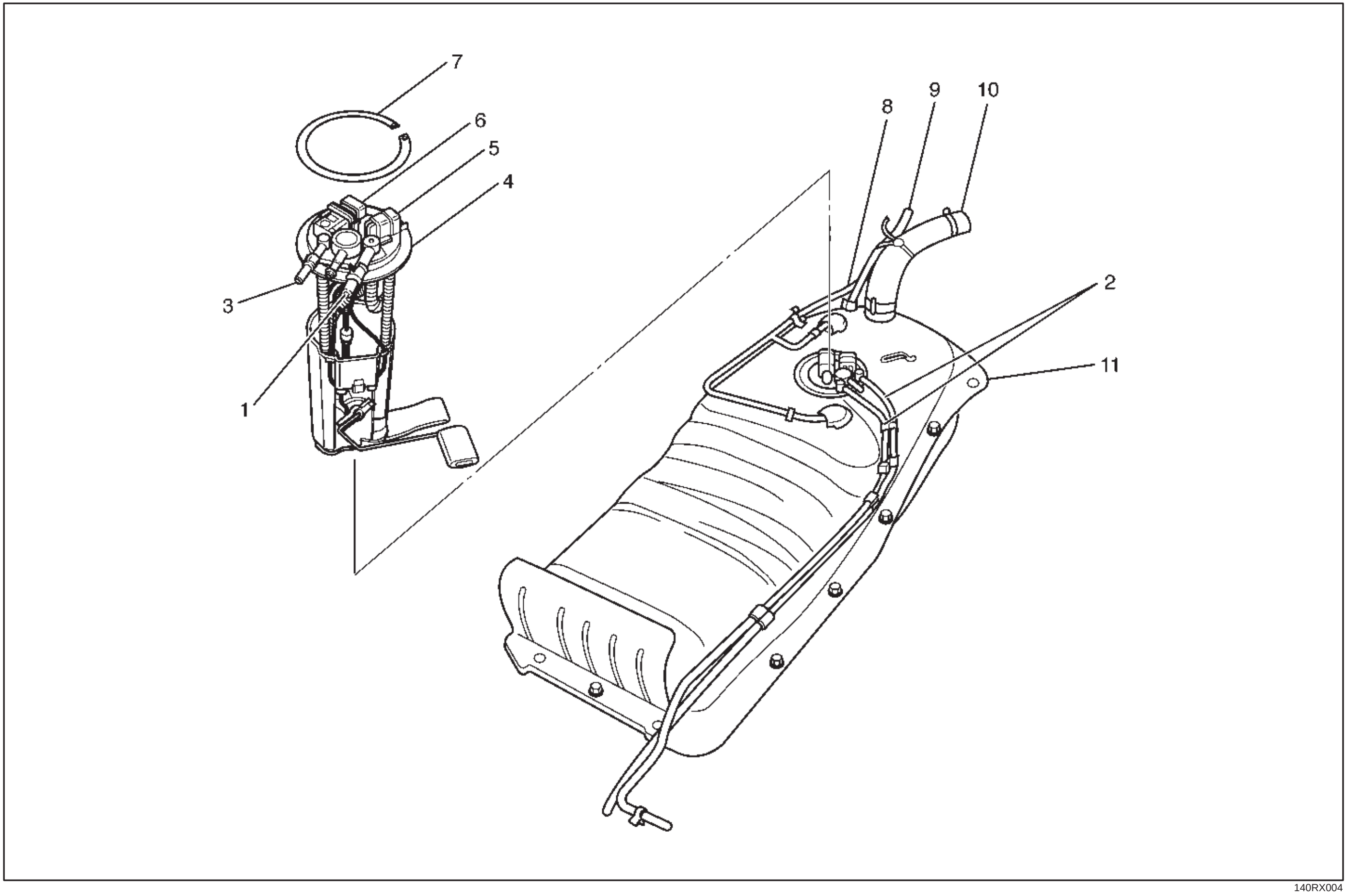
If the measure value is out of standard, conduct the pressure test.

Pressure test

For the pressure test to the fuel system, see Section 6E "Fuel Control System".

Fuel Pump

Fuel Pump and Associated Parts



Legend

(1) Fuel Feed Port
(2) Fuel Tube/Quick Connector
(3) Fuel Return Port
(4) Fuel Pump and Sender Assembly
(5) Connector; Fuel Feed Pump
(6) Connector; Fuel Level Sensor
(7) Snap Ring
(8) Hose; Evaporative Fuel
(9) Hose; Air Breather
(10) Hose; Fuel Filler
(11) Fuel Tank Assembly

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section “Driveability and Emission”.

1. Disconnect battery ground cable.
2. Loosen fuel filler cap.
3. Support underneath of the fuel tank assembly (11) with a lifter.
4. Remove fuel tank assembly(11). Refer to “Fuel Tank Removal” in this section.
5. Remove Fuel Tube/Quick Connector (2).

NOTE: Handling of the fuel tube sure to refer “Fuel Tube/Quick Connector Fittings” in this section.

6. Remove fuel pump and sender (FPAS) assembly (4) fixing snap ring and remove the FPAS assembly.

NOTE: After removing pump assembly (4), cover fuel tank to prevent any dust entering.

Installation

1. Install FPAS assembly(4).
2. Install Fuel Tube/Quick Connector (2).

NOTE: Handling of the fuel tube sure to refer “Fuel Tube/Quick Connector Fittings” in this section.

3. Install fuel tank assembly(11). Refer to “Fuel Tank Installation”.
4. Fill the tank with fuel and tighten fuel filler cap.
5. Connect battery ground cable.

Fuel Tube / Quick – Connector Fittings

Precautions

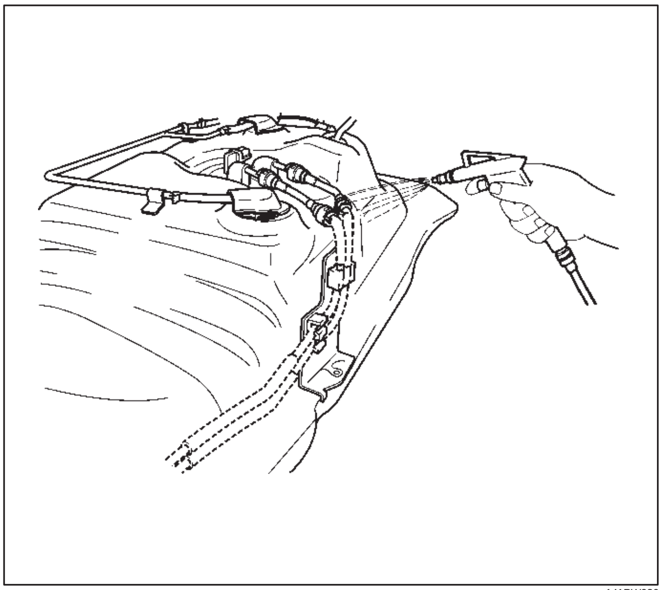
- Lighting of Fires Prohibited.
- Keep flames away from your work area to prevent the inflammable from catching fire.
- Disconnect the battery negative cable to prevent shorting during work.
- When welding or conducting other heat-generating work on other parts, be sure to provide pretreatment to protect the piping system from thermal damage or spattering.

Cautions During Work

Do not expose the assembly to battery electrolyte or do not wipe the assembly with a cloth used to wipe off spilt battery electorolyte.
The piping wet with battery electrolyte cannot be used.
Be careful not to give a bending or twisting force to the piping during the work. If deformed, replace with a new piping.

Removal

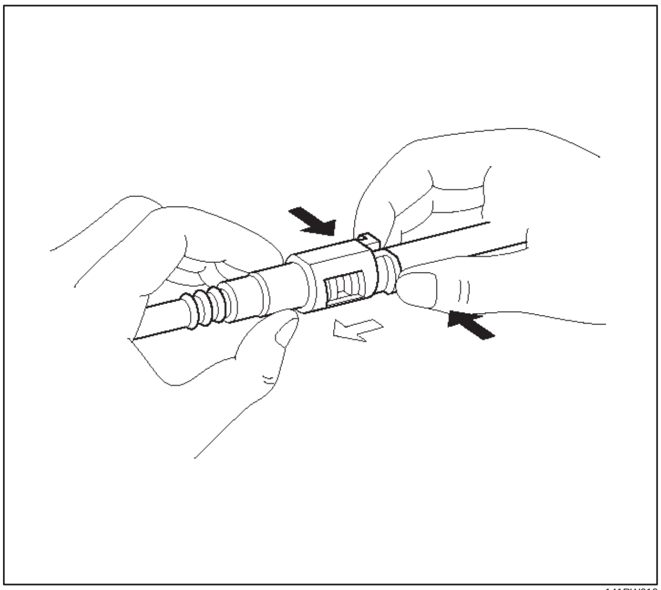
1. Open the fuel cap to relieve the fuel pressure in the tank.
   If the fuel quick-connect fittings are dusty, clean with an air blower, etc. and then remove it.



141RW036

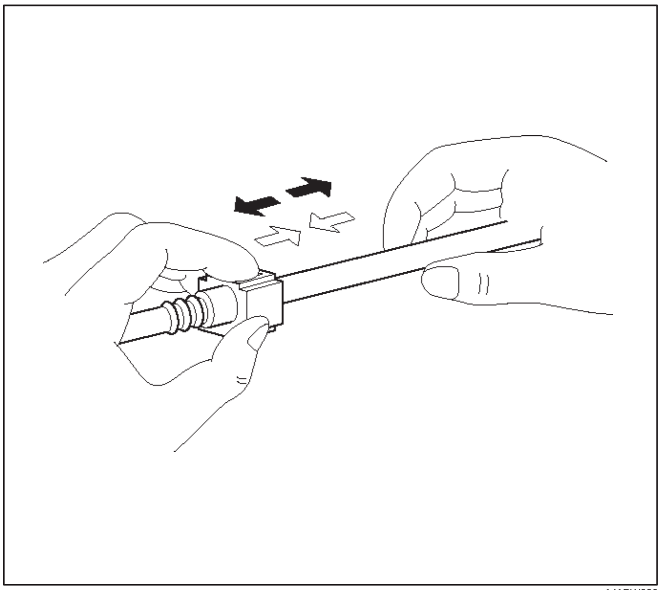
   As some pressure may remain in the piping, cover the connector with a cloth, etc. to prevent the splashing of fuel in the first disconnection of the piping.

2. For removal of the delivery pipe (feeding fuel to the engine), hold the connector in one hand, and hold the retainer tab with the other hand and pull out the connector, as illustrated. The pipe can be removed with the retainer attached.



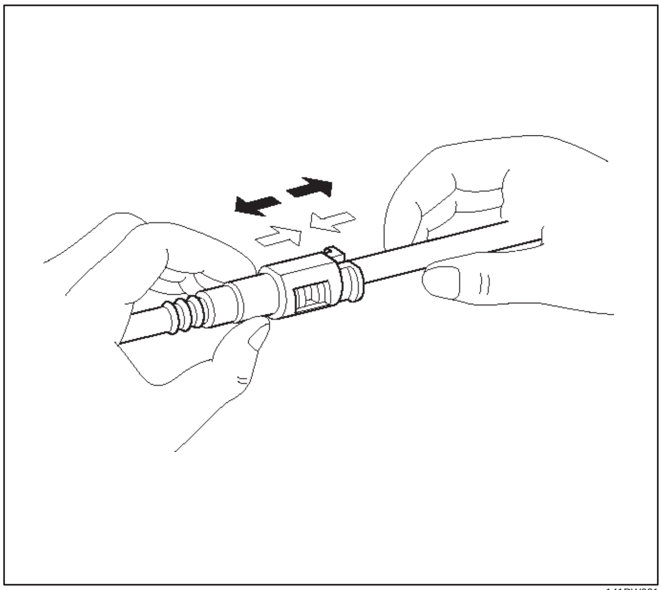
141RW019

3. For removal of the return pipe (returnig fuel to the tank), hold the pipe in one hand, and pull out the connentor with the other hand while pressing the square relieve button of the retainer, as illustrated.



141RW020

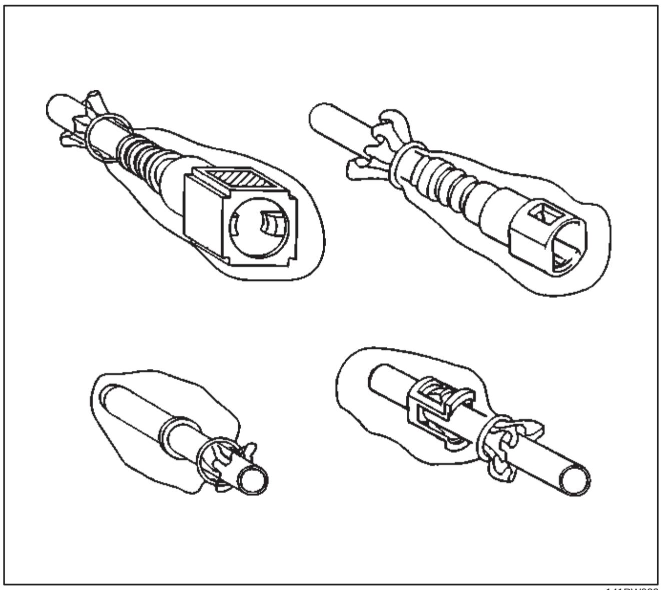
NOTE: This work should be done by hands. Do not use any tools. Should the pipe can hardly be removed from the connector, use a lubricant (light oil) and/or push and pull the connector longitudinally until the pipe is removed.



141RW021

When reusing the delivery pipe retainer, reuse without removing the retainer from the pipe. If the retainer is damaged or deformed, however, replace with a new retainer.

Cover the connectors removed with a plastic bag, etc. to prevent the entry of dust or rain water.



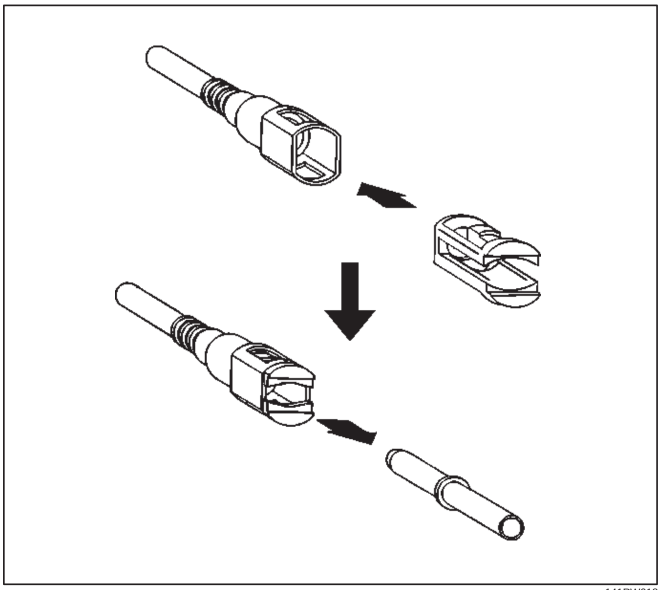
141RW022

Reuse of Quick–Connector

(Delivery Pipe)

- Replace the pipe and connector if scratch, dent or crack is found.
- Remove mud and dust from the pipe and make sure that the end including spool is free of defects, such as scratch, rust, and dent, which may cause poor sealability. If defective, replace with a new pipe.
- If the retainer removed according to the removal step above is attached to the pipe, clean and insert it straight into the quick-connector till it clicks. After it clicks, try pulling it out to make sure that it is not drawn and is securely locked.

NOTE: The retainer, once removed from the pipe, cannot be reused. Just replace with a new retainer. Insert the new retainer into the connector side until it clicks, and connect the pipe as inserting it into the retainer until it clicks.

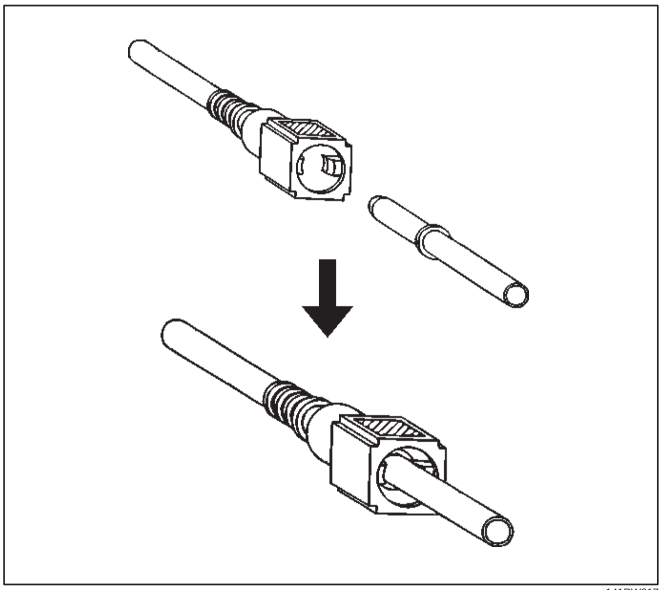


141RW018

(Return Pipe)

- Replace the pipe and connector if scratch, dent or crack is found.
- Remove mud or dust from the pipe and make sure that the end including spool is free from defects, such as scratch, rust, and dent, which may cause poor sealability. If defective, replace with a new pipe.

- After cleaning the pipe, insert it straight into the connector until it clicks. After it clicks, try pulling it out to make sure that it is not drawn and is securely locked.



141RW017

Assembling Advice

Application of engine oil or light oil to the pipe facilitates connecting work. The work should be started immediately after lubrication, since dust may stick to the pipe surface to cause poor sealability if a long time passes after lubrication.

Test/Inspection After Assembling

1. Reconnect the battery negative cable.
2. Turn the ignition key to the “ON” position and check pump startup sound. As the pump is actuated to raise fuel pressure, check and see fuel leak from the piping system.
3. Make sure of no fuel leakage by conducting the above fuel leak check a few times.
4. Start the engine and make sure of stable idling speed and normal vehicle run.The entry of dust during the work may sometimes affect the fuel injection system.

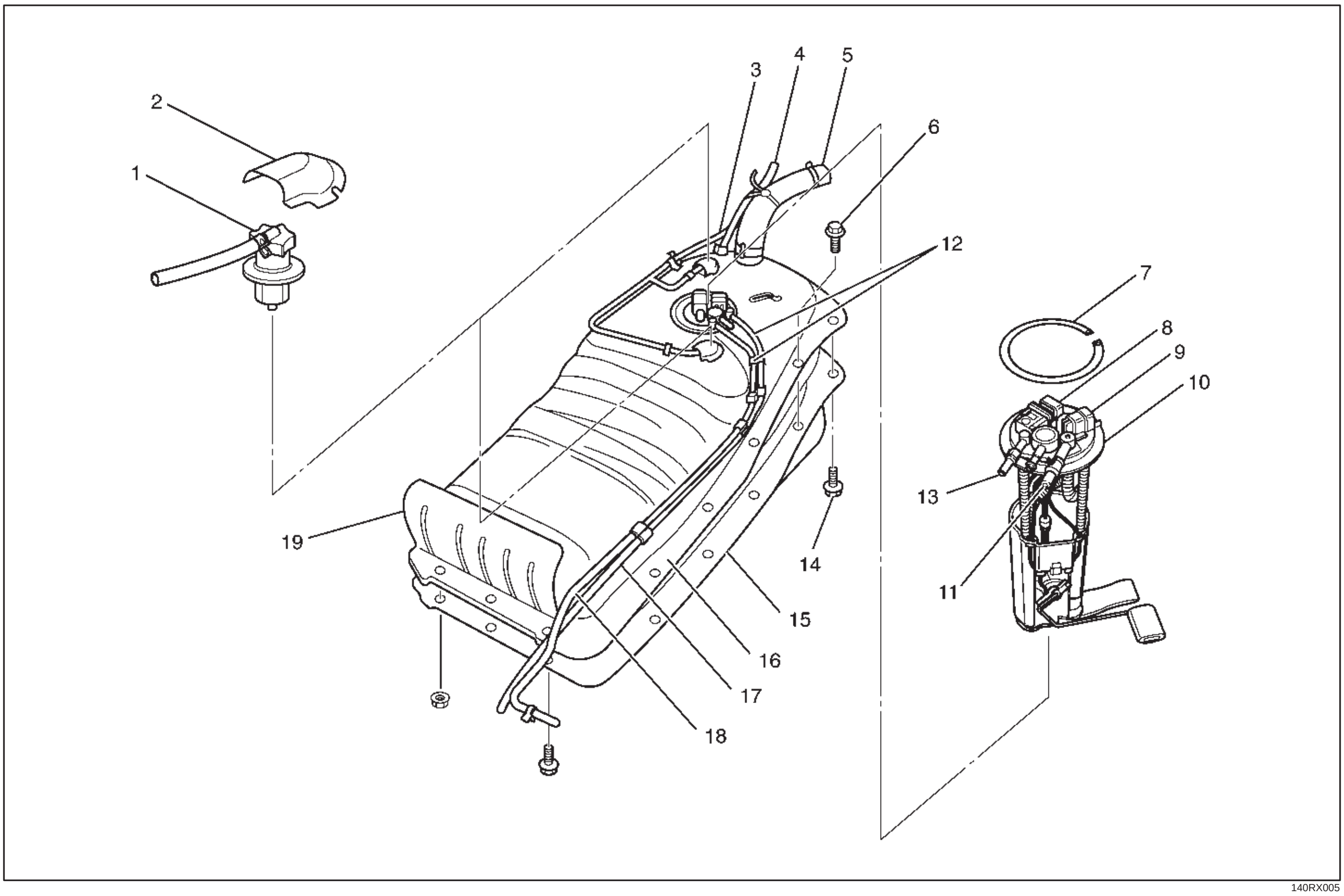
Fuel Pump Relay

General Description

In order to control the FPAS operation, the FPAS relay is provided. When the starter switch is turned to “ON” position, the FPAS relay operates the FPAS for 2 seconds.
When it is turned to “START” position, the Engine Control Module receives the reference pulse from the Ignition Control Module and it operates the relay, again causing the FPAS to feed fuel.

Fuel Tank

Fuel Tank and Associated Parts



Legend

(1) Roll Over&Float Valve
(2) Retaining Cover
(3) Hose; Evaporative Fuel
(4) Hose; Air Breather
(5) Hose; Fuel Filler
(6) Bolt; Fuel Tank Protector Fixing
(7) Snap Ring
(8) Connector; Fuel Level Sensor
(9) Connector; Fuel Feed Pump
(10) Fuel Pump and Sender Assembly
(11) Fuel Feed Port
(12) Fuel Tube/Quick Connector
(13) Fuel Return Port
(14) Bolt; Fuel Tank Asm. Fixing
(15) Protector; Fuel Tank
(16) Fuel Tank Assembly
(17) Hose; Fuel Feed
(18) Hose; Fuel Return
(19) Protector; Heat

Removal

CAUTION: When repair to the fuel system has been completed, start engine and check the fuel system for loose connection or leakage. For the fuel system diagnosis, see Section “Driveability and Emission”.

1. Disconnect battery ground cable.
2. Loosen fuel filler cap.
3. Support underneath of the fuel tank protector (15) with a lifter.
4. Disconnect evaporative fuel hose (3) at the canister.
5. Disconnect fuel feed hose (17) and fuel return hose (18) near the fuel filter.

NOTE: Plug both ends of the fuel hoses to prevent fuel leakage.

6. Disconnect air breather hose (4) and fuel filler hose (5) at the fuel filler neck.

NOTE: Cover fuel hose to prevent any dust entering.

7. Remove the four fuel tank assembly fixing bolts (14) at four corners of the tank.
8. Let down the tank and disconnect the wiring connectors (8,9).
9. Remove fuel tank assembly along with protectors (15,19) .
10. Remove retaining cover (2) and roll over & float valve (1) along with the evaporative fuel hose and pipe (3).

11. Remove Fuel Tube/Quick Connector (12).

NOTE: Handling of the fuel tube sure to refer "Fuel Tube/Quick Connector Fittings" in this section.

12. Remove fuel pump and sender assembly (10) by removing the snap ring (7) along with the fuel hoses (17,18).
13. Remove protectors (15,19) by removing the six fixing bolts (6).

Installation

1. Install protectors (15,19) and tighten the six fixing bolts to the specified torque.

   Torque: 68 N·m (50 lb ft)

2. Install fuel pump and sender assembly by fitting in of the snap ring (7).
3. Install Fuel Tube/Quick connector (12).

NOTE: Handling of the fuel tube sure to refer "Fuel Tube/Quick Connector Fittings" in this section.

4. Install roll over & float valve (1) by fitting in of the retaining cover (2).
5. Lift up fuel tank assembly and connect the wiring connectors (8,9).
6. Install fuel tank assembly along with protectors and tighten the four fixing bolts to the specified torque.

   Torque: 68 N·m (50 lb ft)

7. Connect fuel filler hose (5) and air breather hose (4), and clip them firmly.
8. Connect fuel feed hose (17) and fuel return hose (18), and clip them firmly.
9. Connect evaporative fuel hose (3).
10. Tighten fuel filler cap.
11. Connect battery ground cable.

Fuel Gauge Unit

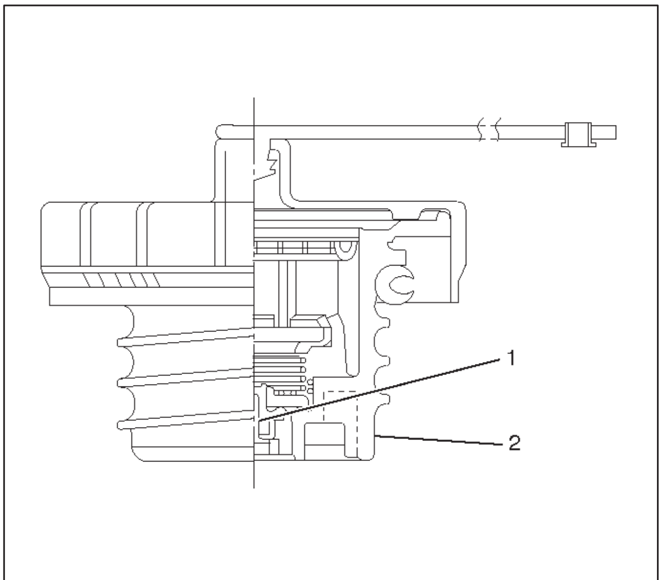
Removal and Installation

As for removal and installation of the Fuel Gauge Unit, refer to "Fuel Tank" of this section 6C as the fuel gauge unit is combined with the fuel pump and sender assembly.

Fuel Filler Cap

General Description

Fuel filler cap includes vacuum valve.
In case any high vacuum happen in tank, the valve works to adjust the pressure to prevent the tank from being damaged.



140RW014

Legend

(1) Vacuum Valve
(2) Fuel Filler Cap

Inspection

Check the seal ring in the filler cap for presence of any abnormality and for seal condition.
Replace the filler cap, if abnormal.

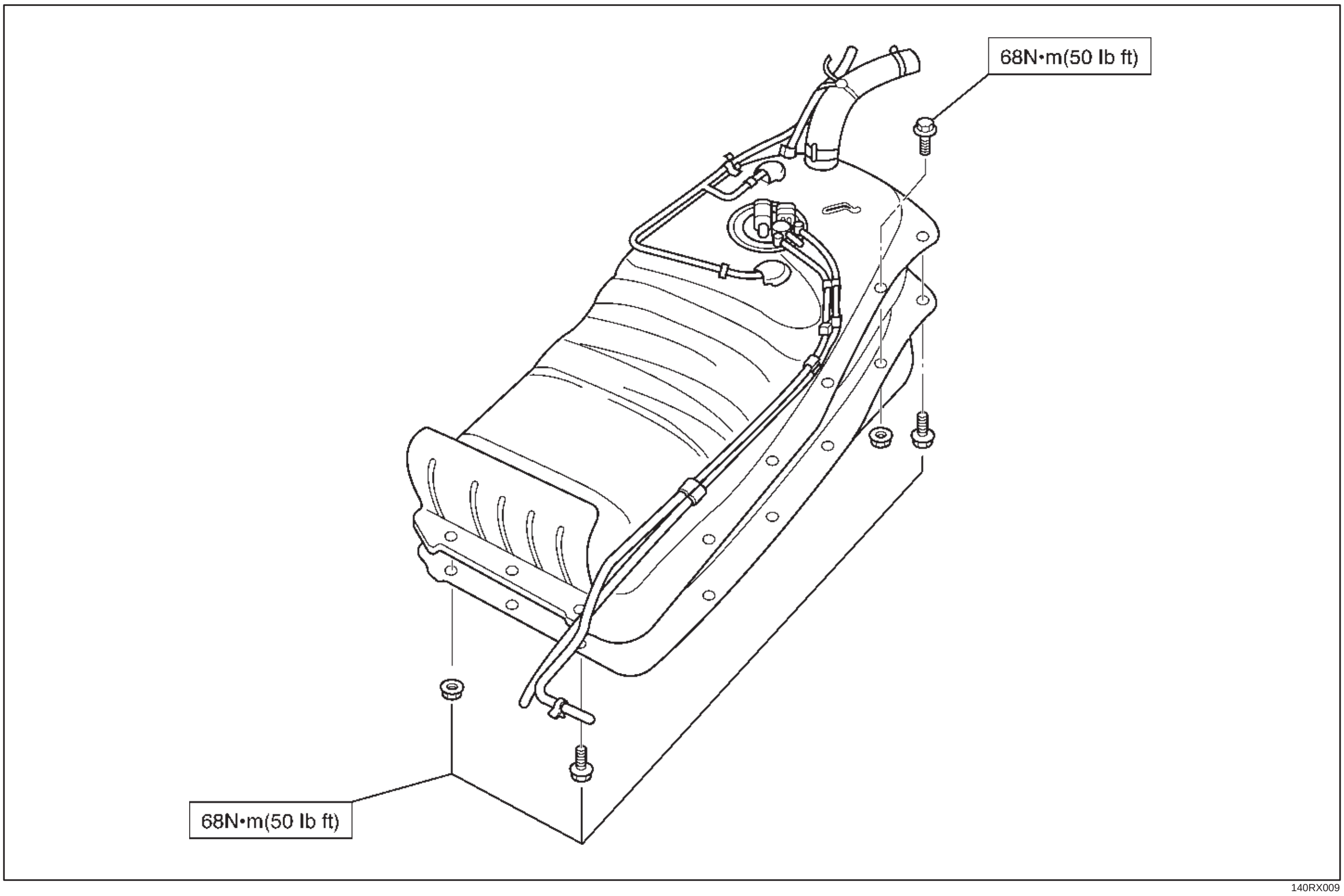
CAUTION:

The fuel filler cap valve has characteristics.

A defective valve, no valve at all or a valve with the wrong characteristics will do a lot of harm to engine operating characteristics; be sure to use the same fuel filler cap as installed in this vehicle.

Main Data and Specifications

Torque Specification



RODEO

ENGINE

ENGINE ELECTRICAL (6VD1 3.2L)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Battery

General Description

There are six battery fluid caps on the top of the battery. These are covered by a paper label.
The battery is completely sealed except for the six small vent holes on the side. These vent holes permit the escape of small amounts of gas generated by the battery.
This type of battery has the following advantages over conventional batteries:

1. There is no need to add water during the entire service life of the battery.
2. The battery protects itself against overcharging. The battery will refuse to accept an extensive charge. (A conventional battery will accept an excessive charge, resulting in gassing and loss of battery fluid.)
3. The battery is much less vulnerable to self discharge than a conventional type battery.

Diagnosis

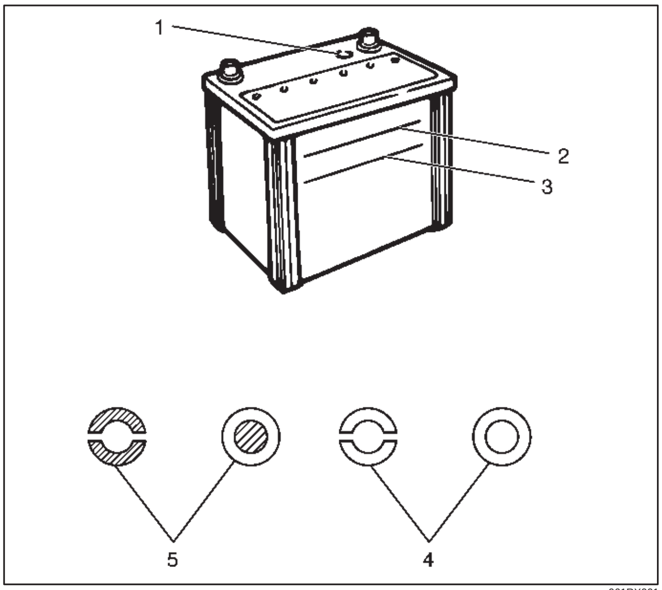
1. Visual Inspection

Inspect the battery for obvious physical damage, such as a cracked or broken case, which would permit electrolyte loss.
Replace the battery if obvious physical damage is discovered during inspection.
Check for any other physical damage and correct it as necessary.

2. Hydrometer Check

There is a built–in hydrometer (Charge test indicator(1)) at the top of the battery. It is designed to be used during diagnostic procedures.
Before trying to read the hydrometer, carefully clean the upper battery surface.
If your work area is poorly lit, additional light may be necessary to read the hydrometer.

a. BLUE RING OR DOT VISIBLE(5) – Go to Step 4.
b. BLUE RING OR DOT NOT VISIBLE(4) – Go to Step 3.

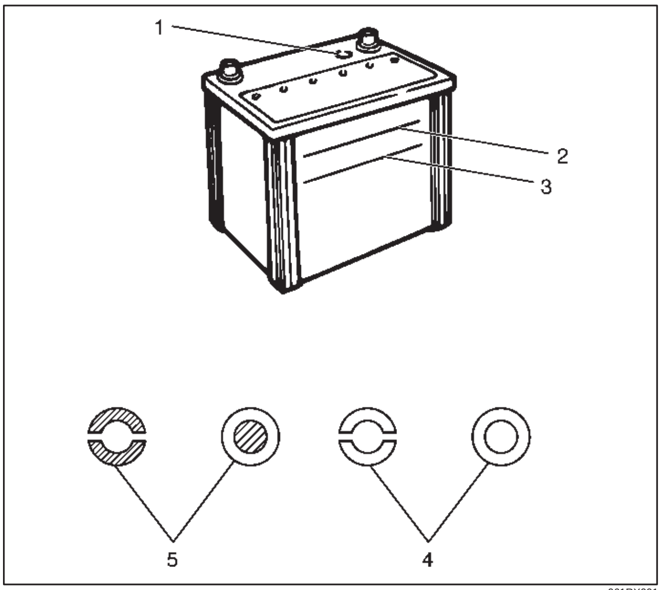


061RX001

3. Fluid Level Check

The fluid level should be between the upper level line(2) and lower level line(3) on side of battery.

a. CORRECT FLUID LEVEL – Charge the battery.
b. BELOW LOWER LEVEL – Replace battery.



061RX001

4. Voltage Check

1. Put voltmeter test leads to battery terminals.
   a. VOLTAGE IS 12.4V OR ABOVE – Go to Step 5.
   b. VOLTAGE IS UNDER 12.4V – Go to procedure (2) below.
2. Determine fast charge amperage from specification. (See Main Data and Specifications in this section).
   Fast charge battery for 30 minutes at amperage rate no higher than specified value.
   Take voltage and amperage readings after charge.
   a. VOLTAGE IS ABOVE 16V AT BELOW 1/3 OF AMPERAGE RATE – Replace battery.
   b. VOLTAGE IS ABOVE 16V AT ABOVE 1/3 OF AMPERAGE RATE – Drop charging voltage to 15V and charge for 10 – 15 hours. Then go to Step 5.
   c. VOLTAGE IS BETWEEN 12V AND 16V – Continue charging at the same rate for an additional 3–1/2 hours. Then go to Step 5.
   d. VOLTAGE BELOW 12V – Replace Battery.

5. Load Test

1. Connect a voltmeter and a battery load tester across the battery terminals.
2. Apply 300 ampere load for 15 seconds to remove surface charge from the battery. Remove load.
3. Wait 15 seconds to let battery recover. Then apply specified load from specifications (See Main Data and Specifications in this section).
   Read voltage after 15 seconds, then remove load.
   a. VOLTAGE DOES NOT DROP BELOW THE MINIMUM LISTED IN THE TABLE – The battery is good and should be returned to service.
   b. VOLTAGE IS LESS THAN MINIMUM LISTED – Replace battery.

ESTIMATED TEMPERATURE		MINIMUM VOLTAGE
˚F	˚C	V
70	21	9.6
60	16	9.5
50	10	9.4
40	4	9.3
30	–1	9.1
20	–7	8.9
10	–12	8.7
0	–18	8.5
The battery temperature must be estimated by feel and by the temperature the battery has been exposed to for the preceding few hours.		

Battery Charging

Observe the following safety precautions when charging the battery:

1. Never attempt to charge the battery when the fluid level is below the lower level line on the side of the battery. In this case, the battery must be replaced.
2. Pay close attention to the battery during charging procedure.
   Battery charging should be discontinued or the rate of charge reduced if the battery feels hot to the touch.
   Battery charging should be discontinued or the rate of charge reduced if the battery begins to gas or spew electrolyte from the vent holes.
3. In order to more easily view the hydrometer blue dot or ring, it may be necessary to jiggle or tilt the battery.
4. Battery temperature can have a great effect on battery charging capacity.
5. The sealed battery used on this vehicle may be either quick charged or slow charged in the same manner as other batteries.
   Whichever method you decide to use, be sure that you completely charge the battery. Never partially charge the battery.

Jump Starting

Jump Starting with an Auxiliary (Booster) Battery

CAUTION: Never push or tow the vehicle in an attempt to start it. Serious damage to the emission system as well as other vehicle parts will result.

Treat both the discharged battery and the booster battery with great care when using jumper cables. Carefully follow the jump starting procedure, being careful at all times to avoid sparking.

WARNING: FAILURE TO CAREFULLY FOLLOW THE JUMP STARTING PROCEDURE COULD RESULT IN THE FOLLOWING:

1. Serous personal injury, particularly to your eyes.
2. Property damage from a battery explosion, battery acid, or an electrical fire.
3. Damage to the electronic components of one or both vehicles particularly.

Never expose the battery to an open flame or electrical spark. Gas generated by the battery may catch fire or explode.

Remove any rings, watches, or other jewelry before working around the battery. Protect your eyes by wearing an approved set of goggles.

Never allow battery fluid to come in contact with your eyes or skin.

Never allow battery fluid to come in contact with fabrics or painted surfaces.

Battery fluid is a highly corrosive acid.

Should battery fluid come in contact with your eyes, skin, fabric, or a painted surface, immediately and thoroughly rinse the affected area with clean tap water.

Never allow metal tools or jumper cables to come in contact with the positive battery terminal, or any other metal surface of the vehicle. This will protect against a short circuit.

Always keep batteries out of reach of young children.

Jump Starting Procedure

1. Set the vehicle parking brake.
   If the vehicle is equipped with an automatic transmission, place the selector level in the “PARK” position.
   If the vehicle is equipped with a manual transmission, place the shift lever in the “NEUTRAL” position.
   Turn “OFF” the ignition.
   Turn “OFF” all lights and any other accessory requiring electrical power.
2. Look at the built–in hydrometer.
   If the indication area of the built–in hydrometer is completely clear, do not try to jump start.

3. Attach the end of one jumper cable to the positive terminal of the booster battery.

   Attach the other end of the same cable to the positive terminal of the discharged battery.

   Do not allow the vehicles to touch each other. This will cause a ground connection, effectively neutralizing the charging procedure.

   Be sure that the booster battery has a 12 volt rating.
4. Attach one end of the remaining cable to the negative terminal of the booster battery.

   Attach the other end of the same cable to a solid engine ground (such as the air conditioning compressor bracket or the generator mounting bracket) of the vehicle with the discharged battery.

   The ground connection must be at least 450 mm (18 in.) from the battery of the vehicle whose battery is being charged.

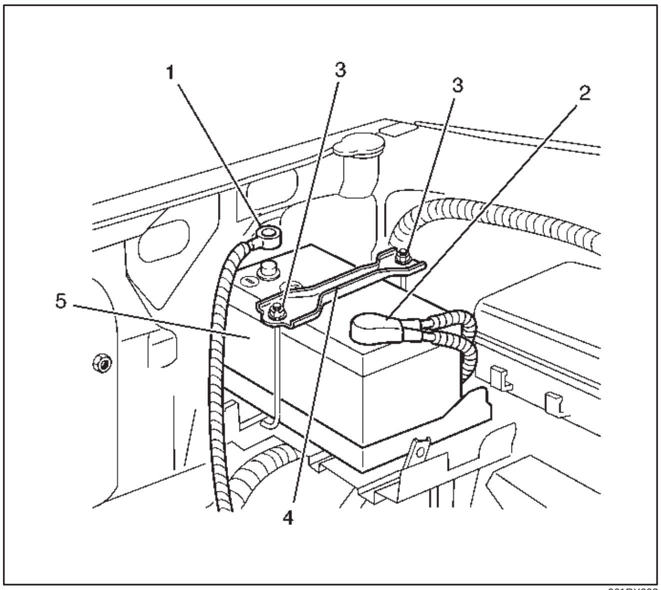
WARNING: NEVER ATTACH THE END OF THE JUMPER CABLE DIRECTLY TO THE NEGATIVE TERMINAL OF THE DEAD BATTERY.

5. Start the engine of the vehicle with the good battery.

   Make sure that all unnecessary electrical accessories have been turned “OFF”.
6. Start the engine of the vehicle with the dead battery.
7. To remove the jumper cables, follow the above directions in reverse order.

   Be sure to first disconnect the negative cable from the vehicle with the discharged battery.

Battery Removal



061RX002

1. Remove negative cable (1).
2. Remove positive cable (2).
3. Remove retainer screw and rods (3).
4. Remove retainer (4).
5. Remove battery (5).

Battery Installation

1. Install battery (5).
2. Install retainer (4).
3. Install retainer screw and rods (3).

NOTE: Make sure that the rod is hooked on the body side.

4. Install positive cable (2).
5. Install negative cable (1).

Main Data and Specifications

General Specifications

Model	24R–600
Voltage (V)	12
Cold–Cranking Performance (Amp)	600
Reserve Capacity (Min)	118
Load Test (Amp)	300
BCI Group No.	24

RODEO

ENGINE

IGNITION SYSTEM (6VD1 3.2L)

CONTENTS

Service Precaution

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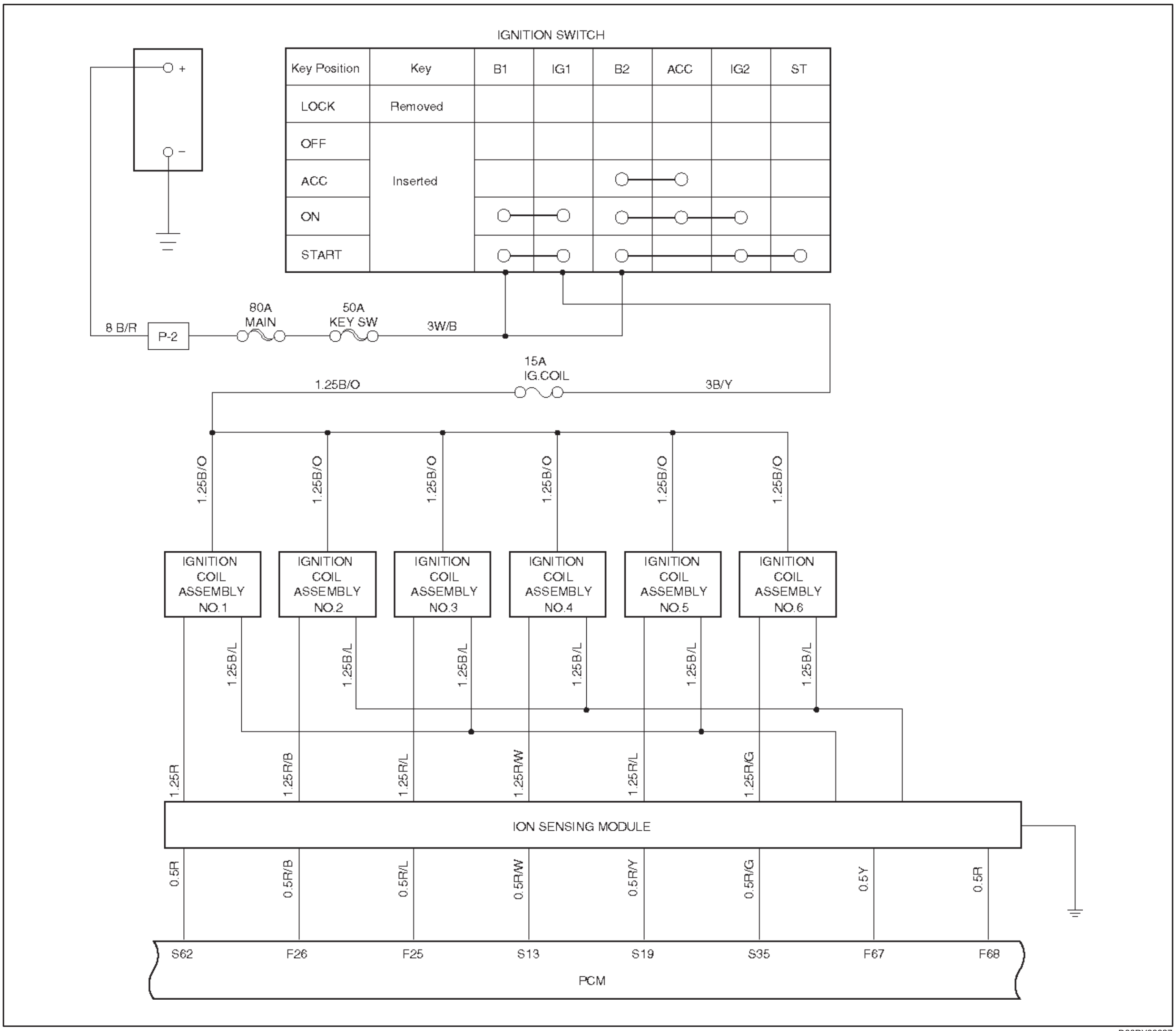
General Description

Ignition is done by the electronic ignition (EI) that directly fires the spark plugs from ignition coils through spark plug wires without using a distributor. The firing orders are selected No.1, No.2, No.3, No.4, No.5, and No6.
Since the cylinder on exhaust stroke requires less energy to fire its ignition plug, energy from the ignition coils can be utilized to fire the mating cylinder on compression stroke. After additional 360° rotation, respective cylinder strokes are reversed.
The EI consists of six ignition coils,ignition control module, crank position sensor, powertrain control module (PCM) and other components.
The ignition coils are connected with the PCM by means of a 80 pin connector.
The ignition control module turns on/off the primary circuit of ignition coils, and also it controls the ignition timing at the engine speed below 538 rpm.
A notch in the timing disc on the crankshaft activates the crank position sensor which then sends information such as firing order and starting timing of each ignition coil to the PCM.
Further, the EI employs ignition control (IC) to control similar to a distributor system.
By receiving signals such as crank position,engine speed, water temperature and Manifold Absolute Pressure (MAP), the PCM controls the ignition timing.



D06RY00037

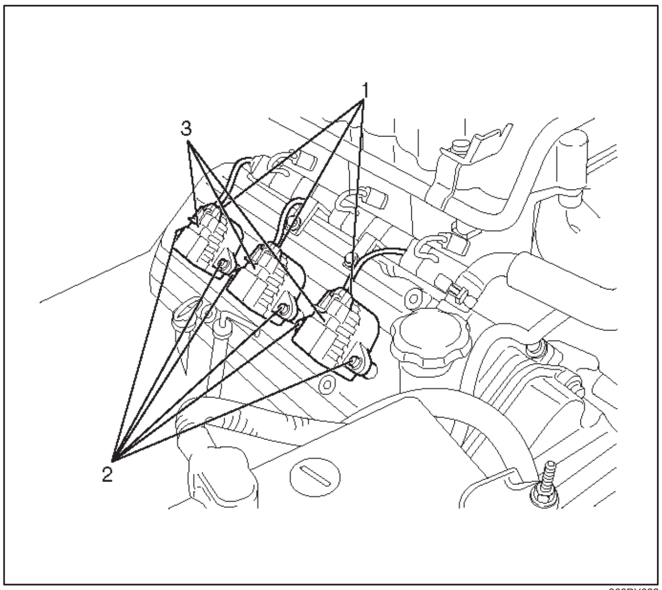
Diagnosis

Refer to Section Drivability and Emissions for the diagnosis to electronic ignition system (EI system).

Ignition Coil

Removal

1. Disconnect battery ground cable.
2. Ignition coil connector and ignition coil.
   - Disconnect three connector from ignition coil.
   - Remove harness bracket bolt on cylinder head cover.
   - Remove fixing bolts on ignition coil.



060RY023

Legend

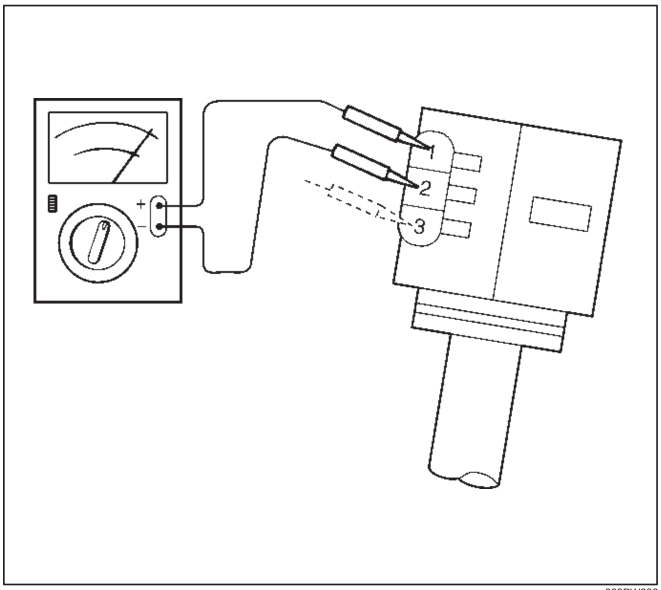
(1) Ignition Coil Connector
(2) Bolt
(3) Ignition Coil Assembly

Inspection and Repair

Check the ignition coil assembly for insulation. Check terminals for corrosion or damage, and replace as necessary.
Measuring resistance of ignition coil assembly.

Terminal No.	Limit
1 to 2	Without 0 ohm or infinity maximum ohm.
1 to 3	Same as above
2 to 3	Same as above

Measure resistance of ignition coil assembly, and replace the ignition coil assembly if its value exceeds the standard.

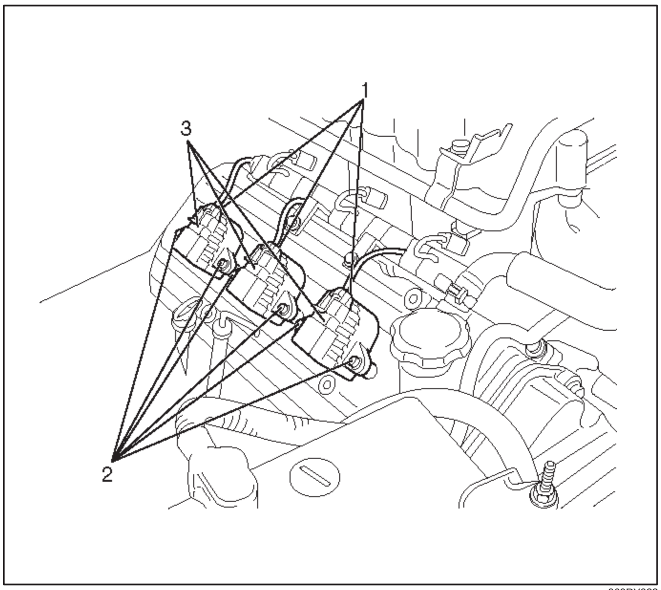


060RW006

Installation

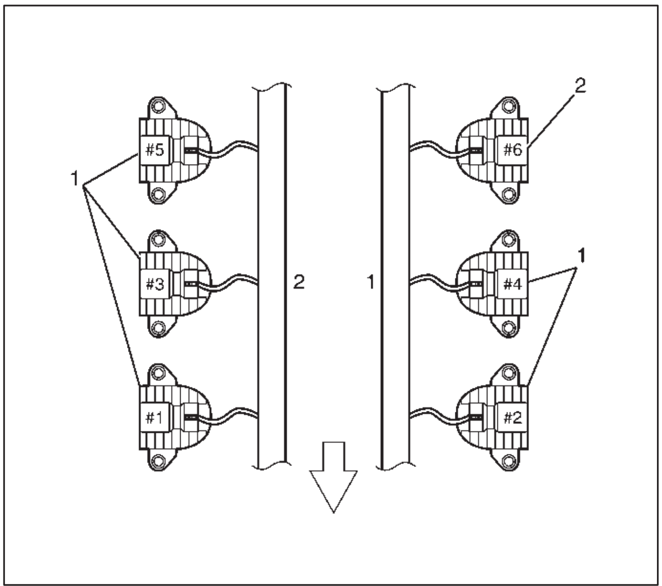
1. Install the ignition coil assembly (3).
   Connect ignition coil connector (1) and ignition coil (3), then tighten bolt (2) to the specified torque.

Torque: 4 N·m (35.4 lb in)



060RY023

CAUTION: Ignition coil assembly #6 is different from ignition coil assembly from #1 to #5. Ignition coil assembly #6 is short type. So, note it when installing ignition coil assembly of #6.



060RY00002

Legend

(1) Long Type Ignition Coil Assemblies (#1 ~ #5)
(2) Short Type Ignition Coil Assembly (#6)

2. Connect battery ground cable.

Spark Plug

Removal

1. Remove spark plugs.

Inspection and Repair

The spark plug affects entire engine performance and therefore its inspection is very important.

- Check electrode and insulator for presence of cracks, and replace if any.
- Check electrode for wear, and replace if necessary.
- Check gasket for damage, and replace if necessary.
- Measure insulation resistance with an ohmmeter, and replace if faulty.
- Adjust spark plug gap to 1.0 mm (0.04 in) ~ 1.1 mm (0.043 in).
- Check fuel and electrical systems if spark plug is extremely dirty.
- Use spark plugs having low heat value (hot type plug) if fuel and electrical systems are normal.
- Use spark plugs having high heat value (cold type plug) if insulator and electrode are extremely burned.

Sooty Spark Plugs

Much deposit of carbon or oil on the electrode and insulator of spark plug reduces the engine performance.

Possible causes:

- Too rich mixture
- Presence of oil in combustion chamber
- Incorrectly adjusted spark plug gap

Burning Electrodes

This fault is characterized by scorched or heavily oxidized electrode or blistered insulator nose.

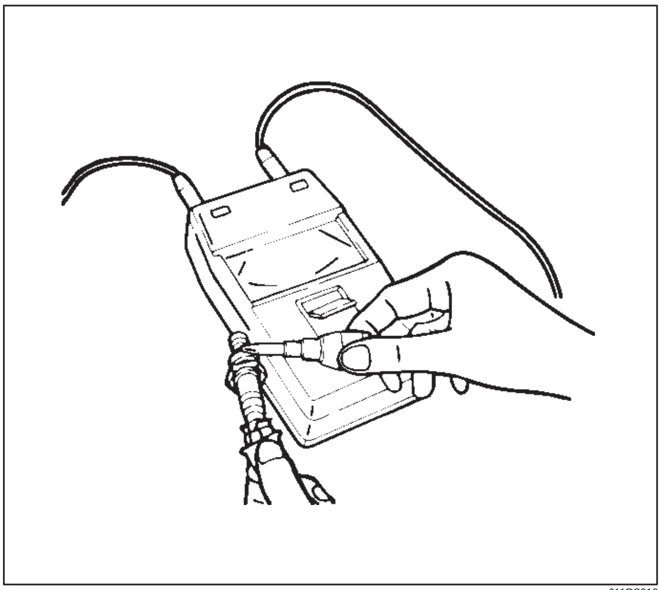
Possible causes:

- Too lean mixture
- Improper heat value

Measuring Insulation Resistance

- Measure insulation resistance using a 500 volt megaohm meter.
- Replace spark plugs if measured value is out of standard.

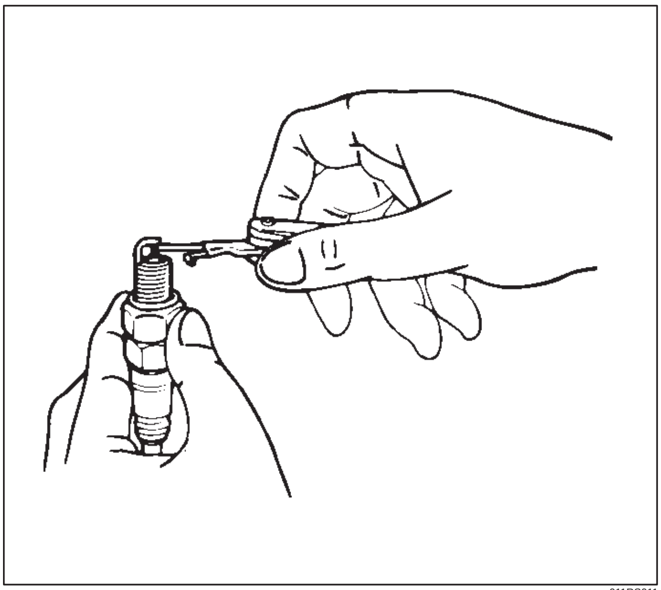
Insulation resistance: 50 MΩ or more



011RS010

Cleaning Spark Plugs

- Clean spark plugs with a spark plug cleaner.
- Raise the ground electrode to an position of 45 to 60 degrees. If electrode is wet, dry it before cleaning.
- After spark plug is thoroughly cleaned, check insulator for presence of cracks.
- Clean threads and metal body with a wire brush.
- File the electrode tip if electrode is extremely worn.
- Bend the ground electrode to adjust the spark plug gap.



011RS011

Installation

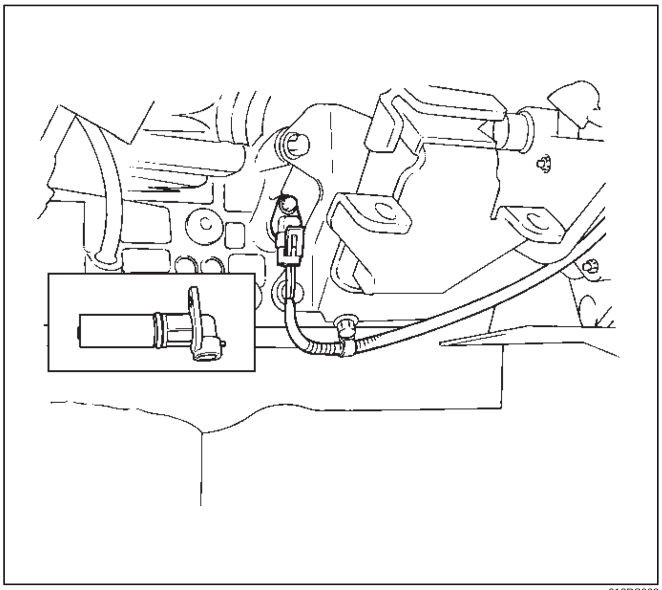
1. Spark plugs
   - Tighten spark plugs to the specified torque.

Torque: 18 N·m (13 lb ft)

Crankshaft Position Sensor

Removal

1. Disconnect battery ground cable
2. Wiring connector from crankshaft position sensor.
3. Remove crankshaft position sensor from cylinder block.



012RS008

Installation

1. Install crankshaft position sensor into the cylinder block.

   Before installation,apply small amount of engine oil to the O–ring.

   Torque: 10 N·m (89 lb in)

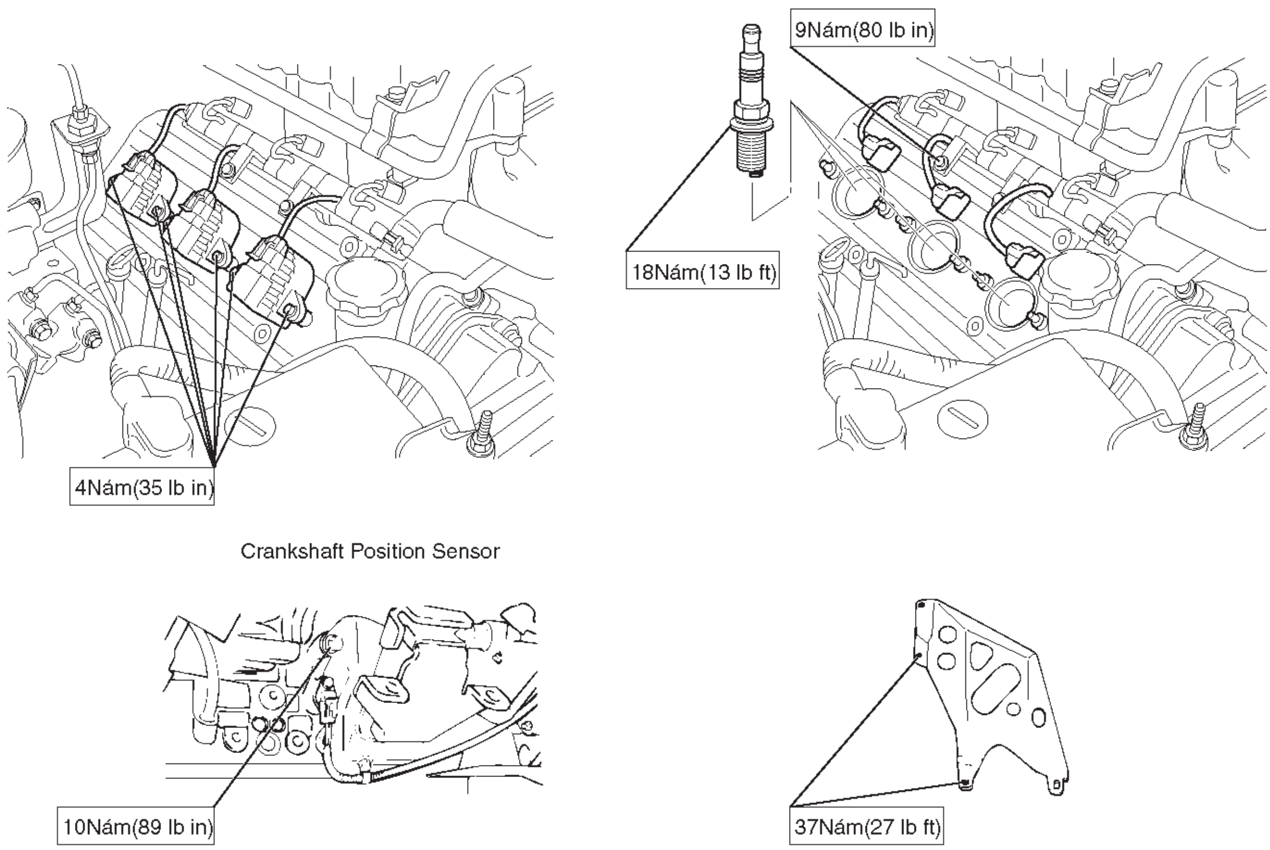
2. Reconnect wiring connector to crankshaft position sensor.

Main Data and Specifications

General Specifications

Ignition System	
Ignition Form	Electronic Ignition System (El system) with Crankshaft position Sensor
Spark Plug	
Type	K16PR–P11 RC10PYP4 PK16PR11
Plug gap	1.0 mm (0.04 in) – 1.1 mm (0.043 in)
Torque	18 N·m (13lb ft)

Torque Specifications



E06RY001

RODEO

ENGINE

STARTING AND CHARGING SYSTEM (6VD1 3.2L)

CONTENTS

Service Precaution

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Starting System

General Description

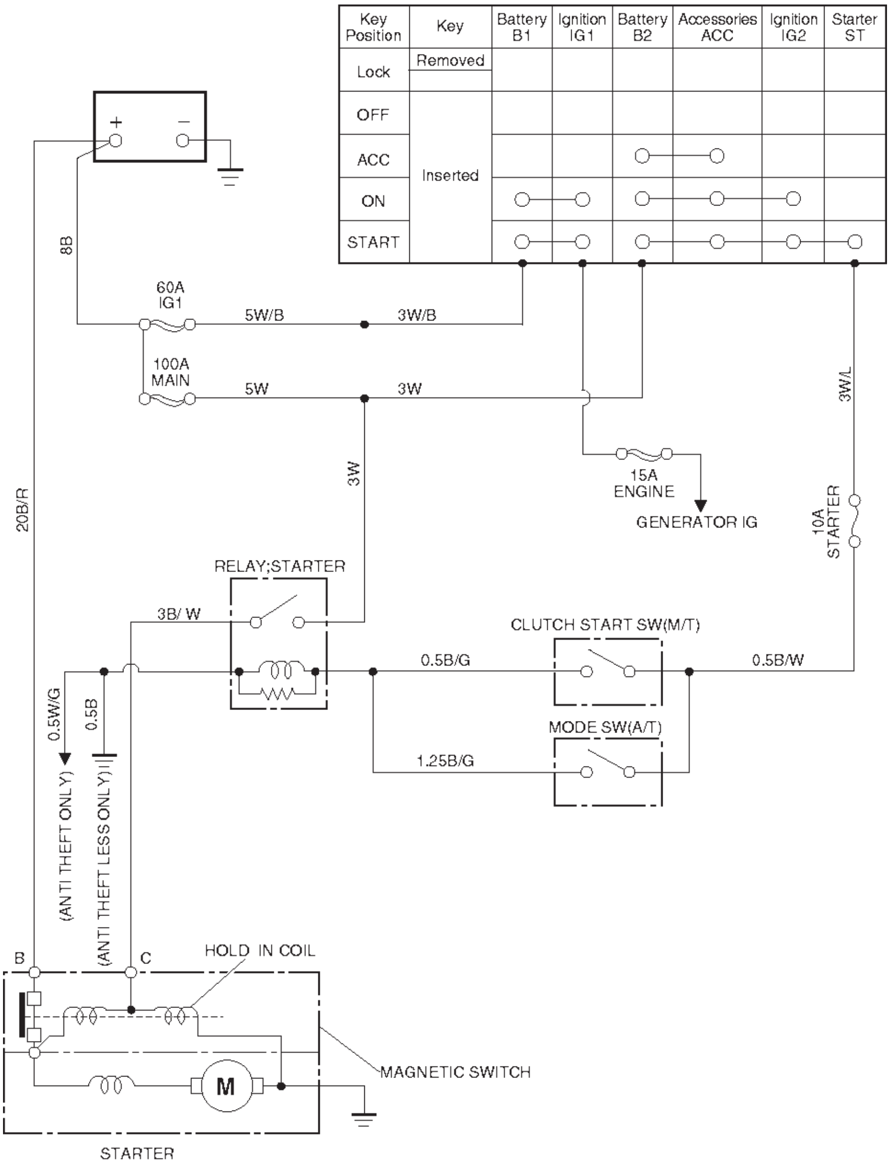
Cranking Circuit

The cranking system consists of a battery, starter, starter switch, starter relay, etc. These main components are connected.

Starter

The cranking system employs a magnetic type reduction starter in which the motor shaft is also used as a pinion shaft. When the starter switch is turned on, the contacts of magnetic switch are closed, and the armature rotates. At the same time, the plunger is attracted, and the pinion is pushed forward by the shift lever to mesh with the ring gear.

Then, the ring gear runs to start the engine. When the engine starts and the starter switch is turned off, the plunger returns, the pinion is disengaged from the ring gear, and the armature stops rotation. When the engine speed is higher than the pinion, the pinion idles, so that the armature is not driven.


Key Position
Key
Battery B1
Ignition IG1
Battery B2
Accessories ACC
Ignition IG2
Starter ST
Lock
Removed
OFF
Inserted
ACC
ON
START
+
–
8B
60A IG1
5W/B
3W/B
100A MAIN
5W
3W
3W
15A ENGINE
GENERATOR IG
3W/L
10A STARTER
20B/R
RELAY;STARTER
3B/ W
CLUTCH START SW(M/T)
0.5B/G
0.5B/W
MODE SW(A/T)
1.25B/G
0.5W/G
0.5B
(ANTI THEFT ONLY)
(ANTI THEFT LESS ONLY)
B
C
HOLD IN COIL
M
MAGNETIC SWITCH
STARTER

C06RY00003

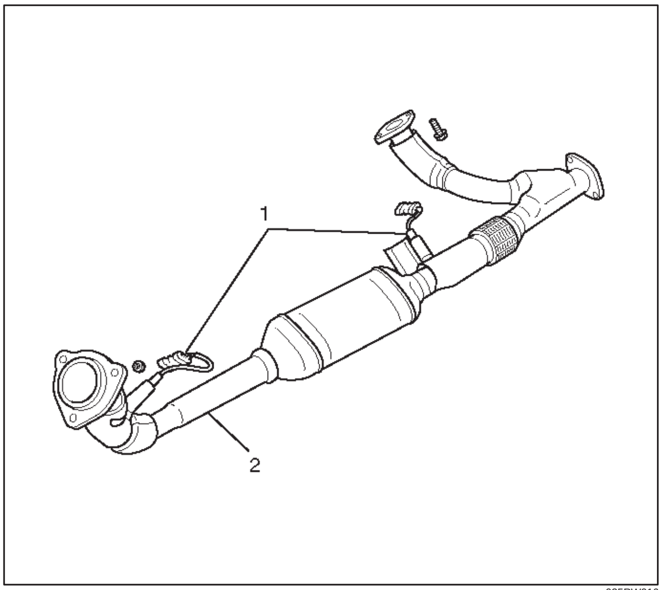
Diagnosis

Condition	Possible cause	Correction
Starter does not run	Charging failure	Repair charging system
	Battery Failure	Replace Battery
	Terminal connection failure	Repair or replace terminal connector and/or wiring harness
	Starter switch failure	Repair or replace starter switch
	Starter failure	Repair or replace starter

Starter

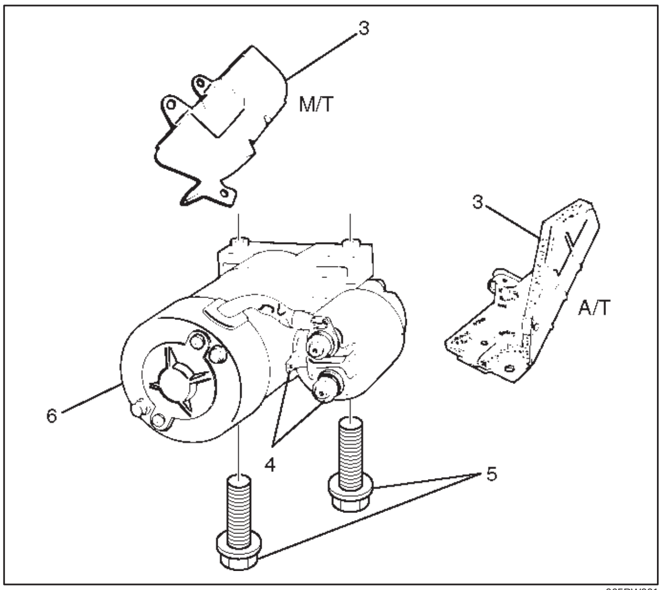
Removal

1. Battery ground cable.
2. Disconnect Heated O_2 Sensor connector (1).
3. Remove exhaust front left pipe(2).



035RW016

4. Remove heat protector(3).
5. Disconnect starter wiring connector from terminals “B” and “S”(4).
6. Remove starter assembly mounting bolts on inside and outside(5).
7. Remove starter assembly toward the bottom of engine(6).



065RW001

Installation

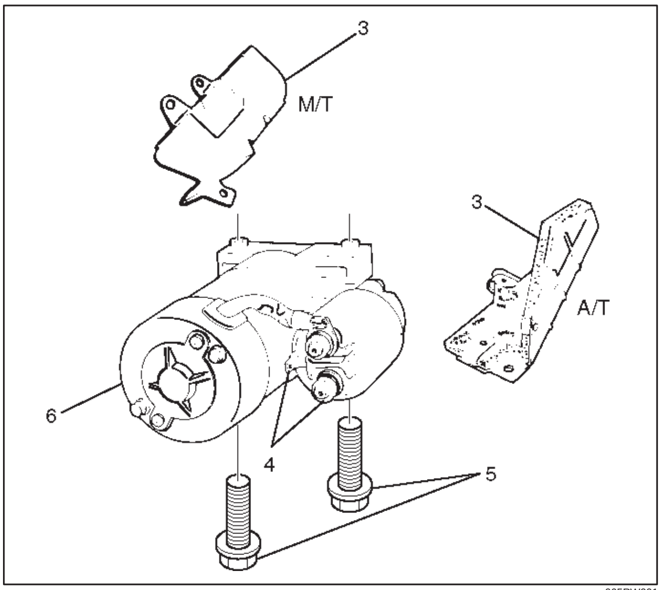
1. Install starter assembly(6).
2. Install mounting bolts and tighten bolts to specified torque(5).

Torque: 40 N·m (30 lb ft)

3. Reconnect the connectors to terminals “B” and “S” and tighten Terminals “B” to specified torque.

Torque: 9 N·m (80 lb in)

4. Install heat protector(3).



065RW001

5. Install exhaust front left pipe and tighten bolts and nuts to specified torque(2).

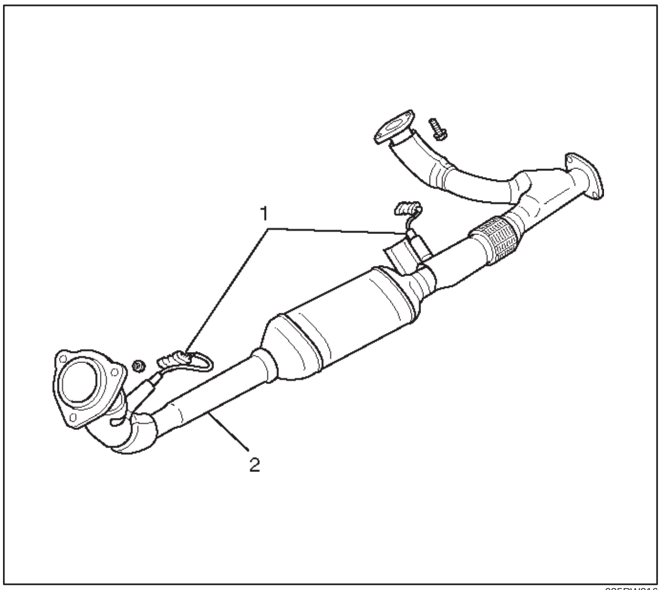
Stud Nuts

Torque: 67 N·m (49 lb ft)

Nuts

Torque: 43 N·m (32 lb ft)

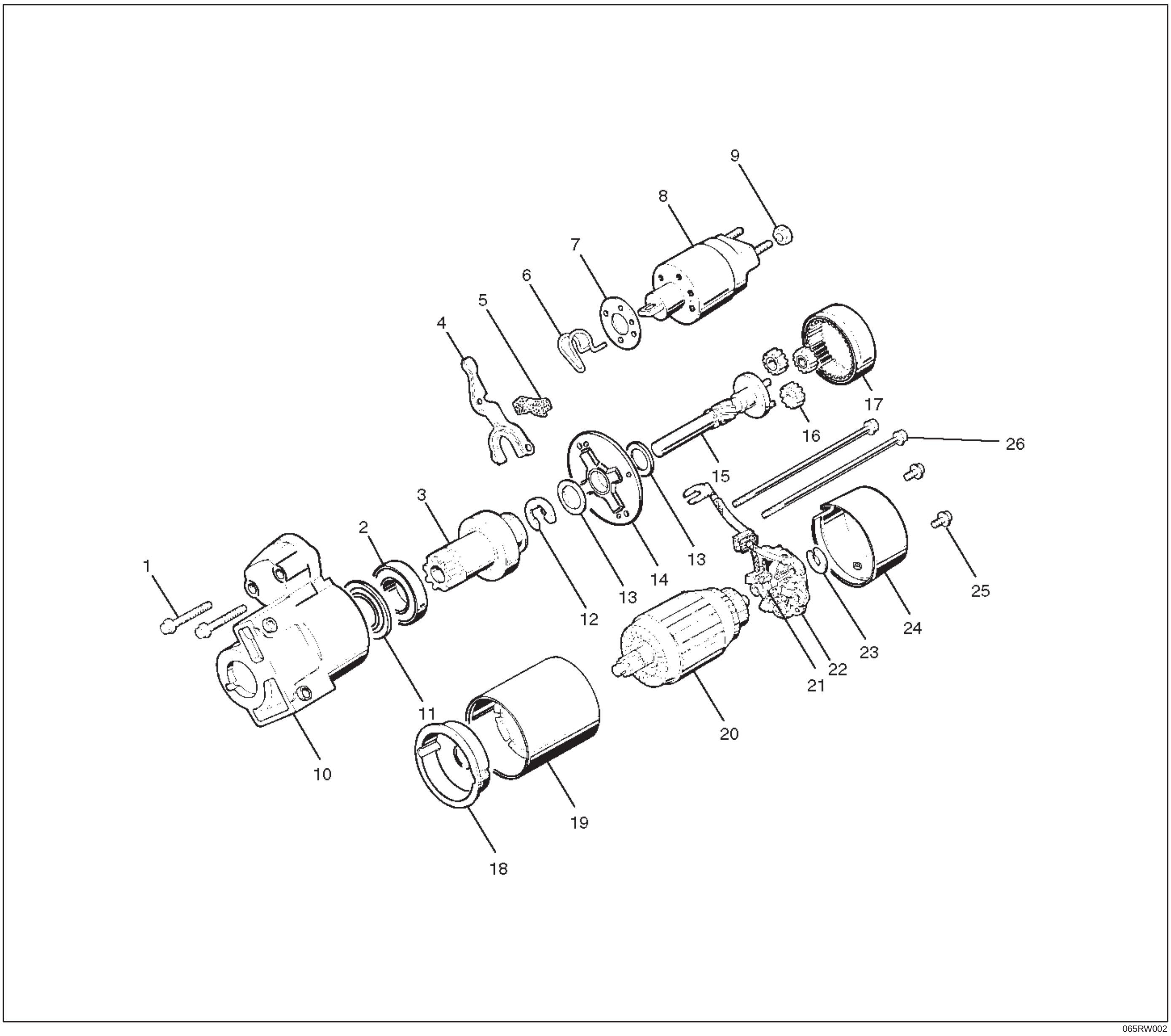
6. Connect Heated O_2 Sensor connector (1).



035RW016

7. Reconnect the battery ground cable.

Disassembled View

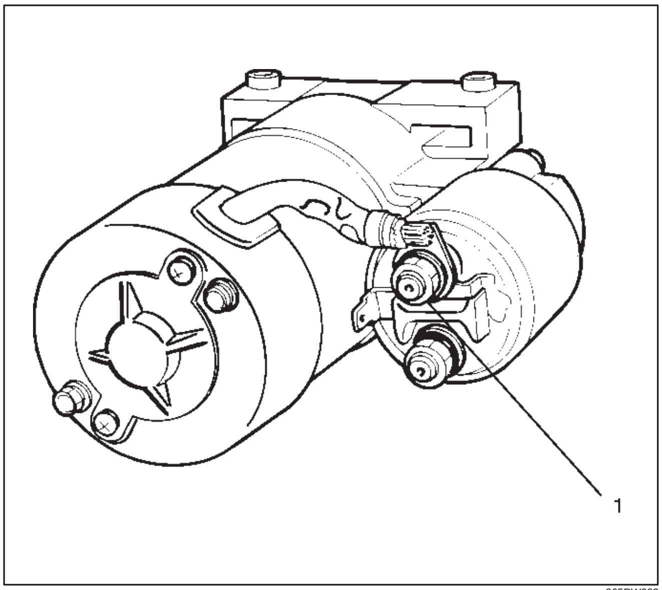


Legend

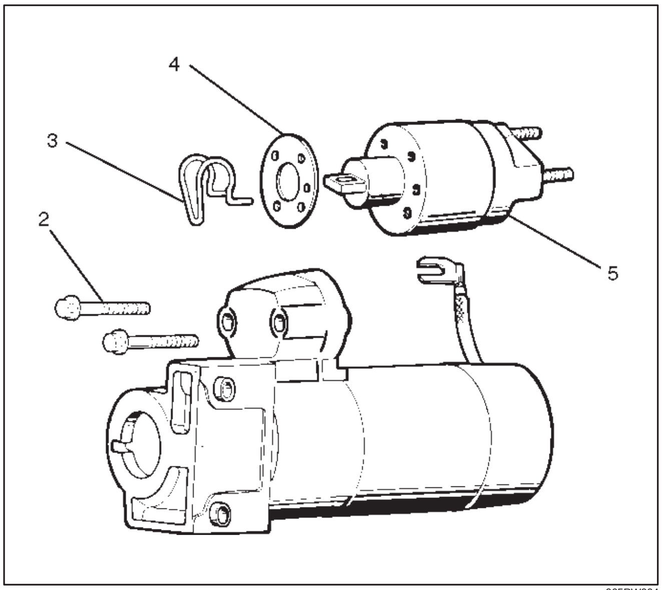
(1) Bolt (2 pcs)
(2) Ball Bearing
(3) Pinion
(4) Shift Lever
(5) Dust Cover
(6) Torsion Spring
(7) Dust Cover
(8) Magnetic Switch
(9) Nut
(10) Gear Case
(11) Bearing Cover
(12) E–ring
(13) Thrust Washer (2)
(14) Center Bracket
(15) Pinion Shaft
(16) Planet Gear (3)
(17) Internal Gear
(18) Center Bracket (A)
(19) Yoke Assembly
(20) Armature
(21) Brush
(22) Brush Holder
(23) Thrust Washer
(24) Rear Cover
(25) Screw (2 pcs)
(26) Through Bolt (2 pcs)

Disassembly

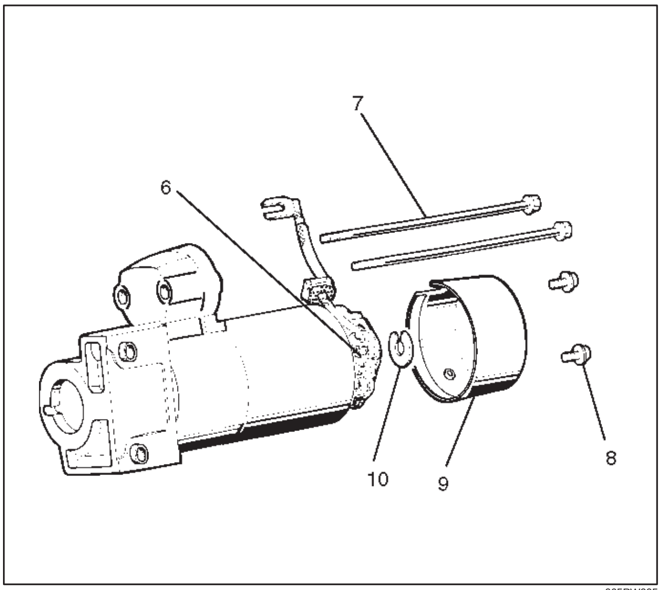
1. Loosen the nut(1) on terminal “M” of magnetic switch and disconnect the connector cable.
2. Remove bolt (2 pcs) (2).



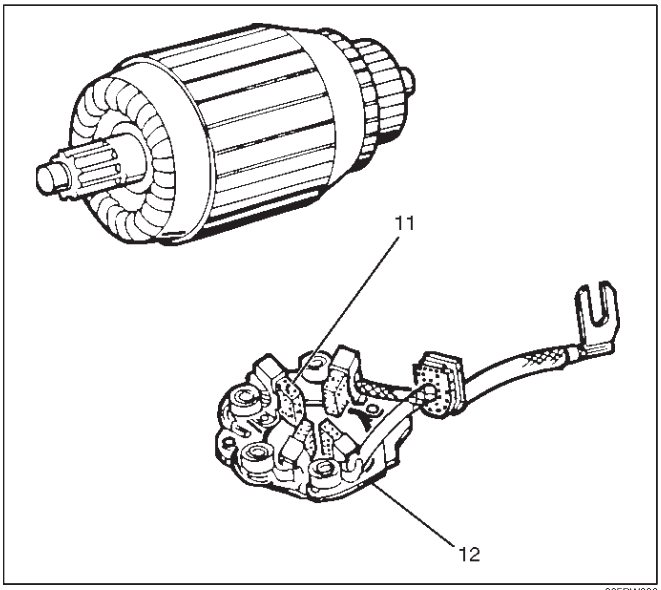
3. Remove magnetic switch(5).
4. Remove dust cover(4).
5. Remove torsion spring bolts, then the magnetic switch assembly.
6. Remove torsion spring(3) from magnetic switch assembly(5).



7. Remove screw (2 pcs) (8).
8. Remove through bolt (2 pcs) (7).
9. Remove screws and through bolts, then the rear cover(9) then remove thrust washer(10).
10. Remove brush holder(6).

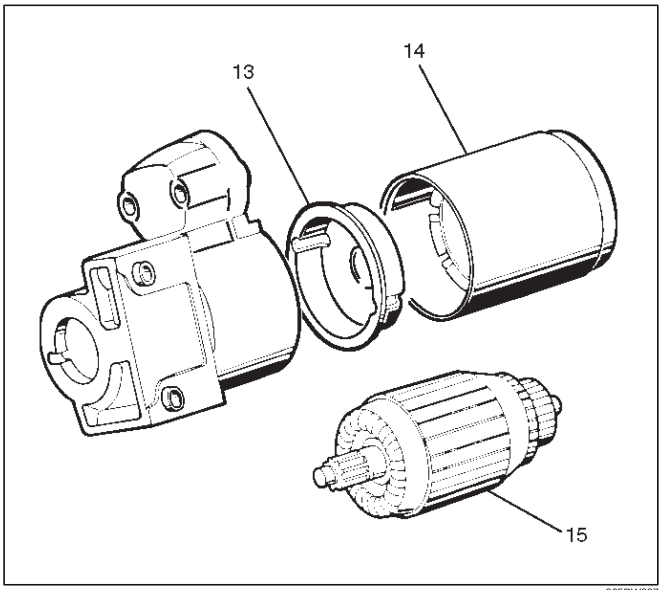


11. Raise a brush spring to detach brushes (4 pcs) from the commutator face and pull off the brush holder(12) and brush(11).



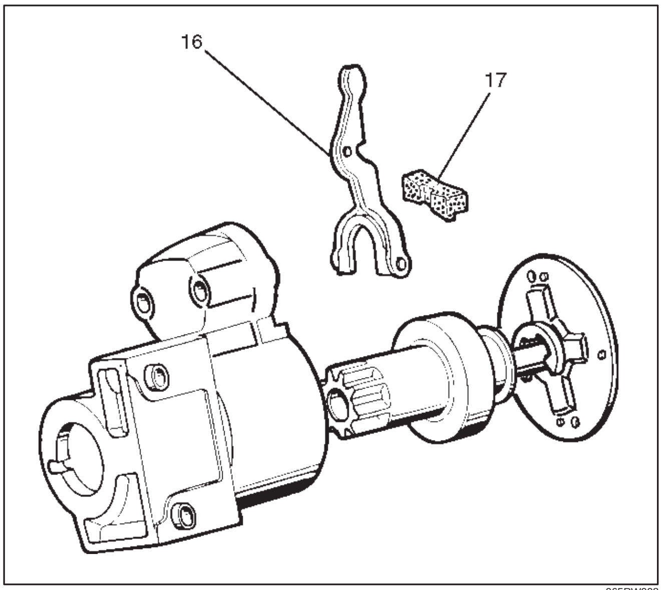
12. Remove yoke assembly(14).
13. Remove armature(15).
14. Pull off the yoke assembly, then remove armature, washer and center bracket.(A) (13).

NOTE: In disassembling the yoke assembly, hold the armature and pull off slowly the yoke assembly. Because of strong magnetic force, avoid placing a metallic part near armature.



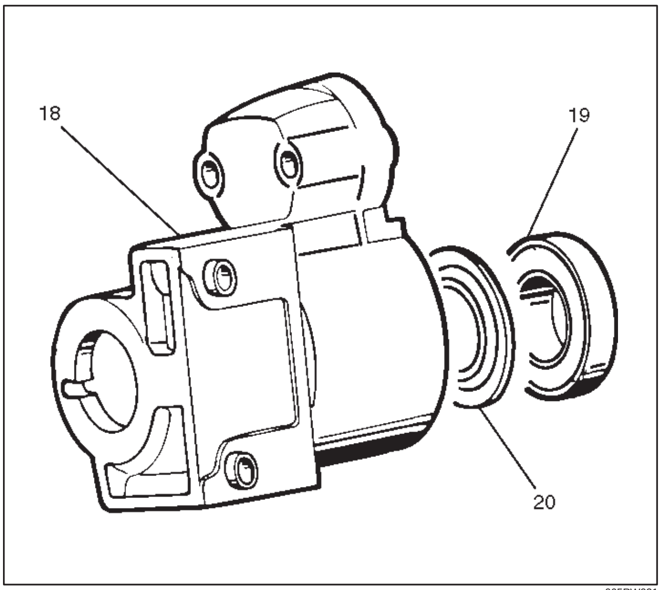
065RW007

15. Remove dust cover(17).
16. Remove a dust cover and shift lever(16) from the gear case.



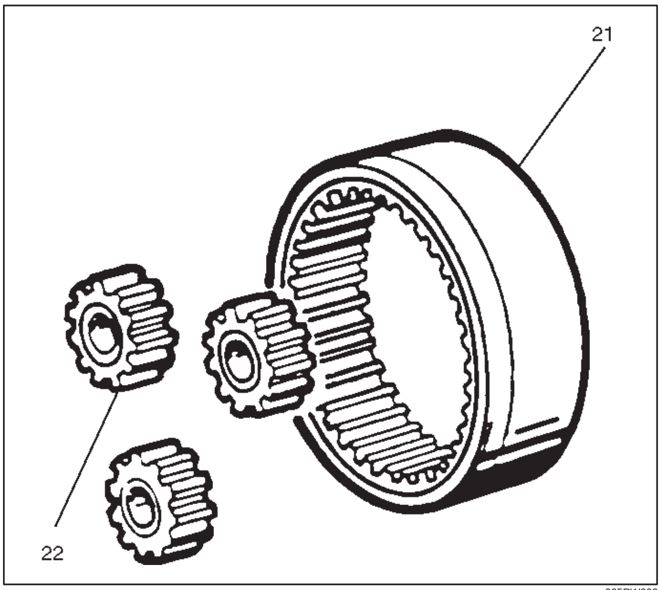
065RW008

17. Remove ball bearing(19).
18. Remove bearing cover(20).
19. Remove a ball bearing and bearing cover from the gear case(18).



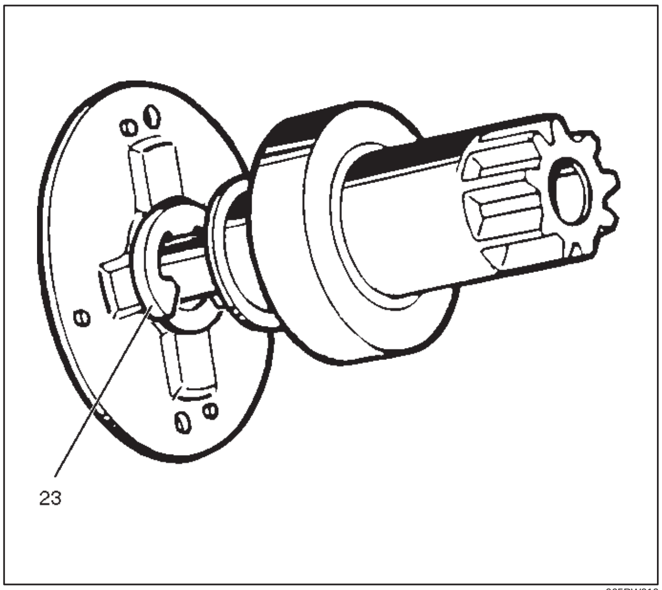
065RW021

20. Internal gear(21).
21. Remove internal gear and planet gear(3) (22).



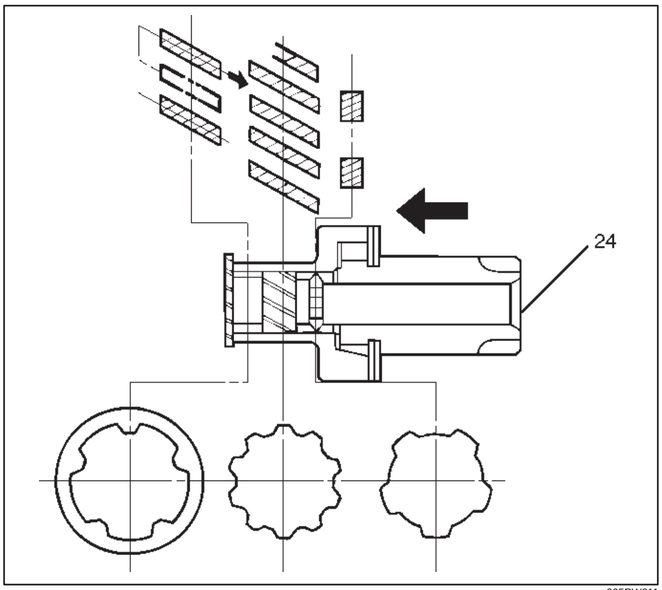
065RW009

22. Remove an E–ring(23) from the pinion shaft using a flat blade screwdriver.



065RW010

23. Holding the pinion shaft, push pinion toward the center bracket and turn the pinion clockwise or counterclockwise by one tooth of spline, then pull off the pinion.
24. Remove thrust washer(24).
25. Remove center bracket
26. Remove pinion shaft.



065RW011

Inspection and Repair

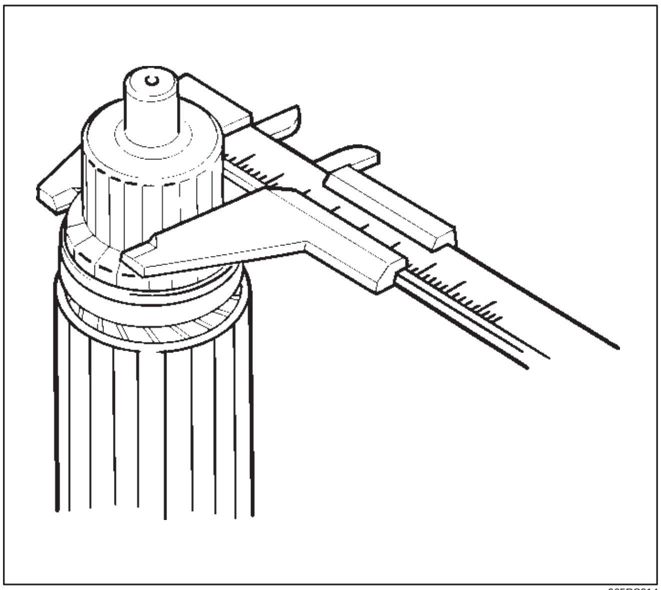
Repair or replace necessary parts if extreme wear or damage is found during inspection.

Armature

Measure the outer diameter of commutator, and replace with a new one if it is out of the limit.

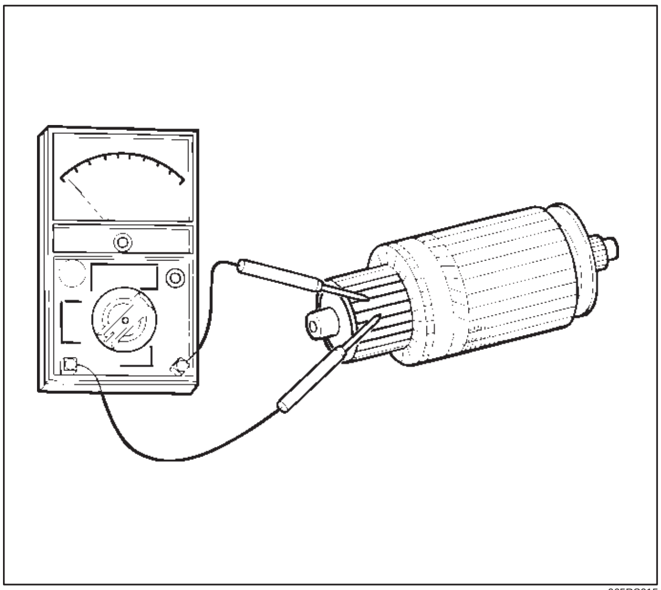
Standard: 33.0 mm (1.30 in)

Limit: 32.0 mm (1.26 in)



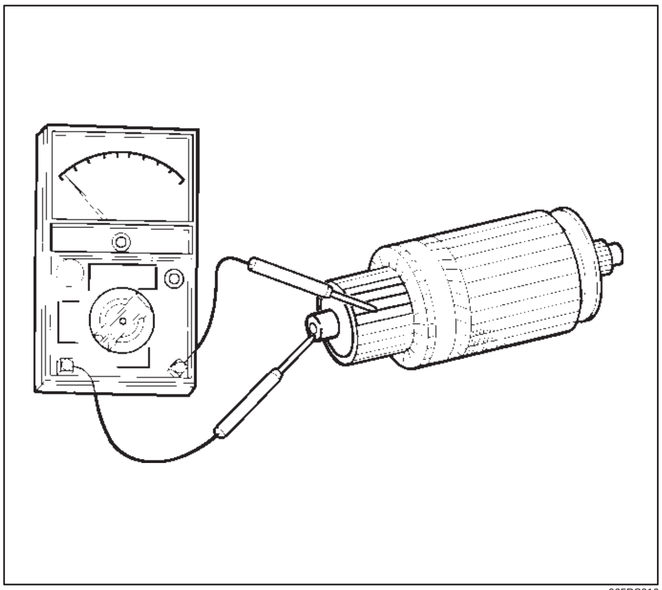
065RS014

Check for continuity between commutator and segment. Replace commutator if there is no continuity (i.e., disconnected).



065RS015

Check for continuity between commutator and shaft. Also, check for continuity between commutator and armature core,armature core and shaft. Replace commutator if there is continuity (i.e., internally grounded).



065RS016

Measure runout of armature core and commutator with a dial gauge. Repair or replace, if it exceeds the limit.

Armature

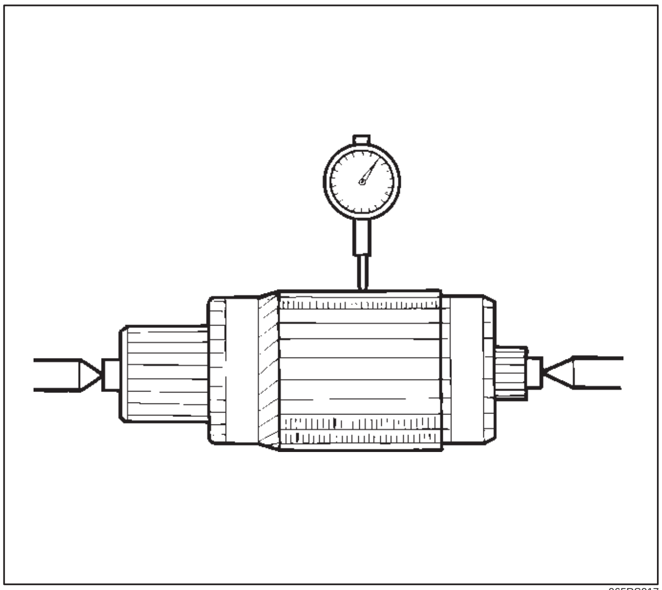
Standard: 0.05 mm (0.002 in) Max.

Limit: 0.10 mm (0.004 in)

Commutator

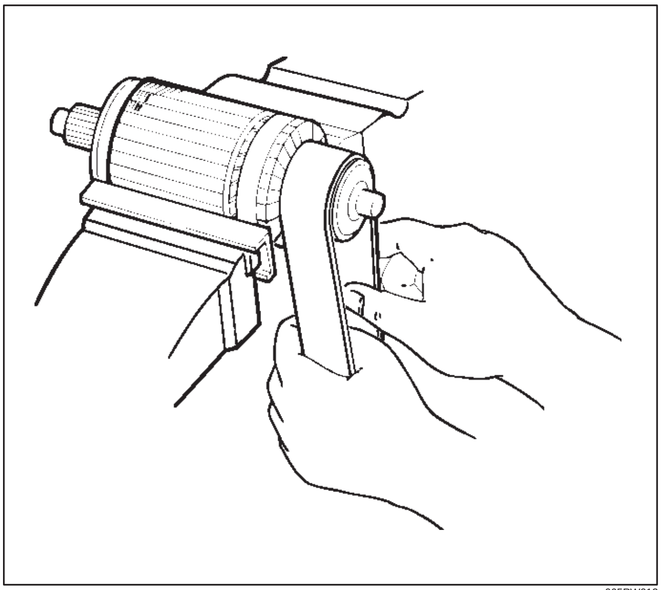
Standard: 0.05 mm (0.002 in) Max.

Limit: 0.10 mm (0.004 in)



065RS017

Polish the commutator surface with sandpaper #500 to #600 if it is rough.

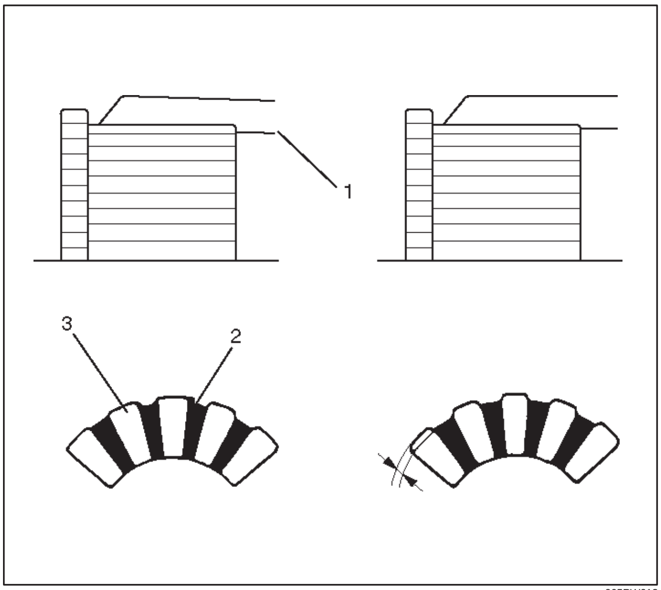


065RW012

Measure the depth of insulator in commutator. Repair, if it is below the limit.

Standard: 0.5 mm to 0.8 mm (0.02 in to 0.03 in)

Limit: 0.2 mm (0.008 in)



065RW013

Legend

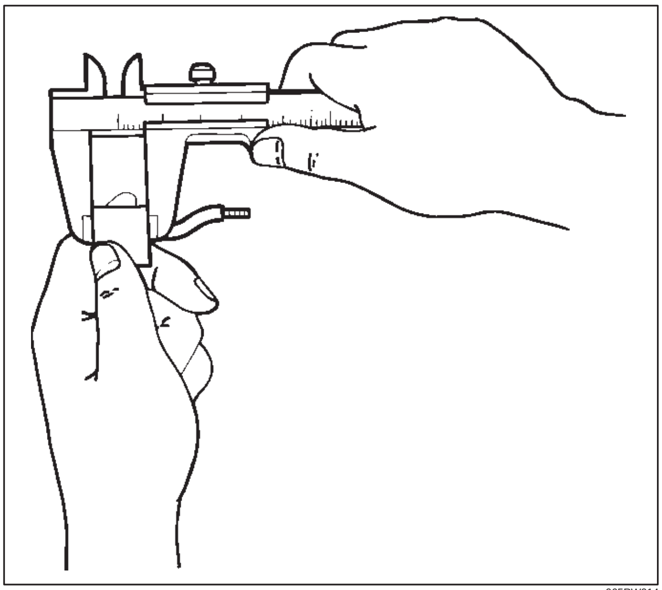
(1) Steel Saw
(2) Insulator
(3) Commutator Segments

Brush

Measure the length of brush.
Replace with a new one, if it is below the limit.

Standard: 16 mm (0.63 in)

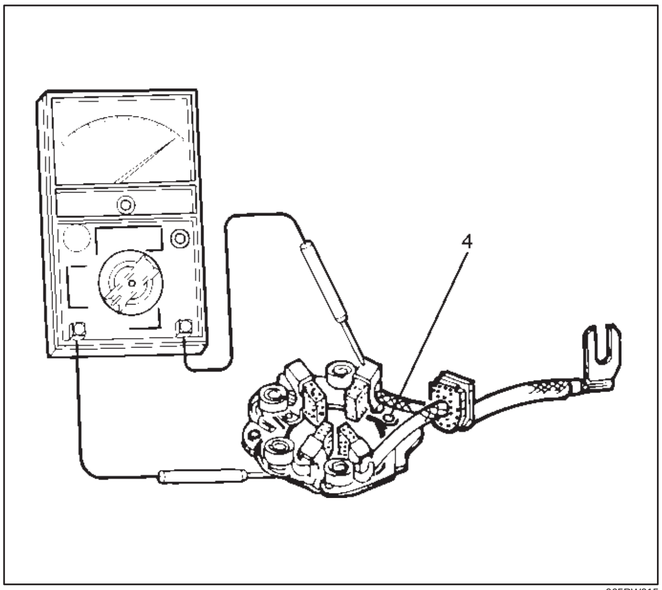
Limit: 11 mm (0.43 in)



065RW014

Brush Holder

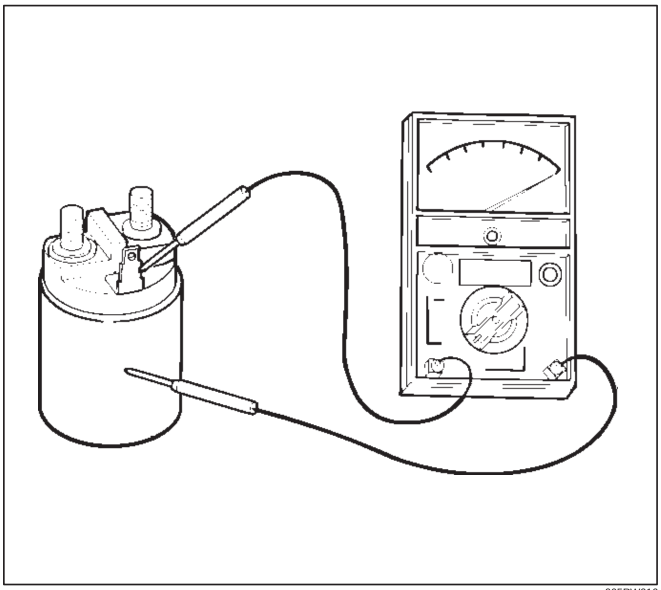
Check for continuity between brush holder (+) (4) and base (–). Replace, if there is continuity (i.e., insulation is broken).



065RW015

Magnetic Switch

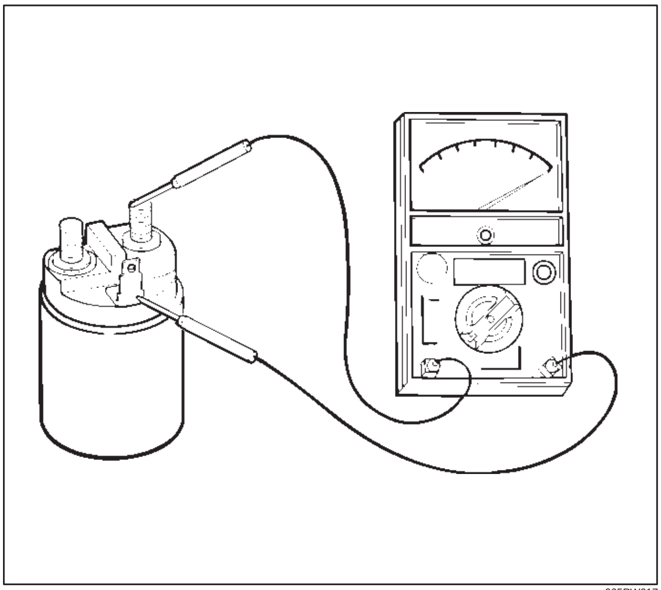
Check for continuity of shunt coil between terminals S and M.
Replace, if there is no continuity (i.e., coil is disconnected).



065RW016

Continuity of Series Coil

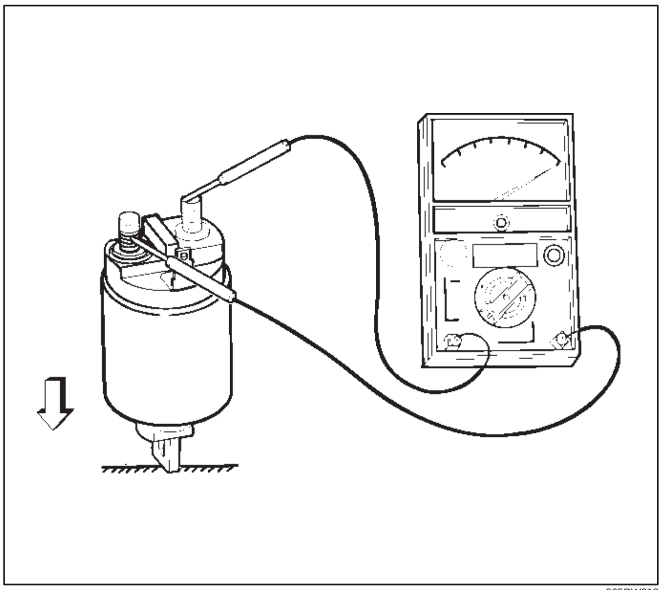
Check for continuity between terminals S and M.
Replace, if there is no continuity (i.e., coil is disconnected).



065RW017

Continuity of Contacts

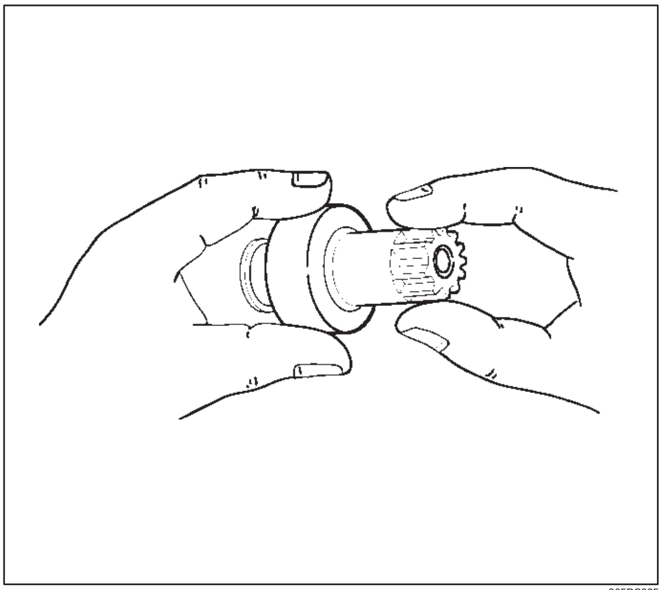
With the plunger faced downward, push down the magnetic switch. In this state, check for continuity between terminals B and M. Replace, if there is no continuity (i.e., contacts are faulty).



065RW018

Pinion

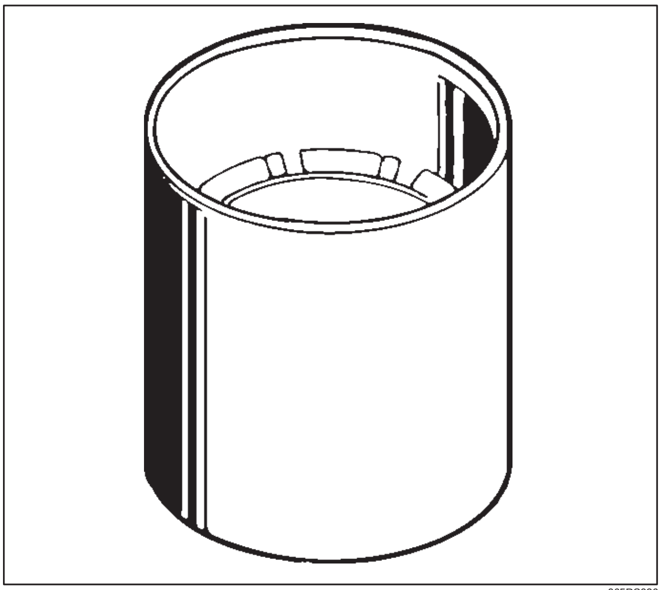
Check if the pinion rotates smoothly in drive direction by hand, or if it is locked when it is rotated in reverse. If not, replace the pinion.



065RS025

Yoke Assembly

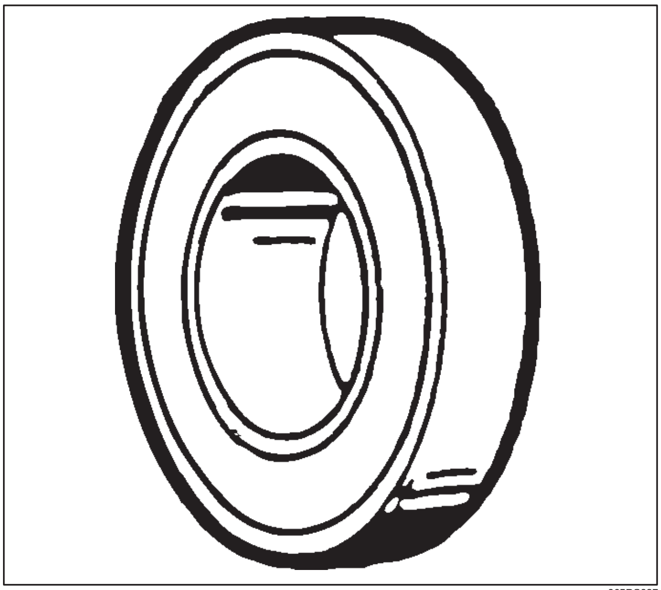
Check a magnet inside the yoke.
Replace the yoke assembly if it is broken.



065RS026

Ball Bearing

Clamp the inner race of the ball bearing with your finger, and check for sticking or play when rotating the outer race.
Replace, if abnormality is found.

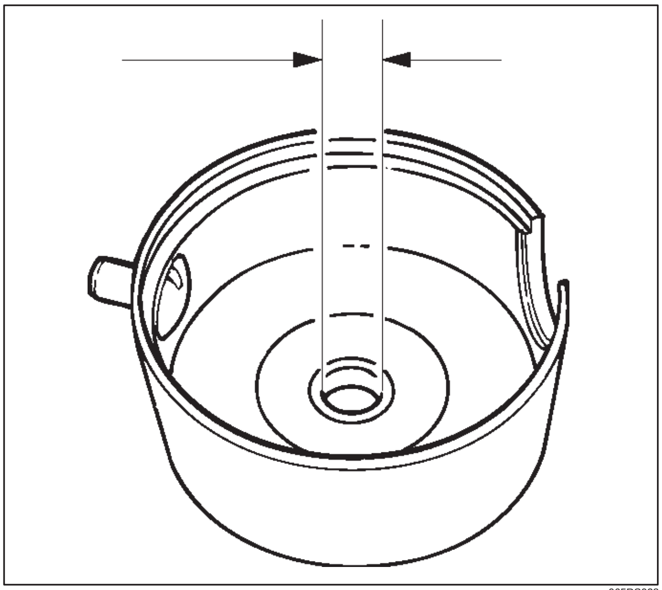


065RS027

Measure inner diameter of bushing in the rear cover, and replace if it exceeds the limit.

Standard: 12.50 mm to 12.527 mm (0.492 in to 0.4932 in)

Limit: 12.60 mm (0.4961 in)

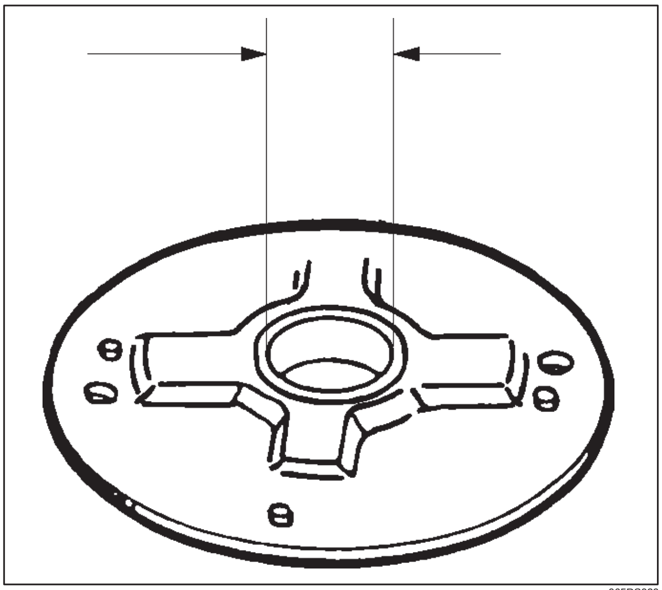


065RS028

Measure inner diameter of bushing in the center bracket (P), and replace if it exceeds the limit.

Standard: 18.01 mm to 18.127 mm (0.7091 in to 0.7137 in)

Limit: 18.15 mm (0.7146 in)



065RS029

Reassembly

To install, follow the removal steps in the reverse order, noting the following points:

Grease application places

- Bushing in rear cover and center bracket
- Gears in reduction gear
- Shift lever operating portion
- Sliding portion of pinion
- Plunger sliding portion of magnetic switch

Reassembling Yoke Assembly

Before reassembly, make sure that no metallic parts attach to the yoke assembly. Because of strong magnetic force, hold the yoke assembly and insert it slowly into the armature.

Torque

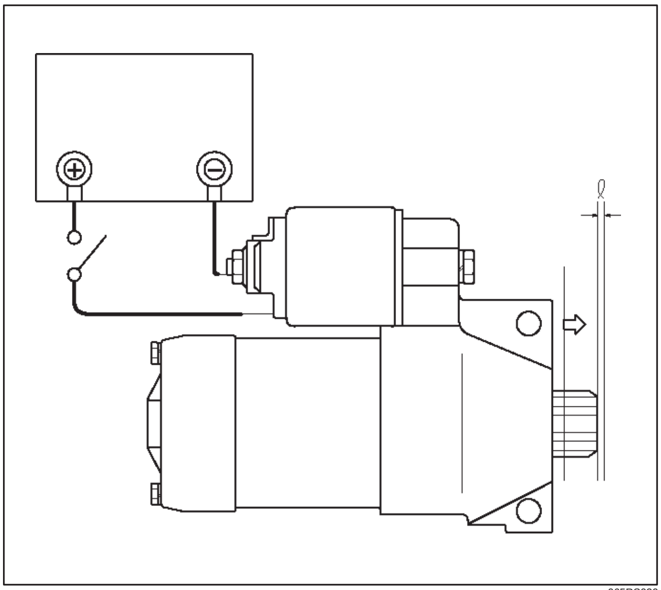
Torque for each part (See Torque Specifications in this section)

Pinion Jump–out Dimension

Connect the "+" cable of battery to terminal S and the "–" cable to terminal M. Turn the switch on, and measure pinion travel dimension in thrust direction from the jump–out position.

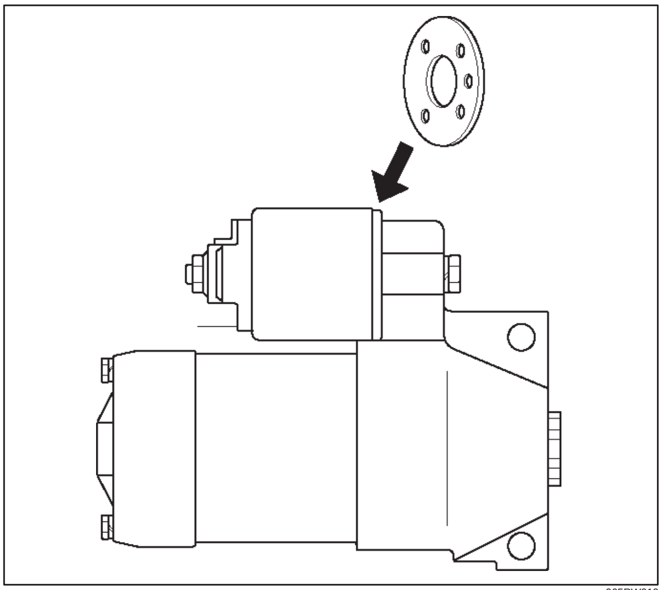
In measuring the dimension, pull the pinion out a little in the arrow direction.

Dimension(L): 0.05 mm to 1.5 mm (0.002 in to 0.06 in)



065RS030

If the measured value is out of standard, insert dust cover, or disassemble and adjust.



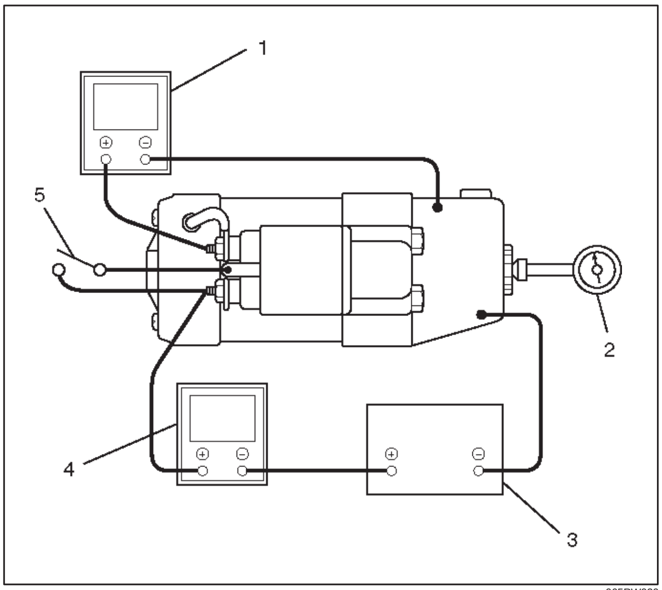
065RW019

Characteristic Test

For easily confirming the characteristics, conduct the no load test as follows:

Rating as short as 30 seconds requires rapid testing.

Fix the starter on the test bench, and wire as shown in illustration. When the switch is closed, the current flows and the starter runs under no load. At this time, measure current, voltage and speed to check if they satisfy the standard.



065RW020

Legend

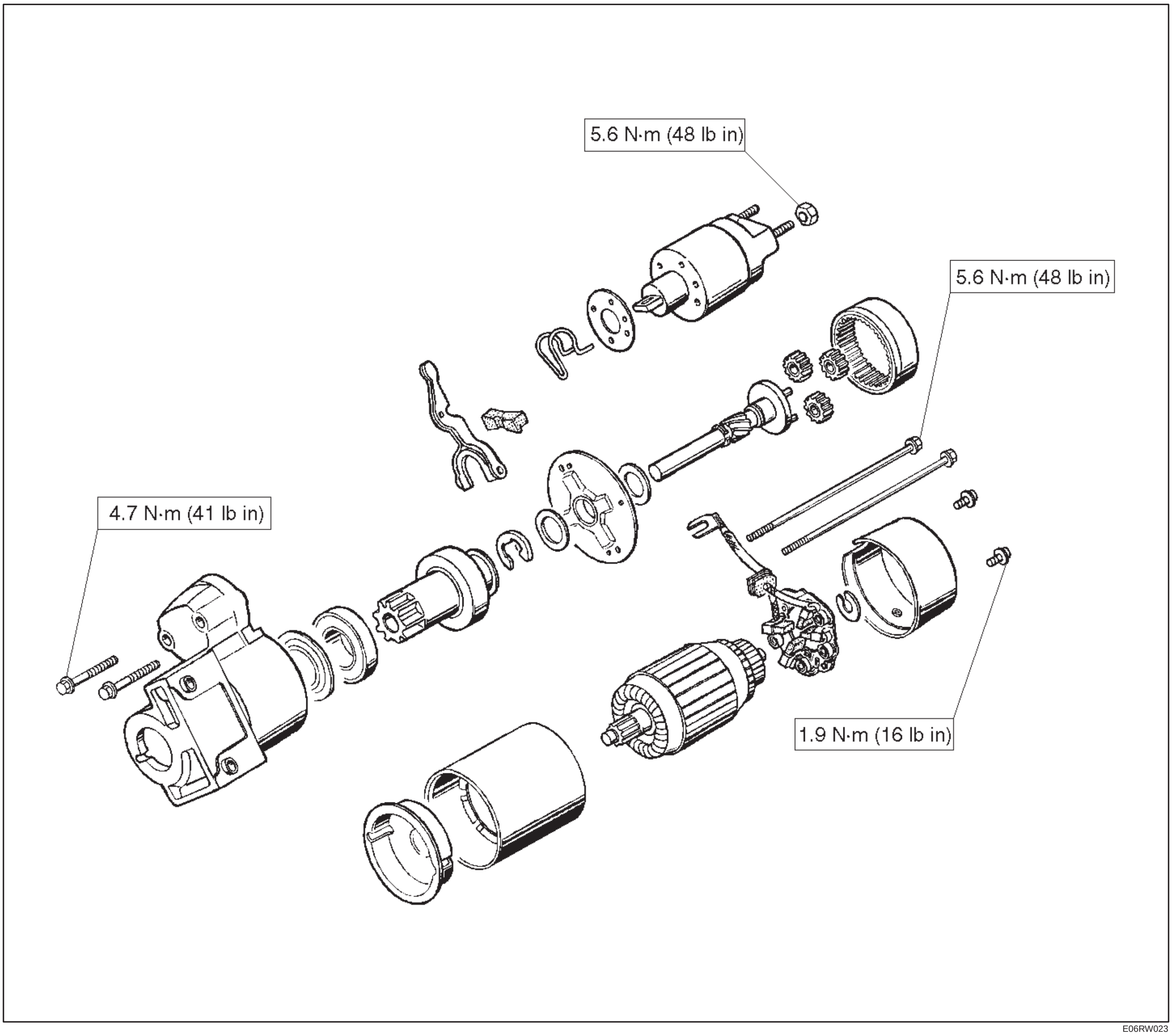
(1) Volt Meter
(2) Tachometer
(3) Battery
(4) Ammeter
(5) Switch

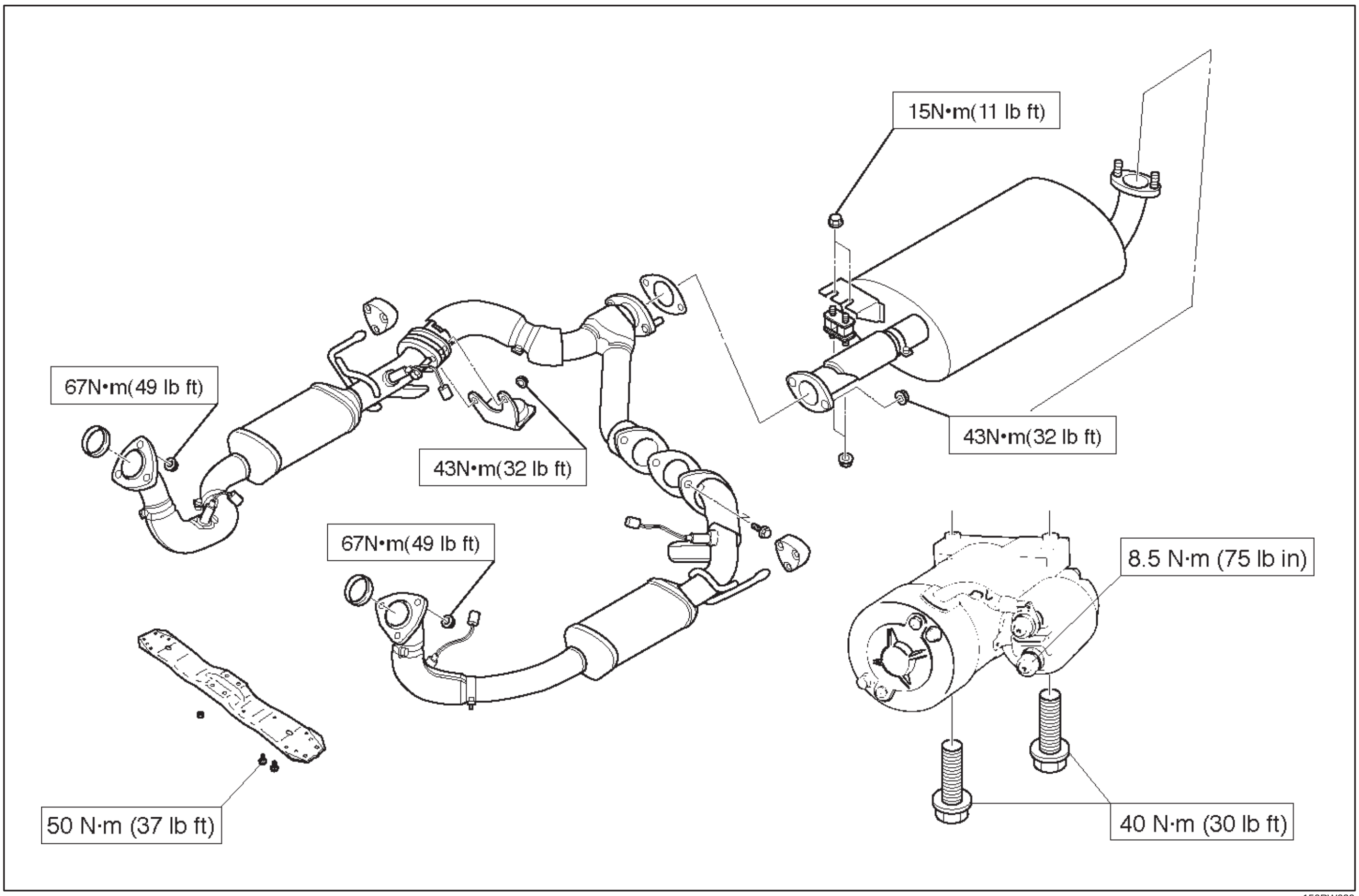
Main Data and Specifications

General Specifications

Model	Specification
Rating	
Voltage	12 V
Output	1.4 Kw
Time	30 sec
Number of teeth of pinion	9
Rotating direction(as viewed from pinion)	Clockwise
Weight(approx.)	37 N
No–load characteristics	
Voltage /Current	11.5V/90A or less
Speed	3000rpm or more
Load characteristics	
Voltage/current	8.5V/350A or more
Torque	13.2N·m or more
Speed	1000rpm or more
Locking characteristics	
Voltage/current	2.4V/500A or less
Torque	11.8N·m or more

Torque Specifications



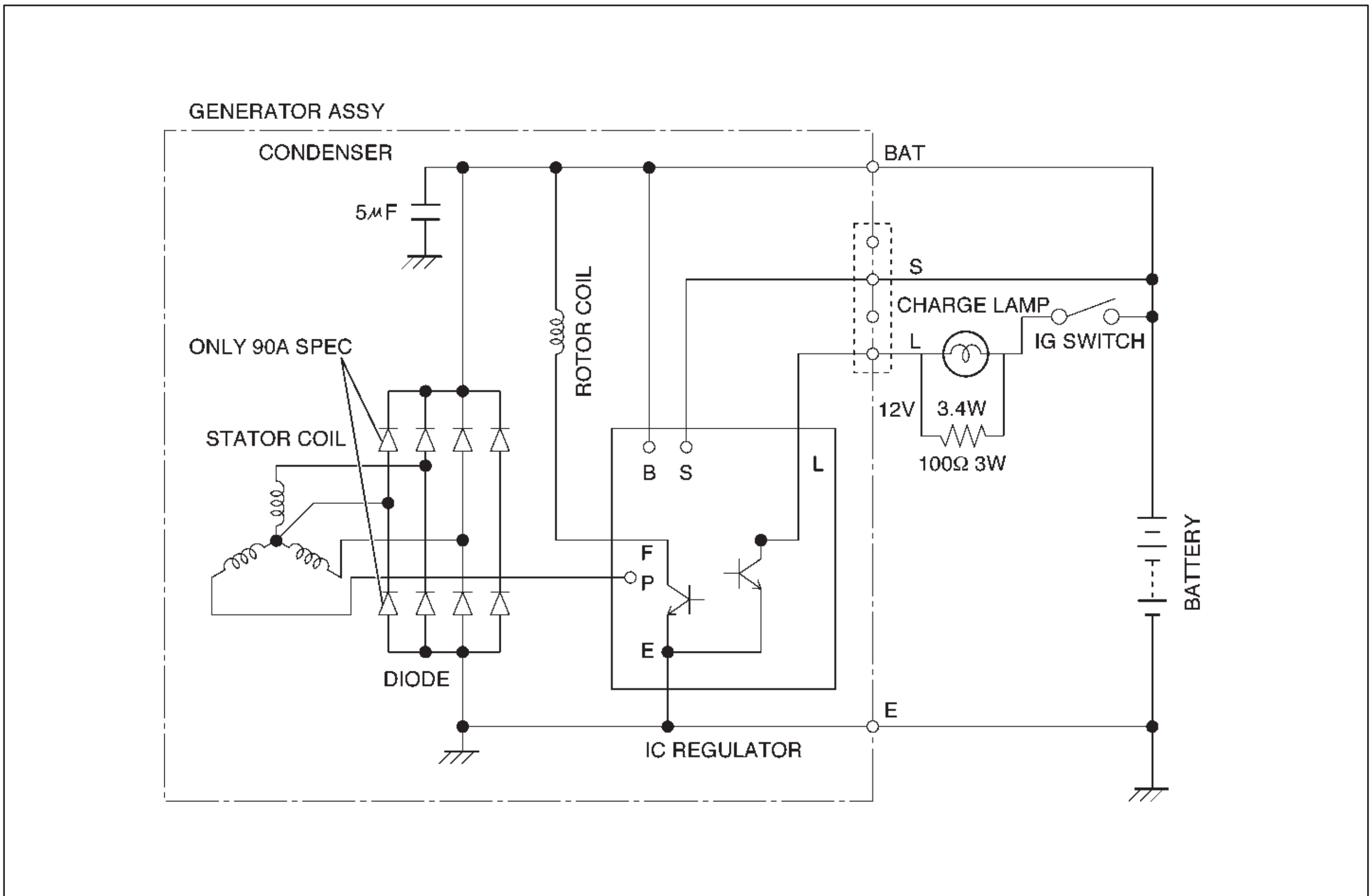

15N•m(11 lb ft)
67N•m(49 lb ft)
43N•m(32 lb ft)
43N•m(32 lb ft)
67N•m(49 lb ft)
8.5 N·m (75 lb in)
50 N·m (37 lb ft)
40 N·m (30 lb ft)

150RW029

Charging System

General Description

The IC integral regulator charging system and its main components are connected as shown in illustration.
The regulator is a solid state type and it is mounted along with the brush holder assembly inside the generator installed on the rear end cover.
The generator does not require particular maintenance such as voltage adjustment.
The rectifier connected to the stator coil has diodes to transform AC voltage into DC voltage.
This DC voltage is connected to the output terminal of generator.



F06RX002

General On–Vehicle Inspection

A basic wiring diagram is shown in the illustration. When operating normally, the indicator bulb will come on when the switch is turned on, and will then go out when the engine starts. If the indicator operates abnormally, or if an undercharged or overcharged battery condition occurs, the following procedure may be used to diagnose the charging system. Remember that an undercharged battery is often caused by accessories being left on overnight, or by a defective switch which allows a bulb, such as a trunk or glove box light, to stay on.

OBSERVE THE FOLLOWING PROCEDURE:

1. Visually check belt and wiring.
2. Go to step 5. for vehicles without charge indicator light.
3. Switch on, engine stopped, light should be on. If not, detach harness at generator, ground “L” terminal lead.
   a. Lamp lights, replace or repair generator.
   b. Lamp dose not light, locate open circuit between grounding lead and ignition switch. Bulb may be open.
4. Switch on, engine running at moderate speed. Light should be off. If not, detach wiring harness at generator.
   a. If light goes off, replace or repair generator.
   b. If light stays on, check for grounded “L” terminal wire in harness.
5. Battery undercharged or overcharged.
   a. Detach wiring harness connector from generator.
   b. With switch on, engine not running connect voltmeter from ground to “L” terminal in wiring harness, and to “IG” terminal. If used. Wiring harness may connect to either “L” or “IG” or both.
   c. Zero reading indicates open circuit between terminal and battery. Connect as required.

d. Re-connect harness connector to generator, run engine at moderate speed, with electrical accessories turned off.

e. Measure voltage across battery. If above 16.0V, replace or repair generator.

f. Connect ammeter at generator output terminal. Turn on accessories, load battery with carbon pile to obtain maximum amperes output.

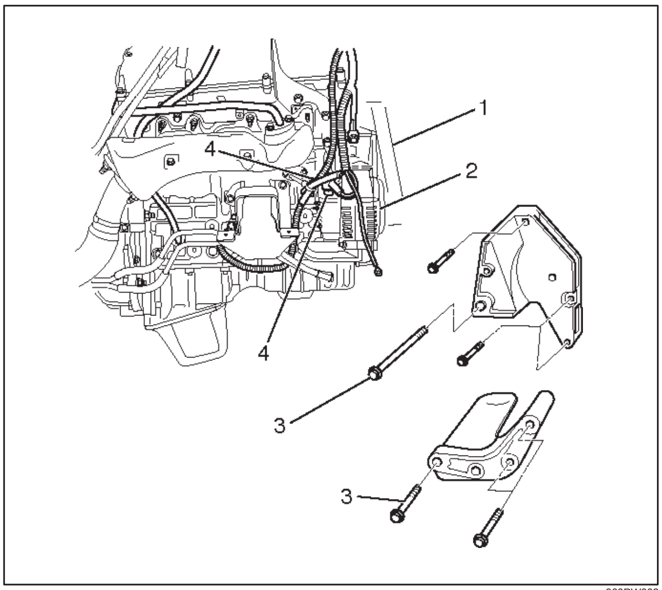
Maintain voltage at 13.0V or above.

1. If within 15 amperes of rated output, generator is OK.
2. If not within 15 amperes of rated output, replace or repair generator.

Generator

Removal

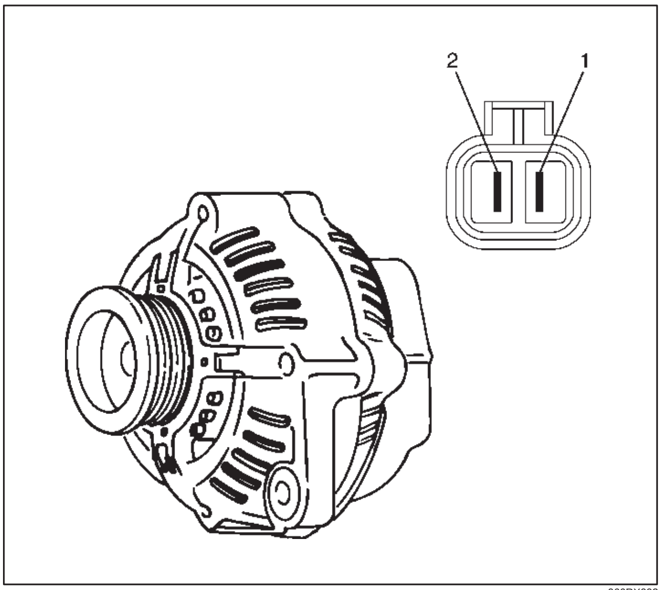
1. Disconnect battery ground cable.
2. Move drive belt tensioner to loose side using wrench then remove drive belt (1).
3. Disconnect the wire from terminal "B" and disconnect the connector (4).
4. Remove generator fixing bolt (3).
5. Remove generator assembly (2).



060RW002

Inspection

1. Disconnect the wiring connector from generator.
2. With the engine stopped, turn starter switch to "on" and connect a voltmeter between connector terminal L (1) and ground or between terminal IG (2) and ground.



066RX002

If voltage is not present, the line between battery and connector is disconnected and so requires repair.

3. Reconnect the wiring connector to the generator, run the engine at middle speed, and turn off all electrical devices other than engine.
4. Measure battery voltage. If it exceeds 16V, repair or replace the generator.
5. Connect an ammeter to output terminal of generator, and measure output current under load by turning on the other electrical devices (eg., headlights). At this time the amperes must not be less than 15A and the voltage must not be less than 13V.

Installation

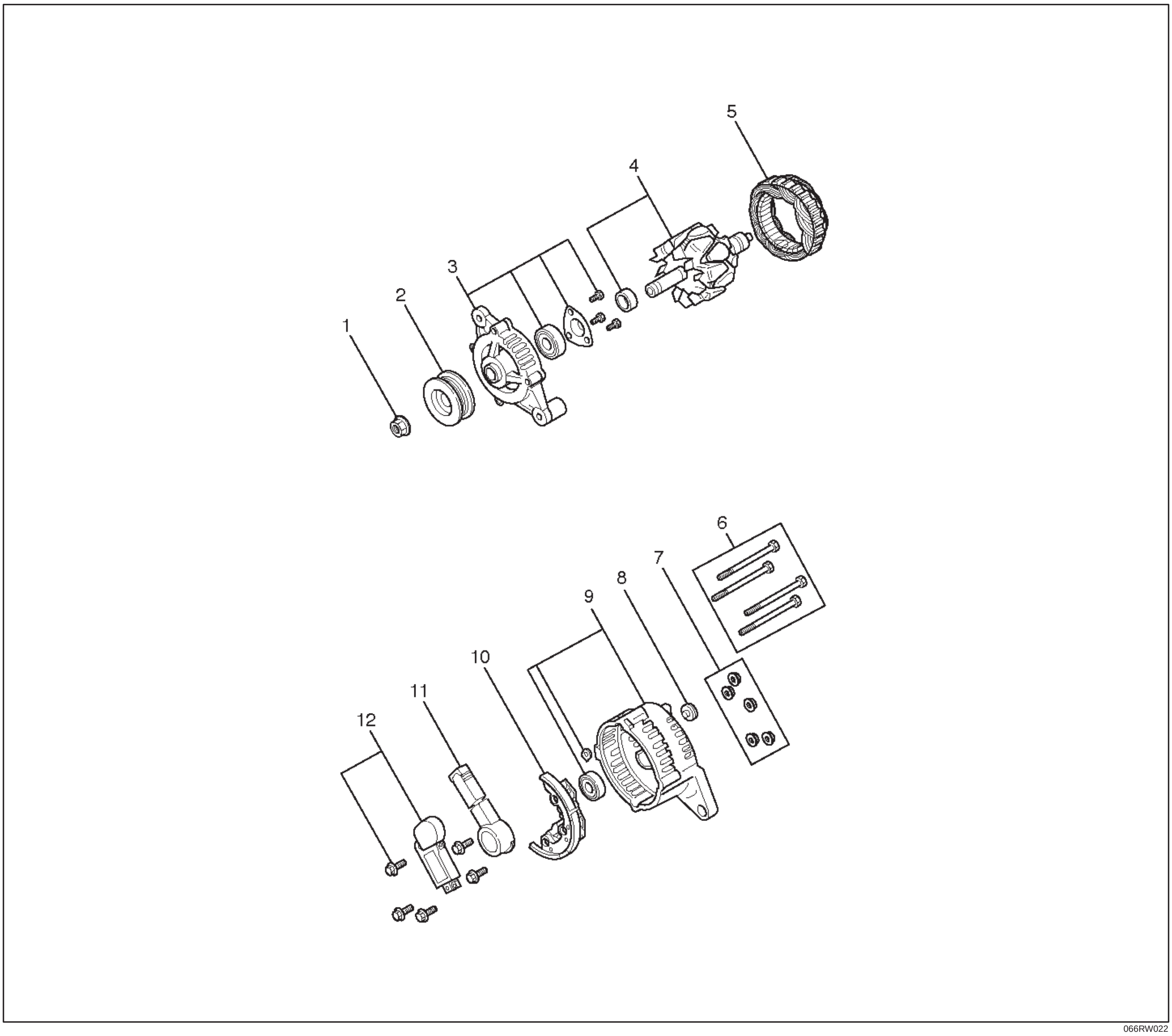
1. Install generator assembly to the position.
2. Install generator assembly and tighten the fixing bolts to the specified torque.

   Torque:

   M10 bolt: 41 N·m (30 lb ft)

   M8 bolt: 21 N·m (15 lb ft)
3. Connect wiring harness connector and direct terminal “B”.
4. Move drive belt tensioner to loose side using wrench, then install drive belt to normal position.
5. Reconnect battery ground cable.

Disassembled View



Legend

(1) Pulley Nut
(2) Pulley
(3) Front Cover Assembly
(4) Rotor Assembly
(5) Stator Assembly
(6) Through Bolt
(7) Nut
(8) Terminal Insulator
(9) Rear Cover Assembly
(10) Rectifier
(11) Brush Holder Assembly
(12) Regulator Assembly

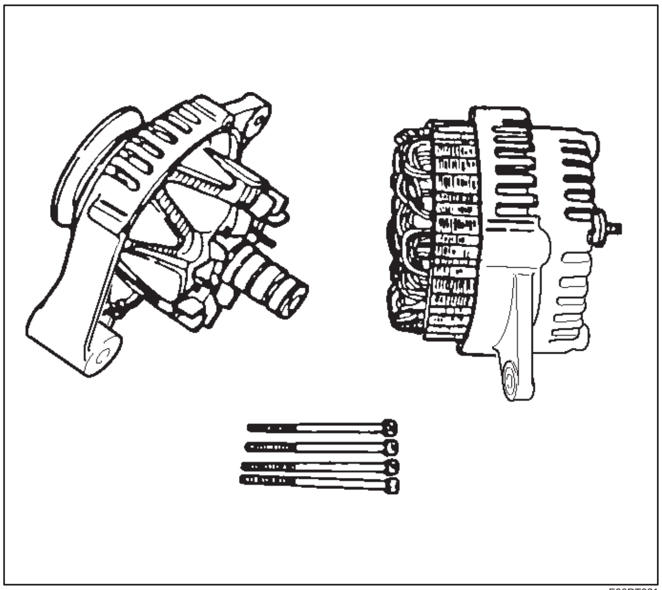
Disassembly

1. Remove the through bolt.

   Insert the tip of a pry bar into the gaps between the front cover and the stator core.

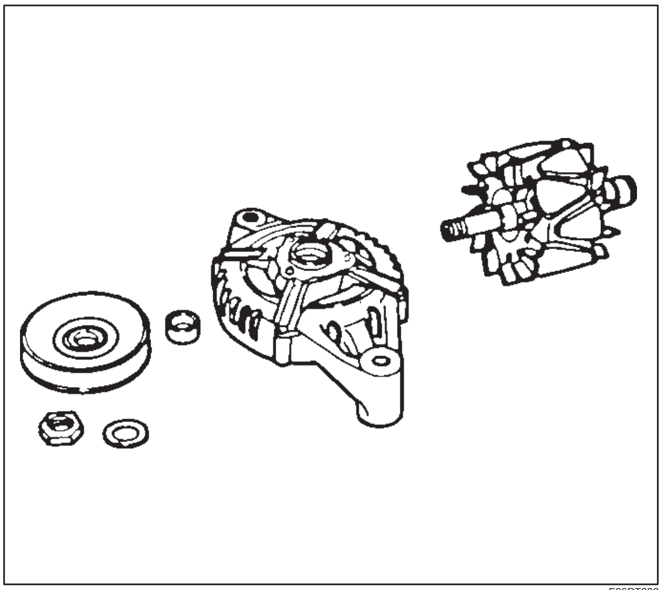
   Pry apart and separate the front cover, rotor, the rear cover and stator.

NOTE: Take care not to scratch or otherwise damage the stator coil with pry bar.



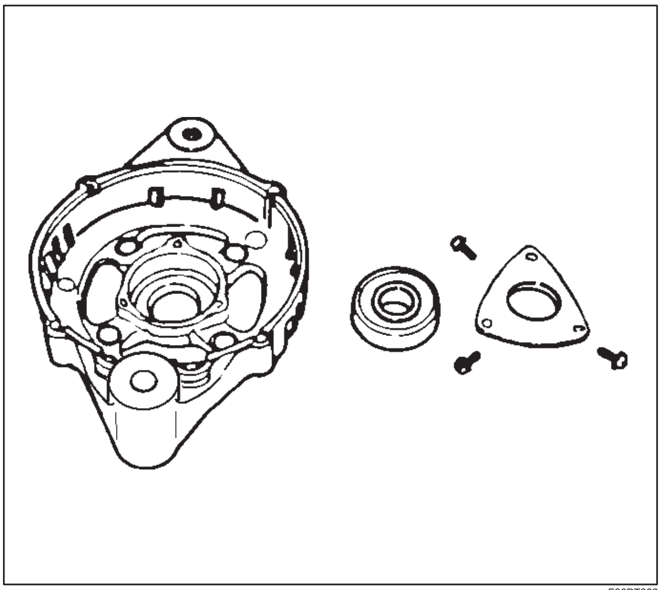
F06RT021

2. Clamp the rotor in a vise and then remove the nut and pulley.
3. Remove the rotor assembly from front cover.



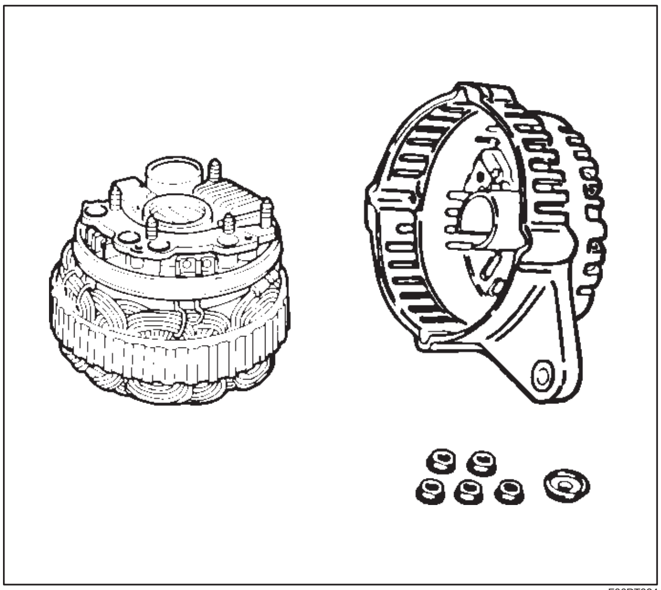
F06RT022

4. Remove screws with bearing retainer from front cover and remove bearing.



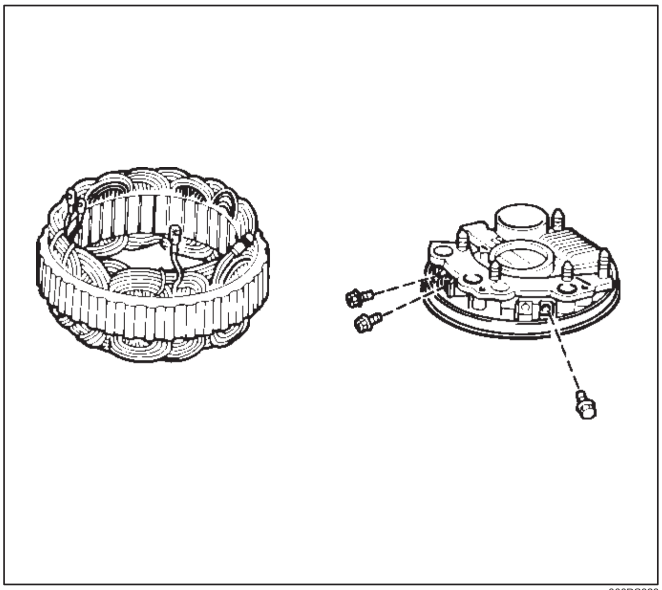
F06RT023

5. Remove the mounting nuts holding the “B” terminal, the diode, and the brush holder.
6. Separate the rear cover from the stator.



F06RT024

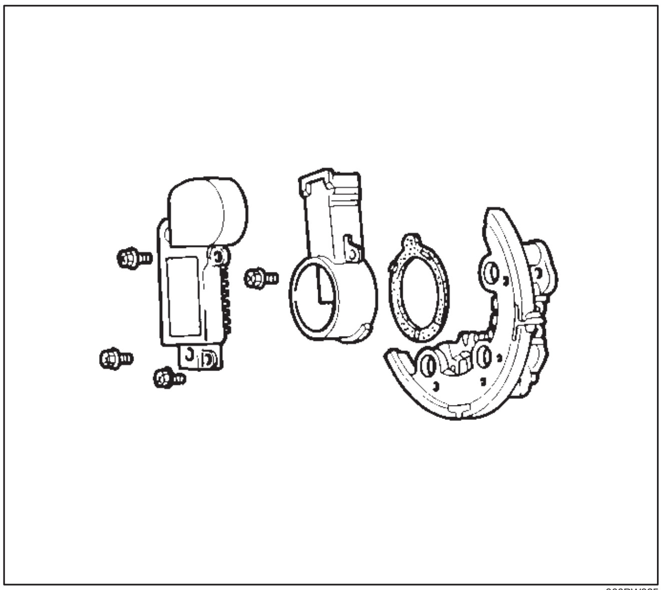
7. Remove bolts which secure stator terminal to rectifier terminal, and remove stator.



066RS030

8. Remove Bolts which secure regulator, rectifier and brush-holder, and separate these parts.

NOTE: Do not apply a shock or load to regulator, rectifier and brush holder.



066RW025

Inspection and Repair

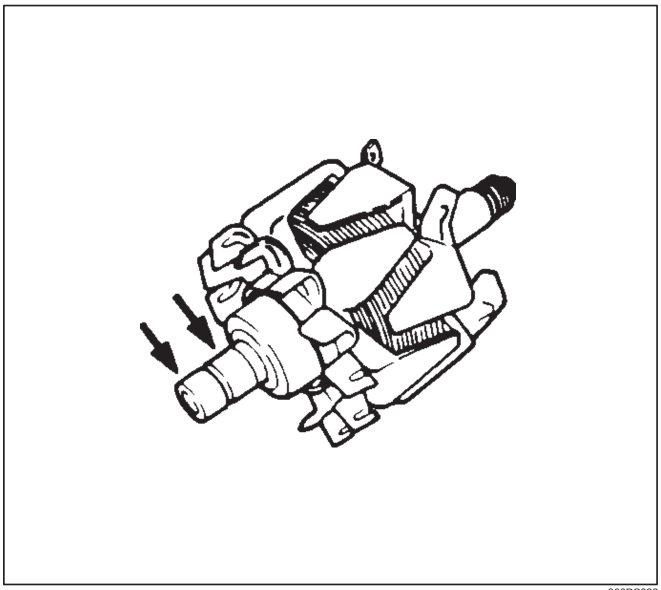
Repair or replace necessary parts if extreme wear or damage is found during inspection.

Rotor Assembly

1. Check the face of the slip rings for contamination and roughness. If found to be scored, dress with a fine sandpaper (#500 –600). If found to be contaminated, clean with a cloth saturated with alcohol.
2. Measure the outside diameter of the slip rings.

Standard: 27mm (1.06in)

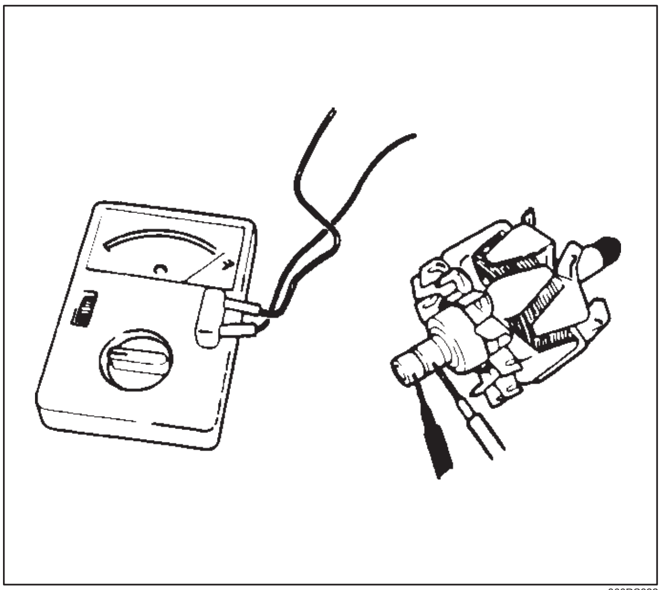
Limit: 26mm (1.02in)



066RS032

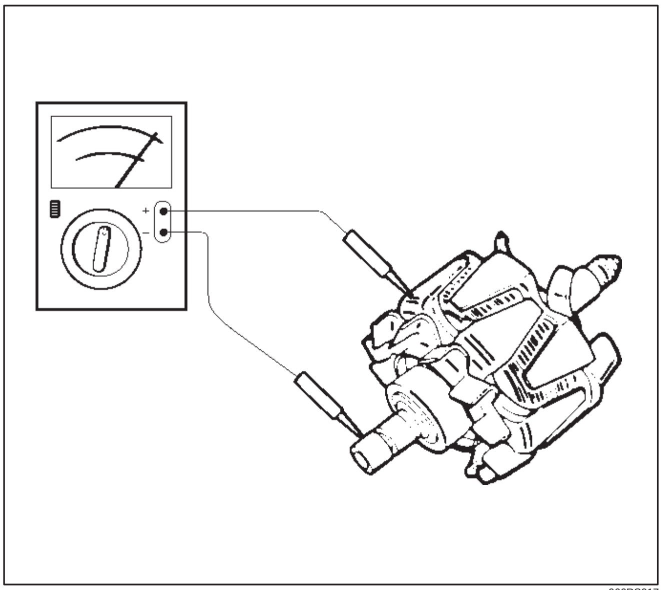
3. Check resistance between slip rings, and replace if there is no continuity.

Standard: 3.75Ω or less



066RS033

4. Check for continuity between slip ring and rotor core. In case of continuity, replace the rotor assembly.

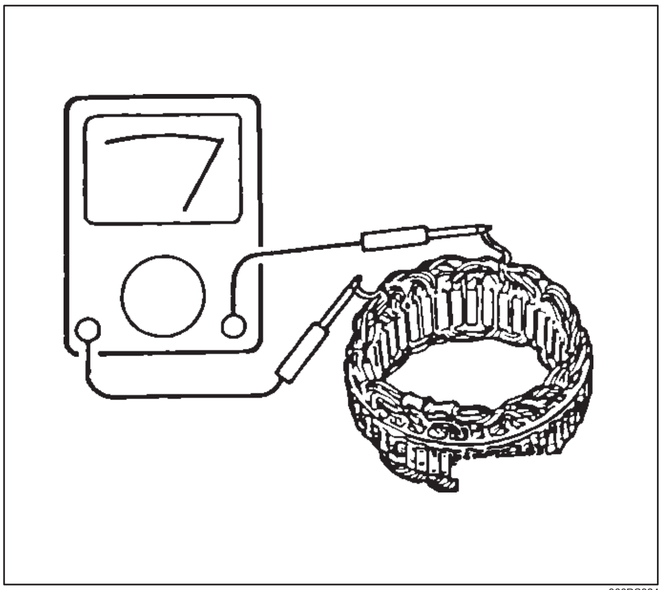


066RS017

Stator Coil

1. Check for continuity across the stator coils. If no continuity exists, replace the coils.
   Resistance value at 20°C.

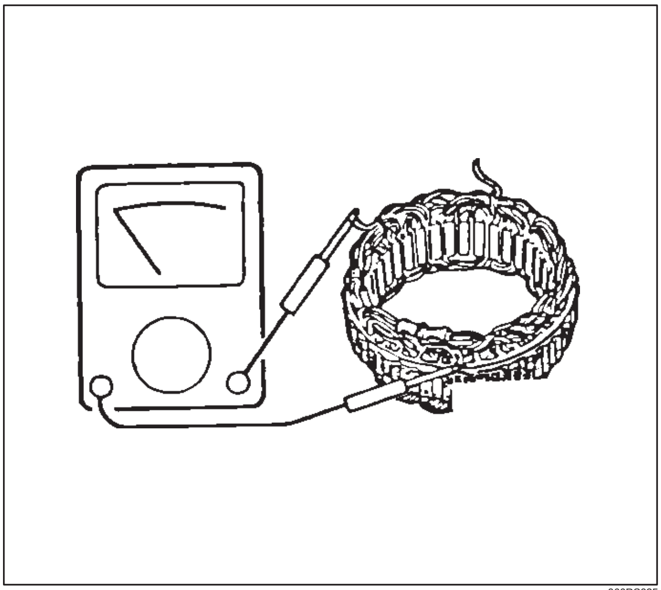
Standard: Approx. 0.07Ω



066RS034

2. Check for continuity across one of the stator coils and stator core. If a continuity exists, replace the coil.

Standard: More than 1MΩ



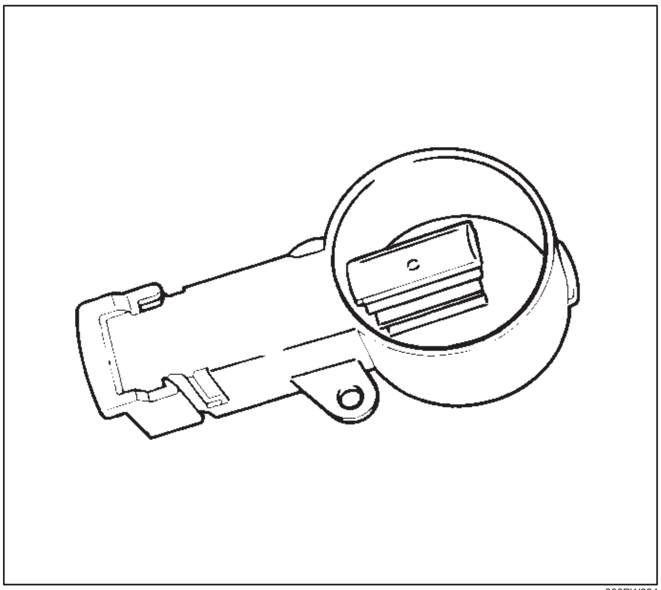
066RS035

Brush

Measure the brush length.
If more than limit, replace the brush.

Standard: 18.0mm (0.709in)

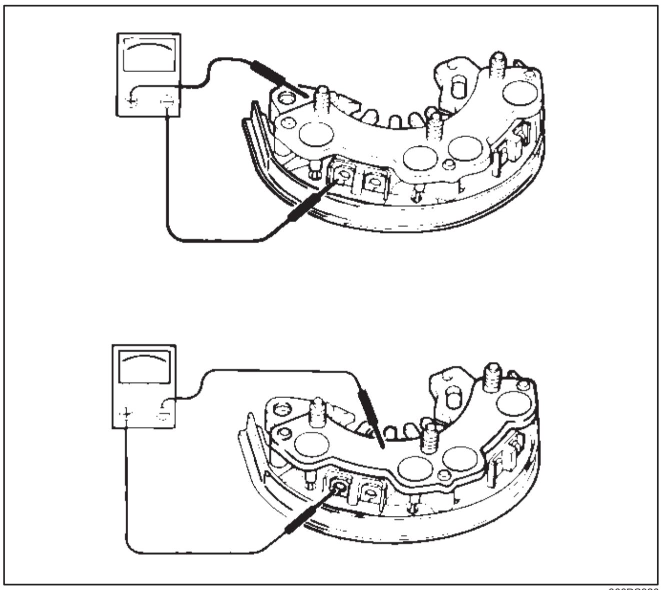
Limit: 5.5mm (0.217in)



066RW024

Rectifier Assembly

1. Measure the resistance between each diode terminal and aluminum diode fin in forward and reverse directions with the connection of the tester leads switched. The diodes are normal if resistance is nearly zero ohms in one direction and is infinitely high in the other direction.
2. If a diode has no resistance or equal resistance in both directions, it is defective and should be replaced together with the holder.



066RS036

IC Regulator Assembly

Connect a variable resistor, two 12V batteries, a fixed resistor, and a voltmeter to the IC regulator as shown in illustration.

a. Measuring equipment specifications

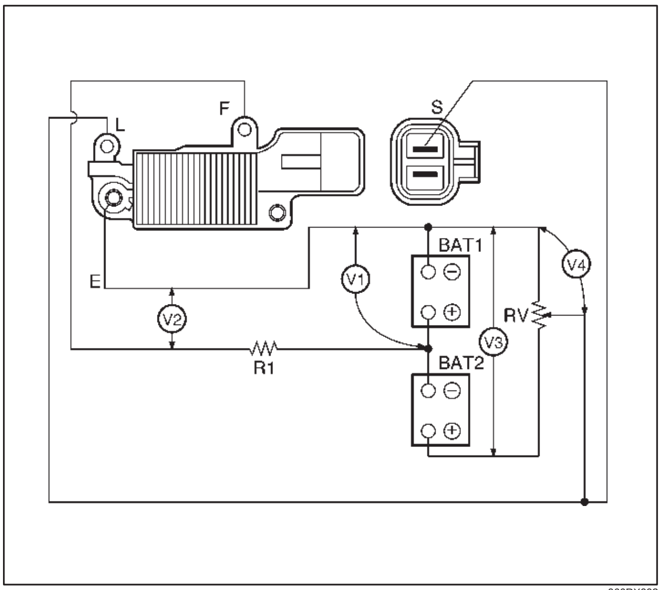
1. Fixed resistor (R1) : 10 Ohms /3W
2. Variable resistor (Rv) : 0-300 Ohms/12W
3. Batteries (BAT1, BAT2) : 12V (2 Batteries)
4. DC voltmeter : 0-50V/0.5 steps (4 Check points)

b. Measuring procedure

1. Measure the voltage “V1” across the first battery (BAT1). If the reading is between 10 and 13 volts, the battery is normal.
2. Measure the voltage “V3” across both the batteries (BAT1, BAT2). If the reading is between 20 and 26 bolts, the batteries are normal.
3. Gradually increase the resistance of the variable resistor from zero. Measure the voltage “V2” (the voltage across the F and E terminals).

Check to see that the voltage across “V1” changes at this time. If there is no change, the voltage regulator is faulty and must be replaced.

4. Measure the voltage at “V4” (the voltage across the variable resistor center tap and terminal E with the variable resistor resistance held constant). The measure voltage should be within the specified (14.4±0.3 volts) limits. If it is not, the regulator must be replaced.



066RX003

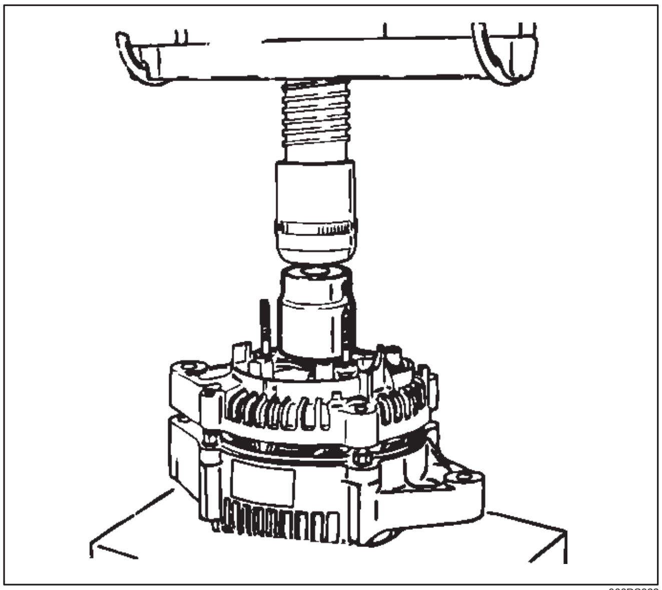
Reassembly

To reassemble, follow the disassembly steps in the reverse order, noting the following points:

NOTE:

- Never make battery connections with polarities reversed, or battery will be shorted via the diodes.
  This will cause damage to the diodes.
- Do not connect generator B terminal to ground; it is connected directly to the battery.
  This cable will burn if it is connected to ground.
- Make sure to disconnect the positive (+) terminal of the battery when quick-charging battery .
  Diodes may be damaged due to abnormal pulse voltage generated bye the quick charger.
- When reassembling the front section to rear section, insert a stiff wire into hole in the rear face of the rear cover from the outboard side to support the brush in raised position, then insert the front section to which rotor is assembled.
- Reassemble parts carefully to be sure they fit into their original position, paying attention to the insulated portions.
- Wipe insulating tubes, washers and plates clean and install them in position carefully to avoid getting oil or grease on them.

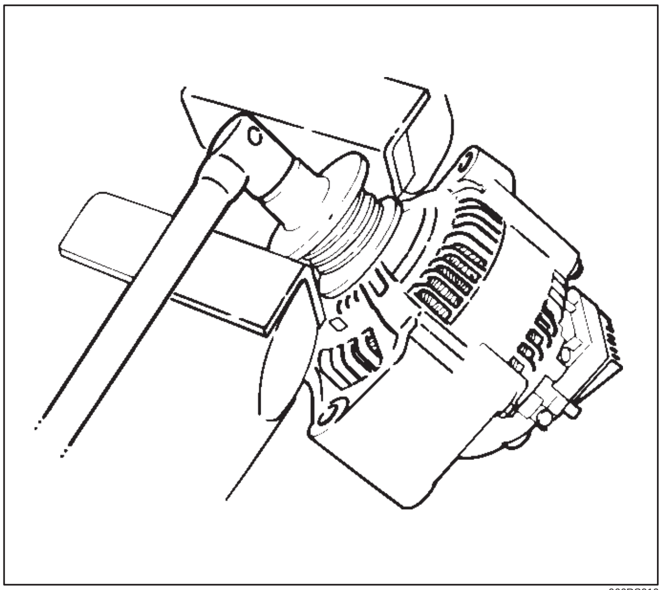
1. Using a press with a socket wrench attached, reassemble rotor and rear end cover assembly in the front cover.



066RS022

2. Install pulley on the rotor.
   Secure the pulley directly in the vise between two copper plates, and tighten nut to the specified torque.

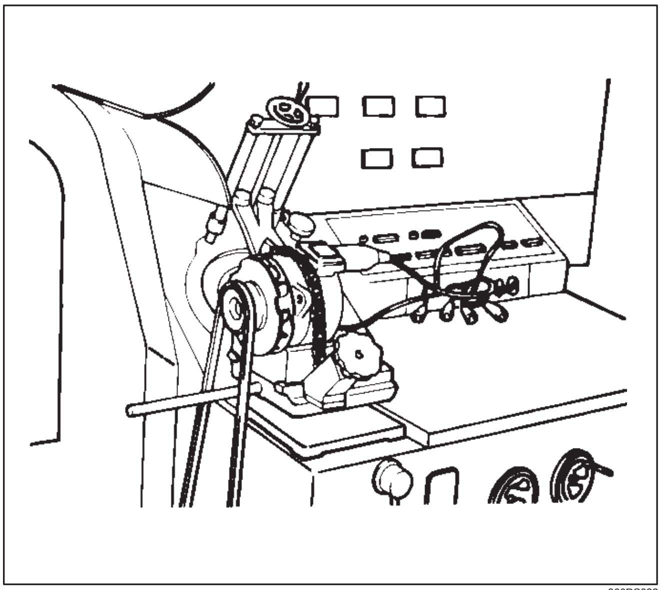
Torque: 111 N·m (82 lb ft)



066RS010

Bench Test

Conduct a bench test of the generator.

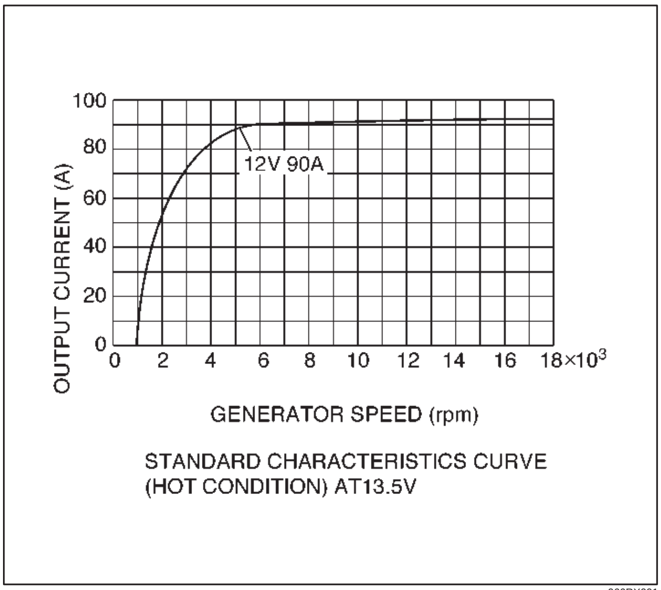


066RS023

Preparation

Remove generator from the vehicle (see “Generator removal”).

1. Secure generator to the bench test equipment and connect wires.
   Terminal “IG” for energization
   Terminal “L” for neutral (warning lamp)
   Terminal “B” for output
2. Conduct the generator characteristic test.
   Characteristics of generator are shown in illustration.
   Repair or replace the generator if its outputs are abnormal.



066RX001

Main Data and Specifications

General Specifications

Battery voltage	V	12
Rated output	A	90
Direction of rotation (as viewed from pulley side)		Clockwise
Rated rotation speed	rpm	5000
Maximum speed	rpm	18000

RODEO

ENGINE

RODEO 3.2L ENGINE DRIVEABILITY AND EMISSIONS

CONTENTS

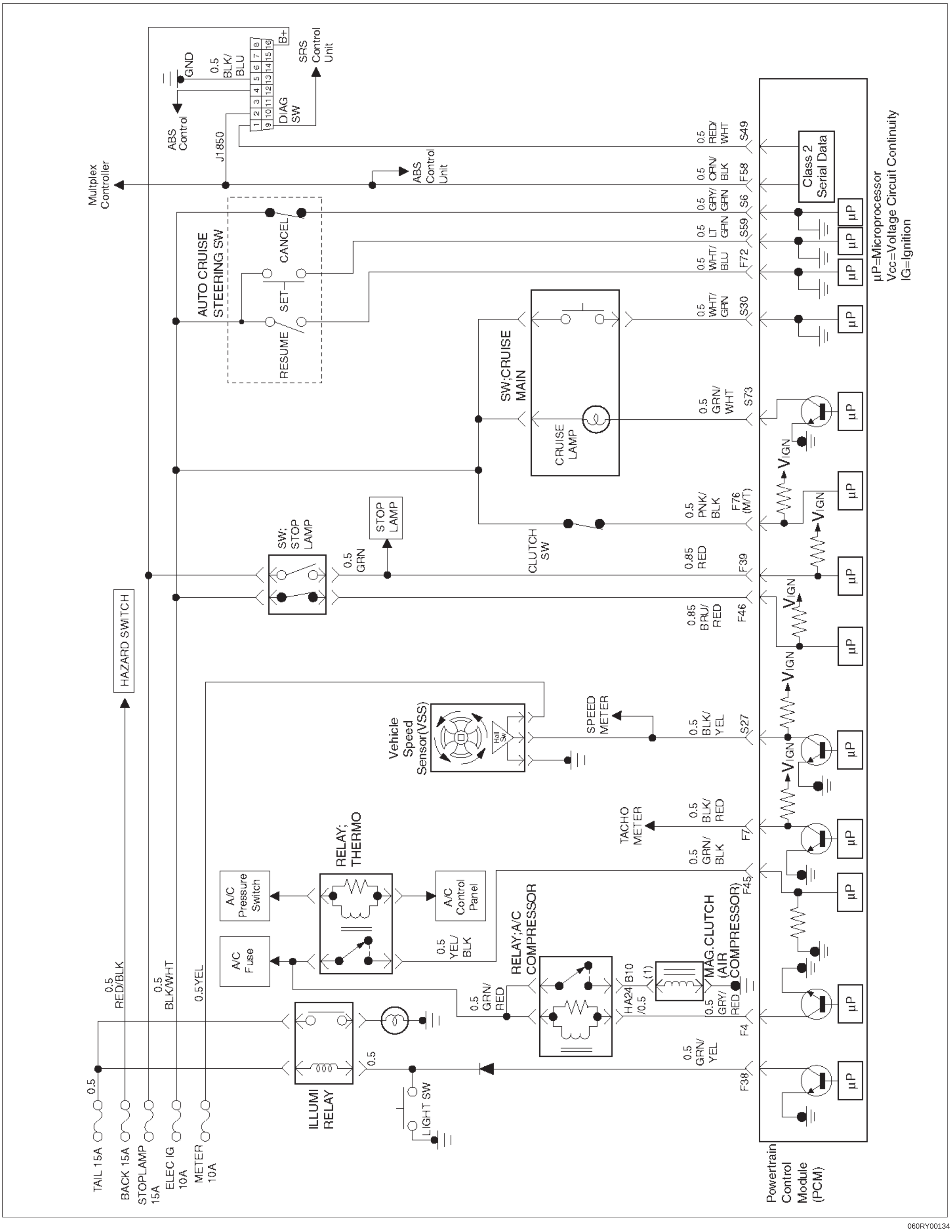
Specifications

Tightening Specifications

Application	N·m	Lb Ft.	Lb In.
Camshaft Position Sensor Retaining Screw	9	—	78
Crankshaft Position Sensor Mounting Bolt	9	—	78
EGR Bolt	25	18	—
Engine Coolant Temperature Sensor	30	22	—
Fuel Drain Plug	20	14	—
Fuel Pressure Regulator Attaching Screw	3	—	26
Fuel Rail Bolts	25	18	—
Fuel Tank Undercover Retaining Bolts	36	27	—
Heated Oxygen Sensor	55	40	—
Lower Intake Manifold to Engine Block Bolts	25	18	—
Lower Intake Manifold to Engine Block Nuts	25	18	—
Spark Plugs	18	13	—
Throttle Body Mounting Bolts	10	—	87
Common Chamber to Lower Intake Manifold Bolts	25	18	—
VSS Retaining Bolt	16	12	—

Diagrams and Schematics

PCM Wiring Diagram (1 of 7)



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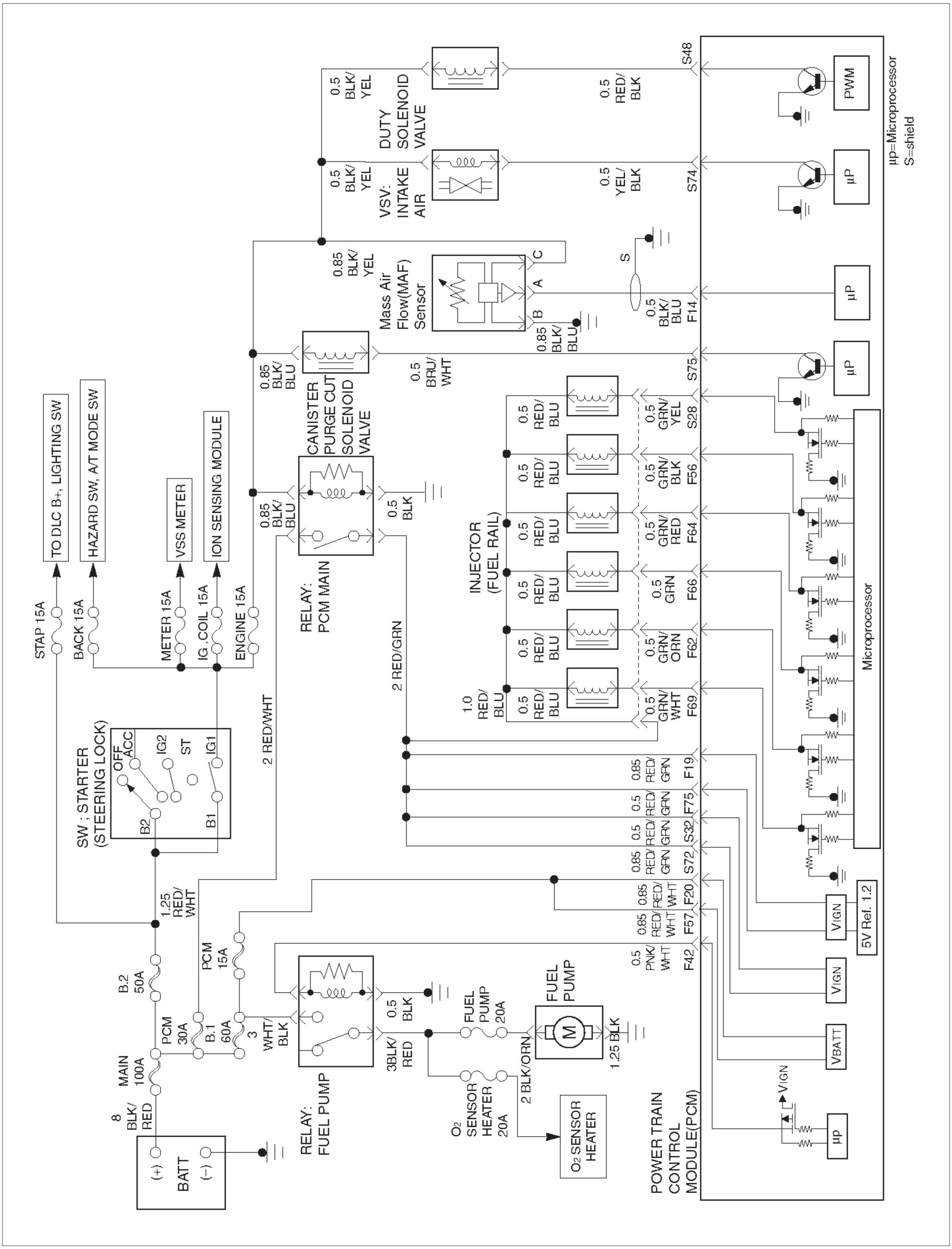
PCM Wiring Diagram (2 of 7)



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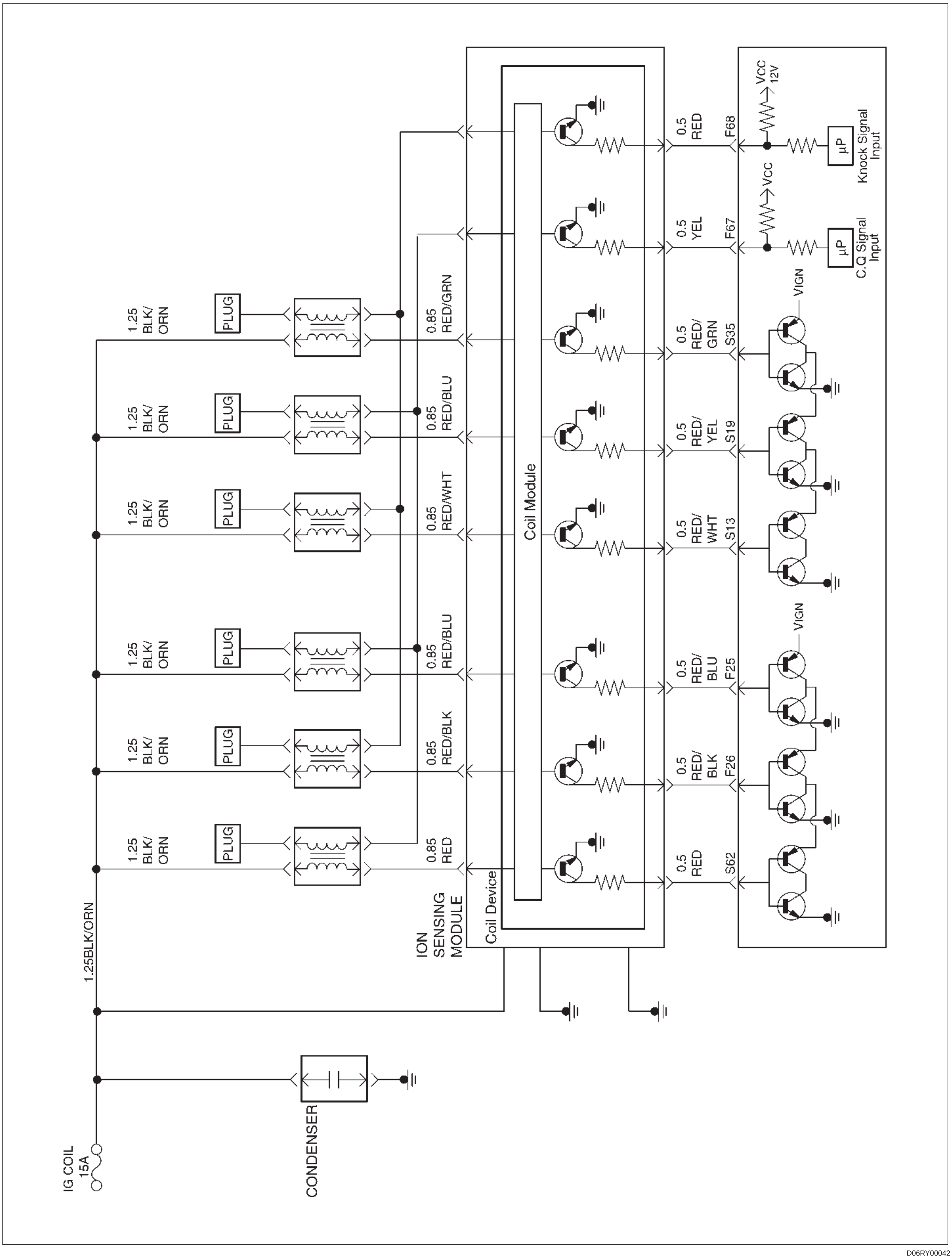
PCM Wiring Diagram (3 of 7)



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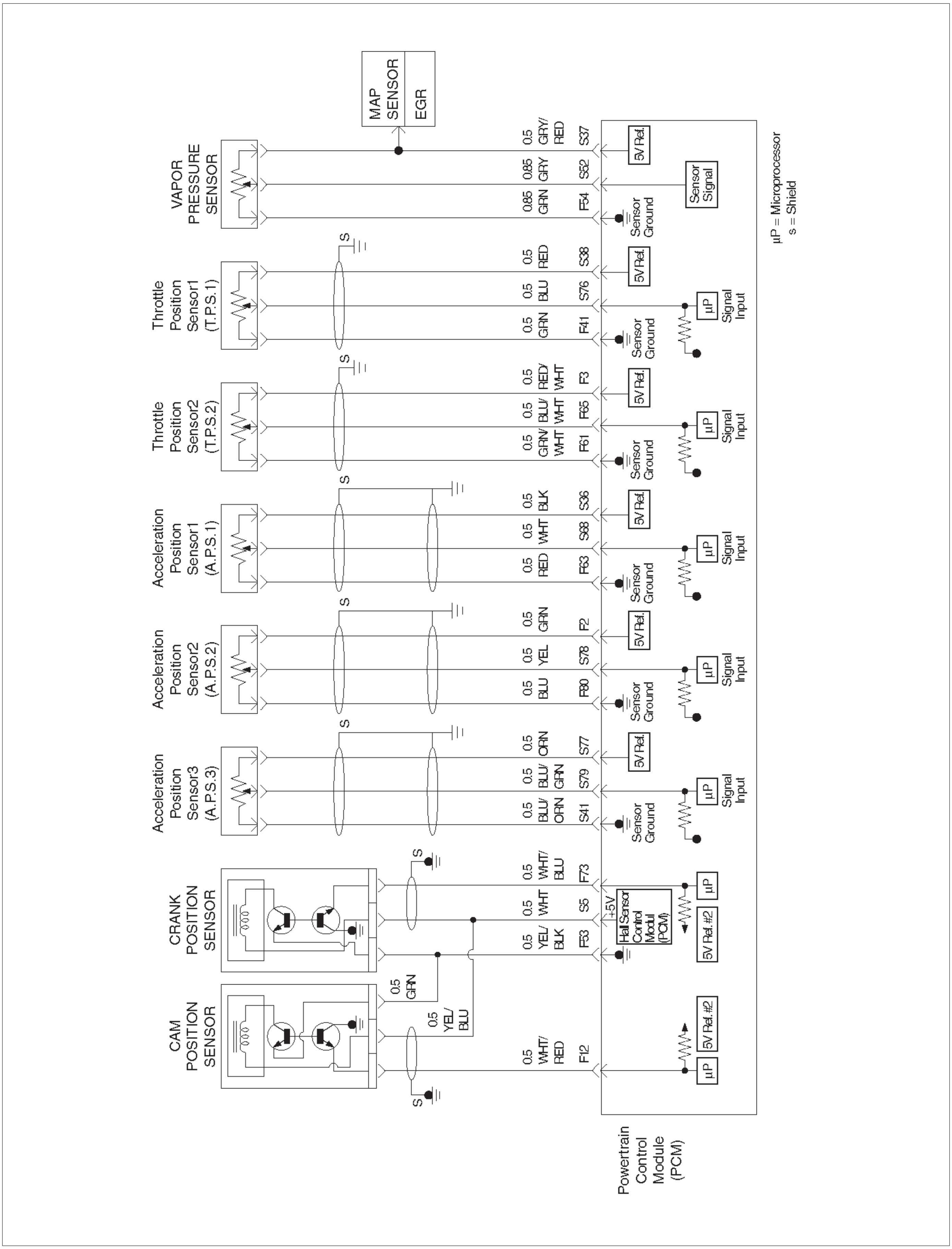
PCM Wiring Diagram (4 of 7)



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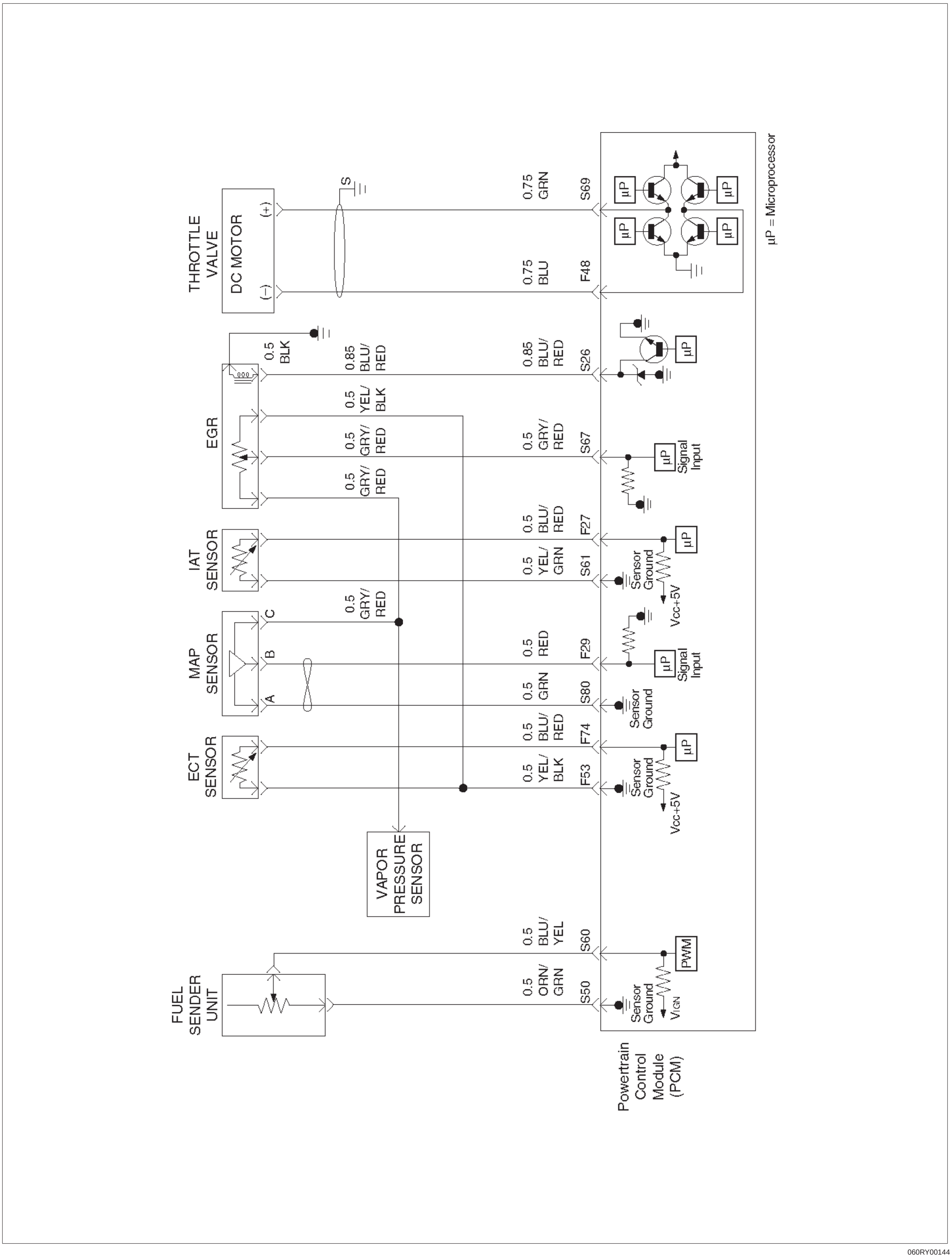
PCM Wiring Diagram (5 of 7)



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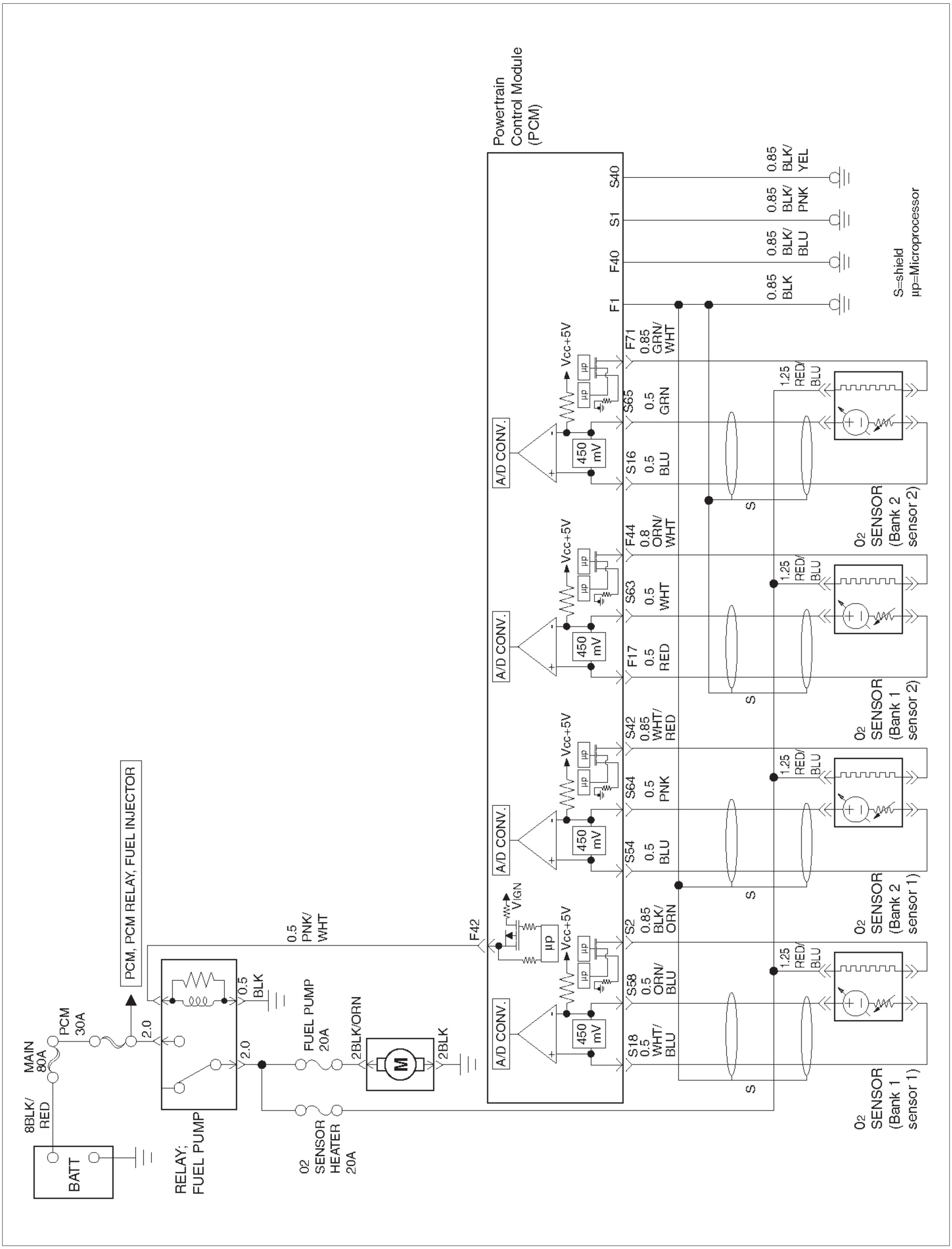
PCM Wiring Diagram (6 of 7)



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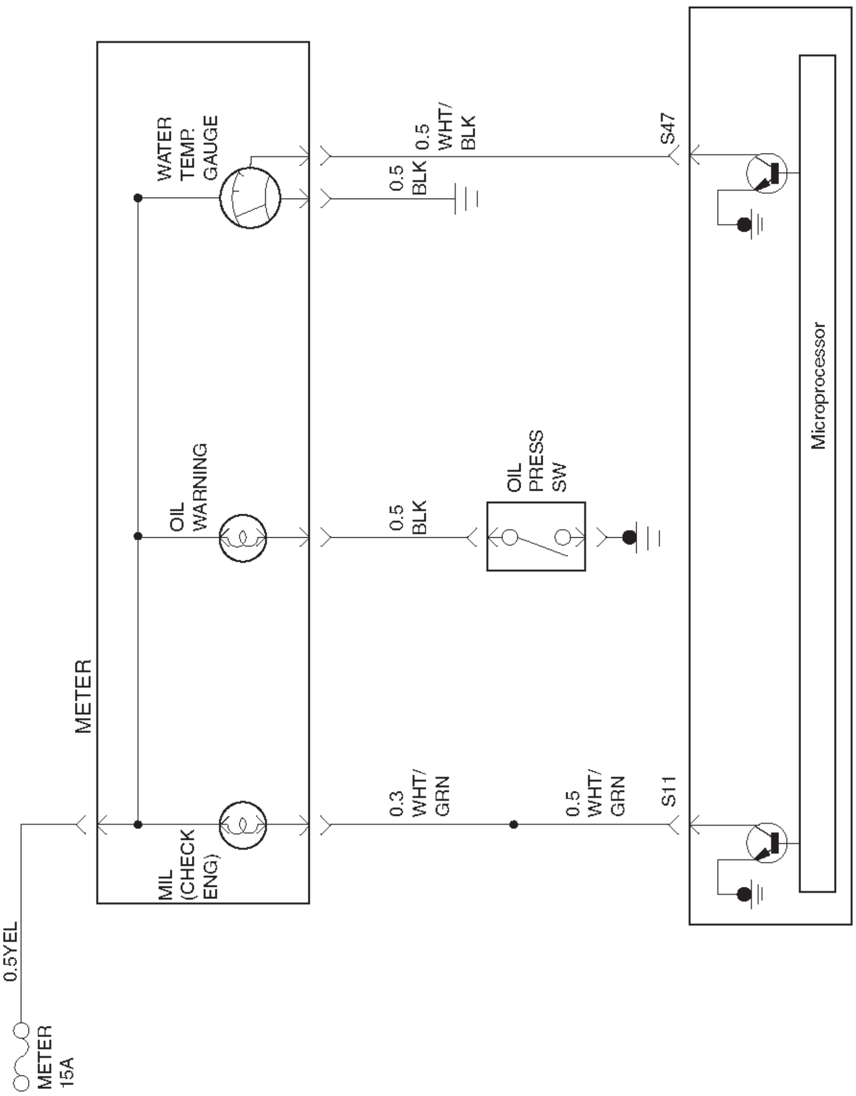
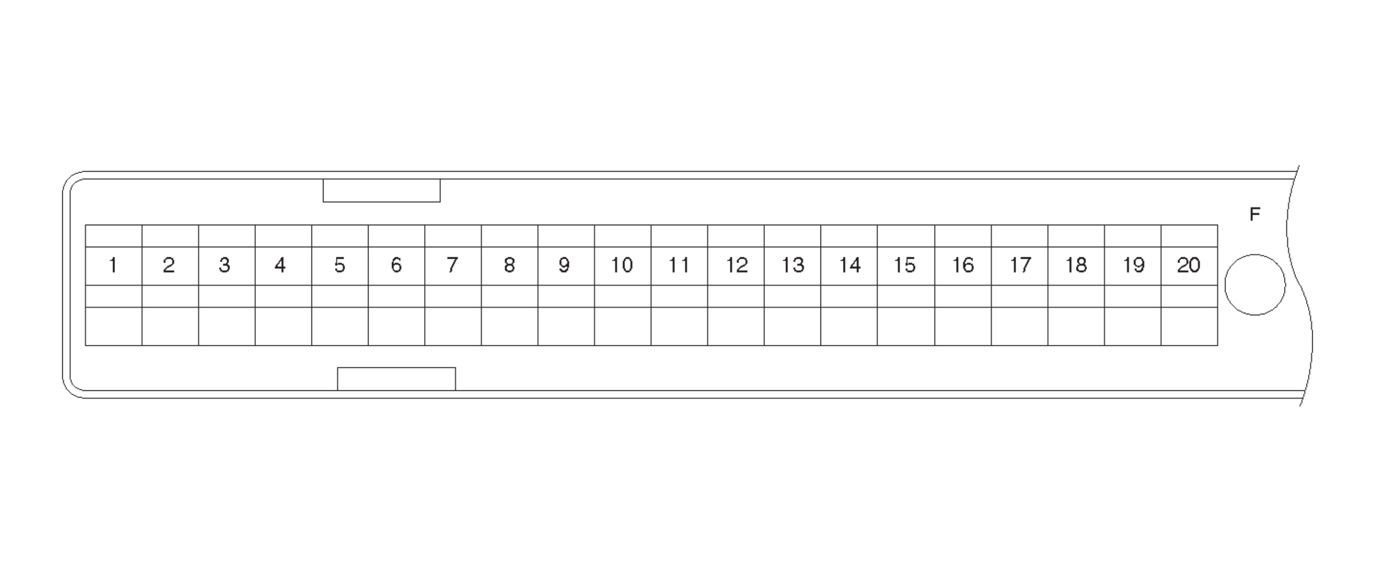
PCM Wiring Diagram (7 of 7)



060RY00146

PCM Pinouts

PCM Pinout Table, 80-Way Blue Connector – Row “F1 ~ 20”

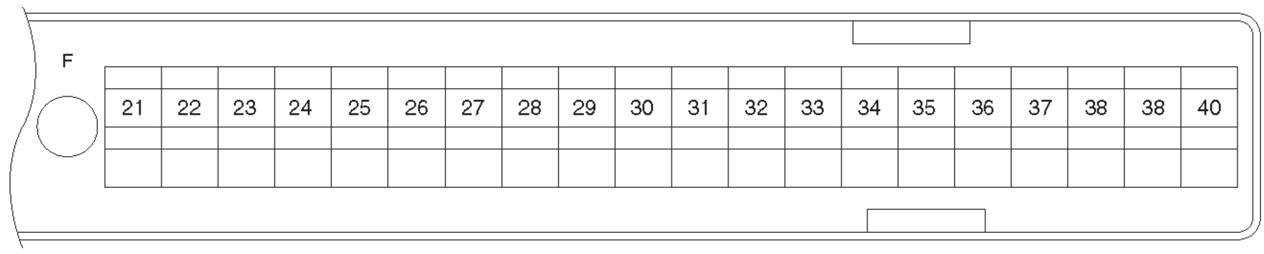


060RY00045

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F1	PCM Ground	BLK	0.0V	0.0V	Chassis Electrical
F2	5Volt Reference“2” (AP Sensor 2)	GRN	5.0V	5.0V	Appropriate Sensor
F3	5Volt Reference“2” (TP Sensor 2)	RED/WHT	5.0V	5.0V	Appropriate Sensor
F4	A/C Clutch	GRY/RED	B+(A/C off)	B+(A/C off)	General Description and Operation, A/C Clutch Circuit Operation
F5	Mission Main Case	GRN/RED	0.0V	0.0V	4L30E T/Mission
F6	Not Used	—	—	—	—
F7	Tachometer	BLK/RED	8.8V	10.0V (at idle)	Chassis Electrical
F8	Not Used	—	—	—	—
F9	Not Used	—	—	—	—
F10	Not Used	—	—	—	—
F11	Not Used	—	—	—	—
F12	Camshaft Position Sensor	WHT/RED	5.0V or less than 1.0V	4.6V	General Description and Operation, Camshaft Position Sensor
F13	Not Used	—	—	—	—
F14	Mass Air Flow(MAF)	BLK/BLU	4.9V	4.2V	General Description, Mass Air Flow Sensor
F15	Not Used	—	—	—	—
F16	Not Used	—	—	—	—
F17	Bank 1 HO2S Low	RED	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S 2
F18	Not Used	—	—	—	—

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F19	Ignition Feed	RED/GRN	B+	B+	6D Section
F20	Ignition Feed	RED/WHT	B+	B+	6D Section

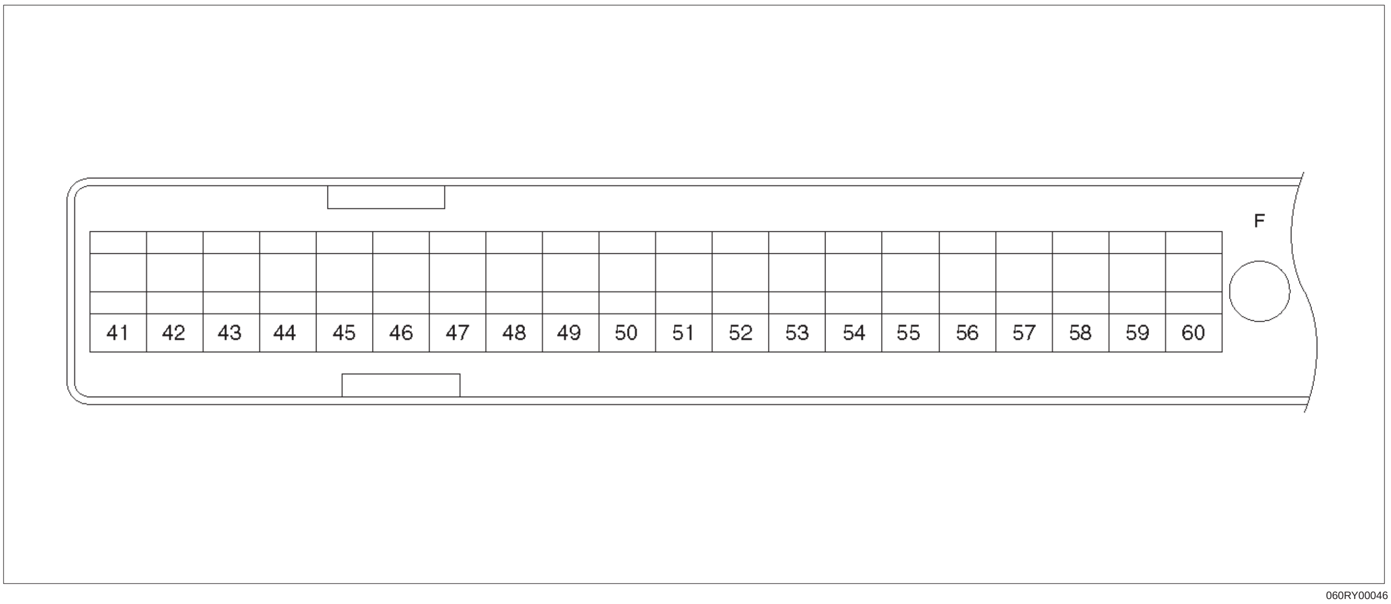
PCM Pinout Table, 80-Way Blue Connector – Row “F20 ~ 40”



060RY00156

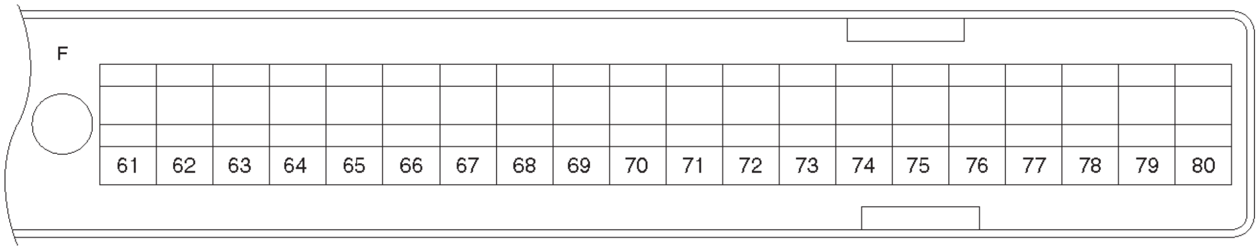
PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F21	Not Used	—	—	—	—
F22	Not Used	—	—	—	—
F23	Ground	BLK	0V	0V	General Description
F24	Not Used	—	—	—	—
F25	ION Sensing Module	RED/BLU	1.555V	1.555V	General Description and Operation, ION Sensing Module
F26	ION Sensing Module	BLK	1.555V	1.555V	General Description and Operation, ION Sensing Module
F27	Intake Air Temperature (IAT) Sensor	BLU/RED	0.5–4.9V	0.5–4.9V	General Description and Operation, IAT
F28	Not Used	—	—	—	—
F29	Manifold Absolute Pressure (MAP)	RED	3.5V–4.9V (depends on altitude and barometric pressure)	0.6-1.3V	General Description and Operation, Manifold Absolute Pressure
F30	Not Used	—	—	—	—
F31	Not Used	—	—	—	—
F32	Not Used	—	—	—	—
F33	Not Used	—	—	—	—
F34	Not Used	—	—	—	—
F35	Not Used	—	—	—	—
F36	Not Used	—	—	—	—
F37	Power Steering Pressure (PSP)	GRN/YEL	B+	B+	Power Steering
F38	Illuminated Switch	GRN/YEL	B+	B+	Chassis Electrical
F39	Brake Switch	RED	0.0V	0.0V	4L30E T/Mission
F40	PCM Ground	BLK/BLU	0.0V	0.0V	Chassis Electrical

PCM Pinout Table, 80-Way Blue Connector – Row “F41 ~ 60”



PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F41	Throttle Position(TP) 1 Sensor Ground	GRN	0.0V	0.0V	General Description and Operation, TPS
F42	Fuel Pump Relay	PNK/WHT	0.0V	B+	On Vehicle Service, Fuel Pump Relay
F43	Adaptor Case	VIO/RED	0.0V	0.0V	4L30E T/Mission
F44	Bank 1 HO2S 2 Heater Ground	ORN/WHT	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 2
F45	A/C Request	GRN/BLK	0.0V	0.0V	Chassis Electrical
F46	Stop Lamp Switch	GRY/RED	0.0V	0.0V	Chassis Electrical
F47	Adaptor Case	VIO/WHT	B+	B+	4L30E T/Mission
F48	Throttle Valve DC Motor(–)	BLU	Duty Cycle	Duty Cycle	General Description and Operation, ETC
F49	Shielded Wire (ION Sensing Module)	SIL	0.0V	0.0V	Chassis Electrical
F50	Not Used	—	—	—	—
F51	Not Used	—	—	—	—
F52	Not Used	—	—	—	—
F53	ECT Ground	YEL/BLK	0.0V	0.0V	General Description and Operation, ECT Sensor
F54	Vapor Pressure Sensor Ground	GRN	0.0V	0.0V	General Description and Operation, VP Sensor
F55	Not Used	—	—	—	—
F56	Injector Cylinder #5	GRN/BLK	B+	B+	General Description and Operation, Fuel Injector
F57	Ignition Feed	RED/WHT	B+	B+	Chassis Electrical
F58	Class 2 Data	ORN/BLK	0.0V	0.0V	General Description
F59	Not Used	—	—	—	—
F60	Shielded Wire	SIL	0.0V	0.0V	Chassis Electrical

PCM Pinout Table, 80-Way Blue Connector – Row “F61 ~ 80”



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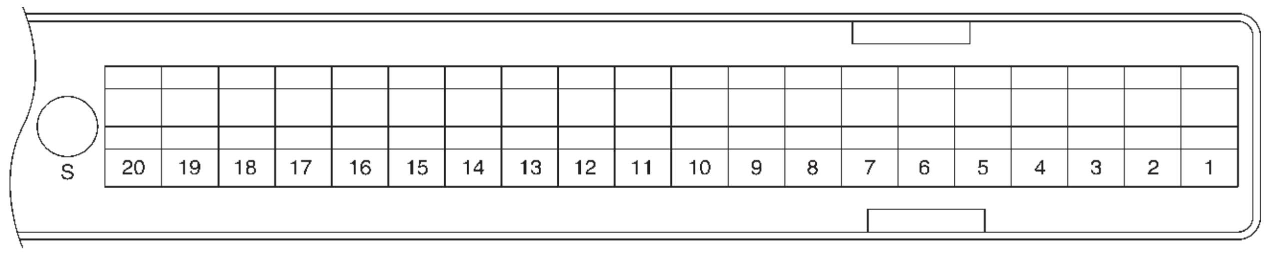
PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F61	Throttle Position(TP) 2 Sensor Ground	GRN/WHT	0.0V	0.0V	General Description and Operation, TPS
F62	Injector Cylinder #2	GRN/ORN	B+	B+	General Description and Operation, Fuel Injector
F63	AP Sensor 1 Sensor Ground	RED	0.0V	0.0V	General Description and Operation, APS
F64	Injector Cylinder #4	GRN/RED	B+	B+	General Description and Operation, Fuel Injector
F65	Throttle Psition(TP) 2 Sensor Signal	BLU/WHT	0.5–0.8V	0.8–0.8V (at idle)	General Description and Operation, TPS
F66	Injector Cylinder #3	GRN	B+	B+	General Description and Operation, Fuel Injector
F67	ION Sensing Module	YEL	1.555V	1.555V	General Description and Operation, ION Sensing Module
F68	ION Sensing Module	RED	1.555V	1.555V	General Description and Operation, ION Sensing Module
F69	Injector Cylinder #1	GRN/WHT	B+	B+	General Description and Operation, Fuel Injector
F70	Not Used	—	—	—	—
F71	Bank 2 HO2S 2 Heater Ground	GRN/WHT	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S 1
F72	Auto Cruise Switch Resume	WHT/BLU	0.0V	0.0V	Chassis Electrical
F73	Crankshaft Position Sensor	GRN/WHT	0.3V	2.2V	General Description and Operation, CKP sensor
F74	ECT Sensor	BLU/RED	0.5–4.9V	0.5–4.9V	General Description and Operation, ECT Sensor
F75	Ignition Feed	RED/GRN	B+	B+	Chassis Electrical
F76	Clutch Switch (M/T only)	GRN	B+	B+	Manual T/Mission
	Mode Switch (A/T only)	PNK/BLK	B+	B+	4L30E T/Mission

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
F77	Mode Switch	PNK/BLU	B+	B+	4L30E T/Mission
F78	Mode Switch	PNK/YEL	B+	B+	4L30E T/Mission
F79	Mode Switch	PNK	B+	B+	4L30E T/Mission
F80	AP Sensor 2 Sensor Ground	BLU	0.0V	0.0V	General Description and Operation, APS

PCM Pinout Table, 80-Way Red Connector – Row “S1 ~ 20”

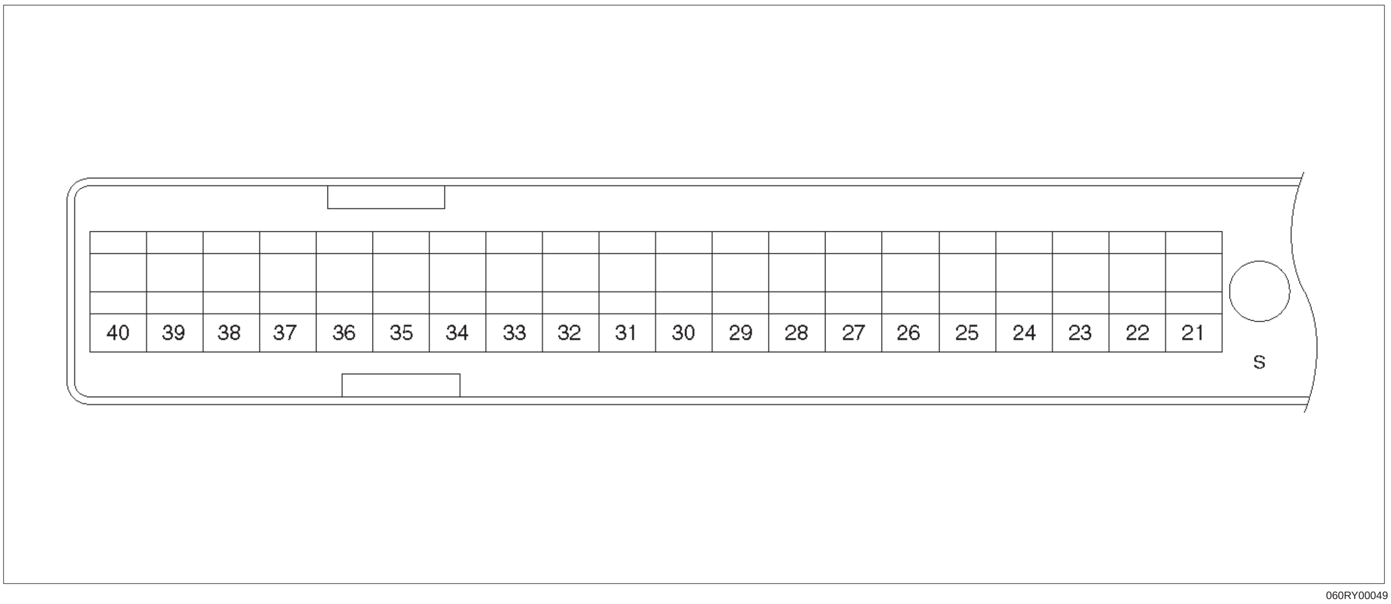


060RY00069

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S1	PCM Ground	BLK/PNK	0.0V	0.0V	Chassis Electrical
S2	Bank 1 HO2S 1 Heater Ground	BLK/ORN	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S
S3	Not Used	—	—	—	—
S4	Not Used	—	—	—	—
S5	5Volt Reference“2” (CKP Sensor/CMP Sensor)	WHT	5.0V	5.0V	Appropriate Sensor (CKP Sensor, CMP Sensor, AP2 Sensor)
S6	Auto Cruise Switch Cancel	GRY/GRN	0.0V	0.0V	Chassis Electrical
S7	Fuel Gauge	YEL/RED	B+	B+	General Description and Chassis Electrical
S8	Not Used	—	—	—	—
S9	Not Used	—	—	—	—
S10	Shift High (Band Apply)	BRN/YEL	B+	B+	4L30E T/Mission
S11	Malfunction Indicator (Check Engine) Lamp	WHT/GRN	0.0V	B+	Chassis Electrical
S12	Not Used	—	—	—	—
S13	ION Sensing Module	RED/WHT	1.555V	1.555V	General Description and Operation, ION Sensing Module
S14	Not Used	—	—	—	—
S15	Not Used	—	—	—	—
S16	Bank 2 HO2S 2 Low	BLU	0.0V	0.1V	General Description and Operation, Catalyst Monitor HO2S
S17	Not Used	—	—	—	—
S18	Bank 1 HO2S 1 Low	WHT/BLU	0.0V	0.1V	General Description and Operation, Catalyst Monitor HO2S

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S19	ION Sensing Module	RED/YEL	1.555V	1.555V	General Description and Operation, ION Sensing Module
S20	Transmission Fluid Temperature Sensor Ground	RED/WHT	0.0V	0.0V	4L30E T/Mission

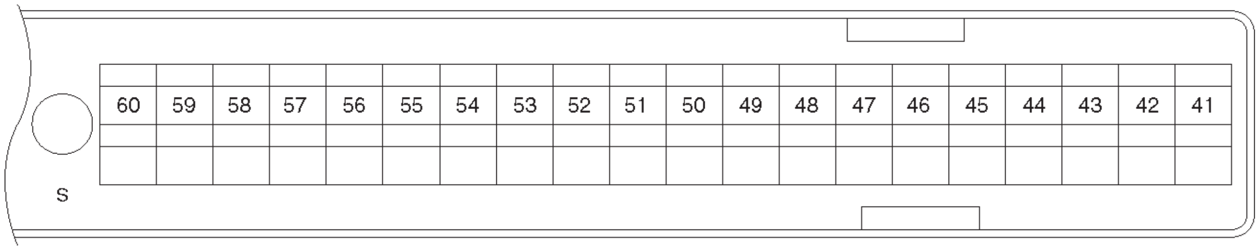
PCM Pinout Table, 80-Way Red Connector – Row “S21 ~ 40”



PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S21	Rr Def. Switch	YEL/GRN	—	—	Chassis Electrical
S22	Transmission Output Speed Sensor	BLU/YEL	0.0V	0.0V	4L30E T/Mission
S23	PCM Ground	BLK	0.0V	0.0V	Chassis Electrical
S24	Not Used	—	—	—	—
S25	Not Used	—	—	—	—
S26	EGR Control Low	BLU/RED	B+	B+	General Description and Operation, EGR Control
S27	VSS Input	BLK/YEL	0.0V	0.1V (at rest)	Chassis Electrical
S28	Injector Cylinder #6	GRN/YEL	B+	B+	General Description and Operation, Fuel Injector
S29	Winter Switch	VIO/GRN	B+	B+	4L30E T/Mission
S30	Auto Cruise Main Switch	WHT/GRN	0.0V	0.0V	Chassis Electrical
S31	Transmission Range Signal“2–3”	GRN	0.0V	0.0V	4L30E T/Mission
S32	Ignition Feed	RED/GRN	B+	B+	Chassis Electrical
S33	TCC Solenoid	BRN/WHT	0.0V	0.0V	T/Mission
S34	Not Used	—	—	—	—
S35	ION Sensing Module	RED/GRN	1.555V	1.555V	General Description and Operation, ION Sensing Module
S36	5Volt Reference (AP Sensor 1)	BLK	5.0V	5.0V	AP Sensor
S37	5Volt Reference (Fuel Tank Pressure Sensor/MAP Sensor/EGR Position Sensor)	GRY/RED	5.0V	5.0V	(Fuel Tank Pressure Sensor/MAP Sensor/EGR Position Sensor) Sensor
S38	5Volt Reference (TP Sensor 1)	RED	5.0V	5.0V	TP Sensor

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S39	Auto Cruise Lamp	WHT	0.0V	0.0V	Chassis Electrical
S40	PCM Ground	BLK/YEL	0.0V	0.0V	Chassis Electrical

PCM Pinout Table, 80-Way Red Connector – Row “S41 ~ 60”



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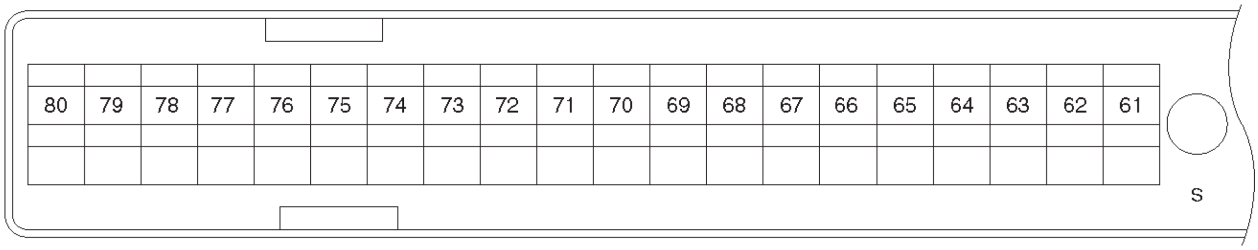
PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S41	AP Sensor 3 Sensor Ground	ORN/BLU	0.0V	0.0V	General Description and Operation, APS
S42	Bank 2 HO2S 1 Heater Ground	WHT/RED	0.0V	0.0V	General Description and Operation, Catalyst Monitor HO2S
S43	Transmission Range Signal“1–2” “3–4”	GRY/WHT	0.0V	0.0V	4L30E T/Mission
S44	Rr Def. Relay	RED/WHT	—	—	—
S45	Not Used	—	—	—	—
S46	Not Used	—	—	—	—
S47	Water Temp. Gauge	WHT/BLK	B+	B+	4L30E T/Mission
S48	Duty Solenoid valve	RED/BLU	B+	5.7V	General Description and Operation, EVAP Emission Control System
S49	DLC	RED/WHT	B+	B+	General Description
S50	Fuel Sender Unit	ORN/GRN	0.0V	0.0V	—
S51	TCC Solenoid	BRN/BLU	B+	B+	T/Mission
S52	Vapor Pressure Sensor Signal	GRY	0.2–4.8V	0.2–4.8V	General Description and Operation, VP Sensor
S53	Power Switch	VIO/RED	B+	B+	4L30E T/Mission
S54	Bank 2 HO2S 1 Low	BLU	0.0V	0.1V	General Description and Operation, Catalyst Monitor HO2S
S55	Transmission Output Speed Sensor	BLU/GRN	0.0V	0.0V	4L30E T/Mission
S56	Not Used	—	—	—	—
S57	Not Used	—	—	—	—
S58	Bank 1 HO2S 1 High	ORN/BLU	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S59	Auto Cruise Steering Set Switch	Light GRN	0.0V	0.0V	Chassis Electrical
S60	Fuel Sender Unit	BLU/YEL	0.5–4.9V	0.5–4.9V	ON-Vehicle Service PCM and Sensors

PCM Pinout Table, 80-Way Red Connector – Row “S61 ~ 80”



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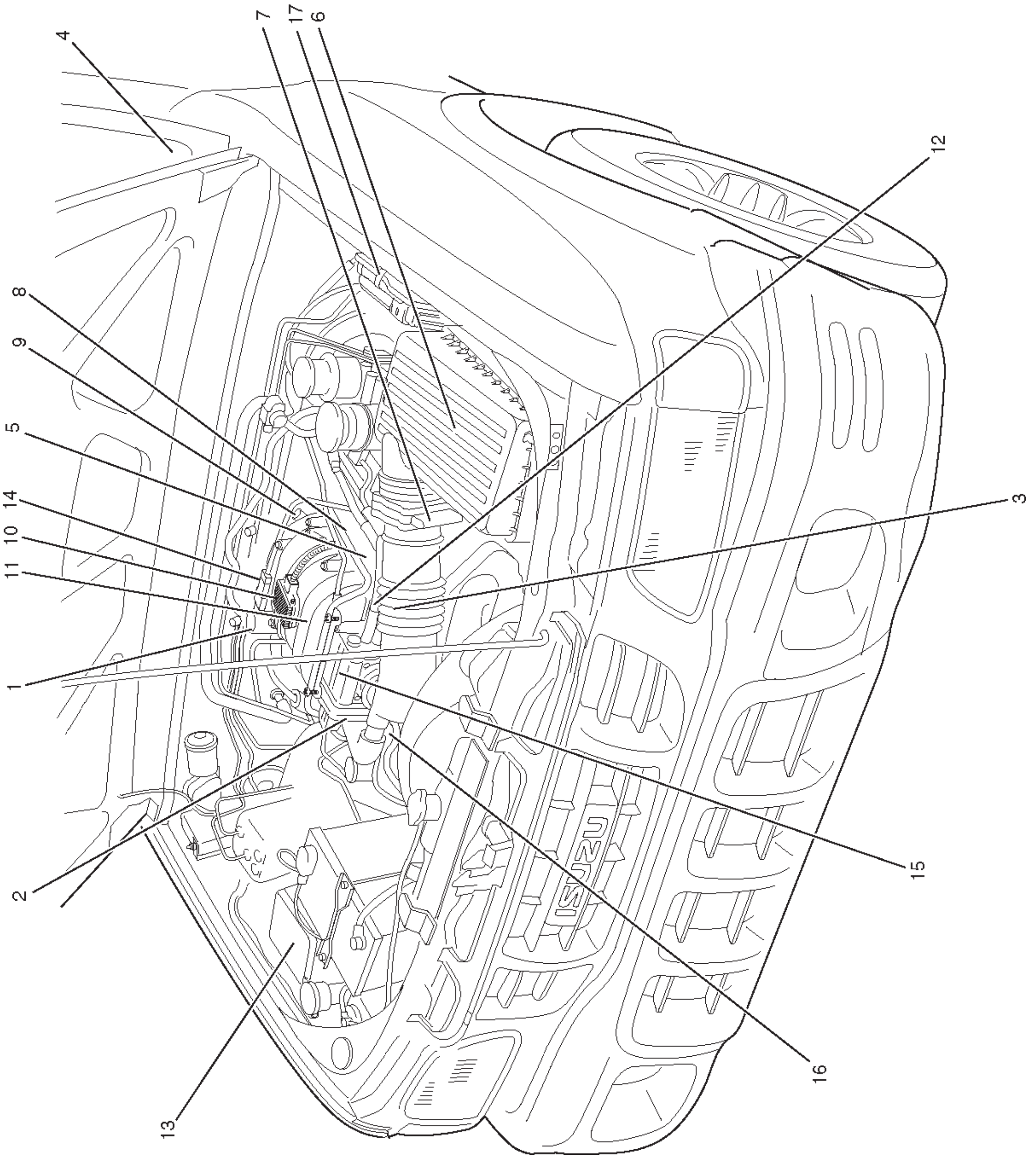
PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S61	Intake Air Temperature (IAT) Sensor Ground	YEL/GRN	0.0V	0.0V	General Description and Operation, IAT
S62	ION Sensing Module	RED	1.555V	1.555V	General Description and Operation, ION Sensing Module
S63	Bank 1 HO2S 2 High	WHT	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S
S64	Bank 2 HO2S 1 High	PNK	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S
S65	Bank 2 HO2S 2 High	GRN	0.3V	0.1–0.9V	General Description and Operation, Catalyst Monitor HO2S
S66	Transmission Fluid Temperature Sensor	RED/BLU	0.5–4.9V (depends on temperature)	0.5–4.9V (depends on temperature)	4L30E T/Mission
S67	Exhaust Gas Recirculation (EGR)	GRY/RED	0.6V	0.6V	General Description and Operation, EGR Control
S68	Accelerator Position (AP) Sensor 1	WHT	0.41–0.45V	0.41–0.45V	General Description and Operation, AP Sensor
S69	Throttle Valve DC Motor(+)	GRN	Duty Cycle	Duty Cycle	General Description and Operation, ETC
S70	Not Used	—	—	—	—
S71	Not Used	—	—	—	—
S72	Ignition Feed for ETC	RED/GRN	B+	B+	Chassis Electrical
S73	Auto Cruise Main Lamp	GRN/WHT	B+	B+	Chassis Electrical
S74	Variable Intake Manifold	YEL/BLK	0.0V	B+ (rpm 3600 over)	General Description
S75	Canister Purge Cut Solenoid Valve	BRN/WHT	6.0V Tank empty	5.7V Tank empty	General Description and Operation, EVAP
S76	Throttle Position (TP) 1 Sensor Signal	BLU	0.5–0.8V	0.5–0.8V (at idle)	General Description and Operation, TPS

PIN	PIN Function	Wire Color	IGN ON	ENG RUN	Refer To
S77	5Volt Reference (AP Sensor 3)	ORN	5.0V	5.0V	Appropriate Sensor
S78	Accelerate Position (AP) Sensor 2	YEL	0.41–0.45V	0.41–0.45V	General Description and Operation, AP Sensor
S79	Accelerate Position (AP) Sensor 3	BLU/GRN	4.55–4.99V	0.41–0.45V	General Description and Operation, AP Sensor
S80	Manifold Absolute Pressure (MAP)	GRN	0V	0V	General Description and Operation, Manifold Absolute Pressure

Component Locators

Engine Component Locator



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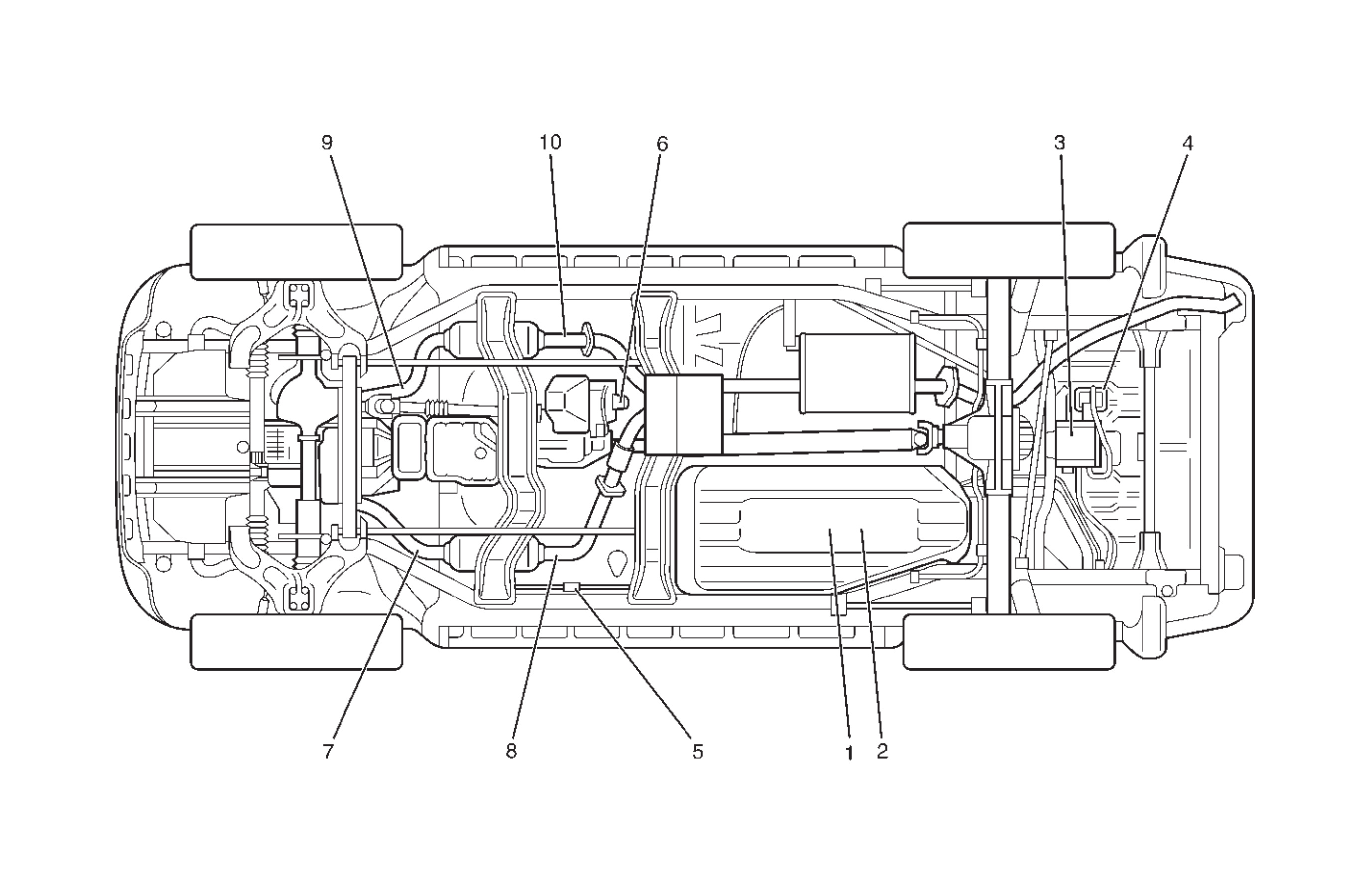
Engine Component Locator Table

Number	Name	Location
1	Linear Exhaust Gas Recirculation (EGR) Valve	Rear right side of the engine
2	Throttle Position (TP) Sensor	On the throttle body
3	Intake Air Temperature (IAT) Sensor	On the intake air duct near the throttle body
4	Check Engine (MIL) Light	On the instrument panel beneath the tachometer
5	Positive Crankcase Ventilation (PCV) Valve	On the left of the cylinder head cover
6	Air Cleaner	Left front of the engine bay
7	Mass Air Flow (MAF) Sensor	Attached to the air filter box
8	Camshaft Position (CMP) Sensor	On the rear right side of the left cylinder head
9	Fuel Pressure Regulator	Rear side of the engine
10	ION Sensing module	Bolted to the top of the Common Chamber
11	Common Chamber	Top of the engine
12	EVAP Duty Solenoid Valve	Bolted to the front of the coolant pipe
13	Fuse/Relay Box	Along the inside of the right fender
14	Manifold Absolute Pressure (MAP) Sensor	Bolted to the top of the Common Chamber
15	Throttle Body	Between the intake air duct and the Common Chamber
16	Engine Coolant Temperature Sensor	On the coolant crossover pipe at the front of the engine, near the throttle body
17	Power Train Control Module (PCM)	Along the inside of the right fender

Undercarriage Component Locator



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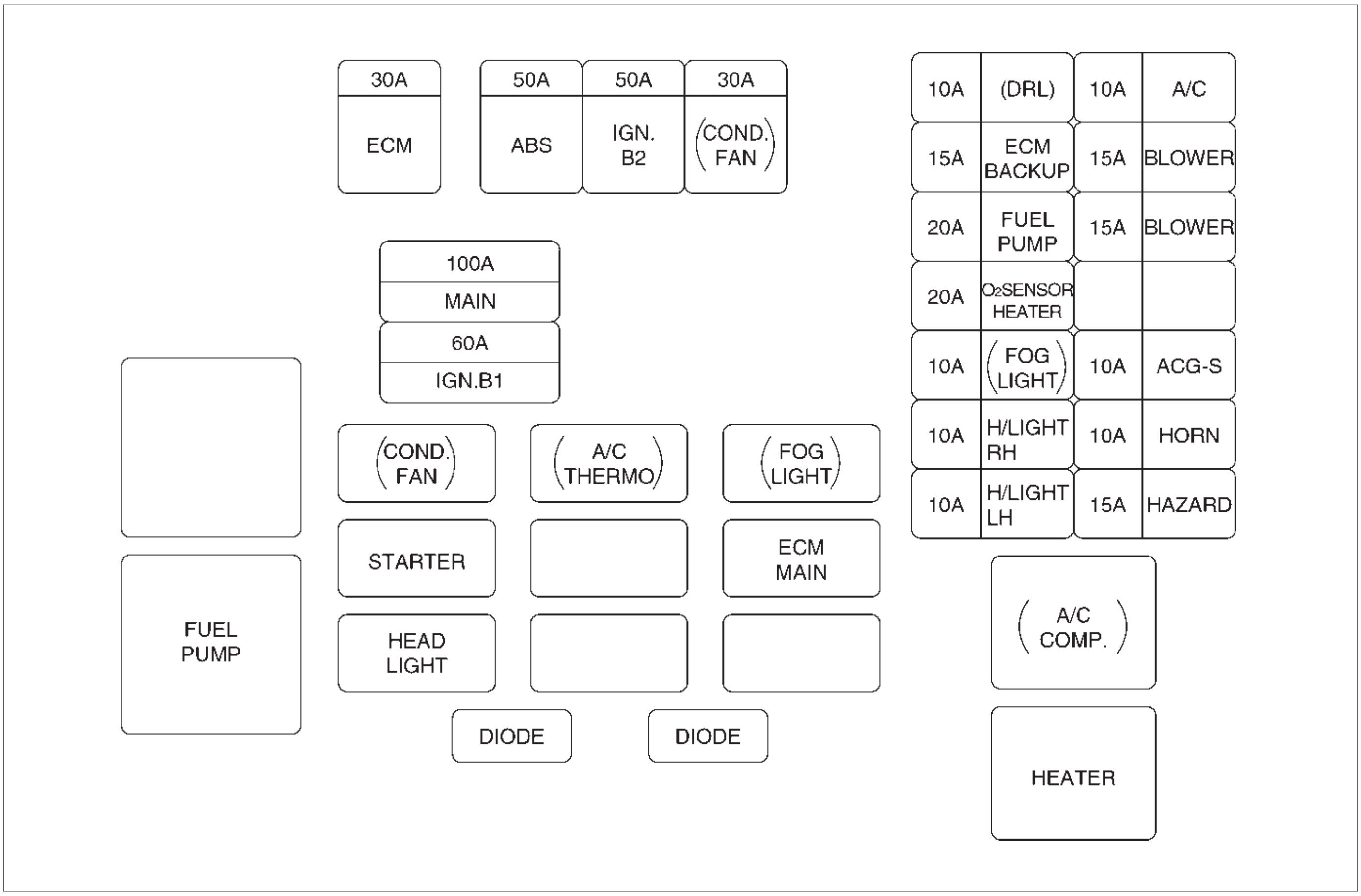
Undercarriage Component Locator Table

Number	Name	Location
1	Fuel Pump Assembly and Fuel Tank Pressure Sensor	Installed in the top of the fuel tank
2	Fuel Gauge Unit	Installed in the top of the fuel tank
3	Evaporative (EVAP) Canister	On the top of the bracket that is located behind of the cross member
4	EVAP Canister Vent Solenoid	On the top of the bracket that is located behind of the cross member
5	Fuel Filter	Located along the inside of the right frame rail, ahead of the fuel tank
6	Vehicle Speed Sensor (VSS)	Protrudes from the transmission housing, just ahead of the propeller shaft
7	Heated Oxygen Sensor (Bank 1, HO2S 1)	Threaded into the exhaust pipe behind the right-hand catalytic converter
8	Heated Oxygen Sensor (Bank 1, HO2S 2)	Threaded into the exhaust pipe ahead of the right-hand catalytic converter
9	Heated Oxygen Sensor (Bank 2, HO2S 1)	Threaded into the exhaust pipe ahead the left-hand catalytic converter
10	Heated Oxygen Sensor (Bank 2, HO2S 2)	Threaded into the exhaust pipe behind the left-hand catalytic converter

Fuse and Relay Panel (Underhood Electrical Center)



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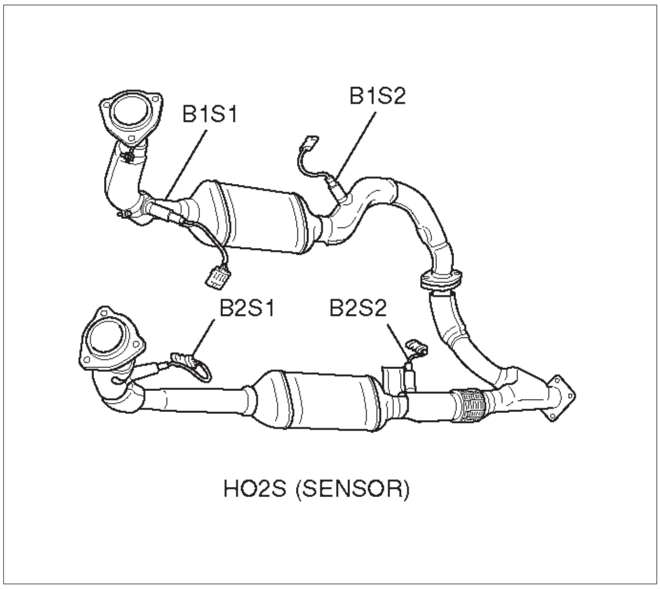
Sensors and Miscellaneous Component Locators



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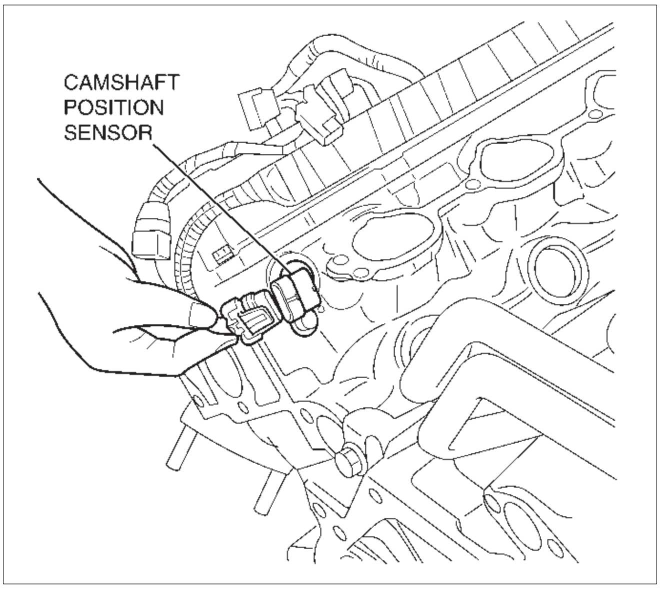

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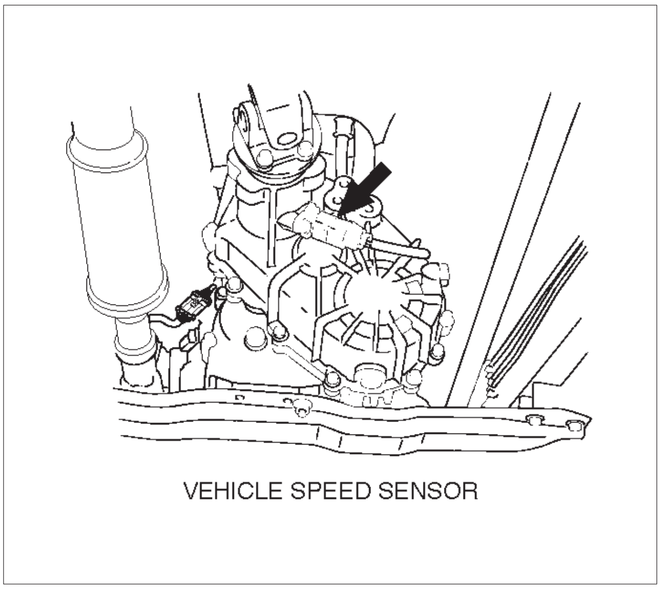

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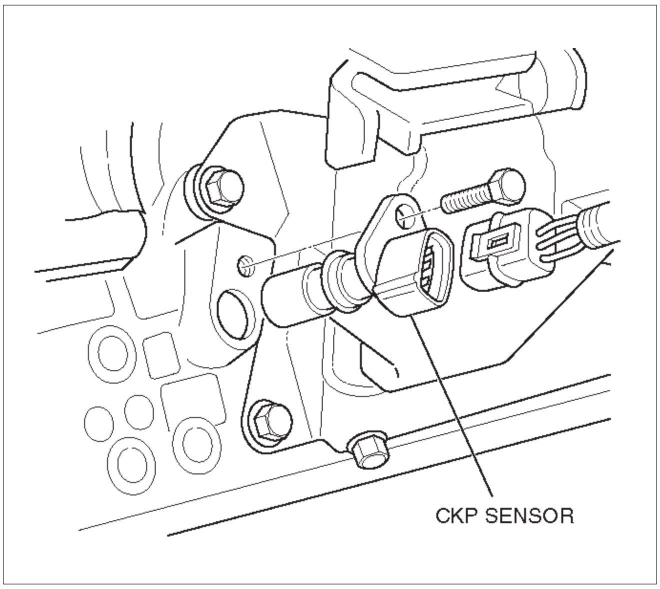

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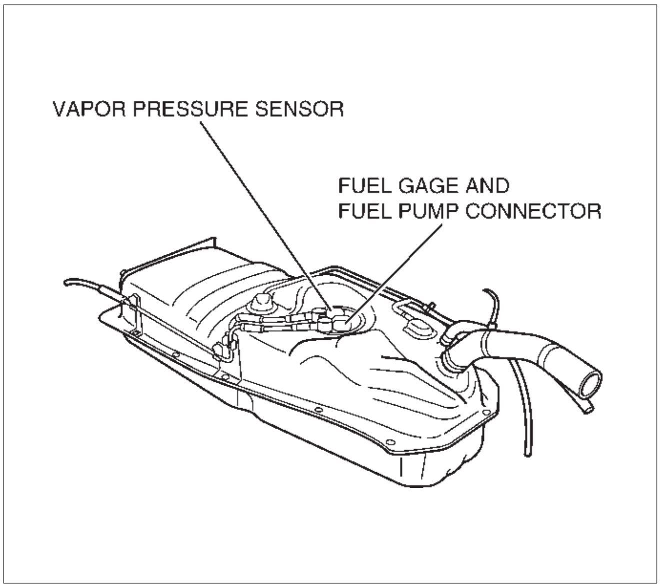

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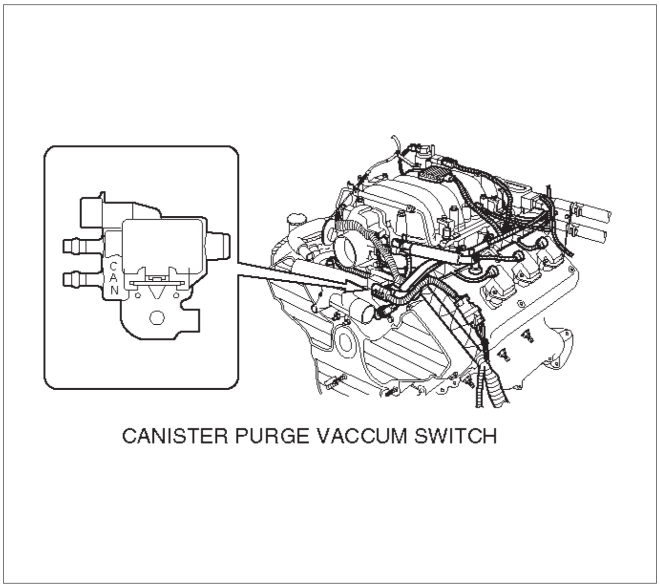

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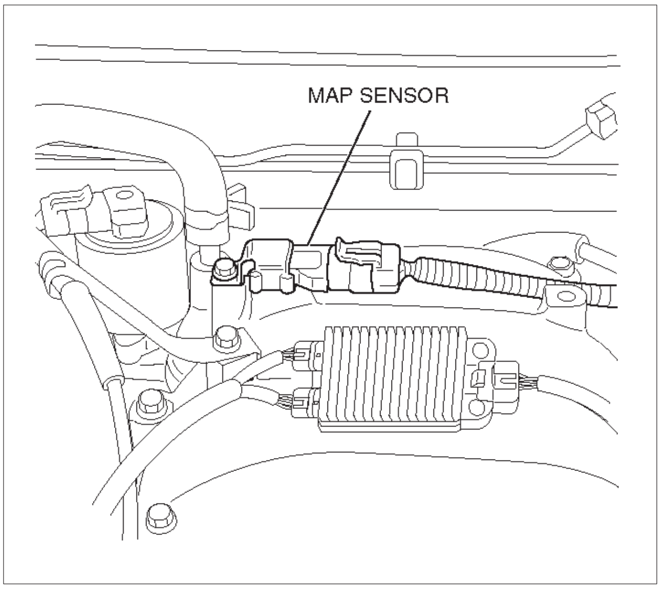

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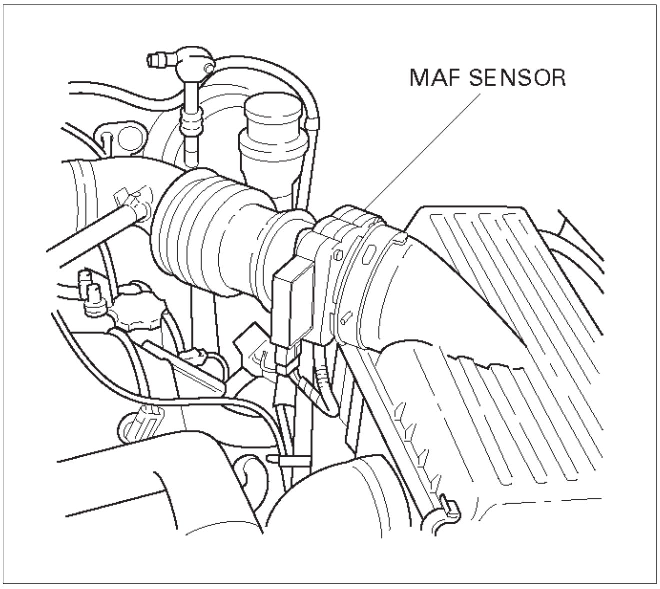

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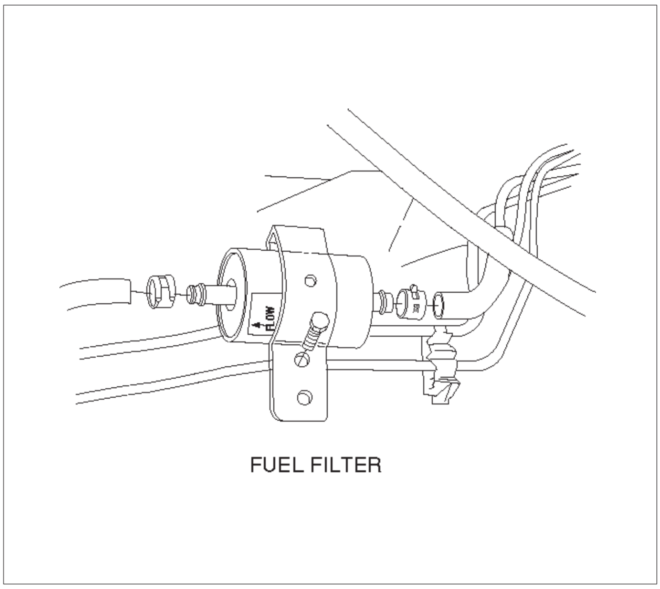

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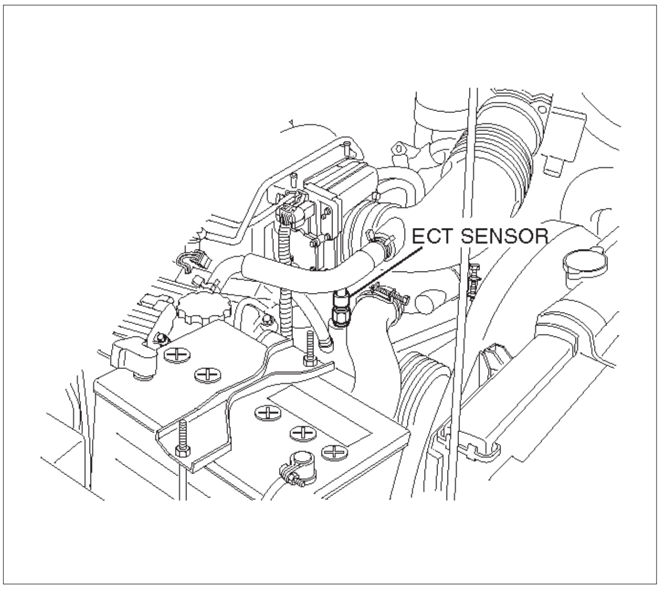

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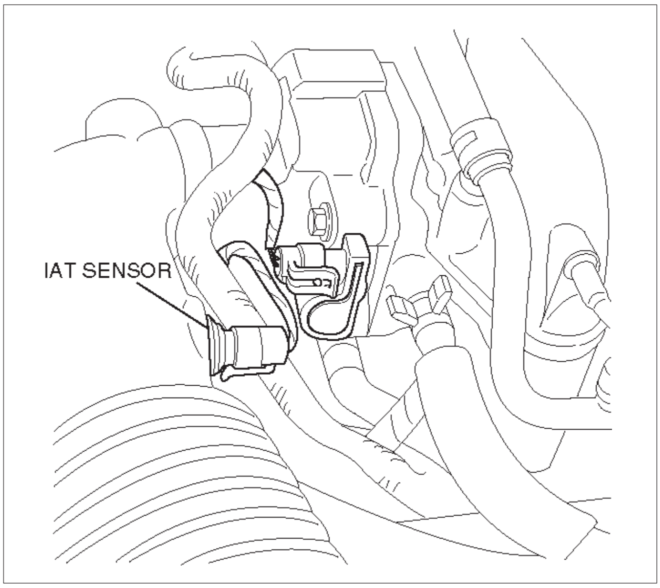

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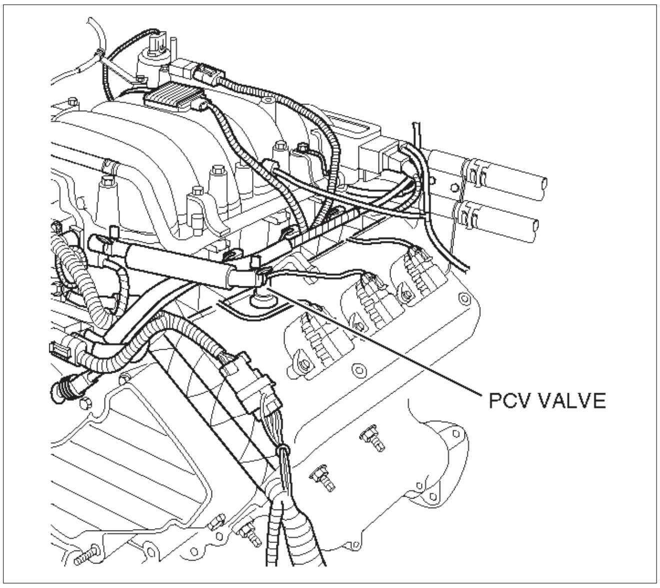

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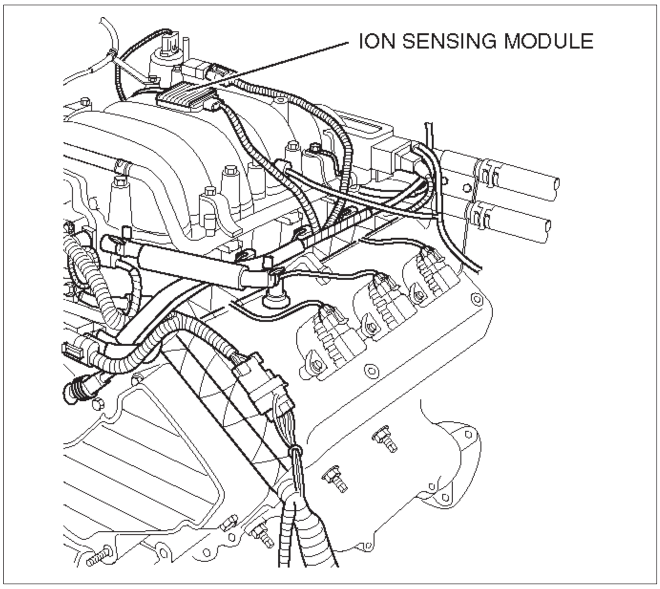

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Diagnosis

Strategy-Based Diagnostics

Strategy-Based Diagnostics

The strategy-based diagnostic is a uniform approach to repair all Electrical/Electronic (E/E) systems. The diagnostic flow can always be used to resolve an E/E system problem and is a starting point when repairs are necessary. The following steps will instruct the technician how to proceed with a diagnosis:

1. Verify the customer complaint.
   - To verify the customer complaint, the technician should know the normal operation of the system.
2. Perform preliminary checks.
   - Conduct a thorough visual inspection.
   - Review the service history.
   - Detect unusual sounds or odors.
   - Gather diagnostic trouble code information to achieve an effective repair.
3. Check bulletins and other service information.
   - This includes videos, newsletters, etc.
4. Refer to service information (manual) system check(s).
   - “System checks” contain information on a system that may not be supported by one or more DTCs. System checks verify proper operation of the system. This will lead the technician in an organized approach to diagnostics.
5. Refer to service diagnostics.

DTC Stored

Follow the designated DTC chart exactly to make an effective repair.

No DTC

Select the symptom from the symptom tables. Follow the diagnostic paths or suggestions to complete the repair. You may refer to the applicable component/system check in the system checks.

No Matching Symptom

1. Analyze the complaint.
2. Develop a plan for diagnostics.
3. Utilize the wiring diagrams and the theory of operation.

Combine technician knowledge with efficient use of the available service information.

Intermittents

Conditions that are not always present are called intermittents. To resolve intermittents, perform the following steps:

1. Observe history DTCs, DTC modes, and freeze frame data.
2. Evaluate the symptoms and the conditions described by the customer.
3. Use a check sheet or other method to identify the circuit or electrical system component.
4. Follow the suggestions for intermittent diagnosis found in the service documentation.

Most Scan Tools, such as the Tech 2, have data-capturing capabilities that can assist in detecting intermittents.

No Trouble Found

This condition exists when the vehicle is found to operate normally. The condition described by the customer may be normal. Verify the customer complaint against another vehicle that is operating normally. The condition may be intermittent. Verify the complaint under the conditions described by the customer before releasing the vehicle.

1. Re-examine the complaint.

   When the Complaint cannot be successfully found or isolated, a re-evaluation is necessary. The complaint should be re-verified and could be intermittent as defined in *Intermittents* section, or could be normal.
2. Repair and verify.

   After isolating the cause, the repairs should be made. Validate for proper operation and verify that the symptom has been corrected. This may involve road testing or other methods to verify that the complaint has been resolved under the following conditions:
   - Conditions noted by the customer.
   - If a DTC was diagnosed, verify a repair by duplicating conditions present when the DTC was set as noted in the Failure Records or Freeze Frame data.

Verifying Vehicle Repair

Verification of the vehicle repair will be more comprehensive for vehicles with OBD II system diagnostics. Following a repair, the technician should perform the following steps:

IMPORTANT: Follow the steps below when you verify repairs on OBD II systems. Failure to follow these steps could result in unnecessary repairs.

1. Review and record the Failure Records and the Freeze Frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for an A or B type diagnostic and only if the MIL(”Check Engine” lamp) has been requested).
2. Clear the DTC(S).
3. Operate the vehicle within conditions noted in the Failure Records and Freeze Frame data.
4. Monitor the DTC status information for the DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

General Service Information

OBD II Serviceablity Issues

With the introduction of OBD II diagnostics across the entire passenger car and light-duty truck market in 1996, illumination of the MIL (“Check Engine” lamp) due to a non-vehicle fault could lead to misdiagnosis of the vehicle, increased warranty expense and customer dissatisfaction. The following list of non-vehicle faults does not include every possible fault and may not apply equally to all product lines.

Fuel Quality

Fuel quality is not a new issue for the automotive industry, but its potential for turning on the MIL (“Check Engine” lamp) with OBD II systems is new.

Fuel additives such as “dry gas” and “octane enhancers” may affect the performance of the fuel. If this results in an incomplete combustion or a partial burn, it will show up as a Misfire DTC P0300. The Reid Vapor Pressure of the fuel can also create problems in the fuel system, especially during the spring and fall months when severe ambient temperature swings occur. A high Reid Vapor Pressure could show up as a Fuel Trim DTC due to excessive canister loading. High vapor pressures generated in the fuel tank can also affect the Evaporative Emission diagnostic as well.

Using fuel with the wrong octane rating for the vehicle may cause driveability problems. Many of the major fuel companies advertise that using “premium” gasoline will improve the performance of the vehicle. Most premium fuels use alcohol to increase the octane rating of the fuel. Although alcohol-enhanced fuels may raise the octane rating, the fuel’s ability to turn into vapor in cold temperatures deteriorates. This may affect the starting ability and cold driveability of the engine.

Low fuel levels can lead to fuel starvation, lean engine operation, and eventually engine misfire.

Non-OEM Parts

All of the OBD II diagnostics have been calibrated to run with OEM parts. Something as simple as a high-performance exhaust system that affects exhaust system back pressure could potentially interfere with the operation of the EGR valve and thereby turn on the MIL (“Check Engine” lamp). Small leaks in the exhaust system near the post catalyst oxygen sensor can also cause the MIL (“Check Engine” lamp) to turn on.

Aftermarket electronics, such as transceivers, stereos, and anti-theft devices, may radiate EMI into the control system if they are improperly installed. This may cause a false sensor reading and turn on the MIL (“Check Engine” lamp).

Environment

Temporary environmental conditions, such as localized flooding, will have an effect on the vehicle ignition system. If the ignition system is rain-soaked, it can temporarily cause engine misfire and turn on the MIL (“Check Engine” lamp).

Refueling

A new OBD II diagnostic was introduced in 1996 on some vehicles. This diagnostic checks the integrity of the entire evaporative emission system. If the vehicle is restarted after refueling and the fuel cap is not secured correctly, the on-board diagnostic system will sense this as a system fault and turn on the MIL (“Check Engine” lamp) with a DTC P0440.

Vehicle Marshaling

The transportation of new vehicles from the assembly plant to the dealership can involve as many as 60 key cycles within 2 to 3 miles of driving. This type of operation contributes to the fuel fouling of the spark plugs and will turn on the MIL (“Check Engine” lamp) with a P0300 Misfire DTC.

Poor Vehicle Maintenance

The sensitivity of OBD II diagnostics will cause the MIL (“Check Engine” lamp) to turn on if the vehicle is not maintained properly. Restricted air filters, fuel filters, and crankcase deposits due to lack of oil changes or improper oil viscosity can trigger actual vehicle faults that were not previously monitored prior to OBD II. Poor vehicle maintenance can’t be classified as a “non-vehicle fault”, but with the sensitivity of OBD II diagnostics, vehicle maintenance schedules must be more closely followed.

Related System Faults

Many of the OBD II system diagnostics will not run if the PCM detects a fault on a related system or component. One example would be that if the PCM detected a Misfire fault, the diagnostics on the catalytic converter would be suspended until Misfire fault was repaired. If the Misfire fault was severe enough, the catalytic converter could be damaged due to overheating and would never set a Catalyst DTC until the Misfire fault was repaired and the Catalyst diagnostic was allowed to run to completion. If this happens, the customer may have to make two trips to the dealership in order to repair the vehicle.

Emissions Control Information Label

The engine compartment “Vehicle Emissions Control Information Label” contains important emission specifications and setting procedures. In the upper left corner is exhaust emission information. This identifies the emission standard (Federal, California, or Canada) of the engine, the displacement of the engine in liters, the class of the vehicle, and the type of fuel metering system. There is also an illustrated emission components and vacuum hose schematic.

This label is located in the engine compartment of every vehicle. If the label has been removed it should be replaced. It can be ordered from Isuzu Dealership.

Visual / Physical Engine Compartment Inspection

Perform a careful visual and physical engine compartment inspection when performing any diagnostic procedure or diagnosing the cause of an emission test failure. This can often lead to repairing a problem without further steps. Use the following guidelines when performing a visual/physical inspection:

- Inspect all vacuum hoses for pinches, cuts, disconnections, and proper routing.
- Inspect hoses that are difficult to see behind other components.

- Inspect all wires in the engine compartment for proper connections, burned or chafed spots, pinched wires, contact with sharp edges or contact with hot exhaust manifolds or pipes.

Basic Knowledge of Tools Required

NOTE: Lack of basic knowledge of this powertrain when performing diagnostic procedures could result in an incorrect diagnosis or damage to powertrain components. Do not attempt to diagnose a powertrain problem without this basic knowledge.

A basic understanding of hand tools is necessary to effectively use this section of the Service Manual.

Serial Data Communications

Class II Serial Data Communications

Government regulations require that all vehicle manufacturers establish a common communication system. This vehicle utilizes the “Class II” communication system. Each bit of information can have one of two lengths: long or short. This allows vehicle wiring to be reduced by transmitting and receiving multiple signals over a single wire. The messages carried on Class II data streams are also prioritized. If two messages attempt to establish communications on the data line at the same time, only the message with higher priority will continue. The device with the lower priority message must wait. The most significant result of this regulation is that it provides Scan tool manufacturers with the capability to access data from any make or model vehicle that is sold.

The data displayed on other Scan tools will appear the same, with some exceptions. Some Scan tools will only be able to display certain vehicle parameters as values that are a coded representation of the true or actual value. On this vehicle the Scan tool displays the actual values for vehicle parameters. It will not be necessary to perform any conversions from coded values to actual values.

On-Board Diagnostic (OBD II)

On-Board Diagnostic Tests

A diagnostic test is a series of steps, the result of which is a pass or fail reported to the diagnostic executive. When a diagnostic test reports a pass result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The diagnostic test has passed during the current ignition cycle.
- The fault identified by the diagnostic test is not currently active.

When a diagnostic test reports a fail result, the diagnostic executive records the following data:

- The diagnostic test has been completed since the last ignition cycle.
- The fault identified by the diagnostic test is currently active.
- The fault has been active during this ignition cycle.
- The operating conditions at the time of the failure.

Remember, a fuel trim DTC may be triggered by a list of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Comprehensive Component Monitor Diagnostic Operation

Comprehensive component monitoring diagnostics are required to monitor emissions-related input and output powertrain components. The *CARB OBD II Comprehensive Component Monitoring List Of Components Intended To illuminate MIL* is a list of components, features or functions that could fall under this requirement.

Input Components:

Input components are monitored for circuit continuity and out-of-range values. This includes rationality checking. Rationality checking refers to indicating a fault when the signal from a sensor does not seem reasonable, i.e. Throttle Position (TP) sensor that indicates high throttle position at low engine loads or MAP voltage. Input components may include, but are not limited to the following sensors:

- Vehicle Speed Sensor (VSS)
- Crankshaft Position (CKP) sensor
- Throttle Position (TP) sensor
- Engine Coolant Temperature (ECT) sensor
- Camshaft Position (CMP) sensor
- Manifold Absolute Pressure (MAP) sensor
- Mass Air Flow (MAF) sensor

In addition to the circuit continuity and rationality check, the ECT sensor is monitored for its ability to achieve a steady state temperature to enable closed loop fuel control.

Output Components:

Output components are diagnosed for proper response to control module commands. Components where functional monitoring is not feasible will be monitored for circuit continuity and out-of-range values if applicable.

Output components to be monitored include, but are not limited to, the following circuits:

- Control module controlled EVAP Canister Purge Valve
- Electronic Transmission controls
- A/C relays
- Cooling fan relay
- VSS output
- MIL control
- Cruise control inhibit

Refer to PCM and Sensors in General Descriptions.

Passive and Active Diagnostic Tests

A passive test is a diagnostic test which simply monitors a vehicle system or component. Conversely, an active test, actually takes some sort of action when performing diagnostic functions, often in response to a failed passive test. For example, the EGR diagnostic active test will force the EGR valve open during closed throttle decel and/or force the EGR valve closed during a steady state. Either action should result in a change in manifold pressure.

Intrusive Diagnostic Tests

This is any on-board test run by the Diagnostic Management System which may have an effect on vehicle performance or emission levels.

Warm-Up Cycle

A warm-up cycle means that engine at temperature must reach a minimum of 70°C (160°F) *and* rise at least 22°C (40°F) over the course of a trip.

Freeze Frame

Freeze Frame is an element of the Diagnostic Management System which stores various vehicle information at the moment an emissions-related fault is stored in memory and when the MIL is commanded on. These data can help to identify the cause of a fault. Refer to *Storing And Erasing Freeze Fame Data* in this section for more detailed information.

Failure Records

Failure Records data is an enhancement of the OBD II Freeze Frame feature. Failure Records store the same vehicle information as does Freeze Frame, but it will store that information for any fault which is stored in on-board memory, while Freeze Frame stores information only for emission-related faults that command the MIL on.

System Status and Drive Cycle for Satisfying Federal Inspection/Maintenance (I/M 240) Regulations

I/M Ready Status means a signal or flag for each emission system test that had been set in the PCM. I/M Ready Status indicates that the vehicle on-board emissions diagnostics have been run. I/M Ready Status is not concerned whether the emission system passed or failed the test, only that on-board diagnosis is complete. Not all vehicles use all possible I/M flags.

Common OBD II Terms

Diagnostic

When used as a noun, the word diagnostic refers to any on-board test run by the vehicle's Diagnostic Management System. A diagnostic is simply a test run on a system or component to determine if the system or component is operating according to specification. There are many diagnostics, shown in the following list:

- Misfire
- Oxygen sensors
- Oxygen sensor heaters
- EGR
- Catalyst monitoring

Enable Criteria

The term "enable criteria" is engineering language for the conditions necessary for a given diagnostic test to run. Each diagnostic has a specific list of conditions which must be met before the diagnostic will run. "Enable criteria" is another way of saying "conditions required".

The enable criteria for each diagnostic is listed on the first page of the DTC description in Section 6E under the heading "Conditions for Setting the DTC". Enable criteria varies with each diagnostic, and typically includes, but is not limited to the following items:

- engine speed
- vehicle speed
- ECT
- MAF/MAP
- barometric pressure
- IAT
- TP
- high canister purge
- fuel trim
- TCC enabled
- A/C on

Trip

Technically, a trip is a key on-run-key off cycle in which all the enable criteria for a given diagnostic are met, allowing the diagnostic to run. Unfortunately, this concept is not quite that simple. A trip is official when all the enable criteria for a given diagnostic are met. But because the enable criteria vary from one diagnostic to another, the definition of trip varies as well. Some diagnostics are run when the vehicle is at operating temperature, some when the vehicle first starts up; some require that the vehicle be cruising at a steady highway speed, some run only when the vehicle is idle; some diagnostics function with the TCC disable. Some run only immediately following a cold engine start-up.

A trip then, is defined as a key on-run-key off cycle in which the vehicle was operated in such a way as to satisfy the enabling criteria for a given diagnostic, and this diagnostic will consider this cycle to be one trip. However, another diagnostic with a different set of enable criteria (which were not met) during this driving event, would not consider it a trip. No trip will occur for that particular diagnostic until the vehicle is driven in such a way as to meet all the enable criteria.

The Diagnostic Executive

The Diagnostic Executive is a unique segment of software which is designed to coordinate and prioritize the diagnostic procedures as well as define the protocol for recording and displaying their results. The main responsibilities of the Diagnostic Executive are listed as the following:

- Commanding the MIL ("Check Engine" lamp) on and off
- DTC logging and clearing
- Freeze Frame data for the first emission related DTC recorded
- Non-emission related Service Lamp

- Operating conditions Failure Records buffer, (the number of records will vary)
- Current status information on each diagnostic
- System Status (I/M ready)

The Diagnostic Executive records DTCs and turns on the MIL when emission-related faults occur. It can also turn off the MIL if the conditions cease which caused the DTC to set.

Diagnostic Information

The diagnostic charts and functional checks are designed to locate a faulty circuit or component through a process of logical decisions. The charts are prepared with the requirement that the vehicle functioned correctly at the time of assembly and that there are no multiple faults present.

There is a continuous self-diagnosis on certain control functions. This diagnostic capability is complemented by the diagnostic procedures contained in this manual. The language of communicating the source of the malfunction is a system of diagnostic trouble codes. When a malfunction is detected by the control module, a diagnostic trouble code is set and the Malfunction Indicator Lamp (MIL) ("Check Engine" lamp) is illuminated.

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) looks the same as the MIL you are already familiar with ("Check Engine" lamp). However, OBD II requires that it illuminate under a strict set of guide lines.

Basically, the MIL is turned on when the PCM detects a DTC that will impact vehicle emissions.

The MIL is under the control of the Diagnostic Executive. The MIL will be turned on if an emissions-related diagnostic test indicates a malfunction has occurred. It will stay on until the system or component passes the same test, for three consecutive trips, with no emissions related faults.

If the vehicle is experiencing a misfire malfunction which may cause damage to the Three-Way Catalytic Converter (TWC), the MIL will flash once per second. This will continue until the vehicle is outside of speed and load conditions which could cause possible catalyst damage, and the MIL will stop flashing and remain on steady.

Extinguishing the MIL

When the MIL is on, the Diagnostic Executive will turn off the MIL after *three(3) consecutive* trips that a "test passed" has been reported for the diagnostic test that originally caused the MIL to illuminate.

Although the MIL has been turned off, the DTC will remain in the PCM memory (both Freeze Frame and Failure Records) until *forty(40) warm-up cycles after no faults* have been completed.

If the MIL was set by either a fuel trim or misfire-related DTC, additional requirements must be met. In addition to the requirements stated in the previous paragraph, these requirements are as follows:

- The diagnostic tests that are passed must occur within 375 RPM of the RPM data stored at the time the last test failed.
- Plus or minus ten (10) percent of the engine load that was stored at the time the last failed.
- Similar engine temperature conditions (warmed up or warming up) as those stored at the time the last test failed.

Meeting these requirements ensures that the fault which turned on the MIL has been corrected.

The MIL ("Check Engine" lamp) is on the instrument panel and has the following function:

- It informs the driver that a fault affects vehicle emission levels has occurred and that the vehicle should be taken for service as soon as possible.
- As a bulb and system check, the MIL will come "ON" with the key "ON" and the engine not running. When the engine is started, the MIL will turn "OFF."
- When the MIL remains "ON" while the engine is running, or when a malfunction is suspected due to a driveability or emissions problem, a Powertrain On-Board Diagnostic (OBD ll) System Check must be performed. The procedures for these checks are given in On-Board Diagnostic (OBD) System Check. These checks will expose faults which may not be detected if other diagnostics are performed first.

DTC Types

Each DTC is directly related to a diagnostic test. The Diagnostic Management System sets DTC based on the failure of the tests during a trip or trips. Certain tests must fail two (2) consecutive trips before the DTC is set. The following are the four (4) types of DTCs and the characteristics of those codes:

- Type A
  - Emissions related
  - Requests illumination of the MIL of the first trip with a fail
  - Stores a History DTC on the first trip with a fail
  - Stores a Freeze Frame (if empty)
  - Stores a Fail Record
  - Updates the Fail Record each time the diagnostic test fails
- Type B
  - Emissions related
  - "Armed" after one (1) trip with a fail
  - "Disarmed" after one (1) trip with a pass
  - Requests illumination of the MIL on the *second consecutive trip* with a fail
  - Stores a History DTC on the second consecutive trip with a fail (The DTC will be armed after the first fail)
  - Stores a Freeze Frame on the second consecutive trip with a fail (if empty)
  - Stores a Fail Record when the first test fails (not dependent on *consecutive trip* fails)
  - Updates the Fail Record each time the diagnostic test fails

(Some special conditions apply to misfire and fuel trim DTCs)

- Type C (if the vehicle is so equipped)
  - Non-Emissions related

- Requests illumination of the Service Lamp or the service message on the Drive Information Center (DIC) on the *first trip* with a fail
- Stores a History DTC on the *first trip* with a fail
- *Does not* store a Freeze Frame
- Stores Fail Record when test fails
- Updates the Fail Record each time the diagnostic test fails

- Type D
  - Non-Emissions related
  - Not request illumination of any lamp
  - Stores a History DTC on the *first trip* with a fail
  - *Does not* store a Freeze Frame
  - Stores Fail Record when test fails
  - Updates the Fail Record each time the diagnostic test fails

IMPORTANT: Only four Fail Records can be stored. Each Fail Record is for a different DTC. It is possible that there will not be Fail Records for every DTC if multiple DTCs are set.

Special Cases of Type B Diagnostic Tests

Unique to the misfire diagnostic, the Diagnostic Executive has the capability of alerting the vehicle operator to potentially damaging levels of misfire. If a misfire condition exists that could potentially damage the catalytic converter as a result of high misfire levels, the Diagnostic Executive will command the MIL to “flash” at a rate of once per seconds during those the time that the catalyst damaging misfire condition is present.

Fuel trim and misfire are special cases of *Type B* diagnostics. Each time a fuel trim or misfire malfunction is detected, engine load, engine speed, and engine coolant temperature are recorded.

When the ignition is turned off, the last reported set of conditions remain stored. During subsequent ignition cycles, the stored conditions are used as reference for similar conditions. If a malfunction occurs during two consecutive trips, the Diagnostic Executive treats the failure as a normal *Type B* diagnostic, and not use the stored conditions. However, if a malfunction occurs on two non-consecutive trips, the stored conditions are compared with the current conditions. The MIL will then illuminate under the following conditions:

- When the engine load conditions are within 10% of the previous test that failed.
- Engine speed is within 375 rpm, of the previous test that failed.
- Engine coolant temperature is in the same range as the previous test that failed.

Storing and Erasing Freeze Frame Data and Failure Records

Government regulations require that engine operating conditions be captured whenever the MIL is illuminated. The data captured is called Freeze Frame data. The Freeze Frame data is very similar to a single record of operating conditions. Whenever the MIL is illuminated, the corresponding record of operating conditions is recorded to the Freeze Frame buffer.

Freeze Frame data can only be overwritten with data associated with a misfire or fuel trim malfunction. Data from these faults take precedence over data associated with any other fault. The Freeze Frame data will not be erased unless the associated history DTC is cleared.

Each time a diagnostic test reports a failure, the current engine operating conditions are recorded in the *Failure Records* buffer. A subsequent failure will update the recorded operating conditions. The following operating conditions for the diagnostic test which failed *typically* include the following parameters:

- Air Fuel Ratio
- Air Flow Rate
- Fuel Trim
- Engine Speed
- Engine Load
- Engine Coolant Temperature
- Vehicle Speed
- TP Angle
- MAP/BARO
- Injector Base Pulse Width
- Loop Status

Intermittent Malfunction Indicator Lamp

In the case of an “intermittent” fault, the MIL (“Check Engine” lamp) may illuminate and then (after three trips) go “OFF”. However, the corresponding diagnostic trouble code will be stored in the memory. When unexpected diagnostic trouble codes appear, check for an intermittent malfunction.

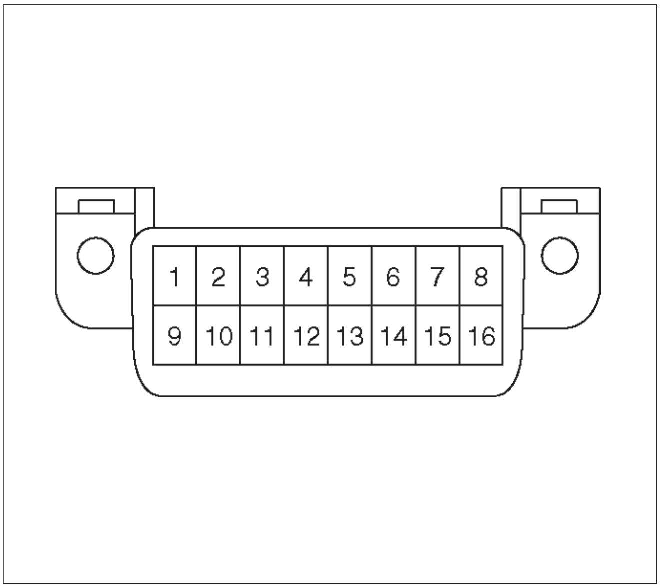
A diagnostic trouble code may reset. Consult the “Diagnostic Aids” associated with the diagnostic trouble code. A physical inspection of the applicable sub-system most often will resolve the problem.

Data Link Connector (DLC)

The provision for communication with the control module is the Data Link Connector (DLC). It is located at the lower left of the instrument panel behind a small square cover. The DLC is used to connect to the Tech 2 Scan Tool. Some common uses of the Tech 2 are listed below:

- Identifying stored Diagnostic Trouble Codes (DTCs).
- Clearing DTCs.

- Performing output control tests.
- Reading serial data.



TS24064

Decimal/Binary/Hexadecimal Conversions

Beginning in 1996, Federal Regulations require that all auto manufacturers selling vehicles in the United States provide Scan Tool manufacturers with software information to display vehicle operating parameters. All Scan Tool manufacturers will display a variety of vehicle information which will aid in repairing the vehicle. Some Scan Tools will display encoded messages which will aid in determining the nature of the concern. The method of encoding involves the use of a two additional numbering systems: Binary and Hexadecimal.

The binary number system has a base of two numbers. Each digit is either a 0 or a 1. A binary number is an eight digit number and is read from right to left. Each digit has a position number with the farthest right being the 0 position and the farthest left being the 7 position. The 0 position, when displayed by a 1, indicates 1 in decimal. Each position to the left is double the previous position and added to any other position values marked as a 1.

A hexadecimal system is composed of 16 different alpha numeric characters. The alpha numeric characters used are numbers 0 through 9 and letters A through F. The hexadecimal system is the most natural and common approach for Scan Tool manufacturers to display data represented by binary numbers and digital code.

Verifying Vehicle Repair

Verification of vehicle repair will be more comprehensive for vehicles with OBD II system diagnostic. Following a repair, the technician should perform the following steps:

1. Review and record the Fail Records and/or Freeze Frame data for the DTC which has been diagnosed (Freeze Frame data will only be stored for an A or B type diagnostic and only if the MIL has been requested).
2. Clear DTC(s).
3. Operate the vehicle within conditions noted in the Fail Records and/or Freeze Frame data.
4. Monitor the DTC status information for the DTC which has been diagnosed until the diagnostic test associated with that DTC runs.

Following these steps are very important in verifying repairs on OBD ll systems. Failure to follow these steps could result in unnecessary repairs.

Reading Diagnostic Trouble Codes Using The Tech 2 Scan Tool

The procedure for reading diagnostic trouble code(s) is to use a diagnostic Scan Tool. When reading DTC(s), follow instructions supplied by tool manufacturer.

Clearing Diagnostic Trouble Codes

IMPORTANT: Do not clear DTCs unless directed to do so by the service information provided for each diagnostic procedure. When DTCs are cleared, the Freeze Frame and Failure Record data which may help diagnose an intermittent fault will also be erased from memory.

If the fault that caused the DTC to be stored into memory has been corrected, the Diagnostic Executive will begin to count the “warm-up” cycles with no further faults detected, the DTC will automatically be cleared from the PCM memory.

To clear Diagnostic Trouble Codes (DTCs), use the diagnostic Scan Tool “clear DTCs” or “clear information” function. When clearing DTCs follow instructions supplied by the tool manufacturer.

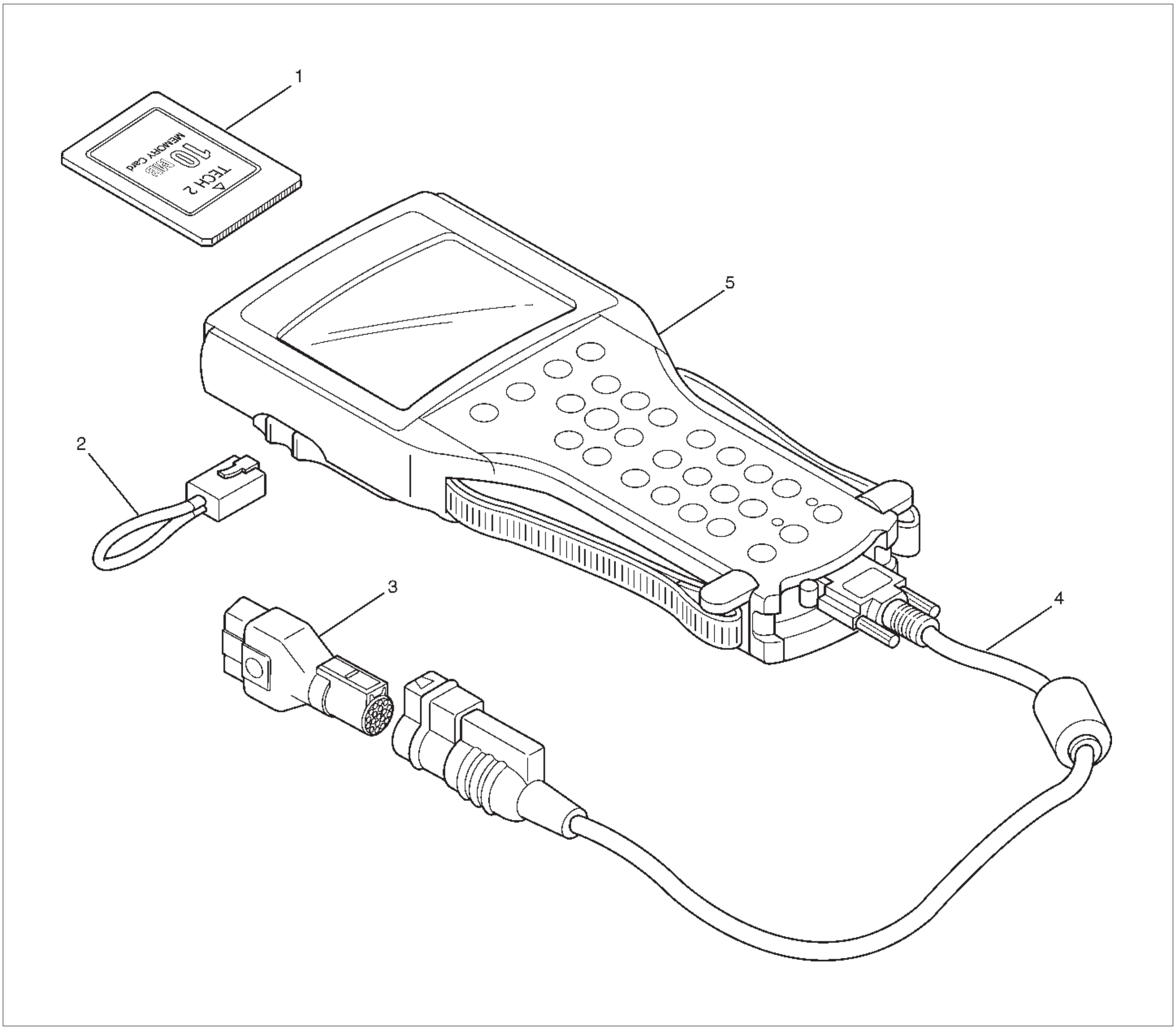
When a Scan Tool is not available, DTCs can also be cleared by disconnecting *one* of the following sources for at least thirty (30) seconds.

NOTE: To prevent system damage, the ignition key must be “OFF” when disconnecting or reconnecting battery power.

- The power source to the control module. Examples: fuse, pigtail at battery PCM connectors etc.
- The negative battery cable. (Disconnecting the negative battery cable will result in the loss of other on-board memory data, such as preset radio tuning).

Tech 2

From 98 MY, Isuzu dealer service departments are recommended to use the Tech 2 Scan Tool. Please refer to the Tech 2 user guide.



Legend

(1) PCMCIA Card
(2) RS 232 Loop Back Connector
(3) SAE 16/19 Adaptor
(4) DLC Cable
(5) Tech–2

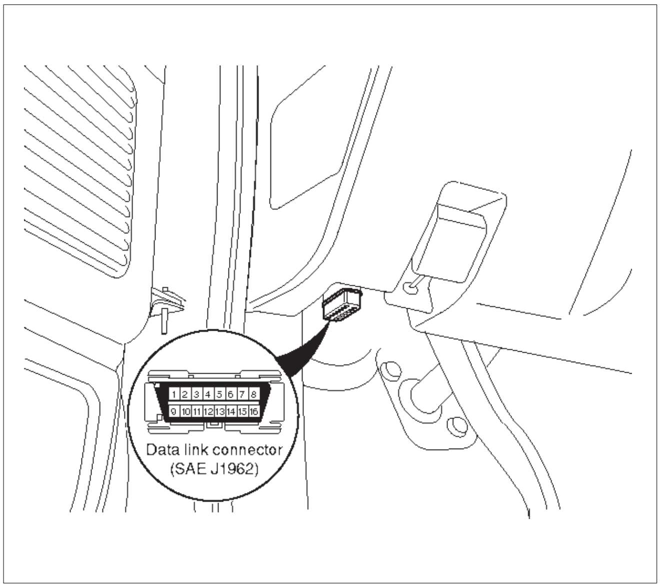
Tech 2 Features

1. Tech 2 is a 12 volt system. Do not apply 24 volts.
2. After connecting and/or installing the Vehicle Communications Interface (VCI) module, PCMCIA card and DLC connector to the Tech 2, connect the tool to the vehicle DLC.
3. Make sure the Tech 2 is powered OFF when removing or installing the PCMCIA card.
4. The PCMCIA card has a capacity of 10 Megabytes which is 10 times greater than the memory of the Tech 1 Mass Storage Cartridge.
5. The Tech 2 has the capability of two snapshots.
6. The PCMCIA card is sensitive to magnetism and static electricity, so care should be taken in the handling of the card.
7. The Tech 2 can plot a graph when replaying a snapshot.
8. Always return to the Main Menu by pressing the EXIT key several times before shutting down.
9. To clear Diagnostic Trouble Codes (DTCs), open Application Menu and press “F1: Clear DTC Info”.

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 2000 System PCMCIA card (1) inserts into the Tech 2 (5).
2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (5)
4. Make sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.



826RW002

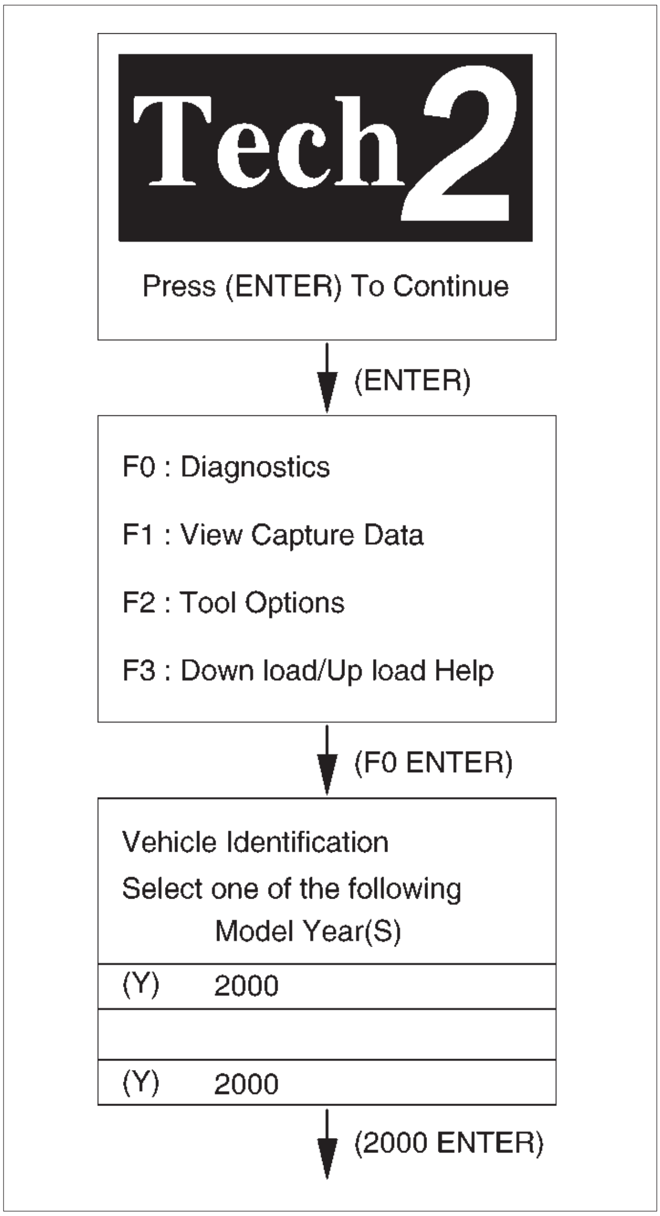
6. Turn on the vehicle ignition.
7. Power the Tech 2 ON and verify the Tech 2 power up display.

060RW009

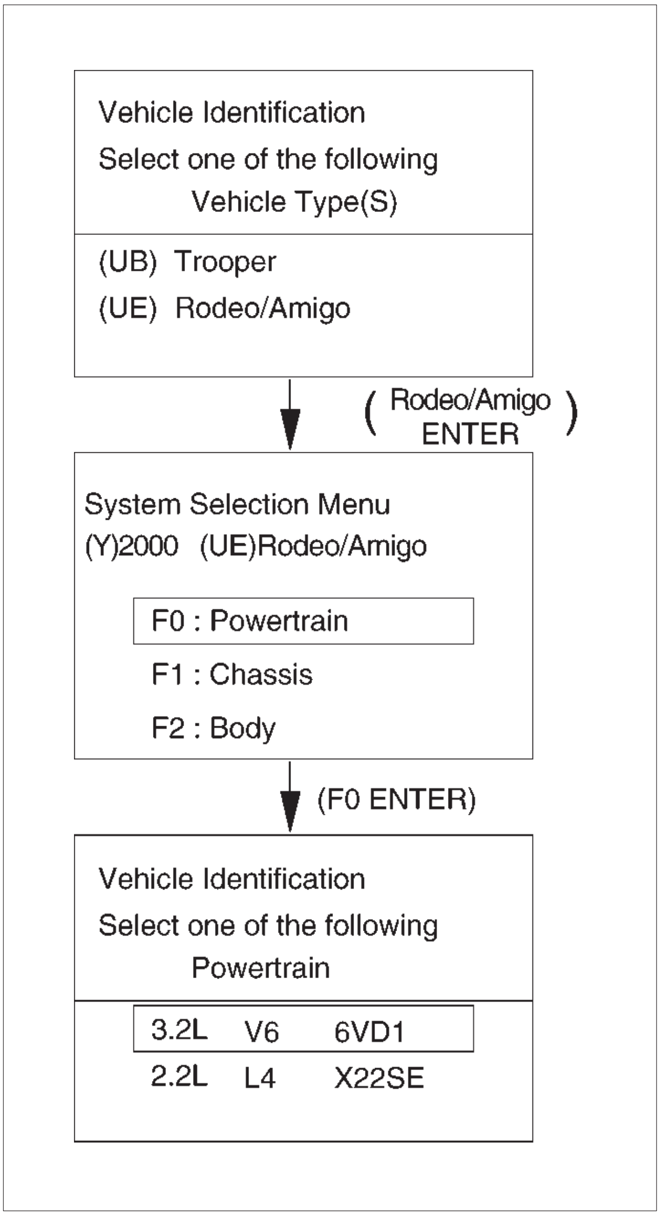
NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2. Refer to user guide of the Tech 2.

Operating Procedure (For Example)

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



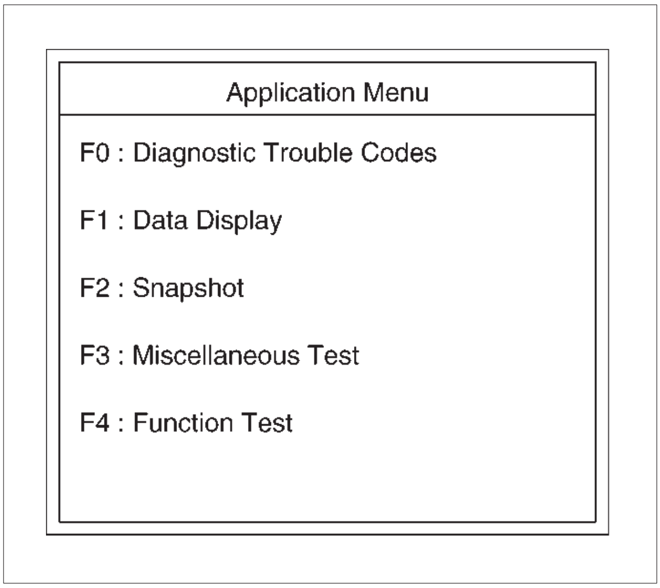
060RY027



060RY00109

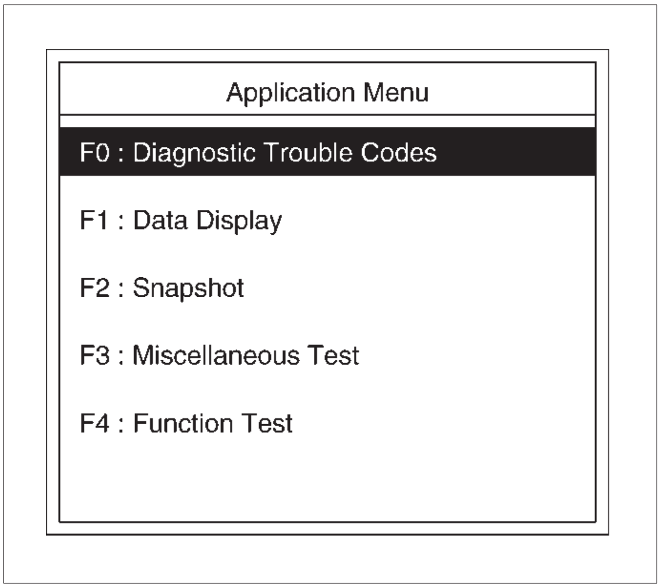
Menu

- The following table shows which functions are used for the available equipment versions.



060RY00073

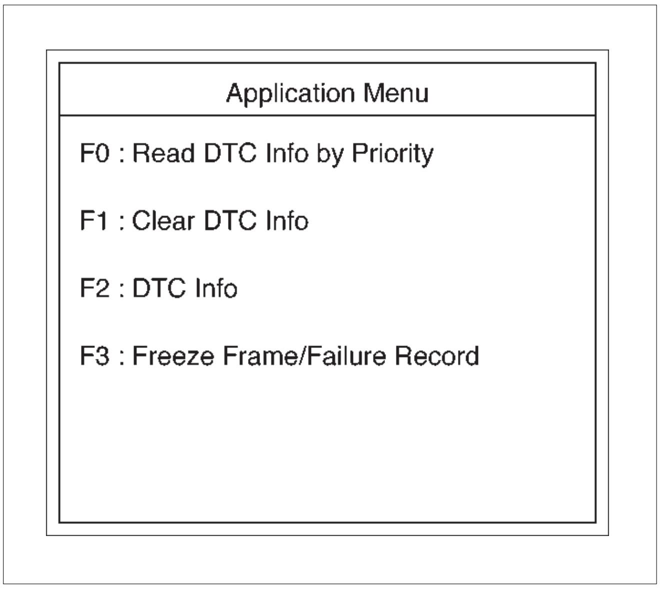
DTC Modes



060RY00074

On OBD II vehiles there are options available in Tech 2 DTC mode to display the enhanced information available. After selecting DTC, the following menu appears:

1. Read DTC Info by Priority
2. Freeze Frame
3. Fail Records (not all applications)
4. DTC Info
5. Clear Info



060RW223

The following is a brief description of each of the sub menus in DTC Info and DTC. The order in which they appear here is alphabetical and not necessarily the way they will appear on the Tech 2.

DTC Information Mode

Use the DTC info mode to search for a specific type of stored DTC information.

DTC Status

This selection will display any DTCs that have not run during the current ignition cycle or have reported a test failure during this ignition up to DTCs. DTC tests which run and pass will cause that DTC number to be removed from Tech 2 screen.

Fail This Ignition

This selection will display all DTCs that have failed during the present ignition cycle.

History

This selection will display only DTCs that are stored in the PCM's history memory. It will display all type A and B DTCs that have requested the MIL and have failed within the last 40 warm-up cycles. In addition, it will display all type C and type D DTCs that have failed within the last 40 warm-up cycles.

Last Test Failed

This selection will display only DTCs that have failed the last time the test run. The last test may have run during a previous ignition cycle if a type A or type B DTC is displayed. For type C and type D DTCs, the last failure must have occurred during the current ignition cycle to appear as Last Test Fail.

MILSVC or Message Request

This selection will display only DTCs that are requesting the MIL. Type C and type D DTCs cannot be displayed using this option. This selection will report type B DTCs only after the MIL has been requested.

Not Run Since Code Cleared

This option will display up to DTCs that have not run since the DTCs were last cleared. Since any displayed DTCs have not run, their condition (passing or failing) is unknown.

Test Failed Since Code Cleared

This selection will display all active and history DTCs that have reported a test failure since the last time DTCs were cleared. DTCs that last failed more than 40 warm-up cycles before this option is selected will not be displayed.

Miscellaneous Test

This test consists of eight menus-Lights, Relays, EVAP, Fuel System, Instruments, EGR Control, Variable Intake Manifold Solenoid, and Injector Balance Tests.

In these tests, Tech 2 sends operating signals to the systems to confirm their operations thereby to judge the normality of electric circuits.

To judge intermittent trouble,

1. Confirm DTC freeze frame data, and match the freeze frame data as test conditions with the data list displayed by Miscellaneous Test.
2. Confirm DTC setting conditions, and match the setting conditions as test conditions with the data list displayed by Miscellaneous Test.
3. Refer to the latest Service Bulletin.
   Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM.

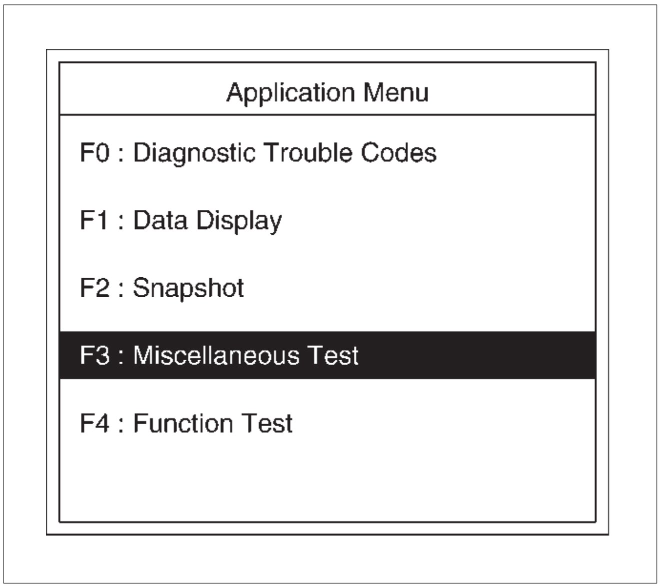
Lamps Test

This test is conducted check MIL, Up Shift Lamp, Low Fuel Lamp, Reduced Power Lamp and Cruise Control Lamp for its working.

Tech2 must be used for this test.

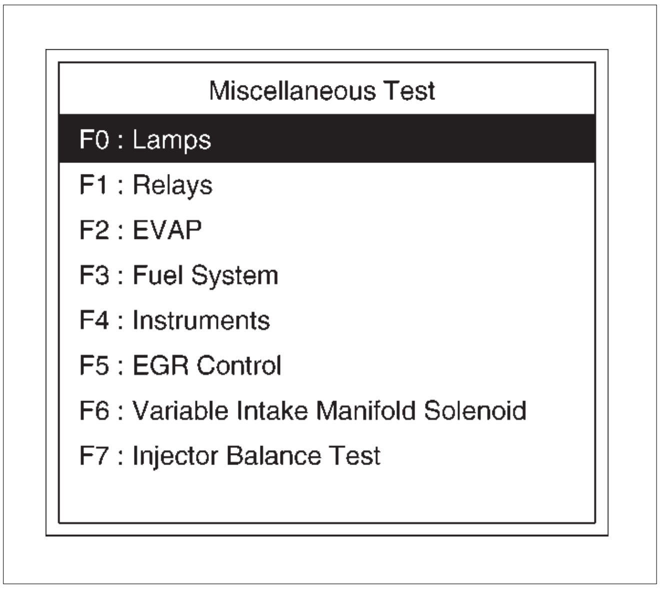
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



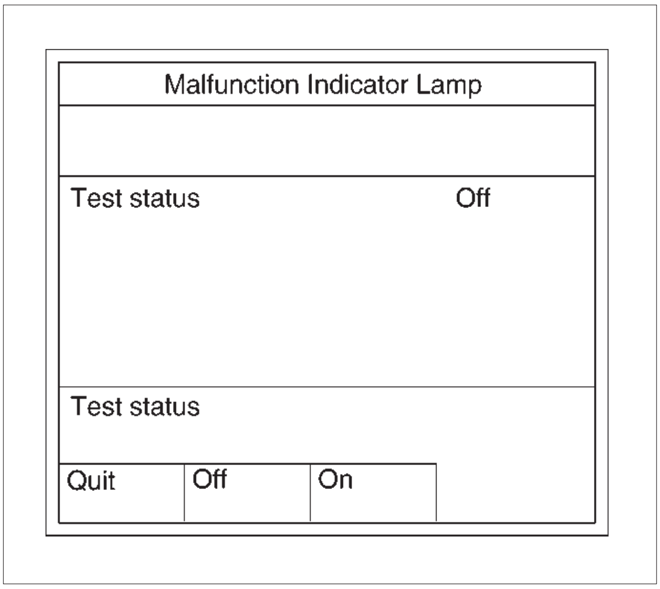
060RY00075

4. Select F0:Lamps Test in the Miscellaneous Test.



060RY00080

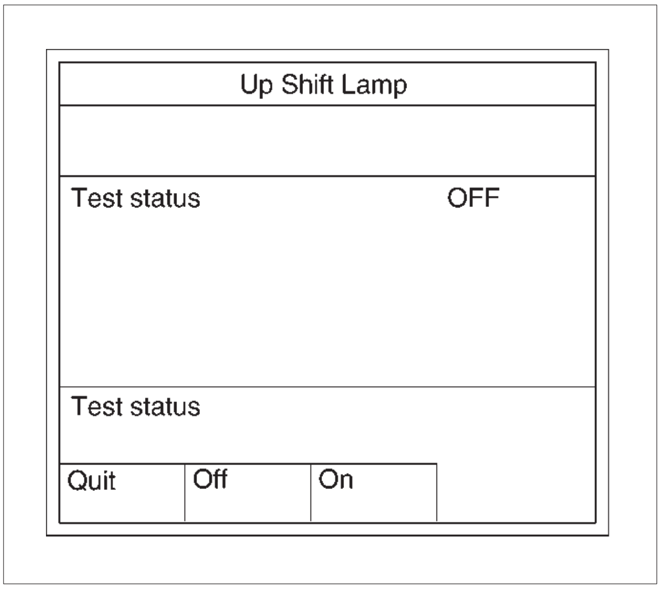
5. Select F0:Malfunction Indicator Lamp.



060RY00091

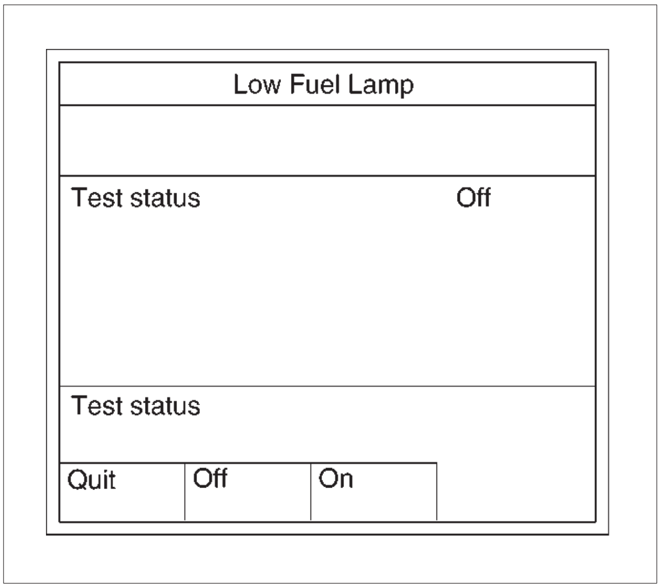
6. Push”On” soft key.
7. Make sure Lamp illuminates.
8. If lamp illuminates, the Lamp is operating correctly.

9. Select F2: Up Shift Lamp



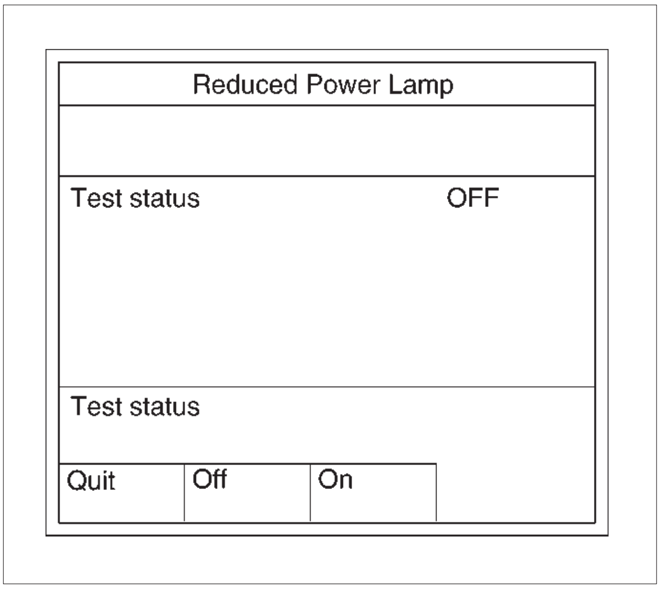
060RY00076

10. Push “On” of soft key.
11. Make sure Lamp illuminates.
12. If Lamp illuminates, the Lamp is operating correctly.
13. Select F2:Low Fuel Lamp



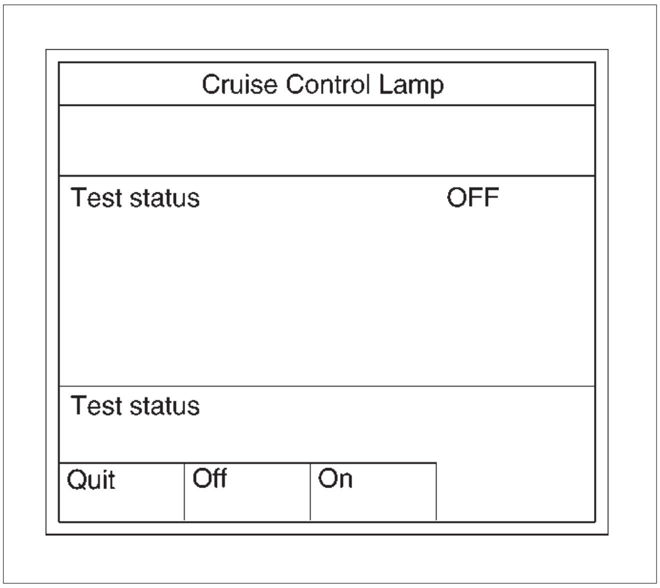
060RY00092

14. Push ”On” of soft key.
15. Make sure Lamp illuminates.
16. If Lamp illuminates, the Lamp is operating correctly.
17. Select F3:Reduced Power Lamp



060RY00077

18. Push ”On” of soft key.
19. Make sure Lamp illuminates.
20. If Lamp illuminates, the Lamp is operating correctly.
21. Select F5:Cruise Control Lamp



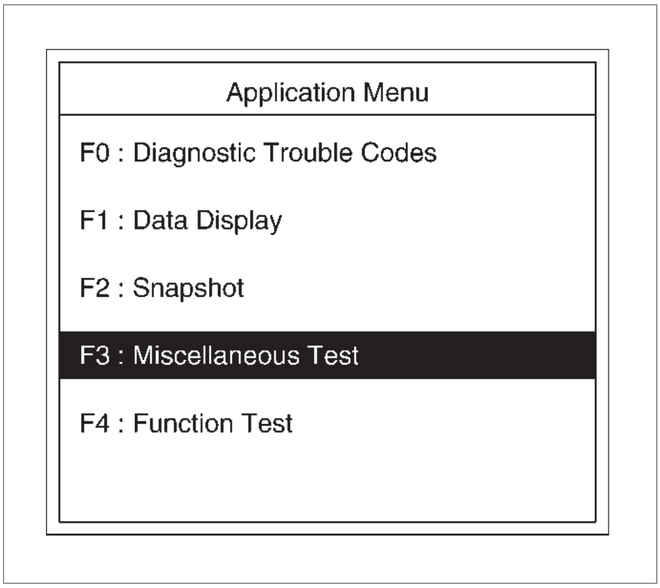
060RY00078

22. Push ”On” of soft key.
23. Make sure Lamp illuminates.
24. If Lamp illuminates, the Lamp is operating correctly.

Relays Test

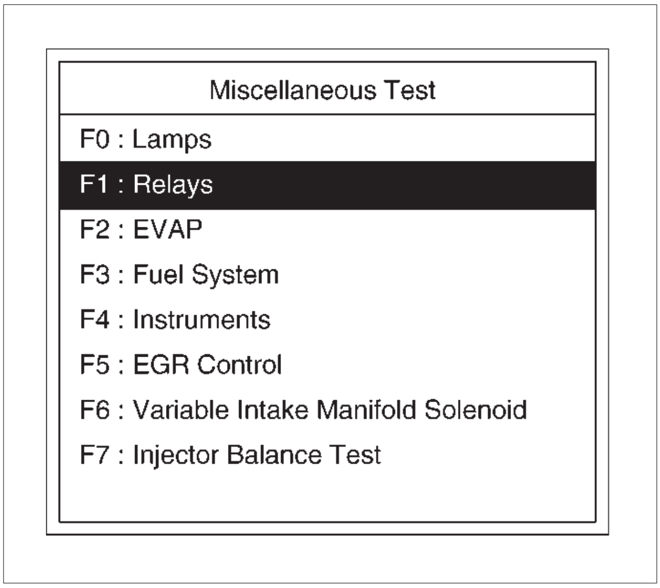
This test is conducted to check Fuel Pump Relay and A/C Clutch for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is "On".
3. Select F3: Miscellaneous Test in the Application Menu.



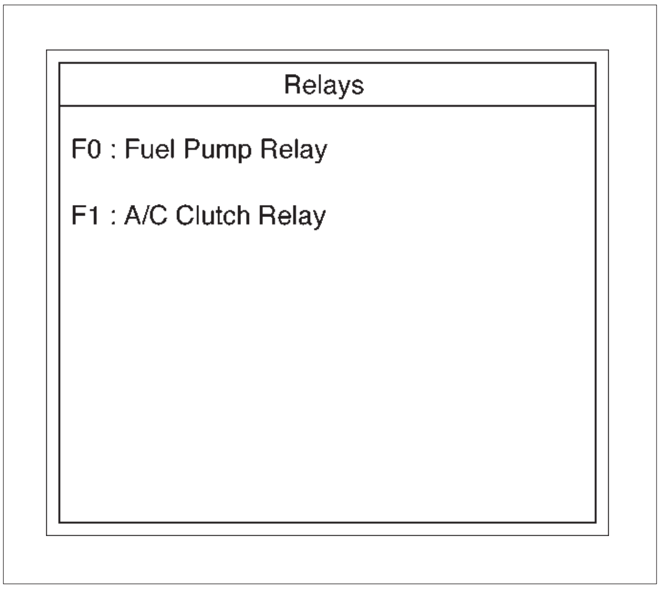
060RY00075

4. Select F1:Relay Test in the Miscellaneous Test.



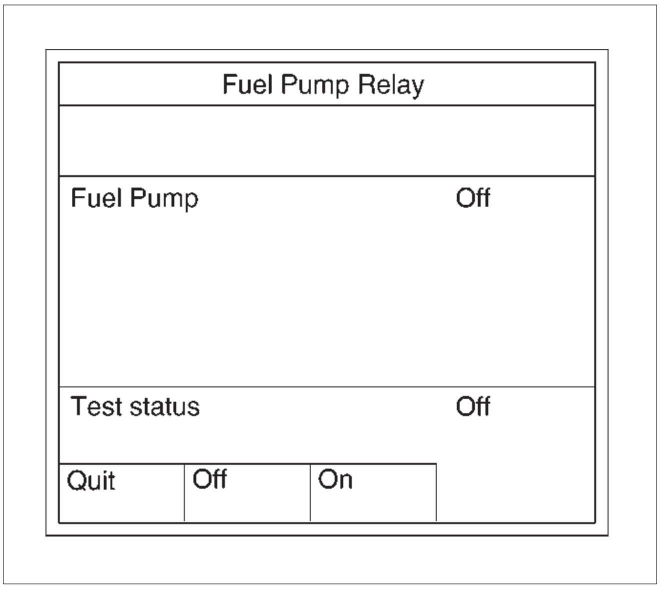
060RY00081

5. Select F0:Fuel Pump Relay.



060RX021

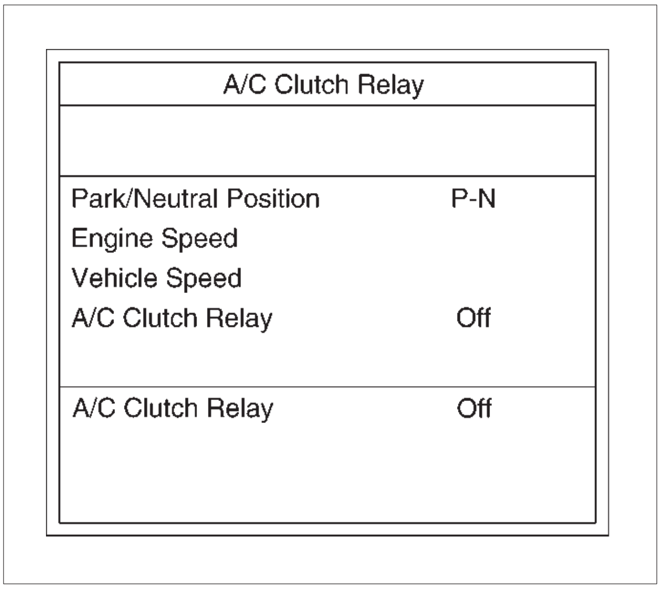
6. Push "On" soft key.



060RY00093

7. Control Fuel Pump Relay and check data list.
8. If the data list changes, the Fuel Pump Relay is normal.
9. Select F1:A/C Clutch Relay.
10. Run the Engine at idle.

11. Turn on Air Condtioning.



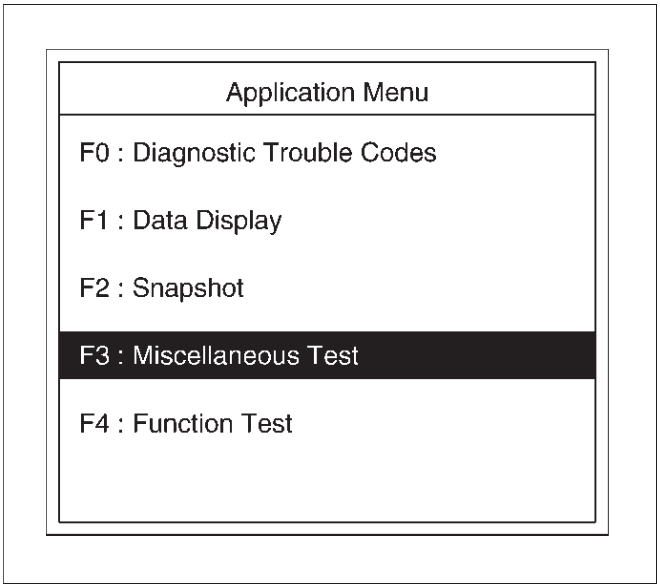
060RY00094

12. Turn “On” and “Off” A/C Switch.
13. Contol A/C Clutch Relay and check data list.
14. If the data list changes, the Fuel Pump Relay is normal.

EVAP Test

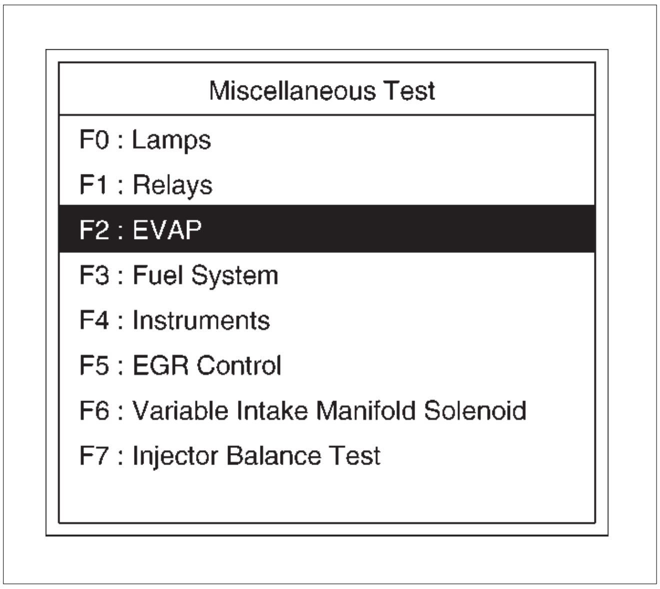
This test is conducted to check EVAP system for its power operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



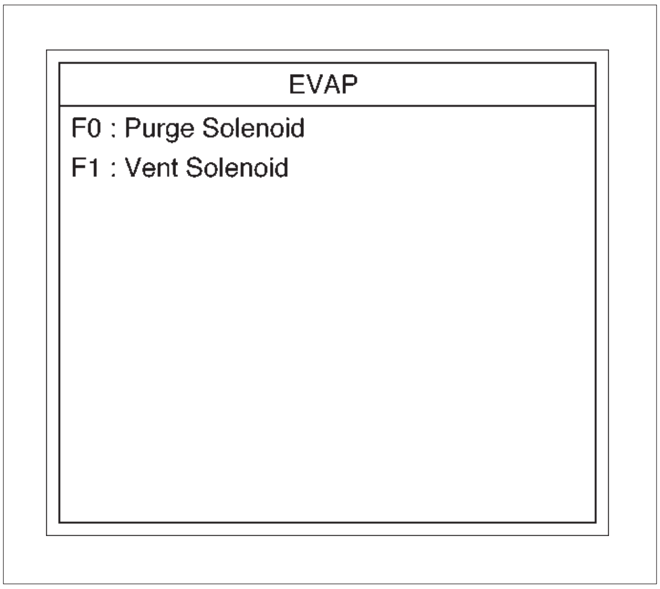
060RY00075

4. Select F2: EVAP Test in the Miscellaneous Test.



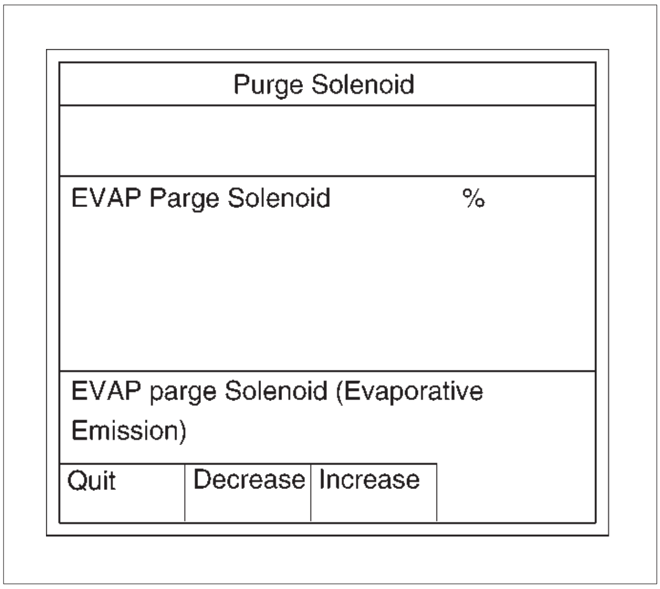
060RY00082

5. Select F0: Purge Solenoid.



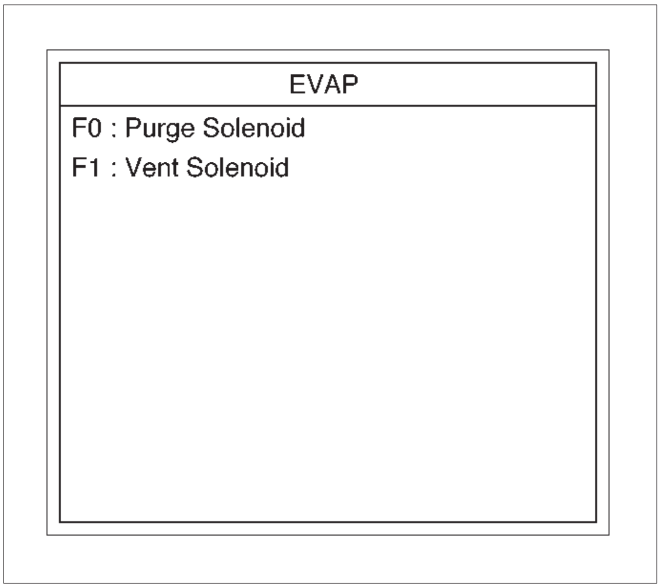
060RX025

6. Push “Decrease” or “Increase” soft key.



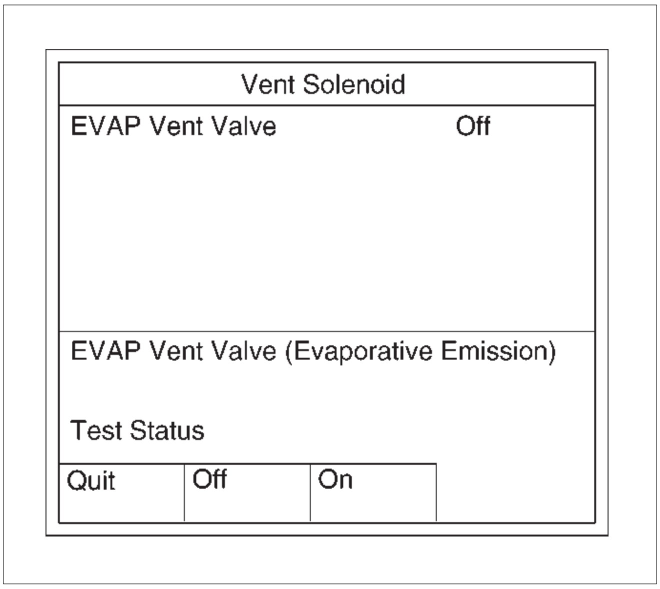
060RY00095

7. Control EVAP Purge Solenoid and check a data list.
8. If the data list changes, the Purge Solenoid is normal.
9. Turn engine off, turn ignition SW “On”.
10. Select F1:EVAP Vent Solenoid.



060RX025

11. Push “On” or “Off” soft key.



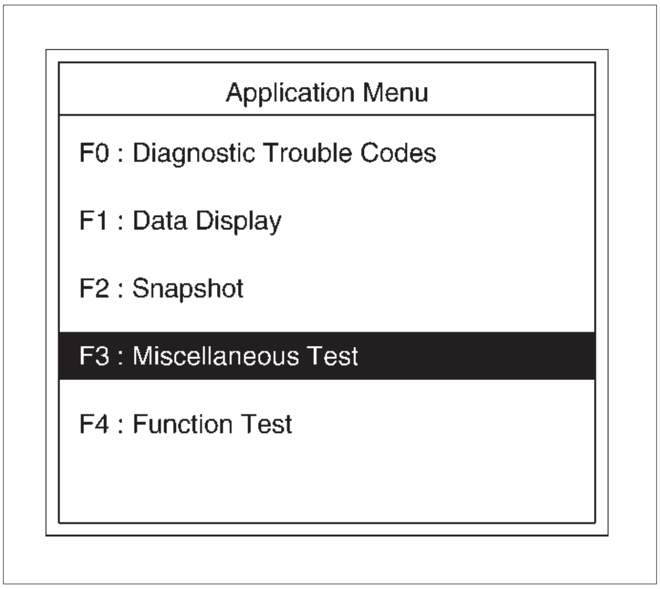
060RY00096

12. Control EVAP Vent Solenoid and check data list.
13. If the data list changes, the EVAP Vent Solenoid is normal.

Fuel System Test

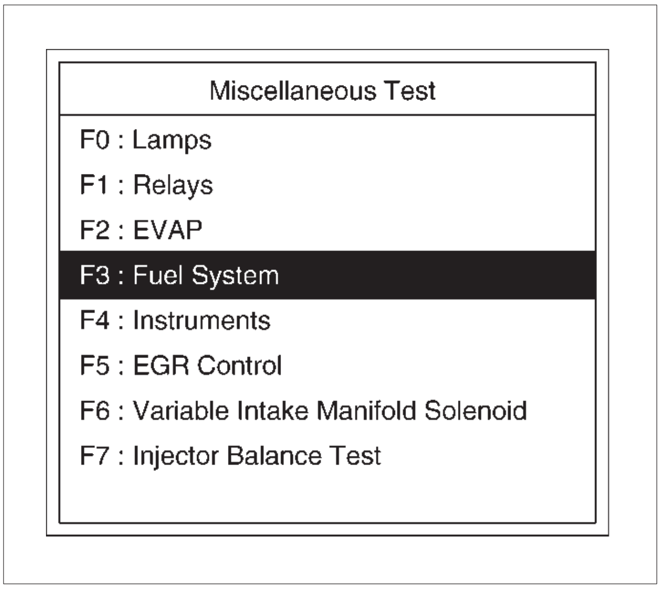
This test is conducted check Fuel system for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.



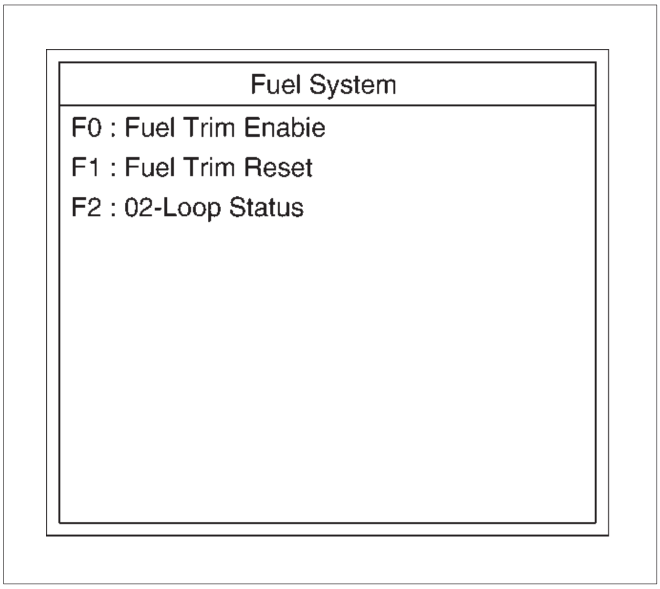
060RY00075

4. Select F3: Fuel System in the Miscellaneous Menu.



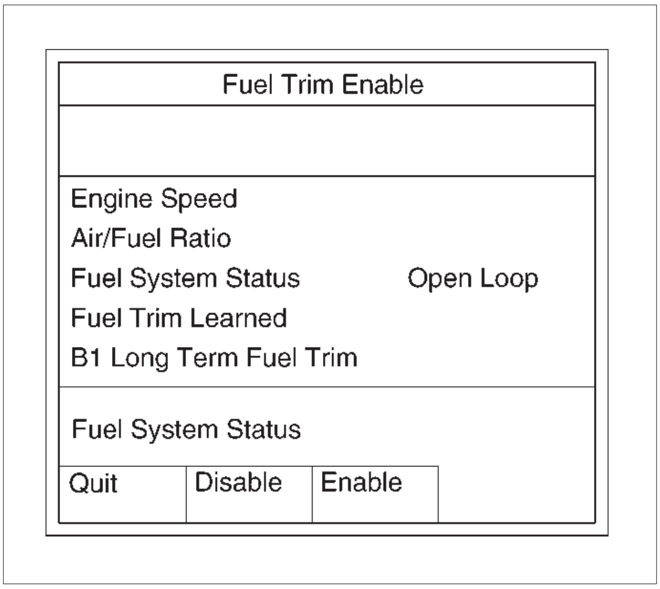
060RY00083

5. Select F0: Fuel Trim Enable.



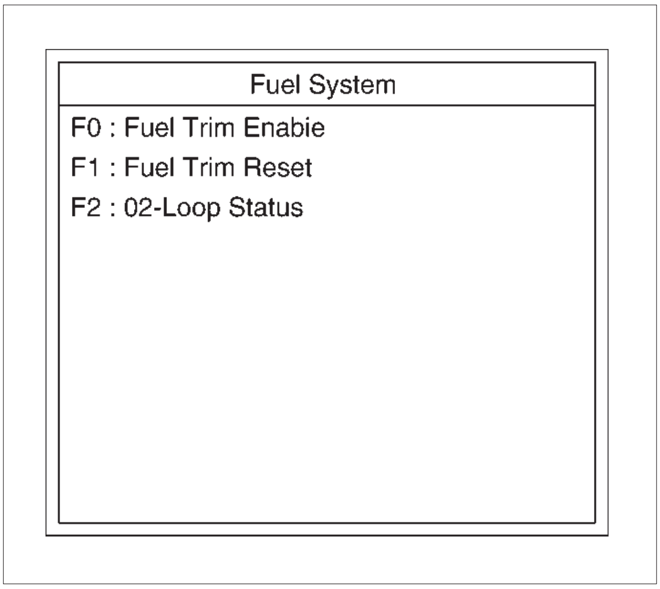
060RY00079

6. Push “Disable” or “Enable” soft key.



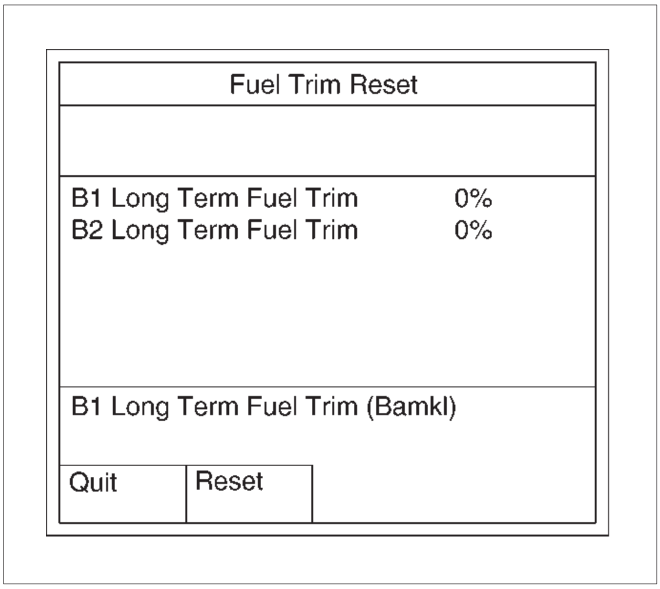
060RY00097

7. Control Fuel Trim and check data list.
8. If data list changes, the Fuel Trim is normal.
9. Select F1: Fuel Trim Reset.



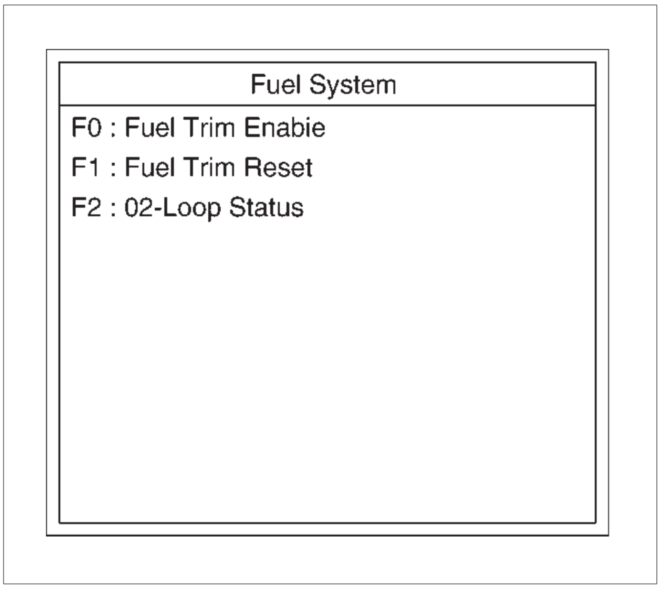
060RY00079

10. Push “Reset” of soft key.



060RY00098

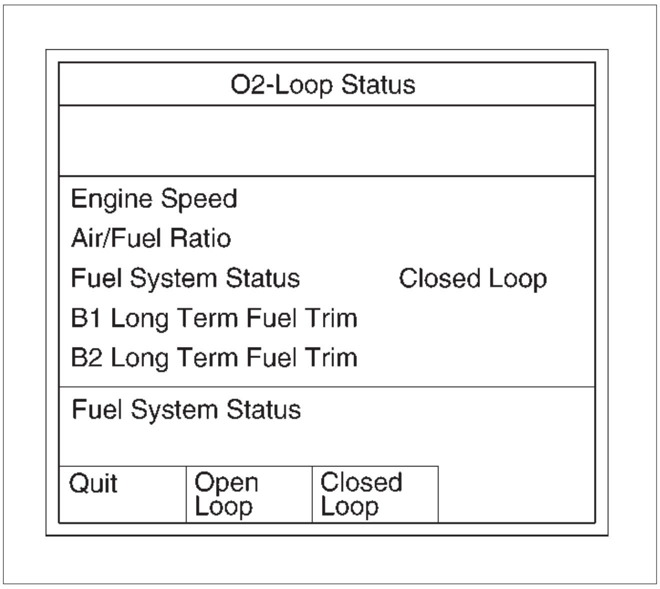
11. Select F2: O2-Loop status.



060RY00079

12. This test is check the “Closed Loop Status” performance.

13. Push “Open Loop” or “Closed Loop” soft key.



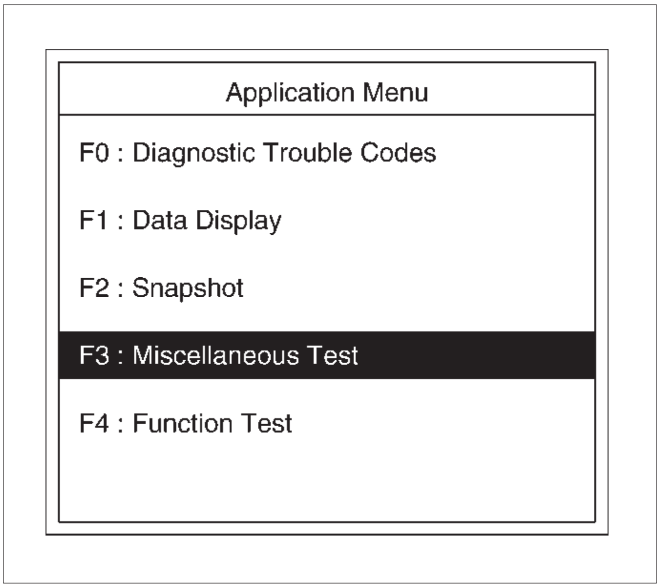
060RY00099

14. Control O2-Loop and check data list.
15. If data list changes, the O2-Loop is normal.

Instruments Test

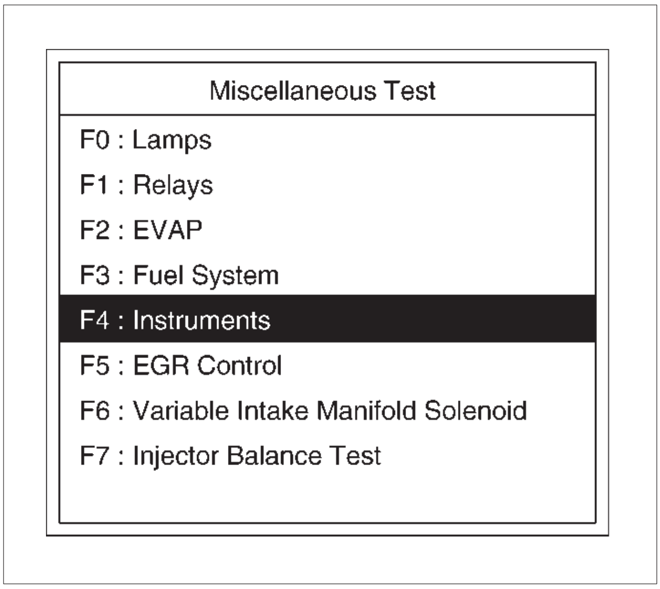
This test is conducted check Instruments for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Ignition SW is “On”.
3. Select F3: Miscellaneous Test in the Application Menu.



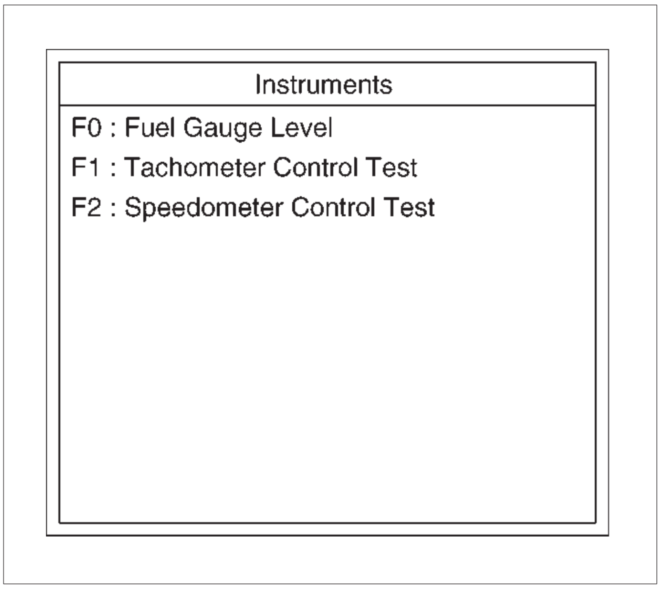
060RY00075

4. Select F4: Instruments in the Miscellaneous Menu.



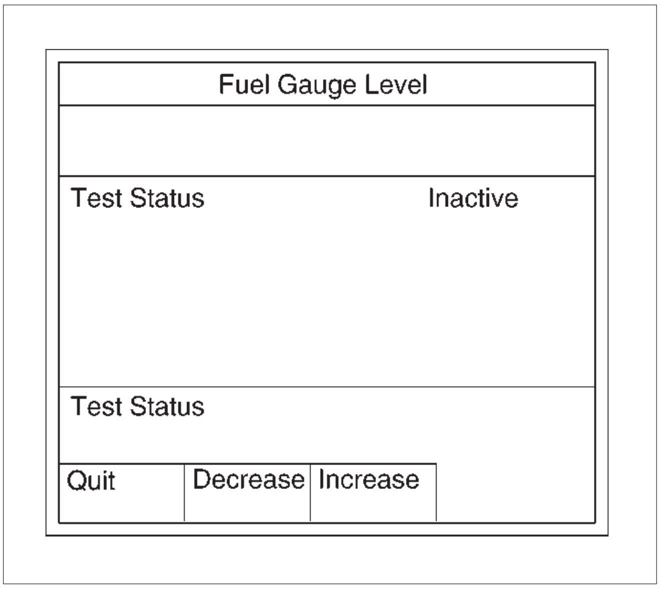
060RY00106

5. Select F0: Fuel Gauge level.



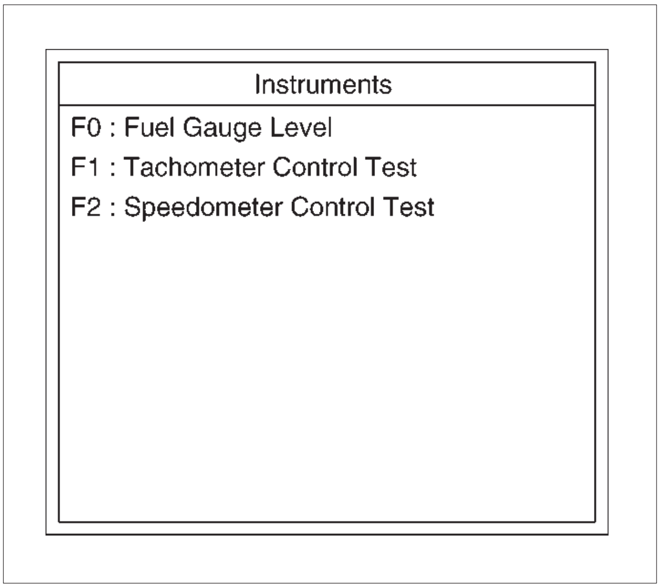
060RY00107

6. Push “Decrease” or “Increase” soft key.



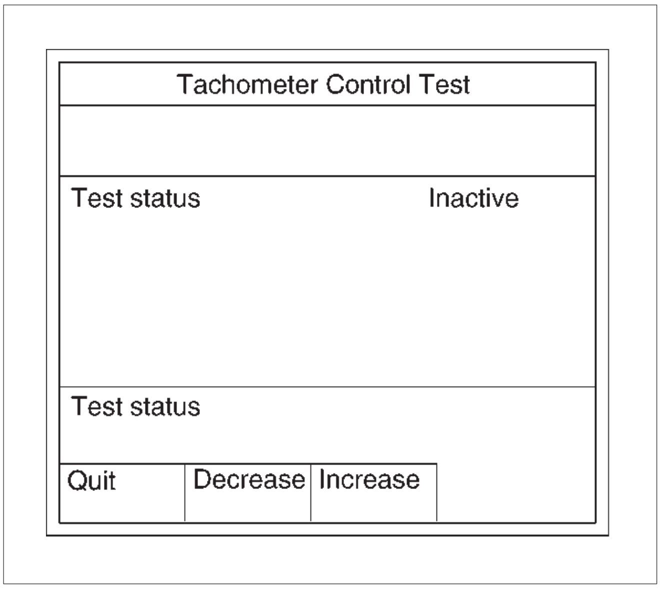
060RY00100

7. Control Fuel Level and check data list.
8. If data list and Fuel gauge meter changes, Fuel Gauge level is normal.
9. Select F1: Tachometer Control Test.



060RY00107

10. Push “Inactive” or “active” soft key.



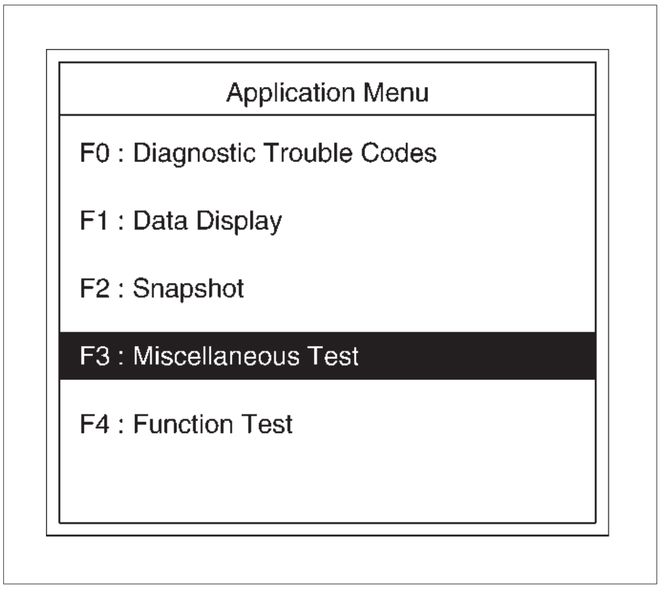
060RY00101

11. Control tachometer and data list.
12. If data list and meter changes, the tachometer control is normal.

EGR Control Test

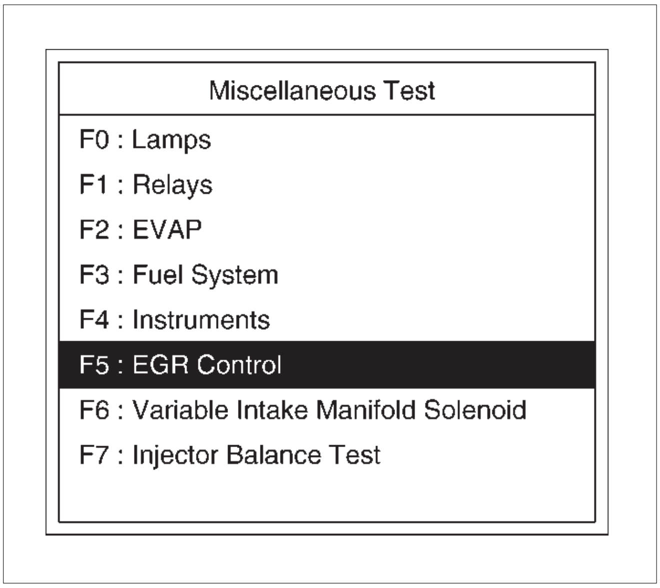
This test is conducted check EGR valve for proper operation.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



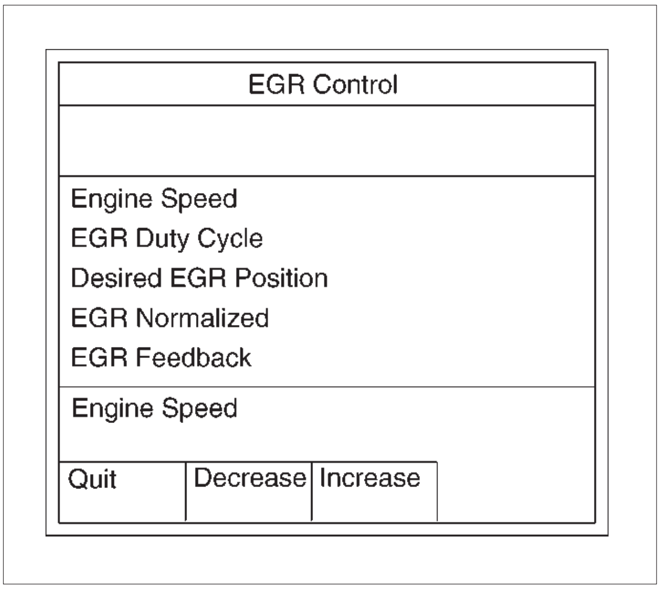
060RY00075

4. Select F5: EGR Control Test in the Miscellaneous Test.



060RY00084

5. Control EGR Valve and check data list.



060RY00103

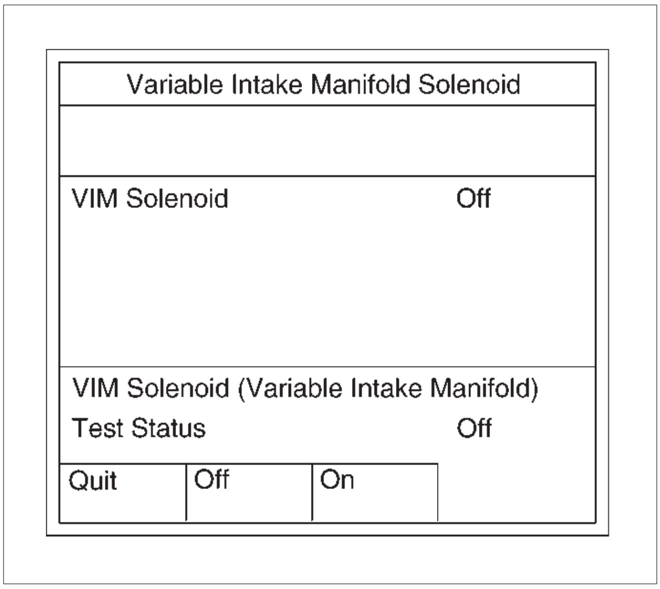
6. If data list changes, the EGR Contol is normal.

Variable Intake Manifold Solenoid Test

This test is conducted check VIM Solenoid for proper operation.
Tech 2 must be used for this test.
Test Procedure:

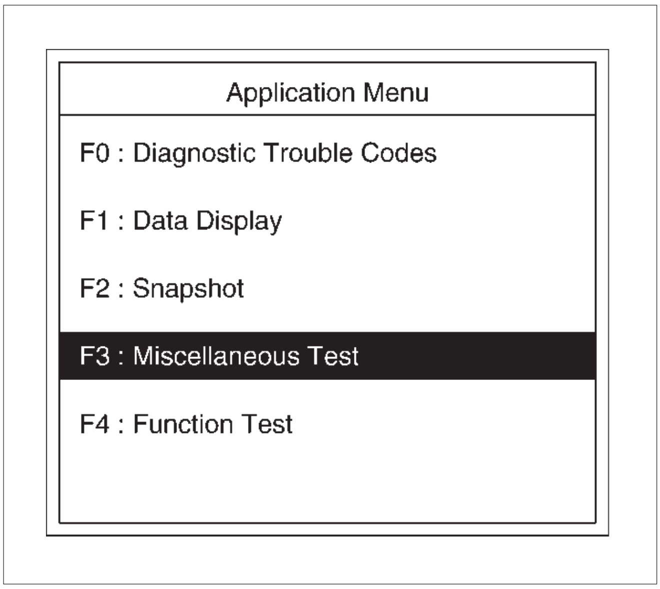
1. Connect Tech 2 to the vehicle DLC.

2. Ignition SW is “On”.



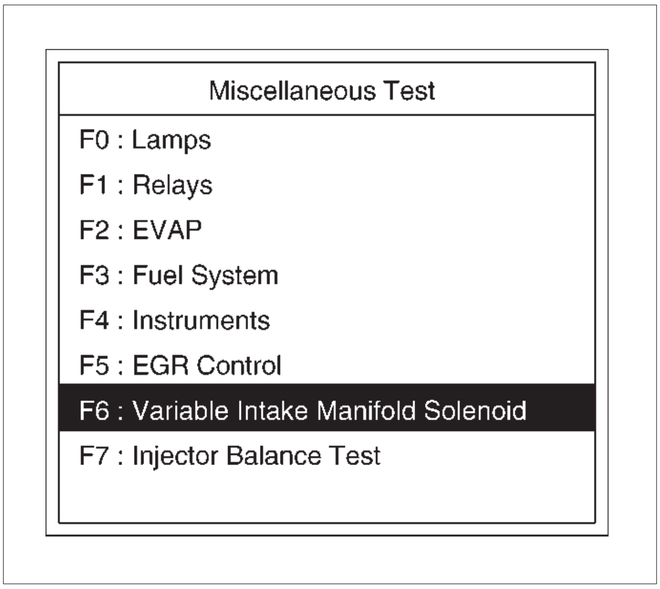
060RY00104

3. Select F3: Miscellaneous Test in the Application Menu.



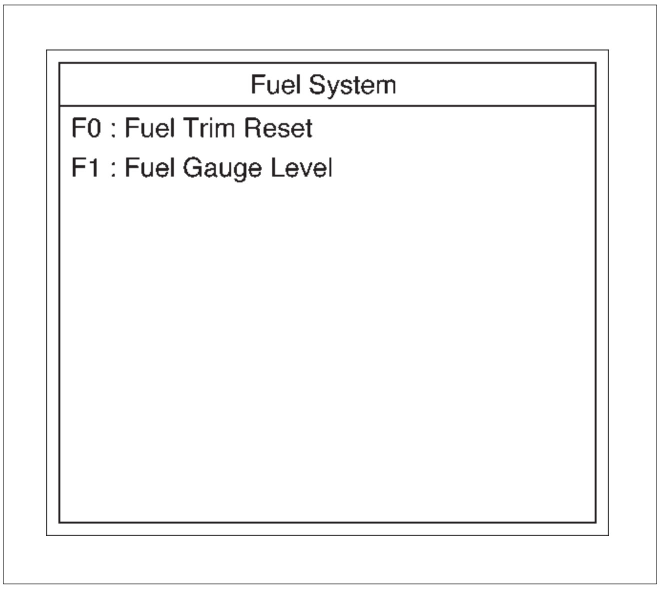
060RY00075

4. Select F6: Variable Intake Manifold Solenoid Test.



060RY00085

5. Push “On” or “Off” of soft key.



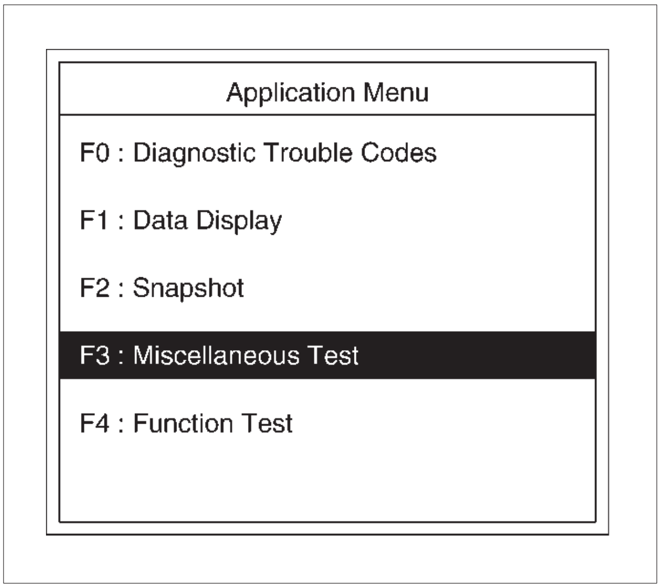
060RX028

6. Control VIM Solenoid check data list.
7. If data list changes, the VIM Solenoid is normal.

Injector Balance Test

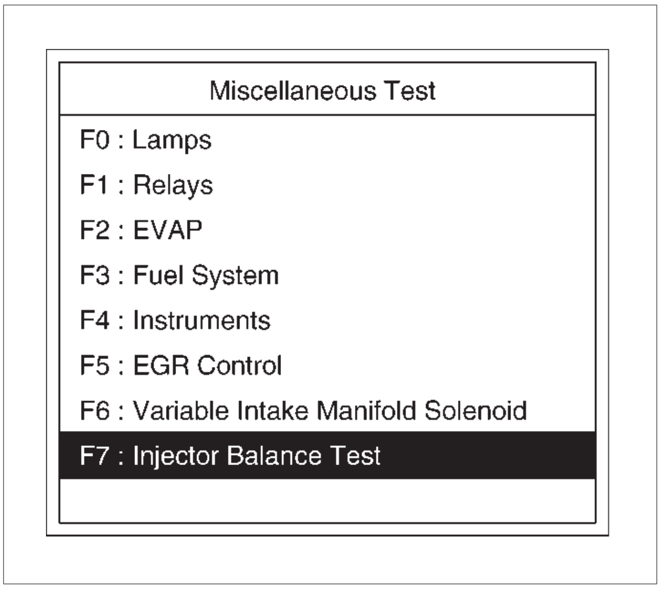
This test is conducted to make sure the appropriate electric signals are being sent to injectors Nos. 1–6.
Tech 2 must be used for this test.
Test Procedure:

1. Connect Tech 2 to the vehicle DLC.
2. Run the Engine at idle.
3. Select F3: Miscellaneous Test in the Application Menu.



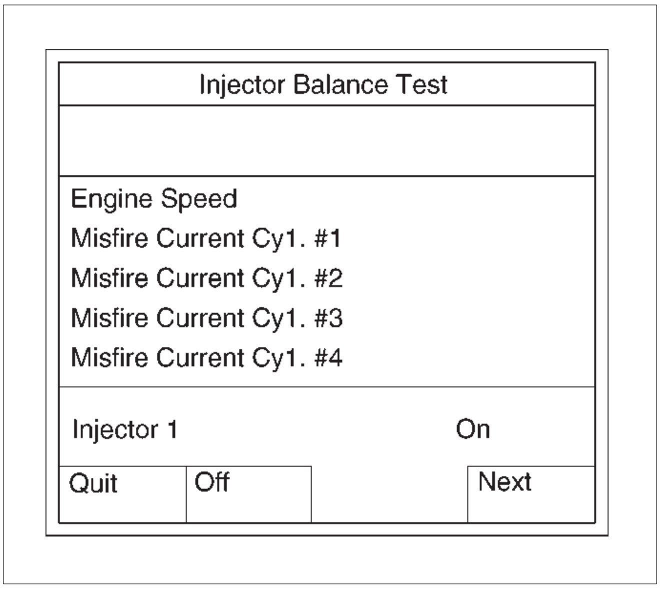
060RY00075

4. Select F7: Injector Balance Test in the Miscellaneous Test.



060RY00086

5. Select injector number and push “injector off” soft key.

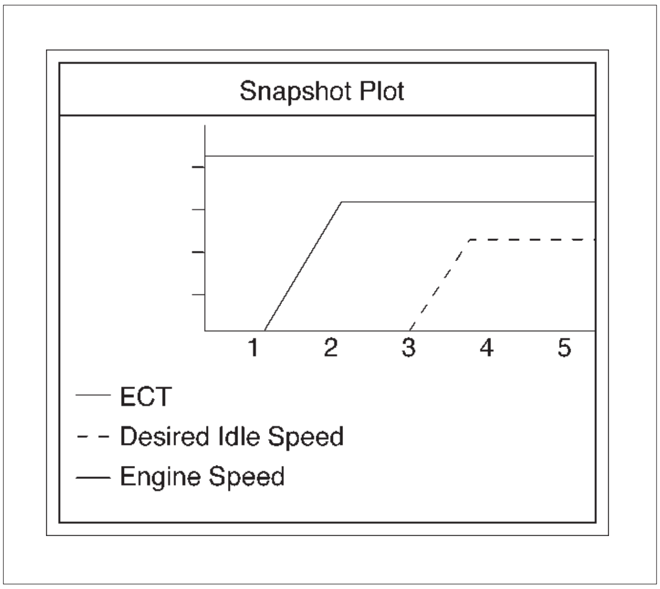


060RY00105

6. Make sure of engine speed change.
7. If engine speed changes, the injector electric circuit is normal.
   If engine speed does not change, the injector electric circuit or the injector itself is not normal.

Plotting Snapshot Graph

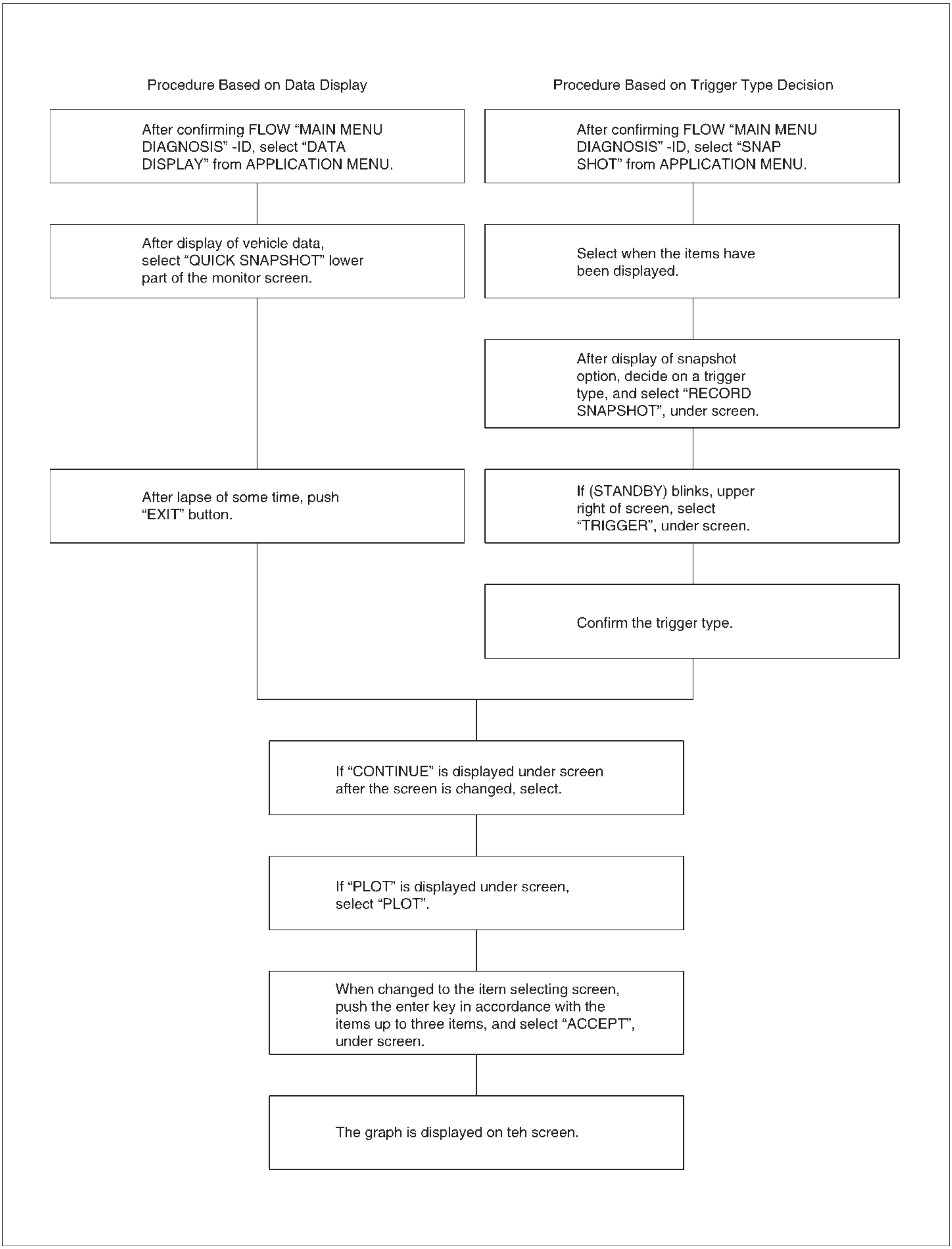
This test selects several necessary items from the data list to plot graphs and makes data comparison on a long term basis. It is an effective test particularly in emission related evaluations.



060RX037

For trouble diagnosis, you can collect graphic data (snap shot) directly from the vehicle.
You can replay the snapshot data as needed. Therefore, accurate diagnosis is possible, even though the vehicle is not available.

Plotting Graph Flow Chart (Plotting graph after obtaining vehicle information)



D06RY00167

Flow Chart for Snapshot Replay (Plotting Graph)

Press the enter-key in initial display.

Select "VIEW CAPTURE DATA"

If snapshot option is displayed, decide on a trigger type, and slect "REVIEW DATA" under screen.

When the data triggered by vehicle is displayed, select the data.
(Plural display of data depending on the number of times of triggering.)

data is displayed on the screen.
To see the graph, select "PLOT" under screen.

Changed to the item selection screen, push the enter key up to three times, and select "ACCEPT" under screen.

The graph is displayed on the screen.

060RX040

Primary System-Based Diagnostic

Primary System-Based Diagnostic

There are primary system-based diagnostics which evaluate system operation and its effect on vehicle emissions. The primary system-based diagnostics are listed below with a brief description of the diagnostic function:

Oxygen Sensor Diagnosis

The fuel control heated oxygen sensors (Bank 1 HO2S 1 and Bank 2 HO2S 1) are diagnosed for the following conditions:

- Heater performance (time to activity on cold start)
- Slow response
- Response time (time to switch R/L or L/R)
- Inactive signal (output steady at bias voltage – approx. 450 mV)
- Signal fixed high
- Signal fixed low

The catalyst monitor heated oxygen sensors (Bank 1 HO2S 2 and Bank 2 HO2S 2) are diagnosed for the following conditions:

- Heater performance (time to activity on cold start).
- Signal fixed low during steady state conditions or power enrichment (hard acceleration when a rich mixture should be indicated).
- Signal fixed high during steady state conditions or deceleration mode (deceleration when a lean mixture should be indicated).
- Inactive sensor (output steady at approx. 438 mV).

If the oxygen sensor pigtail wiring, connector or terminal are damaged, the entire oxygen sensor assembly must be replaced. DO NOT attempt to repair the wiring, connector or terminals. In order for the sensor to function properly, it must have clean reference air provided to it. This clean air reference is obtained by way of the oxygen sensor wire(s). Any attempt to repair the wires, connector or terminals could result in the obstruction of the reference air and degrade oxygen sensor performance. Refer to *On-Vehicle Service, Heated Oxygen Sensors* in this section.

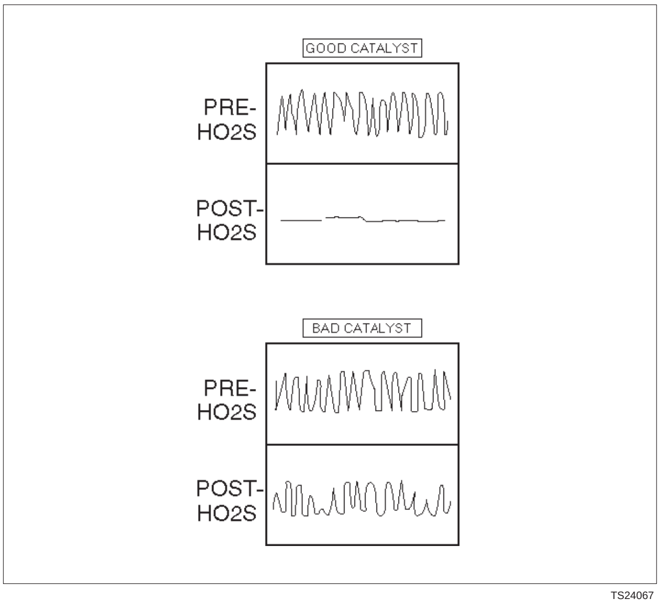
Fuel Control Heated Oxygen Sensor

The main function of the fuel control heated oxygen sensors is to provide the control module with exhaust stream oxygen content information to allow proper fueling and maintain emissions within mandated levels. After it reaches operating temperature, the sensor will generate a voltage, inversely proportional to the amount of oxygen present in the exhaust gases. The control module uses the signal voltage from the fuel control heated oxygen sensors while in closed loop to adjust fuel injector pulse width. While in closed loop, the PCM can adjust fuel delivery to maintain an air/fuel ratio which allows the best combination of emission control and driveability. The fuel control heated oxygen sensors are also used to determine catalyst efficiency.

HO2S Heater

Heated oxygen sensors are used to minimize the amount of time required for closed loop fuel control to begin operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors (Bank 1 HO2S 1 and Bank2 HO2S 1) to become active. Oxygen sensor heaters are required by catalyst monitor and sensor (Bank 1 HO2S 2 and Bank 2 HO2S 2) to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further away from the engine.

Catalyst Monitor Heated Oxygen Sensors and Diagnostic Operation



To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The PCM has the ability to monitor this process using the pre-catalyst and post-catalyst heated oxygen sensors. The pre-catalyst sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The post-catalyst sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the pre-catalyst signal will be far more active than that produced by the post-catalyst sensor.

In addition to catalyst monitoring, the heated oxygen sensors have a limited role in controlling fuel delivery. If the sensor signal indicates a high or low oxygen content for an extended period of time while in closed loop, the PCM will adjust the fuel delivery slightly to compensate.

- For the 3.5L w/automatic transmission, the pre-catalyst sensor are designated Bank 1 HO2S 1 and Bank 2 HO2S 1. The post-catalyst sensors are Bank 1 HO2S 2 and Bank 2 HO2S 2.

Catalyst Monitor Outputs

The catalyst monitor diagnostic is sensitive to the following conditions:

- Exhaust leaks
- HO2S contamination
- Alternate fuels

Exhaust system leaks may cause the following:

- Preventing a degraded catalyst from failing the diagnostic.
- Causing a false failure for a normally functioning catalyst.
- Preventing the diagnostic from running.

Some of the contaminants that may be encountered are phosphorus, lead, silica, and sulfur. The presence of these contaminants will prevent the TWC diagnostic from functioning properly.

Three-Way Catalyst Oxygen Storage Capacity

The Three-Way catalyst (TWC) must be monitored for efficiency. To accomplish this, the control module monitors the pre-catalyst HO2S and post-catalyst HO2S oxygen sensors. When the TWC is operating properly, the post-catalyst oxygen sensor will have significantly less activity than the pre-catalyst oxygen sensor. The TWC stores and releases oxygen as needed during its normal reduction and oxidation process. The control module will calculate the oxygen storage capacity using the difference between the pre-catalyst and post catalyst oxygen sensor's voltage levels. If the activity of the post-catalyst oxygen sensor approaches that of the pre-catalyst oxygen sensor, the catalyst's efficiency is degraded.

Stepped or staged testing level allow the control module to statistically filter test information. This prevents falsely passing or falsely failing the oxygen storage capacity test. The calculations performed by the on-board diagnostic system are very complex. For this reason, post catalyst oxygen sensor activity should not be used to determine oxygen storage capacity unless directed by the service manual.

Two stages are used to monitor catalyst efficiency. Failure of the first stage will indicate that the catalyst requires further testing to determine catalyst efficiency. The seconds stage then looks at the inputs for the pre and post catalyst HO2S sensors more closely before determining if the catalyst is indeed degraded. This further statistical processing is done to increase the accuracy of oxygen storage capacity type monitoring. Failing the first (stage 1) test DOES NOT indicate a failed catalyst. The catalyst may be marginal or the fuel sulfur content could be very high.

Aftermarket HO2S characteristics may be different from the original equipment manufacturer sensor. This may lead to a false pass or a false fail of the catalyst monitor diagnostic. Similarly, if an aftermarket catalyst does not contain the same amount of cerium as the original part, the correlation between oxygen storage and conversion efficiency may be altered enough to set a false DTC.

Evaporative Emission (EVAP) Purge System Vacuum Switch

The EVAP system uses a switch located in the purge line between the canister and the purge valve to detect when purge is occurring. This switch senses the flow from the engine through the purge valve. When no purge is present, the switch is closed, applying a 12 volt signal to the control module as a NO PURGE signal. When canister purging occurs, the switch opens, interrupting the 12 volt signal to the control module. A Tech 2 display will indicate that purge is occurring.

Clogging of the canister fresh air vent could allow the purge hose between the switch and canister to trap vacuum with the purge valve closed. This would result in a diagnostic indication of a purge valve stuck open or a vacuum switch failure. Similarly, leaks or blockages in the purge hoses may result in misdiagnosis of the purge valve or vacuum switch.

When servicing a purge valve diagnostic trouble code, check the canister fresh air vent, vacuum switch and the integrity of all purge hoses prior to servicing the valve. (Refer to EVAP Vacuum Switch in On-Vehicle Service Procedures in this section.)

Misfire Monitor Diagnostic Operation

Misfire Monitor Diagnostic Operation

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.

The misfire ratio is calculated once every 100 engine cycles. For example, on a 6-cylinder engine, 600 ignition plug sparks occur every 100 cycles and if a misfire occurs 12 times during that time, the misfire is $12/600 \times 100 = 2$ %.

Misfire Counters

Whenever a cylinder misfires, the misfire diagnostic counts the misfire and notes the crankshaft position at the time the misfire occurred. These “misfire counters” are basically a file on each engine cylinder. A current and a history misfire counter are maintained for each cylinder. The misfire current counters (Misfire Cur #1-6) indicate the number of firing events out of the last 100 cylinder firing events which were misfires. The misfire current counter will display real time data without a misfire DTC stored. The misfire history counters (Misfire Hist #1-6) indicate the total number of cylinder firing events which were misfires. The misfire history counters will display 0 until the misfire diagnostic has failed and a DTC P0300 is set. Once the misfire DTC P0300 is set, the misfire history counters will be updated every 100 cylinder firing events. A misfire counter is maintained for each cylinder.

If the misfire diagnostic reports a failure, the diagnostic executive reviews all of the misfire counters before reporting DTC. This way, the diagnostic executive reports the most current information.

When crankshaft rotation is erratic, a misfire condition will be detected. Because of this erratic condition, the data that is collected by the diagnostic can sometimes incorrectly identify which cylinder is misfiring. Misfires are counted from more than one cylinder. Cylinder #1 has the majority of counted misfires. In this case, the Misfire Counters would identify cylinder #1 as the misfiring cylinder. The misfires in the other counters were just background noise caused by the erratic misfire rotation of the crankshaft. If the number of accumulated misfires is sufficient for the diagnostic to identify a true misfire, the diagnostic will set DTC P0300 – Misfire Detected.

Use diagnostic equipment to monitor misfire counter data on OBD II-compliant vehicles. Knowing which specific cylinder(s) misfired can lead to the root cause, even when dealing with a multiple cylinder misfire. Using the information in the misfire counters, identify which cylinders are misfiring. If the counter indicate cylinders numbers 1 and 4 misfired, look for a circuit or component common to both cylinders number 1 and 4.

Misfire counter information is located in the “Eng.” menu, “Misfire Data” sub-menu of the data list.

The misfire diagnostic may indicate a fault due to a temporary fault not necessarily caused by a vehicle emission system malfunction. Examples include the following items:

- Contaminated fuel
- Low fuel
- Fuel-fouled spark plugs
- Basic engine fault

Fuel Trim System Monitor Diagnostic Operation

Fuel Trim System Monitor Diagnostic Operation

This system monitors the averages of short-term and long-term fuel trim values. If these fuel trim values stay at their limits for a calibrated period of time, a malfunction is indicated. The fuel trim diagnostic compares the averages of short-term fuel trim values and long-term fuel trim values to rich and lean thresholds. If either value is within the thresholds, a pass is recorded. If both values are outside their thresholds, a rich or lean DTC will be recorded.

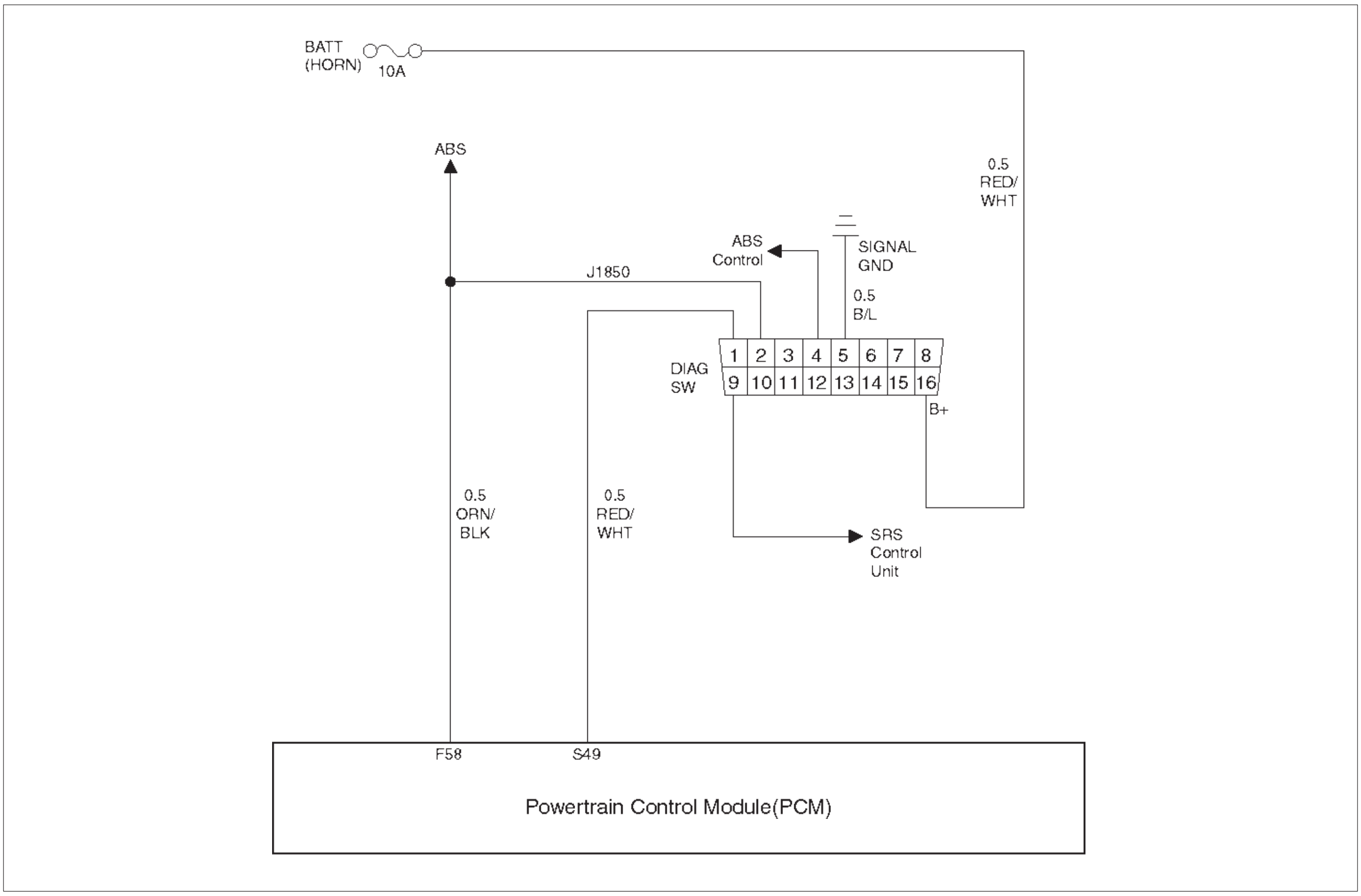
The fuel trim system diagnostic also conducts an intrusive test. This test determines if a rich condition is being caused by excessive fuel vapor from the EVAP canister. In order to meet OBD II requirements, the control module uses weighted fuel trim cells to determine the need to set a fuel trim DTC. A fuel trim DTC can only be set if fuel trim counts in the weighted fuel trim cells exceed specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e., engine idle high due to a small vacuum leak or rough idle due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use the Tech 2 to observe fuel trim counts while the problem is occurring.

A fuel trim DTC may be triggered by a number of vehicle faults. Make use of all information available (other DTCs stored, rich or lean condition, etc.) when diagnosing a fuel trim fault.

Fuel Trim Cell Diagnostic Weights

No fuel trim DTC will set regardless of the fuel trim counts in cell 0 unless the fuel trim counts in the weighted cells are also outside specifications. This means that the vehicle could have a fuel trim problem which is causing a problem under certain conditions (i.e. engine idle high due to a small vacuum leak or rough due to a large vacuum leak) while it operates fine at other times. No fuel trim DTC would set (although an engine idle speed DTC or HO2S DTC may set). Use the Tech 2 to observe fuel trim counts while the problem is occurring.

On-Board Diagnostic (OBD II) System Check



060RY00139

Circuit Description

The on-board diagnostic system check is the starting point for any driveability complaint diagnosis. Before using this procedure, perform a careful visual/physical check of the PCM and engine grounds for cleanliness and tightness.

The on-board diagnostic system check is an organized approach to identifying a problem created by an electronic engine control system malfunction.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the PCM harness and connector for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

1.The MIL (“Check Engine lamp”) should be “ON” steady with the ignition “ON ”engine “OFF.”If not, the “No MIL” chart should be used to isolate the malfunction.

2.The RPL (“Reduced Power lamp”) should be “ON” steady with the ignition “ON ”engine “OFF.” If not, the “No RPL”chart should be used to isolate the malfunction.

3.Checks the Class 2 data circuit and ensures that the PCM is able to transmit serial data.

4.This test ensures that the PCM is capable of controlling the MIL (“Check Engine lamp”) and the MIL (“Check Engine lamp”) driver circuit is not shorted to ground.

5.This test ensures that the PCM is capable of controlling the RPL (“Reduced Power lamp”) and the RPL (“Reduced Power lamp”) driver circuit is not shorted to ground.

7.Check the DTCs (System ,Volts Supply circuit).

8.Check the DTCs (PCM{Software} detect Errors).

10.If the engine will not start, the Cranks But Will Not Run chart should be used to diagnose the condition.

13.A Tech 2 parameter which is not within the typical range may help to isolate the area which is causing the problem.

14.This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to *PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors* of this section.

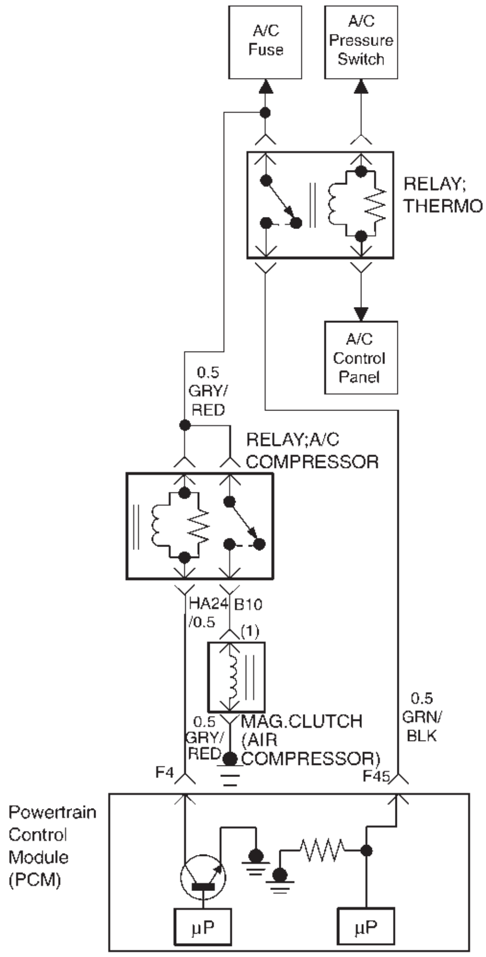
On-Board Diagnostic (OBD II) System Check

Step	Action	Value(s)	Yes	No
1	1. Ignition “ON,” engine “OFF.” 2. Observe the malfunction indicator lamp (MIL or “Check Engine lamp”). Is the MIL (“Check Engine lamp”)“ON?”	—	Go to *Step 2*	Go to *No MIL(“Check Engine lamp”)*
2	1. Ignition “ON,” engine “OFF.” 2. Observe the malfunction indicator lamp (“Reduced Power lamp”). Is the MIL (“Reduced Power lamp”) “ON?”	—	Go to *Step 3*	Go to *No RPL(“Reduced Power lamp”)*
3	1. Ignition “OFF.” 2. Install Tech 2. 3. Ignition “ON.” 4. Attempt to display PCM engine data with the Tech 2. Does the Tech 2 display PCM data?	—	Go to *Step 4*	Go to *Step 12*
4	1. Using the Tech 2 output tests function, select MIL (“Check Engine lamp”) control and command the MIL (“Check Enginelamp”) “OFF.” 2. Observe the MIL (“Check Engine lamp”). Did the MIL (“Check Engine lamp”) turn “OFF?”	—	Go to *Step 5*	Go to *MIL(“Check Engine lamp”) On Steady*
5	1. Using the Tech 2 output tests function, select MIL (“Reduced Power lamp”) control and command the MIL (“Reduced Power lamp”) “OFF.” 2. Observe the MIL (“Reduced Power lamp”). Did the MIL (“Reduced Power lamp”) turn “OFF?”	—	Go to *Step 6*	Go to *RPL(“Reduced Power lamp”) On Steady*
6	Select “Display DTCs” with the Tech 2. Are any DTCs stored?	—	Go to *Step 7*	Go to *Step 11*
7	Following below the DTCs stored: P0562, P0563, P0601, P0602, P0604, P0606, P1625, P1635, P1639, P1640, P1650	—	Go to *applicable DTC table*	Go to *Step 8*
8	Following below the DTCs stored: P1514, P1515, P1516, P1523, P1125, P1290, P1295, P1299	—	Go to *applicable DTC table*	Go to *Step 9*
9	Following below the DTCs stored: 1. P0425, P0106, P0107, P1107, P0401, P1404, P0405, P1120, P1221, P1515, P1516, P1275, P1635, P1271, P1273, P1285, P1272 2. P0336, P0337, P0341, P0342, P1220, P1515, P1221, P1516, P1280, P1639, P1271, P1272	—	Go to *“Multiple PCM Information sensor DTCs Set”*	Go to *Step 10*
10	Attempt to start the engine. Did the engine start and continue to run?	—	Go to *Step 6*	Go to *Cranks But Will Not Run*

On-Board Diagnostic (OBD II) System Check (Cont'd)

Step	Action	Value(s)	Yes	No
11	Compare PCM data values displayed on the Tech 2 to the typical engine scan data values. Are the displayed values normal or close to the typical values?	—	Go to *Symptom*	Refer to *indicated Component System Checks*
12	1. Ignition "OFF," disconnect the PCM. 2. Ignition "ON," engine "OFF." 3. Check the Class 2 data circuit for an open, short to ground, or short to voltage. Also, check the DLC ignition feed circuit for an open or short to ground and the DLC ground circuit for an open. 4. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 2*	Go to *Step 13*
13	1. Attempt to reprogram the PCM. Refer to *Powertrain Control Module (PCM) in On-Vehicle Service.* 2. Attempt to display PCM data with the Tech 2. Does the Tech 2 display PCM engine data?	—	Go to *Step 2*	Go to *Step 14*
14	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to *Step 2*	—

A/C Clutch Control Circuit Diagnosis



D06RY00162

Circuit Description

When air conditioning and blower fan are selected, and if the system has a sufficient refrigerant charge, a 12-volt signal is supplied to the A/C request input of the powertrain control module (PCM). The A/C request signal may be temporarily canceled during system operation by the electronic thermostat in the evaporator case. When the A/C request signal is received by the PCM, the PCM supplies a ground from the compressor clutch relay if the engine operating conditions are within acceptable ranges. With the A/C compressor relay energized, voltage is supplied to the compressor clutch coil.

The PCM will enable the compressor clutch to engage whenever A/C has been selected with the engine running, unless any of the following conditions are present:

- The throttle is greater than 90%.
- The ignition voltage is below 10.5 volts.
- The engine speed is greater than 4500 RPM for 5 seconds or 5400 RPM.
- The engine coolant temperature (ECT) is greater than 125 ˚C (257 ˚F).
- The intake air temperature (IAT) is less than 5˚C (41˚F).
- The power steering pressure switch signals a high pressure condition.

Diagnostic Aids

To diagnose an the intermittent fault, check for following conditions:

- Poor connection at the PCM–Inspect connections for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness–Inspect the wiring harness for damage. If the harness appears to OK, observe the A/C clutch while moving connectors and wiring harnesses related to the A/C. A sudden clutch malfunction will indicate the source of the intermittent fault.

A/C Clutch Diagnosis

This chart should be used for diagnosing the electrical portion of the A/C compressor clutch circuit. A Tech 2 will be used in diagnosing the system. The Tech 2 has the ability to read the A/C request input to the PCM. The Tech 2 can display when the PCM has commanded the A/C clutch "ON." The Tech 2 should have the ability to override the A/C request signal and energize the A/C compressor relay.

Test Description

IMPORTANT: Do not engage the A/C compressor clutch with the engine running if an A/C mode is not selected at the A/C control switch.

The numbers below refer to the step numbers on the Diagnostic Chart:

3. This a test determine is the problem is with the refrigerant system. If the switch is open, A/C pressure gauges will be used to determine if the pressure switch is faulty or if the system is partially discharged or empty.
4. Although the normal complaint will be the A/C clutch failing to engage, it is possible for a short circuit to cause the clutch to run when A/C has not been selected. This step is a test for that condition.
7. There is an extremely low probability that both relays will fail at the same time, so the substitution process is one way to check the A/C Thermostat relay. Use a known good relay to do a substitution check.

A/C Clutch Control Circuit Diagnosis

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any other DTCs stored?	—	Go to the other DTC chart(s) first	Go to *Step 3*
3	1. Disconnect the electrical connector at the pressure switch located on the receiver/drier. 2. Use an ohmmeter to check continuity across the pressure switch. Is the pressure switch open?	—	Go to Air *Conditioning* to diagnose the cause of the open pressure switch	Go to *Step 4*
4	**IMPORTANT:** Before continuing with the diagnosis, the following conditions must be met: • The intake air temperature must be greater than 15˚C. (60˚F). • The engine coolant temperature must be less than 119˚C (246˚F). 1. A/C "OFF." 2. Start the engine and idle for 1 minute. 3. Observe the A/C compressor. Is the A/C compressor clutch engaged even though A/C has not been requested?	—	Go to *Step 37*	Go to *Step 5*
5	1. Idle the engine. 2. A/C "ON". 3. Blower "ON". 4. Observe the A/C compressor. Is the A/C compressor magnetic clutch engaged?	—	Refer to *Diagnostic Aids*	Go to *Step 6*
6	1. Engine idling. 2. A/C "ON". 3. Blower "ON". 4. Observe the "A/C Request" display on the Tech 2. (Refer to the Miscellaneous test) Does the tool "A/C Request" display indicate "Yes?"	—	Go to *Step 26*	Go to *Step 7*

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
7	Temporarily substitute the A/C compressor relay in place of the A/C thermostat relay, then repeat Step 5. Did the "A/C Request" display indicate "Yes?"	—	Go to *Step 8*	Go to *Step 9*
8	Replace the original A/C thermostat relay. Is the action complete?	—	Verify repair	—
9	Dose the blower operate?	—	Go to *Step 10*	Go to *Step 11*
10	Repair the blower. Is the action complete?	—	Verify repair	—
11	Check for a faulty 10A A/C fuse in the underdash fuse panel. Was the 10A fuse OK?	—	Go to *Step 13*	Go to *Step 12*
12	Check for short circuit and make repairs if necessary. Replace the 10A A/C fuse. Is the action complete?	—	Verify repair	—
13	1. Remove the glove box to gain access to the A/C thermostat. 2. Disconnect the thermostat connector. 3. Attach a fused jumper between ground and the thermostat wire. 4. A/C "ON." 5. Blower "ON." Dose A/C request indicate "YES" on the Tech 2?	—	Go to *Step 14*	Go to *Step 17*
14	1. Ignition "ON." 2. Use a DVM to check voltage at the electronic A/C thermostat. Was voltage equal to the specified value?	B+	Go to *Step 17*	Go to *Step 15*
15	Check for an open between the thermostat and the A/C switch. Was the wire open?	—	Go to *Step 16*	Go to *Step 17*
16	Repair the open wire between the thermostat and the A/C switch. Is the action complete?	—	Verify repair	—
17	Check for an open circuit between A/C thermostat relay and PCM A/C request terminal (F45). Was there an open circuit?	—	Go to *Step 18*	Go to *Step 19*
18	Repair the open circuit between the PCM and A/C thermostat relay. Is the action complete?	—	Verify repair	—
19	1. Ignition "ON." 2. Use a DVM to check voltage at the A/C pressure switch (BRN). Was voltage equal to the specified value?	B+	Go to *Step 21*	Go to *Step 20*
20	Repair the open circuit between the 10A A/C fuse and the pressure switch. Is the action complete?	—	Verify repair	—

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
21	Use an ohmmeter to check continuity between the pressure switch and the A/C thermostat relay. Was the circuit open?	—	Go to *Step 22*	Go to *Step 23*
22	Repair the open circuit between the pressure switch and the A/C thermostat relay. Is the action complete?	—	Verify repair	—
23	Check for damaged pin or terminal at F45 of the PCM. Was a damaged pin or terminal found?	—	Go to *Step 24*	Go to *Step 25*
24	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
25	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
26	1. Remove the A/C compressor relay. 2. Ignition "ON." 3. Use a DVM to check voltage at both of the wires at the A/C compressor relay socket. Is the voltage equal to the specified value?	B+	Go to *Step 28*	Go to *Step 27*
27	Repair the faulty wire between the A/C fuse and the A/C compressor relay . Is the action complete?	—	Verify repair	—
28	1. A/C compressor relay removed. 2. Engine idling. 3. A/C "ON." 4. Blower "ON." 5. Use a DVM to measure voltage between the wire at the A/C compressor relay socket and battery±. Did the DVM indicate the specified value?	B+	Go to *Step 32*	Go to *Step 29*
29	Check for an open wire between PCM terminal F4 and the A/C compressor relay. Was the wire open?	—	Go to *Step 30*	Go to *Step 31*
30	Repair the open wire between the PCM and the A/C compressor relay. Is the action complete?	—	Verify repair	—
31	Check for a damaged pin or terminal at F4 of the PCM. Was a damaged pin or a terminal found?	—	Go to *Step 24*	Go to *Step 25*

A/C Clutch Control Circuit Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
32	1. A/C compressor relay removed. 2. Connect a fused jumper at the A/C compressor relay socket with either wires. 3. Engine idling. 4. A/C "ON." 5. Blower "ON." Did the compressor magnetic clutch engage?	—	Go to *Step 33*	Go to *Step 34*
33	Repair the A/C compressor relay. Is the action complete?	—	Verify repair	—
34	Check for an open circuit between the A/C compressor relay and the A/C clutch. Was an open circuit found?	—	Go to *Step 35*	Go to *Step 36*
35	Repair the open circuit between the compressor Clutch and the A/C compressor relay. Is the action complete?	—	Verify repair	—
36	Service the compressor clutch or replace the compressor due to a faulty internal overheat switch. Is the action complete?	—	Verify repair	—
37	1. Remove the A/C compressor relay. 2. Idle the engine. Is the compressor clutch still engaged when A/C is not selected?	—	Go to *Step 38*	Go to *Step 39*
38	Repair the short to voltage between the A/C clutch and A/C compressor relay. Is the action complete?	—	Verify repair	—
39	1. Reinstall the A/C compressor relay. 2. Remove the A/C thermostat relay. 3. Engine idling. Is the compressor clutch still engaged when A/C is not selected?	—	Go to *Step 40*	Go to *Step 42*
40	Use a DVM to check for a short to ground between the A/C compressor relay and F4 of the PCM. Was a short detected?	—	Go to *Step 41*	Go to *Step 25*
41	Repair the short to ground between the PCM and A/C compressor relay. Is the action complete?	—	Verify repair	—
42	Repair the short to ground between the A/C thermostat relay and the electronic thermostat. Is the action complete?	—	Verify repair	—

Electronic Ignition System Diagnosis

If the engine cranks but will not run or immediately stalls, the Engine Cranks But Will Not Start chart must be used to determine if the failure is the ignition system or the fuel system. If DTC P0300 through P0306, P0341, or P0336 is set, the appropriate diagnostic trouble code chart must be used for diagnosis.
If a misfire is being experienced with no DTC set, refer to the *Symptoms* section for diagnosis.

EVAP Canister Purge Solenoid and EVAP Vacuum Switch

A continuous purge condition with no purge commanded by the PCM will set a DTC P1441. Refer to the DTC charts for further information.

Visual Check of The Evaporative Emission Canister

- If the canister is cracked or damaged, replace the canister.
- If fuel is leaking from the canister, replace the canister and check hoses and hose routing.

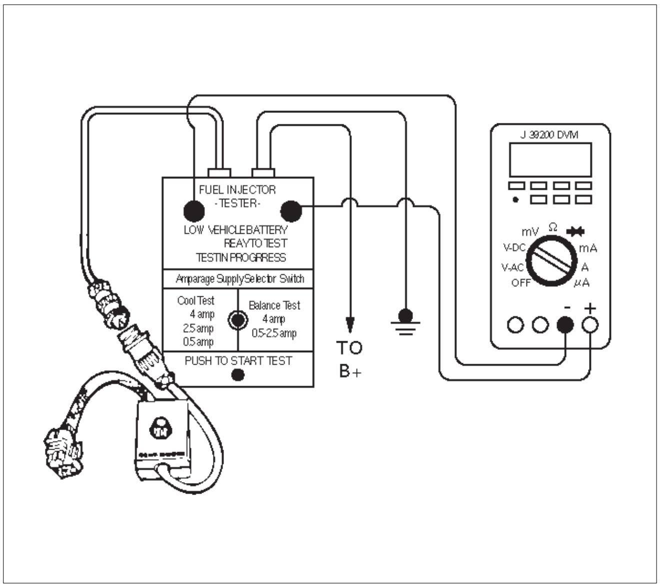
Fuel Metering System Check

Some failures of the fuel metering system will result in an "Engine Cranks But Will Not Run" symptom. If this condition exists, refer to the *Cranks But Will Not Run* chart. This chart will determine if the problem is caused by the ignition system, the PCM, or the fuel pump electrical circuit.
Refer to *Fuel System Electrical Test* for the fuel system wiring schematic.
If there is a fuel delivery problem, refer to *Fuel System Diagnosis*, which diagnoses the fuel injectors, the fuel pressure regulator, and the fuel pump. If a malfunction occurs in the fuel metering system, it usually results in either a rich HO2S signal or a lean HO2S signal. This condition is indicated by the HO2S voltage, which causes the PCM to change the fuel calculation (fuel injector pulse width) based on the HO2S reading. Changes made to the fuel calculation will be indicated by a change in the long term fuel trim values which can be monitored with a Tech 2. Ideal long term fuel trim values are around 0%; for a lean HO2S signal, the PCM will add fuel, resulting in a fuel trim value above 0%. Some variations in fuel trim values are normal because all engines are not exactly the same. If the evaporative emission canister purge is "ON," the fuel trim may be as low as –38%. If the fuel trim values are greater than +23%, refer to *DTC P0131, DTC P0151, DTC P0171, and DTC 1171* for items which can cause a lean HO2S signal.

Fuel System Pressure Test

A fuel system pressure test is part of several of the diagnostic charts and symptom checks. To perform this test, refer to *Fuel Systems Diagnosis.*

Fuel Injector Coil Test Procedure and Fuel Injector Balance Test Procedure



T32003

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Relieve the fuel pressure by connecting the J 34730-1 Fuel Pressure Gauge to the fuel pressure connection on the fuel rail.

CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.

Place the fuel pressure gauge bleed hose in an approved gasoline container.

With the ignition switch "OFF," open the valve on the fuel pressure gauge.

3. Record the lowest voltage displayed by the DVM after the first second of the test. (During the first second, voltage displayed by the DVM may be inaccurate due to the initial current surge.)

Injector Specifications:

Resistance Ohms	Voltage Specification at 10°C-35°C (50°F-95°F)
11.8 – 12.6	5.7 – 6.6

- The voltage displayed by the DVM should be within the specified range.
- The voltage displayed by the DVM may increase throughout the test as the fuel injector windings warm and the resistance of the fuel injector windings changes.

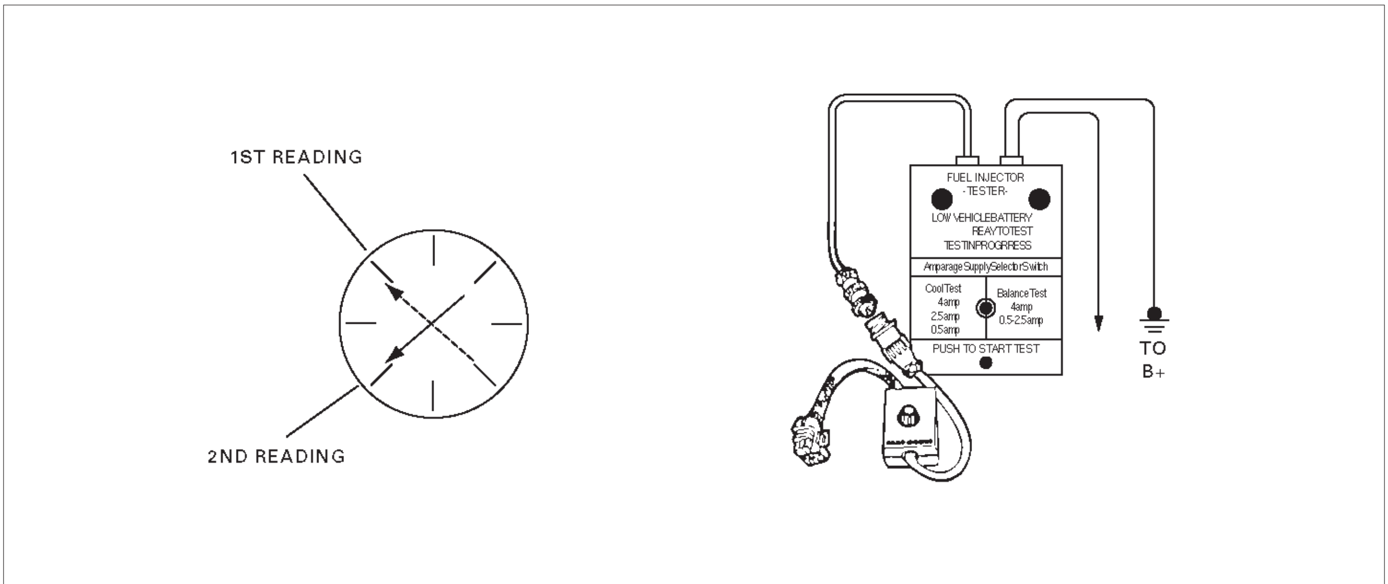
- An erratic voltage reading (large fluctuations in voltage that do not stabilize) indicates an intermittent connection within the fuel injector.

5. Injector Specifications:

Highest Acceptable Voltage Reading Above/Below 35˚C/10˚C (95˚F/50˚F)	Acceptable Subtracted Value
9.5 Volts	0.6 Volts

7. The Fuel Injector Balance Test portion of this chart (Step 7 through Step 11) checks the mechanical (fuel delivery) portion of the fuel injector. An engine cool-down period of 10 minutes is necessary in order to avoid irregular fuel pressure readings due to “Hot Soak” fuel boiling.

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11)



R262001

CYLINDER	1	2	3	4	5	6
1st Reading (1)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)	296 kPa (43 psi)
2nd Reading (2)	131 kPa (19 psi)	117 kPa (17 psi)	124 kPa (18 psi)	145 kPa (21 psi)	131 kPa (19 psi)	130 kPa (19 psi)
Amount of Drop (1st Reading–2nd Reading)	165 kPa (24 psi)	179 kPa (26 psi)	172 kPa (25 psi)	151 kPa (22 psi)	165 kPa (24 psi)	166 kPa (24 psi)
Av.drop = 166 kPa/24 psi ± 10 kPa/1.5 psi = 156 – 176 kPa or 22.5 – 25.5 psi	OK	Faulty, Rich (Too Much Fuel Drop)	OK	Faulty, Lean (Too Little Fuel Drop)	OK	OK

NOTE: These figures are examples only.

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to *OBD System Check*
2	1. Turn the engine “OFF.” NOTE: In order to prevent flooding of a single cylinder and possible engine damage, relieve the fuel pressure before performing the fuel injector coil test procedure. 2. Relieve the fuel pressure. Refer to *Test Description Number 2.* 3. Connect the J 39021-5V Fuel Injector Tester to B+ and ground, and to the J 39021-90 Injector Switch Box. 4. Connect the injector switch box to the grey fuel injector harness connector located on the front of the EVAP canister bracket. 5. Set the amperage supply selector switch on the fuel injector tester to the “Coil Test” 0.5 amp position. 6. Connect the leads from the J 39200 Digital Voltmeter (DVM) to the injector tester. Refer to the illustrations associated with the test description. 7. Set the DVM to the tenths scale (0.0). 8. Observe the engine coolant temperature. Is the engine coolant temperature within the specified values?	10°C (50°F) to 35°C (95°F)	Go to *Step 3*	Go to *Step 5*
3	1. Set injector switch box injector #1. 2. Press the “Push to Start Test” button on the fuel injector tester. 3. Observe the voltage reading on the DVM. **IMPORTANT:** The voltage reading may rise during the test. 4. Record the lowest voltage observed after the first second of the test. 5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4. Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading outside of the specified values?	5.7-6.6 V	Go to *Step 4*	Go to *Step 7*
4	Replace the faulty fuel injector(s). Refer to *Fuel Injector.* Is the action complete?	—	Go to *Step 7*	—

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11) (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Set injector switch box injector #1. 2. Press the "Push to Start Test" button on the fuel injector tester. 3. Observe the voltage reading on the DVM. **IMPORTANT:** The voltage reading may rise during the test. 4. Record the lowest voltage observed after the first second of the test. 5. Set the injector switch box to the next injector and repeat steps 2, 3, and 4. Did any fuel injector have an erratic voltage reading (large fluctuations in voltage that did not stabilize) or a voltage reading above the specified value?	9.5 V	Go to *Step 4*	Go to *Step 6*
6	1. Identify the highest voltage reading recorded (other than those above 9.5 V). 2. Subtract the voltage reading of each injector from the highest voltage selected in step 1. Repeat until you have a subtracted value for each injector. For any injector, is the subtracted Value in step 2 greater than the specified value?	0.6 V	Go to *Step 4*	Go to *Step 7*
7	**CAUTION: In order to reduce the risk of fire and personal injury, wrap a shop towel around the fuel pressure connection. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gauge. Place the towel in an approved container when the connection of the fuel pressure gauge is complete.** 1. Connect the J 34730-1 Fuel Pressure Gauge to the fuel pressure test port. 2. Energize the fuel pump using the Tech 2. 3. Place the bleed hose of the fuel pressure gauge into an approved gasoline container. 4. Bleed the air out of the fuel pressure gauge. 5. With the fuel pump running, observe the reading on the fuel pressure gauge. Is the fuel pressure within the specified values?	296-376 kPa (43-55 psi)	Go to *Step 8*	Go to *Fuel System Diagnosis*
8	Turn the fuel pump "OFF." Does the fuel pressure remain constant?	—	Go to *Step 9*	Go to *Fuel System Diagnosis*

Injector Coil Test Procedure (Steps 1-6) and Injector Balance Test Procedure (Steps 7-11) (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Connect the J 39021-5V Fuel Injector Tester and J 39021-90 Injector Switch Box the fuel injector harness connector. 2. Set the amperage supply selector switch on the fuel injector tester to the "Balance Test" 0.5–2.5 amp position. 3. Using the Tech 2 turn the fuel pump "ON" then "OFF" in order to pressurize the fuel system. 4. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure stabilizes. This is the first pressure reading. 5. Energize the fuel injector by depressing the "Push to Start Test" button on the fuel injector tester. 6. Record the fuel pressure indicated by the fuel pressure gauge after the fuel pressure gauge needle has stopped moving. This is the second pressure reading. 7. Repeat steps 1 through 6 for each fuel injector. 8. Subtract the second pressure reading from the first pressure reading for one fuel injector. The result is the pressure drop value. 9. Obtain a pressure drop value for each fuel injector. 10. Add all of the individual pressure drop values. This is the total pressure drop. 11. Divide the total pressure drop by the number of fuel injectors. This is the average pressure drop. Does any fuel injector have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value?	10 kPa (1.5 psi)	Go to *Step 10*	Go to *OBD System Check*
10	Re-test any fuel injector that does not meet the specification. Refer to the procedure in step 9. NOTE: Do not repeat any portion of this test before running the engine in order to prevent the engine from flooding. Does any fuel injector still have a pressure drop value that is either higher than the average pressure drop or lower than the average pressure drop by the specified value?	10 kPa (1.5 psi)	Go to *Step 11*	Go to *Symptoms*
11	Replace the faulty fuel injector(s). Refer to *Fuel Injector.* Is the action complete?	—	Verify repair	—

Powertrain Control Module (PCM) Diagnosis

To read and clear diagnostic trouble codes, use a Tech 2.

IMPORTANT: Use of a Tech 2 is recommended to clear diagnostic trouble codes from the PCM memory. Diagnostic trouble codes can also be cleared by turning the ignition "OFF" and disconnecting the battery power from the PCM for 30 seconds. Turning off the ignition and disconnecting the battery power from the PCM will cause all diagnostic information in the PCM memory to be cleared. Therefore, all the diagnostic tests will have to be re-run.

Since the PCM can have a failure which may affect only one circuit, following the diagnostic procedures in this section will determine which circuit has a problem and where it is.

If a diagnostic chart indicates that the PCM connections or the PCM is the cause of a problem, and the PCM is replaced, but this does not correct the problem, one of the following may be the reason:

- There is a problem with the PCM terminal connections. The terminals may have to be removed from the connector in order to check them properly.
- EEPROM program is not correct for the application. Incorrect components or reprogramming the PCM with the wrong EEPROM program may cause a malfunction and may or may not set a DTC.
- The problem is intermittent. This means that the problem is not present at the time the system is being checked. In this case, refer to the *Symptoms* portion of the manual and make a careful physical inspection of all component and wiring associated with the affected system.
- There is a shorted solenoid, relay coil, or harness. Solenoids and relays are turned "ON" and "OFF" by the PCM using internal electronic switches called drivers. A shorted solenoid, relay coil, or harness will not damage the PCM but will cause the solenoid or relay to be inoperative.

Multiple PCM Information Sensor DTCs Set

Circuit Description

The powertrain control module (PCM) monitors various sensors to determine the engine operating conditions.

The PCM controls fuel delivery, spark advance, transmission operation, and emission control device operation based on the sensor inputs.

The PCM provides a sensor ground to all of the sensors. The PCM applies 5 volts through a pull–up resistor, and determines the status of the following sensors by monitoring the voltage present between the 5–volt supply and the resistor:

- The engine coolant temperature (ECT) sensor
- The intake air temperature (IAT) sensor
- The transmission fluid temperature (TFT) sensor

The PCM provides the following sensors with a 5–volt reference and a sensor ground signal:

1

- The exhaust gas recirculating (EGR) pintle position
- sensor
- The manifold absolute pressure (MAP) sensor
- The throttle position (TP) sensor 1
- The acceleration position (AP) sensor 1
- The acceleration position (AP) sensor 3
- The Vapor Pressure Sensor

2

- The Crank position (CKP) sensor
- The Camshaft Position (CMP) Sensor
- The throttle position (TP) sensor 2
- The acceleration position (AP) sensor 2

The PCM monitors the separate feedback signals from these sensors in order to determine their operating status.

Diagnostic Aids

IMPORTANT: Be sure to inspect PCM and engine grounds for being secure and clean.

A short to voltage in one of the sensor input circuits may cause one or more of the following DTCs to be set:

- P0425
- P0108, P1106
- P0406
- P1120, P1515, P1221, P1516, P1635
- P1275, P1639, P1271, P1273
- P1285, P1272, P1273
- P0336, P0337
- P0341, P0342
- P1220, P1515, P1221, P1515, P1516
- P1280, P1271, P1272

IMPORTANT: If a sensor input circuit has been shorted to voltage, ensure that the sensor is not damaged. A damaged sensor will continue to indicate a high or low voltage after the affected circuit has been repaired. If the sensor has been damaged, replace it.

An open in the sensor ground circuit between the PCM and the splice will cause one or more of the following DTCs to be set:

- P0425
- P0108, P1106
- P0406
- P1120, P1515, P1221, P1516, P1635
- P1275, P1639, P1271, P1273
- P1285, P1272, P1273
- P0336, P0337
- P0341, P0342
- P1220, P1515, P1221, P1515, P1516
- P1280, P1271, P1272

A short to ground in the 5–volt reference A or B circuit will cause one or more of the following DTCs to be set:

- P0453
- P0106, P0107, P1107
- P0401, P1404, P0405
- P1120, P1515, P1221, P1516, P1635
- P1275, P1639, P1271, P1273
- P1285, P1272, P1273
- P0336, P0337
- P0341, P0342
- P1220, P1515, P1221, P1515, P1516
- P1280, P1271, P1272

Check for the following conditions:

- **Poor connection at PCM.** Inspect the harness connectors for backed–out terminals, improper mating, broken locks, improperly formed or damage terminals, and a poor terminal–to–wire connection.
- **Damaged harness.** Inspect the wiring harness for damage. If the harness is not damaged, observe an affected sensor fs displayed value on the Tech 2 with the ignition “ON” and the engine “OFF” while you move the connectors and the wiring harnesses related to the following sensors:
  - Vapor Pressure Sensor
  - MAP Sensor
  - EGR
  - TPS1/TPS2
  - APS1/APS2/APS3
  - CKP/CMP

Multiple PCM Information Sensor DTCs Set

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Turn the ignition “OFF,” disconnect the PCM. 2. Turn the ignition “ON,” check the 5 volt reference 1 and 2 circuit for the following conditions: • A poor connection at the PCM. • An open between the PCM connector and the splice. • A short to ground. • A short to voltage. Is there an open or short?	—	Go to *Step 3*	Go to *Step 4*
3	Repair the open or short. Is the action complete?	—	Verify repair	—
4	Check the sensor ground circuit for the following conditions: • A poor connection at the PCM or the affected sensors. • An open between the PCM connector and the affected sensors. Is there an open or a poor connection?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the open or the poor connection. Is the action complete?	—	Verify repair	—
6	Following below the DTCs stored: P1635, P1639	—	Go to *applicable DTC table*	Go to *Step 7*
7	Measure the resistance below the items: • Between EGR sensor supply circuit and Vapor Pressure Sensor supply circuit. • Between MAP sensor supply circuit and Vapor Pressure Sensor supply circuit. • Between Vapor Pressure Sensor supply circuit and PCM harness connector. (5Volt supply circuit) Does the resistance measure near the specified value?	—	Go to *Step 9*	Go to *Step 8*
8	Locate and repair the open circuit in the MAP or EGR or Vapor Pressure sensor suppy circuit. Is the action complete?	—	Verify repair	—
9	1. Disconnect the MAP , Vapor pressure sensor and EGR connector. 2. Ignition “ON.” 3. Measure the resistance below the items: • MAP sensor GND circuit. • EGR GND circuit. • Vapor pressure sensor GND circuit. Does the voltage resistance near the specified value?	—	Go to *Step 11*	Go to *Step 10*

Multiple PCM Information Sensor DTCs Set (Cont'd)

Step	Action	Value(s)	Yes	No
10	Locate and repair the short circuit in the MAP or EGR or Vapor Pressure sensor signal or GND circuit. Is the action complete?	—	Verify repair	—
11	Measure the resistance below the items: ● Between CKP sensor supply circuit and CMP Sensor supply circuit. ● Between CKP Sensor supply circuit and PCM harness connector. (5Volt supply circuit) Does the voltage resistance near the specified value?	—	Go to *Step 13*	Go to *Step 12*
12	Locate and repair the open circuit in the CKP or CMP sensor supply circuit. Is the action complete?	—	Verify repair	—
13	1. Disconnect the CKP and CMP sensor connector. 2. Ignition "ON." 3. Measure the voltage below the items: ● CKP sensor GND circuit and shield circuit. ● CMP sensor GND circuit and shield circuit. Does the voltage resistance near the specified value?	—	Go to *Step 15*	Go to *Step 14*
14	Locate and repair the short circuit in the CKP or CMP sensor signal or GND circuit. Is the action complete?	—	Verify repair	—
15	Are more of the following items for DTCs stored? EGR, Vapor Pressure Sensor, MAP, CKP, CMP, TPS, APS	—	Go to *applicable DTC table*	Go to *Step 16*
16	Replace the PCM. The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to *OBD System Check*	—

Exhaust Gas Recirculation (EGR) Diagnosis

An EGR flow check diagnosis of the linear EGR system is covered by DTC P0401. Pintle position error diagnosis is covered by DTC P0402, P0404, P1404, P0405, P0406. If EGR diagnostic trouble codes P0401 and/or P0402, P0404, P1404, P0405, P0406 are encountered, refer to the DTC charts.

Engine Tech 2 Data Definitions and Ranges

A/C CLUTCH – Tech 2 Displays ON or OFF –
Indicates whether the PCM has commanded the A/C clutch ON. Used in A/C system diagnostic.

A/C REQUEST — Tech 2 Displays YES or NO —
Indicates the state of the A/C request input circuit from the HVAC controls. The PCM uses the A/C request signal to determine whether A/C compressor operation is being requested.

AIR/FUEL RATIO — Tech 2 Range 0.0-25.5 —
Air/fuel ratio indicates the PCM commanded value. In closed loop, the air/fuel ratio should normally be displayed around “14.2-14.7.” A lower air/fuel ratio indicates a richer commanded mixture, which may be seen during power enrichment or TWC protection modes. A higher air/fuel ratio indicates a leaner commanded mixture. This can be seen during deceleration fuel mode.

AP1 —Tech 2 Range 0%-100% —
AP (accelerator pedal) angle is computed by the PCM from the AP sensor voltage. AP angle should display “3%” at idle and “85-89%” at wide open throttle.

AP2 —Tech 2 Range 0%-100% —
AP (accelerator pedal) angle is computed by the PCM from the AP sensor voltage. AP angle should display “85-89%” at idle and “11-15%” at wide open throttle.

AP3 —Tech 2 Range 0%-100% —
AP (accelerator pedal) angle is computed by the PCM from the AP sensor voltage. AP angle should display “85-89%” at idle and “32-36%” at wide open throttle.

BAROMETRIC PRESSURE — Tech 2 Range 10-105 kPa/0.00-5.00 Volts —
The barometric pressure reading is determined from the MAP sensor signal monitored during key up and wide open throttle (WOT) conditions. The barometric pressure is used to compensate for altitude differences and is normally displayed around “61-104” depending on altitude and barometric pressure.

CHECK TRANS LAMP — AUTO TRANSMISSION —
Indicates the need to check for a DTC with the Tech 2 when the lamp is flashing 0.2 seconds ON and 0.2 seconds OFF.

DESIRED EGR POS. — Tech 2 Range 0%-100% —
Represents the EGR pintle position that the PCM is commanding.

DESIRED IDLE — Tech 2 Range 0-3187 RPM —
The idle speed that the PCM is commanding. The PCM will compensate for various engine loads based on engine coolant temperature, to keep the engine at the desired speed.

ECT — (Engine Coolant Temperature) Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F) —
The engine coolant temperature (ECT) is mounted in the coolant stream and sends engine temperature information to the PCM. The PCM applies 5 volts to the ECT sensor circuit. The sensor is a thermistor which changes internal resistance as temperature changes. When the sensor is cold (high resistance), the PCM monitors a high signal voltage and interprets that as a cold engine. As the sensor warms (decreasing resistance), the voltage signal will decrease and the PCM will interpret the lower voltage as a warm engine.

EGR DUTY CYCLE — Tech 2 Range 0%-100% —
Represents the EGR valve driver PWM signal from the PCM. A duty cycle of 0% indicates that no EGR flow is being commanded; a 100% duty cycle indicates maximum EGR flow commanded.

EGR FEEDBACK — Tech 2 Range 0.00-5.00 Volts —
Indicates the EGR pintle position sensor signal voltage being monitored by the PCM. A low voltage indicates a fully extended pintle (closed valve); a voltage near 5 volts indicates a retracted pintle (open valve).

ENGINE LOAD — Tech 2 Range 0%-100% —
Engine load is calculated by the PCM from engine speed and MAF sensor readings. Engine load should increase with an increase in RPM or air flow.

ENGINE RUN TIME — Tech 2 Range 00:00:00-99:99:99 Hrs:Min:Sec —
Indicates the time elapsed since the engine was started. If the engine is stopped, engine run time will be reset to 00:00:00.

ENGINE SPEED — Range 0-9999 RPM —
Engine speed is computed by the PCM from the 58X reference input. It should remain close to desired idle under various engine loads with engine idling.

EVAP PURGE PWM — Tech 2 Range 0%-100% —
Represents the PCM commanded PWM duty cycle of the EVAP purge solenoid valve. “0%” displayed indicates no purge; “100%” displayed indicates full purge.

EVAP VACUUM SWITCH (Vent Valve) — Tech 2 Displays ON or OFF —
The EVAP purge vacuum switch is a normally closed switch positioned in the purge line between the canister and the EVAP purge solenoid. The EVAP purge vacuum switch will open when vacuum increases to greater than 5 inches of water in the purge line. The EVAP purge vacuum switch is used by the PCM to monitor EVAP canister purge solenoid operation and purge system integrity. The EVAP purge vacuum switch should be closed to ground with no vacuum present (0% EVAP purge PWM). With EVAP purge PWM at 25% or greater, the EVAP purge vacuum switch should be open and “PURGE” should be indicated.

FUEL PUMP — Tech 2 Displays ON or OFF —
Indicates the PCM commanded state of the fuel pump relay driver circuit.

HO2S BANK 1, SEN. 1
— Tech 2 Range 0-1132 mV —
Represents the fuel control exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10 mV (lean exhaust) and 1000 mV (rich exhaust) while operating in closed loop.

HO2S BANK 1, SEN. 2
— Tech 2 Range 0-1000mV —
Monitors the exhaust oxygen sensor output voltage. The PCM monitors the operating efficiency of catalytic converter by comparing the output voltages of sensor 1 and sensor 2 in this bank. If the catalytic converter is operating efficiently, the output voltage of sensor 1 will give a greater fluctuation than that of sensor 2. If the PCM detects an abnormal level of voltage fluctuation from sensor 2, a DTC P0420 will be set, indicating that the catalytic converter for this bank is no longer operating efficiently.

HO2S BANK2, SEN. 1 —Tech 2 Range 0-1132 mV—
Represents the fuel control exhaust oxygen sensor output voltage. Should fluctuate constantly within a range between 10mV (lean exhaust) and 1000 mV (rich exhaust) while operating in closed loop.

HO2S BANK 2, SEN. 2—Tech 2 Range 0-1000 mV—
Monitors the exhaust oxygen sensor output voltage. The PCM monitors the operating efficiency of catalytic converter by comparing the output voltages of sensor 1 and sensor 2 in this bank. If the catalytic converter is operating efficiently, the output voltage of sensor 1 will have a greater fluctuation than that of sensor 2. If the PCM detects an abnormal level of voltage fluctuation from sensor 2, a DTC P0430 will be set, indicating that the catalytic converter for this bank is no longer operating efficiently.

HO2S BANK 1, SEN. 1—Tech 2 Displays NOT READY or READY—
Indicates the status of the exhaust oxygen sensor. The Tech 2 will indicate that the exhaust oxygen sensor is ready when the PCM detects a fluctuating HO2S voltage sufficient to allow closed loop operation. This will not occur unless the exhaust oxygen sensor is warmed up.

HO2S BANK 2, SEN. 1 — Tech 2 Displays NOT READY or READY —
Indicates the status of the exhaust oxygen sensor. The Tech 2 will indicate that the exhaust oxygen sensor is ready when the PCM detects a fluctuating HO2S voltage sufficient to allow closed loop operation. This will not occur unless the exhaust oxygen sensor is warmed up.

HO2S WARM UP TIME BANK 1, SEN. 1/BANK 1, SEN 2/BANK 2 SEN. 1/BANK 2 SEN. 2 — Tech 2 Range 00:00:00-99:99:99 HRS:MIN:SEC —
Indicates warm-up time for each HO2S. The HO2S warm-up time is used for the HO2S heater test. The PCM will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that tool much time was required for the HO2S to become active, a DTC will set. If the engine was warm when started, HO2S warm-up will the display “00:00:00”.

IAT (INTAKE AIR TEMPERATURE) — Tech 2 Range –40˚C to 151˚C (–40˚F to 304˚F) —
The PCM converts the resistance of the intake air temperature sensor to degrees. Intake air temperature (IAT) is used by the PCM to adjust fuel delivery and spark timing according to incoming air density.

IGNITION 1 — Tech 2 Range 0-25.5 Volts —
This represents the system voltage measured by the PCM at its ignition feed.

INJ. PULSE BANK 1/INJ. PULSE BANK 2 — Tech 2 Range 0-1000 msec. —
Indicates the amount of time the PCM is commanding each injector “ON” during each engine cycle. A longer injector pulse width will cause more fuel to be delivered. Injector pulse width should increase with increased engine load.

LONG TERM FUEL TRIM BANK 1/BANK 2 —
The long term fuel trim is derived from the short term fuel trim values and represents a long term correction of fuel delivery for the bank in question. A value of 0% indicates that fuel delivery requires no compensation to maintain the PCM commanded air/fuel ratio. A negative value significantly below 0% indicates that the fuel system is rich and fuel delivery is being reduced (decreased injector pulse width). A positive value significantly greater than 0% indicates that a lean condition exists and the PCM is compensating by adding fuel (increased injector pulse width). Because long term fuel trim tends to follow short term fuel trim, a value in the negative range due to canister purge at idle should not be considered unusual. Fuel trim values at maximum authority may indicate an excessively rich or lean system.

Fuel System STATUS — Tech 2 Displays OPEN or CLOSED —
“CLOSED” indicates that the PCM is controlling fuel delivery according to oxygen sensor voltage. In “OPEN” the PCM ignores the oxygen sensor voltage and bases the amount of fuel to be delivered on TP sensor, engine coolant, and MAF sensor inputs only.

MAF — Tech 2 Range 0.0-512 gm/s —
MAF (mass air flow) is the MAF input frequency converted to grams of air per second. This indicates the amount of air entering the engine.

MAP
— Tech 2 Range 10-105 kPa (0.00-4.97 Volts) —
The manifold absolute pressure (MAP) sensor measures the change in the intake manifold pressure from engine load, EGR flow, and speed changes. As intake manifold pressure increases, intake vacuum decreases, resulting in a higher MAP sensor voltage and kPa reading. The MAP sensor signal is used to monitor intake manifold pressure changes during the EGR flow test, to update the BARO reading, and as an enabling factor for several of the diagnostics.

MIL — Tech 2 Displays ON or OFF —
Indicates the PCM commanded state of the malfunction indicator lamp.

MISFIRE CUR. CYL. #1 /#2 /#3 /#4 / #5 / #6 — Tech 2 Range 0-255 Counts —
The misfire current counters increase at a rate according to the number of the possible misfires being detected on each cylinder. The counters may normally display some activity, but the activity should be nearly equal for all the cylinders.

MISFIRE CUR. CYL. #1 /#2 /#3 /#4 / #5 / #6 — Tech 2 Range 0-65535 Counts —
The misfire history counters display the relative level of misfire that has been detected on each cylinder. The misfire history counters will not update or show any activity until a misfire DTC (P0300) has become active.

MISFIRE FAILURES SINCE FIRST FAIL — Tech 2 Range 0-65535 Counts —
Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently high to report a fail.

MISFIRE PASSES SINCE FIRST FAIL — Tech 2 Range 0-65535 Counts —
Indicates the number of 200 crankshaft revolution sample periods during which the level of misfire was sufficiently low to report a pass.

POWER ENRICHMENT — Tech 2 Displays ACTIVE or INACTIVE —
“ACTIVE” displayed indicates that the PCM has detected conditions appropriate to operate in power enrichment mode. The PCM will command power enrichment mode when a large increase in throttle position and load is detected. While in power enrichment mode, the PCM will increase the amount of fuel delivered by entering open loop and increasing the injector pulse width. This is done to prevent a possible sag or hesitation from occurring during acceleration.

SPARK — Tech 2 Range –64° to 64° —
Displays the amount of spark advance being commanded by the PCM on the IC circuit.

START-UP ECT — Tech 2 Range –40°C to 151°C (–40°F to 304°F) —
Indicates the engine coolant temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start-up was a cold start.

START-UP IAT — Tech 2 Range –40°C to 151°C (–40°F to 304°F) —
Indicates the intake air temperature at the time that the vehicle was started. Used by the HO2S diagnostic to determine if the last start-up was a cold start.

TOTAL MISFIRE CURRENT COUNT — Tech 2 Range 0-255 —
Indicates the total number of cylinder firing events that were detected as being misfires during the last 200 crankshaft revolution sample period.

TP — Tech 2 Range 0%-100% —
TP (throttle position) angle is computed by the PCM from the TP sensor voltage. TP angle should display “8-13%” at idle and “87-97%” at wide open throttle.

CATALYST PROTECTION MODE — Tech 2 Displays YES or NO —
“YES” displayed indicates that the PCM has detected conditions appropriate to operate in TWC protection mode. The PCM will decrease the air/fuel ratio to a value that depends on mass air flow (higher mass air flow = lower air/fuel ratio).

UPSHIFT LAMP (MANUAL TRANSMISSION)
VEHICLE SPEED — Tech 2 Range 0-255 km/h (0-155 mph) —
The vehicle speed sensor signal is converted into km/h and mph for display.

WEAK CYLINDER — Tech 2 Displays Cylinder Number —
This indicates that the PCM has detected crankshaft speed variations that indicate 2% or more cylinder firing events are misfires.

Typical Scan Data Values

Use the Typical Scan Data Values Table only after the On-Board Diagnostic System Check has been completed, no DTC(s) were noted, and you have determined that the on-board diagnostics are functioning properly. Tech 2 values from a properly-running engine may be used for comparison with the engine you are diagnosing. The typical scan data values represent values that would be seen on a normally-running engine.

NOTE: A Tech 2 that displays faulty data should not be used, and the problem should be reported to the Tech 2 manufacturer. Use of a faulty Tech 2 can result in misdiagnosis and unnecessary replacement of parts.

Only the parameters listed below are referred to in this service manual for use in diagnosis. For further information on using the Tech 2 to diagnose the PCM and related sensors, refer to the applicable reference section listed below. If all values are within the typical range described below, refer to the *Symptoms* section for diagnosis.

Test Conditions

Engine running, lower radiator hose hot, transmission in park or neutral, closed loop, accessaries off, brake not applied and air conditioning off.

3.5L V-6 Engine (Automatic and Manual Transmission)

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
A/C Clutch Relay	Engine	On/Off	Off	Off	General Description and Operation, A/C Clutch Circuit Operation
A/C Request	Engine	Yes/No	No	No	General Description and Operation, A/C Request Signal
Air/Fuel Ratio	Engine	Ratio: _ to 1	14.7	14.7	General Description and Operation, Fuel System Metering Purpose
APP Sensor1	Engine	Percent	11–13	35–40	General Description and Operation
APP Sensor2	Engine	Percent	87–88	60–65	General Description and Operation
APP Sensor3	Engine	Percent	87–88	50–57	General Description and Operation
Barometric Pressure	Engine	kPa	61-104 (depends on altitude and barometric)	61-104 (depends on altitude and barometric)	General Description and Operation
Brake Light Switch	Engine	Open 0V/Closed 12V	Open 0V	Open 0V	Refer to Section 5
Check Trans Lamp (**Auto Trans**)	Engine	On/Off	Off	Off	4L30-E Automatic Transmission Diagnosis
Cruise Main Switch	Engine	Active/Inactive	Inactive	Inactive	Refer to Section 10
Cruise Set Switch	Engine	Active/Inactive	Inactive	Inactive	Refer to Section 10
Cruise Cancel Switch	Engine	Active/Inactive	Inactive	Inactive	Refer to Section 10
Cruise Resume Switch	Engine	Active/Inactive	Inactive	Inactive	Refer to Section 10
Decel Fuel Cutoff	Engine	Active/Inactive	Inactive	Inactive	General Description and Operation, Deceleration Mode
Desired EGR Position	Engine	Percent	0%	0%	General Description and Operation, EGR Pintle Position Sensor
Desired Idle Speed	Engine	RPM	750	800	General Description and Operation
ECT (Engine Coolant Temp)	Engine	Degrees C, Degrees F	80-100˚C (176-212˚F)	80-100˚C (176-212˚F)	General Description and Operation, Engine Coolant Temperature (ECT) Sensor
EGR Closed Pintle Position	Engine	Steps	20-40	20-40	General Description and Operation, EGR Pintle Position Sensor
EGR Duty Cycle	Engine	Percent	0%	0%	General Description and Operation, Linear EGR Operation and Results of Incorrect Operation

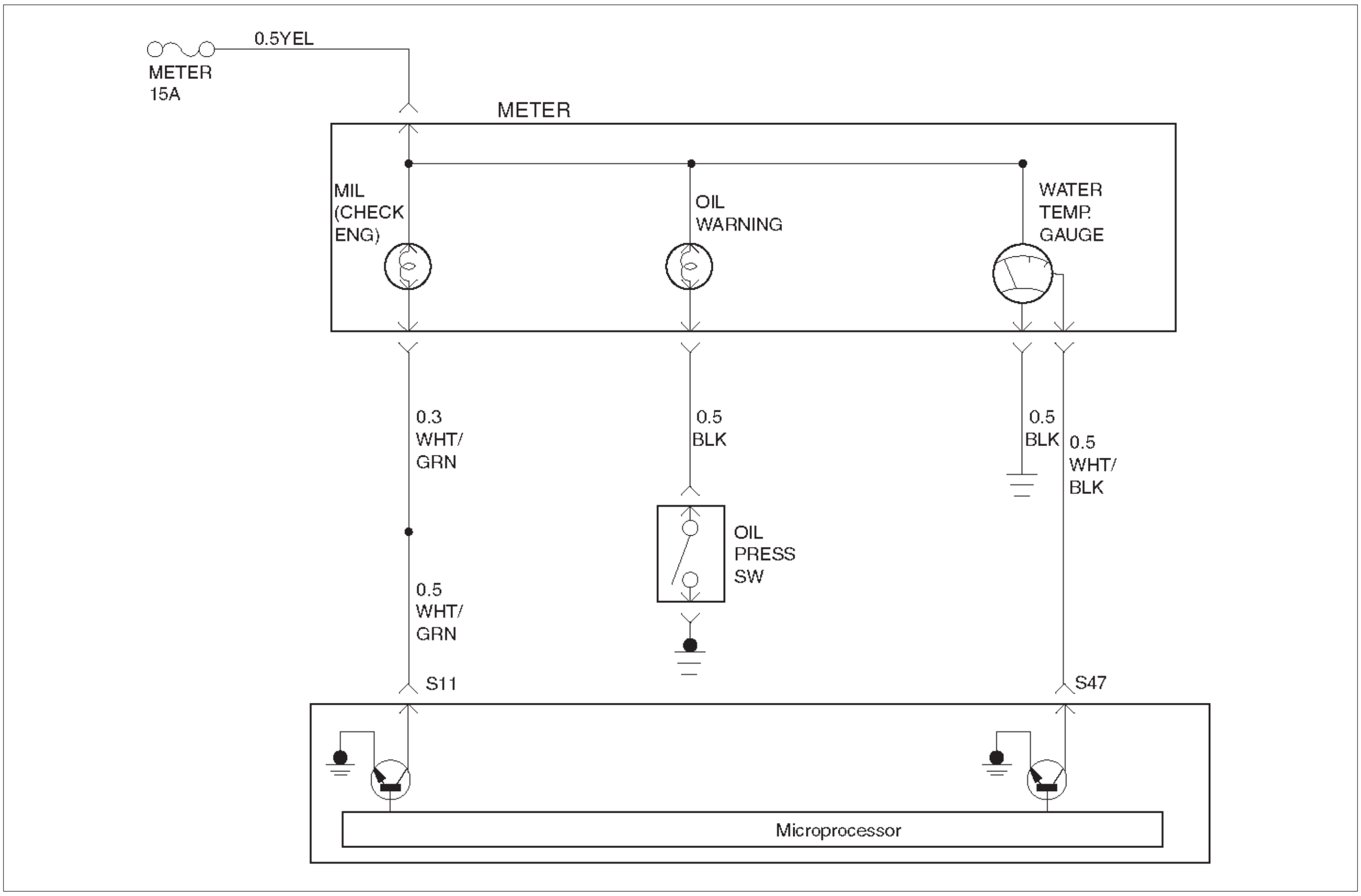
Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
EGR Feedback	Engine	Volts	0.45-0.80	0.45-0.80	—
EGR Normalized	Engine	Percent	0%	0%	—
Engine Load	Engine	Percent	2.0% - 5.5%	8.0% - 16.0%	General Description and Operation, Mass Air Flow (MAF) Sensor
Time From Start	Engine	Sec	Varies. Resets at each engine start.	Varies. Resets at each engine start.	—
Engine Speed	Engine	RPM	Within –50 to +100 of "Desired Idle"	Actual engine speed	—
EVAP Purge Solenoid	Engine	Percent	0%	0%	Diagnosis, EVAP Emission Canister Purge Valve Check
EVAP Vent Valve	Engine	On/Off	Off	Off	Diagnosis, EVAP Canister Purge Solenoid and EVAP Vacuum Switch and Visual Check; DTCs: P1441, P1442
Fuel System Status	Engine	Open Loop/Closed Loop	Closed Loop	Closed Loop	General Description
Fuel Level	Engine	Percent	—	—	Engine Fuel
Fuel Level Sensor	Engine	Volts	—	—	Engine Fuel
Fuel Tank Pressure Sensor	Engine	Volts	1.02 – 1.86	1.02 – 2.57	General Description and Operation
		in. H2O	—	—	
Fuel Pump	Engine	On/Off	On	On	Engine Fuel
HO2S Bank 1 Sen.1 (millivolts)	O2 Sensor Data	Millivolts	50-950 changing quickly	50-950, always changing quickly	General Description and Operation, Fuel control HO2S
HO2S Bank 1 Sen.2 (millivolts) (**Auto Trans**)	O2 Sensor Data	Millivolts	200-700 changing slowly	250-650 changing slowly	General Description and Operation, Fuel Metering System
HO2S Bank 1 Sen.2 (millivolts) (**Manual Trans**)	O2 Sensor Data	Millivolts	50-950 changing quickly	50-950 changing quickly	General Description and Operation, Fuel Metering System
HO2S Bank 1 Sen.3 (millivolts) (**Manual Trans**)	O2 Sensor Data	Millivolts	200-700 changing slowly	250-650 changing slowly	General Description and Operation, Catalyst Monitor Heated Oxygen Sensor (Manual Trans)
HO2S Bank 2 Sen.1 (millivolts)	O2 Sensor Data	Millivolts	50-950 changing quickly	50-950 changing quickly	General Description and Operation, Fuel Control HO2S
HO2S Bank 2 Sen.2 (millivolts) (**Auto trans**)	O2 Sensor Data	Millivolts	200-700 changing slowly	250-650 changing slowly	General Description and Operation, Fuel Metering System

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
HO2S Bank 1 Sen.1 (ready/not ready)	O2 Sensor Data	Ready Yes/No	Ready Yes	Ready Yes	General Description and Operation, Fuel Control HO2S; DTC: P0135
HO2S Bank 2 Sen.1 (ready/not ready)	O2 Sensor Data	Ready Yes/No	Ready Yes	Ready Yes	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 1 Sen.1	O2 Sensor Data	Seconds	25-45	25-45	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 1 Sen.2	O2 Sensor Data	Seconds	60-100	60-100	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 2 Sen.1	O2 Sensor Data	Seconds	25-45	25-45	General Description and Operation, Fuel Control HO2S
HO2S Warm-Up Time Bank 2 Sen.2	O2 Sensor Data	Seconds	60-100	60-100	General Description and Operation, Catalyst Monitor Heated Oxygen Sensor (Auto Trans)
IAT (Intake Air Temp)	Engine	Degrees C, Degrees F	0-100˚C, depends on underhood	0-80˚C, depends on underhood	General Description and Operation, Intake Air Temperature (IAT) Sensor
Illumination Switch	Engine	Closed 0V/Open 12V	Closed 0V	Closed 0V	Refer to Section 8
Ignition Voltage	Engine	Volts	12.8-14.1	12.8-14.1	General Description and Operation, Electronic Ignition System
Inj. Pulse Bank 1	Engine	Milliseconds	2.0-4.0	2.5-4.0	General Description, Fuel Metering, Fuel Injector
Inj. Pulse Bank 2	Engine	Milliseconds	2.0-4.0	2.5-4.0	General Description, Fuel Metering, Fuel Injector
Knock Present	Engine	No/Yes	No	No	General Description and ION Sensing Module
Knock Signal	Engine	Percent	1~4	1~4	General Description and ION Sensing Module
Knock Sensor Retard	Engine	˚CA	0	0	General Description and ION Sensing Module
Knock Counter	Engine	Counts	—	—	General Description
Long Term FT Bank 1 (Long Term Fuel Trim)	Misfire	Counts and Percent	100 to 150 counts, –22% to +17%	100 to 150 counts, –22% to +17%	Diagnosis, Fuel Trim System Monitor; DTCs: P0171, P0172
Long Term FT Bank 2 (Long Term Fuel Trim)	Misfire	Counts and Percent	100 to 150 counts, –22% to +17%	100 to 150 counts, –22% to +17%	Diagnosis, Fuel Trim System Monitor; DTCs: P0171
MAF (Mass Air Flow)	Engine	Grams per second	2.85-6.65	9.5-16.5	General Description and Operation, MAF; DTCs: P101, P0102, P0103

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
MAP kPa (Manifold Absolute Pressure)	Engine	Kilopascals	23-40	19-32	General Description and Operation, Manifold Absolute Pressure (MAP) Sensor; DTCs: P0106, P0107, P0108
		Volts	0.65-1.32	0.46-1.10	
MIL	Engine	On/Off	Off	Off	On-Board Diagnostic System Check
Misfire Cur. Cyl #1	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #2	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #3	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #4	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #5	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Cur. Cyl #6	Misfire	Counts	0-2	0-2	DTC P0300
Misfire Hist. Cyl #1	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #2	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #3	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #4	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #5	Misfire	Counts	0	0	DTC P0300
Misfire Hist. Cyl #6	Misfire	Counts	0	0	DTC P0300
Misfire Failures Since First Fail	Misfire	Counts	0	0	DTC P0300
Misfire Passes Since First Fail	Misfire	Counts	0	0	DTC P0300
PNP (Park/Neutral Position)	Engine	P-N / R-D-3-2-L	P-N	P-N	4L30-E Automatic Transmission Diagnosis
Power Enrichment	Engine	NO/YES	NO	NO	General Description and Operation, Acceleration Mode
PSP Switch (Power Steering Pressure)	Engine	Normal/Hi	Normal Pressure	Normal Pressure	Refer to 2A Section
Spark (Advance)	Engine	Degrees Before Top Dead Center	15-22	34-44	General Description and Operation, Electronic Ignition System
Start-Up ECT (Engine Coolant Temp)	Engine	Degrees C, Degrees F	Depends on engine coolant temperature at time of start-up	Depends on engine coolant temperature at time of start-up	General Description and Operation, Engine Coolant Temperature (ECT) Sensor

Tech 2 Parameter	Data List	Units Displayed	Typical Data Values (IDLE)	Typical Data Values (2500 RPM)	Refer To
Start-Up IAT (Intake Air Temp)	Engine	Degrees C, Degrees F	Depends on intake air temperature at time of start-up	Depends on intake air temperature at time of start-up	General Description and Operation, Intake Air Temperature (IAT) Sensor
TCC Cruise Brake Switch	Engine	Active/Inactive	Active	Active	Refer to Section 10
Total Misfire Current Count	Misfire	Counts	0-5	0-5	DTC P0300
TP Sensor 1 (Throttle Position Sensor 1)	Engine	Percent	8–13	28–36	General Description and Operation, Throttle Position (TP) Sensor
TP Sensor 2 (Throttle Position Sensor 2)	Engine	Percent	8–13	28–36	General Description and Operation, Throttle Position (TP) Sensor
Throttle at Idle	Engine	No/Yes	Yes	No	General Description and Operation, Throttle Position (TP) Sensor
Upshift Lamp (manual trans)	Engine	On/Off	Off	Off	Manual Transmission
Vehicle Speed	Engine	MPH / km/h	0	0	4L30-E Automatic Transmission Diagnosis
Weak Cylinder	Misfire	Cylinder #	—	—	DTC P0300

No Malfunction Indicator Lamp (MIL)



060RY00146

Circuit Description

The "Check Engine" lamp (MIL) should always be illuminated and steady with the ignition "ON" and the engine stopped. Ignition feed voltage is supplied to the MIL bulb through the meter fuse. The powertrain control module (PCM) turns the MIL "ON" by grounding the MIL driver circuit.

Diagnostic Aids

An intermittent MIL may be cased by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Inspect the PCM harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- If the engine runs OK, check for a faulty light bulb, an open in the MIL driver circuit, or an open in the instrument cluster ignition feed.
- If the engine cranks but will not run, check for an open PCM ignition or battery feed, or a poor PCM to engine ground.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. A "No MIL" condition accompanied by a no-start condition suggests a faulty PCM ignition feed or battery feed circuit.

9. Using a test light connected to B+, probe each of the PCM ground terminals to ensure that a good ground is present. Refer to *PCM Terminal End View* for terminal locations of the PCM ground circuits.

12. In this step, temporarily substitute a known good relay for the PCM relay. The horn relay is nearby, and it can be verified as "good" simply by honking the horn. Replace the horn relay after completing this step.

17. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to *PCM Replacement and Programming Procedures Powertrain Control Module (PCM) and Sensors.*

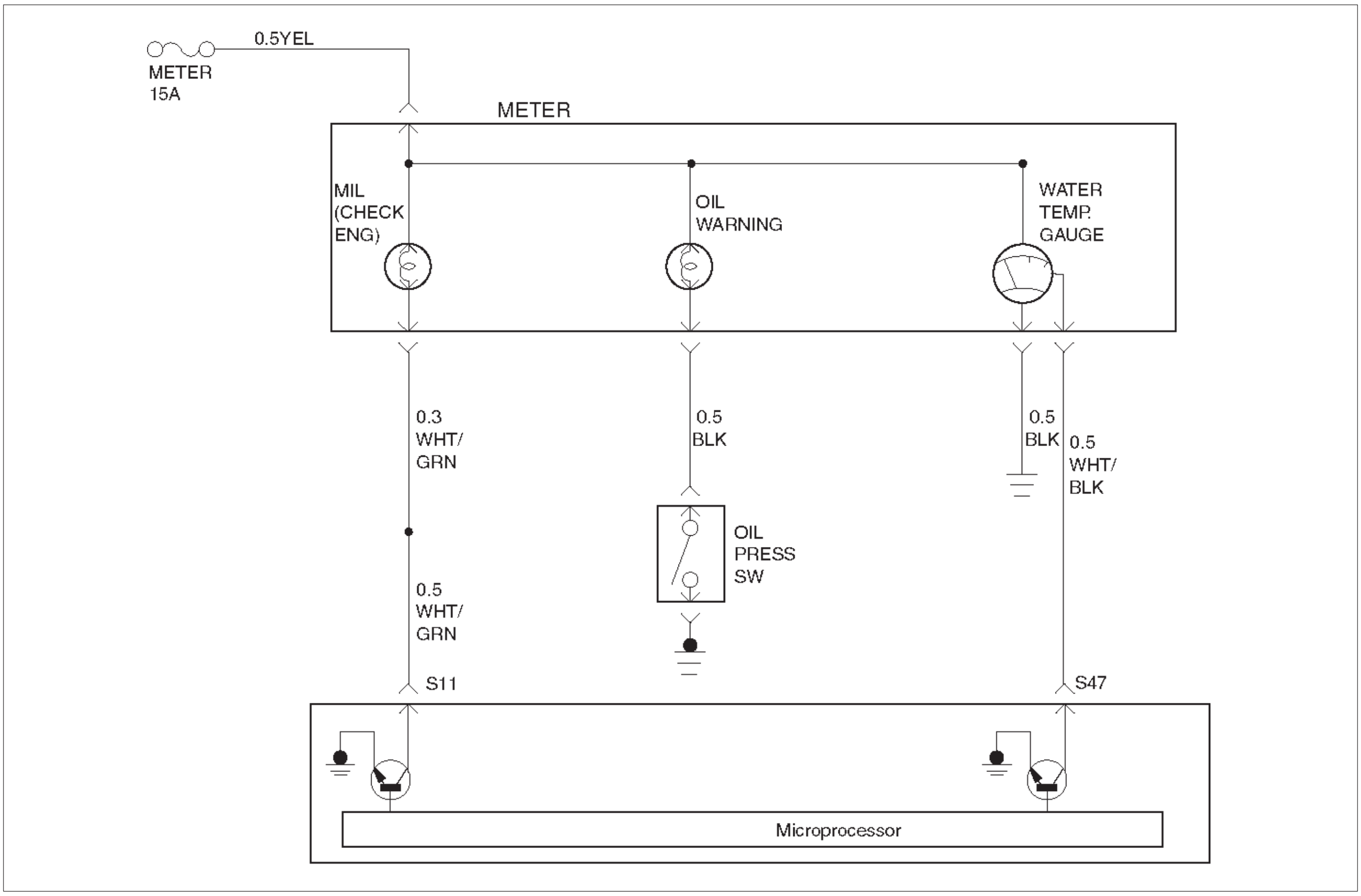
No Malfunction Indicator Lamp (MIL)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Attempt to start the engine. Does the engine start?	—	Go to *Step 3*	Go to *Step 6*
3	Check the meter fuse for the instrument cluster ignition feed circuit. Is the fuse OK?	—	Go to *Step 4*	Go to *Step 16*
4	Ignition “ON,” probe the ignition feed circuit at the cluster connector with a test light to ground. Is the test light “ON?”	—	Go to *Step 5*	Go to *Step 13*
5	1. Ignition “OFF.” 2. Disconnect the PCM. 3. Jumper the MIL driver circuit at the PCM connector to ground. 4. Ignition “ON.” Is the MIL “ON?”	—	Go to *Step 10*	Go to *Step 11*
6	Check the PCM ignition feed and battery feed fuses (15 A engine fuse and 15 A PCM fuse). Are both fuses OK?	—	Go to *Step 7*	Go to *Step 15*
7	1. Ignition “OFF.” 2. Disconnect the PCM. 3. Ignition “ON.” 4. Probe the ignition feed circuit at the PCM harness connector with a test light to ground. Is the test light “ON?”	—	Go to *Step 8*	Go to *Step 12*
8	Probe the battery feed circuit at the PCM harness connector with a test light to ground. Is the test light “ON?”	—	Go to *Step 9*	Go to *Step 14*
9	Check for a faulty PCM ground connection. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check for damaged terminals at the PCM. Was a problem found?	—	Verify repair	Go to *Step 17*
11	Check for an open MIL driver circuit between the PCM and the MIL. Was a problem found?	—	Verify repair	Go to *Step 18*
12	Substitute a known “good” relay for the PCM main relay. Was the malfunction fixed?	—	Verify repair	Go to *Step 13*
13	Repair the open in the ignition feed circuit. Is the action complete?	—	Verify repair	—
14	Locate and repair the open PCM battery feed circuit. Is the action complete?	—	Verify repair	—

No Malfunction Indicator Lamp (MIL) (Cont'd)

Step	Action	Value(s)	Yes	No
15	Locate and repair the short to ground in the PCM ignition feed circuit or PCM battery feed circuit. Is the action complete?	—	Verify repair	—
16	Locate and repair the short to ground in the ignition feed circuit to the instrument cluster, and replace the fuse. Is the action complete?	—	Verify repair	—
17	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *PCM* in *ON-Vehicle Service* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
18	Check the MIL driver circuit for a poor connection at the instrument panel connector. Was a problem found?	—	Verify repair	Go to *Instrument Panel* in *Electrical Diagnosis*

Malfunction Indicator Lamp (MIL) "ON" Steady



060RY00146

Circuit description

The malfunction indicator lamp (MIL) should always be illuminated and steady with ignition "ON" and the engine stopped. Ignition feed voltage is supplied directly to the MIL indicator. The powertrain control module (PCM) turns the MIL "ON" by grounding the MIL driver circuit.

The MIL should not remain "ON" with the engine running and no DTC(s) set. A steady MIL with the engine running and no DTC(s) suggests a short to ground in the MIL driver circuit.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

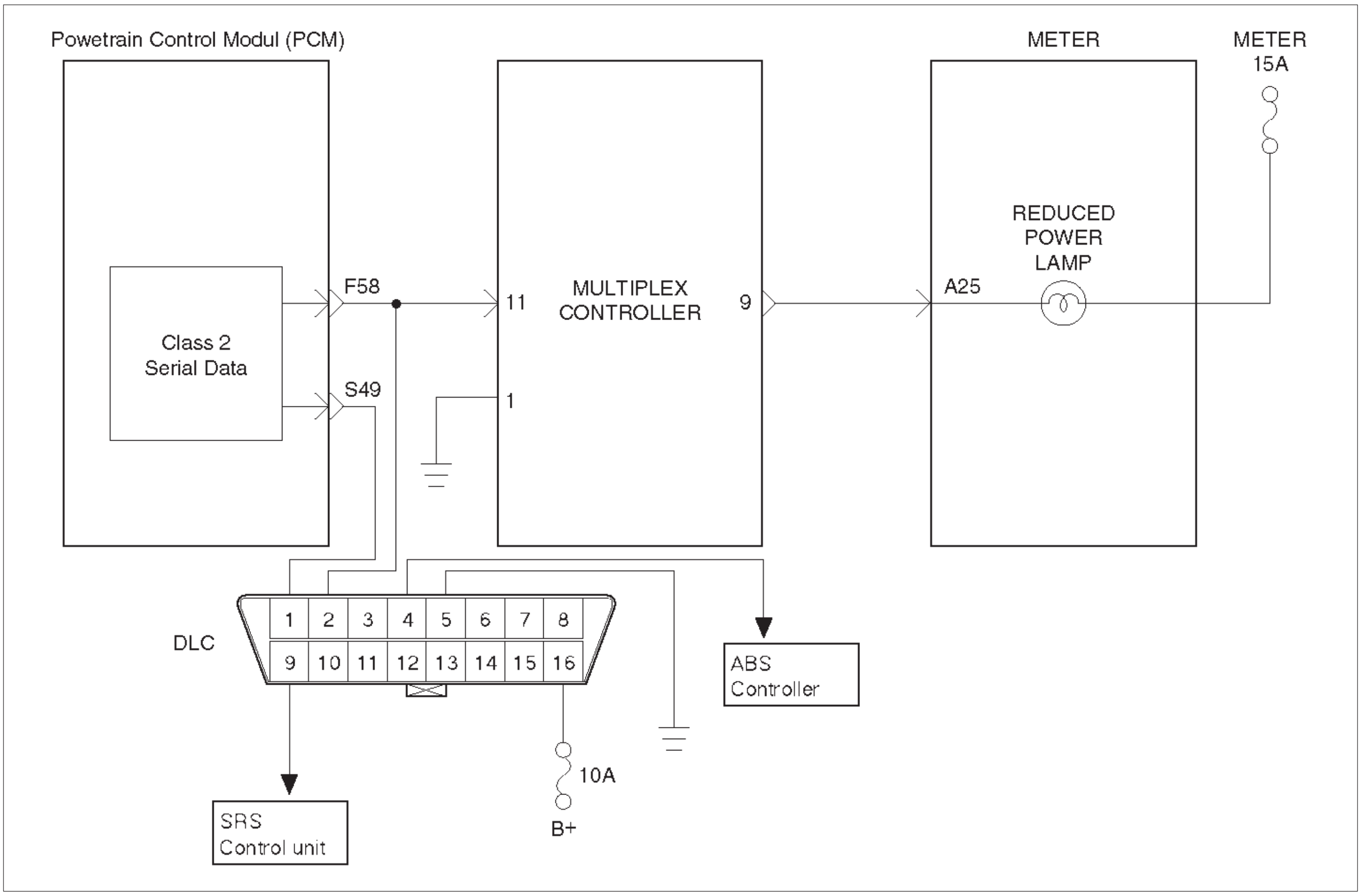
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If the MIL does not remain "ON" when the PCM is disconnected, the MIL driver wiring is not faulty.
3. If the MIL driver circuit is OK, the instrument panel cluster is faulty.
6. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to *PCM Replacement and Programming Procedures* in *Powertrain Control Module (PCM) and Sensors.*

Malfunction Indicator Lamp (MIL) “ON” Steady

Step	Action	Value(s)	Yes	No
1	Was the “On-Board diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “OFF,” disconnect PCM. 2. Ignition “ON,” observe the MIL (Service Engine Soon lamp). Is the MIL “ON?”	—	Go to *Step 3*	Go to *Step 5*
3	1. Ignition “OFF,” disconnect the instrument panel cluster. 2. Check the MIL driver circuit between the PCM and the instrument panel cluster for a short to ground. 3. If a problem is found, repair as necessary. Was the MIL driver circuit shorted to ground?	—	Go to *OBD System Check*	Go to *Step 4*
4	Replace the instrument panel cluster. Is the action complete?	—	Go to *OBD System Check*	—
5	1. Ignition “OFF,” reconnect the PCM. 2. Ignition “ON,” reprogram the EEPROM. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. 3. Using the Tech 2 output controls function, select MIL dash lamp control and command the MIL “OFF.” (Refer to the Miscellaneous test) Did the MIL turn “OFF?”	—	Go to *OBD System Check*	Go to *Step 6*
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Go to *OBD System Check*	—

No Reduced Power Lamp (RPL)



Circuit Description

The Reduced Power lamp (RPL) should always be illuminated and steady with the ignition "ON" and the engine stopped. Ignition feed voltage is supplied to the RPL bulb through the meter fuse. The powertrain control module (PCM) orderes the RPL "ON" signal for Multiplex Control Unit. When Multiplex Control Unit is received RPL "ON" signal that turn RPL "ON" by grounding the RPL driver circuit.

Diagnostic Aids

An intermittent RPL may be cased by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Inspect the PCM and Multiplex Control Unit harness and connections for improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection, and damaged harness.
- If the engine runs OK, check for a faulty light bulb, an open in the MIL driver circuit, or an open in the instrument cluster ignition feed.
- If the engine cranks but will not run, check for an open PCM ignition or battery feed, or a poor PCM to engine ground.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. A "No RPL" condition accompanied by a no–start condition suggests a faulty PCM ignition feed or battery feed circuit.

9. Using a test light connected to B+, probe each of the Multiplex Control Unit ground terminals to ensure that a good ground is present. Refer to Multiplex Control Unit Terminal End View for terminal locations of the Unit Terminal End View for terminal locations of the Multiplex Control Unit ground circuits.

12. Using a test light connected to B+, probe each of the PCM ground terminals to ensure that a good ground is present. Refer to PCM Terminal End View for terminal locations of the PCM ground circuits.

21. In this step, temporarily substitute a known good relay for the PCM relay. The horn relay is nearby, and it can be verified as "good" simply by honking the horn. Replace the horn relay after completing this step.

24. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.

No Reduced Power Lamp (RPL)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” Performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Attempt to start the engine. Does the engine start?	—	Go to *Step 3*	Go to *Step 11*
3	Check the following fuses: MAIN(100A), B+1(60A), B+2(50A), METER(15A), ECM(15A) , ENGINE(15A) Was a problem found?	—	Go to *Step 14*	Go to *Step 4*
4	1. Ignition ”OFF.” 2. Disconnect the cluster meter connector. 3. Ignition “ON,” Probe the ignition feed circuit at the cluster connector with a test light to ground. Is the test light “ON?”	—	Go to *Step 5*	Go to *Step 15*
5	1. Ignition “OFF.” 2. Disconnect the Multiplex Control Unit. 3. Check the circuit (Lamp driver Circuit) between PCM and Multiplex Control Unit. Was a problem found?	—	Go to *Step 16*	Go to *Step 6*
6	1. Reconnect the cluster meter connector. 2. Disconnect the Multiplex Control Unit. 3. Jumper the RPL driver circuit at the Multiplex Control Unit connector to ground. 4. Ignition “ON.” Is the RPL “ON?”	—	Go to *Step 7*	Go to *Instrument Panel in Electrical Diagnosis*
7	1. Ignition “OFF.” 2. Probe the ignition feed circuit at the Multiplex Control Unit connector with a test light to ground. 3. Ignition “ON.” Is the test light “ON?”	—	Go to *Step 8*	Go to *Step 17*
8	1. Ignition “OFF.” 2. Disconnect the PCM. 3. Check the circuit (Lamp driver Circuit) between PCM and Multiplex Control Unit. Was a problem found?	—	Go to *Step 18*	Go to *Step 9*
9	Check the Multiplex Control Unit ground connection and circuit. Was a problem found?	—	Go to *Step 19*	Go to *Step 10*
10	Check for damaged terminals at the Multiplex Control Unit. Was a problem found?	—	Go to *Step 20*	Go to *Step 11*
11	1. Ignition “ON.” 2. Probe the ignition feed circuit at the PCM harness connector with a test light to ground. Is the test light “ON?”	—	Go to *Step 12*	Go to *Step 21*

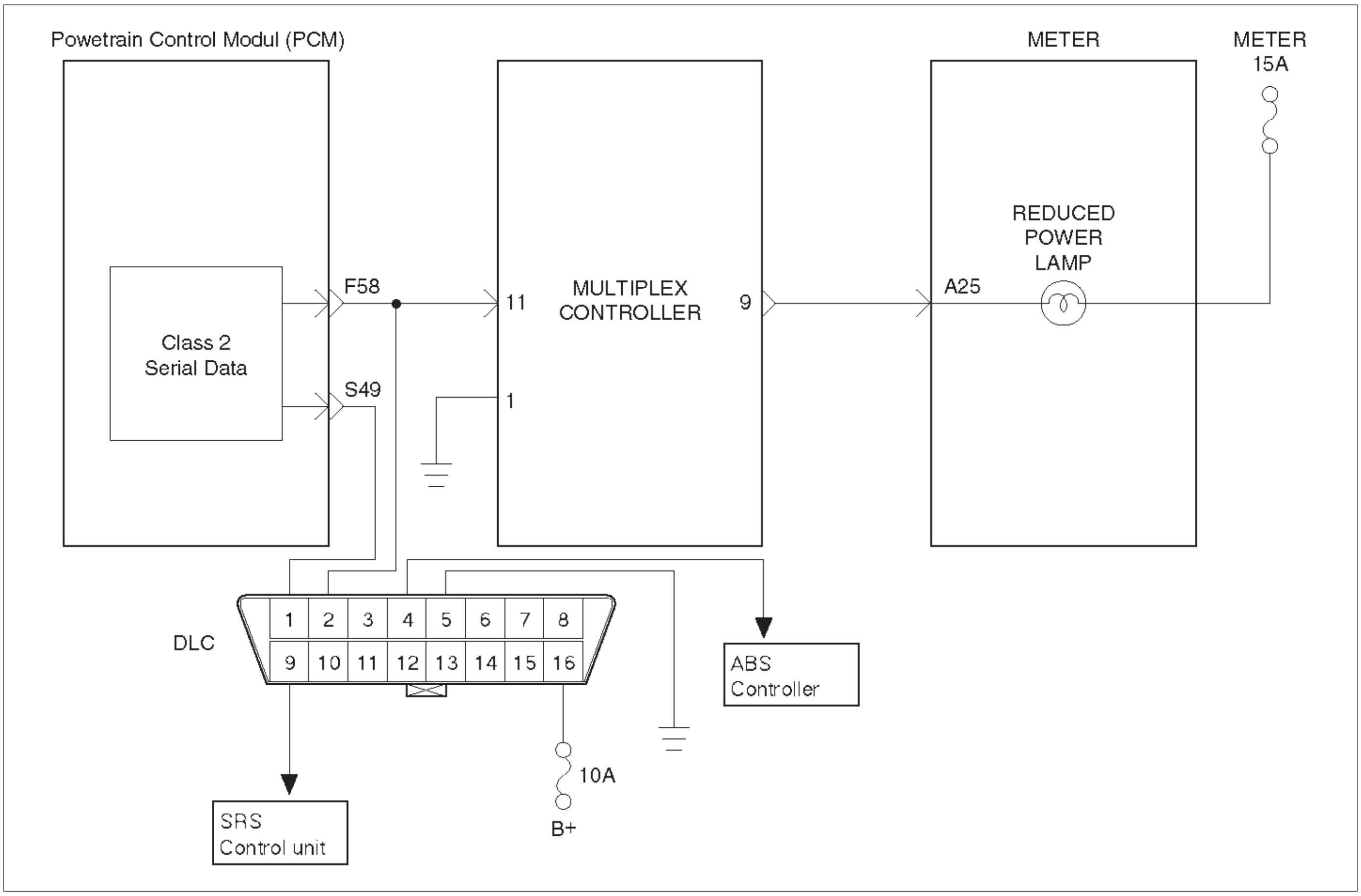
No Reduced Power Lamp (RPL) (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Ignition "OFF." 2. Check for a faulty PCM ground connection and Circuit. Was a problem found?	—	Go to *Step 23*	Go to *Step 13*
13	Check for damaged terminals at the PCM. Was a problem found?	—	Go to *Step 24*	Go to *Step 25*
14	Replace the fuse. Is the action complete?	—	Verify repair	—
15	Locate and repair the cluster meter battery feed open circuit. Is the action complete?	—	Verify repair	—
16	Locate and repair the between cluster meter and Multiplex Control Unit open circuit. Is the action complete?	—	Verify repair	—
17	Locate and repair the Multiplex Control Unit battery feed open circuit. Is the action complete?	—	Verify repair	—
18	Locate and repair the between Multiplex Control Unit and PCM open circuit. Is the action complete?	—	Verify repair	—
19	Locate and repair the ground connection for Multiplex Control Unit circuit. Is the action complete?	—	Verify repair	—
20	Replace the Multiplex Control Unit. circuit. Is the action complete?	—	Verify repair	—
21	Substitute a known "good" relay for the PCM main relay. Was the malfunction fixed?	—	Verify repair	Go to *Step 22*
22	Repair the open in the ignition feed circuit. Is the action complete?	—	Verify repair	—
23	Locate and repair the ground connection for PCM circuit. Is the action complete?	—	Verify repair	—
24	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to ON-Vehicle Service in Power Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

No Reduced Power Lamp (RPL) (Cont'd)

Step	Action	Value(s)	Yes	No
25	1. Ignition "OFF." 2. Reconnect the all connector. 3. Install the Tech 2. 4. Ignition "ON." 5. Using the Tech 2 output controls function, select RPL dash lamp control and command the RPL "ON." (Refer to the Miscellaneous test) Did the RPL turn "ON?"	—	Verify repair	Go to *Step 26*
26	1. Ignition "OFF." 2. Disconnect the PCM. 3. Check the circuit (DLC line) between PCM and DLC. Was a problem found?	—	Go to *Step 27*	Go to *Step 24*
27	Locate and repair the between PCM and DLC. Is the action complete?	—	Go to *Step 25*	—

Reduced Power Lamp (RPL) “ON” Steady



060RY00148

Circuit Description

The Reduced Power lamp (RPL) should always be illuminated and steady with the ignition “ON” and the engine stopped. Ignition feed voltage is supplied to the RPL bulb through the meter fuse. The powertrain control module (PCM) orderes the RPL “ON” signal for Multiplex Control Unit. When Multiplex Control Unit is received RPL “ON” signal that turn RPL “ON” by grounding the RPL driver circuit.

The RPL should not remain “ON” with the engine running and no DTC(s) set. A steady RPL with the engine running and no DTC(s) suggests a short to ground in the RPL driver circuit.

Diagnostic Aids

An intermittent RPL may be cased by a poor connection, rubbed through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal to wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If the RPL does not remain “ON” when the Multiplex Control Unit is disconnected, the RPL driver wiring is not faulty.
3. If the RPL driver circuit is OK, the instrument panel cluster is faulty.
10. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is replaced, the new PCM must be programmed. Refer to PCM Replacement and Programming Procedures in Powertrain Control Module (PCM) and Sensors.

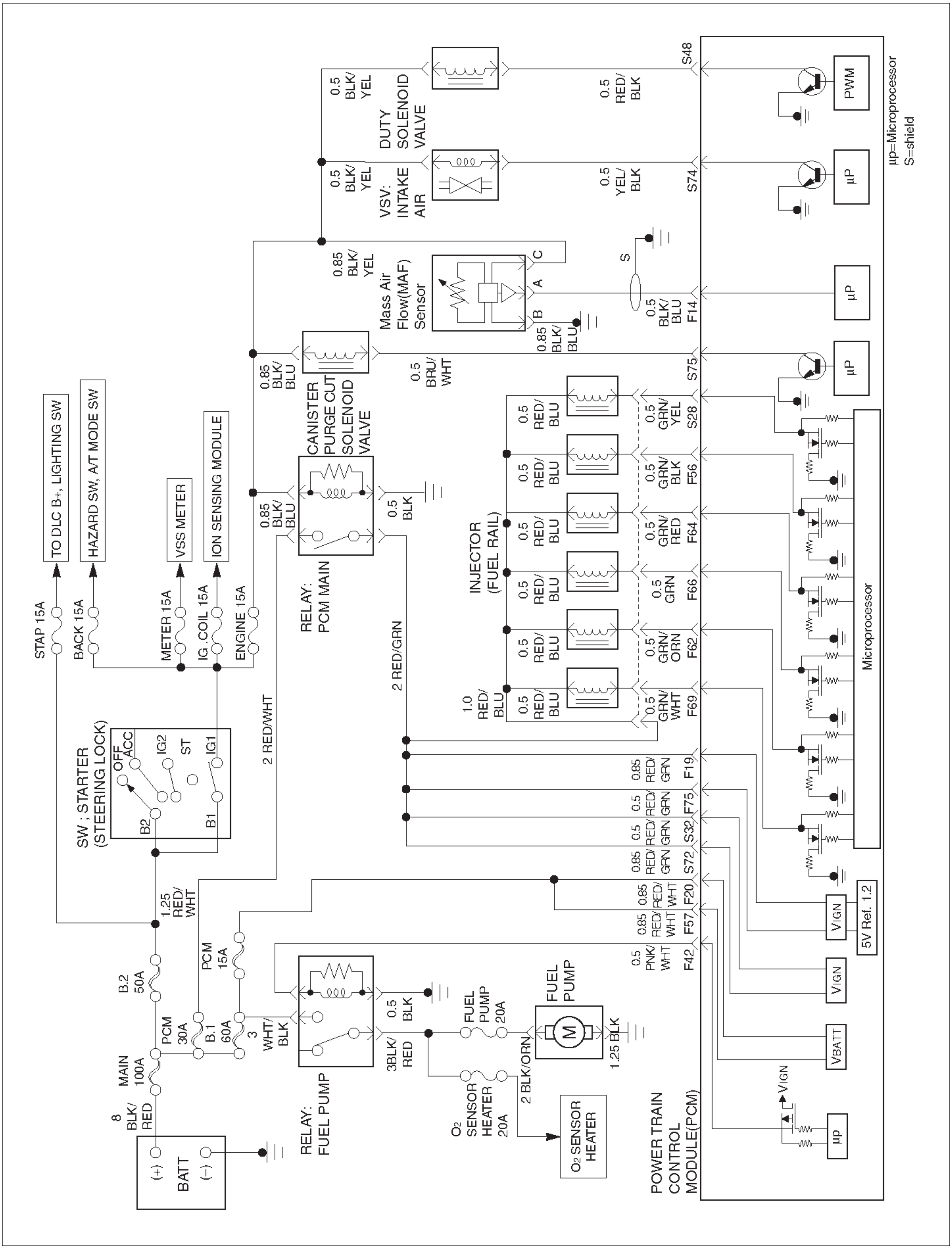
Reduced Power Lamp (RPL) "ON" Steady

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "OFF," disconnect Multiplex Control Unit. 2. Ignition "ON," observe the RPL (Reduced Power Lamp). Is the RPL "ON?"	—	Go to *Step 3*	Go to *Step 4*
3	1. Ignition "OFF," disconnect the instrument panel cluster. 2. Check the RPL driver circuit between the Multiplex Control Unit and the instrument panel cluster for a short to ground. 3. If a problem is found, repair as necessary. Was the RPL driver circuit shorted to ground?	—	Verify repair	Go to *Step 4*
4	1. Replace the Multiplex Control Unit. 2. Install the Tech 2 3. Ignition "ON." 4. Using the Tech 2 output controls function, select RPL dash lamp control and command the RPL "OFF." (Refer to the Miscellaneous test) Did the MIL turn "OFF?"	—	Verify repair	Go to *Step 5*
5	1. Ignition "OFF." 2. Disconnect the PCM. 3. Check the circuit (Lamp driver Circuit) between PCM and Multiplex Control Unit. Was a problem found?	—	Go to *Step 6*	Go to *Step 7*
6	Locate and repair the between Multiplex Control Unit and PCM open circuit. Is the action complete?	—	Go to *Step 7*	—
7	1. Install the Tech 2 2. Ignition "ON." 3. Using the Tech 2 output controls function, select RPL dash lamp control and command the RPL "OFF." (Refer to the Miscellaneous test) Did the MIL turn "OFF?"	—	Go to *Verify repair*	Go to *Step 8*
8	1. Ignition "OFF." 2. Disconnect the PCM. 3. Check the circuit (DLC line) between PCM and DLC. Was a problem found?	—	Go to *Step 9*	Go to *Step 10*

Reduced Power Lamp (RPL) “ON” Steady (Cont’d)

Step	Action	Value(s)	Yes	No
9	Locate and repair the between PCM and DLC. Is the action complete?	—	Go to *Step 2*	—
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to ON-Vehicle Service in Power Control Module and Sensors for procedures. And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Go to *OBD System Check*	—

Engine Cranks But Will Not Run



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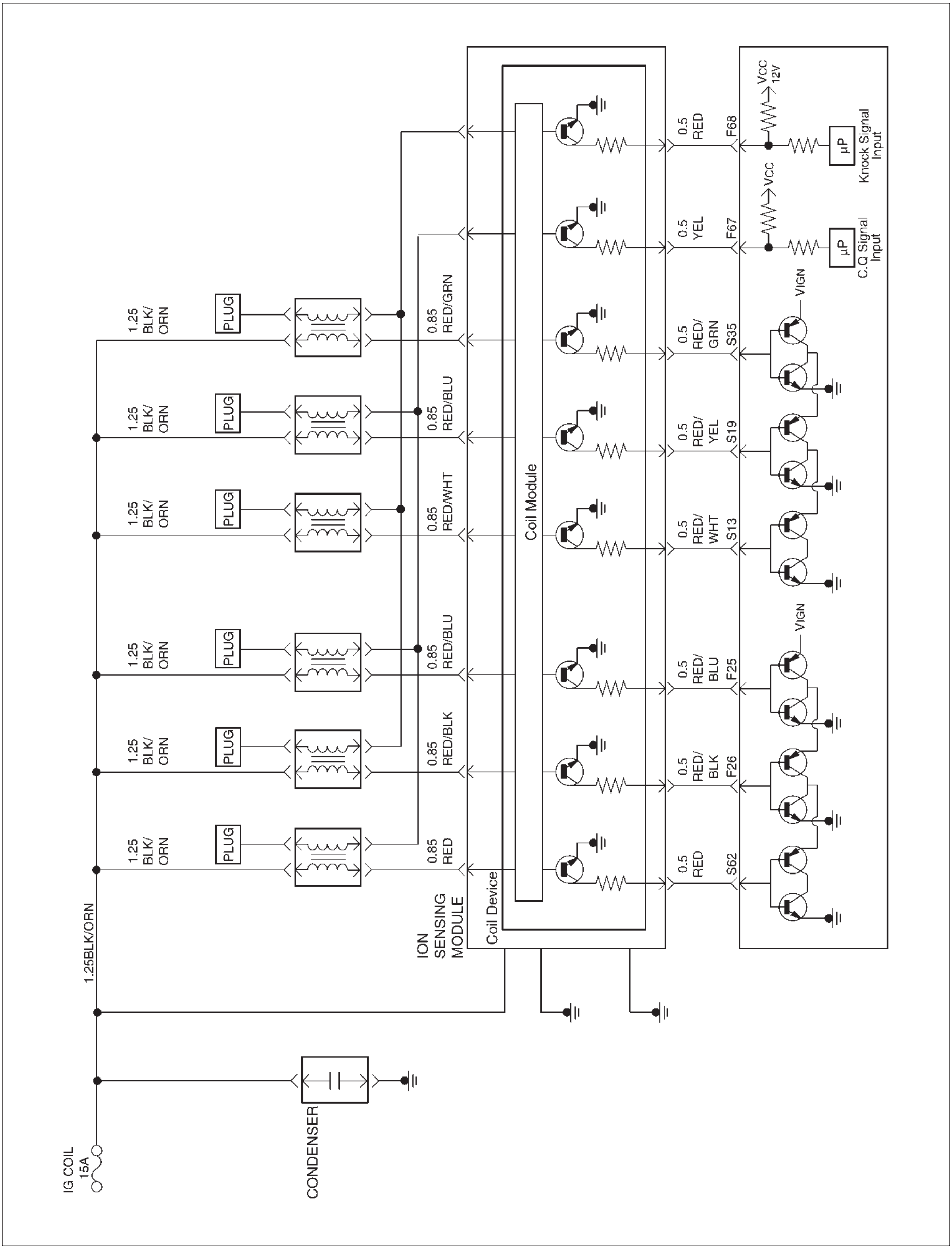

IG COIL
15A
CONDENSER
1.25BLK/ORN
1.25 BLK/ORN
PLUG
0.85 RED/GRN
0.85 RED/BLU
0.85 RED/WHT
0.85 RED/BLU
0.85 RED/BLK
0.85 RED
ION SENSING MODULE
Coil Device
Coil Module
0.5 RED F68
0.5 YEL F67
0.5 RED/GRN S35
0.5 RED/YEL S19
0.5 RED/WHT S13
0.5 RED/BLU F25
0.5 RED/BLK F26
0.5 RED S62
VCC 12V
VCC
μP
Knock Signal Input
C.Q Signal Input
VIGN

D06RY00042

Circuit Description

The electronic Ignition system uses a coil -at-plug method of spark distribution. In this type of ignition system, the powertrain control module (PCM) triggers the correct driver outside the Ignition Current Sense System (ICSS), which then triggers the correct ignition coil based on the 58X signal received from the crankshaft position sensor (CKP). The spark plug connected to the coil fires when the ICSS opens the ground circuit for the coil's primary circuit.

During crank, the PCM monitors the CKP 58X signal. The CKP signal is used to determine which cylinder will fire first. After the CKP 58X signal has been processed by the PCM, it will command all six injectors to allow a priming shot of fuel for all the cylinders. After the priming, the injectors are left "OFF" during the next six 58X reference pulses from the CKP. This allows each cylinder a chance to use the fuel from the priming shot. During this waiting been received by the PCM. The CMP signal allows the PCM to operate the injectors sequentially based on camshaft position. If the camshaft position signal is not present at start - up, the PCM will begin sequential fuel delivery with a 1 -in-6 chance that fuel delivery is correct. The engine will run without a CMP signal, but will set a DTC code.

Diagnostic Aids

An intermittent problem may be caused by a poor connection, rubbed - through wire insulation or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness-Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty engine coolant temperature sensor-Using a Tech 2, compare engine coolant temperature with intake air temperature on a completely cool engine. Engine coolant temperature should be within 10 ° C of intake air temperature. If not, replace the ECT sensor.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

5. An obvious cause of low fuel pressure would be an empty fuel tank.
6. The engine will easily start and run if a few injectors are disabled. It is not necessary to test all injectors at this time since this step is only a test to verify that all of the injectors have not been disabled by fuel contamination.
7. A blinking test light verifies that the PCM monitoring the 58X crankshaft reference signal and is capable of activating the injectors. If there is an open or shorted driver circuit, DTCs 201 – 206 and a misfire DTC 300 – 306 should be set.
19. By using a spark tester, each ignition coil's ability to produce 25,000 volts is verified.
25. If there is an open or shorted driver circuit, DTCs 201 – 206 and a misfire DTC 301 – 306 should be set. All six injector driver circuits can be checked at one time without removing the intake manifold if a J 39021 – 95 test light is available. This is the alternative procedure:
    - With the ignition "OFF", disconnect the gray connector located at the rear of the air filter, attached to a bracket on the purge canister.
    - Connect test light J 39021 – 95 to the connector. Do any of the light constantly illuminate or fail to blink when the engine is cranked? If so, repair the short or open circuit, or replace the PCM if indicated.

This procedure only tests the driver circuit as far as the test connection, so step 31 is added to test the circuit all the way to the injector.

Engine Cranks But Will Not Run

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Check the ignition coil fuse, the engine fuse, and the PCM fuse. Was a fuse blown?	—	Go to *Step 3*	Go to *Step 4*
3	Check for a short to ground and replace the fuse. Is the action complete?	—	Verify repair	—

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
4	1. Ignition "OFF", install a fuel pressure gauge at the test fitting on the fuel supply line in the engine compartment. (Use a shop cloth to absorb any fuel leakage while making the connection.) 2. Ignition "ON," observe the fuel pressure. Is the fuel pressure within the specified values, and does it hold steady?	285 - 375 kPa (43 – 55 psi)	Go to *Step 6*	Go to *Step 5*
5	Is any fuel pressure indicated?	—	Go to *Fuel System Electrical Test*	Go to *Fuel System Diagnosis*
6	Install the switch box J 39021–2 at the injector test connector and activate an injector. Did the fuel pressure drop when the injector was activated?	—	Go to *Step 7*	Go to *Step 18*
7	Install an injector test light at the #2 cylinder injector harness connector. Does the light blink when the engine is cranked?	—	Go to *Step 8*	Go to *Step 24*
8	1. Ignition " OFF." 2. Disconnect the 11-pin connector at the ION sensing module. 3. With a test light to B + , probe each of the 6 exposed ION sensing module pins, one at a time, while the engine is cranked. (Use the gray narrow Metri - Pak © flexible female connector from the J - 35616 kit to make the pin accessible.) Does the light flash at each pin when the engine is cranked?	—	Go to *Step 12*	Go to *Step 9*
9	1. Remove the 4-pin connector at the ION sensing module. 2. Ignition " ON." 3. Use a test light at the harness connector to verify that the module is being supplied with B + and ground. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*
10	Repair the open ignition feed circuit or ground circuit to the ION sensing module. Is the action complete?	—	Verify repair	—
11	Repair the ION sensing module. Is the action complete?	—	Verify repair	—
12	1. Reconnect the ION sensing module 11-pin connector. 2. Remove the electrical connector from each coil. 3. With a test light to B+, probe each of the coil connectors at the wire which runs to the ION sensing module. Does the light flash at each coil connector when the engine is cranked?	—	Go to *Step 14*	Go to *Step 13*
13	Check for an open circuit between the coil and ION sensing module. Is the action complete?	—	Verify repair	—

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Ignition "ON." 2. While the coil connectors are disconnected, touch each coil connector's ignition feed terminal with a grounded test light (the ignition feed wire is YEL tracer). Did the test light illuminate?	—	Go to *Step 16*	Go to *Step 15*
15	Repair the open ignition feed circuit. Is the action complete?	—	Verify repair	—
16	While the coil connectors are disconnected, touch each connector's secondary ground terminal with a test light to B +. (The ground wires are black.) Did the test light illuminate at each coil connector?	—	Go to *Step 18*	Go to *Step 17*
17	Repair the open secondary ground circuit. Is the action complete?	—	Verify repair	—
18	1. Test the fuel for contamination. 2. If a problem is found, clean the fuel system and correct the contaminated fuel condition as necessary. Replace the fuel filter and replace any injectors that are not delivering fuel (see Injector Balance Test). Was a problem found?	—	Verify repair	Go to *Step 19*
19	1. Remove any ignition coil and install a spark tester at the spark plug end of the coil. 2. Observe the tester while the engine is cranking. Was a crisp, blue spark observed? Only one or two sparks followed by no result is considered the same as "No Spark."	—	Go to *Step 21*	Go to *Step 20*
20	Replace the ignition coil, and return to Step 19 to test the remaining coils. Is the action complete?	—	Verify repair	—
21	Repeat Step 19 for each coil. Remove only one coil at a time, and reinstall each coil on its spark plug after testing, but do not refasten coils with screws at this time. After all coils have passed the spark test, does the engine start?	—	Refasten all coils with their screws	Go to *Step 22*
22	1. Remove the spark plugs from all cylinders. 2. Visually inspect the spark plug electrodes. 3. Replace any spark plugs with loose or missing electrodes or cracked insulators. Did your inspection reveal any spark plugs exhibiting excessive fouling?	—	Correct the fouling condition	Go to *Step 23*

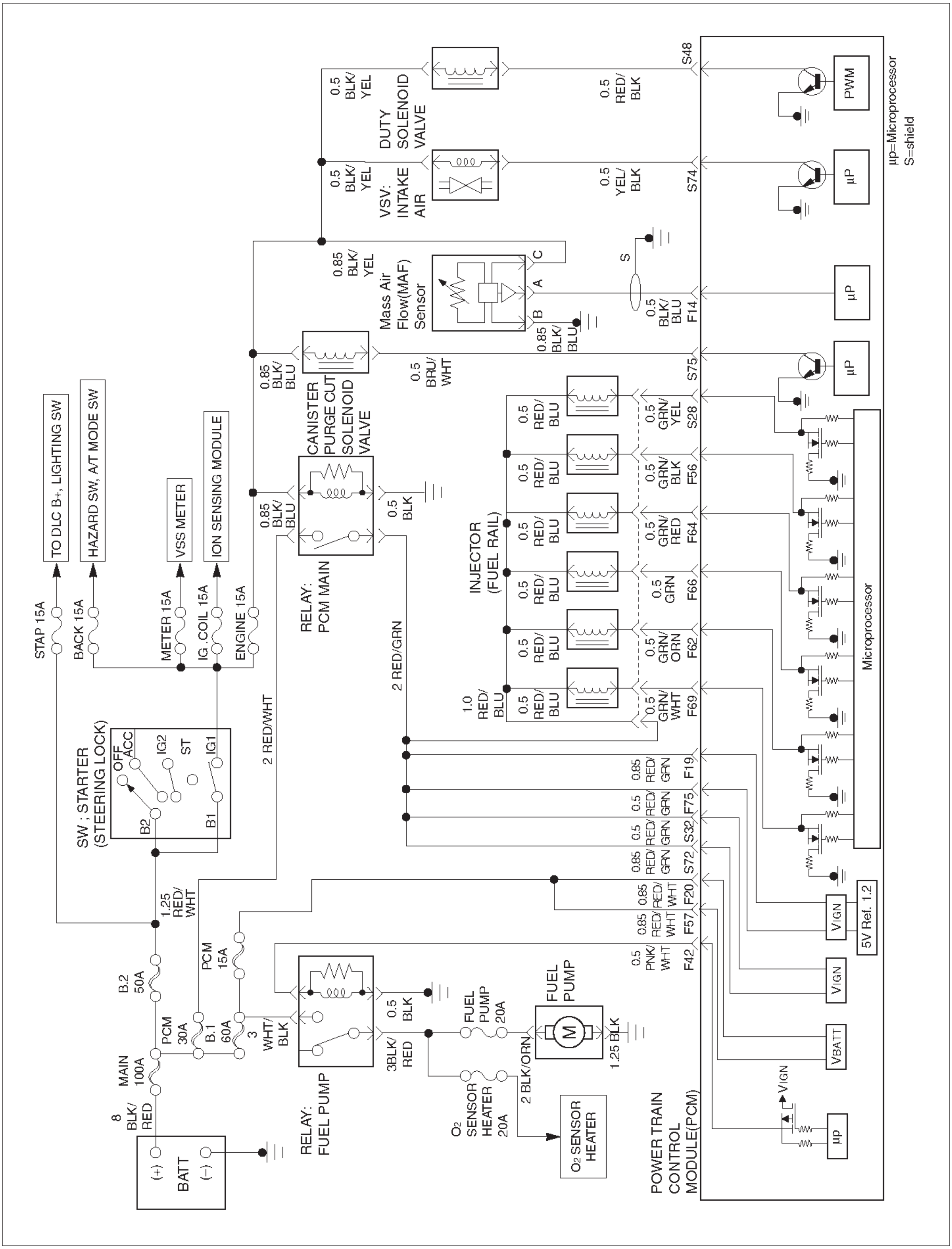
Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
23	Refer to *Engine Mechanical Diagnosis* to diagnose the following conditions: • Faulty or incorrect camshaft drive belts • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • Incorrect valve timing • Leaking head gasket Is the action complete?	—	Verify repair	Go to *Step 25*
24	Observe the "Engine Speed" data display on the Tech 2 while cranking the engine. Is the engine RPM indicated?	—	Go to *Step 25*	Go to *Step 34*
25	1. Disconnect the 7-pin gray connector at the rear of the air filter beneath the point where the air duct attaches to the MAF sensor. 2. Ignition "ON." 3. Using a test light connected to ground, probe the ignition terminal at the PCM (female) side of the 7-pin connector. Is the test light "ON?"	—	Go to *Step 26*	Go to *Step 32*
26	1. At the PCM (female) side of the connector, connect a test light between the ignition + terminal and one of the injector driver circuits at the same connector. 2. Ignition "ON." 3. Observe the test light, and repeat the test for each injector driver circuit. Did the test light stay on when checking any of the 6 injector driver circuits?	—	Go to *Step 27*	Go to *Step 29*
27	1. Ignition "OFF," disconnect the PCM. 2. Ignition "ON," observe the test light. Is the test light "ON?"	—	Go to *Step 28*	Go to *Step 33*
28	Locate and repair the short to ground in the injectordriver circuit. Is the action complete?	—	Verify repair	—
29	1. Using the same test location as in step 26, connect a test light between the ignition terminal and one of the driver circuits. 2. Crank the engine and observe the test light. 3. Repeat for each injector driver circuit. Did the light blink during the test for each circuit?	—	Go to *Step 31*	Go to *Step 30*
30	Check for an open injector driver circuit. Was a problem found?	—	Verify repair	Go to *Step 33*

Engine Cranks But Will Not Run (Cont'd)

Step	Action	Value(s)	Yes	No
31	1. At the injector (male) side of the gray connector mentioned in step 25, connect an ohmmeter between the ignition pin and one of the driver circuit pins. 2. Check for continuity in the circuit. 3. Repeat for each injector circuit. The readings should be approximately equal to the specified value for injector resistance. Was a problem found?	12.5 Ω	Verify repair	Go to *Step 8*
32	Repair the ignition feed circuit. Is the action complete?	—	Verify repair	—
33	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
34	1. Raise the vehicle and disconnect the CKP sensor harness. 2. Ignition "ON." 3. With a test light to ground, probe the harness ignition feed terminal. Did the light illuminate?	—	Go to *Step 36*	Go to *Step 35*
35	Check the ignition feed wire between the sensor and the PCM for a short to ground or open circuit. Is the action complete?	—	Verify repair	—
36	1. Ignition "ON." 2. At the CKP harness connector, connect a test light between the ignition and ground terminals. Did the light illuminate?	—	Go to *Step 38*	Go to *Step 37*
37	Check the sensor ground circuit for an open or short to voltage. Is the action complete?	—	Verify repair	—
38	Check the signal circuit between the sensor and the PCM for a short to ground, short to voltage, or an open. Was a problem found?	—	Verify repair	Go to *Step 39*
39	Replace the CKP position sensor. Is the action complete?	—	Verify repair	Go to *Step 33*

Fuel System Electrical Test



Circuit Description

When the ignition switch is first turned “ON,” the powertrain control module (PCM) energizes the fuel pump relay which applies power to the in-tank fuel pump. The fuel pump relay will remain “ON” as long as the engine is running or cranking and the PCM is receiving 58X crankshaft position pulses. If no 58X crankshaft position pulses are present, the PCM de-energizes the fuel pump relay within 2 seconds after the ignition is turned “ON” or the engine is stopped.

The fuel pump delivers fuel to the fuel rail and injectors, then to the fuel pressure regulator. The fuel pressure regulator controls fuel pressure by allowing excess fuel to be returned to the fuel tank. With the engine stopped and ignition “ON,” the fuel pump can be turned “ON” by using a command by the Tech 2.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation, or a wire broken inside the insulation. Check for the following items:

- Poor connection or damaged harness – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If the fuel pump is operating but incorrect pressure is noted, the fuel pump wiring is OK and the “Fuel System Pressure Test” chart should be used for diagnosis.

CAUTION: To reduce the risk of fire and personal injury:

- **It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.**
- **A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the procedure is completed.**

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge J 34730-1 to the fuel feed line located in front of and above the right side valve train cover .
3. Reinstall the fuel pump relay.

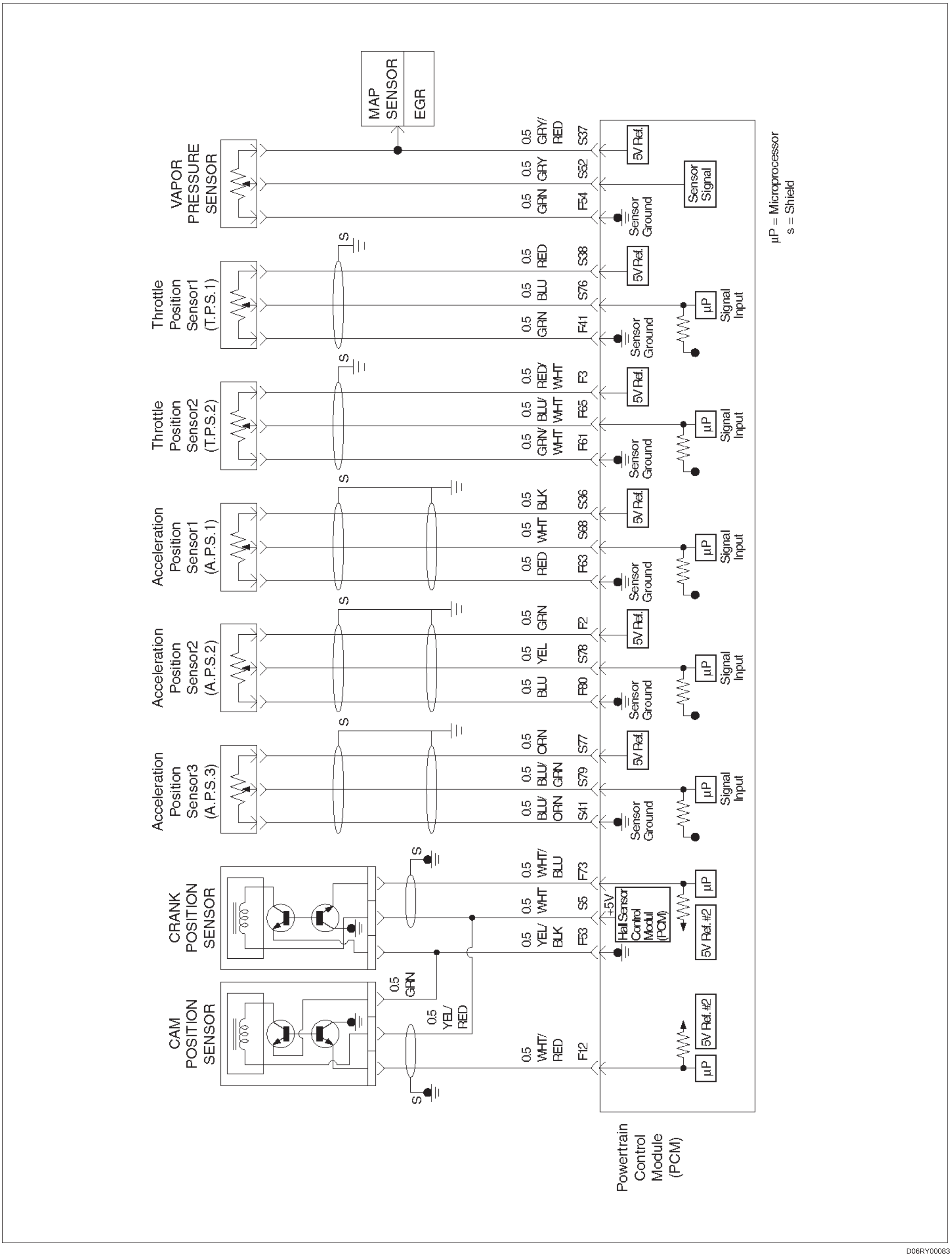
Fuel System Electrical Test

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Read the “Caution” above. 2. Relieve the fuel system pressure and install the fuel pump pressure gauge to the test fitting. 3. Ignition ON, Engine is Off. 4. Use a Tech 2 to command the fuel pump “ON.” (Refer to the Miscellaneous Test.) Is there an immediate pressure build-up which indicates the pump is running?	—	Go to *Step 3*	Go to *Step 4*
3	1. Verify that the pump is not running by removing the fuel filler cap and listening. 2. Command the pump “ON” with the Tech 2. Did the pump turn “OFF” after 2 seconds?	—	Test completed	Go to *Step 12*
4	1. Ignition “OFF.” 2. Remove the fuel pump relay. 3. Using a test light connected to ground, probe the battery feed to the relay. Did the light illuminate?	—	Go to *Step 6*	Go to *Step 5*
5	Repair short or open battery feed to fuel pump relay. Is the action complete?	—	Verify repair	—
6	1. Connect a test light between the two wires that connect to the fuel pump relay pull-in coil. 2. Ignition “ON.” Did the test light illuminate for 2 seconds and then turn off?	—	Go to *Step 12*	Go to *Step 7*
7	1. With a test light connected to battery (–), probe the fuel pump relay connector at the wire which runs from the relay pull-in coil to the PCM. 2. Ignition “ON.” Did the test light illuminate for 2 seconds and then turn off?	—	Go to *Step 8*	Go to *Step 9*
8	Locate and repair open in the fuel pump relay ground circuit. Is the action complete?	—	Verify repair	—
9	Check for short or open between the PCM and the fuel pump relay. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check the fuel pump relay circuit for a poor terminal connection at the PCM. 2. If a problem is found, replace terminal as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*

Fuel System Electrical Test (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
12	1. Reconnect the fuel pump relay. 2. Disconnect the fuel pump electrical connector at the fuel tank. 3. Using a test light connected to ground, probe the fuel pump feed wire (harness side). 4. Command the fuel pump "ON" with a Tech 2. Did the light illuminate for 2 seconds?	—	Go to *Step 15*	Go to *Step 13*
13	1. Honk the horn to verify that the horn relay is functioning. 2. Substitute the horn relay for the fuel pump relay. 3. Leave the test light connected as in step 12. 4. Command the fuel pump "ON" with the Tech 2. Did the test light illuminate for 2 seconds when the fuel pump was commanded "ON?"	—	Go to *Step 17*	Go to *Step 14*
14	1. Re-connect the horn relay in its proper location. 2. Check for a short circuit, blown fuse or open circuit between the relay and the fuel tank. Is the action complete?	—	Verify repair	—
15	1. With the fuel pump electrical connector at the fuel tank disconnected, connect a test light between the feed wire and the ground wire (harness side). 2. Command the fuel pump "ON" with a Tech 2. Did the test light illuminate for 2 seconds?	—	Go to *Step 18*	Go to *Step 16*
16	Repair the open circuit in the fuel pump ground wire. Is the action complete?	—	Verify repair	—
17	1. Re-connect the horn relay in its proper location. 2. Replace the fuel pump relay. Is the action complete?	—	Verify repair	—
18	Replace the fuel pump. Is the action complete?	—	Verify repair	—

Electric Throttle Control (ETC) System Check



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Circuit Description

- The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to the DC motor coil in PWM (%) to adjust the throttle valve into a passage in the throttle body to allow air flow. This method allows highly accurate control of engine speed and quick response to changes in engine load.
- The acceleration position (AP1) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle will vary about 13% at idle position to about 87% at wide open throttle(WOT).

  APS signal is used to determine which DC motor will adjust throttle position.

  After the APS signal has been processed by the PCM, it will command DC motor to allow movement of throttle position.

Diagnostic Aids

- An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the PCM harness and connector for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Throttle body – Check for objects blocking the DC motor or throttle bore, excessive deposits in the ETC passage and on the valve spring, and excessive deposits in the throttle bore and on the throttle valve plate.
- Acceleration pedal – Check for objects blocking the AP sensor or pedal arm with spring, and excessive deposits in the acceleration pedal arm and on the acceleration pedal.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Visually/physically inspect for the following throttle valve conditions.
3. Visually/physically inspect for the following acceleration pedal conditions.
5. Check the following circuits for throttle valve and DC moter. Check the following TP sensor resistance and DC motor.
7. Check the following circuits for acceleration pedal. Check the following AP sensor resistance.
10. Following DTC: Software detect Error for ETC system.
11. Following DTC: Software detect Error for ETC system.

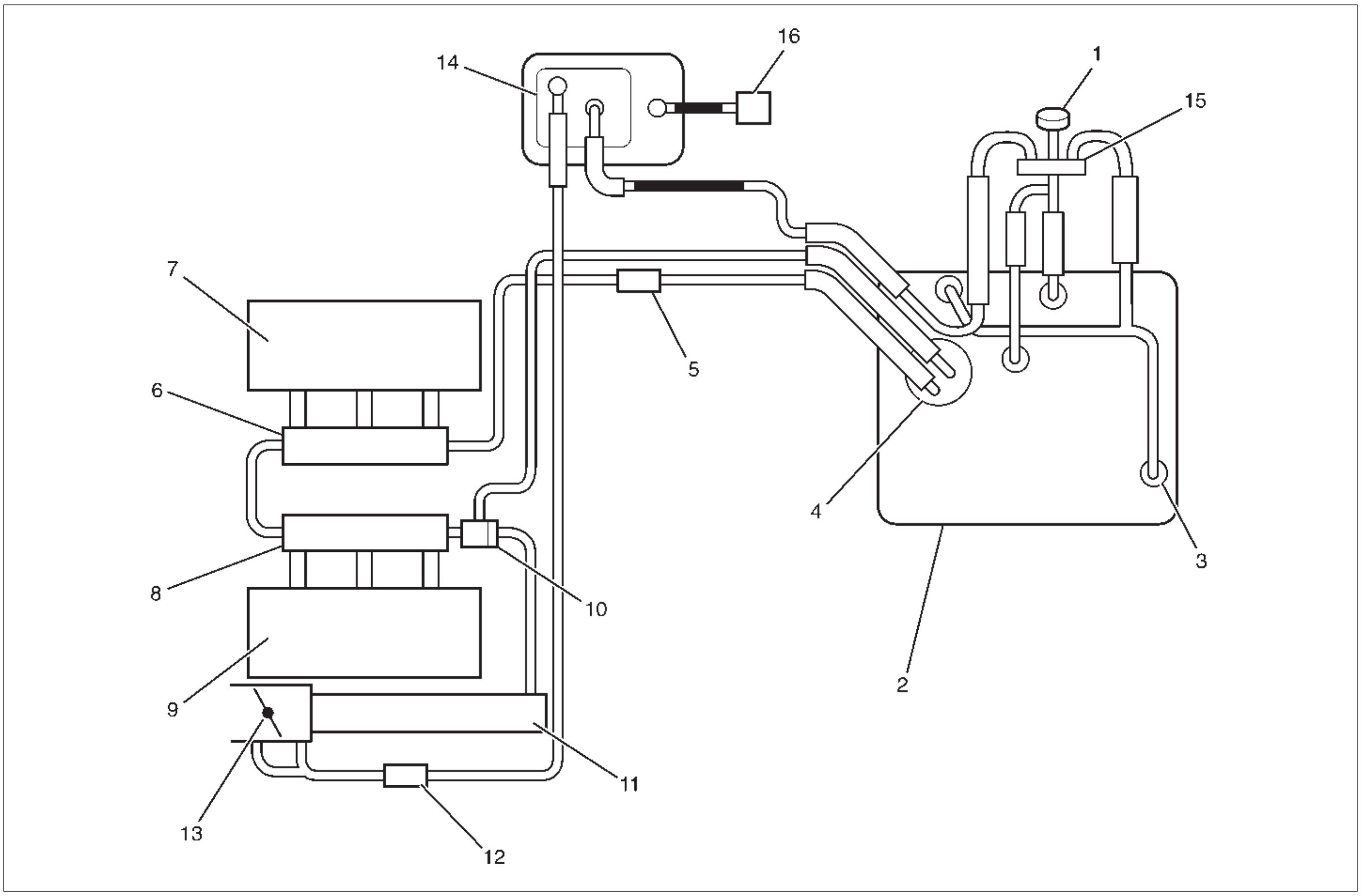
Electric Throttle Control (ETC) System Check

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Visually/physically inspect for the following conditions: • Throttle body tampering. • Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. • Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate. • Throttle body with lever: When check for objects to send round the throttle spring lever that lever is smooth movement by less than 9 l·bm{1.0 N·m}, and spring lever has not excessive play. • Throttle function: Check for the throttle function. When ignition switch “ON” that throttle lever is smooth operated by step on the acceleration pedal. Did any of the above require a repair?	—	Refer to *appropriate section for on-vehicle service*	Go to *Step 3*
3	Visually/physically inspect for the following conditions: • Acceleration pedal tampering. • Acceleration pedal : Check for objects blocking the spring or pedal arm. • Acceleration pedal : For check for objects to move the acceleration pedal that pedal is smooth movement, and acceleration pedal arm has not excessive play. Did any of the above require a repair?	—	Refer to *appropriate section for on-vehicle service*	Go to *Step 4*
4	1. Check for a poor connection at the throttle body harness connector. 2. Check for a poor connection at the acceleration position sensor harness connector. 3. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: • Throttle position sensor 1 circuit. • Throttle position sensor 2 circuit. • Throttle DC motor circuit. • Throttle position sensor resistance. • Throttle DC motor resistance. If a problem is found, repair as necessary. Was a problem found?	Vcc–GND 1–7kΩ SIG–GND change resistance 0.3–100Ω	Verify repair	Go to *Step 6*

Electric Throttle Control (ETC) System Check (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Install the Tech 2 2. Ignition "ON" but not engine run. 3. Chech the valve for APS and TPS. Was the prblem found?	Idle AP1 = 11–13% AP2 = 87–88% AP3 = 87–88% TP1 = 8–13% TP2 = 8–13% WOT AP1 = 85–89% AP2 = 11–15% AP3 = 32–36% TP1 = 87–97% TP2 = 87–97%	Go to *Step 10*	Go to *Step 7*
7	Replace the throttle valve. Is the action complete?	—	Go to *Step 3*	—
8	Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: ● Acceleration position sensor 1 circuit. ● Acceleration position sensor 2 circuit. ● Acceleration position sensor 3 circuit. ● Acceleration position sensor resistance. If a problem is found, repair as necessary. Was a problem found?	Vcc–GND 4–6kΩ SIG–GND change resistance	Verify repair	Go to *Step 9*
9	Replace the acceleration position sensor. Is the action complete?	—	Go to *Step 10*	–
10	Following below the DTCs stored: P1125, P1290, P1295, P1299	—	Go to *applicable DTC table*	Go to *Step 11*
11	Following below the DTCs stored: P1514, P1515, P1516, P1523, P1271, P1272, P1273	—	Go to *applicable DTC table*	Go to *Step 12*
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Fuel System Diagnosis



Legend

(1) Fuel Filler Cap
(2) Fuel Tank
(3) Rollover Valve
(4) Fuel Pump (Fuel Level Sending Unit/Fuel Tank Pressure Sensor)
(5) Fuel Filter
(6) Fuel Rail Right
(7) Right Bank
(8) Fuel Rail Left
(9) Left Bank
(10) Fuel Pressure Control Valve
(11) Common Chamber
(12) Duty Solenoid Valve
(13) Throttle Valve
(14) Canister
(15) Evap Shut Off Valve
(16) Vent Solenoid Cut Valve

Circuit Description

When the ignition switch is turned "ON," the powertrain control module (PCM) will turn "ON" the in-tank fuel pump. The in-tank fuel pump will remain "ON" as long as the engine is cranking or running and the PCM is receiving 58X crankshaft position pulses. If there are no 58X crankshaft position pulses, the PCM will turn the in-tank fuel pump "OFF" 2 seconds after the ignition switch is turned "ON" or 2 seconds after the engine stops running. The in-tank fuel pump is an electric pump within an integral reservoir. The in-tank fuel pump supplies fuel through an in-line fuel filter to the fuel rail assembly. The fuel pump is designed to provide fuel at a pressure above the pressure needed by the fuel injectors. A fuel pressure regulator, attached to the fuel rail, keeps the fuel available to the fuel injectors at a regulated pressure. Unused fuel is returned to the fuel tank by a separate fuel return line.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Connect the fuel pressure gauge to the fuel feed line as shown in the fuel system illustration. Wrap a shop towel around the fuel pressure connection in order to absorb any fuel leakage that may occur when installing the fuel pressure gauge. With the ignition switch "ON" and the fuel pump running, the fuel pressure indicated by the fuel pressure gauge should be 333-376 kPa (48-55 psi). This pressure is controlled by the amount of pressure the spring inside the fuel pressure regulator can provide.
3. A fuel system that cannot maintain a constant fuel pressure has a leak in one or more of the following areas:
   - The fuel pump check valve.

- The fuel pump flex line.
- The valve or valve seat within the fuel pressure regulator.
- The fuel injector(s).

4. Fuel pressure that drops off during acceleration, cruise, or hard cornering may case a lean condition. A lean condition can cause a loss of power, surging, or misfire. A lean condition can be diagnosed using a Tech 2. If an extremely lean condition occurs, the oxygen sensor(s) will stop toggling. The oxygen sensor output voltage(s) will drop below 500 mV. Also, the fuel injector pulse width will increase.

IMPORTANT: Make sure the fuel system is not operating in the “Fuel Cut-Off Mode.”

When the engine is at idle, the manifold pressure is low (high vacuum). This low pressure (high vacuum) is applied to the fuel pressure regulator diaphragm. The low pressure (high vacuum) will offset the pressure being applied to the fuel pressure regulator diaphragm by the spring inside the fuel pressure regulator. When this happens, the result is lower fuel pressure. The fuel pressure at idle will vary slightly as the barometric pressure changes, but the fuel pressure at idle should always be less than the fuel pressure noted in step 2 with the engine “OFF.”

16. Check the spark plug associated with a particular fuel injector for fouling or saturation in order to determine if that particular fuel injector is leaking. If checking the spark plug associated with a particular fuel injector for fouling or saturation does not determine that a particular fuel injector is leaking, use the following procedure:
    - Remove the fuel rail, but leave the fuel lines and injectors connected to the fuel rail. Refer to *Fuel Rail Assembly* in *On-Vehicle Service.*
    - Lift the fuel rail just enough to leave the fuel injector nozzles in the fuel injector ports.

CAUTION: In order to reduce the risk of fire and personal injury that may result from fuel spraying on the engine, verify that the fuel rail is positioned over the fuel injector ports and verify that the fuel injector retaining clips are intact.

- **Pressurize the fuel system by connecting a 10 amp fused jumper between B+ and the fuel pump relay connector.**
- **Visually and physically inspect the fuel injector nozzles for leaks.**

17. A rich condition may result from the fuel pressure being above 376 kPa (55 psi). A rich condition may cause a DTC P0132 or a DTC P0172 to set. Driveability conditions associated with rich conditions can include hard starting (followed by black smoke) and a strong sulfur smell in the exhaust.

20. This test determines if the high fuel pressure is due to a restricted fuel return line or if the high fuel pressure is due to a faulty fuel pressure regulator.

21. A lean condition may result from fuel pressure below 333 kPa (48 psi). A lean condition may cause a DTC P0131 or a DTC P0171 to set. Driveability conditions associated with lean conditions can include hard starting (when the engine is cold), hesitation, poor driveability, lack of power, surging , and misfiring.

22. Restricting the fuel return line causes the fuel pressure to rise above the regulated fuel pressure. Command the fuel pump “ON” with the Tech 2. The fuel pressure should rise above 376 kPa (55 psi) as the fuel return line becomes partially closed.

NOTE: Do not allow the fuel pressure to exceed 414 kPa (60 psi). Fuel pressure in excess of 414 kPa (60 psi) may damage the fuel pressure regulator.

CAUTION: To reduce the risk of fire and personal injury:

- **It is necessary to relieve fuel system pressure before connecting a fuel pressure gauge. Refer to Fuel Pressure Relief Procedure, below.**
- **A small amount of fuel may be released when disconnecting the fuel lines. Cover fuel line fittings with a shop towel before disconnecting, to catch any fuel that may leak out. Place the towel in an approved container when the procedure is completed.**

Fuel Pressure Relief Procedure

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay center.
3. Start the engine and allow it to stall.
4. Crank the engine for an additional 3 seconds.

Fuel Gauge Installation

1. Remove the shoulder fitting cap.
2. Install fuel gauge J 34730-1 to the fuel feed line located in front of and above the right side valve train cover.
3. Reinstall the fuel pump relay.

Fuel System Diagnosis

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Turn the ignition “OFF.” 2. Turn the air conditioning system “OFF.” 3. Relieve fuel system pressure and install the fuel pressure gauge. 4. Turn the ignition “ON.” NOTE: The fuel pump will run for approximately 2 seconds. Use the Tech 2 to command the fuel pump “ON”. (Refer to the Miscellaneous Test.) 5. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running. Is the fuel pressure within the specified limits?	290-376 kPa (42-55 psi)	Go to *Step 3*	Go to *Step 17*
3	NOTE: The fuel pressure will drop when the fuel pump stops running, then it should stabilize and remain constant. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to *Step 4*	Go to *Step 12*
4	1. When the vehicle is at normal operation temperature, turn the ignition “ON” to build fuel pressure and observe the measurement on the gauge. 2. Start the engine and observe the fuel pressure gauge. Did the reading drop by the amount specified after the engine was started?	21-105 kPa (3-15 psi)	Go to *Step 5*	Go to *Step 9*
5	Is fuel pressure dropping off during acceleration, cruise, or hard cornering?	—	Go to *Step 6*	Check for improper fuel
6	Visually and physically inspect the following items for a restriction: ● The in-pipe fuel filter. ● The fuel feed line. Was a restriction found?	—	Verify repair	Go to *Step 7*
7	Remove the fuel tank and visually and physically inspect the following items: ● The fuel pump strainer for a restriction. ● The fuel line for a leak. ● Verify that the correct fuel pump is in the vehicle. Was a problem found in any of these areas?	—	Verify repair	Go to *Step 8*
8	Replace the fuel pump. Is the action complete?	—	Verify repair	—
9	1. Disconnect the vacuum hose from the fuel pressure regulator. 2. With the engine idling, apply 12-14 inches of vacuum to the fuel pressure regulator. Does the fuel pressure indicated by the fuel pressure gauge drop by the amount specified?	21-105 kPa (3-15 psi)	Go to *Step 10*	Go to *Step 11*

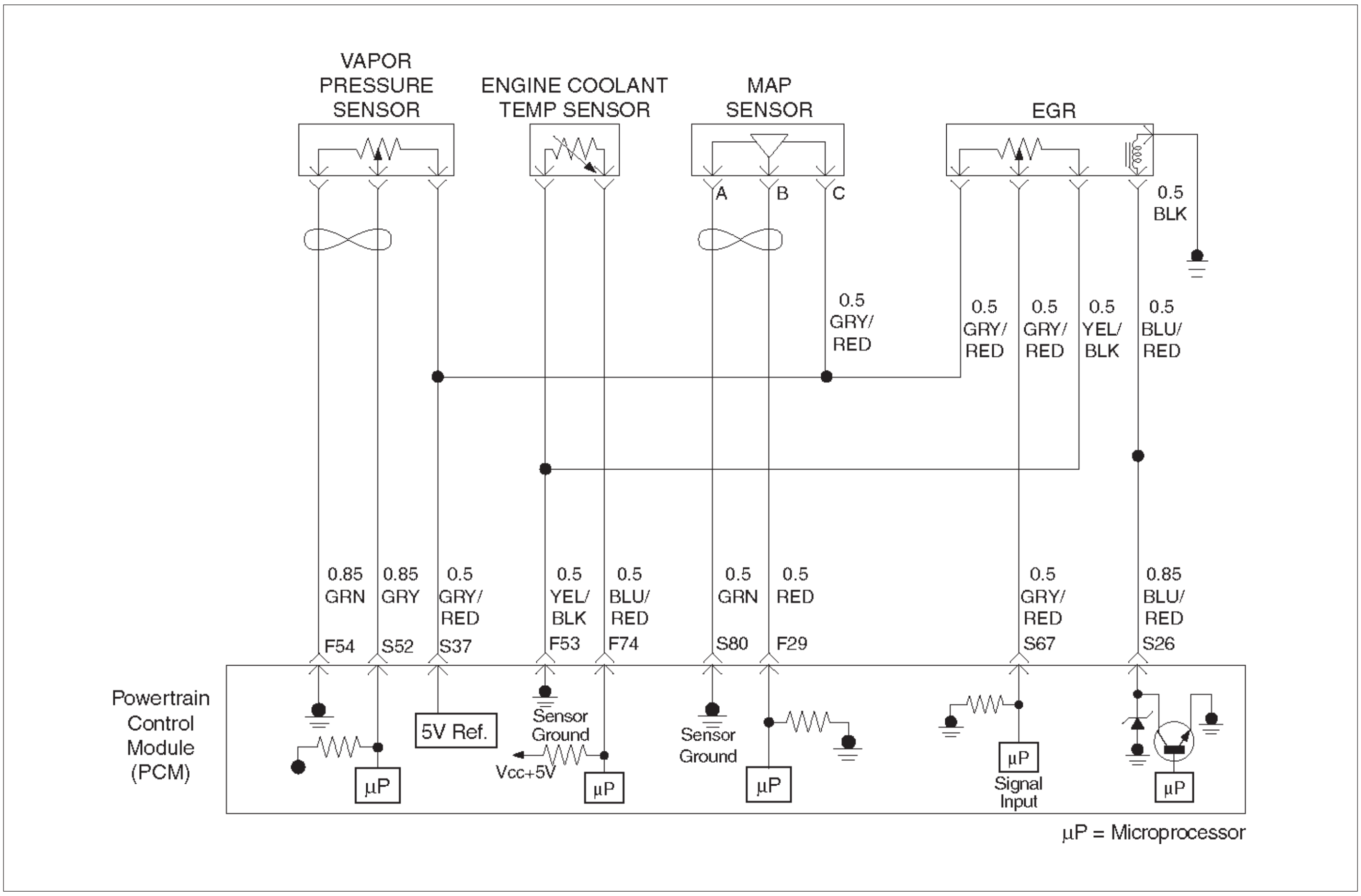
Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
10	Locate and repair the loss of vacuum to the fuel pressure regulator. Is the action complete?	—	Verify repair	—
11	Replace the fuel pressure regulator. Is the action complete?	—	Verify repair	—
12	1. Run the fuel pump with the Tech 2. 2. After pressure has built up, turn off the pump and clamp the supply hose shut with suitable locking pliers which will not damage the hose. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to *Step 13*	Go to *Step 15*
13	Visually inspect the fuel supply line and repair any leaks. Was a problem found?	—	Verify repair	Go to *Step 14*
14	Remove the fuel tank and inspect for leaky hose or in-tank fuel line. Was a problem found?	—	Verify repair	Go to *Step 8*
15	1. If the pliers are still clamped to the fuel supply hose, remove the locking pliers. 2. With suitable locking pliers, which will not damage the hose, clamp the fuel return line to prevent fuel from returning to the fuel tank. 3. Run the fuel pump with the Tech 2. 4. After pressure has built up, remove power to the pump. Does the fuel pressure indicated by the fuel pressure gauge remain constant?	—	Go to *Step 11*	Go to *Step 16*
16	Locate and replace any leaking fuel injector(s). Is the action complete?	—	Verify repair	—
17	Is the fuel pressure indicated by the fuel pressure gauge above the specified limit?	376 kPa (55 psi)	Go to *Step 18*	Go to *Step 21*
18	1. Relieve the fuel pressure. Refer to the *Fuel Pressure Relief.* 2. Disconnect the fuel return line from the fuel rail. 3. Attach a length of flexible hose to the fuel rail return outlet passage. 4. Place the open end of the flexible hose into an approved gasoline container. 5. Run the fuel pump with the Tech 2. 6. Observe the fuel pressure indicated by the fuel pressure gauge with the fuel pump running. Is the fuel pressure within the specified limits?	290-376 kPa (42-55 psi)	Go to *Step 19*	Go to *Step 20*
19	Locate and correct the restriction in the fuel return line. Is the action complete?	—	Verify repair	—
20	Visually and physically inspect the fuel rail outlet passages for a restriction. Was a restriction found?	—	Verify repair	Go to *Step 11*

Fuel System Diagnosis (Cont'd)

Step	Action	Value(s)	Yes	No
21	Is the fuel pressure indicated by the fuel pressure gauge above the specified value?	0 kPa (0 psi)	Go to *Step 22*	Go to *Step 23*
22	1. Command the fuel pump "ON" with the Tech 2. 2. Using suitable pliers which will not damage the fuel hose, gradually apply pressure with the pliers to pinch the flexible fuel return hose closed. **CAUTION: Do not let the fuel pressure exceed the second specified value.** Does the fuel pressure indicated by the fuel pressure gauge rise above the first specified value?	376 kPa (55 psi) 414 kPa (60 psi)	Go to *Step 11*	Go to *Step 7*
23	1. Command the fuel pump "ON" with the Tech 2. 2. Remove the fuel filler cap and listen for the sound of the fuel pump running. 3. Turn the pump off. Was the fuel pump running?	—	Go to *Step 7*	Go to *Fuel System Electrical Test Chart*

Exhaust Gas Recirculation (EGR) System Check



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Circuit Description

A properly operation exhaust gas recirculation (EGR) system will directly affect the air/fuel requirements of the engine. Since the exhaust gas introduced into the air/fuel mixture is an inert gas (contains very little or no oxygen), less fuel is required to maintain a correct air/fuel ratio. Introducing exhaust gas into the combustion chamber lowers combustion temperatures and reduces the formation of oxides of nitrogen (NOx) in the exhaust gas. Lower combustion temperatures also prevent detonation. If the EGR pintle were to stay closed, the inert exhaust gas would be replaced with air and the air/fuel mixture would be leaner. The powertrain control module (PCM) would compensate for the lean condition by adding fuel, resulting in higher long term fuel trim values.

Diagnostic Aids

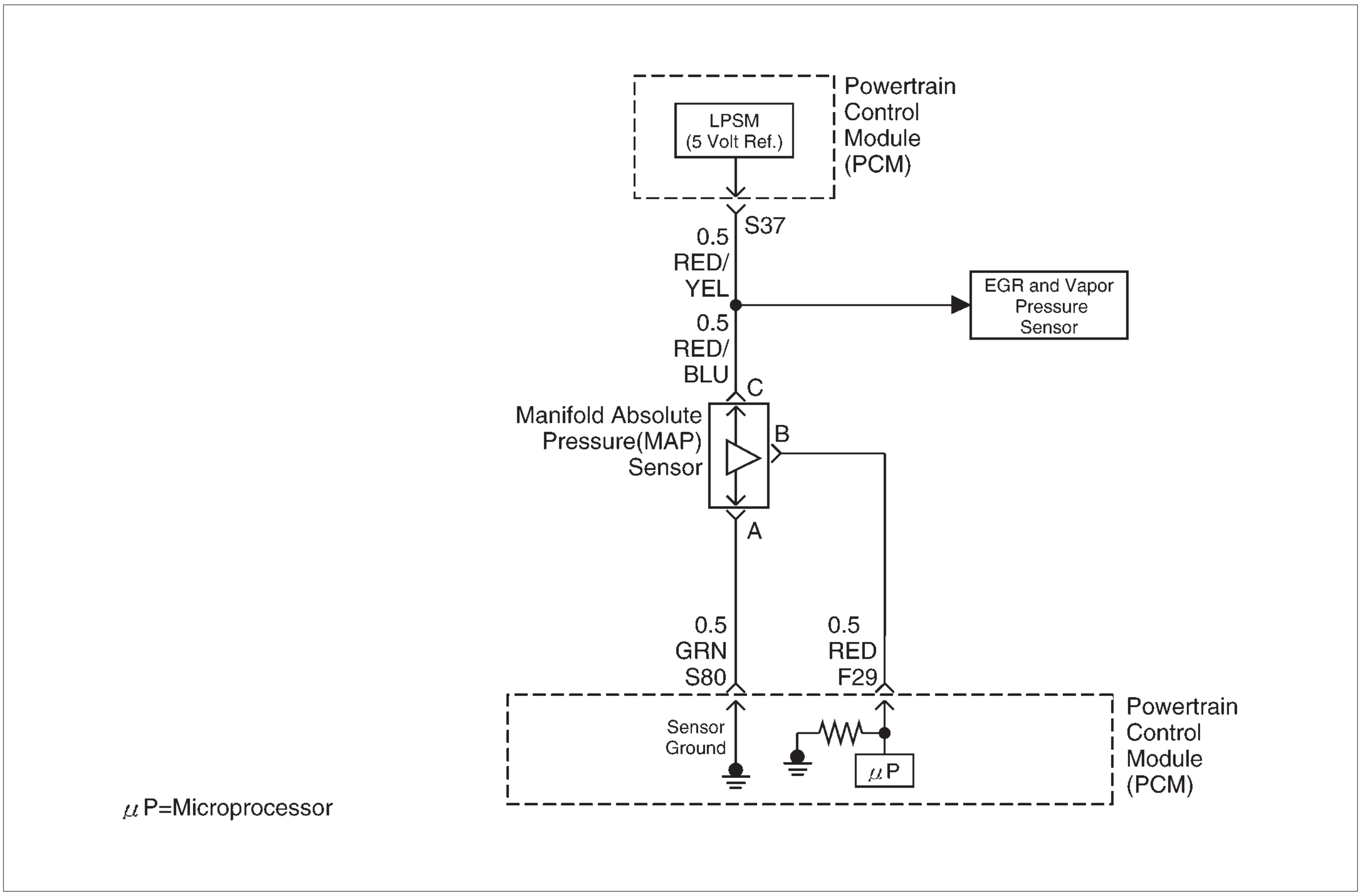
The EGR valve chart is a check of the EGR system. An EGR pintle constantly in the closed position could cause detonation and high emissions of NOx. It could also result in high long term fuel trim values in the open throttle cell, but not in the closed throttle cell. An EGR pintle constantly in the open position would cause a rough idle. Also, an EGR mounted incorrectly (rotated 180°) could cause rough idle. Check for the following items:

- EGR passages – Check for restricted or blocked EGR passages.
- Manifold absolute pressure sensor – A manifold absolute pressure sensor may shift in calibration enough to affect fuel delivery. Refer to *Manifold Absolute Pressure Output Check.*

Exhaust Gas Recirculation (EGR) System Check

Step	Action	Value(s)	Yes	No
1	Check the EGR valve for looseness. Is the EGR valve Loose?	—	Go to *Step 2*	Go to *Step 3*
2	Tighten the EGR valve. Is the action complete?	—	Verify repair	—
3	1. Place the transmission selector in Park or Neutral. 2. Start the engine and idle until warm. 3. Using a Tech 2, command EGR “50% ON.” (Refer to the Miscellaneous Test.) Does the engine idle rough and lose RPMs?	—	EGR system working properly. No problem found.	Go to *Step 4*
4	1. Engine “OFF.” 2. Ignition “ON.” 3. Using a test light to ground, check the EGR harness between the EGR valve and the ignition feed. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 5*
5	Repair the EGR harness ignition feed. Was the problem corrected?	—	Verify repair	Go to *Step 6*
6	1. Remove the EGR valve. 2. Visually and physically inspect the EGR valve pintle, valve passages and adapter for excessive deposits, obstructions or any restrictions. Does the EGR valve have excessive deposits, obstructions or any restrictions?	—	Go to *Step 7*	Go to *Step 8*
7	Clean or replace EGR system components as necessary. Was the problem corrected?	—	Verify repair	Go to *Step 8*
8	1. Ground the EGR valve metal case to battery (–). 2. Using a Tech 2, command EGR “ON” and observe the EGR valve pintle for movement. Does the EGR valve pintle move according to command?	—	Go to *Step 9*	Go to *DTC P1406 chart*
9	1. Remove the EGR inlet and outlet pipes from the intake and exhaust manifolds. 2. Visually and physically inspect manifold EGR ports and EGR inlet and outlet pipes for blockage or restriction caused by excessive deposits or other damage. Do the manifold EGR ports or inlet and outlet pipes have excessive deposits, obstructions, or any restrictions?	—	Go to *Step 10*	EGR system working properly. No problem found.
10	Clean or replace EGR system components as necessary. Is the action complete?	—	Verify repair	—

Manifold Absolute Pressure (MAP) Output Check



D06RY00165

Circuit Description

The manifold absolute pressure (MAP) sensor measures the changes in the intake MAP which result from engine load (intake manifold vacuum) and engine speed changes; and converts these into a voltage output. The powertrain control module (PCM) sends a 5-volt reference voltage to the MAP sensor. As the MAP changes, the output voltage of the sensor also changes. By monitoring the the sensor output voltage, the PCM knows the MAP. A lower pressure (low voltage) output voltage will be about 1-2 volts at idle. Higher pressure (high voltage) output voltage will be about 4-4.8 volts at wide open throttle. The MAP sensor is also used, under certain conditions, to measure barometric pressure, allowing the PCM to make adjustments for different altitudes. The PCM uses the MAP sensor to diagnose proper operation of the EGR system, in addition to other functions.

Test Description

IMPORTANT: Be sure to used the same diagnostic test equipment for all measurements.

The number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Applying 34 kPa (10 Hg) vacuum to the MAP sensor should cause the voltage to be 1.5-2.1 volts less than the voltage at step 1. Upon applying vacuum to the sensor, the change in voltage should be instantaneous. A slow voltage change indicates a faulty sensor.
3. Check the vacuum hose to the sensor for leaking or restriction, Be sure that no other vacuum devices are connected to the MAP hose.

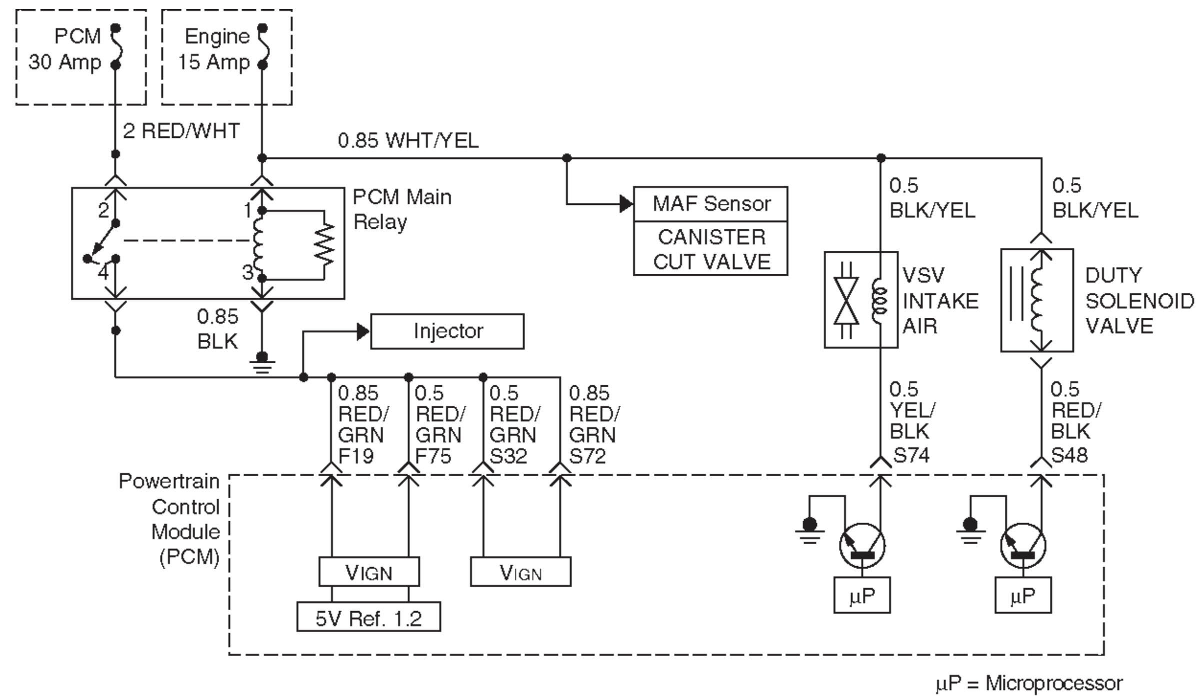
IMPORTANT: Make sure the electrical connector remains securely fastened.

4. Disconnect the sensor from the bracket. Twist the sensor with your hand to check for an intermittent connection. Output changes greater than 0.10 volt indicate a bad sensor.

Manifold Absolute Pressure (MAP) Output Check

Step	Action	Value(s)	Yes	No
1	1. Turn the ignition “OFF” and leave it “OFF” for 15 seconds. 2. Ignition “ON.” Don’t crank engine. 3. The Tech 2 should indicate a manifold absolute pressure (MAP) sensor voltage. 4. Compare this scan reading to scan reading of a known good vehicle obtained using the exact same procedure as in Steps 1-4. Is the voltage reading the same +/–0.40 volt?	—	Go to *Step 2*	Go to *Step 5*
2	1. Disconnect the vacuum hose at the MAP sensor and plug the hose. 2. Connect a hand vacuum pump to the MAP sensor. 3. Start the engine. 4. Apply 34 kPa (10 Hg) of vacuum and note the voltage change. Is the voltage change 1.5-2.1 volts less than Step 1?	—	Go to *Step 3*	Go to *Step 4*
3	Check the sensor cover for leakage or restriction. Does the hose supply vacuum to the MAP sensor only?	—	Go to *Step 5*	Go to *Step 4*
4	Repair the hose to block. Is the action complete?	—	Verify repair	—
5	Check the sensor connection. Is the sensor connection good?	—	Go to *Step 6*	Go to *Step 7*
6	Refer to *On-Vehicle Service, MAP Sensor.* Is the action complete?	—	Verify repair	—
7	Repair the poor connection. Is the action complete?	—	Verify repair	—

Evaporative (EVAP) Emissions Canister Purge Valve Check



060RY00158

Circuit Description

Canister purge is controlled by a solenoid valve that allows manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge "ON"). The EVAP purge solenoid control is turned "ON" and "OFF" several times a second. The duty cycle (pulse width or "ON" time) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the purge solenoid is enabled when the appropriate conditions have been met:

- The engine run time after start is more than 60 seconds.
- The engine coolant temperature is above 30°C (86°F).
- The fuel control system is operating in the closed-loop mode.

Diagnostic Aids

- Make a visual check of vacuum hoses.
- Check the throttle body for possible cracked.
- Check the malfunction indicator lamp for a possible mechanical problem.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

1. Check to see if the solenoid is open or closed. The solenoid is normally de-energized in this step, so it should be closed.
2. This step checks to determine if the solenoid was open due to an electrical circuit problem or a defective solenoid.
3. This should normally energize the solenoid, opening the valve and allowing the vacuum to drop (purge "ON").

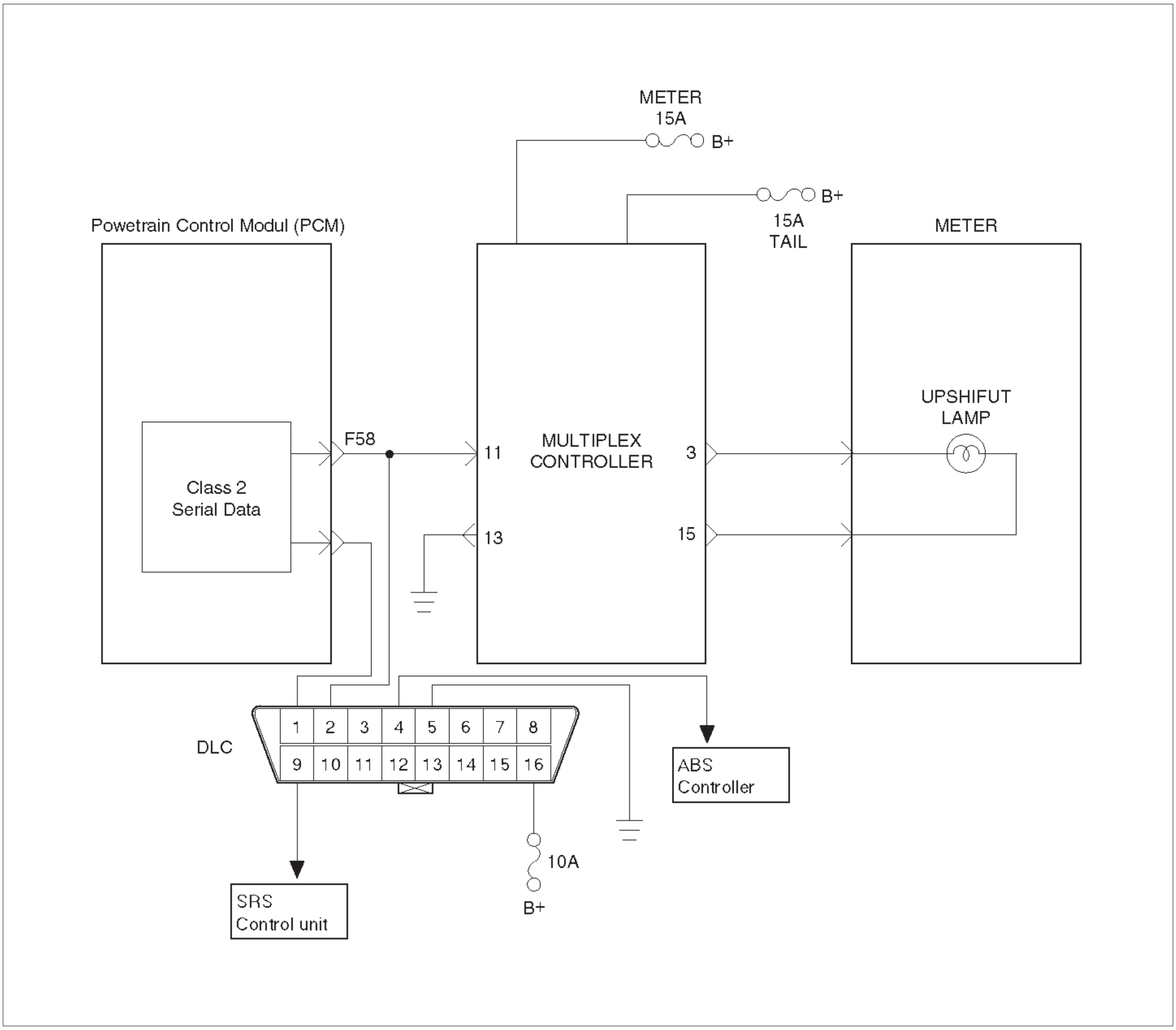
Evaporative (EVAP) Emissions Canister Purge Valve Check

Step	Action	Value(s)	Yes	No
1	1. Ignition "OFF." 2. Ignition "ON," engine "OFF." 3. At the throttle body, disconnect the hose that goes to the pump solenoid. 4. Using a hand vacuum pump with an attached vacuum gauge J 23738-A, apply vacuum (10" Hg or 34 kPa) to the solenoid. Does the solenoid hold the vacuum?	—	Go to *Step 3*	Go to *Step 2*
2	1. Disconnect the solenoid electrical connector. 2. As in Step 1, apply vacuum (10" Hg or 34 kPa) to the solenoid. Does the solenoid hold the vacuum?	—	Go to *Step 4*	Go to *Step 7*
3	1. At the throttle body, put a cap over the vacuum port where the hose was disconnected for testing. This is to prevent a vacuum leak when the engine is started. 2. Ignition "OFF." 3. Install the Tech 2. 4. Apply vacuum to the purge solenoid with the hand vacuum pump. 5. Start the engine, run at 2500 RPM. 6. Using the Tech 2, select Powertrain, 3.5–V6 6VE1, F3: Misc. Tests, F2: EVAP Purge, F0: EVAP Purge. (Refer to the Misellaneous Test.) 7. Turn the purge solenoid "ON." Did the vacuum drop when the purge was turned on?	—	Go to *Step 8*	Go to *Step 9*
4	Check for a short to ground in the YEL/RED wire. Is there a short?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the short to ground. Is the action complete?	—	Verify repair	—
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service*in *Powertrain Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
7	Replace the faulty purge solenoid. Refer to *On-Vehicle Service, EVAP Canister Purge Solenoid.* Is the action complete?	—	Verify repair	—

Evaporative (EVAP) Emissions Canister Purge Valve Check (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Turn the ignition "OFF." 2. At the throttle body, install a vacuum gauge where the hose from the purge solenoid was disconnected for testing. 3. Start the engine. 4. Stabilize the engine speed at about 2500 RPM. 5. Momentarily snap the throttle open and let it return to idle. Is there approximately 10" Hg (34 kPa) of vacuum available at the EVAP emission canister purge solenoid?	—	No problem found in the EVAP emission canister purge valve check	Refer to *Diagnostic Aids*
9	1. Disconnect the solenoid electrical connector. 2. Connect a test lamp between the harness terminals. Does the test lamp light?	—	Go to *Step 7*	Go to *Step 10*
10	Probe terminal A and terminal B with a test lamp to ground. Does the test lamp light on both terminals?	—	Go to *Step 11*	Go to *Step 12*
11	Repair the short to voltage in the YEL/RED wire. Is the action complete?	—	Verify repair	—
12	Does on of the terminals light the test lamp?	—	Go to *Step 13*	Go to *Step 14*
13	Check for an open in the YEL/RED wire between the purge solenoid and the PCM. Was there an open circuit?	—	Go to *Step 15*	Go to *Step 6*
14	Repair the open in the BLK/YEL wire. Is the action complete?	—	Verify repair	—
15	Repair the open in the YEL/RED wire. Is the action complete?	—	Verify repair	—

Upshift Lamp System Check (Manual Transmission Only)



060RY00160

Circuit Description

The shift lamp indicates the best transmission shift point for maximum fuel economy.

The lamp is controlled by the Power Train Control Module (PCM) the and Multiplex Controller, it is turned “ON” by grounding in the Multiplex Controller.

The PCM is used information from the following inputs to control the upshift lamp.

- Engine Coolant temperature (ECT) Sensor
- Throttle Position Sensor
- Vehicle Speed Sensor
- Engine Speed

The PCM uses the measured RPM and the vehicle speed to calculate what gear the vehicle is in.

It’s this calculation that determines when the upshift lamp should be turned “ON”.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation. Check for poor connections or a damaged harness.

Inspect the PCM harness and connector for proper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection and damaged harness.

Up-Shift Lamp System Check

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "OFF." 2. Disconnect the cluster meter connector. 3. Disconnect the Multiplex Control Unit connector. 4. Check the circuit (Voltage feed circuit and Lamp driver circuit) between cluster meter connector and Multiplex Control Unit. Was a problem found?	—	Go to *Step 3*	Go to *Step 4*
3	Locate and repair the between cluster meter and Multiplex Control Unit open circuit. Is the action complete?	—	Verify repair	—
4	1. Reconnect the cluster meter connector. 2. Check the circuit resistance between voltage feed circuit and lamp driver circuit at Multiplex Control Unit connector. Was a problem found?	—	Go to *Instrument Panel in Electrical Diagnosis*	Go to *Step 5*
5	1. Check for an Clutch Switch operation and the fixing condition. 2. Check for an open or short of Clutch Switch. 3. Check for circuit between backup fuse and Clutch Switch. 4. Check for circuit between PCM and Clutch Switch Was a problem found?	—	Go to *Step 6*	Go to *Step 7*
6	Replace the Clutch Switch or Locator and repair the between backup fuse and Clutch Switch circuit or Locate and repair the between PCM and Clutch Switch circuit. Is the action complete?	—	Verify repair	—
7	1. Check for an open or short of 1–2 Transmission Switch. 2. Check for an open or short of 3–4 Transmission Switch. Check for an open or short the wiring harness between Clutch Switch and Transmission Switches. Was a problem found?	—	Go to *Step 8*	Go to *Step 9*
8	1. Replace the applicable Transmission Switch. 2. Repair for an open or short of the wiring harness. Is the action complete ?	—	Verify repair	—
9	1. Ignition "OFF." 2. Disconnect the Alam Relay Control Unit. 3. Ignition "ON," Probe the ignition feed circuit at the Alarm Relay Control Unit connector with a test light to ground. Is the test light "ON?"	—	Go to *Step 11*	Go to *Step 10*
10	Locator and repair the Alarm Relay Control Unit battery feed open circuit. Is the action complete ?	—	Verify repair	—

Up-Shift Lamp System Check (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check the Alarm Relay Control Unit ground connection and circuit. Was a problem found?	—	Go to *Step 12*	Go to *Step 13*
12	Locator and repair the ground connector for Alarm Relay Control Unit Circuit. Is the action complete?	—	Verify repair	—
13	1. Disconnect the Multiplex Control Unlit. 2. Check the circuit between Alarm Relay control Unlit and Multiplex Control Unit. Was a problem found?	—	Go to *Step 14*	Go to *Step 15*
14	Locate and repair the between Multiplex Control Unit and PCM open circuit. Is the action complete?	—	Verify repair	—
15	Check for damaged terminals at the Multiplex Control Unit. Was a problem found?	—	Go to *Step 16*	Go to *Step 17*
16	Replace the Multiplex Alarm Relay control Unit. Is the action complete?	—	Go to *Step 19*	—
17	1. Ignition "OFF." 2. Reconnect the all connector. 3. Install the Tech 2. 4. Ignition "ON". 5. Using the Tech 2 output control function, select Upshift lamp control and command the Upshift lamp "ON" and "OFF." (Refer to the Miscellaneous test) Is the action complete?	—	Go to *Step 16*	Go to *Step 26*
18	Replace the Multiplex Control Unit. Is the action complete?	—	Go to *Step 19*	—
19	1. Verify the customer complaints in accordance with mentioned below: Go to the adequate Step Chart first. ● At the 1st gear position, the lamp does not illuminate: Go to Step Chart ● At the 3rd gear position, the lamp does not illuminate: Go to Step Chart ● Upshift Lamp does not illuminate always. 2. Ignition "ON," or "OFF." 3. Using the Tech 2, check to see if the upshift lamp turn "ON" or "OFF." Is the action complete?	—	Verify repair	Go to *Step 20*

Up-Shift Lamp System Check (Cont'd)

Step	Action	Value(s)	Yes	No
20	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed refer to *ON-Vehicle Service in PowerTrain Control Module and Sensor* for procedure. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

PCM Diagnostic Trouble Codes

The following table lists the diagnostic trouble codes supported by this vehicle application. If any DTCs not listed here are displayed by a Tech 2, the Tech 2 data may be faulty; notify the Tech 2 manufacturer of any DTCs displayed that are not included in the following table.

PCM Diagnostic Trouble Codes

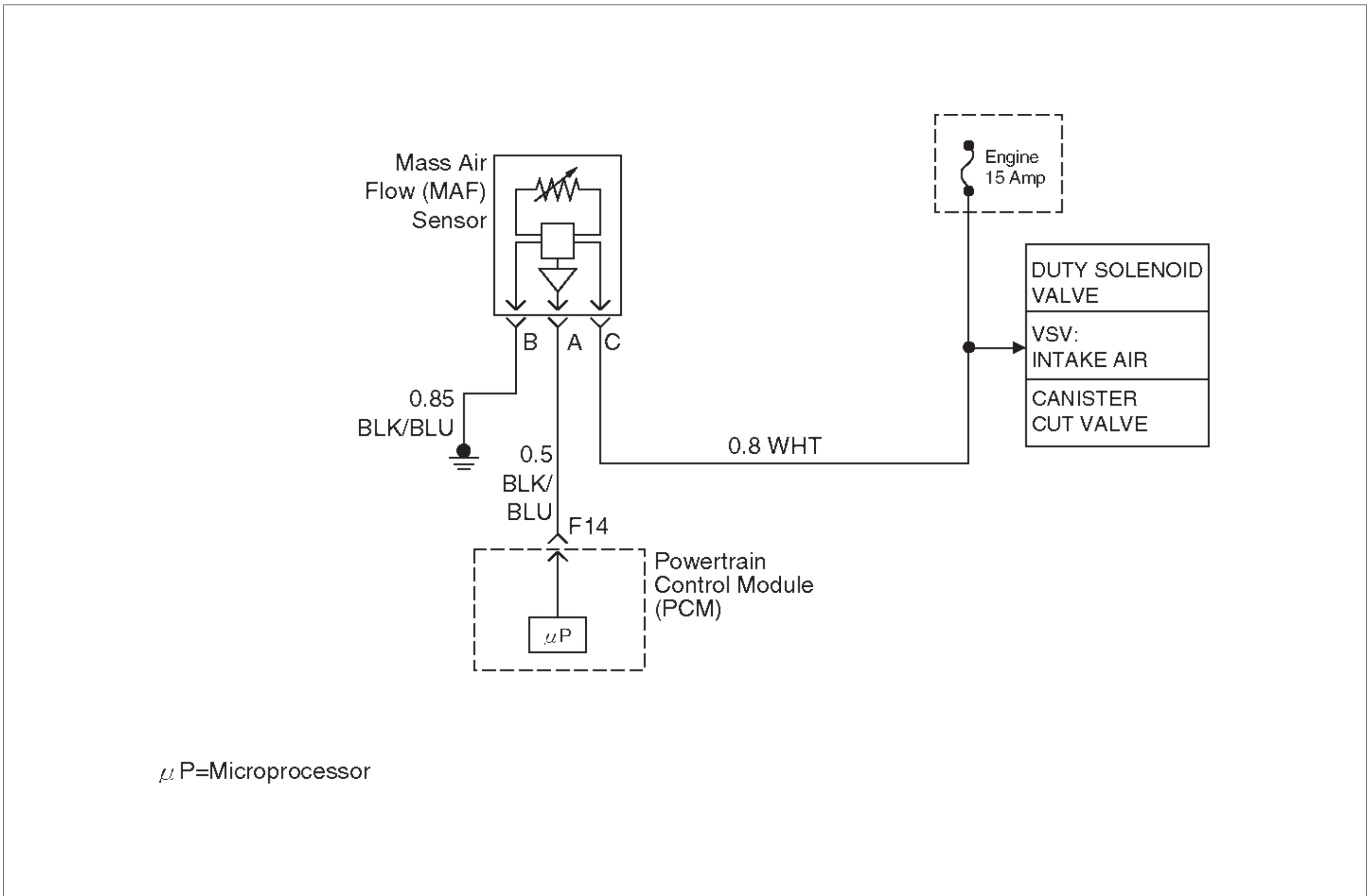
DTC	Description	Type	Illuminate MIL (Check Enigne Lamp)	Illuminate RPL (Reduced Power Lamp)
P0101	MAF System Performance	B	Yes	No
P0102	MAF Sensor Circuit Low Frequency	B	Yes	No
P0103	MAF Sensor Circuit High Frequency	B	Yes	No
P0106	MAP Rationality/Performance	B	Yes	No
P0107	MAP Circuit Low Input Voltage	B	Yes	No
P0108	MAP Circuit Hgh Input Voltage	B	Yes	No
P0112	IAT Circuit Low Input Voltage	B	Yes	No
P0113	IAT Circuit Hgh Input Voltage	B	Yes	No
P0117	ECT Circuit Low Input Voltage	B	Yes	No
P0118	ECT Circuit Hgh Input Voltage	B	Yes	No
P0125	ECT Insufficient for Closed Loop Fuel Control	B	Yes	No
P0128	ECT Below Thermostat Regulating Temperature	B	Yes	No
P0131	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 1)	B	Yes	No
P0132	O2 Sensor Circuit High Voltage (Bank 1 Sensor 1)	B	Yes	No
P0133	O2 Sensor Circuit Slow Response (Bank 1 Sensor 1)	B	Yes	No
P0134	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 1)	B	Yes	No
P0135	O2 Sensor Heater Circuit (Bank 1 Sensor 1)	B	Yes	No
P0137	O2 Sensor Circuit Low Voltage (Bank 1 Sensor 2)	B	Yes	No
P0138	O2 Sensor Circuit High Voltage (Bank 1 Sensor 2)	B	Yes	No
P0140	O2 Sensor Circuit No Activity Detected (Bank 1 Sensor 2)	B	Yes	No
P0141	O2 Sensor Heater Circuit (Bank 1 Sensor 2)	B	Yes	No
P0151	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 1)	B	Yes	No
P0152	O2 Sensor Circuit High Voltage (Bank 2 Sensor 1)	B	Yes	No
P0153	O2 Sensor Circuit Slow Response (Bank 2 Sensor 1)	B	Yes	No
P0154	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 1)	B	Yes	No
P0155	O2 Sensor Heater Circuit (Bank 2 Sensor 1)	B	Yes	No
P0157	O2 Sensor Circuit Low Voltage (Bank 2 Sensor 2)	B	Yes	No
P0158	O2 Sensor Circuit High Voltage (Bank 2 Sensor 2)	B	Yes	No
P0160	O2 Sensor Circuit No Activity Detected (Bank 2 Sensor 2)	B	Yes	No
P0161	O2 Sensor Heater Circuit (Bank 2 Sensor 2)	B	Yes	No
P0171	O2 Sensor – System too Lean (Bank 1)	B	Yes	No
P0172	O2 Sensor – System too Rich (Bank 1)	B	Yes	No
P0174	O2 Sensor – System too Lean (Bank 2)	B	Yes	No
P0175	O2 Sensor – System too Rich (Bank 2)	B	Yes	No
P0201	Injector 1 Control Circuit	A	Yes	No

DTC	Description	Type	Illuminate MIL (Check Enigne Lamp)	Illuminate RPL (Reduced Power Lamp)
P0202	Injector 2 Control Circuit	A	Yes	No
P0203	Injector 3 Control Circuit	A	Yes	No
P0204	Injector 4 Control Circuit	A	Yes	No
P0205	Injector 5 Control Circuit	A	Yes	No
P0206	Injector 6 Control Circuit	A	Yes	No
P0300	Engine Misfire Detected	B	Yes	No
P0301	Engine Misfire Detected Cylinder #1	B	Yes	No
P0302	Engine Misfire Detected Cylinder #2	B	Yes	No
P0303	Engine Misfire Detected Cylinder #3	B	Yes	No
P0304	Engine Misfire Detected Cylinder #4	B	Yes	No
P0305	Engine Misfire Detected Cylinder #5	B	Yes	No
P0306	Engine Misfire Detected Cylinder #6	B	Yes	No
P0325	ION Sensing Module	B	Yes	No
P0336	CKP Sensor Circuit Range/Performance (58X)	B	Yes	No
P0337	CKP Sensor Circuit No signal (58X)	B	Yes	No
P0341	CMP Sensor Circuit Range/Performance	D	No	No
P0342	CMP Sensor Circuit No signal	D	No	No
P0351	Injection 1 Control Circuit	A	Yes	No
P0352	Ignition 2 Control Circuit	A	Yes	No
P0353	Ignition 3 Control Circuit	A	Yes	No
P0354	Ignition 4 Control Circuit	A	Yes	No
P0355	Ignition 5 Control Circuit	A	Yes	No
P0356	Ignition 6 Control Circuit	A	Yes	No
P0401	EGR Flow Insufficient	B	Yes	No
P0402	EGR Flow Excessive	B	Yes	No
P0404	EGR Range/Performance (Open Valve)	B	Yes	No
P0405	EGR Sensor Circuit Low Voltge	B	Yes	No
P0406	EGR Sensor Circuit High Voltge	B	Yes	No
P0420	Catalyst System Low Efficiency (Bank 1)	A	Yes	No
P0430	Catalyst System Low Efficiency (Bank 2)	A	Yes	No
P0440	EVAP Control System	B	Yes	No
P0442	EVAP Control System Small Leak Deteced	B	Yes	No
P0446	EVAP Control System Vent Valve Blocked	B	Yes	No
P0452	EVAP Control System Tank Pressure Sensor Low Input	B	Yes	No
P0453	EVAP Control System Tank Pressure Sensor High Input	B	Yes	No
P0456	EVAP Control System Very Small Leak Deteced	B	Yes	No
P0461	Fuel Level Sensor Circuit Range/Performance	D	No	No
P0462	Fuel Level Sensor Circuit Low Input Voltage	D	No	No
P0463	Fuel Level Sensor Circuit High Input Voltage	D	No	No
P0502	No VSS Signal	B	Yes	No

DTC	Description	Type	Illuminate MIL (Check Enigne Lamp)	Illuminate RPL (Reduced Power Lamp)
P0506	Idle Speed Control RPM too Low	B	Yes	No
P0507	Idle Speed Control RPM too High	B	Yes	No
P0562	System Voltge is Low	D	No	No
P0563	System Voltge is High	B	Yes	No
P0565	Cruise Main Circuit (Refer to Chassis Electrical)	C	No	No
P0566	Cruise Cancel Circuit (Refer to Chassis Electrical)	C	No	No
P0567	Cruise Resume Circuit (Refer to Chassis Electrical)	C	No	No
P0568	Cruise Set Circuit (Refer to Chassis Electrical)	C	No	No
P0575	Cruise Analog Input Circuit (Refer to Chassis Electrical)	C	No	No
P0601	PCM/ECM Memory Checksum	D	No	No
P0602	PCM/ECM Programming error	D	No	No
P0604	PCM/ECM RAM error	D	No	No
P0606	PCM/ECM Internal Preformance	D	No	No
P1106	MAP Circuit Intermittent High Voltage)	D	No	No
P1107	MAP Circuit Intermittent Low Input Voltage	D	No	No
P1111	IAT Circuit Intermittent High Voltage	D	No	No
P1112	IAT Circuit Intermittent Low Input Voltage	D	No	No
P1114	ECT Circuit Intermittent Low Voltage	D	No	No
P1115	ECT Circuit Intermittent High Voltage	D	No	No
P1120	TPS1 Circuit	D	No	No
P1125	ETC Limit Performance Mode	D	No	Yes
P1133	O2 Sensor – Too Few Rich/Lean and Lean/Rich Switches (Bank 1 Sensor 1)	B	Yes	No
P1134	O2 Sensor – Transition Switch Time ratio (Bank 1 Sensor 1)	B	Yes	No
P1153	O2 Sensor – Too Few Rich/Lean and Lean/Rich Switches (Bank 2 Sensor 1)	B	Yes	No
P1154	O2 Sensor – Transition Switch Time ratio (Bank 2 Sensor 1)	B	Yes	No
P1167	Fuel supply System RICH During Decel Fuel Cut Off	D	No	No
P1169	Fuel supply System RICH During Decel Fuel Cut Off	D	No	No
P1171	Fuel supply System Lean During Power Enrichment	D	No	No
P1220	TPS2 Circuit	D	No	No
P1221	TPS1–TPS2 Correlation (Circuit Performance)	D	No	No
P1271	APS1–APS2 Correlation (Circuit Performance)	D	No	No
P1272	APS2–APS3 Correlation (Circuit Performance)	D	No	No
P1273	APS1–APS3 Correlation (Circuit Performance)	D	No	No
P1275	APS1 Circuit	D	No	No
P1280	APS2 Circuit	D	No	No
P1285	APS3 Circuit	D	No	No
P1290	ETC Forced Idle Mode	D	No	Yes
P1295	ETC Power Management Mode	A	Yes	Yes
P1299	ETC Forced Engine Shotdown Mode	D	No	Yes

DTC	Description	Type	Illuminate MIL (Check Enigne Lamp)	Illuminate RPL (Reduced Power Lamp)
P1310	ION Sensing Module Diagnostic	A	Yes	No
P1311	ION Sensing Module SEC 1 Line Circuit Fault	A	Yes	No
P1312	ION Sensing Module SEC 2 Line Circuit Fault	A	Yes	No
P1326	ION Sensing Module Combustion Quality circuit	A	Yes	No
P1340	ION Sensing Module – Cylinder Synchronization	B	Yes	No
P1404	EGR Range/Performance (Closed Valve)	B	Yes	No
P1441	EVAP Control System Comtinuous Open Puege Flow	B	Yes	No
P1514	TPS–MAF Correlation	A	Yes	No
P1515	Command–Acrual TPS Correlation	A	Yes	No
P1516	Command–Acrual TPS Correlation Error	A	Yes	No
P1523	Throttle Actuator Control Return Performance	D	No	No
P1625	PCM/ECM System Reset	D	No	No
P1635	Reference Voltage #1 Ciecuit	D	No	No
P1639	Reference Voltage #2 Ciecuit	D	No	No
P1640	ODM Output circuit Fault	D	No	No
P1650	QDM Output Circuit Fault	D	No	No

Diagnostic Trouble Code (DTC) P0101 MAF System Performance



060RY00161

Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity or air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load. DTC P0101 will be set if the signal from the MAF sensor does not match a predicted value based on throttle position and engine RPM.

Conditions for setting the DTC

- The engine is running.
- No TP sensor and MAP sensor DTCs are set.
- No MAF frequency DTCs are set.
- System voltage is between 11.5 volts and 16 volts.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P0101 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P0101 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.
- he duct work at the MAF sensor for leaks.
- An engine vacuum leak.
- The PCV system for vacuum leaks.
- An incorrect PCV valve.
- The engine oil dip stick not fully seated.
- The engine oil fill cap loose or missing.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness- Inspect the wiring harness for damage. If the harness appears to be OK, observe the Mass Air Flow (MAF) display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.
- Plugged intake air duct or filter element
- A wide–open throttle acceleration from a stop should cause the mass air flow displayed on a Tech 2 to increase from about 3–6 g/s at idle to 100 g/s or greater at the time of the 1–2 shift. If not, check for a restriction.

A change in the display will indicate the location of the fault.

If DTC P0101 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P001 Diagnostic Chart may isolate the cause of the fault.

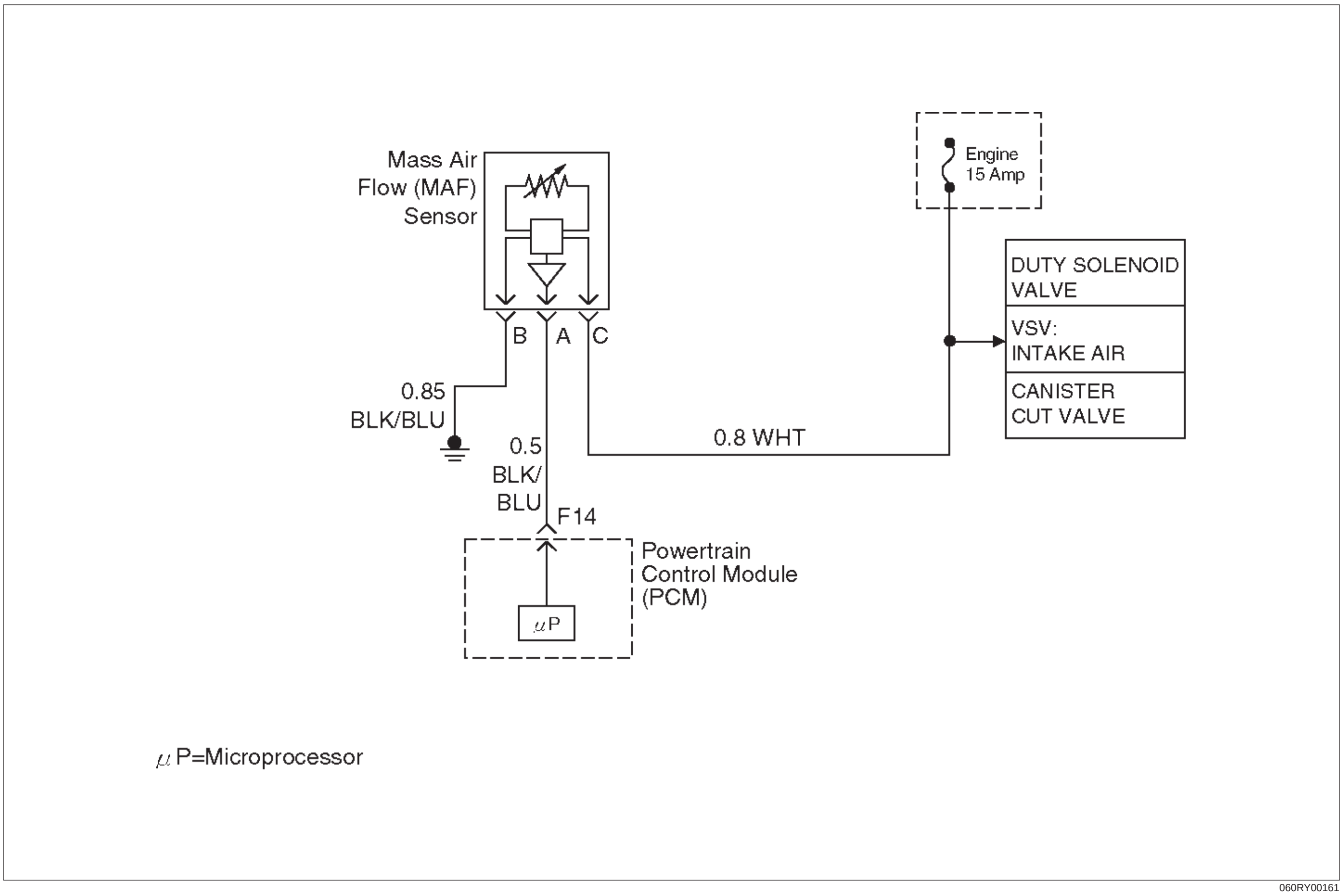
DTC P0101 – MAF System Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “OFF.” 2. Disconnect the Mass Air Flow (MAF) Sensor harness connector from the MAF Sensor. 3. Place an unpowered test lamp between the 12 volt signal circuit and the ground circuit, both at the MAF Sensor connector. 4. Ignition “ON,” Engine“OFF.” Did the test lamp illuminate?	—	Go to *Step 6*	Go to*Step 3*
3	1. Ignition “ON,” Engine “OFF.” 2. Using a Digital Voltmeter (DVM), check the 12 volt signal circuit for the correct voltage. Did the DVM indicate a value within the following range?	11.5 to 12.5 Volt	Go to *Step 5*	Go to *Step 4*
4	1. Ignition “OFF.” 2. Check the 12 volt signal circuit for the following conditions: • An open circuit • A short to ground Was the problem found?	—	Verify repair	—
5	Check the MAF ground circuit for the following conditions: • An open circuit • A short to voltage Was a problem found?	—	Verify repair	—
6	1. Ignition “OFF.” 2. Check the MAF Sensor signal circuit between the PCM and the MAF Sensor for the following conditions: • An open circuit • A short to ground • A short to battery voltage Was a problem found?	—	Verify repair	Go to *Step 7*

DTC P0101 – MAF System Performance (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Connect the MAF Sensor wiring harness connector to the MAF Sensor. 2. Connect the Tech 2 to the vehicle. 3. Place the Transmission in Park/Neutral, and fully apply the Parking Brake. 4. Start the engine. 5. Select the Mass Air Flow (MAF) parameter on the Tech 2. With the engine idling, does the Tech 2 display the following value(s)?	4 to 7 g/s	Go to *Step 8*	Go to *Step 9*
8	Observe the Tech 2 value while increasing the engine RPM to its upper limit. Does the Tech 2 display the following value(s)?	25 to 40 g/s	Go to *Step 10*	Go to *Step 9*
9	Replace the MAF Sensor. Is the action complete?	—	Verify repair	—
10	Replace the PCM. **IMPORTANT:** The PCM must be reprogrammed. Refer to PCM reprogramming. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0102 MAF Sensor Circuit Low Frequency



Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40 g/s at maximum engine load. DTC P0102 will be set if the signal from the MAF sensor is below the possible range of a normally operating MAF sensor.

Conditions for Setting the DTC

- The engine is running above 500 RPM for greater than 10 seconds.
- System voltage is above 11.5 volts.
- MAF signal frequency is below 1.6g/s for a total of 50-percent of the last 1000 samples monitored. A sample is taken every cylinder event.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0102 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0102 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Misrouted harness – Inspect the MAF sensor harness to ensure that it is not routed too close to high voltage wires.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 while moving connectors and wiring harnesses related to the MAF sensor. A change in the display will indicate the location of the fault.
- Plugged intake air duct or filter element – A wide-open throttle acceleration from a stop should cause the mass air flow displayed on a Tech 2 to increase from

about 3-6 g/second at idle to 100 g/second or greater at the time of the 1-2 shift. If not, check for a restriction.

If DTC P0102 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. This step verifies that the problem is present at idle.
4. A voltage reading of less than 4 or over 5 volts at the MAF sensor signal circuit indicates a fault in the wiring or a poor connection.
5. This verifies that ignition feed voltage and a good ground are available at the MAF sensor.

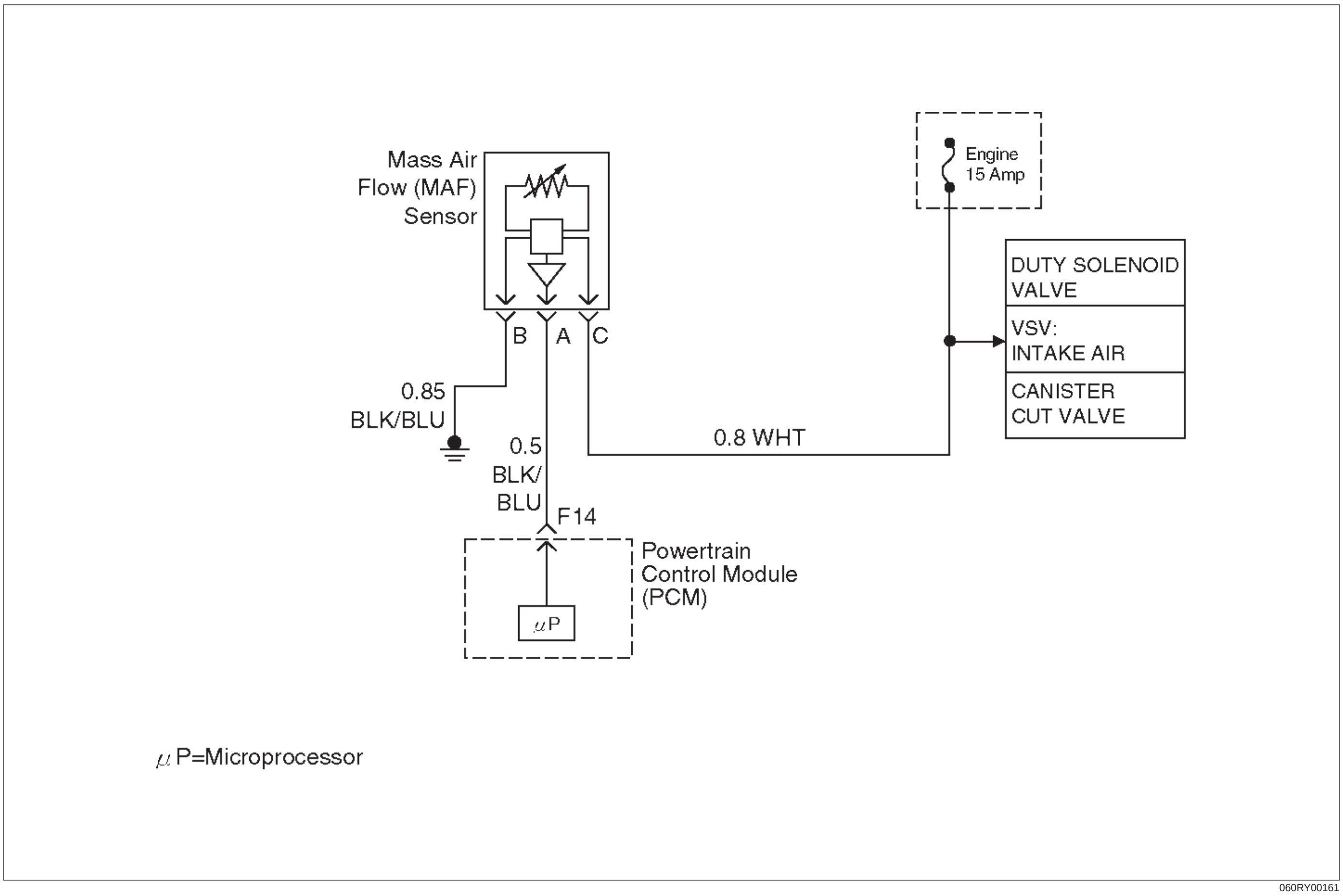
DTC P0102 – MAF Sensor Circuit Low Frequency

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. 2. With the engine idling, monitor “MAF Frequency” display on the Tech 2. Is the “MAF Frequency” below the specified value?	1.6 g/s	Go to *Step 4*	Go to *Step 5*
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0102. Does the Tech 2 indicate DTC P0102 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition “OFF.” 2. Disconnect the MAF sensor connector. 3. Ignition “ON,” engine “OFF.” 4. Using a DVM, measure voltage between the MAF sensor signal circuit and battery ground. Is the voltage near the specified value?	5 V	Go to *Step 5*	Go to *Step 8*
5	Connect a test light between the MAF sensor ignition feed and ground circuits at the MAF sensor harness connector. Is the test light “ON?”	—	Go to *Step 13*	Go to *Step 6*
6	Connect a test light between the MAF sensor ignition feed circuit and battery ground. Is the test light “ON?”	—	Go to *Step 12*	Go to *Step 7*
7	1. Check for a poor connection at the MAF sensor. 2. If a poor connection is found, replace the faulty terminal(s). Was a poor connection found?	—	Verify repair	Go to *Step 11*
8	1. Ignition “OFF.” 2. Disconnect the MAF sensor. 3. Disconnect the PCM connector for the MAF signal circuit. 4. Ignition “ON,” engine “OFF.” 5. With the DVM, measure the voltage between the MAF signal terminal at the PCM and battery ground. Is the voltage under the specified value?	4 V	Go to *Step 9*	Go to *Step 10*

DTC P0102 – MAF Sensor Circuit Low Frequency (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Ignition "OFF." 2. Disconnect the PCM connector. 3. Ignition "ON." 4. Check the MAF sensor signal circuit for a short to 5 volts. Is the action complete?	—	Verify repair	—
10	1. Ignition "OFF." 2. Disconnect the PCM connector. 3. Ignition "ON." 4. Check the MAF sensor signal circuit between the PCM and the MAF sensor for an open, short to ground, or short to the MAF ground circuit. Is the action complete?	—	Verify repair	Go to *Step 13*
11	Locate and repair the open in the ground circuit to the MAF sensor. Is the action complete?	—	Verify repair	—
12	Locate and repair the open in the ignition feed circuit to the MAF sensor. Is the action complete?	—	Verify repair	—
13	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 14*
14	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0103 MAF Sensor Circuit High Frequency



Circuit Description

The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain control module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A large quantity of air entering the engine indicates an acceleration or high load situation, while a small quantity of air indicates deceleration or idle.

The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40 g/s at maximum engine load. DTC P0103 will be set if the signal from the MAF sensor is above the possible range of a normally operating MAF sensor.

Conditions for Setting the DTC

- The engine is running above 500 RPM for more than 10 seconds.
- System voltage is above 11.5 volts.
- MAF signal frequency is above 40g/s for a total of 50 percent of the last 200 samples monitored. A sample is taken every cylinder event.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an airflow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0103 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0103 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

If DTC P0103 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. This step verifies that the problem is present at idle.

4. A frequency reading with the MAF sensor connector disconnected indicates an electromagnetic interfernce (EMI) related fault.

8. This vehicle is equipped with a PCM which utilizes an electrically erasable programmable read only memory (EEPROM). When the PCM is being replaced, the new PCM must be programmed. Refer to *PCM Replacement and Programming Procedures* in *Powertrain Control Module (PCM) and Sensor*.

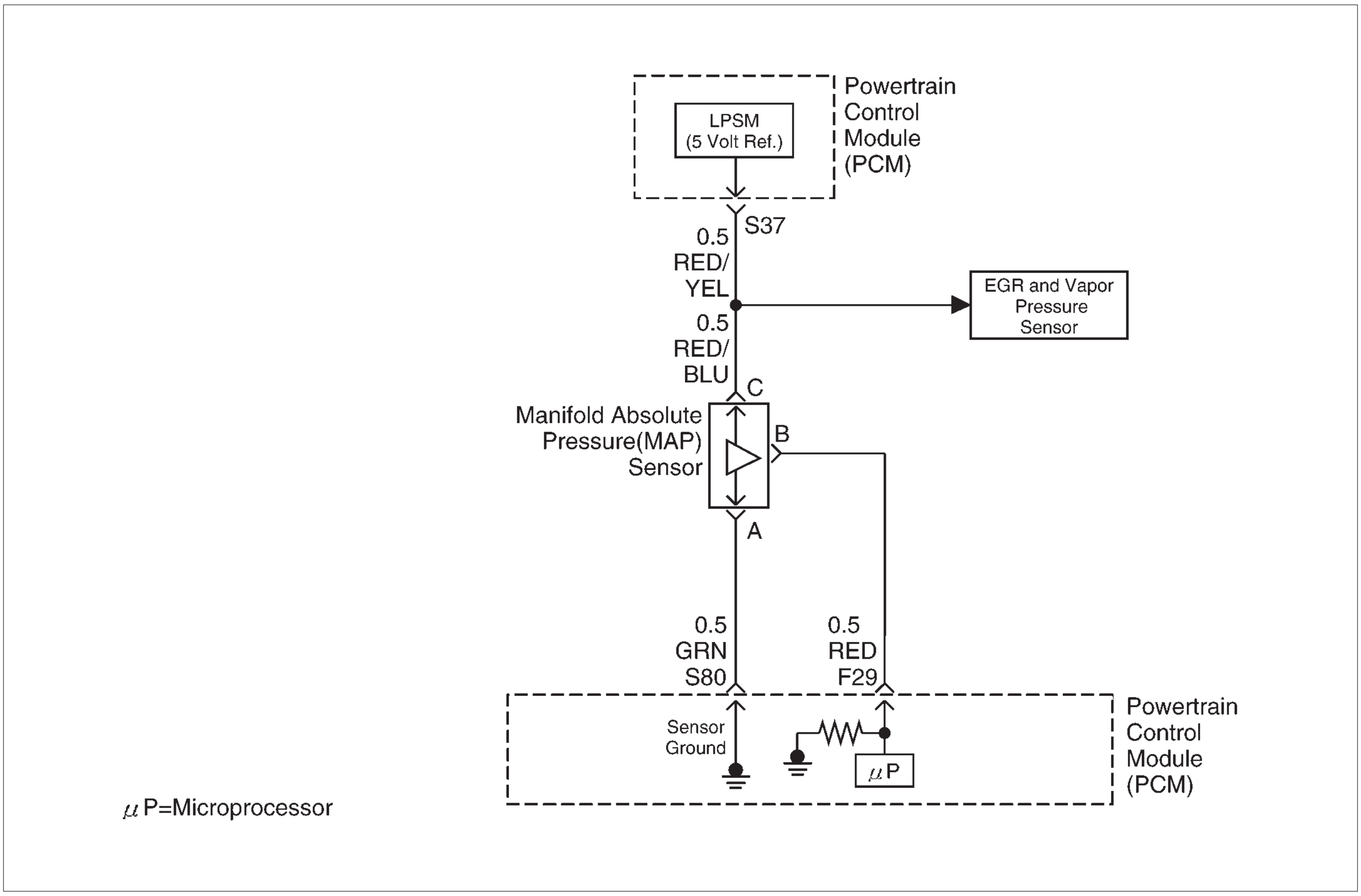
DTC P0103 – MAF Sensor Circuit High Frequency

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0103. Does the Tech 2 indicate DTC P0103 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Start the engine. 2. With the engine idling, monitor "MAF Frequency" display on the Tech 2. Is "MAF Frequency" above the specified value?	40g/s	Go to *Step 4*	Go to *Step 7*
4	1. Ignition "OFF." 2. Disconnect the MAF sensor connector. 3. Ignition "ON," engine idling. 4. Using a Tech 2, monitor "MAF Frequency." Does the Tech 2 indicate a "MAF Frequency" at the specified value?	0g/s	Go to *Step 5*	Go to *Step 6*
5	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 8*
6	1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors). 2. If incorrect routing is found, correct the harness routing. Was a problem found?	—	Verify repair	Go to *Step 6*

DTC P0103 – MAF Sensor Circuit High Frequency (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. With the engine idling, monitor "MAF Frequency" display on the Tech 2. 2. Quickly snap open throttle to wide open throttle while under a road load and record value. Does the Tech 2 indicate "MAF Frequency" above the specified value?	40g/s	Go to *Step 5*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0106 MAP System Performance



D06RY00165

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts at wide-open throttle (low vacuum) at sea level.

The MAP sensor is used to determine: manifold pressure changes while the linear exhaust gas recirculation (EGR) flow test diagnostic is being run (refer to DTC P0401), engine vacuum level for some other diagnostics, and barometric pressure (BARO). The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factor. If the PCM detects a MAP signal that varies excessively above or below the calculated value, DTC P0106 will set.

Conditions for Setting the DTC

- No TP sensor DTCs are present.
- Engine speed is steady, changing less then 100 RPM.
- Throttle position is steady, throttle angle changes less than 1%.
- EGR flow rate is steady, changing less than 4%.
- No change in brake switch, A/C clutch, TCC or power steering pressure switch status.
- Above conditions are met for longer than 1 second.
- Actual MAP value varies more than 10 kPa.
- The MAP value must vary for a total of 10 seconds over a 20-second period of time that the samples were monitored.
- The failure must occur for 2 consecutive trips.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0106 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0106 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0106 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1107 Diagnostic Chart may isolate the cause of the fault.

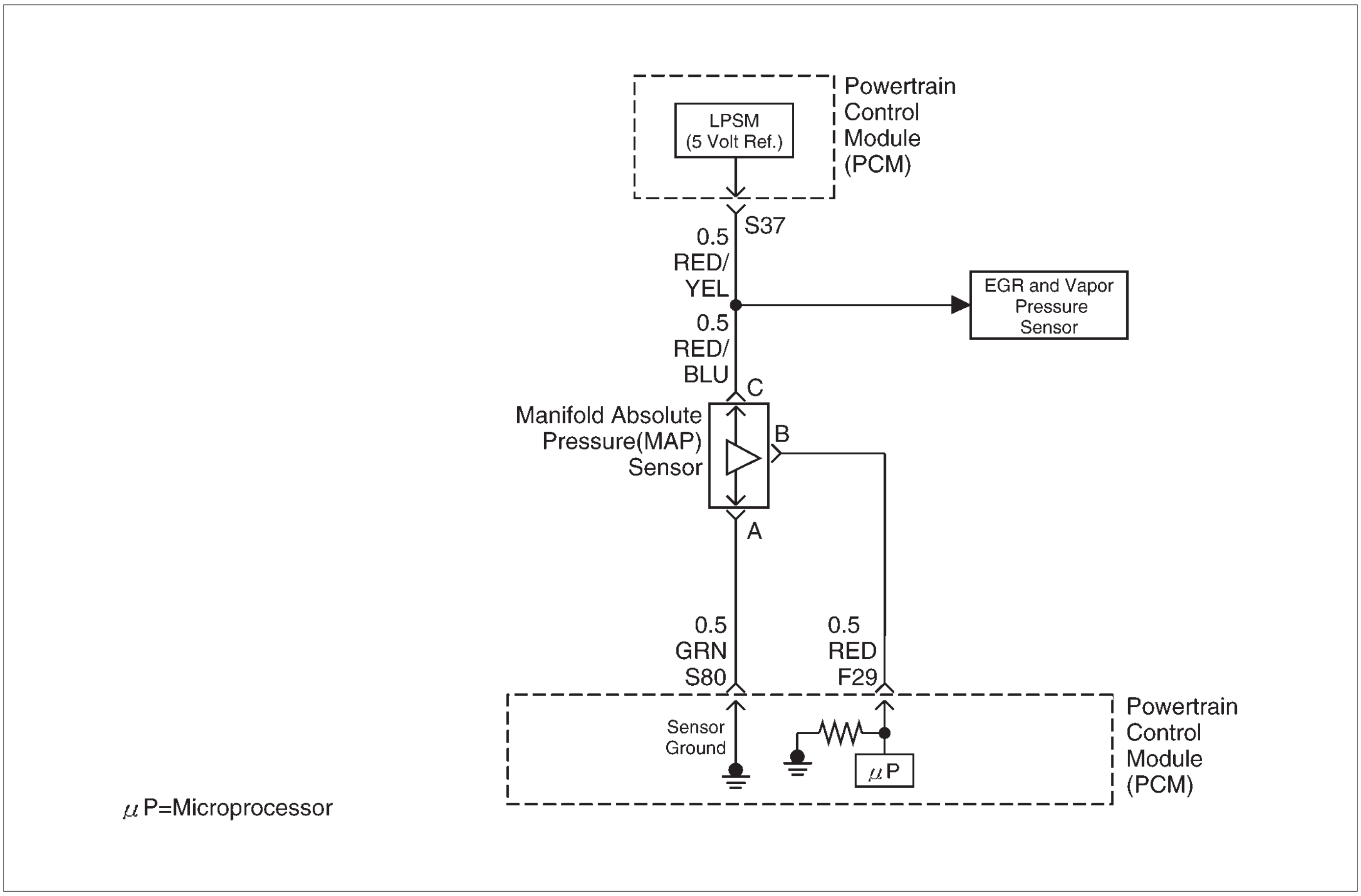
DTC P0106 – MAP System Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0106. Does the Tech 2 indicate DTC P0106 failed?	—	Go to *Step 4*	Go to *Step 3*
3	1. Check for the following conditions: • Vacuum hoses disconnected, damaged, or incorrectly routed; • Intake manifold vacuum leaks; • Vacuum leaks at throttle body; • Vacuum leaks at EGR valve flange and pipes; • Crankcase ventilation valve faulty, missing or incorrectly installed. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*
4	1. Disconnect the MAP sensor electrical connector. 2. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	11 kPa	Go to *Step 5*	Go to *Step 13*
5	1. Connect a test light between B+ and the MAP sensor signal circuit at the MAP sensor harness connector. 2. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	105 kPa	Go to *Step 6*	Go to *Step 9*
6	1. Jumper the 5 volt reference circuit and the MAP signal circuit together at the MAP sensor harness connector. 2. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	104 kPa	Go to *Step 7*	Go to *Step 8*
7	1. Ignition “OFF.” 2. Disconnect the PCM and check the sensor ground circuit for high resistance, an open between the PCM and the MAP sensor, or for a poor connection at the PCM. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*

DTC P0106 – MAP System Performance (Cont’d)

Step	Action	Value(s)	Yes	No
8	1. Check the 5 volt reference circuit for high resistance, an open between the PCM and the MAP sensor, or a poor connection at the PCM. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
9	1. Ignition “OFF.” 2. Disconnect the PCM, and check the MAP sensor signal circuit for high resistance, an open, a short to ground, or a short to the sensor ground circuit. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check the MAP sensor signal circuit for a poor connection at the PCM. 2. If a problem is found, repair as necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
11	1. Check for a poor connection at the MAP sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
13	1. Ignition “OFF,” disconnected the PCM. 2. Ignition “ON,” check the MAP signal circuit for a short to voltage or a short to the 5 volt reference circuit. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0107 MAP Sensor Circuit Low Voltage



Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition "ON," engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the exhaust gas recirculation (EGR) flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively low, DTC P0107 will be set.

Conditions for Setting the DTC

- No TP sensor DTCs present.
- Engine is running.
- Throttle angle is above 1% if engine speed is less than 1000 RPM.
- Throttle angle is above 2% if engine speed is above 1000 RPM.
- The MAP sensor indicates manifold absolute pressure at or below 11 kPa for a total of approximately 10 seconds over a 16-second period.
- Ignition voltage more than 11 volts.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0107 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0107 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Check for intermittent codes.
- The MAP sensor shares a 5 Volt reference with the Fuel Tank Pressure Sensor. If these codes are also set, it could indicate a problem with the 5 Volt reference circuit .
- The MAP sensor shares a ground with the Fuel Tank Pressure Sensor, the ECT sensor, and the Transmission Fluid Temperature sensor.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0107 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P0107 Diagnostic Chart may isolate the cause of the fault.

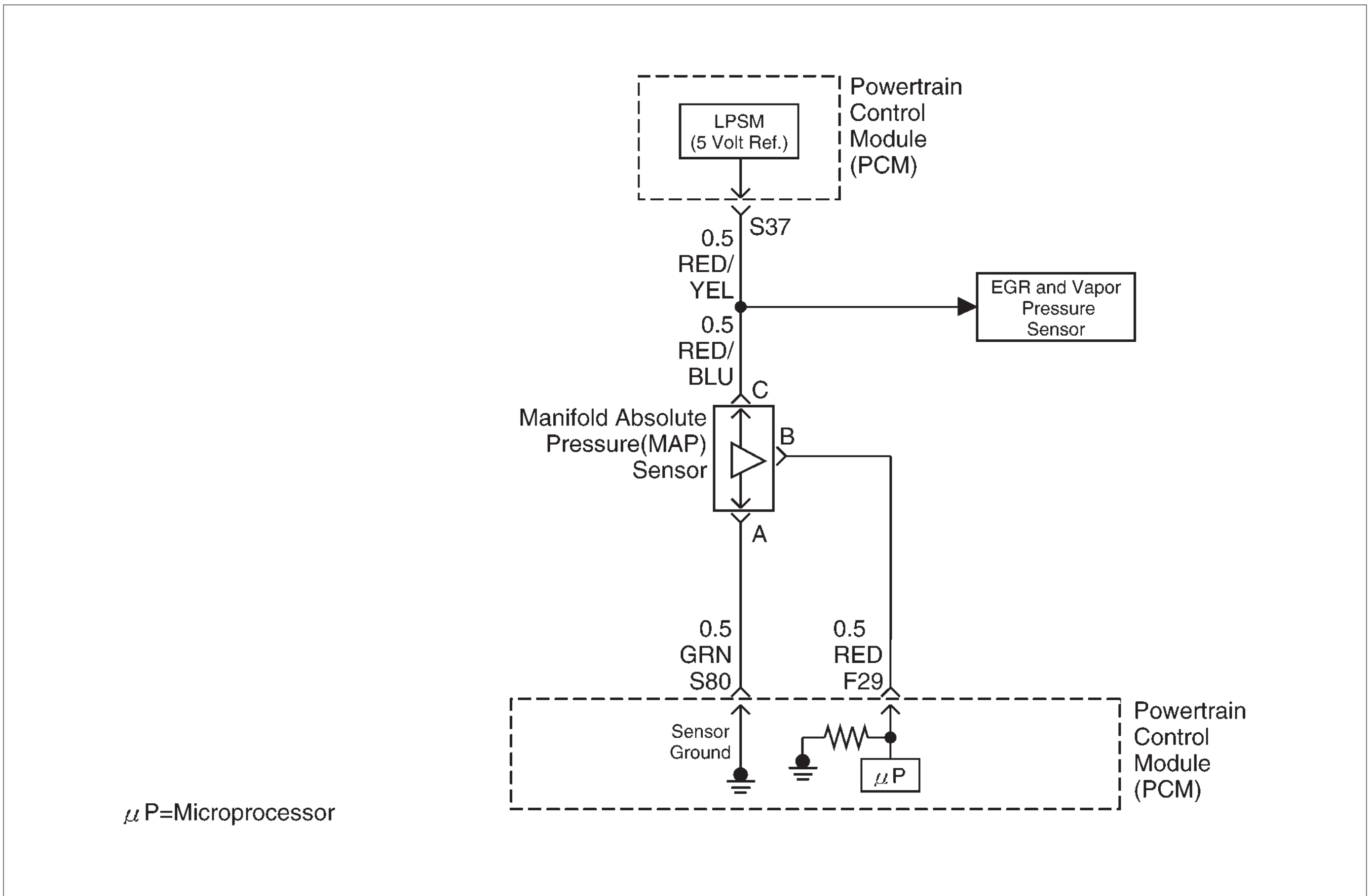
DTC P0107 – MAP Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. With the throttle closed, observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value?	0 V 11 kPa at sea level	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0107. Does the Tech 2 indicate DTC P0107 failed?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF." 2. Disconnect the MAP sensor electrical connector. 3. Jumper the 5 volt reference circuit and the MAP signal together at the MAP sensor harness connector. 4. Ignition "ON." 5. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.)	5 V 104 kPa	Go to *Step 10*	Go to *Step 5*
5	1. Disconnect the jumper. 2. Connect a test light between B+ and the MAP sensor signal circuit at the MAP sensor harness connector. 3. Observe the MAP value displayed on the Tech 2. Is the MAP value near the specified value.	5 V 104 kPa	Go to *Step 6*	Go to *Step 8*
6	1. Ignition "OFF." 2. Disconnect the PCM and check the 5 volt reference circuit for an open or short to ground. 3. If the 5 volt reference circuit is open or shorted to ground, repair it as necessary. Was the 5 volt reference circuit open or shorted to ground?	—	Verify repair	Go to *Step 7*
7	Check the 5 volt reference circuit for a poor connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 11*

DTC P0107 – MAP Sensor Circuit Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF." 2. Disconnect the PCM, and check the MAP signal circuit for an open, short to ground, or short to the sensor ground circuit. 3. If the MAP sensor signal circuit is open or shorted to ground, repair it as necessary. Was the MAP signal circuit open or shorted to ground?	—	Verify repair	Go to *Step 9*
9	Check the MAP sensor signal circuit for a poor connection at the PCM and the MAP sensor; replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 11*
10	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0108 MAP Sensor Circuit High Voltage



D06RY00165

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the key “ON,” engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM monitors the MAP signals for voltages outside the normal range of the MAP sensor. If the PCM detects a MAP signal voltage that is excessively high, DTC P0108 will be set.

Conditions for Setting the DTC

- No TP sensor DTCs present.
- Engine is running for more than 10 seconds.
- Throttle position is below 3% if engine speed is below 1000 RPM.
- Throttle position is below 10% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure above 80 kPa for a total of approximately 10 seconds over a 16-second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will default to a BARO value of 79.3 kPa.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0108 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0108 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- The MAP sensor shares a 5 Volt reference with the Fuel Tank Pressure Sensor (Vapor Pressure Sensor). If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the Fuel Tank Pressure Sensor, the ECT sensor, and the Transmission Fluid Temperature sensor.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0108 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1108 Diagnostic Chart may isolate the cause of the fault.

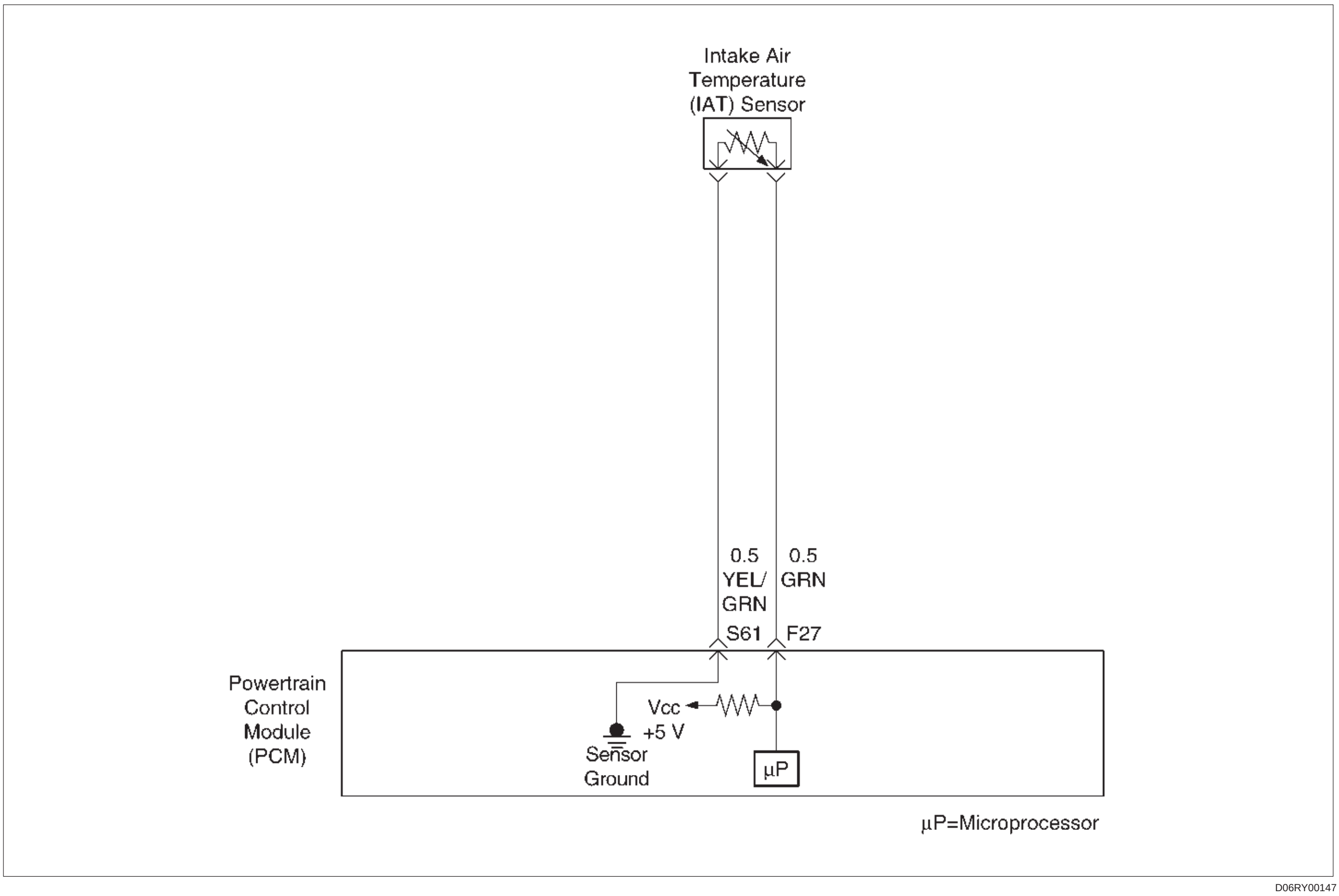
DTC P0108 – MAP Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. If the engine idle is rough, unstable or incorrect, repair the idle problem before using this chart. Refer to *Symptoms* section. 2. With the engine idling, note the MAP value on the Tech 2. Is the MAP reading above the specified value?	90 kPa	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0108. Does the Tech 2 indicate DTC P0108 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF." 2. Disconnect the MAP sensor electrical connector. 3. Ignition "ON." 4. Note the MAP sensor voltage displayed on the Tech 2. (If no, start with diagnostic chart for other sensors in the circuit and see if 5V returns.) Is the MAP sensor voltage at the specified value?	11 kPa 0.0 V	Go to *Step 5*	Go to *Step 6*
5	Probe the sensor ground circuit with a test light to B+. Is the test light "ON?"	—	Go to *Step 7*	Go to *Step 9*
6	1. Check the MAP signal circuit for a short to voltage or a short to the 5 volt reference circuit. 2. If the MAP sensor signal circuit is shorted, repair circuit as necessary. Was the MAP sensor signal circuit shorted?	—	Verify repair	Go to *Step 11*
7	1. Check for a poor sensor ground terminal connection at the MAP sensor electrical connector. 2. If a problem if found, replace the faulty terminal. Did the terminal require replacement?	—	Verify repair	Go to *Step 8*
8	Check for a plugged or leaking vacuum supply to the MAP sensor. Is the vacuum supply plugged or leaking?	—	Verify repair	Go to *Step 12*
9	1. Check for a poor sensor ground terminal connection at the PCM. 2. If a problem is found, replace the faulty terminal. Did the terminal require replacement?	—	Verify repair	Go to *Step 10*

DTC P0108 – MAP Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check the continuity of the MAP sensor ground circuit. 2. If the MAP sensor ground circuit measures over 5 ohms, repair open or poor connection. Was a condition found and corrected?	—	Verify repair	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify Repair	—
12	Replace the MAP sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0112 IAT Sensor Circuit Low Voltage



Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower, causing the PCM to monitor a lower voltage. DTC P0112 will set when the PCM detects an excessively low signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 2 minutes.
- Vehicle speed is greater than 30 mph (48 km/h) .
- IAT signal voltage indicates and intake air temperature greater than 148°C (298°F) (about 5 volts) for a total of 12.5 seconds over a 25-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0112 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0112 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-bout terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

If DTC P0112 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.

3. If DTC P0112 can be repeated only by duplicating the Failure Records condition, refer to the *Temperature vs. Resistance Value* table. The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a “shifted” sensor that may be stored above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

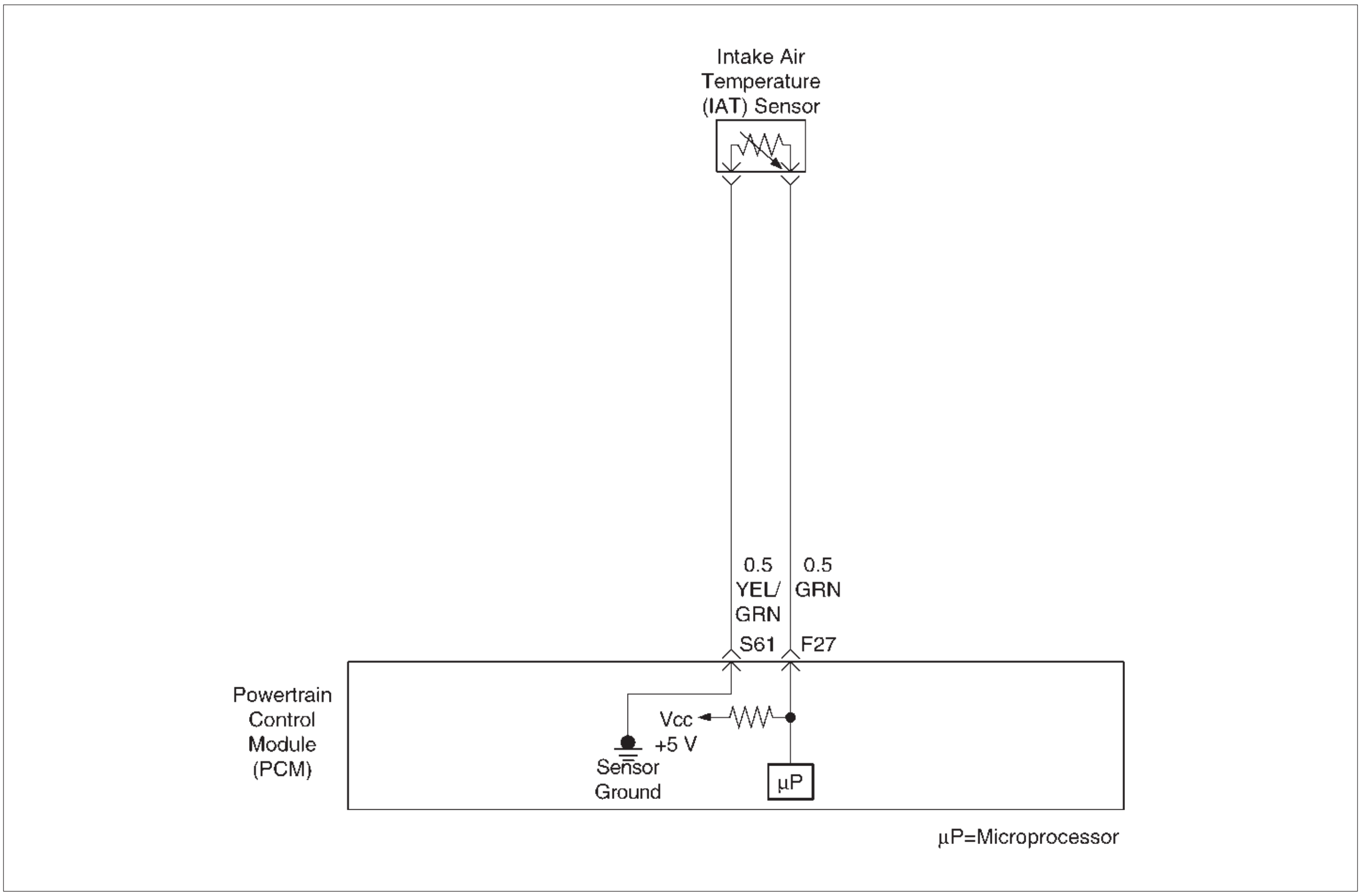
Intake Air Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P0112–IAT Sensor Circuit Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. Using a Tech 2, monitor the intake air temperature (IAT). Is the intake air temperature greater than the specified value?	148˚C (283˚F)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF." Review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor the "DTC" info for DTC P0112. Does the Tech 2 indicate DTC P0112 failed this ignition?	—	Refer to *Test Description*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF." 2. Disconnect the IAT sensor electrical connector. 3. Ignition "ON." 4. Observe the intake air temperature on the Tech 2. Is the intake air temperature below the specified value?	–38˚C (–36˚F)	Go to *Step 6*	Go to *Step 5*
5	1. Ignition "OFF." 2. Disconnect the PCM electrical connectors. 3. Check the IAT sensor signal circuit for a short to ground. Is the IAT sensor signal circuit shorted to ground?	—	Verify repair	Go to *Step 7*
6	Replace the IAT sensor. Is the action complete?	—	Verify repair	—
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0113 IAT Sensor Circuit High Voltage



D06RY00147

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. DTC P0113 will set when the PCM detects an excessively high signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 4 minutes.
- Vehicle speed is less than 20 mph (32 km/h).
- ECT signal temperature is above 60°C (140°F).
- Mass air flow is less then 20 g/second.
- IAT signal voltage indicates an intake air temperature less than –39°C (–38°F) for total of 12.5 seconds over a 25-second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0113 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0113 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- The IAT sensor shares a ground with the EGR position sensor and the TP sensor. Check the ground if these DTC’s are set.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

If DTC P0113 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Verifies that the fault is present.
3. If DTC P0113 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Values" table. The table may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be open above or below a certain temperature. If this is the case, replace the IAT sensor. If the IAT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

Intake Air Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

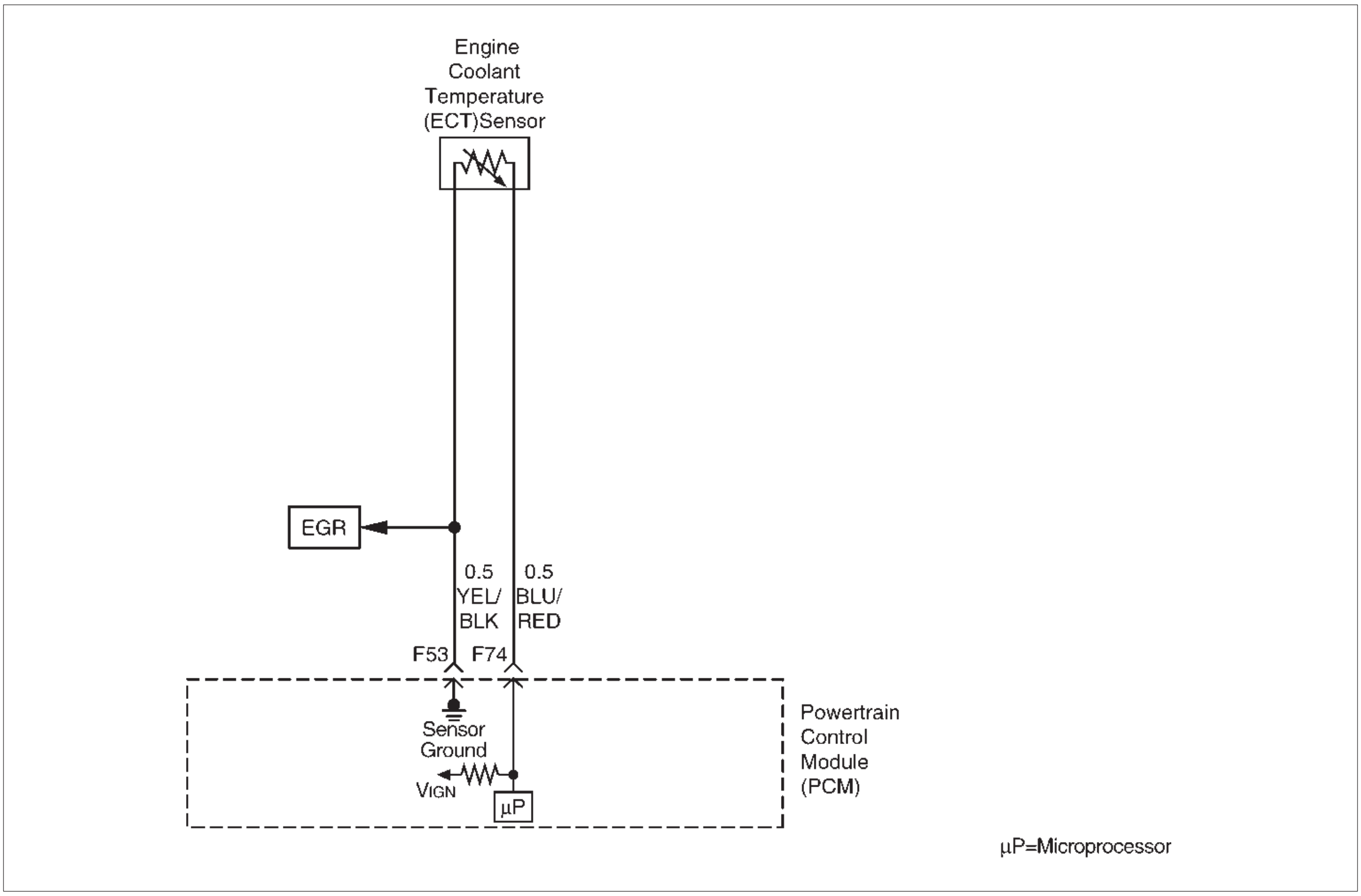
DTC P0113 –IAT Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Ignition "ON," engine "OFF." Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" below the specified value?	–38°C (–36°F)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data parameters. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0113. Does the Tech 2 indicate DTC P0113 failed?	—	Refer to *Test Description*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF." 2. Disconnect the IAT sensor electrical connector. 3. Jumper the IAT signal circuit and the sensor ground circuit together at the IAT sensor harness connector. 4. Ignition "ON." 5. Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" at the specified value?	140°C (284°F)	Go to *Step 6*	Go to *Step 5*
5	1. Jumper the IAT signal circuit at the IAT sensor harness connector to chassis ground. 2. Observe the "Intake Air Temp" display on the Tech 2. Is the "Intake Air Temp" at the specified value?	140°C (284°F)	Go to *Step 7*	Go to *Step 8*

DTC P0113 –IAT Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
6	Check for poor connections at the IAT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 10*
7	1. Ignition "OFF." 2. Disconnect the PCM, and check the IAT sensor ground circuit for an open. 3. If the IAT sensor ground circuit is open, repair it as necessary. Was the IAT sensor ground circuit open?	—	Verify repair	Go to *Step 9*
8	1. Ignition "OFF." 2. Disconnect the PCM, and check the IAT signal circuit for an open. 3. If the IAT sensor signal circuit is open, repair it as necessary. Was the IAT signal circuit open?	—	Verify repair	Go to *Step 9*
9	Check for a poor sensor ground or IAT signal circuit terminal connection at the PCM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to *Step 11*
10	Replace the IAT sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0117 ECT Sensor Circuit Low Voltage



D06RY00148

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted on a coolant crossover pipe at the front of the engine. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes lower, and the ECT signal voltage measured at the PCM drops. With a fully warmed-up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts.

Conditions for Setting the DTC

- Engine running time is longer than one minute.
- The ECT sensor signal indicates an engine coolant temperature greater than 150°C (302°F) (about 0.10 V) for a total of 50 seconds over a 100–second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start-up intake air temperature and running time.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0117 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0117 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If DTC P0117 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1114 Diagnostic Chart may isolate the cause of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.
3. If DTC P0117 can be repeated only by duplicating the Failure Records conditions, refer to the “Temperature vs. Resistance Values” table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a “shifted” sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

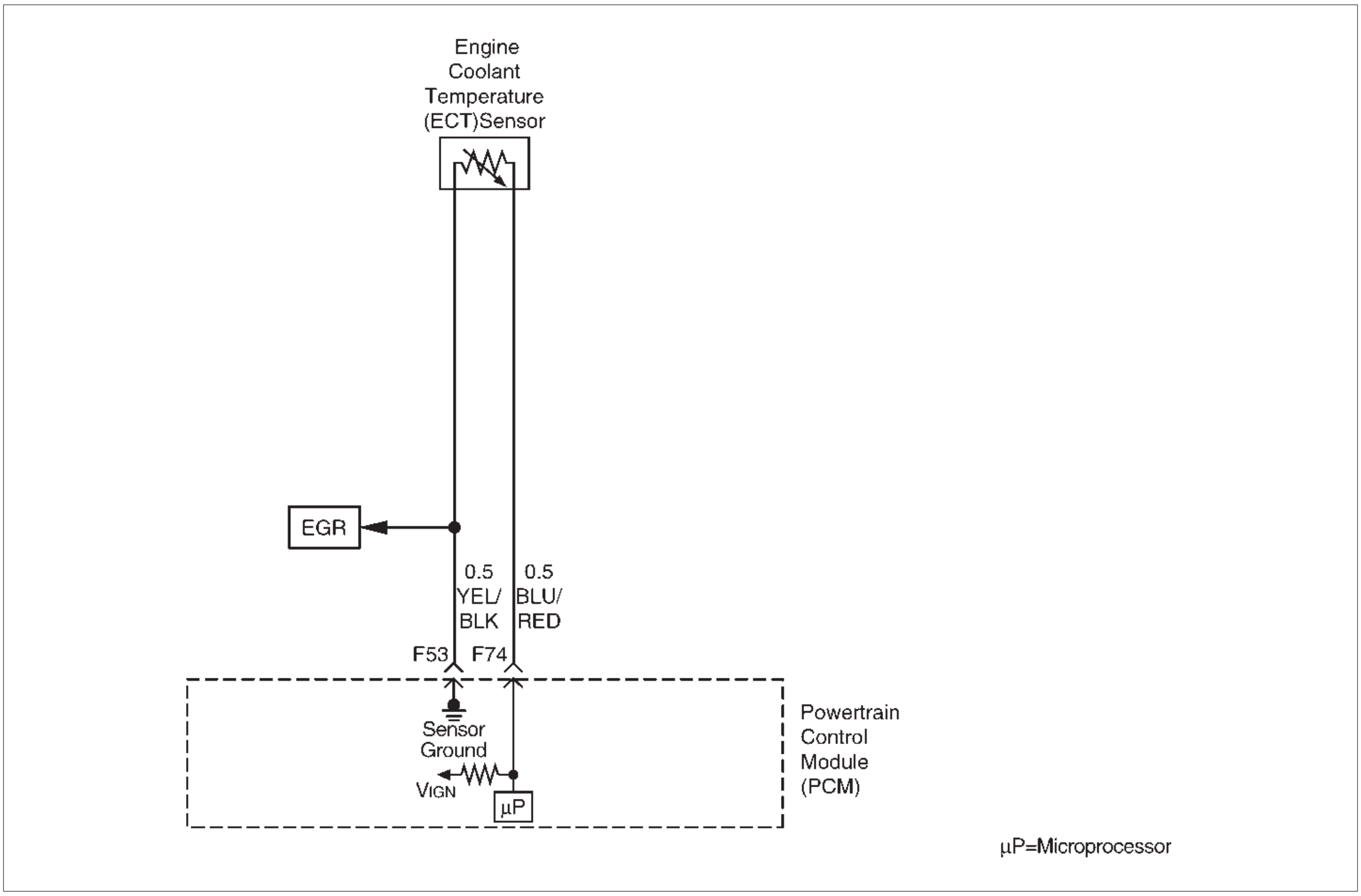
Engine Coolant Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P0117 – ECT Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" below the specified value?	139°C (282°F)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0117. Does the Tech 2 indicate DTC P0117 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Disconnect the ECT sensor electrical connector. 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" at the specified value?	–39°C (–38°F)	Go to *Step 6*	Go to *Step 5*
5	1. Ignition "OFF." 2. Disconnect the PCM and check the ECT signal circuit for a short to ground or a short to the sensor ground circuit. 3. If the ECT signal circuit is shorted. repair it as necessary. Was the ECT signal circuit shorted to ground?	—	Verify repair	Go to *Step 7*
6	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0118 ECT Sensor Circuit High Voltage



D06RY00148

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in on a coolant crossover pipe at the front of the engine. The powertrain control module (PCM) applies a voltage (about 5 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed-up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts.

Conditions for Setting the DTC

- Engine running time is longer than 1.5 minutes.
- The ECT sensor signal indicates an engine coolant temperature of –39˚C (–38˚F) or less (about 5 volts) for a total of 50 seconds over a 100-second period.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will substitute the ECT reading with a default engine coolant temperature value. The default value is based on start-up intake air temperature and running time.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0118 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0118 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

The ECT shares a ground with the Transmission Fluid Temperature sensor, the Fuel Tank Pressure sensor, and the MAP sensor.

Check the ground if these DTCs are also set.

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

If DTC P0118 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage since the DTC was last set. If it is determined that the DTC occurs intermittently, performing the DTC P1115 Diagnostic Chart may isolate the cause of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.
3. If DTC P0118 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Value" table. The table may be used to test the ECT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the ECT sensor. If the ECT sensor appears to be OK, the fault is intermittent; refer to *Diagnostic Aids*.

Engine Coolant Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

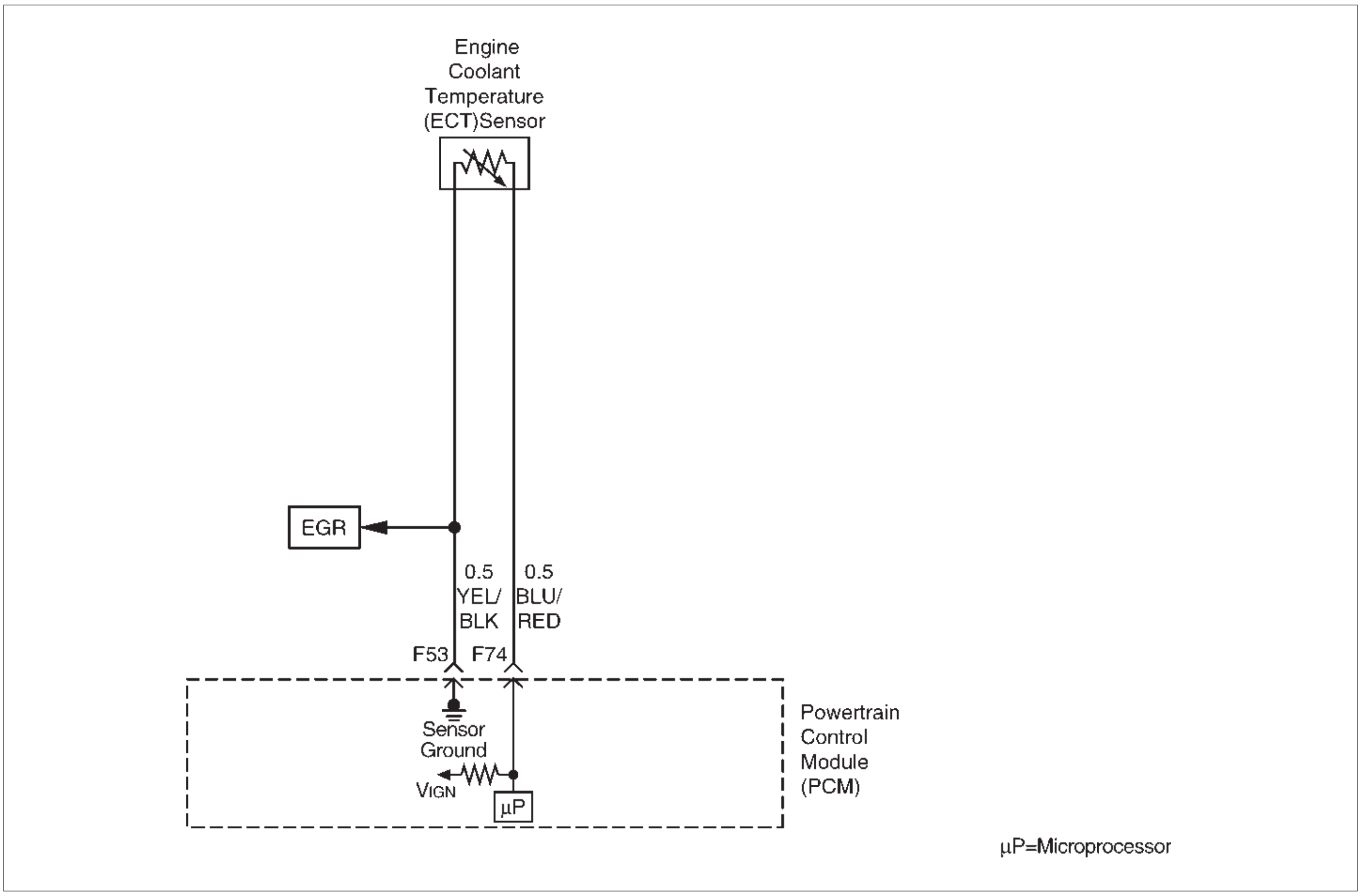
DTC P0118 – ECT Sensor Circuit High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" below the specified value?	–39˚C (–38˚F)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor the "DTC" info for DTC P0118. Does the Tech 2 indicate DTC P0118 failed?	—	Refer to *Test Description*	Refer to *Diagnostic Aids*
4	1. Disconnect the ECT sensor electrical connector. 2. Jumper the ECT signal circuit and the sensor ground circuit together at the ECT sensor harness connector. 3. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" at the specified value?	140˚C (284˚F)	Go to *Step 6*	Go to *Step 5*
5	1. Jumper the ECT signal circuit at the ECT sensor harness connector to chassis ground. 2. Observe the "Eng Cool Temp" display on the Tech 2. Is the "Eng Cool Temp" at the specified value?	140˚C (284˚F)	Go to *Step 7*	Go to *Step 8*
6	Check for poor connections at the ECT sensor and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 10*

DTC P0118 – ECT Sensor Circuit High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition "OFF." 2. Disconnect the PCM, and check the ECT sensor ground circuit for an open. 3. If the ECT sensor ground circuit is open, repair it as necessary. Was the ECT sensor ground circuit open?	—	Verify repair	Go to *Step 9*
8	1. Ignition "OFF." 2. Disconnect the PCM, and check the ECT signal circuit for an open. 3. If the ECT sensor signal circuit is open, repair it as necessary. Was the ECT signal circuit open?	—	Verify repair	Go to *Step 9*
9	Check for a poor sensor ground or ECT signal circuit terminal connection at the PCM and replace terminal(s) if necessary. Did any of the terminals need to be replaced?	—	Verify repair	Go to *Step 11*
10	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0125 ECT Excessive Time to Closed Loop Fuel Control



D06RY00148

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. When the vehicle is first started, the powertrain control module (PCM) controls fuel delivery in “open loop,” ignoring the heated oxygen sensor (HO2S) signals and calculating air/fuel ratio based on inputs from the engine coolant temperature, throttle position, and mass air flow sensors. The PCM will begin using the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals for controlling fuel delivery under “closed loop” conditions when the following conditions have been met:

- The HO2S output signals are varying, indicating that the sensors are hot enough to operate properly.
- The engine coolant temperature sensor indicates coolant temperature above 50˚C (122˚F).
- Time since start-up is at least 16 seconds for a warm engine or 23 seconds for a cold engine.

Conditions for Setting the DTC

- No active IAT or ECT DTC(s) are present.
- Engine is running.
- Vehicle speed is greater than 5 mph (8 km/h) .
- Intake air temperature is greater than –10˚C (14˚F) 0˚C (32˚F).
- Start–up engine coolant temperature is between –10˚C (–14˚F) and 28˚C (82˚F).
- For a warm engine (intake air temperature is greater than 10˚C/50˚F), engine coolant temperature sufficient to allow “closed loop” operation (50˚C/122˚F) is not achieved within 2 minutes of start-up. For a cold engine (intake air temperature between (–7˚C and 10˚C), engine coolant temperature sufficient to allow “closed loop” operation (50˚C/122˚F) is not achieved within 10 minutes of start-up.
- The above condition fails 20 consecutive times.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0125 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0125 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

DTC P0125 set indicates a faulty ECT sensor. Comparing the engine coolant temperature displayed on a Tech 2 with actual coolant temperature measured with a thermometer may isolate this condition. If the displayed engine coolant temperature is not close to the actual coolant temperature, replace the ECT sensor.

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0125 cannot be duplicated, the information included in the Failure Records data can be useful in determining vehicle mileage wince the DTC was last set.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Comparing the engine coolant temperature displayed on a Tech 2 with actual coolant temperature measured with a thermometer may isolate this condition. If the displayed engine coolant temperature is not close to the actual coolant temperature, replace the ECT sensor. If the temperatures are close, the fault is intermittent; refer to *Diagnostic Aids*.

Engine Coolant Temperature

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

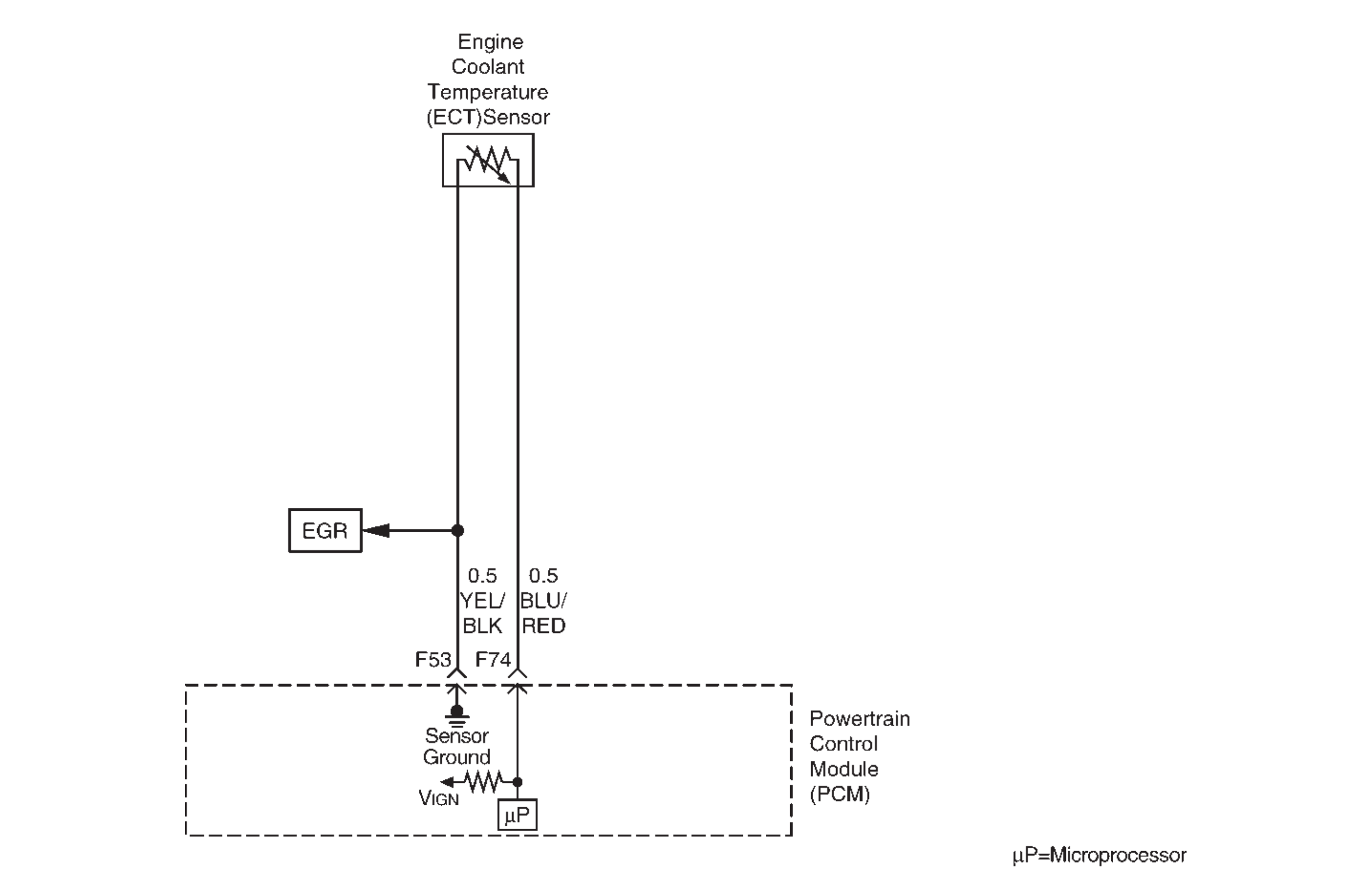
DTC P0125 –ECT Excessive Time to Closed Loop Fuel Control

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any ECT sensor DTCs set?	—	Go to applicable ECT sensor DTC chart	Go to *Step 3*
3	1. Allow the engine to cool completely. 2. Check the cooling system coolant level (refer to *Cooling and Radiator*). Is the coolant level OK?	—	Go to *Step 4*	Go to *Step 9*
4	1. Start the engine. 2. With the engine idling, monitor “ENG COOL TEMP” display on the Tech 2. Does “ENG COOL TEMP” increase to above the specified value within 2 minutes?	21˚C (70˚F)	Refer to *Diagnostic Aids*	Go to *Step 5*
5	Check for proper operation of the thermostat (refer to *Cooling and Radiator*). Is the thermostat operating correctly?	—	Go to *Step 6*	Go to *Step 9*

DTC P0125 –ECT Excessive Time to Closed Loop Fuel Control (Cont'd)

Step	Action	Value(s)	Yes	No
6	Compare engine coolant temperature displayed on the Tech 2 to the actual coolant temperature measured with a thermometer. (Observe normal precautions when opening the cooling system.) Is the Tech 2 engine coolant temperature indication close to the measured temperature?	—	Go to *Step 9*	Go to *Step 7*
7	1. Ignition "OFF." 2. Disconnect the PCM. 3. Using a DVM, measure the resistance of the ECT at the PCM connector. 4. Compare the DVM reading with the chart in "Test Description." Is the chart value approximately equal to the thermometer reading?	—	Go to *Step 12*	Go to *Step 8*
8	Check for high resistance in wiring related to the ECT sensor. Also, check for poor connections at the ECT sensor and the PCM. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*
9	Refer to *Cooling and Radiator* for cooling system diagnosis and repair condition as necessary. Is the action complete?	—	Verify repair	—
10	Replace the faulty terminal(s) or repair faulty wiring as necessary. Is the action complete?	—	Verify repair	—
11	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code(DTC)
P0128 Thermostat Insufficient temperrature for Stable Opreation



D06RY00148

Circuit Description

- The engine coolant temperature (ECT) sensor thermistor mounted on a coolant crossover pipe at the front of the engine.

  This code determines if system has insufficient coolant temperatures for stable operation.

Conditions for setting the DTC

- Engine running.
- No IAT, ECT and MAF DTCs set.
- No VSS DTC set.

Warm case(Ambient temperature is between 50˚F and 128˚F.):

Time for coolant to reach stabillzed closed loop value is less than 239 sec.

Cold case(Ambient temperature is between 20˚F and 50˚F.):

Time for coolant to reach stabillzed thermostat regulation temperature is more than 263 sec.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp(MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P0128 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P0128 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

  Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM–Inspect harness connectors for backed out terminals,improper mating,broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness for damage.

If the harness appears to be OK,observe the ECT display on the Tech2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

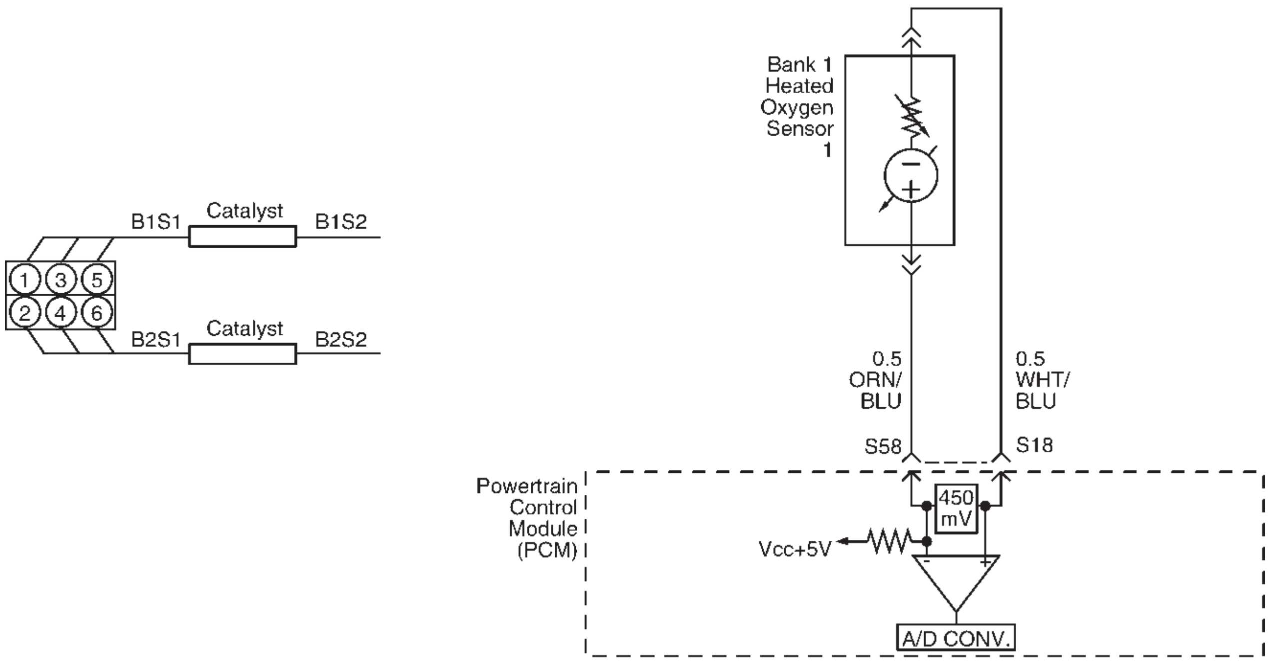
If DTC P0128 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P0128 Diagnostic Chart may isolate the cause of the fault.

Diagnostic Trouble Code (DTC)
P0128 Thermostat Insufficient temperrature for stable opreation

Step	Action	Value(s)	Yes	No
1	Was the “On-Board(OBD)System Check”performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Visually/physically check air duct and water pipe for splits, kinks,and proper conections and routing. 2. If a problem is found,repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 3*
3	1. Remove and check the filter element for dirt or restrictions. 2. Replace the air filter element if necessary. Was a problem found?	—	Verify repair	Go to *Step 4*
4	1. Remove and check the Thermostat for stable opreation. Refer to *6B section.* 2. Replace the thermostat if necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition “ON”,engine “OFF”. 2. Review and record Tech 2 Failure Records. 3. Opreate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0128. Does the Tech 2 indicate DTC P0128 failed this ignition?	—	Go to *Step 6*	Refer to *DiagnosticAids*
6	1. Ignition “ON”, engine “OFF”. 2. Oberve the “Eng Cool Temp”display on the Tech 2. Is the “Eng Cool Temp” below the specified value?	139°C (282°F)	Verify repair	Go to *Step 7*
7	1. Ignition “OFF”. 2. Disconnect the PCM and check the ECT signal circuit for a short to ground or a short to the sensor ground circuit. 3. If the ECT signal circuit is shorted,repair it as necessary. Was a problem found?	—	Verify repair	Refer to *Diag-nostic* Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0131 HO2S Circuit Low Voltage Bank 1 Sensor 1



D06RY00136

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 350 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively low for an extended period of time, DTC P0131 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Vehicle is operating in "closed loop."
- Engine coolant temperature is above 60°C (140°F).
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 1 signal voltage remains below 22 mV during normal "closed loop" operation for a total of 77 seconds over a 90-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0131 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0131 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be routed incorrectly and contacting the exhaust system.
- Poor PCM to engine block grounds.
- Fuel pressure – The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, If fuel pressure is too low, a DTC P0131 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform "Injector Balance Test."

- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Check for exhaust leaks that may cause a false lean condition to be indicated.
- MAF sensor – The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to step numbers on the diagnostic chart.

3. DTC P0131 failing during operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0131 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

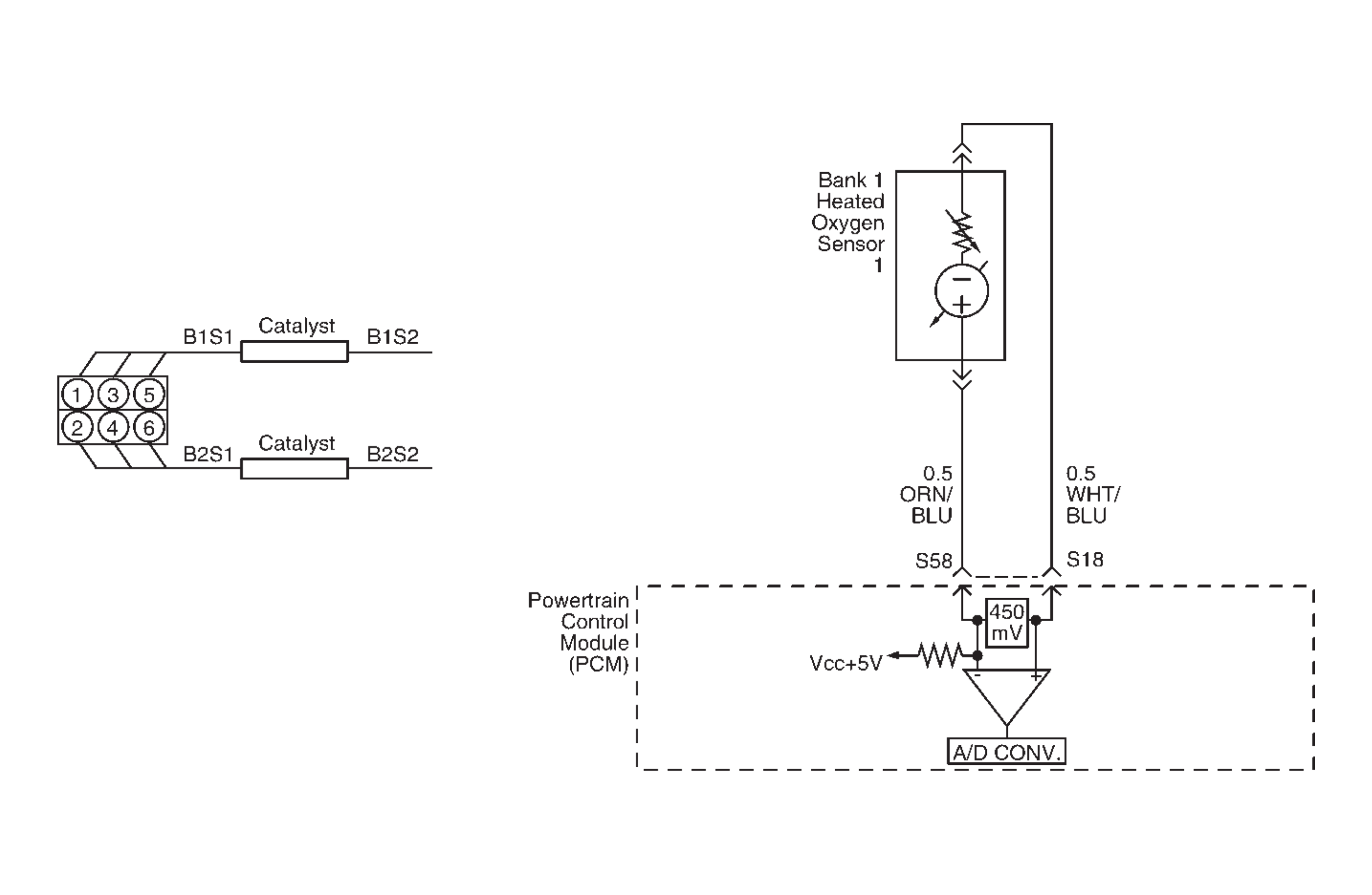
DTC P0131 –HO2S Circuit Low Voltage Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 1 voltage remain below the specified value?	22 mV	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON,” engine “OFF,” review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0131 until the DTC P0131 test runs. Note test result. Does Tech 2 indicate DTC P0131 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Turn the ignition “OFF.” 2. Disconnect the PCM. 3. Check the Bank 1 HO2S 1 high and low circuits for a short to ground or a short to the heater ground circuit. Are the Bank 1 HO2S 1 signal circuits shorted to ground?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the Bank 1 HO2S 1 signal circuit. Is the action complete?	—	Verify repair	—
6	1. Turn the ignition “OFF,” HO2S 1 and PCM disconnected. 2. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to *Step 7*	Go to *Step 8*

DTC P0131 –HO2S Circuit Low Voltage Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition "OFF." 2. Reconnect the PCM, leave the sensor disconnected. 3. Ignition "ON." Does the Tech 2 indicate Bank 1 HO2S 1 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0132 HO2S Circuit High Voltage Bank 1 Sensor 1



D06RY00136

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains excessively high for an extended period of time, DTC P0132 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature is above 60˚C (140˚F)
- “Closed loop” commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 1 signal voltage remains above 952 mV during normal “closed loop” operation for a total of 77 seconds over a 90-second period.

OR

- Bank 1 HO2S 1 signal voltage remains above 500 mV during “deceleration fuel cutoff mode” operation for 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0132 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0132 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check the following items:

- Fuel pressure – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a DTC P0132 may be set. Refer to *Fuel System Diagnosis*.
- Perform “Injector Balance Test” – Refer to *Fuel System Diagnosis*.
- Check the EVAP canister for fuel saturation – If full of fuel, check canister control and hoses. Refer to *Evaporative (EVAP) Emission Control System*.

- MAF sensor –The system can go rich if MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see it the rich condition is corrected. If so, replace the MAF sensor.
- Check for a leak in the fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel. There should be no fuel in the vacuum line.
- An intermittent TP sensor output will cause the system to go rich due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S) –If the HO2S is internally shorted, the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key "ON," engine "OFF." If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit or Faulty HO2S–A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle by monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal circuit wiring and associated terminal conditions.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0132 failing during "deceleration fuel cutoff mode" operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0132 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

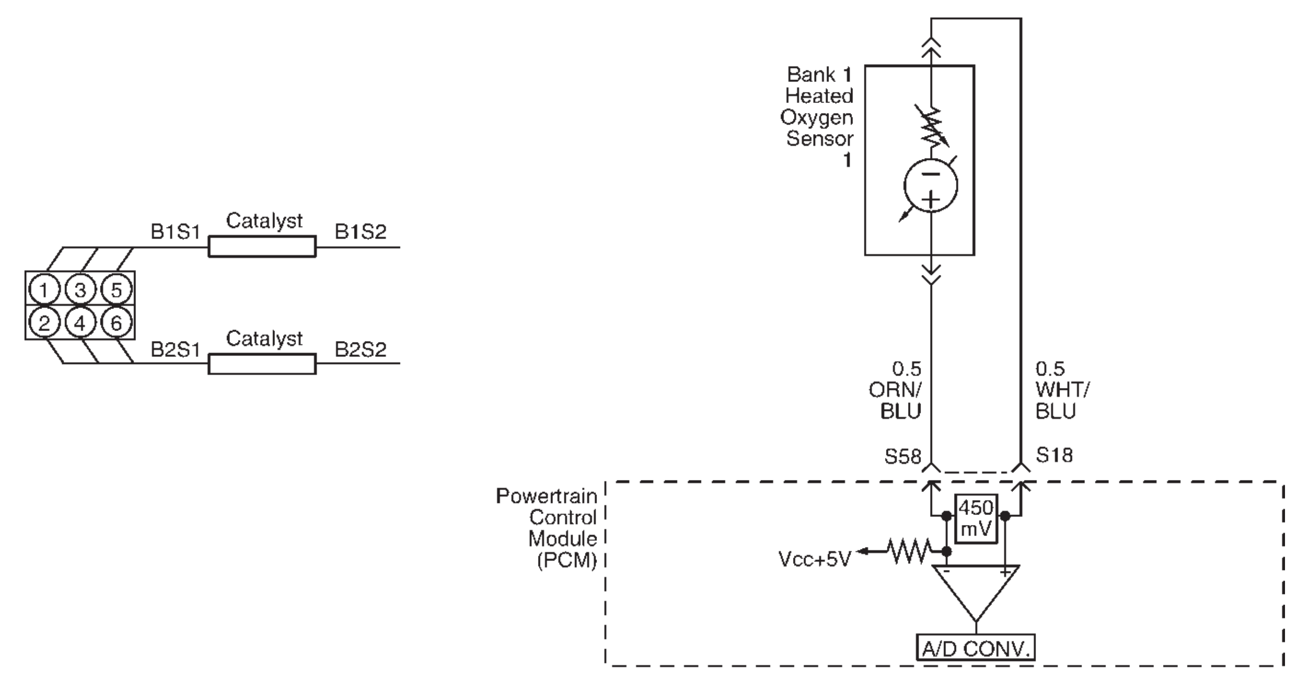
DTC P0132 – HO2S Circuit High Voltage Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Does the Bank 1 HO2S 1 voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cutoff mode)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0132 until the DTC P0132 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0132 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF." 2. Disconnect Bank 1 HO2S 1. 3. Ignition "ON." 4. At HO2S Bank 1 Sensor 1 connector (PCM side) use a DVM to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	3-4 V	Go to *Step 5*	Go to *Step 6*
5	Repair short to voltage in signal circuit. Is the action complete?	—	Verify repair	—

DTC P0132 – HO2S Circuit High Voltage Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition "ON," engine"OFF." 2. At Bank 1 HO2S 1 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage below the specified value?	10 mV	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the jumpers to ground from Bank 1 HO2S 1 PCM-side connector. 2. With the HO2S 1 connector disconnected, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0133 HO2S Slow Response Bank 1 Sensor 1



D06RY00136

Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after "closed loop" has been enabled. During the monitoring period the PCM counts the number of times that a rich-to-lean and lean-to-rich response is indicated and adds the amount of time it took to complete all rich-to-lean transitions and lean-to-rich transitions. With this information, an average time for rich-to-lean and lean-to-rich transitions can be determined. If the average response time of either transition is too slow, a DTC P0133 will be set.

A lean-to-rich transition is indicated when the HO2S voltage changes from less than 300 mV to greater than 600 mV. A rich-to-lean transition is indicated when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is likely to be faulty and should be replaced.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ETC) is above 50˚C (122˚F) for automatic transmission; 75˚C (167˚F) for manual transmission.
- Engine is operating in "closed loop."
- Engine has been running for at least 1 minute.
- Engine speed is between 1500 RPM and 3000 RPM.
- Canister purge duty cycle is greater than 2%.
- Mass air flow is between 9 g/second and 42 g/second.
- All above conditions are met for 3 seconds.
- 90 seconds after "closed loop" has been enabled, Bank1 HO2S 1 average transition time between 300 mV and 600 mV is too slow. The lean-to-rich average transition response time was longer than 94 milliseconds or rich-to-lean average transition response time was longer than 105 milliseconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator Lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0133 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0133 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

If DTC P0133 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is currently present.

3. HO2S transition time, ratio mean volts and switching DTCs set for multiple sensors indicate probable contamination. Before replacing the sensors, isolate and correct the source of the contamination to avoid damaging the replacement sensors.

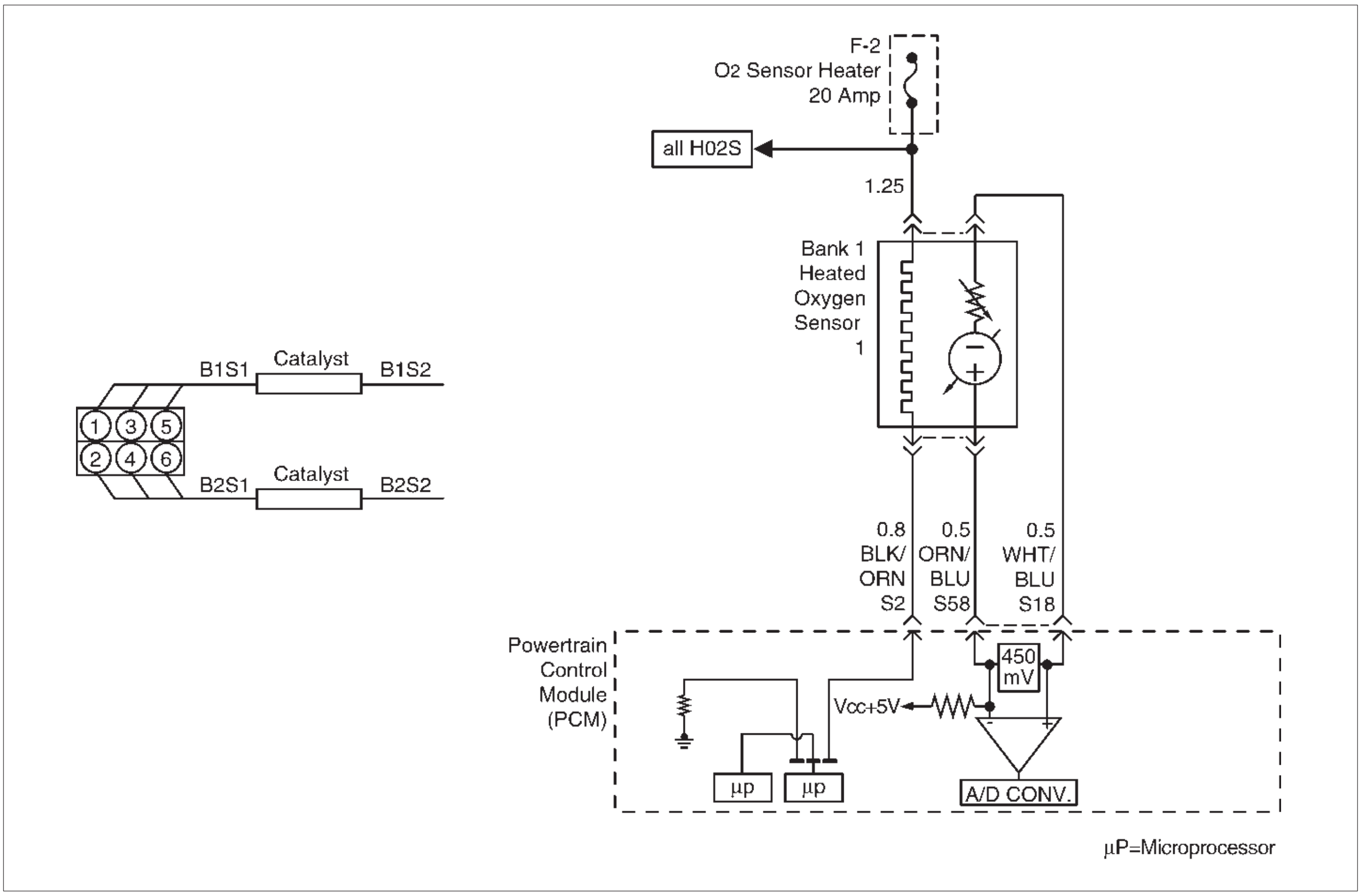
DTC P0133 – HO2S Slow Response Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If any DTCs are set (expect P0153, P1133, P1134, P1153, and/or P1154), refer to those DTCs before proceeding with this diagnostic chart. 1. Install the Tech 2. 2. Idle the engine at operating temperature. 3. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" included in Diagnostic Support. 4. Using a Tech 2, monitor "DTC" info for DTC P0133 until the DTC P0133 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0133 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate DTC P0153, P1133, P1134, P1153, and/or P1154 failed this ignition?	—	Go to *Step 17*	Go to *Step 4*
4	Check for leaks at the pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U–bolt nuts at the leaking joints. Is the action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is the action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 2*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is the action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*
11	Replace the exhaust pipes, as required. Is the action complete?	—	Go to *Step 2*	—
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications to replace the manifold if necessary. Is the action complete?	—	Go to *Step 2*	—

DTC P0133 – HO2S Slow Response Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
14	Visually/physically inspect the following items: • Ensure that the Bank 1 HO2S 1 is securely installed. • Check for corrosion on terminals. • Check terminal tension (at Bank 1 HO2S 1 and at the PCM). • Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to *Step 18*	Go to *Step 15*
15	1. Disconnect Bank 1 HO2S 1. 2. Ignition "ON." 3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. Also measure the voltage between the low signal circuit and ground. Are both voltages in the specified range?	3-4 V	Go to *Step 16*	Go to *Step 19*
16	1. With Bank 1 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition "ON." 3. Using a Tech 2, monitor the Bank 1 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to *Step 21*	Go to *Step 22*
17	Replace the affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. • Fuel contamination. • Use of improper RTV sealant. • Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
18	Repair condition as necessary. Is the action complete?	—	Verify repair	—
19	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to *Step 20*
20	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	—
21	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0134 HO2S Circuit Insufficient Activity Bank 1 Sensor 1



D06RY00135

Circuit Description

- The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) high and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during “closed loop” operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 1 voltage remains at or near the 450 mV bias for an extended period of time, DTC P0134 will be set, indicating an open sensor signal or sensor low circuit.
- Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active.
- Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- No related DTCs.
- Battery voltage is above 10 volts.
- Engine run time is longer than 40 seconds.
- Oxygen sensor heater has been determined to be functioning properly.
- Bank 1 HO2S 1 signal voltage remains between 400 mV and 500 mV for a total of 77 seconds over a 90-second period of time.

Action Take When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- “Open loop” fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0134 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0134 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.

- Faulty HO2S heater or heater circuit – With the ignition “ON,” engine “OFF,” after a cool down period, the HO2S 1 voltage displayed on the Tech 2 is normally 455-460 mV. A reading over 1000 mV indicates a signal line shorted to voltage. A reading under 5 mV indicates a signal line shorted to ground or signal lines shorted together. Disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light for 2 seconds when the ignition is turned on, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test – With the Ignition “ON,” monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. If the DTC P0134 test passes while the Failure Records conditions are being duplicated, an intermittent conditions is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

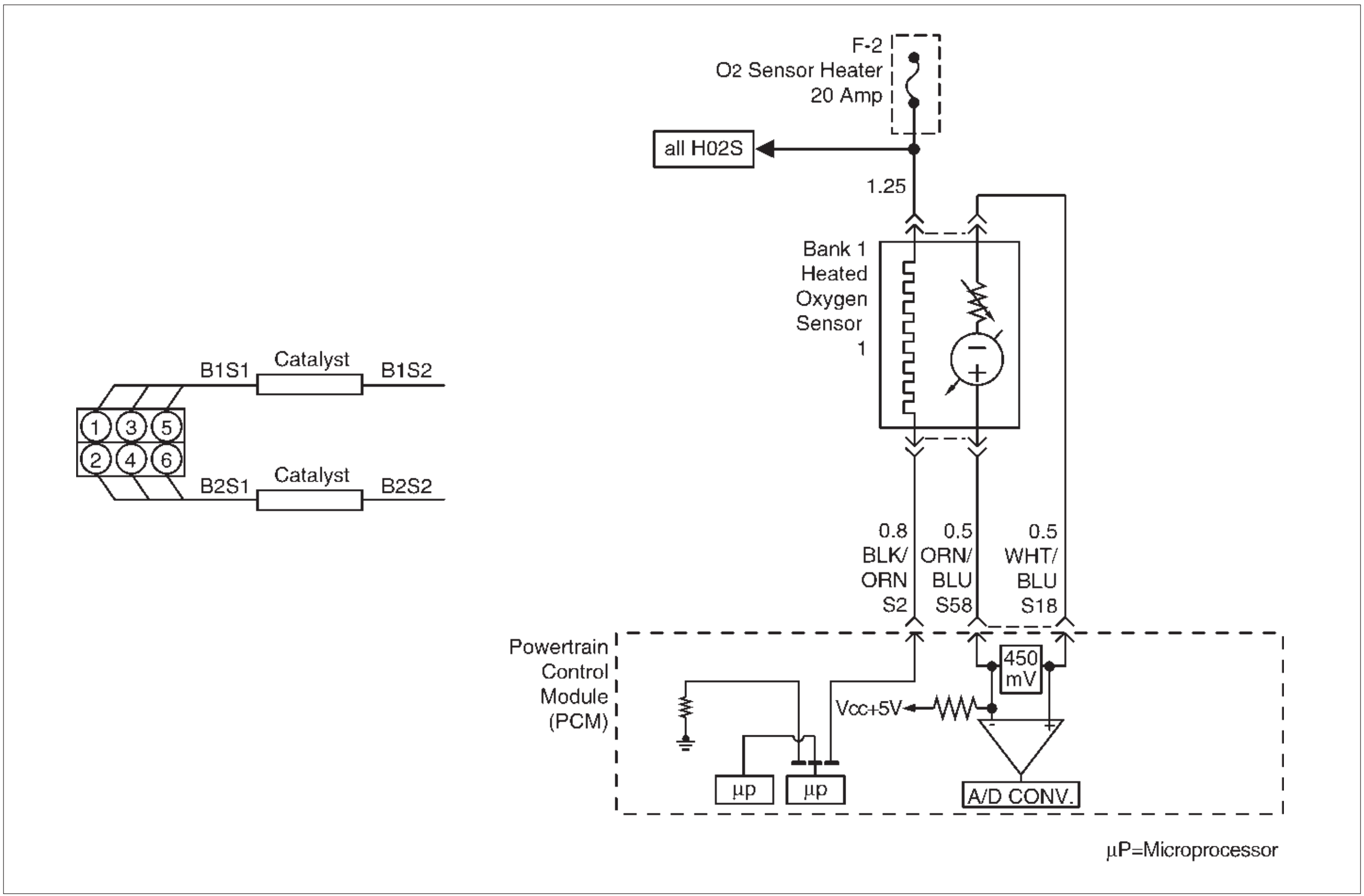
DTC P0134 –HO2S Circuit Insufficient Activity Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 1 HO2S 1 voltage varying outside the specified values?	400-500 mV	Go to *Step 3*	Go to *Step 4*
3	1. Ignition “ON,” engine “OFF,” review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0134 until the DTC P0134 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0134 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Check for a damaged harness. Was a problem found?	—	Verify repair	Go to *Step 5*
5	Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the Bank 1 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 6*
6	Check for poor Bank 1 HO2S 1 high and low circuit terminal connections at the PCM and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 7*
7	1. Ignition “OFF.” 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 high circuit. 3. If the Bank 1 HO2S 1 high circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 1 high circuit problem found and corrected?	—	Verify repair	Go to *Step 8*

DTC P0134 –HO2S Circuit Insufficient Activity Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 low circuit measures over 5 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 1 low circuit problem found and corrected?	—	Verify repair	Go to *Step 9*
9	1. Ignition "ON," engine "OFF." 2. Disconnect Bank 1 HO2S 1 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 1 voltage. Is Bank 1 HO2S 1 voltage in the specified range?	0-10 mV	Go to *Step 10*	Go to *Step 11*
10	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0135 HO2S Heater Circuit Bank 1 Sensor 1



Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine. The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 1 HO2S 1 to become active, a DTC P0135 will set. The time it should take the HO2S to reach operating temperature is based on the accumulated amount of air that has passed through the MAF sensor and into the engine (more accumulated air flow = shorter time to HO2S activity).

Conditions for Setting the DTC

- No related DTCs.
- Intake air temperature (IAT) is less than 32°C (90°F) at start-up.
- Engine coolant temperature (ECT) is less than 32°C (90°F) at start-up.
- IAT and ECT are within 6°C (11°F) of each other at start-up.
- Ignition voltage is between 11 and 18 V.
- Average mass air flow is less than 21 g/second during sample period.
- Bank 1 HO2S 1 voltage does not change more than 150 mV from the bias voltage (between 400 mV and 500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 150 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulate air flow since start-up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0135 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0135 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. Ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. Checks the HO2S heater ground circuit.
6. Checks or an open or shorted HO2S heater element.
10. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

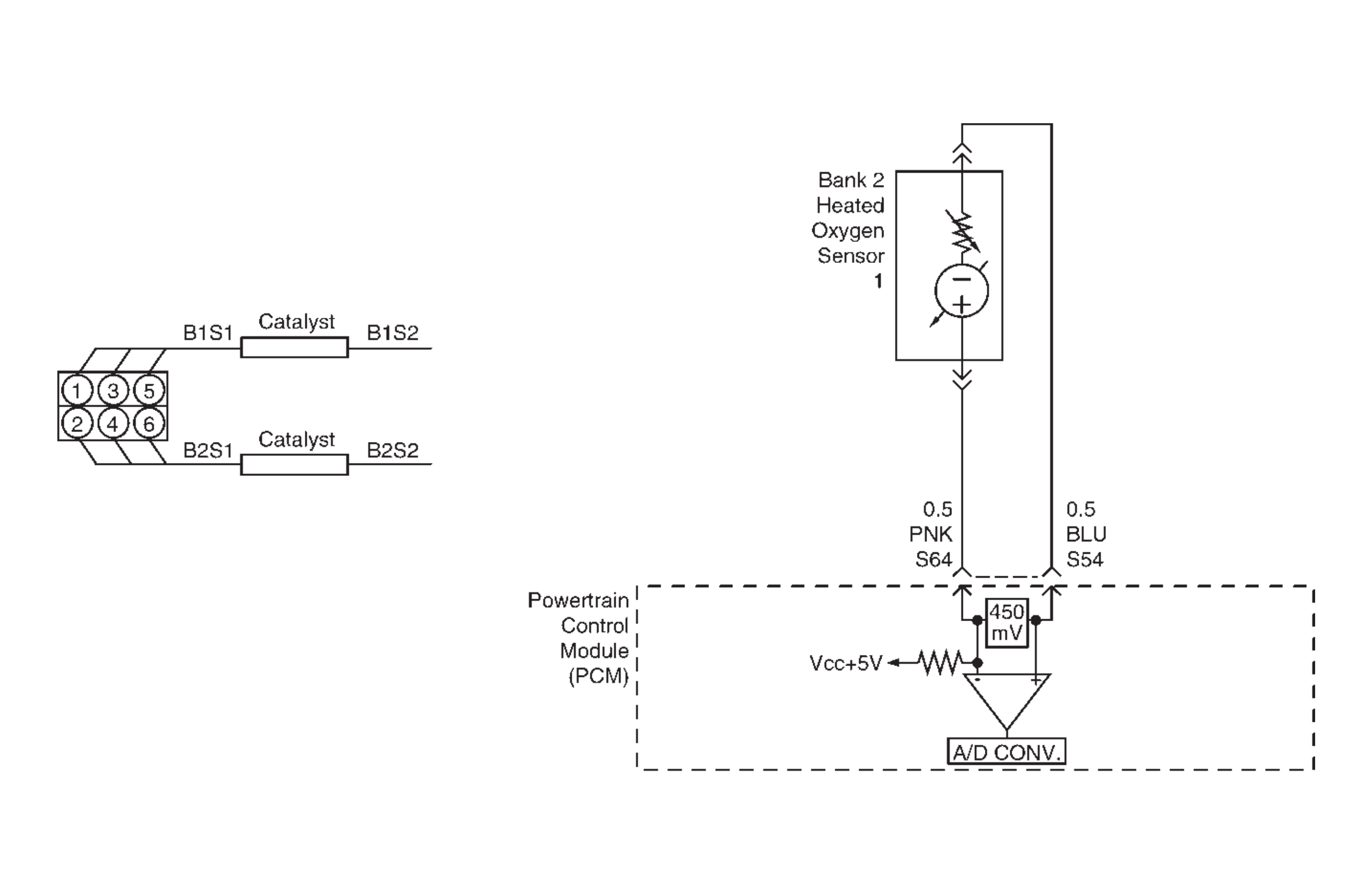
DTC P0135 – HO2S Heater Circuit Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If the engine has just been operating ,allow the engine to cool for at least 15 minutes before proceeding. 1. Remove the fuel pump relay. 2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses. 3. Ignition “OFF.” 4. Install a Tech 2. 5. Ignition “ON,” engine “OFF.” 6. Monitor the Bank 1 HO2S 1 voltage for several minutes. Did the HO2S voltage go from bias voltage to above or below the specified values?	Above 650 mV or below 250 mV	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Inspect the fuse for the Bank 1 HO2S 1 ignition feed. Is the fuse open?	—	Go to *Step 15*	Go to *Step 4*
4	1. Ignition “OFF.” 2. Raise the vehicle. 3. Disconnect the Bank 1 HO2S 1 electrical connector. 4. Using a test light connected to a good ground (do not use Bank 1 HO2S 1 heater ground or Bank 1 HO2S 1 low), probe the ignition feed circuit at the Bank 1 HO2S 1 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to *Step 5*	Go to *Step 7*
5	Connect the test light between the Bank 1 HO2S 1 ignition feed and the Bank 1 HO2S 1 heater ground. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 8*

DTC P0135 – HO2S Heater Circuit Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Allow the HO2S to cool for at least 15 minutes. 2. Using a DVM, measure the resistance between the Bank 1 HO2S 1 ignition feed and the Bank 1 HO2S 1 heater ground at the Bank 1 HO2S 1 pigtail. Is the HO2S heater resistance within the specified values?	3-6 ohms	Go to *Step 9*	Go to *Step 10*
7	Repair the open Bank 1 HO2S 1 ignition feed circuit to Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 1 HO2S 1 heater ground circuit to Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 1 HO2S 1 harness terminals. 2. If a poor connection is found, replace terminals. Was a poor connection found?	—	Verify repair	Go to *Step 10*
10	Check for a poor Bank 1 HO2S 1 high or low circuit terminal connection at the Bank 1 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF." 2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 1 signal circuit and the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 high circuit or HO2S low circuit measures over 5 ohms, repair open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check for a poor Bank 1 HO2S 1 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 13*
13	Check for a poor Bank 1 HO2S 1 high circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
14	Replace the Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in Bank 1 HO2S 1 ignition feed circuit and replace the fault fuse. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0137 HO2S Circuit Low Voltage Bank 1 Sensor 2



D06RY00137

Circuit Description

The powertrain control module (PCM) supplies bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm impedance digital voltmeter, this may display as low as 350 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when the exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 2 signal voltage remains excessively low for an extended period of time, DTC P0137 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in "closed loop."
- Engine coolant temperature is above 60˚C (140˚F).
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 2 signal voltage remains below 22 mV during normal "closed loop" operation for a total of 106 seconds over a 125-second period of time.

OR

- Bank 1 HO2S 2 signal voltage remains below 400 mV during power enrichment mode fuel control operation for up to 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0137 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0137 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and contacting the exhaust system.
- Poor PCM to engine grounds.
- Fuel pressure – A condition which causes a lean exhaust can cause DTC P0137 to set. The system will go lean if pressure is too low. The PCM can

compensate for some decrease. However, if fuel pressure is too low, a DTC P0137 may be set. Refer to *Fuel System Diagnosis*.

- Lean injector(s) – Perform “Injector Balance Test.”
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the DTC P0137 to set. Check for exhaust leaks near the Bank 1 HO2S 2 sensor.
- MAF sensor – The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0137 failing during operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC0137 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

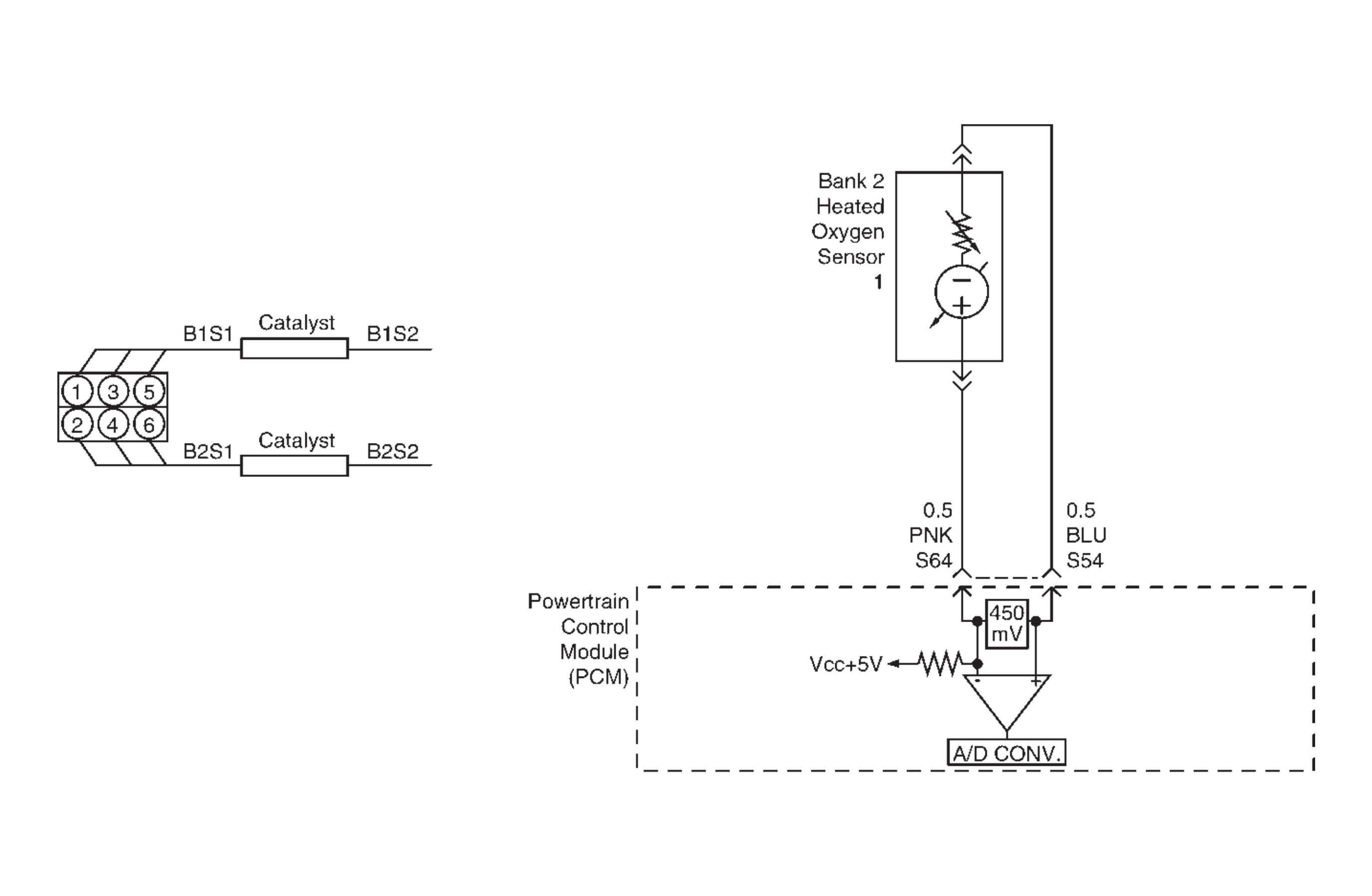
DTC P0137 –HO2S Circuit Low Voltage Bank 1 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Does the Bank 1 HO2S voltage remain below the specified value?	22 mV	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON,” engine “OFF,” review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0137 until the DTC P0137 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0137 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Turn ignition “OFF.” 2. Disconnect the PCM. 3. Check the Bank 1 HO2S 2 high and low signal circuits for a short to ground or a short to the heater ground circuit. Were Bank 1 HO2S 2 signal circuits shorted?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the Bank 1 HO2S 2 signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition “OFF.” 2. Leave the PCM and HO2S 2 disconnected. 3. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to *Step 7*	Go to *Step 8*

DTC P0137 –HO2S Circuit Low Voltage Bank 1 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition "OFF." 2. Reconnect the PCM, leave HO2S 2 disconnected. 3. Ignition "ON." Does the Tech 2 indicate Bank 1 HO2S 2 voltage near the specified value?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0138 HO2S Circuit High Voltage Bank 1 Sensor 2



D06RY00137

Circuit Description

The powertrain control module (PCM) supplies bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when exhaust is rich, down through about 10 mV when the exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 1 HO2S 2 voltage remains excessively high for an extended period of time, DTC P0138 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in "closed loop."
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Engine coolant temperature is above 60°C (140°F).
- Throttle angle is between 3% and 19%.
- Bank 1 HO2S 2 signal voltage remains above 952 mV during normal "closed loop" operation for a total of 106 seconds over a 125-second period of time.

OR

- Bank 1 HO2S 2 signal voltage remains above 500 mV during deceleration fuel cut–off mode operation for up to 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0138 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0138 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Fuel pressure – An excessively rich fuel mixture can cause a DTC P0138 to be set. Refer to *Fuel System Diagnosis*.
- Rich injector(s) – Perform "Injector Balance Test."
- Leaking injector – Refer to *Fuel System Diagnosis*.

- Evaporative emissions (EVAP) canister purge – Check for fuel saturation. If full of fuel, check the canister control and hoses. Refer to *Evaporative Emission (EVAP) Control System*.
- MAF sensor –The system can go rich if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the rich condition is corrected. If so, replace the MAF sensor.
- Check for a leak in fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel. There should be no fuel in the vacuum line.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S) – If the HO2S is internally shorted the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key "ON," engine "OFF." If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit of Faulty HO2S – A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal and wiring and associated terminal connections.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0138 being set during deceleration fuel mode operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0138 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

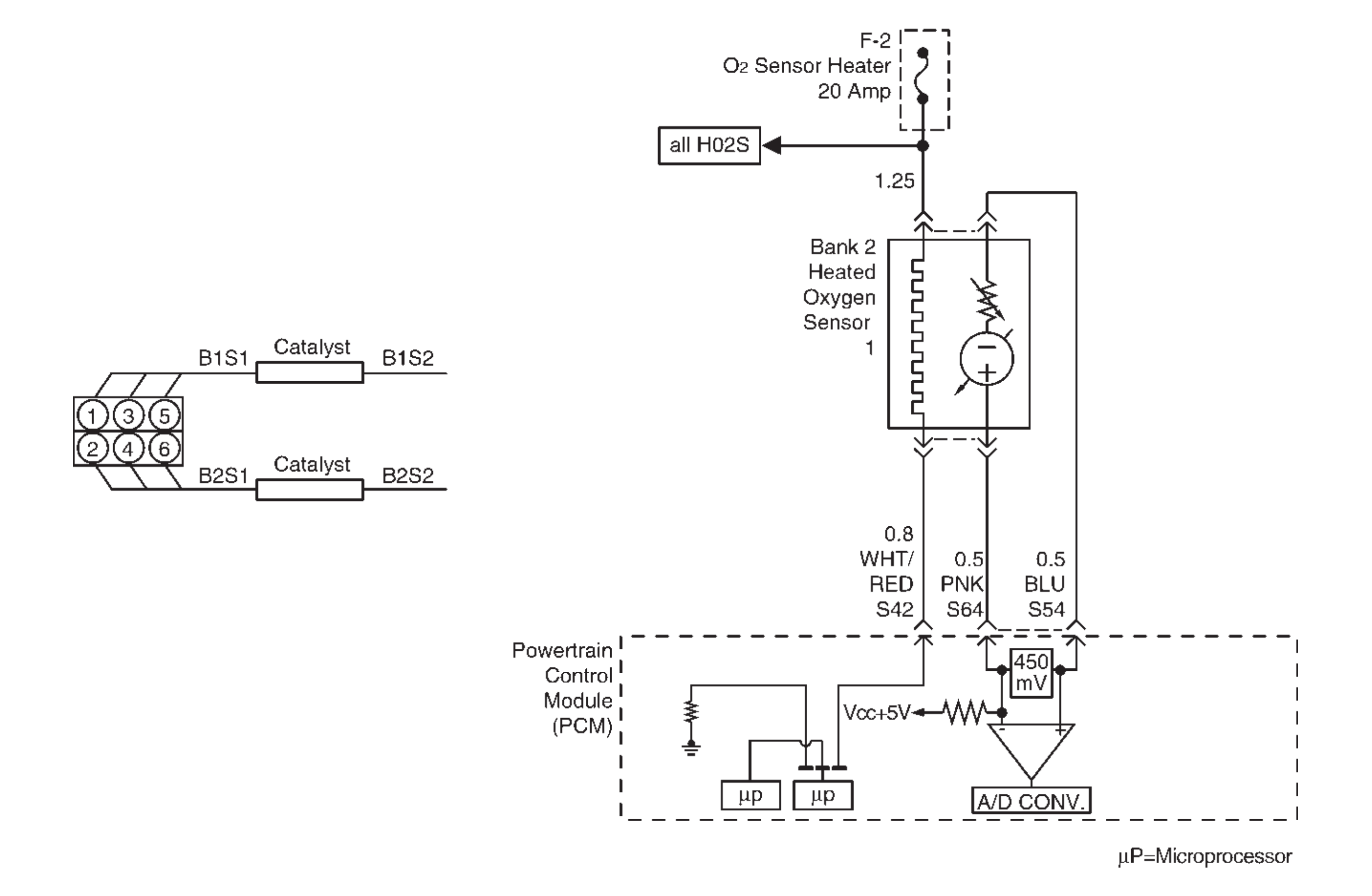
DTC P0138 – HO2S Circuit High Voltage Bank 1 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Does the Bank 1 HO2S voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cutoff mode)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON," review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0138 until the DTC P0138 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0138 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition "OFF." 2. Disconnect Bank 1 HO2S 1. 3. Ignition "ON." 4. At the HO2S Bank 1 Sensor 2 connector (PCM side), use a DVM to measure voltages at the high and low signal terminals. Are the voltages above the specified range?	3-4 V	Go to *Step 5*	Go to *Step 6*

DTC P0138 – HO2S Circuit High Voltage Bank 1 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
5	Repair short to voltage in the signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition "ON," engine"OFF." 2. At Bank 1 HO2S 2 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Is Bank 1 HO2S 2 voltage below the specified value?	10 mV	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the jumpers to ground from Bank 1 HO2S 2 PCM–side connector. 2. With the HO2S 2 connector disconnected, monitor BANK 1 HO2S 2 voltage. Is the Bank 1 HO2S 2 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code(DTC)
P0140 HO2S Circuit Insufficient Activity Bank 1 Sensor 2



D06RY00138

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 2 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the Bank 1 HO2S 2 signal voltage remains between 400 mV and 500 mV for an extended period of time, DTC P0140 will be set. Heated oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- No related DTCs.
- Battery voltage is above 10 volts.
- Engine run time is longer than 40 seconds.
- Oxygen sensor heater is functioning properly.
- Engine is operating in "closed loop"
- Bank 1 HO2S 2 signal voltage remains between 426 mV and 474 mV for a total of 106 seconds over a 125-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Cleaning the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0140 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0140 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness– Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty HO2S heater or heater circuit–With the ignition“ON,” engine “OFF,” the HO2S voltage displayed on a Tech 2 should gradually drop to below 250 mV. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test–With the ignition “ON,” monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number (s) below refer to the step number (s) on the Diagnostic Chart.

3. If the DTC P0140 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

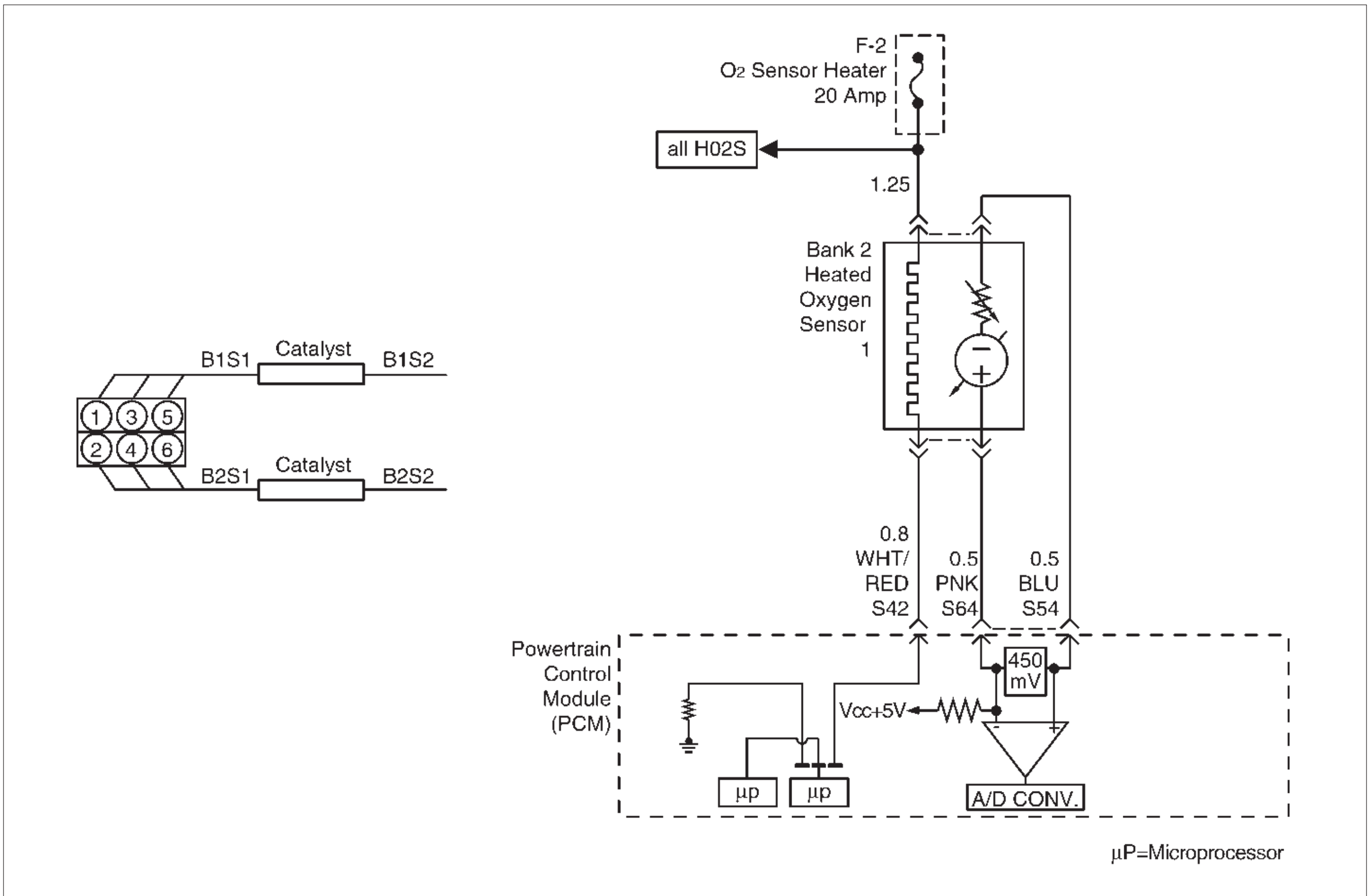
DTC P0140 – HO2S Circuit Insufficient Activity BANK 1 SENSOR 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 1 HO2S 2 voltage varying outside the specified values?	425-475 mV	Go to *Step 3*	Go to *Step 4*
3	1. Ignition “ON,” engine “OFF,” review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0140 until the DTC P0140 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0140 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Check for a damaged harness. Was a problem found?	—	Verify repair	Go to *Step 5*
5	Check for poor Bank 1 HO2S 2 high and low circuit terminal connections at the Bank 1 HO2S 2 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 6*
6	Check for poor Bank 1 HO2S 2 high and low circuit terminal connections at the PCM and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 7*
7	1. Ignition “OFF.” 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 2 high circuit. 3. If the Bank 1 HO2S 2 high circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 2 high circuit problem found and corrected?	—	Verify repair	Go to *Step 8*

DTC P0140 – HO2S Circuit Insufficient Activity BANK 1 SENSOR 2 (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 1 HO2S 2 high circuit. 3. If the Bank 1 HO2S 2 low circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 1 HO2S 2 low circuit problem found and corrected?	—	Verify repair	Go to *Step 9*
9	1. Ignition "ON," engine"OFF." 2. Disconnect Bank 1 HO2S 2 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 1 HO2S 2 voltage. Is Bank 1 HO2S 2 voltage in the specified range?	0-10 mV	Go to *Step 10*	Go to *Step 11*
10	Replace Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0141 HO2S Heater Circuit Bank 1 Sensor 2



D06RY00138

Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for closed loop fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine.

The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the Bank HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 1 HO2S 2 to become active, a DTC P0141 will set. The time it should take the HO2S to reach operating temperature is based on the total amount of air that has passed through the MAF sensor and into the engine (more total airflow = shorter time to HO2S activity).

Conditions for Setting the DTC

- No related DTCs.
- Intake air temperature (IAT) is less than 32°C (90°F) at start-up.
- Engine coolant temperature (ECT) is less than 32°C (90°F) at start-up.
- IAT and ECT are within 6°C (11°F) of each other at start-up.
- Ignition voltage is between 11 volts and 18 volts.
- Average mass airflow is less than 23 g/second during the sample period.
- Bank 1 HO2S 2 voltage does not change more than 150 mV from the bias voltage (between 400 mV–500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 120 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulated air flow since start-up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0141 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0141 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. This ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. This checks the HO2S heater ground circuit.
6. This checks for an open or shorted HO2S heater element.
11. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

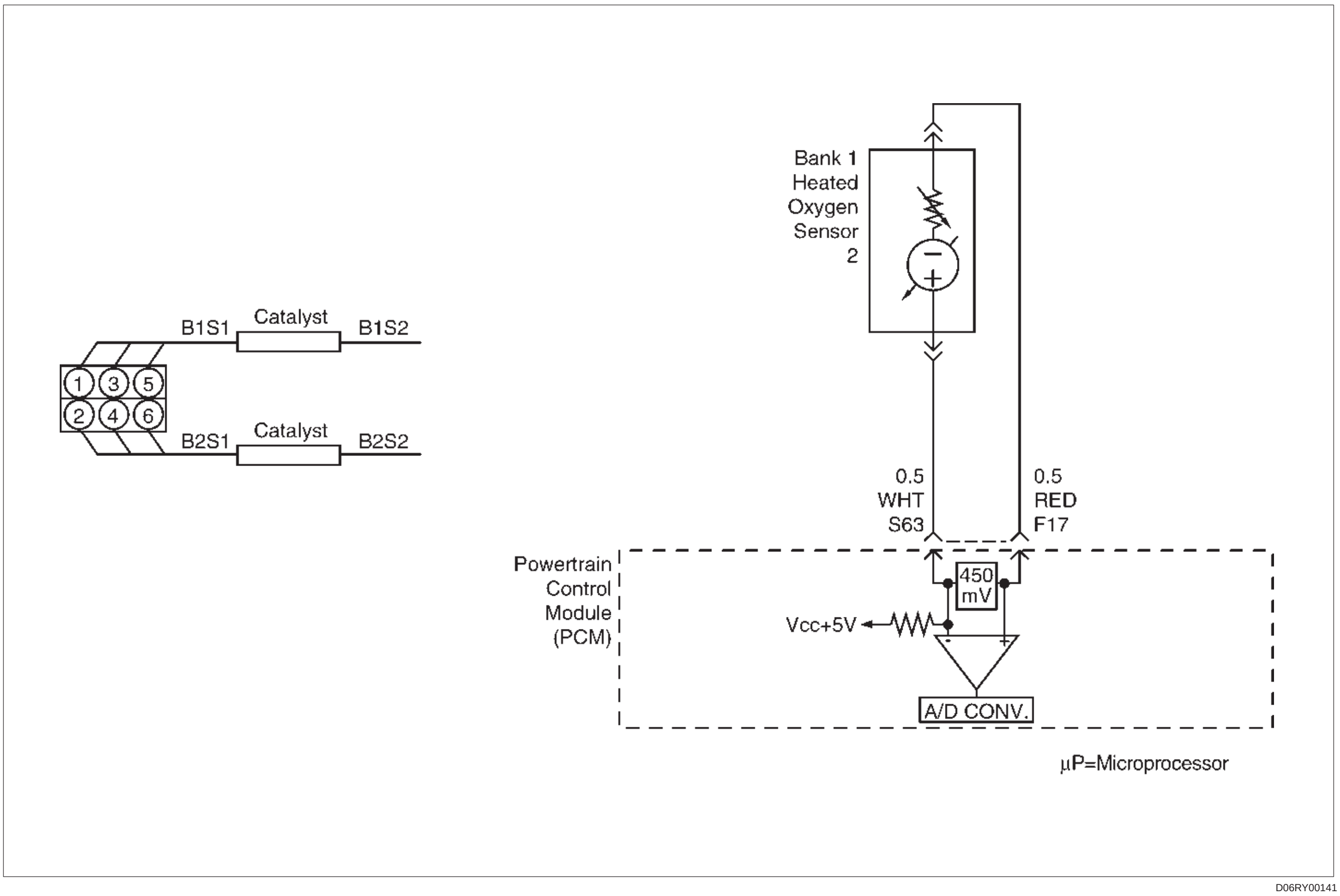
DTC P0141 – HO2S Heater Circuit Bank 1 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If the engine has just been operating, allow the engine to cool for at least 15 minutes before proceeding. 1. Remove the fuel pump relay. 2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses. 3. Ignition “OFF.” 4. Install a Tech 2. 5. Ignition “ON,” engine “OFF.” 6. Monitor the Bank 1 HO2S 1 voltage for several minutes. Did the HO2S voltage go from bias voltage to above or below the specified values?	Above 650 mV or below 250 mV	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Inspect the fuse for Bank 1 HO2S 2 ignition feed. Is the fuse open?	—	Go to *Step 15*	Go to *Step 4*
4	1. Ignition “OFF.” 2. Raise the vehicle. 3. Disconnect the Bank 1 HO2S 2 electrical connector. 4. Using a test light connected to a good ground (do not use Bank 1 HO2S 2 heater ground or Bank 1 HO2S 2 low), probe the ignition feed circuit at the Bank 1 HO2S 2 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to *Step 5*	Go to *Step 7*
5	Connect the test light between the Bank 1 HO2S 2 ignition feed and the Bank 1 HO2S 2 heater ground. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 8*

DTC P0141 – HO2S Heater Circuit Bank 1 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Allow the HO2S to cool for at least 15 minutes. 2. Using a DVM, measure the resistance between the Bank 1 HO2S 2 ignition feed and the Bank 1 HO2S 2 heater ground at the Bank 1 HO2S 2 pigtail. Is the HO2S resistance within the specified values?	3-6 ohms	Go to *Step 9*	Go to *Step 10*
7	Repair the open Bank 1 HO2S 2 ignition feed circuit to Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 1 HO2S 2 heater ground circuit. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 1 HO2S 2 harness terminals. 2. If a poor connection is found, replace the terminals. Was a poor connection found?	—	Verify repair	Go to *Step 10*
10	1. Ignition "OFF." 2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 2 signal circuit and the Bank 1 HO2S 2 low circuit. 3. If the Bank 1 HO2S 2 signal circuit or the HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF." 2. Disconnect the PCM and check the continuity of the Bank 1 HO2S 1 signal circuit and the Bank 1 HO2S 1 low circuit. 3. If the Bank 1 HO2S 1 high circuit or the HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check for a poor Bank 1 HO2S 2 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 13*
13	Check for a poor Bank 1 HO2S 2 high circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
14	Replace Bank 1 HO2S 2. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in Bank 1 HO2S 2 ignition feed circuit and replace the faulty fuse. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0151 HO2S Circuit Low Voltage Bank 2 Sensor 1



Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains excessively low for an extended period of time, DTC P0151 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop."
- Engine coolant temperature is above 60°C (140°F).
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Throttle angle is between 3% and 19%.
- Bank 2 HO2S 1 signal voltage remains below 22 mV during normal "closed loop" operation for a total of 77 seconds over a 90-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0151 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0151 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and contacting the exhaust system.
- Poor PCM to engine block grounds.
- Fuel pressure – The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a DTC P0151 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform "Injector Balance Test."

- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the system to appear lean. Check for exhaust leaks that may cause a false lean condition to be indicated.
- MAF sensor –The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the lean condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0151 failing during operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0151 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicate.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

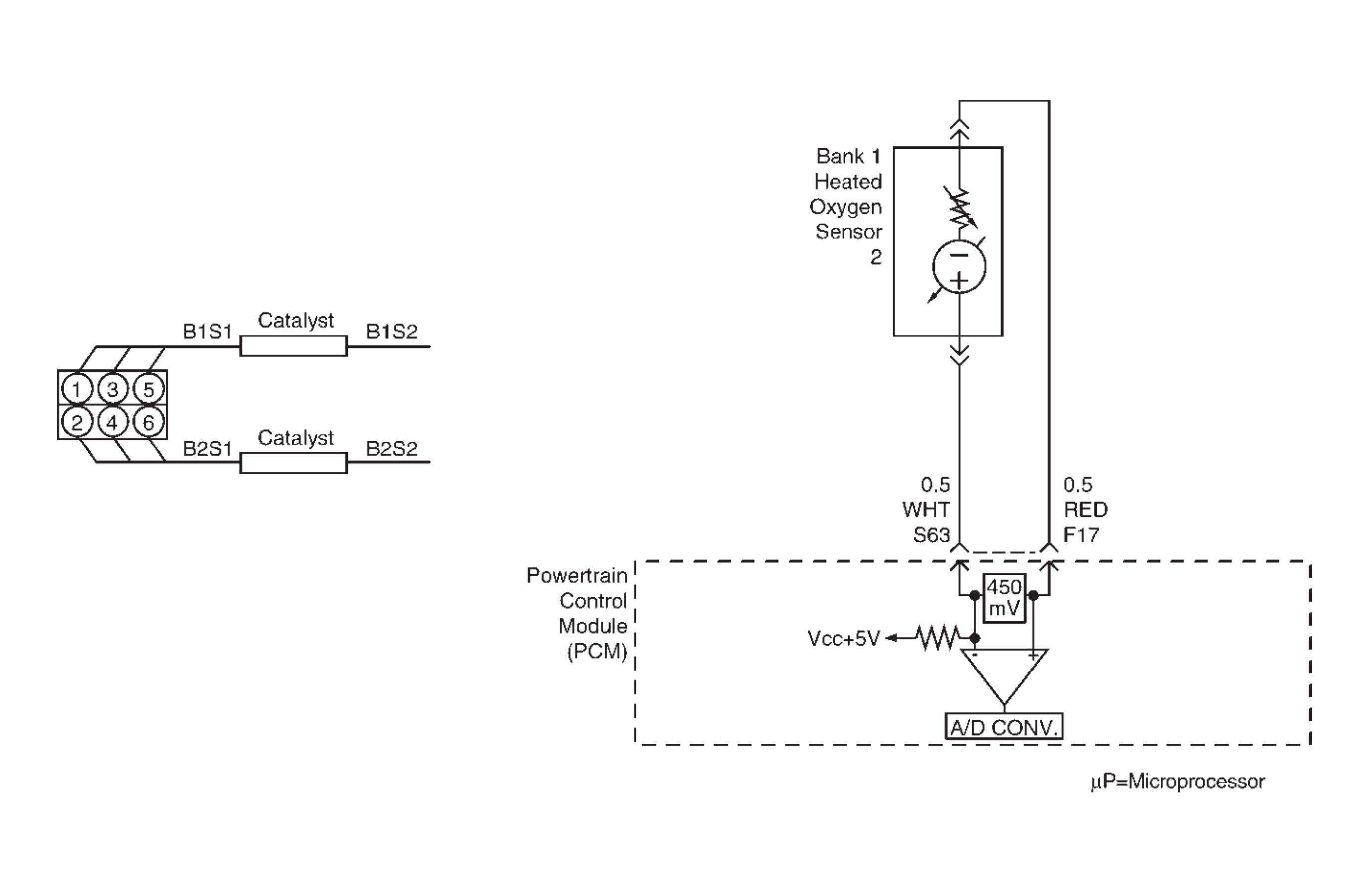
DTC P0151 – HO2S Circuit Low Voltage Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 2 HO2S 1 voltage. Does the Bank 2 HO2S 1 voltage remain below the specified value?	22 mV	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON,” engine “OFF,” review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0151 until the DTC P0151 test runs. 4. Note test result. Does the Tech 2 indicate DTC P0151 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Turn ignition “OFF.” 2. Disconnect the PCM. 3. Check the Bank 2 HO2S 1 high and low signal circuits for a short to ground or a short to the heater ground circuit. Were Bank 2 HO2S 1 signal circuits shorted?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the Bank 2 HO2S 1 signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition “OFF.” 2. Leave the PCM and HO2S 1 disconnected. 3. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to *Step 7*	Go to *Step 8*

DTC P0151 – HO2S Circuit Low Voltage Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition "OFF." 2. Reconnect the PCM, leave HO2S disconnected. 3. Ignition "ON." Does the Tech 2 indicate Bank 2 HO2S 1 voltage near the specified value?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0152 HO2S Circuit HIGH Voltage Bank 2 Sensor 1



D06RY00141

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) signal high and signal low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing the injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains excessively high for an extended period of time, DTC P0152 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop."
- The engine coolant temperature is above 60°C (140°F).
- "Closed loop" commanded air/fuel ratio between 14.5 and 14.8.
- Bank 2 HO2S 1 signal voltage remains above 952 mV during normal "closed loop" operation for a total of 77 seconds over a 90-second period.

OR

- Bank 2 HO2S 1 signal voltage remains above 500 mV during deceleration fuel cutoff mode operation for up to 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0152 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0152 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Fuel pressure – The system will go rich if pressure is too high. The PCM can compensate for some increase. However, if fuel pressure is too high, a DTC P0152 may be set. Refer to *Fuel System Diagnosis*.
- Rich injector(s) – Perform "Injector Balance Test."
- Leaking injector – Refer to *Fuel System Diagnosis*.
- Evaporative emissions (EVAP) system – Check the canister for fuel saturation. If the canister is full of fuel, check EVAP control system components and hoses.

Refer to *Evaporative Emission (EVAP) Control System*.

- MAF sensor – The system can go rich if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if rich condition is corrected. If so, replace MAF sensor.
- Check for leaking fuel pressure regulator diaphragm by checking vacuum line to regulator for the presence of fuel. There should be no fuel in the vacuum line.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S)– If the HO2S is internally shorted, the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key “ON,” engine “OFF.” If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can cause a high HO2S voltage to be indicated. This condition is indicated by powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S Signal Circuit of Faulty HO2S– A poor connection or open in the HO2S signal circuit can cause the DTC to set during deceleration fuel mode. An HO2S which is faulty and not allowing a full voltage switch between the rich and lean thresholds can also cause the condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S is limited within a range between 300 mV to 600 mV, check the HO2S signal circuit wiring and associated terminal connections.
- If none of the above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0152 failing during deceleration fuel cutoff mode operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0152 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

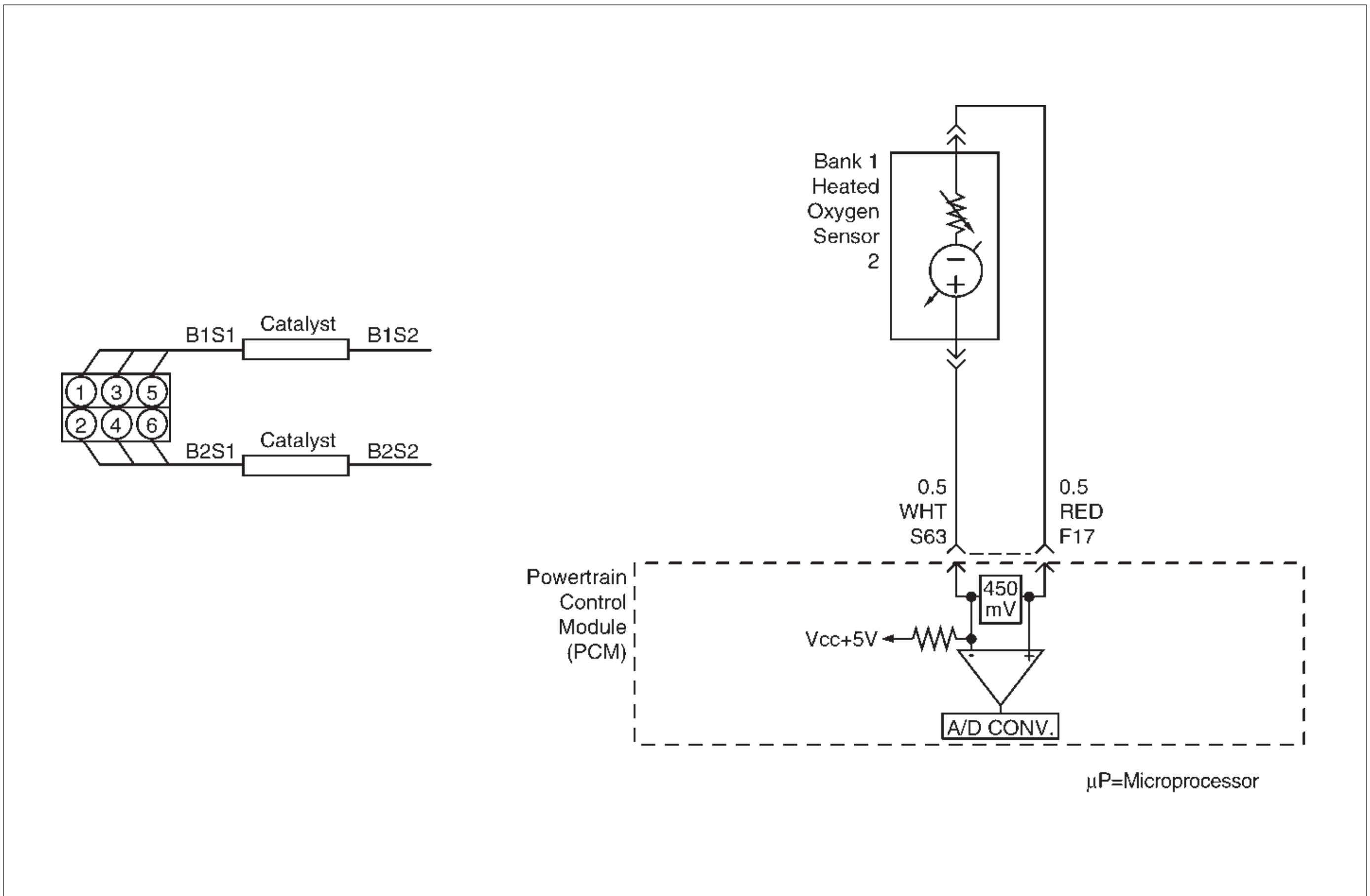
DTC P0152 – HO2S Circuit High Voltage Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Engine is at operating temperature. 3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 2 HO2S 1 voltage. Does the Bank 2 HO2S 1 voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cut-off mode)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0152 until the DTC P0152 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0152 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Ignition “OFF.” 2. Disconnect Bank 2 HO2S 1. 3. Ignition “ON.” 4. At HO2S Bank 2 Sensor 1 connector (PCM side) use a DVM to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	3-4 V	Go to *Step 5*	Go to *Step 6*
5	Repair short to voltage in signal circuit. Is the action complete?	—	Verify repair	—

DTC P0152 – HO2S Circuit High Voltage Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition "ON," engine"OFF." 2. At Bank 2 HO2S 1 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 2 HO2S 1 voltage. Is Bank 2 HO2S 1 voltage below the specified value?	10 mV	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the jumpers to ground from Bank 2 HO2S 1 PCM-side connector. 2. With the HO2S 1 connector disconnected, monitor Bank 2 HO2S 1 voltage. Is the Bank 2 HO2S 1 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0153 HO2S Slow Response Bank 2 Sensor 1



D06RY00141

Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after "closed loop" has been enabled. During the monitoring period the PCM counts the number of times that a rich-to-lean and lean-to-rich response is indicated and adds the amount of time it took to complete all rich-to-lean transitions and lean-to-rich transitions. With this information, an average time for rich-to-lean and lean-to-rich transitions can be determined. If the average response time of either transition is too slow, a DTC P0153 will be set.

A lean-to-rich transition is indicated when the HO2S voltage changes from less than 300 mV to greater than 600 mV. A rich-to-lean transition is indicated when the HO2S voltage changes from more than 600 mV to less than 300 mV. An HO2S that responds too slowly is likely to be faulty and should be replaced.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ECT) is above 50°C (122°F) for automatic transmission; 75° (167°F) for manual transmission.
- The engine is operating in "closed loop."
- Engine has been running for at least one minute.
- Canister purge duty cycle is above 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow is between 9 g/second and 42 g/second.
- All above conditions are met for 3 seconds.
- 90 seconds after "closed loop" has been enabled, Bank 2 HO2S 1 average transition time between 300 mV and 600 mV is too slow. The lean-to-rich average transition response time was longer than 94 milliseconds or the rich-to-lean average transition response time was longer than 105 milliseconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0153 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0153 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken

locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.

- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is currently present.
3. HO2S transition time, ratio mean volts and switching DTCs set for multiple sensors indicate probable contamination. Before replacing the sensors, isolate and correct the source of the contamination to avoid damaging the replacement sensors.

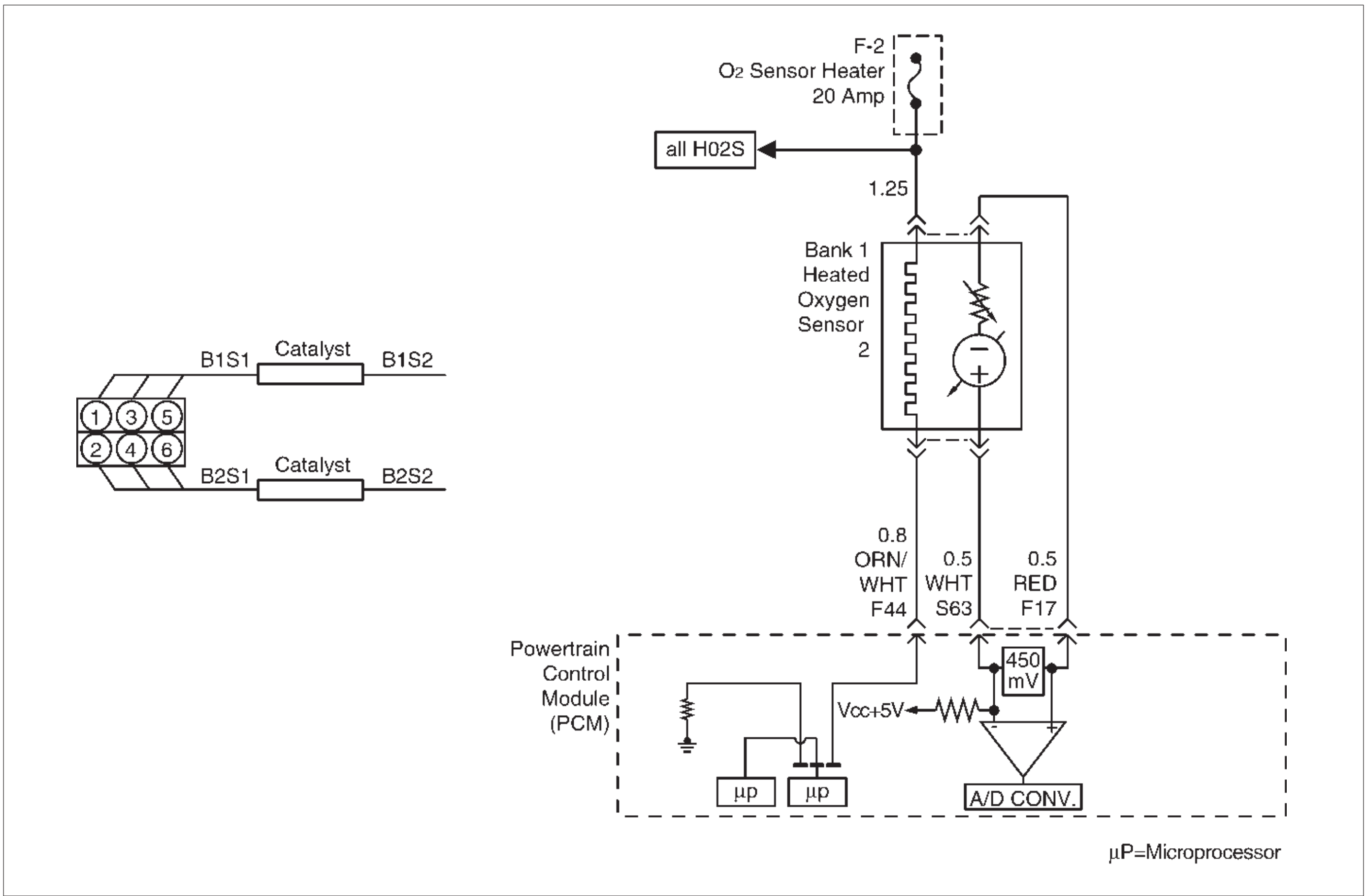
DTC P0153 – HO2S Slow Response Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If any DTCs are set, (except P0133, P1133, P1134, P1153, and/or P1154), refer to those DTCs before proceeding with this diagnostic chart. 1. Install the Tech 2. 2. Idle the engine at operating temperature. 3. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor “DTC” info for DTC P0153 until the DTC P0153 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0153 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate DTC P0153, P1133, P1134, P1153, and/or P1154 test failed this ignition?	—	Go to *Step 17*	Go to *Step 4*
4	Check for leaks at the pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U-bolt nuts at the leaking joint. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damage or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—

DTC P0153 – HO2S Slow Response Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Visually/physically inspect the following items: • Ensure that the Bank 2 HO2S 1 is securely installed. • Check for corrosion on terminals. • Check terminal tension (at Bank 2 HO2S 1 and at the PCM). • Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to *Step 18*	Go to *Step 15*
15	1. Disconnect Bank 2 HO2S 1. 2. Ignition "ON." 3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. Are both voltages in the specified range?	3-4 V	Go to *Step 16*	Go to *Step 19*
16	1. With Bank 2 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition "ON." 3. Using a Tech 2, monitor the Bank 2 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to *Step 21*	Go to *Step 22*
17	Replace the affected heated oxygen sensors. NOTE: Before replacing the sensors, the cause of the contamination must be determined and corrected. • Fuel contamination. • Use of improper RV sealant. • Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
18	Repair condition as necessary. Is the action complete?	—	Verify repair	—
19	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to *Step 20*
20	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	—
21	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0154 HO2S Circuit Insufficient Activity Bank 2 Sensor 1



D06RY00139

Circuit Description

The powertrain control module (PCM) supplies a bias voltage of about 450 mV between the heated oxygen sensor (HO2S) high and low circuits. When measured with a 10 megaohm digital voltmeter, this may display as low as 320 mV. The oxygen sensor varies the voltage within a range of about 1000 mV when the exhaust is rich, down through about 10 mV when exhaust is lean. The PCM constantly monitors the HO2S signal during "closed loop" operation and compensates for a rich or lean condition by decreasing or increasing injector pulse width as necessary. If the Bank 2 HO2S 1 voltage remains at or near the 450 mV bias for an extended period of time, DTC P0154 will be set, indicating an open sensor signal or sensor low circuit.

Heated oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- No related DTCs.
- Battery voltage is above 10 volts.
- Engine running time is longer than 40 seconds.
- Oxygen sensor heater is functioning properly.
- Bank 2 HO2S 1 signal voltage remains between 400 mV and 500 mV for a total of 77 seconds over a 90-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.
- "Open loop" fuel control will be in effect.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0154 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0154 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire-connection, and damaged harness.

- Faulty HO2S heater or heater circuit – With the ignition "ON," engine "OFF," the HO2S 1 voltage displayed on the Tech 2 is normally 455-460 mV. A reading over 1000 mV indicates a signal line shorted to voltage. A reading under 5 mV indicates a signal line shorted to ground or signal lines shorted together. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light for 2 seconds when the ignition is turned on, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test – With the ignition "ON," monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. If the DTC P0154 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

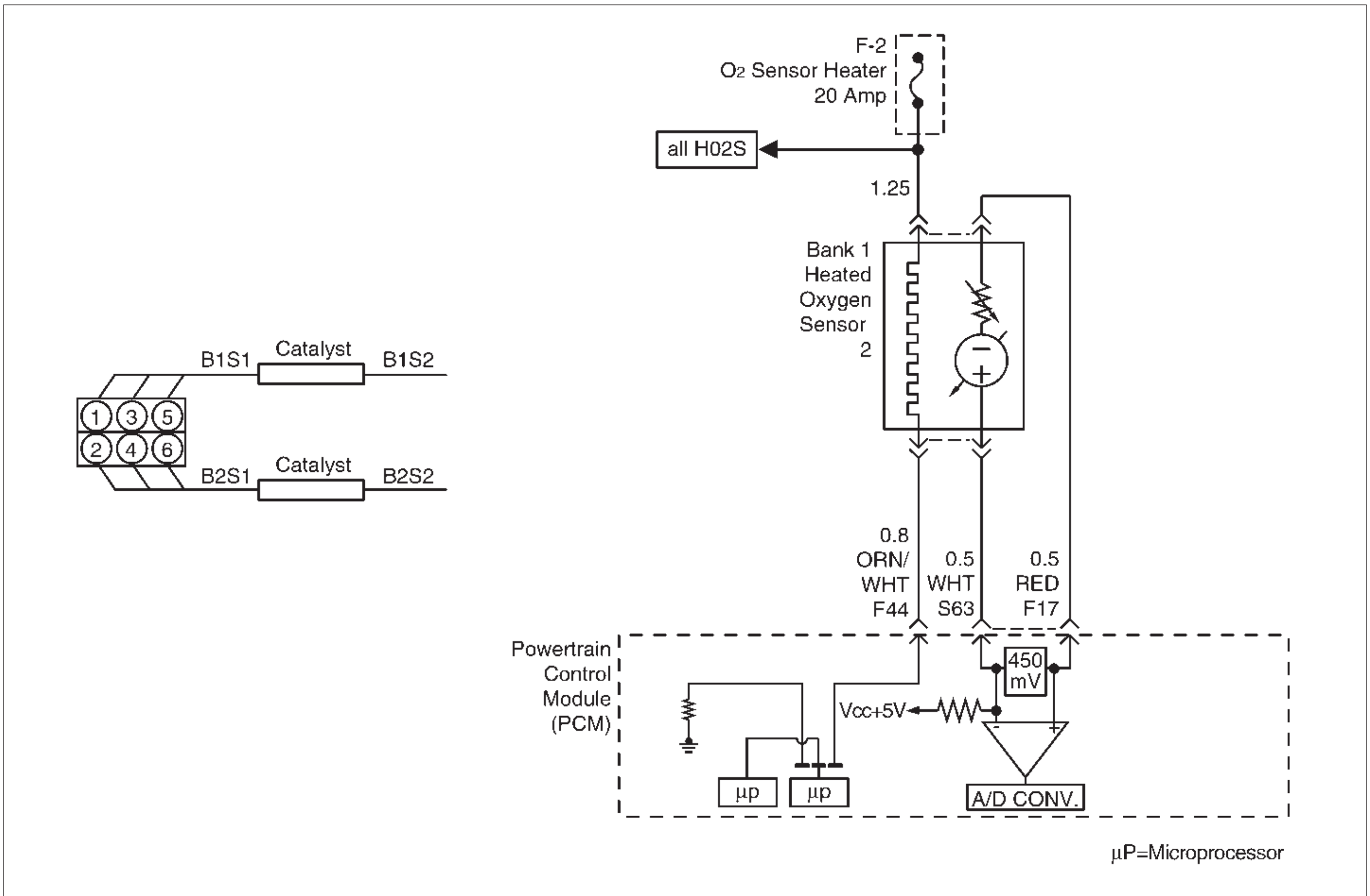
DTC P0154 –HO2S Circuit Insufficient Activity Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 2 HO2S 1 voltage varying outside the specified values?	400-500 mV	Go to *Step 3*	Go to *Step 4*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data and note parameters. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0154 until the DTC P0154 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0154 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Check for a damaged harness. Was a problem found?	—	Verify repair	Go to *Step 5*
5	Check for a poor Bank 2 HO2S 1 high and low circuit terminal connections at the Bank 2 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 6*
6	Check for a poor Bank 2 HO2S 1 high and low circuit terminal connections at the PCM and replace terminal(s) if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 7*

DTC P0154 –HO2S Circuit Insufficient Activity Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 2 HO2S 1 high circuit. 3. If the Bank 2 HO2S 1 high circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 2 HO2S 1 high circuit problem found and corrected?	—	Verify repair	Go to *Step 8*
8	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 2 HO2S 1 low circuit. 3. If the Bank 2 HO2S 1 low circuit measures over 5.0 ohms, repair open or poor connection as necessary. Was a Bank 2 HO2S 1 low circuit problem found and corrected?	—	Verify repair	Go to *Step 9*
9	1. Ignition "ON," engine "OFF." 2. Disconnect Bank 2 HO2S 1 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 2 HO2S 1 voltage. Is the Bank 2 HO2S 1 voltage in the specified range?	0-10 mV	Go to *Step 10*	Go to *Step 11*
10	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0155 HO2S Heater Circuit Bank 2 Sensor 1



D06RY00139

Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for closed loop fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine.

The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started the PCM will monitor the HO2S voltage. When the Bank HO2S voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 2 HO2S 1 to become active, a DTC P0155 will set. The time it should take the HO2S to reach operating temperature is based on the total amount of air that has passed through the mass air flow (MAF) sensor and into the engine (more total air flow = shorter time to HO2S activity).

Conditions for Setting the DTC

- No related DTCs.
- Intake air temperature (IAT) is less than 32˚C (90˚F) at start-up.
- Engine coolant temperature (ECT) is less than 32˚C (90˚F) at start-up.
- IAT and ECT are within 6˚C (11˚F) of each other at start-up.
- Ignition voltage is between 11 volts and 18 volts.
- Average mass air flow for the sample period is less than 21 g/second.
- Bank 1 HO2S 2 voltage does not change more than 150 mV from the bias voltage (between 400 mV-500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 120 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulated air flow since start-up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0155 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0155 can be cleared by using the Tech 2 “Clear info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. Ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. Checks the HO2S heater ground circuit.
6. Checks for an open or shorted HO2S heater element.
10. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

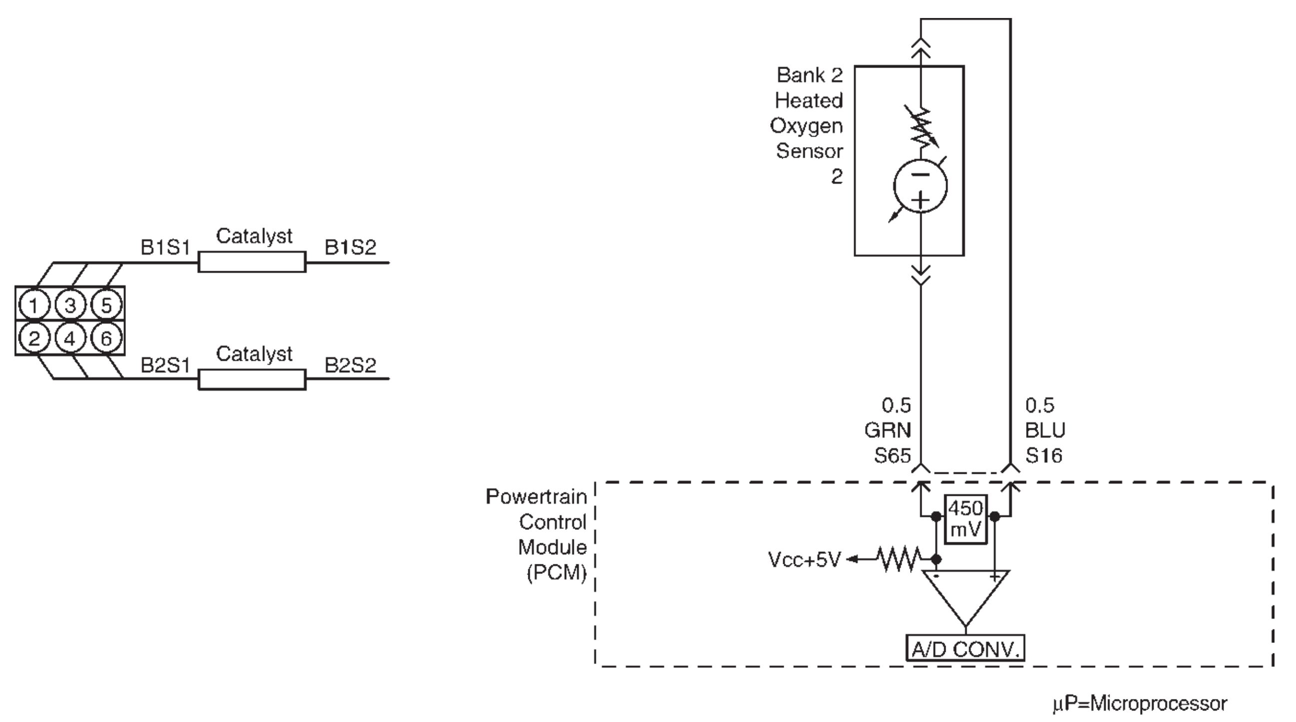
DTC P0155 – HO2S Heater Circuit Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If the engine has just been operating, allow the engine to cool for at least 15 minutes before proceeding. 1. Remove the fuel pump relay. 2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses. 3. Ignition “OFF.” 4. Install a Tech 2. 5. Ignition “ON,” engine “OFF.” 6. Monitor the Bank 1 HO2S 1 voltage for several minutes. Did the HO2S voltage go from bias voltage to above or below the specified value?	Above 650 mV or below 250 mV	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Inspect the fuse for the Bank 2 HO2S 1 ignition feed. Is the fuse open?	—	Go to *Step 15*	Go to *Step 4*
4	1. Ignition “OFF.” 2. Raise the vehicle. 3. Disconnect the Bank 2 HO2S 1 electrical connector. 4. Using a test light connected to a known good ground (do not use Bank 2 HO2S 1 heater ground or Bank 2 HO2S 1 low), probe the ignition feed circuit at the Bank 2 HO2S 1 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to *Step 5*	Go to *Step 7*

DTC P0155 – HO2S Heater Circuit Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
5	Connect the test light between Bank 2 HO2S 1 ignition feed and Bank 2 HO2S 1 heater ground. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 8*
6	1. Allow the HO2S to cool for at least 15 minutes. 2. Using a DVM, measure resistance between the Bank 2 HO2S 1 ignition feed and the Bank 2 HO2S 1 heater ground at the Bank 2 HO2S 1 pigtail. Is the HO2S resistance within the specified values?	3-6 ohms	Go to *Step 9*	Go to *Step 10*
7	Repair the open Bank 2 HO2S 1 ignition feed circuit to Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 2 HO2S 1 heater ground circuit. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 2 HO2S 1 harness terminals. 2. If a poor connection is found, replace terminals. Was a poor connection found?	—	Verify repair	Go to *Step 10*
10	Check for a poor Bank 2 HO2S 1 signal or low circuit terminal connection at the Bank 2 HO2S 1 harness connector and replace terminal(s) if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF." 2. Disconnect the PCM and check the continuity of the Bank 2 HO2S 1 signal circuit and the Bank 2 HO2S 1 low circuit. 3. If the Bank 2 HO2S 1 signal circuit or HO2S low circuit measures over 5 ohms, repair open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check for a poor Bank 2 HO2S 1 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 13*
13	Check for a poor Bank 2 HO2S 1 signal circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
14	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
15	Locate and repair short to ground in Bank 2 HO2S 1 ignition feed circuit and replace the faulty fuse. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0157 HO2S Circuit Low Voltage Bank 2 Sensor 2



D06RY00140

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the Bank 2 HO2S 2 signal voltage remains excessively low for an extended period of time, DTC P0157 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop."
- Engine coolant temperature is above 60°C (140°F).
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8
- Bank 2 HO2S 2 signal voltage remains below 22 mV during normal "closed loop" operation for a total of 106 seconds over a 125-second period of time.

OR

- Bank 2 HO2S 2 signal voltage remains below 400 mV during "power enrichment" mode fuel control operation for up to 5 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0157 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0157 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Heated oxygen sensor wiring – The sensor pigtail may be mispositioned and contacting the exhaust system.
- Poor PCM to engine grounds.
- Fuel pressure – A condition which causes a lean exhaust can cause DTC P0157 to set. The system will go lean if pressure is too low. The PCM can compensate for some decrease. However, if fuel pressure is too low, a DTC P0157 may be set. Refer to *Fuel System Diagnosis*.
- Lean injector(s) – Perform “Injector Balance Test.”
- Vacuum leaks – Check for disconnected or damaged vacuum hoses and for vacuum leaks at the intake manifold, throttle body, EGR system, and PCV system.
- Exhaust leaks – An exhaust leak may cause outside air to be pulled into the exhaust gas stream past the HO2S, causing the DTC P0157 to set. Check for exhaust leaks near the Bank 1 HO2S 2 sensor.
- MAF sensor – The system can go lean if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if the condition is corrected. If so, replace the MAF sensor.
- Fuel contamination – Water, even in small amounts, can be delivered to the fuel injectors. The water can cause a lean exhaust to be indicated. Excessive alcohol in the fuel can also cause this condition. Refer to *Fuel System Diagnosis* for the procedure to check for fuel contamination.
- If none of above conditions are present, replace the affected HO2S 2.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0157 failing during operation may indicate a condition described in the “Diagnostic Aids” above. If the DTC P0157 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

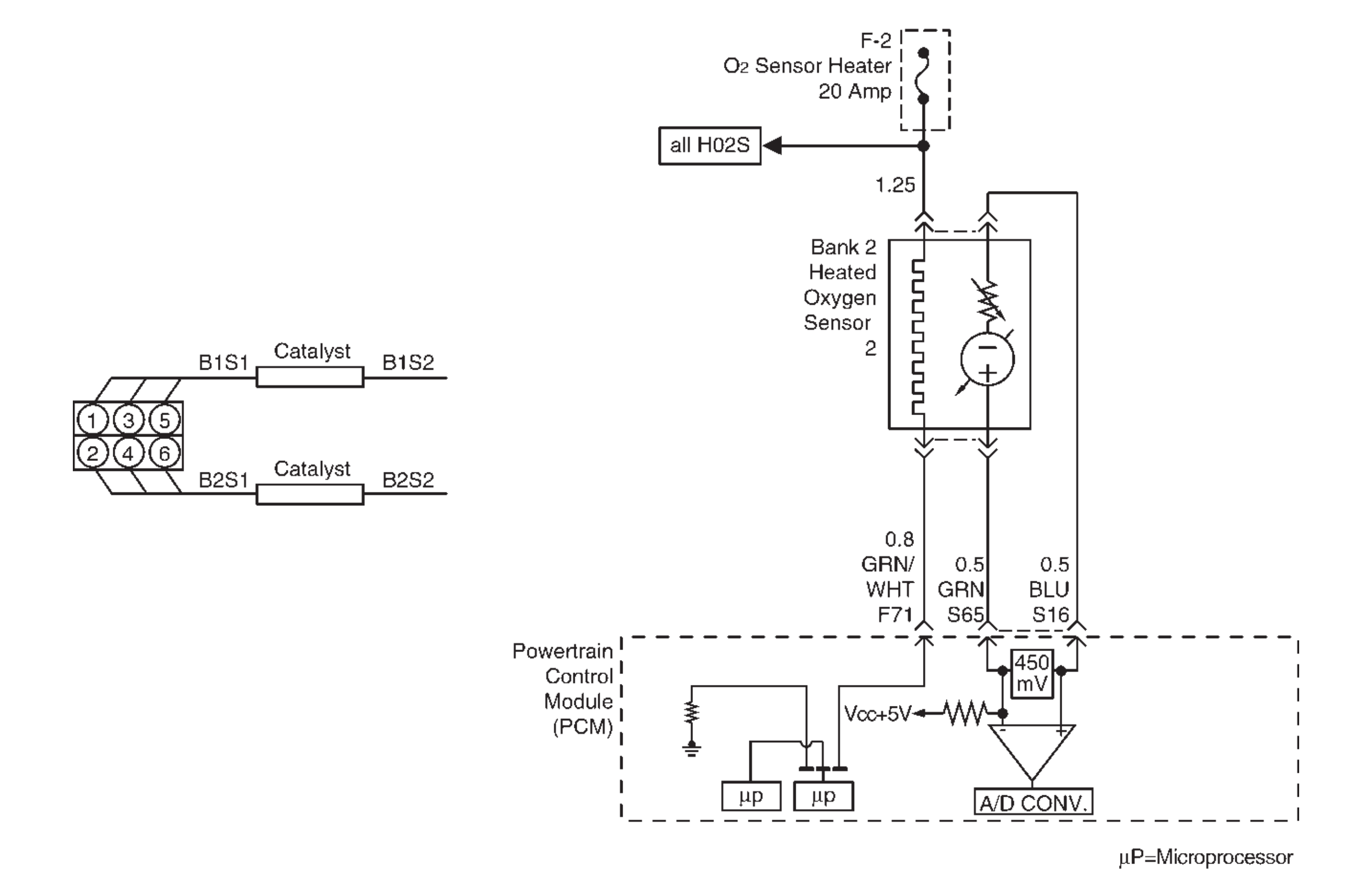
DTC P0157 – HO2S Circuit Low Voltage Bank 2 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within the parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 2 HO2S 2 voltage. Does the Bank 2 HO2S 2 voltage remain below the specified value?	22 mV	Go to *Step 4*	Go to *Step 3*
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data and note parameters. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0157 until the DTC P0157 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0157 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Turn the ignition “OFF.” 2. Disconnect the PCM. 3. Check the Bank 2 HO2S 2 high and low signal circuits for a short to ground or a short to the heater ground circuit. Were Bank 2 HO2S 2 signal circuits shorted?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the Bank 1 HO2S 2 signal circuit. Is the action complete?	—	Verify repair	—

DTC P0157 – HO2S Circuit Low Voltage Bank 2 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Ignition "OFF." 2. Leave the PCM and HO2S 2 disconnected. 3. Check for continuity between the high and low signal circuits. Was there continuity between the high and low circuits?	—	Go to *Step 7*	Go to *Step 8*
7	Repair the short between the high and low circuits. Is the action complete?	—	Verify repair	—
8	1. Ignition "OFF." 2. Reconnect the PCM, leave HO2S 2 disconnected. 3. Ignition "ON." Does the Tech 2 indicate Bank 2 HO2S 2 voltage near the specified value?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P0158 HO2S Circuit High Voltage Bank 2 Sensor 2



D06RY00142

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the Bank 2 HO2S 2 signal voltage remains excessively high for an extended period of time, DTC P0158 will be set.

Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in "closed loop."
- "Closed loop" commanded air/fuel ratio is between 14.5 and 14.8.
- Engine coolant temperature is above 60˚C (140˚F).
- Bank 2 HO2S 2 signal voltage remains above 952 mV during normal "closed loop" operation for a total of 106 seconds over a 125-second period.

OR

- Bank 2 HO2S 2 signal voltage remains above 500 mV during deceleration fuel cutoff mode operation for up to 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0158 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0158 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Fuel pressure – An excessively rich fuel mixture can cause a DTC P0158 to be set. Refer to *Fuel System Diagnosis*.
- Rich injector(s) – Perform "Injector Balance Test."
- Leaking injector – Refer to *Fuel System Diagnosis*.
- Evaporative emissions (EVAP) canister purge – Check for fuel saturation. If full of fuel, check canister control and hoses. Refer to *Evaporative Emission (EVAP) Control System*.
- MAF sensor –The system can go rich if the MAF sensor signal indicates an engine airflow measurement that is not correct. Disconnect the MAF sensor to see if a rich condition is corrected. If so, replace the MAF sensor.
- Check for a leaking fuel pressure regulator diaphragm by checking the vacuum line to the regulator for the presence of fuel. There should be no fuel in the vacuum line.
- TP sensor – An intermittent TP sensor output will cause the system to go rich, due to a false indication of the engine accelerating.
- Shorted Heated Oxygen Sensor (HO2S) – If the HO2S is internally shorted, the HO2S voltage displayed on the Tech 2 will be over 1 volt. Try disconnecting the affected HO2S with the key "ON," engine "OFF." If the displayed HO2S voltage changes from over 1000 mV to around 450 mV, replace the HO2S. Silicon contamination of the HO2S can also cause a high HO2S voltage to be indicated. This condition is indicated by a powdery deposit on the portion of the HO2S exposed to the exhaust stream. If contamination is noticed, replace the affected HO2S.
- Open HO2S signal or low circuit, or faulty HO2S – A poor connection or open in the HO2S signal or low circuit can cause the DTC to set during deceleration fuel cutoff mode operation. An HO2S which is faulty and does not allow full voltage swing between the rich and lean thresholds can also cause this condition. Operate the vehicle while monitoring the HO2S voltage with a Tech 2. If the HO2S voltage is limited within a range between 300 mV to 600 mV, check the HO2S signal and low circuit wiring and associated terminal connections. If the wiring and connections are OK, replace the HO2S.
- If none of above conditions are present, replace the affected HO2S.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. DTC P0158 being set during deceleration fuel cutoff mode operation may indicate a condition described in the "Diagnostic Aids" above. If the DTC P0158 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

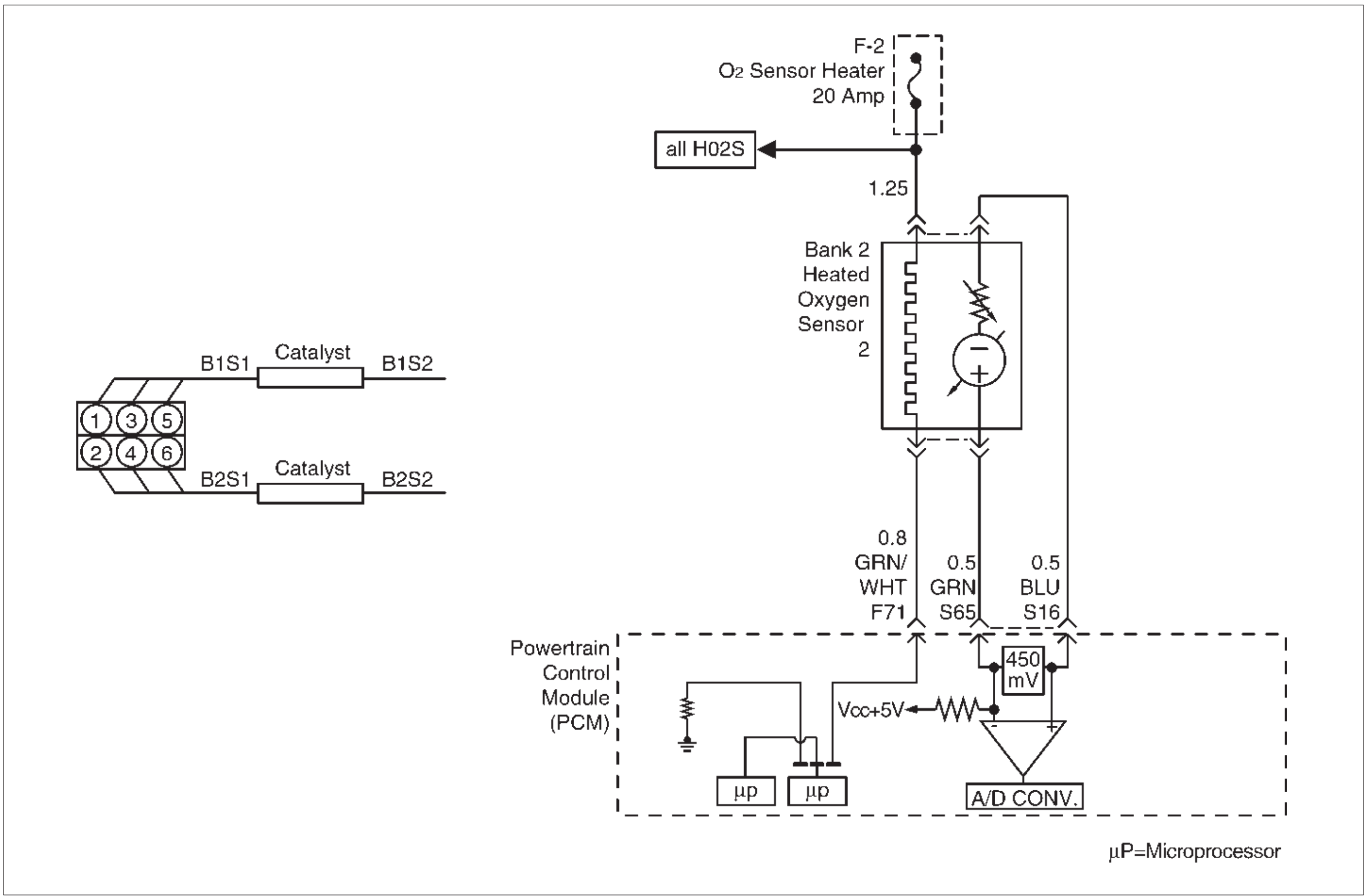
DTC P0158 – HO2S Circuit High Voltage Bank 2 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 4. Using a Tech 2, monitor Bank 2 HO2S 2 voltage. Does the Bank 2 HO2S 2 voltage remain above the specified value?	952 mV (500 mV in deceleration fuel cut-out mode)	Go to *Step 4*	Go to *Step 3*
3	1. Ignition "ON." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P0158 until the DTC P0158 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0158 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*

DTC P0158 – HO2S Circuit High Voltage Bank 2 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
4	1. Ignition "OFF." 2. Disconnect Bank 2 HO2S 2. 3. Ignition "ON." 4. At the HO2S Bank 2 Sensor 2 connector (PCM side), use a DVM to measure voltages at the high and low signal terminals. Are the voltages in the specified range?	3-4 V	Go to *Step 5*	Go to *Step 6*
5	Repair short to voltage in signal circuit. Is the action complete?	—	Verify repair	—
6	1. Ignition "ON," engine "OFF." 2. At Bank 2 HO2S 2 connector (PCM side) jumper both the HO2S high and low signal circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 2 HO2S 2 voltage. Is Bank 2 HO2S 2 voltage below the specified value?	10 mV	Go to *Step 7*	Go to *Step 8*
7	1. Disconnect the jumpers to ground from Bank 2 HO2S 2 PCM-side connector. 2. With the HO2S 2 connector disconnected, monitor Bank 2 HO2S 2 voltage. Is Bank 2 HO2S 2 voltage between the specified values?	425-475 mV	Refer to *Diagnostic Aids*	Go to *Step 8*
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0160 HO2S Circuit Insufficient Activity Bank 2 Sensor 2



D06RY00142

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalytic converter is used. The catalyst within the converter promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the Bank 2 HO2S 2 signal voltage remains between 400 mV and 500 mV for an extended period of time, DTC P0160 will be set.

Heated Oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- No related DTCs.
- Battery voltage is above 10 volts.
- Engine run time is longer than 40 seconds.
- Oxygen sensor heater is functioning properly.
- Engine is in "closed loop" operation.
- Bank 2 HO2S 2 signal voltage remains between 426 mV and 474 mV for a total of 106 seconds over a 125-second period of time.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0160 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0160 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Faulty HO2S heater or heater circuit – With the ignition “ON,” engine “OFF,” the HO2S voltage displayed on a Tech 2 should gradually drop to below 250 mV. If not, disconnect the HO2S and connect a test light between the HO2S ignition feed and heater ground circuits. If the test light does not light, repair the open ignition feed or sensor ground circuit as necessary. If the test light lights and the HO2S signal and low circuits are OK, replace the HO2S.
- Intermittent test – With the ignition “ON,” monitor the HO2S signal voltage while moving the wiring harness and related connectors. If the fault is induced, the HO2S signal voltage will change. This may help isolate the location of the malfunction.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. If the DTC P0160 test passes while the Failure Records conditions are being duplicated, an intermittent condition is indicated.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

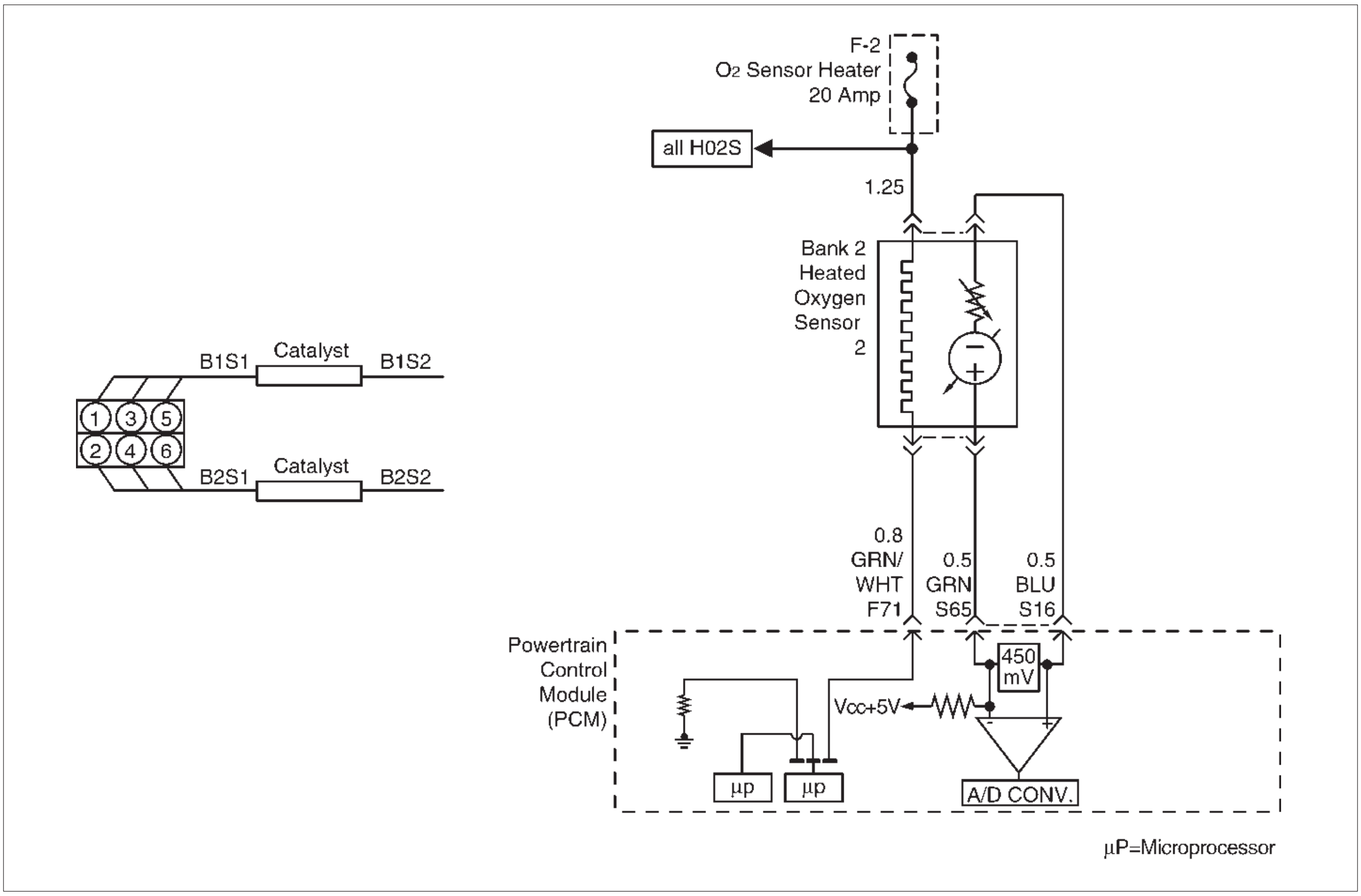
DTC P0160 – HO2S Circuit Insufficient Activity Bank 2 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Install the Tech 2. 2. Run the engine at operating temperature. 3. Operate the engine above 1200 RPM for two minutes. Does the Tech 2 indicate Bank 2 HO2S 2 voltage varying outside the specified values?	425-475 mV	Go to *Step 3*	Go to *Step 4*
3	1. Ignition “ON,” engine “OFF,” review and record Tech 2 Failure Records data and note parameters. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0160 until the DTC P0160 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0160 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Check for a damaged harness. Was problem found?	—	Verify repair	Go to *Step 5*
5	Check for poor Bank 2 HO2S 2 high and low circuit terminal connections at the Bank 2 HO2S 2 harness connector and replace terminal(s) if necessary. Did either terminal require replacement?	—	Verify repair	Go to *Step 6*
6	Check for poor Bank 2 HO2S 2 high and low circuit terminal connections at the PCM and replace terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 7*

DTC P0160 – HO2S Circuit Insufficient Activity Bank 2 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 2 HO2S 2 high circuit. 3. If the Bank 2 HO2S 2 high circuit measures over 5.0 ohms, repair open or poor connections as necessary. Was a Bank 2 HO2S 2 high circuit problem found and corrected?	—	Verify repair	Go to *Step 8*
8	1. Ignition "OFF." 2. With the PCM disconnected, check continuity of the Bank 2 HO2S 2 low circuit. 3. If the Bank 2 HO2S 2 low circuit measures over 5 ohms, repair open or poor connections as necessary. Was a Bank 2 HO2S 2 low circuit problem found and corrected?	—	Verify repair	Go to *Step 9*
9	1. Ignition "ON," engine "OFF." 2. Disconnect Bank 2 HO2S 2 and jumper the HO2S high and low circuits (PCM side) to ground. 3. Using a Tech 2, monitor Bank 2 HO2S 2 voltage. Is Bank 2 HO2S 2 voltage in the specified range?	0-10 mV	Go to *Step 10*	Go to *Step 11*
10	Replace Bank 2 HO2S 2. Is the action complete?	—	Verify repair	—
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0161 HO2S Heater Circuit Bank 2 Sensor 2



Circuit Description

Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature which allows accurate exhaust oxygen content readings further from the engine. The powertrain control module (PCM) will run the heater test only after a cold start (determined by engine coolant and intake air temperature at the time of start-up) and only once during an ignition cycle. When the engine is started, the PCM will monitor the HO2S voltage. When the Bank 2 HO2S 2 voltage indicates a sufficiently active sensor, the PCM looks at how much time has elapsed since start-up. If the PCM determines that too much time was required for the Bank 2 HO2S 2 to become active, a DTC P0161 will set. The time it should take the HO2S to reach operating temperature is based on the total amount of air that has passed through the MAF sensor and into the engine (more total air flow = shorter time to HO2S activity).

Conditions for Setting the DTC

- No related DTCs.
- Intake air temperature (IAT) is less than 32°C (90°F) at start-up.
- Engine coolant temperature (ECT) is less than 32°C (90°F) at start-up.
- IAT and ECT are within 6°C (11°F) of each other at start-up.
- Ignition voltage is between 11 volts and 18 volts.
- Average mass air flow for the sample period is less than 23 g/second.
- Bank 2 HO2S 2 voltage does not change more than 150 mV from the bias voltage (between 400 mV-500 mV) for a longer amount of time than it should. The maximum amount of time to come up to operating range is 120 seconds. This warm-up time depends on the engine coolant temperature at start-up and accumulated air flow since start-up.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0161 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0161 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The HO2S should be allowed to cool before performing this test. If the HO2S heater is functioning, the signal voltage will gradually increase or decrease as the sensor element warms. If the heater is not functioning, the HO2S signal will remain near the 450 mV bias voltage.
4. This ensures that the ignition feed circuit to the HO2S is not open or shorted. The test light should be connected to a good chassis ground, in case the HO2S low or HO2S heater ground circuit is faulty.
5. This checks the HO2S heater ground circuit.
6. This checks for an open or shorted HO2S heater element.
11. An open HO2S signal or low circuit can cause the HO2S heater to appear faulty. Check these circuits before replacing the sensor.

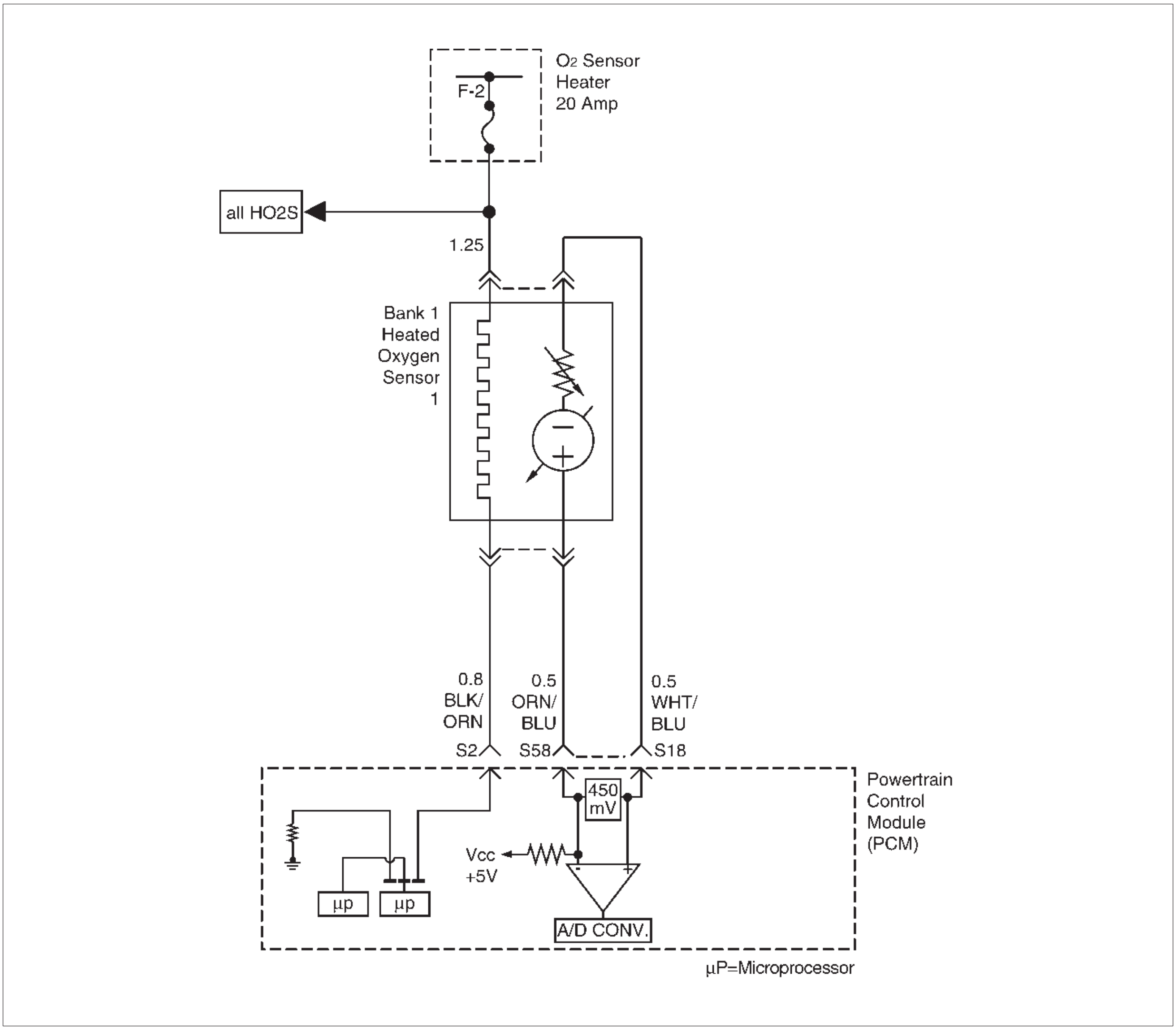
DTC P0161 – HO2S Heater Circuit Bank 2 Sensor 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	NOTE: If the engine has just been operating, allow the engine to cool for at least 15 minutes before proceeding. 1. Remove the fuel pump relay. 2. Connect a fused jumper at the fuel pump relay socket, between the battery positive at the relay and the relay wire that leads to the fuel pump and HO2S fuses. 3. Ignition “OFF.” 4. Install a Tech 2. 5. Ignition “ON,” engine “OFF.” 6. Monitor the Bank 2 HO2S 2 voltage for several minutes. Did the HO2S voltage go from bias voltage to above or below the specified values?	Above 650 mV or Below 250 mV	Refer to *Diagnostic Aids*	Go to *Step 3*
3	Inspect the fuse for the Bank 2 HO2S 2 ignition feed. Is the fuse open?	—	Go to *Step 15*	Go to *Step 4*
4	1. Ignition “OFF.” 2. Raise the vehicle. 3. Disconnect the Bank 2 HO2S 2 electrical connector. 4. Using a test light connected to a known good ground (do not use Bank 2 HO2S 2 heater ground or Bank 2 HO2S 2 low), probe the ignition feed circuit at the Bank 2 HO2S 2 electrical connector (PCM harness side). Does the test light illuminate?	—	Go to *Step 5*	Go to *Step 7*
5	Connect the test light between the Bank 2 HO2S 2 ignition feed and the Bank 2 HO2S 2 heater ground. Does the test light illuminate?	—	Go to *Step 6*	Go to *Step 8*

DTC P0161 – HO2S Heater Circuit Bank 2 Sensor 2 (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Allow the HO2S to cool for at least 15 minutes. 2. Using a DVM, measure resistance between the Bank 2 HO2S 2 ignition feed and the Bank 2 HO2S 2 heater ground at the Bank 2 HO2S 2 pigtail. Is the HO2S resistance within the specified values?	3-6 ohms	Go to *Step 9*	Go to *Step 10*
7	Repair the open Bank 2 HO2S 2 ignition feed circuit to Bank 2 HO2S 2. Is the action complete?	—	Verify repair	—
8	Repair the open Bank 2 HO2S 2 heater ground circuit. Is the action complete?	—	Verify repair	—
9	1. Check for a poor connection at the Bank 2 HO2S 2 harness terminals. 2. If a poor connection is found, replace the terminals. Was a poor connection found?	—	Verify repair	Go to *Step 10*
10	1. Ignition "OFF." 2. Disconnect the PCM and check the continuity of the Bank 2 HO2S 2 signal circuit and the Bank 2 HO2S 2 low circuit. 3. If the Bank 2 HO2S 2 signal circuit or HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF." 2. Disconnect the PCM and check the continuity of the Bank 2 HO2S 2 signal circuit and the Bank 2 HO2S 2 low circuit. 3. If the Bank 2 HO2S 2 signal circuit or HO2S low circuit measures over 5 ohms, repair the open or poor connection as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check for a poor Bank 2 HO2S 2 low circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 13*
13	Check for a poor Bank 2 HO2S 2 high circuit terminal connection at the PCM and replace the terminal if necessary. Did the terminal require replacement?	—	Verify repair	Go to *Step 14*
14	Replace Bank 2 HO2S 2. Is the action complete?	—	Verify repair	—
15	Locate and repair the short to ground in the Bank 2 HO2S 2 ignition feed circuit and replace the faulty fuse. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0171 Fuel Trim System Lean Bank 1



D06RY00144

Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. While in “closed loop,” the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected on Bank 1, the PCM will set DTC P0171.

The PCM’s maximum authority to control long term fuel trim allows a range between –15% (automatic transmission) or –12% (manual transmission) and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following: EGR DTCs, HO2S DTCs, (response, transition, open, low volts, no activity), MAF DTCs, TP sensor DTCs, MAP DTCs, IAT DTCs, canister purge DTCs, EVAP DTCs, injector circuit DTCs, or misfire DTCs.
- Engine coolant temperature is between 25˚C (77˚F) and 100˚C (212˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady below 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.

- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in “closed loop.”
- Canister purge duty cycle is greater than 0% if on.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0171 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0171 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0171 and P0174 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0171/P0174.

4. If the DTC P0171 test passes while the Failure Records conditions are being duplicated, the lean condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

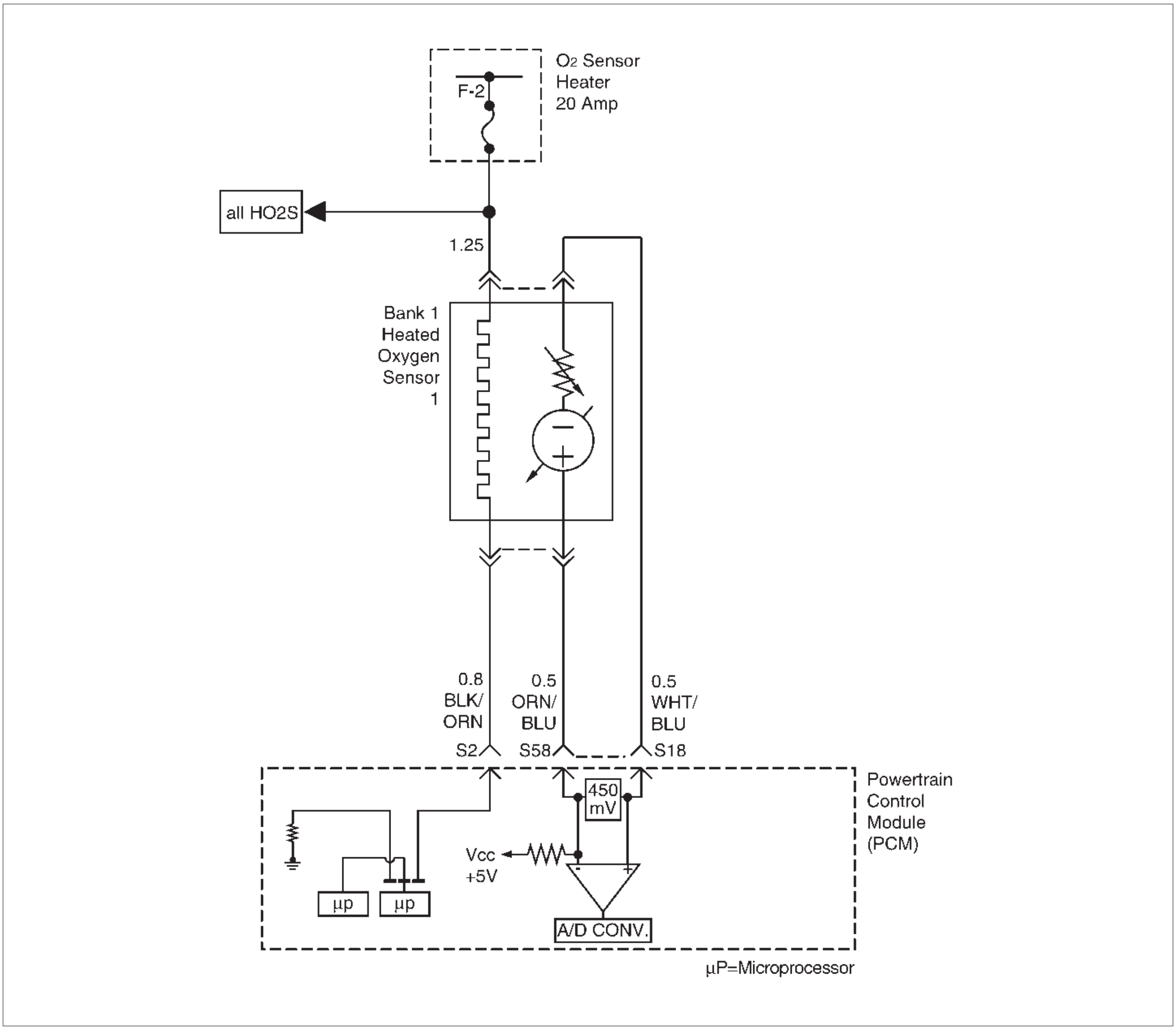
DTC P0171 – Fuel Trim System Lean Bank 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any DTCs set other than P0171 and P0174?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart	Go to *Step 3*
3	1. Start the engine and operate the vehicle in “closed loop.” 2. Observe the “BANK 1 L.T. FUEL TRIM” display on the Tech 2. Is the displayed value greater than the specified value?	L.T. Fuel Trim: +20%	Go to *Step 5*	Go to *Step 4*
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the DTC P0171/P0174 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 “DTC” info for DTC P0171 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0171 test runs and note the test result. Does the Tech 2 indicate DTC P0171 failed this ignition?	—	Go to *Step 5*	The lean condition is not present. If a driveability symptom still exists, refer to *Symptoms* section.
5	Was DTC P0174 also set?	—	Go to *Step 6*	Go to *Step 15*
6	Visually and physically inspect the vacuum hoses for disconnections, splits, kinks, improper routing and improper connections and repair any problem found. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 7*
7	Visually and physically inspect the crankcase ventilation valve for proper installation and repair any problem found (refer to *Crankcase Ventilation System*). Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 8*
8	1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block the air flow sample through the MAF sensor. 2. Correct any problem that is found as necessary. Did your inspection of the MAF sensor reveal a condition requiring repair?	—	Verify repair	Go to *Step 9*
9	Start the engine and note the idle quality. Is a high or unsteady idle being experienced?	—	Go to *Step 10*	Go to *Step11*
10	1. Visually and physically inspect the throttle body, intake manifold, EGR valve and the EGR feed pipe for vacuum leaks. 2. Repair any vacuum leaks as necessary. Did your inspection reveal a vacuum leak?	—	Verify repair	Go to *Step 11*

DTC P0171 – Fuel Trim System Lean Bank 1 (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check the fuel for excessive water, alcohol, or other contaminants (see *Diagnosis* in *Engine Fuel* for the procedure) and correct the contaminated fuel condition if present (see *Engine Fuel*). Was the fuel contaminated?	—	Verify repair	Go to *Step 12*
12	1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight, and in their proper locations. 2. If a faulty ground condition is present, correct it as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 13*
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 1 S.T. FUEL TRIM" displayed on the Tech 2. Does "BANK 1 S.T. FUEL TRIM" value decrease to near the specified value?	0%	Go to *Step 19*	Go to *Step 14*
14	Perform the procedure in the "Fuel System Pressure Test" and repair fuel system problem if necessary. Did Fuel System Pressure Test isolate a condition requiring repair?	—	Verify repair	Go to *Step 15*
15	1. Visually and physically inspect the intake manifold, injector O-rings, EGR adapter, EGR valve and the EGR feed pipes for vacuum leaks. 2. Repair any problem that is found. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 16*
16	Visually and physically inspect the Bank 1 exhaust manifold for leaks and loose or missing hardware and correct any problem found. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 17*
17	Perform the "Injector Balance Test," and correct any problem found (refer to *Fuel Metering System*). Did Injector Balance Test isolate a problem?	—	Verify repair	Go to *Step 18*
18	1. Visually and physically inspect the Bank 1 HO2S 1 to ensure that it is installed securely and that the Bank 1 HO2S 1 pigtail and wiring harness are not contacting the exhaust or otherwise damaged. 2. If a problem is found, correct it as necessary. Did your inspection reveal a problem?	—	Verify repair	Refer to *Diagnostic Aids*
19	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0172 Fuel Trim System Rich Bank 1



Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. While in “closed loop,” the powertrain control module (PCM) monitors the Bank 1 heated oxygen sensors (HO2S) 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected on Bank 1, the PCM will set DTC P0172.

The PCM’s maximum authority to control long term fuel trim allows a range between –15% (automatic transmission) or –12 (manual transmission) and +20%. The PCM’s maximum authority to control short term fuel trim allows a range between –11% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following was set: EGR DTCs, HO2S DTCs, (response, transition, open, low volts, no activity), MAF DTCs, TPS DTCs, MAP DTCs, IAT DTCs, canister purge DTCs, EVAP DTCs, injector circuit DTCs, or misfire DTCs.
- Engine coolant temperature is between 25°C (77°F) and 100°C (212°F).
- Intake air temperature is between –40°C (–40°F) and 120°C (248°F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady below 95%.

- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in "closed loop."
- Canister purge duty cycle is greater than 0%, if "ON."

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0172 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0172 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 1 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0172 and P0175 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0172/P0175.
4. If the DTC P0172 test passes while the Failure Records conditions are being duplicated, the rich condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

DTC P0172 – Fuel Trim System Rich Bank 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any DTCs set other than P0172 and P0175?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart	Go to *Step 3*
3	1. Start the engine and operate the vehicle in "closed loop." 2. Observe "B1 Long Term Fuel Trim" display on the Tech 2. Is the displayed value more negative than the specified value?	L.T. Fuel Trim: –15% (auto. trans.) OR –12% (man. trans.)	Go to *Step 5*	Go to *Step 4*
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the DTC P0172/P0175 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 "DTC" info for DTC P0172 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0172 test runs and note test result. Does the Tech 2 indicate DTC P0172 failed this ignition?	—	Go to *Step 5*	The rich condition is not present. If a driveability symptom still exists, refer to *Symptoms*.

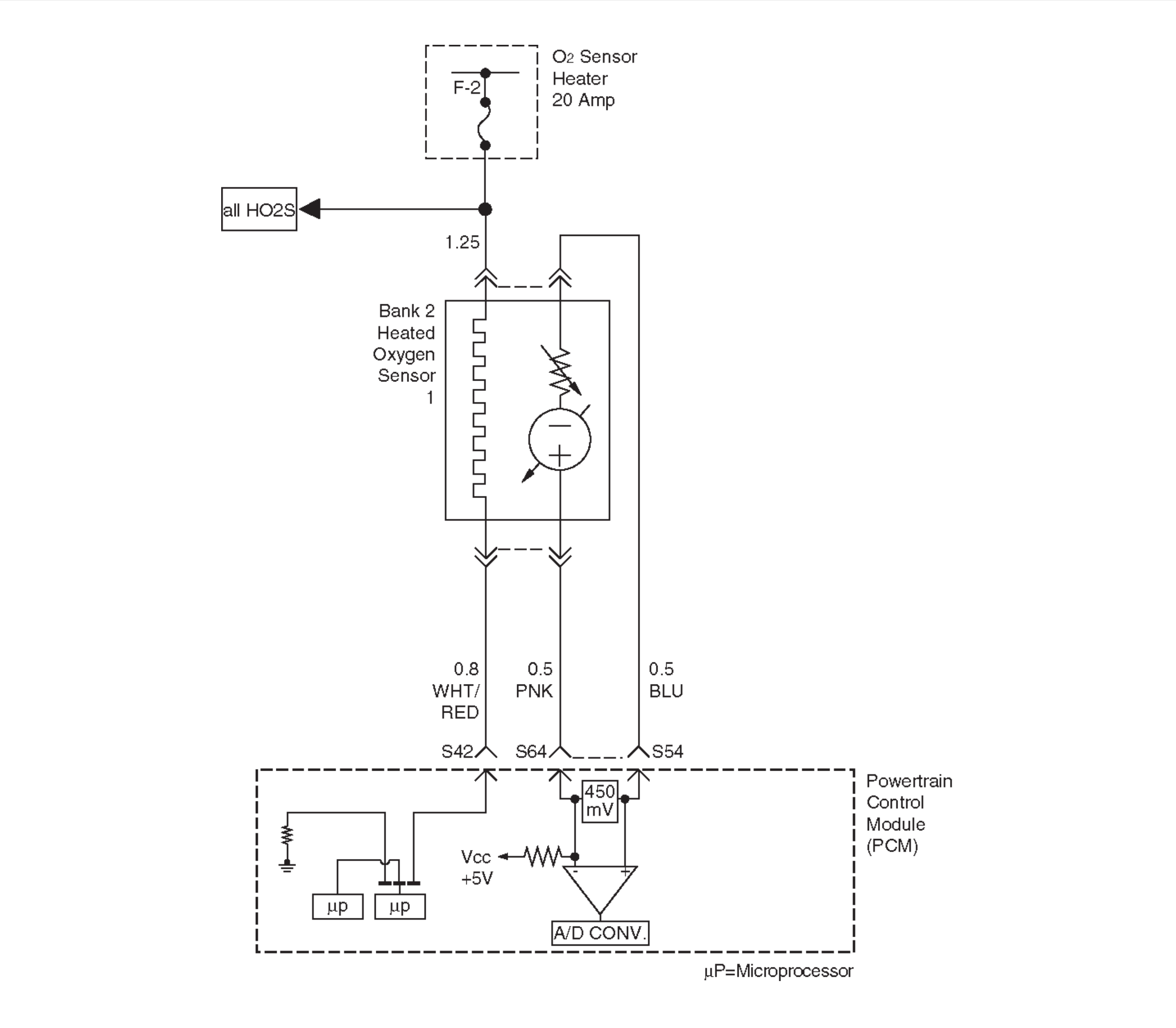
DTC P0172 – Fuel Trim System Rich Bank 1 (Cont'd)

Step	Action	Value(s)	Yes	No
5	Is DTC P0175 also set?	—	Go to *Step 6*	Go to *Step 15*
6	Visually and physically inspect the air filter element and replace it if necessary. Did the air filter require replacement?	—	Verify repair	Go to *Step 7*
7	Visually and physically inspect the air intake duct for collapse or restriction and repair if necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 8*
8	Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block air flow through the screen and correct any problem found. Did your inspection of the MAF sensor reveal a condition requiring repair or replacement?	—	Verify repair	Go to *Step 9*
9	Start the engine and note the idle quality. Is a low or unsteady idle being experienced?	—	Go to *Step 10*	Go to *Step 11*
10	1. Ignition "OFF." 2. Physically inspect the throttle body bore and throttle plate for coking and foreign objects. 3. If a problem was found, repair as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 11*
11	1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is present in the vacuum hose, replace the fuel pressure regulator (refer to *Fuel Metering System*). Did the fuel pressure regulator require replacement?	—	Verify repair	Go to *Step 12*
12	Ignition "ON," engine "OFF," monitor the TP1 Angle display on the Tech 2 while slowly depressing the accelerator pedal. Does the TP Angle display increase steadily and evenly from minimum value at closed throttle to maximum value at wide-open throttle?	Minimum 8% Maximum 92%	Go to *Step 13*	Go to *Step 21*
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 1 L.T. FUEL TRIM" and "BANK 1 S. T. FUEL TRIM" display on the Tech 2. Did both values change to near the specified value?	0%	Go to *Step 22*	Go to *Step 14*
14	1. Perform "Fuel System Pressure Test." 2. If Fuel System Pressure Test isolates a problem, repair as necessary (refer to *Engine Fuel* or *Fuel Metering System*). Did the Fuel System Pressure Test isolate a problem requiring repair?	—	Verify repair	Go to *Step 15*
15	1. Ignition "ON," engine "OFF." 2. Connect a test light between the harness connector terminals of canister purge solenoid. Is the test light on?	—	Go to *Step 16*	Go to *Step 19*

DTC P0172 – Fuel Trim System Rich Bank 1 (Cont'd)

Step	Action	Value(s)	Yes	No
16	Check for short to ground in the wire (YEL/RED) between the canister purge solenoid and PCM terminal S-48. Was there a short to ground?	—	Go to *Step 17*	Go to *Step 18*
17	Repair the short to ground. Is the action complete?	—	Verify repair	—
18	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
19	1. Perform the “Injector Balance Test.” 2. If Injector Balance Test isolates a problem, repair as necessary (refer to *Fuel Metering System*). Did the Injector Balance Test isolate a problem requiring repair?	—	Verify repair	Go to *Step 20*
20	1. Remove and visually/physically inspect the Bank 1 HO2S 1 for silicon contamination. This will be indicated by a powdery deposit on the portion of the HO2S that is exposed to the exhaust stream. 2. If contamination is evident on the Bank 1 HO2S 1, replace the contaminated sensors. Did the sensor require replacement?	—	Verify repair	Refer to *Diagnostic Aids*
21	1. Check the TP sensor mounting screws and tighten or replace them as necessary if they are loose or missing. 2. If the screws are OK, replace the TP sensor. Is the action complete?	—	Verify repair	—
22	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0174 Fuel Trim System Lean Bank 2



Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a "closed loop" air/fuel metering system is used. While in "closed loop," the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively lean condition is detected on Bank 2, the PCM will set DTC P0174.

The PCM's maximum authority to control long term fuel trim allows a range between –15%(automatic transmission) or –12%(manual transmission) and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following DTCs are set: idle system, EGR, HO2S, (response, transition, open, low volts, no activity), MAF, TP sensor, MAP, IAT, canister purge, EVAP, injector circuit, or misfire.
- Engine coolant temperature is between 25°C (77°F) and 100°C (212°F).
- Intake air temperature is between –40°C (–40°F) and 120°C (248°F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady between 3 and 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.
- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.

- Ignition voltage is above 9.5 volts.
- Fuel system is in “closed loop.”
- Canister purge duty cycle is greater than 0%, if “ON.”

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the failure is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0174 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0174 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0171 and P0174 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0171/P0174.

4. If the DTC P0174 test passes while the Failure Records conditions are being duplicated, the lean condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

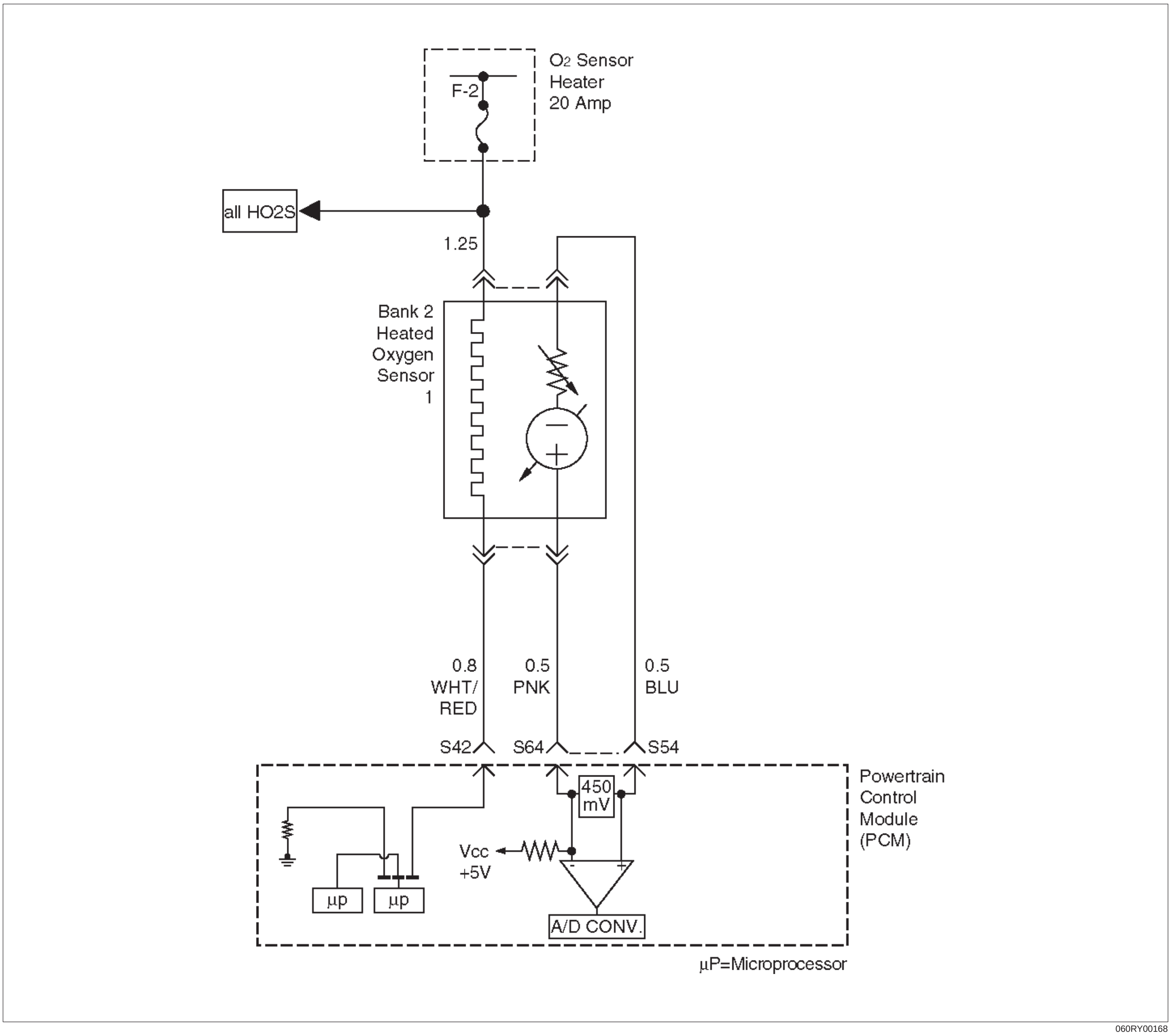
DTC P0174 – Fuel Trim System Lean Bank 2

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any DTCs set other than P0174 and P0171?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart.	Go to *Step 3*
3	1. Start the engine and operate the vehicle in "closed loop." 2. Observe the "BANK 2 L.T. FUEL TRIM" display on the Tech 2. Is the displayed values greater than the specified values?	L.T. Fuel Trim: +20%	Go to *Step 5*	Go to *Step 4*
4	1. Review and record Tech 2 Failure Records data. 2. Clear the DTC P0171/P0174 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 "DTC" info for DTC P0174 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0174 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0174 failed this ignition?	—	Go to *Step 5*	The lean condition is not present. If a driveability symptom still exists, refer to *Symptoms* section.
5	Was DTC P0171 also set?	—	Go to *Step 6*	Go to *Step 15*
6	Visually and physically inspect the vacuum hoses for disconnections, splits, kinks, improper routing and improper connections and repair any problem found. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 7*
7	Visually and physically inspect the crankcase ventilation valve for proper installation and repair any problem found (refer to *Crankcase Ventilation System*). Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 8*
8	1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block the air flow sample through the MAF sensor. 2. Correct any problem that is found as necessary. Did your inspection of the MAF sensor reveal a condition requiring repair?	—	Verify repair	Go to *Step 9*
9	Start the engine and note the idle quality. Is a high or unsteady idle being experienced?	—	Go to *Step 10*	Go to *Step 11*

DTC P0174 – Fuel Trim System Lean Bank 2 (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Visually and physically inspect the throttle body, intake manifold, EGR valve and the EGR feed pipe for vacuum leaks. 2. Repair any vacuum leaks as necessary. Did your inspection reveal a vacuum leak?	—	Verify repair	Go to *Step 11*
11	Check the fuel for excessive water, alcohol, or other contaminants (see *Diagnosis* in *Engine Fuel* for procedure) and correct the contaminated fuel condition is present (see *Engine Fuel*). Was the fuel contaminated?	—	Verify repair	Go to *Step 12*
12	1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight, and in their proper locations. 2. If a faulty ground condition is present, correct it as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 13*
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 2 S.T. FUEL TRIM" displayed on the Tech 2. Does the "BANK 2 S.T. FUEL TRIM" value decrease to near the specified value?	0%	Go to *Step 19*	Go to *Step 14*
14	Perform the procedure in the "Fuel System Pressure Test" and repair fuel system problem if necessary. Did the Fuel System Pressure Test isolate a condition requiring repair?	—	Verify repair	Go to *Step 15*
15	1. Visually and physically inspect the intake manifold, injector O-rings, EGR adapter, EGR valve and the EGR feed pipes for vacuum leaks. 2. Repair any problem that is found. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 16*
16	Visually and physically inspect the Bank 2 exhaust manifold for leaks and loose or missing hardware and correct any problem found. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 17*
17	Perform the "Injector Balance Test," and correct any problem found (refer to *Fuel Metering System*). Did the Injector Balance Test isolate a problem?	—	Verify repair	Go to *Step 18*
18	1. Visually and physically inspect the Bank 2 HO2S 1 to ensure that it is installed securely and that the Bank 2 HO2S 1 pigtail and wiring harness are not contacting the exhaust or otherwise damaged. 2. If a problem is found, correct it as necessary. Did your inspection reveal a problem?	—	Verify repair	Refer to *Diagnostic Aids*
19	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0175 Fuel Trim System Rich Bank 2



Circuit Description

To provide the best possible combination of driveability, fuel economy, and emission control, a “closed loop” air/fuel metering system is used. While in “closed loop,” the powertrain control module (PCM) monitors the Bank 1 HO2S 1 and Bank 2 HO2S 1 signals and adjusts fuel delivery based upon the HO2S signal voltages. A change made to fuel delivery will be indicated by the long and short term fuel trim values which can be monitored with a Tech 2. Ideal fuel trim values are around 0%; if the HO2S signals are indicating a lean condition the PCM will add fuel, resulting in fuel trim values above 0%. If a rich condition is detected, the fuel trim values will be below 0%, indicating that the PCM is reducing the amount of fuel delivered. If an excessively rich condition is detected on Bank 2, the PCM will set DTC P0175.

The PCM’s maximum authority to control long term fuel trim allows a range between –15%(automatic transmission) or –12%(manual transmission) and +20%. The PCM’s maximum authority to control short term fuel trim allows a range between –11% and +20%. The PCM monitors fuel trim under various engine speed/load fuel trim cells before determining the status of the fuel trim diagnostic.

Conditions for Setting the DTC

- No Tech 2 test is being run.
- None of the following DTCs are set: idle system, EGR, HO2S, (response, transition, open, low volts, no activity), MAF, TPS, MAP, IAT, canister purge, EVAP, injector circuit, or misfire.
- Engine coolant temperature is between 25˚C (77˚F) and 100˚C (212˚F).
- Intake air temperature is between –40˚C (–40˚F) and 120˚C (248˚F).
- Manifold absolute pressure is between 24 kPa and 99 kPa.
- Throttle angle is steady between 3 and 95%.
- Vehicle speed is below 136 km/h (85 mph).
- Engine speed is between 400 and 6,000 RPM.

- Barometric pressure is greater than 72.5 kPa.
- Mass air flow is between 2 g/second and 200 g/second.
- Ignition voltage is above 9.5 volts.
- Fuel system is in “closed loop.”

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the failure is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0175 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0175 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed -out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Bank 2 HO2S 1 display on the Tech 2 while moving connectors and wiring harnesses related to the engine harness. A change in the display will indicate the location of the fault.

Reviewing the Failure Records Vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. DTCs other than P0172 and P0175 may indicate a condition present which may cause a lean condition. If this is the case, repairing the condition which caused the other DTC will most likely correct the DTC P0172/P0175.
4. If the DTC P0175 test passes while the Failure Records conditions are being duplicated, the rich condition is intermittent. Refer to *Diagnostic Aids* or *Symptoms* for additional information on diagnosing intermittent problems.

DTC P0175 – Fuel Trim System Rich Bank 2

Step	Action	Value(s)	Yes	No
1	Was the ”On-Board Diagnostic (OBD) System Check” performed?	—	Go to Step 2	Go to *OBD System Check*
2	Are any DTCs set other than P0172 and P0175?	—	Go to the applicable DTC charts and repair the other DTCs before proceeding with this chart.	Go to *Step 3*
3	1. Start the engine and operate the vehicle in “closed loop.” 2. Observe the “BANK 2 L.T. FUEL TRIM” display on the Tech 2. Is the displayed value more negative than the specified value?	L.T. Fuel Trim: –15% (auto. trans.) OR –12% (man. trans.)	Go to *Step 5*	Go to *Step 4*

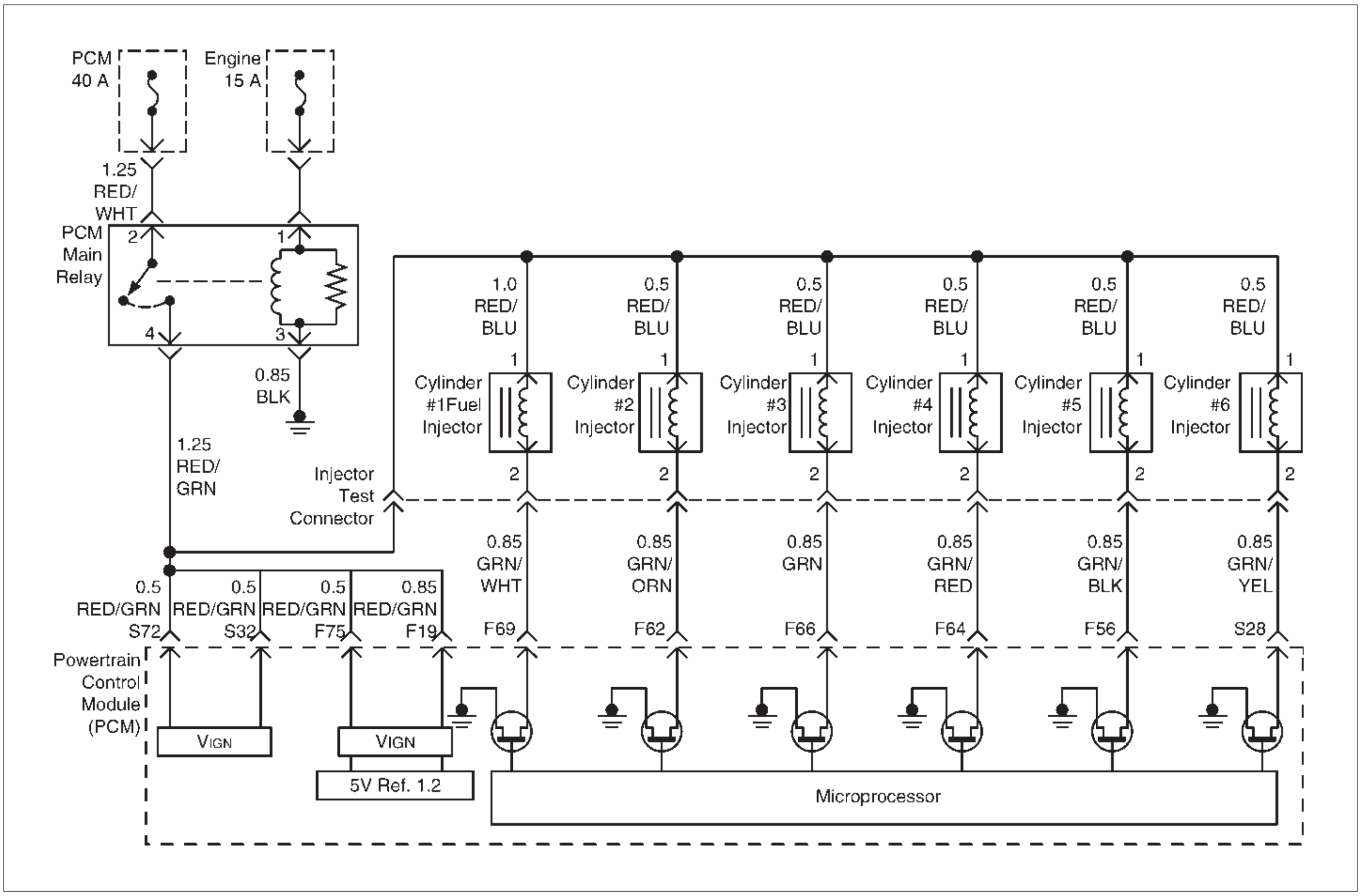
DTC P0175 – Fuel Trim System Rich Bank 2 (Cont'd)

Step	Action	Value(s)	Yes	No
4	1. Review and record the Tech 2 Failure Records data. 2. Clear the DTC P0172/P0175 and operate the vehicle to duplicate the Failure Records conditions. 3. Monitor the Tech 2 "DTC" info for DTC P0175 while operating the vehicle to duplicate the Failure Records conditions. 4. Continue operating the vehicle until the DTC P0175 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0175 failed this ignition?	—	Go to *Step 5*	The rich condition is not present. If a driveability symptom still exists, refer to *Symptoms*.
5	Was DTC P0172 also set?	—	Go to *Step 6*	Go to *Step 15*
6	Visually and physically inspect the air filter element and replace it if necessary. Did the air filter require replacement?	—	Verify repair	Go to *Step 7*
7	Visually and physically inspect the air intake duct for collapse or restriction and repair if necessary. Did your inspection reveal a problem requiring repair?	—	Verify repair	Go to *Step 8*
8	Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects which may partially block air flow through the screen and correct any problem found. Did your inspection of the MAF sensor reveal a condition requiring repair or replacement?	—	Verify repair	Go to *Step 9*
9	Start the engine and note the idle quality. Is a low or unsteady idle being experienced?	—	Go to *Step 10*	Go to *Step 11*
10	1. Turn the ignition off and physically inspect the throttle body bore, throttle plate, and IAC passages for coking and foreign objects. 2. If a problem was found, repair as necessary. Did your inspection reveal a condition requiring repair?	—	Verify repair	Go to *Step 11*
11	1. Disconnect the vacuum hose from the fuel pressure regulator and inspect the hose for the presence of fuel. 2. If fuel is present in the vacuum hose, replace the fuel pressure regulator (refer to *Fuel Metering System*). Did the fuel pressure regulator require replacement?	—	Verify repair	Go to *Step 12*
12	1. Ignition "ON," engine "OFF." 2. Monitor the TP Angle display on the Tech 2 while slowly depressing the accelerator pedal. Does the TP Angle display increase steadily and evenly from minimum value at closed throttle to maximum value at wide-open throttle?	Minimum 8% Maximum 92%	Go to *Step 13*	Go to *Step 21*
13	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 2 L.T. FUEL TRIM" and "BANK 2 S.T. FUEL TRIM" display on the Tech 2. Did both values change to near the specified value?	0%	Go to *Step 22*	Go to *Step 14*

DTC P0175 – Fuel Trim System Rich Bank 2 (Cont'd)

Step	Action	Value(s)	Yes	No
14	1. Perform the "Fuel System Pressure Test." 2. If Fuel System Pressure Test isolates a problem, repair as necessary (refer to *Engine Fuel* or *Fuel Metering System*). Did the Fuel System Pressure Test isolate a condition requiring repair?	—	Verify repair	Go to *Step 15*
15	1. Ignition "ON," engine "OFF." 2. Connect a test light between the harness connector terminals of canister purge solenoid. Is the test light on?	—	Go to *Step 16*	Go to *Step 19*
16	Check for short to ground in the wire (YEL/RED) between the canister purge solenoid and PCM terminal S-48. Was there a short to ground?	—	Go to *Step 17*	Go to *Step 18*
17	Repair the short to ground. Is the action complete?	—	Verify repair	—
18	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
19	1. Perform the "Injector Balance Test." 2. If the Injector Balance Test isolates a problem, repair as necessary (refer to *Fuel Metering System*). Did the Injector Balance Test isolate a problem requiring repair?	—	Verify repair	Go to *Step 20*
20	1. Remove and visually/physically inspect the Bank 2 HO2S 1 for silicon contamination. This will be indicated by a powdery deposit on the portion of the HO2S that is exposed to the exhaust stream. 2. If contamination is evident on the Bank 2 HO2S 1, replace the contaminated sensor. Did the sensor require replacement?	—	Verify repair	Refer to *Diagnostic Aids*
21	1. Check the TP sensor mounting screws and tighten or replace them as necessary if they are loose or missing. 2. If the screws are OK, replace the TP sensor. Is the action complete?	—	Verify repair	—
22	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0201 Injector 1 Control Circuit



Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON.”
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0201 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0201 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0201 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

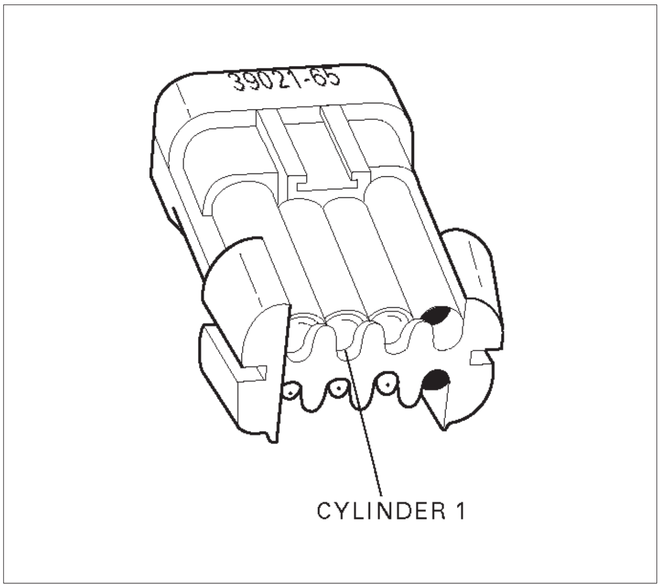
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0201 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 1 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



R321054

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

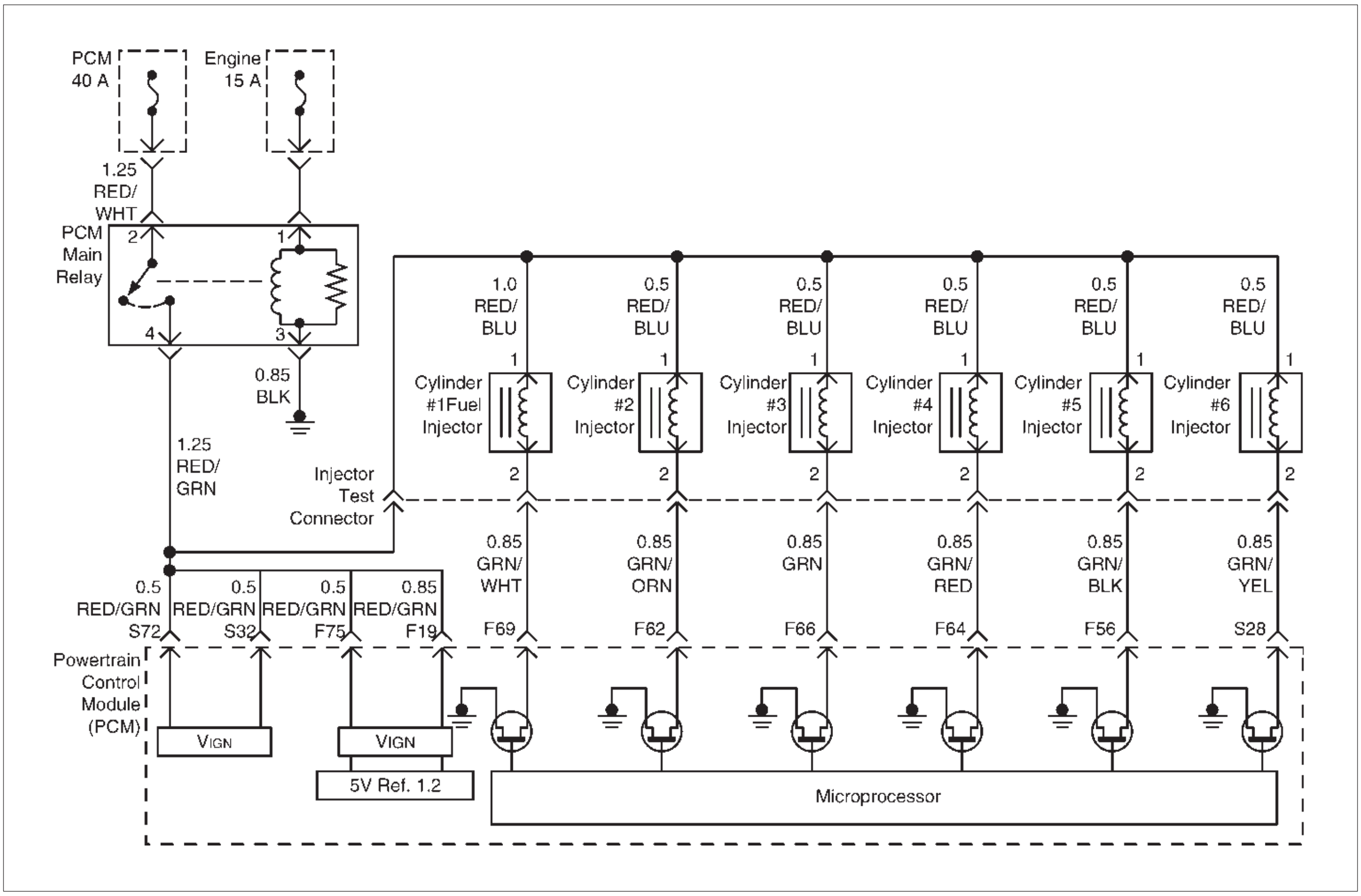
DTC P0201 – Injector 1 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0201 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0201 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*

DTC P0201 – Injector 1 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Engine "OFF." 2. Disconnect the injector connector. 3. Install an injector test light J-39021-65 on the injector test connector. 4. Crank the engine and note the light. Does the injector test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*
6	Note whether the injector test light for cylinder 1 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 1 (green with white tracer). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/white wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0202 Injector 2 Control Circuit



D06RY00108

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When a driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON.”
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0202 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0202 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0202 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

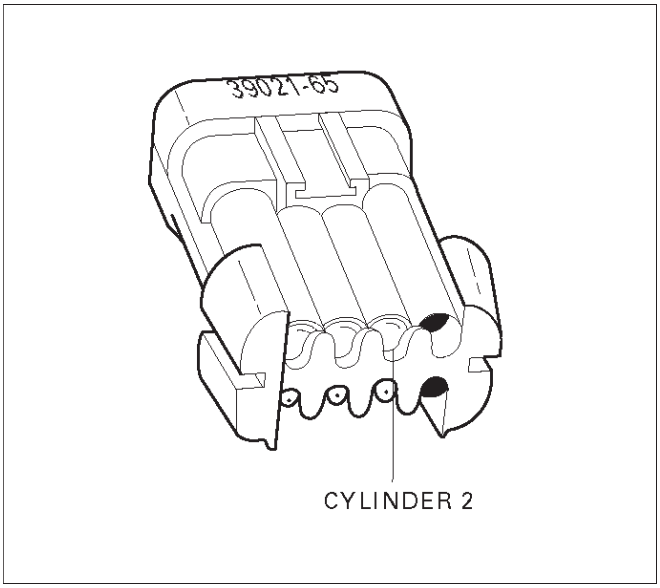
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0202 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 2 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



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7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

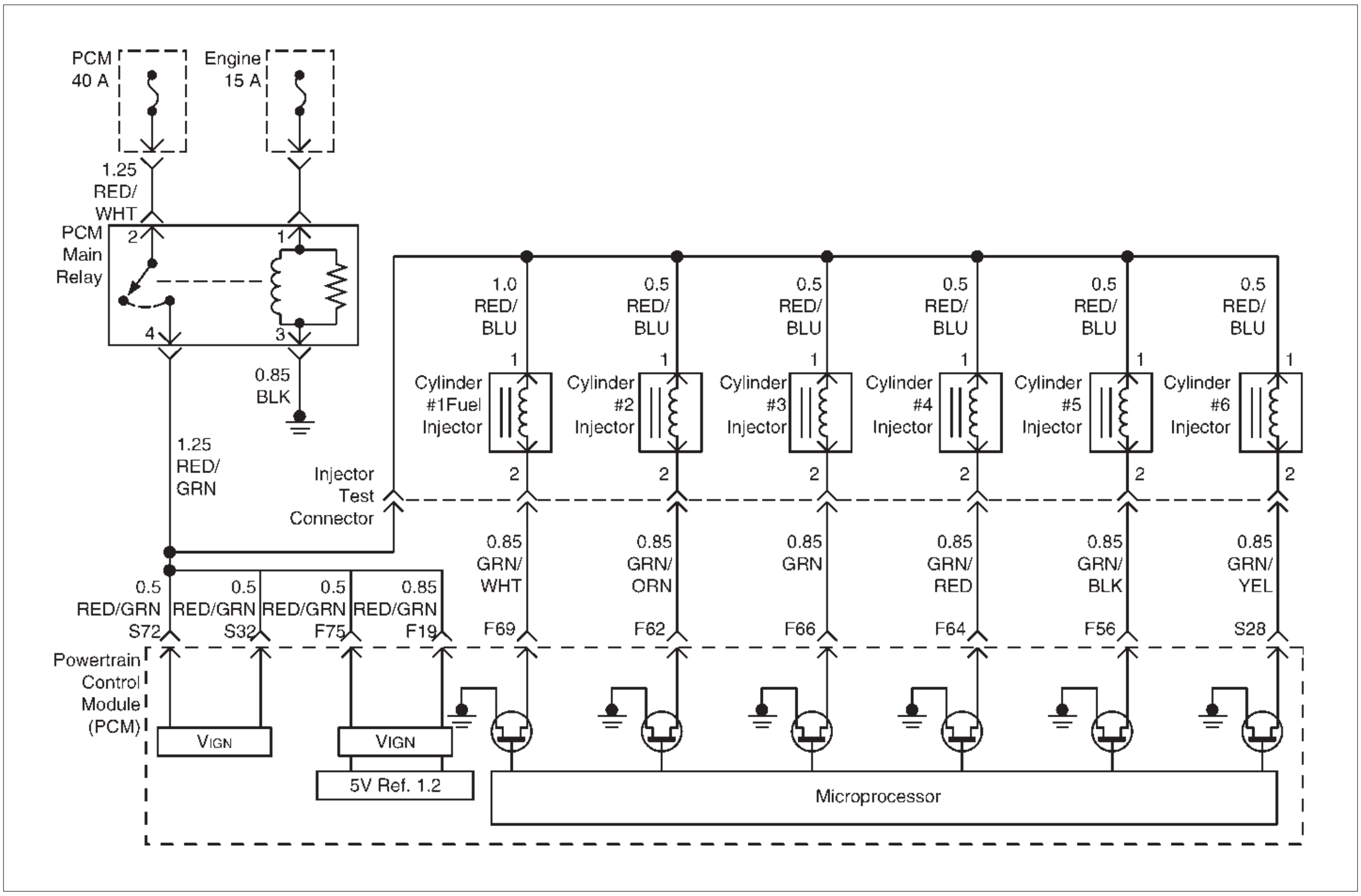
DTC P0202 – Injector 2 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0202 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0202 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*

DTC P0202 – Injector 2 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Engine "OFF." 2. Disconnect the injector test connector. 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 2 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*
6	Note whether the injector test light for cylinder 2 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 2 (green with orange tracer). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/orange wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0203 Injector 3 Control Circuit



D06RY00108

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON.”
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0203 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0203 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0203 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

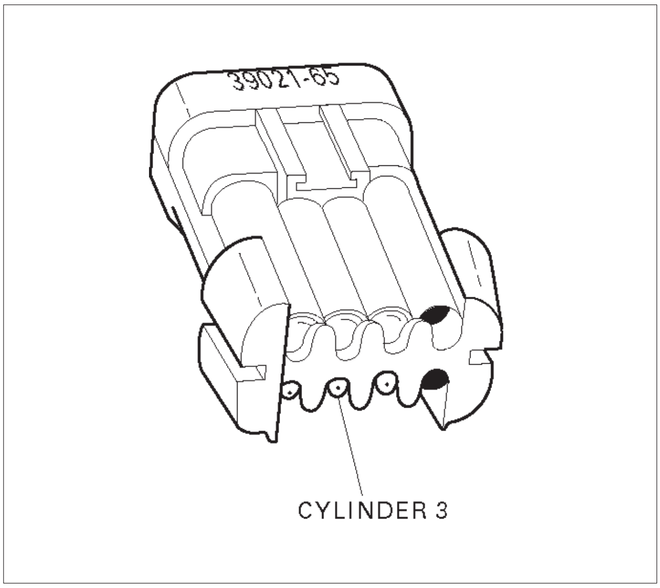
The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0203 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 3 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.
9. The reading should be about 12-14Ω.
10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.



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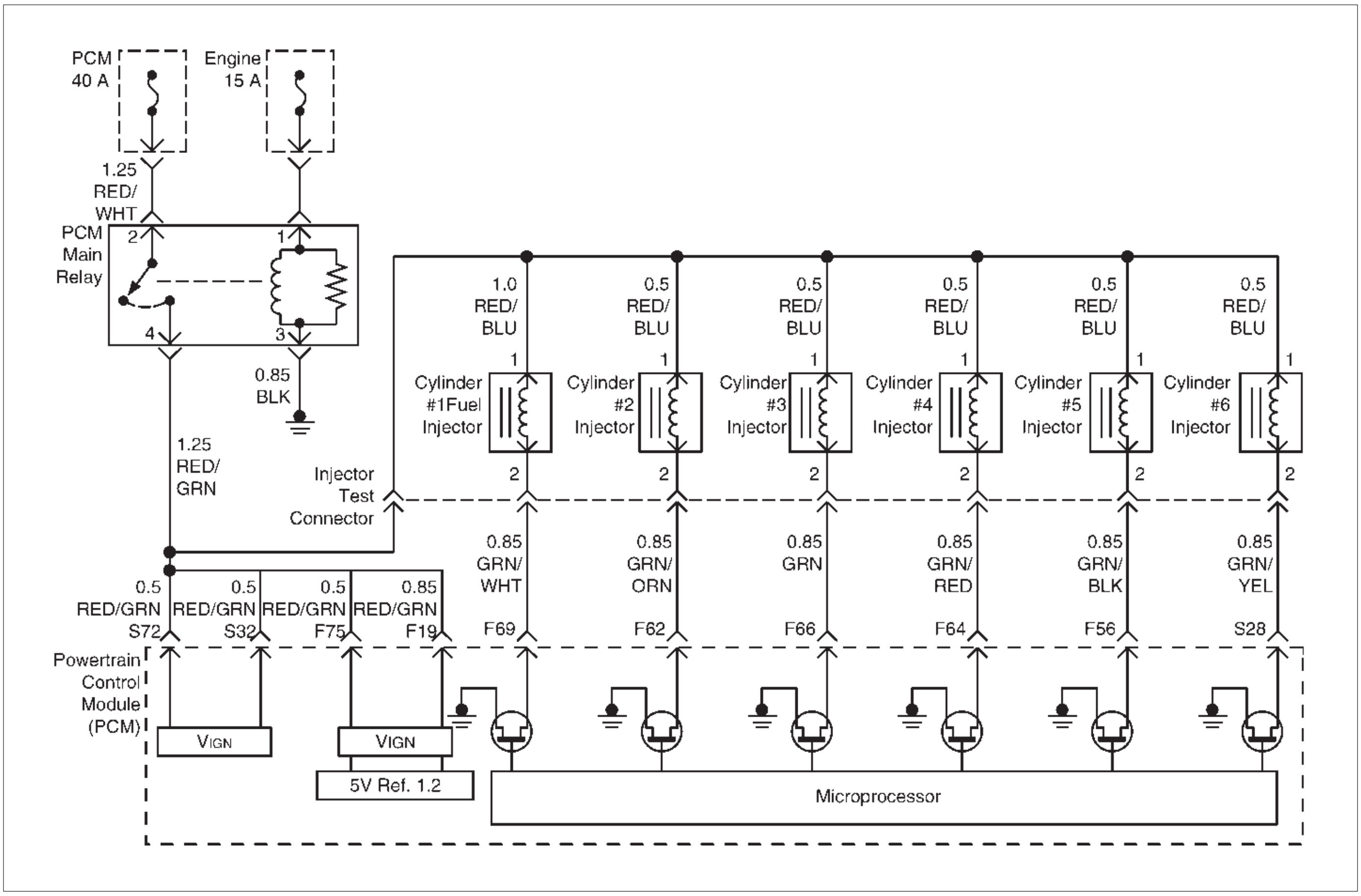
DTC P0203 – Injector 3 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0203 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0203 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*

DTC P0203 – Injector 3 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Engine "OFF." 2. Disconnect the injector test connector . 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 3 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*
6	Note whether the injector test light for cylinder 3 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 3 (green). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0204 Injector 4 Control Circuit



D06RY00108

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON.”
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0204 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0204 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0204 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

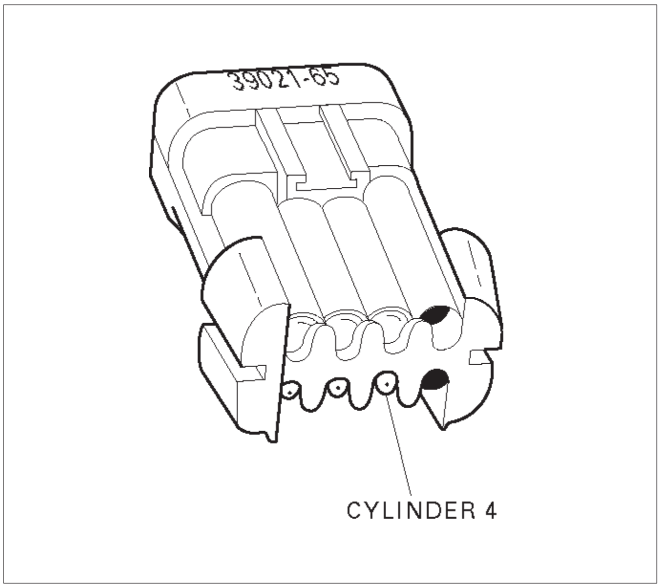
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0204 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold. The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 4 is "ON" steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



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7. Because the test light was "ON" steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.
9. The reading should be about 12-14Ω.
10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

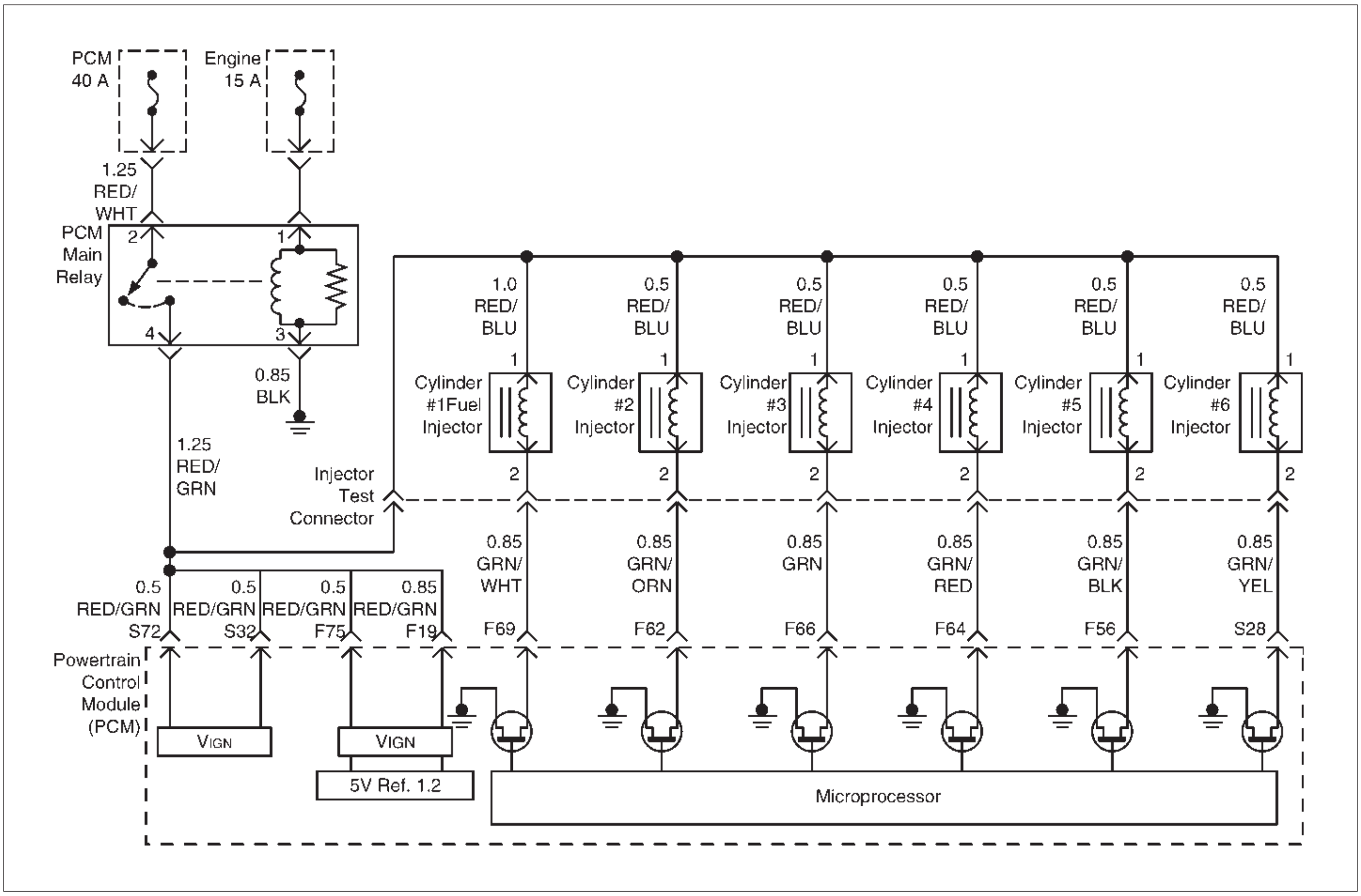
DTC P0204 – Injector 4 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0204 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition "ON" and the engine "OFF" and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0204 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*

DTC P0204 – Injector 4 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Engine "OFF." 2. Disconnect the injector test connector. 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 4 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to Step 6
6	Note whether the injector test light for cylinder 4 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 4 (green/red). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/red wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0205 Injector 5 Control Circuit



D06RY00108

Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by the 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON.”
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0205 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0205 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0205 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.
Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0205 is the result of a hard failure or an intermittent condition.

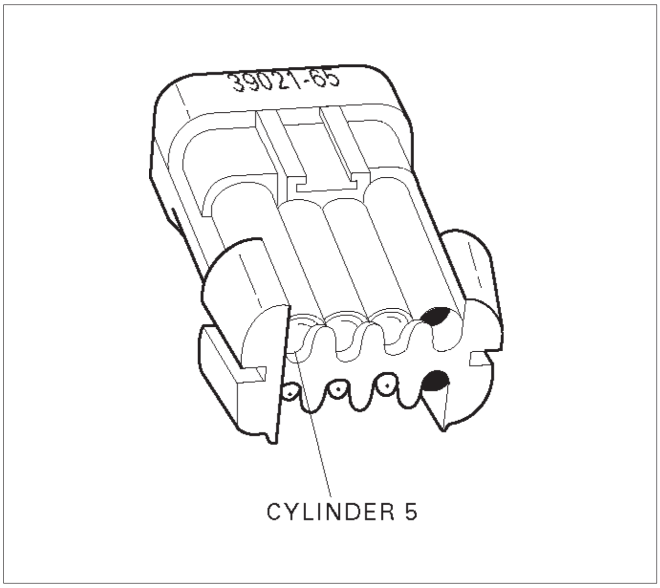
5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold.The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 5 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.

7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.



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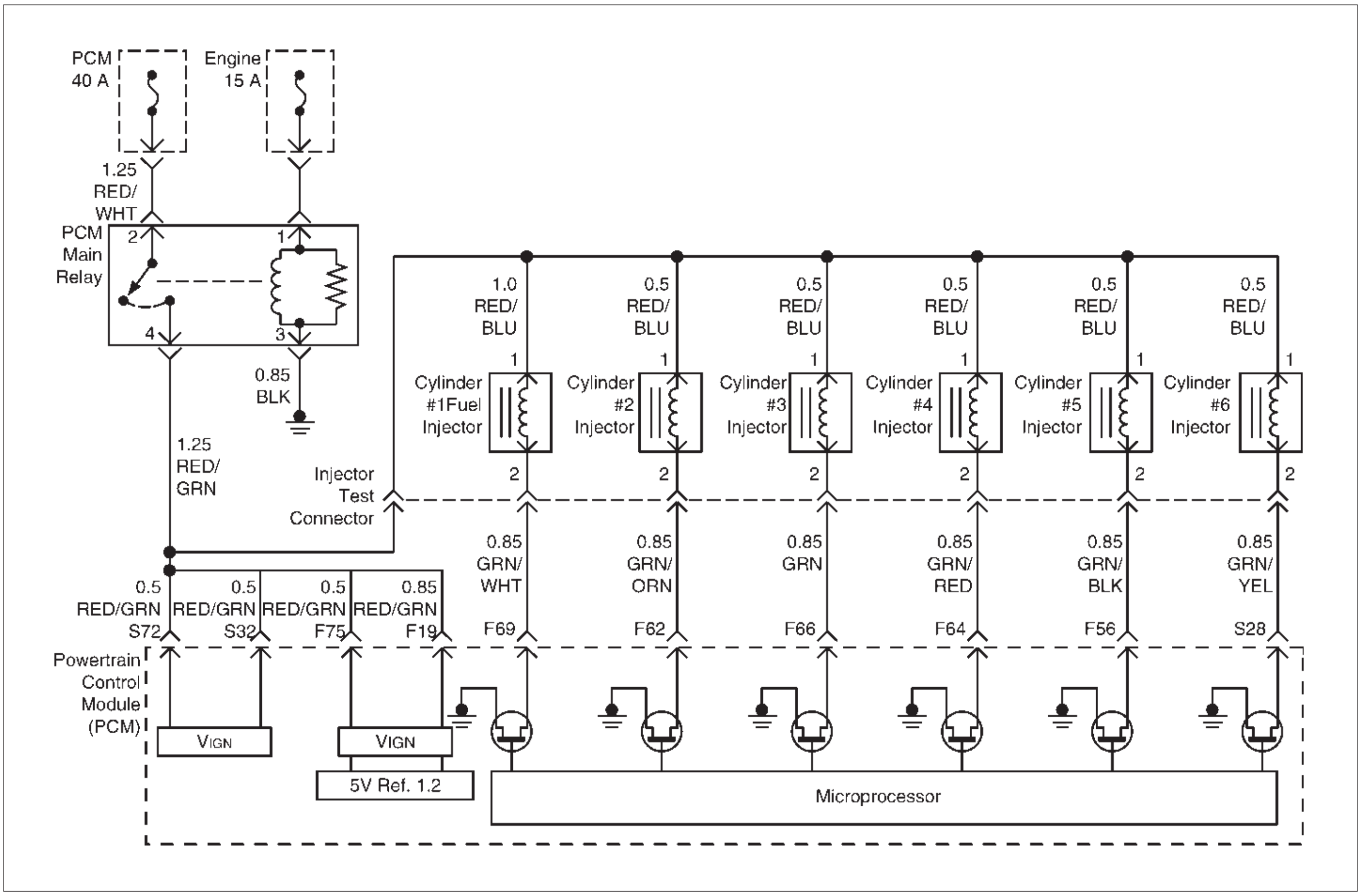
DTC P0205 – Injector 5 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0205 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0205 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*

DTC P0205 – Injector 5 Control Circuit (Cont’d)

Step	Action	Value(s)	Yes	No
5	1. Engine “OFF.” 2. Disconnect the injector test connector. 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 5 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*
6	Note whether the injector test light for cylinder 5 was “OFF” or “ON” steady in step 5. Was the test light “ON” steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 5 (green with black tracer). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector. Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/black wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0206 Injector 6 Control Circuit



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Circuit Description

The powertrain control module (PCM) has six individual injector driver circuits. Each controls an injector. When the driver circuit is grounded by the PCM, the injector is activated. The PCM monitors the current in each driver circuit. The voltage on each driver is monitored to detect a fault. If the voltage is not what the PCM expects to monitor on the circuit, a DTC is set. This DTC is also set if an injector driver is shorted to voltage or if there is an open circuit.

Conditions for Setting the DTC

- The battery voltage is more than 9 volts.
- The engine is turning, determined by 58X crankshaft position input signal.
- The injector voltage does not equal the ignition voltage when the injector is commanded “OFF” or the injector voltage does not equal 0 volts when the injector is commanded “ON.”
- The above conditions are met for 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn “OFF” the MIL on the third consecutive trip cycle in which the diagnostic has been run and the fault is no longer present.
- A history DTC P0206 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0206 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An injector driver circuit that is open or shorted to voltage will cause a DTC P0206 to set. It will also cause a misfire due to an inoperative injector. A misfire DTC will also be set indicating which cylinder is inoperative.

Long term and short term fuel trims that are excessively high or low are a good indication that an injector is faulty. Use Fuel Injector Coil Test Procedure to check for faulty injectors.

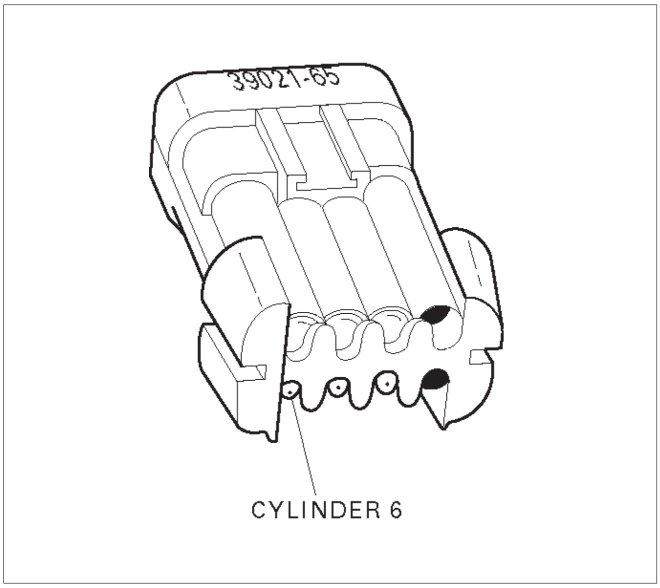
Test Description

The number(s) below refer to the step number(s) on the Diagnostic Chart.

3. This step determines if DTC P0206 is the result of a hard failure or an intermittent condition.

5. A special injector test connector is provided so that the injectors can be electrically tested without removal of the manifold.The test connector can be identified by the blue connector lock which is tethered to the wiring harness. If the light for cylinder 6 is “ON” steady before cranking the engine as well as while cranking the engine, then the injector driver circuit is shorted to ground.

   If the test light blinks while cranking, the PCM and the wiring to the injectors are OK. The Fuel Injector Coil Test Procedure will check if the injectors are faulty.



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7. Because the test light was “ON” steady, voltage to the injector is OK, but the driver circuit is grounded at all times. This step determines if the circuit is shorted to ground or the PCM is faulty.

9. The reading should be about 12-14Ω.

10. Locating the open in the harness or in the injector will require removal of the manifold to provide access.

DTC P0206 – Injector 6 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Will the engine start?	—	Go to *Step 3*	Go to *Engine Cranks But Will Not Run* chart
3	1. Install the Tech 2. Clear the DTC. 2. Idle the engine for one minute. Does DTC P0206 reset?	—	Go to *Step 5*	Go to *Step 4*
4	1. Review the Freeze Frame data with the ignition “ON” and the engine “OFF” and note the parameters. 2. Operate the vehicle within the Freeze Frame conditions as noted. Does P0206 reset?	—	Go to *Step 5*	Go to *Diagnostic Aids*

DTC P0206 – Injector 6 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Engine "OFF." 2. Disconnect the injector test connector. 3. Install an injector test light J-39021-65 on injector connector. 4. Crank the engine and note the light. Does the cylinder 6 test light blink?	—	Go to *Fuel Injector Coil Test Procedure*	Go to *Step 6*
6	Note whether the injector test light for cylinder 6 was "OFF" or "ON" steady in step 5. Was the test light "ON" steady while cranking the engine?	—	Go to *Step 7*	Go to *Step 9*
7	1. Disconnect the PCM connector for the affected injectors. 2. With a test light connected to B+, probe the affected injector driver circuit. Does the test light illuminate?	—	Go to *Step 8*	Go to *Step 15*
8	Repair short to ground in the injector driver circuit. Is the action complete?	—	Go to *OBD System Check*	—
9	1. Disconnect the injector test connector. 2. At the injector side of the harness, connect an ohmmeter between the positive wire (red with blue tracer) and the wire for cylinder 6 (green with yellow tracer). Does the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 10*
10	Repair the open injector harness wire or open injector Is the action complete?	—	Verify repair	—
11	At the PCM side of the injector test connector, check the green/yellow wire for a short to voltage. Was there a short to voltage?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the short to voltage. Is the action complete?	—	Verify repair	—
13	Check for an open circuit between the injector test connector and the PCM. Was there an open circuit?	—	Go to *Step 14*	Go to *Step 15*
14	Repair the open circuit. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to the latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0300 Engine Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ION Sensing Module. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.

This DTC P0300 will determine if a multiple cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, VSS, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The engine temperature sensor (ECT) indicates an engine temperature between –7°C (20°F) and 120°C (248°F).
- Throttle angle is steady and throttle changes less than 15% per 125 milliseconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will disable the TCC operation.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0300 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0300 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

The Tech 2 display "Misfire Cur. #1 through #6" can be useful to determine whether the misfire is isolated to a single cylinder.

- Damaged or faulty ignition coil – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

If the misfire is random, check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- MAF – A mass air flow (MAF) sensor output that causes the PCM to sense a lower than normal air flow will cause a lean condition.
- Air induction system – Air leaks into the induction system which bypass the MAF sensor will cause a lean condition. Check for disconnected or damaged vacuum hoses, incorrectly installed or faulty PCV valve, or for vacuum leaks at the throttle body, EGR valve, and intake manifold mounting surfaces.
- Fuel pressure – Perform a fuel system pressure test. A faulty fuel pump, plugged filter, or faulty fuel system pressure regulator will contribute to a lean condition.
- Injector(s) – Perform an injector coil/balance test to locate faulty injector(s) contributing to a lean or flooding condition. In addition to the above test, check the condition of the injector O-rings.
- EGR – Check for a leaking valve, adapter, or feed pipes which will contribute to a lean condition or excessive EGR flow.
- Fuel quality – Using fuel with the wrong octane rating for the vehicle may cause driveability problems. Although alcohol-enhanced fuels may raise the octane rating, the fuel's ability to turn into vapor in cold temperatures deteriorates. This may affect the cold driveability of the engine. The Reid Vapor Pressure of the fuel can also create problems in the fuel system, especially during the spring and fall when changes by the refineries may not coincide with changes in the weather.
- Vehicle marshalling – The transportation of new vehicles from the assembly plant to the dealership can involve as many as 60 key cycles within 2 to 3 miles of driving. This type of operation contributes to the fuel fouling of the spark plugs and will turn on the MIL with a P0300 Misfire DTC.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0300 – Engine Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record the Tech 2 Freeze Frame data. 3. Operate the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data). 4. Monitor the Tech 2 “Misfire Cur. #” display for each cylinder. Is “Misfire Cur. #” display increasing for any cylinder (indicating a misfire currently occurring)?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. 2. If a problem is found, repair or replace the vacuum hoses as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 4*
4	1. Visually and physically inspect the following areas for vacuum leaks: • The intake manifold • The injector O-rings • The EGR adapter • The EGR feed pipes • ION Sensing Module 2. If a problem is found, repair the vacuum leak as necessary. Did your inspection reveal a vacuum leak?	—	Verify repair	Go to *Step 5*
5	1. Visually and physically inspect the crankcase ventilation valve for improper installation or damaged grommet. 2. If a problem is found, repair as necessary (refer to *Crankcase Ventilation System*). Did your inspection reveal a problem?	—	Verify repair	Go to *Step 6*
6	1. Inspect the MAF sensor inlet screen for damage or for the presence of foreign objects that may partially block the air flow sample through the MAF sensor. 2. If a problem is found, repair or replace the MAF sensor as necessary. Did your inspection of the MAF sensor reveal a condition requiring repair or replacement?	—	Verify repair	Go to *Step 7*
7	1. Remove the EGR valve and visually/physically inspect the valve to ensure that the pintle is not sticking partially open. Also, inspect the EGR valve pintle and seat for carbon deposits or burrs that may interfere with the pintle closing completely. 2. If a problem is found, clean the EGR valve pintle and seat or replace the EGR valve as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 8*

DTC P0300 – Engine Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
8	1. Install a spark tester at the spark plug end of the ignition coil for a cylinder that indicated a misfire. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 14*	Go to *Step 9*
9	1. Remove and visually/physically inspect the ignition coil(s) associated with the cylinders that were indicated as misfiring. Ensure that the coil(s) are free of cracks. 2. If a problem is found, replace the damaged ignition coil(s) as necessary. Did any ignition coils require replacement?	—	Verify repair	Go to *Step 10*
10	1. Remove the spark plugs from the cylinders that were indicated as misfiring. 2. Visually inspect the spark plug electrodes. Does your inspection reveal any spark plugs exhibiting excessive fouling?	—	Go to *Engine Mechanical Diagnosis*	Go to *Step 11*
11	1. Visually inspect the spark plug insulators for cracks, carbon tracking, or other damage. 2. If a problem is found, replace the faulty spark plug(s) as necessary. Did your inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	1. Disconnect the MAF sensor electrical connector. 2. Operate the vehicle in "closed loop" while monitoring the "BANK 1 L.T. FUEL TRIM" and "BANK 1 S.T. FUEL TRIM" display on the Tech 2. Do both values decrease below the specified values?	"BANK 1 L.T. FUEL TRIM" below +20%; "BANK 1 S.T. FUEL TRIM" below +50%	Go to *Step 13*	Replace the ignition coil of the affected cylinder
13	Replace the ignition coil control module. Is the action complete?	—	Verify repair	—
14	1. Visually and physically inspect the PCM injector grounds, power grounds and sensor grounds to ensure that they are clean, tight and in their proper locations. 2. If a problem is found, correct the faulty ground condition as necessary. Did your inspection reveal a poor ground?	—	Verify repair	Go to *Step 15*
15	1. Perform the "Fuel System Pressure Test" procedure. 2. If a problem is found, repair as necessary (refer to *Engine Fuel or Fuel Metering System*). Was a fuel system problem found?	—	Verify repair	Go to *Step 16*
16	1. Check the fuel for excessive water, alcohol, or other contaminants (refer to *Diagnosis* in *Engine Fuel* for procedure). 2. If a problem is found, correct the contaminated fuel condition as necessary. Was the fuel contaminated?	—	Verify repair	Go to *Step 17*

DTC P0300 – Engine Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
17	1. Perform the “Injector Coil/Balance Test.” 2. If a problem is found, replace faulty injector(s) as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 18*
18	1. Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • Incorrect valve timing • A leaking head gasket • A loose or broken motor mount 2. If a problem is found, repair as necessary. Was a basic engine mechanical problem found and repaired?	—	Verify repair	Go to *Step 19*
19	1. Check for a transmission TCC problem. Refer to *4L30-E Automatic Transmission Diagnosis*. 2. If a problem is found, repair the transmission as necessary. Refer to *4L30-E Automatic Transmission Unit Repair*. Was a transmission problem found and repaired?	—	Verify repair	Go to *Step 20*
20	Replace the MAF sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0301 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.
This DTC P0301 will determine if the No.1 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 120˚C (248˚F).
- The throttle angle is steady.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0301 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0301 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0301 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #1” on the Tech 2. Is “Misfire Cur. #1” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #1” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #1” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #1 ignition coil. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0301 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #1. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #1 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test." 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0302 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.
This DTC P0302 will determine if the No.2 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 120˚C (248˚F).
- The throttle angle is steady.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0302 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0302 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0302 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #2” on the Tech 2. Is “Misfire Cur. #2” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #2” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #2” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #2 ignition coil. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0302 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #2. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #2 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test." 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0303 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.
This DTC P0303 will determine if the No.3 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 120˚C (248˚F).
- The throttle angle is steady.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0303 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0303 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector — Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0303 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #3” on the Tech 2. Is “Misfire Cur. #3” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #3” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #3” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #3 ignition coil. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0303 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #3. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #3 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test." 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0304 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.
This DTC P0304 will determine if the No.4 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7˚C (28˚F) and 120˚C (248˚F).
- The throttle angle is steady.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0304 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0304 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0304 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #4” on the Tech 2. Is “Misfire Cur. #4” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #4” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #4” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #4 ignition wire. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0304 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #4. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #4 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test." 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0305 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.
This DTC P0305 will determine if the No.5 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following DTCs occur: TP sensor, MAF sensor,vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7°C (28°F) and 120°C (248°F).
- The throttle angle is steady.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0305 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0305 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks, carbon tracking or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

DTC P0305 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #5” on the Tech 2. Is “Misfire Cur. #5” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #5” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #5” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #5 ignition wire. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0305 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #5. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #5 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test." 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0306 Cylinder Misfire Detected

Circuit Description

Misfire is monitored as a function of the combustion quality (CQ) signals generated from the ignition current sense system. Combustion signals represent the degree of combustion in each cylinder. Misfire is detected when the combustion signal is below a predetermined value.

This DTC P0306 will determine if the No.6 cylinder misfire is occurring by monitoring the Combustion Quality.

Conditions for Setting the DTC

- None of the following occur: TP sensor, MAF sensor, vehicle speed sensor, ECT sensor.
- The engine speed is between 600 and 6250 RPM.
- The system voltage is between 11 and 16 volts.
- The ECT indicates an engine temperature between –7°C (28°F) and 120°C (248°F).
- The throttle angle is steady.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- If the misfire is severe enough to cause possible catalyst damage, the PCM will flash the MIL for as long as the misfire remains at catalyst damaging levels.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive ignition cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0306 will clear after 40 consecutive ignition cycles occur without a fault.
- DTC P0306 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- System grounds – Ensure all connections are clean and properly tightened.
- Injector – Perform the injector coil/balance test to locate a faulty injector that contributes to a lean condition on the affected cylinder. In addition to the above test, check the condition of the injector O-ring.
- Faulty spark plug – Check for a cracked insulator, carbon tracking, incorrect gap, and worn electrodes.
- Damaged or faulty ignition coil – Check for cracks or other damage.
- Substitute a known good coil – Swap the ignition coils and retest. If the misfire follows the coil, replace the ignition coil.

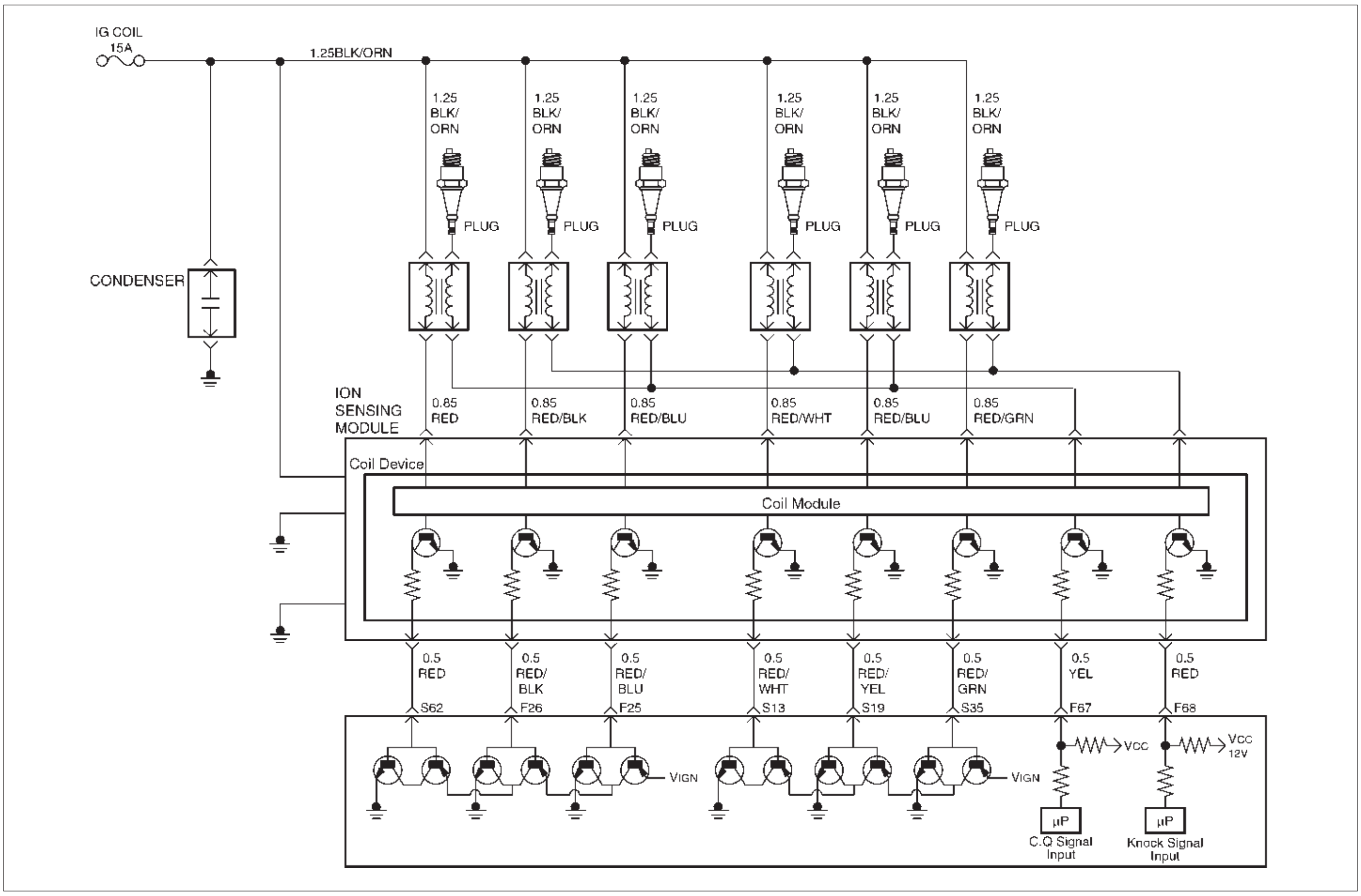
DTC P0306 – Cylinder Misfire Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Start the engine. Run the engine at idle. 2. Review and record Tech 2 Freeze Frame data. 3. Monitor “Misfire Cur. #6” on the Tech 2. Is “Misfire Cur. #6” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Go to *Step 3*
3	Monitor “Misfire Hist. #6” while operating the vehicle to duplicate the conditions present when the DTC was set (as defined by the Freeze Frame data recorded in Step 2). Is “Misfire Hist. #6” increasing (indicating a misfire currently occurring)?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Visually and physically inspect the vacuum hoses for splits, kinks, and improper connections. Also, inspect the intake manifold for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 5*
5	1. Install a spark tester at the spark plug end of the cylinder #6 ignition wire. 2. Crank the engine while observing the spark tester. A crisp, blue spark should be observed. Is adequate spark present?	—	Go to *Step 8*	Go to *Step 6*

DTC P0306 – Cylinder Misfire Detected (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Remove and visually/physically inspect the ignition coil associated with cylinder #6. Ensure that the coil is free of cracks and carbon tracking. 2. If a problem is found, replace the damaged ignition coil as necessary. Did the visual inspection reveal a problem?	—	Verify repair	Go to *Step 7*
7	1. Measure the ignition coil primary resistance. 2. If resistance is not within the specified value, replace the faulty ignition coil. Did the ignition coil require replacement?	2.6-2.7 KΩ	Verify repair	Go to *Step 12*
8	Remove the cylinder #6 spark plug and visually inspect the spark plug electrode. Does the inspection reveal excessive fouling?	—	Go to *Contamination Diagnosis* chart in *Engine Mechanical Diagnosis*	Go to *Step 9*
9	1. Visually inspect the spark plug insulator for cracks, carbon tracking, or other damage. 2. If the spark plug is damaged, replace the spark plug. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 10*
10	1. Perform the "Injector Coil/Balance Test." 2. If any faulty injectors are found, replace them as necessary. Did any of the injectors require replacement?	—	Verify repair	Go to *Step 11*
11	1. Inspect the intake manifold and the injector O-rings for a vacuum leak. 2. If a problem is found, repair it as necessary. Did the inspection reveal a problem?	—	Verify repair	Go to *Step 12*
12	Check for an engine mechanical problem. Refer to *Engine Mechanical Diagnosis* to diagnose and repair the following conditions: • A faulty or incorrect camshaft • Leaking or sticky valves or rings • Excessive valve deposits • Weak valve springs • A leaking head gasket Was a basic engine mechanical problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0325 ION Sensing Module/ION Sensing Knock Intensity Circuit Fault



D06RY00067

Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine opreating conditions.

- The test is performed to evauate the Knock Intensity (KI) signal pulse width if it is within a predetermined renge. If the KI signal puls width is out of the predetermined range, the fail counter will be incremented. If the failure counter excceds the calibration, then test is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the test is complete and a pass will be reported. This test will detect an open/short in the KI line circuit, ION module faults and analog input faults in the PCM.

Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- No Crank DTCs set.
- No EST DTCs set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P0325 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P0325 can be cleared using the Tech2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM- Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage.

  If the harness appears to be OK, observe the Knock Present, Knock Sensor Noise Channel display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault.

If DTC P0325 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P0325 Diagnostic Chart may isolate the cause of the fault.

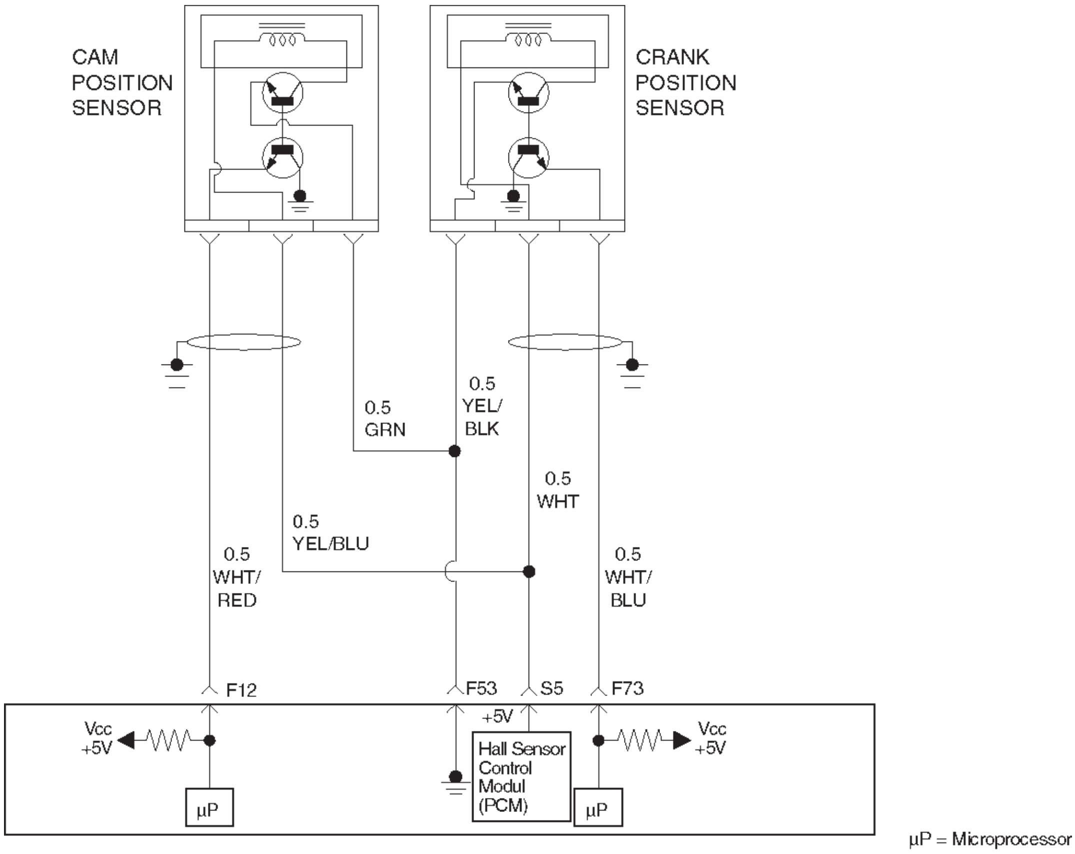
DTC P0325 - ION Sensing Module Knock Intensity Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0325. Does the Tech 2 indicate DTC P0325 failed thisignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition “OFF.” 2. Disconnect the ION sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	—
4	Check the ION sensing harness between the PCM (F68) and ION sensing module circuit (RED Wire) at the KI line harness connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	—
6	Check the ION sensing harness between the ignition coil and ION sensing module circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION sensing module ground circuit for a poor connection. 2. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*

DTC P0325 - ION Sensing Module Knock Intensity Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 10*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not .And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0336 58X Reference Signal Circuit



Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft pulses will be produced. The powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CMP) signal pulses being received. If the PCM receives an incorrect number of pulses on the 58X reference circuit, DTC P0336 will set.

Conditions for Setting the DTC

- Engine is running.
- Extra or missing pulse is detected between consecutive 58X reference pulses.
- Above condition is detected in 10 of 100 crankshaft rotations.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0336 will clear after 40 consecutive warm–up cycles have occurred without a fault.
- DTC P0336 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

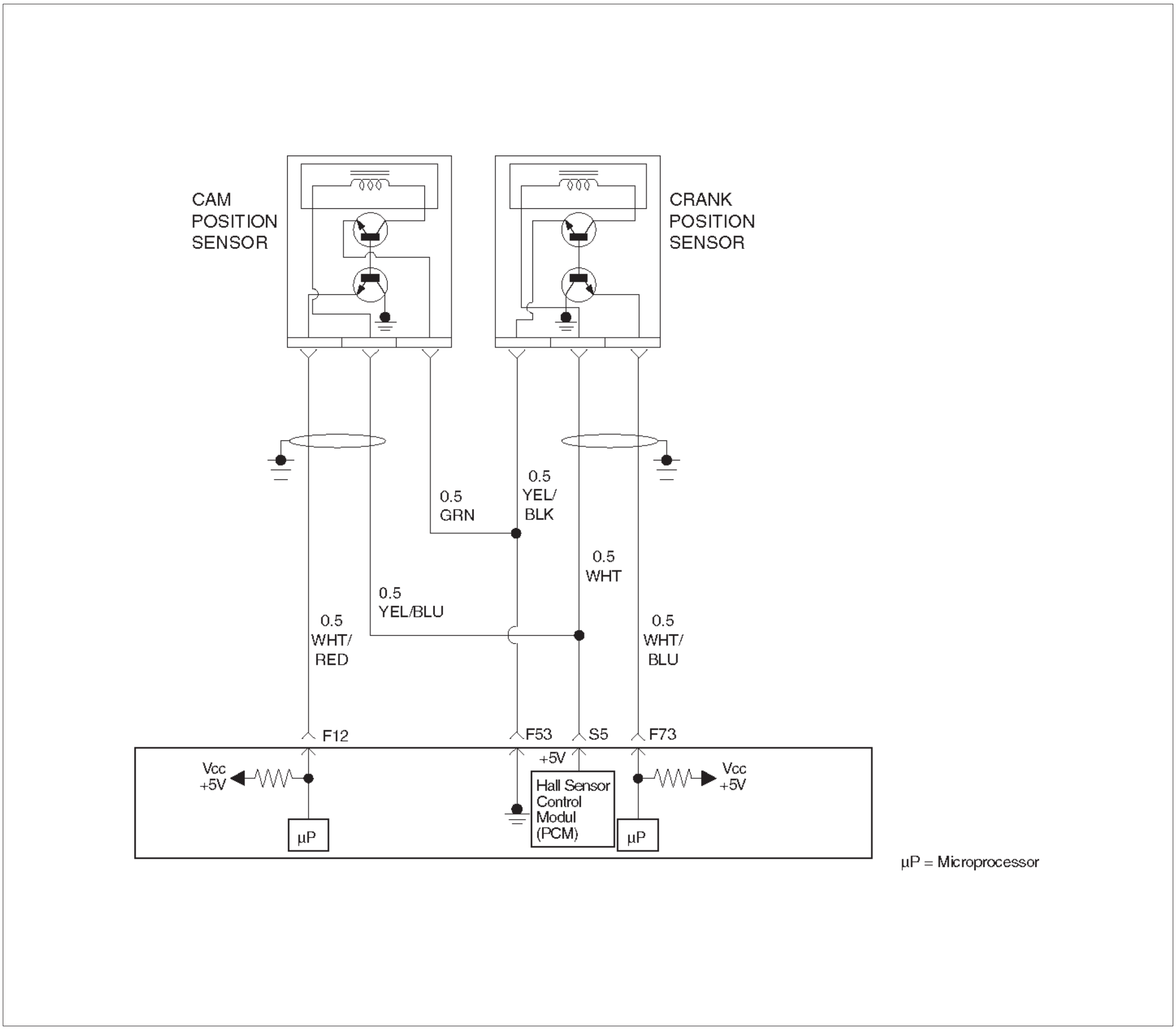
- Poor connection - Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P0336 – 58X Reference Signal Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Attempt to start the engine. Does the engine start?	—	Go to *Step 3*	Go to *“Engine Cranks But Will Not Run”* chart
3	1. Review and record Failure Records information. 2. Clear DTC P0336. 3. Start the engine and idle for 1 minute. 4. Observe DTCs. Is DTC P0336 set?	—	Go to *Step 4*	Refer to Diagnostic Aids
4	1. Disconnect the PCM and CKP sensor. 2. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Reconnect the PCM and CKP sensor. 2. Connect a DVM to measure voltage on the 58X reference circuit at the PCM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to *Step 8*	Go to *Step 6*
6	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 7*
7	Replace the CKP sensor. Use caution to avoid any hot oil that may drip out. Is the action complete?	—	Verify repair	—
8	Check connections at the PCM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 9*
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0337 CKP Sensor Circuit Low Frequency



Circuit Description

The 58X reference signal is produced by the crankshaft position (CKP) sensor. During one crankshaft revolution, 58 crankshaft reference pulses will be produced. The powertrain control module (PCM) uses the 58X reference signal to calculate engine RPM and crankshaft position. The PCM constantly monitors the number of pulses on the 58X reference circuit and compares them to the number of camshaft position (CMP) signal pulses being received. If the PCM does not receive pulses on the 58X reference circuit, DTC P0337 will set.

Conditions for Setting the DTC

- No camshaft position (CMP) sensor DTCs are set.
- Engine cranking.
- Crankshaft position (CKP) sensor signal is not present between two cam pulses.
- CKP reference pulse is not detected within 8 CMP pulses.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0337 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P0337 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the 58X reference circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

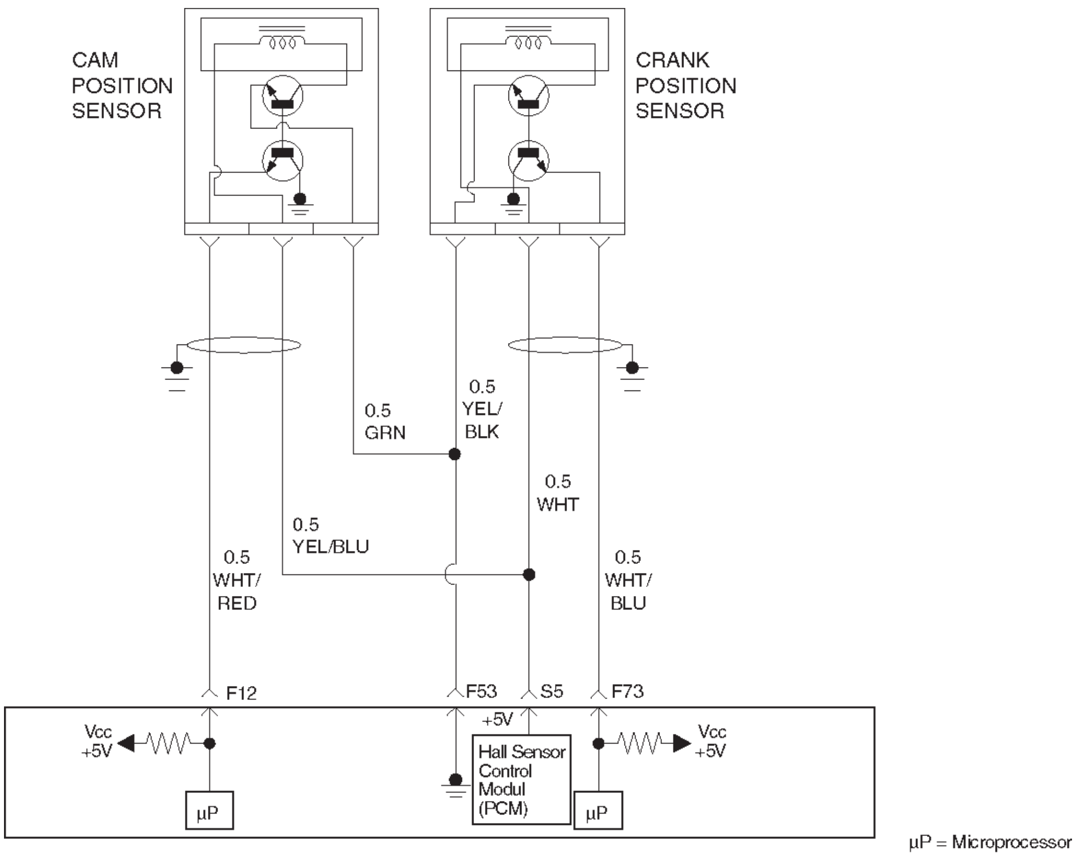
DTC P0337 – CKP Sensor Circuit Low Frequency

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Attempt to start the engine. Does the engine start?	—	Go to *Step 3*	Go to *Chart 3*
3	1. Review and record Failure Records information. 2. Clear DTC P0337. 3. Start the engine and idle for 1 minute. 4. Observe DTCs. Is DTC P0337 set?	—	Go to *Step 4*	Refer to *Diagnostic Aid*
4	1. Disconnect the CKP sensor. 2. Ignition “ON.” 3. Using a DVM, verify that 5 V reference and ground are being supplied at the sensor connector (PCM side). Are 4-6 volts and ground available at the sensor?	—	Go to *Step 7*	Go to *Step 5*
5	1. Ignition “ON.” 2. With a DVM, backprobe the PCM connector 5 V reference and ground connections. Are 5 V reference and ground available at the PCM?	—	Go to *Step 6*	Go to *Step 11*
6	Check 5 V reference or ground between the CKP sensor and PCM and repair the open circuit, short to ground or short to voltage. Is the action complete?	—	Verify repair	—
7	1. Ignition “OFF.” 2. Disconnect the PCM and CKP sensor. 3. Check for an open or a short to ground in the 58X reference circuit between the CKP sensor connector and the PCM harness connector. 4. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Reconnect the PCM and CKP sensor. 2. Connect a DVM to measure voltage on the 58X reference circuit at the PCM connector. 3. Observe the voltage while cranking the engine. Is the voltage near the specified value?	2.5 V	Go to *Step 11*	Go to *Step 9*

DTC P0337 – CKP Sensor Circuit Low Frequency (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the connections at the CKP sensor and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 10*
10	Replace the CKP sensor. Use caution and avoid hot oil that may drip out. Is the action complete?	—	Verify repair	—
11	Check the connections at the PCM and replace the terminals if necessary. Did any terminals require replacement?	—	Verify repair	Go to *Step 12*
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0341 CMP Sensor Circuit Performance



060RY00162

Circuit Description

The CMP signal is produced by the camshaft position (CMP) sensor pulses when the engine is running and crankshaft position (CKP) sync pulses are also being received. The powertrain control module (PCM) uses the CMP signal pulses to initiate sequential fuel injection. The PCM constantly monitors the number of pulses on the CMP signal circuit and compares the number of CMP pulses to the number of 58X reference pulses received. If the PCM receives an incorrect number of pulses on the CMP reference circuit, DTC P0341 will set and the PCM will initiate injector sequence without the CMP signal with a one in six chance that injector sequence is correct. The engine will continue to start and run normally, although the misfire diagnostic will be affected if a misfiring condition occurs.

Conditions for Setting the DTC

- The engine is running (1X CMP reference pulses are being received).
- The CMP sensor signal is not detected at the correct interval every 6 cylinders.
- Above condition fails for 100 occurrences within 200 test samples.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will initiate the injector sequence without the CMP signal with a one in six chance that the injector sequence is correct.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0341 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0341 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the CMP signal circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM and the CMP sensor. A change in voltage will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Ensures that the fault is present.

12. Determines whether the fault is being caused by a missing camshaft magnet or a faulty sensor. The voltage measured in this step should read around 4 volts, toggling to near 0 volts when the CMP sensor interfaces with the camshaft magnet.

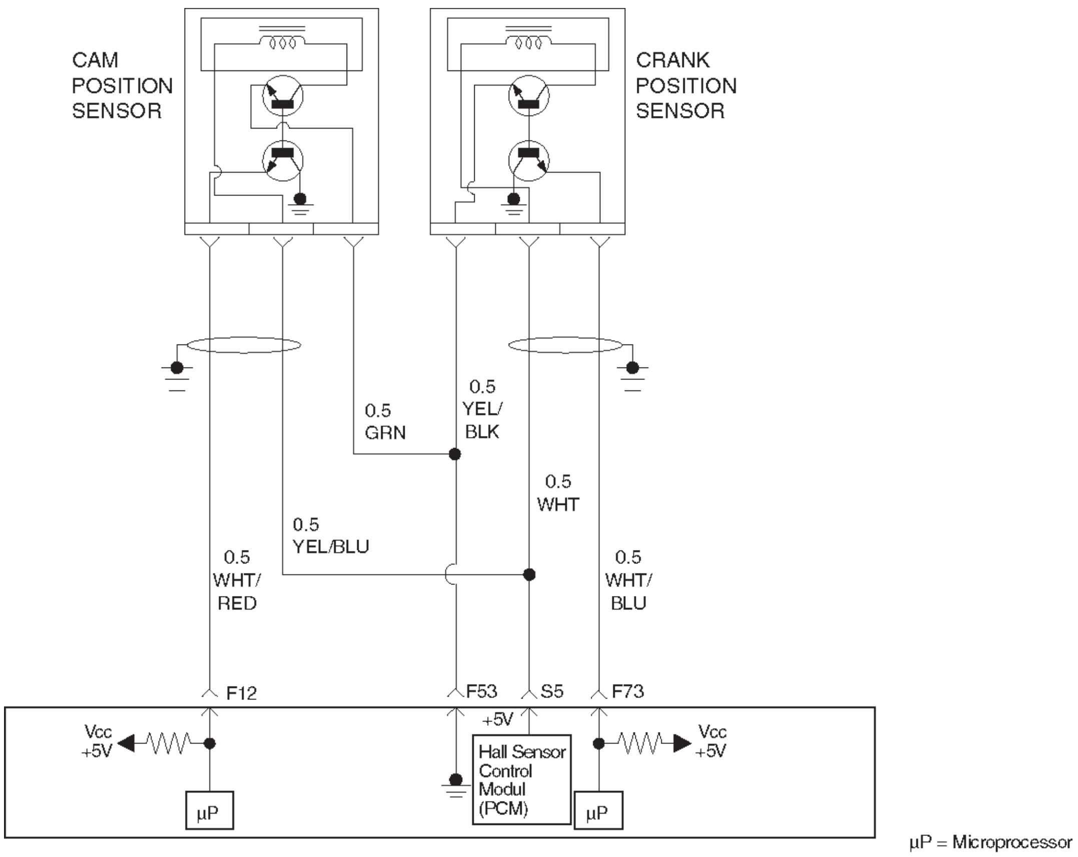
DTC P0341 – CMP Sensor Circuit Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P0341 until the DTC P0341 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0341 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the CMP sensor. 2. Measure the voltage between the sensor feed circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to *Step 4*	Go to *Step 5*
4	Measure the voltage between the CMP sensor signal circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to *Step 11*	Go to *Step 8*
5	If the voltage measured in step 3 was less than 4-6 volts, proceed directly to step 6 without completing this step. If the voltage in step 3 was greater than 4-6 V, repair the short to voltage in the CMP feed circuit. Is the action complete?	—	Verify repair	—
6	1. Check for poor connections at the camshaft position sensor. 2. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Ignition “OFF,” disconnect the PCM and the CMP sensor. 2. Check the following circuits for an open between the ignition control module and the CMP sensor: • The sensor feed circuit. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	1. Ignition “OFF,” disconnect the PCM (leave the CMP sensor disconnected). 2. Ignition “ON,” check the following circuits: • The CMP sensor signal circuit for an open or a short to voltage. • The CMP sensor input signal circuit for a short to ground. 3. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	Check for a short or open in the sensor ground circuit. Was a problem found?	—	Verify repair	Go to *Step 10*

DTC P0341 – CMP Sensor Circuit Performance (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check for poor connections at the PCM. 2. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	Backprobe the PCM connector with a DVM to monitor voltage on the camshaft position input signal circuit while cranking the engine with the sensor connected. (Use rubber band, tape, or an assistant to keep the DVM lead in contact with the sensor terminal during this test.) Does the voltage toggle between the specified values?	4-0 V	Go to *Step 15*	Go to *Step 12*
12	1. Remove the CMP sensor. 2. Place a magnet on the CMP sensor. (If you use a magnet that is too small to cover the face of the sensor, test on every part of the sensor face because only a small area will respond to this test.) Does the DVM display a voltage near the specified value?	0 V	Go to *Step 13*	Go to *Step 14*
13	Replace the faulty or missing camshaft position sensor magnet. Is the action complete?	—	Verify repair	—
14	Replace the camshaft position sensor. Is the action complete?	—	Verify repair	—
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0342 CMP Sensor Circuit Low



060RY00162

Circuit Description

The CMP signal produced by the camshaft position (CMP) sensor pulses when the engine is running and crankshaft position (CKP) sync pulses are also being received. The hall type CMP sensor and the CKP sensor share 5 V and ground connections at the powertrain control module (PCM). The third wire at the sensor is a signal circuit to the PCM. The PCM uses the CMP signal pulses to initiate sequential fuel injection. The PCM constantly monitors the number of pulses on the CMP signal circuit and compares the number of CMP pulses to the number of 58X reference pulses received. If the PCM does not receive pulses on the CMP reference circuit, DTC P0342 will set and the PCM will initiate injector sequence without the CMP signal with a one in six chance that injector sequence is correct. The engine will continue to start and run normally, although the misfire diagnostic will be affected if a misfiring condition occurs.

Conditions for Setting the DTC

- The engine is running.
- The CMP sensor signal is not received by the PCM once every 6 cylinders.
- The above condition occurs for 10 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will initiate injector sequence without the CMP signal with a one in six chance that the injector sequence is correct.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0342 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0342 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by a poor connection, rubbed-through wire insulation or a wire broken inside the insulation. Check for:

- Poor connection – Inspect the PCM harness and connectors for improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, disconnect the PCM, turn the ignition on and observe a voltmeter connected to the CMP signal circuit at the PCM harness connector while moving connectors and wiring harnesses related to the PCM and the CMP sensor. A change in voltage will indicate the location of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Ensures that the fault is present.

14. Determines whether the fault is being caused by a damaged camshaft or a faulty PCM. The voltage measured in this step should read around 4 volts, toggling to near 0 volts when the CMP sensor interfaces with the camshaft magnet.

DTC P0342 – CMP Sensor Circuit Low

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" information for DTC P0342 until the DTC P0342 test runs. 5. Note test result. Does the Tech 2 indicate DTC P0342 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition "ON." 2. Disconnect the CMP sensor. 3. Measure the voltage between the sensor feed circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to *Step 7*	Go to *Step 4*
4	1. Ignition "OFF," disconnect the PCM and the CMP sensor. 2. Check for poor connections at the camshaft position sensor. 3. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Check for poor connections at the PCM. 2. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*

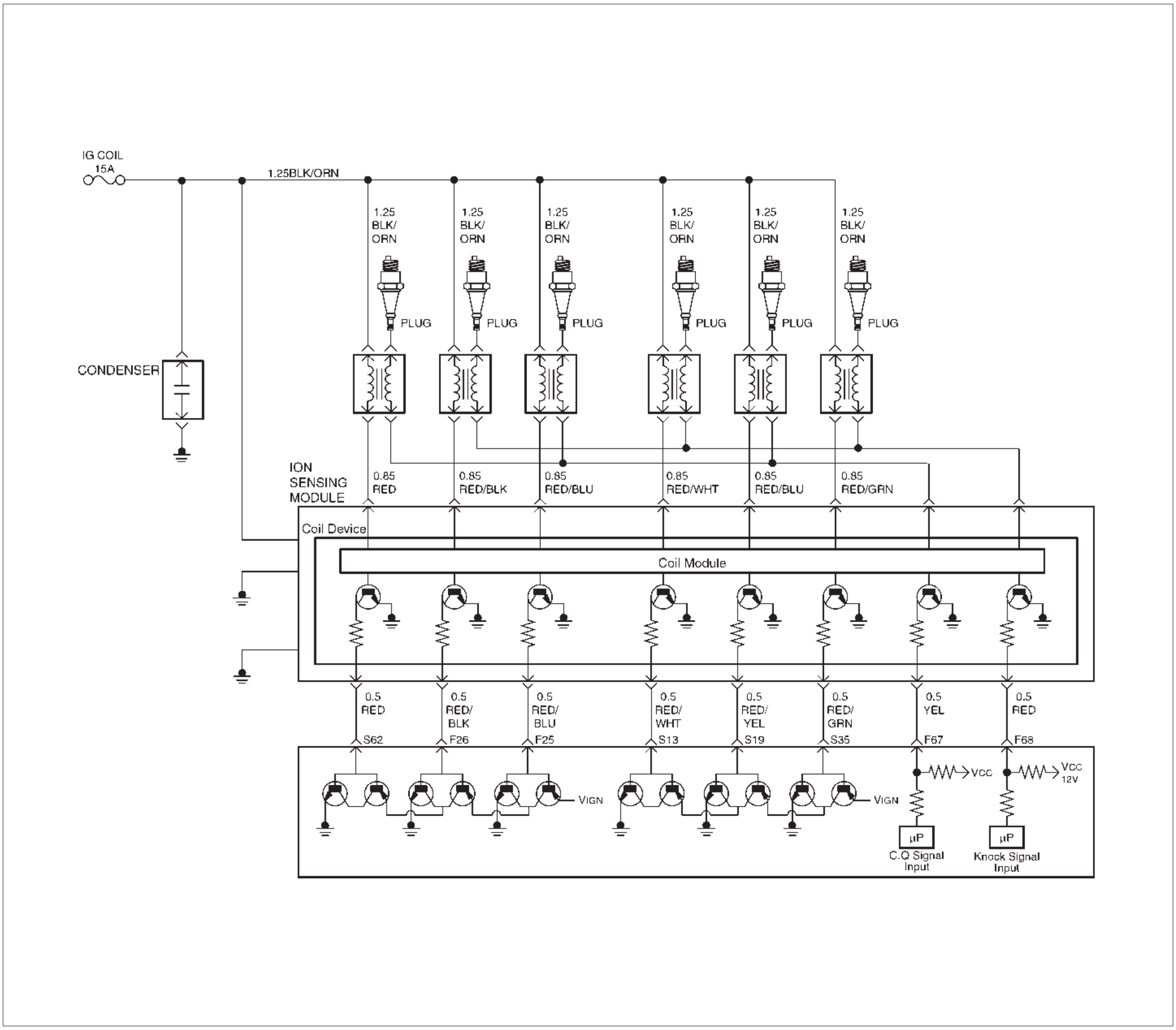
DTC P0342 – CMP Sensor Circuit Low (Cont'd)

Step	Action	Value(s)	Yes	No
6	1. Check the following circuits between the PCM and the CMP sensor: • The sensor feed circuit. Open or short to ground? • The sensor ground circuit. Open or short to voltage? 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	—
7	1. Ignition "ON," engine "OFF." 2. Measure the voltage between the CMP sensor signal circuit and the sensor ground circuit at the CMP sensor harness connector. Does the voltage measure near the specified value?	4-6 V	Go to *Step 8*	Go to *Step 9*
8	1. Turn the ignition "OFF." 2. Disconnect the PCM and connect a DVM to monitor voltage on the camshaft position signal circuit at the PCM connector. 3. Ignition "ON." 4. Monitor the voltage display on the DVM while repeatedly touching the CMP sensor signal circuit at the CMP sensor connector with a test light to ground. Does the DVM voltage display switch between 0 and approximately 5 volts when the test light is touched to the CMP sensor signal circuit?	—	Go to *Step 12*	Go to *Step 9*
9	1. Ignition "OFF." 2. Leave the PCM disconnected. 3. Ignition "ON." 4. Probe the camshaft position signal circuit at the PCM connector with a test light to B+. 5. If the test light is "ON," locate and repair the short to ground in the camshaft position input signal circuit. Was either circuit shorted to ground?	—	Verify repair	Go to *Step 10*
10	1. Ignition "OFF." 2. Leave the PCM disconnected. 3. Ignition "ON." 4. Probe the camshaft position signal circuit with a test light to ground. 5. If the test light is "ON," locate and repair the short to voltage in the camshaft position input signal circuit. Was the test light "ON"?	—	Verify repair	Go to *Step 11*
11	1. Ignition "OFF," disconnect the PCM (leave the CMP sensor disconnected). 2. Ignition "ON," check the following circuit: • The CMP sensor signal circuit for an open. 3. If a problem is found, repair it as necessary. Was a problem found?	—	Verify repair	—

DTC P0342 – CMP Sensor Circuit Low (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Ignition "ON." 2. Remove the CMP sensor. 3. Place a magnet on the CMP sensor. If you use a magnet that is too small to cover the face of the sensor, test on every part of the sensor face because only a small area will respond to this test. Does the DVM display a voltage near the specified value?	0 V	Go to *Step 14*	Go to *Step 13*
13	Replace the camshaft position sensor. Is the action complete?	—	Verify repair	—
14	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0351 Ignition 1 Control Circuit



D06RY00067

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 1, it will set a DTC P0351.

Conditions for Setting the DTC

- The ignition is “ON.”
- The engine is turning, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON.”
- The output voltage is not equal to 0 volts when output is “OFF.”
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0351 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0351 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0351 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

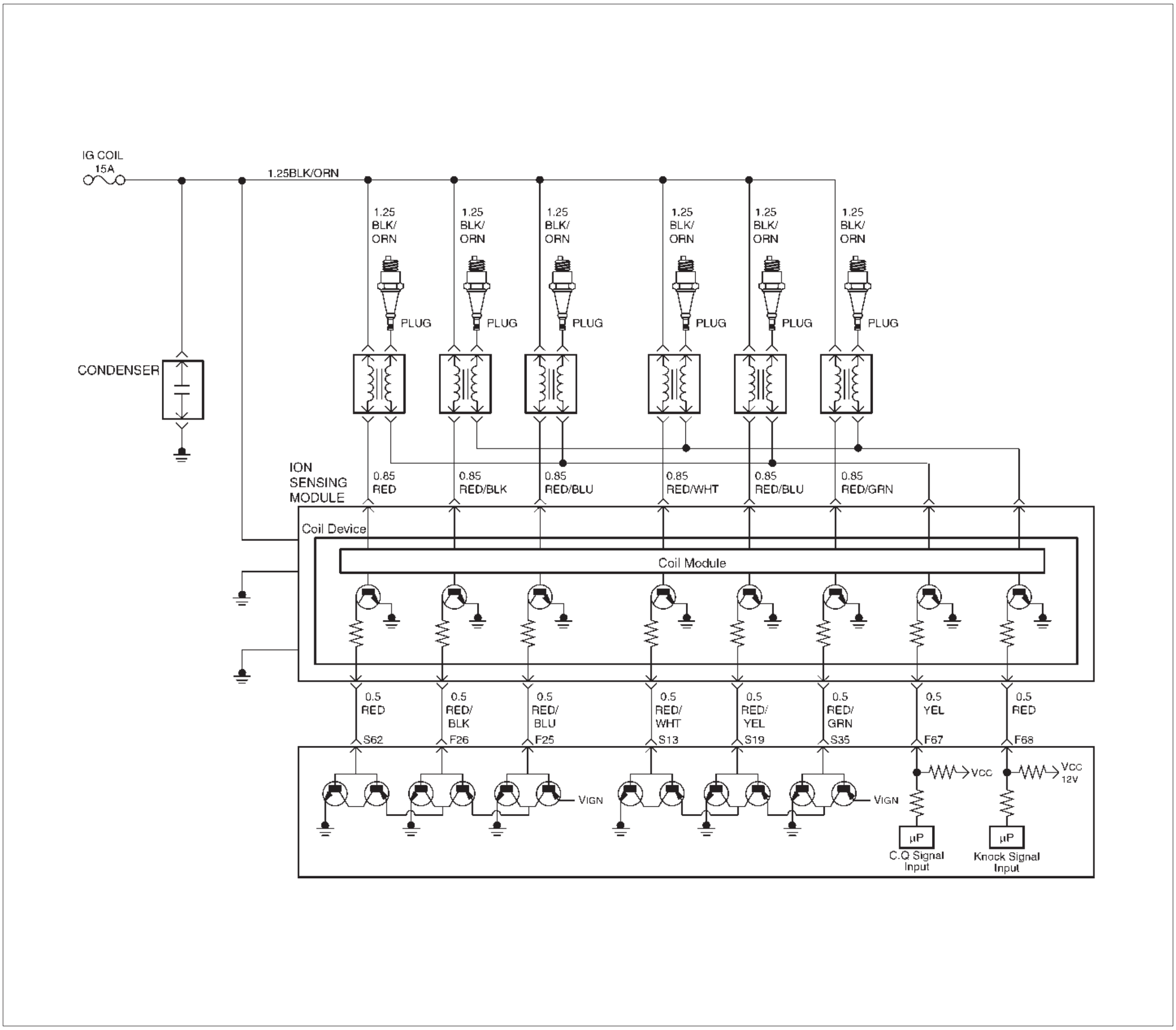
DTC P0351 – Ignition 1 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the “DTC” information for DTC P0351 until the DTC P0351 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0351 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition “ON,” engine “OFF.” 2. Back probe the ignition control circuit 1 at the ION Sensing Module with a DVM. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition “ON,” engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition “OFF.” 2. Disconnect the 3-pin and connector at the ignition coil. 3. Check ignition control circuit 1 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition “OFF.” 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 1 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 1 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0351 – Ignition 1 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 1. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0352 Ignition 2 Control Circuit



D06RY00067

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 2, it will set a DTC P0352.

Conditions for Setting the DTC

- The ignition is “ON.”
- The engine is turning, determined by the 58 X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON.”
- The output voltage is not equal to 0 volts when output is “OFF.”
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0352 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0352 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0352 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

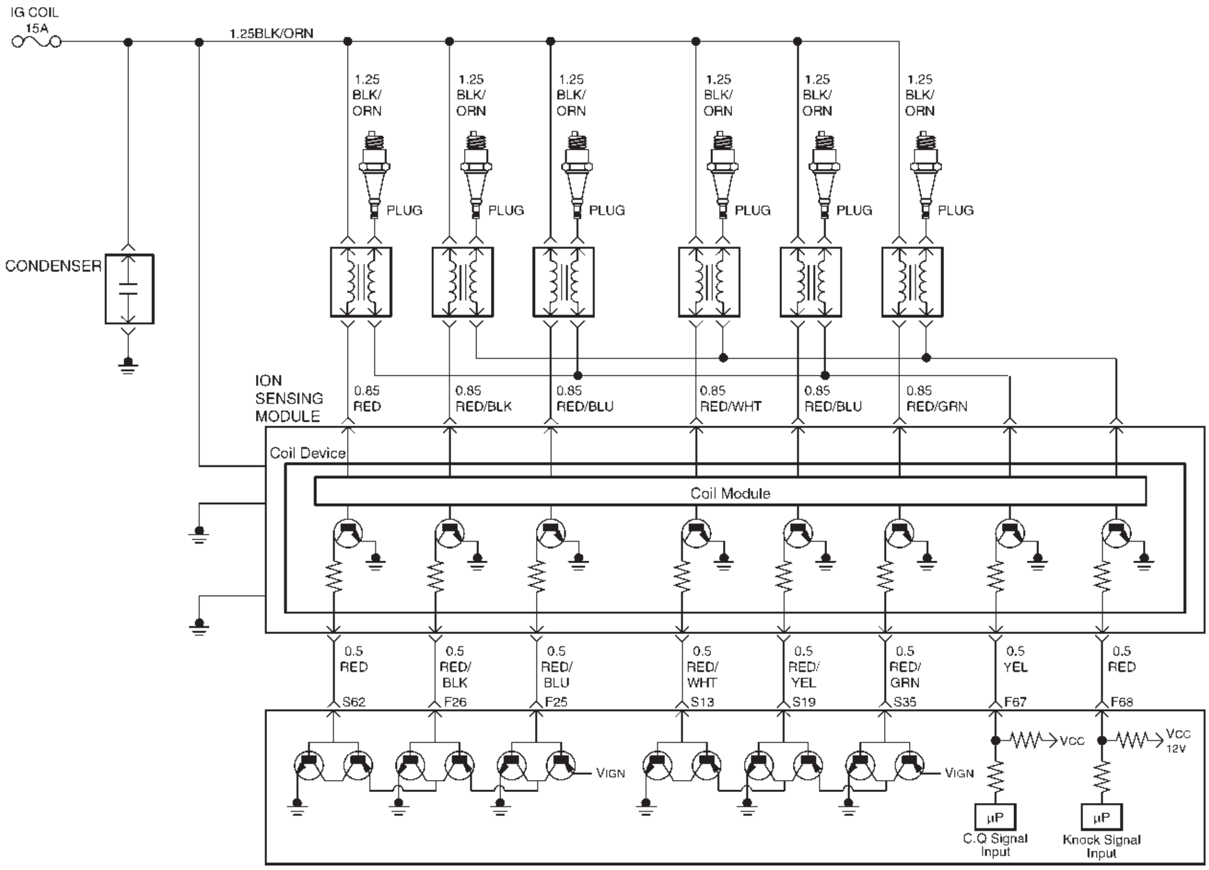
DTC P0352 – Ignition 2 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the “DTC” information for DTC P0352 until the DTC P0352 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0352 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition “ON,” engine “OFF.” 2. Back probe the ignition control circuit 2 at the ION Sensing Module with a DVM . Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition “ON,” engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition “OFF.” 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 2 voltage at the ignition coil connector while cranking the engine connector. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition “OFF.” 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 2 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 2 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0352 – Ignition 2 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 2. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0353 Ignition 3 Control Circuit



D06RY00067

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 3, it will set a DTC P0353.

Conditions for Setting the DTC

- The ignition is “ON.”
- The engine is turning, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON.”
- The output voltage is not equal to 0 volts when output is “OFF.”
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0353 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0353 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0353 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

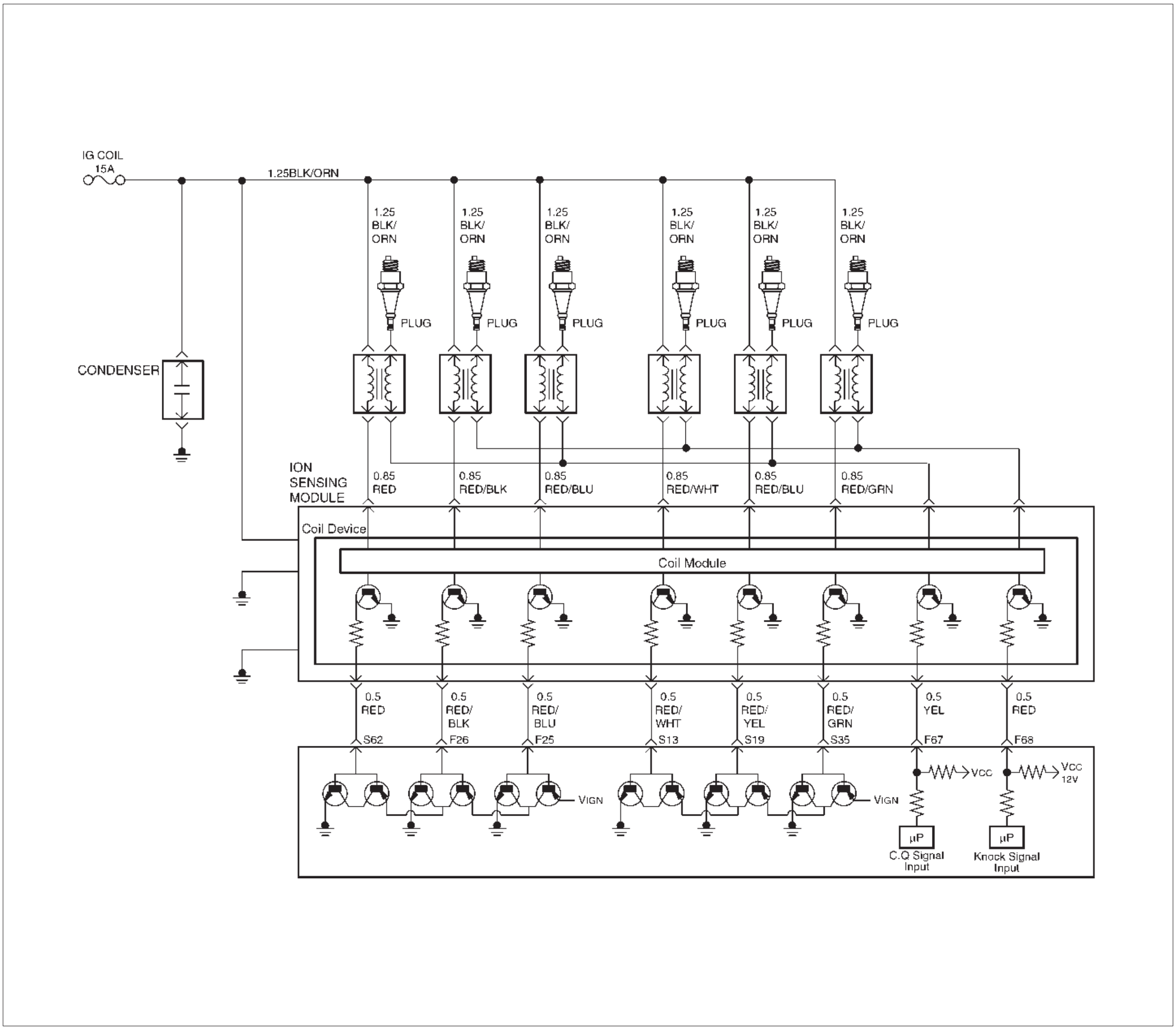
DTC P0353 – Ignition 3 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the “DTC” information for DTC P0353 until the DTC P0353 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0353 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition “ON,” engine “OFF.” 2. Back probe the ignition control circuit 3 at the ION Sensing Module with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition “ON,” engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition “OFF.” 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 3 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition “OFF.” 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 3 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 3 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0353 – Ignition 3 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 3. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0354 Ignition 4 Control Circuit



D06RY00067

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 4, it will set a DTC P0354.

Conditions for Setting the DTC

- The ignition is “ON.”
- The engine is turning, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON.”
- The output voltage is not equal to 0 volts when output is “OFF.”
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0354 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0354 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0354 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

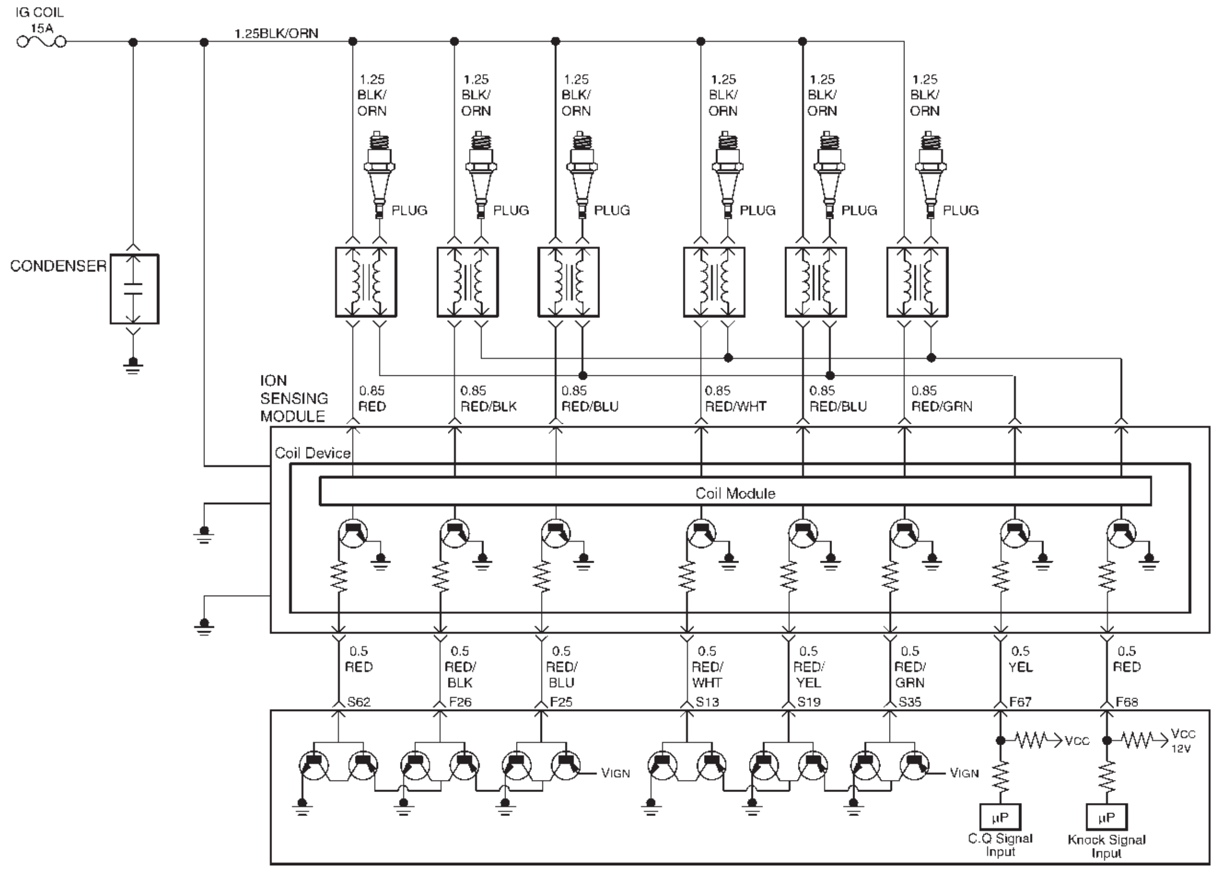
DTC P0354 – Ignition 4 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the “DTC” information for DTC P0354 until the DTC P0354 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0354 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition “ON,” engine “OFF.” 2. Back probe the ignition control circuit 4 at the ION Sensing with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition “ON,” engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition “OFF.” 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 4 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition “OFF.” 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 4 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 4 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0354 – Ignition 4 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 4. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open in ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0355 Ignition 5 Control Circuit



D06RY00067

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST in control circuit 5, it will set a DTC P0355.

Conditions for Setting the DTC

- The ignition is “ON.”
- The engine is turning, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON.”
- The output voltage is not equal to 0 volts when output is “OFF.”
- Ten test failures occur within 10 samples of continuous spark events.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0355 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0355 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0355 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

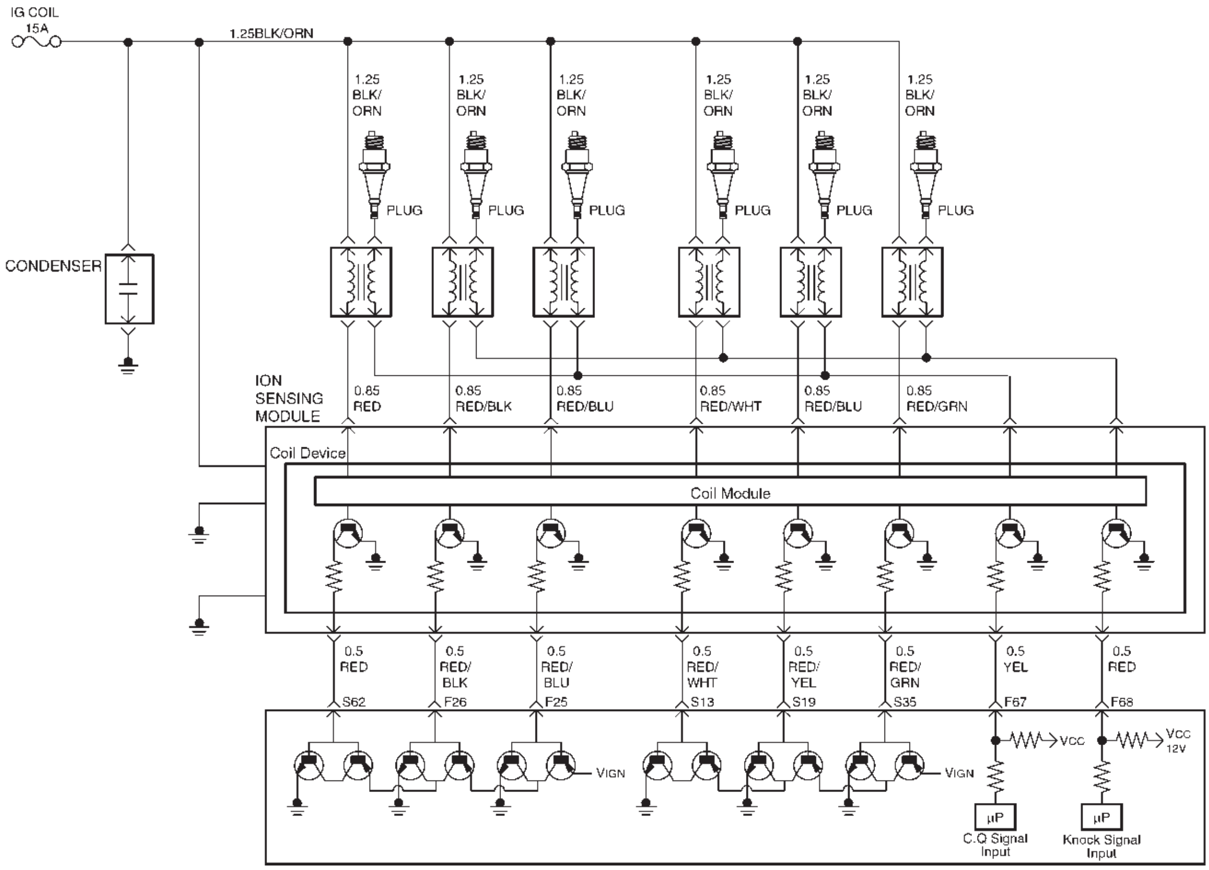
DTC P0355 – Ignition 5 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the “DTC” information for DTC P0355 until the DTC P0355 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0355 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition “ON,” engine “OFF.” 2. Back probe the ignition control circuit 5 at the ION Sensing Module with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition “ON,” engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition “OFF.” 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 5 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition “OFF.” 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 5 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 5 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0355 – Ignition 5 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 5. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0356 Ignition 6 Control Circuit



D06RY00067

Circuit Description

ION Sensing Module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The PCM controls ignition timing and dwell time.

This diagnosis detects open circuit or short-circuiting in the Ignition Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

When the PCM detects a problem on EST control circuit 6, it will set a DTC P0356.

Conditions for Setting the DTC

- The ignition is “ON.”
- The engine is turning, determined by the 58X crankshaft position input signal.
- The output voltage is not equal to 5 volts when output is “ON.”
- The output voltage is not equal to 0 volts when output is “OFF.”
- Ten test failures occur within 10 samples of continuous circuit monitoring.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle in which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0356 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P0356 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect the harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connections.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Tech 2 display related to DTC P0356 while moving the connector and wiring related to the ignition system. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

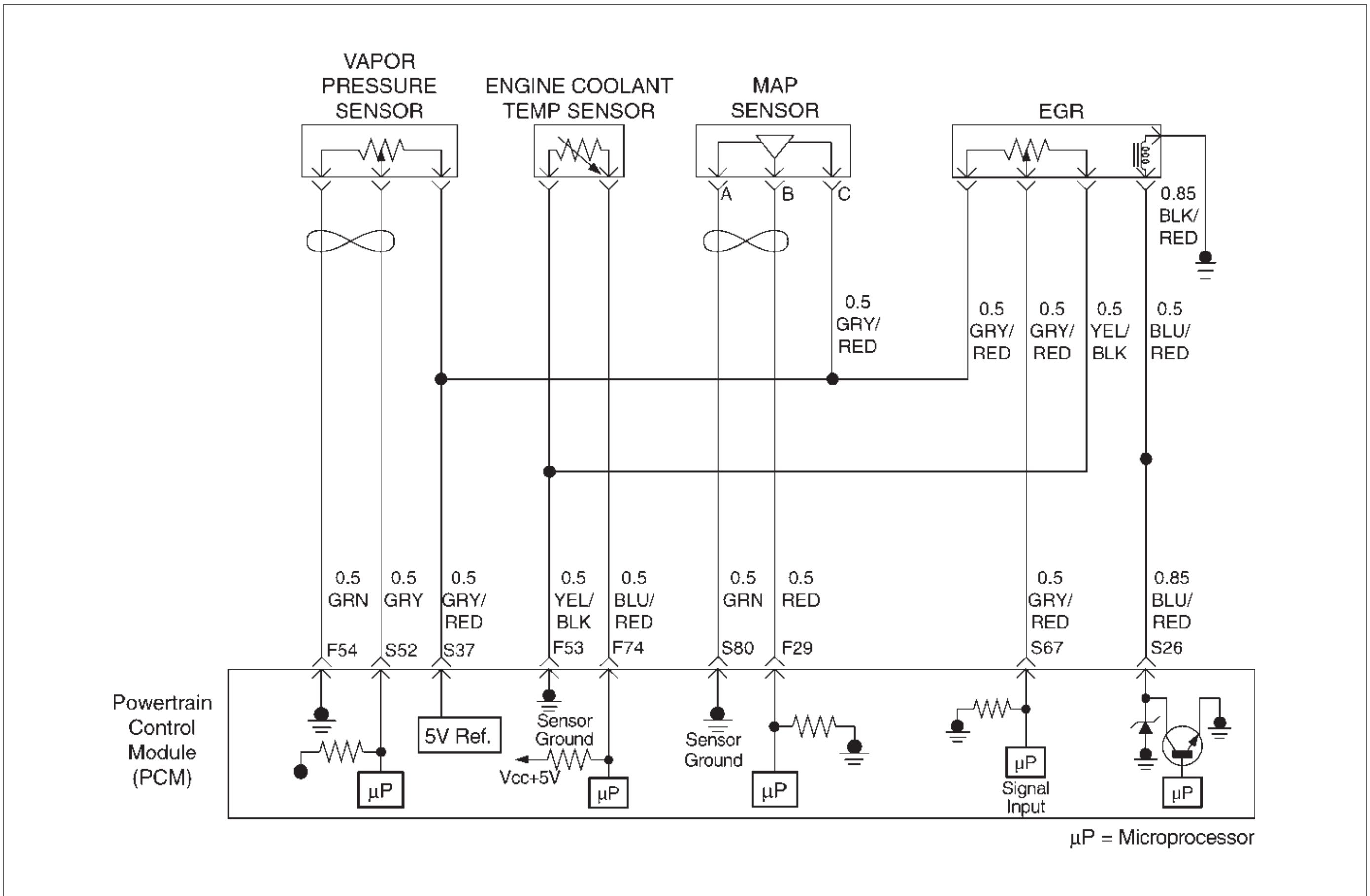
DTC P0356 – Ignition 6 Control Circuit

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Record conditions as noted. 4. Use a Tech 2 to monitor the "DTC" information for DTC P0356 until the DTC P0356 test runs. 5. Note the test result. Does the Tech 2 indicate DTC P0356 failed this ignition cycle?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	Check for faulty connection at ignition coil. Was a problem found?	—	Verify repair	Go to *Step 4*
4	Check for faulty connection at PCM connector. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Ignition "ON," engine "OFF." 2. Back probe the ignition control circuit 6 at the ION Sensing Module with a DVM positive lead with the negative lead to ground. Is the voltage near the specified value?	25-55 mV	Go to *Step 6*	Go to *Step 9*
6	1. Ignition "ON," engine running. 2. Back probe the ignition control circuit at the ION Sensing Module for the cylinder being tested. Is the voltage in the specified range, rapidly toggling back and forth to a reading 20-50 mV higher?	100-180 mV	Go to *Step 7*	Go to *Step 13*
7	1. Ignition "OFF." 2. Disconnect the 3-pin connector at the ignition coil. 3. Check ignition control circuit 6 voltage at the ignition coil connector while cranking the engine. Does the voltage measure between the specified values?	200-1200 mV	Go to *Step 8*	Go to *Step 11*
8	Replace the ignition coil. Is the action complete?	—	Verify repair	—
9	1. Ignition "OFF." 2. Disconnect the PCM and the ignition coil. 3. Check ignition control circuit 6 for short to ground. Was a problem found?	—	Verify repair	Go to *Step 10*
10	Check ignition control circuit 6 for short to voltage. Was a problem found?	—	Verify repair	Go to *Step 13*

DTC P0356 – Ignition 6 Control Circuit (Cont'd)

Step	Action	Value(s)	Yes	No
11	Check for an open ignition control circuit 6. Was the ignition control circuit open?	—	Go to *Step 12*	Go to *Step 13*
12	Repair the open ignition control circuit. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0401 EGR Flow Insufficient



D06RY00145

Circuit Description

The powertrain control module (PCM) tests the exhaust gas recirculation (EGR) system during deceleration by momentarily commanding the EGR valve to open while monitoring the manifold absolute pressure (MAP) sensor signal. When the EGR valve is opened, the PCM monitors the change in MAP input signal. The PCM compares the MAP change to a RPM vs. BARO table. When the PCM interprets the change in MAP to be out of limits, the PCM will set DTC P0401. The number of test samples required to accomplish this may vary according to the severity of the detected flow error.

Normally, the PCM will only allow one EGR flow test sample to be taken during an ignition cycle. To aid in verifying a repair, the PCM allows twelve test samples during the first ignition cycle following a Tech 2 "Clear Info" or a battery disconnect. Between nine and twelve samples should be sufficient for the PCM to determine adequate EGR flow and pass the EGR test.

Conditions for Setting the DTC

- No TP sensor, vehicle speed sensor (VSS), MAP sensor, EGR Pintle Position sensor, ECT sensor, misfire, or automatic transmission DTCs set.
- Engine coolant temperature is greater than 60°C (140°F).
- Ignition voltage between 11.5 and 16 volts.
- Vehicle speed is greater than 24 km/h (15 mph).
- A/C clutch status is unchanged.
- TCC status is unchanged.

Start Test

- TP angle is less than 1%.
- EGR duty cycle is less than 1%.
- MAP is steady, changing less than 2 kPa.
- Engine speed is between 1100 RPM and 2000 RPM.
- MAP between 10 kPa and 40 kPa.

The test will be aborted if the vehicle speed changes by more than 16 km/h (10 mph), engine speed changes by more than 100 RPM or the EGR is opened less than 95% of commanded position.

- The PCM will only run the EGR test during a closed throttle condition.
- The PCM will only run the EGR test at vehicle speeds above 24 km/h (15 mph).
- Several deceleration cycles will be necessary to run a sufficient number of EGR flow tests.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the Actual EGR Position display on the Tech 2 while moving connectors and wiring harnesses related to the EGR valve. A change in the display will indicate the location of the fault.
- Ensure EGR valve is correctly mounted. See *On-Vehicle Service*.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

NOTE: If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possibly a plugged catalytic converter) using the "Restricted Exhaust System Check."

Test Description

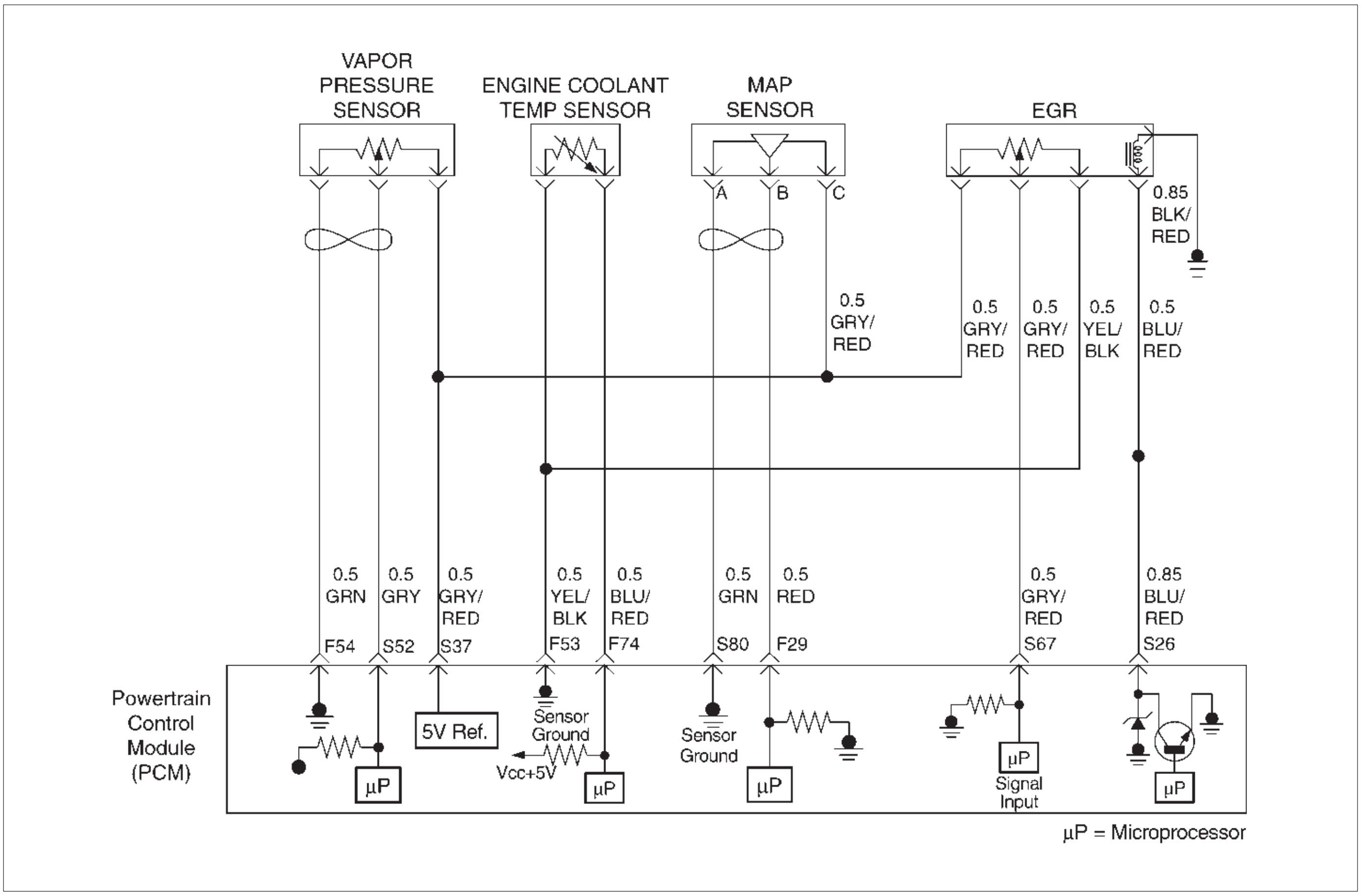
Number(s) below refer to the step number(s) on the Diagnostic Chart

3. A malfunctioning MAP sensor can set an EGR DTC. The MAP sensor could send a constant signal which is not low enough to set a low MAP DTC. The constant signal from the MAP sensor also may not be high enough to set a high MAP DTC. This step verifies that the MAP sensor is responding.

DTC P0401 – EGR Flow Insufficient

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P1404 also set?	—	Go to *DTC 1404*	Go to *Step 3*
3	1. Start the engine. 2. Monitor the MAP signal with a Tech 2 while idling. 3. While idling, jab the accelerator pedal about halfway down and immediately let the engine return to idle. Did the MAP value on the Tech 2 show an immediate large change?	—	Go to *Step 5*	Go to *Step 4*
4	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
5	1. Inspect the exhaust system for modification of original installed parts or leaks. 2. If a problem was found, repair exhaust system as necessary. Was a condition present that required repair?	—	Go to *Step 8*	Go to *Step 6*
6	1. Remove the EGR valve. 2. Visually and physically inspect the pintle, valve passages and the adapter for excessive deposits or any kind of a restriction. 3. If a problem is found, clean or replace EGR system components as necessary. Was a condition present that required repair?	—	Go to *Step 8*	Go to *Step 7*
7	1. Remove the EGR inlet and outlet pipes from the exhaust manifold and the intake manifold. 2. Inspect the manifold EGR ports and the EGR inlet and outlet pipes for a blockage caused by excessive deposits or other damage. 3. If a problem is found, correct the condition as necessary. Was a condition present that required repair?	—	Go to *Step 8*	Refer to *Diagnostic Aids*
8	1. Review and record the Tech 2 Failure Records data. 2. Clear DTC and monitor the Tech 2 System Info Screen while operating the vehicle as specified in “Diagnostic Aids.” 3. Using a Tech 2, monitor “DTC” info for DTC P0401 until the DTC P0401 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P0401 failed this ignition?	—	—	Repair complete

Diagnostic Trouble Code (DTC) P0402 EGR Pintle Crank Error



D06RY00145

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if pintle position is stuck open. If the PCM detects a pintle position signal indicates more than 21.5% and more than for 625 msec during cranking, the PCM will set DTC P0402.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- Intake Air temp is more than 3˚C
- At Engine revolution less than 600 RPM, EGR pintle position indicates more than 21.0% and more than for 625 msecs.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0402 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

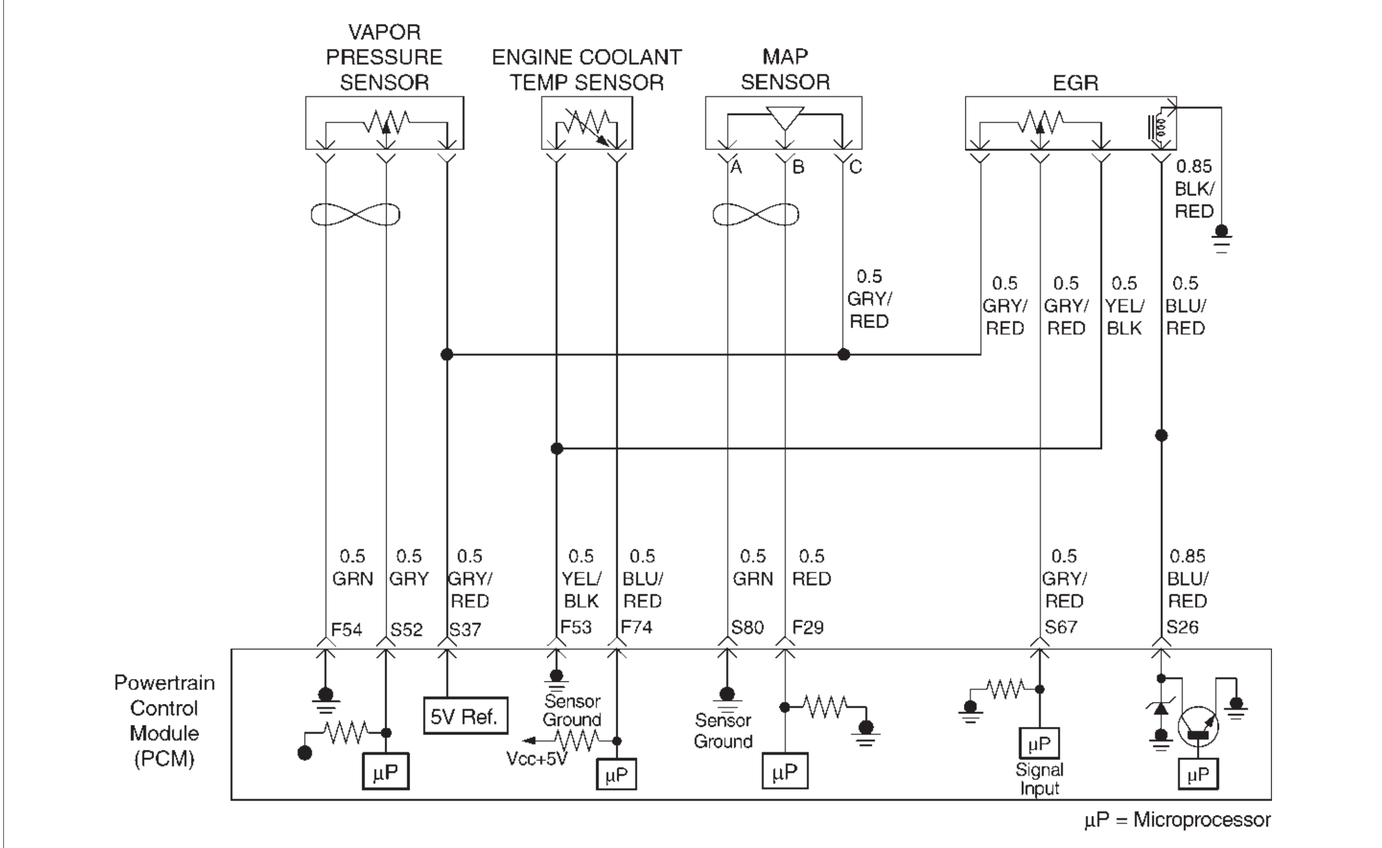
- Foreign material on EGR valve between pintle and seat may cause EGR stuck open. Inspect foreign material in EGR valve.
- Excessive carbon deposit may cause unsmooth operation of EGR valve shaft. Inspect carbon deposit and clean up inside of carbon deposit.
- Poor connection or damaged harness–inspect the wiring harness for damage If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

NOTE: If the EGR valve shows signs of excessive heat, check the exhaust system for blockage (possibly a plugged catalytic converter) using the “Restricted Exhaust System Check”.

DTC P0402 – EGR Pintle Crank Open Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine “OFF”, review and record Tech 2 Failure Records data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0402 until the DTC P0402 test runs. Note the result. Does the Tech 2 indicates DTC P0402 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
5	1. Remove EGR valve from Engine. 2. Inspect EGR valve whether there is any foreign material between seat and pintle. Was any foreign material in EGR valve?	—	Go to *Step 6*	Go to *Step 7*
6	1. Remove EGR valve foreign material from EGR valve and clean up inside. 2. Visually inspect damage of pintle and seat, which leakage may occur. Was there any severe damage which affects function?	—	Go to *Step 7*	Verify repair Go to *Step 8*
7	1. Reconnect. 2. Ignition “OFF”. 3. Install the Tech 2. 4. Run the engine at idle. 5. On Tech-II, select special function for EGR. 6. Use the “UP” arrow to increase the EGR from 0% to 40%. Did EGR work properly?	—	—	Go to *Step 8*
8	Replace the EGR valve. Does DTC P0402 still fail “DTC” test on the Tech 2?	—	Go to *Step 9*	Verify repair
9	Replace the EGR valve. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0404 EGR Open Stuck



D06RY00145

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if pintle position is different from commanded position. If the PCM detects a pintle position signal indicates more than 15 points different between current and commanded and more than 15 seconds, the PCM will set DTC P0404.

Conditions for Setting the DTC

- The engine is running.
- Ignition voltage is between 11 and 16 volts.
- Intake Air temp is more than 3˚C.
- Desire EGR position is more than 0.
- The difference between desired EGR and current EGR is less than 3%.
- Difference EGR pintle position between current and commanded position becomes more than 15% and last more than 15 seconds, and this condition meets three times in a trip. Then it trigger, the PCM lights on.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected after consecutive 2nd trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0404 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

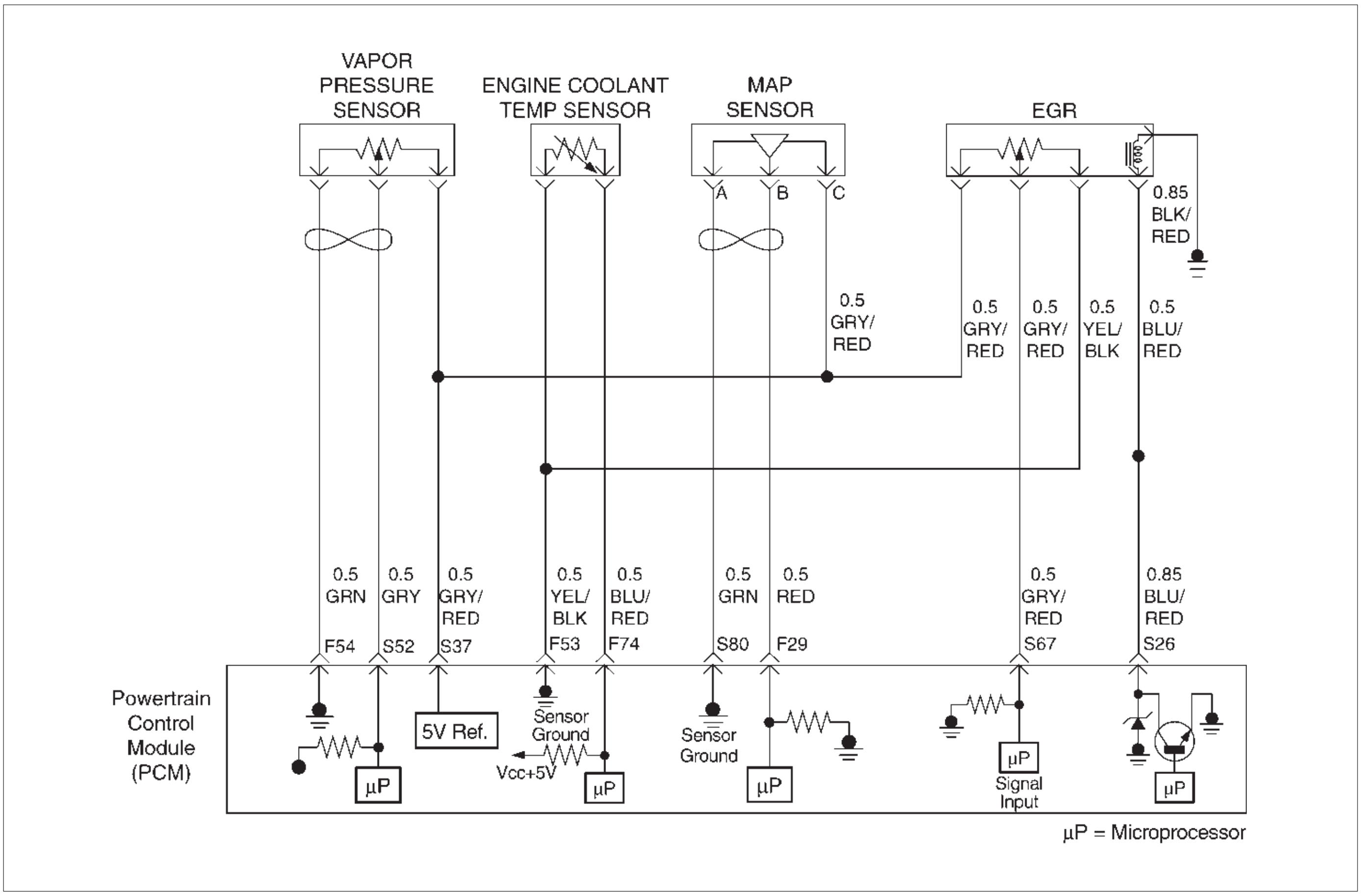
Check for the following conditions:

- Excessive carbon deposit on EGR valve shaft may cause EGR stuck open or unsmooth operation. Those carbon deposit may occur by unusual port operation. Clean up carbon may make smooth function of EGR valve.
- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

DTC P0404 – EGR Open Stuck

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF”, review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0404 until the DTC P0404 test runs. Note the result. Does the Tech 2 indicates DTC P0404 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal.	—	Verify repair	Is the action complete?
5	1. Remove EGR valve from Engine. 2. Inspect EGR valve whether there is any excessive carbon deposit on EGR shaft. Was excessive carbon deposit on EGR valve shaft?	—	Go to *Step 6*	Go to *Step 7*
6	1. Clean up EGR valve shaft and inside of EGR valve. 2. Visually inspect damage of pintle and seat if is bent, leakage may occur. Was there any severe damage which affects function?	—	Go to *Step 8*	Verify repair Go to *Step 7*
7	1. Reconnect. 2. Ignition “OFF”. 3. Install the Tech 2. 4. Run the engine at idle. 5. On the Tech 2, select EGR Control Test. 6. Use the “UP” arrow to increase the EGR from 0% to 40%. Did EGR work properly?	—	—	Go to *Step 8*
8	Replace the EGR valve. Does DTC P0404 still fail “DTC” test on the Tech 2?	—	Go to *Step 9*	Verify repair
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0405 EGR Low Voltage



D06RY00145

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to command from the PCM. If current pintle position voltage indicates less than 0.1 V and last more than 10 seconds, then the PCM will set DTC P0405.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- EGR pintle position is less than 2% and last more than 10 sec. Action taken when the DTC sets.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0405 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

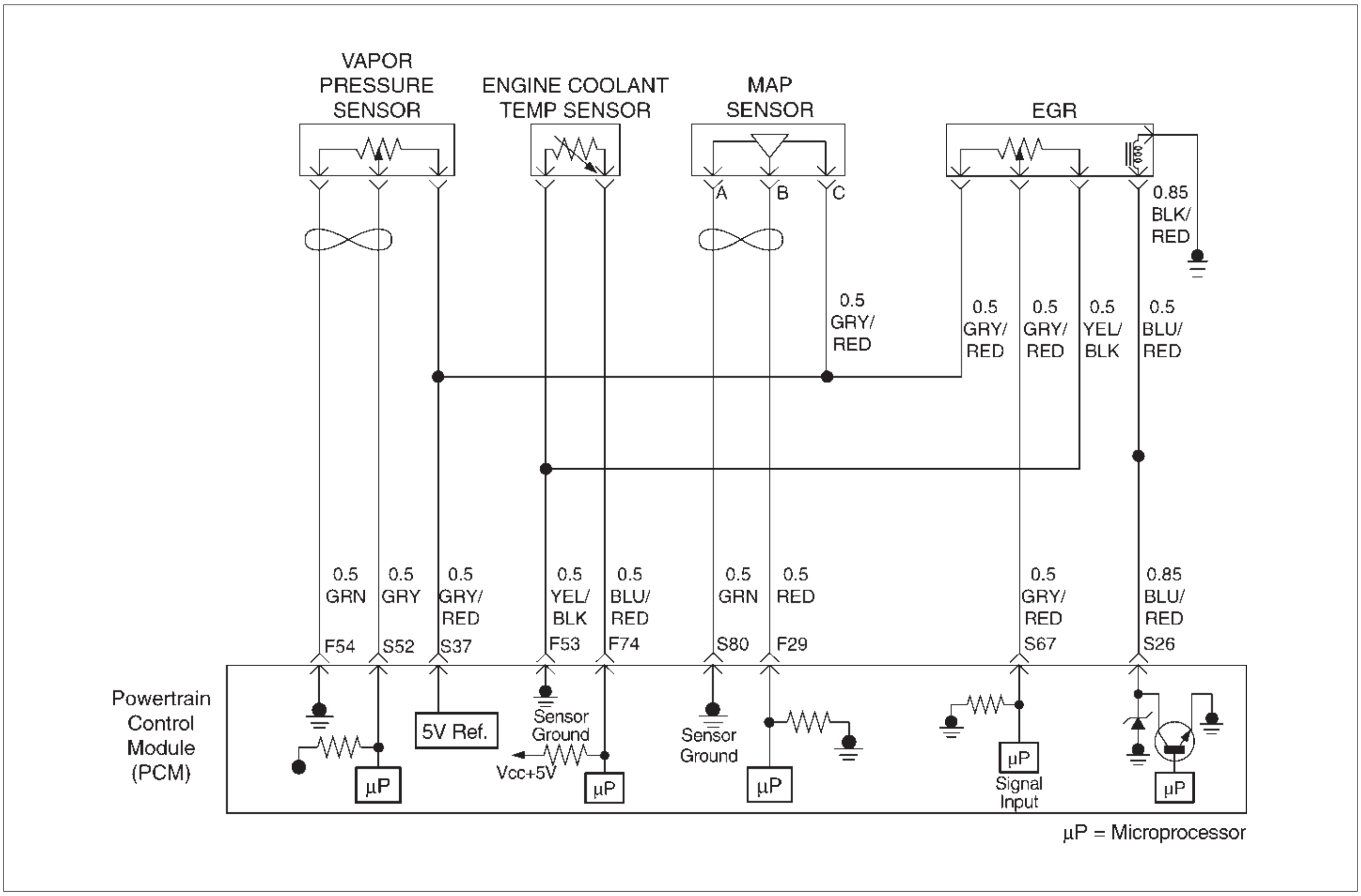
DTC P0405 – EGR Low Volt

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0405 until the DTC P0405 test runs. Note the result. Does the Tech 2 indicates DTC P0405 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
5	1. Disconnect the EGR harness connector. 2. Ignition "ON". 3. At the EGR valve, use a DVM to check the voltage at the 5 volt reference wire (GRY/RED) and ground. Did the DVM indicate the specified value?	4–6 V	Go to *Step 6*	Go to *Step 7*
6	1. Disconnect the EGR harness connector. 2. Measure resistance between terminal 5 volt reference wire and ground. Was resistance in range?	5–5.5 KΩ	Go to *Step 10*	Go to *Step 17*
7	1. Ignition "ON". 2. At the PCM connector, back prove with a DVM at the 5 volt reference for the EGR valve. Did the DVM indicate the specified value?	4–6 V	Go to *Step 8*	Go to *Step 18*
8	Repair the open 5 volt reference circuit. Is the action complete?	—	Verify repair	—
9	Repair the damaged sensor ground wire. Is the action complete?	—	Verify repair	—
10	1. Disconnect the EGR harness 2. Use an ohmmeter to measure between the pintle position pin and the sensor ground pin on the EGR valve. NOTE: J-35616 Connector Test Adapter Kit may be useful for gaining access to the recessed pins on the valve. Was the ohmmeter reading approximately equal to the specified value?	1 to 1.25 KΩ	Go to *Step 13*	Go to *Step 17*
11	1. Ignition "ON". 2. Backprobe with a DVM to measure voltage at EGR valve pintle position pin and sensor ground pin. Was voltage in range?	Less than 0.1 V	Go to *Step 17*	Go to *Step 12*

DTC P0405 – EGR Low Volt (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Ignition "ON". 2. Backprobe with a DVM to measure voltage at PCM sensor ground pin and pintle position pin. Was voltage in range?	Less than 0.1 V	Go to *Step 13*	Go to *Step 18*
13	1. Ignition "OFF". 2. Disconnect the EGR harness. 3. Check short circuit between EGR pintle position circuit and EGR ground circuit. Was any short circuit?	—	Go to *Step 14*	Go to *Step 18*
14	Locate and repair the short to ground in the pintle position circuit Is the action complete?	—	Verify repair	—
15	1. Ignition "OFF". 2. Disconnect the PCM. 3. Ignition "ON". 4. Measure the voltage between the EGR pintle position circuit and ground. Is the measured voltage near the specified value?	Less than 0.1 V	Go to *Step 17*	Go to *Step 16*
16	Check for a short circuit between other wires and the pintle position circuit Is there any short circuit?	—	Repair short circuit Verify repair	Go to *Step 17*
17	Replace the EGR valve. Does DTC P1404 still fail "DTC test on the Tech 2?	—	Go to *Step 18*	Verify repair
18	Examine the PCM pin and terminal connection. Was there a damaged terminal?	—	Go to *Step 4*	Go to *Step 19*
19	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0406 EGR High Voltage



D06RY00145

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to command from the PCM. If current pintle position voltage indicates more than 4.8 V and last more than 10 seconds, then the PCM will set DTC P0406.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- EGR pintle position is more than 99% and last more than 10 sec.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection or damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the EGR actual position display on the Tech 2 while moving connectors and wiring harnesses related to EGR valve. A change in the display will indicate the location of the fault.

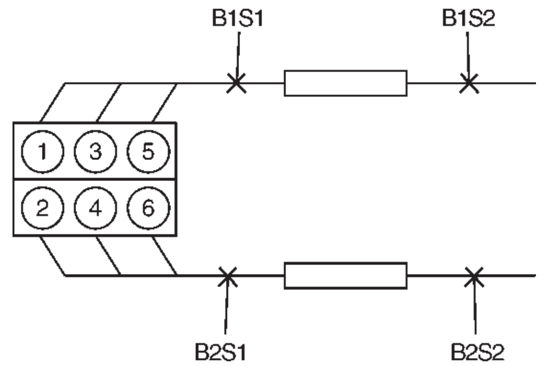
DTC P0406 – EGR High Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF", review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor "DTC" info for DTC P0406 until the DTC P0406 test runs. Note the result. Does the Tech 2 indicates DTC P0406 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	Is the action complete?
5	1. Disconnect the EGR harness connector. 2. Ignition "ON". 3. At the EGR valve, use a DVM to check the voltage at the 5 volt reference wire (GRY/RED). Did the DVM indicate the specified value?	4–6 V	Go to *Step 8*	Go to *Step 6*
6	1. Ignition "ON". 2. At the PCM connector, backprove with a DVM at the 5 volt reference for the EGR valve. Did the DVM indicate the specified value?	4–6 V	Go to *Step 7*	Go to *Step 16*
7	Repair the open 5 volt reference circuit Is the action complete?	—	Verify repair	—
8	1. Ignition "OFF" 2. Disconnect the EGR harness. 3. Use a DVM to check for an resistance between 5 V reference and Sensor Ground at EGR sensor terminals. NOTE: J-35616 Connector Test Adapter Kit may be useful for gaining access to the recessed pins on the valve. Was the measured resistance in range?	5 to 5 KΩ	Go to *Step 9*	Go to *Step 15*
9	1. Ignition "OFF". 2. Disconnect the EGR harness. 3. Use a DVM to check for an resistance between Sensor Ground and Signal Wire at EGR sensor terminal. Is there an open circuit?	—	Go to *Step 15*	Go to *Step 10*
10	1. Ignition "OFF". 2. Disconnect the EGR harness at PCM connector. 3. Use a DVM to check for shorted wire between S37 and F53. Is there a shorted wire?	—	Go to *Step 14*	Go to *Step 11*

DTC P0406 – EGR High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Ignition "ON". 2. Use a DVM to backprove at terminal Connector of EGR valve for voltage. Was measured voltage more than 4.8 V?	more than 4.8 V	Go to *Step 12*	Go to *Step 12*
12	1. Ignition "ON". 2. Stay the EGR harness connected. 3. Check voltage by backproving at PCM S37 terminal. Was voltage more than 4.8 V?	4.8 V	Go to *Step 16*	Go to *Step 13*
13	1. Locate short circuit at EGR harness between GRY/RED to GRY/RED or GRY/RED to YEL/BLK, BLU/RED. 2. Replace EGR harness. Is the action complete?	—	Verify repair	—
14	Replace EGR harness. Is the action complete?	—	Verify repair	—
15	Replace the EGR valve. Does DTC P1404 still fail "DTC test on the Tech 2?	—	Go to *Step 16*	Verify repair
16	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0420 TWC System Low Efficiency Bank 1



T321075

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalyst (TWC) is used. The catalyst promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 1 HO2S 1 and the Bank 1 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 1 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 1 HO2S 1 signal will be far more active than that produced by the Bank 1 HO2S 2 sensor. If the PCM detects a level of Bank 1 HO2S 2 activity that indicates the catalyst is no longer operating efficiently, DTC P0420 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop."
- Engine air load is below 99%.
- Engine coolant temperature is between 70°C (158°F) and 120°C (248°F).
- Mass air flow is between 2.5 g/second and 10 g/second.
- Engine speed is below 200 RPM.
- Catalyst temperature is above 350°C (662°F).
- The PCM determines that the catalyst's oxygen storage capacity is below the acceptable threshold.
- Intake Air Temperature is between –10°C (14°F) and 70°C (158°F).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0420 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0420 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

The "TWC Monitor Test Counter" displayed on the Tech 2 may be used to monitor the progress of the TWC diagnostic. To complete the TWC diagnostic with a good catalyst, the counter must be allowed to increment to 49 samples and roll over to 0 at least twice. A failed catalyst will require three or more 50-sample tests to report a failure.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

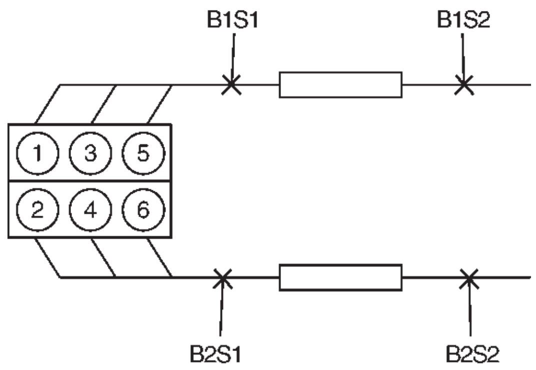
7. Difficulty completing the DTC P0420 “Status This Ign.” test may be encountered in areas where test conditions cannot be maintained easily, especially in urban areas. To minimize the amount of driving required to complete the DTC P0420 “Status This Ign.” test, use the following procedure:

- Allow the engine to warm completely.
- With the vehicle in “Park,” monitor mass air flow on the Tech 2 and hold part throttle to maintain a reading of over 12 g/second for at least 2 minutes. This will achieve the “warm catalyst” required for running the test.
- Operate the vehicle in second or third gear to remain in the DTC P0420 test conditions described in “Conditions for Setting the DTC” as much as possible. If you must stop the vehicle, maintain the “warm catalyst” criteria as follows:
  - Place the vehicle in “Park” or “Neutral.”
  - Hold part throttle to maintain a mass air flow reading of over 15 g/second for the duration of the stop.

DTC P0420 – TWC System Low Efficiency Bank 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any other DTCs set (such as P0140)?	—	Diagnose other DTC(s) first	Go to *Step 3*
3	1. Visually and physically inspect the three-way catalytic converter for damage. Check for the following: • dents • severe discoloration caused by excessive temperatures • holes • internal rattle caused by damaged catalyst 2. Also, ensure that the three-way catalytic converter is a proper original equipment manufacturer part. Did your inspection reveal a problem?	—	Go to *Step 6*	Go to *Step 4*
4	1. Visually and physically inspect the exhaust system between the three-way catalytic converter and the rear converter flange for leaks, damage, and loose or missing hardware. 2. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to *Step 7* to verify repair	Go to *Step 5*
5	1. Visually and physically inspect the Bank 1 HO2S 2. 2. Ensure that the Bank 1 HO2S 2 is secure and that the pigtail and wiring harness is not contacting the exhaust pipe or is not otherwise damaged. 3. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to *Step 7* to verify repair	Go to *Step 6*
6	Replace the three-way catalytic converter. NOTE: Check for conditions which may cause catalyst damage (refer to *Diagnostic Aids*). Is the action complete?	—	Go to *Step 7* to verify repair	—
7	1. Review and record the Tech 2 Failure Records data. 2. Clear DTC P0420. 3. Start the engine and allow it to warm up until the engine coolant temperature monitored on the Tech 2 is above the specified value. 4. Run the engine to maintain the specified mass air flow range for at least 2 minutes. 5. Operate the vehicle to maintain DTC P0420 test conditions (refer to *DTC Test Description* in *Diagnostic Support* for detailed instructions). 6. Using a Tech 2, monitor “DTC” info for DTC P0420 until the DTC P0420 test runs. 7. Note the test result. Does the Tech 2 indicate DTC P0420 passed this ignition?	Engine coolant temp: greater than 60°C (140°F). Mass air flow: between 8 g/second and 50 g/second	Repair complete. If a driveability symptom still exists, refer to *Symptoms*.	Go to the *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0430 TWC System Low Efficiency Bank 2



T321075

Circuit Description

To control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx), a three-way catalyst (TWC) is used. The catalyst promotes a chemical reaction which oxidizes the HC and CO present in the exhaust gas, converting them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx, converting it to nitrogen. The powertrain control module (PCM) has the ability to monitor this process using the Bank 2 HO2S 1 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 2 HO2S 1 sensor produces an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 2 HO2S 2 sensor produces an output signal which indicates the oxygen storage capacity of the catalyst; this in turn indicates the catalyst's ability to convert exhaust gases efficiently. If the catalyst is operating efficiently, the Bank 2 HO2S 1 signal will be far more active than that produced by the Bank 2 HO2S 2 sensor. If the PCM detects a level of Bank 2 HO2S 2 activity that indicates the catalyst is no longer operating efficiently, DTC P0430 will be set.

Conditions for Setting the DTC

- No related DTCs.
- The engine is operating in "closed loop."
- Engine air load is below 99%.
- Engine coolant temperature is between 70°C (158°F) and 115°C (239°F).
- Mass air flow is between 2.5 g/second and 10 g/second.
- Change in engine load is below 8%.
- Engine speed is below 200 RPM.
- Catalyst temperature is above 350°C (662°F).
- The PCM determines that the catalyst's oxygen storage capacity is below the acceptable threshold.
- Intake air temperature is between –20°C (4°F) and 70°C (158°F).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0430 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0430 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

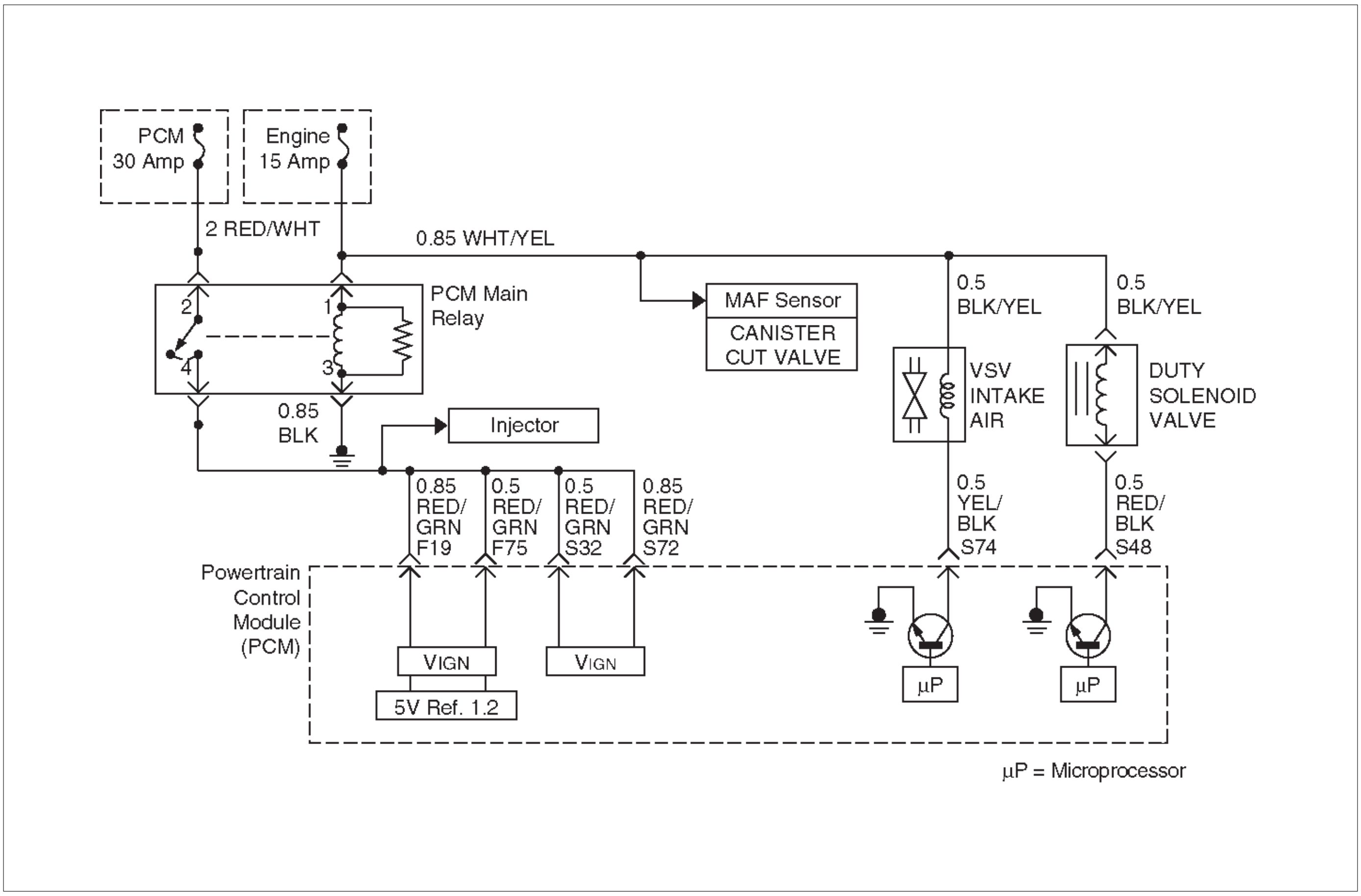
7. Difficulty completing the DTC P0430 “Status This Ign.” test may be encountered in areas where test conditions cannot be maintained easily, especially in urban areas. To minimize the amount of driving required to complete the DTC P0430 “Status This Ign.” test, use the following procedure:
   - Allow the engine to warm completely.
   - With the vehicle in “Park,” monitor mass air flow on the Tech 2 and hold part throttle to maintain a reading of over 12 g/second for at least 2 minutes. This will achieve the “warm catalyst” required for running the test.
   - Operate the vehicle in second or third gear to remain in the DTC P0430 test conditions described in “Conditions for Setting the DTC” as much as possible. If you must stop the vehicle, maintain the “warm catalyst” criteria as follows:
     - Place the vehicle in “Park” or “Neutral.”
     - Hold part throttle to maintain a mass air flow reading of over 15 g/second for the duration of the stop.

The “TWC Monitor Test Counter” displayed on the Tech 2 may be used to monitor the progress of the TWC diagnostic. To complete the TWC diagnostic with a good catalyst, the counter must be allowed to increment to 49 samples and roll over to 0 at least twice.

DTC P0430 – TWC System Low Efficiency Bank 2

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any other DTCs set (such as P0160)?	—	Diagnose other DTC(s) first	Go to *Step 3*
3	1. Visually and physically inspect the three-way catalytic converter for damage. Check for the following: • dents • severe discoloration caused by excessive temperatures • holes • internal rattle caused by damaged catalyst 2. Also, ensure that the three-way catalytic converter is a proper original equipment manufacturer part. Did your inspection reveal a problem?	—	Go to *Step 6*	Go to *Step 4*
4	1. Visually and physically inspect the exhaust system between the three-way catalytic converter and the rear converter flange for leaks, damage, and loose or missing hardware. 2. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to *Step 7* to verify repair	Go to *Step 5*
5	1. Visually and physically inspect the Bank 2 HO2S 2. 2. Ensure that the Bank 2 HO2S 2 is secure and that the pigtail and wiring harness is not contacting the exhaust pipe or is not otherwise damaged. 3. If a problem is found, repair as necessary. Did your inspection reveal a problem?	—	Go to *Step 7* to verify repair	Go to *Step 6*
6	Replace the three-way catalytic converter. NOTE: Check for conditions which may cause catalyst damage (refer to *Diagnostic Aids*). Is the action complete?	—	Go to *Step 7* to verify repair	—
7	1. Review and record the Tech 2 Failure Records data. 2. Clear DTC P0430. 3. Start the engine and allow it to warm up until the engine coolant temperature monitored on the Tech 2 is above the specified value. 4. Run the engine to maintain the specified mass air flow range for at least 6 minutes. 5. Operate the vehicle to maintain DTC P0430 test conditions (refer to *DTC Test Description* in *Diagnostic Support* for detailed instructions). 6. Using a Tech 2, monitor “DTC” info for DTC P0430 until the DTC P0430 test runs. 7. Note the test result. Does the Tech 2 indicate DTC P0430 passed this ignition?	Engine coolant temp: greater than 70°C (158°F). Mass air flow: between 2.5 g/second and 10 g/second	Repair complete. If a driveability symptom still exists, refer to *Symptoms*.	Go to the *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0440 EVAP System



060RY00158

Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister duty solenoid valve
- Fuel tank pressure sensor
- Fuel pipes and hoses
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister cut valve (purge solenoid)

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The powertrain control module (PCM) monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid and the EVAP canister vent solenoid are turned “ON,” allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system. If a sufficient vacuum level cannot be achieved, a large leak or a faulty EVAP canister purge solenoid is indicated. This can be caused by the following conditions:

- Disconnected or faulty fuel tank pressure sensor
- Missing or faulty fuel cap
- Disconnected, damaged, pinched, or blocked EVAP purge line
- Disconnected or damaged EVAP vent hose
- Disconnected, damaged, pinched, or blocked fuel tank vapor line
- Disconnected or faulty EVAP canister cut valve
- Disconnected or faulty EVAP canister duty solenoid
- Open ignition feed circuit to the EVAP canister vent solenoid or the EVAP canister cut valve
- Damaged EVAP canister
- Leaking fuel sender assembly O-ring
- Leaking fuel tank or fuel filler neck

Any of the above conditions can set DTC P0440.

Conditions for Setting the DTC

- No TP sensor, IAT sensor, or MAP sensor DTCs set.
- Start-up engine coolant temperature is less than 32°C (90°F).
- Start-up engine coolant temperature is not more than 7°C (13°F) greater than start-up intake air temperature.
- Start-up intake air temperature is greater than 4°C (39°F) .
- Start-up intake air temperature is not more than 2°C (4°F) greater than start-up engine coolant temperature.
- Vehicle speed is less than 5 mph (8 km/h).
- Throttle position is greater than 3%.
- Minimal fuel slosh.
- BARO is greater than 70 kPa.
- The EVAP system is unable to achieve or maintain vacuum during the diagnostic test.

- Above conditions are present for 60 to 180 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the second key cycle in which the DTC sets.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" when the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0440 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0440 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Cracked or punctured EVAP canister.
- Damaged or disconnected source vacuum line, EVAP purge line, vent hose or fuel tank vapor line.
- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness to the EVAP canister vent solenoid, EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.
- Kinked, pinched, or plugged vacuum source, EVAP purge, or fuel tank vapor line–Verify that the lines are not restricted.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If an EVAP canister vent solenoid or an EVAP canister purge solenoid electrical fault is present, the purge system will not operate correctly. Repairing the electrical fault will very likely correct the condition that set DTC P0440.
3. Checks the fuel tank pressure sensor at ambient pressure.
4. Determines whether or not the EVAP system can be sealed sufficiently to be pressurized. If not, the large leak must be located and corrected before continuing with diagnosis.
5. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.
8. Checks for a blocked EVAP canister purge solenoid. The PCM commands the EVAP canister purge solenoid "OFF" (open) and the vent solenoid "ON" (closed) with the Tech 2 "System Perf." EVAP output control function activated. Any pressure in the system should be released through the EVAP canister purge solenoid within a few seconds when "System Perf." is activated.
9. Ensures that sufficient source vacuum is present at the EVAP canister purge solenoid.

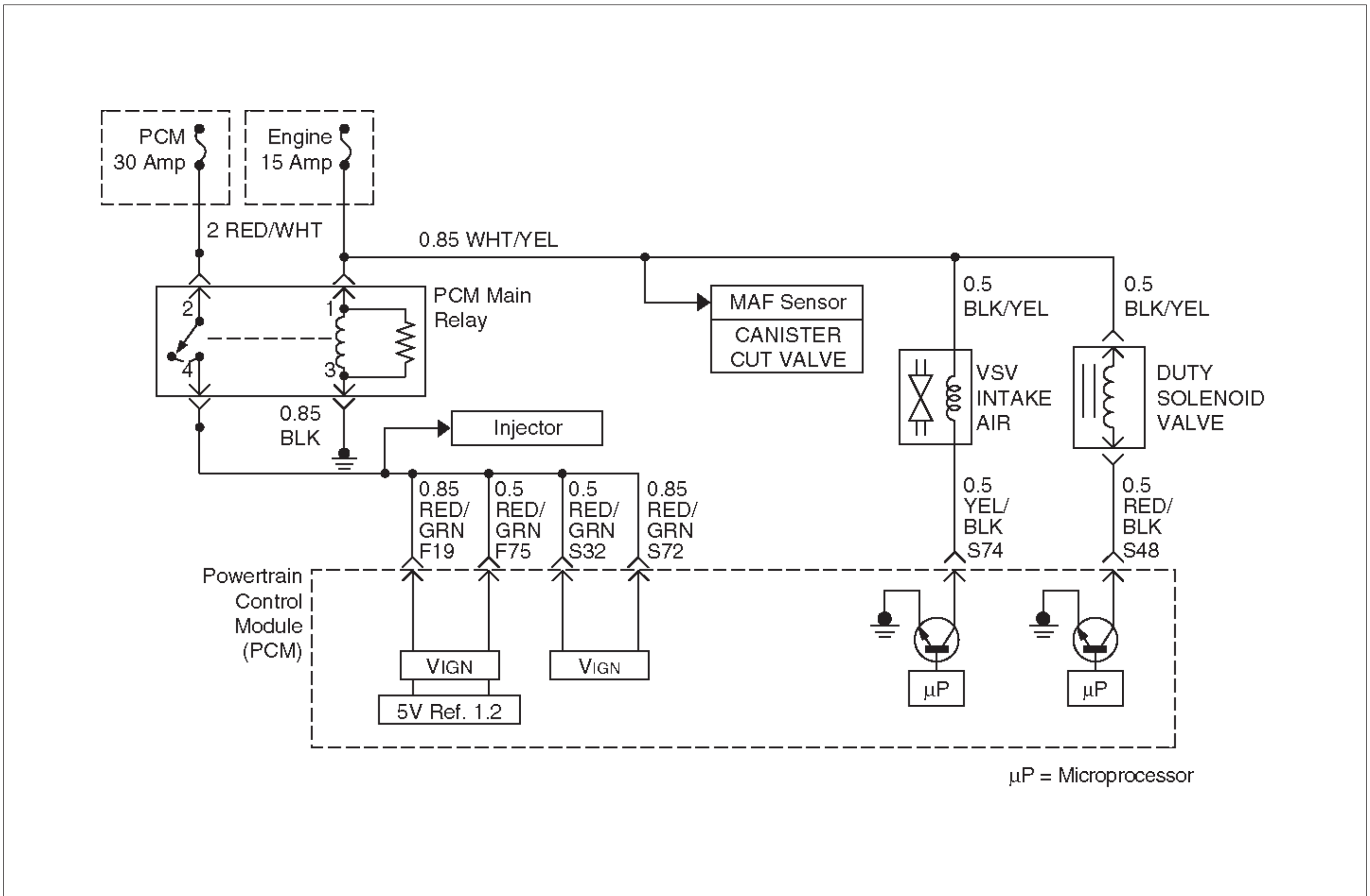
DTC P0440 – EVAP System

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0452 or P0453 also set?	—	Go to *other DTC first*	Go to *Step 3*
3	1. Ignition "OFF." 2. Remove the fuel cap. 3. Ignition "ON." 4. Observe "Fuel Tank Pressure" on the Tech 2. Does the Tech 2 indicate "Fuel Tank Pressure" at the specified value?	1.51 V	Go to *Step 4*	Go to *DTC P0452* or *DTC P0453*
4	1. Replace the fuel cap. 2. Engine is running. 3. Observe "Fuel Tank Vacuum" on the Tech 2. Does Tech 2 indicate "Fuel Tank Vacuum" at the specified value?	1.47–1.51 V	Go to *Step 7*	Go to *Step 6*

DTC P0440 – EVAP System (Cont'd)

Step	Action	Value(s)	Yes	No
5	Ignition "OFF". 1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister. 2. Block the canister fitting for the fuel tank vapor line. 3. Connect a hand vacuum pump to the canister fitting for the EVAP purge line. 4. Ensure that the EVAP canister vent solenoid is still commanded "ON" (closed). 5. Attempt to apply vacuum to the EVAP canister. Observe "Fuel tank pressure" on the Tech 2. Does the Tech 2 indicate "Fuel tank pressure" at the specified value?	1.47–1.51 V	Go to *Step 8*	Go to *Step 7*
6	1. Visually/physically check for the following conditions: • Restricted fuel tank vapor line. • Restricted EVAP purge line. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *DTC P0452* or *DTC P0453*
7	1. Visually/physically check for the following conditions: • Vent hose disconnected or the damaged. • EVAP canister damaged. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
8	1. Visually/physically check for the following conditions: • Missing or faulty fuel cap. • Disconnected or leaking fuel tank vapor line. • Disconnected or damaged EVAP purge line. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	Replace the EVAP canister purge solenoid. Is the action complete?	—	Verify repair	—
10	Locate and repair cause of no source vacuum to the EVAP canister purge solenoid. Is the action complete?	—	Verify repair	—
11	Replace the EVAP canister vent solenoid. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0442 EVAP System Small Leak Detected



060RY00158

Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister vent solenoid
- Fuel tank pressure sensor
- Fuel pipes and hoses
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister purge solenoid

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The powertrain control module (PCM) monitors vacuum level via the fuel tank pressure sensor input. At an appropriate time, the EVAP canister purge solenoid and the EVAP canister vent solenoid are turned “ON,” allowing engine vacuum to draw a small vacuum on the entire evaporative emissions system. After the desired vacuum level has been achieved, the EVAP canister purge solenoid is turned “OFF,” sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant. A small leak in the system will cause DTC P0442 to be set.

Conditions for Setting the DTC

- No TP sensor, ECT sensor, Tank pressure sensor, IAT sensor, or MAP sensor DTCs set.
- The DTC P0440 diagnostic test has passed.
- A vacuum decay condition, indicating a small leak, is detected during the diagnostic test.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) during the second key cycle in which the DTC sets.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0442 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0442 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Cracked or punctured EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel tank vapor line.

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness to the EVAP canister vent solenoid, EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If an EVAP canister vent solenoid or an EVAP canister purge solenoid electrical fault is present, the purge system will not operate correctly. Repairing the electrical fault will very likely correct the condition that set DTC P0442.
3. Checks the fuel tank pressure sensor at ambient pressure.
4. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.

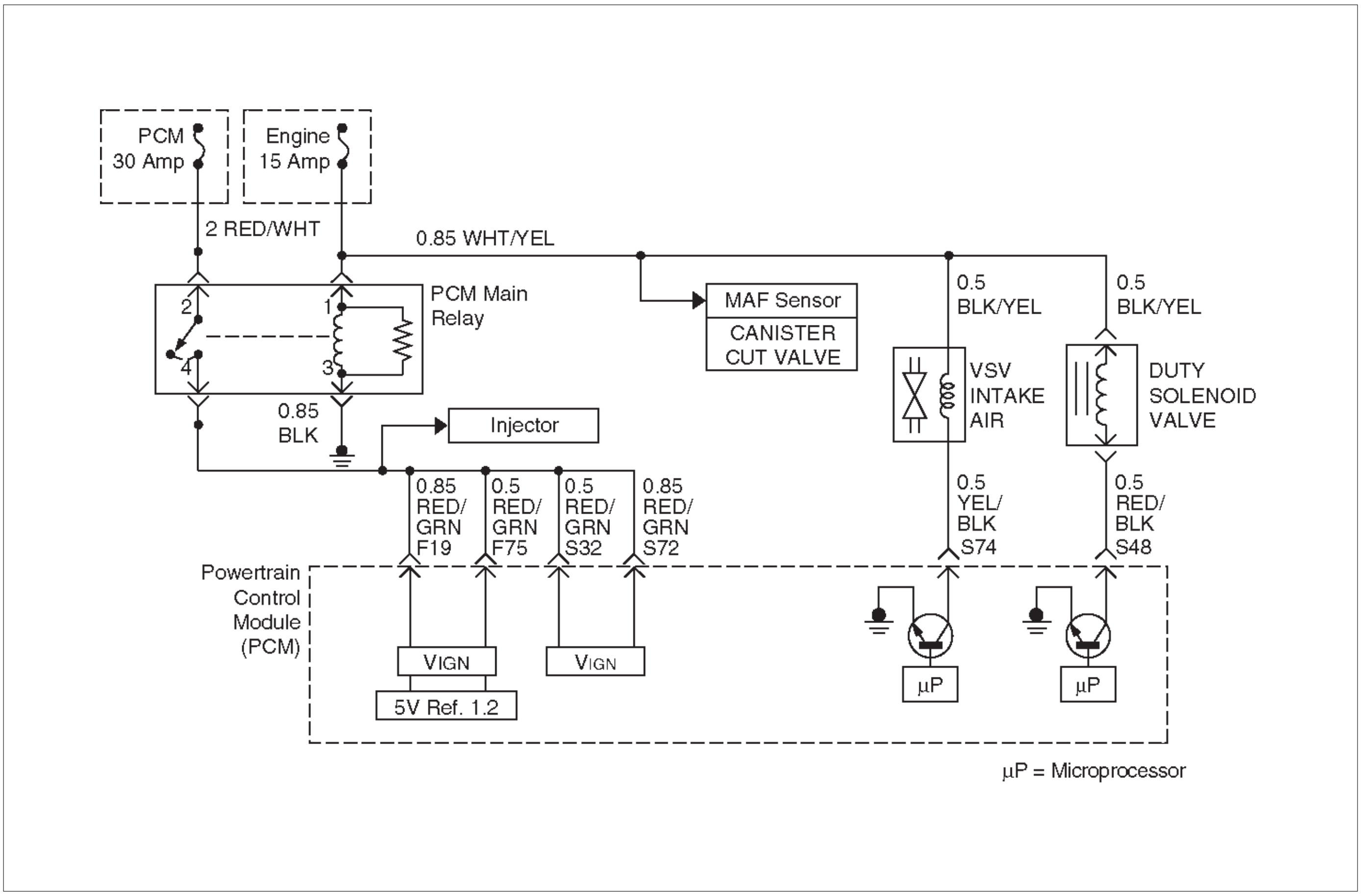
DTC P0442 – EVAP System Leak Detected

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “OFF.” 2. Remove the fuel cap. 3. Ignition “ON.” 4. Observe “Fuel Tank Pressure” on the Tech 2. Does the Tech 2 indicate “Fuel Tank Pressure” at the specified value?	1.51V	Go to *Step 3*	Go to *Fuel Tank Pressure System*
3	**IMPORTANT:** Before continuing with diagnosis, zero the EVAP pressure and vacuum gauges on EVAP pressure/purge cart J 41413 (refer to tool operating instructions). 1. Replace the fuel cap. 2. Capture Failure Records data for DTC P0442 and clear DTCs. 3. Connect the EVAP pressure/purge cart J 41413 to the EVAP service port. 4. Using the Tech 2, command the EVAP canister vent solenoid “ON” (closed). 5. Using the EVAP pressure/purge cart J 41413, pressurize the EVAP system to the specified value. 6. Observe “Fuel Tank Pressure” on the Tech 2. Does the Tech 2 indicate “Fuel Tank Pressure” at the specified value?	1.47V	Go to *Step 4*	Go to *Fuel Tank Pressure System*
4	1. Ignition “ON,” engine idling. 2. Using the Tech 2, command the EVAP canister vent solenoid “ON” (closed). 3. Using the EVAP pressure/purge cart J 41413, pressurize the EVAP system to 15 in. H2O. 4. Switch the rotary switch on the cart to “HOLD” and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	1.47 – 1.51V	Go to *Step 5*	Refer to *Diagnostic Aids*

DTC P0442 – EVAP System Leak Detected (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect the fuel tank vapor line and the EVAP purge line from the EVAP canister. 2. Block the canister fitting for the fuel tank vapor line. 3. Connect a hand vacuum pump to the canister fitting for the EVAP purge line. 4. Ensure that the EVAP canister vent solenoid is still commanded "ON" (closed). 5. Attempt to apply vacuum to the EVAP canister. Can the vacuum be maintained at the specific value?	1.46V	Go to *Step 8*	Go to *Step 6*
6	1. Visually/physically check for the following conditions: • Vent hose disconnected or damaged. • EVAP canister damaged. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 7*
7	Replace the EVAP canister vent solenoid. Is the action complete?	—	Go to *Step 10*	—
8	1. Visually/physically check for the following conditions: • Missing or faulty fuel cap. • Disconnected or leaking fuel tank vapor line. • Disconnected or damaged EVAP purge line. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 9*
9	1. Using Tech 2, command the EVAP canister vent solenoid "ON" (closed). 2. With the cart connected to the EVAP service port, continuously attempt to pressurize the EVAP system by leaving the cart control knob in the pressurize position. 3. Using ultrasonic leak detector J 41416, locate and repair leak in EVAP system. (It may be necessary to partially lower the fuel tank to examine the connections on top of the tank.) Is the action complete?	—	Go to *Step 10*	—
10	1. Ignition "ON," engine not running. 2. Using the Tech 2, command the EVAP canister vent solenoid "ON" (closed). 3. Using the EVAP pressure/purge cart J 41413, pressurize and monitor the EVAP system to 15 in. H_2O. 4. Switch the rotary switch on the cart to "HOLD" and observe the EVAP pressure gauge. Does the pressure decrease to less than the specified value within 2 minutes?	2.14V	Go to *Step 2*	Verify repair

Diagnostic Trouble Code (DTC) P0446 EVAP Canister Vent Blocked



060RY00158

Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister vent solenoid
- Fuel tank pressure sensor
- Fuel pipes and hoses
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister purge solenoid

An incorrect fuel tank pressure sensor signal is detected by monitoring fuel tank pressure when the key is first turned “ON” during a cold start. If the fuel tank pressure signal is out of range, DTC P0446 will set. A restricted or blocked EVAP vent path is detected by monitoring fuel tank pressure during normal operation (EVAP canister vent solenoid open, EVAP canister purge solenoid normal). With the EVAP canister vent solenoid open, vacuum level in the system should be very low unless the vent path is blocked. A blockage can be caused by the following condition:

- Faulty EVAP canister vent solenoid (stuck closed).
- Plugged, kinked or pinched vent hose.
- Shorted EVAP canister vent solenoid driver circuit.
- Plugged evaporative canister.

If any of these conditions are present, DTC P0446 will set.

Conditions for Setting the DTC

- No TP sensor, ECT sensor, Tank pressure sensor, IAT sensor, or MAP sensor DTCs set.
- Start-up engine coolant temperature is less than 32°C (90°F).
- Start-up engine coolant temperature is not more than 7°C (13°F) greater than start-up intake air temperature.
- Vehicle speed is less than 75 mph (120 km/h).
- Throttle position is greater than 7% but less than 30%.
- Minimal fuel slosh.
- Fuel tank level is between 10% and 90%.
- BARO is greater than 70 kPa.
- Fuel tank pressure is not between –1.5 and 1.5.

Action Taken When the DTC Sets

- The PCM will illuminate the MIL during the second key cycle in which the DTC sets.
- The PCM will store conditions which were present when the DTC set as Freeze Frame and Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.

- A history DTC P0446 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0446 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness to the EVAP canister vent solenoid, EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.
- Kinked, pinched, or plugged vent hose–Verify that the vent hose between the EVAP canister and EVAP canister vent solenoid is not restricted.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. If a vent solenoid electrical fault is present, the purge system will not operate correctly. Repairing the electrical fault will very likely correct the condition that set DTC P0446.
3. Checks the fuel tank pressure sensor at ambient pressure.
4. Verifies that the fuel tank pressure sensor accurately reacts to EVAP system pressure changes.
6. Checks for a blocked EVAP canister.

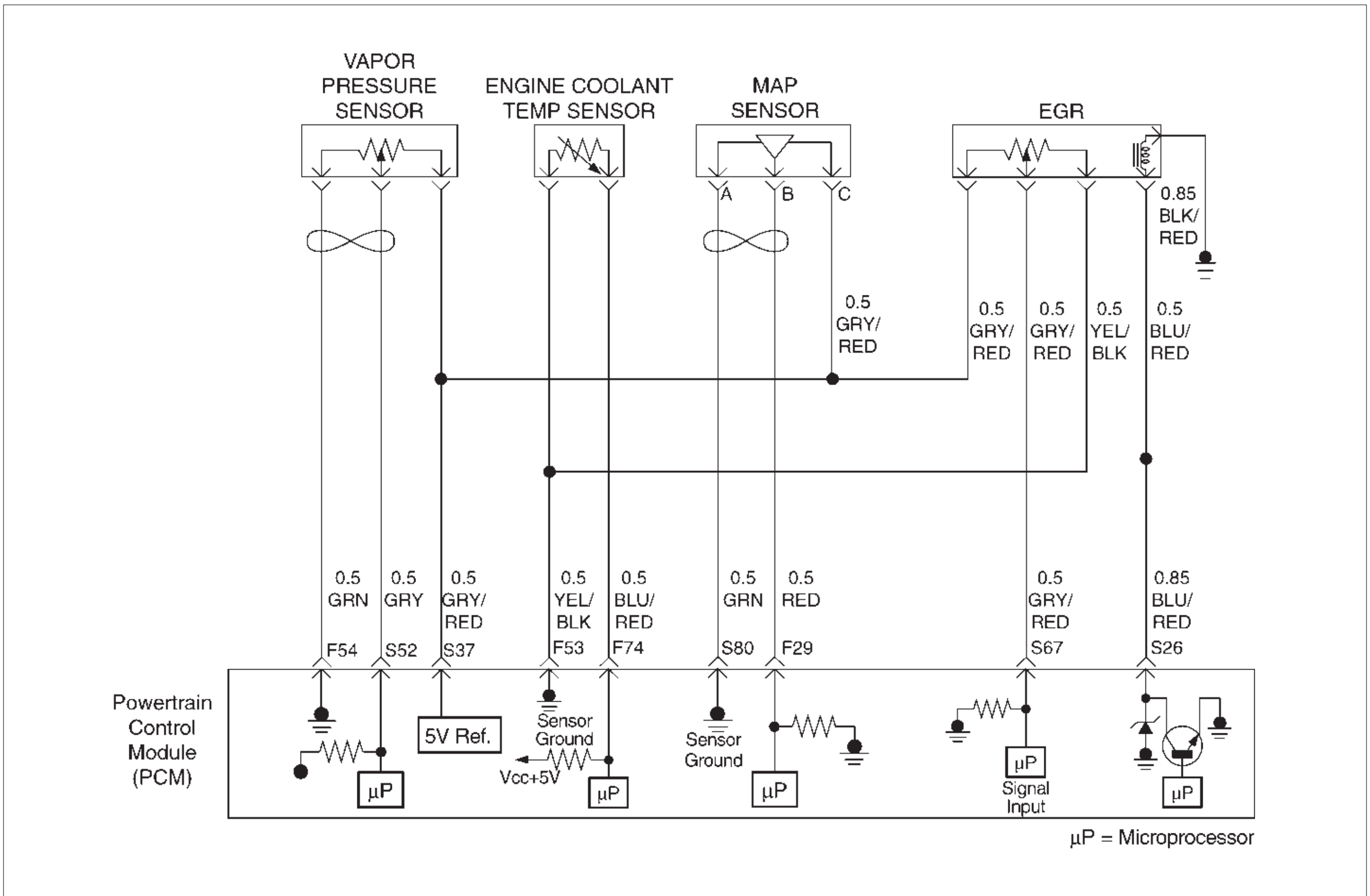
DTC P0446– EVAP Canister Vent Blocked

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON.” 2. Capture Failure Records data for DTC P0446 and clear DTCs. 3. Ignition “OFF.” 4. Remove the fuel cap. 5. Ignition “ON.” 6. Observe “Fuel Tank Pressure” on the Tech 2. Does Tech 2 indicate “Fuel Tank Pressure” at the specified value?	1.51V	Go to *Step 3*	Go to *Fuel Tank Pressure System*
3	**IMPORTANT:** Before continuing with diagnosis, zero the EVAP pressure and vacuum gauges on the EVAP pressure/purge cart J 41413 (refer to tool operating instructions). 1. Replace the fuel cap. 2. Using the Tech 2, command the EVAP vent solenoid “ON” (closed). 3. Connect the EVAP pressure/purge cart J 41413 to the EVAP service port. 4. Using the EVAP pressure/purge cart J 41413, pressurize the EVAP system to the specified value. 5. Observe “Fuel Tank Pressure” on the Tech 2. Does Tech 2 indicate “Fuel Tank Pressure” at the specified value?	1.52 – 1.69V	Go to *Step 4*	Go to *Fuel Tank Pressure System*
4	1. Maintain the EVAP pressure at 5 in. at H2O. 2. Using Tech 2, command the EVAP vent solenoid “OFF” (open) while observing the EVAP pressure gauge on the cart J 41413. Does the EVAP pressure return to the specified value within 5 seconds?	0 in. H2O	Refer to *Diagnostic Aids*	Go to *Step 5*

DTC P0446– EVAP Canister Vent Blocked (Cont'd)

Step	Action	Value(s)	Yes	No
5	1. Disconnect the large vent hose (marked "AIR") from the EVAP canister. 2. Switch the rotary switch on the cart J 41413 to "PURGE." 3. Ignition "ON," engine idling at normal operating temperature. 4. Observe vacuum gauge for 5 seconds while holding the engine speed at 2500 RPM. Does the vacuum remain less than the specified value?	30 in. H2O	Go to *Step 6*	Go to *Step 8*
6	1. Inspect the vent hose between the EVAP canister and the EVAP canister vent solenoid for kinks, pinched areas, or any other form of blockage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 9*	Go to *Step 7*
7	Replace the EVAP canister vent solenoid. Is the action complete?	—	Go to *Step 9*	—
8	Replace the EVAP canister. Is the action complete?	—	Go to *Step 9*	—
9	1. Using Tech 2, command the EVAP canister vent solenoid "ON" (closed). 2. Using the EVAP pressure/purge cart J 41413, pressurize and monitor the EVAP system to 15 in. H2O. 3. Switch the rotary switch on cart J 41413 to "HOLD." 4. Using the Tech 2, command the EVAP canister vent solenoid "OFF" (open) while observing the EVAP pressure gauge on cart J 41413. Does the EVAP pressure return to the specified value within 5 seconds?	0 in. H^2O	Verify repair	Go to *Step 2*

Diagnostic Trouble Code (DTC) P0452 Fuel Tank Pressure Sensor Low Voltage



D06RY00145

Circuit Description

The powertrain control module (PCM) monitors fuel tank pressure sensor (Vapor pressure sensor) of the Enhanced Evapo system. When the tank pressure output indicates low voltage, PCM will set DTC P0452.

Conditions for Setting the DTC

- Tank sensor output is less than 0.2 volts for 12.5 sec.
- 100 test failures within a 200 tests.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0402 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Open circuit of 5 volt reference line – Inspect wiring harness from PCM to the sensor. The PCM turns P0452, and P0107 at the same time.
- Open circuit or short circuit to ground line – Inspect wiring harness from PCM to the sensor. The PCM turns P0452 and P0107 at the same time.
- Tank fuel pressure sensor malfunction may cause P0452.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

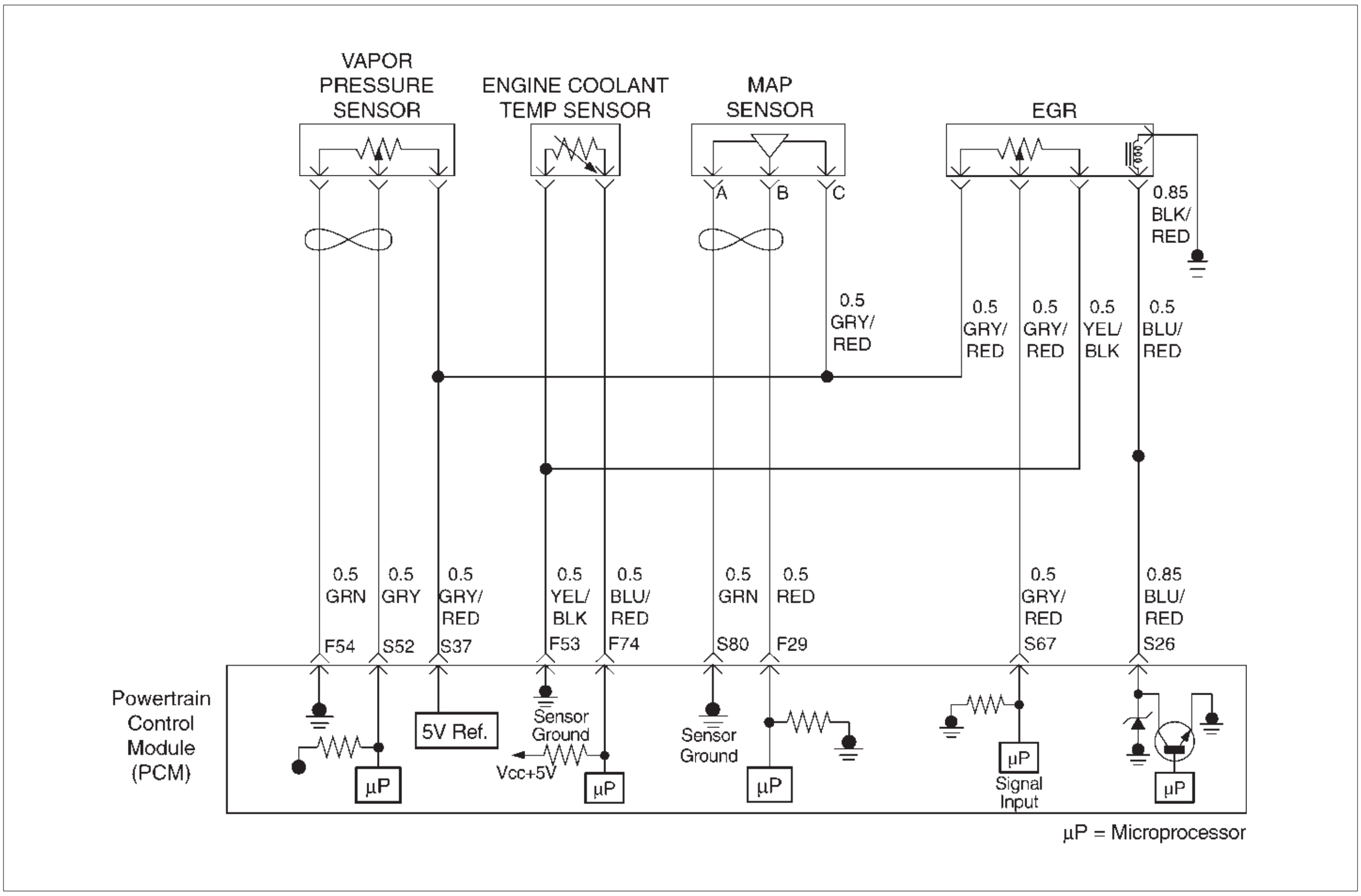
DTC P0452 – Tank Pressure Sensor Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF”, review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0452 until the DTC P0452 test runs. Note the result. Does the Tech 2 indicates DTC P0452 or P0452/P0107 failed this ignition?	—	P0452/P0107 turn on Go to *Step 3* P0452 turns on Go to *Step 6*	Refer to *Diagnostic Aids*
3	1. Ignition “OFF”. 2. Disconnect connector at the PCM. 3. Ignition “ON”. 4. At the PCM connector, measure voltage with a DVM at F54 and S37 terminals. Was the voltage in range of voltage?	4–6 V	Go to *Step 4*	Go to *Step 10*
4	1. Ignition “OFF”. 2. Connect the PCM connector to the PCM. 3. Backprobe with a DVM at fuel tank pressure sensor between 5 V reference terminal and sensor ground terminal. Was the voltage within range?	4–6 V	For P0452 go to *Step 5* and for P0107, go to diagnosis section.	Go to *Step 5*
5	1. Locate open wiring of 5 volt reference circuit from the PCM to fuel tank pressure sensor. 2. Repair wiring harness. Is the action complete?	—	Verify repair	—
6	1. Ignition “ON” 2. At the PCM connector, backprove with a DVM at the sensor output for the voltage. Was voltage within the range?	Less than 0.2 V	Go to *Step 7*	Go to *Step 10*
7	At the sensor output terminal, backprobe with a DVM at the sensor output Was voltage within the range?	Less than 0.2 V	Go to *Step 9*	Go to *Step 8*
8	1. Locate open circuit or short circuit to ground line. 2. Repair the harness. Is the action complete?	—	Verify repair	—
9	1. Locate open circuit or short circuit to ground line. 2. Repair the harness. Is the action complete?	—	Verify repair	—

DTC P0452 – Tank Pressure Sensor Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0453 Fuel Tank Pressure Sensor (Vapor pressure Sensor) High Voltage



D06RY00145

Circuit Description

The powertrain control module (PCM) monitors fuel tank pressure sensor (Vapor pressure sensor) of the Enhanced Evapo system. When the tank pressure output indicates high voltage , PCM will set DTC P0453.

Conditions for Setting the DTC

- Tank sensor output is more than 4.9 volts for 12.5 sec.
- 100 test failures within a 200 tests.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) as soon as failure detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0453 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- Info function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Open circuit of sensor ground line – Inspect wiring harness from PCM to the sensor. The PCM turns P0453, and P0108 at the same time.
- Open circuit or short circuit to 5 volt reference line – Inspect wiring harness from PCM to the sensor. The PCM turns P0453 and P0108 at the same time.
- Tank fuel pressure sensor malfunction may cause P0453.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

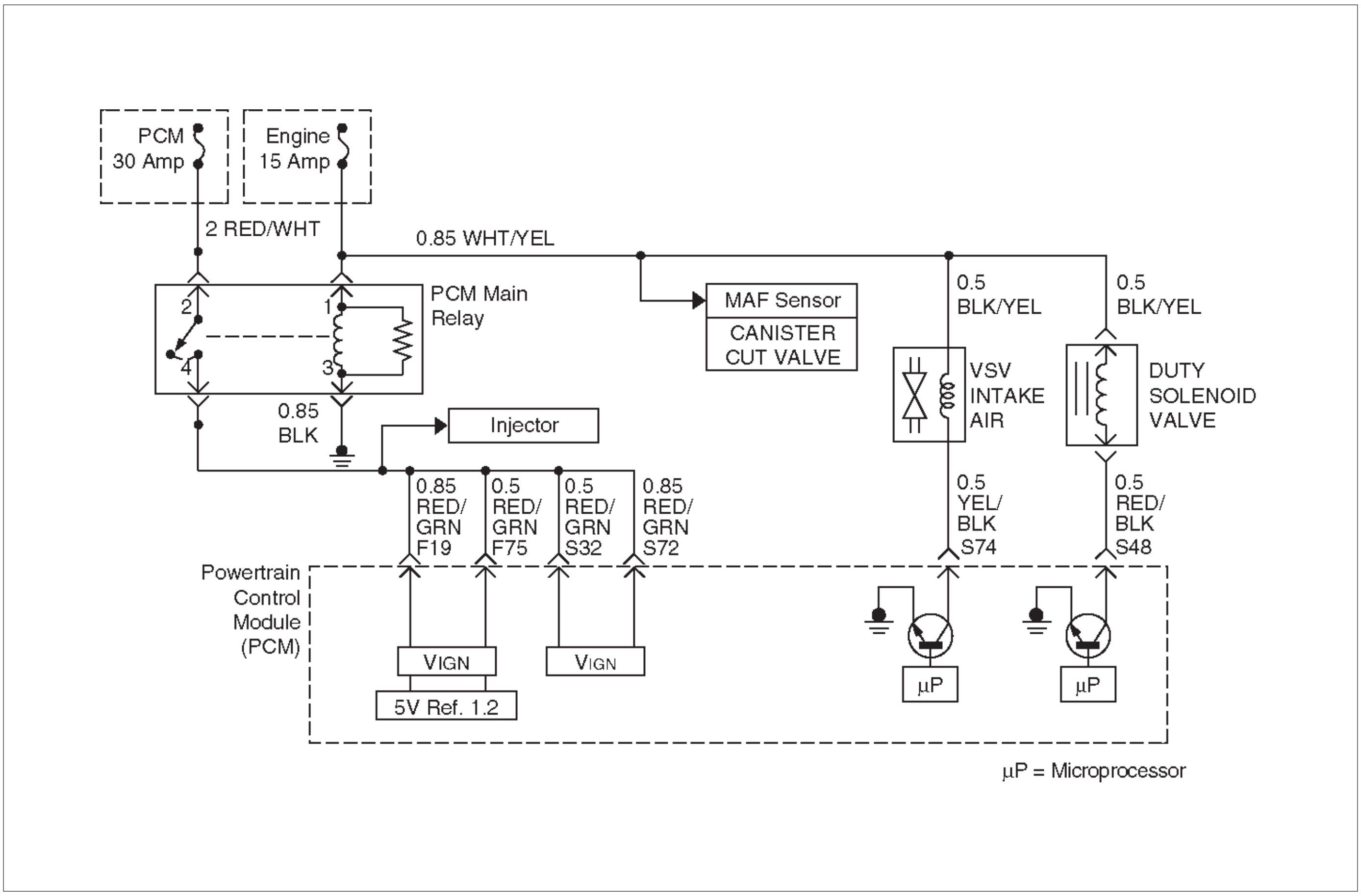
DTC P0453 – Fuel Tank Pressure Sensor High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF”, review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC” info for DTC P0453 until the DTC P0453 test runs. Note the result. Does the Tech 2 indicates DTC P0452 or P0452/P0107 failed this ignition?	—	P0453/P0108 turn on Go to *Step 3* P0452 turns on Go to *Step 6*	Refer to *Diagnostic Aids*
3	1. Ignition “OFF”. 2. Disconnect connector at the PCM. 3. Ignition “ON”. 4. At the PCM connector, measure voltage with a DVM at F54 and S37 terminals. Was the voltage in range of voltage?	4–6 V	Go to *Step 4*	Go to *Step 10*
4	1. Ignition “OFF”. 2. Connect the PCM connector to the PCM. 3. Disconnect sensor harness at fuel pressure sensor. Measure voltage with a DVM at the end of the tank pressure wiring between 5 V reference terminal and sensor ground terminal. Was the voltage within range?	4–6 V	For P0453 go to *Step 6* and for P0108, go to diagnosis section.	Go to *Step 5*
5	1. Locate open wiring of ground line from the PCM to fuel tank pressure sensor. 2. Repair wiring harness. Is the action complete?	—	Verify repair	—
6	1. Ignition “ON”. 2. At the PCM connector, backprove with a DVM at the sensor output for the voltage. Was voltage within the range?	More than 4.9 V	Go to *Step 7*	Go to *Step 10*
7	At the sensor output terminal, backprobe with a DVM at the sensor output. Was the voltage within range?	More than 4.9 V	Go to *Step 9*	Go to *Step 8*
8	1. Locate open circuit or short circuit to ground line. 2. Repair the harness. Is the action complete?	—	Verify repair	—
9	Replace the tank pressure sensor. Is the action complete?	—	Verify repair	—

DTC P0453 – Fuel Tank Pressure Sensor High Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0456 EVAP Very Small Leak



060RY00158

Circuit Description

The evaporative system includes the following components:

- Fuel tank
- EVAP canister vent solenoid
- Fuel tank pressure sensor
- Vapor lines
- Fuel cap
- Evaporative emissions canister
- Purge lines
- EVAP canister purge solenoid

The evaporative leak detection diagnostic strategy is based on applying vacuum to the EVAP systemand monitoring vacuum decay. The powertrain control module(PCM)monitors vacuum level via the fuel tank presuure sensor input .At an appropriate time, the EVAP canister purge solenoid and the EVAP canister vent solenoid are turned "ON," allowing engine vacuum to draw a very small on the entire evaporative emissions system. After the desired vacuum level has been achieved, the EVAP canister purge solenoid is turned "OFF", sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant.

A very small leak in the system will cause DTC P0456 to be set.

Conditions for setting the DTC

- No MAP DTC's set.
- No TPS DTC's set.
- No IAT DTC's set.
- No ECT DTC's set.
- No tank pressure sensor DTC's set.
- Baro is more than 70KPa.
- A vacuum decay condition, indicating a very small leak, is detected during the diagnostic test.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Warm up cycles have occurred without a fault.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0456 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P0456 can be cleared using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Cracked or punctured EVAP canister.
- Damaged source vacuum line, EVAP purge line, EVAP vent hose or fuel tank vapor line. to wire connection.
- Poor connection at PCM–Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged hanrness-Inspect the wiring harness to the EVAP canister purge solenoid and the fuel tank pressure sensor for an intermittent open or short circuit.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs.

This may assist in diagnosing the condition.

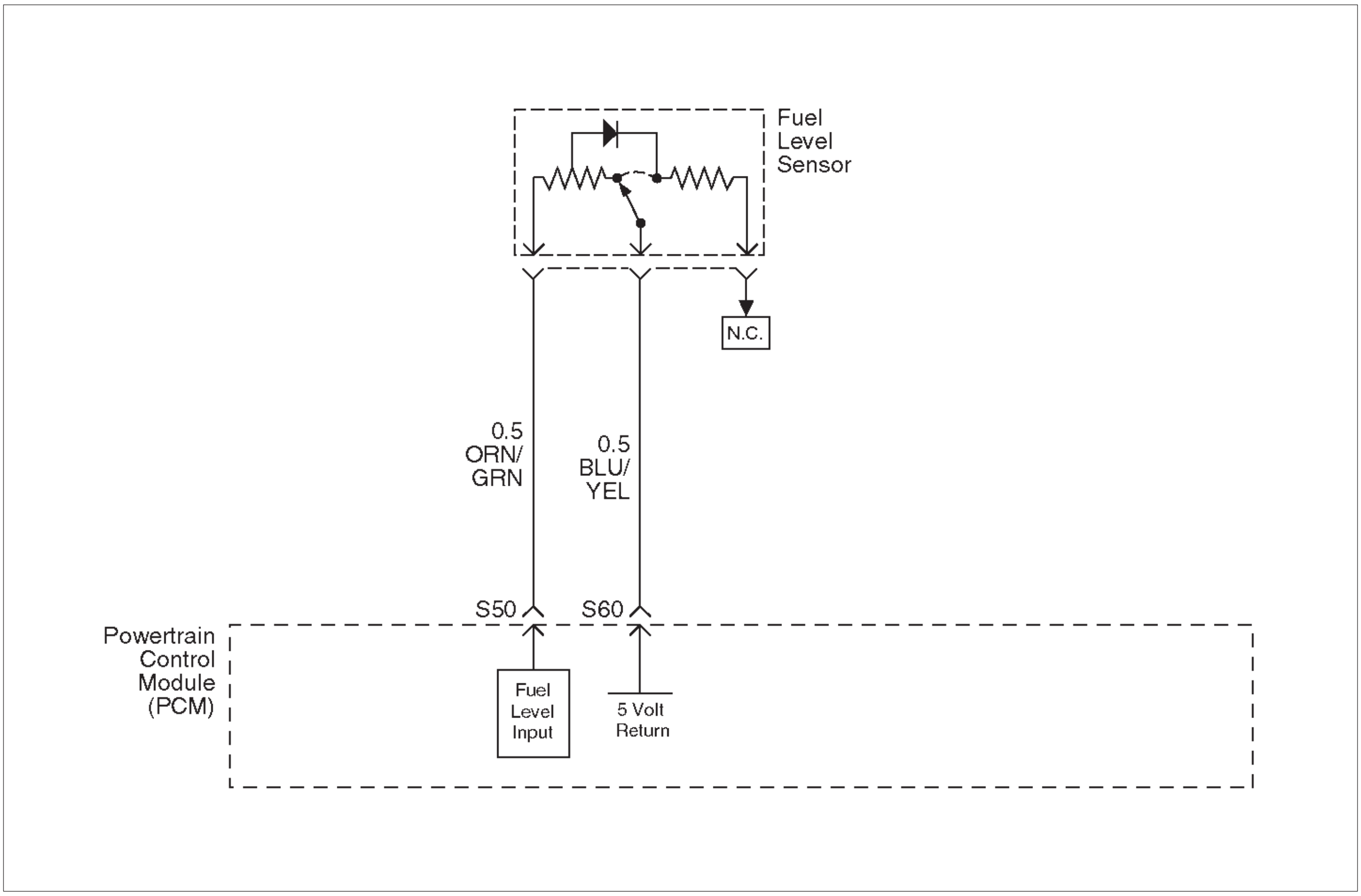
Diagnostic Trouble Code(DTC)P0456 EVAP Very Small Leak

Step	Action	Value(s)	Yes	No
1	Was the “On-Board(OBD)System Check”performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “OFF”. 2. Remove the fuel cap. 3. Ignition “ON”. 4. Observe “Fuel Tank Pressure” on the Tech 2. Does the Tech 2 indicate “Fuel Tank Pressure” at the specified value?	1.51V	Go to*Step 3*	Go to*Fuel Tank Pressure System*
3	1. Visually/physically check for the following conditions: • Vent hose disconnected or darmaged. • EVAP canister damaged. • Fuel cap damaged 2. If a problem is found,repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 4*
4	1. Ignition “ON”, engine “OFF”. 2. Install the fuel cap. 3. Review and record Tech 2 Failure Records data. 4. Operate the vehicle within Failure Records conditions as noted. 5. Using theTech 2,monitor the “DTC” info for DTC P0456. Does the Tech 2 indicate DTC P0456?	—	Go to *Step 5*	Refer to *Diagnostic Aids*
5	1. Ignition “ON”, engine idling. 2. Observe “Fuel Tank Pressure” on the Tech 2. Does the Tech 2 indicate “Fuel Tank Pressure” at the specified value?	—	Refer to *Diagnostic Aids*	Go to *Step 5*
6	1. Ignition “ON”, engine idling. 2. Using theTech 2, command the EVAP canister vent solenoid “ON” (closed) 3. Observe “EVAP canister vent solenoid operation”. second value? 4. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*

Diagnostic Trouble Code(DTC)P0456 EVAP Very Small Leak (Cont'd)

Step	Action	Value(s)	Yes	No
7	1. Visually/physically check for the following conditions: • Disconnected or leaking fuel tank vapor line. • Disconnected or damage EVAP purge line. 2. If a problem is found,repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P0462 Fuel Level Sensor Circuit–Low Voltage



060RY00163

Circuit Description

The fuel level sensor is an important input to powertrain control module (PCM) for the enhanced evaporative system diagnostic. Fuel level information is needed for the PCM to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the evaporative system. Several of the enhanced evaporative system diagnostic sub-tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is greater than 85%, or less than 15% full. Fuel level DTCs should be diagnosed before other evaporative system DTCs because they can cause other DTCs to be set.

The sending unit is a float in the fuel tank which moves a wiper arm across a variable resistor. Low fuel level causes high resistance in the sending unit, and this is recognized by the PCM because the circuit operates at a corresponding low voltage. When the circuit is continuously open or has a high resistance connection, DTC P0462 is set.

Conditions for Setting the DTC

- Fuel tank level “slosh test” is completed.
- Fuel tank level “main test” is completed.
- Fuel tank level data is valid.
- Fuel tank level signal is less than a specified value.
- There are 100 test failures within a 200-test sample.

Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON.”
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- The PCM will turn the MIL “OFF” after three consecutive trips without a fault condition present. A history DTC will be cleared if no fault conditions have been detected for 40 warm-up cycles (engine coolant temperature has risen 4°C (40°F) from the start-up ECT, and ECT exceeds 71°C (160°F) during that same ignition cycle).
- DTC P0462 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

8. The following chart can be used to check the sending unit:

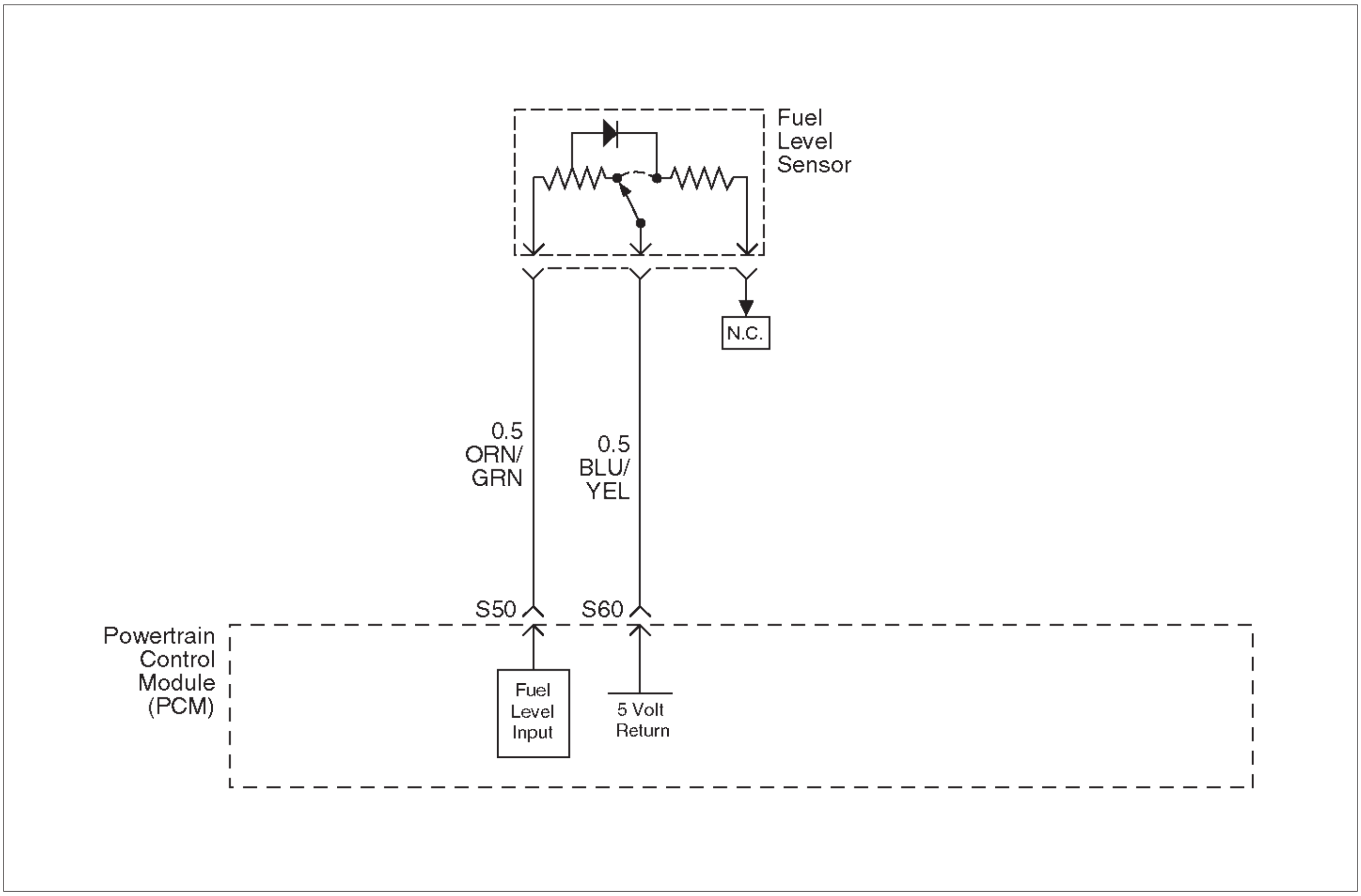
DTC P0462– Fuel Level Sensor Circuit –Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Disconnected the fuel level sensor harness from its connector at the fuel tank. 2. Ignition "ON," engine "OFF." 3. Using a DVM, measure the voltage between the sensor harness positive and ground wires. Is the voltage approximately equal to the specified value?	5 V	Go to *Step 6*	Go to *Step 3*
3	1. Ignition "ON," engine "OFF." 2. With a DVM, backprobe the PCM connector at the terminal which supplies 5 volts to the fuel level sensor. Is the voltage approximately equal to the specified value?	5 V	Go to *Step 4*	Go to *Step 9*
4	1. Ignition "ON," engine "OFF." 2. Fuel level sensor disconnected from wiring harness. 3. With a DVM, probe the 5-volt supply wire at the sensor harness. Is the voltage approximately equal to the value measured in Step 4?	—	Go to *Step 5*	Go to *Step 9*
5	Check for open or high resistance connection in the ground wire between the PCM and the fuel level sensor. Is the action complete?	—	Verify repair	—
6	Remove the fuel level sensor and check the following: • Does the arm move freely? • Are the wires open or intermittently open when wiggled? • Do the resistance values match the specification chart? Was a problem found?	—	Go to *Step 7*	Go to *Step 9*
7	Replace the fuel level sensor. Is the action complete?	—	Verify repair	—

DTC P0462– Fuel Level Sensor Circuit –Low Voltage (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
9	Short to ground between the PCM connector and the fuel level sensor. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0463 Fuel Level Sensor Circuit–High Voltage



060RY00163

Circuit Description

The fuel level sensor is an important input to powertrain control module (PCM) for the enhanced evaporative system diagnostic. Fuel level information is needed for the PCM to know the volume of fuel in the tank. The fuel level affects the rate of change in air pressure in the evaporative system. Several of the enhanced evaporative system diagnostic sub-tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is greater than 85% or less than 15%, full. Fuel level DTCs should be diagnosed before other evaporative system DTCs because they can cause other DTCs to be set.

The sending unit is a float in the fuel tank which moves a wiper arm across a variable resistor. High fuel level causes low resistance in the sending unit. This is recognized by the PCM because the circuit operates at a corresponding high voltage. When the circuit is continuously shorted to a voltage source greater than a specified value, or when the 5 volt signal is shorted to ground, DTC P0463 is set.

Conditions for Setting the DTC

- Fuel tank level “slosh test” is completed.
- Fuel tank level “main test” is completed.
- Fuel tank level data is valid.
- Fuel tank level signal is greater than a specified value.
- There are 100 test failures within a 200-test sample.

Action Taken When the DTC Sets

- The PCM will not turn the malfunction indicator lamp (MIL) “ON.”
- The PCM will store conditions which were present when the DTC set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the DTC

- The PCM will turn the MIL “OFF” after three consecutive trips without a fault condition present. A history DTC will be cleared if no fault conditions have been detected for 40 warm-up cycles (engine coolant temperature has risen 4°C (40°F) from the start-up ECT, and ECT exceeds 71°C (160°F) during that same ignition cycle) or the scan tool clearing function has been used.
- DTC P0463 can be cleared by using the scan tool “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the fuel level display on the scan tool while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Test Description

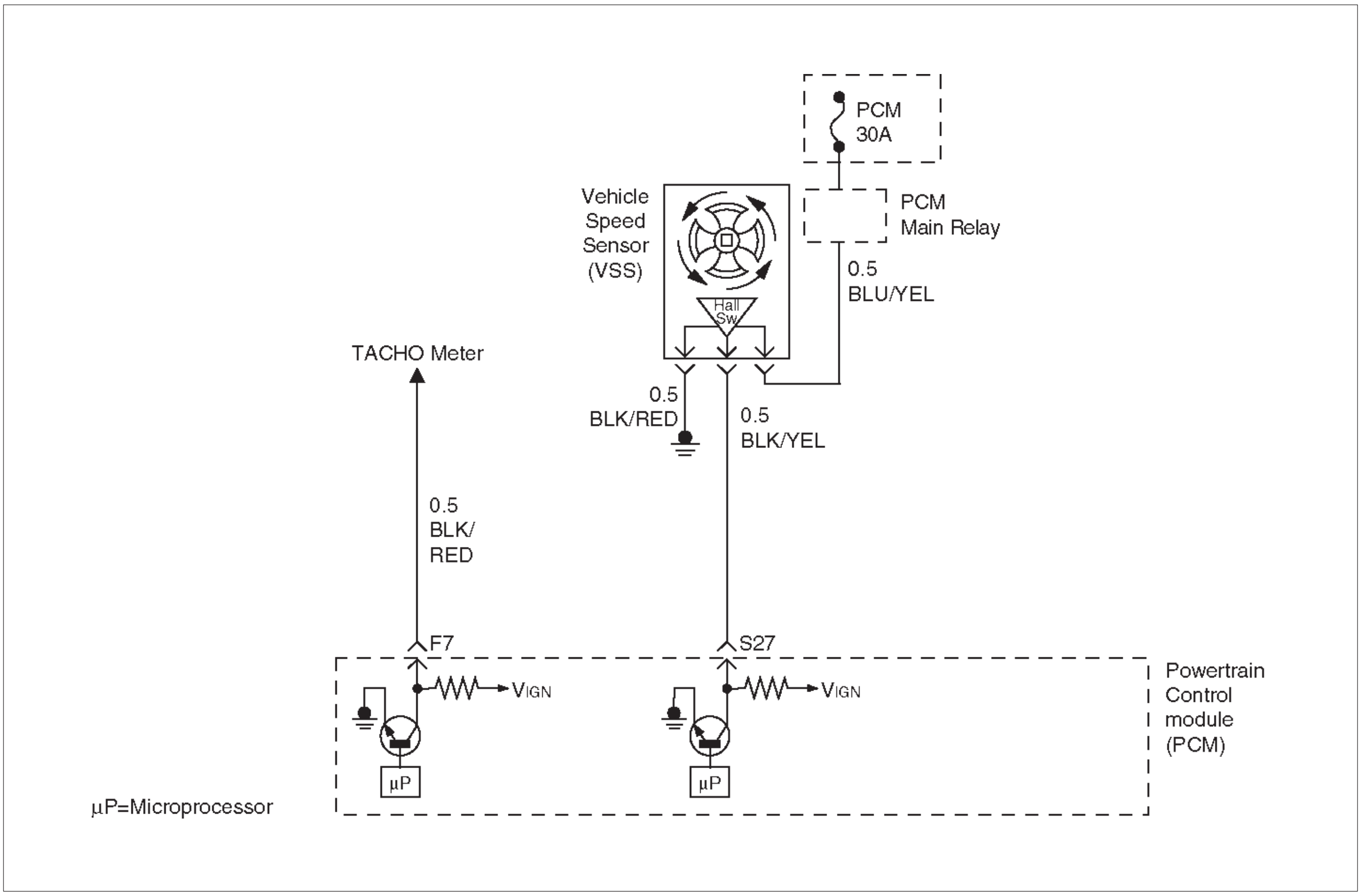
Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The ETC and MAP sensors share a ground at PCM terminal D9.
9. Equates the resistance values at various float positions to the following fuel gauge readings:

DTC P0463– Fuel Level Sensor Circuit –High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Disconnected the fuel level sensor harness from its connector at the fuel tank. 2. Ignition “ON,” engine “OFF.” 3. Using a DVM, measure the voltage between the sensor harness positive and ground wires. Is the voltage approximately equal to the specified value?	5 V	Go to *Step 8*	Go to *Step 3*
3	With the negative DVM lead connected to ground, use the positive DVM lead to probe the sensor ground wire with the harness still disconnected. Does the DVM indicate a short to a voltage source?	—	Go to *Step 4*	Go to *Step 5*
4	Repair short to voltage between the sensor and the PCM. Is the repair complete?	—	Verify repair	—
5	With the negative DVM lead connected to ground, use the positive DVM lead to probe the sensor positive wire with the harness still disconnected. Does the DVM indicate a voltage greater than the specified value?	5 V	Go to *Step 4*	Go to *Step 6*
6	Open circuit between the PCM connector and the fuel level sensor?	—	Verify repair	Go to *Step 7*
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—
8	Remove the fuel level sensor and check the following: • Does the arm move freely? • Are the wire leads shorted together? • Do the resistance values match the specification chart? Was a problem found?	—	Go to *Step 9*	Go to *Step 7*
9	Replace the fuel level sensor. Is the repair complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0502 VSS Circuit Low Input



060RY00164

Circuit Description

The vehicle speed sensor has a magnet rotated by the transmission output shaft. Attached to the sensor is a hall effect circuit the interacts with the magnetic field treated by the rotating magnet. A 12-volt operating supply for the speed sensor hall circuit is supplied from the meter fuse. The VSS pulses to ground the 9-volt signal sent from the powertrain control module (PCM) on the reference circuit. The PCM interprets vehicle speed by the number of pulses to ground per second on the reference circuit.

Conditions for Setting the DTC

- Engine is running.
- Engine speed is between 1800 RPM and 2500 RPM.
- Throttle angle is between 10% and 40%.
- Engine load is greater than 50 kPa.
- PCM detects no VSS signal for 12.5 seconds over a period of 15 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0502 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0502 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

10. To avoid backprobing the VSS and possibly damaging a seal or terminal, the VSS output can be tested at the point where the transmission harness connects to the engine harness. Power and ground are applied by jumpers to the VSS through the connectors which are located to the rear of the air cleaner assembly. The VSS signal is monitored with a DVM as the rear driveshaft turns. The wheels can be turned to rotate the driveshaft, or in 2-wheels-drive vehicles the driveshaft can be turned directly.

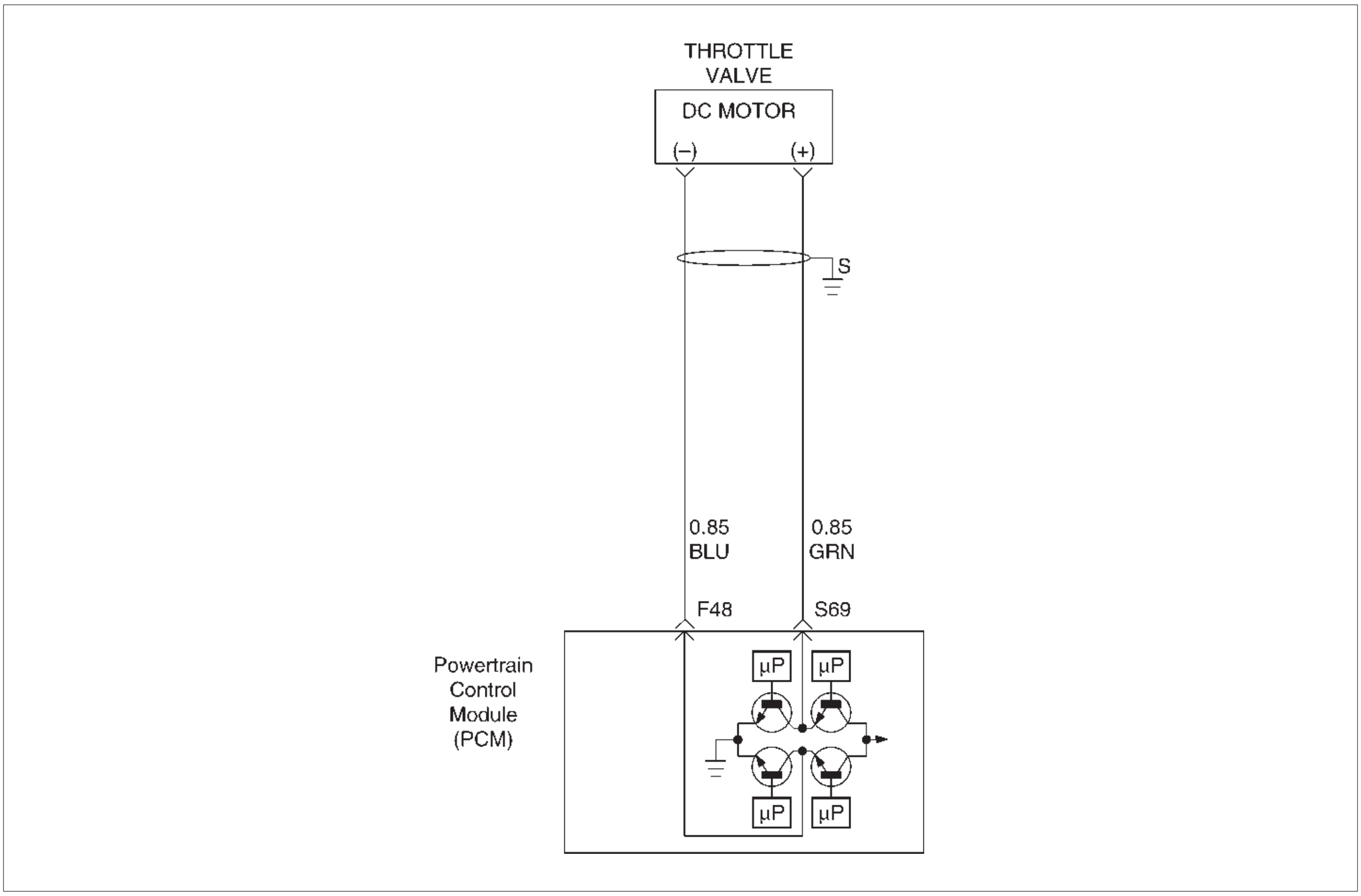
DTC P0502 – VSS Circuit Low Input

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Does the speedometer work?	—	Go to *Step 10*	Go to *Step 3*
3	1. Disconnect the VSS connector. 2. Ignition "ON." 3. Using a test light to battery +, probe the connector ground wire. Did the light illuminate?	—	Go to *Step 5*	Go to *Step 4*
4	Repair the sensor ground. Is the action complete?	—	Verify repair	—
5	1. Ignition "ON," sensor disconnected. 2. Using a DVM, measure at the VSS connector between ground and voltage supply. Was the measurement near the specified value?	Battery voltage	Go to *Step 7*	Go to *Step 6*
6	Repair the open or short to ground which may have blown the meter fuse. Is the action complete?	—	Verify repair	—
7	1. Ignition "ON," VSS disconnected. 2. Using a DVM, measure at the VSS connector between ground and the wire from the speedometer. Was the measurement near the specified value?	7.5-8 V	Go to *Step 9*	Go to *Step 8*
8	Check for an open or short circuit between the speedometer and the VSS. Was an open or short circuit located?	—	Verify repair	Go to *Step 9*
9	Replace the speedometer. Is the action complete?	—	Verify repair	—

DTC P0502 – VSS Circuit Low Input (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Ignition "OFF." 2. Disconnect the MAF sensor. The connector attaches the VSS wires from the transmission harness to the left-side engine harness. 3. Disconnect the black 16-way connector. 4. Select a terminal adapter from kit J 35616 that can be used with a jumper to supply B+ to the blue wire with a yellow tracer (transmission side of the connector). 5. Use another terminal adapter to attach a voltmeter to the light-green wire with a white tracer (next to the wire in the previous step.) 6. Disconnect the blue connector next to the black 16-way connector, and locate the black/red tracer wire at one corner of the blue connector. The black/red wire is the VSS ground. Use a terminal adapter to attach a jumper to ground to the black/red VSS ground wire at the transmission side of the blue connector. 7. Raise the rear wheels off the ground with transmission in neutral. Does the DVM toggle back and forth between 0.6 V and 10 V as the wheels (and driveshaft) are rotated?	—	Go to *Step 11*	Go to *Step 10*
11	Replace the VSS. Is the action complete?	—	Verify repair	—
12	Check for an open or short between the PCM and the speedometer. Was a problem found?	—	Verify repair	Go to *Step 13*
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0506 Idle Air Control System Low RPM



D06RY00161

Circuit Description

The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to the DC motor coil in position (%) to adjustment the throttle valve into a passage in the throttle body to air flow. This method allows highly accurate control of engine speed and quick response to changes in engine load.

If the PCM detects a condition where too low of an idle speed is present and the PCM is unable to adjust idle speed by increasing the throttle position, DTC P0506 will set, indicating a problem with the idle control system.

Conditions for Setting the DTC

- No TPS, VSS, ECT, EGR, MAF, low voltage, fuel system, canister purge, injector control, or ignition control DTCs are set.
- MAP is less than 60 kPa.
- Canister purge duty cycle is above 10%.
- Engine running time is more than 125 seconds.
- Vehicle speed is less than 1 mph.
- Engine coolant temperature (ECT) is above 50°C.
- Ignition voltage is between 9.5 volts and 16.7 volts.
- The throttle is closed.
- EVAP purge duty cycle more than 10%.
- All conditions are met for 10 seconds.
- Engine speed is more than 100-200 RPM lower than desired idle based upon coolant temperature.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- DTC P0506 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or throttle DC motor – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.
- Restricted air intake system – Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system.
- Throttle body – Check for objects blocking the ETC passage or throttle bore, excessive deposits in the

ETC passage and on the ETC position, and excessive deposits in the throttle bore and on the throttle plate.

- Large vacuum leak – Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty PCV valve or brake booster hose disconnected.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

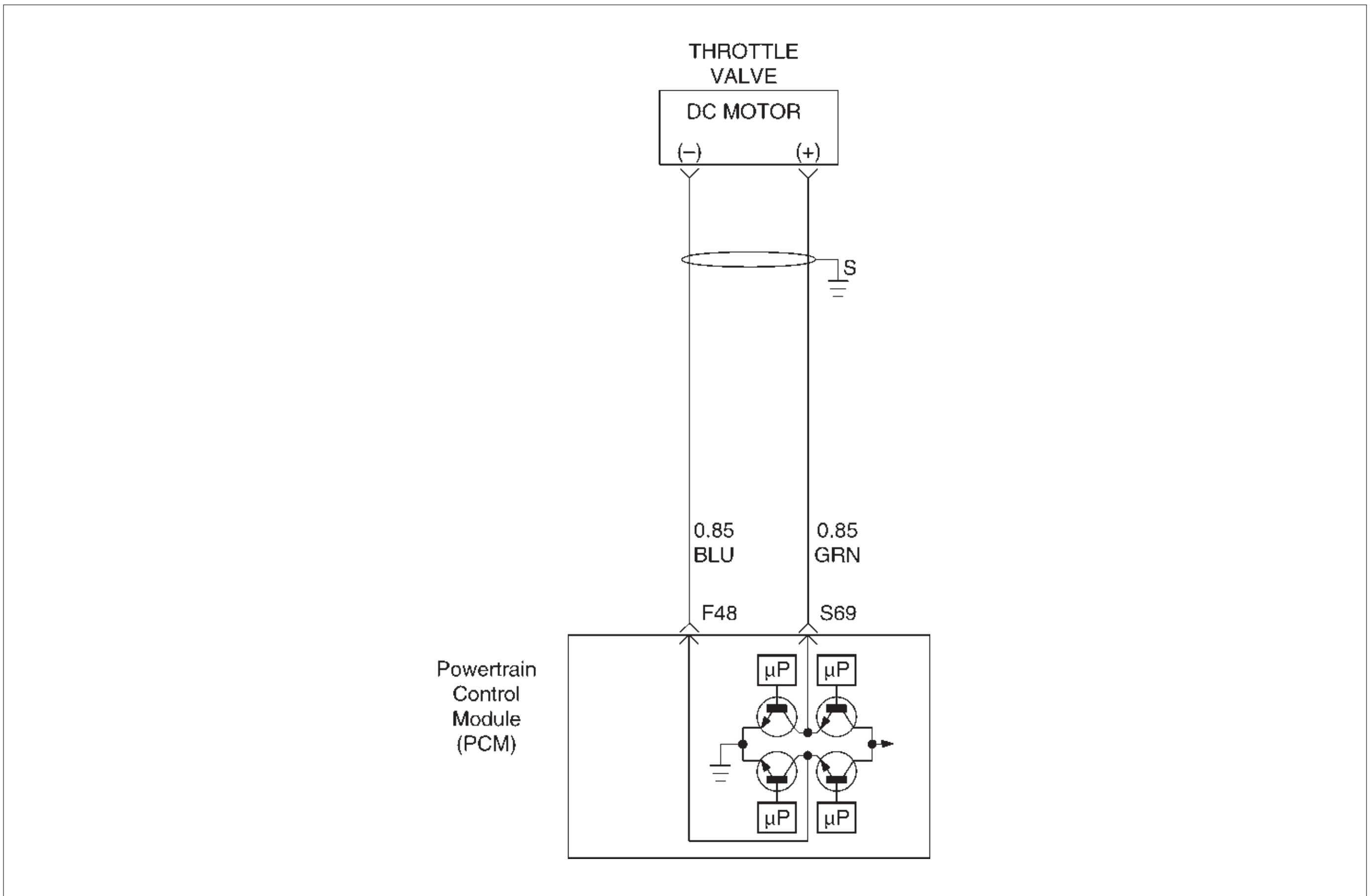
DTC P0506 – Idle Air Control System Low RPM

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Visually/physically inspect for the following conditions: ● Throttle body tampering. ● Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ● Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate. ● Throttle body with lever: Check for objects send round the throttle spring lever that lever is smooth movement, and spring lever has not excessive play Do any of the above require a repair?	—	Refer to *appropriate section foron–vehicle service*	Go to *Step 4*
3	Visually/physically inspect for the following conditions: ● Acceleration pedal tampering. ● Acceleration pedaL : Check for objects blocking the spring or pedal arm. ● Acceleration pedal : Check for objects move the acceleration pedal that pedal is smooth movement, and acceleration pedal arm has not excessive play. Do any of the above require a repair?	—	Refer to *appropriate section foron–vehicle service*	Go to *Step 4*
4	1. Check for a poor connection at the throttle body harness connector. 2. Check for a poor connection at the acceleration position sensor harness connector. 3. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
5	Check the following circuits for an open, short tovoltage, short to ground, or poor connection at thePCM: ● Throttle position sensor 1 circuit. ● Throttle position sensor 2 circuit. ● Throttle DC motor circuit. ● Throttle position sensor resistance. ● Throttle DC motor resistance. ● If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 1–7kΩ SIG-DND change resistance0.3 – 100Ω	Verify repair	Go to *Step 6*

DTC P0506 – Idle Air Control System Low RPM (Cont'd)

Step	Action	Value(s)	Yes	No
6	Replace the throttle valve. Is the action complete?	—	Go to *Step 3*	—
7	1. Check the following circuits for an open, short tovoltage, short to ground, or poor connection at the PCM: Acceleration position sensor 1 circuit. Acceleration position sensor 2 circuit. C position sensor 2 circuit. V position sensor resistance. 2. If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 4–6kΩ SIG-DND change resistance	Verify repair	Go to *Step 8*
8	Replace the acceleration position sensor. Is the action complete?	—	Go to *Step 9*	—
9	Following below the DTCs stored: P1125, P1290, P1295, P1299	—	Go to *applicableDTC table*	Go to *Step 10*
10	Following below the DTCs stored:P1514, P1515, P1516, P1523, P1271, P1272, P1273	—	Go to *applicable DTC table*	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0507 Idle Air Control System High RPM



D06RY00161

Circuit Description

The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to the DC motor coil in position (%) to adjustment the throttle valve into a passage in the throttle body to air flow. This method allows highly accurate control of engine speed and quick response to changes in engine load.

If the PCM detects a condition where too high of an idle speed is present and the PCM is unable to adjust idle speed by increasing the throttle position, DTC P0507 will set, indicating a problem with the idle control system.

Conditions for Setting the DTC

- No TPS, VSS, ECT, EGR, MAF, low voltage, fuel system, canister purge, injector control or ignition control DTCs are set.
- Barometric pressure is above 75 kPa.
- Canister purge duty cycle is above 10%.
- Engine running time is more than 125 seconds.
- Vehicle speed is less than 1 mph.
- Engine coolant temperature (ECT) is above 50°C.
- Ignition voltage is between 9.5 volts and 16.7 volts.
- The throttle is closed.
- EVAP purge duty cycle is more than 10%.
- All conditions are met for 10 seconds.
- Engine speed is more than 100-200 RPM higher than desired idle based upon coolant temperature.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0507 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0507 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM or throttle DC motor – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage.
- Vacuum leak – Check for a condition that causes a vacuum leak, such as disconnected or damaged hoses, leaks at EGR valve and EGR pipe to intake

manifold, leak at the throttle body, a faulty or incorrectly installed PCV valve, leaks at the intake manifold, etc.

- Throttle body – Check for sticking throttle plate. Also inspect the air passage for deposits or objects which will not allow the ETC position to fully extend or properly seat.

If DTC P0507 cannot be duplicated, reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

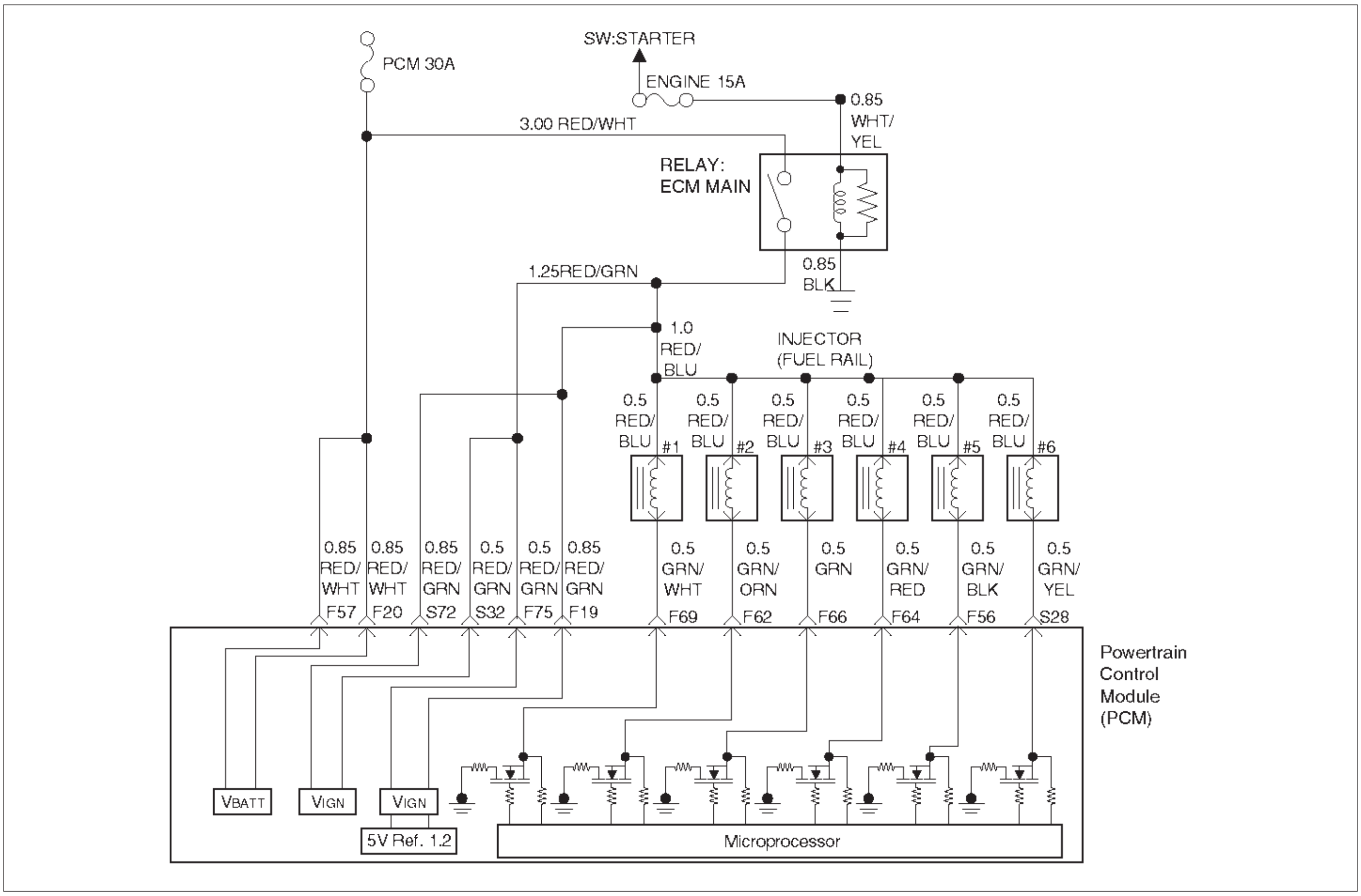
DTC P0507 – Idle Air Control System High RPM

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Visually/physically inspect for the following conditions: ● Throttle body tampering. ● Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ● Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate. ● Throttle body with lever: Check for objects send round the throttle spring lever that lever is smooth movement, and spring lever has not excessive play Do any of the above require a repair?	—	Refer to *appropriate section for on-vehicle service*	Go to *Step 4*
3	Visually/physically inspect for the following conditions: ● Acceleration pedal tampering. ● Acceleration pedaL : Check for objects blocking the spring or pedal arm. ● Acceleration pedal : Check for objects move the acceleration pedal that pedal is smooth movement, and acceleration pedal arm has not excessive play. Do any of the above require a repair?	—	Refer to *appropriate section for on-vehicle service*	Go to *Step 4*
4	1. Check for a poor connection at the throttle body harness connector. 2. Check for a poor connection at the acceleration position sensor harness connector. 3. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
5	Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: ● Throttle position sensor 1 circuit. ● Throttle position sensor 2 circuit. ● Throttle DC motor circuit. ● Throttle position sensor resistance. ● Throttle DC motor resistance. ● If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 1–7kΩ SIG-DND change resistance 0.3 – 100Ω	Verify repair	Go to *Step 6*

DTC P0507 – Idle Air Control System High RPM (Cont'd)

Step	Action	Value(s)	Yes	No
6	Replace the throttle valve. Is the action complete?	—	Go to *Step 3*	—
7	1. Check the following circuits for an open, short tovoltage, short to ground, or poor connection at the PCM: ● Acceleration position sensor 1 circuit. ● Acceleration position sensor 2 circuit. ● C position sensor 3 circuit. ● V position sensor resistance. 2. If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 4–6kΩ SIG-DND change resistance	Verify repair	Go to *Step 8*
8	Replace the acceleration position sensor. Is the action complete?	—	Go to *Step 9*	—
9	Following below the DTCs stored: P1125, P1290, P1295, P1299	—	Go to *applicable DTC table*	Go to *Step 10*
10	Following below the DTCs stored:P1514, P1515, P1516, P1523, P1271, P1272, P1273	—	Go to *applicable DTC table*	Go to *Step 11*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0562 System Voltage Low



060RY00165

Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminal to the PCM. A system voltage DTC will set whenever the voltage is below a calibrated value.

Conditions for Setting the DTC

- Ignition “ON.”
- System voltage is below 11.5 volts for 15 minutes.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store as Failure Records conditions which were present when the DTC was set. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P0562 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0562 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

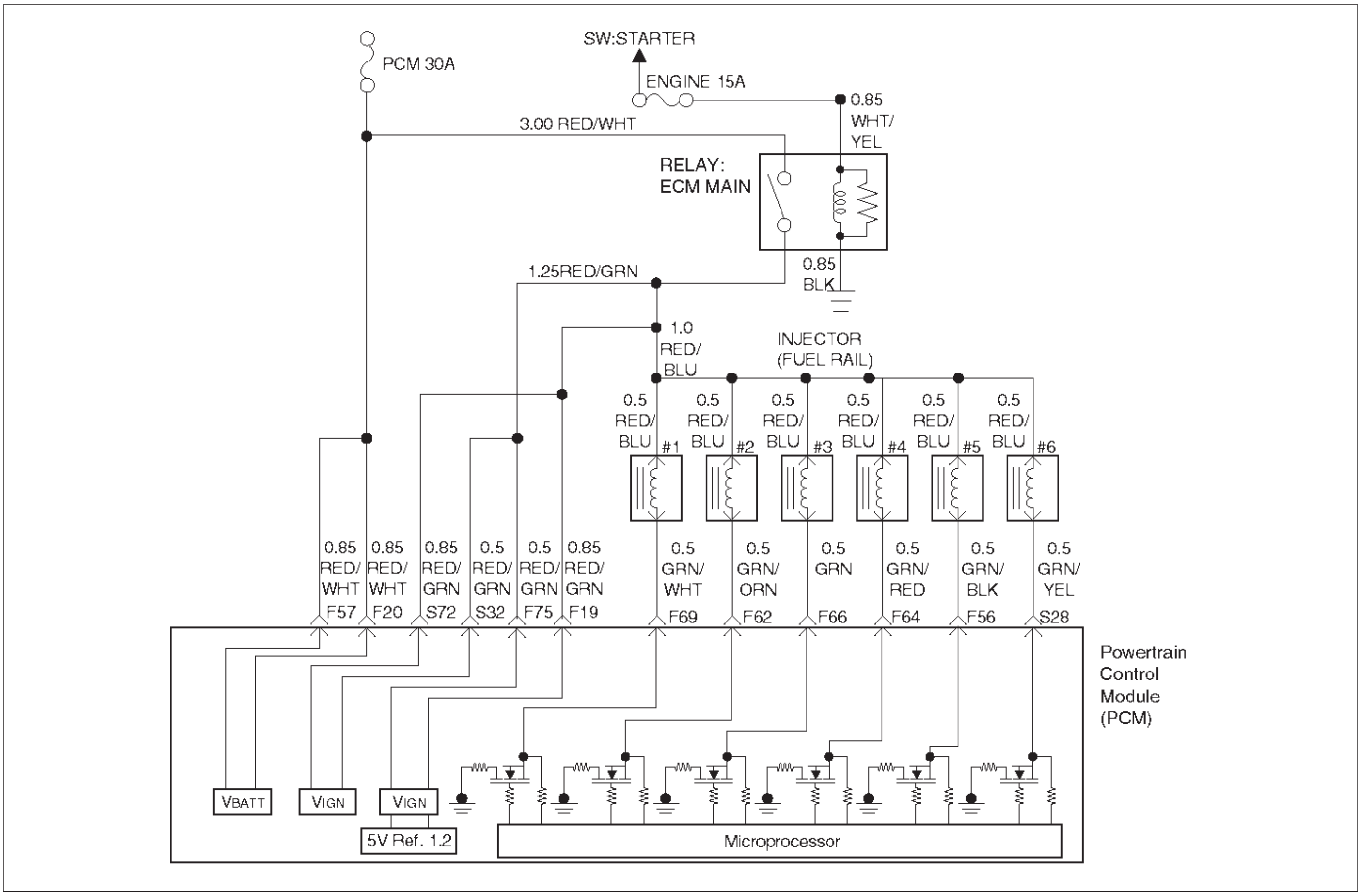
Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

DTC P0562 – System Voltage Low

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Using a DVM, measure the battery voltage at the battery. Is the battery voltage greater than the specified value?	11.5 V	Go to *Step 3*	Charge battery, then go to *Step 3*
3	1. Install a Tech 2. 2. Select "Ignition Volts" on the Tech 2. 3. Start the engine and raise the engine speed to the specified value. 4. Load the electrical system by turning on the headlights, high blower, etc. Is the ignition voltage approximately equal to the specified value?	2000 RPM 12.8-14.1 V	Go to *Step 4*	Go to *Starting/Charging*
4	1. Ignition "OFF." 2. Disconnect the PCM connector at the PCM. 3. Using a DVM, measure the battery voltage at the PCM connector F-20 and F-57. Is it approximately equal to battery voltage?	—	Check for excessive current draw with ignition "OFF," engine "OFF."	Go to *Step 5*
5	1. Check for faulty connections at the PCM harness terminals. 2. Repair as necessary. Was a repair necessary?	—	Verify repair	Go to *Step 6*
6	Check for an open battery feed circuit to the PCM. Is the action complete?	—	Verify repair	Go to *Step 7*
7	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0563 System Voltage High



060RY00165

Circuit Description

The powertrain control module (PCM) monitors the system voltage on the ignition feed terminals to the PCM. A system voltage DTC will set whenever the voltage is above a calibrated value.

Conditions for Setting the DTC

- Ignition "ON."
- System voltage is above 16 volts for 15 minutes.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store as Failure Records only conditions which were present when the DTC was set. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P0563 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0563 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

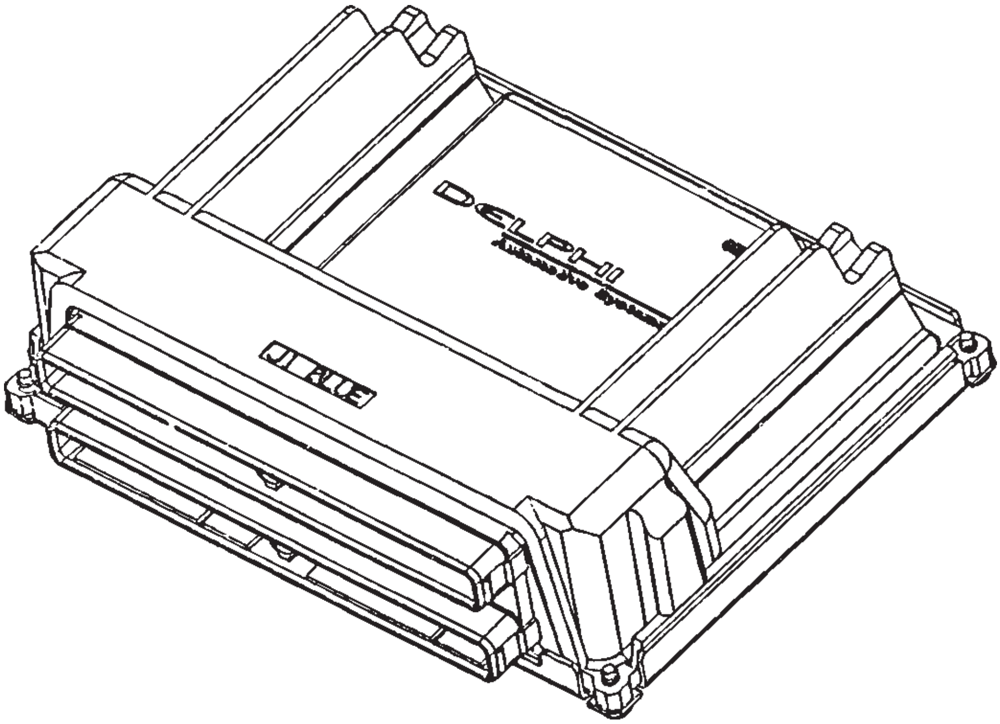
Diagnostic Aids

If the DTC sets when an accessory is operated, check for a poor connection or excessive current draw.

DTC P0563 – System Voltage High

Step	Action	Value(s)	Yes	No
1	Was the “ON-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Using a DVM, measure the battery voltage at the battery. Is the battery voltage less than the specified value?	11.5 V	Go to *Step 3*	Go to *Step 4*
3	1. Charge the battery and clean the battery terminals. 2. Clean the battery ground cable connection if corrosion is indicated. Is the battery voltage less than the specified value?	11.5 V	Replace battery	Go to *Step 4*
4	1. Turn “OFF” all the accessories. 2. Install a Tech 2. 3. Select the ignition voltage parameter on the Tech 2. 4. Start the engine and raise the engine RPM to the specified value. Is the voltage more than 2.5 volts greater than the measurement taken in step 2 or 3?	2000 RPM	Go to *Starting/Charging*	Go to *Step 5*
5	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0601 PCM Memory



060RY014

Circuit Description

The powertrain control module (PCM) used in this vehicle utilizes an electrically erasable programmable read-only memory (EEPROM). The EEPROM contains program information and the calibrations required for engine, transmission, and powertrain diagnostics operation.

Unlike the PROM used in past applications, the EEPROM is not replaceable. When the PCM is replaced or a calibration update is required, the PCM must be programmed using a Tech 2. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for the EEPROM programming procedure.

Conditions for Setting the DTC

- The PCM detects an internal program fault (check sum error).

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0601 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0601 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

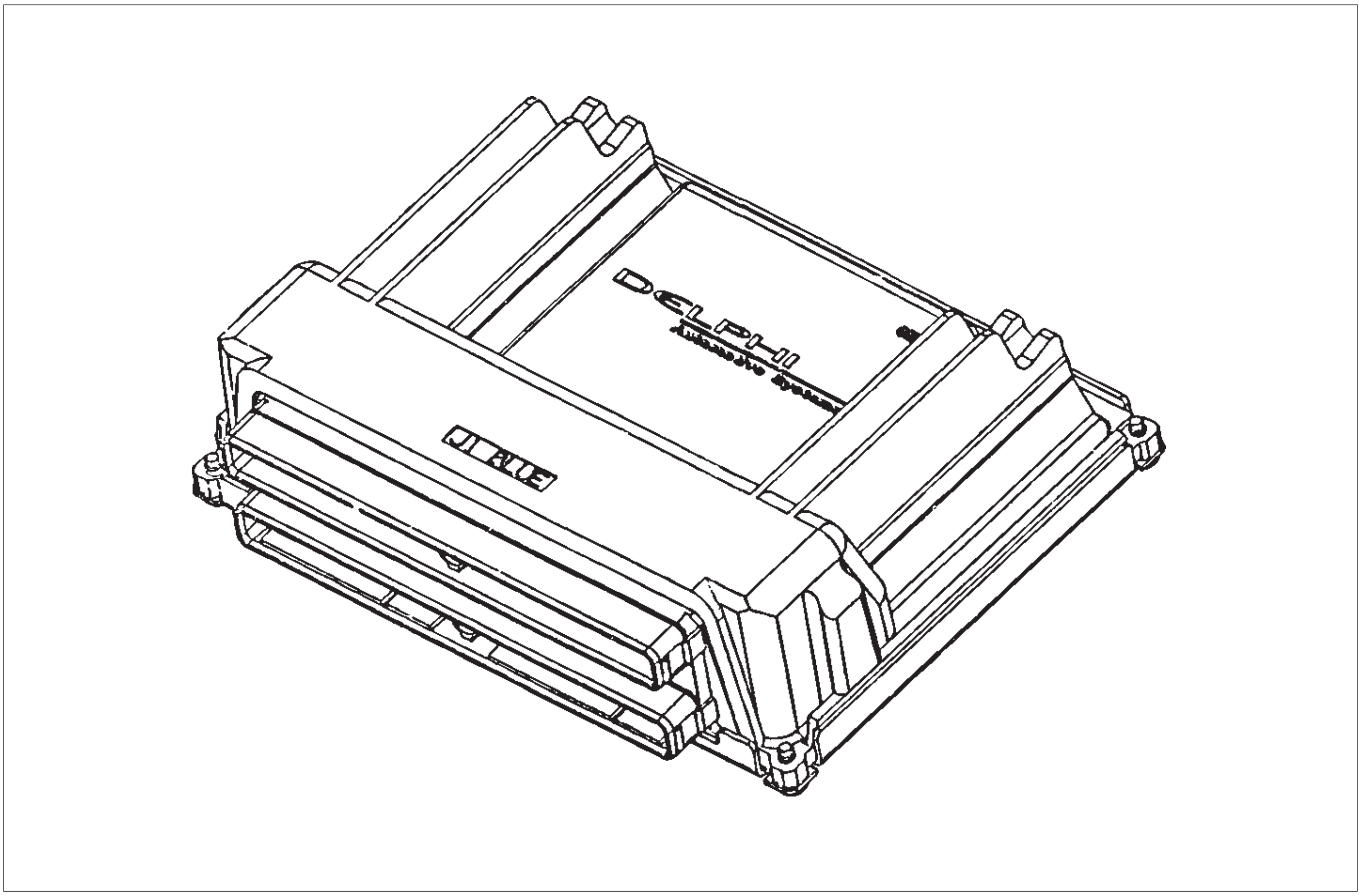
Diagnostic Aids

- DTC P0601 indicates that the contents of the EEPROM have changed since the PCM was programmed. The only possible repair is PCM replacement. Remember to program the replacement PCM with the correct software and calibration for the vehicle.

DTC P0601 – PCM Memory

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0602 PCM Programming Error



060RY014

Circuit Description

The powertrain control module (PCM) used Main CPU and Watchdog CPU software/calibration.

Conditions for Setting the DTC

- This code detects inconsistencies between Main CPU and Watchdog CPU software/calibration.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

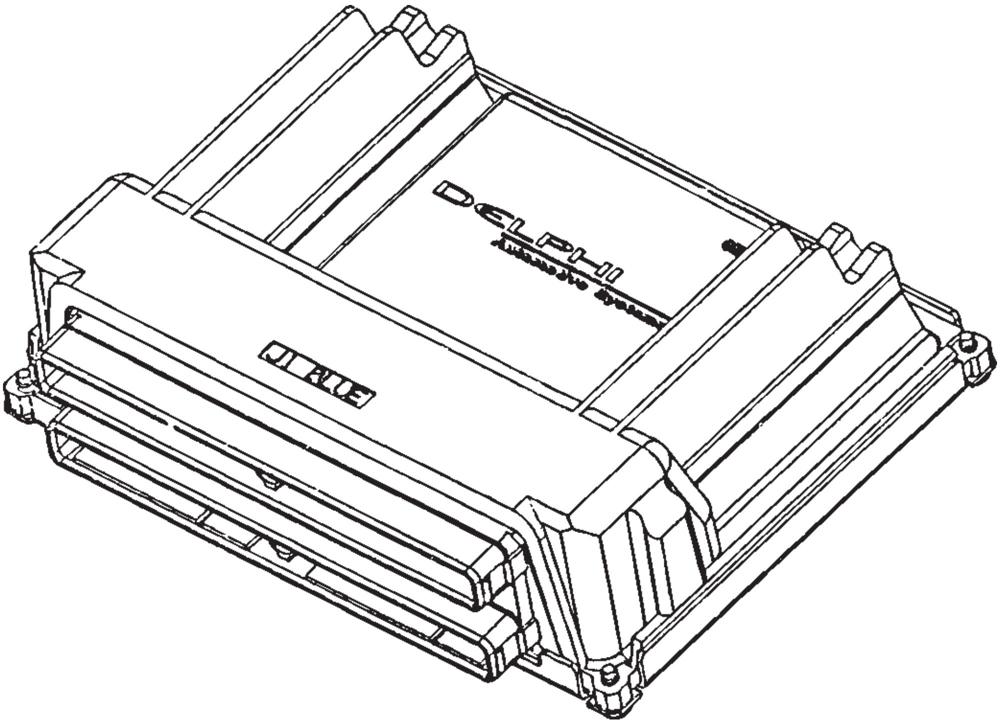
Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0602 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0602 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

DTC P0602 – PCM Programming Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0604 PCM RAM Error



060RY014

Circuit Description

The powertrain control module (PCM) used Main CPU RAM and Watchdog CPU RAM.

Conditions for Setting the DTC

- This code detects inconsistencies between Main CPU RAM and Watchdog CPU RAM.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

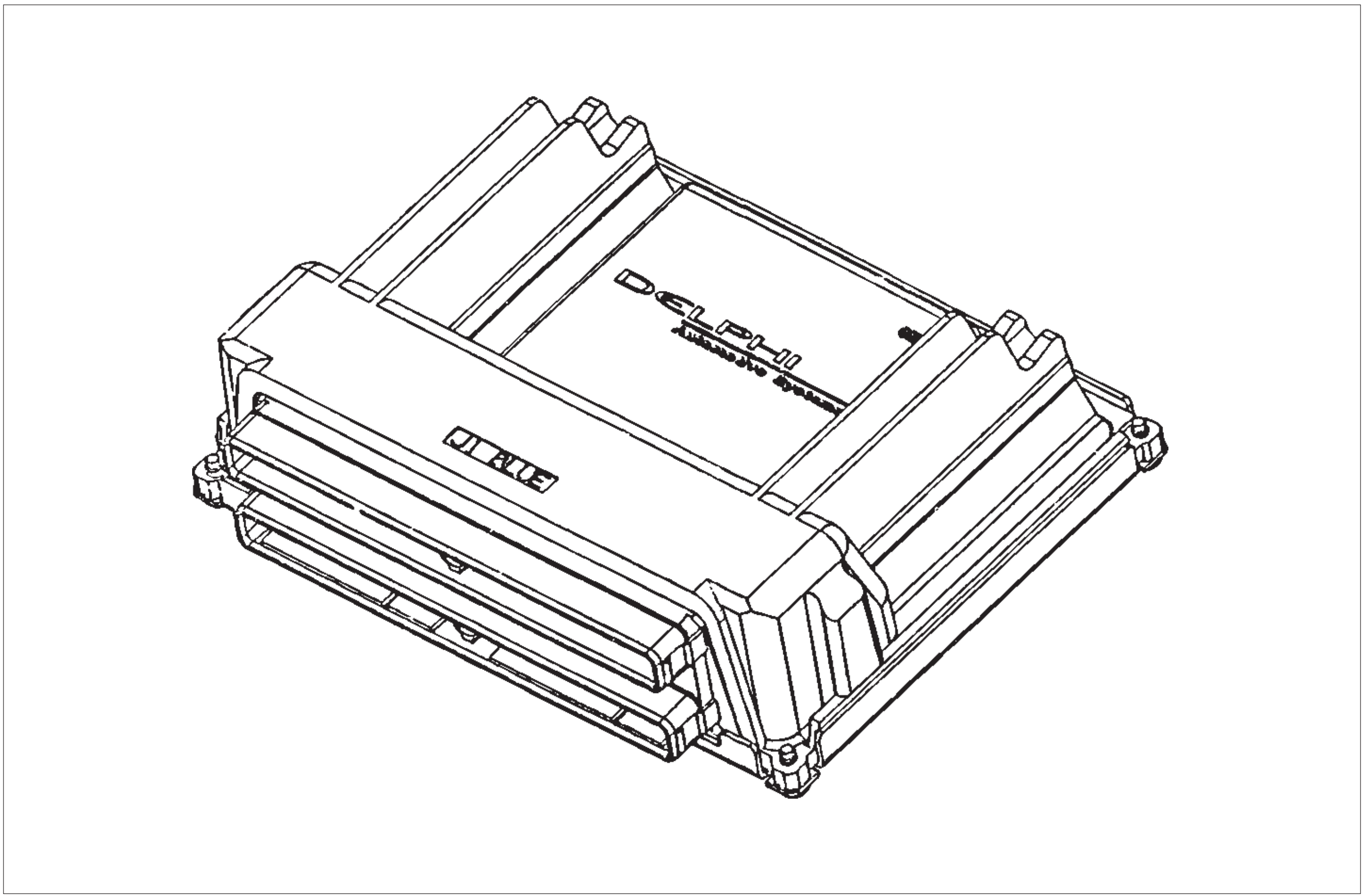
Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0604 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0604 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

DTC P0604 – PCM RAM Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P0606 PCM Internal Performance



060RY014

Circuit Description

The input/output devices in the PCM include analog-to-digital converters, signal buffers, counters, and special drivers. The PCM controls most components with electronic switches which complete a ground circuit when turned “ON”. These switches are arranged in groups of 4 and 7, called either a surface-mounted quad driver module (QDM), which can independently control up to 4 output terminals, or QDMs which can independently control up to 7 outputs.

Conditions for Setting the DTC

- This code detects inconsistencies between Main CPU A/D converters and Watchdog CPU A/D converters.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set in the Failure Records data only.

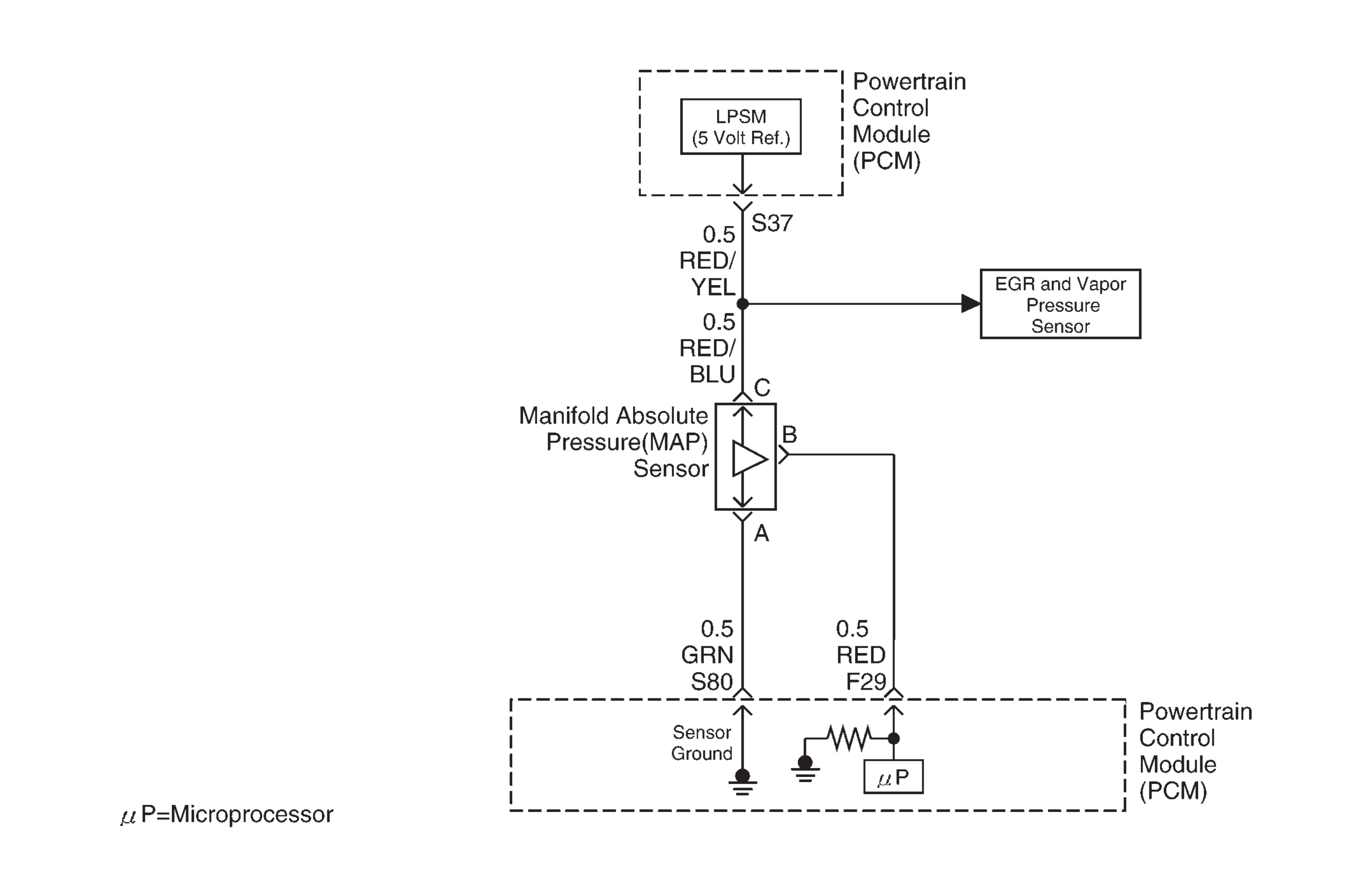
Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P0606 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P0606 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

DTC P0606 – PCM Internal Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. ANd also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1106 MAP Sensor Circuit Intermittent High Voltage



Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition "ON," engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the liner EGR flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that is intermittently above the calculated value, DTC P1106 will set.

Conditions for Setting the DTC

- No TP sensor DTCs are present.
- Engine is running for at least 10 seconds.
- Throttle angle is below 3% if engine speed is below 1000 RPM.
- Throttle angle is below 10% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure above 80 kPa for a total of approximately 5 seconds over a 16-second period of time.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1106 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1106 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Leaking or plugged vacuum supply line to the MAP sensor.
- Inspect PCM harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often

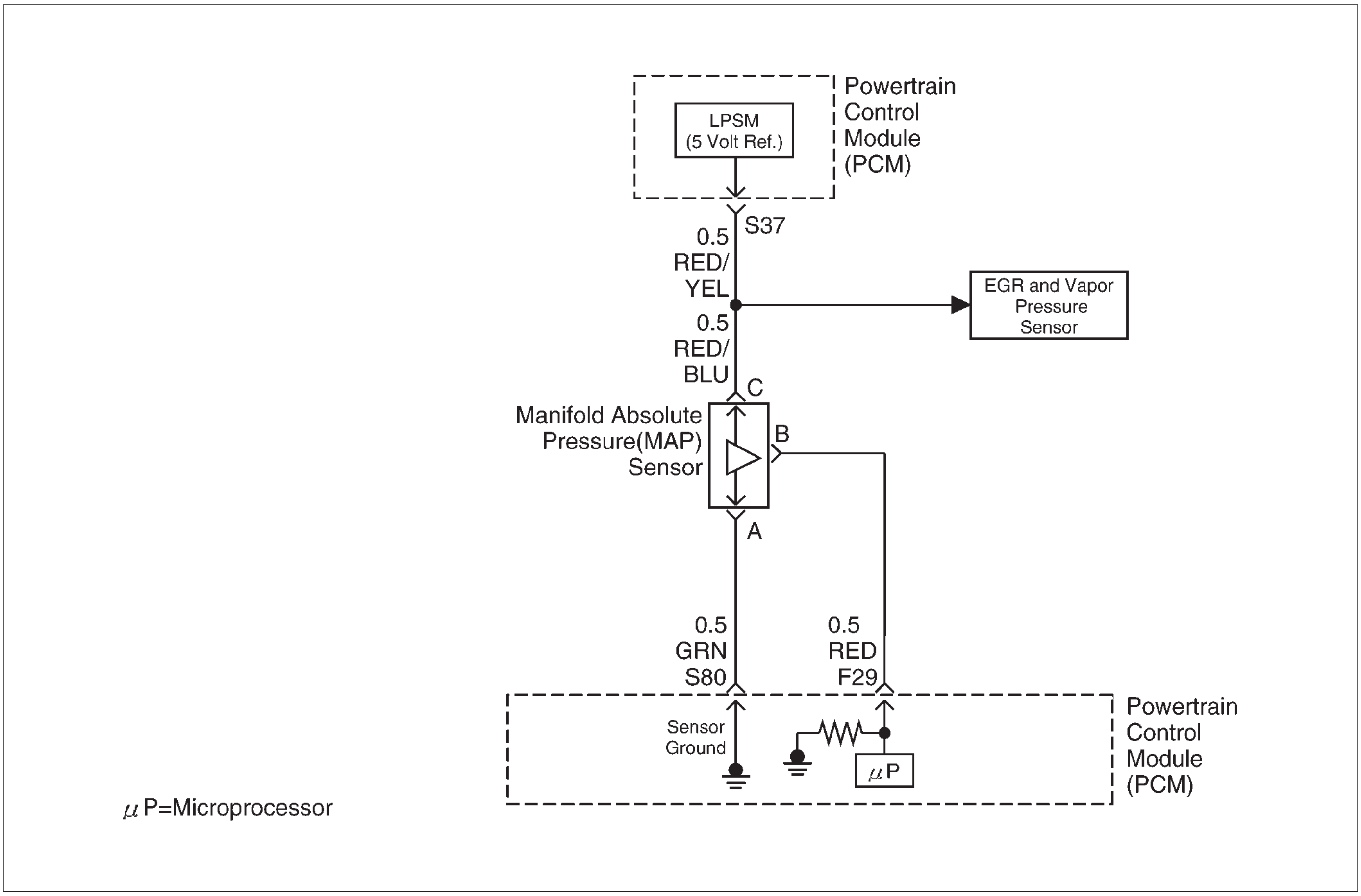
the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

- The MAP sensor shares a 5 Volt Reference with the Fuel Tank Pressure sensor. Check the 5 Volt reference if this DTC is also set.
- The MAP sensor shares a ground with the Fuel Tank Pressure sensor and the ECT Sensor. Check the ground if these other DTCs are also set.

DTC P1106 – MAP Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0108 also set?	—	Go to *DTC P0108* chart first	Go to *Step 3*
3	Are DTC P1111, P1115, and/or P1120 also set?	—	Go to *Step 6*	Go to *Step 4*
4	Check for a poor sensor ground circuit terminal connection at the MAP sensor. Was a problem found?	—	Go to *Step 9*	Go to *Step 5*
5	Check the MAP signal circuit between the MAP sensor connector and the PCM for an intermittent short to voltage. Was a problem found?	—	Go to *Step 10*	Go to *Step 8*
6	Check for an intermittent short to voltage on the 5 volt reference circuit between the PCM and the following components: ● MAP sensor ● EGR valve ● TP sensor Was a problem found?	—	Go to *Step 10*	Go to *Step 7*
7	Check for a poor sensor ground circuit terminal connection at the PCM. Was a problem found?	—	Go to *Step 9*	Go to *Step 8*
8	Check for an intermittent open or a faulty splice in the sensor ground circuit. Was a problem found?	—	Go to *Step 10*	Refer to *Diagnostic Aids*
9	Replace the faulty harness connector terminal for the sensor ground circuit. Is the action complete?	—	Verify repair	—
10	Locate and repair the intermittent open/short circuit in the wiring harness as necessary. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1107 MAP Circuit Intermittent Low Voltage



D06RY00165

Circuit Description

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the powertrain control module (PCM) varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition "ON," engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine manifold pressure changes while the linear EGR flow test diagnostic is being run (refer to *DTC P0401*), to determine engine vacuum level for some other diagnostics and to determine barometric pressure (BARO). The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that is intermittently below the calculated value, DTC P1107 will be set.

Conditions for Setting the DTC

- No TP sensor DTCs are present.
- Engine is running.
- Ignition voltage is more than 11 volts.
- Throttle angle is above 1% if engine speed is less than 1000 RPM.
- Throttle angle is above 2% if engine speed is above 1000 RPM.
- The MAP sensor indicates an intermittent manifold absolute pressure below 11 kPa for a total of approximately 5 seconds over a 16-second period of time.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1107 will Clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1107 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- The MAP Sensor shares a 5 Volt reference with the EGR Valve. If these codes are also set, it could indicate a problem with the 5 Volt reference circuit or components itself.
- The MAP Sensor share a ground with the EGR Valve and the IAT Sensor.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the MAP display on the Tech 2 while moving connectors

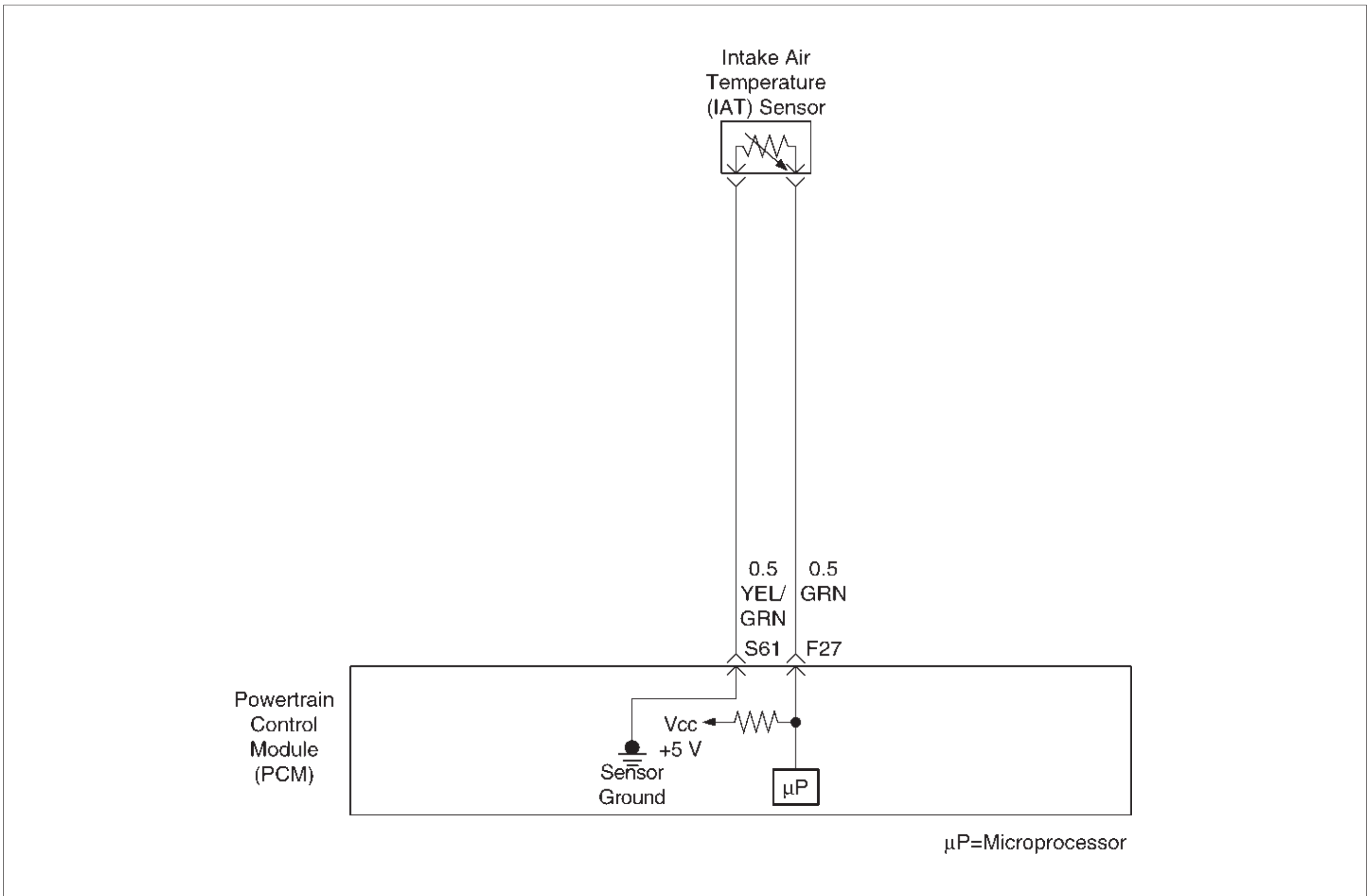
and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

DTC P1107 – MAP Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0107 also set?	—	Go to *DTC P0107* chart first	Go to *Step 3*
3	Check for a poor 5 volt reference circuit or MAP signal circuit terminal connection at the MAP sensor. Was a problem found?	—	Go to *Step 8*	Go to *Step 4*
4	Check the MAP signal circuit between the MAP sensor connector and the PCM for an intermittent open or short to ground. Was a problem found?	—	Go to *Step 9*	Go to *Step 7*
5	Check for an intermittent short to ground on the 5 volt reference circuit between the PCM and the following components: • MAP sensor • EGR valve • TP sensor Was a problem found?	—	Go to *Step 9*	Go to *Step 6*
6	Check for a poor 5 volt reference terminal connection at the PCM. Was a problem found?	—	Go to *Step 8*	Go to *Step 7*
7	Check for an intermittent open or a faulty splice in the 5 volt reference circuit. Was a problem found? (If no, start with the diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to *Step 9*	Refer to *Diagnostic Aids*
8	Replace the faulty harness connector terminal(s) for the 5 volt reference circuit and/or the MAP signal circuit as necessary. Is the action complete?	—	Verify repair	—
9	Repair intermittent open/short circuit in the wiring harness as necessary. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1111 IAT Sensor Circuit Intermittent High Voltage



D06RY00147

Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance is lower causing the PCM to monitor a lower voltage. DTC P1111 will set when the PCM intermittently detects an excessively high signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 4 minutes.
- Vehicle speed is less than 32 km/h (20 mph).
- Engine coolant temperature is above 60°C (140°F).
- Mass air flow is less than 20g/second.
- IAT signal voltage indicates and intake air temperature intermittently less than –39°C (–38°F) (about 5 volts) for approximately 2.5 seconds over a 25-second period of time.

Action Taken When the DTC Sets

- The PCM will substitute a default value for intake air temperature.
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.
- DTC P1111 does not illuminate the MIL.

Conditions for Clearing the MIL/DTC

- A history DTC P1111 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1111 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM –Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

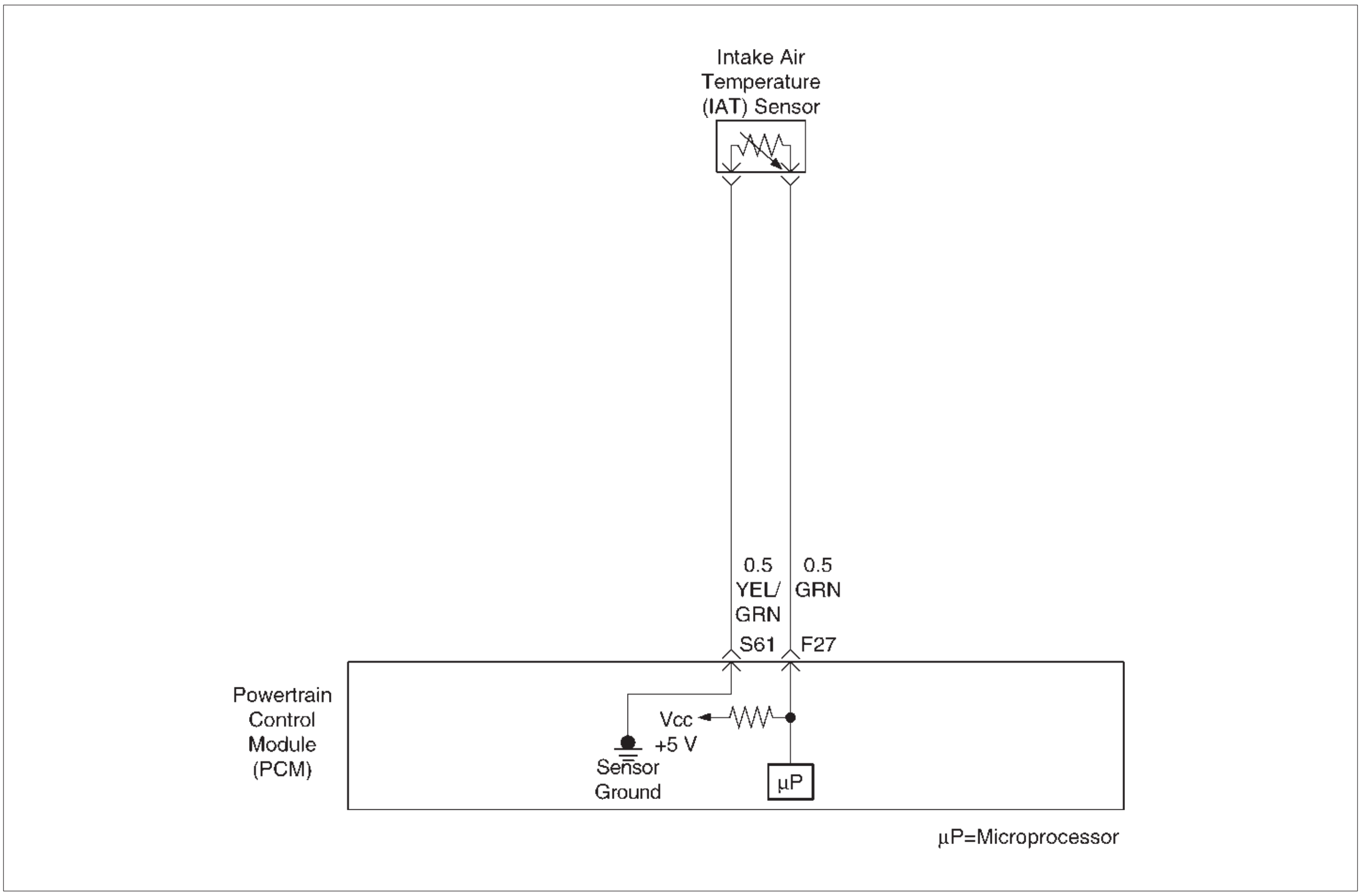
Intake Air Temperature Sensor

˚C	˚F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1111 –IAT Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0113 also set?	—	Go to *DTC P0113* chart first	Go to *Step 3*
3	Is DTC P1115, also set?	—	Go to *Step 6*	Go to *Step 4*
4	1. Check for a poor sensor ground circuit terminal connection at the IAT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Check for a poor IAT signal circuit terminal connection at the IAT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent open. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent short to voltage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Check for a poor sensor ground circuit terminal connection at the PCM. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	1. Check for an intermittent open or a faulty splice in the sensor ground circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC)
P1112 IAT Sensor Circuit Intermittent Low Voltage



Circuit Description

The intake air temperature (IAT) sensor is a thermistor which measures the temperature of the air entering the engine. The powertrain control module (PCM) applies 5 volts through a pull-up resistor to the IAT sensor. When the intake air is cold, the sensor resistance is high and the PCM will monitor a high signal voltage on the IAT signal circuit. If the intake air is warm, the sensor resistance becomes lower, causing the PCM to monitor a lower voltage. DTC P1112 will set when the PCM intermittently detects an excessively low signal voltage on the intake air temperature sensor signal circuit.

Conditions for Setting the DTC

- The engine has been running for over 2 minutes.
- Vehicle speed is greater than 48 km/h (30 mph).
- IAT signal voltage is greater than 148°C (298°F) (about 0.10 volt) for a total of 2.5 seconds over a 25-second period of time.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.
- The PCM will substitute a default value for intake air temperature.

Conditions for Clearing the MIL/DTC

- A history DTC P1112 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1112 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the IAT display on the Tech 2 while moving connectors and wiring harnesses related to the IAT sensor. A change in the IAT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. Verifies that the fault is present.
3. If DTC P1112 can be repeated only by duplicating the Failure Records conditions, refer to the "Temperature vs. Resistance Value Chart." The chart may be used to test the IAT sensor at various temperatures to evaluate the possibility of a "shifted" sensor that may be shorted above or below a certain temperature. If this is the case, replace the IAT sensor.

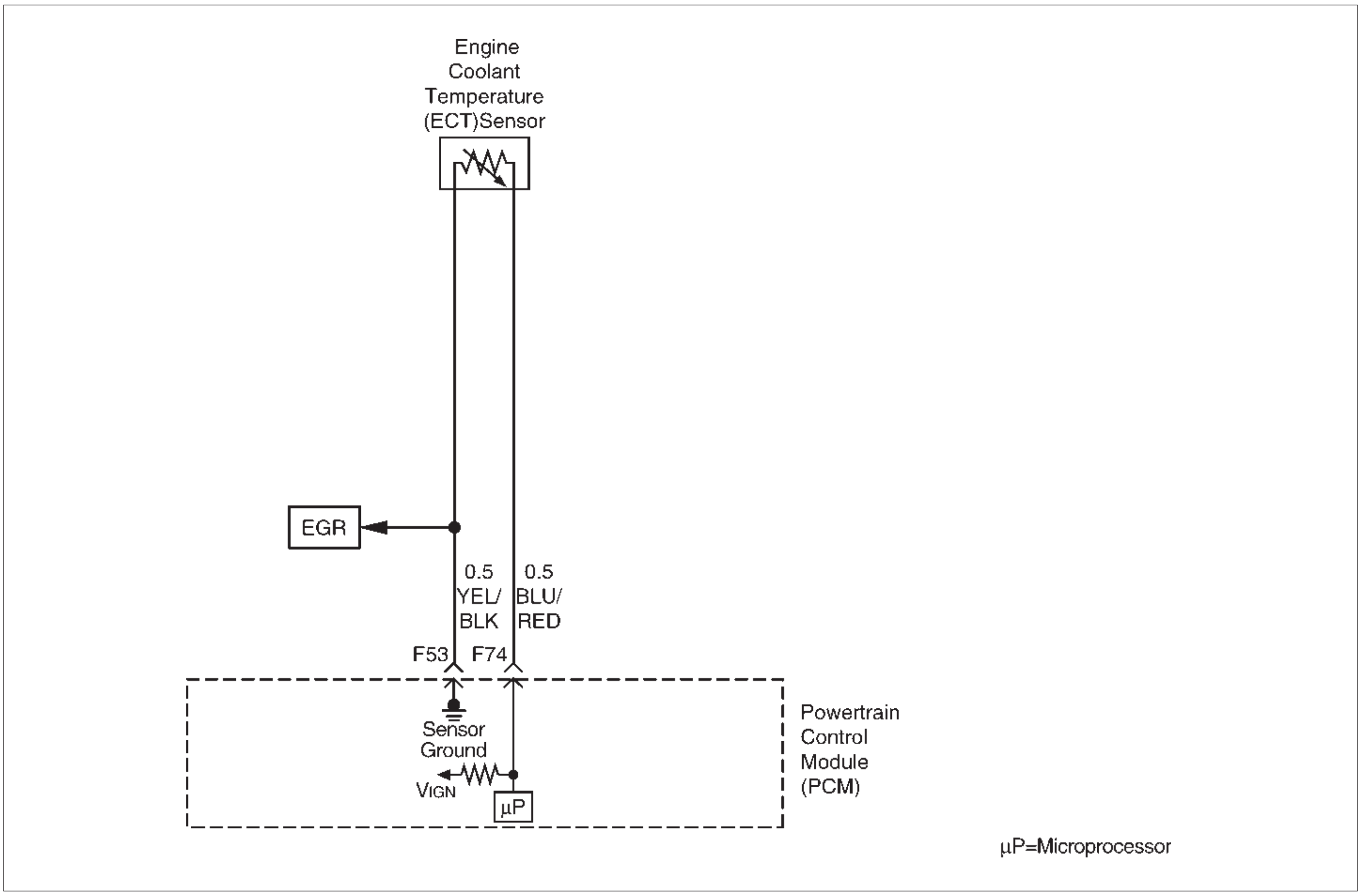
Intake Air Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1112 – IAT Sensor Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0112 also set?	—	Go to *DTC P0112* first	Go to *Step 3*
3	1. Check the IAT signal circuit between the IAT sensor connector and the PCM for an intermittent short to ground. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P1114 ECT Sensor Circuit Intermittent Low Voltage



D06RY00148

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5.0 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently below the range of the ECT sensor, DTC P1114 will set.

Conditions for Setting the DTC

- Engine run time longer than 60 seconds.
- The ECT sensor signal is intermittently greater than 150°C (302°F) (about 0.10 volt) for a total of 10 seconds over a 100-second period.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1114 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1114 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often

the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

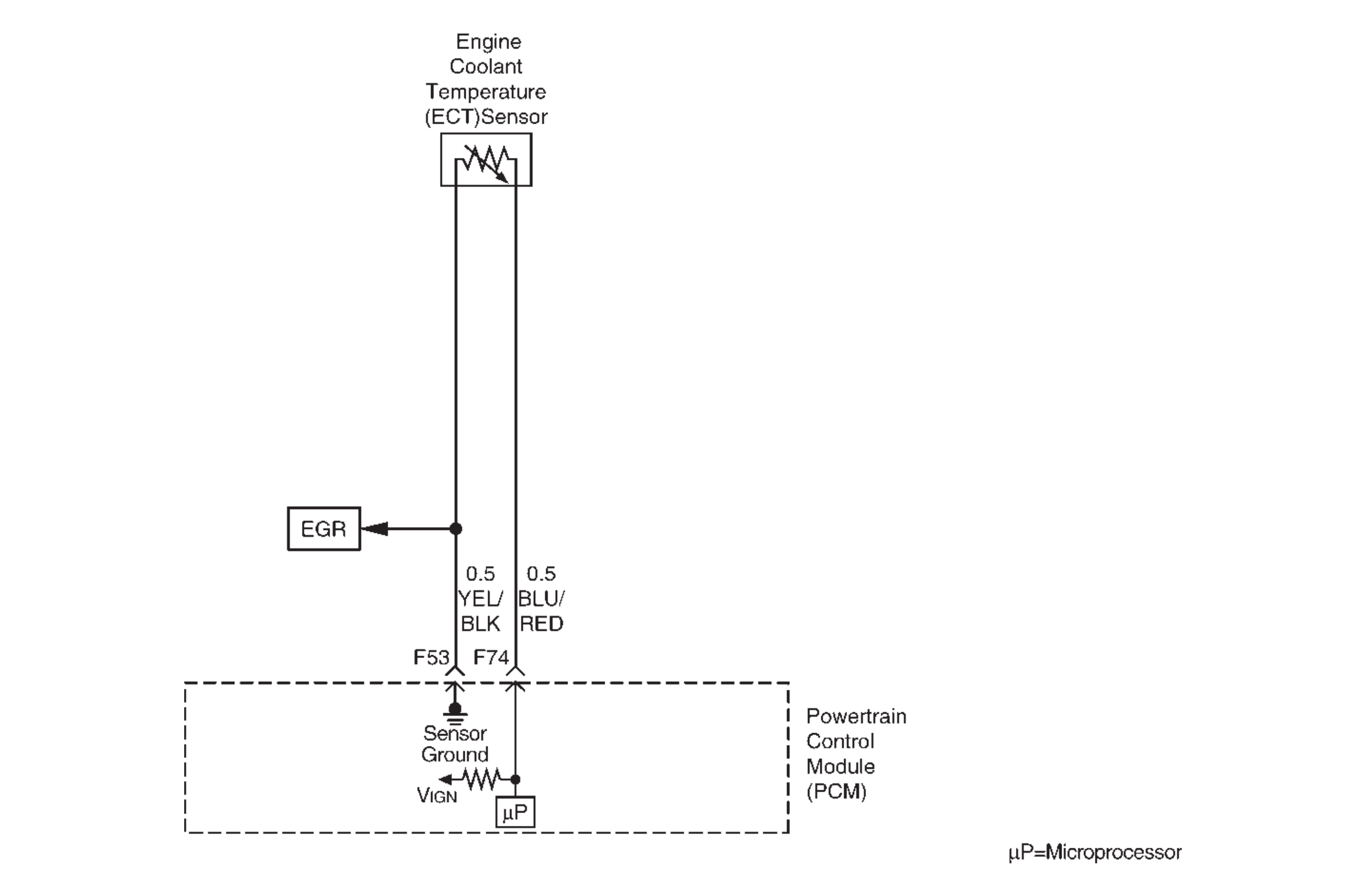
Engine Coolant Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1114 – ECT Circuit Intermittent Low Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0117 also set?	—	Go to *DTC P0117* first	Go to *Step 3*
3	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent short to ground. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code (DTC)
P1115 ECT Sensor Circuit Intermittent High Voltage



D06RY00148

Circuit Description

The engine coolant temperature (ECT) sensor is a thermistor mounted in the engine coolant stream. The powertrain control module (PCM) applies a voltage (about 5.0 volts) through a pull-up resistor to the ECT signal circuit. When the engine coolant is cold, the sensor (thermistor) resistance is high, therefore the PCM will measure a high signal voltage. As the engine coolant warms, the sensor resistance becomes less, and the ECT signal voltage measured at the PCM drops. With a fully warmed up engine, the ECT signal voltage should measure about 1.5 to 2.0 volts. If the PCM detects an ECT signal that is intermittently above the range of the ECT sensor, DTC P1115 will set.

Conditions for Setting the DTC

- Engine running time longer than 90 seconds.
- The ECT sensor signal is intermittently greater than –39°C (–38°F) (about 5 volts) for a total of 10 seconds over a 100-second period.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records data only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1115 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1115 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage. If the harness appears to be OK, observe the ECT display on the Tech 2 while moving connectors and wiring harnesses related to the ECT sensor. A change in the ECT display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often

the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

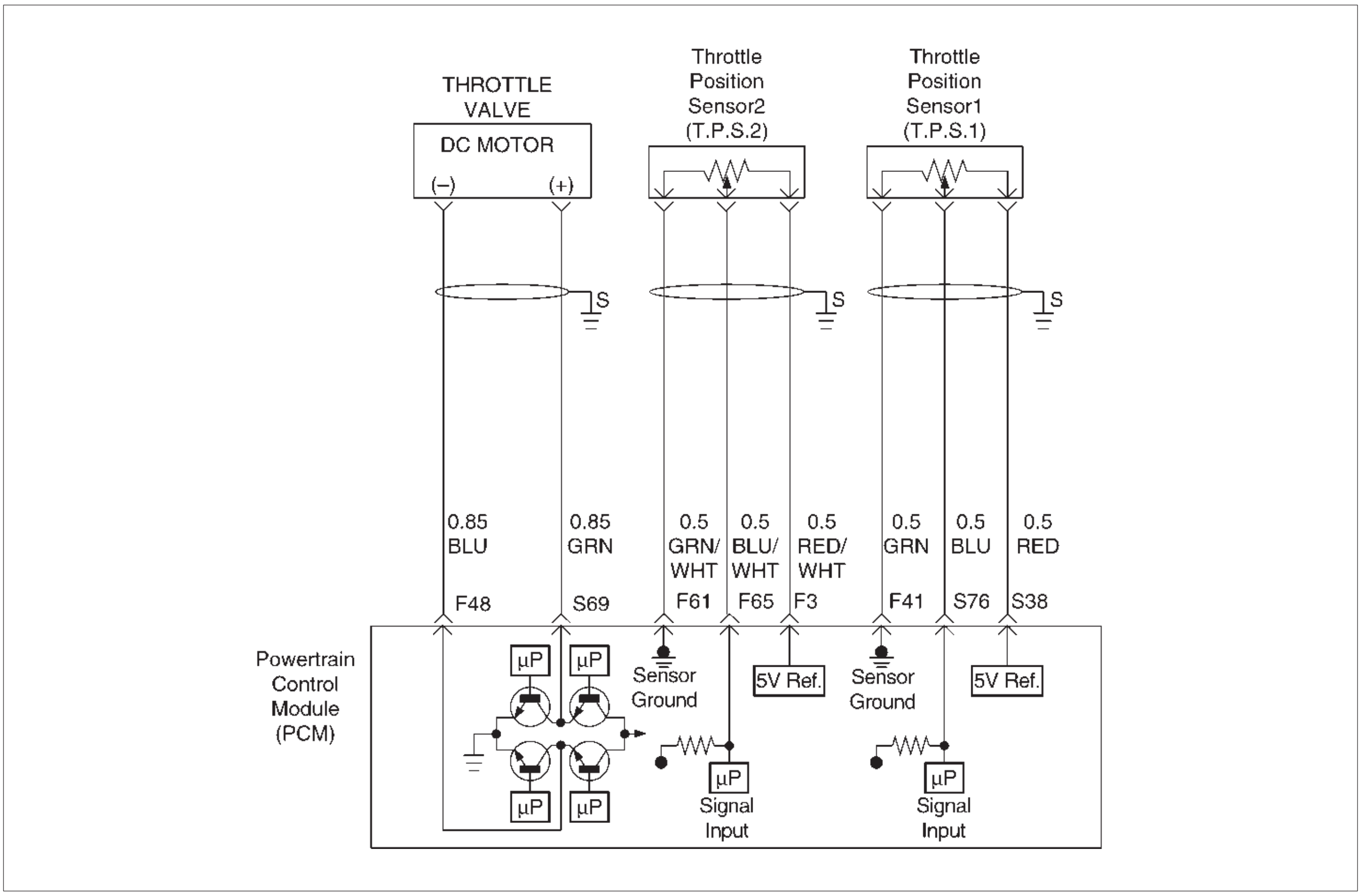
Engine Coolant Temperature Sensor

°C	°F	OHMS
Temperature vs. Resistance Values (approximate)		
100	212	177
80	176	332
60	140	667
45	113	1188
35	95	1802
25	77	2796
15	59	4450
5	41	7280
–5	23	12300
–15	5	21450
–30	–22	52700
–40	–40	100700

DTC P1115 – ECT Sensor Circuit Intermittent High Voltage

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Is DTC P0118 also set?	—	Go to *DTC P0118* chart first	Go to *Step 3*
3	Is DTC P1111 also set?	—	Go to *Step 8*	Go to *Step 4*
4	1. Check for a poor sensor ground circuit terminal connection at the ECT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Check for a poor ECT signal circuit terminal connection at the ECT sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent open. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check the ECT signal circuit between the ECT sensor connector and the PCM for an intermittent short to voltage. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Check for a poor sensor ground circuit terminal connection at the PCM. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	1. Check for an intermittent open or a faulty splice in the sensor ground circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Refer to *Diagnostic Aids*

Diagnostic Trouble Code(DTC)
P1120-TPS 1 Throttle Position Sensor (TPS1) Circuit Fault



D06RY00111

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle blade angle.

  The throttle blade angle will vary about 8 % at closed throttle to about 92 % at wide open throttle(WOT).

  This code detects a continuous short to ground or high in either the cicuit or the sensor.

Conditions for setting the DTC

- The Ignition is “ON”.
- The throttle blade angle is less than 2.5 % or more tnan 97.5 % for 18 failres within 500 test samples (15.6m sec)

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A histror DTC P1120 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1120 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK,observe the TPS 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault.

  If DTC P1120 cannot be duplicated,the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P1120 Diagnostic Chart may isolate the cause of the fault.

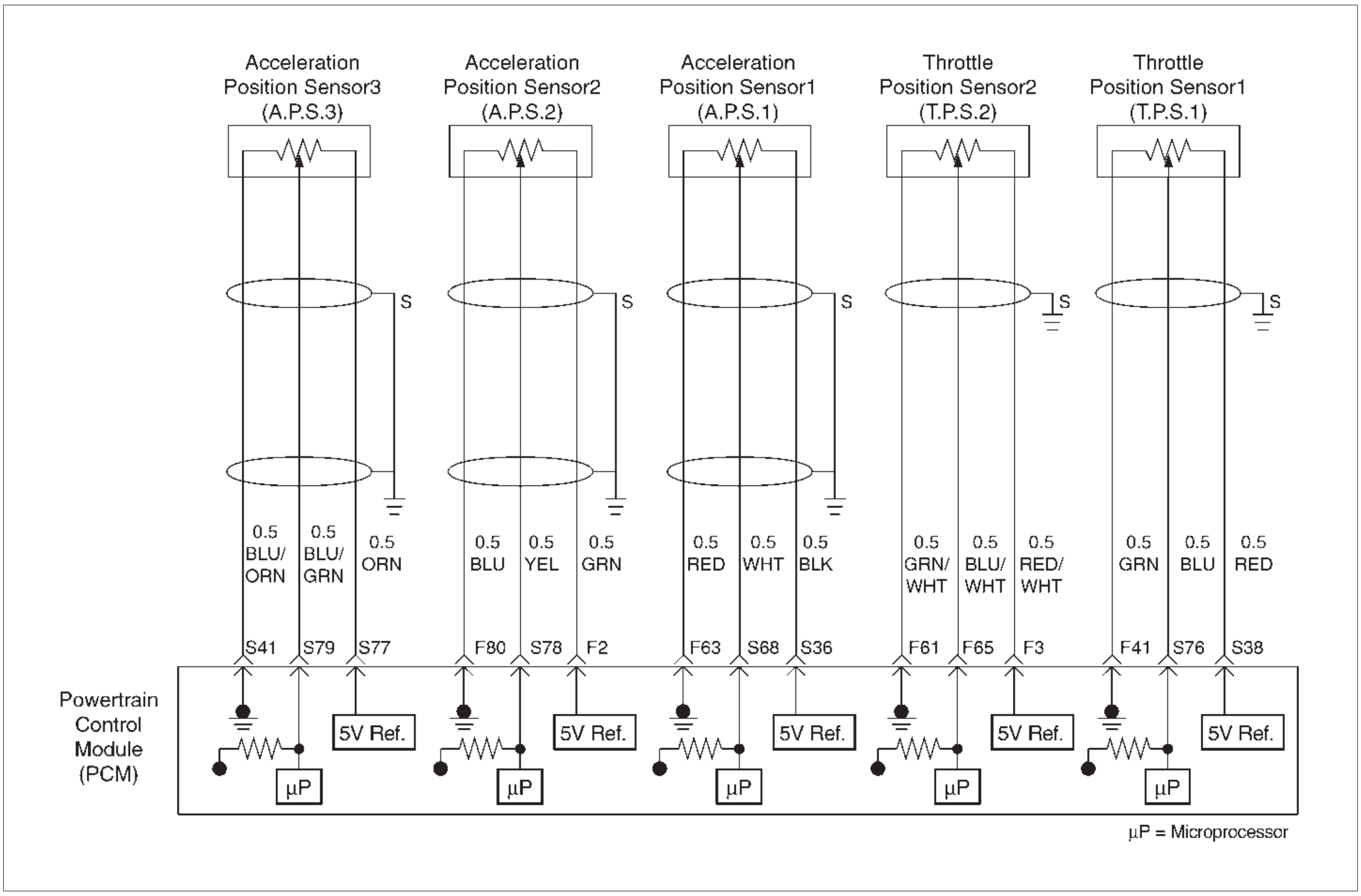
Diagnostic Trouble Code(DTC)P1120-TPS 1 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board(OBD)System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65kPa	Go to *Step 3*	Go to *Step 6*
3	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value? (If no, start with diagnosis chart forother sensors in the circuit and see if 5V returns.)	—	Go to *Step 5*	Go to *Step 4*
4	1. Check the MAP signal circuit between the PCM and MAP grund circuit. 2. If the MAP signal circuit is open or shoted, repair it as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 12*
5	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
6	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle =8 % Wide open throttle =92 %	Refer to *Diagnostic Aids*	Go to *Step 7*
7	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 8*	Go to *Step 9*
8	1. Connect a test light between the 5Volt reference circuit and the TP sensor signal circuit at the TPsensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 11*	Go to *Step 10*
9	Check the following items; 1. TP1 signal circuit for a short to voltage. 2. TP1 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1 sensor ground circuit for a poor connection. 4. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*

Diagnostic Trouble Code(DTC)P1120-TPS 1 Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP signal circuit or 5 volt reference circuit for a poor connection. 2. TP signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
11	Replace the TP sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1125 ETC (Electric throttle control) Limit Performance Mode



D06RY00163

Circuit Description

- The acceleration position (AP1) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle will vary about 13 % at idle position to about 87 % at wide open throttle (WOT).

  This code detects if the system is in Limit Performance Mode (Fail safe Mode) and Multiple DTCs performance Mode.

Conditions for setting the DTC

- The Ignition is " ON".
- Limit Performance Mode is active. (Fail safe Mode)

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1125 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1125 can be cleared using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 1, APP sensor 2, APP sensor 3 display on the Tech 2 While moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault.

  If DTC P1125 cannot be duplicated,the information includedin the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently,performing the DTC P1125 Diagnostic Chart may isolate the cause of the fault.

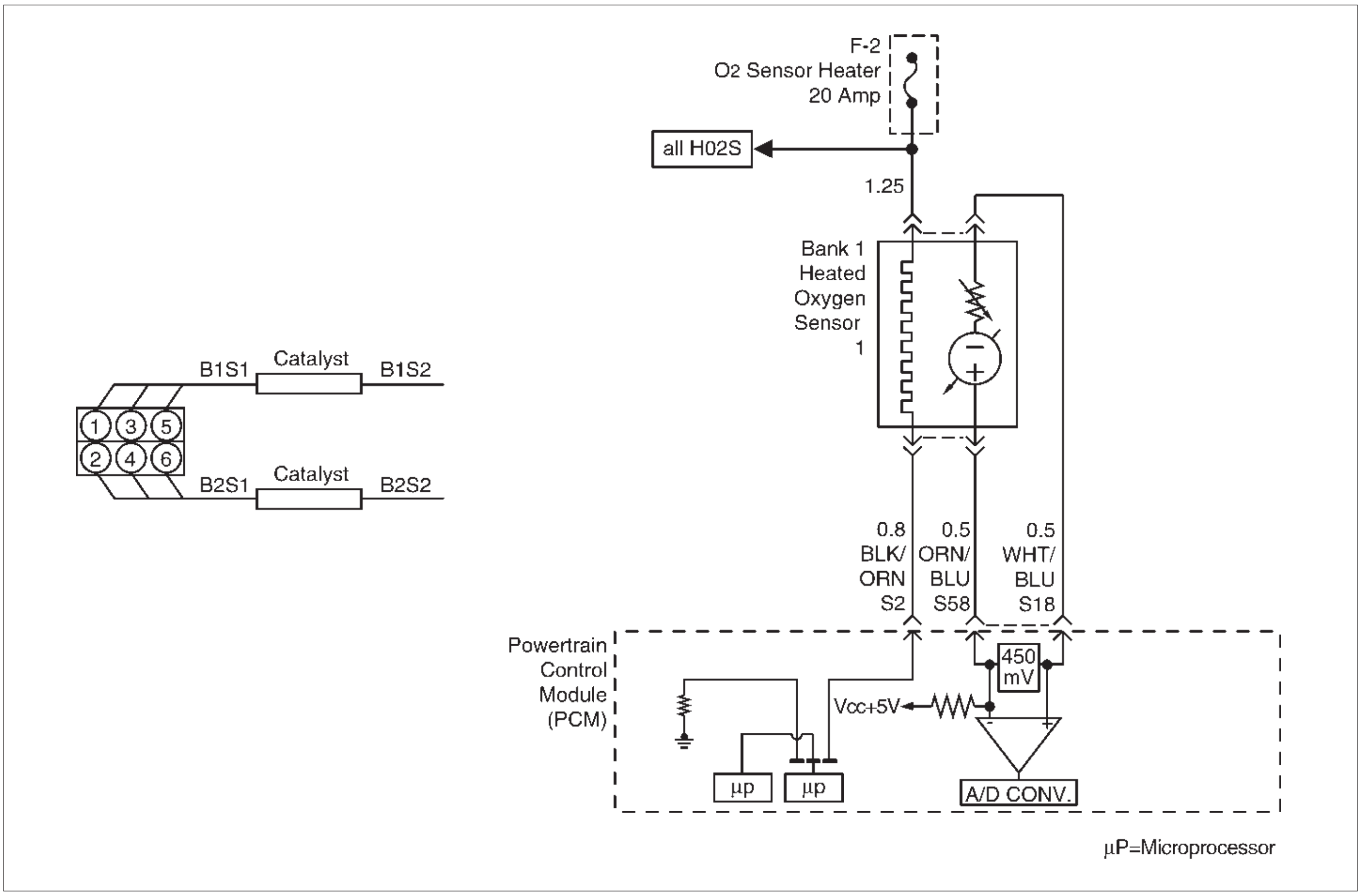
DTC P1125 – ETC Limit Performance Model

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Chcek" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position APP sensor 1 =13 % APP sensor 2, 3 =85 ~ 89 % open throttle APP sensor 1 =85 ~ 89 % APP sensor 2 =11 ~ 15 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP1, AP2 AND AP3 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP1, AP2 or AP3 signal circuit for a short to voltage. 2. AP1, AP2 or AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1, AP2 or AP3 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1, AP2 or AP3 signal circuit or 5 volge supply circuit for a poor connection. 2. AP1, AP2 or AP3 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP1, AP2 or AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*

DTC P1125 – ETC Limit Performance Model (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed.Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1133 HO2S Insufficient Switching Bank 1 Sensor 1



D06RY00135

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” and stoichiometric operation have been enabled. During this test period the PCM counts the number of times that the HO2S signal voltage crosses the rich-to-lean and lean-to-rich threshold. If the PCM determines that the HO2S did not switch enough times, DTC P1133 will be set.

A lean-to-rich switch is determined when the HO2S voltage changes above and below 450 mV.

Heated oxygen sensors are used to minimize the amount of time required for “closed loop” fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- Engine coolant temperature (ECT) is above 50°C (122°F) for automatic transmission; 75°C (167°F) for manual transmission.
- Engine is operating in “closed loop”.
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow (MAF) is between 9 g/second and 42 g/second.
- Above conditions are present for 3 seconds.
- 90 seconds after “closed loop” and stoichiometric operation have been achieved, the PCM monitors the oxygen sensor as it switches above and below 450 mV. If fewer than 23 rich-to-lean and lean-to-rich switches are detected, DTC P1133 will be set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- ”Open loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1133 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1133 can be cleared by using Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1133 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1133 continues to set, replace the Bank 1 HO2S 1.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help to determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging the replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
11. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

DTC P1133 – HO2S Insufficient Switching Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	**IMPORTANT:** If any DTCs are set (except P1153 or P1154) refer to those DTCs before proceeding with this diagnostic chart. 1. Engine idling at operating temperature. 2. Operating the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 3. Using a Tech 2, monitor “DTC” info for DTC P1133 until the DTC P1133 test runs. 4. Note the test result. Does the Tech 2 indicate DTC P1133 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate that the P1153 or P1154 tests failed?	—	Go to *Step 20*	Go to *Step 4*
4	Check for leaks at the exhaust pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the bolt/nuts at the leaking joints. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*

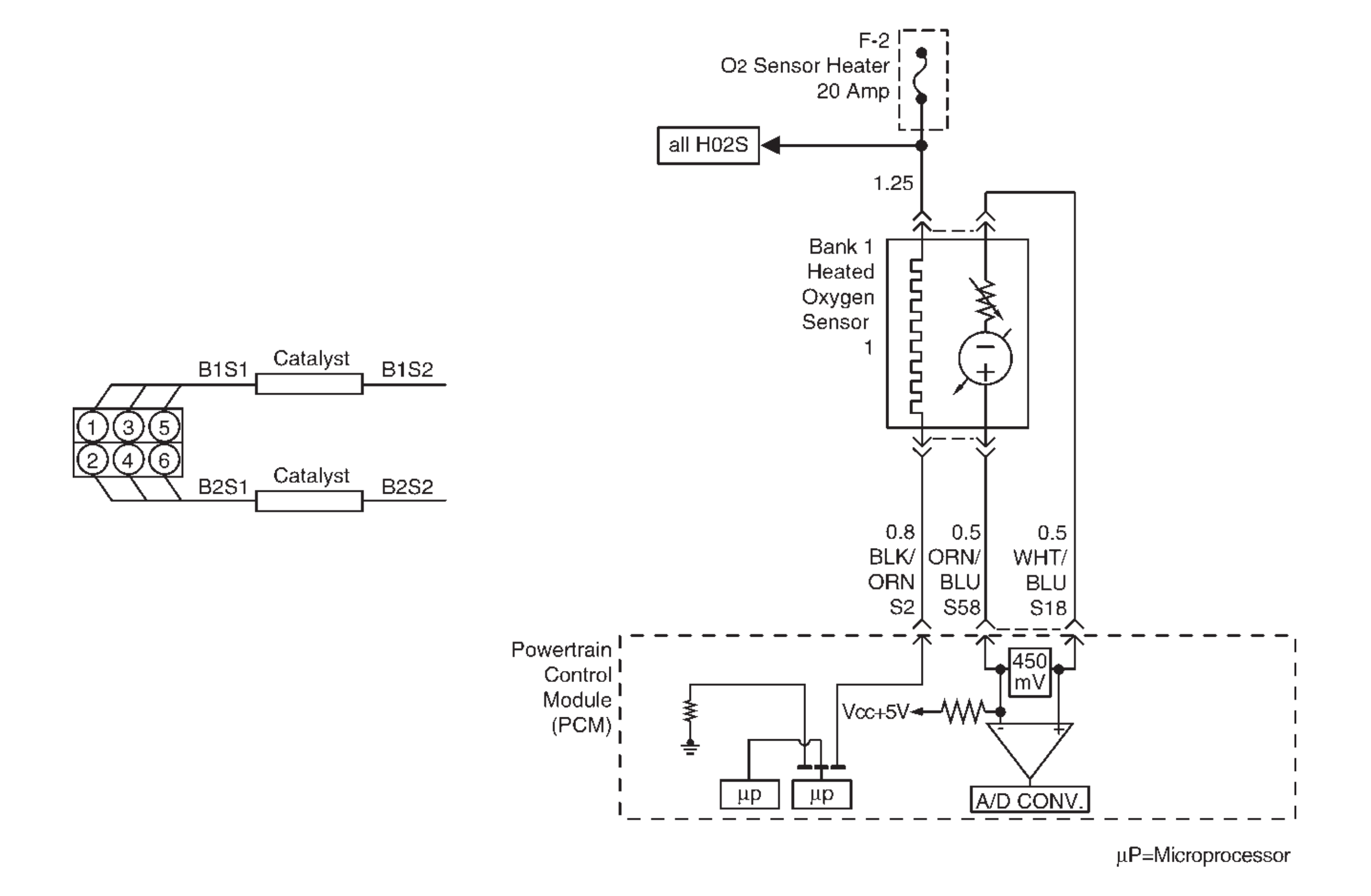
DTC P1133 – HO2S Insufficient Switching Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—
14	Visually/physically inspect the following items: • Ensure that the Bank 1 HO2S 1 is securely installed. • Check for corrosion on the terminals. • Check the terminals at Bank 1 HO2S 1 and at the PCM. • Check for damaged wiring. Was a problem found in any of the above areas?	—	Verify repair	Go to *Step 15*
15	1. Disconnect Bank 1 HO2S 1. 2. Ignition "ON." 3. Using a DVM at the PCM side of the connector, check the voltage between the high signal circuit and ground. Also measure between the low signal circuit and ground. Are both voltages in the specified range?	3-4 mV	Go to *Step 18*	Go to *Step 16*
16	1. Ignition "OFF." 2. Check for damage to PCM pins or terminals. Was a problem found.	—	Verify repair	Go to *Step 17*
17	Check for a short to voltage or ground or an open in the signal circuit. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Ignition "OFF." 2. Disconnect the PCM connector. 3. With the HO2S disconnected, check for high and low signal circuits shorted together between the PCM and HO2S. Was a problem found?	—	Verify repair	Go to *Step 19*
19	With the PCM connected and Bank 1 HO2S 1 disconnected from the harness, check Bank 1 HO2S 1 with a Tech 2. Is the voltage in the specified range?	425-475 mV	Go to *Step 21*	Go to *Step 22*
20	Replace the affected heated oxygen sensors. NOTE: Before replacing the sensors, the cause of the contamination must be determined and corrected. • Fuel contamination • Use of improper RTV sealant. • Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—

DTC P1133 – HO2S Insufficient Switching Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action compete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1134 HO2S Transition Time Ratio Bank 1 Sensor 1



D06RY00135

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” and stoichiometric operation have been established. During the monitoring period the PCM counts the number of times that the HO2S responds from rich-to-lean and from lean-to-rich and adds the amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. The PCM then divides the rich-to-lean average by the lean-to-rich average to obtain a ratio. If the HO2S transition time ratio is not within this range, DTC P1134 will be set, indicating that the oxygen sensor is not responding as expected to changes in exhaust oxygen content.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ECT) is above 50˚C (122˚F) for automatic transmission; 75˚C (167˚F) for manual transmission.
- Engine is operating in “closed loop.”
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow (MAF) is between 9 g/second and 42 g/second.
- Above conditions are present for a 3-second monitoring period.
- 90 seconds after “closed loop” and stoichiometric operation have been enabled, Bank 1 HO2S 1 transition ratio between lean-to-rich and rich-to-lean is less than 0.44 or greater than 3.8.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after second consecutive trip in which the fault is detected.
- ”Open loop” fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1134 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1134 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1134 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1134 continues to set, replace the Bank 1 HO2S 1.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
8. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

DTC P1134 – HO2S Transition Time Ratio Bank 1 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	**IMPORTANT:** If any DTCs are set (except P1153 and/or P1154), refer to those DTCs before proceeding with this diagnostic chart. 1. Idle the engine at operating temperature. 2. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 3. Using a Tech 2, monitor “DTC” info for DTC P1134 until the DTC P1134 test runs. 4. Note the test result. Does Tech 2 indicate DTC 1134 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate P1153, and/or P1154 test failed?	—	Go to *Step 17*	Go to *Step 4*
4	Check for leaks at the exhaust pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U-bolt nuts at the leaking joints. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—

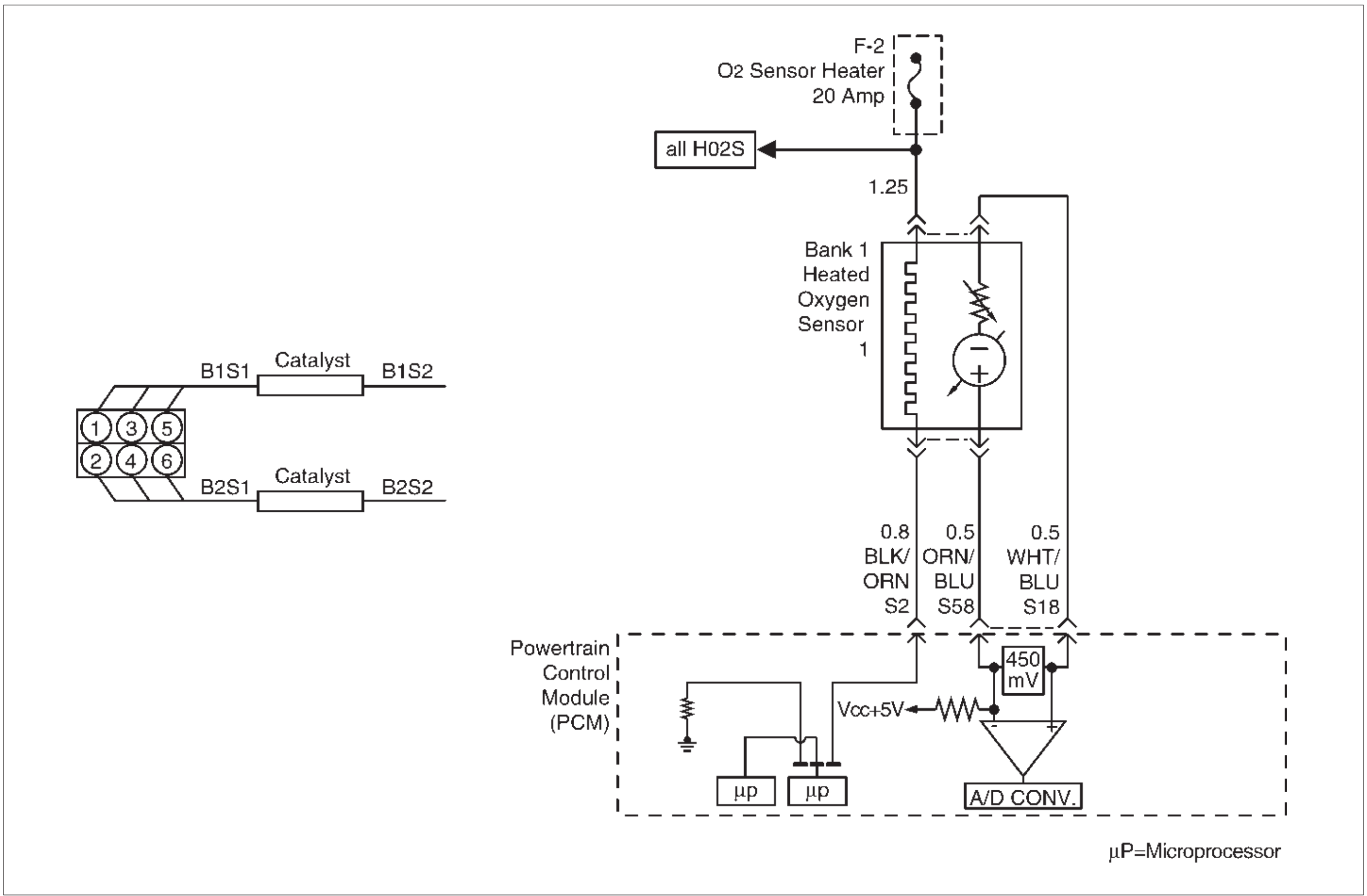
DTC P1134 – HO2S Transition Time Ratio Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—
14	Visually/physically inspect the following items: ● Ensure that the Bank 1 HO2S 1 is securely installed. ● Check for corrosion on terminals. ● Check the terminal tension (at Bank 1 HO2S 1 and at the PCM). ● Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to *Step 18*	Go to *Step 15*
15	1. Disconnect Bank 1 HO2S 1. 2. Ignition "ON." 3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. 4. Also measure the voltage between the low signal circuit and ground. Are both voltages in the specified range?	3-4V	Go to *Step 16*	Go to *Step 19*
16	1. With Bank 1 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition "ON." 3. Using a Tech 2, monitor the Bank 1 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to *Step 21*	Go to *Step 22*
17	Replace affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. ● Fuel contamination. ● Use of improper RTV sealant. ● Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
18	Repair condition as necessary. Is the action complete?	—	Verify repair	—
19	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to *Step 20*
20	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	Go to *Step 7*

DTC P1134 – HO2S Transition Time Ratio Bank 1 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace Bank 1 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1153 HO2S Insufficient Switching Bank 2 Sensor 1



D06RY00135

Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after "closed loop" and stoichiometric operation have been enabled. During this test period the PCM counts the number of times that the HO2S signal voltage crosses the rich-to-lean and lean-to-rich thresholds. If the PCM determines that the HO2S did not switch enough times, DTC P1153 will be set.

A lean-to-rich switch is determined when the HO2S voltage changes above and below 450 mV.

Heated oxygen sensors are used to minimize the amount of time required for "closed loop" fuel control operation and to allow accurate catalyst monitoring. The oxygen sensor heater greatly decreases the amount of time required for fuel control sensors Bank 1 HO2S 1 and Bank 2 HO2S 1 to become active. Oxygen sensor heaters are required by post-catalyst monitor sensors to maintain a sufficiently high temperature for accurate exhaust oxygen content readings further from the engine.

Conditions for Setting the DTC

- The engine is operating in "closed loop."
- Engine coolant temperature (ECT) is above 50˚C (122˚F) for automatic transmission; 75˚C (167˚F) for manual transmission.
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow is between 9 g/second and 42 g/second.
- Above conditions are present for a 3 seconds.
- 90 seconds after "closed loop" and stoichiometric operation have been enabled, the PCM monitors the oxygen sensor switching above and below 450 mV. If fewer than 27 rich-to-lean and lean-to-rich switches for Bank 2 HO2S 1 are detected, DTC P1153 will set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- "Open loop" fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1153 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1153 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

A malfunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1153 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1153 continues to set, replace the Bank 2 HO2S 1.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.
5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.
8. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

DTC P1153 – HO2S Insufficient Switching Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	**IMPORTANT:** If any DTCs are set, (except P1133 and/or P1134), refer to those DTCs before proceeding with this diagnostic chart. 1. Idle the engine at operating temperature. 2. Operate the vehicle within parameters specified under "Conditions for Setting the DTC" criteria included in Diagnostic Support. 3. Using a Tech 2, monitor "DTC" info for DTC P1153 until the DTC P1153 test runs. Note the test result. Does Tech 2 indicate DTC failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate P1133 and/or P1134 test failed?	—	Go to *Step 20*	Go to *Step 4*
4	Check for leaks at the exhaust pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U-bolt nuts at the leaking joints. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*

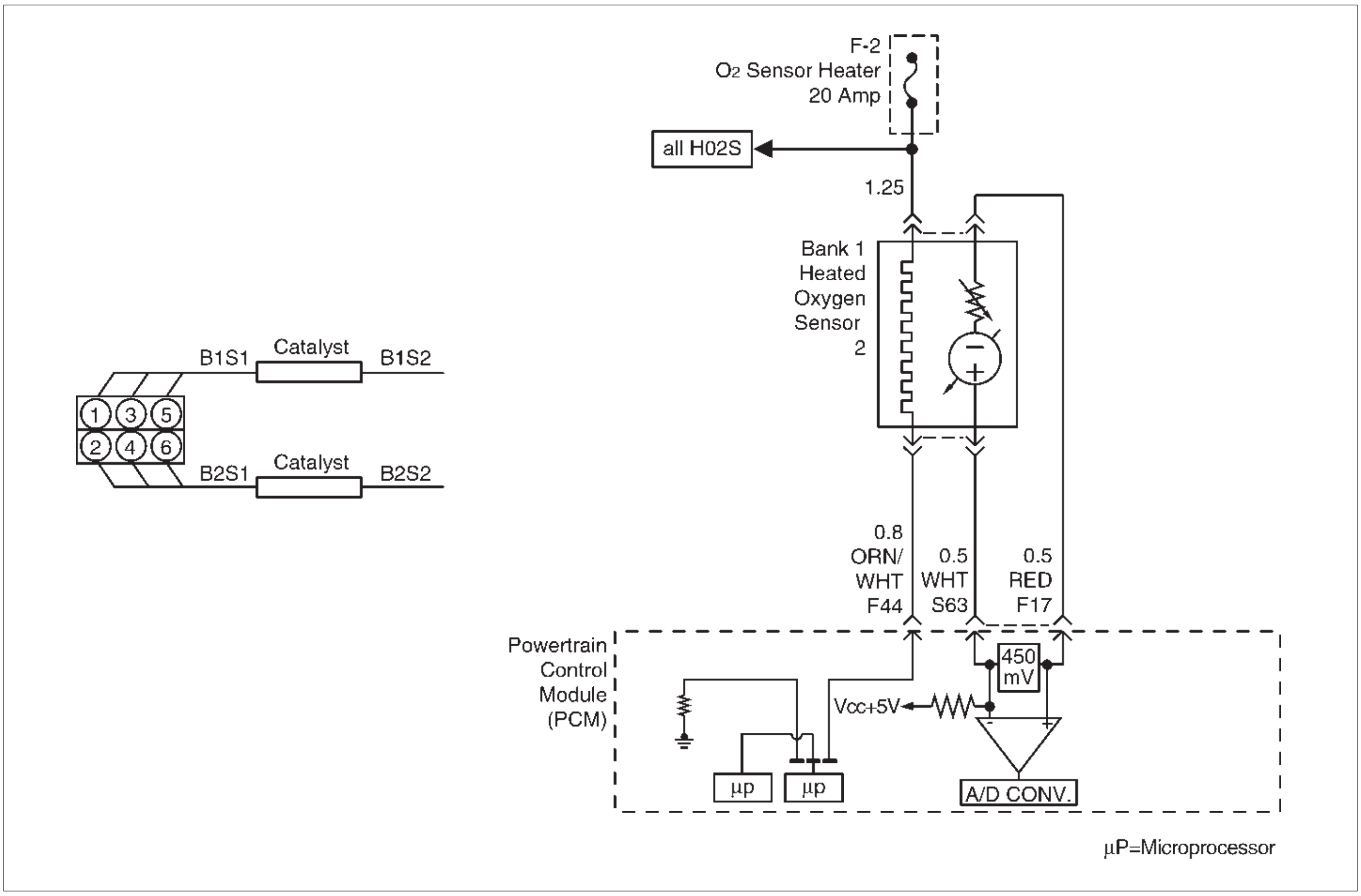
DTC P1153 – HO2S Insufficient Switching Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—
14	Visually/physically inspect the following items: • Ensure that the Bank 2 HO2S 1 is securely installed. • Check for corrosion on terminals. • Check the terminal tension at Bank 2 HO2S 1 and at the PCM. • Check for damaged wiring. Was a problem found in any of the above areas?	—	Verify repair	Go to *Step 15*
15	1. Disconnect Bank 2 HO2S 1. 2. Ignition "ON." 3. Using a DVM at the PCM side of the connector, check the voltage between the high signal circuit and ground. Also measure between the low signal circuit and ground. Are both voltages in the specified range?	3-4V	Go to *Step 18*	Go to *Step 16*
16	1. Ignition "ON." 2. Check for damage to PCM pins or terminals. Was a problem found?	—	Verify repair	Go to *Step 17*
17	Check for short to voltage or ground or an open in the signal circuit. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Ignition "OFF." 2. Disconnect the PCM connector. 3. With HO2S disconnected, check for high and low signal circuits shorted together between the PCM and HO2S. Was a problem found?	—	Verify repair	Go to *Step 19*
19	With the PCM connected and Bank 2 HO2S 1 disconnected from the harness, check Bank 2 HO2S 1 with a Tech 2. Is the voltage in the specified range?	425-475 mV	Go to *Step 21*	Go to *Step 22*
20	Replace affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. • Fuel contamination. • Use of improper RTV sealant. • Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—

DTC P1153 – HO2S Insufficient Switching Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1154 HO2S Circuit Transition Time Ratio Bank 2 Sensor 1



Circuit Description

The powertrain control module (PCM) monitors the heated oxygen sensor (HO2S) activity for 90 seconds after "closed loop" and stoichiometric operation have been enabled. During the monitor period the PCM counts the number of times that the HO2S responds from rich-to-lean and from lean-to-rich and adds the amount of time it took to complete all transitions. With this information, an average time for all transitions can be determined. The PCM then divides the rich-to-lean average by the lean-to-rich average to obtain a ratio. If the HO2S transition time ratio is not within this range, DTC P1154 will be set, indicating that the oxygen sensor is not responding as expected to changes in exhaust oxygen content.

Conditions for Setting the DTC

- No related DTCs.
- Engine coolant temperature (ETC) is above 50°C (122°F) for automatic transmission; 75°C (167°F) for manual transmission.
- The engine is operating in "closed loop."
- The engine has been running at least one minute.
- Canister purge duty cycle is greater than 2%.
- Engine speed is between 1500 RPM and 3000 RPM.
- Mass air flow is between 9 g/second and 42 g/second.
- Above conditions are present for a 3-second monitoring period.
- 90 seconds after "closed loop" and stoichiometric operation have been enabled, Bank 2 HO2S 1 transition ratio between lean to rich and rich to lean is less than 0.44 or greater than 3.8.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- "Open loop" fuel control will be in effect.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1154 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1154 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

A multifunction in the HO2S heater ignition feed or ground circuit may cause a DTC P1154 to set. Check HO2S heater circuitry for intermittent faults or poor connections. If connections and wiring are OK and DTC P1154 continues to set, replace the Bank 2 HO2S 1.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

3. A condition that affects other heated oxygen sensors indicates probable contamination. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

5. This step checks for conditions which may cause the heated oxygen sensor to appear faulty. Correct any of the described conditions if present.

8. To avoid damaging replacement sensors, correct the condition which caused the contamination before replacing the affected sensors.

DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	**IMPORTANT:** If any other DTCs are set (except P1133 and/or P1134), refer to those DTCs before proceeding with this diagnostic chart. 1. Idle the engine at operating temperature. 2. Operate the vehicle within parameters specified under “Conditions for Setting the DTC” criteria included in Diagnostic Support. 3. Using a Tech 2, monitor “DTC” info for DTC P1154 until the DTC P1154 test runs. Note the test result. Does Tech 2 indicate DTC failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	Did the Tech 2 also indicate P1133, and/or P1134 test failed?	—	Go to *Step 17*	Go to *Step 4*
4	Check for leaks at the exhaust pipe joints. Are the joints leaking?	—	Go to *Step 5*	Go to *Step 6*
5	Tighten the U-bolt nuts at the leaking joints. Is your action complete?	—	Go to *Step 2*	—
6	Check for gaskets that are damaged or improperly installed. Are there damaged or misaligned gaskets?	—	Go to *Step 7*	Go to *Step 8*
7	1. Replace the damaged gaskets. 2. Align the connections. 3. Tighten the connections. Is your action complete?	—	Go to *Step 2*	—
8	Check for loose exhaust flange connections. Are the flange connections loose?	—	Go to *Step 9*	Go to *Step 10*
9	Tighten the stud nuts or bolts to specifications. Is your action complete?	—	Go to *Step 2*	—
10	Check for burned or corroded exhaust pipes. Are the exhaust pipes burned or corroded?	—	Go to *Step 11*	Go to *Step 12*
11	Replace the exhaust pipes, as required. Is your action complete?	—	Go to *Step 2*	—

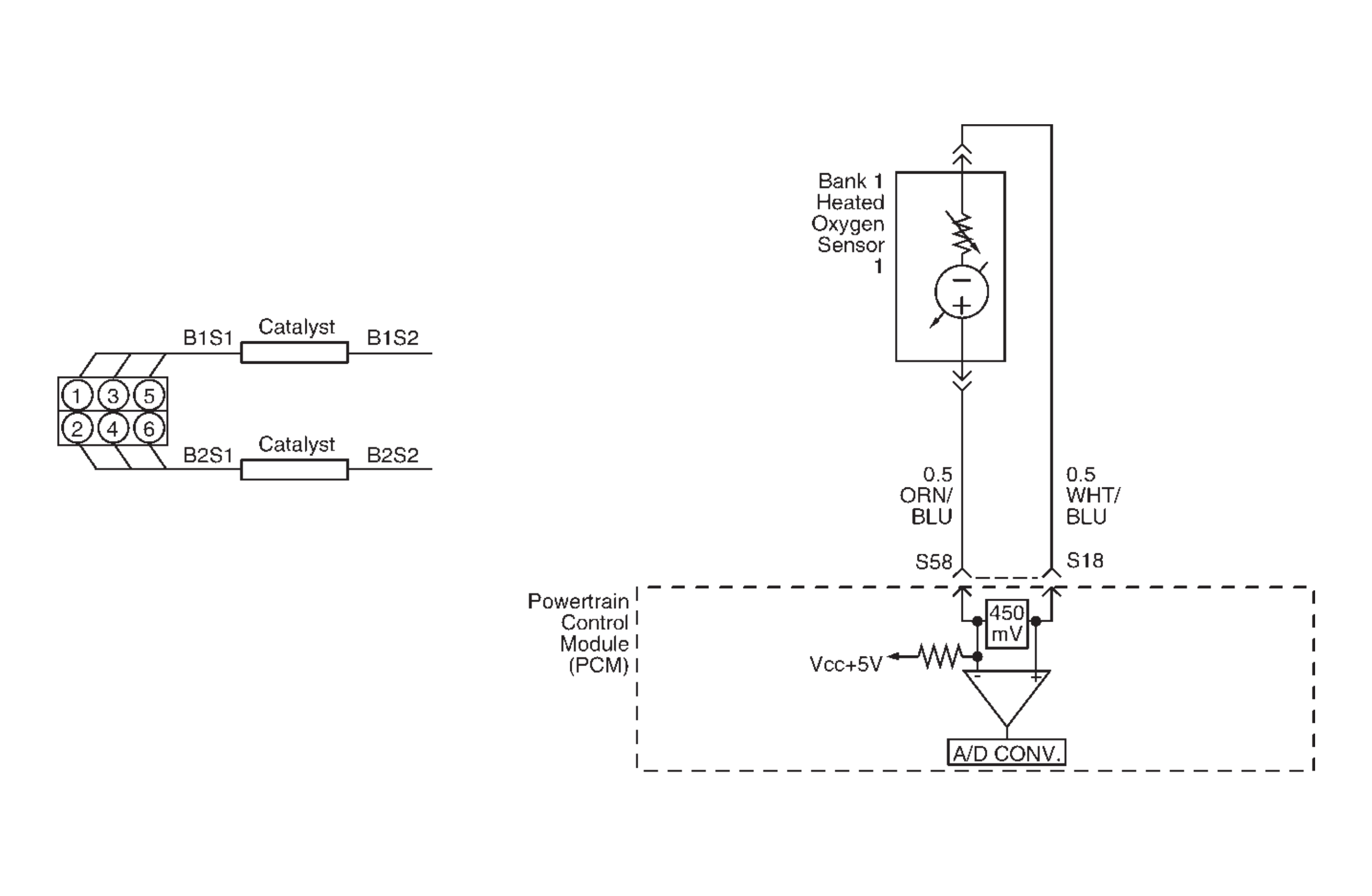
DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
12	Check for leaks at the exhaust manifold. Are there leaks at the exhaust manifold?	—	Go to *Step 13*	Go to *Step 14*
13	Tighten the bolts to specifications or replace the manifold if necessary. Is your action complete?	—	Go to *Step 2*	—
14	Visually/physically inspect the following items: • Ensure that the Bank 2 HO2S 1 is securely installed. • Check for corrosion on terminals. • Check terminal tension (at Bank 2 HO2S 1 and at the PCM). • Check for damaged wiring. Was a problem found in any of the above areas?	—	Go to *Step 18*	Go to *Step 15*
15	1. Disconnect Bank 2 HO2S 1. 2. Ignition "ON." 3. Using a DVM at the PCM side of the HO2S 1 connector, measure the voltage between the high signal circuit and ground. Also measure the voltage between the low signal circuit and ground. Are both voltages in the specified range?	3-4 V	Go to *Step 16*	Go to *Step 19*
16	1. With Bank 2 HO2S 1 disconnected, jumper the high and low (PCM side) signal circuits to ground. 2. Ignition "ON." 3. Using a Tech 2, monitor the Bank 2 HO2S 1 voltage. Does the Tech 2 indicate less than 10 mV and immediately return to about 450 mV when the jumper is removed?	—	Go to *Step 21*	Go to *Step 22*
17	Replace affected heated oxygen sensors. NOTE: Before replacing sensors, the cause of the contamination must be determined and corrected. • Fuel contamination. • Use of improper RTV sealant. • Engine oil/coolant consumption. Is the action complete?	—	Verify repair	—
18	Repair condition as necessary. Is the action complete?	—	Verify repair	—
19	Check for faulty PCM connections or terminal damage. Is the action complete?	—	Verify repair	Go to *Step 20*
20	Repair open, short or grounded signal circuit. Is the action complete?	—	Verify repair	—

DTC P1154 – HO2S Transition Time Ratio Bank 2 Sensor 1 (Cont'd)

Step	Action	Value(s)	Yes	No
21	Replace Bank 2 HO2S 1. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1167 Fuel System Rich During Decel Fuel Cut Off (Bank 1)



D06RY00136

Circuit Description

The powertrain control module (PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” has been enabled. During the monitoring period the powertrain control module (PCM) counts the number of times a rich to lean and respones is indicated and adds the amountof time it look to complete all rich to lean transisitions and lean to rich transitions.

This code detects if Bank1 02 sensor indicated rich exhaust while in Decel Fuel Cut Off (DFCO) for fuel control sensors.

Conditions for setting the DTC

- No related DTCs.
- The engine coolant temperature is more than 60 ˚C (140 ˚F).
- Engine is operating in “closed loop” power enrichment mode for 3 secondes.
- While in “power enrichment” mode the oxygen sensor voltage remains more than 600mV in DFCO.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction malfunction indicator lamp (MIL).
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- A history DTC P1167 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1167 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

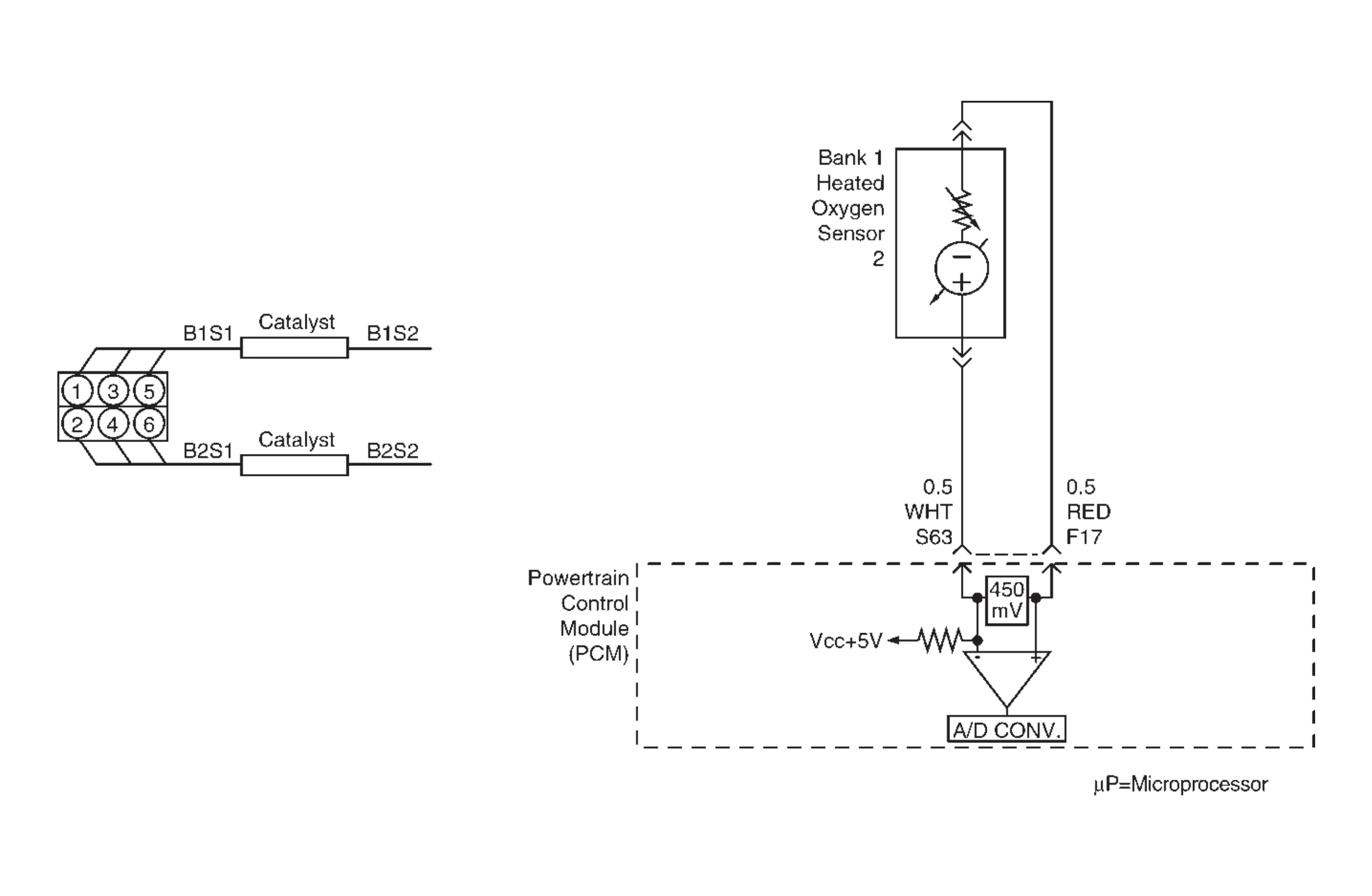
Diagnostic Aids

- Check for faulty fuel injectors and fuel pump.

Diagnostic Trouble Code (DTC)
P1167 Fuel System Rich During Decel Fuel Cut Off (Bank1)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any component related DTCs set?		Go to *component DTC charts*	Go to *Step 3*
3	1. Place the transmission in Park. 2. Using a Tech 2, HO2S 1 voltage while running warm engine 75 ˚C – 95 ˚C (167 ˚F – 203 ˚F) at 1200 RPM. 3. HO2S 1 votages should vary within the specified range. (100 – 900mV) 4. Quickly open the wide open the throtle for a few Did the voltage suddenly rise toward the low endof the specified range?	100 – 600 mV	Go to *OBD System Check*	Go to *Step 4*
4	1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure. 2. Install the fuel pressure gauge. 3. Start the engine and idle at normal operating temperatur. 4. Disconnect the vacuum line going to the fuel pressure regurlator. With the engine running, is the fuel pressure within the specified range?	280 – 325Kpa (41 – 46psi)	Go to *OBD System Check*	Go to *Step 5*
5	1. Ignition “OFF”. 2. Remove the fuel pump relay and replace it with a fused jumper which will connect the relay’s battery terminal to the terminal leading to the fuel pump fuse. 3. While the fuel pump is opreating, use pliers to slowly close the return line (do not exceed the first specified value). Using the pliers to restrict the return line, can the fuel pressure be manipulated to exceed the second value? Is the TP sensor reading near the specified value?	414KPa (60psi) 325KPa (46psi)	Refer to *Diagnostic Aids*	Go to *Step 6*
6	Check the following items; ● Faulty fuel pump ● Incorrect fuel pump ● Incorrect fuel being used ● Cold fuel If a problem is found, repair one as necessary. Was a problem found?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1169 Fuel System Rich During Decel Fuel Cut Off (Bank 2)



D06RY00141

Circuit Description

The powertrain control module(PCM) continuously monitors the heated oxygen sensor (HO2S) activity for 90 seconds after “closed loop” has been enabled. During the monitoring period the powertrain control module (PCM) counts the number of times a rich to lean and respones is indicated and adds the amountof time it look to complete all rich to lean transisitions and lean to rich transitions.

This code detects if Bank2 sensor indicated rich exhaust while in Decel Fuel Cut Off (DFCO) for fuel control sensors.

Conditions for setting the DTC

- No related DTCs.
- The engine coolant temperature is more than 60 °C (140 °F).
- Engine is operating in “closed loop” power enrichment mode for 3 secondes.
- While in “power enrichment” mode the oxygen sensor voltage remains more than 600mV in DFCO.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction malfunction indicator lamp(MIL).
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- A history DTC P1169 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1169 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

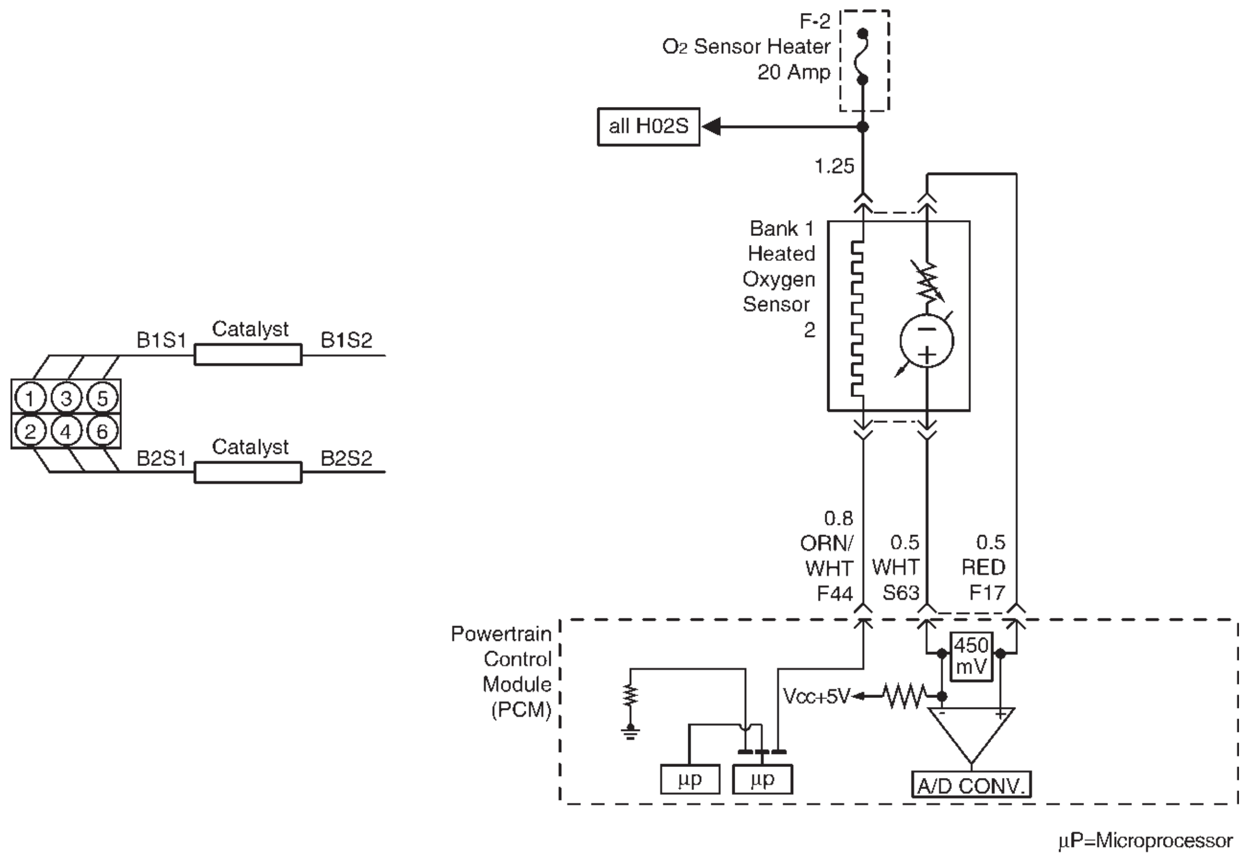
Diagnostic Aids

- Check for faulty fuel injectors and fuel pump.

Diagnostic Trouble Code (DTC) P1169 Fuel System Rich During Decel Fuel Cut Off (Bank2)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any component related DTCs set?		Go to *component DTC charts*	Go to *Step 3*
3	1. Place the transmission in Park. 2. Using a Tech 2, HO2S 2 voltage while running warm engine75 C – 95 C (167 F – 203 F) at 1200 RPM. 3. HO2S 1 votages should vary within the specified range. (100 – 900mV) 4. Quickly open the wide open the throtle for a few Did the voltage suddenly rise toward the low end of the specified range?	100 – 600 mV	Go to *OBD System Check*	Go to *Step 4*
4	1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure. 2. Install the fuel pressure gauge. 3. Start the engine and idle at normal operating temperatur. 4. Disconnect the vacuum line going to the fuel pressure regurlator. With the engine running, is the fuel pressure within the specified range?	280 – 325Kpa (41 – 46psi)	Go to *OBD System Check*	Go to *Step 5*
5	1. Ignition “OFF”. 2. Remove the fuel pump relay and replace it with a fused jumper which will connect the relay’s battery terminal to the terminal leading to the fuel pump fuse. 3. While the fuel pump is opreating, use pliers to slowly close the return line (do not exceed the first specified value). Using the pliers to restrict the return line, can the fuel pressure be manipulated to exceed the second value? Is the TP sensor reading near the specified value?	414KPa (60psi) 325KPa (46psi)	Refer to *Diagnostic Aids*	Go to *Step 6*
6	Check the following items; • Faulty fuel pump • Incorrect fuel pump • Incorrect fuel being used • Cold fuel. If a problem is found, repair one as necessary. Was a problem found?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1171 Fuel System Lean During Acceleration



D06RY00139

Circuit Description

The powertrain control module (PCM) internal circuitry can identify if the vehicle fuel system is capable of supplying adequate amounts of fuel during heavy acceleration (power enrichment). The PCM monitors the voltage of the oxygen sensor during power enrichment. When a power enrichment mode of operation is requested during “closed loop” operation (by heavy acceleration), the PCM will provide more fuel to the engine. Under these conditions the PCM should detect a “rich” condition (high oxygen sensor voltage). If this “rich” exhaust is not detected at this time, a DTC P1171 will set. A plugged fuel filter, restricted fuel line, restricted in-tank filter or defective fuel pump can prevent adequate amounts of fuel from being supplied during power enrichment mode.

Conditions for Setting the DTC

- No related DTCs.
- Engine is operating in “closed loop power enrichment” mode for 3 seconds.
- Engine coolant temperature is above 60°C (140°F).
- While in “power enrichment” mode the oxygen sensor voltage remains below 400 mV for 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1171 will clear after 40 consecutive warm-up cycles have occurred without a fault.

- DTC P1171 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

- A restricted fuel filter or fuel line, restricted in-tank filter, or a defective fuel pump may supply adequate amounts of fuel at idle, but may not be able to supply enough fuel during heavy acceleration.
- Water or alcohol in the fuel may cause low HO2S voltage during acceleration.
- Check for faulty or plugged fuel injector(s).
- Check for low fuel.

Test Description

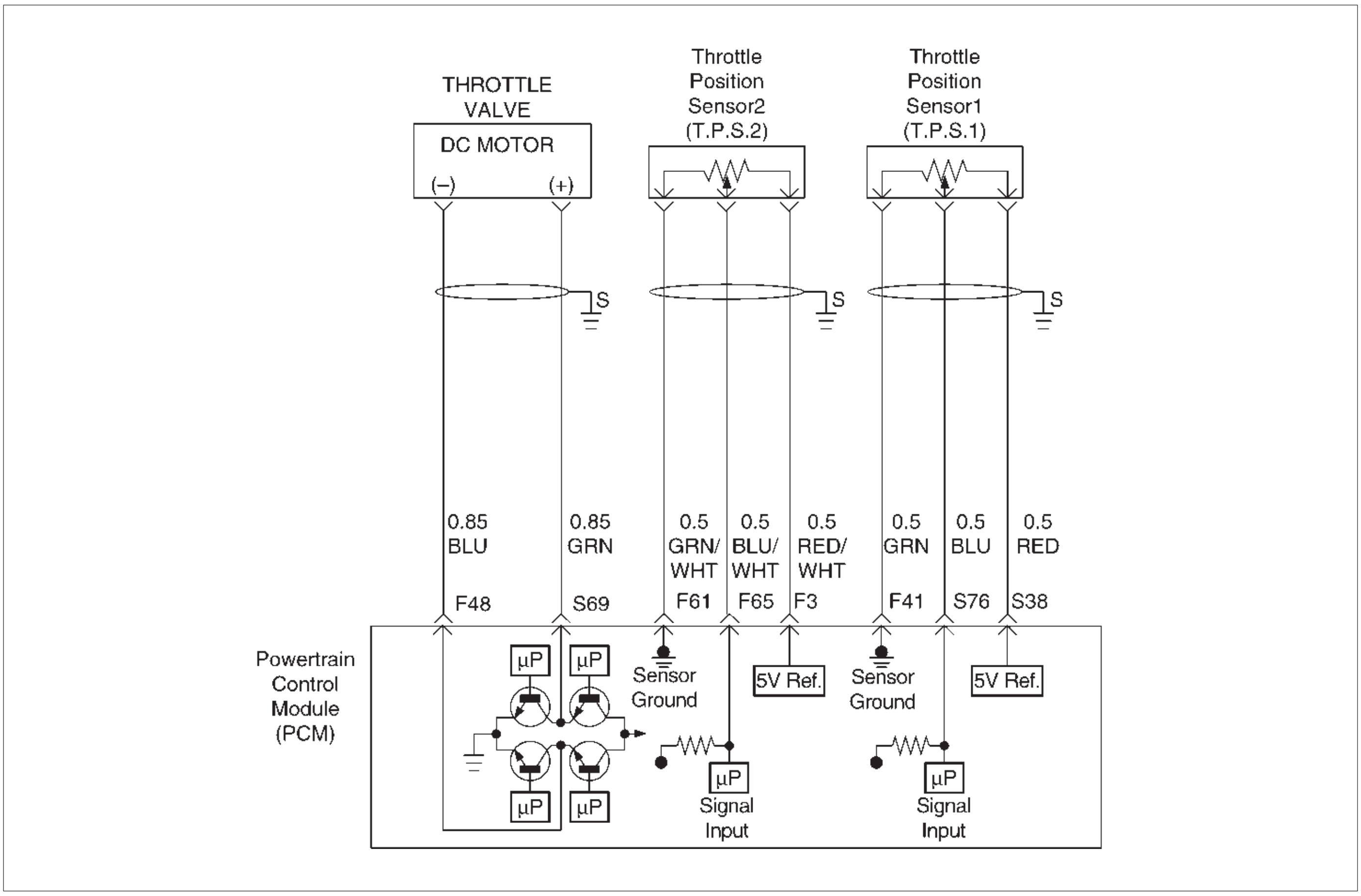
Number(s) below refer to the step number(s) on the Diagnostic Chart.

4. When the engine is idling or at steady cruise, the HO2S voltage should vary from between approximately 100 mV to 900 mV. It is possible to measure a satisfactory fuel pressure at idle even though the pressure may drop at high flow requirements. It may be necessary to watch fuel pressure at high engine load.
5. Wrap a shop towel around the fuel pressure connector to absorb any small amount of fuel leakage that may occur when installing gauge. Ignition “ON,” pump pressure should be 280-320 kPa.
7. Add Caution, Use correct pliers so damage to fuel lines will not occur.

DTC P1171 – Fuel System Lean During Acceleration

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Are any component-related DTCs set?	—	Go to component DTC charts	Go to *Step 3*
3	1. Check the vehicle's fuel tank for an adequate amount of fuel. 2. Add fuel to the vehicle's fuel tank if the tank is almost empty. Was fuel added to the vehicle's fuel tank?	—	Go to *Step 4*	Go to *Step 5*
4	1. Place the transmission in park. 2. Using a Tech 2, observe HO2S 1 voltage while running warm engine 75°C-95°C (167°F-203°F) at 1200 RPM. 3. HO2S 1 voltage should vary within the specified range. 4. Quickly open the throttle halfway for a few seconds. Did the voltage suddenly rise toward the high end of the specified range?	100-900 mV	Go to *Fuel System Electrical Test*	Go to *Step 5*
5	1. Disconnect the fuel pump relay and crank the engine to relieve the fuel pressure. 2. Install the fuel pressure gauge. 3. Start the engine and idle at normal operating temperature. 4. Disconnect the vacuum line going to the fuel pressure regulator. With the engine running, is the fuel pressure within the specified range?	280-325 kPa (41-46 psi)	Go to *OBD System Check*	Go to *Step 6*
6	Check for restricted fuel lines or restricted in-line filter. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Ignition "OFF." 2. Remove the fuel pump relay and replace it with a fused jumper which will connect the relay's battery terminal to the terminal leading to the fuel pump fuse. 3. While the fuel pump is operating, use pliers to slowly close the return line (do not exceed the first specified value). Using the pliers to restrict the return line, can the fuel pressure be manipulated to exceed the second specified value?	414 kPa (60 psi) 325 kPa (46 psi)	Go to *Diagnostic Aids*	Go to *Step 8*
8	Check for: • Faulty fuel pump • Restricted fuel pump strainer (sock) • Incorrect fuel pump • Incorrect fuel being used • Hot fuel Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1220 Throttle Position Senser2 (TPS2) Circuit Fault



D06RY00111

Circuit Description

- The throttle position (TP2) sensor circuit provides a voltage signal relative to throttle blade angle.

  The throttle blade angle will vary about 8 % at closed throttle to about 92 % at wide open throttle (WOT).

  This code detects a continuous short to ground or high in either the cicuit or the sensor.

Conditions for setting the DTC

- The Ignition is “ON”.
- The throttle blade angle is less than 2.5 % or more tnan 97.5 % for 18 failres within 500 test samples (15.6m sec).

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1120 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1120 can be cleared using the Tech2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- The MAP sensor shares a 5 Volt reference with the Fuel Tank Pressure.If these codes are also set, it could indicate a problem with the 5 Volt reference circuit.
- The MAP sensor shares a ground with the Fuel Tank Pressure,the ECT sensor,and the Transmission Fluid
- Poor connection at PCM-Inspect harness connectors for backed out terminals,improper mating,broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK,observe the TP sensor display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1120 cannot be duplicated,the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently,performing the DTC P1120 Diagnostic Chart may isolate the cause of the fault.

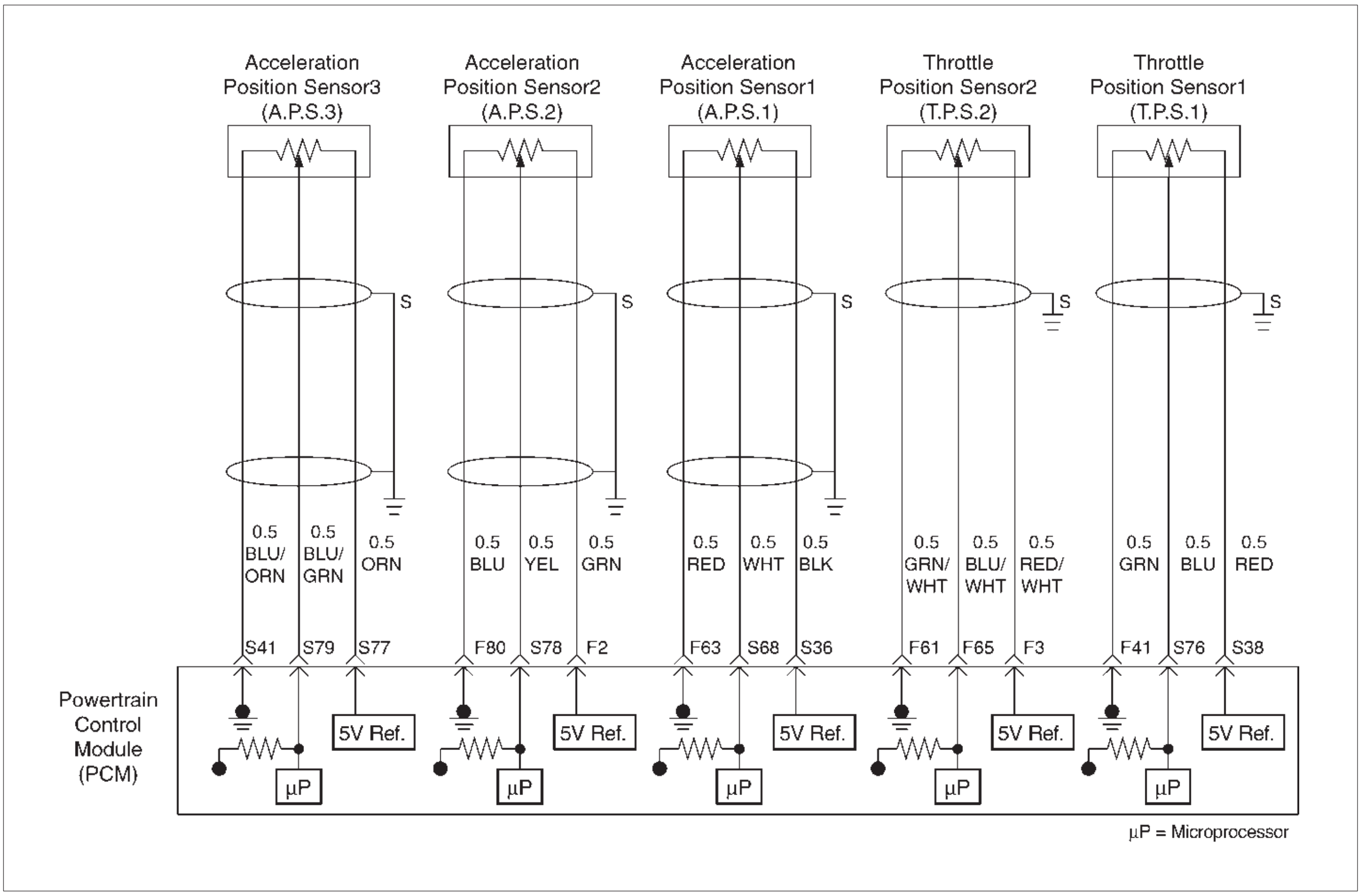
DTC P1220-TPS 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition “ON”, engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65 kPa	Go to *Step 4*	Go to *Step 7*
4	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5V returns.)	—	Go to *Step 6*	Go to *Step 5*
5	1. Check the MAP signal circuit between the PCM and MAP ground circuit. 2. If the MAP signal circuit is open or shorted, repair as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 13*
6	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
7	Observe the TP angle reading on the Tech-2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed TP sensor 1 =8 ~ 10 % TP sensor 2 =8 ~ 10 % Wide open TP sensor 1 =90 ~ 92 % TP sensor 2 =90 ~ 92 %	Refer to *Diagnostic Aids*	Go to *Step 8*
8	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	0V	Go to *Step 9*	Go to *Step 10*
9	1. Connect a test light between the 5Volt reference circuit and the TP2 sensor signal circuit at the TPsensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 12*	Go to *Step 11*

DTC P1220-TPS 2 Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP2 signal circuit for a short to voltage. 2. TP2 sensor ground circuit for high resistance between the PCM and the TP2 sensor. 3. TP2 sensor ground circuit for a poor connection. 4. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
11	Check the following items; 1. TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
12	Replace the TP sensor. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnosis Truble Code(DTC)
P1221 TPS1 – TPS2 correlation(Circuit Performance)



D06RY00163

Circuit Description

- The powertrain control module (PCM) controls engine speed by adjusting the position of the throttle control valve (DC motor). The throttle motor is a DC motor driven by one coil. The PCM applies current to DC motor coil in steps (%) to adjustment the valve into a passage in the throttle body to air flow.

  This method allows highly accurate control of engine speed and quick response to changes in engine load.
- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP1) will vary about 13% at idle position to about 87% at open throttle(WOT).

  APS signal is used to determine which DC will adjusting throttle position.

  After the APS signal has been processed by the PCM, it will command DC motor to allow a move of throttle position.
- Acceleration pedal – Check for objects blocking the AP sensor or pedal arm with spring, and excessive deposits in the acceleration pedal arm and on the acceleration pedal.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart:

2. Visually/physically inspect for the following throttle valve conditions.

3.Visually/physically inspect for the following acceleration pedal conditions.

5.Check the following circuits for throttle valve and DC moter. Check the following TP sensor resistance and DC motor.

7.Check the following circuits for acceleration pedal. Check the following AP sensor resistance.

9.Following DTC: Software detect Error for ETC system.

10.Following DTC: Software detect Error for ETC system.

Diagnostic Aids

- An intermittent may be caused by a poor connection, rubbed–through wire insulation or a wire broken inside the insulation. Check for poor connections or a damaged harness. Inspect the PCM harness and connector for improper mating, broken locks, improperly formed or damaged terminals, poor terminal-to-wire connection, and damaged harness.
- Throttle body – Check for objects blocking the DC motor or throttle bore, excessive deposits in the ETC passage and on the valve spring, and excessive deposits in the throttle bore and on the throttle valve plate.

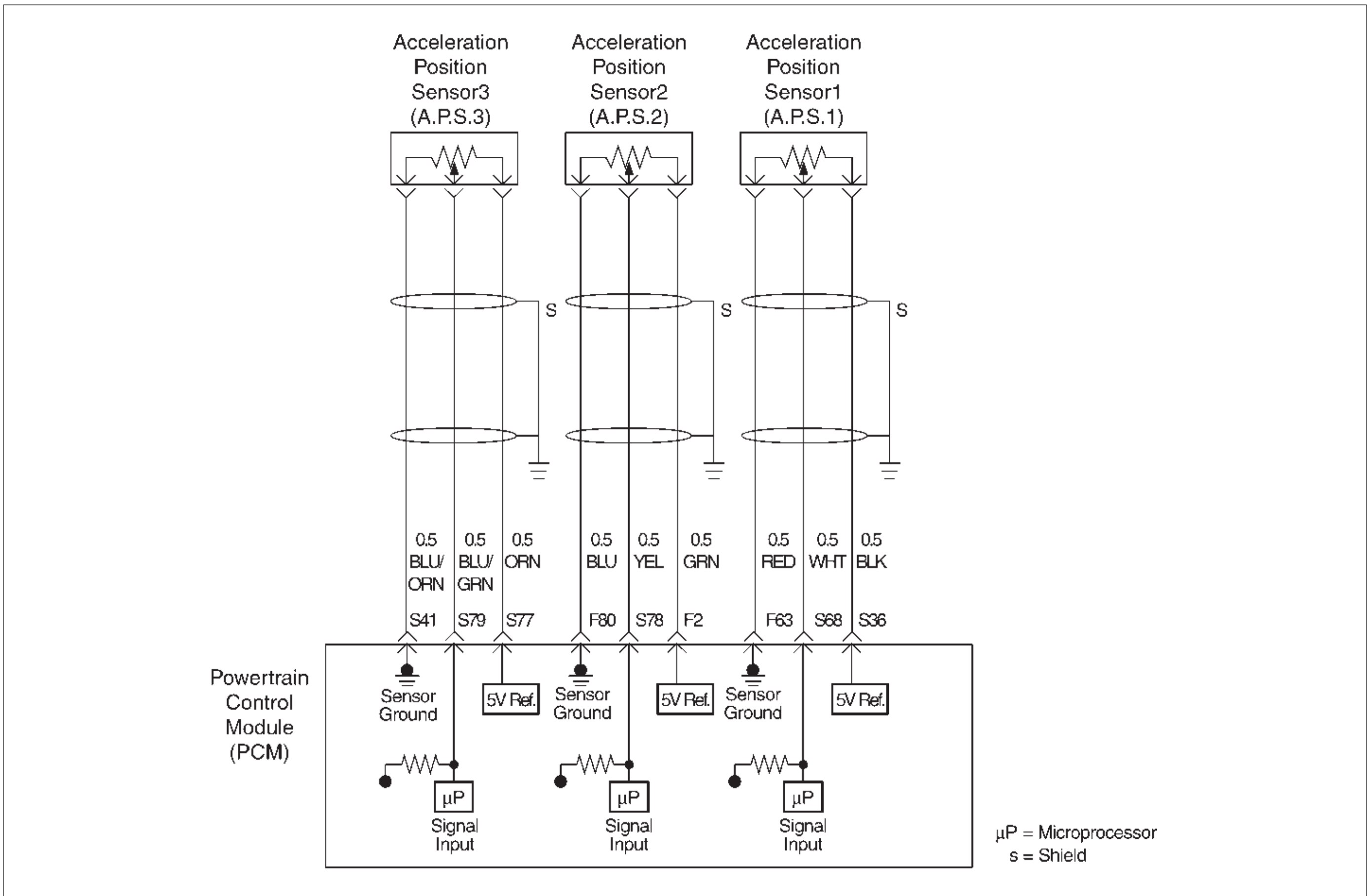
Diagnosis Truble Code(DTC)
P1221 TPS1 – TPS2 correlation(Circuit Perfoemance)

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check"performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Visually/physically inspect for the following conditions: ● Throttle body tampering. ● Restricted intake throttle system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. ● Throttle body: Check for objects blocking the throttle passage or throttle bore, excessive deposits in the throttle passage and on the throttle valve, and excessive deposits in the throttle bore and on the throttle plate. ● Throttle body with lever: Check for objects send round the throttle spring lever that lever is smooth movement, and spring lever has not excessive play Do any of the above require a repair?	—	Refer to *appropriate section for on–vehicle service*	Go to *Step 5*
4	Visually/physically inspect for the following conditions: ● Acceleration pedal tampering. ● Acceleration pedal : Check for objects blocking the spring or pedal arm. ● Acceleration pedal : Check for objects move the acceleration pedal that pedal is smooth movement, and acceleration pedal arm has not excessive play. Do any of the above require a repair?	—	Refer to *appropriate section for on–vehicle service*	Go to *Step 5*
5	1. Check for a poor connection at the throttle body harness connector. 2. Check for a poor connection at the acceleration position sensor harness connector. 3. If a problem is found, replace faulty terminals as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
6	1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: Throttle position sensor 1 circuit. Throttle position sensor 2 circuit. Throttle DC motor circuit. Throttle position sensor resistance. Throttle DC motor resistance. 2. If a problem is found, repair as necessary. Was a problem found?	Vcc-GND 1–7kΩ SIG-DND change resistance 0.3 – 100Ω	Verify repair	Go to *Step 7*

Diagnosis Truble Code(DTC)
P1221 TPS1 – TPS2 correlation(Circuit Perfoemance) (Cont'd)

Step	Action	Value(s)	Yes	No
7	Replace the throttle valve. Is the action complete?	—	Go to *Step 4*	—
8	1. Check the following circuits for an open, short to voltage, short to ground, or poor connection at the PCM: • Acceleration position sensor 1 circuit. • Acceleration position sensor 2 circuit. • C position sensor 3 circuit. • V position sensor resistance. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	Replace the acceleration position sensor. Is the action complete?	—	Go to *Step 10*	—
10	Following below the DTCs stored: P1125, P1290, P1295, P1299	—	Go to *applicable DTC table*	Go to *Step 11*
11	Following below the DTCs stored: P1514, P1515, P1516, P1523, P1271, P1272, P1273	—	Go to *applicable DTC table*	Go to *Step 12*
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1271 APS 1– 2 Correlation Error



D06RY00075

Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP1) will vary about 13 % at idle position to about 87 % at wide open throttle(WOT).

  This code detects a correlation error between APS1 and APS2.

Conditions for setting the DTC

- The Ignition is “ON”.
- The acceleration pedal angle difference is less than 4.5 % between ASP1 and APS2 for 50 counts within 50 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1271 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1271 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 1, APP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1271 cannot be duplicated,the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTCP1271 Diagnostic Chart may isolate the cause of the fault.

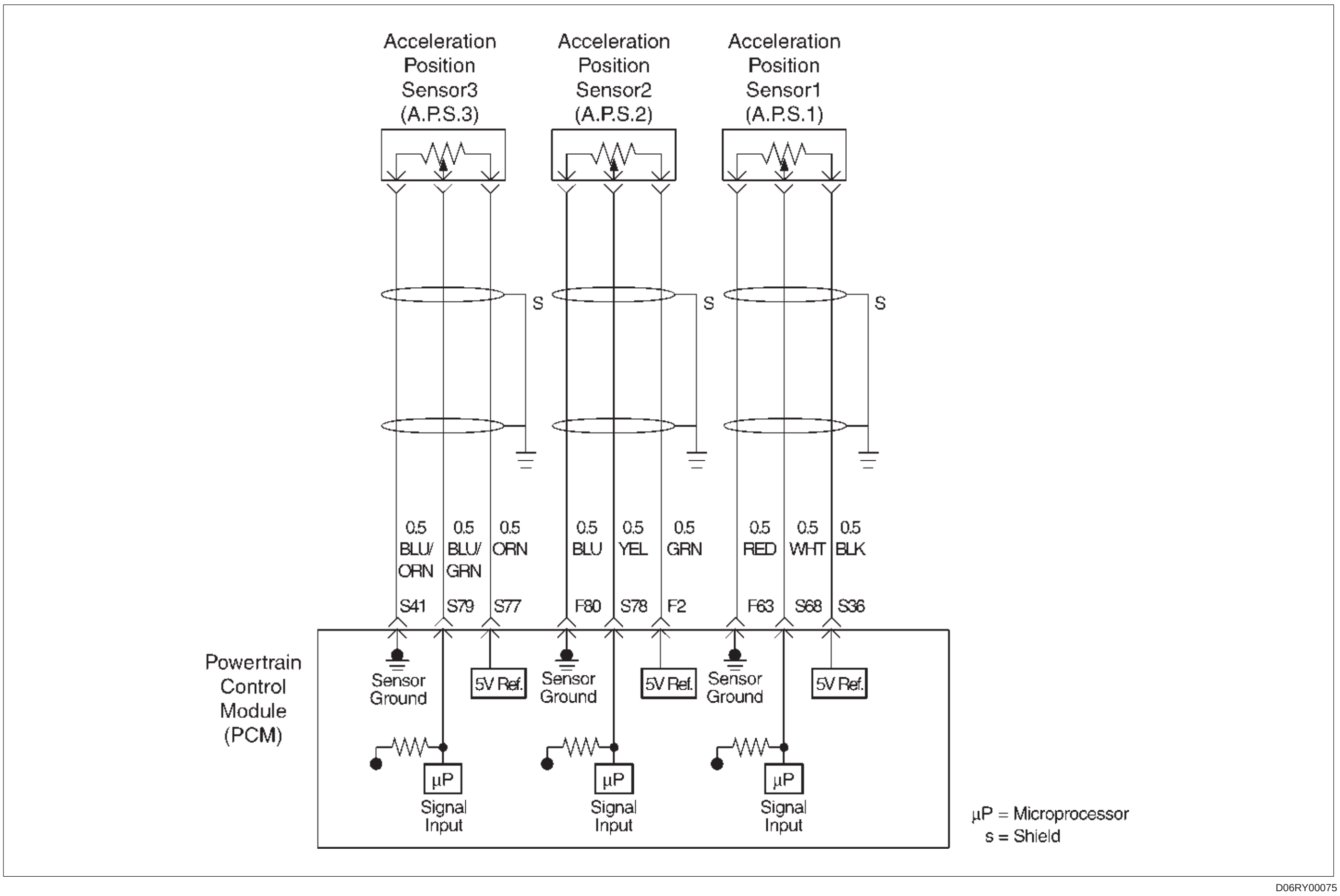
DTC P1271 – APS 1– 2 Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position APP sensor 1 =13 % APP sensor 2 =85 ~ 89 % Wide open throttle APP sensor 1 =85 ~ 89 % APP sensor 2 =11 ~ 15 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP sensor signal circuit at the AP1, AP2 sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP1and AP2 signal circuit for a short to voltage. 2. AP1and AP2 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1and AP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1and AP2 signal circuit or 5 volge supply circuit for a poor connection. 2. AP1and AP2 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP1 and AP2 sensor. 3. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*

DTC P1271 – APS 1– 2 Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released ornot. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1272 APS 2 – 3 Correlation Error



Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP2) will vary about 87 % at idle position to about 13 % at wide open throttle (WOT).

  This code detects a correlation error betweenAPS2 and APS3.

Conditions for setting the DTC

- The Ignition is “ON”.
- The acceleration pedal angle difference is less than 4.5 % between ASP2 and APS3 for 50 counts within 50 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1272 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1272 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals,improper mating,broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 2, APP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1272 cannot be duplicated, the information includedin the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC

P1272 Diagnostic Chart may isolate the cause of the fault.

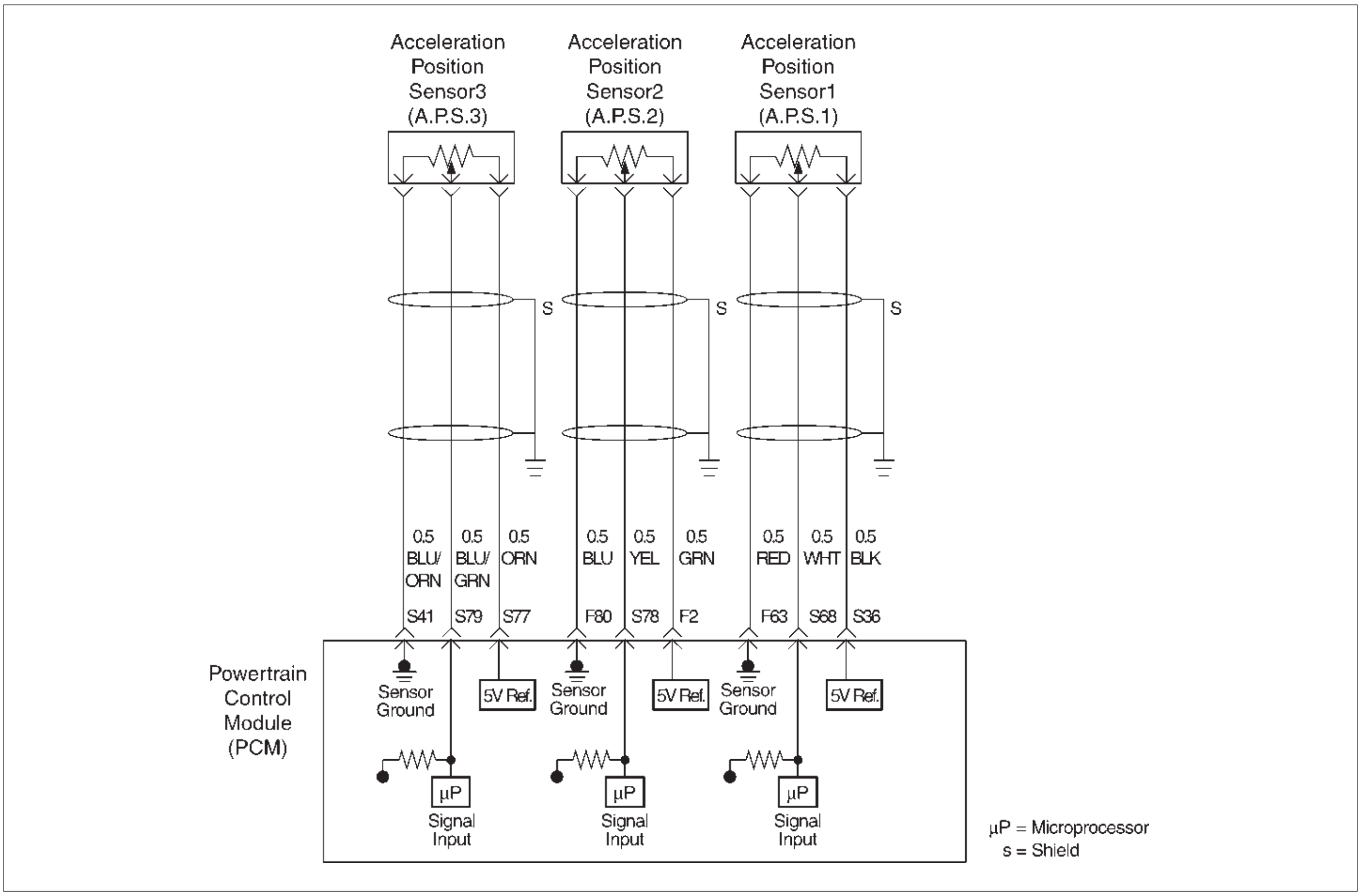
DTC P1272 – APS 2 – 3 Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idleposition APP sensor 2 =86 ~ 88 % APP sensor 3 =86 ~ 88 % Wide open throttle APP sensor 2 =12 ~ 14 % APP sensor 3 =32 ~ 36 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP sensor signal circuit at the AP2 and AP3 sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 6*	Go to *Step 8*
6	Check the following items; 1. AP2 and AP3 signal circuit for a short to voltage. 2. AP2 and AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP2 and AP3 sensor ground circuit for a poor connection. 4. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP2 and AP3 signal circuit or 5 volge supply circuit for a poor connection. 2. AP2 and AP3 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP2 and AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*

DTC P1272 – APS 2 – 3 Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1273 APS 1 – 3 Correlation Error



D06RY00075

Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP1) will vary about 13 % at idle position to about 87 % at wide open throttle (WOT).

  This code detects a correlation error between APS1 and APS3.

Conditions for setting the DTC

- The Ignition is “ON”.
- The acceleration pedal angle difference is less than 4.5 % between ASP1 and APS3 for 50 counts within 50 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1273 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1273 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK,observe the APP sensor 1, APP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1273 cannot be duplicated,the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently,performing the DTC

P1273 Diagnostic Chart may isolate the cause of the fault.

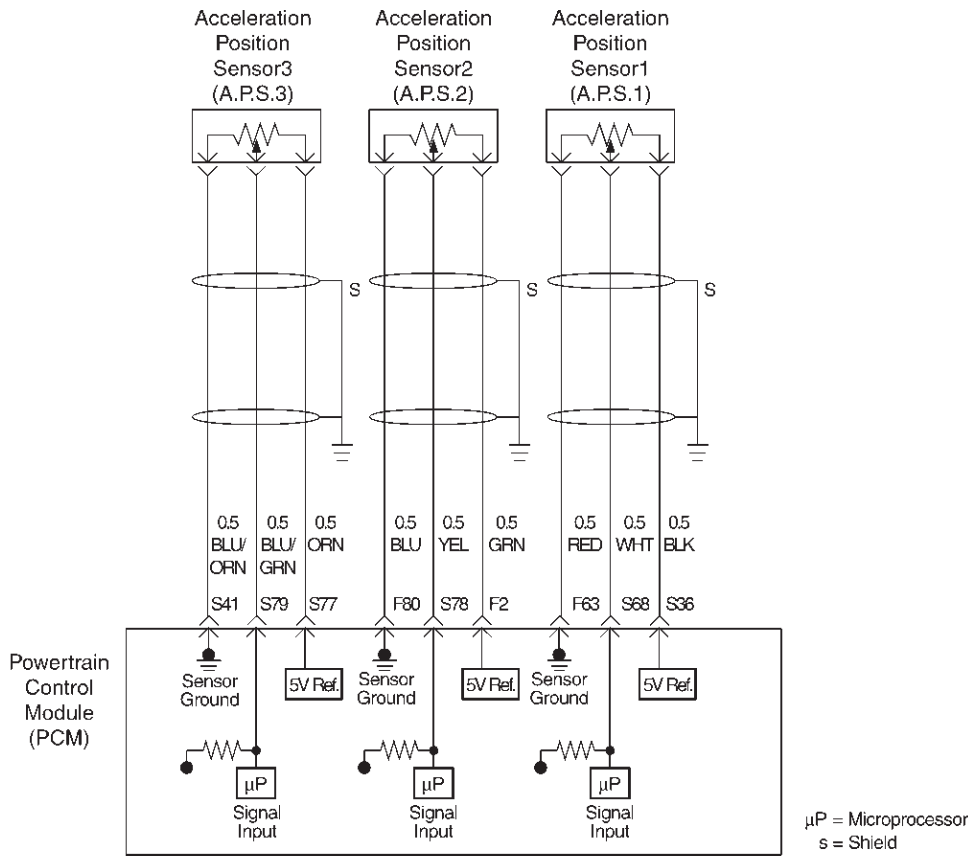
DTC P1273 – APS 1 – 3 Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idleposition APP sensor 1 =13 % APP sensor 3 =85 ~ 89 % Wide open throttle APP sensor 1 =85 ~ 89 % APP sensor 3 =32 ~ 36 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP sensor signal circuit at the AP1 and AP3 sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP1 and AP3 signal circuit for a short to voltage. 2. AP1 and AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1 and AP3 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1 and AP3 signal circuit or 5 volge supply circuit for a poor connection. 2. AP1 and AP3 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP1 and AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*

DTC P1273 – APS 1 – 3 Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released ornot. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1275 APS 1 Circuit Fault



D06RY00075

Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP1) will vary about 13 % at idle position to about 87 % at wide open throttle (WOT).

  This code detects a continuous short to ground or high in either the cicuit or the sensor.

Conditions for setting the DTC

- The Ignition is “ON”.
- The acceleration pedal angle is less than 2.5 % or more than 97 % for 12 counts within 500 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will store condition which werepresent when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1275 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1275 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK,observe the APP sensor 1 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1275 cannot be duplicated,the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

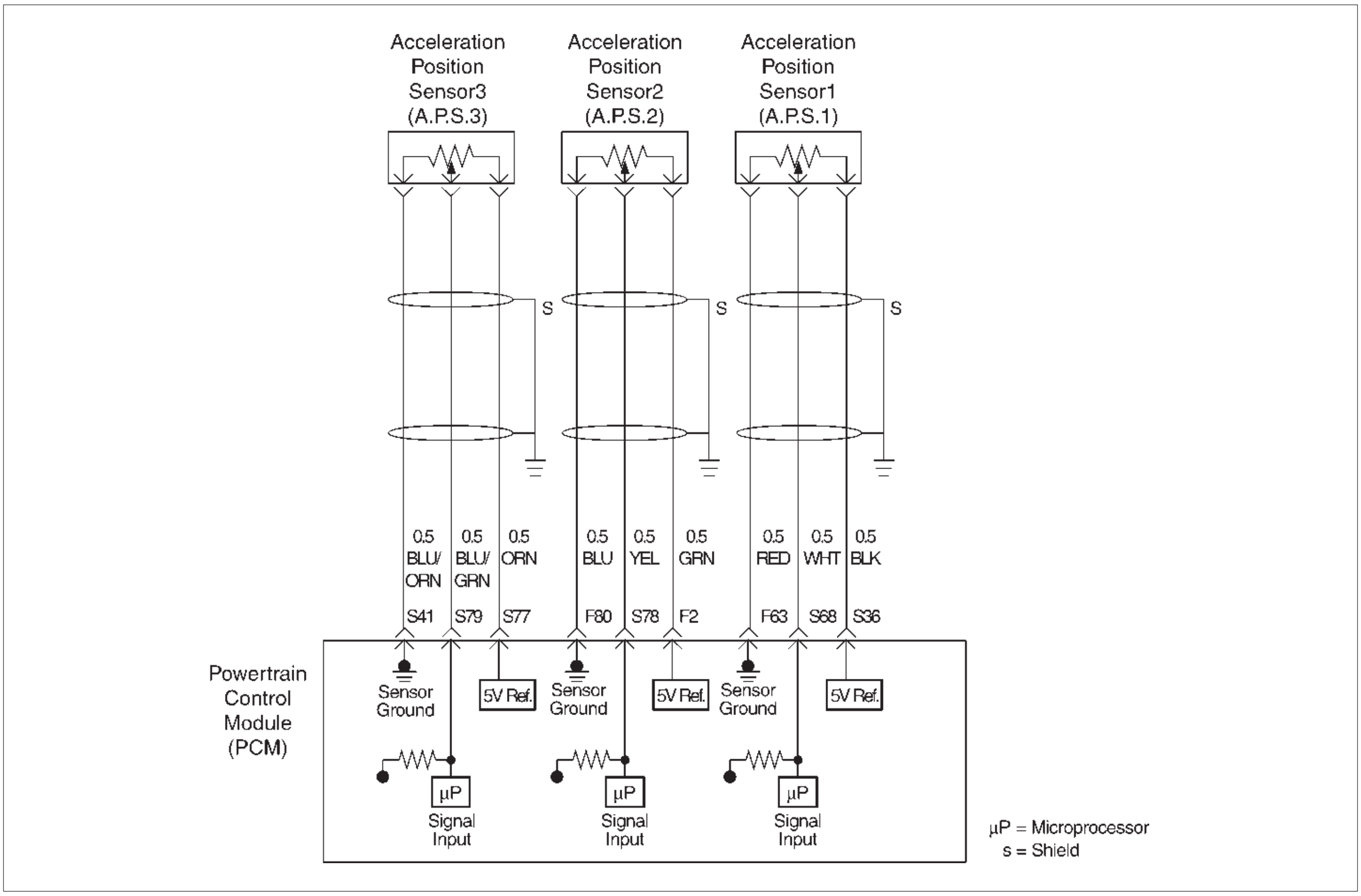
  If it is determined that the DTC occurs intermittently, performing the DTC

P1275 Diagnostic Chart may isolate the cause of the fault.

DTC P1275 – APS 1 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position =12 ~ 14 % Wide open throttle =86 ~ 88 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP1 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP1 signal circuit for a short to voltage. 2. AP1 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1 sensor ground circuit for a poor connection. 4. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1 signal circuit or 5 volge supply circuit for a poor connection. 2. AP1 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP1 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1280 APS 2 Circuit Fault



Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP2) will vary about 87 % at idle position to about 13 % at wide open throttle(WOT).

  This code detects a continuous short to ground or high in either the cicuit or the sensor.

Conditions for setting the DTC

- The Ignition is “ON”.
- The acceleration pedal angle is less than 2.5 % or more than 97 % for 12 counts within 500 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1280 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1280 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1280 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

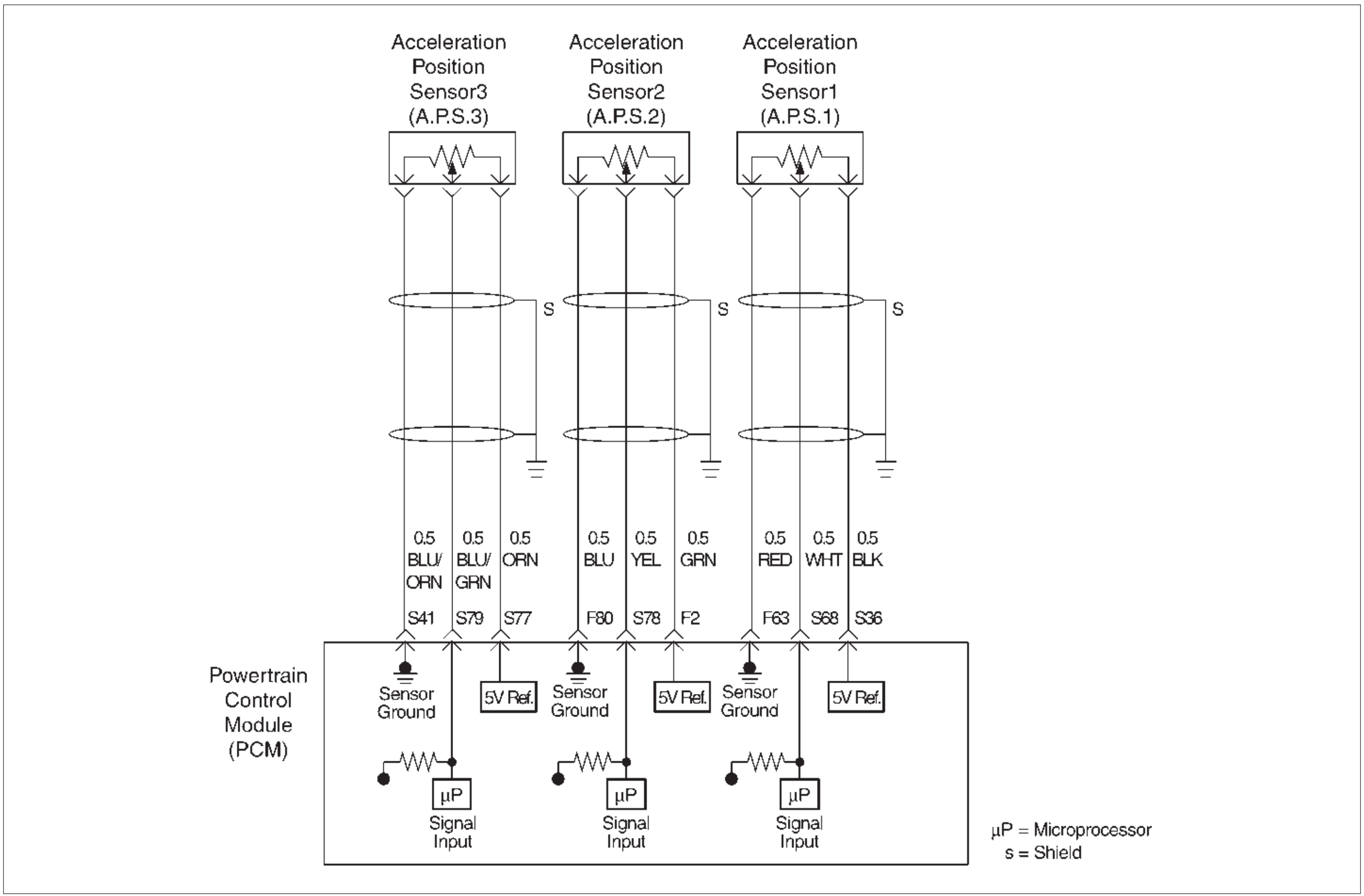
  If it is determined that the DTC occurs intermittently, performing the DTC

P1280 Diagnostic Chart may isolate the cause of the fault.

DTC P1280 - APS 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position =86 ~ 88 %Wide open throttle =12 ~ 14 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP2 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP2 signal circuit for a short to voltage. 2. AP2 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP2 signal circuit or 5 volge supply circuit for a poor connection. 2. AP2 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed.Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1285 APS 3 Circuit Fault



D06RY00075

Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP3) will vary about 87 % at idle position to about 34 % at wide open throttle(WOT).

  This code detects a continuous short to ground or high in either the circuit or the sensor.

Conditions for setting the DTC

- The Ignition is “ON”.
- The acceleration pedal angle is less than 2.5 % or more than 97 % for 12 counts within 500 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1285 will clear after 40 consecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1285 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1285 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

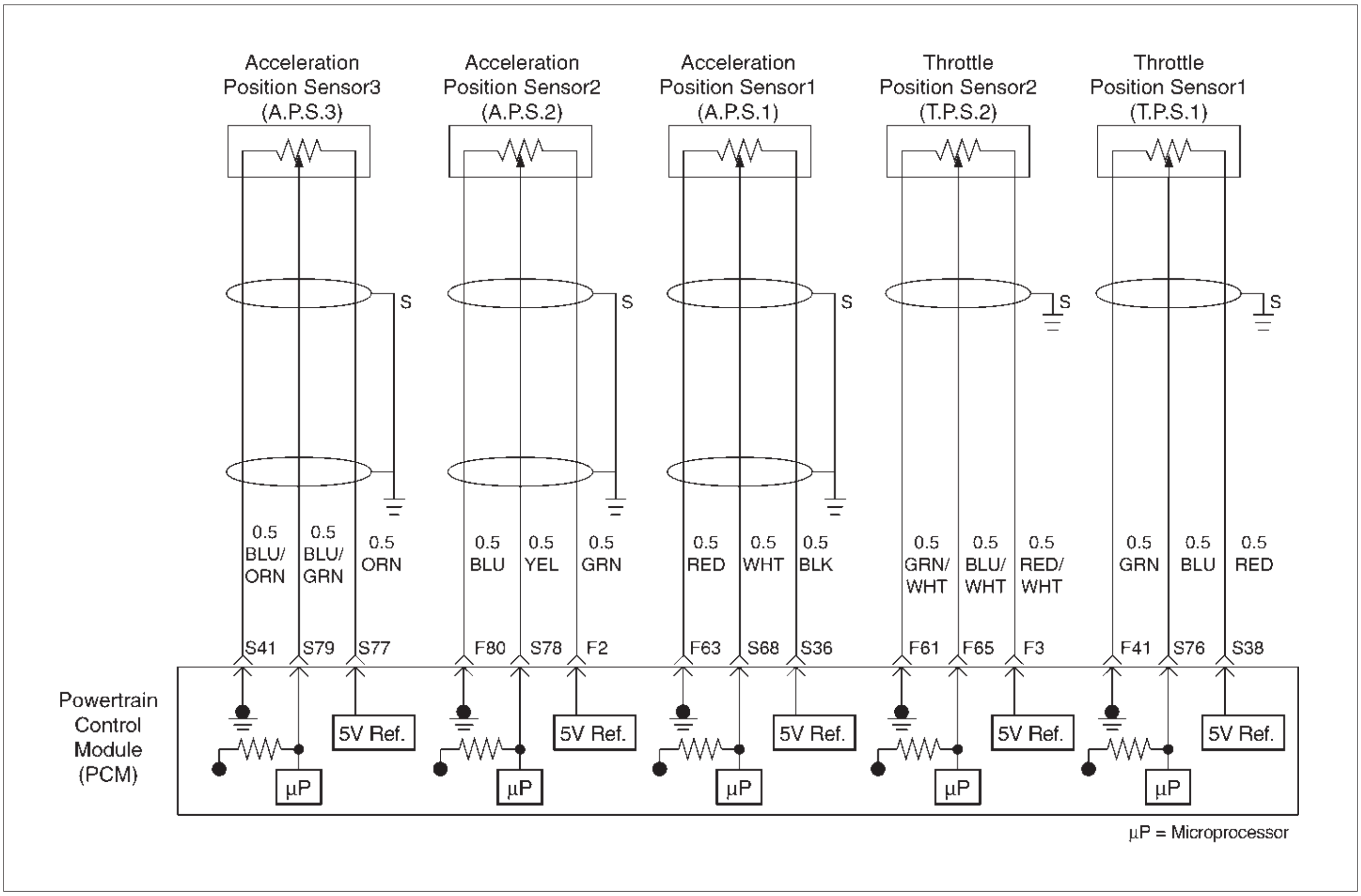
  If it is determined that the DTC occurs intermittently, performing the DTC

P1285 Diagnostic Chart may isolate the cause of the fault.

DTC P1285 – APS 3 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech 2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position =86 ~ 88 %Wide open throttle =32 ~ 36 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP3 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP3 signal circuit for a short to voltage. 2. AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP3 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP3 signal circuit or 5 volge supply circuit for a poor connection. 2. AP3 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released ornot. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1290 ETC Forced Idle Mode



D06RY00163

Circuit Description

- The acceleration position (AP) sensor circuit provides a voltage signal relative to acceleration pedal angle.

  The acceleration pedal angle (AP1) will vary about 13 % at idle position to about 87 % at wide open throttle (WOT).

  This code detects that if the systm is in Forced Idle Mode. (Fail safe Mode)

Conditions for setting the DTC

- The Ignition is “ON”.
- Forced Idle Mode is active. (Fail safe Mode)

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1290 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1290 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the APP sensor 1, APP sensor 2, APP sensor 3 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1290 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC

P1290 Diagnostic Chart may isolate the cause of the fault.

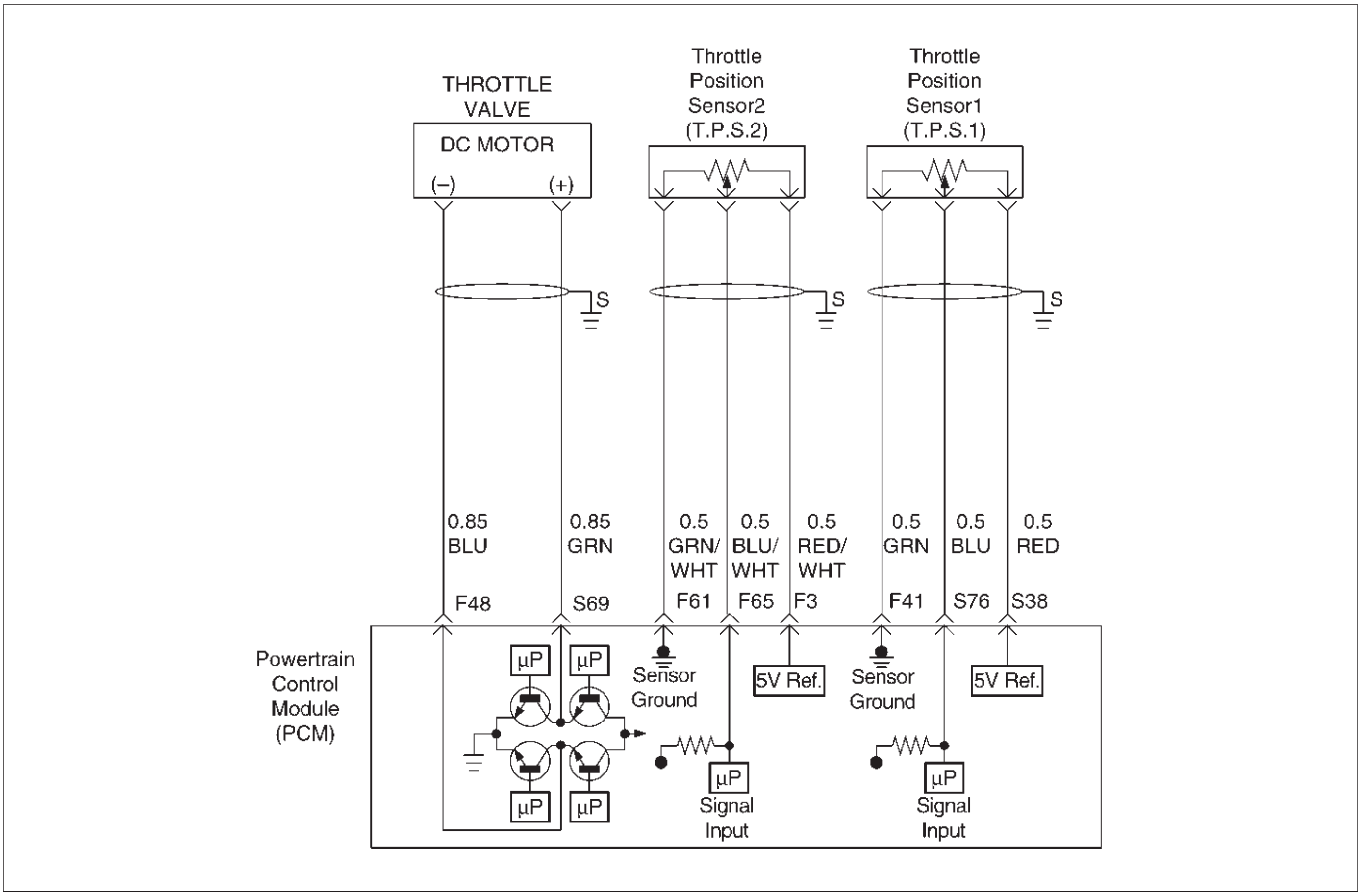
DTC P1290 - ETC Forced Idle Mode

Step	Action	Value(s)	Yes	No
1	Was the “On - Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the AP angle reading on the Tech2 while slowly opening the throttle. Does the AP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Idle position APP sensor 1 =12 ~ 14 % APP sensor 2, 3 =86 ~ 88 % Wide open throttle APP sensor 1 =86 ~ 88 % APP sensor 2 =12 ~ 14 % APP sensor 3 =32 ~ 36 %	Refer to *Diagnostic Aids*	Go to *Step 4*
4	1. Disconnect the AP sensor. 2. Observe the AP sensor reading on the Tech 2. Is the AP sensor reading near the specified value?	0V	Go to *Step 5*	Go to *Step 6*
5	1. Connect a test light between the 5 Voltge supply circuit and the AP1, AP2 and AP3 sensor signal circuit at the AP sensor harness connector. 2. Observe the AP sensor reading on the Tech2. Is the AP sensor reading near the specified value?	5V	Go to *Step 7*	Go to *Step 8*
6	Check the following items; 1. AP1,AP2 and AP3 signal circuit for a short to voltage. 2. AP1, AP2 and AP3 sensor ground circuit for high resistance between the PCM and the AP sensor. 3. AP1, AP2 and AP3 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
7	Check the following items; 1. AP1, AP2 and AP3 signal circuit or 5 volge supply circuit for a poor connection. 2. AP1, AP2 and AP3 signal circuit or 5 volge supply circuit for high resistance between the PCM and the AP1, AP2 and AP3 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*

DTC P1290 - ETC Forced Idle Mode (Cont'd)

Step	Action	Value(s)	Yes	No
8	Replace the AP sensor. Is the action complete?	—	Verify repair	—
9	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1295 Power Management Mode



D06RY00111

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary about 8 % at closed throttle to about 92 % at wide open throttle (WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain Control Module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations.

  A large quantitiy of air entering the engine indicates an accleration or high load situation, while a small quantity or air indicates deceleration or idle.

  The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load.
- This DTC ditects that if the systm is in PowerManagement Mode.(Fail safe Mode)

Conditions for setting the DTC

- The ignition is “ON”.
- Power Management Mode is active. (Fail safe Mode)

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1295 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1295 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken

locks, improperly formed or damaged terminals,and poor terminal to wire connection.

- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault.If DTC P1295 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P1295 Diagnostic Chart may isolate the cause of the fault.

DTC P1295 - Power Management Mode

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P1295. Does the Tech 2 indicate DTC P1295 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =8 ~ 10 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =90 ~ 92 %	Go to *Step 9*	Go to *Step 5*
5	1. Ignition "OFF." 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100 Ω	Go to *Step 6*	Go to *Step 8*
6	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the throttle valve assembly. Was a problem found?		Verify repair	Go to *Step 8*
8	Replace the DC motor. (Replace the Throttle valve assembly) Is the action complete?	—	Verify repair	Go to *Step 7*
9	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 10*	Go to *Step 11*

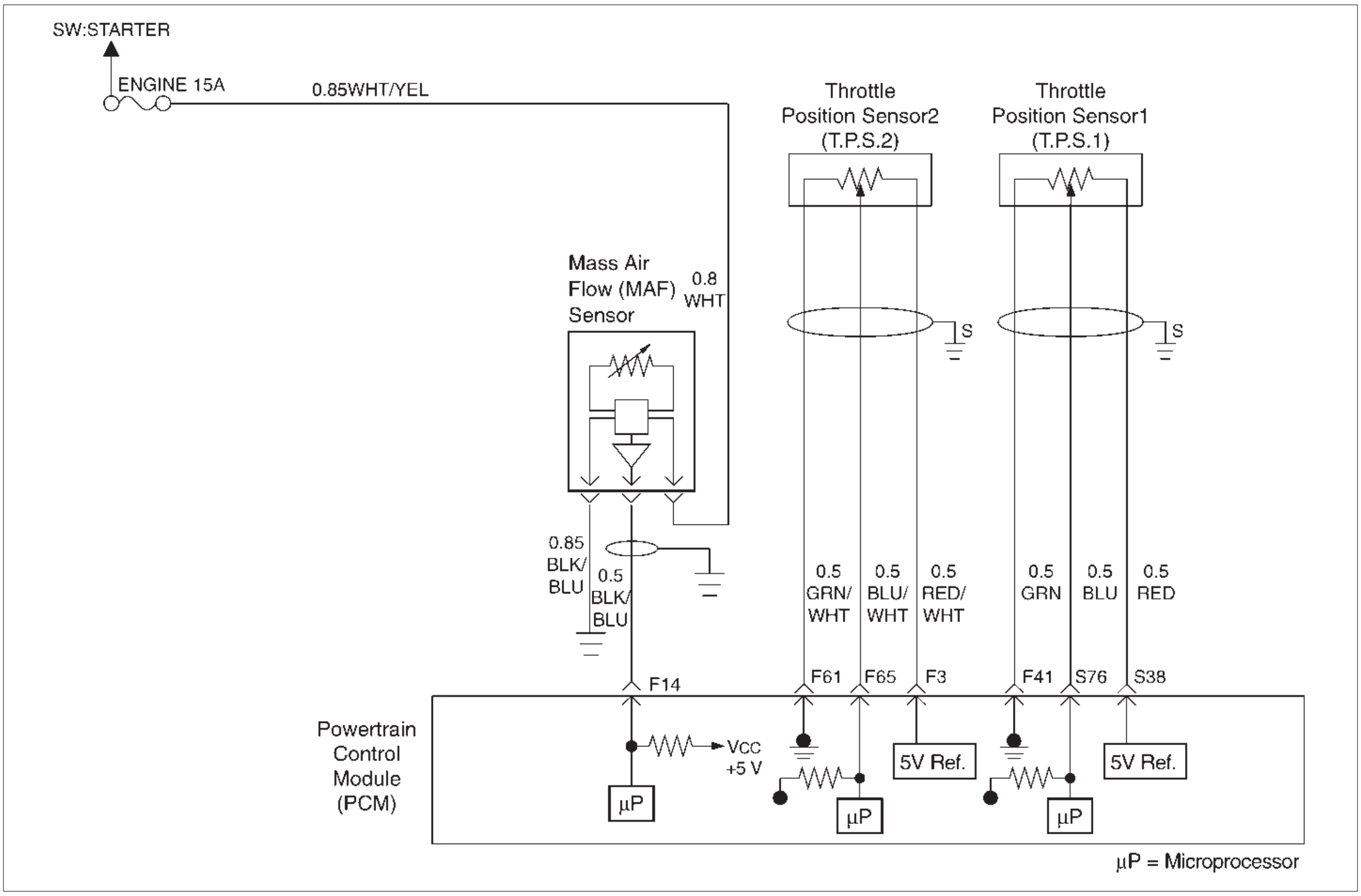
DTC P1295 - Power Management Mode (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Connect a test light between the 5Volt reference "A"circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 13*	Go to *Step 12*
11	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
12	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
13	Replace the TP sensor. Is the action complete?	—	Verify repair	—
14	1. Start the engine. 2. With the engine idling, monitor "MAF Frequency" display on the Tech 2. Is the "MAF Frequency" below the specified value?	6 ~ 10 g/s	Go to *Step 15*	Go to *Step 18*
15	1. Ignition "OFF." 2. Disconnect the MAF sensor connector. 3. Ignition "ON," engine idling. 4. Using a Tech 2, monitor "MAF Frequency." Does the Tech 2 indicate a "MAF Frequency" at the specified value?	0g/s	Go to *Step 16*	Go to *Step 17*
16	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 19*
17	1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors). 2. If incorrect routing is found, correct the harness routing. Was a problem found?	—	Verify repair	Go to *Step 17*
18	1. With the engine idling, monitor "MAF Frequency." display on the Tech 2. 2. Quickly snap open throttle to wide open throttle while under a road load and record value. Does the Tech 2 indicate a "MAF Frequency" at thespecified value?	6 ~ 10 g/s	Go to *Step 16*	Go to *Step 19*

DTC P1295 - Power Management Mode (Cont'd)

Step	Action	Value(s)	Yes	No
19	1. Ignition "ON",engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65kPa	Go to *Step 20*	Go to *Step 23*
20	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value? (If no, start with diagnosis chart forother sensors in the circuit and see if 5V returns.)	—	Go to *Step 22*	Go to *Step 21*
21	1. Check the MAP signal circuit between the PCM and MAP grund circuit. 2. If the MAP signal circuit is open or shoted, repair it as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 23*
22	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
23	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin.Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1299 ETC Forced Engine Shutdown Mode



D06RY00113

Circuit Description

- The throttle position sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary about 8% at closed throttle to about 92% at wide open throttle(WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain Control Module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations. A laege quantitiy of air entering the engine indicates an accleration or high load situation, while a small quantity or air indicates deceleration or idle.

  The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load.
- This DTC ditects if the system is in ECT Forced Engine Shutdown Mode.(Fail safe Mode)

Conditions for setting the DTC

- The ignition is “ON”.
- ECT Forced Engine Shutdown Mode is active. (Fail safe Mode)

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1299 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1299 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech 2 while

moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1299 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1299 Diagnostic Chart may isolate the cause of the fault.

DTC P1299 - ETC Forced Engine Shutdown Mode

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =8 ~ 10 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =90 ~ 92 %	Go to *Step 8*	Go to *Step 4*
4	1. Ignition “OFF.” 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100Ω	Go to *Step 5*	Go to *Step 7*
5	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
6	Check the throttle valve assembly. Was a problem found?		Verify repair	Go to *Step 7*
7	Replace the DC motor. (Replace the Throttle valve assembly) Is the action complete?	—	Verify repair	Go to *Step 8*
8	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 9*	Go to *Step 10*
9	1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. .Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 12*	Go to *Step 11*

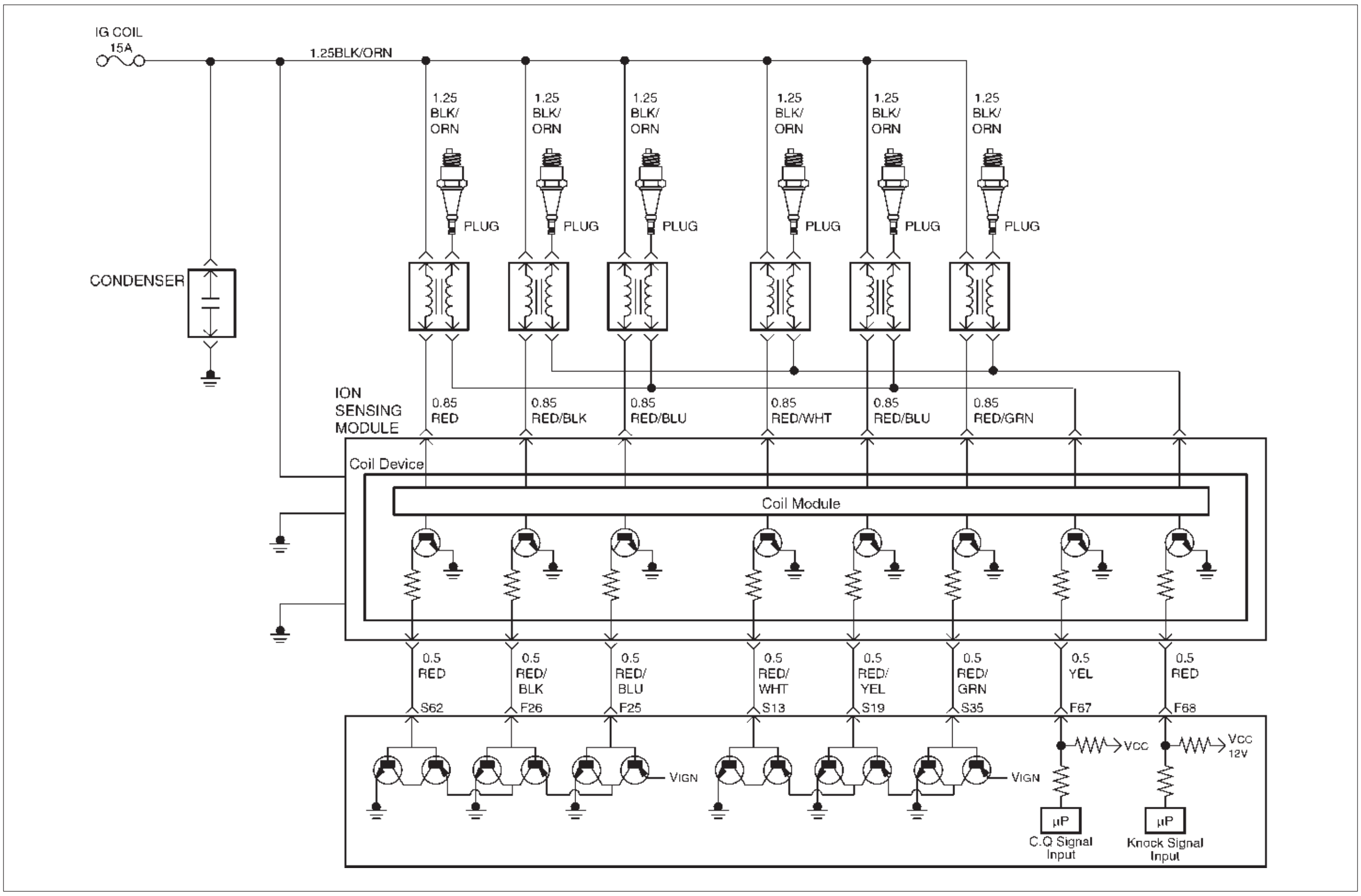
DTC P1299 - ETC Forced Engine Shutdown Mode (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
11	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
12	Replace the TP sensor. Is the action complete?	—	Verify repair	—
13	1. Start the engine. 2. With the engine idling, monitor "MAF Frequency" display on the Tech 2. Is the "MAF Frequency" below the specified value?	6 ~ 10 g/s	Go to *Step 16*	Go to *Step 17*
14	1. Ignition "OFF." 2. Disconnect the MAF sensor connector. 3. Ignition "ON," engine idling. 4. Using a Tech 2, monitor "MAF Frequency." Does the Tech 2 indicate a "MAF Frequency" at the specified value?	0g/s	Go to *Step 15*	Go to *Step 16*
15	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 18*
16	1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors). 2. If incorrect routing is found, correct the harness routing. Was a problem found?	—	Verify repair	Go to *Step 16*
17	1. With the engine idling, monitor "MAF Frequency." display on the Tech 2. 2. Quickly snap open throttle to wide open throttle while under a road load and record value. Does the Tech 2 indicate a "MAF Frequency" at the specified value?	6 ~ 10 g/s	Go to *Step 15*	Go to *Step 18*
18	1. Ignition "ON",engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65kPa	Go to *Step 19*	Go to *Step 22*

DTC P1299 - ETC Forced Engine Shutdown Mode (Cont'd)

Step	Action	Value(s)	Yes	No
19	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?(If no, start with diagnosis chart for other sensors in the circuit and see if 5Vreturns.)	—	Go to *Step 21*	Go to *Step 20*
20	1. Check the MAP signal circuit between the PCM and MAP ground circuit. 2. If the MAP signal circuit is open or shorted ,repair it as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 22*
21	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
22	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1310 ION Sensing Module Diagnosis



D06RY00067

Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine operating conditions.

- The Deceleration Fuel Cut Off (DFCO) test is performed to evaluate the Combustion Quality (CQ) signal pulse width if it is below a predetermined value, the value it is expected to be during DFCO conditions. If the CQ signal pilse width is above the predetermined threshold, the fail counter will be incremented. If the failure counter exceeds the calibration, then the test is conplete and a failure will be reported.
- The Power Enrichment (PE) test is performed to evaluate the Combustion Quality (CQ) signal pulse width if it is below a predetermined value, the value it is expected to be during PE conditions.

  If the CQ signal pulse width is above the predetermined threshold, the fail counter will be incremented. If the failure counter exceeds the calibration, then the test is complete and a failure will be reported.
- The Combustion Quality (CQ) test is performed to check if inappropriate (CQ) signal status were detected. If missing CQ pulses or multiple CQ pulses or CQ pulse width calculation errors were detected, the fail counter will be incremented. If the failure counter exceeds the calibration, then the test is complete and a failure will be reported.

Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- MAP sensor signal is between 26kPa and 100 kPa.
- Fuel level is more than 10%.
- Engine speed is between 650rpm and 6500rpm.
- No Crank DTCs set.
- No System voltage DTCs set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1310 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1310 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1310 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1310 Diagnostic Chart may isolate the cause of the fault.

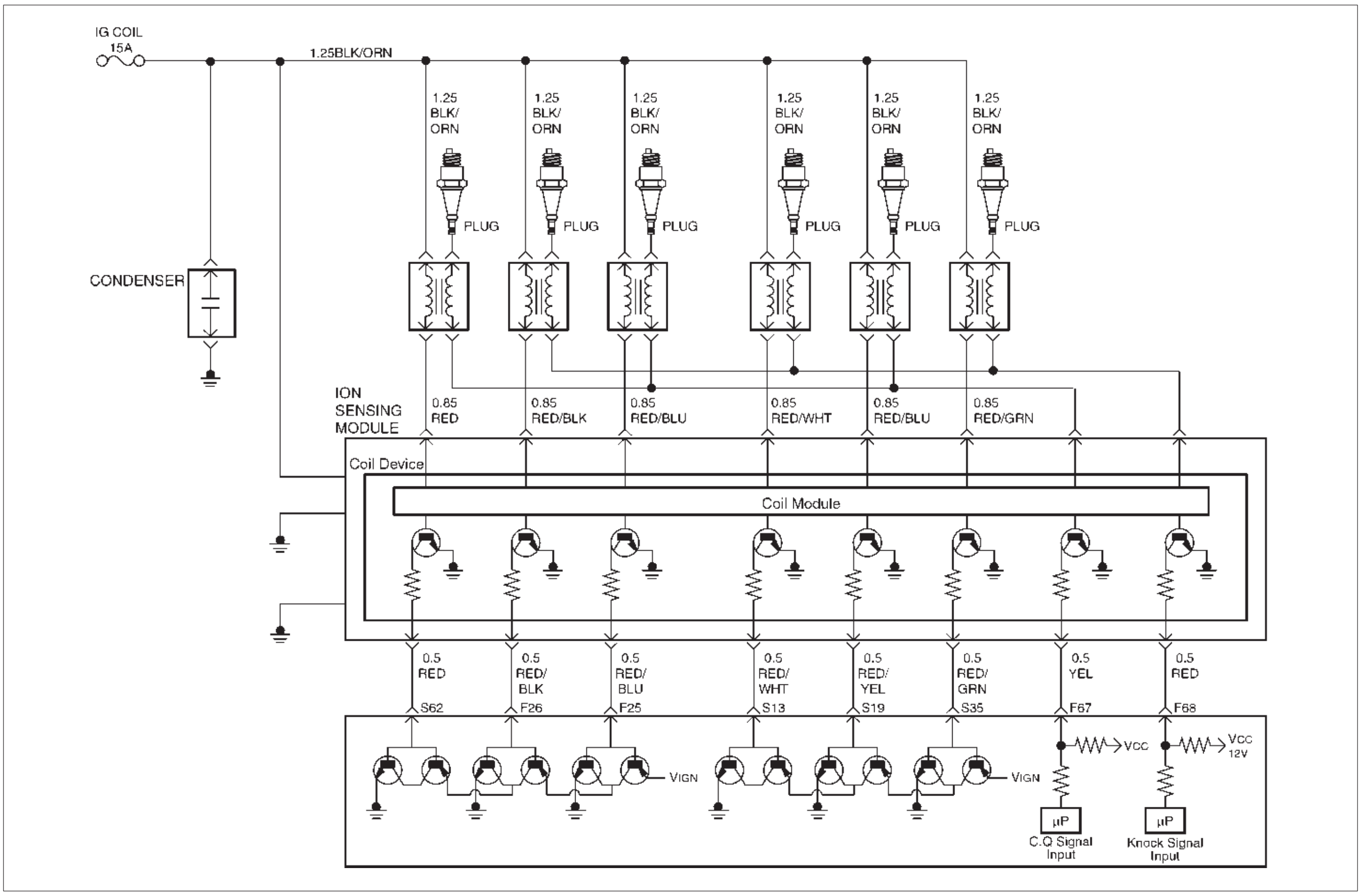
DTC P1310 - ION Sensing Module Diagnostic

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P1310. Does the Tech 2 indicate DTC P1310 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition “OFF.” 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing harness between the PCM and ION Sensing module circuit harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing harness between the ignition coil and ION Sensing module circuit at the ION Sensing Module harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*

DTC P1310 - ION Sensing Module Diagnostic (Cont'd)

Step	Action	Value(s)	Yes	No
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 10*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1311 ION Sensing Module SEC line 1 Circuit Fault



D06RY00067

Circuit Description

- The Power Control Module (PCM) will compara the secondary current reading to a predetermined maximum and minimum thresholds.

  If the secondary current signal pulse width is out of the predetermined renge, the fail counter will be incremented. If the failure counter exceeds the calibration, then the PCM is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the PCM is complete and pass will be reported.

  This PCM will detect an open/short circuit in the secondary current sense input circuit, misfire on the entire bank for the secondary current sense input circuit, coil failure, and same internal Ignition Current Sense System (ICSS) module faults.

Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- MAP sensor signal is between 26kPa and 100 kPa.
- Fuel level is more than 10%.
- Engine speed is between 650rpm and 6500rpm.
- ION Sensing Module circuit is open or shorted signals on the SEC 1 line.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1311 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1311 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.
- A change in the display will indicate the location of the fault. If DTC P1311 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.
- If it is determined that the DTC occurs intermittently, performing the DTC P1311 Diagnostic Chart may isolate the cause of the fault.

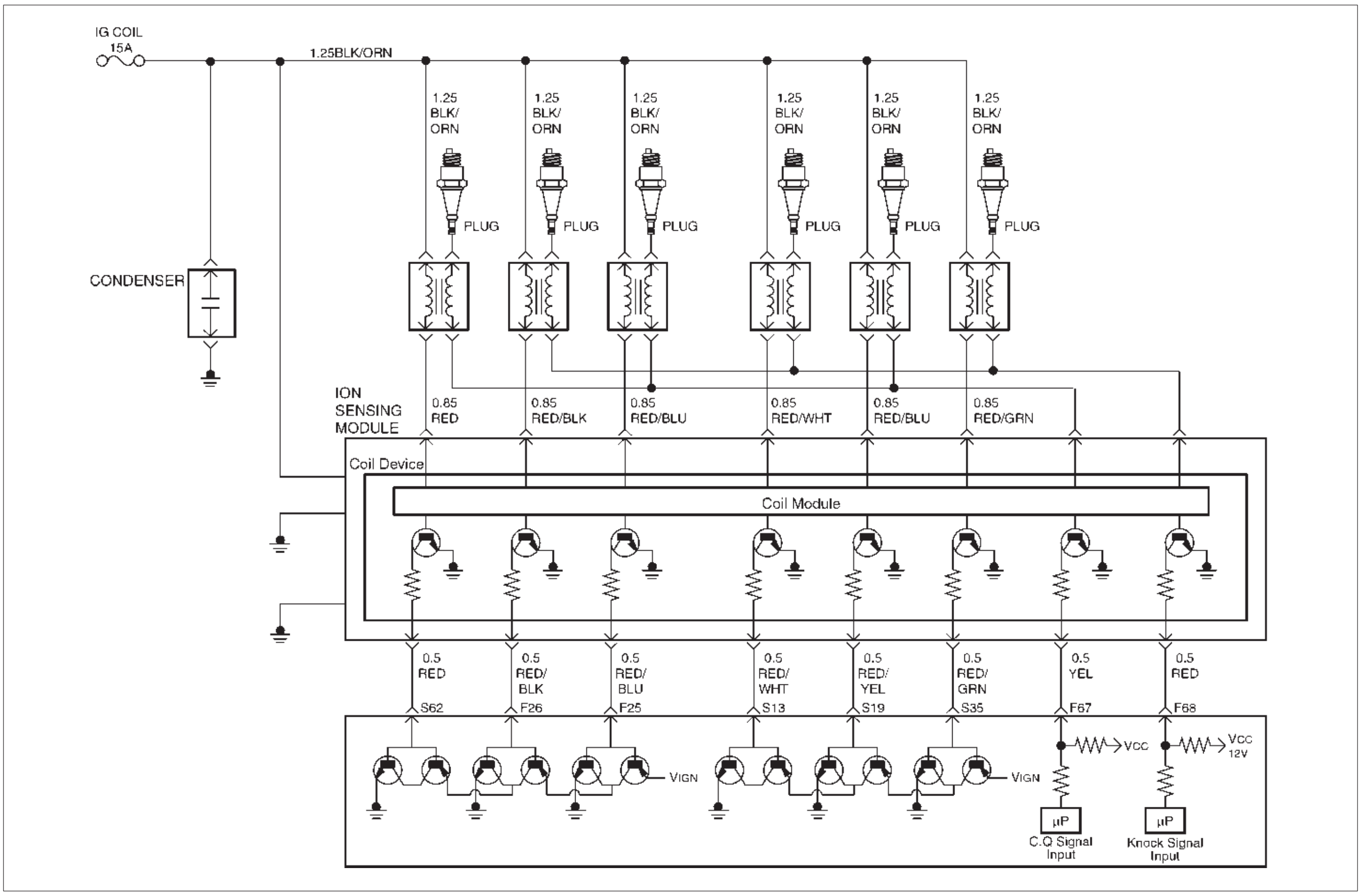
DTC P1311 - ION Sensing Module SEC line 1 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P1311. Does the Tech 2 indicate DTC P1311 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition “OFF.” 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing module harness between the PCM and ION Sensing module circuit at the ION Sensing module harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing module harness between the ignition coil and ION Sensing module circuit at the SEC line 1 harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*

DTC P1311 - ION Sensing Module SEC line 1 Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 10*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1312 ION Sensing Module SEC line 2 Circuit Fault



D06RY00067

Circuit Description

- The Power Control Module (PCM) will compara the secondary current reading to a predetermined maximum and minimum thresholds.

  If the secondary current signal pulse width is out of the predetermined renge, the fail counter will be incremented. If the failure counter exceeds the calibration, then the PCM is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the PCM is complete and pass will be reported.

  This PCM will detect an open/short circuit in the secondary current sense input circuit, misfire on the entire bank for the secondary current sense input circuit, coil failure, and same internal Ignition Current Sense System (ICSS) module faults.

Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- MAP sensor signal is between 26kPa and 100 kPa.
- Fuel level is more than 10%.
- Engine speed is between 650rpm and 6500rpm.
- ION Sensing Module circuit is open or shorted signals on the SEC 2 line.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1312 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1312 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1312 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1312 Diagnostic Chart may isolate the cause of the fault.

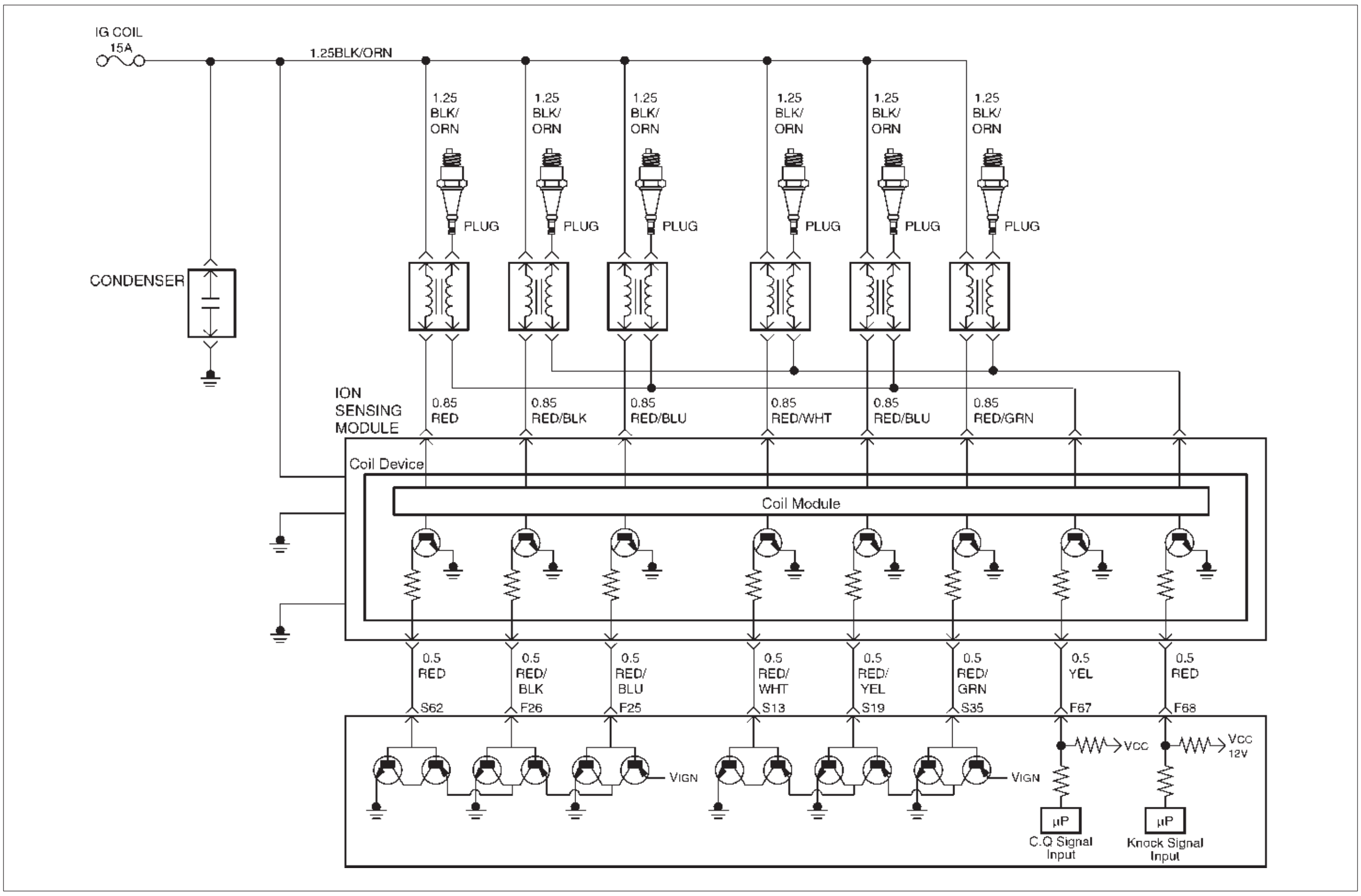
DTC P1312 - ION Sensing Module SEC line 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P1312. Does the Tech 2 indicate DTC P1312 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition "OFF." 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing module harness between the PCM and ICSS module circuit at the ION Sensing Module harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing module harness between the ignition coil and ION Sensing module circuit at the SEC line 2 harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*

DTC P1312 - ION Sensing Module SEC line 2 Circuit Fault (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 10*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1326 ION Sensing Module Combustion Quality Input Circuit Fault



D06RY00067

Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine operating conditions.

- The test is performed to evauate the Combustion Quality (CQ) signal pulse width if it is within a predetermined range. If the CQ signal puls width is out of the predetermined range, the fail counter will be incremented. If the failure counter exceeds the calibration, then test is complete and a failure will be reported. If the sample counter threshold is reached before the failure threshold, then the test is complete and a pass will be reported. This test will detect an open/short in the QC line circuit, ION Sensing module faults and analog input faults in the PCM.

Conditions for setting the DTC

- Ignition voltage is between 10volt and 16 volts.
- No Cramk DTCs set.
- No cylinder ID DTCs set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1326 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1326 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connections.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1326 cannot be duplicated, the information included in the Failure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1326 Diagnostic Chart may isolate the cause of the fault.

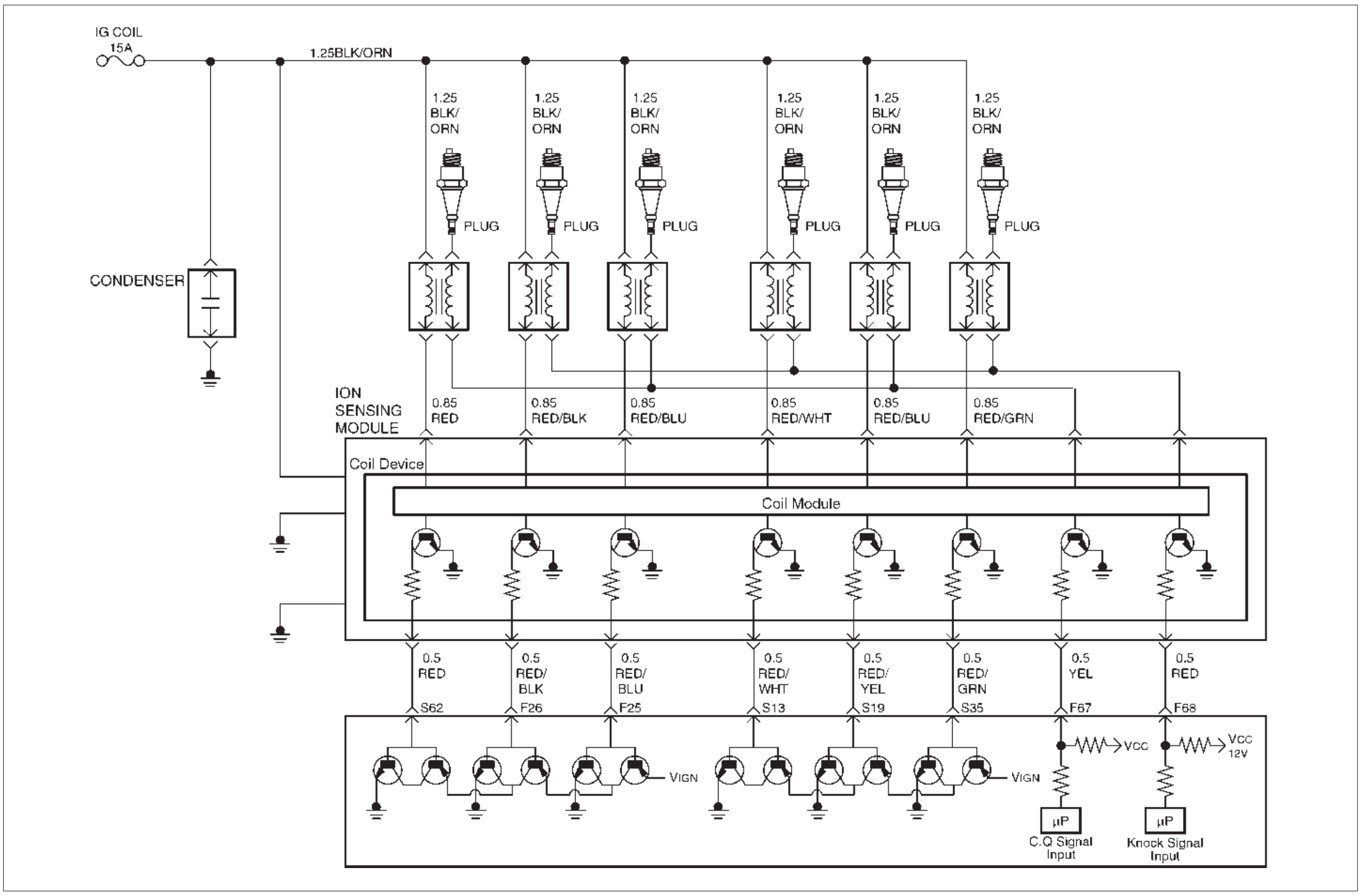
DTC P1326 - ION Sensing Module Combustion

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC”info for DTC P1326. Does the Tech 2 indicate DTC P1326 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Ignition “OFF.” 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing module harness between the PCM and ION Sensing module circuit at the QC line harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing module harness between the ignition coil and ICSS module circuit at the ION Sensing Module harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*

DTC P1326 - ION Sensing Module Combustion (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 10*
11	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin .Check to see if the latest software is released or not. And then Down Load the LATEST PROGRMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC)
P1340 ION Sensing Module Cylinder ID Fault (Cylinder Synchronization Fail)



D06RY00067

Circuit Description

The Power Control Module (PCM) checks the validity of the signals used in the ION Sensing module at the following engine opreating conditions.

- This test will return a fault if the cylinder synchronization routine has not been completed after a predetermined number of events after crank. This test will detect fault that will prevent the PCM from synchronaization, such as Knock Signal (KI) - Combustion Quality (CQ) lines being swapped, shorted spark plugs, ION Sensing module faults, an PCM hardware faults.

Conditions for setting the DTC

- Ignition voltage is between 11volt and 16 volts.
- Engine speed is between 650rpm and 6500rpm.
- No ECT DTCs set.
- No injector DTCs set.
- No Fuel Trim DTCs set.
- No Misfire DTCs set.
- No system voltage DTCs set.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1340 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1340 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals,and poor terminal to wire connection.
- Damaged harness–Inspect the wiring harness for damage. If the harness appears to be OK, observe the moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1340 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1340 Diagnostic Chart may isolate the cause of the fault.

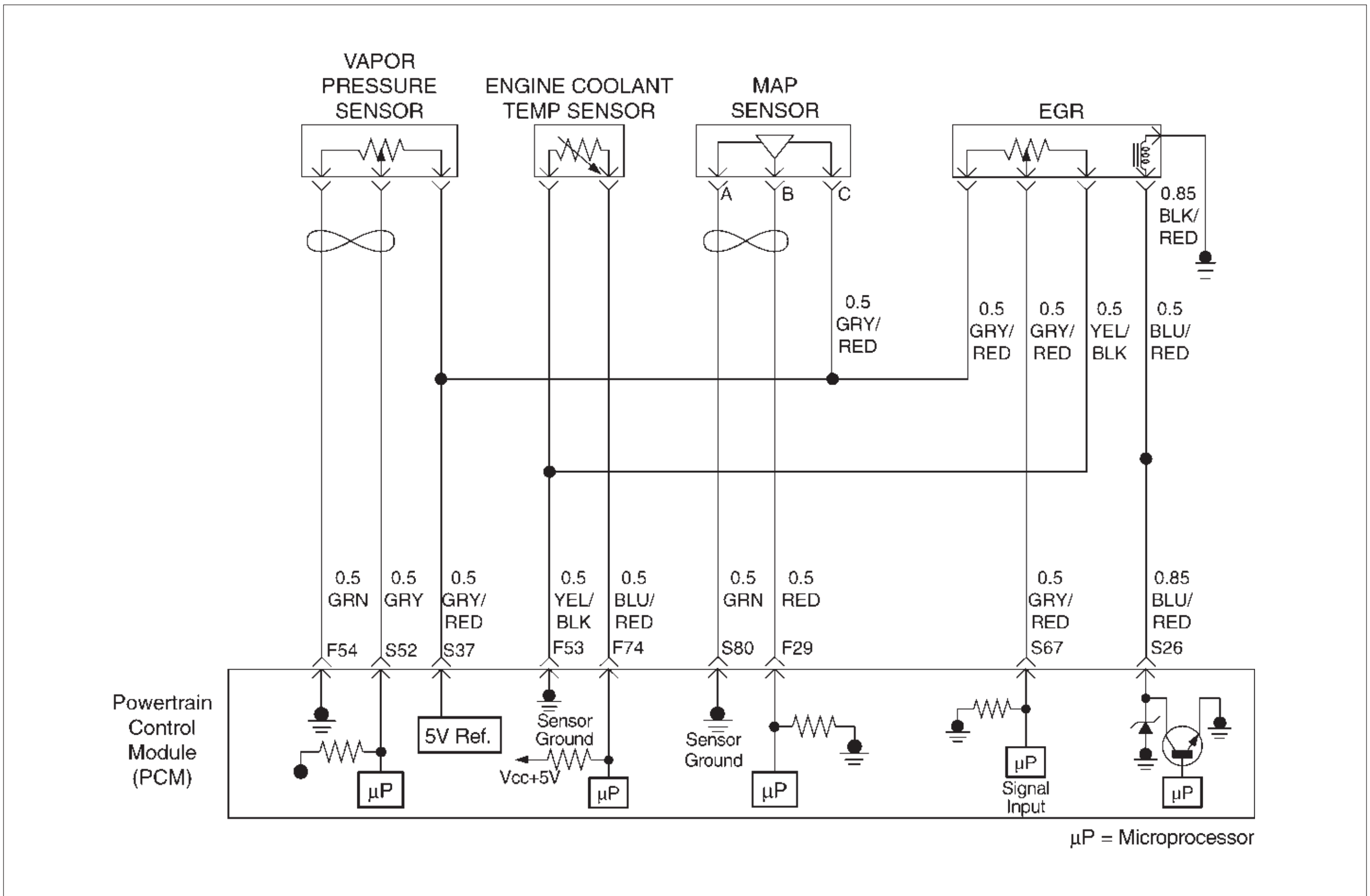
DTC P1340 - ION Sensing Module Cylinder ID Fault (Cylinder Synchronization Fail)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “ DTC” info for DTC P1340. Does the Tech 2 indicate DTC P1340 failed thisignition?	—	Go to *Step 3*	Refer to *DiagnosticAids*
3	1. Ignition “OFF.” 2. Disconnect the ION Sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 4*	Go to *Step 3*
4	Check the ION Sensing module harness between the PCM and ICSS module circuit at the QC line harness connector. Was a problem found?	—	Verify repair	Go to *Step 6*
5	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 6*	Go to *Step 5*
6	Check the ION Sensing module harness between the ignition coil and ION Sensing module circuit at the ION Sensing Module harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 9*
9	Check the following items; 1. ION Sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 11*

DTC P1340 - ION Sensing Module Cylinder ID Fault (Cylinder Synchronization Fail) (Cont'd)

Step	Action	Value(s)	Yes	No
10	Replace the ION Sensing module. Is the action complete?	—	Verify repair	Go to *Step 10*
11	Replace the PCM. **IMPORTANT:** IMPORTANT; The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin.Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1404 EGR Stuck Closed



D06RY00145

Circuit Description

The powertrain control module (PCM) monitors the EGR valve pintle position input to ensure that the valve responds properly to commands from the PCM, and to detect a fault if current pintle zero position is different from the learned zero position. If the PCM detects a pintle position signal indicates more than 30 % different between current zero position and the learned zero position for more than 5 seconds, and this condition exists 3 times during trip, then the PCM will set DTC P1404.

Conditions for Setting the DTC

- Ignition voltage is between 11 and 16 volts.
- Intake Air temp is more than 3°C.
- Desired EGR position is 0.
- Difference of EGR pintle position between current and the learned zero is more than 30 % for more than 5 seconds, and exists three time to the above condition during a trip the PCM will set DTC 1404. Then it trigger the PCM lights on.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after consecutive 2nd trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1404 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1404 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Excessive carbon deposit on EGR valve shaft and/or foreign material may cause the EGR valve not to fully seated. The carbon deposit may occur by unusual port operation. Remove foreign material and/or excessive carbon deposit on EGR valve shaft and may allow the EGR valve to be fully seated.
- Poor connection or damaged harness – Inspect the wiring harness for damage.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

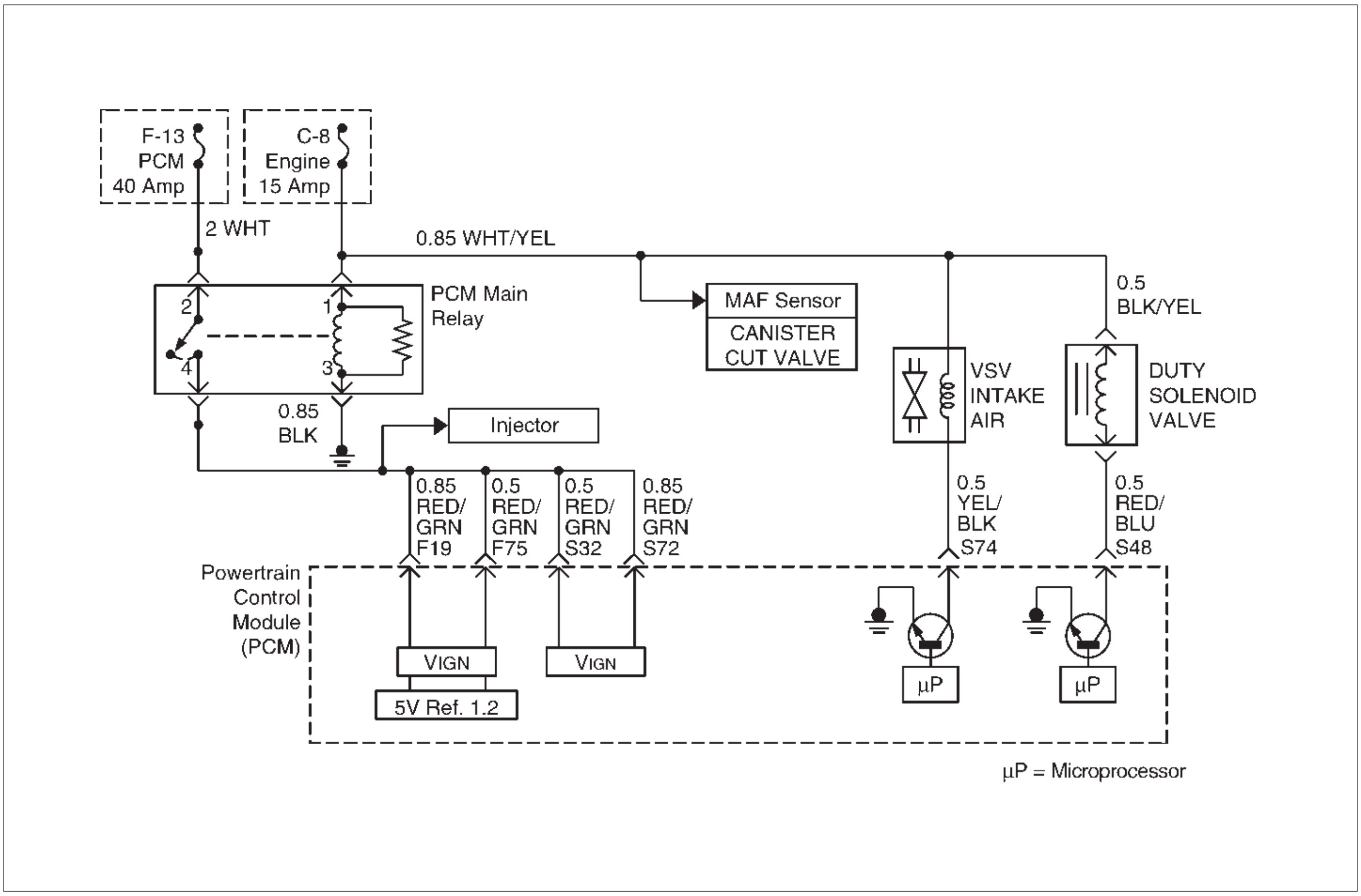
DTC P1404 – EGR Stuck Closed

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON,” engine “OFF”, review and record Tech 2 Failure Records Data. 2. Operate the vehicle within Failure Records conditions as noted. 3. Using a Tech 2, monitor “DTC inf. for DTC P1404 until the DTC P1404 test runs. Note the result. Does the Tech 2 indicates DTC P1404 failed this ignition?	—	Go to *Step 3*	Refer to *Diagnostic Aids*
3	1. Disconnect the EGR valve harness connector. 2. Inspect the EGR valve and connectors for damaged pin or terminals. Were there any damaged pins or terminals?	—	Go to *Step 4*	Go to *Step 5*
4	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
5	1. Remove EGR valve from Engine. 2. Inspect EGR valve for any excessive carbon deposit on EGR shaft. 3. Inspect for any foreign material inside of EGR valve. Was excessive carbon deposit on EGR valve shaft and/or foreign material in EGR valve ?	—	Go to *Step 6*	Go to *Step 7*
6	1. Clean up EGR valve shaft and inside of EGR valve. 2. Remove foreign material from EGR valve. 3. Visually inspect damage of pintle and seat to see if it is bent. If damaged leakage may occur. Was there any severe damage which affects function?	—	Go to *Step 8*	Verify repair Go to *Step 7*
7	1. Install the EGR valve. 2. Ignition “OFF”. 3. Install the Tech 2. 4. Run the engine at idle. 5. On the Tech 2, select EGR Control Test. 6. Use the “UP” arrow to increase the EGR from 0% to 40%. Did EGR work properly?	—	—	Go to *Step 8*
8	1. Reset the learned zero EGR valve position. 2. Repeat step 7. Did EGR work properly?	—	Verify repair	Go to *Step 9*

DTC P1404 – EGR Stuck Closed (Cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the EGR valve. Does DTC P1404 still fail "DTC" test on the Tech 2?	—	Go to *Step 10*	Verify repair
10	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1441 EVAP System Flow During Non-Purge



Circuit Description

Canister purge is controlled by a solenoid valve that allows manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge "ON"). The EVAP purge solenoid control is pulse-width modulated (PWM) or turned "ON" and "OFF" several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met.

The EVAP purge vacuum switch is a normally closed switch positioned in the purge line between the canister and to EVAP purge solenoid. The EVAP purge vacuum switch will open when vacuum increases to greater than 5 inches of water in the purge line. The PCM monitors the EVAP purge vacuum switch signal to determine if the evaporative emission control system is working properly. If the switch is open (purge flow detected) when the PCM is not commanding the EVAP purge solenoid "ON," DTC P1441 will be set.

Conditions for Setting the DTC

- No active ECT sensor, IAT sensor, MAP sensor, vacuum switch, or TP sensor DTCs set.
- BARO reading is above 85 kPa.
- Engine coolant temperature is below 70°C (158°F).
- Start-up intake air temperature (IAT) and start-up engine coolant temperature (ECT) are both above 5°C (41°F).
- The difference between start-up ECT and start-up IAT is less than 25°C (45°F).
- TP sensor indicates a throttle position above 12%.
- Battery voltage is between 11.5 volts and 16 volts.
- Engine speed is between 800 and 6,000 RPM.
- Canister purge duty cycle is below 3%.
- Canister purge vacuum switch is open, which results in the PCM signal voltage (from the vacuum switch input) being approximately 12 volts.
- All conditions are present for at least 3 seconds.

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) after the second consecutive trip in which the fault is detected.
- The PCM will store conditions which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1441 will clear after 40 consecutive warm–up cycles have occurred without a fault.

- DTC P1441 can be cleared by using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wring harness for damage. If the harness appears to be OK, observe the EVAP vacuum switch display on the Tech 2 while moving connectors and wiring harnesses related to the sensor. A change in the display will indicate the location of the fault.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

2. The canister purge vacuum switch is normally closed when no vacuum (purge) is present. With the ignition “ON” and the engine “OFF,” there shouldn’t be any vacuum (purge) present in the EVAP system.
3. Determines if the PCM is able to control the EVAP purge solenoid valve.
4. Determines if the DTC will set under the conditions present when the DTC was originally stored. If not, the fault is intermittent.
5. Checks for a grounded EVAP purge solenoid driver circuit, a faulty EVAP vacuum switch, or a leaking EVAP purge solenoid valve.

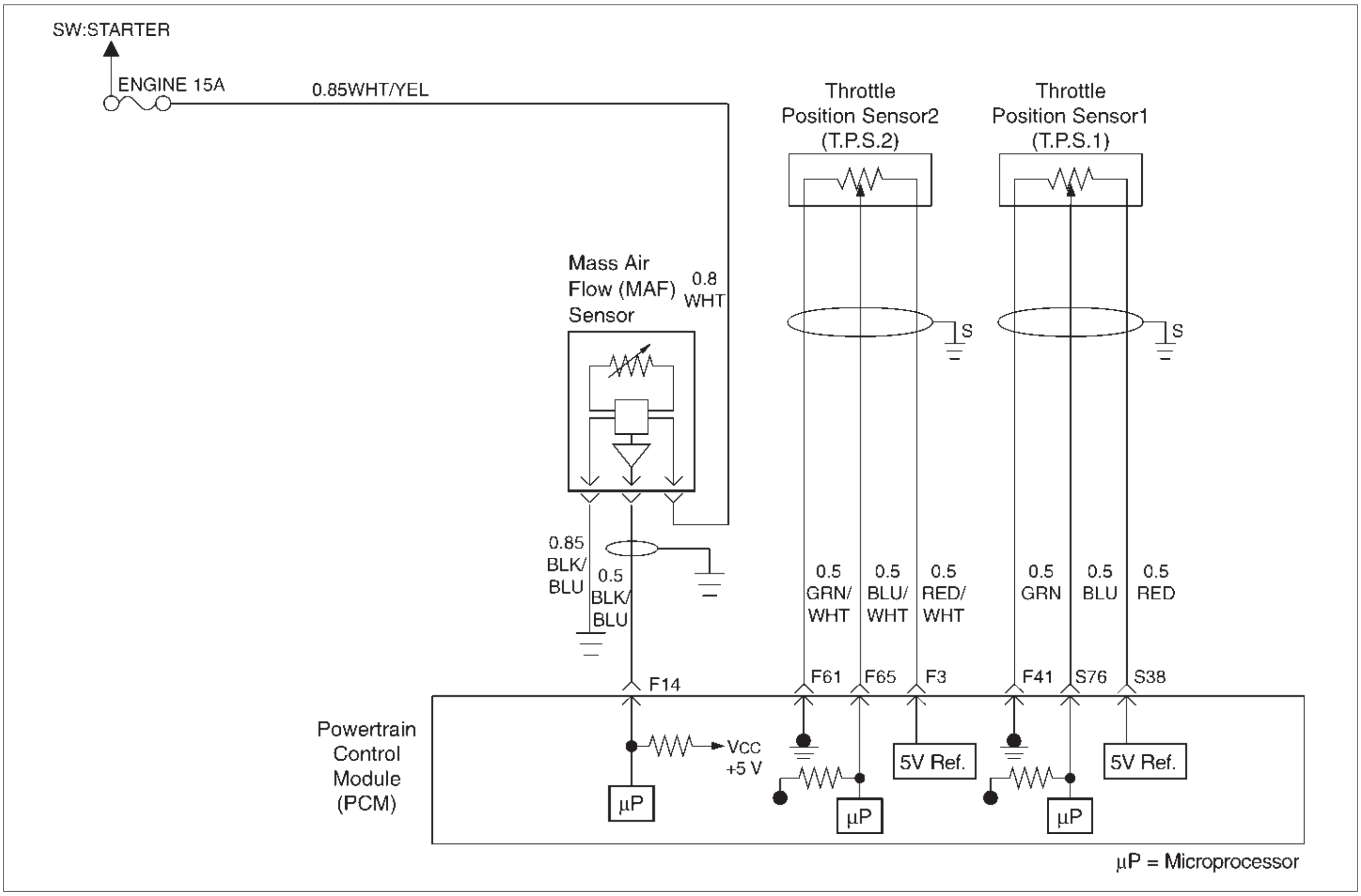
DTC P1441 – EVAP System Flow During Non-Purge

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “OFF.” 2. Remove the fuel filler cap. 3. Ignition “ON.” 4. Observe “Fuel Tank Pressure” on the Tech 2. Is “Fuel Tank Pressure” at the specified value?	1.51V	Go to *Step 3*	Go to *DTC P0452 or P0453*
3	1. Re-install the fuel filler cap. 2. Using the Tech 2, command the EVAP Vent Solenoid Valve “ON” (Closed). 3. Disconnect the canister side rubber hose end that hose is connected between the Purge Solenoid Valve and Canister. **IMPORTANT:** Before continuing with the diagnosis, zero the EVAP pressure/purge cart J41413 (refer to the tool operating instructions). And them monitor the fuel tank inner pressure using the Tech 2. Does the fuel tank pressure remain the specified value?	1.52 - 1.60V	Go to *Step 4*	Go to *Step 6*
4	1. Disconnect the EVAP pressure/purge cart J41413, and then plug the hose end. 2. Disconnect the rubber hose end of engine vacuum source side, (the hose connected between Purge Solenoid Valve and engine). 3. Connect the vacuum hand pump to this rubber hose end. 4. Then apply the -15 in H2O vacuum by the vacuum pump. 5. Monitor the fuel tank inner pressure using the Tech 2. Does the fuel tank inner pressure hold the specified value?	1.47 - 1.51V	Go to *Step 6*	Go to *Step 5*

DTC P1441 – EVAP System Flow During Non-Purge (Cont'd)

Step	Action	Value(s)	Yes	No
5	Replace the Purge Solenoid Valve.	—	Verify Repair	—
6	1. Check leaks, kinks or pinched hoses at the EVAP system rubber hose line, and also check if the rubber hoses are correctly connected or not. 2. Check for a leak from Vent Solenoid Valve and EVAP system rubber hoses, and also check for clogged Filter of air separator which is located near the vent solenoid valve. Was a problem found? Using the Vacuum Hose Routing Diagram, repair or re-connect the rubber hoses correctly.	—	Verify Repair	Go to *Step 7*
7	1. Start engine. 2. Remove the Fuel Filler cap. 3. Using the Tech 2, command the EVAP Vent Solenoid Valve “ON” (closed) and Purge Solenoid Valve “OFF” (0%). 4. Replace the Fuel Filler Cap. 5. Run the engine at 2500RPM constant while monitoring “Fuel Tank Vacuum” on the Tech 2. Does the fuel tank vacuum remain at the specified value while the EVAP Vent Solenoid Valve “ON” (closed) and Purge Solenoid Valve “OFF” (0%)?	30 - 40 %	Verify Repair	Go to *Diagnostic Aids*

Diagnostic Trouble Code (DTC) P1514 TPS - MAF Correlation Error



D06RY00113

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle blade angle.

  The throttle blade angle will vary about 8 % at closed throttle to about 92 % at wide open throttle (WOT).
- The mass air flow (MAF) sensor measures the amount of air which passes through it into the engine during a given time. The powertrain Control Module (PCM) uses the mass air flow information to monitor engine operating conditions for fuel delivery calculations.

  A large quantitiy of air entering the engine indicates an accleration or high load situation, while a small quantity or air indicates deceleration or idle.

  The MAF sensor produces a frequency signal which can be monitored using a Tech 2. The frequency will vary within a range of around 4 to 7g/s at idle to around 25 to 40g/s at maximum engine load.

Conditions for setting the DTC

- The engine is running.
- No MAF sensor DTCs are set.
- Throttle actuation mode is not off.
- MAF reading-ETC estimated air flow is less than 40g/s for 250 failres within test 1000 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1514 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1514 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM - Inspect harness connectors for backed out terminals, improper mating,broken

locks, improperly formed or damaged terminals,and poor terminal to wire connection.

- Damaged harness - Inspect the wiring harness for damage. If the harness appears to be OK, observe the Mass Air Flow, TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.
- Plugged intake air duct or filter element
- A wide - open throttle acceleration from a stop should cause the mass air flow displayed on a Tech 2 to increase from about 3 – 6 g/s at idle to 100 g/s or greater at the time of the 1 – 2 shift. If not, check for a restriction.

A change in the display will indicate the location of the fault. If DTC P1514 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1514 Diagnostic Chart may isolate the cause of the fault.

DTC P1514 - TPS-MAF Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition “ON,” engine “OFF.” 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor “DTC” info for DTC P1514. Does the Tech 2 indicate DTC P1514 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	1. Start the engine. 2. With the engine idling, monitor “MAF Frequency” display on the Tech 2. Is the “MAF Frequency” below the specified value?	6 ~ 10 g/s	Go to *Step 5*	Go to *Step 8*
5	1. Ignition “OFF.” 2. Disconnect the MAF sensor connector. 3. Ignition “ON,” engine idling. 4. Using a Tech 2, monitor “MAF Frequency.” Does the Tech 2 indicate a “MAF Frequency” at the specified value?	0g/s	Go to *Step 6*	Go to *Step 7*
6	Replace the MAF sensor. Is the action complete?	—	Verify repair	Go to *Step 9*
7	1. Check the MAF harness for incorrect routing near high voltage components (solenoids, relays, motors). 2. If incorrect routing is found, correct the harness routing. Was a problem found?	—	Verify repair	Go to *Step 7*
8	1. With the engine idling, monitor “MAF Frequency.” display on the Tech 2. 2. Quickly snap open throttle to wide open throttle while under a road load and record value. Does the Tech 2 indicate a “MAF Frequency” at thespecified value?	6 ~ 10 g/s	Go to *Step 6*	Go to *Step 9*

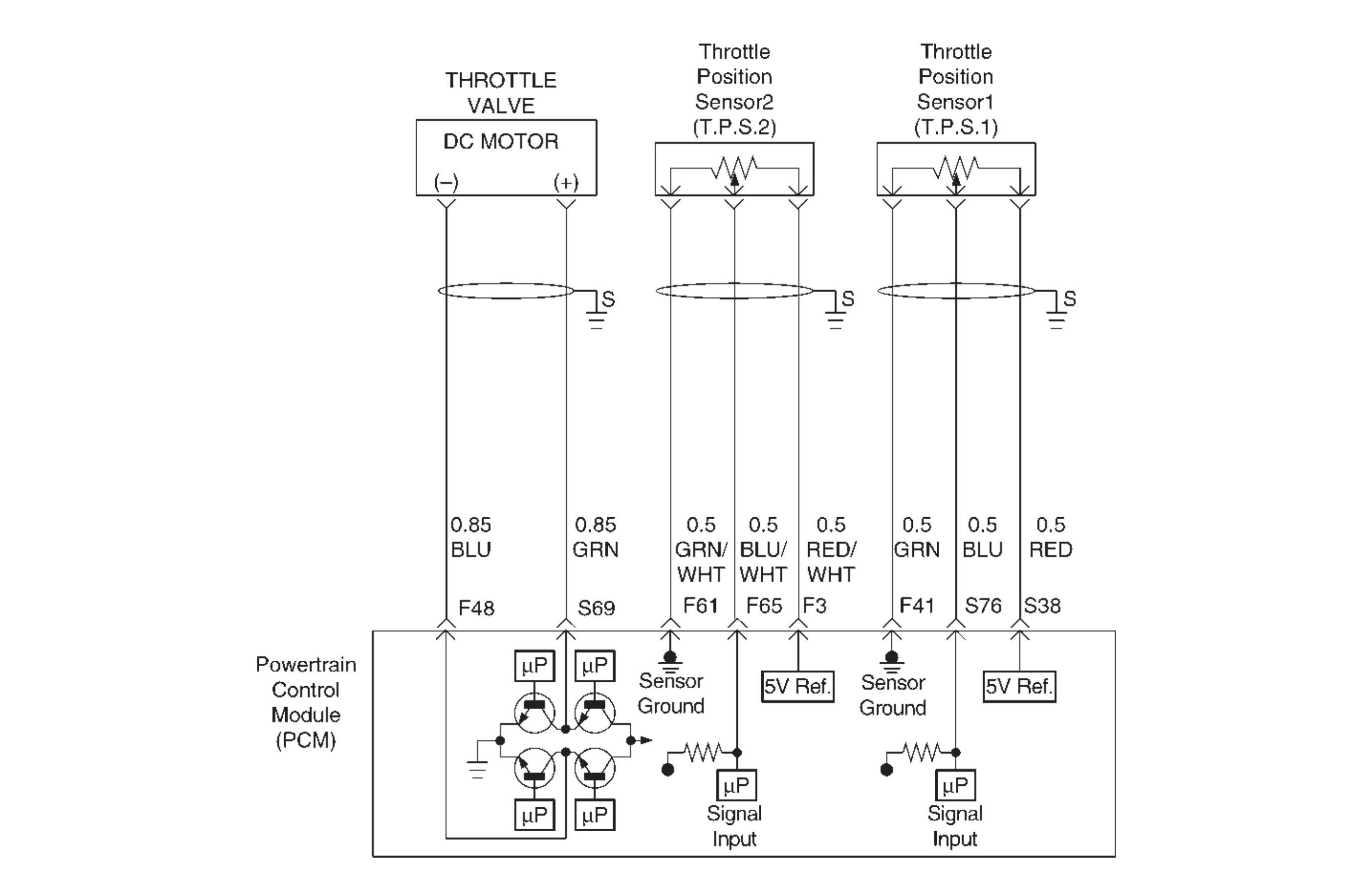
DTC P1514 - TPS-MAF Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Ignition"ON", engine not running. 2. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value?	65kPa	Go to *Step 10*	Go to *Step 13*
10	1. Disconnect the MAP sensor. 2. Connect a test 5 volt reference circuit and the MAP signal at the MAP sensor harness connector. 3. Observe the MAP reading on the Tech 2. Is the MAP reading less than the specified value? (If no, start with diagnosis chart for other sensors in the circuit and see if 5Vreturns.)	—	Go to *Step 12*	Go to *Step 11*
11	1. Check the MAP signal circuit between the PCM and MAP ground circuit. 2. If the MAP signal circuit is open or shoted, repair it as necessary. Was the MAP signal circuit open or shorted?	—	Verify repair	Go to *Step 13*
12	Replace the MAP sensor. Is the action complete?	—	Verify repair	—
13	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =8 ~ 10 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =90 ~ 92 %	Refer to *Diagnostic Aids*	Go to *Step 14*
14	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	0V	Go to *Step 15*	Go to *Step 16*
15	1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	5V	Go to *Step 18*	Go to *Step 17*
16	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1 and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 19*

DTC P1514 - TPS-MAF Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
17	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	Replace the TP sensor. Is the action complete?	—	Verify repair	—
19	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin.Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1515 Command - Actual TPS Correlation Error



D06RY00111

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary about 8 % at closed throttle to about 92 % at wide open throttle(WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- This DTC ditects the difference between actual throttle position and command throttle position.

Conditions for setting the DTC

- The ignition is “ON”.
- Throttle actuation mode is normal.
- Command Throttle position - Actual Throttle position is more than + 5 % for 100 counts within test 1000 test samples (15.6 m sec) else Actual Throttle position is less than + 40 % and Command Throttle position - Actual Throttle position is more than - 5 % or Command Throttle position - Actual Throttle position is more than - 20 % for 150 failres within test 1000 test samples (15.6 m sec).

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1515 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1515 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, mproper mating, locks, improperly formed or damaged terminals, and poor terminal to wire connection.

- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1515 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P1515 Diagnostic Chart may isolate the cause of the fault.

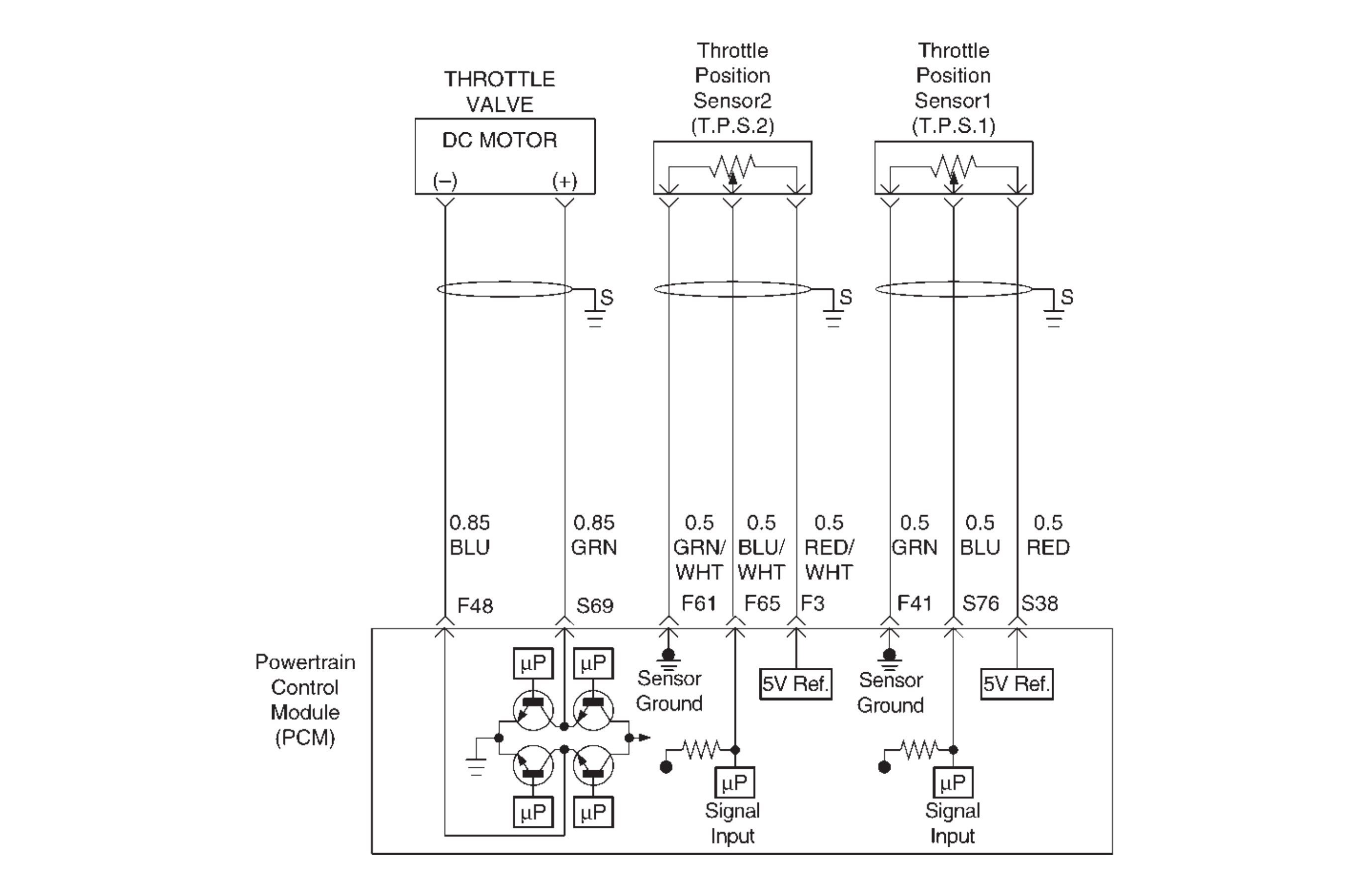
DTC P1515 - Command - Actual TPS Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor " DTC" info for DTC P1515. Does the Tech 2 indicate DTC P1515 failed thisignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =8 ~ 10 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =90 ~ 92 %	Go to *Step 8*	Go to *Step 5*
5	1. Ignition "OFF." 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100 Ω	Go to *Step 6*	Go to *Step 7*
6	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 8*
7	Replace the DC motor. Is the action complete?	—	Verify repair	Go to *Step 6*
8	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 9*	Go to *Step 10*
9	1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	5V	Go to *Step 12*	Go to *Step 11*

DTC P1515 - Command - Actual TPS Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found,repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
11	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
12	Replace the TP sensor. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1516 Command - Actual TPS Correlation Error



D06RY00111

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle). The throttle blade angle will vary about 8% at closed throttle to about 92 % at wide open throttle (WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- This DTC detects the dufference between actual throttle position and command throttle position in steady state.

Conditions for setting the DTC

- The ignition is “ON”.
- Throttle Actuation mode is normal.
- Command Throttle position-Actual Throttle positionis less than 8 % when desird TPS is sutudy wihtin 0.5 %for 30 second within test samples (30 second)

Action Taken When the DTC Sets

- The PCM will illuminate the malfunction indicator lamp (MIL) the first time the fault is detected.
- The PCM calculates an air flow value based on idle air control valve position, throttle position, RPM and barometric pressure.
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1516 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1516 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness - Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech2 while moving connectors and wiring harnesses related to the sensor.

A change in the display will indicate the location of the fault. If DTC P1516 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

If it is determined that the DTC occurs intermittently, performing the DTC P1516 Diagnostic Chart may isolate the cause of the fault.

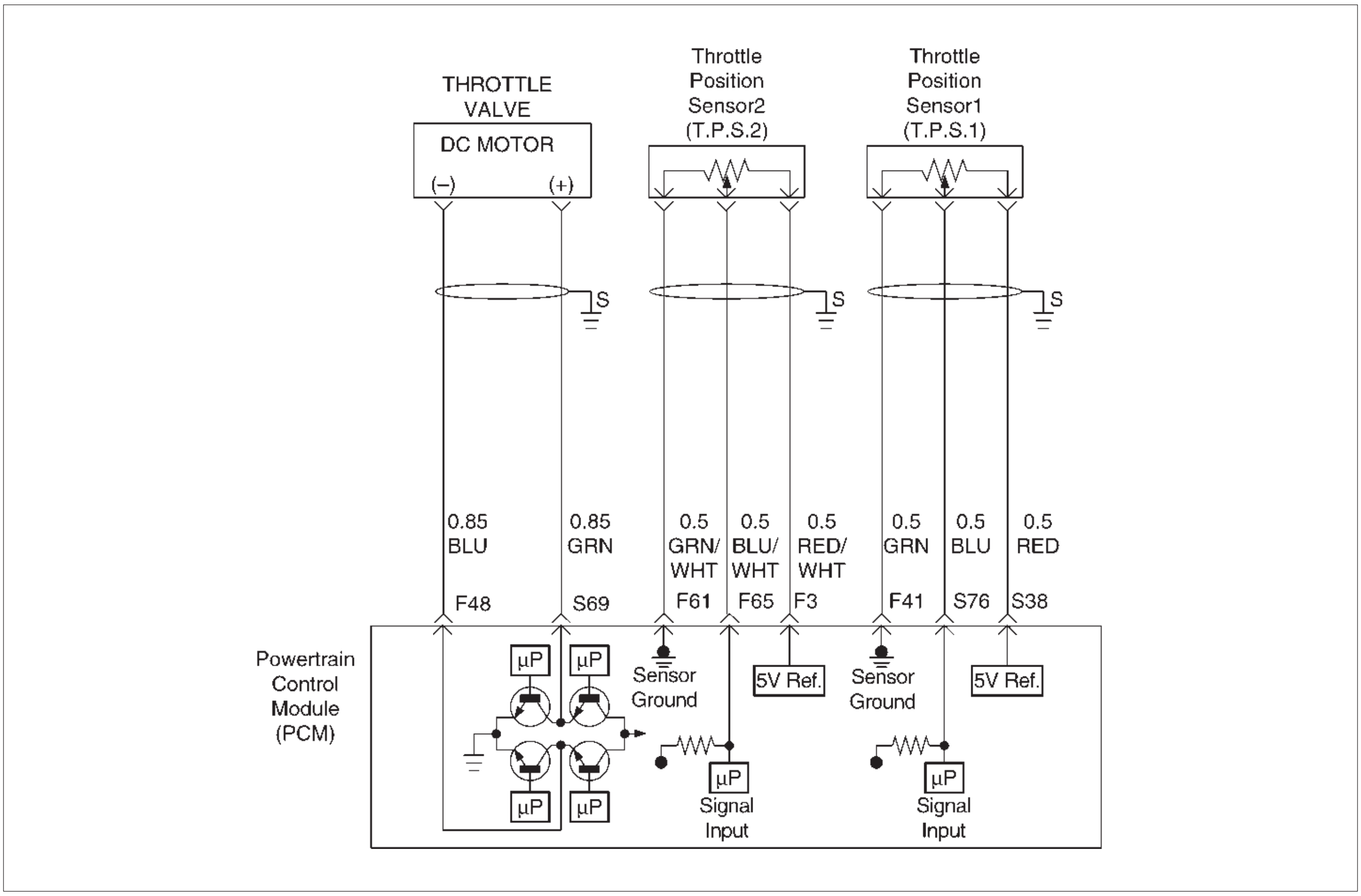
DTC P1516 - Command - Actual TPS Correlation Error

Step	Action	Value(s)	Yes	No
1	Was the "On-Board (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Ignition "ON," engine "OFF." 2. Review and record Tech 2 Failure Records data. 3. Operate the vehicle within Failure Records conditions as noted. 4. Using a Tech 2, monitor "DTC" info for DTC P1516. Does the Tech 2 indicate DTC P1516 failed this ignition?	—	Go to *Step 4*	Refer to *Diagnostic Aids*
4	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =8 ~ 10 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =90 ~ 92 %	Go to *Step 8*	Go to *Step 5*
5	1. Ignition "OFF." 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100 Ω	Go to *Step 6*	Go to *Step 7*
6	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 8*
7	Replace the DC motor. Is the action complete?	—	Verify repair	Go to *Step 6*
8	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech2. Is the TP sensor reading near the specified value?	0V	Go to *Step 9*	Go to *Step 10*
9	1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 12*	Go to *Step 11*

DTC P1516 - Command - Actual TPS Correlation Error (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
11	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1 and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
12	Replace the TP sensor. Is the action complete?	—	Verify repair	—
13	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1523 Actuator Control Return Performance



D06RY00111

Circuit Description

- The throttle position (TP) sensor circuit provides a voltage signal relative to throttle position (blade angle).

  The throttle blade angle will vary about 8 % at closed throttle to about 92 % at wide open throttle(WOT).
- The DC motor circuit provides a voltage signal relative to command throttle position (blade angle).
- This DTC ditects if the throttle return to the default position at key on, steady state.

Conditions for setting the DTC

- The ignition is “ON”.
- Normalized TPS is less than 0 % but Normalized TPS is more than 25 %.

Action Taken When the DTC Sets

- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1523 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1523 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Aids

An intermittent may be caused by the following:

- Poor connectons.
- Mis routed harness.
- Rubbed through wire insulation.
- Broken wire inside the insulation.

Check for the following conditions:

- Poor connection at PCM-Inspect harness connectors for backed out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal to wire connection.
- Damaged harness-Inspect the wiring harness for damage. If the harness appears to be OK, observe the TP sensor 1, TP sensor 2 display on the Tech 2 while moving connectors and wiring harnesses related to the sensor.

  A change in the display will indicate the location of the fault. If DTC P1523 cannot be duplicated, the information included in the Faillure Records data can be useful in determined vehicle mileage since the DTC was last set.

  If it is determined that the DTC occurs intermittently, performing the DTC P1523 Diagnostic Chart may isolate the cause of the fault.

DTC P1523 - Actuator Control Return Performance

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	Observe the TP angle reading on the Tech 2 while slowly opening the throttle. Does the TP angle increase steadily and evenly from the closed throttle value to the wide open throttle value?	Closed throttle TP sensor 1 =8 ~ 10 % TP sensor 2 =8 ~ 10 % Wide open throttle TP sensor 1 =90 ~ 92 % TP sensor 2 =90 ~ 92 %	Go to *Step 7*	Go to *Step 4*
4	1. Ignition “OFF.” 2. Disconnect the DC motor. Is the DC motor reading near the specified value?	0.3 ~ 100 Ω	Go to *Step 5*	Go to *Step 6*
5	Check the DC motor harness between the PCM and DC Motor circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 7*
6	Replace the DC motor. Is the action complete?	—	Verify repair	Go to *Step 5*
7	1. Disconnect the TP sensor. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	0V	Go to *Step 8*	Go to *Step 9*
8	1. Connect a test light between the 5Volt reference circuit and the TP1 and TP2 sensor signal circuit at the TP sensor harness connector. 2. Observe the TP sensor reading on the Tech 2. Is the TP sensor reading near the specified value?	5V	Go to *Step 11*	Go to *Step 10*
9	Check the following items; 1. TP1 and TP2 signal circuit for a short to voltage. 2. TP1 and TP2 sensor ground circuit for high resistance between the PCM and the TP sensor. 3. TP1and TP2 sensor ground circuit for a poor connection. 4. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*

DTC P1523 - Actuator Control Return Performance (Cont'd)

Step	Action	Value(s)	Yes	No
10	Check the following items; 1. TP1and TP2 signal circuit or 5 volt reference circuit for a poor connection. 2. TP1 and TP2 signal circuit or 5 volt reference circuit for high resistance between the PCM and the TP1and TP2 sensor. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
11	Replace the TP sensor. Is the action complete?	—	Verify repair	—
12	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1625 PCM Unexpected Reset

Circuit Description

The powertrain control module (PCM) monitors unexpected PCM reset. This will not turn on MIL light on, only records code DTC P1625.

Conditions for Setting the DTC

- Clock or COP (Computer Operating Properly) reset.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1625 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1625 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

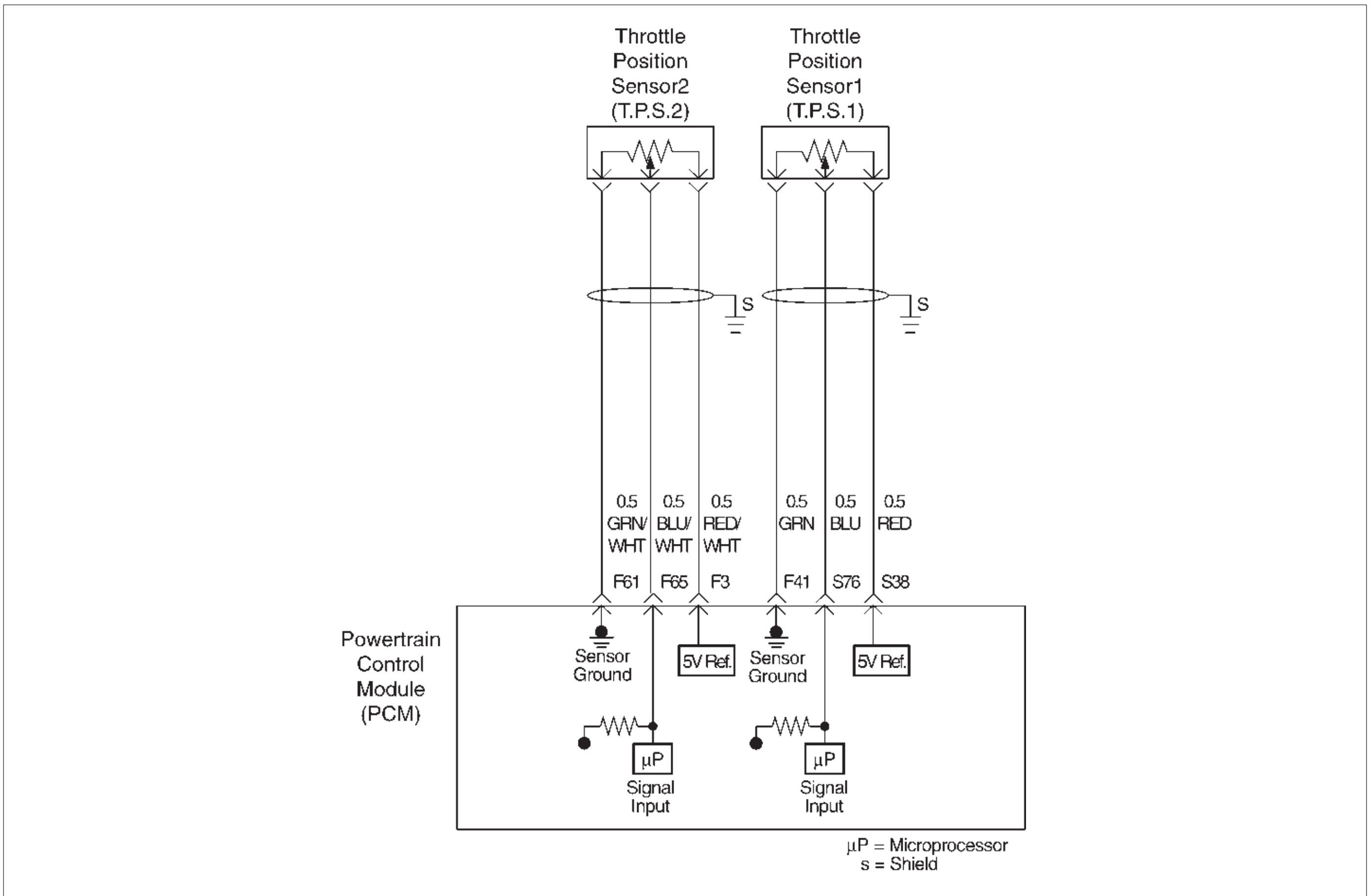
Check for the following conditions:

- P1625 alone stored does not need diagnosis. Clear DTC code.

DTC P1625 – PCM Unexpected Reset

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to Step 2	Go to *OBD System Check*
2	1. Ignition is "ON". 2. Install the Tech 2. 3. Start the engine at let it Idle. 4. On the Tech 2, select "DTC info". Does the Tech 2 indicate DTC P1625 failed?	—	Go to *Step 3*	Go to *Diagnostic Aids*
3	1. Ignition is "ON". 2. Clear DTC P1625 by using the Tech 2 "Clear Info". 3. Start the engine at let it Idle. 4. On the Tech 2, select "DTC info". Does the Tech 2 indicate DTC P1625 failed?	—	Go to *Step 4*	Go to *Diagnostic Aids*
4	1. Check for aftermarket electronics, such as transceiver, stereos, and anti theft devices. They may radiate EMI into the control system if they are improperly installed. (This may cause a false sensor reading and turn on the MIL.) 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1635 Reference Voltage # 1 Circuit Fault



D06RY00093

Circuit Description

The TP sensor # 1 shares a 5 Volt reference with the PCM.

If the PCM detects the 5 Volt reference for the TP sensor # 1 is failure, DTCP1635 will be set.

Conditions for setting the DTC

- The ignition is “ON”.
- The 5 Volt reference voltage for the TP sensor # 1 is less than 4 volts.
- The 5 Volt reference voltage for the TP sensor # 1 is more than 5 volts.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL) .
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

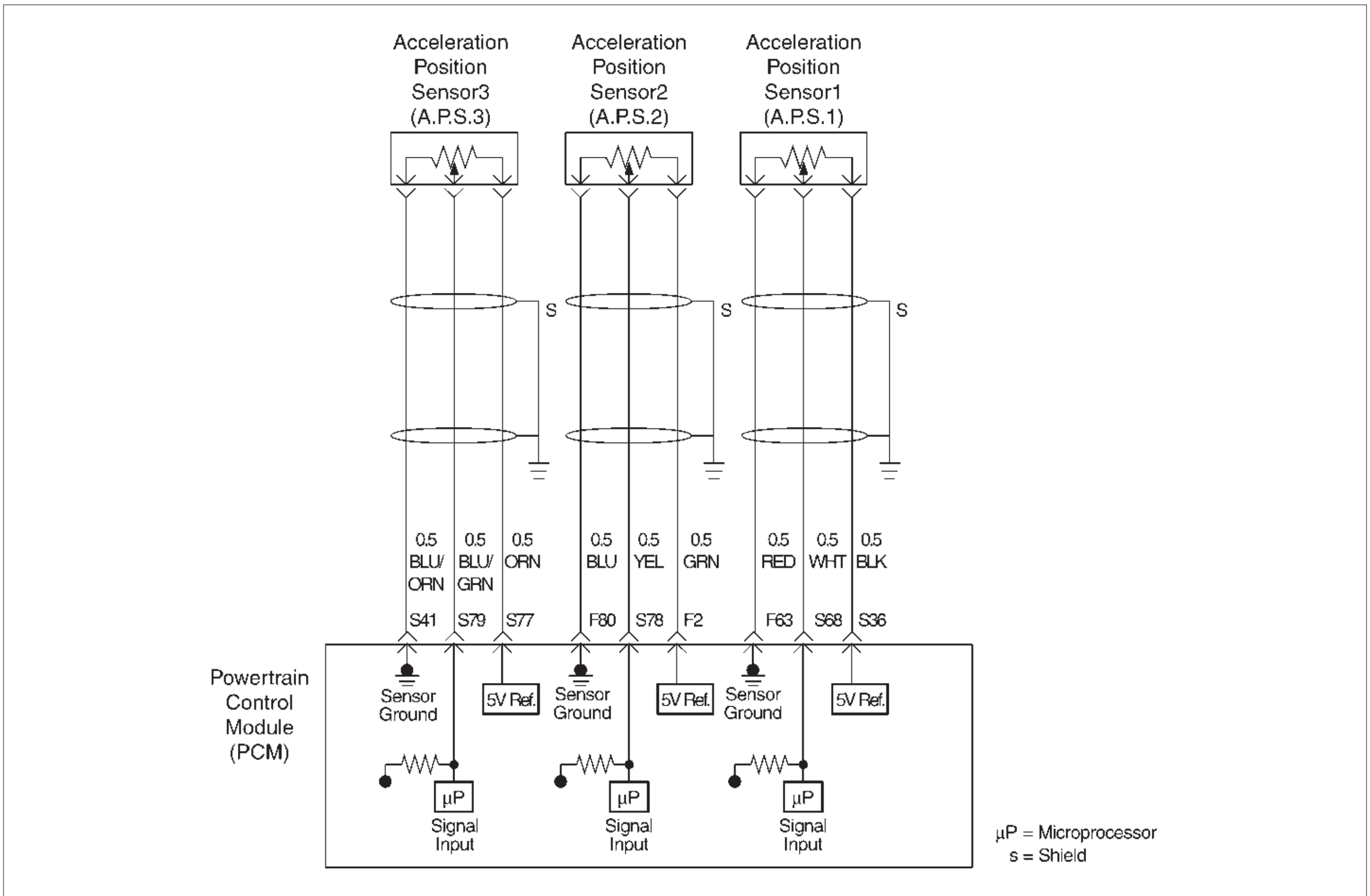
Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1635will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1635 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed. Tech2 “ Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Trouble Code (DTC) P1635 Reference Voltage # 1 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board(OBD)System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the votage at terminal S38 (RED) pin. Is the voltage in specified range?	4.95 – 5.0V	Go to *ETC System Check*	Go to *Step 3*
3	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the votage at terminal F20 (RED/WHT) pin. Is the voltage in specified range?	11.6 – 12.7V	Go to *Step 4*	Go to *Step 5*
4	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the votage at terminal F57 (RED/WHT) pin. Is the voltage in specified range?	11.6 – 12.7V	Go to *Step 6*	Go to *Step 5*
5	Observe the battery voltage and circuit. If the probrem found, repair it as necessary. Was the probrem found?	—	Verify repair	Go to *Step 6*
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin. Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1639 Reference Voltage # 2 Circuit Fault



D06RY00075

Circuit Description

The AP sensor # 1shares a 5Volt reference with the PCM. If the PCM detects the 5 Volt reference for the AP sensor # 1 is failure, DTC P1635 will be set.

Conditions for setting the DTC

- The ignition is “ON”.
- The 5 Volt reference voltage for the AP sensor # 1 is less than 4 volts.
- The 5 Volt reference voltage for the AP sensor # 1 is more than 5 volts.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store condition which were present when the DTC was set as Freeze Frame and in the Failure Records data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL “OFF” on the third consecutive trip cycle during which the diagnostic has been run and the fault condtion is no longer present.
- A history DTC P1639 will clear after 40 cosecutive trip cycle during which the warm up cycles have occurred without a fault.
- DTC P1639 can be cleared using the Tech 2 “Clear Info” function or by disconnecting the PCM battery feed. Tech 2 “Clear Info” function or by disconnecting the PCM battery feed.

Diagnostic Trouble Code (DTC) P1639 Reference Voltage # 2 Circuit Fault

Step	Action	Value(s)	Yes	No
1	Was the “On-Board (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the votage at terminal S36 (BLK) pin. Is the voltage in specified range?	4.95 – 5.0V	Go to *ETC System Check*	Go to *Step 3*
3	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the votage at terminal F20(RED/WHT) pin. Is the voltage in specified range?	11.6 – 12.7V	Go to *Step 4*	Go to *Step 5*
4	1. Ignition “ON”, engine not running. 2. Using a DVM at the PCM side of the connector, check the votage at terminal F57 (RED/WHT) pin. Is the voltage in specified range?	11.6 – 12.7V	Go to *Step 6*	Go to *Step 5*
5	Observe the battery voltage and circuit. If the probrem found, repair it as necessary. Was the probrem found?	—	Verify repair	Go to *Step 6*
6	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *ON-Vehicle Service in Power Control Module and Sensors for procedures.* And also refer to latest Service Bulletin.Check to see if the latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replasement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1640 Driver-1-Output Circuit Fault (ODM)

Circuit Description

Output driver modules (ODMs) are used by the powertrain control module (PCM) to turn "ON" many of the current-driven devices that are needed to control various engine and transmission functions. Each ODM is capable of controlling up to 7 separate outputs by applying ground to the device which the PCM is commanding "ON."

Unlike the Quad Driver Modules (QDMs) used in prior model years, ODMs have the capability of diagnosing each output circuit individually. DTC P1640 set indicates an improper voltage level has been detected on an ODM output.

Since A/C is an option, No A/C will cause the air conditioning clutch relay output to always fail. If a fault is seen on the air conditioning clutch relay output, it will not be logged as a fault until the A/C request input interrupts a high voltage, indicating that A/C has been installed.

Conditions for Setting the DTC

- Ignition "ON."
- Engine running.
- No DTC 1618.
- Ignition voltage is above 13.2 volts for 4 seconds.
- Output voltage does not equal ignition voltage when output is "OFF" or output voltage is not less than 1 volt when output is "ON."
- Above conditions occur for at least 1 second.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- A history DTC P1640 will clear after 40 consecutive warm-up cycles occur without a fault.
- DTC P1640 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage, If the harness appears to be OK, disconnect the PCM, turn the ignition "ON" and observe a voltmeter connected to the suspect driver circuit at the PCM harness connector while moving connectors and wiring harnesses relates to the MIL. A change in voltage will indicate the location of the fault.
- Poor connection at component – Examine for damaged connectors, unplugged connector, or damaged terminals at the following locations: Instrument cluster harness, canister purge solenoid, A/C clutch relay. An open ignition feed circuit at any of these components will cause DTC P1640 to be set.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

4. The Tech 2 Driver Module Status indicates the PCM pin that is affected.

9. The Tech 2 may indicate "short circuit" even when the problem is an open circuit. The cause of an open circuit may be in the component itself-lamp, purge, solenoid, or A/C compressor relay.

11. A short to ground on the ignition side of the component will blow the fuse. Since the fuse was checked in Step 2, a short to ground would be between the affected component and the PCM.

DTC P1640 – Driver-1-Output Circuit Fault (ODM)

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Check the fuse for the driver circuit that was shown as faulty. Was the fuse blown?	—	Go to *Step 3*	Go to *Step 4*
3	1. Check for a short to ground between the fuse and the affected component. 2. Replace the fuse after making any necessary repairs. Is the action complete?	—	Verify repair	—
4	Disconnect the PCM connector for the affected driver circuit. Is there any damage to the PCM pin or connector?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
6	Were either of the lamp circuits for “Check Engine” or “Check Trans.” indicated as faulty by the Tech 2?	—	Go to *Step 7*	Go to *Step 13*
7	1. Leave the PCM connector for the lamp driver circuit disconnected. 2. Ignition “ON.” 3. Using a DVM, check the voltage at the PCM connector for the affected lamp driver circuit. Was the voltage equal to the specified value?	B+	Go to *Step 15*	Go to *Step 8*
8	1. Ignition “ON.” 2. Check for battery voltage at the fuse for the affected lamp circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
9	Repair the open circuit between the ignition switch and the fuse. Is the action complete?	—	Verify repair	—
10	1. Ignition “OFF.” 2. Disconnect the PCM connector for the affected driver terminal. 3. Connect an ohmmeter between a good ground and the PCM connector for the affected driver. Did the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 12*
11	Repair the short to ground between the affected component and its PCM driver terminal. Is the action complete?	—	Verify repair	—
12	Repair the open circuit between the fuse and the PCM driver terminal for the affected circuit. Is the action complete?	—	Verify repair	—

DTC P1640 – Driver-1-Output Circuit Fault (ODM) (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Connect the PCM. 2. Start the engine and let it idle. 3. Backprobe the affected terminal at the PCM with a DVM. Was the voltage equal to the specified value?	+B	Go to *Step 15*	Go to *Step 14*
14	1. Run the engine at idle. 2. Check for battery voltage at the fuse for the affected circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Diagnostic Trouble Code (DTC) P1650 Quad Driver Module "A" Fault

Circuit Description

The Quad Driver Module (QDMs) are used by the powertrain control module (PCM) to turn "ON" current–driven devices that are needed to control two engine functions. The PCM monitors open or short circuit of either of Canister Control Purge (CCP) Vent solenoid or Variable Intake Manifold (VIM).

Conditions for Setting the DTC

- Ignition "ON".
- Engine running.
- Ignition voltage.
- Output voltage does not equal voltage is not less than 1 volt when out put is "ON".
- Above conditions occur for at least 0.5 second.

Action Taken When the DTC Sets

- The PCM will not illuminate the malfunction indicator lamp (MIL).
- The PCM will store conditions which were present when the DTC was set as Failure Records only. This information will not be stored as Freeze Frame data.

Conditions for Clearing the MIL/DTC

- The PCM will turn the MIL "OFF" on the third consecutive trip cycle during which the diagnostic has been run and the fault condition is no longer present.
- A history DTC P1650 will clear after 40 consecutive warm-up cycles have occurred without a fault.
- DTC P1650 can be cleared by using the Tech 2 "Clear Info" function or by disconnecting the PCM battery feed.

Diagnostic Aids

Check for the following conditions:

- Poor connection at PCM – Inspect harness connectors for backed-out terminals, improper mating, broken locks, improperly formed or damaged terminals, and poor terminal-to-wire connection.
- Damaged harness – Inspect the wiring harness for damage, If the harness appears to be OK, disconnect the PCM, turn the ignition "ON" and observe a voltmeter connected to the suspect driver circuit at the PCM harness connector while moving connectors and wiring harnesses relates to the MIL. A change in voltage will indicate the location of the fault.
- Poor connection at component – Examine for damaged connectors, unplugged connector, or damaged terminals at the following locations: canister purge solenoid, fuel level sensor. An open ignition feed circuit at any of these components will cause DTC P1650 to be set.

Reviewing the Failure Records vehicle mileage since the diagnostic test last failed may help determine how often the condition that caused the DTC to be set occurs. This may assist in diagnosing the condition.

The following PCM pins are controlled by Quad driver modules (QDMs):

- S74 – VIM
- S48 – Canister control purge

Test Description

Number(s) below refer to the step number(s) on the Diagnostic Chart.

4. The Tech 2 Driver Module Status indicates the PCM pin that is affected.

9.The Tech 2 may indicate "short circuit" even when the problem is an open circuit. The cause of an open circuit may be in the component itself.

11.A short to ground on the ignition side of the component will blow the fuse. Since the fuse was checked in Step 2, a short to ground would be between the affected component and the PCM.

DTC P1650 – Quad Driver Module (QDM) Fault

Step	Action	Value(s)	Yes	No
1	Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Check the fuse for the driver circuit that was shown as faulty. Was the fuse blown?	—	Go to *Step 5*	Go to *Step 6*
3	1. Check for a short to ground between the fuse and the affected component. 2. Replace the fuse after making any necessary repairs. Is the action complete?	—	Verify repair	—
4	Disconnect the PCM connector for the affected driver circuit. Is there any damage to the PCM pin or connector?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the damaged pin or terminal. Is the action complete?	—	Verify repair	—
6	Were either of the lamp circuits for "Check Engine" or "Check Trans." indicated as faulty by the Tech 2?	—	Go to *Step 7*	Go to *Step 13*
7	1. Leave the PCM connector for the lamp driver circuit disconnected. 2. Ignition "ON." 3. Using a DVM, check the voltage at the PCM connector for the affected lamp driver circuit. Was the voltage equal to the specified value?	B+	Go to *Step 15*	Go to *Step 8*
8	1. Ignition "ON." 2. Check for battery voltage at the fuse for the affected lamp circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
9	Repair the open circuit between the ignition switch and the fuse. Is the action complete?	—	Verify repair	—
10	1. Ignition "OFF." 2. Disconnect the PCM connector for the affected driver terminal. 3. Connect an ohmmeter between a good ground and the PCM connector for the affected driver. Did the ohmmeter indicate continuity?	—	Go to *Step 11*	Go to *Step 12*
11	Repair the short to ground between the affected component and its PCM driver terminal. Is the action complete?	—	Verify repair	—
12	Repair the open circuit between the fuse and the PCM driver terminal for the affected circuit. Is the action complete?	—	Verify repair	—

DTC P1650 – Quad Driver Module (QDM) Fault (Cont'd)

Step	Action	Value(s)	Yes	No
13	1. Connect the PCM. 2. Start the engine and let it idle. 3. Backprobe the affected terminal at the PCM with a DVM. Was the voltage equal to the specified value?	+B	Go to *Step 15*	Go to *Step 14*
14	1. Run the engine at idle. 2. Check for battery voltage at the fuse for the affected circuit. Was battery voltage available at the fuse?	—	Go to *Step 10*	Go to *Step 9*
15	Replace the PCM. **IMPORTANT:** The replacement PCM must be programmed. Refer to *On-Vehicle Service* in *Powertrain Control Module and Sensors* for procedures. And also refer to latest Service Bulletin. Check to see if the Latest software is released or not. And then Down Load the LATEST PROGRAMMED SOFTWARE to the replacement PCM. Is the action complete?	—	Verify repair	—

Symptom Diagnosis

Preliminary Checks

Before using this section, perform the "On-Board Diagnostic (OBD) System Check" and verify all of the following items:

- The powertrain control module (PCM), and malfunction indicator lamp (MIL) (Check Engine lamp) and Reduced Power Lamp (RPL) are operating correctly.
- There are no DTC(s) stored.
- Tech 2 data is within normal operating range. Refer to *Typical Scan Data Values*.
- Verify the customer complaint and locate the correct symptom in the table of contents. Perform the procedure included in the symptom chart.

Visual/Physical Check

Several of the symptom procedures call for a careful visual/physical check. This can lead to correcting a problem without further checks and can save valuable time.

This check should include the following items:

- PCM grounds for cleanliness, tightness and proper location.
- Vacuum hoses for splits, kinks, and proper connections, as shown on the "Vehicle Emission Control Information" label. Check thoroughly for any type of leak or restriction.
- Air intake ducts for collapsed or damaged areas.
- Air leaks at throttle body mounting area, mass air flow (MAF) sensor and intake manifold sealing surfaces.
- Ignition components for cracking, hardness, and carbon tracking.
- Wiring for proper connections, pinches and cuts.

Intermittents

IMPORTANT: An intermittent problem may or may not turn on the malfunction indicator lamp (MIL) or store a DTC. DO NOT use the Diagnostic Trouble Code (DTC) charts for intermittent problems. The fault must be present to locate the problem.

Most intermittent problems are caused by faulty electrical connections or wiring. Perform a careful visual/physical check for the following conditions:

- Poor mating of the connector halves or a terminal not fully seated in the connector (backed out).
- Improperly formed or damaged terminal.
- All connector terminals in the problem circuit should be carefully checked for proper contact tension.
- Poor terminal-to-wire connection. This requires removing the terminal from the connector body to check.

Road test the vehicle with a J 39200 Digital Multimeter connected to a suspected circuit. An abnormal voltage when the malfunction occurs is a good indication that there is a fault in the circuit being monitored.

Use a Tech 2 to help detect intermittent conditions. The scan tool has several features that can be used to locate an intermittent condition. Use the following feature to find intermittent faults:

- Using a Tech 2's "Freeze Frame" buffer or "Failure Records" buffer can aid in locating an intermittent condition. Review and record the information in the freeze frame or failure record associated with the intermittent DTC being diagnosed. The vehicle can be driven within the conditions that were present when the DTC originally set.

To check for loss of diagnostic code memory, disconnect the MAP sensor and idle the engine until the MIL (Check Engine lamp) comes on. DTC P0107 should be stored and kept in memory when the ignition is turned "OFF." If not, the PCM is faulty. When this test is completed, make sure that you clear the DTC P0107 from memory.

An intermittent MIL (Check Engine lamp) with no stored DTC may be caused by the following:

- Ignition coil shorted to ground and arcing.
- MIL (Check Engine lamp) wire to PCM shorted to ground.
- Poor PCM grounds. Refer to the PCM wiring diagrams.

Check for improper installation of electrical options such as lights, cellular phones, etc. Check all wires from the PCM to the ignition coils for poor connections.

Check for an open diode across the A/C compressor clutch and check for other open diodes (refer to wiring diagrams in *Electrical Diagnosis*).

If problem has not been found, refer to *PCM Connector Symptom* tables.

- Check the "Calibration ID" of the PCM, and compare it with the latest Isuzu service bulletins and/or Isuzu EEPROM reprogramming equipment to determine if an update to the PCM's reprogrammable memory has been released. To check the "Calibration ID", connect the Tech 2, then look for "Powertrain", then select "Calibration ID". This identifies the contents of the reprogrammable software and calibration contained in the PCM. If the "Calibration ID" is not the most current available, it is advisable to reprogram the PCM's EEPROM memory, which may either help identify a hard-to-find problem or may fix the problem.
- Calibration ID (example)

Part number	9377709
Broadcast Code	CYYD
Identifier	801

Hard Start Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine cranks, but does not start for a long time. Does eventually run, or may start but immediately stalls. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/Physical Check*
5	Check engine coolant temperature (ECT) sensor for shift in value. After 8 hours with the hood up and the engine not running, connect the Tech 2. With the ignition "ON" and the engine not running, compare engine coolant temperature to intake air temperature. Are ECT and IAT within the specified value of each other?	$\pm$ 5°C ($\pm$ 9°F)	Go to *Step 10*	Go to *Step 6*
6	1. Using a Tech 2, display the engine coolant temperature and note the value. 2. Check the resistance of the engine coolant temperature sensor. 3. Refer to *Engine Coolant Temperature Sensor Temperature vs. Resistance* chart on *DTC P0118 Diagnostic Support* for resistance specifications. Is the resistance value near the resistance for the temperature noted?	—	Go to *Step 8*	Go to *Step 7*
7	Replace the ECT sensor. Is the action complete?	—	Verify repair	—
8	Locate and repair high resistance or poor connection in the ECT signal circuit or the ECT sensor ground. Is the action complete?	—	Verify repair	—
9	1. Check for a faulty, plugged, or incorrectly installed PCV valve. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check for water- or alcohol-contaminated fuel. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Perform the procedure in *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*

Hard Start Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electric Ignition System* for procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Check for a loose ignition coil ground and ION Sensing module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Remove the ignition coils and check the ignition coils for cracks or carbon tracking. 2. If a problem is found, replace affected coil(s) as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Check for the following engine mechanical problems (refer to *Engine Mechanical*): ● Low compression ● Leaking cylinder head gaskets ● Worn or incorrect camshaft ● Camshaft drive belt slipped or stripped 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Surges and/or Chuggles Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine power variation under steady throttle or cruise. Feels like the vehicle speeds up and slows down with no change in the accelerator pedal. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/Physical Check*
5	Be sure that the driver understands transmission torque converter clutch and A/C compressor operation as explained in the owner's manual. Inform the customer how the TCC and the A/C clutch operate. Is the customer experiencing a normal condition?	—	System OK	Go to *Step 6*
6	1. Check the the fuel control heated oxygen sensors (HO2S, B1S1 and B2S1). The fuel control heated oxygen sensors (HO2S) should respond quickly to different throttle positions. If they don't, check them for silicone or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating. Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication). The PCM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem. For more information, refer to *Powertrain Control Module (PCM) and Sensors*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check the fuel pressure. Refer to *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	Monitor the long term fuel trim on the Tech 2. Is the long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 9*	Go to *Step 10*
9	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 11*	Verify repair

Surges and/or Chuggles Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 11*	Verify repair
11	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electric Ignition System* for procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	1. Check for a loose ignition coil ground and ION Sensing module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Check the ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
14	1. Remove the spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check the injector connections. 2. If any of the injector connectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Check PCM grounds for the cleanliness, tightness and proper locations. Refer to the PCM wiring diagrams in *Electrical Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Check MAF sensor connections. 2. If a problem is found, replace the faulty terminals as necessary. Refer to *Electrical Diagnosis* for wiring repair procedures. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Visually/physically check vacuum hoses for splits, kinks, and proper connections and routing as shown on the "Vehicle Emission Control Information" label. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 19*

Surges and/or Chuggles Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
19	1. Check the exhaust system for possible restriction: • Inspect the exhaust system for damaged or collapsed pipes. • Inspect the muffler for heat distress or possible internal failure. • Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to *Restricted Exhaust System Check*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 20*
20	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Lack of Power, Sluggish or Spongy Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine delivers less than expected power. Little or no increase in speed when accelerator pedal is pushed down part-way. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/Physical Check*
5	1. Remove and check the air filter element for dirt or restrictions. Refer to *Air Intake System* in *ON-Vehicle Service*. 2. Replace the air filter element if necessary. Was a repair required?	—	Verify repair	Go to *Step 6*
6	1. Check for low fuel pressure. Refer to *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check for water- or alcohol-contaminated fuel. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Install the Tech 2. 2. Run the engine at idle. 3. On the Tech 2, select F3: Miscellaneous Test, F6: Variable Intake Manifold. 4. Repeat Switch ON or OFF of VIM solenoid valve by using the Tech 2. 5. Check to see if the actuator works normally. 6. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*

Lack of Power, Sluggish or Spongy Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Remove the spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Check the ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	1. Check the PCM grounds for the cleanliness, tightness and proper locations. Refer to the PCM wiring diagrams in *Electrical Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Check the exhaust system for possible restriction: • Inspect the exhaust system for damaged or collapsed pipes. • Inspect the muffler for heat distress or possible internal failure. • Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to *Restricted Exhaust System Check*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Check the torque converter clutch (TCC) for proper operation. Refer to *4L30-E Transmission Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check for an engine mechanical problem. Check for low compression, incorrect or worn camshaft, loose timing belt, etc. Refer to *Engine Mechanical*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Detonation/Spark Knock Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** A mild to severe ping, usually worse under acceleration. The engine makes sharp metallic knocks that change with throttle opening. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/Physical Check*
4	If Tech 2 readings are normal (refer to *Typical Scan Values*) and there are no engine mechanical faults, fill the fuel tank with a known quality gasoline that has a minimum octane rating of 87 and re-evaluate the vehicle performance. Is detonation present?	—	Go to *Step 5*	Verify repair
5	1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive. 2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to *4L30-E Automatic Transmission Diagnosis*). Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Check TCC operation. Refer to *4L30-E Transmission Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check for obvious overheating problems: • Low engine coolant. • Restricted air flow to radiator, or restricted water flow through radiator. • Correct coolant solution should be a 50/50 mix of approved antifreeze/coolant and water. Refer to *Engine Cooling*. • EGR operation. Refer to *DTC P0401*. • ION sensing module fault. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Ignition "OFF." 2. Disconnect the ION sensing module. 3. Disconnect the PCM. Is the action complete?	—	Go to *Step 9*	—
9	Check the ION sensing harness between the PCM (F68) and ION sensing module circuit (RED Wire) at the Kl line harness connector. Was a problem found?	—	Verify repair	Go to *Step 10*

Detonation/Spark Knock Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Disconnect the ignition coil. Is the action complete?	—	Go to *Step 11*	—
11	Check the ION sensing harness between the ignition coil and ION sensing module circuit at the DC motor harness connector. Was a problem found?	—	Verify repair	Go to *Step 12*
12	Check the following items; 1. Ignition coil and ignition coil circuit. 2. Ignition coil ground circuit for a poor connection. 3. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	Replace the Ignition coil. Is the action complete?	—	Verify repair	Go to *Step 14*
14	Check the following items; 1. ION sensing module ground circuit for a poor connection. 2. If a problem is found, repair wiring harness as necessary. Was a problem found?	—	Go to *Step 10*	Go to *Step 16*
15	Replace the ION sensing module. Is the action complete?	—	Verify repair	Go to *Step 16*
16	1. Check fuel pressure. Refer to Chart Fuel System Pressure Test. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Check items that can cause an engine to run lean (long term fuel trim significantly in the positive range). For a lean condition, refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Spark plugs for proper heat range. Refer to *General Information*. 2. If incorrect spark plugs are installed, replace spark plugs as necessary. Did any spark plugs require replacement?	—	Verify repair	Go to *Step 19*
19	1. Remove excessive carbon buildup with a top engine cleaner. Refer to instructions on the top engine cleaner can. 2. Re-evaluate vehicle performance. Is detonation still present?	—	Go to *Step 20*	Verify repair

Detonation/Spark Knock Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
20	1. Check for an engine mechanical problem. Perform a cylinder compression check. Refer to *Engine Mechanical*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 21*
21	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Rough, Unstable, or Incorrect Idle, Stalling Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine runs unevenly at idle. If severe, the engine or vehicle may shake. Engine idle speed may vary in RPM. Either condition may be severe enough to stall the engine. Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the “Electric Throttle Control (ETC) System Check” performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Go to *Step 14*	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/Physical Check*
5	1. Check the PCM grounds for cleanliness, tightness and proper routing. Refer to the PCM wiring diagrams in *Electrical Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	Observe the long term fuel trim on the Tech 2. Is the long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 7*	Go to *Step 8*
7	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
8	Is the long term fuel trim significantly in the positive range (lean condition)?	—	Go to *Step 9*	Go to *Step 10*
9	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check for incorrect idle speed. Ensure that the following conditions are present: • The engine is fully warm. • The accessories are “OFF.” 2. Using a Tech 2, monitor the Engine Speed. Is the Engine Speed within the specified values?	Desired Idle Speed	Go to *Step 12*	Go to *Step 11*

Rough, Unstable, or Incorrect Idle, Stalling Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Visually/physically inspect for the following conditions: • Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. • Large vacuum leak. Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty crankcase ventilation valve or a disconnected brake booster hose. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
12	Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Perform the "Injector Coil/Balance Test" in *Fuel Metering System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Check for fuel in the pressure regulator vacuum hose. 2. If fuel is present, replace the fuel pressure regulator assembly. Refer to *Fuel Metering System*. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for the procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Check for a loose ignition coil ground and ION Sensing Module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Check ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 19*

Rough, Unstable, or Incorrect Idle, Stalling Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
19	Using a Tech 2, monitor the throttle position 1 and 2 angle with the engine idling. Is the TP angle at the specified value and steady?	8 ~ 10%	Go to *Step 20*	Refer to *DTC* for further diagnosis
20	1. Check the positive crankcase ventilation (PCV) valve for proper operation. Refer to *Crankcase Ventilation System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 21*
21	1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive. 2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to *4L30-E Automatic Transmission Diagnosis*). Was a problem found?	—	Verify repair	Go to *Step 22*
22	1. Check for the following engine mechanical items. Refer to *Engine Mechanical* for diagnosis procedures: ● Low compression ● Sticking or leaking valves ● Worn camshaft lobe(s) ● Camshaft drive belt slipped or stripped ● Incorrect valve timing ● Worn rocker arms ● Broken valve springs 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 23*
23	1. Check for faulty motor mounts. Refer to *Engine Mechanical* for inspection of mounts. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 24*
24	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records buffer ● All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Poor Fuel Economy Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Fuel economy, as measured by an actual road test, is noticeably lower than expected. Also, economy is noticeably lower than it was on this vehicle at one time, as previously shown by an actual road test. (Non-standard tires will cause odometer readings to be incorrect, and that may cause fuel economy to appear poor when it is actually normal.) Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/Physical Check*
4	Check owner's driving habits. • Is the A/C "ON" full time (defroster mode "ON")? • Are tires at the correct pressure? • Are excessively heavy loads being carried? • Is acceleration too much, too often? Was a problem found?	—	Go to *Step 5*	Go to *Step 6*
5	Review the items in Step 4 with the customer and advise as necessary. Is the action complete?	—	System OK	—
6	1. Visually/physically check: Vacuum hoses for splits, kinks, and improper connections and routing as shown on the "Vehicle Emission Control Information" label. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Remove and check the air filter element for dirt or for restrictions. Refer to *Air Intake System*. 2. Replace the air filter element if necessary. Was a repair required?	—	Verify repair	Go to *Step 8*
8	1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Spark Plug Replacement*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
9	1. Check for low engine coolant level. Refer to *Engine Cooling*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*

Poor Fuel Economy Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check for an incorrect or faulty engine thermostat. Refer to *Engine Cooling*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Check for low engine compression. Refer to *Engine Mechanical*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	1. Check the TCC operation. Refer to *4L30-E Transmission Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Check the exhaust system for possible restriction: • Inspect the exhaust system for damaged or collapsed pipes. • Inspect the muffler for heat distress or possible internal failure. • Check for a possible plugged three-way catalytic converter by checking the exhaust system back pressure. Refer to *Restricted Exhaust System Check*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	Check for proper calibration of the speedometer. Does the speed indicated on the speedometer closely match the vehicle speed displayed on the Tech 2?	—	Go to *Step 16*	Go to *Step 15*
15	Diagnose and repair an inaccurate speedometer condition as necessary. Refer to *Vehicle Speed Sensor* in *Electrical Diagnosis*. Was a problem found?	—	Verify repair	—
16	1. Check the air intake system and the crankcase for air leaks. Refer to *Air Intake System* and *Crankcase Ventilation System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Review all diagnostic procedures within this table. 2. When all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records buffer • All connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	Perform the procedure in *Fuel System Pressure Test*. Was the fuel pressure normal?	—	Contact Technical Assistance	Verify repair

Excessive Exhaust Emissions or Odors Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Vehicle fails an emission test. Vehicle has excessive “rotten egg” smell. (Excessive odors do not necessarily indicate excessive emissions.) Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Go to *Step 13*	Go to *Step 3*
3	Was a thorough visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/Physical Check*
4	1. Check for vacuum leaks. Check vacuum lines, intake manifold, throttle body, etc. 2. If a problem is found, repair as necessary. Were any vacuum leaks located?	—	Go to *Step 13*	Go to *Step 5*
5	1. Check the fuel cap for proper installation. 2. Secure the fuel cap if necessary. Was the fuel cap installed properly?	—	Go to *Step 6*	Go to *Step 13*
6	1. Check the fuel pressure. Perform the procedure in *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 7*
7	1. Check for a faulty, plugged, or incorrectly installed crankcase ventilation valve; also check the crankcase ventilation system for plugging. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 8*
8	1. Check the injector connections. 2. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 9*
9	1. Perform the “Injector Coil/Balance Test” in *Fuel Metering System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 10*
10	1. Refer to *Engine Cooling* for cooling system diagnosis. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 11*
11	1. Check EVAP canister for fuel loading. Refer to *Evaporative Emission Control System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 12*

Excessive Exhaust Emissions or Odors Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
12	1. Remove excessive carbon buildup with a top engine cleaner. Refer to the instructions on the top engine cleaner can. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to *Step 14*
13	Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to *Step 14*
14	Does the exhaust emission test indicate excessive CO and HC levels or is long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 15*	Go to *Step 16*
15	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. Make any necessary repairs. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to *Step 17*
16	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. Make any necessary repairs. 2. Perform the exhaust emission test. Does the vehicle pass the test?	—	System OK	Go to *Step 17*
17	1. Check the EGR system (refer to *DTC P0401*). 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 18*
18	1. Check for an engine mechanical problem. Perform a cylinder compression check (refer to *Engine Mechanical*). 2. If a problem is found, repair as necessary. Was a problem found?	—	Go to *Step 13*	Go to *Step 19*
19	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records butter • All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Dieseling, Run-On Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Engine continues to run after key is turned "OFF," but runs very rough. If engine runs smooth, check ignition switch and adjustment. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/Physical Check*
4	1. Check for a short between B+ and any of the ignition feed circuits. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records butter ● All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Backfire Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Fuel ignites in the intake manifold, or in the exhaust system, making a loud popping noise. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/Physical Check*
4	1. Check for proper ignition voltage coil output with spark tester J 26792 (ST-125). Refer to *Electric Ignition System* for procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 5*
5	1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. Refer to *DTC P0172* to determine the cause of a rich condition or *Engine Mechanical* for an oil fouling condition. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Visually/physically inspect the ignition coils for cracks. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	1. Check for an intermittent ignition system malfunction: • Intermittent CKP 58X signal. • Intermittent ignition feed circuit or sensor ground circuit to the crankshaft position sensor. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 8*
8	1. Check the fuel pressure. Refer to *Fuel System Pressure Test*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*

Backfire Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
9	1. Check for the following engine mechanical conditions. Refer to *Engine Mechanical* for diagnosis procedures: • Low compression • Sticking or leaking valves • Worn camshaft lobe(s) • Camshaft drive belt slipped or stripped • Incorrect valve timing 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check the intake and exhaust manifold(s) for casting flash. Refer to *Engine Mechanical*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records butter • All electrical connections within a suspected circuit and/or system. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Cuts Out, Misses Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Steady pulsation or jerking that follows engine speed; usually more pronounced as engine load increases. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Go to *Step 14*	Go to *Step 3*
3	Was a visual/physical check performed?	—	Go to *Step 4*	Go to *Visual/Physical Check*
4	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 5*	Go to *ETC System Check*
5	1. Check the PCM grounds for clearness, tightness and proper routing. Refer to the PCM wiring diagrams in *Electrical Diagnosis*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	Observe the long term fuel trim on the Tech 2. Is the long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 7*	Go to *Step 8*
7	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
8	Is the long term fuel trim significantly in the positive range (lean condition)?	—	Go to *Step 9*	Go to *Step 10*
9	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 10*
10	1. Check for incorrect idle speed. Ensure that the following conditions are present: • The engine is fully warm. • The accessories are "off." 2. Using a Tech 2, monitor the Engine Speed. Is the Engine Speed within the specified values?	Desired Idle Speed	Go to *Step 12*	Go to *Step 11*

Cuts Out, Misses Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
11	1. Visually/physically inspect for the following conditions: • Restricted air intake system. Check for a possible collapsed air intake duct, restricted air filter element, or foreign objects blocking the air intake system. • Large vacuum leak. Check for a condition that causes a large vacuum leak, such as an incorrectly installed or faulty PCV valve or brake booster hose disconnected . 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 9*
12	Check the injector connections. If any of the injectors are connected to an incorrect cylinder, correct as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Perform the "Injector Coil/Balance Test" in *Fuel Metering System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Check for fuel in the pressure regulator vacuum hose. 2. If fuel is present, replace the fuel pressure regulator assembly. Refer to *Fuel Metering System*. 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for the procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Remove spark plugs. Check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 17*
17	1. Check for a loose ignition coil ground and ION Sensing module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Check ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 19*
19	Using a Tech 2, monitor the TP 1, 2 angle with the engine idling. Is the TP angle at the specified value and steady?	8 ~ 10%	Go to *Step 20*	Refer to *DTC P0123* for further diagnosis

Cuts Out, Misses Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
20	1. Check the PCV valve for proper operation. Refer to *Crankcase Ventilation System*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 21*
21	1. Check the transmission range switch circuit. Use a Tech 2 and be sure the Tech 2 indicates that the vehicle is in drive with the gear selector in drive or overdrive. 2. If a problem is found, diagnose and repair the transmission range switch as necessary (refer to *4L30-E Automatic Transmission Diagnosis*). Was a problem found?	—	Verify repair	Go to *Step 22*
22	1. Check the following engine mechanical items. Refer to *Engine Mechanical* for diagnosis procedures: ● Low compression ● Sticking or leaking valves ● Worn camshaft lobe(s) ● Camshaft drive belt slipped or stripped ● Incorrect valve timing ● Worn rocker arms ● Broken valve springs 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 23*
23	1. Check for faulty motor mounts. Refer to *Engine Mechanical* for inspection of mounts. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 24*
24	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: ● Visual/physical inspection ● Tech 2 data ● Freeze Frame data/Failure Records butter ● All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Hesitation, Sag, Stumble Symptom

Step	Action	Value(s)	Yes	No
1	**DEFINITION:** Momentary lack of response as the accelerator is pushed down. Can occur at any vehicle speed. Usually most pronounced when first trying to make the vehicle move, as from a stop sign. May cause the engine to stall if severe enough. Was the "On-Board Diagnostic (OBD) System Check" performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	Was the "Electric Throttle Control (ETC) System Check" performed?	—	Go to *Step 3*	Go to *ETC System Check*
3	1. Perform a bulletin search. 2. If a bulletin that addresses the symptom is found, correct the condition as instructed in the bulletin. Was a bulletin found that addresses the symptom?	—	Verify repair	Go to *Step 4*
4	Was a visual/physical check performed?	—	Go to *Step 5*	Go to *Visual/Physical Check*
5	1. Check the fuel control heated oxygen sensors (HO2S, B1S1 and B2S1). The fuel control heated oxygen sensors (HO2S) should respond quickly to different throttle positions. If they don't, check them for silicon or other contaminants from fuel or use of improper RTV sealant. The sensors may have a white powdery coating. Silicon contamination causes a high but false HO2S signal voltage (rich exhaust indication). The PCM will then reduce the amount of fuel delivered to the engine, causing a severe driveability problem. For more information, refer to *Powertrain Control Module (PCM) and Sensors*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 6*
6	1. Check the fuel pressure. Refer to *Fuel System Pressure Test.* 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 7*
7	Observe the TP 1, 2 angle display on the Tech 2 while slowly increasing throttle pedal. Does the TP angle display steadily increase from 8 ~ 10% at closed throttle to 90 ~ 92% at WOT?	—	Go to *Step 8*	Go to *Step 19*
8	Monitor the long term fuel trim on the Tech 2. Is the long term fuel trim significantly in the negative range (rich condition)?	—	Go to *Step 9*	Go to *Step 10*
9	1. Check items that can cause the engine to run rich. Refer to *Diagnostic Aids* in *DTC P0172 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*

Hesitation, Sag, Stumble Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Check items that can cause the engine to run lean. Refer to *Diagnostic Aids* in *DTC P0171 Diagnostic Support*. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 11*
11	1. Check for proper ignition voltage output with spark tester J 26792 (ST-125). Refer to *Electronic Ignition System* for the procedure. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 12*
12	1. Check for a loose ignition coil ground and ION Sensing module circuit. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 13*
13	1. Check the ignition coils for cracks or carbon tracking. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 14*
14	1. Remove spark plugs and check for wet plugs, cracks, wear, improper gap, burned electrodes, or heavy deposits. Refer to *Electronic Ignition System*. NOTE: If spark plugs are gas or oil fouled, the cause of the fouling must be determined before replacing the spark plugs. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 15*
15	1. Check the PCM grounds for clearness, tightness and proper routing. Refer to the PCM wiring diagrams in Electrical Diagnosis. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 16*
16	1. Check the MAF sensor connections. 2. If a problem is found, replace the faulty terminals as necessary. Refer to *Electrical Diagnosis* for wiring repair procedures. Was a problem found?	—	Verify repair	Go to *Step 17*

Hesitation, Sag, Stumble Symptom (Cont'd)

Step	Action	Value(s)	Yes	No
17	1. Visually/physically check vacuum hoses for splits, kinks, and proper connections and routing as shown on the "Vehicle Emission Control Information" label. 2. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Go to *Step 18*
18	1. Review all diagnostic procedures within this table. 2. If all procedures have been completed and no malfunctions have been found, review/inspect the following: • Visual/physical inspection • Tech 2 data • Freeze Frame data/Failure Records butter • All electrical connections within a suspected circuit and/or system 3. If a problem is found, repair as necessary. Was a problem found?	—	Verify repair	Contact Technical Assistance

Bank 1 Restricted Exhaust System Check

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Remove the Bank 1 HO2S 2. 2. Install the Exhaust Backpressure Tester (BT-8515-V or equivalent) in place of the Bank 1 HO2S 2. 3. Run the engine at normal operating temperature. 4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build. 5. Observe the exhaust system backpressure reading on the gauge. Does the reading exceed the amount in the value column?	8.62 kPa (1.25 psi)	Go to *Step 3*	Go to *Step 4*
3	Repair the restriction in the exhaust system after the catalytic converter. Possible faults include: • Collapsed pipe • Heat distress • Internal muffler failure Is the action complete?	—	Verify repair	—
4	1. Install the Bank 1 HO2S 2. 2. Install the Exhaust Backpressure Tester in place of Bank 1 HO2S 1. 3. Run the engine at normal operating temperature. 4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build. 5. Observe the exhaust system backpressure reading on the gauge. Does the reading exceed the amount in the value column?	8.62 kPa (1.25 psi)	Go to *Step 5*	No trouble found. If a driveability symptom exists, refer to symptom charts
5	Repair the restriction in the catalytic converter. Is the action complete?	—	Verify repair	—

NOTE: DTCs will be set by running the vehicle to normal operating temperature after a cold start with the O2 sensor disconnected. After performing these tests, use the Tech 2 to erase the DTCs that were set by the lack of O2 sensor activity.

Bank 2 Restricted Exhaust System Check

Step	Action	Value(s)	Yes	No
1	Was the “On-Board Diagnostic (OBD) System Check” performed?	—	Go to *Step 2*	Go to *OBD System Check*
2	1. Remove the Bank 2 HO2S 2. 2. Install the Exhaust Backpressure Tester (BT-8515-V or equivalent) in place of the Bank 2 HO2S 2. 3. Run the engine at normal operating temperature. 4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build. 5. Observe the exhaust system backpressure reading on the gauge. Does the reading exceed the amount in the value column?	8.62 kPa (1.25 psi)	Go to *Step 3*	Go to *Step 4*
3	Repair the restriction in the exhaust system after the catalytic converter. Possible faults include: • Collapsed pipe • Heat distress • Internal muffler failure Is the action complete?	—	Verify repair	—
4	1. Install the Bank 2 HO2S 2. 2. Install the Exhaust Back pressure Tester in place of Bank 1 HO2S 1. 3. Run the engine at normal operating temperature. 4. Increase the engine speed to 2000 RPM and allow 10 seconds for pressure to build. 5. Observe the exhaust system backpressure reading on the gauge. Does the reading exceed the amount in the value column?	8.62 kPa (1.25 psi)	Go to *Step 5*	No trouble found. If a driveability symptom exists, refer to symptom charts
5	Repair the restriction in the catalytic converter. Is the action complete?	—	Verify repair	—

NOTE: DTCs will be set by running the vehicle to normal operating temperature after a cold start with the O2 sensor disconnected. After performing these tests, use the Tech 2 to erase the DTCs that were set by the lack of O2 sensor activity.

Default Matrix Table

Service Procedure Default Strategy

A referral strategy has been established to assist the technician with additional information when the cause of the failure cannot be determined. If no problem is found after performing diagnostics, then refer to the default matrix table for further diagnostic information.

Default Matrix Table

Strategy Based Diagnostic Charts	Initial Diagnosis	Default Section(s)
On-Board Diagnostic (OBD) System Check	Vehicle does not enter diagnostics.	Chassis Electrical
On-Board Diagnostic (OBD) System Check	Vehicle enters diagnostics and communicates with the Tech 2. MIL is "ON" in diagnostics. Engine does not start and run.	Ignition System Check
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of vibration.	—
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of harsh or soft shift, poor performance, delayed or no engagement into drive or reverse, transmission fluid leak, transmission noise or vibration, or improper TCC operation.	Automatic Transmission
PCM Power and Ground Check	On-Board Diagnostic (OBD) System Check.	Chassis Electrical
PCM Power and Ground Check	On-Board Diagnostic (OBD) System Check. PCM power and ground circuits OK. Data link voltage incorrect.	Chassis Electrical
On-Board Diagnostic (OBD) System Check	Engine starts and runs, no PCM codes set. Customer complains of harsh or soft shift, poor performance, delayed or no engagement into drive or reverse, transmission fluid leak, transmission noise or vibration, or improper TCC operation.	Automatic Transmission

Symptoms	Initial Diagnosis	Default Section(s)
Intermittents	1. On-board Diagnostic (OBD) system check. 2. Careful visual/physical inspections.	Chassis Electrical
Hard Starts	1. OBD system check. 2. ETC system check. 3. Sensors (ECT, MAP, MAF, TP) ; MAP output chart. 4. Fuel system electrical test, fuel system diagnosis. 5. Ignition system.	Engine Mechanical, Ignition System Check, Exhaust System Diagnosis

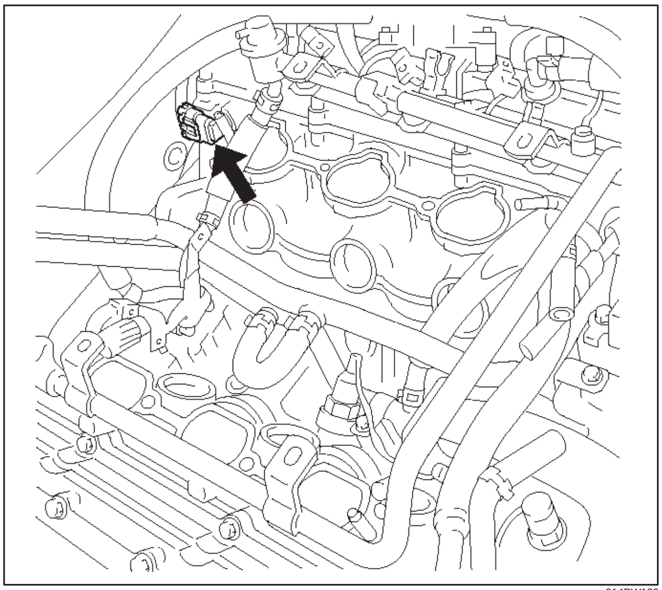
Symptoms	Initial Diagnosis	Default Section(s)
Surges and/or Chuggles	1. OBD system check. 2. ETC system check. 3. Heated oxygen sensors. 4. Fuel system diagnosis. 5. Ignition system.	Calibration ID/Service Bulletins, Ignition System Check, Generator Output, Exhaust System Diagnosis, 4L30-E System Test
Lack of Power, Sluggish or Spongy	1. OBD system check. 2. ETC system check. 3. Fuel system diagnosis. 4. Ignition system. 5. EGR operation. 6. EGR system check.	Refer to *Exhaust System* in *Engine Exhaust*, TCC Operation, Calibration ID/Service Bulletins
Detonation/Spark Knock	1. OBD system check. 2. Transmission range switch. 3. EGR operation. 4. EGR system check. 5. TCC operation. 6. Fuel system diagnosis. 7. Ignition system. 8. ION sensing module check.	TCC operation, Cooling System, Ignition System Check, Calibration ID/Service Bulletins
Rough, Unstable, or Incorrect Idle, Stalling	1. OBD system check. 2. ETC system check. 3. Fuel injector and fuel injector balance test. 4. EVAP emission canister purge valve check. 5. Ignition system. 6. EGR operation.	MAP Output Check, Throttle Linkage, EGR System Check, A/C Clutch Control Circuit Diagnosis, Crankcase Ventilation System, Calibration ID/Service Bulletins, Generator Output Voltage (refer to *Chassis Electrical*), Exhaust Diagnosis
Poor Fuel Economy	1. OBD system check. 2. Careful visual/physical inspection. 3. Ignition system. 4. Cooling system.	TCC Operation, Exhaust System (refer to *Engine Exhaust*)
Hesitation, Sag, Stumble	1. OBD system check. 2. ETC system check. 3. TP. 4. MAP output check. 5. Fuel system diagnosis. 6. Fuel injector and fuel injector balance test. 7. EVAP emission canister purge valve. 8. Ignition system.	EGR Operation, EGR System Check, Generator Output Voltage (refer to *Chassis Electrical*), Calibration ID/Service Bulletins, Ignition System Check
Cuts Out, Misses	1. OBD system check. 2. Cylinder balance test. 3. ETC system check.	Ignition System Check
Engine Cranks But Will Not Run	1. OBD system check.	Fuel System Electrical Diagnosis, Fuel System Diagnosis, Fuel Injector and Fuel Injector Balance Test.

Symptoms	Initial Diagnosis	Default Section(s)
Excessive Exhaust Emissions or Odors	1. OBD system check. 2. Emission test. 3. Cooling system. 4. Fuel system diagnosis. 5. Fuel injector and fuel injector balance test. 6. EVAP emission canister purge valve. 7. Crankcase ventilation system. 8. Ignition system. 9. MAP output check.	EGR System Check, Exhaust Diagnosis, Calibration ID/Service Bulletins
Dieseling, Run-On	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis.	—
Backfire	1. OBD system check. 2. Ignition system. 3. Fuel system diagnosis. 4. Fuel injector and fuel injector balance test. 5. EGR operation, EGR system check.	Exhaust System Diagnosis, Intake Casting Flash, Ignition System Check
Misfire	1. OBD system check. 2. Ignition system. 3. Fuel system diagnosis. 4. Fuel injector and fuel injector balance test.	Vibrations, Transmission, Driveshaft and Axle
Catalyst Monitor	1. OBD system check. 2. Careful visual/physical inspection. 3. Heated oxygen sensors.	Exhaust System
Fuel Trim	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis. 4. Heated oxygen sensors, MAF sensors.	Exhaust System Intake Air System
Evaporative Emissions	1. OBD system check. 2. Careful visual/physical inspection. 3. Fuel system diagnosis.	—
Heated Oxygen Sensors	1. OBD system check. 2. Careful visual/physical inspection.	Exhaust System

On-Vehicle Service Camshaft Position (CMP) Sensor

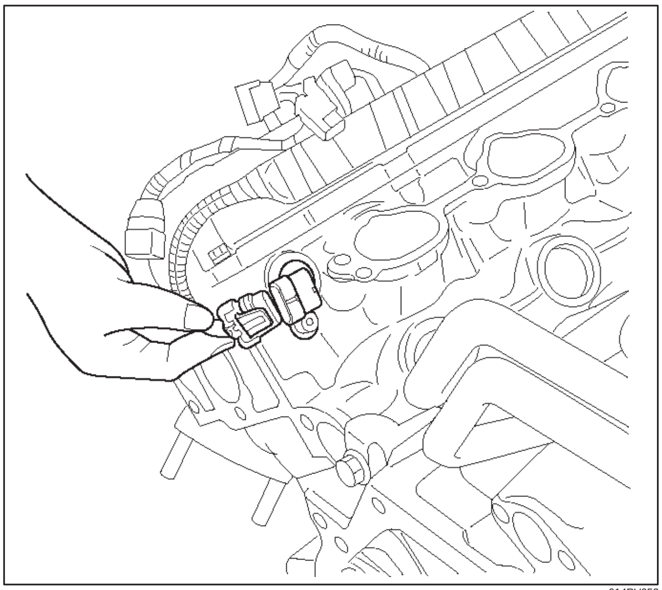
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the engine cover.
3. Remove the common chamber assembly.
   Refer to Common Chamber in Engine Mechanical section.



014RW120

4. Disconnect the electrical connector to the CMP sensor.



014RV053

5. Remove the CMP retaining bolt from the side of left cylinder head.
6. Remove the CMP sensor from the cylinder head.

Inspection Procedure

1. Inspect the sensor O-ring for cracks or leaks.
2. Replace the O-ring if it is worn or damaged.
3. Lubricate the new O-ring with engine oil.
4. Install the lubricated O-ring.

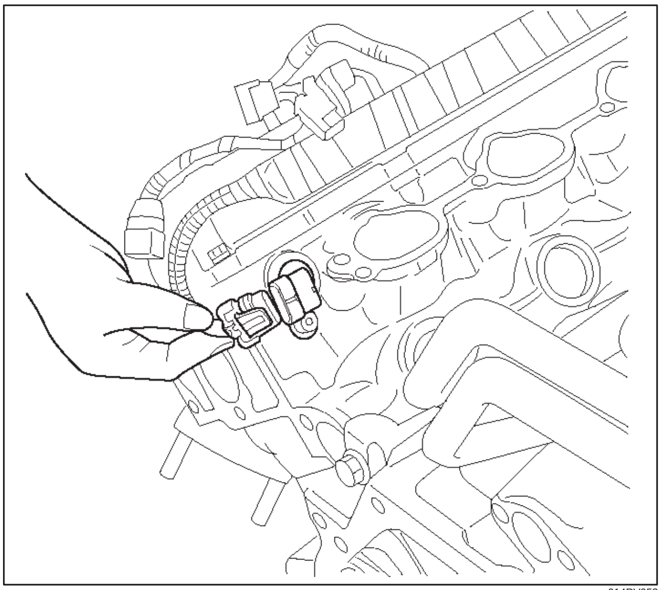
Installation Procedure

1. Install the CMP sensor in the cylinder head.
2. Install the CMP sensor retaining bolt.

Tighten

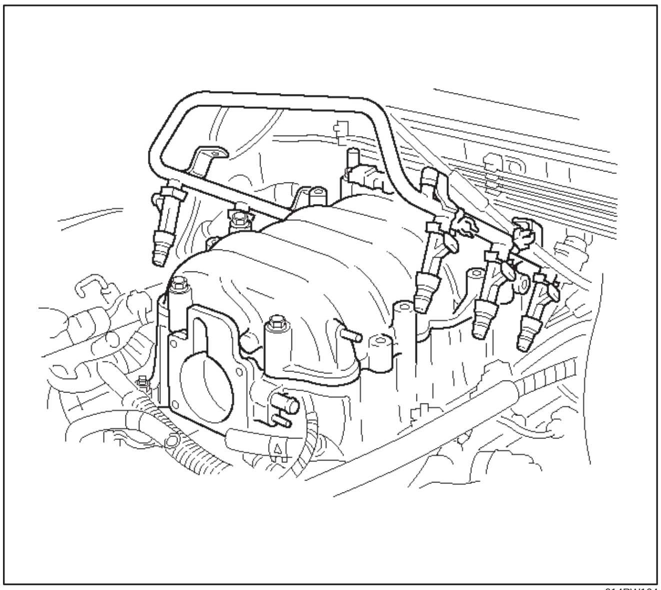
- **Tighten the retaining screw to 9 N·m (78 lb in.).**

3. Connect the electrical connector to the CMP sensor.



014RV053

4. Install the common chamber assembly.
   Refer to Common Chamber in Engine Mechanical section.



014RW164

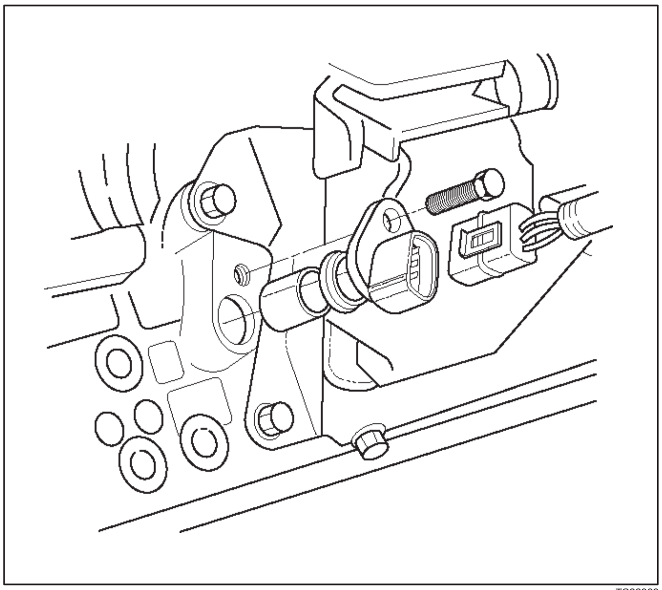
5. Install the engine cover.
6. Connect the negative battery cable.

Crankshaft Position (CKP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector to the CKP sensor.
3. Remove one bolt and the CKP sensor from the right side of the engine block, just behind the mount.

NOTE: Use caution to avoid any hot oil that might drip out.



TS22909

Inspection Procedure

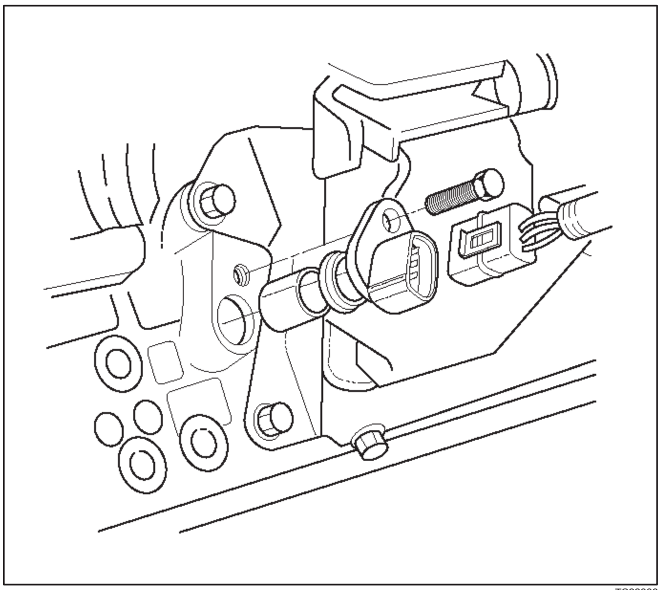
1. Inspect the sensor O-ring for cracks or leaks.
2. Replace the O-ring if it is worn or damaged.
3. Lubricate the new O-ring with engine oil.
4. Install the lubricated O-ring.

Installation Procedure

1. Install the CKP sensor in the engine block.
2. Install the CKP sensor mounting bolt.

Tighten

- **Tighten the mounting bolt to 9 N·m (78 lb in.).**



TS22909

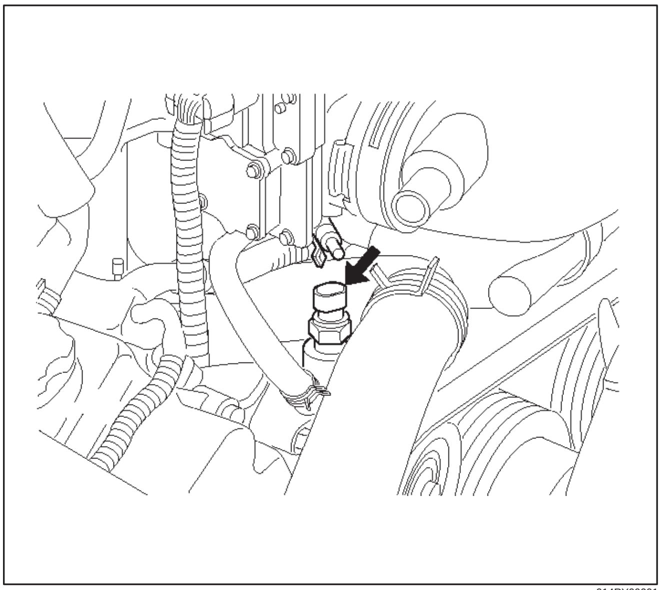
3. Connect the electrical connector to the CKP sensor.
4. Connect the negative battery cable.

Engine Coolant Temperature (ECT) Sensor

Removal Procedure

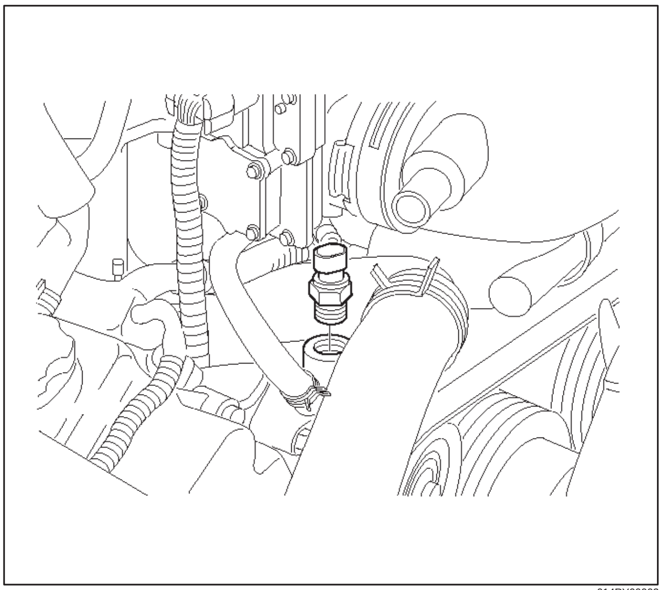
NOTE: Care must be taken when handling the engine coolant temperature (ECT) sensor. Damage to the ECT sensor will affect proper operation of the fuel injection system.

1. Disconnect the negative battery cable.
2. Drain the radiator coolant. Refer to *Draining and Refilling Cooling System* in *Engine Cooling* section.
3. Disconnect the electrical connector.



014RY00001

4. Remove the ECT sensor from the coolant crossover.



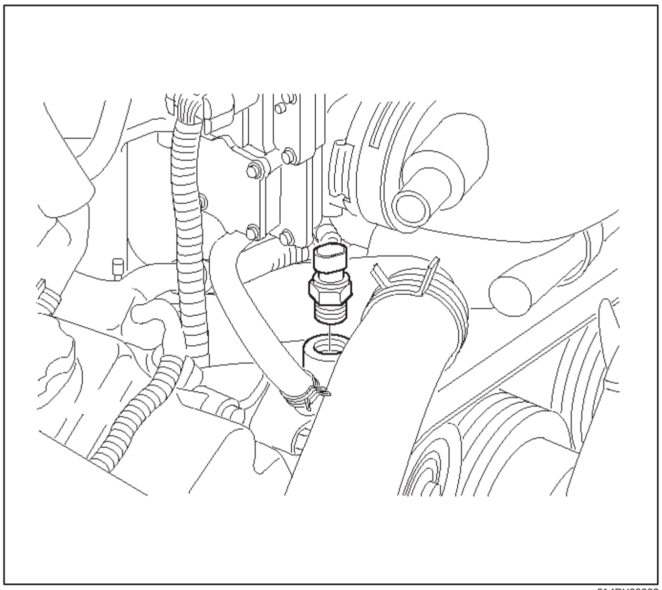
014RY00002

Installation Procedure

1. Apply sealer or the equivalent to the threads of the ECT sensor.
2. Install the ECT sensor in the coolant crossover.

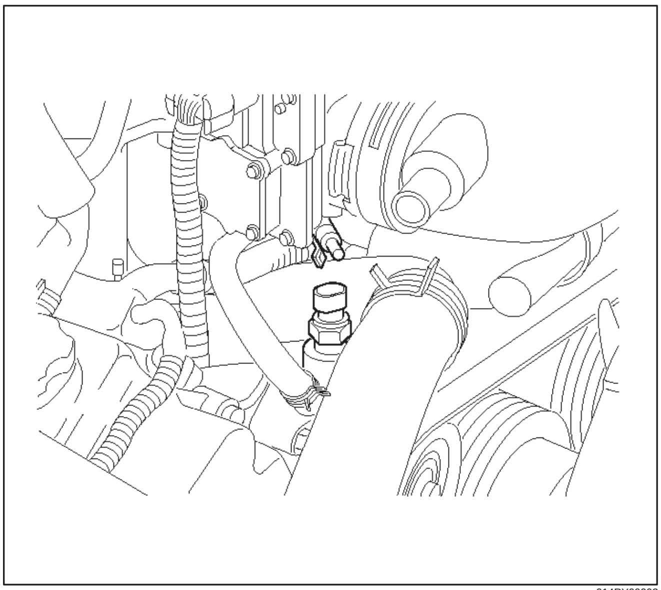
Tighten

- **Tighten the ECT sensor to 30 N·m (22 lb ft.).**



014RY00002

3. Connect the electrical connector.



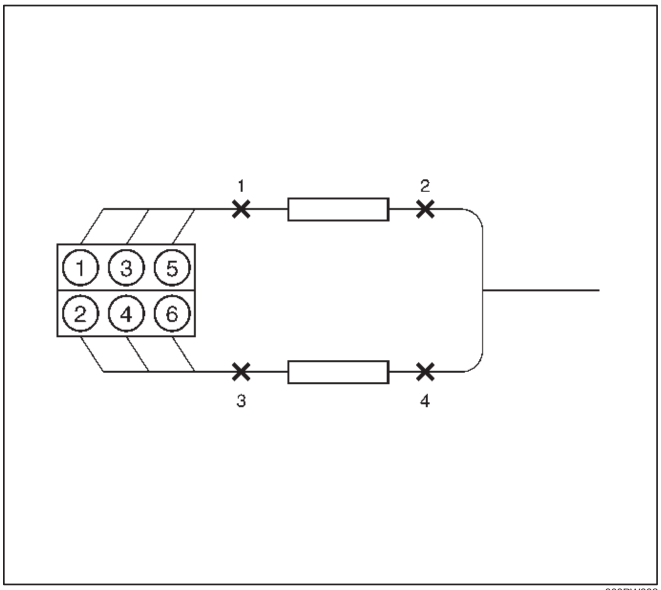
014RY00003

4. Fill the radiator with coolant. Refer to *Draining and Refilling Cooling System* in *Engine Cooling* section.
5. Connect the negative battery cable.

Heated Oxygen Sensor (HO2S)

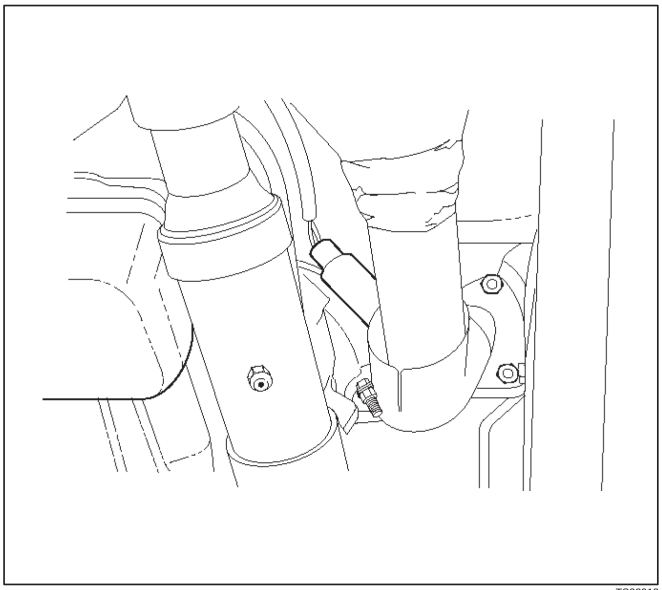
Removal Procedure

1. Disconnect the negative battery cable.
2. Locate the four oxygen sensors.



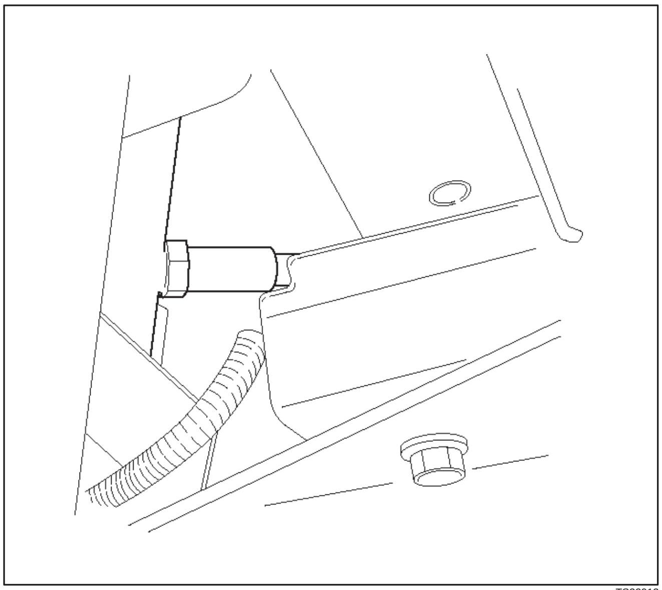
060RW008

- Bank 1 sensor 1 is mounted on the exhaust pipe ahead of the right-hand catalytic converter.



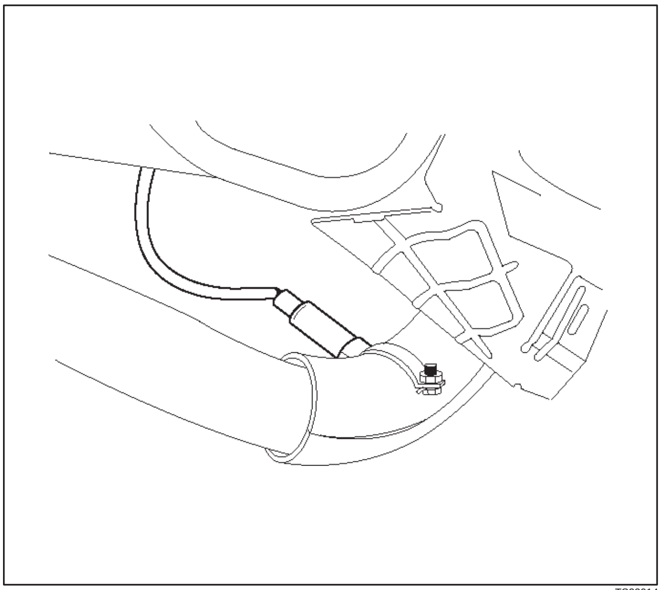
TS22912

- Bank 1 sensor 2 is mounted behind the right-hand catalytic converter.



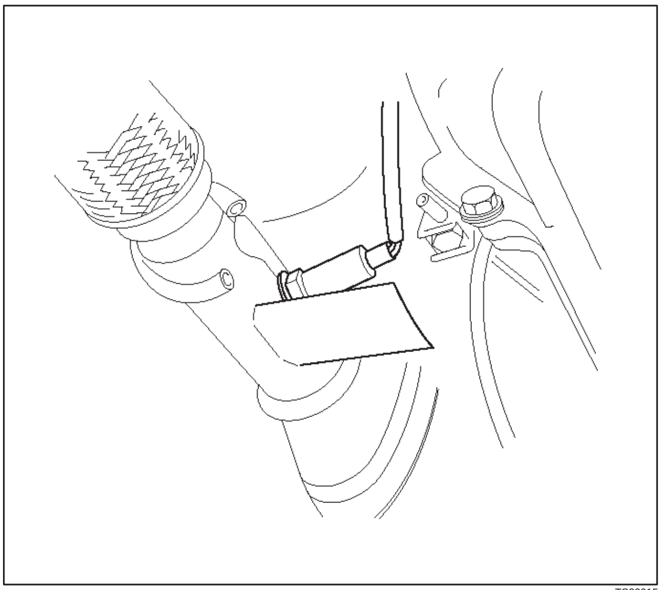
TS22913

- Bank 2 sensor 1 is mounted on the exhaust pipe ahead of the left-hand catalytic converter.



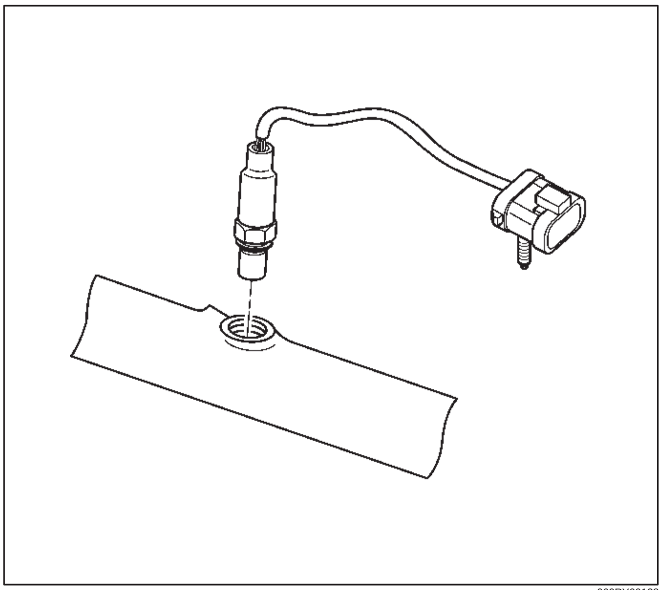
TS22914

- Bank 2 sensor 2 is mounted behind the left-hand catalytic converter.



TS22915

3. Disconnect the pigtail from the wiring harness.

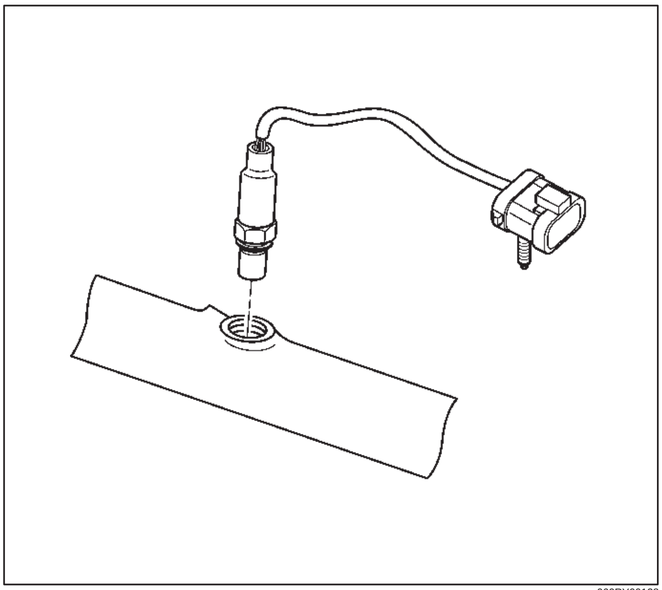


060RY00128

IMPORTANT: The pigtail is permanently attached to the sensor. Be careful not to pull the wires out.

NOTE: Do not use a torch to remove an HO2S unless the sensor is being replaced. Using a torch could damage the sensor.

4. Remove the sensor from the exhaust pipe.
   - Because of the expansion and contraction of the metal in the exhaust system over time, this may be difficult if the engine temperature is below 48°C (120°F).

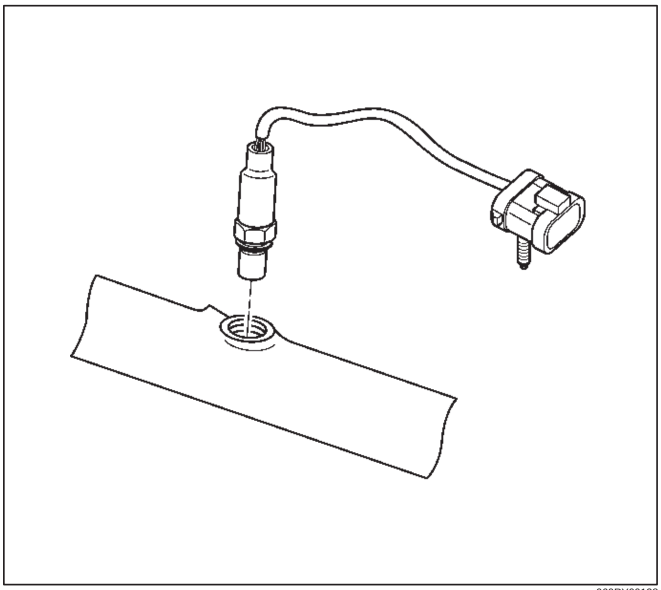


060RY00128

Inspection Procedure

All four sensors are identical. Inspect each in the same way.

1. Inspect the pigtail and the electrical connector for grease, dirt, corrosion, and bare wires or worn insulation.
2. Inspect the louvered end of the sensor for grease, dirt, or other contaminations.



060RY00128

Installation Procedure

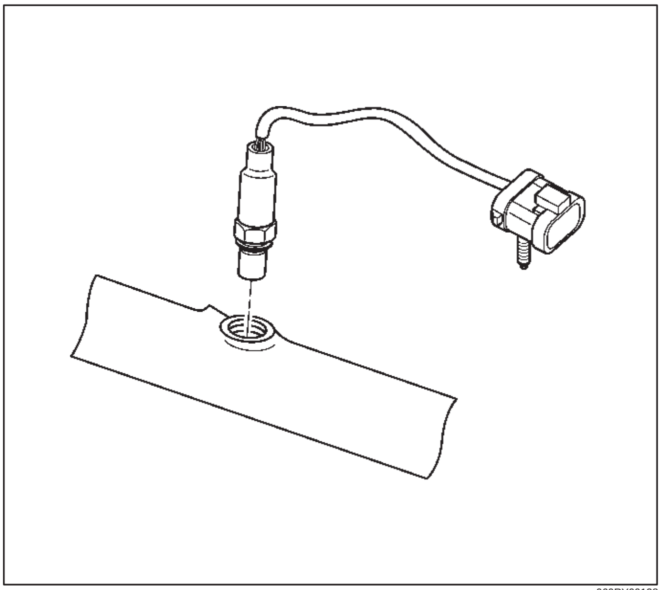
IMPORTANT:

- A special anti-seize compound on the HO2S threads. This compound consists of glass beads suspended in a liquid graphite solution. The graphite burns away with engine heat, but the glass beads will remain, making the sensor easier to remove.
- New or service sensors will already have the compound applied to the threads. If a sensor is removed and is to be reinstalled for any reason, the threads must have anti-seize compound applied.

1. Apply anti-seize compound or the equivalent to the threads of the oxygen sensor, if necessary.
2. Install the oxygen sensor on the exhaust pipe in its original position.

Tighten

- **Tighten the oxygen sensor to 55 N·m (40 lb ft.).**



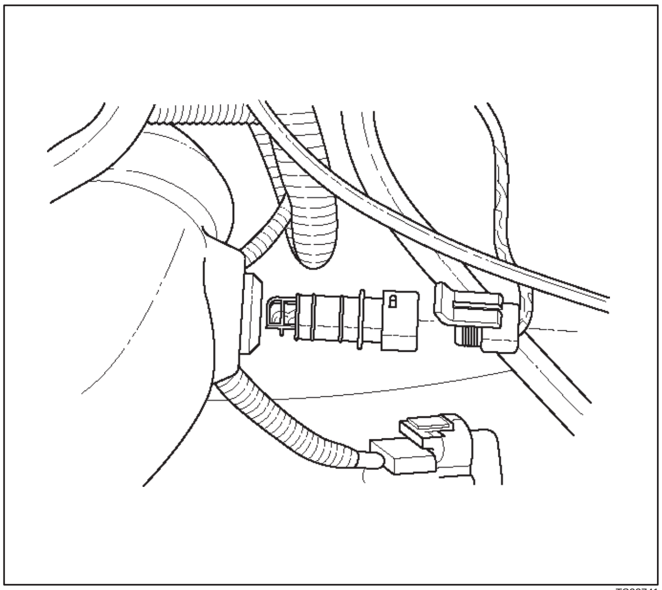
060RY00128

3. Connect the pigtail to the wiring harness.
4. Connect the negative battery cable.

Intake Air Temperature (IAT) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the engine cover
3. The IAT sensor is located in the intake air duct, behind the throttle body.
4. Disconnect the electrical connector from the IAT sensor.

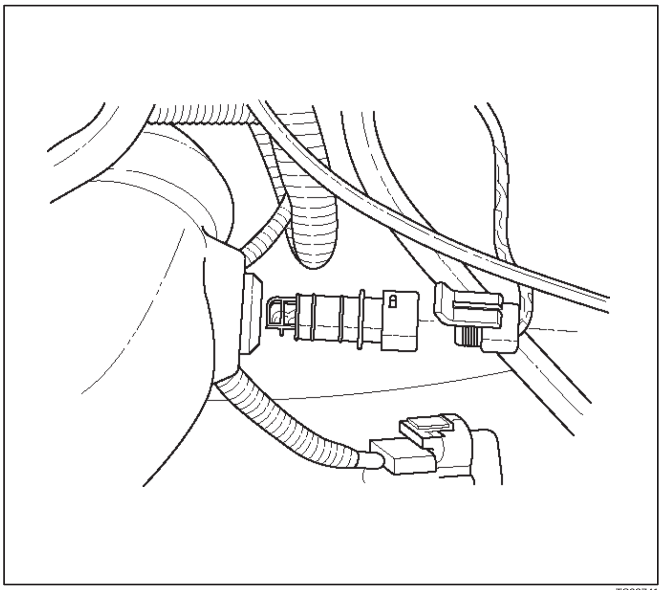


TS23741

5. Remove the IAT sensor from the intake air duct by using a rocking motion while pulling the sensor.

Installation Procedure

1. Install the IAT sensor into the grommet in the intake air duct.
2. Correct the IAT electrical connector.



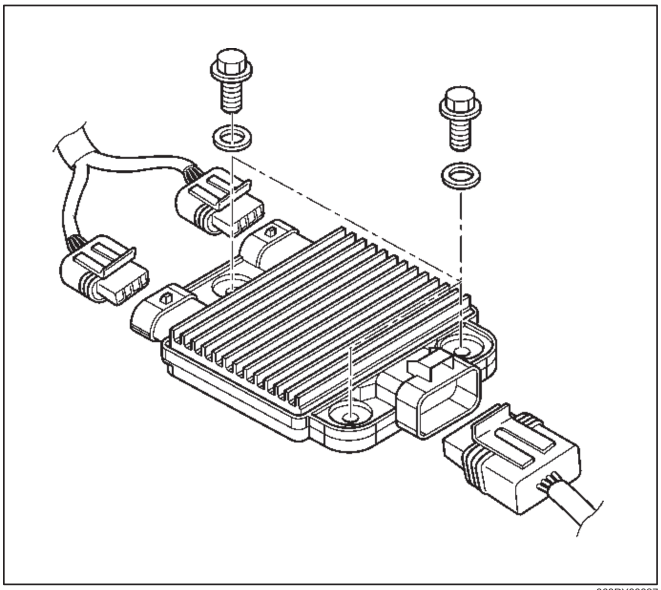
TS23741

3. Install the engine cover.
4. Connect the negative battery cable.

ION Sensing Module

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the ION sensing module connector.
3. Remove the bolts and the ION sensing module from the common chamber.



060RY00087

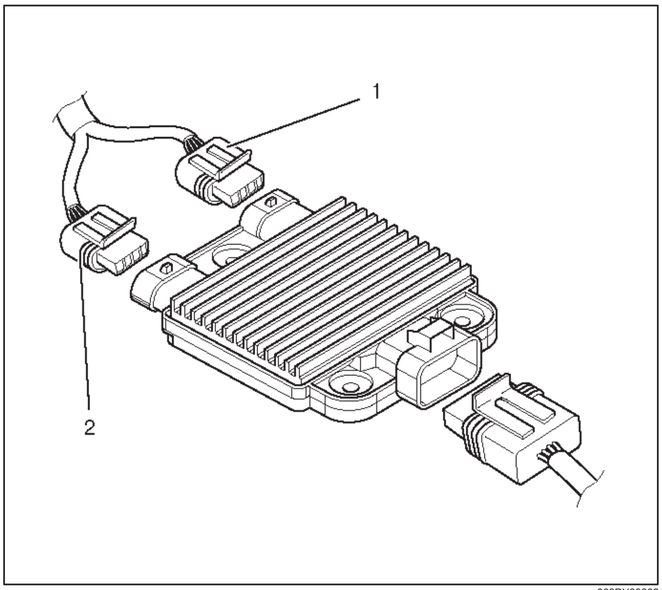
Installation Procedure

1. Install the ION sensing module on the common chamber with the bolts.

Tighten

- **Tighten the ION sensing module to 4 N·m (35 lb in.).**

2. Connect the ION sensing module connectors as shown in the illustration.



Legend

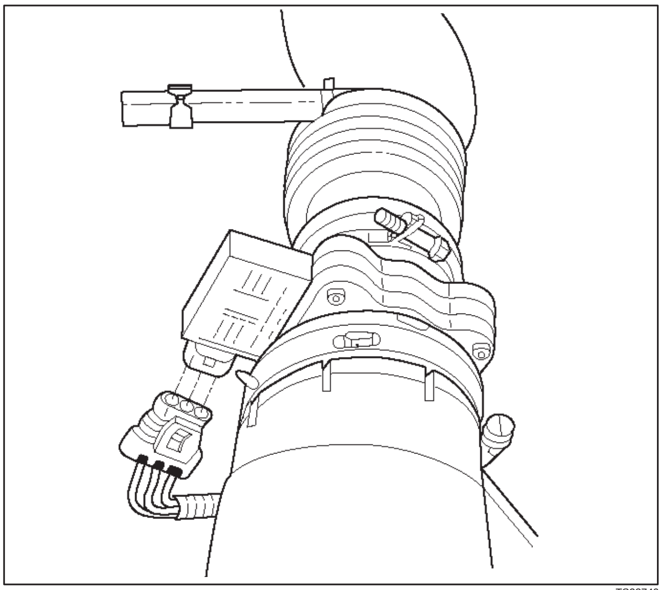
(1) Green Color Connector
(2) Blue Color Connector

3. Connect the negative battery cable.

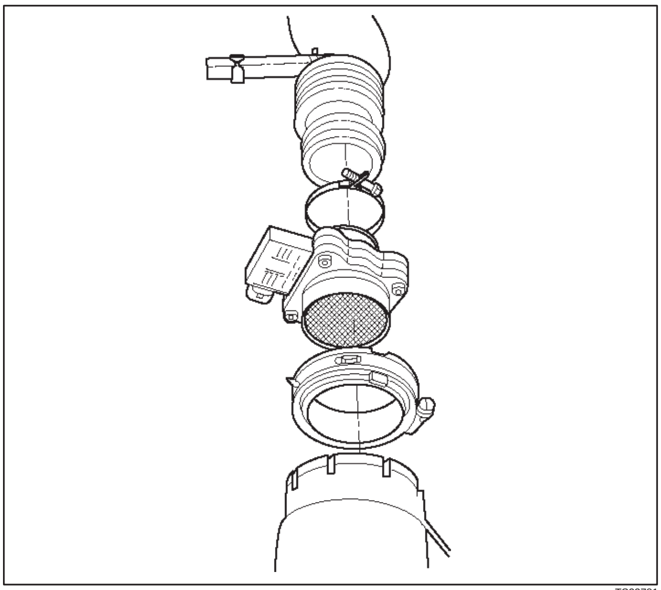
Mass Air Flow (MAF) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the MAF sensor.

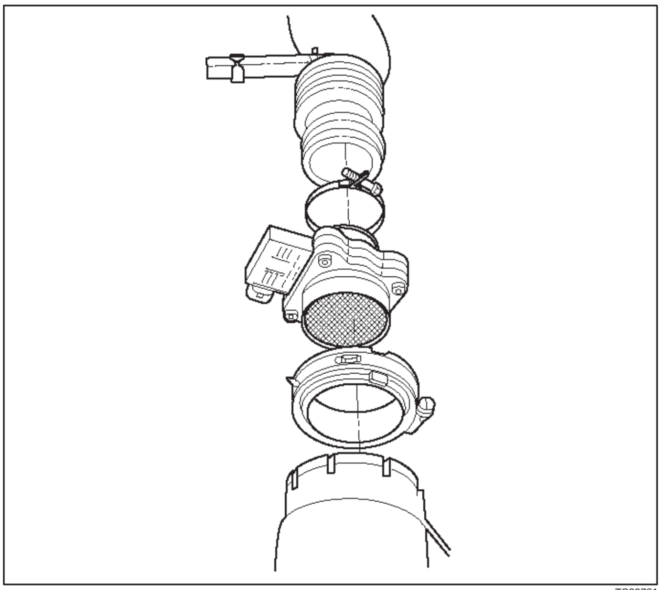


3. Loosen the clamps which secure the intake air duct and the air cleaner to the MAF sensor.
4. Remove the intake air duct from the MAF sensor.
5. Remove the MAF sensor from the air cleaner.



Installation Procedure

1. Install the MAF sensor on the air cleaner with the clamp.
2. Install the intake air duct and the clamp on the MAF sensor.

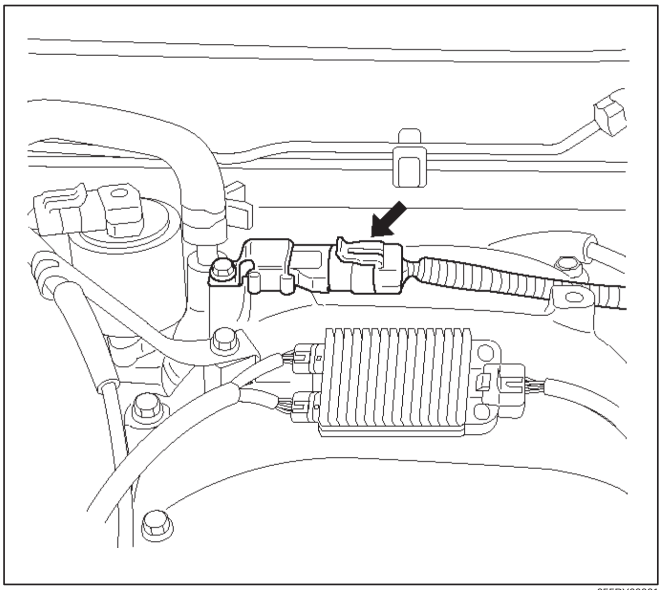


3. Tighten the clamps to secure the MAF sensor to the intake air duct and the air cleaner.
4. Connect the MAF electrical connector.
5. Connect the negative battery cable.

Manifold Absolute Pressure (MAP) Sensor

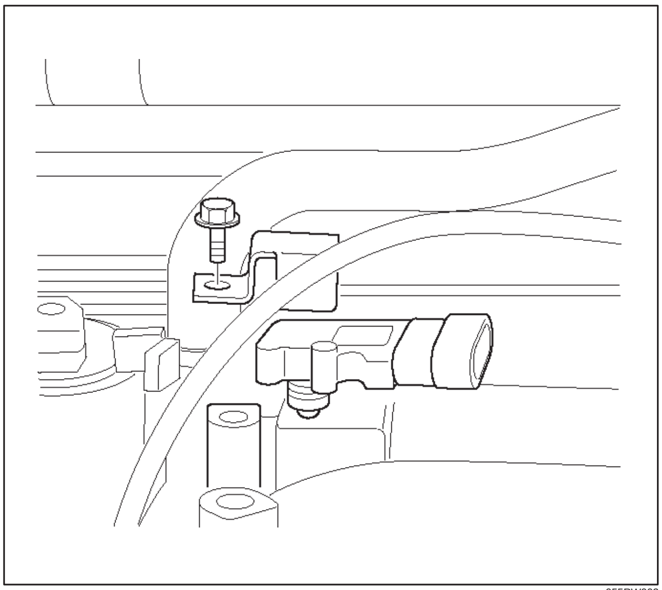
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the MAP sensor.



055RY00001

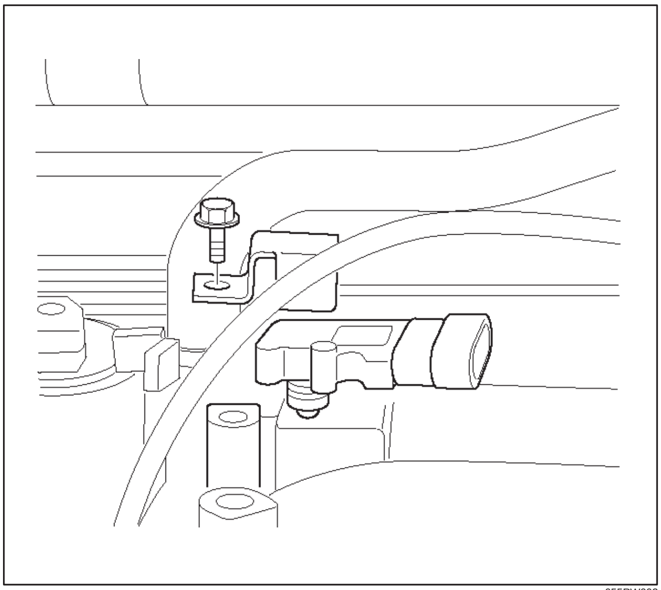
3. Remove the bolt securing the MAP sensor to the mounting bracket on the common chamber.
4. Remove the MAP sensor from the mounting bracket.



055RW002

Installation Procedure

1. Install the MAP sensor in the mounting bracket.



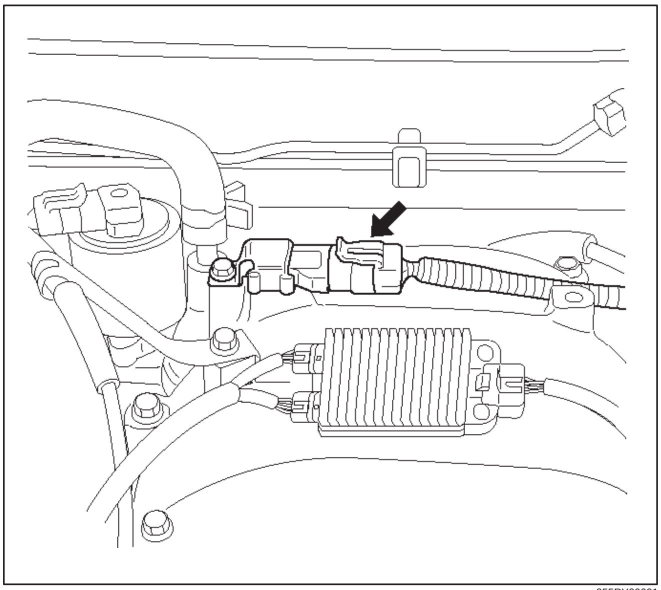
055RW002

2. Install the mounting bracket retaining bolt on the common chamber.

Tighten

- **Tighten the bolt to 20 N·m (12 lb ft.).**

3. Connect the MAP electrical connector.



055RY00001

4. Connect the negative battery cable.

Malfunction Indicator Lamp (MIL)

Removal and Installation Procedure

Refer to Warning light bulb, indicator light valve, illumination light bulb, A/T indicator light bulb in Meter and Gauge.

Reduced Power Lamp

The reduced power lamp (RPL) turns on when the ignition key is moved to the ON position. It should turn off in approximately 3 seconds or immediately after the engine starts.

If the RPL turns on during vehicle operation, a vehicle system failure resulting in reduced engine output is indicated.

If both the reduced RPL and the check engine light turn on, a serious problem affecting vehicle performance is indicated.

Refer to the *OBD system check NO and RPL "ON" steady* in this manual.

Powertrain Control Module (PCM)

Service Precaution

NOTE: To prevent possible electrostatic discharge damage to the PCM, do not touch the connector pins or soldered components on the circuit board.

Electrostatic Discharge (ESD) Damage

Electronic components used in the control systems are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.

There are several ways for a person to become statically charged. The most common methods of charging are by friction and by induction. An example of charging by friction is a person sliding across a car seat.

Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTE: To prevent possible Electrostatic Discharge damage, follow these guidelines:

- Do not touch the control module connector pins or soldered components on the control module circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, or while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

NOTE: To prevent internal PCM damage, the ignition must be in the "OFF" position in order to disconnect or reconnect power to the PCM (for example: battery cable, PCM pigtail, PCM fuse, jumper cables, etc.).

IMPORTANT: When replacing the production PCM with a service PCM, it is important to transfer the broadcast code and production PCM number to the service PCM label. This will allow positive identification of PCM parts throughout the service life of the vehicle. Do not record this information on the metal PCM cover.

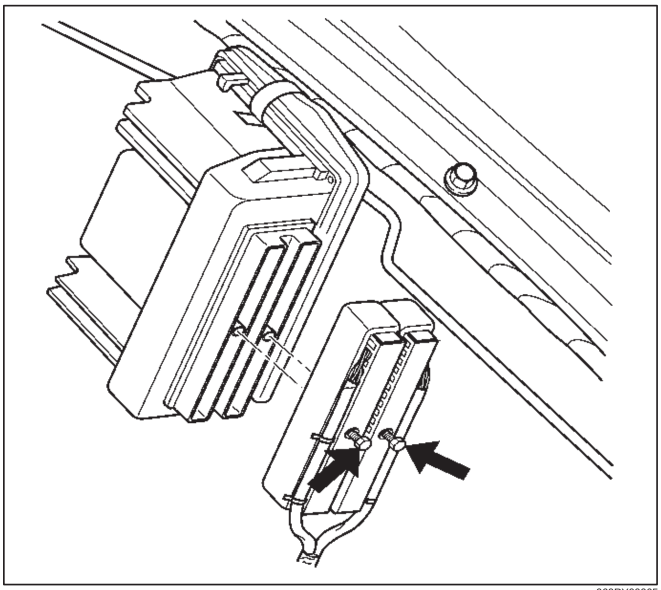
IMPORTANT: The ignition should always be in the "OFF" position in order to install or remove the PCM connectors.

Service of the PCM should normally consist of either replacement of the PCM or EEPROM programming. If the diagnostic procedures call for the PCM to be replaced, the PCM should be checked first to ensure it is the correct part. If it is, remove the faulty PCM and install the new service PCM.

The service PCM EEPROM will not be programmed. DTC P0601 indicates the check sum error.

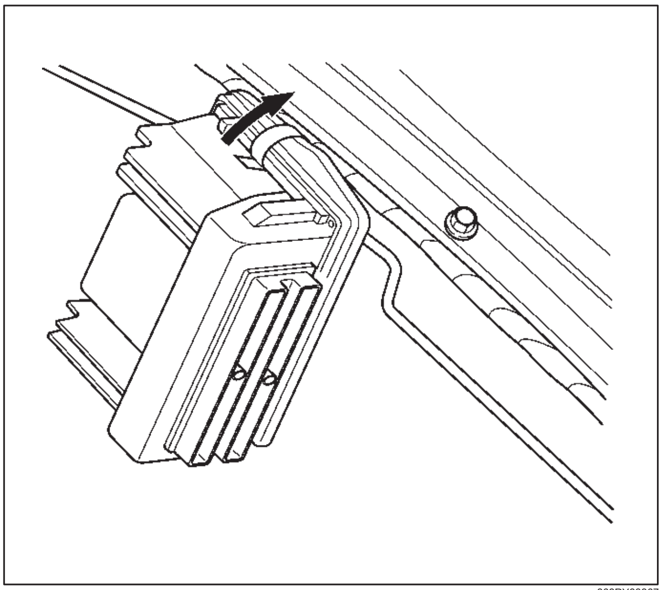
Removal Procedure

1. Disconnect the negative battery cable.
2. Block the wheels.
3. Remove the two screws from the PCM electrical connectors.
4. Disconnect the PCM electrical connectors.



060RY00065

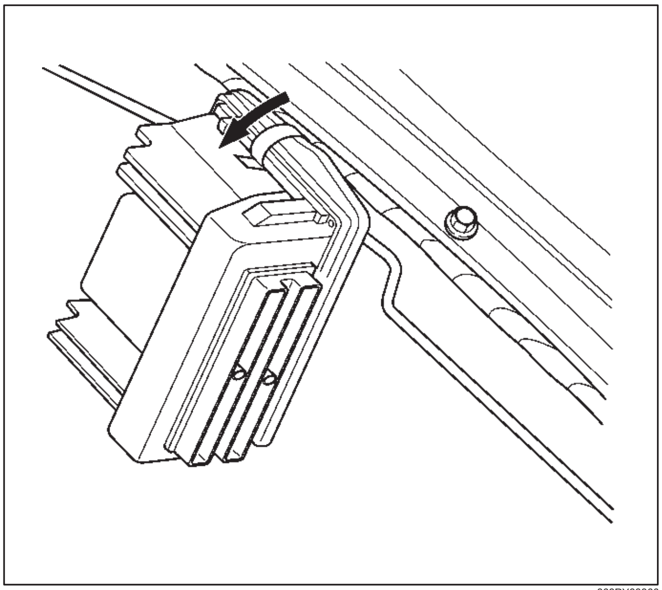
5. After removing the clip which fixes the PCM to the bracket, remove PCM.



060RY00067

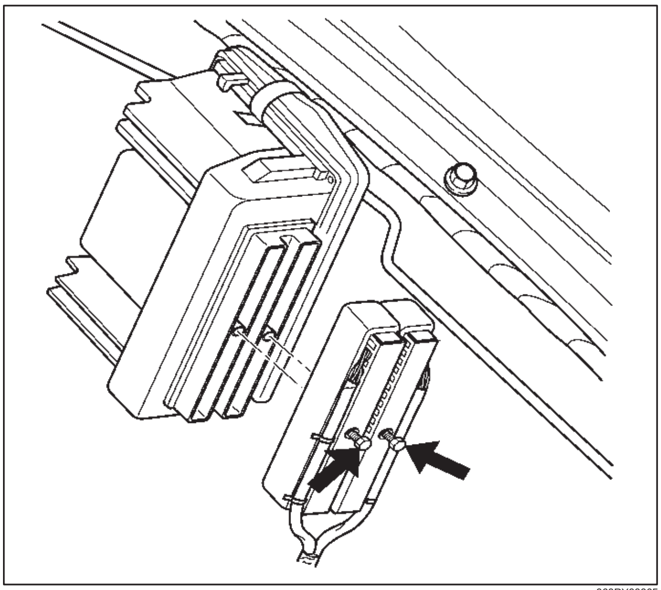
Installation Procedure

1. Install the PCM to bracket and fix with the clip.



060RY00066

2. Connect the PCM electrical connectors.
3. Install the two screws to PCM electrical connectors.



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EEPROM

General Description

The Electronically Erasable Programmable Read Only Memory (EEPROM) is a permanent memory that is physically soldered within the PCM. The EEPROM contains program and calibration information that the PCM needs to control powertrain operation.

EEPROM Programming

1. Set-up – Ensure that the following conditions have been met:
   - The battery is fully charged.
   - The ignition is “ON.”
   - The Vehicle Interface Module cable connection at the DLC is secure.
2. Program the PCM using the latest software matching the vehicle. Refer to up-to-date Techline equipment user’s instructions.
3. If the PCM fails to program, proceed as follows:
   - Ensure that all PCM connections are OK.
   - Check the Techline equipment for the latest software version.
   - Attempt to program the PCM. If the PCM still cannot be programmed properly, replace the PCM. The replacement PCM must be programmed.

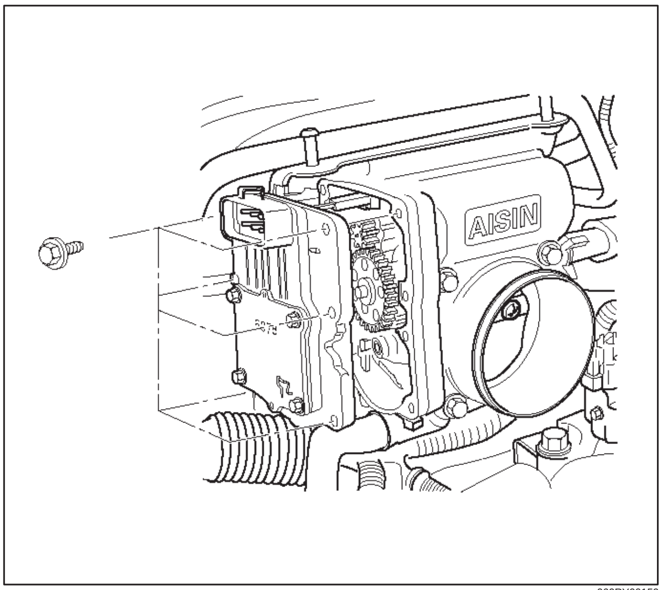
Functional Check

1. Perform the On-Board Diagnostic System Check.
2. Start the engine and run for one minute.
3. Scan for DTCs using the Tech 2.

Throttle Position (TP) Sensor

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the TPS electrical connector.
3. Remove the bolts and the TP sensor from the throttle body.



060RY00159

NOTE: Do not clean the TP sensor by soaking it in solvent. The sensor will be damaged as a result.

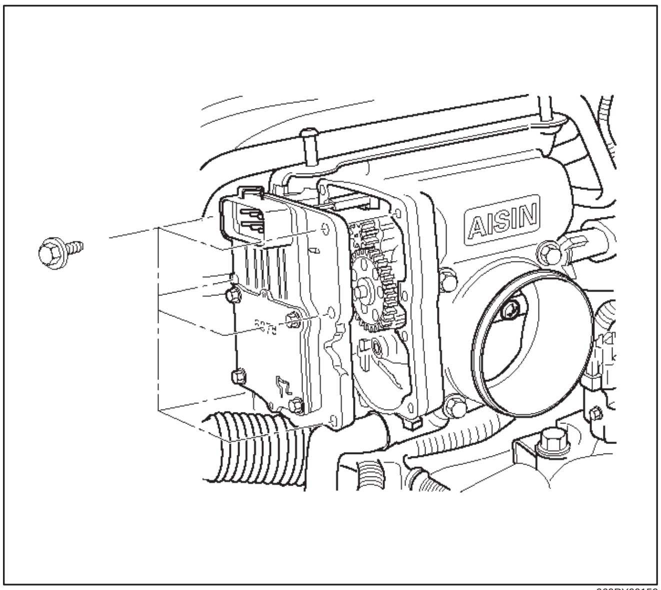
Function Check

Use a Tech 2 to check the TP sensor output voltage at closed throttle.

- The voltage should be under 0.85 volt.
- If the reading is greater than 0.85 volt, check the throttle shaft to see if it is binding.

Installation Procedure

1. Install the TP sensor on the throttle body with the bolts.



060RY00159

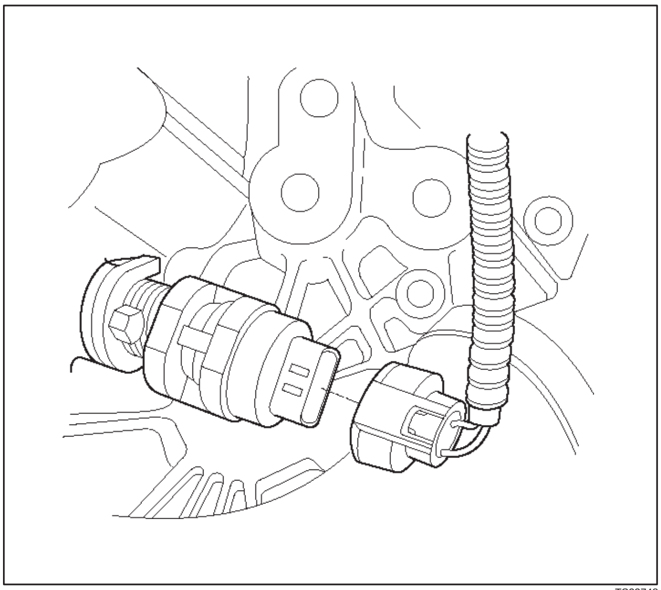
2. Connect the TP electrical connector.
3. Install the negative battery cable.

Vehicle Speed Sensor (VSS)

Removal Procedure

CAUTION: The VSS is located on the right side of the transfer case just ahead of the rear propeller shaft and very close to the exhaust pipes for 4WD and on the extension cover for 2WD. Be sure that the exhaust pipes are cool enough to touch before trying to remove the VSS. If the pipes are hot, you could be burned.

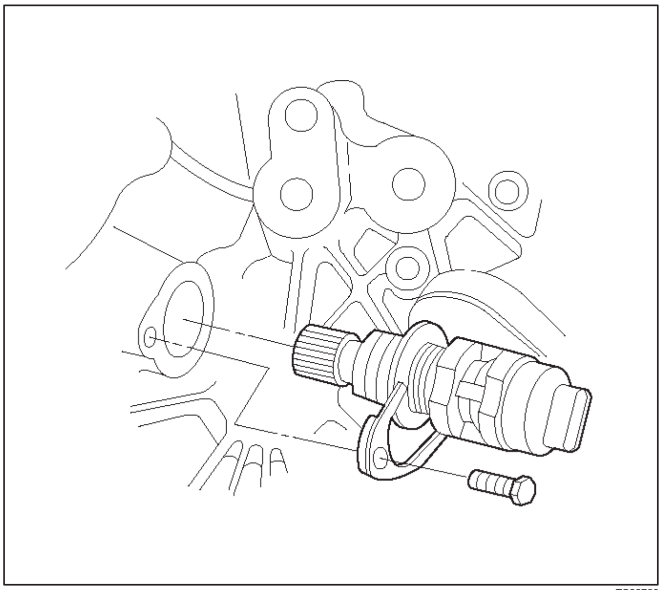
1. Disconnect the negative battery cable.
2. Disconnect the VSS electrical connector.



TS23748

3. Remove the bolt and the clamp securing the VSS in place.

IMPORTANT: Have a container ready to catch any fluid that leaks out when the VSS is removed from the transfer case for 4WD and on the extension cover for 2WD.



TS23780

4. Remove the VSS from the transfer case by wiggling it slightly and pulling it straight out.

Inspection Procedure

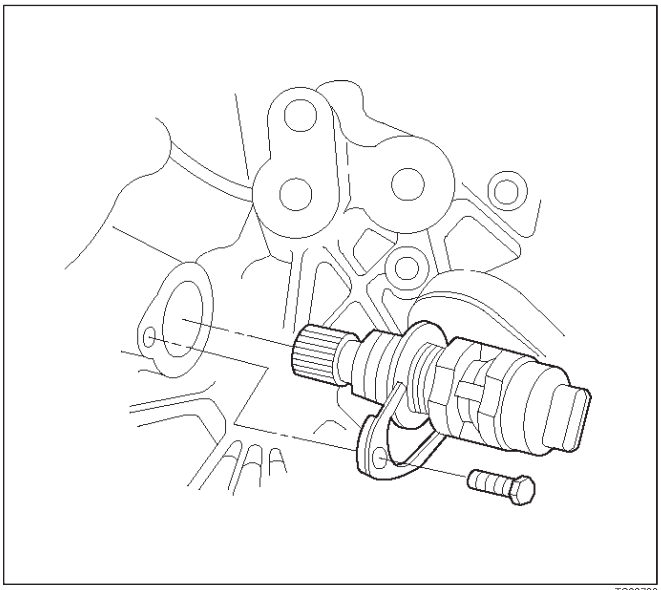
1. Inspect the electrical connector for signs of corrosion or warping. Replace the VSS if the electrical connector is corroded or warped.
2. Inspect the VSS driven gear for chips, breaks, or worn condition. Replace the VSS if the driven gear is chipped, broken or worn.
3. Inspect the O-ring for wear, nicks, tears, or looseness. Replace the O-ring if necessary.

Installation Procedure

1. Install the VSS in the transfer case with the notch for the connector facing the rear.
2. Secure the VSS in place with the clamp and the bolt.

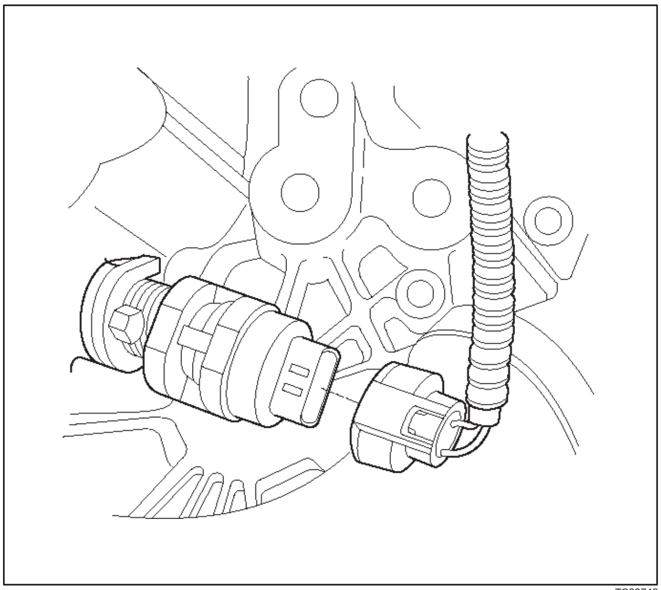
Tighten

- **Tighten the bolt to 16 N·m (12 lb ft.).**



TS23780

3. Connect the VSS electrical connector.



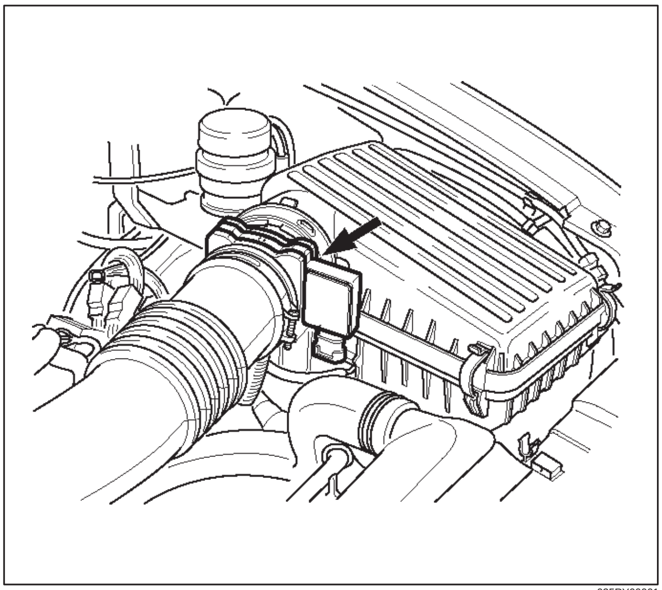
TS23748

4. Check the transfer case oil level. Add fluid if necessary.
5. Connect the negative battery cable.

Air Cleaner/Air Filter

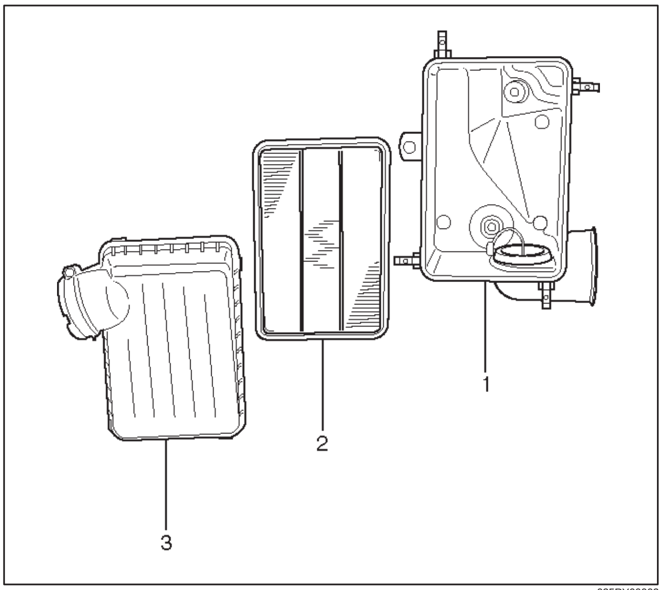
Removal Procedure

1. Loosen the clamp between the air cleaner lid and the mass air flow sensor.



025RY00001

2. Release the four latches securing the lid to the air cleaner housing.
3. Remove the air cleaner lid.
4. Remove the air filter element.
5. Remove the retaining bolts and the air cleaner housing from the vehicle.



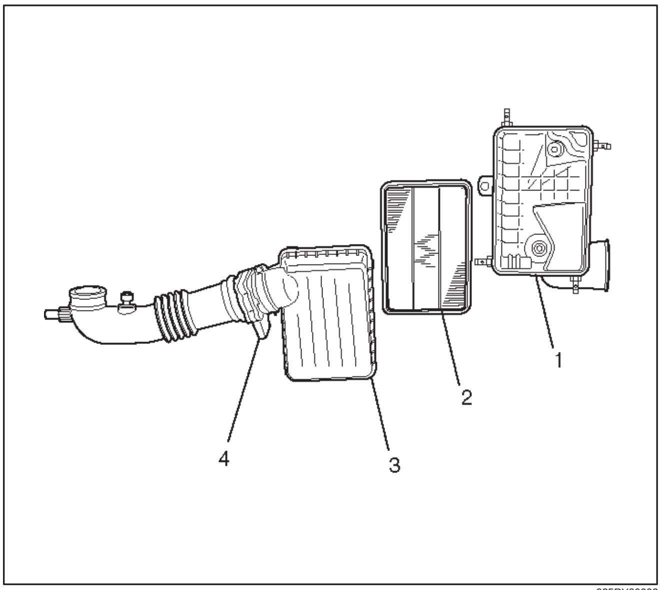
025RY00002

Legend

(1) Air Cleaner Housing
(2) Air Filter Element
(3) Air Cleaner Lid

Installation Procedure

1. Install the air cleaner housing in the vehicle with the retaining bolts.
2. Install the air filter element in the air cleaner housing.
3. Install the air cleaner lid on the MAF sensor and the air cleaner housing.



025RY00003

Legend

(1) Air Cleaner Housing
(2) Air Filter Element
(3) Air Cleaner Lid
(4) Mass Air Flow Sensor

4. Tighten the clamp and secure the four latches between the lid and the air cleaner housing.

Common Chamber

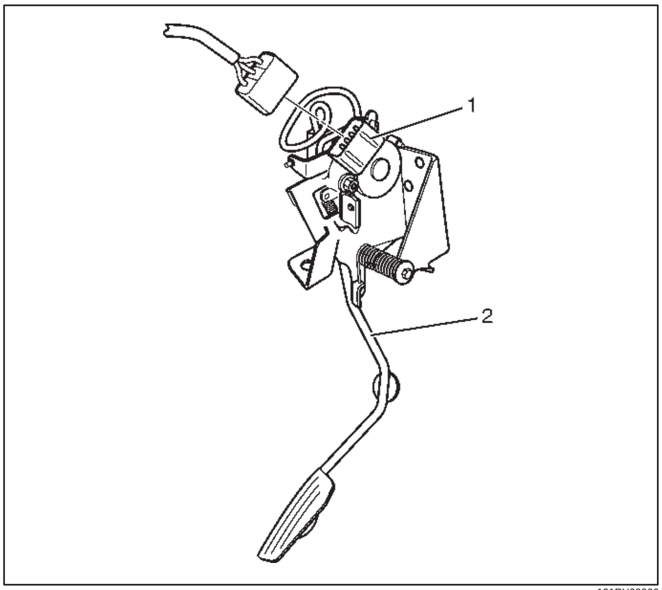
Removal and Installation Procedure

Refer to Common Chamber in Engine Mechanical section.

Accelerator Pedal Replacement

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical harness from the accelerator position sensor.

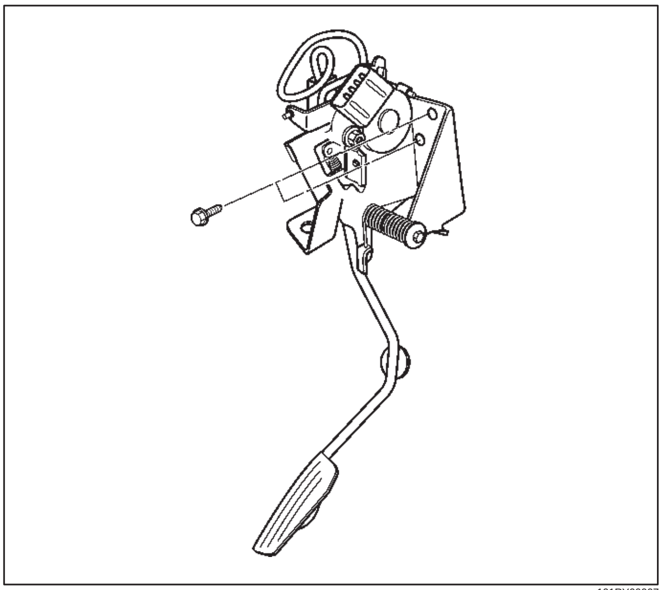


101RY00006

Legend

(1) Accelerator Position Sensor
(2) Accelerator Pedal Assembly

3. Remove the two screws from the accelerator pedal assembly.



101RY00007

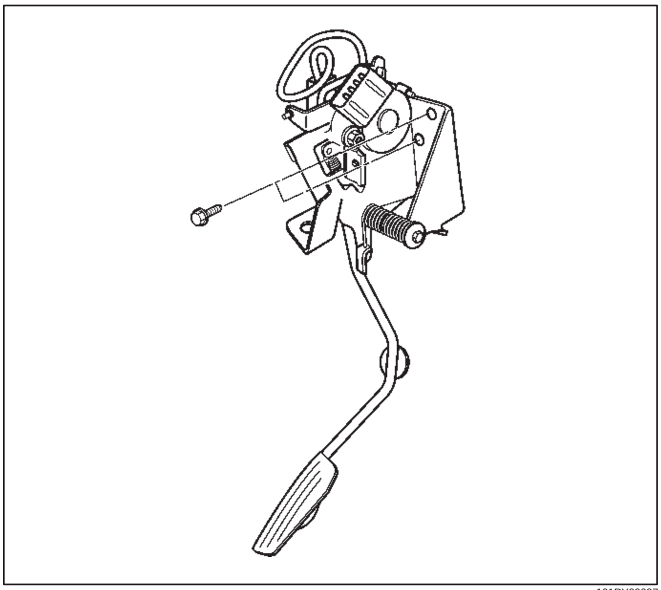
4. Remove the accelerator pedal assembly from the bulkhead.

Installation Procedure

1. Install the accelerator pedal assembly on the bulkhead.
2. Install the two screws to the accelerator pedal assembly.

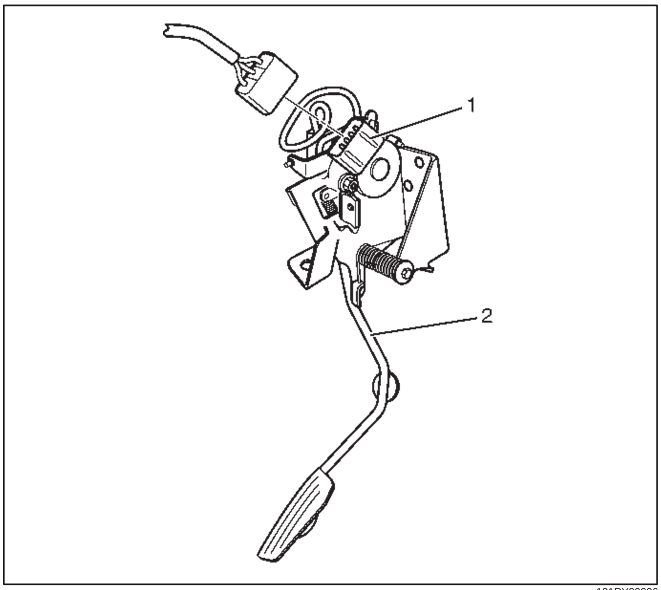
Tighten

- **Tighten the screws to 22 N·m (16 lb ft.).**



101RY00007

3. Connect the electrical harness to the accelerator position sensor.



101RY00006

Legend

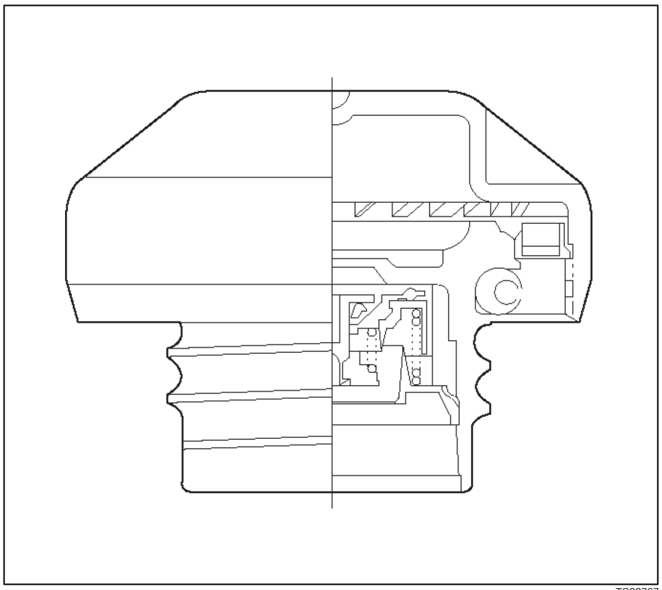
(1) Accelerator Position Sensor
(2) Accelerator Pedal Assembly

4. Install the negative battery cable.

Fuel Filler Cap

General Description

The fuel filler cap includes a vacuum valve and a pressure valve.
If high vacuum or high pressure occurs in the fuel tank, each valve works to adjust the pressure in order to prevent damage of the tank.



TS23767

Inspection Procedure

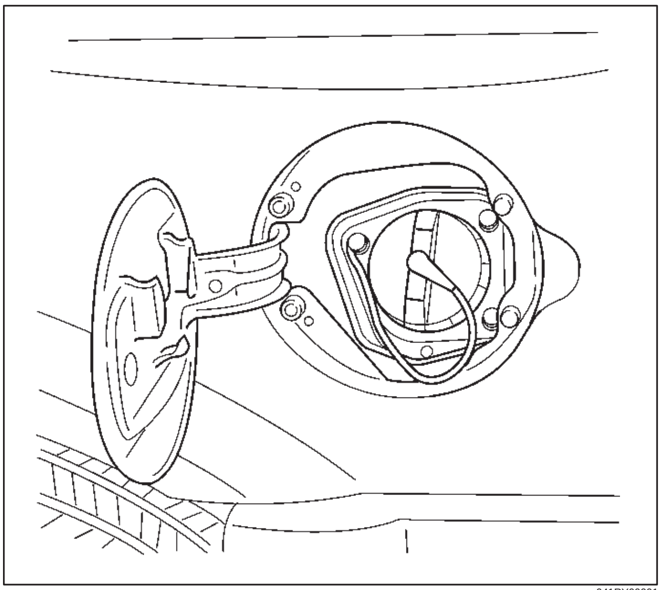
NOTE: Replace the fuel filler cap with the same type of filler cap that was originally installed on the vehicle.

- Check the seal ring in the filler cap for any abnormality and for seal condition.
- Replace the filler cap if any abnormality is found.

Fuel Filter

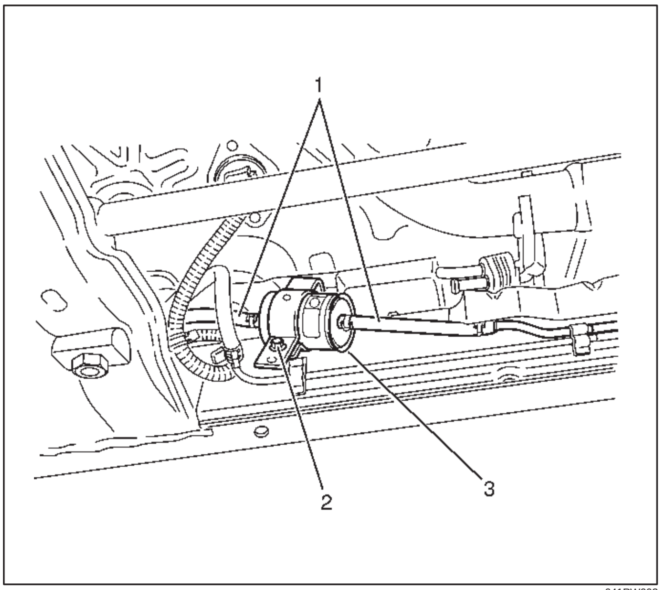
Removal Procedure

1. Disconnect the negative battery cable.
2. Remove the fuel filler cap.



041RY00001

3. Disconnect the fuel hose from the fuel filter on the engine side.
4. Disconnect the fuel hose from the fuel filter on the fuel tank side.
5. Remove the bolt on the fuel filter holder.



041RW003

Legend

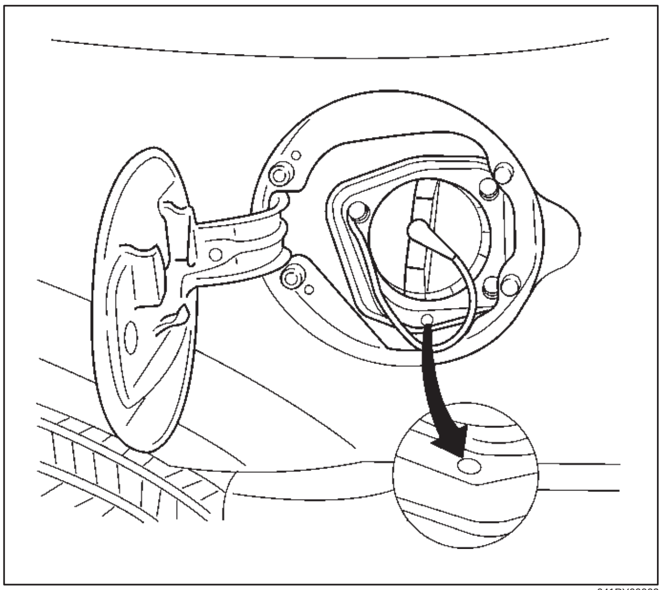
(1) Fuel Hose
(2) Fuel Filter Fixing Bolt
(3) Fuel Filter

6. Remove the fuel filter.

Inspection Procedure

1. Replace the fuel filter when the following occur:
   - Fuel leaks from the fuel filter body.
   - The fuel filter body is damaged.
   - The fuel filter is clogged with dirt or sediment.

2. If the drain hole is clogged, clean the drain.



041RY00002

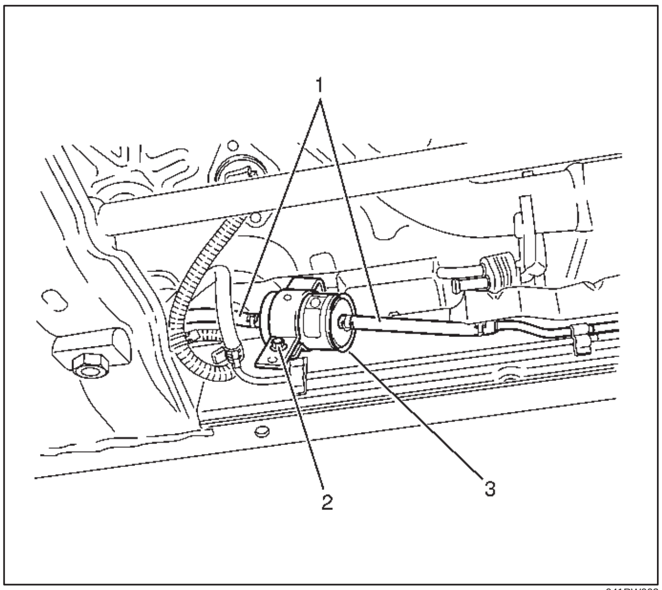
Installation Procedure

1. Install the fuel filter in the correct direction.
2. Install the bolt on the fuel filter holder.

Tighten

- **Tighten the screws to 20 N·m (14 lb ft.).**

3. Connect the fuel hose on the engine side.
4. Connect the fuel hose on the fuel tank side.

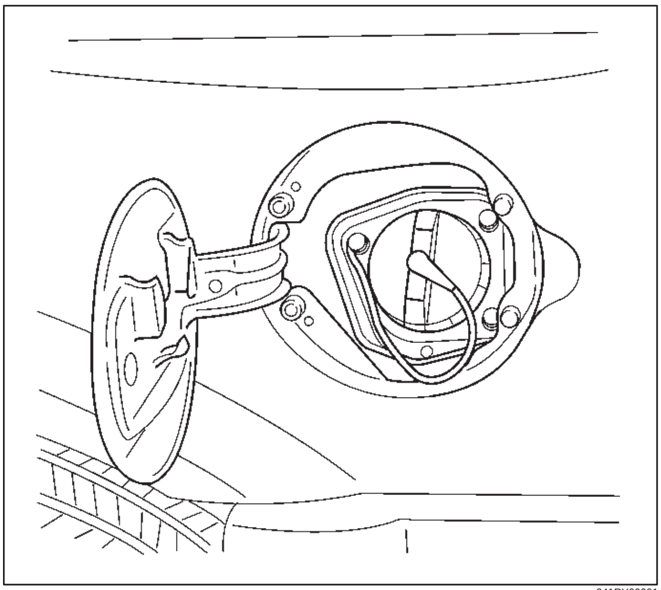


041RW003

Legend

(1) Fuel Hose
(2) Fuel Filter Fixing Bolt
(3) Fuel Filter

5. Install the fuel filler cap.



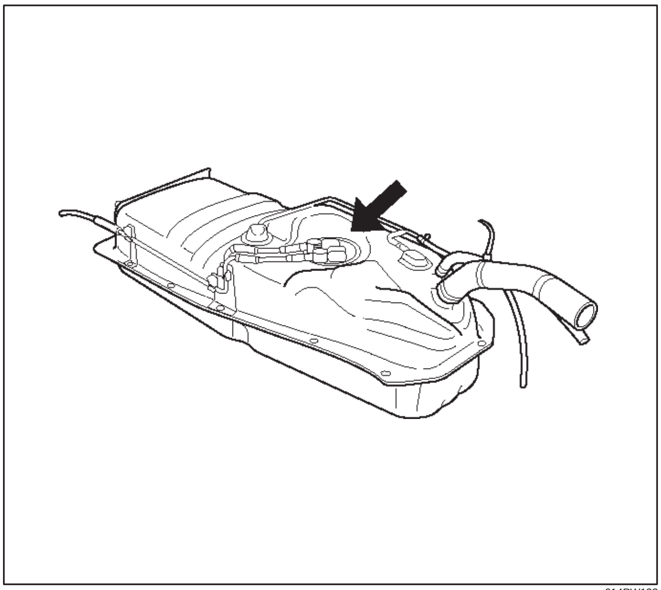
041RY00001

6. Connect the negative battery cable.

Fuel Gauge Unit

Removal Procedure

Refer to *Fuel Gauge Unit Engine Fuel* section.



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Fuel Injectors

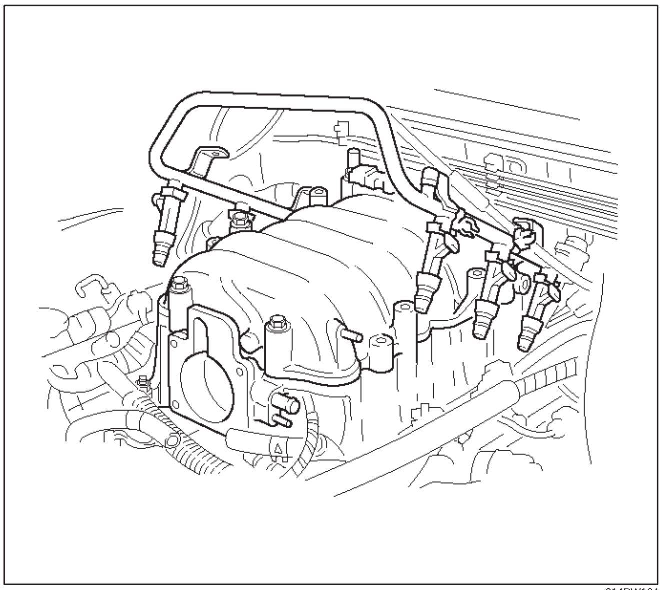
Removal Procedure

NOTE: If the fuel injectors are leaking, the engine oil may be contaminated with fuel. Check the oil for signs of contamination and change the oil and the filter if necessary.

NOTE: Use care in removing the fuel injectors in order to prevent damage to the fuel injector electrical connector pins or the fuel injector nozzles. The fuel injector is an electrical component and should not be immersed in any type of cleaner as this may damage the fuel injector.

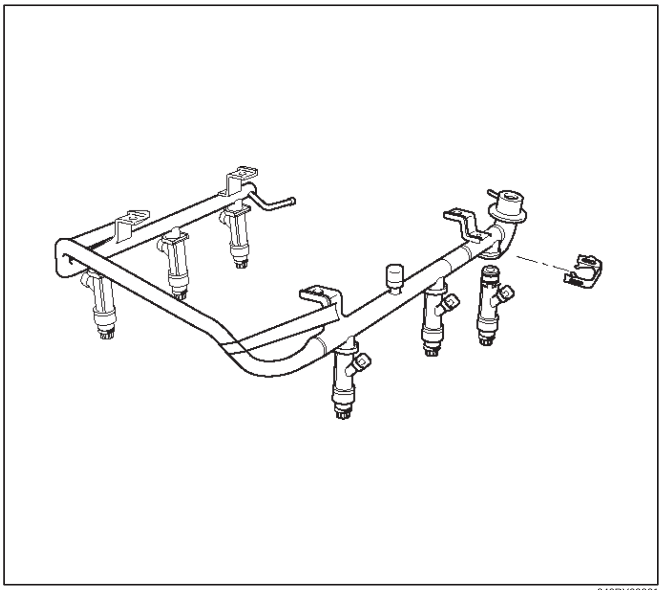
IMPORTANT: Fuel injectors are serviced as a complete assembly only.

1. Disconnect the negative battery cable.
2. Remove the common chamber. Refer to *Common Chamber in Engine Mechanical* section.
3. Remove the fuel rail. Refer to *Fuel Rail* section.



014RW164

4. Remove the injector retainer clip.



040RY00001

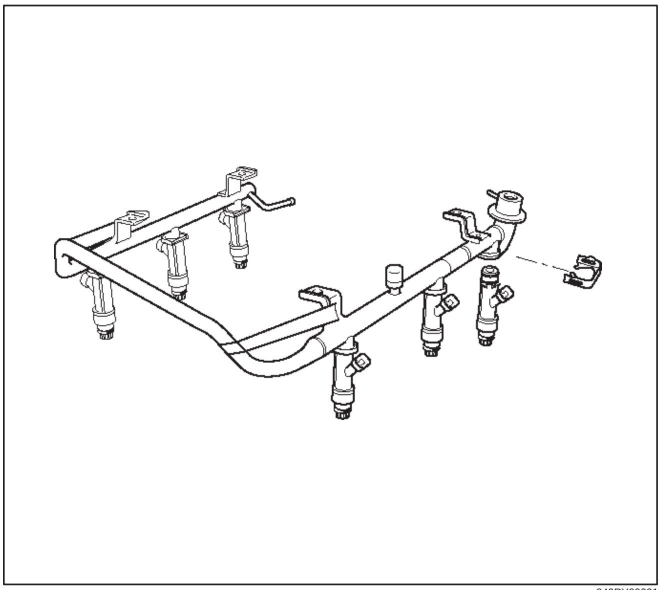
5. Remove the fuel injector assembly.
6. Remove the O-ring from the fuel injector.
7. Remove the O-ring backup from the fuel injector .

Inspection Procedure

1. Inspect the O-rings for cracks or leaks.
2. Replace worn or damaged O-rings.
3. Lubricate the new O-rings with engine oil before installation.

Installation Procedure

1. Install the O-ring backup on the fuel injector.
2. Install the new O-ring on the fuel injector.
3. Install the fuel injector on the fuel rail.



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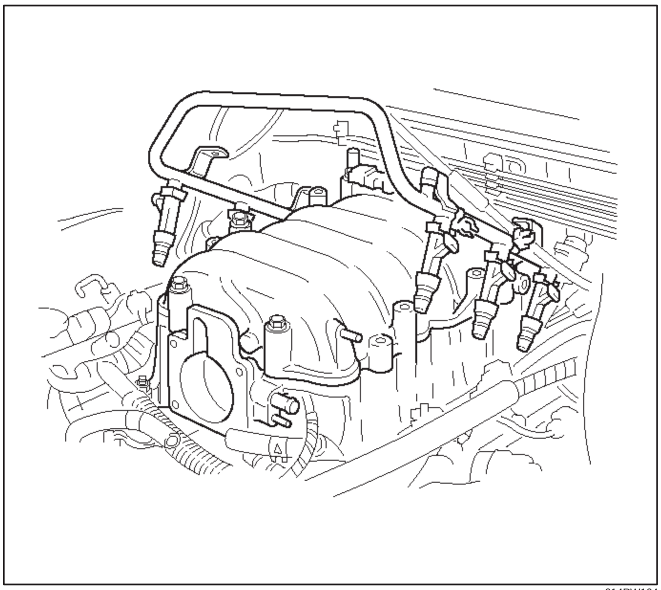
4. Use new fuel injector retainer clips to retain the fuel injector to the fuel rail.
5. Coat the end of the fuel injector with gasoline.
6. Install the fuel rail. Refer to *Fuel Rail* section.



014RW164

7. Install the common chamber. Refer to *Common Chamber in Engine Mechanical* section.
8. Install the engine cover.
9. Connect the negative battery cable.

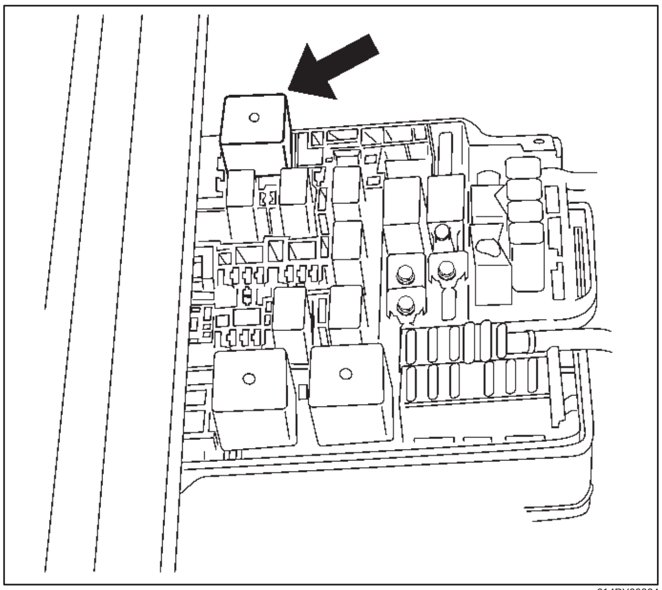
Fuel Metering System

Fuel Pressure Relief Procedure

CAUTION: To reduce the risk of fire and personal injury, there are necessary to relieve the fuel system pressure before filler and gauge unit servicingthe fuel system components.

CAUTION: After relieving the system pressure, a small amount of fuel may be released when servicing fuel lines or connections. Reduce the chance of personal injury by covering the fuel line fittings with a shop towel before you disconnect the fittings. The towels will absorb any fuel that may leak out. When the disconnect is completed, place the towel in an approved container.

1. Remove the fuel cap.
2. Remove the fuel pump relay from the underhood relay box. Refer to *Fuel Pump Relay* section.



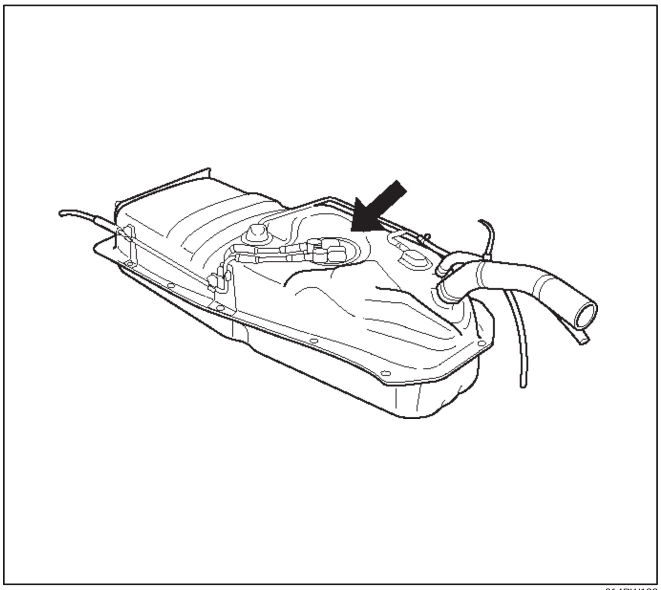
014RY00004

3. Start the engine and allow it to stall.
4. Crank the engine for 30 seconds.
5. Disconnect the negative battery cable.

Fuel Pump Assembly

Removal Procedure

Refer to *Fuel Tank In Fuel Pump Relay* section.

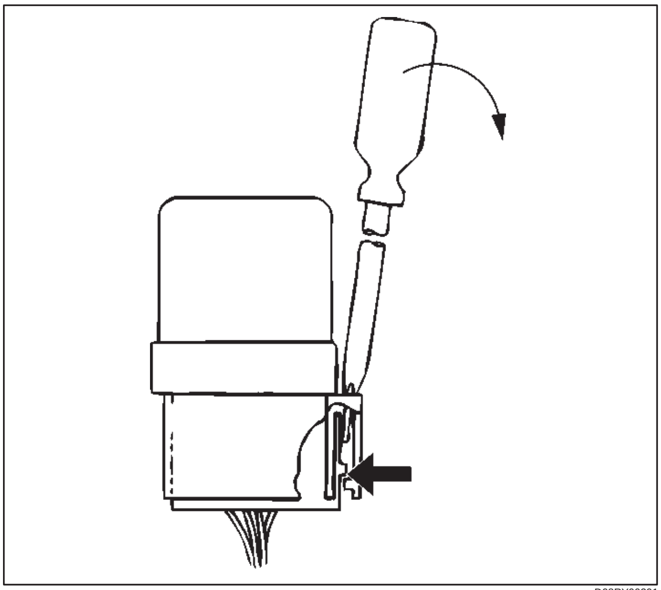


014RW133

Fuel Pump Relay

Removal Procedure

1. Remove the fuse and relay box cover from under the hood.
2. Consult the diagram on the cover to determine which is the correct relay.
3. Insert a small screwdriver into the catch slot on the forward side of the fuel pump relay.
   - The screwdriver blade will release the catch inside.



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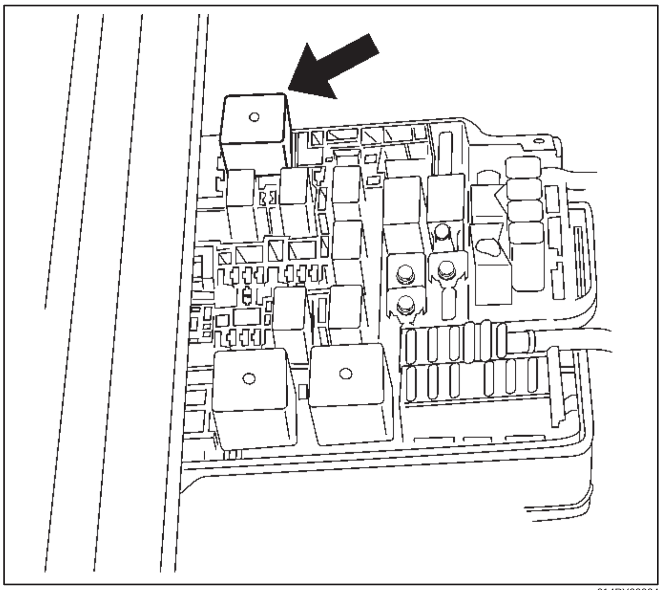
4. Pull the relay straight up and out of the fuse and relay box.



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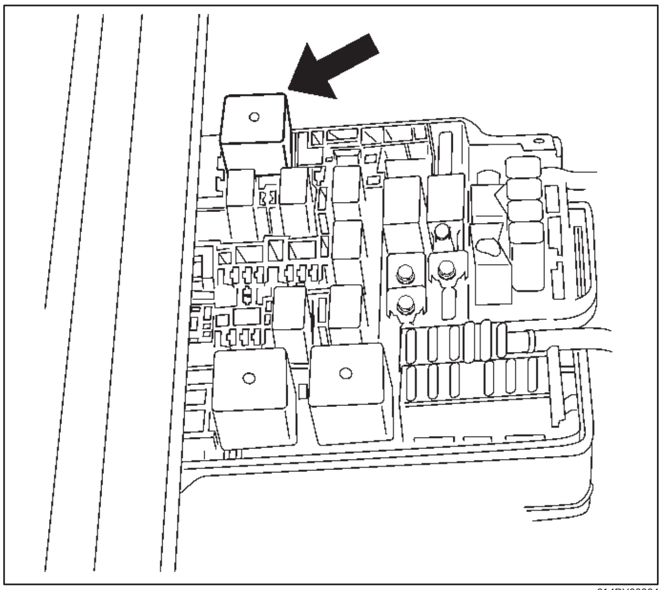
Installation Procedure

1. Insert the relay into the correct place in the fuse and relay box with the catch slot facing forward.
2. Press down until the catch engages.
   - An audible "click" will be heard.



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3. Install the fuse and relay box cover.

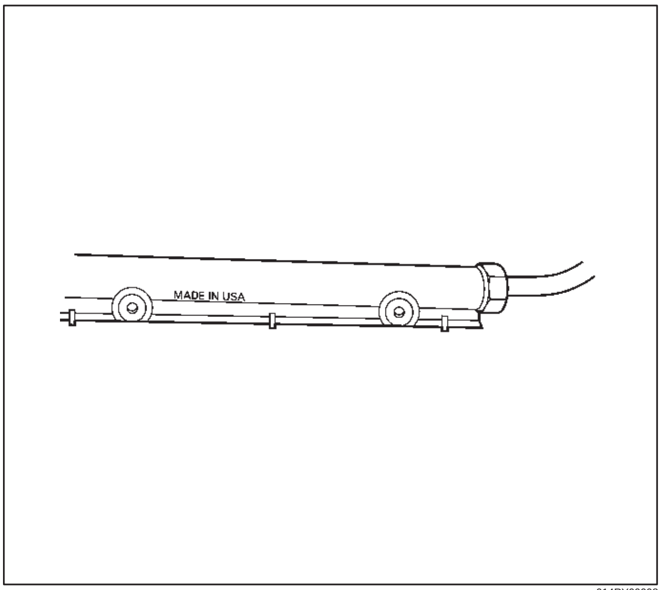
Fuel Rail Assembly

Removal Procedure

NOTE:

- Do not attempt to remove the fuel inlet fitting on the fuel rail. It is staked in place. Removing the fuel inlet fitting will result in damage to the fuel rail or the internal O-ring seal.
- Use care when removing the fuel rail assembly in order to prevent damage to the injector electrical connector terminals and the injector spray tips.
- Fittings should be capped and holes plugged during servicing to prevent dirt and other contaminants from entering open lines and passages.

IMPORTANT: An eight-digit identification number is stamped on the side of the fuel rail. Refer to this number when you service the fuel rail or when a replacement part is required.

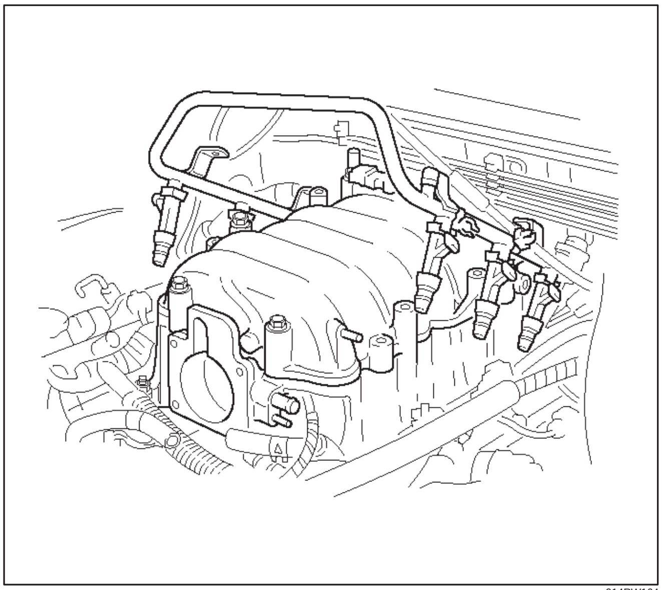


014RY00008

Before removal, the fuel rail assembly may be cleaned with a spray type engine cleaner. Follow the spray package instructions. Do not immerse the fuel rails in liquid cleaning solvent.

1. Depressurize the fuel system. Refer to Fuel Pressure Relief Procedure in this Section.
2. Disconnect the negative battery cable.
3. Remove the engine cover.
4. Disconnect the throttle position sensor electrical connector from throttle body.
5. Disconnect the connectors from manifold absolute pressure sensor, solenoid valve, electric vacuum sensing valve.
6. Disconnect the vacuum hose on canister VSV and positive crankcase ventilation hose.

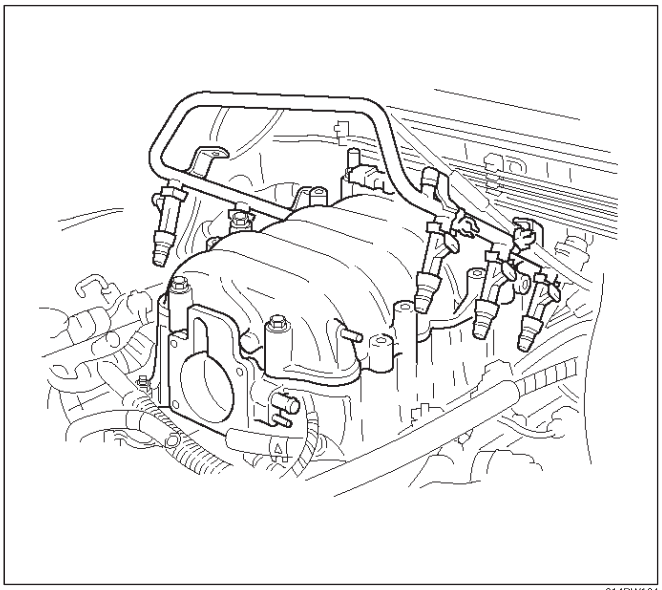
7. Remove the common chamber. Refer to the common chamber in Engine Mechanical section.
   1. Lift up carefully on the fuel injectors. Do not separate the fuel injectors from the fuel rail.
   2. If an injector becomes separated from the fuel rail, the infector O-ring seals and the retainer clip must be replaced.
   3. Drain residual fuel into an approved container.


014RW164

8. If removal of the fuel pressure regulator is necessary, refer to *Fuel Pressure Regulator* section.
9. If removal of the fuel injectors is necessary, refer to *Fuel Injectors* section.

Installation Procedure

1. If the fuel injectors were removed, install them. Refer to *Fuel Injectors* section.
2. If the fuel pressure regulator was removed, install it. Refer to *Fuel Pressure Regulator* section.
3. Install the common chamber. Refer to common chamber in engine Mechanical section.

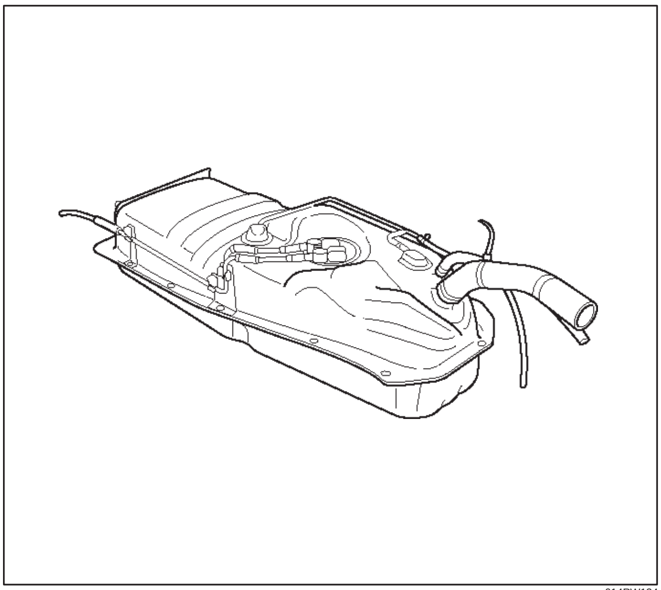

014RW164

4. Connect the vacuum hose on Canister VSV and positive crankcase ventilation hose.
5. Connect the connectors to manifold absolute pressure sensor, solenoid valve, electric vacuum sensing valve.
6. Connect the throttle position sensor electrical connector to throttle body.
7. Install the engine cover.
8. Connect the negative battery cable.
9. Crank the engine until it starts. Cranking the engine may take longer than usual due to trapped air in the fuel rail and in the injectors.

Fuel Tank

Removal Procedure

Refer to *Fuel Tank In Fuel Pump Relay*

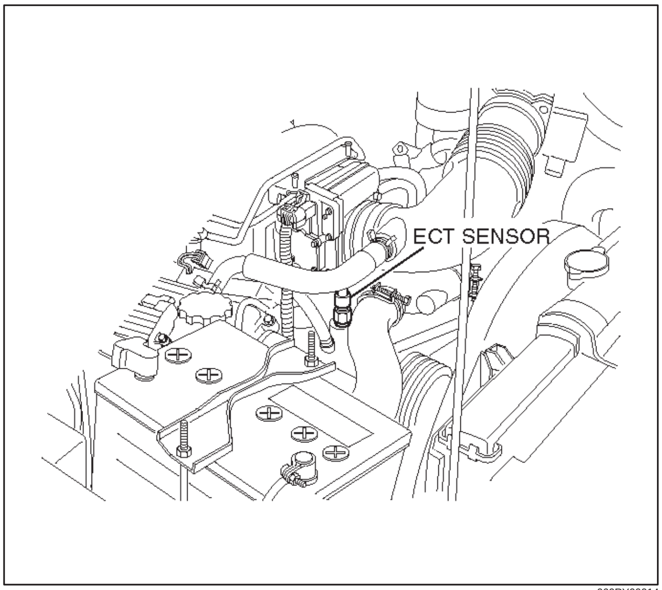

014RW134

Throttle Body (TB)

Removal Procedure

1. Disconnect the negative battery cable.
2. Drain the cooling system. Refer to *Cooling System* section.

3. Disconnect the electrical connectors:
   - Throttle position (TP) sensor.
   - Intake air temperature (IAT) sensor. Refer to *Intake Air Temperature Sensor* section.



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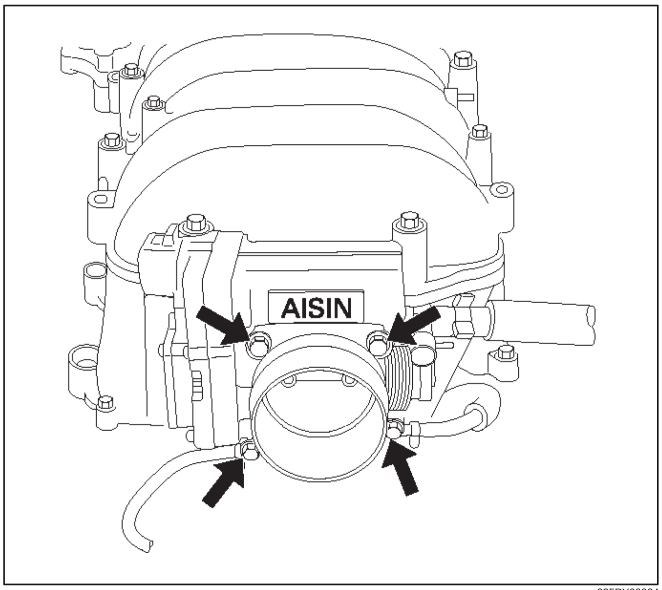
4. Disconnect the vacuum hose below the air horn.
5. Remove the intake air duct clamp.
6. Disconnect the intake air duct.
7. Disconnect the coolant lines from the throttle body.
8. Remove the bolts from the common chamber.
9. Remove the throttle body from the common chamber.
10. Remove the gasket from the common chamber.



025RY00004

11. Remove the TP sensor. Refer to *Throttle Position (TP) Sensor* section.

Inspection Procedure

NOTE: Do not use solvent of any type when you clean the gasket surfaces on the intake manifold and the throttle body assembly. The gasket surfaces and the throttle body assembly may be damaged as a result.

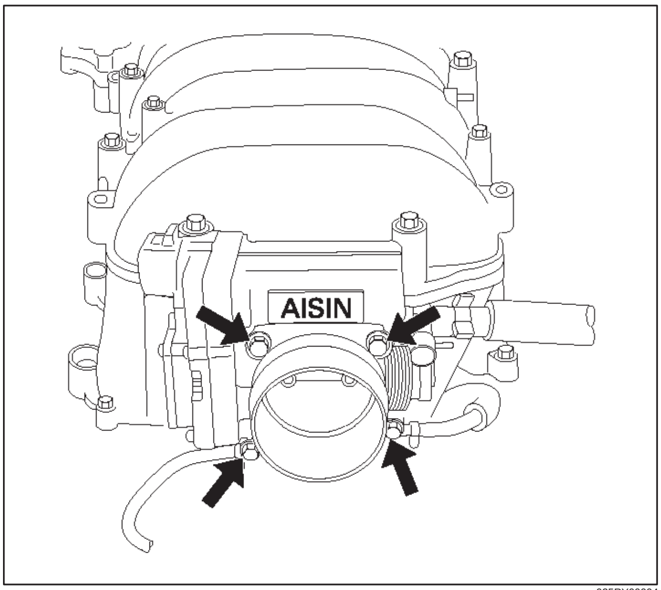
- If the throttle body gasket needs to be replaced, remove any gasket material that may be stuck to the mating surfaces of the manifold.
- Do not leave any scratches in the aluminum casting.

Installation Procedure

1. Install the TP sensor. Refer to *Throttle Position (TP) Sensor* section.
2. Install the gasket on the common chamber.
3. Install the throttle body on the common chamber.
4. Secure the gasket and the throttle body with the four bolts.
   - The vacuum lines must be properly routed under the throttle body before tightening the mounting bolts.

Tighten

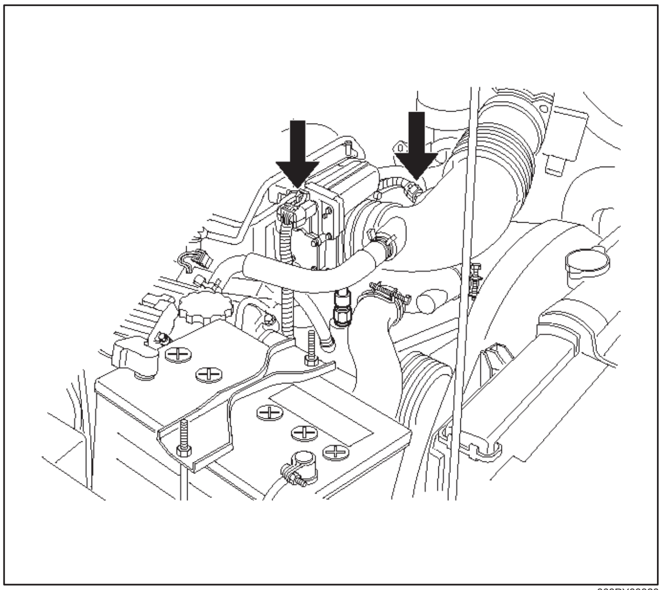
- **Tighten the throttle body mounting bolts to 10 N·m (87 lb in).**



025RY00004

5. Install the coolant lines.
6. Connect all the vacuum lines.
7. Install the intake air duct.
8. Tighten the intake air duct clamp.

9. Connect all the electrical connectors:
   - Throttle position (TP) sensor.
   - Intake air temperature (IAT) sensor. Refer to *Intake Air Temperature Sensor* section.

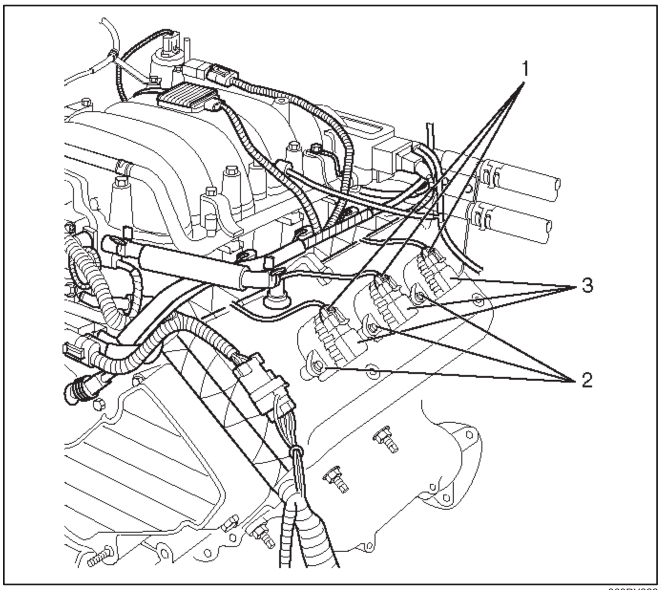

060RY00020

10. Install the accelerator cable assembly. Refer to *Accelerator Cable in Engine Speed Control System* section.
11. Fill the cooling system. Refer to *Cooling System* section.
12. Install the negative battery cable.

Electronic Ignition System

Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the ignition coil connector at the ignition coil assemblies.
3. Remove the two screws that secure the ignition coil assemblies to the rocker cover.



060RY022

Legend

(1) Ignition Coil Connectors
(2) Bolts
(3) Ignition Coil Assemblies

4. Remove the ignition coil assemblies and the spark plug boot from the spark plug.
   - Twist the ignition coil assemblies while pulling it straight up.
5. Use the appropriate spark plug socket in order to remove the spark plug from the engine.

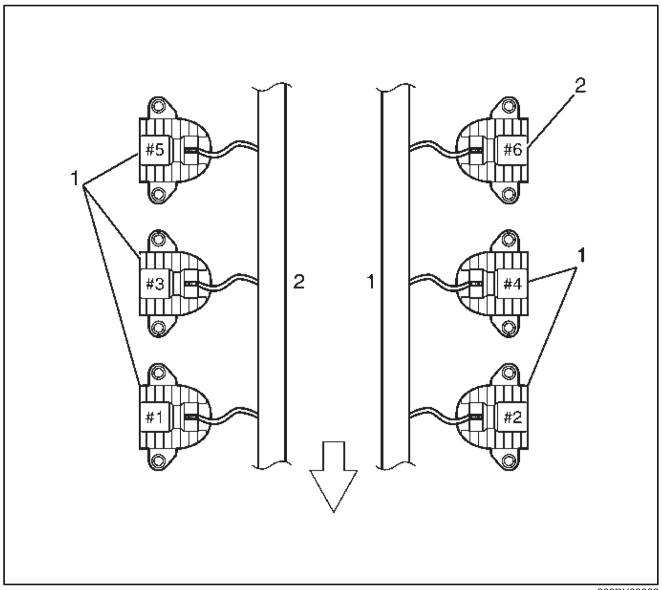
Installation Procedure

NOTE: The plug must thread smoothly into the cylinder head and be fully seated. Use a thread chaser if necessary to clean the threads in the cylinder head. Cross-threading or failure to fully seat the spark plug can cause plug overheating, exhaust blow-by gases, or thread damage. Do not overtighten the spark plugs. Over tightening can cause aluminum threads to strip.

1. Install the spark plug in the engine. Use the appropriate spark plug socket.

   Tighten
   - **Tighten the spark plug to 18 N·m (13 lb ft.).**
2. Install the ignition coil assemblies and spark plug boot over the spark plug.

CAUTION: Ignition coil assembly #6 is different from ignition coil assembly from #1 to #5. Ignition coil assemblies #6 is short type. So, note it when installing ignition coil assembly of #6.



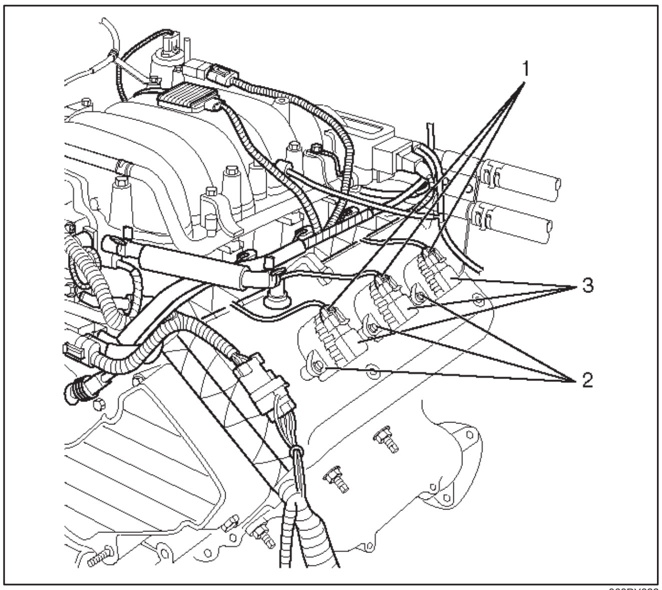
060RY00002

Legend

(1) Long Type Ignition Coil Assemblies (#1 ~ #5)
(2) Short Type Ignition Coil Assembly (#6)

3. Install ignition coil assemblies and tighten the fixing bolts to the specified torque.

Torque: 4 N·m (35.4 lb in)



060RY022

Legend

(1) Ignition Coil Connectors
(2) Bolts
(3) Ignition Coil Assemblies

4. Connect the ignition coil connector at the ignition coil assemblies.
5. Connect the negative battery cable.

Catalytic Converter

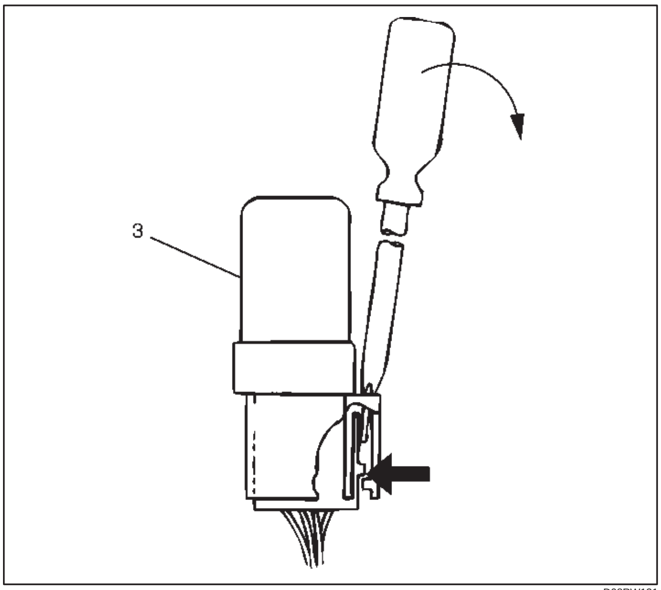
Removal and Installation Procedure

Refer to *Engine Exhaust in Engine* section.

Air Conditioning Thermo Relay

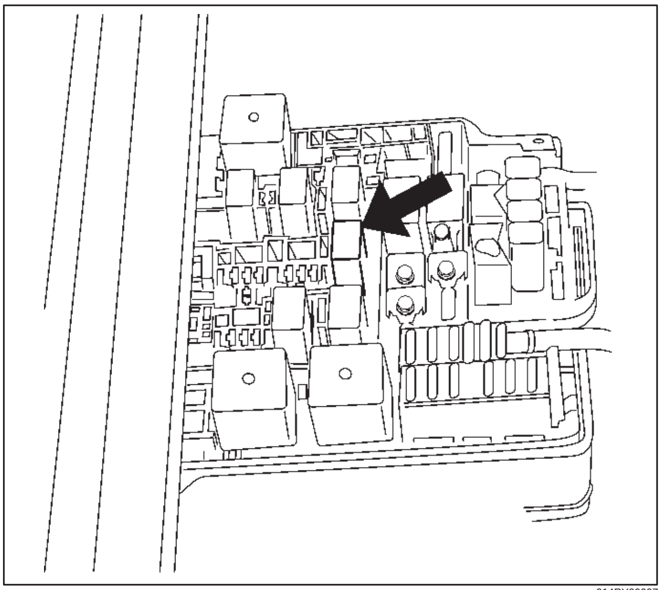
Removal Procedure

1. Remove the fuse and relay box cover from under the hood.
2. Consult the diagram on the cover to determine which is the correct relay.
3. Insert a small screwdriver into the catch slot on the forward side of the fuel pump relay.
   - The screwdriver blade will release the catch inside.



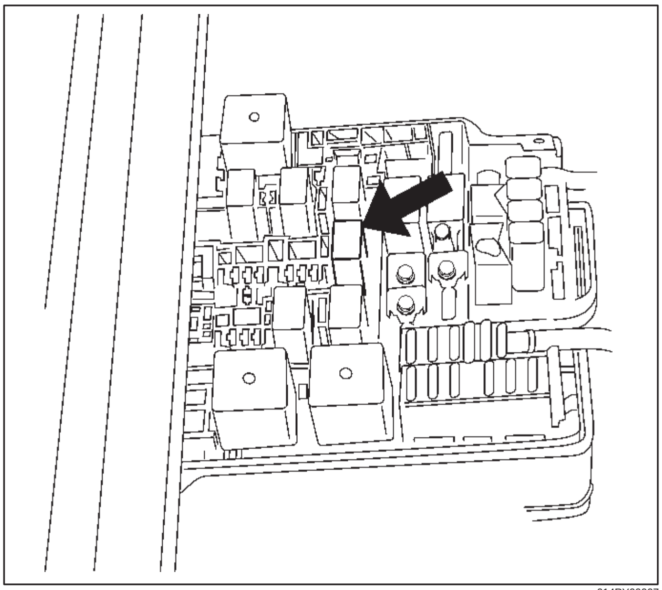
D08RW131

4. Pull the relay straight up and out of the fuse and relay box.


014RY00007

Installation Procedure

1. Insert the relay into the correct place in the fuse and relay box with the catch slot facing forward.
2. Press down until the catch engages.
   - An audible “click” will be heard.
3. Install the fuse and relay box cover.



014RY00007

EVAP Canister Hoses

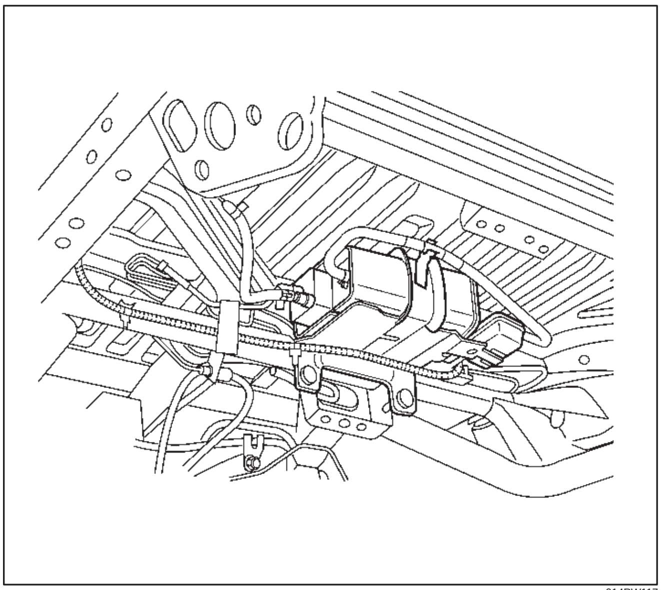
Service Information

To view the routing of the EVAP canister hoses, refer to *Vehicle Emission Control Information* in *Diagnosis*. Use 6148M or equivalent when you replace the EVAP canister hoses.

EVAP Canister

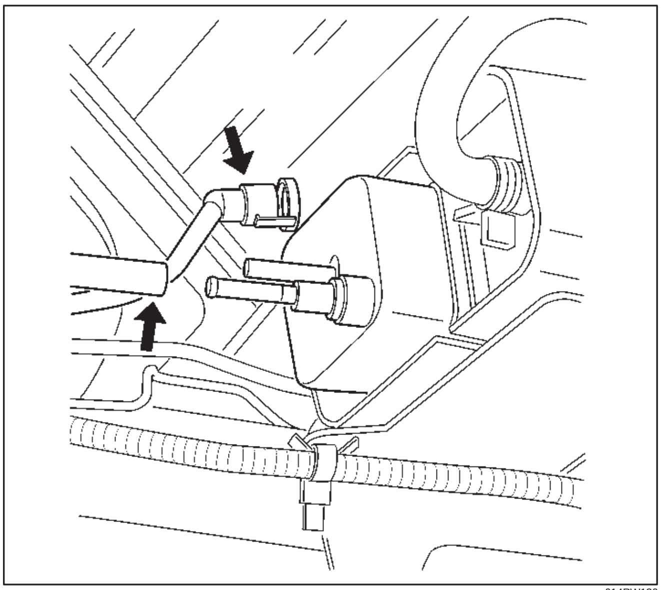
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the two hoses from the EVAP canister.



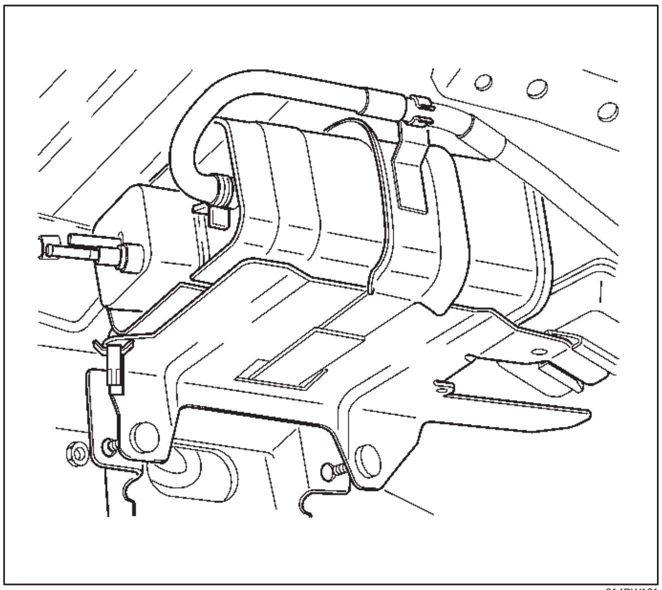
014RW117

3. Disconnect the fuel vapor connector and the purge hose from the EVAP canister vent solenoid.



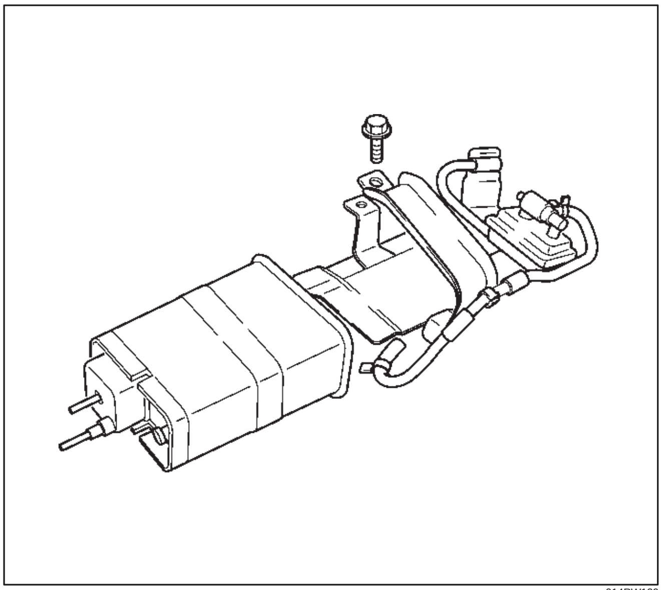
014RW130

4. Remove the two retaining bolts the EVAP canister to the mounting bracket on the cross member.



014RW131

5. Remove the retaining bolt on the mounting bracket the slide the canister out of mounting bracket.



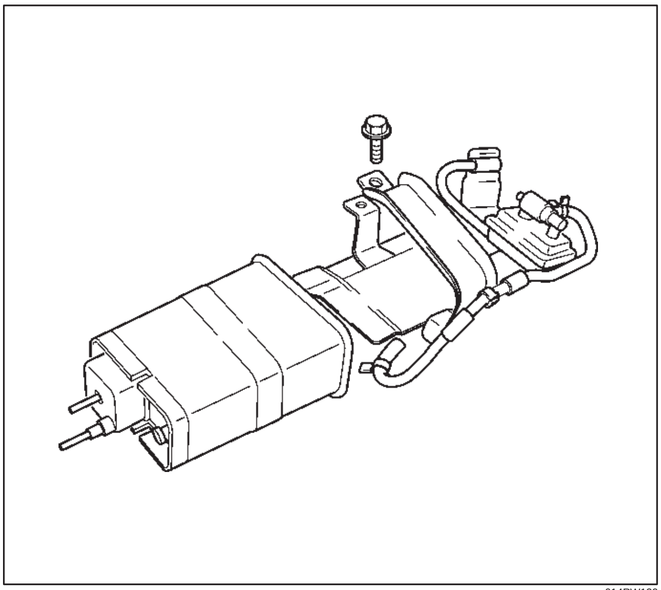
014RW129

Inspection Procedure

1. Inspect the hoses for cracks and leaks.
2. Inspect the canister for a damaged case.

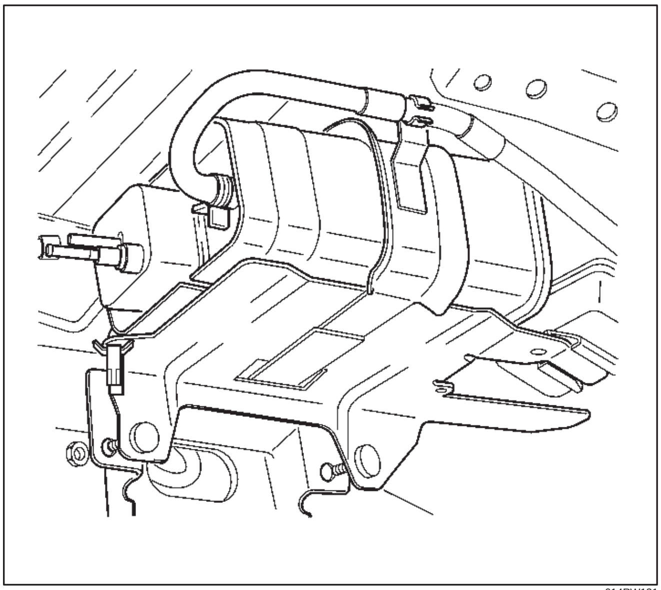
Installation Procedure

1. Slide the canister into mounting bracket the install the mounting bracket bolt.



014RW129

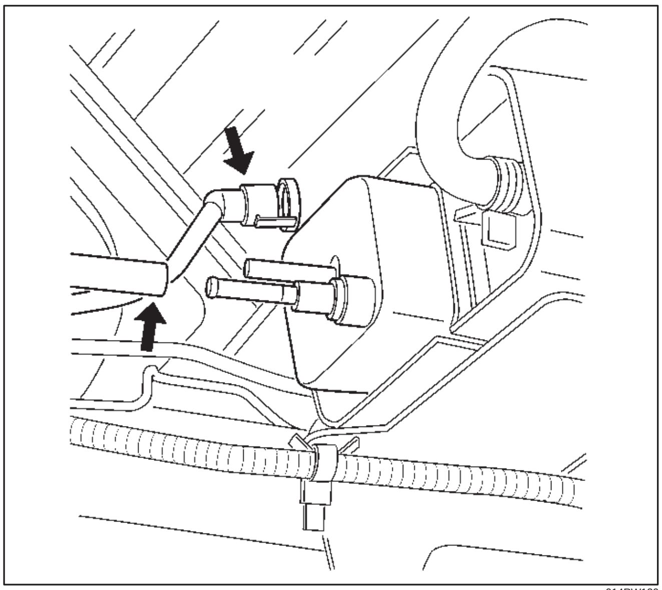
2. Install the retaining bolts the EVAP canister to the mounting bracket on the cross member.



014RW131

3. Connect the fuel vapor connector to the EVAP canister vent solenoid.

4. Connect the two hoses to the EVAP canister.



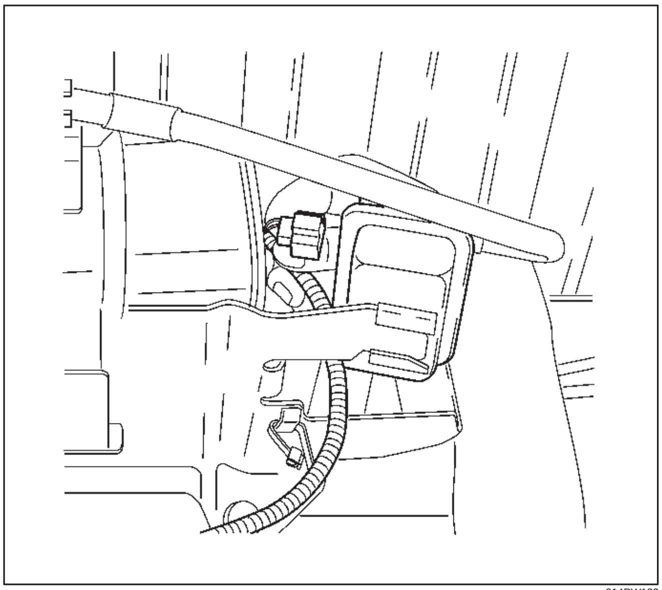
014RW130

5. Disconnect the negative battery cable.

EVAP Canister Vent Solenoid

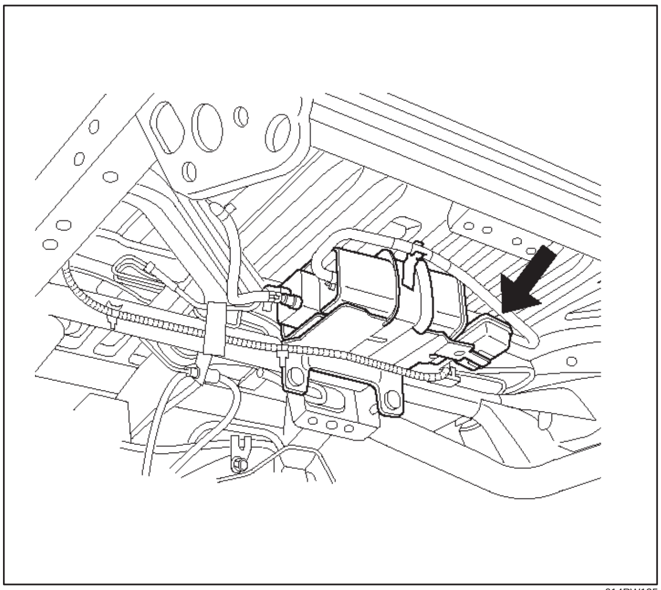
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the connector and hose.



014RW132

3. Slide the out of EVAP canister vent solenoid from mounting bracket.



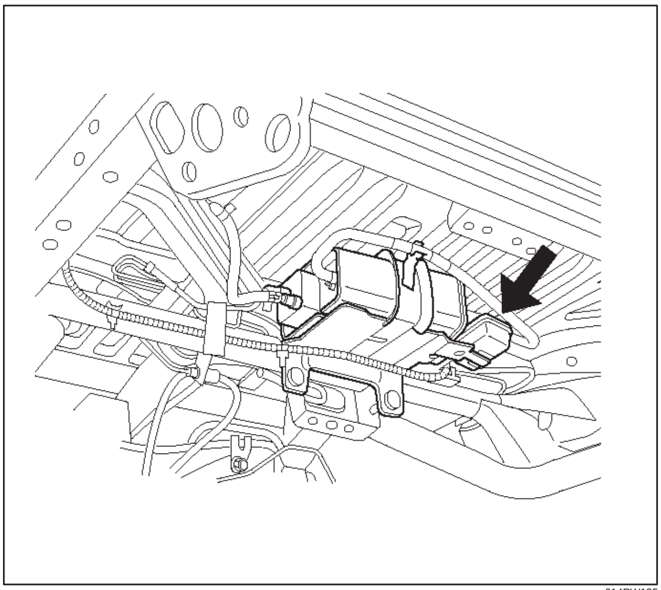
014RW135

Inspection Procedure

1. Check for cracks or leaks.
2. Energize the solenoid and try to blow through it. The solenoid should not allow passage of air when energized. (J 35616 Connector Test Kit can be used to easily attach jumper wires from the battery to the solenoid).

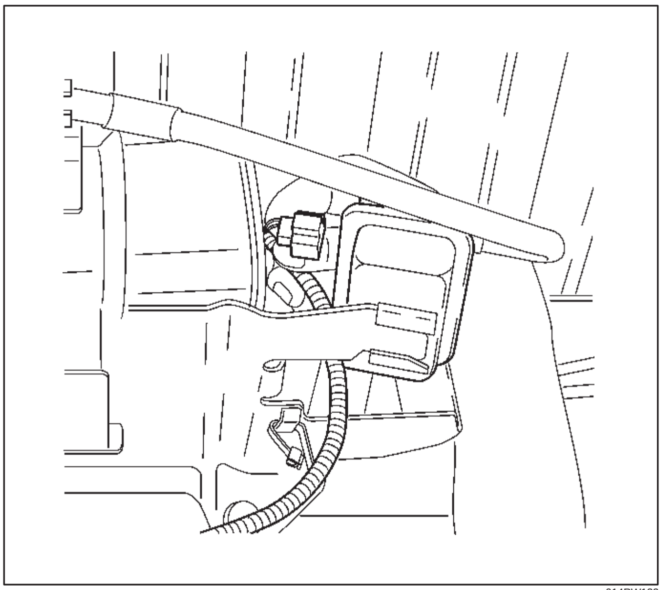
Installation Procedure

1. Slide the into EVAP canister vent solenoid from mounting bracket.



014RW135

2. Connect the connector and hose.



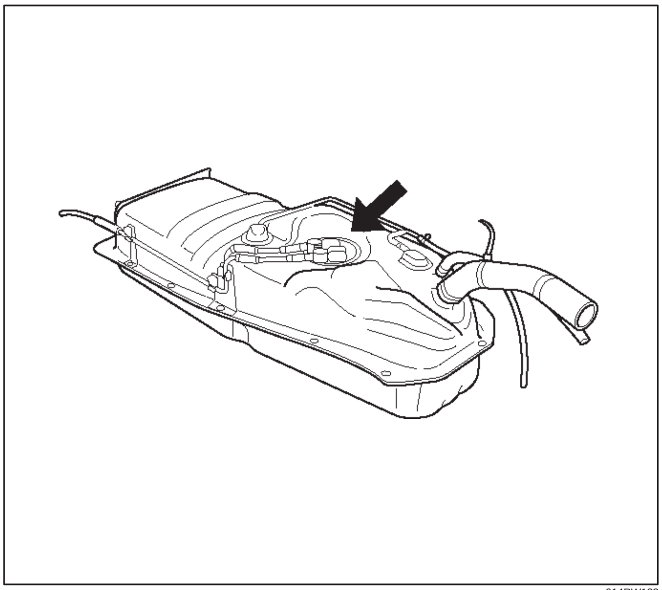
014RW132

3. Connect the negative battery cable.

Fuel Tank Pressure Sensor

Removal Procedure

1. Remove the fuel pump assembly. Refer to *Fuel Tank In Fuel Pump*.
2. Carefully pry the fuel tank pressure sensor out of the top of the fuel pump assembly.



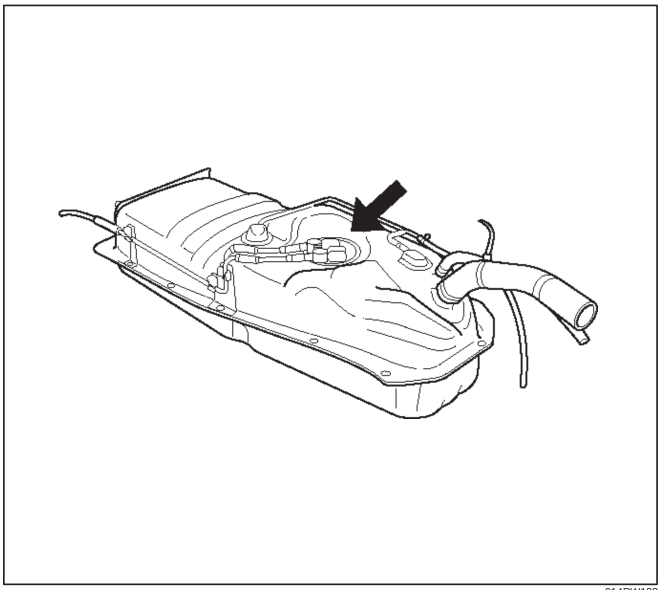
014RW133

Inspection Procedure

1. Inspect the vapor pressure sensor for cracks in the housing and corrosion on the electrical terminals.
2. Inspect the rubber grommet for tears and signs of rot.

Installation Procedure

1. Install the rubber grommet on the fuel pump assembly.



014RW133

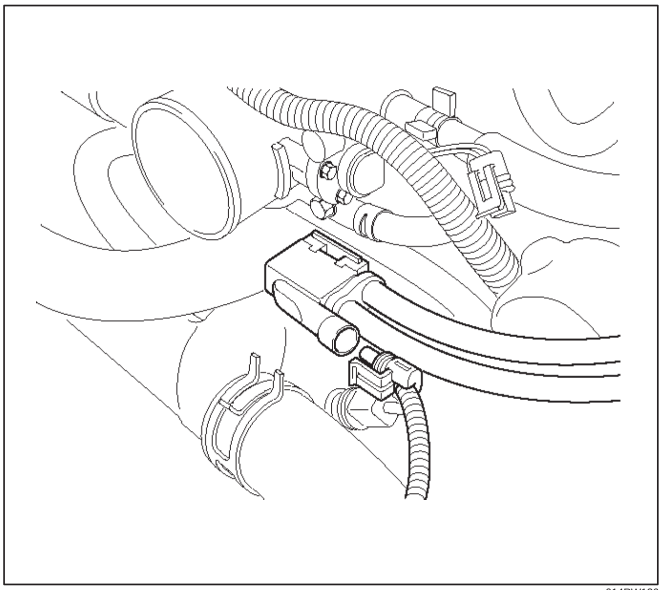
2. Install the fuel tank vapor pressure sensor on the fuel pump assembly.
   - Insert the sensor nipple firmly into the grommet.
   - Keep twisting and pushing the sensor until the wide portion of the nipple shows on the other side of the grommet.
3. Install the fuel pump assembly on the fuel tank. Refer to *Fuel Tank In Fuel Pump.*.

EVAP Canister Purge Solenoid

Removal Procedure

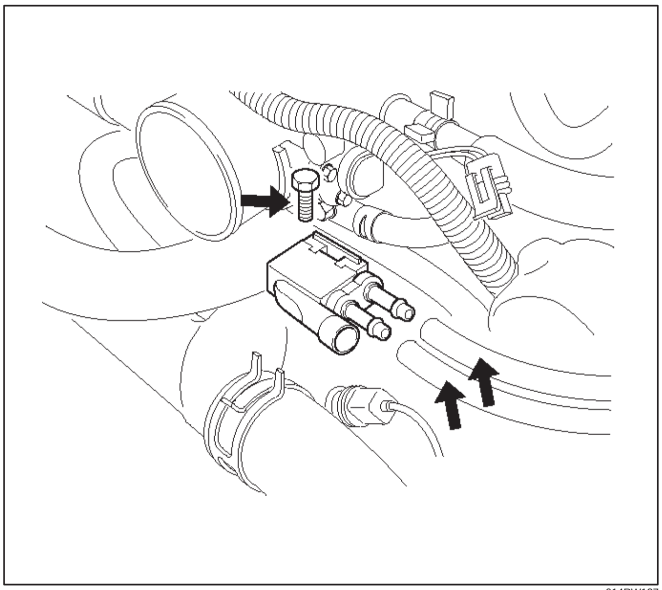
1. Disconnect the negative battery cable.
2. Disconnect the electrical connector from the EVAP canister purge solenoid.

3. Disconnect the vacuum hoses from the EVAP canister purge solenoid.



014RW136

4. Remove the EVAP canister purge solenoid retaining bolt from the common chamber.
5. Remove the EVAP canister purge solenoid.



014RW137

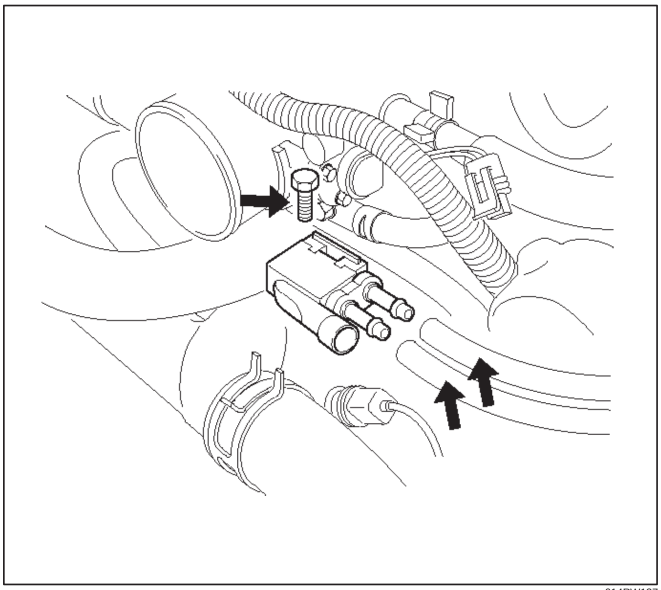
Installation Procedure

1. Install the EVAP canister purge solenoid on the upper intake manifold.
2. Install the EVAP canister purge solenoid retaining bolt.

Tighten

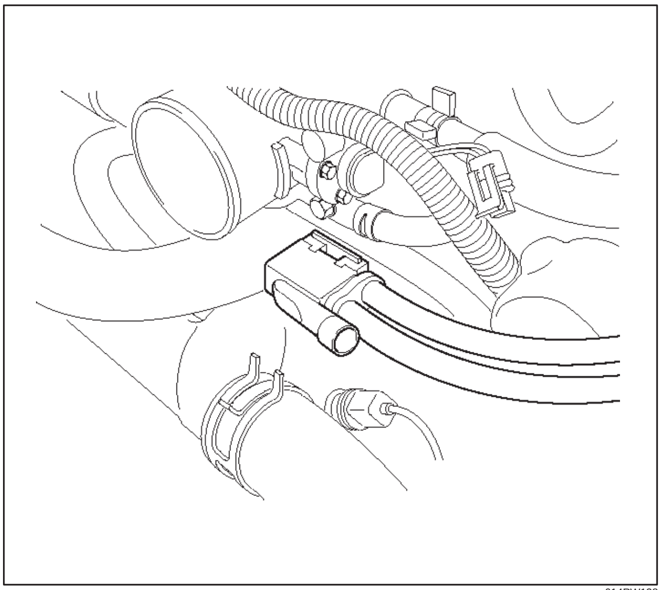
- **Tighten the bolts to 20 N·m (16 lb ft.).**

3. Connect the vacuum hoses to the EVAP canister purge solenoid.



014RW137

4. Connect the electrical connector to the EVAP canister purge solenoid.



014RW138

Fuel Tank Vent Valve

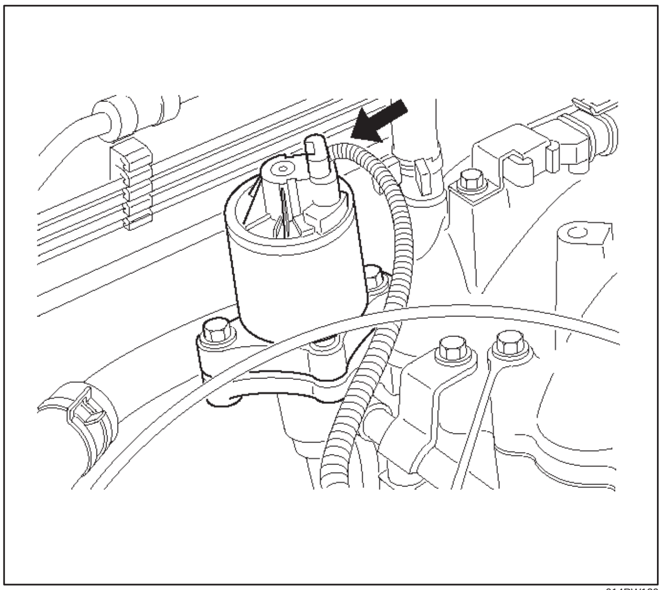
Removal and Installation Procedure

Refer to *Fuel Pump* section.

Linear Exhaust Gas Recirculation (EGR) Valve

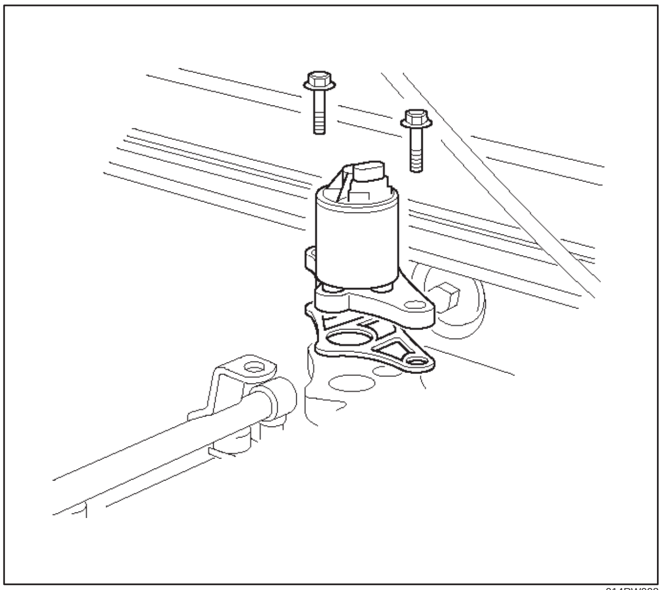
Removal Procedure

1. Disconnect the negative battery cable.
2. Disconnect the electrical connector at the EGR valve.



014RW139

3. Remove the bolts from the common chamber.



014RW098

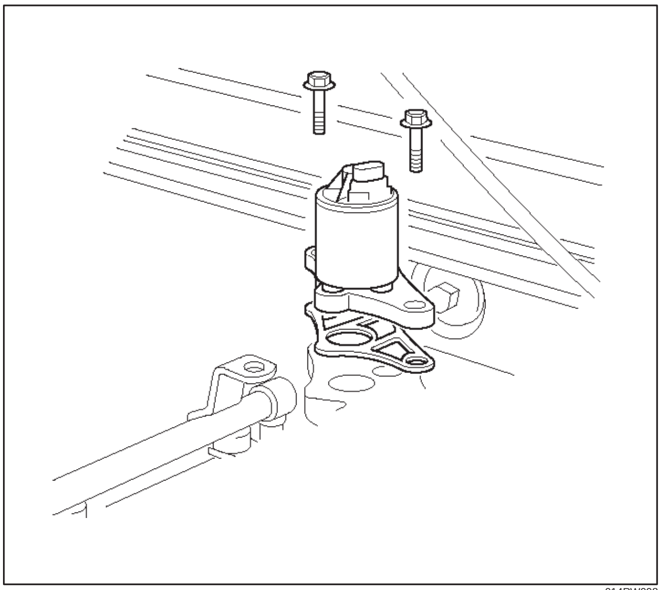
4. Remove the EGR valve from the common chamber manifold.
5. Remove the gasket from the common chamber manifold.

Installation Procedure

1. Install the gasket on the common chamber.
2. Install the EGR valve on the common chamber.
3. Secure the EGR valve and the gasket with the bolts.

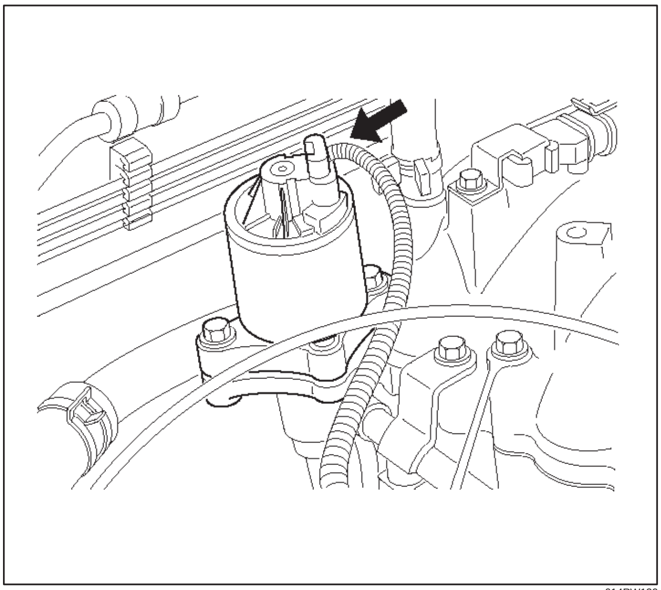
Torque: 25 N·m (18 lb ft)

NOTE: It is possible to install the EGR valve rotated 180° from the correct position. Make sure that the base of the valve is placed so that it aligns with the mounting flange.



014RW098

4. Connect the electrical connector at the EGR valve.



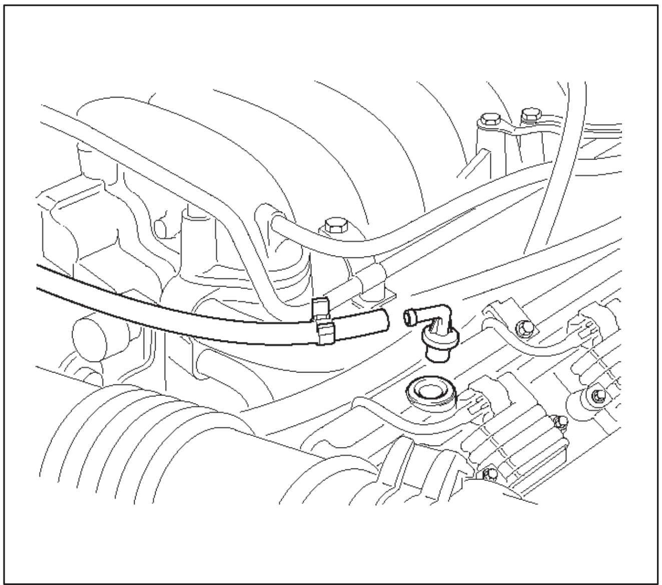
014RW139

5. Connect the negative battery cable.

Positive Crankcase Ventilation (PCV) Valve

Removal Procedure

1. Remove the vacuum hose at the PCV valve.
   - Slide the clamp back to release the hose.
2. Pull the PCV valve from the rubber grommet in the right valve cover.



014RW097

Inspection Procedure

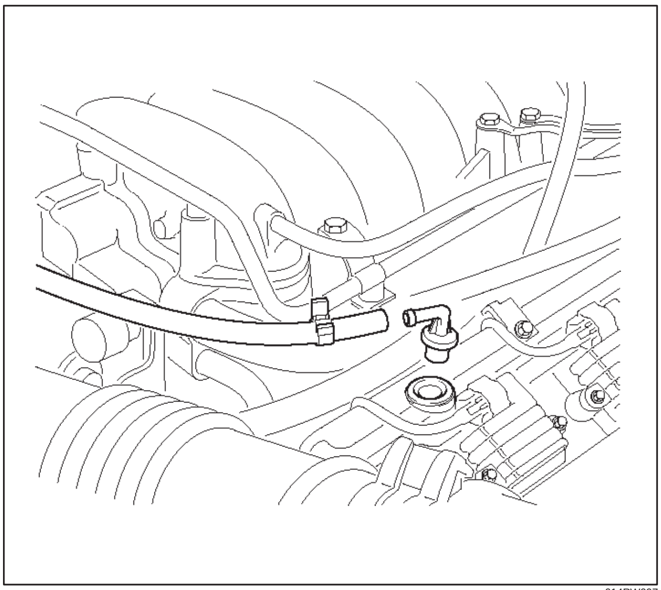
Before inspecting the PCV valve, make sure that the hoses are connected properly and are in good condition. Also check that the oil pan and rocker cover gaskets are sealing properly.

PCV Valve

1. Run the engine at normal operating temperature.
2. Disconnect the valve from the rocker cover.
   RESULT: A hissing noise should be heard from the valve. If no noise is heard, the PCV valve or hose is plugged.
3. Remove the PCV valve from the engine.
   a. Blow air into the rocker cover side of the valve.
   RESULT: Air should pass freely.
   b. Blow air into the air cleaner side of the valve.
   RESULT: Air should not pass through the valve.
4. Re-install the PCV valve and remove the oil filler cap.
   RESULT: A small vacuum should be felt at the oil filler hole.

Installation Procedure

1. Push the PCV valve into the rubber grommet in the left valve cover.
2. Install the vacuum hose on the PCV valve and secure the vacuum hose with the clamp.



014RW097

Wiring and Connectors

Wiring Harness Service

The control module harness electrically connects the control module to the various solenoids, switches and sensors in the vehicle engine compartment and passenger compartment.

Replace wire harnesses with the proper part number replacement.

Because of the low amperage and voltage levels utilized in powertrain control systems, it is essential that all wiring in environmentally exposed areas be repaired with crimp and seal splice sleeves.

The following wire harness repair information is intended as a general guideline only. Refer to *Chassis Electrical* section for all wire harness repair procedures.

Connectors and Terminals

Use care when probing a connector and when replacing terminals. It is possible to short between opposite terminals. Damage to components could result. Always use jumper wires between connectors for circuit checking. NEVER probe through Weather-Pack seals. Use an appropriate connector test adapter kit which contains an assortment of flexible connectors used to probe terminals during diagnosis. Use an appropriate fuse remover and test tool for removing a fuse and to adapt the fuse holder to a meter for diagnosis.

Open circuits are often difficult to locate by sight because oxidation or terminal misalignment are hidden by the connectors. Merely wiggling a connector on a sensor, or in the wiring harness, may temporarily correct the open circuit. Intermittent problems may also be caused by oxidized or loose connections.

Be certain of the type of connector/terminal before making any connector or terminal repair. Weather-Pack and Com-Pack III terminals look similar, but are serviced differently.

PCM Connectors and Terminals

Removal Procedure

1. Remove the connector terminal retainer.
2. Push the wire connected to the affected terminal through the connector face so that the terminal is exposed.
3. Service the terminal as necessary.

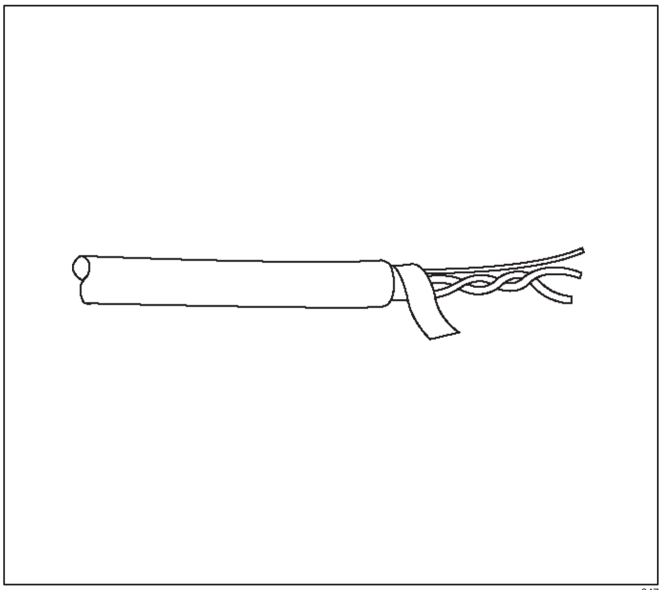
Installation Procedure

1. Bend the tab on the connector to allow the terminal to be pulled into position within the connector.
2. Pull carefully on the wire to install the connector terminal retainer.

Wire Harness Repair: Twisted Shielded Cable

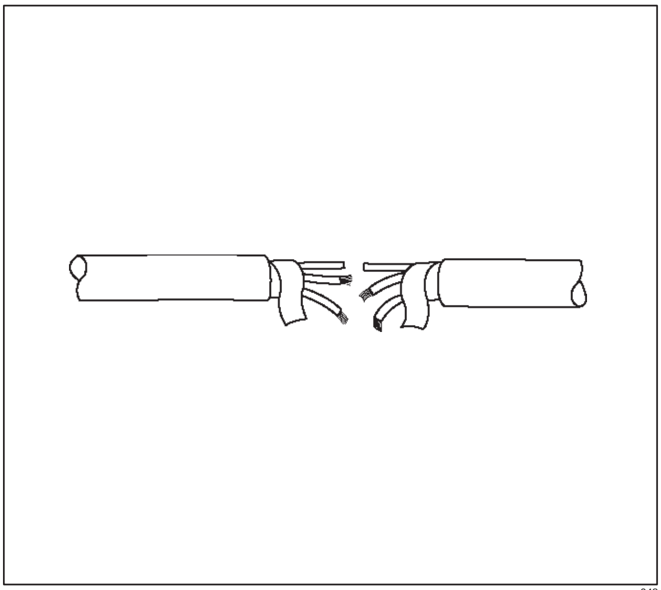
Removal Procedure

1. Remove the outer jacket.
2. Unwrap the aluminum/mylar tape. Do not remove the mylar.



047

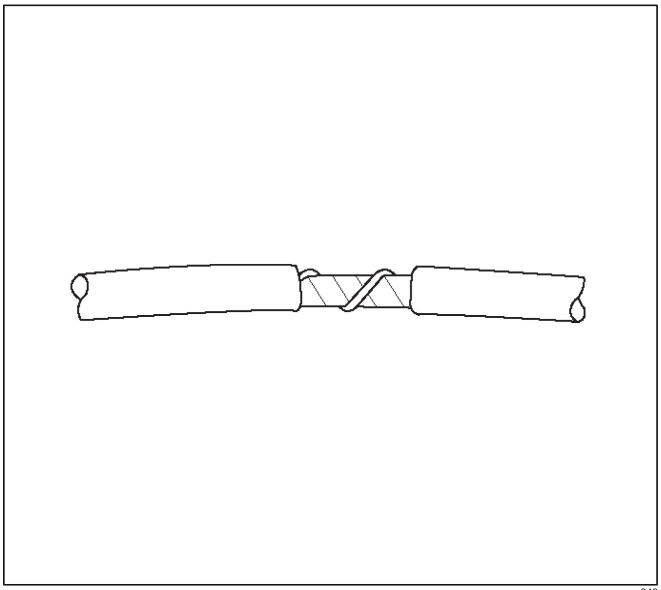
3. Untwist the conductors.
4. Strip the insulation as necessary.



048

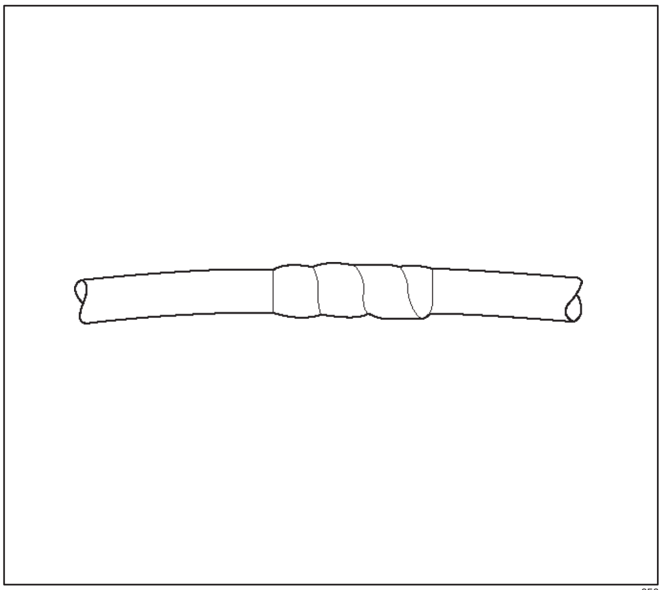
Installation Procedure

1. Splice the wires using splice clips and rosin core solder.
2. Wrap each splice to insulate.
3. Wrap the splice with mylar and with the drain (uninsulated) wire.



049

4. Tape over the whole bundle to secure.

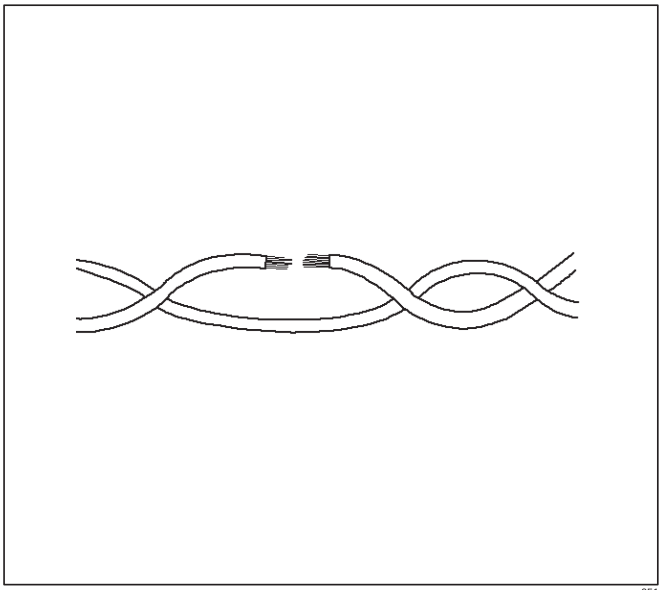


050

Twisted Leads

Removal Procedure

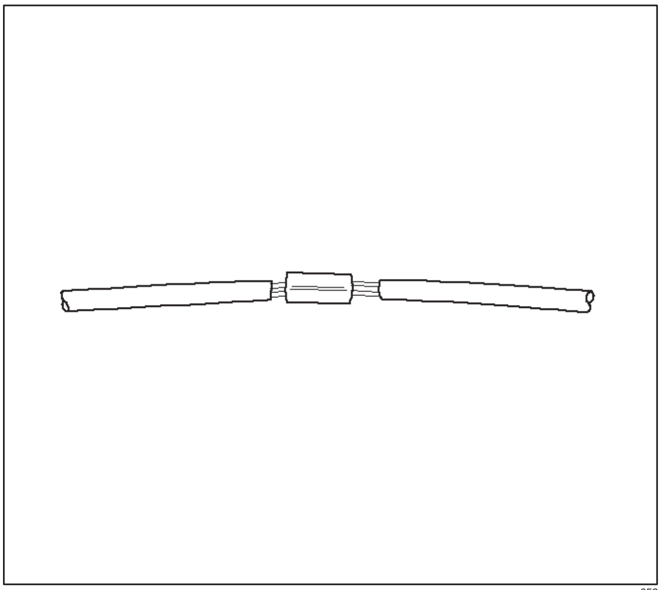
1. Locate the damaged wire.
2. Remove the insulation as required.



051

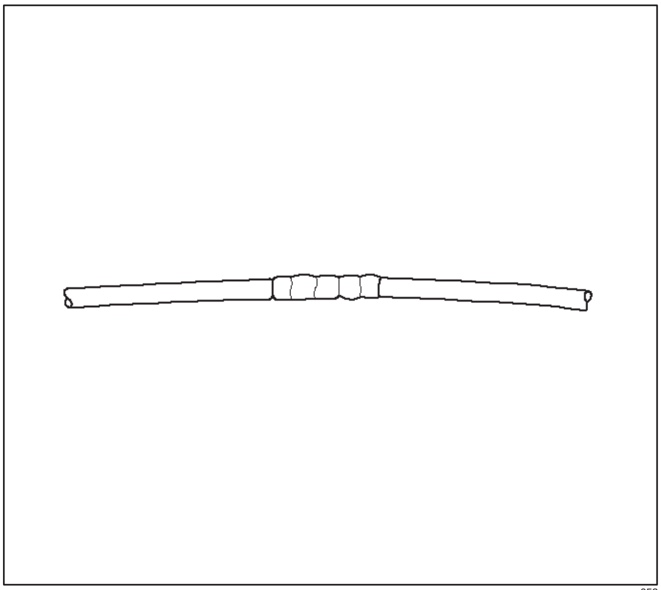
Installation Procedure

1. Use splice clips and rosin core solder in order to splice the two wires together.



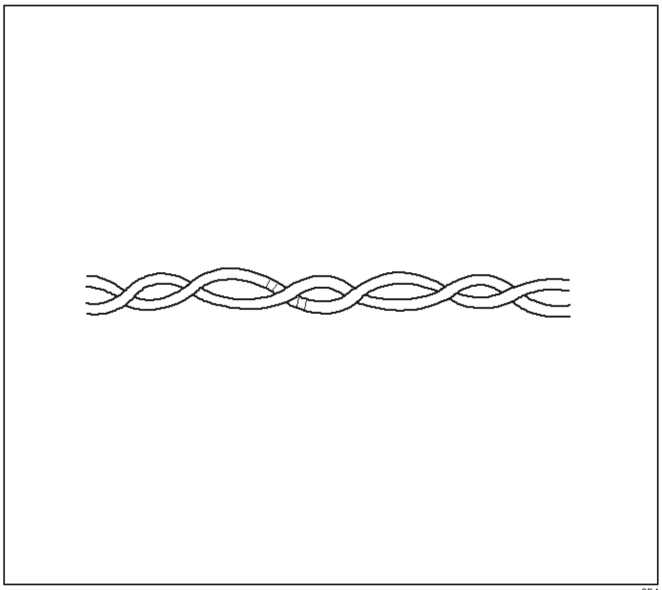
052

2. Cover the splice with tape in order to insulate it from the other wires.

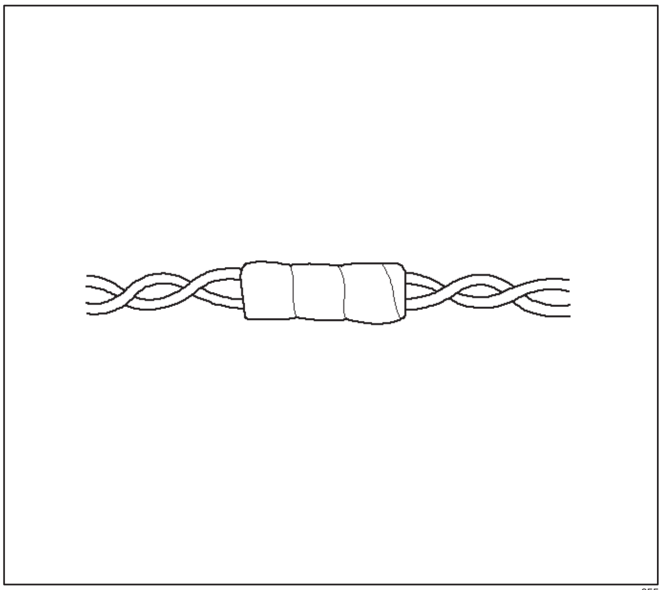


053

3. Twist the wires as they were before starting this procedure.



4. Tape the wires with electrical tape. Hold in place.



Weather-Pack Connector

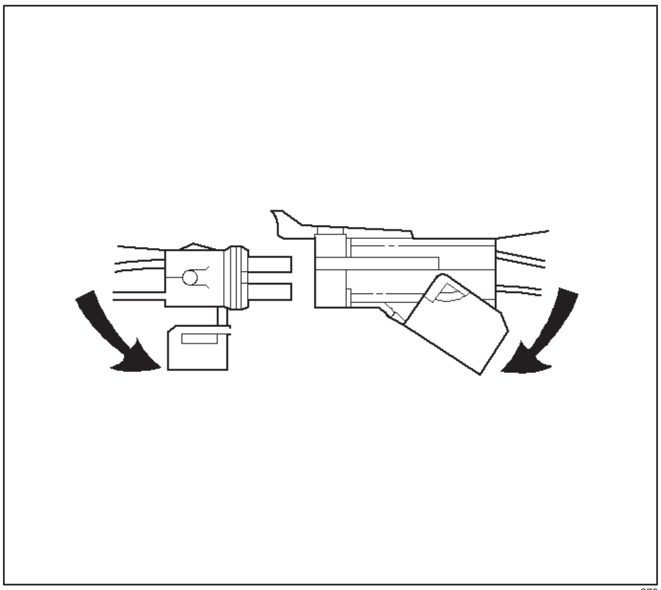
Tools Required

J 28742-A Weather-Pack II Terminal Remover

Removal Procedure

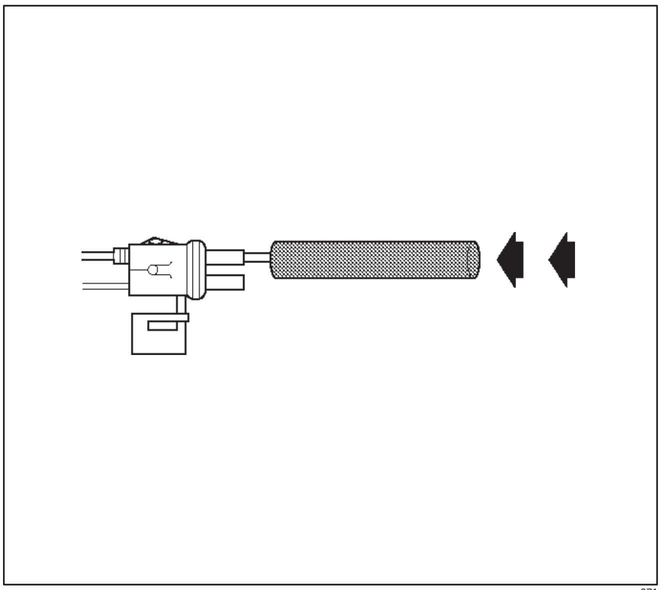
A Weather-Pack connector can be identified by a rubber seal at the rear of the connector. This engine room connector protects against moisture and dirt, which could from oxidation and deposits on the terminals. This protection is important, because of the low voltage and the low amperage found in the electronic systems.

1. Open the secondary lock hinge on the connector.

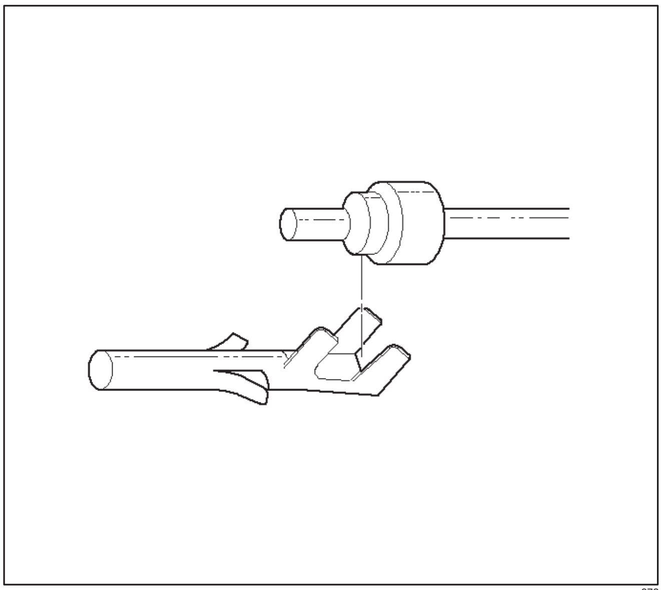


2. Use tool J 28742-A or the equivalent to remove the pin and the sleeve terminals. Push on J 28742-A to release.

NOTE: Do the use an ordinary pick or the terminal may be bent or deformed. Unlike standard blade terminals, these terminals cannot be straightened after they have been improperly bent.



3. Cut the wire immediately behind the cable seal.



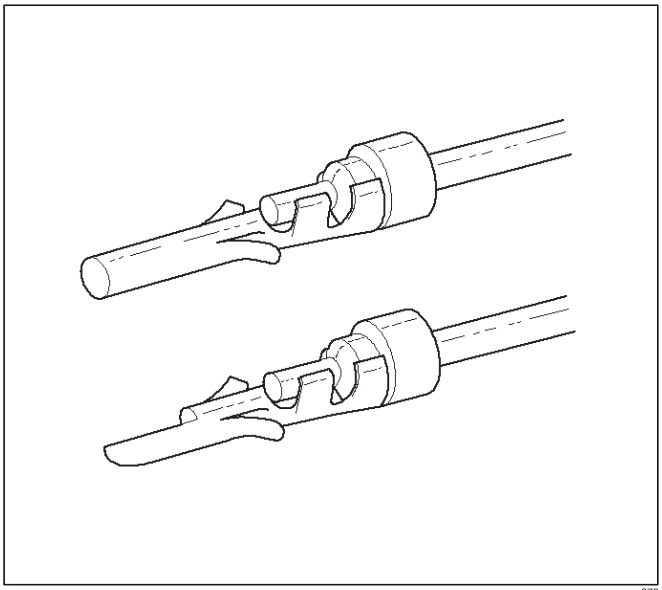
072

Installation Procedure

Make certain the connectors are properly seated and all of the sealing rings are in place when you reconnect the leads. The secondary lock hinge provides a backup locking feature for the connector. The secondary lock hinge is used for added reliability. This flap should retain the terminals even if the small terminal lock tangs are not positioned properly.

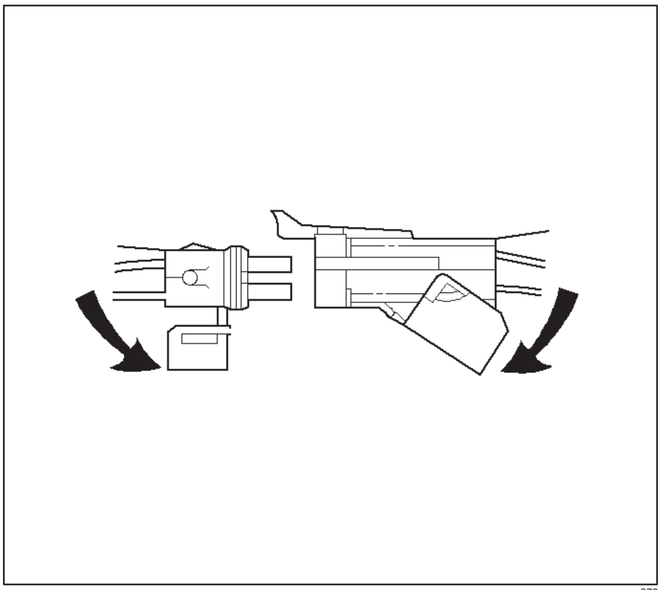
Do not replace the Weather-Pack connections with standard connections. Read the instructions provided with the Weather-Pack connector and terminal packages.

1. Replace the terminal.
2. Slip the new seal onto the wire.
3. Strip 5 mm (0.2”) of insulation from the wire.
4. Crimp the terminal over the wire and the seal.



073

5. Push the terminal and the connector to engage the locking tangs.



070

6. Close the secondary locking hinge.

Com-Pack III

General Information

The Com-Pack III terminal looks similar to some Weather-Pack terminals. This terminal is not sealed and is used where resistance to the environment is not required. Use the standard method when repairing a terminal. Do not use the Weather-Pack terminal tool J 28742-A or equivalent. These will damage the terminals.

Metri-Pack

Tools Required

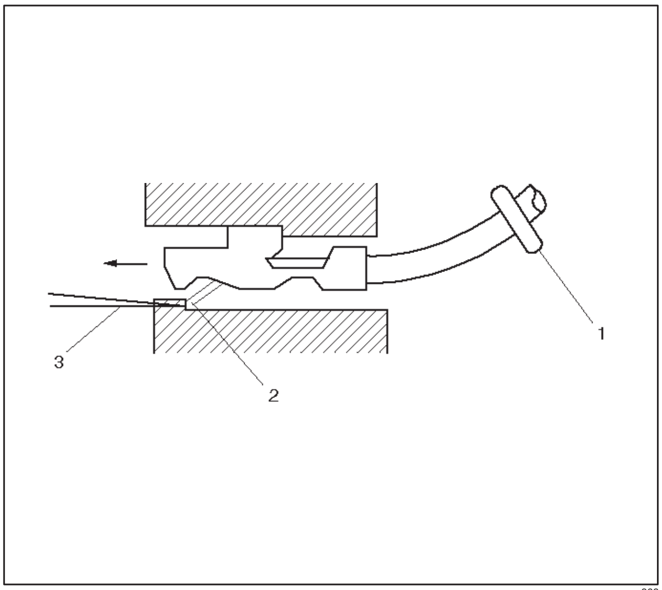
J 35689 Terminal Remover

Removal Procedure

Some connectors use terminals called Metri-Pack Series 150. These may be used at the engine coolant temperature (ECT) sensor.

1. Slide the seal (1) back on the wire.

2. Insert the J 35689 tool or equivalent (3) in order to release the terminal locking tang (2).



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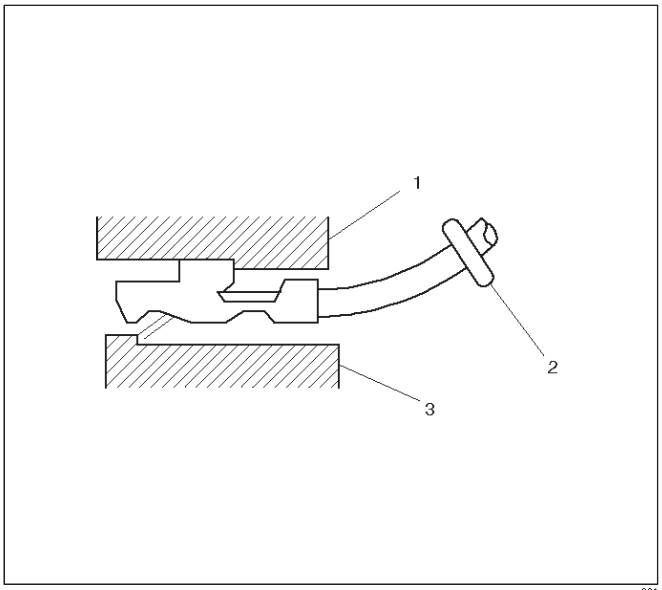
3. Push the wire and the terminal out through the connector. If you reuse the terminal, reshape the locking tang.

Installation Procedure

Metri-Pack terminals are also referred to as “pull-to-seat” terminals.

1. In order to install a terminal on a wire, the wire must be inserted through the seal (2) and through the connector (3).
2. The terminal (1) is then crimped onto the wire.



061

3. Then the terminal is pulled back into the connector to seat it in place.

General Description (PCM and Sensors)

58X Reference PCM Input

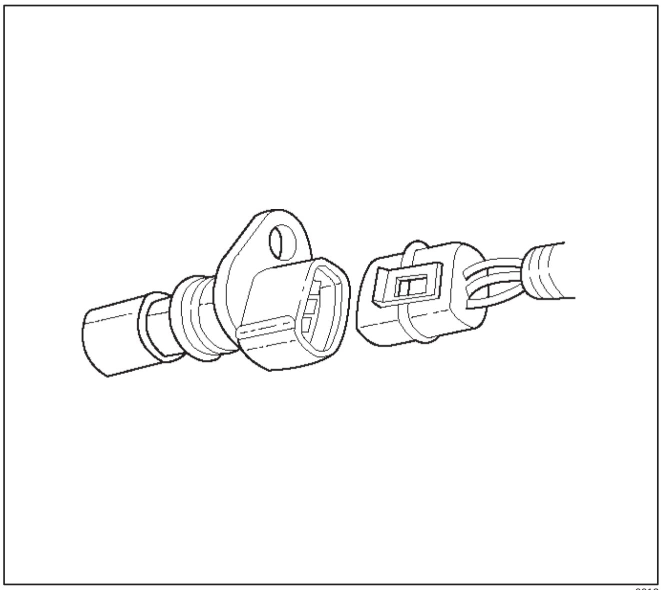
The powertrain control module (PCM) uses this signal from the crankshaft position (CKP) sensor to calculate engine RPM and crankshaft position at all engine speeds. The PCM also uses the pulses on this circuit to initiate injector pulses. If the PCM receives no pulses on this circuit, DTC P0337 will set. The engine will not start and run without using the 58X reference signal.

A/C Request Signal

This signal tells the PCM when the A/C mode is selected at the A/C control head. The PCM uses this to adjust the idle speed before turning "ON" the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.
Refer to *A/C Clutch Circuit Diagnosis* section for A/C wiring diagrams and diagnosis for the A/C electrical system.

Crankshaft Position (CKP) Sensor

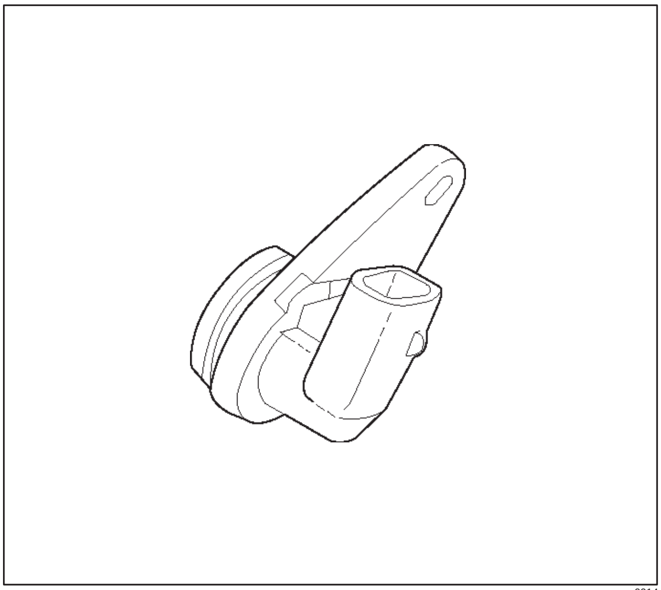
The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The CKP sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position.
Refer to *Electronic Ignition System* section for additional information.



0013

Camshaft Position (CMP) Sensor and Signal

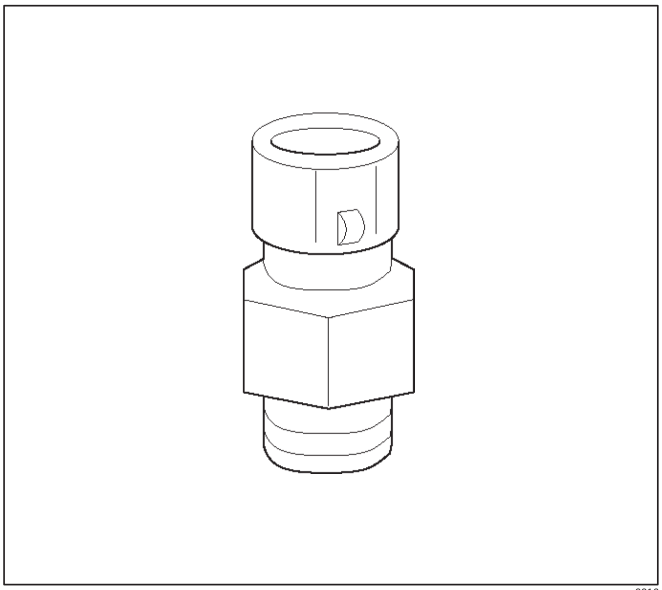
The camshaft position (CMP) sensor sends a CMP signal to the PCM. The PCM uses this signal as a "sync pulse" to trigger the injectors in the proper sequence. The PCM uses the CMP signal to indicate the position of the #1 piston during its power stroke. This allows the PCM to calculate true sequential fuel injection (SFI) mode of operation. If the PCM detects an incorrect CMP signal while the engine is running, DTC P0341 will set. If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection mode based on the last fuel injection pulse, and the engine will continue to run. As long as the fault is present, the engine can be restarted. It will run in the calculated sequential mode with a 1-in-6 chance of the injector sequence being correct.
Refer to *DTC P0341* for further information.



0014

Engine Coolant Temperature (ECT) Sensor

The engine coolant temperature (ECT) sensor is a thermistor (a resistor which changes value based on temperature) mounted in the engine coolant stream. Low coolant temperature produces a high resistance of 100,000 ohms at –40˚C (–40˚F). High temperature causes a low resistance of 70 ohms at 130˚C (266˚F). The PCM supplies a 5-volt signal to the ECT sensor through resistors in the PCM and measures the voltage. The signal voltage will be high when the engine is cold and low when the engine is hot. By measuring the voltage, the PCM calculates the engine coolant temperature. Engine coolant temperature affects most of the systems that the PCM controls.
The Tech 2 displays engine coolant temperature in degrees. After engine start-up, the temperature should rise steadily to about 85˚C (185˚F). It then stabilizes when the thermostat opens. If the engine has not been run for several hours (overnight), the engine coolant temperature and intake air temperature displays should be close to each other. A hard fault in the engine coolant sensor circuit will set DTC P0177 or DTC P0118. An intermittent fault will set a DTC P1114 or P1115.



0016

Electrically Erasable Programmable Read Only Memory (EEPROM)

The electrically erasable programmable read only memory (EEPROM) is a permanent memory chip that is physically soldered within the PCM. The EEPROM contains the program and the calibration information that the PCM needs to control powertrain operation.

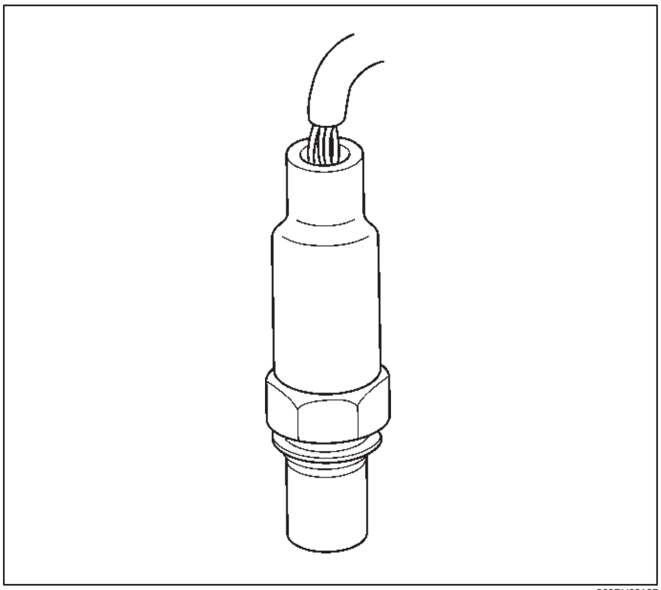
Unlike the PROM used in past applications, the EEPROM is not replaceable. If the PCM is replaced, the new PCM will need to be programmed. Equipment containing the correct program and calibration for the vehicle is required to program the PCM.

Fuel Control Heated Oxygen Sensors

The fuel control heated oxygen sensors (Bank 1 HO2S 1 and Bank 2 HO2S 1) are mounted in the exhaust stream where they can monitor the oxygen content of the exhaust gas. The oxygen present in the exhaust gas reacts with the sensor to produce a voltage output. This voltage should constantly fluctuate from approximately 100 mV to 900 mV. The heated oxygen sensor voltage can be monitored with a Tech 2. By monitoring the voltage output of the oxygen sensor, the PCM calculates the pulse width command for the injectors to produce the proper combustion chamber mixture.

- Low HO2S voltage is a lean mixture which will result in a rich command to compensate.
- High HO2S voltage is a rich mixture which will result in a lean command to compensate.

An open Bank 1 HO2S 1 signal circuit will set a DTC P0134 and the Tech 2 will display a constant voltage between 400-500 mV. A constant voltage below 300 mV in the sensor circuit (circuit grounded) will set DTC P0131. A constant voltage above 800 mV in the circuit will set DTC P0132. Faults in the Bank 2 HO2S 1 signal circuit will cause DTC 0154 (open circuit), DTC P0151 (grounded circuit), or DTC P0152 (signal voltage high) to set. A fault in the Bank 1 HO2S 1 heater circuit will cause DTC P0135 to set. A fault in the Bank 2 HO2S 1 heater circuit will cause DTC P0155 to set. The PCM can also detect HO2S response problems. If the response time of an HO2S is determined to be too slow, the PCM will store a DTC that indicates degraded HO2S performance.



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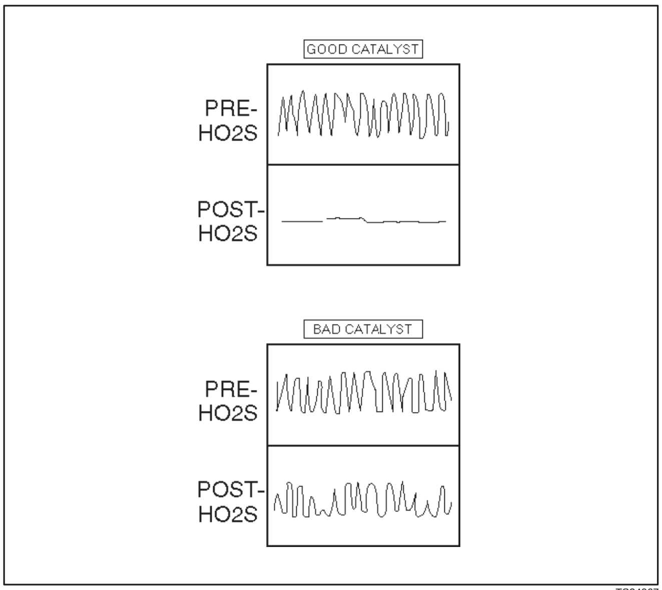
Catalyst Monitor Heated Oxygen Sensors

Three-way catalytic converters are used to control emissions of hydrocarbons (HC), carbon monoxide (CO), and oxides of nitrogen (NOx). The catalyst within the converters promotes a chemical reaction. This reaction oxidizes the HC and CO present in the exhaust gas and converts them into harmless water vapor and carbon dioxide. The catalyst also reduces NOx by converting it to nitrogen. The PCM can monitor this process using the Bank 1 HO2S 2 and the Bank 2 HO2S 2 heated oxygen sensors. The Bank 1 HO2S 1 and the Bank 2 HO2S 1 sensors produce an output signal which indicates the amount of oxygen present in the exhaust gas entering the three-way catalytic converter. The Bank 1 HO2S 2 and the Bank 2 HO2S 2 sensors produce an output signal which indicates the oxygen storage capacity of the catalyst. This indicates the catalyst's ability to efficiently convert exhaust gases. If the catalyst is operating efficiently, the Bank 1 HO2S 1 and the Bank 2 HO2S 1 signals will be more active than the signals produced by the Bank 1 HO2S 2 and the Bank 2 HO2S 2 sensors.

The catalyst monitor sensors operate the same as the fuel control sensors. The Bank 1 HO2S 2 and the Bank 2 HO2S 2 sensors' main function is catalyst monitoring, but they also have a limited role in fuel control. If a sensor output indicates a voltage either above or below the 450 mV bias voltage for an extended period of time, the PCM will make a slight adjustment to fuel trim to ensure that fuel delivery is correct for catalyst monitoring.

A problem with the Bank 1 HO2S 2 signal circuit will set DTC P0137, P0138, or P0140, depending on the specific condition. A problem with the Bank 2 HO2S 2 signal circuit will set DTC P0157, P0158, or P0160, depending on the specific condition. A fault in the heated oxygen sensor heater element or its ignition feed or ground will result in lower sensor response. This may cause incorrect catalyst monitor diagnostic results.



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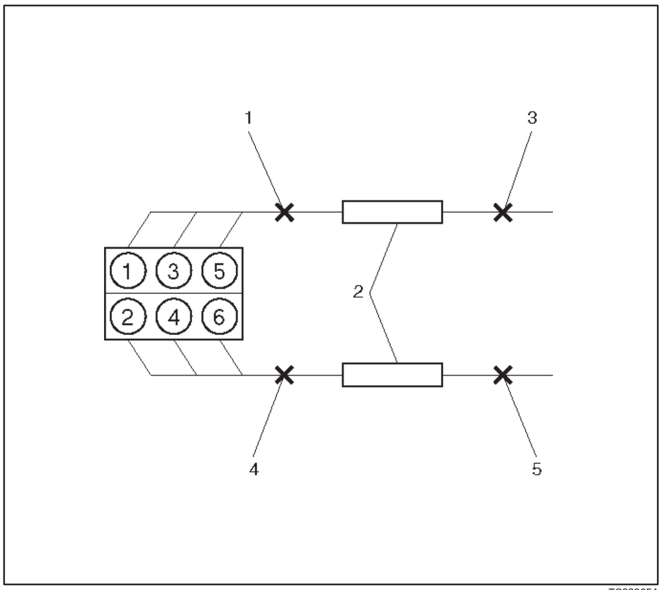


TS23365A

Legend

(1) Bank 1 Sensor 1 (Fuel Control)
(2) Catalytic Converter
(3) Bank 1 Sensor 2 (Catalyst Monitor)
(4) Bank 2 Sensor 1 (Fuel Control)
(5) Bank 2 Sensor 2 (Catalyst Monitor)

Intake Air Temperature (IAT) Sensor

The intake air temperature (IAT) sensor is a thermistor which changes its resistance based on the temperature of air entering the engine. Low temperature produces a high resistance of 100,000 ohms at –40˚C (–40˚F). High temperature causes low resistance of 70 ohms at 130˚C (266˚F) . The PCM supplies a 5-volt signal to the sensor through a resistor in the PCM and monitors the signal voltage. The voltage will be high when the incoming air is cold. The voltage will be low when the incoming air is hot. By measuring the voltage, the PCM calculates the incoming air temperature. The IAT sensor signal is used to adjust spark timing according to the incoming air density.

The Tech 2 displays the temperature of the air entering the engine. The temperature should read close to the ambient air temperature when the engine is cold and rise as underhood temperature increases. If the engine has not been run for several hours (overnight), the IAT sensor temperature and engine coolant temperature should read close to each other. A fault in the IAT sensor circuit will set DTC P0112 or DTC P0113.

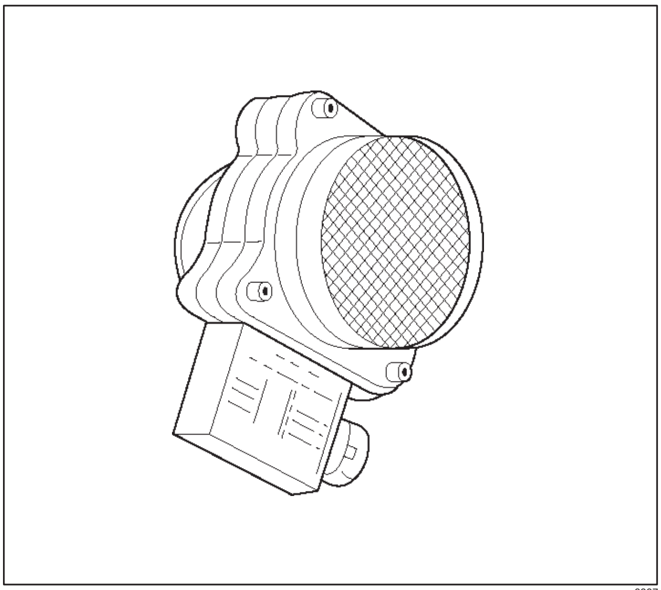
Linear Exhaust Gas Recirculation (EGR) Control

The PCM monitors the exhaust gas recirculation (EGR) actual position and adjusts the pintle position accordingly. The PCM uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Mass air flow (MAF) sensor.

Mass Air Flow (MAF) Sensor

The mass air flow (MAF) sensor measures the difference between the volume and the quantity of air that enters the engine. “Volume” means the size of the space to be filled. “Quantity” means the number of air molecules that will fit into the space. This information is important to the PCM because heavier, denser air will hold more fuel than lighter, thinner air. The PCM adjusts the air/fuel ratio as needed depending on the MAF value. The Tech 2 reads the MAF value and displays it in terms of grams per second (gm/s). At idle, the Tech 2 should read between 4-7 gm/s on a fully warmed up engine. Values should change quickly on acceleration. Values should remain stable at any given RPM. A failure in the MAF sensor or circuit will set DTC P0101, DTC P0102, or DTC P0103.



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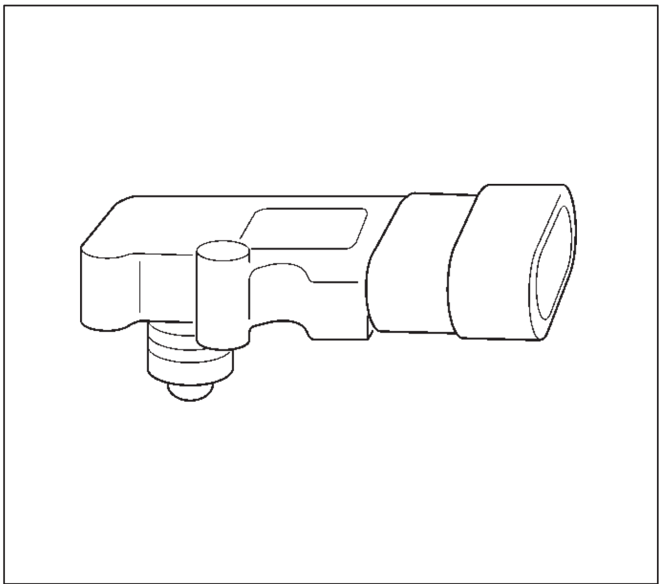
Manifold Absolute Pressure (MAP) Sensor

The manifold absolute pressure (MAP) sensor responds to changes in intake manifold pressure (vacuum). The MAP sensor signal voltage to the PCM varies from below 2 volts at idle (high vacuum) to above 4 volts with the ignition ON, engine not running or at wide-open throttle (low vacuum).

The MAP sensor is used to determine the following:

- Manifold pressure changes while the linear EGR flow test diagnostic is being run. Refer to *DTC P0401*.
- Barometric pressure (BARO).

If the PCM detects a voltage that is lower than the possible range of the MAP sensor, DTC P0107 will be set. A signal voltage higher than the possible range of the sensor will set DTC P0108. An intermittent low or high voltage will set DTC P1107, respectively. The PCM can detect a shifted MAP sensor. The PCM compares the MAP sensor signal to a calculated MAP based on throttle position and various engine load factors. If the PCM detects a MAP signal that varies excessively above or below the calculated value, DTC P0106 will set.



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Powertrain Control Module (PCM)

The powertrain control module (PCM) is located in the passenger compartment below the center console. The PCM controls the following:

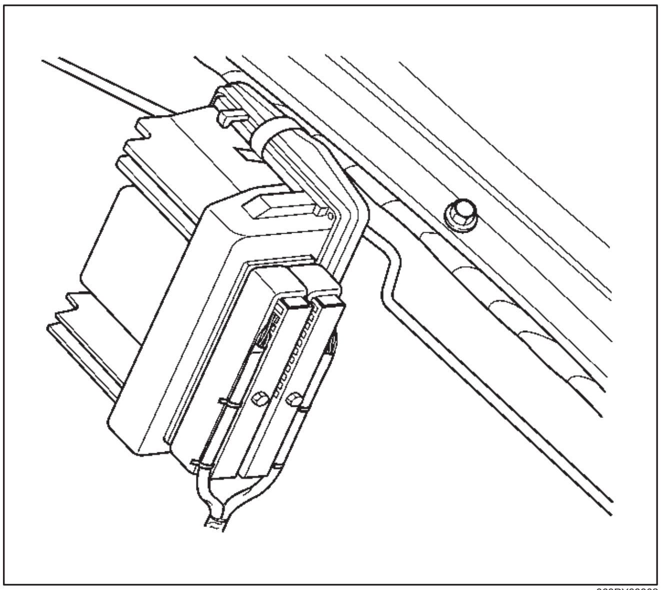
- Fuel metering system.
- Transmission shifting (automatic transmission only).
- Ignition timing.
- On-board diagnostics for powertrain functions.

The PCM constantly observes the information from various sensors. The PCM controls the systems that affect vehicle performance. The PCM performs the diagnostic function of the system. It can recognize operational problems, alert the driver through the MIL (Check Engine lamp), and store diagnostic trouble codes (DTCs). DTCs identify the problem areas to aid the technician in making repairs.

PCM Function

The PCM supplies either 5 or 12 volts to power various sensors or switches. The power is supplied through resistances in the PCM which are so high in value that a test light will not light when connected to the circuit. In some cases, even an ordinary shop voltmeter will not give an accurate reading because its resistance is too low. Therefore, a digital voltmeter with at least 10 megohms input impedance is required to ensure accurate voltage readings. Tool J 39200 meets this requirement. The PCM controls output circuits such as the injectors, fan relays, etc., by controlling the ground or the power feed circuit through transistors or through either of the following two devices:

- Output Driver Module (ODM)
- Quad Driver Module (QDM)



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PCM Components

The PCM is designed to maintain exhaust emission levels to government mandated standards while providing excellent driveability and fuel efficiency. The PCM monitors numerous engine and vehicle functions via electronic sensors such as the throttle position (TP) sensor, heated oxygen sensor (HO2S), and vehicle speed sensor (VSS). The PCM also controls certain engine operations through the following:

- Fuel injector control
- Ignition control module
- ION sensing module
- Automatic transmission shift functions
- Cruise control
- Evaporative emission (EVAP) purge
- A/C clutch control

PCM Voltage Description

The PCM supplies a buffered voltage to various switches and sensors. It can do this because resistance in the PCM is so high in value that a test light may not illuminate when connected to the circuit. An ordinary shop voltmeter may not give an accurate reading because the voltmeter input impedance is too low. Use a 10-megohm input impedance digital voltmeter (such as J 39200) to assure accurate voltage readings.

The input/output devices in the PCM include analog-to-digital converters, signal buffers, counters, and special drivers. The PCM controls most components with electronic switches which complete a ground circuit when turned “ON.” These switches are arranged in groups of 4 and 7, called either a surface-mounted quad driver module (QDM), which can independently control up to 4 output terminals, or QDMs which can independently control up to 7 outputs. Not all outputs are always used.

PCM Input/Outputs

Inputs – Operating Conditions Read

- Air Conditioning “ON” or “OFF”
- Engine Coolant Temperature
- Crankshaft Position
- Exhaust Oxygen Content
- Electronic Ignition
- Manifold Absolute Pressure
- Battery Voltage
- Throttle Position
- Vehicle Speed
- Fuel Pump Voltage
- Power Steering Pressure
- Intake Air Temperature
- Mass Air Flow
- Engine Knock
- Camshaft Position

Outputs – Systems Controlled

- EVAP Canister Purge
- Exhaust Gas Recirculation (EGR)
- Ignition Control
- Fuel Control
- ION Sensing Module
- Electric Fuel Pump
- Air Conditioning
- Diagnostics
  - Malfunction Indicator Lamp
  - Data Link Connector (DLC)
  - Data Output
- Transmission Control Module

PCM Service Precautions

The PCM is designed to withstand normal current draws associated with vehicle operation. Avoid overloading any circuit. When testing for opens and shorts, do not ground or apply voltage to any of the PCM’s circuits unless instructed to do so. These circuits should only be tested using digital voltmeter J 39200. The PCM should remain connected to the PCM or to a recommended breakout box.

Reprogramming The PCM

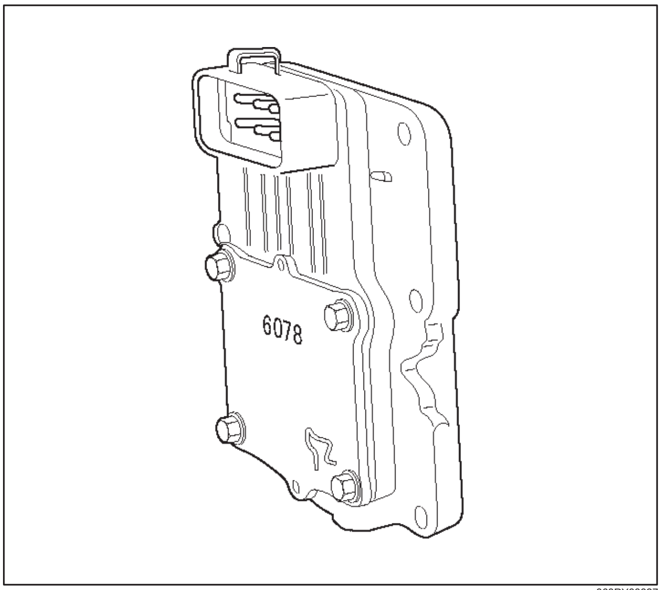
Reprogramming of the PCM is done without removing it from the vehicle . This provides a flexible and cost-effective method of making changes in software calibrations.

Refer to the latest Techline information on reprogramming or flashing procedures.

Throttle Position (TP) Sensor

The throttle position (TP) sensor is a potentiometer connected to the throttle shaft on the throttle body. The PCM monitors the voltage on the signal line and calculates throttle position. As the throttle valve angle is changed (accelerator pedal moved), the TP sensor signal also changes. At a closed throttle position, the output of the TP1 sensor is low. As the throttle valve opens, the output increases so that at wide open throttle (WOT), the output voltage should be above 92% (Tech 2 Display).

The PCM calculates fuel delivery based on throttle valve angle (driver demand). A broken or loose TP sensor may cause intermittent bursts of fuel from an injector and unstable idle because the PCM thinks the throttle is moving.



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Transmission Fluid Temperature (TFT) Sensor

The transmission fluid temperature sensor is a thermistor which changes its resistance based on the temperature of the transmission fluid. For a complete description of the TFT sensor, refer to *4L30-E Automatic Transmission Diagnosis* section.

A failure in the TFT sensor or associated wiring will cause DTC P0712 or DTC P0713 to set. In this case, engine coolant temperature will be substituted for the TFT sensor value and the transmission will operate normally.

Transmission Range Switch

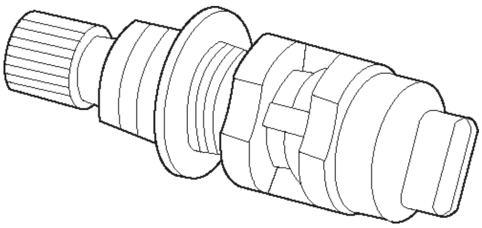
IMPORTANT: The vehicle should not be driven with the transmission range switch disconnected; idle quality will be affected.

The four inputs from the transmission range switch indicate to the PCM which position is selected by the transmission selector lever. This information is used for ignition timing, EVAP canister purge, EGR operation.

For more information on the transmission on the transmission range switch, refer to *4L30-E Automatic Transmission* section.

Vehicle Speed Sensor (VSS)

The PCM determines the speed of the vehicle by converting a plusing voltage signal from the vehicle speed sensor (VSS) into miles per hour. The PCM uses this signal to operate the cruise control, speedometer, and the TCC and shift solenoids in the transmission. For more information on the TCC and shift solenoids, refer to *4L30-E Automatic Transmission* section.



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Use of Circuit Testing Tools

Do not use a test light to diagnose the powertrain electrical systems unless specifically instructed by the diagnostic procedures. Use Connector Test Adapter Kit J 35616 whenever diagnostic procedures call for probing connectors.

Aftermarket Electrical and Vacuum Equipment

Aftermarket (add-on) electrical and vacuum equipment is defined as any equipment which connects to the vehicle's electrical or vacuum systems that is installed on a vehicle after it leaves the factory. No allowances have been made in the vehicle design for this type of equipment.

NOTE: No add-on vacuum equipment should be added to this vehicle.

NOTE: Add-on electrical equipment must only be connected to the vehicle's electrical system at the battery (power and ground).

Add-on electrical equipment, even when installed to these guidelines, may still cause the powertrain system to malfunction. This may also include equipment not connected to the vehicle electrical system such as portable telephones and radios. Therefore, the first step in diagnosing any powertrain problem is to eliminate all aftermarket electrical equipment from the vehicle. After this is done, if the problem still exists, it may be diagnosed in the normal manner.

Electrostatic Discharge Damage

Electronic components used in the PCM are often designed to carry very low voltage. Electronic components are susceptible to damage caused by electrostatic discharge. Less than 100 volts of static electricity can cause damage to some electronic components. By comparison, it takes as much as 4000 volts for a person to feel even the zap of a static discharge.

TS23793

There are several ways for a person to become statically charged. The most common methods of charging are by friction and induction.

- An example of charging by friction is a person sliding across a vehicle seat.
- Charge by induction occurs when a person with well insulated shoes stands near a highly charged object and momentary touches ground. Charges of the same polarity are drained off leaving the person highly charged with the opposite polarity. Static charges can cause damage, therefore it is important to use care when handling and testing electronic components.

NOTE: To prevent possible electrostatic discharge damage, follow these guidelines:

- Do not touch the PCM connector pins or soldered components on the PCM circuit board.
- Do not open the replacement part package until the part is ready to be installed.
- Before removing the part from the package, ground the package to a known good ground on the vehicle.
- If the part has been handled while sliding across the seat, while sitting down from a standing position, or while walking a distance, touch a known good ground before installing the part.

Upshift Lamp

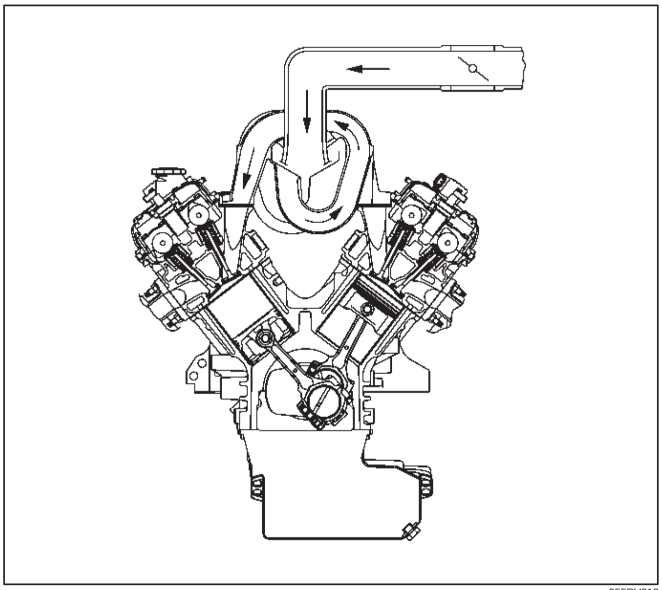
Refer to *Manual Transmission* section.

General Description (Air Induction)

Air Induction System

The air induction system filters contaminants from the outside air, and directs the progress of the air as it is drawn into the engine. A remote-mounted air cleaner prevents dirt and debris in the air from entering the engine. The air duct assembly routes filtered air to the throttle body. Air enters the engine by to following steps:

1. Through the throttle body.
2. Into the common chamber.
3. Through the cylinder head intake ports.
4. Into the cylinders.



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General Description (Fuel Metering)

Acceleration Mode

The PCM provides extra fuel when it detects a rapid increase in the throttle position and the air flow.

Battery Voltage Correction Mode

When battery voltage is low, the PCM will compensate for the weak spark by increasing the following:

- The amount of fuel delivered.
- The idle RPM.
- Ignition dwell time.

CMP Signal

The PCM uses this signal to determine the position of the number 1 piston during its power stroke, allowing the PCM to calculate true sequential multiport fuel injection (SFI). Loss of this signal will set a DTC P0341. If the CMP signal is lost while the engine is running, the fuel injection system will shift to a calculated sequential fuel injection based on the last fuel injection pulse, and the engine will continue to run. The engine can be restarted and will run in the calculated sequential mode as long as the fault is present, with a 1-in-6 chance of being correct.

Clear Flood Mode

Clear a flooded engine by pushing the accelerator pedal down all the way. The PCM then de-energizes the fuel injectors. The PCM holds the fuel injectors de-energized as long as the throttle remains above 80% and the engine speed is below 800 RPM. If the throttle position becomes less than 80%, the PCM again begins to pulse the injectors "ON" and "OFF," allowing fuel into the cylinders.

Deceleration Mode

The PCM reduces the amount of fuel injected when it detects a decrease in the throttle position and the air flow. When deceleration is very fast, the PCM may cut off fuel completely for short periods.

Engine Speed/Vehicle Speed/Fuel Disable Mode

The PCM monitors engine speed. It turns off the fuel injectors when the engine speed increase above 6400 RPM. The fuel injectors are turned back on when engine speed decreases below 6150 RPM.

Fuel Cutoff Mode

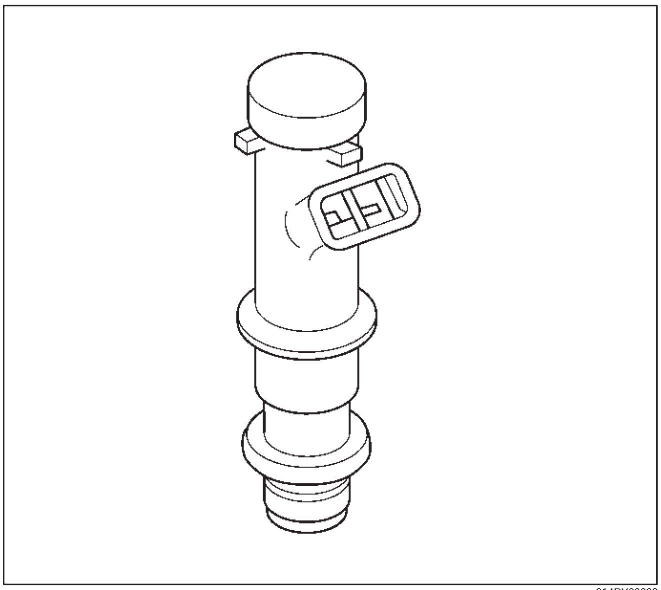
No fuel is delivered by the fuel injectors when the ignition is "OFF." This prevents engine run-on. In addition, the PCM suspends fuel delivery if no reference pulses are detected (engine not running) to prevent engine flooding.

Fuel Injector

The sequential multiport fuel injection (SFI) fuel injector is a solenoid-operated device controlled by the PCM. The PCM energizes the solenoid, which opens a valve to allow fuel delivery.

The fuel is injected under pressure in a conical spray pattern at the opening of the intake valve. Excess fuel not used by the injectors passes through the fuel pressure regulator before being returned to the fuel tank.

A fuel injector which is stuck partly open will cause a loss of fuel pressure after engine shut down, causing long crank times.



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Fuel Metering System Components

The fuel metering system is made up of the following parts:

- The fuel injectors.
- The throttle body.
- The fuel rail.

- The fuel pressure regulator.
- The PCM.
- The crankshaft position (CKP) sensor.
- The camshaft position (CMP) sensor.
- The ION sensing module.
- The fuel pump.
- The fuel pump relay.

Basic System Operation

The fuel metering system starts with the fuel in the fuel tank. An electric fuel pump, located in the fuel tank, pumps fuel to the fuel rail through an in-line fuel filter. The pump is designed to provide fuel at a pressure above the pressure needed by the injectors. A fuel pressure regulator in the fuel rail keeps fuel available to the fuel injectors at a constant pressure. A return line delivers unused fuel back to the fuel tank. Refer to *Section 6C* for further information on the fuel tank, line filter, and fuel pipes.

Fuel Metering System Purpose

The basic function of the air/fuel metering system is to control the air/fuel delivery to the engine. Fuel is delivered to the engine by individual fuel injectors mounted in the intake manifold near each intake valve.

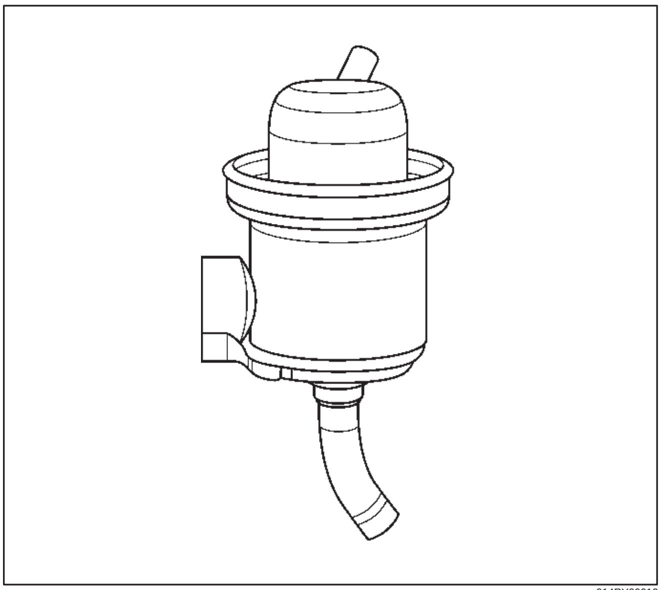
The main control sensor is the heated oxygen sensor (HO2S) located in the exhaust system. The HO2S tells the PCM how much oxygen is in the exhaust gas. The PCM changes the air/fuel ratio to the engine by controlling the amount of time that fuel injector is “ON.” The best mixture to minimize exhaust emissions is 14.7 parts of air to 1 part of gasoline by weight, which allows the catalytic converter to operate most efficiently. Because of the constant measuring and adjusting of the air/fuel ratio, the fuel injection system is called a “closed loop” system.

The PCM monitors signals from several sensors in order to determine the fuel needs of the engine. Fuel is delivered under one of several conditions called “modes.” All modes are controlled by the PCM.

Fuel Pressure Regulator

The fuel pressure regulator is a diaphragm-operated relief valve mounted on the fuel rail with fuel pump pressure on one side and manifold pressure on the other side. The fuel pressure regulator maintains the fuel pressure available to the injector at three times barometric pressure adjusted for engine load. It may be serviced separate.

If the pressure is too low, poor performance and a DTC P0131, DTC P0151,DTC P0171 or DTC P1171 will be the result. If the pressure is too high, excessive odor and/or a DTC P0132, DTC P0152,DTC P0172 will be the result. Refer to *Fuel System Diagnosis* for information on diagnosing fuel pressure conditions.



014RY00010

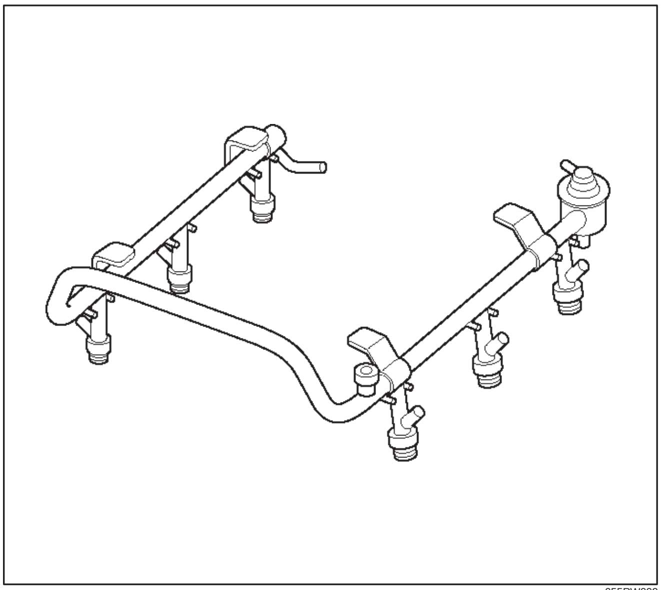
Fuel Pump Electrical Circuit

When the key is first turned “ON,” the PCM energizes the fuel pump relay for two seconds to build up the fuel pressure quickly. If the engine is not started within two seconds, the PCM shuts the fuel pump off and waits until the engine is cranked. When the engine is cranked and the 58 X crankshaft position signal has been detected by the PCM, the PCM supplies 12 volts to the fuel pump relay to energize the electric in-tank fuel pump.

An inoperative fuel pump will cause a “no-start” condition. A fuel pump which does not provide enough pressure will result in poor performance.

Fuel Rail

The fuel rail is mounted to the top of the engine and distributes fuel to the individual injectors. Fuel is delivered to the fuel inlet tube of the fuel rail by the fuel lines. The fuel goes through the fuel rail to the fuel pressure regulator. The fuel pressure regulator maintains a constant fuel pressure at the injectors. Remaining fuel is then returned to the fuel tank.



055RW009

Run Mode

The run mode has the following two conditions:

- Open loop
- Closed loop

When the engine is first started the system is in “open loop” operation. In “open loop,” the PCM ignores the signal from the heated oxygen sensor (HO2S). It calculates the air/fuel ratio based on inputs from the TP, ECT, and MAF sensors.

The system remains in “open loop” until the following conditions are met:

- The HO2S has a varying voltage output showing that it is hot enough to operate properly (this depends on temperature).
- The ECT has reached a specified temperature.
- A specific amount of time has elapsed since starting the engine.
- Engine speed has been greater than a specified RPM since start-up.

The specific values for the above conditions vary with different engines and are stored in the programmable read only memory (PROM). When these conditions are met, the system enters “closed loop” operation. In “closed loop,” the PCM calculates the air/fuel ratio (injector on-time) based on the signal from the HO2S. This allows the air/fuel ratio to stay very close to 14.7:1.

Starting Mode

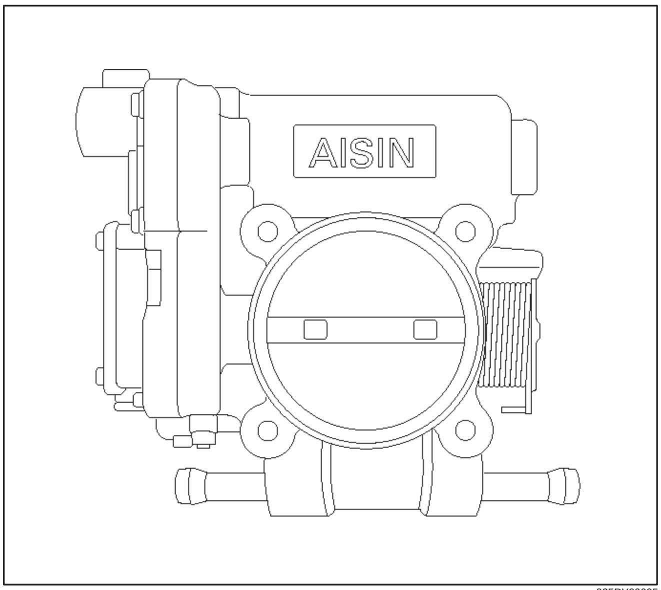
When the ignition is first turned “ON,” the PCM energizes the fuel pump relay for two seconds to allow the fuel pump to build up pressure. The PCM then checks the engine coolant temperature (ECT) sensor and the throttle position (TP) sensor to determine the proper air/fuel ratio for starting.

The PCM controls the amount of fuel delivered in the starting mode by adjusting how long the fuel injectors are energized by pulsing the injectors for very short times.

Throttle Body Unit

The throttle body has a throttle plate to control the amount of air delivered to the engine. The TP sensor are also mounted on the throttle body. Vacuum ports located behind the throttle plate provide the vacuum signals needed by various components.

Engine coolant is directed through a coolant cavity in the throttle body to warm the throttle valve and to prevent icing.

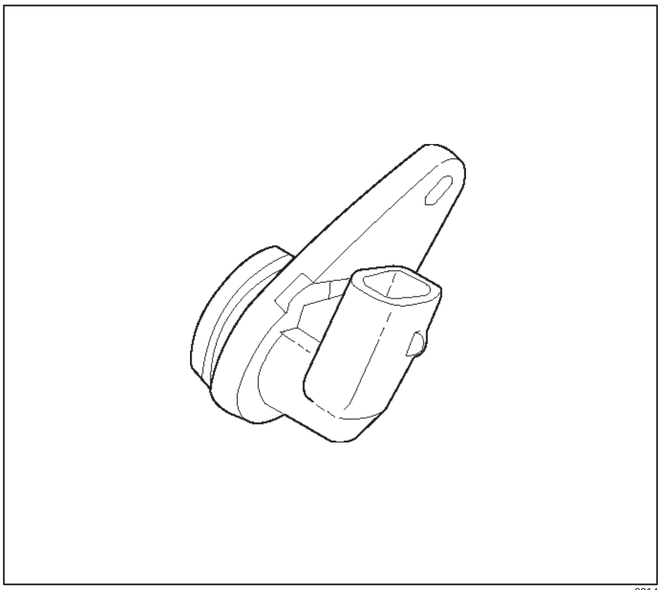


025RY00005

General Description (Electronic Ignition System)

Camshaft Position (CMP) Sensor

CMP is located Left Rear cylinder head. When the Hall-effect switch is activated, it grounds the signal line to the PCM, pulling the camshaft position sensor signal circuit’s applied voltage low. This is a CMP signal. The CMP signals is created as piston #1 is approximately 25° after top dead counter on the power stroke. If the correct CMP signal is not received by the PCM, DTC P0341 will be set.



0014

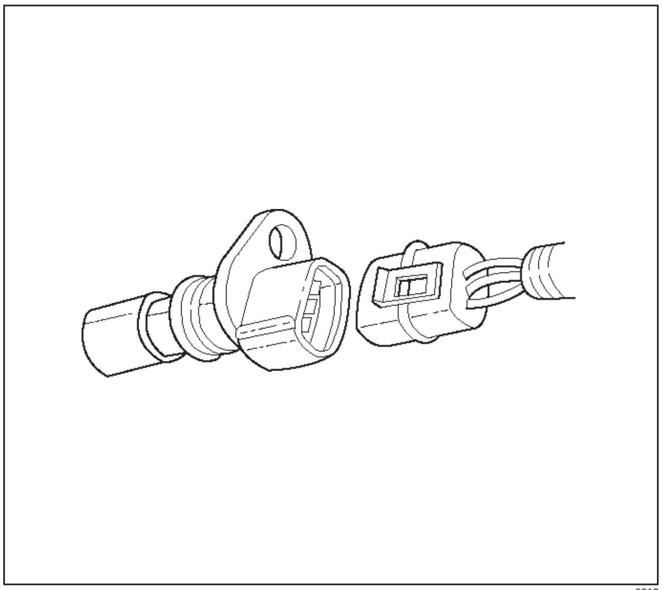
Crankshaft Position (CKP) Sensor

The crankshaft position (CKP) sensor provides a signal used by the powertrain control module (PCM) to calculate the ignition sequence. The sensor initiates the 58X reference pulses which the PCM uses to calculate RPM and crankshaft position. Refer to *Electronic Ignition System* section for additional information.

Electronic Ignition

The electronic ignition system controls fuel combustion by providing a spark to ignite the compressed air/fuel mixture at the correct time. To provide optimum engine performance, fuel economy, and control of exhaust emissions, the PCM controls the spark advance of the ignition system. Electronic ignition has the following advantages over a mechanical distributor system:

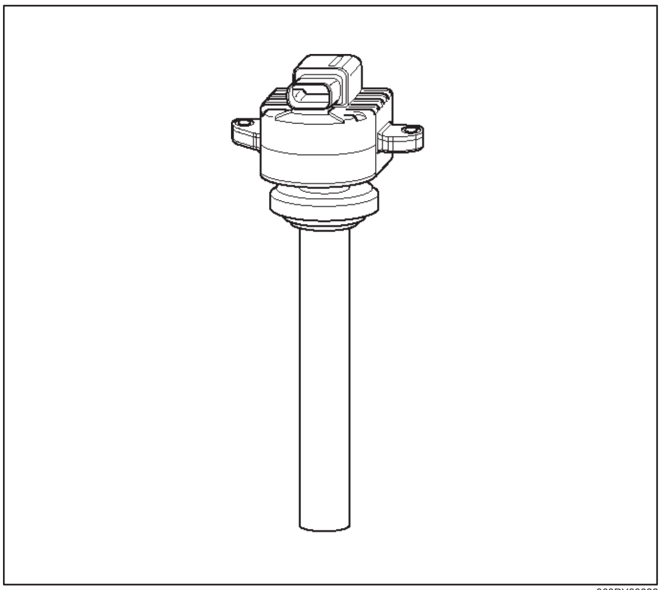
- No moving parts.
- Less maintenance.
- Remote mounting capability.
- No mechanical load on the engine.
- More coil cooldown time between firing events.
- Elimination of mechanical timing adjustments.
- Increased available ignition coil saturation time.



0013

Ignition Coils

A separate coil-at-plug module is located at each spark plug. The coil-at-plug module is attached to the engine with two screws. It is installed directly to the spark plug by an electrical contact inside a rubber boot. A three-way connector provides 12-volt primary supply from the 15-amp ignition fuse, a ground-switching trigger line from the PCM, and a ground.



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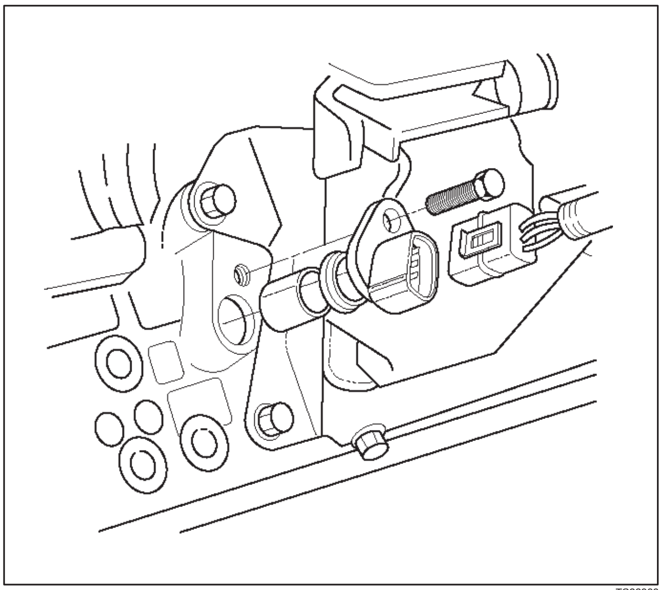
Ignition Control

The ignition control (IC) spark timing is the PCM's method of controlling the spark advance and the ignition dwell. The IC spark advance and the ignition dwell are calculated by the PCM using the following inputs:

- Engine speed.
- Crankshaft position (58X reference).
- Camshaft position (CMP) sensor.
- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- ION sensing module.
- Park/Neutral position (PRNDL input).
- Vehicle speed (vehicle speed sensor).
- PCM and ignition system supply voltage.
- The crankshaft positron (CKP) sensor sends the PCM a 58X signal related to the exact position of the crankshaft.



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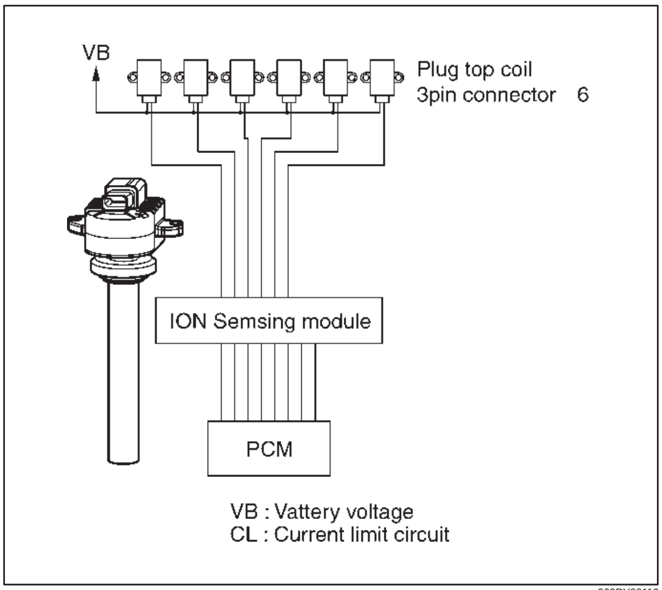
- The camshaft position (CMP) sensor sends a signal related to the position of the camshaft.

Based on these sensor signals and engine load information, the PCM sends 5V to each ignition coil.



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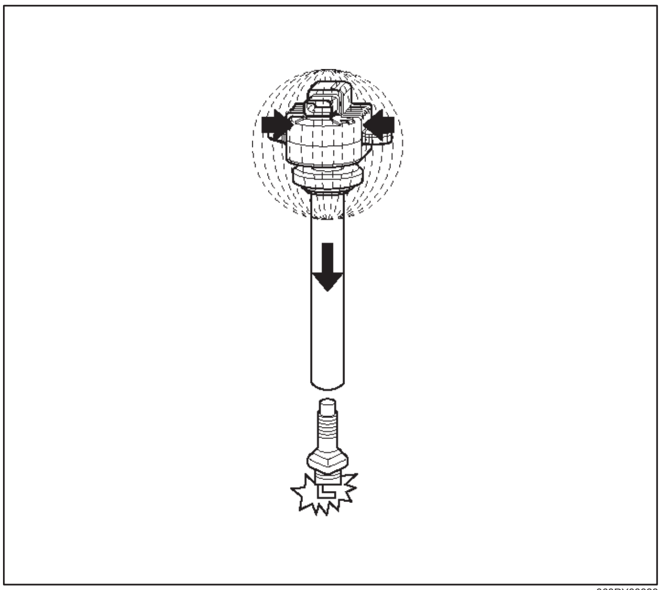
This module has the function to energize and de-energize the primary ignition coil in response to signals from the PCM. The Throttle PCM controls ignition timing and dwell time.

Continuity and out-or-range value check:

This diagnosis detects open circuit or short-circuiting in the Electronic Spark Timing (EST) line by monitoring EST signals. A failure determination is made when the signal voltage remains higher or lower than the threshold for corresponding fault code beyond a predetermined time period.

Diagnosis enabling conditions are as follows:

- RPM is higher than the specified threshold.
- EST line is enabled.



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Ignition Control PCM Output

The PCM provides a zero volt (actually about 100 mV to 200 mV) or a 5-volt output signal to the ignition control (IC) module. Each spark plug has its own primary and secondary ignition coil assembly (”coil-at-plug”) located at the spark plug itself. When the ignition coil receives the 5-volt signal from the PCM, it provides a ground path for the B+ supply to the primary side of the coil-at -plug module. When the PCM shuts off the 5-volt signal to the ION sensing module, the ground path for the primary coil is broken. The magnetic field collapses and induces a high voltage secondary impulse which fires the spark plug and ignites the air/fuel mixture.

The circuit between the PCM and the ignition coil is monitored for open circuits, shorts to voltage, and shorts to ground. If the PCM detects one of these events, it will set one of the following DTCs:

- P0351: Ignition coil Fault on Cylinder #1
- P0352: Ignition coil Fault on Cylinder #2
- P0353: Ignition coil Fault on Cylinder #3
- P0354: Ignition coil Fault on Cylinder #4
- P0355: Ignition coil Fault on Cylinder #5
- P0356: Ignition coil Fault on Cylinder #6

Powertrain Control Module (PCM)

The PCM is responsible for maintaining proper spark and fuel injection timing for all driving conditions. To provide optimum driveability and emissions, the PCM monitors the input signals from the following components in order to calculate spark timing:

- Engine coolant temperature (ECT) sensor.
- Intake air temperature (IAT) sensor.
- Mass air flow (MAF) sensor.
- PRNDL input from transmission range switch.
- Throttle position (TP) sensor.
- Vehicle speed sensor (VSS) .
- Crankshaft position (CKP) sensor.

Spark Plug

Although worn or dirty spark plugs may give satisfactory operation at idling speed, they frequency fail at higher engine speeds. Faulty spark plugs may cause poor fuel economy, power loss, loss of speed, hard starting and generally poor engine performance. Follow the scheduled maintenance service recommendations to ensure satisfactory spark plug performance. Refer to *Maintenance and Lubrication* section.

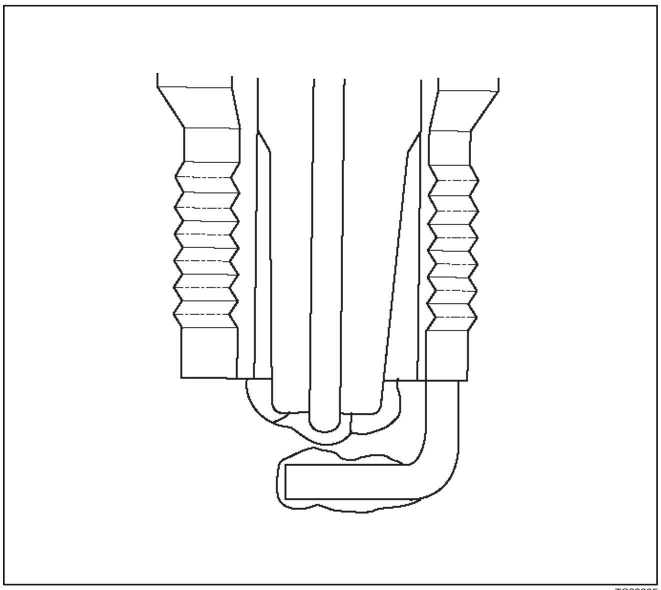
Normal spark plug operation will result in brown to grayish-tan deposits appearing on the insulator portion of the spark plug. A small amount of red-brown, yellow, and white powdery material may also be present on the insulator tip around the center electrode. These deposits are normal combustion by-products of fuels and lubricating oils with additives. Some electrode wear will also occur. Engines which are not running properly are often referred to as “misfiring.” This means the ignition spark is not igniting the air/fuel mixture at the proper time. While other ignition and fuel system causes must also be considered, possible causes include ignition system conditions which allow the spark voltage to reach ground in some other manner than by jumping across the air gap at the tip of the spark plug, leaving the air/fuel mixture unburned. Refer to *DTC P0300*. Misfiring may also occur when the tip of the spark plug becomes overheated and ignites the mixture before the spark jumps. This is referred to as “pre-ignition.”

Spark plugs may also misfire due to fouling, excessive gap, or a cracked or broken insulator. If misfiring occurs before the recommended replacement interval, locate and correct the cause.

Carbon fouling of the spark plug is indicated by dry, black carbon (soot) deposits on the portion of the spark plug in the cylinder. Excessive idling and slow speeds under light engine loads can keep the spark plug temperatures so low that these deposits are not burned off. Very rich fuel mixtures or poor ignition system output may also be the cause. Refer to DTC P0172.

Oil fouling of the spark plug is indicated by wet oily deposits on the portion of the spark plug in the cylinder, usually with little electrode wear. This may be caused by oil during break-in of new or newly overhauled engines.

Deposit fouling of the spark plug occurs when the normal red-brown, yellow or white deposits of combustion by products become sufficient to cause misfiring. In some cases, these deposits may melt and form a shiny glaze on the insulator around the center electrode. If the fouling is found in only one or two cylinders, valve stem clearances or intake valve seals may be allowing excess lubricating oil to enter the cylinder, particularly if the deposits are heavier on the side of the spark plug facing the intake valve.



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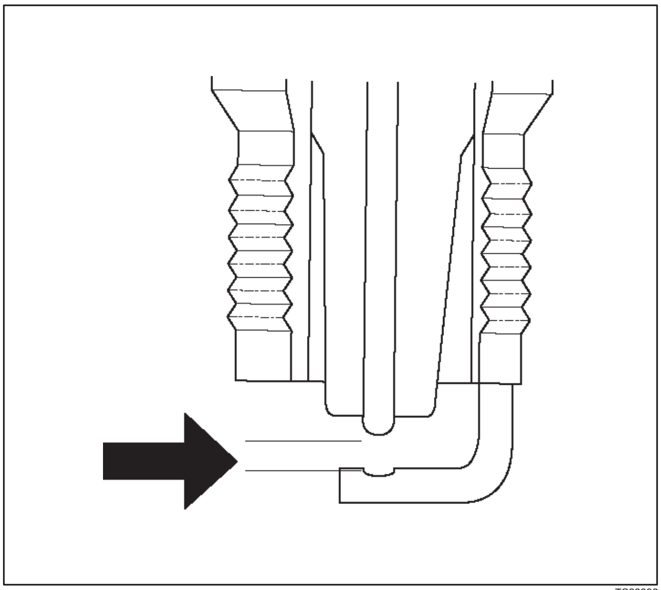
Excessive gap means that the air space between the center and the side electrodes at the bottom of the spark plug is too wide for consistent firing. This may be due to improper gap adjustment or to excessive wear of the electrode during use. A check of the gap size and comparison to the gap specified for the vehicle in *Maintenance and Lubrication* section will tell if the gap is too wide. A spark plug gap that is too small may cause an unstable idle condition. Excessive gap wear can be an indication of continuous operation at high speeds or with engine loads, causing the spark to run too hot. Another possible cause is an excessively lean fuel mixture.



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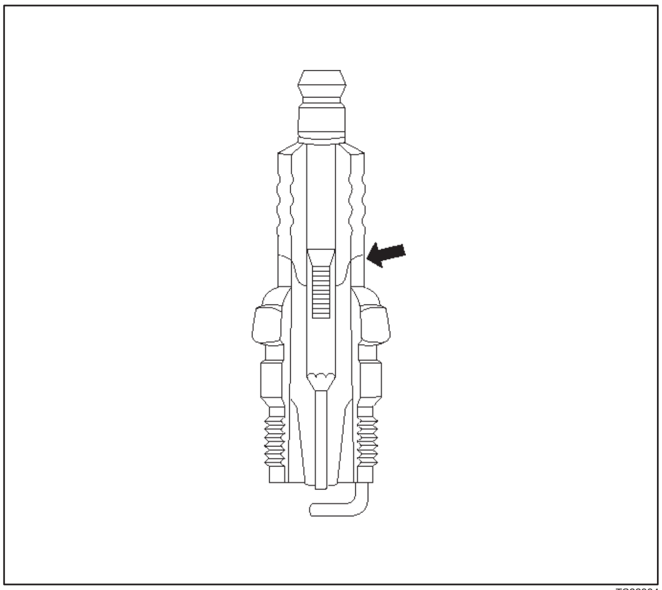
Low or high spark plug installation torque or improper seating can result in the spark plug running too hot and can cause excessive center electrode wear. The plug and the cylinder head seats must be in good contact for proper heat transfer and spark plug cooling. Dirty or damaged threads in the head or on the spark plug can keep it from seating even though the proper torque is applied. Once spark plugs are properly seated, tighten them to the torque shown in the Specifications Table. Low torque may result in poor contact of the seats due to a loose spark plug. Overtightening may cause the spark plug shell to be stretched and will result in poor contact between the seats. In extreme cases, exhaust blow-by and damage beyond simple gap wear may occur.

Cracked or broken insulators may be the result of improper installation, damage during spark plug re-gapping, or heat shock to the insulator material. Upper insulators can be broken when a poorly fitting tool is used during installation or removal, when the spark plug is hit from the outside, or is dropped on a hard surface. Cracks in the upper insulator may be inside the shell and not visible. Also, the breakage may not cause problems until oil or moisture penetrates the crack later.



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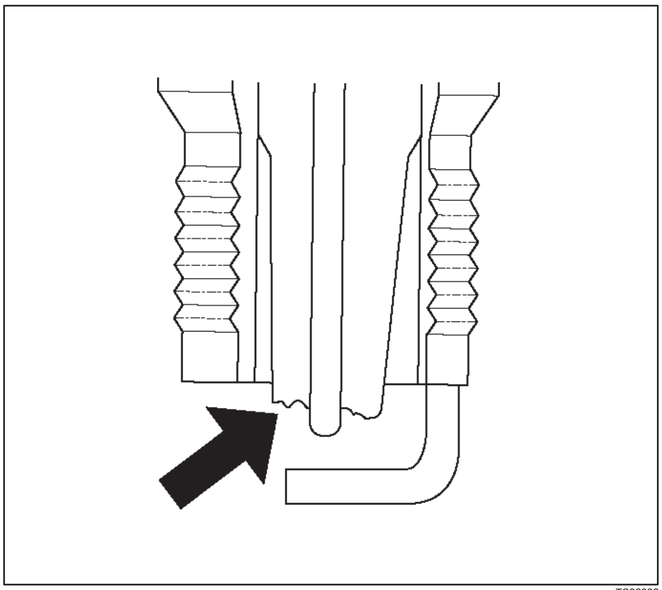
A broken or cracked lower insulator tip (around the center electrode) may result from damage during re-gapping or from “heat shock” (spark plug suddenly operating too hot).



TS23993

- Damage during re-gapping can happen if the gapping tool is pushed against the center electrode or the insulator around it, causing the insulator to crack. When re-gapping a spark plug, make the adjustment by bending only the ground side terminal, keeping the tool clear of other parts.
- ”Heat shock” breakage in the lower insulator tip generally occurs during several engine operating conditions (high speeds or heavy loading) and may be caused by over-advanced timing or low grade fuels. Heat shock refers to a rapid increase in the tip temperature that causes the insulator material to crack.

Spark plugs with less than the recommended amount of service can sometimes be cleaned and re-gapped , then returned to service. However, if there is any doubt about the serviceability of a spark plug, replace it. Spark plugs with cracked or broken insulators should always be replaced.

A/C Clutch Diagnosis

A/C Clutch Circuit Operation

A 12-volt signal is supplied to the A/C request input of the PCM when the A/C is selected through the A/C control switch.

The A/C compressor clutch relay is controlled through the PCM. This allows the PCM to modify the idle air control position prior to the A/C clutch engagement for better idle quality. If the engine operating conditions are within their specified calibrated acceptable ranges, the PCM will enable the A/C compressor relay. This is done by providing a ground path for the A/C relay coil within the PCM. When the A/C compressor relay is enabled, battery voltage is supplied to the compressor clutch coil. The PCM will enable the A/C compressor clutch whenever the engine is running and the A/C has been requested. The PCM will not enable the A/C compressor clutch if any of the following conditions are met:

- The throttle is greater than 90%.
- The engine speed is greater than 6315 RPM.
- The ECT is greater than 119˚C (246˚F).
- The IAT is less than 5˚C (41˚F).
- The throttle is more than 80% open.

A/C Clutch Circuit Purpose

The A/C compressor operation is controlled by the powertrain control module (PCM) for the following reasons:

- It improvises idle quality during compressor clutch engagement.
- It improvises wide open throttle (WOT) performance.
- It provides A/C compressor protection from operation with incorrect refrigerant pressures.

The A/C electrical system consists of the following components:

- The A/C control head.
- The A/C refrigerant pressure switches.
- The A/C compressor clutch.
- The A/C compressor clutch relay.
- The PCM.

A/C Request Signal

This signal tells the PCM when the A/C mode is selected at the A/C control head. The PCM uses this to adjust the idle speed before turning on the A/C clutch. The A/C compressor will be inoperative if this signal is not available to the PCM.

Refer to *A/C Clutch Circuit Diagnosis* section for A/C wiring diagrams and diagnosis for A/C electrical system.

General Description (Evaporative (EVAP) Emission System)

EVAP Emission Control System Purpose

The basic evaporative emission (EVAP) control system used on all vehicles is the charcoal canister storage method. Gasoline vapors from the fuel tank flow into the canister through the inlet labeled “TANK.” These vapors are absorbed into the activated carbon (charcoal) storage device (canister) in order to hold the vapors when the vehicle is not operating. The canister is purged by PCM control when the engine coolant temperature is over 60˚C (140˚F), the IAT reading is over 10˚C (50˚F), and the engine has been running. Air is drawn into the canister through the air inlet grid. The air mixes with the vapor and the mixture is drawn into the intake manifold.

EVAP Emission Control System Operation

The EVAP canister purge is controlled by a solenoid valve that allows the manifold vacuum to purge the canister. The powertrain control module (PCM) supplies a ground to energize the solenoid valve (purge on). The EVAP purge solenoid control is pulse-width modulated (PWM) (turned on and off several times a second). The duty cycle (pulse width) is determined by engine operating conditions including load, throttle positron, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM. The output is commanded when the appropriate conditions have been met. These conditions are:

- The engine is fully warmed up.
- The engine has been running for a specified time.
- The IAT reading is above 10˚C (50˚F).

A continuous purge condition with no purge commanded by the PCM will set a DTC P1441.

Poor idle, stalling and poor driveability can be caused by:

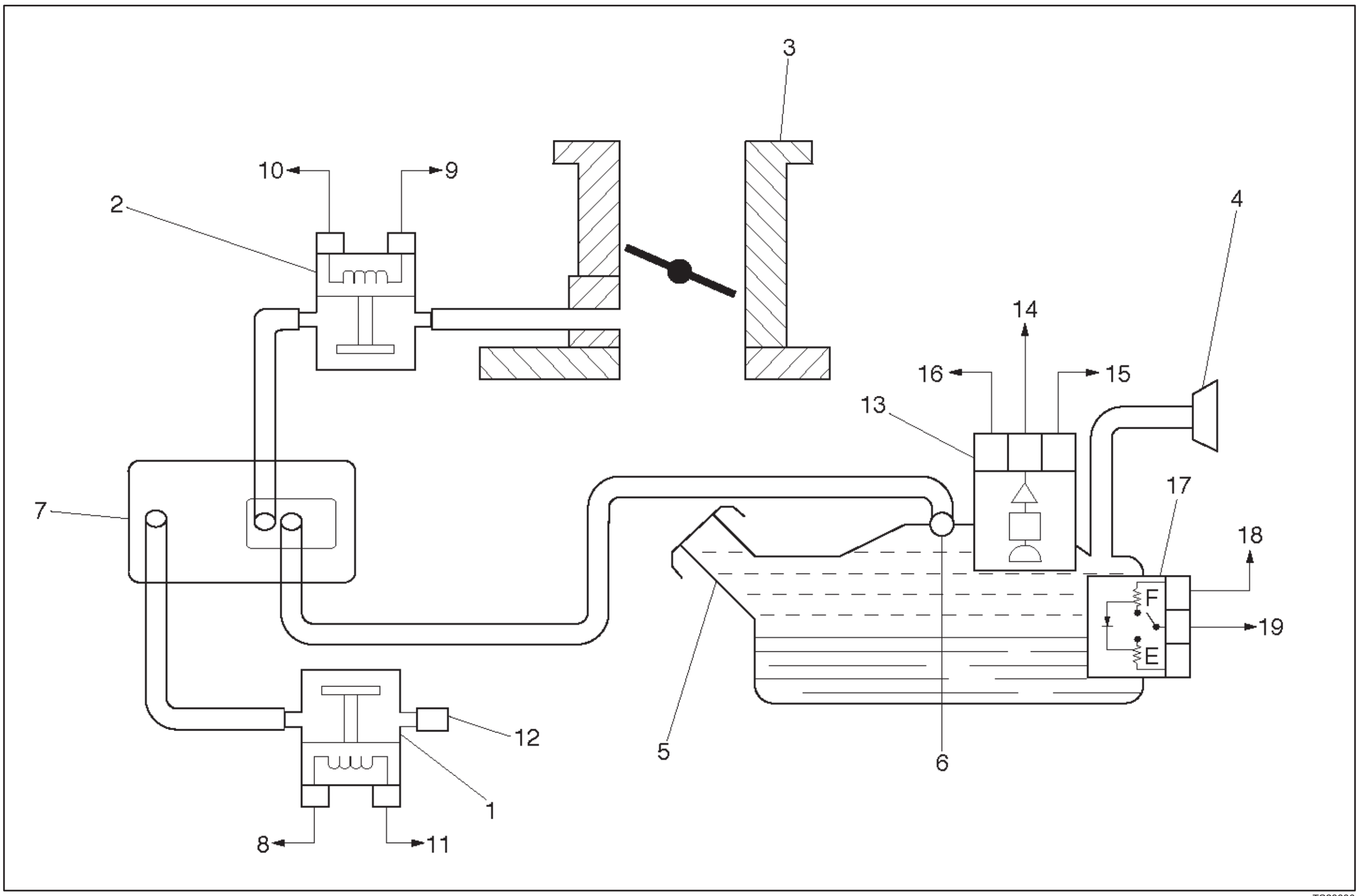
- A malfunctioning purge solenoid.
- A damaged canister.
- Hoses that are split, cracked, or not connected properly.

Enhanced Evaporative Emission Control System

The basic purpose of the Enhanced Evaporative Emissions control system is the same as other EVAP systems. A charcoal-filled canister captures and stores gasoline fumes. When the PCM determines that the time is right, it opens a purge valve which allows engine vacuum to draw the fumes into the intake manifold.

The difference between this and other systems is that the PCM monitors the vacuum and/or pressure in the system to determine if there is any leakage. If the PCM determines that the EVAP system is leaking or not functioning properly, it sets a Diagnostic Trouble Code (DTC) in the PCM memory.

The enhanced EVAP system is required to detect evaporative fuel system leaks as small as 0.040 in. (1.0 mm) between the fuel filler cap and purge solenoid. The system can test the evaporative system integrity by applying a vacuum signal (ported or manifold) to the fuel tank to create a small vacuum. The PCM then monitors the ability of the system to maintain the vacuum. If the vacuum remains for a specified period of time, there are no evaporative leaks and a PASS report is sent to the diagnostic executive. If there is a leak, the system either will not achieve a vacuum, or a vacuum cannot be maintained. Usually, a failure can only be detected after a cold start with a trip of sufficient length and driving conditions to run the needed tests. The enhanced EVAP system diagnostic will conduct up to eight specific sub-tests to detect fault conditions. If the diagnostic fails a sub-test, the PCM will store a Diagnostic Trouble Code (DTC) to indicate the type of detected.



TS30006

Legend

(1) Vent Solenoid
(2) EVAP Purge Solenoid
(3) Throttle Body
(4) Fuel Filler Neck
(5) Fuel Tank
(6) Rollover Valve
(7) EVAP Canister
(8) Ignition Feed
(10) EVAP Purge Solenoid Driver Signal from PCM
(11) Vent Solenoid Driver Signal from PCM
(12) Vent Filter
(13) Fuel Tank Pressure Sensor
(14) Fuel Tank Pressure Signal to PCM
(15) 5 Volt Reference “A” Circuit from PCM
(16) Sensor Ground Circuit from PCM
(17) Fuel Level Sensor
(18) Fuel Level Signal to PCM
(19) 5 Volt Return

Electrical Components

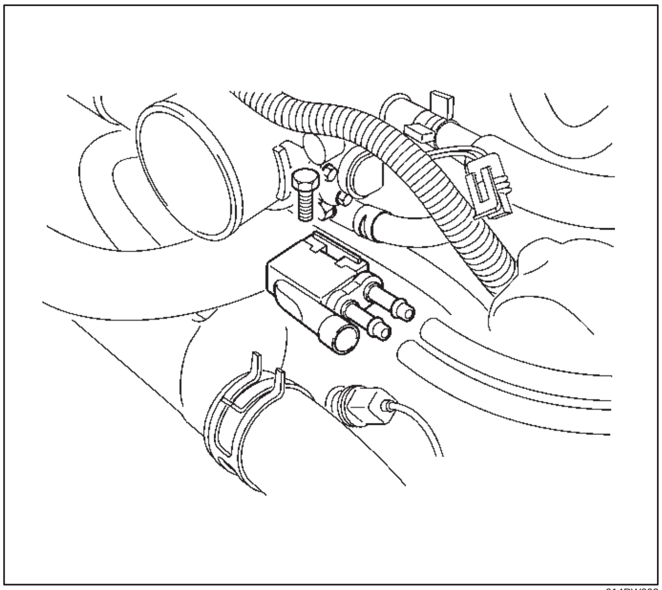
The electrical components that make up the enhanced EVAP system are:

- Fuel Tank Pressure Sensor. The fuel tank pressure sensor is a three-wire strain gauge sensor similar to a common MAP sensor. However, the fuel tank pressure sensor has very different electrical characteristics due to its pressure differential design. The sensor measures the difference between the air pressure (or vacuum) in the fuel tank and the outside air pressure.

The sensor mounts at the top of the fuel pump assembly. A three-wire electrical harness connects it to the PCM. The PCM supplies a five-volt reference voltage and a ground to the sensor. The sensor will return a voltage between 0.1 and 4.9 volts. When the air pressure in the fuel tank is equal to the outside air pressure, such as when the fuel cap is removed, the output voltage of the sensor will be 1.3 to 1.7 volts.

When the air pressure in the fuel tank is 4.5 in. H2O (1.25 kPa), the sensor output voltage will be 0.5 $\pm$ 0.2 V. When there is neither vacuum nor pressure in the fuel tank, the sensor voltage will be 1.5 V. At –14 in. H2O (–3.75 kPa), the sensor voltage will be 4.5 $\pm$ 0.2 V.

- EVAP Canister Purge Solenoid. Normally closed, the purge solenoid opens upon the PCM's signal to allow engine vacuum to purge gasoline fumes from the canister. Mounted on the water pipe to front of the engine assembly.



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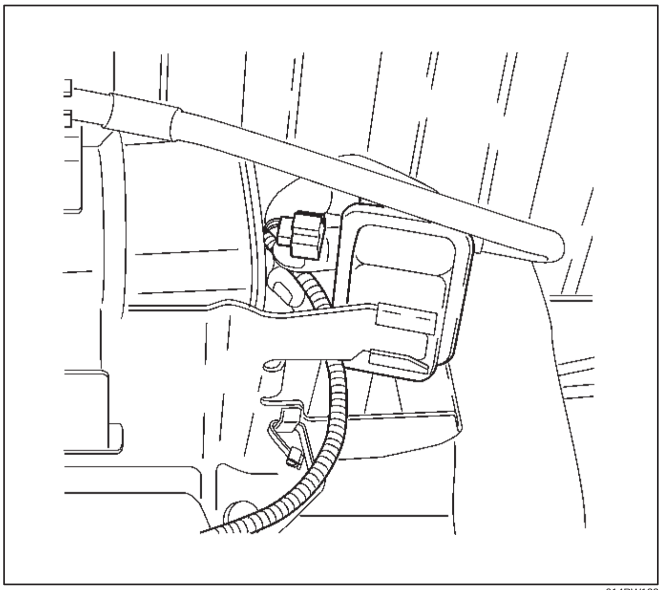
- EVAP Canister Vent Solenoid. Located next to the canister, the vent solenoid opens to allow air into the EVAP system. Fresh air is necessary to completely remove gasoline fumes from the canister during purge. The EVAP vent solenoid closes to seal off the evaporative emissions system for leak testing.



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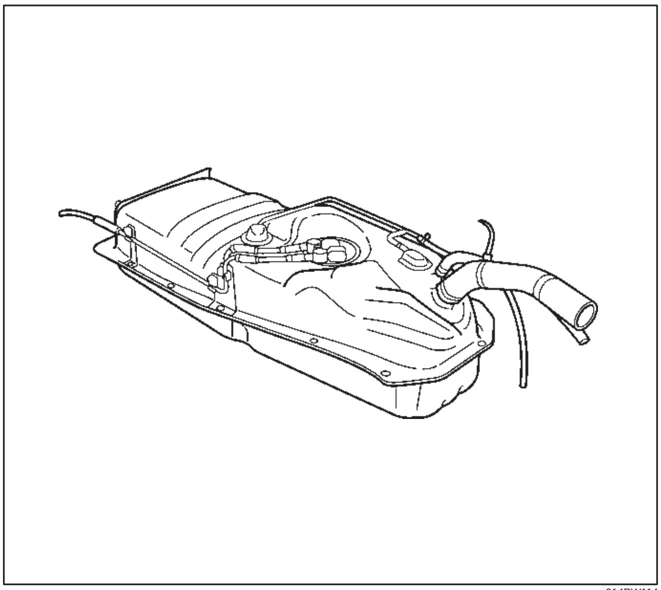
- Fuel Level Sensor. The fuel level sensor is an important input to the PCM for the enhanced EVAP system diagnostic. The PCM needs fuel level information to know the volume of fuel in the tank. The fuel level affects the rate of change of air pressure in the EVAP system. Several of the enhanced EVAP system diagnostic sub-tests are dependent upon correct fuel level information. The diagnostic will not run when the tank is less than 15% or more than 85% full. Be sure to diagnose any Fuel Level Sensor DTCs first, as they can cause other DTCs to set.



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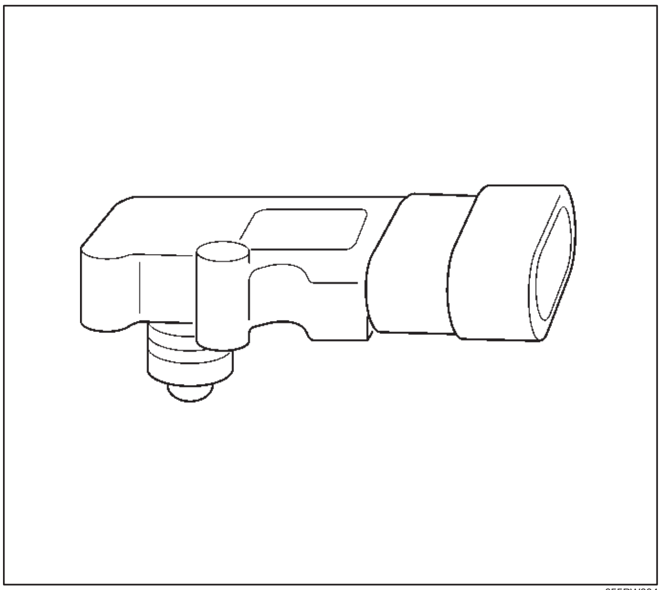
- Manifold Absolute Pressure (MAP) Sensor. The PCM compares the signals from the fuel tank pressure sensor and the MAP sensor to ensure that a relative vacuum is maintained the EVAP system.



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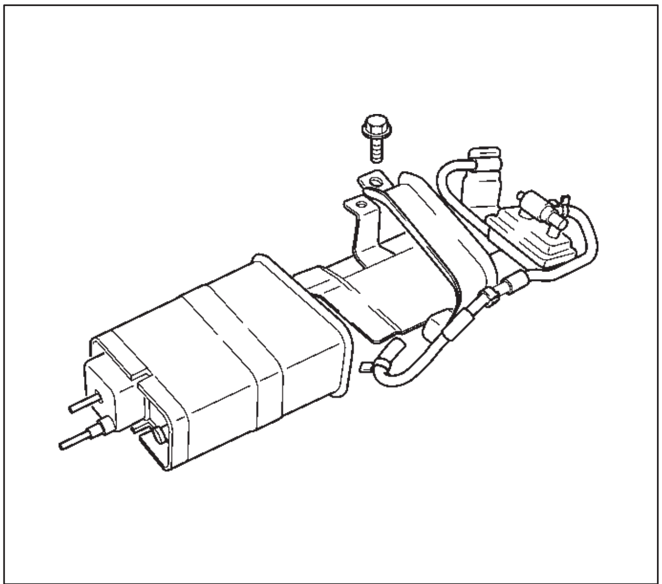
Non-Electrical Components

- Purge/Vacuum Hoses. Made of rubber compounds, these hoses route the gasoline fumes from their sources to the canister and from the canister to the intake air flow.
- EVAP Canister. Mounted on a bracket ahead of the fuel tank, the canister stores fuel vapors until the PCM determines that engine conditions are right for them to be remove and burned.
- Fuel Tank. The tank has a built-in air space designed for the collection of gasoline fumes.



014RW129

- Vacuum Source. The vacuum source is split between two ports, one on either side of the throttle body.
- Fuel Cap. The fuel cap is designed to be an integral part of the EVAP system.

System Fault Detection

The EVAP leak detection strategy is based on applying vacuum to the EVAP system and monitoring vacuum decay. The PCM monitors vacuum level via the fuel tank pressure sensor. At an appropriate time, the EVAP purge solenoid and the EVAP vent solenoid are turned “ON,” allowing the engine vacuum to draw a small vacuum on the entire evaporative emission system.

After the desired vacuum level has been achieved, the EVAP purge solenoid is turned “OFF,” sealing the system. A leak is detected by monitoring for a decrease in vacuum level over a given time period, all other variables remaining constant. A small leak in the system will cause DTC P0442 to be set.

If the desired vacuum level cannot be achieved in the test described above, a large leak or a faulty EVAP purge solenoid is indicated.

Leaks can be caused by the following conditions:

- Disconnected or faulty fuel tank pressure sensor
- Missing or faulty fuel cap
- Disconnected, damaged, pinched, or blocked EVAP purge line
- Disconnected or damaged EVAP vent hose
- Disconnected, damaged, pinched, or blocked fuel tank vapor line
- Disconnected or faulty EVAP purge solenoid
- Disconnected or faulty EVAP vent solenoid
- Open ignition feed circuit to the EVAP vent or purge solenoid
- Damaged EVAP canister
- Leaking fuel sender assembly O-ring
- Leaking fuel tank or fuel filler neck

A restricted or blocked EVAP vent path is detected by drawing vacuum into the EVAP system, turning “OFF” the EVAP vent solenoid and the EVAP purge solenoid (EVAP vent solenoid “OPEN,” EVAP purge Pulse Width Modulate (PWM) “0%”) and monitoring the fuel tank vacuum sensor input. With the EVAP vent solenoid open, any vacuum in the system should decrease quickly unless the vent path is blocked. A blockage like this will set DTC P0446 and can be caused by the following conditions:

- Faulty EVAP vent solenoid (stuck closed)
- Plugged, kinked or pinched vent hose
- Shorted EVAP vent solenoid driver circuit
- Plugged EVAP canister

The PCM supplies a ground to energize the purge solenoid (purge “ON”). The EVAP purge control is PWM, or turned “ON” and “OFF,” several times a second. The duty cycle (pulse width) is determined by engine operating conditions including load, throttle position, coolant temperature and ambient temperature. The duty cycle is calculated by the PCM and the output is commanded when the appropriate conditions have been met.

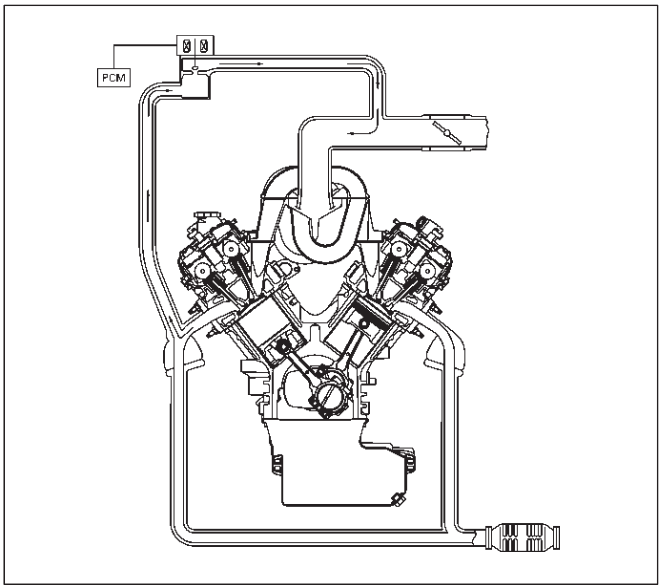
The system checks for conditions that cause the EVAP system to purge continuously by commanding the EVAP vent solenoid “ON” and the EVAP purge solenoid “OFF” (EVAP vent solenoid “CLOSED,” EVAP purge PWM “0%”). If fuel tank vacuum level increases during the test, a continuous purge flow condition is indicated, which will set a DTC P1441. This can be cause by the following conditions:

- EVAP purge solenoid leaking
- EVAP purge and engine vacuum lines switched at the EVAP purge solenoid
- EVAP purge solenoid driver circuit grounded

General Description (Exhaust Gas Recirculation (EGR) System)

EGR Purpose

The exhaust gas recirculation (EGR) system is use to reduce emission levels of oxides of nitrogen (NOx). NOx emission levels are caused by a high combustion temperature. The EGR system lowers the NOx emission levels by decreasing the combustion temperature.



057RW002

Linear EGR Valve

The main element of the system is the linear EGR valve. The EGR valve feeds small amounts of exhaust gas back into the combustion chamber. The fuel/air mixture will be diluted and combustion temperatures reduced.

Linear EGR Control

The PCM monitors the EGR actual positron and adjusts the pintle position accordingly. The uses information from the following sensors to control the pintle position:

- Engine coolant temperature (ECT) sensor.
- Throttle position (TP) sensor.
- Mass air flow (MAF) sensor.

Linear EGR Valve Operation and Results of Incorrect Operation

The linear EGR valve is designed to accurately supply EGR to the engine independent of intake manifold vacuum. The valve controls EGR flow from the exhaust to the intake manifold through an orifice with a PCM controlled pintle. During operation, the PCM controls pintle position by monitoring the pintle position feedback signal. The feedback signal can be monitored with a Tech 2 as “Actual EGR Pos.” “Actual EGR Pos.” should always be near the commanded EGR position (”Desired EGR Pos.”). If a problem with the EGR system will not allow the PCM to control the pintle position properly, DTC P1406 will set. The PCM also tests for EGR flow. If incorrect flow is detected, DTC P0401 will set. If DTCs P0401 and/or P1406 are set, refer to the DTC charts.

The linear EGR valve is usually activated under the following conditions:

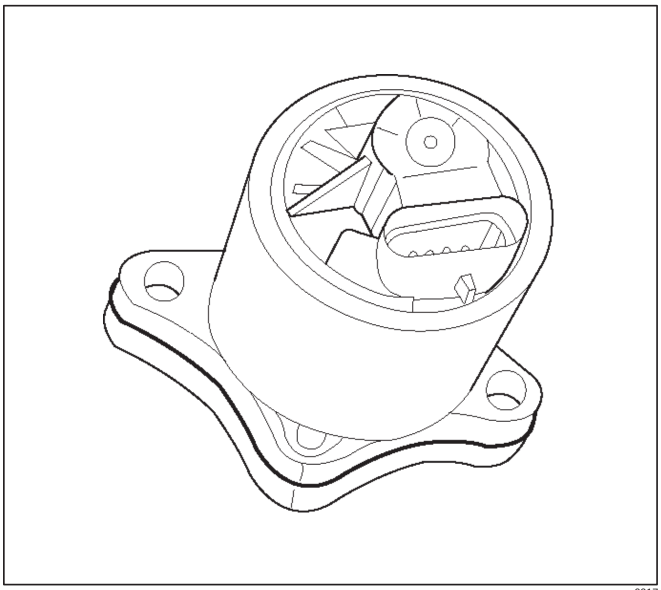
- Warm engine operation.
- Above-idle speed.

Too much EGR flow at idle, cruise or cold operation may cause any of the following conditions to occur:

- Engine stalls after a cold start.
- Engine stalls at idle after deceleration.
- Vehicle surges during cruise.
- Rough idle.
- DTC P0300 (misfire detected).

Too little or no EGR flow may allow combustion temperatures to get too high. This could cause:

- Spark knock (detonation).
- Engine overheating.
- Emission test failure.
- DTC P0401 (EGR flow test).
- Poor fuel economy.



0017

EGR Pintle Position Sensor

The PCM monitors the EGR valve pintle position input to endure that the valve responds properly to commands from the PCM and to detect a fault if the pintle position sensor and control circuits are open or shorted. If the PCM detects a pintle position signal voltage outside the normal range of the pintle position sensor, or a signal voltage that is not within a tolerance considered acceptable for proper EGR system operation, the PCM will set DTC P1406.

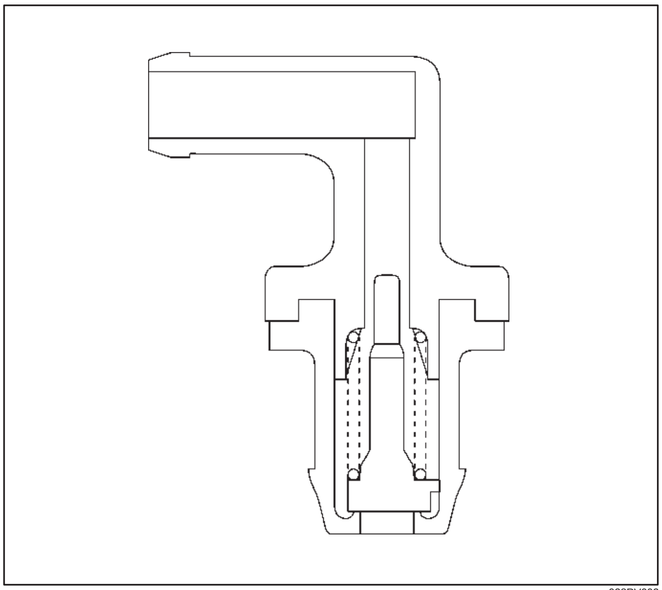
General Description (Positive Crankcase Ventilation (PCV) System)

Crankcase Ventilation System Purpose

The crankcase ventilation system is use to consume crankcase vapors in the combustion process instead of venting them to the atmosphere. Fresh air from the throttle body is supplied to the crankcase and mixed with blow-by gases. This mixture is then passed through the positive crankcase ventilation (PCV) valve into the common chamber.

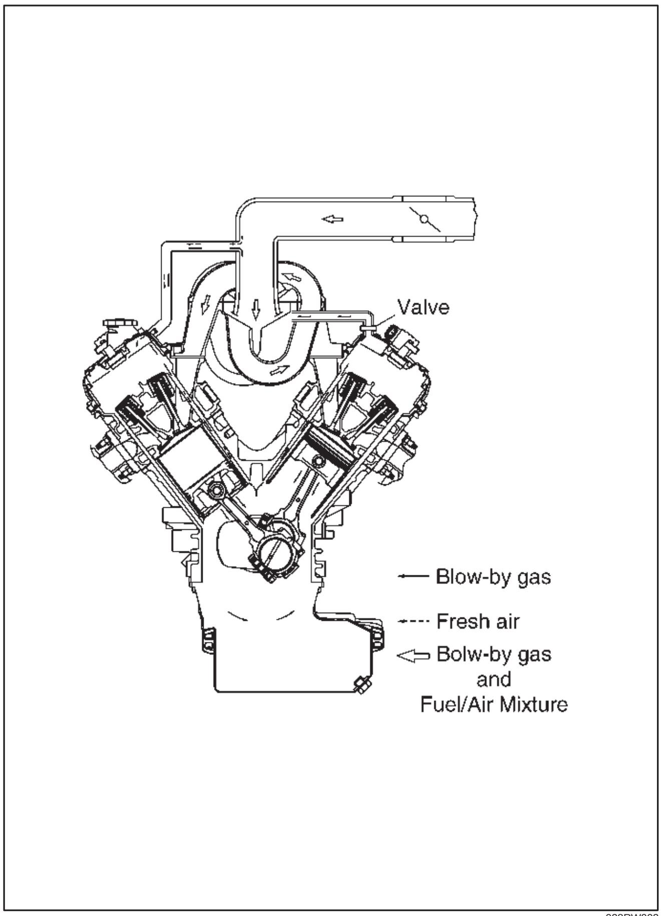
Crankcase Ventilation System Operation

The primary control is through the positive crankcase ventilation (PCV) valve. The PCV valve meters the flow at a rate that depends on the intake vacuum. The PCV valve restricts the flow when the inlet vacuum is highest. In addition, the PCV valve can seal the common chamber off in case of sudden high pressure in the crankcase.



028RV002

While the engine is running, exhaust fuses and small amounts of the fuel/air mixture escape past the piston rings and enter the crankcase. These gases are mixed with clean air entering through a tube from the air intake duct.



028RW002

During normal, part-throttle operation, the system is designed to allow crankcase gases to flow through the PCV valve into the throttle body to be consumed by normal combustion.

A plugged valve or PCV hose may cause the following conditions:

- Rough idle.
- Stalling of slow idle speed.
- Oil leaks.
- Sludge in the engine.

A leaking PCV hose would cause:

- Rough idle.
- Stalling.
- High idle speed.

Special Tools

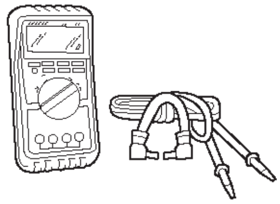
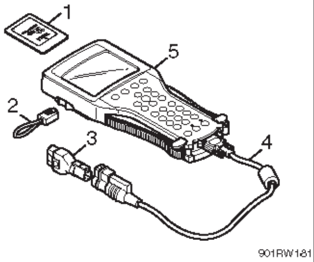
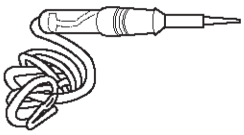
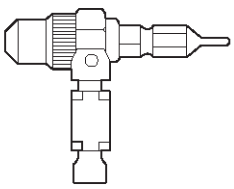
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 39200** High Impedance Multimeter (Digital Voltmeter – DVM)
	(1) PCMCIA Card (2) RS232 Loop Back Connector (3) SAE 16/19 Adapter (4) DLC Cable (5) TECH–2
	**J 34142-B** Unpowered Test Light
	Connector Test Adapter Kit J 35616-A/BT-8637
	**J 26792/BT-7220-1** Spark Tester
	**J 34730-E** Port Fuel Injection Diagnostic Kit

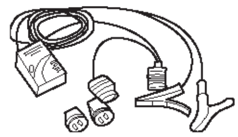
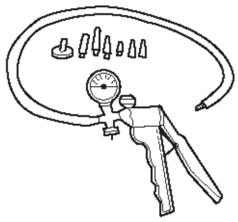
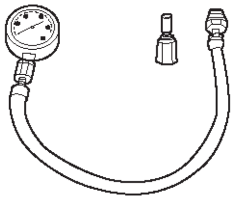
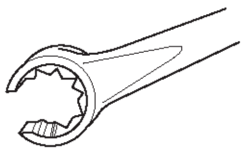
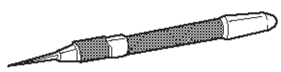
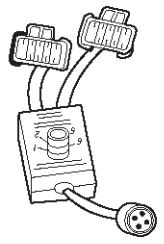
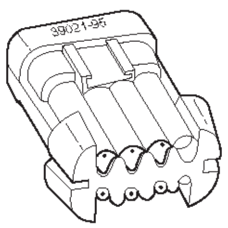
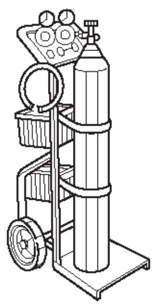
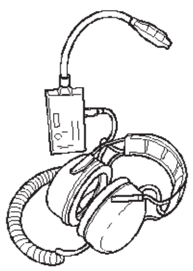
ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 37027-A** IAC Motor Analyzer
	**J 23738-A** Vacuum Pump with Gauge
	**BT-8515/8515V** Exhaust Back Pressure Tester
	**J 39194-B** Heated Oxygen Sensor Wrench
	**J 35689-A** Terminal Remover
	**J 28742-A** Weather Pack II Terminal Remover

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J 39021-90** Injector Switch Box
	**J 39021-65** Injector Test Light
	**J 41413**[1] EVAP Pressure/Purge Diagnostic Station
	**J 41416**[2] Ultrasonic Leak Detector

1. J 41413 EVAP Pressure/Purge Diagnostic Station is a multipurpose tool which is used to perform several diagnostic procedures for enhanced emission testing. The station will accommodate a nitrogen gas filled cylinder which is used to pressurize the vehicle EVAP system for a leakdown test and leak location test when a vehicle is repaired for leakage in the enhanced evaporative emission control system. It also has two additional gauges (inches of mercury and inches of water) which are used to measure both source vacuum and EVAP canister purge vacuum to verify correct operation and vapor flow within the canister purge circuit.
2. J 41416 Ultrasonic Leak Detector is a microprocessor-based device used to detect leaks in the enhanced evaporative emission control system. The evaporative system is pressurized to 30 inches of water using the J 41413 EVAP Pressure/Purge Diagnostic System. Small leaks in the EVAP system will emit sound at a high frequency undetectable by a human ear but detectable with the J 41416. The technician traces along the evaporative system and can pinpoint leaks due to corroded lines, cracked hoses, or a damaged EVAP component. The detector includes a high quality set of headphones to block out surrounding shop noise and the LED sensitivity meter allows a visual reference for locating leaks in conjunction with the audio output heard through the headphones. Powered by (1) nine volt battery.

RODEO

ENGINE

ENGINE EXHAUST (6VD1 3.2L)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

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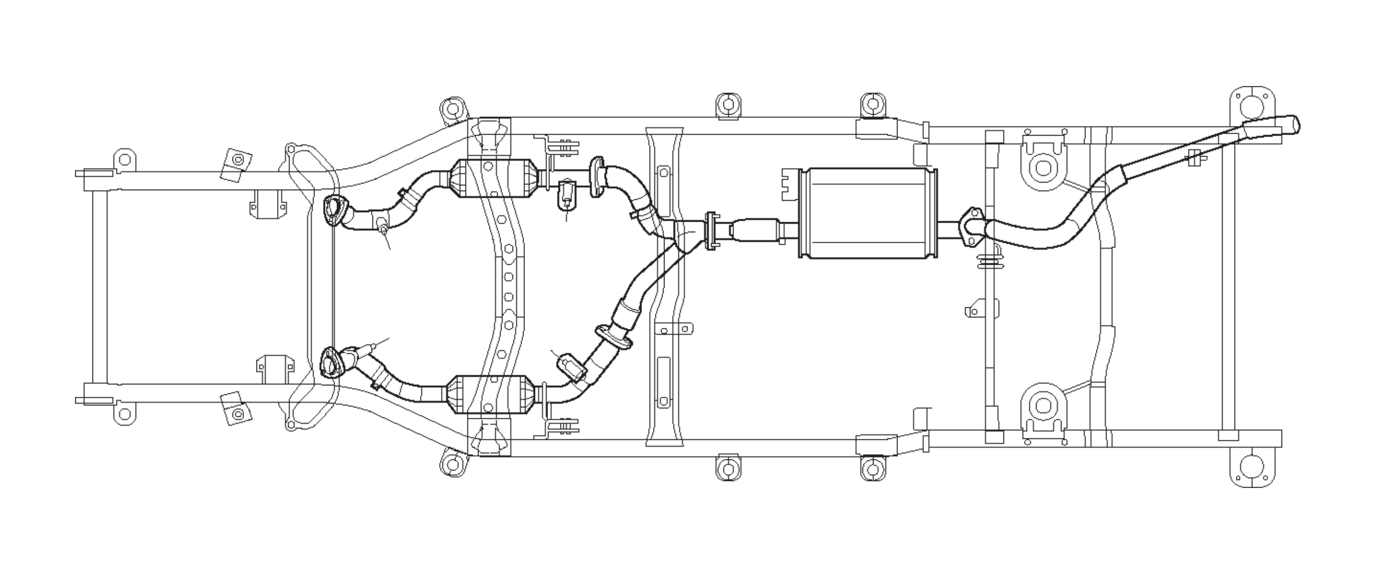
General Description



150RW023

When inspecting or replacing exhaust system components, make sure there is adequate clearance from all points on the underbody to prevent overheating the floor pan and possible damage to the passenger compartment insulation and trim materials.

Check complete exhaust system and nearby body areas and rear compartment lid for broken, damaged, missing or mispositioned parts, open seams, holes, loose connections or other deterioration which could permit exhaust fumes to seep into the rear compartment or passenger compartment. Dust or water in the rear compartment may be an indication of a problem in one of these areas. Any faulty areas should be corrected immediately.

Hangers

Various types of hangers are used to support exhaust system(s). These include conventional rubber straps, rubber rings, and rubber blocks.

The installation of exhaust system supports is very important, as improperly installed supports can cause annoying vibrations which can be difficult to diagnose.

Three Way Catalytic Converter

The three way catalytic converter is an emission control device added to the exhaust system to reduce pollutants from the exhaust gas stream.

CAUTION: The catalytic converter requires the use of unleaded fuel only.

Periodic maintenance of the exhaust system is not required. If the vehicle is raised for other service, it is advisable to check the condition of the complete exhaust system.

A dual bed monolith catalytic converter is used in combination with three way catalytic converter.

Catalytic Converter Types:

Three way (Reduction/Oxidation) catalyst

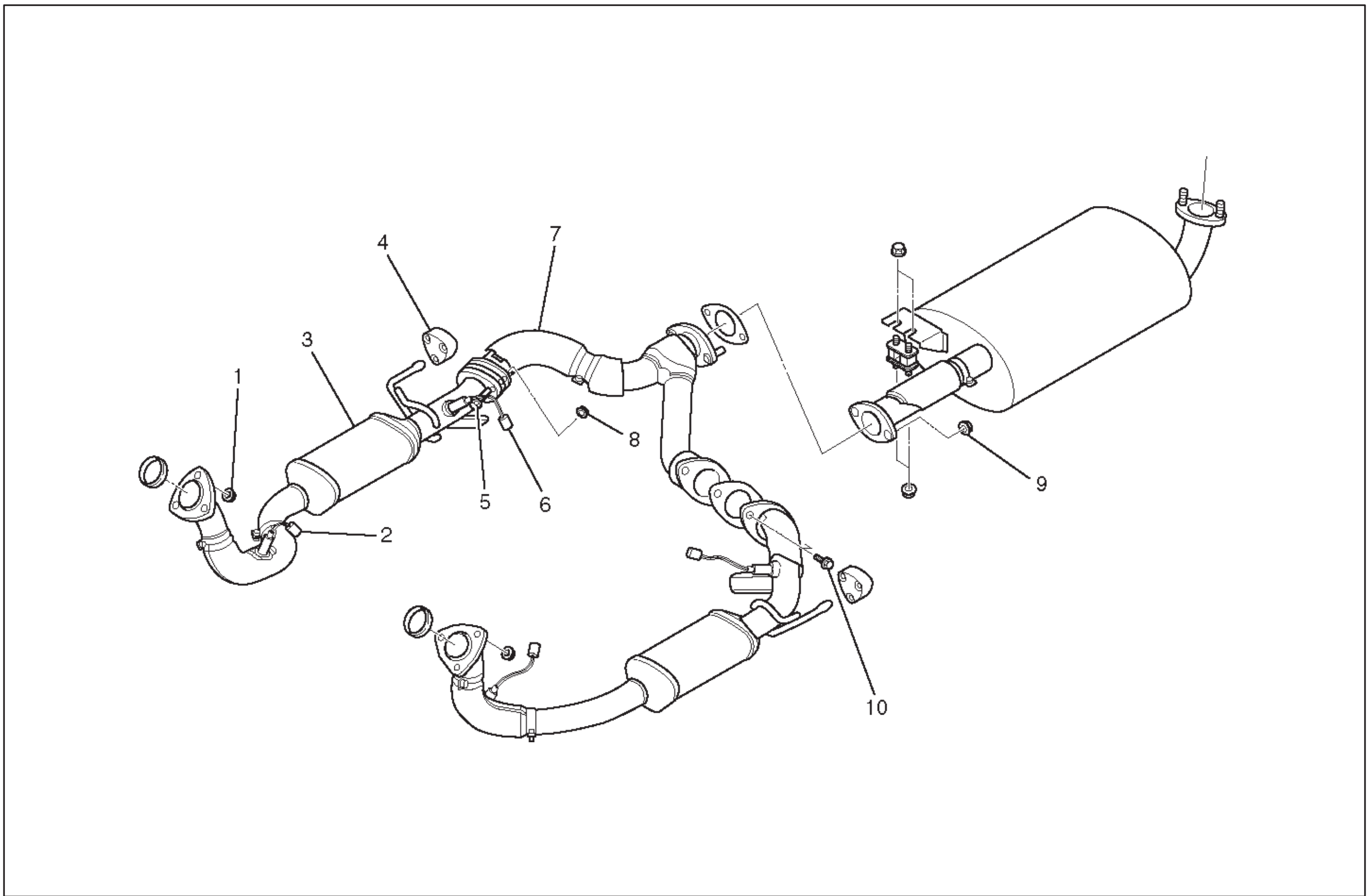
The catalyst coating on the three way (reduction) converter contains platinum and rhodium which lowers the levels of nitrous oxide (NOx) as well as hydrocarbons (HC) and carbon monoxide (Co).

Gasket

The gasket must be replaced whenever a new exhaust pipe, muffler or catalytic converter is installed.

Three Way Catalytic Converter RH and Forked Exhaust Pipe

Three Way Catalytic Converter RH and Forked Exhaust Pipe and Associated Parts



Legend

(1) Three Way Catalytic Converter Fixing Nuts
(2) O_2 Sensor Terminal Connector
(3) Three Way Catalytic Converter RH
(4) Mounting Rubber
(5) Forked Exhaust Pipe Fixing Bolts
(6) O_2 Sensor Terminal Connector
(7) Forked Exhaust Pipe
(8) Forked Exhaust Pipe Fixing Nuts
(9) Exhaust Silencer Fixing Nuts
(10) Forked Exhaust Pipe Fixing Bolts

Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Disconnect O_2 sensor harness connectors (2) (6).
4. Remove the forked exhaust pipe fixing bolts and nuts (5) (8) (10) and the exhaust silencer fixing nuts (9), then remove the forked exhaust pipe (7) and the mass damper.
5. Remove the three way catalytic converter fixing nuts (1) and the mounting rubber (4), then remove the three way catalytic converter (3).

Installation

1. Install the three way catalytic converter (3) and the mounting rubber (4), and tighten the fixing nuts (1) to the specified torque.

   Torque

   Nuts : 67 N·m (49 lb ft)

2. Install the forked exhaust pipe (7), and tighten the fixing bolts (5) & nuts (8) (9) to the specified torque.

   Torque

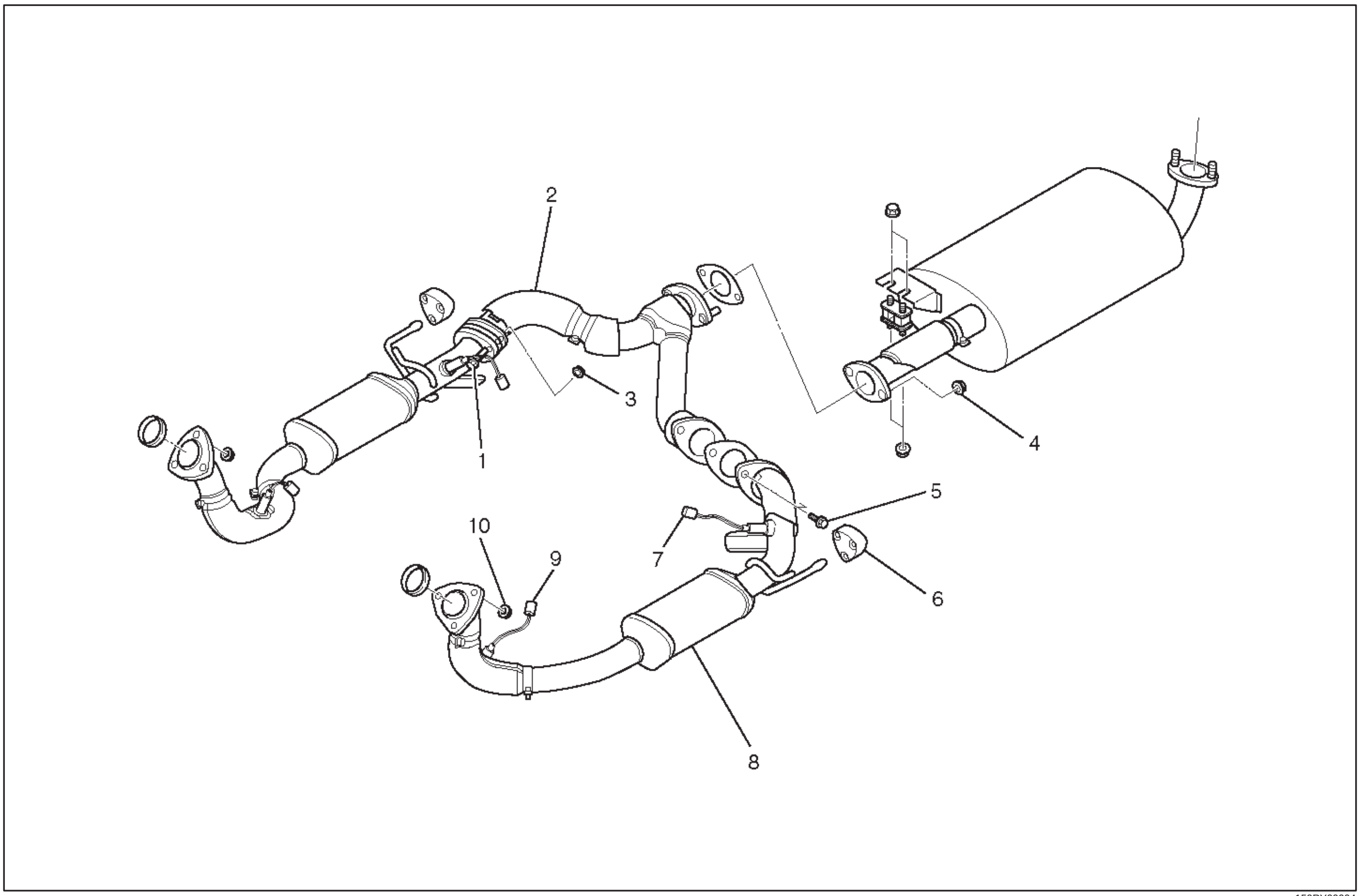
   Bolts&Nuts : 43 N·m (32 lb ft)

   Nuts : 43 N·m (32 lb ft)

3. Connect the O_2 sensor connectors (2) (6).

Three Way Catalytic Converter LH and Forked Exhaust Pipe

Three Way Catalytic Converter LH and Forked Exhaust Pipe and Associated Parts



Legend

(1) Forked Exhaust Pipe Fixing Bolts
(2) Forked Exhaust Pipe
(3) Forked Exhaust Pipe Fixing Nuts
(4) Exhaust Silencer Fixing Nuts
(5) Forked Exhaust Pipe Fixing Bolts
(6) Mounting Rubber
(7) O_2 Sensor Terminal Connector
(8) Three Way Catalytic Converter LH
(9) O_2 Sensor Terminal Connector
(10) Three Way Catalytic Converter Fixing Nuts

Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Disconnect O_2 sensor harness connectors (7) (9).
4. Remove the forked exhaust pipe fixing bolts and nuts (1) (3) (5) and the exhaust silencer fixing nuts (4), then remove the forked exhaust pipe (2).
5. Remove the three way catalytic converter fixing nuts (10) and the mounting rubber (6), then remove the three way catalytic converter (8).

Installation

1. Install the three way catalytic converter (8) and the mounting rubber (6), and tighten the fixing nuts (10) to the specific torque.

Torque

Nuts: 67 N·m (49 lb ft)

2. Install the forked exhaust pipe (2) and tighten the fixing bolts (1) (5) and nuts (3) (4) to the specified torque.

Torque

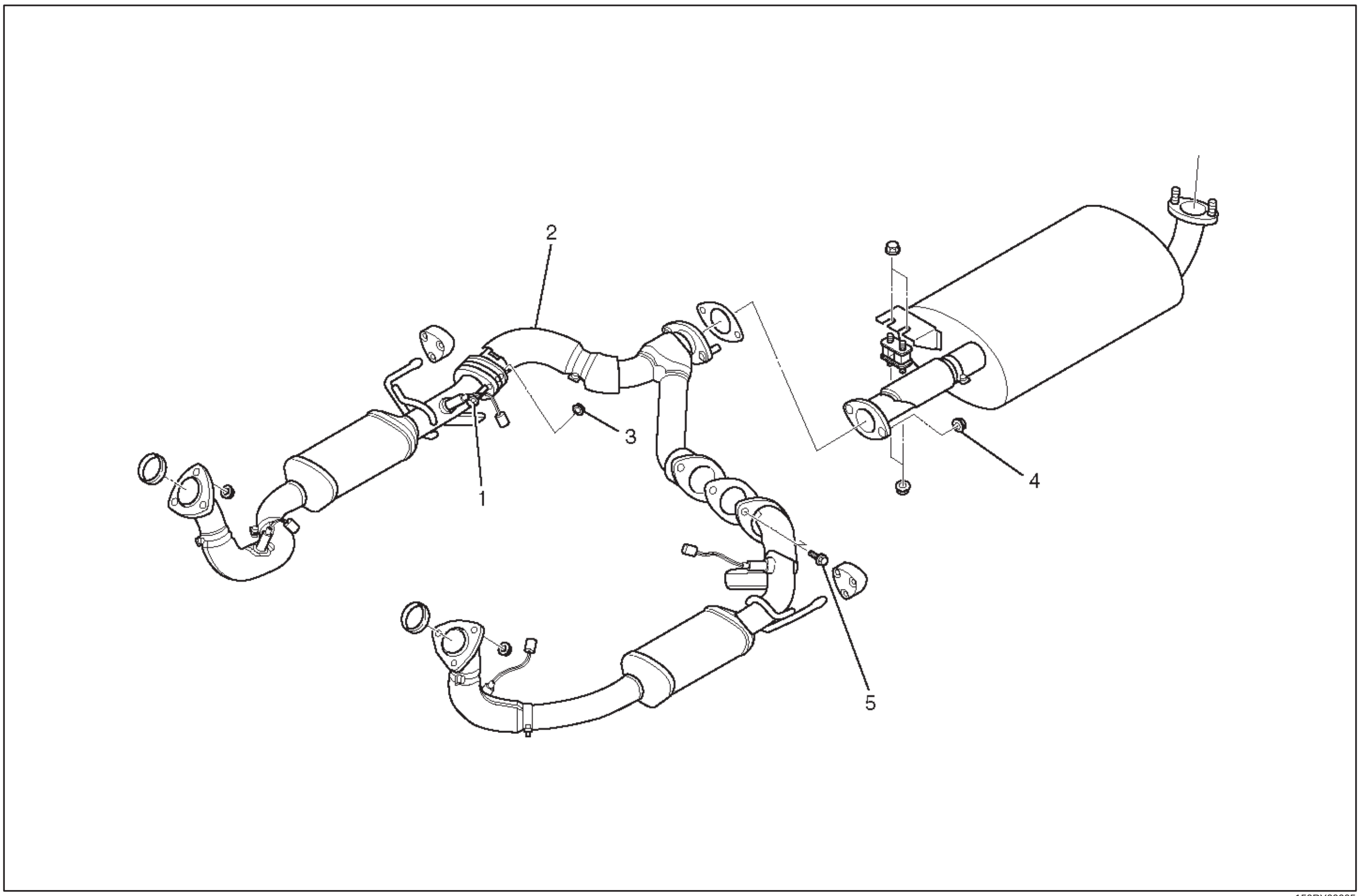
Bolts&Nuts: 43 N·m (32 lb ft)

Nuts: 43 N·m (32 lb ft)

3. Connect the O_2 sensor connectors (7) (9).

Forked Exhaust Pipe

Forked Exhaust Pipe and Associated Parts



Legend

(1) Forked Exhaust Pipe Fixing Bolts
(2) Forked Exhaust Pipe
(3) Forked Exhaust Pipe Fixing Nuts
(4) Exhaust Silencer Fixing Nuts
(5) Forked Exhaust Pipe Fixing Bolts

Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Remove the forked exhaust pipe fixing bolts & nuts (1) (3) (5) and the exhaust silencer fixing nuts (4), then remove the forked exhaust pipe (2).

Installation

1. Install the forked exhaust pipe (2), and tighten the fixing bolts (1) (5) and the nuts (3) (4) to the specified torque.

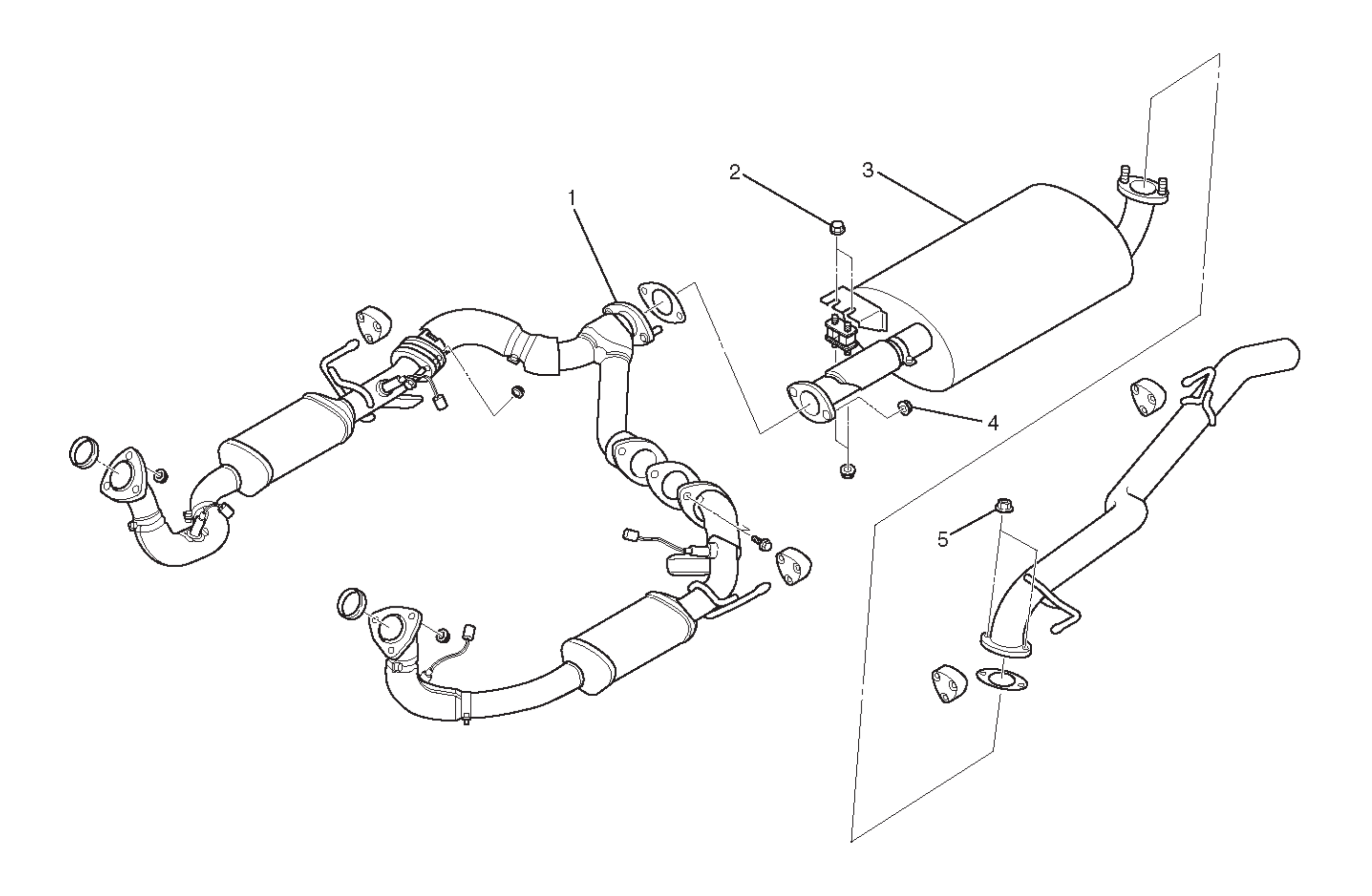
Torque

Bolts&nuts : 43 N·m (32 lb ft)

Nuts : 43 N·m (32 lb ft)

Exhaust Silencer

Exhaust Silencer and Associated Parts



Legend

(1) Forked Exhaust Pipe
(2) Support Rubber Fixing Nuts
(3) Exhaust Silencer
(4) Exhaust Silencer Fixing Nuts
(5) Rear Exhaust Pipe Fixing Nuts

Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Remove the support rubber fixing nuts (2), the exhaust silencer fixing nuts (4) and rear exhaust pipe fixing nuts (5), then remove the exhaust silencer (3).

Installation

1. Install the exhaust silencer (3) and tighten the fixing nuts (4) (5) to the specified torque.

   Torque

   Nuts: 43 N·m (32 lb ft)

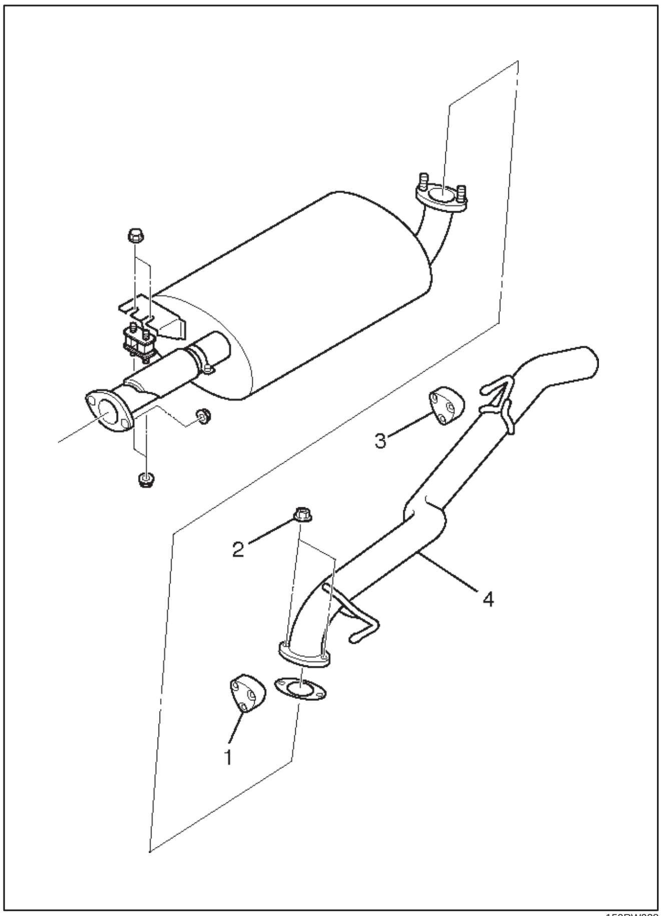
2. Tighten the support rubber fixing nuts (2) to the specified torque.

   Torque

   Bolts: 15 N·m (11 lb ft)

Rear Exhaust pipe

Rear Exhaust pipe and Associated Parts



Legend

(1) Mounting Rubber
(2) Rear Exhaust Pipe Fixing Nuts
(3) Mounting Rubber
(4) Rear Exhaust Pipe

Removal

1. Disconnect battery ground cable.
2. Lift up the vehicle and support with suitable safety stands.
3. Remove the rear exhaust fixing nuts (2) and the mounting rubbers (1) (3), then remove the rear exhaust pipe (4).

Installation

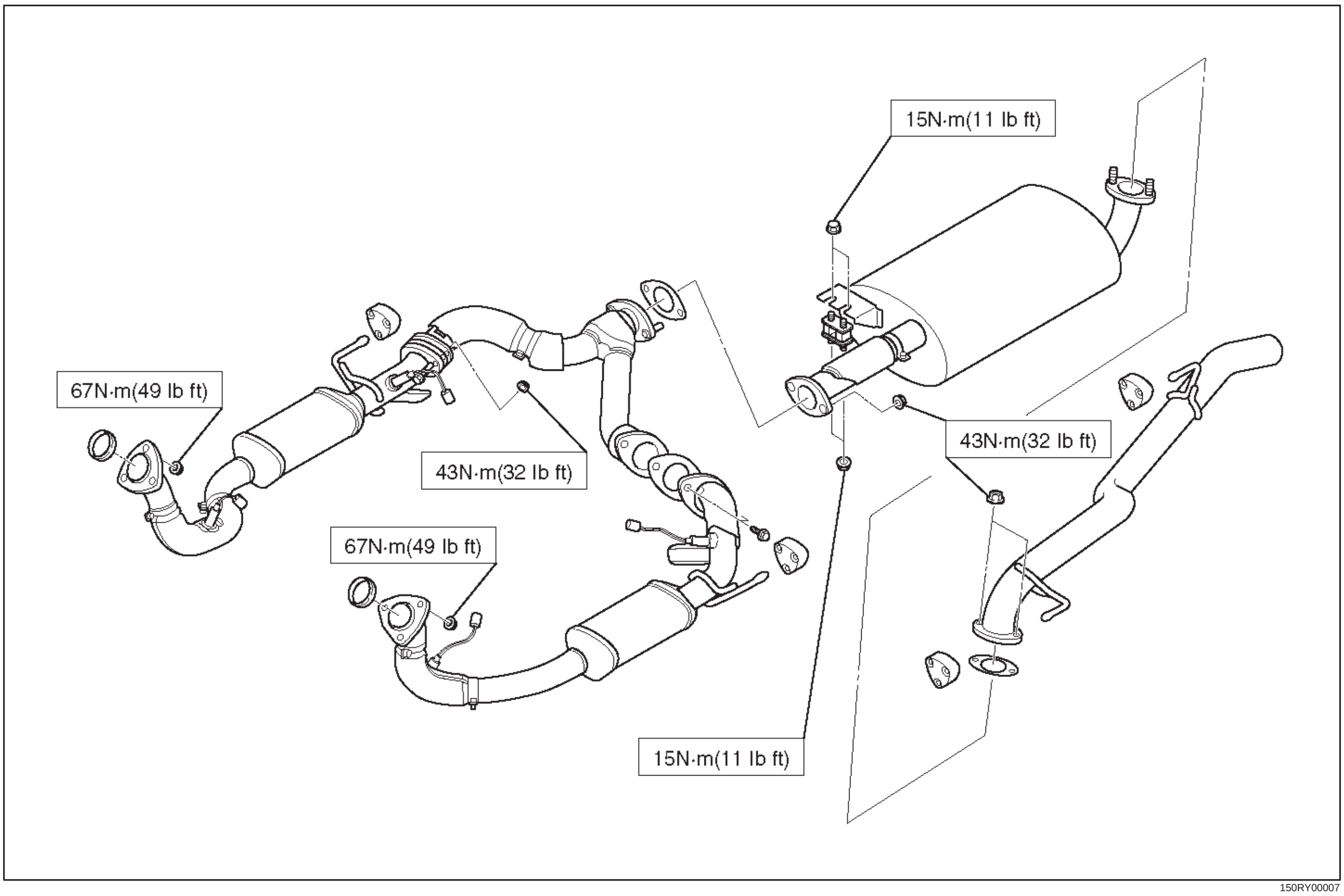
1. Install the rear exhaust pipe (4) and the mounting rubbers (1) (3), then tighten the fixing nuts (2) to the specified torque.

Torque

Nuts: 43 N·m (32 lb ft)

Main Data and Specifications

Torque Specifications



RODEO

ENGINE

ENGINE LUBRICATION (6VD1 3.2L)

CONTENTS

Service Precaution

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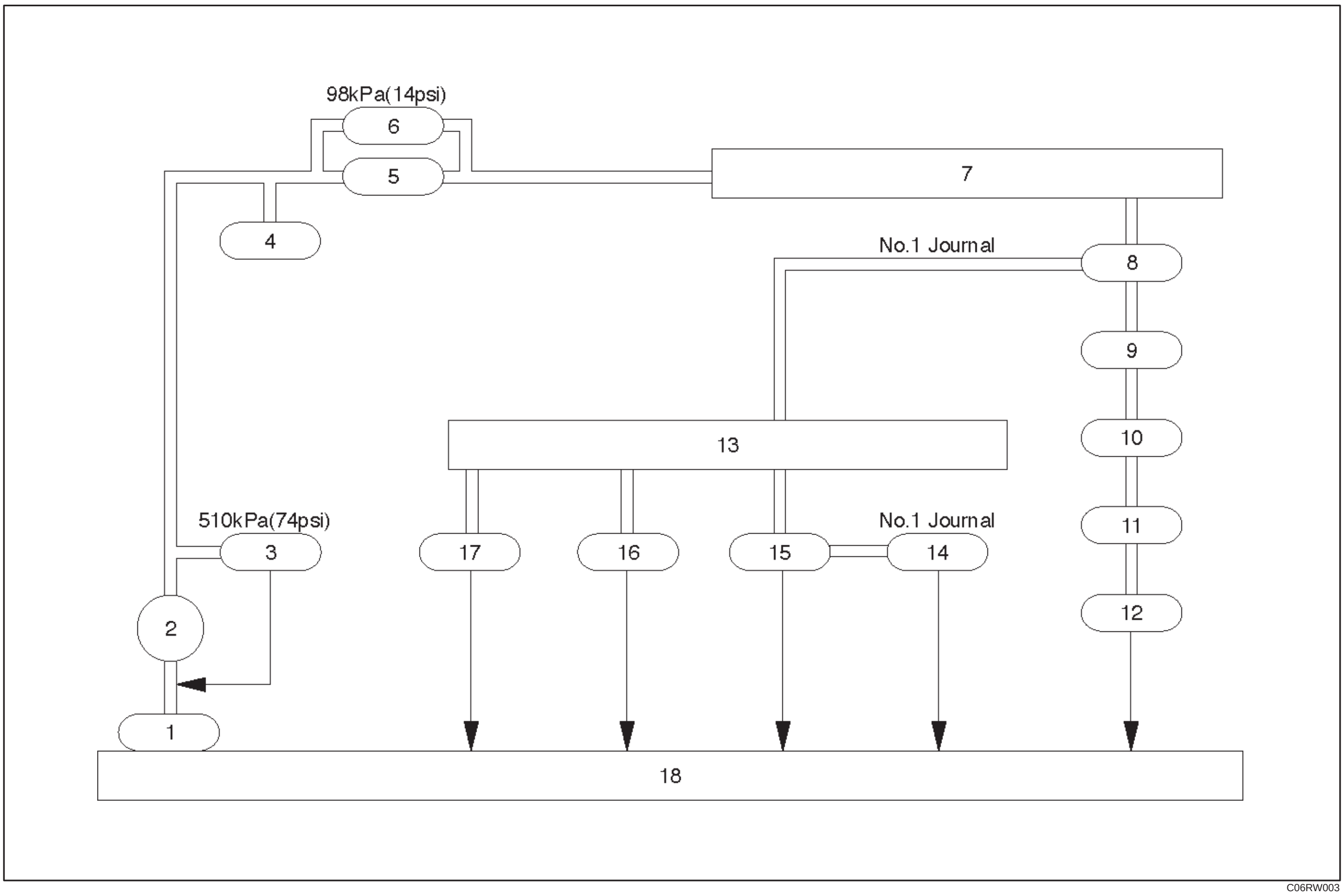
General Description

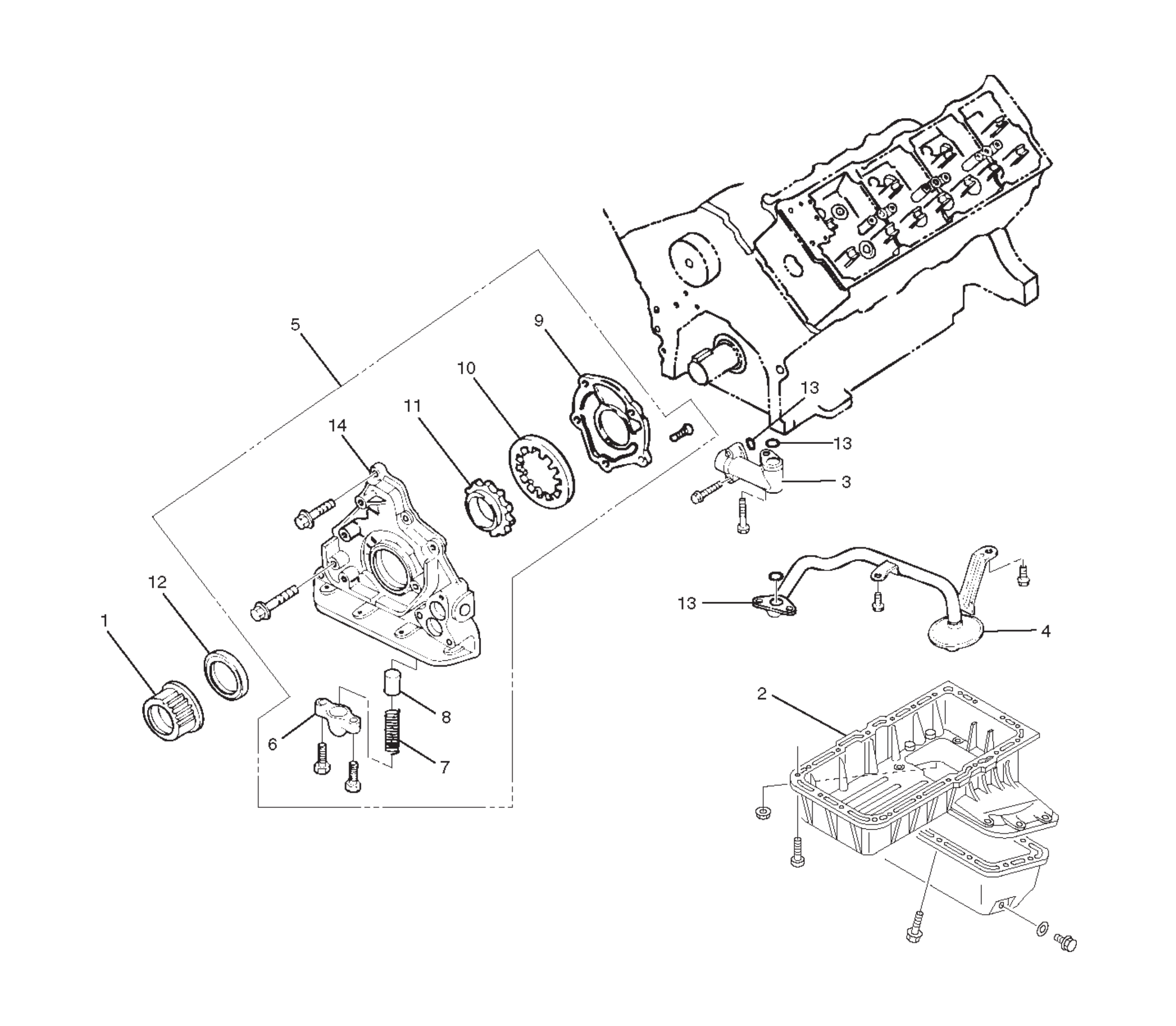


Legend

(1) Oil Strainer
(2) Oil Pump
(3) Relief Valve
(4) Oil Pressure Switch
(5) Oil Filter
(6) Safety Valve
(7) Oil Gallery
(8) Crankshaft Bearing
(9) Crankshaft
(10) Connecting Rod Bearing
(11) Connecting Rod
(12) Piston
(13) Oil Gallery; Cylinder Head
(14) Camshaft
(15) Camshaft Journal
(16) Front Journal; Camshaft Drive Gear
(17) Rear Journal; Camshaft Drive Gear
(18) Oil Pan

Oil Pump

Oil Pump and Associated Parts



Legend

(1) Crankshaft Timing Pulley
(2) Crankcase with Oil Pan
(3) Oil Pipe
(4) Oil Strainer
(5) Oil Pump Assembly
(6) Plug
(7) Spring
(8) Relief Valve
(9) Oil Pump Cover
(10) Driven Gear
(11) Drive Gear
(12) Oil Seal
(13) O-ring
(14) Oil Pump Body

Disassembly

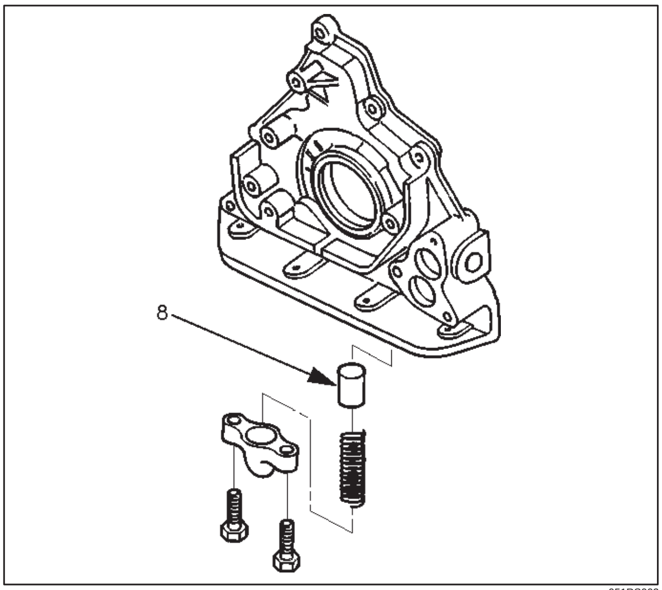
1. Remove crankshaft timing pulley.
2. Remove crankcase with oil pan.
3. Remove oil pipe.
4. Remove oil strainer.
5. Remove oil pump assembly.
6. Remove plug.
7. Remove spring.
8. Remove relief valve.
9. Remove oil pump cover.
10. Remove driven gear.
11. Remove drive gear.
12. Remove oil seal.
13. Remove O-ring.

Inspection and Repair

CAUTION: Make necessary correction or parts replacement if wear, damage or any other abnormal conditions are found during inspection.

Relief Valve (8)

- Check to see that the relief valve slides freely.
- The oil pump must be replaced if the relief valve does not slide freely.
- Replace the spring and/or the oil pump assembly (5) if the spring is damaged or badly worn.



051RS002

Body (14) and Gears (10, 11)

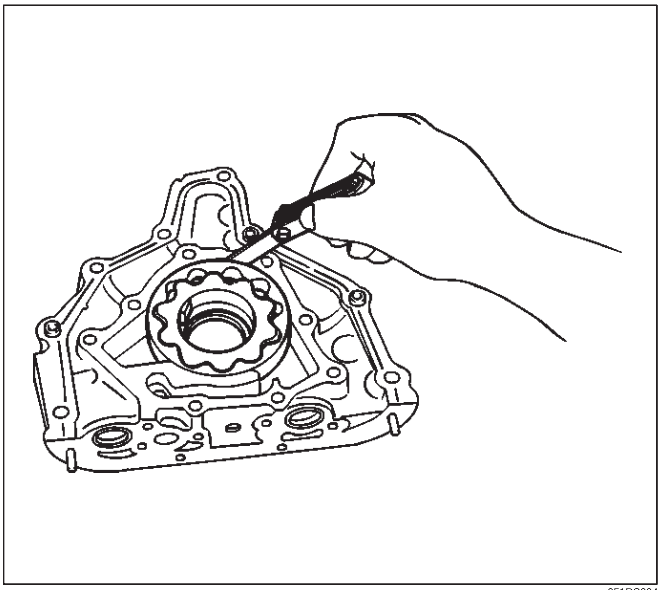
The pump assembly must be replaced if one or more of the conditions below is discovered during inspection.

- Badly worn or damaged driven gear (10).
- Badly worn drive gear (11) driving face.
- Badly scratched or scored body sliding face (14) or driven gear (10).
- Badly worn or damaged gear teeth.

Measure the clearance between the body and the driven gear with a feeler gauge.

Standard : 0.10 mm–0.18 mm (0.0039 in.–0.0070 in)

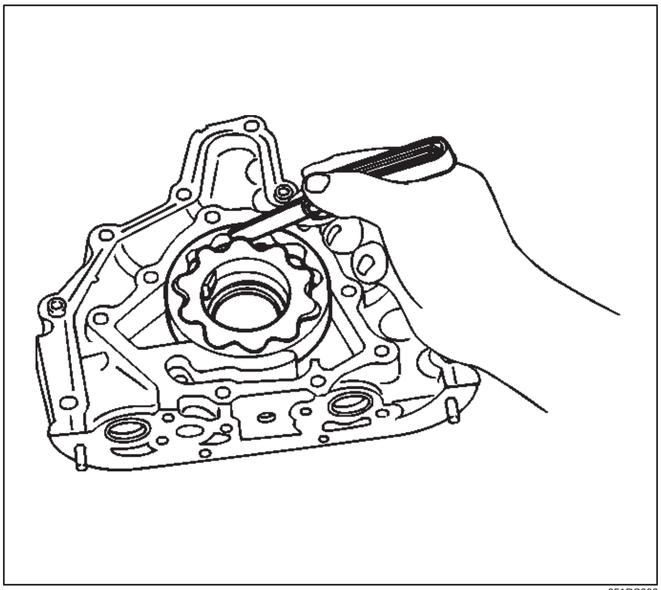
Limit : 0.20mm (0.0079 in)


051RS004

- Measure the clearance between the drive gear and driven gear with a feeler gauge.

Standard : 0.11 mm–0.24 mm (0.0043 in–0.0094 in)

Limit : 0.35mm (0.0138 in)

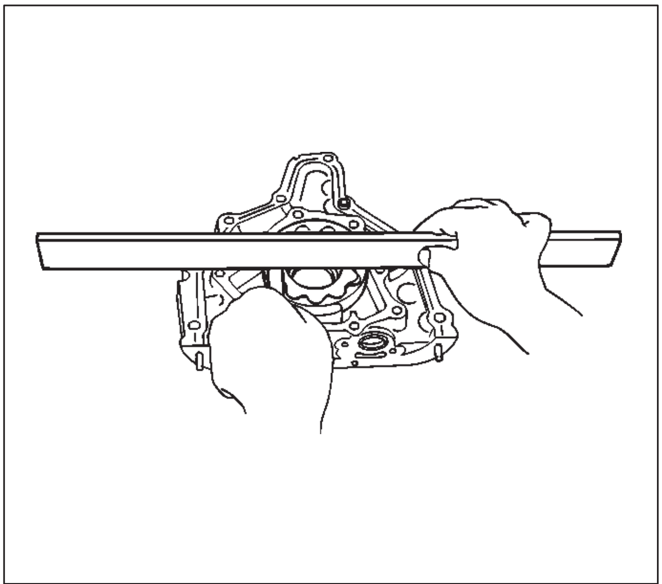

051RS003

- Measure the side clearance with a precision straight edge and a feeler gauge.

Clearance

Standard : 0.03 mm–0.09 mm (0.0011 in–0.0035 in)

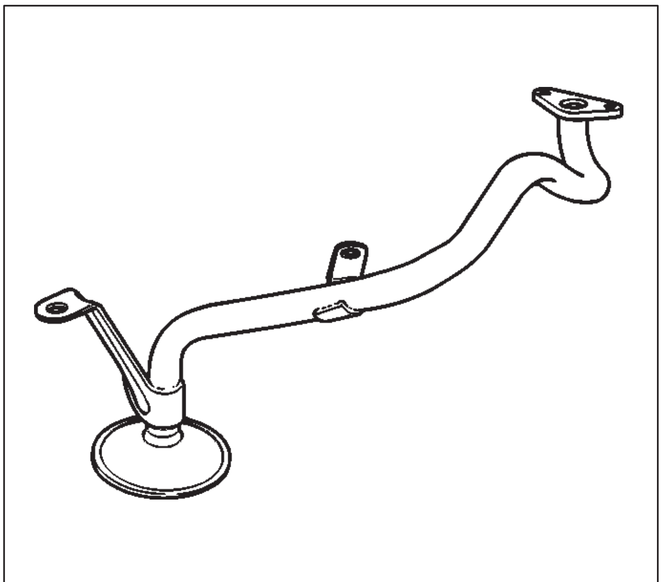
Limit : 0.15mm (0.0059 in)



051RS005

Oil Strainer

Check the oil strainer for cracking and scoring. If cracking and scoring are found, the oil strainer must be replaced.



051RS006

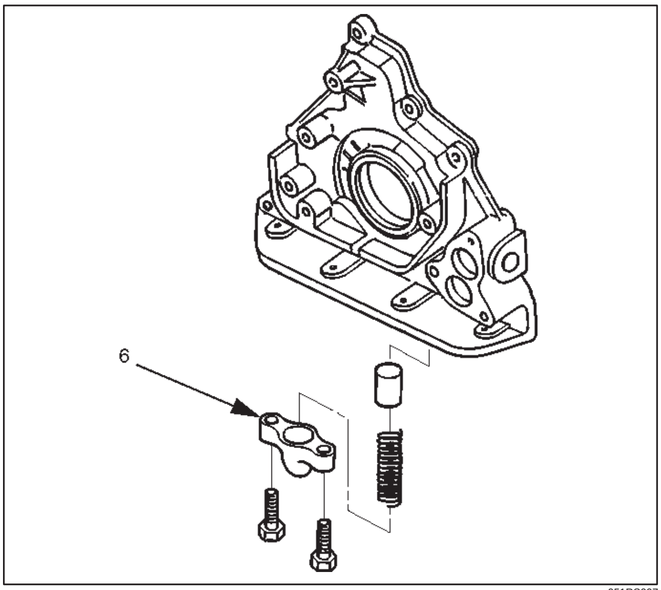
Reassembly

1. Install drive gear (11).
2. Install driven gear (10).
3. Install oil pump cover (9) and first, loosely tighten all of the attaching screws. Next, tighten the attaching screws to the specified torque.

   Torque : 10 N·m (89 lb in)

   After installation, check that the gear rotates smoothly.
4. Install relief valve (8) and apply engine oil to the relief valve and spring (7).
5. Install spring (7).
6. Install the plug (6).

   Torque : 8 N·m (69 lb in)



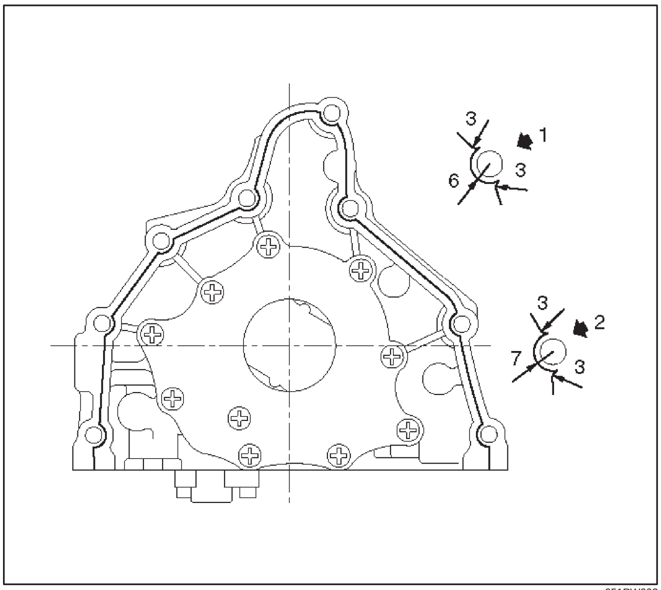
051RS007

7. Install oil pump assembly (5).
   - Carefully remove any oil from the cylinder body and the pump. Apply sealant (TB–1207B or equivalent) to the pump fitting face as shown in illustration. Take care that sealant is not applied to oil port surfaces. The oil pump assembly must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

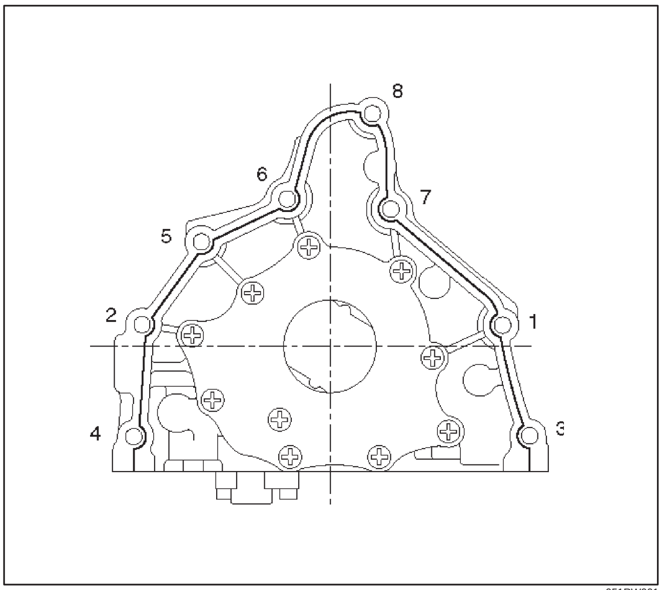
CAUTION: Do not apply an excessive amount of sealant to the contact surface. Applying too much sealant will overflow the contact surfaces. This could cause serious damage to the engine.

- **Attach oil pump assembly to cylinder body.**
- **Tighten the oil pump fixing bolts.**

Torque : 25 N·m (18 lb·ft)



051RW002

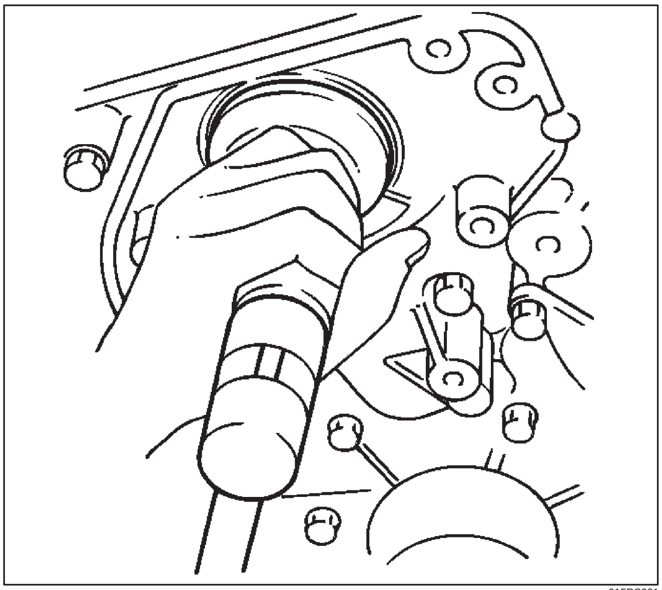


051RW001

Legend

(1) Around Bolt Holes
(2) Around Dowel Pin

8. Install the new oil seal (12). Apply engine oil to the oil seal lip before installation then use J–39202 oil seal Installer, install oil seal.



015RS001

9. Install oil strainer (4) with O-ring (13).

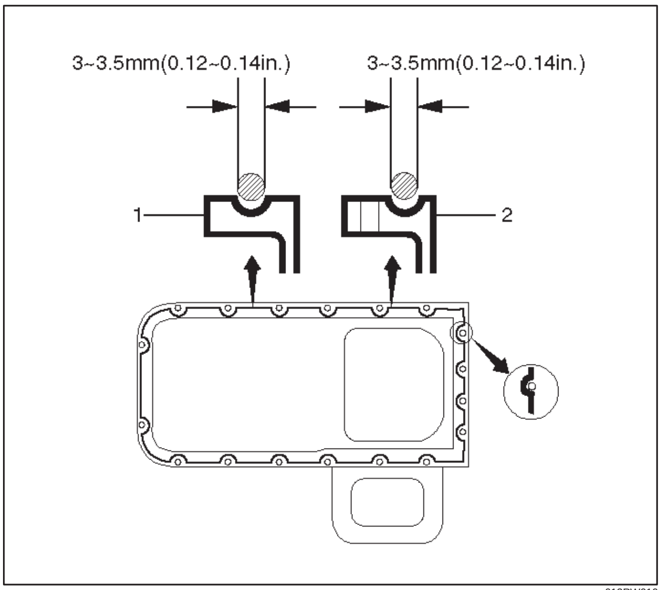
   Torque: 25 N·m (18 lb ft)

10. Install oil pipe (3) with O-ring (13).

    Torque: 25 N·m (18 lb ft)

11. Install crankcase with oil pan (2).
    - Remove oil on crankcase mounting surface and dry the surface.
    - Apply a proper 4.5 mm (0.7 in) wide bead of sealant (TB1207C or equivalent) to the crankcase mounting surface. The bead must be continuous.
    - The crankcase must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.
    - Tighten fixing bolts to the specified torque.

    Torque : 10 N·m (89 lb in)



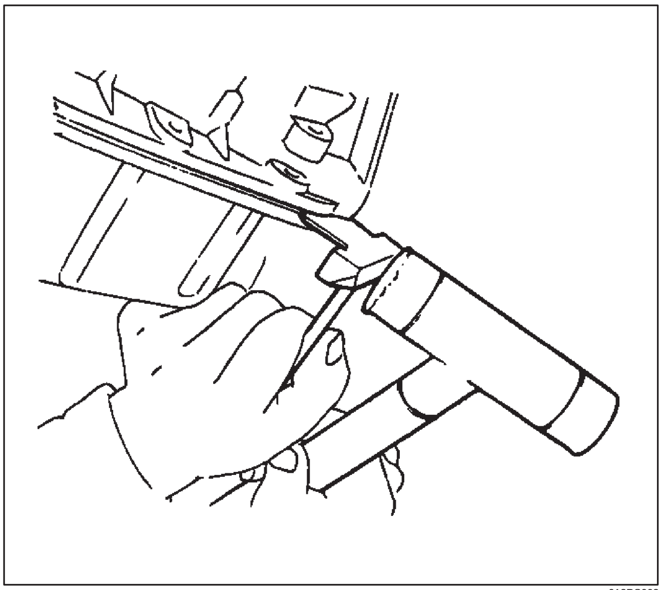
013RW010

12. Install crankshaft timing pulley.

Oil Pan and Crankcase

Removal

1. Disconnect battery ground cable.
2. Lift vehicle by supporting the frame.
3. Remove under cover.
4. Drain engine oil.
5. Remove front wheels.
6. Remove oil level dipstick from level gauge tube.
7. Remove radiator under fan shroud.
8. Remove shift on the fly from axle housing.
9. Remove suspension cross member fixing bolts, 2 pcs each per side and remove suspension cross member.
10. Remove axle housing assembly four fixing bolts from housing isolator side and mounting bolts from wheel side. At this time support the axle with a garage jack and remove axle housing assembly. (for 4×4)
11. Remove the steering unit assembly.
12. Remove starter fixing bolts.
13. Remove oil pan fixing bolts.
14. Remove oil pan, using J-37228 sealer cutter, remove oil pan.

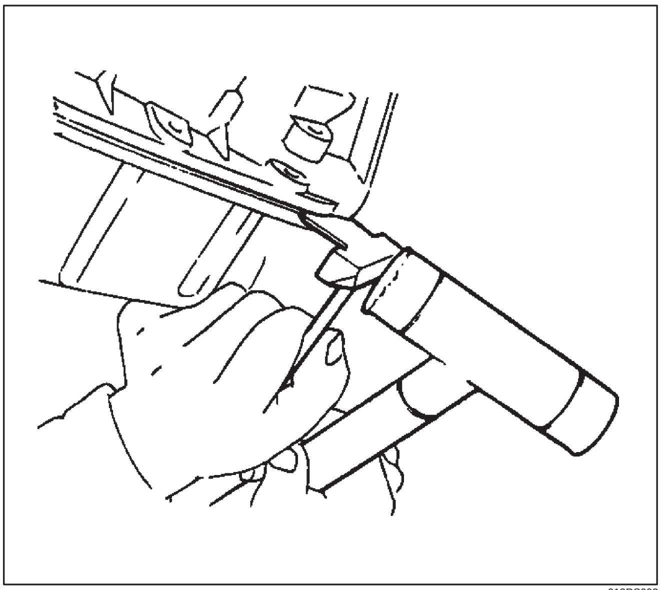


013RS003

15. Remove crankcase fixing bolts.
16. Remove crankcase, using J-37228 sealer cutter, remove crankcase.

NOTE: Do not deform or damage the flange of oil pan and crankcase.

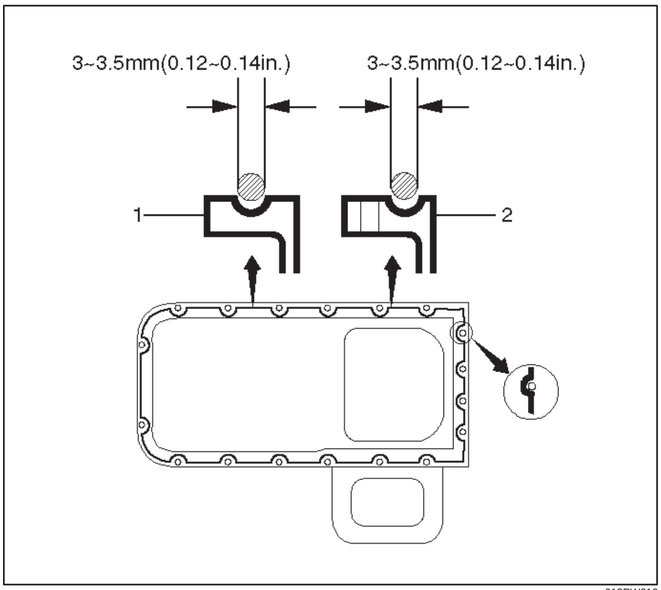
Replace the oil pan and/or crankcase if deformed or damaged.



013RS003

Installation

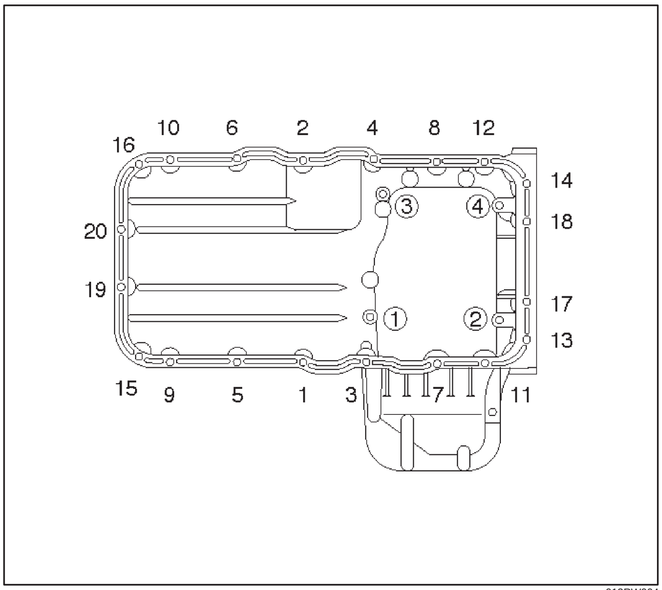
1. Install crankcase.
   A. Remove residual sealant, lubricant and moisture from mounting surface, then dry thoroughly.
   B. Properly apply a 4.5 mm (0.7 in) wide bead of sealant (TB-1207C or equivalent) to mounting surface of crankcase.
   Sealant bead must be continuous.
   - The crankcase must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.



013RW010

C. Install crankcase, tighten crankcase fixing bolts to the specified torque.

Torque : 10 N·m (89 lb in)



013RW004

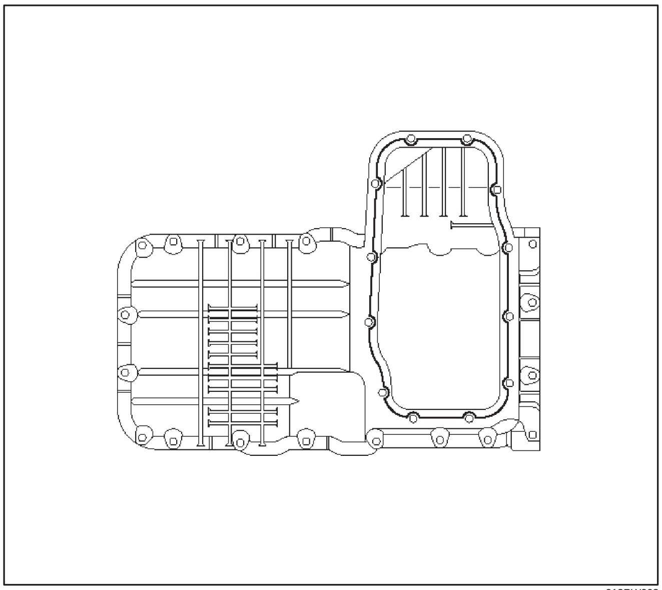
2. Install oil pan

A. Remove residual sealant, lubricant and moisture from mounting surface, then dry thoroughly.

B. Properly apply a 4.5 mm (07 in) wide bead of sealant (TB-1207C or equivalent) to mounting surface of oil pan.

Sealant beat must be continuous.

- The crankcase must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.


013RW003

C. Install oil pan, tighten oil pan fixing bolts to the specified torque.

Torque : 10 N·m (89 lb in)

3. Install starter and tighten fixing bolts.

Torque: 40 N·m (30 lb ft)

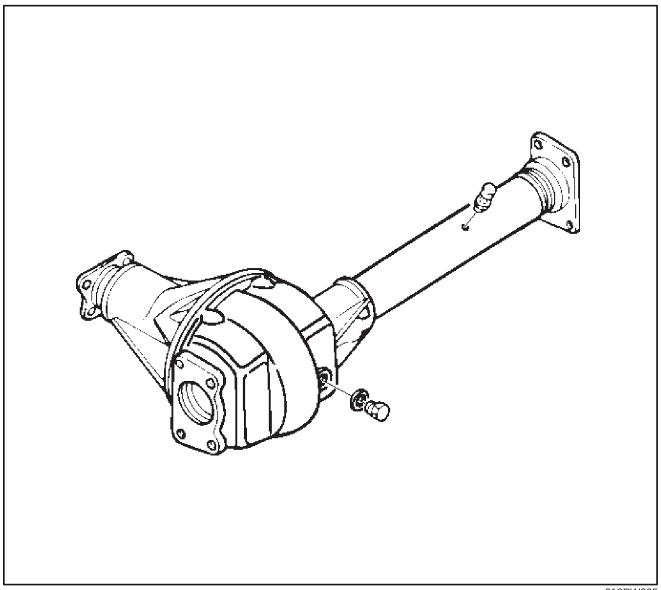
4. Install axle housing assembly and tighten fixing bolts to the specified torque. (for 4×4)

Axle case bolts

Torque : 82 N·m (60 lb ft)

Mounting bolts

Torque : 152 N·m (112 lb ft)


013RW005

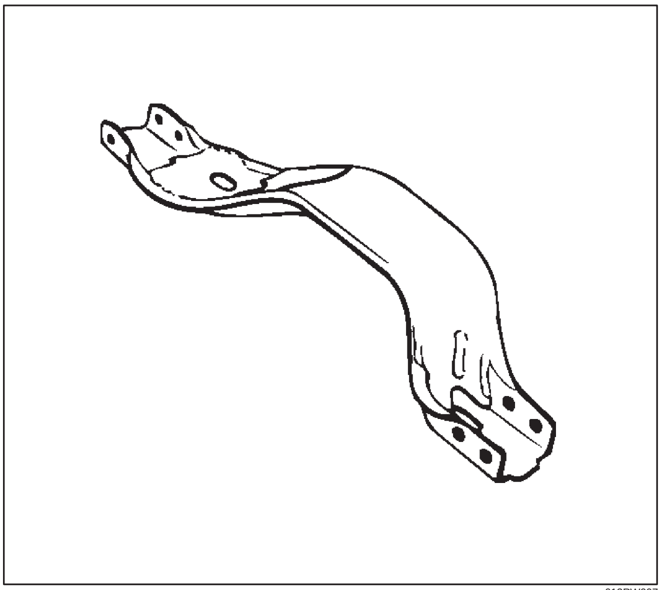
5. Install the shift on the fly.

6. Install relay lever assembly and tighten fixing bolts.

Torque: 44 N·m (32 lb ft)

7. Install suspension cross member and tighten fixing bolts to the specified torque.

Torque : 78 N·m (58 lb ft)


013RW007

8. Install radiator under fan shroud.

9. Install under cover.

10. Install engine oil level dipstick.

11. Fill engine oil until full level on engine oil gauge dipstick.

Oil Pump

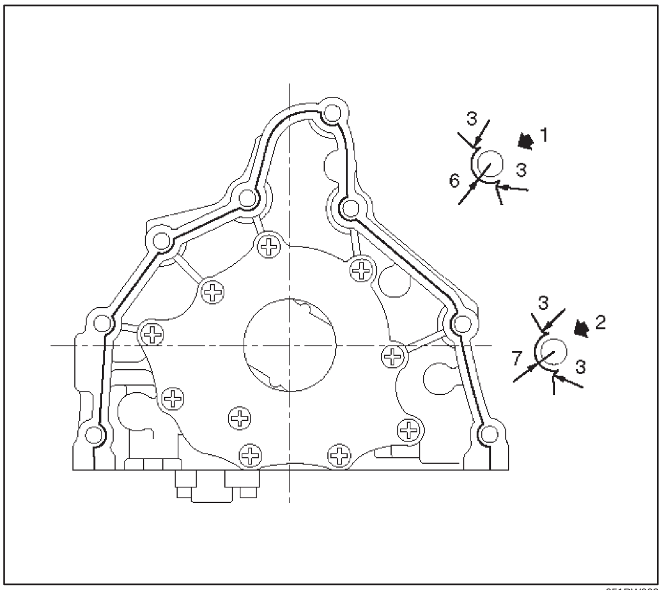
Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove crankcase assembly.
   - Refer to removal procedure for Oil Pan and Crankcase in this manual.
4. Remove crankshaft pulley.
   - Refer to removal procedure for Crankshaft Pulley in this manual.
5. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
6. Remove timing pulley from crankshaft.
7. Remove four fixing bolts from oil filter assembly.
8. Remove oil strainer fixing bolts, remove oil strainer assembly with O-ring.
9. Remove three bolts from oil pipe and O-ring.
10. Remove eight oil pump fixing bolts, then oil pump assembly.
11. Remove sealant from mounting surface of oil pump assembly, cylinder block and take care not to damage mounting surfaces of oil pump and cylinder block.

Installation

1. Install oil pump assembly
   - Apply sealant (TB-1207B or equivalent) to the oil pump mounting surfaces as shown in the illustration.
   - The oil pump assembly must be installed within 5 minutes after sealant application to prevent premature hardening of sealant.

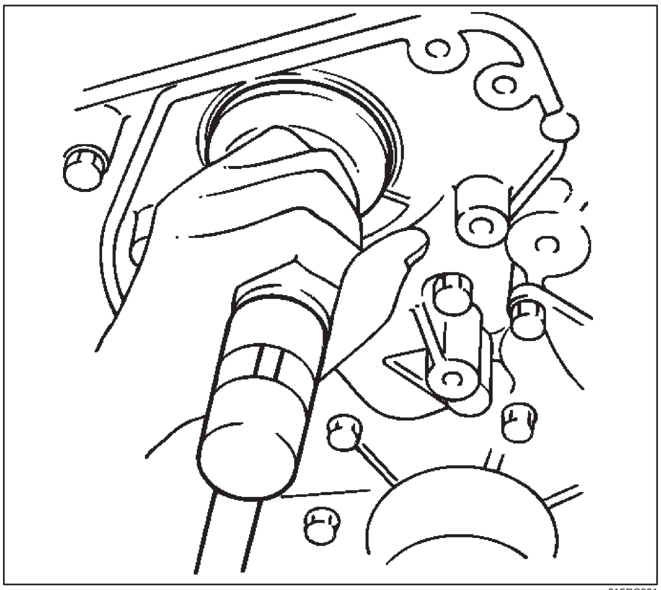
NOTE: Do not apply sealant to the oil ports.



051RW002

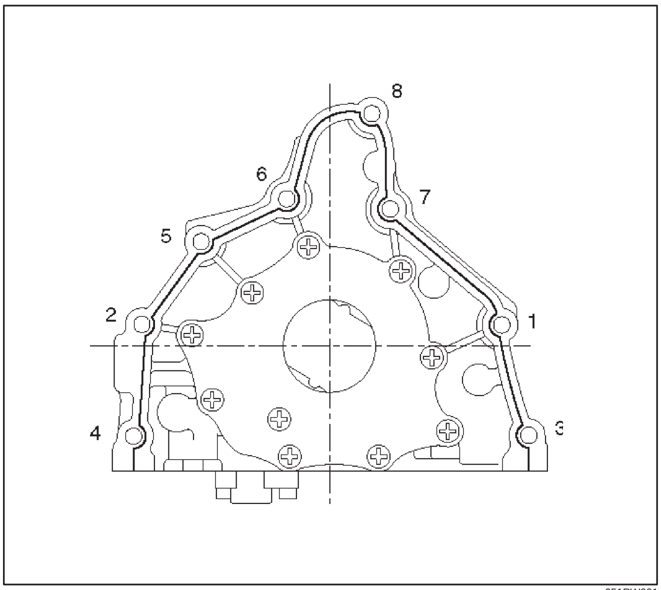
- Use J-39202 installer when installing new oil seal.
- Apply engine oil to oil seal lip.
- Install oil pump assembly to the cylinder block.

NOTE: Do not damage oil seal during installation of oil pump assembly.


015RS001

- Tighten fixing bolts to the specified torque.

Torque : 25 N·m (18 lb ft)



051RW001

2. Install oil pipe with O-ring, tighten fixing bolt to the specified torque.

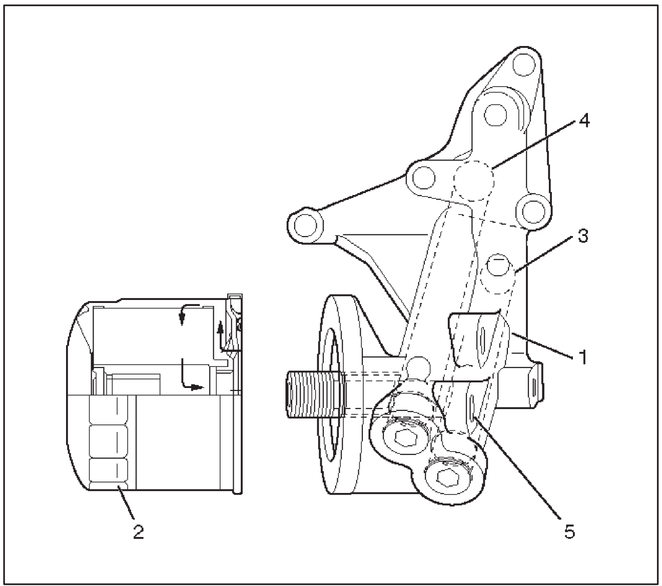
Torque : 10 N·m (89 lb in)

3. Install oil strainer with O-ring, tighten fixing bolt to the specified torque.

Torque : 25 N·m (18 lb ft)

4. Install oil filter assembly and tighten bolts to the specified torque.

Torque : 25 N·m (18 lb ft)



050RW001

Legend

(1) Oil Pump
(2) Oil Filter
(3) Oil Gallery
(4) From Oil Filter
(5) To Oil Filter

5. Install timing pulley on crankshaft.
   Install timing belt.
   - Refer to installation procedure for Timing Belt in this manual.
6. Install crankshaft pulley.
   - Refer to install procedure for Crankshaft Pulley in this manual.
7. Install crankcase assembly.
   - Refer to installation procedure for Oil Pan and Crankcase in this manual.
8. Refill engine oil until full level on engine oil dipstick.

Oil Pump Oil Seal

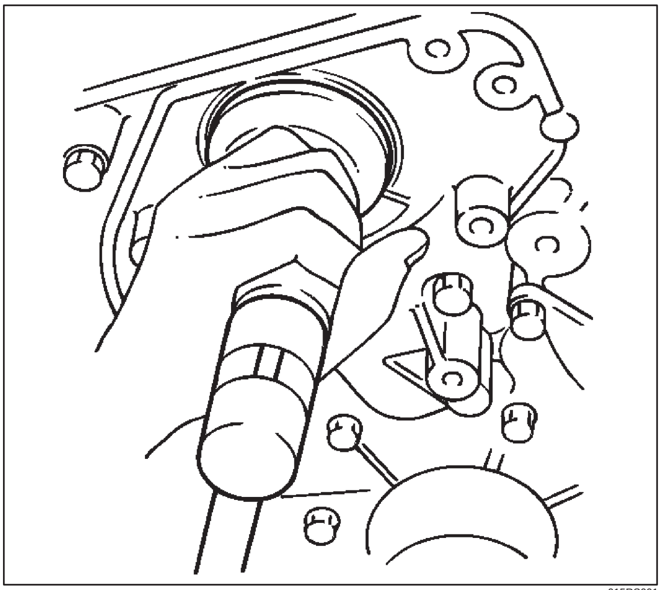
Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove crankshaft pulley.
   - Refer to removal procedure for Crankshaft Pulley in this manual.
4. Remove timing belt.
   - Refer to removal procedure for Timing Belt in this manual.
5. Remove timing pulley from crankshaft.
6. Remove oil pump oil seal using a sealer puller.

NOTE: Take care not to damage sealing surfaces of oil pump and crankshaft when removing oil seal.

Installation

1. Install oil pump oil seal, apply engine oil to oil seal lip, then install oil seal using J-39202 installer.



015RS001

2. Install timing pulley to crankshaft.
3. Install timing belt.
   - Refer to installation procedure for Timing Belt in this manual.
4. Install crankshaft pulley.
   - Refer to installation procedure for CRANKSHAFT PULLEY in this manual.
5. Refill engine oil until full level.

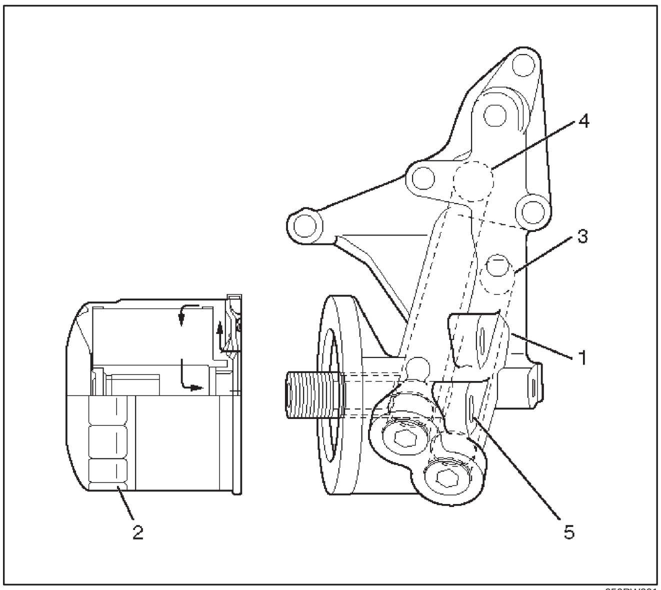
Oil Filter

Removal

1. Disconnect battery ground cable.
2. Drain engine oil.
3. Remove oil filter using J-36390 filter wrench.

Installation

1. Clean filter fitting surface and apply small amount of engine oil to sealing surface.
2. Install oil filter cartridge by hand until it comes in contact with sealing surface then rotate additional 2/3 turn to tighten using J-36390 filter wrench.



Legend

(1) Oil Pump
(2) Oil Filter
(3) Oil Gallery
(4) From Filter
(5) To Filter

3. Fill engine oil until full level on dipstick.
4. Reconnect battery ground cable.

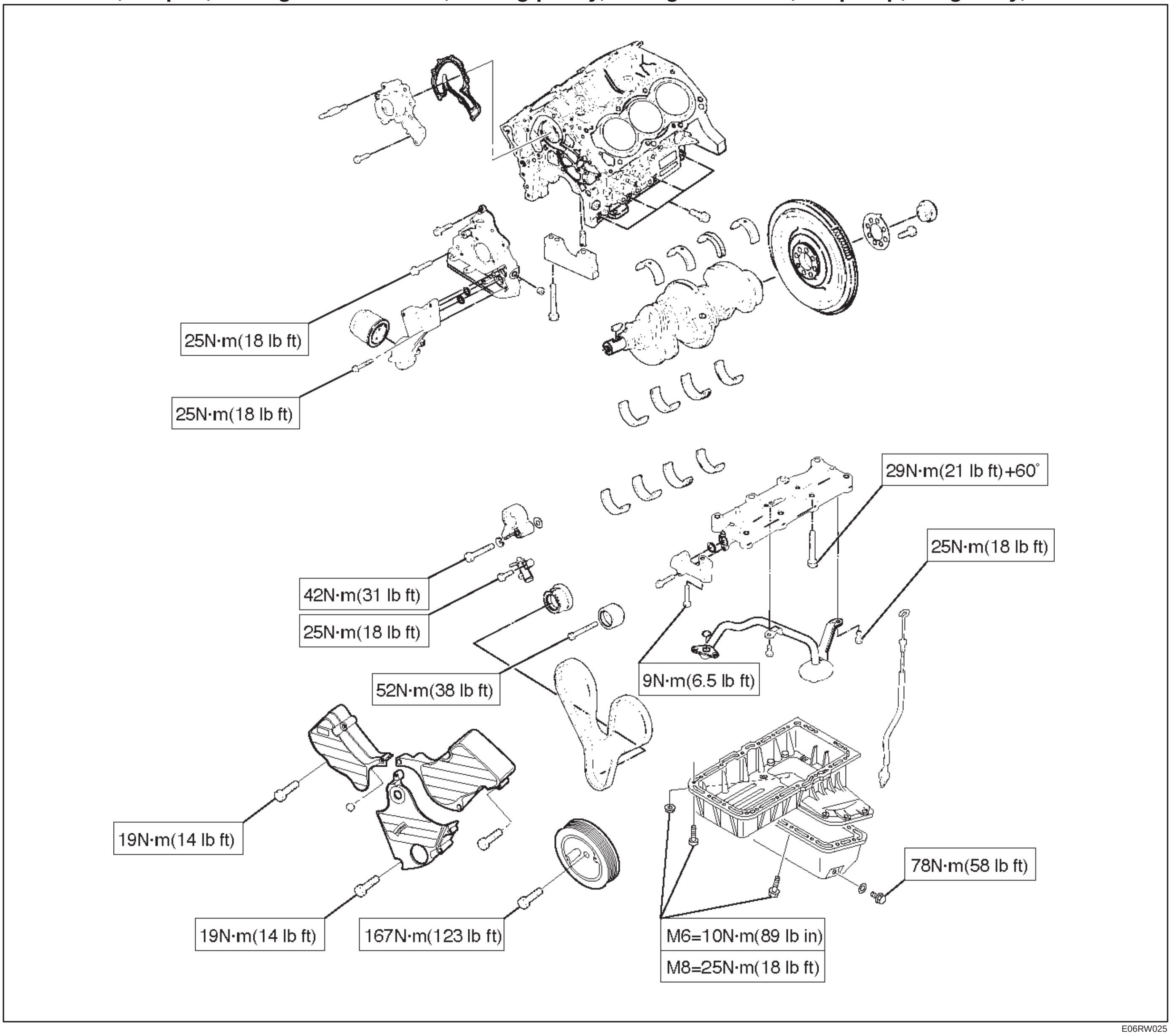
Main Data and Specification

General Specification

Item	Specifications
	6VD1
Oil capacity	5.3 liters

Torque Specifications

Crankcase, Oil pan, Timing belt tensioner, Timing pulley, timing belt cover, Oil pump, Oil gallery, Oil strainer



RODEO

ENGINE

ENGINE SPEED CONTROL SYSTEM

CONTENTS

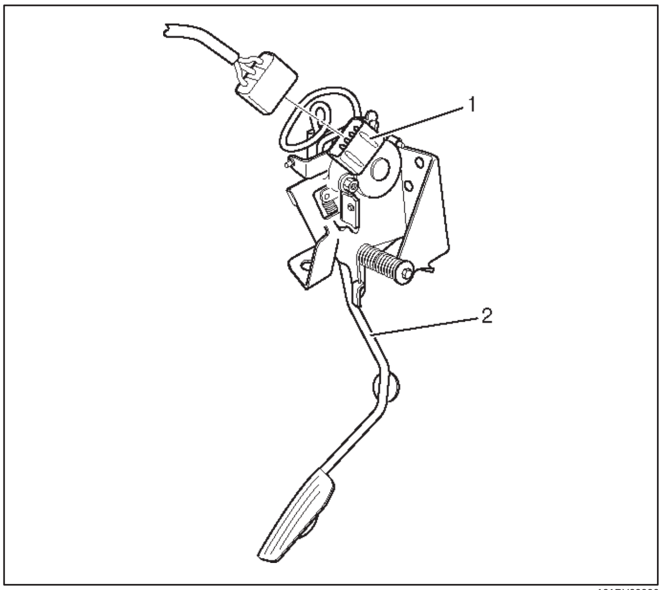
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Accelerator Pedal

Accelerator Pedal and Associated Parts



Legend

(1) Accelerator Position Sensor
(2) Accelerator Pedal Assembly

Removal

1. Disconnect battery ground cable.
2. Disconnect Accelerator position (AP) sensor (1) connector from Accelerator pedal assembly.
3. Remove Accelerator pedal assembly (2).

Installation

1. Install Accelerator pedal assembly (2).
2. Connect AP sensor (1) harness connector.
3. Connect battery ground cable.

RODEO

ENGINE

INDUCTION (6VD1 3.2L)

CONTENTS

Service Precaution

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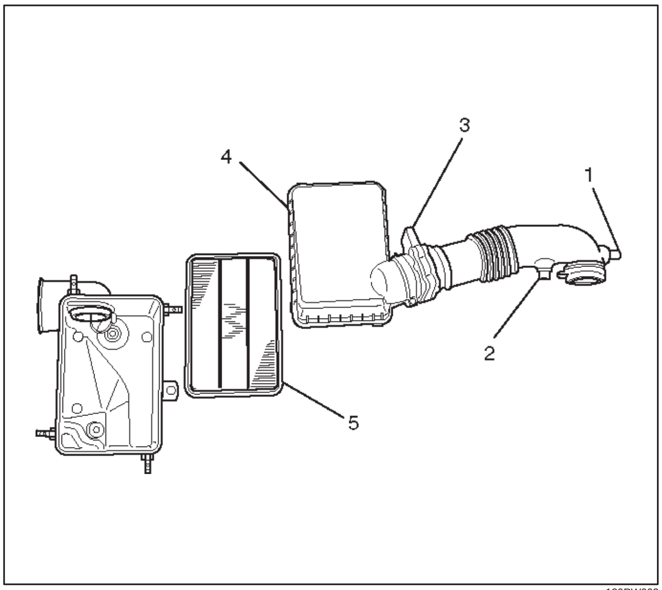
Air Cleaner Element

Removal

1. Remove positive ventilation hose connector(1).
2. Remove intake air temperature sensor(2).
3. Remove air flow sensor(3).
4. Remove air cleaner duct assembly(4).
5. Remove air cleaner element(5).



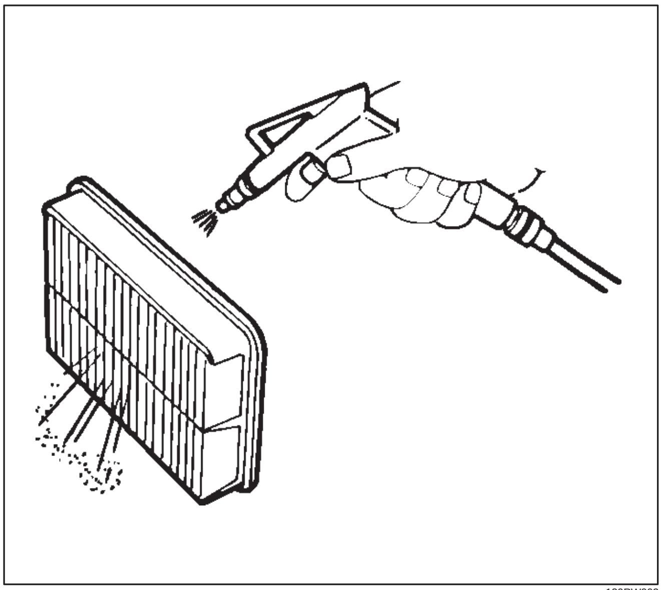
130RW003

Inspection

Check the air cleaner filter for damage or dust clogging. Replace if it is damaged, or clean if it is clogged.

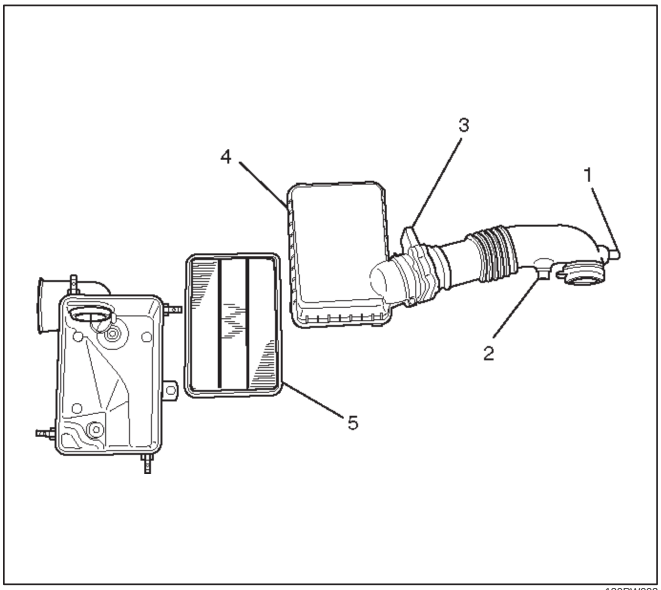
Cleaning Method

Tap the air cleaner filter gently so as not to damage the paper filter, or clean the element by blowing with compressed air of about 490 kPa (71 psi) from the clean side if it is extremely dirty.


130RW002

Installation

1. Install air cleaner element(5).
2. Attach the mass air cleaner duct cover to the body completely, then clamp it with the clip(4).
3. Install air flow sensor(3).
4. Install air temprature sensor(2).
5. Install positive crankcase ventilation hose connector(1).



130RW003

RODEO

TRANSMISSION

CONTENTS

AUTOMATIC TRANSMISSION (4L30–E)

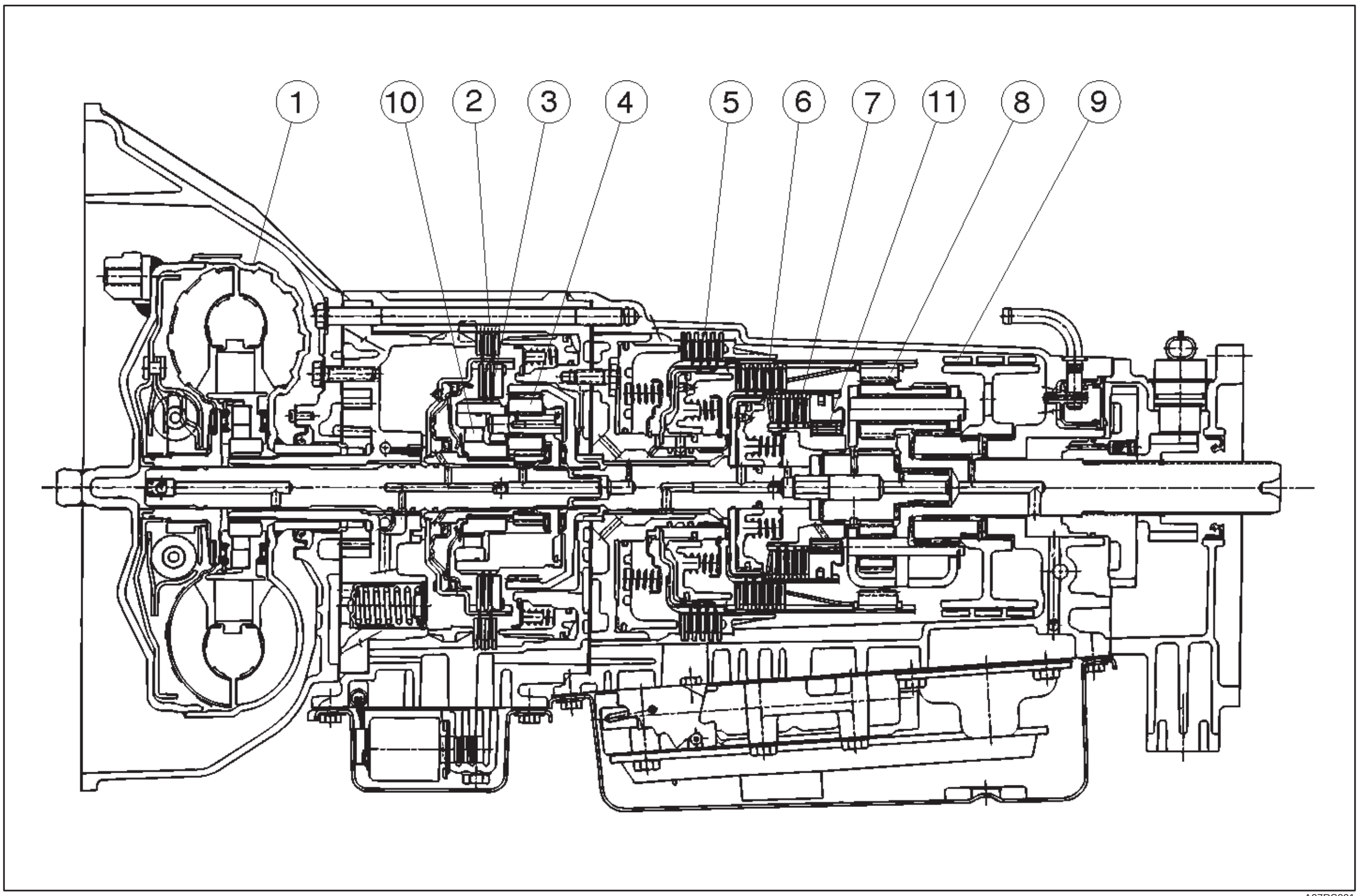
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

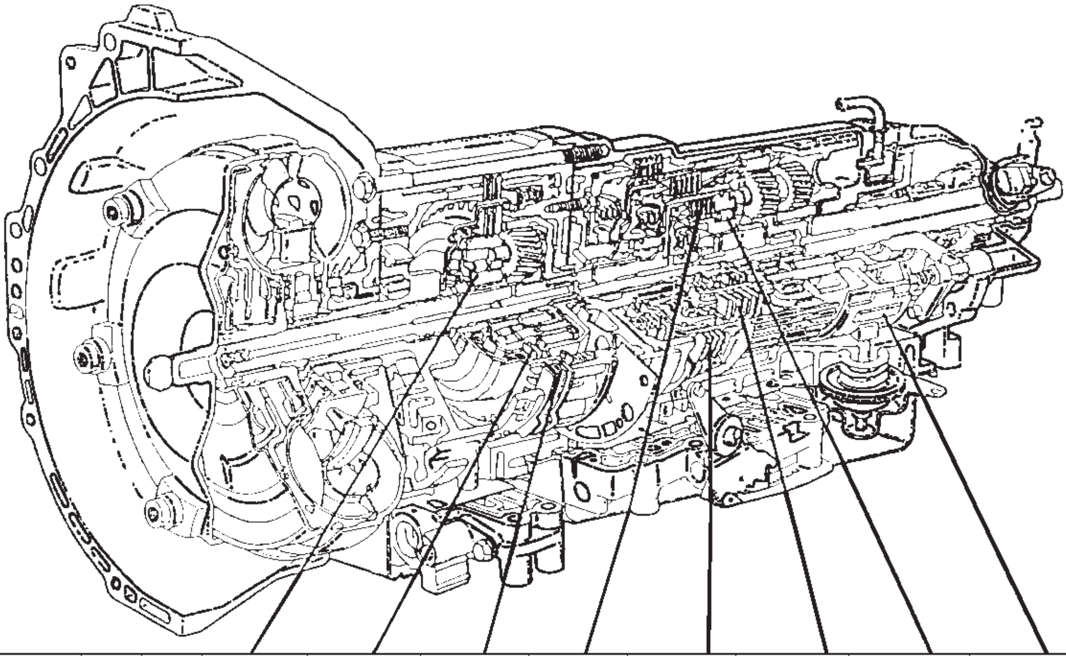
Construction



Legend

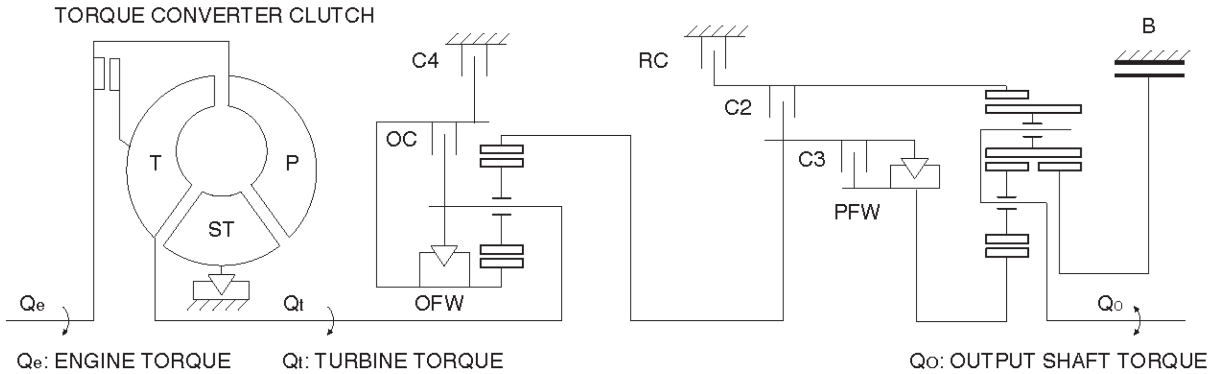
(1) Torque Converter Clutch (TCC)
(2) Fourth Clutch (C4)
(3) Overrun Clutch (OC)
(4) Overdrive Unit
(5) Reverse Clutch (RC)
(6) Second Clutch (C2)
(7) Third Clutch (C3)
(8) Ravigneaux Planetary Gear Set
(9) Brake Band (B)
(10) Overdrive Free Wheel (One Way Clutch) (OFW)
(11) Principle Sprag Assembly (One Way Clutch) (PFW)

Range Reference Chart



RANGE	GEAR	SOL A N.C.	SOL B N.O.	O/DRIVE ROLLER CLUTCH (OFW)	OVERRUN CLUTCH (OC)	FOURTH CLUTCH (C4)	THIRD CLUTCH (C3)	REVERSE CLUTCH (RC)	SECOND CLUTCH (C2)	PRINCIPLE SPRAG ASSEMBLY (PFW)	BAND ASSEMBLY (B)	ENGINE BRAKING
P-N		OFF	ON		APPLIED							NO
R	REVERSE	OFF	ON	LD	APPLIED			APPLIED		LD		NO
D	1ST	OFF	ON	LD	APPLIED					LD	APPLIED	NO
	2ND	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
	3RD	ON	OFF	LD	APPLIED		APPLIED		APPLIED	NE		YES
	4TH	OFF	OFF	FW		APPLIED	APPLIED		APPLIED	NE		YES
3	1ST	OFF	ON	LD	APPLIED					LD	APPLIED	NO
	2ND	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
	3RD	ON	OFF	LD	APPLIED		APPLIED		APPLIED	NE		YES
2	1ST	OFF	ON	LD	APPLIED		APPLIED			LD	APPLIED	YES
	2ND	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
L	1ST	OFF	ON	LD	APPLIED		APPLIED			LD	APPLIED	YES

LD : LOCKED IN DRIVE FW : FREEWHEELING NE : NOT EFFECTIVE



C07RT010

Normal Operation of 2000 4L30–E Transmission

Torque Converter Clutch (TCC) Application Conditions:

The TCC is normally applied in 2nd, 3rd and 4th gears only when all of the following conditions exist:

— The engine coolant temperature is above 70°C (158°F).

— The brake pedal is released.

— The shift pattern requests TCC apply.

Moreover, TCC is always applied in 2nd, 3rd and 4th gears when the transmission oil temperature is above 135°C (275°F).

This mode should be canceled at 125°C (257°F).

ATF Warning Lamp

The ATF warning lamp will be constantly on (not flashing) if the transmission oil temperature is above 145°C (293°F).

The ATF warning lamp goes off again when the transmission oil temperature is below 125°C (257°F).

Reverse Lock Out

With the selector lever in reverse position, the PCM will not close the PWM solenoid until the vehicle is below 15 km/h (9.3 mph), thus preventing reverse engagement above this speed.

Diagnosis

Introduction

The systematic troubleshooting information covered by this Section offers a practical and systematic approach to diagnosing 4L30–E transmission, using information that can be obtained from road tests, electrical diagnosis, oil pressure checks or noise evaluation.

The key to correcting a complaint is to make use of all of the available symptoms and logically letting them direct you to the cause.

When dealing with automatic transmission complaints, it is best to gather as many symptoms as possible before making the decision to remove the transmission from the vehicle.

Frequently, the correction of the complaint does not require removal of the transmission from the vehicle.

Driver Information

To analyze the problem fill out a complete description of the owner’s complaint.

Please draw a circle around the right information and complete the following form. (The next page is an example of a completed form.)You can draw a circle around many numbers if you are not sure.

A - Today's date :	Month :	Day :	Year : ....
B - End User Name, Address :			
C - Date of Problem :	Month :	Day :	Year : ....
D - Mileage : .... Miles / Km	E - With Ignition ON is CHECK TRANS Indicator : 1- Flashing 2- Not Flashing	F -Car load when problem occured : 1 - Towing a trailer 2- .... people OR .... Kg	
G - Weather conditions when problem : 1- Clear 2- Cloudy 3- Rain 4- Snow 5- Unstable 6-Any	H - Weather Temperature when problem: 1- Hot 2- Warm 3- Cool 4- Cold 5- Unstable 6- Any	I - Road Conditions when problem : 1- Any 2- Inter City 3- Outside City 4- Highway 5 - Uphill 6- Downhill 7- Unpaved 8- Snow 9 - Others :	J - Frequency of the Problem : 1- Always 2- Occasional : .... times/day, ... times/month 3- Only Once 4- Others :
K - Engine Condition : 1- Always 2- At Cold 3- During Warming up 4- After Warming or Hot 5- Others	L - Engine Speed when the problem occured : 1- Idling 2- Starting 3- Stalling 4- High RPM 5- Low RPM	M - Transmission Condition when it occured : 1- Any 2- Idling 3- Starting 4- Driving 5- Accelerating 6-Coasting 7- In corner 8- Shifting	

N - If there is a Transmission driveability problem BEFORE THE CHECK TRANS INDICATOR WAS FLASHING :

1- No Power	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
2- No shift	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
3- Shift Shock	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
4- Shift Slip	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
5- Shift Delayed	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
6- Shift Point too high	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
7- Shift Point too low	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
8- TCC Shudder	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
9- Noise	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
Noise type : 1- Buzz 2- Whine 3- Clunk 4- Rattle	5- Whistle // 6- light 7-medium 8- heavy	
10- Other :	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1

O - Other customer concern and comments

P - Isuzu Vehicle Code :	....	Q - VIN Number	....
R - Date of Vehicle Registration	Month :	Day :	Year : ....
S - Trans. model :	....	T - A/T Serial Number :	....
U - Your name :	....		

V - Dealer Name, Address, Phone

F07RT036

Example of form completed.

A - Today's date :	Month : April.............	Day : .13............	Year : .1994.............
B - End User Name, Address :	Dave Smith 6584, Arlington road Plymouth MI 48170 USA		
C - Date of Problem :	Month : April..................	Day : .8................	Year : .1994..............

D - Mileage :
12230...Mile / Km

E - With Ignition ON is CHECK TRANS Indicator :
1- Flashing 2- Not Flashing

F - Car load when problem occured :
1 - Towing a trailer 2- ..2....... people OR ....Kg

G - Weather conditions when problem :
1- Clear 2- Cloudy
3- Rain 4- Snow
5- Unstable 6- Any

H - Weather Temperature when problem:
1- Hot 2- Warm
3- Cool 4- Cold
5- Unstable 6- Any

I - Road Conditions when problem :
1- Any 2- Inter City
3- Outside City 4- Highway
5 - Uphill 6- Downhill
7- Unpaved 8- Snow
9 - Others

J - Frequency of the Problem :
1- Always 2- Occasional :
.... times/day,
...3... times/month
3- Only Once 4- Others :

this means do not take this into account

K - Engine Condition :
1- Always 2- At Cold
3- During Warming up
4- After Warming or Hot
5- Others

L - Engine Speed when the problem occured :
1- Idling 2- Starting
3- Stalling 4- High RPM
5- Low RPM

M - Transmission Condition when it occured :
1- Any 2- Idling
3- Starting 4- Driving
5- Accelerating 6- Coasting
7- In corner 8- Shifting

N - If there is a Transmission driveability problem BEFORE THE CHECK TRANS INDICATOR WAS FLASHING :

1- No Power	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
2- No shift	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
3- Shift Shock	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
4- Shift Slip	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
5- Shift Delayed	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
6- Shift Point too high	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
7- Shift Point too low	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
8- TCC Shudder	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
9- Noise	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1
Noise type : 1- Buzz 2- Whine 3- Clunk 4- Rattle	5- Whistle // 6- light 7-medium 8- heavy	
10- Other :	in Range : All - P - R - N - D - 3 - 2 - L	during a : upshift : 1-2 / 2-3 / 3-4 or downshift : 4-3 / 3-2 / 2-1

O - Other customer concern and comments :

(This is just an example). Shift shock very harsh overall during a downshift. Not sure if it's the 4-3 or 3-2.

P - Isuzu Vehicle Code :	94 UCR	Q - VIN Number	4S2CV58ZXM4324047
R - Date of Vehicle Registration	Month : November.	Day : ....18........	Year : ..1993.........
S - Trans. model :	4L30-E	T - A/T Serial Number :	96 358 654
U - Your name :	Joe Spring		

V - Dealer Name, Address, Phone

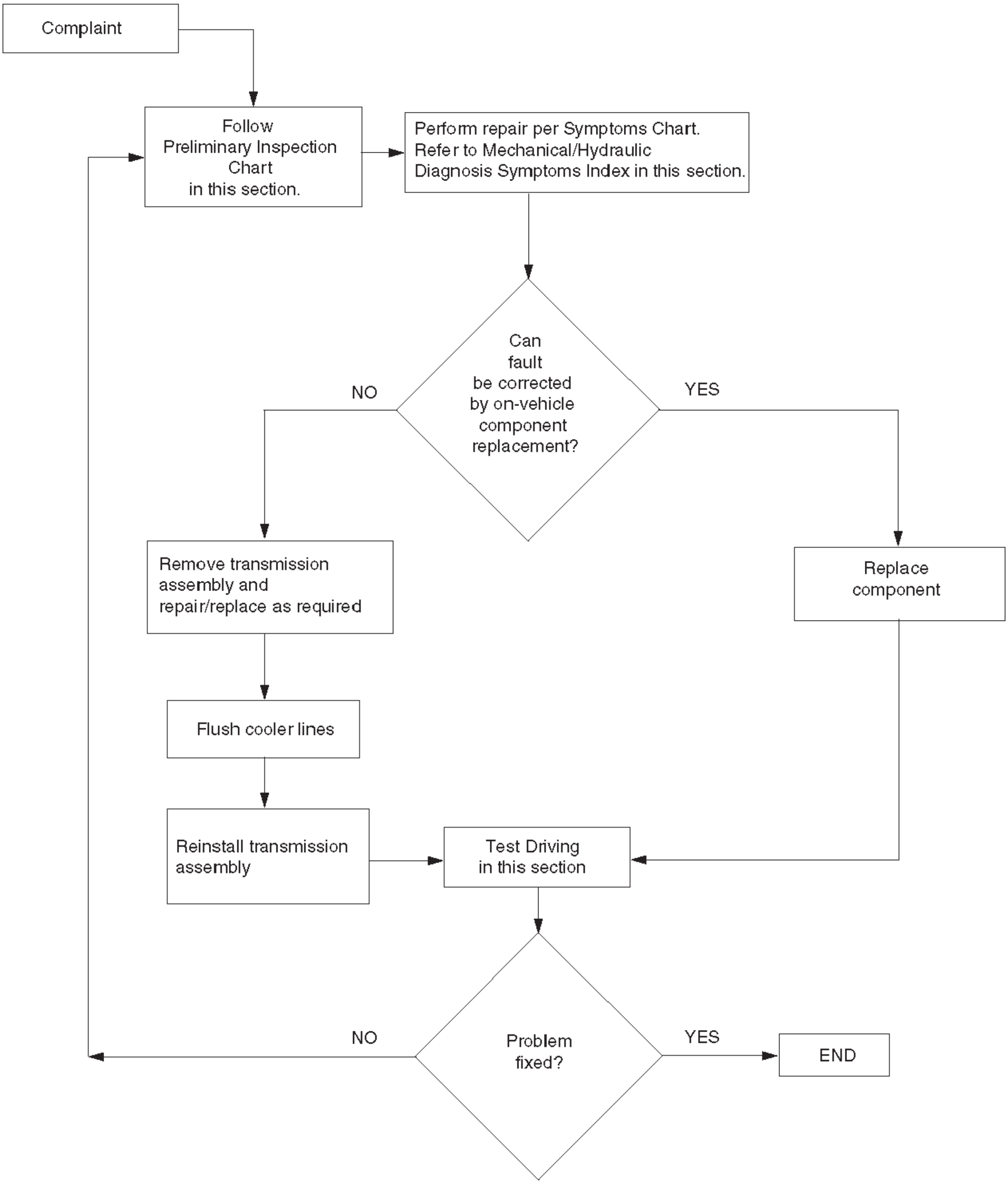
Kent Helfrich

Home-town ISUZU

900 - 999 - 9999

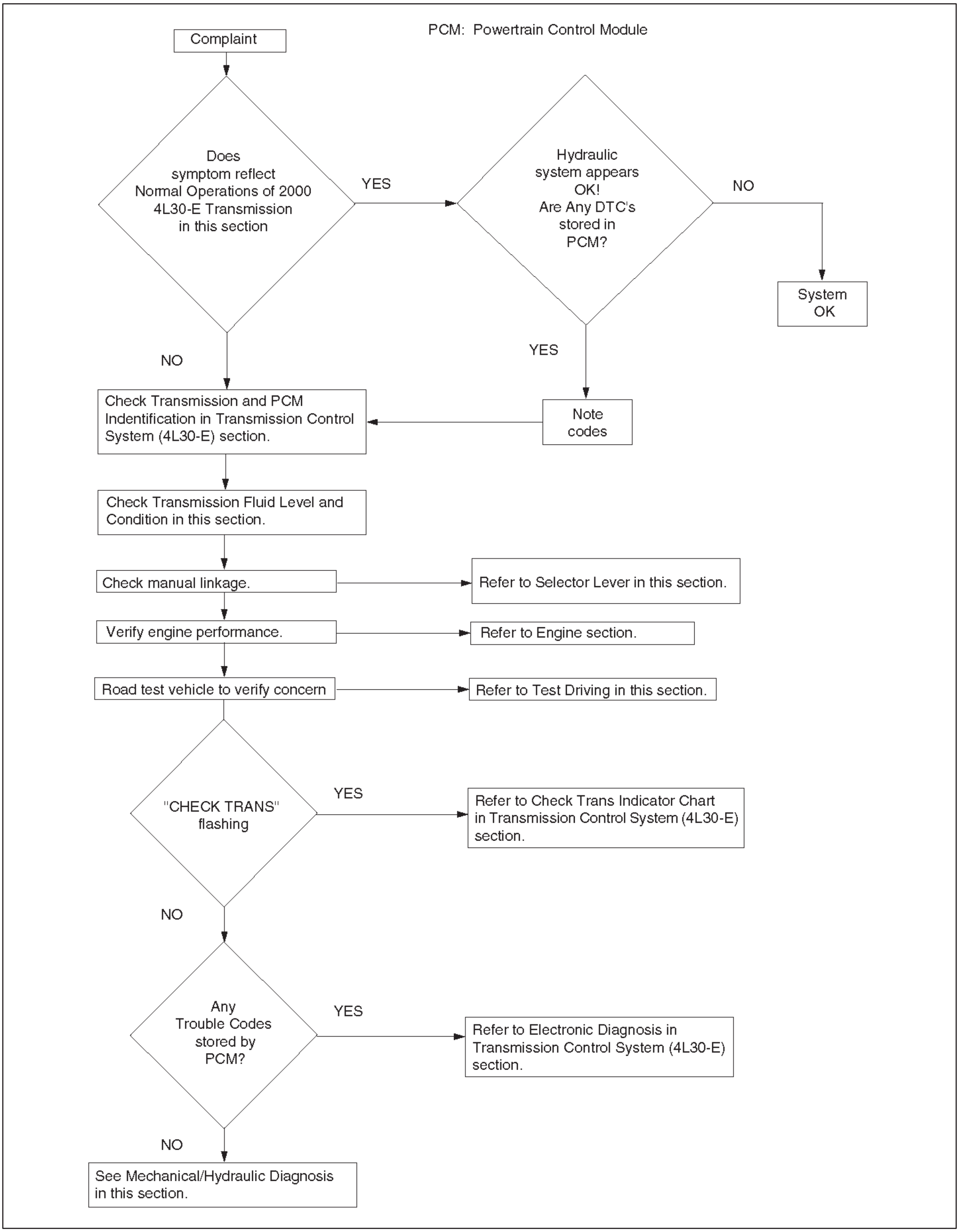
F07RT037

General Diagnosis Procedure



F07RT038

Preliminary Inspection Chart



F07RY00001

Checking Transmission Fluid Level and Condition

Checking fluid level and condition (color and odor) at regular intervals will provide early diagnosis information about the transmission. This information may be used to correct a condition that, if not detected early, could result in major transmission repairs.

IMPORTANT: When new, automatic transmission fluid is red in color. As the vehicle is driven, the transmission fluid will begin to look darker in color. The color may eventually appear light brown.

A dark brown color with burnt odor may indicate excessive fluid deterioration and signal a need for fluid change.

Fluid Level

When adding or changing fluid, use only DEXRON ®–III. Refer to Maintenance and Lubrication in General Information section for maintenance information and servicing interval.

CAUTION: DO NOT OVERFILL.

Overfilling will cause foaming, loss of fluid, abnormal shifting and possible damage to the transmission.

1. Park the vehicle on level ground and apply the parking brake firmly.
2. Check fluid level with engine running at idle.

NOTE: Be sure that transmission fluid temperature is below 30˚C (86˚F).

3. Move the selector lever through all gear ranges.
4. Move the selector lever to “Park”.
5. Let engine idle for 3 minutes and open the overfill screw (1).
6. Add released transmission fluid until it flows out over the overfill screw opening.
7. Let engine idle until a fluid temperature between 32˚C (90˚F) and 57˚C (135˚F) is reached, then close the overfill screw (1).

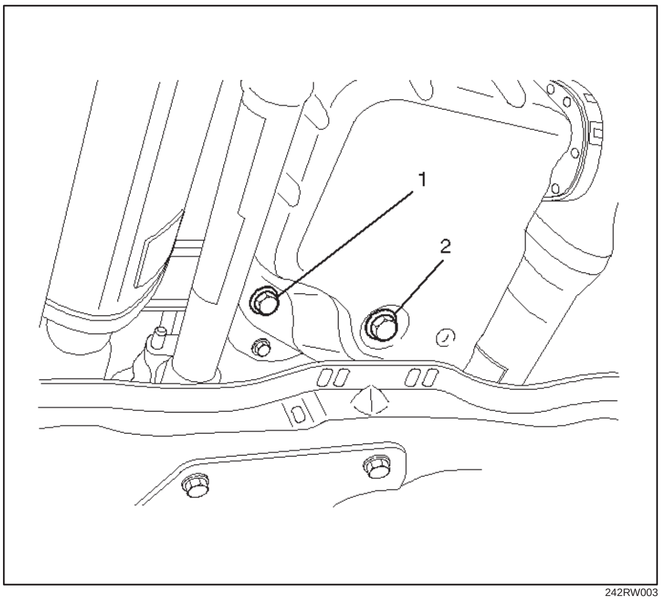
Torque: 38 N•m (28 lb ft)

NOTE: To prevent fluid leaks, the overfill screw and oil drain screws gasket must be replaced each time these screws are removed.

NOTE: Check transmission fluid temperature with scan tool.

Minimum fluid level → 57˚C (135˚F)

Maximum fluid level → 32˚C (90˚F)



CAUTION: Do not open overfill screw with engine stopped.

CAUTION: DO NOT CHECK FLUID LEVEL UNDER THESE CONDITIONS:

- Immediately after driving at sustained highway speeds.
- In heavy city traffic during hot weather.
- If vehicle is towing a trailer.

If the vehicle has been operated under these conditions, shut the engine off and allow the vehicle to “cool” for thirty (30) minutes. After the cool down period, restart the vehicle and continue from step 2 above.

Fluid Condition

	FLUID CONDITION			
	NORMAL*		CONTAMINATED	
COLOR	RED OR LIGHT BROWN	BROWN	NON–TRANSPARENT / PINK	BROWN
DRAIN REQUIRED?	NO	YES	YES	YES
CONTAMI-NATION	NONE	Very small amount of foreign material in bottom of pan	Contamination by coolant or other source	Large pieces of metal or other foreign material in bottom of pan
CORRECT LEVEL AND CONDITION	1. LOW LEVEL: A. Add fluid to obtain proper level & check for external leaks. B. Correct cause of leak. 2. HIGH LEVEL: – Remove excess fluid	– Remove both pans – Change filter – Flush cooler – Add new fluid – Check level	– Repair/replace radiator cooler – Transmission overhaul required – Check for: ● Damaged plates and seals ● Contaminated solenoids – Flush cooler – Add new fluid – Check level	– Transmission overhaul required – Flush cooler and cooler lines – Add new fluid – Check level

*Fluid should be changed according to maintenance schedule.

Test Driving

Some 4L30–E automatic transmission complaints will require a test drive as a part of the diagnostic procedure. Some codes will not set unless the vehicle is moving. The purpose of the test drive is to duplicate the customer's complaint condition and set a current Powertrain Control Module (PCM) trouble code. Perform this procedure before each 4L30–E automatic transmission repair, and again after repairs are made.

IMPORTANT:

- Duplicate the condition under which the customer's complaint was observed.
- Depending on the complaint, the line pressure gauge and the scan tool may be required during the test drive.
- During the test drive, it is important to record all necessary data from the areas being monitored, for use in diagnosis. Also listen for and note any unusual noises.

The following procedure should be used to test drive 4L30–E automatic transmission complaint vehicles:

1. Turn the ignition ON without starting the engine. Check that the "CHECK TRANS" lamp comes on for approximately 2 seconds and then goes out and remains out.
   - If the lamp is flashing, GOTO Check Trans Indicator in Transmission Control System (4L30–E) section.
   - If no serial data is present, GOTO OBD System Check. Refer to Driveability and Emissions in Engine section.
   - If the lamp stays ON or stays OFF, GOTO "Check Trans" Check in Transmission Control System (4L30–E) section.
2. Drive the vehicle. During the test drive, be sure that the transmission achieves normal operating temperature (approx. 20 minutes).
   Allow the transmission to go through all of its gear ranges, checking shift timing and firmness. Duplicate the owner's complaint condition as closely as possible during the test drive.
3. If, during the test drive, the "CHECK TRANS" lamp comes on, use the scan tool to check for trouble codes.
4. If, during the test drive, a problem is felt, but the "CHECK TRANS" lamp does not come on and no trouble codes are present, drive the vehicle with the PCM disconnected (manually shifting the vehicle).
   - In Manual L, the vehicle operates in first gear.
   - In Manual 2, the vehicle operates in third gear.
   - In Manual 3 or "D", the vehicle operates in fourth gear.
   If the problem still exists with the PCM disconnected, refer to Mechanical/Hydraulic Diagnosis in this section.
5. If no problem has been found at this point, check all underhood connections that supply power to the PCM and ignition fuses. Physically and visually inspect all the PCM harness connectors for loose or corroded terminals. Inspect the PCM ground points.

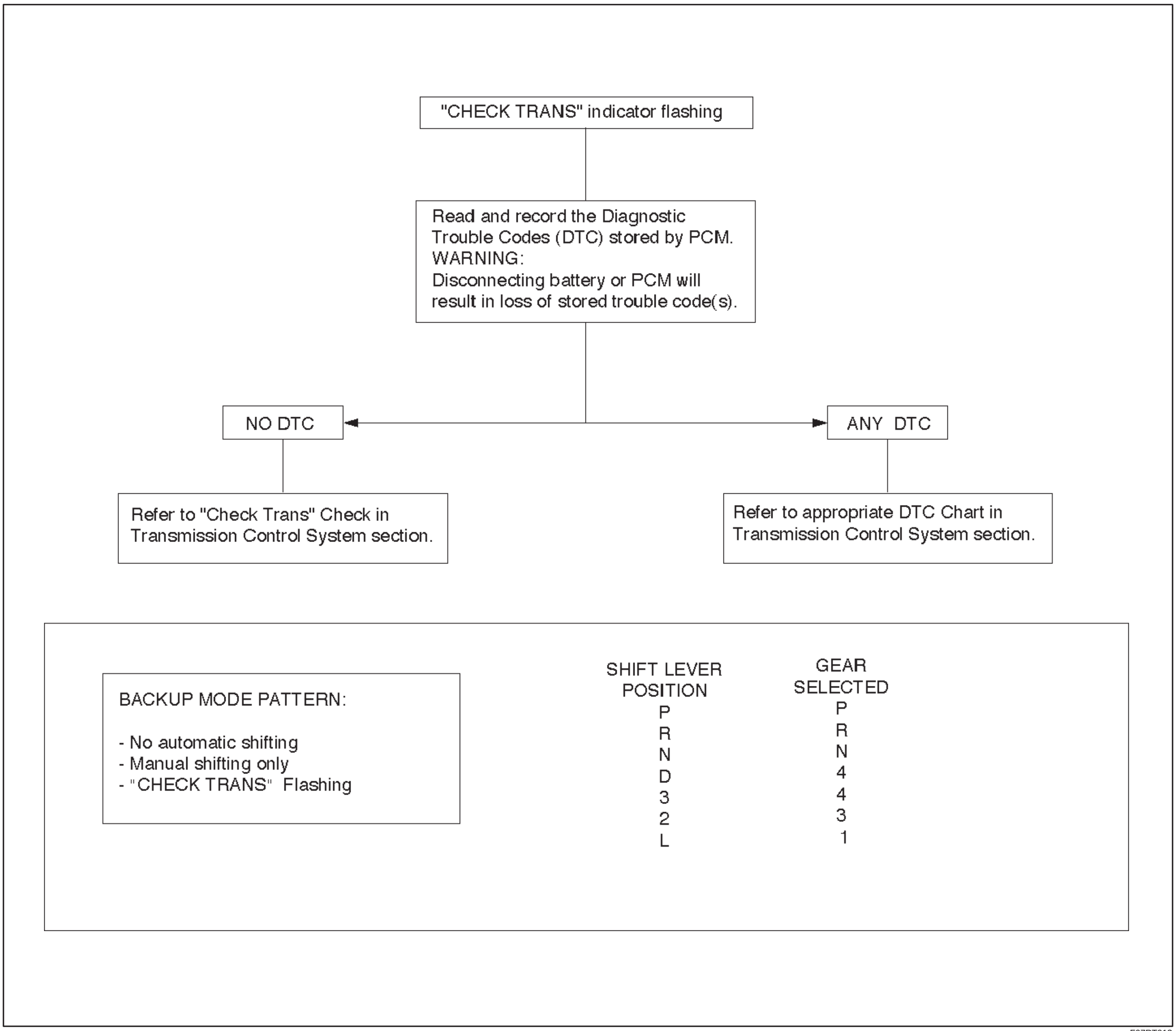
Mechanical / Hydraulic Diagnosis Check Trans Indicator Chart

Perform Preliminary Inspection First!

When the “CHECK TRANS” indicator is flashing, it indicates that a problem related to the transmission, the Powertrain Control Module (PCM), or the vehicle harness has occurred.

The system is now operating in a “BACKUP MODE” where the risk of further damaging the transmission has been reduced. The vehicle may be shifted manually.

If the initial problem is intermittent or seldom, switching the engine OFF/ON might allow normal operation again until the problem reoccurs.



F07RT013

Mechanical / Hydraulic Diagnosis Symptoms Index

Perform Preliminary Inspection First!

CHART	SYMPTOMS
1	NO ENGINE START IN NEUTRAL OR PARK
2	NO FORWARD GEARS IN ANY RANGE/NO REVERSE
3	NO ENGINE BRAKE IN ANY RANGE
4	POOR SHIFTING IN ALL GEARS (ALL HARSH OR ALL SOFT)
5a	DELAYS IN DRIVE AND REVERSE
5b	DELAYS IN REVERSE ONLY
6	DIAGNOSTIC TROUBLE CODE (DTC) P0730
7	HARSH 1–2 SHIFT
8	HARSH 3–4 SHIFT
9a	3–2 DOWNSHIFT COMPLAINT
9b	HARSH SHIFT WHEN SHIFTING INTO “D” OR ACCELERATING FROM STOP
9c	COASTDOWN HARSH SHIFT OR CLUNK AT 3–2 DOWNSHIFT
10	INTERMITTENT 4TH TO 2ND GEAR DOWNSHIFT AT STEADY SPEED
11	ENGINE FLARE AT SHIFTING DURING TURNING ONLY (USUALLY WITH WARM ENGINE)
12	ENGINE FLARE DURING 1–2 OR 2–3 SHIFT
13	SHUDDER ONLY DURING TORQUE CONVERTER CLUTCH (TCC) APPLYING
14	POSSIBLE CAUSES OF TRANSMISSION NOISE
15a	POSSIBLE CAUSES OF LOW LINE PRESSURE
15b	POSSIBLE CAUSES OF HIGH LINE PRESSURE
16	POSSIBLE CAUSES OF TRANSMISSION FLUID LEAKS

NOTE: Numbers with parenthesis on the following charts refer to Parts List at end of this section.

Chart 1: No Engine Start In Neutral Or Park

Step	Action	Yes	No
1	Does engine start when shift lever moved from drive to neutral mostly in hot condition?	Go to Step 2	Go to Step 3
2	Does engine start in park at any condition?	Re–test vehicle	Go to Step 4
3	Does engine also not start in neutral when shift lever moved from park to neutral?	Go to Step 4	Go to Step 5
4	Check mode switch (63) setting. Readjust if necessary. Problems fixed?	Re–test vehicle	Go to Step 5
5	Check start circuit of mode switch (63) open in neutral. Was open found?	Locate and repair open(s).	Replace mode switch (63).

Chart 2: No Forward Gears In Any Range/No Reverse

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section.
2	1. Check internal linkage: – Manual linkage (58) not moving manual valve (326). 2. Check for internal mechanical damage: – Turbine shaft (506) broken loose. – Overrun roller clutch (516) broken loose. Was the problem found?	Repair or replace	—

Chart 3: No Engine Brake In Any Range

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section.
2	1. Check for overrun clutch leaks caused by: – Damaged piston lip (513) – Check ball defective (504) 2. Check for overrun lockout valve (705) stuck by foreign material. 3. Check for leaks at turbine shaft (506) caused by: – Teflon seal rings damaged (508) – Excessive wear of turbine shaft bearing surfaces. Was the problem found?	Repair or replace	—

Chart 4: Poor Shifting In All Gears (All Harsh Or All Soft)

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Go to Step 3
2	1. Check for these conditions which could affect clutch apply time: – Defective band apply solenoid (323). – Defective servo or/and accumulator piston. – Excessive clutch piston travel. 2. Check of possible causes of internal leaks: – Cut or damaged sealing ring(s) – Damaged sealing gasket(s) – Check ball missing or out of location in 2nd and 3rd clutch pistons. 3. Check for causes of burned clutch plates or band. Was the problem found?	Repair or replace	—
3	Was the line pressure high?	Go to Step 4	Use Chart 15a: Possible Causes of Low Line Pressure in this section.
4	Does DTC P0705 set?	Diagnose those DTC(s) first.	Use Chart 15b: Possible Causes of High Line Pressure in this section.

Chart 5a: Delays In Drive and Reverse

NOTE: A short delay (less than 3 seconds) when first engaging drive or reverse after allowing vehicle to sit overnight is normal.

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	More than 3 second delay in drive and reverse with engine off 1 hour or less. Teflon seals (508) on turbine shaft damaged. Repair	Use Chart 15a: Possible Causes of Low Line Pressure in this section.

Chart 5b: Delays In Reverse Only

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section.
2	Main case valve body gasket (88) damaged. – Reverse check ball (85) in valve body (84) missing or out of location. – Check for restrictions at valve body transfer plate orifice. Was the problem found?	Repair	—

Chart 6: Diagnostic Trouble Code (DTC) P0730

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15b: Possible Causes of High Line Pressure in this section.
2	1. 1st and 2nd gear missing or 3rd and 4th gear missing. Check appropriate shift valve. If OK replace solenoid. 2. No engine brake in any range (All ranges in Drive and Reverse are OK) Check for suspected conditions modifying delays to clutch apply: – Overrun clutch seal damaged. – Excessive overrun clutch piston travel. – Defective 3–4 accumulator piston. – Causes of internal leaks. – Causes of burned clutch plates. 3. 1st and 4th gear missing or 2nd and 3rd gear missing. Shift solenoid A stuck. Replace shift solenoid A. 4. DTC P0730 is set in D range 1st gear above 3500 rpm. Go to Step 3. 5. DTC P0730 is set in D range 3rd gear between 55-80 mph. NOTE: Perform this test within safe and legal limits. Check for suspected conditions modifying delays to clutch apply: – 4th clutch seal damaged. – Excessive 4th clutch piston travel. – Defective 3–4 accumulator piston. – Causes of internal leaks. – Causes of burned clutch plates. Was the problem found?	Repair or replace	—
3	Check 3rd gear in “D” in winter mode. Does vehicle move?	Shift solenoid A stuck. Replace shift solenoid A.	Go to Step 4
4	Check for suspected conditions modifying delays to clutch apply: – 2nd clutch seal damaged. – Excessive 2nd clutch piston travel. – Defective accumulator piston. – Causes of internal leaks. – Check ball missing or out of location in 2nd clutch. – Seals cut, damaged or missing. – Gaskets defective. – Causes of burned clutch plates. Was the problem found?	Repair or replace	—

Chart 7: Harsh 1–2 Shift

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Check for 1–2 accumulator valve (320) stuck by foreign material in main case valve body.	Use Chart 15b: Possible Causes of High Line Pressure in this section.

Chart 8: Harsh 3–4 Shift

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15b: Possible Causes of High Line Pressure in this section.
2	1. Check for 3–4 accumulator valve (407) stuck in adapter case valve body (401). 2. Check for 3–4 accumulator piston (18) stuck in adapter case (20). Was the problem found?	Repair or replace	—

Chart 9a: 3–2 Downshift Complaint

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section.
2	Does DTC P1850 set?	Diagnose P1850 first.	Replace band apply solenoid (PWM) (323).

Chart 9b: Harsh Shift When Shifting Into “D” Or Accelerating From Stop

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15b: Possible Causes of High Line Pressure in this section.
2	Does DTC P1850 set?	Diagnose P1850 first.	Replace band apply solenoid (PWM) (323).

Chart 9c: Coastdown Harsh Shift Or Clunk At 3–2 Downshift

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15b: Possible Causes of High Line Pressure in this section.
2	Does DTC P1850 set?	Diagnose P1850 first.	Replace band apply solenoid (PWM) (323).

Chart 10: Intermittent 4TH TO 2ND Gear Downshift At Steady Speed

Step	Action	Yes	No
1	Check for consistent speed sensor reading with scan tool. Was the reading correct?	Replace mode switch for intermittent contact.	Go to Step 2
2	1. Check for wiring harness damage or short to ground. If OK, go to (2). 2. Check transmission speed sensor connections. If OK, go to (3). 3. Replace transmission speed sensor. Was the replacement complete?	—	Replace speed sensor.

Chart 11: Engine Flare At Shifting During Turning Only (Usually With Warm Engine)

Step	Action	Yes	No
1	Check for oil leaks at transmission. Was the problem found?	Replace transmission oil filter and gasket.	—

Chart 12: Engine Flare During 1–2 Or 2–3 Shift

Step	Action	Yes	No
1	Check line pressure. Refer to Line Pressure Test in this section. Was line pressure normal?	Go to Step 2	Use Chart 15a: Possible Causes of Low Line Pressure in this section.
2	1. Check for a stuck 1–2 accumulator valve (320). 2. Check for servo piston (106) leaks. 3. Check for a stuck band apply solenoid (323). Was line pressure normal?	Repair or replace	—

Chart 13: Shudder Only During Torque Converter Clutch (TCC) Applying

Step	Action	Yes	No
1	1. TCC shudder is one of the most commonly misdiagnosed conditions in an automatic transmission. The key to diagnosing TCC shudder is to note when it happens and under what conditions. Once the TCC has been fully applied, it is nearly impossible to make it shudder. TCC shudder (short burst of noise normally less than 1 second) will only occur during clutch applying. It is not a steady state condition. 2. Drive until whole drivetrain is at normal operating temperature. – On 4WD vehicles, the test must be performed with transfer case selector lever in “2H” position. – Shudder is a short burst of noise normally less than 1 second in duration, and can be induced by the following maneuver: 3. From coast condition at 50 mph in “D” range (Normal mode), depress the throttle to 1/4-1/3 throttle. If present, shudder will occur within 5 seconds together with TCC application.(The scan tool may be used to determine the exact time of TCC). Was the problem found?	Replace transmission fluid and filter (remove both pans) and flush cooler lines. Replace converter assembly and O-ring on turbine shaft	Perform mechanical inspection of other drivetrain components.

Chart 14: Possible Causes of Transmission Noise

CAUTION: Before checking transmission for what is believed to be transmission noise, ensure presence and positioning of insulating plugs, pads etc. Also make sure that noise does not come from other drivetrain components.

Condition	Possible cause	Correction
Whine or Buzz	Oil level low	Fill with ATF, check for external leaks.
	Plugged or restricted oil filter	Inspect oil filter. Replace oil filter or ATF as necessary.
	Damaged oil filter gasket	Replace oil filter gasket.
Knocking noise from front of transmission.	Loose bolts (Converter to flex plate)	Tighten to specifications.
	Cracked or broken flex plate	Replace flex plate.
	Converter damaged	Replace converter.
Knocking noise while driving, mostly on acceleration.	Transmission mount loose or broken	Tighten mount bolts or replace transmission mount.
	Cooler line mounts loose or broken	Tighten or replace cooler line mounts.
	Cooler lines touching body or frame	Repair or replace as necessary.
Knocking noise when vehicle is stationary.	Loose flex plate mounting bolts	Tighten to specifications.
	Cracked or broken flex plate	Replace flex plate.
	Damaged converter	Replace converter.

Chart 15a: Possible Causes of Low Line Pressure

Step	Action	Yes	No
1	Check oil level. Was the problem found?	Fill with ATF.	Go to Step 2
2	Check for defective throttle position sensor. Was the problem found?	Replace throttle position sensor.	Go to Step 3
3	Check for plugged, loose, or damaged oil filter (79). Was the problem found?	Inspect oil filter, tighten bolts or replace oil filter (79).	Go to Step 4
4	Check for a stuck force motor plunger (404). (Adapter case valve body) Was the problem found?	Replace force motor plunger (404).	Go to Step 5
5	Check for a stuck feed limit valve (412). (Adapter case valve body) Was the problem found?	Replace feed limit valve (412).	Go to Step 6
6	Check for loose converter bolts (4 & 5). Was the problem found?	Tighten converter bolts (4 & 5).	Go to Step 7
7	Check for a stuck pressure regulator valve (208). (Oil pump) Was the problem found?	Replace pressure regulator valve (208).	Go to Step 8
8	Check for a stuck boost valve (205). (Oil pump) Was the problem found?	Replace boost valve (205).	Go to Step 9
9	Check for blocked intermediate oil passages to pressure regulator valve. (Oil pump) Was the problem found?	Replace oil pump.	Go to Step 10
10	Check for defective oil pump (9, 201, 202 & 209). Was the problem found?	Replace oil pump.	Go to Step 11
11	Check for internal leaks. – Check balls missing or out of location in valve bodies – Seals cut or damaged – Gaskets defective, etc. Was the problem found?	Install balls, or correct ball location. Replace seals. Replace gaskets.	—

Chart 15b: Possible Causes of High Line Pressure

NOTE: If transmission is operating in backup mode, high line pressure will be present.

Step	Action	Yes	No
1	Check for defective throttle position sensor. Was the problem found?	Replace throttle position sensor.	Go to Step 2
2	Check for a stuck force motor plunger (404). (Open circuit/intermittent) (Adapter case valve body) Was the problem found?	Replace force motor plunger (404).	Go to Step 3
3	Check for a stuck feed limit valve (412). (Adapter case valve body) Was the problem found?	Replace feed limit valve (412).	Go to Step 4
4	Check converter bolts (4 & 5). Was the problem found?	Tighten converter bolts (4 & 5).	Go to Step 5
5	Check for a stuck pressure regulator valve (208). (Oil pump) Was the problem found?	Replace pressure regulator valve (208).	Go to Step 6
6	Check for a stuck boost valve (205). (Oil pump) Was the problem found?	Replace boost valve (205).	Go to Step 7
7	Check for internal leaks. – Check balls missing or out of location in valve bodies – Seals cut or missing – Gaskets defective, etc. Was the problem found?	Install balls, or correct ball location. Replace seals. Replace gaskets.	—

Chart 16: Possible Causes of Transmission Fluid Leaks

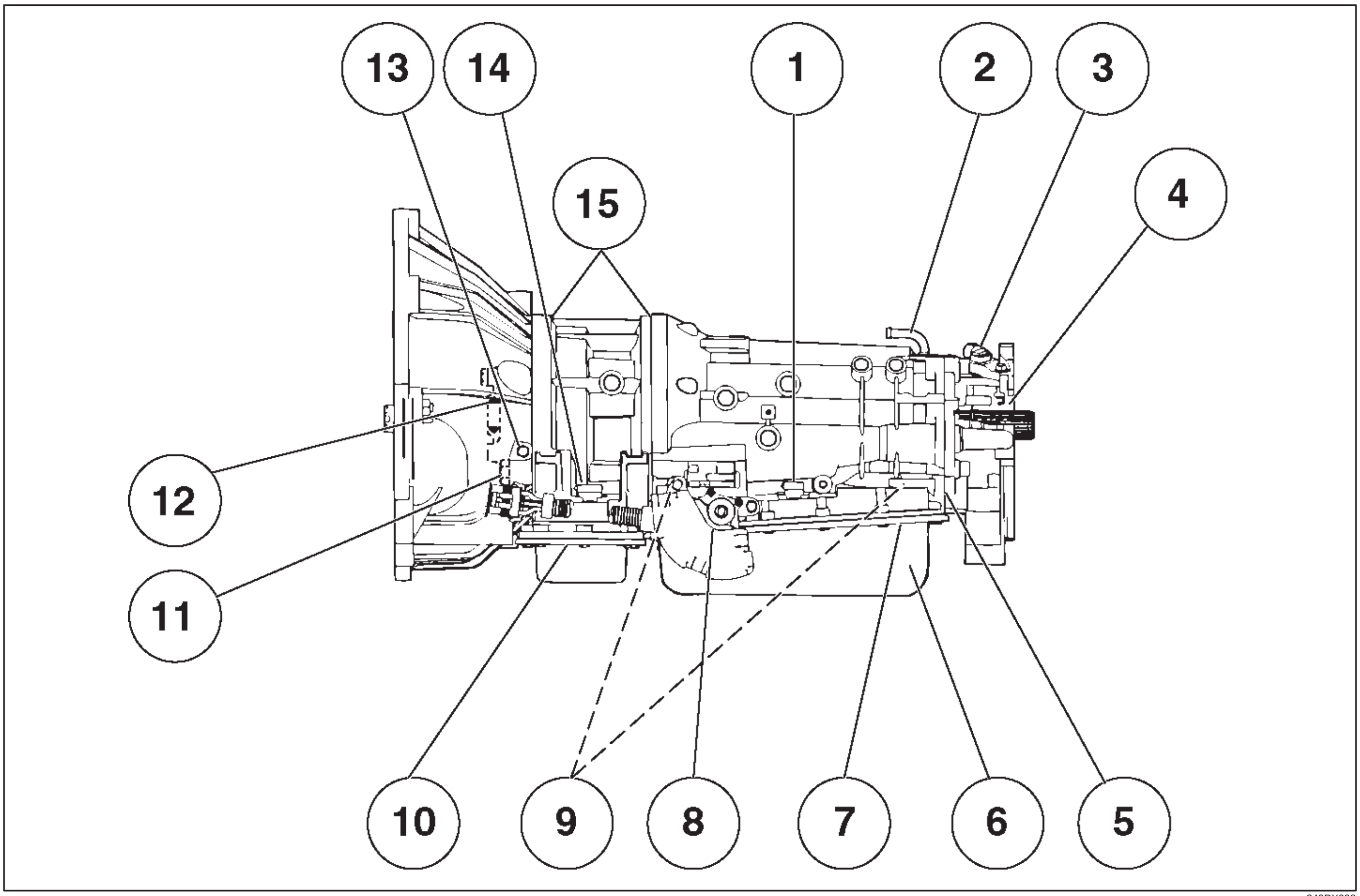
Before attempting to correct an oil leak, the actual source of the leak must be determined. In many cases, the source of the leak may be difficult to determine due to “wind flow” around the engine and transmission.

The suspected area should be wiped clean before inspecting for the source of the leak.

Oil leaks around the engine and transmission are generally carried toward the rear of the vehicle by the air stream. In determining the source of an oil leak, the following two checks should be made:

1. With the engine running, check for external line pressure leaks.
2. With the engine off, check for oil leaks due to the raised oil level caused by drainback of converter oil into the transmission.

Possible Causes of Fluid Leaks Due To Sealing Malfunction



Legend

(1) Electrical Connector (Main Case) Seal
(2) Transmission Vent (Breather)
(3) Speed Sensor O–ring
(4) Extension (Adapter) Lip Seal
(5) Extension (Adapter) to Main Case Gasket
(6) Overfill and Oil Drain Screws Gasket
(7) Oil Pan Gasket (Main Case)
(8) Selector Shaft Seal
(9) Oil Cooler Connectors (2)
(10) Oil Pan Gasket (Adapter Case)
(11) Converter housing attaching bolts not correctly torqued
(12) Converter Housing Lip Seal
(13) Line Pressure Tap Plug
(14) Electrical Connector (Adapter Case) Seal
(15) Adapter Case Seal Rings (2)

Stall Test

The stall test allows you to check the transmission for internal abrasion and the one way clutch for slippage. Torque converter performance can also be evaluated.
The stall test results together with the road test results will identify transmission components requiring servicing or adjustment.

Stall Test Procedure:

1. Check the level of the engine coolant, the engine oil, and the automatic transmission fluid. Replenish if necessary.
2. Block the wheels and set the parking brake.
3. Connect a tachometer to the engine.
4. Start the engine and allow it to idle until the engine coolant temperature reaches 70 – 80˚C (158 – 176˚F).
5. Hold the brake pedal down as far as it will go.
6. Place the selector in the “D” range.
7. Gradually push the accelerator pedal to the floor.
   The throttle valve will be fully open.
   Note the engine speed at which the tachometer needle stabilizes.

Stall Speed : 2,100 ±150 rpm

NOTE: Do not continuously run this test longer than 5 seconds.

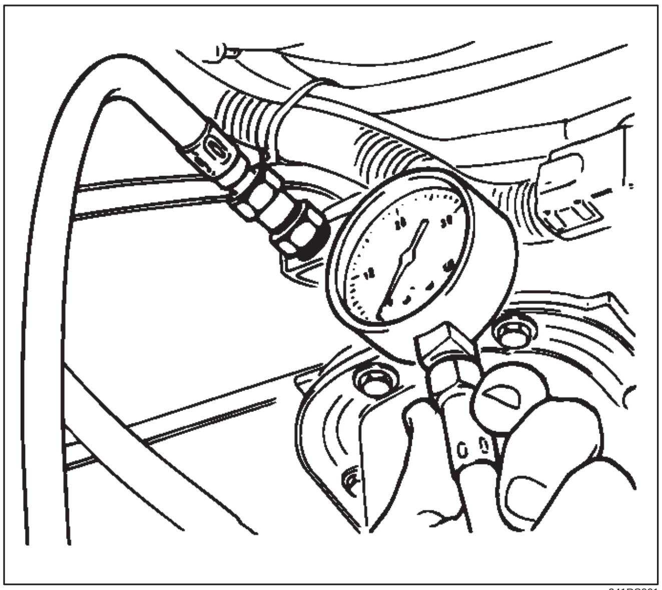
8. Release the accelerator pedal.
9. Place the selector in the “N” range.
10. Run the engine at 1,200 rpm for one minute.
    This will cool the transmission fluid.
11. Repeat Steps 7 – 10 for the “3”, “2”, “L” and “R” ranges.

Line Pressure Test

The line pressure test checks oil pump and control valve pressure regulator valve function. It will also detect oil leakage.

Line Pressure Test Procedure:

1. Check the level of the engine coolant, the engine oil, and the automatic transmission fluid.
   Replenish if required.
2. Block the wheels and set the parking brake.
3. Remove the pressure detection plug at the left side of the transmission case.
   Set J–29770–A pressure gauge and adapter to the pressure detection plug hole.


241RS001

4. Start the engine and allow it to idle until the engine coolant temperature reaches 70 – 80°C (158 – 176°F).
5. Hold the brake pedal down as far as it will go.
6. Place the selector in the “D” range.
7. Note the pressure gauge reading with the engine idling.
8. Gradually push the accelerator pedal to the floor. The throttle valve will be fully open.
   Note the pressure gauge reading with the accelerator pedal fully depressed.

NOTE: Do not continuously run this test longer than 5 seconds.

9. Release the accelerator pedal.
10. Place the selector in the “N” range.
11. Run the engine at 1,200 rpm for one minute.
    This will cool the transmission fluid.
12. Repeat Steps 7 – 11 for the “3”, “2”, “L”, and “R” ranges.
13. Install a pressure detection plug to the transmission case, applying recommended thread locking agent (LOCTITE 242) or its equivalent to thread of plug. Make sure that thread is cleaned before applying locking agents.
14. Tighten the pressure detection plug to the specified torque.

Torque: 9 – 14N·m (7 – 10lb ft)

MODE	LEVER POSITION	ENGINE SPEED	LINE PRESSURE		FORCE MOTOR CURRENT (mA)
			kPa	PSI	
NORMAL/POWER	D,3,2,L	IDLE	590–730	86–106	680–720
WINTER	D	IDLE	300–390	44–57	1,020–1,060
NORMAL/POWER WINTER	REVERSE	IDLE	460–630	67–91	880–920
NORMAL/POWER	D, 3, 2, L	STALL SPEED	1,250–1,380	181–200	70–110
WINTER	D	STALL SPEED	1,250–1,380	181–200	70–110
NORMAL/POWER WINTER	REVERSE	STALL SPEED	1,400–1,580	203–229	340–380

Shift Speed Chart

Transfer gear ratio	High: 1.000
Rear axle ratio	4.100

"Normal mode"

Upshift

Range	Throttle opening	1 → 2 (First Gear) (Second Gear) km/h (mph)	2 → 3 (Second Gear) (Third Gear) km/h (mph)	3 → 4 (Third Gear) (Fourth Gear) km/h (mph)
D (Drive)	Fully opened	54 ~ 60 (34 ~ 37)	111 ~ 117 (69 ~ 73)	169 ~ 175 (105 ~ 109)
	Half throttle	34 ~ 40 (21 ~ 25)	64 ~ 70 (40 ~ 44)	117 ~ 123 (73 ~ 76)
3 (Third)	Fully opened	54 ~ 60 (34 ~ 37)	111 ~ 117 (69 ~ 73)	—
	Half throttle	34 ~ 40 (21 ~ 25)	64 ~ 70 (40 ~ 44)	—
2 (Second)	Fully opened	54 ~ 60 (34 ~ 37)	—	—
	Half throttle	34 ~ 40 (21 ~ 25)	—	—

Downshift

Range	Throttle opening	1 ← 2 (First Gear) (Second Gear) km/h (mph)	2 ← 3 (Second Gear) (Third Gear) km/h (mph)	3 ← 4 (Third Gear) (Fourth Gear) km/h (mph)
D (Drive)	Fully opened	46 ~ 52 (29 ~ 32)	89 ~ 95 (55 ~ 59)	159 ~ 165 (99 ~ 103)
	Half throttle	15 ~ 21 (9 ~ 13)	36 ~ 42 (22 ~ 26)	74 ~ 80 (46 ~ 50)
	Fully closed	14 ~ 20 (9 ~ 12)	21 ~ 27 (13 ~ 17)	28 ~ 34 (17 ~ 21)
3 (Third)	Fully opened	46 ~ 52 (29 ~ 32)	89 ~ 95 (55 ~ 59)	—
	Half throttle	15 ~ 21 (9 ~ 13)	36 ~ 42 (22 ~ 26)	—
	Fully closed	14 ~ 20 (9 ~ 12)	21 ~ 27 (13 ~ 17)	—
2 (Second)	Fully opened	46 ~ 52 (29 ~ 32)	96 ~ 102 (60 ~ 63)	—
	Half throttle	15 ~ 21 (9 ~ 13)	96 ~ 102 (60 ~ 63)	—
	Fully closed	14 ~ 20 (9 ~ 12)	96 ~ 102 (60 ~ 63)	—
L (First)	—	50 ~ 56 (31 ~ 35)	—	—

"Power mode"

Upshift

Range	Throttle open-ing	1 → 2 (First Gear) (Second Gear) km/h (mph)	2 → 3 (Second Gear) (Third Gear) km/h (mph)	3 → 4 (Third Gear) (Fourth Gear) km/h (mph)
D (Drive)	Fully opened	54 ~ 60 (34 ~ 37)	111 ~ 117 (69 ~ 73)	169 ~ 175 (105 ~ 109)
	Half throttle	42 ~ 48 (26 ~ 30)	78 ~ 84 (49 ~ 52)	133 ~ 139 (83 ~ 86)
3 (Third)	Fully opened	54 ~ 60 (34 ~ 37)	111 ~ 117 (69 ~ 73)	—
	Half throttle	42 ~ 48 (26 ~ 30)	78 ~ 84 (49 ~ 52)	—
2 (Second)	Fully opened	54 ~ 60 (34 ~ 37)	—	—
	Half throttle	42 ~ 48 (26 ~ 30)	—	—

Downshift

Range	Throttle opening	1 ← 2 (First Gear) (Second Gear) km/h (mph)	2 ← 3 (Second Gear) (Third Gear) km/h (mph)	3 ← 4 (Third Gear) (Fourth Gear) km/h (mph)
D (Drive)	Fully opened	46 ~ 52 (29 ~ 32)	89 ~ 95 (55 ~ 59)	159 ~ 165 (99 ~ 103)
	Half throttle	23 ~ 29 (14 ~ 18)	59 ~ 65 (37 ~ 40)	108 ~ 114 (67 ~ 71)
	Fully closed	14 ~ 20 (9 ~ 12)	24 ~ 30 (15 ~ 19)	48 ~ 54 (30 ~ 33)
3 (Third)	Fully opened	46 ~ 52 (29 ~ 32)	89 ~ 95 (55 ~ 59)	—
	Half throttle	23 ~ 29 (14 ~ 18)	59 ~ 65 (37 ~ 40)	—
	Fully closed	14 ~ 20 (9 ~ 12)	24 ~ 30 (15 ~ 19)	—
2 (Second)	Fully opened	46 ~ 52 (29 ~ 32)	96 ~ 102 (60 ~ 63)	—
	Half throttle	23 ~ 29 (14 ~ 18)	96 ~ 102 (60 ~ 63)	—
	Fully closed	14 ~ 20 (9 ~ 12)	96 ~ 102 (60 ~ 63)	—
L (First)	—	50 ~ 56 (31 ~ 35)	—	—

“Winter mode”

D range, winter mode ON → OFF	31 ~ 37 km/h (19 ~ 23 mph)

Lockup Speed Chart

Transfer gear ratio	High: 1.000
Rear axle ratio	4.100

	Mode	Lockup ON			Lockup OFF		
		2nd km/h (mph)	3rd km/h (mph)	4th km/h (mph)	2nd km/h (mph)	3rd km/h (mph)	4th km/h (mph)
D range, Throttle opening 6%	Normal	75 ~ 81 (47 ~ 50)	68 ~ 74 (42 ~ 46)	76 ~ 82 (47 ~ 51)	69 ~ 75 (43 ~ 47)	47 ~ 53 (29 ~ 33)	72 ~ 78 (45 ~ 48)
	Power	75 ~ 81 (47 ~ 50)	80 ~ 86 (50 ~ 53)	80 ~ 86 (50 ~ 53)	69 ~ 75 (43 ~ 47)	71 ~ 77 (44 ~ 48)	75 ~ 81 (47 ~ 50)

Changing Transmission Fluid

There is no need to change the transmission fluid unless the transmission is used under one or more of the following heavy duty conditions.

A. Repeated short trips

B. Driving on rough roads

C. Driving on dusty roads

D. Towing a trailer

If the vehicle is used under these conditions, change the fluid every 20,000 miles (32,000 km).

1. Place a large drain pan under the oil pan.
2. Remove the transmission oil drain screw (2) and drain fluid.
3. Tighten drain screw (2).

Torque: 38 N•m (28 lb ft)

4. Remove the transmission overfill screw (1) and fill transmission through overfill screw opening, using DEXRON®–III ATF.

NOTE: Add transmission fluid until it flows out over the overfill screw opening.

5. Let engine idle until a fluid temperature between 32˚C (90˚F) and 57˚C (135˚F) is reached.
6. Add transmission fluid until it flows out over the overfill screw opening, then close the overfill screw (1).

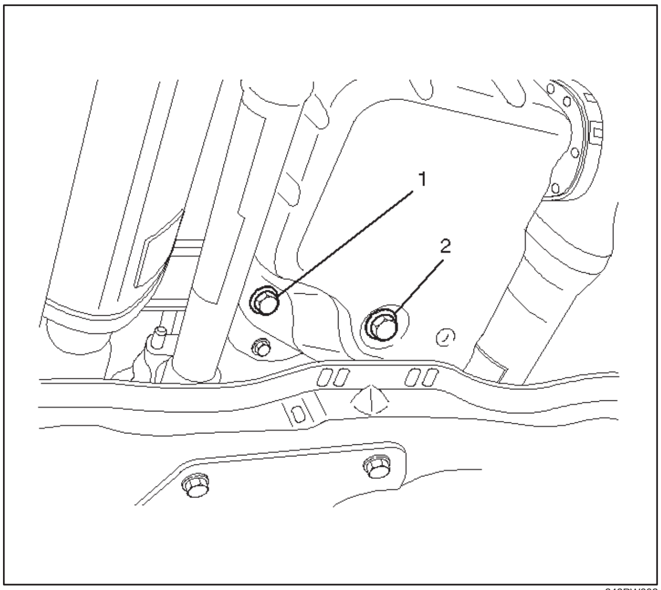
Torque: 38 N•m (28 lb ft)

NOTE: To prevent fluid leaks, the overfill screw and oil drain screws gasket must be replaced each time these screws are removed.

NOTE: Check transmission fluid temperature with scan tool.

7. Reset “Oil Life Monitor” data by using Tech 2.

   Refer to Tech 2 OBD II Connection in Transmission Control System (4L30-E) section.

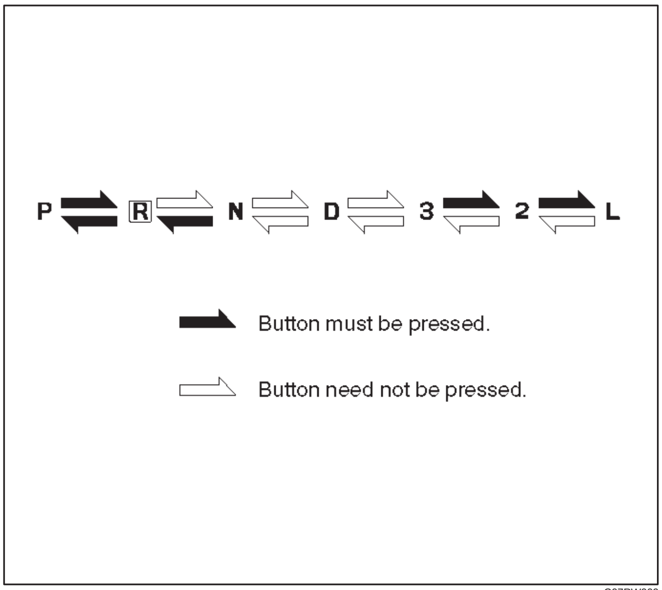


242RW003

Selector Lever

Inspection

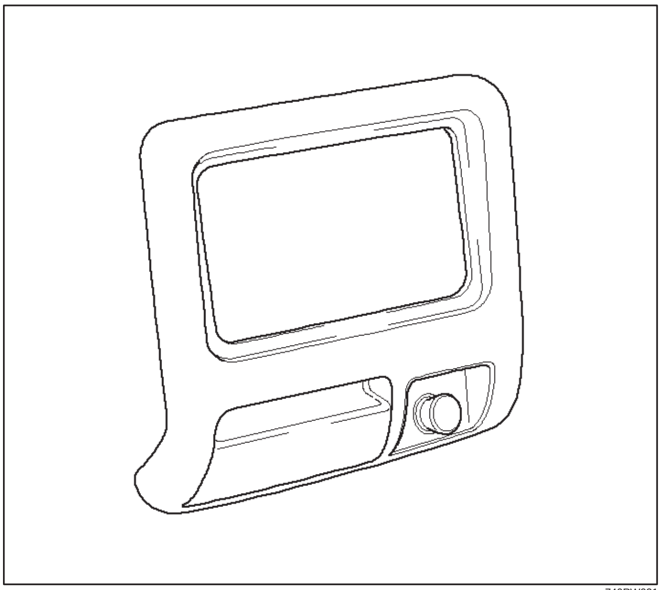
1. Make sure that when the selector lever is shifted from “P” to “L”, a “clicking” can be felt at each shift position. Make sure that the gear corresponds to that of the position plate indicator.
2. Check to see if the selector lever can be shifted as shown in illustration.



C07RW009

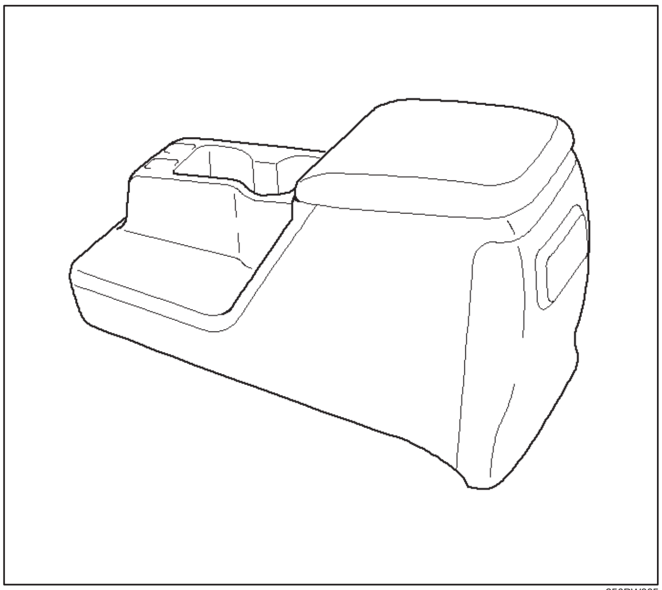
Removal

1. Disconnect battery ground cable.
2. Set ignition Key in “LOCK” position and selector lever in ”P” position.
3. Remove transfer control lever knob (4×4).
4. Remove lower cluster assembly.



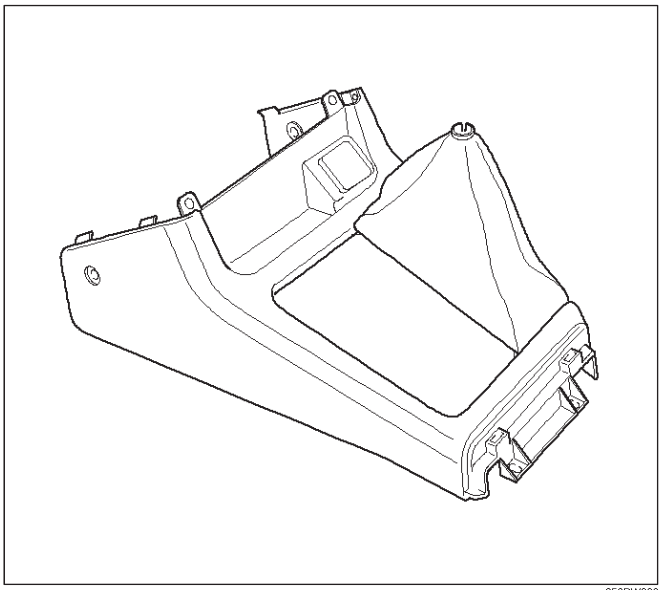
740RW021

5. Remove rear console.



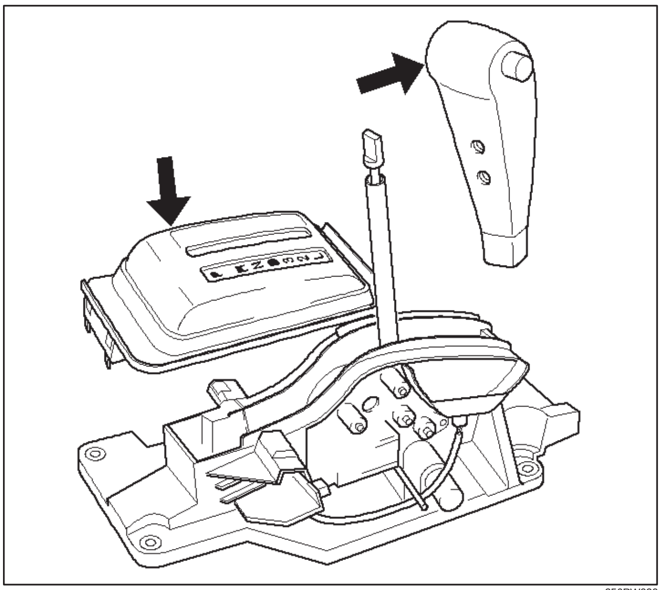
256RW005

6. Remove center console.



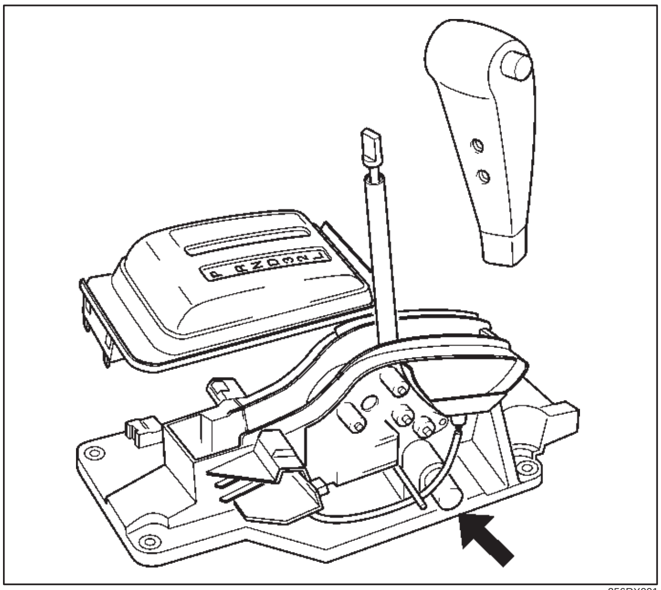
256RW006

7. Remove selector lever knob and cover.



256RW020

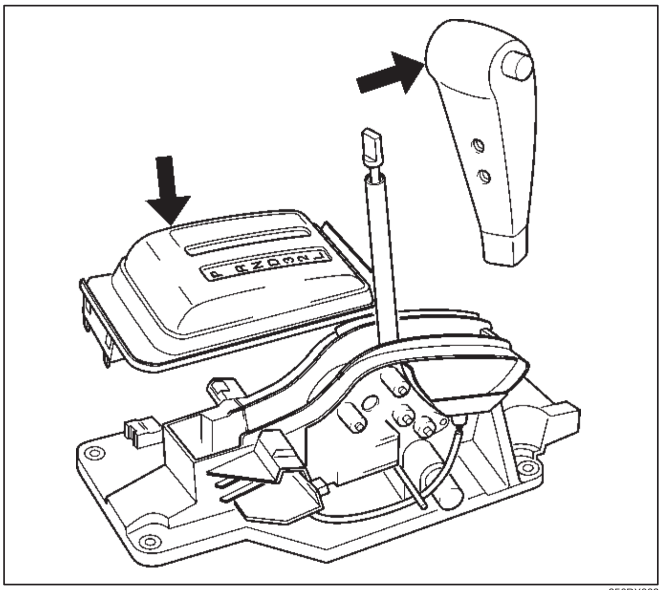
8. Disconnect select cable.
   - Refer to Select Cable in this section.
9. Disconnect shift lock cable.
   - Refer to Shift Lock Cable in this section.
10. Disconnect harness connector.
11. Remove selector lever subassembly.



256RX001

Installation

1. Install selector lever subassembly.
2. Connect harness connector.
3. Connect shift lock cable.
   - Refer to Shift Lock Cable in this section.
4. Connect select cable.
   - Refer to Select Cable in this section.
5. Install selector lever knob and cover.



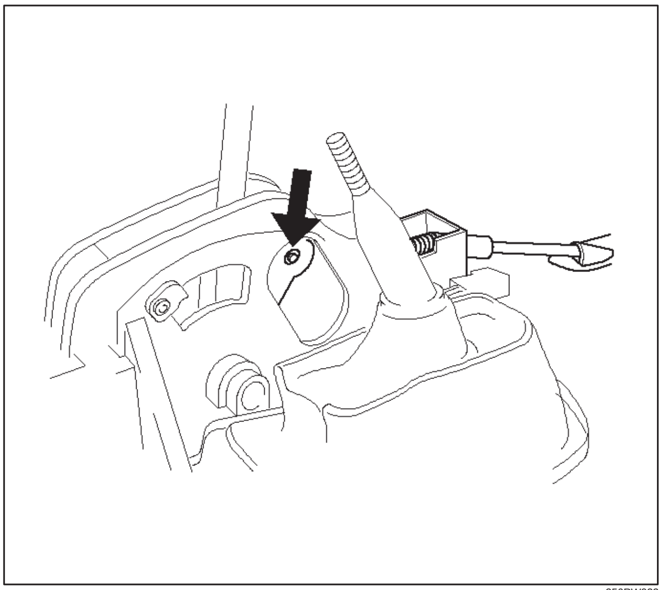
256RX002

6. Install center console.
7. Install rear console.
8. Install lower cluster assembly.
9. Install transfer control lever knob (4×4).
10. Connect negative (–) battery cable.
11. After installation, make sure that the selector lever operates normally, and that each selector position is properly indicated. (The red mark shows through the window.)

Select Cable

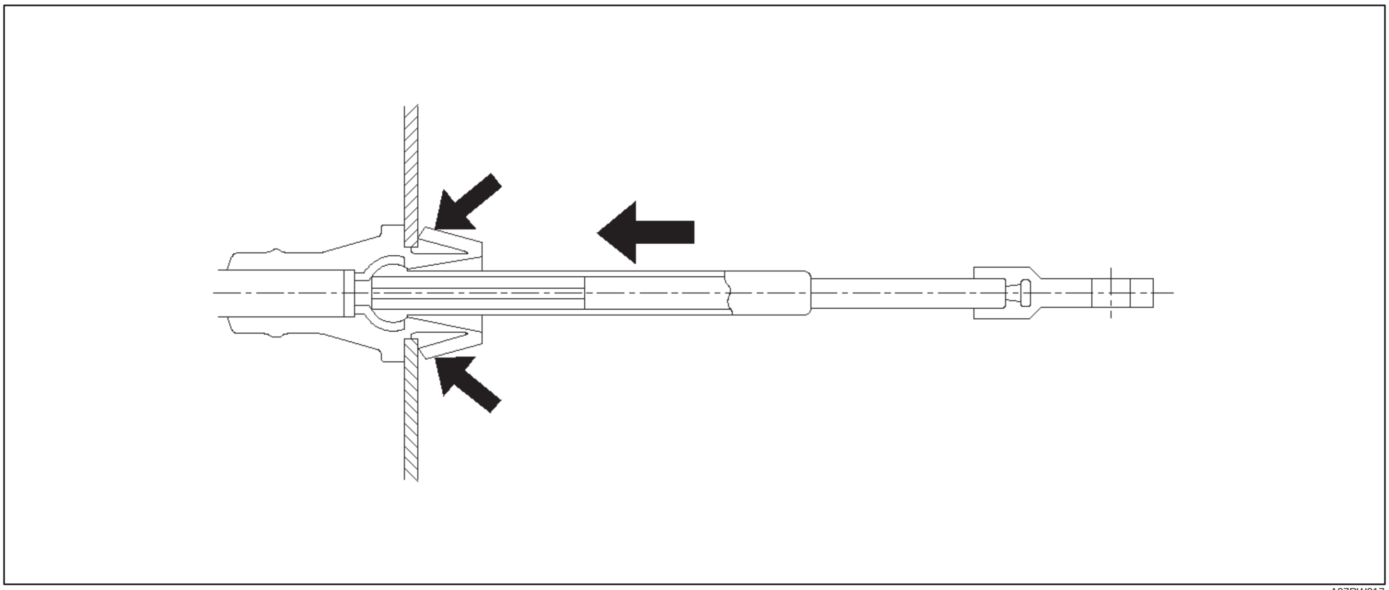
Removal

1. Set selector lever in “P” position.
2. Remove transfer control lever knob, lower cluster assembly, rear console, center console, selector lever knob and cover.
   - Refer to Selector Lever in this section.
3. Disconnect inner cable by pulling projection on pin.



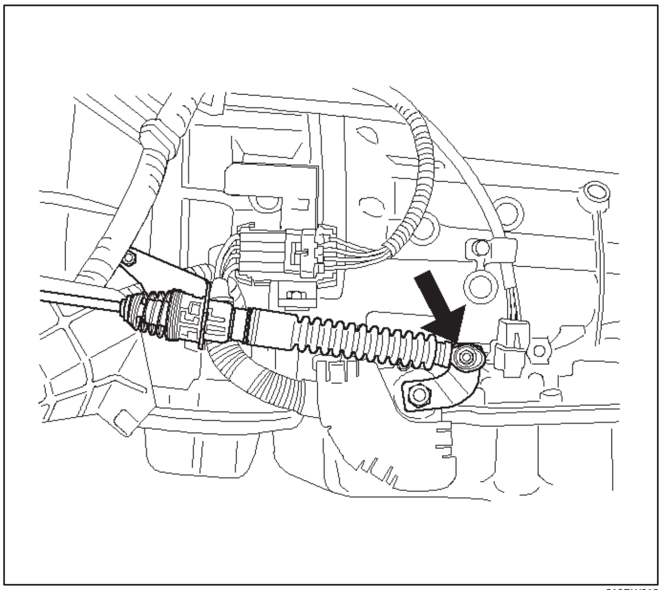
256RW022

4. Press down claws and disconnect cable assembly.



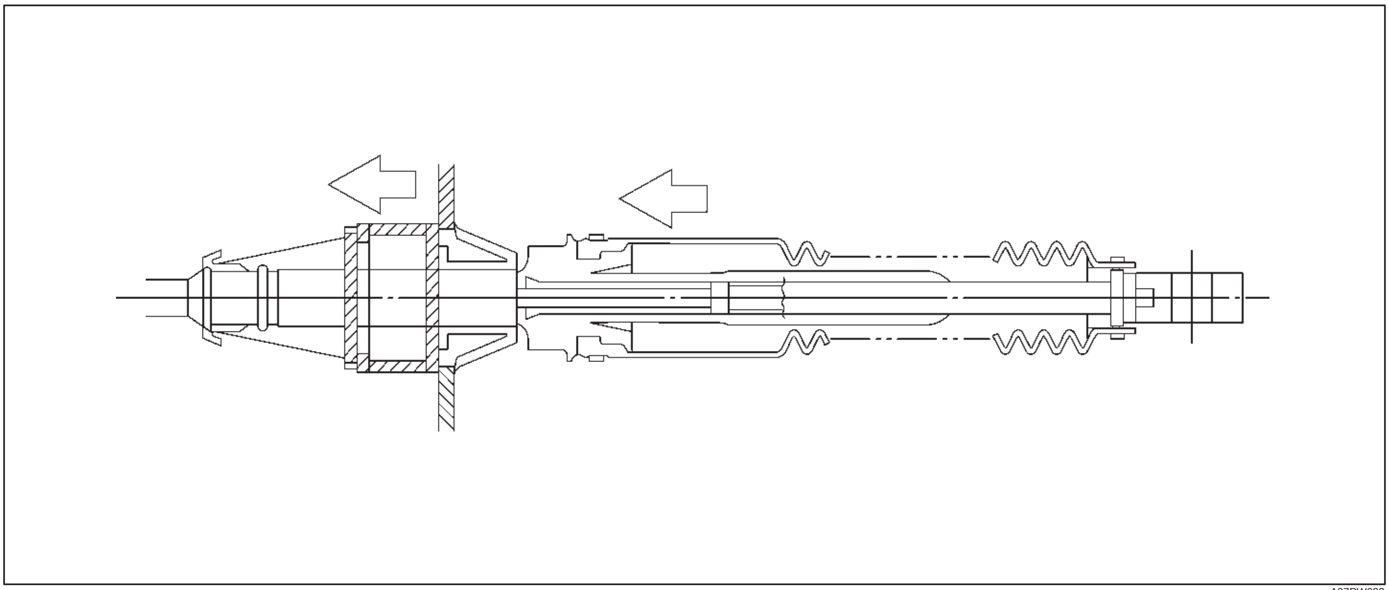
A07RW017

5. Disconnect PCM harness connectors and remove nuts that fasten grommet in select cable assembly.
6. Disconnect inner cable.



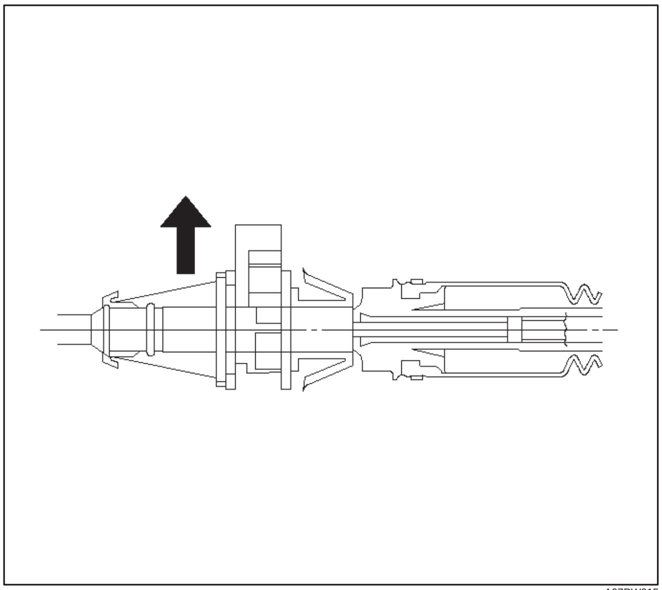
210RW013

7. Slide sleeve and disconnect cable assembly.



A07RW082

8. Pull lock.

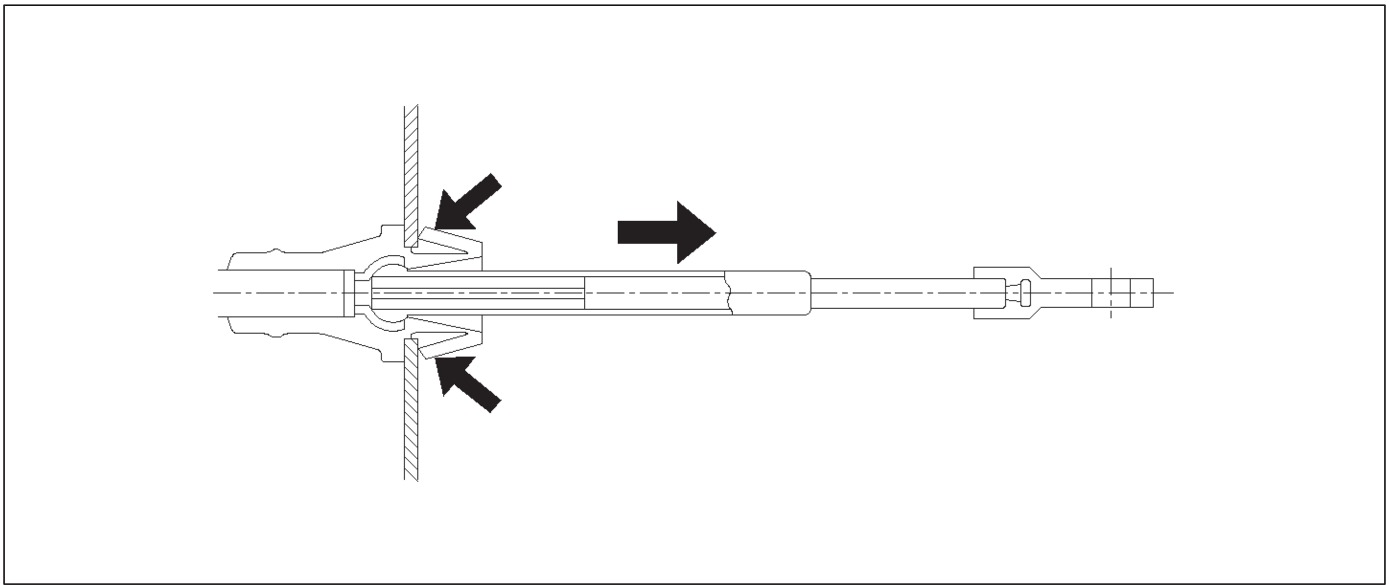


A07RW015

9. Draw select cable assembly into the interior side.

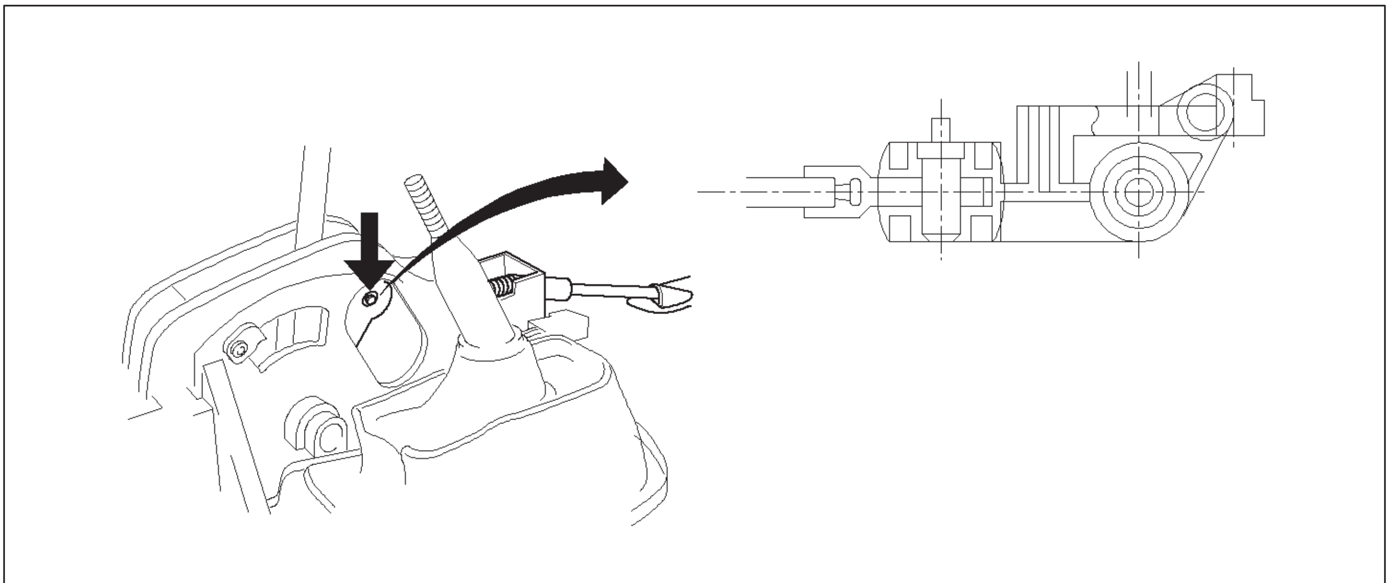
Installation

1. Set selector lever in “P” position.
2. Let out select cable transmission side end from floor hole.
3. Fit outer cable into bracket in selector lever assembly.



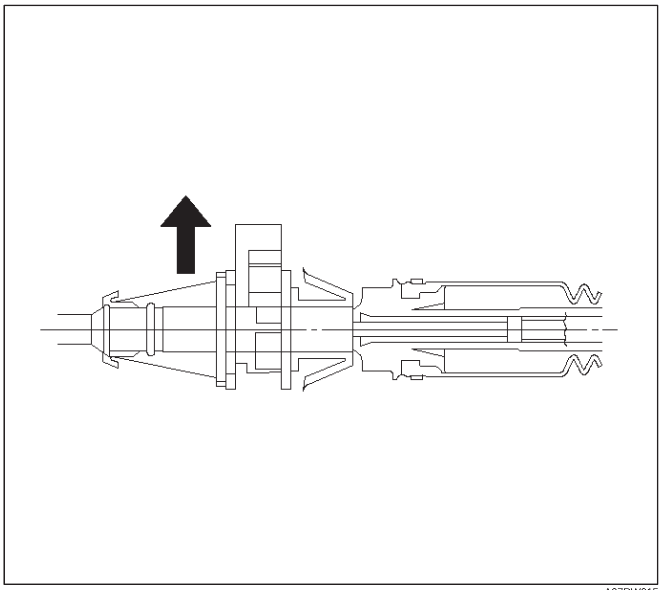
A07RW016

4. Set inner cable end in selector lever and push pin into selector lever hole and inner cable end.



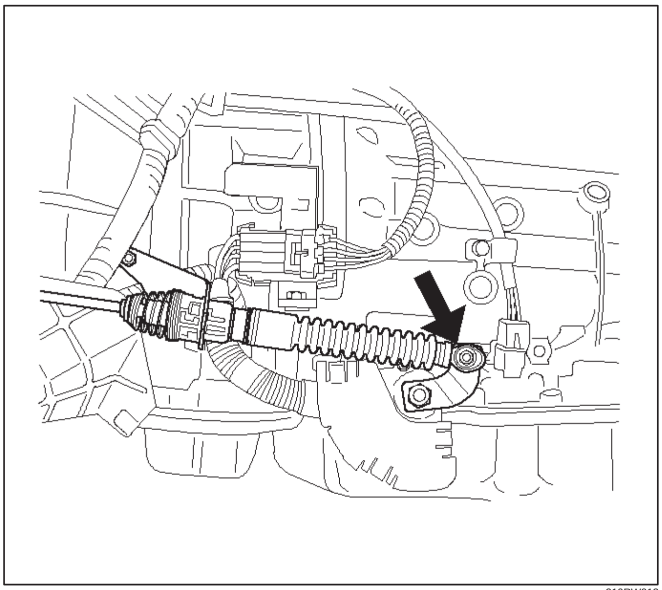
256RW023

5. Check that lock projects.



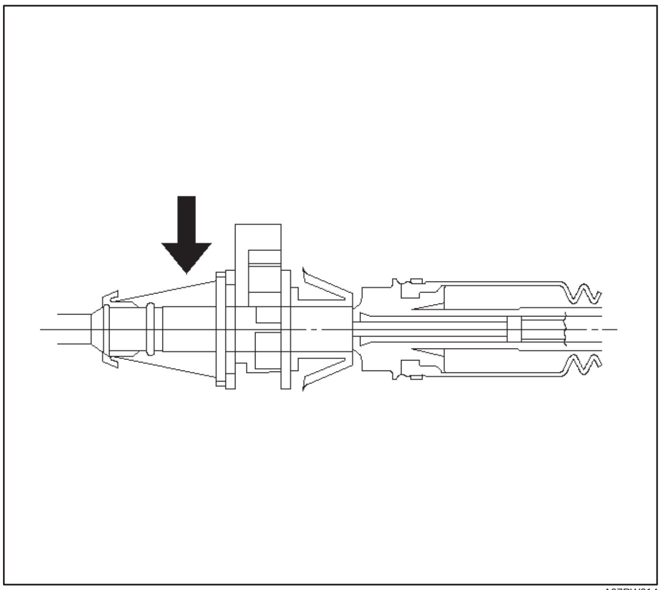
A07RW015

6. Connect adjust end fitting attachment to the bracket on transmission.
7. Set select lever “P” position and connect inner cable to select lever.



210RW013

8. Push lock into adjust end fitting attachment.



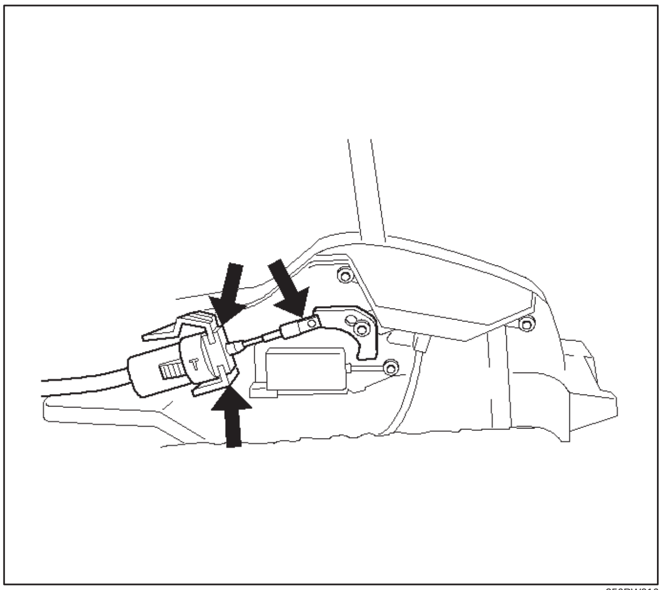
A07RW014

9. Install grommet.
10. About following installation steps, refer to Selector Lever in this section.

Shift Lock Cable

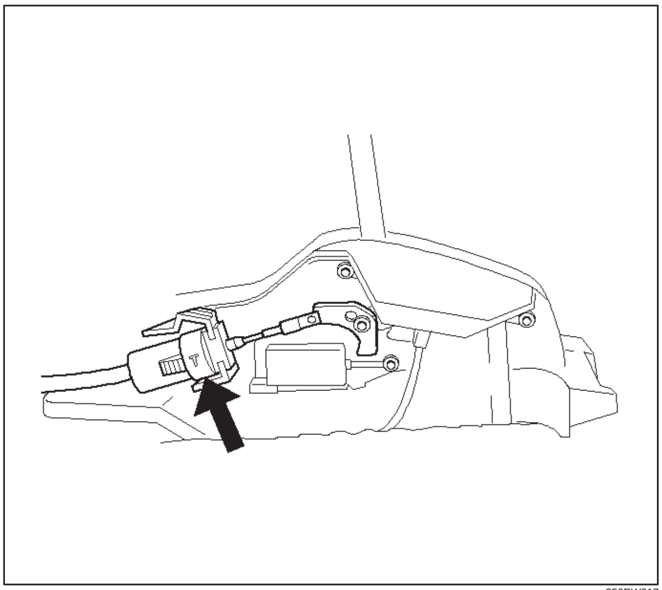
Removal

1. Set ignition key in “LOCK” position and selector lever in “P” position.
2. Remove transfer control lever knob (4×4), lower cluster assembly, rear console, center console, selector lever knob and cover.
   - Refer to Selector Lever in this section.
3. Disconnect inner cable from selector lever assembly then push claw and disconnect cable assembly.



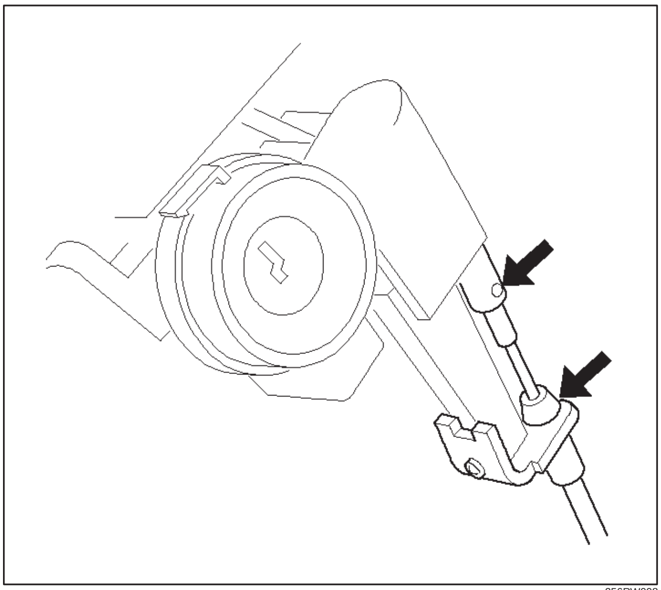
256RW016

4. Disconnect lock adjust.



256RW017

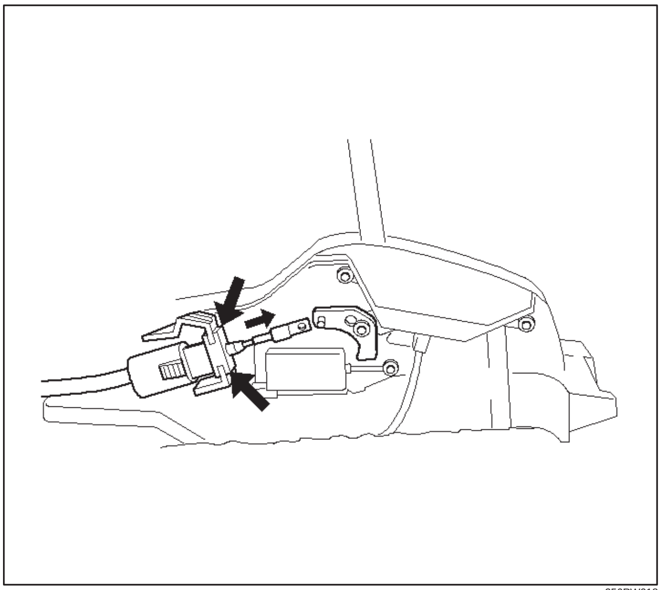
5. Remove instrument panel lower cover and steering column cover.
6. Remove spring pin and disconnect inner cable.
   - Disconnect outer cable from bracket.



256RW008

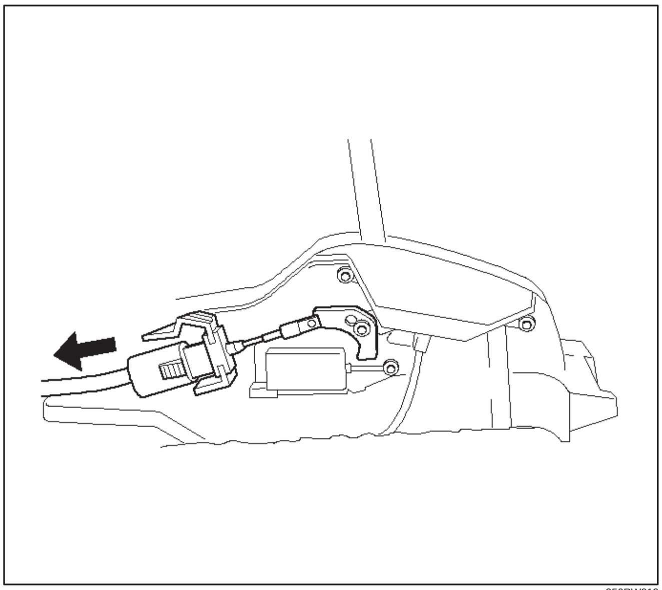
Installation

1. Set ignition key in “LOCK” position and selector lever in “P” position.
2. Connect outer cable to bracket near steering lock.
   - Connect inner cable to steering lock and install spring pin.
3. Install steering column cover and instrument lower cover.
4. Install adjust body of cable assembly to bracket in selector lever assembly.
   - Install inner cable to lever, pulling inner cable with outer cable.



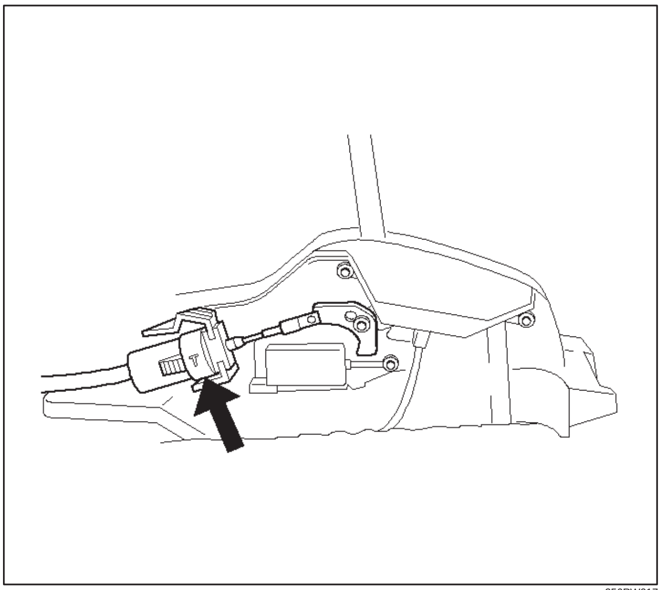
256RW018

5. Check that cable moves smoothly, lightly pulling outer cable rearward.



256RW019

6. Connect lock adjust, aligning “T” mark in the “Up” position.



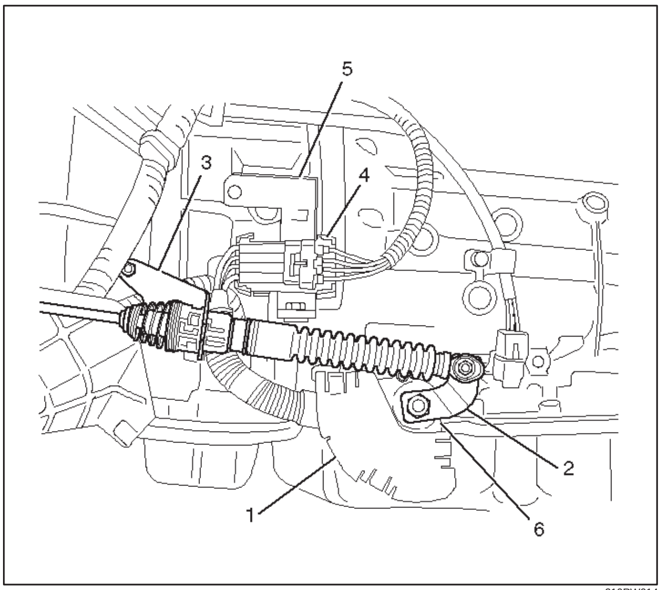
256RW017

7. About following installation steps, refer to Selector Lever in this section.
8. Check the shift lock operation:
   a. Selector lever should not be moved out of “P” position with ignition key in “Lock” position.
   b. Selector lever can be moved out of “P” position with ignition key in “ON”position only when brake pedal is depressed.
   c. ignition key can be turned to “LOCK” position only when selector lever is in “P” position (key can be pulled out).
9. If a. and c. fail, readjust cable. If b. fails, readjust connector wiring and brake pedal switch.

Mode Switch

Removal

1. Place selector lever in neutral.
2. Disconnect battery ground cable.
3. Remove mode switch cover (1).
4. Disconnect selector lever (2) from the mode switch.
5. Remove bracket with cable (3).
6. Disconnect transmission harness from the mode switch connector (4).
7. Remove bracket with mode switch connector from the transmission case.
8. Remove mode switch connector (4) from the bracket (5).
9. Remove two mode switch bolts and nut then remove mode switch (6).



210RW014

Installation

To install, follow the removal steps in the reverse order, noting the following points;

1. Torque

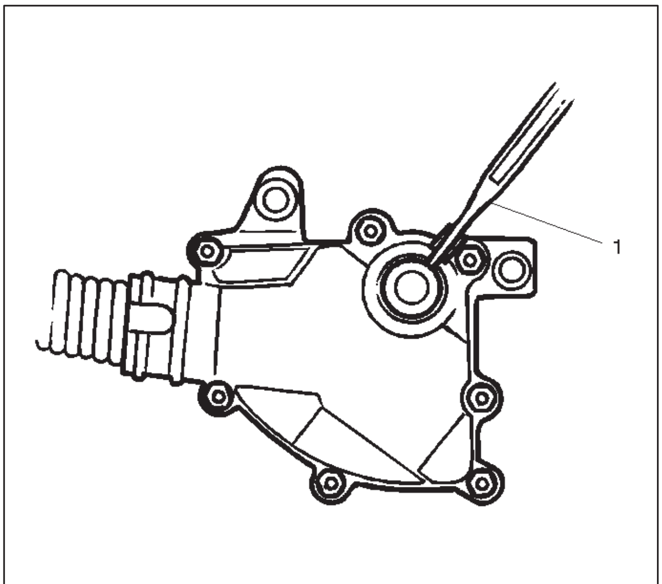
   Mode switch bolt: 13 N•m (113 lb in)

   Selector lever nut: 23 N•m (17 lb ft)

2. Mode switch setting procedure
   Perform either of the following adjustment procedures:

Procedure 1

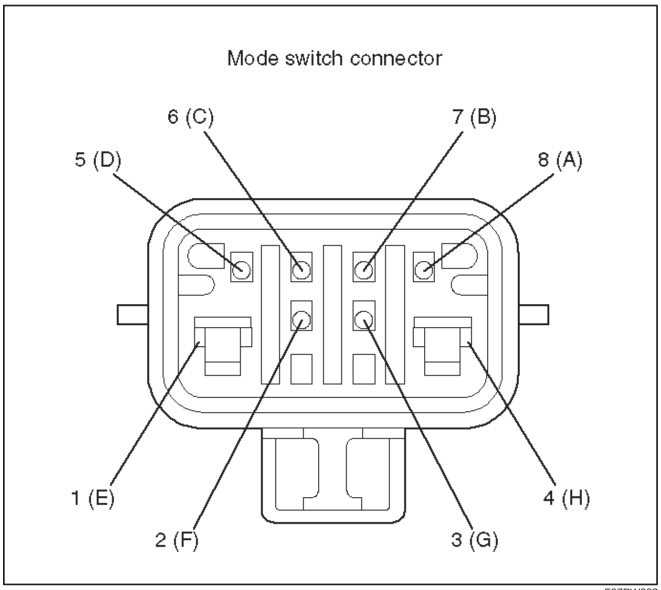
a. Place selector lever in neutral.
b. Remove selector lever from the mode switch.
c. Remove the mode switch cover.
d. Loosen the two 10 mm screws.
e. Rotate the mode switch until the slot in the mode switch housing aligns with the selector shaft bushing, and insert a 3/32 in. (2.4 mm) drill bit or punch (1) into the slot.
f. Tighten the screws to 13 N·m (113 lb in).
g. After completing adjustment, snap the mode switch cover into place.
h. Reinstall the selector lever.



249RW001

Procedure 2

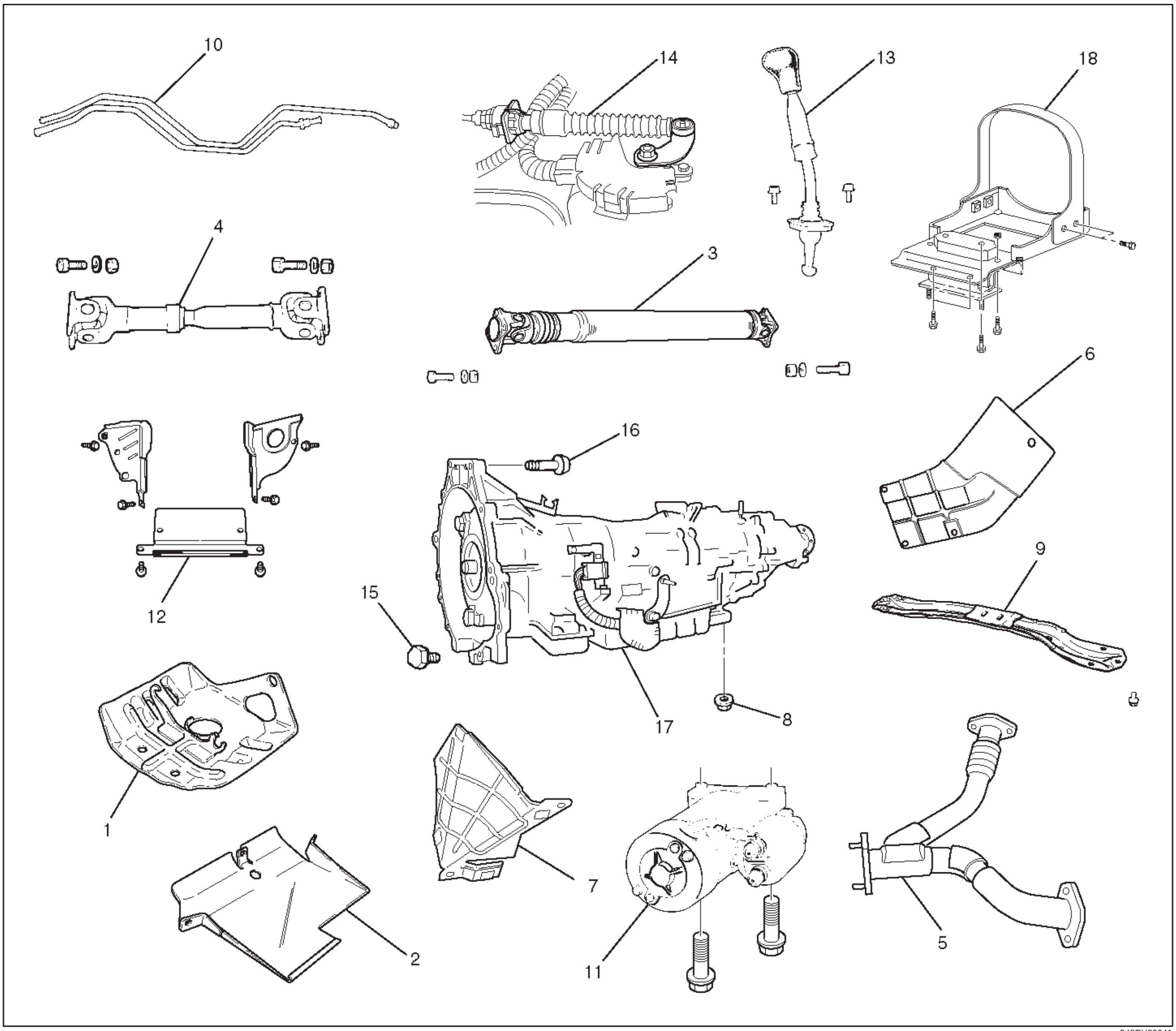
a. Place selector lever in neutral.
b. Disconnect transmission harness connector from mode switch connector.
c. Remove mode switch connector with bracket from the transmission case.
d. Connect multimeter (resistance mode) to terminals 1(E) and 4(H) on mode switch connector.
e. Loosen two mounting screws.
f. Rotate mode switch slightly in both directions to determine the range (approx. 5 degrees) of electrical contact.
g. Position mode switch in middle of contact range.
h. Tighten two mounting screws.
i. Remove multimeter and install mode switch harness connector with bracket to the transmission case.
j. Connect transmission harness connector to mode switch connector.



F07RW003

Transmission (With Transfer Case)

Transmission and Associated Parts



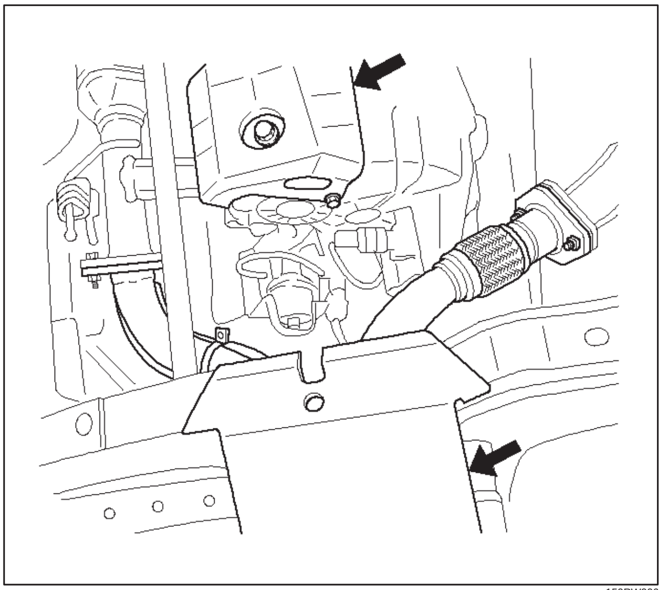
Legend

- (1) Transfer Protector (4×4)
- (2) Fairing Plate
- (3) Rear Propeller Shaft
- (4) Front Propeller Shaft (4×4)
- (5) Center Exhaust Pipe (4×4)
- (6) Fuel Pipe Heat Protector
- (7) Harness Heat Protector
- (8) Rear Mount Nut
- (9) Third Crossmember
- (10) Transmission Oil Cooler Pipe
- (11) Starter
- (12) Under Cover
- (13) Transfer Control Lever (4×4)
- (14) Select Cable
- (15) Torque Converter Bolt
- (16) Engine-Transmission Bolt
- (17) Transmission Assembly (With Transfer Case)
- (18) Rear Mount Rubber and Propeller Protector Assembly (4×2)

Removal

NOTE: Before remove transmission and transfer assembly from vehicle, change the transfer mode to 2WD using push button on dash panel.

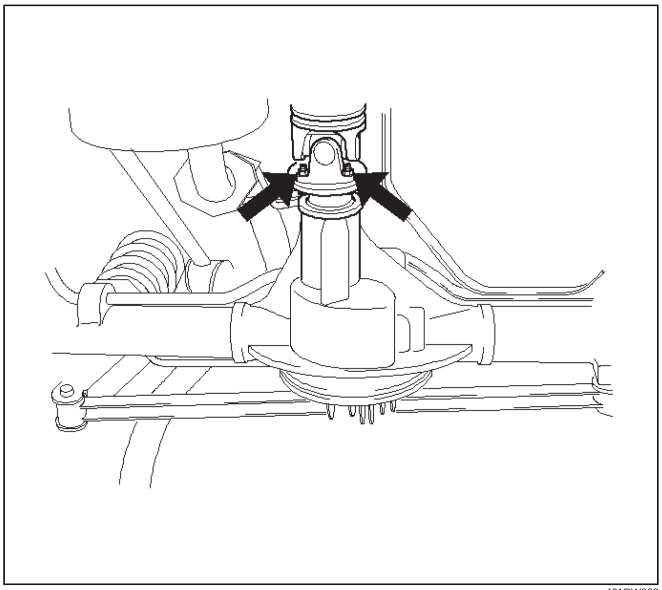
1. Disconnect battery ground cable.
2. Remove transfer protector (4×4) and fairing plate.



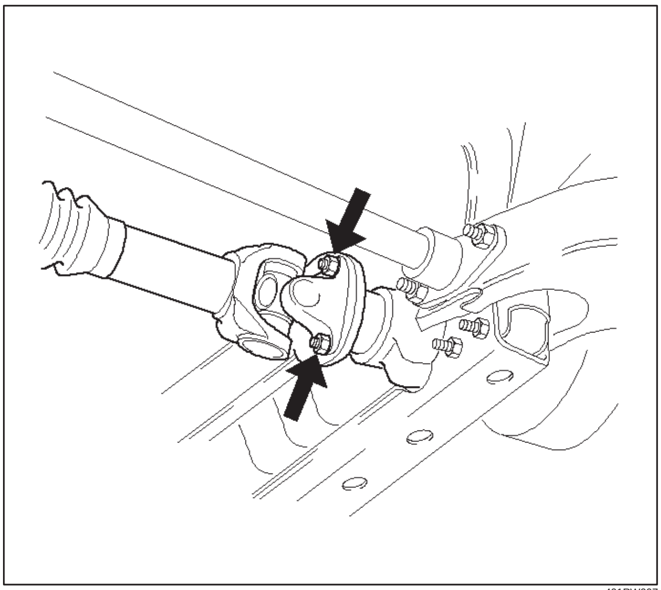
150RW006

3. Remove rear propeller shaft and front propeller shaft (4×4).

NOTE: Apply alignment marks on the flange at both front and rear sides.

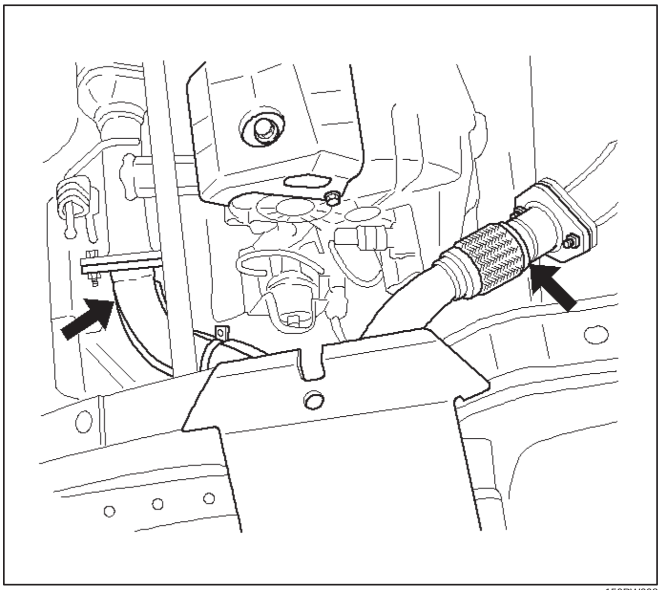


401RW008



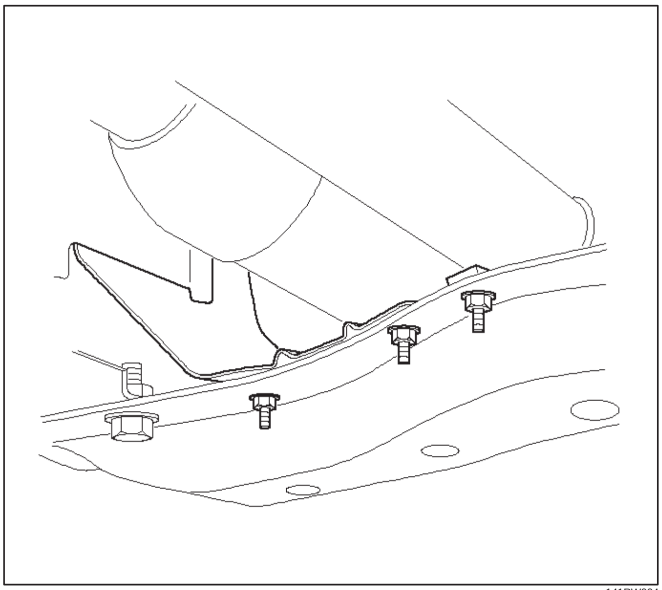
401RW007

4. Remove center exhaust pipe (4×4).



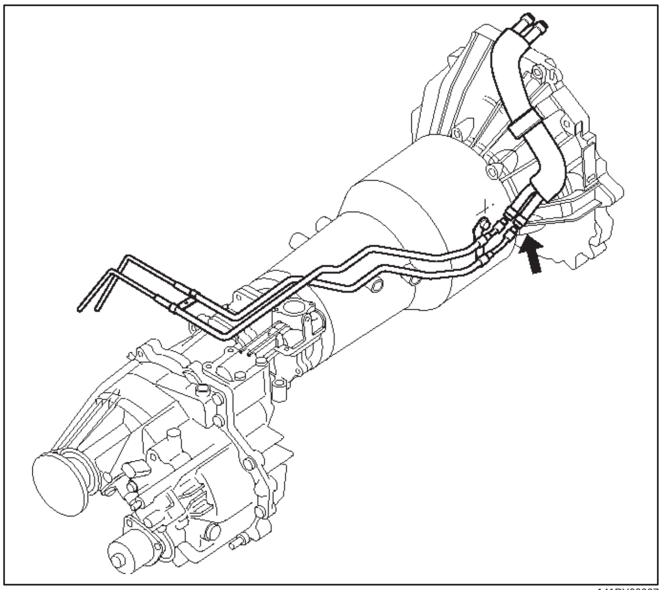
150RW008

5. Remove fuel pipe heat protector and clip.



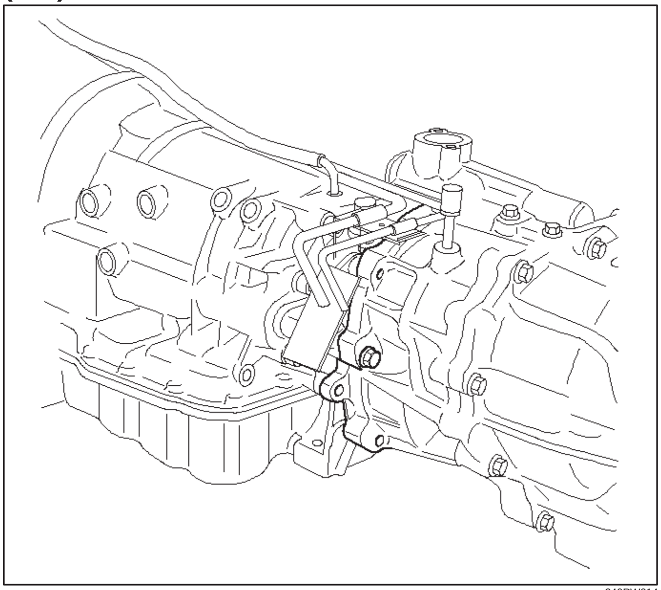
141RW004

6. Disconnect fuel pipe bracket from transmission side.



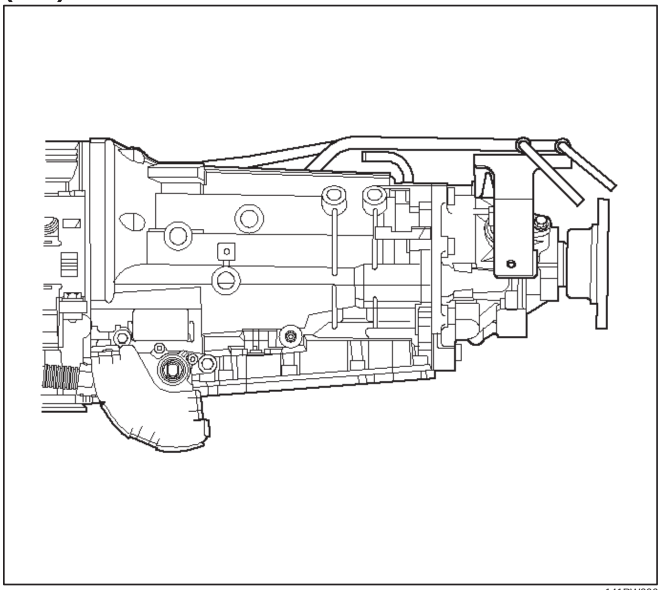
141RY00007

(4×4)



240RW014

(4×2)



141RW006

Fuel hose connector removal procedure

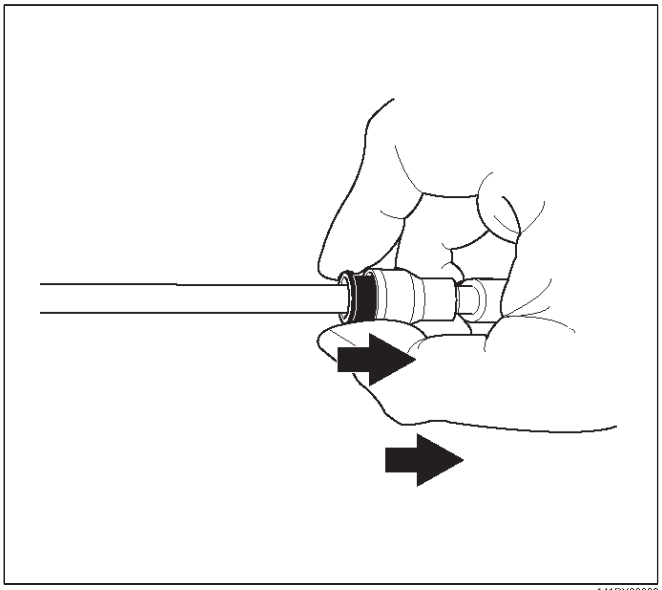
If removal of the fuel hose connector is required for transmission servicing and/or replacement, follow the steps below.

NOTE:

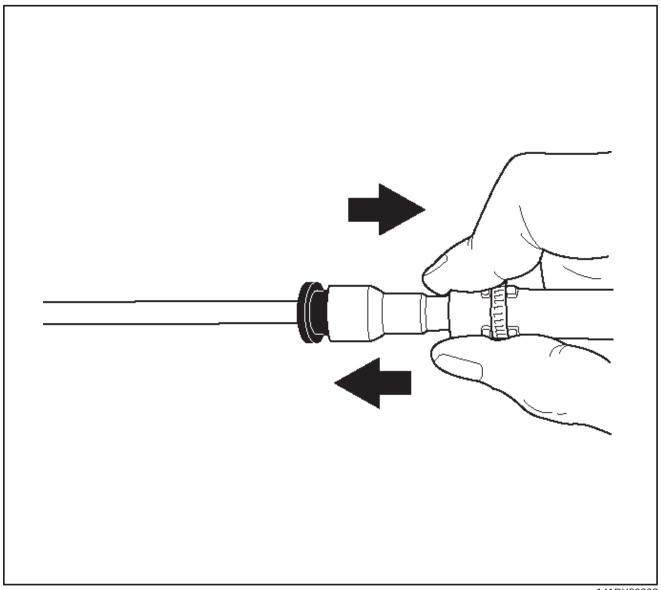
- An O-ring is used as a seal between the fuel pipe and the connector. Take care not to damage the contact surfaces during the removal procedure. Do not allow the serfaces to become contaminated with dirt or other foreign material.
- Perform the entire removal procedure with your hands. Do not use tools.

1. **Separating the connector and fuel pipe**
   1. Clean the fuel pipe and connector to remove mud and other dirt.
   2. Pull the black plastic piece toward the connector. Hold the piece near the connector. Pull the connector from the fuel pipe.

      If the connector and fuel pipe are stuck together, jiggle the connector back and forth to loosen the connector. Do not yank the connector from the fuel pipe.

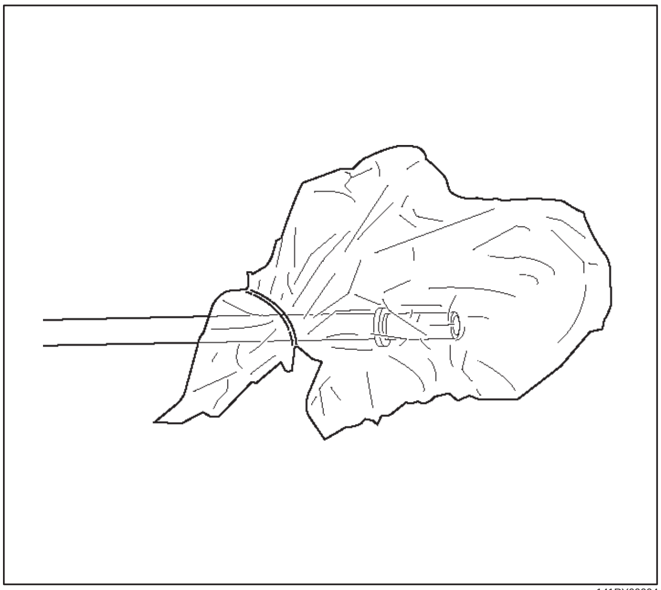


141RY00002



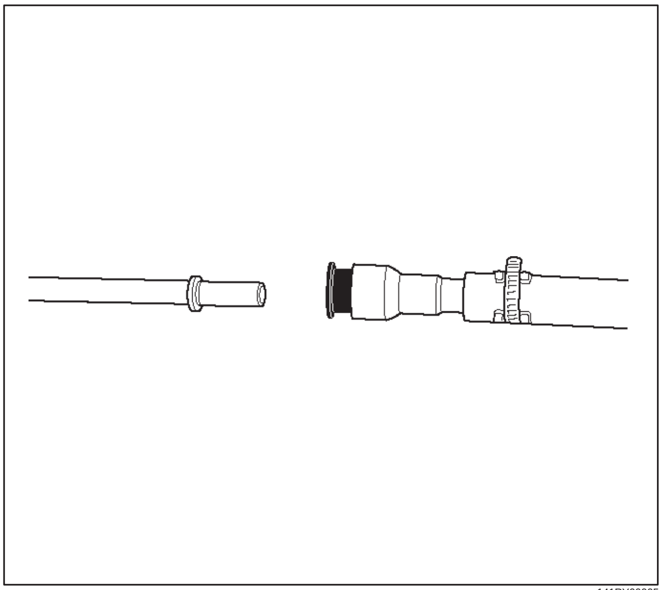
141RY00003

   3. Tie a vinyl bag around the connector and fuel pipe to protect them from dirt.



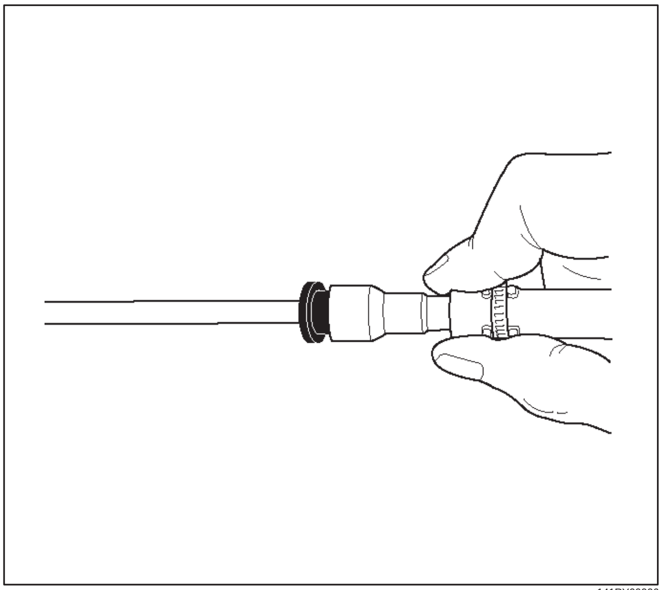
141RY00004

2. **Joining the connector and fuel hose**
   1. Remove the vinyl bags from the connector and fuel hose. Check that the contact surfaces are undamaged and free of dirt and other foreign material. Clean if necessary.
   2. Align the axis of the fuel pipe and connector. Push the connector into the fuel pipe until a distinct click is heard.



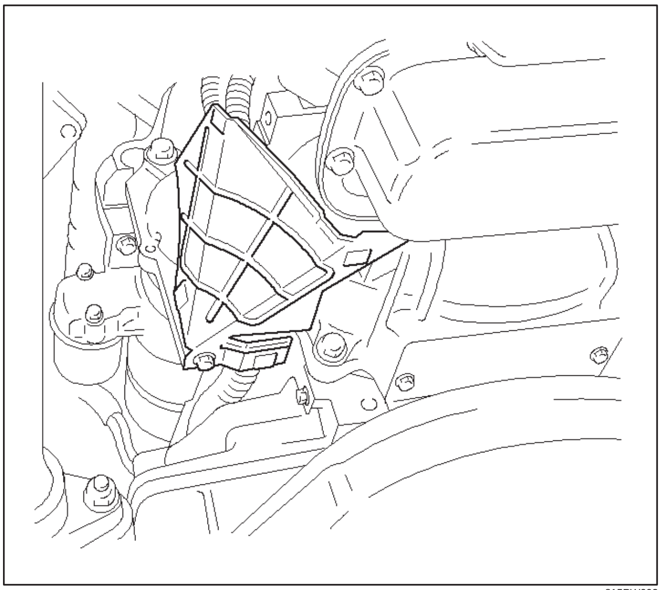
141RY00005

   3. Gently pull on the connector to check that it is securely latched.



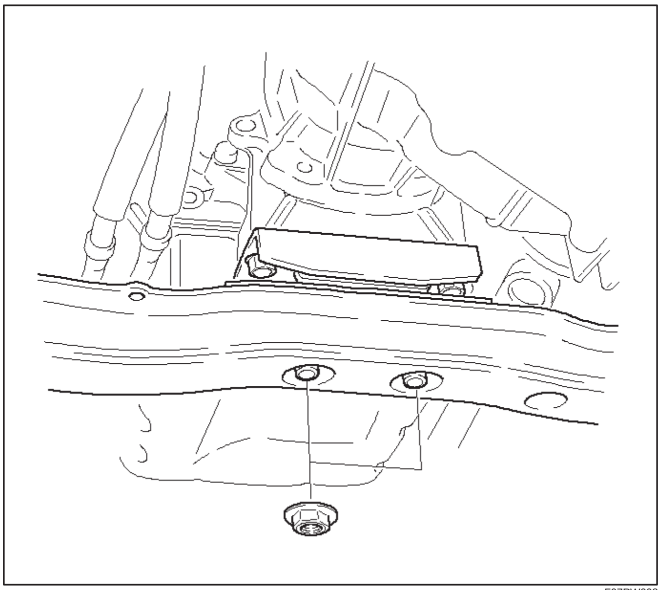
141RY00006

7. Disconnect transmission harness connector and clip.
   Connector : Adapter case, mode switch, main case, magnetic sensor, transfer switch (4×4), 2–4 actuator (4×4) and car speed sensor.
8. Remove harness heat protector.



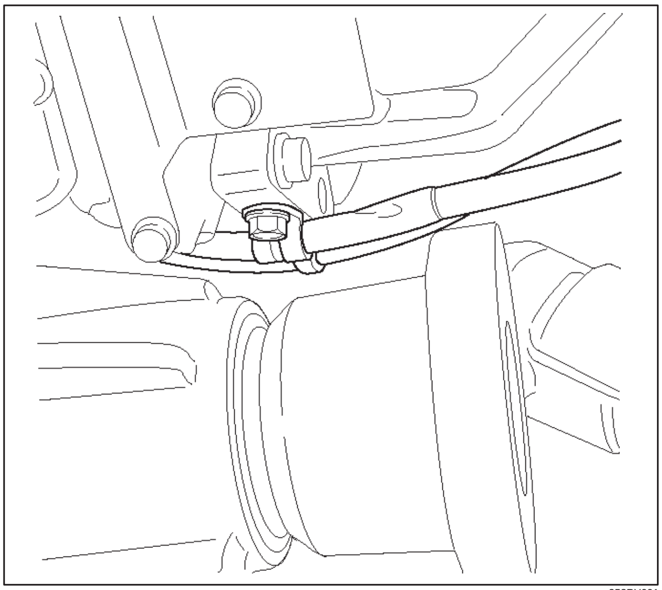
815RW002

9. Support transmission with a jack.
   Remove rear mount nuts from third crossmember.



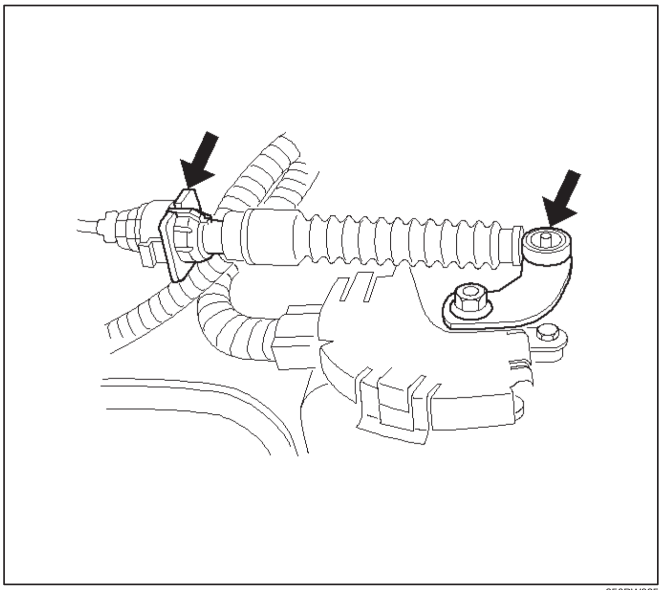
F07RW008

10. Remove third crossmember.
11. Disconnect transmission oil cooler pipes from A/T side.
12. Remove oil pipe clamp and bracket from the converter housing.



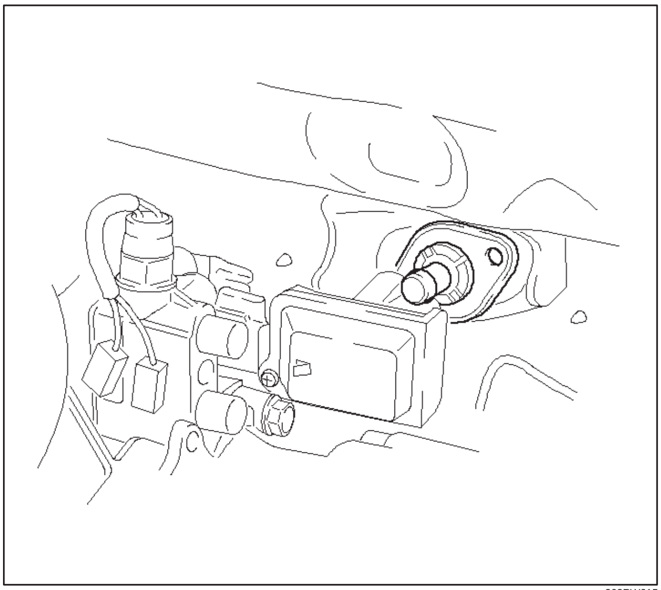
253RY001

13. Loosen oil cooler pipe clamp bolt at the engine mount side.
14. Remove select cable by disconnecting inner cable from select lever and removing outer cable with bracket.



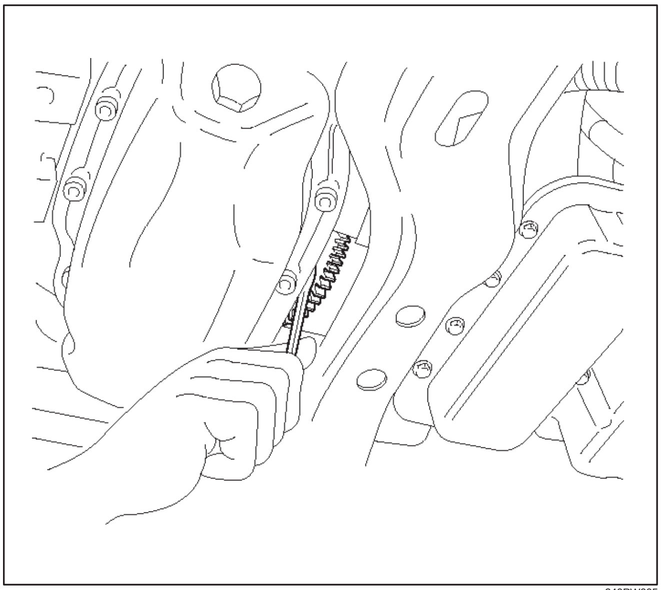
256RW025

15. Remove starter.
16. Remove under covers from the transmission and engine.
17. Remove transfer control lever fixing bolts and push up transfer control lever.



262RW015

18. Remove flex plate torque converter fixing bolts (6 pieces) by turning crankshaft.

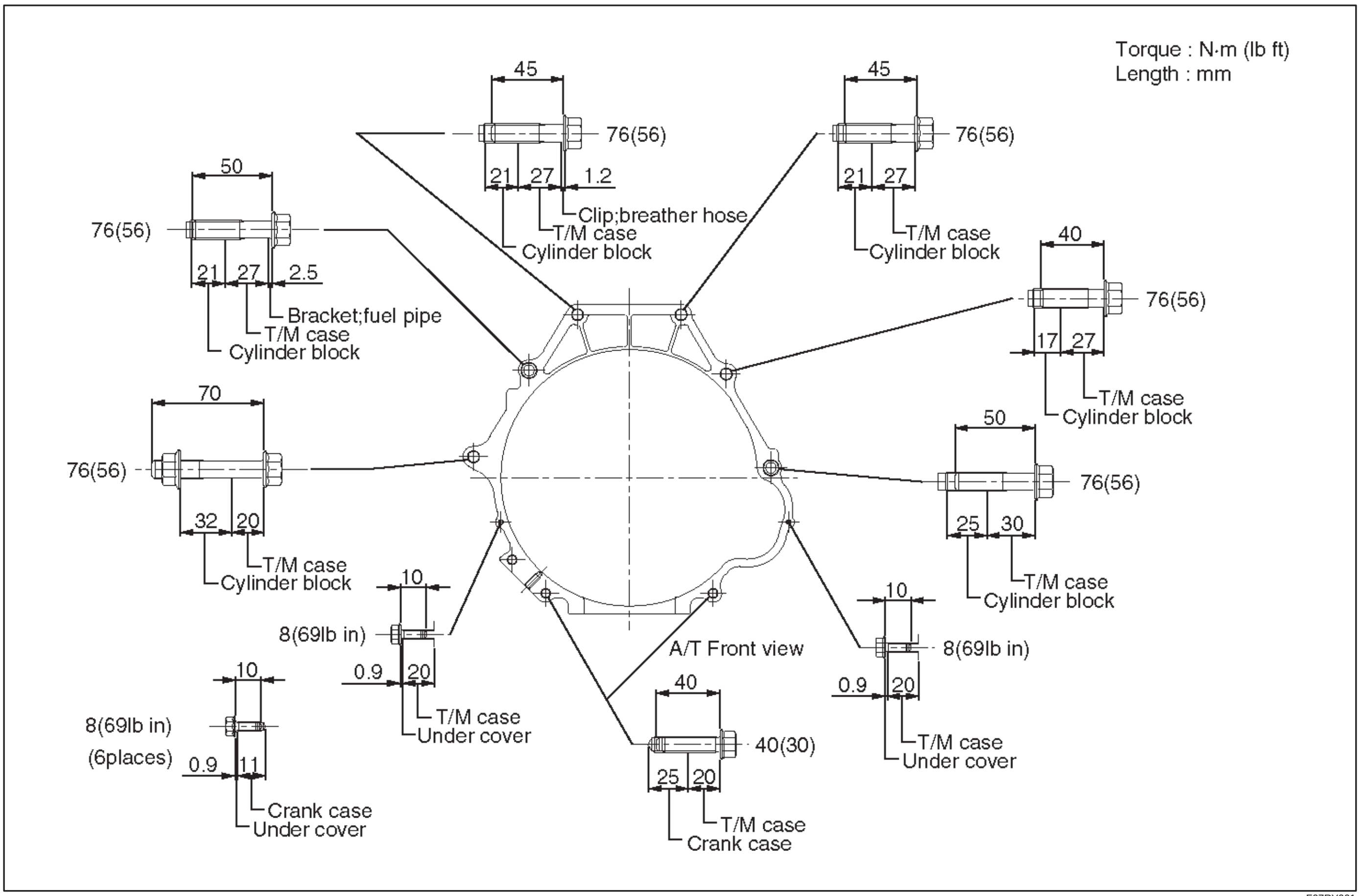


240RW005

19. Remove engine transmission fixing bolts.
20. Pull out transmission from the engine.
21. Remove the rear mount rubber and propeller protector assembly if required (4×2).

Installation

1. Slowly raise transmission jack until front of the transmission is aligned with rear of the engine. Join the transmission to the engine.
2. Tighten engine transmission bolts as shown in the figure.

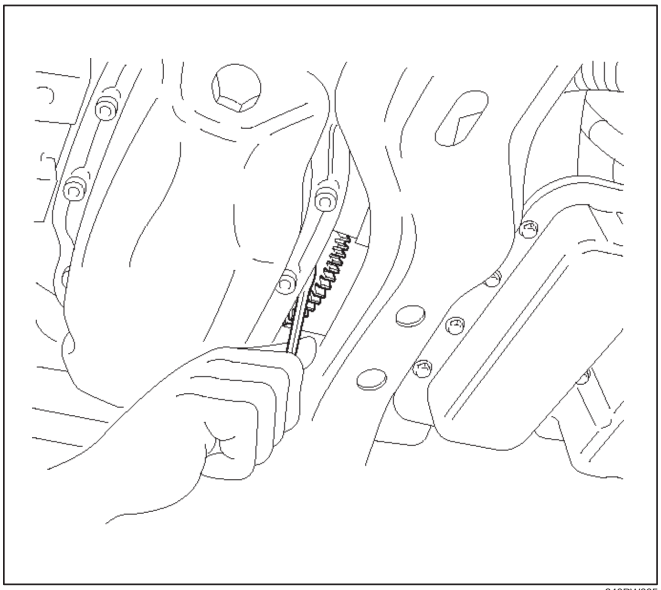


F07RY001

3. Align the flex plate torque converter bolt boss with flex plate hole by turning the torque converter. Install flex plate torque converter bolts (6 pieces) by turning the crankshaft.

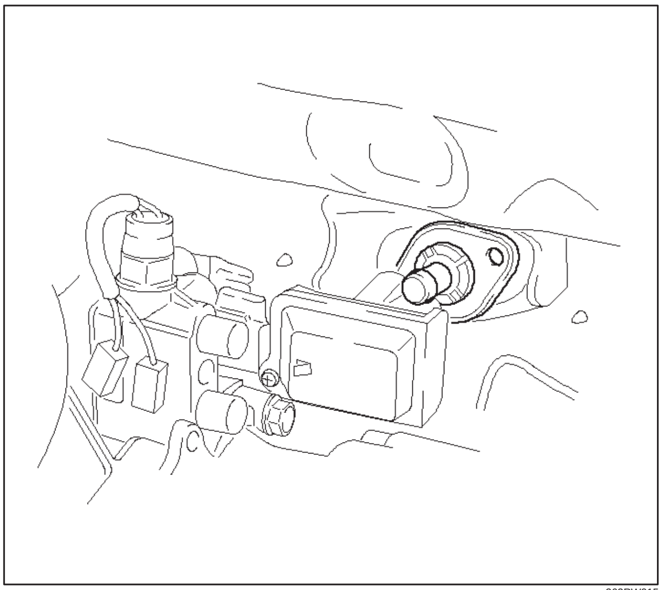
Torque: 54 N•m (40 lb ft)

NOTE: Do not reuse the flex plate torque converter bolt.



240RW005

4. Install transfer control lever on the transfer case (4×4).


262RW015

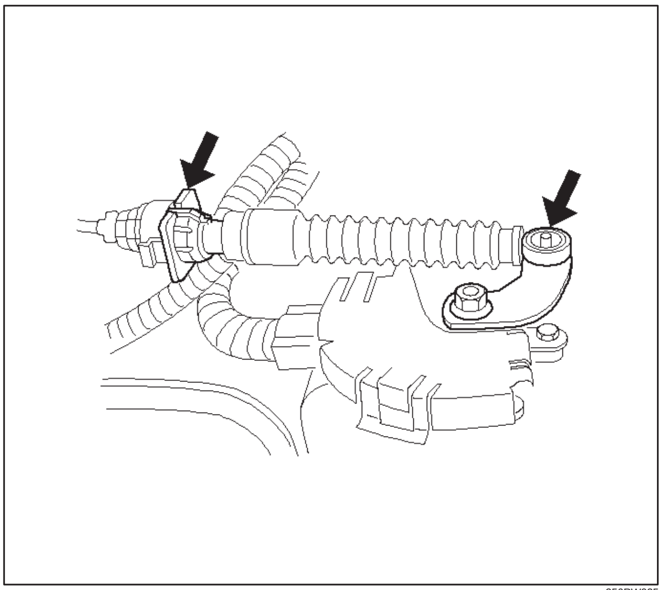
5. Install under covers to the transmission and engine.

Torque: 8 N•m (69 lb in)

6. Install starter.

Torque: 40 N•m (30 lb ft)

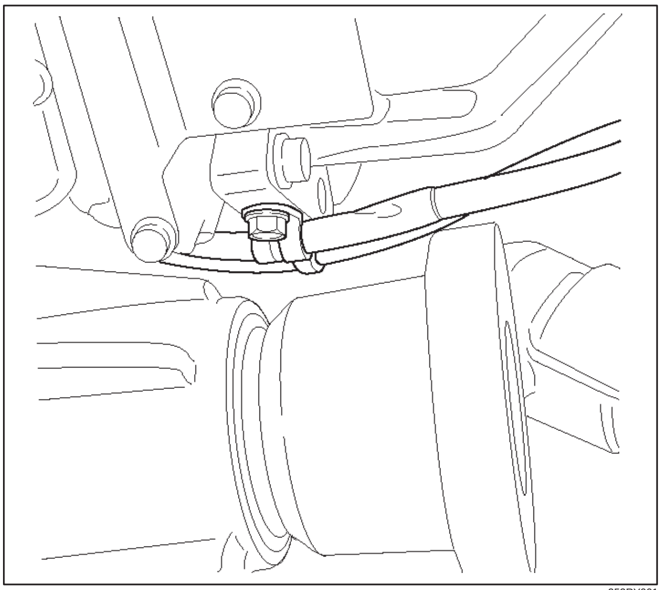
7. Install select cable by connecting inner cable to select lever and installing outer cable with bracket.


256RW025

8. Connect transmission oil cooler pipes to A/T.

Torque: 44 N•m (33 lb ft)

9. Install oil cooler pipe clamp and bracket to the converter housing.

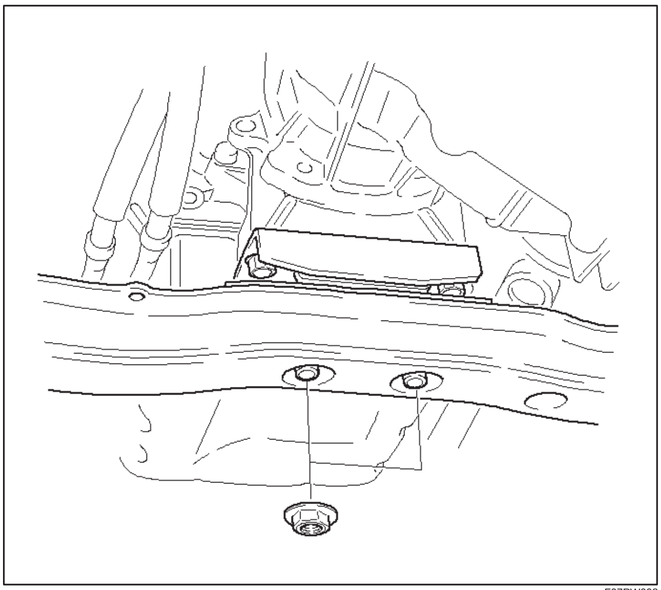

253RY001

10. Tighten oil cooler pipe clamp bolt at the engine mount side.
11. Install third crossmember.

Torque: 76 N•m (56 lb ft)

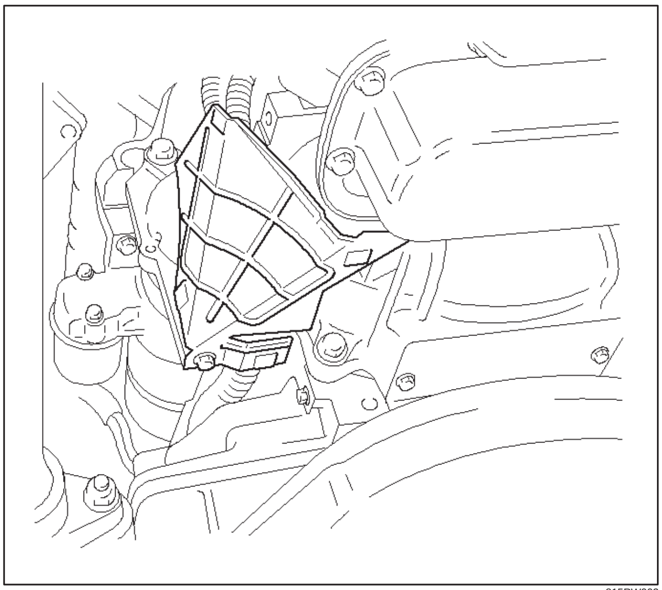
12. Install rear mount nuts.

Torque: 50 N•m (37 lb ft)


F07RW008

13. Install harness heat protector.

Torque: 6 N•m (52 lb in)



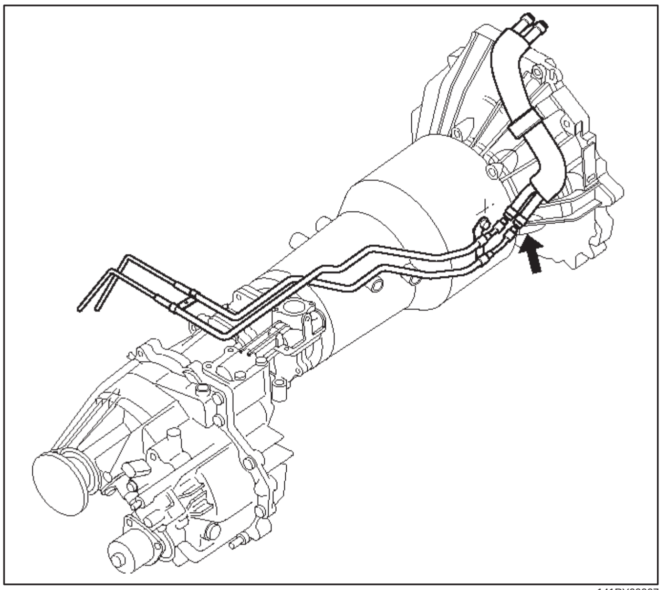
815RW002

14. Connect transmission harness connector and clip.

Connector : Adapter case, mode switch, main case, magnetic sensor, transfer switch, 2–4 actuator and car speed sensor.

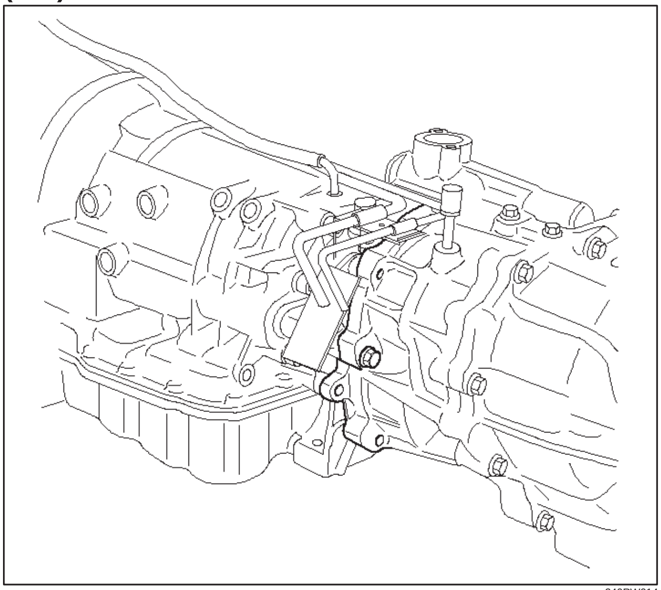
15. Connect fuel pipe bracket to transmission side.

NOTE: See “NOTE” of removal steps.



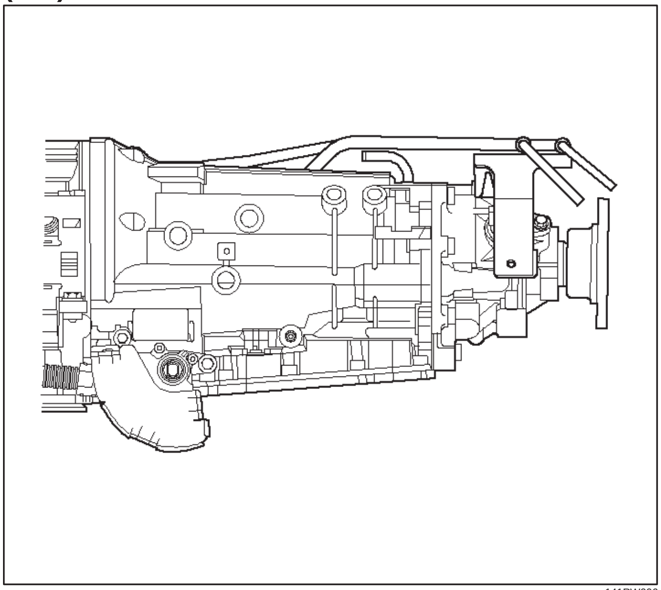
141RY00007

(4×4)



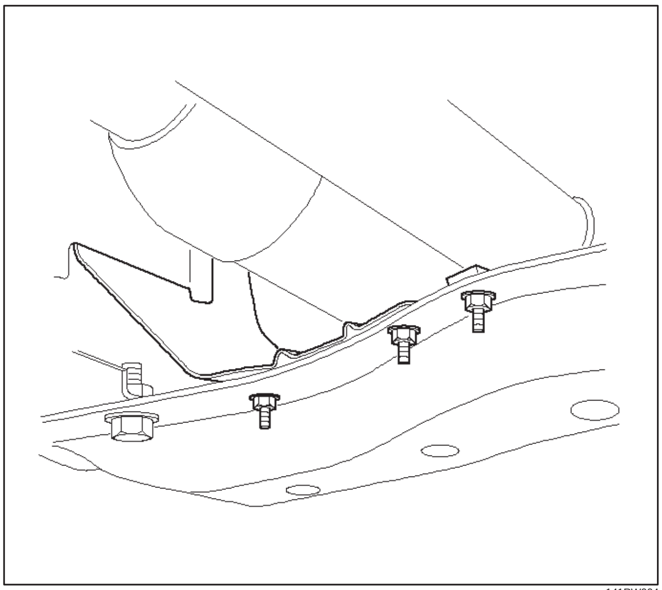
240RW014

(4×2)



141RW006

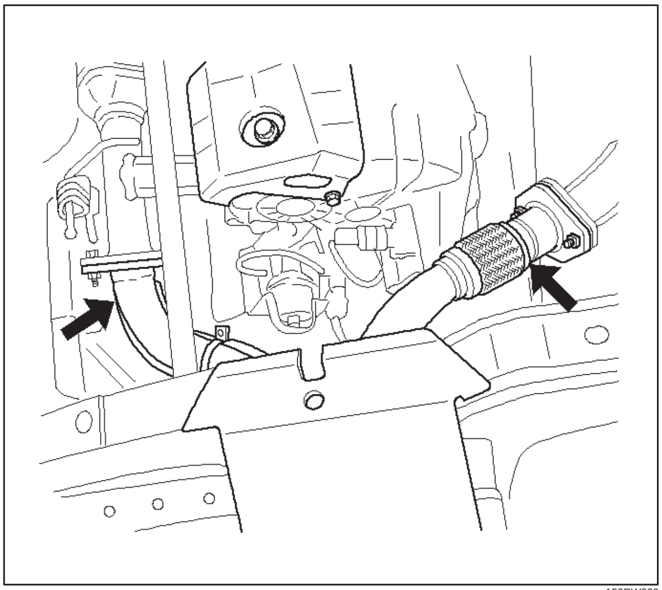
16. Install fuel pipe heat protector and clip.



141RW004

17. Install center exhaust pipe (4×4).

Torque: 43 N•m (32 lb ft)

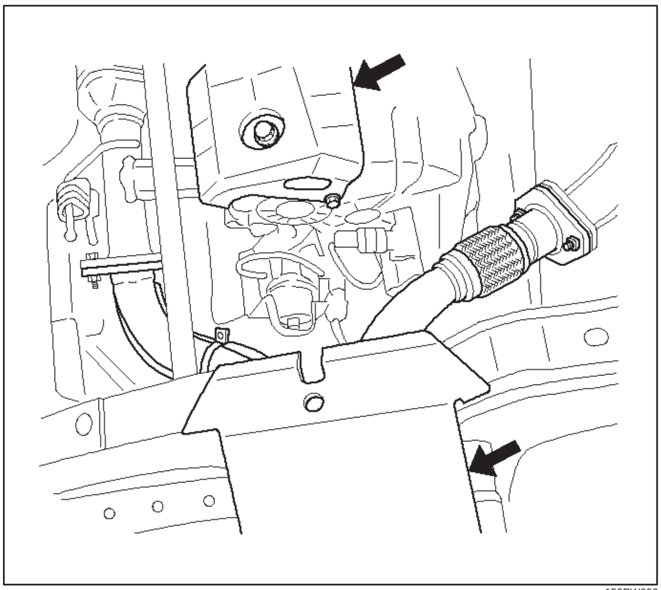


150RW008

18. Install front propeller shaft (4×4) and rear propeller shaft.

Torque: 63 N•m (46 lb ft)

19. Install transfer protector (4×4) and fairing plate.

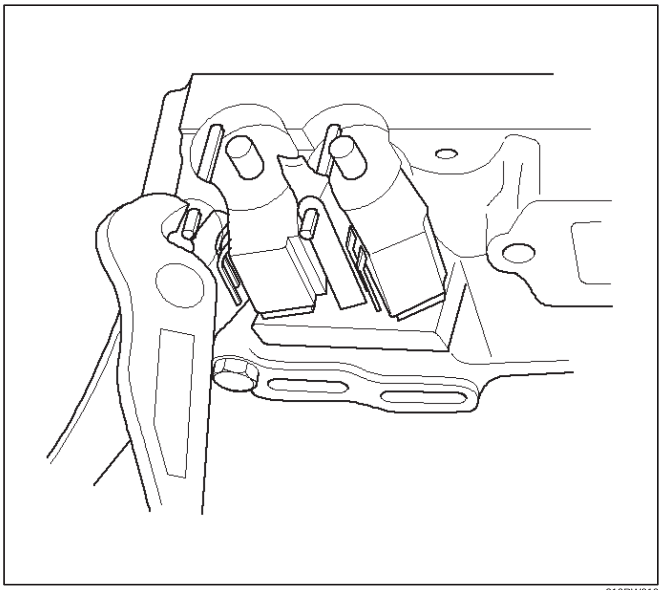


150RW006

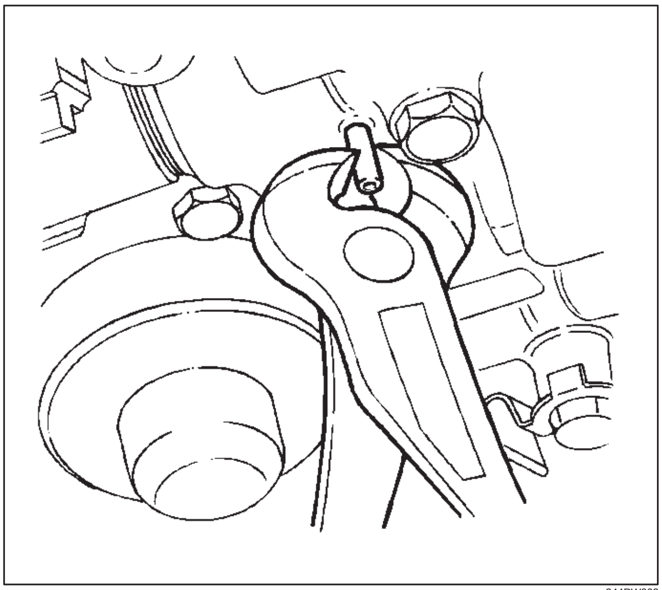
Solenoid (Main Case Valve Body)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove sixteen 10 mm screws, main case oil pan, magnet, and gasket.
5. Remove three 13 mm screws, oil filter.
6. Disconnect wiring harness from band control solenoid and shift solenoids. Pull only on connectors, not on wiring harness.
7. Remove spring pin for shift solenoid A, shift solenoid B, and band control solenoid respectively, using suitable pliers taking care not to damage solenoids.



210RW010

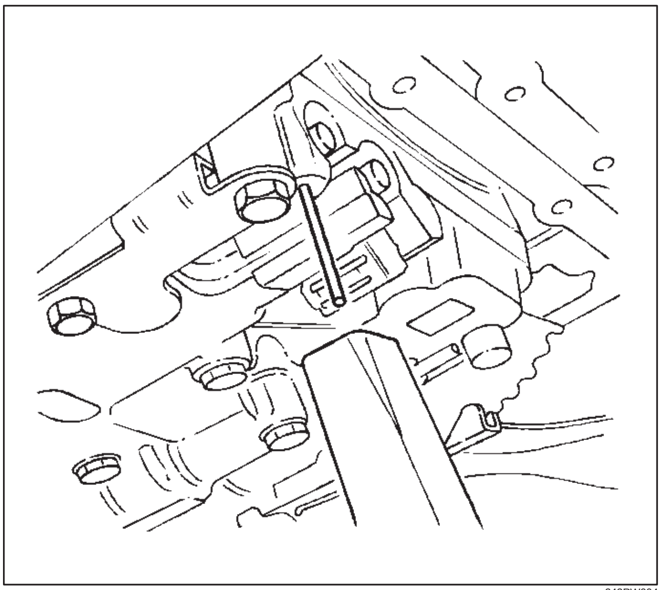


244RW003

8. Remove shift solenoid A, shift solenoid B, band control solenoid, and gaskets from main case valve body. Do not pull on wiring harness. Remove solenoids by grasping the metal tip.

Installation

1. Install shift solenoid A, shift solenoid B, band control solenoid with new gaskets to main case valve body respectively.
2. Carefully install spring pin with hammer to avoid damage to valve body, etc.



243RW004

3. Connect wiring harness to solenoids.
4. Install oil filter with a new gasket and the three 13 mm screws, tighten to the specified torque.

Torque: 20 N•m (15 lb ft)

5. Install magnet, main case oil pan with new gasket, and sixteen 10 mm screws. Tighten the screws to the specified torque.

Torque: 11 N•m (96 lb in)

6. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®–III. Refer to Changing Transmission Fluid in this section.
7. Connect battery ground cable.

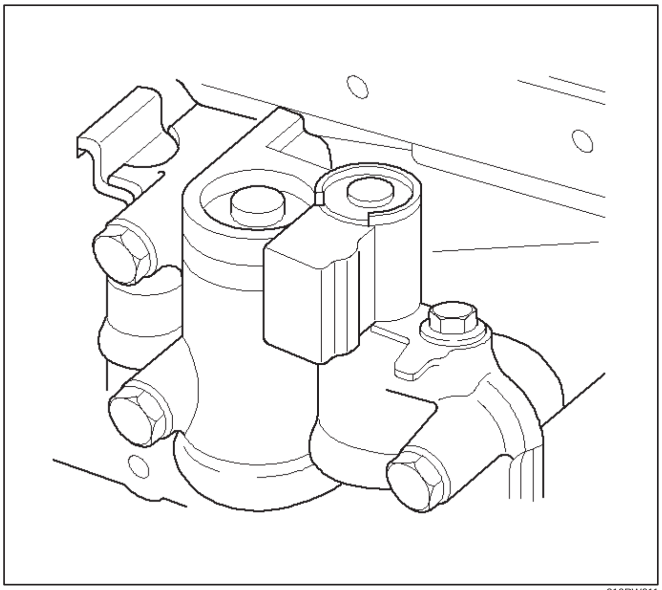
Solenoid (Adapter Case Valve Body)

Removal

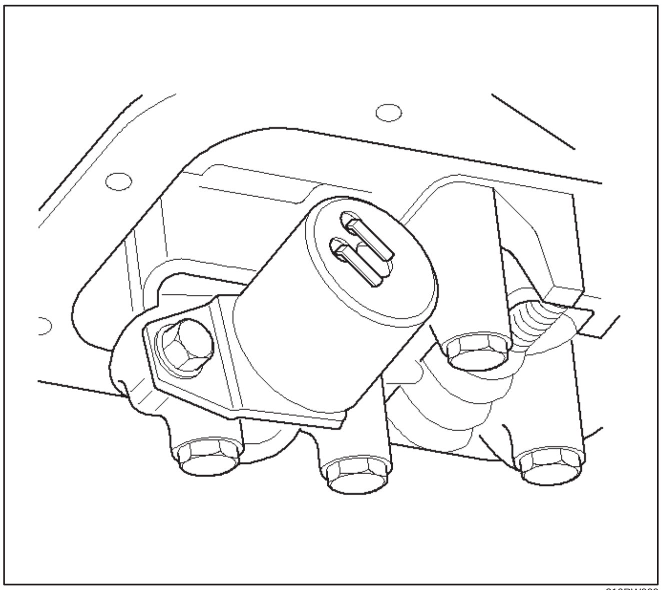
1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove adapter case oil pan twelve fixing 10 mm screws, adapter case oil pan, and gasket.

NOTE: Oil pan still contains transmission fluid. Place a large drain container under the oil pan and drain the fluid carefully.

5. Disconnect wiring harness from force motor solenoid and converter clutch solenoid. Pull only on connectors, not on wiring harness.
6. Remove 11 mm bolt and converter clutch solenoid with two O-rings.


210RW011

7. Remove 11 mm bolt, retainer, and force motor solenoid.


210RW009

Installation

1. Install force motor solenoid, retainer, and 11 mm bolt to adapter case valve body. Tighten the bolt to the specified torque.

Torque: 10 N•m (87 lb in)

2. Install converter clutch solenoid with two O-rings, and 11 mm bolt to adapter case valve body. Tighten the bolt to the specified torque.

Torque : 10 N•m (87 lb in)

3. Connect wiring harness assembly to solenoids.
4. Install adapter case oil pan, new gasket, and twelve 10 mm screws. Tighten the screws to the specified torque.

Torque : 11 N•m (96 lb in)

5. Fill transmission through overfill screw hole oil pan, using ATF DEXRON®–III. Refer to Changing Transmission Fluid in this section.
6. Connect battery ground cable.

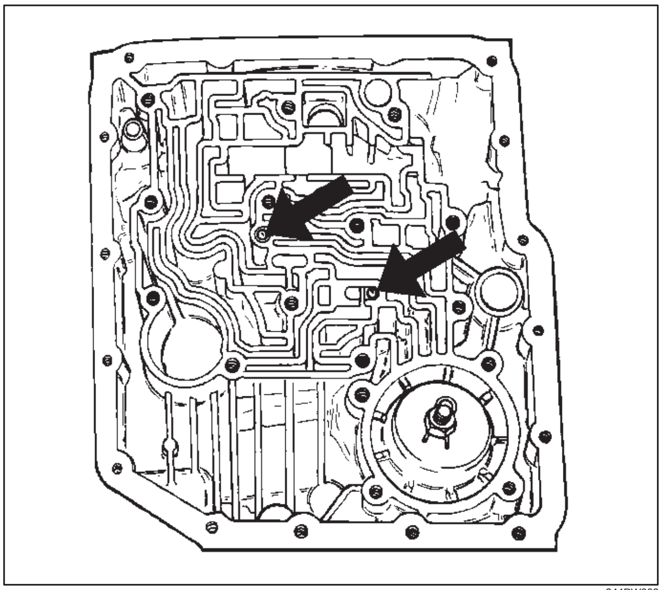
Valve Body Assembly (Main Case)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove sixteen 10 mm screws, main case oil pan, magnet and gasket.
5. Remove three 13 mm oil filter fixing screws, then remove oil filter.
6. Remove two 13 mm manual detent fixing screws, then remove roller and spring assembly.
7. Disconnect wiring harness from band control solenoid and shift solenoids. Pull only on connectors, not on wiring harness.
8. Remove four 13 mm servo cover fixing screws, then remove servo cover and gasket.
9. Remove seven 13 mm valve body fixing screws.
10. Remove main case valve body with manual valve link and transfer plate. Note the position of the link (long end into valve, short end into range selector lever).
11. Remove transfer plate gasket from main case.
12. Remove two check balls from main case.

Installation

1. Install two check balls to main case.



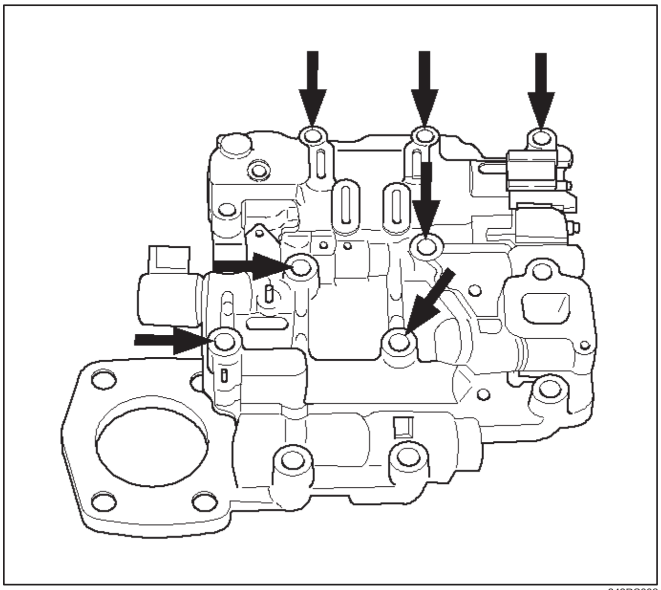
244RW002

2. Inspect electrical 7 way connector and seal of main case. Replace if necessary.
3. Use two J–25025–B guide pin to install main case.
   - Install valve body complete assembly and manual valve link.

NOTE: Valve must be extended as the short end of manual valve link is connected to the range selector lever. Long end of link goes into valve.

4. Install seven 13 mm screws, and tighten them to the specified torque.

Torque: 20 N•m (15 lb ft)



243RS008

5. Remove two guide pins from main case.
6. Install servo cover gasket, cover, and four 13 mm screws. Tighten the screws to the specified torque.

Torque: 25 N•m (18 lb ft)

7. Connect wiring harness to band control and shift solenoids.
8. Install roller and spring assembly to manual detent.
   - Install two 13 mm screws, and tighten them to the specified torque.

Torque: 20 N•m (15 lb ft)

9. Install oil filter and three 13 mm screws. Tighten to the specified torque.

Torque : 20 N•m (15 lb ft)

10. Install oil pan gasket, magnet, oil pan and sixteen 10 mm screws. Tighten the screws to the specified torque.

Torque: 11 N•m (96 lb in)

11. Fill transmission through overfill screw hole of oil pan, using ATF DEXRON®–III. Refer to Changing Transmission Fluid in this section.
12. Connect battery ground cable.

Valve Body Assembly (Adapter Case)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove twelve 10 mm adapter case oil pan fixing screws, adapter case oil pan, and gasket.

NOTE: Oil pan still contains transmission fluid. Place a large drain container under the oil pan.

Drain the fluid carefully.

5. Disconnect wiring harness from force motor solenoid and converter clutch solenoid. Pull only on connectors, not on wiring harness.
6. Remove seven 13 mm screws from adapter case valve body assembly, then remove transfer plate, two gaskets, and adapter case valve body.

Installation

1. Inspect electrical 4 way connector and seal of adapter case. Replace if necessary.
2. Install gasket, transfer plate, and gasket.
3. Install adapter case valve body and seven 13 mm screws. Tighten the screws to the specified torque.

Torque: 20 N•m (15 lb ft)

4. Connect wiring harness assembly to converter clutch solenoid and force motor.
5. Install oil pan gasket, oil pan, and twelve 10 mm screws. Tighten the screws to the specified torque.

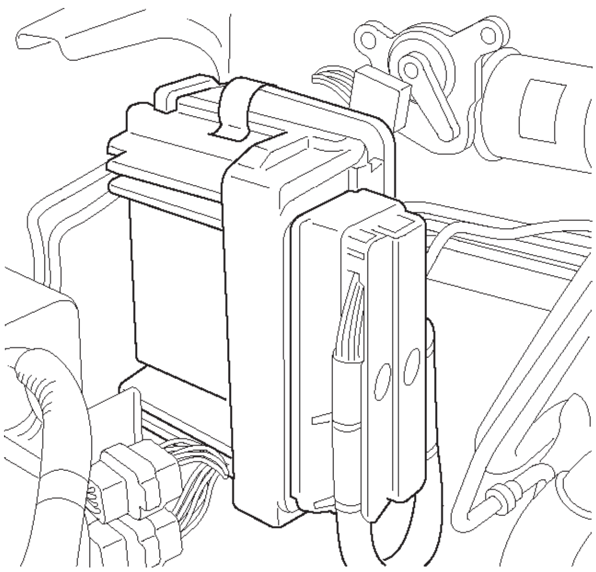
Torque: 11 N•m (96 lb in)

6. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®–III, refer to Changing Transmission Fluid in this section.
7. Connect battery ground cable.

Powertrain Control Module (PCM)

Removal

1. Disconnect battery ground cable.
2. Disconnect PCM wiring harness connectors from PCM.
3. Remove PCM from bracket.



826RY001

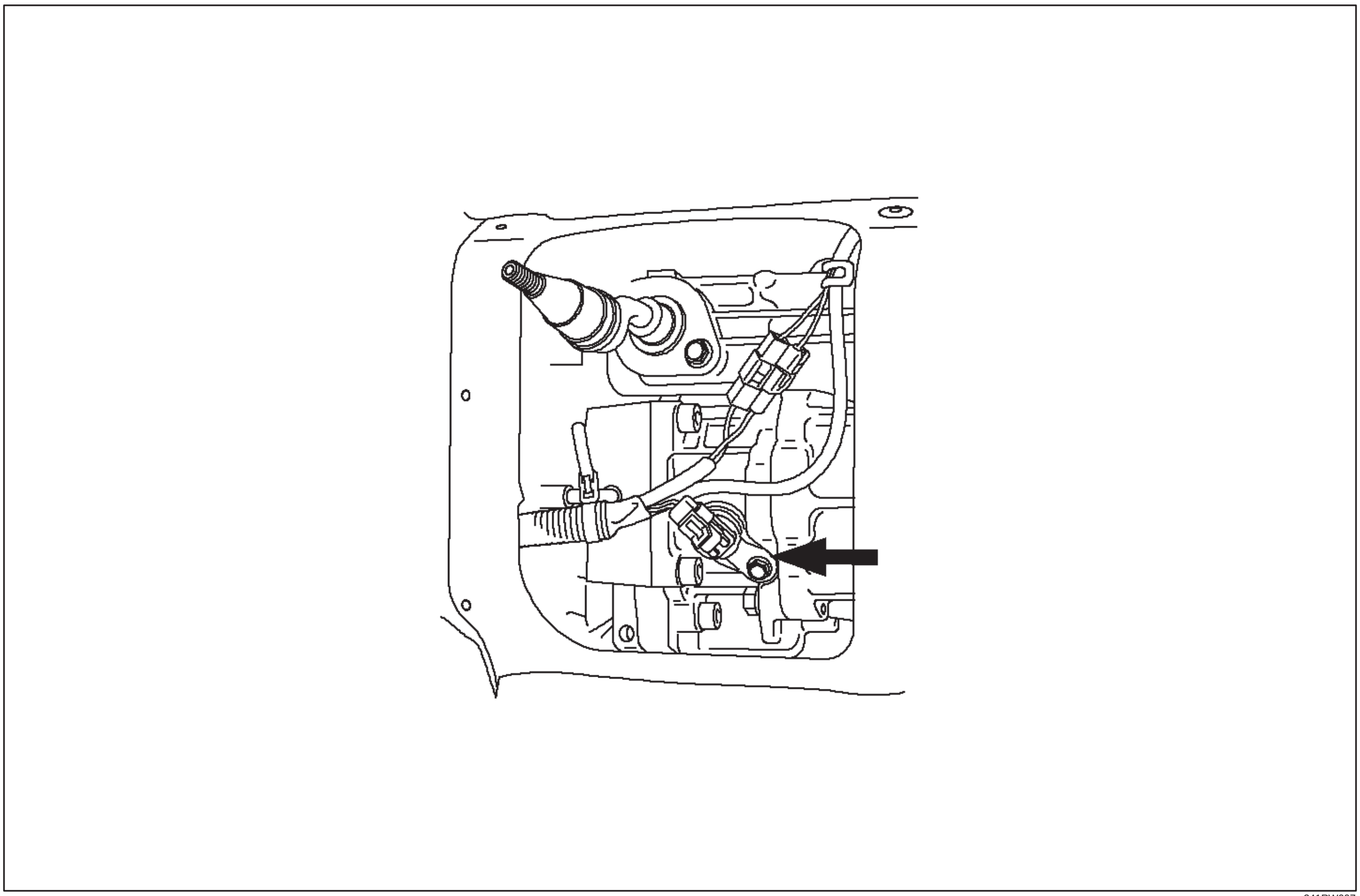
Installation

1. Install PCM to bracket.
2. Connect PCM wiring harness connectors to PCM.
3. Connect battery ground cable.

Speed Sensor (Extension Housing)

Removal

1. Disconnect battery ground cable.
2. Remove front console.
3. Remove selector lever assembly.
4. Disconnect speed sensor harness connector from speed sensor.
5. Remove one 10 mm screw and speed sensor with O-ring.



241RW007

Installation

1. Inspect the speed sensor O-ring, and replace it if necessary.
2. Install speed sensor assembly and 10 mm screw.

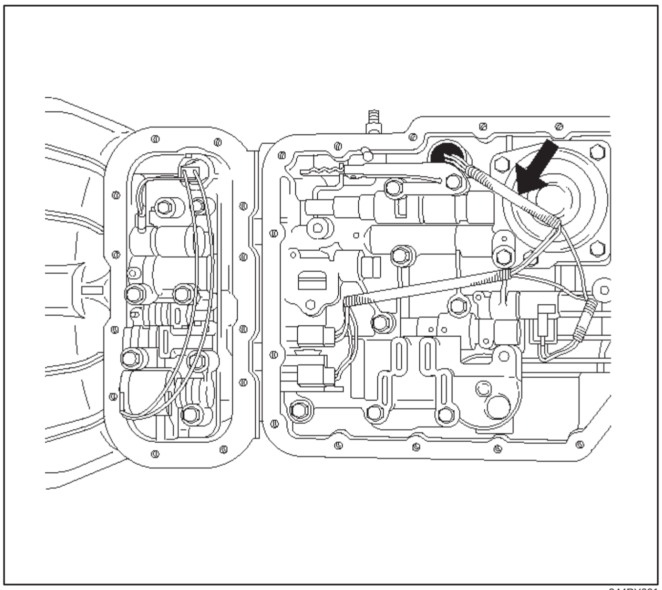
   Torque: 9 N•m (78 lb in)

3. Connect speed sensor harness connector to speed sensor.
4. Install selector lever assembly.
   - Adjust shift lock cable. Refer to Shift Lock Cable in this section.
5. Install front console.
6. Connect battery ground cable.

Transmission Oil Temperature Sensor (Main Case)

Removal

1. Raise the vehicle and support it on jack stands.
2. Disconnect battery ground cable.
3. Drain fluid.
4. Remove sixteen 10 mm main case oil pan fixing screws, main case oil pan, and gasket.
5. Disconnect wiring harness from shift solenoids, band apply solenoid, and 7 way connector of main case. Pull only on connectors, not on wiring harness.
6. Remove wiring harness assembly with transmission oil temperature sensor.



244RY001

Installation

1. Install wiring harness assembly with transmission oil temperature sensor to band apply solenoid, shift solenoids, and 7 way connector of main case.
2. Install oil pan gasket, oil pan and sixteen 10 mm fixing screws. Tighten the screws to the specified torque.

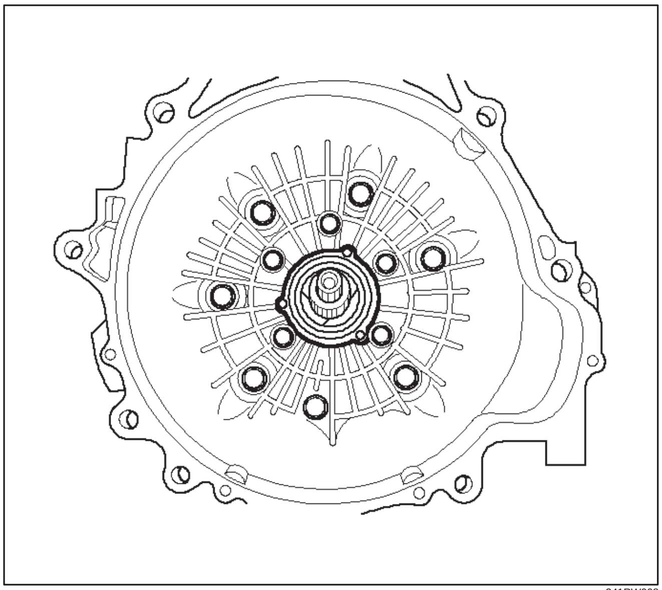
Torque: 11 N•m (96 lb in)

3. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®–III.
   Refer to Changing Transmission Fluid in this section.
4. Connect battery ground cable.

Front Oil Seal (Converter Housing)

Removal

1. Remove transmission assembly from the vehicle ,refer to Transmission in this section.
2. Remove torque converter from converter housing.
3. Remove three screws and oil seal ring from converter housing.



241RW008

Installation

1. Apply clean ATF to the new oil seal ring lip.
   - Install oil seal ring to converter housing, tighten to the specified torque.

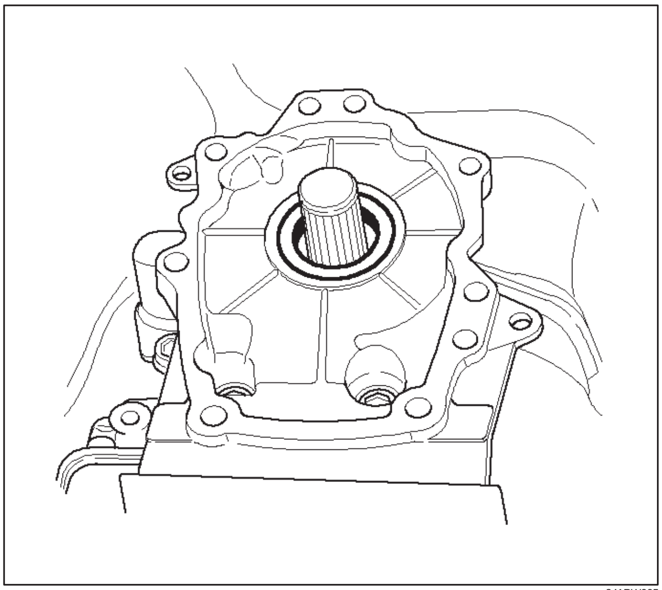
Torque: 3 N•m (26 lb in)

2. Install torque converter to converter housing.
3. Install transmission assembly to the vehicle, refer to Transmission in this section.

Rear Oil Seal (Extension Housing)

Removal

1. Remove transfer case assembly from the vehicle (4×4). Refer to Transfer Case in Drive Line/Axle section.
2. Remove rear oil seal from transmission extension housing.



241RW005

Installation

1. Use J–36797 extension housing oil seal installer, and install the rear oil seal to the transmission extension housing.
2. Install the transfer case assembly to the vehicle (4×4). Refer to Transfer Case in Drive Line/Axle section.

Transmission (4L30–E)

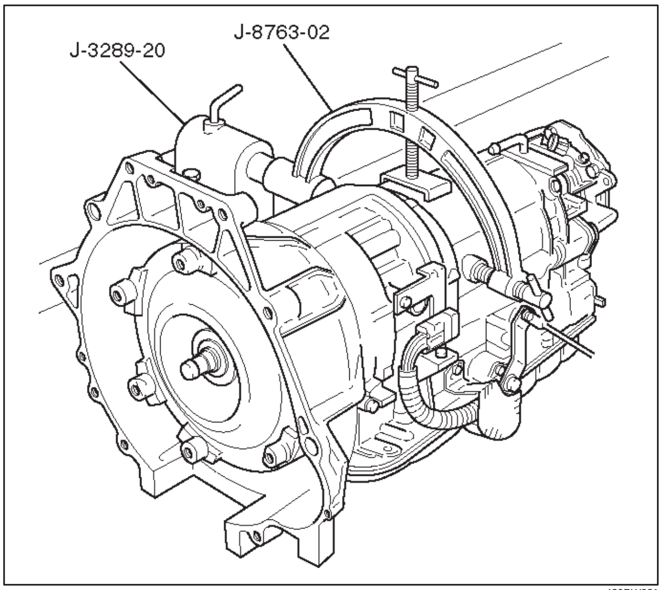
Disassembly

NOTE: During the disassembly and reassembly, perform the following:

- Wash each part thoroughly, and blow air through each oil passage and groove to eliminate blockage.
- Seal rings, roll pins, and gaskets should be replaced.
- When assembling the components, apply DEXRON®–III Automatic Transmission Fluid (ATF) to each seal, rotating part, and sliding part.
- Do not dip part facings, such as clutch or brake drive plates, in cleaner when washing it.
  Also, always coat parts with new ATF two or three times after cleaning with solvent.

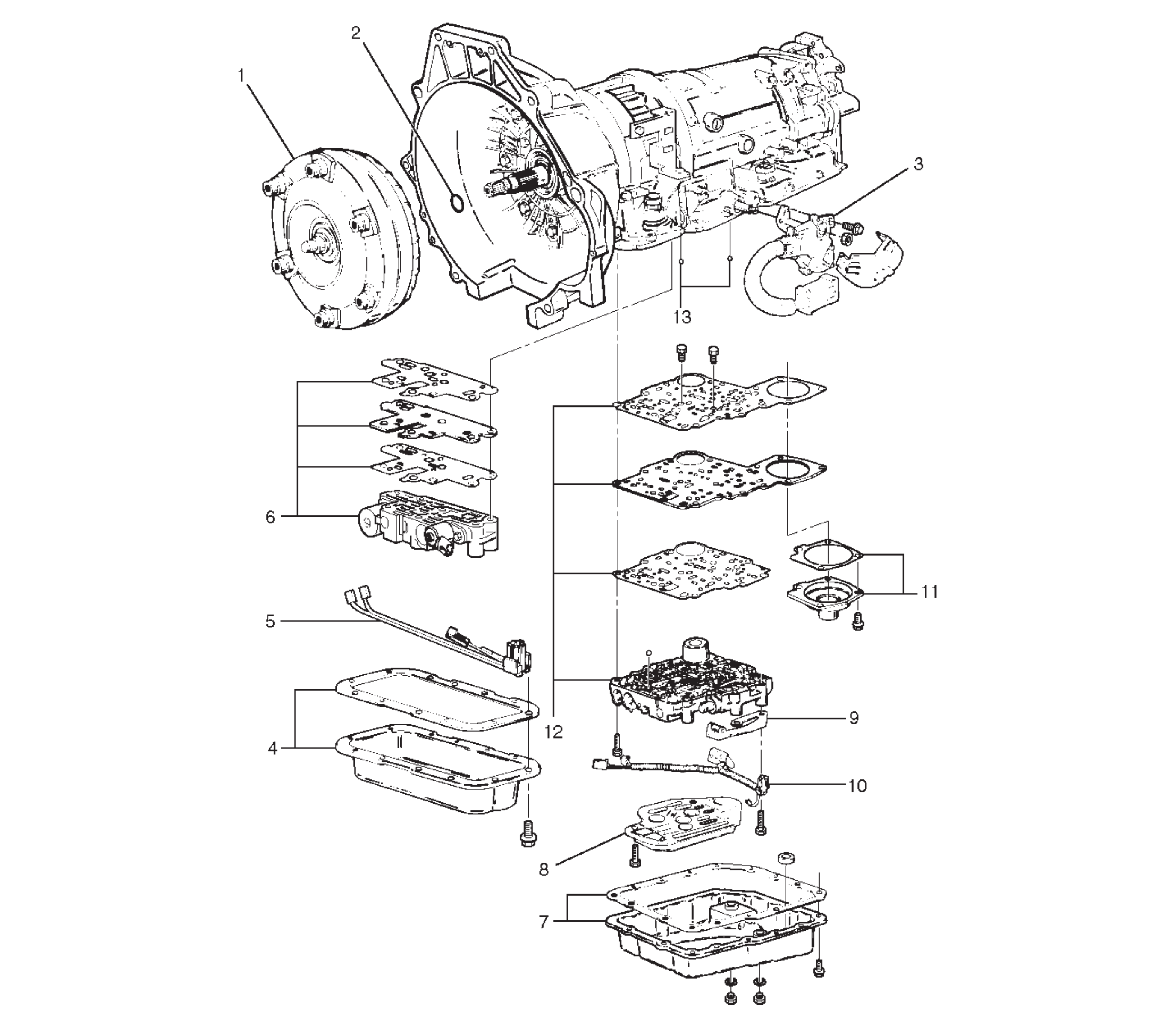
1. Remove torque converter (1).
   - Drain fluid from torque converter.
   - Attach J–8763–02 holding fixture to the transmission and set it on J–3289–20 holding fixture base.

NOTE: Do not overtighten the tool, as case damage may result.



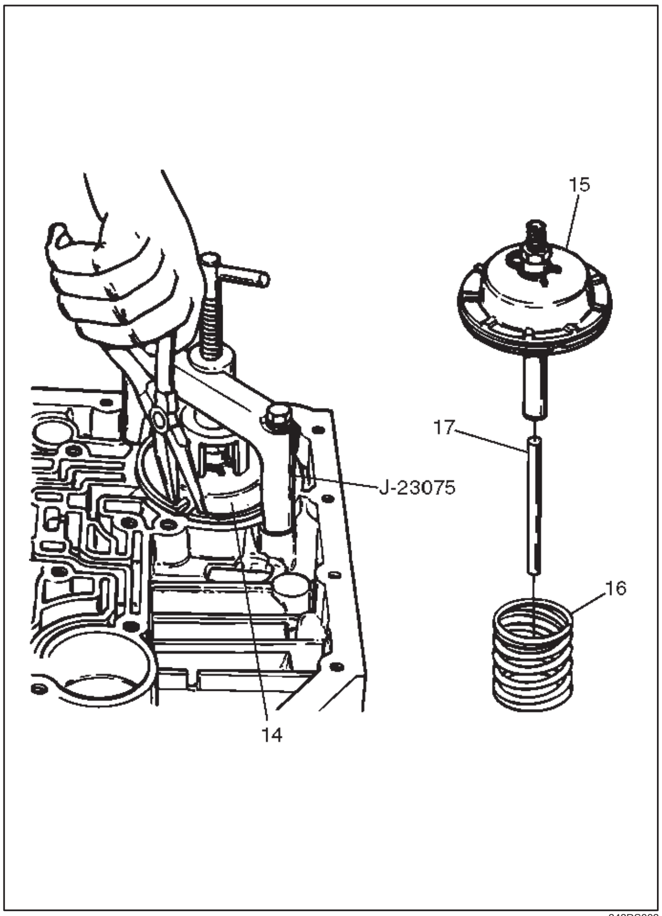
420RW021

2. Remove O-ring (2) from turbine shaft.
3. Remove two 10mm mode switch screws, selector lever nut, cover, and mode switch (3).
4. Remove twelve 10mm adapter case oil pan (4) fixing screws, adapter oil pan, and gasket.
5. Disconnect electrical wiring connections (5) from solenoids and 4 way connector of adapter case. Pull on connectors only, not on wiring harness.
6. Remove seven 13mm adapter case valve body (6) fixing screws, adapter case valve body assembly, transfer plate, and two gaskets.
   - Remove wiring harness and 4 way connector.
7. Remove sixteen 10mm main case oil pan (7) fixing screws, main oil pan, magnet, and gasket.
8. Remove three 13mm oil filter (8) fixing screws and oil filter.
9. Remove two 13mm manual detent (9) fixing screws, roller and spring, and manual detent.
10. Disconnect wiring harness assembly (10) from band apply solenoid, shift solenoids, and main case 7 way connector.
    Pull on connectors only, not on wiring harness.
11. Remove four 13mm servo cover (11) fixing screws, servo cover, and gasket.
12. Remove seven 13mm valve body screws and ground wire from main case.
    - Remove wiring harness assembly (5) from the adapter case side.
    - Remove main valve body assembly (12) with manual valve link and transfer plate. Note the position of the link (long end into valve, short end into range selector lever).
    - Remove 7 way connector.
    - Remove gasket transfer plate from main case.
13. Remove two check balls (13) from main case.



14. Turn transmission to vertical position to drain fluid. Return back to horizontal position when drained.
    - Install J–23075 servo piston spring compressor with offset to the rear of case.
    - Compress servo piston assembly.
    - Remove servo piston retaining ring (14).
    - Slowly release servo piston assembly (15).
    - Remove tool.

15. Remove servo piston assembly (15), return spring (16), and servo apply rod (17).



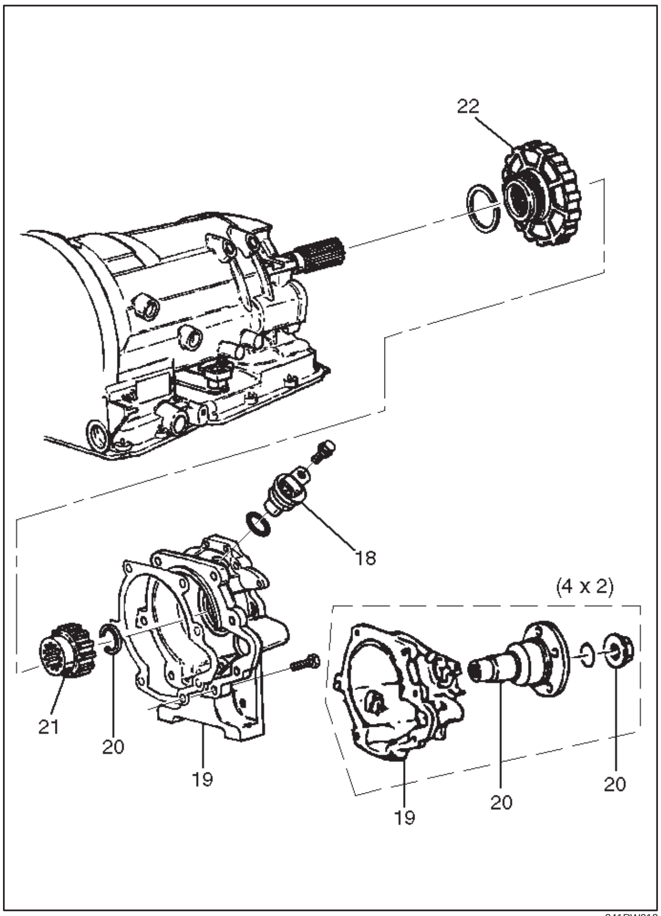
242RS002

16. Rotate transmission to horizontal position, pan side down.
    - Remove one 10mm screw, and speed sensor (18) with “O” ring.
17. Remove seven 8mm extension housing hexagon socket head screws, extension housing assembly (19), and gasket.
18. Remove retaining ring (20). (4×4)

NOTE: Use extra long, needle nose pliers.

- Remove flange nut (20). (4×2)
- Remove flange and O–ring (20). (4×2)

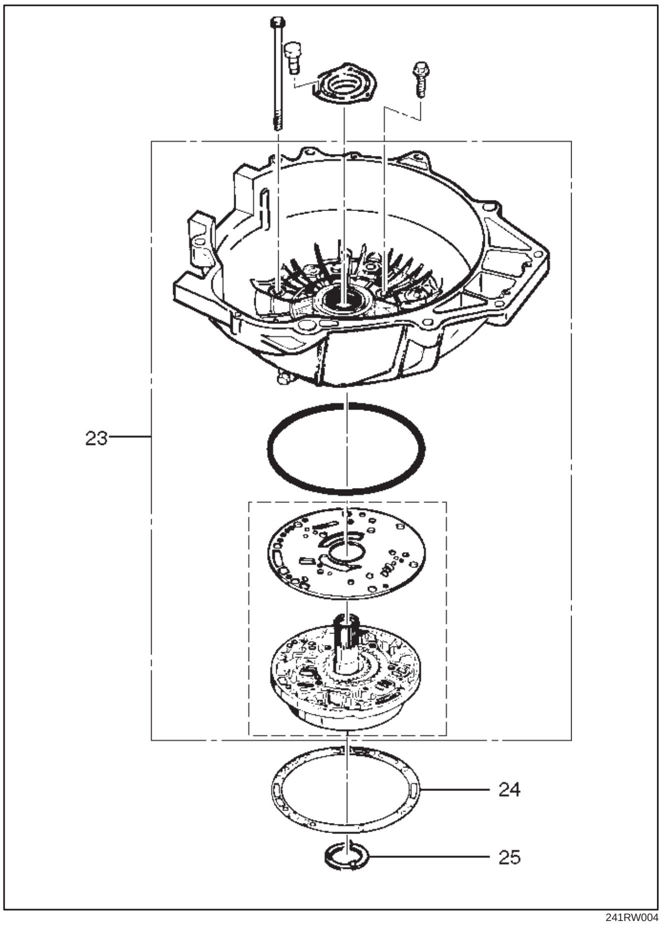
19. Remove speed wheel (21).
20. Remove wheel parking lock (with seal ring) (22).



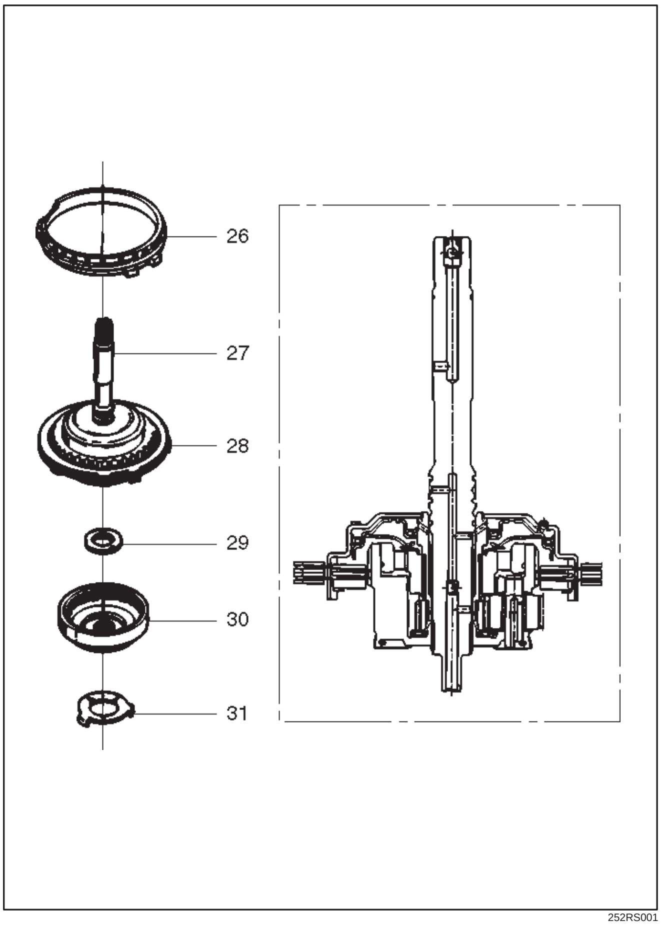
241RW012

21. Rotate transmission to vertical position, converter housing up.
    - Loosen the converter housing and oil pump assembly fixing screws, but do not remove, the five 13 mm inner screws unless oil pump disassembly is required.
    - Remove seven outer screws.
    - Remove converter housing and oil pump assembly (23).
22. Remove gasket (24).

23. Remove selective thrust washer (25).

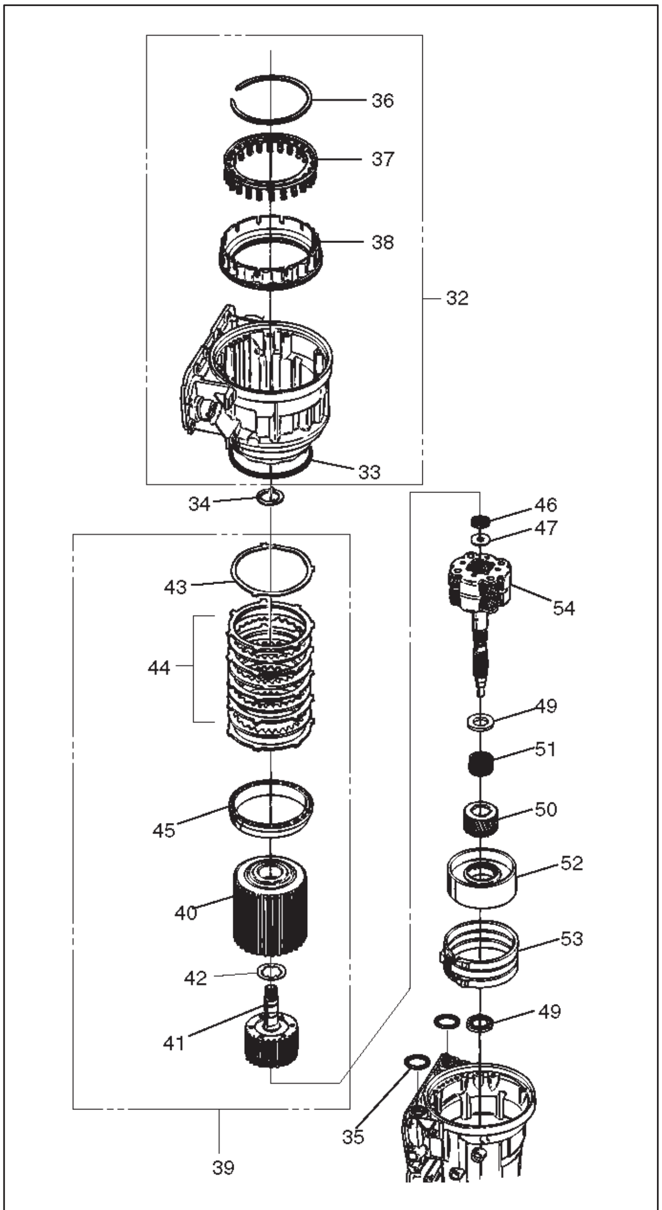


24. Remove fourth clutch retainer (26).
25. Grasp turbine shaft and lift out the overrun clutch housing assembly (27) and fourth clutch plates (28).
26. Remove thrust bearing assembly (29).
27. Remove overdrive internal gear (30).
28. Remove thrust washer (31).



29. Remove adapter case and center support assembly (with fourth clutch piston) (32).
30. Remove seal ring (33).
31. Remove selective thrust washer (34) and two O-ring seals (35) from main case.
32. Use J–23327 and J–23327–90 compressor to compress the fourth clutch spring retainer and springs (37).
    - Release snap ring (36) from groove.
    - Remove clutch compressor and snap ring (36).
33. Remove retainer and spring assembly (37).
34. Insert two converter housing/main case screws to hold adapter case while pulling out fourth clutch piston (38).
    - Remove fourth clutch piston assembly (38) from the adapter case.
    - Remove converter housing/main case screws.
35. Grasp intermediate shaft, twist and pull out the second and third clutch drum assemblies with reverse clutch plates while holding onto output shaft (39).

36. Separate second (40) and third clutch (41) assemblies.
37. Remove thrust washer (42).
38. Remove reverse clutch plates (43 and 44) and reverse clutch pressure plate (45).
39. Remove bearing (46) and washer (47).
40. Remove planetary carrier assembly (48).
41. Remove thrust bearing (49).
42. Remove reaction sun gear (50)
43. Remove needle bearing (51).
44. Remove brake drum (52).
45. Remove brake band (53).
46. Remove thrust bearing (54).



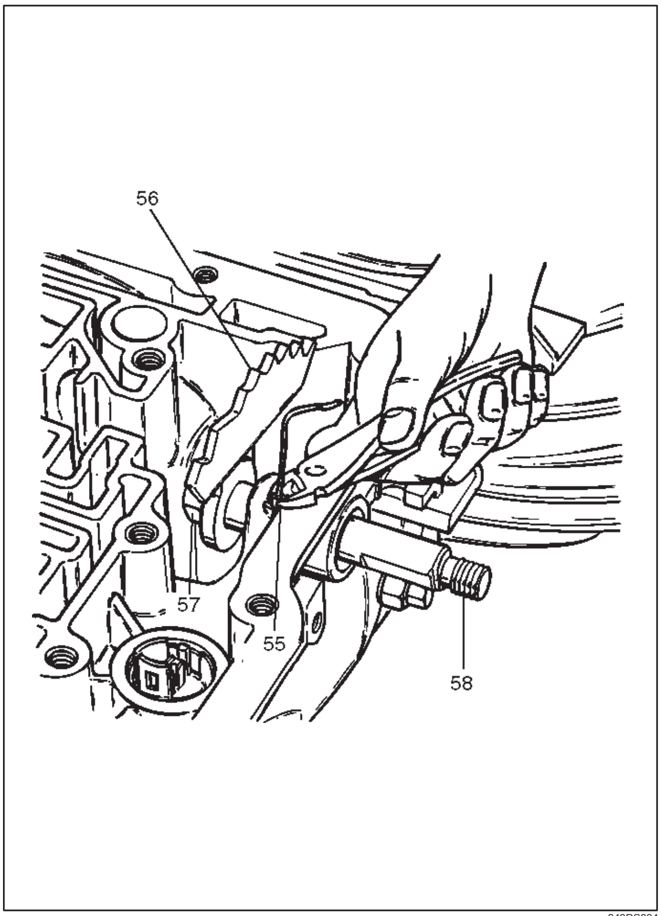
242RW005

47. Rotate case to horizontal position, valve body side facing up.
    - Remove spring pin (55), using cutting pliers, then remove parking lock and selector lever assembly (56).

NOTE: Insert wire in the center of the spring pin to prevent it from collapsing during removal. Be aware of pin height. Protect machined face of main case.

48. Remove parking lock and range selector lever 17 mm nut (57).
49. Remove parking lock and range selector lever (56), and actuator assembly.
50. Remove selector shaft (58).

NOTE: Inspect the shaft for burrs before removing to prevent damaging seal. If necessary, remove burrs by lightly sanding with an oilstone.



249RS004

Reassembly

1. Inspect selector shaft seal and replace it if necessary.

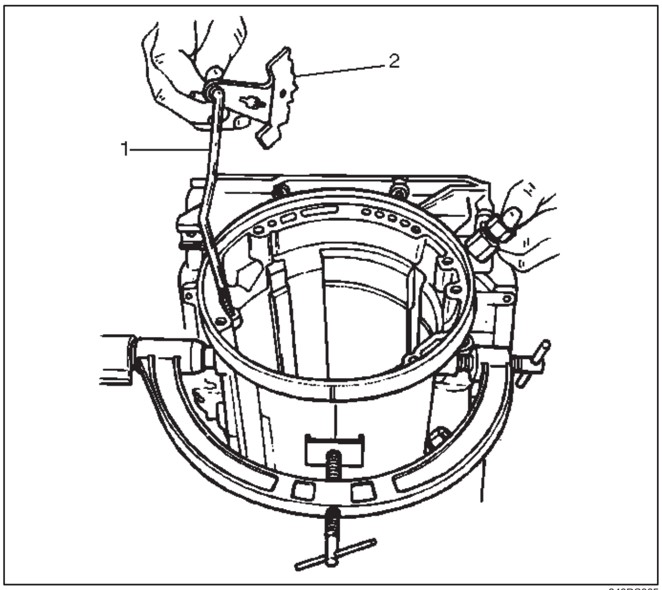
NOTE: Use a seal installer when replacing the seal.

- Install selector shaft.

NOTE: Spring pin groove must be positioned inside the case.

2. Install spring pin. Be sure the selector shaft can move freely.Do not push the pin flush with the case surface. Leave enough height for removal.
3. Install actuator assembly (1).
4. Install parking lock and range selector lever (2) and new 17 mm nut. Tighten the nut to the specified torque.

Torque: 22 N•m (16 lb ft)



249RS005

5. Rotate main case to vertical position, extension end facing down.
   - Install brake band assembly (3).

NOTE: Be sure to align servo pin area with the servo hole.

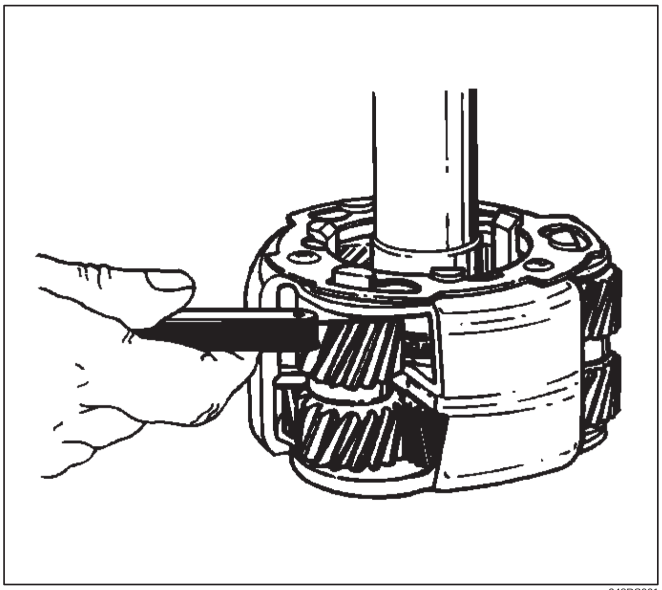
6. Install thrust bearing (4).

NOTE: The case bushing acts as a guide for the thrust bearing.

7. Install brake drum (5).
8. Install reaction sun gear (6).
9. Install needle bearing (7).
10. Inspect planetary carrier assembly (8) for wear and damage. If necessary replace it.
    - Measure pinion end play clearance with a feeler gauge.

Clearance: 0.13mm–0.89mm (0.005 in–0.035 in)

If clearance is outside specified value, replace the planetary carrier assembly.



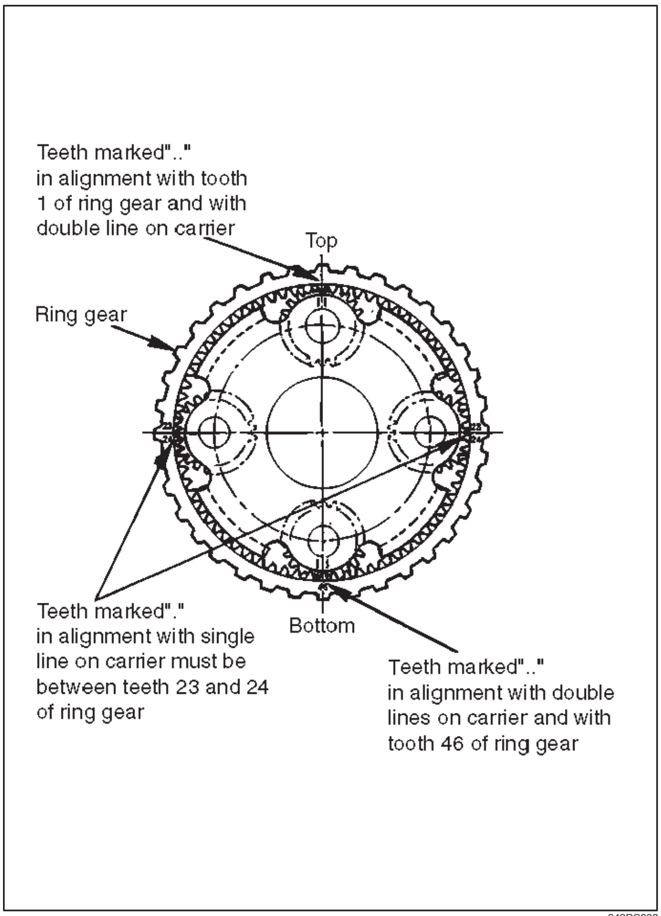
248RS001

11. Install the thrust bearing (9) on the output shaft.

NOTE: Use petroleum jelly to hold the thrust bearing in place.

12. Align planetary pinions. Each pinion is marked with double points to indicate the master tooth space and exactly opposite with a single point to indicate the master tooth. The markings on the planetary carrier consist of double lines which are to be lined up with the double points on two opposite pinions; the single lines are to be lined up with the single points on the other two pinions.
    - After all four pinions are lined up, slide on the third clutch assembly. Rotate third clutch and check mark alignment. Considering that the ring gear tooth between the double points of one planetary pinion is tooth number 1, count the teeth to check that the single points on the two adjacent pinions are between teeth 23 and 24 of the ring gear, and that the ring gear tooth between the double points of the opposite pinion is tooth number 46. If the ring gear and pinions are not lined up, remove and realign them.
13. Install planetary carrier (8) with third clutch (12).

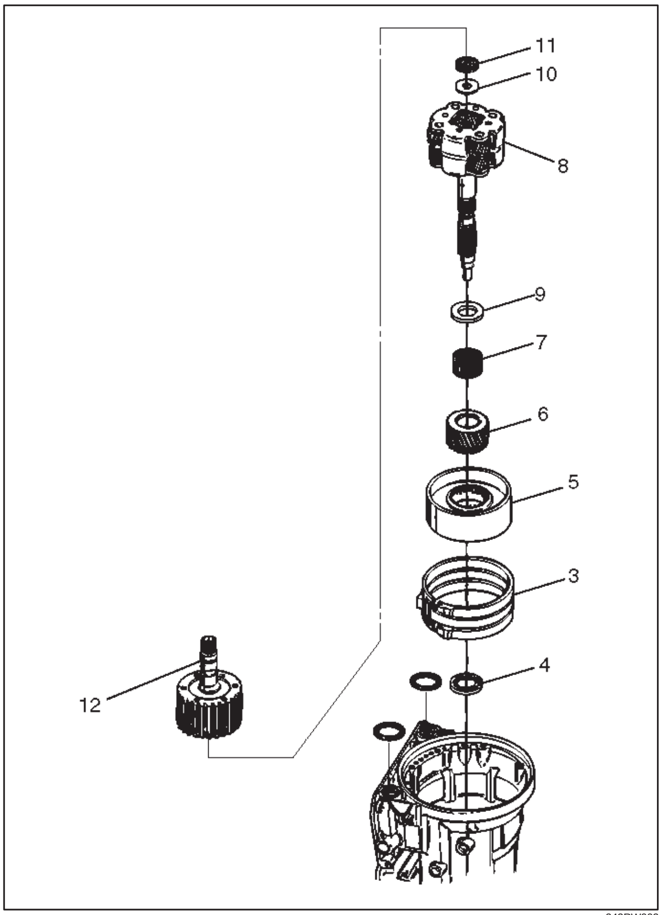
NOTE: Do not force. When properly aligned, the parts will fit together easily.



248RS002

14. Remove the third clutch (12).
15. Install bearing (11) and washer (10).

NOTE: Use petroleum jelly to hold the washer and bearing in place.

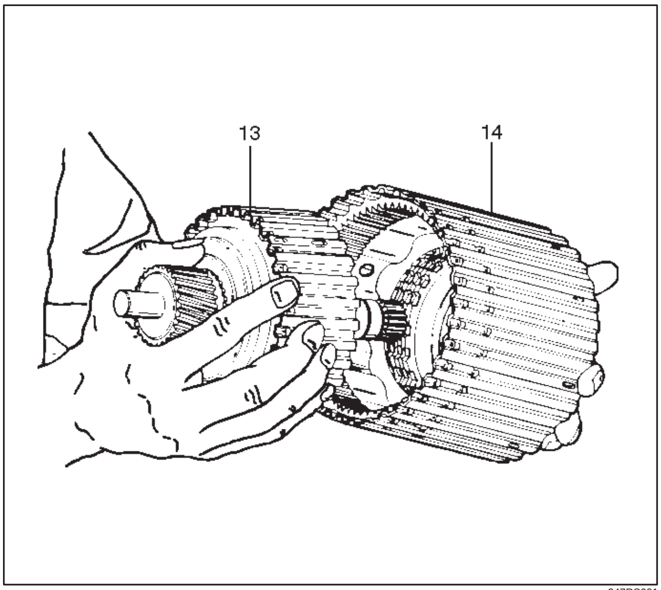


242RW002

16. Carefully align the second clutch plate inner tangs.
    - Install thrust washer, tangs pointing downward, and locating tang positioned in slot on second clutch hub.

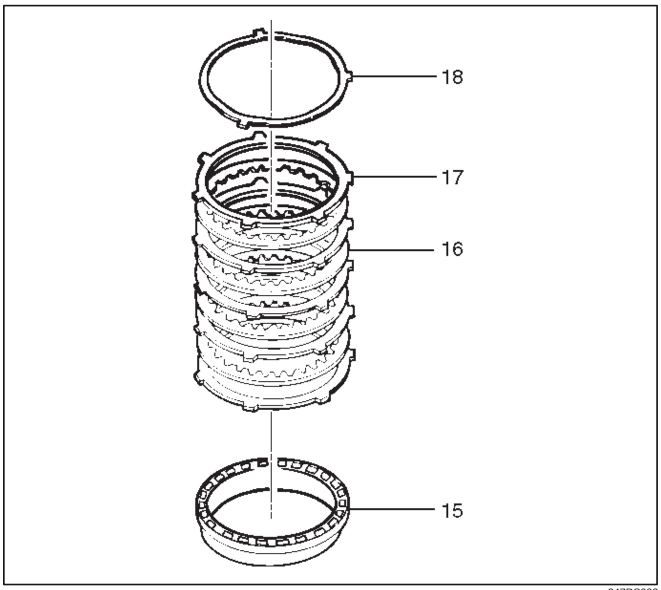
NOTE: Use petroleum jelly to hold thrust washer in place.

17. Install third clutch and intermediate shaft assembly (13) into the second clutch drum (14).
18. Install second and third clutch assemblies into the main case. Twist output shaft and clutch assemblies to ensure proper fit.



247RS001

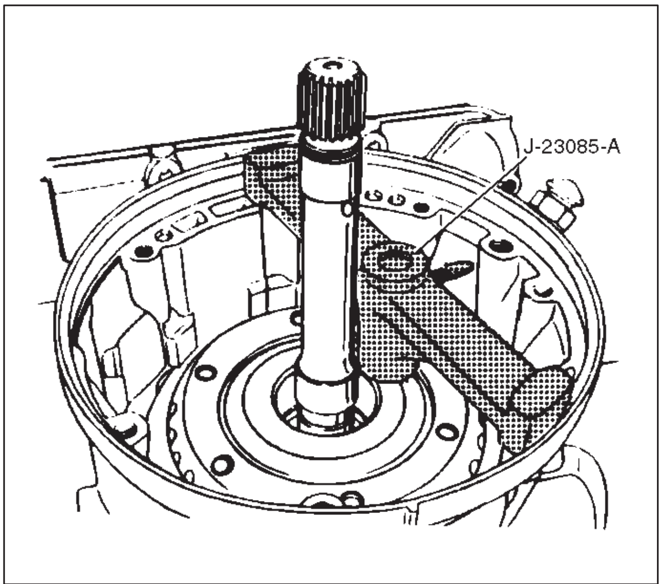
19. Install pressure plate (15) with lip side up, tang facing valve body face.
20. Install reverse clutch plates. Start with a steel plate (17) and alternate with a lined plate (16).
21. Install waved clutch plate (18) with center tang facing valve body side.



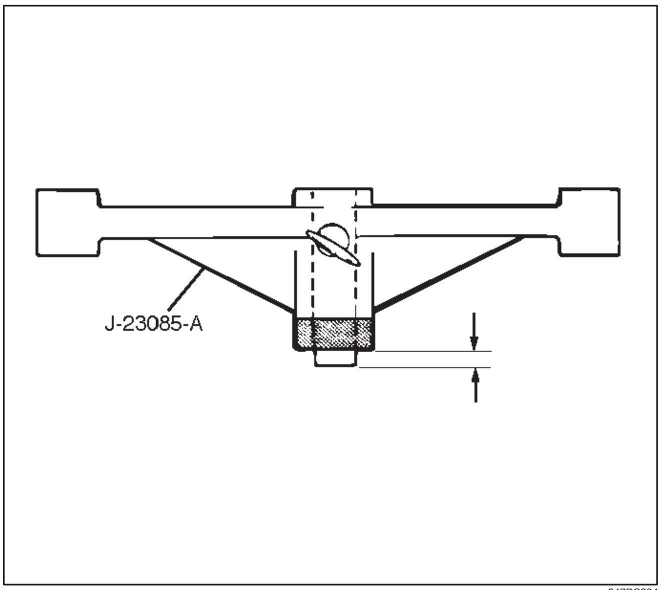
247RS002

22. Second clutch end play measurement
    1. Install the J–23085–A selective washer gauging tool (with spacer ring) on the case flange and against the intermediate shaft.
    2. Position the inner shaft of the gauging tool against the thrust surface of the second clutch hub.
    3. Tighten thumb screw. Remove the tool.
    4. Fit the spacer ring on the inner shaft of the tool.
    5. Measure the gap and select appropriate washer as shown in the chart.

Selective Thrust Washer	
Gap: mm(in)	**Color**
1.53 – 1.63 (0.060 – 0.064)	Yellow
1.72 – 1.82 (0.068 – 0.072)	Red
1.91 – 2.01 (0.075 – 0.079)	Black
2.10 – 2.20 (0.083 – 0.087)	Natural
2.29 – 2.39 (0.090 – 0.094)	Green
2.48 – 2.58 (0.098 – 0.102)	Blue
FOLLOWING THE PROCEDURE SHOULD RESULT IN FINAL END–PLAY FROM 0.36 mm TO 0.79 mm (0.014 in TO 0.031 in)	

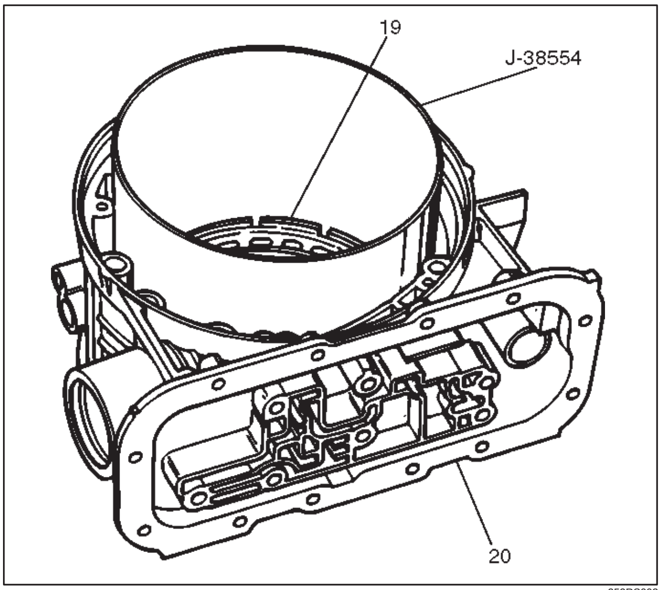


247RS003



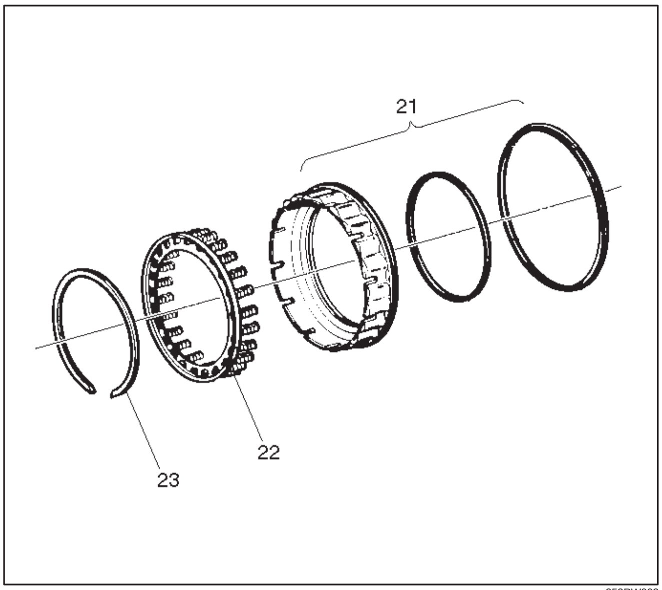
247RS004

23. Inspect fourth clutch piston seals and replace if necessary.
    - Lubricate J–38554 fourth clutch piston fitter and install it on fourth clutch piston (19).
    - Install fourth clutch piston (19) in adapter case (20).
    - Remove fitter.

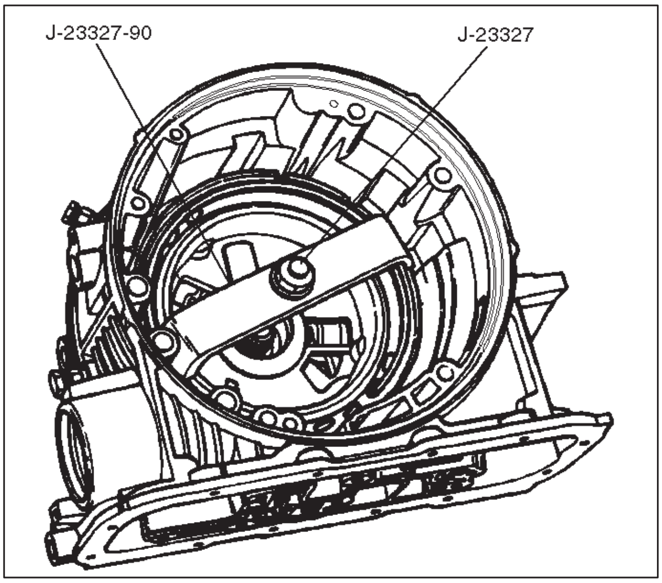


252RS003

24. Install retainer and spring assembly (22) into fourth clutch piston (21).
25. Install snap ring (23) in adapter case.
    - Install J–23327 and J–23327–90 fourth clutch spring compressor.
    - Seat snap ring in groove.
    - Remove compressor.

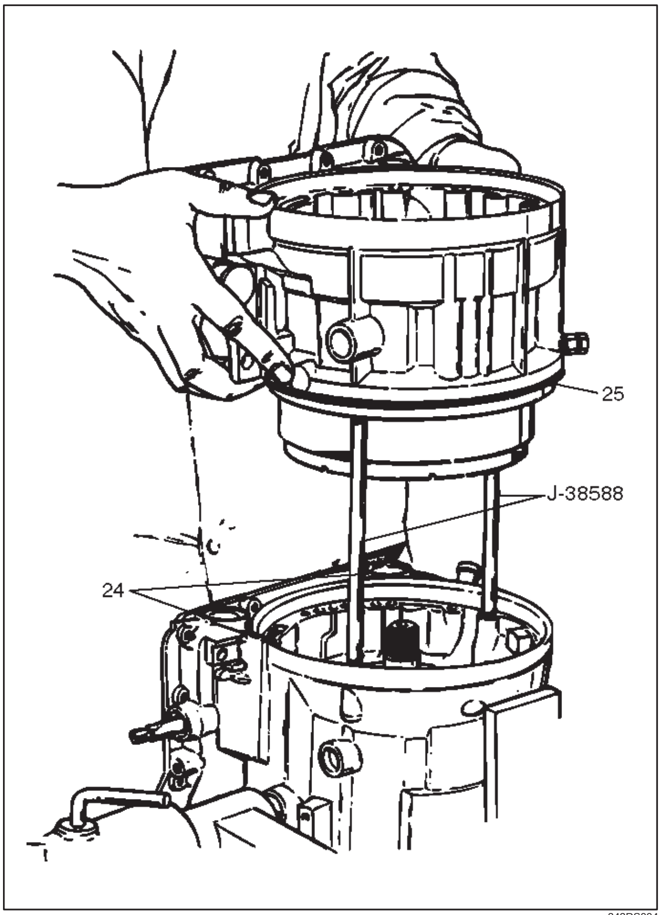


252RW002



252RS004

26. Install selective washer using petroleum jelly.
27. Install two O-ring seals (24) in main case and adapter case/main case seal ring (25).
28. Install J–38588 guide pins.
    - Install adapter case and center support assembly to main case.

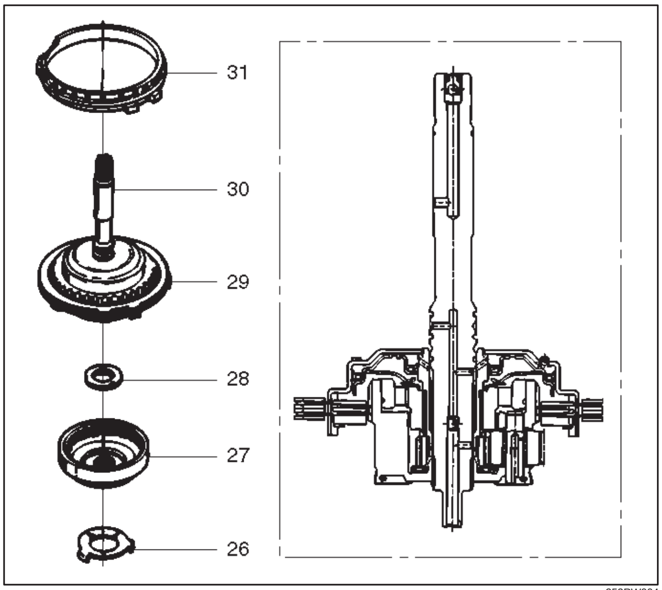


242RS004

29. Install thrust washer (26) into adapter case, with tangs pointing downwards.
30. Preassemble overdrive internal gear (27) and thrust bearing assembly (28) onto the turbine shaft and overrun clutch assembly.

NOTE: Install bearing assembly, black side up. Use petroleum jelly to keep assembly in place.

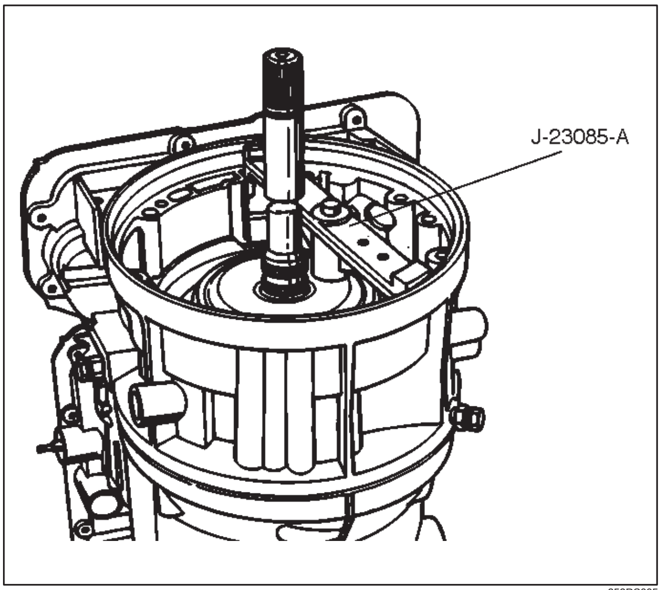
31. Install overdrive carrier (30) and internal gear assembly into adapter case.
32. Install fourth clutch plates (29) in the following order: Steel, Lined, Steel, Steel, Lined, Steel. Steel plates go in with short tang facing towards valve body surface.
33. Install fourth clutch retainer(31) with the notch facing up and positioned towards valve body surface.



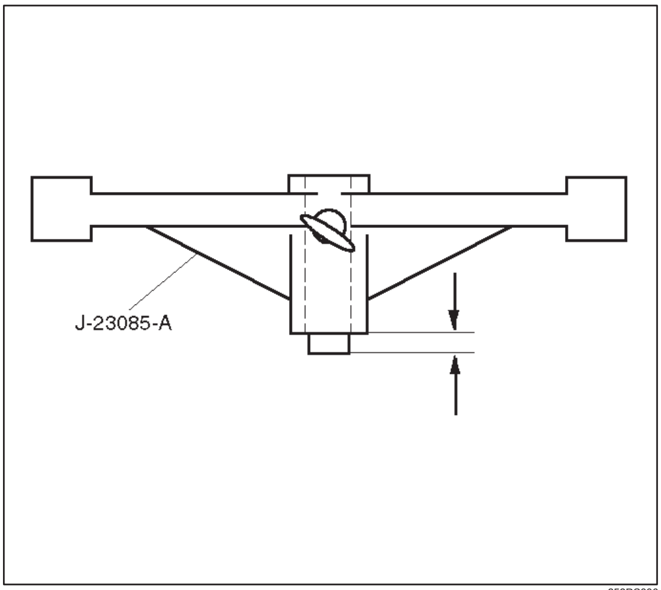
252RW004

34. Overdrive clutch end play measurement
    1. Install the J–23085–A selective washer gauging tool on the adapter case flange and against the input shaft.
    2. Position the inner shaft of the tool against the thrust surface of the overrun clutch housing.
    3. Tighten thumb screw. Remove the tool.
    4. Measure gap. Select appropriate size washer as shown in the chart.
    5. Set selective thrust washer aside.

Selective Thrust Washer	
Gap: mm(in)	**Color**
1.53 – 1.63 (0.060 – 0.064)	Yellow
1.72 – 1.82 (0.068 – 0.072)	Red
1.91 – 2.01 (0.075 – 0.079)	Black
2.10 – 2.20 (0.083 – 0.087)	Natural
2.29 – 2.39 (0.090 – 0.094)	Green
2.48 – 2.58 (0.098 – 0.102)	Blue
FOLLOWING THE PROCEDURE SHOULD RESULT IN FINAL END–PLAY FROM 0.1 mm TO 0.8 mm (0.004 in TO 0.03 in)	



252RS005



252RS006

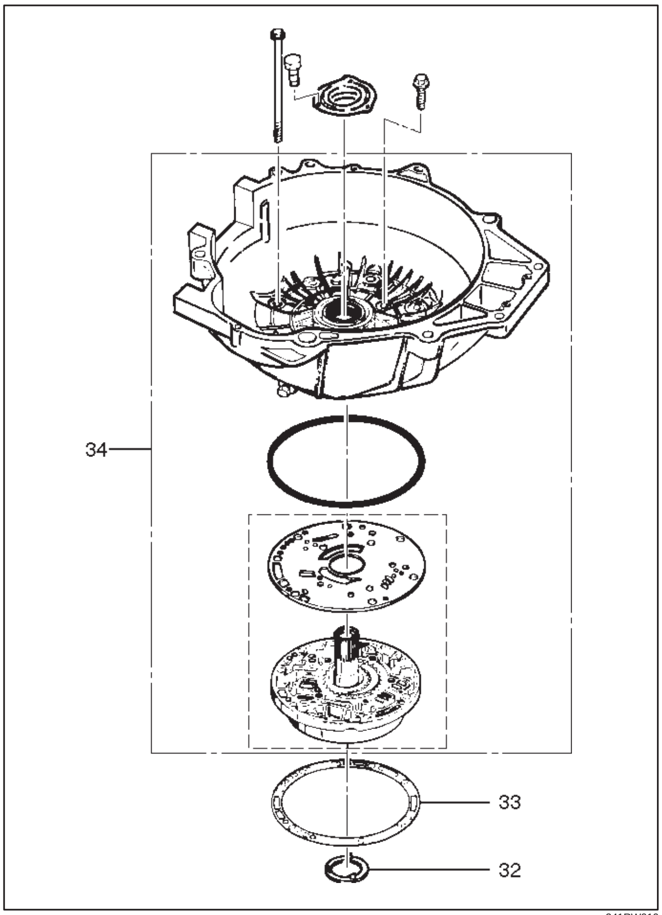
35. Install selective washer (32).

NOTE: Use petroleum jelly to hold selective washer in place.

36. Install gasket (33).
37. Install converter housing and oil pump assembly (34) to adapter case.
   - Fit and tighten seven outer 13 mm screws.

Torque: 39 N•m (29 lb ft)

   - Ensure free rotation of pump using J–23082–01 pump rotation tool.



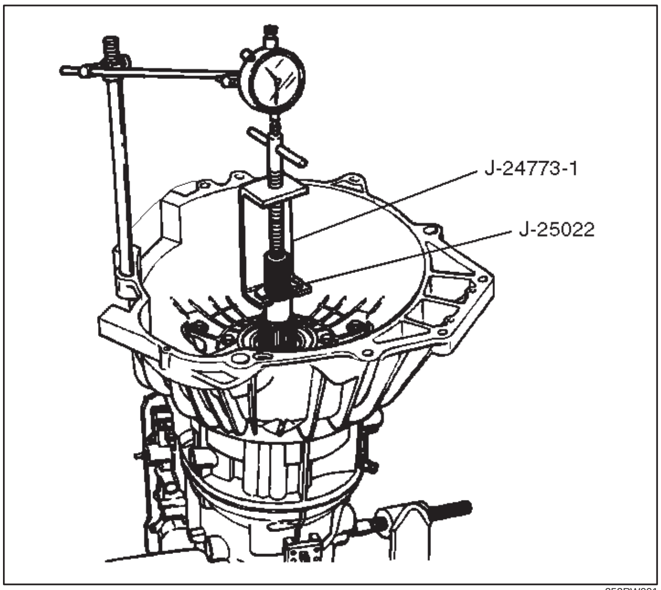
241RW010

38. Overdrive clutch end play measurement
   1. Fit J–25022 and J–24773–1 turbine shaft puller on turbine shaft.
   2. Position axial play checking tool on converter housing mating face.
   3. Pull turbine shaft upwards with puller until first resistance is met. (due to weight of overdrive assembly)
   4. Maintain shaft in this position and set indicator to zero.
   5. Pull turbine shaft further upwards with puller. Read end play shown on indicator.

End play: 0.1mm – 0.8mm (0.004 in – 0.031in)

   6. Remove axial play checking tool and puller.

NOTE: If end play is not correct, repeat selective washer selection.



252RW001

39. Inspect extension housing oil seal and replace if necessary, using J–36797 extension housing oil seal installer.
   - Rotate transmission to horizontal position, with valve body side down.
   - Inspect parking wheel seal ring. Replace if necessary.
   - Install wheel parking lock assembly (35).
40. Install speed wheel (36) and snap ring (37). (4×4)

NOTE: Use extra long, needle nose pliers.

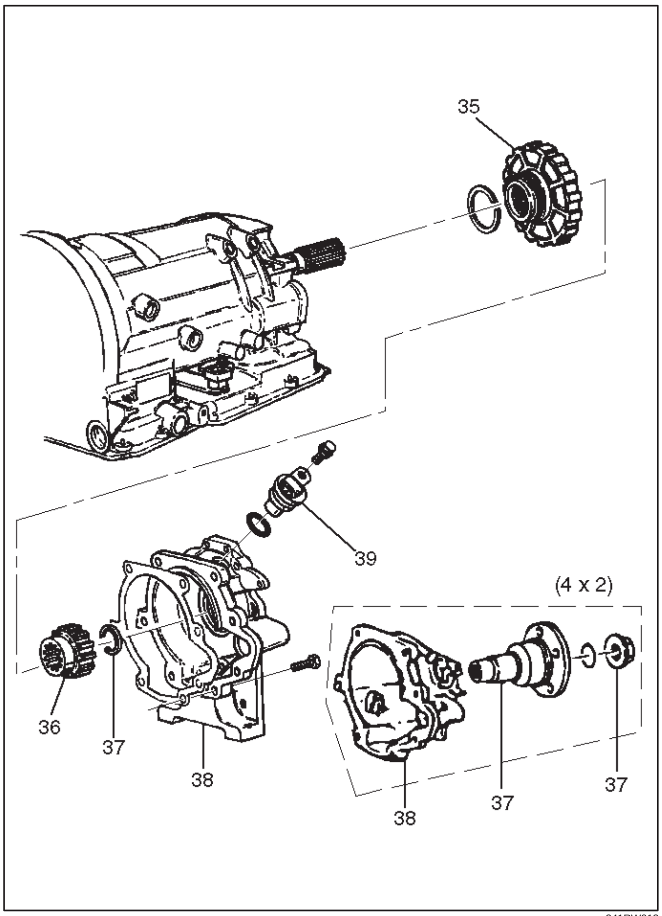
Install flange, O–ring and nut. (4×2)

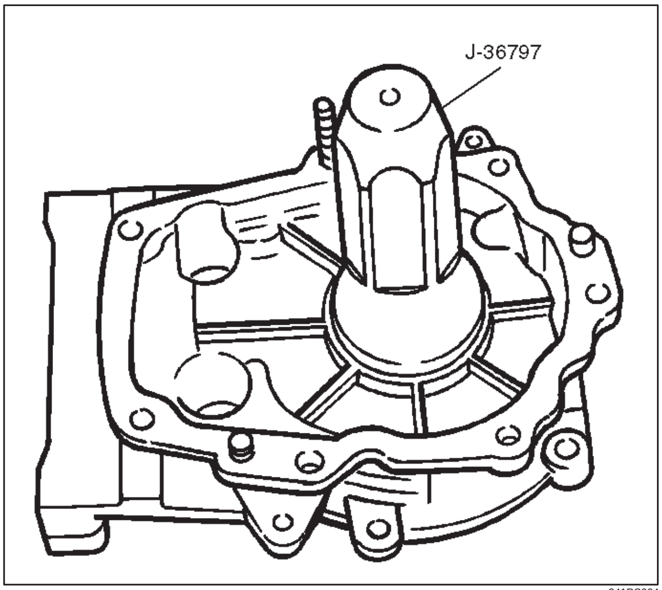
41. Install gasket onto extension assembly with a thin coating of oil.
   - Install extension housing assembly (38), and align parking pawl shaft.
   - Install actuator assembly into extension assembly.
   - Install seven 8 mm hexagon socket head screws.

Torque: 32 N•m (24 lb ft)

42. Inspect speed sensor O-ring. Replace if necessary.
   - Install speed sensor assembly (39) and 10 mm screw.

Torque: 9 N•m (78 lb in)

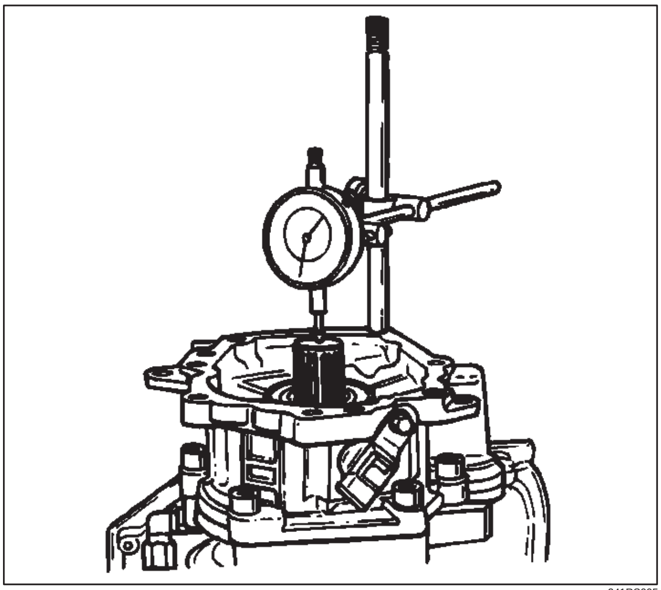




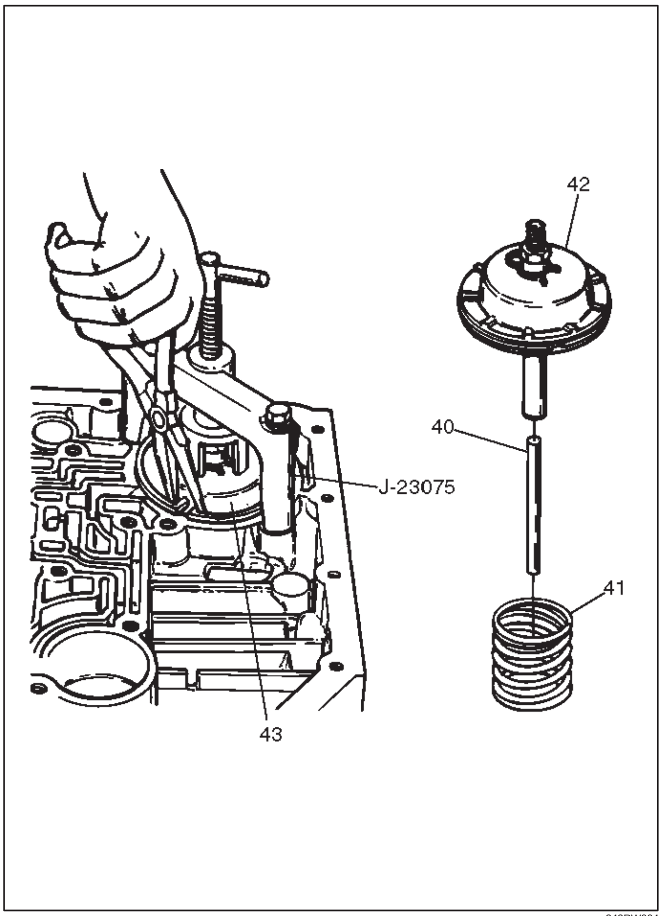
43. Main case end play measurement
    1. Attach axial play checking tool on the extension housing and set indicator to zero on output shaft.
    2. Manually push output shaft upwards.

End play: 0.36mm – 0.80mm (0.014 in – 0.031in)

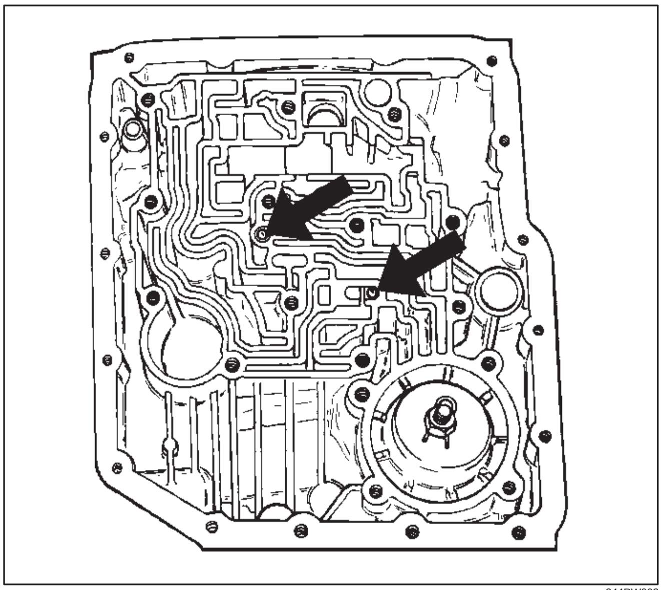
3. Remove axial play checking tool.
4. If end play is not correct, repeat selective washer selection.



44. Inspect servo piston seal ring. Replace if necessary.
    - Ensure brake band is correctly positioned. Rotate output shaft if necessary.
    - Install J–38428 servo piston fitter in servo bore.
    - Install apply rod (40), round end toward band, return spring (41) and piston assembly (42).
45. Install the J–23075 servo spring compressor with offset to rear of case.
    - Compress servo piston seal ring, using fitter while tightening the tool screw.
    - Install servo piston retaining ring (43).
    - Remove tool.
    - Adjust the brake band by tightening the servo adjusting screw to 4.5 N·m torque. Be certain the lock nut is loose, then back-off the screw five turns exactly. Hold piston sleeve with wrench and tighten lock nut to 18.5 N·m torque. Be certain the adjusting screw does not turn.



46. Install two check balls (44).



47. Inspect main case electrical connector and seal, replace if necessary.
    - Install electrical 7 way connector/main case and wiring harness.
48. Install two J–25025–B guide pins into main case.
    - Install main case valve body complete assembly (45) and manual valve link.

NOTE: Valve must be extended as the short end of manual valve link is connected to the range selector lever. Long end of link goes into valve.

- Install seven 13 mm screws, tighten the specified torque.

Torque: 20 N•m (15 lb ft)

- Remove two guide pins.

49. Install servo cover gasket, cover (46) and four 13 mm screws.

Torque: 25 N•m (18 lb ft)

50. Connect wiring harness (47) to band control, shift solenoids, and main case 7 way connector.
51. Install manual detent roller and spring assembly (48) with clip.
    - Install two 13 mm screws.

Torque: 20 N•m (15 lb ft)

52. Install oil filter (49) and three 13 mm screws.

Torque: 20 N•m (15 lb ft)

53. Install oil pan gasket, magnet, main oil pan (50), sixteen 10 mm screws.

Torque: 11 N•m (96 lb in)

54. Inspect adapter case electrical connector and seal. Replace if necessary.
    - Install electrical five pin connector and harness assembly (52) in bottom of adapter case.
55. Install gasket, transfer plate, and gasket.
    - Install adapter case valve body (51) complete and seven 13 mm screws.

Torque: 20 N•m (15 lb ft)

56. Connect wiring harness harness assembly (52) to converter clutch solenoid, force motor, and 4 way connector.
57. Install oil pan gasket, adapter case oil pan (53), and twelve 10 mm screws.

Torque: 11 N•m (96 lb in)

- Rotate transmission, with bottom pan facing down.

58. Install mode switch (54), two 10 mm screws, selector lever nut, and cover.

10 mm screw

Torque: 13 N•m (113 lb in)

Nut

Torque: 23 N•m (17 lb ft)

- Adjust using setting tool, refer to Mode Switch in this section.

59. Install O-ring (55) on turbine shaft.
60. Install torque converter (56).
    The converter assembly must be replaced under any of the following conditions:
    a. Evidence of damage to the pump assembly.
    b. Metal particles are found after flushing the cooler lines.
    c. External leaks in hub weld area.

d. Converter pilot broken, damaged, or poor fit into crankshaft.

e. Converter hub scored or damaged.

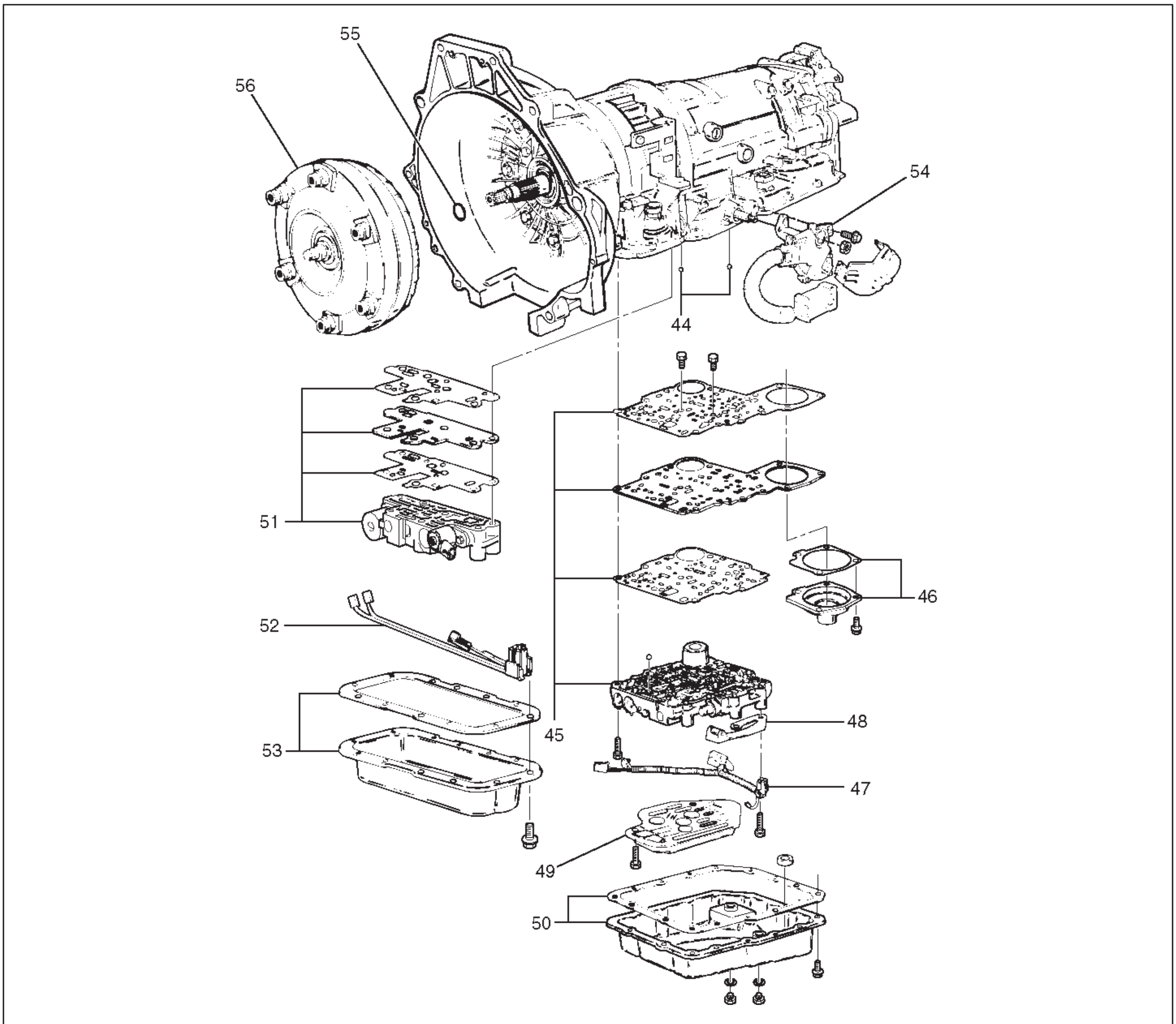
f. Internal failure in stator.

g. Contamination from engine coolant.

h. Excess end play.

- Rotate transmission, bell housing up. Spin converter to insure proper fit.

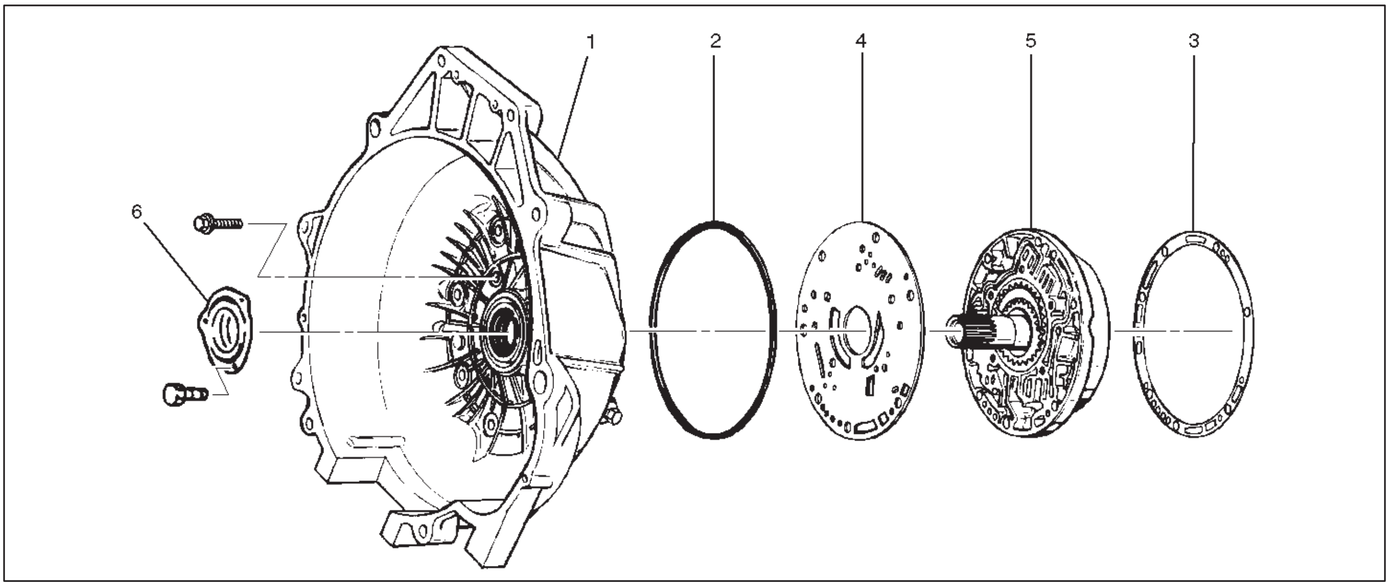
61. Fill transmission through the overfill screw hole of oil pan, using ATF DEXRON®–III. Refer to Changing Transmission Fluid in this section.



240RY002

Converter Housing and Oil Pump Assembly

Disassembled View



241RW003

Legend
(1) Converter Housing
(2) Outer Seal Ring
(3) Gasket
(4) Wear Plate
(5) Oil Pump Assembly
(6) Oil Seal Ring

Disassembly

1. Remove oil pump assembly from converter housing.
2. Remove outer seal ring.
3. Remove gasket.
4. Remove wear plate.
5. Remove oil seal ring.

Inspection and Repair

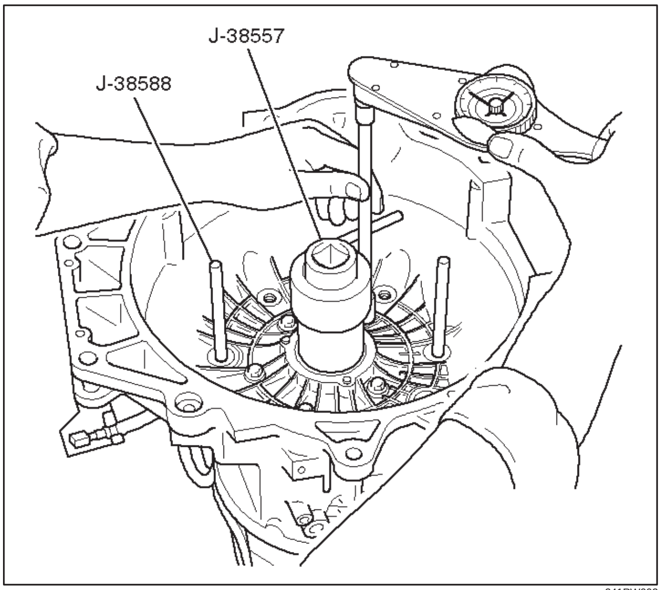
Visual Check:

If any damage, deformation, or local wear is found in a converter housing, outer seal ring, wear plate, or oil seal ring, replace it.

Reassembly

1. Install wear plate onto oil pump assembly.
2. Install converter housing onto complete oil pump assembly. Align with two short J–38588 guide pins on outer bolt holes.
   - Loosely install five 13mm bolts.
   - Center converter housing using J–38557 centering tool.
   - Tighten five inner 13mm bolts in an alternating pattern.

   Torque: 20 N•m (15 lb ft)



241RW002

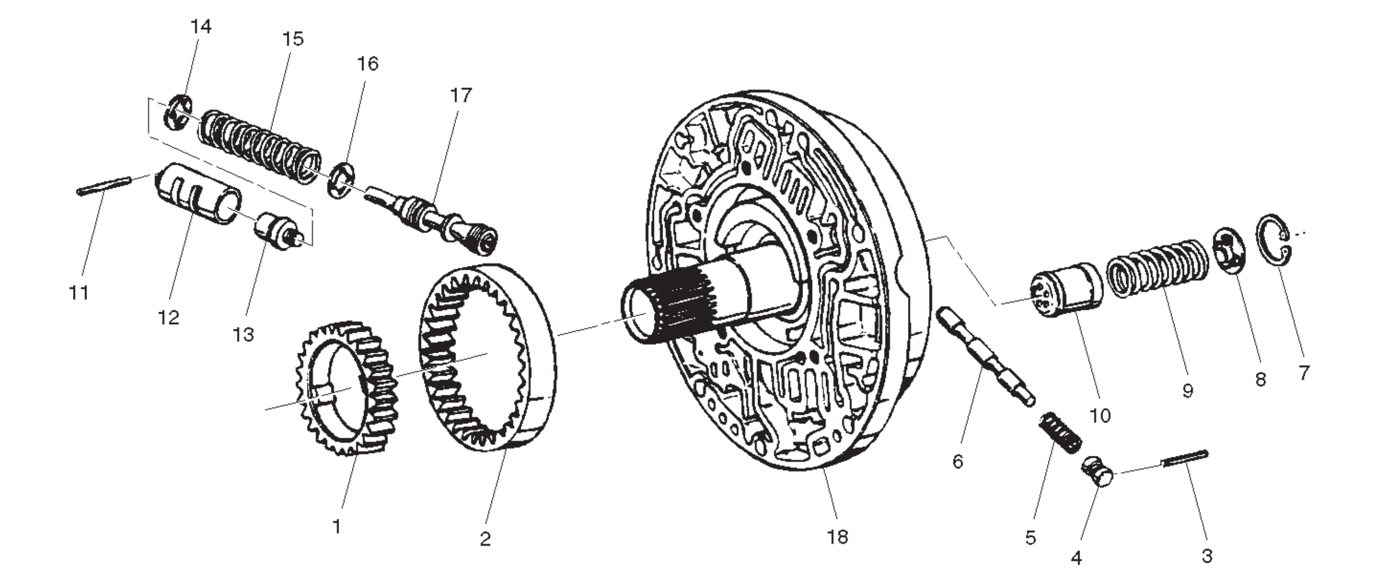
3. Install oil seal ring (3 screws).

   Torque: 3 N•m (26 lb in)

4. Install gasket.
5. Install outer seal ring.

Oil Pump

Disassembled View



Legend

(1) Oil Pump Drive Gear
(2) Oil Pump Driven Gear
(3) Pin
(4) Plug
(5) Spring
(6) Converter Clutch Control Valve
(7) Snap Ring
(8) Spring Seat
(9) Spring
(10) Throttle Signal Accumulator Piston
(11) Sleeve Pin
(12) Sleeve
(13) Boost Valve
(14) Spring Seat
(15) Valve Spring
(16) Spring Seat
(17) Pressure Regulator valve
(18) Oil Pump Assembly

Disassembly

1. Remove oil pump drive gear (1) and driven gear (2).
2. Remove pin (3) from oil pump assembly (18).
3. Remove plug (4), spring (5), and converter clutch control valve (6).
4. Remove snap ring (7) from oil pump assembly (18).
5. Remove spring seat (8), spring (9), and throttle signal accumulator piston (10).
6. Remove sleeve pin (11) from oil pump assembly (18).
7. Remove sleeve (12), boost valve (13), spring seat (14), valve spring (15), spring seat (16), and pressure regulator valve (17).

Inspection and Repair

Visual Check:

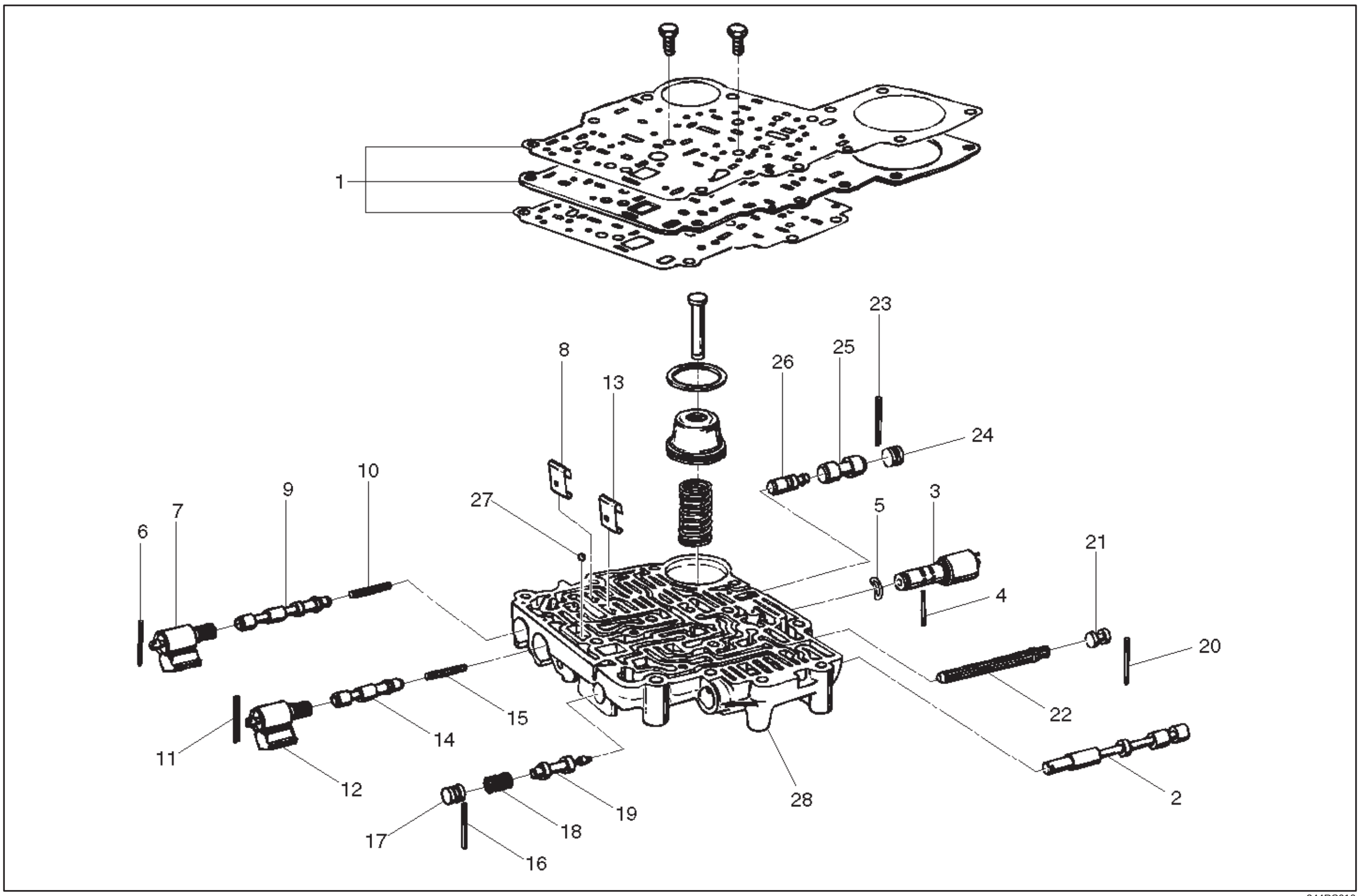
If any damage, deformation or wear is found, replace the damaged part.

Reassembly

1. Lubricate and preinstall pressure regulator spring seat (16) on valve (17), with the flat side against shoulder.
2. Install pressure regulator valve (17) and spring seat (16) assembly, valve spring (15), and spring seat (14) with the flat side away from spring to oil pump assembly (18).
3. Assemble boost valve (13) into sleeve (12).
4. Install boost valve and sleeve assembly, and sleeve pin (11) to oil pump assembly (18).
5. Install throttle signal accumulator piston (10), spring (9), and spring seat (8), with the flat side away from the spring, and snap ring (7) to oil pump assembly (18).
6. Install converter clutch control valve (6), spring (5), plug (4), and pin (3) to oil pump assembly (18).
7. Install oil pump driven gear (2) and drive gear (1).

Main Case Valve Body

Disassembled View



Legend

(1) Gaskets and Transfer Plate
(2) Manual Valve
(3) Band Control Solenoid
(4) Pin
(5) Waved Washer
(6) Spring Pin
(7) Solenoid A
(8) Retainer
(9) 1–2/3–4 Shift Valve
(10) Spring
(11) Spring Pin
(12) Solenoid B
(13) Retainer
(14) 2–3 Shift Valve
(15) Spring
(16) Spring Pin
(17) Plug
(18) Spring
(19) Low Pressure Control Valve
(20) Spring Pin
(21) Plug
(22) Band Control Screen Assembly
(23) Spring Pin
(24) Plug
(25) 1–2 Accumulator Valve
(26) 1–2 Accumulator Control Valve
(27) Check ball
(28) Main Case Valve Body

Disassembly

1. Remove two 11mm bolts from valve body (28), then remove gaskets and transfer plate (1).
2. Remove manual valve (2).
3. Push in band control solenoid (3) to compress waved washer (5), and remove pin (4).
4. Remove band control solenoid (3) and waved washer (5).
5. Remove spring pin (6) with a 3 mm diameter punch.
6. Remove solenoid A (7) by grasping the metal tip. Do not grasp the connector housing.
7. Remove retainer (8), 1–2/3–4 shift valve (9) and spring (10).
8. Remove spring pin (11) with a 3 mm diameter punch.
9. Remove solenoid B (12) by grasping the metal tip. Do not grasp the connector housing.
10. Remove retainer (13), 2–3 shift valve (14), and spring (15).
11. Remove spring pin (16), plug (17), spring (18) and low pressure control valve (19).
12. Remove spring pin (20), plug (21), and band control screen assembly (22).
13. Remove spring pin (23), plug (24), 1–2 accumulator valve (25), and 1–2 accumulator control valve (26).
14. Remove 1 check ball (27) from valve body (28).

Inspection and Repair

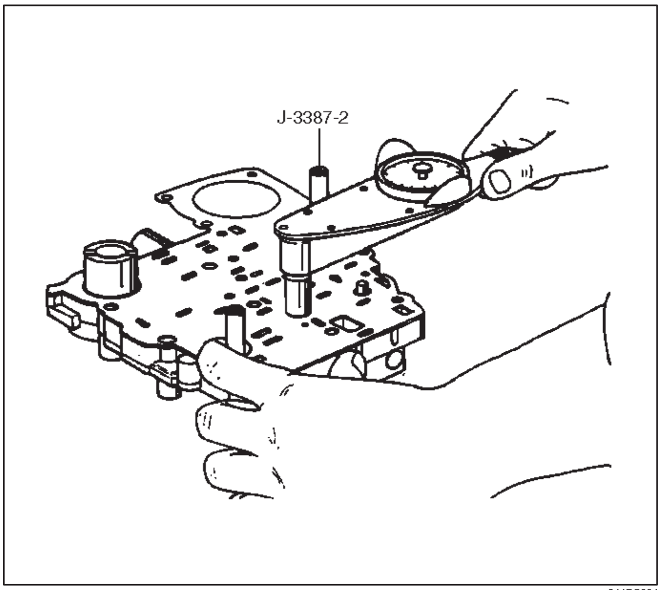
Inspect for the following, and replace any damaged or worn parts:

1. Damage or wear to each valve.
2. Damage in oil passeges.
3. Cracks or damage to valve body.
4. Valve operations.
5. Spring fatigue.

Reassembly

1. Install 1–2 accumulator control valve (26), 1–2 accumulator valve (25), plug (24), and spring pin (23).
2. Install band control screen assembly (22), plug (21), and spring pin (20).
3. Install low pressure control valve (19), spring (18), plug (17), and spring pin (16).
4. Install spring (15), 2–3 shift valve (14), retainer (13), solenoid B (12), and spring pin (11).
5. Install spring (10), 1–2/3–4 shift valve (9), retainer (8), solenoid A (7), and spring pin (6).
6. Install waved washer (5), band control solenoid (3), and pin (4).
7. Install manual valve (2).
8. Install check ball (27) to valve body (28).
9. Install gasket (valve body/transfer plate) and transfer plate using two J–3387–2 guide pins.
   - Install two 11mm bolts.

Torque: 13 N•m (113 lb in)

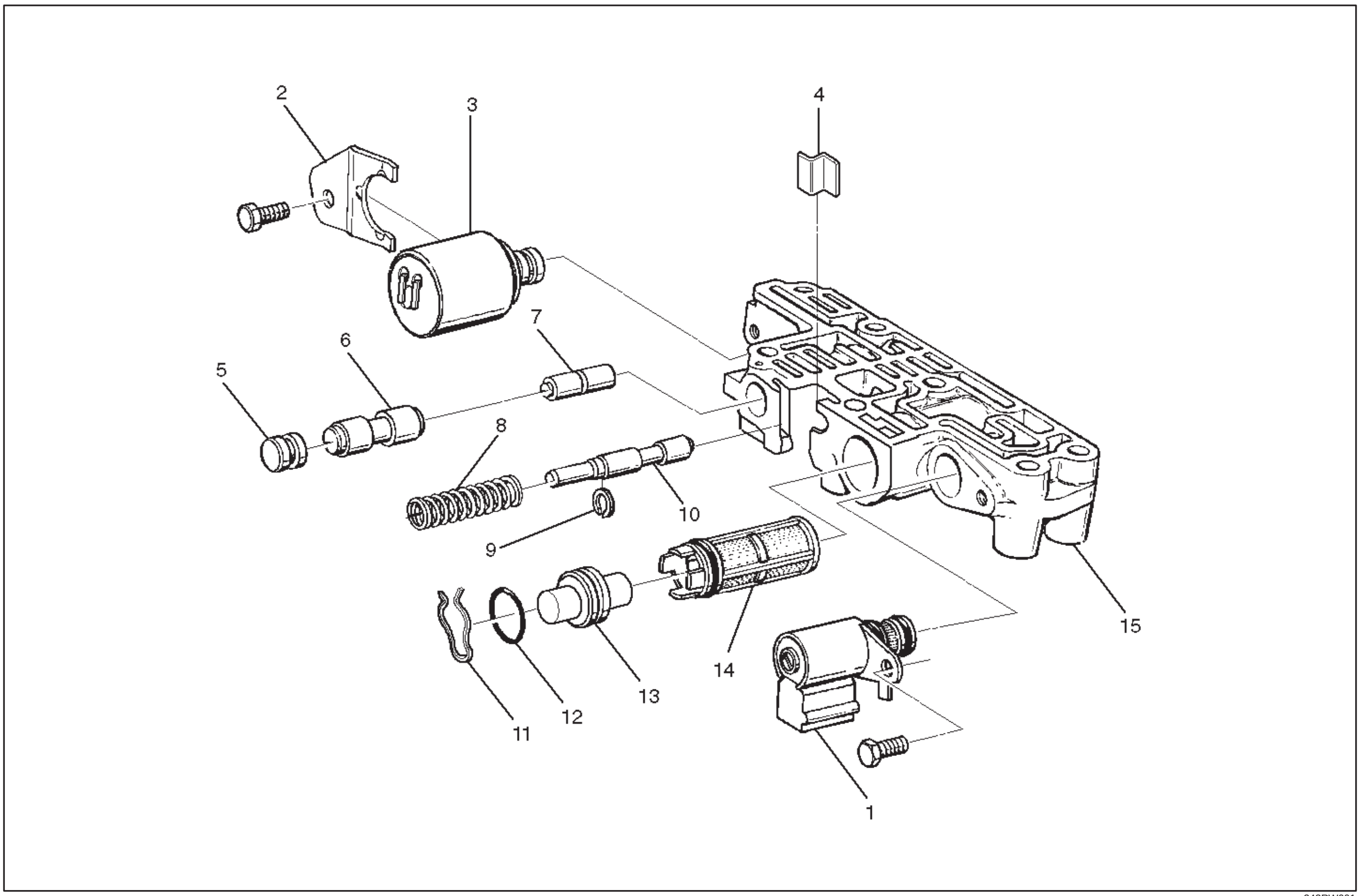


244RS004

- Install gasket (transfer plate/main case).

Adapter Case Valve Body

Disassembled View



243RW001

Legend

(1) Converter Clutch Solenoid Assembly
(2) Retainer
(3) Force Motor Solenoid
(4) Retainer
(5) Plug
(6) 3/4 Accumulator Valve
(7) 3/4 Accumulator Control Valve
(8) Spring
(9) Retaining Ring
(10) Feed limit Valve
(11) Plug Retainer
(12) O-ring
(13) Plug
(14) Force Motor Screen Assembly
(15) Adapter Case Valve Body

Disassembly

1. Remove 11mm bolt from valve body.
   - Remove converter control solenoid assembly (1).
2. Remove 11mm bolt and retainer (2) from valve body.
   - Remove force motor solenoid (3).
3. Remove retainer (4), plug (5), 3/4 accumulator valve (6), and 3/4 accumulator control valve (7)
4. Remove spring (8), retaining ring (9), and feed limit valve (10).
5. Remove plug retainer (11), O-ring (12), plug (13), and force motor screen assembly (14).
   - Use 5 mm bolt to pull plug.

Inspection and Repair

Inspect for the following, and replace any damaged or worn parts:

1. Damage or wear to each valve.
2. Damage in oil passeges.
3. Cracks or damage to valve body.
4. Valve operations.
5. Spring fatigue.

Reassembly

1. Install force motor screen assembly (14), plug (13), O-ring (12), and plug retainer (11).
2. Install feed limit valve (10), retaining ring (9), and spring (8).

3. Install 3/4 accumulator control valve (7), 3/4 accumulator valve (6), plug (5), and retainer (4).
4. Install force motor solenoid (3).
   - Place solenoid terminals pointing towards mating face.
   - Install retainer (2) and bolt.

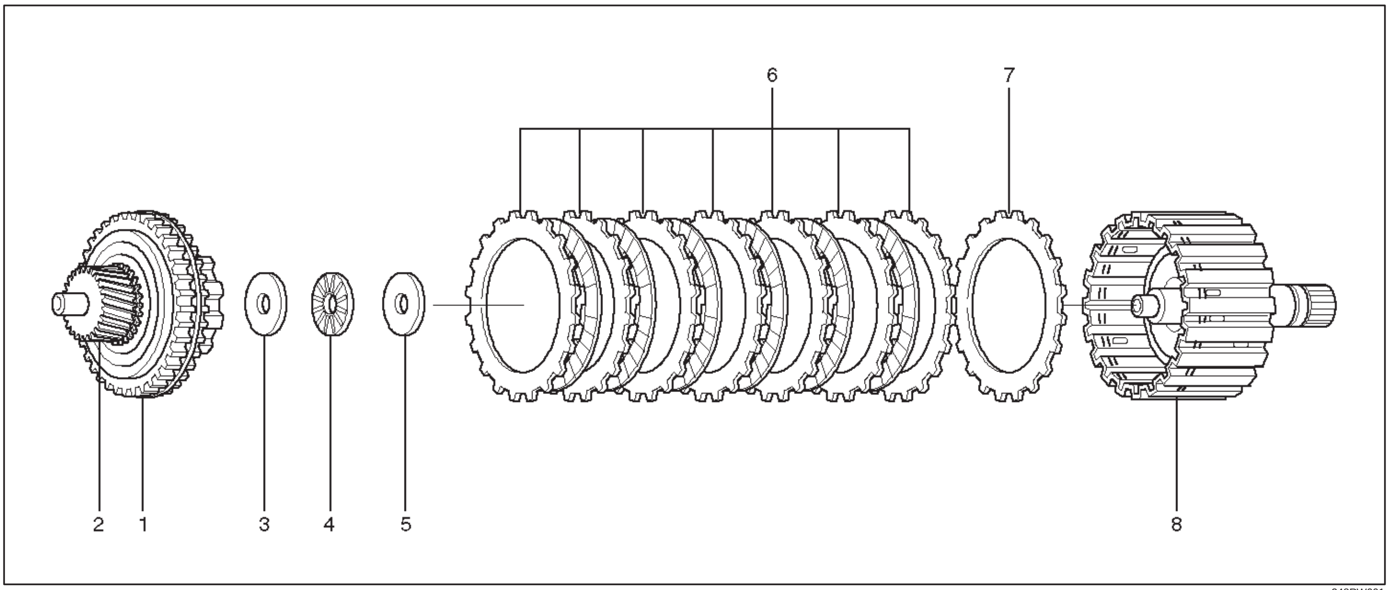
   Torque: 10 N•m (87 lb in)

5. Install converter clutch solenoid assembly with two O-rings (1) to valve body.
   - Install bolt.

   Torque: 10 N•m (87 lb in)

Third Clutch and Sprag Unit

Disassembled View



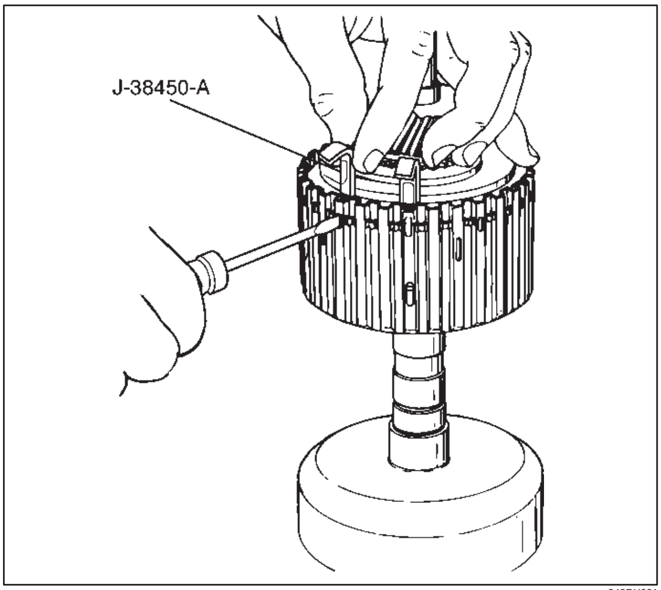
248RW001

Legend

(1) Retaining Ring
(2) Input Sun Gear and Sprag Unit Assembly
(3) Retaining Washer
(4) Bearing
(5) Thrust Washer
(6) Clutch Plates
(7) Third Clutch Spring Cushion Plate
(8) Third Clutch Drum Assembly

Disassembly

1. Place the third clutch drum and intermediate shaft assembly upright, using the overdrive internal gear as a support.
2. Locate the ends of the retaining ring. Depress one end of the ring using a small screwdriver instead of the depressor handle provided with the tool J-38450-A. Slide one blade down between the third clutch drum and the retaining ring.
3. Remove a screwdriver and repeat this step for the other end of retaining ring.
4. Install the remaining four blades approximately (five) notches apart using a screwdriver to depress the retaining ring.
5. Pull up on input sun gear and sprag unit assembly (1 and 2) to release the retaining ring from third clutch drum assembly (8).
6. Remove the tool blades.



248RX001

7. Remove retaining washer (3), bearing (4), thrust washer (5), and clutch plates (6 and 7) from the third clutch drum assembly (8).

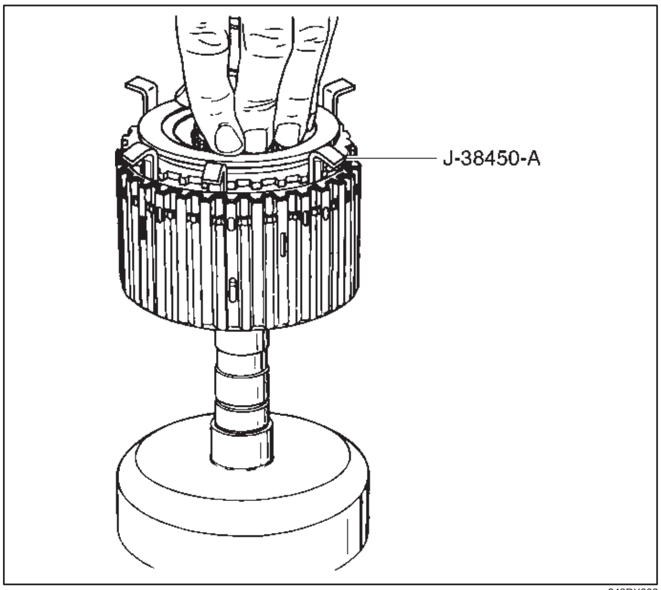
Inspection and Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Reassembly

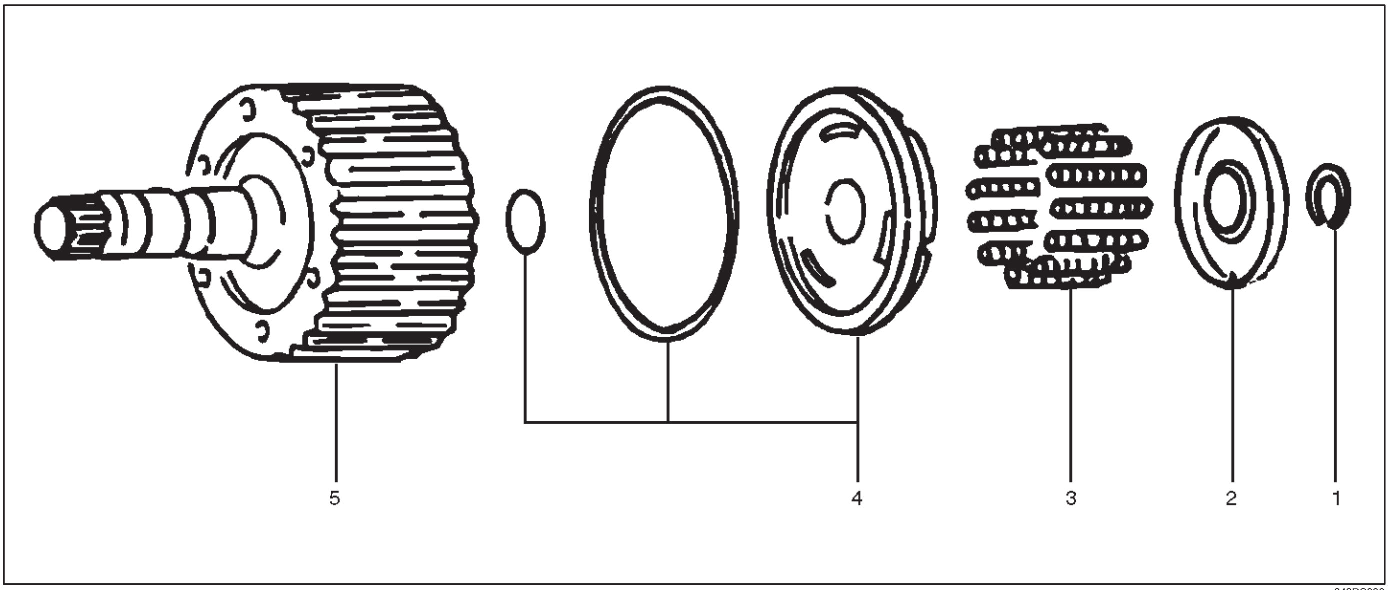
1. Place third clutch drum and intermediate shaft assembly upright, using the overdrive internal gear as a support.
2. Install third clutch spring cushion plate (7), bevel face down.
3. Install third clutch plates (6) into third clutch drum assembly (8). Start with the steel clutch plate and alternate with lined plates.
4. Install thrust washer (5), bearing (4) and retaining washer (3).
5. Fully engage the hub spline of the input sun gear and sprag unit assembly (2) into the third clutch inner tangs.
   - Simultaneously rotate the outer sprag race to engage into the third clutch drum assembly (8).
6. Place J-38450-A blades between the retaining ring and the third clutch drum apporximately (five) notches apart, and one blade at each end of the retaining ring (1). Push down on sprag assembly until the assembly is seated into the third clutch drum assembly (8).
7. Remove the tool blades and engage retaining ring into groove of third clutch drum.



248RX002

Third Clutch

Disassembled View



248RS006

Legend

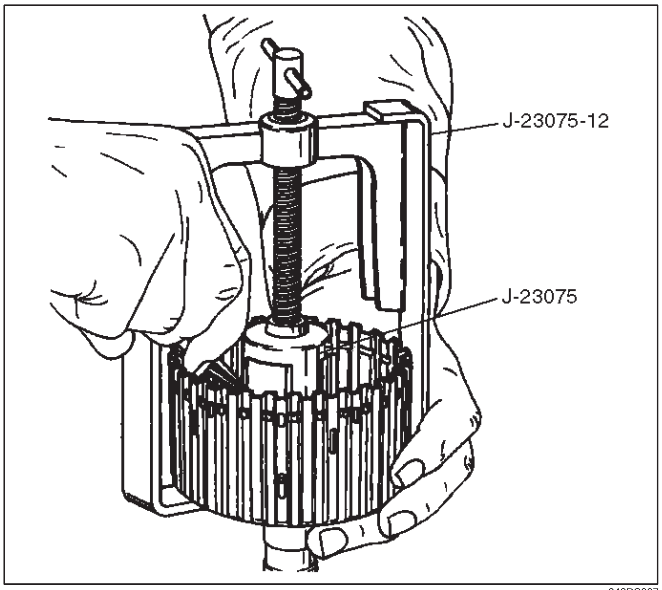
(1) Retaining Ring
(2) Spring Seat
(3) Springs
(4) Piston Assembly
(5) Third Clutch Drum

Disassemble

1. Compress spring seat using the J–23075 spring compressor and J–23075–12 adapter tool.

NOTE: Do not overstress the springs and seat. This will cause damage to the spring seat.

- Remove the tool.
- Remove retaining ring (1).



248RS007

2. Release the spring seat (2).

NOTE: Do not let the spring seat catch in the ring groove.

- Remove spring seat (2) and springs (3).

3. Remove piston assembly (4) from third clutch drum (5).

Inspection and Repair

Visual check:

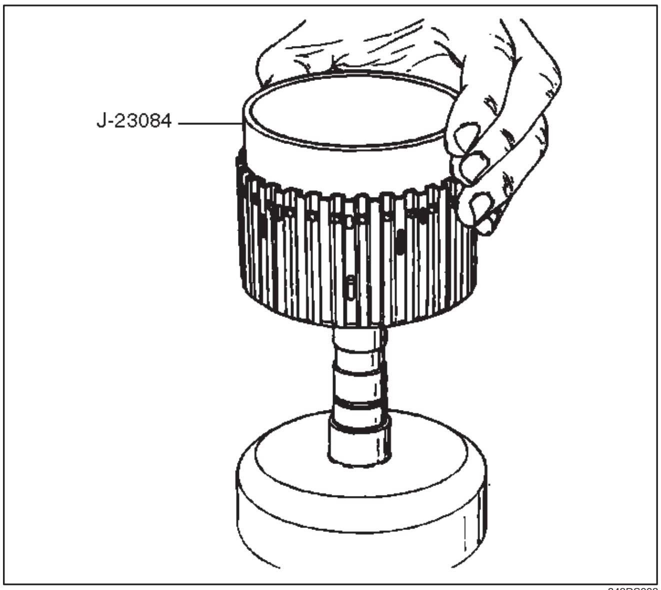
If any damage, deformation or wear is found, replace the damaged part.

Operation check:

Shake the piston and listen for check ball movement. Movement indicates proper check ball operation. Replace the piston if the check ball is missing or falls out.

Reassembly

1. The lip of the piston seal must point toward the front of the transmission. Lubricate the seal lip with transmission fluid.
   - Install piston assembly (4) into the third clutch drum (5). Use the J–23084 third clutch piston installer to protect the outer seal during installation.
   - Remove the seal installer.



248RS008

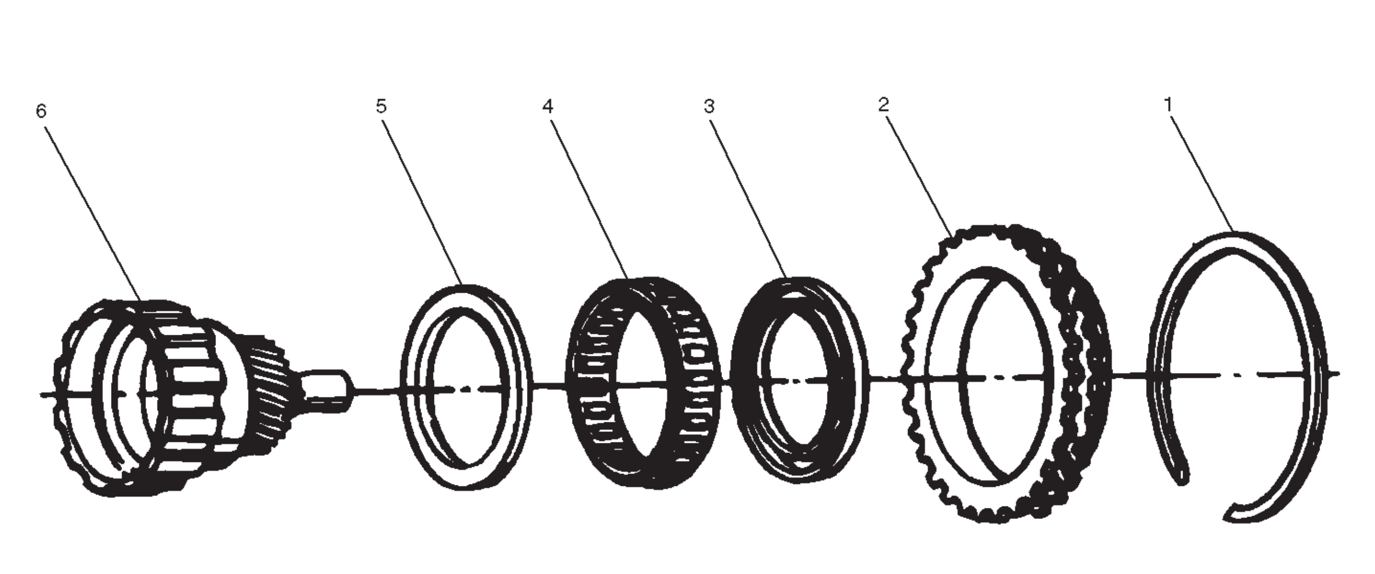
2. Install twelve springs (3) and spring seat (2).
3. Place retaining ring (1) onto spring seat.
   - Compress the piston springs, using the J–23075 piston spring compressor and J–23075–12 adapter.

CAUTION: Do not overstress the springs and seat. Do not let the spring seat catch in the ring groove. This may cause damage to the spring seat.

- Install spring seat retaining ring (1).
- Remove the piston spring compressor and adapter.

Sprag Unit

Disassembled View



248RS009

Legend

(1) Retaining Ring
(2) Sprag Outer Race
(3) Ring
(4) Sprag Assembly
(5) Ring
(6) Third Clutch Hub and Sun Gear Assembly

Disassembly

1. Remove the sprag outer race, retaining ring, and sprag assembly from the third clutch hub and sun gear assembly.
2. Remove the rings and sprag assembly from the sprag outer race.

Inspection and Repair

Visual Check:

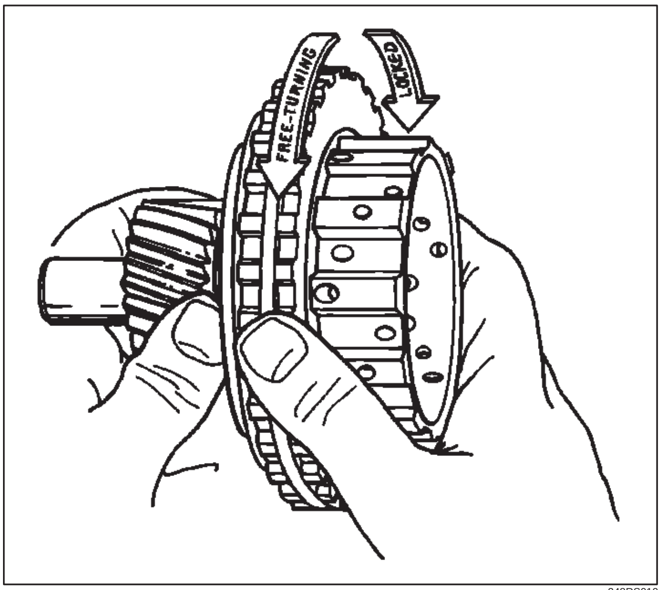
If any damage, deformation or local wear is found, replace the damaged part.

Reassembly

NOTE: Flared shoulder of the sprag cage faces the sun gear. This procedure must be followed exactly to be sure that the sprag assembly is installed properly.

1. Install rings and sprag assembly onto the third clutch hub and sun gear.
2. Install sprag outer race and retaining ring assembly over the sprag cage assembly.
   - Place third clutch hub and sun gear assembly on a flat surface, sun gear facing up. Place sprag outer race and sprag assembly over the sun gear assembly, push down and turn the input sun counterclockwise at the same time.

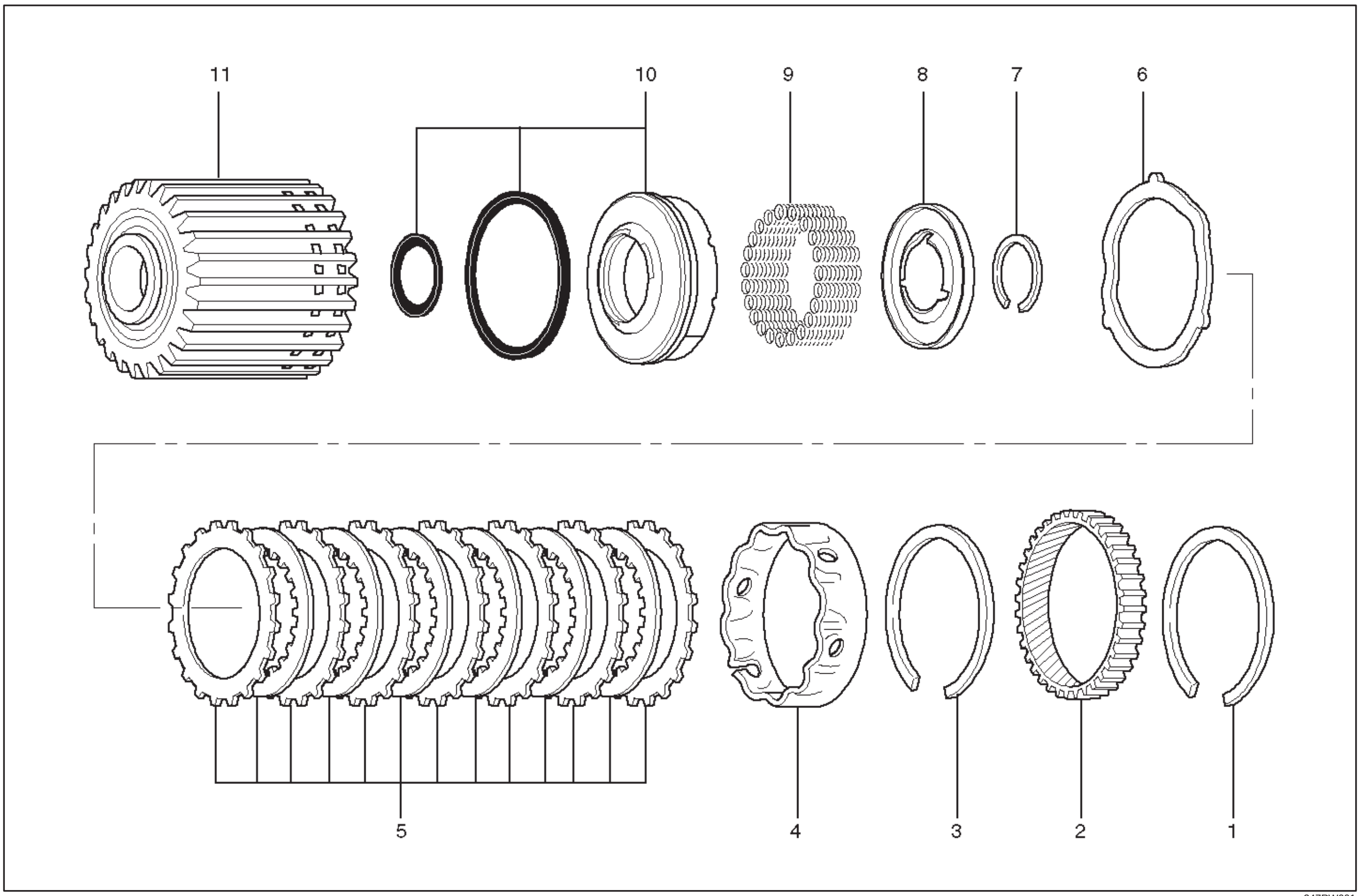
NOTE: Check correct rotation by holding the sun gear in your left hand and turning the outer race. The outer sprag race should turn freely towards you and should lock turning away from you.



248RS010

Second Clutch

Disassembled View



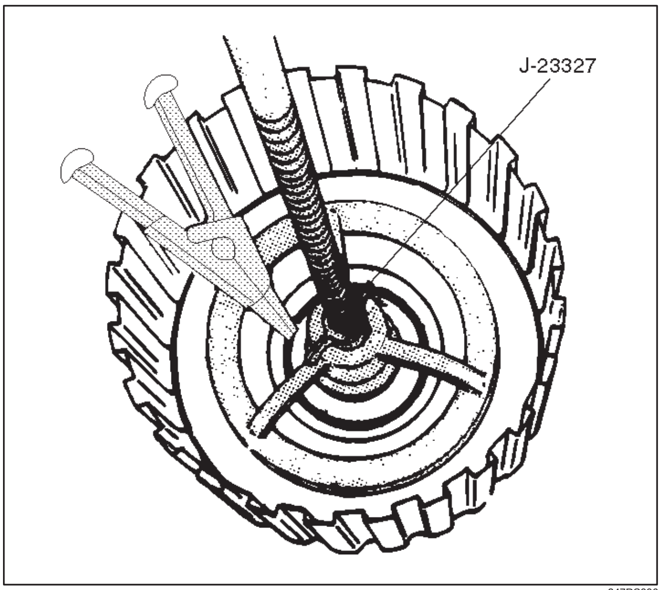
247RW001

Legend

(1) Retaining Ring
(2) Ring Gear
(3) Retaining Ring
(4) Spacer
(5) Clutch Plates
(6) Waved Washer
(7) Retaining Ring
(8) Spring Seat
(9) Springs
(10) Piston Assembly
(11) Second Clutch Drum

Disassembly

1. Remove retaining ring (1) from second clutch drum (11).
2. Remove ring gear (2), retaining ring (3), and spacer (4).
3. Remove clutch plates (5) and waved washer (6).
4. Remove retaining ring (7) using J–23327 compressor to compress the spring seat (8).
5. Remove spring seat (8), springs (9) and piston assembly (10) from second clutch drum (11).



247RS006

Inspection and Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Operation Check:

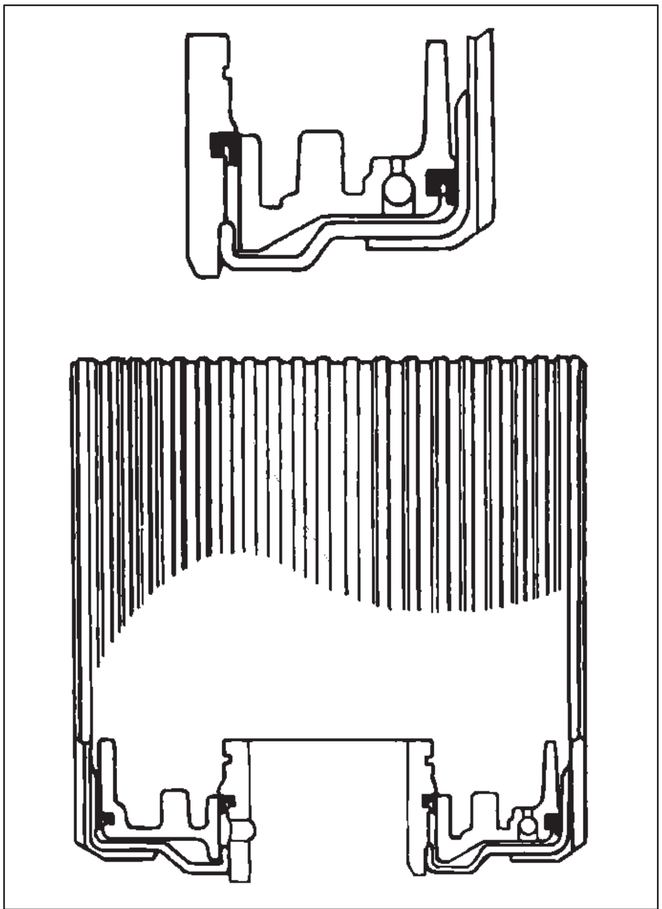
Shake the piston and listen for check ball movement. Movement indicates proper check ball operation. Replace the piston if the check ball is missing or falls out.

Reassembly

1. Install piston assembly (10) into the second clutch drum (11).
   - Lubricate the lip seal with transmission fluid. Use the J–23080–A second clutch piston installer to protect the outer piston lip seal.

NOTE: Lip of the seal should point toward front of transmission.

- Remove the installer.


247RS007

2. Install twenty-two piston springs (9) and spring seat (8) on the second clutch piston (10). Place retaining ring (7) onto spring seat.
   - Use the J–23327 compressor to compress the piston springs.

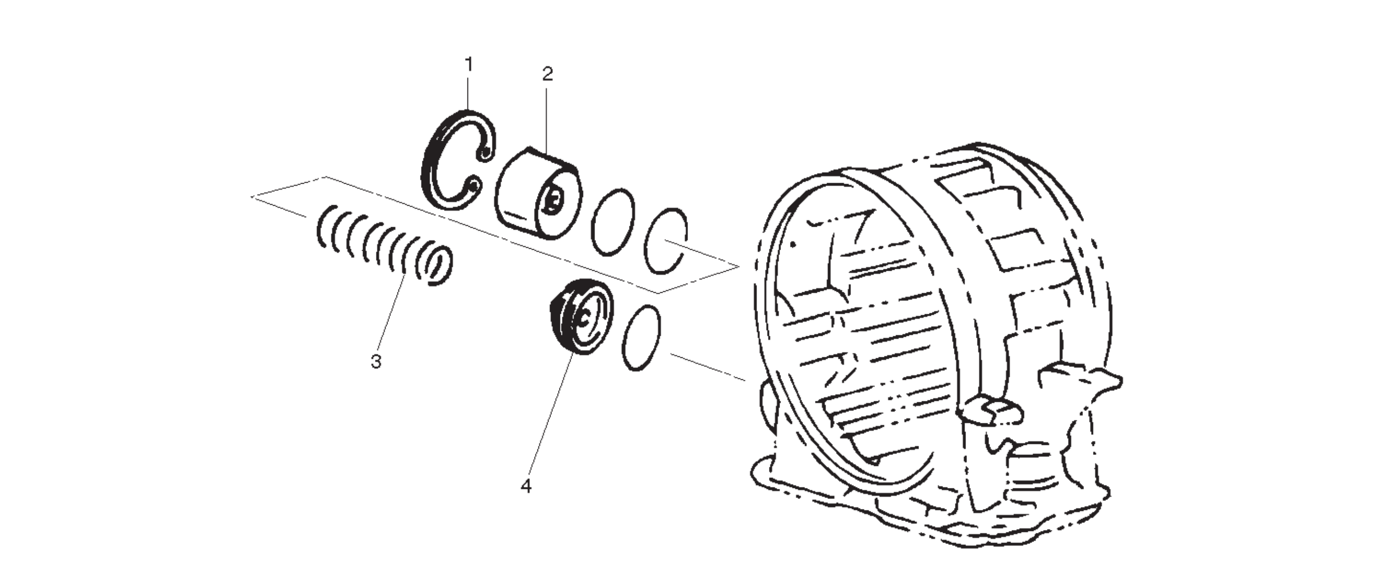
NOTE: Do not let spring seat catch in ring groove.

- Remove the compressor.

3. Install waved plate (6) and clutch plates (5). Start with a steel plate and alternate with lined plates.
   - Align second clutch inner tangs.
4. Install spacer (4), with the fluted end toward clutch plates.
5. Install retaining ring (3), ring gear (2) and retaining ring (1).

3–4 Accumulator Piston

Disassembled View



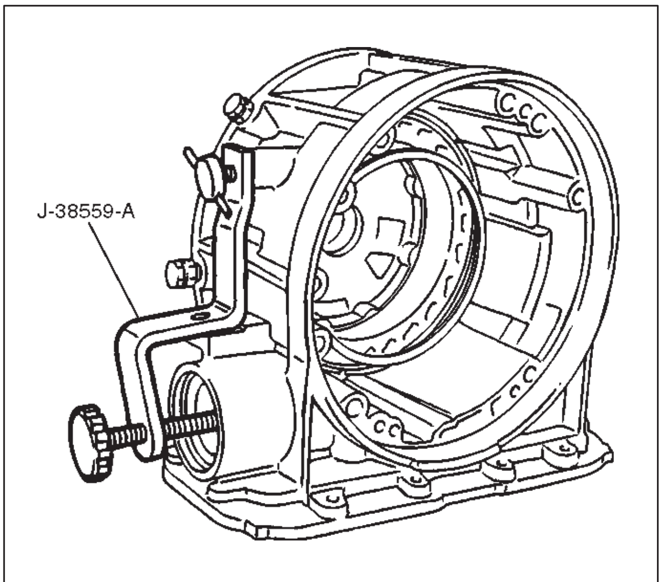
244RS005

Legend

(1) Snap Ring
(2) Cover
(3) Spring
(4) Piston Assembly

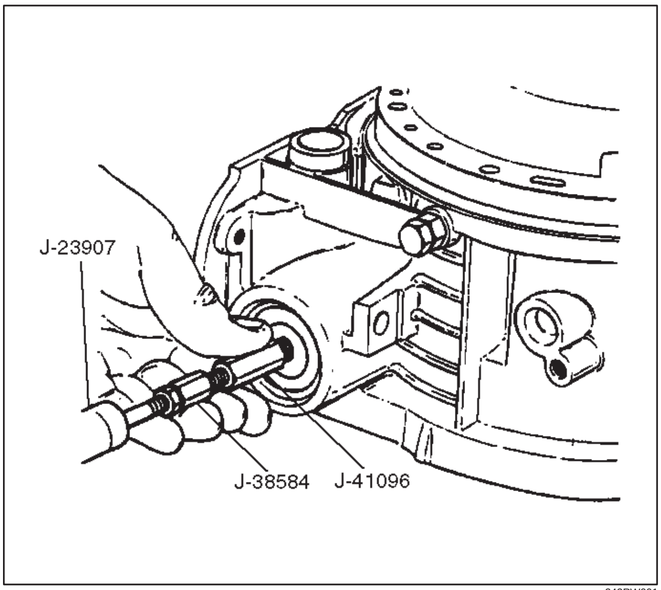
Disassembly

1. Install the J–38559–A cover compressor on adapter case.
   - Compress piston cover then remove snap ring.



242RS007

2. Install the J–41096 cover remover and J–38584 adapter to center hole of cover.
   - Use the J–23907 slide hammer to remove cover.
3. Remove spring and piston assembly.



242RW001

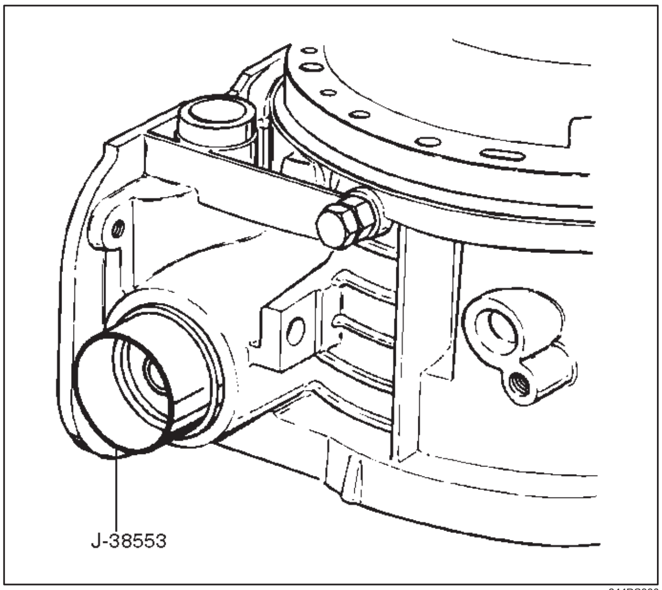
Inspection and Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

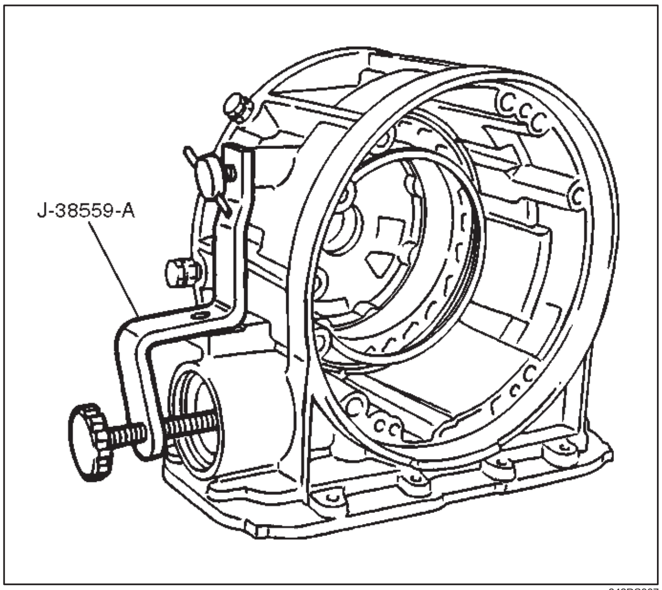
Reassembly

1. Place the J–38553 piston fitter into adaptor case and push the piston into position, using suitable diameter tube.
   - Remove the piston fitter.



244RS006

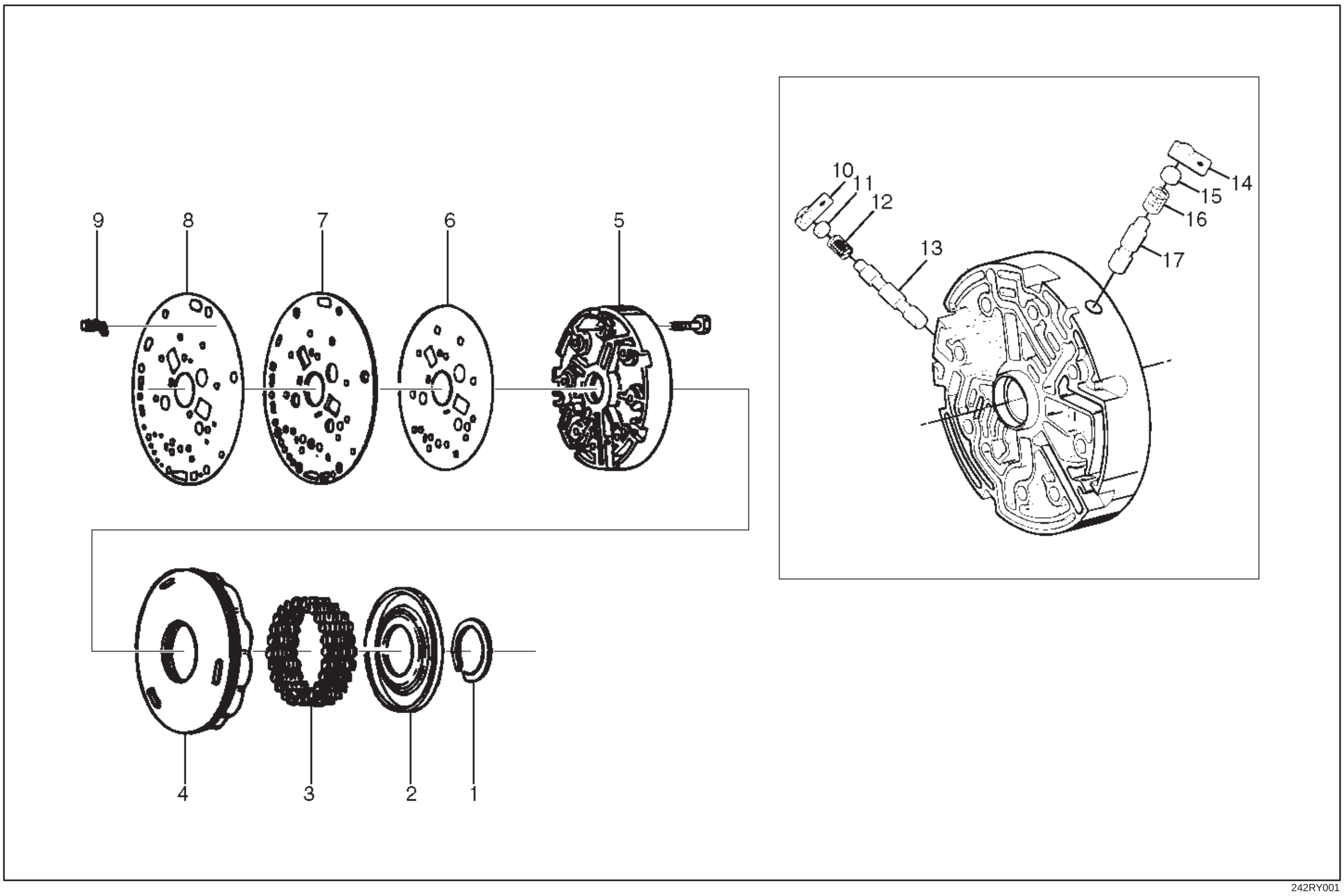
2. Install spring and cover.
3. Install snap ring, using the J–38559–A compressor tool.
   - Install snap ring in groove.
   - Remove the compressor tool.



242RS007

Reverse Clutch Piston and Center Support

Disassembled View



Legend

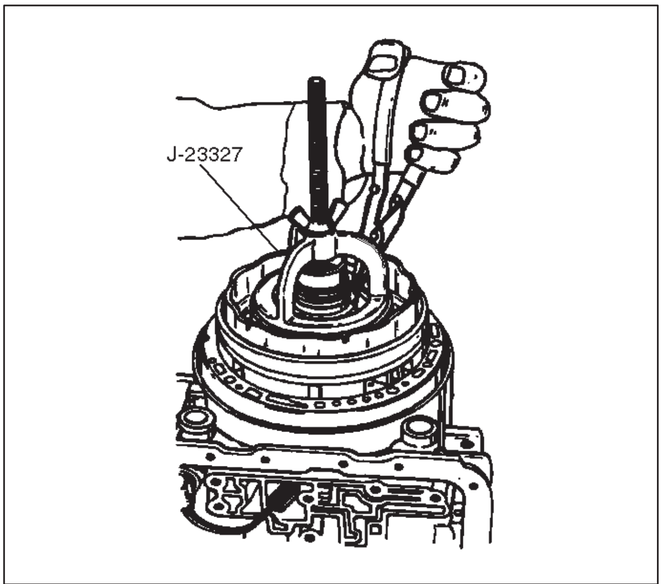
- (1) Retaining Ring
- (2) Spring Seat
- (3) Springs
- (4) Piston Assembly
- (5) Center Support
- (6) Gasket
- (7) Transfer Plate
- (8) Gasket
- (9) Restrictor
- (10) Retainer Plate
- (11) Plug
- (12) Spring
- (13) Overrun Lock Out Valve
- (14) Retainer Plate
- (15) Plug
- (16) Spring
- (17) Reverse Lock Out Control Valve

Disassembly

1. Install the J–23327 compressor tool on spring seat, then compress the spring seat.
   - Remove retaining ring (1).

NOTE: Do not over-stress the springs and seat, as this will cause damage to the spring seat.

- Remove the compressor tool.



247RS008

2. Remove spring seat (2) and springs (3).
3. Remove piston assembly (4).
4. Remove 8 bolts from center support (5), then remove center support (5) from adapter case.
5. Remove gasket transfer plate/outer support (6), center support transfer plate (7), and gasket transfer plate/adapter case (8).
6. Remove restrictor (9) from adapter case housing.
7. Remove retainer plate (10), plug (11), spring (12), and overrun lock out valve (13) from center support (5).
8. Remove retainer plate (14), plug (15), spring (16) and reverse lock out valve (17) from center support (5).

Inspection and Repair

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Reassembly

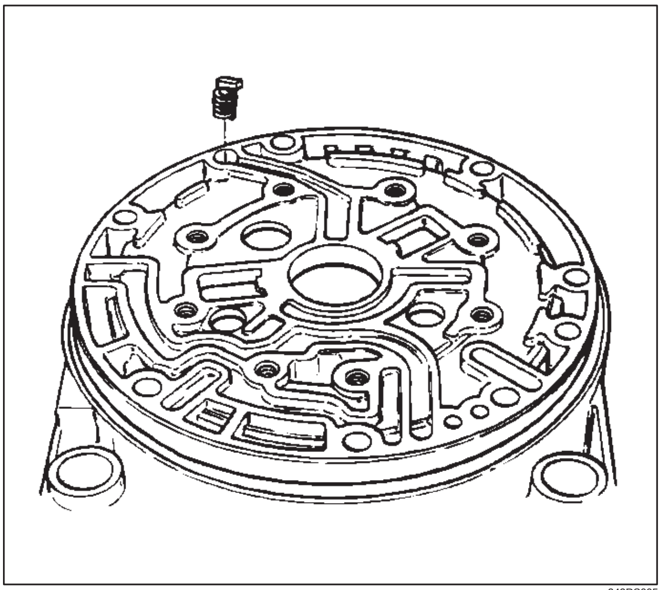
1. Install reverse lock out valve (17) and spring (16) to center support.

NOTE: Ensure correct assembly of valve. The spring should be located over the long small diameter end.

2. Install plug (15) and retainer plate (14).
3. Install overrun lock out valve (13) and spring (12) to center support.

NOTE: Ensure correct assembly of valve. The spring should be located over the long small diameter end.

4. Install plug (11) and retainer plate (10).
5. Place restrictor (9) in the lube overdrive channel in the adapter case housing.


242RS005

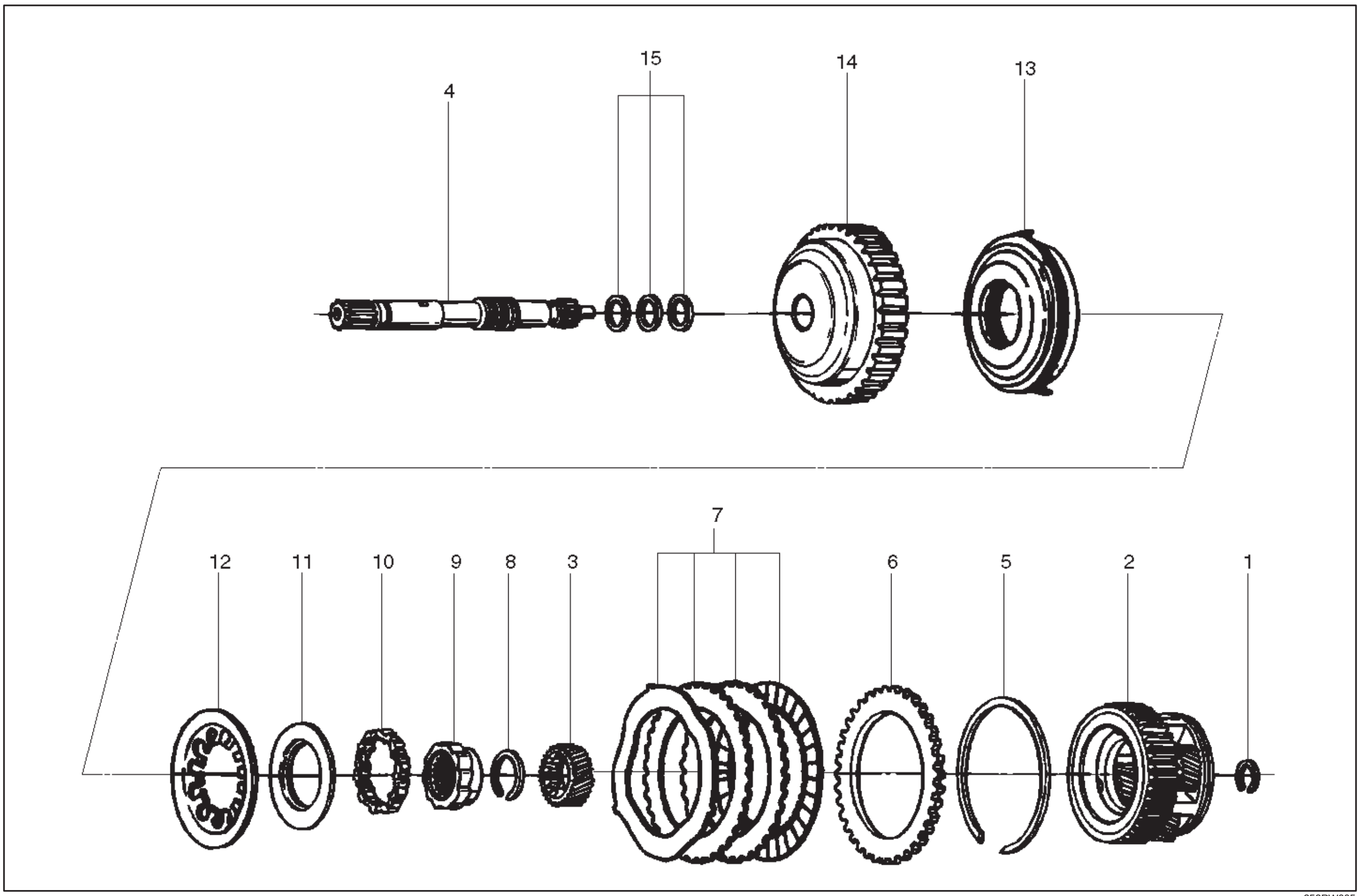
6. Install gasket transfer plate/adapter case (8), center support transfer plate (7), and gasket transfer plate/center support (6).
7. Install center support (5) with 8 bolts.

Torque : 25 N•m (18 lb ft)

8. Install piston assembly (4) into center support (5).
9. Install twenty four springs (3), spring seat (2), and retaining ring (1).
   - Install the J–23327 compressor and compress spring seat (2) and springs (3), then seat snap ring (1) in groove.
   - Remove the tool.

Overrun Clutch and Turbine Shaft

Disassembled View

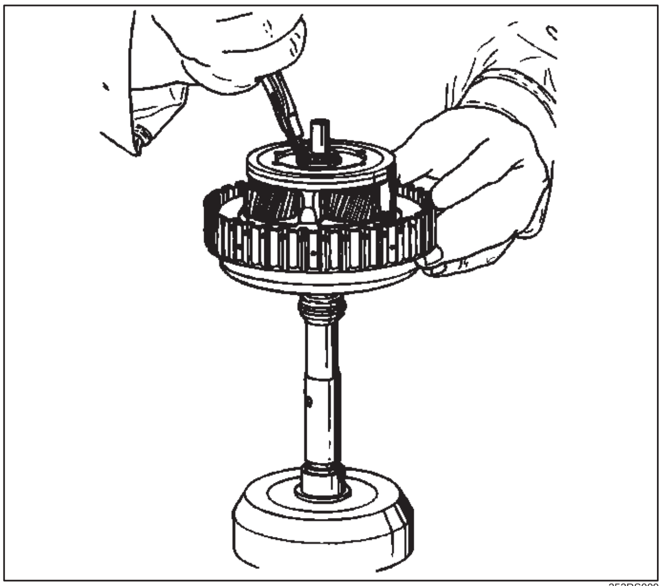


Legend

(1) Snap Ring
(2) Overdrive Carrier Assembly
(3) Sun Gear
(4) Turbine Shaft
(5) Snap Ring
(6) Backing Plate
(7) Clutch Plates
(8) Snap Ring
(9) Overrun Roller Clutch Cam
(10) Roller Clutch Assembly
(11) Overrun Clutch Release Spring Retainer
(12) Diaphragm Spring
(13) Piston Assembly
(14) Overrun Clutch Drum
(15) Turbine Shaft Seal Rings

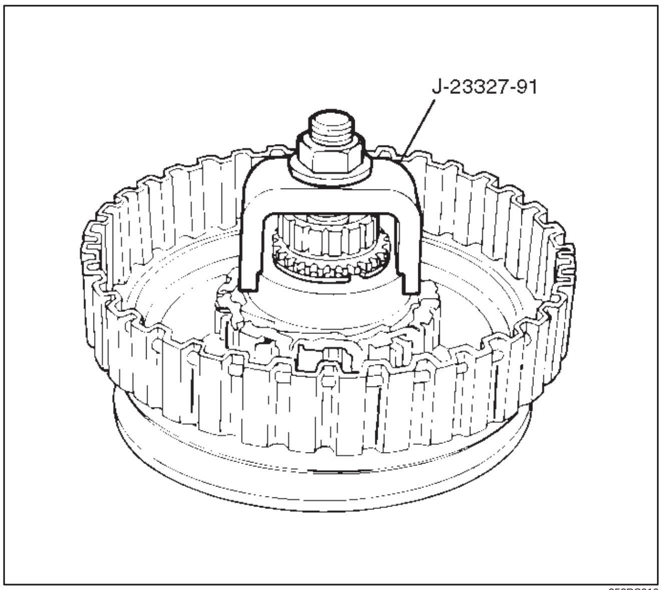
Disassembly

1. Position overrun clutch assembly upright, using the overdrive internal gear as a support.
   - Remove snap ring (1).



252RS009

2. Remove overdrive carrier assembly (2), sun gear (3) and turbine shaft (4).
3. Remove snap ring (5), backing plate (6), and clutch plates (7).
4. Compress diaphragm spring with the J–23327–91 compressor then remove snap ring (8).



252RS010

5. Remove overrun roller clutch cam (9) and roller clutch assembly (10).
6. Remove overrun clutch release spring retainer (11) and diaphragm spring (12).
7. Remove piston assembly (13) from overrun clutch drum (14).
8. Remove turbine shaft seal rings (15).

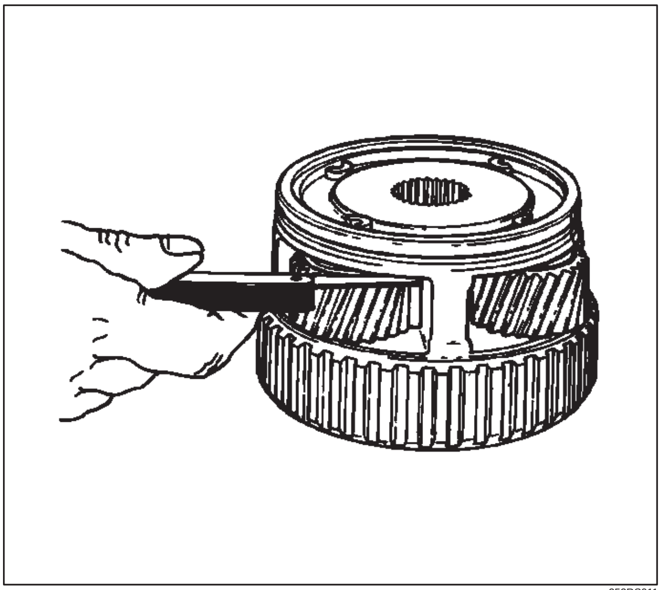
Inspection and Repair

Overdrive Carrier Check

- Check pinion end play with a feeler gauge.

Clearance: 0.24mm–0.64mm (0.0094in–0.025in)

If clearance is outside specified value, replace overdrive carrier assembly.



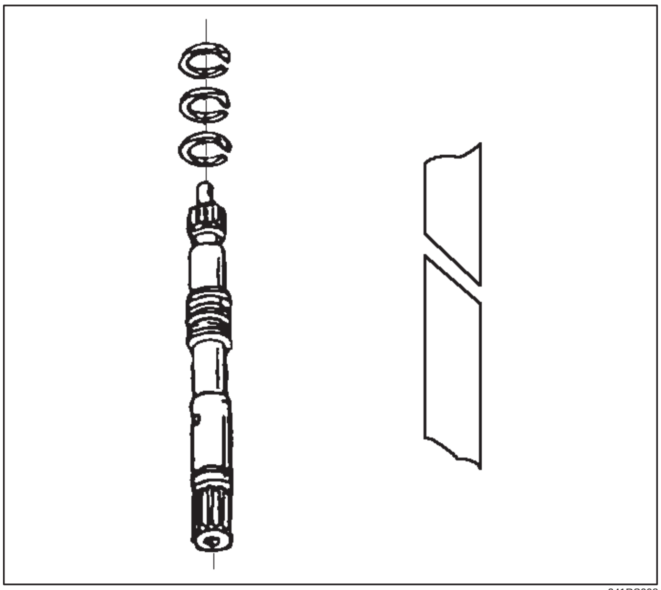
252RS011

Visual Check:

If any damage, deformation or wear is found, replace the damaged part.

Reassembly

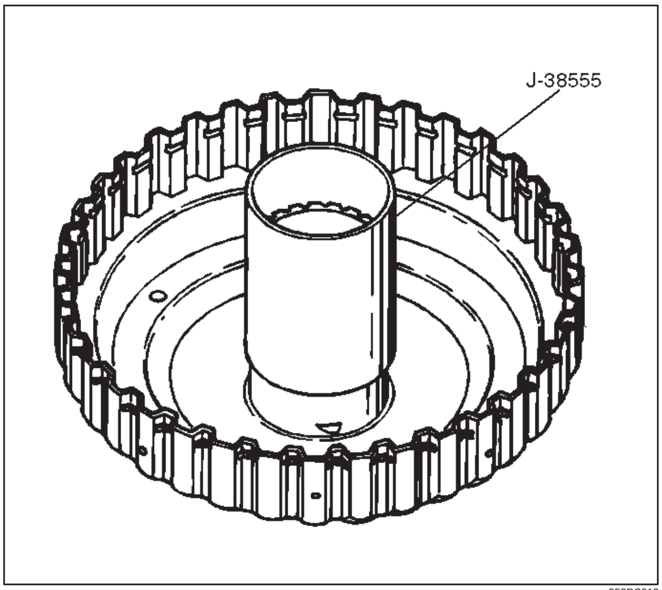
1. Install turbine shaft seal rings (15) with grease (petroleum jelly).



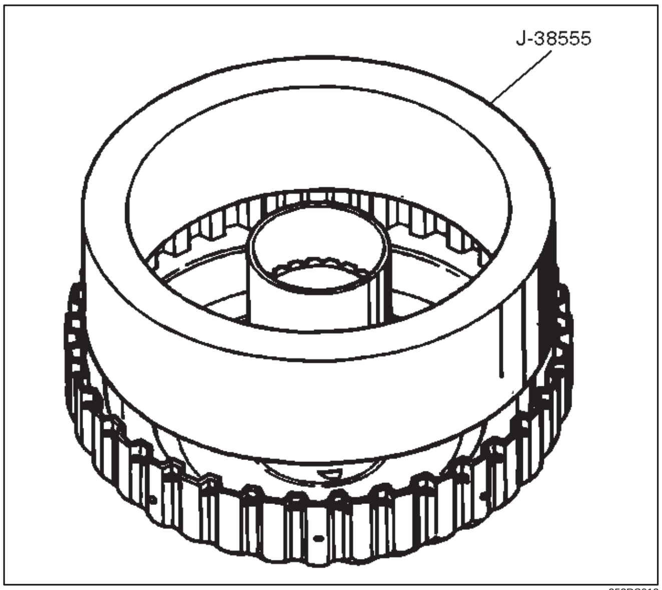
241RS008

2. Install the J–38555 inner installer on the drum (14).
   - Pre-install piston assembly into J–38555 outer installer.
   - Install overrun clutch piston assembly (13). Use the outer installer while pushing piston into drum (14).

- Remove the installer.



252RS012



252RS013

3. Install diaphragm spring (12).
4. Install overrun clutch release spring retainer (11) (lip faces upwards), overrun roller clutch assembly (10) and cam (9).
5. Place snap ring loosely on spring retainer.
   - Hold the J–23327–91 compressor in a vise and compress piston return spring with compressor.
   - Set snap ring (8) in ring groove.
   - Remove the compressor.
6. Install clutch plates (7), start with steel plate and alternate with lined plates.
7. Install backing plate (6).
8. Install snap ring (5).
9. Install overdrive sun gear with countersink pointing downwards.
10. Install the overdrive carrier assembly (2).

NOTE: Turn the assembly in a counter-clockwise direction only until roller clutch enters the outer race. After Installation, rotate the assembly and listen for loose rollers.

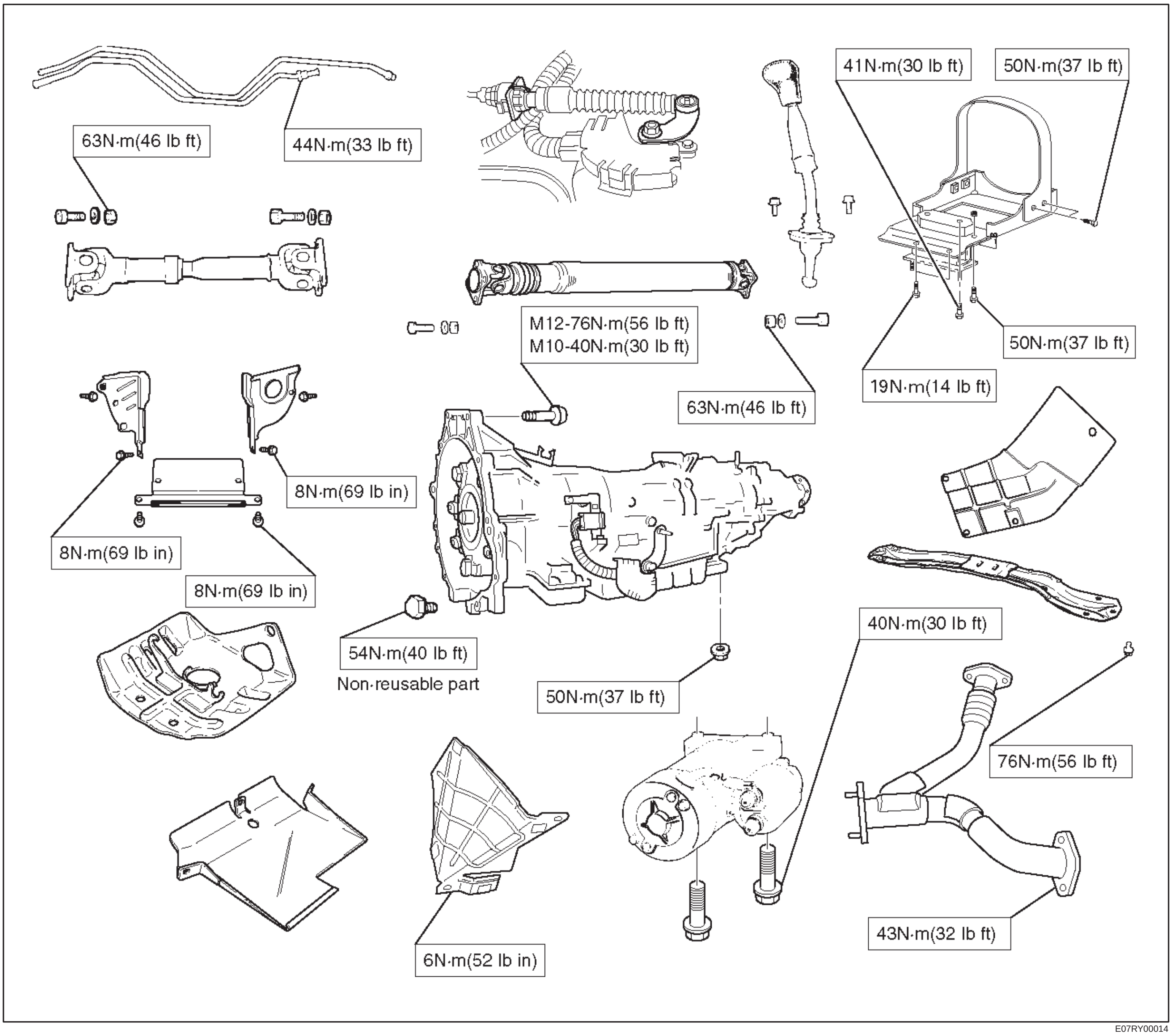
11. Install turbine shaft (4) and snap ring (1).

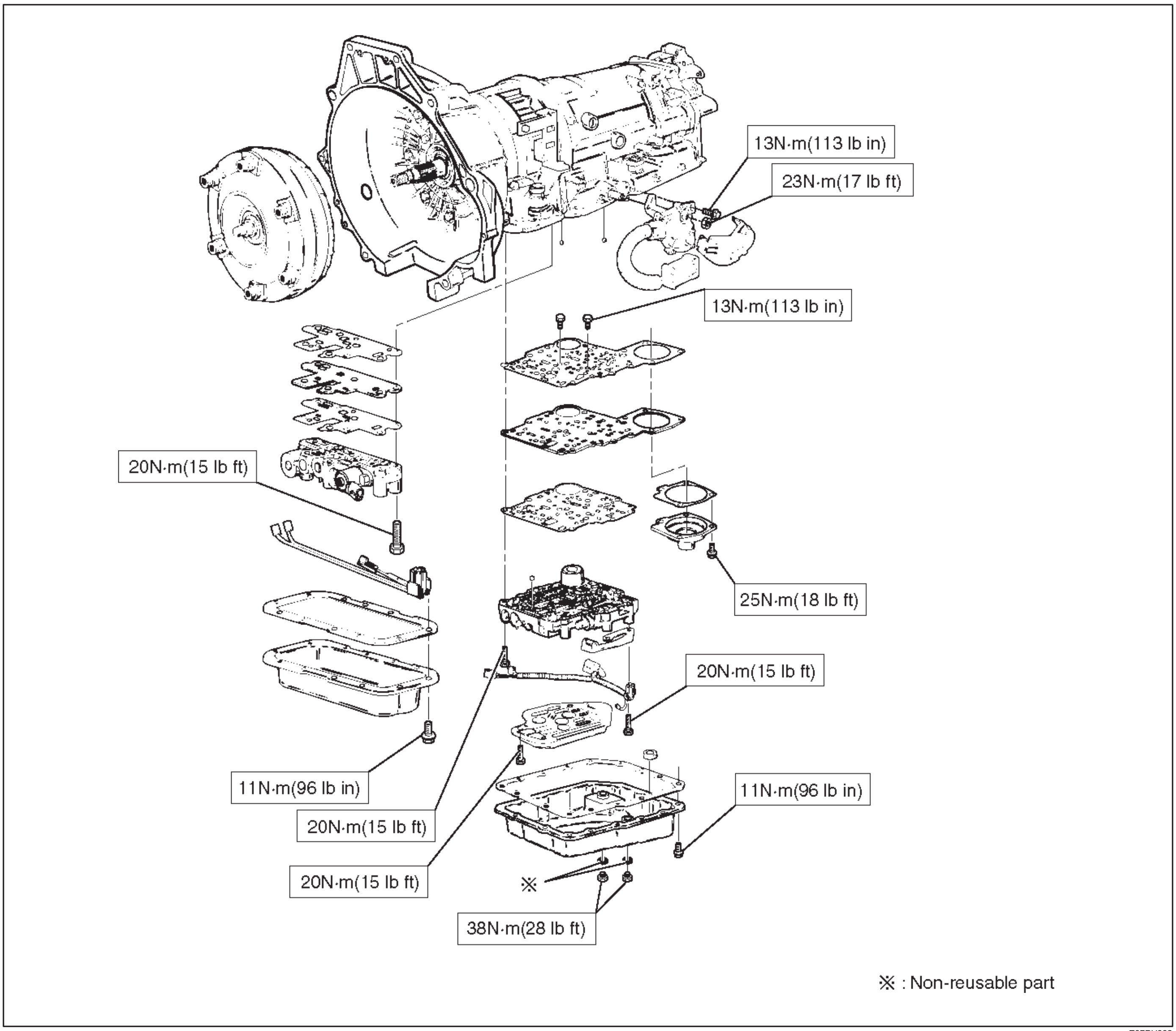
Main Data and Specification

General Specifications

				Remarks
Model			THM 4L30–E	
Engine			V6 3.2L 6VD1	
Type			Automatic four speed overdrive in 4th gear lock-up clutch torque converter	
Control systems	Shift control		Hydraulic	
	Shift pattern		Electronic	
	Shift quality		Electronic	
	Lock-up clutch		Electronic	
Gear ratio	1st		2.856	
	2nd		1.618	
	3rd		1.000	
	4th (O/D)		0.723	
	Reverse		2.000	
Gear set			Noiseless, high torque capability	
Oil used	Name		ATF DEXRON®–III	
	Q'ty liter (qt)		8.6 (9.1)	
Torque converter			2,100 ± 150	Stall speed (rpm)
	Reverse clutch	RC	4	Number of discs
	Second clutch	C2	6	
	Third clutch	C3	6	
	Brake band		Double wrap	
	Fourth clutch	C4	2	Number of discs
	Overrun clutch	OC	1	
	Overdrive roller clutch	OFW	10	Number of rollers
	Principle sprag	PFW	26	Number of sprags
	Ravigneaux type gear train (planetary gear set)	Input sun gear	30	Number of teeth
		Pinion gear	19	
		Long pinion	23	
		Ring gear	90	
		Long pinion	19	
		Output sun gear	46	
	Overdrive carrier (planetary gear set)	Sun gear	31	
		Pinion gear	24	
		Ring gear	81	

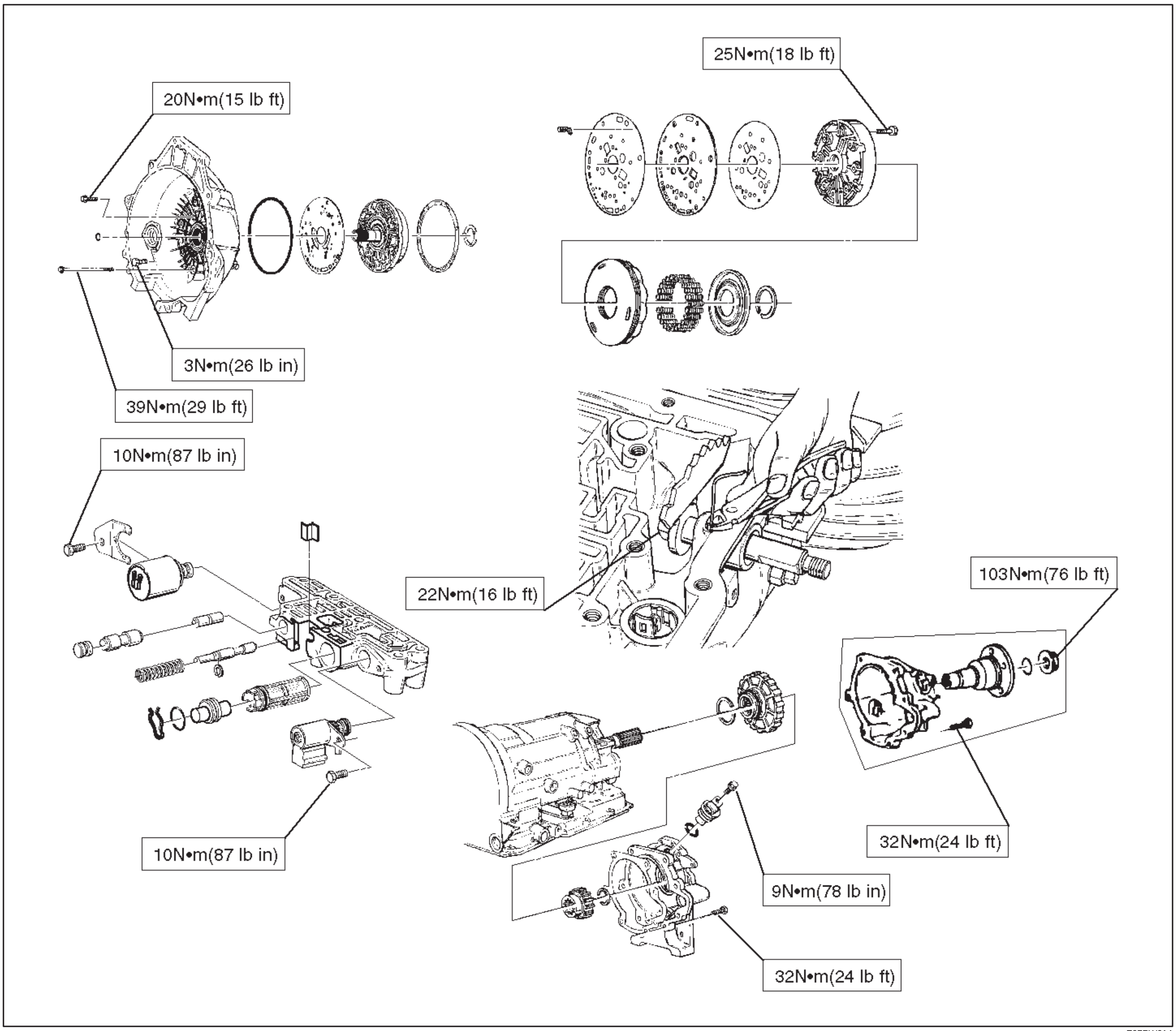
Torque Specifications





13N·m(113 lb in)
23N·m(17 lb ft)
13N·m(113 lb in)
20N·m(15 lb ft)
25N·m(18 lb ft)
20N·m(15 lb ft)
11N·m(96 lb in)
20N·m(15 lb ft)
11N·m(96 lb in)
20N·m(15 lb ft)
※
38N·m(28 lb ft)
※ : Non-reusable part

E07RY003



25N•m(18 lb ft)
20N•m(15 lb ft)
3N•m(26 lb in)
39N•m(29 lb ft)
10N•m(87 lb in)
22N•m(16 lb ft)
103N•m(76 lb ft)
10N•m(87 lb in)
32N•m(24 lb ft)
9N•m(78 lb in)
32N•m(24 lb ft)

E07RW014

Special Tools

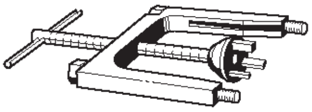
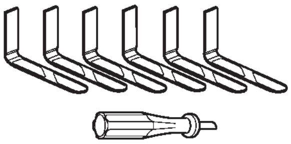
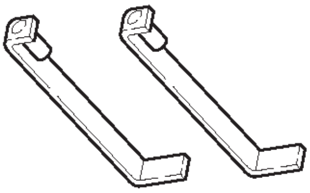
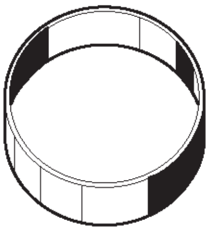
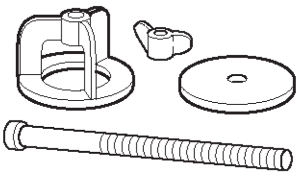
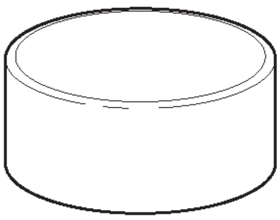
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RT071	J–23075 Spring compressor (For servo piston)
 901RX007	J–38450–A Third clutch snap ring compressor
 901RT073	J–23075–12 Third clutch spring compressor adapter (Use with J–23075)
 901RT074	J–23084 Third clutch piston installer
 901RT075	J–23327 Third clutch spring compressor
 901RT076	J–23080–A Second clutch piston installer

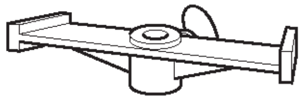
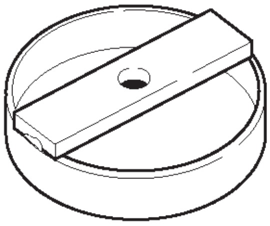
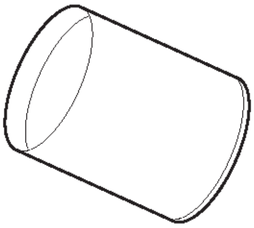
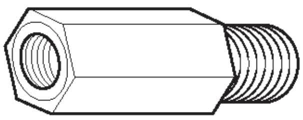
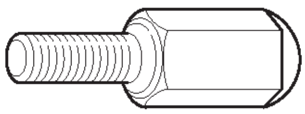
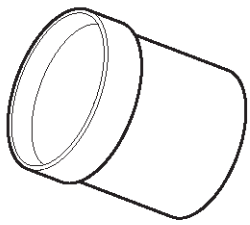
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RT077	J–23085–A Selective washer gaging tool
 901RT078	J–23327–90 Fourth clutch spring compressor (Use with J–23327)
 901RT079	J–38553 3/4 accumulator piston fitter
 901RT080	J–41096 Cover remover (Use with J–38584)
 901RT081	J–38584 Slide hammer adapter (Use with J–23907)
 901RT082	J–38554 Fourth clutch piston fitter

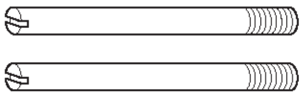
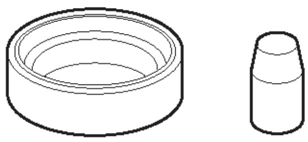
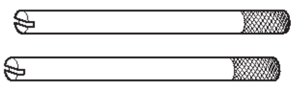
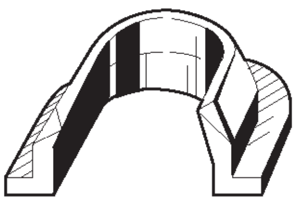
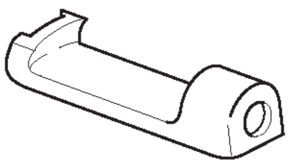
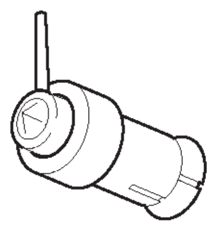
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RT083	J–38588 Guide pins; adapter case to main case
 901RT084	J–38555 Overrun clutch piston seal installer set
 901RT085	J–3387–2 Guide pins; gasket and transfer plate to valve body
 901RT086	J–25022 Turbine shaft puller (Use with J–24773–1)
 901RT087	J–23129 Oil seal remover (Use with J–23907 and J–38584)
 901RT088	J–38557 Oil pump centering tool

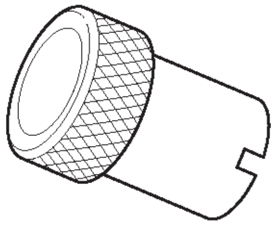
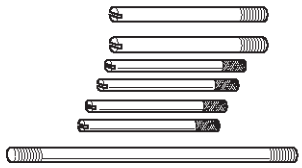
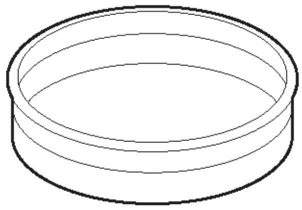
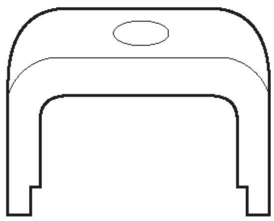
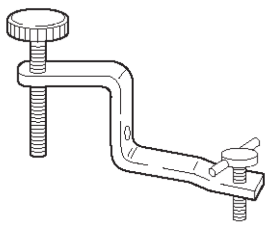
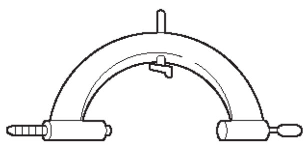
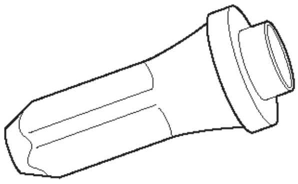
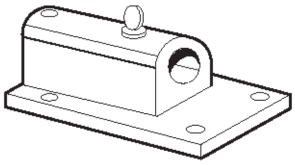
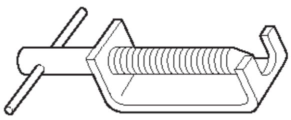
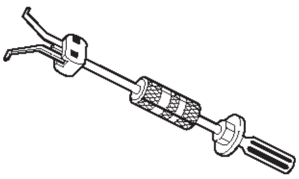
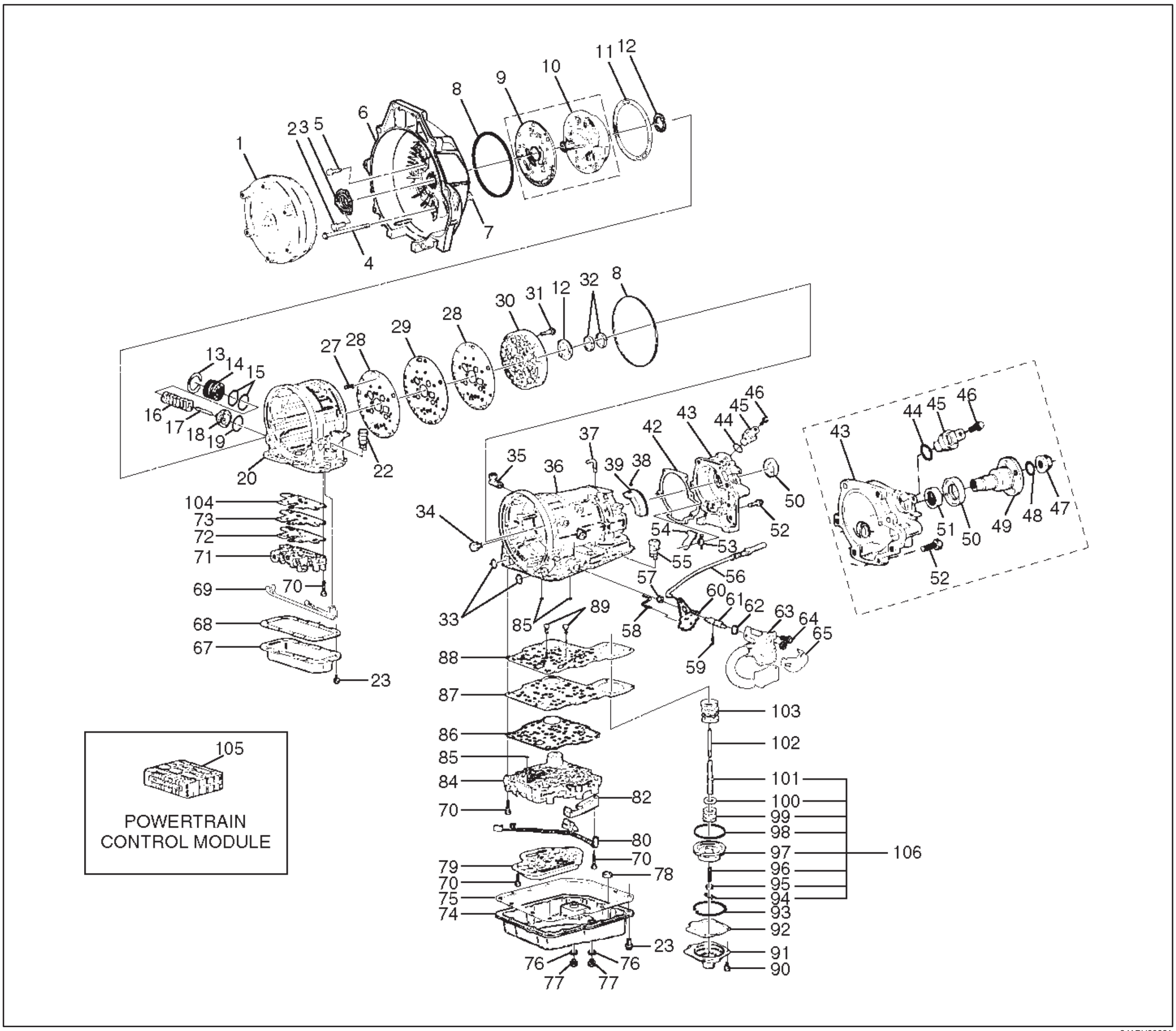
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RT089	J–23082–01 Oil pump rotation tool
 901RT090	J–25025–B Guide pins; valve body to main case
 901RT091	J–38428 Servo piston fitter
 901RT092	J–23327–91 Overrun clutch spring compressor
 901RT093	J–38559–A 3/4 accumulator piston cover compressor
 901RT094	J–8763–02 Holding fixture

ILLUSTRATION	**TOOL NO.** TOOL NAME
	J–36797 A/T extension housing oil seal installer (Inside)
	J–3289–20 Holding fixture base
	J–29770–A Pressure gauge
	J–24773–1 End play fixture (Use with J–25022)
	J–23907 Slide hammer

4L30–E Parts List

Case and Associated Parts



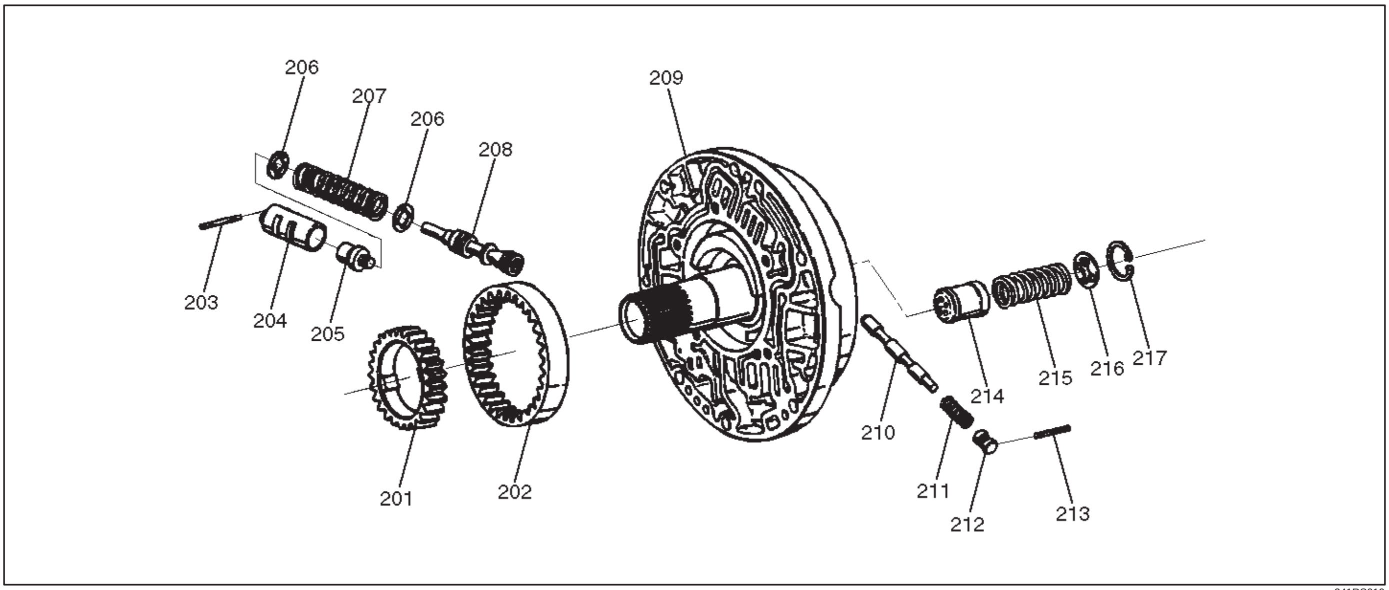
241RY00021

Legend

- (1) Torque Converter
- (2) Screw, Seal Ring Assembly
- (3) Seal Ring Assembly, Converter Housing
- (4) Screw, Converter Housing/Main Case
- (5) Screw, Converter Housing/Oil Pump
- (6) Housing, Converter
- (7) Plug, Converter Housing
- (8) Seal, O-ring
- (9) Wear Plate, Oil Pump Body
- (10) Pump Assembly, Oil
- (11) Gasket
- (12) Washer, Thrust Selective
- (13) Ring, Snap
- (14) Cover, 3–4 Accumulator Piston
- (15) Seal, O-ring, 3–4 Accumulator
- (16) Spring, 3–4 Accumulator Piston
- (17) Pin, 3–4 Accumulator Piston
- (18) Piston, 3–4 Accumulator
- (19) Ring, 3–4, Accumulator Piston
- (20) Case, Adapter
- (22) Connector, Electrical/Adapter Case
- (23) Screw, Pan
- (27) Restrictor, Oil
- (28) Gasket, Transfer Plate/Adapter
- (29) Plate, Transfer Adapter/Center Support
- (30) Support Assembly, Center
- (31) Screw, Center Support
- (32) Ring, Oil Seal
- (33) Seal, O-ring Main Case
- (34) Fitting, Cooler
- (35) Fitting Assembly, Cooler
- (36) Case, Main
- (37) Breather, Pipe

(38) Seal, O-ring
(39) Reservoir
(42) Gasket, Extension Case
(43) Extension Assembly
(44) Seal, O-ring/Speed Sensor
(45) Sensor Assembly, Speed
(46) Screw, Speed Sensor
(47) Nut, Output Shaft/Drive Flange
(48) Seal, O–ring/Drive Flange
(49) Flange, Drive
(50) Seal, Extension Assembly
(51) Bearing, Needle/Extension
(52) Screw, Extension/Main Case
(53) Spring, Parking Pawl Lock
(54) Pawl, Parking Lock
(55) Connector, Electrical/Main Case
(56) Actuator Assembly, Parking Lock
(57) Nut, Parking Lock Lever
(58) Link, Manual Valve
(59) Pin, Spring
(60) Lever, Parking Lock and Range Selector
(61) Shaft, Selector
(62) Seal, Selector Shaft
(63) Mode Switch Assembly
(64) Screw & Conical Washer Assembly
(65) Shield, Mode Switch
(67) Pan, Bottom/Adapter Case
(68) Gasket, Bottom Pan/Adapter Case
(69) Harness Assembly, Adapter Case
(70) Screw, Valve Body
(71) Valve Body Assembly, Adapter Case
(72) Gasket, Adapter Valve Body
(73) Plate, Adapter Valve Body/Transfer
(74) Pan, Bottom/Main Case
(75) Gasket, Bottom Pan/Main Case
(76) Gasket, Oil Drain or Overfill Screw
(77) Screw, Oil Drain or Overfill
(78) Magnet, Chip Collector
(79) Filter Oil
(80) Harness Assembly, Main Case
(82) Roller and Spring Assembly, Manual Detent
(84) Valve Body Assembly, Main Case
(85) Ball, Check
(86) Gasket, Main V.B./Transfer Plate
(87) Plate, Main V.B./Transfer
(88) Gasket, Transfer/Main Case
(89) Screw, Transfer Plate on V.B.
(90) Screw, Servo Cover
(91) Cover, Servo Piston
(92) Gasket, Cover/Servo Piston
(93) Ring, Retaining Servo Piston
(94) Clip, Servo Piston
(95) Nut, Servo Screw
(96) Screw, Servo Piston
(97) Piston, Servo
(98) Seal, Ring/Servo Piston
(99) Spring, Cushion/Servo Piston
(100) Seat, Cushion Spring
(101) Sleeve, Servo Piston Adjust
(102) Rod, Apply/Servo Piston
(103) Spring, Return/Servo Piston
(104) Gasket, Adapter Case/Transfer Plate
(105) Powertrain Control Module
(106) Servo Piston Assembly

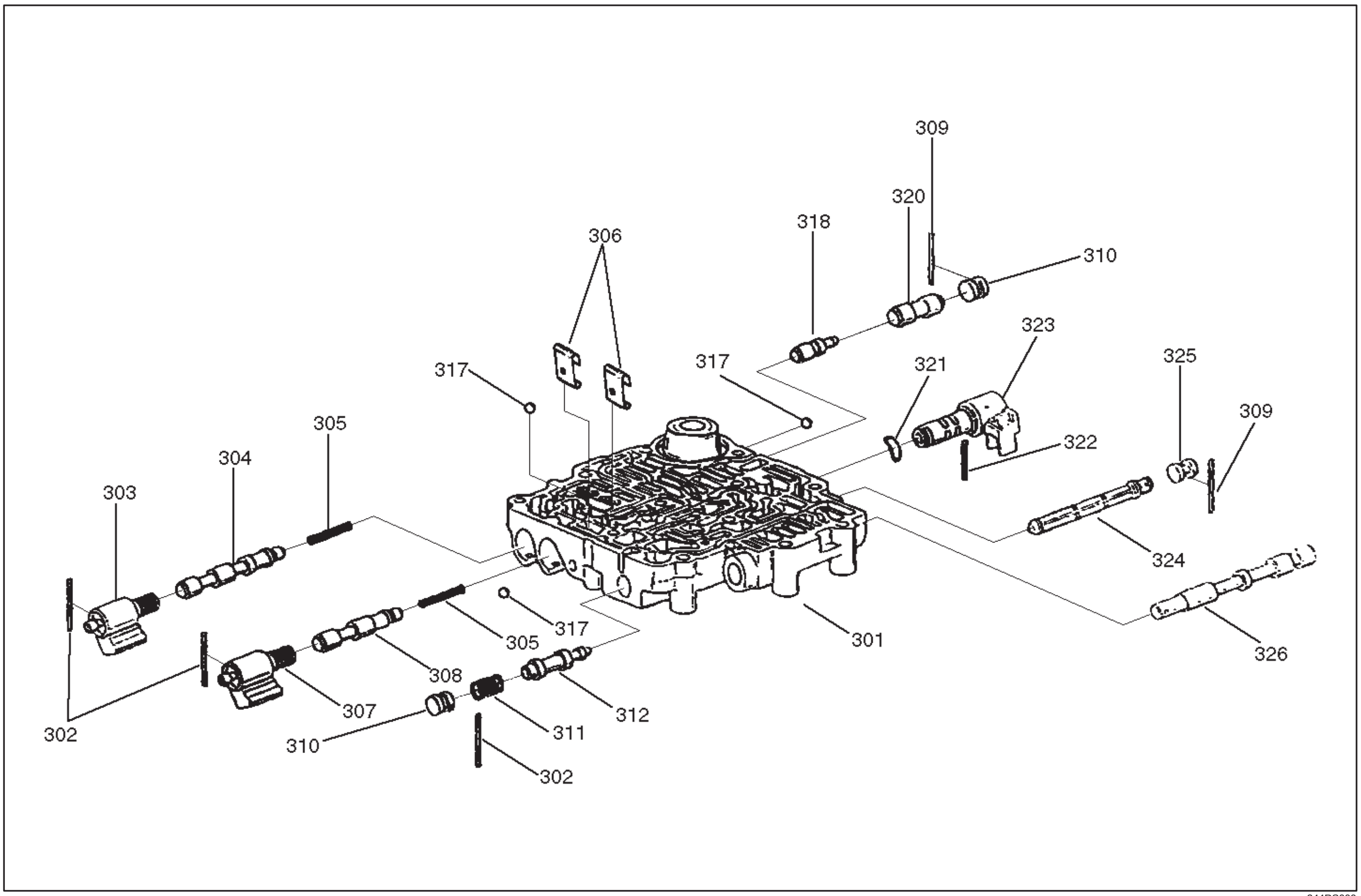
Pump Assembly



Legend
(201) Gear, Oil Pump Drive
(202) Gear, Oil Pump Driven
(203) Pin, Boost Valve Sleeve
(204) Sleeve, Boost Valve
(205) Valve, Boost

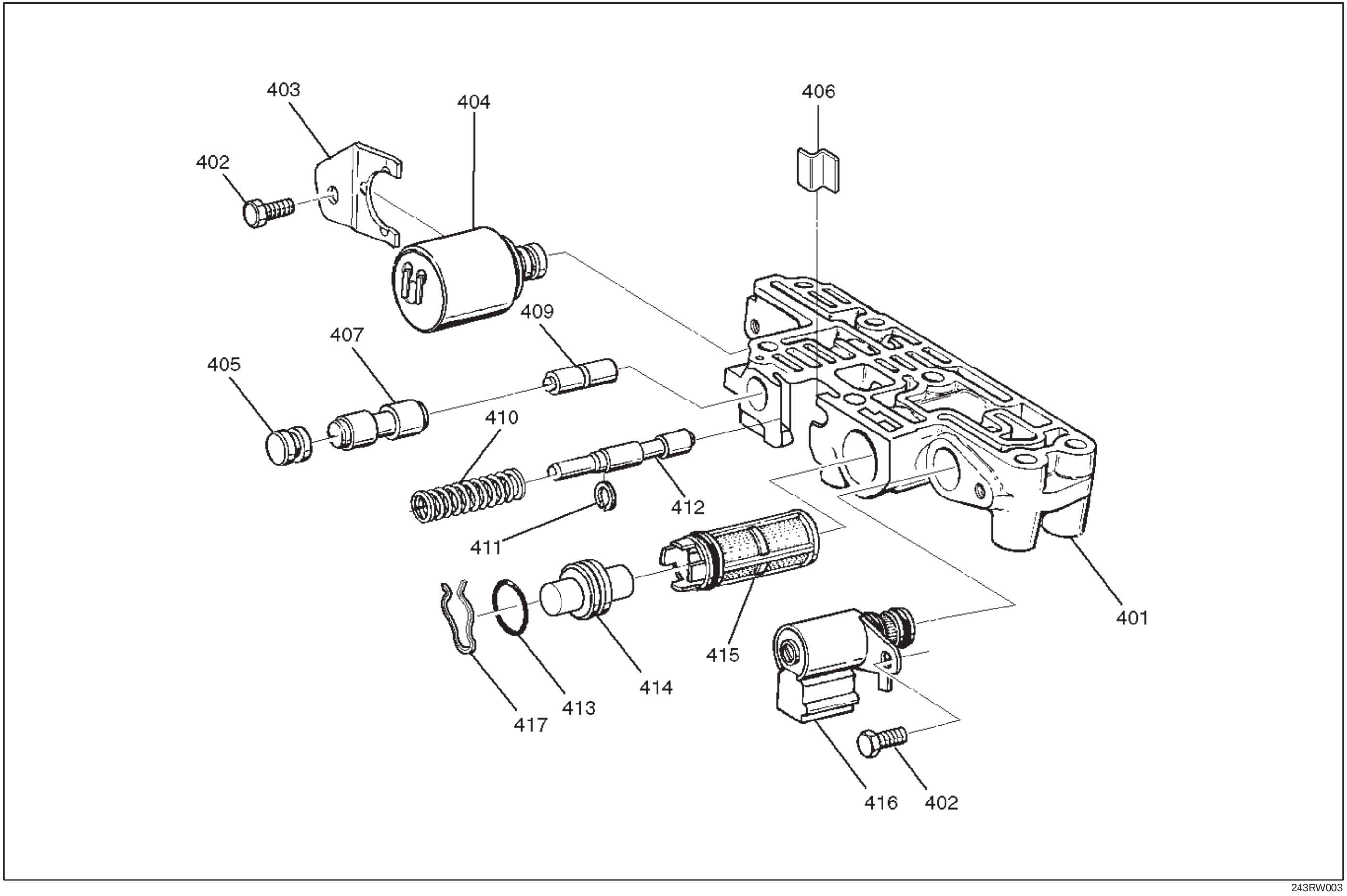
(206) Seat, Spring/Pressure Regulator Valve
(207) Spring, Pressure Regulator Valve
(208) Valve, Pressure Regulator
(209) Pump Assembly, Oil
(210) Valve, Converter Clutch Control
(211) Spring, Converter Clutch Control Valve
(212) Plug, Converter Clutch Control Valve
(213) Pin, Spring
(214) Piston, Throttle Signal Accumulator
(215) Spring, Throttle Signal Accumulator
(216) Seat, Spring/Throttle Signal Accumulator
(217) Ring, Snap/Throttle Signal Accumulator

Valve Body Assemblies



244RS009

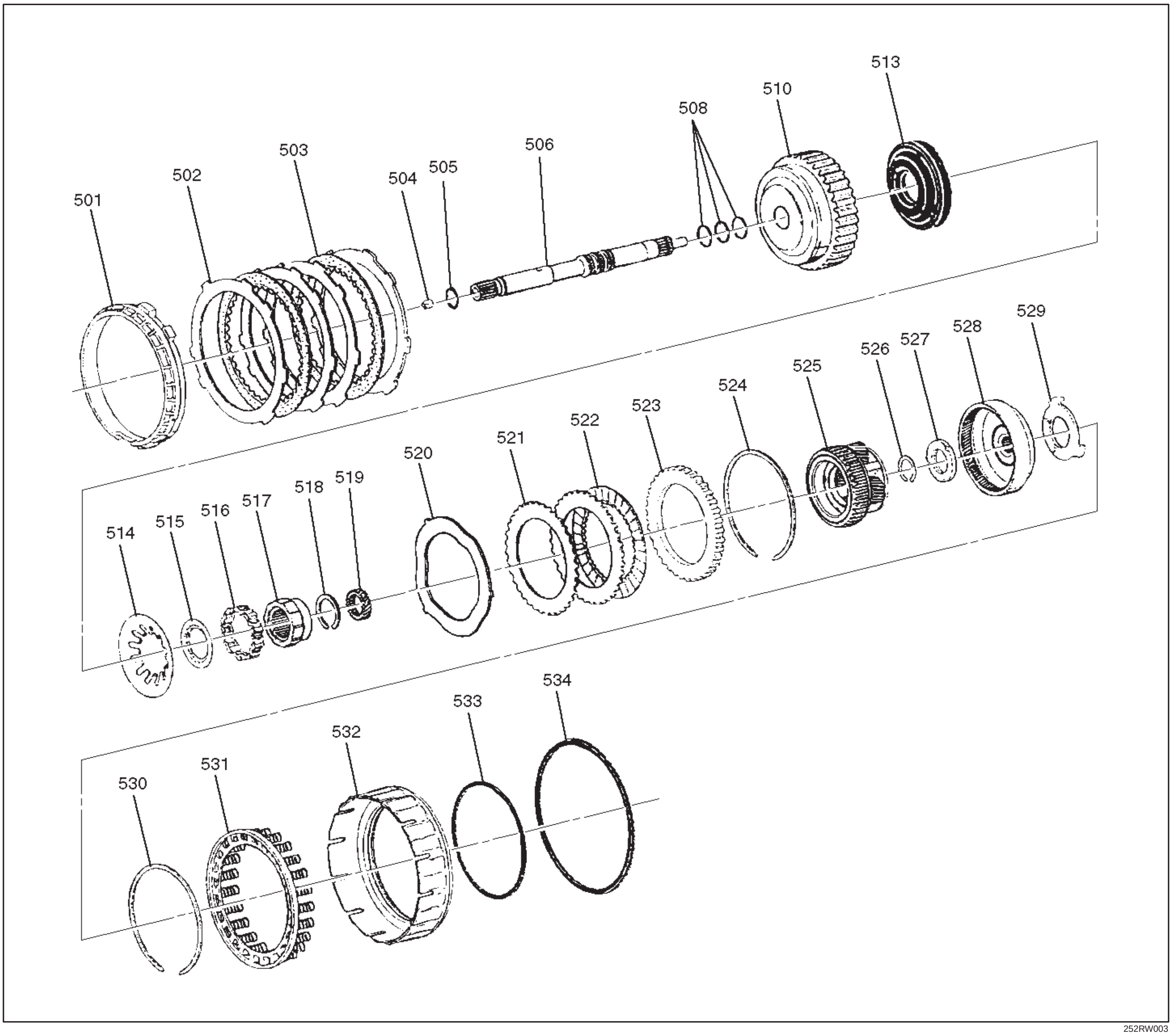
Legend
(301) Body, Valve Main Case
(302) Pin, Spring
(303) Solenoid Assembly, ON/OFF N.C.
(304) Valve, 1–2 & 3–4 Shift
(305) Spring, 1–2 & 3–4 (2–3) Shift
(306) Retainer, Valve
(307) Solenoid Assembly, ON/OFF N.O.
(308) Valve, 2–3 Shift
(309) Pin, Spring
(310) Plug, Valve Bore
(311) Spring, Valve Low Pressure Control
(312) Valve, Low Pressure Control
(317) Ball, Check
(318) Valve, 1–2 Accumulator Control
(320) Valve, 1–2 Accumulator
(321) Washer, Waved PWM Solenoid
(322) Pin, Solenoid PWM
(323) Solenoid Assembly, Band Control PWM
(324) Screen Assembly, PWM Solenoid
(325) Plug, Screen
(326) Valve, Manual



Legend

(401) Body, Valve/Adapter Case
(402) Screw, Solenoid Force Motor
(403) Retainer, Force Motor
(404) Solenoid, Force Motor
(405) Plug, 3–4 Accumulator
(406) Plug and Spring Retainer
(407) Valve, 3–4 Accumulator
(409) Valve, 3–4 Accumulator Control
(410) Spring, Feed Limit Valve
(411) Ring, Retainer
(412) Valve, Feed Limit
(413) Seal, O-ring Plug Filter
(414) Plug, Screen
(415) Screen Assembly, Force Motor
(416) Solenoid, Torque Conv. Clutch ON/OFF N.C.
(417) Plug Retainer

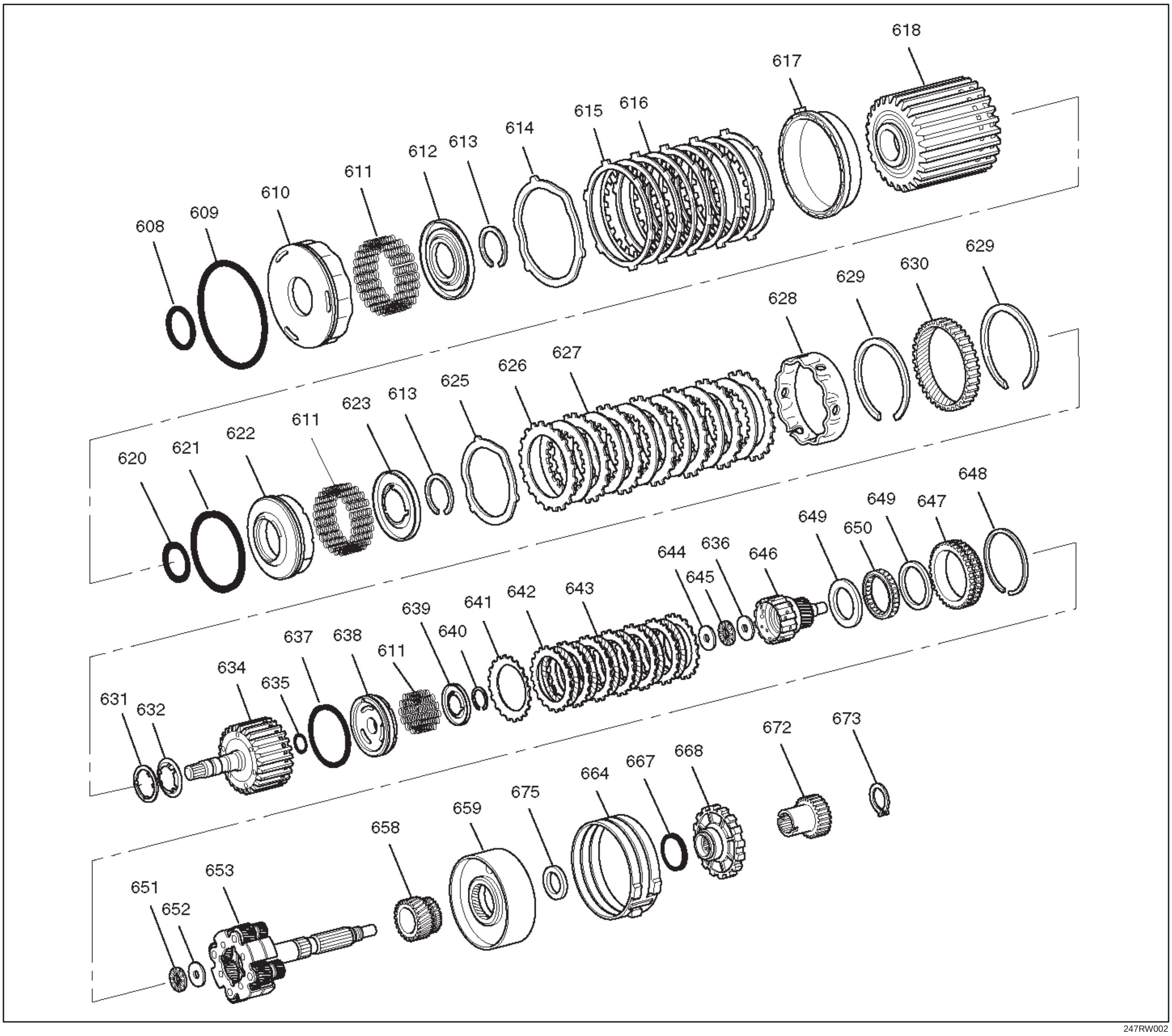
Overdrive Internal Components



Legend

(501) Retainer, 4th Clutch
(502) Plate, 4th Clutch (Steel)
(503) Plate Assembly, 4th Clutch (Lined)
(504) Retainer and Ball Assembly, Check Valve
(505) Seal, O-ring/Turbine Shaft
(506) Shaft, Turbine
(508) Ring, Oil Seal/Turbine Shaft
(510) Housing, Overrun Clutch
(513) Piston, Overrun Clutch
(514) Spring, Overrun Clutch Release
(515) Retainer, Release Spring/Overrun Clutch
(516) Roller Assembly, Overdrive Clutch
(517) Cam, Overdrive Roller Clutch
(518) Ring, Snap/Overrun Clutch Hub
(519) Gear, Overdrive Sun
(520) Plate, Waved/Overrun Clutch
(521) Plate, Overrun Clutch (Steel)
(522) Plate Assembly, Overrun Clutch (Lined)
(523) Plate, Backing/Overrun Clutch
(524) Ring, Snap/Overrun Clutch Housing
(525) Carrier Assembly, Overdrive Complete
(526) Ring, Snap/Turbine Shaft/Carrier
(527) Bearing Assembly, Thrust
(528) Gear, Overdrive Internal
(529) Washer, Thrust/Internal Gear/Support
(530) Ring, Snap/Adapter/4th Clutch Spring
(531) Retainer and spring assembly, 4th clutch
(532) Piston, 4th Clutch
(533) Seal, 4th Clutch Piston (Inner)
(534) Seal, 4th Clutch Piston (outer)

Internal Components

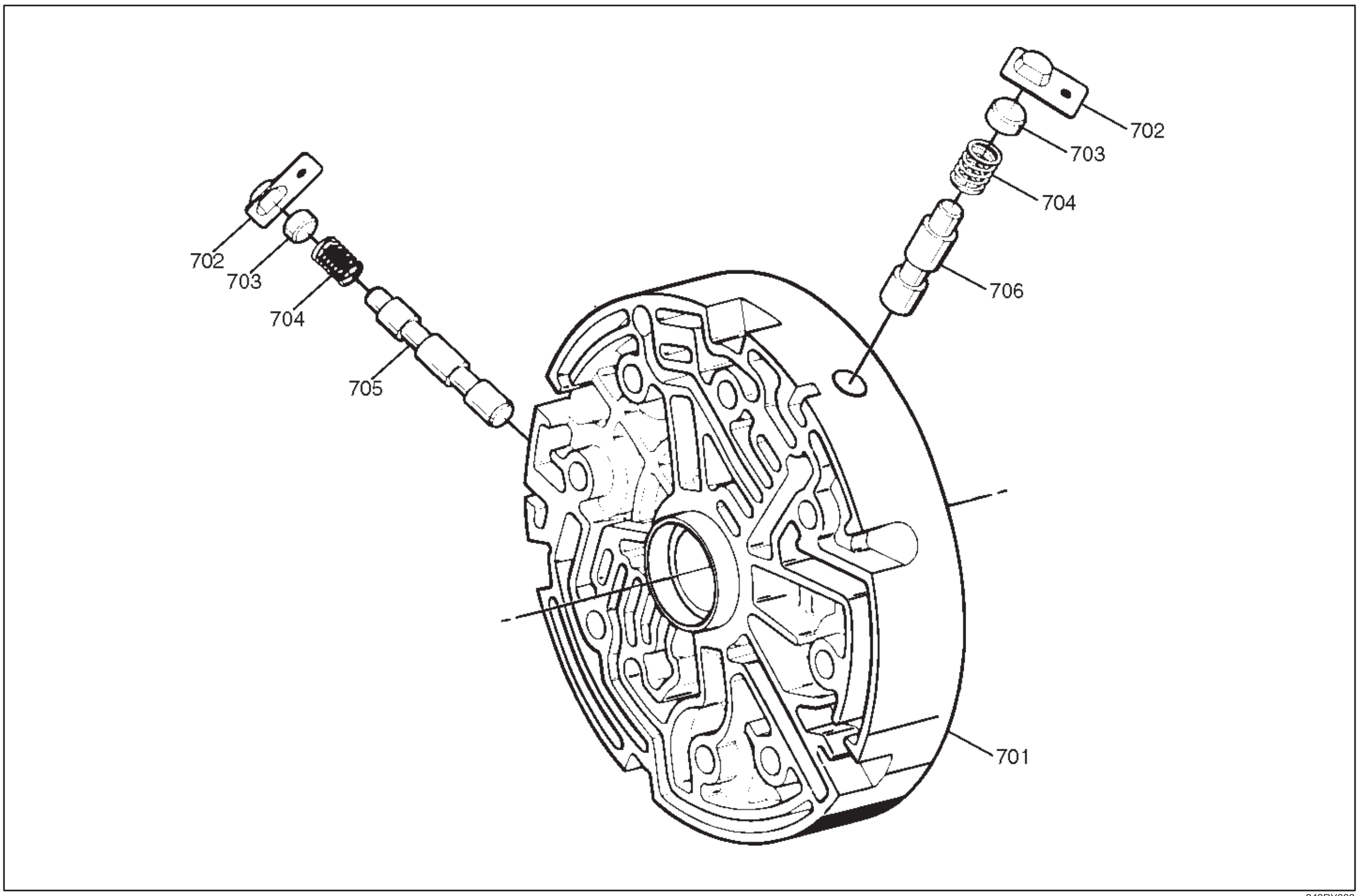


Legend

(608) Seal, Reverse Clutch Piston (Inner)
(609) Seal, Reverse Clutch Piston (Outer)
(610) Piston, Reverse Clutch
(611) Spring, Piston Clutch
(612) Seat, Spring/Reverse Clutch
(613) Ring, Retaining
(614) Plate, Waved/Reverse Clutch
(615) Plate, Reverse Clutch (Steel)
(616) Plate Assembly, Reverse Clutch (Lined)
(617) Plate, Reverse Clutch Pressure/Selective
(618) Drum Assembly, 2nd Clutch
(620) Seal, 2nd Clutch Piston (Inner)
(621) Seal, 2nd Clutch Piston (Outer)
(622) Piston, 2nd Clutch
(623) Seat, Spring/2nd Clutch
(625) Plate, Waved/2nd Clutch
(626) Plate, 2nd Clutch (Steel)
(627) Plate Assembly, 2nd Clutch (Lined)
(628) Spacer, 2nd Clutch
(629) Ring, Retaining
(630) Gear, Ring
(631) Washer, Thrust/2nd Clutch/3rd Clutch
(632) Thrust Washer, Clutch Hub
(634) Drum Assembly, 3rd Clutch
(635) Seal, 3rd clutch piston (Inner)
(636) Washer, Retaining
(637) Seal, 3rd Clutch Piston (Outer)
(638) Piston 3rd Clutch
(639) Seat, Spring/3rd Clutch
(640) Ring, Retaining
(641) Plate, Spring Cushion/3rd Clutch
(642) Plate, 3rd Clutch (Steel)
(643) Plate Assembly, 3rd Clutch (Lined)
(644) Washer, Thrust/Input Sun
(645) Bearing, Input Shaft/Gear Assembly

(646) Gear Assembly, Input Sun
(647) Race Assembly, Sprag
(648) Ring, Retaining/Sprag
(649) Ring, Retaining
(650) Cage Assembly, Sprag
(651) Bearing, Output Shaft/Input Sun
(652) Washer, Output Shaft/Input Sun
(653) Carrier Assembly, Planetary
(658) Gear, Reaction Sun
(659) Drum, Reaction Sun
(664) Band Assembly, Brake
(667) Seal, Ring/Wheel Parking Lock
(668) Wheel, Parking Lock
(672) Wheel, Speed
(673) Ring, Retaining
(675) Bearing, Thrust Assembly

Center Support Assembly



Legend

(701) Center Support
(702) Retainer Plate
(703) Plug, Lockout
(704) Spring, Lockout
(705) Valve, Overrun Lockout
(706) Valve, Reverse Lockout Control

RODEO

TRANSMISSION

TRANSMISSION CONTROL SYSTEM (4L30–E)

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The 4L30–E is a 4–speed fully automatic transmission. It uses a microcomputer as a control unit to judge running conditions including throttle opening rate and vehicle speed, then it sets the shifting point in the optimum timing so that best driving performance can be achieved.
In addition, the built–in shift mode select function can select three shift modes according to the driver's preference:

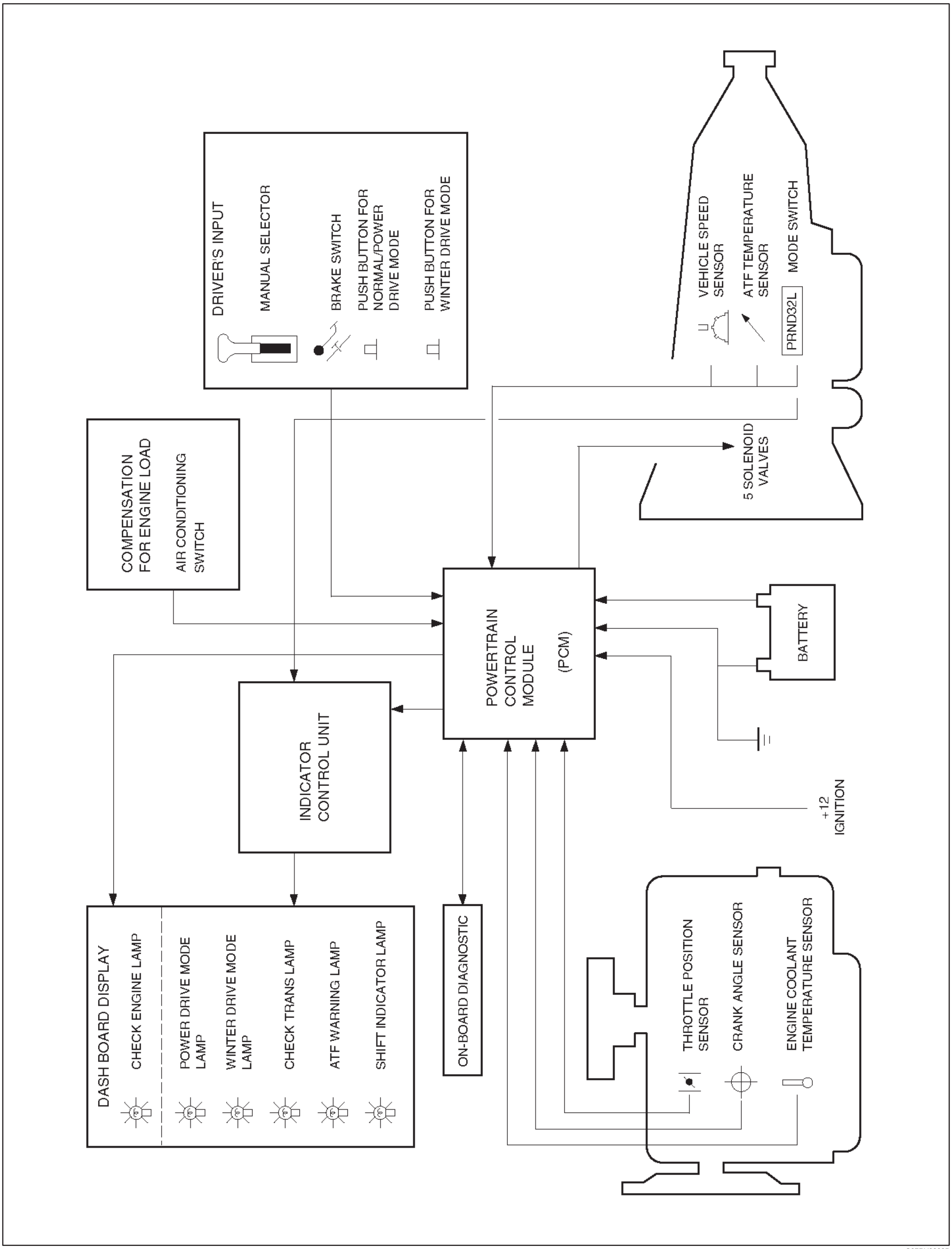
- Normal mode –Normal shift pattern.
- Winter mode –Starts in 3rd gear to reduce slippage on ice or snow.
- Power mode has a delayed upshift for when more powerful acceleration is required.

Also, the built–in fail–safe function ("backup mode") assures driving performance even if the vehicle speed sensor, throttle signal or any solenoid fails.
Further, the self–diagnostic function conducts diagnosis in a short time when the control system fails, thus improving serviceability.
The major features of 4L30–E are as follows:

- A compact structure consisting of 2 sets of planetary gears and flat torque converter.
- Electronic control selects the optimum shift mode according to the driving conditions.
- Electronic control maintains the optimum hydraulic pressure for clutch, band brake as well as transmission so that shift feeling is improved.
- Two sets of planetary gears reduce friction of power train.

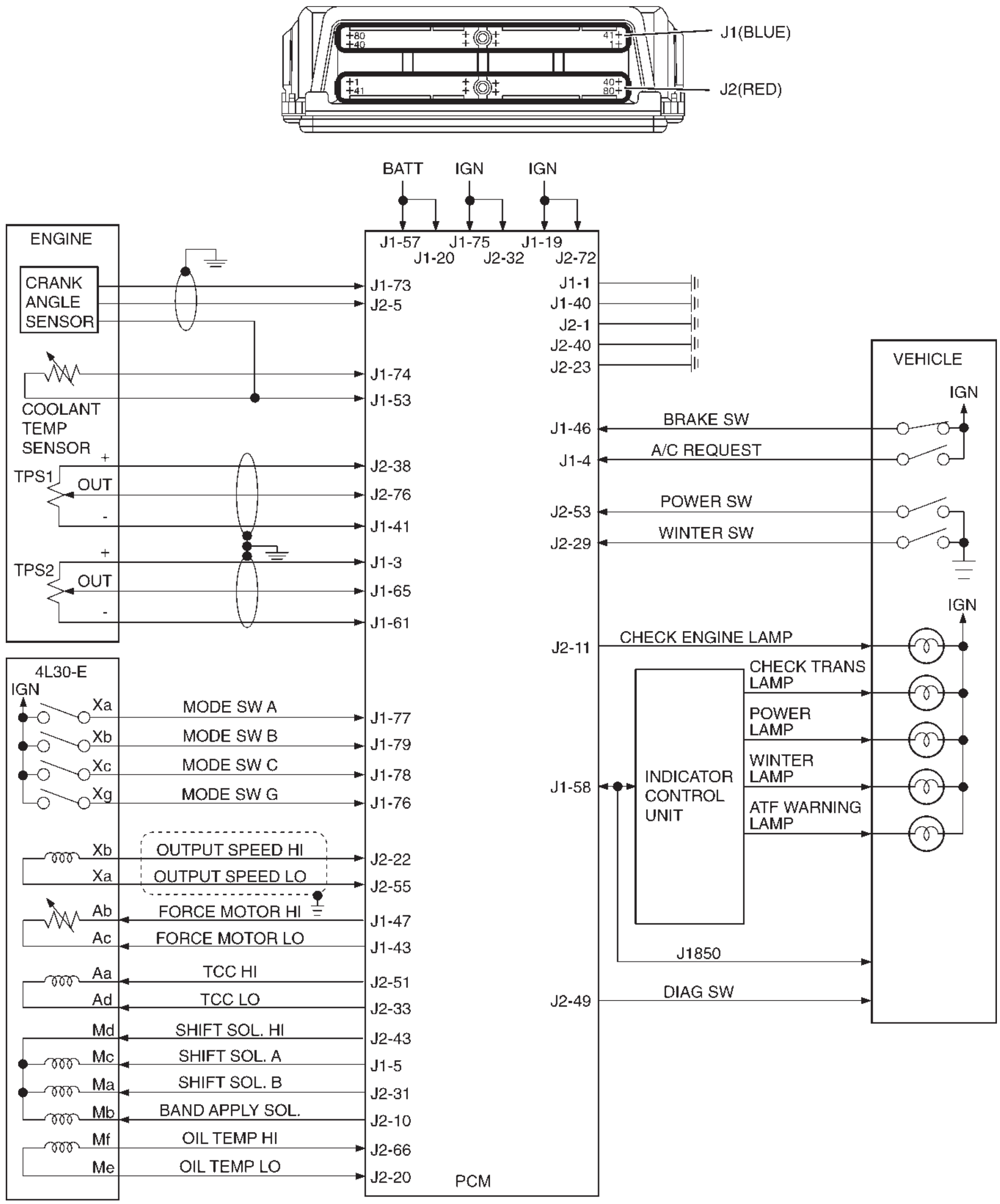
  Also, a lockup mechanism in the torque converter reduces fuel consumption.
- Wide gear ratio and high torque rate of torque converter provide excellent starting performance.

Electronic Control Diagram



C07RY00035

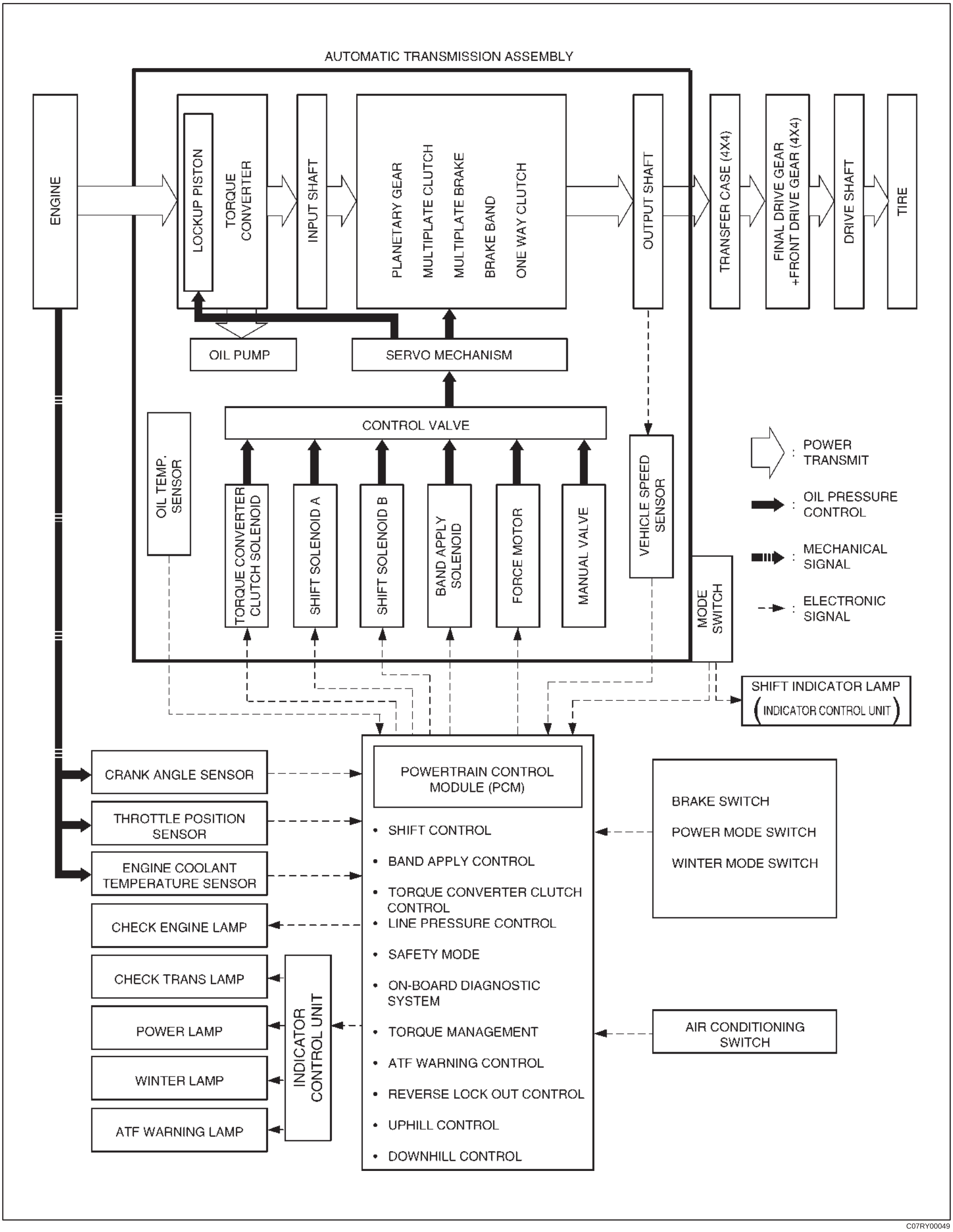
Powertrain Control Module (PCM)



TPS : Throttle Position Sensor
TCC : Torque Converter Clutch

C07RY00048

Control System Diagram



Shift Control

The transmission gear is shifted according to the shift pattern selected by the driver. In shifting gears, the gear ratio is controlled by the ON/ OFF signal using the shift solenoid A and the shift solenoid B.

Band Apply Control

The band apply is controlled when in the 3–2 downshift (engine overrun prevention) and the garage shift (shock control).
The band apply solenoid is controlled by the signal from the Pulse Width Modulation (PWM) to regulate the flow of the oil.

Torque Converter Clutch Control

The clutch ON/OFF is controlled by moving the converter clutch valve through shifting Torque Converter Clutch (TCC) solenoid using the ON/OFF signal.

Line Pressure Control

The throttle signal allows the current signal to be sent to the force motor. After receiving the current signal, the force motor activates the pressure regulator valve to regulate the line pressure.

On–Board Diagnostic System

Several malfunction displays can be stored in the Powertrain Control Module (PCM) memory, and read out of it afterward.
The serial data lines, which are required for the testing of the final assembly and the coupling to other electronic modules, can be regulated by this function.

Fail–Safe Mechanism

If there is a problem in the transmission system, the PCM will go into a “backup” mode.
The vehicle can still be driven, but the driver must use the select lever to shift gears.

Torque Management Control

The transmission control side sends the absolute spark advance signal to the engine control side while the transmission is being shifted. This controls the engine spark timing in compliance with the vehicle running condition to reduce the shocks caused by the change of speed.

ATF Warning Control

The oil temperature sensor detects the ATF oil temperature to control the oil temperature warning, TCC, and the winter mode.

Reverse Lock Out Control

With the selector lever in reverse position, the PCM will not close the PWM solenoid until the vehicle is below 15 km/h (9.3 mph), thus preventing reverse engagement above this speed.

Downhill Control

This mode is automatically activated from NORMAL mode only when downhill conditions are recognized.
The shift pattern is identical to NORMAL mode except 3-4 and 4-3 shift lines at low throttle modified to get engine braking on a larger speed range.

Uphill Control

When uphill condition are recognized the 2-3 and 3-4 shift and TCC apply are down only when the engine torque is sufficient in order to avoid shift hunting.

Shift Mode Control

① Mode Type

Mode Type	Select lever position
Normal drive mode (NOR)	Entire range (excluding "R")
Power drive mode (PWR)	Entire range (excluding "R")
Winter drive mode	"D" range only

② Mode selection

	SWITCH (SW)		LAMP	
Mode Type	POW/NOR. SW	WINTER SW	POWER DRIVE LAMP	WINTER DRIVE LAMP
Normal drive mode (NOR)	OFF	OFF	OFF	OFF
Power drive mode (PWR)	ON	OFF	ON	OFF
Winter drive mode	ON/OFF	ON	OFF	ON

However, the winter switch prevails over the PWR/NOR switch.
The mode becomes normal drive mode when the winter switch is operated from ON to OFF.

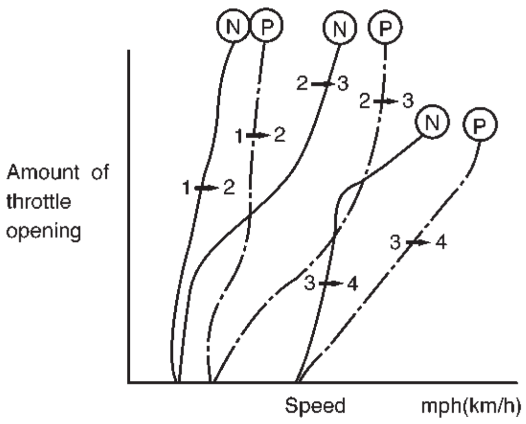
③ Comparison of mode

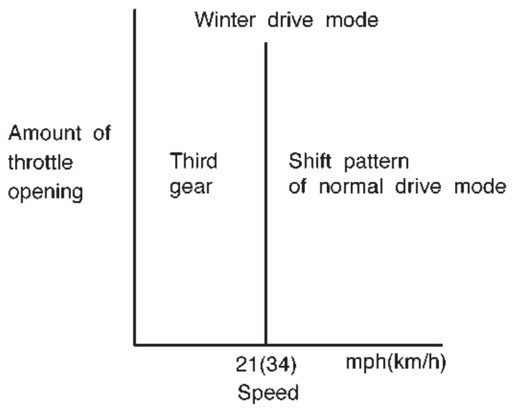
(1) The normal drive mode is set at the normal shift points.

(2) The shift points of the power drive mode are shifted to the higher speed side, compared to the normal drive mode.

(3) The winter drive mode is a special mode used exclusively for starting in third gear.

Shift diagram





F07RX001

Gear Shift Control

(1) Shift pattern

SELECT LEVER RANGE	SHIFT PATTERN
D (Drive)	1⇄2TCC ⇄3TCC ⇄4TCC
3 (Third)	1⇄2TCC ⇄3TCC ←4TCC
2 (Second)	1⇄2TCC ←3TCC
L (First)	1←2

TCC = Torque Converter Clutch

(2) Gear position

The gear is selected by ON/OFF of two solenoids.

Gear \ SOL	A	B
4 (Fourth)	×	×
3 (Third)	○	×
2 (Second)	○	○
1 (First)	×	○
P (park) R (Reverse) N (Neutral)	×	○

○ = ON

× = OFF

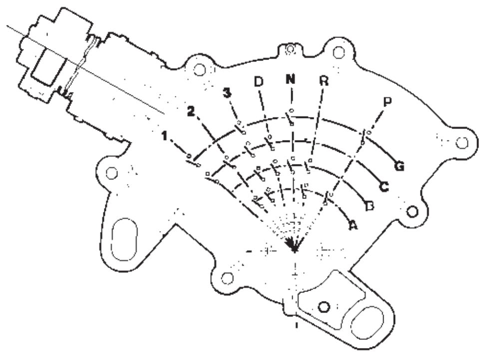
Shift solenoid A (Normally closed) ON → PRESSURE TO SHIFT VALVE

Shift solenoid B (Normally open) OFF → PRESSURE TO SHIFT VALVE

(3) Selecting gear pisition

Seven types of positions can be selected according to 5 signals from the mode switch as below.

	MODE SW TERMINALS				
SELECT LEVER RANGE	5(D)	8(A)	7(B)	6(C)	3(G)
P (park)	•	•			•
R (Reverse)	•	•	•		
N (Neutral)	•		•		•
D (Drive)	•		•	•	
3 (Third)	•	•	•	•	•
2 (Second)	•	•		•	
L (First)	•			•	•



• = Continuity

F07RT034

Winter Drive Mode

1. The winter switch will operate when switched on after all of the following conditions are present:
   a. The gear select position is “D” range only.
   b. Vehicle speed is 7 mph (11 km/h) or less.
   c. Transmission oil temperature is 130°C (266°F) or less.
   d. Accelerator opening is at 8% or less.
2. **Cancel Release**
   1. Cancellation by driver
      a. Turning off the winter drive mode switch
      b. Shifting select position to “3”, “2”, or “L” (Winter drive mode is not canceled by selecting “N”, “R”, or “P”)
      c. Ignition key is turned off.
   2. Automatic cancellation
      a. When vehicle runs at 21mph (34 km/h) or more for 1 second or more
      b. When transmission oil temperature reaches 130°C (266°F) or above

NOTE: The mode returns to normal drive mode or power drive mode after the winter drive mode is canceled.

Backup Mode

If a major system failure occurs which could affect safety or damage the transmission under normal vehicle operation, the diagnostic system detects the fault and overrides the Powertrain Control Module (PCM).
The “CHECK TRANS” light flashes to alert the driver, and the transmission must be manually shifted as follows:

Select lever position	Gear Ratio Selected
D	4 (Fourth)
Manual 3	4 (Fourth)
Manual 2	3 (Third)
Manual L	1 (First)
R	Reverse

Shifts are firmer to prevent clutch slip and consequent wear. The fault should be corrected as soon as possible.

Functions of Input / Output Components

Components			Function
INPUT SIGNAL		Speed sensor (fixed to transmission)	Senses rotation of output shaft and feeds the data to Powertrain Control Module (PCM).
		Throttle position sensor (TPS) (fixed to engine)	Senses the extent of throttle valve opening and the speed of the throttle valve lever motion to open the valve and feeds the data to PCM.
		Brake switch (fixed to brake pedal)	Senses whether the driver has pressed the brake pedal or not and feeds the information to PCM.
		Mode switch (Fixed to transmission)	Senses the select lever position, and feeds the information to PCM.
		Power drive switch (fixed to front console)	Senses whether the driver has selected the power mode, and feeds the information to PCM.
		T/M oil temperature sensor	Senses the T/M oil temperature and feeds the data to PCM.
		Engine coolant tempera-ture sensor	Senses the engine coolant temperature, and feeds the data to PCM.
		Engine speed signal	Feeds the signals monitoring engine speed to PCM from crank angle sensor.
		Air conditioning information	Senses whether the air conditioner has been switched on or not, and feeds the information to PCM.
		Winter switch (fixed to front console)	Senses whether the driver has selected the winter mode, and feeds the information to PCM.
		Cruise controller (Over-drive OFF signal)	Downshift takes place when overdrive OFF signal is received from auto cruise controller integrated in PCM.
OUTPUT SIGNAL	SOLENOID	Shift solenoid A, B	Selects shift point and gear position suited to the vehicle running condition on the basis of PCM output.
		Band apply solenoid	Controls oil flow suited to the vehicle running condition on the basis of PCM output.
		Torque Converter Clutch solenoid	Controls clutch engagement/disengagement suited to the vehicle running condition on the basis of PCM output.
		Force motor (Pressure control solenoid)	Adjusts the oil pump delivery pressure to line pressure suited to the vehicle running condition on the basis of PCM output.
		Power drive mode lamp	Informs the driver whether the vehicle is in power mode or not.
		Winter drive mode lamp	Informs the driver whether the vehicle is in winter mode or not.
		“CHECK TRANS” lamp	Informs the driver of failure in the system.
		ATF warning lamp	Lights when ATF oil temperature rises. (only 4×4)

Diagnosis

Electronic Diagnosis

How To Diagnose The Problem

1. To avoid incorrect diagnostics, this book needs to be followed accurately. Unless stated, **do not jump directly to a section that could contain the solution. Some important information may be missed.**
2. The sections in CAPITALS and bold are the main sections that can be found in the contents.
3. The GOTO **“SECTION”** means to continue to check going to the “section”.
4. The GOTHROUGH **“SECTION”** means to go through the “section” and then to go back to the place the GOTHROUGH was written.
5. BASIC ELECTRIC CIRCUITS:
   You should understand the basic theory of electricity. This includes the meaning of voltage, amps, ohms, and what happens in a circuit with an open or shorted wire. You should also be able to read and understand wiring diagrams.

Check Trans Indicator

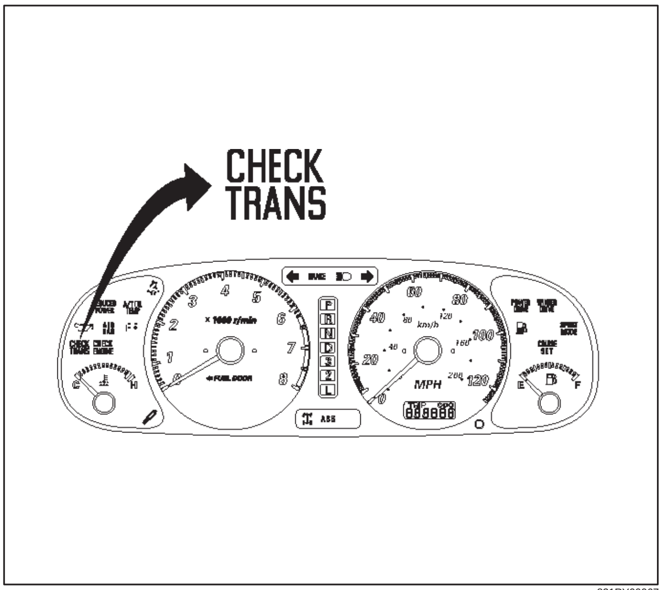
Find CHECK TRANS indicator and verify if it is

A. Flashing: GOTO **DIAGNOSTIC CHECK.**

B. Staying on: GOTHROUGH **CHECK TRANS CHECK**.

C. Is never ON when the ignition key is turned on: GOTHROUGH **CHECK TRANS CHECK**

D. Is ON during 2 seconds at ignition but OFF after: Normal operation. No DTC or malfunction.



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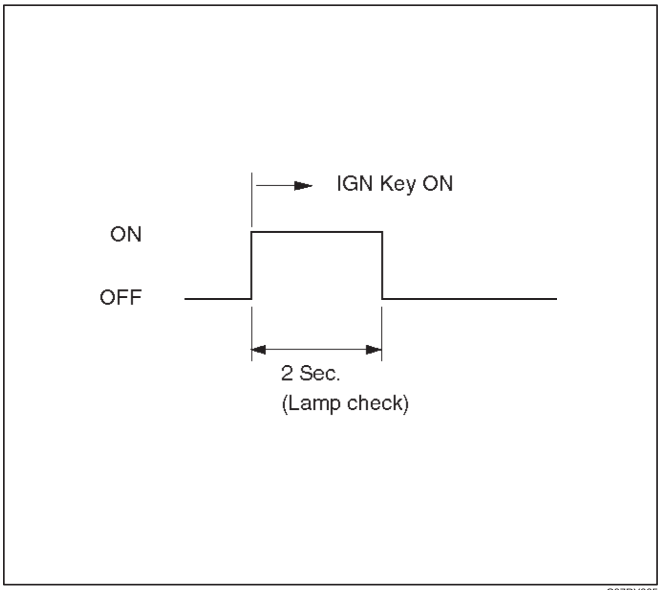
Diagnostic Check

This test determines if the transmission or its input or output connections or sensors are failing.

1. Connect the Tech 2: GOTHROUGH **Tech 2 OBD II CONNECTION**.
2. Turn on the ignition but not the engine.
3. Push “F0” on Tech 2 to see the Diagnostic Trouble Code (DTC):
4. Do you have a DTC?
   YES: write down all code numbers and do the **DTC CHECK**
   NO: the DTC can not help you find the problem.
   1. GOTHROUGH **“CHECK TRANS” CHECK**
   2. IF it is flashing and the flash is 0.5 seconds ON and 0.5 seconds OFF, this means that you should have a DTC stored. Please recheck GOTO **DIAGNOSTIC CHECK** and if you find the same problem, replace the Powertrain Control Module (PCM).

Normal



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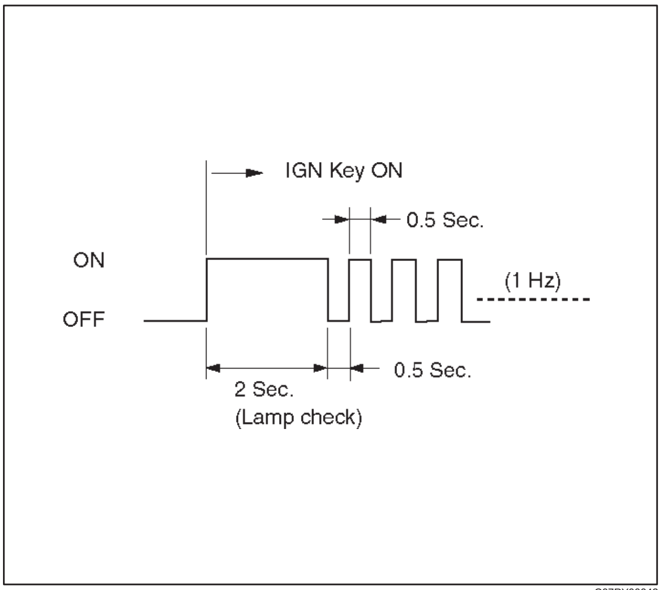
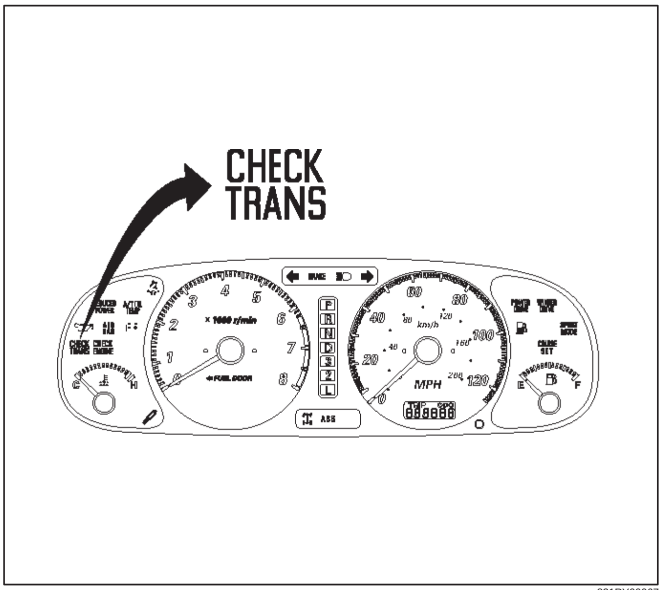
Abnormal



C07RY00042

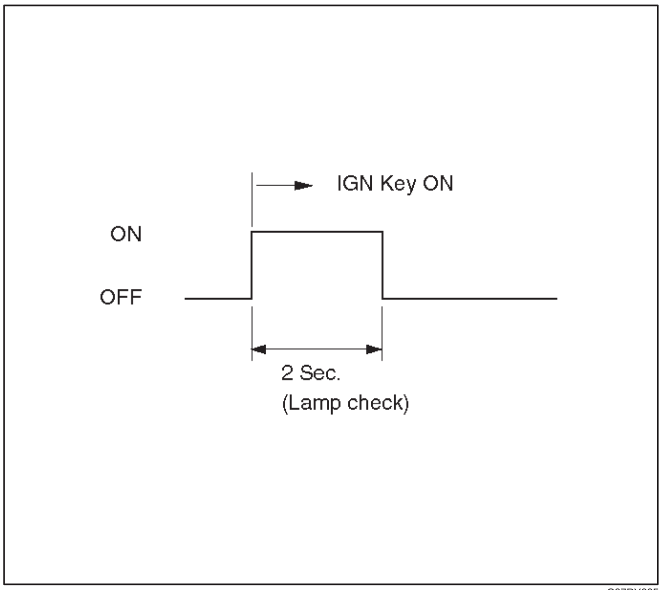
“Check Trans” Check

1. Indicator is ON during 2 seconds at ignition (or when the engine is cranked) but it is OFF after the engine starts. The indicator is working normally GOTO **DIAGNOSTIC CHECK**.



821RY00067

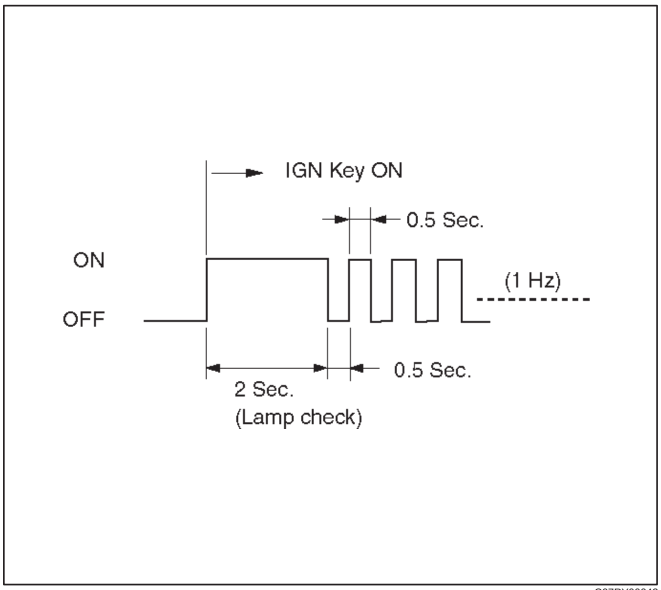
Normal



C07RY005

2. Indicator is flashing and the flash is 0.5 seconds ON and 0.5 seconds OFF always when ignition is on (engine cranked or not). This means that there is a malfunction. GOTO **DIAGNOSTIC CHECK**.

Abnormal



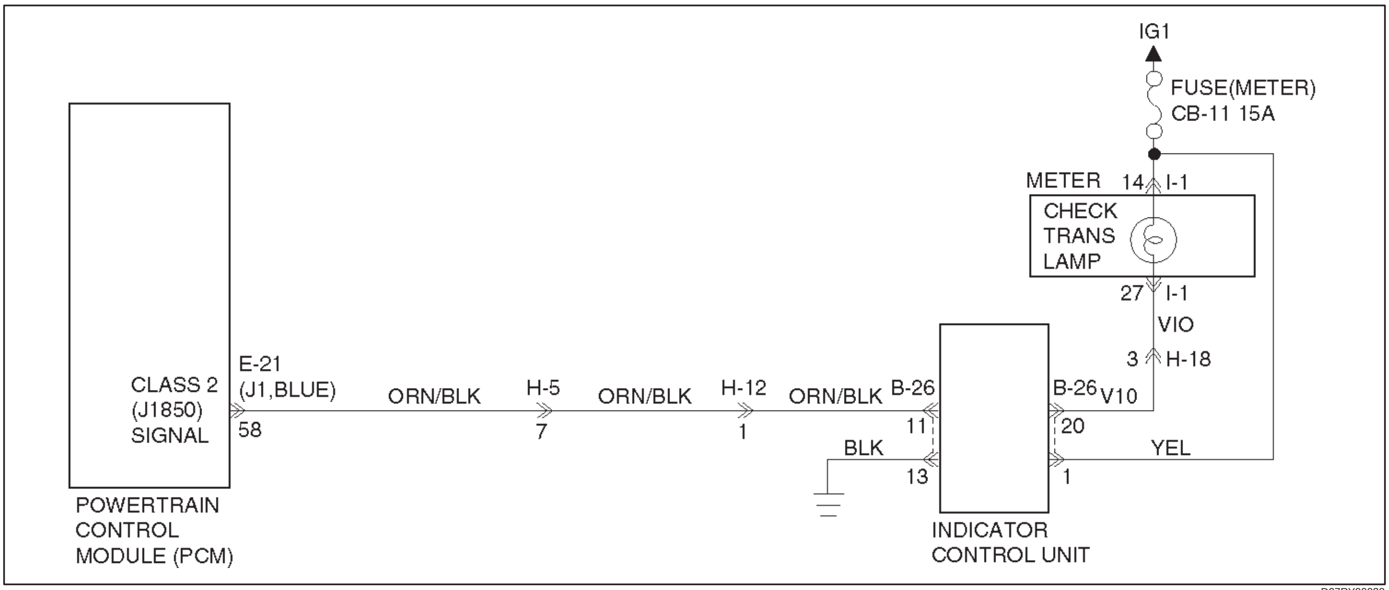
C07RY00042

3. Indicator is staying ON always when Ignition is ON.
   1. This means that connection between the lamp and the indicator control unit is shorted to ground.
   2. Verify if instrument panel terminal 27 of connector I–1 is shorted to ground.
   3. Verify if the indicator control unit connector B–26 terminal 20 is shorted to ground.
   4. Verify that the instrument panel terminal 14 of connector I–1 is connected to battery.
   5. IF problem solved: GOTO **CHECK TRANS INDICATOR**.

   NO:Replace Powertrain Control Module (PCM).
4. Indicator is staying OFF with the ignition ON (engine OFF).
   1. This means that connection between the lamp and the indicator control unit is shorted to battery or opened.
   2. Verify if instrument panel terminal 27 of connector I–1 is shorted to battery or open.
   3. Verify if the indicator control unit connector B–26 terminal 20 is shorted to battery or open.
   4. Verify that the instrument panel terminal 14 of connector I–1 is connected to battery. If not, check the fuses and the connections (terminal 3 of connector H–18) voltage.

5. IF problem solved: GOTO **CHECK TRANS INDICATOR**.

NO: Replace Powertrain Control Module (PCM).

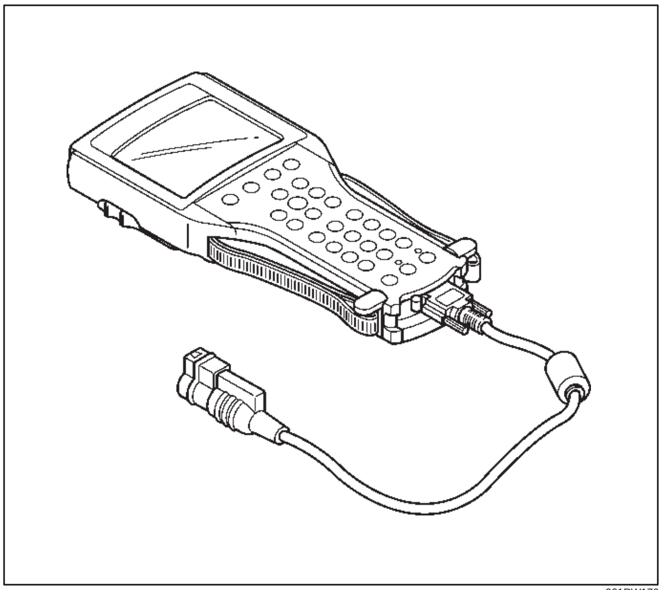


D07RY00028

Tech 2 OBD II Connection

In order to access OBD II Powertrain Control Module (PCM) data, use of the Tech 2 scan tool kit (7000086) is required.

1. The electronic diagnosis equipment is composed of:
   1. Tech 2 hand held scan tool unit (7000057) and DLC cable (3000095).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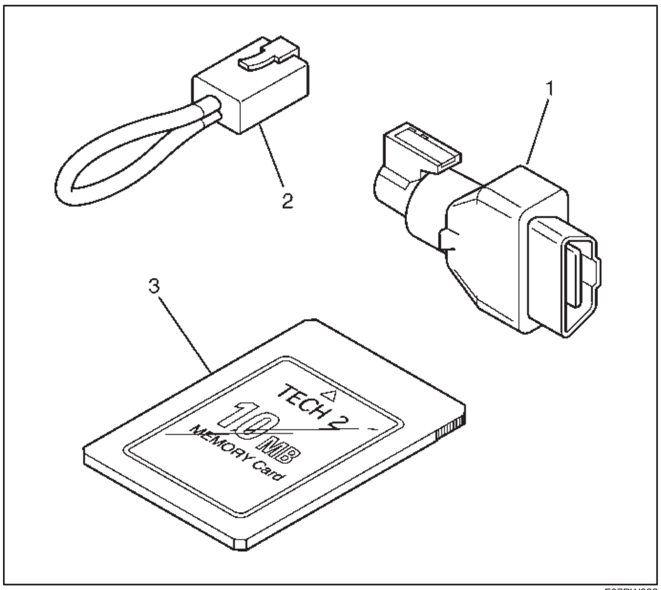
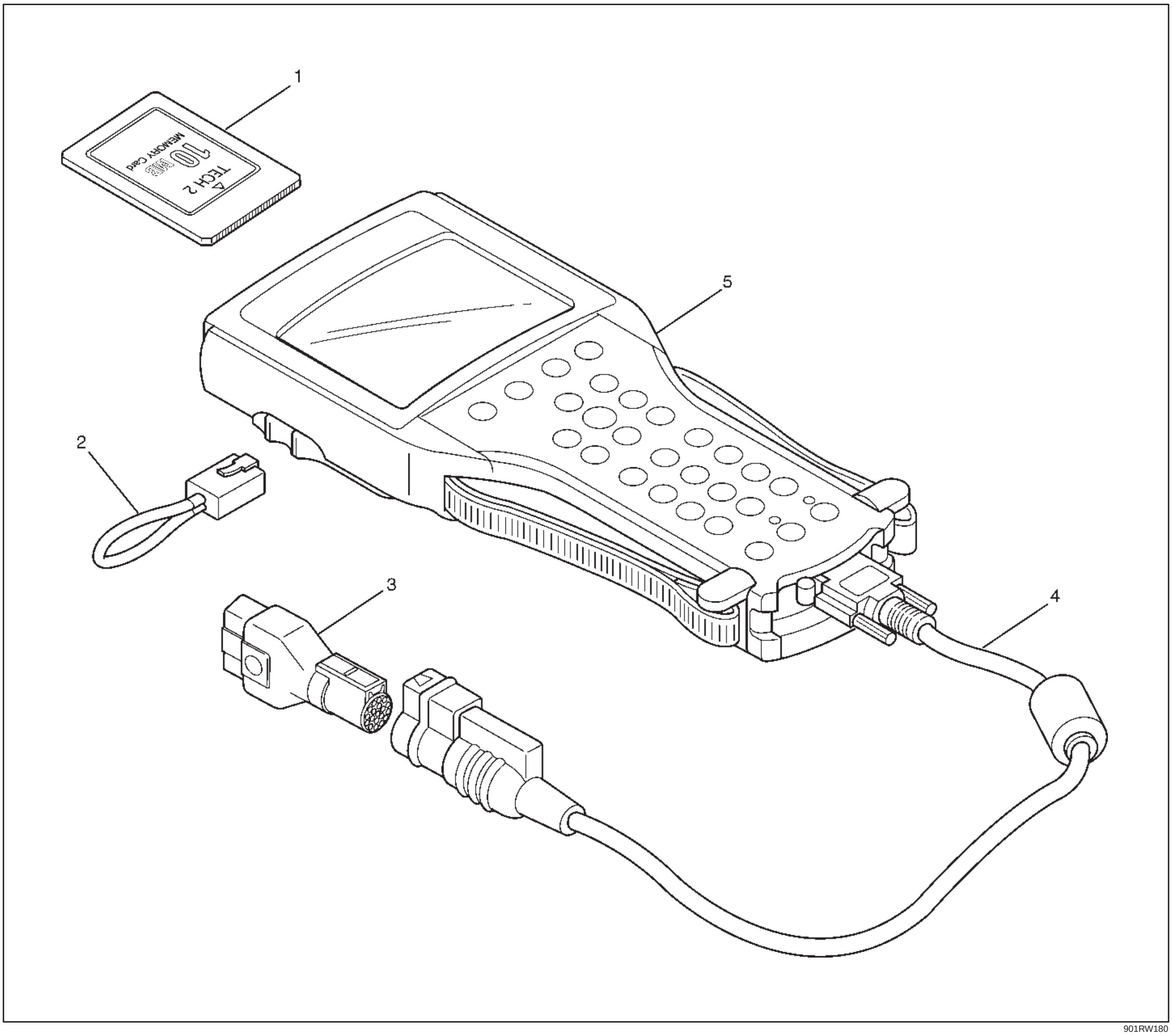
2. SAE 16/19 Pin Adapter (3000098)(1), RS232 Loop Back Connector (3000112)(2), and PCMCIA Card (3000117)(3).



F07RW033

2. Connecting the Tech 2

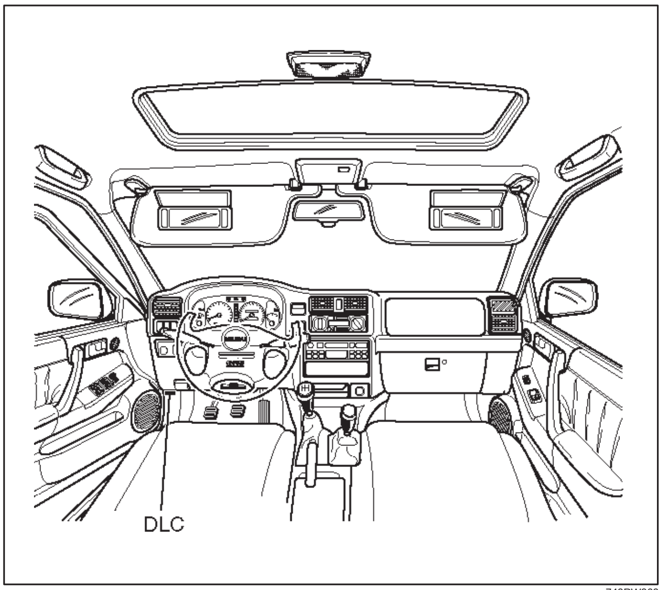


Legend

(1) PCMCIA Card
(2) RS 232 Loop Back Connector
(3) SAE 16/19 Adapter
(4) DLC Cable
(5) Tech 2

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 2000 System PCMCIA card (1) inserts into the Tech 2 (5).
2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (5)
4. Mark sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.



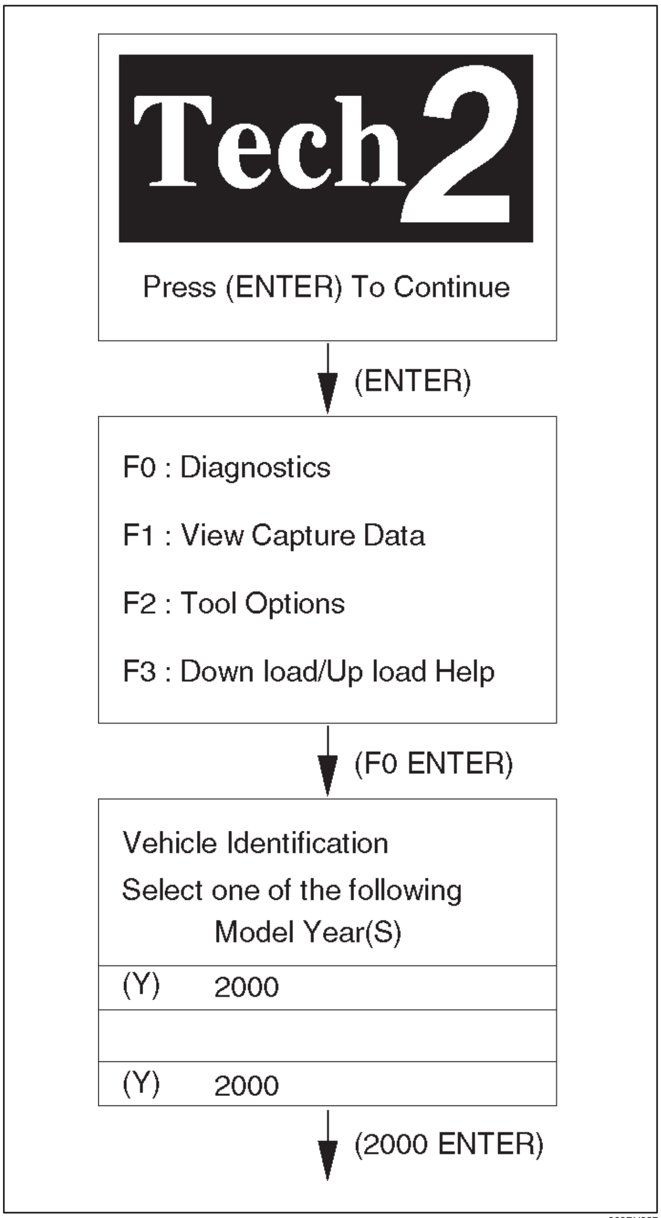
740RW060

6. The vehicle ignition turns on.
7. Verify the Tech 2 power up display.

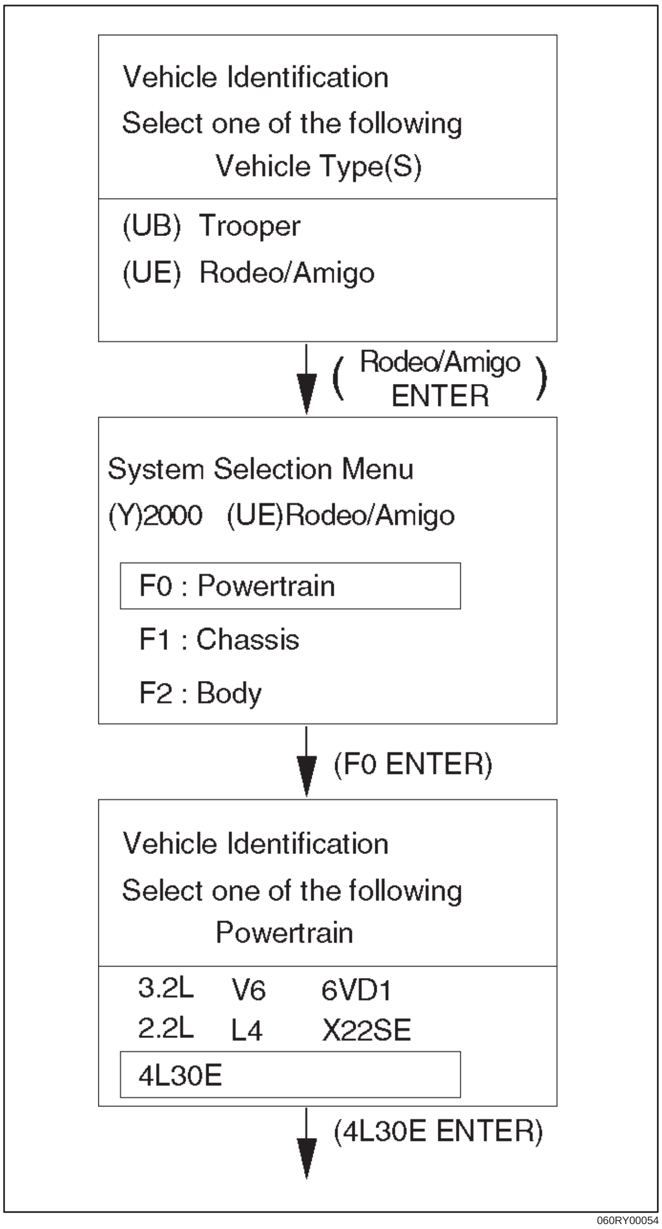
060RW009

NOTE: The RS232 Loop back connector is only to use for diagnosis of Tech 2 and refer to user guide of the Tech 2.

8. The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



060RY027



Once the test vehicle has been identified an “Application (Powertrain) Menu” screen appears. Please select the appropriate application.

The following table shows, which functions are used for the available equipment versions.

- F0: Diagnostic Trouble Codes
  - F0: Read DTC Info Ordered By Priority
  - F1: Clear DTC Information
  - F2: DTC Information
- F1: Data Display
  - F0: Transmission Data
- F2: Snap Shot
- F3: Actuator Tests
  - F0: Lamps
    - F0: Check Light
    - F1: Winter Drive Lamp
    - F2: Power Drive Lamp
    - F3: AT Oil Temperature Lamp
  - F1: Solenoids
    - F0: Solenoid 1-2/3-4 Test
    - F1: Solenoid 2-3 Test
    - F2: TCC Solenoid
    - F3: Band Apply Solenoid
    - F4: Pressure Control Solenoid (PCS)
- F4: Function Tests
  - F0: Reset Oil Life Monitor

Diagnostic Trouble Codes

The purpose of the "Diagnostic Trouble Codes" mode is to display stored PCM trouble codes.
When "Diagnostic Trouble Codes" is selected an "Application Menu" screen appears.

Clear DTC Information

The purpose of the "Clear DTC Information" mode is to command the clearing of stored PCM trouble codes.
When "Clear DTC Information" is selected, a "Clear DTC Information", warning screen appears. This screen informs you that by cleaning DTC's, "all stored DTC information in controller will be erased".
Do you want to clear DTC's (Yes/No).
Press either the Yes or No key when answering.
After clearing codes, confirm system operation by test driving the vehicle.
Allow the vehicle to shift through all four forward gears in a manner which attempts to repeat the failure condition.

NOTE: When the trouble has not been repaired and the trouble code cannot be erased, check the vehicle again.

DTC Information

When "DTC Information" is selected, an "Application Menu" appears with a list of DTC information function keys addressing DTC specifics and their origins.
Function key selections may vary for particular vehicle and/or system.

Data Display

The purpose of the "Data Display" mode is to continuously monitor data parameters.
The current actual values of all important sensors and signals in the system are display through F1 mode.
When "Data Display" is selected an "Application Menu" appears. Please select either "Engine" or "Transmission Data Display".
See "Transmission Data" on next page.

Snapshot

When "Snapshot" is selected an "Application Menu" appears.
When "Transmission Snapshot" application is selected from the "Application Menu", a "Snapshot Menu" appears, displaying several options. "Snapshot" options may vary from one system to another.
"Snapshot" allows a recording of all vehicle parameters. There parameters may then be replayed at a future point in time.
This action allows you to focus on making the condition occur, rather than trying to view all of the data in anticipation of the fault. The snapshot will collect parameter information around a trigger point that you select.
When a snapshot is taken. It is recorded onto the PCMCIA memory card. When the Tech 2 is powered down. Snapshots are not lost.

Actuator Tests

The purpose of "Actuator Tests" mode is to check for correct operation of electronic system actuators.

Lamps

You can operate the lamps by pressing the "ON" and "OFF" buttons.
Preconditions: none

Solenoid

Solenoid 1-2/3-4, Solenoid 2-3, TCC Solenoid
You can operate the solenoids by pressing the "ON" and "OFF" buttons.
Preconditions: P–N position, no vehicle speed, no engine speed

Band Apply Solenoid
You can operate the solenoid by pressing the "ON" and "OFF" buttons.
Preconditions: P-N position, idle engine speed, no vehicle speed.

Pressure Control Solenoid (PCS)
You can set desired PCS Current using the "Increment" (+20) and "Decrement" (–20) button. The PC Solenoid Data informs about PCS Current, Pressure and Duty Cycle.
Preconditions: P–N position, no engine speed, no vehicle speed

Reset Oil Life Monitor

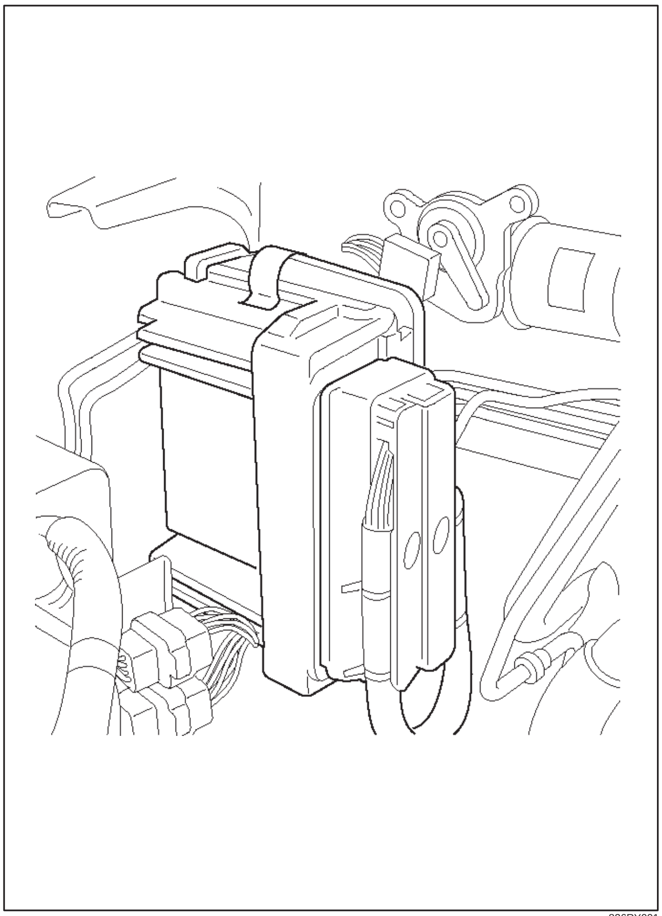
Displays parameter "Oil Life Monitor" and resets to 100% if Yes-button is pressed on Reset-question. "No" leaves test.

Transmission Data

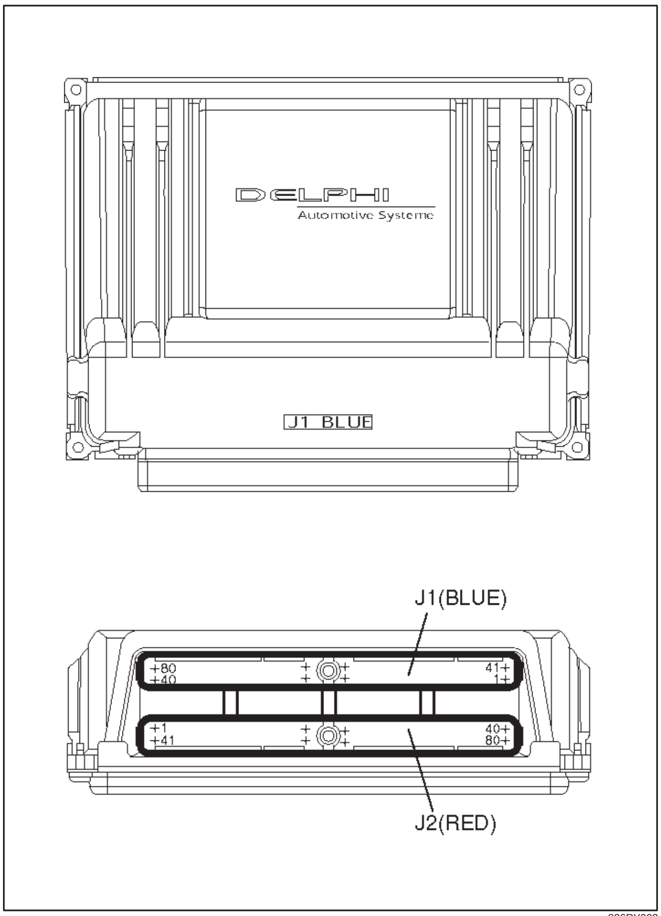
Item	Unit	Engine running at idle
Ignition Voltage	V	12.8 ~ 14.1 V
Engine Speed	RPM	750 ~ 900 RPM
Vehicle Speed	km/h, MPH	0 MPH
AT Output Speed (Automatic Transmission)	RPM	0 RPM
AT Input Speed Ratio (Automatic Transmission)		0.0
Throttle Position	%	0 %
AT Oil Temperature (Automatic Transmission)	˚C, ˚F	70 ~ 80˚C (158 ~ 176˚F)
Transmission Temperature	˚C, ˚F	75 ~ 110˚C (167 ~ 230˚F)
AT Oil Temperature Lamp (Automatic Transmission)	Off, On	Off
AT Oil Life Monitor (Automatic Transmission)	%	100 %
AT Oil Life Lamp (Automatic Transmission)	Off, On	Not used
Commanded Gear		1
Current Gear		1
Mode Switch A	Inactive, Active	Active
Mode Switch B	Inactive, Active	Inactive
Mode Switch C	Inactive, Active	Inactive
Mode Switch G	Inactive, Active	Active
Selector Position		Park
1–2 Shift Solenoid A	Off, On	Off
2–3 Shift Solenoid B	Off, On	On
Solenoid Brake Band	Off, On	Off
TCC Slip Speed	RPM	750 ~ 900 RPM
TCC Solenoid	Off, On	Off
TCC Duty Cycle	%	0 %
PCS Current (Pressure Control Solenoid)	A	approx. 1.0 A
PCS Duty Cycle (Pressure Control Solenoid)	%	approx. 45 %
Desired PCS Pressure (Pressure Control Solenoid)	kPa	43 ~ 52 kPa
Shift Pressure	kPa	43 ~ 52 kPa
Brake Switch	Off, On	On
Winter Switch	On, Off	Off
Winter Drive Lamp	Off, On	Off
Power Switch	Power Drive Normal	Normal
Power Drive Lamp	Off, On	Off
Emergency Mode	Inactive, Active	Inactive
ABS Status	On, Off	(Not used)

OBD II Diagnostic Management System

Powertrain Control Module (PCM) Location



826RY001



826RY002

Class 2 Serial Data Bus

OBD II technology requires a much more sophisticated PCM than does OBD I technology. The OBD II PCM diagnostic management system not only monitors systems and components that can impact emissions, but they also run active tests on these systems and components. The decision making functions of OBD II PCM have also greatly increased. To accommodate this expansion in diagnostic complexity, Isuzu engineers have designed the Class 2 serial data bus, which meets SAE J1850 recommended practice for serial data.

"Serial Data" refers to information which is transferred in a linear fashion – over a single line, one bit at a time. A "Data Bus" is an electronic pathway through which serial data travels.

RODEO previously used a 5 volt data bus called UART, which is an acronym for "Universal Asynchronous Receive and Transmit". When neither the vehicle's control module nor the diagnostic tool, such as a Tech 2, are "talking," the voltage level of the bus at rest is 5 volts. The two computers talk to each other at a rate of 8,192 bits per second, by toggling or switching the voltage on the data bus from 5 volts to ground.

Class 2 data, which is used on OBD II vehicles, is quite different. Data is transferred at a rate of 10.4 kilobits per second, and the voltage is toggled between zero and 7 volts.

C07RT006

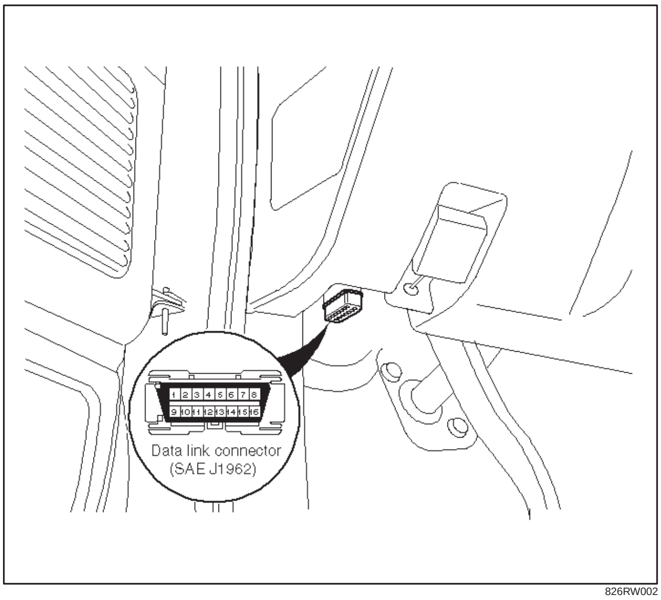
Class 2 data is also pulse width modulated. Each bit of information can have one of two lengths: long or short. On the other hand, UART data bits come in only one length (short). The pulse width modulation of Class 2 data allows better utilization of the data line.

The message carried on Class 2 data streams are also prioritized. This means that if two devices try to communication on the data line at the same time, only the higher priority message will continue. The device with the lower priority message must wait.

NOTE: The Class 2 data wire is always terminal 2 of the new 16–terminal Data Link Connector (DLC).

16 – Terminal Data Link Connector (DLC)

OBD II standardizes Data Link Connector (DLC) configurations. The DLC, formerly referred to as the ALDL, will be a 16–terminal connector found on the lower left side of the driver's side instrument panel. All manufacturers must conform to this 16–terminal standard.



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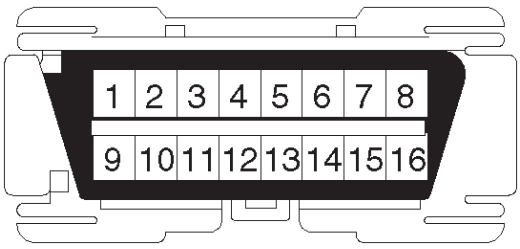


810RT022

PIN 1 –	(Not used)
PIN 2 –	J1850 Bus + L line on 2–wire systems, or single wire (Class 2)
PIN 3 –	(Not used)
PIN 4 –	Chassis ground pin
PIN 5 –	Signal ground pin
PIN 6 –	(Not used)
PIN 7 –	(Not used)
PIN 8 –	(Not used)
PIN 9 –	Primary UART
PIN 10 –	(Not used)
PIN 11 –	(Not used)
PIN 12 –	ABS diagnostic or CCM diagnostic enable
PIN 13 –	SIR diagnostic enable
PIN 14 –	(Not used)
PIN 15 –	(Not used)
PIN 16 –	Battery power from vehicle unswitched (4 AMP MAX.)

Malfunction Indicator Lamp (MIL)

The Malfunction Indicator Lamp (MIL) looks the same as the MIL you are already familiar with ("CHECK ENGINE" lamp). However, OBD II requires that it illuminate under a strict set of guidelines. Basically, the MIL is turned on when the PCM detects a DTC that will impact the vehicle's emissions.

The MIL is under the control of the Diagnostic Executive. The MIL will be turned on if a component or system which has an impact on vehicle emissions indicates a malfunction or fails to pass an emissions–related diagnostic test. It will stay on until the system or component passes the same test, for three consecutive trips, with no emissions–related faults.

Types Of Diagnostic Trouble Codes (DTCs)

The Diagnostic Executive classifies Diagnostic Trouble Codes (DTCs) into certain categories. Each type has different requirements to set the code, and the Diagnostic Executive will only illuminate the Malfunction Indicator Lamp (MIL) for emissions related DTCs. DTCs fall into four categories: A, B, C, and D; only types A and B are emission related The following descriptions define these categories:

TYPE A

Will store the DTC and turn on the MIL ("Check Engine" lamp) on the first trip in which an emission related diagnostic test has run and reported a "test failed" to the Diagnostic Executive.

TYPE B

Will store the DTC and turn on the MIL on the second consecutive trip in which an emission related diagnostic test has run and reported a "test failed" to the Diagnostic Executive. After one failure, the type B DTC is "armed," or prepared to store a history code and turn on the MIL if a second failure occurs. One passed test will disarm a type B DTC. Some special conditions apply to misfire and fuel trim DTCs. For a type B DTC to store and turn on the MIL, two ignition cycles are required.

TYPE C

Will store the DTC and turn on a "SERVICE" lamp ("Check Trans" lamp) on the first trip that a non emission related diagnostic test has run and reported a "test failed" to the Diagnostic Executive. This type of DTC will be used in future applications.

TYPE D

Will store a DTC but will not turn on the MIL on the first trip that a non emission related diagnostic test has run and reported a "test failed" to the Diagnostic Executive. These codes can be very helpful for vehicle service when the driver may comment about a condition, but the MIL did not turn on.

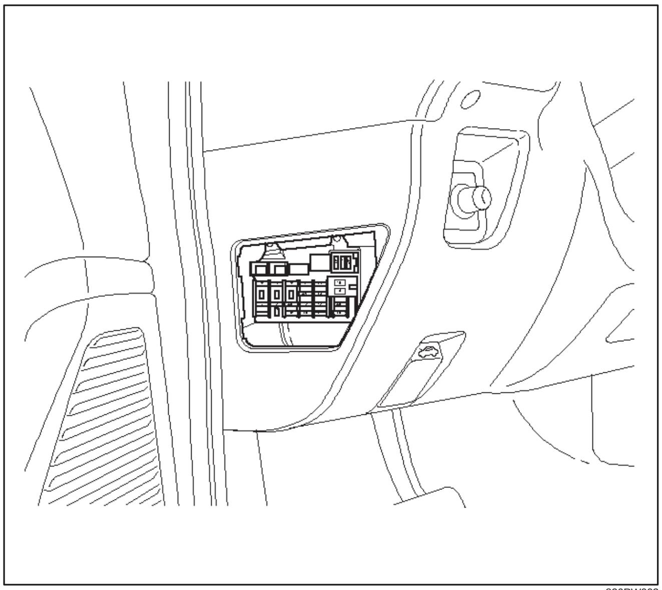
Clear DTC

NOTE: If you clear the DTC (Diagnostic Trouble Codes) you will not be able to read any codes recorded during the last occurrence.

NOTE: To use the DTC again to identify a problem, you will need to reproduce the fault or the problem. This may require a new test drive or just turning the ignition on (this depends on the nature of the fault).

1. IF you have a Tech 2:
   1. Connect the Tech 2 if it is still not connected GOTHROUGH **Tech 2 OBD II CONNECTION.**
   2. Push "F1: Clear DTC Information" in the Application Menu and answer "Yes" to the question "Do you want to clear DTC's?"
      a. When a malfunction remains as it is the Tech 2 displays "4L30E CODES NOT CLEARED". This means that the problem is still there or that the recovery was not done. Please **GOTO DTC CHECK.**
      b. When a malfunction has been repaired and the recovery is done the Tech 2 displays "4L30E CODES CLEARED".

2. IF you have no Tech 2:
   To clear the DTC, remove Fuse “Stop” (CB–13, 15A) for at least 10 seconds.



826RW003

DTC Check

1. Diagnostic Trouble Codes (DTC) have been identified by Tech 2.
2. You have written the list of the DTCs. The order of the malfunctions has no meanings for this PCM. Usually only one or two malfunctions should be set for a given problem.
3. Check directly the DTCs you identified. The DTCs are sorted by number. Refer to Diagnostic Trouble Code (DTC) Identification in this section.

PCM Precaution

The PCM can be damaged by:

1. The electrostatic discharge
2. The short circuit of some terminals to voltage or to ground.

Electrostatic Discharge Damage Description:

1. Electronic components used to control systems are often designed to carry very low voltage, and are very susceptible to damage caused by electrostatic discharge. It is possible for less than 100 volts of static electricity to cause damage to some electronic components. By comparison, it takes as much as 4,000 volts for a person to even feel the zap of a static discharge.
2. There are several ways for a person to become statically charged. The most common methods of charging are by friction and induction. An example of charging by friction is a person sliding across a car seat, in which a charge of as much as 25,000 volts can build up. Charging by induction occurs when a person with well insulated shoes stands near a highly charged object and momentarily touches ground. Charges for the same polarity are drained off, leaving the person highly charged with the opposite polarity. Static charges of either type can cause damage, therefore, it is important to use care when handling and testing electronic components.

NOTICE: To prevent possible electrostatic discharge damage:

1. Do not touch the PCM connector pins or soldered components on the PCM circuit board.
2. Be sure to follow the guidelines listed below if servicing any of these electronic components:
3. Do not open the replacement part package until it is time to install the part.
4. Avoid touching electrical terminals of the part.
5. Before removing the part from its package, ground the package to a known good ground on the vehicle.
6. Always touch a known good ground before handling the part. This step should be repeated before installing the part if the part has been handled while sliding across the seat, while sitting down from a standing position or while walking some distance.

Information On PCM

1. The Powertrain Control Module (PCM) is located in the engine room and is the control center of the electronic transmission control system.
2. The PCM must be maintained at a temperature below 85°C (185°F) at all times. This is most essential if the vehicle is put through a paint baking process. The PCM will become inoperative if its temperature exceeds 85°C (185°F). Therefore, it is recommended that the PCM be removed or that temporary insulation be placed around the PCM during the time the vehicle is in a paint oven or other high temperature process.
3. The PCM is designed to process the various inputs and then respond by sending the appropriate electrical signals to control transmission upshift, downshift, shift feel and torque converter clutch engagement.
4. The PCM constantly interprets information from the various sensors, and controls the systems that affect transmission and vehicle performance. By analyzing operational problems, the PCM is able to perform a diagnostic function by displaying DTC(s) and aid the technician in making repairs.

Intermittent Conditions

If the Tech 2 displays a diagnostic trouble code as intermittent, or if after a test drive a DTC does not reappear though the detection conditions for this DTC are present, the problem is most likely a faulty electrical connection or loose wiring. Terminals and grounds should always be the prime suspect. Intermittents rarely occur inside sophisticated electronic components such as the PCM.

Use the DTC information to understand which wires and sensors are involved.

When an intermittent problem is encountered, check suspect circuits for:

1. Poor terminal to wire connection.
2. Terminals not fully seated in the connector body (backed out).
3. Improperly formed or damaged terminals.
4. Loose, dirty, or corroded ground connections:

   HINT: Any time you have an intermittent in more than one circuit, check whether the circuits share a common ground connection.
5. Pinched or damaged wires.
6. Electromagnetic Interference (EMI):

   HINT: Check that all wires are properly routed away from coil, and generator. Also check for improperly installed electrical options, such as lights, 2–way radios, etc.

Use the F2: SNAPSHOT mode of the Tech 2 to help isolate the cause of an intermittent fault. The snapshot mode will record information before and after the problem occurs. Set the snapshot to “trigger” on the suspect DTC or, if you notice the reported symptom during the test drive, trigger the snapshot manually.

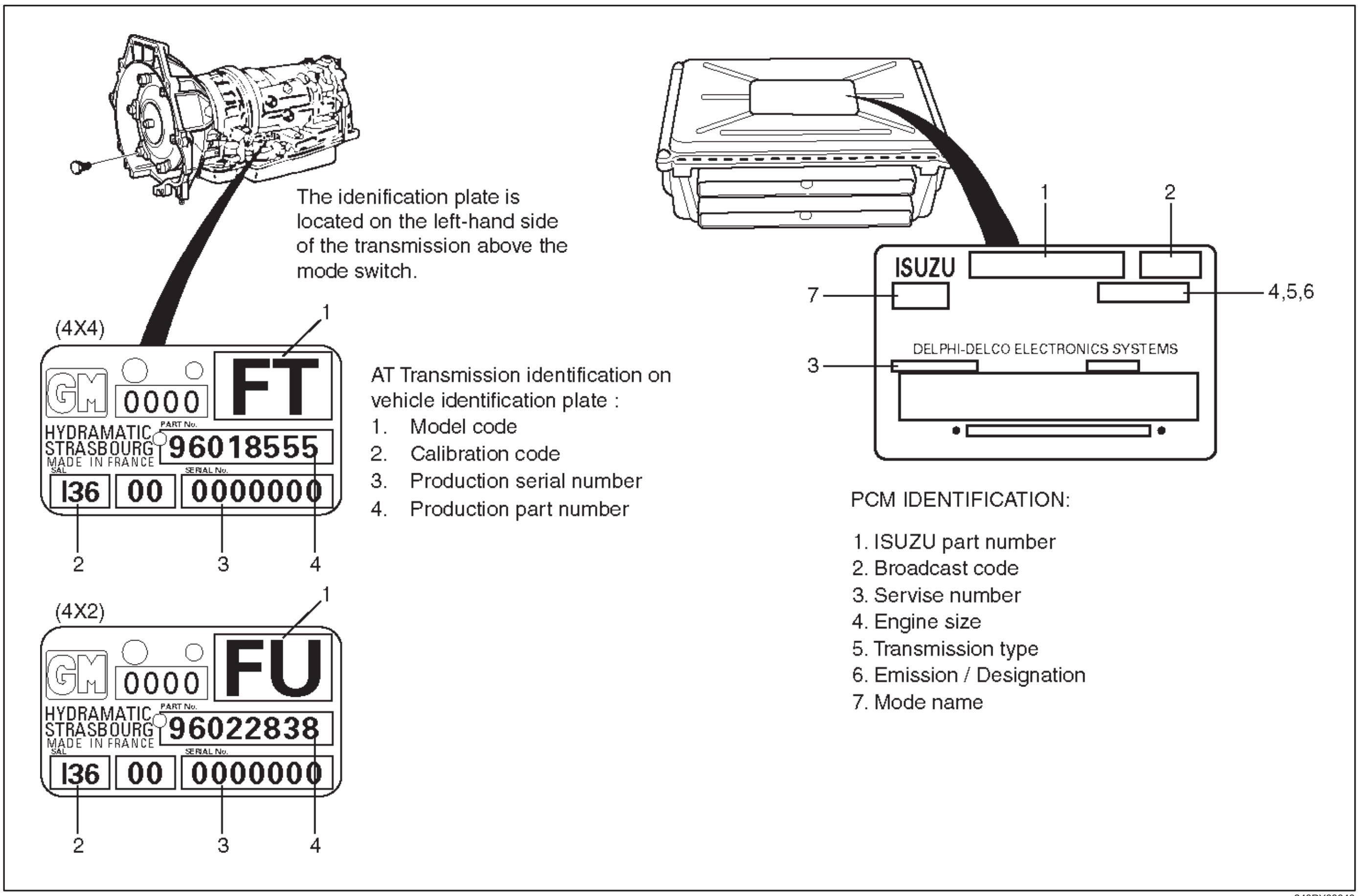
After the snapshot has been triggered, command the Tech 2 to play back the flow of data recorded from each of the various sensors. Sign of an intermittent fault in a sensor circuit is a sudden unexplainable jump in data values out of the normal range.

Transmission and PCM Identification

The chart below contains a list of all important information concerning rear axle ratio, Powertrain Control Module (PCM), and transmission identification.

VEHICLE		Rr axle Ratio	PCM	TRANSMISSION		
Type	Engine		ISUZU Parts No.	Calibration Code	Isuzu Part No.	Model Code
Isuzu / Rodeo	3.2L V6	4.100	8–09385–249–0	I36	8–96018–555–0	FT (4×4)
				I36	8–96022–838–0	FU (4×2)

Isuzu Rodeo



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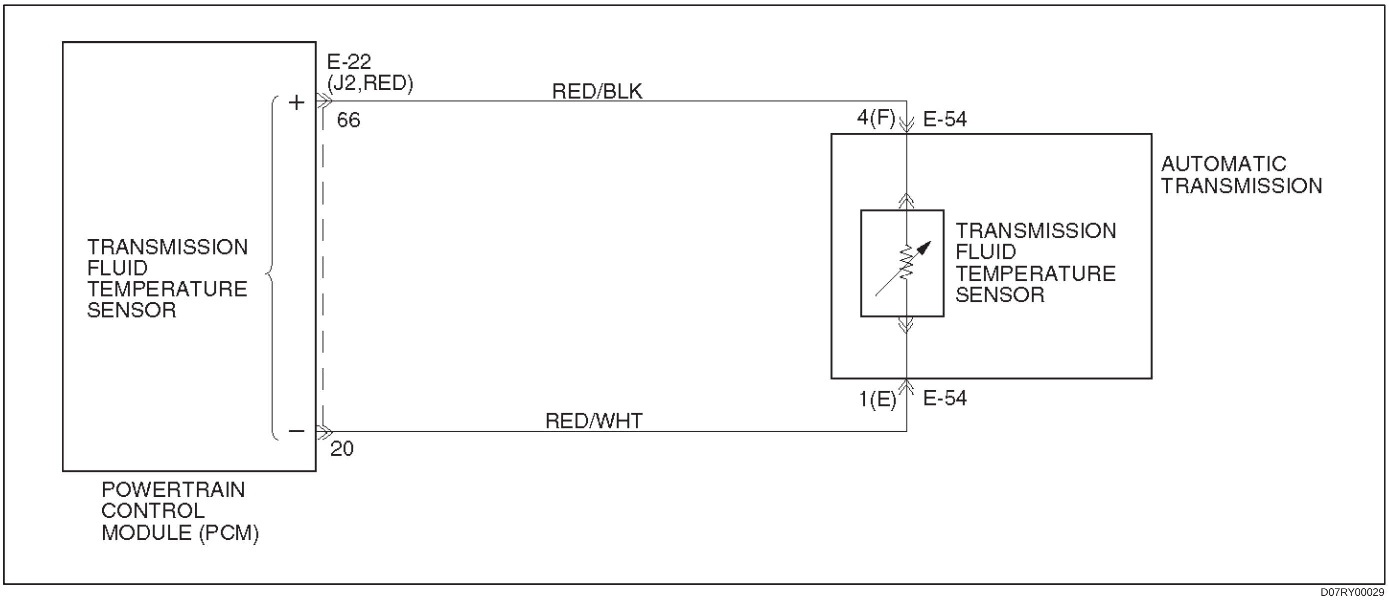
Diagnostic Trouble Code (DTC) Identification

DTC NUMBER	DTC NAME	DTC TYPE	MIL "CHECK ENGINE"	"CHECK TRANS"
P0218	Transmission Fluid Over Temperature	D		
P0705	Transmission Range Switch (Mode Switch) Illegal Position	D		
P0706	Transmission Range Switch (Mode Switch) Performance	D		
P0711	Transmission Fluid Temperature (TFT) Sensor Performance	D		
P0712	Transmission Fluid Temperature (TFT) Sensor Circuit Low Input	D		
P0713	Transmission Fluid Temperature (TFT) Sensor Circuit High Input	D		
P0719	Brake Switch Circuit Low (Stuck On)	D		
P0722	Automatic Transmission Output Speed Sensor (OSS) Low Input	B	ON	Flash
P0723	Automatic Transmission Output Speed Sensor (OSS) Intermittent	B	ON	Flash
P0724	Brake Switch Circuit High (Stuck Off)	D		
P0730	Gear Error Without Input Speed	C		Flash
P0742	Torque Converter Clutch (TCC) System Stuck On	B	ON	Flash
P0748	Pressure Control Solenoid (PCS) (Force Motor) Circuit Electrical	C		Flash
P0751	Shift Solenoid A Performance (Stuck Off)	B	ON	Flash
P0752	Shift Solenoid A Performance (Stuck On)	B	ON	Flash
P0753	Shift Solenoid A Electrical	B	ON	Flash
P0756	Shift Solenoid B Performance (Stuck Off)	B	ON	Flash
P0757	Shift Solenoid B Performance (Stuck On)	B	ON	Flash
P0758	Shift Solenoid B Electrical	B	ON	Flash
P1850	Brake Band Apply Solenoid Malfunction	D		
P1860	TCC Solenoid Electrical	B	ON	Flash
P1870	Transmission Component Slipping (TCC Stuck Off)	B	ON	Flash

DTC TYPE	DEFINITION
B	Emission related, turn on MIL (Check Engine) and flashing Check Trans after 2 consecutive trips (Removal to confirmed)
C	Non–emission related, flashing Check Trans on 1st failure
D	Non–emission related, no lamps

NOTE: On the following charts, refer to Powertrain Control Module (PCM) section for Wiring System and the Body and Accessories section for circuit diagram details, parts location, and connector configuration.

DTC P0218 Transmission Fluid Over Temperature



Circuit Description

The Transmission Fluid Temperature (TFT) sensor is a thermister that controls the signal voltage to the PCM. The PCM supplies a 5–volt reference to the sensor on circuit RED/BLK. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage. As the fluid temperature warms to a normal transmission operating temperature of 100°C (212°F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2.0 volts.
This DTC detects a high transmission temperature for a long period of time. This is a type “D” DTC.

Conditions For Setting The DTC

- No TFT DTCs P0712 or P0713.
- TFT is greater than 135°C (275°F).
- All conditions met for 21 seconds.

Action Taken When The DTC Sets

- Hot mode TCC Shift Pattern.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- ATF Lamp ON. (TFT is greater than 145°C (293°F))
- Disable E–side TCC OFF request.

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warm–up cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and transmission 7-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well.

  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check harness routing for a potential short to ground in circuit RED/BLK.
- Scan tool TFT sensor temperature should rise steadily to about 100°C (212°F), then stabilize.
- Check for a “skewed” (mis–scaled) sensor by comparing the TFT sensor temperature to the ambient temperature after a vehicle cold soak. A “skewed” sensor can cause delayed garage shifts or TCC complaints.
- Check for a possible torque converter stator problem.
- Verify customer driving habits, trailer towing, etc.

Test Description

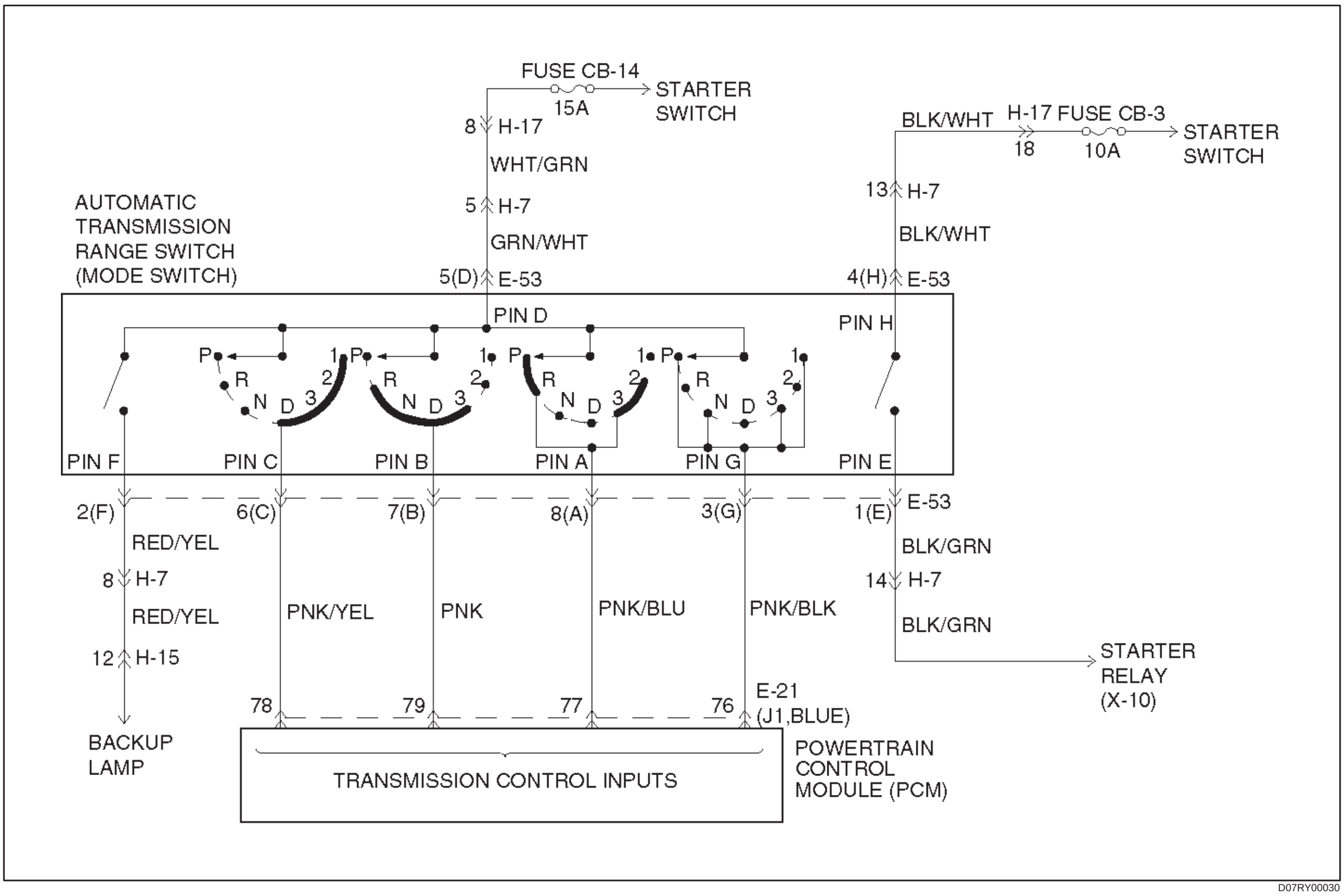
The numbers below refer to the step numbers on the diagnostic chart.

3. This test checks for a “skewed” sensor or shorted circuit.
4. This test simulates a TFT DTC P0713.

DTC P0218 Transmission Fluid Over Temperature

Step	Action	Yes	No
1	Were you sent here from the "Powertrain On–Board Diagnostic (OBD) System Check"?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	Perform the following checks: ● Check for possible engine system problems. ● Transmission fluid checking procedure. Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) Section. Were the checks performed?	Go to Step 3	—
3	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Failure Records" for reference, as data will be lost when "Clear Info" function is used. 3. Record the DTC "Failure Records". Is the TFT sensor signal voltage less than 0.33 volts?	Go to Step 4	Go to Diagnostic Aids
4	1. Turn the ignition "off". 2. Disconnect the transmission 7–way connector E–54 (additional DTCs may set). Is the TFT sensor signal voltage greater than 4.92 volts?	Go to Internal Wiring Harness Check	Go to Step 5
5	Inspect/repair circuit RED/BLK for a short to ground. Was a problem found?	Go to Step 7	Go to Step 6
6	1. Inspect the PCM for poor connections. 2. Replace the PCM if no poor connections were found. Is the replacement complete?	Go to Step 7	—
7	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: TFT is less than 125°C (257°F) for at least 10 seconds. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0705 Transmission Range Switch (Mode Switch) Illegal Position



Circuit Description

- The range switch supplies the Powertrain Control Module (PCM) with information regarding the selector lever position: P, R, N, D, 3, 2 or L. The selector lever position is indicated by the state of four ON/OFF contacts. The range switch is located on one side of the transmission. It is on the transmission manual shaft and is fixed to the main case.
- The range switch is also used to provide the information P or N to the engine crank wiring. The engine can be cranked only if connector E–53 terminal 4(H) is connected to terminal 1(E) which is connected to ground.
- The range switch is also used to provide the backup lamp power in reverse. This is the reason why the range switch is supplied through a 15A fuse (CB–14). This fuse can burn due to a short circuit in the back up lamp.

This DTC detects when a fuse is open or the range switch circuit does not work. This is a type “D” DTC.

Conditions For Setting The DTC

- Range switch illegal positions met for 5 seconds.

Action Taken When The DTC Sets

- Default to D position.
- Inhibit torque management.
- Maximum line pressure.
- Turn Force Motor OFF.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Refer to accompanying chart for the normal range signals and the illegal combinations.
- Inspect the wiring for poor electrical connections at the PCM and at the transmission 8–way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Refer to the “Range Switch Logic Table” for further information.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks the indicated range signal to the manual valve actually selected.
6. This test checks for continuity between each selected range switch connector terminals.

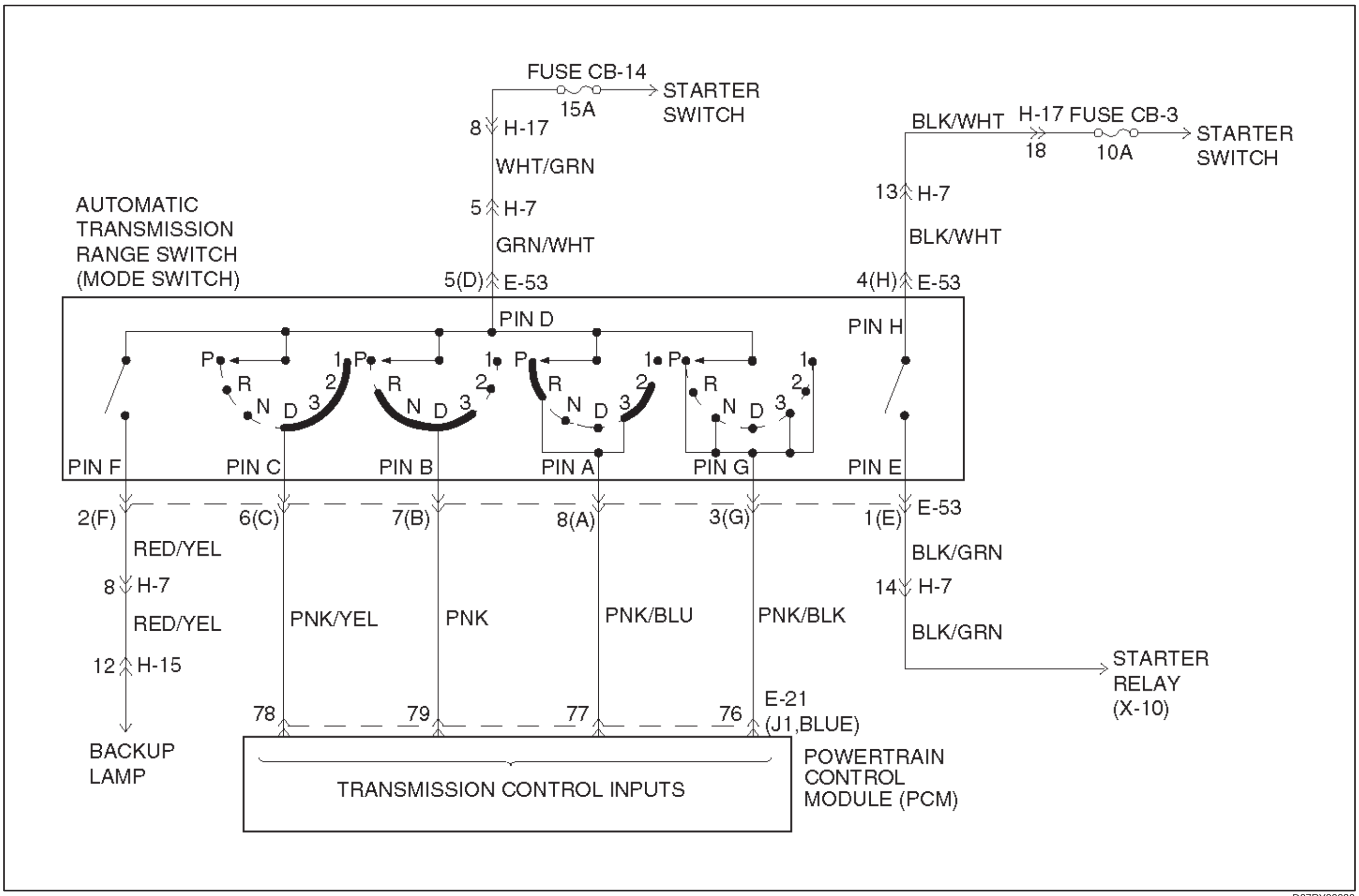
Range Switch Logic Table

Range Position	Range Switch Pin			
	A	B	C	P(G)
Park	ON	OFF	OFF	ON
Reverse	ON	ON	OFF	OFF
Neutral	OFF	ON	OFF	ON
D4	OFF	ON	ON	OFF
D3	ON	ON	ON	ON
2	ON	OFF	ON	OFF
L	OFF	OFF	ON	ON
Illegal	OFF	OFF	OFF	OFF
Illegal	OFF	OFF	OFF	ON

DTC P0705 Transmission Range Switch (Mode Switch) Illegal Position

Step	Action	Yes	No
1	Were you sent here from the "Powertrain On–Board Diagnostic (OBD) System Check"?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	Perform the following checks: ● The transmission linkage from the select lever to the manual valve is adjusted properly. ● Diagnostic circuit check. Were the checks performed?	Go to Step 3	—
3	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Freeze Frame" and "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Freeze Frame" and "Failure Records". 4. Select each transmission range: D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the scan tool "Range Switch" display?	Go to Diagnostic Aids	Go to Step 4
4	Are all range switch pin displays incorrect?	Go to Step 5	Go to Step 6
5	Check fuse and wiring to the 8–way connector terminal 5(D) for opens. Refer to Mode Switch in Automatic Transmission (4L30–E) section. If no problem was found, replace the range switch. Is the replacement complete?	Go to Step 9	—
6	1. Disconnect the 8–way range switch connector. 2. Using ohmmeter, check continuity between terminal 5(D) and respectively terminals 3(G), 6(C), 7(B) and 8(A) of the 8–way range switch connector. 3. Move shift selector lever through all positions and compare results with "Range Switch Logic Table". Is one range switch pin display incorrect?	Go to Step 7	Go to Step 8
7	Check the affected wiring and connector, and repair. Is the repair complete?	Go to Step 9	—
8	Check the Powertrain Control Module (PCM) connectors for poor connection. If no problem was found, replace the PCM. Is the replacement complete?	Go to Step 9	—
9	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and road test the vehicle. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0706 Transmission Range Switch (Mode Switch) Performance



D07RY00030

Circuit Description

- The range switch supplies the Powertrain Control Module (PCM) with information regarding the selector lever position: P, R, N, D, 3, 2 or L. The selector lever position is indicated by the state of four ON/OFF contacts. The range switch is located on one side of the transmission. It is on the transmission manual shaft and is fixed to the main case.
- The range switch is also used to provide the information P or N to the engine crank wiring. The engine can be cranked only if connector E–53 terminal 4(H) is connected to terminal 1(E) which is connected to ground.
- The range switch is also used to provide the back up lamp power in reverse. This is the reason why the mode switch is supplied through a 15A fuse (CB–14). This fuse can burn due to a short circuit in the back up lamp.
- This DTC detects an invalid state of the range switch or the range switch circuit by deciphering the range switch inputs. This is a type “D” DTC.

Conditions For Setting The DTC

This DTC will set if any of the following conditions occurs:

Condition 1 (“R” bad position):

- Engine is running.
- No output speed DTCP0722, P0723.
- Output speed greater than 3,200 RPM.
- Range switch indicates “R”.
- All conditions met for 4 seconds.

Condition 2 (“P” or “N” bad position):

- Engine is running.
- No TPS codes.
- Engine speed is less than 3,000 RPM.
- TP angle is greater than 20%.
- Range switch indicates “P” or “N”.
- All conditions met for 4 seconds.

Action Taken When The DTC Sets

- Default to “D” position.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Refer to the accompanying chart for the normal range signals and the illegal combinations.
- Inspect the wiring for poor electrical connections at the PCM and at the transmission 8–way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Refer to the “Range Switch Logic Table” for further information.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks the indicated range signal to the manual valve actually selected.
6. This test checks for continuity between each selected range switch connector terminals.

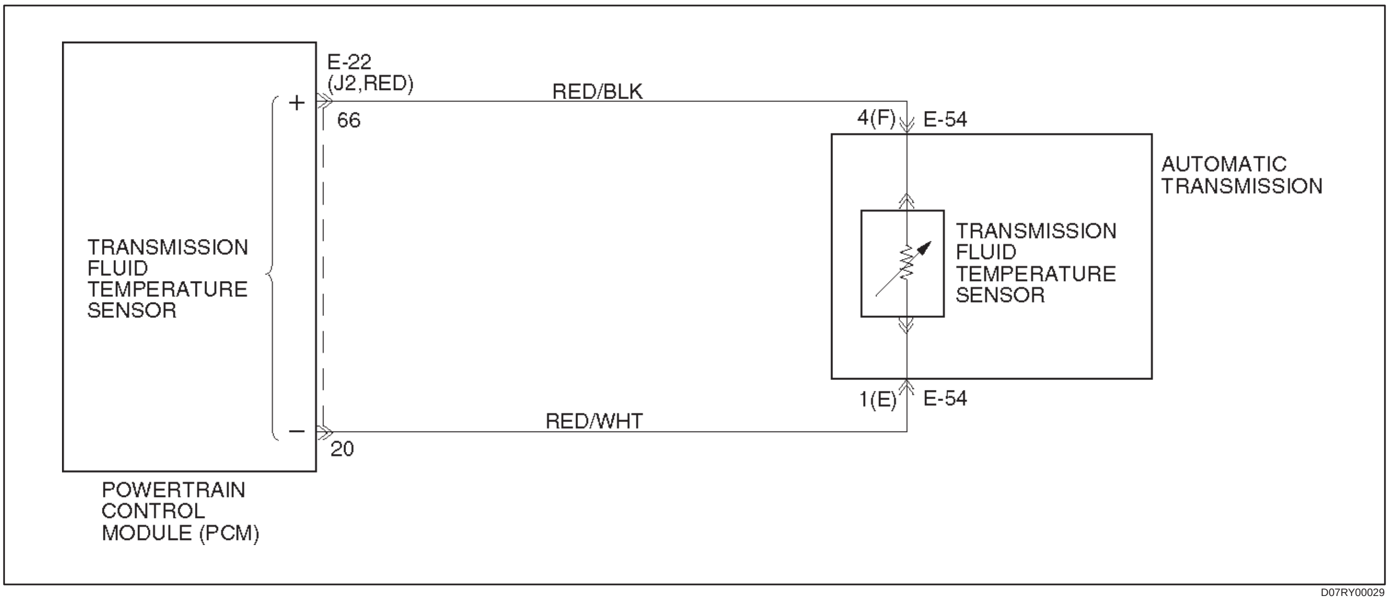
Range Switch Logic Table

Range Position	Range Switch Pin			
	A	B	C	P(G)
Park	ON	OFF	OFF	ON
Reverse	ON	ON	OFF	OFF
Neutral	OFF	ON	OFF	ON
D4	OFF	ON	ON	OFF
D3	ON	ON	ON	ON
2	ON	OFF	ON	OFF
L	OFF	OFF	ON	ON
Illegal	OFF	OFF	OFF	OFF
Illegal	OFF	OFF	OFF	ON

DTC P0706 Transmission Range Switch (Mode Switch) Performance

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	Perform the following checks: ● The transmission linkage from the select lever to the manual valve is adjusted properly. ● Diagnostic circuit check. Were the checks performed?	Go to Step 3	—
3	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. Select each transmission range: D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the scan tool “Range Switch” display?	Go to Diagnostic Aids	Go to Step 4
4	Are all range switch pin displays incorrect?	Go to Step 5	Go to Step 6
5	Check fuse and wiring to the 8–way connector terminal 5(D) for opens. Refer to Mode Switch in Automatic Transmission (4L30–E) section. If no problem was found, replace the range switch. Is the replacement complete?	Go to Step 9	—
6	1. Disconnect the 8–way range switch connector. 2. Using ohmmeter, check continuity between terminal 5(D) and respectively terminals 3(G), 6(C), 7(B) and 8(A) of the 8–way range switch connector. 3. Move shift selector lever through all positions and compare results with “Range Switch Logic Table”. Is one range switch pin display incorrect?	Go to Step 7	Go to Step 8
7	Check the affected wiring and connector, and repair. Is the repair complete?	Go to Step 9	—
8	Check the Powertrain Control Module (PCM) connectors for poor connection. If no problem was found, replace the PCM. Is the replacement complete?	Go to Step 9	—
9	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0711 Transmission Fluid Temperature (TFT) Sensor Performance



Circuit Description

The TFT sensor is a thermister that controls the signal voltage to the PCM. The PCM supplies a 5 volt reference signal to the sensor on circuit RED/BLK. When the transmission fluid is cold, the sensor resistance is high and the PCM detects high signal voltage. As the transmission fluid temperature increases to normal operating temperature of 100˚C (212˚F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2 volts.

When the PCM detects a TFT sensor that remains at the startup value, or a sensor that has a change delta of greater than 20˚C (36˚F) less than 1 second, DTC P0711 sets. DTC P0711 is a type D.

Conditions For Setting The DTC

- No VSS DTCs P0722 or P0723.
- No Transmission Component Slipping DTC P1870.
- Engine is running.
- TFT is between 20 A/D (Analog/Digital) counts and 248 A/D counts.
- TFT is between –40˚C (–40˚F) and +21˚C (69.8˚F) at engine startup.
- Engine coolant temperature is greater than 70˚C (150˚F).
- Engine coolant temperature has changed by greater than 50˚C (90˚F) since engine startup.
- Vehicle speed has been greater than 5 mph for greater than 410 seconds since engine startup (cumulative timer).
- TCC slip speed has been greater than 120 rpm for greater than 410 seconds since engine startup (cumulative timer).
- Battery voltage is between 10 and 16 volts.

All of the above is true and either of the following occurs:

- If the sensor is stuck, the TFT has not changed for greater than 2 counts (from startup temperature) for greater than 410 seconds.
- If the sensor shows an unrealistic change, the TFT exhibits a change delta of greater than 20˚C (36˚F), greater than 14 times in 7 seconds.

Action Taken When The DTC Sets

- Transmission default temperature will be:

  80˚C (176˚F) if engine temperature code is set.

  100˚C (212˚F) if engine temperature is warm.

  80˚C (176˚F) if engine run time is greater than 5 minutes.

  21˚C (69.8˚F) if engine run time is less than 5 minutes.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM. Inspect the wiring for poor electrical connections at the transmission 7-way connector. Look for the following conditions:
  a. A bent terminal
  b. A backed out terminal
  c. A damaged terminal
  d. Poor terminal tension
  e. A chafed wire
  f. A broken wire inside the insulation

- When diagnosing for an intermittent short or open connection, move the wiring harness while watching the test equipment for a change.
- First diagnose and clear any engine DTCs or TP Sensor codes. Then inspect for any transmission DTCs that may have reset.

Test Description

The number below refers to the step number on the diagnostic chart:

3. This test checks PCM and associated wiring up to the 7–way connector E–54. If the voltage increases to match chart the problem is isolated to the transmission wiring.

Resistance Chart

˚C	˚F	Resistance (kΩ)
–40	–40	672
0	32	65
20	68	25
80	176	2.5
120	248	0.78
150	304	0.37

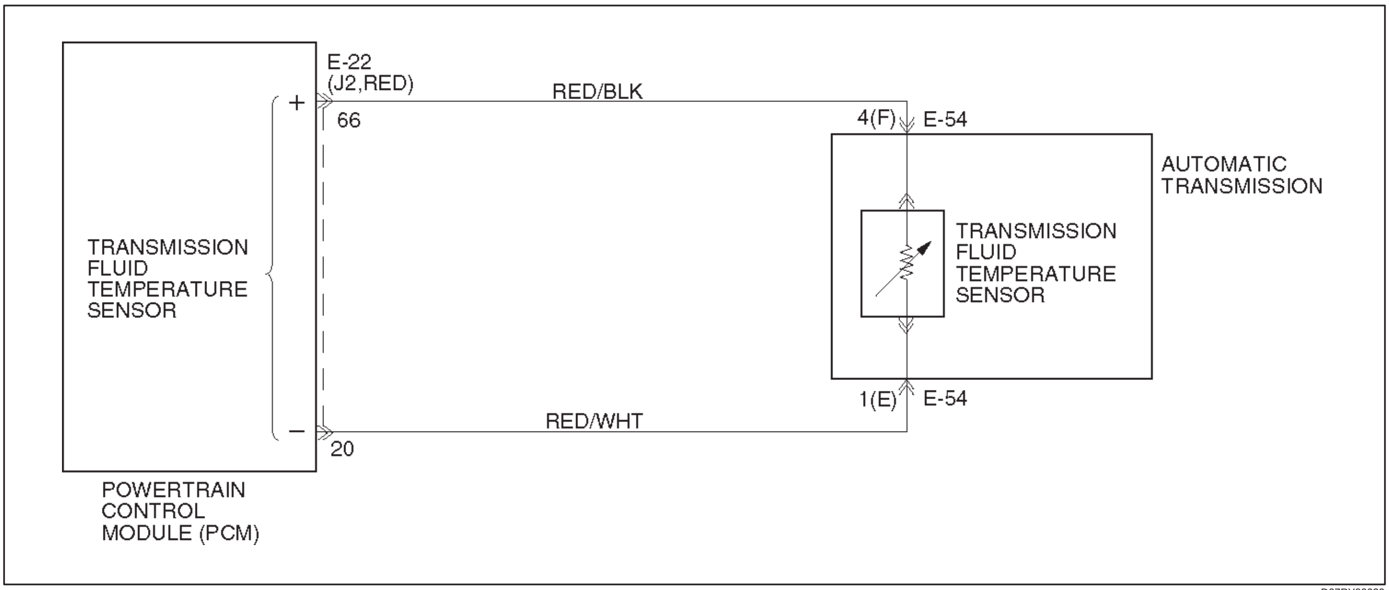
DTC P0711 Transmission Fluid Temperature (TFT) Sensor Performance

Step	Action	Yes	No
1	Was the Powertrain On–Board Diagnostic (OBD) System Check performed?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	Perform the transmission fluid checking procedure. Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section. Did you perform the fluid checking procedure?	Go to Step 3	Go to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section
3	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch to the “on” position. NOTE: Before clearing DTCs, use the scan tool in order to record the Freeze Frame and Failure Records for reference. The Clear Info function will erase the data. 3. Record the DTC Freeze Frame and Failure Records. 4. Select TFT on the scan tool. 5. While observing the scan tool display, move or massage the engine wiring harness from PCM connectors J2–66 and J2–20 to the transmission 7–way connector E–54. Does the TFT change by more than ±20˚C (36˚F)?	Go to Step 6	Go to Step 4
4	1. Turn the ignition “off”. 2. Disconnect the transmission 7–way connector E–54. 3. Install Jumper Harness on the transmission side of the 7–way connector E–54. 4. Using the J39200 DVOM and J35616 Connector Test Adapter Kit, connect the DVOM leads from terminal E54–4(F) to terminal E54–1(E). 5. Set the DVOM on MIN/MAX to measure resistance. 6. Record the TFT sensor resistance. 7. Move or massage the automatic transmission wiring harness assembly from the PCM to the TFT sensor connector. Does the DVOM MAX display a resistance greater than the value recorded in Action item 6 of this step?	Go to Step 7	Go to Step 5
5	Does the DVOM MIN display a resistance less than the value recorded in Action item 6 of step 4?	Go to Step 8	—

DTC P0711 Transmission Fluid Temperature (TFT) Sensor Performance (Cont'd)

Step	Action	Yes	No
6	Inspect circuit RED/BLK and RED/WHT of the engine wiring harness for an intermittent open or short condition. Repair the circuits if necessary. Did you find a problem?	Go to Step 12	Go to Step 11
7	Inspect the automatic transmission wiring harness assembly for an intermittent open in circuits RED/BLK and RED/WHT. Did you find a problem?	Go to Step 9	Go to Step 10
8	Inspect the automatic transmission wiring harness assembly for an intermittent shorted condition in circuits RED/BLK and RED/WHT. Did you find a problem?	Go to Step 9	Go to Step 10
9	Replace the automatic transmission wiring harness assembly. Is the replacement complete?	Go to Step 12	—
10	Replace TFT Sensor. Refer to Transmission Oil Temperature Sensor (Main Case) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 12	—
11	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 12	—
12	In order to verify your repair, perform the following procedure. 1. Select DTC. 2. Select Clear Info. 3. Drive the vehicle and ensure the following conditions are met: ● The TFT changes by more than 2.25°C (4.05°F) for 11 seconds since startup. ● The TFT does not change by more than 20°C (36°F) within 0.200 second for a period of at least 11 seconds. 4. Select Specific DTC. 5. Enter DTC P0711. Has the test run and passed?	System OK	Begin the diagnosis again Go to Step 1

DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input



Circuit Description

The TFT sensor is a thermister that controls the signal voltage to the PCM. The PCM supplies a 5–volt reference signal to the sensor on circuit RED/BLK. When the transmission fluid is cold, the sensor resistance is high. The PCM detects high signal voltage. As the transmission fluid temperature increases to the normal operating temperature of 100˚C (212˚F), the sensor resistance becomes less and the voltage decreases to 1.5 to 2 volts. With transmission fluid over temperature and DTC P0218 also set, check the transmission cooling system.

This DTC detects a continuous short to ground in the TFT signal circuit or the TFT sensor. This is a type “D” DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- Ignition is “on”.
- TFT sensor indicating a voltage less than 0.4 volts.
- All conditions met for 20 seconds.

Action Taken When The DTC Sets

- Transmission default temperature will be:

  80˚C (176˚F) if engine temperature code is set.

  100˚C (212˚F) if engine temperature is warm.

  80˚C (176˚F) if engine run time is greater than 5 minutes.

  21˚C (69.8˚F) if engine run time is less than 5 minutes.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Check harness routing for a potential short to ground in circuit RED/BLK. Scan tool TFT display should rise steadily to about 100˚C (212˚F), then stabilize.
- Inspect the wiring for poor electrical connection at the PCM and transmission 7-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- The temperature to resistance value scale may be used to test the TFT sensor at the various temperature levels to evaluate the possibility of a “skewed” (mis–scaled) sensor.

  A “skewed” sensor could result in delayed garage shifts or TCC complaints.
- Verify customer driving habits, trailer towing, etc.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for a short to ground or a “skewed” sensor.
4. This test checks for an internal fault within the transmission by creating an open.

Resistance Chart

˚C	˚F	Resistance (kΩ)
–40	–40	672
0	32	65
20	68	25
80	176	2.5
120	248	0.78
150	304	0.37

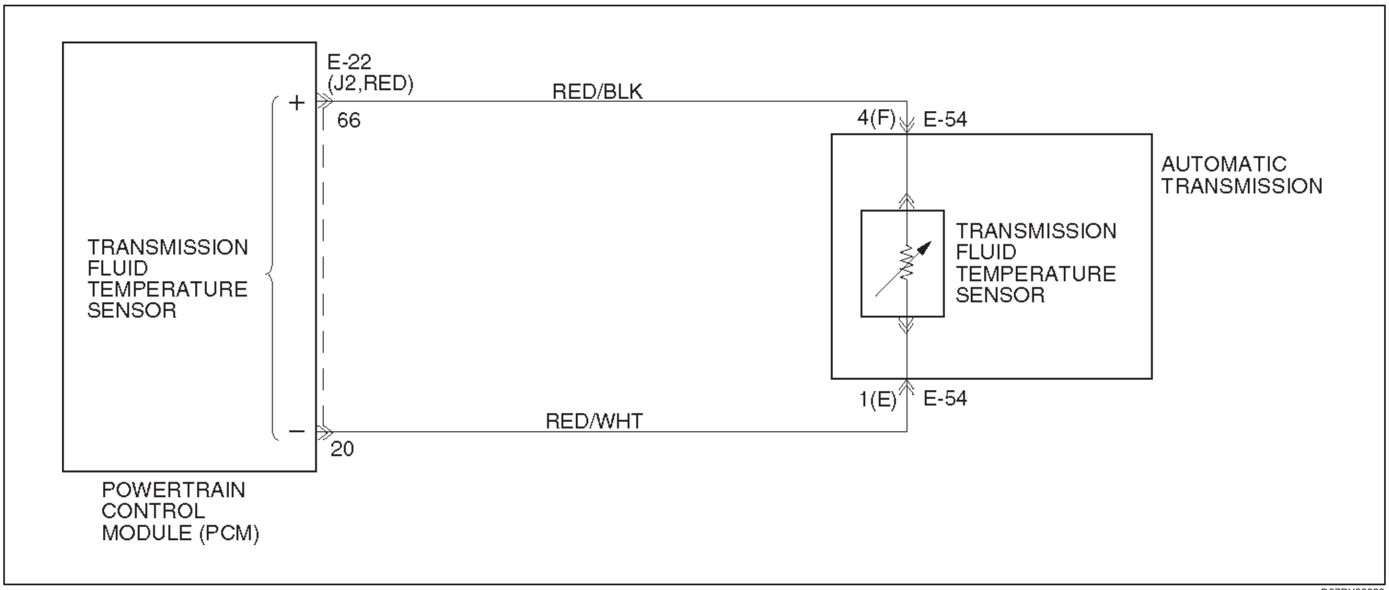
DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input

Step	Action	Yes	No
1	Were you sent here from the "Powertrain On–Board Diagnostic (OBD) System Check"?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	Perform the transmission fluid checking procedure. Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section Was the fluid checking procedure performed?	Go to Step 3	Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section
3	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Freeze Frame" and "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Freeze Frame" and "Failure Records". Does the scan tool display a TFT sensor signal voltage less than 0.4 volts?	Go to Step 4	Go to Diagnostic Aids
4	1. Turn the ignition "off". 2. Disconnect the transmission 7–way connector E–54. 3. Turn the ignition "on". Does the TFT signal voltage change to match the voltage 4.92 volts?	Go to Step 5	Go to Step 10
5	Using the J39200 DVOM, measure the resistance between terminals E54–4(F) and E54–1(E). Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 6
6	1. Disconnect the transmission 7–way connector E–54. 2. Using the J39200 DVOM, measure the resistance between terminals E54–4(F) and E54–1(E). Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 7
7	1. Remove the transmission oil pan. Refer to Transmission Oil Temperature Sensor (Main Case) in Automatic Transmission (4L30–E) section. 2. Check the internal wiring harness for a short to ground. Was a problem found?	Go to Step 9	Go to Step 8

DTC P0712 Transmission Fluid Temperature (TFT) Sensor Circuit Low Input (Cont'd)

Step	Action	Yes	No
8	1. Disconnect the internal wiring harness at the TFT sensor. 2. Measure the resistance of the TFT sensor. Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 9
9	Replace the TFT Sensor. Is the replacement complete?	Go to Step 13	—
10	Check circuit RED/BLK for a short to ground. Was a problem found?	Go to Step 13	Go to Step 11
11	Check the PCM for faulty connections. Was a problem found?	Go to Step 13	Go to Step 12
12	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 13	—
13	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: TFT sensor indicates a voltage greater than 0.33 volts for 2 seconds. 2. Review the scan tool "DTC info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input



D07RY00029

Circuit Description

The TFT sensor is a thermistor that controls the signal voltage to the PCM. The PCM supplies a 5–volt reference signal to the sensor on circuit RED/BLK. When the transmission fluid is cold, the sensor resistance is high and the PCM will sense high signal voltage. As the transmission fluid temperature warms to the normal operating temperature of 100˚C (212˚F), the sensor resistance becomes less and the voltage decreases to about 1.5 to 2 volts.

This DTC detects a continuous open or short to power in the TFT signal circuit or the TFT sensor. This is a type “D” DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- Ignition is “on”.
- TFT sensor indicating a voltage greater than 4.86 volts.
- All conditions met for 20 seconds.

Action Taken When The DTC Sets

- Transmission default temperature will be:

  80˚C (176˚F) if engine temperature code is set.

  100˚C (212˚F) if engine temperature is warm.

  80˚C (176˚F) if engine run time is greater than 5 minutes.

  21˚C (69.8˚F) if engine run time is less than 5 minutes.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and transmission 7-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Scan tool displays transmission fluid temperature in degrees. After transmission is operating, the temperature should rise steadily to about 100˚C (212˚F), then stabilize.
- The temperature to resistance value scale may be used to check the TFT sensor at the various temperature levels to evaluate the possibility of a “skewed” (mis–scaled) sensor.

  A “skewed” sensor could result in hard shifts or TCC complaints.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This check verifies problem in the TFT sensor circuit.
4. This test simulates a TFT sensor DTC P0712. If the PCM recognizes the low signal voltage (high temperature), and the scan tool displays 146˚C (295˚F) or greater, the PCM and wiring are OK.

5. This test checks the TFT sensor and internal wiring harness.

Resistance Chart

˚C	˚F	Resistance (kΩ)
–40	–40	672
0	32	65
20	68	25
80	176	2.5
120	248	0.78
150	304	0.37

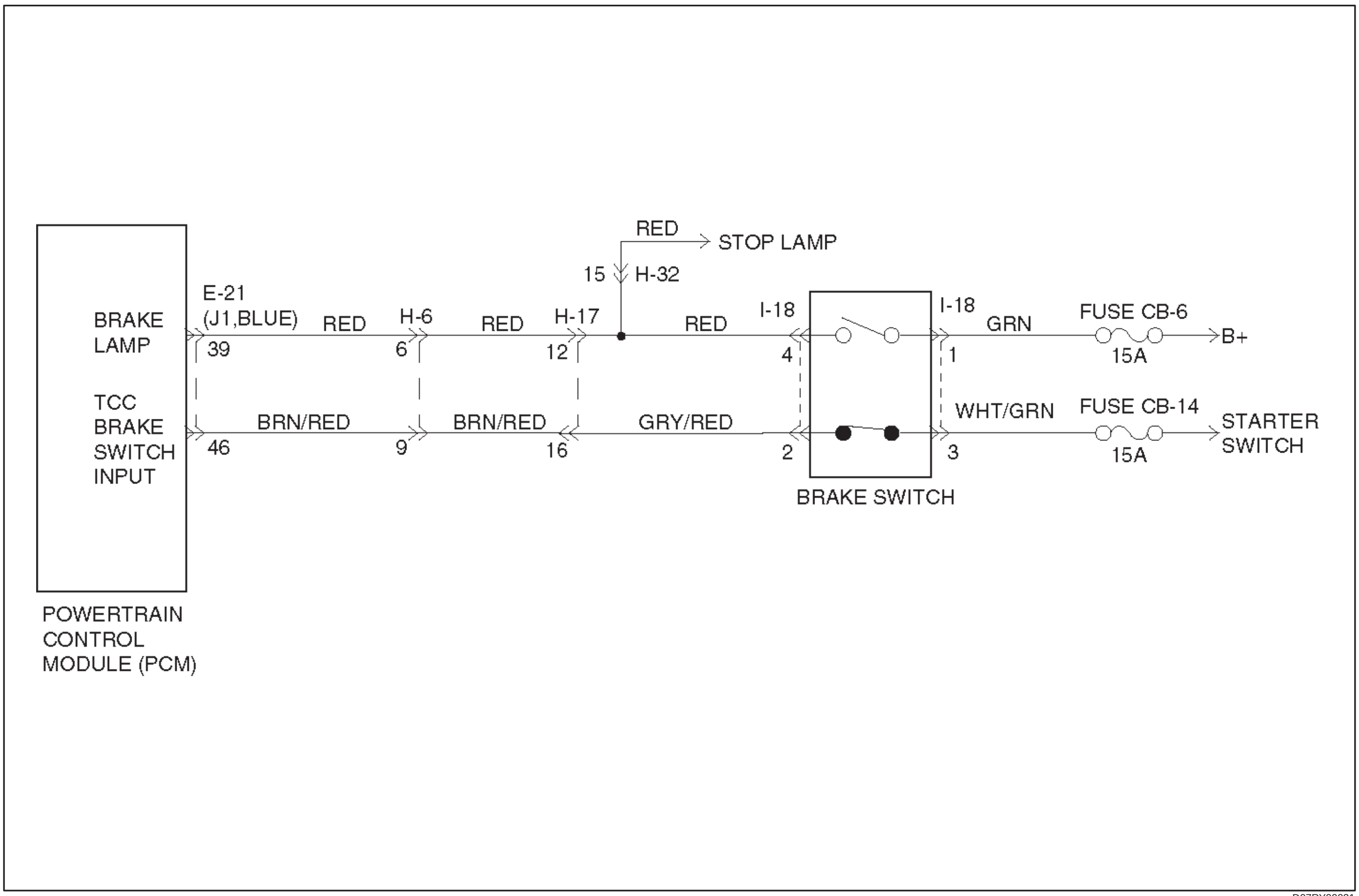
DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	Perform the transmission fluid checking procedure. Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section. Was the fluid checking procedure performed?	Go to Step 3	Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section
3	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Does the scan tool display a TFT sensor signal voltage greater than 4.86 volts?	Go to Step 4	Go to Diagnostic Aids
4	1. Turn the ignition “off”. 2. Disconnect the transmission 7–way connector E–54. 3. Install a fused jumper wire from terminal E54–4(F) to E54–1(E) on the engine harness. 4. Turn the ignition “on”. Does the TFT signal voltage drop to less than 0.4 volts?	Go to Step 5	Go to Step 10
5	1. Turn the ignition “off”. 2. Using the J39200 DVOM, measure the resistance between terminals E54–4(F) and E54–1(E). Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 6
6	1. Disconnect the transmission 7–way connector E–54. 2. Using the J39200 DVOM, measure the resistance between terminals E54–4(F) and E54–1(E). Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 7

DTC P0713 Transmission Fluid Temperature (TFT) Sensor Circuit High Input (Cont'd)

Step	Action	Yes	No
7	1. Remove the transmission oil pan. 2. Check the internal wiring harness for an open. Refer to Transmission Oil Temperature Sensor (Main Case) in Automatic Transmission (4L30–E) section. Was a problem found and corrected?	Go to Step 14	Go to Step 8
8	1. Disconnect the internal wiring harness at the TFT sensor. 2. Measure the resistance of the TFT sensor. Is the resistance within specifications? (See Resistance Chart.)	Go to Diagnostic Aids	Go to Step 9
9	Replace TFT sensor. Refer to Transmission Oil Temperature Sensor (Main Case) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 14	—
10	Check circuit RED/BLK for an open or short to B+. Was a problem found?	Go to Step 14	Go to Step 11
11	Check circuit RED/WHT for an open. Was a problem found?	Go to Step 14	Go to Step 12
12	Check the PCM for faulty or intermittent connections. Was a problem found?	Go to Step 14	Go to Step 13
13	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 14	—
14	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: 2. TFT sensor indicates a voltage less than 4.92 volts for 2 seconds. 3. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0719 Brake Switch Circuit Low (Stuck On)



Circuit Description:

The brake switch indicates brake pedal status to the Powertrain Control Module (PCM). The brake switch is a normally–closed switch that supplies battery voltage on circuit GRY/RED–BRN/RED to the PCM. Applying the brake pedal opens the switch, interrupting voltage to the PCM. When the brake pedal is released, the PCM receives a constant voltage signal. If the PCM receives a zero voltage signal at the brake switch input, and the Torque Converter Clutch (TCC) is engaged, the PCM de–energizes the Torque Converter Clutch Solenoid Valve (TCC Sol. Valve). The PCM disregards the brake switch input for TCC scheduling if there is a brake switch circuit fault (Refer to Diagnostic Aids).

When the PCM detects an open brake switch circuit (0 volts, low input) during accelerations, then DTC P0719 sets. DTC P0719 is a type D DTC.

Conditions For Setting The DTC

- No OSS Assy. DTCs P0722 or P0723.
- The PCM detects an open brake switch or circuit (0 volts) for 15 minutes without changing for 2 seconds, and the following events occur seven consecutive times.
  - The vehicle speed is less than 8 km/h (5 mph).
  - then the vehicle speed is 8–32 km/h (5–20 mph) for 4 seconds.
  - then the vehicle speed is greater than 32 km/h (20 mph) for 4 seconds.

Action Taken When The DTC Sets

- The PCM does not illuminate the Malfunction Indicator Lamp (MIL).
- DTC P0719 stores in PCM history.

Conditions For Clearing The DTC

- A scan tool can clear the DTC from the PCM history. The PCM clears the DTC from the PCM history if the vehicle completes 40 warm–up cycles without a failure reported.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and brake switch. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check customer driving habits and/or unusual driving conditions (i.e. stop and go, highway).
- Check brake switch for proper mounting and adjustment.

Test Description

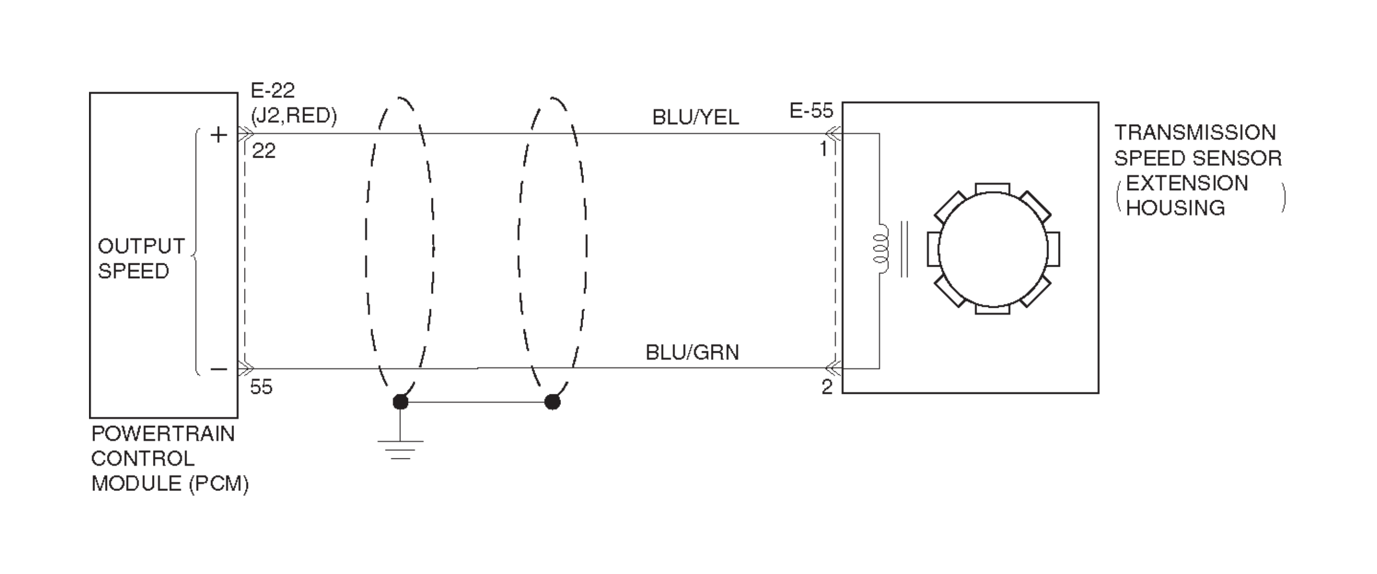
The numbers below refer to the step numbers on the diagnostic chart.

3. This step isolates the brake switch as a source for setting the DTC.

DTC P0719 Brake Switch Circuit Low (Stuck On)

Step	Action	Yes	No
1	Was the Powertrain On–Board Diagnostic (OBD) System Check performed?	Go to Step 2	Go to Powertrain OBD System Check
2	1. Install the scan tool. 2. With the engine "off," turn the ignition switch to the "on" position. NOTE: Before clearing the DTC(s), use the scan tool in order to record the "Failure Records" for reference. Using the "Clear Info" function will erase the stored "Failure Records" from the PCM. 3. Record the "DTC Failure Records", then clear the DTC(s). 4. Select "TCC Brake Switch" on the scan tool. 5. Disconnect the brake switch connector from the brake switch. 6. Connect a test lamp from cavity I18–3 of the brake switch connector to a known good ground. Is the test lamp ON?	Go to Step 3	Go to Step 4
3	Install a J 36169–A Fused Jumper Wire from terminal I18–2 to terminal I18–3 of the brake switch connector. Did the TCC Brake Switch status change from Open to Closed?	Go to Step 7	Go to Step 9
4	1. Remove the fuse CB–14 (15A). 2. Inspect the fuse for an open. Is the fuse open?	Go to Step 5	Go to Step 8
5	Inspect circuit WHT/GRN for a short to ground condition. Repair the circuit if necessary. Did you find a short to ground condition?	Go to Step 11	Go to Step 6
6	Inspect circuit GRY/RED–BRN/RED for a short to ground condition. Repair the circuit if necessary. Did you find a short to ground condition?	Go to Step 11	Go to Step 10
7	Replace the brake switch. Is the replacement complete?	Go to Step 11	—
8	Inspect circuit WHT/GRN for an open condition. Repair the circuit if necessary. Did you find and correct an open condition?	Go to Step 11	—
9	Inspect circuit GRY/RED–BRN/RED for an open. Did you find an open condition?	Go to Step 11	Go to Step 10
10	Replace the PCM. Is the replacement complete?	Go to Step 11	—
11	In order to verify your repair, perform the following procedure: 1. Select DTC. 2. Select Clear Info. 3. With the engine "off," turn the ignition switch to the "on" position. 4. Do not depress the brake pedal. 5. Verify that the TCC Brake Switch status indicates "Closed" (12 volts) for 2 seconds. 6. Select Specific DTC. Enter DTC P0719. Has the test run and passed?	System OK	Begin the diagnosis again. Go to Step 1

DTC P0722 Automatic Transmission Output Speed Sensor (OSS) Low Input



D07RY00032

Circuit Description

Output speed information is provided to the PCM by the OSS, which is a permanent magnet (PM) generator. The PM generator produces a pulsing AC voltage. The AC voltage level and number of pulses increases as the speed of the vehicle increases. The PCM then converts the pulsing voltage to output speed, which is used for calculations. The vehicle speed can be displayed with a scan tool.

This DTC detects a low output speed when there is a high engine speed in a drive gear range. This is a type “B” DTC.

Conditions For Setting The DTC

- No MAP DTCs P0107 or P0108, P0106, P1106, P1107.
- No TPS DTCs P0122 or P0123.
- Not in Park or Neutral.
- TP angle is greater than 10%.
- Engine vacuum is between 0 and 70kPa.
- Engine speed is between 3000 and 7000 rpm.
- Transmission output speed is less than 0 rpm.
- All conditions met for 5 seconds.

Action Taken When The DTC Sets

- Fixed to 4th gear.
- Maximum line pressure.
- Inhibit TCC engagement.
- For lamp illuminate refer to DTC type definition (type B).

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool. The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- An OSS DTC P0722 will set when no output speed is at detected at start off.
- Inspect the wiring for poor electrical connection at the PCM. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move or massage the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

4. This test checks the OSS circuit.
5. This test checks the integrity of the OSS.
7. This test checks the 5–volt and ground circuit of the PCM.

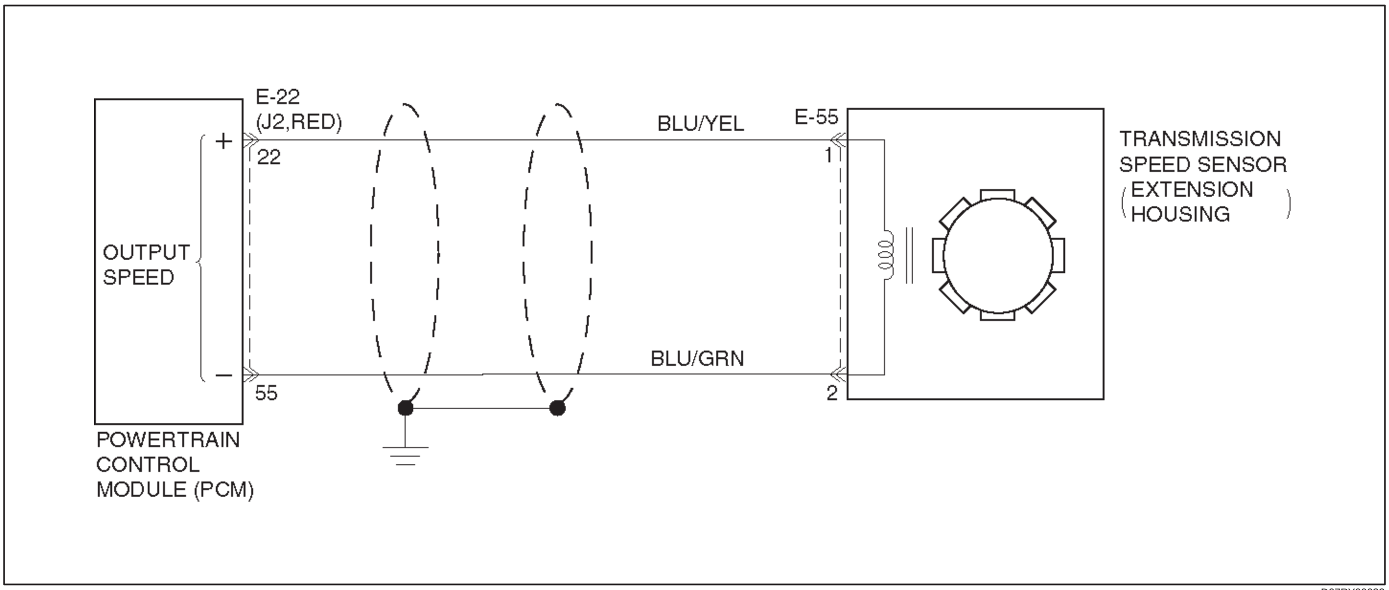
DTC P0722 Automatic Transmission Output Speed Sensor (OSS) Low Input

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. Raise the drive wheels. 5. Start the engine. 6. Place the transmission in any drive range. With the drive wheels rotating, does the “Trans Output Speed” increase with the drive wheel speed?	Go to Diagnostic Aids	Go to Step 3
3	Check for the most current and/or incorrect calibration. Is the calibration current?	Go to Step 16	Go to Step 4
4	1. Turn the ignition “off”. 2. Disconnect the J2 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between harness connector terminals J2–22 and J2–55. Is the reading 3000 ohms?	Go to Step 5	Go to Step 6
5	1. Select AC volts. 2. Rotate the rear wheels, ensuring the driveshaft is turning. Is the voltage greater than 0.5 volts?	Go to Step 7	Go to Step 8
6	Inspect circuits BLU/YEL and BLU/GRN for a poor connection or an open circuit. Was a problem found?	Go to Step 17	Go to Step 8
7	1. Reconnect the J2 (RED) PCM connector. 2. Disconnect the OSS harness from the OSS. 3. With the engine “off”, turn the ignition “on”. 4. Using the J 39200 DVOM, measure the voltage at the OSS harness connector terminals E55–1 and E55–2. Is the reading between 4.0 to 5.1 volts?	Go to Step 16	Go to Step 10
8	1. Remove the OSS. 2. Check the output shaft speed sensor rotor for damage or misalignment. Refer to Speed Sensor (Extension Housing) in Automatic Transmission (4L30–E) section. Was a problem found?	Go to Step 17	Go to Step 9
9	Replace the OSS. Is the replacement complete?	Go to Step 17	—
10	Was the reading in step 7 less than 4.0 volts?	Go to Step 12	Go to Step 11
11	Was the reading in Step 7 greater than 5.1 volts?	Go to Step 15	—
12	Using the J 39200 DVOM to chassis ground, measure the voltage on circuit BLU/YEL. Is the reading between 4.0 to 5.1 volts?	Go to Step 13	Go to Step 14

DTC P0722 Automatic Transmission Output Speed Sensor (OSS) Low Input (Cont'd)

Step	Action	Yes	No
13	Repair the open in circuit BLU/GRN. Is the repair complete?	Go to Step 17	—
14	Check circuit BLU/YEL for a short to ground or open. Was a problem found and corrected?	Go to Step 17	Go to Step 16
15	Repair the short to B+ in circuit BLU/YEL. Is the repair complete?	Go to Step 17	—
16	Replace the PCM. Refer to Powertrain Control Module (PCM) in automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 17	—
17	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: Transmission output speed is greater than 101 rpm for 3 seconds. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0723 Automatic Transmission Output Speed Sensor (OSS) Intermittent



Circuit Description

Output speed information is provided to the PCM by the OSS, which is a permanent magnet (PM) generator. The PM generator produces a pulsing AC voltage. The AC voltage level and number of pulses increases as the speed of the vehicle increases. The PCM then converts the pulsing voltage to output speed, which is used for calculations. The vehicle speed can be displayed with a scan tool.

This DTC detects a fast decrease of output speed when engine running in a drive gear range. This is a type “B” DTC.

Conditions For Setting The DTC

Drive range

- Engine running time is greater than 5 seconds.
- Output speed is greater than 1300 rpm for 2 second.
- NORAW–NOLAST < 200 rpm for 2 seconds.
  - NORAW: Latest raw data of output shaft speed.
  - NOLAST: Fitered previous data of output speed.
- Transmission negative output speed change is greater than 1300 rpm.
- Conditions met for 3 seconds.

Action During Detection Time

- Output speed value is frozen

Action Taken When The DTC Sets

- Fixed to 4th gear.
- Maximum line pressure.
- Inhibit TCC engagement.
- For lamp illuminate refer to DTC type definition (type B).

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- A OSS DTC P0723 will set when output speed has been detected and is lost.
- Inspect the wiring for poor electrical connection at the PCM. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

4. This test checks the OSS circuit.
5. This test checks the integrity of the OSS.
7. This test checks the 5–volt and ground circuit of the PCM.

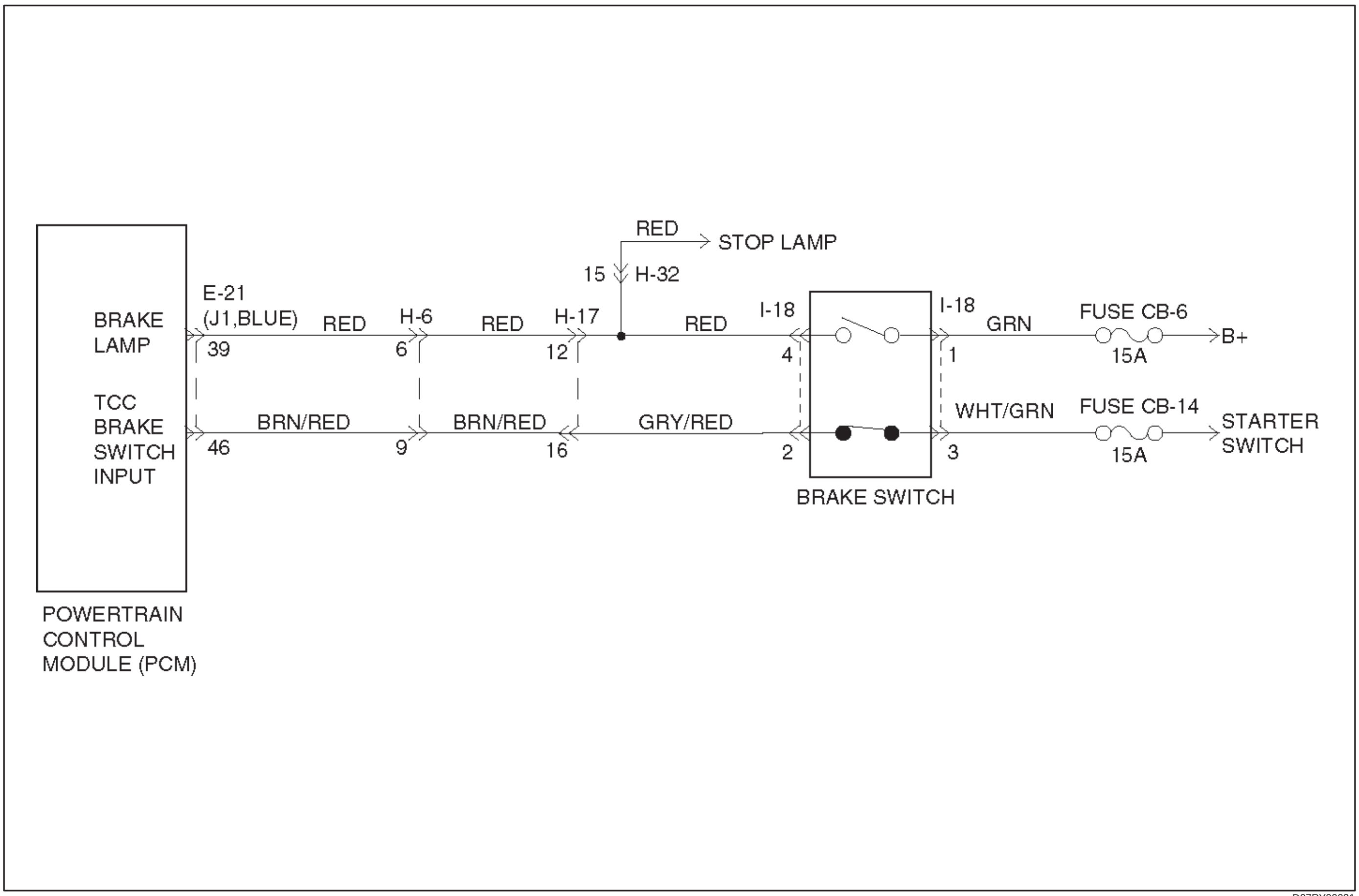
DTC P0723 Automatic Transmission Output Speed Sensor (OSS) Intermittent

Step	Action	Yes	No
1	Were you sent here from the "Powertrain On–Board Diagnostic (OBD) System Check"?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Freeze Frame" and "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Freeze Frame" and "Failure Records". 4. Raise the drive wheels. 5. Start the engine. 6. Place the transmission in any drive range. With the drive wheels rotating, does the "Trans Output Speed" increase with the drive wheel speed?	Go to Diagnostic Aids	Go to Step 3
3	Check for the most current and/or incorrect calibration. Is the calibration current?	Go to Step 16	Go to Step 4
4	1. Turn the ignition "off". 2. Disconnect the J2 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between harness connector terminals J2–22 and J2–55. Is the reading 3,000 ohms?	Go to Step 5	Go to Step 6
5	1. Select AC volts. 2. Rotate the rear wheels, ensuring the driveshaft is turning. Is the voltage greater than 0.5 volts?	Go to Step 7	Go to Step 8
6	Inspect circuits BLU/YEL and BLU/GRN for a poor connection or an open circuit. Was a problem found?	Go to Step 17	Go to Step 8
7	1. Reconnect the J2 (RED) PCM connector. 2. Disconnect the OSS harness from the OSS. 3. With the engine "off", turn the ignition "on". 4. Using the J 39200 DVOM, measure the voltage at the OSS harness connector terminals E55–1 and E55–2. Is the reading between 4.0 to 5.1 volts?	Go to Step 16	Go to Step 10
8	1. Remove the OSS. 2. Check the output shaft speed sensor rotor for damage or misalignment. Refer to Speed Sensor (Extension Housing) in Automatic Transmission (4L30–E) section. Was a problem found?	Go to Step 17	Go to Step 9
9	Replace the OSS. Is the replacement complete?	Go to Step 17	—
10	Was the reading in step 7 less than 4.0 volts?	Go to Step 12	Go to Step 11
11	Was the reading in Step 7 greater than 5.1 volts?	Go to Step 15	—
12	Using the J 39200 DVOM to chassis ground, measure the voltage on circuit BLU/YEL. Is the reading between 4.0 to 5.1 volts?	Go to Step 13	Go to Step 14

DTC P0723 Automatic Transmission Output Speed Sensor (OSS) Intermittent (Cont'd)

Step	Action	Yes	No
13	Repair the open in circuit BLU/GRN. Is the repair complete?	Go to Step 17	—
14	Check circuit BLU/YEL for a short to ground or open. Was a problem found and corrected?	Go to Step 17	Go to Step 16
15	Repair the short to B+ in circuit BLU/YEL. Is the repair complete?	Go to Step 17	—
16	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 17	—
17	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: Transmission output speed is greater than 101 rpm for 3 seconds. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0724 Brake Switch Circuit High (Stuck Off)



D07RY00031

Circuit Description:

The brake switch indicates brake pedal status to the Powertrain Control Module (PCM). The brake switch is a normally–closed switch that supplies battery voltage on circuit GRY/RED–BRN/RED to the PCM. Applying the brake pedal opens the switch, interrupting voltage to the PCM. When the brake pedal is released, the PCM receives a constant voltage signal. If the PCM receives a zero voltage signal at the brake switch input, and the Torque Converter Clutch (TCC) is engaged, the PCM de–energizes the Torque Converter Clutch Solenoid Valve (TCC Sol. Valve). The PCM disregards the brake switch input for TCC scheduling if there is a brake switch circuit fault (Refer to Diagnostic Aids).

When the PCM detects a closed brake switch circuit (12 volts, high input) during decelerations, then DTC P0724 sets. DTC P0724 is a type D DTC.

Conditions For Setting The DTC

- No OSS Assy. DTCs P0722 or P0723.
- The PCM detects a closed brake switch circuit (12 volts) without changing and the following events occur seven consecutive times.
  - The vehicle speed is greater than 32 km/h (20 mph) for 4 seconds.
  - then the vehicle speed is between 8–32 km/h (5–20 mph) for 4 seconds.
  - then the vehicle speed is less than 8 km/h (5 mph).

Action Taken When The DTC Sets

- The PCM does not illuminate the Malfunction Indicator Lamp (MIL).
- DTC P0724 stores in PCM history.

Conditions For Clearing The DTC

- A scan tool can clear the DTC from the PCM history. The PCM clears the DTC from the PCM history if the vehicle completes 40 warm–up cycles without a failure reported.
- The PCM cancels the DTC default actions when the fault no longer exists and the ignition is OFF long enough in order to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check customer driving habits and/or unusual traffic conditions (i.e. stop and go, expressway).
- Check brake switch for proper mounting and adjustment.

Test Description

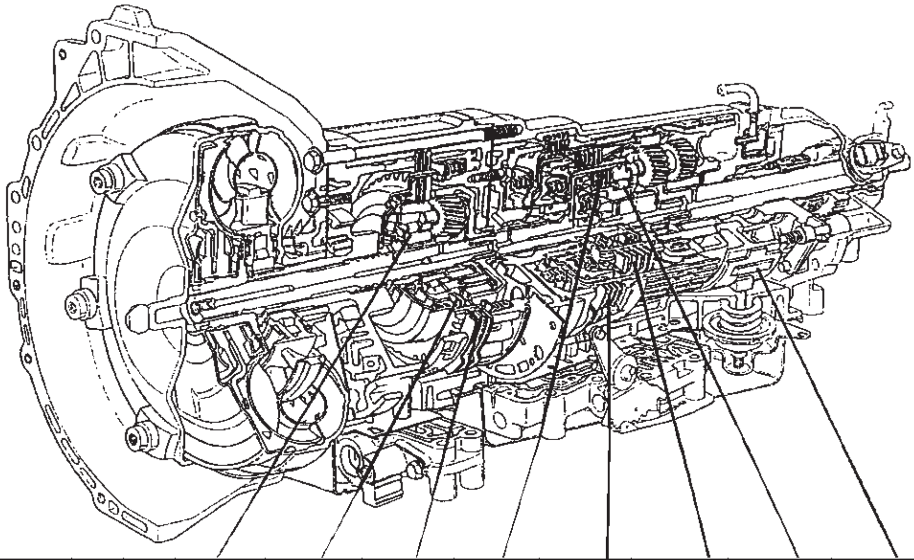
The numbers below refer to the step numbers on the diagnostic chart.

2. This step isolates the brake switch as a source for setting the DTC.

DTC P0724 Brake Switch Circuit High (Stuck Off)

Step	Action	Yes	No
1	Was the Powertrain On–Board Diagnostic (OBD) System Check performed?	Go to Step 2	Go to Powertrain OBD System Check
2	1. Install the scan tool. 2. With the engine "off," turn the ignition switch to the "on" position. NOTE: Before clearing the DTC(s), use the scan tool in order to record the "Failure Records" for reference. Using the "Clear Info" function will erase the stored "Failure Records" from the PCM. 3. Record the DTC Failure Records, then clear the DTC(s). 4. Select "TCC Brake Switch" on the scan tool. 5. Disconnect the brake switch connector from the brake switch. Did the TCC brake switch status change from "Closed" to "Open"?	Go to Step 3	Go to Step 4
3	Replace the brake switch. Is the replacement complete?	Go to Step 6	—
4	Inspect circuit GRY/RED–BRN/RED for a short to B+ condition. Repair the circuit if necessary. Did you find a short to B+ condition?	Go to Step 6	Go to Step 5
5	Replace the PCM. Is the replacement complete?	Go to Step 6	—
6	In order to verify your repair, perform the following procedure: 1. Select DTC. 2. Select "Clear Info". 3. With the engine "off" turn the ignition switch to the "on" position. 4. Apply the brake pedal. 5. Verify that the TCC brake switch status indicates "Open" (0 volts) for 2 seconds. 6. Select Specific DTC. Enter DTC P0724. Has the test run and passed?	System OK	Begin the diagnosis again. Go to Step 1

DTC P0730 Gear Error Without Input Speed



RANGE	GEAR	SOL A N.C.	SOL B N.O.	O/DRIVE ROLLER CLUTCH (OFW)	OVERRUN CLUTCH (OC)	FOURTH CLUTCH (C4)	THIRD CLUTCH (C3)	REVERSE CLUTCH (RC)	SECOND CLUTCH (C2)	PRINCIPLE SPRAG ASSEMBLY (PFW)	BAND ASSEMBLY (B)	ENGINE BRAKING
P-N		OFF	ON		APPLIED							NO
R	REVERSE	OFF	ON	LD	APPLIED			APPLIED		LD		NO
D	1ST	OFF	ON	LD	APPLIED					LD	APPLIED	NO
	2ND	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
	3RD	ON	OFF	LD	APPLIED		APPLIED		APPLIED	NE		YES
	4TH	OFF	OFF	FW		APPLIED	APPLIED		APPLIED	NE		YES
3	1ST	OFF	ON	LD	APPLIED					LD	APPLIED	NO
	2ND	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
	3RD	ON	OFF	LD	APPLIED		APPLIED		APPLIED	NE		YES
2	1ST	OFF	ON	LD	APPLIED		APPLIED			LD	APPLIED	YES
	2ND	ON	ON	LD	APPLIED				APPLIED	FW	APPLIED	YES
L	1ST	OFF	ON	LD	APPLIED		APPLIED			LD	APPLIED	YES

LD : LOCKED IN DRIVE FW : FREEWHEELING NE : NOT EFFECTIVE

D07RT015

Circuit Description

- The Powertrain Control Module (PCM) calculates the slippage of the converter and transmission based upon the engine speed, the output speed, and the current gear ratio.
- The slippage of the converter at a high enough engine speed is low. The transmission should not slip more than a given value when there is no shift.
- This DTC detects a slip at each gear. This is a type “C” DTC.

Conditions For Setting The DTC

- No Output Speed Sensor DTC(s) P0722, P0723.
- No Transmission Range Switch DTC(s) P0705, P0706.
- Not in Park, Neutral or Reverse.
- Engine speed is greater than 3500 rpm.
- 3 seconds since upshift.
- 3 seconds since downshift.
- 3 seconds since garage shift (N→D).
- And one of the following conditions occur:
  - Slip is greater than 720 rpm in 1st gear.
  - Slip is greater than 680 rpm in 2nd gear.
  - Slip is greater than 660 rpm on 3rd gear.
  - Slip is greater than 650 rpm on 4th gear.
- All conditions met for 5.5 seconds.

Action Taken When The DTC Sets

- Maximum line pressure.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

- The PCM will illuminate the CHECK TRANS Lamp.
- Turn Force Motor OFF.

Conditions For Clearing The DTC/CHECK TRANS Lamp

- The PCM will turn “off” the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from PCM memory by using a scan tool. The DTC can also be cleared from memory when the vehicle has made 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC Actions Taken items when the fault conditions no longer exist and the ignition is cycles “off” long enough to power down the PCM.

Diagnostic Aids

- Check for intermittent output speed sensor circuit problems.
- Check for possible incorrect calibration. (PCM part No., tire specifications, and rear axle ratio)

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This step checks for possible low fluid level causing slipping resulting in an undefined gear ratio.
4. This step checks for correct gear ratios for commanded gears.
5. This step checks for low line pressure.

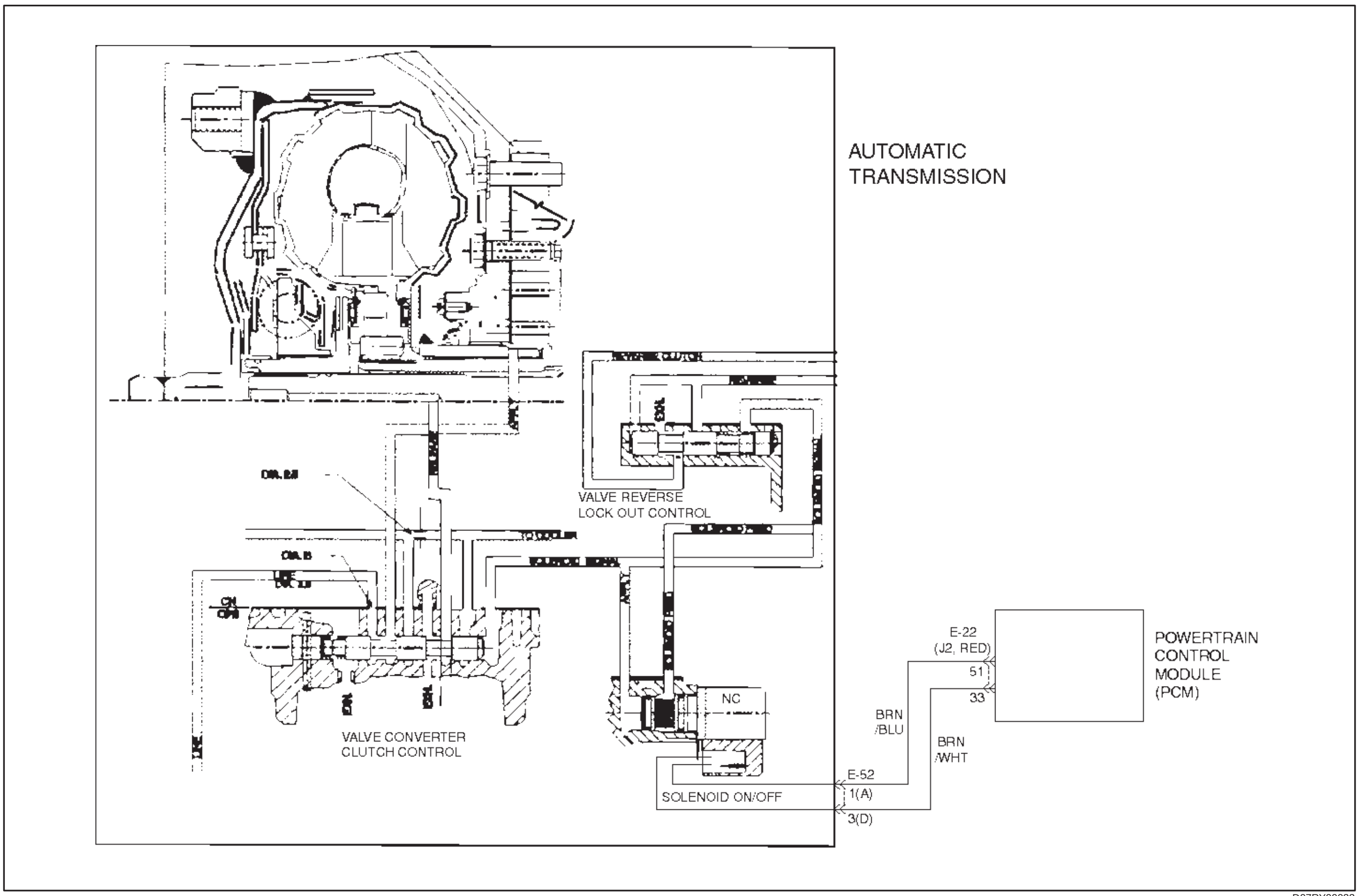
DTC P0730 Gear Error Without Input Speed

Step	Action	Yes	No
1	Were you sent here from the “On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	Visually inspect the transmission cooling system for fluid leaks. • Refer to Chart 16: Possible Causes of Transmission Fluid Leaks of Mechanical/Hydraulic Diagnosis Symptoms Index in Automatic Transmission (4L30–E) section. Was condition found and corrected?	Go to Step 7	Go to Step 3
3	Inspect the transmission fluid level and condition. Refer to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section. Has transmission fluid checking procedure been performed?	Go to Step 4	Go to Checking Transmission Fluid Level and Condition in Automatic Transmission (4L30–E) section
4	1. Install the scan tool. 2. Turn the ignition switch to the “on” position. 3. Engine not running. NOTE: Before clearing DTC(s) use the scan tool to record the “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 4. Record the Failure Record data. 5. Use the scan tool snapshot mode to record transmission gear ratios. 6. Drive vehicle in transmission gear ranges 1, 2, 3, and D with the engine speed is greater than 3,500 rpm for 5.5 seconds. 7. Record each transmission gear. 1st:2.73 – 2.99 2nd:1.54 – 1.71 3rd:0.93 – 1.05 4th:0.66 – 0.78 Does commanded gear ratio match ranges as shown?	Refer to Diagnostic Aids	Go to Step 5

DTC P0730 Gear Error Without Input Speed (Cont’d)

Step	Action	Yes	No
5	Perform line pressure check. ● Refer to Line Pressure Test in Automatic Transmission (4L30–E) section. Was condition found and corrected?	Go to Step 7	Go to Step 6
6	Check for possible clutch slippage. ● Refer to Chart 6: Diagnostic Trouble Code (DTC) P0730 of Mechanical/Hydraulic Diagnosis Symptoms Index in Automatic Transmission (4L30–E) section. Was condition found and corrected?	Go to Step 7	—
7	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear info” function. 2. Operate the vehicle under the following conditions: ● Drive the vehicle in D4 with the engine speed greater than 3,500 rpm to obtain any one of the following gear ratios for seven seconds. 1st 1:2.73 – 1:2.99 2nd 1:1.54 – 1:1.71 3rd 1:0.93 – 1:1.05 4th 1:0.66 – 1:0.78 Has the last test failed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0742 Torque Converter Clutch (TCC) System Stuck On



Circuit Description

The PCM energizes the TCC solenoid by creating a ignition voltage on circuit BRN/BLU. When ignition voltage is energized by the PCM, the TCC solenoid stops converter signal oil from exhausting. This causes converter signal oil pressure to increase and move the TCC valve. The TCC solenoid will deenergize when the PCM no longer provides an ignition voltage. When the TCC solenoid is deenergized, it will exhaust fluid and release the TCC.

This DTC detects low torque converter slip when the TCC is commanded “off”. This is a type “B” DTC.

Conditions For Setting The DTC

The following conditions occur once per TCC cycle, three consecutive times:

- No TPS DTCs P0122 or P0123.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTC P1860.
- TP angle is greater than 20%.
- Engine speed is greater than 500 rpm and less than 3000 rpm.
- Engine vacuum is between 0 and 70 kPa.
- Commanded gear is not 1st.
- Gear range is D4.
- TCC is commanded “off”.
- No TCC stuck off DTC P1870
- TCC slip speed is between –20 and 40 rpm for 2 seconds.
- Vehicle speed is greater than 25 km/h (15 mph) and less than 120 km/h (75 mph).
- Speed ratio is greater than 0.9 and less than 2.0.

Action Taken When The DTC Sets

- For lamp illuminate refer to DTC type definition (type B).
- Inhibit TCC engagement.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- If the TCC is mechanically stuck "on" with the parking brake applied and any gear range selected, the TCC fluid will mechanically apply the TCC, possibly causing an engine stall.

Test Description

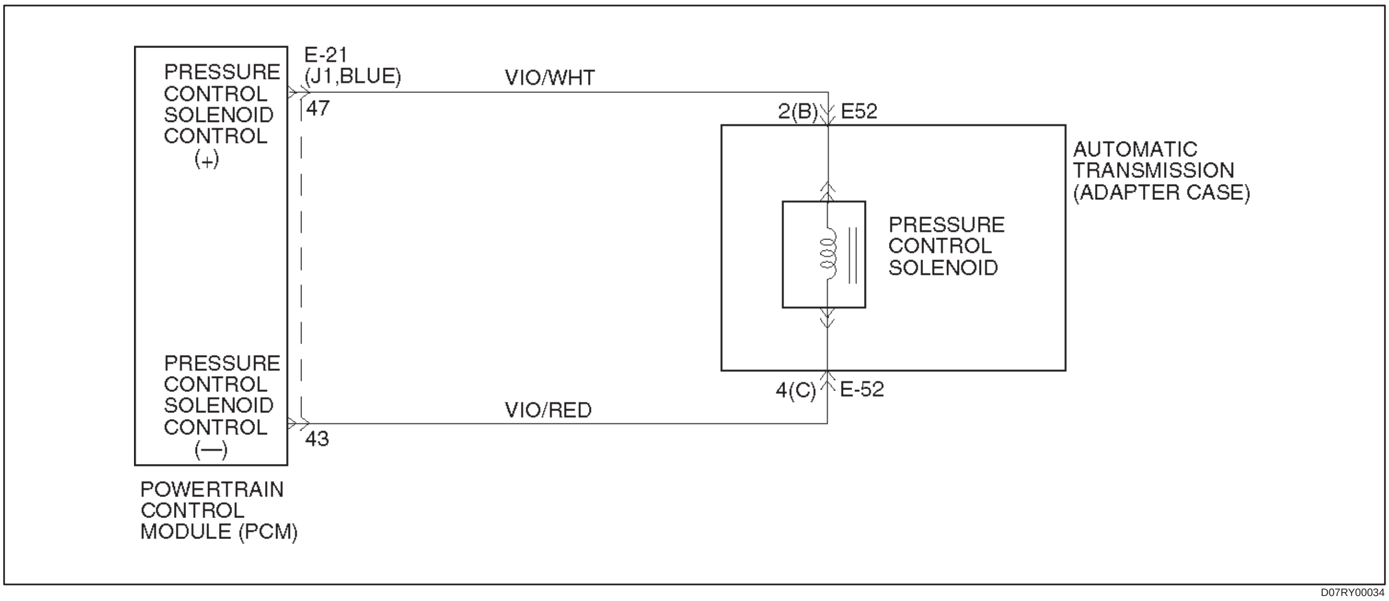
The number below refers to the step number on the diagnostic chart:

3. This test checks the mechanical state of the TCC. (When the PCM commands the TCC solenoid "off", the slip speed should increase).

DTC P0742 Torque Converter Clutch (TCC) System Stuck On

Step	Action	Yes	No
1	Were you sent here from the "Powertrain On–Board Diagnostic (OBD) System Check"?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Freeze Frame" and "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Freeze Frame" and "Failure Records". 4. Using the scan tool, verify the "TP Sensor" operation. Are the "TP Sensor" values within 0.6 – 5.0 volts?	Go to Step 3	Go to Diagnostic Aids
3	Drive the vehicle in the D4 drive range in fourth gear under steady acceleration, with a TP angle greater than 20%. Does the scan tool display "TCC Slip Speed" between –30 and +30 rpm, while the displayed TCC solenoid state is "off"?	Go to Step 4	Go to Diagnostic Aids
4	The TCC is mechanically stuck "on". Check the following items: • Clogged exhaust orifice in the TCC solenoid. • Converter clutch apply valve stuck in the apply position. • Misaligned or damaged valve body gasket. • Restricted release passage. Was a problem found and corrected?	Go to Step 5	—
5	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: TCC slip speed must be between 200 and 2,500 rpm for 4 seconds. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0748 Pressure Control Solenoid (PCS) (Force Motor) Circuit Electrical



Circuit Description

The PCS is a PCM–controlled device used to regulate transmission line pressure. The PCM compares TPS voltage, engine rpm, and other inputs to determine the line pressure appropriate for a given load. The PCM will regulate the pressure by applying a varying amperage to the PCS. The applied amperage can vary from 70 to 1060 milliampere (mA), and is monitored by the PCM.

This DTC detects a continuous open or short to ground in the PCS circuit or the PCS. This is a type “C” DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- The PCM detects that the different between commanded and actual current is 200 milliampere (mA) for over 1 second.
- Engine speed is greater than 300 rpm.

Action Taken When the DTC Sets

- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).
- Maximum line pressure.
- The PCM will illuminate the CHECK TRANS Lamp.
- Turn Force Motor OFF.

Conditions For Clearing The DTC/CHECK TRANS Lamp

- The PCM will turn “off” the CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from PCM history by using a scan tool.
- The DTC will be cleared from memory when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and at the transmission 4–way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

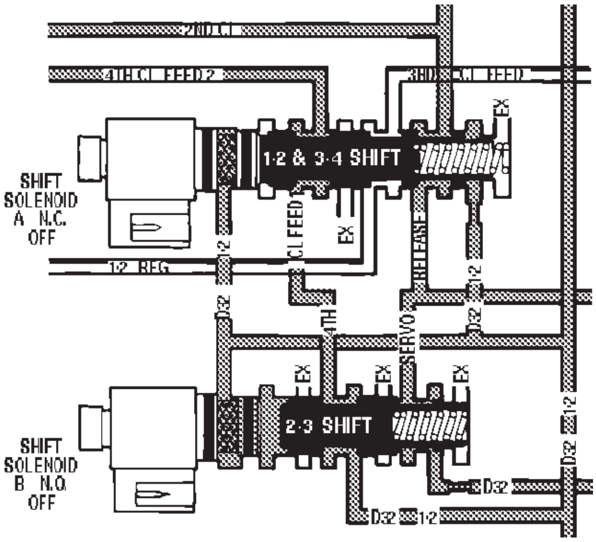
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the ability of the PCM to command the PCS.
3. This test checks the PCS and internal wiring harness for incorrect resistance.

DTC P0748 Pressure Control Solenoid (PCS) (Force Motor) Circuit Electrical

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Failure Records”. 4. While the engine is operating, put the transmission in Park. 5. Using the scan tool, apply 70 through 1060 milliampere (mA) while observing “PC Ref. Current” and “PC Act. Current”. Is the “PC Act. Current” reading always within 160 mA?	Go to Diagnostic Aids	Go to Step 3
3	1. Turn the ignition “off”. 2. Disconnect the transmission 4–way connector E–52. 3. Using the J39200 DVOM, measure the resistance between terminals E52–2(B) and E52–4(C). Is the resistance within 3–7 ohms?	Go to Step 7	Go to Step 4
4	1. Remove the transmission oil pan. Refer to Solenoid (Adapter Case Valve Body) in Automatic Transmission (4L30–E) section. 2. Disconnect the internal wiring harness at the PCS. 3. Measure the resistance of the PCS. Is the resistance within 3–7 ohms?	Go to Step 6	Go to Step 5
5	Replace the PCS. Is the replacement complete?	Go to Step 10	—
6	Repair the internal wiring harness for an open. Is the repair complete?	Go to Step 10	—
7	Inspect/repair circuits VIO/WHT and VIO/RED. Was a problem found?	Go to Step 10	Go to Step 8
8	Inspect/repair circuits VIO/WHT and VIO/RED for a short to ground or poor connections. Was a problem found?	Go to Step 10	Go to Step 9
9	Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 10	—
10	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and ensure the following conditions are met: The PCS duty cycle is not at its electrical high or low limit. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0751 Shift Solenoid A Performance (Stuck Off)



D07RT011

Circuit Description

The shift solenoid A is used to control fluid flow acting on the 1–2 and 3–4 shift valves. The solenoid is a normally close exhaust valve that is used with the shift solenoid B to allow four different shifting combinations.

The DTC detects when there is only a 1–1–4–4 shift pattern depending on the state of the mechanical failure instead of a 1–2–3–4 shift pattern. This is a type "B" DTC.

Conditions For Setting The DTC

- No ETC DTCs.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTCs P0742, P1860, P1870.
- No shift solenoid A DTC P0753.
- No shift solenoid B DTC P0758.
- Gear range is D4.
- Transmission temperature is between 20° and 130°C (68° and 266°F).
- Output speed is greater than 375 rpm.
- No range code P0705, P0706.
- No torque code (to be confirmed).
- Engine run for more 0 seconds and not influed cut-off (to be confirmed).

All the above conditions have been met and the combination of conditions 1, 2 occur two consecutive times.

Condition 1:

- 2nd gear is commanded for ≥ 1 second.
- 40 ≤ Engine Torque ≤ 400 N·m
- Speed ratio ≥ 0.6
- Throttle position ≥ 10 %
- 800 ≤ TCC Slip ≤ 4000 rpm
- 2.75 ≤ Modeled Ratio ≤ 3.2 for 1 second.

Condition 2:

- 3rd gear is commanded for ≥ 1 second.
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle position ≥ 10 %
- 8000 ≤ TCC Slip ≤ 8000 rpm
- Speed ratio ≥ 0.45
- 0.62 ≤ Modeled Ratio ≤ 0.92 for 3 second.

Action Taken When the DTC Sets

- Maximum line pressure.
- For lamp illuminate refer to DTC type definition (type B).
- Turn Force Motor OFF.

Conditions For Clearing The The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the 4L30–E shift speed chart.
- Other internal transmission failures may cause more than one shift to occur.

Test Description

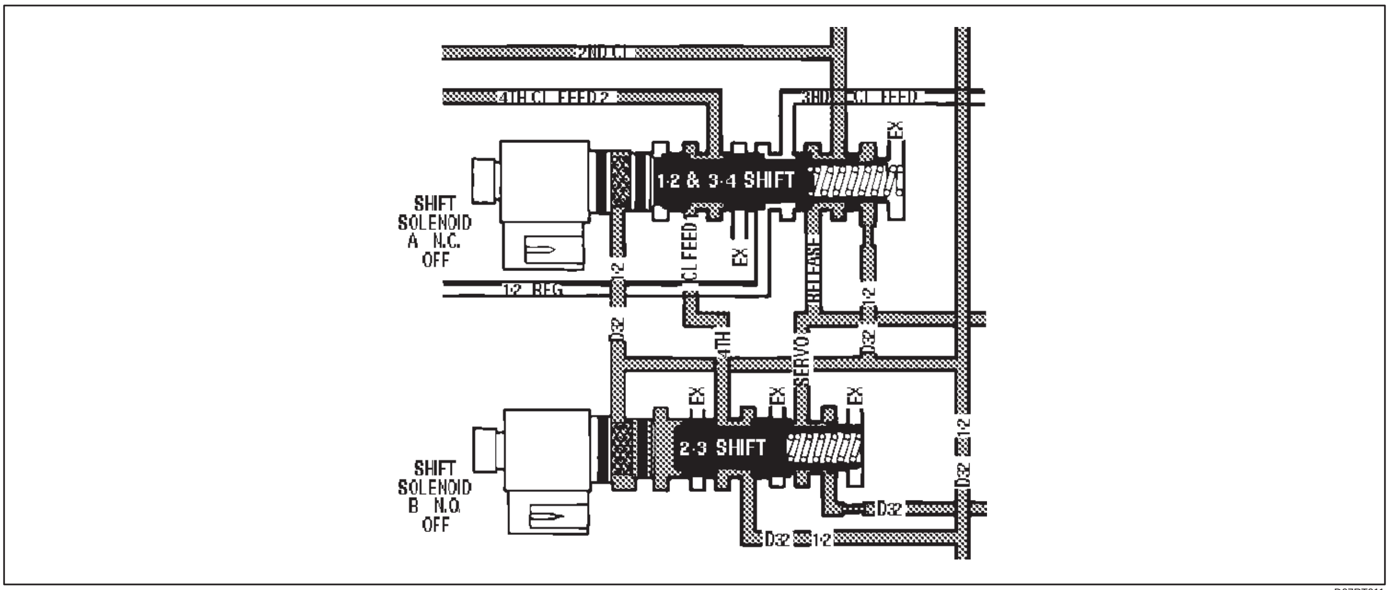
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the function of the range switch (mode switch).
3. This test checks that the scan tool commanded all shifts, all shifts solenoids responded correctly, but all the shifts did not occur.

DTC P0751 Shift Solenoid A Performance (Stuck Off)

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. With the engine operating, apply the brake pedal and select each transmission range D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the “TR Switch” on the scan tool?	Go to Step 3	Go to“Range Switch Logic Table”
3	1. While the engine is operating, raise the drive wheels. 2. With the transmission in D4 range, use the scan tool to command 1st, 2nd and 3rd, and 4th gears while accelerating the vehicle. Was a 2–3 or 1–4 only shift pattern detected? (Road testing the vehicle may be necessary).	Go to Step 4	Go to Diagnostic Aids
4	Check the shift solenoid/hydraulic circuit for: ● One or both of the shift solenoids for an internal malfunction. ● Contamination or sediment in one or both of the shift solenoids. ● Damaged seals on one or both of the shift solenoids. Refer to Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section. Was a problem found and corrected?	Go to Step 5	Go to Diagnostic Aids
5	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0752 Shift Solenoid A Performance (Stuck On)



D07RT011

Circuit Description

The shift solenoid A is used to control fluid flow acting on the 1–2 and 3–4 shift valves. The solenoid is a normally close exhaust valve that is used with the shift solenoid B to allow four different shifting combinations.

The DTC detects when there is only a 2–2–3–3 shift pattern depending on the state of the mechanical failure instead of a 1–2–3–4 shift pattern. This is a type “B” DTC.

Conditions For Setting The DTC

- No ETC DTCs.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTC P0742, P1860, P1870.
- No shift solenoid A DTC P0753.
- No shift solenoid B DTC P0758.
- Gear range is D4.
- Output speed is greater than 375 rpm.
- Transmission temperature is between 20° and 130°C (68° and 266°F).
- No range code P0705, P0706.
- No torque code (to be confirmed).
- Engine run for more 0 seconds and not influed cut-off (to be confirmed).

All the above conditions have been met and the combination of condition 1, 2 occur two consecutive times.

Condition 1:

- 1st gear is commanded for ≥ 1 sec
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle positon ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Transmission out speed ≥ 375 rpm
- Speed ratio ≥ 0.3
- 1.5 ≤ Modeled Ratio ≤ 2.4 for 0.687 seconds

Condition 2:

- 4th Gear is commanded for ≥ 1 sec.
- 40 ≤ Engine Torque ≤ 400 N·m
- Trottle position ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Speed ratio ≥ 0.6
- 0.92 ≤ Modeled Ratio ≤ 1.5 for 7 seconds

Action Taken When the DTC Sets

- Maximum line pressure.
- For lamp illuminate refer to DTC type definition (type B).
- Turn Force Motor OFF.

Conditions For Clearing The The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the 4L30–E shift speed chart.
- Other internal transmission failures may cause more than one shift to occur.

Test Description

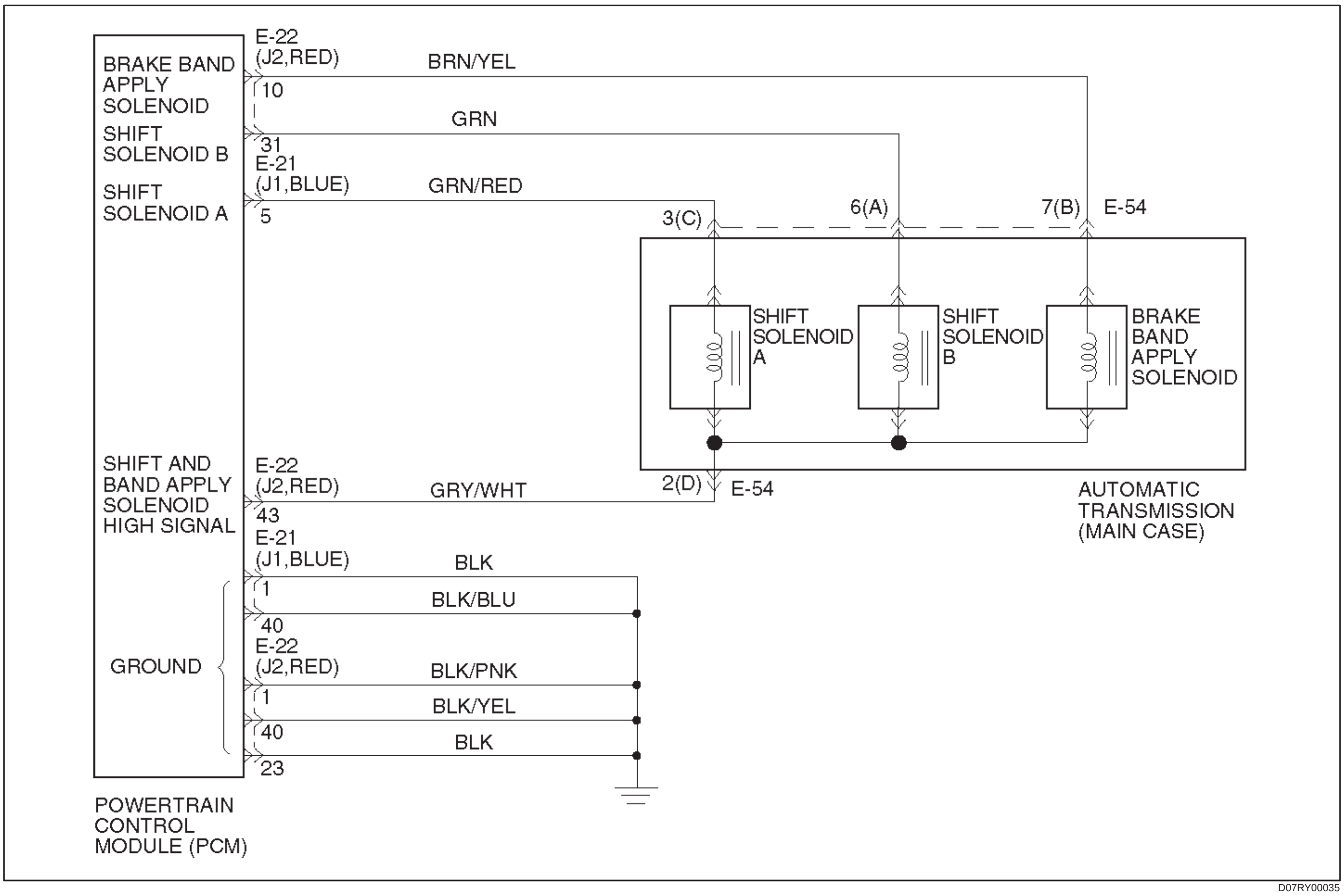
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the function of the range switch (mode switch).
3. This test checks that the scan tool commanded all shifts, all shifts solenoids responded correctly, but all the shifts did not occur.

DTC P0752 Shift Solenoid A Performance (Stuck On)

Step	Action	Yes	No
1	Were you sent here from the "Powertrain On–Board Diagnostic (OBD) System Check"?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Freeze Frame" and "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Freeze Frame" and "Failure Records". 4. With the engine operating, apply the brake pedal and select each transmission range D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the "TR Switch" on the scan tool?	Go to Step 3	Go to"Range Switch Logic Table"
3	1. While the engine is operating, raise the drive wheels. 2. With the transmission in D4 range, use the scan tool to command 1st, 2nd and 3rd, and 4th gears while accelerating the vehicle. Was a 2–3 or 1–4 only shift pattern detected? (Road testing the vehicle may be necessary).	Go to Step 4	Go to Diagnostic Aids
4	Check the shift solenoid/hydraulic circuit for: • One or both of the shift solenoids for an internal malfunction. • Contamination or sediment in one or both of the shift solenoids. • Damaged seals on one or both of the shift solenoids. Refer to Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section. Was a problem found and corrected?	Go to Step 5	Go to Diagnostic Aids
5	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and road test the vehicle. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0753 Shift Solenoid A Electrical



Circuit Description

- The shift solenoid A is a simple on/off solenoid located in the main case valve body. The solenoid is the normally closed type. In second or third gear the Powertrain Control Module (PCM) energizes the solenoid to open a fluid inlet port. When the port is open, fluid pressure actuates the shift valve.
- The solenoid is activated by a current. This current is produced by applying a voltage to one side (the High side) and a ground to the other side (Low side).
- The High Side Driver (HSD) is a circuit of the PCM that acts as a switch between the solenoids and the supply voltage. The High side of the solenoid is permanently supplied with voltage, except in BACKUP MODE or when ignition is off the HSD is turned off.

This DTC detects a continuous open or short to ground in the shift solenoid A circuit or the shift solenoid A. This is a type “B” DTC.

Conditions For Setting The DTC

- Ignition is “on”, Engine “run”.
- Battery voltage is between 10 and 16 volts.
- The PCM commands the solenoid “on” and the voltage remains high (B+), or the PCM commands the solenoid “off” and the voltage remains low (zero volts).
- All conditions met for 0.84 – 1.0 seconds.

Action Taken When The DTC Sets

- Maximum line pressure.
- Immediate landing to 4th gear.
- Inhibit TCC engagement.
- For lamp illuminate refer to DTC type definition (type B).

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and at the transmission 7-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.

- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- An open ignition feed circuit can cause multiple DTCs to set.
- A shift solenoid B DTC P0758 could also set with a shift solenoid A electrical failure.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for power to the shift solenoid A from the ignition through the PCM.
5. This test measures the resistance of the component.
8. This test checks the function of the shift solenoid A and the transmission internal wiring harness.

Shift Solenoid Status Chart

Gear	Shift solenoid A	Shift solenoid B
1st	OFF	ON
2nd	ON	ON
3rd	ON	OFF
4th	OFF	OFF

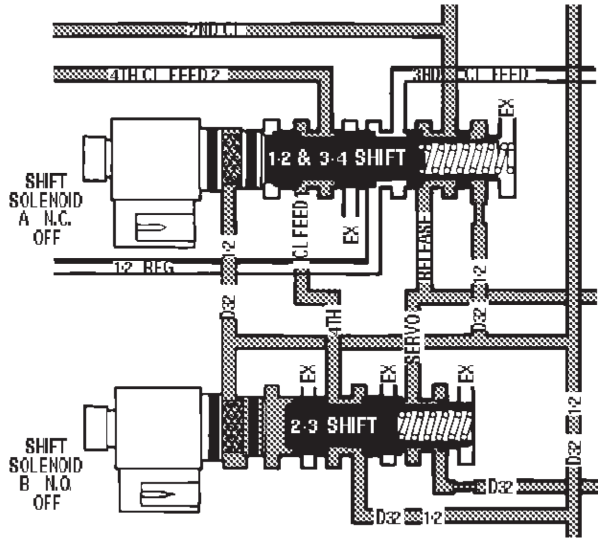
DTC P0753 Shift Solenoid A Electrical

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	1. Install the scan tool. 2. With the engine “on”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Were DTCs P0753, P0758, P1860 set?	Go to Step 3	Go to Diagnostic Aids
3	1. Turn the ignition “on”. 2. Using the J39200 DVOM, measure the voltage between PCM connector terminals J2–43 and J1–1 (GND). Is the voltage within 10–12 volts?	Go to Step 4	Go to Step 5
4	1. Turn the ignition “off”. 2. Disconnect the J1 (BLUE) and J2 (RED) PCM connector. 3. Turn the ignition “on”. 4. Using the J39200 DVOM, measure the voltage between PCM connector terminals J1–5 and ground. Is the voltage within 10 – 12 volts?	Go to Step 10	Go to Step 5
5	1. Turn the ignition “off”. 2. Disconnect the J1 (BLUE) and J2 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals J2–43 and J1–5. Is the resistance within 18 – 20 ohms?	Go to Step 6	Go to Step 8
6	1. Disconnect the J1 (BLUE) and J2 (RED) PCM connectors. 2. Using the J39200 DVOM, check a continuity between PCM terminals J1–5 and ground. Is there a continuity?	Go to Step 11	Go to Step 7
7	Using the J39200 DVOM, check a continuity between J2 (RED) PCM terminal 43 and ground. Is there a continuity?	Go to Step 12	Go to Step 9

DTC P0753 Shift Solenoid A Electrical (Cont'd)

Step	Action	Yes	No
8	1. Disconnect the transmission main case 7–way connector E–54. 2. Using the J39200 DVOM, measure the resistance between terminals E54–2(D) and E54–3(C). Is the resistance within 18–20 ohms?	Go to Step 13	Go to Step 14
9	Check every connection at the PCM connector. Was a problem found?	Go to Step 16	Go to Step 15
10	The wiring harness between PCM connector terminals J1–5 and transmission harness terminal E54–3(C) is shorted to voltage. Was a problem found and corrected?	Go to Step 17	—
11	The wiring harness between PCM connector terminal J1–5 and transmission harness terminal E54–3(C) is shorted to ground. Was a problem found and corrected?	Go to Step 17	—
12	The wiring harness between PCM connector terminals J2–43 and transmission harness terminal E54–2(D) is shorted to ground. Was a problem found and corrected?	Go to Step 17	—
13	The wiring harness between PCM connector J1 or J2 and transmission 7–way connector E–54 is open or poor connection. Was a problem found and corrected?	Go to Step 17	—
14	The shift solenoid A is faulty. Replace the shift solenoid A. Refer to Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 17	—
15	The PCM may be faulty. Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 17	—
16	Repair the PCM connector connection. Was a problem found and corrected?	Go to Step 17	—
17	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: • The shift solenoid A is commanded "on" and the voltage drops to zero. • The shift solenoid A is commanded "off" and the voltage increases to B+. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0756 Shift Solenoid B Performance (Stuck Off)



D07RT011

Circuit Description

The shift solenoid B is used to control fluid flow acting on the 2–3 shift valves. The solenoid is a normally open exhaust valve that is used with the shift solenoid A to allow four different shift combinations.

This DTC detects when there is only a 4-3-3-4 shift pattern depending on the state of the mechanical failure instead of a 1-2-3-4 shift pattern. This is a type “B” DTC.

Conditions For Setting The DTC

- No ETC DTCs.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTCs P0742, P1860, P1870.
- No shift solenoid DTCs P0753, P0758.
- Gear range is D4.
- Output speed is greater than 375 rpm.
- Transmission fluid temperature is between 20˚ and 130˚C (68˚ and 266˚F).
- No range code P0705, P0706.
- No torque code (to be confirmed).
- Engine run for more 0 seconds and influed cut-off (to be confirmed).

  All the above conditions have been met and the combination of condition 1, 2 occur two consecutive times.

Condition 1:

- 1st gear is commanded for ≥ 1 second
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle position ≥ 10 %
- –2300 ≤ TCC Slip ≤ 200 rpm.
- Transmission output speed ≥ 400 rpm
- Speed ratio ≥ 0.3
- 0.60 ≤ Modeled Ratio ≤ 1.49 for 1 second.

Condition 2:

- 2nd gear is commanded for ≥ 1 second
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle position ≥ 10 %
- –8000 ≤ TCC Slip ≤ 8000 rpm.
- Speed ratio ≥ 0.6
- 0.92 ≤ Modeled Ratio ≤ 1.5 for 0.687 second.

Action Taken When the DTC Sets

- Maximum line pressure.
- For lamp illuminate refer to DTC type definition (type B).
- Turn Force Motor OFF.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the 4L30-E shift speed chart.
- Other internal transmission failures may allow more than one shift to occur.

Test Description

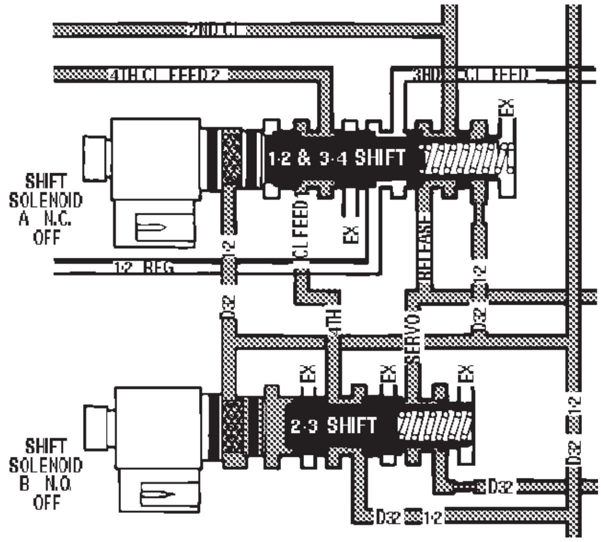
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the function of the range switch (mode switch).
3. This test checks for selected gear ratio vs. a ratio not obtainable under normal driving conditions.

DTC P0756 Shift Solenoid B Performance (Stuck Off)

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. With the engine operating, apply the brake pedal and select each transmission range D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the “TR Switch” on the scan tool?	Go to Step 3	Go to “Range Switch Logic Table”
3	1. While the engine is operating, raise the drive wheels. 2. With the transmission in D4 range, use the scan tool to command 1st, 2nd, and 3rd, and 4th gears while accelerating the vehicle. Was 1st gear commanded and not achieved, or 4th gear commanded and other than 4th gear occurred? (Road testing the vehicle may be necessary.)	Go to Step 4	Go to Diagnostic Aids
4	Check the shift solenoid/hydraulic circuit for: • One or both of the shift solenoids for an internal malfunction. • Contamination or sediment in one or both of the shift solenoids. • Damaged seals on the one or both of the shift solenoids. Refer to Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section. Was a problem found and corrected?	Go to Step 5	Go to Diagnostic Aids
5	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0757 Shift Solenoid B Performance (Stuck On)



D07RT011

Circuit Description

The shift solenoid B is used to control fluid flow acting on the 2–3 shift valves. The solenoid is a normally open exhaust valve that is used with the shift solenoid A to allow four different shift combinations.
This DTC detects when there is only a 1–2–2–1 shift pattern depending on the state of the mechanical failure instead of a 1–2–3–4 shift pattern. This is a type “B” DTC.

Conditions For Setting The DTC

- No ETC DTCs.
- No OSS DTCs P0722 or P0723.
- No TCC solenoid DTC P0742, P1860, P1870.
- No shift solenoid DTCs P0753.
- No shift solenoid B DTC P0758.
- Gear range is D4.
- Output speed is greater than 375 rpm.
- Transmission fluid temperature is between 20° and 130°C (68° and 266°F).
- No range code P0705, P0706.
- No torque code (to be confirmed).
- Engine run for more 0 seconds and not influed cut-off (to be confirmed).

All of the above conditions have been met and the combination of condition 1,2 occur two consecutive times.

Condition 1:

- 3rd gear is commanded for ≥ 1 second
- 40 ≤ Engine Torque ≤ 400 N·m
- Throttle positon ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Transmission out speed ≥ 375 rpm
- Speed ratio ≥ 0.6
- 1.44 ≤ Modeled Ratio ≤ 2.4 for 4 seconds

Condition 2:

- 4th Gear is commanded for ≥ 1 second
- 15 ≤ Engine Torque ≤ 400 N·m
- Trottle position ≥ 10%
- –8000 ≤ TCC slip ≤ 8000 rpm
- Speed ratio ≥ 0.6
- 2.75 ≤ Modeled Ratio ≤ 3.2 for 2 seconds

Action Taken When the DTC Sets

- Maximum line pressure.
- For lamp illuminate refer to DTC type definition (type B).
- Turn Force Motor OFF.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Verify that the transmission meets the specifications in the 4L30-E shift speed chart.
- Other internal transmission failures may cause more than one shift to occur.

Test Description

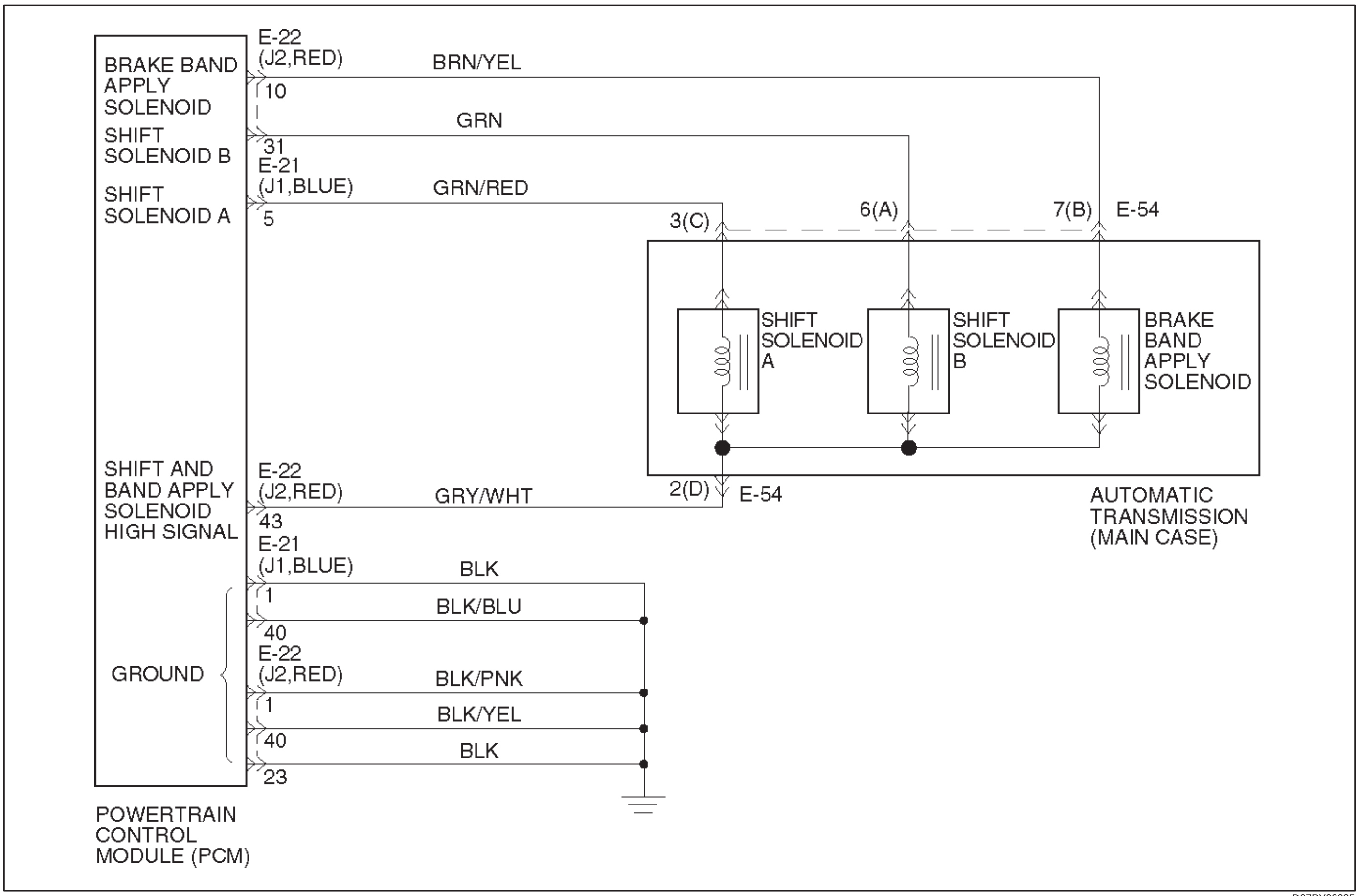
The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the function of the range switch (mode switch).
3. This test checks for selected gear ratio vs. a ratio not obtainable under normal driving conditions.

DTC P0757 Shift Solenoid B Performance (Stuck On)

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emissions in Engine section
2	1. Install the scan tool. 2. With the engine “off”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. 4. With the engine operating, apply the brake pedal and select each transmission range D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the “TR Switch” on the scan tool?	Go to Step 3	Go to “Range Switch Logic Table”
3	1. While the engine is operating, raise the drive wheels. 2. With the transmission in D4 range, use the scan tool to command 1st, 2nd, and 3rd, and 4th gears while accelerating the vehicle. Was 1st gear commanded and not achieved, or 4th gear commanded and other than 4th gear occurred? (Road testing the vehicle may be necessary.)	Go to Step 4	Go to Diagnostic Aids
4	Check the shift solenoid/hydraulic circuit for: • One or both of the shift solenoids for an internal malfunction. • Contamination or sediment in one or both of the shift solenoids. • Damaged seals on the one or both of the shift solenoids. Refer to Solenoid (Main Case Valve Body) in Automatic Transmission (4L30–E) section. Was a problem found and corrected?	Go to Step 5	Go to Diagnostic Aids
5	1. After the repair is complete, use the scan tool to select “DTC”, then “Clear Info” function and road test the vehicle. 2. Review the scan tool “DTC Info”. Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P0758 Shift Solenoid B Electrical



Circuit Description

- The shift solenoid B is a simple on/off solenoid located in the main case valve body. It is normally open. When the port is open, fluid pressure actuates the shift valve. In first or second gear, the Powertrain Control Module (PCM) energizes the solenoid to close a fluid inlet port.
- The solenoid is activated by current. This current is produced by applying a voltage to one side (the High side) and a ground to the other side (Low side).
- The High Side Driver (HSD) is a circuit of the PCM that acts as a switch between the solenoids and the supply voltage. The High side of the solenoid is permanently supplied with voltage. In BACKUP MODE or when the ignition is off, the HSD is turned off.

This DTC detects a continuous open or short to ground in the shift solenoid B circuit or shift solenoid B. This is a type “B” DTC.

Conditions For Setting The DTC

- Ignition is “on”, Engine “run”.
- Battery voltage is between 10 and 16 volts.
- The PCM commands the solenoid “on” and the voltage remains high (B+), or the PCM commands the solenoid “off” and the voltage remains low (zero volts).
- All conditions met for 0.84 ~ 1.0 seconds.

Action Taken When The DTC Sets

- Fixed to 4th gear.
- Maximum line pressure.
- Inhibit TCC engagement.
- For lamp illuminate refer to DTC type definition (type B).
- The PCM will illuminate the Malfunction Indicator Lamp (MIL) and CHECK TRANS lamp.

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.

- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled “off” long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and transmission 7-way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

5. This test measures the resistance of the component.

6. This test checks the function of the shift solenoid B and the transmission internal wiring harness.

9. This test checks for power to the shift solenoid B from the ignition through the PCM.

Shift Solenoid Status Chart

Gear	Shift solenoid A	Shift solenoid B
1st	OFF	ON
2nd	ON	ON
3rd	ON	OFF
4th	OFF	OFF

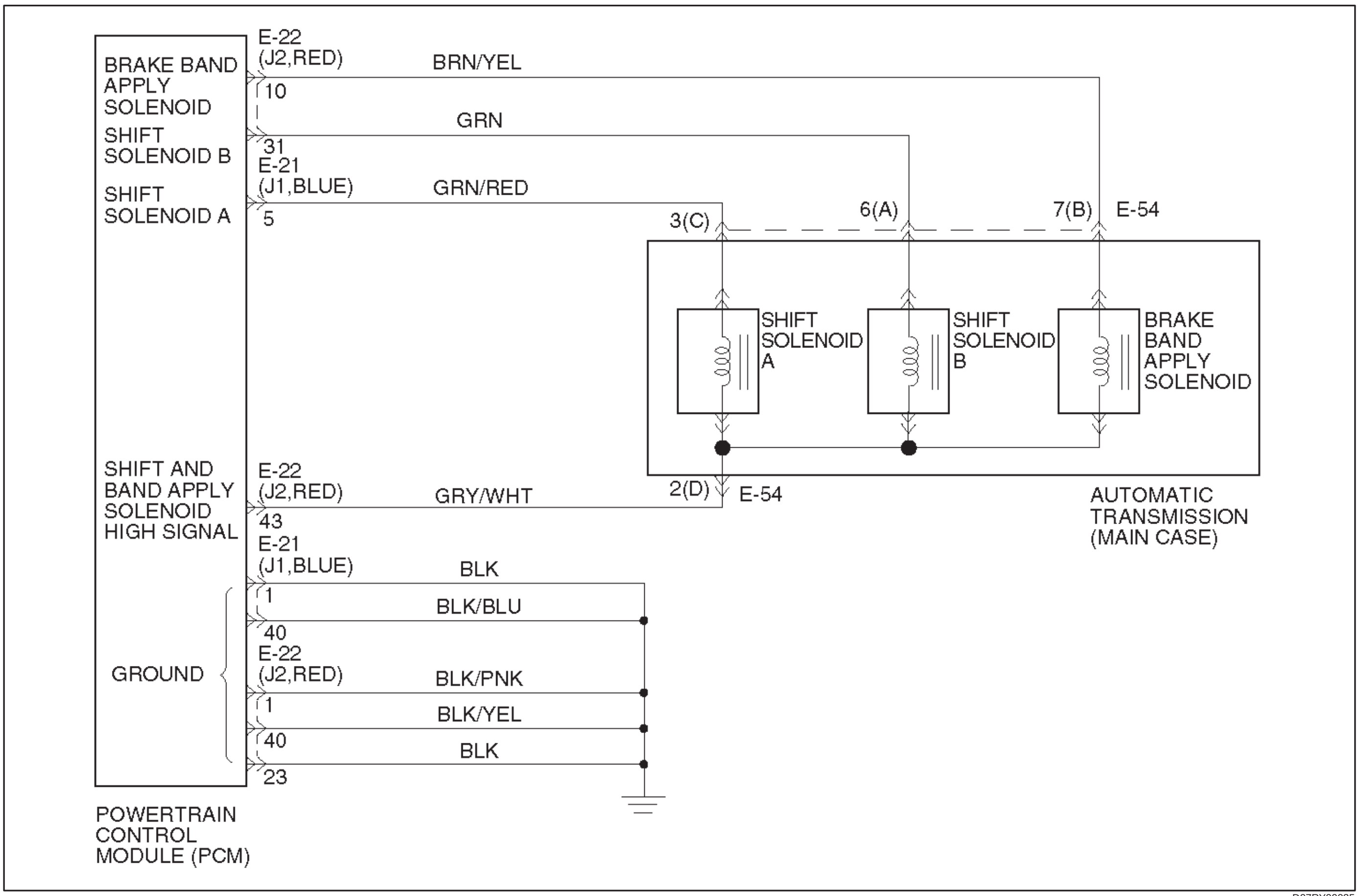
DTC P0758 Shift Solenoid B Electrical

Step	Action	Yes	No
1	Were you sent here from the "Powertrain On–Board Diagnostic (OBD) System Check"?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	1. Install the scan tool. 2. With the engine "on", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Freeze Frame" and "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Freeze Frame" and "Failure Records". Were DTCs P0753, P0758, P1860 set?	Go to Step 4	Go to Step 3
3	1. The engine "on". 2. Apply brake pedal and select transmission range "D". 3. Press and hold down the winter switch and select transmission mode "winter". Does the scan tool display DTC P0758 at 3rd gear?	Go to Step 7	Go to Diagnostic Aids
4	1. Turn the ignition "off". 2. Disconnect the J1 (BLUE) and J2 (RED) PCM connectors. 3. Turn the ignition "on". 4. Using the J39200 DVOM, measure the voltage between PCM connector terminals J2–31 and J2–1. Is the voltage within 10 – 12 volts?	Go to Step 13	Go to Step 5
5	1. Turn the ignition "off". 2. Using the J39200 DVOM, measure the resistance between PCM connector terminals J2–31 and J2–43. Is the resistance within 18 – 20 ohms?	Go to Step 14	Go to Step 6
6	1. Disconnect the transmission main case connector E–54. 2. Using the J39200 DVOM, measure the resistance between terminals E54–6(A) and E54–2(D). Is the resistance within 18 – 20 ohms?	Go to Step 15	Go to Step 16
7	1. Turn the ignition "off". 2. Disconnect the J1 (BLUE) and J2 (RED) PCM connectors. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals J2–31 and J2–43. Is the resistance within 18 – 20 ohms?	Go to Step 8	Go to Step 10
8	Using the J39200 DVOM, check a continuity between PCM connector terminal J2–31 and ground. Is there a continuity?	Go to Step 17	Go to Step 9
9	Using the J39200 DVOM, check a continuity between PCM connector terminal J2–43 and ground. Is there a continuity?	Go to Step 18	Go to Step 11
10	1. Disconnect the transmission main case connector E–54. 2. Using the J39200 DVOM, measure the resistance between terminals E54–6(A) and E54–2(D). Is the resistance within 18 – 20 ohms?	Go to Step 19	Go to Step 20
11	Check every connection of the PCM. Was a problem found and corrected?	Go to Step 22	Go to Step 12

DTC P0758 Shift Solenoid B Electrical (Cont'd)

Step	Action	Yes	No
12	1. Connect the J1 (BLUE) and J2 (RED) PCM connectors to the PCM. 2. Turn the ignition "on", the engine "on". 3. Repeat Step 3. Does the scan tool display DTC P0758 at 3rd gear?	Go to Step 21	Go to Diagnostic Aids
13	The wiring harness between PCM connector terminal J2–31 and transmission main case terminal E54–6(A) is shorted to voltage. Was a problem found and corrected?	Go to Step 22	—
14	The PCM internal terminal J2–31 is shorted to voltage. Replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 22	—
15	The wiring harness between PCM connector and transmission main case connector is shorted. Was a problem found and corrected?	Go to Step 22	—
16	The shift solenoid B is faulty, or the internal wiring harness from the shift solenoid B is shorted. Was a problem found and corrected?	Go to Step 22	—
17	The wiring harness between PCM connector terminal J2–31 and transmission main case connector terminal E54–6(A) is shorted to ground. Was a problem found and corrected?	Go to Step 22	—
18	The wiring harness between PCM connector terminal J2–43 and transmission main case connector terminal E54–2(D) is shorted to ground. Was a problem found and corrected?	Go to Step 22	—
19	The wiring harness between PCM connector terminal J2–31 and transmission main case connector terminal E54–6(A), or between PCM connector terminal J2–43 and main case connector terminal E54–2(D) is open. Was a problem found and corrected?	Go to Step 22	—
20	The internal wiring harness from the shift solenoid B is open, or the shift solenoid B is faulty. Was a problem found and corrected?	Go to Step 22	—
21	Replace the PCM. Is the replacement complete?	Go to Step 22	—
22	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and operate the vehicle under the following conditions: ● The shift solenoid B is commanded "on" and voltage drops to zero. ● The shift solenoid B is commanded "off" and voltage increases to B+. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P1850 Brake Band Apply Solenoid Malfunction



Circuit Description

- The brake band apply solenoid is a normally open solenoid which controls the flow of fluid for brake band application. The Powertrain Control Module (PCM) uses Pulse Width Modulation (PWM) and changes the duty cycle to control the solenoid. The PCM turns the solenoid on (energized) and off (deenergized) at a constant frequency. The length of time the solenoid is energized during each on/off cycle is called the pulse width. By varying or "modulating" the pulse width, the solenoid output pressure is changed. Since the solenoid is normally open, increasing the pulse width increases the duty cycle and decreases the output pressure. PWM control provides smooth band application without an accumulator. The band is only applied in first and second gears.
- In the event of an electrical failure (open), the solenoid regulates at the maximum oil flow (0% duty cycle).
- The solenoid is activated by a current. This current is produced by applying a voltage to one side (the High side) and a ground to the other side (Low side).
- The High Side Driver (HSD) is a circuit of the PCM that acts as a switch between the solenoids and the supply voltage. The High side of the solenoid is permanently supplied with voltage. When the ignition is off, the HSD is turned off.

This DTC detects a continuous open or short to ground in the brake band apply solenoid circuit or the brake band apply solenoid. This is a type "D" DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- Ignition is "on", Engine "run".
- The PCM commands the solenoid "on" and the voltage remains high (B+), or the PCM commands the solenoid "off" and the voltage remains low (zero volts).
- All conditions met in 1.34 ~ 1.56 seconds.

Action Taken When The DTC Sets

- Inhibit brake band apply solenoid.
- The PCM will not illuminate the Malfunction Indicator Lamp (MIL).

Conditions For Clearing The DTC

- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connection at the PCM and at the transmission 7–way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for power to the brake band apply solenoid from the ignition through the PCM.
4. This test checks the resistance of the transmission internal wiring harness and brake band apply solenoid.
5. This test checks the ability of the PCM and wiring to control the ground circuit.

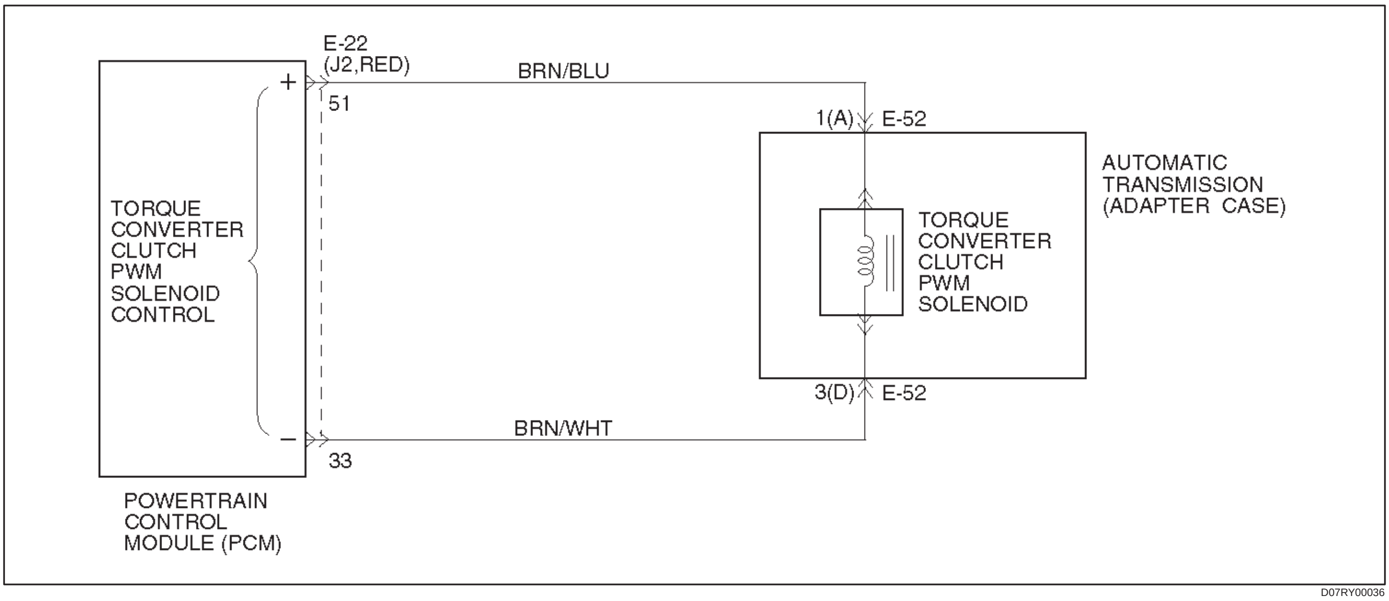
DTC P1850 Brake Band Apply Solenoid Malfunction

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	1. Install the scan tool. 2. With the engine “on”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the “Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Were DTCs P0753, P0758 set?	Go to Step 3	Go to Step 4
3	Using the J39200 DVOM, back probe between PCM connector terminals J2–43 and J2–1. Is the voltage between 10 to 12 volts?	Go to Step 5	Go to Step 6
4	1. Turn the ignition “off”. 2. Disconnect the J1 (BLUE) and J2 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals J2–43 and J2–10. Is the resistance within 10–12 ohms?	Go to Step 10	Go to Step 11
5	Using the J39200 DVOM, back probe between PCM connector terminals J2–10 and J2–1. Is the voltage between 10 to 12 volts?	Go to Step 19	Go to Step 4
6	1. Turn the ignition “off”. 2. Disconnect the J1 (BLUE) and J2 (RED) PCM connector. 3. Using the J39200 DVOM, check continuity between PCM terminal J2–43 and ground. Is there a continuity?	Go to Step 7	Go to Step 8
7	1. Disconnect the transmission main case connector E–54. 2. Using the J39200 DVOM, check continuity between the terminal E54–7(B) and ground. Is there continuity?	Go to Step 13	Go to Step 14
8	1. Disconnect the J1 (BLUE) and J2 (RED) PCM Connector. 2. Using the J39200 DVOM, measure the resistance between the PCM connector terminals J2–43 and J2–10. Is the resistance within 10–12 ohms?	Go to Step 19	Go to Step 9
9	1. Disconnect the transmission main case connector E–54. 2. Using the J39200 DVOM, measure the resistance between the terminals E54–7(B) and E54–2(D). Is the resistance within 10–12 ohms?	Go to Step 15	Go to Step 16
10	Using the J39200 DVOM, check continuity between PCM terminal J2–10 and ground. Is there continuity?	Go to Step 12	Go to Step 19
11	1. Disconnect the transmission main case connector E–54. 2. Using the J39200 DVOM, measure the resistance between the terminals E54–7(B) and E54–2(D). Is the resistance within 10–12 ohms?	Go to Step 18	Go to Step 16

DTC P1850 Brake Band Apply Solenoid Malfunction (Cont'd)

Step	Action	Yes	No
12	1. Disconnect the transmission main case connector E–54. 2. Using the J39200 DVOM, check continuity between the terminals E54–7(B) and ground. Is there a continuity?	Go to Step 13	Go to Step 17
13	The brake band apply solenoid is faulty, or the internal wiring harness from the brake band apply solenoid is shorted to ground. Was a problem found and corrected?	Go to Step 20	—
14	The wiring harness between the PCM connector terminal J2–43 and the transmission main case connector terminal E54–2(D) is shorted to ground. Was a problem found and corrected?	Go to Step 20	—
15	The wiring harness between the PCM connector terminal J2–43 and the transmission main case connector terminal E54–2(D) is open. Was a problem found and corrected?	Go to Step 20	—
16	The brake band apply solenoid is faulty, or the internal wiring harness from the brake band apply solenoid is open. Was a problem found and corrected?	Go to Step 20	—
17	The wiring harness between the PCM connector terminal J2–10 and the transmission main case connector terminal E54–7(B) is shorted ground. Was a problem found and corrected?	Go to Step 20	—
18	The wiring harness between the PCM connector terminal J2–10 and the transmission main case connector terminal E54–7(B) is open. Was a problem found and corrected?	Go to Step 20	—
19	Check every connection at the PCM. If OK, replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 20	—
20	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: ● The brake band apply solenoid is commanded "on" and the volts drop to zero. ● The brake band apply solenoid is commanded "off" and the volts increase to B+. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P1860 TCC Solenoid Electrical



Circuit Description

The PCM allows current to flow through the solenoid (0 or 12 volts). This current flow through the solenoid coil creates a magnetic field that magnetizes the solid core. The magnetized core attracts the check ball to seat against spring pressure. This blocks the exhaust for the TCC signal fluid and allows solenoid feed drive fluid to feed to TCC signal circuit. The TCC signal fluid pressure acts on the torque converter clutch control valve. When the TCC control valve is in the apply position, line pressure is directed through the TCC valve to apply the torque converter clutch. The TCC solenoid is attached to the valve body within the transmission.

This DTC detects a continuous open or short to ground or ignition in the TCC circuit or the TCC solenoid. This is a type "B" DTC.

Conditions For Setting The DTC

- Battery voltage is between 10 and 16 volts.
- No shift solenoid A DTCs P0751 or P0752 or P0753.
- No shift solenoid B DTCs P0756 or P0757 or P0758.
- Ignition "on". Engine "run".
- The PCM commands the solenoid "on" and the voltage remains low (zero volts).
- The PCM commands the solenoid "off" and the voltage remains high (B+).
- All conditions met for 0.875 ~ 1.25 seconds.

Action Taken When The DTC Sets

- Inhibit TCC engagement.
- For lamp illuminate refer to DTC type definition (TYPE B).

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the PCM and at the transmission 4–way connector. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

3. This test checks for voltage to the solenoid.
4. This test checks the ability of the PCM and wiring to control the ignition circuit.
8. This test checks the resistance of the TCC solenoid and the internal wiring harness.

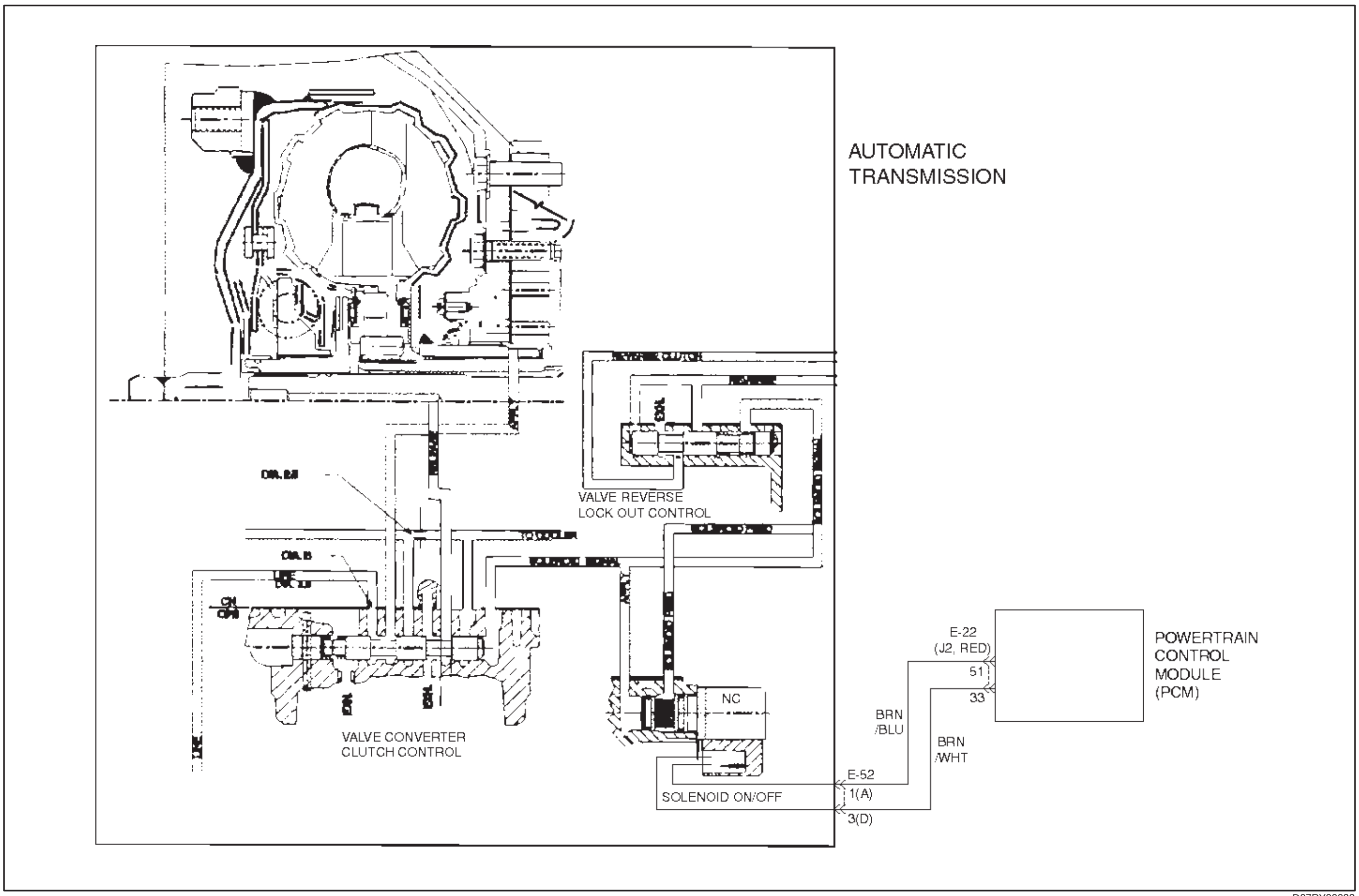
DTC P1860 TCC Solenoid Electrical

Step	Action	Yes	No
1	Were you sent here from the “Powertrain On–Board Diagnostic (OBD) System Check”?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	1. Install the scan tool. 2. With the engine “on”, turn the ignition switch “on”. NOTE: Before clearing DTC(s), use the scan tool to record “Freeze Frame” and “Failure Records” for reference, as data will be lost when the“Clear Info” function is used. 3. Record the DTC “Freeze Frame” and “Failure Records”. Was DTC P1860 set?	Go to Step 3	Go to Step 4
3	Using the J39200 DVOM, back probe between PCM connector terminals J2–51 and J2–33. Is the voltage 0?	Go to Step 5	Go to Step 6
4	1. Apply brake pedal and select transmission range “D”. 2. Do a test drive, and increase the vehicle speed to TCC “on” at 4th. Does the scan tool display DTC P1860 at TCC “ON”?	Go to Step 9	Go to Diagnostic Aids
5	1. Turn the ignition “off”. 2. Disconnect the J2 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between PCM connector terminals J2–51 and J2–33. Is the resistance within 18 – 20 ohms?	Go to Step 7	Go to Step 8
6	The wiring harness between PCM connector terminal J2–51 and transmission adapter case connector terminal E52–1(A) is shorted to voltage. Was a problem found and corrected?	Go to Step 15	Go to Step 16
7	Intermittent condition. Check the wiring harness and terminals between PCM connector J2 and transmission adapter case connector E–52. Was a problem found and corrected?	Go to Step 15	Go to Step 16
8	1. Disconnect the transmission adapter case connector E–52. 2. Using the J39200 DVOM, measure the resistance between terminal E52–1(A) and ground. Is the resistance within 18 – 20 ohms?	Go to Step 13	Go to Step 14
9	1. Turn the ignition “off”. 2. Disconnect the J2 (RED) PCM connector. 3. Using the J39200 DVOM, measure the resistance between terminals J2–51 and J2–33. Is the resistance within 18 – 20 ohms?	Go to Step 15	Go to Step 10
10	1. Disconnect the transmission adapter case connector E–52. 2. Using the J39200 DVOM, measure the resistance between terminal E52–1(A) and ground. Is the resistance within 18–20 ohms?	Go to Step 11	Go to Step 12
11	The wiring harness between PCM connector J2 and adapter case connector E–52 is shorted to ground. Was a problem found and corrected?	Go to Step 17	—

DTC P1860 TCC Solenoid Electrical (Cont'd)

Step	Action	Yes	No
12	The TCC solenoid is faulty, or the internal wiring harness from the TCC solenoid is shorted to ground. Was a problem found and corrected?	Go to Step 17	—
13	The wiring harness between PCM connector terminal J2–51 and adapter case terminal E52–1(A) is open. Was a problem found and corrected?	Go to Step 17	—
14	The TCC solenoid is faulty, or the internal wiring harness from the TCC solenoid is open. Was a problem found and corrected?	Go to Step 17	—
15	Check every connection at the PCM. If OK, replace the PCM. Refer to Powertrain Control Module (PCM) in Automatic Transmission (4L30–E) section. Is the replacement complete?	Go to Step 17	—
16	Check the PCM connector terminal J2–51, and transmission adapter case connector terminal E52–1(A). Was a problem found and corrected?	Go to Step 17	—
17	1. After the repair is complete, use the scan tool to select "DTC", then "Clear Info" function and ensure the following conditions are met: ● The TCC solenoid is commanded "on" and the volts increase to B+. ● The TCC solenoid is commanded "off" and the volts drop to zero. 2. Review the scan tool "DTC Info". Has the last test failed or is the current DTC displayed?	Begin diagnosis again Go to Step 1	Repair verified Exit DTC table

DTC P1870 Transmission Component Slipping (TCC Stuck Off)



Circuit Description

The PCM monitors the difference in engine speed and transmission output speed. In D3 drive range with the TCC engaged, the engine speed should closely match transmission output speed.

This DTC detects excessive TCC slip when the TCC is engaged. This is a type "B" DTC.

Conditions For Setting The DTC

The following conditions are met for three TCC cycles with reported excessive TCC slip conditions.

- No OSS DTCs P0722 or P0723.
- No shift solenoid A DTCs P0751 or P0752 or P0753.
- No shift solenoid B DTCs P0756 or P0757 or P0758.
- No TCC solenoid DTCs P0742 or P1860 or P1870.
- Engine speed is between 1000 and 3500 rpm for 0.5 seconds.
- Engine vacuum is between 0 and 70 kPa.
- Gear range is D4.
- TP angle is greater than 10%.
- TFT is between 20° and 150°C (68° and 302°F).
- TCC slip speed is between 250 rpm and 800 rpm for 3 times 7 seconds.
- Vehicle speed is between 25 km/h (15 mph) and 255 km/h (158 mph).
- Speed ratio is between 0.6 and 0.95.
- 13% < TPS < 99%
- 50 < Engine Torque < 300 N·m
- Low (0.8) < TCC capacity < hi (0.99) for 5 seconds.

Action Taken When The DTC Sets

- Only stored in memory.
- For lamp illuminate refer to DTC type definition (TYPE B).

Conditions For Clearing The MIL/DTC

- The PCM will turn off the MIL and CHECK TRANS Lamp after three consecutive ignition cycles without a failure reported.
- The DTC can be cleared from the PCM history by using a scan tool.
- The DTC will be cleared from history when the vehicle has achieved 40 warmup cycles without a failure reported.
- The PCM will cancel the DTC default actions when the fault no longer exists and the ignition is cycled "off" long enough to power down the PCM.

Diagnostic Aids

- Range switch malfunction could set a DTC P1870.
- A mechanical failure of the shift solenoids, TCC solenoid, or TCC PWM solenoid could set a DTC P1870.

- Internal transmission failures may set a DTC P1870.
- An intermittent or incorrect engine speed signal may set a DTC P1870.

Test Description

The numbers below refer to the step numbers on the diagnostic chart:

2. This test checks the indicated range signal to the actual selected range. A faulty switch could set a DTC P1870.
3. This test checks the torque converter for slippage while in a commanded lockup state.

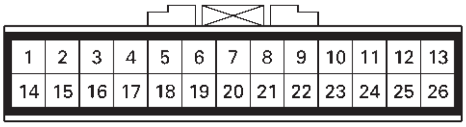
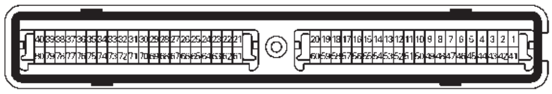
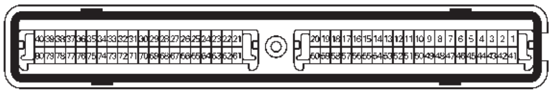
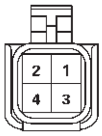
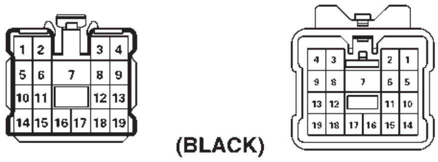
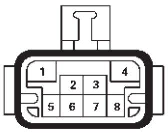
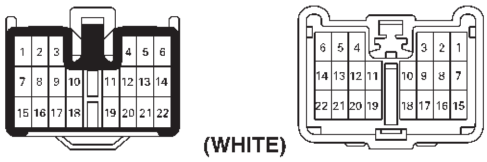
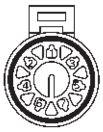
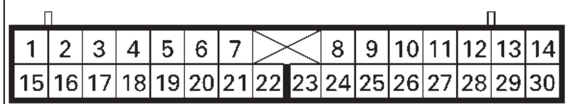
Range Switch Logic Table

Range Position	Range Switch Pin			
	A	B	C	P(G)
Park	ON	OFF	OFF	ON
Reverse	ON	ON	OFF	OFF
Neutral	OFF	ON	OFF	ON
D4	OFF	ON	ON	OFF
D3	ON	ON	ON	ON
2	ON	OFF	ON	OFF
L	OFF	OFF	ON	ON
Illegal	OFF	OFF	OFF	OFF
Illegal	OFF	OFF	OFF	ON

DTC P1870 Transmission Component Slipping (TCC Stuck Off)

Step	Action	Yes	No
1	Were you sent here from the "Powertrain On–Board Diagnostic (OBD) System Check"?	Go to Step 2	Go to OBD System Check Refer to Driveability and Emission in Engine section
2	1. Install the scan tool. 2. With the engine "off", turn the ignition switch "on". NOTE: Before clearing DTC(s), use the scan tool to record "Freeze Frame" and "Failure Records" for reference, as data will be lost when the "Clear Info" function is used. 3. Record the DTC "Freeze Frame" and "Failure Records". 4. Apply the brake pedal. 5. Select each transmission range: D1, D2, D3, D4, N, R, and P. Does each selected transmission range match the scan tool "TR Switch" display?	Go to Step 3	Go to "Range Switch Logic Table"
3	Drive the vehicle in 4th gear while the TCC is engaged. At any time is the "TCC Slip Speed" greater than 130 rpm for 8 seconds while the TCC is engaged?	Go to System Diagnosis Charts	Go to Diagnostic Aids

Connector List

No.	Connector face	No.	Connector face
B-26		H-7	 (WHITE)
E-21 (J1)	 (BLUE)	H-12	 (BLUE)
E-22 (J2)	 (RED)	H-15	 (BLUE)
E-52	 (GRAY)	H-17	 (BLACK)
E-53	 (BLACK)	H-18	 (WHITE)
E-54	 (BLACK)	I-1	
E-55		I-18	
H-5	 (GREEN)		
H-6	 (BLUE)		

RODEO

TRANSMISSION

MANUAL TRANSMISSION MUA 5C

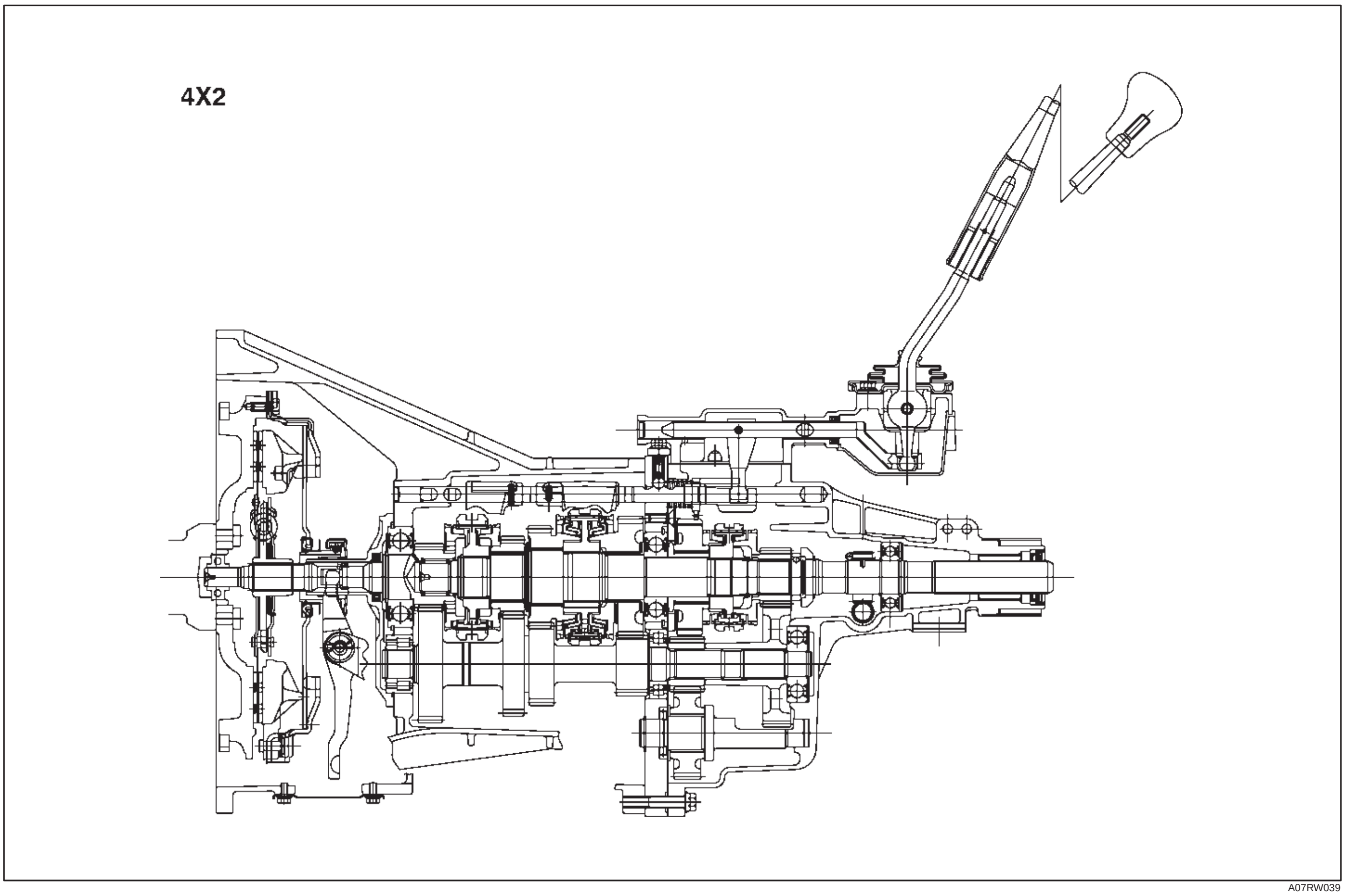
CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

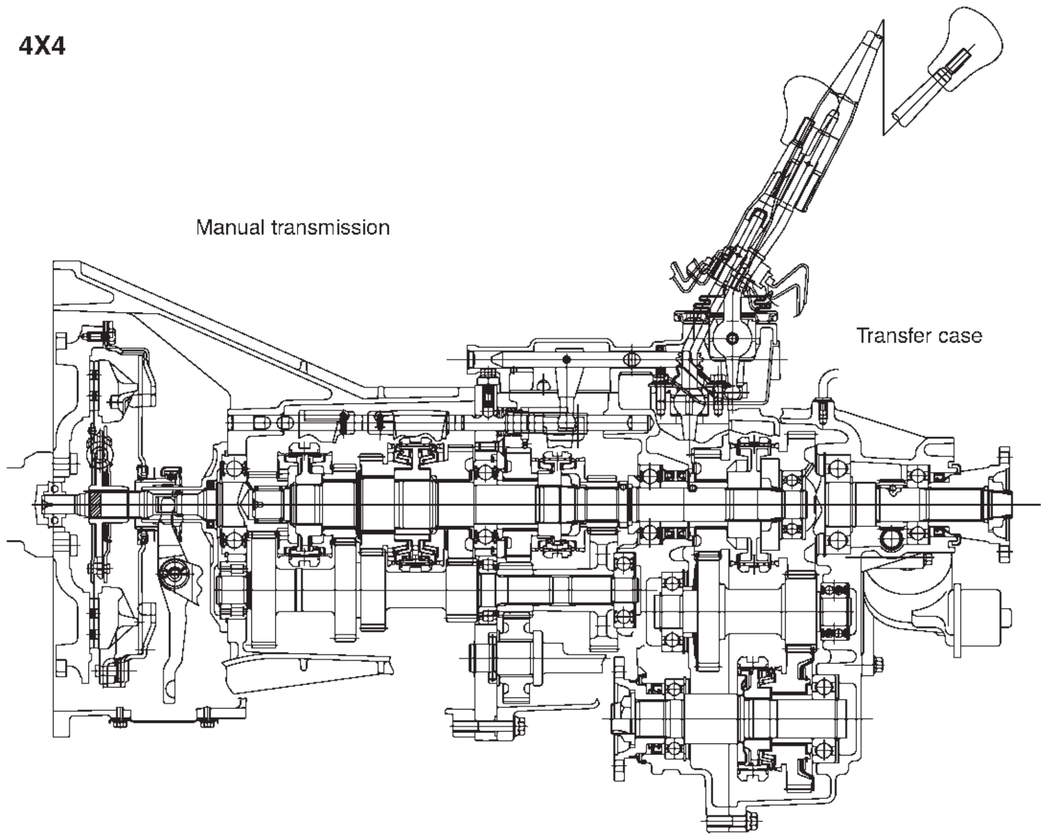
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description



A07RW039

4X4



A07RW040

The MUA5C is a constant mesh transmission, synchronized in all speeds. The transmission is designed for a great reduction of the shift effort and the quietest possible operation.

Principle parts of the transmission are the integral clutch housing, intermediate plate, the transfer case, the rear cover, and the gears.

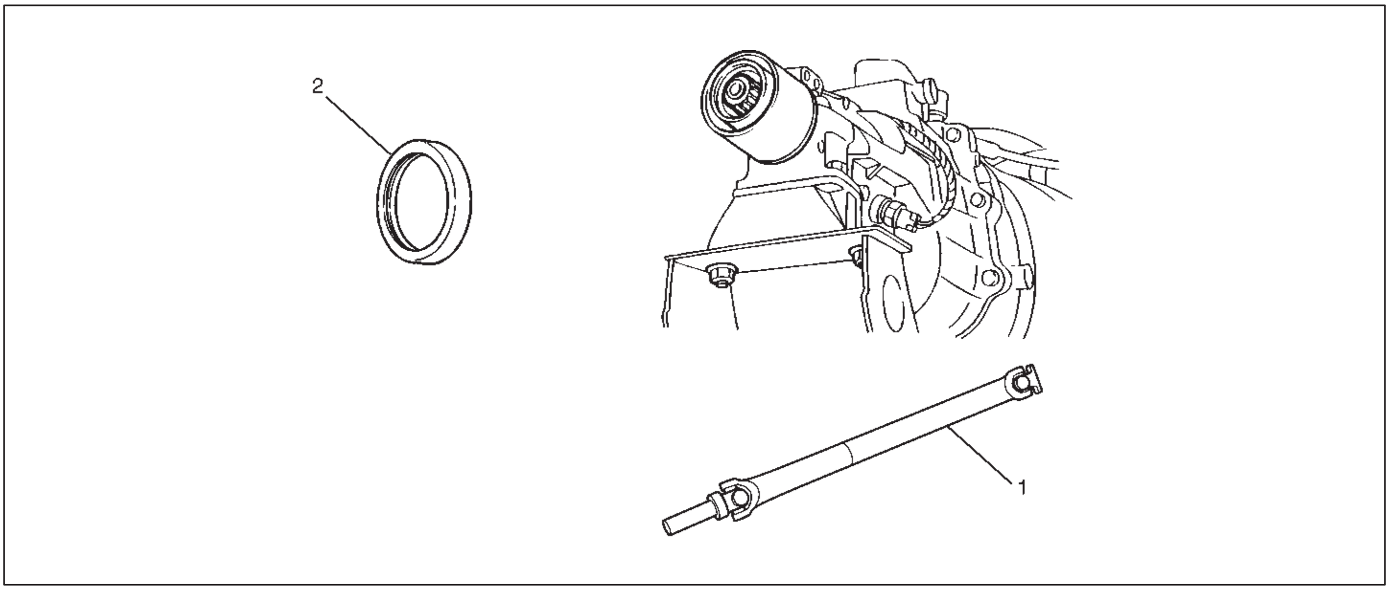
The transmission control box and transfer control box are built into the transmission and transfer case.

Diagnosis

Condition	Possible cause	Correction
Abnormal noise	Flywheel pilot bearing worn	Replace
	Bearings worn or broken (Mainshaft, counter shaft, and transfer shaft)	Replace
	Gear tooth contact surfaces worn or scuffed (Mainshaft, counter shaft, reverse idler gear and transfer gears)	Replace
	Splines worn (Mainshaft, synchronizer clutch hub)	Replace
	Gear or bearing thrust face seized	Replace
	Lack of backlash between meshing gears	Replace
Hard Shifting	Improper clutch pedal free play	Readjust
	Change lever sliding portions worn	Repair or replace Regrease
	Shift block, shift rod and/or control box sliding faces worn	Replace
	Shift arm and synchronizer sleeve groove worn	Replace worn parts
	Thrust washer, collar, and/or gear thrust faces worn (Mainshaft and counter shaft thrust play)	Replace worn parts
	Synchronizer parts worn	Replace
Walking or Jumping out of gear	Detent ball worn	Replace
	Detent spring weakened or broken	Replace
	Shift rod and/or control box sliding faces worn	Replace
	Shift arm and synchronizer sleeve groove worn	Replace worn parts
	Thrust washer, collar, and/or gear thrust faces worn (Mainshaft and counter shaft thrust play)	Replace worn parts
	Bearings worn or broken	Replace
	Splines worn (Mainshaft, synchronizer hub)	Replace
	Synchronizer spring weakened or broken	Replace
Oil leakage	Loose drain plug(s) and/or filler plug(s)	Tighten Replenish oil
	Defective or improperly installed gasket(s)	Replace
	Oil seal worn or scratched	Replace

Rear Oil Seal (4X2)

Disassembled View



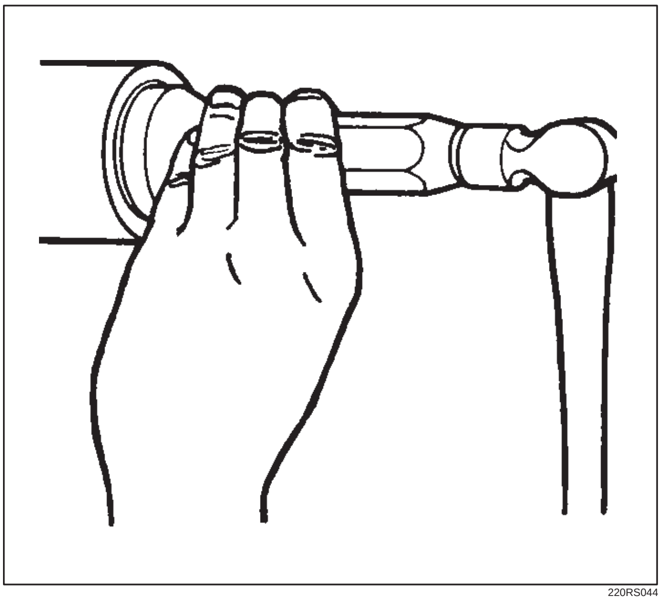
Legend
(1) Rear Propeller Shaft
(2) Rear Oil Seal

Removal

1. Raise and support vehicle with suitable jack stands.
2. Remove propeller shaft flange yoke bolts and nuts at the differential side.
   Remove propeller shaft from the transmission main shaft spline.
3. Use a screwdriver to pry the rear oil seal from the rear cover.

Installation

1. Install a new oil seal(2) or (3) using the installer J–29769.



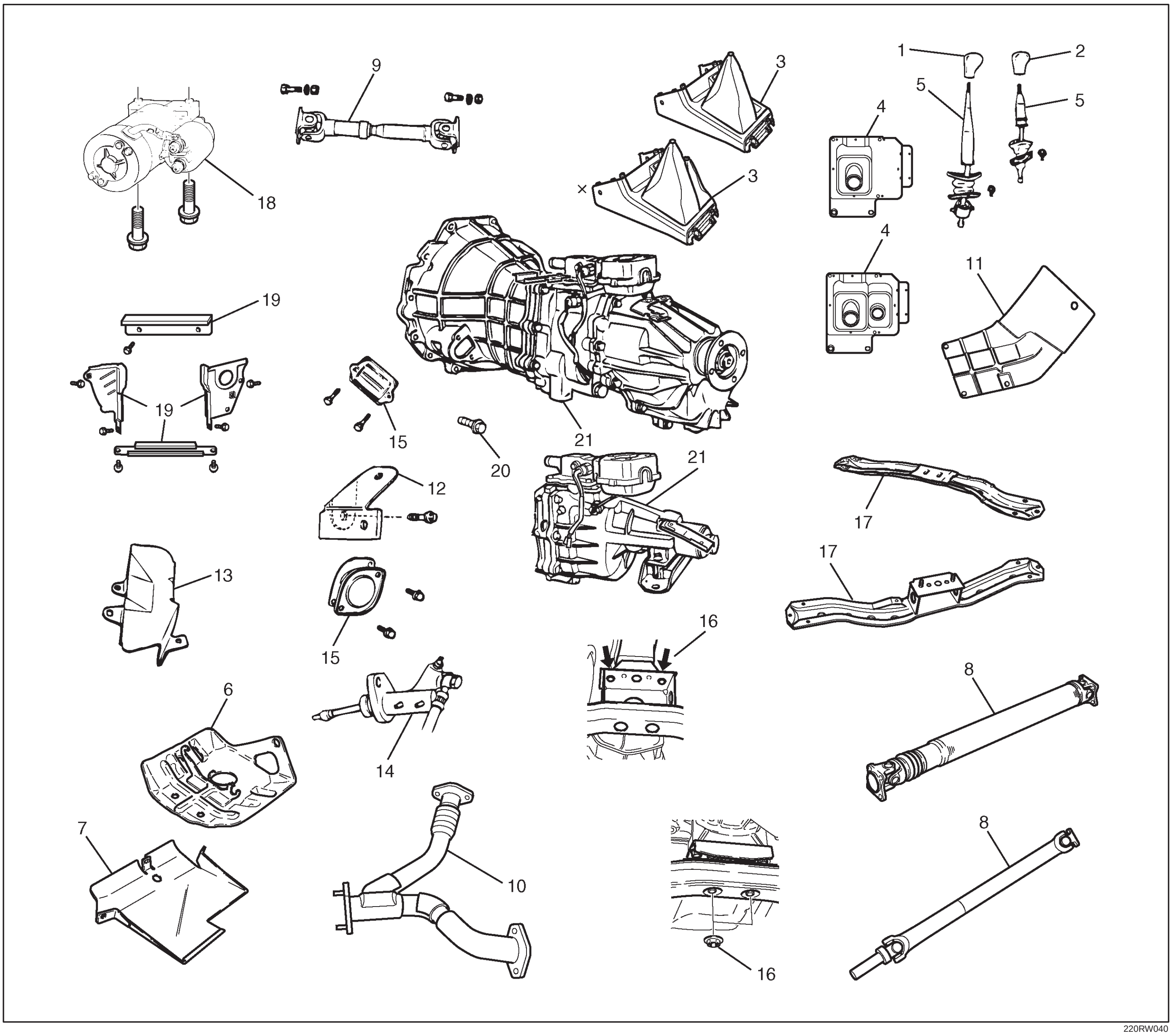
2. Insert the splined yoke into the transmission mainshaft spline.
3. Install the propeller shaft flange yoke to the drive pinion flange.

Torque: 63 N·m (46 lb ft)

4. Check transmission fluid level.
5. Lower vehicle.

Transmission

Disassembled View



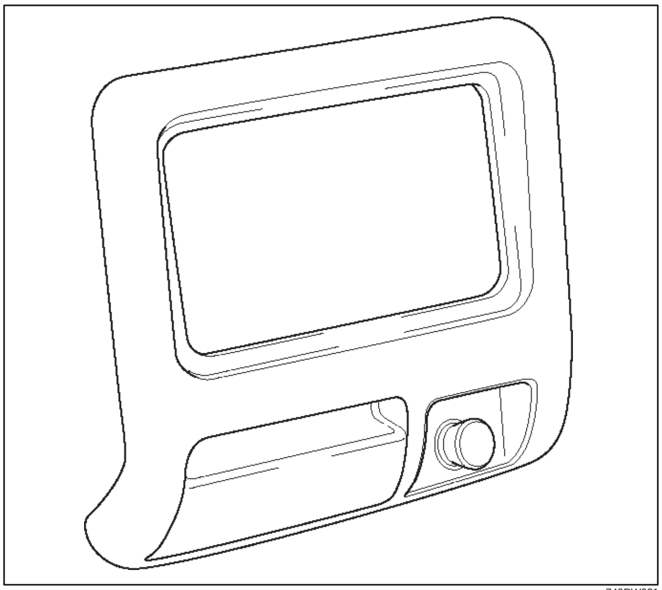
Legend

(1) Gear Control Lever Knob
(2) Transfer Control Lever Knob
(3) Center Console
(4) Grommet Assembly
(5) Gear Control Lever and Transfer Control Lever
(6) Transfer Protector
(7) Fairing Plate
(8) Rear Propeller Shaft
(9) Front Propeller Shaft
(10) Center Exhaust Pipe
(11) Fuel Pipe Heat Protector
(12) Harness Clamp
(13) Harness Heat Protector
(14) Slave Cylinder
(15) Dust Cover
(16) Rear Mount Nut
(17) Third Crossmember
(18) Starter
(19) Flywheel Undercover
(20) Transmission Retaining Nut and Bolt
(21) Transmission

Removal

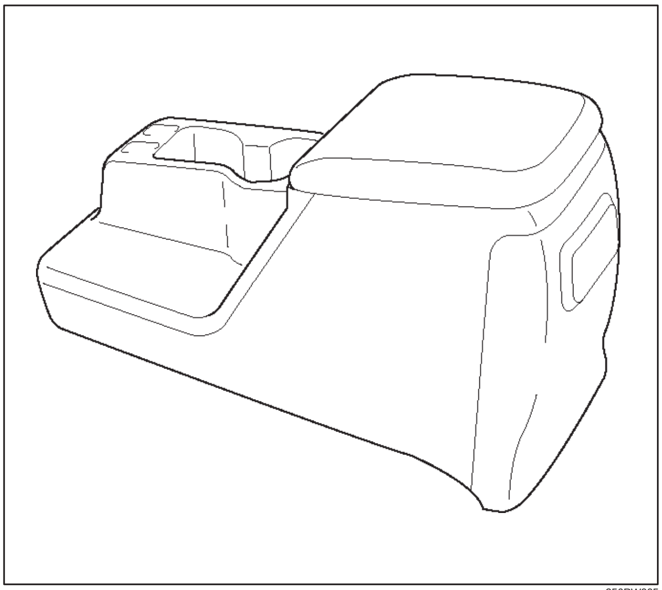
NOTE: Befor removing transmission assembly(4X4) from vehicle, change the transfar mode to 2WD using the 4WD push button on dash panel.

1. Disconnect battery ground cable.
2. Remove gear control lever knob(1).
3. Remove transfer control lever knob(2) (4X4).
4. Remove lower cluster assembly.



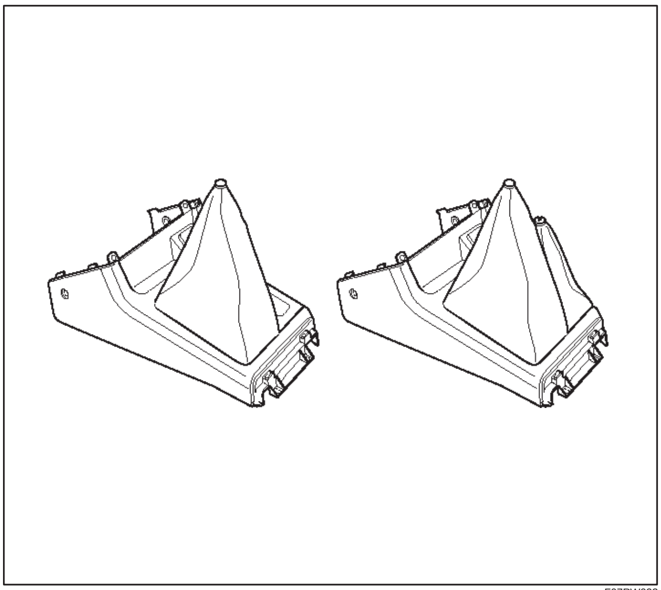
740RW021

5. Remove rear console.



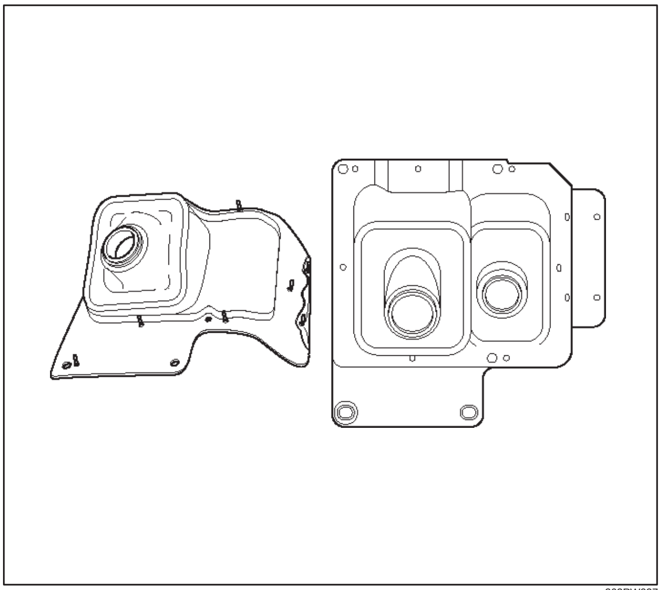
256RW005

6. Remove center console(3).



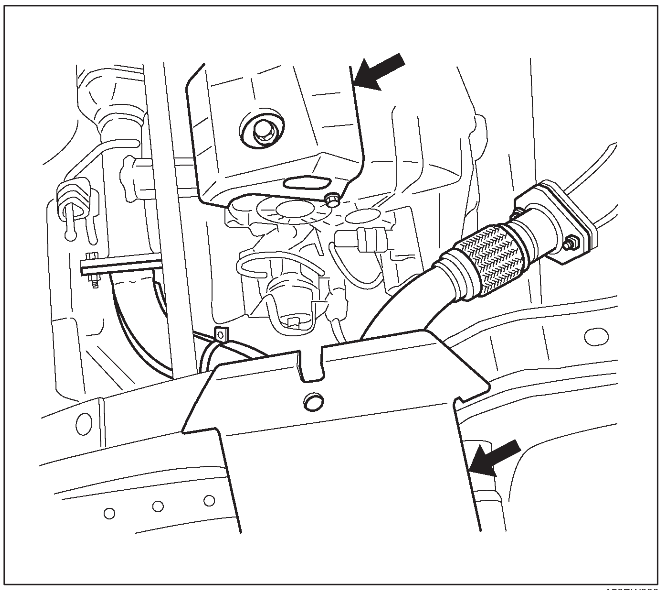
F07RW023

7. Remove grommet assembly(4).



262RW027

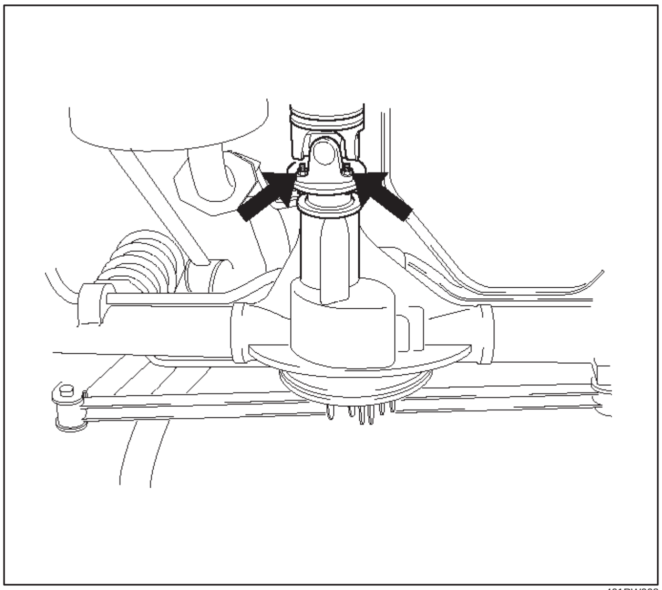
8. Remove gear control lever(5) and transfer control lever(5) (4X4).
9. Raise and support vehicle with suitable stands.
   Remove transfer protector(6) (4X4) and fairing plate(7).



150RW006

10. Remove rear propeller shaft(8).

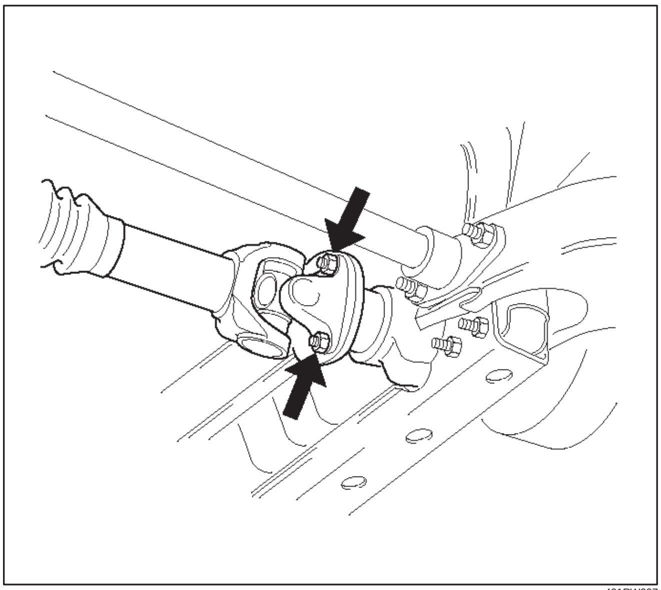
NOTE: Apply alignment marks on the flange at both front and rear sides.



401RW008

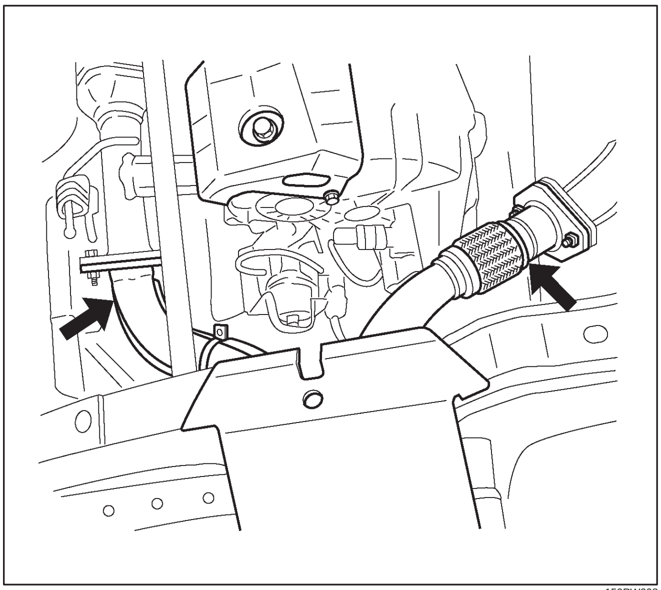
11. Remove front propeller shaft(9) (4X4).

NOTE: Apply alignment marks on the flange at both front and rear sides.



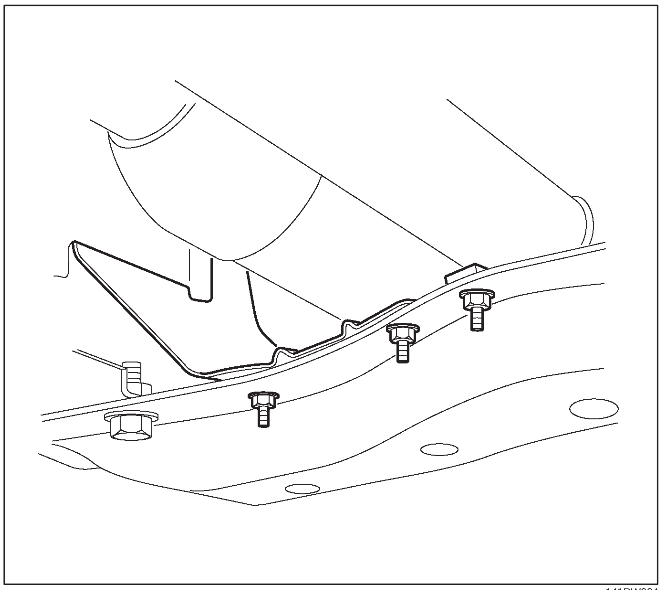
401RW007

12. Remove center exhaust pipe(10) (6VD1 engine).



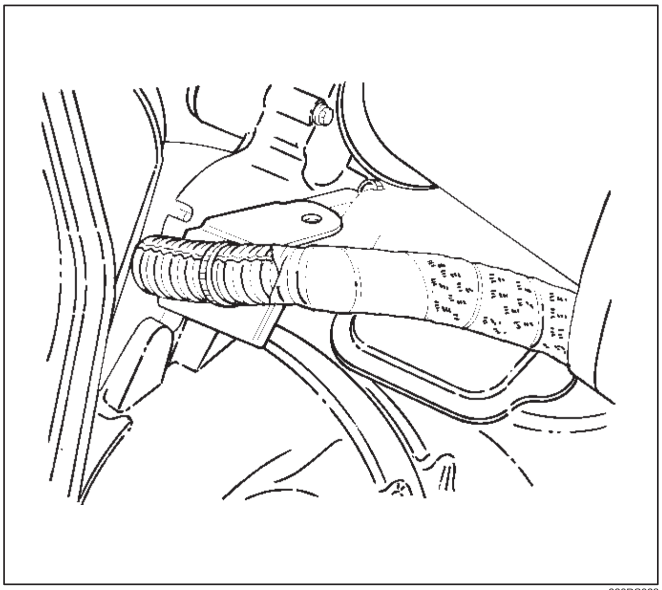
150RW008

13. Remove fuel pipe heat protector(11) and clip.



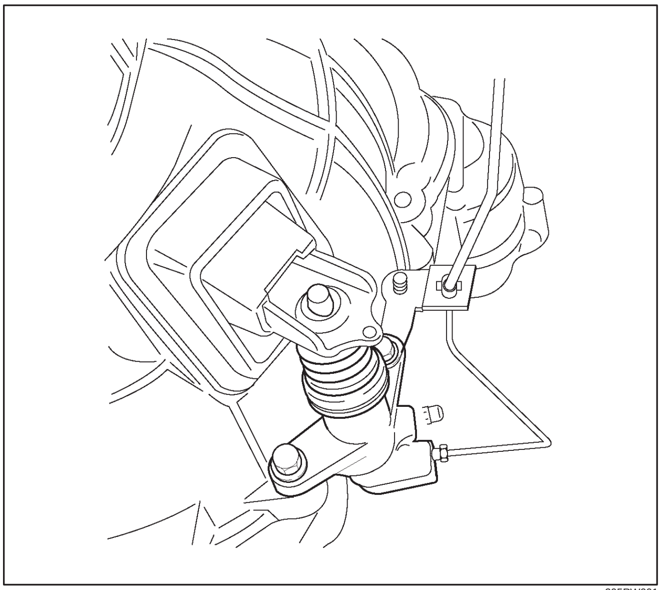
141RW004

14. Disconnect transmission harness connectors and clip.
    Connector: Transfer switch (4X4), 2–4 actuator (4X4), speed sensor, back up switch 1–2 and 3–4 indicator switch.
15. Remove transmission harness clamps(12) from the transmission case and bracket.



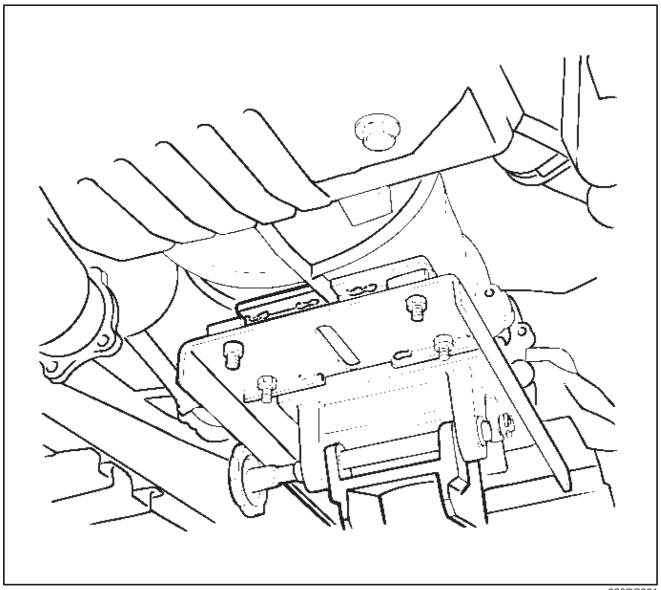
220RS028

16. Remove harness heat protector(13) (6VD1 engine).
17. Remove slave cylinder(14) and flexible hose fixing bracket (X22SE engine).



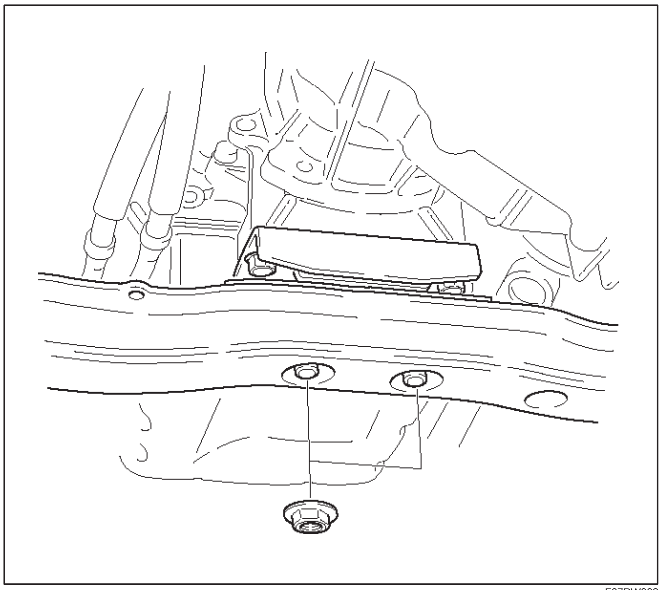
205RW001

18. Remove dust covers(15) (6VD1 engine).
19. Support transmission with a transmission jack.

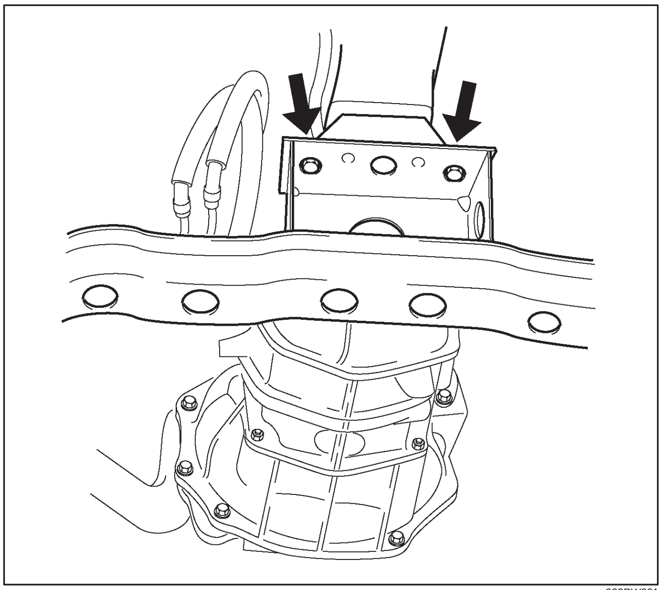


220RS001

20. Remove engine rear mount nuts(16) from third crossmember.

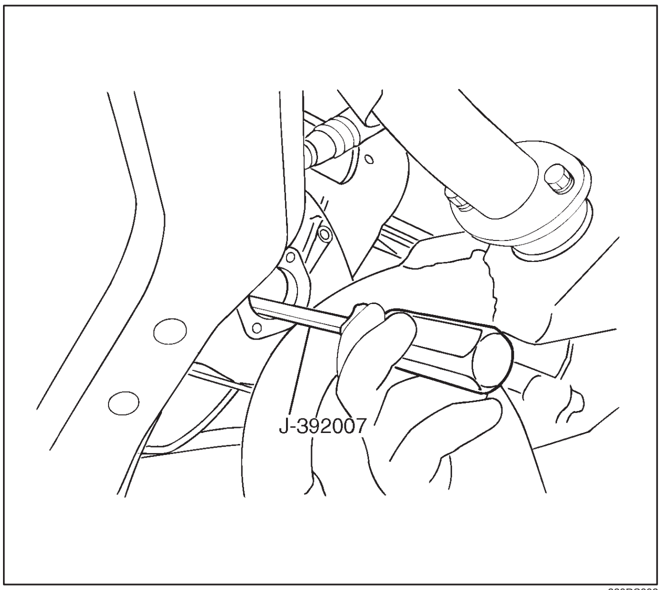


F07RW008



022RW001

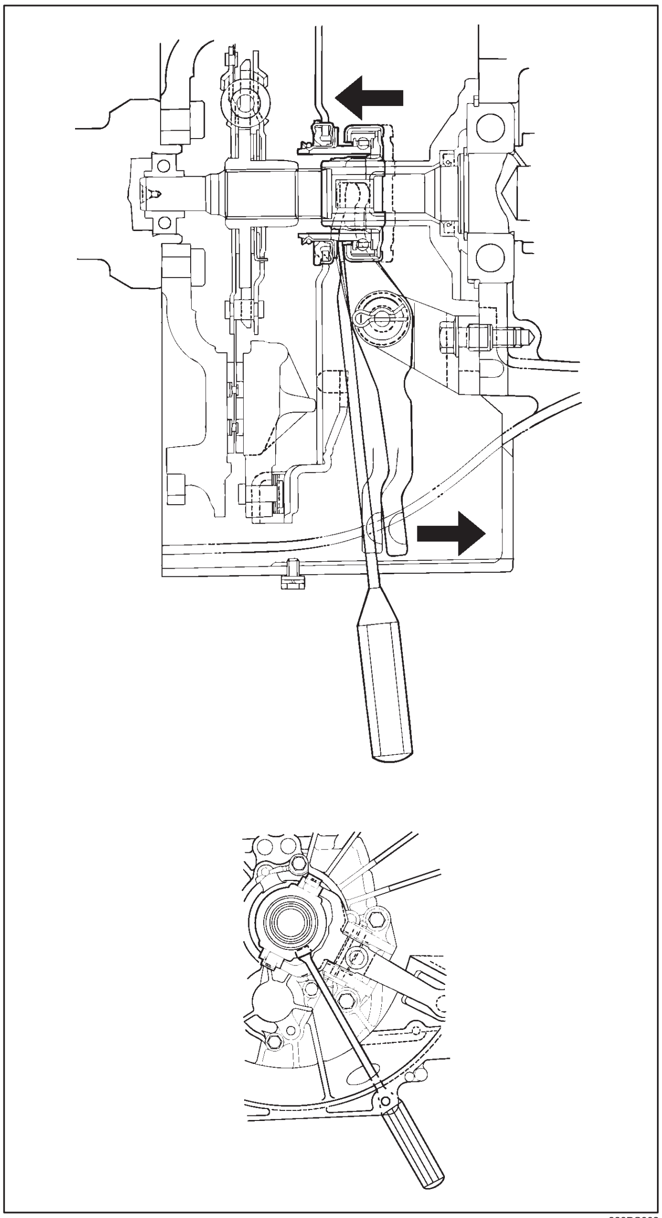
21. Remove third crossmember(17) by removing six fixing bolts.
22. Remove starter(18) (6VD1 engine).
23. Remove flywheel under cover(19). 6VD1 engine:3 pieces, X22SE engine:1 piece.
24. Use clutch release bearing remover J–39207 to disconnect the clutch release bearing from the clutch pressure plate (6VD1 engine).



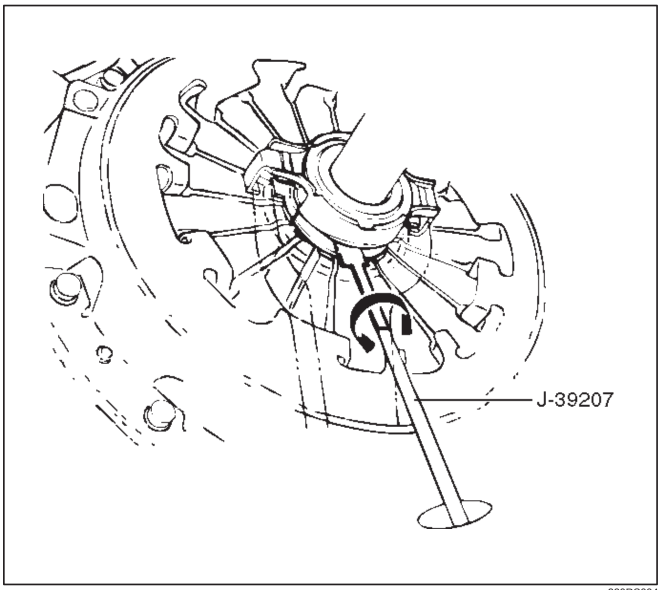
220RS002

25. Pull the shift fork toward the transmission to press the clutch release bearing against the clutch (6VD1 engine).
26. Insert the clutch release bearing remover between the wedge collar and the release bearing (6VD1 engine).

NOTE: Be sure not to insert the remover between the wedge collar and the clutch.


220RS003

27. Turn the remover to separate the release bearing (6VD1 engine).

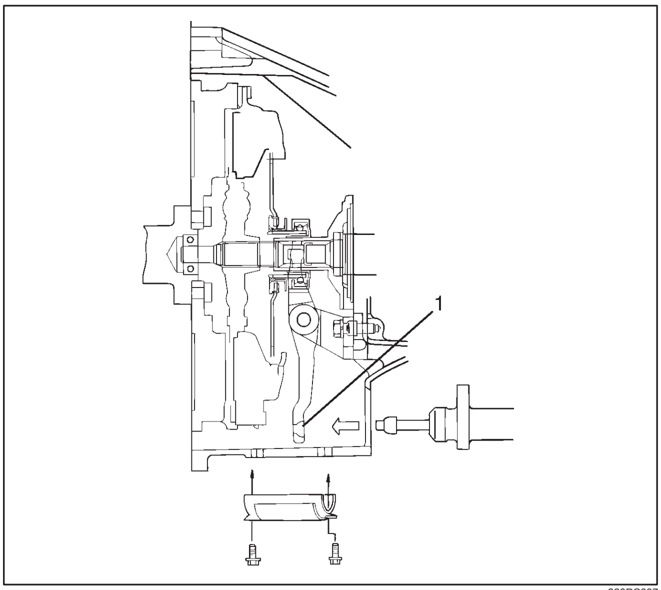


220RS004

28. Remove transmission retaining nuts and bolts(20). Remove transmission(21) from the vehicle.

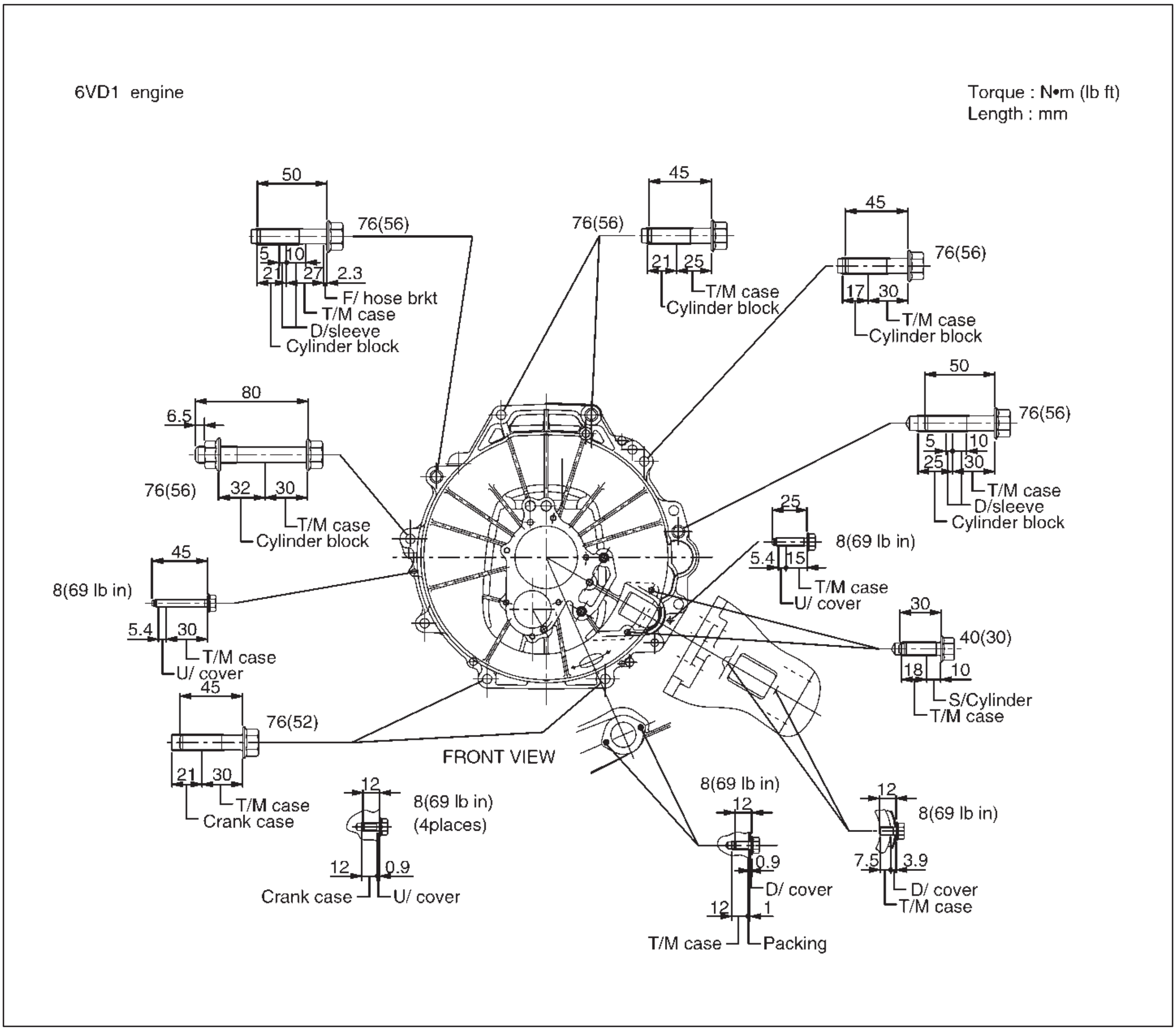
Installation

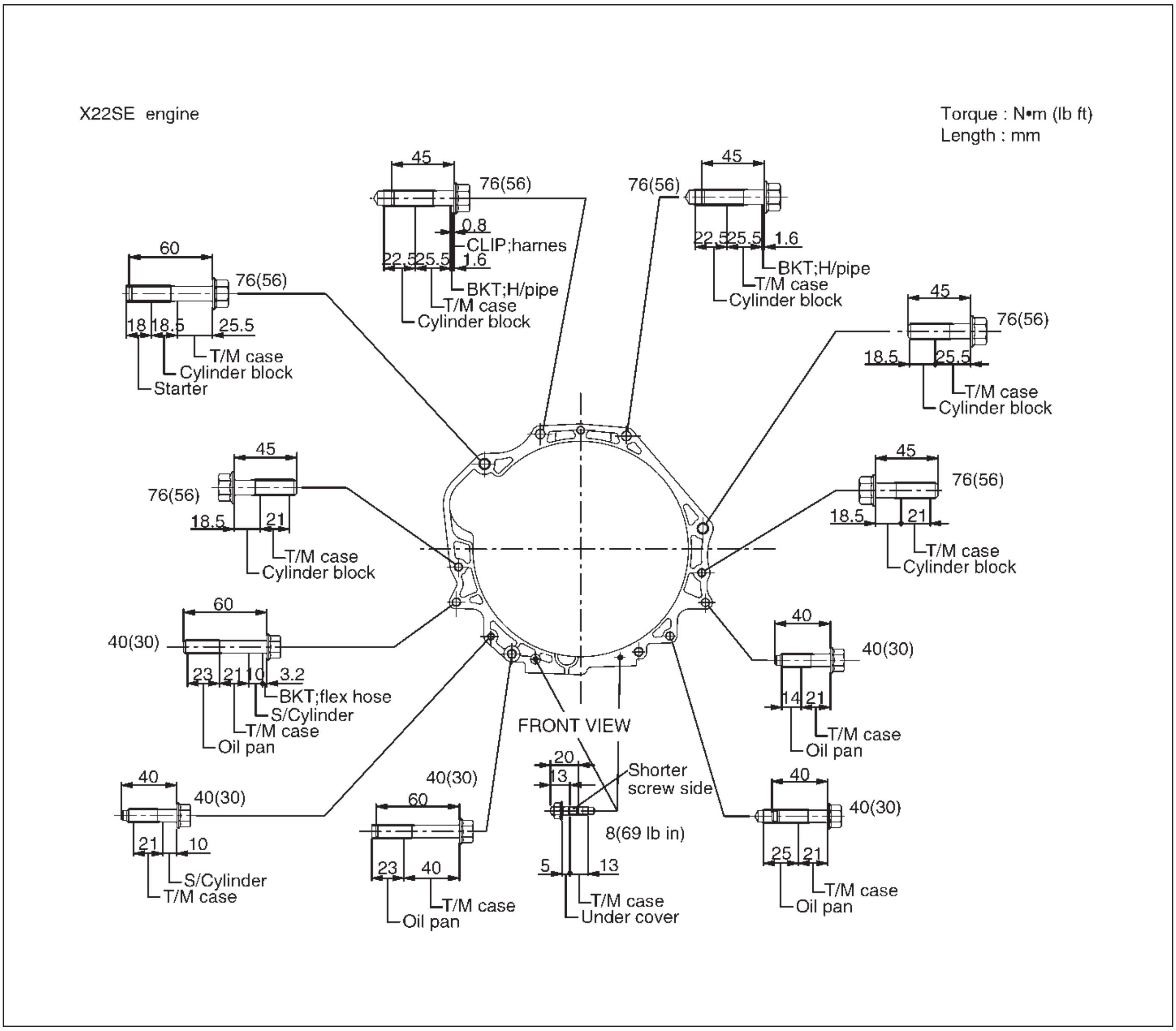
1. Apply a thin coat of molybdenum disulfide grease to the top gear shaft spline.
2. Slowly operate the transmission jack until the front of transmission is aligned with the rear of the engine. The slope of the engine and the transmission must be the same.
3. Align the top gear shaft spline with the clutch driven plate spline.



220RS007

4. Install the transmission to the engine.
   Tighten the transmission nuts and bolts as shown in the figure.

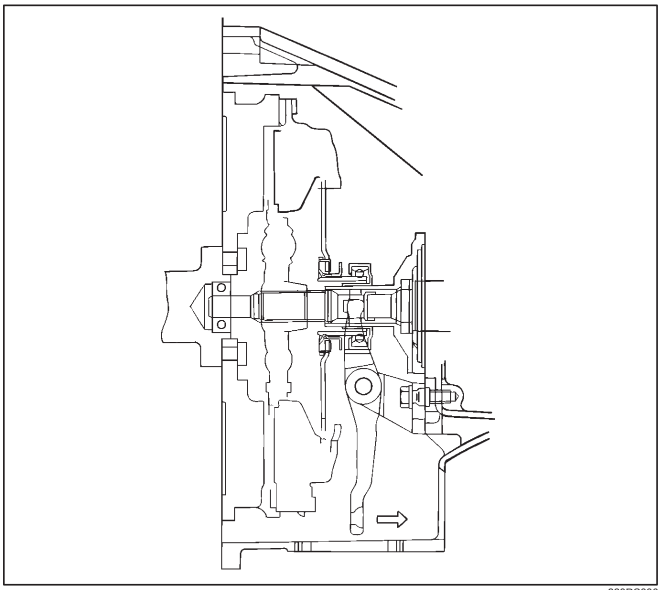




5. Apply a force of 59 – 78 N (13.2 – 17.6 lb) to the tip of the shift fork in the direction of the transmission to engage the clutch pressure plate and release bearing.

NOTE: A click sound is heard when the release bearing and the tip of the diaphragm spring engage each other.

Check to see if they are securely engaged by pushing the tip of the shift fork toward the engine side while applying a force of about 25 N (5.5 lb). If the shift fork will not move, then they are securely engaged.


220RS006

6. Install flywheel under cover(19). 6VD1 engine 3 pieces, HEC engine 1 piece.

Torque: 8 N·m (69 lb in)

7. Install starter(18).

Torque: 40 N·m (30 lb ft)

8. Install third crossmember(17).

Torque: 50 N·m (37 lb ft)

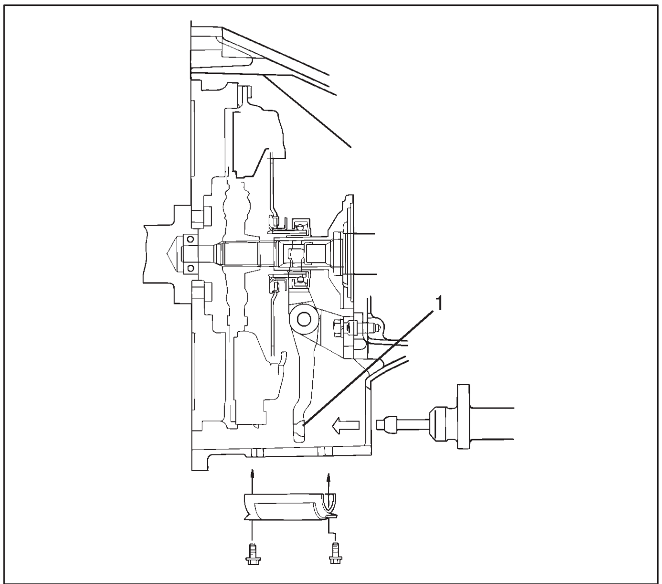
9. Install engine rear mount nuts(16).

Torque: 40 N·m (30 lb ft)

Remove the transmission jack from transmission side.

10. Apply grease to top hole portion of the shift fork.
Install slave cylinder(14) and flexible hose fixing bracket (X22SE engine).

Torque: 43 N·m (32 lb ft)



220RS007

Legend

(1) Apply Grease

11. Install clutch dust covers(15) to clutch housing (6VD1 engine).

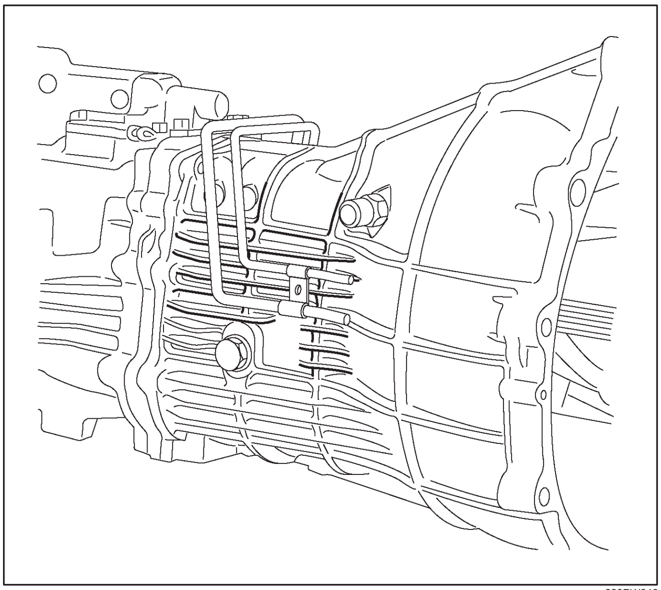
Torque: 6 N·m (52 lb in)

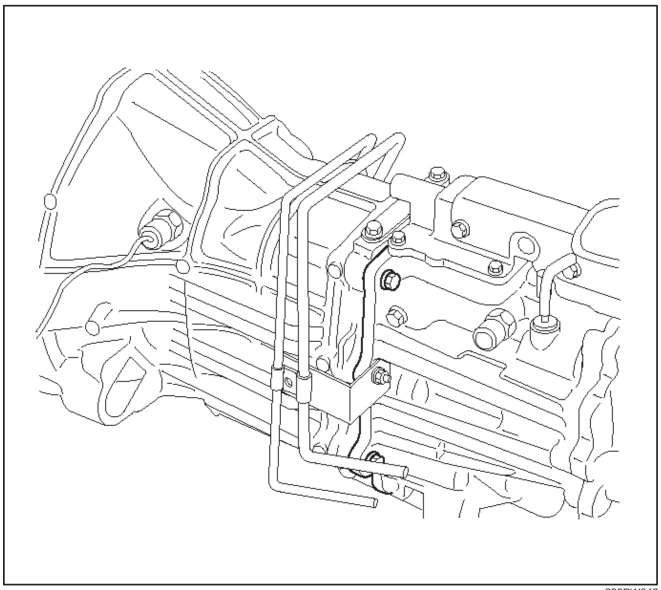
12. Connect transmission harness connectors and clip.
Connector: transfer switch (4X4), 2–4 actuator (4X4), car speed sensor, 1–2 and 3–4 indicator switch.

13. Install bracket and transmission harness clamps(12) to the transmission case.

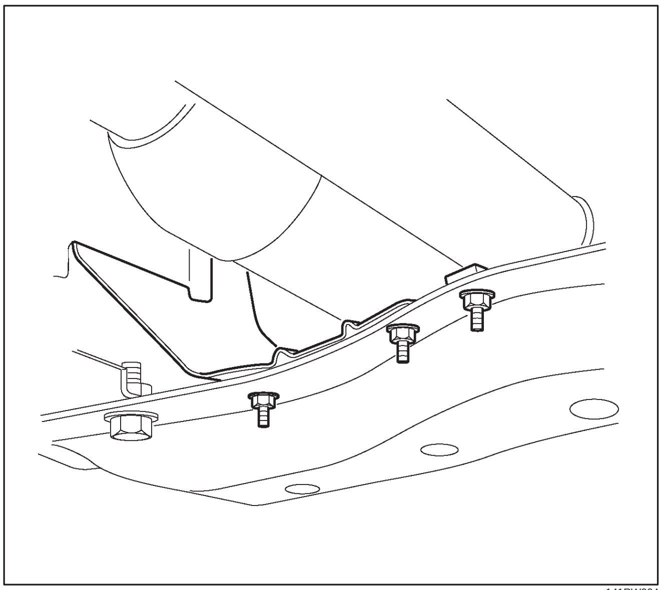
14. Install harness heat protector(13) (6VD1 engine).

15. Connect fuel pipe to transmission side.


220RW046


220RW047

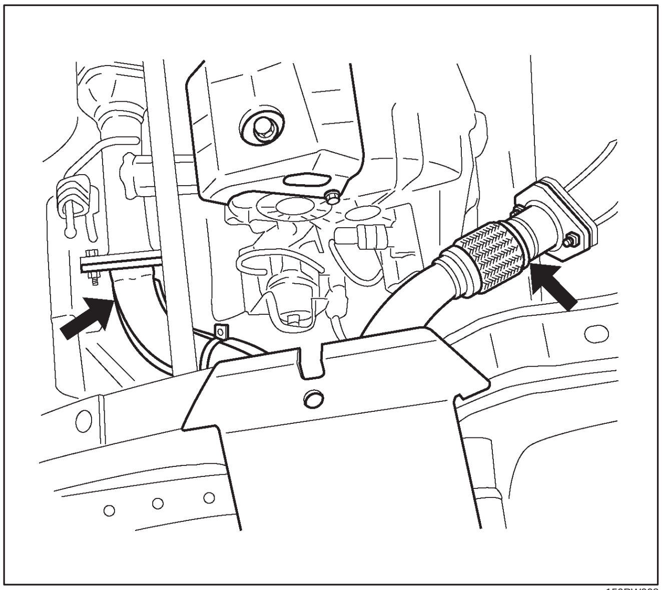
16. Install fuel pipe heat protector(11) and clip.



141RW004

17. Install center exhaust pipe(10) (6VD1 engine).

Torque: 43 N·m (32 lb ft)

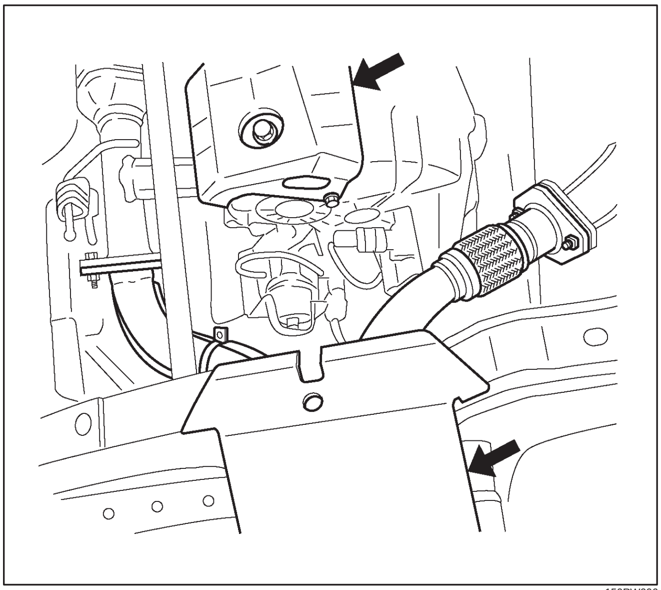


150RW008

18. Install front(9) (4X4) and rear propeller shaft(8).

Torque: 63 N·m (46 lb ft)

19. Install transfer protector(6) (4X4) and fairing plate(7). Lower the vehicle.

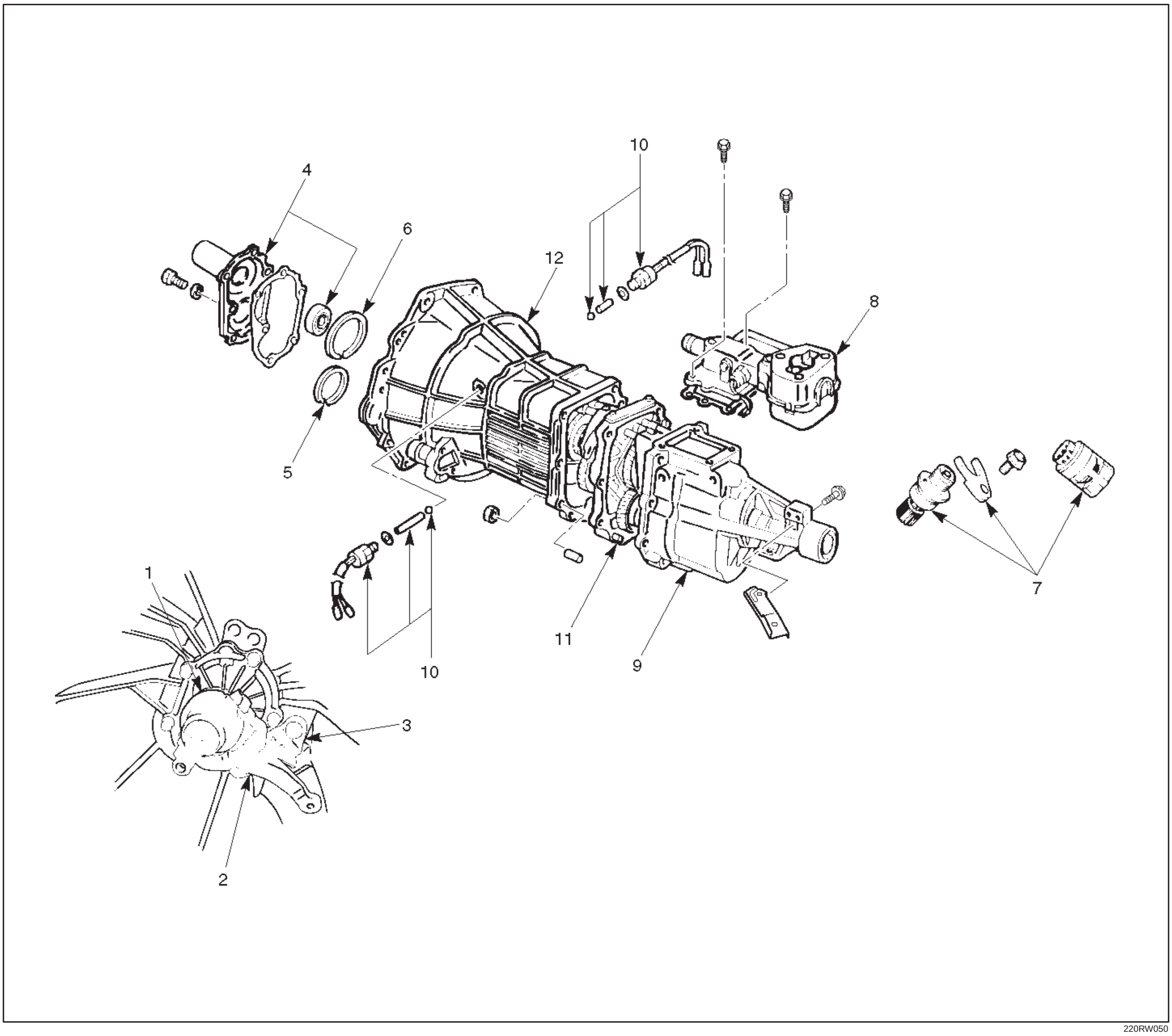


150RW006

20. Install gear control lever(5) and transfer control lever(5) (4X4).
21. Install grommet assembly(4).
22. Install center console(3), rear console and lower cluster assembly.
23. Install transfer control lever knob(2) (4X4) and gear control lever knob(1).
24. Connect battery ground cable.

Transmission Case

Major Component (4X2)

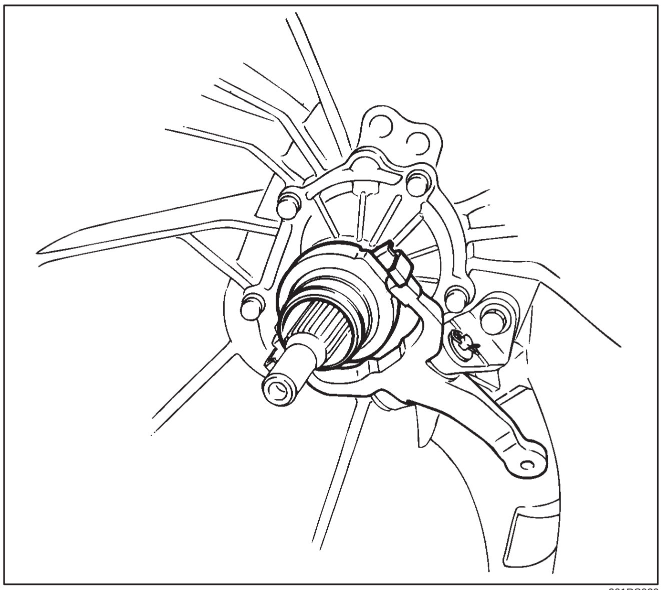


Legend

(1) Clutch Release Bearing
(2) Shift Fork
(3) Fulcrum Bridge
(4) Front Cover (with Oil Seal)
(5) Counter Front Bearing Snap Ring
(6) Top Gear Bearing Snap Rring
(7) Speedometer Sensor and Speedometer Driven Gear
(8) Gear Control Box Assembly
(9) Rear Cover with Oil Seal
(10) 1–2 and 3–4 Indicator Switch, Pin, and Ball
(11) Intermediate Plate with Gear Assembly
(12) Transmission Case

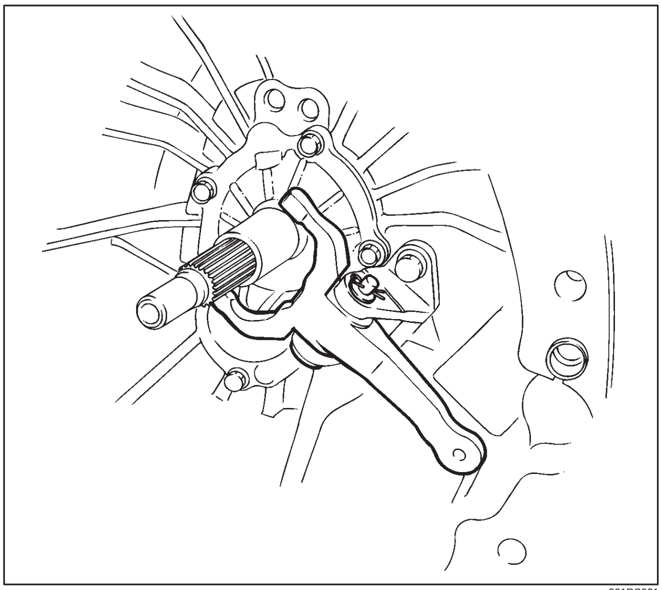
Disassembly

1. Clean the exterior of the unit with solvent.
2. Remove the drain plug from the transmission case and drain the lubricant.
3. Remove the clutch release bearing(1) from the transmission case.



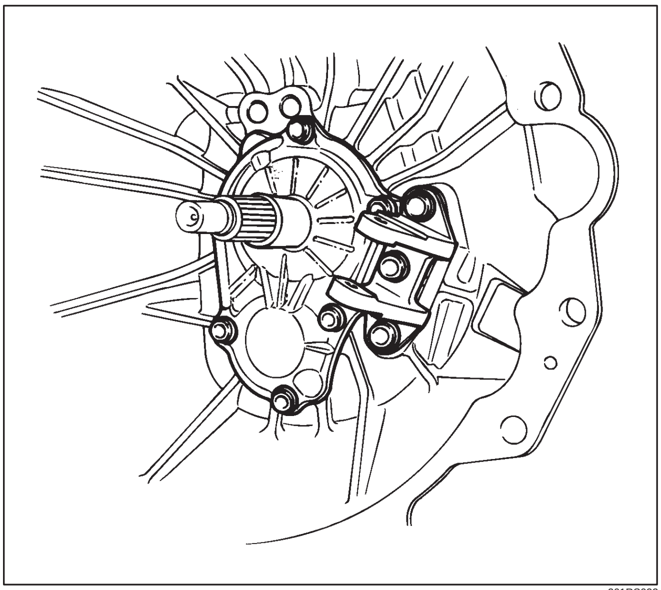
201RS020

4. Remove the snap pin.
   Remove the shift fork pin and shift fork(2) from the fulcrum bridge.



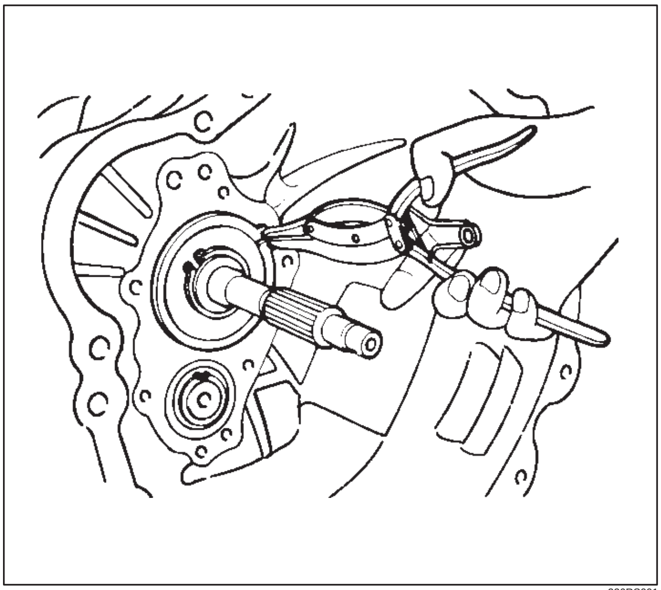
201RS021

5. Remove the fulcrum bridge bolts.
   Remove the fulcrum bridge(3) from the transmission case.
   Remove the front cover(4) and gasket from the transmission case.



201RS022

6. Remove snap ring(5) fixing counter front bearing.
7. Use a pair of snap ring pliers to remove the snap ring(6) fixing top gear bearing.



226RS001

8. Remove the speedometer sensor(7).
   Remove the plate(7).
   Remove the driven gear bushing and driven gear(7).

NOTE: Apply a reference mark to the driven gear bushing before removal.

9. Remove gear control box assembly(8).
10. Remove the rear cover assembly from the transmission case.
11. Remove 1–2 and 3–4 indicator switch(10), pin(10) and ball(10).
    Remove intermediate plate with gear assembly(11) from transmission case(12).

Reassembly

1. Apply recommended liquid gasket (LOCTITE 17430) or its equivalent to the transmission case(12), intermediate plate(11) and rear cover(9) fitting surfaces.
2. Install the intermediate plate with gear assembly(11) to the transmission case(12).
   Pull out the top gear shaft until the ball bearing snap ring groove protrudes from the transmission case front cover fitting face.
   Avoid subjecting the mainshaft to sudden shock or stress.
3. Tighten the transmission rear cover bolts to the specified torque.

   Torque: 37 N·m (27 lb ft)

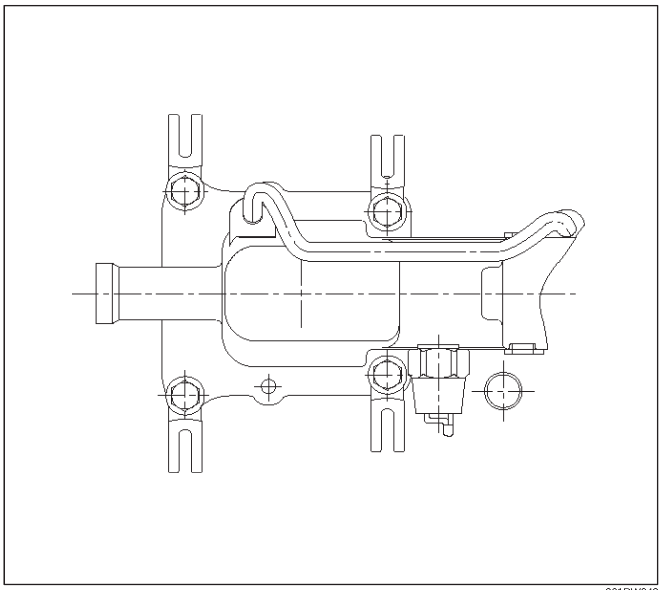
NOTE:

Notes When Tightening the Bolt:

- After cleaning the bolt hole, dry it thoroughly with air.
- After cleaning the screw face of a removed bolt or new one, dry it thoroughly. Apply recommended liquid gasket (LOCTITE 242) or its equivalent before tightening it.

4. Install a new gasket and gear control box assembly(8).
   Install the harness clips and brackets and then tighten four new gear control box bolts to the specified torque.

   Torque: 20 N·m (14 lb ft)



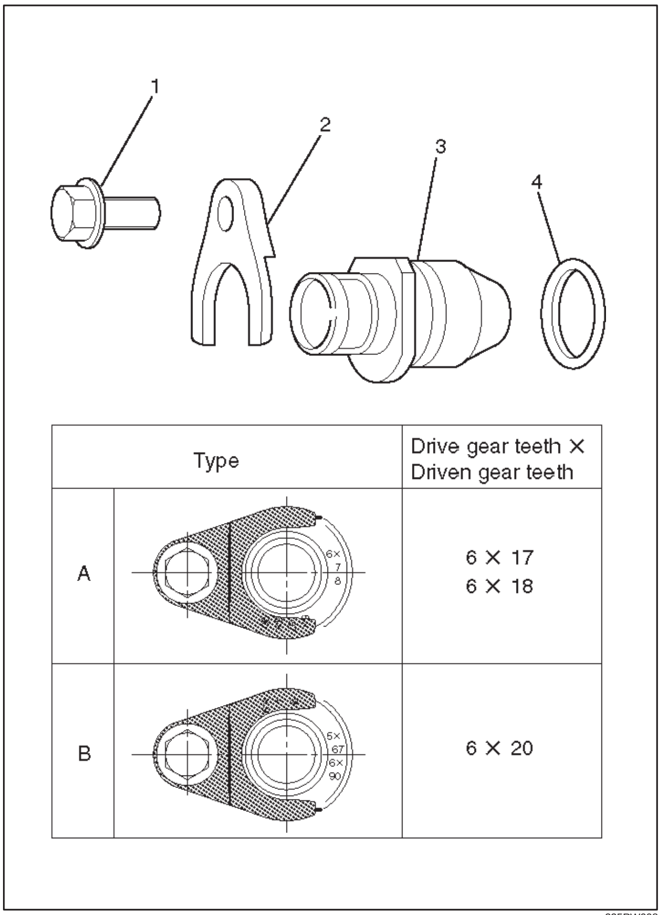
261RW043

5. Install the O-ring(4) to the speedometer driven gear bushing(3).
   Install the driven gear to the speedometer driven gear bushing(3).
6. Install the speedometer driven gear assembly(7) to the transmission rear cover(9).
   Install the plate(1) to the transmission rear cover(9).

   Torque: 15 N·m (11 lb ft)

7. Install the speedometer sensor(7).

   Torque: 27 N·m (20 lb ft)



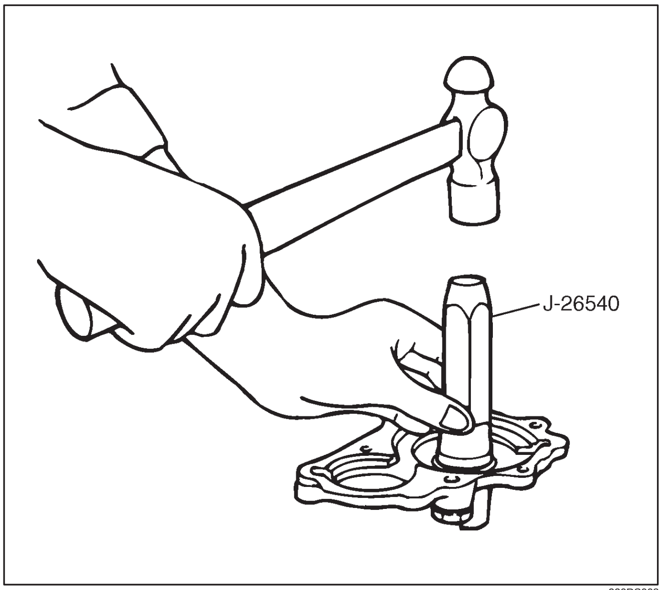
Type		Drive gear teeth × Driven gear teeth
A		6 × 17 6 × 18
B		6 × 20

225RW008

8. Install top gear bearing snap ring(6) and counter front bearing snap ring(5).
   - Use a pair of snap ring pliers to install the snap rings to the mainshaft and countershaft.
   - The snap rings must be fully inserted into the bearing snap ring groove.
9. Install front cover (with oil seal) (4).

Front Cover Oil Seal Replacement

- Remove the oil seal from the front cover.
- Apply engine oil to a new oil seal outer circumference.
- Apply recommended grease to the oil seal lip.
- Use the oil seal installer J–26540 to install the oil seal to the front cover.



220RS008

10. Install a new packing and front cover(4) to the transmission case.

NOTE: Take care not to damage the oil seal.

Notes When Tightening the Bolt:

- After cleaning the bolt hole, dry it thoroughly with air.
- After cleaning the screw face of a removed bolt or new one, dry it thoroughly. Apply recommended liquid gasket (LOCTITE 242) or its equivalent before tightening it.

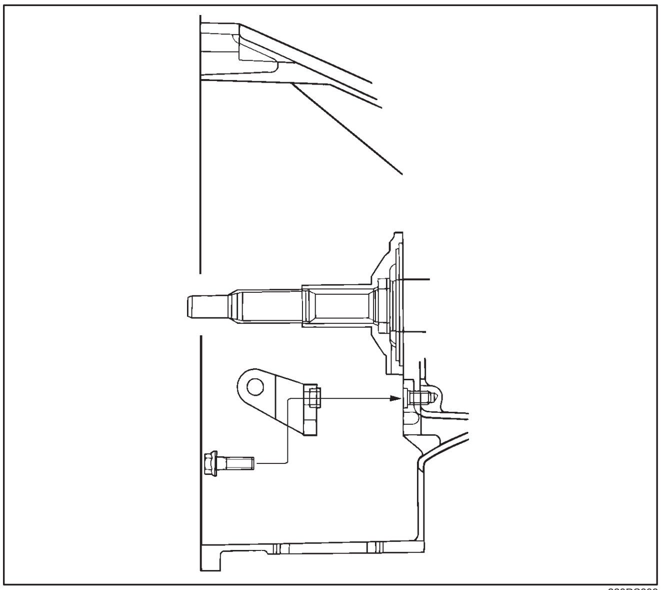
  Tighten six new front cover bolts to the specified torque.

Torque: 25 N·m (18 lb ft)

11. Install the fulcrum bridge(3) to the transmission case.

    Tighten three fulcrum bridge bolts to the specified torque.

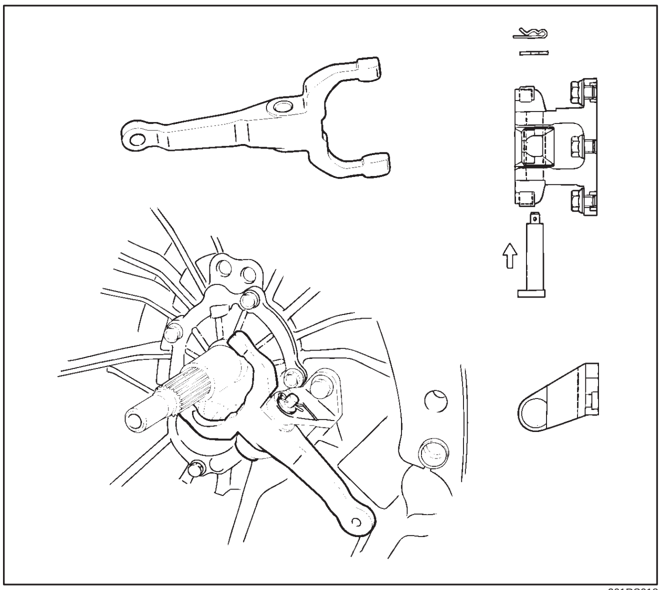
Torque: 38 N·m (28 lb ft)


220RS009

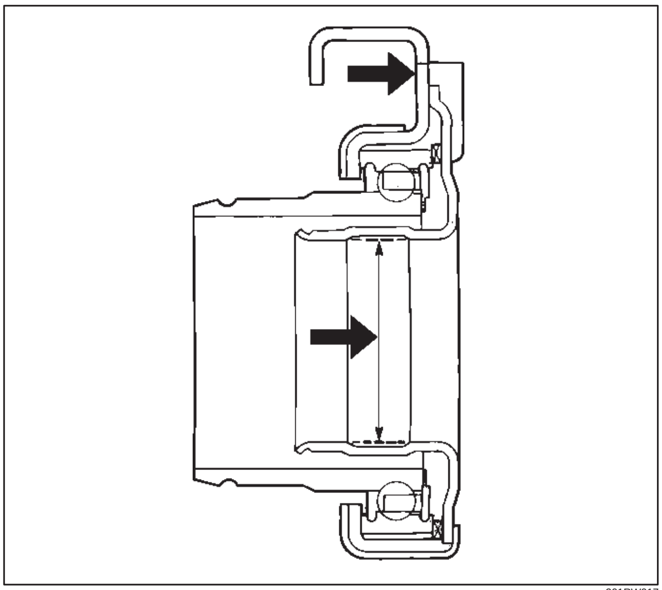
12. Apply grease to the pin hole inner circumferences and thrust surfaces.

    Attach the shift fork(2) to the fulcrum bridge(3) by inserting the shift fork pin from the bottom side of the fulcrum bridge.

    Install the washer and snap pin.


201RS018

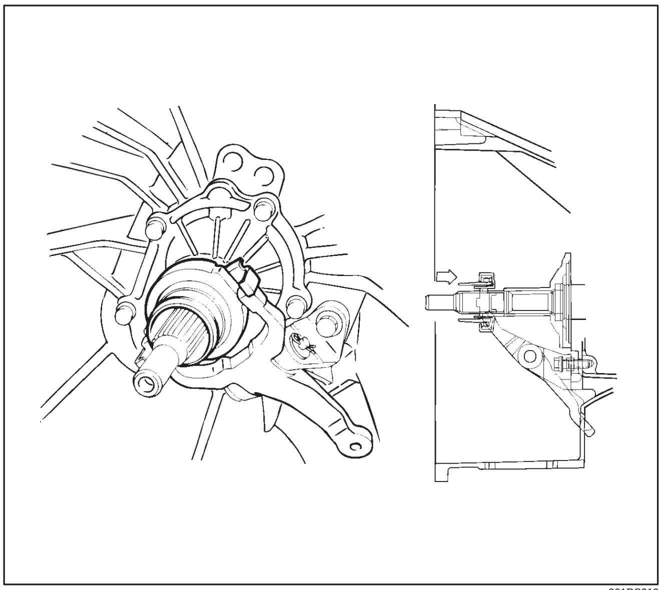
13. Apply grease to the areas as shown in the figure.



201RW017

- Install the release bearing(1) to the shift fork(2) in the proper direction.

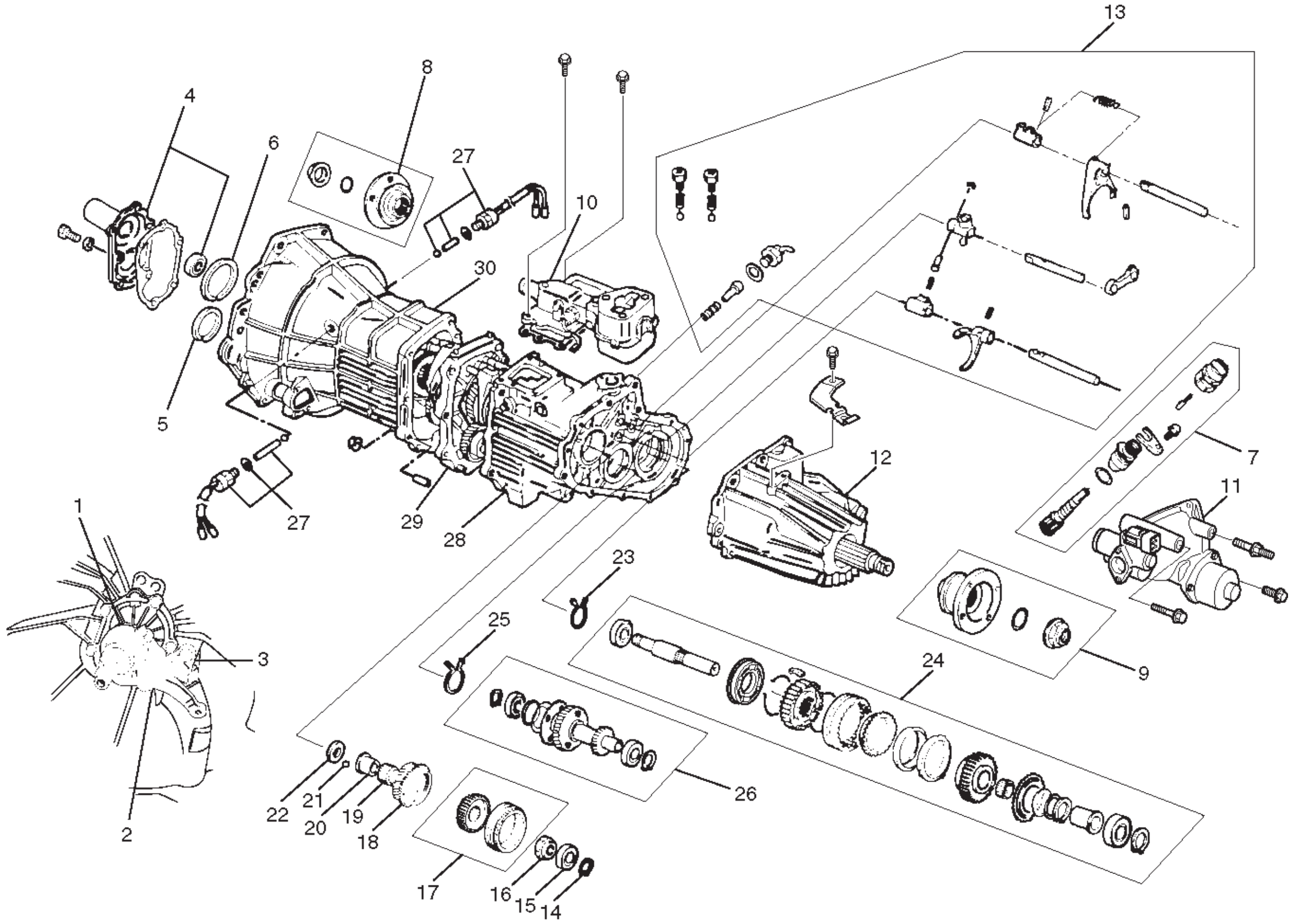
NOTE: Ensure release bearing is properly positioned during installation, as shown in the figure.



201RS019

Transmission Case and Transfer Case

Major Component (4X4)



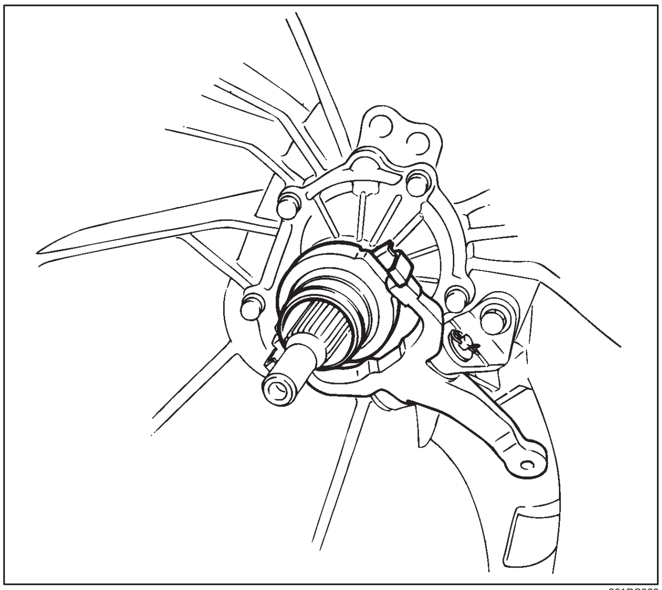
220RW041

Legend

(1) Clutch Release Bearing
(2) Shift Fork
(3) Fulcrum Bridge
(4) Front Cover (with Oil Seal)
(5) Counter Front Bearing Snap Ring
(6) Top Gear Bearing Snap Ring
(7) Speedometer Sensor and Speedometer Driven Gear
(8) Front Companion Flange
(9) Rear Companion Flange
(10) Gear Control Box Assembly
(11) 2WD–4WD Actuator Assembly
(12) Transfer Rear Case Assembly
(13) Detent, Shift Arm, and Interlock Pin
(14) Bearing Snap Ring
(15) Ball Bearing
(16) Lock Nut
(17) High-Low Clutch Hub and Sleeve
(18) Transfer Input Gear
(19) Needle Bearing
(20) Bearing Collar
(21) Ball
(22) Plate
(23) Bearing Snap Ring
(24) Front Output Gear Assembly
(25) Bearing Snap Ring
(26) Counter Gear Assembly
(27) 1–2 and 3–4 Indicator Switch, Pin, and Ball
(28) Transfer Case Assembly
(29) Intermediate Plate with Gear Assembly
(30) Transmission Case

Disassembly

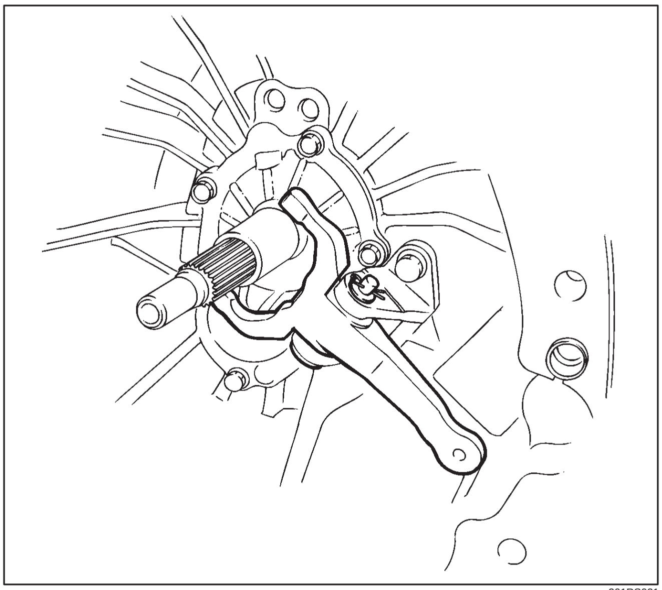
1. Clean the exterior of the unit with solvent.
2. Remove the drain plug from the transmission case and transfer case and drain the lubricant.
3. Remove the clutch release bearing(1) from the transmission case.



201RS020

4. Remove the snap pin.

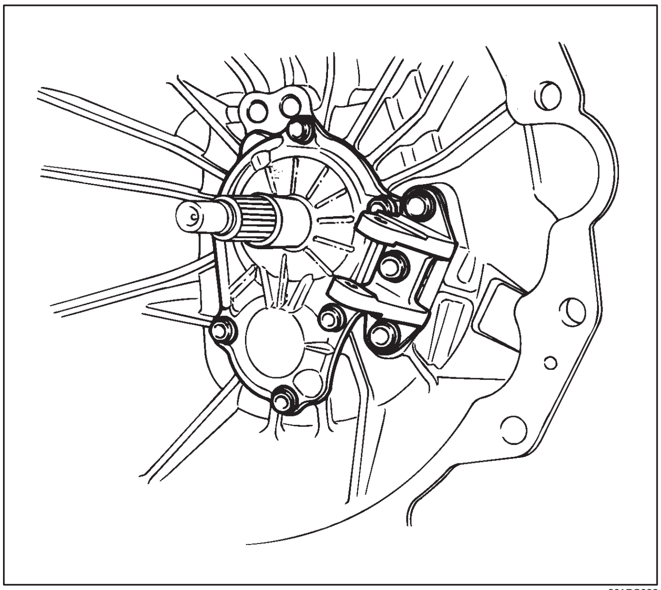
   Remove the shift fork pin and shift fork(2) from the fulcrum bridge(3).



201RS021

5. Remove the fulcrum bridge bolts.
   - Remove the fulcrum bridge(3) from the transmission case.

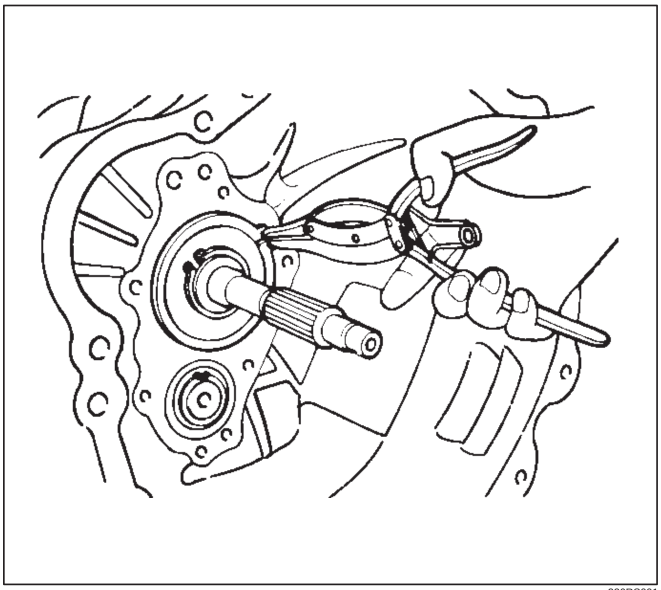
   Remove the front cover(4) and gasket from the transmission case.



201RS022

6. Remove counter front bearing snap ring(5) and top gear bearing snap ring(6).

   Use a pair of snap ring pliers to remove the snap ring.

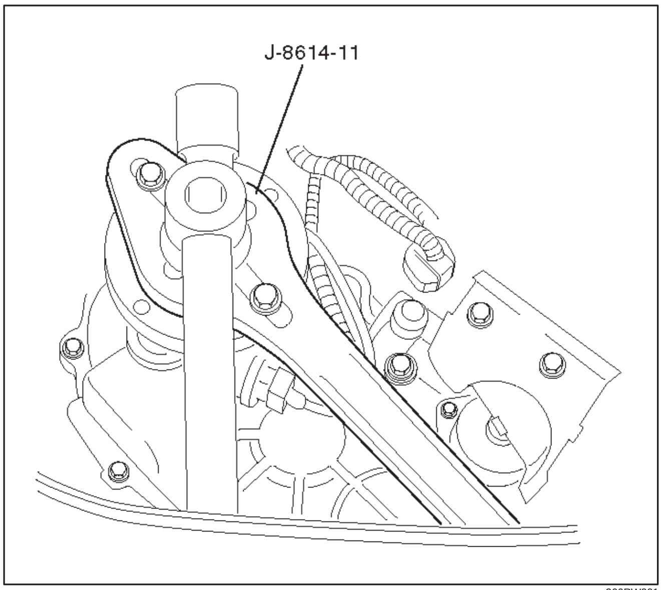


226RS001

7. Remove the speedometer sensor(7).
   Remove the plate(7).
   Remove the driven gear bushing and driven gear(7).

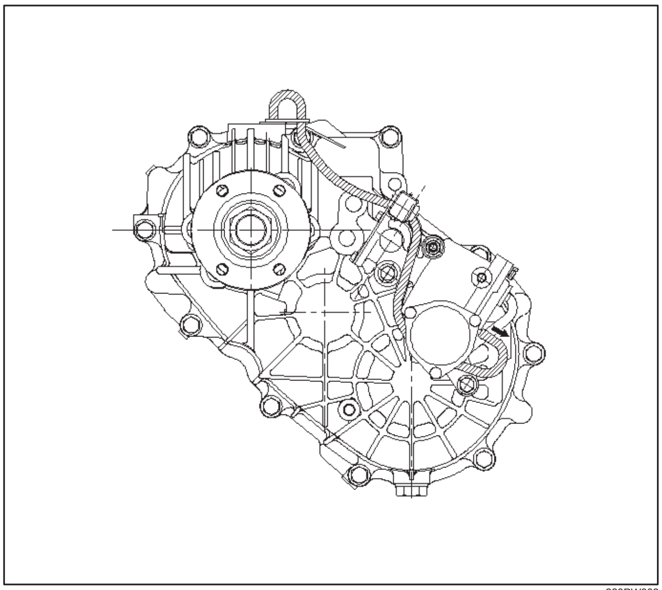
NOTE: Apply a reference mark to the driven gear bushing before removal.

8. Remove front companion flange(8) and rear companion flange(9) using the flange holder J–8614–11 to remove the end nut.



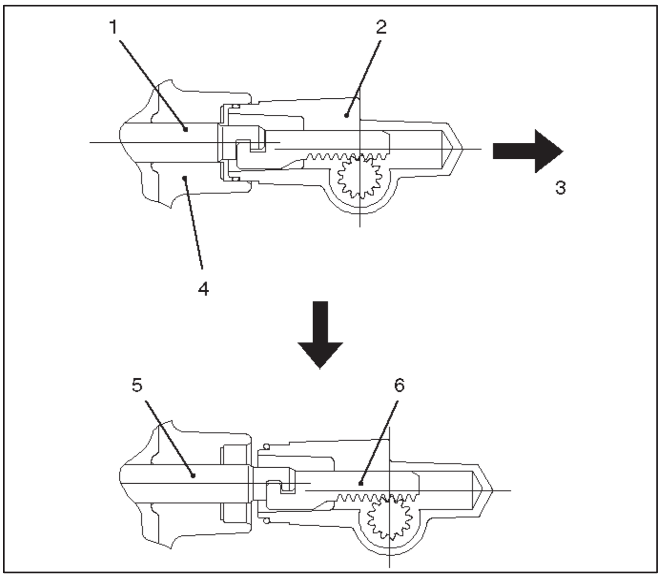
266RW001

9. Disconnect breather hose from transmission and remove gear control box assembly(10).
10. Remove 2WD–4WD actuator assembly(11) by performing the following steps:
    1. Disconnect the actuator breather hose from 2WD–4WD actuator assembly(11).



220RW002

2. Remove the 2WD–4WD actuator assembly bolts.
3. Pull the 2WD–4WD actuator assembly with 2WD–4WD shift rod.

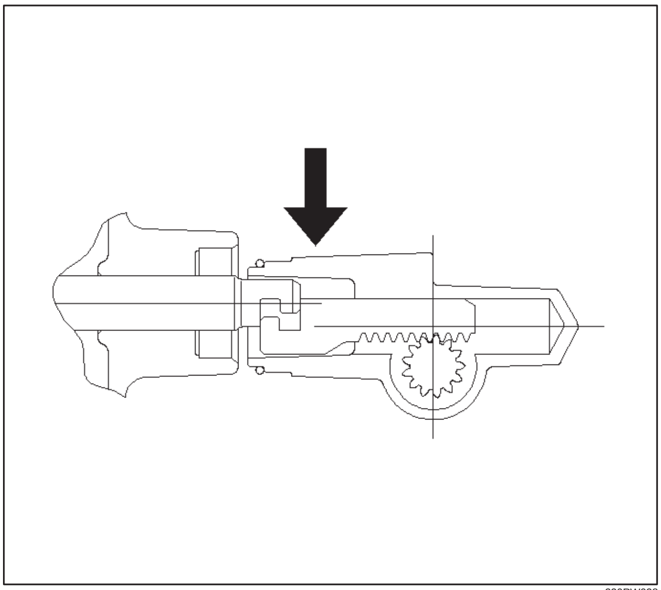


220RW027

Legend

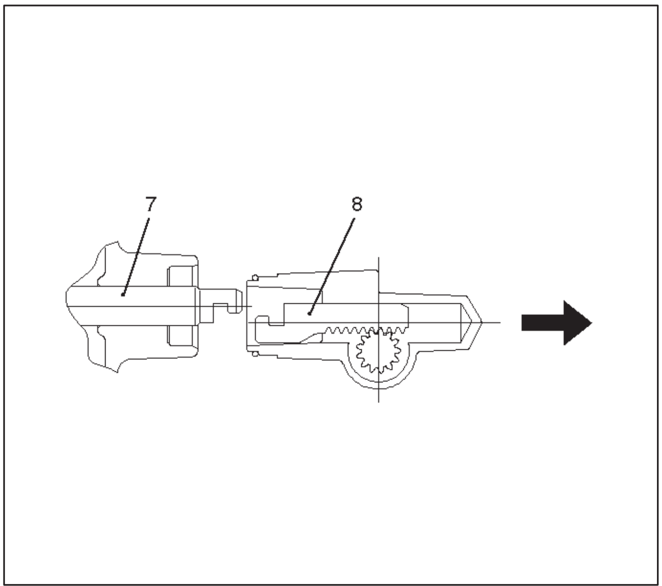
(1) Shift Rod: 2WD–4WD (Position: 2WD)
(2) 2WD–4WD Actuator Assembly
(3) Pull
(4) Rear Case Assembly
(5) Position: 4WD
(6) Position: 2WD

4. Offset the actuator assembly.



220RW028

5. Remove the actuator assembly.



220RW029

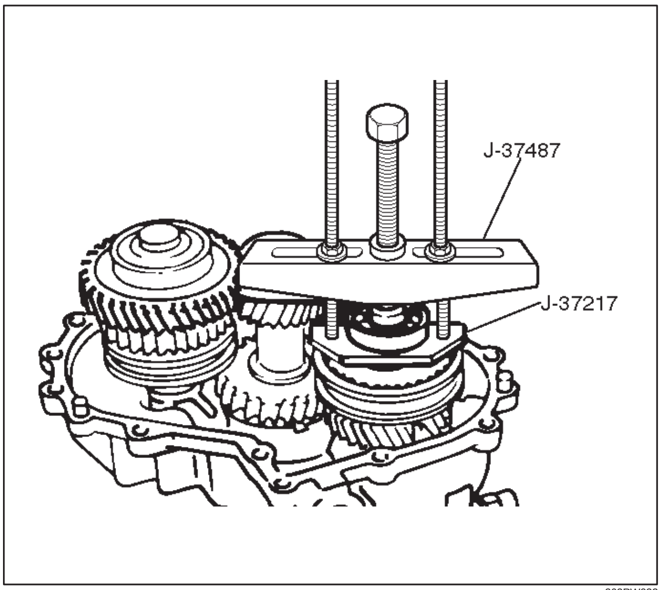
Legend

(7) Position: 4WD

(8) Mode: 2WD

NOTE: Before removing the transmission and transfer assembly from vehicle, change the transfer mode to 2WD using the 4WD push button switch on dash panel.

11. Remove the transfer rear cover assembly(12) from the transfer case(28).
12. Regarding detent, shift arm, and interlock pin(13) disassembly, refer to Detent, Shift Arm, and Interlock Pin in Drive Line/Axle section.
13. Use a pair of snap ring pliers to remove the bearing snap ring(14).
14. Use a bearing remover J–37217 and puller J–37487 to remove the ball bearing(15).

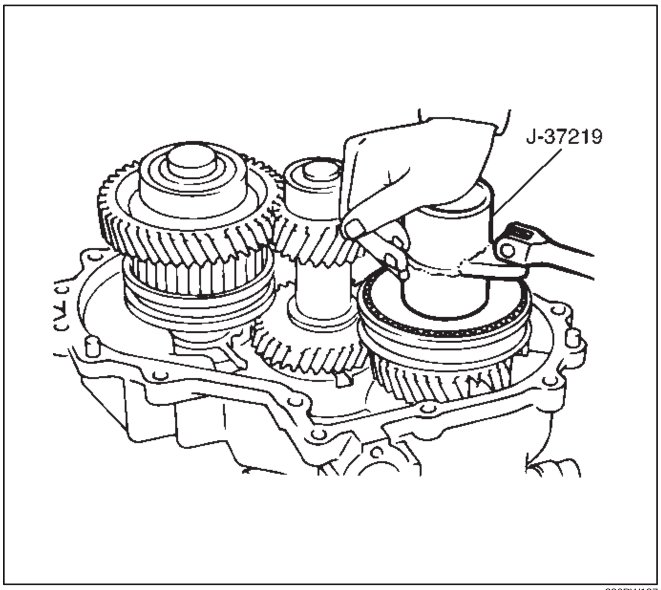


262RW032

15. Install the front companion flange temporarily.

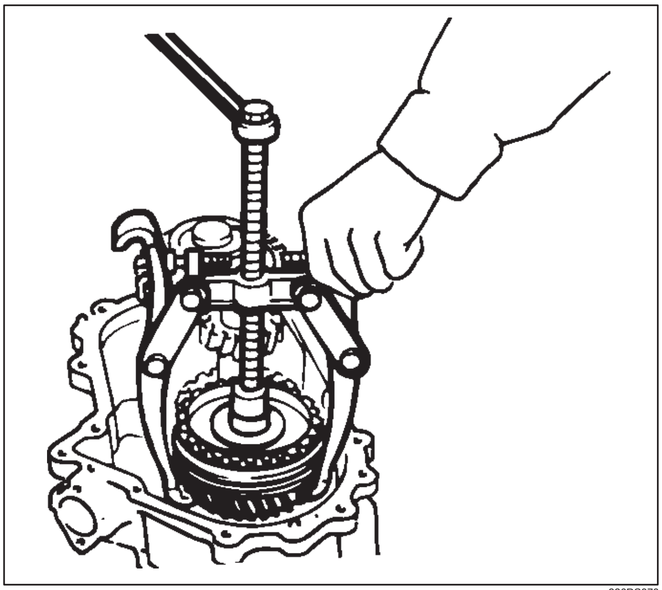
    Use the flange holder J–8614–11 and lock nut wrench J–37219 to remove the lock nut(16).

    Remove the front companion flange.



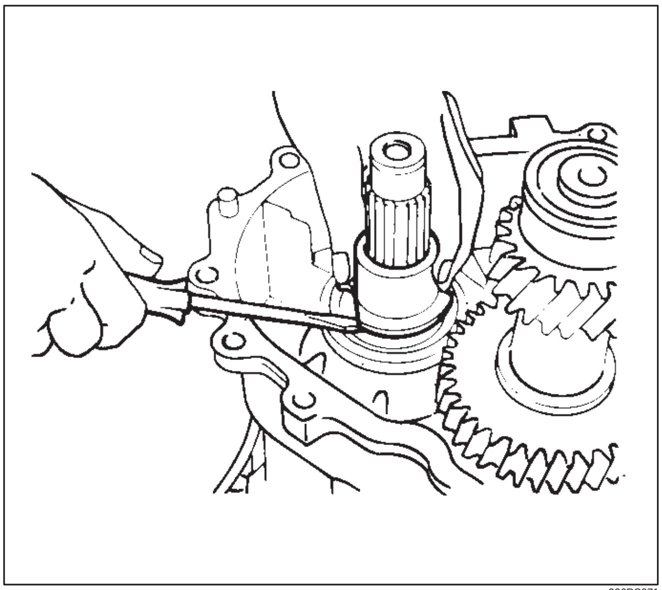
226RW137

16. Remove high-low clutch sleeve(17).
    Use the universal puller to remove the high-low clutch hub(17) and transfer input gear(18).



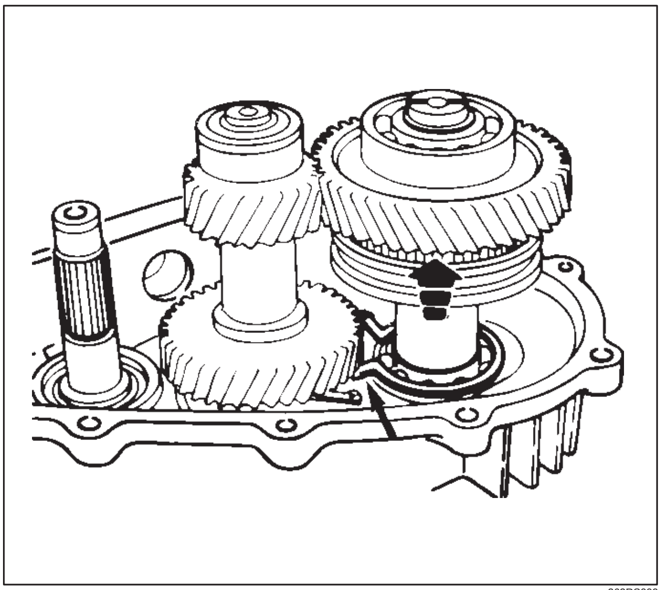
226RS070

17. Remove needle bearing(19), bearing collar(20), ball(21), and plate(22).



226RS071

18. Use a pair of snap ring pliers to remove the bearing snap ring(23).
19. Use a plastic hammer to tap the front output gear assembly(24) free.



262RS009

20. Remove bearing snap ring(25) by using a pair of snap ring pliers.
21. Remove the counter gear assembly(26) from the transfer case(28).
22. Remove 1–2 and 3–4 indicator switch, pin and ball(27).
23. Remove the transfer case assembly(28) from the transmission case.
    - Refer to Transfer Case Assembly in Drive Line/Axle section for repair of transfer case assembly.
24. Pull out intermediate plate with gear assembly(29) from transmission case.

Reassembly

1. Apply recommended liquid gasket (LOCTITE 17430) or its equivalent to the transmission case(30), intermediate plate(29) and transfer case(28) fitting surfaces.
2. Install the intermediate plate with gear assembly(29) to the transmission case(30).
   Pull out the top gear shaft until the ball bearing snap ring groove protrudes from the transmission case front cover fitting face.
   Avoid subjecting the mainshaft to sudden shock or stress.
3. Install the transfer case assembly(28) to the intermediate plate with gear assembly.
   Tighten the eight transmission-transfer case bolts to the specified torque.

   Torque: 37 N·m (27 lb ft)

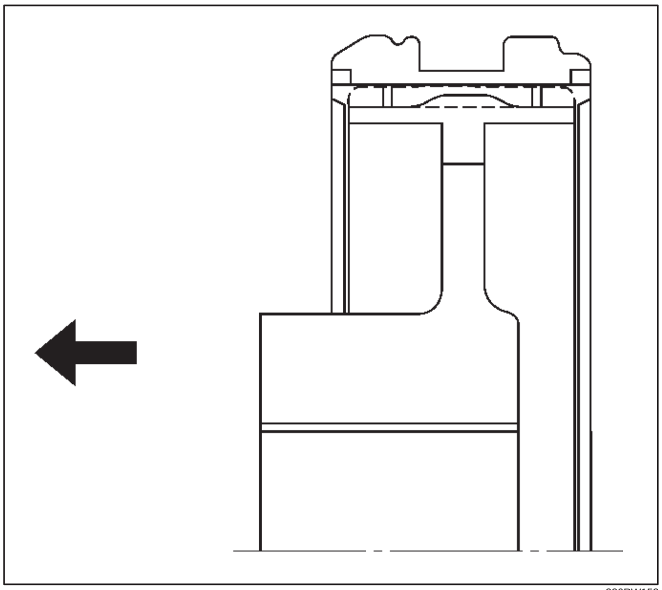
   Refer to Transfer Rear Case Assembly in Drive Line/Axle section for oil seal replacement.
4. Install 1–2 and 3–4 indicator switch, pin and ball(27).
5. Install the counter gear assembly(26) to the transfer case(28).
6. Use a pair of snap ring pliers to install the snap ring(25) to the transfer case(28).

NOTE: The snap ring must be fully inserted into the transfer case snap ring groove.

7. Install front output gear assembly(24).
8. Use a pair of snap ring pliers to install the snap ring (23) to the transfer case(28).

NOTE: The snap ring must be fully inserted into the transfer case snap ring groove.

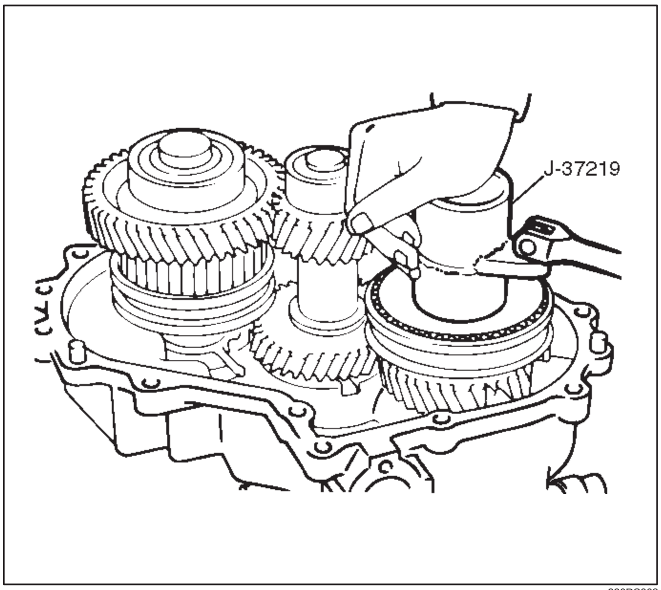
9. Install plate(22), ball(21), bearing collar(20), needle bearing(19), and transfer input gear(18).
10. Install High-low clutch hub and sleeve(17).
    The clutch hub face (with the heavy boss) must be facing the transfer input gear side.



226RW152

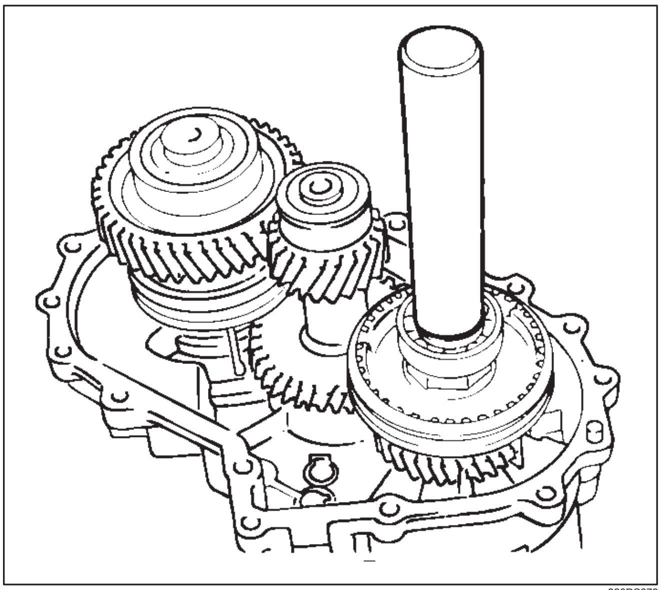
11. Install the front companion flange temporarily.
    - Use the flange holder J–8614–11 and lock nut wrench J–37219 to install the lock nut(16).

Torque: 137 N·m (101 lb ft)



226RS068

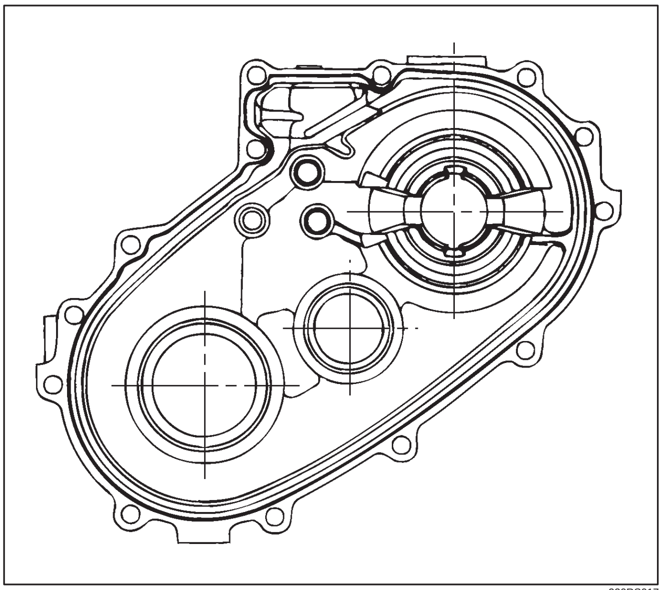
12. Use the punch to stake the lock nut at one spot.
13. Use a suitable drift and hammer to install the ball bearing(15).



226RS079

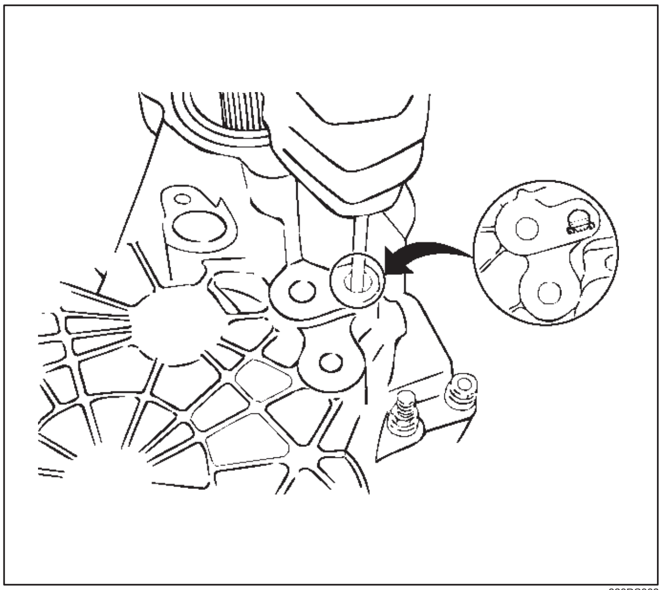
14. Use a pair of snap ring pliers to install the bearing snap ring(14).
15. Regarding detent, shift arm, and interlock pin(13) assembly, refer to Detent, Shift Arm, and Interlock Pin in Drive Line/Axle section.

16. Apply recommended liquid gasket (LOCTITE 17430) or its equivalent to the transfer rear case fitting faces.



220RS017

17. Perform the following steps before fitting the transfer rear case(12):
    1. Shift the High-Low shift rod to the 4H side.
    2. The cut-away portion of select rod head should align with the rear case hole's stopper.

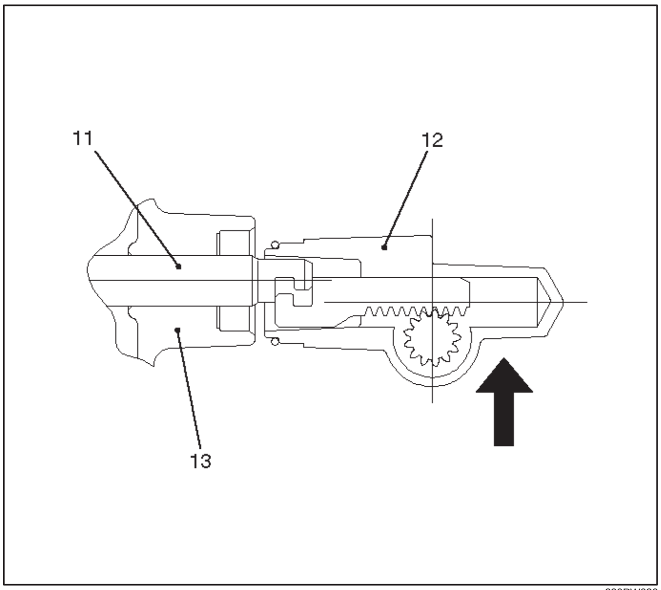


230RS002

18. Tighten the eleven transfer rear case bolts to the specified torque.

Torque: 37 N·m (27 lb ft)

19. Install 2WD–4WD actuator assembly(11) by performing the following steps.
    1. Shift the 2WD–4WD shift rod to the 4WD side.
    2. Join the rod grooves of 2WD–4WD actuator assembly and shift rod.

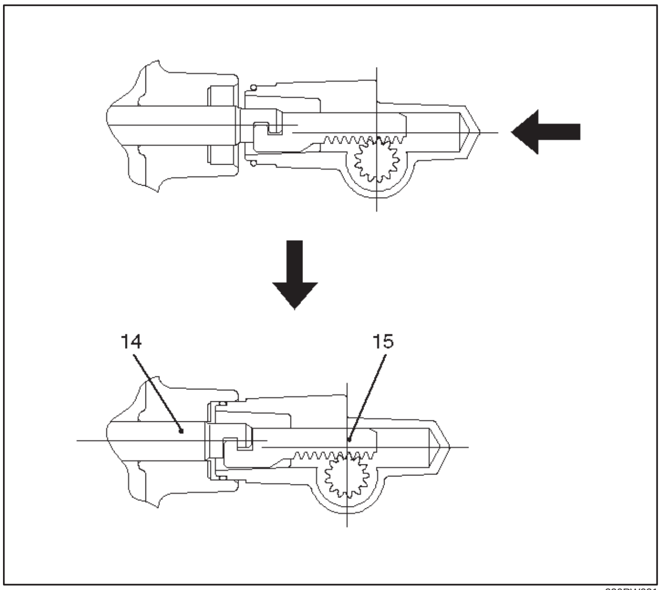


220RW030

Legend

(11) Shift Rod: 2WD–4WD (Position: 4WD)
(12) 2WD–4WD Actuator Assembly (Mode: 2WD)
(13) Rear Case Assembly

3. Push the 2WD–4WD actuator assembly with 2WD–4WD shift rod till the shift rod reaches the 2WD position.



220RW031

Legend

(14) Position: 2WD
(15) Mode: 2WD

4. Tighten the 2WD–4WD actuator bolts to the specified torque.

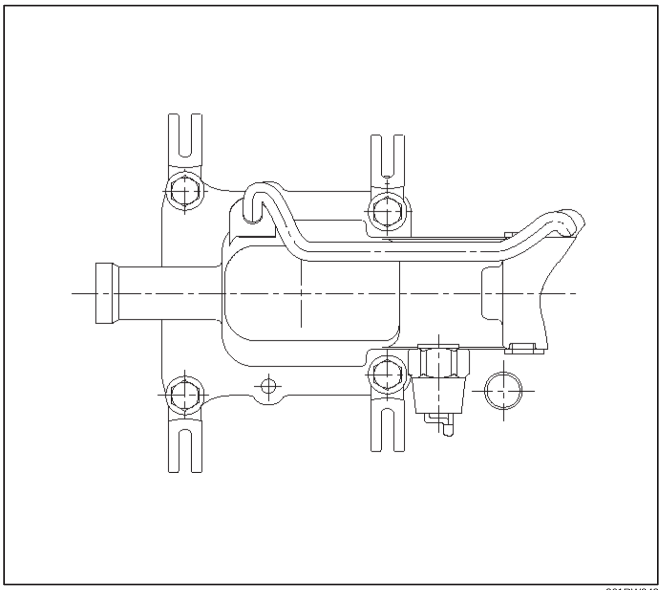
Torque: 19 N·m (14 lb ft)

5. Connect the actuator breather hose to actuator.

20. Install a new packing and gear control box assembly(10).

    Install the harness clips and brackets and then tighten four new gear control box bolts to the specified torque.

Torque: 20 N·m (14 lb ft)



261RW043

21. Install the rear and front companion flange(9) (8).

    Install the O-ring(9).

    Use the flange holder J–8614–11 to tighten the flange nuts(9) (8) to the transfer case.

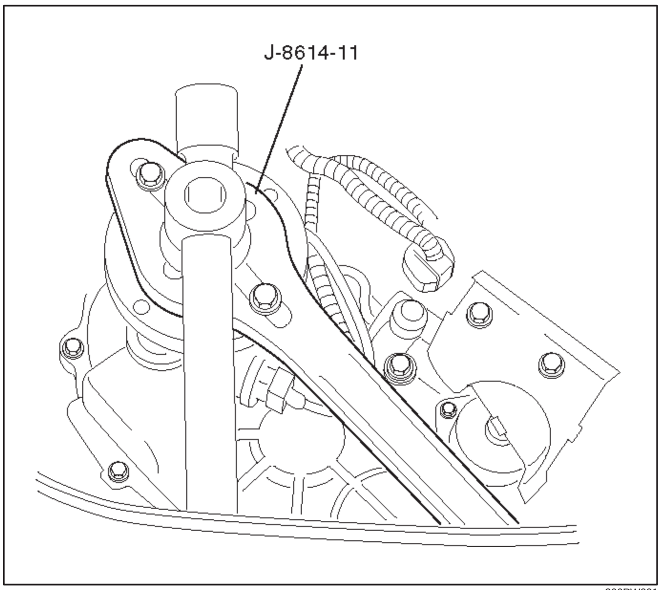
    Tighten new transfer flange nuts(9) (8) to the specified torque.

Rear Companion Flange

Torque: 167 N·m (123 lb ft)

Front Companion Flange

Torque: 137 N·m (101 lb ft)



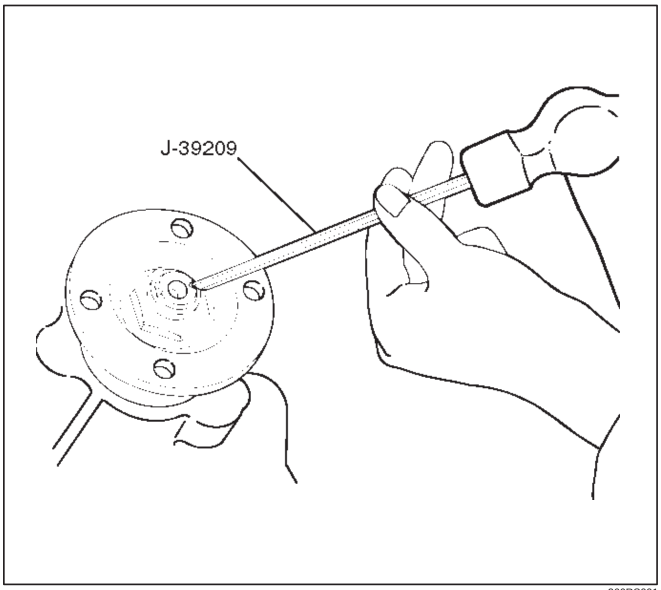
266RW001

22. Use the punch J–39209 to stake the rear companion flange nut at two spots.

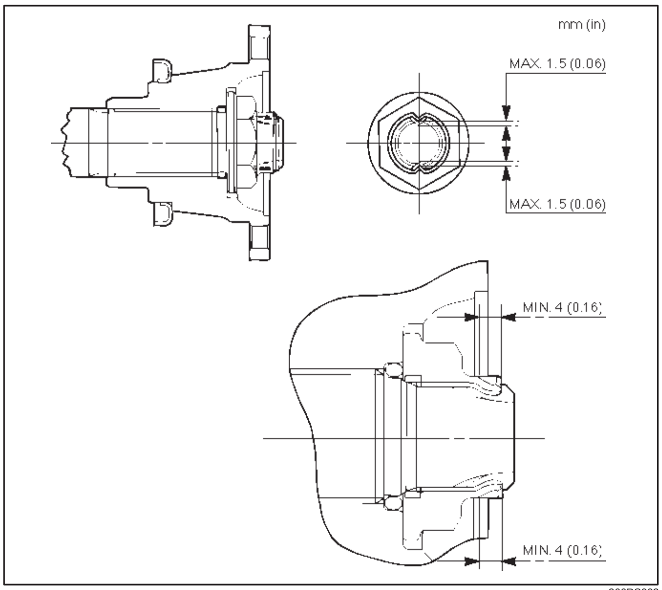
    Punch: J–39209

    - Stake the front companion flange nut at one spot.

NOTE: Be sure to confirm that there is no crack at the staked portion of the flange nut after staking.



266RS001

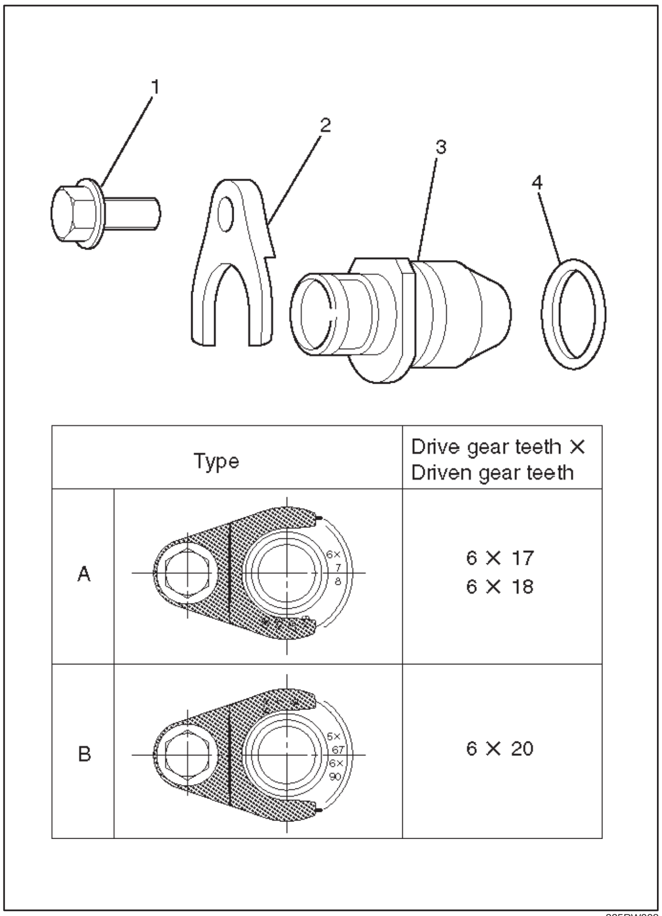


266RS003

23. Install the O-ring (4) to the speedometer driven gear bushing(3).

    Install the driven gear to the speedometer driven gear bushing(3).

    Install the speedometer driven gear assembly(7) to the transfer rear cover.



225RW008

24. Install the plate to the transfer rear cover.

    Torque: 15 N·m (11 lb ft)

25. Install the speedometer sensor.

    Torque: 27 N·m (20 lb ft)

26. Install top gear bearing snap ring(6) and counter front bearing snap ring(5).

    Use a pair of snap ring pliers to install the snap rings to the mainshaft and countershaft.

    The snap rings must be fully inserted into the bearing snap ring groove.

27. Install a new packing and front cover (with oil seal) (4) to the transmission case.

NOTE: Take care not to damage the oil seal.

Notes When Tightening the Bolt:

- After cleaning the bolt hole, dry it thoroughly with air.
- After cleaning the screw face of a removed bolt or new one, dry it thoroughly. Apply recommended liquid gasket (LOCTITE 242) or its equivalent before tightening it.

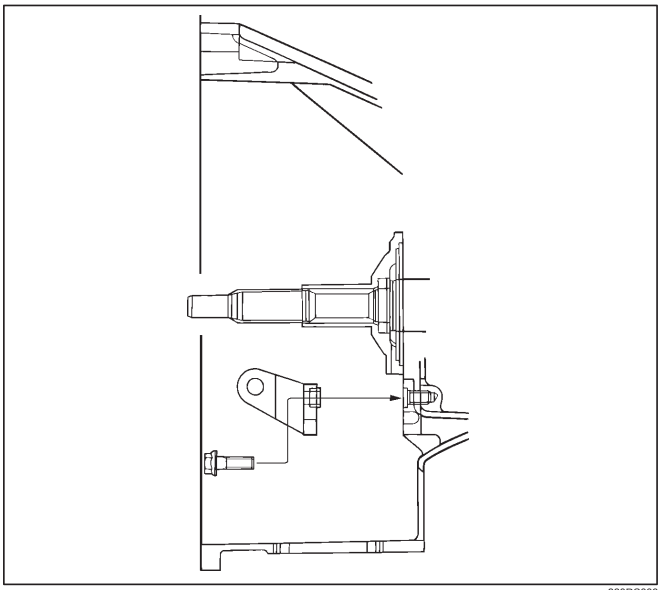
  Tighten six new front cover bolts to the specified torque.

  Torque: 25 N·m (18 lb ft)

28. Install the fulcrum bridge(3) to the transmission case.

    Tighten three fulcrum bridge bolts to the specified torque.

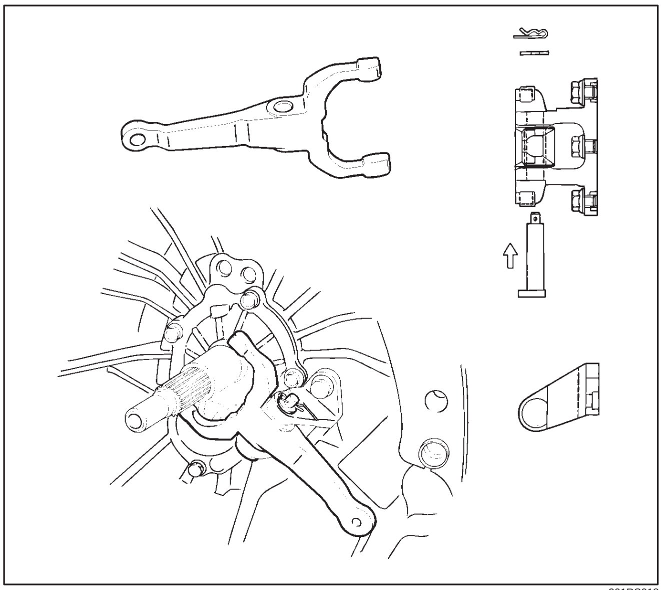
    Torque: 38 N·m (28 lb ft)


220RS009

29. Apply grease to the pin hole inner circumferences and thrust surfaces.

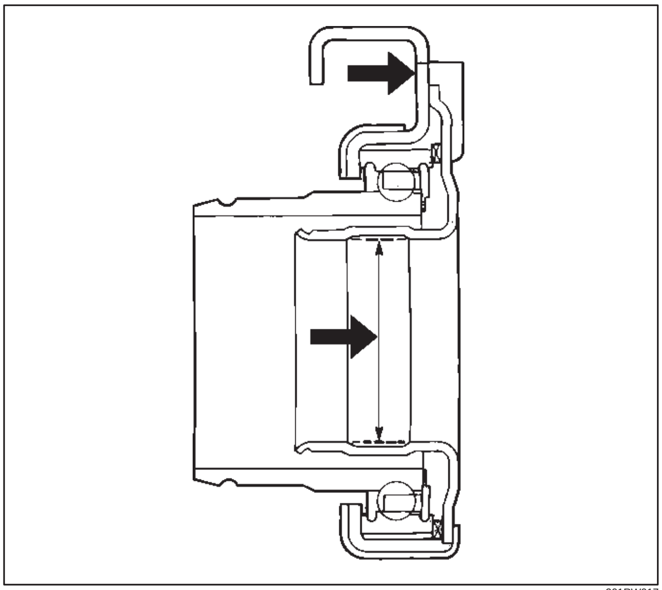
    Attach the shift fork(2) to the fulcrum bridge(3) by inserting the shift fork pin from the bottom side of the fulcrum bridge.

    Install the washer and snap pin.



201RS018

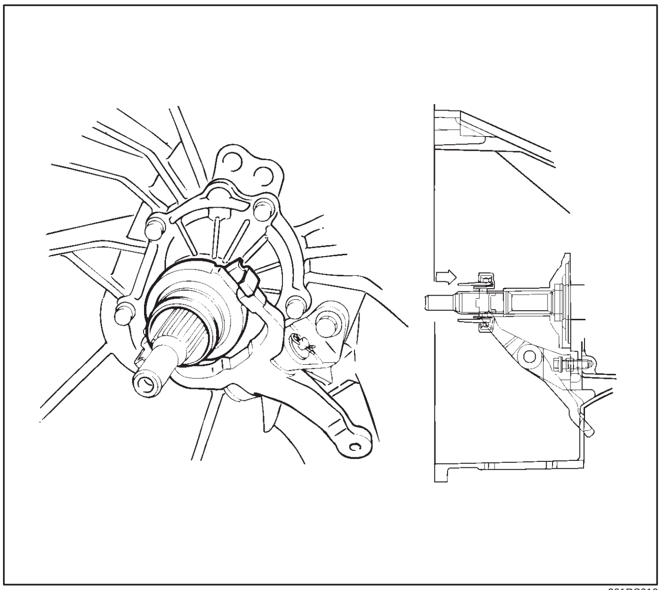
30. Apply grease to the areas shown in the figure.



201RW017

Install the release bearing(1) to the shift fork(2) in the proper direction.

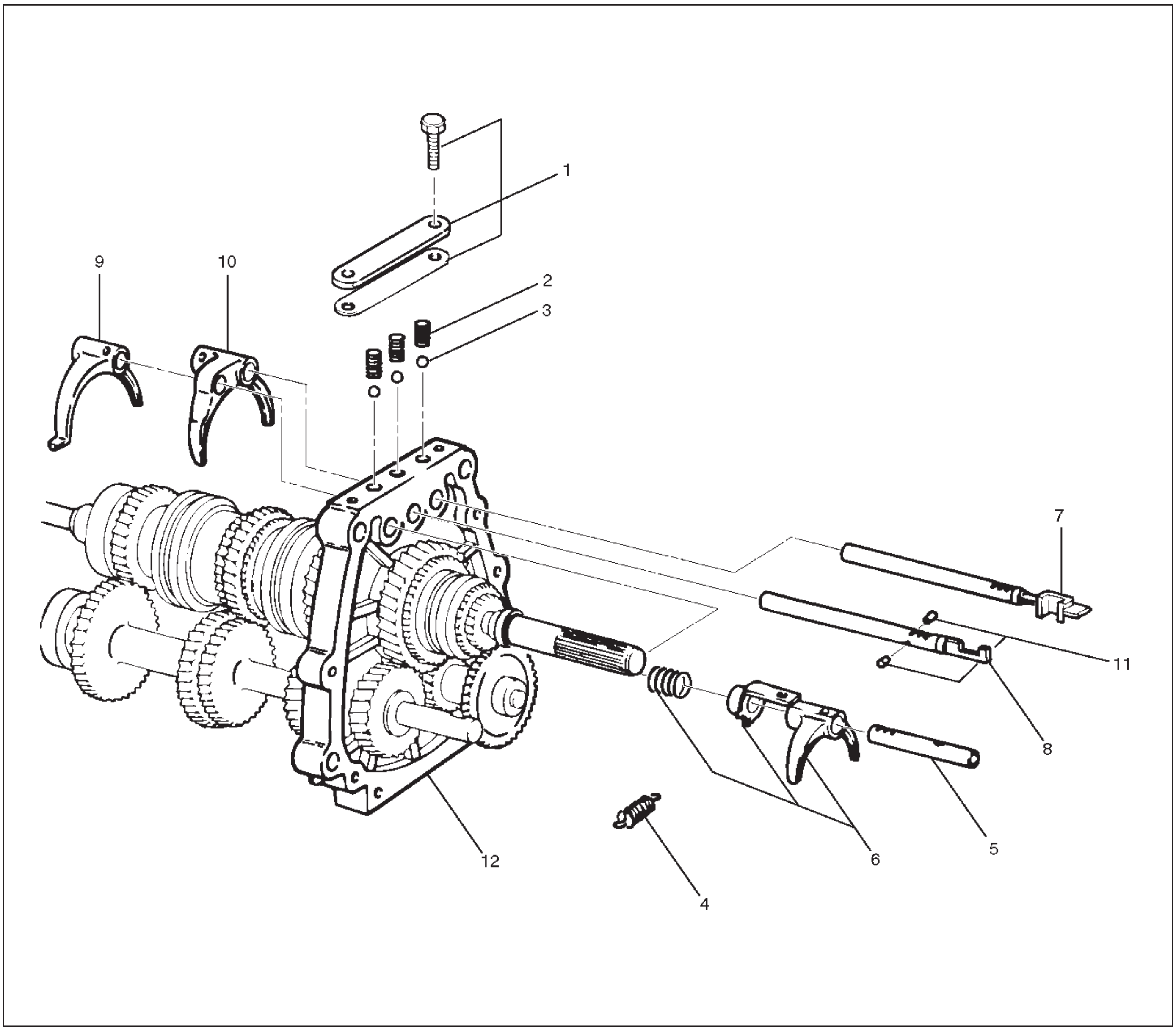
NOTE: Ensure release bearing is properly positioned during installation, as shown in the figure.



201RS019

Intermediate Plate with Gear Assembly, Detent, Shift Arm, and Interlock Pin

Disassembled View

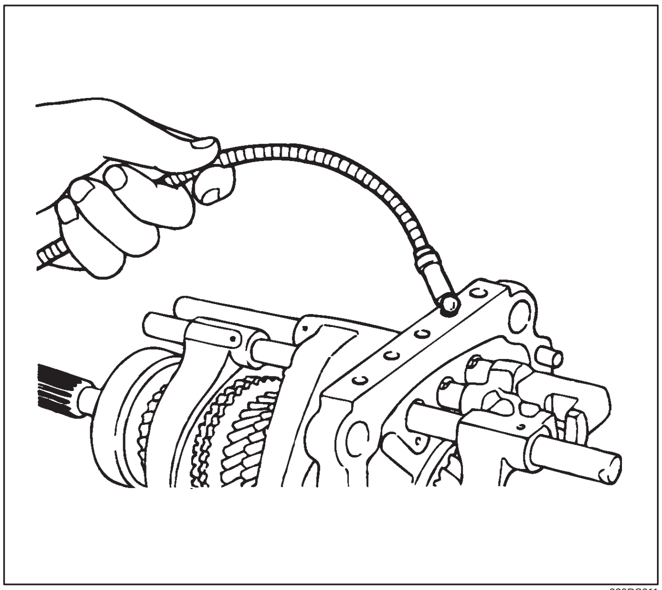


Legend

(1) Detent Spring Plate and Gasket
(2) Detent Spring
(3) Detent Ball
(4) Spring
(5) Rev–5th Shift Rod
(6) Rev–5th Shift Arm and Reverse Inhibitor
(7) 1st–2nd Shift Rod
(8) 3rd–4th Shift Rod
(9) 3rd–4th Shift Arm
(10) 1st–2nd Shift Arm
(11) Interlock Pin
(12) Intermediate Plate and Gear Assembly

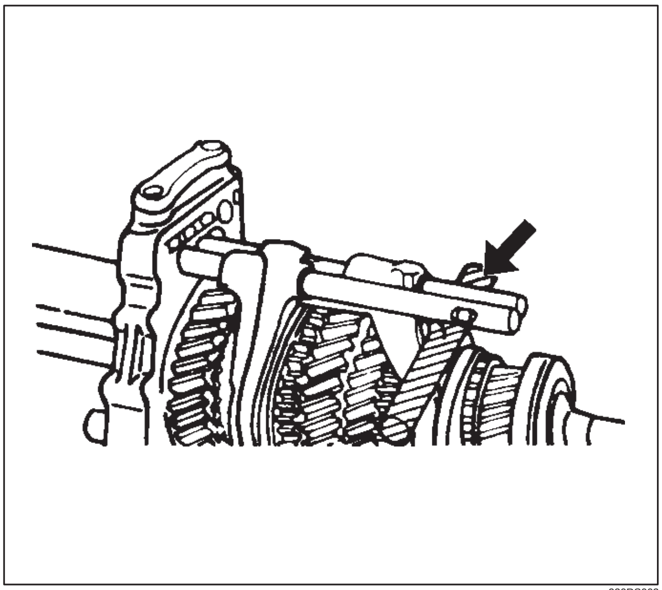
Disassembly

1. Remove detent spring plate and gasket(1), detent spring(2) and detent ball(3).
   Use a magnetic hand to remove the detent balls from the intermediate plate.



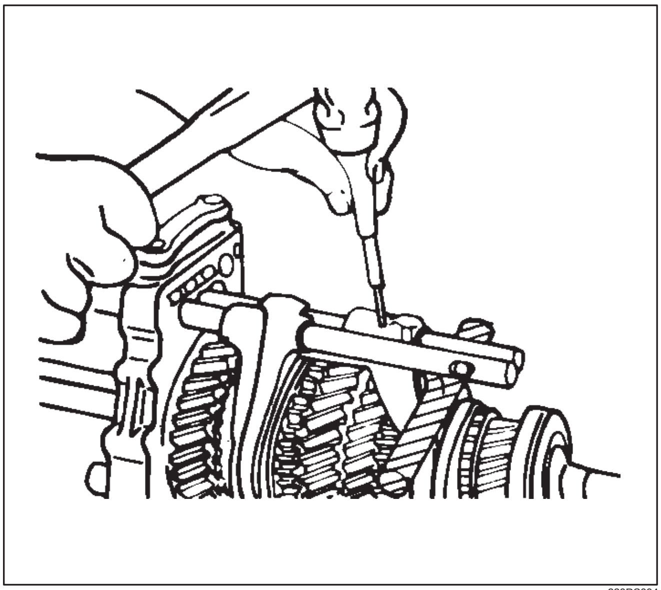
220RS011

2. Remove spring(4).
3. Remove rev–5th shift rod(5), and rev–5th shift arm and reverse inhibitor(6).
   Remove 1st–2nd shift rod(7), 3rd–4th shift rod(8), 3rd–4th shift arm(9), and 1st–2nd shift arm (10).
   - Hold a round bar against the shift rod end.



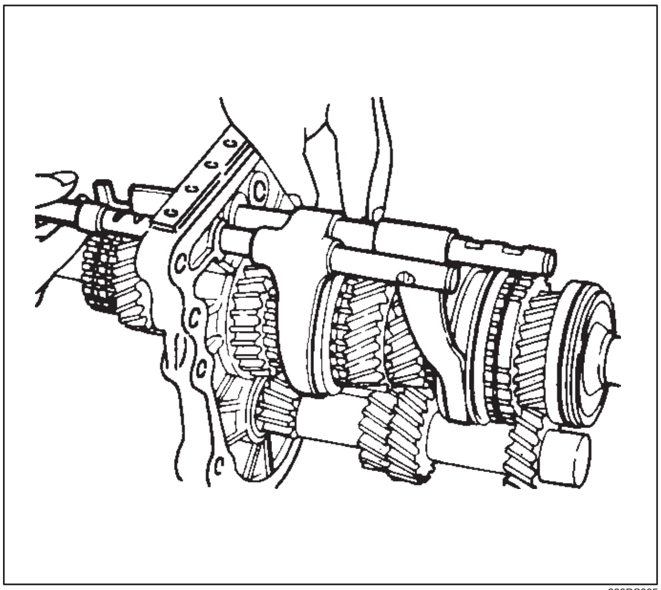
230RS003

- Use a spring pin remover to remove the shift arm spring pins from the shift arms and the shift rods.



230RS004

- Move the 3rd–4th shift rod forward.



230RS005

- Remove the rev–5th, 1st–2nd and 3rd–4th shifter rods carefully. Interlock pins are located between the shifter rods in the intermediate plate.

4. Remove interlock pin(11) from intermediate plate and gear assembly(12).

Inspection and Repair

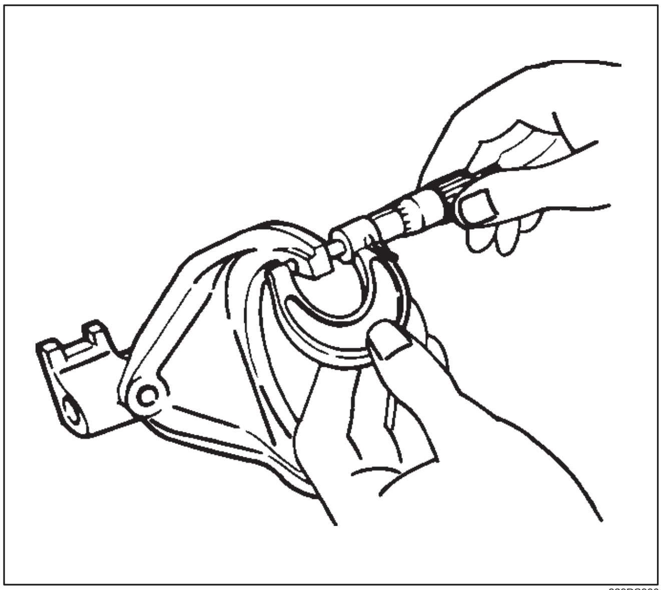
Make the necessary adjustments, and part replacements if excessive wear or damage is discovered during inspection.

Shift Arm Thickness

- Use a micrometer to measure the shift arm thickness.
  If the measured value is less than the specified limit, the shift arm must be replaced.

Shift Arm Thickness

	Standard	Limit
1st–2nd	9.60–9.85 mm (0.378–0.388 in)	9.0 mm (0.354 in)
3rd–4th Rev.5th	9.60–9.80 mm (0.378–0.386 in)	



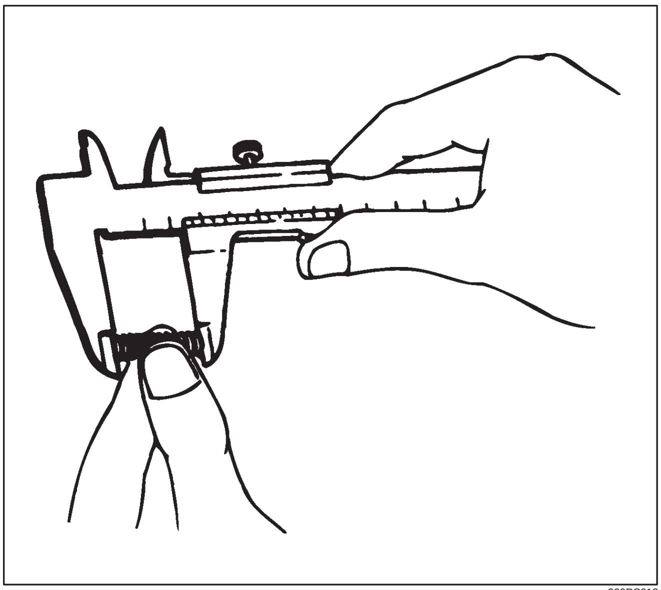
230RS006

Detent Spring Free Length

- Use a vernier caliper to measure the detent spring free length.
  If the measured value is less than the specified limit, the detent spring must be replaced.

Detent Spring Free Length

Standard	Limit
26.8 mm (1.06 in)	26.2 mm (1.03 in)



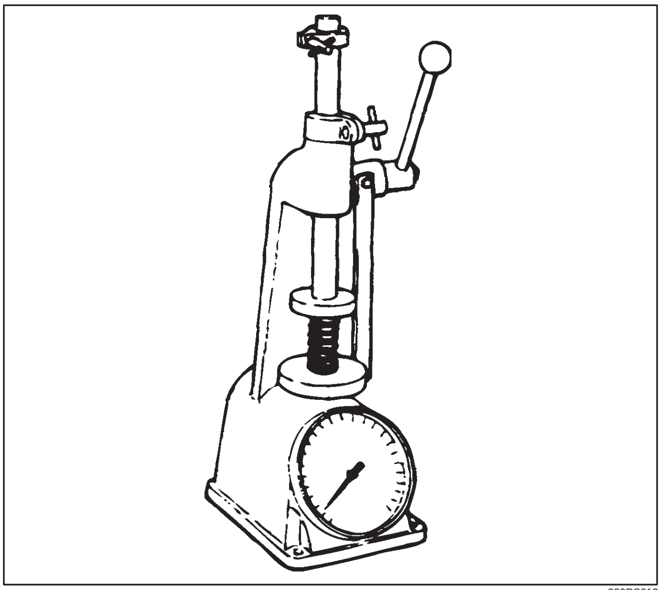
220RS012

Detent Spring Tension

- Use a spring tester to measure the valve spring tension.
  If the measured value is less than the specified limit, the detent spring must be replaced.

Detent Spring Tension

Compressed height	Standard
20 mm (0.787 in)	87.2 – 97.1 N (19.6 – 21.8 lb)



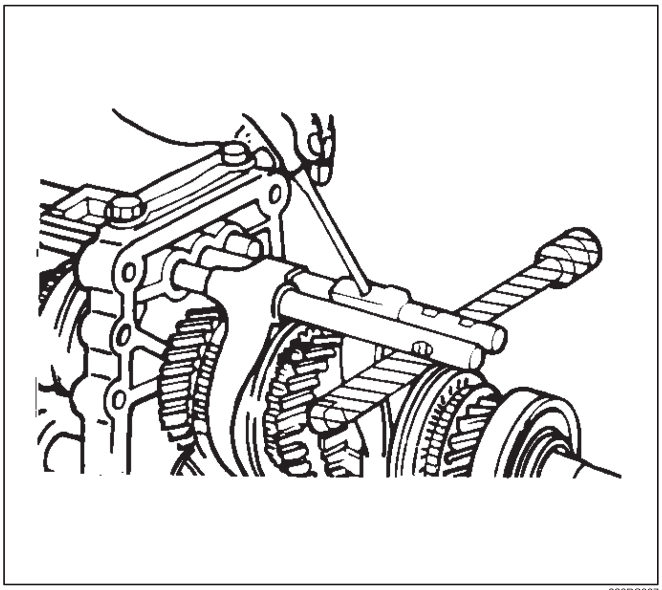
220RS013

Reassembly

1. Install 1st–2nd shift arm(10) and 3rd–4th shift arm(9) to intermediate plate and gear assembly(12).
2. Install 3rd–4th shift rod(8) and 1st–2nd shift rod(7).
   - Install the interlock pin(11) to the shift rod.
   - Install the shift rod together with the interlock pin to the intermediate plate.

     Do not allow the interlock pin to fall from the shift rod.
   - Hold a round bar against the shift rod end lower face to protect it against damage.
   - Install a new spring pin.

     Never reinstall the used spring pin.



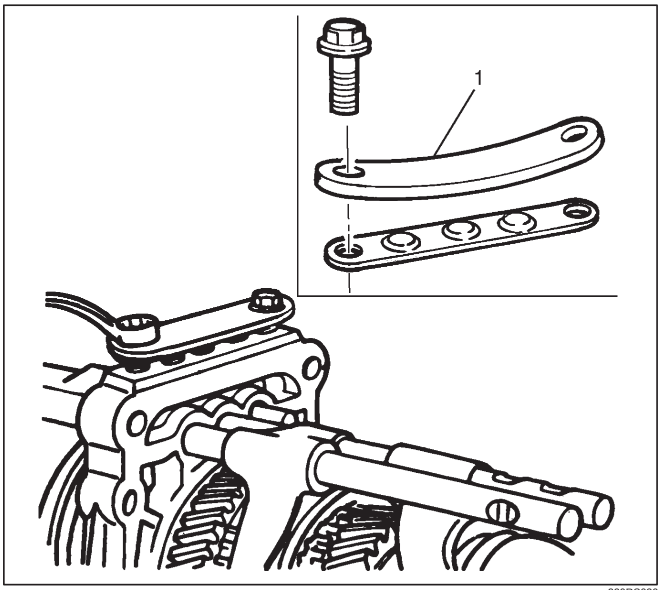
230RS007

3. Install rev–5th shift arm and reverse inhibitor(6) and rev–5th shift rod(5).
   - Apply oil to the reverse inhibitor inner surface.
   - Install the interlock pin(11) to the shift rod.
   - Install the shift rod together with the interlock pin to the intermediate plate.

     Do not allow the interlock pin to fall from the shift rod.
   - Hold a round bar against the shift rod end lower face to protect it against damage.
   - Install a new spring pin.

     Never reinstall the used spring pin.
4. Install spring(4).
5. Put detent balls(3) in the intermediate plate holes.
   - Apply oil to the detent balls.
6. Install detent springs(2) and detent spring plate and gasket(1).
   - Install a new gasket and the detent spring plate.
   - Tighten the detent spring plate bolts to the specified torque.

Torque: 20 N·m (14 lb ft)



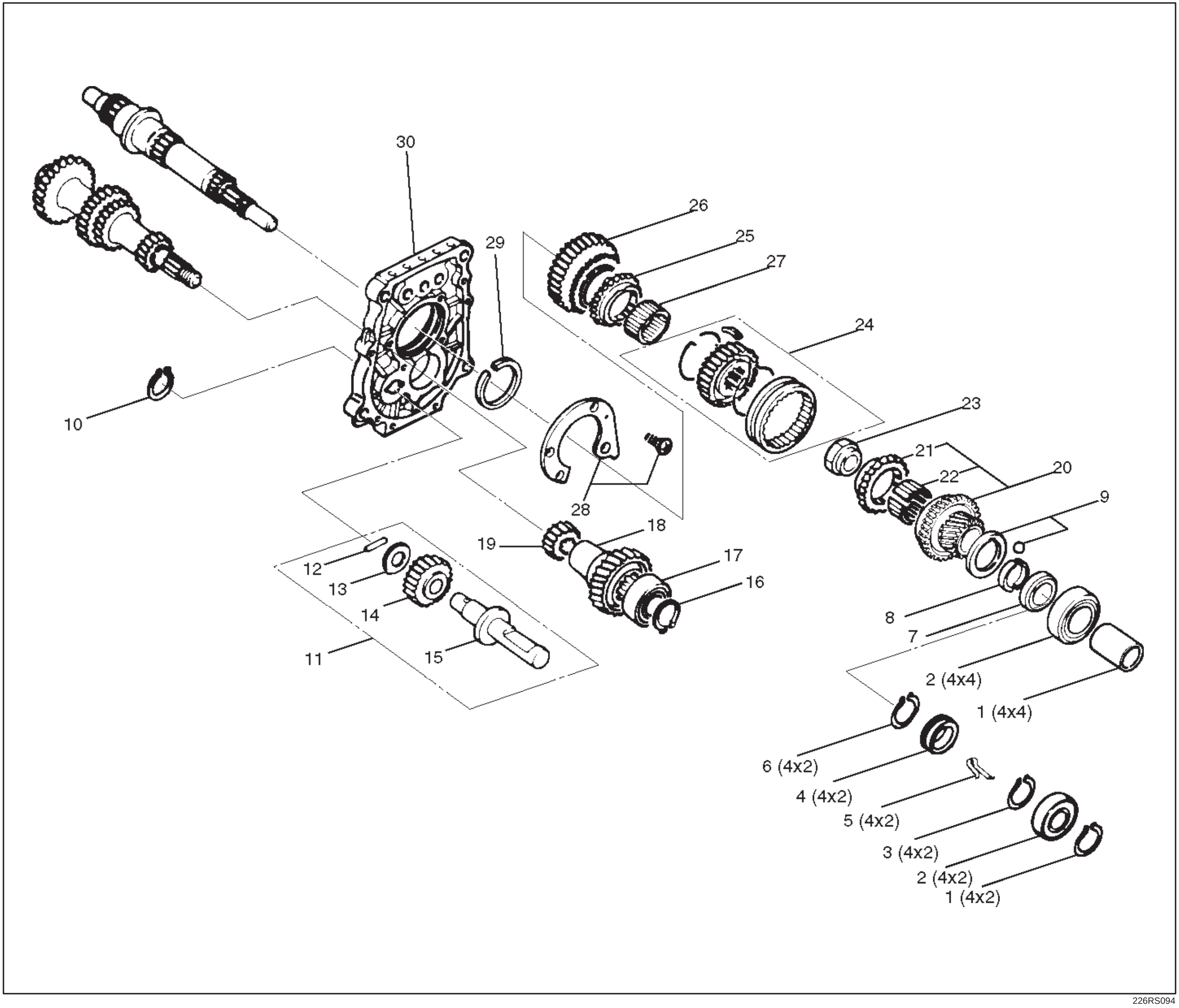
220RS030

Legend

(1) Warped

Reverse Gear and 5th Gear

Disassembled View



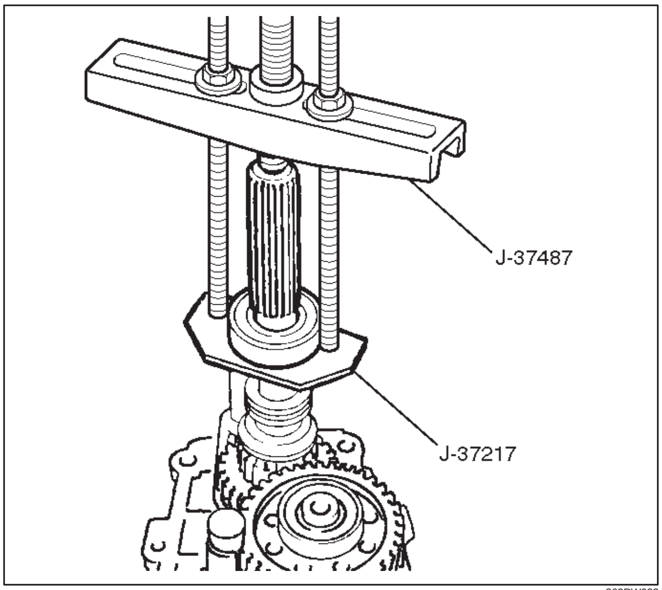
Legend

(1) Oil Seal Collar (4X4)
(2) Ball Bearing (4X4)

(1) Bearing Snap Ring (4X2)
(2) Ball Bearing (4X2)
(3) Bearing Snap Ring (4X2)
(4) Speedometer Drive Gear (4X2)
(5) Clip (4X2)
(6) Retainer Snap Ring (4X2)
(7) Retainer
(8) Thrust Plate
(9) Thrust Washer and Lock Ball
(10) Reverse Idler Gear Snap Ring
(11) Reverse Idler Gear Assembly
(12) Idle Shaft Pin
(13) Thrust Washer
(14) Reverse Idler Gear
(15) Reverse Idler Shaft
(16) Bearing Snap Ring
(17) Ball Bearing
(18) Counter 5th Gear
(19) Counter Reverse Gear
(20) 5th Gear
(21) 5th Block Ring
(22) Needle Bearing
(23) Mainshaft Nut
(24) Rev–5th Synchronizer Assembly
(25) Reverse Block Ring
(26) Reverse Gear
(27) Needle Baring
(28) Bearing Plate and Screw
(29) Bearing Snap Ring
(30) Intermediate Plate

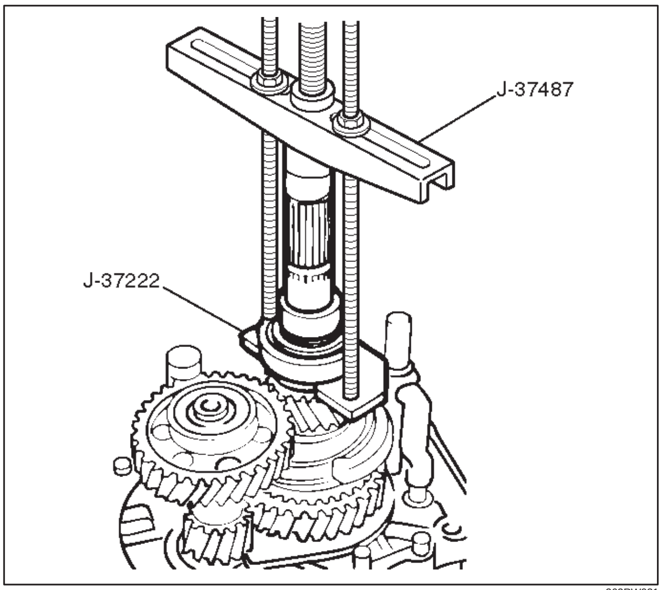
Disassembly

1. Use a pair of snap ring pliers to remove the bearing snap ring(1). (4X2)
2. Set the bearing remover J–37217 and puller J–37487 to the bearing and the mainshaft end to remove ball bearing(2). (4X2)



262RW033

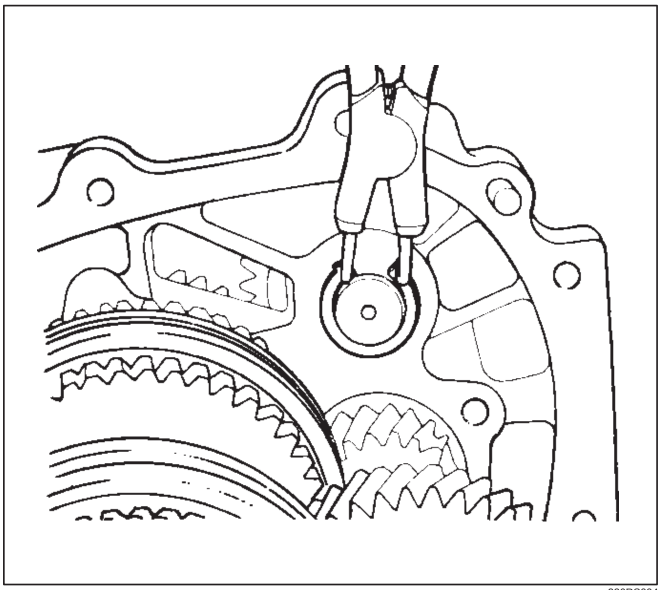
3. Remove bearing snap ring(3), speedometer drive gear(4), clip(5), retainer snap ring(6) and retainer(7). (4X2)
4. Set the retaining ring remover J–37222 and puller J–37487 to the retainer(7) and the mainshaft end. (4X4)



262RW031

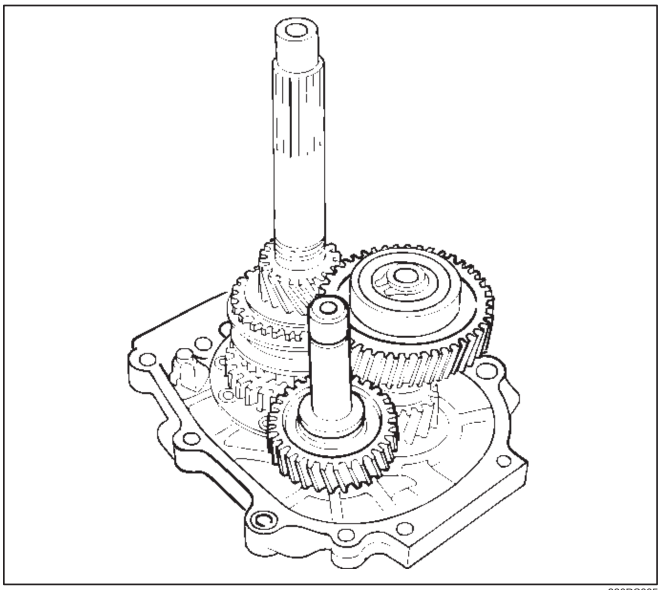
5. Remove the retainer(7) together with the bearing(2) and the oil seal collar(1). (4X4)

   The universal puller may be used in place of the retaining ring remover.
6. Remove thrust plate(8) and thrust washer and lock ball(9).
7. Use a pair of snap ring pliers to remove reverse idler gear snap ring(10).



226RS004

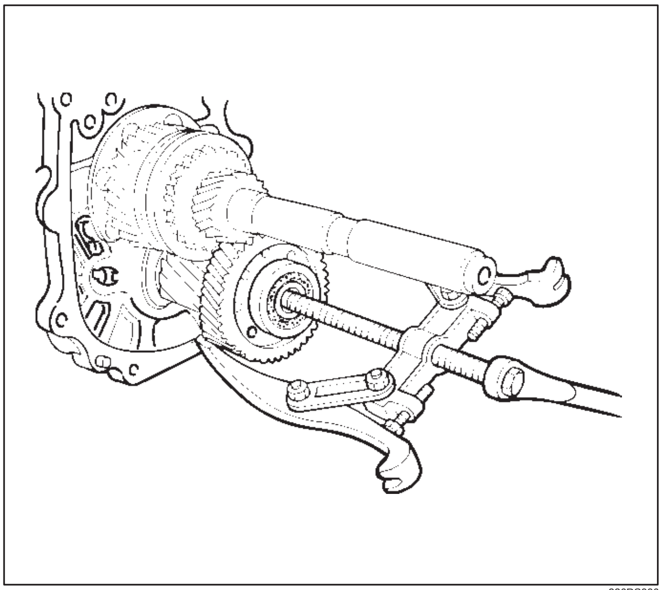
8. Remove the reverse idler gear assembly(11) from the intermediate plate(30).



226RS005

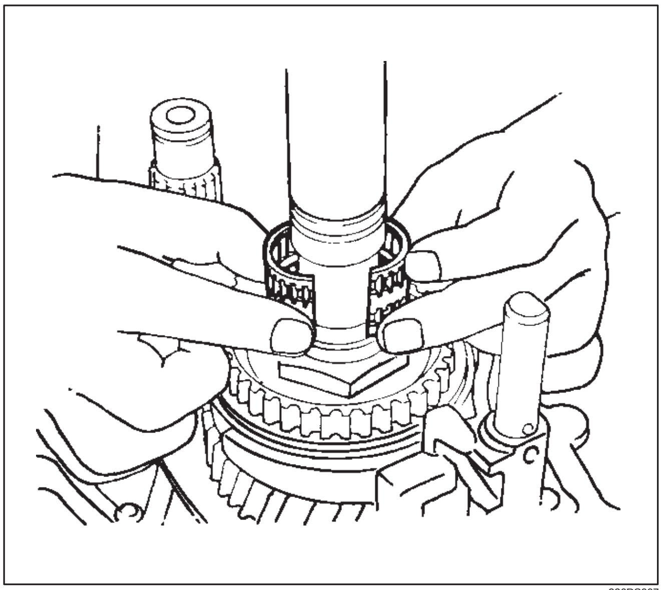
9. Remove idle shaft pin(12), thrust washer(13), reverse idler gear(14), and reverse idler shaft(15).
10. Use a pair of snap ring pliers to remove the snap ring(16).

11. Attach the bearing remover to the counter gear shaft. Use the bearing remover to remove the ball bearing(17) and the counter 5th gear(18).



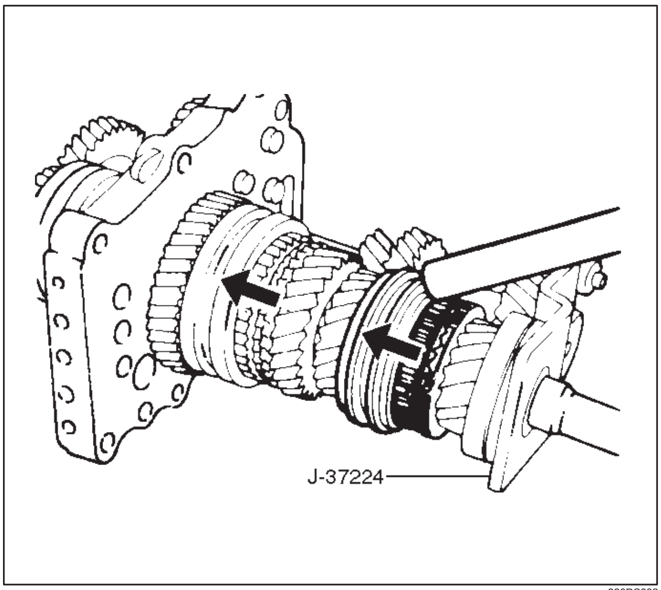
226RS006

12. Remove counter reverse gear(19).
13. Remove 5th gear(20), 5th block ring(21), and needle bearing (2 piece type) (22).



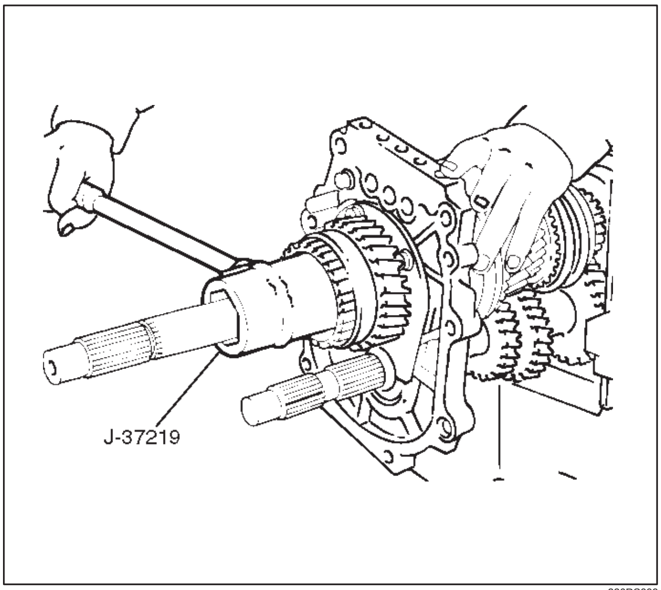
226RS007

14. Engage the 3rd–4th synchronizer with the 3rd gear. Engage the 1st–2nd synchronizer with the 1st gear. Attach the holding fixture J–37224 and base J–3289–20 to the mainshaft and the counter gear.



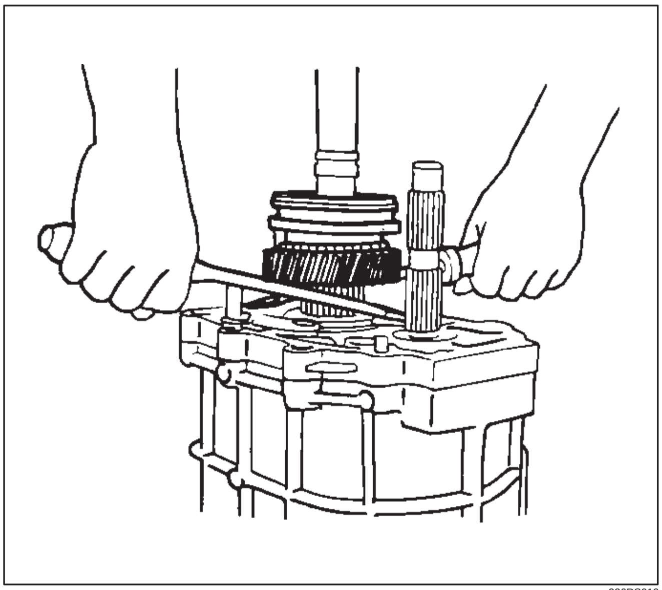
226RS008

Use the mainshaft nut wrench J–37219 to remove the mainshaft nut(23).



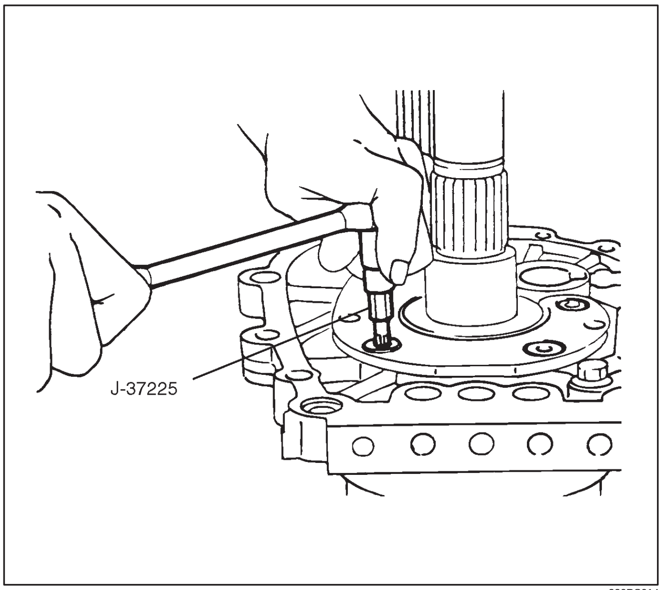
226RS009

15. Use pry bars between the reverse gear(26) and bearing plate(28) to remove the Rev–5th synchronizer assembly(24) together with reverse block ring(25) and reverse gear(26).



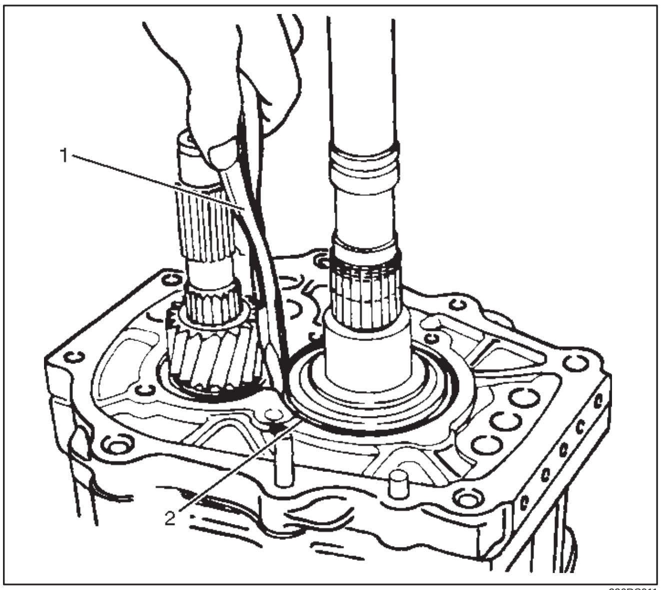
226RS010

16. Remove needle bearing(27).
17. Use the torx bit wrench J–37225(T45) to remove the bearing plate and screw(28) from the intermediate plate.



220RS014

18. Use the snap ring pliers(2) to remove the mainshaft bearing snap ring(1) (29).



226RS011

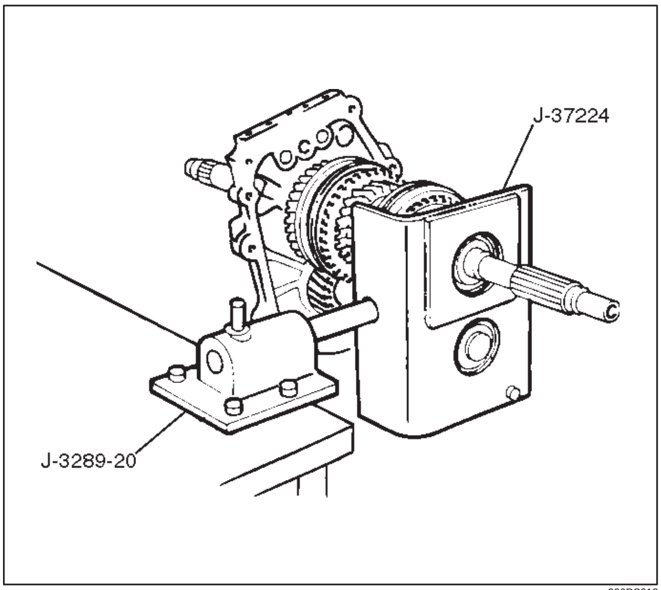
19. Hold the snap ring open with the pliers.
    Push the intermediate plate(30) toward the rear of the transmission to remove it.
    The bearing snap ring will come free.

Inspection and Repair

Refer to Top Gear Shaft, Main Gear Shaft, and Counter Gear in this section for inspection and repair.

Reassembly

1. Mesh the counter gear with the mainshaft assembly.
   Install the holding fixture J–37224 and base J–3289–20 to the mainshaft and the counter gear.



226RS012

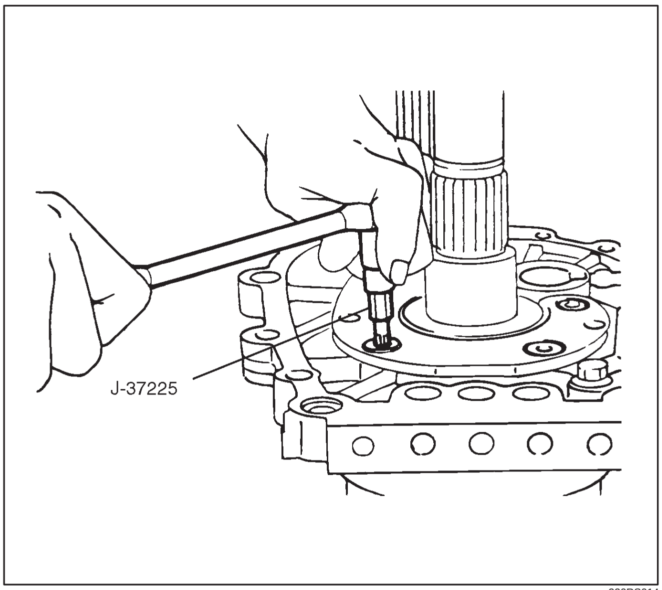
2. Place the holding fixture (with the mainshaft and the counter shaft) in a vise.

   Install the intermediate plate(30).
3. Install bearing snap ring(29).
4. Apply recommended thread locking agents (LOCTITE 242) or its equivalent to each of the bearing plate screw threads.

   Install bearing plate and screw(28).

   Tighten the screws to the specified torque by using torx bit wrench J–37225.

Torque: 15 N·m (11 lb ft)

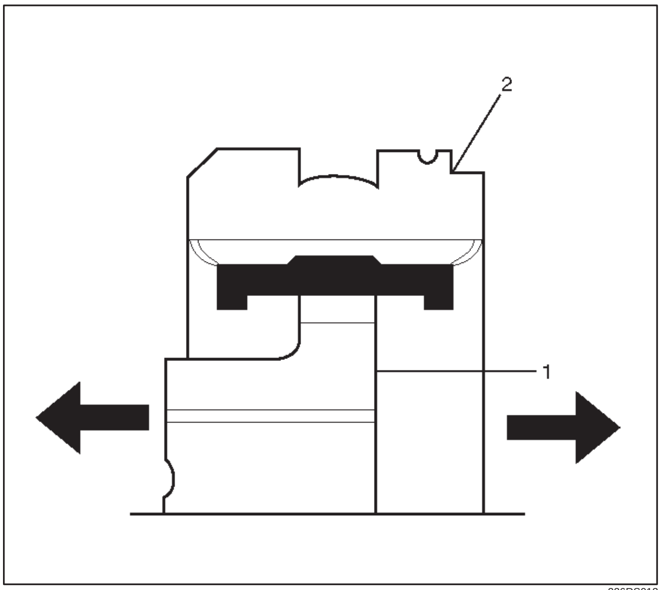


220RS014

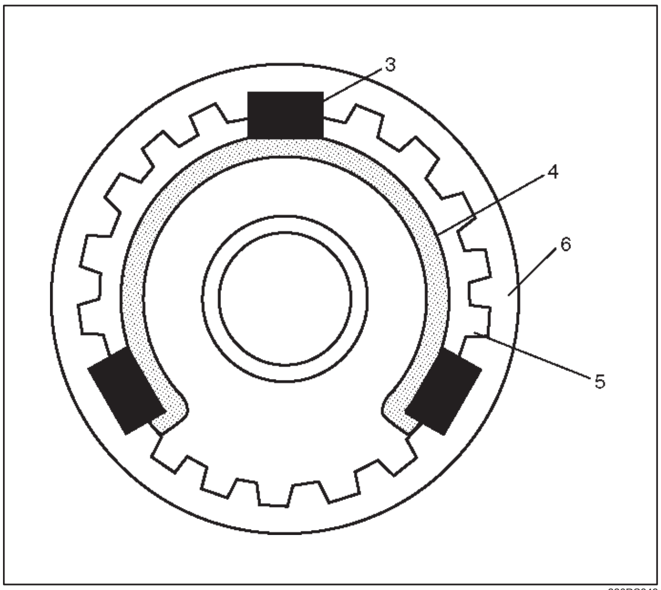
5. Install needle bearing(27), reverse gear(26), and reverse block ring(25).
6. Assemble rev–5th synchronizer assembly(24) by performing the following steps.
   1. Turn the clutch hub face(1) toward the sleeve groove(2) (rear side) on the outer circumference.
   2. Check that the inserts(3) fit snugly into the block ring insert grooves.
   3. Check that the inserts springs(4) are fitted to the inserts as shown in the illustration.
   4. Check that the clutch hub(5) and the sleeve(6) slide smoothly.

5. Install the synchronizer assembly to the mainshaft.

   The clutch hub face (with the heavy boss) must be facing the reverse gear side.

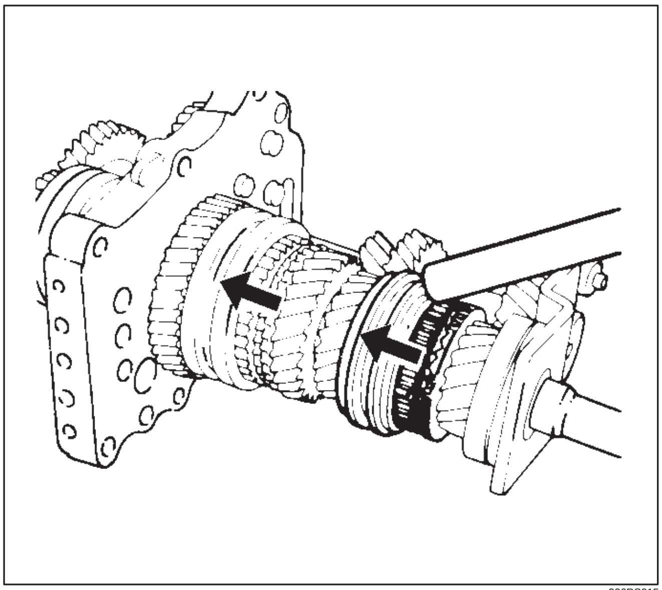


226RS013



226RS049

7. Mesh the 1st–2nd and 3rd–4th synchronizers with both the 1st and 3rd gears (double engagement).

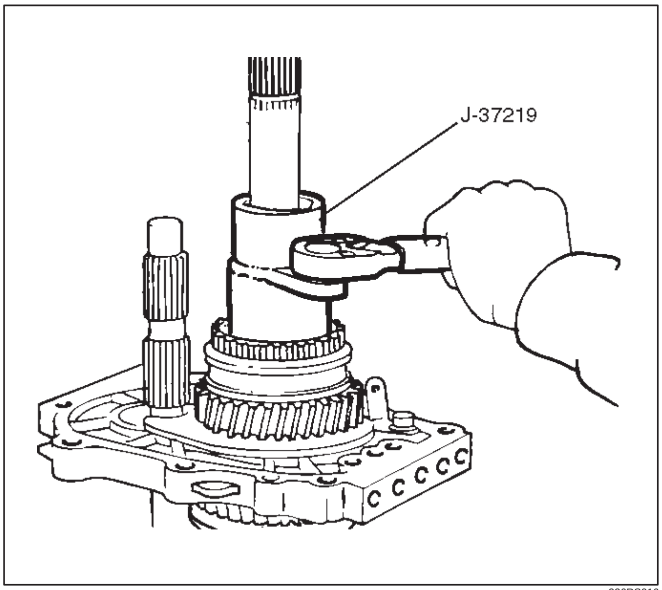


226RS015

This will prevent the mainshaft from turning.

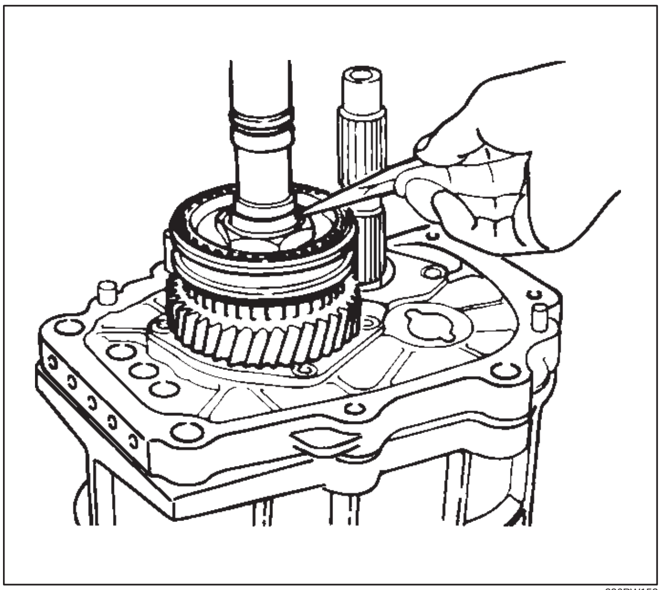
8. Install the new mainshaft hub nut.
   Use the mainshaft nut wrench J–37219 to tighten the mainshaft nut(23) to the specified torque.

Torque: 137 N·m (101 lb ft)



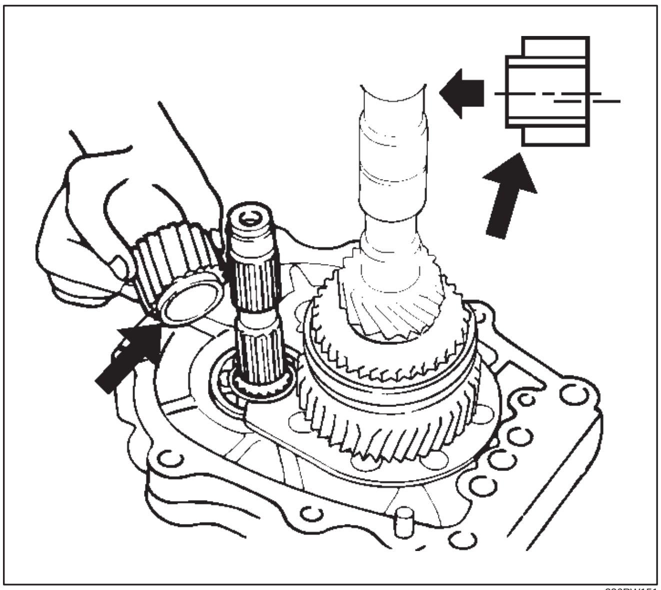
226RS016

9. Use a punch to stake the mainshaft nut.



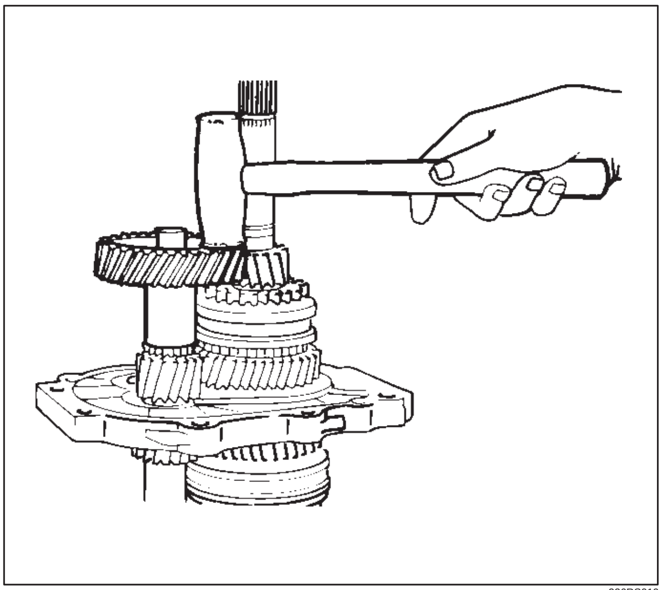
226RW153

10. Install needle bearing(22), 5th block ring(21), and 5th gear(20).
11. Apply engine oil to the counter reverse gear(19) and the reverse gear(26).
    Install the counter reverse gear(19) to the counter shaft.
    The reverse gear projection must be facing the intermediate plate.



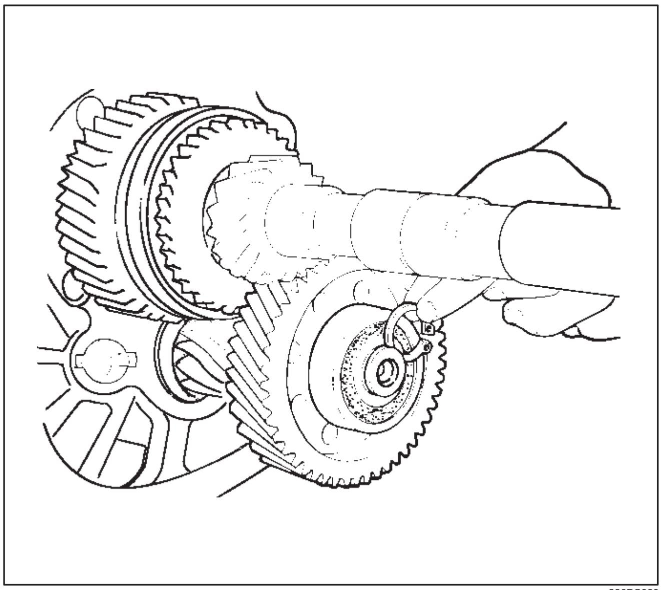
226RW151

12. Install the counter 5th gear(18) to the transmission.



226RS019

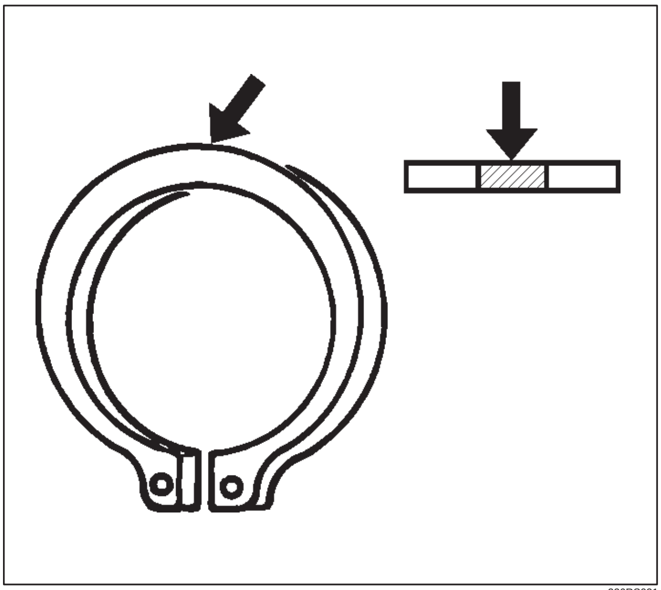
13. Install ball bearing(17) and bearing snap ring by performing the following steps:
    - Select the snap ring which will provide the minimum clearance between the ball bearing and the snap ring.



226RS020

- There are six snap ring sizes available.

  The snap rings are color-coded to indicate their thickness.



226RS021

Ball Bearing and Snap Ring Clearance

Standard: 0–0.15 mm (0–0.0059 in)

Snap Ring Availability

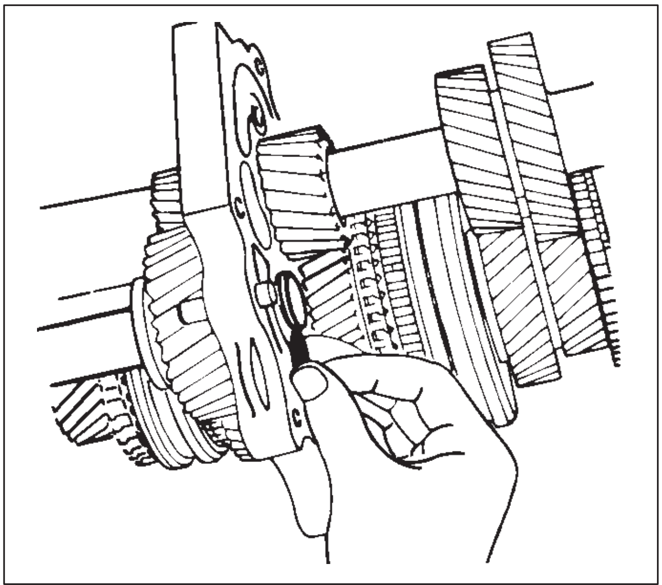
Thickness	Color Coding
1.1 mm (0.043 in)	White
1.2 mm (0.047 in)	Yellow
1.3 mm (0.051 in)	Blue
1.4 mm (0.055 in)	Pink
1.5 mm (0.059 in)	Green
1.6 mm (0.063 in)	Brown

- Use a pair of snap ring pliers to install the snap ring(16) to the counter gear shaft.

  The snap ring must be fully inserted into the counter gear shaft snap ring groove.

14. Assemble reverse idler shaft(15), reverse idler gear(14), thrust washer(13), and idle shaft pin(12) into reverse idler gear assembly(11).

15. Select reverse idler gear snap ring(10) which will provide the minimum clearance between the intermediate plate(30) and the snap ring(10).



226RS022

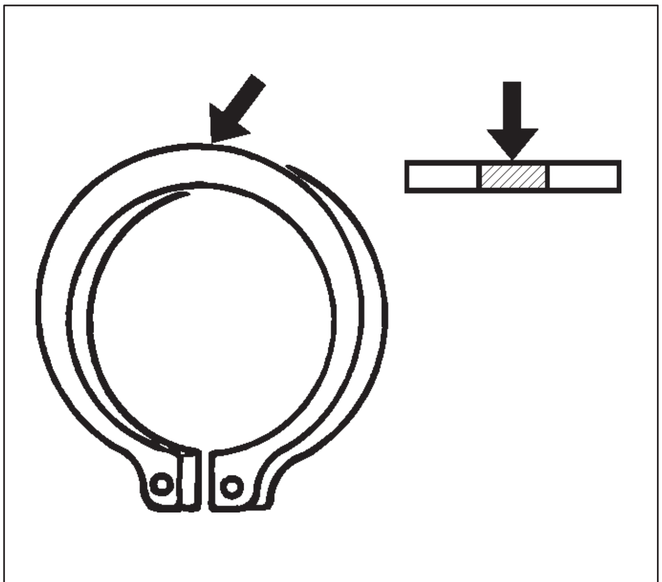
- There are three snap ring sizes available.
  The snap rings are color-coded to indicate their thickness.

Intermediate Plate and Snap Ring Clearance

Standard: 0 – 0.15 mm (0 – 0.0059 in)

Snap Ring Availability

Thickness	Color Coding
1.2 mm (0.047 in)	White
1.3 mm (0.051 in)	Yellow
1.4 mm (0.055 in)	Blue



226RS021

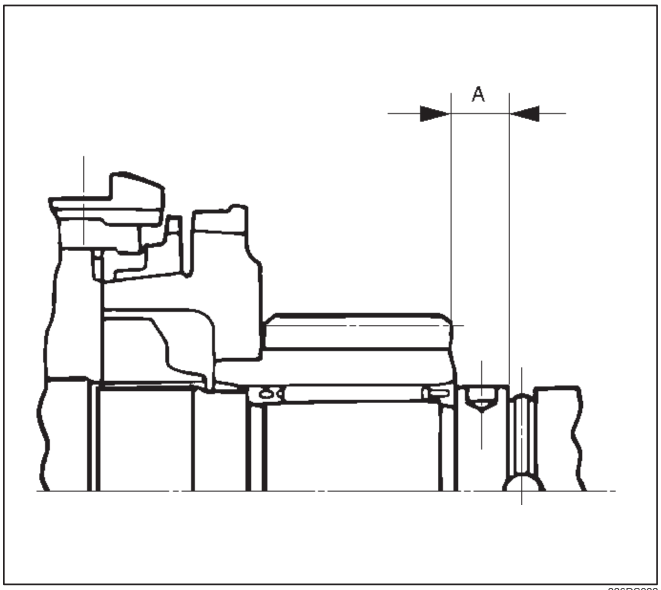
- Use a pair of snap ring pliers to install the snap ring to the reverse idler shaft.
  The snap ring must be fully inserted into the reverse idler shaft snap ring groove.

16. Install thrust washer and lock ball(9) by performing the following steps:
    - Use a thickness gauge to measure the clearance between the 5th gear and the thrust washer.

5th Gear and Thrust Washer Clearance

Standard: 0.10 – 0.25 mm (0.004 – 0.010 in)

- Measure clearance “A” as shown in the figure.

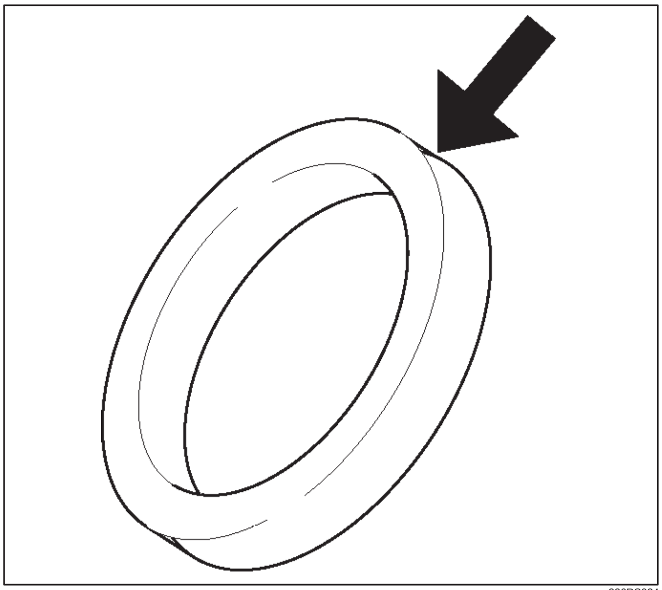


226RS023

- Select appropriate thrust washer from chart.
- There are four thrust washer sizes available.
- The thrust washers are color coded to indicate their thickness.

Thrust Washer Availability

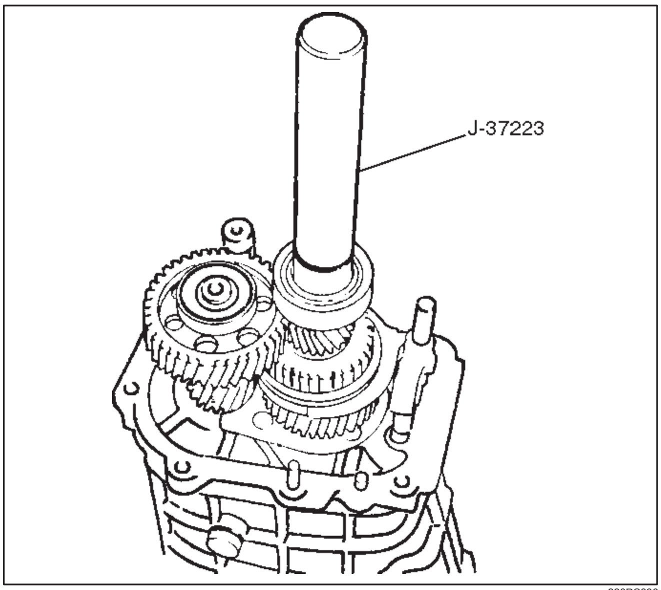
Thickness mm (in)	Color Coding	A mm (in)	Clearance mm (in)
7.9 (0.311)	White	8.05–8.1 (0.317–0.319)	0.15–0.25 (0.006–0.010)
8.0 (0.315)	Yellow	8.1–8.2 (0.319–0.323)	0.1–0.25 (0.004–0.010)
8.1 (0.319)	Green	8.2–8.3 (0.323–0.327)	0.1–0.25 (0.004–0.010)
8.2 (0.323)	Bluen	8.3–8.36 (0.327–0.329)	0.1–0.21 (0.004–0.008)



226RS024

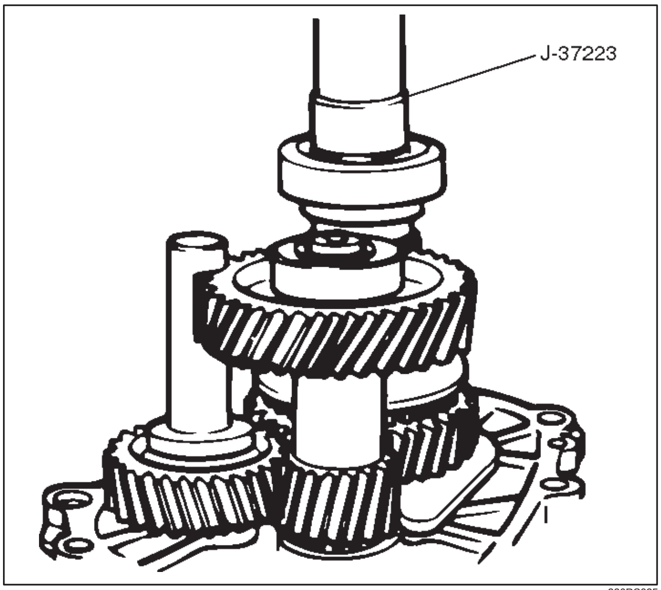
- Apply grease to the thrust washer and the lock ball.
- Install the thrust washer and the lock ball.

17. Install thrust plate(8) and retainer(7).
18. Install retaining snap ring(6), clip(5), speedometer drive gear(4), and bearing snap ring(3). (4X2)
19. Use the installer J–37223 to install the ball bearing(2) to the mainshaft. (4X2)



226RS096

20. Install bearing snap ring(1). (4X2)
21. Apply engine oil to the bearing inner and outer circumference. (4X4)
    Use the installer J–37223 to install the ball bearing(2) to the mainshaft in proper direction. (4X4)

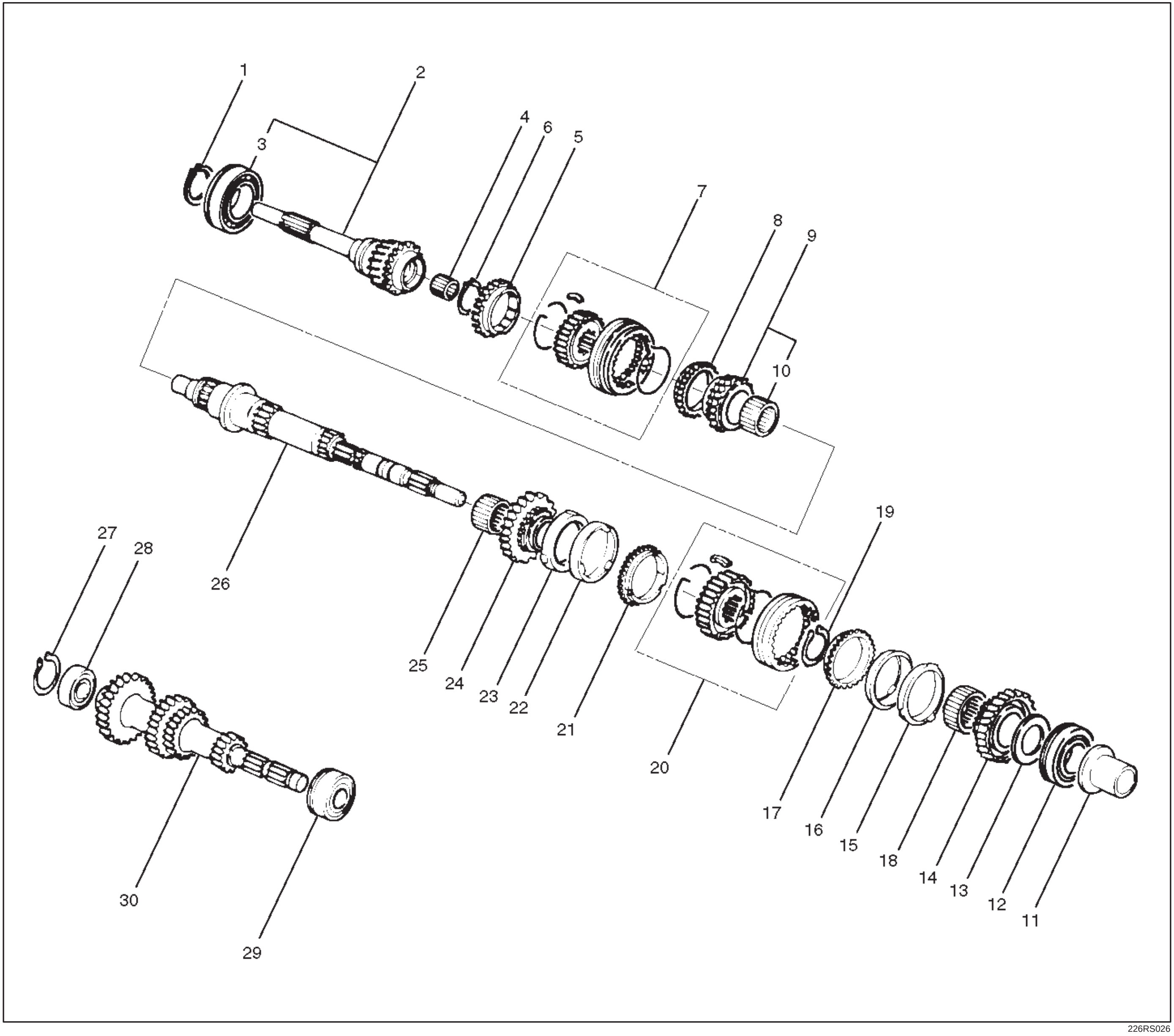


226RS025

22. Install oil seal collar(1). (4X4)

Top Gear Shaft, Main Gear Shaft, and Counter Gear Shaft

Disassmebled View

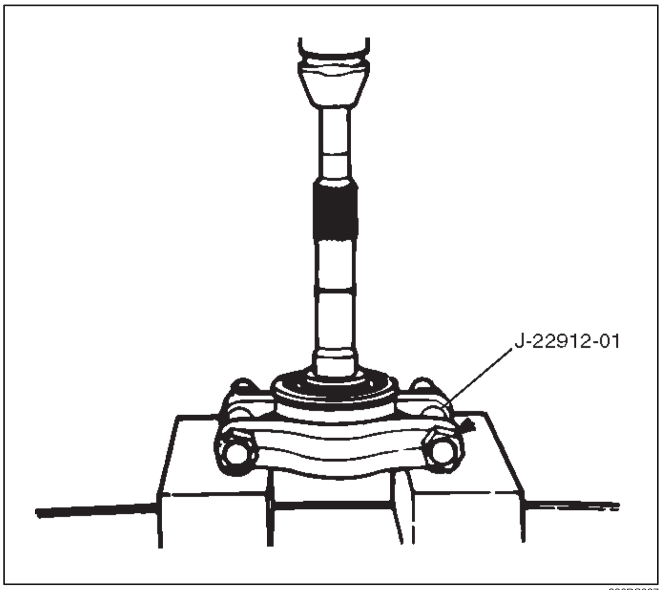


Legend

(1) Top Gear Shaft Snap Ring
(2) Top Gear Shaft
(3) Ball Bearing
(4) Needle Bearing
(5) Top Block Ring
(6) Mainshaft Snap Ring
(7) 3rd–4th Synchronizer Assembly
(8) 3rd Block Ring
(9) 3rd Gear
(10) Needle Bearing
(11) Needle Bearing Collar
(12) Mainshaft Ball Bearing
(13) 1st Gear Thrust Bearing
(14) 1st Gear
(15) 1st Inside Ring
(16) 1st Outside Ring
(17) 1st Block Ring
(18) Needle Bearing
(19) Clutch Hub Snap Ring
(20) 1st–2nd Synchronizer Assembly
(21) 2nd Block Ring
(22) 2nd Outside Ring
(23) 2nd Inside Ring
(24) 2nd Gear
(25) Needle Bearing
(26) Mainshaft
(27) Bearing Snap Ring
(28) Front Rollar Bearing
(29) Center Roller Bearing
(30) Counter Gear Shaft

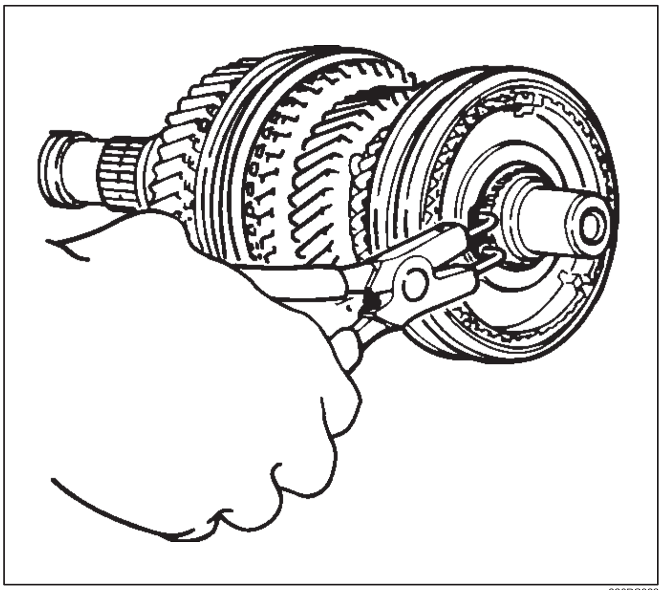
Disassembly

1. Use a pair of snap ring pliers to remove the top gear shaft snap ring(1).
2. Remove top gear shaft(2) with ball bearing(3).
3. Use a bench press and the bearing remover J–22912–01 to remove the ball bearing(3).

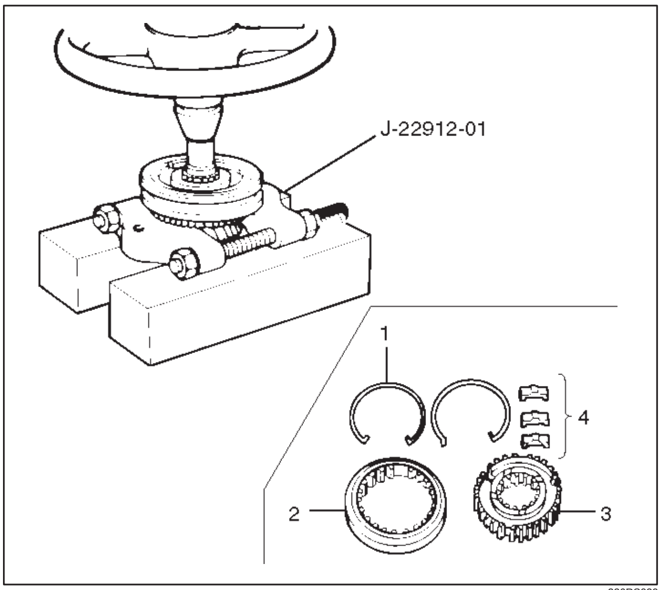


226RS027

4. Remove needle bearing(4) and top block ring(5), mainshaft snap ring.
5. Use a pair of snap ring pliers to remove the mainshaft snap ring(6).


226RS028

6. Use a bench press and the bearing remover J–22912–01 to remove the 3rd–4th synchronizer assembly(7) as a set.
   Disassemble the synchronizer assembly.

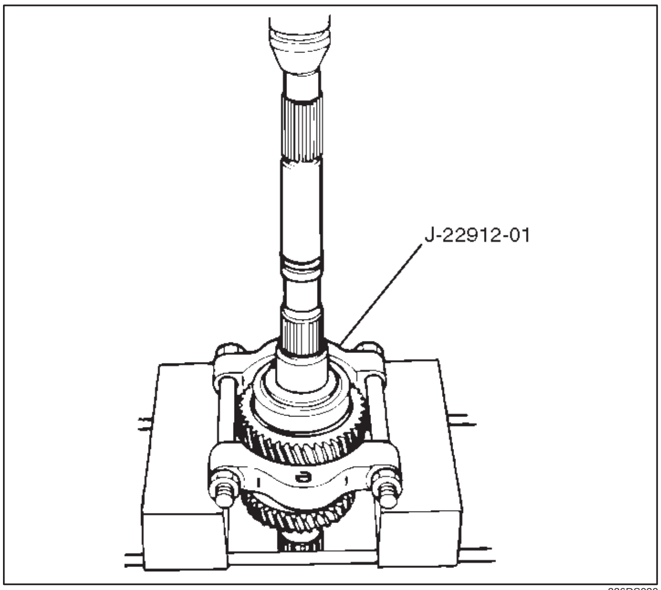


226RS029

Legend

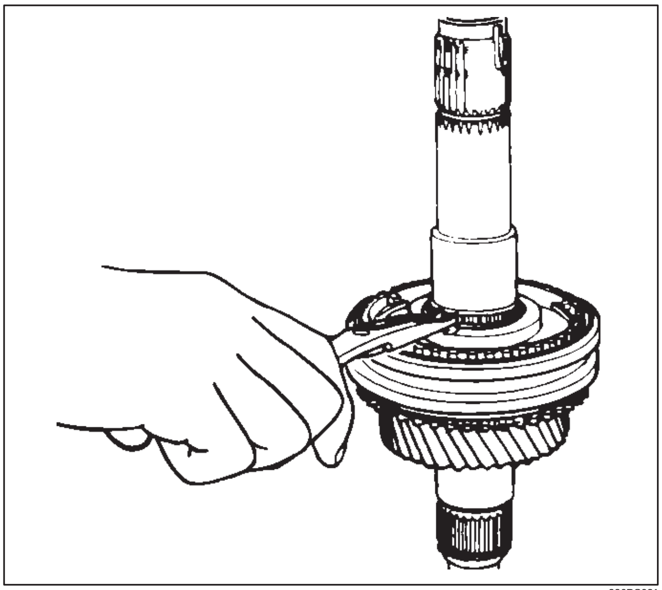
(1) Springs
(2) Sleeve
(3) Clutch Hub
(4) Inserts

7. Remove 3rd block ring(8), 3rd gear(9), and needle bearing(10).
8. Remove needle bearing collar(11).
9. Use a bench press and the bearing remover J–22912–01 to remove the 1st gear(14) together with the mainshaft ball bearing(12) and 1st gear thrust bearing(13).



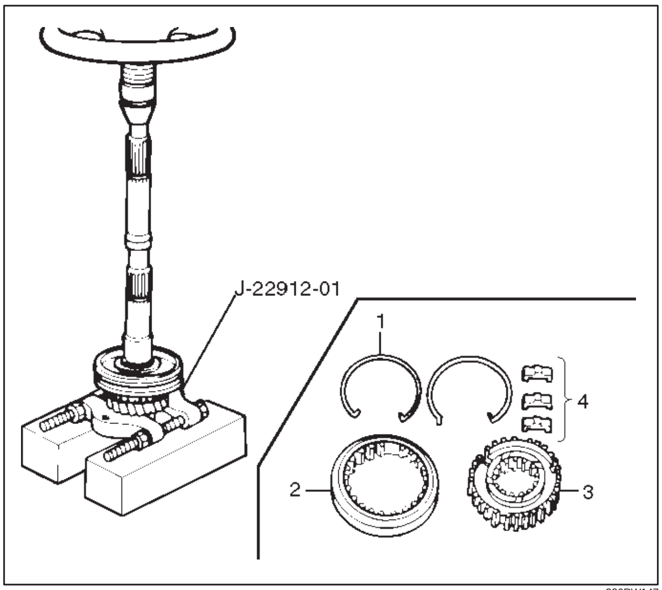
226RS030

10. Disassemble 1st inside ring(15), 1st outside ring(16), and 1st block ring(17).
11. Remove needle bearing(18).
12. Use a pair of snap ring pliers to remove the clutch hub snap ring(19).



226RS031

13. Use a bench press and the bearing remover J–22912–01 to remove the 2nd gear(24) together with 1st–2nd synchronizer assembly(20), 2nd block ring(21), 2nd outside ring(22), and 2nd inside ring(23).
    Disassemble the synchronizer assembly.

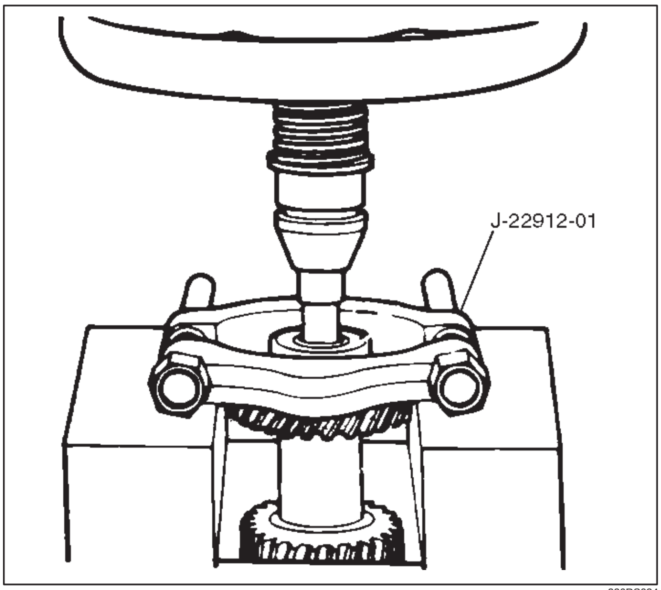


226RW147

Legend

(1) Springs
(2) Sleeve
(3) Clutch Hub
(4) Inserts

14. Remove needle bearing(25) from mainshaft(26).
15. Remove bearing snap ring(27)
16. Use a bench press and the bearing remover J–22912–01 to remove the front roller bearing(28).



226RS034

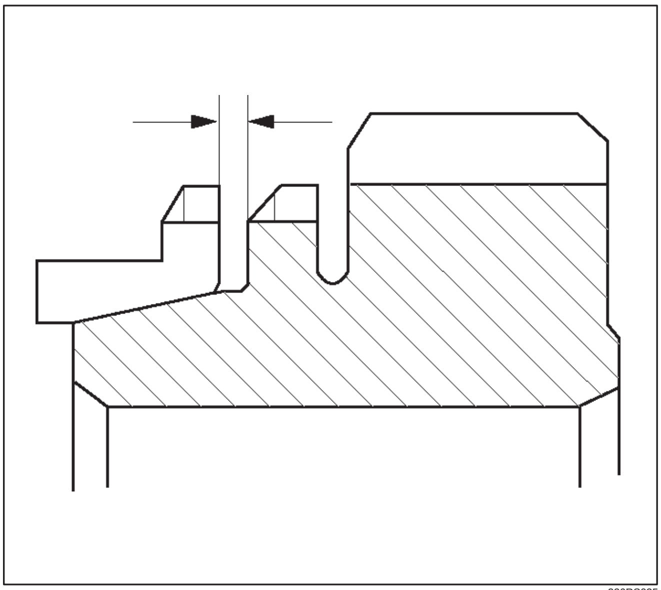
17. Remove center roller bearing(29) from counter gear shaft(30).

Inspection and Repair

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Block Ring and Dog Teeth Clearance

- Use a thickness gauge to measure the clearance between the block ring and the dog teeth.



226RS035

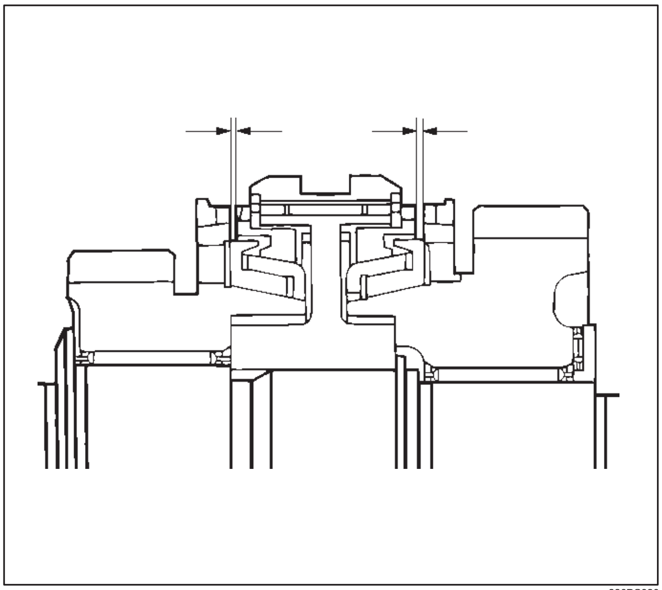
If the measured value exceeds the specified limit, the block ring must be replaced.

Block Ring and Dog Teeth Clearance

Standard	Limit
1.5 mm (0.059 in)	0.8 mm (0.032 in)

1st–2nd Synchronizer (3–CONE)

- Use a thickness gauge to measure the clearance between the block ring and the dog teeth.



226RS036

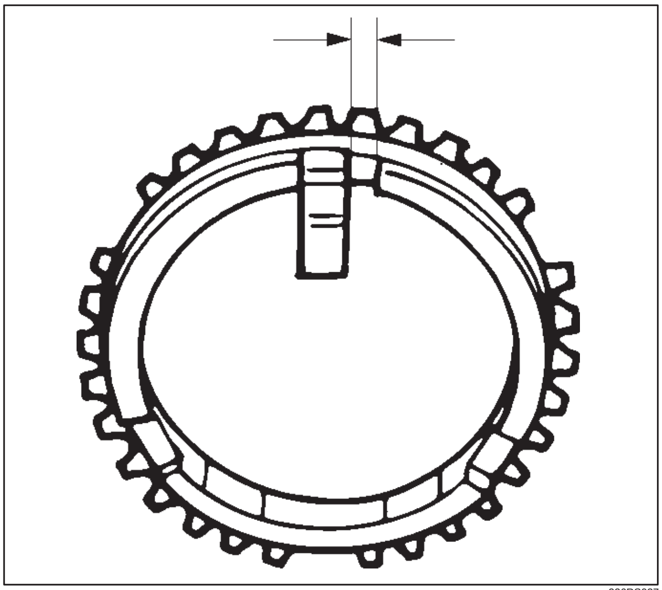
If the measured value exceeds the specified limit,the 1st–2nd synchronizer assembly must be replaced.

Block Ring and Dog Teeth Clearance

Standard	Limit
1.5 mm (0.059 in)	0.8 mm (0.032 in)

Block Ring and Insert Clearance

- Use a vernier caliper or thickness gauge to measure the clearance between the block ring and the insert.



226RS037

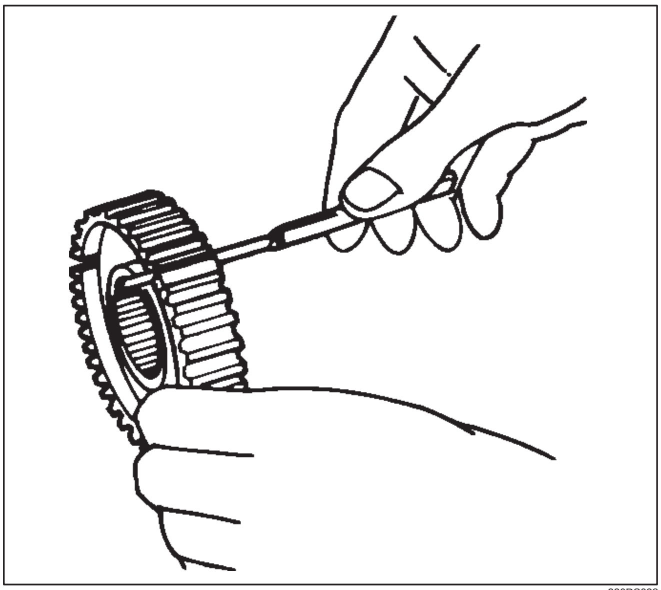
If the measured value exceeds the specified limit, the block ring and the insert must be replaced.

Block and Insert Clearance

	Standard	Limit
3rd–4th	3.46 – 3.74 mm (0.136 – 0.147 in)	4.0 mm (0.158 in)
1st–2nd	4.34 – 4.66 mm (0.171 – 0.183 in)	4.9 mm (0.193 in)
Rev–5th	3.59 – 3.91 mm (0.141 – 0.154 in)	4.1 mm (0.161 in)

Clutch Hub and Insert Clearance

- Use a thickness gauge to measure the clearance between the clutch hub and the insert.



226RS038

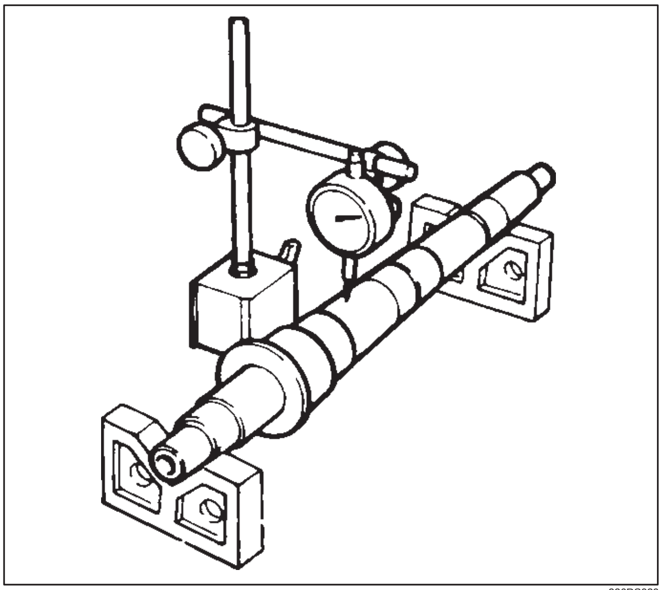
If the measured value exceeds the specified limit, the clutch hub and the insert must be replaced.

Clutch Hub and Insert Clearance

	Standard	Limit
3rd–4th	0.01 – 0.19 mm (0.0004 – 0.0075 in)	0.3 mm (0.012 in)
1st–2nd Rev–5th	0.09 – 0.31 mm (0.0035 – 0.0122 in)	0.4 mm (0.016 in)

Mainshaft Run-out

- Install the mainshaft to V-blocks.
- Use a dial indicator to measure the mainshaft central portion run-out.



226RS039

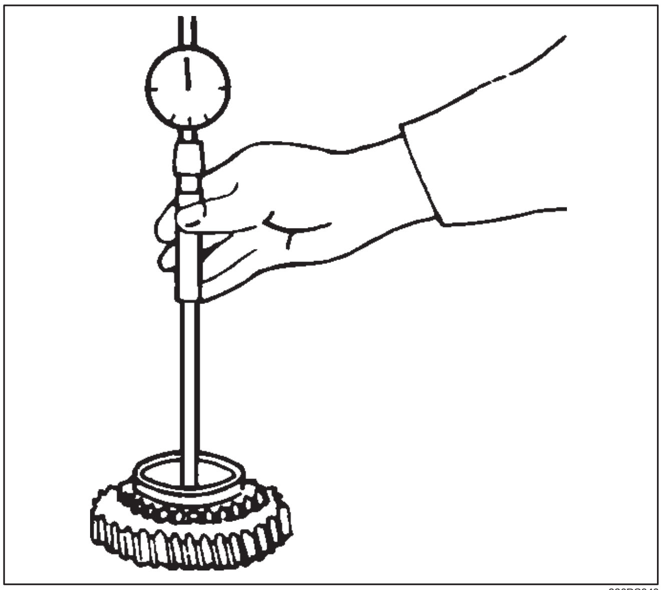
If the measured mainshaft run-out exceeds the specified limit, the mainshaft must be replaced.

Mainshaft Run–out

Limit: 0.05 mm (0.0020 in)

Gear Inside Diameter

- Use an inside dial indicator to measure the gear inside diameter.



226RS040

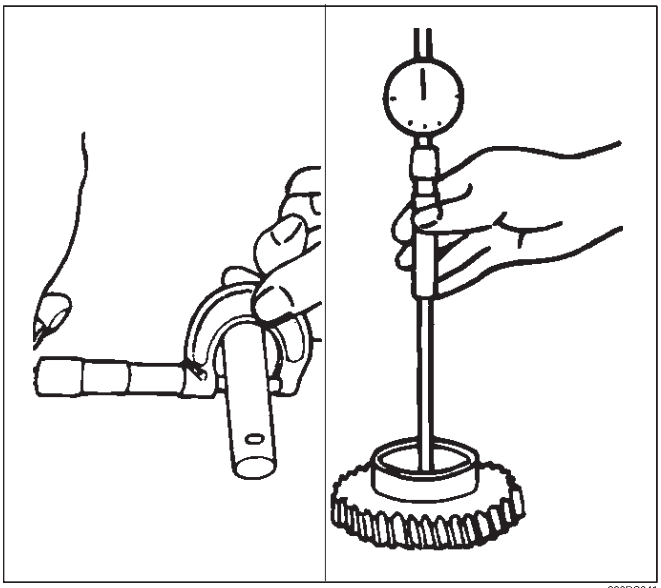
If the measured value is less than the specified limit, the gear must be replace.

Gear Inside Diameter

	Standard	Limit
1st 3rd	45.000 – 45.013 mm (1.771 – 1.772 in)	45.100 mm (1.776 in)
2nd	52.000 – 52.013 mm (2.047 – 2.048 in)	52.100 mm (2.051 in)
Rev.	48.000 – 48.013 mm (1.889 – 1.890 in)	48.100 mm (1.894 in)
5th	32.000 – 32.013 mm (1.259 – 1.260 in)	32.100 mm (1.246 in)

Reverse Idler Gear and Idler Gear Shaft Clearance

- Use a micrometer to measure the idler gear shaft diameter.
- Use an inside dial indicator to measure the idler gear inside diameter.



226RS041

- Calculate the idler gear and idler gear shaft clearance.

  Idler gear inside diameter-idler gear shaft diameter = idle gear and idler gear shaft clearance.

  If the measured value exceeds the specified limit, the idle gear and/or the idler gear shaft must be replaced.

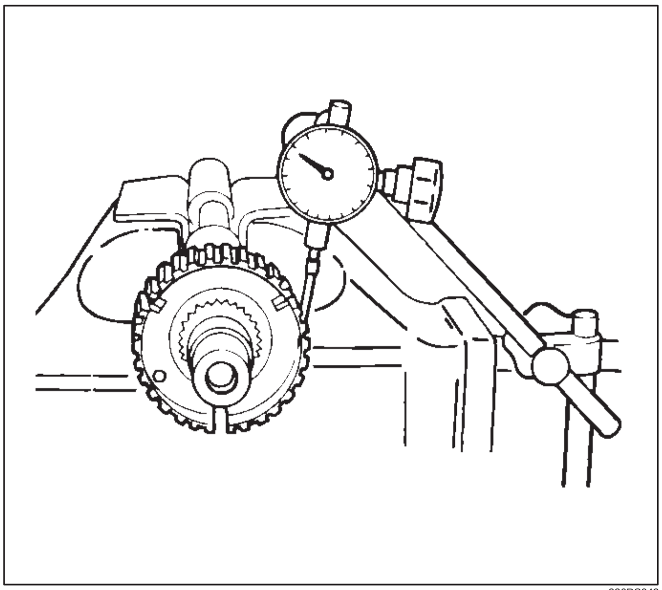
Idler Gear and Idler Gear Shaft Clearance

Standard: 0.041–0.074 mm (0.016–0.0029 in)

Limit: 0.150 mm (0.0059 in)

Clutch Hub Spline Play

- Set a dial indicator to the clutch hub to be measured.



226RS042

- Move the clutch hub as far as possible to both the right and the left.
  Note the dial indicator reading.
  If the measured value exceeds the specified limit, the clutch hub must be replaced.

Clutch Hub Spline Play

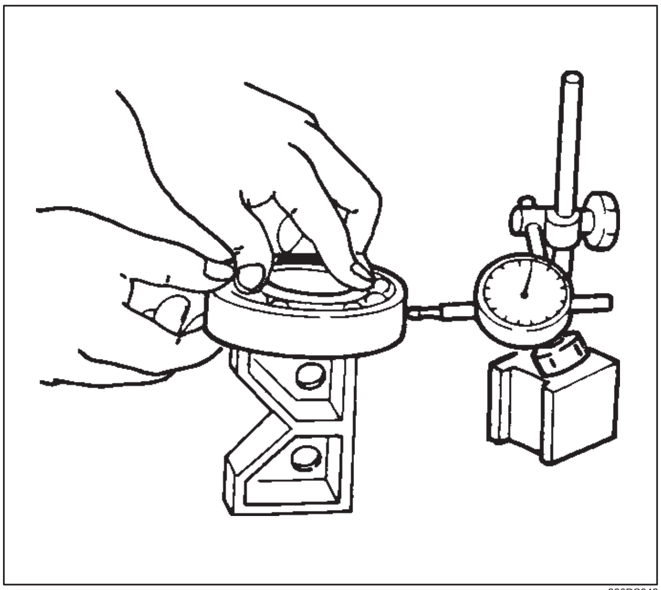
	Standard	Limit
1st–2nd 3rd–4th	0 – 0.1 mm (0 – 0.004 in)	0.2 mm (0.008 in)
Rev. 5th	0 – 0.2 mm (0 – 0.008 in)	0.3 mm (0.012 in)

Ball Bearing Play

- Use a dial indicator to measure the ball bearing play.

Ball Bearing Play

Limit: 0.2 mm (0.008 in)

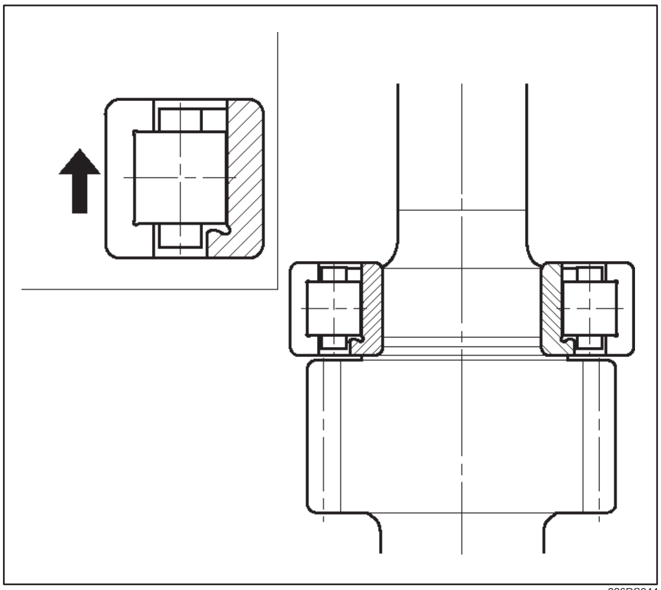


226RS043

Reassembly

1. Install center roller bearing(29) to counter gear shaft(30).
   - Apply engine oil to the bearing inner and outer circumferences.
   - Install the roller bearing in the proper direction.

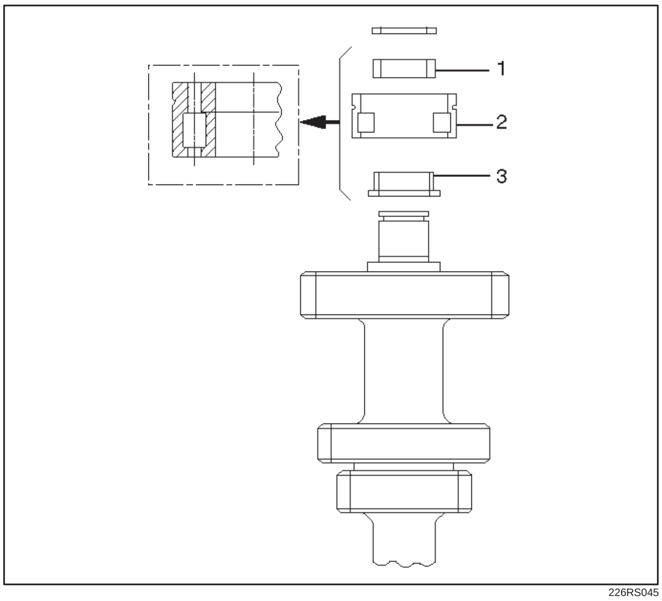
NOTE: Check that outer race moves only in the direction of arrow.



226RS044

2. Install front roller bearing(28) by performing the following steps.
   - Use bearing installer to install the front roller bearing inner race to the counter gear shaft.
   - Install the outer race and roller assembly.
     The snap ring groove must be facing the transmission front side.

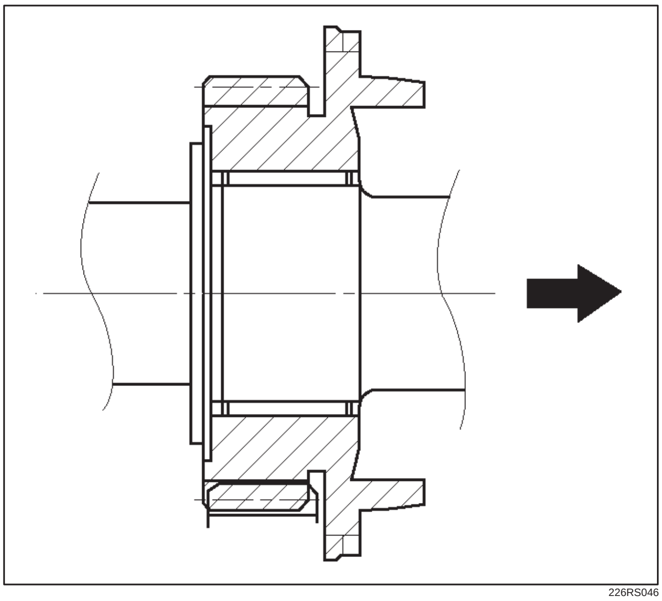
- Use bearing installer J–35283 to install the ring.



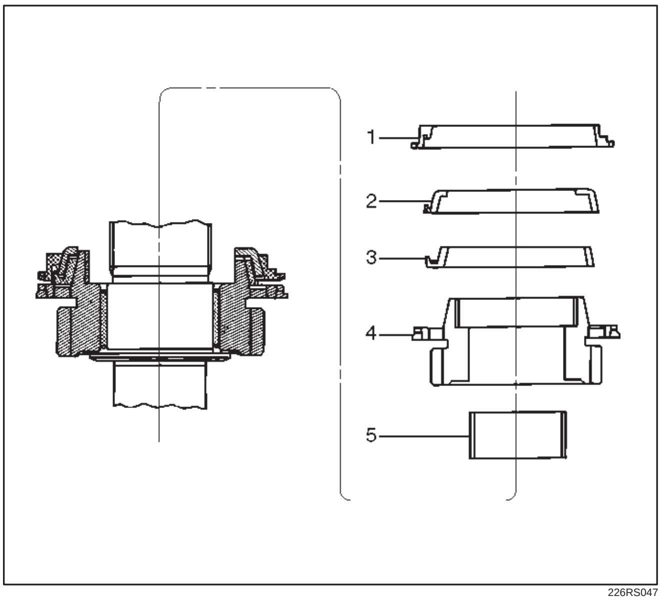
Legend

(1) Ring
(2) Outer Race and Roller Assembly
(3) Inner Race

3. Install bearing snap ring(27) to mainshaft(26).
4. Apply engine oil to the needle bearing(25) and the 2nd gear thrust surfaces.
   Install the needle bearing(25) and the 2nd gear(24) to the mainshaft.
   The 2nd gear dog teeth must be facing the transmission rear side.



5. Assemble 2nd inside ring(23), 2nd outside ring(22), and 2nd block ring(21).
   - Apply engine oil to the synchronizer ring friction surfaces.

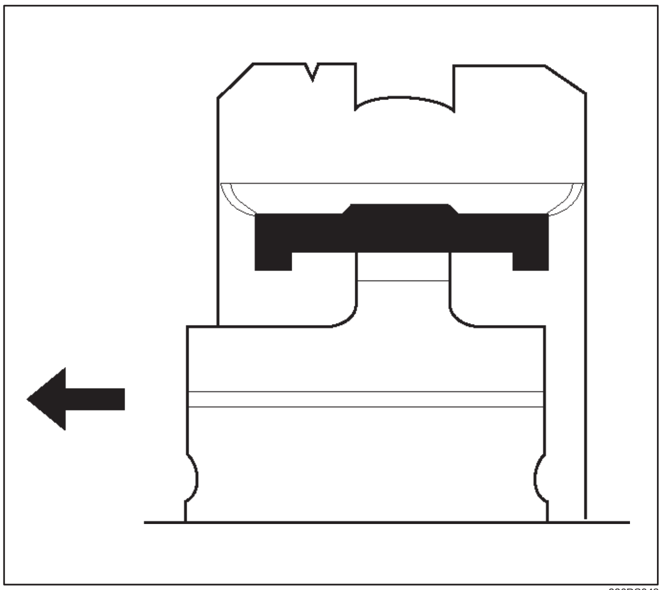


Legend

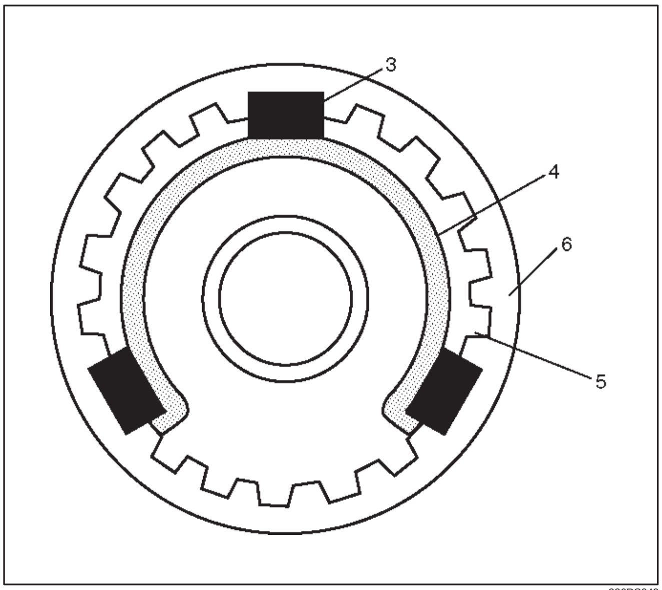
(1) Block Ring
(2) Outside Ring
(3) Inside Ring
(4) 2nd Gear
(5) Needle Bearing

6. Assemble 1st–2nd synchronizer assembly by performing the following steps:
   1. Check that the inserts(3) fit snugly into the block ring insert grooves.
   2. Check that the inserts springs(4) are fitted to the inserts as shown in the illustration.
   3. Check that the clutch hub(5) and the sleeve(6) slide smoothly.
   4. Install the synchronizer assembly to the mainshaft.

   The clutch hub face (with the heavy boss) must be facing the 2nd gear side.

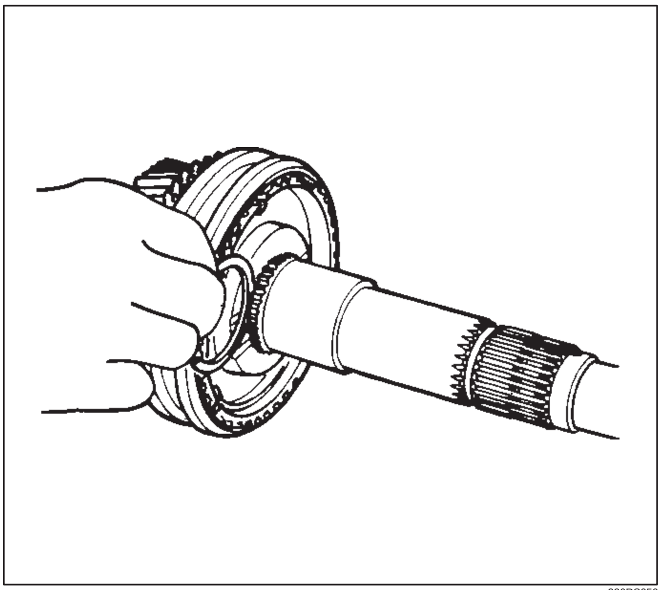


226RS048



226RS049

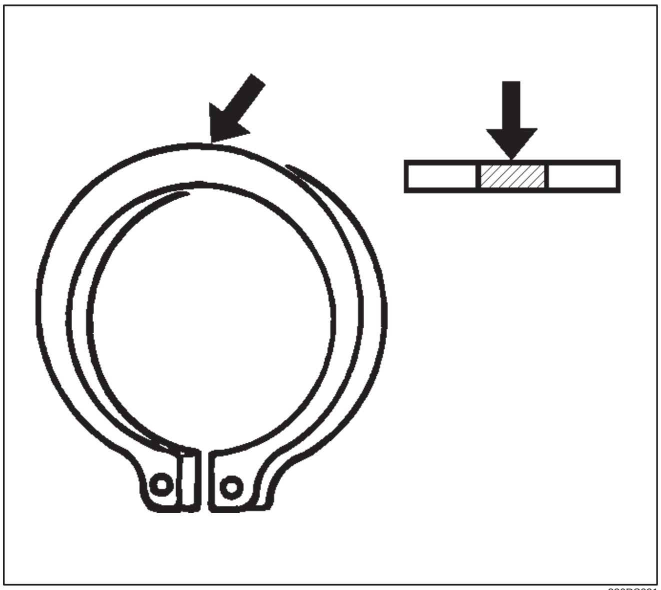
7. Install clutch hub snap ring(19) by performing the following steps:
   - Select the snap ring which will provide the minimum clearance between the 1st–2nd clutch hub and the snap ring.



226RS050

There are three snap ring sizes available.

The snap rings are color coded to indicate their thickness.



226RS021

Clutch Hub and Snap Ring Clearance

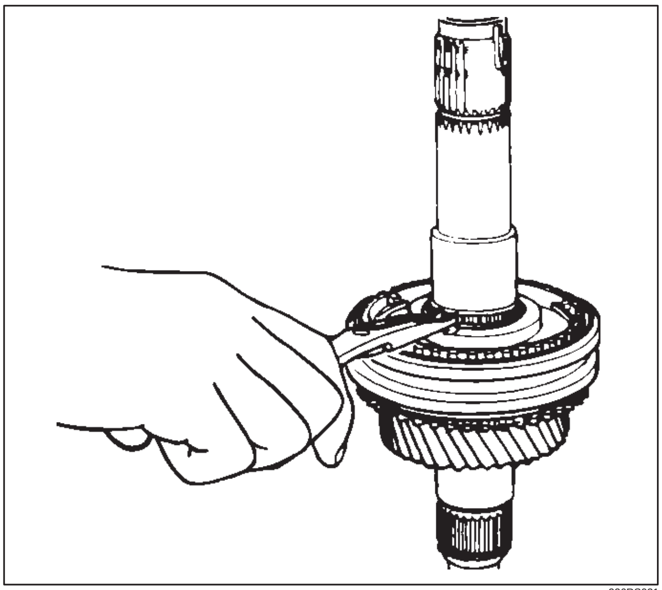
Standard: 0 – 0.1 mm (0 – 0.004 in)

Snap Ring Availability

Thickness	Color Coding
1.80 mm (0.071 in)	White
1.85 mm (0.073 in)	Yellow
1.90 mm (0.075 in)	Blue

- Use a pair of snap ring pliers to install the snap ring to the mainshaft.

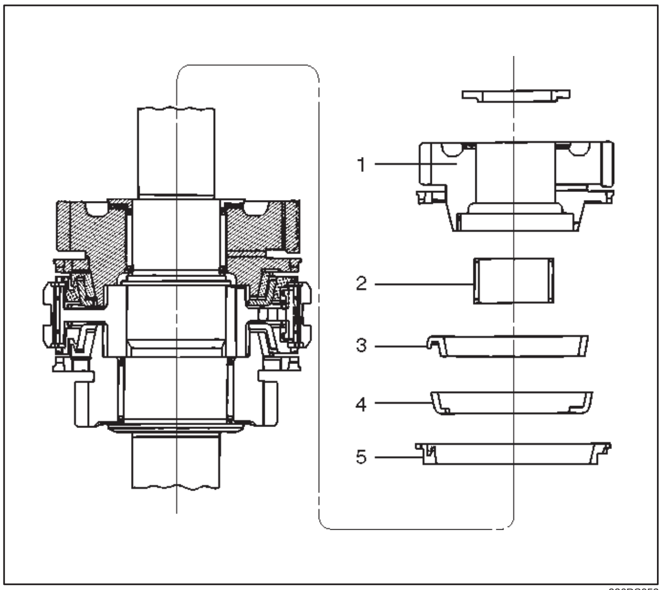
  The snap ring must be fully inserted into the mainshaft snap ring groove.



226RS031

8. Install needle bearing(18), 1st block ring(17), 1st outside ring(16), 1st inside ring(15), and 1st gear(14).
   - Apply engine oil to the needle bearing, 1st gear thrust surfaces and synchronizer ring friction surfaces.
   - Install the needle bearing and the 1st gear to the mainshaft.

     The 1st gear dog teeth must be facing the transmission front side.



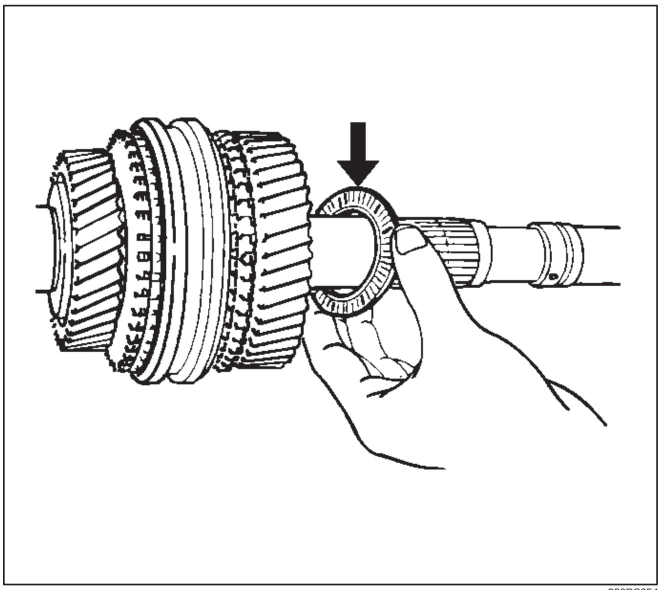
226RS053

Legend

(1) 1st Gear
(2) Needle Bearing
(3) Inside Ring
(4) Outside Ring
(5) Block Ring

9. Install the 1st gear thrust bearing and the race(13) to the main shaft.

   The thrust bearing side must be facing the transmission front side.



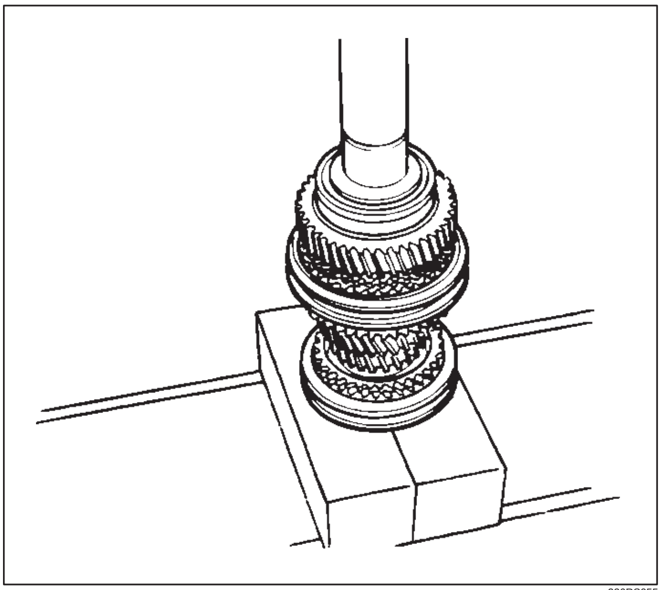
226RS054

10. Apply engine oil to the mainshaft ball bearing(12) and the mainshaft(26).

    Install the ball bearing(12) and needle bearing collar(11) to the mainshaft(26).

    The ball bearing snap ring groove must be facing the transmission rear side.

    Use a bench press and installer J–6133–01 to slowly force the collar into place.

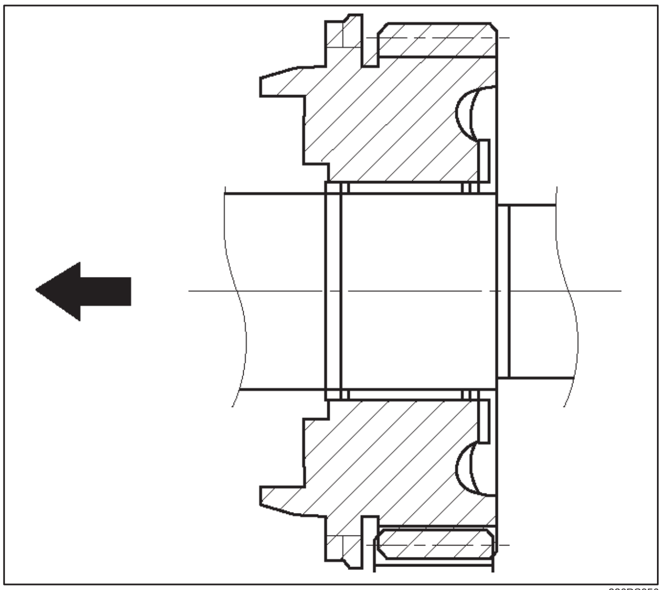


226RS055

11. Apply engine oil to the needle bearing and the 3rd gear thrust surfaces.

    Install the needle bearing(10) and the 3rd gear(9) to the mainshaft.

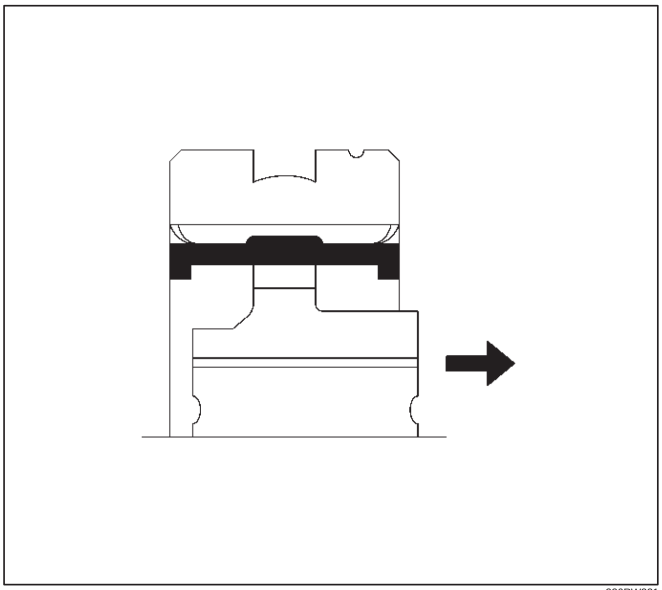
    The 3rd gear dog teeth must be facing the transmission front side.



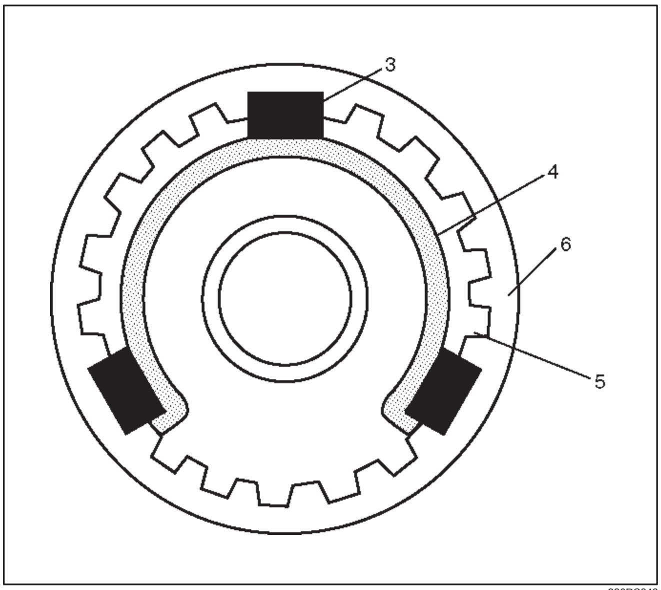
226RS056

12. Install 3rd block ring(8).
13. Check and install 3rd–4th synchronizer assembly(7) by the following steps:
    1. Check that the inserts(3) fit snugly into the block ring insert grooves.
    2. Check that the insert springs(4) are fitted to the inserts as shown in the illustration.
    3. Check that the clutch hub(5) and the sleeve(6) slide smoothly.
    4. Install the synchronizer assembly to the mainshaft.

    The clutch hub face (with the heavy boss) must be facing the 3rd gear side.

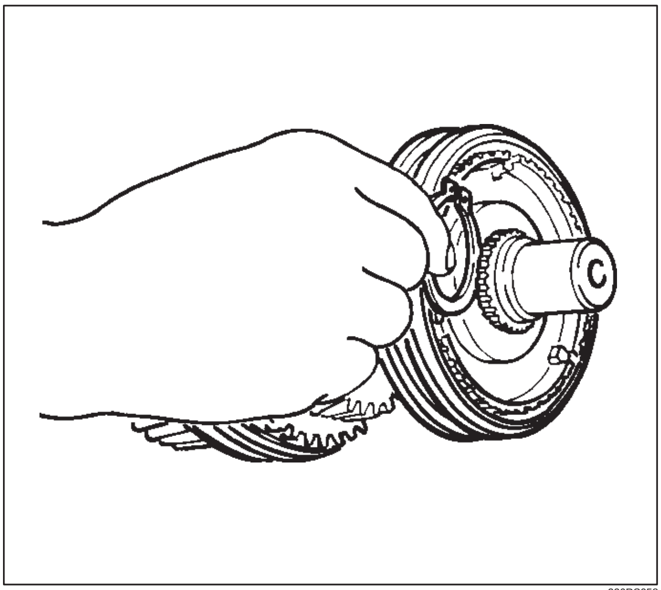


226RW221



226RS049

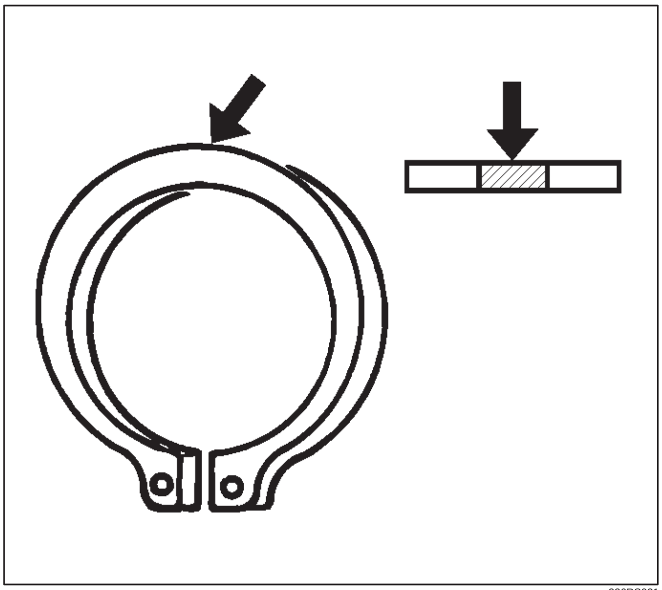
14. Select and install mainshaft snap ring(6) in the following way:
    - Select the snap ring which will provide the minimum clearance between the 3rd–4th clutch hub and the snap ring.



226RS058

There are three snap ring sizes available.

The snap rings are color coded to indicate their thickness.



226RS021

Clutch Hub and Snap Ring Clearance

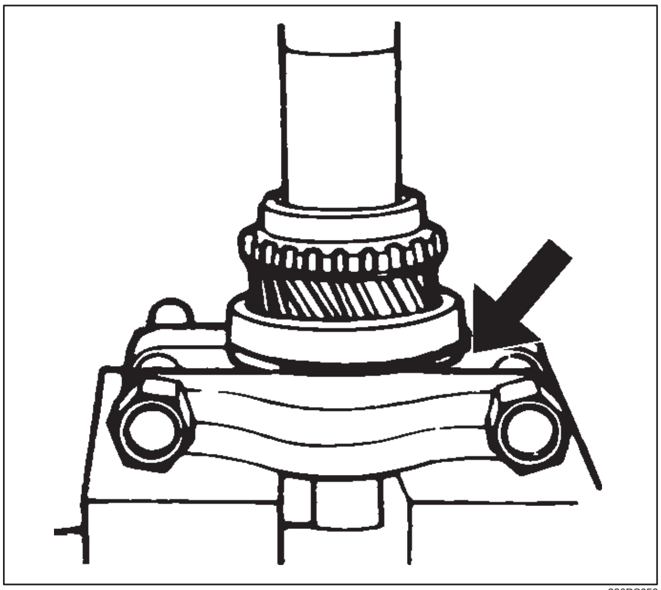
Standard: 0 – 0.1 mm (0 – 0.004 in)

Snap Ring Availability

Thickness	Color Coding
1.80 mm (0.071 in)	White
1.85 mm (0.073 in)	Yellow
1.90 mm (0.075 in)	Blue

- Use a pair of snap ring pliers to install the snap ring to the mainshaft.
  The snap ring must be fully inserted into the mainshaft snap ring groove.

15. Install top block ring(5).
16. Apply grease to the bearing inner and outer circumferences and install needle bearing(4).
17. Use a bench press to install the top gear shaft ball bearing(3) to the top gear shaft(2).



226RS059

The snap ring groove must be facing the transmission front side.

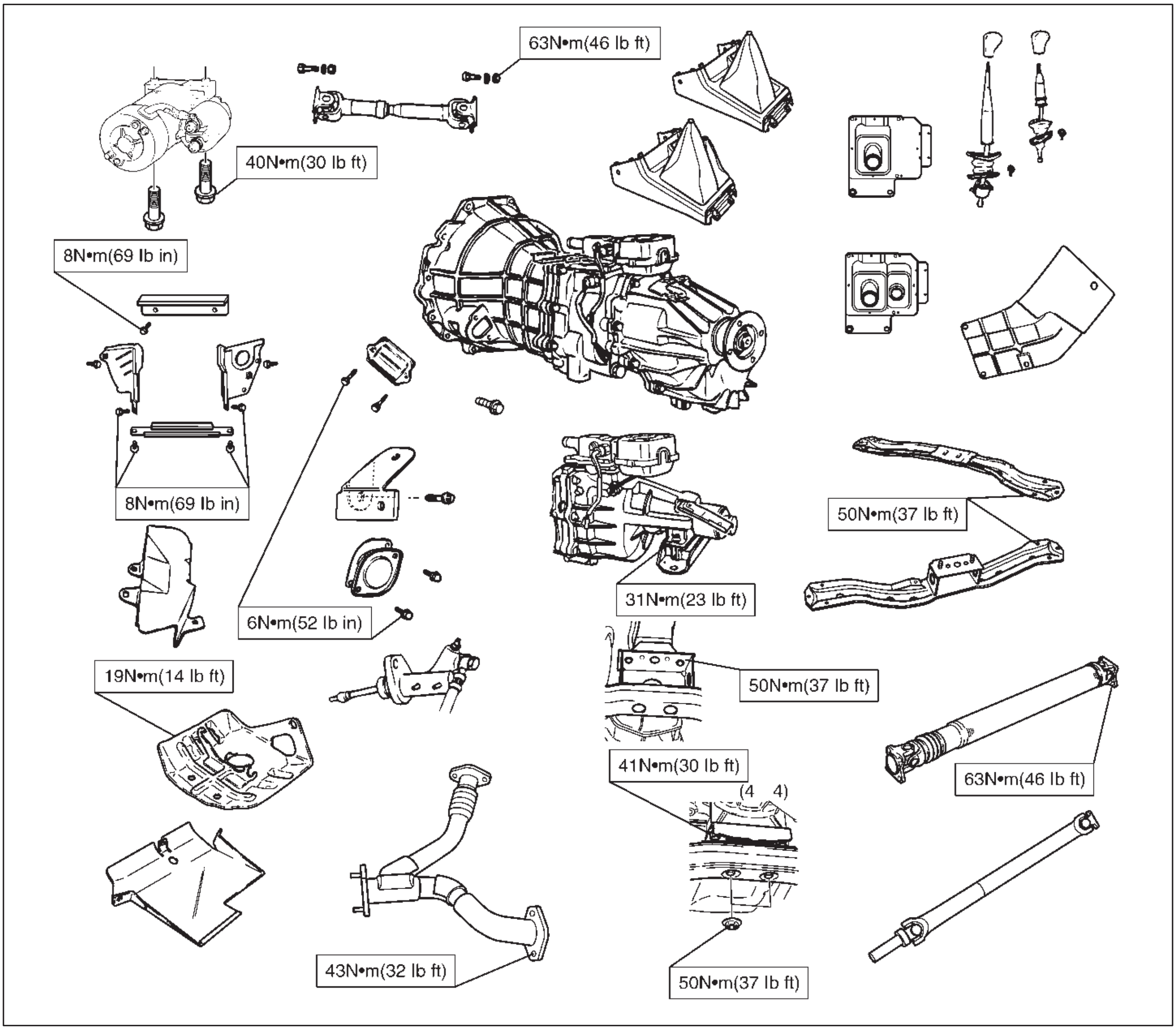
18. Use a pair of snap ring pliers to install the top gear shaft snap ring(1) to the bearing.

Main Data and Specifications

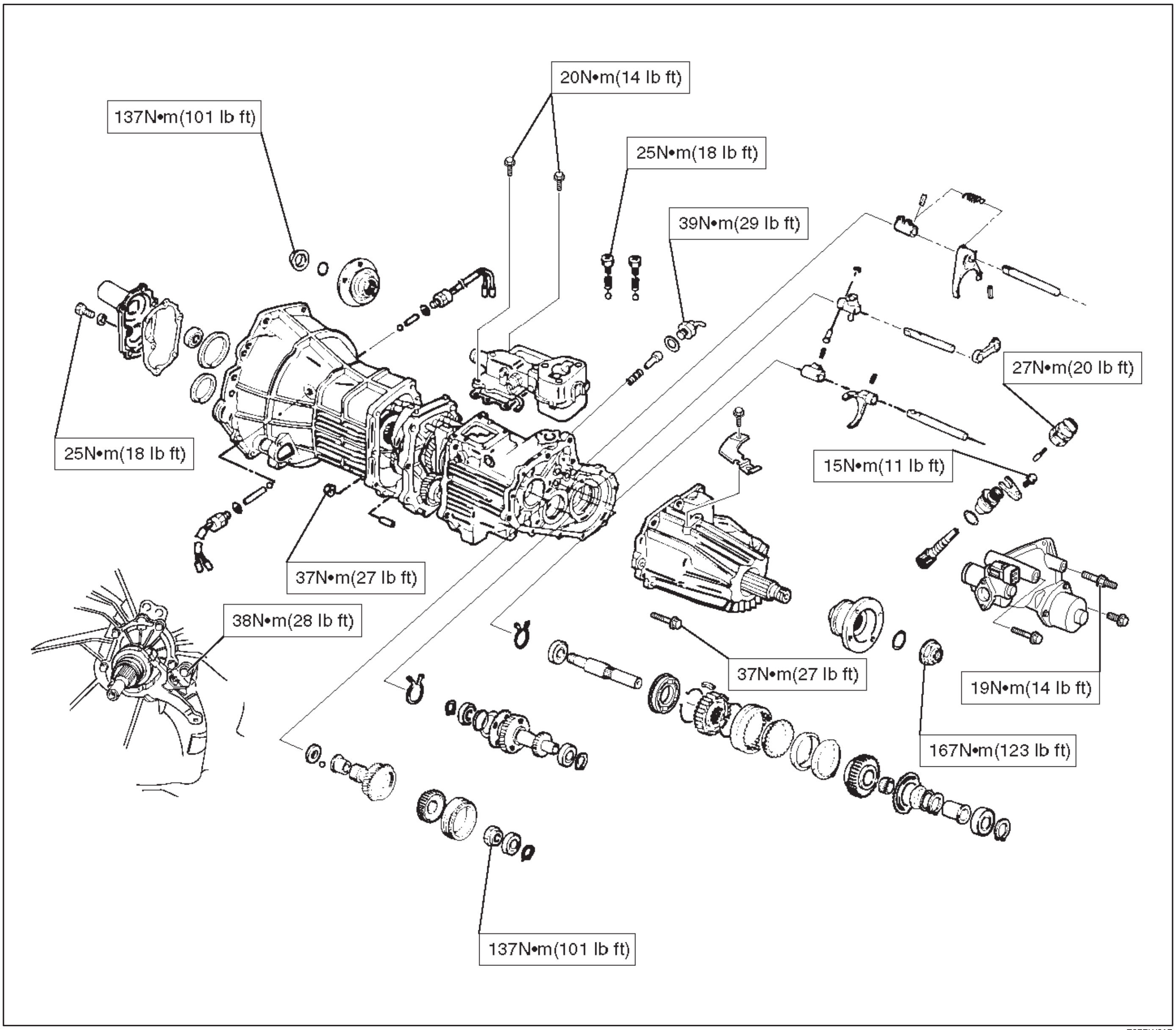
General Specifications

		4X2	4X4
Transmission type		Fully synchronized forward and reverse gears	
Transfer case		—	Synchronized type gears shifting between the 2– and 4–wheel drive mode. Constant mesh type gears between “low” and “high”
Control method		Remote control with the gear shift lever on the floor.	
Gear ratio: Transmission	1st	3.767	
	2nd	2.248	
	3rd	1.404	
	4th	1.000	
	5th	0.809	
	Rev.	3.873	
Gear ratio: Transfer	High	—	1.000
	Low	—	2.050
Transmission oil capacity		2.95 lit. (3.12 US qt)	
Transfer oil capacity		—	1.45 lit. (1.53 US qt)
Type of lubricant		Engine oil: Refer to the chart in “SECTION 0”	

Torque Specifications

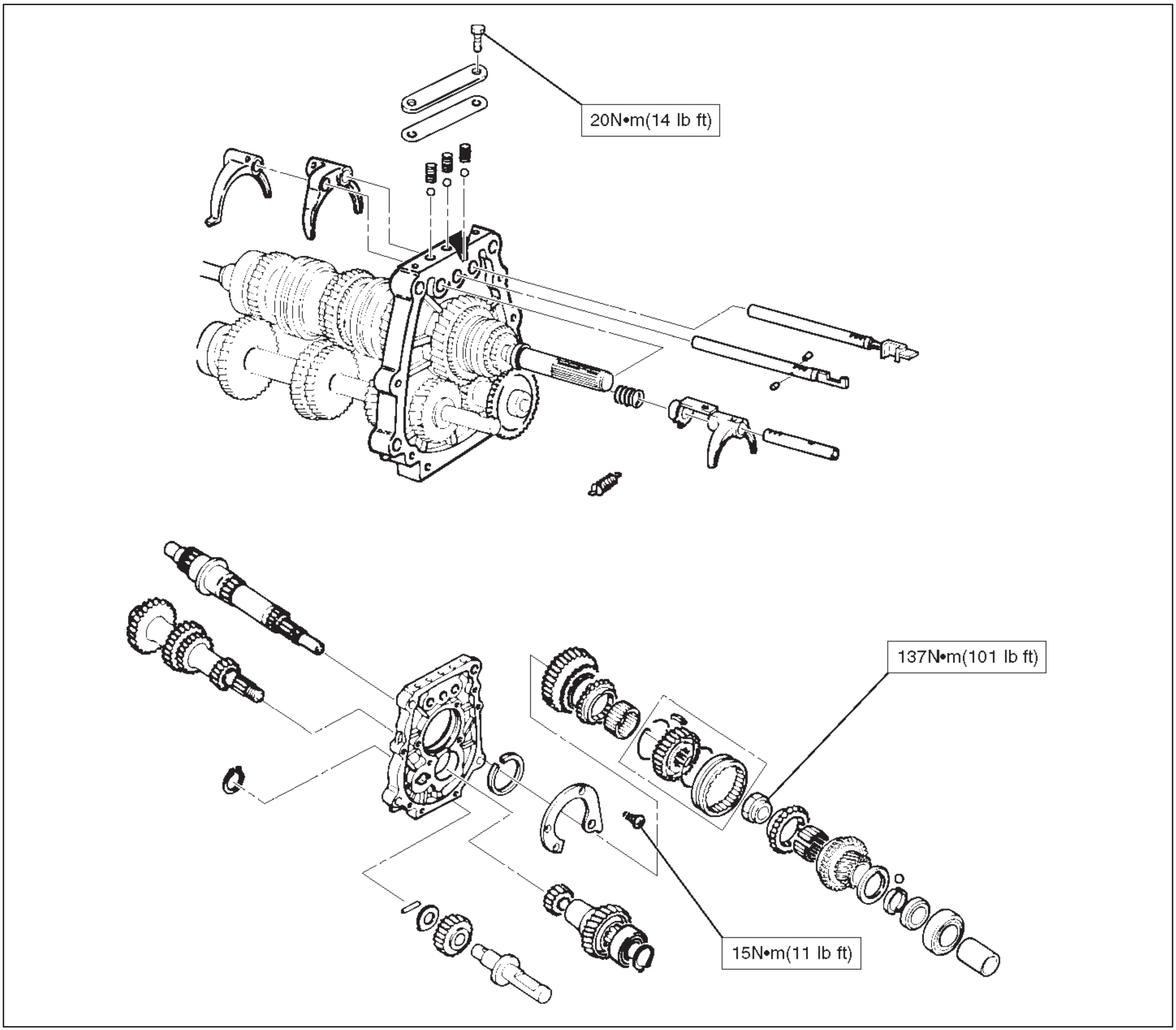


Torque Specifications (Cont'd)



E07RW017

Torque Specifications (Cont'd)



E07RW019

Special Tools (MUA)

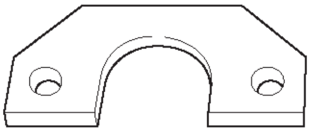
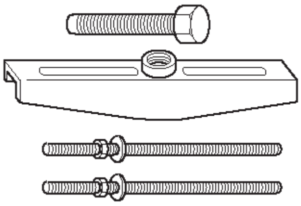
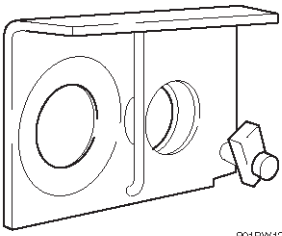
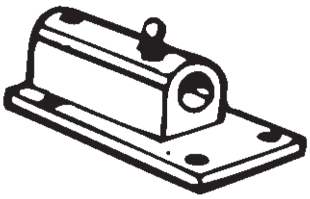
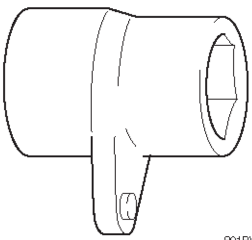
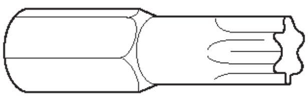
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RW143	**J–37222** Mainshaft collar remover
 901RW132	**J–37487** Puller
 901RW124	**J–37224** Holding fixture
 901RS213	**J–3289–20** Holding fixture base
 901RW122	**J–37219** Wrench
 901RW125	**J–37225** Tork bit wrench (T–45)

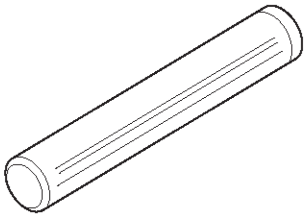
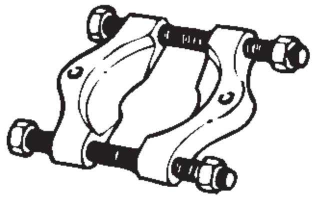
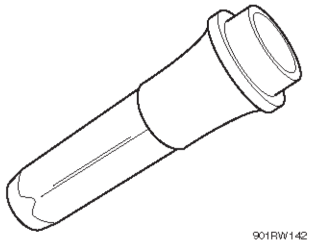
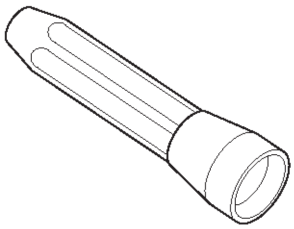
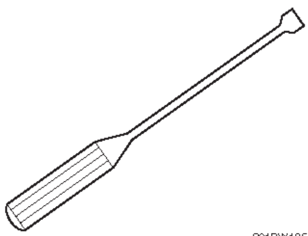
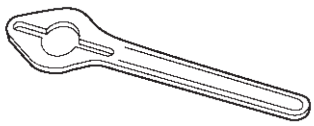
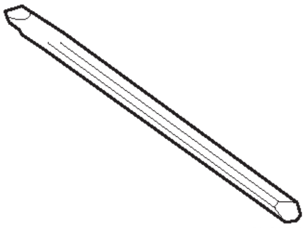
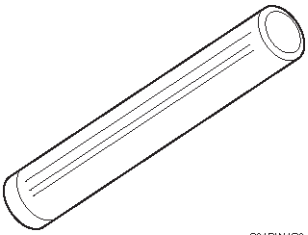
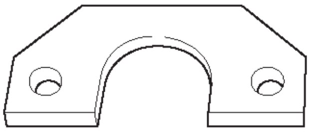
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RW123	**J–37223** Mainshaft end bearing installer
 901RS239	**J–22912–01** Bearing remover/installer
 901RW142	**J–29769** Rear cover oil seal installer
 901RW118	**J–26540** Front cover oil seal installer
 901RW135	**J–39207** Remover; Clutch release bearing
 901RW071	**J–8614–11** Flange holder

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS228	**J–39209** Punch; end nut
 901RW120	**J–35283** Counter shaft bearing installer
 901RW143	**J–37217** Bearing remover

RODEO

TRANSMISSION

CLUTCH

CONTENTS

Service Precaution

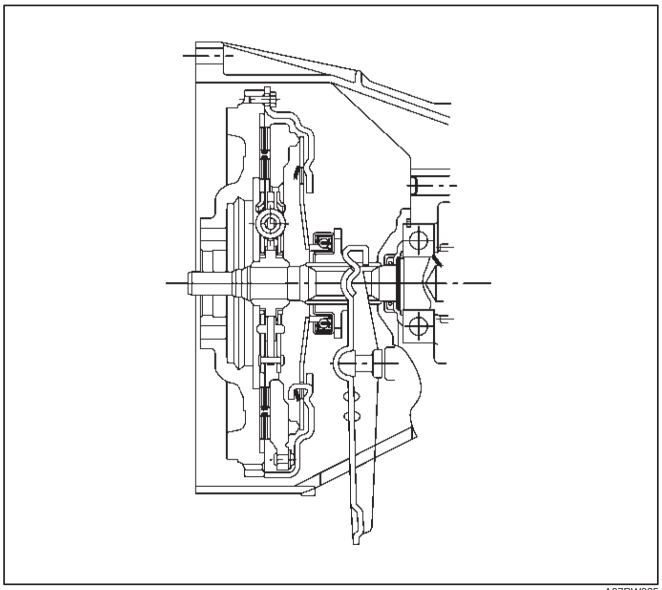
WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

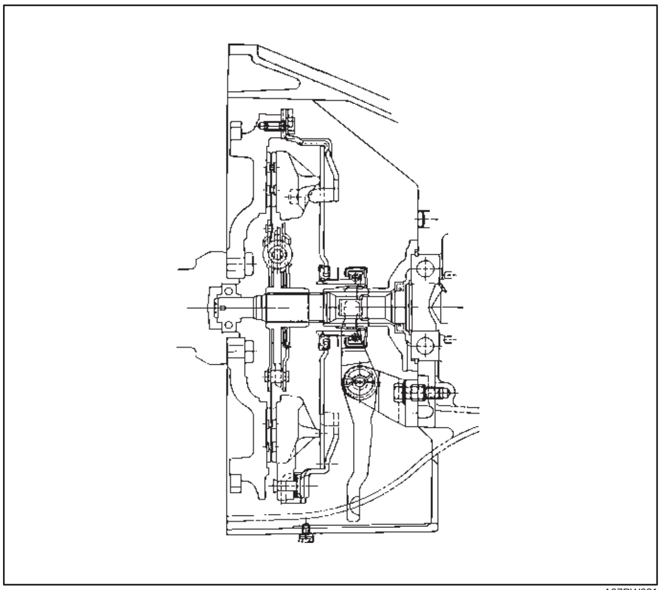
Clutch

X22SE



A07RW035

6VD1



A07RW031

The clutch assembly consists of the pressure plate assembly and the driven plate assembly.

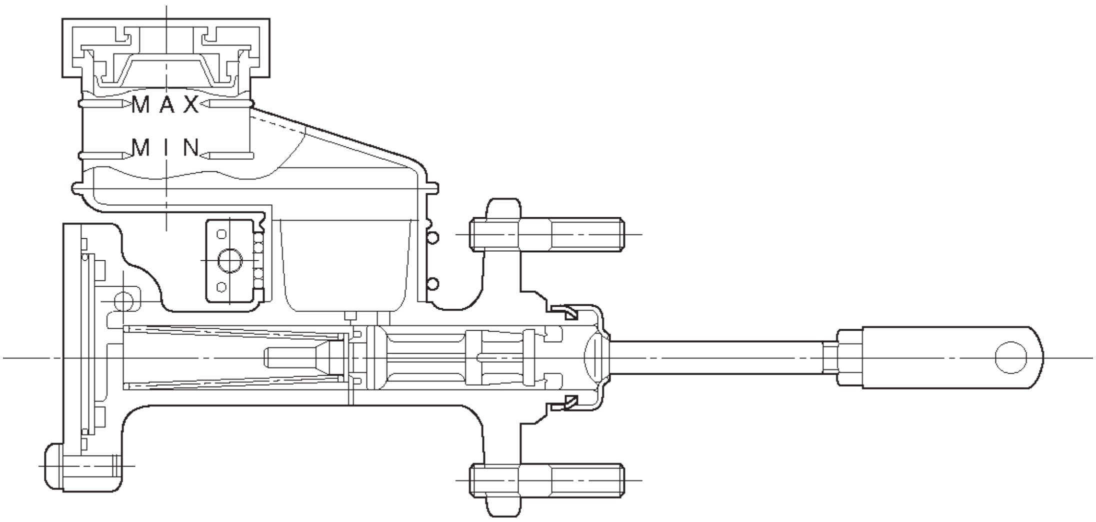
The clutch pedal is connected to the release bearing through the shift fork.

The driven plate assembly is installed between the flywheel and the pressure plate. Diaphragm spring pressure holds the driven plate against the flywheel and the pressure plate to provide the friction necessary to engage the clutch.

Depressing the clutch pedal moves the shift fork against the release bearing. The release bearing force overcomes the force of the diaphragm spring and separates the driven plate from the flywheel and pressure plate to disengage the clutch.

For 6VD1 (3.2L) engine model, the pull–type clutch is employed.

Master Cylinder

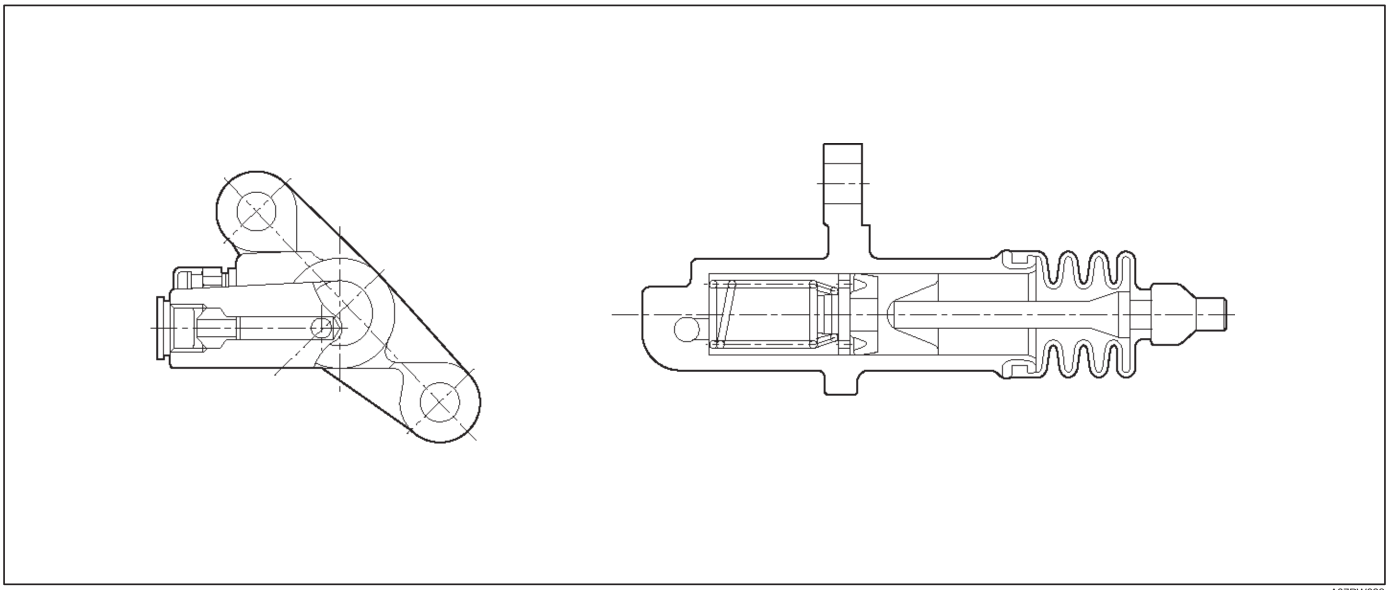


A07RW007

The master cylinder converts mechanical energy into hydraulic energy.
Depressing the clutch pedal causes the push rod to move against the piston to close the return port.
Clutch fluid is forced out of the master cylinder.
Releasing the clutch pedal causes the return spring to force the piston back to its original position.

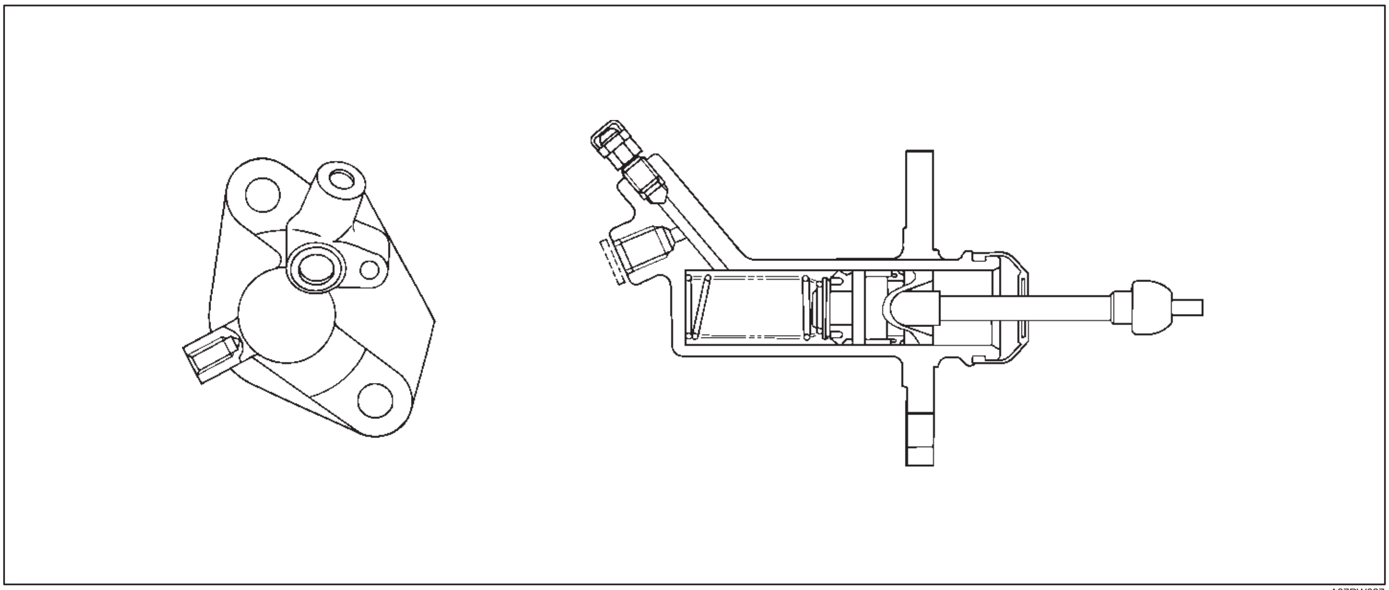
Slave Cylinder

X22SE



A07RW028

6VD1

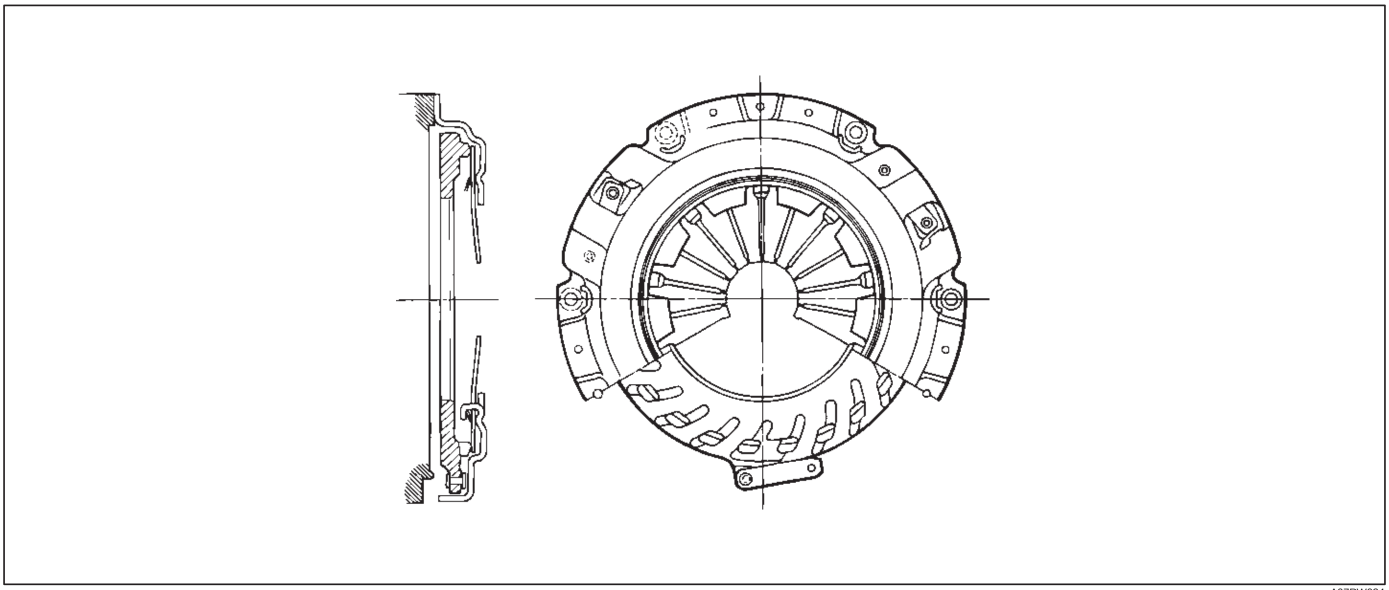


A07RW037

The slave cylinder converts hydraulic energy into mechanical energy. Hydraulic fluid supplied by the master cylinder moves the slave cylinder piston to actuate the shift fork. The mechanical energy produced by the slave cylinder is directly proportional to the diameters of the master cylinder and the slave cylinder.

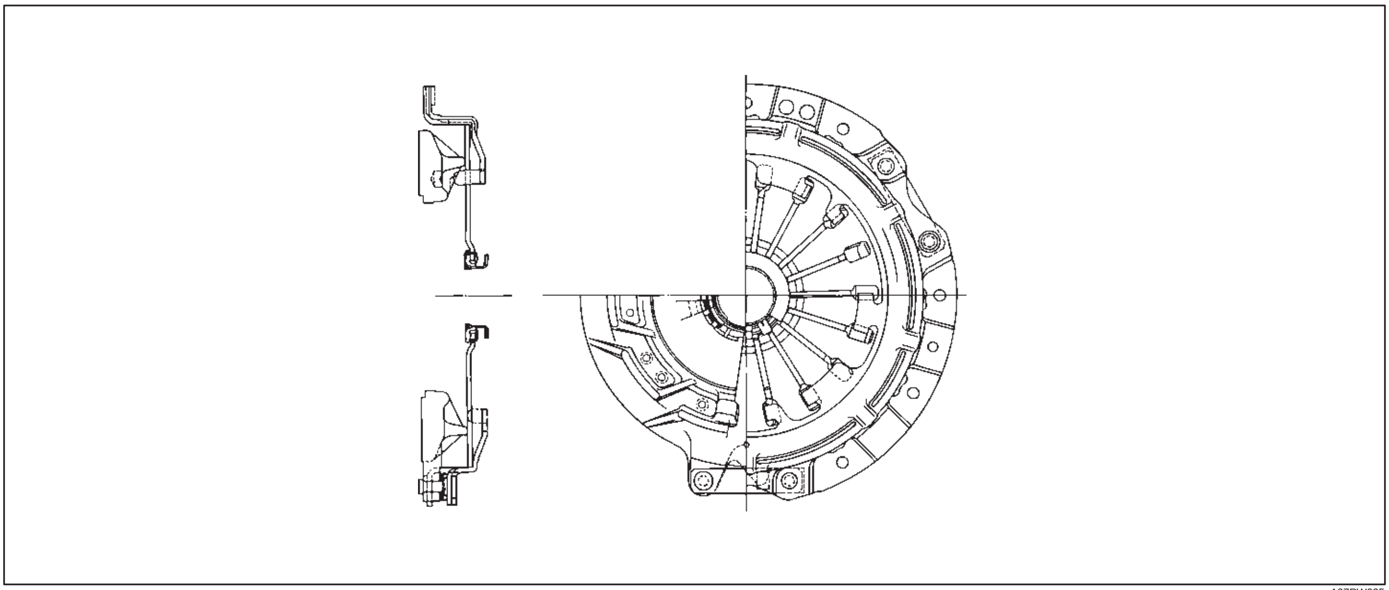
Pressure Plate Assembly

X22SE



A07RW024

6VD1



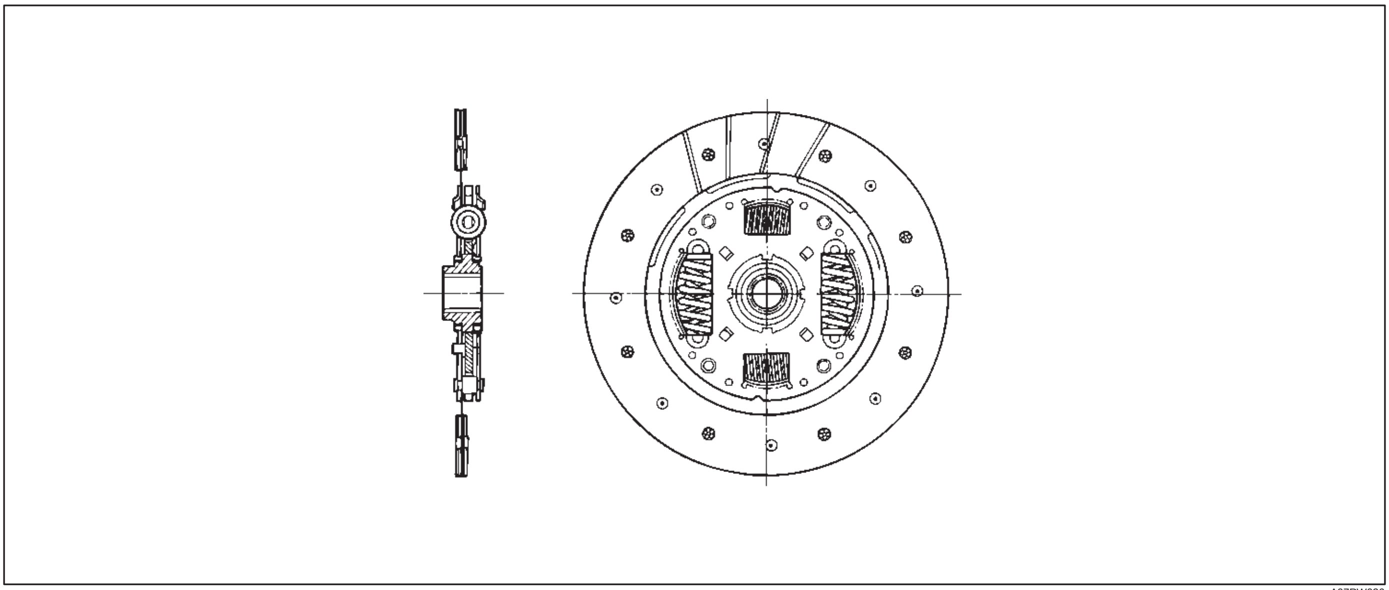
A07RW025

The pressure plate assembly consists of the clutch cover, the pressure plate with diaphragm spring.

Operating the clutch pedal causes the pressure plate to move in an axial direction to engage and disengage the clutch.

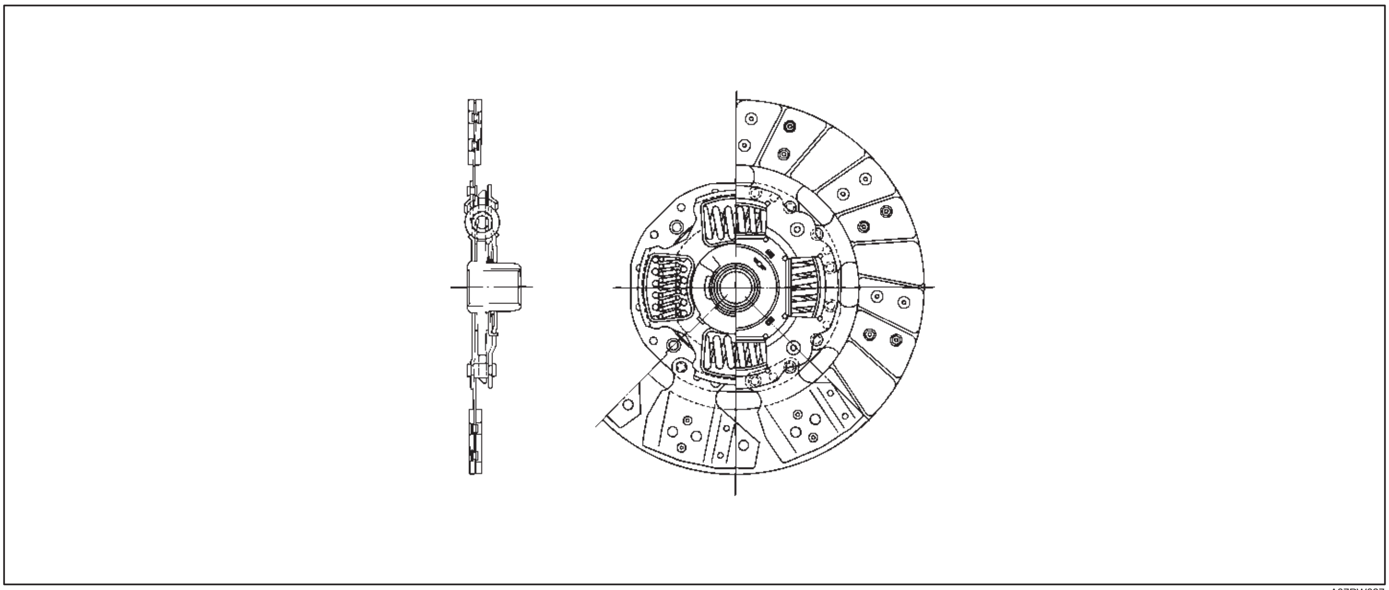
Driven Plate Assembly

X22SE



A07RW026

6VD1



A07RW027

The driven plate assembly consists of the plate and the facing.

The plate consists of the clutch center, the cushioning plate, and the torsion springs.

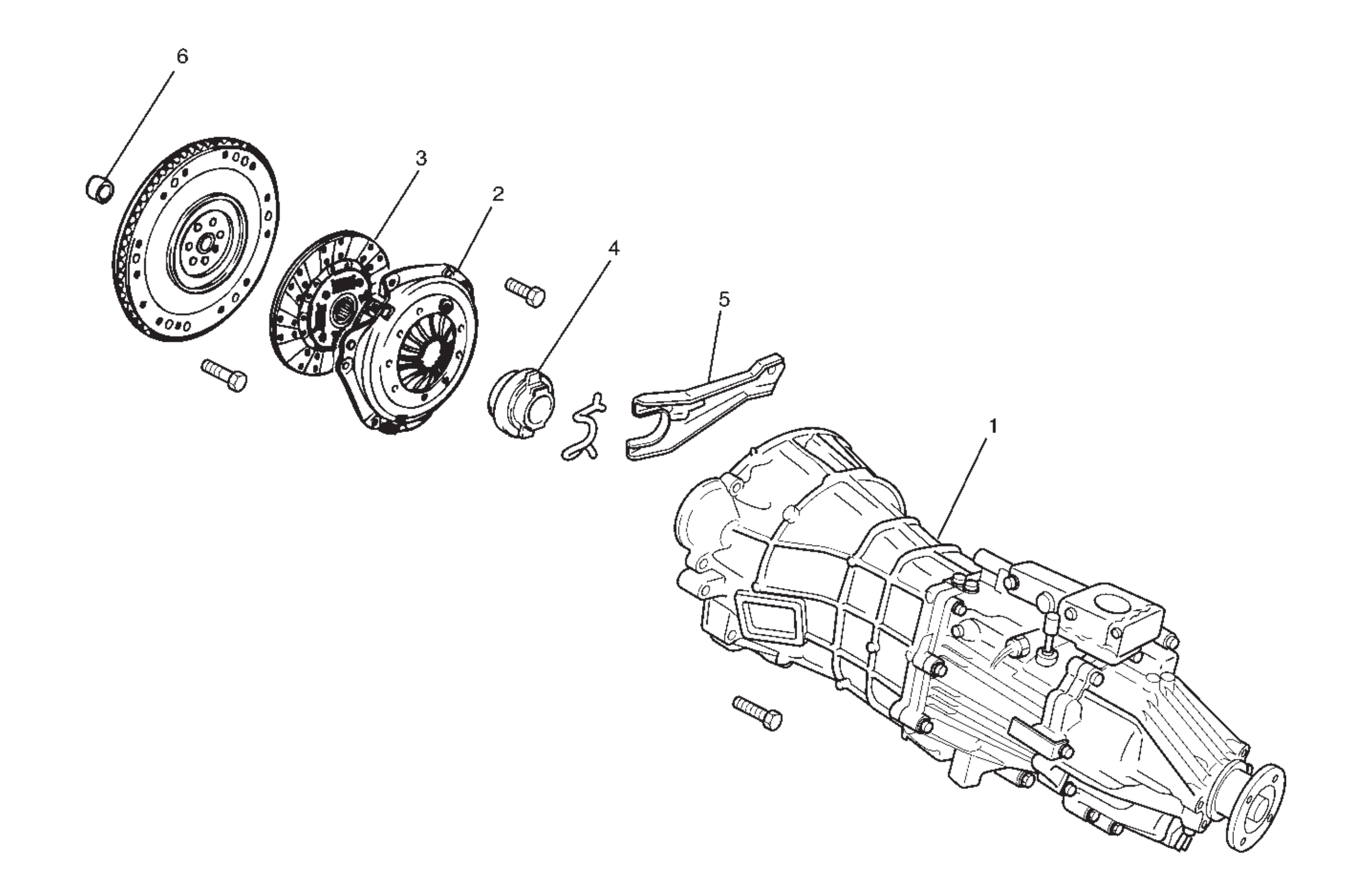
The facing is riveted to both sides of the cushioning plate. The cushioning plate provides a longer service life by minimizing wear and vibration at the clutch contact surfaces.

Diagnosis

Condition	Possible cause	Correction
Dragging	Air in circuit.	Bleed and check for damage.
	Driven plate worn or warped.	Replace.
	Clutch fork off the ball stud.	Install correctly and lubricate.
	Diaphragm spring weak or tip of fingers worn.	Replace.
	Driven plate sticking on splines.	Clean and free splines and lubricate with grease.
	Pilot bearing worn or damaged.	Replace.
	Master cylinder and slave cylinder seals worn.	Replace.
Slipping	Clutch facing worn.	Replace.
	Driven plate friction pads worn or oilsoaked.	Replace and check for leaks as needed.
	Diaphragm spring weak.	Replace pressure plate.
	Pressure plate or flywheel warped.	Replace.
	Master cylinder and slave cylinder seals worn.	Replace as needed.
Chattering	Clutch facing in poor contact or facing warped.	Replace.
	Surface of facing hardened.	Replace.
	Driven plate friction pads oil soaked.	Replace and check for leaks.
	Damper springs weakened or broken.	Replace.
	Rivets on clutch plate loosened.	Replace.
	Pressure plate or flywheel warped.	Replace as needed.
Rattling	Diaphragm spring weak.	Replace the pressure plate.
	Clutch fork loose or off the ball stud.	Replace the retaining spring or install the fork correctly.
	Driven plate springs weak or oil in the damper.	Replace and check for leaks as needed.
Release bearing noisy with the clutch engaged	Release bearing binding.	Clean, or replace if damaged, and lubricate.
	Clutch fork off the ball stud or loose spring tension.	Install correctly, and lubricate.
	Linkage return springs weak.	Replace.
Noisy	Release bearing worn or damaged.	Replace.
	Clutch fork off the ball stud.	Install correctly and lubricate.
	Pilot bearing loose.	Replace.
Pedal stays on the floor when disengaged	Replace bearing binding.	Free up, or replace, and lubricate.
	Diaphragm spring weak.	Replace the pressure plate.
Pedal is hard to push	Hydraulic line blocked or crimped.	Clean out or replace.
	Master or slave cylinders bindinig.	Repair or replace as needed.
	Driven plate worn.	Replace.
Squeaking	Ball stud not lubricated or incorrectly lubricated.	Lubricate with high temperature grease.

Clutch Assembly (X22SE)

Clutch Assembly (X22SE) and Associated Parts



201RX003

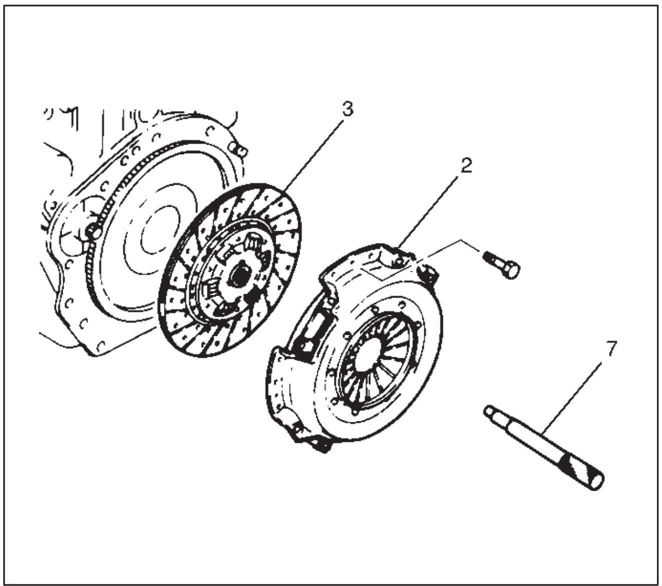
Legend

(1) Transmission Assembly
(2) Pressure Plate Assembly
(3) Driven Plate Assembly
(4) Release Bearing
(5) Shift Fork
(6) Crank Shaft Bearing

Removal

1. Remove transmission assembly, refer to “MANUAL TRANSMISSION” of Section 7B for “REMOVAL AND INSTALLATION” procedure.

2. Use the clutch pilot aligner (7) J–42877 to prevent the driven plate assembly from falling free.

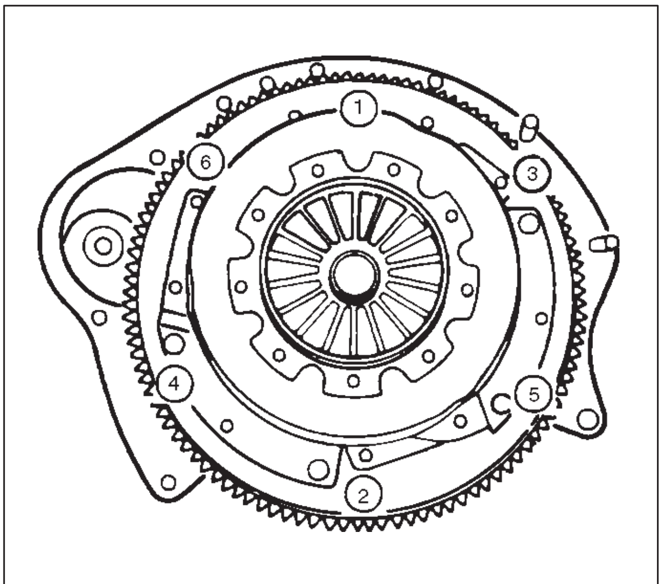


201RX002

Legend

(3) Driven Plate Assembly
(2) Pressure Plate Assembly
(7) Pilot Aligner

3. Mark the flywheel, clutch cover and pressure plate (2) lug for alignment when installing.
4. Loosen the clutch cover bolts in the numerical order shown in the illustration.

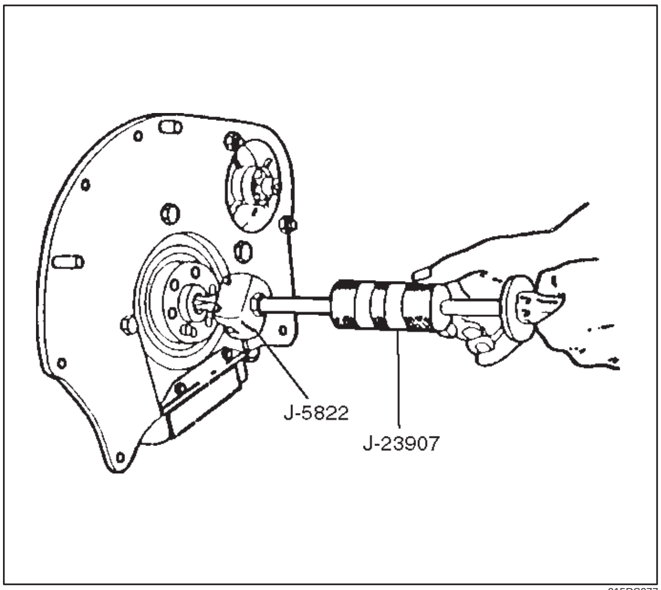


201RS036

5. Remove pressure plate assembly (2) and driven plate assembly (3).
6. Remove release bearing (4).

NOTE: The release bearing is permanently packed with lubricant and should not be soaked in cleaning solvent, as this will dissolve the lubricant.

7. Remove shift fork.
   - Do not remove crank shaft bearing (6) except for replacement.
     Remove the crank shaft bearing (6) using remover J–5822 and sliding hammer J–23907.



015RS077

Inspection and Repair

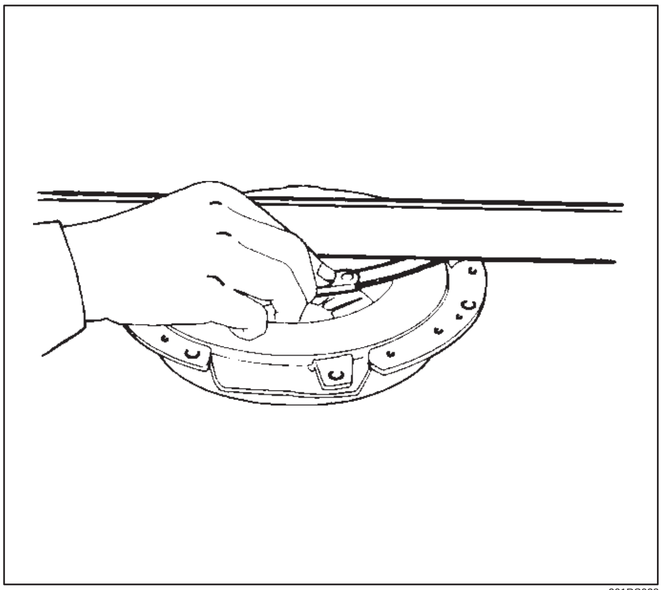
Make necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

Pressure Plate Assembly

Visually inspect the pressure plate friction surface for excessive wear and heat cracks. If excessive wear or deep heat cracks are present, the pressure plate must be replaced.

Pressure Plate Warpage

Use a straight edge and a feeler gauge to measure the pressure plate friction surface flatness in four directions.



201RS038

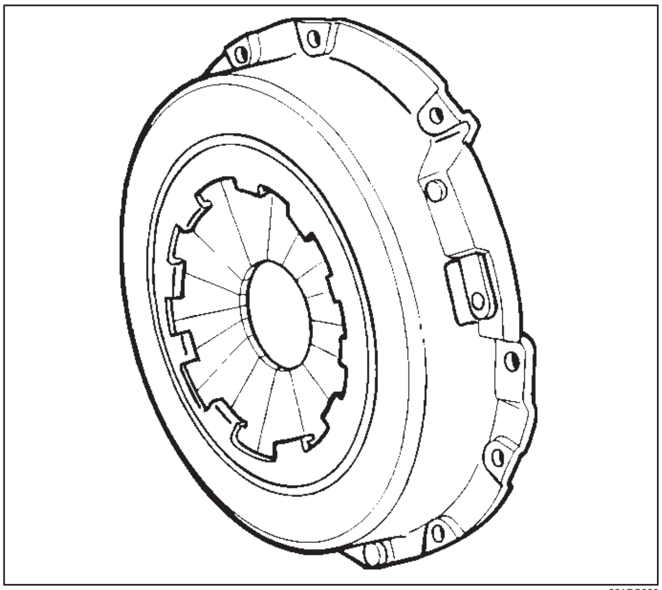
If any of the measured values exceed the specified limit, the pressure plate must be replaced.

Pressure Plate Warpage

Limit: 0.3mm (0.012in)

Clutch Cover

Visually inspect the entire clutch cover for excessive wear, cracking, and other damage. The clutch cover must be replaced if any of these conditions are present.



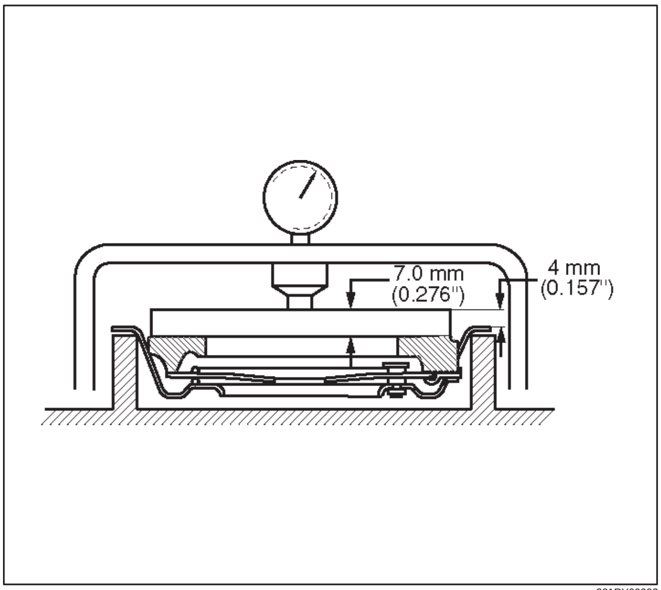
201RS039

Clutch Set Force

1. Invert the pressure plate assembly.
2. Place a new driven plate over the pressure plate. A metal sheet with thickness of 7.0mm (0.276in) may be used in place of the driven plate.
3. Compress the pressure plate assembly until the distance becomes 4mm (0.157in).
4. Note the pressure gauge reading.

Clutch Set Force

Standard: 5488N (1235lb)



201RY00003

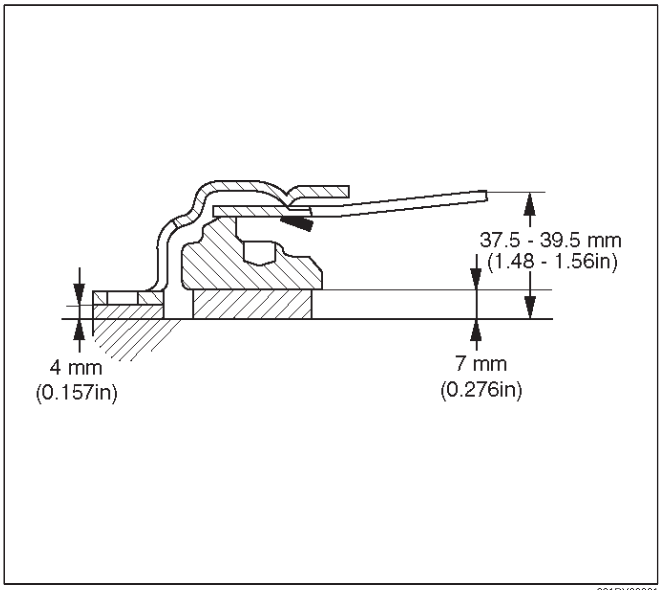
Diaphragm Spring Finger Height

1. Place a 7.0mm (0.276in) spacer beneath the pressure plate.
2. Fully compress the pressure plate and diaphragm spring.
   There are two ways to do this:
   a. Use a bench press to press down on the assembly from the top.
   b. Tighten the fixing bolts.

3. Measure the spring finger height from base to spring tip.
   If the measured value exceeds the specified limit, the pressure plate assembly must be replaced.

   Spring Finger Height

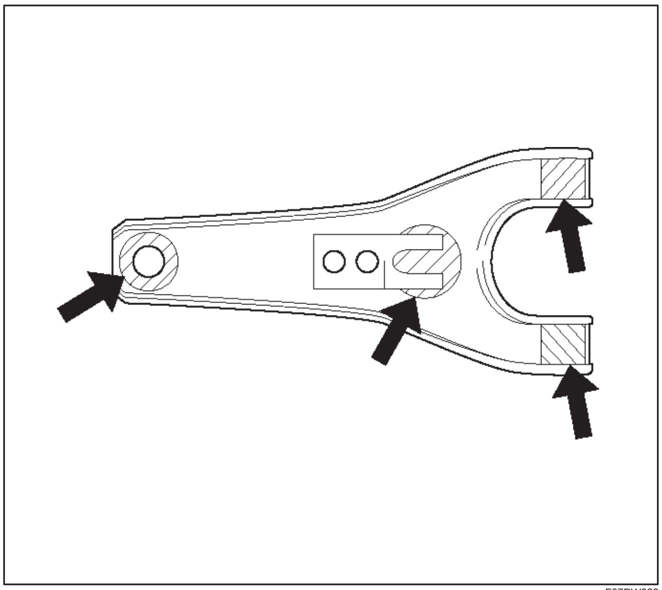
   Standard: 37.5 mm – 39.5 mm (1.48 in – 1.56 in)



201RY00001

Shift Fork

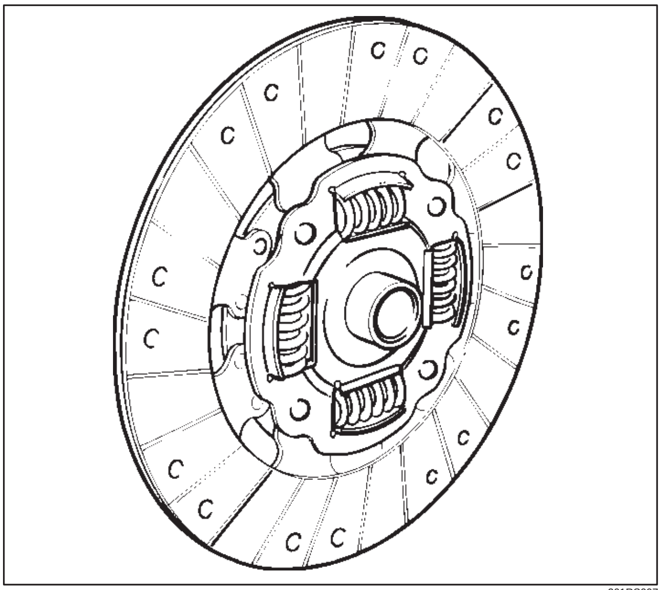
1. Visually inspect the surfaces of the shift fork making contact with the shift block.
2. Remove any minor stepping or abrasion from the shift block with an oil stone.
3. Apply molybdenum disulfide type grease to the areas as shown in the figure.



F07RW030

Driven Plate Assembly

1. Visually inspect the torsion spring for looseness, breakage, and weakening. If any of these conditions are discovered, the driven plate assembly must be replaced.
2. Visually inspect the facing surfaces for cracking and excessive scorching. Visually inspect the facing surfaces for the presence of oil or grease. If any of these conditions are discovered, the facing must be cleaned or replaced.

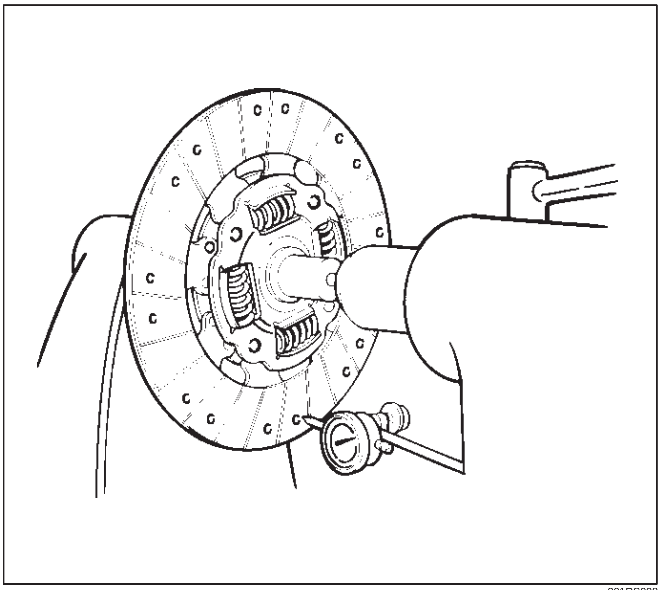


201RS007

3. Check that the driven plate moves smoothly on the transmission top gear shaft spline.
   Minor ridges on the top gear shaft spline may be removed with an oil stone.

Driven Plate Warpage

1. Insert the clutch pilot aligner J–42877 into the driven plate splined hub.
   The clutch pilot aligner must be held perfectly horizontal.
2. Set a dial indicator to the driven plate outside circumference.



201RS008

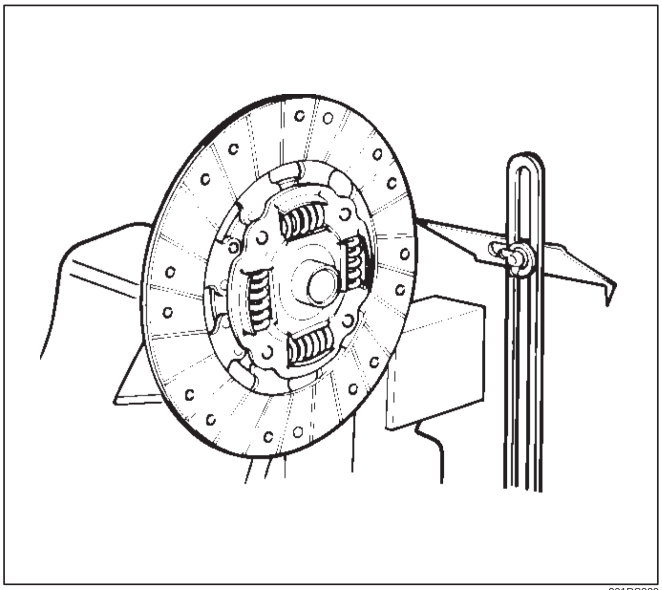
3. Slowly turn the driven plate. Read the dial indicator as you turn the driven plate.
   If the measured value exceeds the specified limit, the driven plate assembly must be replaced.

Driven Plate Warpage
Standard: 0.7 mm (0.028 in)
Limit: 1.0 mm (0.039 in)

Driven Plate Splined Hub Spline Wear

1. Clean the driven plate splined hub.
2. Install the driven plate to the transmission top gear shaft spline.
3. Set a surface gauge to the driven plate outside circumference.
4. Slowly turn the driven plate counterclockwise. Measure the spline rotation play as you turn the driven plate.

Driven Plate Splined Hub Spline Wear
Standard: 0.5 mm (0.020 in)
Limit: 1.0 mm (0.039 in)

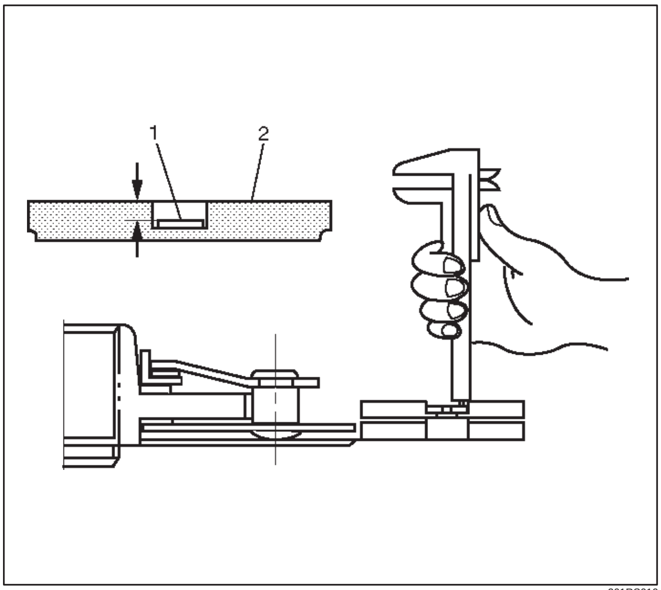


201RS009

Rivet Head Depression

Use a depth gauge or a straight edge with steel rule to measure the rivet head depression (1) from the facing surface (2).
Be sure to measure the rivet head depression on both sides of the driven plate. If the measured value is less than the specified limit, the facing must be replaced.

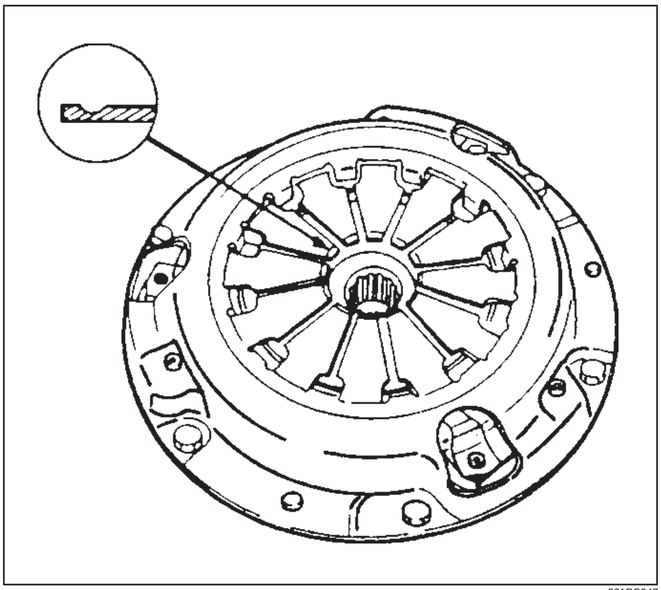
Rivet Head Depression
Standard: MIN 1.3 mm (0.051 in)
Limit: 0.2 mm (0.008 in)



201RS010

Pressure Plate Assembly

Check the cover for cracks and distortion, and the diaphragm spring for heat distortion, loosened rivets. Check the diaphragm spring for wear.

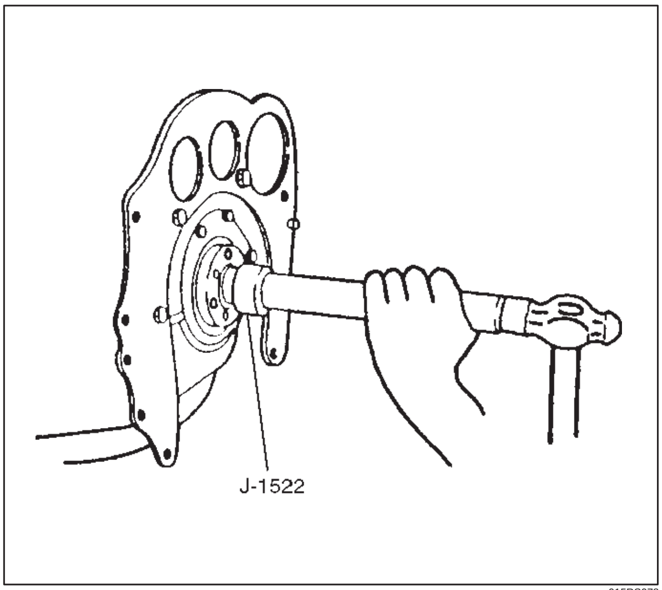


201RS047

Installation

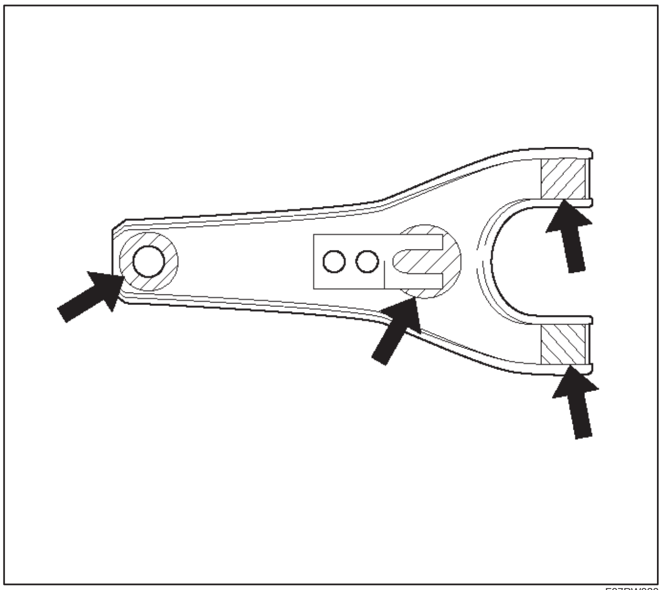
1. Clean and lubricate with grease.
2. Use installer J–1522 to install crankshaft bearing (6).

X22SE



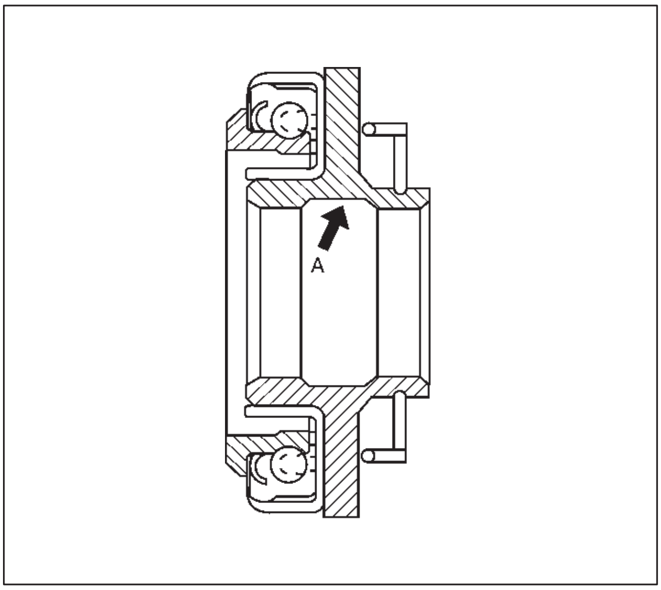
015RS078

3. Apply molybdenum disulfide type grease to the areas as shown in the figure and install shift fork (5).

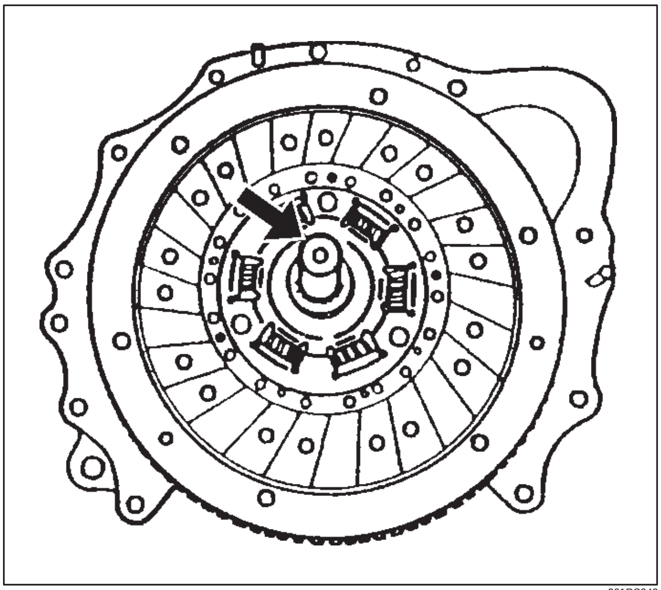


F07RW030

4. Pack the inside recess (A) of the release bearing with grease as shown in the figure.



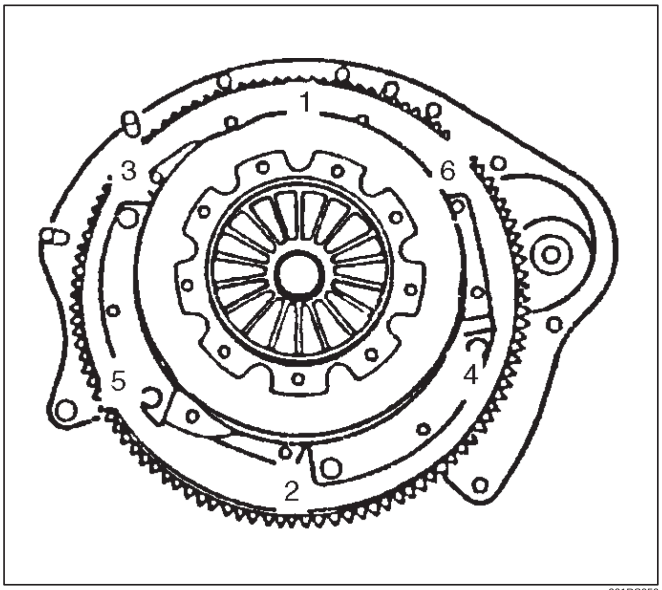
5. Install driven plate assembly by using aligner J–42877 (MUA).



201RS049

6. Tighten the bolts holding the pressure plate assembly (2) in the order shown in the figure.

Torque: 18N·m (13 lb ft)



201RS050

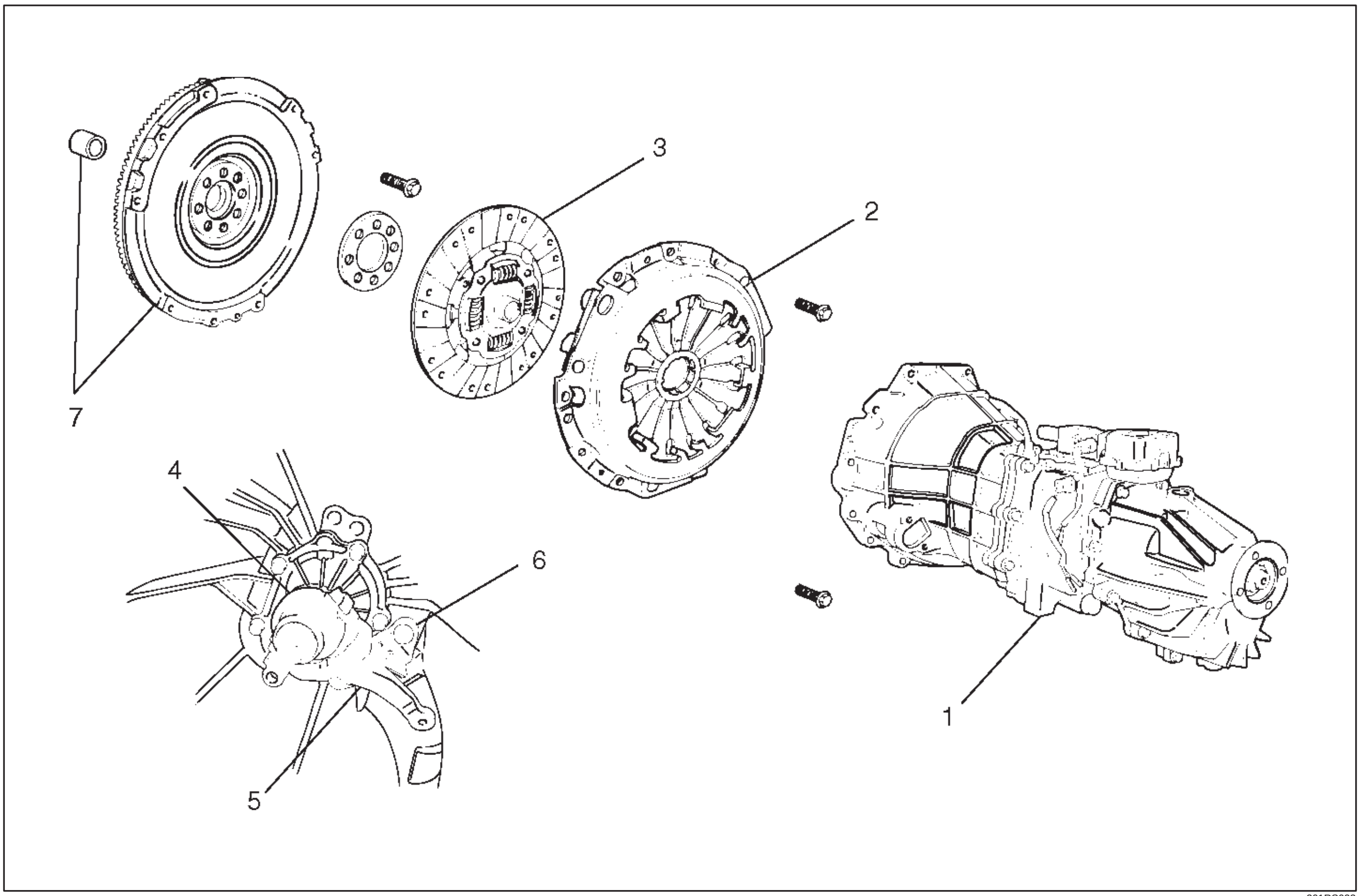
7. Remove the aligner.

NOTE: Do not strike the aligner with a hammer to remove it.

8. Install transmission assembly (1) to the engine. Refer to Transmission Installation in Manual Transmission section.

Clutch Assembly (6VD1)

Clutch Assembly (6VD1) and Associated Parts



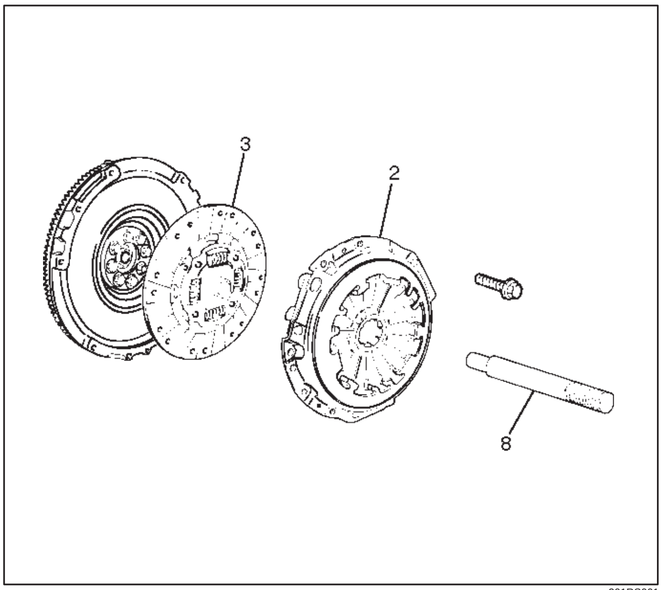
Legend

(1) Transmission Assembly
(2) Pressure Plate Assembly
(3) Driven Plate Assembly
(4) Release Bearing
(5) Shift Fork
(6) Fulcrum Bridge
(7) Flywheel Assembly and Crankshaft Bearing

Removal

1. Refer to “MANUAL TRANSMISSION” of Section 7B for “REMOVAL AND INSTALLATION” procedure of transmission assembly (1).

2. Use the pilot aligner J24547 to prevent the driven plate assembly (3) from falling free.

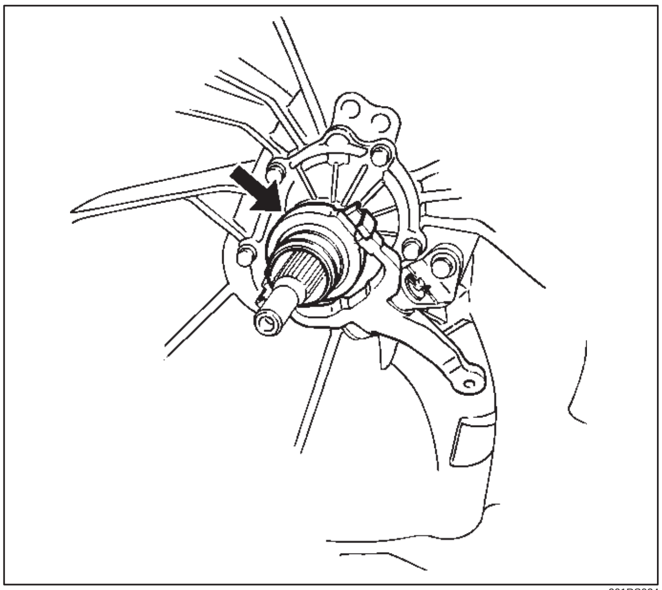


201RS001

Legend

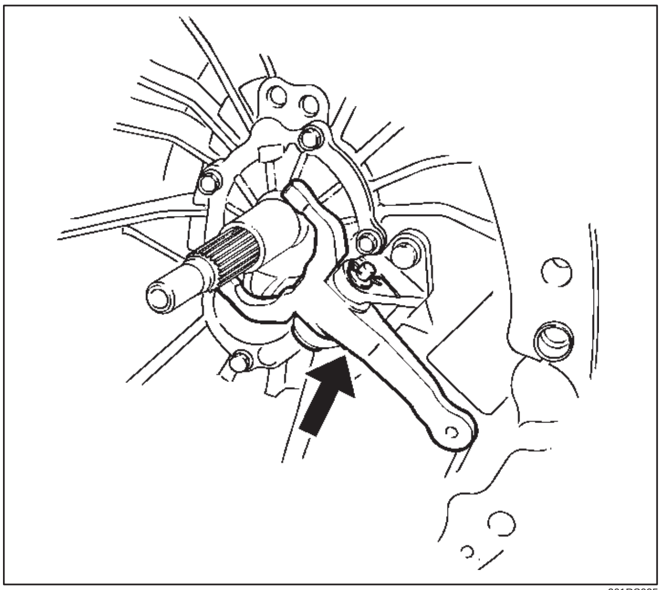
(2) Pressure Plate Assembly
(3) Driven Plate Assembly
(8) Pilot Aligner

3. Mark the flywheel, clutch cover and pressure plate lug for alignment when installing.
4. Remove the release bearing (4) from the transmission case.



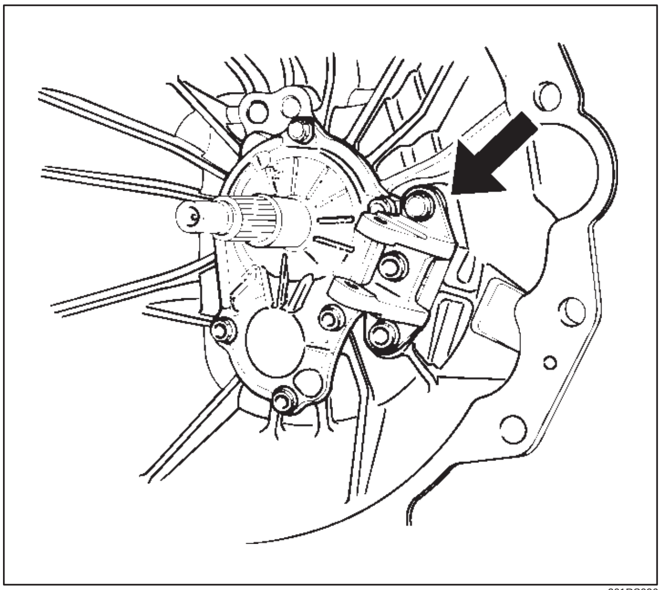
201RS024

5. Remove the snap pin. Remove the shift fork pin and shift fork from the fulcrum bridge.



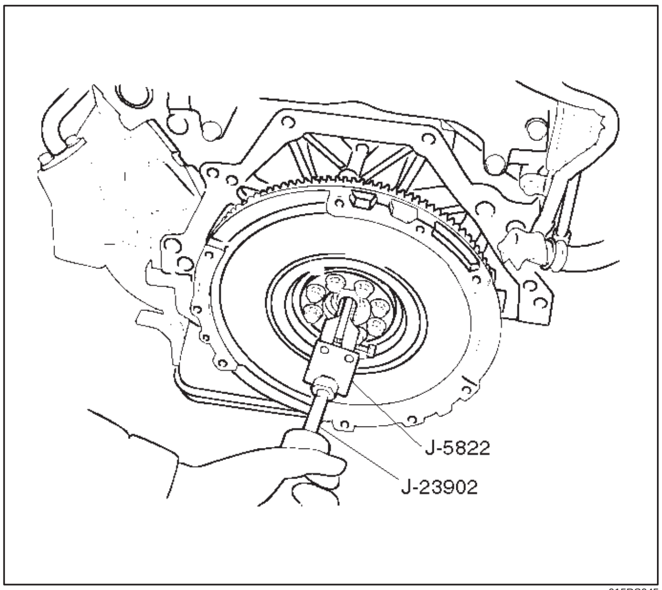
201RS025

6. Remove the fulcrum bridge bolts. Remove the fulcrum bridge (6) from the transmission case.



201RS026

- Do not remove crankshaft bearing (7) except for replacement.
- Use the remover J–5822 and sliding hammer J–23907 to remove the crankshaft bearing.



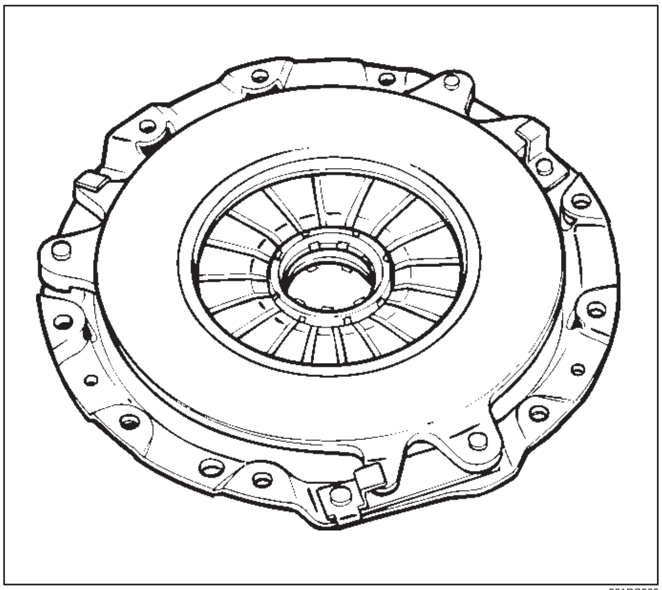
015RS045

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, or any other abnormal condition are found through inspection.

Pressure Plate Assembly

- Visually check the pressure plate friction surface for excessive wear and heat cracks. If excessive wear or deep heat cracks are present, the pressure plate must be replaced.



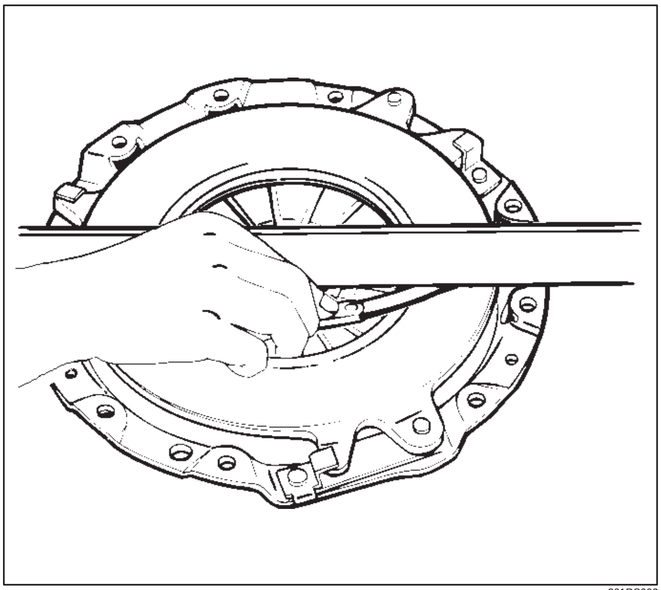
201RS002

Pressure Plate Warpage

- Use a straight edge and a feeler gauge to measure the pressure plate friction surface flatness in four directions. If any of the measured values exceed the specified limit, the pressure plate must be replaced.

Pressure Plate Warpage

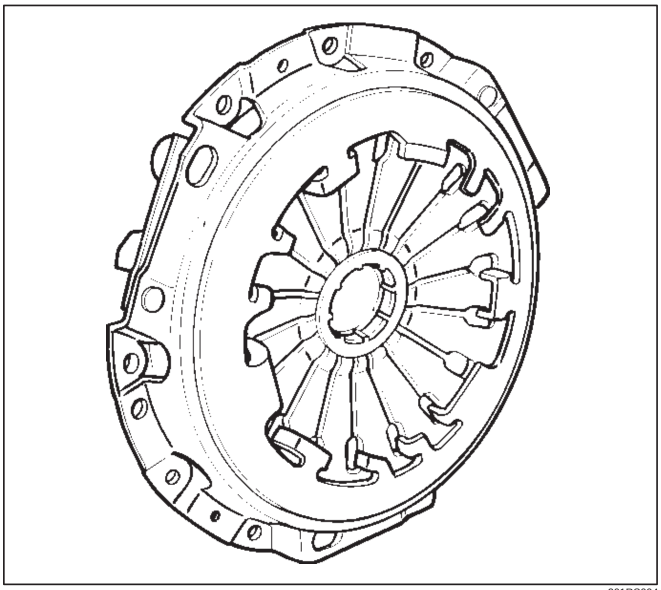
Limit: 0.3 mm (0.012 in)



201RS003

Clutch Cover

- Visually check the entire clutch cover for excessive wear, cracking, and other damage. The clutch cover must be replaced if any of these conditions are present.



201RS004

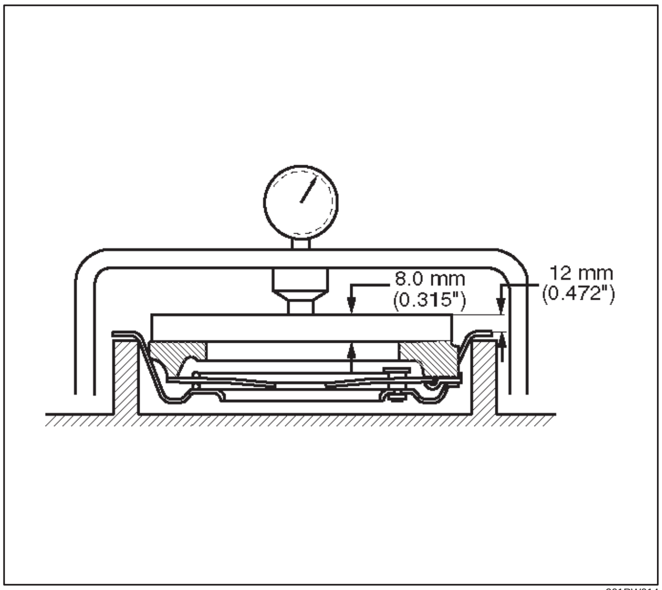
Clutch Set Force

1. Invert the pressure plate assembly.
2. Place a new driven plate over the pressure plate. A metal sheet with thickness of 8.0mm (0.315in) may be used in place of the driven plate.
3. Compress the pressure plate assembly until the distance becomes 12mm (0.472in).
4. Note the pressure gauge reading. If the measured value is less than the specified limit, the pressure plate assembly must be replaced.

Clutch Set Force

Standard: 7208N (1621lb)

Limit: 6669N (1499lb)



201RW014

Diaphragm Spring Finger Height

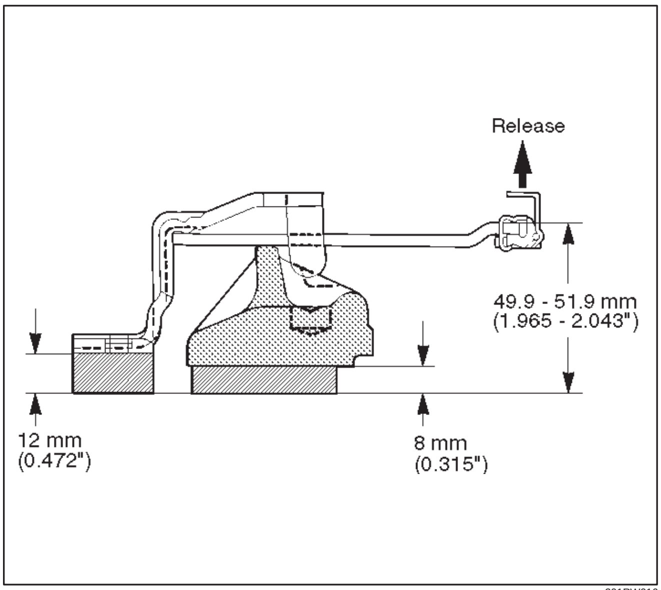
1. Place a new driven plate or a 8.0mm (0.315in) spacer beneath the pressure plate.
2. Fully compress the pressure plate and diaphragm spring.
   There are two ways to do this:
   a. Use a bench press to press down on the assembly from the top.
   b. Tighten the fixing bolts.

NOTE: Preload on diaphragm spring finger must be 4998N (11-22lb) in direction of release, when clutch cover assembly is bolted to the flywheel.

3. Measure the spring height from base to spring tip. If the measured value exceeds the specified limit, the pressure plate assembly must be replaced.

Spring Finger Height

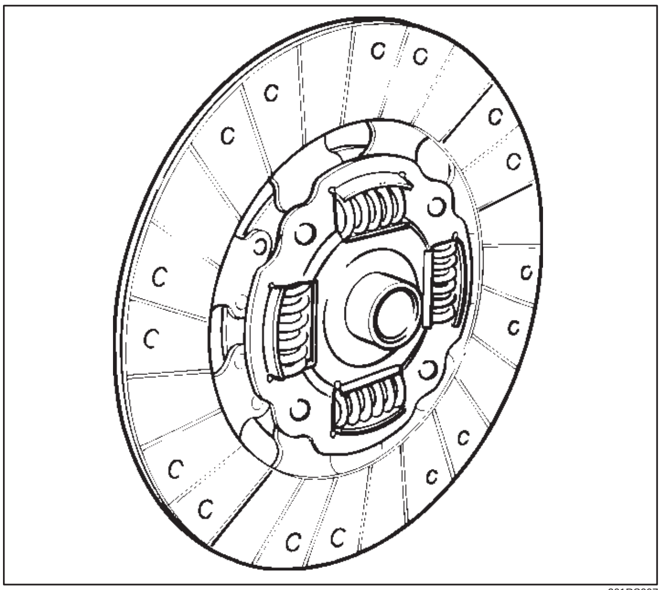
Standard: 49.9 – 51.9 mm (1.965– 2.043 in)



201RW016

Driven Plate Assembly

- Visually check the torsion spring for looseness, breakage, and weakening. If any of these conditions are discovered, the driven plate assembly must be replaced.
- Visually check the facing surfaces for cracking and excessive scorching. Visually inspect the facing surfaces for the presence of oil or grease. If any of these conditions are discovered, the facing must be cleaned or replaced.
- Check that the driven plate moves smoothly on the transmission top gear shaft spline. Minor ridges on the top gear shaft spline may be removed with an oil stone.



201RS007

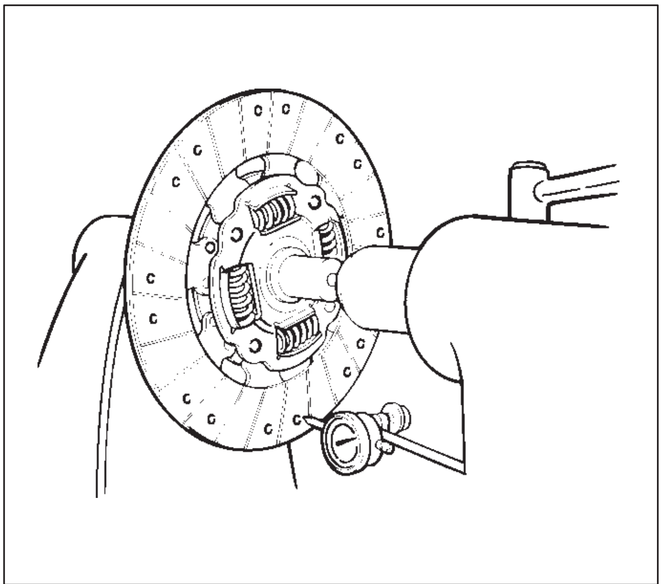
Driven Plate Warpage

1. Insert the clutch pilot aligner J–24547 into the driven plate splined hub. The clutch pilot aligner must be held perfectly horizontal.
2. Set a dial indicator to the driven plate outside circumference.
3. Slowly turn the driven plate. Read the dial indicator as you turn the driven plate. If the measured value exceeds the specified limit, the driven plate assembly must be replaced.

Driven Plate Warpage

Standard: 0.7mm (0.028in)

Limit: 1.0mm (0.039in)



201RS008

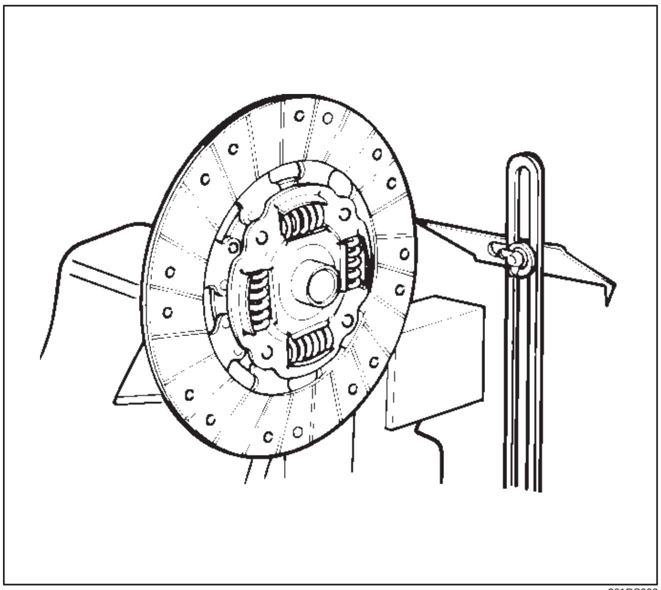
Driven Plate Splined Hub Spline Wear

1. Clean the driven plate splined hub.
2. Install the driven plate to the transmission top gear shaft spline.
3. Set a surface gauge to the driven plate outside circumference.
4. Slowly turn the driven plate counterclockwise. Measure the spline rotation play as you turn the driven plate. If the measured value exceeds the specified limit, the driven plate assembly must be replaced.

Driven Plate Warpage

Standard: 0.5mm (0.020in)

Limit: 1.0mm (0.039in)



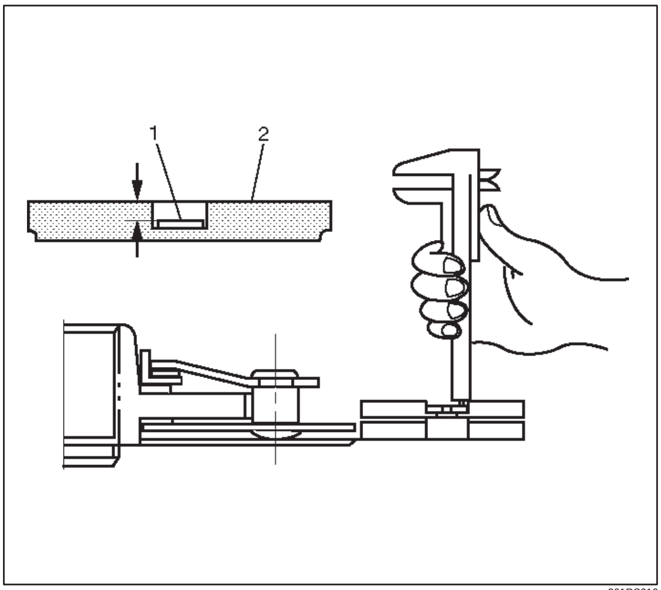
201RS009

Rivet Head Depression

- Use a depth gauge or a straight edge with steel rule to measure the rivet head depression (1) from the facing surface (2).
- Be sure to measure the rivet head depression on both sides of the driven plate. If the measured value is less than the specified limit, the driven plate assembly must be replaced.

Rivet Head Depression

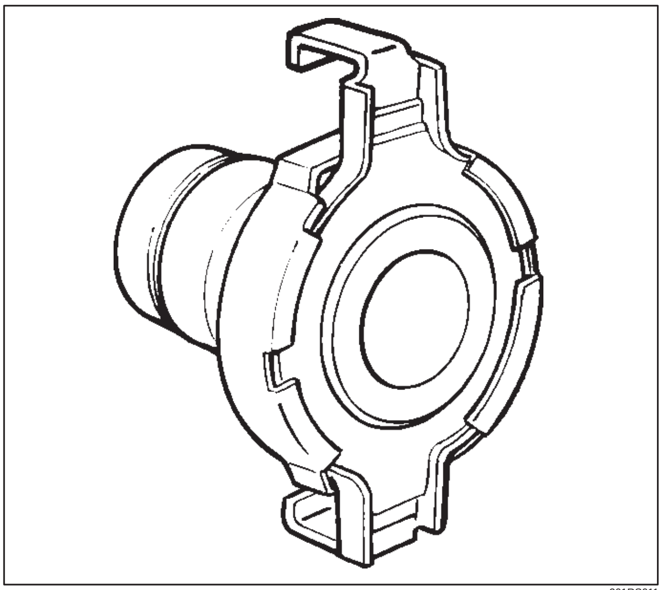
	Standard	Limit
Fly wheel side	1.2–1.8mm (0.047–0.071in)	0.2mm (0.008in)
Pressure plate side	1.6–2.2mm (0.062–0.087in)	



201RS010

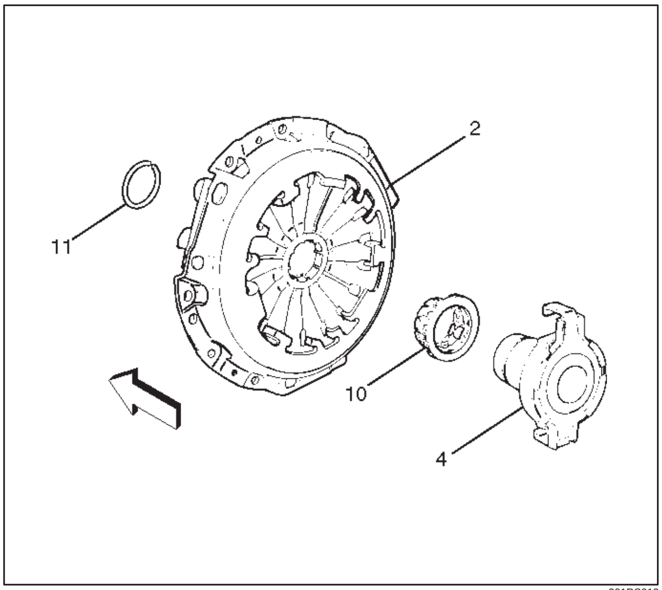
Release Bearing

- Visually check the release bearing for excessive play, noise and breakage. If any of these conditions are discovered, the release bearing must be replaced.



201RS011

- When replacing the release bearing (4), replace both the wedge collar (10) and wire ring (11) at the same time.



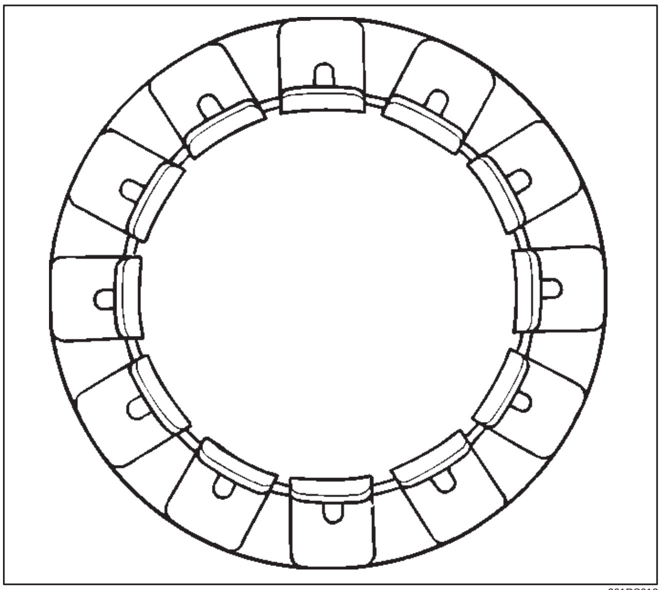
201RS012

Legend

(2) Pressure Plate Assembly
(4) Release Bearing
(10) Wedge collar
(11) Wire Ring

Wedge Collar (10)

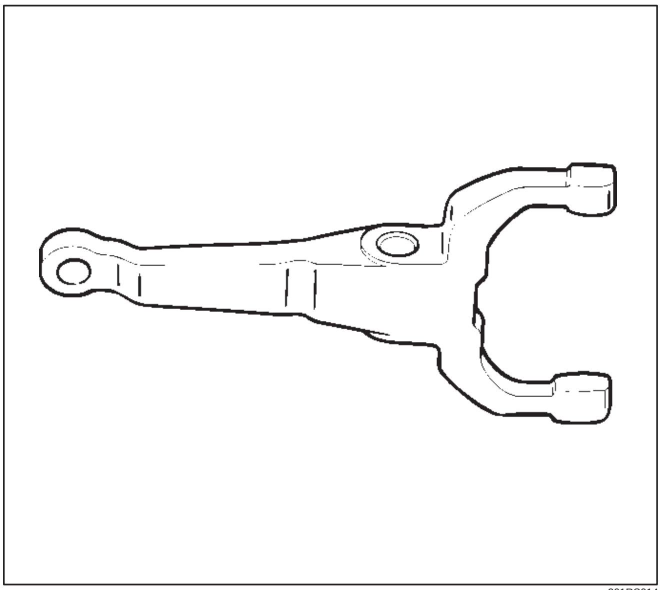
- Visually check the surfaces of the wedge collar making contact with the release bearing for excessive wear and damage.
- Replace exhibiting excessive wear or damage.



201RS013

Shift Fork

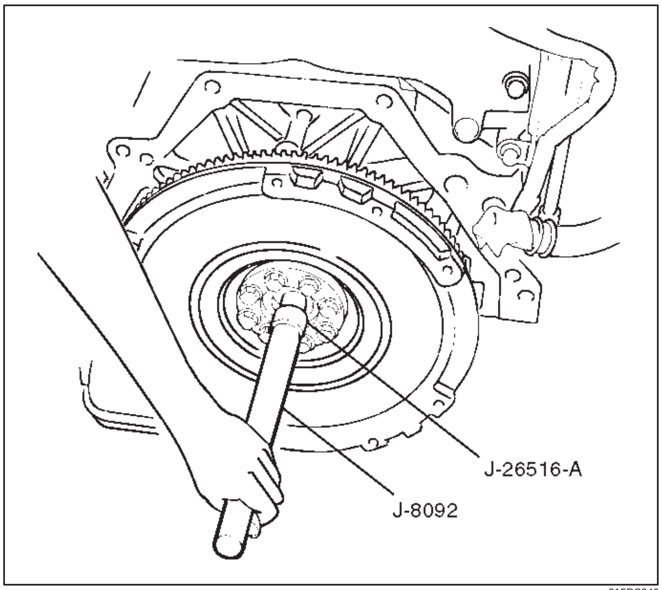
- Visually check the surfaces of the shift fork making contact with the release bearing for excessive wear and damage.
- Remove any minor stepping or abrasion from shift fork with an oil stone. Replace exhibiting excessive wear or damage.



201RS014

Installation

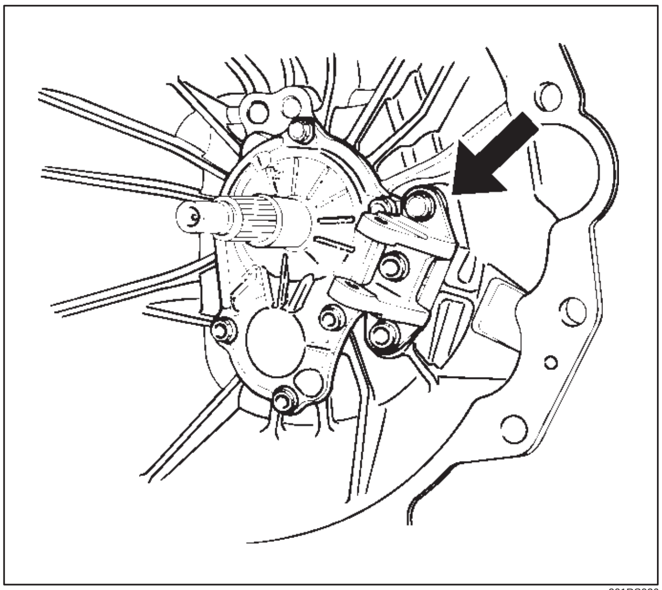
1. Clean and lubricate with grease.
2. Use the installer J–26516–A and driver handle J–8092 to install the crankshaft bearing (7).



015RS046

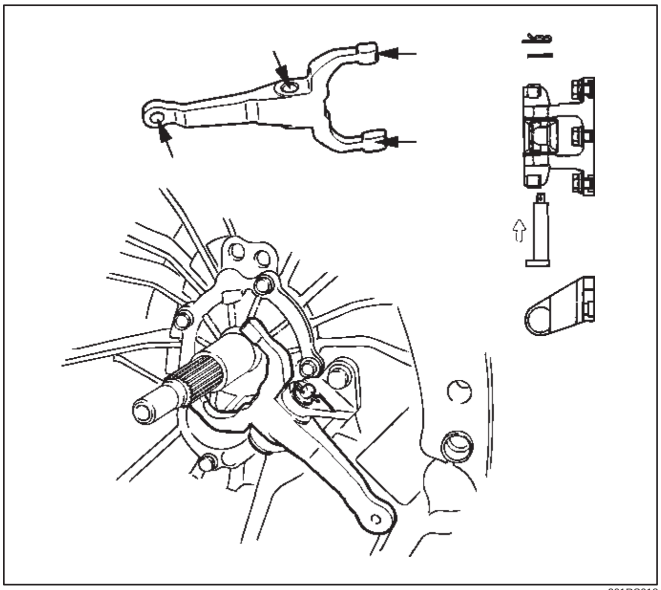
3. Install the fulcrum bridge (6) to the transmission case. Tighten three fulcrum bridge bolts to the specified torque.

Torque: 38 N·m (28 lb ft)



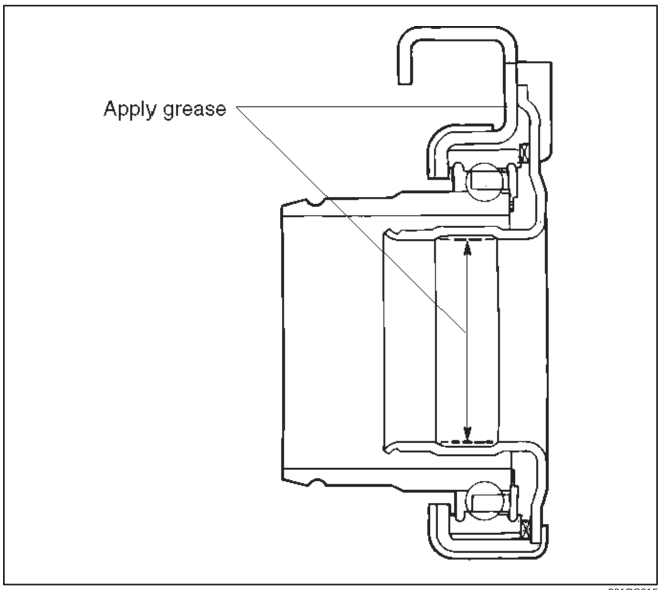
201RS026

4. Apply molybdenum disulfide type grease to the pin hole inner circumferences and thrust surfaces. Attach the shift fork (5) to the fulcrum bridge (6) and insert the pin from below of the fulcrum bridge. Install the washer and snap pin.



201RS018

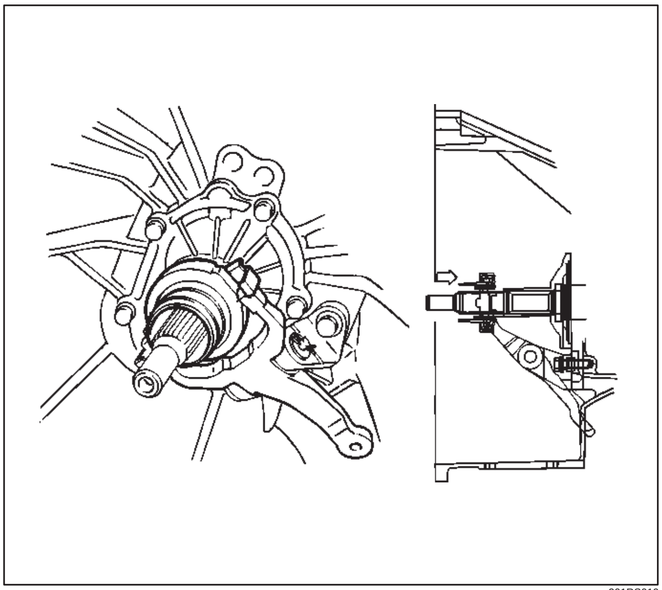
5. Apply molybdenum disulfide type grease to the areas shown in the figure.



201RS015

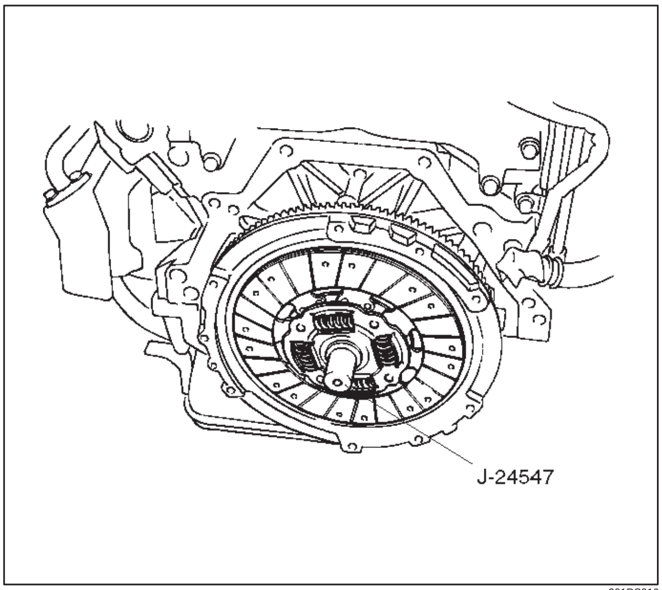
Install the release bearing (4) in the proper direction.

NOTE: Ensure release bearing is properly positioned during installation, as shown in the figure.



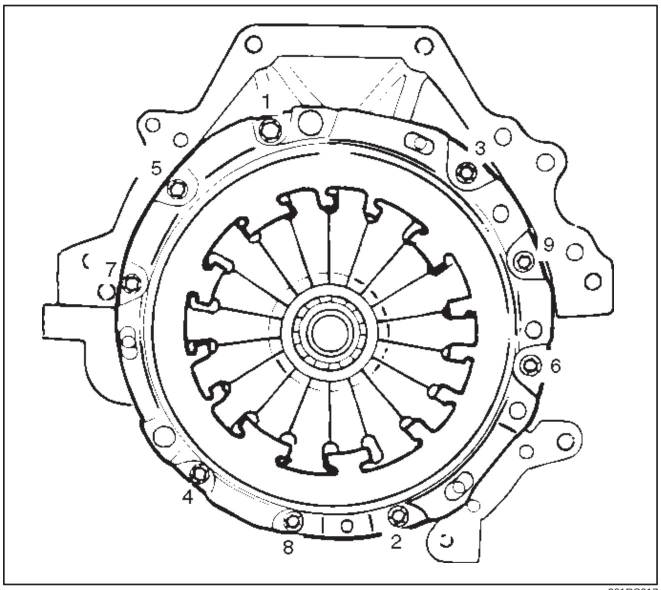
201RS019

6. Use the pilot aligner J–24547 to install the driven plate assembly (3).



201RS016

7. Tighten the bolts holding the pressure plate assembly (2) in the order shown in the figure.



201RS017

Torque: 18 N·m (13 lb ft)

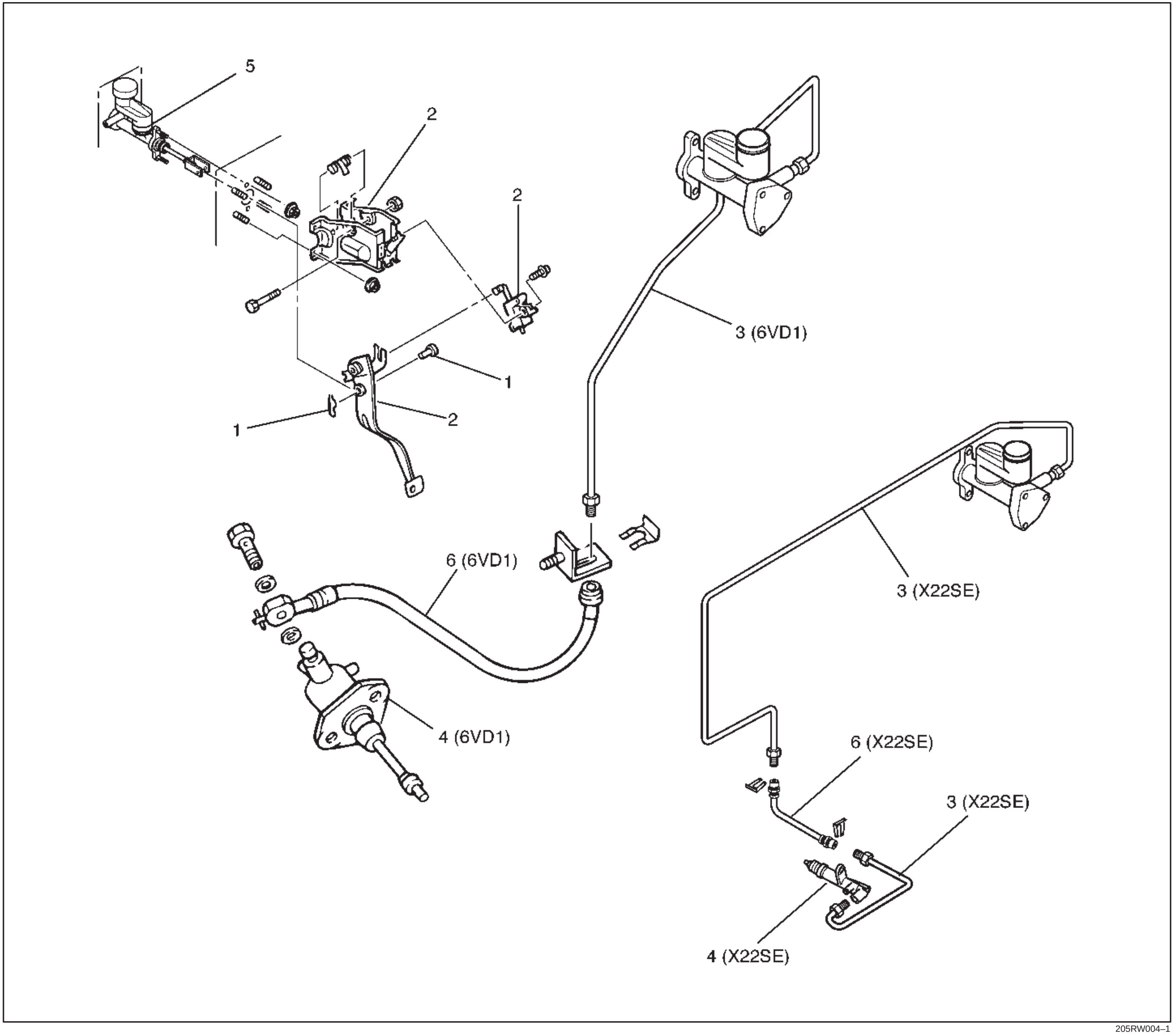
8. Remove the aligner.

NOTE: Do not strike the aligner with a hammer to remove it.

9. Install transmission assembly to the engine.

Clutch Control

Parts Location View

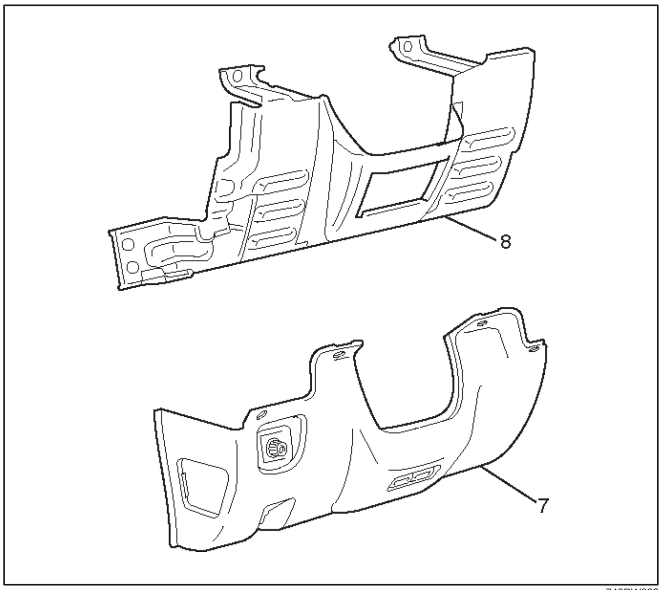


Legend

(1) Pin and Jaw Joint Pin
(2) Pedal Assembly and Switch
(3) Oil Line Pipe
(4) Slave Cylinder Assembly
(5) Master Cylinder Assembly
(6) Oil Line Hose

Removal

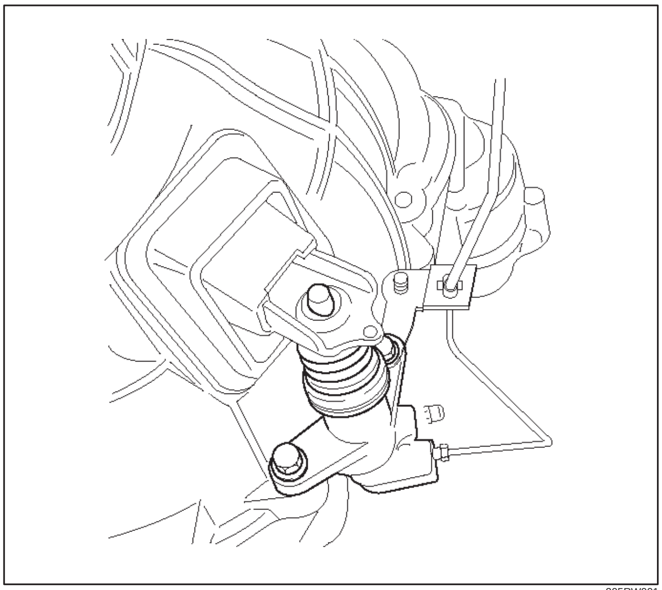
1. Disconnect the ground battery cable.
2. Remove the instrument panel lower cover (7) and driver knee bolster panel assembly (8).



Legend
(7) Driver Lower Cover
(8) Driver Knee Bolster Panel

3. Remove pin and jaw joint pin (1).
4. Remove pedal assembly and switch (2).
5. Remove oil line pipe (3).
6. Remove slave cylinder assembly (4).

X22SE MUA



7. Remove master cylinder assembly (5).
8. Remove oil line hose (6).

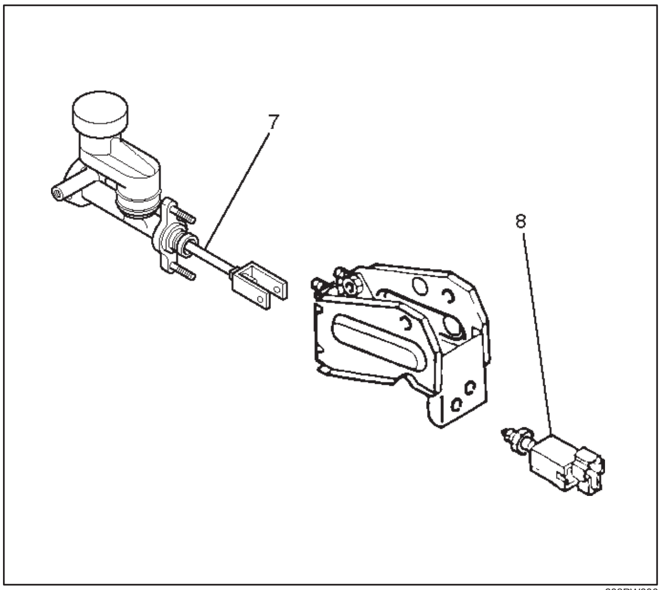
Inspection and Repair

Make necessary adjustments, repairs, and part replacements if wear, damage or other problems are discovered during inspection.

Installation

Clutch Pedal Adjustment

1. With clutch switch.
   1. Disconnect clutch switch connector.
   2. Loosen lock nut, then turn switch out until there is a gap between the switch plunger and clutch pedal.

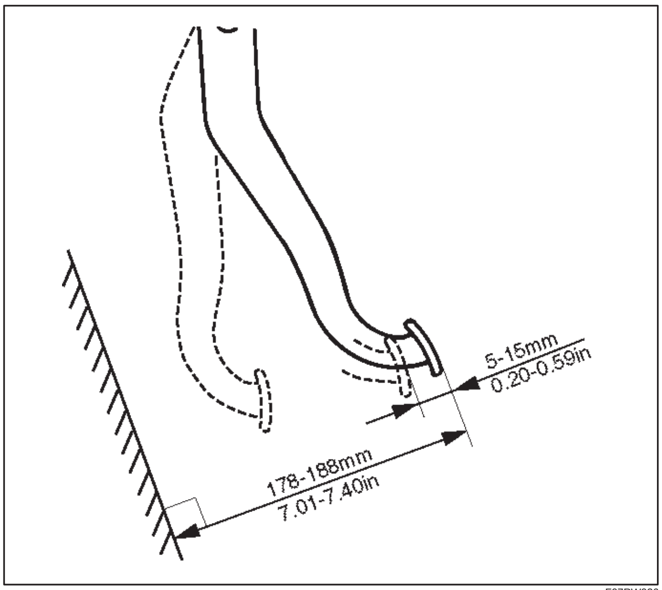


Legend
(7) Push Rod
(8) Clutch Switch

2. Loosen clutch master cylinder push rod lock nut. Turn push rod by hand to set clutch pedal height to within specification. Tighten push rod lock nut.

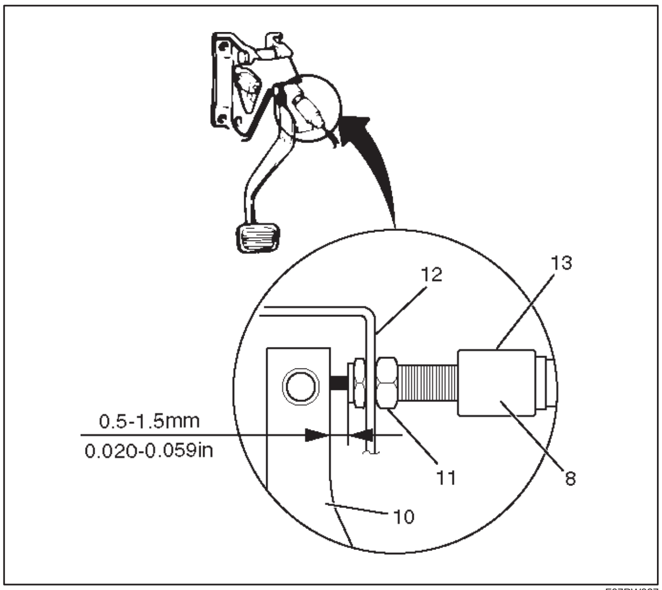
Clutch Pedal Height

178 – 188 mm (7.01 – 7.40 in)



F07RW026

3. With clutch switch.
   1. Turn the clutch switch until the switch bolt just touches the clutch pedal arm.
   2. Adjust clutch switch by backing it out half a turn, and measure the clearance between the clutch pedal arm and the clutch switch bolt end.



F07RW027

Legend
- (8) Clutch Switch
- (10) Clutch Pedal Arm
- (11) Lock Nut
- (12) Bracket
- (13) Back Out Switch 1/2 Turn

   3. Lock the lock nut.
   4. Connect clutch switch connector.

Clutch Switch and Clutch Pedal Clearance

0.5 – 1.5 mm (0.020 – 0.059 in)

4. After adjusting the clutch pedal height, push the clutch pedal by hand to ensure the clutch pedal free play is within specification.

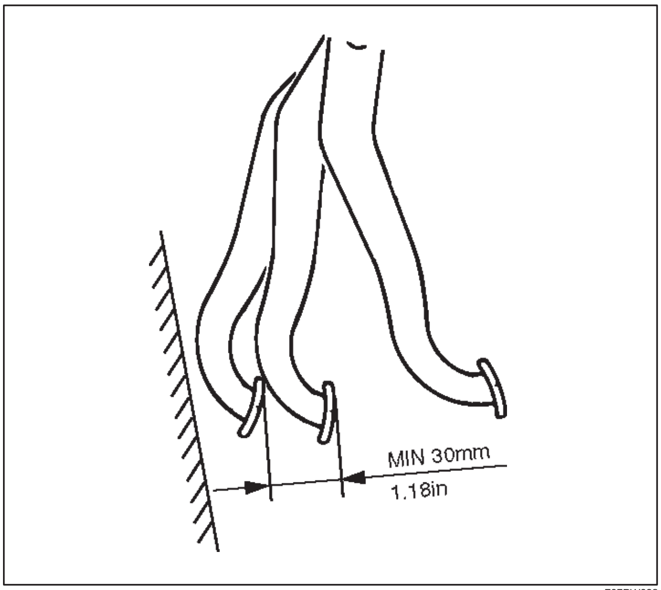
Pedal Free Play

5 – 15 mm (0.20 – 0.59 in)

5. Perform clutch pedal engagement height inspection:
   1. Operate the parking brake lever and block the wheels.
   2. Start the engine, fully step on the clutch pedal slowly and move the shift lever 1st position.
   3. With the engine idling, release the clutch pedal slowly and measure its stroke – just prior to its clutching position.

Clutch Pedal Engagement Height (H3)

MIN. 30 mm (1.18 in)



F07RW028

6. If the measured value exceeds the specified limit, check the following points and repair if necessary:
   - Hydraulic circuit for fluid leakage or air in circuit.
   - Clutch disc warped.
   - Diaphragm spring weakened or tip of fingers worn.
   - Driven plate sticking on sprines.
   - Release bearing worn or damaged.
   - Master cylinder and slave cylinder worn.

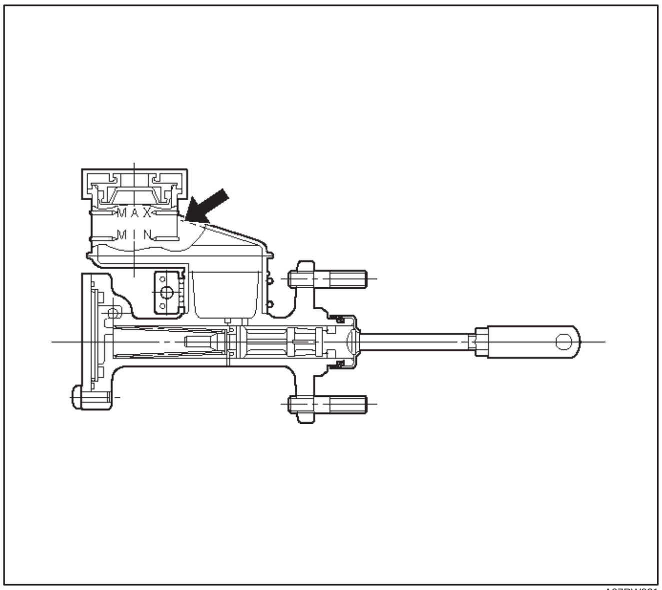
Torque

- **Master cylinder to dash panel**
  16 N·m (12 lb ft)
- **Clutch pedal to dash panel**
  15 N·m (11 lb ft)
- **Master cylinder push rod to yoke**
  17 N·m (12 lb ft)

- **Clutch pipe to master cylinder**
  16 N·m (12 lb ft)
- **Clutch pipe to flex, hose**
  20 N·m (14 lb ft)
- **Slave cylinder to case**
  43 N·m (32 lb ft)
- **Slave cylinder bleeder screw**
  8 N·m (69 lb in)
- **Clutch pipe to slave cylinder**
  20 N·m (14 lb ft)

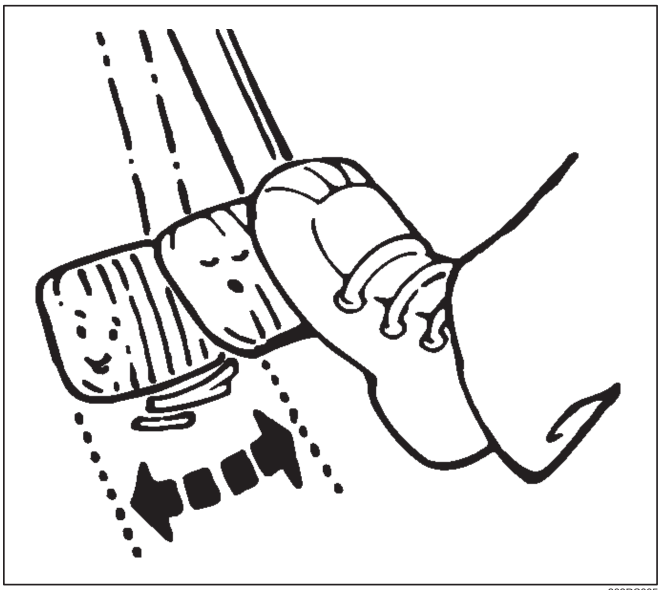
Bleeding

1. Check the level of clutch fluid in the reservoir and replenish if necessary.



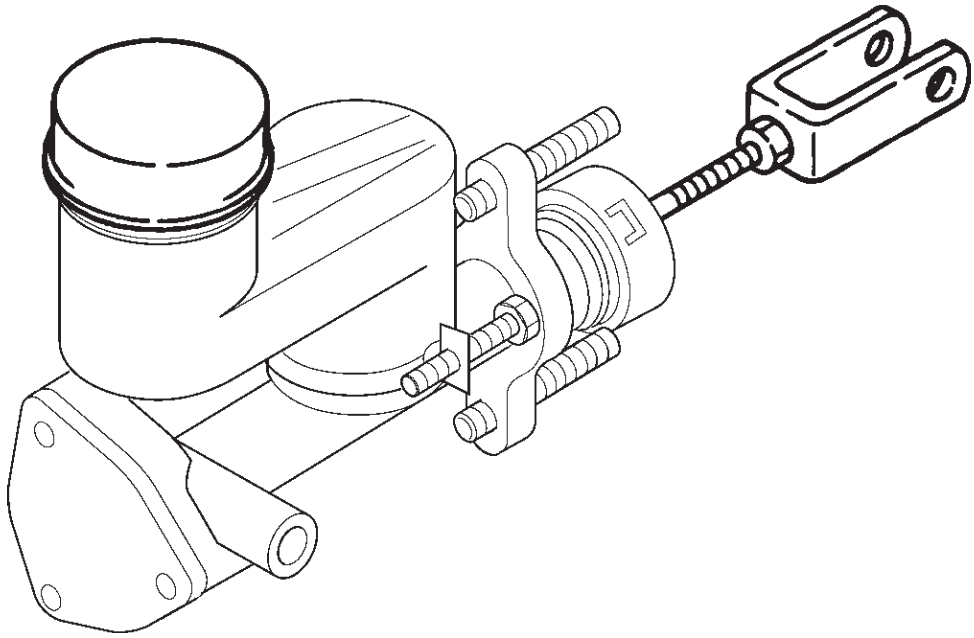
A07RW021

2. Bleeding the slave cylinder.
   1. Remove the rubber cap from the bleeder screw and wipe clean the bleeder screw. Connect a vinyl tube to the bleeder screw and insert the other end of the vinyl tube into a transparent container.
   2. Pump the clutch pedal repeatedly and hold it depressed.


203RS005

   3. Loosen the bleeder screw to release clutch fluid with air bubbles into the container, then tighten the bleeder screw immediately.
   4. Release the clutch pedal carefully. Repeat the above operation until air bubbles disappear from the clutch fluid being pumped out into the container. During the bleeding operation, keep the clutch fluid reservoir filled to the specified level. Reinstall the rubber cap.

Master Cylinder

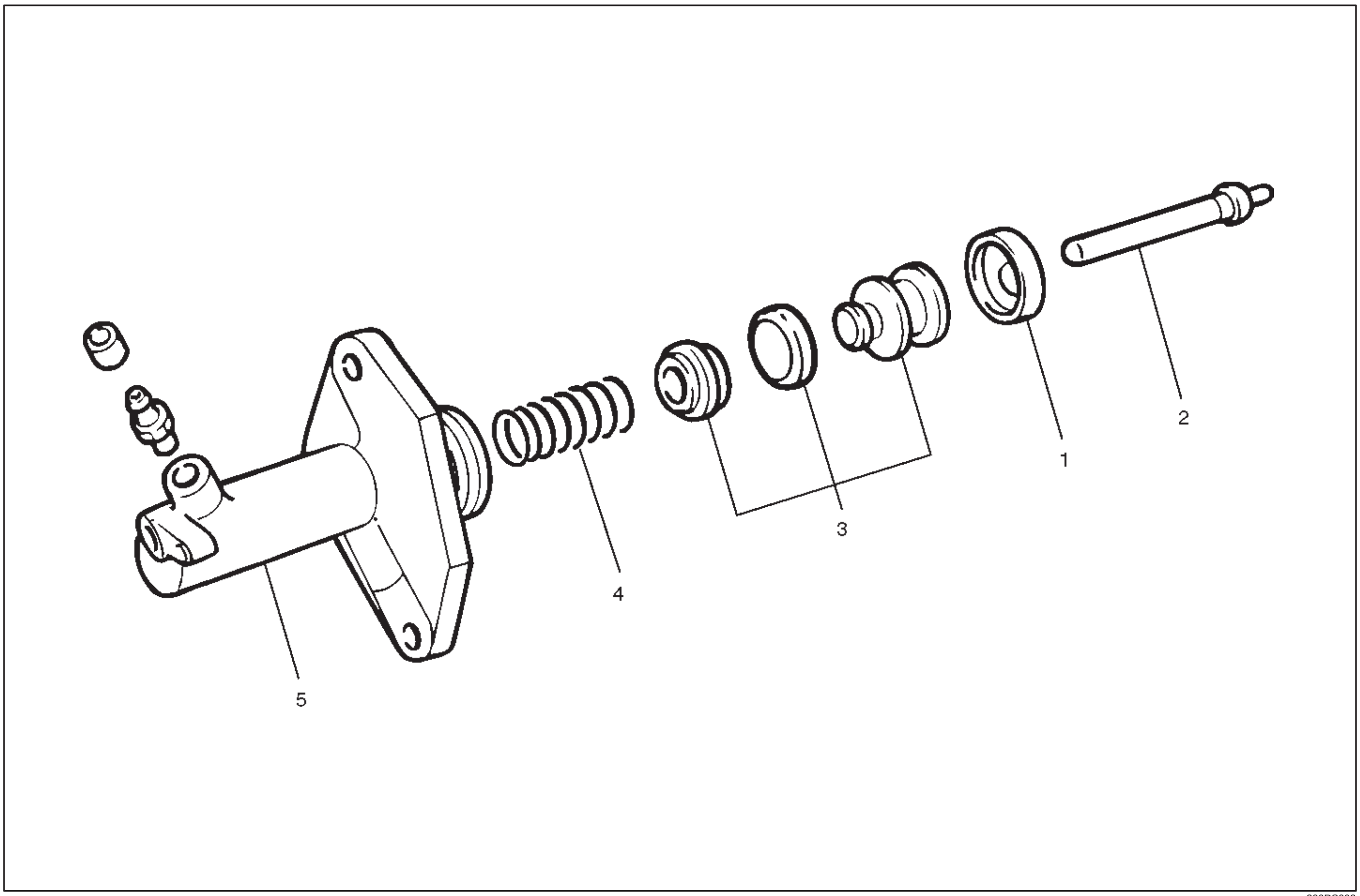


208RX001

NOTE: Disassembling and assembling the master cylinder is not approved.

Slave Cylinder

Disassembled View



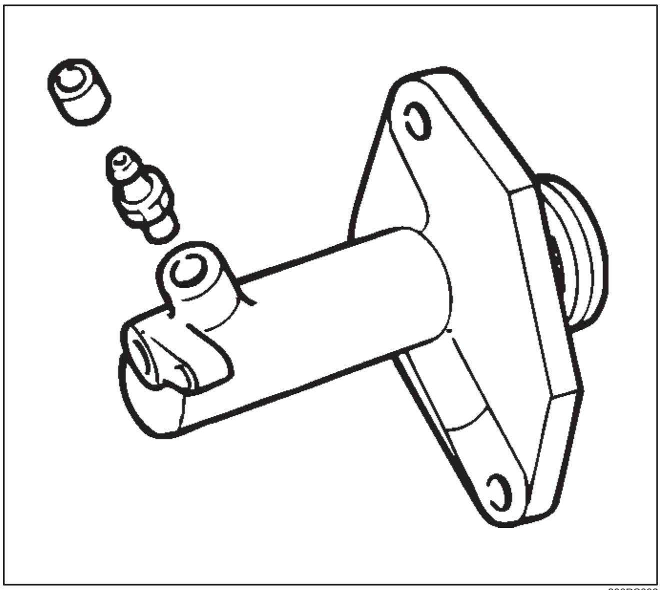
206RS002

Legend

(1) Push Rod
(2) Boot
(3) Piston and Piston Cup
(4) Spring
(5) Cylinder Body

Disassembly

1. Disassemble boot (1), push rod (2), piston and piston cup (3), and spring (4) from cylinder body (5).



206RS003

Inspection and Repair

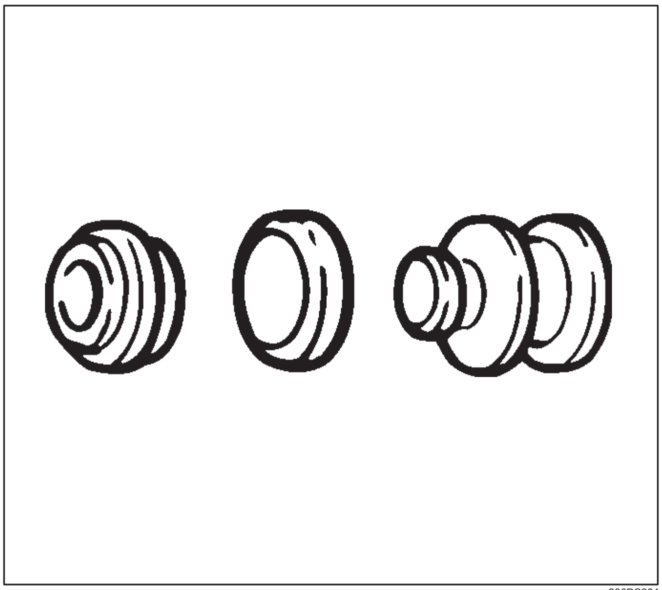
Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.

Cylinder Body

1. Clean the cylinder body.
2. Check the fluid return port for restrictions and clean it if necessary.

Piston and Piston Cup

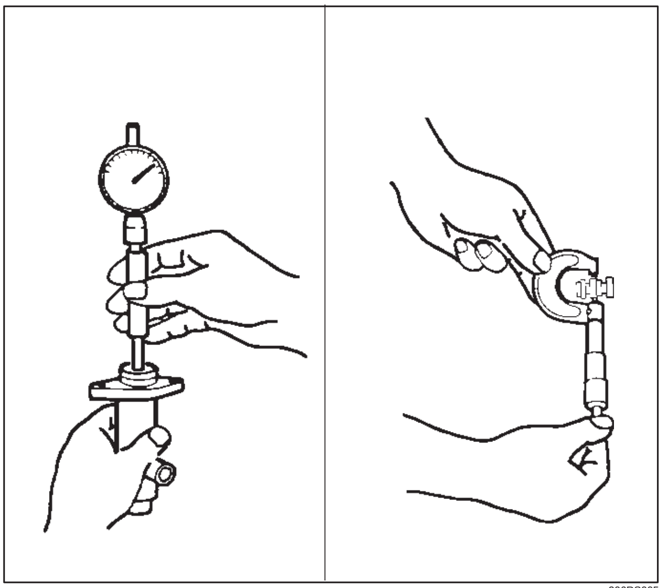
1. Visually inspect the disassembled piston and piston cup for excessive wear and damage.



206RS004

Replace the inner parts with new parts if necessary.

2. Measure the clearance between slave cylinder wall and piston.



206RS005

If the measured value exceeds the specified limit, the slave cylinder assembly must be replaced.

Standard: 0.07 mm (0.0028 in)

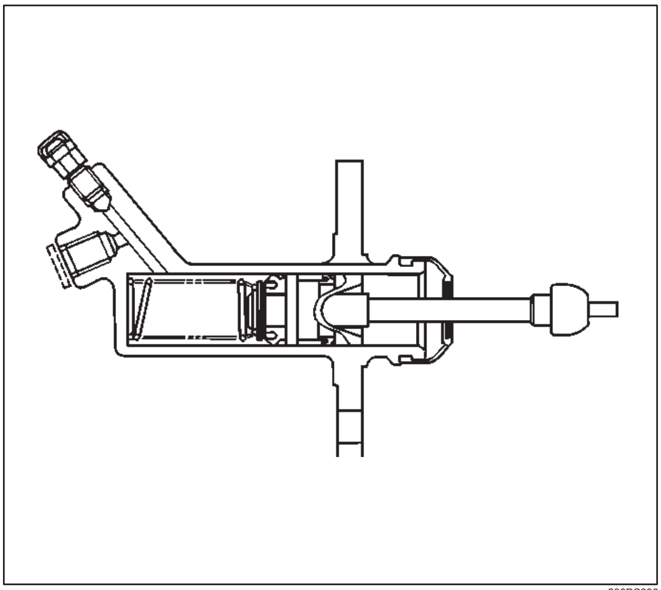
Limit: 0.15 mm (0.0059 in)

Reassembly

To reassemble, follow the disassembly steps in the reverse order, noting the following points:

Piston Assembly

1. Before installing the parts, apply a thin coat of rubber grease.
2. Install cup in groove in piston with the lip turned to the front of cylinder. Use care so as not to scratch the cylinder.



206RS006

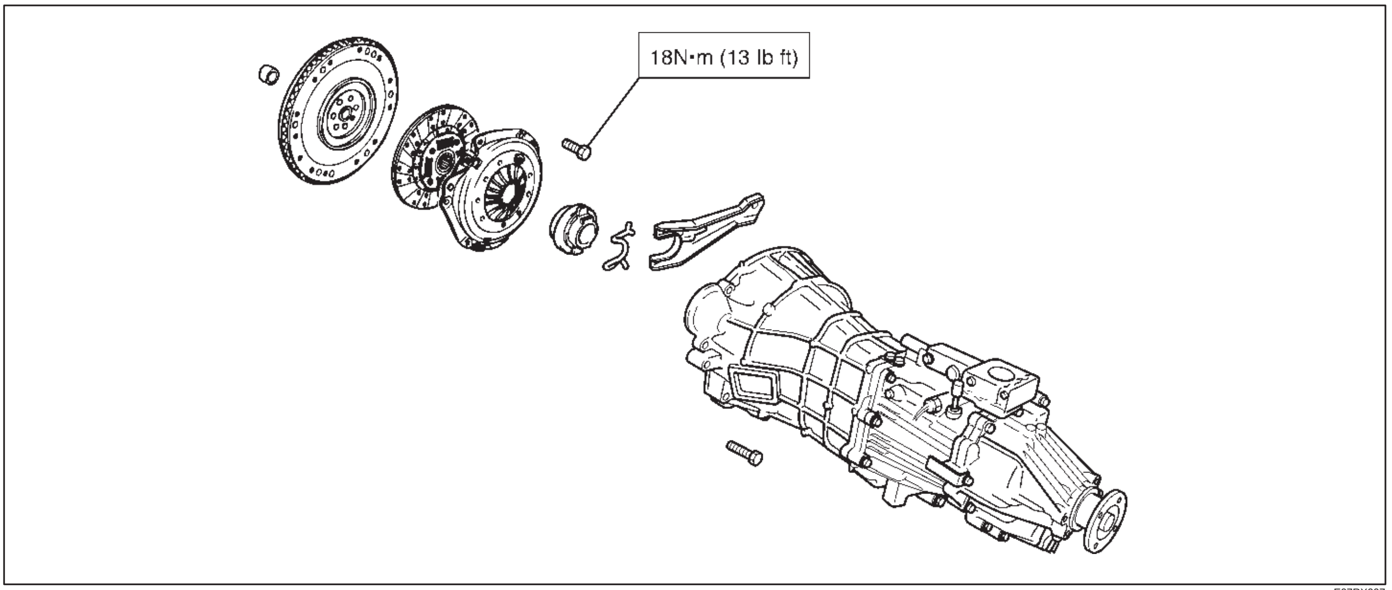
Main Data and Specifications

General Specifications

Engine	X22SE	6VD1
Type	Dry single plate type with diaphragm spring	
Size	240 mm (9.45 in)	260 mm (10.24 in)
Pressure plate		
Outside diameter	299 mm (11.77 in)	332 mm (13.07 in)
Clamping force	5488 N (1235 lb)	7208 N (1621 lb)
Spring finger height	37.5 – 39.5 mm (1.476 – 1.555 in)	49.9 – 51.9 mm (1.965 – 2.043 in)
Driven plate		
Outside diameter × inside diameter	240 × 160 mm (9.45 × 6.30 in)	260 × 170 mm (10.24 × 6.70 in)
Thickness		
Clutch disengaged	7.3 mm (0.287 in)	8.6 mm (0.339 in)
Clutch engaged	7.0 mm (0.276 in)	8.0 mm (0.315 in)
Total friction area	251 × 2 cm^2 (39 × 2 in^2)	304 × 2 cm^2 (47 × 2 in^2)
Clutch control type	Hydraulic	
Clutch pedal free play	5 – 15 mm (0.20 – 0.59 in)	
Clutch pedal stroke	165.5 –175.5 mm (6.52 – 6.91 in)	
Clutch pedal height	178 – 188 mm (7.01 – 7.40 in)	

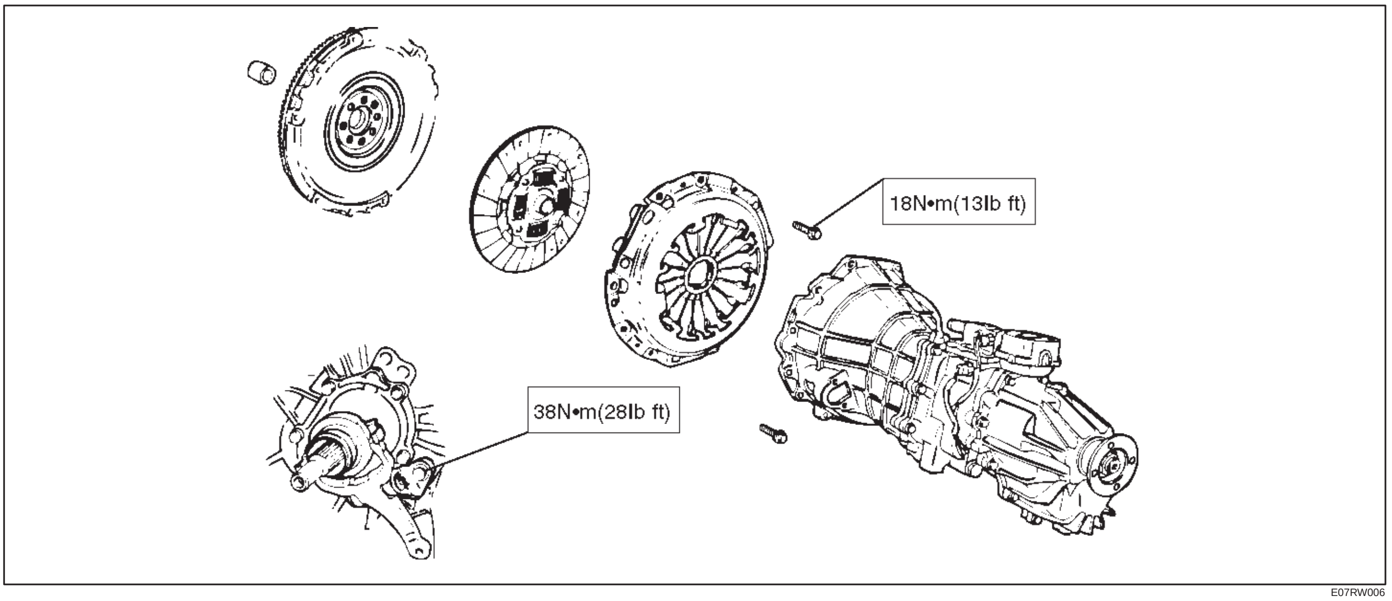
Torque Specifications

X22SE

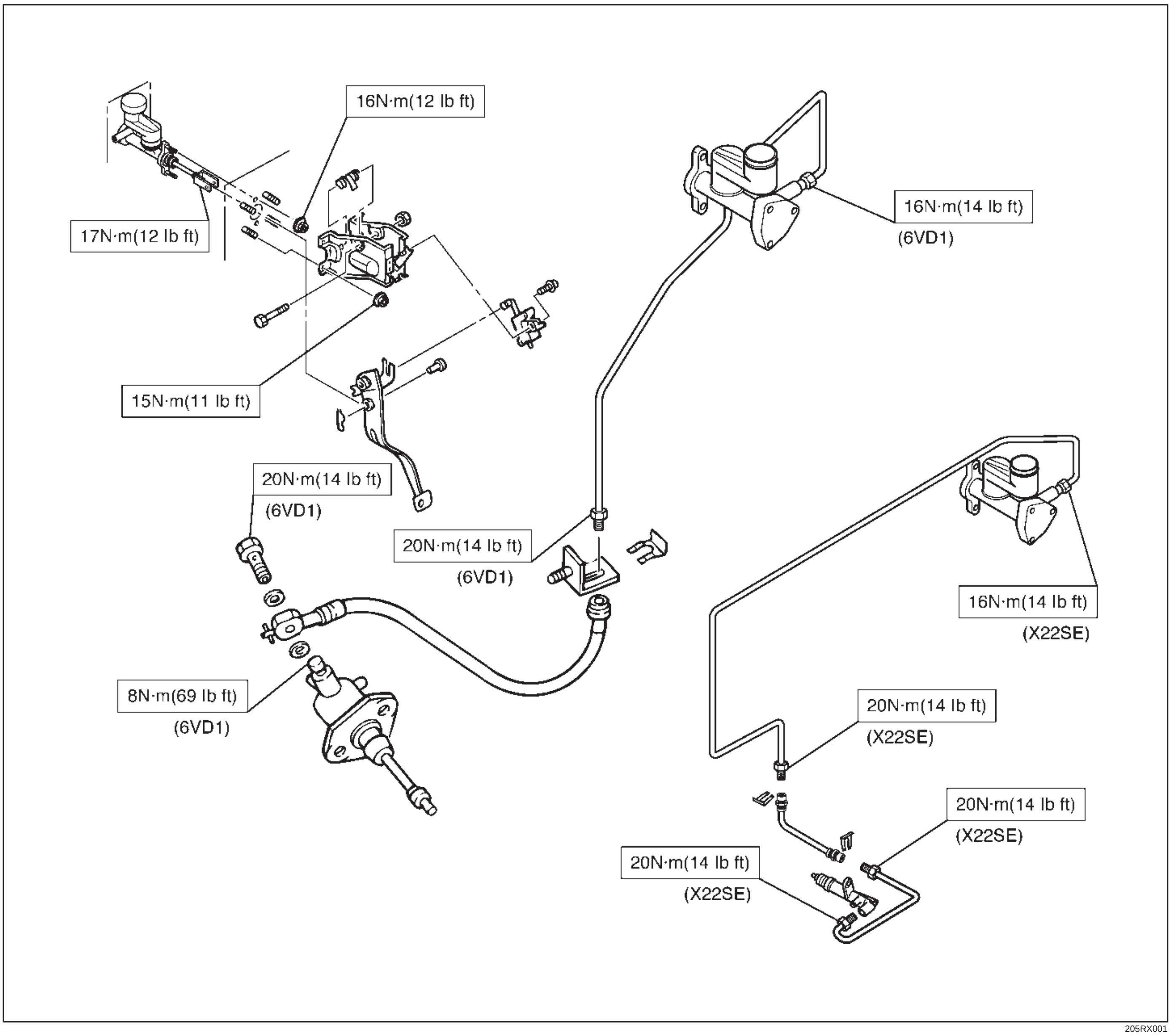


E07RX007

6VD1



E07RW006


16N·m(12 lb ft)
17N·m(12 lb ft)
15N·m(11 lb ft)
16N·m(14 lb ft)
(6VD1)
20N·m(14 lb ft)
(6VD1)
20N·m(14 lb ft)
(6VD1)
8N·m(69 lb ft)
(6VD1)
16N·m(14 lb ft)
(X22SE)
20N·m(14 lb ft)
(X22SE)
20N·m(14 lb ft)
(X22SE)
20N·m(14 lb ft)
(X22SE)
205RX001

Special Tools

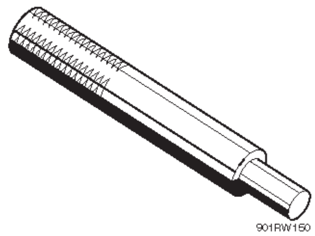
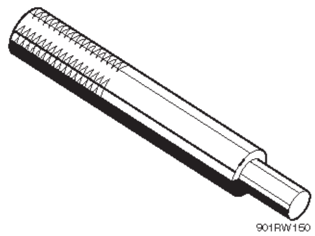
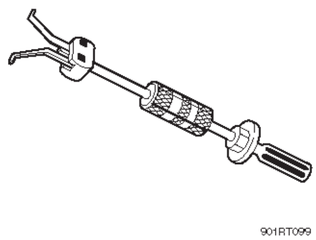
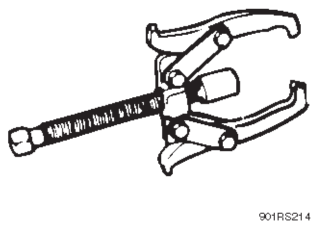
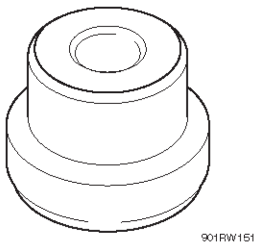
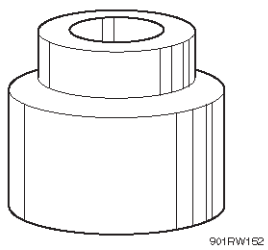
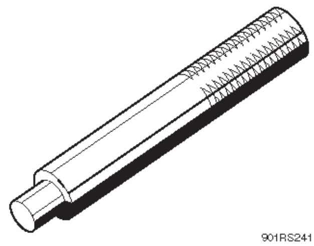
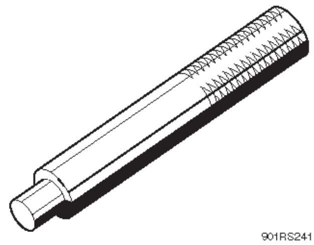
ILLUSTRATION	**PART NO.** PART NAME
	**J–24547** Driven plate aligner (6VD1)
	**J–42877** Driven plate aligner (X22SE)
	**J–5822 and J–23907** Pilot bearing remover and Sliding hammer
	**J–22888** Bearing puller
	**J–2241–11** Adapter
	**J–26516–A** Crankshaft pilot bearing installer (6VD1)

ILLUSTRATION	**PART NO.** PART NAME
	**J–1522** Crankshaft pilot bearing installer (X22SE)
	**J–8092** Driver handle

RODEO

BODY AND ACCESSORIES

CONTENTS

LIGHTING SYSTEM

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

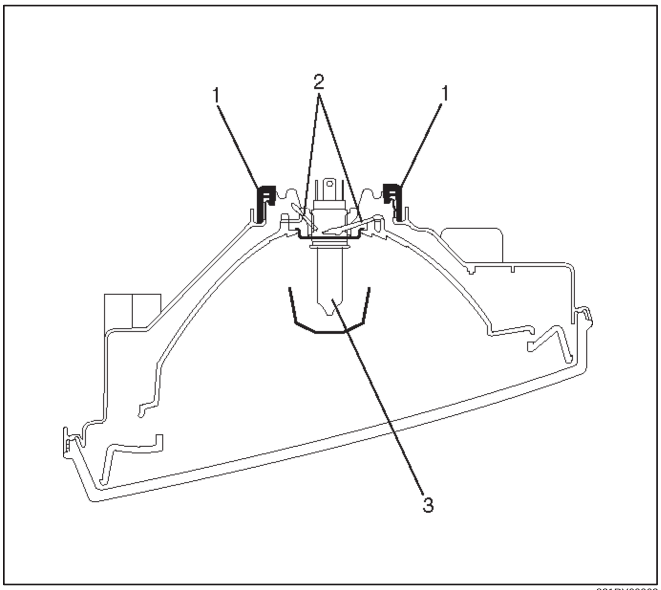
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fasteners joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fasteners. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Headlight Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the headlight bulb (3).
   - Disconnect the connector.
   - Remove the bulb cover (1).
   - Release the retaining ring (2).

CAUTION: The halogen light bulb produces heat and temperature rises high, therefore, if the glass surface is contaminated, it will be burnt by heat leaving stains which will not come out. This may reduce the illuminating power or damage the bulb due to thermal deformation during evaporation. In order to prevent this problem, do not touch the glass surface with your fingers.



821RY00063

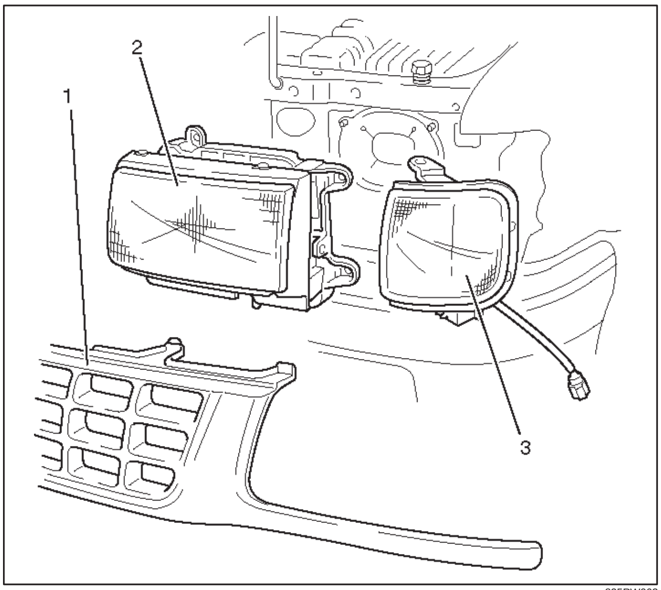
Installation

To install, follow the removal steps in the reverse order.

Headlight Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the radiator grille (1).
   - Remove eight clips and a screw.
3. Remove the front combination light (3).
   - Remove three screws.
   - Disconnect the connector.
4. Remove the headlight assembly (2).
   - Disconnect the connector.
   - Remove four screws.



825RW063

Installation

To install, follow the removal steps in the reverse order.

CAUTION: After installing the headlight, be sure to adjust the headlight aim.

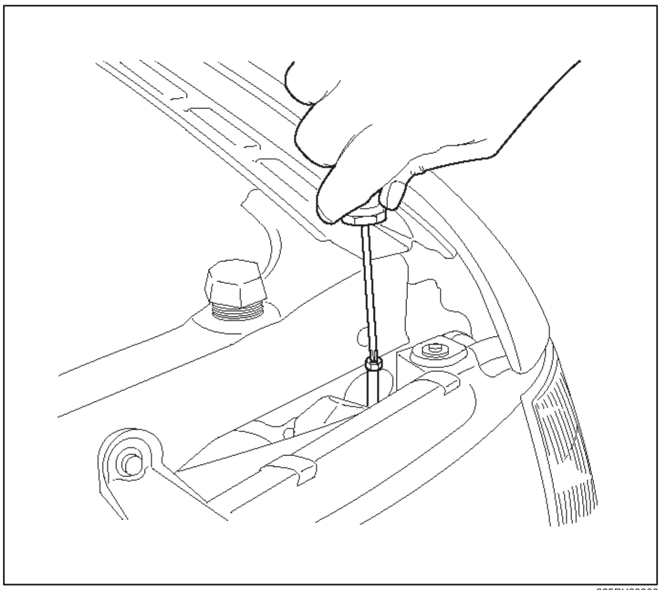
Headlight Adjustment

Preparation

Place the unloaded vehicle on a level surface and check to see if the inflation pressure of the tires is correct, the lenses are clean, and the battery is sufficiently charged. Adjust the aim with the headlight tester, if necessary.
When adjusting, follow the procedure of the tester manufacture’s.

Vertical Adjustment

Use a screwdriver for vertical adjustment.

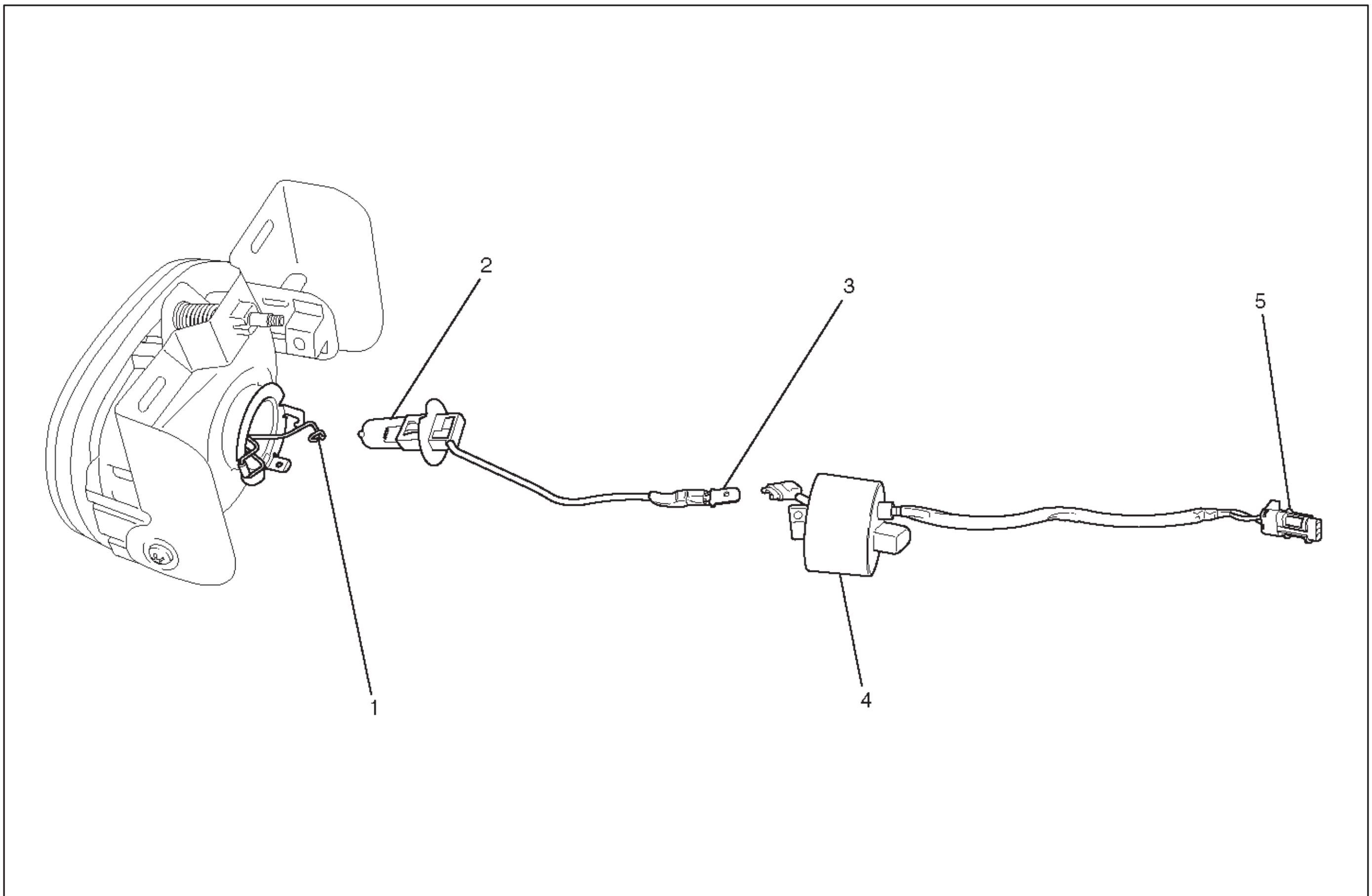


825RY00066

Fog Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the fog light bulb (2).
   - Disconnect the connector (5).
   - Remove the cap (4).
   - Loosen the retaining clip (1).
   - Pull out the bulb (2).
   - Disconnect the terminal (3).



825RY00068

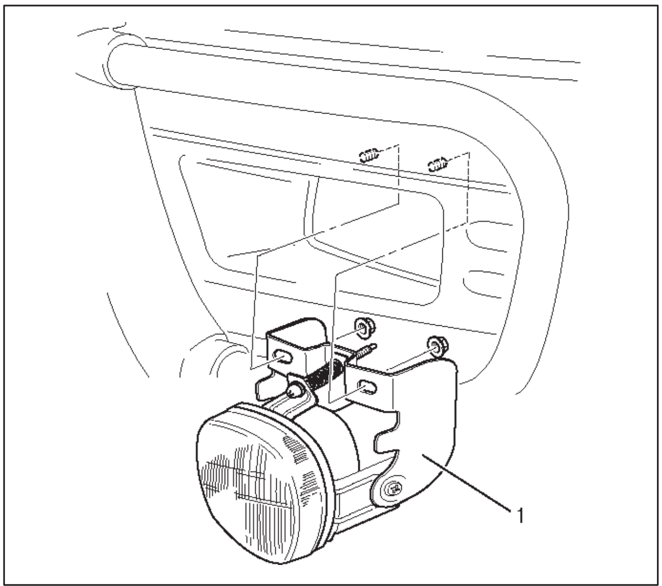
Installation

To install, follow the removal steps in the reverse order.

Fog Light Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the fog light assembly (1).
   - Disconnect the connector.
   - Remove two nuts from the bracket.



825RY00065

Installation

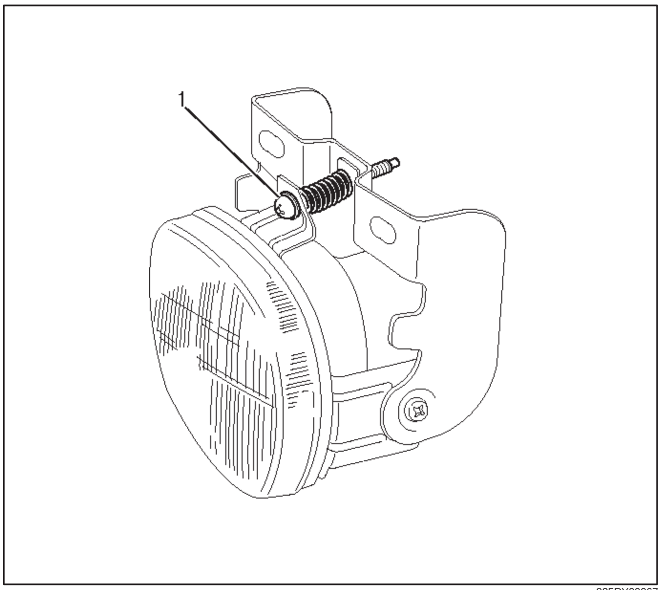
To install, follow the removal steps in the reverse order.

CAUTION: After installing the fog light, be sure to adjust the fog light aim.

Fog Light Adjustment

Vertical Adjustment

Turn the adjusting screw (1) with a screwdriver to adjust the aim of the fog light vertically.

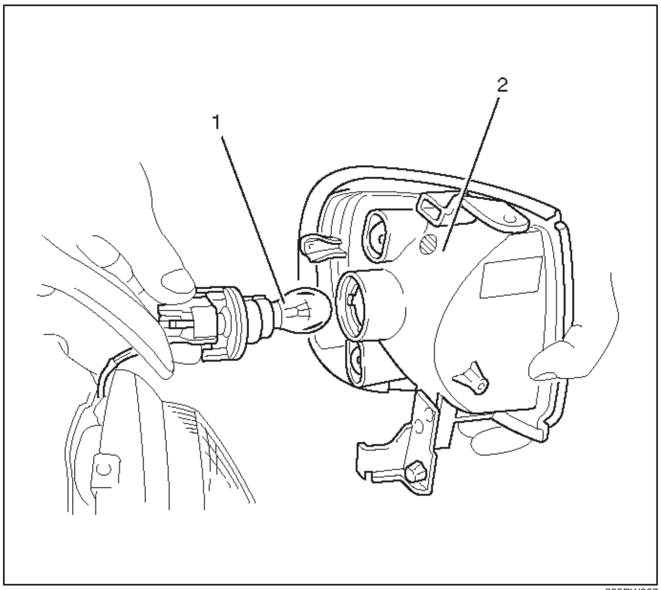


825RY00067

Side Marker Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the radiator grille.
   - Refer to Engine Hood and Fender in Body Structure section.
3. Remove the front combination light (2).
   - Remove three screws.
4. Remove the bulb (1).
   - Remove the side marker light socket by turning it counterclockwise.
   - Remove the bulb by turning it counterclockwise while pushing it at the same time.



825RW067

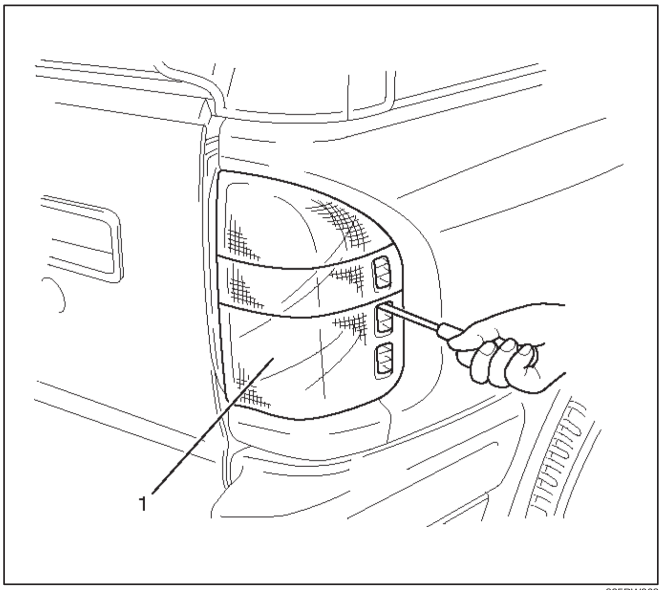
Installation

To install, follow the removal steps in the reverse order.

Taillight Bulb

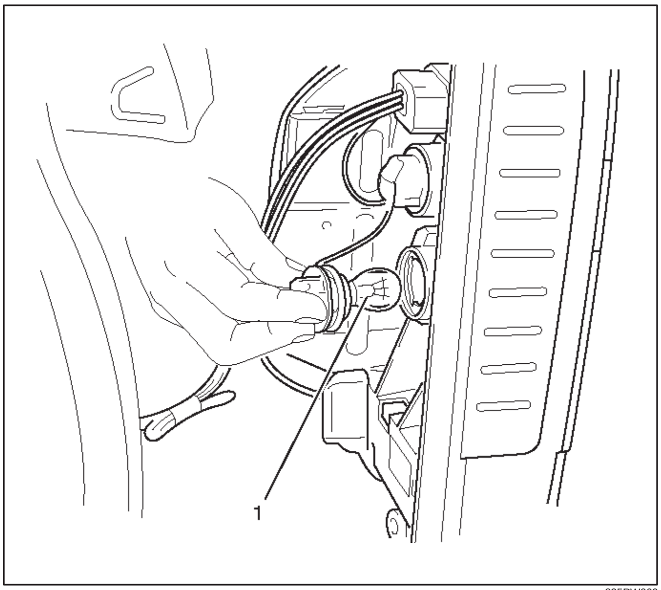
Removal

1. Disconnect the battery ground cable.
2. Remove the rear combination light assembly (1).
   - Remove three screws.
   - Pull out the rear combination light assembly to ward you.



825RW068

3. Remove the bulb (1).
   - Remove the taillight socket by turning it counterclockwise.
   - Remove the bulb by turning it counterclockwise while pushing it at the same time.



825RW069

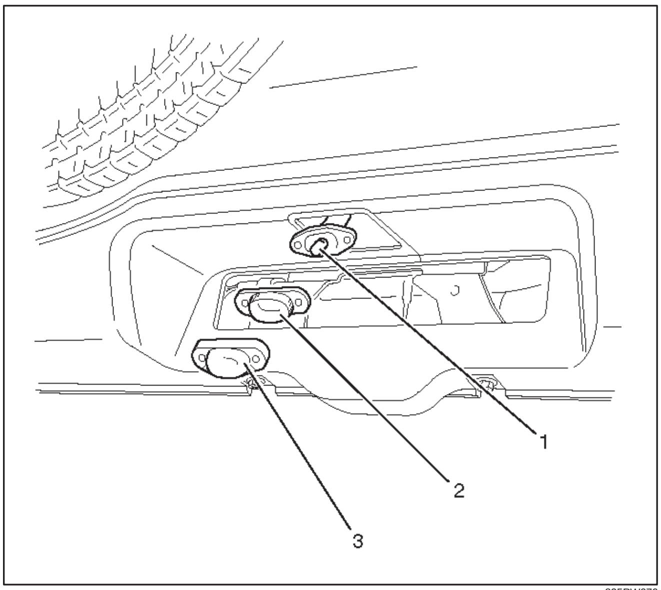
Installation

To install, follow the removal steps in the reverse order.

License Plate Light Bulb (Bumper Type)

Removal

1. Disconnect the battery ground cable.
2. Remove the lens cover (3).
   - Remove two screws.
3. Remove the lens (2).
4. Remove the bulb (1).
   - Pull out the bulb from the socket.



825RW070

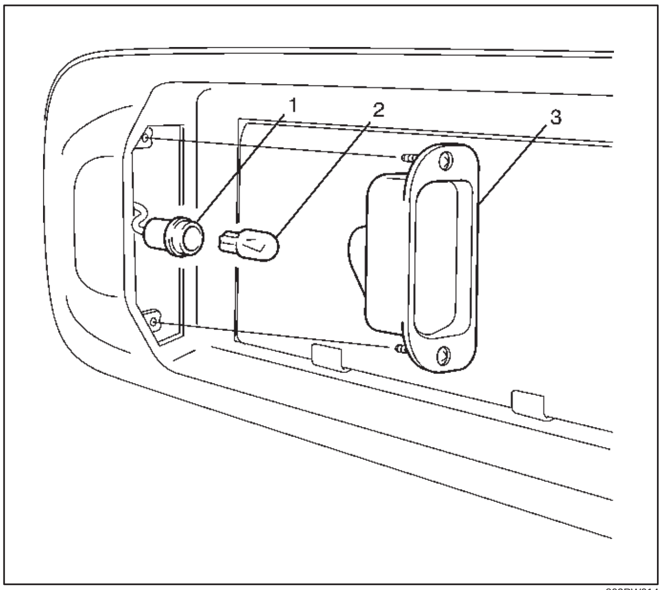
Installation

To install, follow the removal steps in the reverse order.

License Plate Light Bulb (Tailgate Type)

Removal

1. Disconnect the battery ground cable.
2. Remove the lens cover (3).
   - Remove two screws.
3. Remove the bulb (2).
   - Pull out the bulb from the socket (1).



803RW014

Installation

To install, follow the removal steps in the reverse order.

Stoplight Bulb

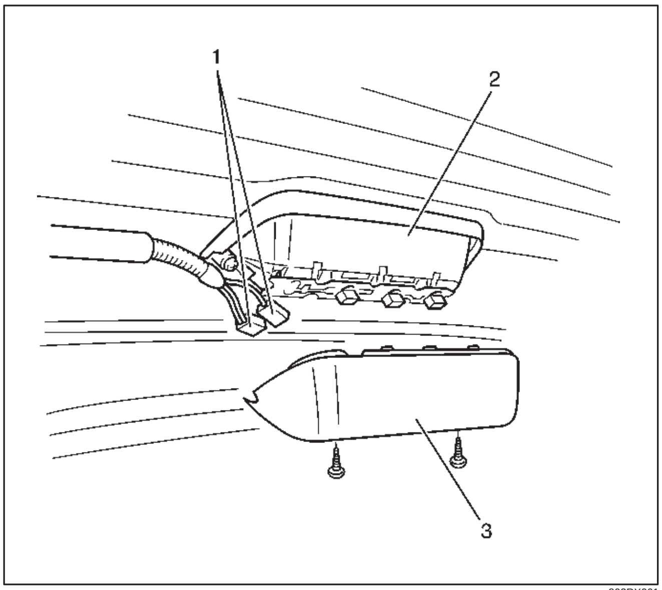
Removal and Installation

Refer to Taillight Bulb in this section.

High Mounted Stoplight Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the high mounted stoplight assembly (2).
   - Remove the cover (3).
   - Disconnect the connectors (1).
   - Remove two screws.



803RX001

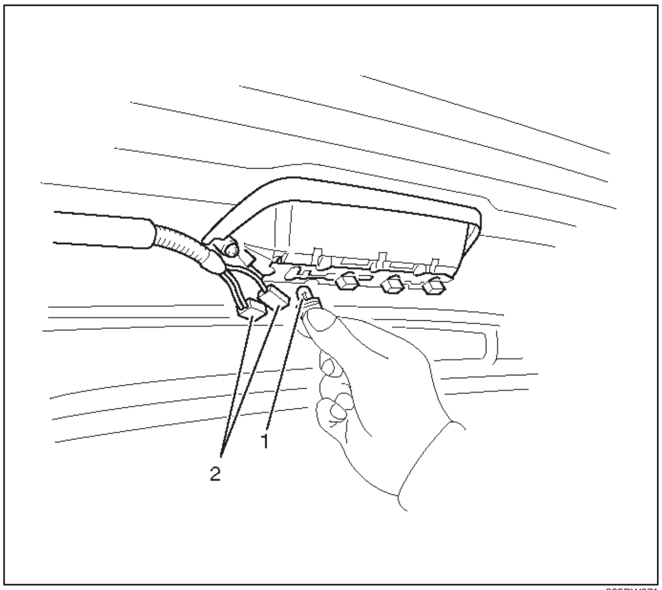
Installation

To install, follow the removal steps in the reverse order.

High Mounted Stoplight Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the cover.
3. Disconnect the connectors (2).
4. Remove the bulb (1).
   - Remove the socket by turning it counterclockwise.



825RW071

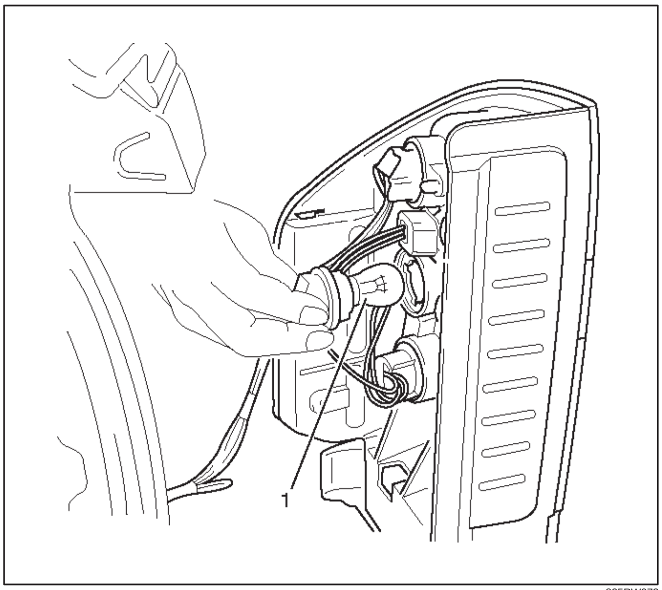
Installation

To install, follow the removal steps in the reverse order.

Backup Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the rear combination light assembly.
   - Refer to the Taillight Bulb removal step 2 in this section.
3. Remove the bulb (1).
   - Remove the backup light socket by turning it counterclockwise.
   - Remove the bulb by turning it counterclockwise while pushing it at the same time.



825RW073

Installation

To install, follow the removal steps in the reverse order.

Front Turn Signal Light Bulb

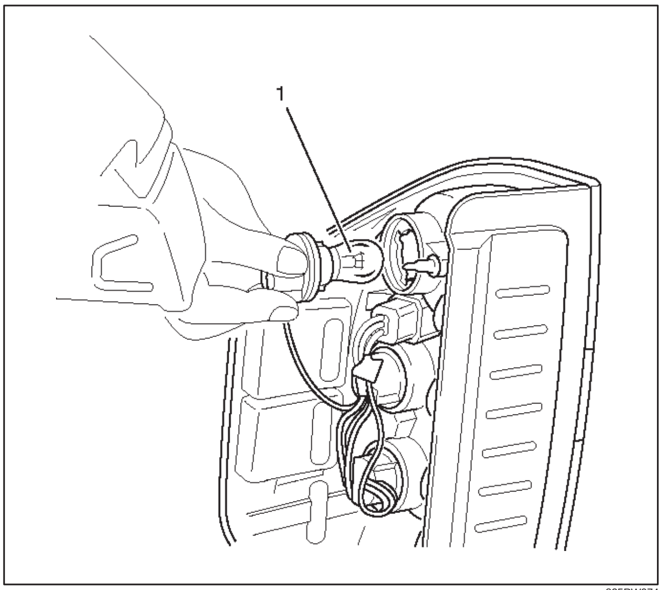
Removal and Installation

Refer to Side Marker Light Bulb in this section.

Rear Turn Signal Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the rear combination light assembly.
   - Refer to the Taillight Bulb removal step in this section.
3. Remove the bulb (1).
   - Remove the rear turn signal light socket by turning it counterclockwise.
   - Remove the bulb by turning it counterclockwise while pushing it at the same time.



825RW074

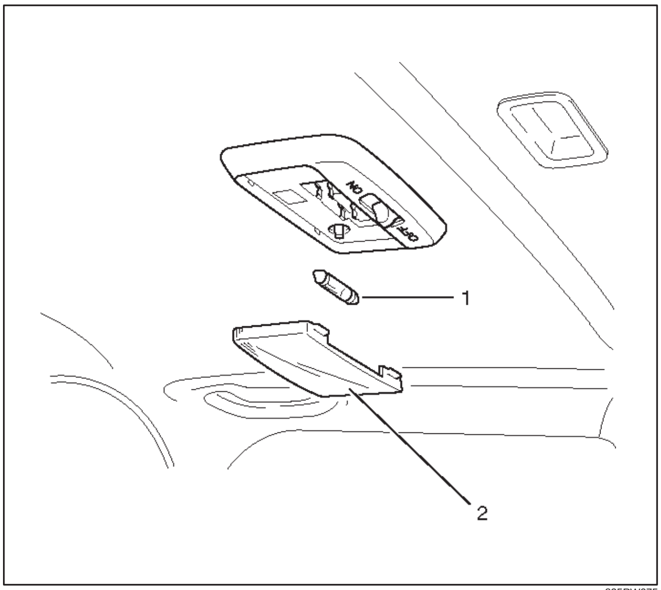
Installation

To install, follow the removal steps in the reverse order.

Dome Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens (2).
3. Remove the bulb (1).
   - Pull out the bulb.



825RW075

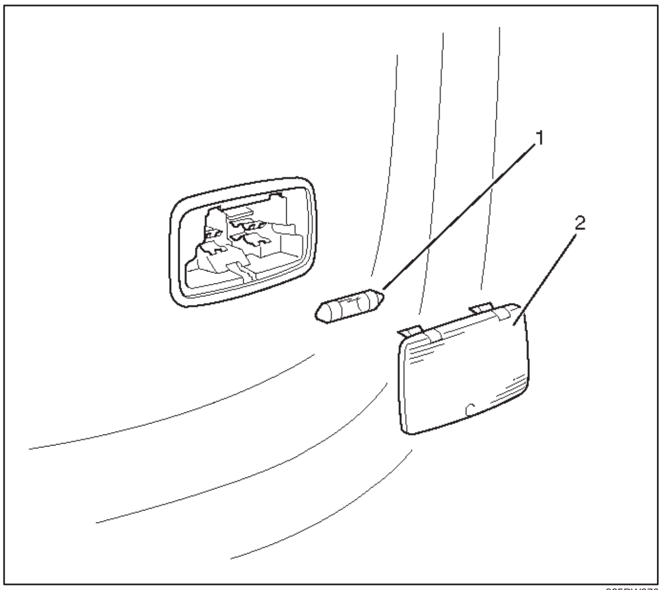
Installation

To install, follow the removal steps in the reverse order.

Courtesy Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens (2).
3. Remove the bulb (1).
   - Pull out the bulb.



825RW076

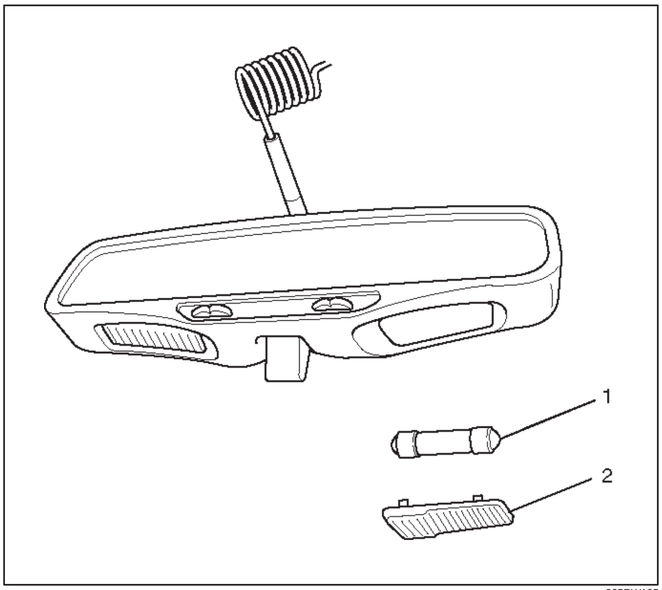
Installation

To install, follow the removal steps in the reverse order.

Spotlight Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens (2).
3. Remove the bulb (1).
   - Pull out the bulb.



825RW105

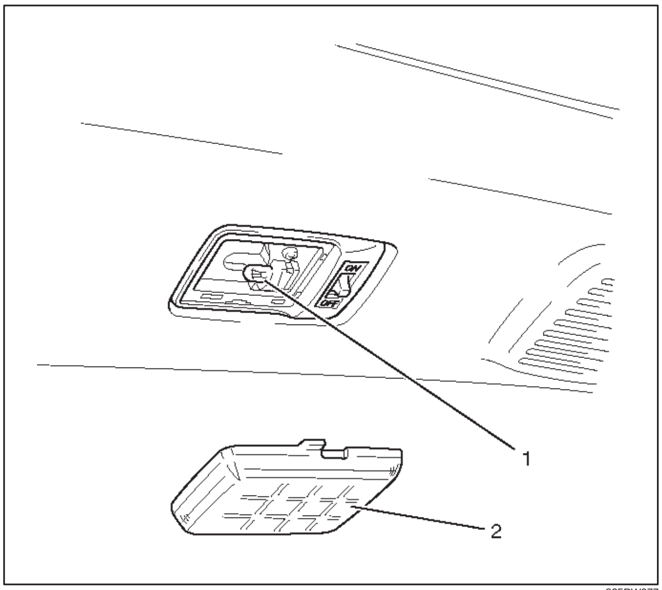
Installation

To install, follow the removal steps in the reverse order.

Luggage Room Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens (2).
3. Remove the bulb (1).
   - Pull out the bulb.



825RW077

Installation

To install, follow the removal steps in the reverse order.

HVAC Bezel Illumination Light Bulb

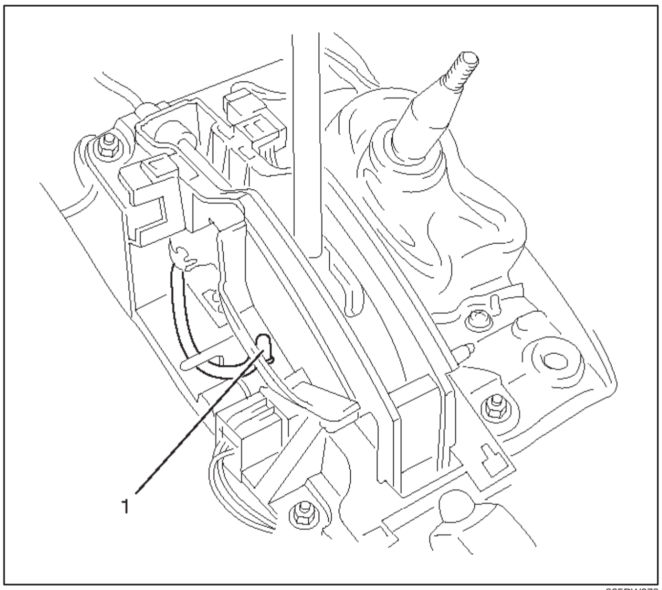
Removal and Installation

Refer to Control Panel Illumination bulb in Heating, Ventilation and Air Conditioning (HVAC) section.

Shift Lever Illumination Light Bulb (A/T)

Removal

1. Disconnect the battery ground cable.
2. Remove the console assembly.
   - Remove four screws.
3. Remove the bulb (1).
   - Turn the bulb socket counterclockwise.
   - Pull out the bulb from the socket.



825RW078

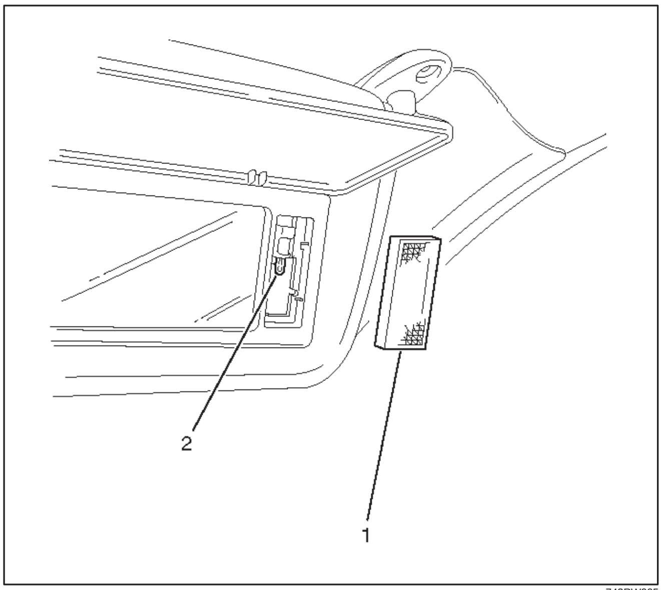
Installation

To install, follow the removal steps in the reverse order.

Vanity Mirror Illumination Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the lens (1).
3. Remove the bulb (2).
   - Attach some scotch tape to the bulb and pull it out.



743RW005

Installation

To install, follow the removal steps in the reverse order.

Starter Switch

Removal and Installation

Refer to Lock cylinder in steering section.

Lighting Switch (Combination Switch)

Removal and Installation

Refer to Combination Switch in Steering section.

Dimmer·Passing Switch (Combination Switch)

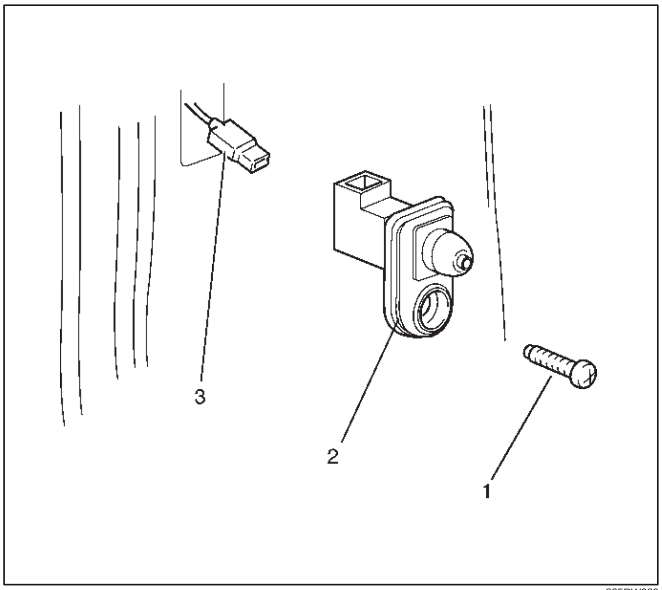
Removal and Installation

Refer to Combination Switch in Steering section.

Door Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the door switch (2).
   - Remove the screw (1).
   - Disconnect the connector (3).



825RW289

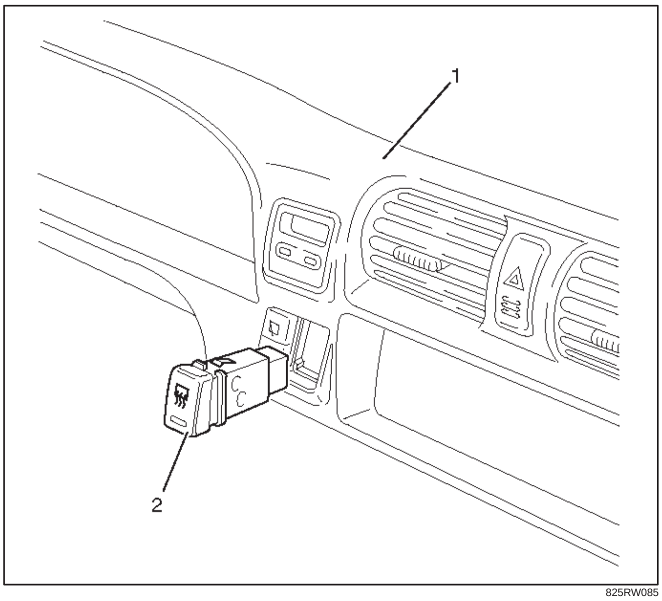
Installation

To install, follow the removal steps in the reverse order.

Rear Defogger Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the meter cluster assembly (1).
   - Refer to Instrument Panel Assembly in Body Structure section.
3. Remove the rear defogger switch (2).
   - Disconnect the switch connector.
   - To remove the switch, push the lock from the back side of the meter cluster assembly.



Installation

To install, follow the removal steps in the reverse order.

Key Remind Switch (Starter Switch)

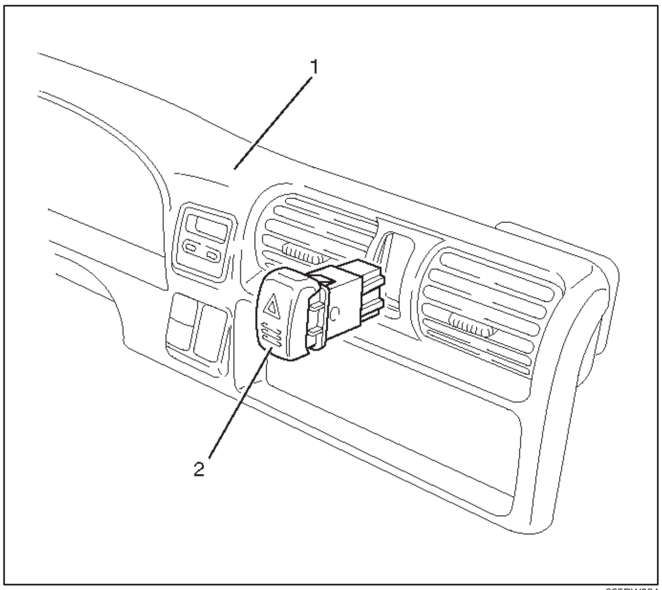
Removal and Installation

Refer to Lock Cylinder in Steering section.

Hazard Warning Light Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the meter cluster assembly (1).
   - Refer to Instrument Panel Assembly in Body Structure section.
3. Remove the hazard warning switch (2).
   - Disconnect the switch connector.
   - To remove the switch, push the lock from the back side of the meter cluster assembly.



825RW084

Installation

To install, follow the removal steps in the reverse order.

Stoplight Switch

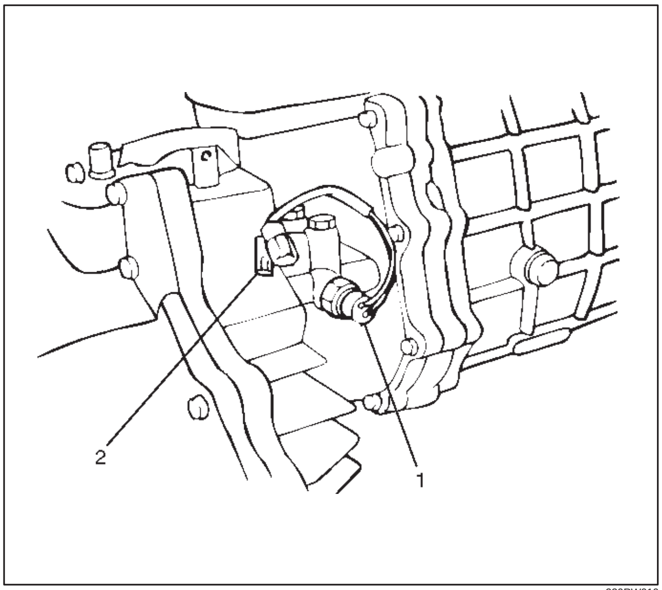
Removal and Installation

Refer to Stoplight Switch in Brake section.

Backup Light Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the backup light switch (1).
   - Disconnect the connector (2).



230RW010

Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Apply liquid gasket to the screw portion of the switch to prevent oil leak.

Turn Signal Light Switch (Combination Switch)

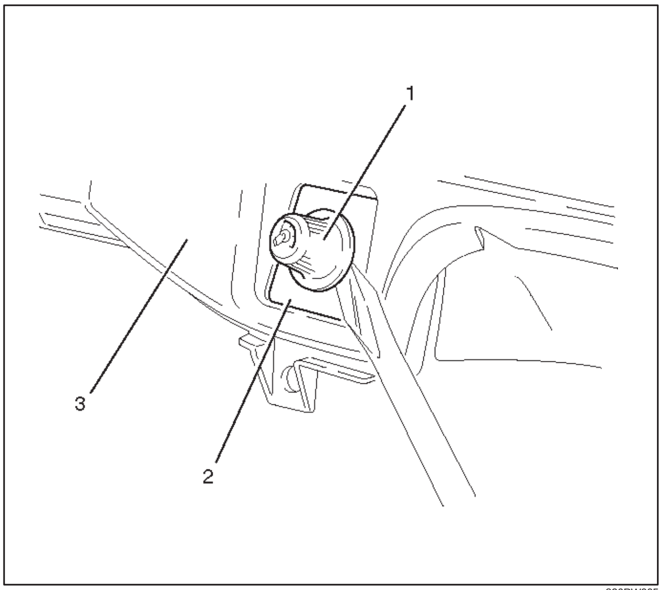
Removal and Installation

Refer to Combination Switch in Steering section.

Illumination Controller

Removal

1. Disconnect the battery ground cable.
2. Remove the instrument panel driver lower cover assembly (3).
   - Refer to Instrument Panel Assembly in Body Structure section.
3. Remove the illumination controller (2).
   - Disconnect the controller connector.
   - Remove the controller knob (1).
   - Remove the nut.
   - Remove the controller from the back side of the instrument panel driver lower cover assembly.



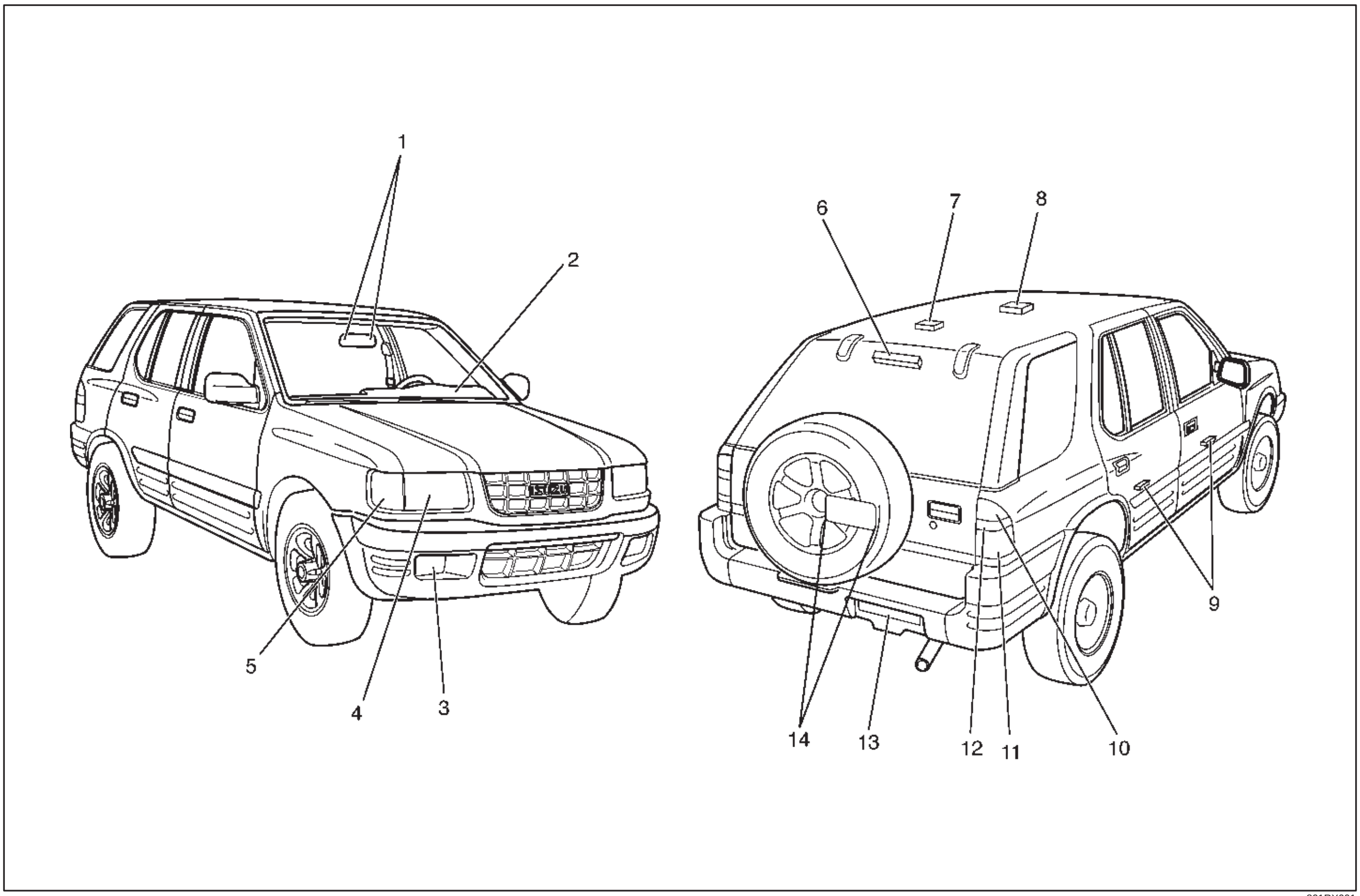
826RW005

Installation

To install, follow the removal steps in the reverse order.

Light and Bulb Specifications

Light and Bulb Specifications



801RX001

Legend
(1) Map Light
(2) Meter
(3) Fog Light
(4) Headlight
(5) Front Turn Signal Light/Front Side Marker Light/Parking Light
(6) High Mounted Stoplight
(7) Luggage Room Light
(8) Dome Light
(9) Courtesy Light
(10) Rear Turn Signal Light
(11) Taillight/Stoplight
(12) Backup Light
(13) License Plate Light (Bumper Type)
(14) License Plate Light (Tailgate Type)

<table>
<tr><th colspan="2">Light Name</th><th>Bulb No.</th><th>Rated Power</th><th>Number of Bulbs</th><th>Lens Color</th><th>Remarks</th></tr>
<tr><td colspan="2">Headlight</td><td>—</td><td>65w/45w</td><td>2</td><td>White</td><td>Halogen</td></tr>
<tr><td colspan="2">Front Turn signal Light/
Front Side Marker Light/Parking Light</td><td>—</td><td>21w/5w</td><td>2</td><td>Amber</td><td></td></tr>
<tr><td colspan="2">Fog Light</td><td>—</td><td>55w</td><td>2</td><td>White</td><td>Halogen</td></tr>
<tr><td colspan="2">Rear Turn Signal Light</td><td>—</td><td>21w</td><td>2</td><td>Amber</td><td></td></tr>
<tr><td colspan="2">Backup Light</td><td>—</td><td>21w</td><td>2</td><td>White</td><td></td></tr>
<tr><td colspan="2">Taillight/Stoplight</td><td>—</td><td>21w/5w</td><td>2</td><td>Red</td><td></td></tr>
<tr><td colspan="2">High Mount Stoplight</td><td>—</td><td>5w</td><td>4</td><td>Red</td><td></td></tr>
<tr><td colspan="2">License Plate Light (Tailgate type)</td><td>—</td><td>5w (5W)</td><td>1 (2)</td><td>White</td><td></td></tr>
<tr><td colspan="2">Map Light</td><td>—</td><td>5w</td><td>2</td><td>White</td><td></td></tr>
<tr><td colspan="2">Dome Light</td><td>—</td><td>7w</td><td>1</td><td>White</td><td></td></tr>
<tr><td colspan="2">Luggage Room Light</td><td>—</td><td>5w</td><td>1</td><td>White</td><td></td></tr>
<tr><td colspan="2">Courtesy Light</td><td>—</td><td>3.4w</td><td>4</td><td>White</td><td></td></tr>
<tr><td rowspan="20">Indicator/Warning Light</td><td>Check Trans</td><td>—</td><td>1.4w</td><td>1</td><td>Red</td><td>Meter</td></tr>
<tr><td>A/T Oil Temp</td><td>—</td><td>3w</td><td>1</td><td>Red</td><td>Meter</td></tr>
<tr><td>Cruise Set</td><td>—</td><td>1.4w</td><td>1</td><td>Green</td><td>Meter</td></tr>
<tr><td>Power Drive</td><td>—</td><td>1.4w</td><td>1</td><td>Amber</td><td>Meter</td></tr>
<tr><td>Winter Drive</td><td>—</td><td>1.4w</td><td>1</td><td>Green</td><td>Meter</td></tr>
<tr><td>Turn Signal</td><td>—</td><td>1.4w</td><td>2</td><td>Green</td><td>Meter</td></tr>
<tr><td>Upshift</td><td>—</td><td>1.4w</td><td>1</td><td>Amber</td><td>Meter</td></tr>
<tr><td>High Beam</td><td>—</td><td>1.4w</td><td>1</td><td>Blue</td><td>Meter</td></tr>
<tr><td>ABS</td><td>—</td><td>1.4w</td><td>1</td><td>Amber</td><td>Meter</td></tr>
<tr><td>Seat Belt</td><td>—</td><td>2w</td><td>1</td><td>Red</td><td>Meter</td></tr>
<tr><td>Malfunction Indicator
(Check Engine)</td><td>—</td><td>1.4w</td><td>1</td><td>Amber</td><td>Meter</td></tr>
<tr><td>Low Fuel</td><td>—</td><td>1.4w</td><td>1</td><td>Amber</td><td>Meter</td></tr>
<tr><td>4WD</td><td>—</td><td>1.4w</td><td>1</td><td>Green</td><td>Meter</td></tr>
<tr><td>Oil Pressure</td><td>—</td><td>1.4w</td><td>1</td><td>Red</td><td>Meter</td></tr>
<tr><td>Brake System</td><td>—</td><td>1.4w</td><td>1</td><td>Red</td><td>Meter</td></tr>
<tr><td>Charge</td><td>—</td><td>1.4w</td><td>1</td><td>Red</td><td>Meter</td></tr>
<tr><td>A/T Shift Position</td><td>—</td><td>1.4w</td><td>7</td><td>P,N,D,3,2,L
:Green
R: Amber</td><td>Meter</td></tr>
<tr><td>Air Bag</td><td>—</td><td>2w</td><td>1</td><td>Red</td><td>Meter</td></tr>
<tr><td rowspan="2">Illumination Light</td><td>Meter</td><td>—</td><td>3.4w</td><td>4</td><td></td><td>Meter</td></tr>
<tr><td>Shift lever</td><td>—</td><td>1.4w</td><td>1</td><td>White</td><td>Shift lever</td></tr>
</table>

RODEO

BODY AND ACCESSORIES

WIPER / WASHER SYSTEM

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Windshield Wiper/Washer System

General Description

The circuit consists of the starter switch, windshield wiper & washer switch, windshield wiper motor, windshield washer motor and alarm & relay control unit.

When the windshield wiper & washer switch is turned on with the starter switch on, the battery voltage is applied to the wiper motor to activate the wiper.
The washer motor squirts glass cleaning fluid while the washer switch is being pushed. The alarm & relay control unit relay is used to control motion of the wiper.

Windshield Wiper And Washer Switch

Removal and Installation

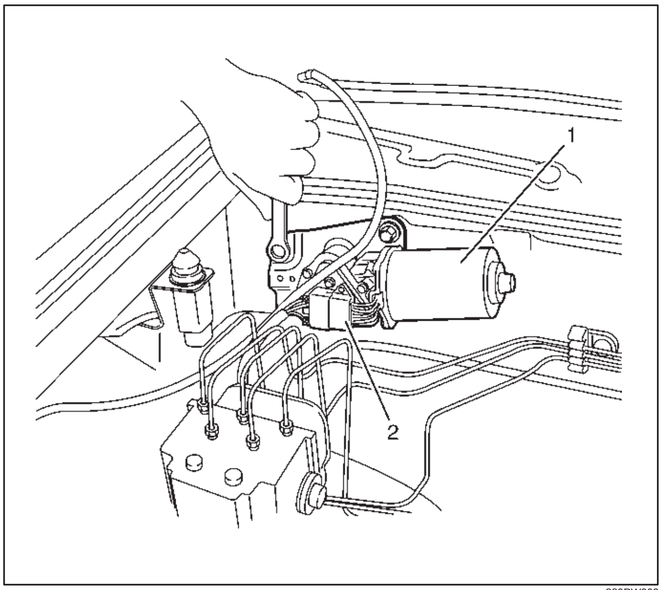
Refer to Combination Switch in Steering section.

Windshield Wiper Motor

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector(2).
3. Remove 4 mounting bolts.
4. Remove the nut of the wiper motor shaft, and disconnect the linkage.
5. Remove the windshield wiper motor(1).

CAUTION: To facilitate the removal of the nuts, be sure to put out the tip portion of the linkage sufficiently through the mounting hole of the motor by sliding the wiper blade slowly.



880RW002

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the wiper motor shaft nut to the specified torque.

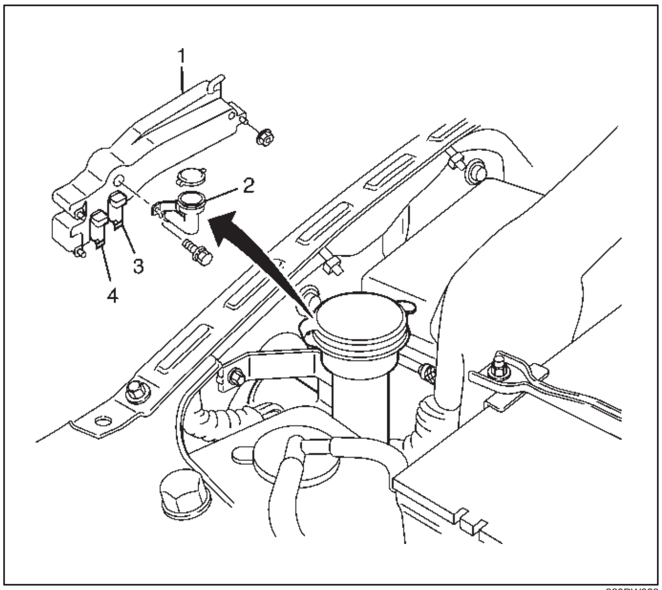
   Torque: 14 N·m (122 lb in)

2. Remove the wiper arms on both sides, and rotate the wiper motor until it gets to the autostop position to reinstall the wiper blade.

Windshield Washer Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the fender inner liner (right side).
3. Disconnect the windshield washer motor connector and the rear washer motor connector.
4. Disconnect the windshield washer hose connector and the rear washer hose connector.
5. Remove the filler neck (2).
   - Remove the bolt.
6. Remove the washer tank (1).
   - Remove the three nuts.
7. Pull the windshield washer motor (4) from the washer tank.

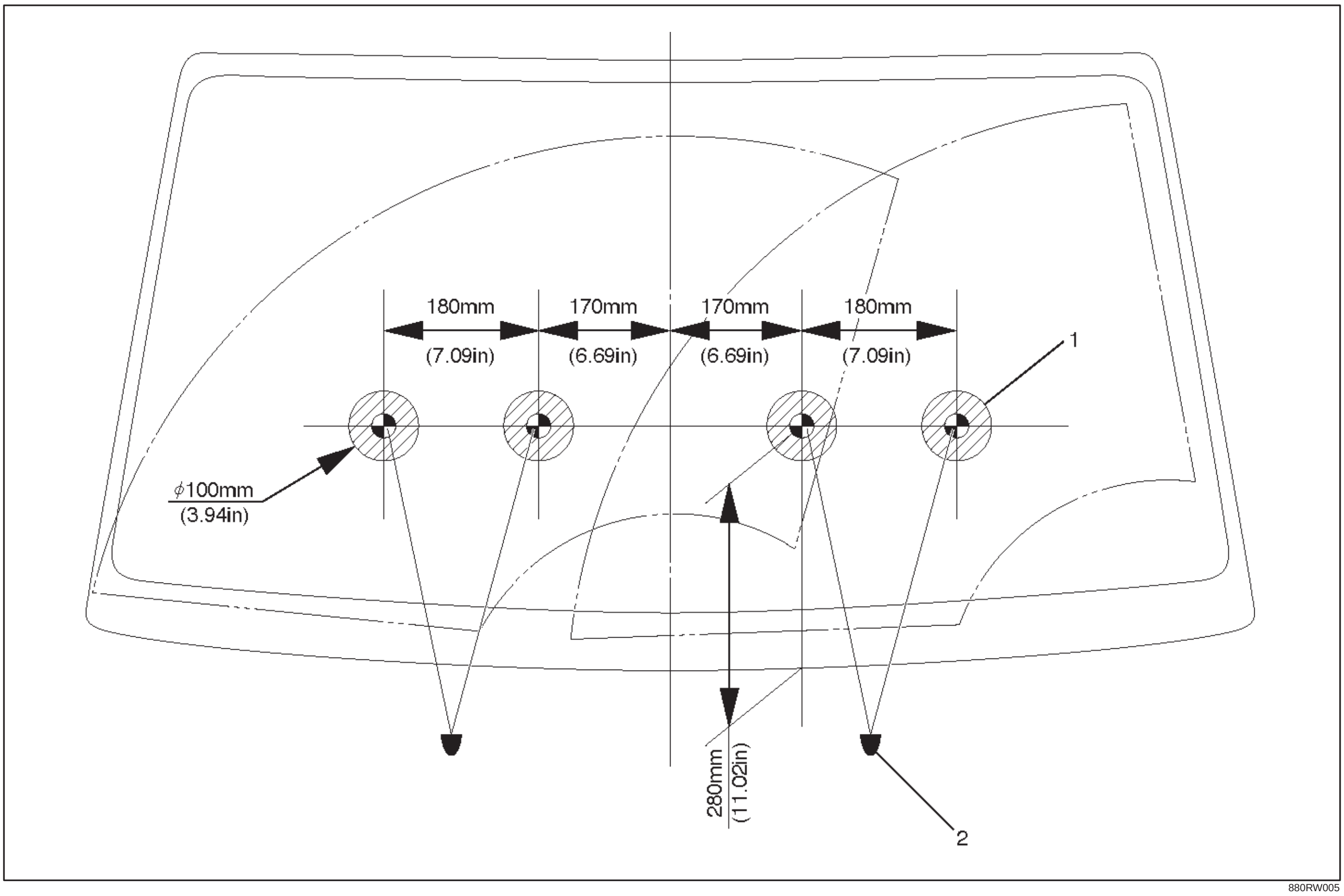


880RW028

Installation

To install, follow the removal steps in the reverse order.

Windshield Washer Spray Pattern

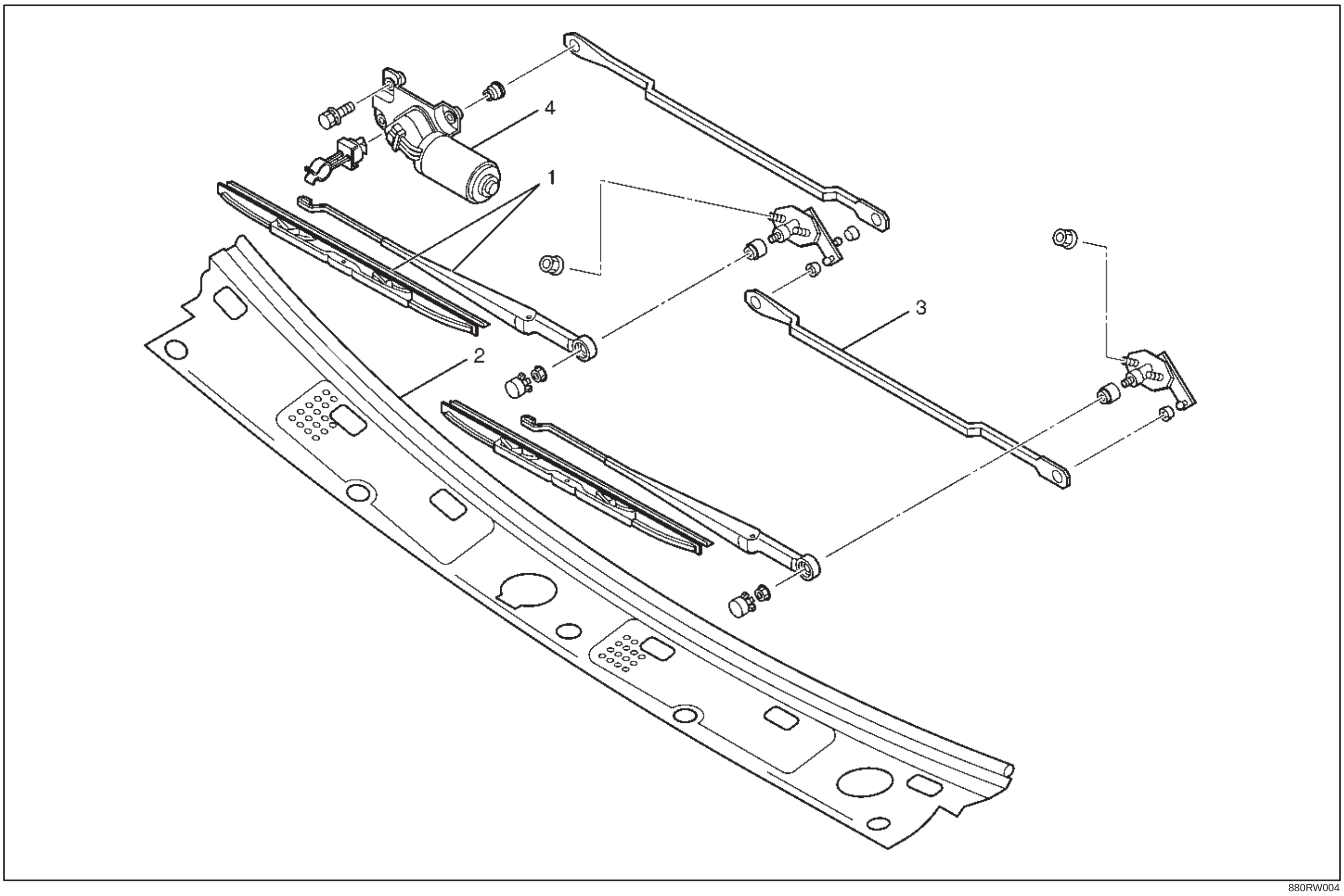


Legend

(1) Spray Target
(2) Washer Nozzle

Windshield Wiper Linkage

Windshield Wiper Linkage and Associated Parts



Legend

(1) Windshield Wiper Arm/Blade
(2) Vent Cowl Cover
(3) Windshield Wiper Linkage Assembly
(4) Windshield Wiper Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the windshield wiper arm/blade.
3. Remove the vent cowl cover.
4. Remove the windshield wiper motor.
5. Remove the pivot assembly mounting nuts, fixing screws.
6. Take out the windshield wiper linkage assembly from the opening of the cowl.

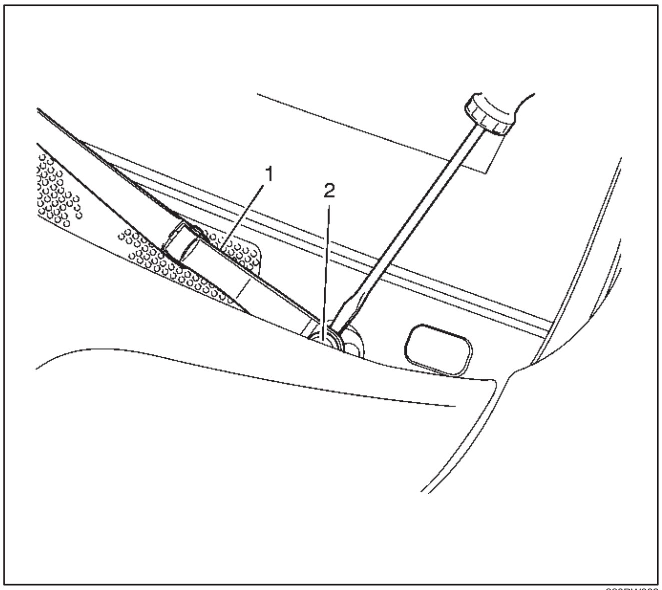
Installation

To install, follow the removal steps in the reverse order.

Windshield Wiper Arm/Blade

Removal

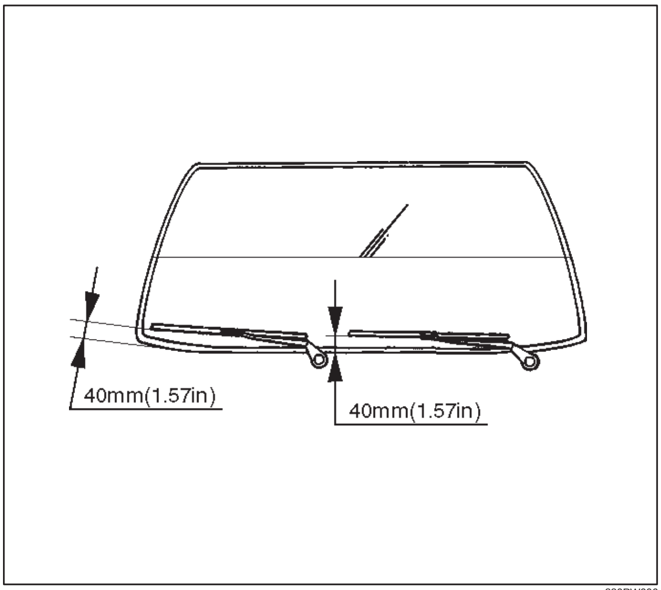
1. Dry the cap(2) off with the tip of a screwdriver.
2. Remove the nut.
3. Remove the wiper arm/blade(1).



880RW003

Installation

To install, follow the removal steps in the reverse order, noting the following points:



880RW006

1. Before installing the wiper arm/blade to the shaft, confirm that the motor stops at the autostop position.
2. Set the wiper arm/blade so that the tips of both blades are positioned about 40 mm (1.57 in) from the upper edge of the cowl cover as shown in the figure.
3. Tighten the nuts to the specified torque.

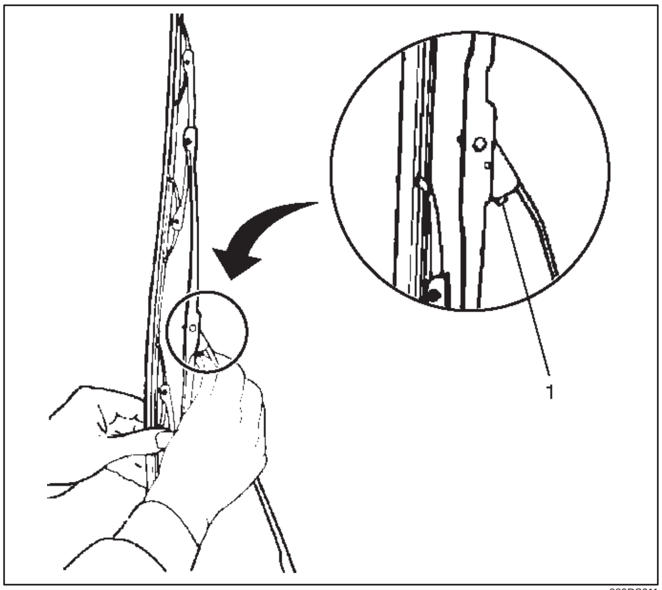
Torque: 23 N·m (17 lb ft)

Windshield Wiper Blade Rubber

Removal

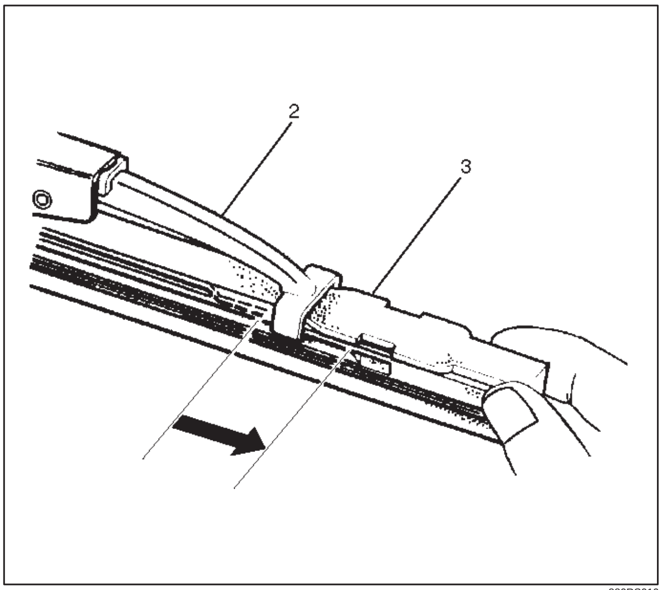
1. Push the wiper blade lock(1) while pulling the wiper blade in the arrow direction as shown in the figure.

CAUTION: When the wiper blade has been removed, wrap the tip of the wiper arm with cloth, to avoid damaging the glass.



880RS011

2. Pull the end of rubber and remove the projection(3) from the click of the blade stay (2).



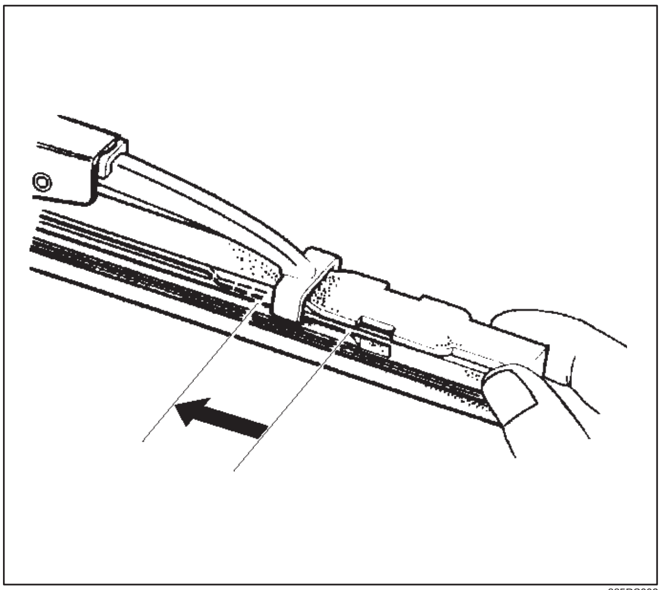
880RS010

3. Pull the rubber out in the same direction.

Installation

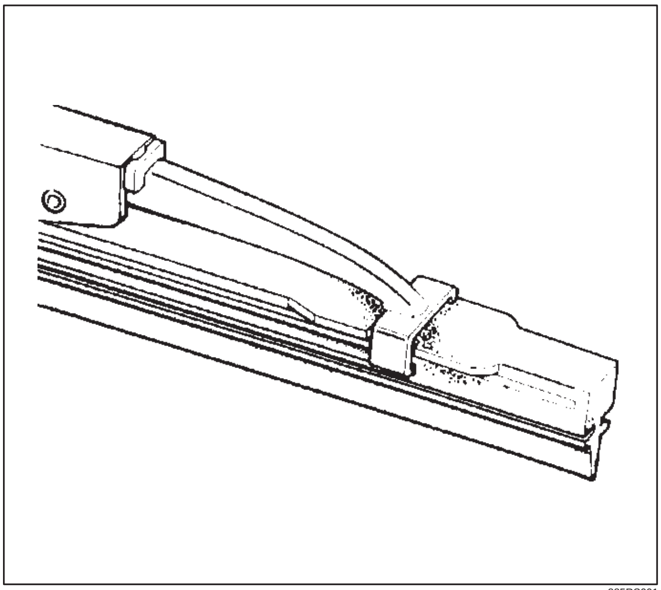
To install, follow the removal steps in the reverse order, noting the following points:

1. Install the click of the blade stay in the groove of the new rubber and slide it in. Complete wiper blade installation by pushing the click.



885RS002

2. Finally, check that the click of the stay has caught in the hole of the rubber.



885RS001

Rear Wiper/Washer System

General Description

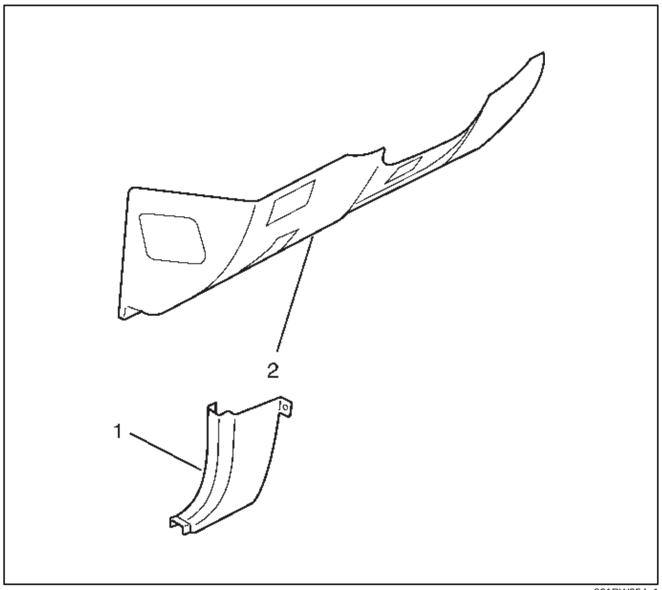
The circuit consists of the starter switch, rear wiper & washer switch, rear wiper motor, rear washer motor and Alarm & relay control unit.

When the rear wiper & washer switch is turned on with the starter switch on, the battery voltage is applied to the wiper motor to activate the wiper.
The washer motor squirts glass cleaning fluid while the washer switch is being pushed. The alarm & relay control unit is used to control motion of the wiper.

Rear Wiper and Washer Switch

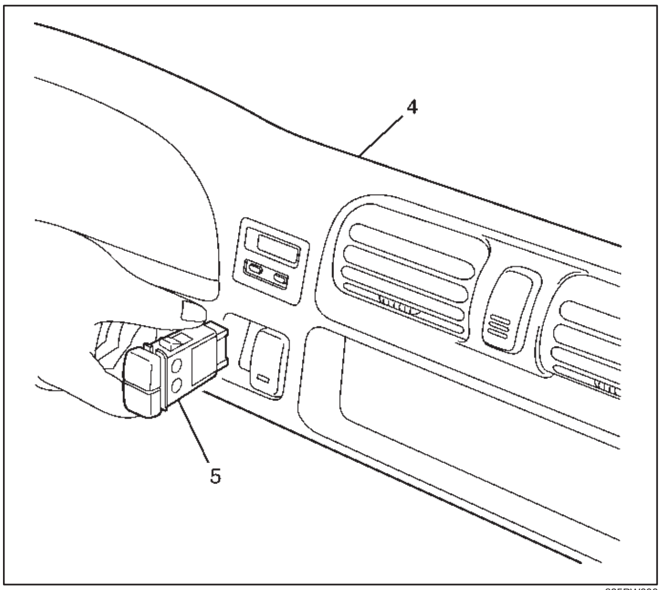
Removal

1. Disconnect the battery ground cable.
2. Remove the dash side trim panel(1).
3. Remove the lower cover assembly(2).
   - Refer to Instrument panel Assembly in Body Structure section.



821RW254–1

4. Remove the meter cluster assembly(4).
5. Remove the rear wiper & washer switch (5).
   - Disconnect the connector.
   - Push the lock from the back side of the meter cluster assembly.



825RW090

Installation

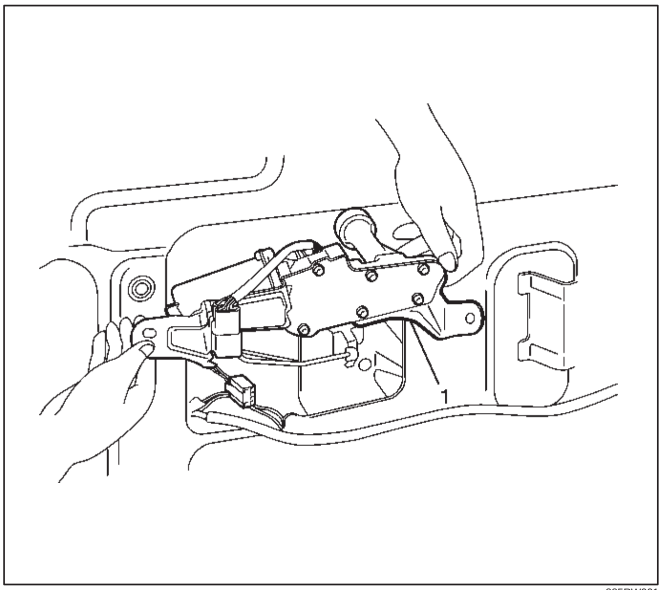
To install, follow the removal steps in the reverse order, noting the following point:

1. Push the switch with your fingers until it locks securely.

Rear Wiper Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim pad.
3. Remove the wiper arm/blade.
   Refer to Rear Wiper Arm/Blade in section.
4. Remove the rear wiper motor (1).
   - Disconnect the connector.
   - Remove the rear wiper motor fixing screws.

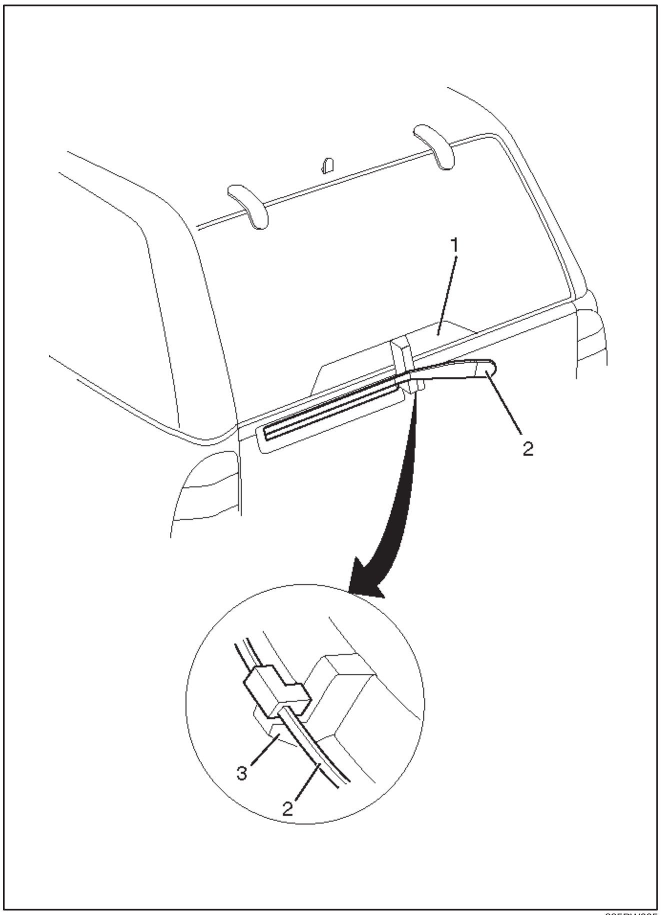


885RW001

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Before installing the wiper arm/blade to the motor shaft, confirm that the motor stops at the autostop position.
2. Install the wiper arm/blade so that the wiper arm (2) contact with the stopper portion (3) on the hatch gate cover (1) as shown in the figure.



885RW005

3. Tighten the motor shaft nut to the specified torque.

   Torque: 10 N·m (87 lb in)

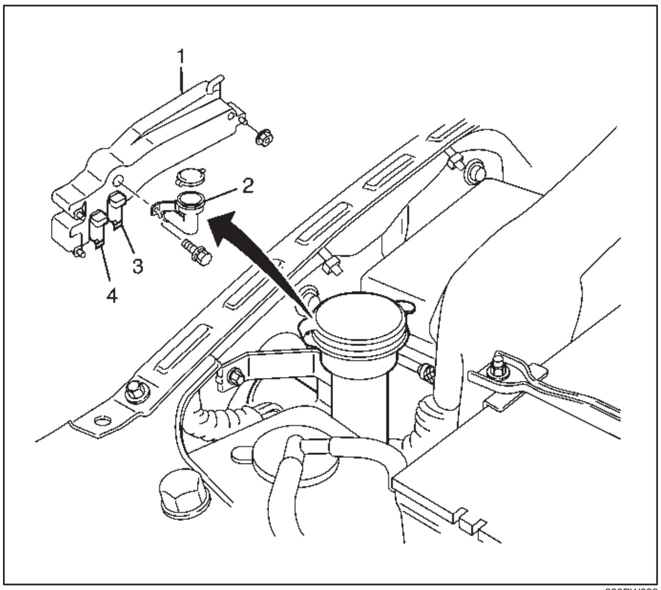
4. Tighten the wiper arm nut to the specified torque.

   Torque: 14 N·m (122 lb in)

Rear Washer Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the fender inner liner (right side).
3. Disconnect the windshield washer motor connector and the rear washer motor connector.
4. Disconnect the windshield washer hose connector and the rear washer hose connector.
5. Remove the filler neck (2).
   - Remove the bolt.
6. Remove the washer tank (1).
   - Remove the three nuts.
7. Pull out the rear washer motor (3) from the washer tank.



880RW028

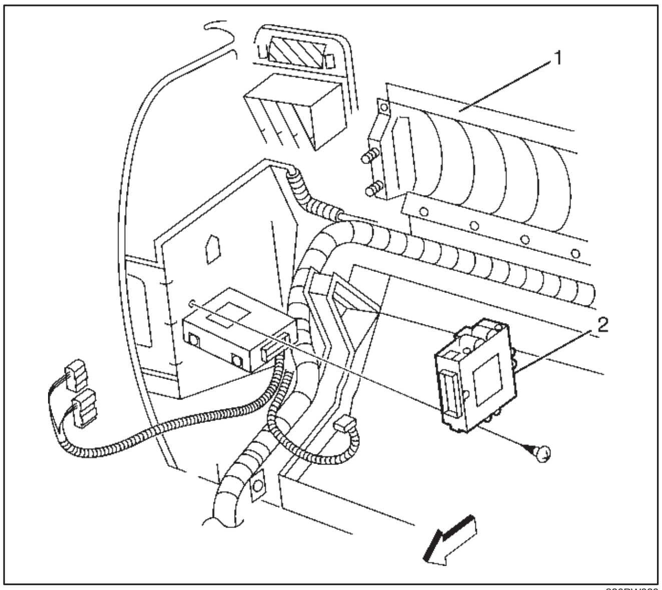
Installation

To install, follow the removal steps in the reverse order.

Alarm and Relay Control Unit

Removal

1. Disconnect the battery ground cable.
2. Remove the instrument panel (1).
3. Remove the alarm and relay control unit (2).
   Disconnect the connector.



826RW039

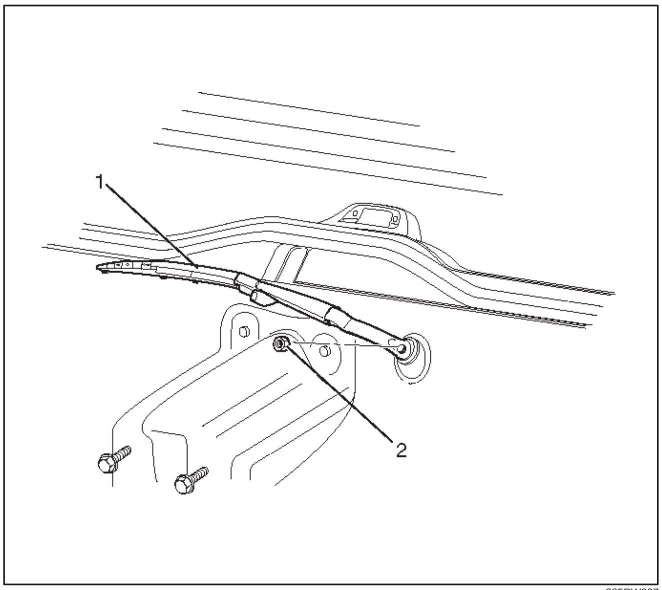
Installation

To install, follow the removal steps in the reverse order.

Rear Wiper Arm/Blade

Removal

1. Remove the arm nut(2).
2. Remove the wiper arm/blade(1).



885RW007

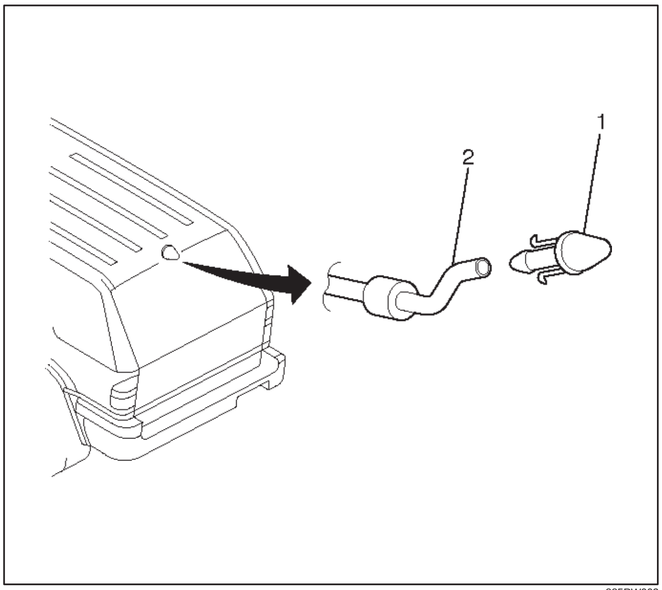
Installation

Refer to Rear Wiper Motor in section.

Rear Washer Nozzle

Removal

1. Remove the washer nozzle(1).
   - Pull out the washer nozzle from the washer hose (2).

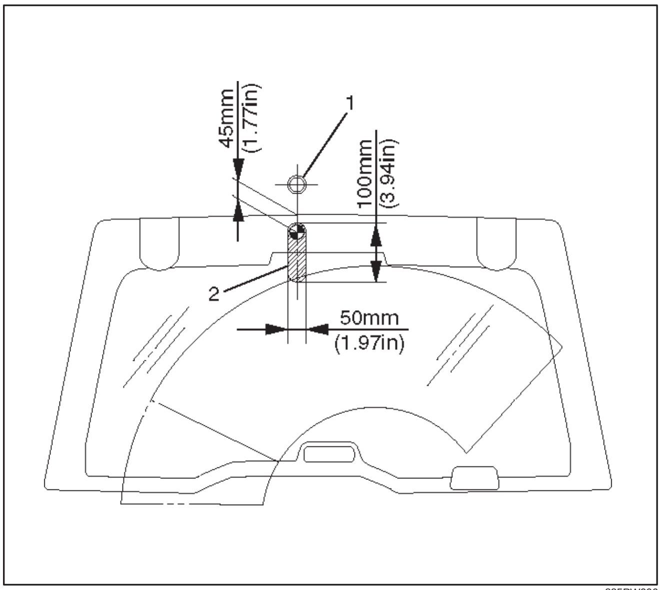


885RW003

Installation

To install, follow the removal steps in the reverse order.

Rear Washer Spray Pattern



885RW006

Legend

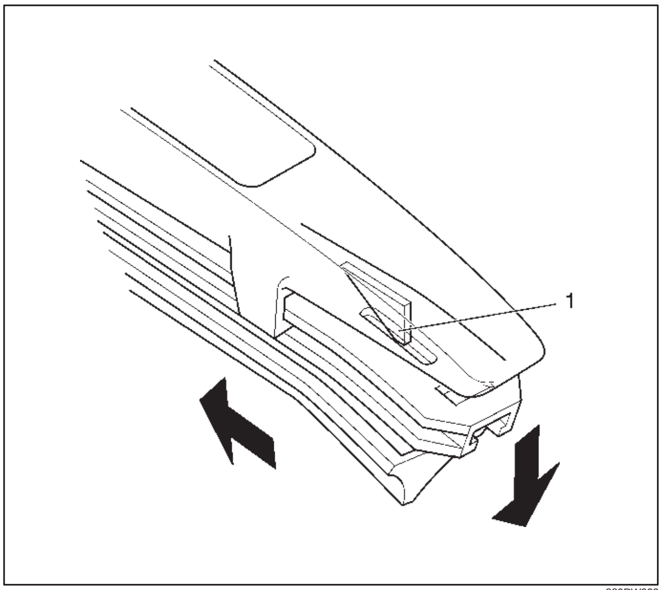
(1) Washer Nozzle
(2) Spray Target

Rear Wiper Blade Rubber

Removal

1. Remove the wiper blade from the wiper arm.
2. Push out the wiper rubber from the wiper blade by sliding it horizontally while holding down the rubber on the wiper blade convex (1) side.

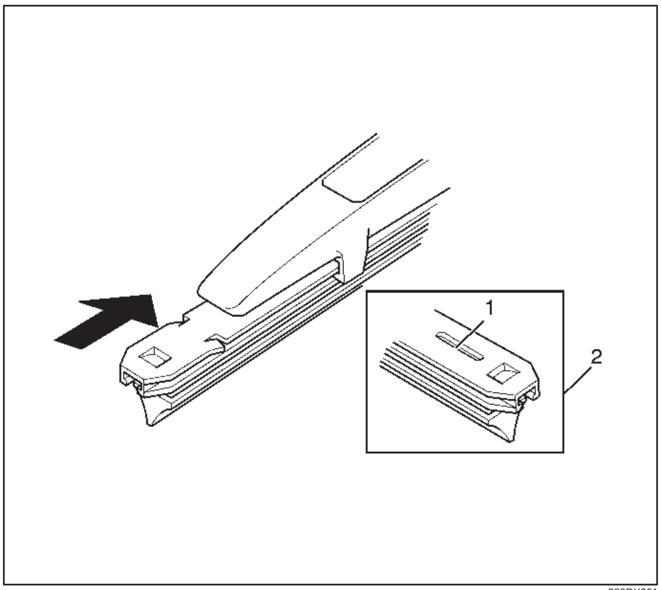
CAUTION: When the wiper blade has been removed, wrap the tip of the wiper arm with cloth, to avoid damaging the glass.



880RW022

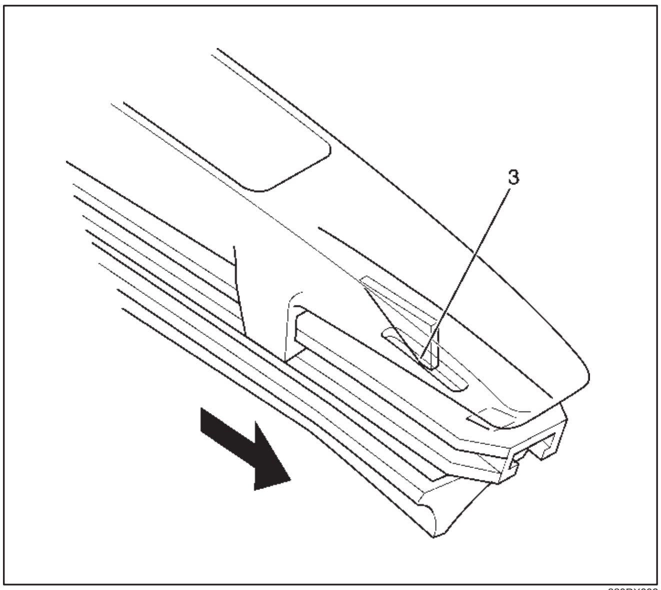
Installation

1. Install the wiper blade rubber.
   - Insert the tip of wiper rubber (2) from the opposite side of removal in the arrow direction.



880RX001

   - Check if the convex part (3) of wiper blade is installed in the groove of the wiper rubber.



880RX002

Main Data and Specifications

Torque Specifications

Application	N·m	Lb Ft	Lb In
Windshield Wiper Motor Shaft Nut	14	—	122
Windshield Wiper Arm Nuts	23	17	—
Rear Wiper Motor Shaft Nut	10	—	87
Rear Wiper Arm Nut	14	—	122

RODEO

BODY AND ACCESSORIES

ENTERTAINMENT

CONTENTS

Service Precaution

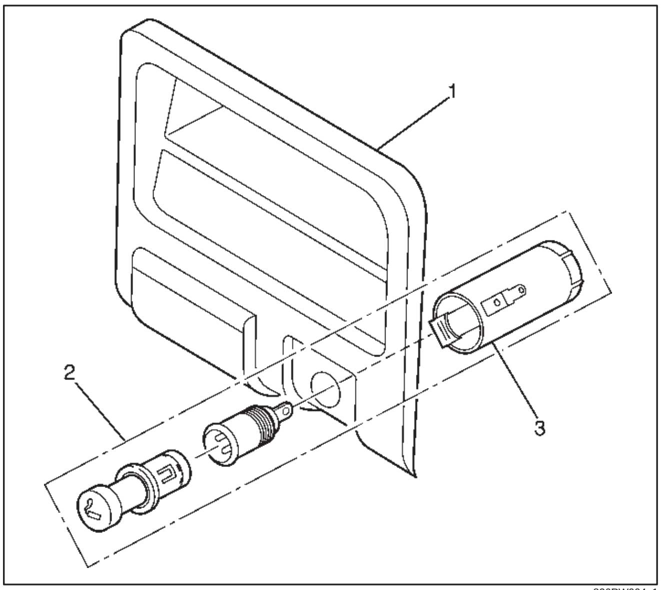
WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fasteners joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fasteners. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Cigarette Lighter

General Description

When the cigarette lighter is pushed in with the starter switch at either “ACC” or “ON” position, a circuit is formed in the cigarette lighter case to heat the lighter coil.
The cigarette lighter springs back to its original position after the lighter coil is heated.



826RW004–1

Removal

1. Disconnect the battery ground cable.
2. Remove the lower cluster assembly (1).
   - Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the cigarette lighter assembly (2).
   - Disconnect the connectors.
   - Remove the socket (3).

Installation

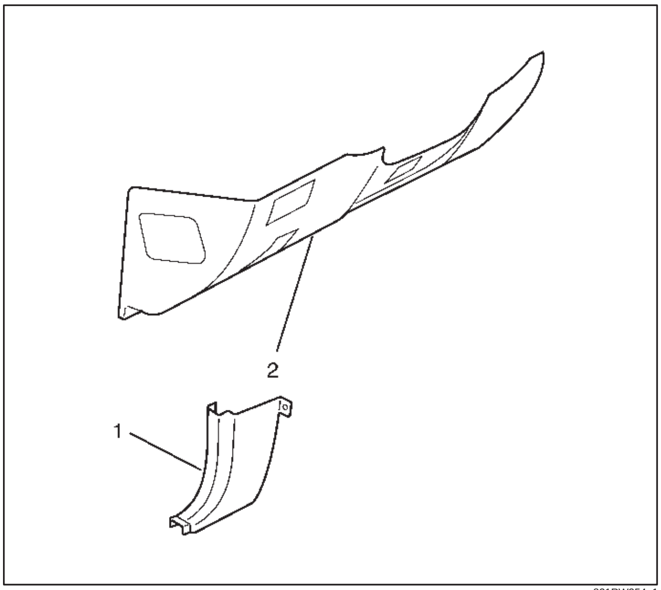
To install, follow the removal steps in the reverse order, noting the following point:

1. When installing the bezel, align the projected portion of the socket with the notch of the bezel.

Digital Clock

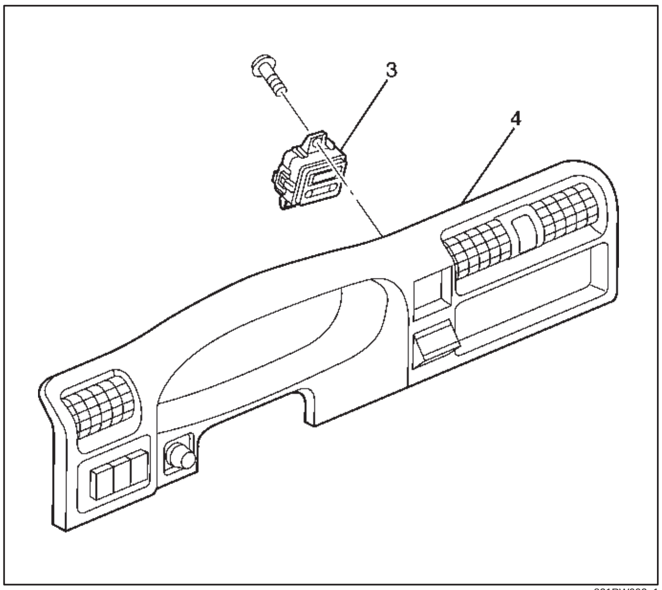
Removal

1. Disconnect the battery ground cable.
2. Remove the dash side trim panel-LH (1).
   Refer to Instrument Panel Assembly in Body Structure section.
3. Remove the lower cover assembly (2).
   Refer to instrument Panel Assembly in Body Structure section.



821RW254–1

4. Remove the meter cluster assembly (4).
   Refer to Instrument Panel Assembly in Body Structure section.
5. Remove the digital clock (3).
   - Remove the fixing screw.
   - Disconnect the connector.



821RW092–1

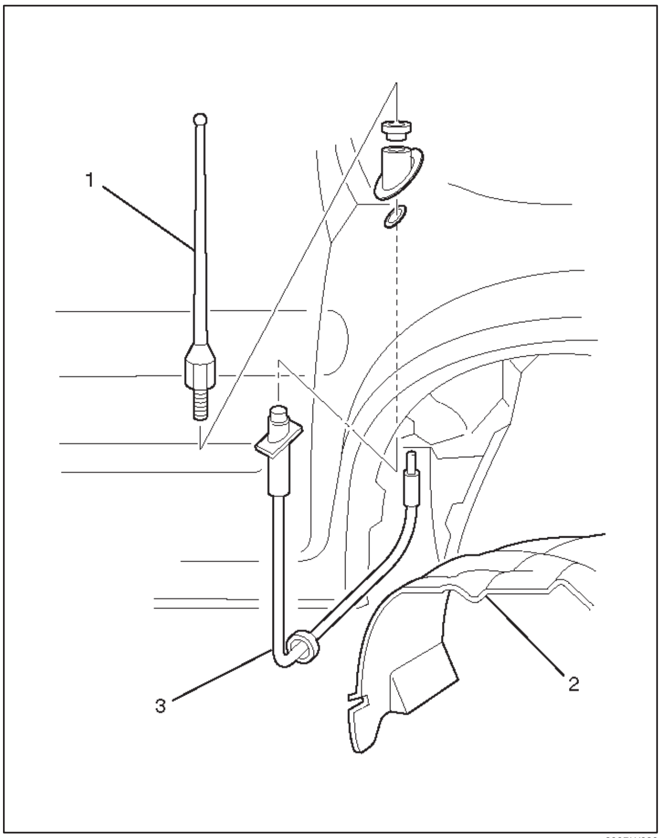
Installation

To install, follow the removal steps in the reverse order.

Rod Type Antenna

Removal

1. Disconnect the battery ground cable.
2. Turn the antenna rod (1) counterclockwise to remove it.
3. Remove three screws and nine clips to remove the fender inner liner (2).
4. Disconnect the feeder cable connector (3) at the inside of the vehicle, remove the housing bracket screw, turn the lock nut counterclockwise to remove it together with the base mold and then remove the housing.



890RW020

Installation

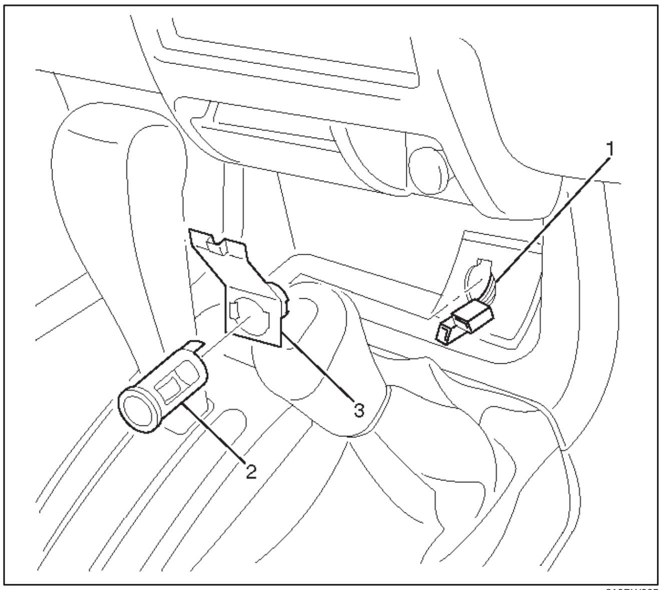
To install, follow the removal steps in the reverse order, noting the following point:

Accessory Socket

Front Accessory Socket

Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly.
3. Remove the front accessory socket (2).
   - Disconnect the connectors (1).
   - Pull out the front accessory socket from the soket cover (3).



810RW005

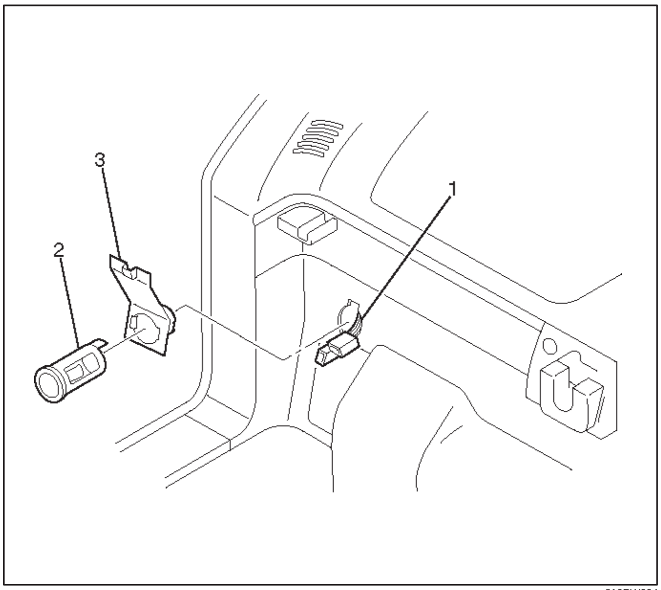
Installation

To install, follow the removal steps in the reverse order, noting the following point:

Rear Accessory Socket

Removal

1. Disconnect the battery ground cable.
2. Remove the quarter trim lower cover.
3. Remove the rear accessory socket (2).
   - Disconnect the connectors (1).
   - Pull out the front accessory socket from the soket cover (3).



810RW004

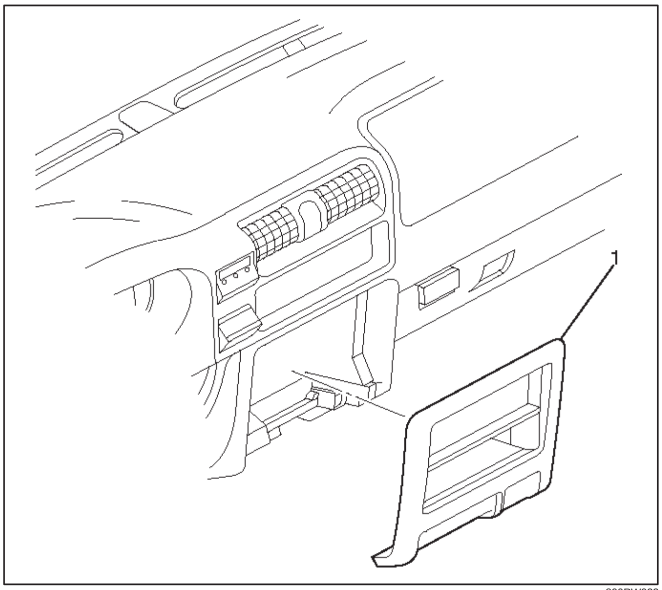
Installation

To install, follow the removal steps in the reverse order, noting the following point:

Radio

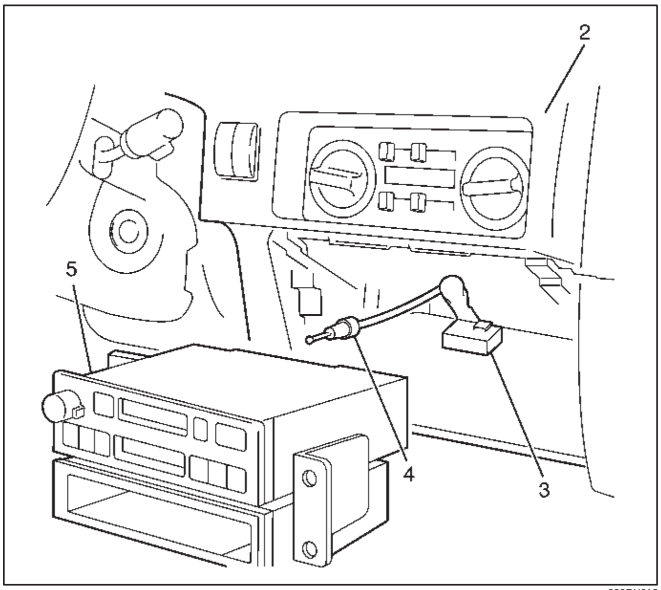
Removal

1. Disconnect the battery ground cable.
2. Remove the lower cluster assembly (1).
   - Refer to Instrument Panel Assembly in Body Structure section.



890RW022

3. Remove the radio (5).
   - Remove the two fixing screws.
   - Disconnect the connector (3) and the antenna cable (4).



890RX013

Installation

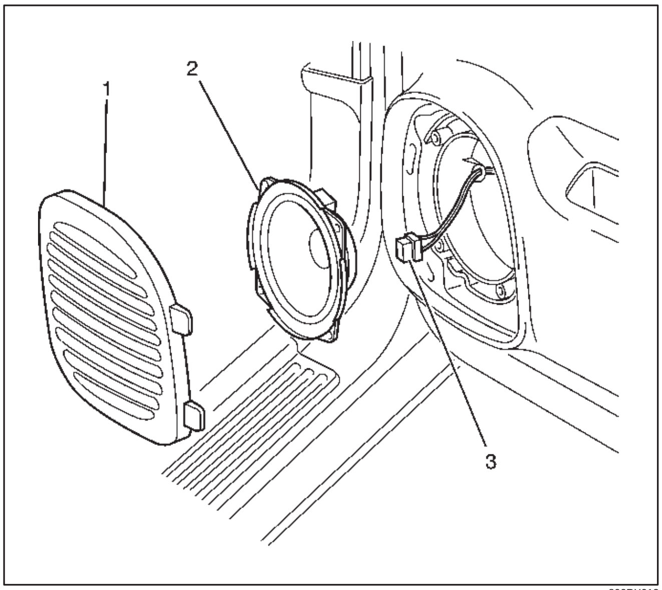
To install, follow the removal steps in the reverse order, noting the following point:

Speaker

Front Speaker

Removal

1. Disconnect the battery ground cable.
2. Pull the grille (1) to release the locks and then remove it.
3. Remove four screws and disconnect the connector (3) to remove the speaker (2).



890RX012

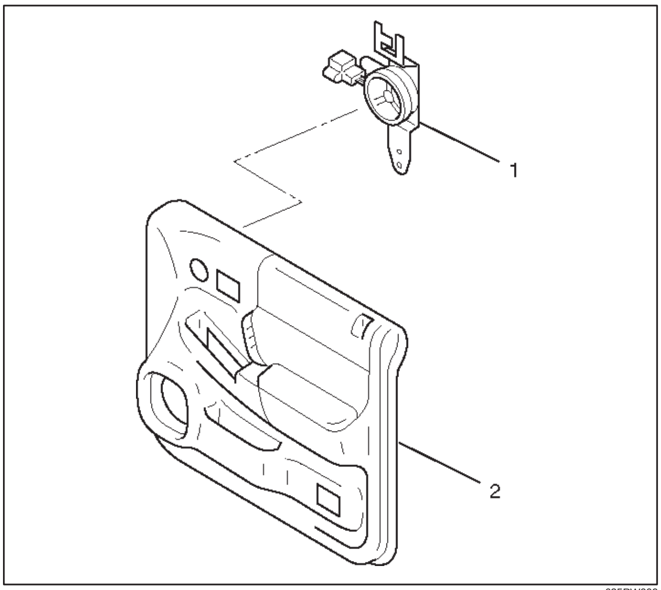
Installation

To install, follow the removal steps in the reverse order, noting the following point:

Tweeter Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the front door trim pad (2).
   - Refer to Front Window Regulator, Glass And Glass Run in Body Structure section:
3. Remove the tweeter (1).
   - Disconnect the connector.



635RW009

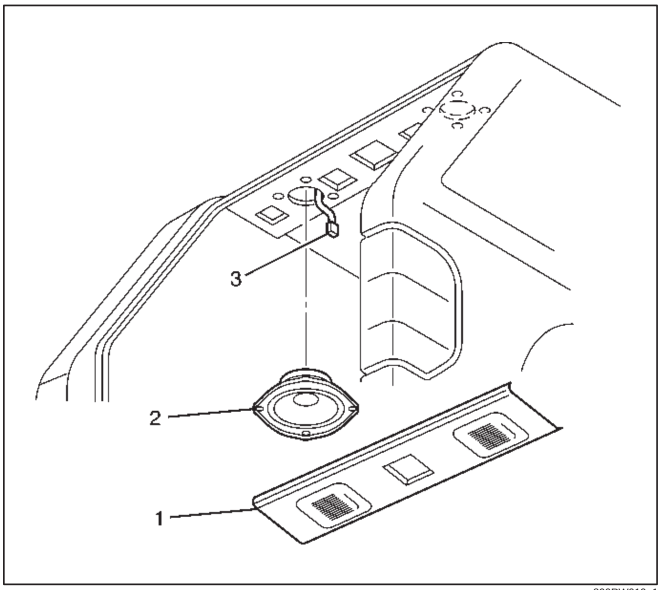
Installation

To install, follow the removal steps in the reverse order, noting the following point:

Rear Speaker

Removal

1. Disconnect the battery ground cable.
2. Remove the roof rear lining (1).
   - Release the locks and clips.
3. Remove the speaker (2).
   - Remove the four screws.
   - Disconnect the connector (3).



890RW019–1

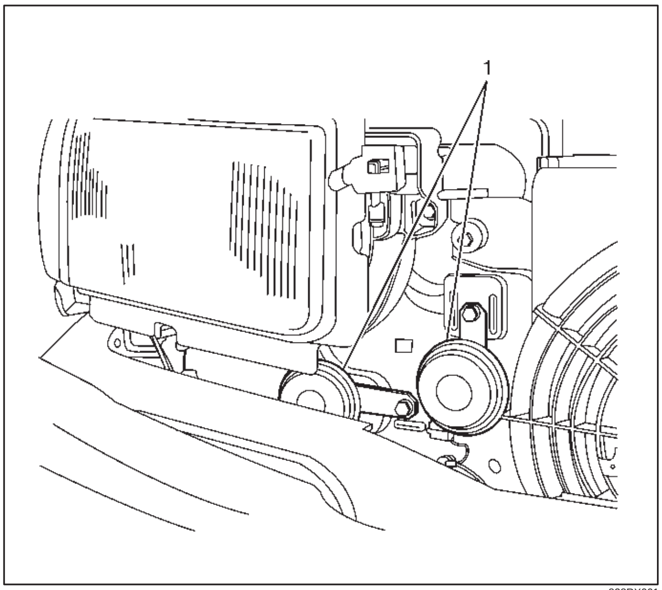
Installation

To install, follow the removal steps in the reverse order, noting the following point:

Horn

Removal

1. Disconnect the battery ground cable.
2. Remove the radiator grille.
   - Refer to Engine Hood and Fender in Body Structure section.
3. Remove the horn (1).
   - Disconnect the connector.
   - Remove the horn mounting bolt.



828RX001

Installation

To install, follow the removal steps in the reverse order.

RODEO

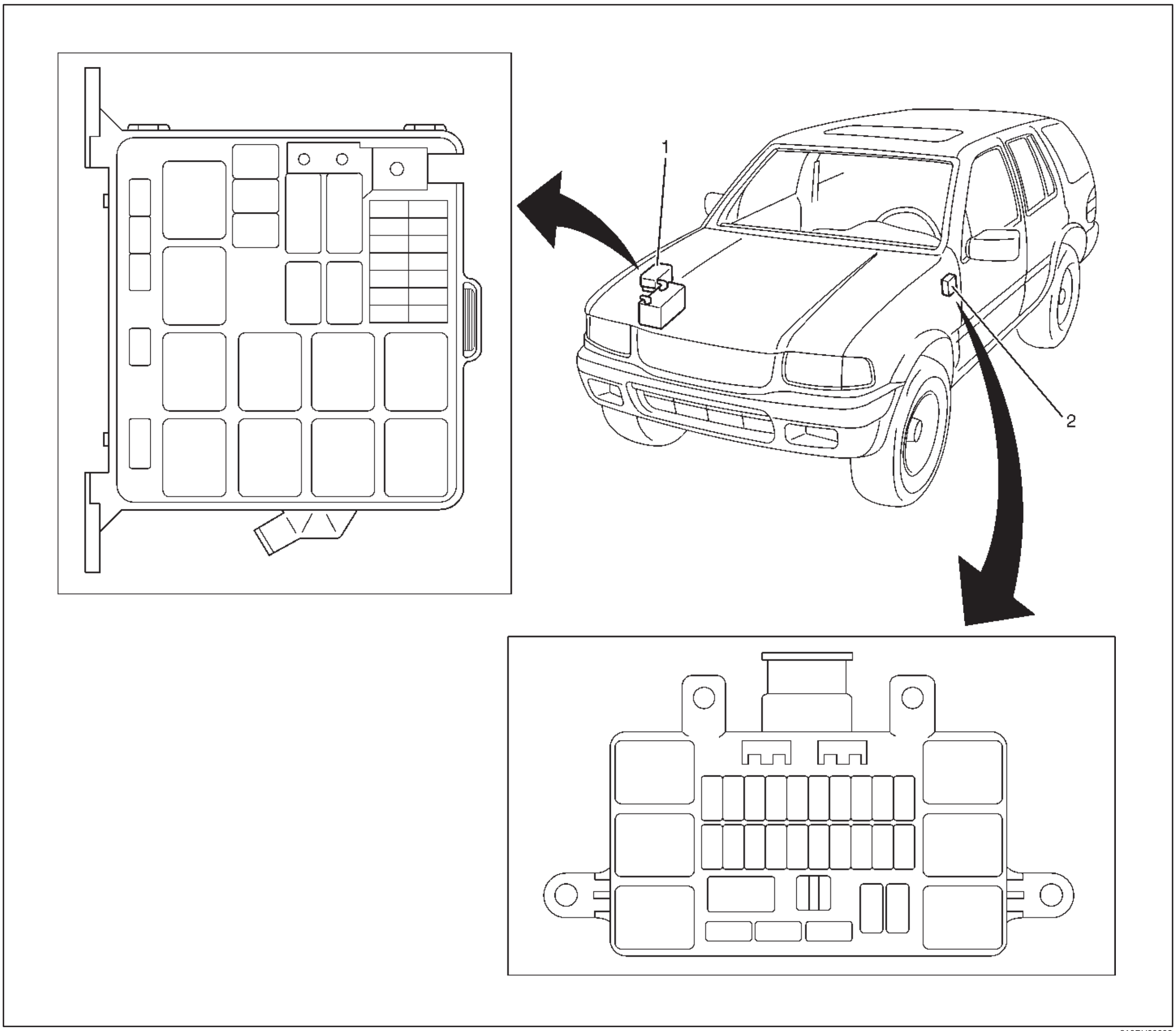
BODY AND ACCESSORIES

WIRING SYSTEM

CONTENTS

Fuse, Relay and Diode

Relay / Fuse Box Location

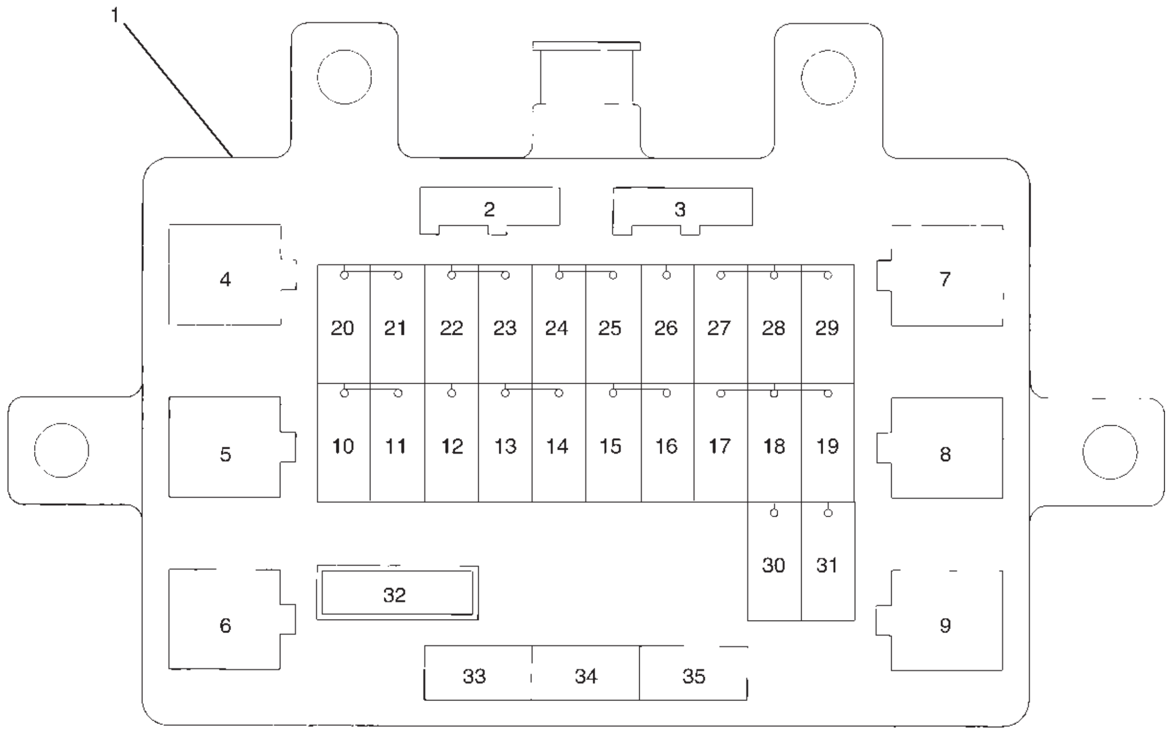


Legend

(1) Relay/Fuse Box (Engine Room)

(2) Relay/Fuse Box (Instrument Panel)

Relay / Fuse Box (Instrument Panel)

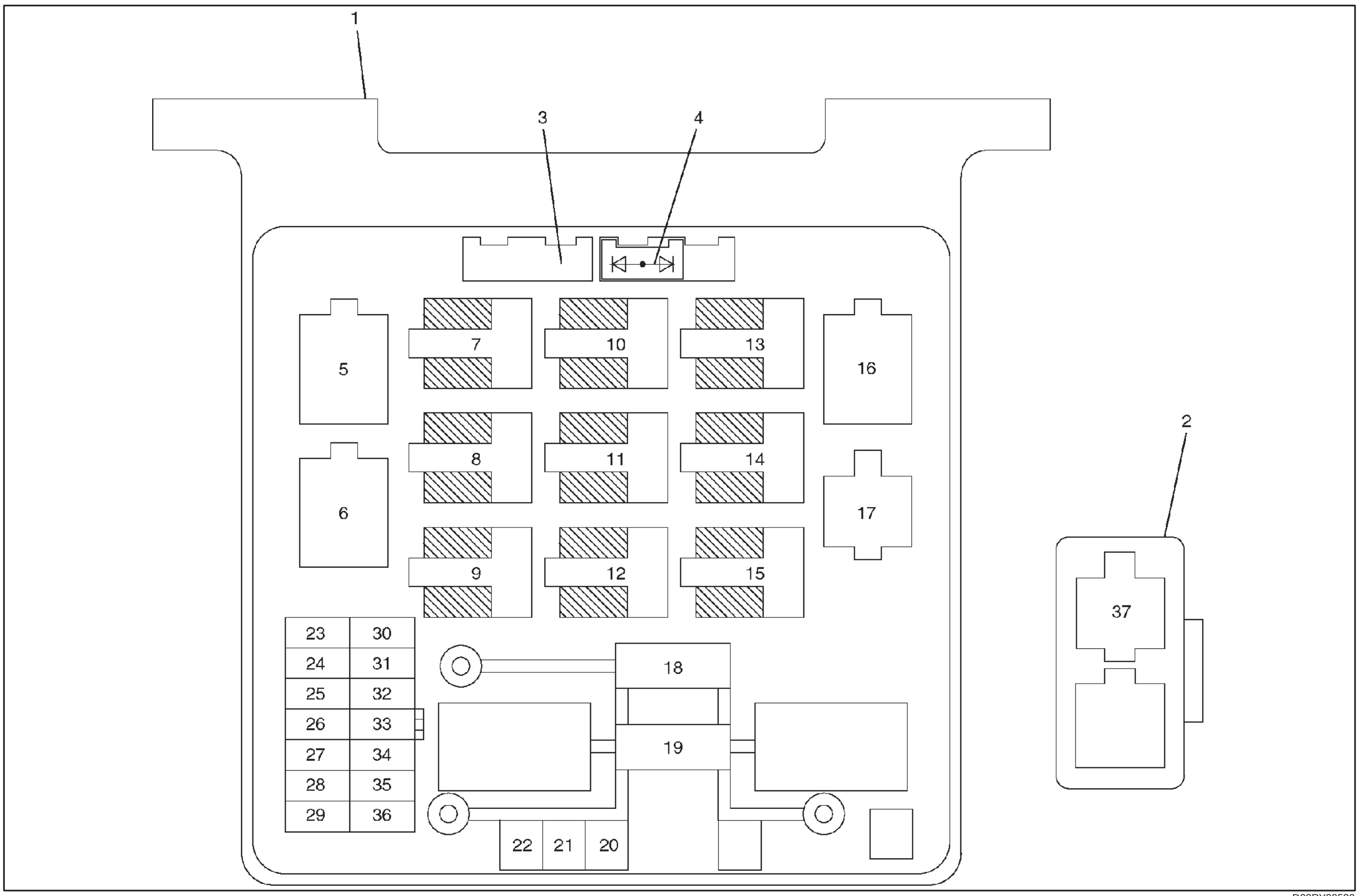


D08RY00529

Legend

(1) Fuse/Relay Box
(2) Diode
(3) Diode
(4) Tail Relay
(5) Not Used
(6) ACC Socket Relay
(7) Power Window Relay
(8) Not Used
(9) Rear Defogger Relay
(10) Fuse ACC Socket (20A)
(11) Fuse Audio (ACC) (15A)
(12) Fuse Starter (10A)
(13) Fuse Tail (15A)
(14) Fuse Room Lamp (10A)
(15) Fuse Stop Lamp (15A)
(16) Fuse Door Lock (20A)
(17) Fuse Mirror Defogger (10A)
(18) Fuse Rear Defogger (15A)
(19) Fuse Rear Defogger (15A)
(20) Fuse Meter (15A)
(21) Fuse ENG. (15A)
(22) Fuse IG. Coil (15A)
(23) Fuse Back Up (15A)
(24) Fuse ELEC. IG. (15A)
(25) Fuse RR Wiper (10A)
(26) Fuse FRT Wiper (20A)
(27) Fuse Audio (10A)
(28) Fuse Cigar Lighter (15A)
(29) Fuse Anti-theft (10A)
(30) Fuse SRS (10A)
(31) Fuse (Not Used)
(32) Circuit Breaker Power Window (30A)
(33) Spare Fuse (20A)
(34) Spare Fuse (15A)
(35) Spare Fuse (10A)

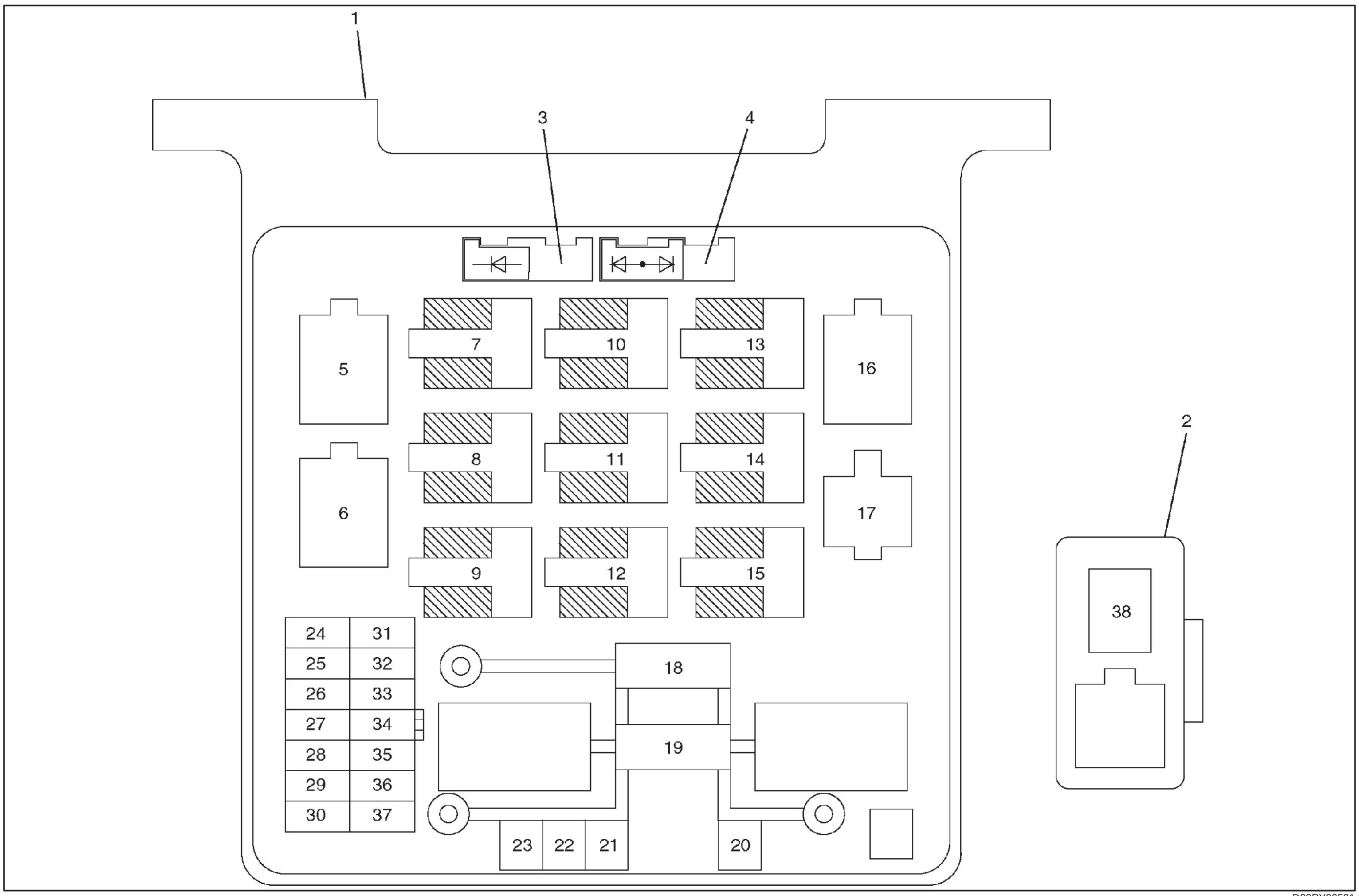
Relay / Fuse Box (L4 Engine Room)



Legend

- (1) Fuse/Relay Box
- (2) Option Box
- (3) Diode
- (4) Diode
- (5) Heater Relay
- (6) A/C Compressor Relay
- (7) Not Used
- (8) ECM Main Relay
- (9) Fog Lamp Relay
- (10) Not Used
- (11) Not Used
- (12) Thermo Relay
- (13) Headlamp Relay
- (14) Starter Relay
- (15) Not Used
- (16) Fuel Pump Relay
- (17) Electric Fan (LO) Relay
- (18) IG.1 (60A)
- (19) Main (100A)
- (20) ABS (50A)
- (21) IG.2 (50A)
- (22) Electric Fan (30A)
- (23) Hazard (15A)
- (24) Horn (10A)
- (25) Not Used
- (26) Not Used
- (27) Blower (15A)
- (28) Blower (15A)
- (29) A/C (10A)
- (30) Headlamp–LH (10A)
- (31) Headlamp–RH (10A)
- (32) Fog Lamp (10A)
- (33) O_2 Sensor (20A)
- (34) Fuel Pump (20A)
- (35) ECM (15A)
- (36) Not Used

Relay / Fuse Box (V6 Engine Room)



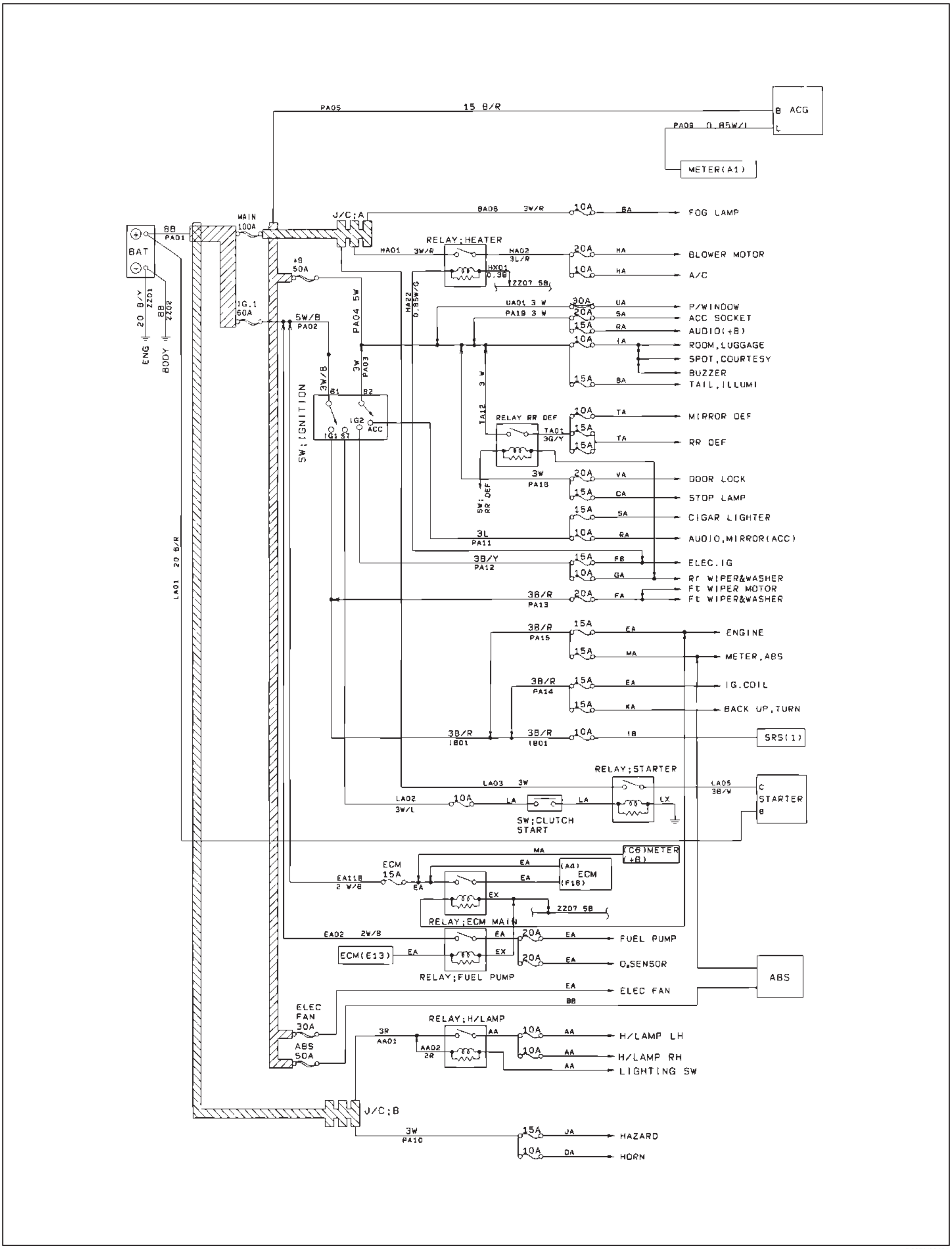
D08RY00531

Legend

(1) Fuse/Relay Box
(2) Option Box
(3) Diode
(4) Diode
(5) Heater Relay
(6) A/C Compressor Relay
(7) Not Used
(8) ECM Main Relay
(9) Fog Lamp Relay
(10) Not Used
(11) Not Used
(12) Thermo Relay
(13) Headlamp Relay
(14) Starter Relay
(15) Not Used
(16) Fuel Pump Relay
(17) Condenser Fan Relay (A/T Only)
(18) IG.1 (60A)
(19) Main (100A)
(20) ECM (30A)
(21) ABS (50A)
(22) IG.2 (50A)
(23) Condenser Fan (A/T Only) (30A)
(24) Hazard (15A)
(25) Horn (10A)
(26) ACG (S) (10A)
(27) Not Used
(28) Blower (15A)
(29) Blower (15A)
(30) A/C (10A)
(31) Headlamp–LH (10A)
(32) Headlamp–RH (10A)
(33) Fog Lamp (10A)
(34) O_2 Sensor (20A)
(35) Fuel Pump (20A)
(36) ECM (15A)
(37) Not Used (10A)
(38) Intelligent Suspension (30A)

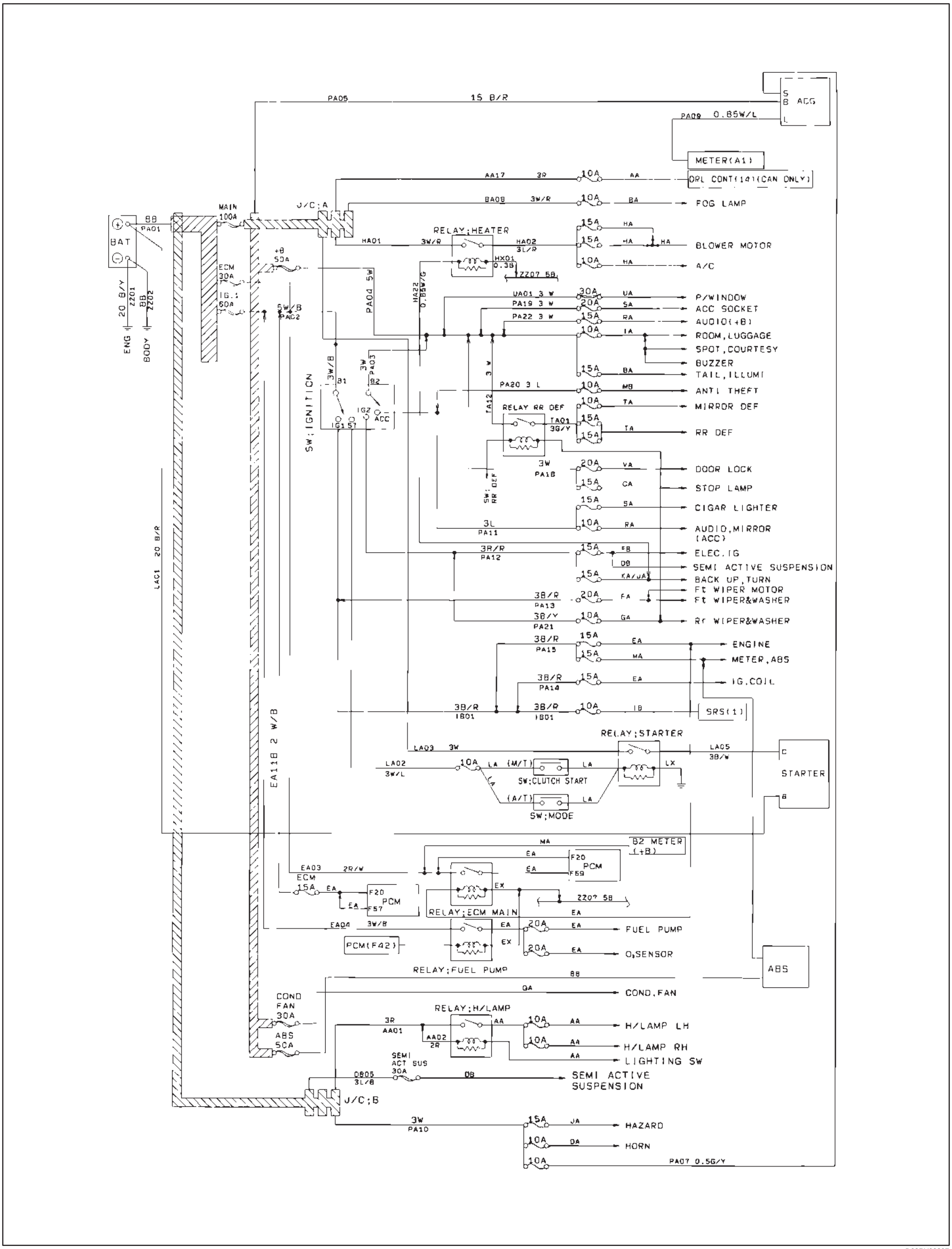
Circuit Diagram

Fuse Block Circuit–1 (L4)



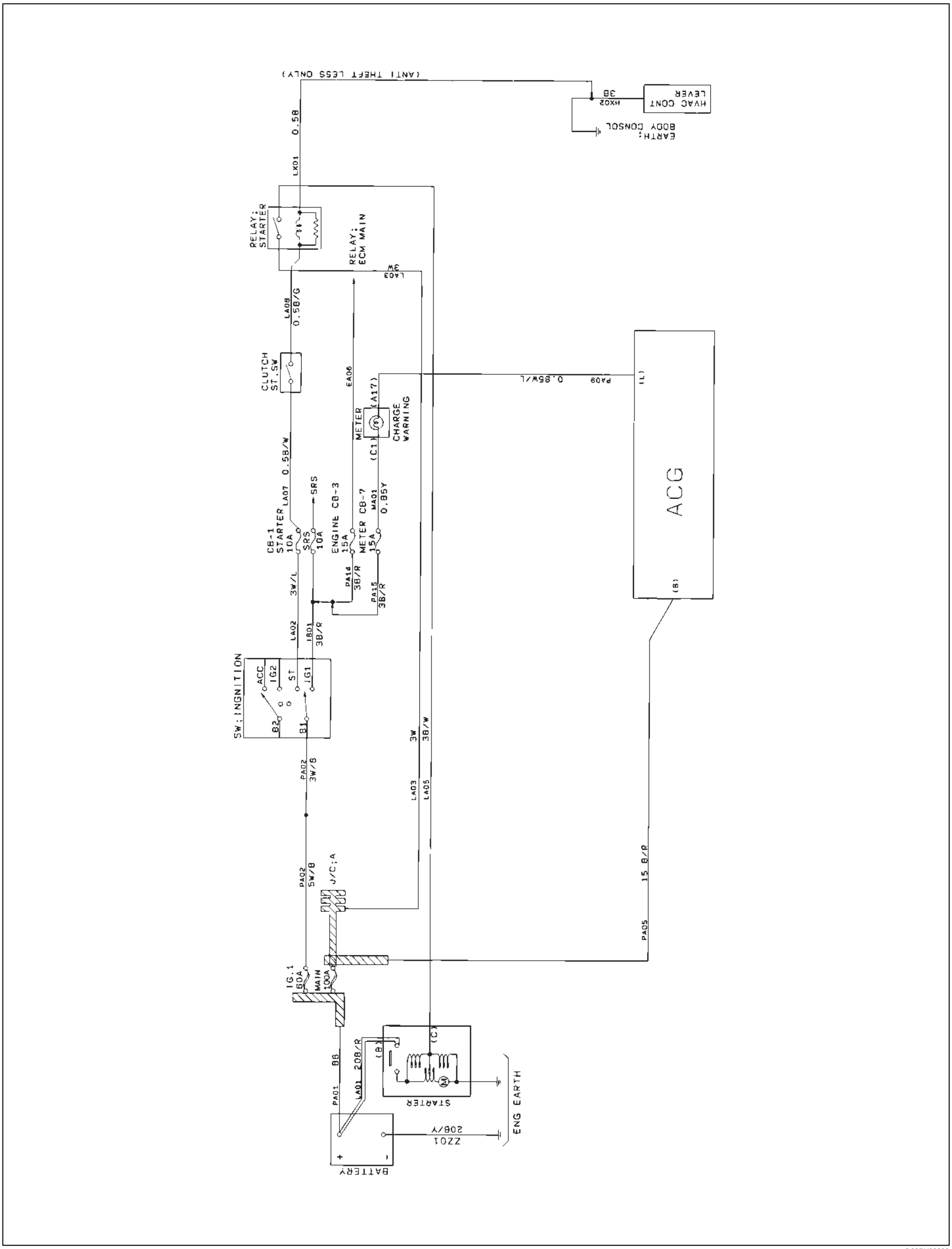
D08RY00401

Fuse Block Circuit–2 (V6)



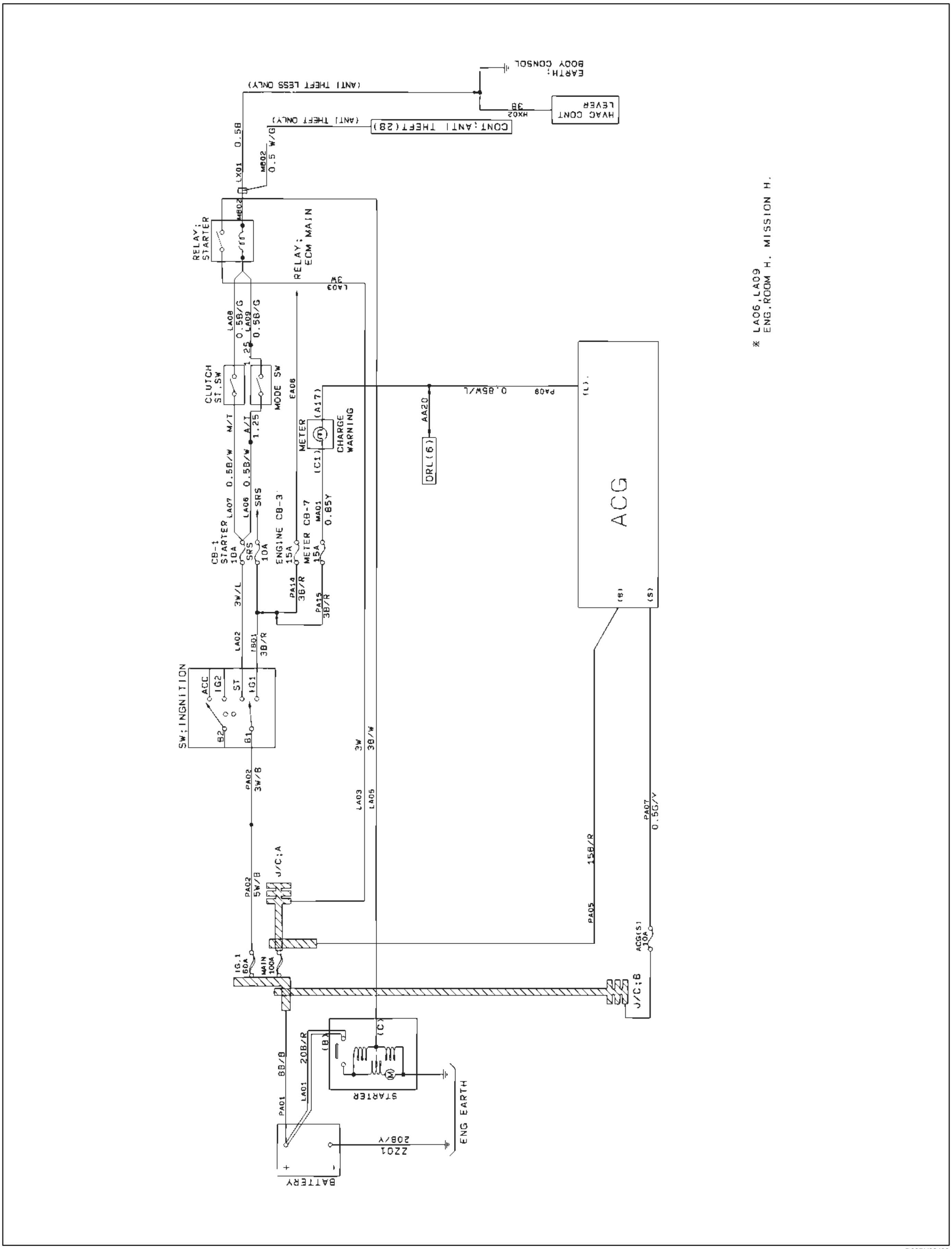
D08RY00397

Starter and Generator (L4)



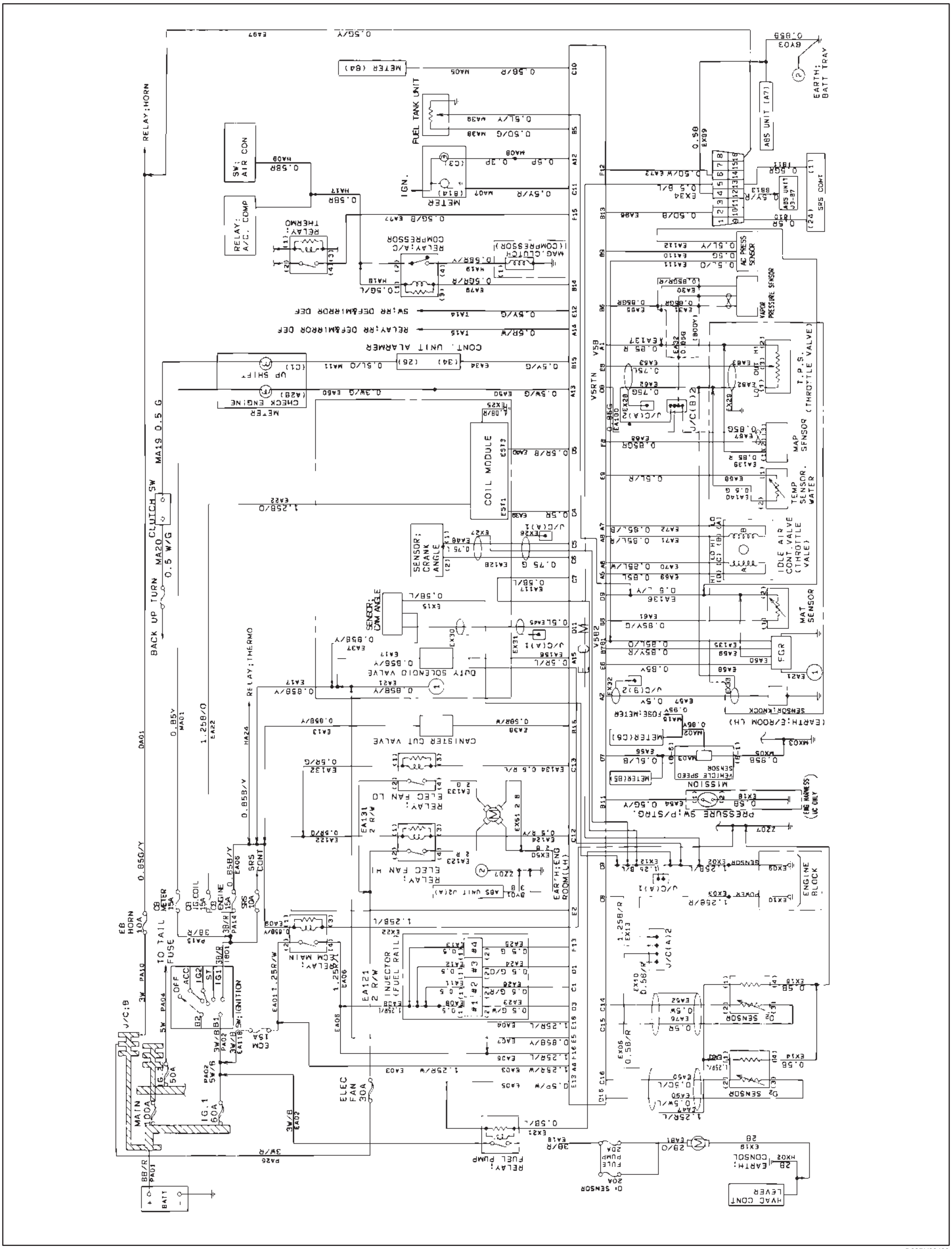
D08RY00398

Starter and Generator (V6)



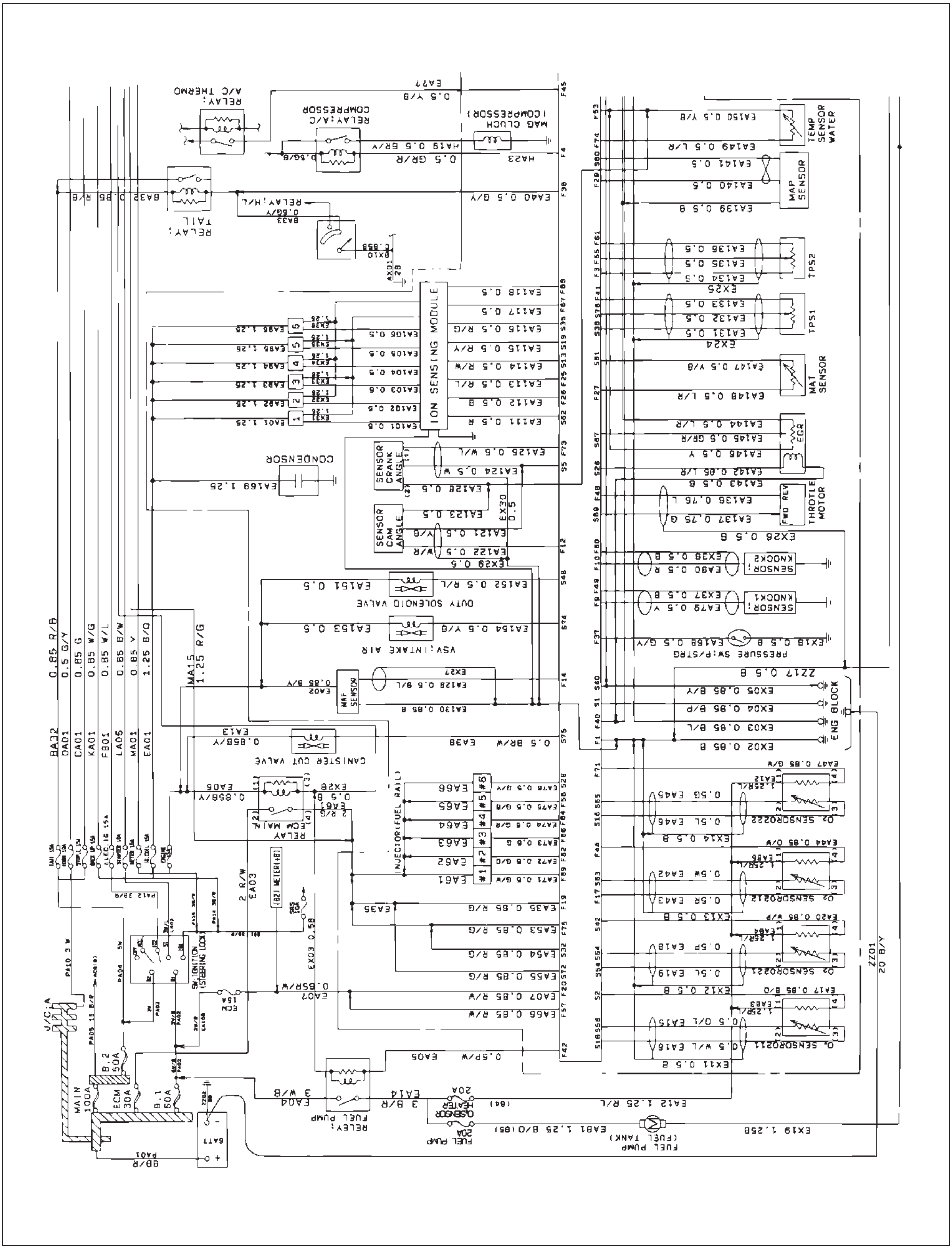
D08RY00403

ECM (L4)



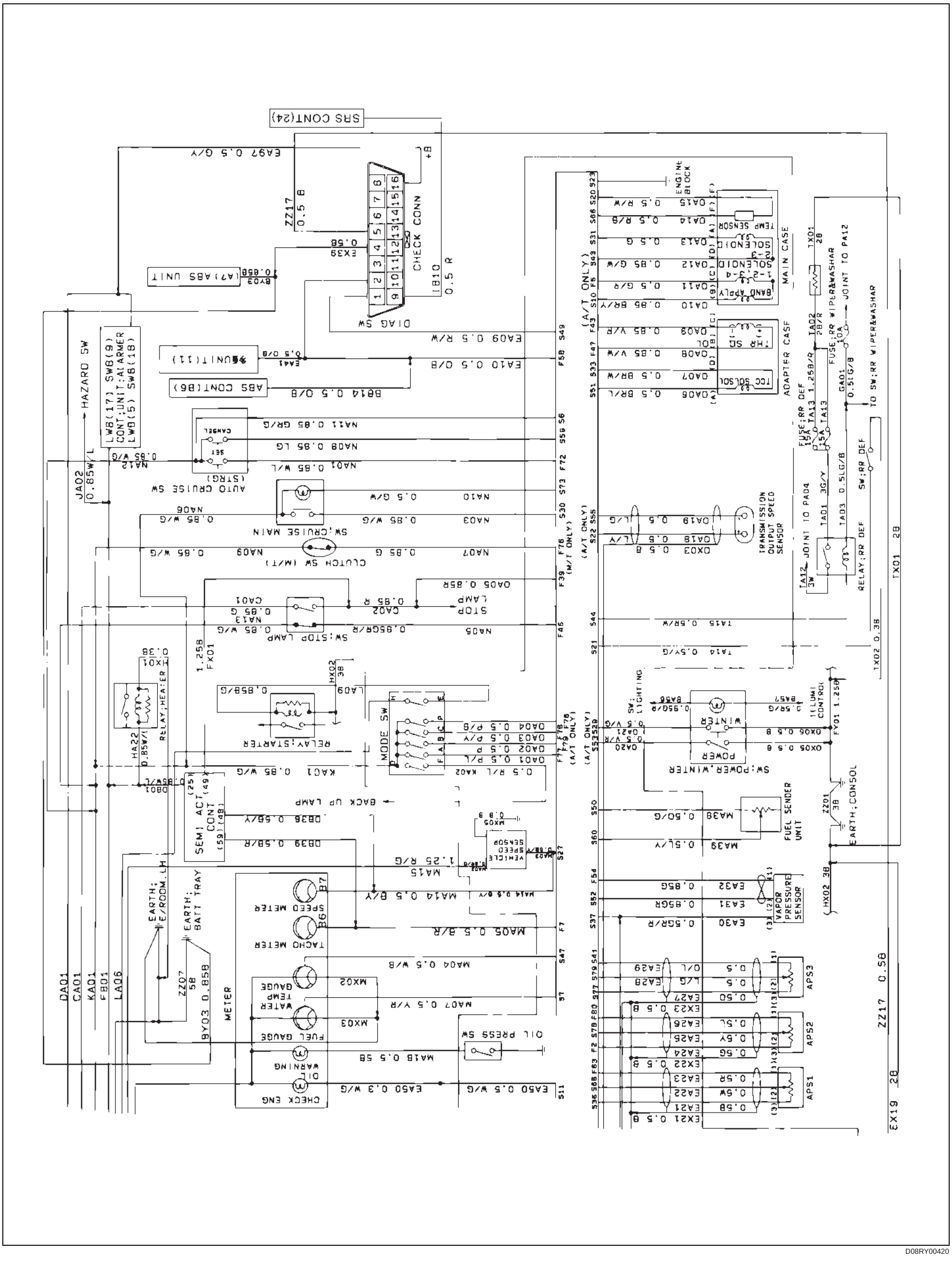
D08RY00400

PCM (V6)–1



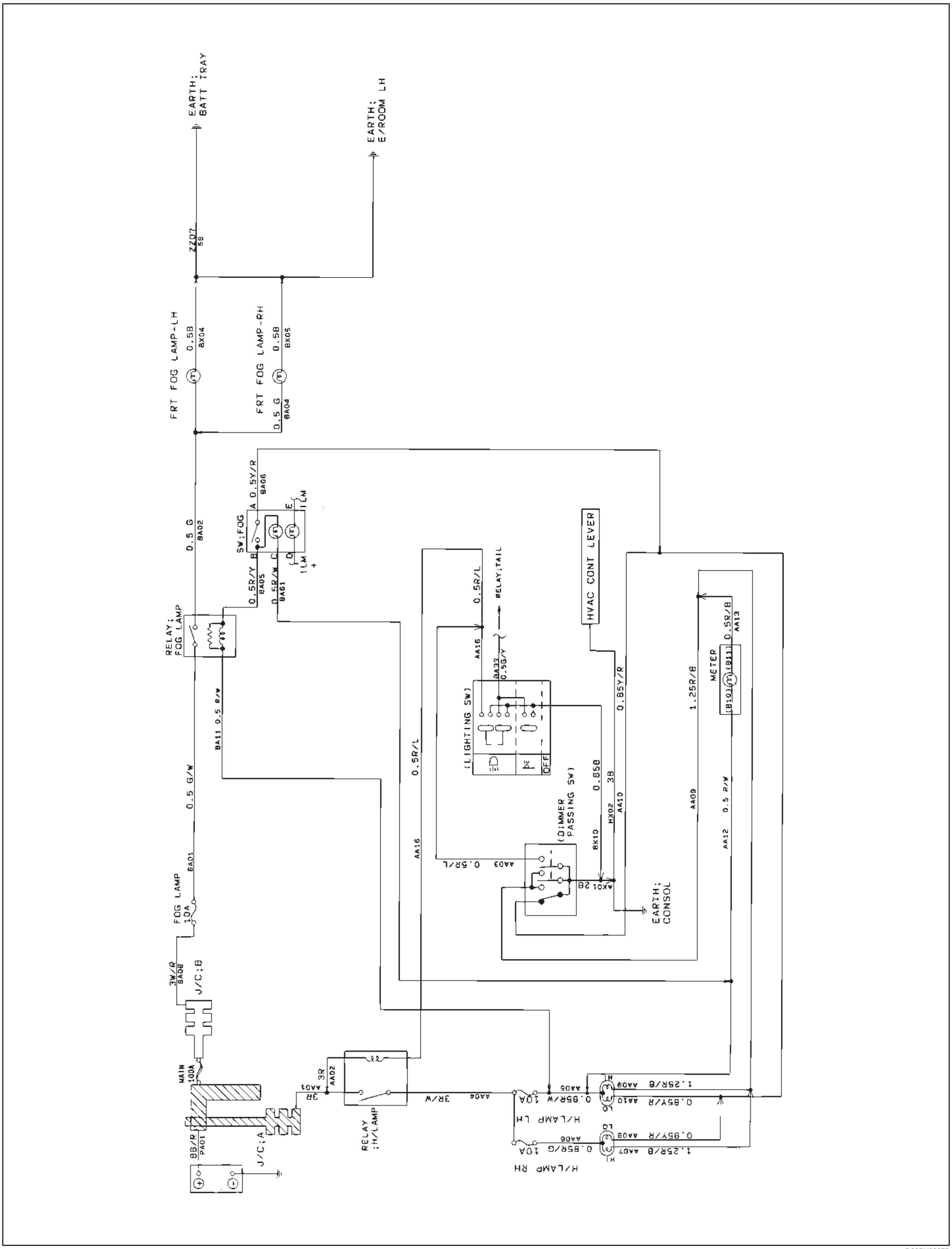
D08RY00419

PCM (V6)–2



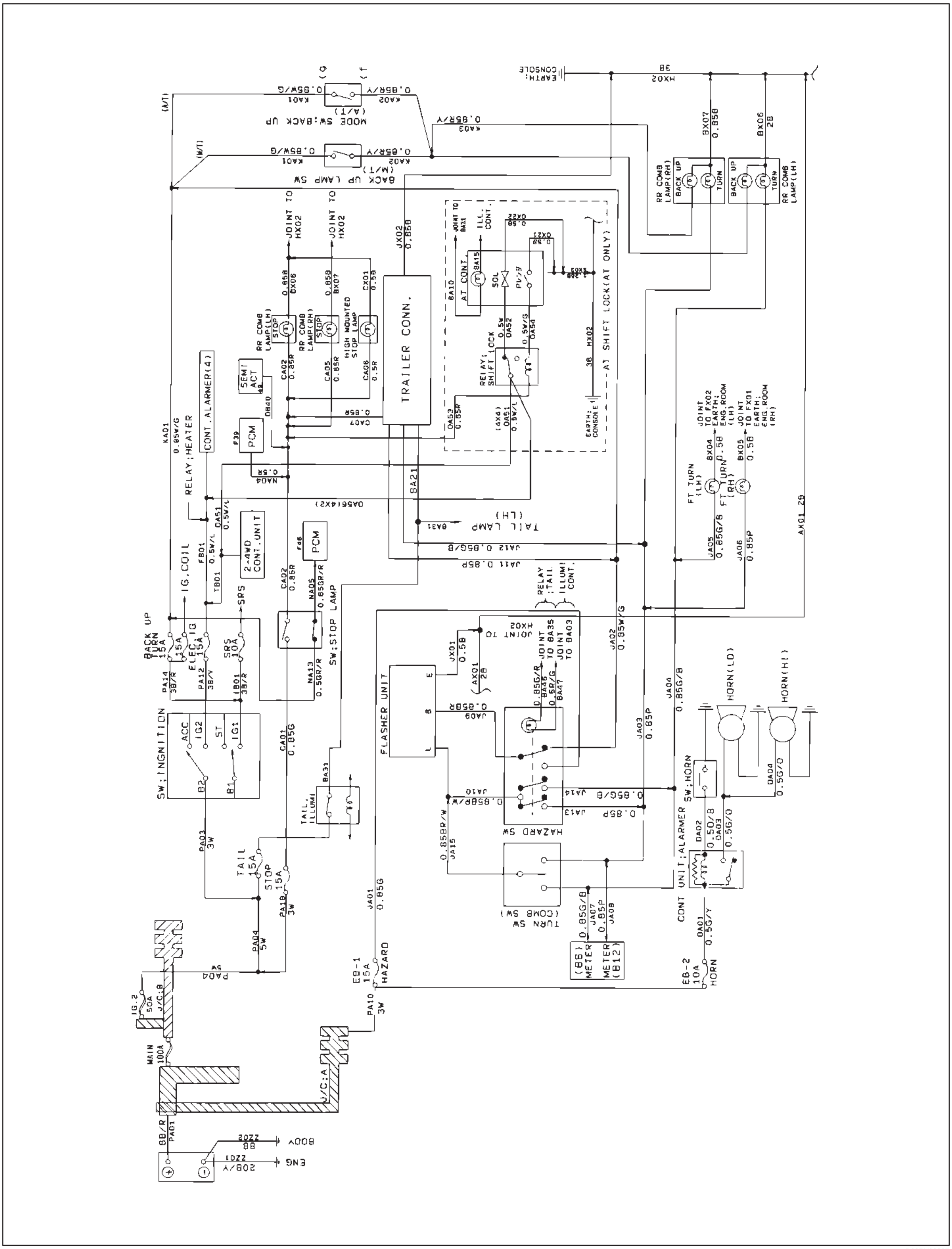
D08RY00420

Headlight and Fog Light



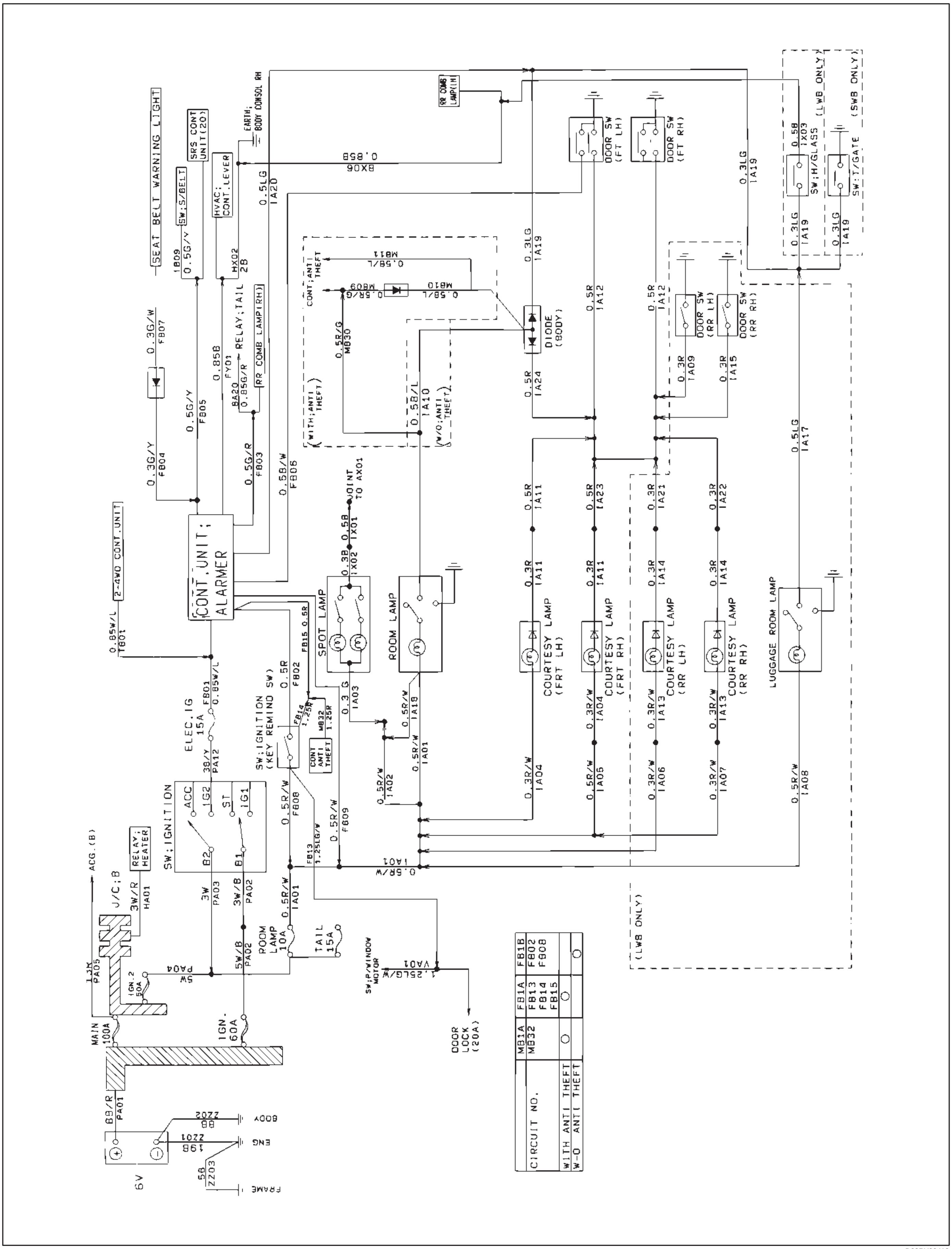
D08RY00375

TURN, HAZARD, STOP, Back Up, Horn and A/T Shift Lock



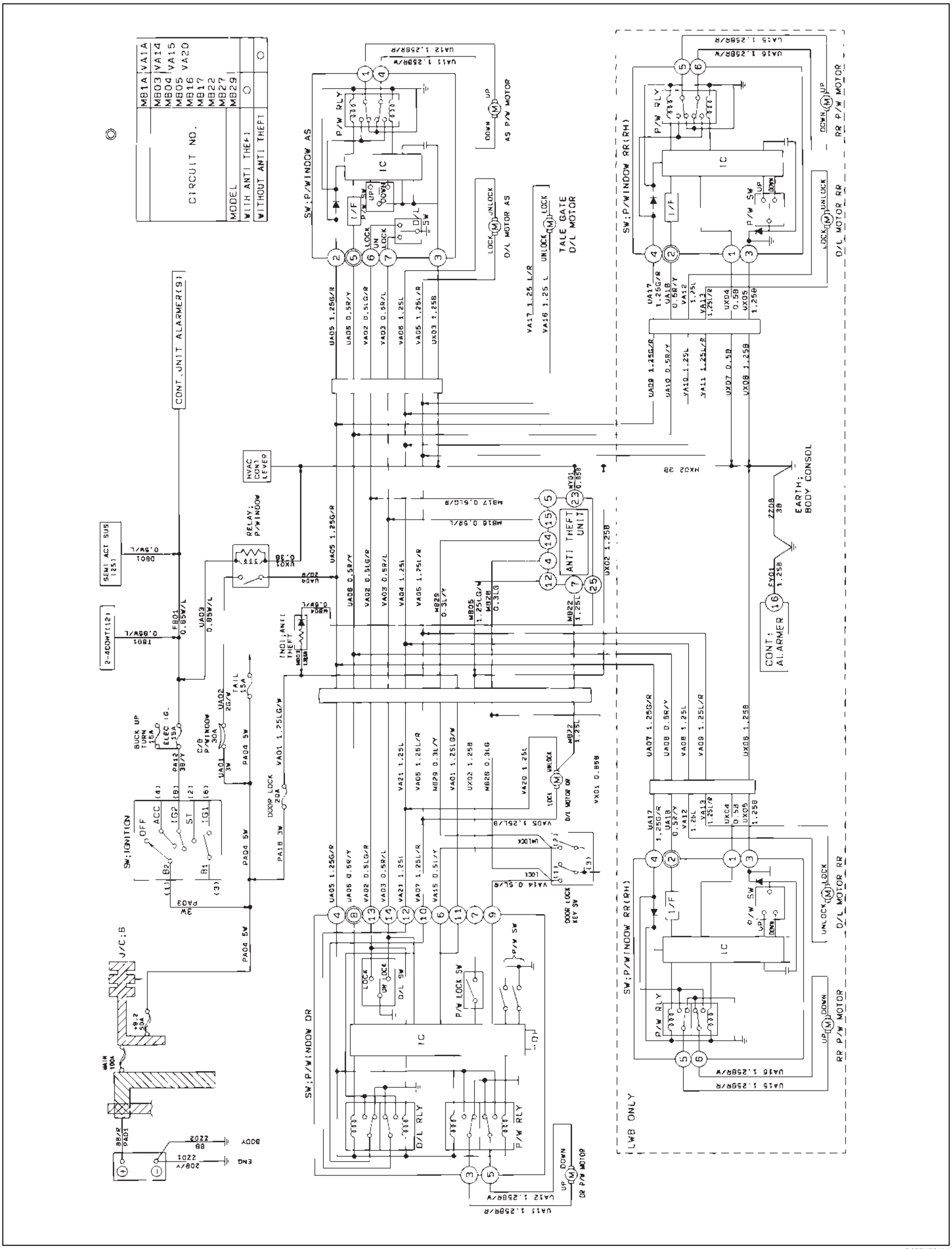
D08RY00387

Room, Luggage, Courtesy, Spot, Warning Buzzer



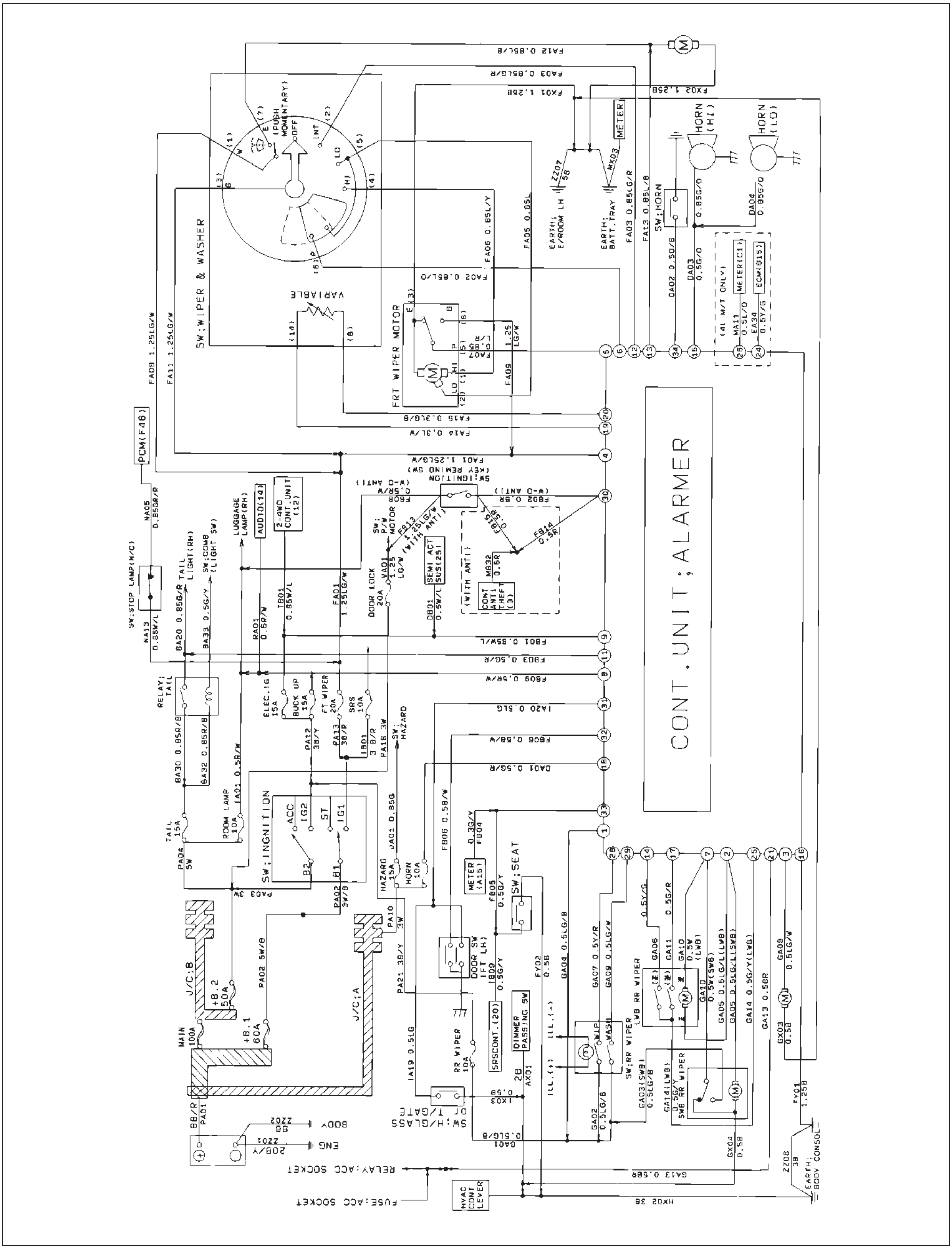
D08RY00413

Power Window and Door Lock



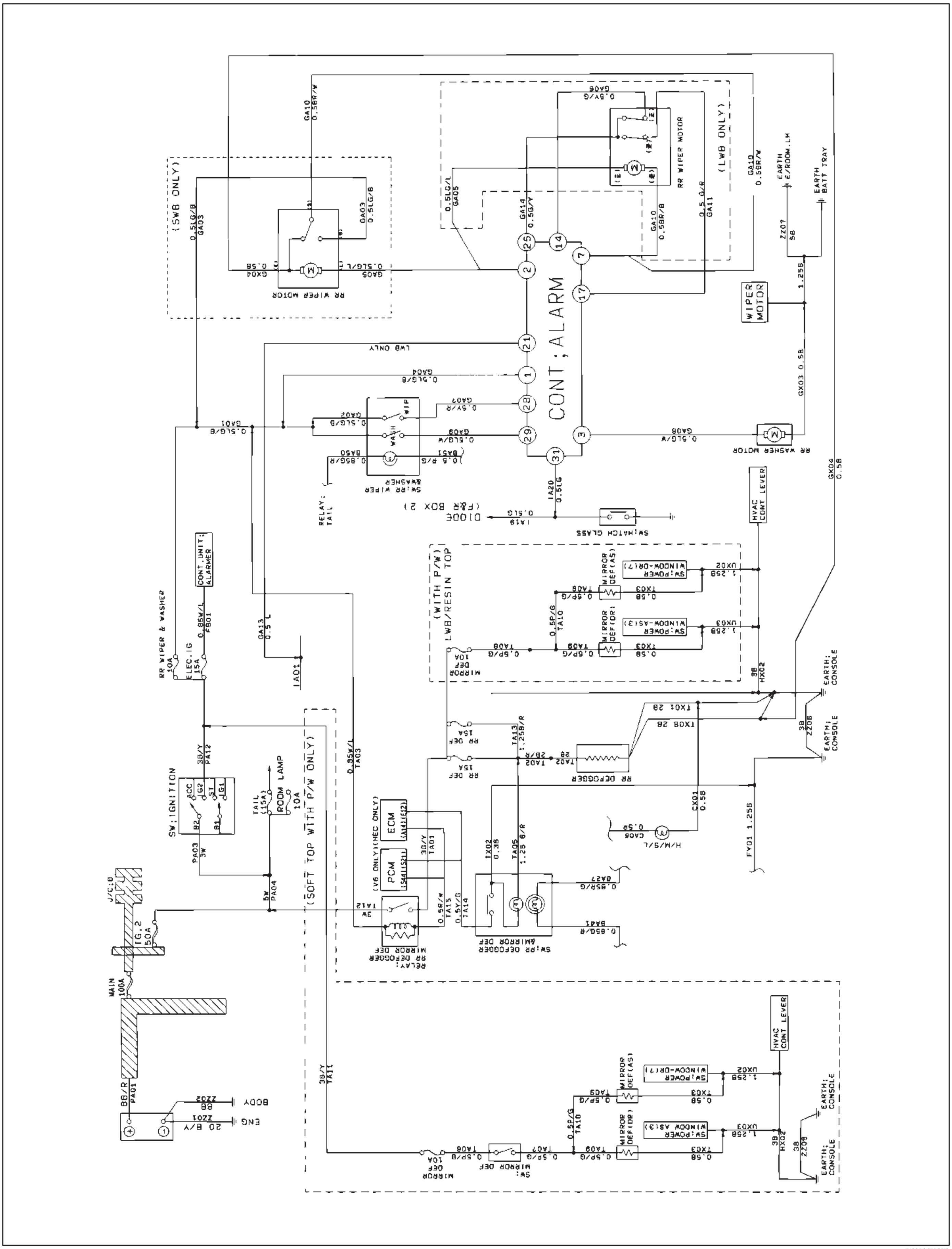
D08RY00414

Alarmer Unit



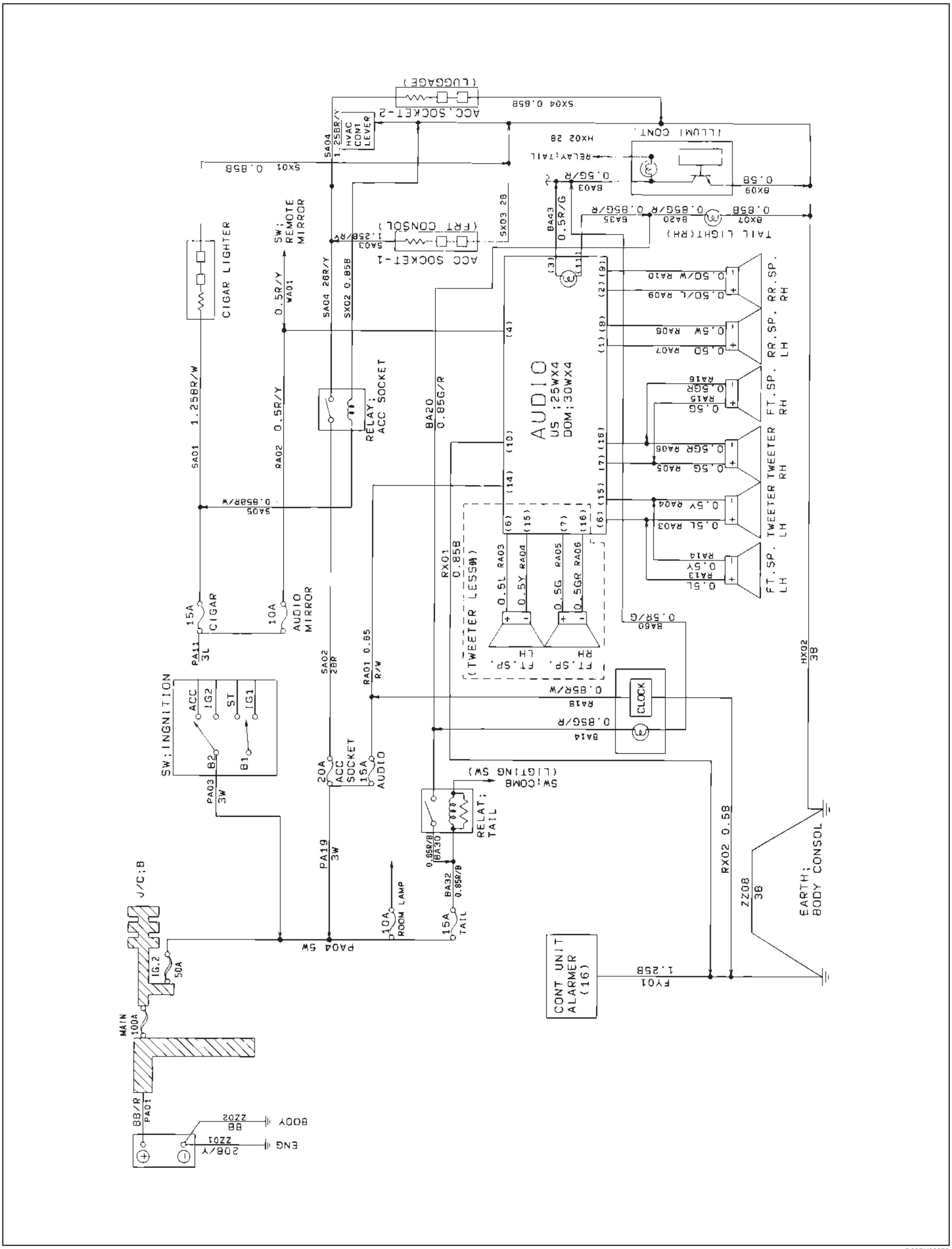
D08RY00410

Rear Wiper/Washer, Rear Defogger and Mirror Defogger



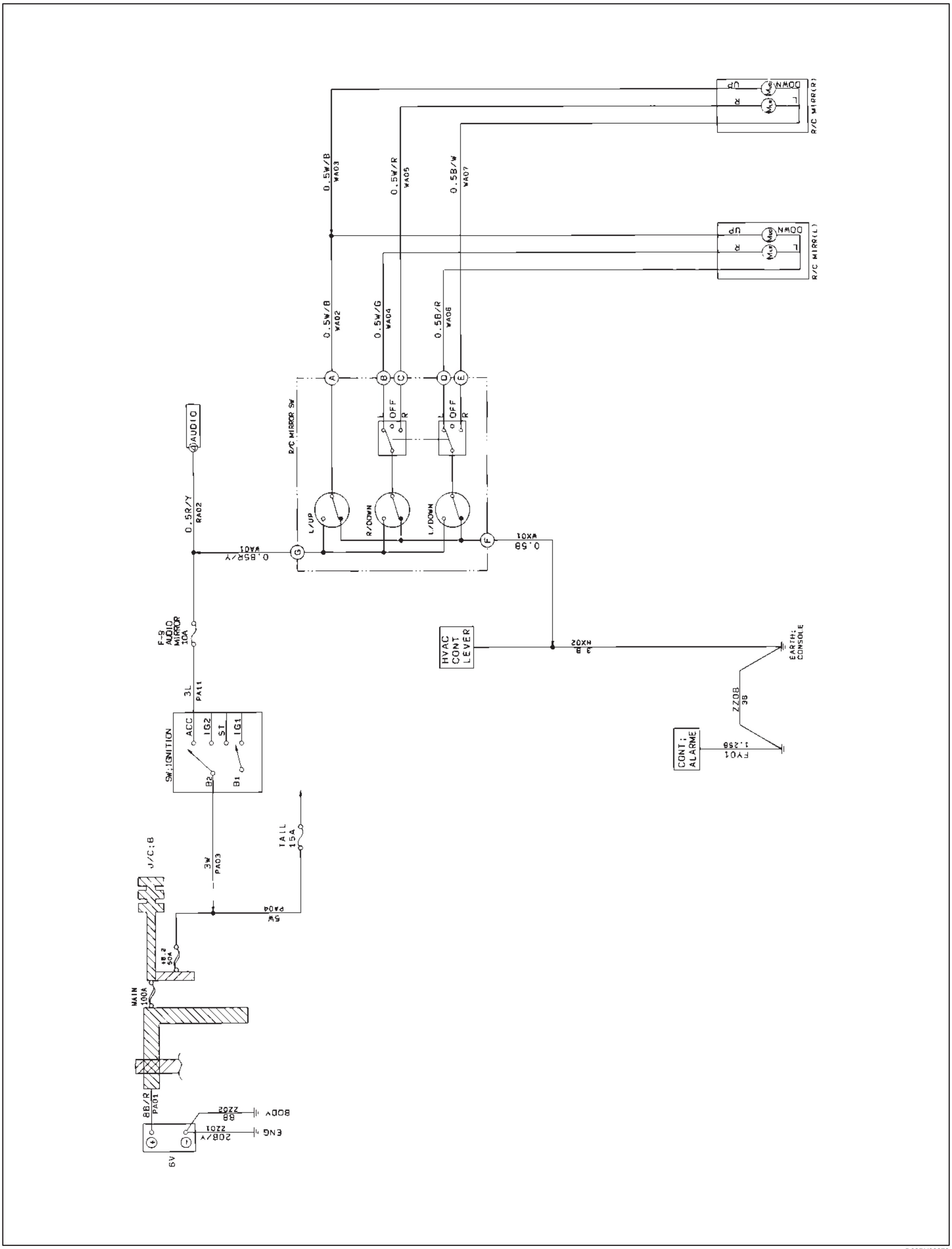
D08RY00372

Audio, Clock, Cigarette Lighter and ACC Socket



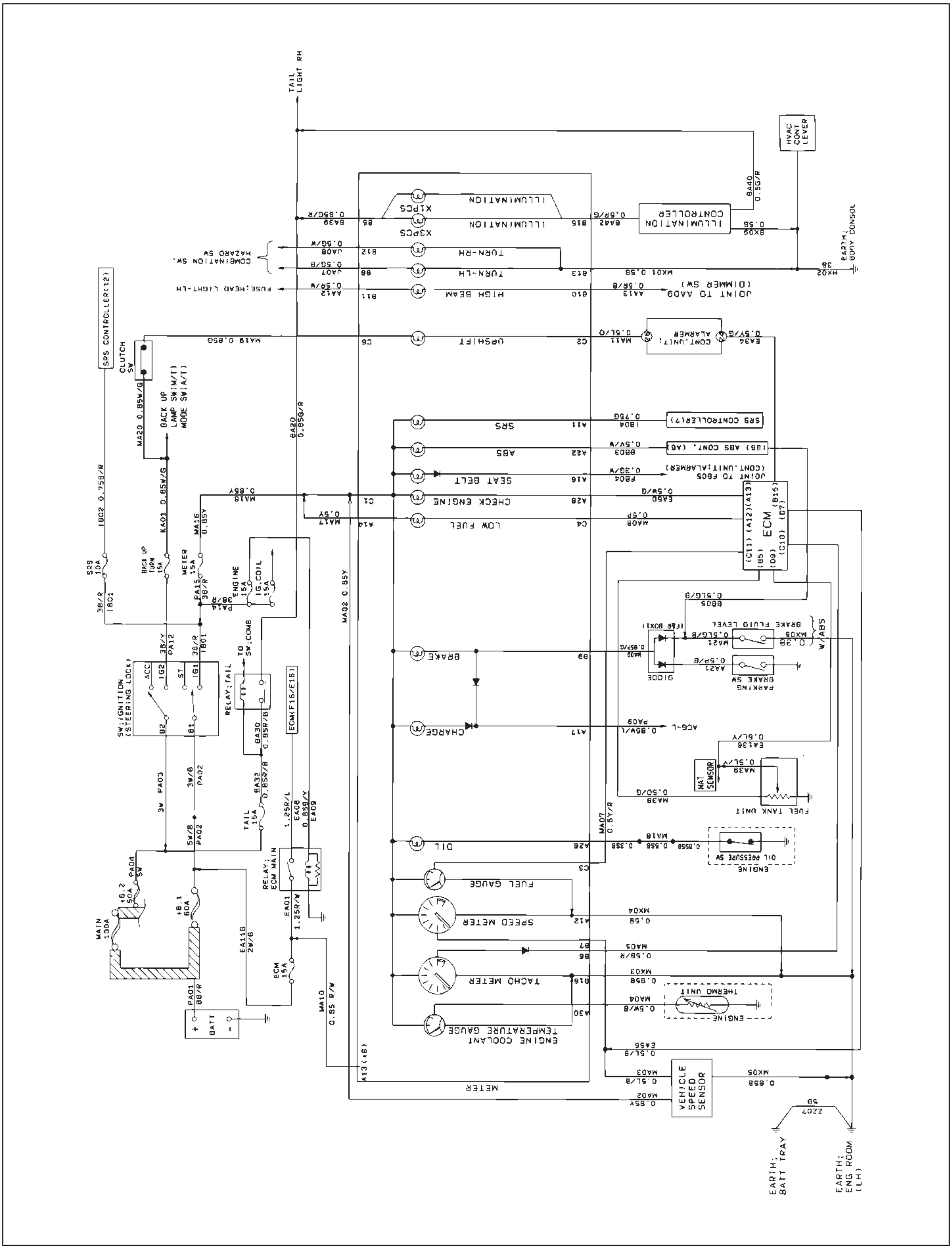
D08RY00373

Door Mirror



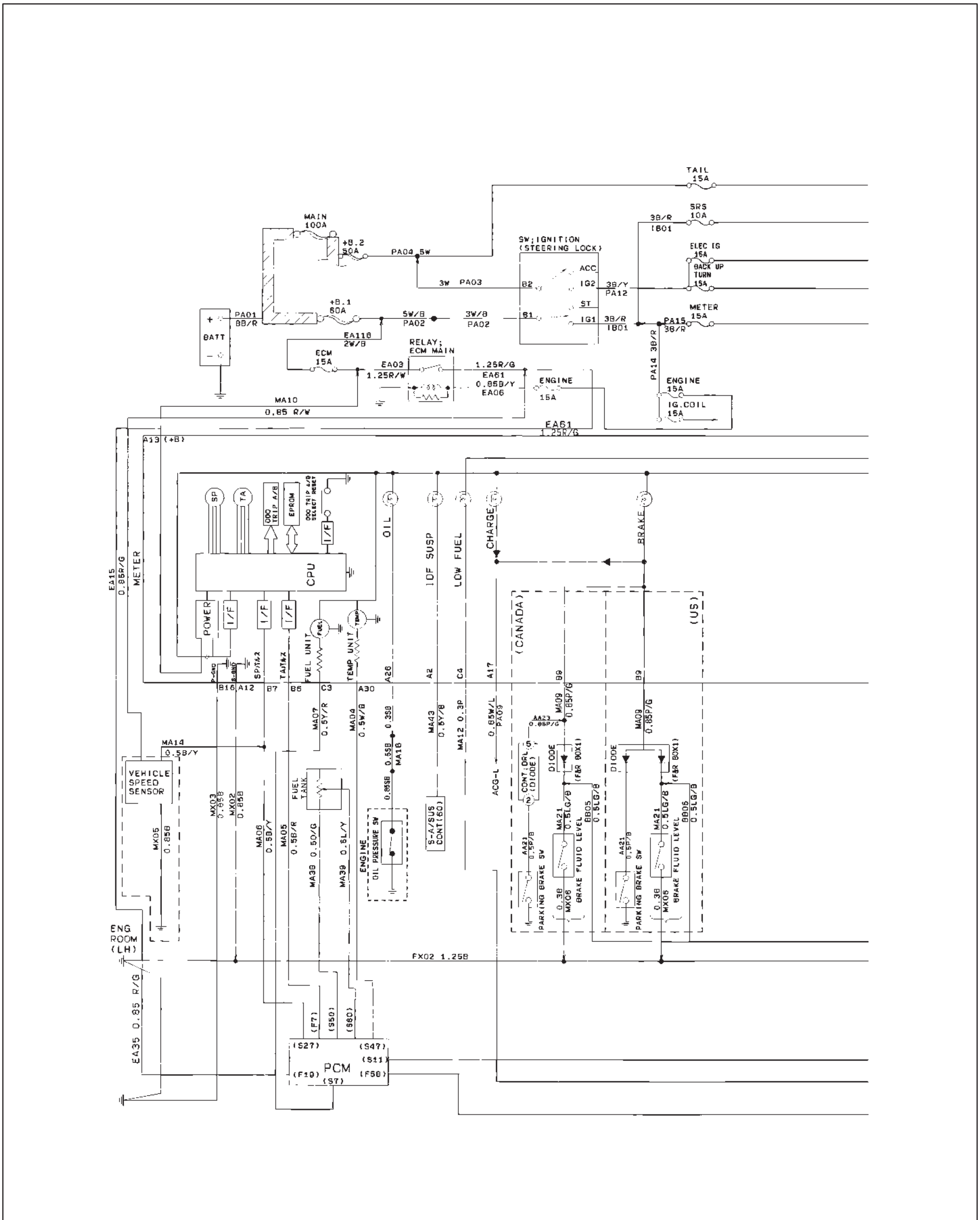
D08RY00378

Meter (L4)



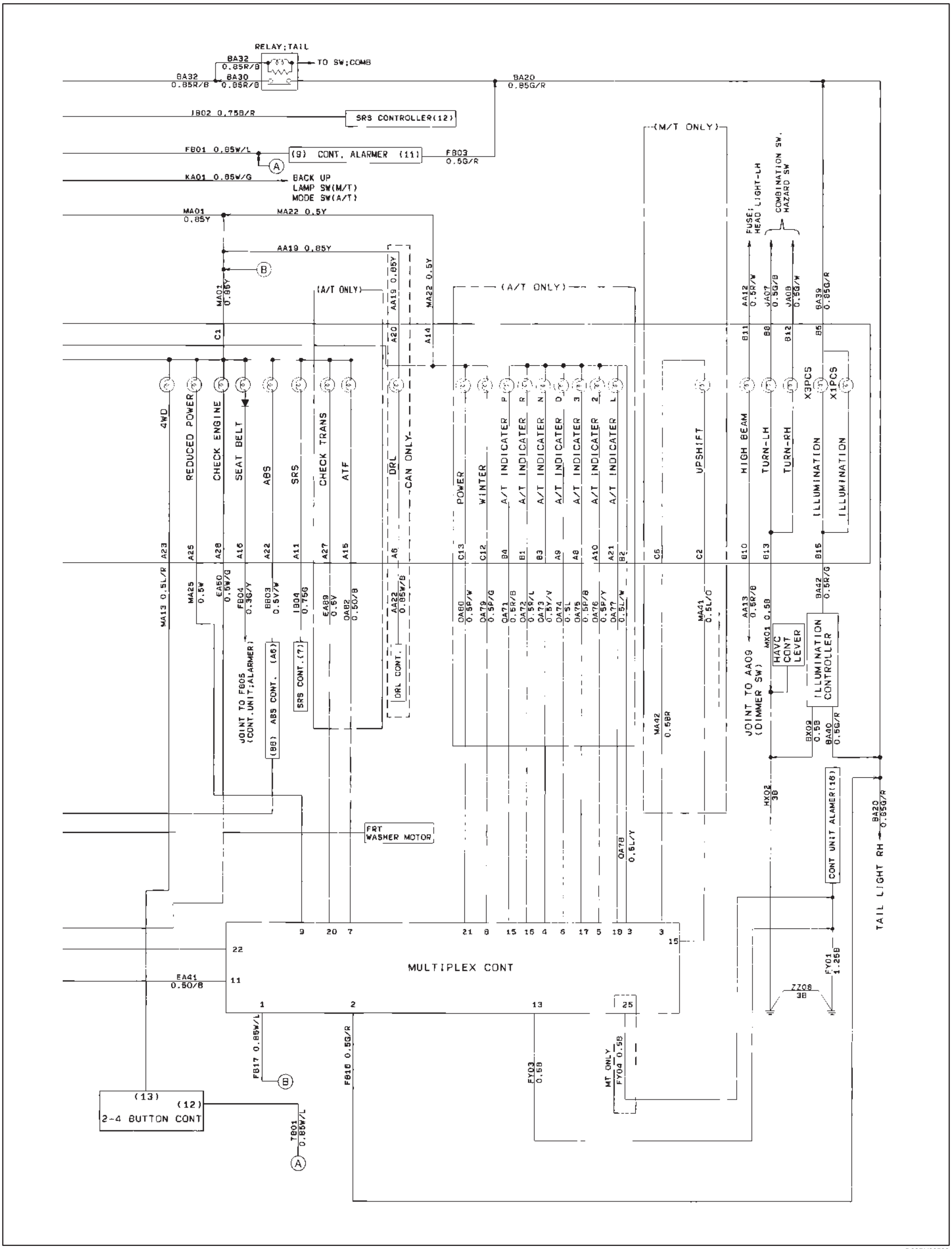
D08RY00411

Meter (V6)–1



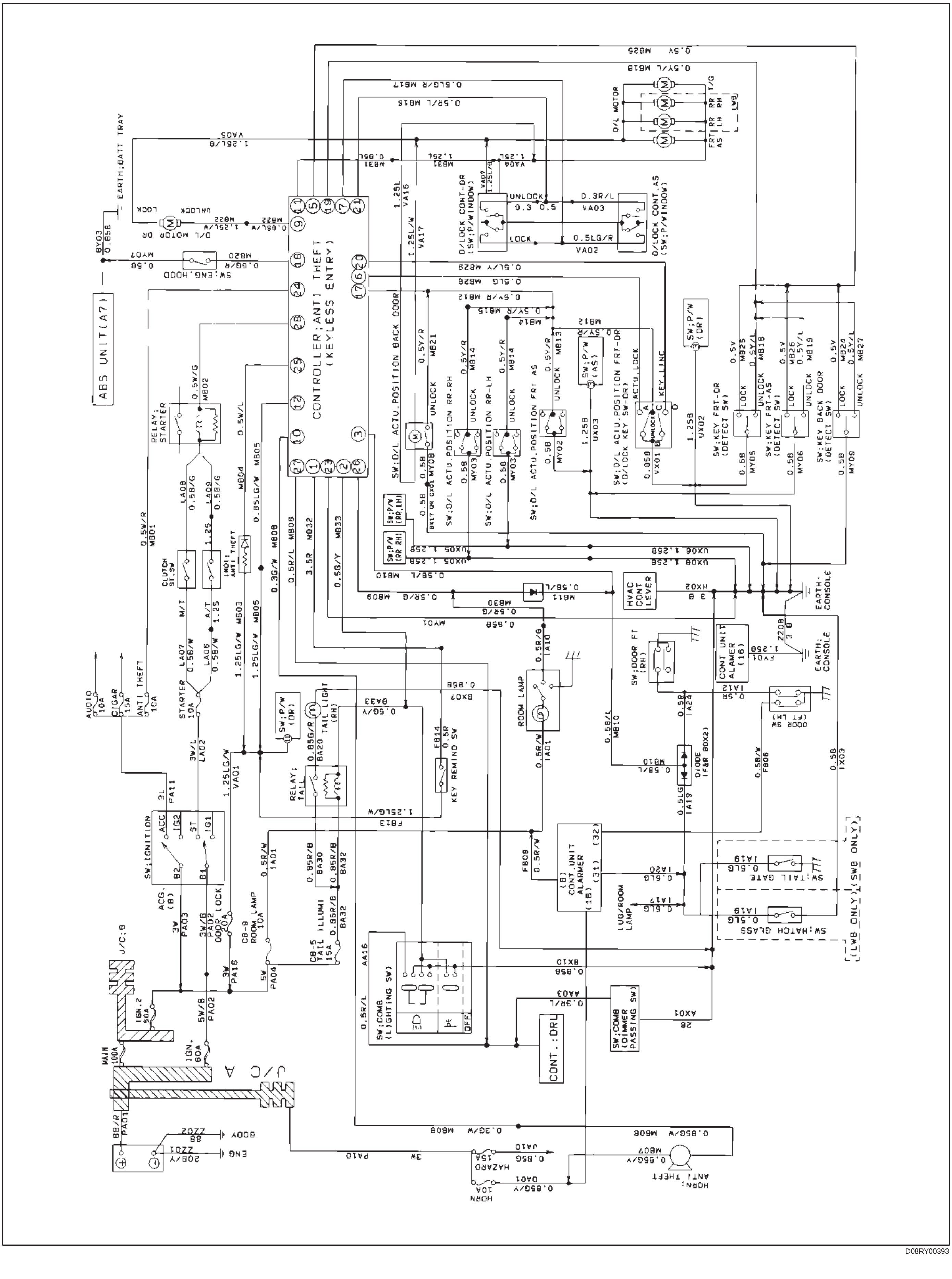
D08RY00532

Meter (V6)–2



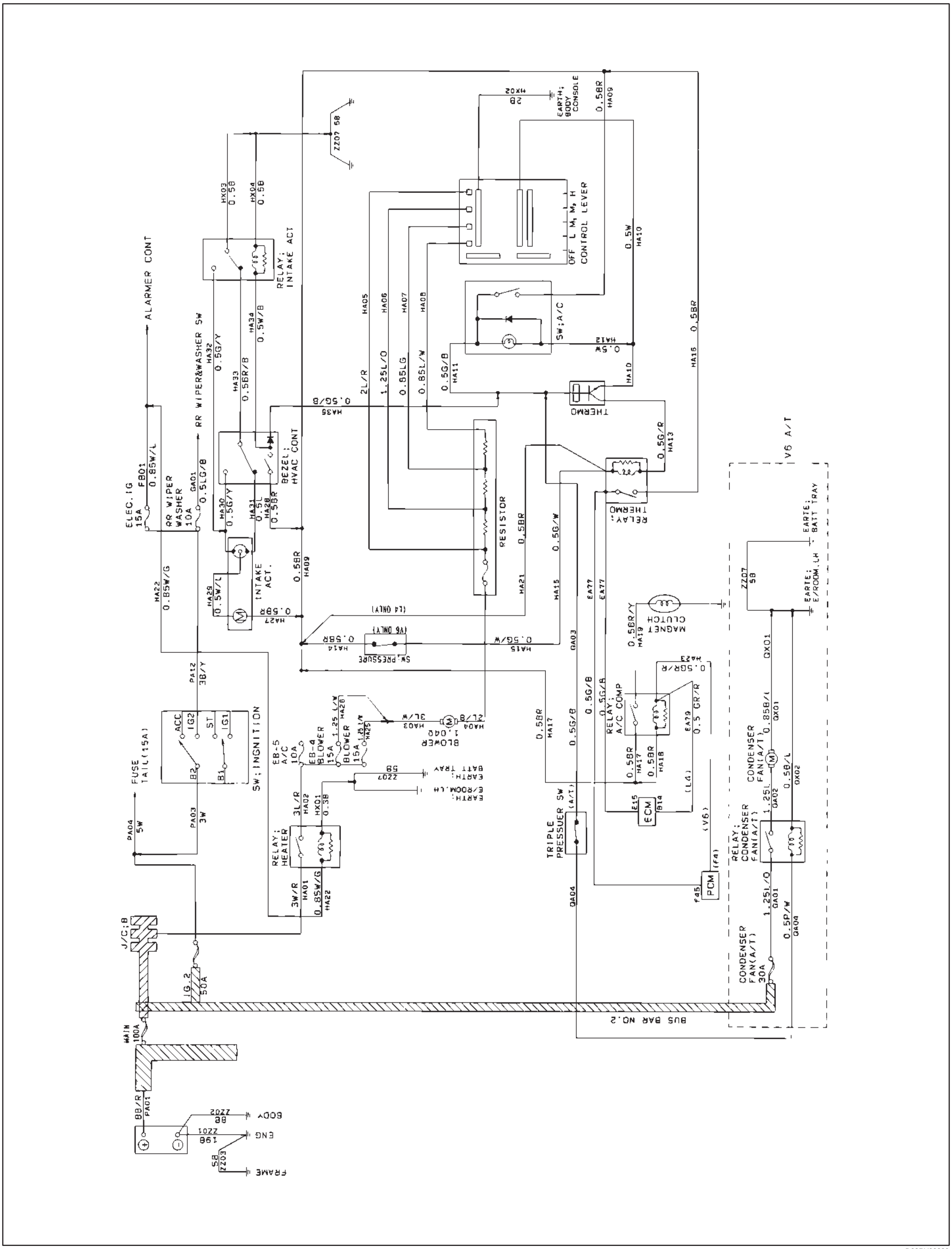
D08RY00533

Anti-theft with Keyless Entry



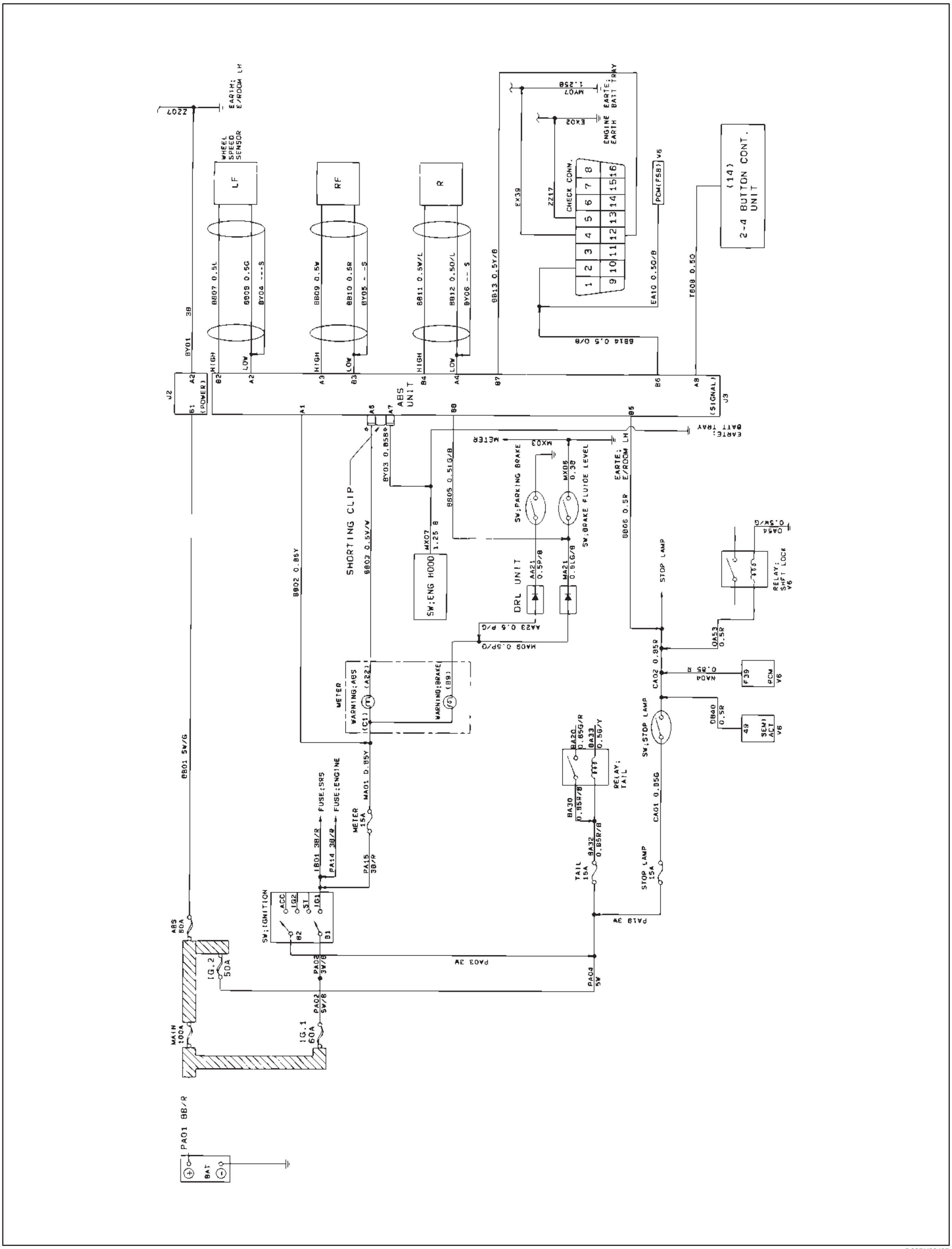
D08RY00393

Air Conditioning



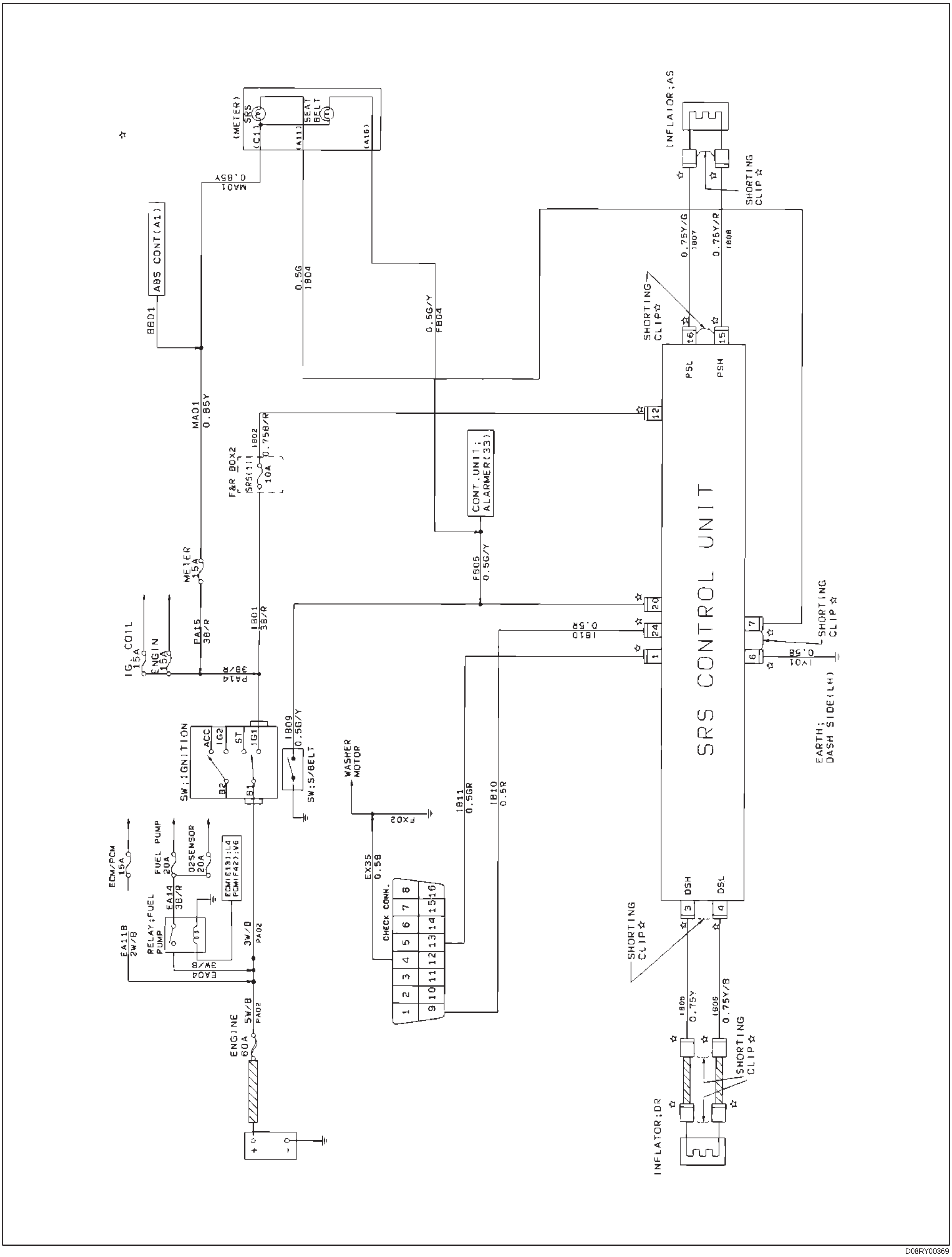
D08RY00389

ABS



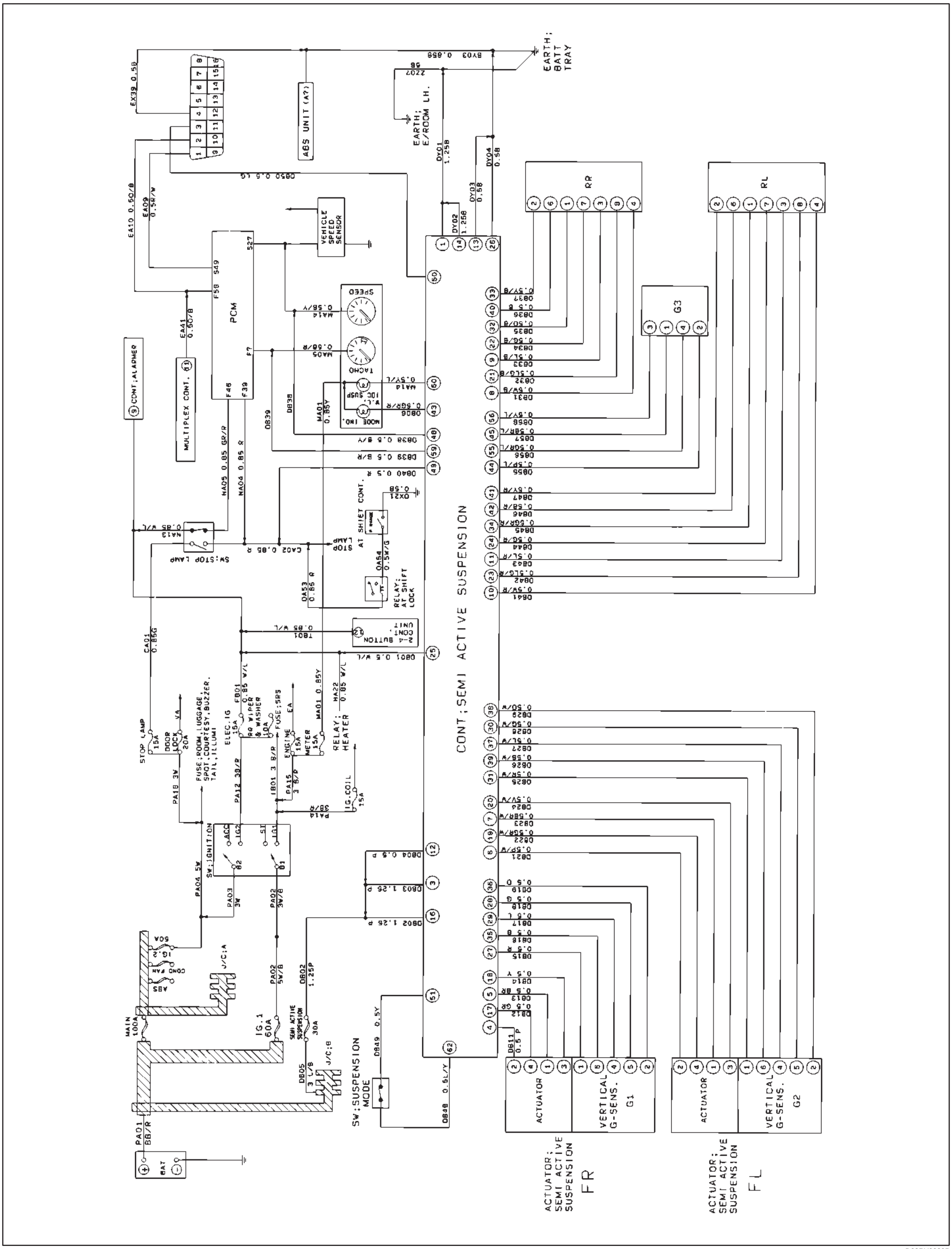
D08RY00407

SRS–Air Bag



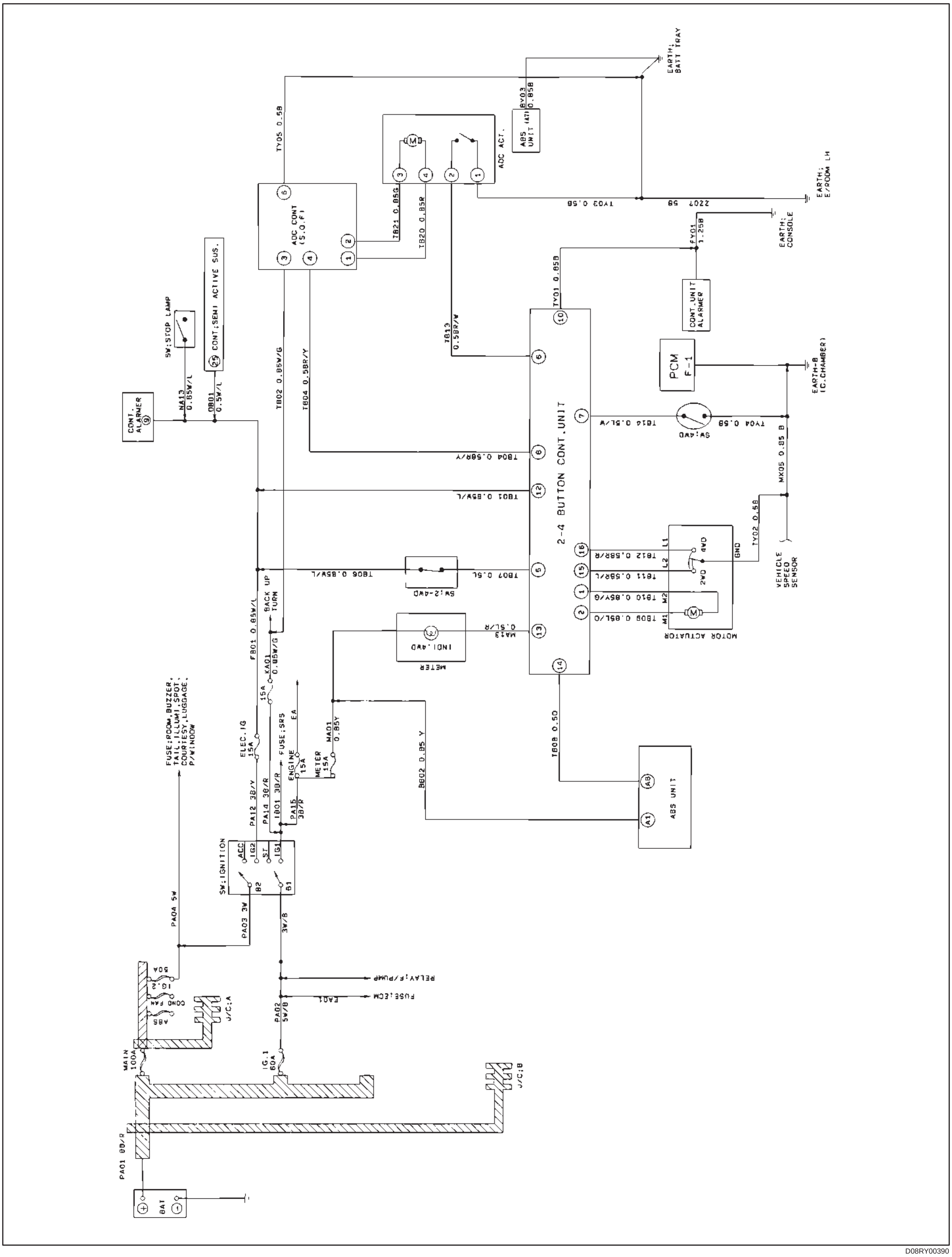
D08RY00369

Intelligent Suspension



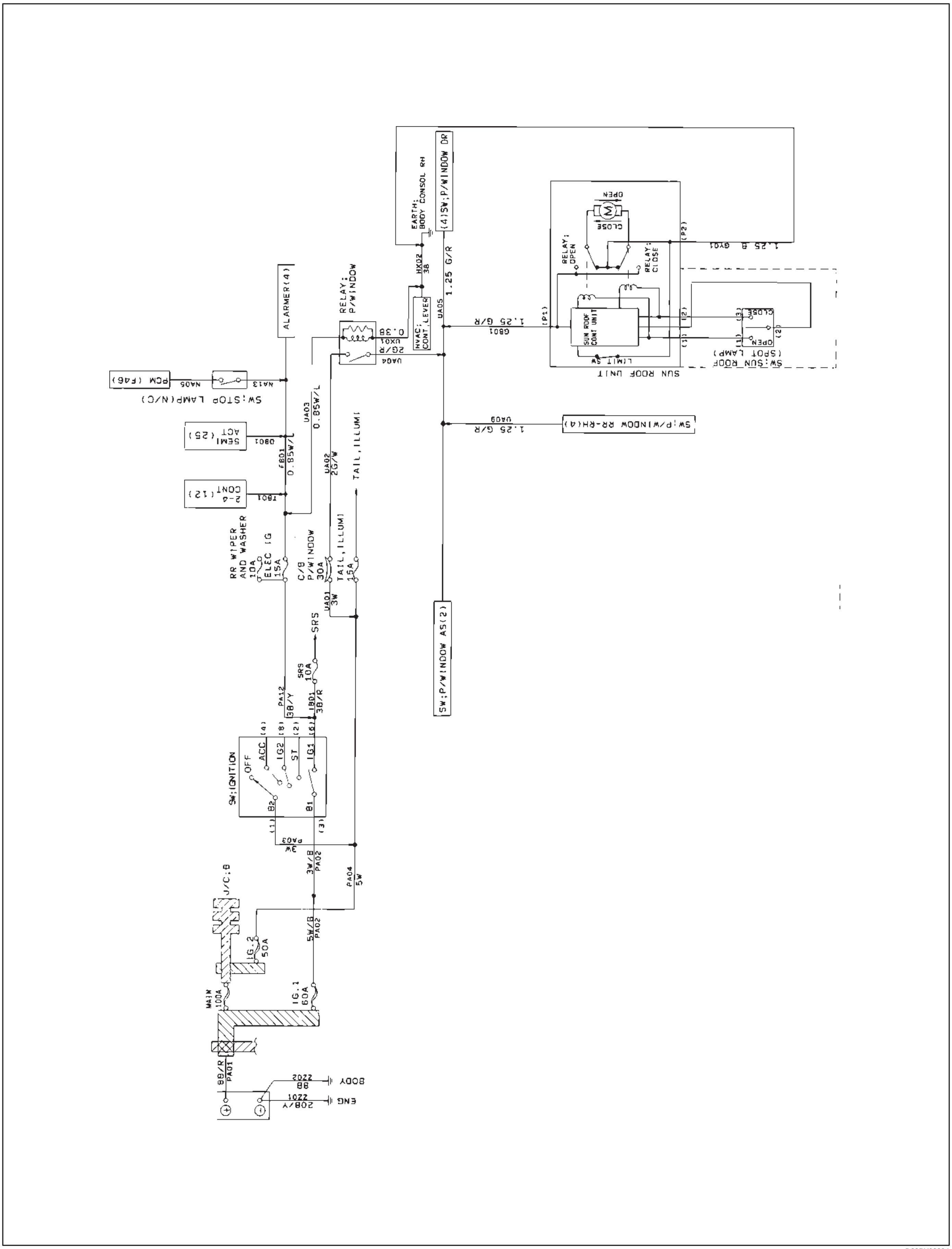
D08RY00395

Shift on the Fly



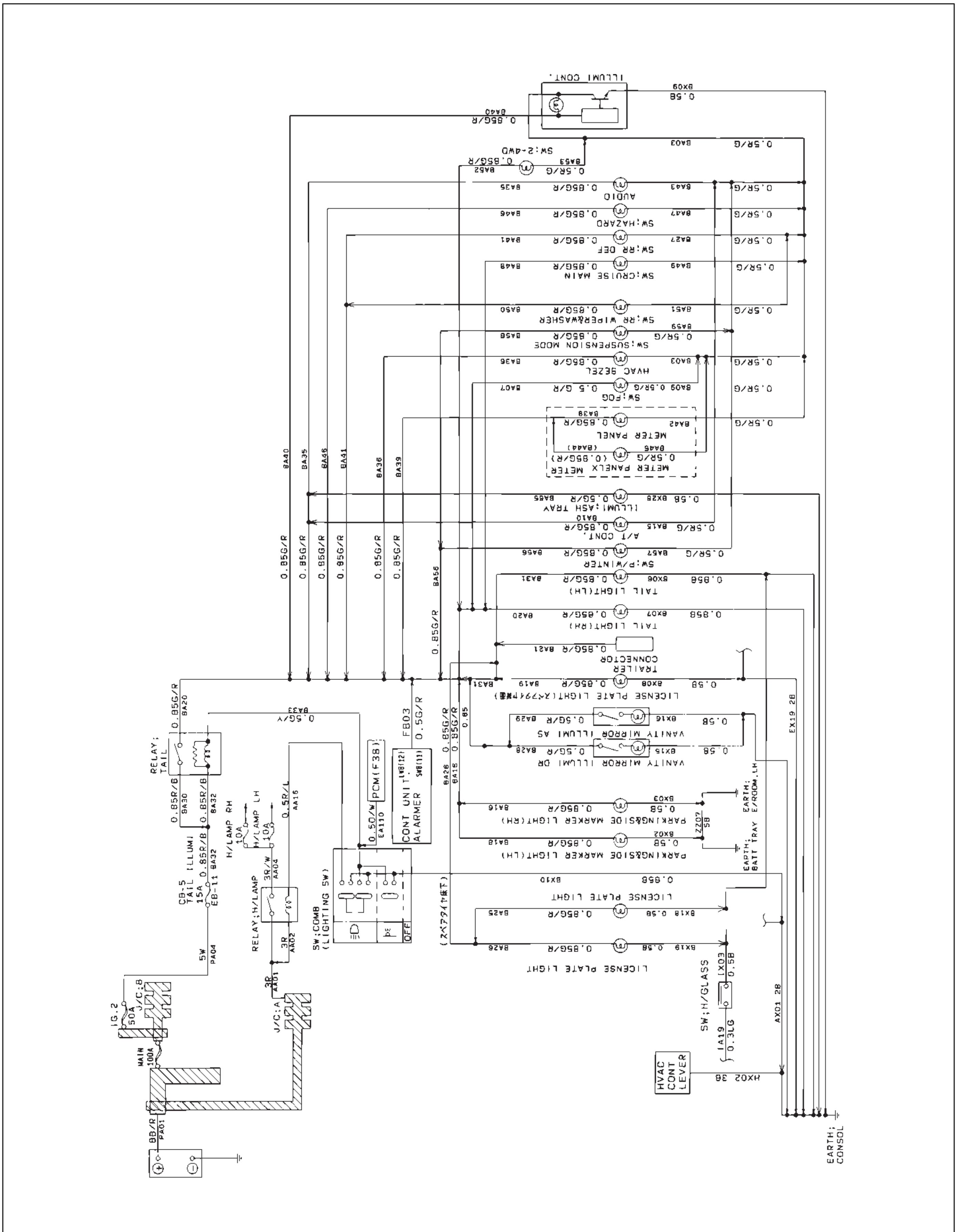
D08RY00390

Sunroof



D08RY00394

Illumination Light



D08RY00402

RODEO

BODY AND ACCESSORIES

METER AND GAUGE

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The circuit consists of the starter switch, meter assembly, Vehicle speed sensor, transmission switch, lighting switch, turn signal switch, thermo unit, oil pressure unit, Powertrain Control Module (PCM), fuel tank unit, 4WD switch, oil pressure switch, parking brake switch, brake fluid switch, seat belt switch, illumination controller, multi meter and ambient sensor.

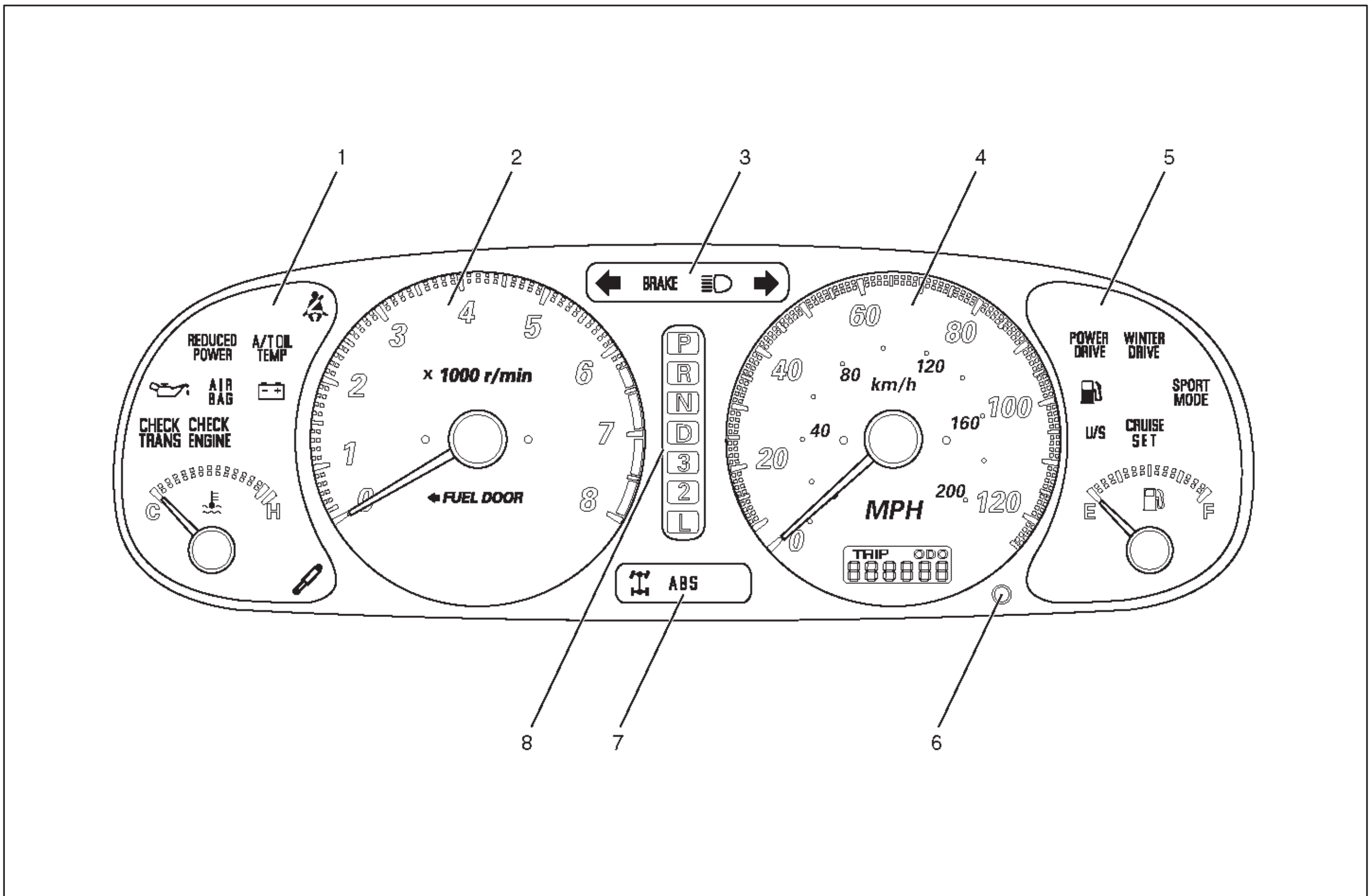
Meter Assembly

General Description

The meter assembly has the speedometer, tachometer, engine coolant temperature gauge, fuel gauge and warning/indicator lights. In addition, the meter assembly.

Layout for Meters/Gauges, Warning Lights, Indicator Lights and Illumination Lights

Front View

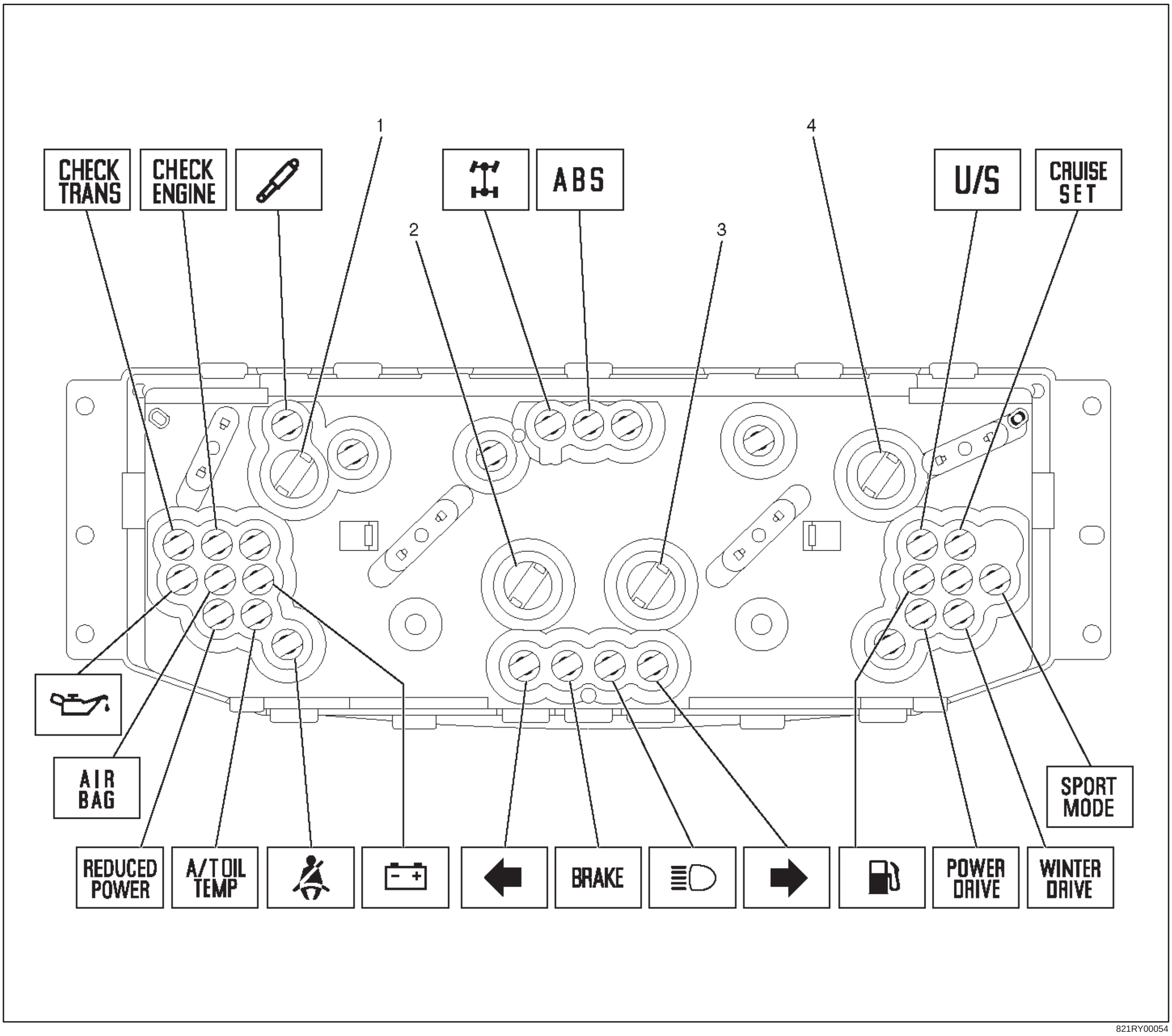


821RY00052

Legend

(1) Engine Coolant Temperature Gauge
(2) Tachometer
(3) Warning Light Lens
(4) Speedometer
(5) Fuel Gauge
(6) Reset Button
(7) Warning Light Lens
(8) A/T Shift Indicator

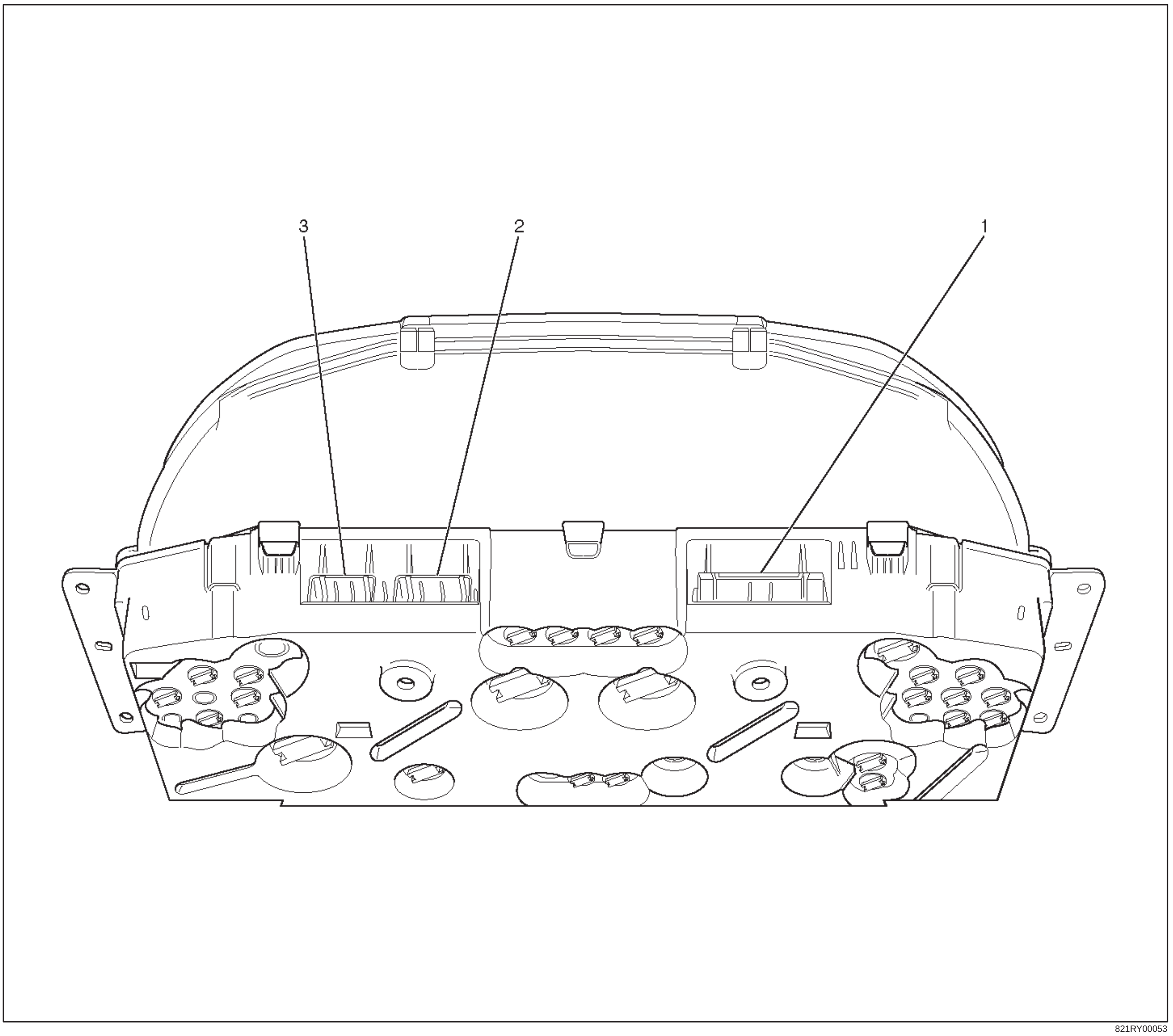
Rear View



Legend

(1) Illumination Light Bulb
(2) Illumination Light Bulb
(3) Illumination Light Bulb
(4) Illumination Light Bulb

Table for Meter/Gauge Connector Terminal Connections



821RY00053

Legend

(1) Connector A
(2) Connector B
(3) Connector C

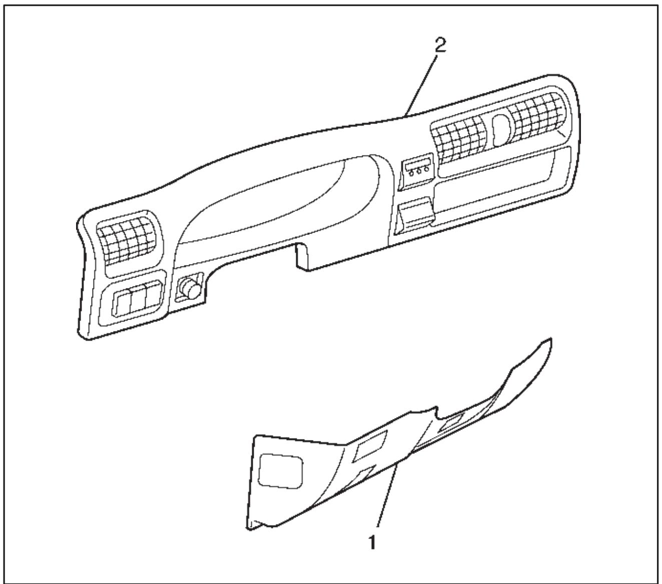
Connector A	
Terminal	Function
1	—
2	Intelligent suspension indicator light
3	—
4	—
5	—
6	—
7	—
8	A/T shift indicator light “3”
9	A/T shift indicator light “D”
10	A/T shift indicator light “2”
11	SRS – air bag warning light
12	Ground
13	Battery
14	Stater switch
15	A/T oil temperature warning light
16	Seat belt indicator light
17	Charge warning light
18	—
19	—
20	—
21	A/T shift indicator light “L”
22	ABS warning light
23	4WD indicator light
24	—
25	Reduced power warning light
26	Oil pressure warning light
27	Check trans warning light
28	MIL(check engine) warning light
29	—
30	Engine coolant temperature gauge

Connector B	
Terminal	Function
1	A/T shift indicator light “R”
2	A/T shift indicator light
3	A/T shift indicator light “N”
4	A/T shift indicator light “P”
5	Illumination light
6	Engine revolution pulse
7	Speed sensor pulse
8	Turn signal indicator light (LH)
9	Brake warning light
10	High beam indicator light
11	High beam indicator light
12	Turn signal indicator light (RH)
13	Turn signal indicator light
14	—
15	Illumination light
16	Ground

Connector C	
Terminal	Function
1	Starter switch
2	Upshift indicator light
3	Fuel gauge
4	Low fuel warning light
5	Cruise set indicator light
6	Upshift indicator light
7	—
8	—
9	—
10	Sport mode indicator light
11	—
12	Winter drive indicator light
13	Power drive indicator light
14	—

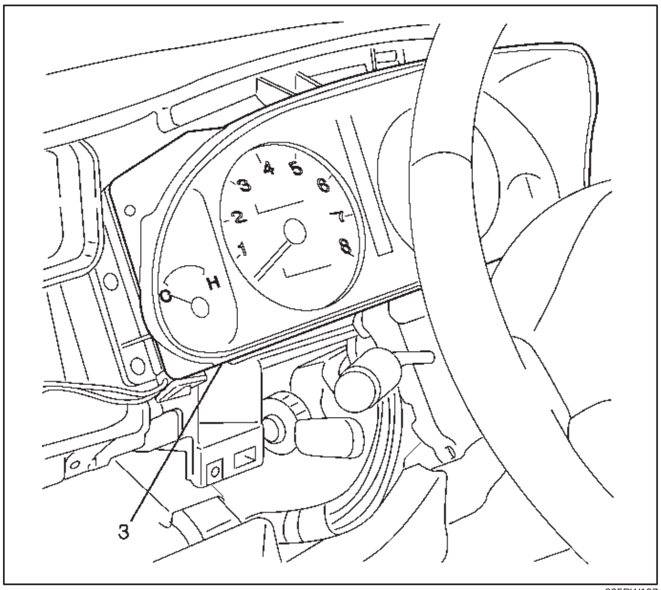
Removal

1. Disconnect the battery ground cable.
2. Remove the Dash Side Trim Panel –LH.
3. Remove the lower cover Assembly(1).
   - Refer to the Instrument Panel Assembly in Body Structure section.
4. Remove the meter cluster Assembly(2).
   - Refer to the Instrument Panel Assembly in Body Structure section.



821RW253

5. Remove the meter assembly(3).
   - Remove four fixing screws.
   - Disconnect the meter connector.



825RW197

CAUTION: The removed meter assembly should be placed upright or with its face side up.

Installation

To install, follow the removal steps in the reverse order.

Warning Light Bulb and Indicator Light Bulb

Removal

1. Disconnect the battery ground cable.
2. Remove the meter assembly.
   - Refer to the Meter Assembly removal steps in Meter and Gauge section.
3. Remove the bulb.
   - Hold the bulb socket by hand, rotate it counterclockwise and pull it out.

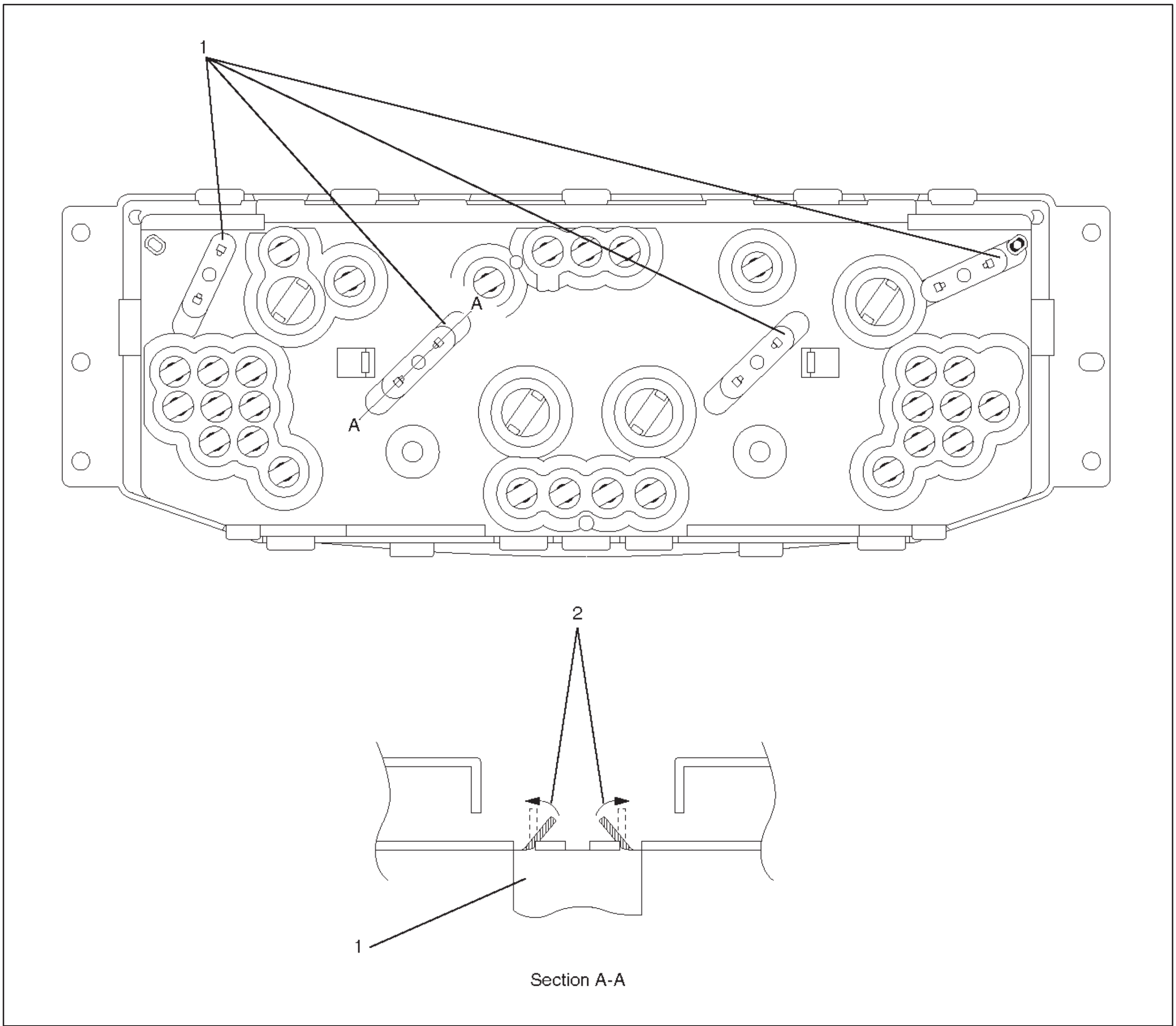
Installation

To install, follow the removal steps in the reverse order.

A/T Shift Indicator Light Bulb

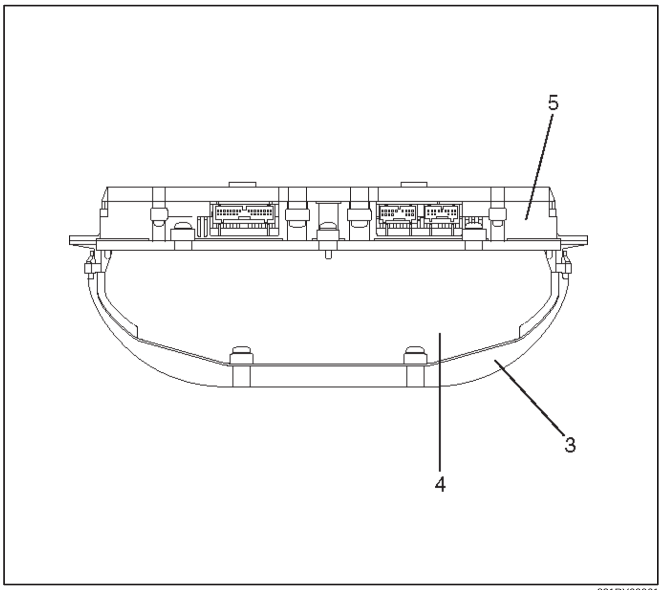
Removal

1. Disconnect the battery ground cable.
2. Pry up the bended portions(2) of the metal cover(1).



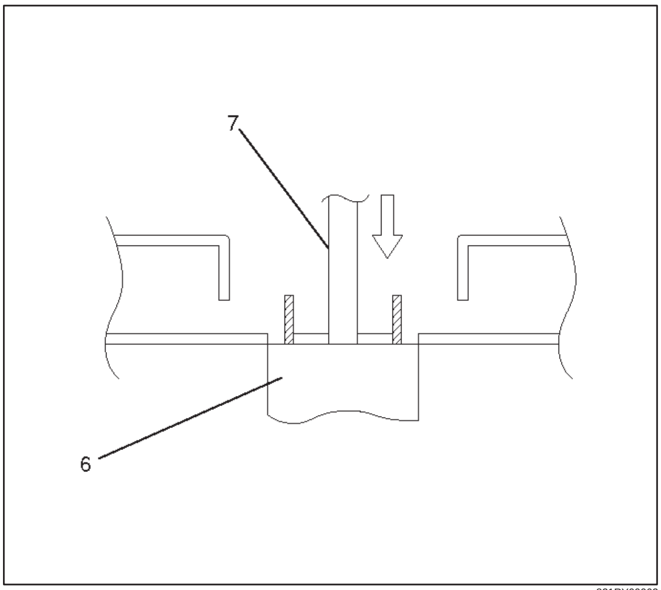
821RY00060

3. Remove the meter lense(3) from the meter visor(4).
4. Remove the meter visor from the meter case(5).



821RY00061

5. Remove the meter assembly.
   - Push the metal cover(6) with the screw driver(7).



821RY00062

6. Remove the meter rear cover.
7. Remove the meter circuit board.
8. Remove the A/T shift indicator bulb.

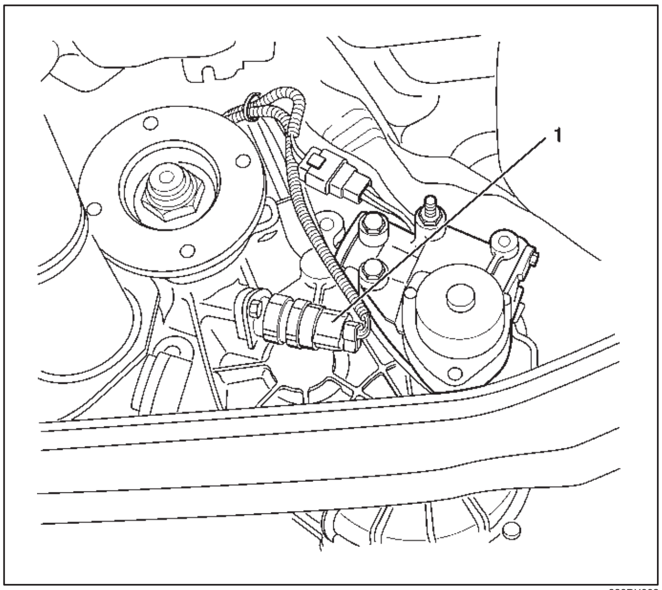
Installation

To install, follow the removal steps in the reverse order.

Vehicle Speed Sensor

Removal

1. Disconnect the battery ground cable.
2. Remove the vehicle speed sensor(1).
   - Disconnect the connector.
   - Rotate the sensor counterclockwise.



220RX003

Installation

To install, follow the removal steps in the reverse order, noting the following point.

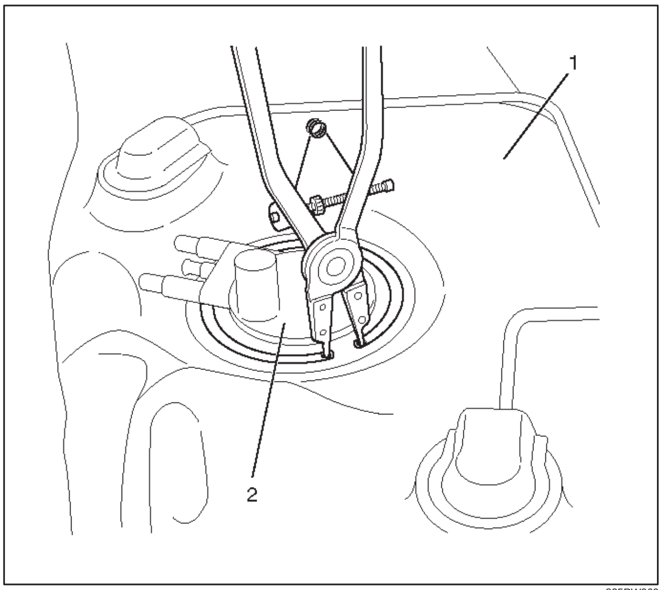
1. Tighten the vehicle speed sensor to the specified torque.

Torque: 27 N·m (20 lb ft)

Fuel Tank Unit

Removal

1. Disconnect the battery ground cable.
2. Remove the fuel tank(1).
   - Refer to the Fuel Tank removal steps in Engine section
3. Remove the fuel tank unit(2).
   - Disconnect the connector.
   - Remove the five fixing screws.



825RW060

Installation

To install, follow the removal steps in the reverse order.

Main Data and Specifications

Torque Specifications

Application	N·m	Lb Ft	Lb In
Vehicle Speed Sensor Fixing	27	20	—

RODEO

BODY AND ACCESSORIES

BODY STRUCTURE

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

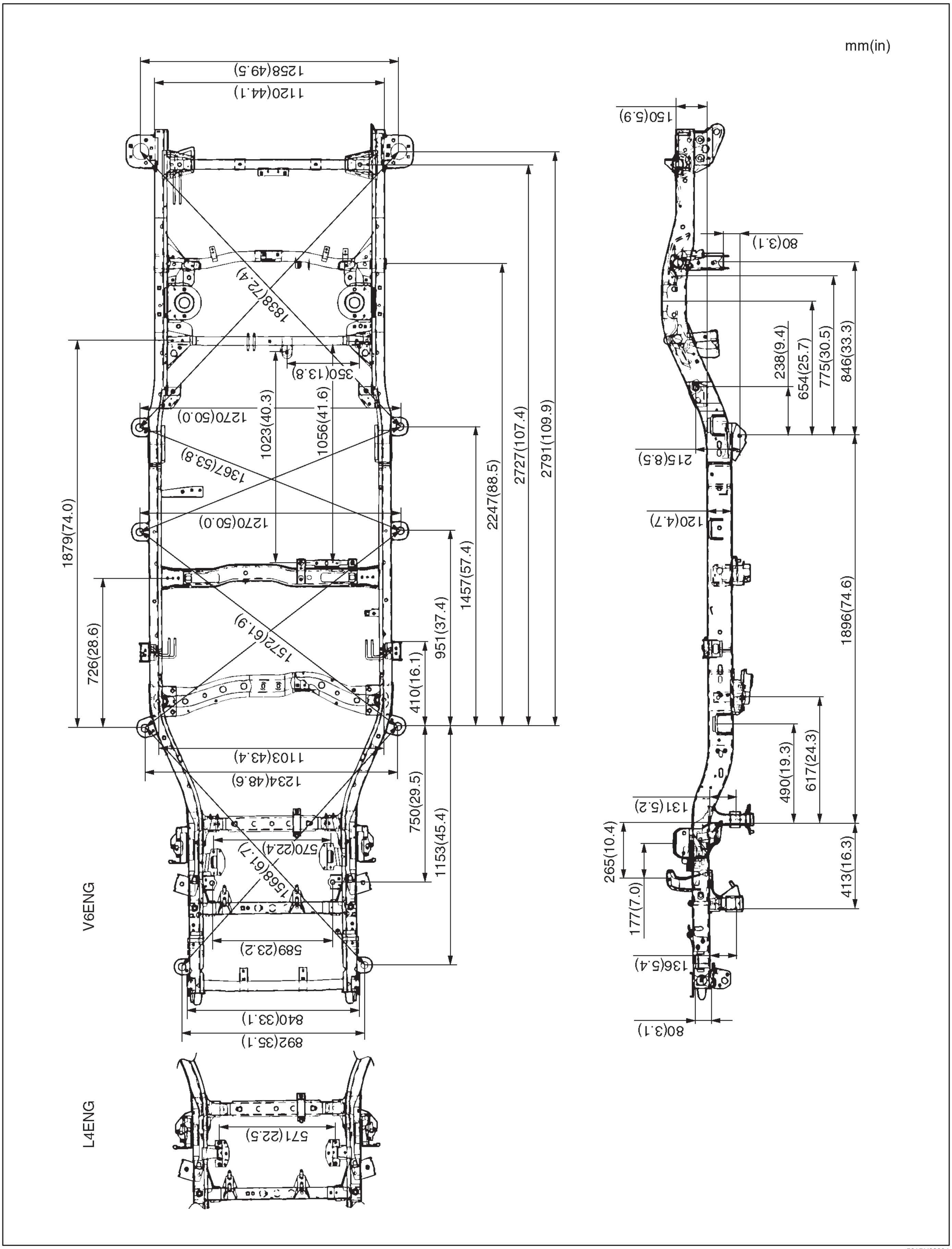
CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Frame

General Description

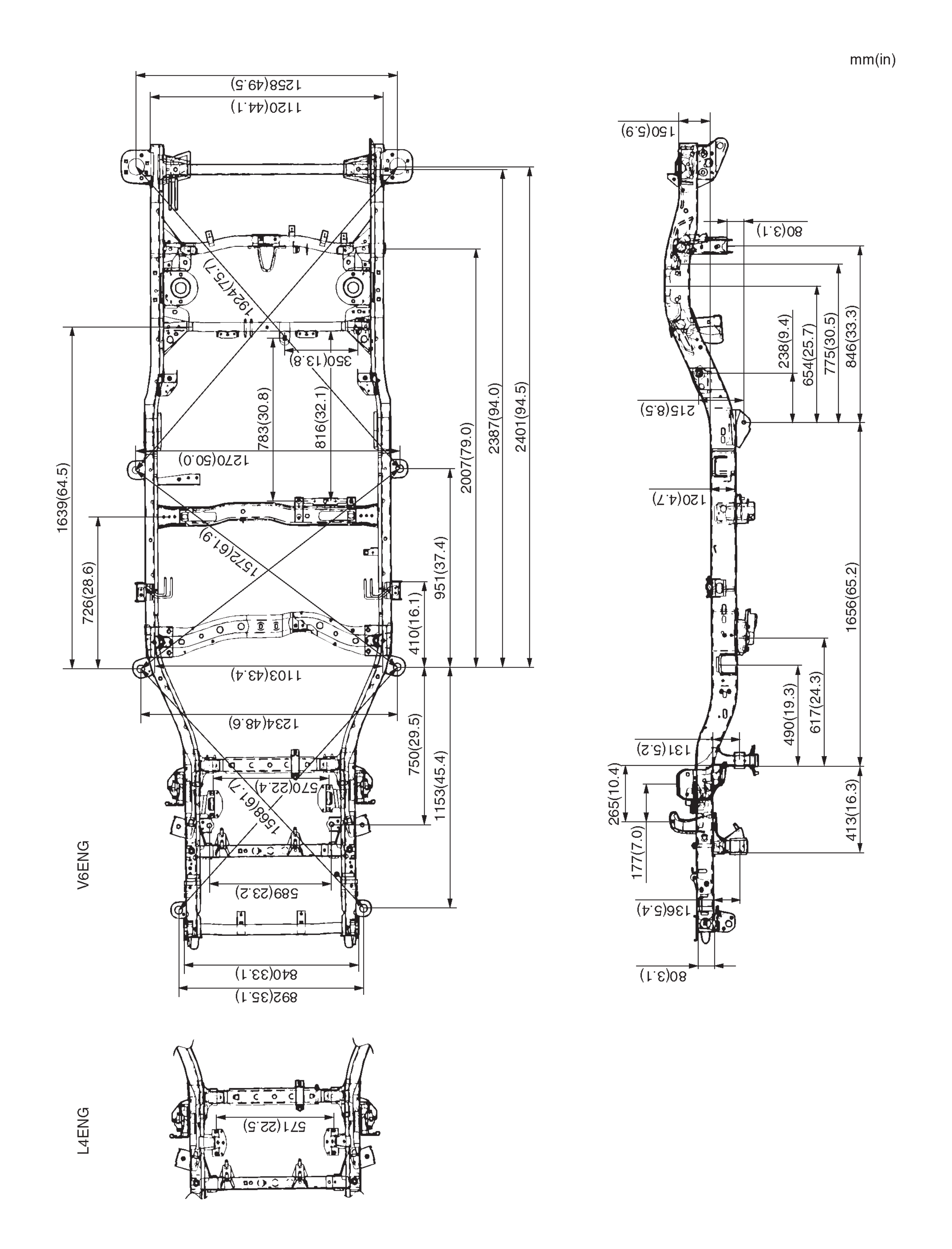
Proper frame alignment is important to assure normal vehicle life and performance of many other parts of the vehicle. If the vehicle has been involved in a fire, collision or has been overloaded, it is necessary to check the frame alignment.

Frame Dimensions (LWB)



501RY00004

Frame Dimensions (SWB)



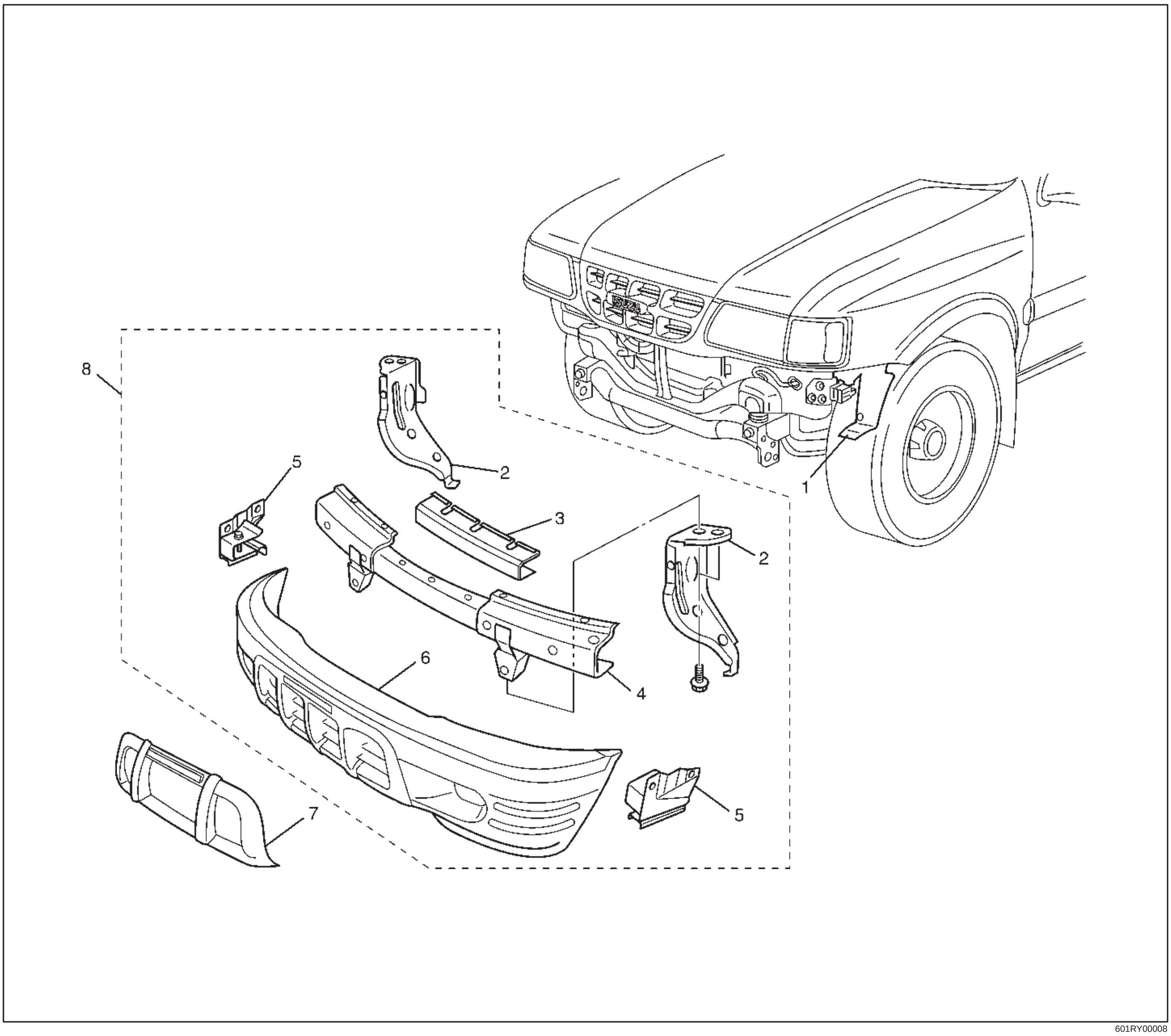
501RY00005

General Description (Bumper)

Front and rear bumpers consist of bumper fascia, support, and reinforcement.
The absorbing capability for both front and rear bumper systems are achieved through reinforcements in each bumper.

Front Bumper

Parts Location

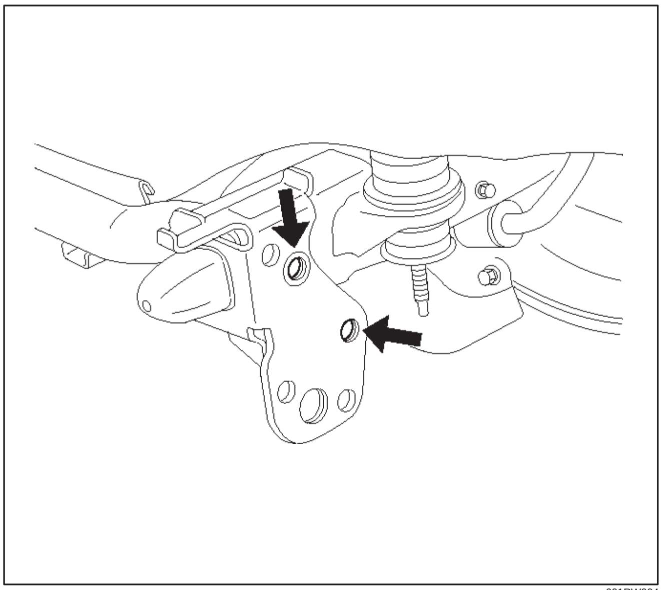


Legend

(1) Inner Liner
(2) Backbar
(3) Support Assembly
(4) Front Bumper Reinforcement Assembly
(5) Bumper Support
(6) Front Bumper Fascia
(7) Front Bumper Extension (SWB only)
(8) Front Bumper Assembly

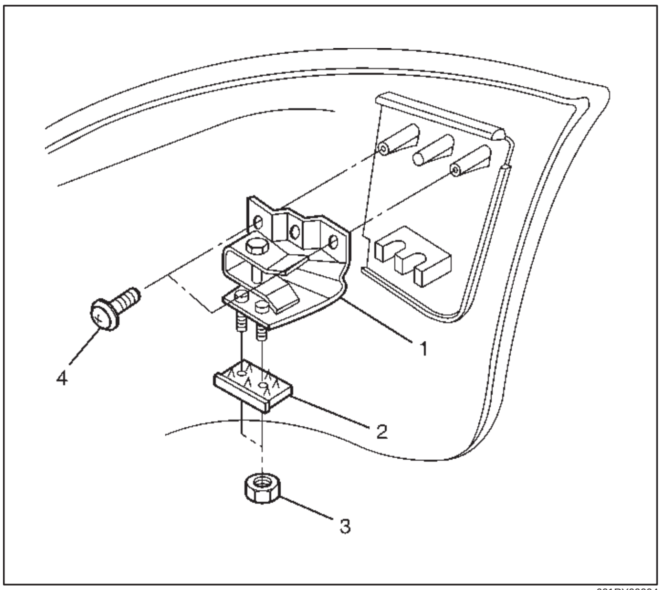
Removal

1. Disconnect the battery ground cable.
2. Disconnect front fog light connector (With fog light).
3. Remove each clip on the right and left side of the inner liner.
4. Remove the front bumper fixing bolts.
   - Remove the two bolts from both sides of the front bumper.



601RW004

5. Remove the front bumper assembly.
6. Remove the support assembly.
   - Remove the three fixing bolts.
7. Remove the front bumper reinforcement assembly.
   - Remove the eleven fixing bolts.
8. Remove the front bumper extension (SWB only).
   - Remove the three nuts and nine bolts.
9. Remove the three bolts at each backbar and remove backbars.
10. Remove the front fog light assembly (With fog light).
11. Remove the front bumper slider(1).
    - Remove the two screws(4) and the two nuts(3), and release the claw from the washer(2).



601RY00004

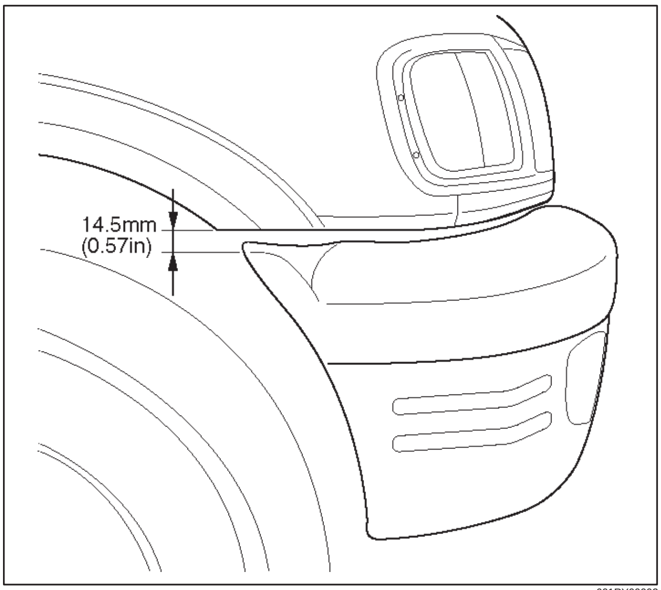
Installation

To install, follow the removal steps in reverse order noting the following points:

1. Tighten the front bumper assembly fixing bolts to the specified torque.

   Torque : 147 N·m (108 lb ft)

2. Front bumper adjustment
   - When the bolts fixing front bumper assembly are tightened, adjustment should be made between the backbar and front side bumper so that a clearance of 14.5 mm (0.57 in) is provided between the lower side of the fender and the upper side of the front bumper.

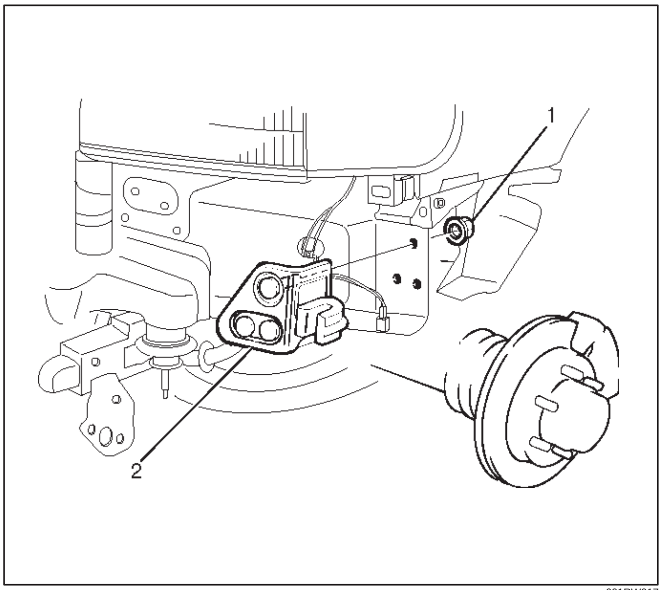


601RY00002

Front Bumper Slider Bracket

Removal

1. Disconnect the battery ground cable.
2. Remove the front bumper.
   - Refer to Front Bumper in this section.
3. Remove the three nuts(1) and draw out the slider bracket(2).



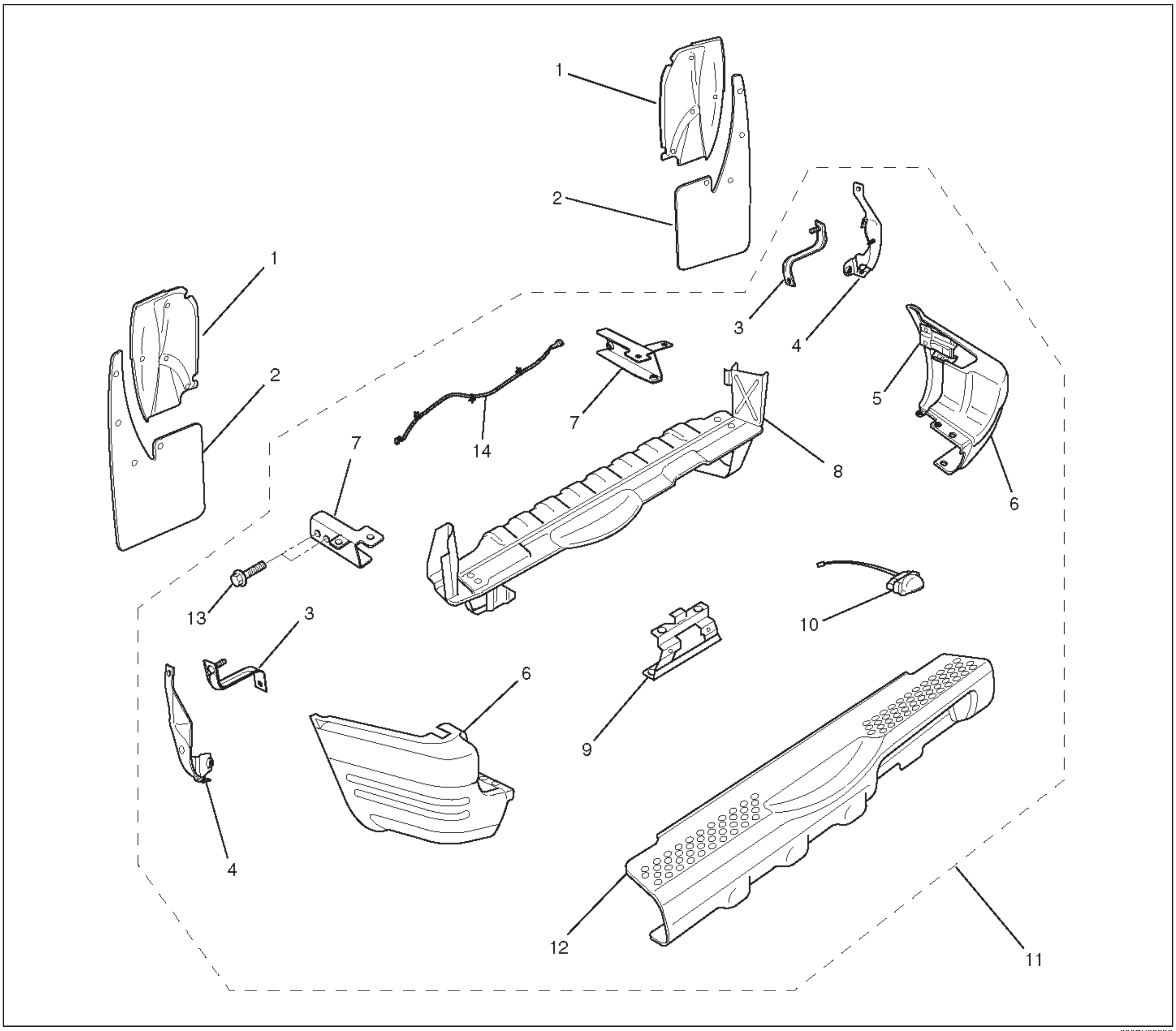
601RW017

Installation

To install, follow the removal steps in reverse order.

Rear Bumper

Parts Location (Spare tire mounted tailgate model)

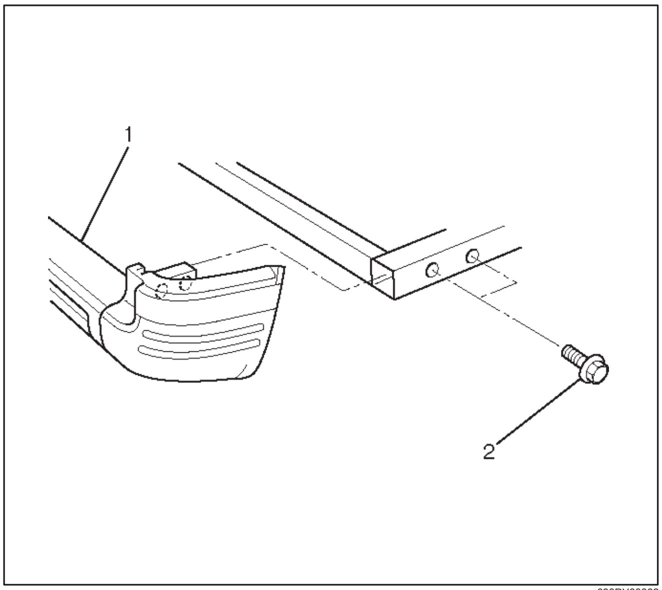


Legend

(1) Protector
(2) Rear Mud Flap
(3) Bumper Bracket
(4) Rear Bumper Support
(5) Rear Bumper Slider Bracket
(6) Rear Corner Bumper
(7) Backber
(8) Rear Bumper Reinforcement Assembly
(9) Rear License Plate Bracket
(10) License Plate Light Assembly
(11) Rear Bumper Assembly
(12) Rear Center Bumper
(13) Rear Bumper Fixing Bolt
(14) License Plate Light Harness

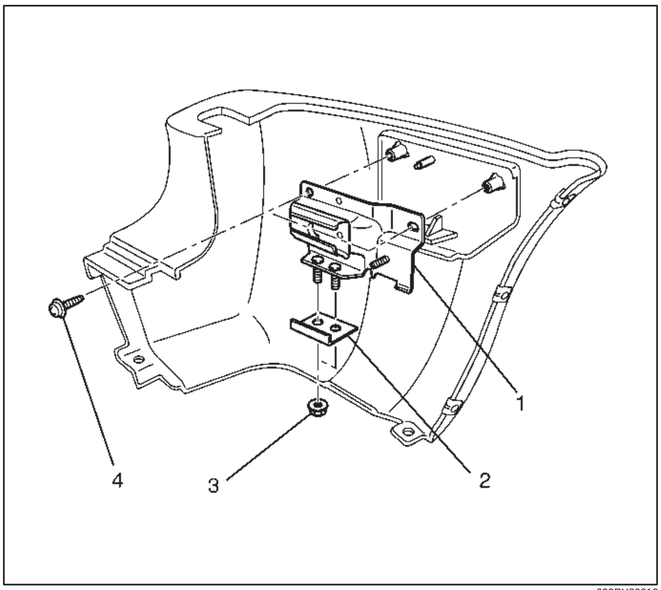
Removal

1. Disconnect the battery ground cable.
2. Remove the rear mud flaps.
   - Remove the four bolts.
3. Remove the protectors.
   - Remove the three clips on the right side and five clips on the left side.
4. Remove the bumper brackets.
   - Remove the two nuts.
5. Remove the rear bumper supports.
   - Remove the nut and bolt.
6. Remove the rear bumper assembly(1).
   - Remove the two bolts(2) from each side.
   - Disconnect the license plate light harness connector.
   - Open the tailgate in an angle of 60° to avoid the interference with the spare tire.



690RY00002

7. Remove the license plate light assembly and license plate harness.
8. Remove the rear license plate bracket.
9. Remove the rear center bumper.
   - Remove the eight clips from the step part and three bolts from each upper and lower sides.
10. Remove the rear corner bumpers.
    - Remove the three bolts from each rear corner bumper.
11. Remove the rear bumper slider brackets(1).
    - Remove the two screws(4) and two nuts(3), and then remove claw caught in the washer(2).



690RY00010

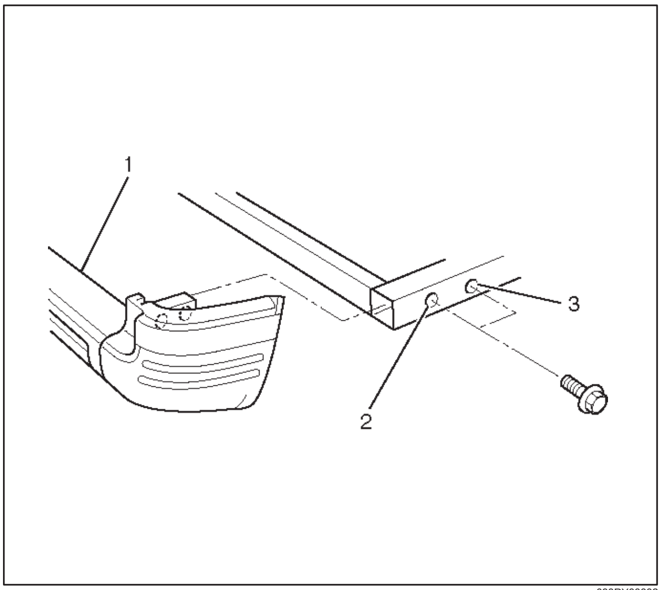
12. Remove the backbers from the rear bumper reinforcement assembly.
    - Remove the three bolts at each backber.

Installation

To install, follow the removal steps in reverse order, noting the following points:

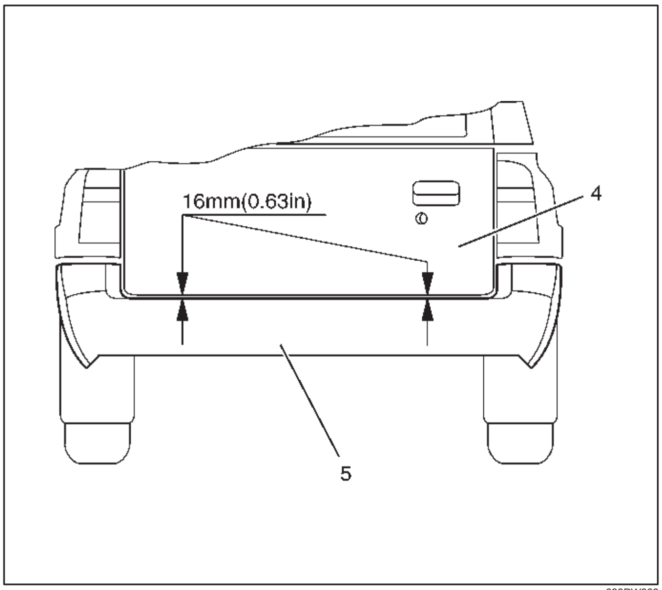
1. Partially tighten the rear bumper bolts(2) (3) and adjust the clearance between the body (tailgate) and the rear bumper(1).
   Then fully tighten the rear bumper bolts(2) (3).

   Torque : 147 N·m (108 lb ft)



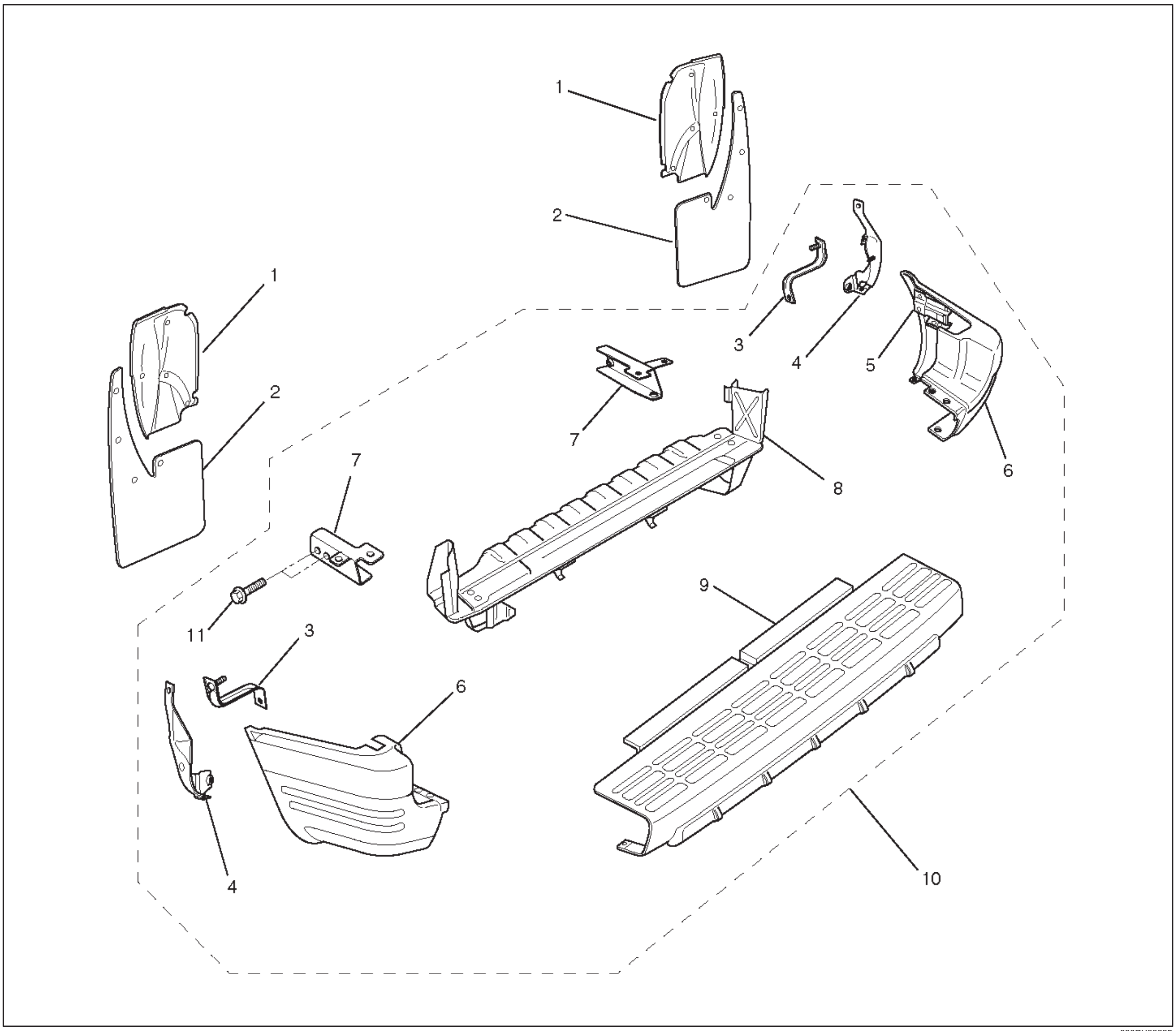
690RY00003

2. Rear bumper adjustment.
   - When the bolts fixing rear bumper assembly are tightened, adjustment should be made with shims so that clearances shown in the figure below are provided between the body (tailgate) (4) and the rear bumper(5).



690RW009

Parts Location (Spare tire mounted under floor model)

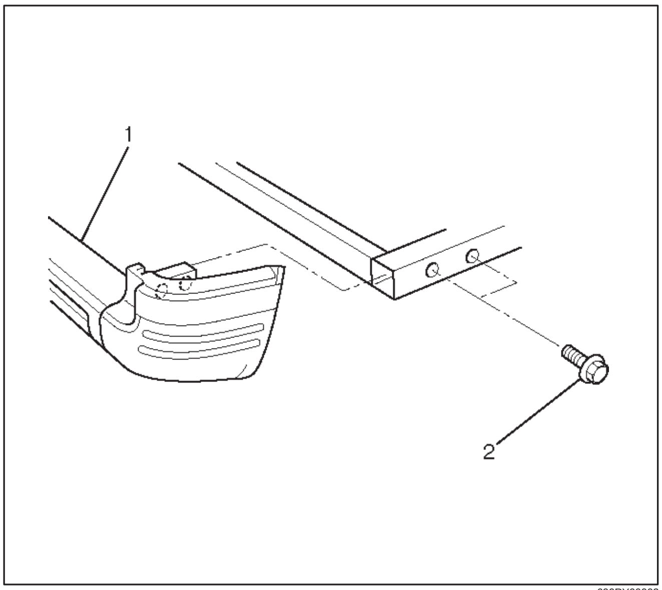


Legend

(1) Protector
(2) Rear Mud Flap
(3) Bumper Bracket
(4) Rear Bumper Support
(5) Rear Bumper Slider Bracket
(6) Rear Corner Bumper
(7) Backber
(8) Rear Bumper Reinforcement Assembly
(9) Rear Center Bumper
(10) Rear Bumper Assembly
(11) Rear Bumper Fixing Bolt

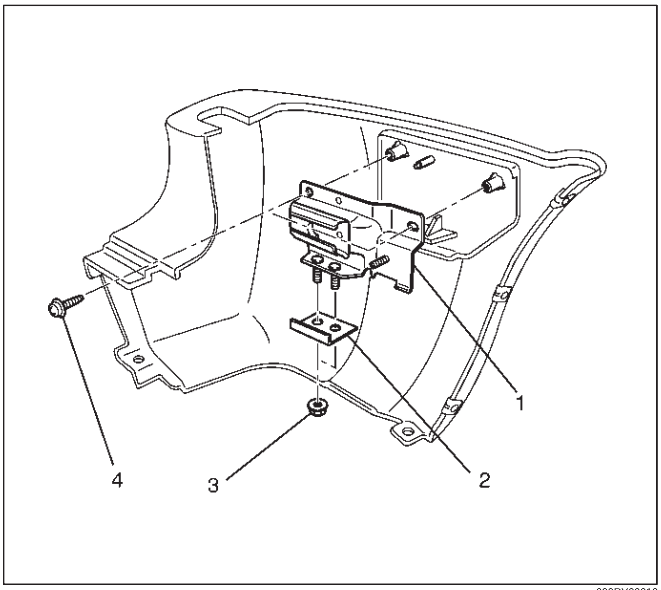
Removal

1. Disconnect the battery ground cable.
2. Remove the rear mud flaps.
   - Remove the four bolts.
3. Remove the protectors.
   - Remove the three clips on the right side and five clips on the left side.
4. Remove the bumper brackets.
   - Remove the two nuts.
5. Remove the rear bumper supports.
   - Remove the nut and bolt.
6. Remove the rear bumper assembly(1).
   - Remove the two bolts(2) from each side.



690RY00002

7. Remove the rear center bumper.
   - Remove the ten clips from the step part and three bolts from each upper and lower sides.
8. Remove the rear corner bumpers.
   - Remove the three bolts from each rear corner bumper.
9. Remove the rear bumper slider brackets(1).
   - Remove the two screws(4) and two nuts(3), and then remove claw caught in the washer(2).



690RY00010

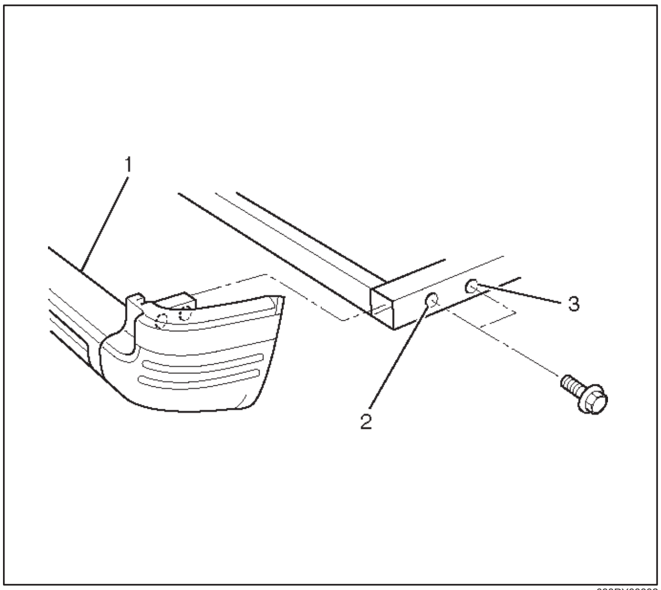
10. Remove the backbers from the rear bumper reinforcement assembly.
    - Remove the three bolts at each backber.

Installation

To install, follow the removal steps in reverse order, noting the following points:

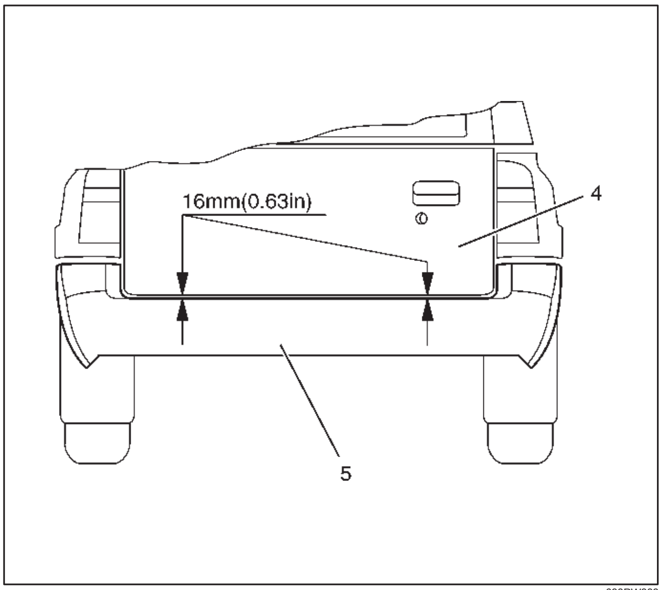
1. Partially tighten the rear bumper bolts(2) (3) and adjust the clearance between the body (tailgate) and the rear bumper(1).
   Then fully tighten the rear bumper bolts(2) (3).

   Torque : 147 N·m (108 lb ft)



690RY00003

2. Rear bumper adjustment.
   - When the bolts fixing rear bumper assembly are tightened, adjustment should be made with shims so that clearances shown in the figure below are provided between the body (tailgate) (4) and the rear bumper(5).



690RW009

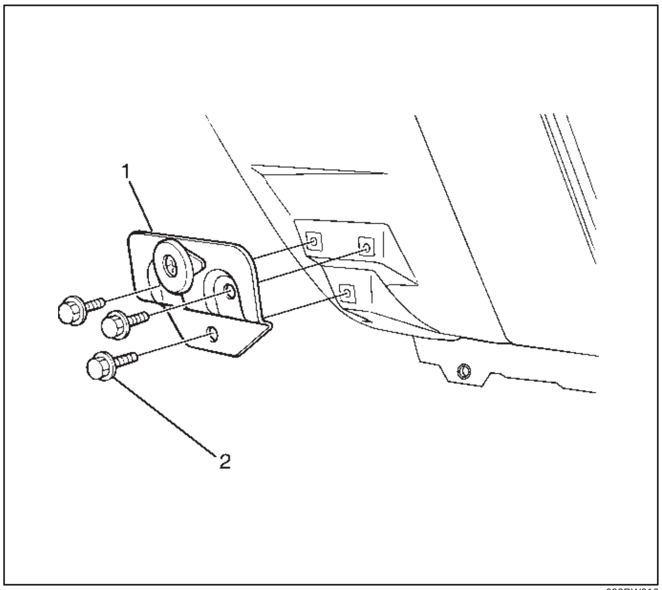
3. Tighten the spare tire fixing bolts to the specified torque.

Torque : 118 N·m (87 lb ft)

Rear Bumper Slider

Removal

1. Remove the Rear bumper.
   - Refer to Rear bumper removal (in this section).
2. Remove the rear bumper slider(1).
   - Remove the three bolts(2).



690RW016

Installation

To install, follow the removal steps in reverse order, noting the following point.

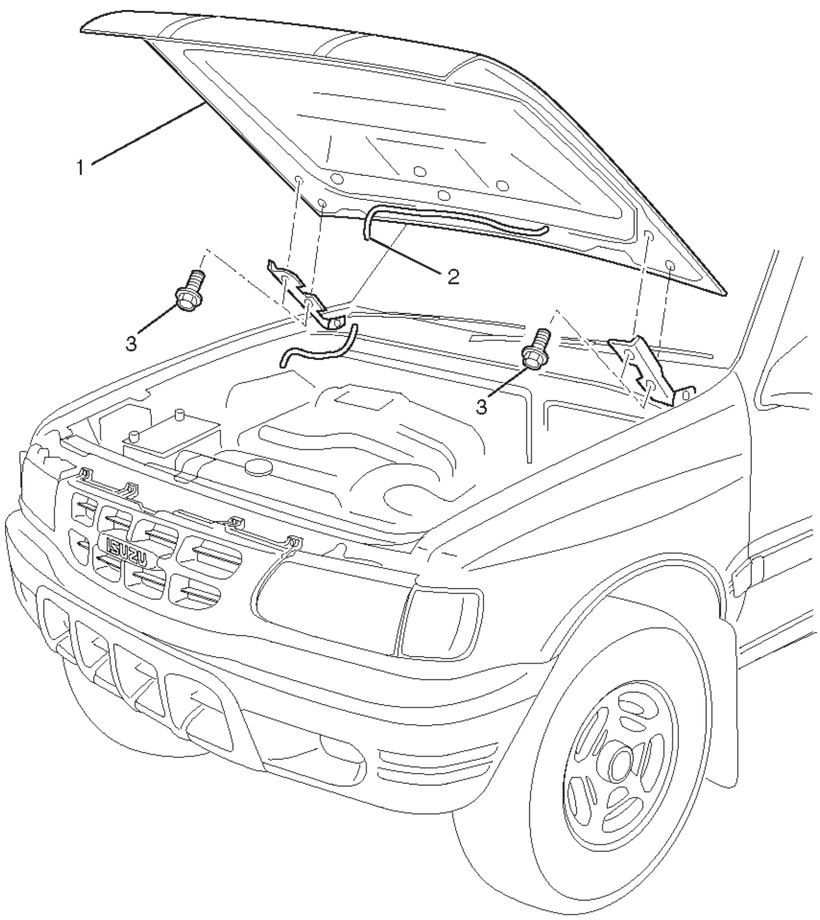
1. Apply chassis grease to the slider and the slider bracket moving surface.

General Description (Sheet Metal)

This section includes items of front end sheet metal that are attached by bolts, screws or clips and related accessory components.
Anticorrosion materials have been applied to the interior surfaces of some metal panels to provide rust resistance. When servicing these panels, areas on which this material has been disturbed, should be properly recoated with service–type anticorrosion material.

Engine Hood

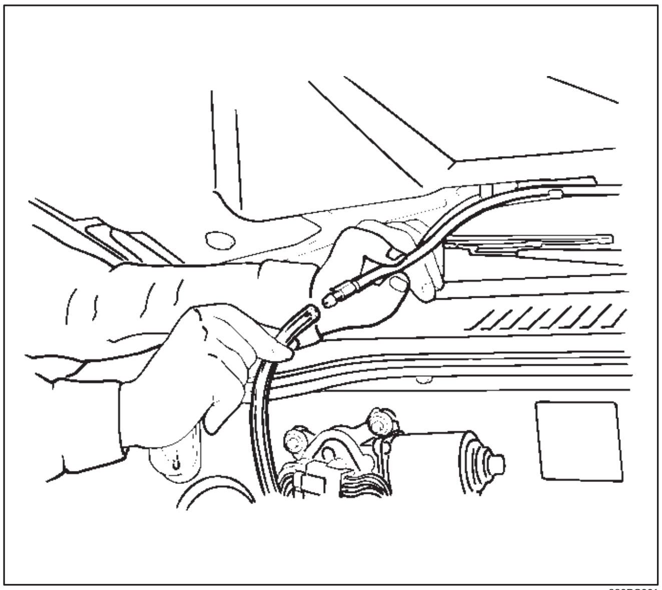
Parts Location



Legend
(1) Engine Hood Assembly
(2) Windowshield Washer Nozzle Tube
(3) Hood Hinge Bolt

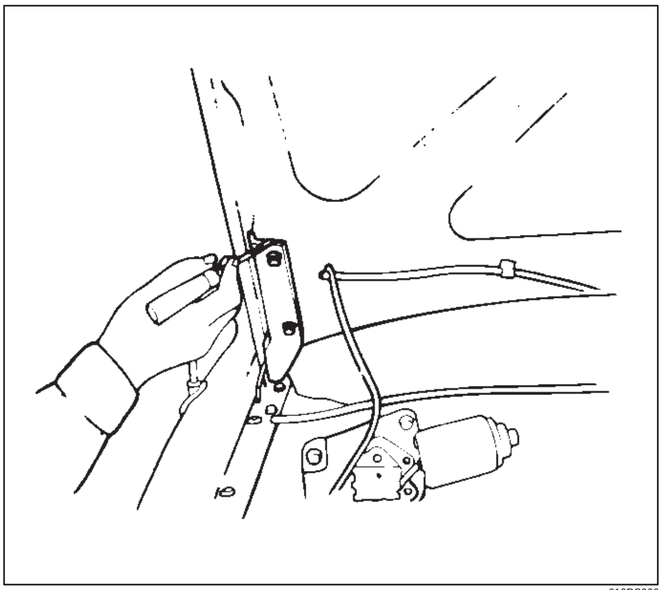
Removal

1. Open the hood.
2. Support the hood.
3. Remove the windshield washer nozzle tube.



880RS001

4. Remove the hood hinge bolts.
   - Before removing the hinges from the engine hood, scribe a mark showing location of the hinges to facilitate installation in the original position.



610RS006

5. Remove the engine hood.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the engine hood hinge fixing bolts to the specified torque.

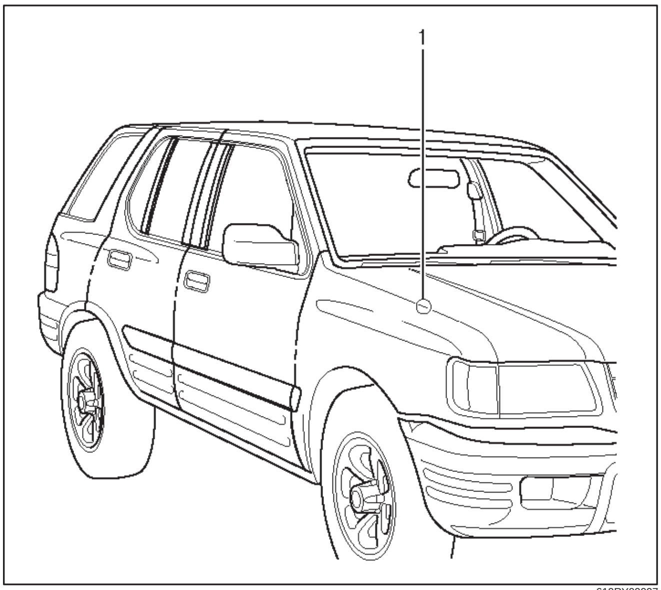
   Torque : 10 N·m (87 lb in)

2. Check the engine hood and fender(1).

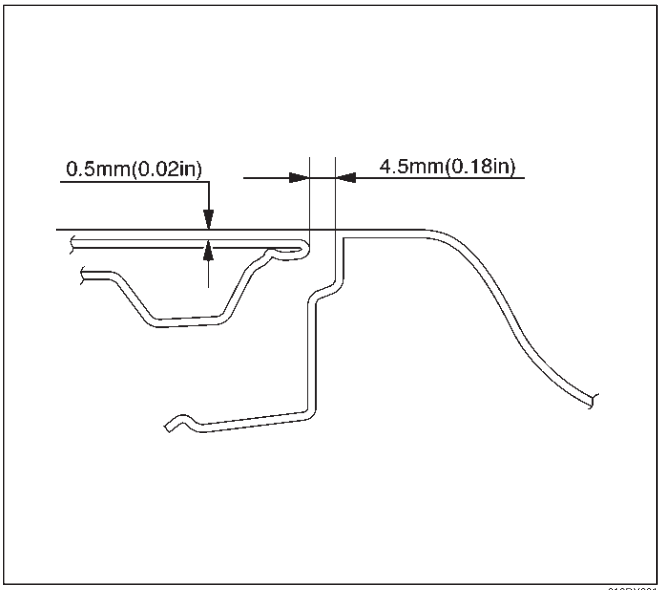
   Clearance: 4.5 mm (0.18 in)

   Height (step): 0.5 mm (0.02 in)

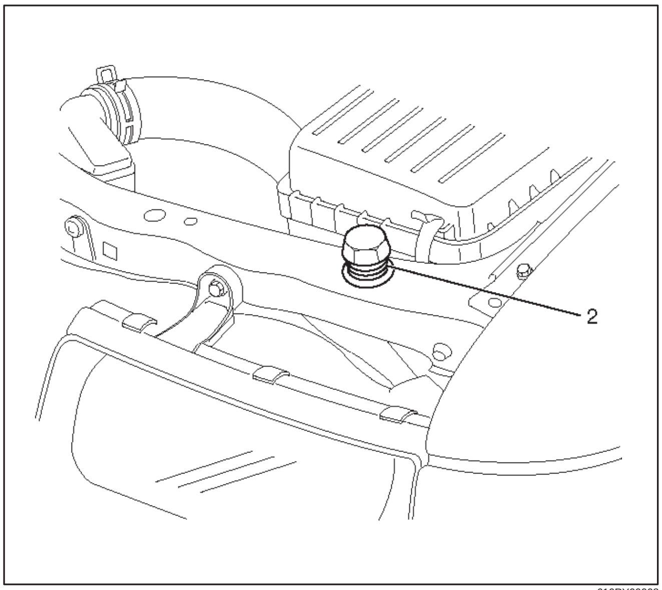
   - Adjust clearance with the hinges on the engine hood.
   - Adjust height (step) with the hood rests(2).



610RY00007



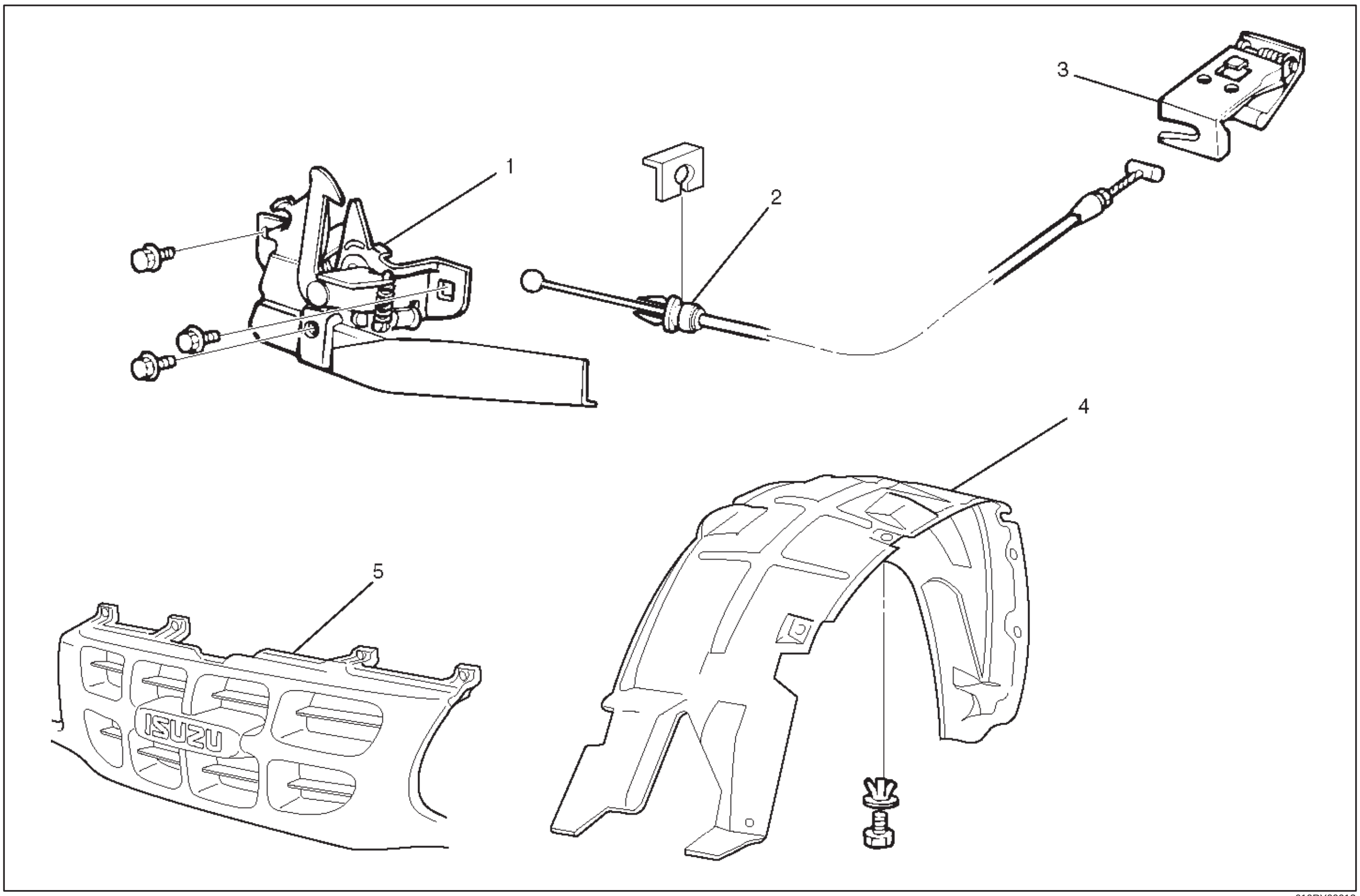
610RX001



610RY00008

Engine Hood Lock

Parts Location



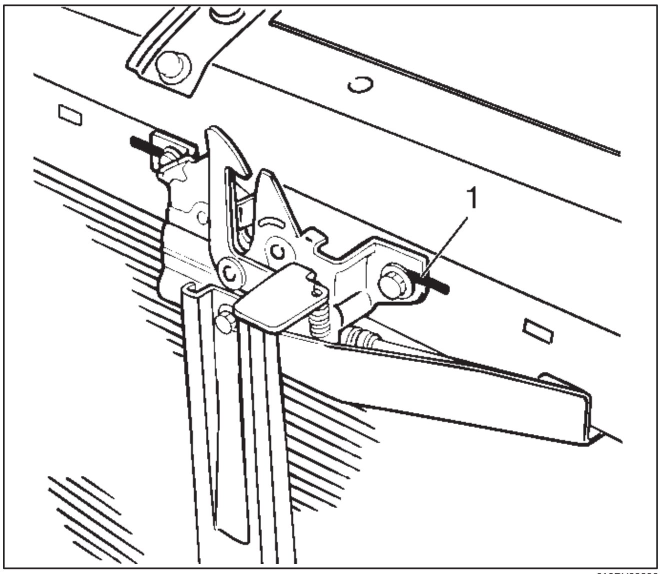
610RY00012

Legend

(1) Engine Hood Lock Assembly
(2) Control Cable
(3) Hood Lock Control Lever
(4) Inner Liner
(5) Radiator Grille

Removal

1. Remove the hood lock control lever.
2. Remove the inner liner.
3. Remove the control cable.
   - Remove the cable fixing clips from the body panel.
4. Remove the radiator grille.
   - Refer to Radiator Grille in this section.
5. Remove the engine hood lock assembly.
   - Apply setting marks(1) to the hood lock assembly and the body prior to removal.



610RY00006

Installation

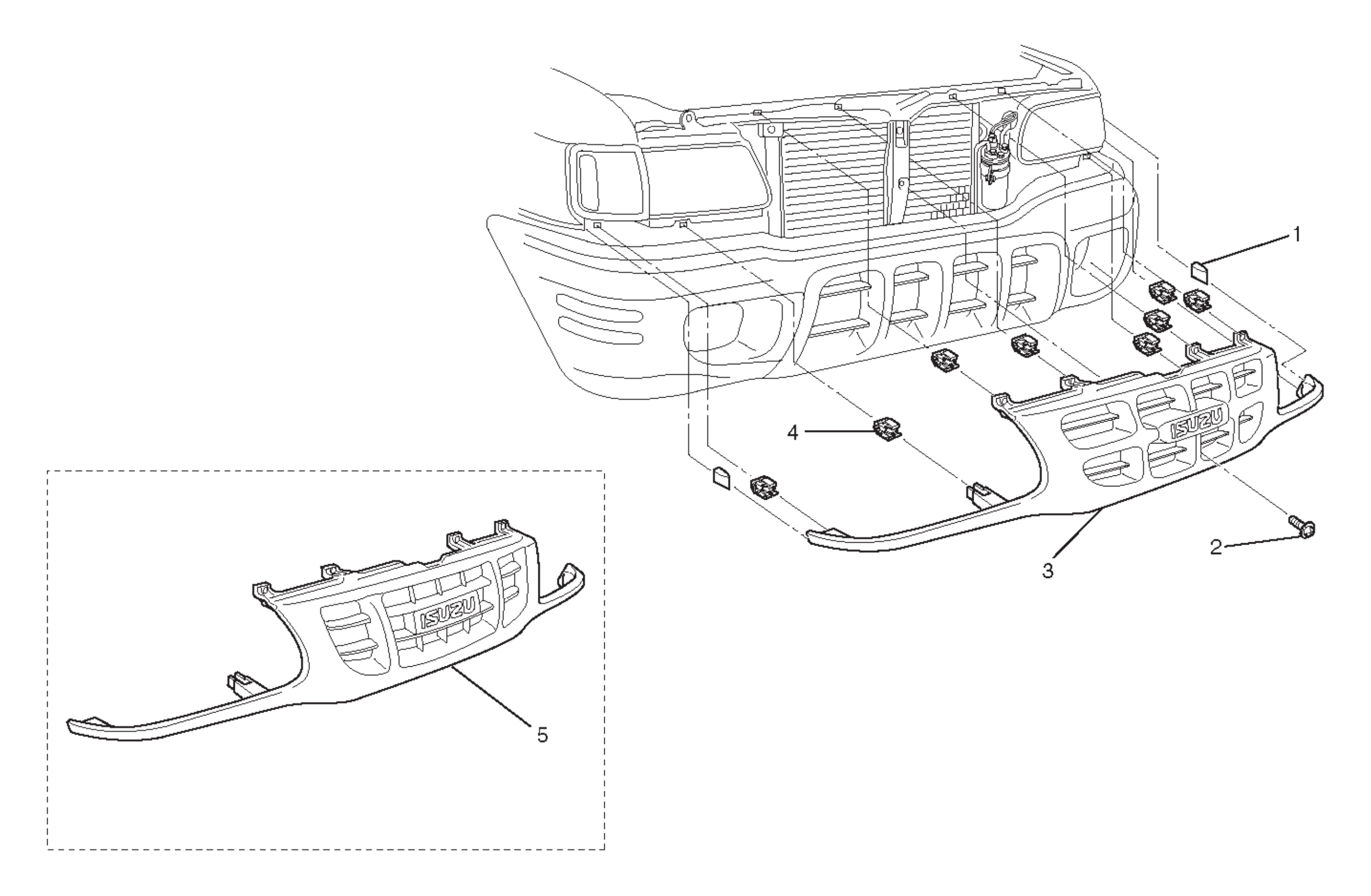
To install, follow the removal steps in the reverse order noting the following points:

1. Reroute the control cable to its original position, and check and see if the lock assembly and control lever work normally.
2. Tighten the hood lock assembly fixing bolts to the specified torque.

   Torque : 10 N·m (87 lb in)

Radiator Grille

Parts Location

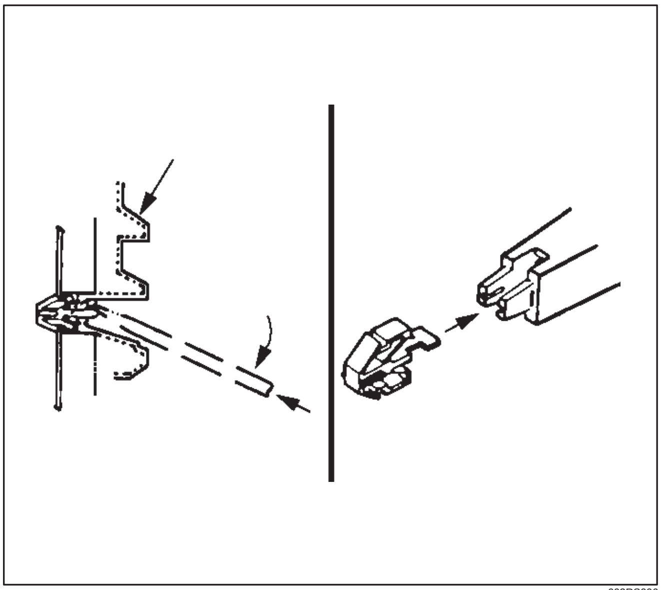


603RY00004

Legend
(1) Radiator Grille Rubber
(2) Screw
(3) Radiator Grille Assembly (LWB)
(4) Clip
(5) Radiator Grille Assembly (SWB)

Removal

1. Open the hood.
2. Support the hood.
3. Remove radiator grille.
   - Raise the clips on the radiator grille and remove screw.


603RS006

4. Pull out the radiator grille rubber from fender panel front lower side.

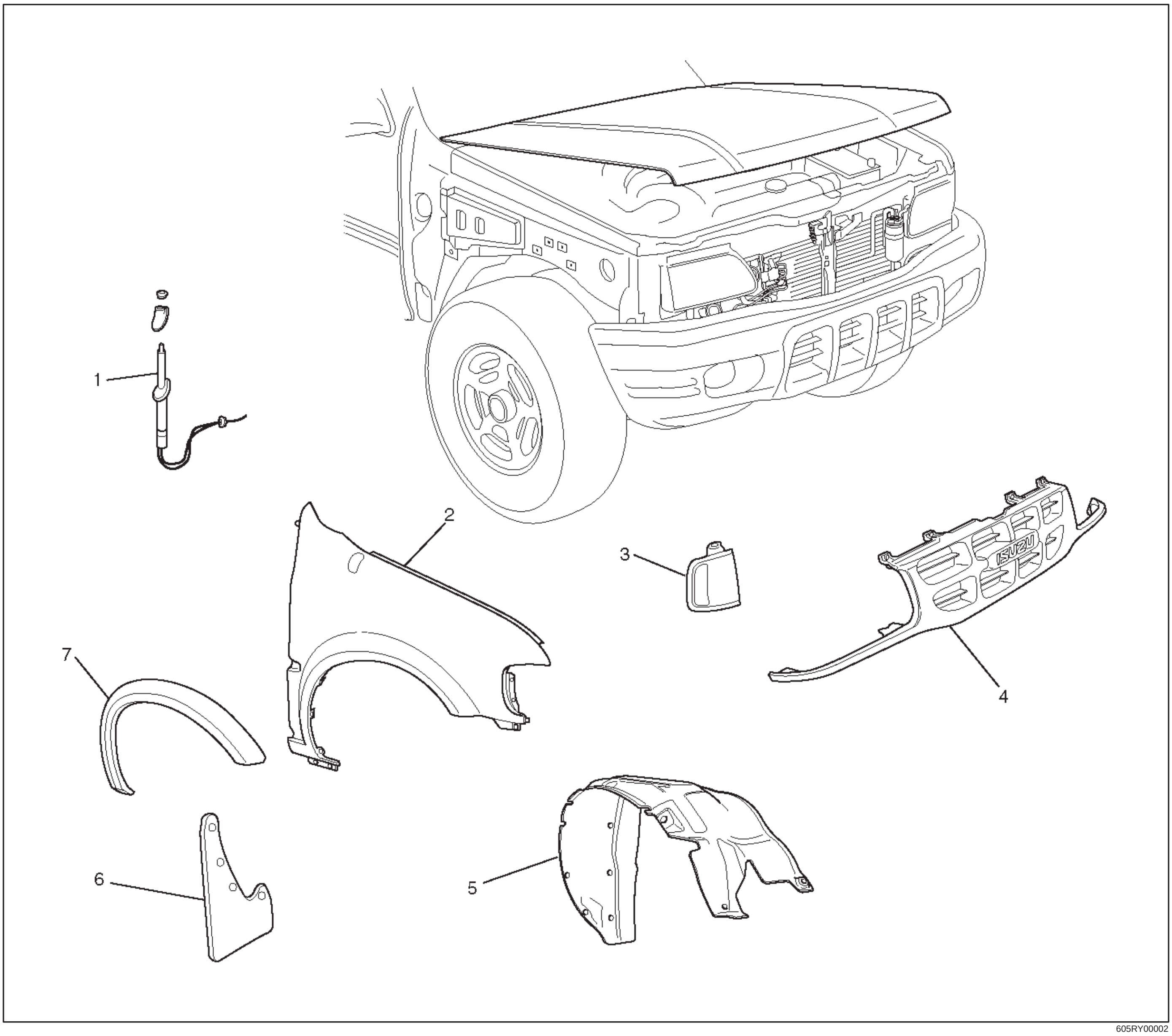
Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Install the radiator grille clips remaining on the body side in the radiator grille, and then install the radiator grille on the body.

Front Fender Panel

Parts Location



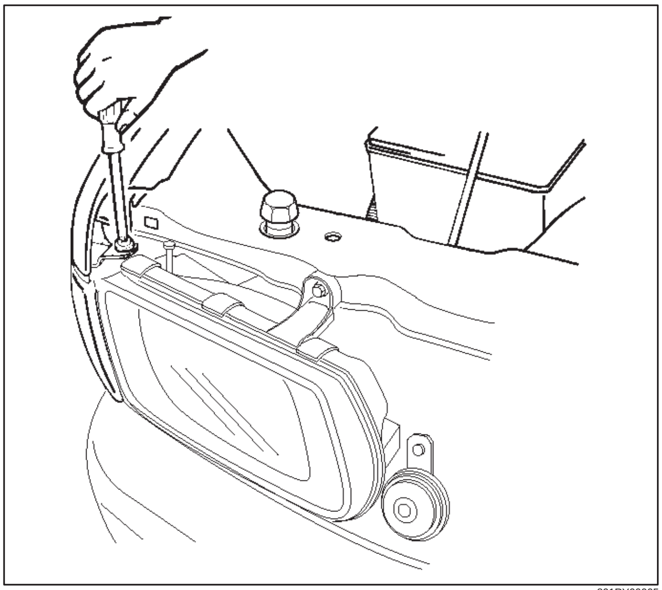
Legend

(1) Antenna Assembly
(2) Front Fender Panel
(3) Front Combination Light Assembly
(4) Radiator Grille
(5) Inner Liner
(6) Front Mud Flap
(7) Front Wheel Arch Moulding (if so equipped)

Removal

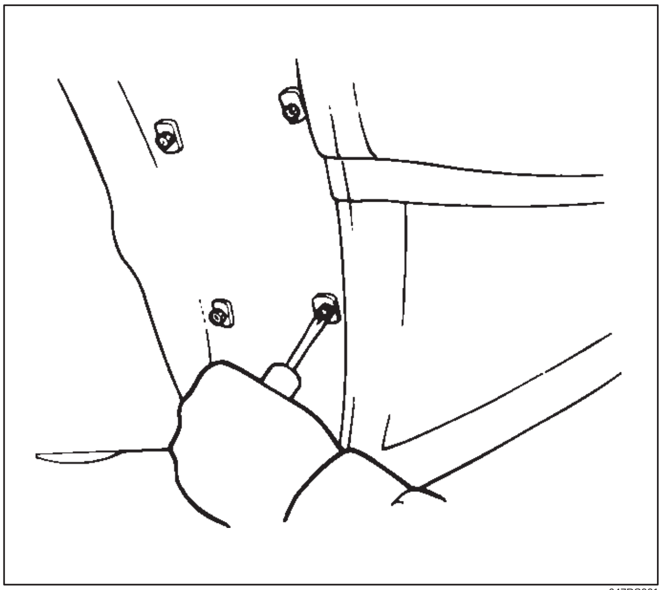
1. Disconnect the battery ground cable.
2. Remove the radiator grille assembly.
   - Refer to Radiator Grille in this section.

3. Remove the front combination light assembly.
   - Remove the fixing screw and disconnect the connector.



801RY00005

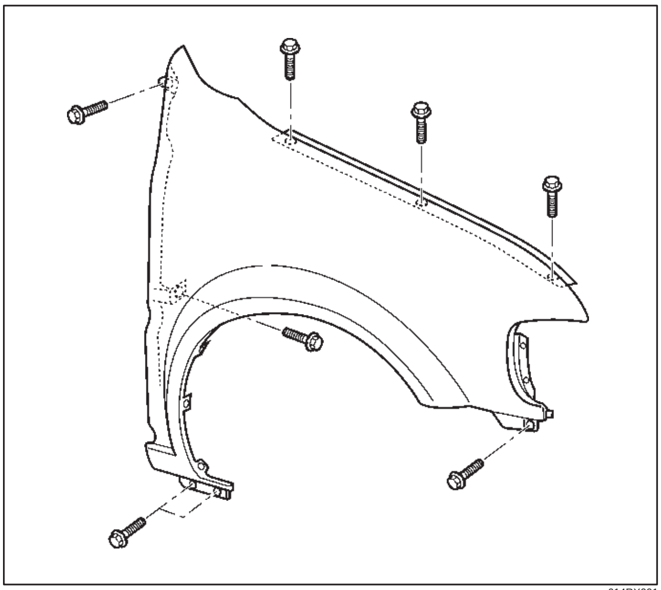
4. Remove the front mud flap.
5. Remove the inner liner.



647RS001

6. Remove the antenna assembly.
   - Refer to Rod Type Antenna in Entertainment section.

7. Remove the front fender panel.
   - Remove the eight fixing bolts.



614RX001

8. Remove the front wheel arch moulding (If so equipped).
   - Refer to Wheel Arch Moulding in Exterior/Interior Trim section.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

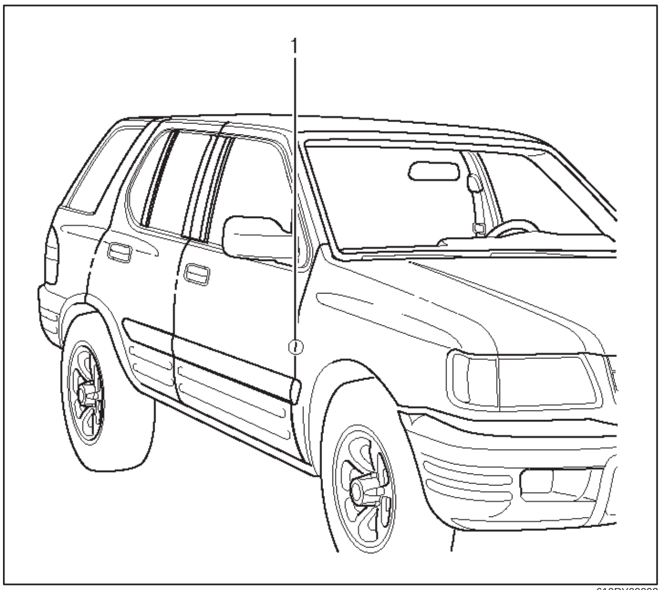
1. Tighten the front fender panel fixing bolts to the specified torque.

   Torque : 7 N·m (61 lb in)

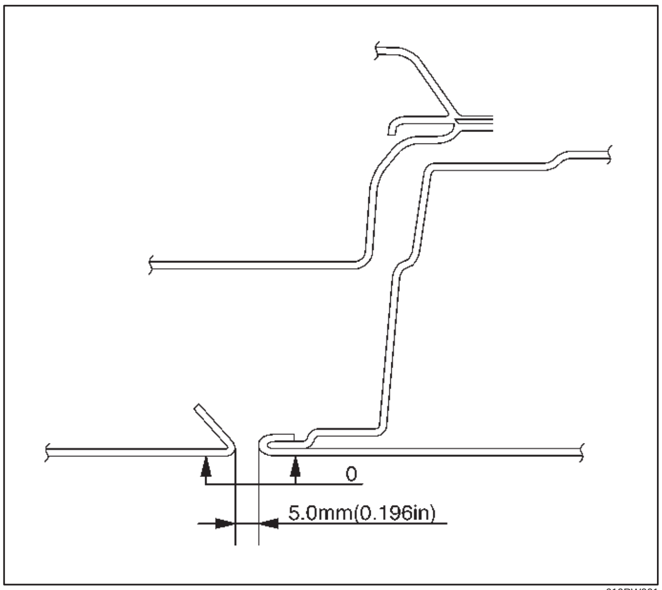
2. Check the fender and front door(1).

   Clearance: 5.0 mm (0.196 in)

   Height (step): Flush



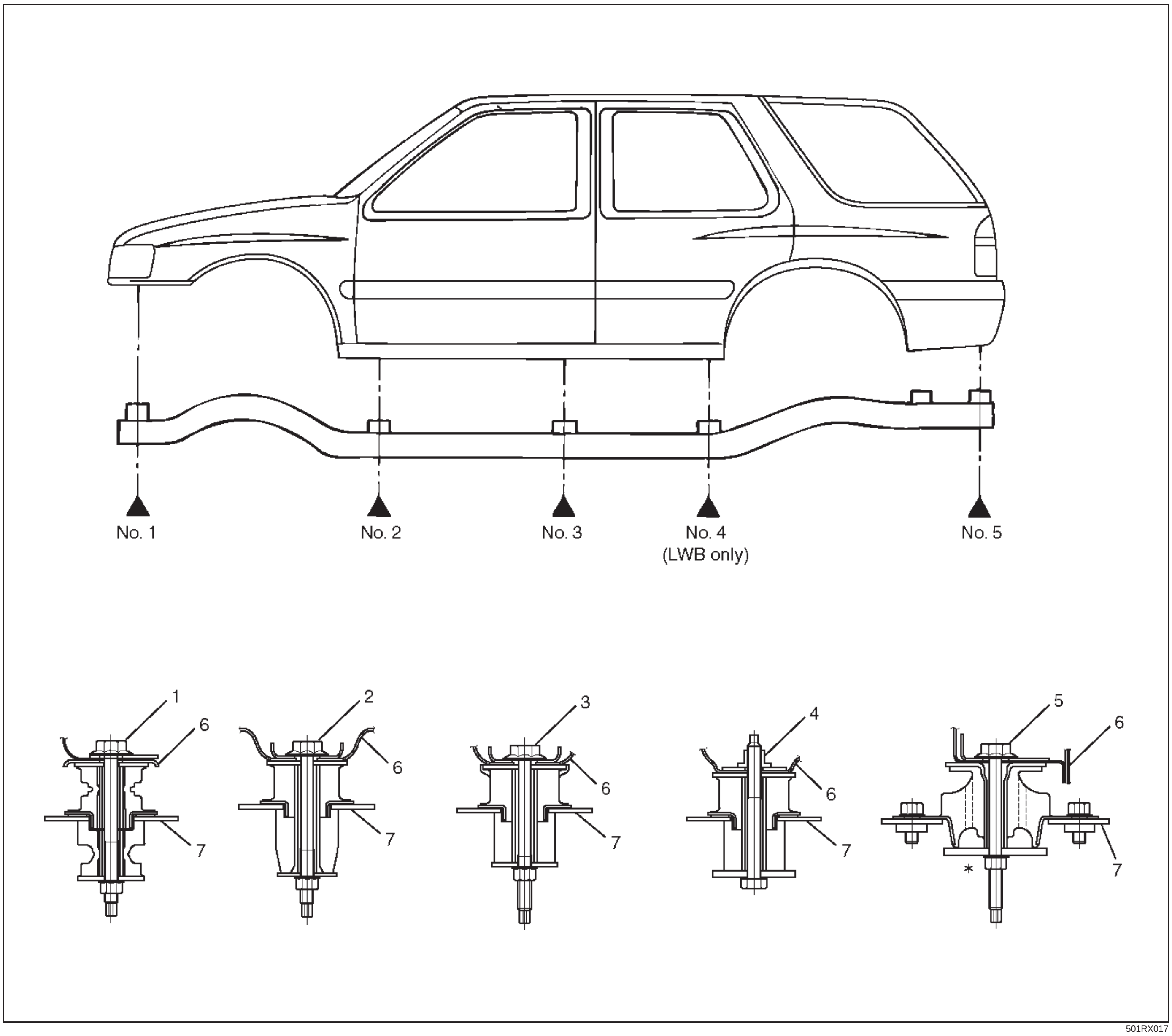
610RY00002



610RW001

Body Mounting

Parts Location



Legend

(1) No.1 Body Mounting
(2) No.2 Body Mounting
(3) No.3 Body Mounting
(4) No.4 Body Mounting (LWB only)
(5) No.5 Body Mounting
(6) Body Side Mounting Bracket
(7) Frame Side Mounting Bracket

Tightening Torque

1. Tighten the body mounting bolts to specified torque.

Torque : 50 N·m (41 lb ft)

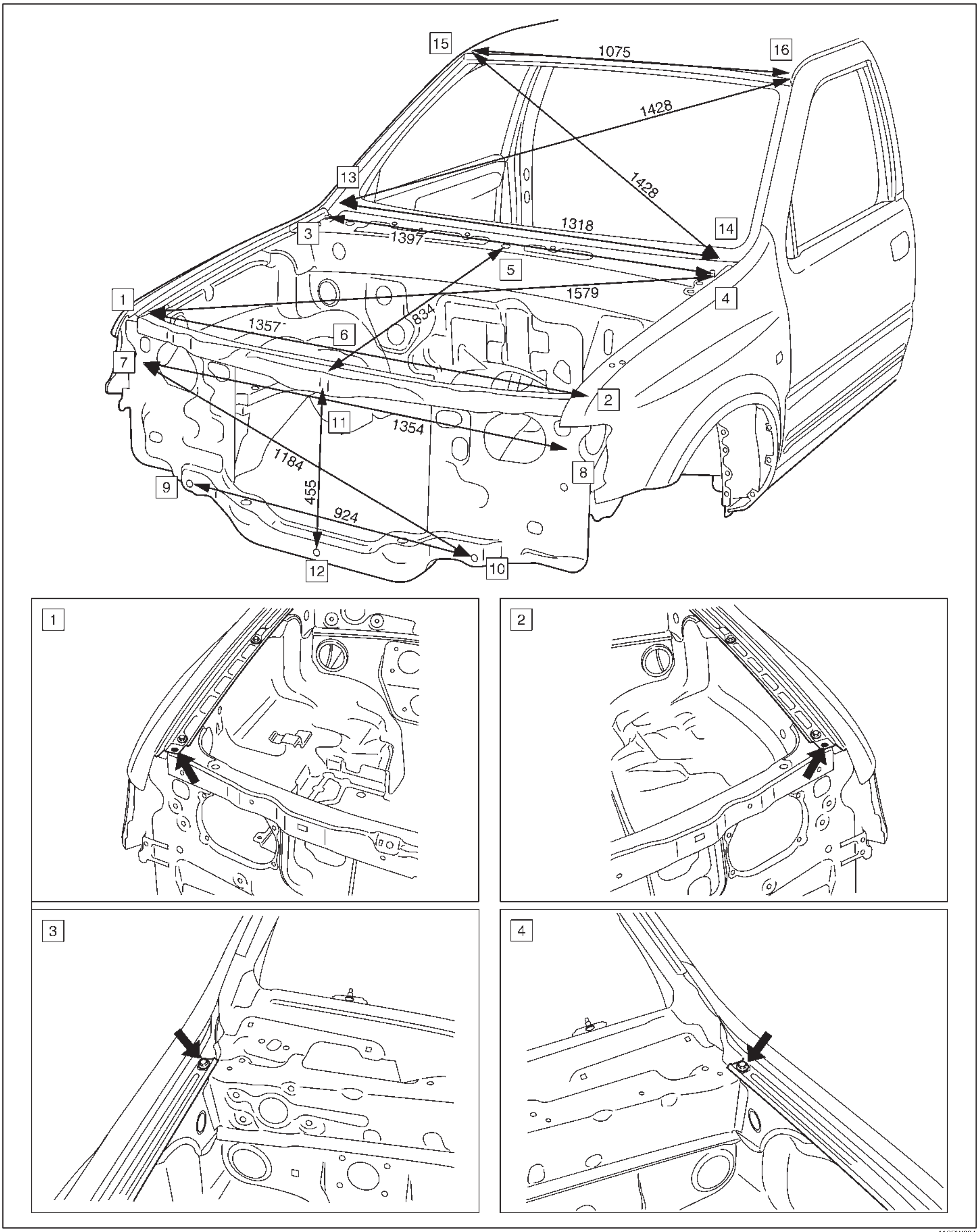
*** mark position**

(LWB) Torque : 50 N·m (41 lb ft)

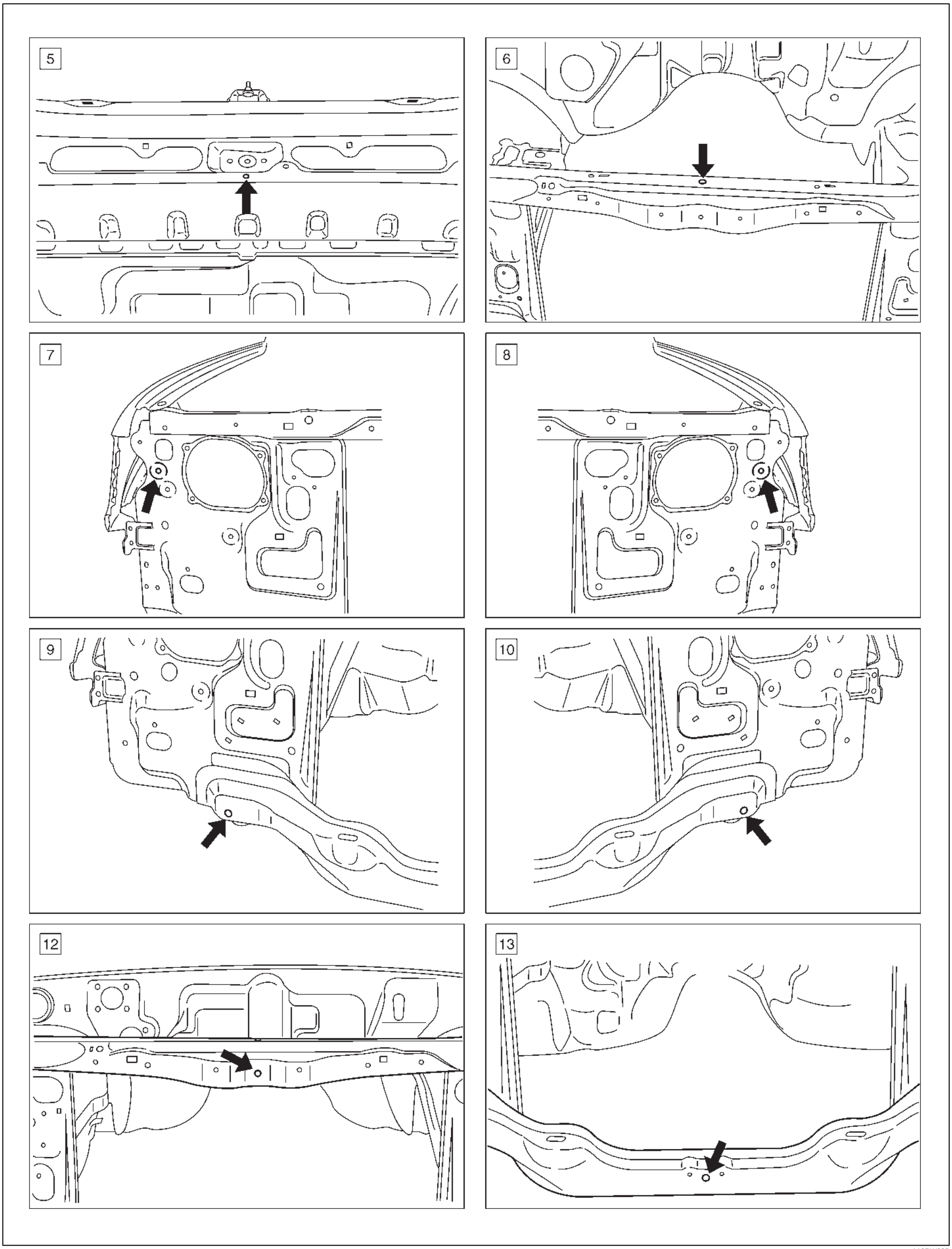
(SWB) Torque : 103 N·m (76 lb ft)

Body Dimension

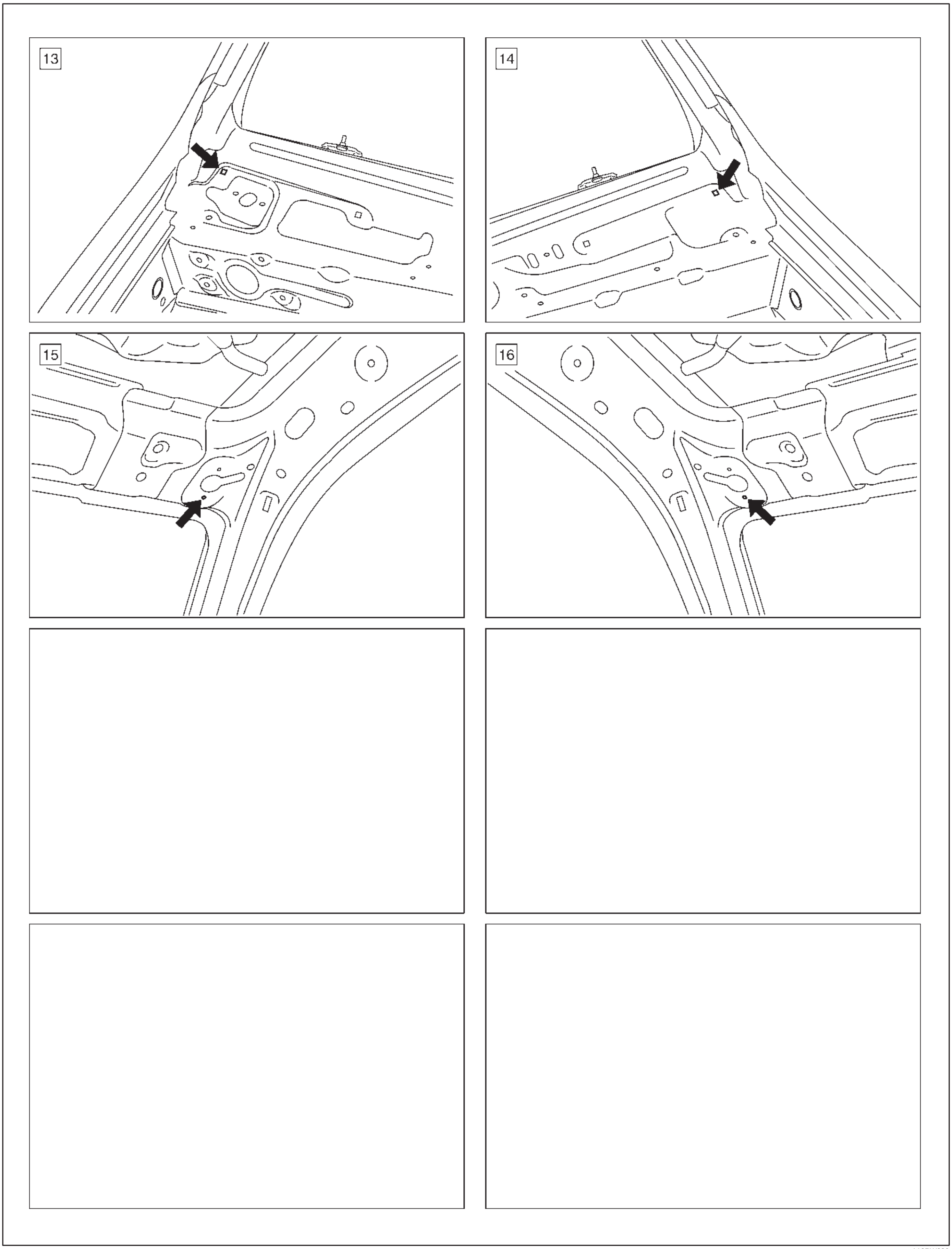
Front Section



A10RW034

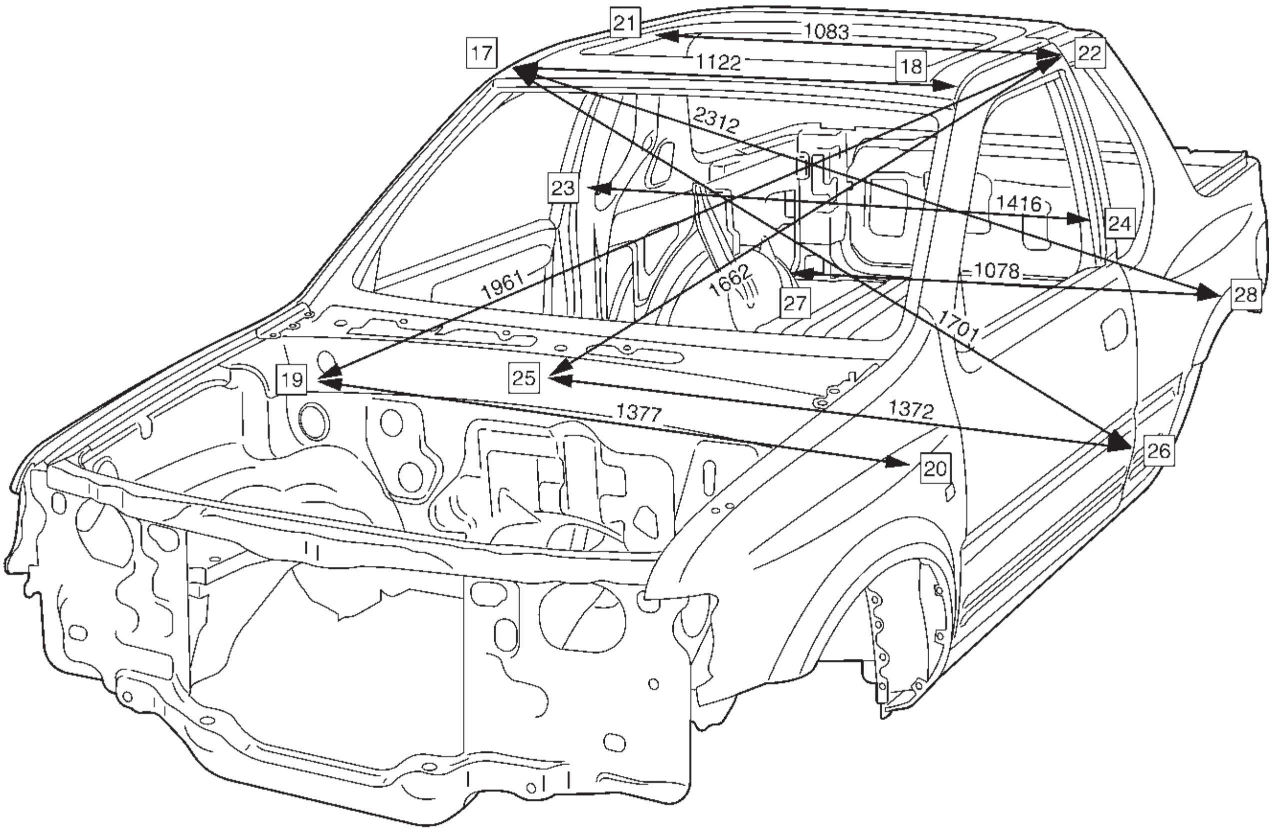


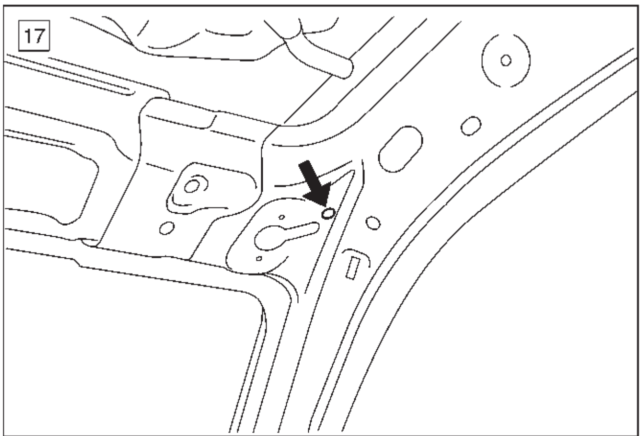
A10RW035

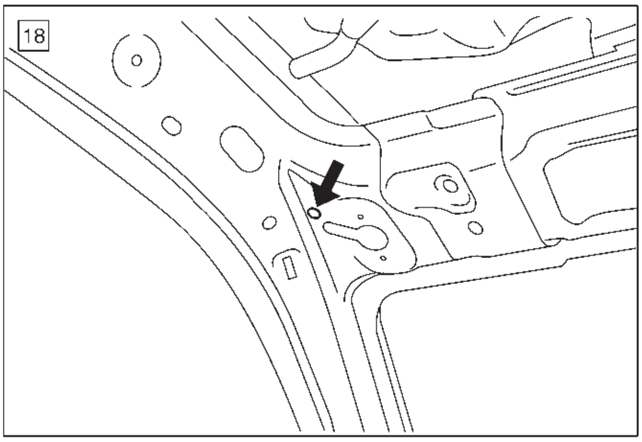


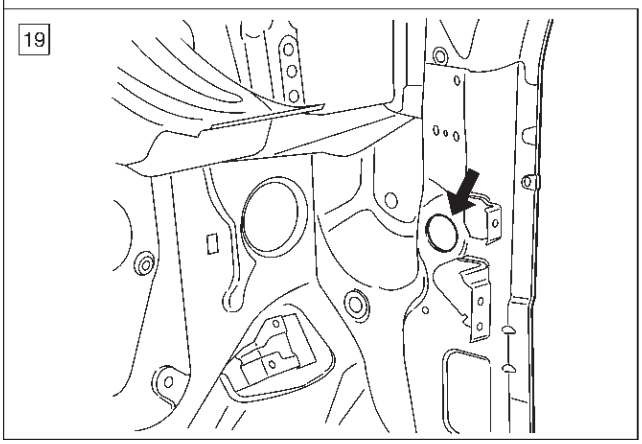
A10RW036

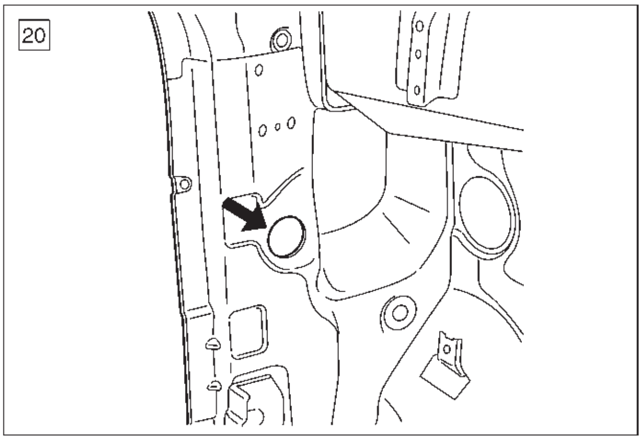
Room Section (SWB)



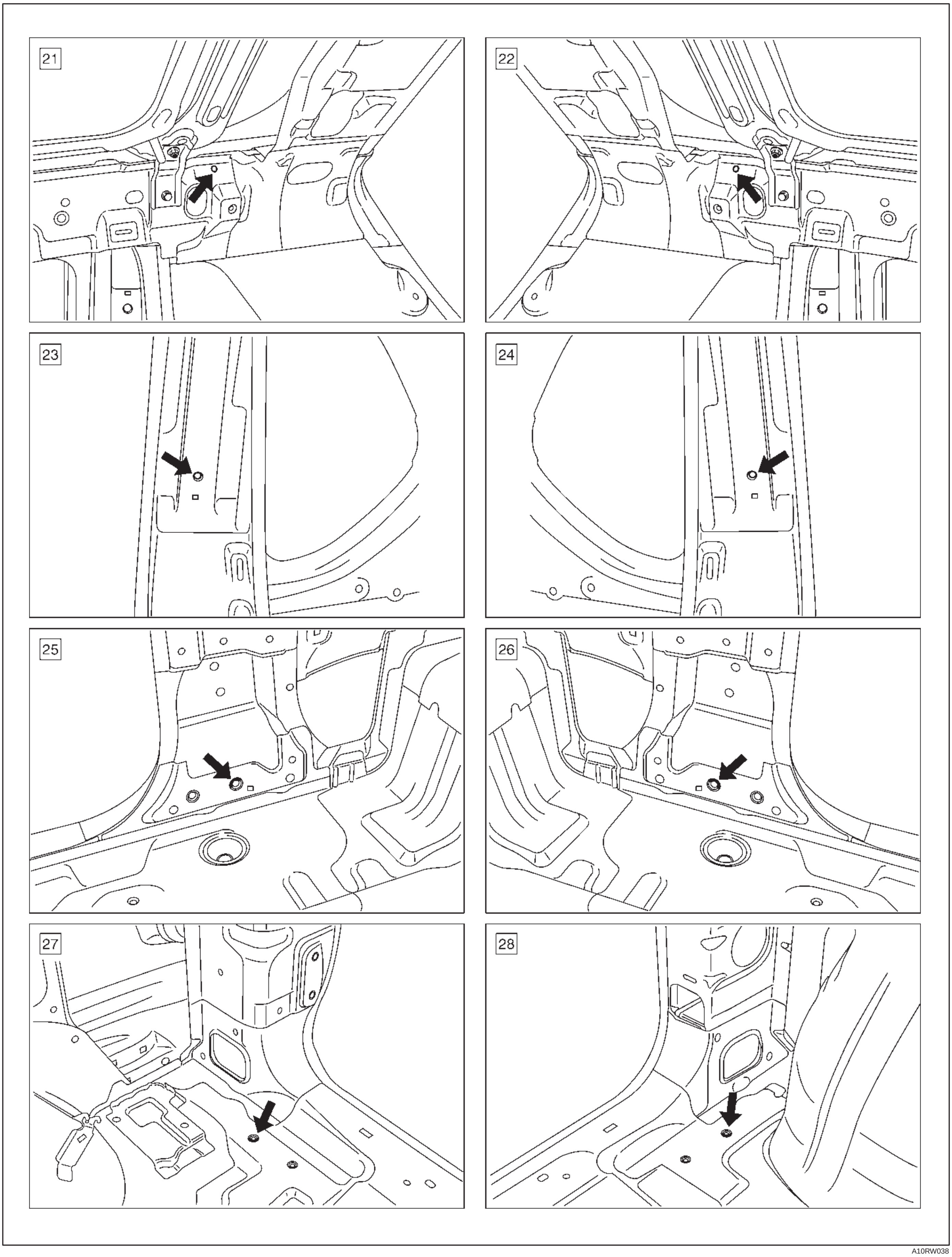








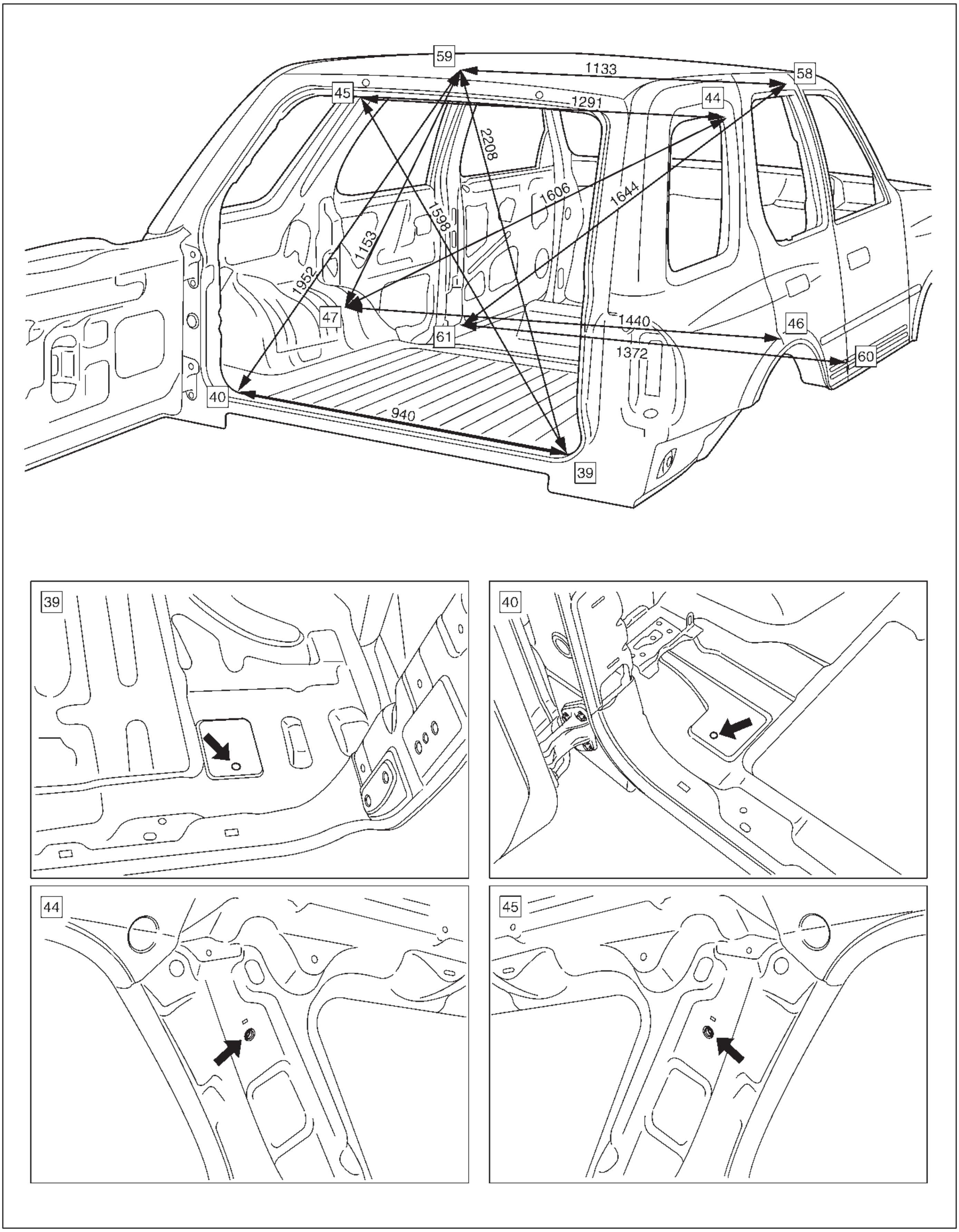
A10RW037



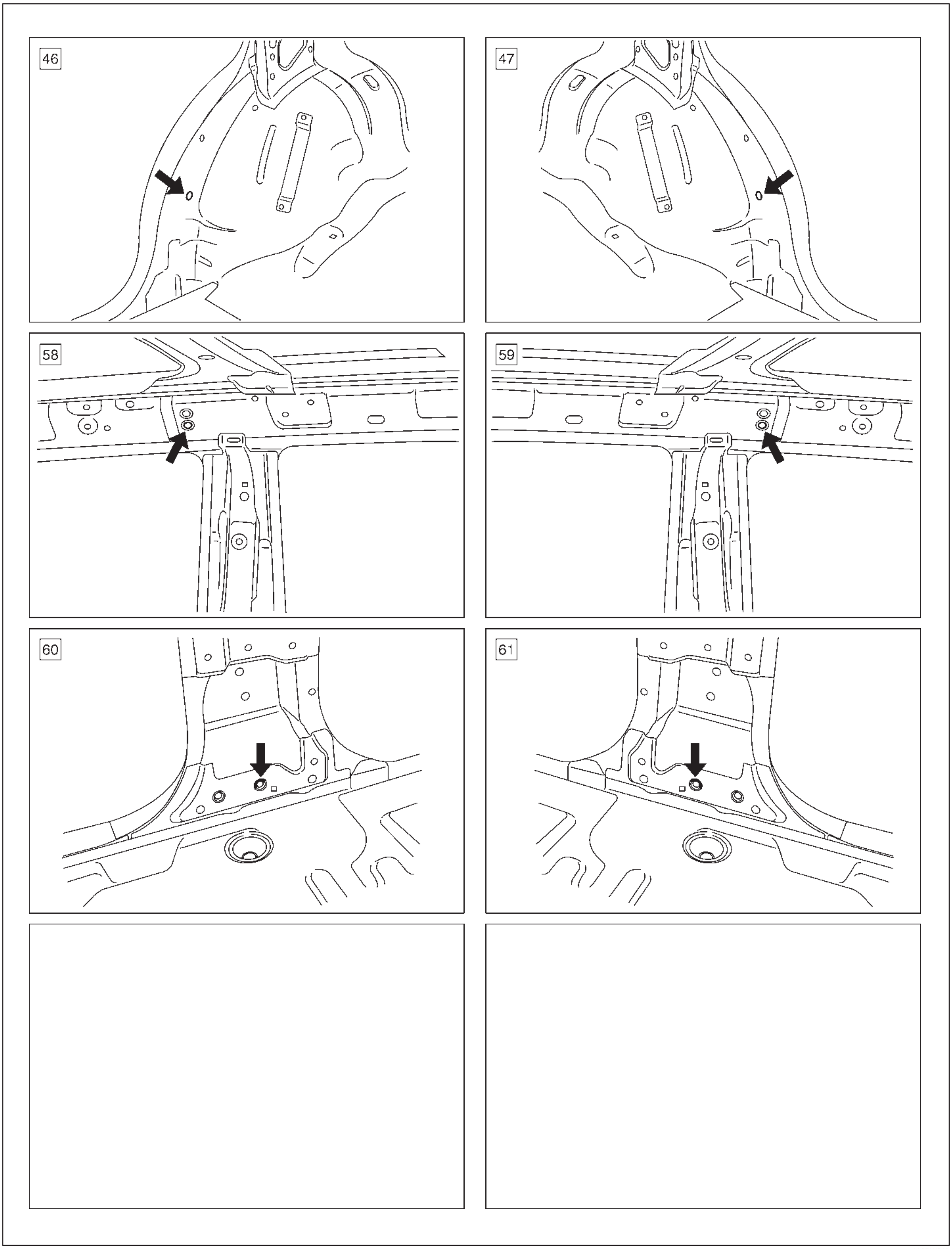
A10RW038

Room Section (LWB)

Refer to SWB for front side of room section.

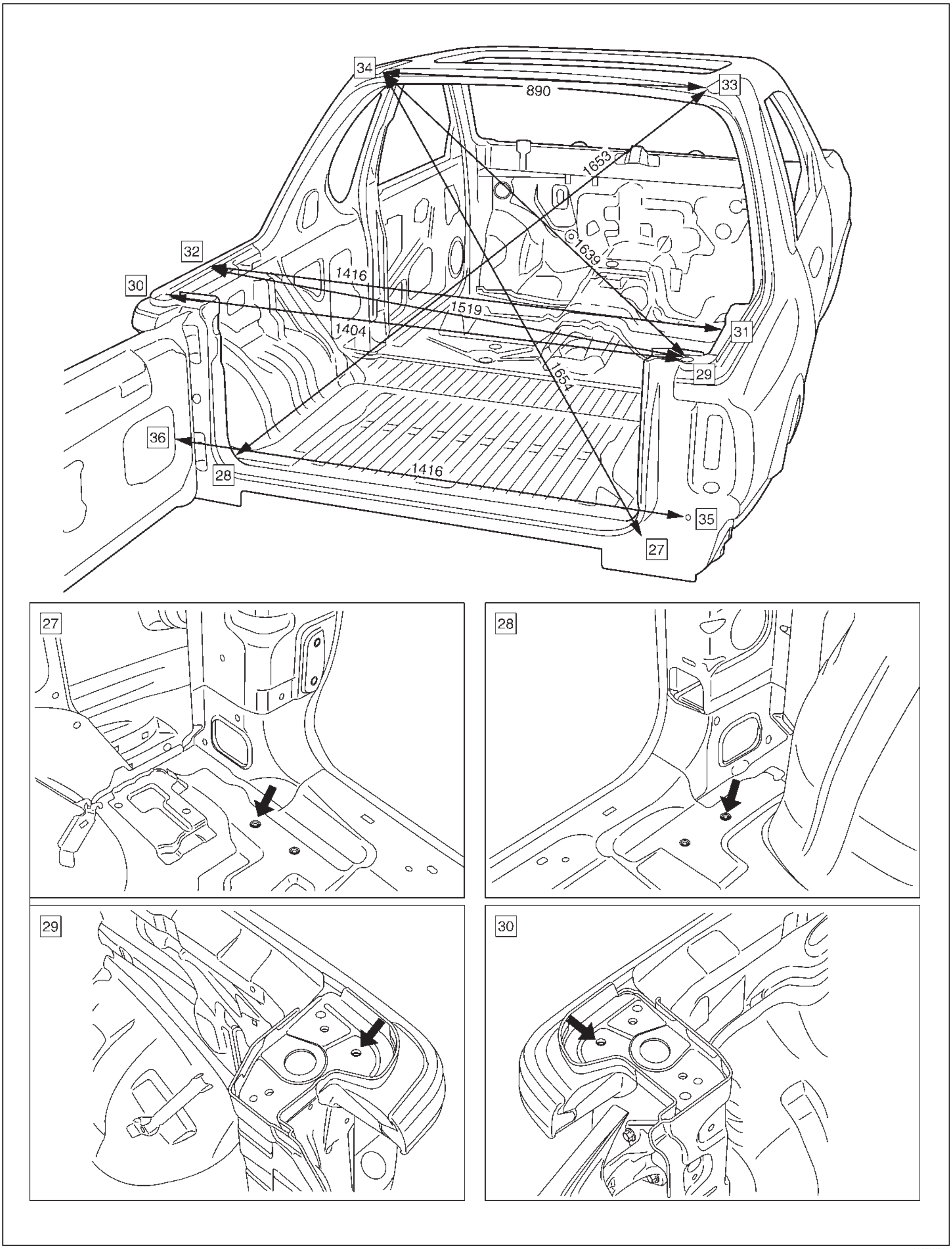


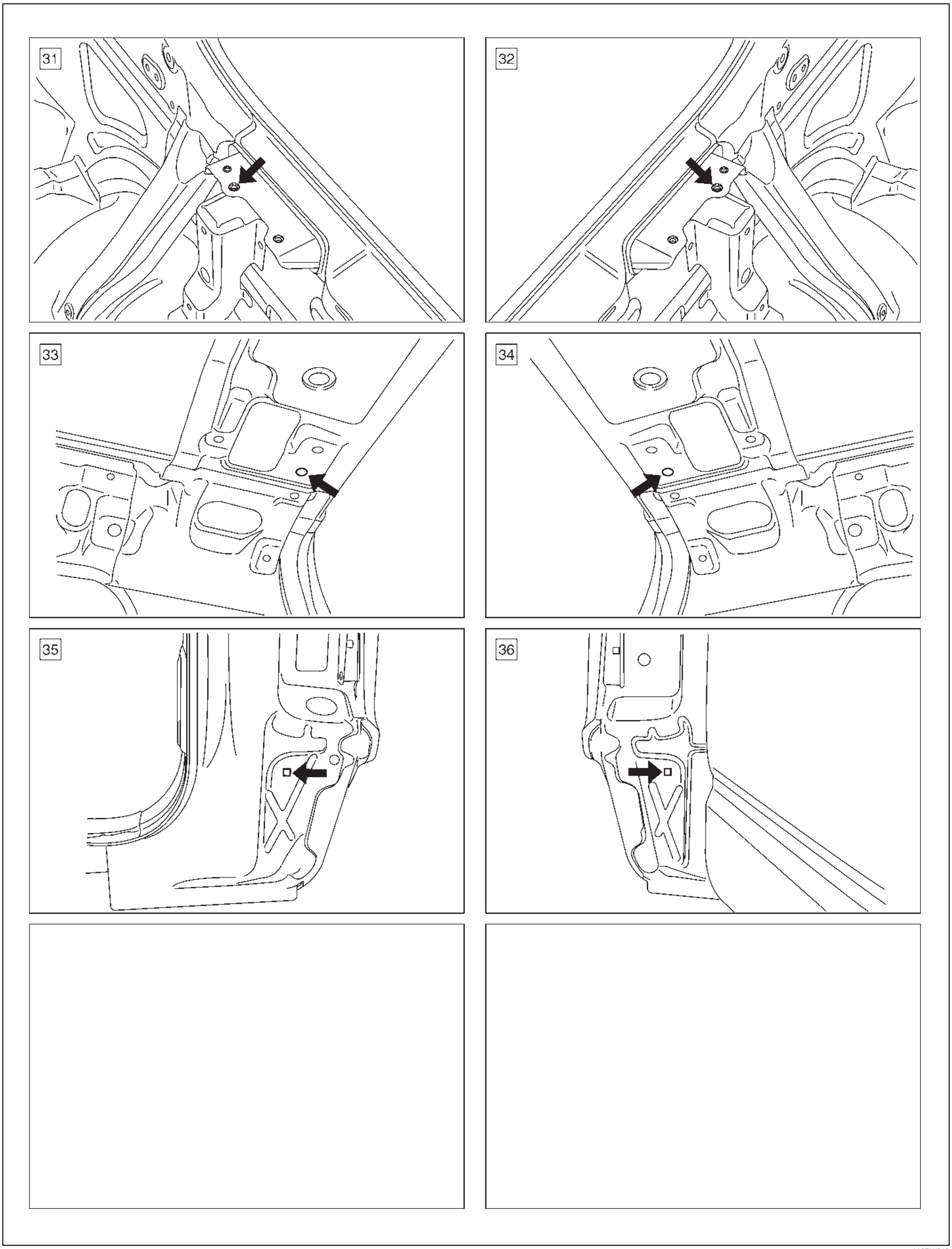
A10RW039



A10RW040

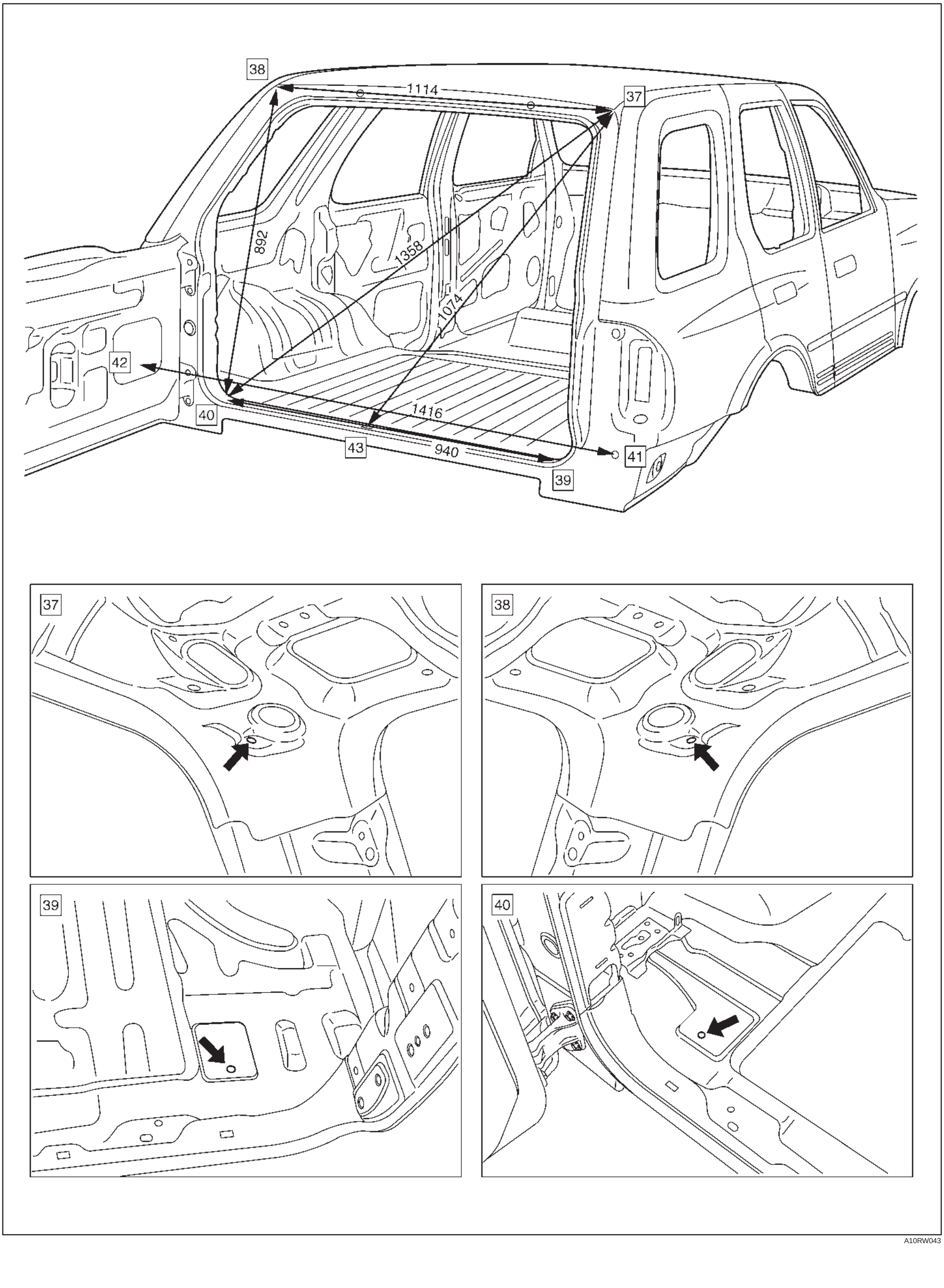
Rear Section (SWB)

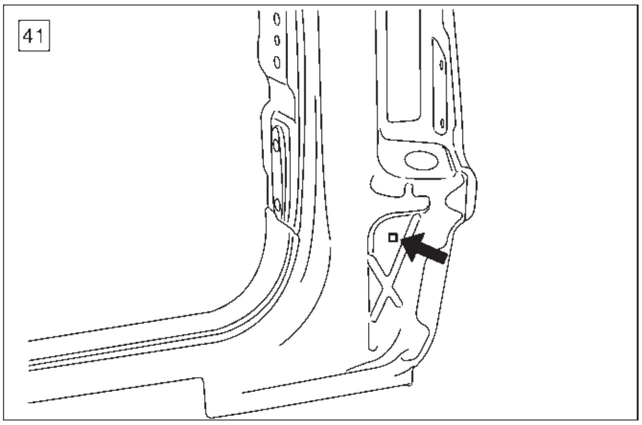


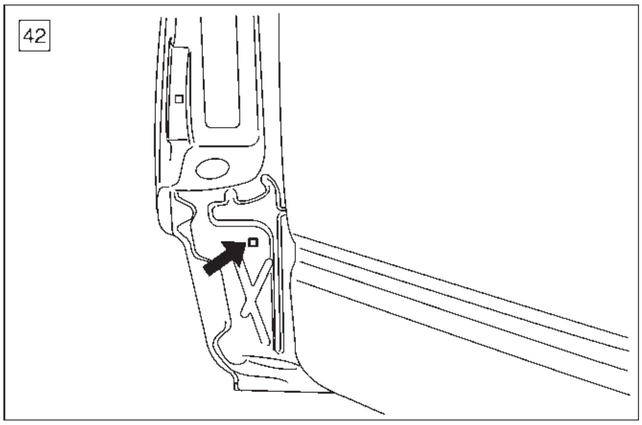


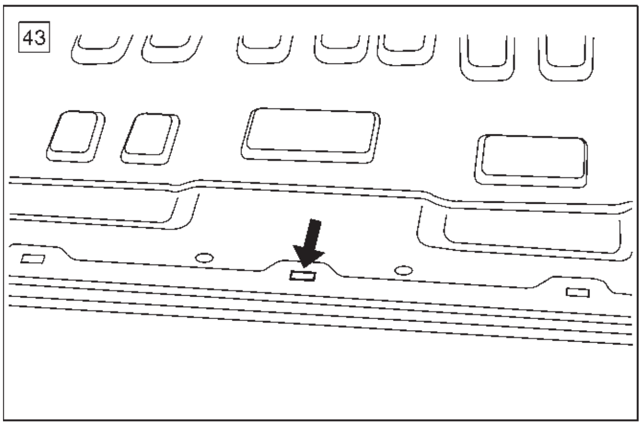
A10RW042

Rear Section (LWB)



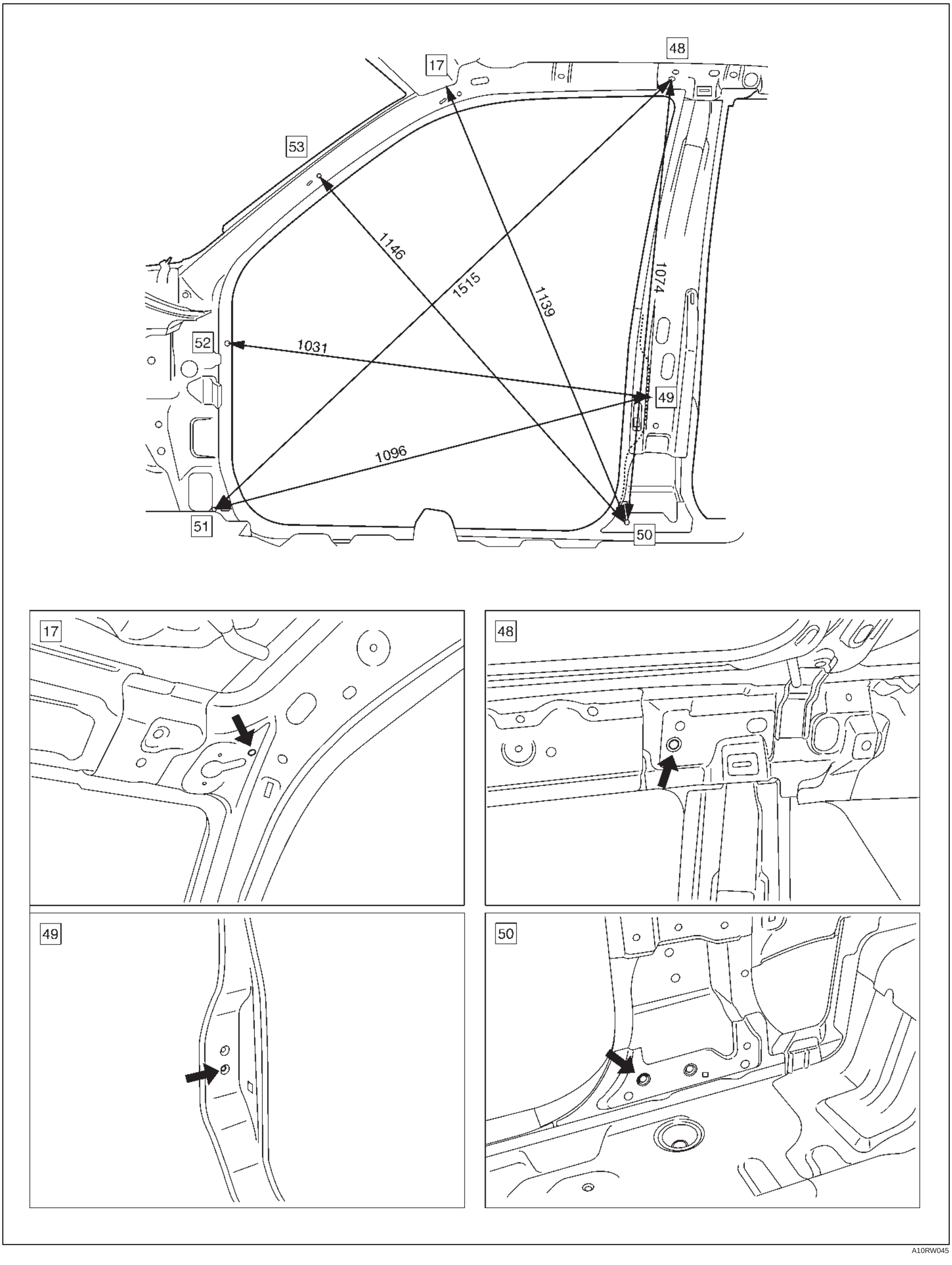


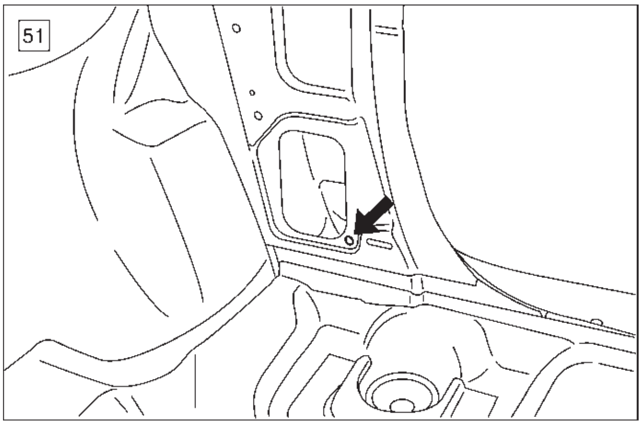


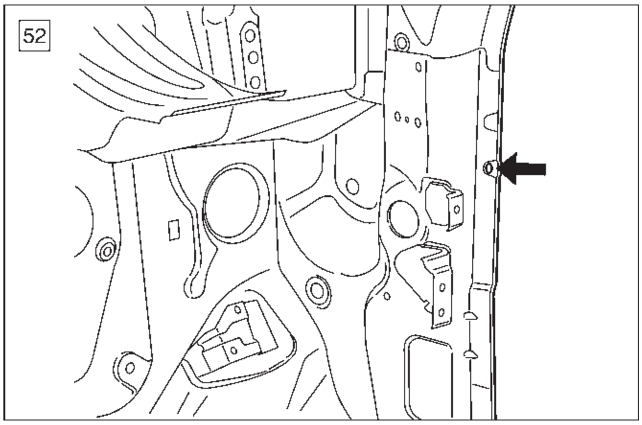


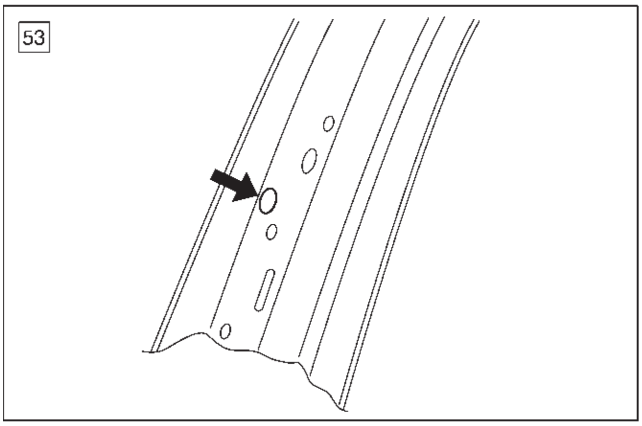
A10RW044

Side Body Section (Front side)



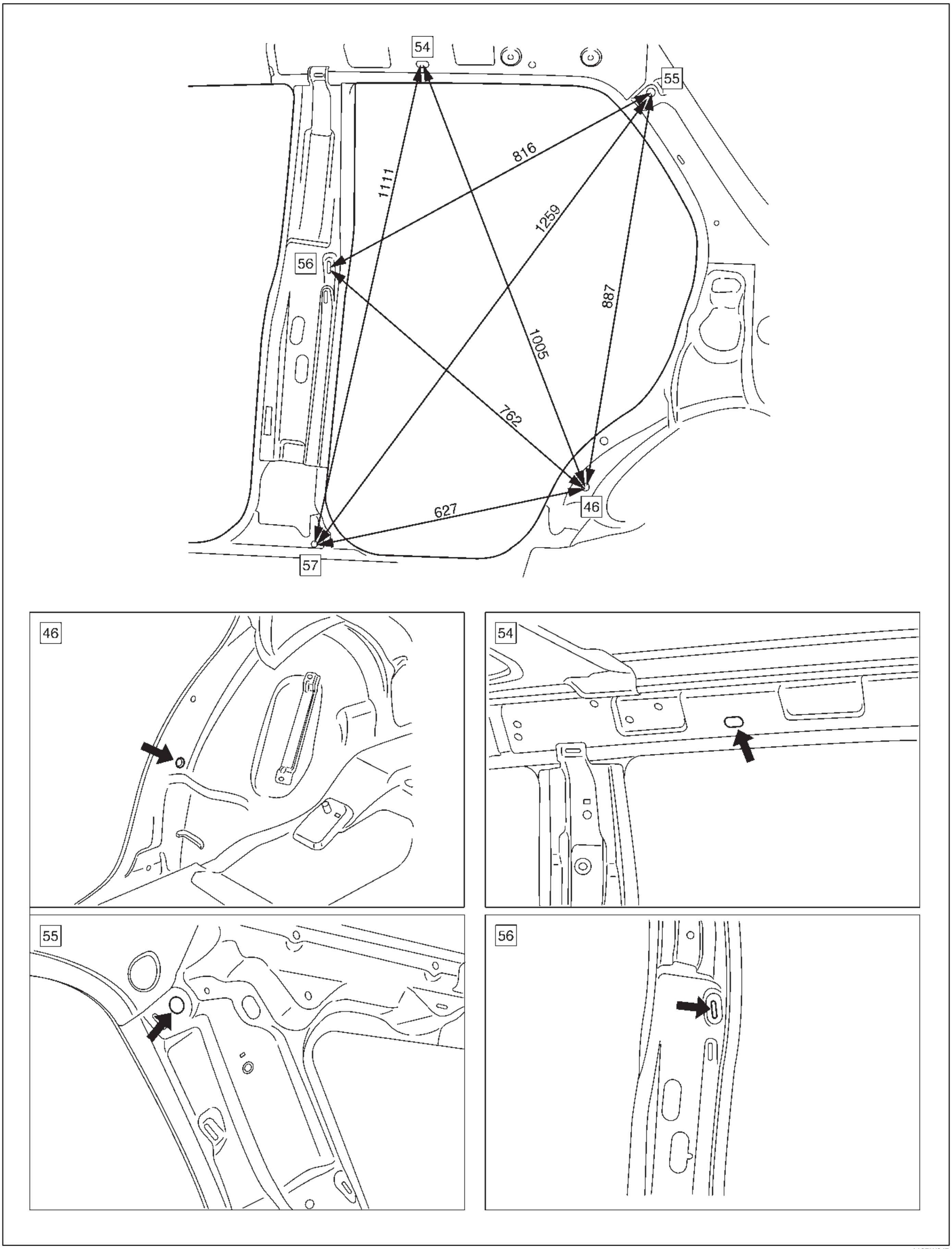






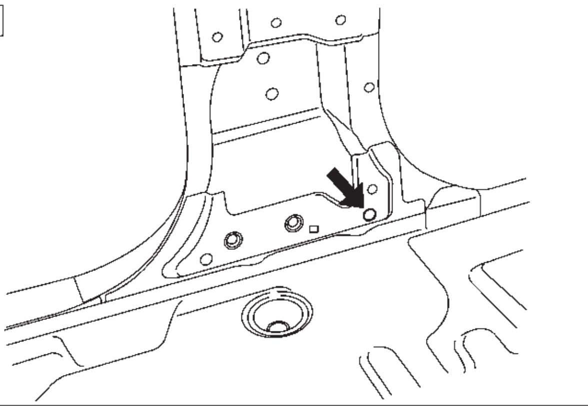
A10RW046

Side Body Section (Rear side)



A10RW047

57

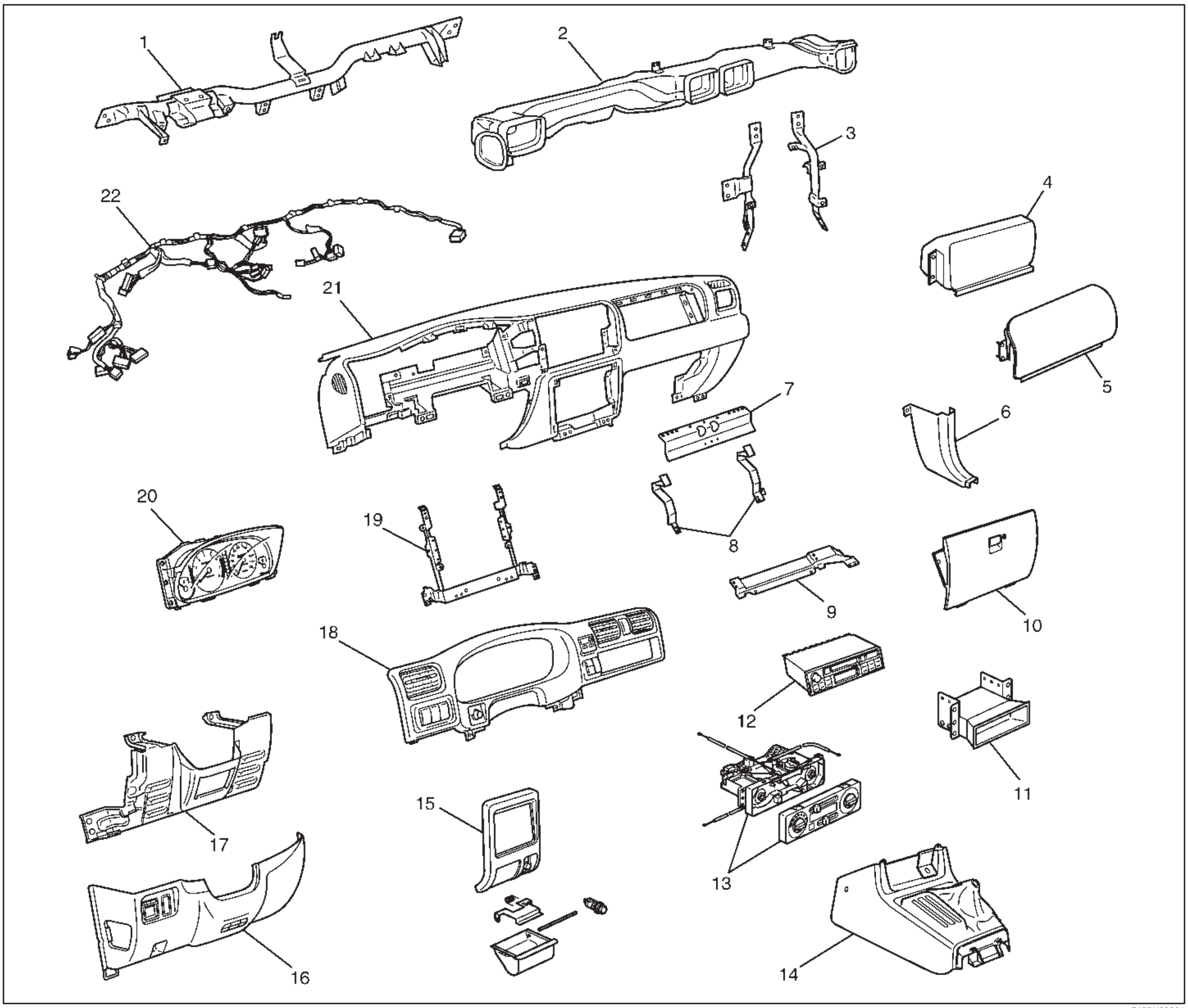


General Description (Body)

This publication contains essential removal, installation, adjustment and maintenance procedures.

Instrument Panel Assembly

Parts Location



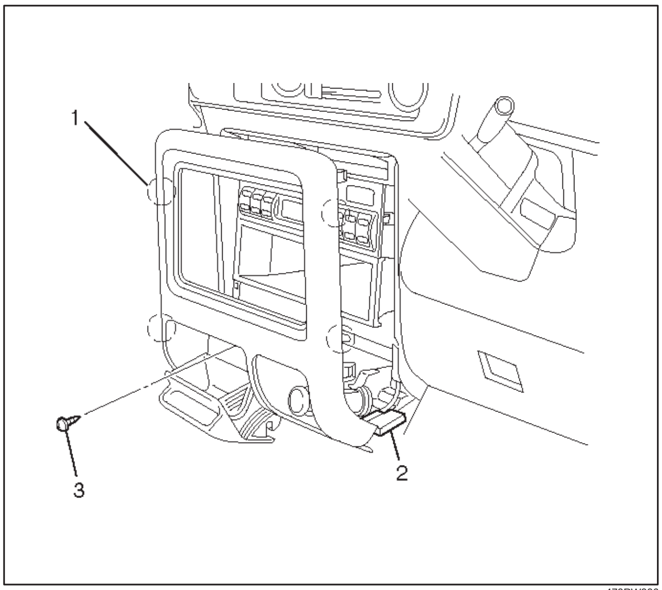
Legend

(1) Cross Beam
(2) Vent Duct Assembly
(3) Instrument Panel Stay
(4) Passenger Air Bag
(5) Passenger Air Bag Cover
(6) Dash Side Trim Panel
(7) Instrument Upper Reinforcement
(8) Glove Box Side Reinforcement
(9) Passenger Lower Bracket
(10) Glove Box
(11) Audio Sub Box
(12) Radio Assembly
(13) Control Lever Assembly
(14) Front Console Assembly
(15) Lower Cluster Assembly
(16) Instrument Panel Driver Lower Cover Assembly
(17) Driver Knee Bloster Assembly
(18) Meter Cluster Assembly
(19) Instrument Panel Center Reinforcement
(20) Meter Assembly
(21) Instrument Panel Assembly
(22) Instrument Harness Assembly

Removal

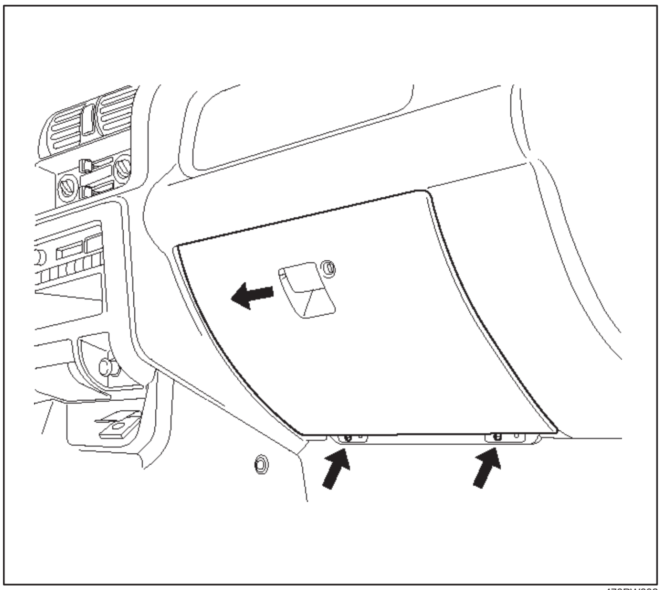
CAUTION: For precautions on installation or removal of SRS – air bag system, refer to Supplemental Restraint System (SRS) – AIR BAG in Restraint section.

1. Disconnect the battery ground cable.
2. Remove the lower cluster assembly.
   - Remove screw (3) and pull out the cluster at the clip positions (1).
   - Disconnect the cigarette lighter connectors (2).

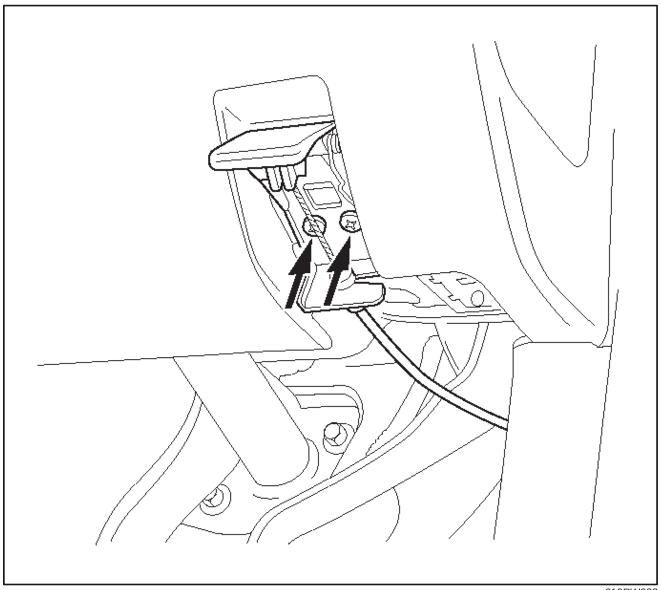


470RW006

3. Remove the radio assembly and audio sub box.
   - Refer to Radio in Entertainment section.
4. Remove the front and rear consoles.
   - Refer to Consoles in Exterior/Interior Trim section.
5. Remove the dash side trim panels.
   - Remove the sill plates, then remove the trim panels.
6. Remove the glove box.
   - Remove the two fixing screws.


470RW002

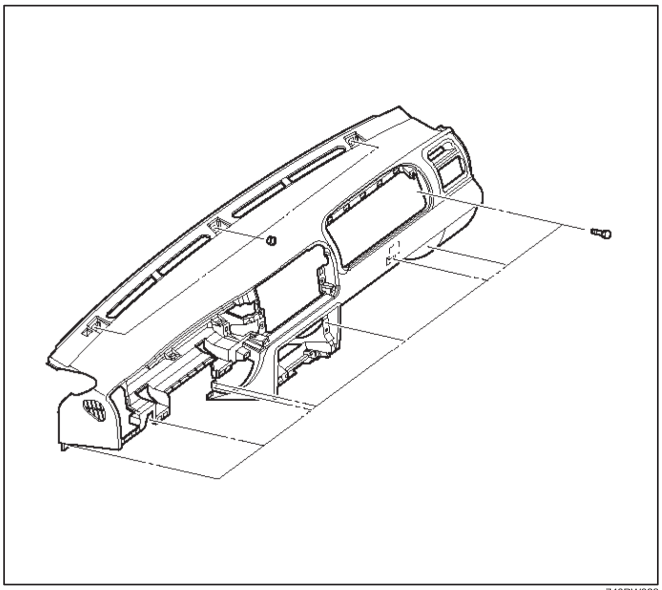
7. Remove the instrument panel driver lower cover assembly.
   - Remove the engine hood opener two fixing screws and another one fixing screw.
     After four clips are pried, disconnect switch connector and duct.


610RW023

8. Remove the meter cluster assembly.
   - Remove the five fixing screws, two clips and switch connectors.
9. Remove the meter assembly.
   - Remove the four fixing screws and disconnect the connectors.
10. Remove the driver knee bolster assembly.
    - Remove the six fixing bolts and screw.
11. Remove the control lever assembly.
    - Refer to Control Lever Assembly and/or Control Cable in Heating, Ventilation and Air Conditioning (HVAC) section.
12. Remove the Instrument panel assembly.

CAUTION: For precautions on installation or removal of SRS – air bag system, refer to Supplemental Restraint System (SRS) – AIR BAG in Restraint section.

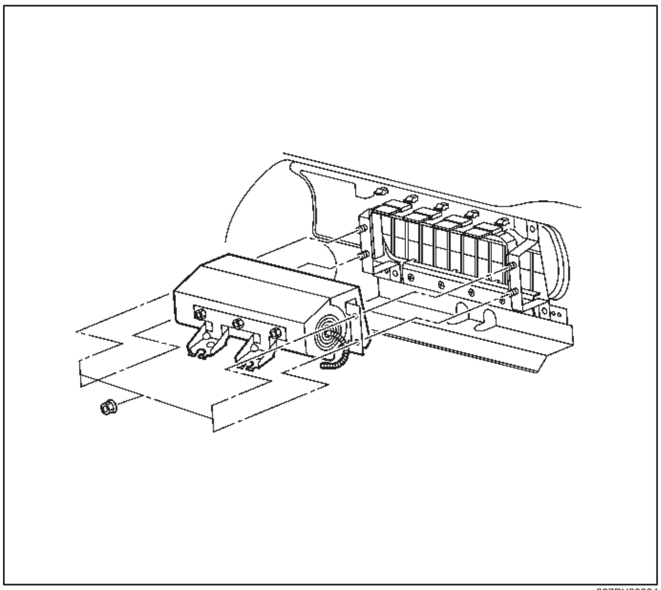
- Disconnect the instrument harness connectors (six connectors on the driver's side, three connectors on the passenger side and two connectors on the center side).
- Disconnect radio antenna cable plug and the ground cable fixing bolts from dash side panel.
- Remove the two fixing bolts of passenger air bag assembly and disconnect the connector.
- Remove the two fixing screws from fuse box.
- After pry the three hole cover from the surface of instrument panel, remove the three nuts.
- Remove the six bolts and one screw.



740RW038

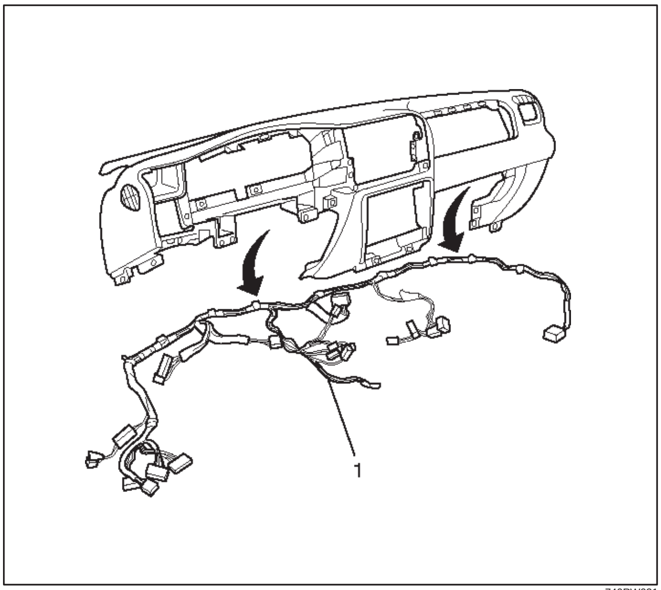
13. Remove the passenger air bag (1).
    - Remove the four fixing nuts.

CAUTION: For precautions on installation or removal of SRS – air bag system, refer to Supplemental Restraint System in Restraint section.



827RY00004

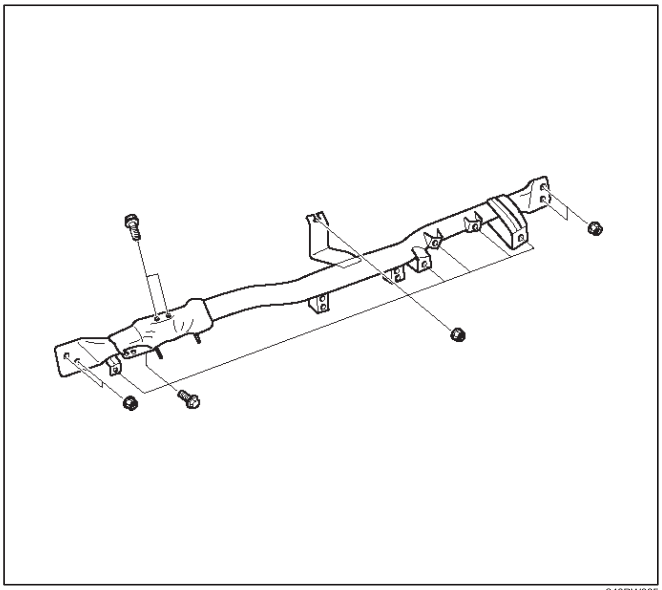
14. Remove the vent duct assembly.
    - Remove the five fixing screws.
15. Remove the passenger lower bracket.
    - Remove the three screws.
16. Remove the glove box side reinforcement.
17. Remove the instrument upper reinforcement.
    - Remove the nine screws.
18. Remove the instrument panel center reinforcement.
    - Remove the six screws.
19. Remove the instrument panel harness assembly (1).
    - Remove the clips.



740RW031

20. Remove the instrument panel stays.
    - Remove the two fixing nuts and two fixing bolts for each bracket.

21. Remove the cross beam.
    - Remove the five fixing nuts, two fixing bolts (upper) and six fixing bolts (lower).



840RW005

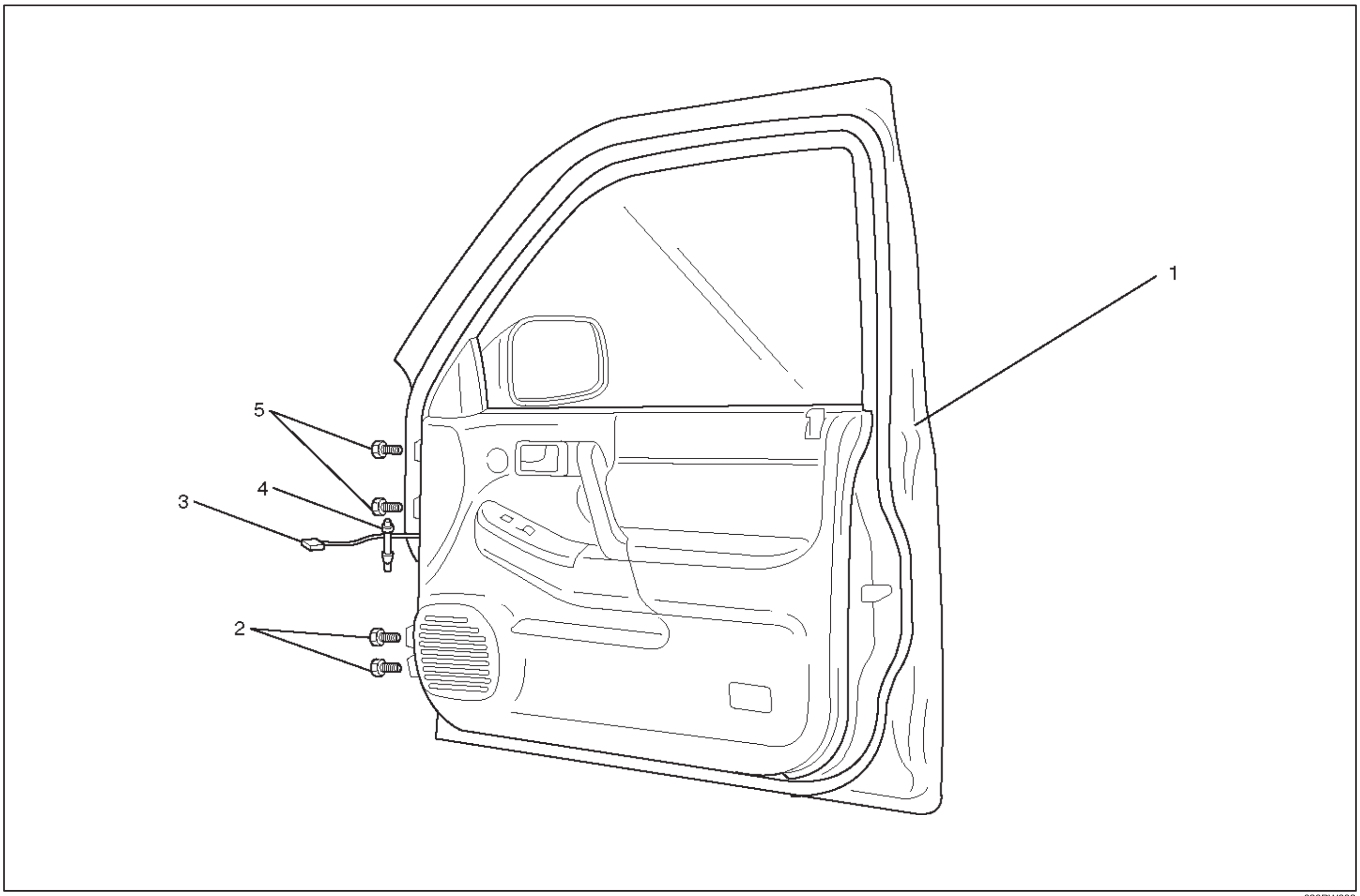
Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Adjust the control cable.
   - Refer to Control Lever Assembly in Heating, Ventilation and Air Conditioning (HVAC) section.

Front Door Assembly

Parts Location



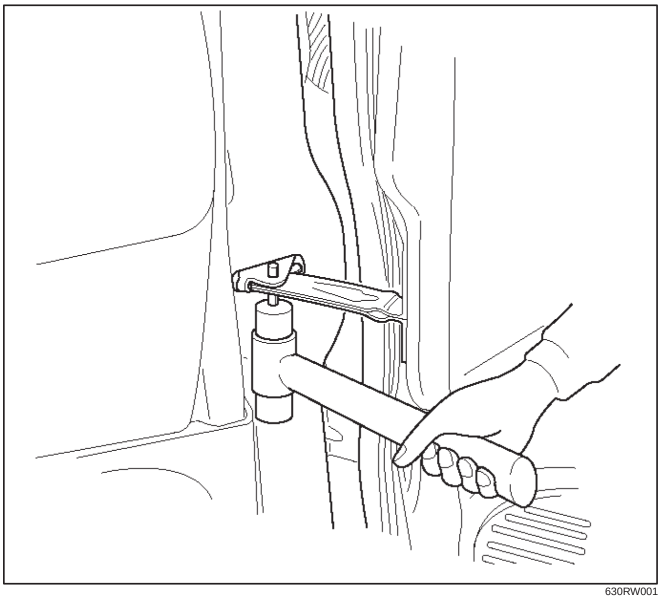
630RW002

Legend

(1) Front Door Assembly
(2) Lower Hinge Bolt
(3) Door Harness Connection
(4) Door Check Arm Pin
(5) Upper Hinge Bolt

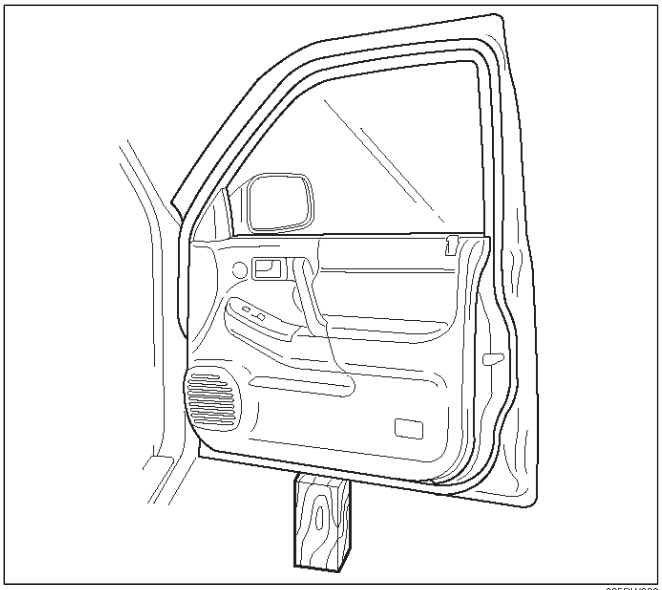
Removal

1. Disconnect the battery ground cable.
2. Apply a setting mark on the body side hinge.
3. Remove the door check arm pin.



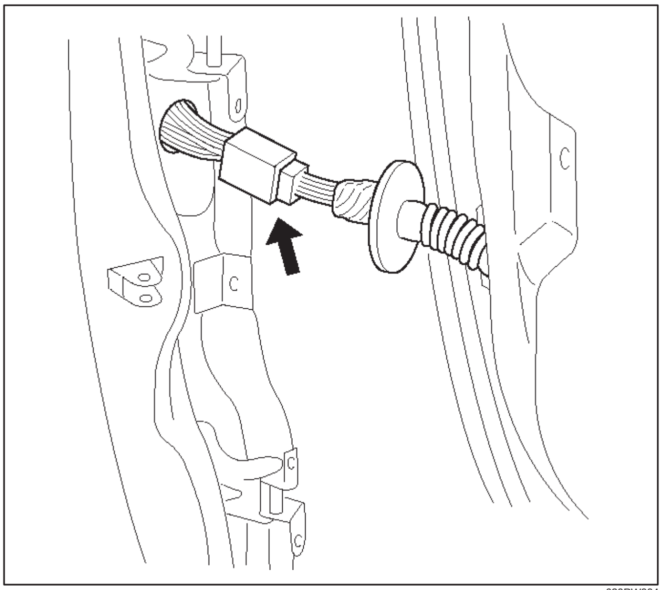
630RW001

4. Remove the upper and lower hinge bolts.
   - Position a wood block under the door for protection and support the door assembly with hands during removal or installation.



635RW003

5. Remove the door harness connection.
   - Pull the door harness grommet out in order to disconnect the harness connection.



630RW004

6. Remove the front door assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Align the door fitting to the body.
   - Check the fender and front door (3).

   Clearance: 5.0 mm (0.196 in)

   Height (step): Flush

   - Check the front door and rear door (2).

   Clearance: 6.0 mm (0.23 in)

   Height (step): Flush

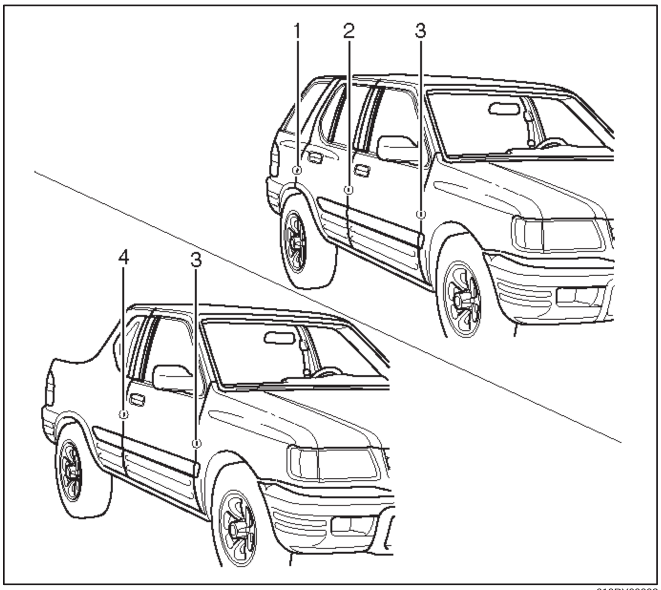
   - Check the rear door and body (1) (4).

   Clearance: 5.0 mm (0.196 in)

   Height (step): Flush

   Adjust clearance with door hinges.

   Adjust height (step) by tapping on the fender lightly with a rubber hammer.



610RY00003

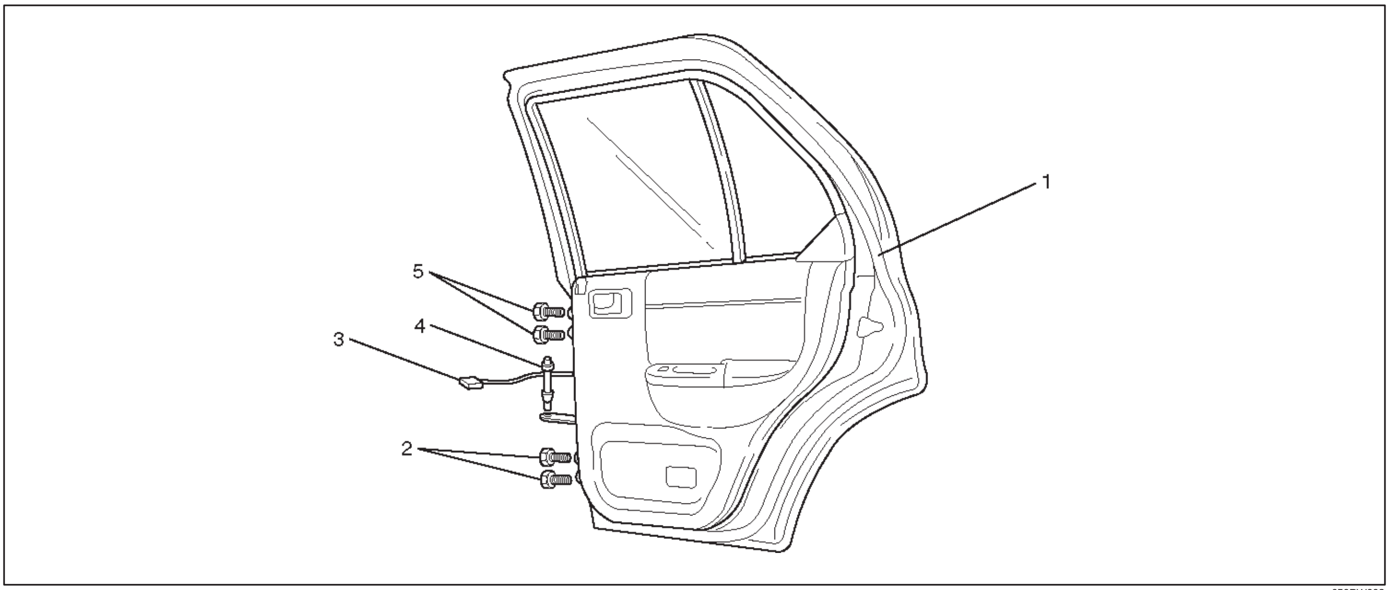
2. Tighten the door hinge bolts to the specified torque.

   Torque : 34 N·m (25 lb ft)

3. Apply chassis grease to the door check arm pin and the door hinge moving surface.

Rear Door Assembly

Parts Location

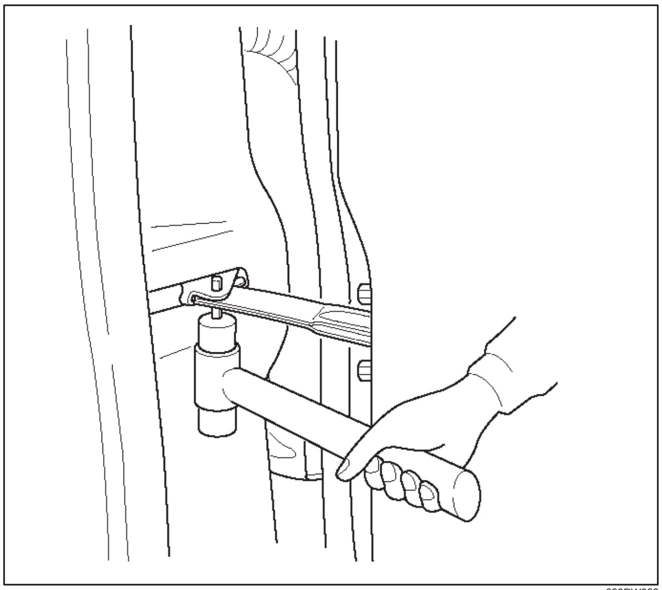


650RW003

Legend
- (1) Rear Door Assembly
- (2) Lower Hinge Bolt
- (3) Door Harness Connection
- (4) Door Check Arm Pin
- (5) Upper Hinge Bolt

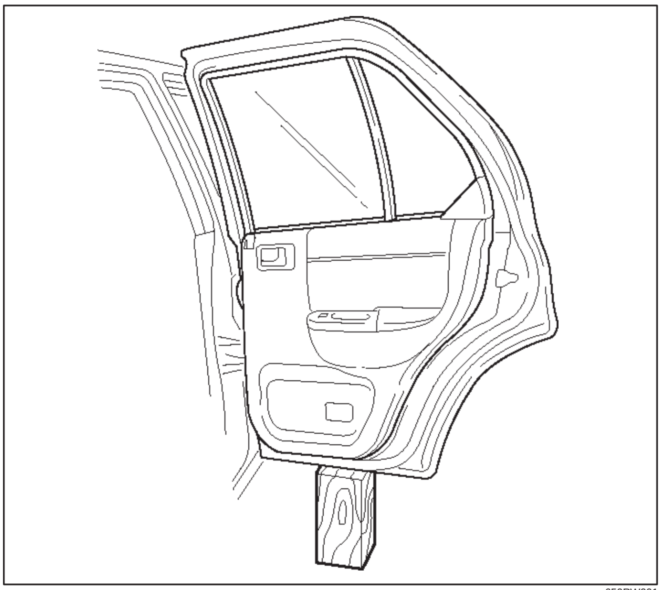
Removal

1. Disconnect the battery ground cable.
2. Apply a setting mark on the body side hinge.
3. Remove the door check arm pin.



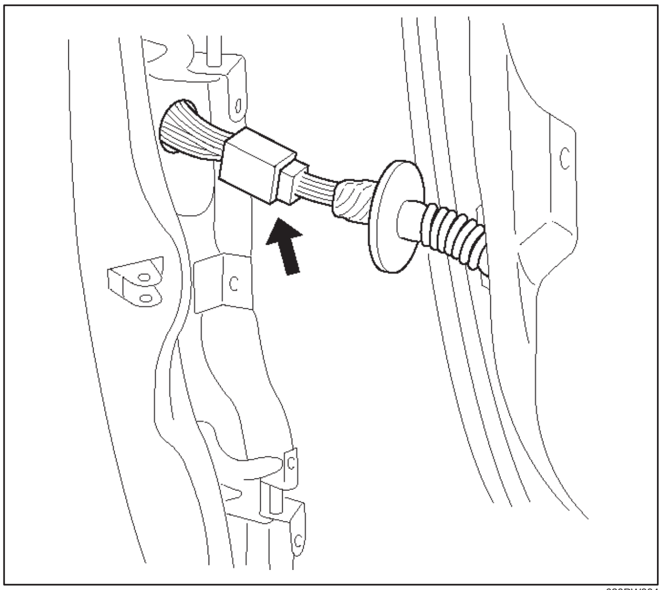
630RW003

4. Remove the upper and lower hinge bolts.
   - Position a wood block under the door for protection and support the door assembly with hands during removal or installation.



650RW001

5. Remove the door harness connection.
   - Pull the door harness grommet out in order to disconnect the door harness connection.



630RW004

6. Remove the rear door assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

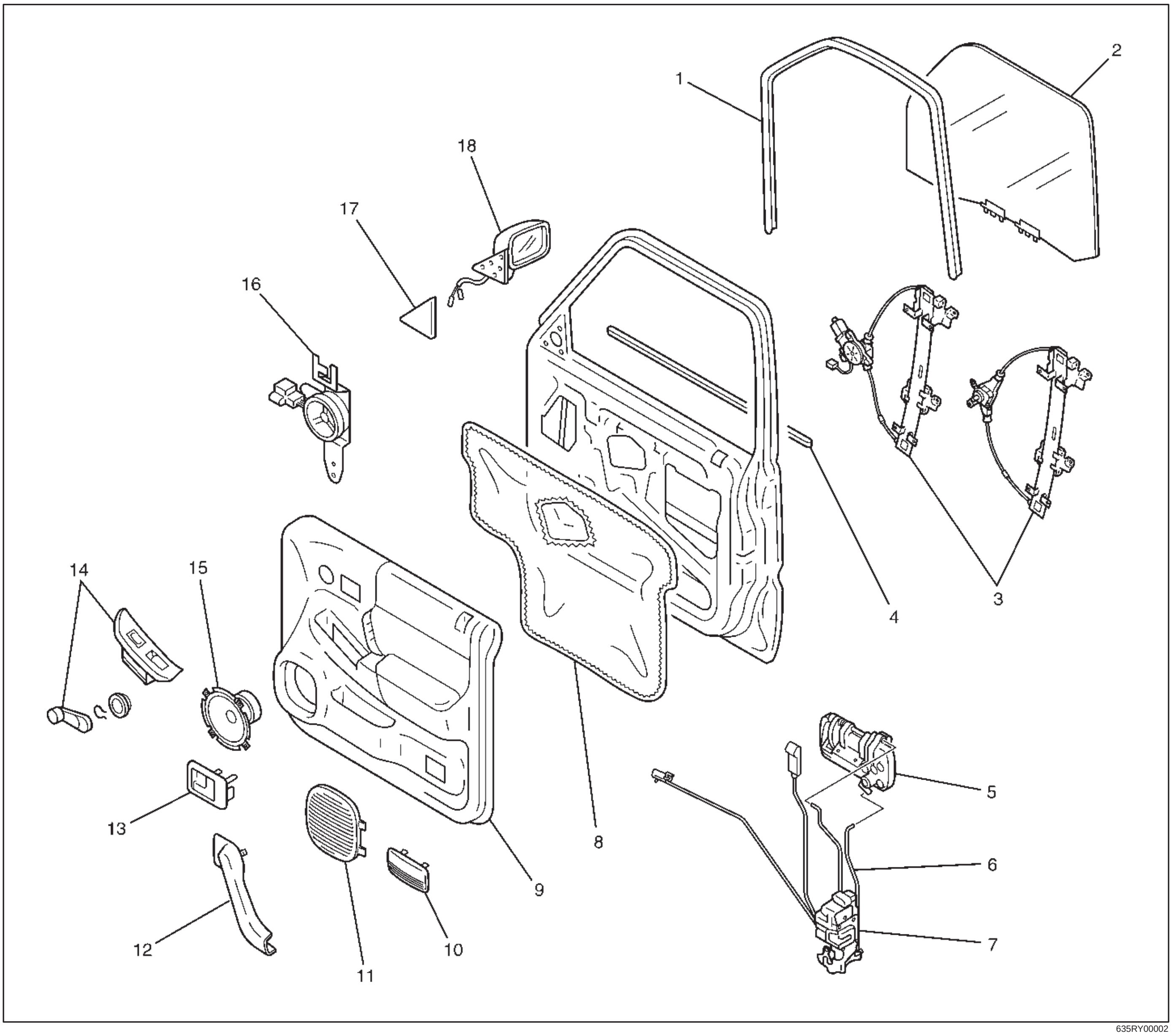
1. Align the door fitting to the body by referring to Front Door Assembly in this section.
2. Tighten the door hinge bolts to the specified torque.

   Torque : 34 N·m (25 lb ft)

3. Apply chassis grease to the check arm pin and the door hinge moving surface.

Front Window Regulator, Glass and Glass Run

Parts Location

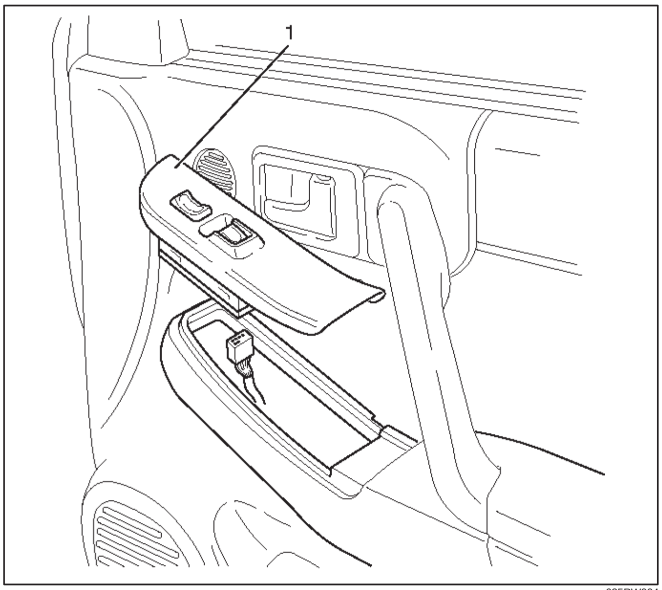


Legend

(1) Glass Run
(2) Glass
(3) Window Regulator
(4) Waist Seal
(5) Outside Handle
(6) Locking Link
(7) Door Lock Assembly
(8) Waterproof Sheet
(9) Door Trim Panel
(10) Courtesy Light Lens
(11) Speaker Grille
(12) Grip Cover
(13) Inside Handle
(14) Power Window Switch/Window Regulator Handle
(15) Speaker Assembly
(16) Tweeter
(17) Door Mirror Cover
(18) Door Mirror Assembly

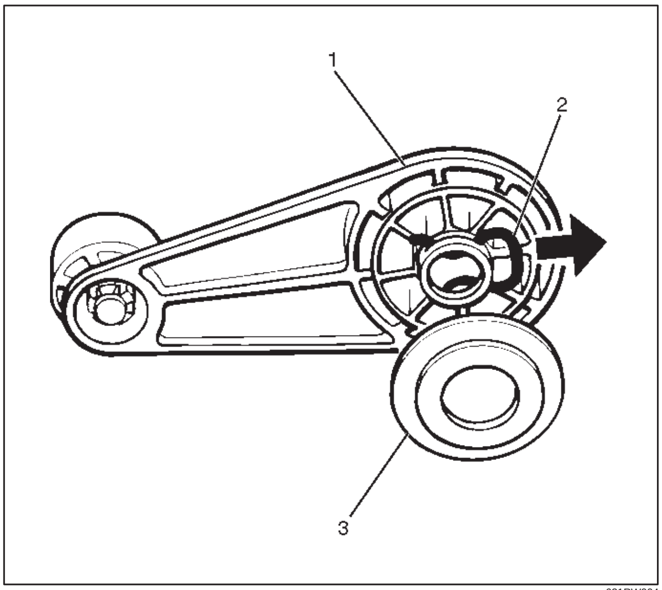
Removal

1. Disconnect the battery ground cable.
2. Remove the power window switch/regulator handle.
   - Pry out the power window switch and remove the connectors.



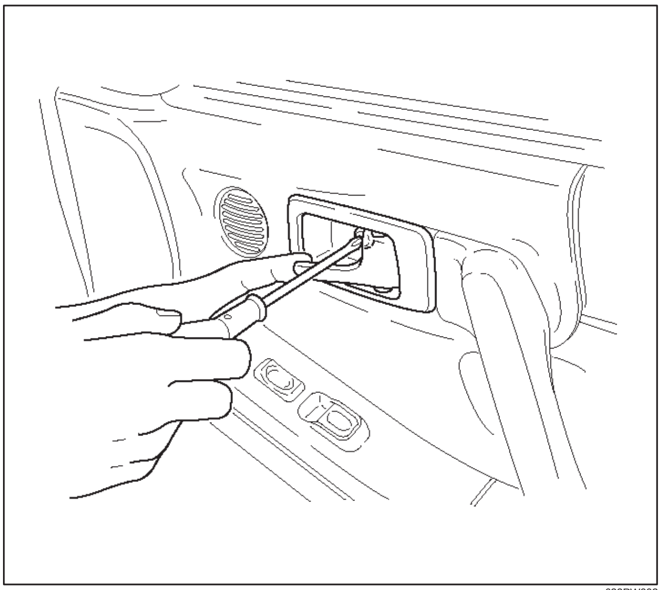
635RW004

   - To remove the regulator handle (1), remove the clip (2) at the root of the handle by using wire with hook.



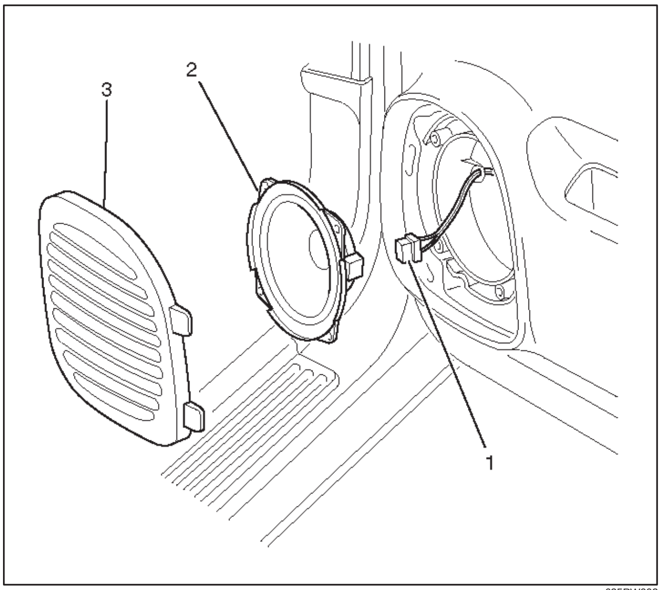
631RW004

3. Remove the screw while pulling the inside lever toward you and then remove the inside handle.



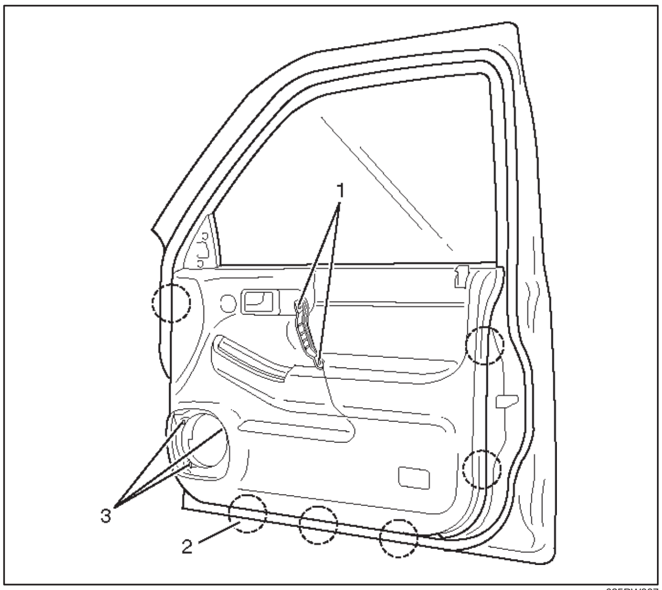
632RW003

4. Remove the speaker grille (3).
   - Pull out the front side of the grille.
5. Remove the speaker assembly (2).
   - Remove the 4 screws and disconnect the speaker harness connector (1).



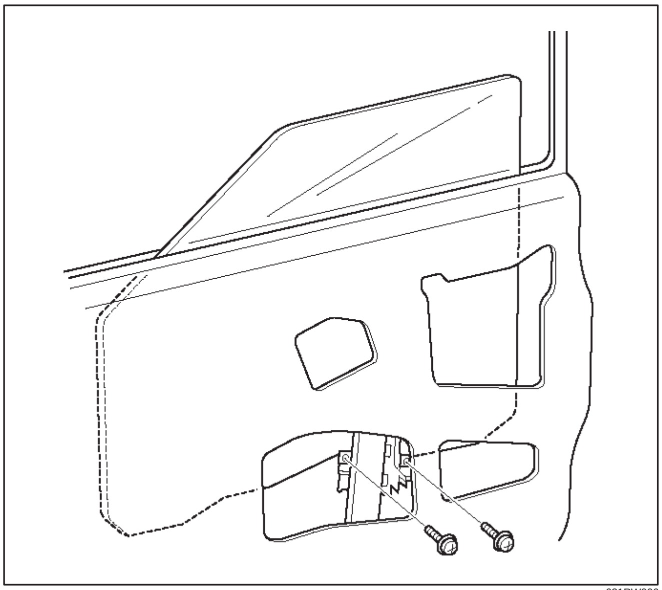
635RW002

6. Remove the door mirror cover.
7. Remove the grip cover.
8. Remove the 5 screws (1), (3) and pull out the trim panel at the 6 clip positions (2).

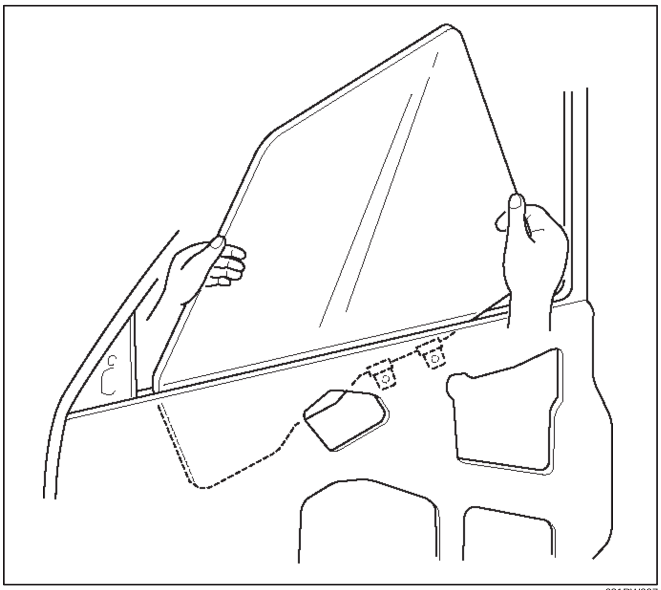


635RW007

9. Remove the waterproof sheet.
10. Remove the 2 screws through the access hole and pull out the glass upward.

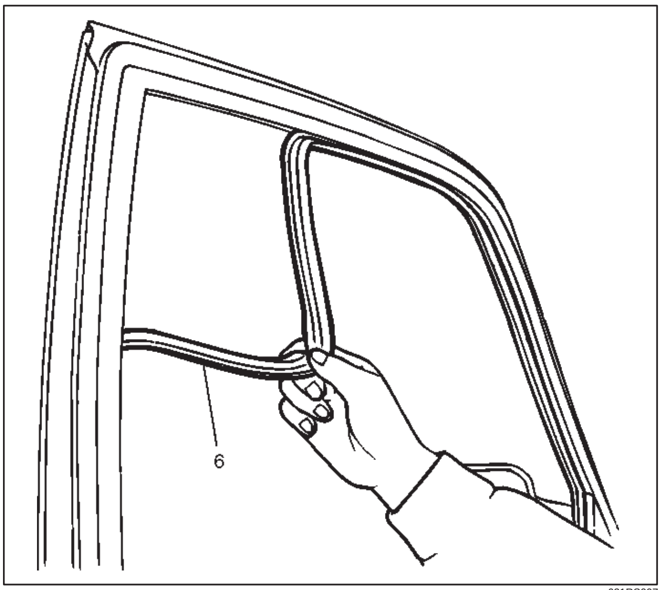


631RW006



631RW007

11. Remove the window regulator.
    - Disconnect the window regulator motor harness connector, if equipped with power windows.
12. Remove the glass run.
    - Pull the glass run (6) out from the door frame groove.

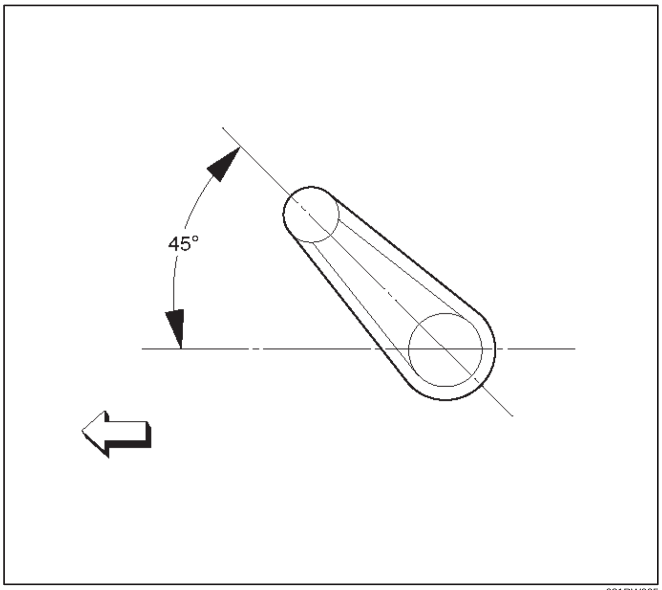


631RS007

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Install the regulator handle as shown in the illustration, if equipped without power windows.

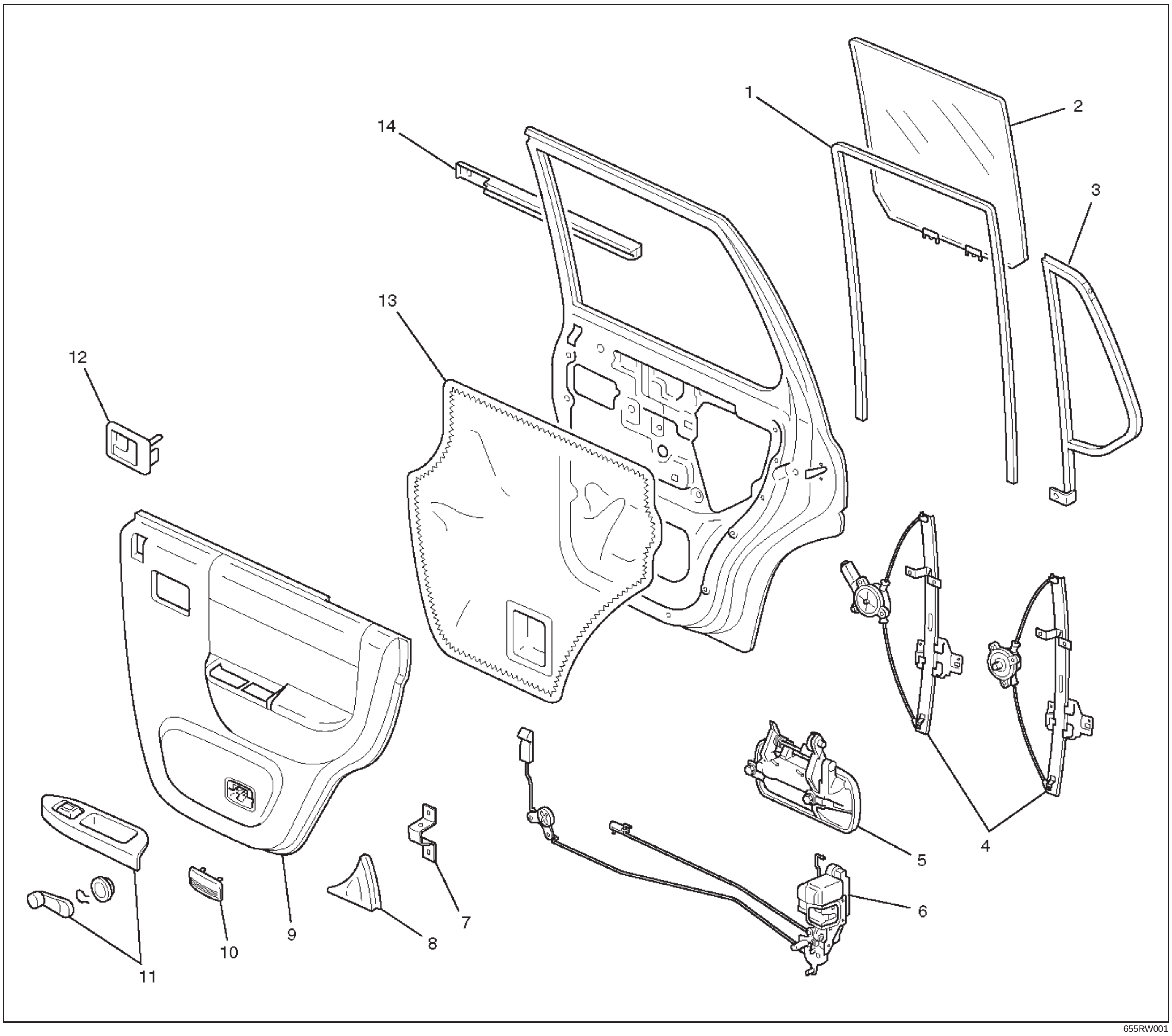


631RW005

2. Check to see that the window regulator operates smoothly and the glass opens and closes properly. Install the waterproof sheet with to clearance between the door panel and the water proof sheet.

Rear Window Regulator, Glass and Glass Run

Parts Location

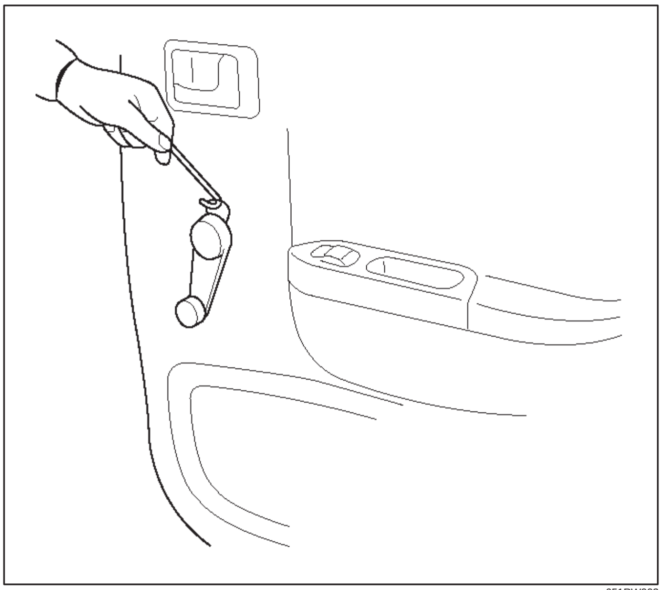


Legend

(1) Glass Run
(2) Glass
(3) Fixed Glass
(4) Window Regulator
(5) Outside Handle
(6) Door Lock Assembly
(7) Bracket
(8) Rear Corner Garnish
(9) Door Trim Panel
(10) Courtesy Light Lens
(11) Power Window Switch/Window Regulator Handle
(12) Inside Handle
(13) Waterproof Sheet
(14) Waist Seal

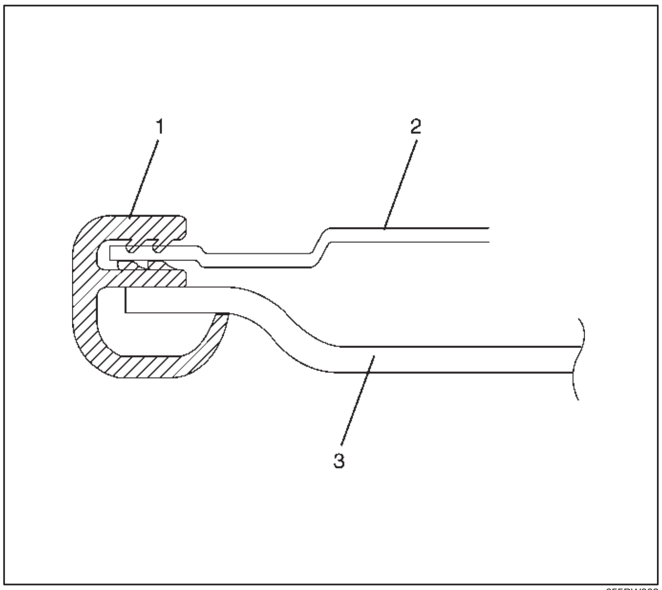
Removal

1. Disconnect the battery ground cable.
2. Remove the rear corner garnish.
3. Remove the window regulator handle.
   - Remove the clip on the rear side of the regulator handle using a wire.



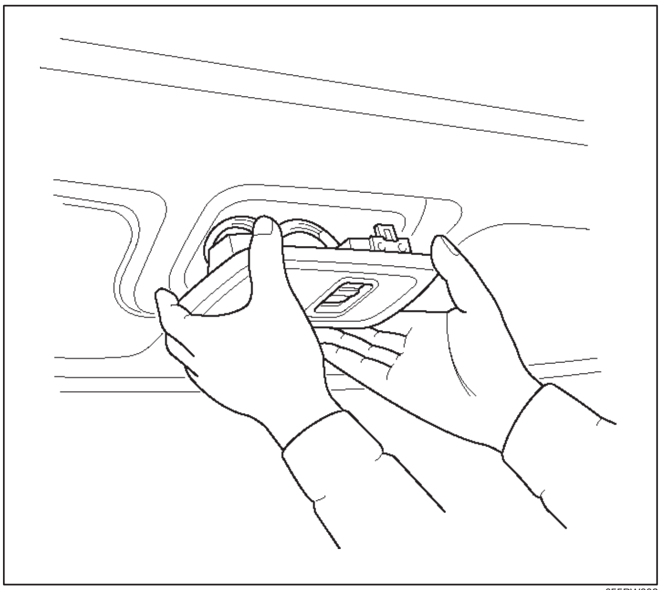
651RW003

4. Remove the screw while pulling the inside lever toward you and then remove the inside handle.
5. Remove the 1 screw at the pull case.



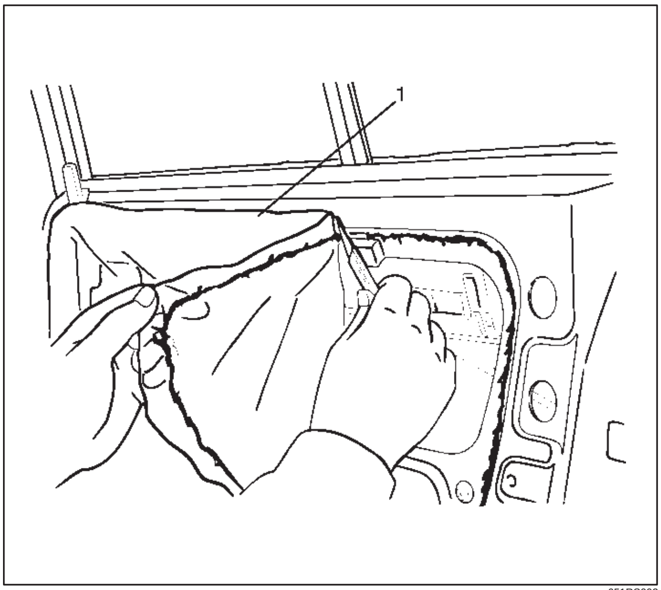
655RW003

6. Remove the rear corner garnish.
7. Pull out the trim panel at the 8 clip positions.
   - Disconnect the power window switch connector and courtesy light connector.



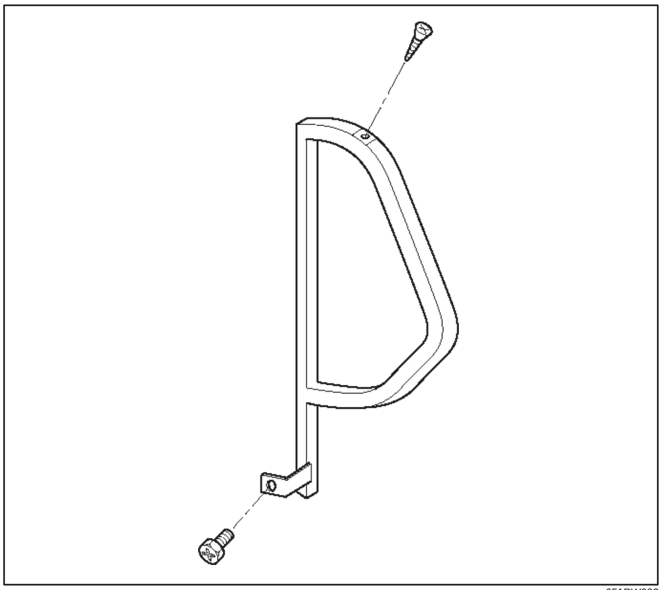
655RW002

8. Remove the power window switch, if equipped.
9. Remove the bracket.
10. Remove the waterproof sheet (1).
    - Taking notice of the door harness, peel the waterproof sheet off the door panel carefully.



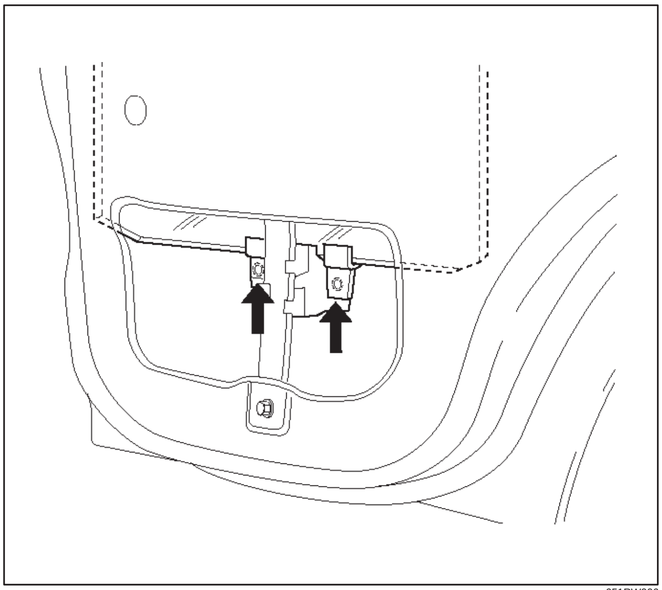
651RS002

11. Remove the fixied glass.
- Remove one bolt and screw as shown in the figure, then pull it upward.



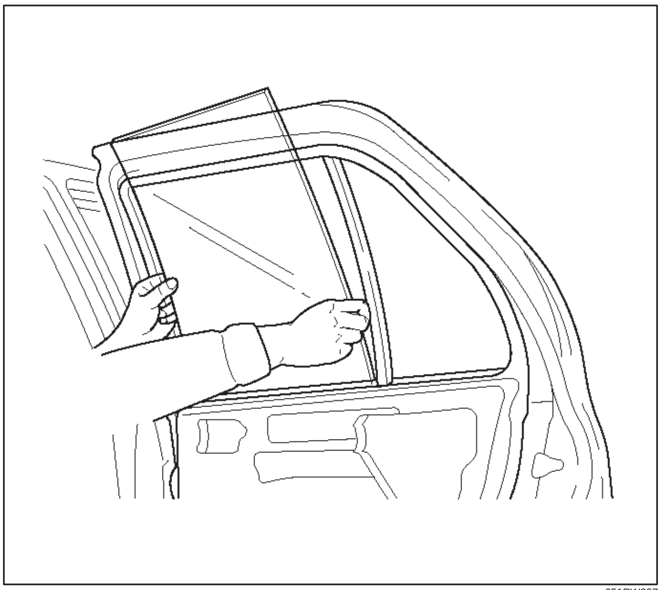
651RW002

12. Remove the glass.
- First, align the height of regulator to the access hole. Remove 2 screws attaching bottom channel and regulator, then remove the glass.



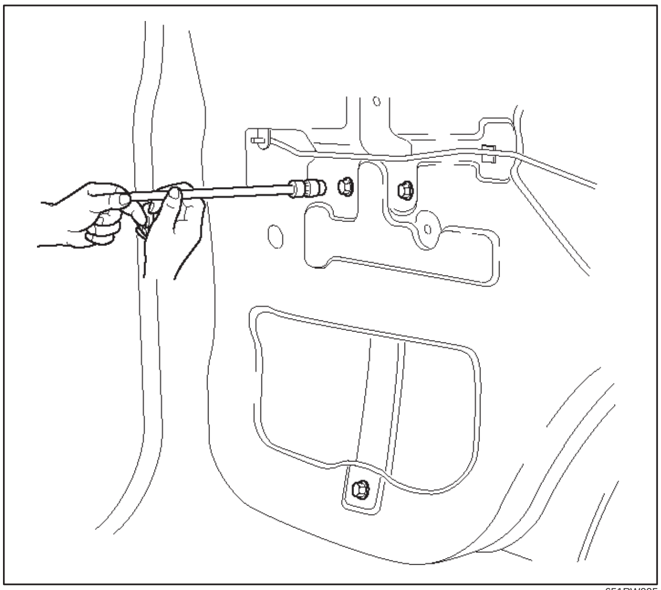
651RW006

- Remove the window glass by tilting it as necessary.



651RW007

13. Remove the window regulator.
- Remove the window regulator fixing bolts and pull the regulator out from the lower hole of the door panel.



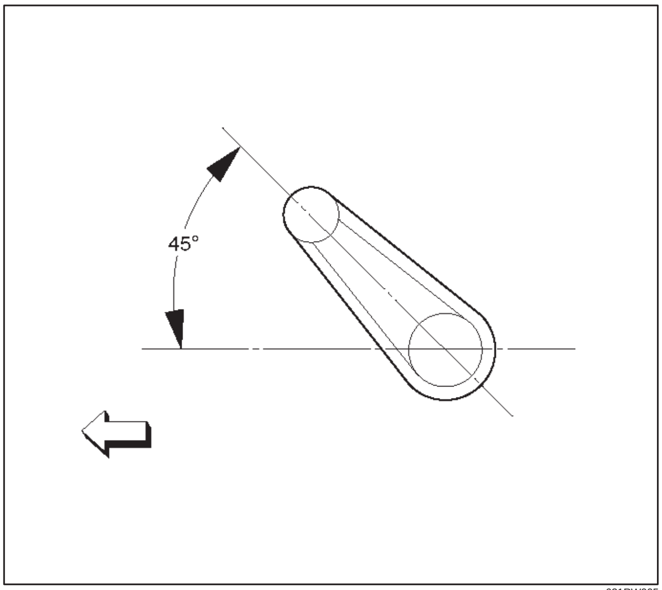
651RW005

14. Remove the glass run.
- Pull the glass run out from the door frame.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Install the regulator handle as shown in the illustration, if equipped without power windows.

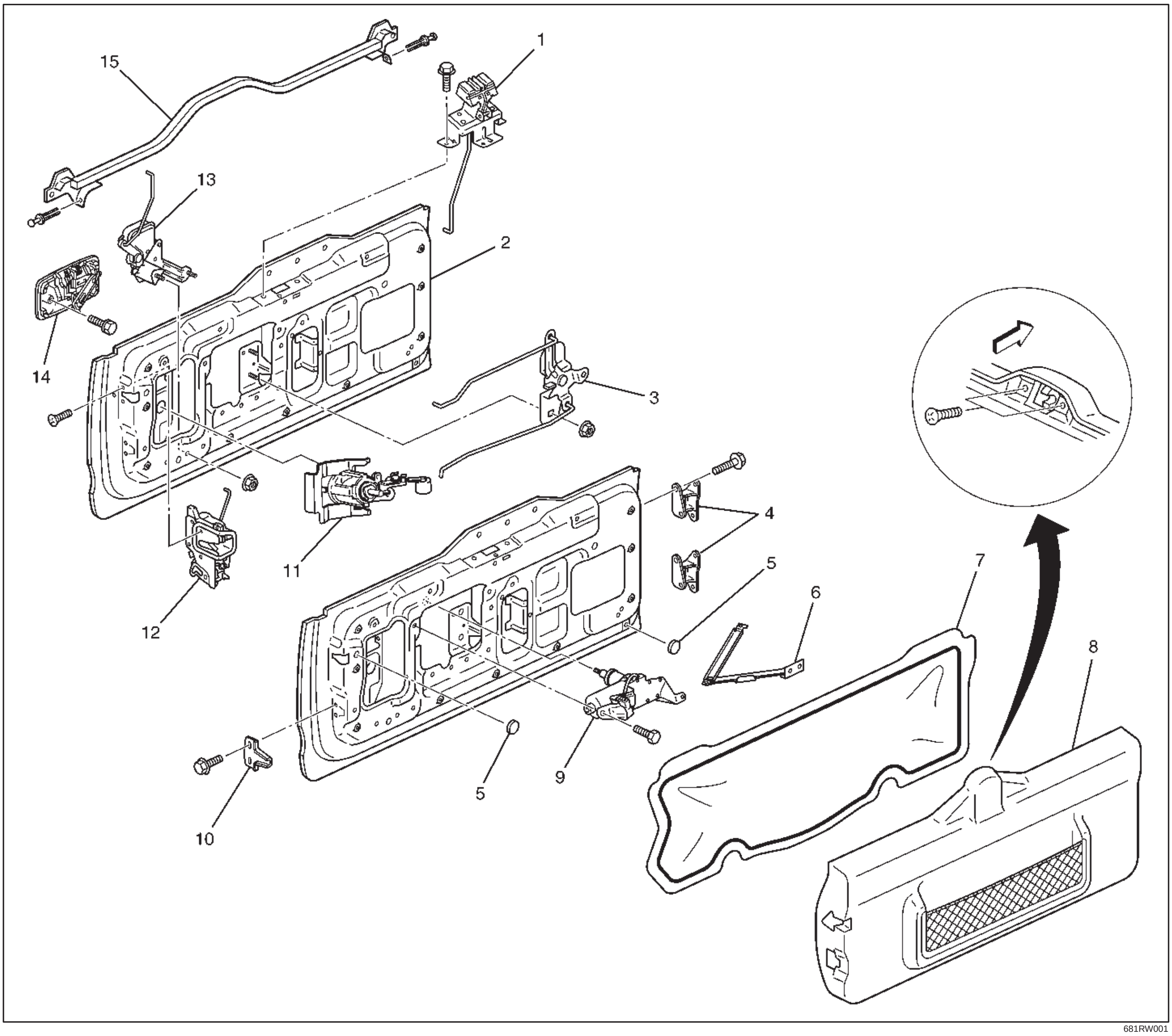


631RW005

2. Check to see that the window regulator operates smoothly and the glass opens and closes properly. Install the waterproof sheet with no clearance between the door panel and the waterproof sheet.

Tailgate (LWB)

Parts Location

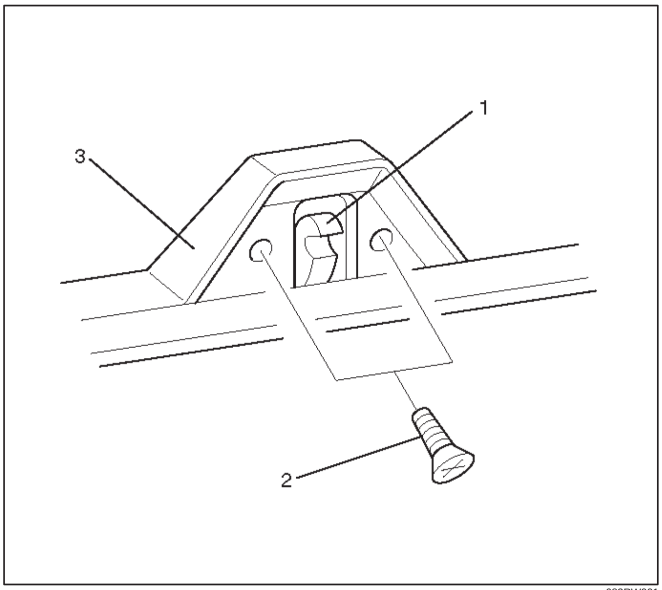


Legend

(1) Hatchgate Lock Assembly
(2) Tailgate Assembly
(3) Tailgate Bell Crank
(4) Hinges
(5) Plug
(6) Tailgate Stopper Link
(7) Waterproof Sheet
(8) Trim Cover Assembly
(9) Rear Wiper Motor
(10) Dove Tail
(11) Key Cylinder
(12) Tailgate Lock Assembly
(13) Hatchgate Lock Actuator Assembly
(14) Outside Handle
(15) Tailgate Waist Seal

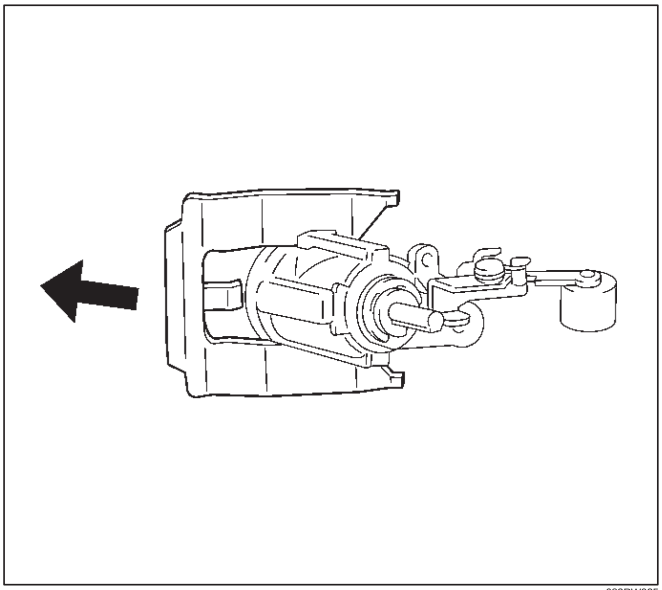
Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim cover assembly (3).
   - Remove the two screws (2) holding the hatchgate lock assembly (1) first and the two screws fixing the trim cover assembly. Pull up the trim cover while detaching the clips from tailgate panel.



683RW001

3. Remove the waterproof sheet.
   - Remove the waterproof sheet, taking special care so as not to break it.
4. Remove the hatchgate lock.
   - Disconnect the lock link and connector and remove the three fixing bolts.
5. Remove the key cylinder.
   - Disconnect the locking links.
   - Remove the key cylinder retaining clip with screwdriver to remove the key cylinder.

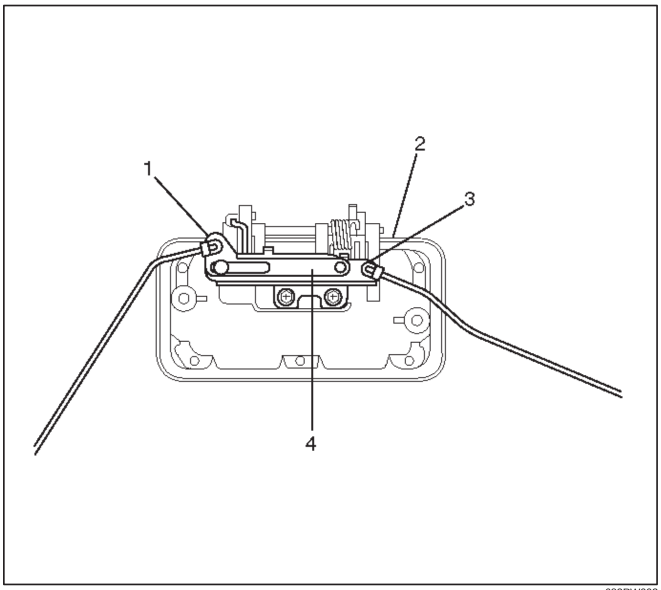

683RW025

6. Remove the hatchgate lock actuator assembly.
   - Disconnect the actuator harness connector.
   - Remove the two nuts holding hatchgate lock actuator assembly from inside.
7. Remove the outside handle.
   - Remove the two bolts holding the outside handle from inside.
8. Remove the tailgate lock assembly.
   - Remove the three screws holding the lock assembly.
9. Remove the dove tail.
10. Remove the tailgate locking links.
11. Remove the rear wiper arm.
    - Refer to Rear Wiper Arm/Blade in Wiper/Washer System section.
12. Remove the rear wiper motor.
13. Remove the tailgate harness cable.
14. Remove the spare tire carrier.
    - Refer to Spare Tire Carrier in this section.
15. Remove the tailgate stopper link.
16. Remove the tailgate assembly.
    - Remove the tailgate assembly, taking care so as not to damage the hinge. Tailgate assembly is heavy and removal operation require two people.
17. Remove the tailgate waist seal.

Installation

To install, follow the removal steps in the reverse order, noting the following point:

1. When setting up links, pay attention to the position and direction of the links.



683RW003

Legend

(1) Tailgate Lock Link
(2) Outside Handle
(3) Key Cylinder Lock Link
(4) Cancel Mechanism

2. Tighten the tailgate hinge fixing bolts to the specified torque.

   Torque: 34 N·m (25 Ib ft)

3. Tighten the tailgate stopper link fixing bolts to the specified torque.

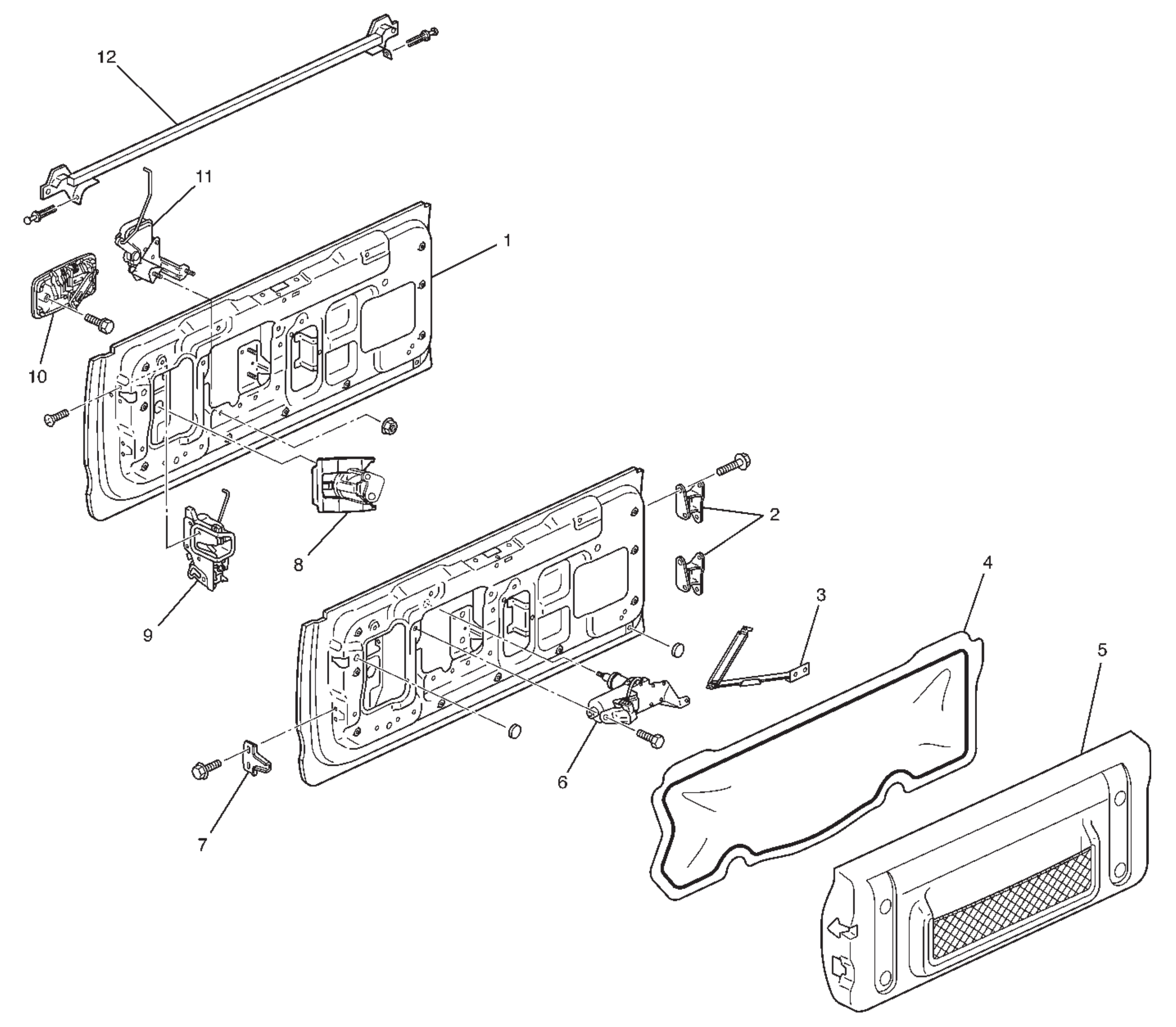
   Torque: 34 N·m (25 Ib ft)

4. Tighten the dove tail fixing bolts to the specified torque.

   Torque: 25 N·m (19 Ib ft)

Tailgate (SWB)

Parts Location



Legend

(1) Tailgate Assembly
(2) Hinges
(3) Tailgate Stopper Link
(4) Waterproof Sheet
(5) Tailgate Trim Cover Assembly
(6) Rear Wiper Motor
(7) Dove Tail
(8) Key Cylinder
(9) Tailgate Lock Assembly
(10) Outside Handle
(11) Hatchgate Lock Actuator Assembly
(12) Tailgate Waist Seal

Removal

1. Disconnect the battery ground cable.
2. Remove the spare tire carrier.
   - Refer to Spare Tire Carrier in this section.
3. Remove the rear wiper arm.
   - Refer to Rear Wiper Arm/Blade in Wiper/Washer System section.
4. Remove the tailgate glass stay and tailgate glass.
   - Refer to Tailgate Glass (SWB) in this section.

5. Remove the tailgate trim cover assembly.
   - Remove the two screws fixing the trim cover assembly and pull up the trim cover after detaching the clips from tailgate panel.
6. Remove the waterproof sheet.
   - Remove the waterproof sheet, taking special care so as not to break it.
7. Remove the rear wiper motor.
   - Disconnect the motor connector and remove the two fixing bolts.
8. Remove the key cylinder.
   - Disconnect the locking links.
   - Remove the key cylinder retaining clip with screwdriver to remove the key cylinder.
9. Remove the hatchgate lock actuator assembly.
   - Disconnect the actuator harness connector.
   - Remove the two nuts holding hatchgate lock actuator assembly from inside.
10. Remove the outside handle.
    - Remove the two bolts holding the outside handle from inside.
    - Disconnect the locking link.
11. Remove the tailgate lock assembly.
    - Remove the three screws holding the lock assembly.
12. Remove the dove tail.
13. Remove the tailgate harness cable.
14. Remove the tailgate stopper link.
15. Remove the tailgate assembly.
    - Remove the tailgate assembly, taking care so as not to damage the hinge. Tailgate assembly is heavy and removal operation requires two people.
16. Remove the tailgate waist seal.

Installation

To install, follow the removal steps in the reverse order, noting the following point:

1. Tighten the tailgate hinge fixing bolts to the specified torque.

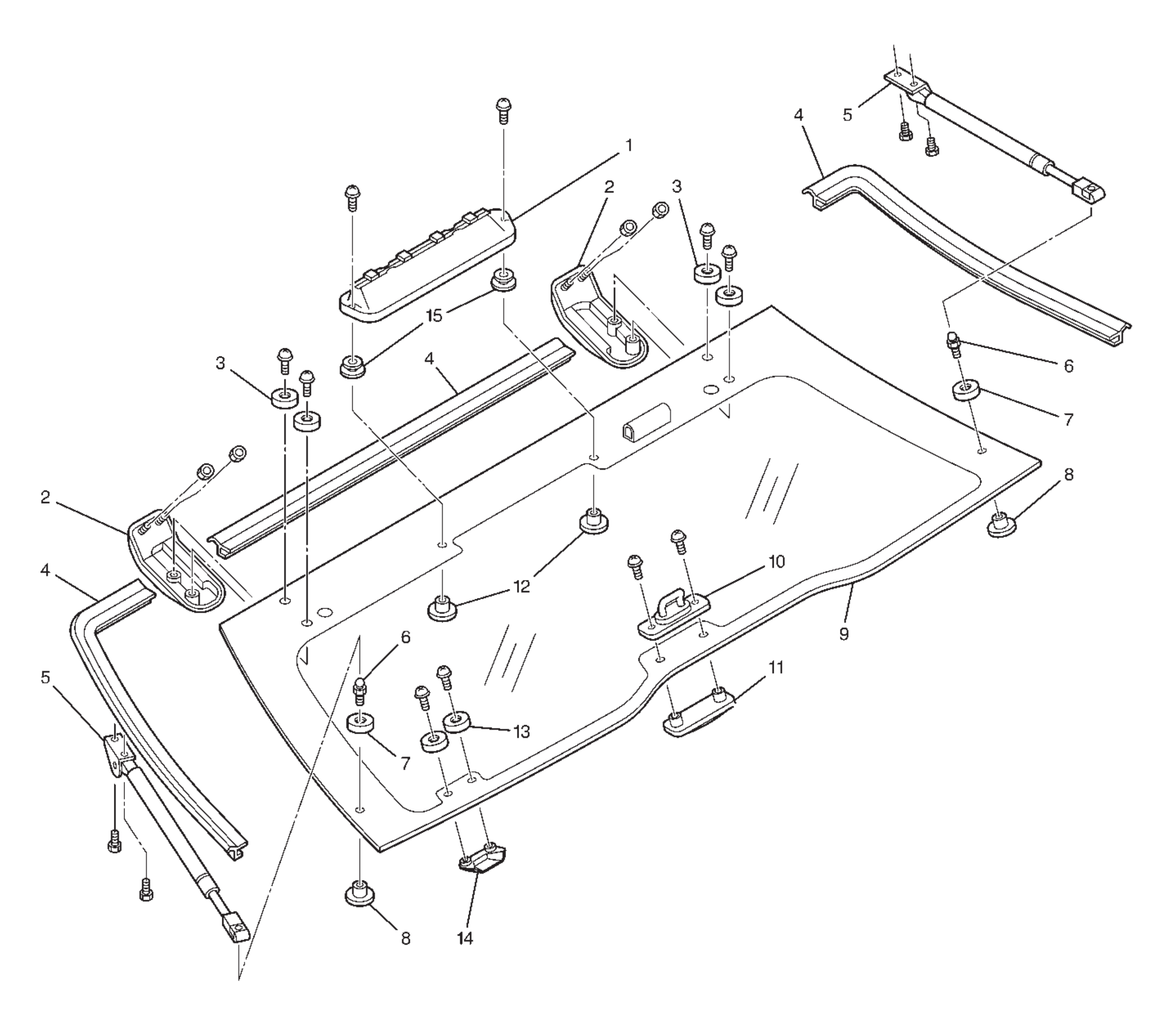
   Torque: 34 N·m (25 lb ft)
2. Tighten the tailgate stopper link fixing bolts to the specified torque.

   Torque: 34 N·m (25 lb ft)
3. Tighten the dove tail fixing bolts to the specified torque.

   Torque: 25 N·m (19 lb ft)

Rear Hatchgate (LWB)

Parts Location

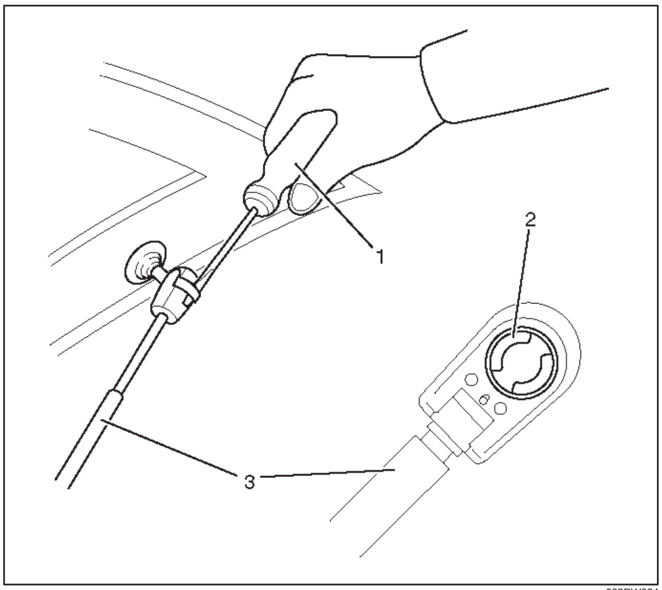


Legend

(1) High Mount Stoplight
(2) Hatchgate Hinge
(3) Hinge Collar
(4) Hatchgate Glass Seal
(5) Hatchgate Gas Stay
(6) Hatchgate Ball Stud
(7) Ball Stud Spacer
(8) Ball Stud Fastener
(9) Hatchgate Glass
(10) Hatchgate Striker
(11) Striker Fastener
(12) High Mount Stoplight Fastener
(13) Outside Handle Collar
(14) Outside Handle
(15) High Mount Stoplight Spacer

Removal

1. Disconnect the battery ground cable.
2. Disconnect the high mount stoplight and rear defogger harness connectors.
3. Remove the hatchgate ball stud (LH and RH).
   - Remove gas stay fixing screw and pull up the gas stay assembly (3) from the ball stud by spreading the retainer (2) holding the ball stud at the end of the gas stay with screwdriver (1), etc.



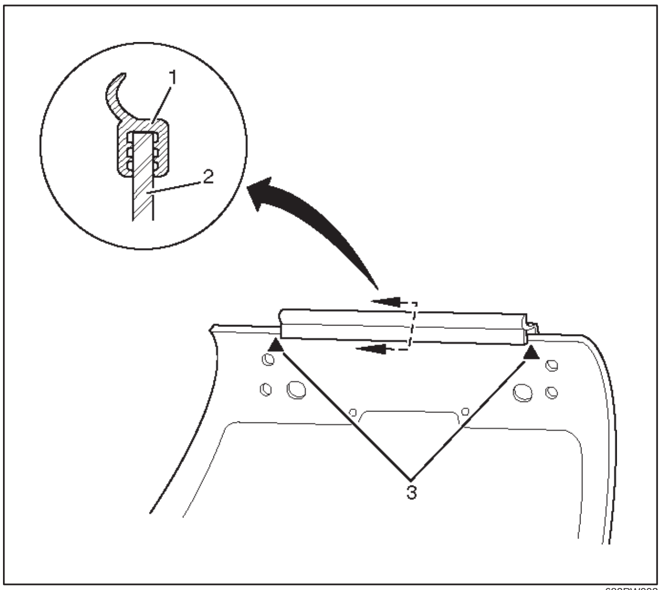
683RW004

4. Remove the hatchgate hinge nuts from body side.
5. Remove the hatchgate glass.
   - When pulling down the hatchgate glass, exercise special care so as not to damage it.
     Hatchgate glass assembly is heavy and removal operation requires the two people.
6. Remove the two screws to remove hatchgate striker and fastener.
7. Remove the outside handle.
8. Remove the hinges.
9. Remove the high mount stoplight.
10. Remove the hatchgate finisher.

Installation

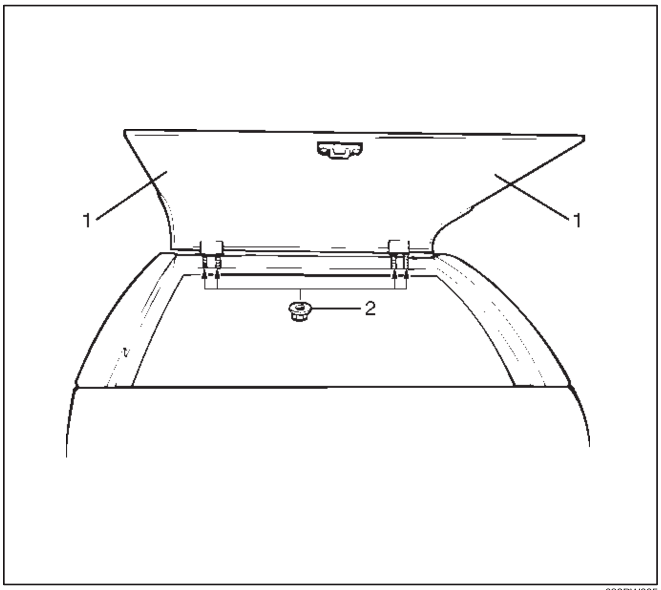
To install, follow the removal steps in the reverse order, noting the following points.

1. Attach the upper seal (1) to the hatchgate glass (2) indicated portion (3) so that the end of the glass contacts the bottom of the upper seal.



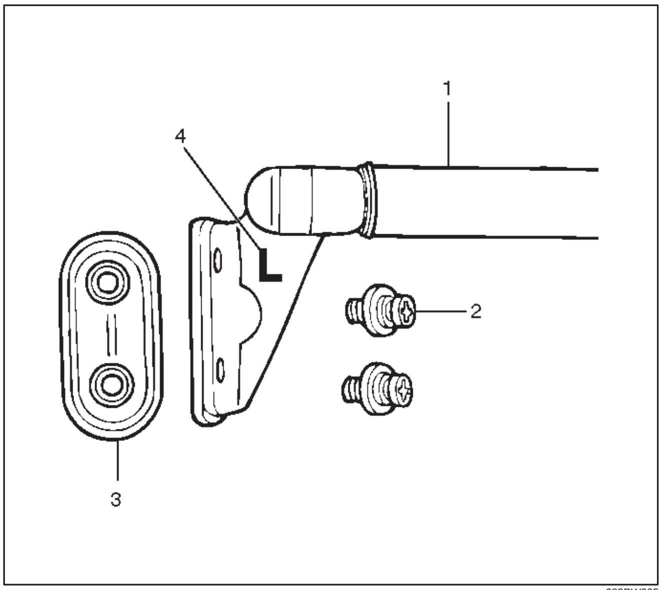
682RW003

2. When installing the hatchgate glass, first attach the hinge to the hatchgate glass. Align the stud of the hinge to the hole at body while supporting the hatchgate glass with two people at indicated positions (1), and then partially tighten the hinge to body nut (2).
   After adjustment (refer to Adjustment in this section) is completed, fully tighten the nut, hinge to body nut.
   - Hatchgate hinge assembly for left and right sides from each other.



682RW005

3. When installing gas stay assembly (1), first install the gas stay onto the rear quarter panel with fixing screw (2) and fastener (3) and then attach the gas stay upper end to the ball stud by spreading the retainer with screwdriver, etc. Gas stay assemblies for left and right sides differ from each other (The letter (4) L(LH) or R(RH) is embossed on the gas stay assembly.)



683RW005

4. When installing hatchgate striker assembly, first partially tighten the fixing screw and close the hatchgate and tailgate. Then fully tighten the fixing screw with the condition that the striker fits the hatchgate lock assembly at the tailgate.

   Make sure that clearance exists between hatchgate striker and lock assembly.

   After installation, again make sure that the striker fits the lock assembly properly.
5. Tighten the nuts; hinge to body (LH and RH)

   Torque : 6 N·m (52 lb in)
6. Tighten the screws; glass and hinge fix (LH and RH)

   Torque : 6 N·m (52 lb in)

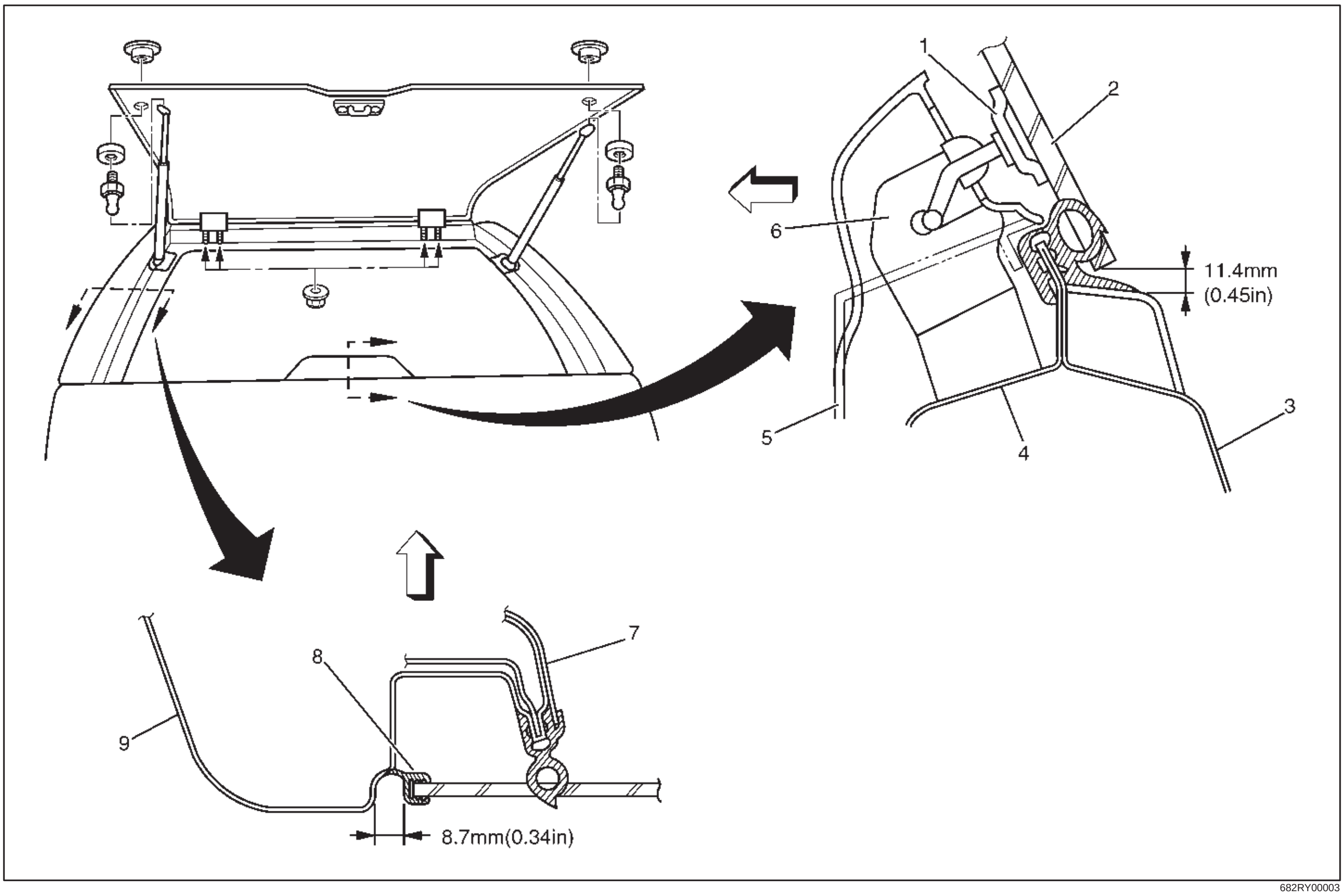
NOTE: When installing the hinge to the body, exercise special care not to damage the body paint surface.

7. Tighten the hatchgate striker fixing screws.

   Torque : 6 N·m (52 lb in)

Adjustment

- Hatchgate alignment is obtained by moving hatchgate hinges.

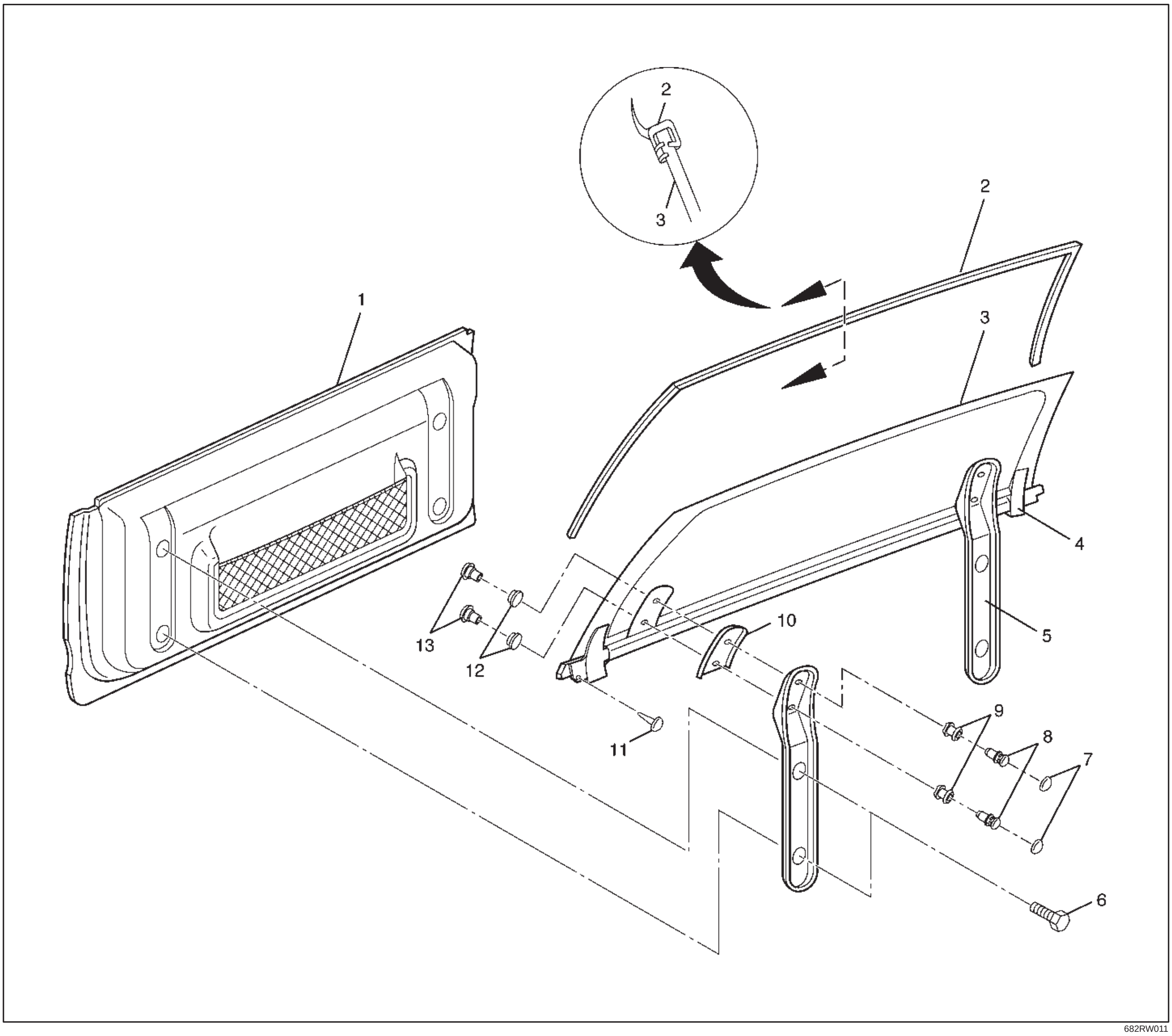


Legend

(1) Hatchgate Striker
(2) Hatchgate Glass
(3) Tailgate Outer Panel
(4) Tailgate Inner Panel
(5) Trim Cover
(6) Hatchgate Lock Assembly
(7) Quarter Trim
(8) Hatchgate Glass Seal
(9) Quarter Outer Panel

Tailgate Glass (Resin Top)

Parts Location



Legend
- (1) Tailgate Trim Cover
- (2) Tailgate Seal
- (3) Tailgate Glass Assembly
- (4) Tailgate Moulding
- (5) Tailgate Glass Stay
- (6) Bolt
- (7) Cap
- (8) Screw
- (9) Collar
- (10) Gasket
- (11) Clip
- (12) Grommet
- (13) Nut

Removal

1. Disconnect the battery ground cable.
2. Remove the spare tire.
3. Remove the rear wiper.
   - Refer to Rear Wiper Arm/Blade in Wiper/Washer System section.
4. Disconnect the rear defogger connectors (LH & RH).

5. Remove the tailgate glass stays.
   - Remove the two seats of two tailgate trim cover fixing bolts.
6. Remove the tailgate glass assembly.
   - Remove the two caps each on the left and right sides, then remove the screws.
   - Remove the two clips from the two ends of the tailgate moulding, then lift the glass assembly up and out.
   - Removing and installing the glass assembly require two persons.
7. Remove the tailgate seal.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

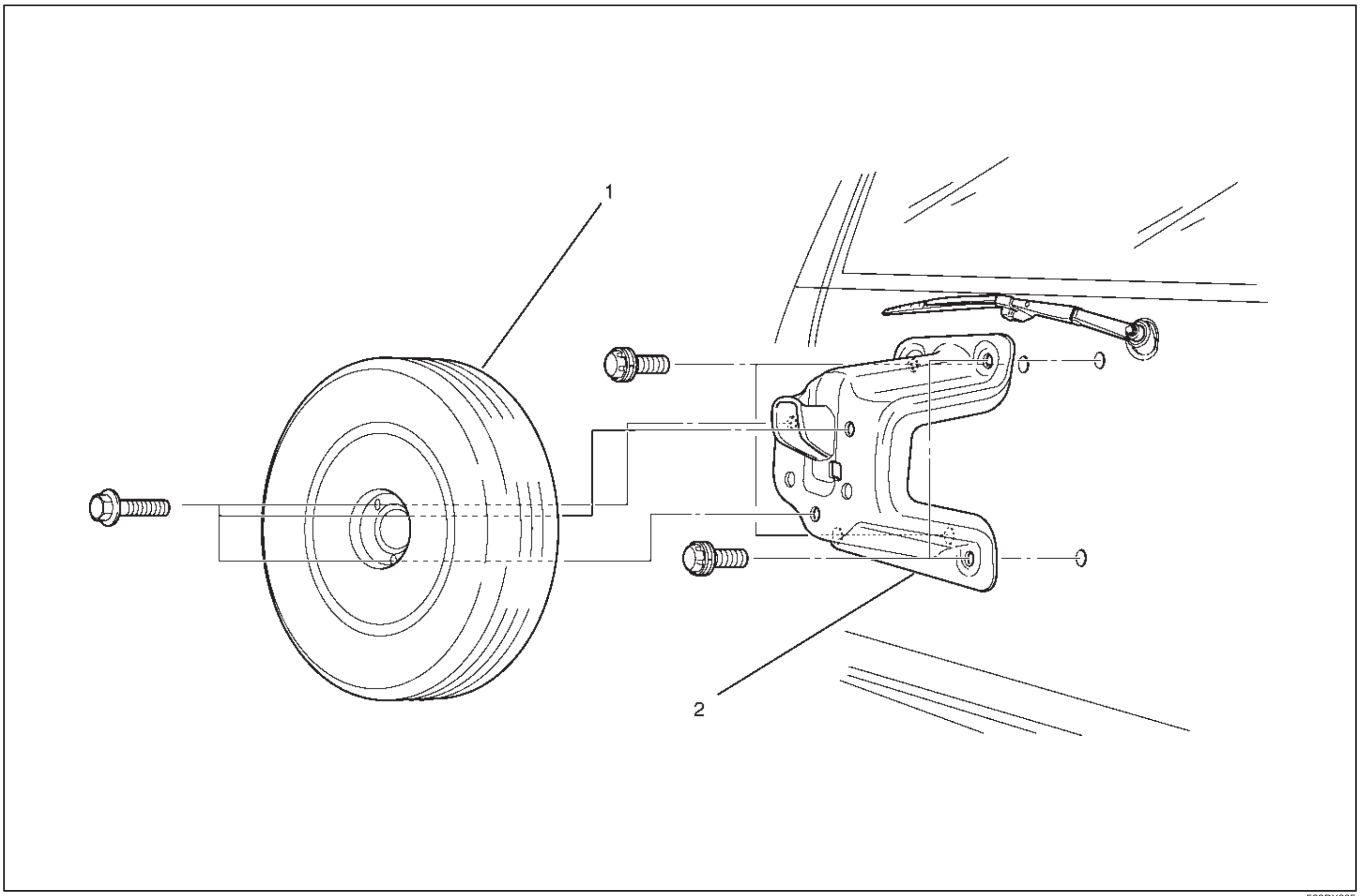
1. Tighten the tailgate glass stay fixing bolts to the specified torque.

   Torque : 19 N·m (14 lb ft)

2. Make sure the lip is properly oriented when installing the tailgate seal.

Spare Tire Carrier

Parts Location



530RX005

Legend

(1) Spare Tire
(2) Spare Tire Carrier

Removal

1. Remove the spare tire.
2. Remove the spare tire carrier by using spare tire carrier nut wrench J–34355.

Installation

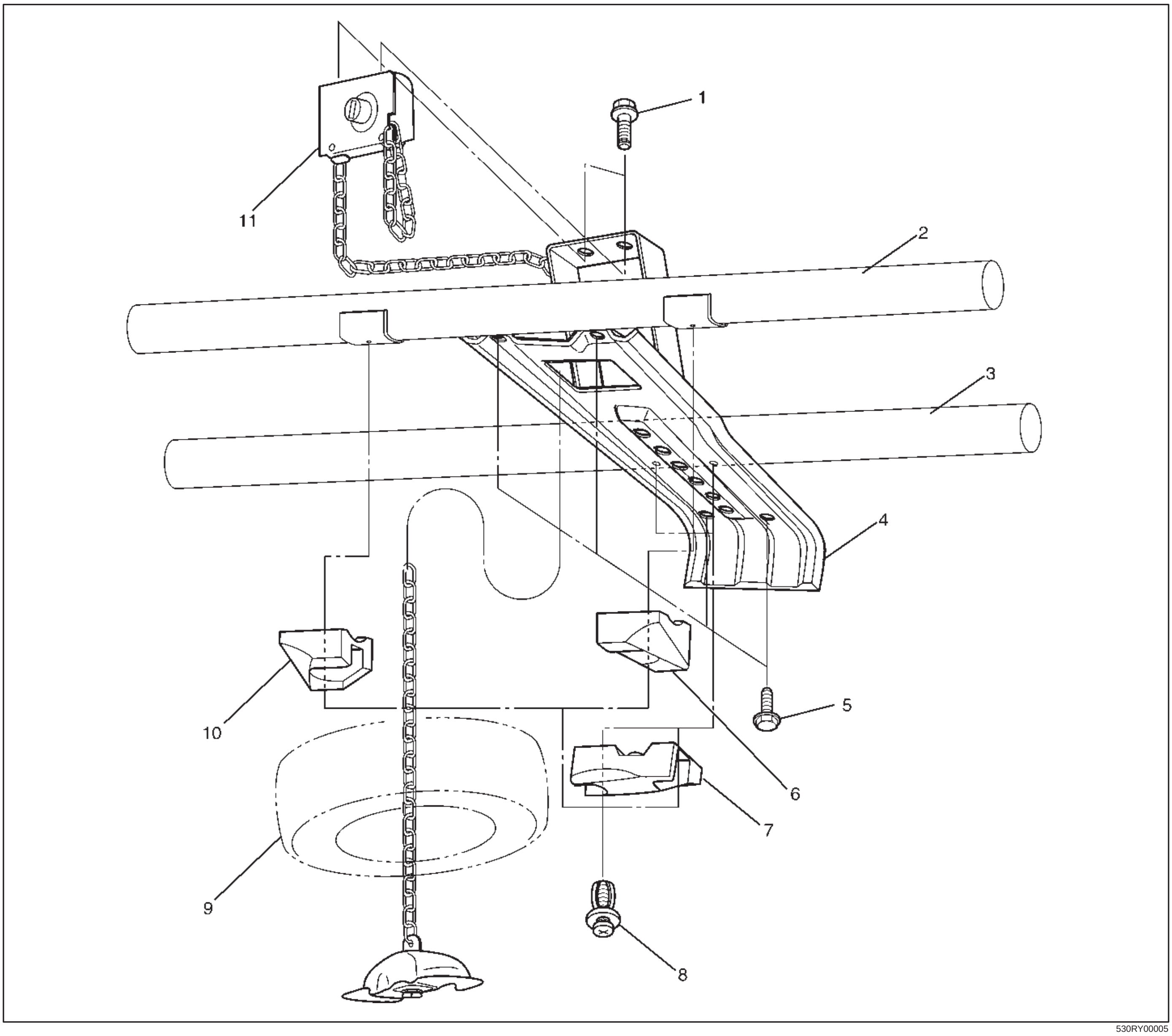
1. Spare tire carrier.
   - Tighten the carrier fixing bolts to the specified torque.

   Torque : 31 N·m (23 lb ft)
2. Spare tire
   - Tighten the spare tire fixing bolts to the specified torque.

   Torque : 118 N·m (87 lb ft)

Spare Tire Hanger

Parts Location

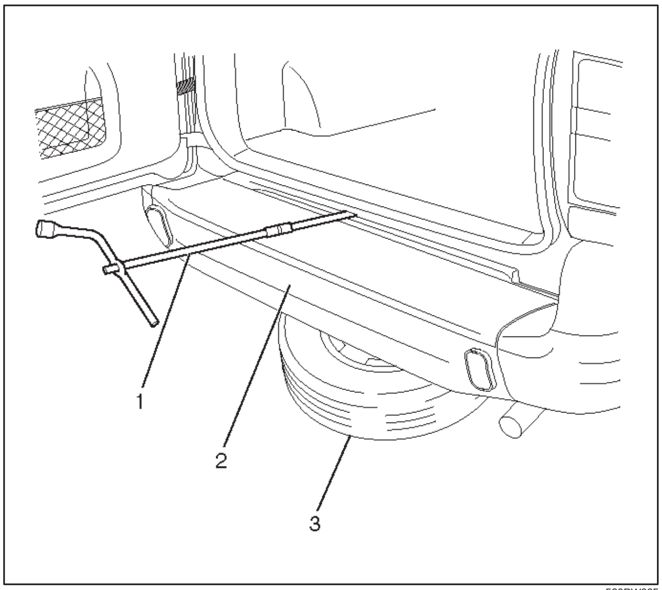


Legend

(1) Spare Tire Hanger Assembly Fixing Bolt
(2) End Cross Member
(3) Rear Suspension · Cross Member
(4) Spare Tire Support
(5) Spare Tire Support Fixing Bolt
(6) Spare Tire Stopper Rubber (RH)
(7) Spare Tire Stopper Rubber (Front)
(8) Stopper Rubber Fixing Clip
(9) Spare Tire
(10) Spare Tire Stopper Rubber (LH)
(11) Spare Tire Hanger Assembly

Removal

1. Open the hatch gate and tail gate.
2. Remove the spare tire (3).
   - Put the spare tire handle (1) to the center of upper side of rear bumper (2) and turn counterclockwise. Put spare tire down.



530RW005

3. Remove the spare tire support.
   - Remove the four bolts that are fixed to frame cross member.
4. Remove the spare tire hanger assembly.
   - Remove the two fixing bolts.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Install the spare tire firmly.
2. Tighten the spare tire support fixing bolts to the specified torque.

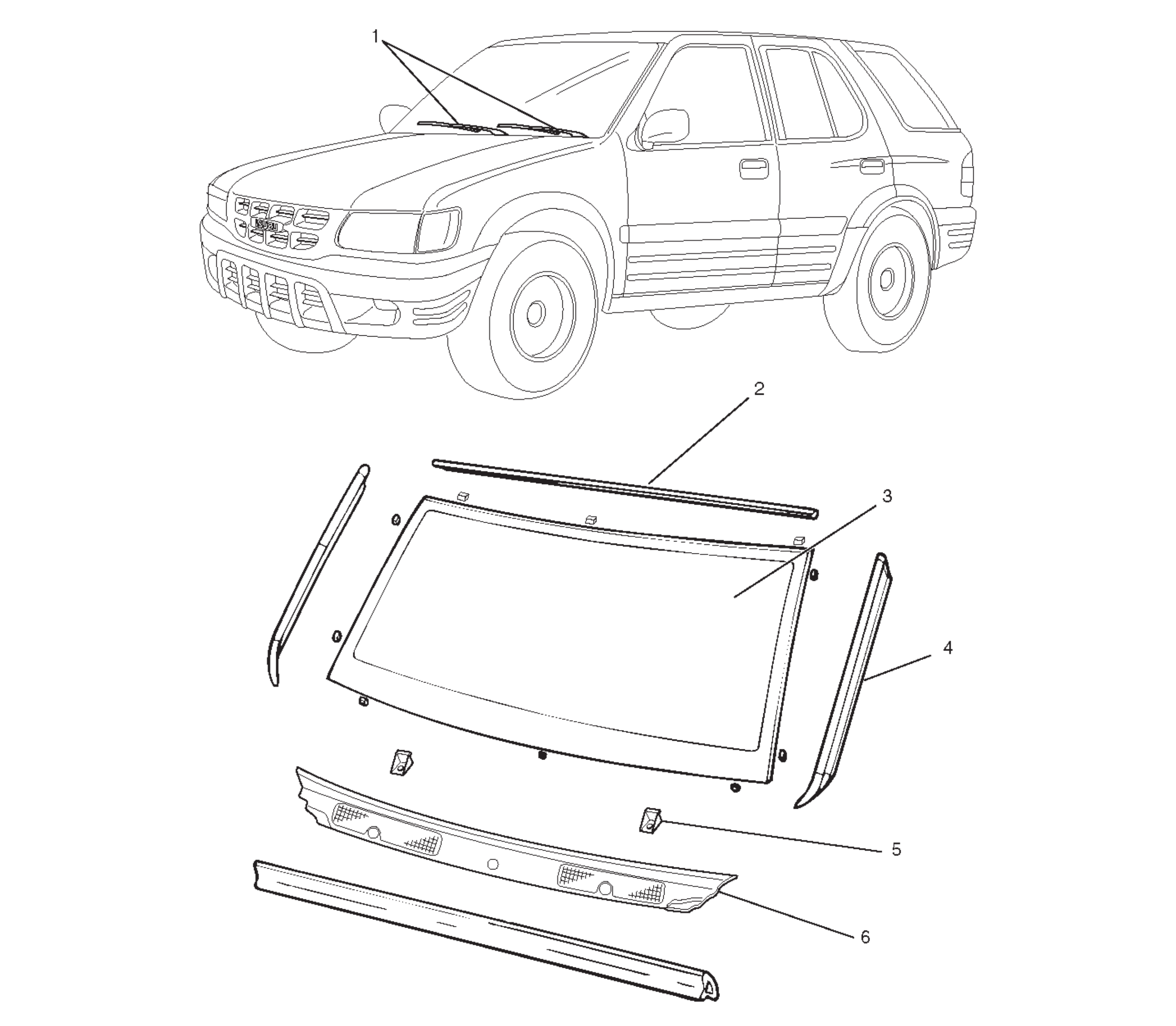
   Torque : 40 N·m (4.1 kg·m)

3. Tighten the spare tire hanger fixing bolts to the specified torque.

   Torque : 19 N·m (1.9 kg·m)

Windshield

Parts Location



607RY00001

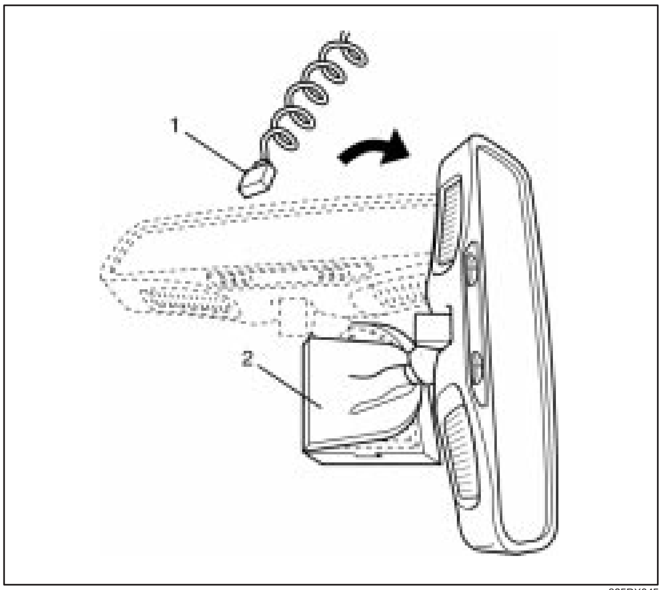
Legend

(1) Windshield Wiper Arm
(2) Windshield Upper Molding
(3) Windshield
(4) Windshield Side Molding
(5) Windshield Support
(6) Front Cowl Cover

Removal

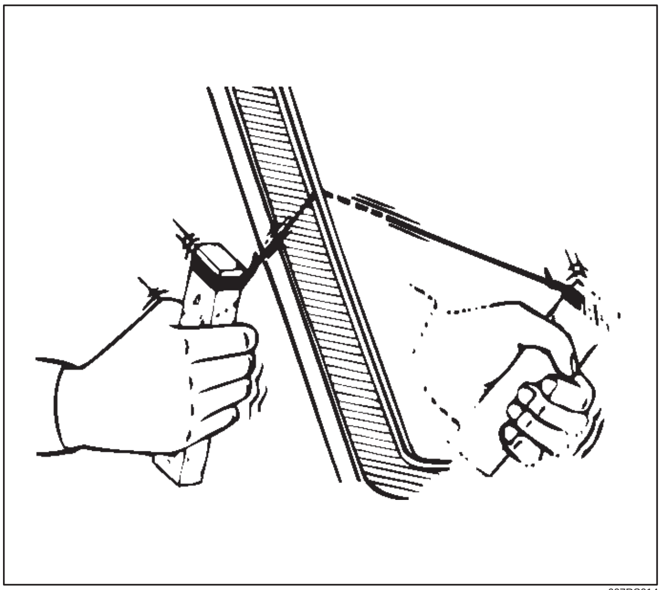
1. Disconnect the battery ground cable.
2. Remove the front pillar trim cover.
   - Turn up the finisher and pry the trim cover clips free from the body panel.
3. Remove the sunvisors and sunvisor holders.
   - Refer to Headlining in Exterior/Interior Trim section.
4. Remove the rear view mirror.
   - Disconnect the connector (1).

- Turn the channel mount (2) 90 degrees clockwise and pull down.



825RX045

5. Remove the windshield wiper arm.
   - Refer to Windshield Wiper Arm/Blade in Wiper/Washer System section.
6. Remove the windshield side molding.
   - Pull the molding out from drip rail.
7. Remove the front cowl cover.
8. Remove the windshield support.
9. Remove the upper moulding.
10. Remove the windshield.
    - Use a knife to cut through part of the adhesive caulking material.
    - Secure one end of a piece of steel piano wire (0.02 inches in diameter) to a piece of wood that can serve as a handle.
    - Use a pair of needle nose pliers to insert the other end of the piano wire through the adhesive caulking material at the edge of the windshield glass.
    - Secure the other end of the piano wire to another piece of wood.
    - With the aid of an assistant, carefully move the piano wire with a sawing motion to cut through the adhesive caulking material around the entire circumference of the windshield glass.
    - Attach some cloth tape (1) on the body for protecting the painting surface.



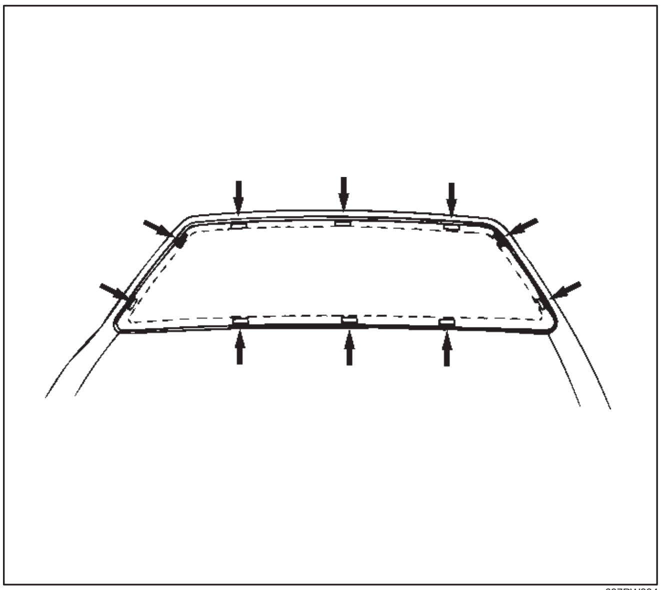
607RS014

- Clean the remaining adhesive caulking material from the area of the body which holds the windshield.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Clean the bonding surfaces of both the windshield and body panel with a soft rag and white gasoline.
2. Install the spacer.
   - Attach spacers in ten locations as shown in the figure.
   - Always use new spacer.



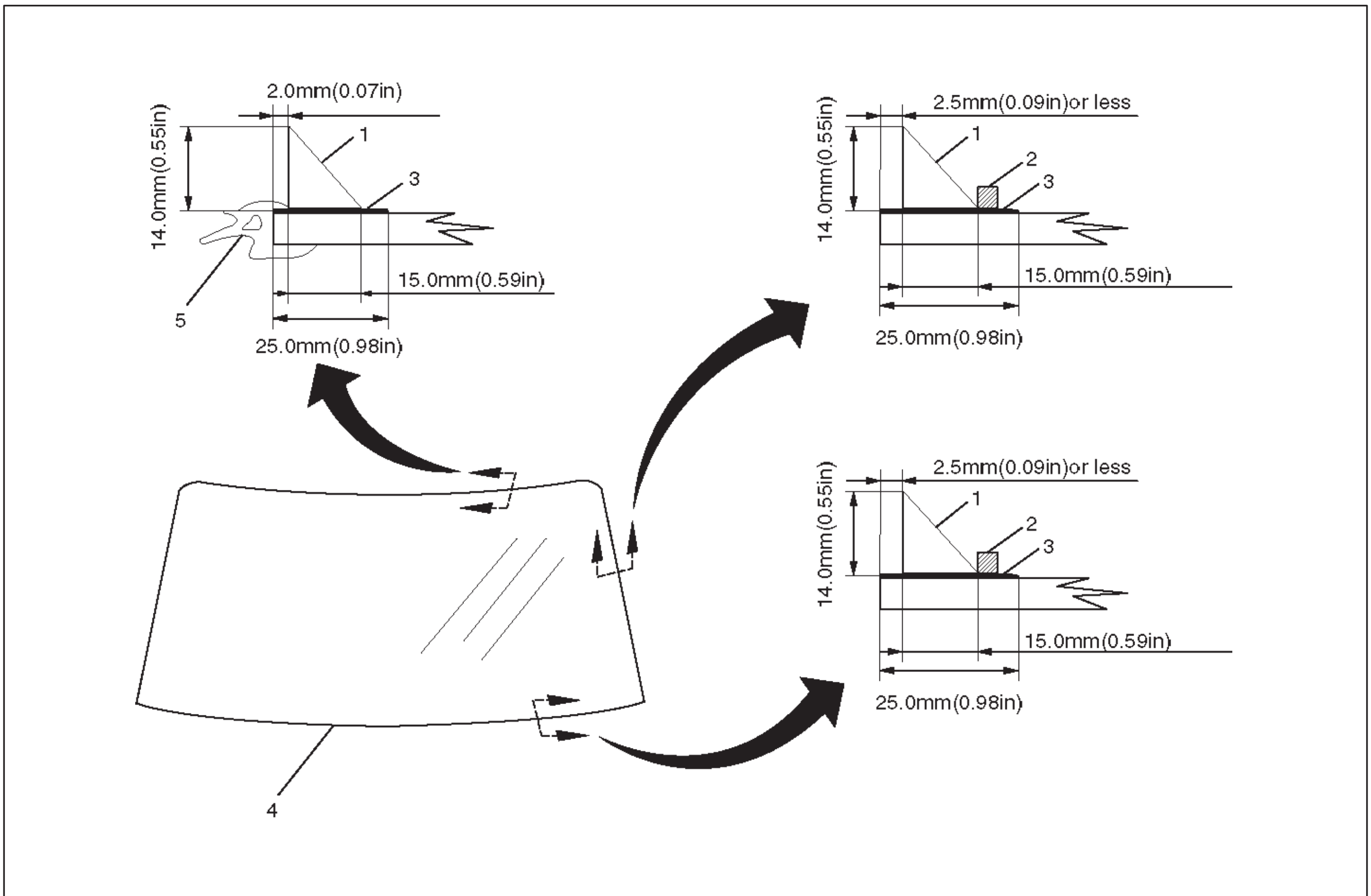
607RW004

3. Install the windshield upper molding.
   - Peel off the tear-away paper from the windshield upper molding, and start applying it with one end of the glass and cut away the surplus at the other end of the glass for length adjustment.
   - Always use new upper molding.
4. Temporary install the windshield support.
5. Apply the primer to the windshield and body panel.
   - Apply the primer (3) (Sun star # 435-40 or equivalent) to the windshield side bonding surface as shown in the figure.
   - Apply the primer (Sun star # 435-95 or equivalent) to the body side bonding surface.

NOTE: Apply an adhesive 3 minutes or more but within 24 hours after the application of primer. If more than 24 hours have passed, reapply primer.

Primer should be handled as following:

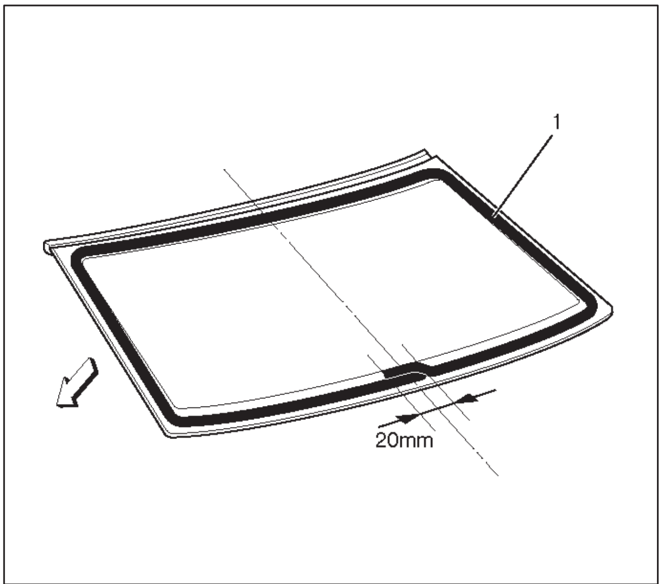
1. Use the primer manufactured 3 months or less ago and having been kept in an refrigerator.
2. Wipe off primer-stains on positions other than requires application.
3. Stir the primer for a minute or more before use.



Legend

(1) Adhesive
(2) Sealing Dam
(3) Primer Coating Area
(4) Windshield
(5) Upper Molding

6. Apply the adhesive (1) to the windshield.
   - After drying primer completely, apply a sealing adhesive (Sun star # 555 or equivalent) along the edge of the glass so that the sealing adhesive has a 20 mm (0.79 in) junction at middle of the base of the glass.



607RW015

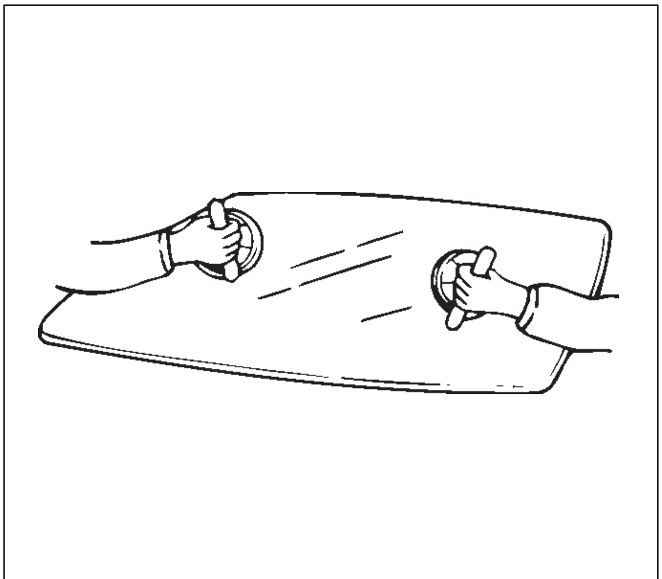
NOTE: Apply an adhesive 3 minutes or more but within 24 hours after the application of primer. If more than 24 hours have passed, reapply primer.

Adhesive should be handled as follows:

1. Use the adhesive manufactured 3 months or less ago.
2. Wipe off adhesive-stains on positions other than requires application.

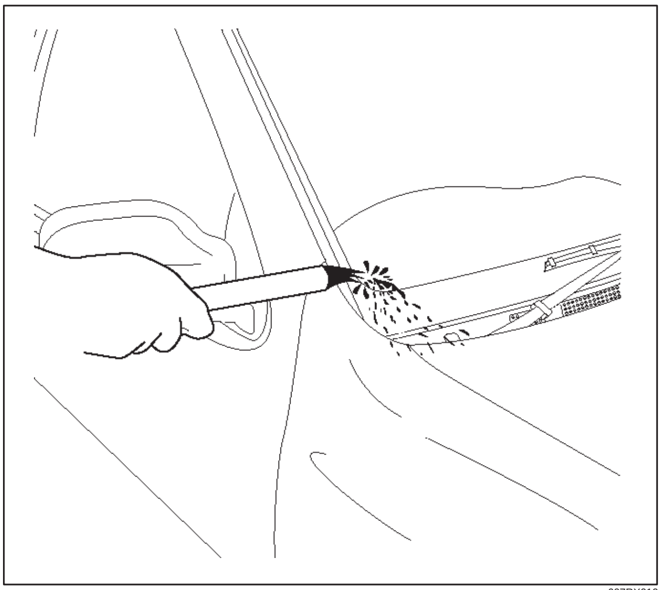
7. Install the windshield.
   - Set the windshield with sealing adhesive applied to entire circumference in the body panel. Specifically, adjust windshield support with the upper molding making contact with the body panel, press the glass, and tighten the windshield support.

NOTE: Affix the glass within 5 minutes of application.



607RS017

8. Install the front cowl cover.
9. Install side molding.
   - Use white gasoline and a soft cloth to wipe away any excess adhesive.
   - Cure the bonding at a temperature of 20˚C – 30˚C (68˚F – 86˚F) for 24 hours.
   - Check that the windshield does not leak water.

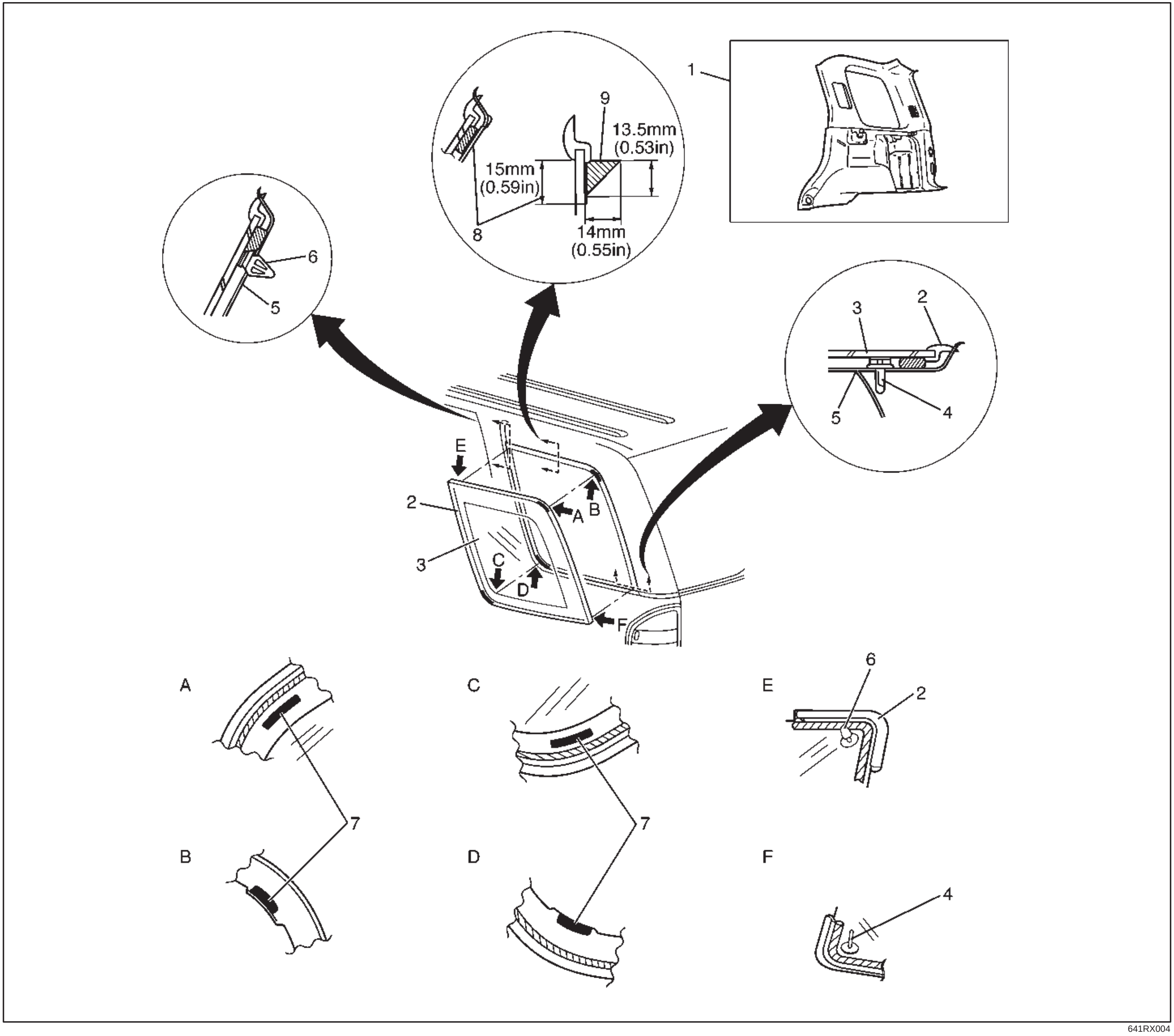


607RX010

10. Install windshield wiper arm.

Rear Quarter Glass (LWB)

Parts Location



Legend

(1) Quarter Trim Panel
(2) Rear Quarter Glass Molding
(3) Rear Quarter Glass
(4) Clip
(5) Body Panel
(6) Clip
(7) Fastener Tape
(8) Primer Coating Area (Glass side & Body side)
(9) Sealant

Removal

1. Disconnect the battery ground cable.
2. Remove the rear quarter trim panel.
   - Refer to Interior Trim Panels (LWB) in Exterior/Interior Trim section.
3. Remove the rear quarter glass.
   - Refer to Windshield in this section.

Installation

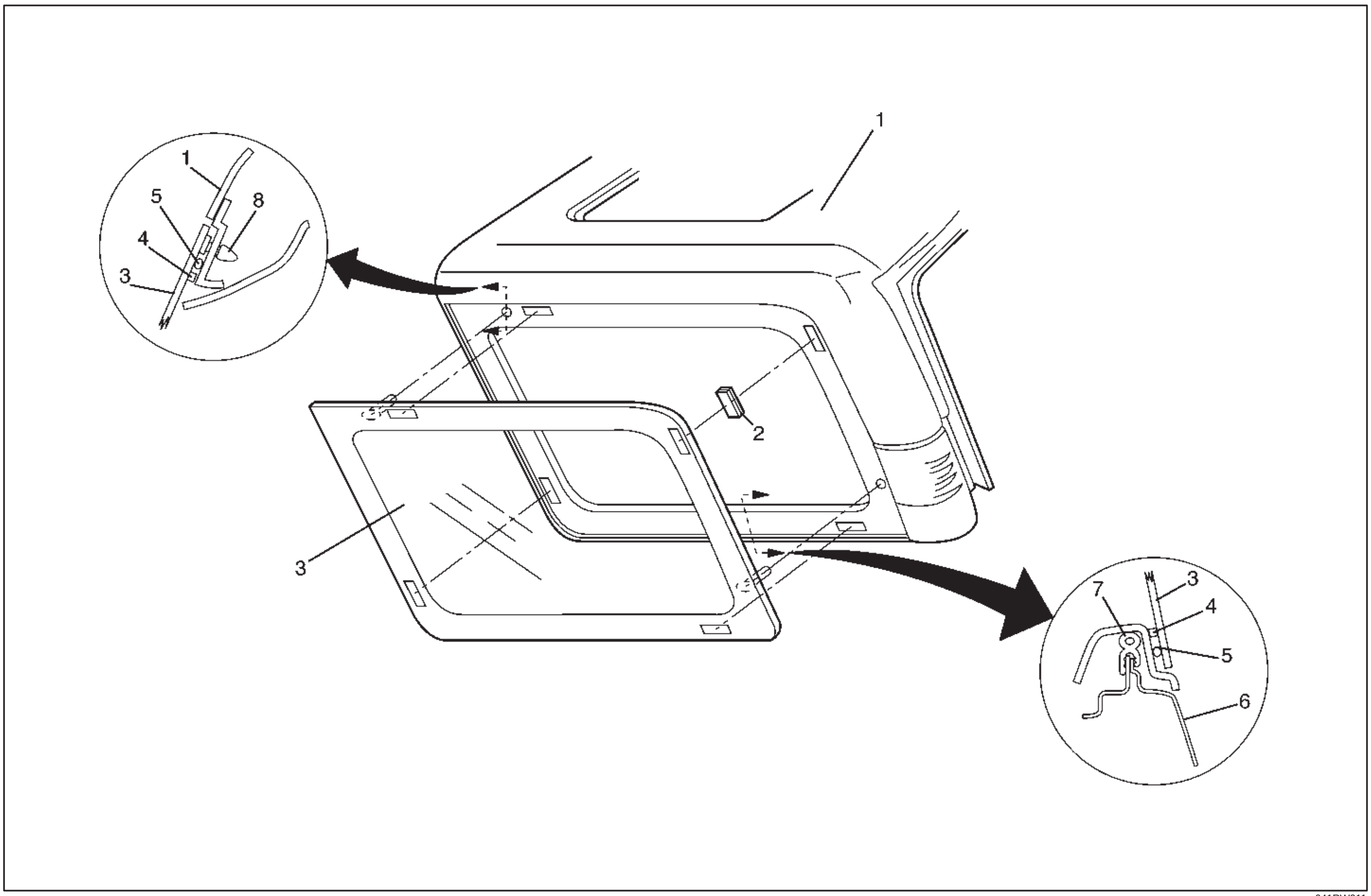
1. Rear quarter glass.
   - Clean the bonding surfaces of both the glass and the body panel.
   - Be absolutely sure to apply glass primer to the side glass.
   - Be absolutely sure to apply body primer fully to the body.

NOTE: Immediately wipe off the primer left on the body or extruded sealant.

   - Attach the fastener to the indicated position of body with sealant as shown in the figure.
   - Apply the sealant to the circumference of glass as shown in the figure.
   - Insert the location pins on glass into the panel, push the glass against the panel, and bond them.
   - Attach the molding to the body with sealant.
   - Cure the bonding at a temperature of 20°C – 30°C (68°F – 86°F) for 24 hours.
   - Check that the rear quarter glass does not leak water.
2. Install the rear quarter trim panel.

Rear Quarter Glass (Resin Top)

Parts Location



641RW011

Legend

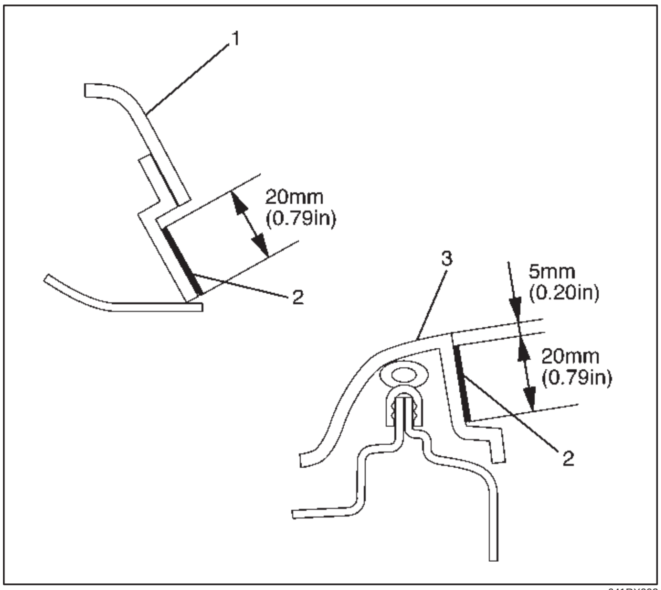
(1) Resin Top
(2) Fastener Tape
(3) Rear Quarter Glass Assembly
(4) Dam Seal
(5) Adhesive
(6) Body Panel
(7) Weather Strip
(8) Clip

Removal

1. Disconnect the battery ground cable.
2. Remove the rear quarter glass assembly.
   - Refer to Windshield in this section.

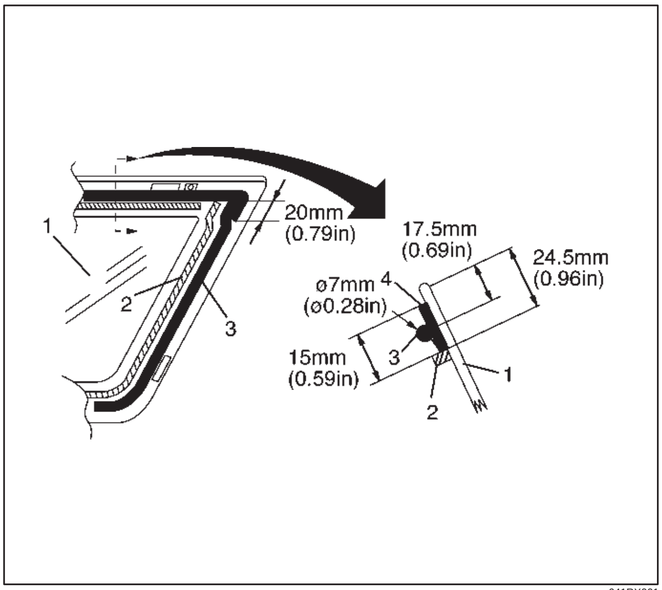
Installation

1. Use alcohol or the like to wipe clean the areas of the resin top and glass assembly that are to be affixed to each other.
2. Apply the primer (2) to the area of the resin top to which the glass is to be affixed.
   - Top edge (1) and bottom edge (3) primer coat areas.



641RX002

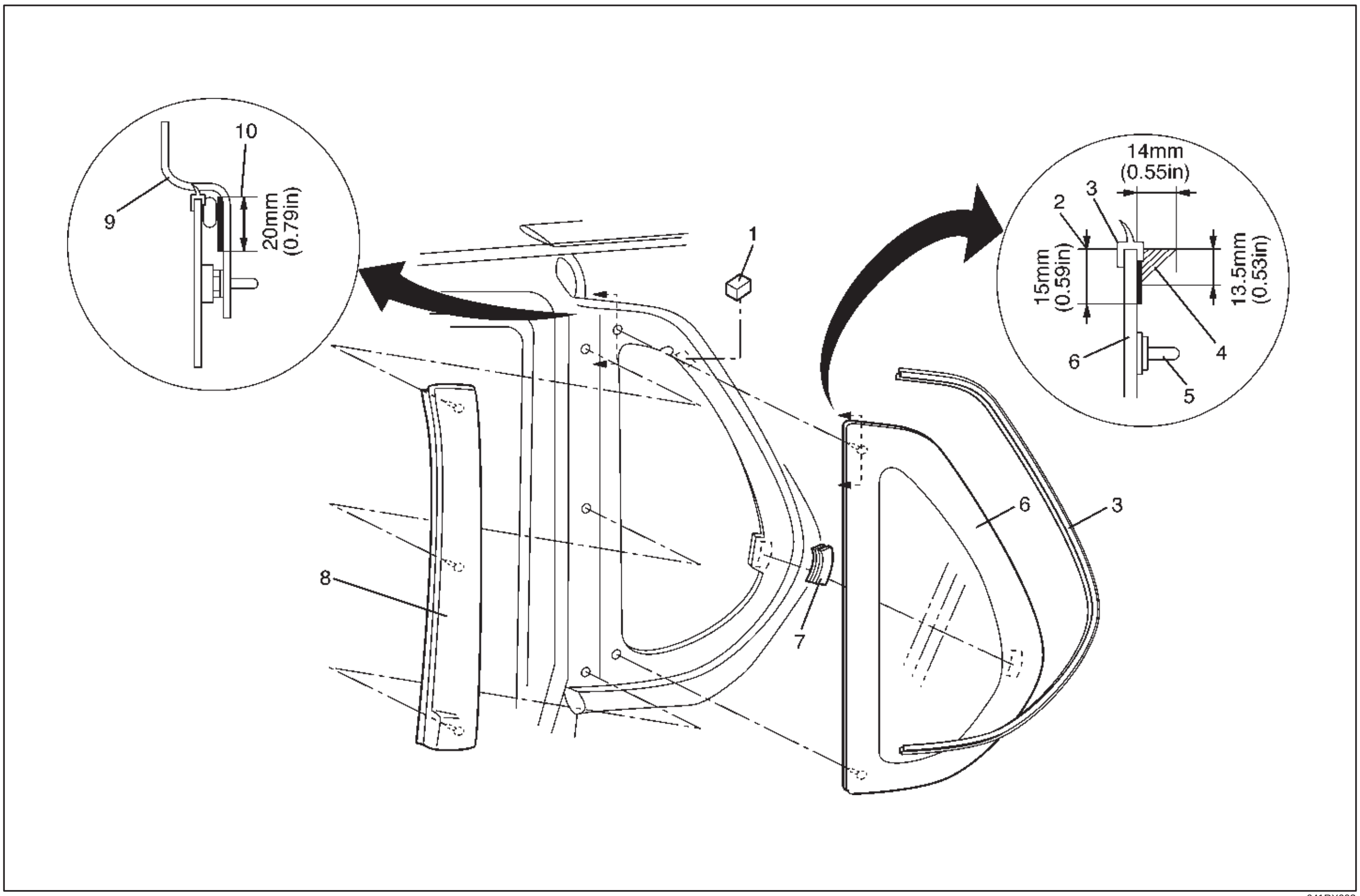
3. Stick the fasteners tape to the body in the specified locations.
4. Install the rear quarter glass assembly (1).
   - Apply the primer (4) to the rear quarter glass as shown in the figure.
   - Stick the dam seal (2) in place and then apply adhesive (3), as shown in the figure.
   - Allow a 20mm (0.79 in) overlap at the ends of the adhesive.
   - Insert the glass clips into the hole in the panel and then push the glass against the panel to affix it in place.



641RX001

Side Window Glass (SWB)

Parts Location



Legend

(1) Spacer
(2) Primer Coating Area on Glass Side
(3) Side Window Molding
(4) Adhesive
(5) Clip
(6) Side Window Glass
(7) Fastener Tape
(8) Side Window Garnish Assembly
(9) Body Panel
(10) Primer Coating Area on Body Side

Removal

1. Remove the quarter trim cover.
   - Refer to Interior Trim Panels (SWB) in Exterior/Interior Trim section.
2. Remove the side window garnish assembly.
   - Pull out the three clips to disengage them.
3. Remove the side window molding.
4. Remove the side window glass.
   - Refer to Windshield in this section.

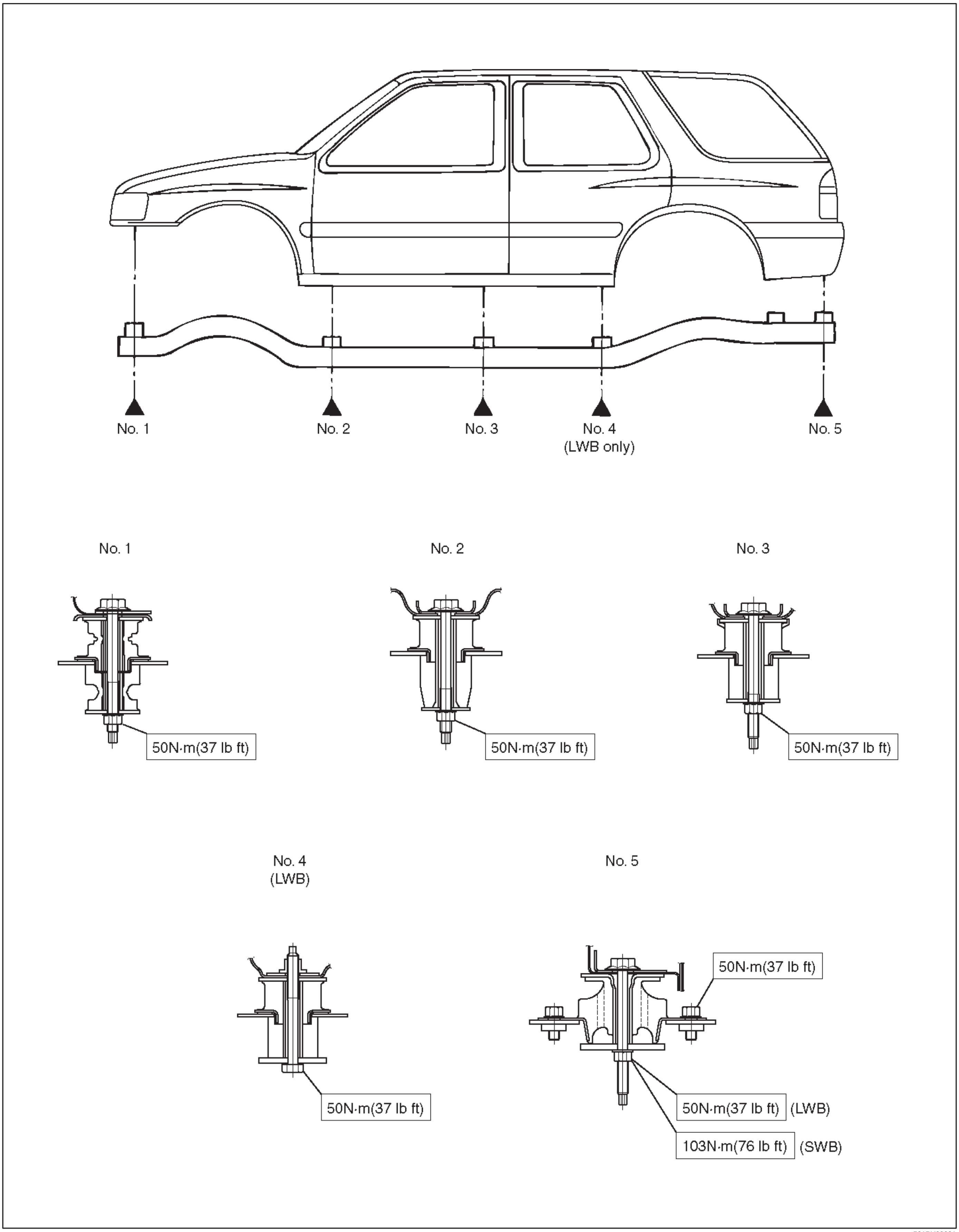
Installation

1. Install the side window glass.
   - Clean the areas of the glass and body panel that are to be affixed to each other.
   - Apply the primer to the specified areas of the glass and body panel.
   - Stick the spacer and fastener tape in place in the specified locations.
   - Apply the adhesive to the entire circumference of the glass, as shown in the figure.
   - Insert the glass clips into the panel and then push the glass against the panel to affix it in place.
   - Wipe away any adhesive that oozes out around the edges.
2. Install the side window garnish assembly.
   - Install it securely so that it does not come loose in places.

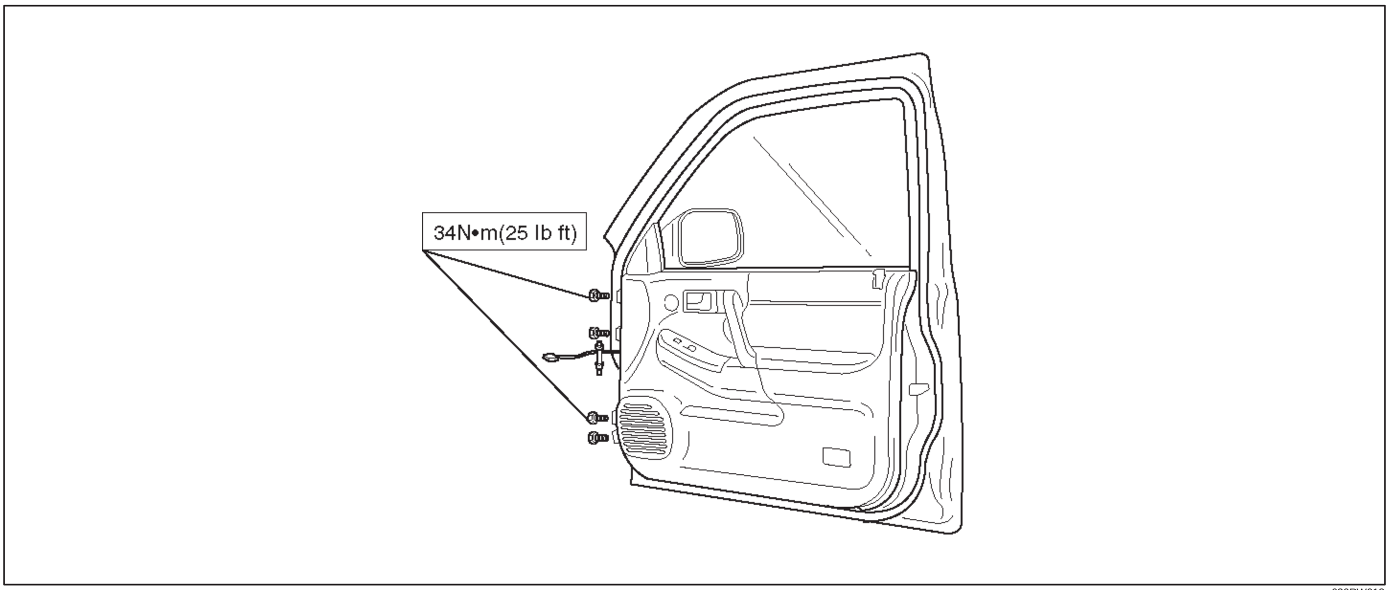
3. Install the side window molding.
   - Insert it securely so that it does not come loose in places.
   - Make sure that there is no water leakage from the side window glass.
4. Install the quarter trim cover.

Main Data and Specifications

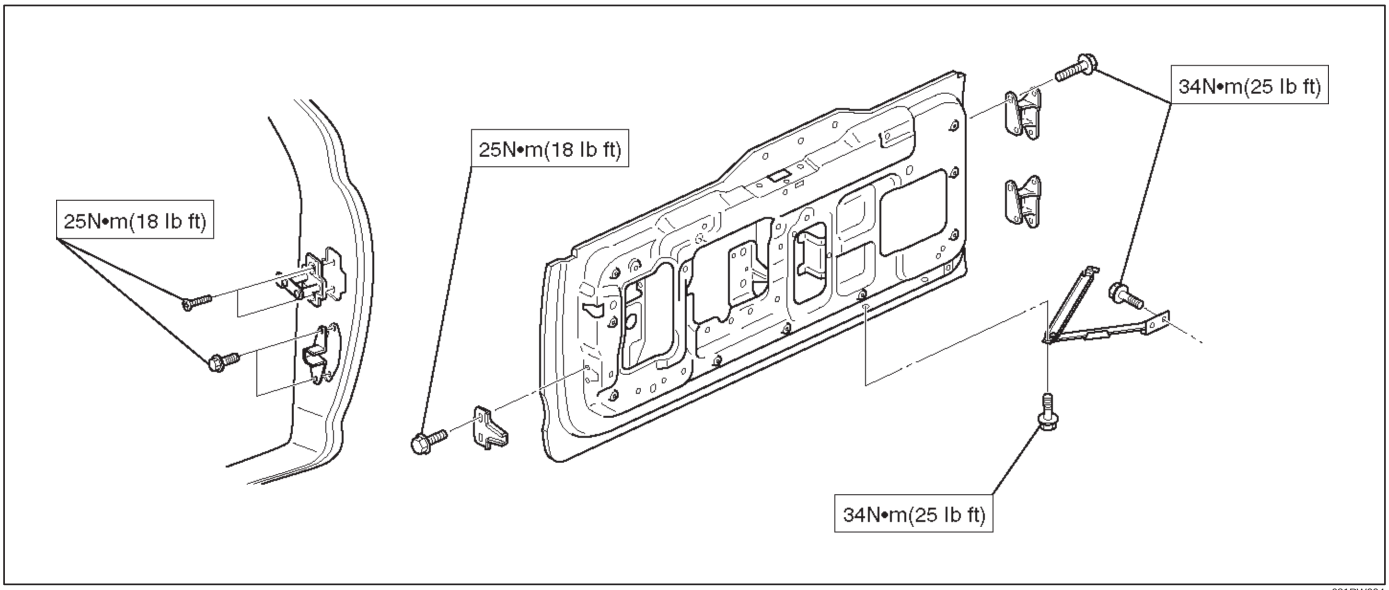
Torque Specification



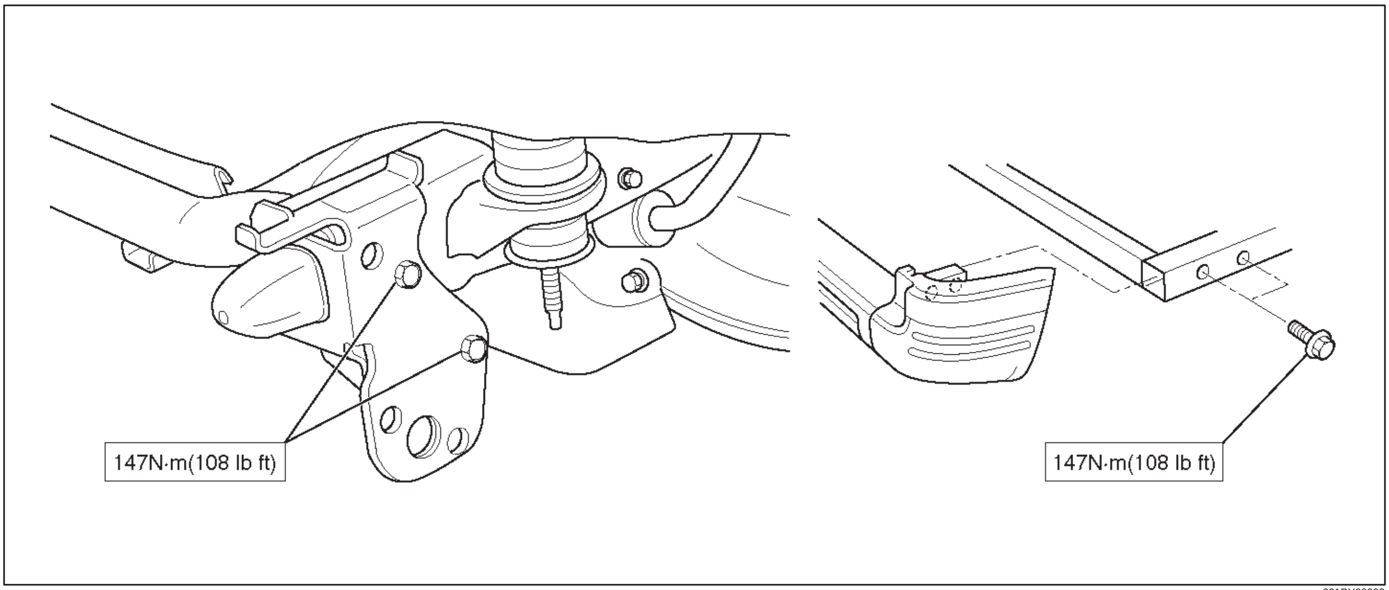
501RY00001



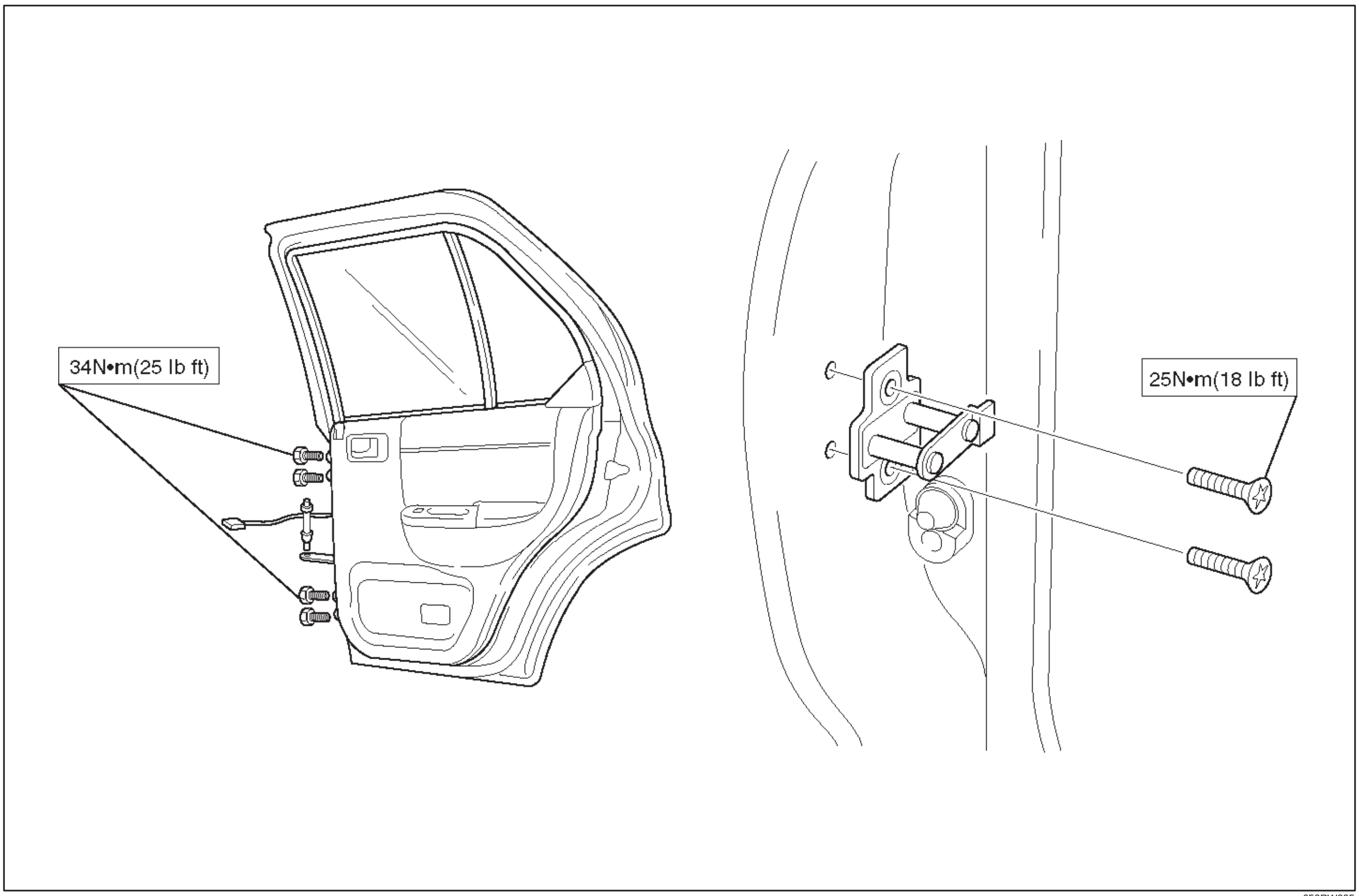
630RW013



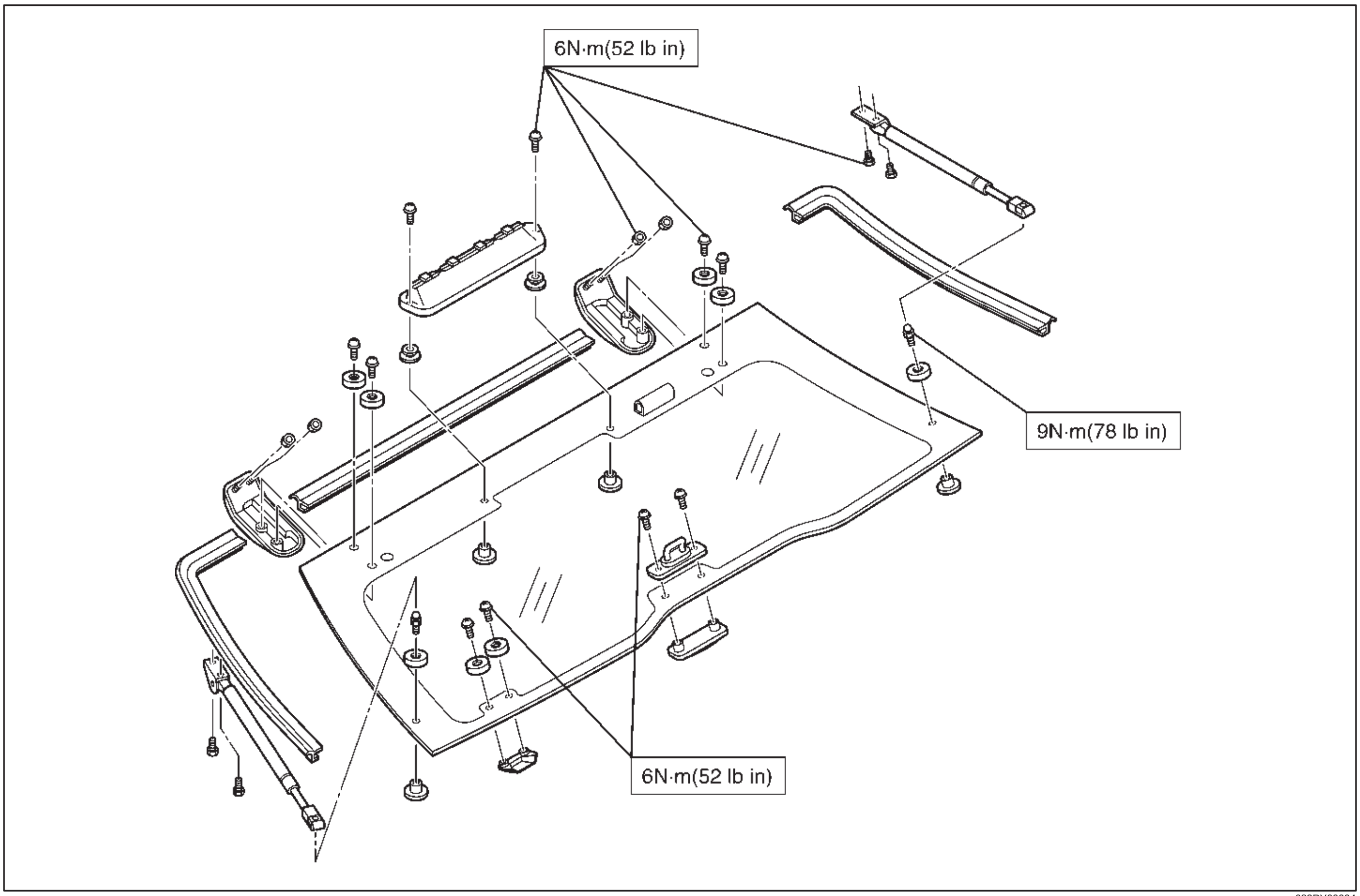
681RW004



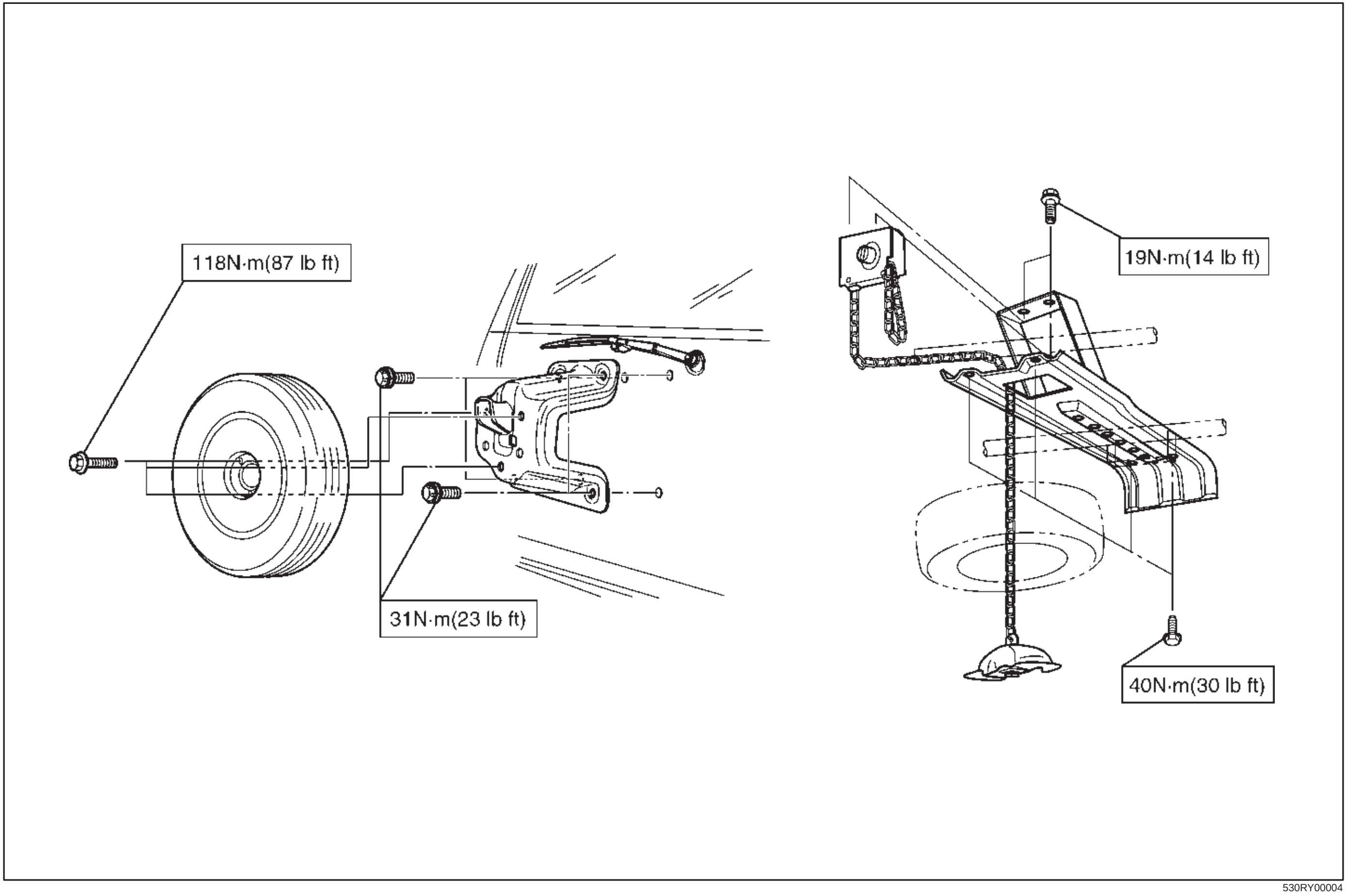
601RY00003



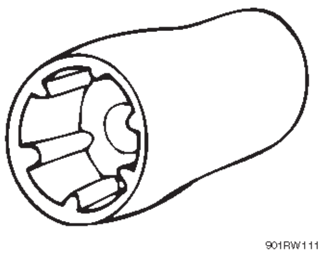
650RW005



682RY00004



Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–34355** Spare Tire Carrier Nut Wrench

RODEO

BODY AND ACCESSORIES

SEATS

CONTENTS

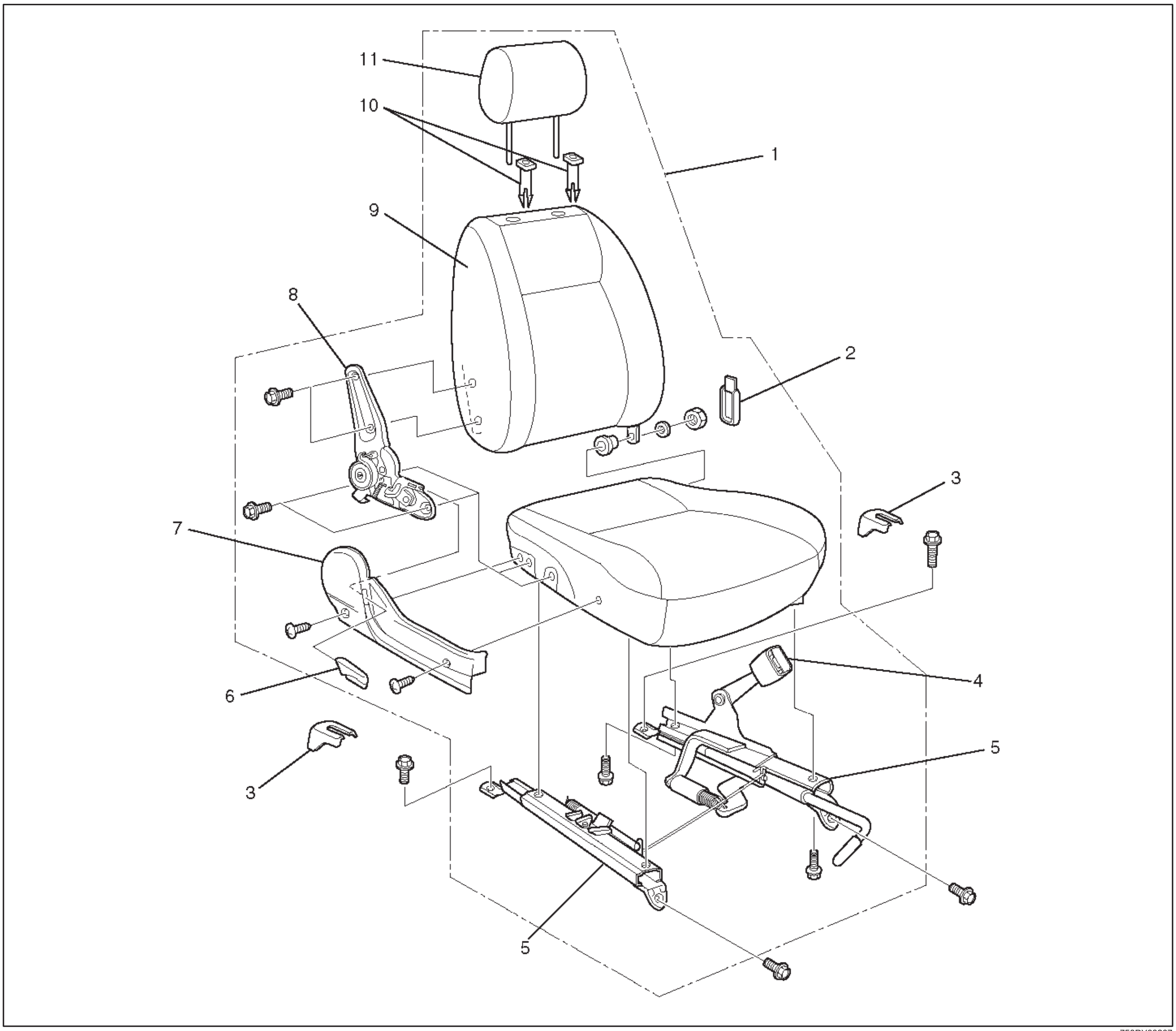
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Front Seat Assembly

Front Seat Assembly and Associated Parts



750RY00267

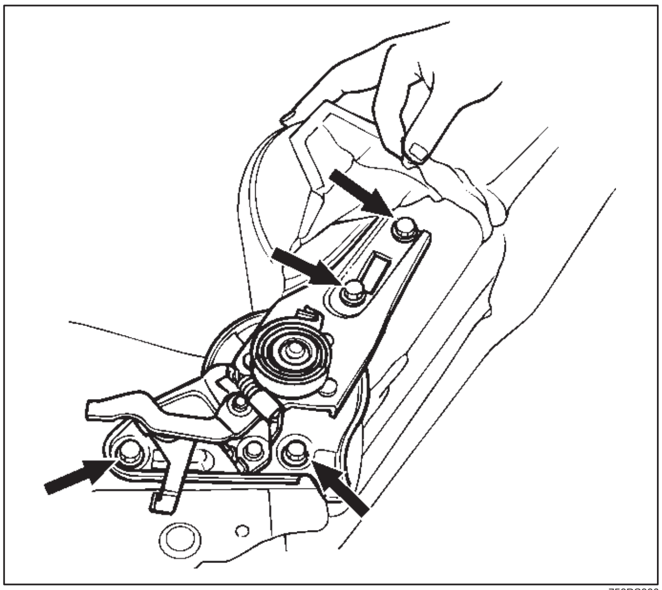
Legend

(1) Front Seat Assembly
(2) Hinge Cover
(3) Rear Cover
(4) Front Seat Belt Buckle Assembly
(5) Seat Adjuster
(6) Reclining Knob
(7) Side Cover
(8) Reclining Device
(9) Seat Back Assembly
(10) Guide Holder
(11) Headrest

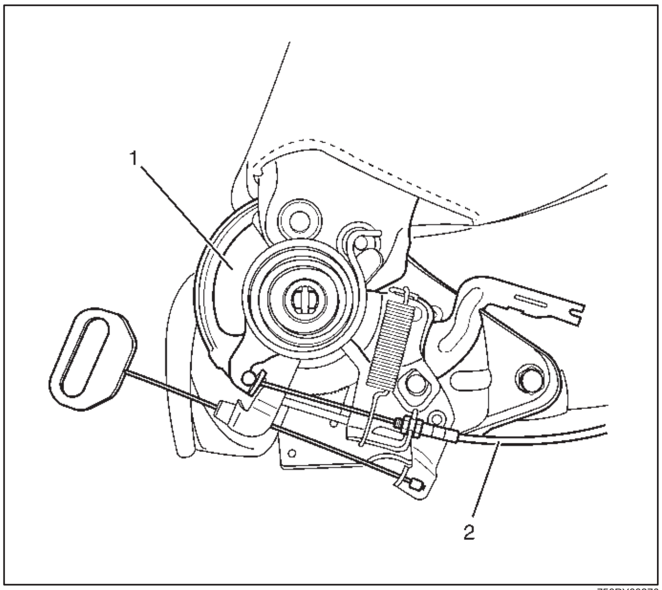
Removal

1. Disconnect the battery ground cable.
2. Remove the rear covers.
3. Remove the front seat assembly.
   - Remove the four fixing bolts.
   - Disconnect the seat belt warning connector (Driver's side only).

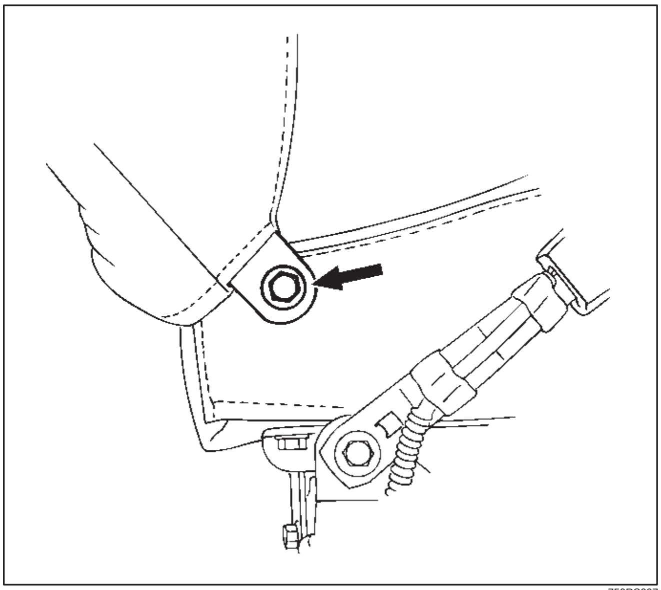
4. Pull out the reclining knob.
5. Remove the side cover.
   - Remove the two screws.
6. Remove the headrest.
7. Remove the reclining device.
   - Turn up the seat back trim cover in order to remove the reclining device fixing bolts (LWB).



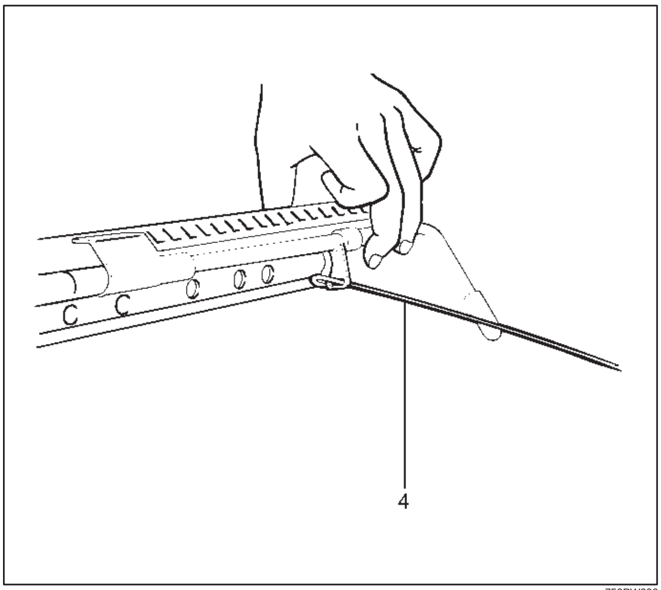
   - Remove the device (1) and disconnect the walk–in cable (2) (SWB).



8. Remove the seat back assembly.
   - Remove the seat back assembly fixing nut on the opposite side of the reclining device.



9. Remove the trim cover (Seat back side).
10. Remove the guide holder.
    - Pull the guide holder out by holding the bottom end of it from the seat back assembly.
11. Remove the seat adjuster.
    - Disconnect the release wire (4) and remove the fixing bolts.



12. Remove the seat belt buckle assembly.
13. Remove the trim cover (Seat cushion side).

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the reclining device fixing bolts to the specified torque.

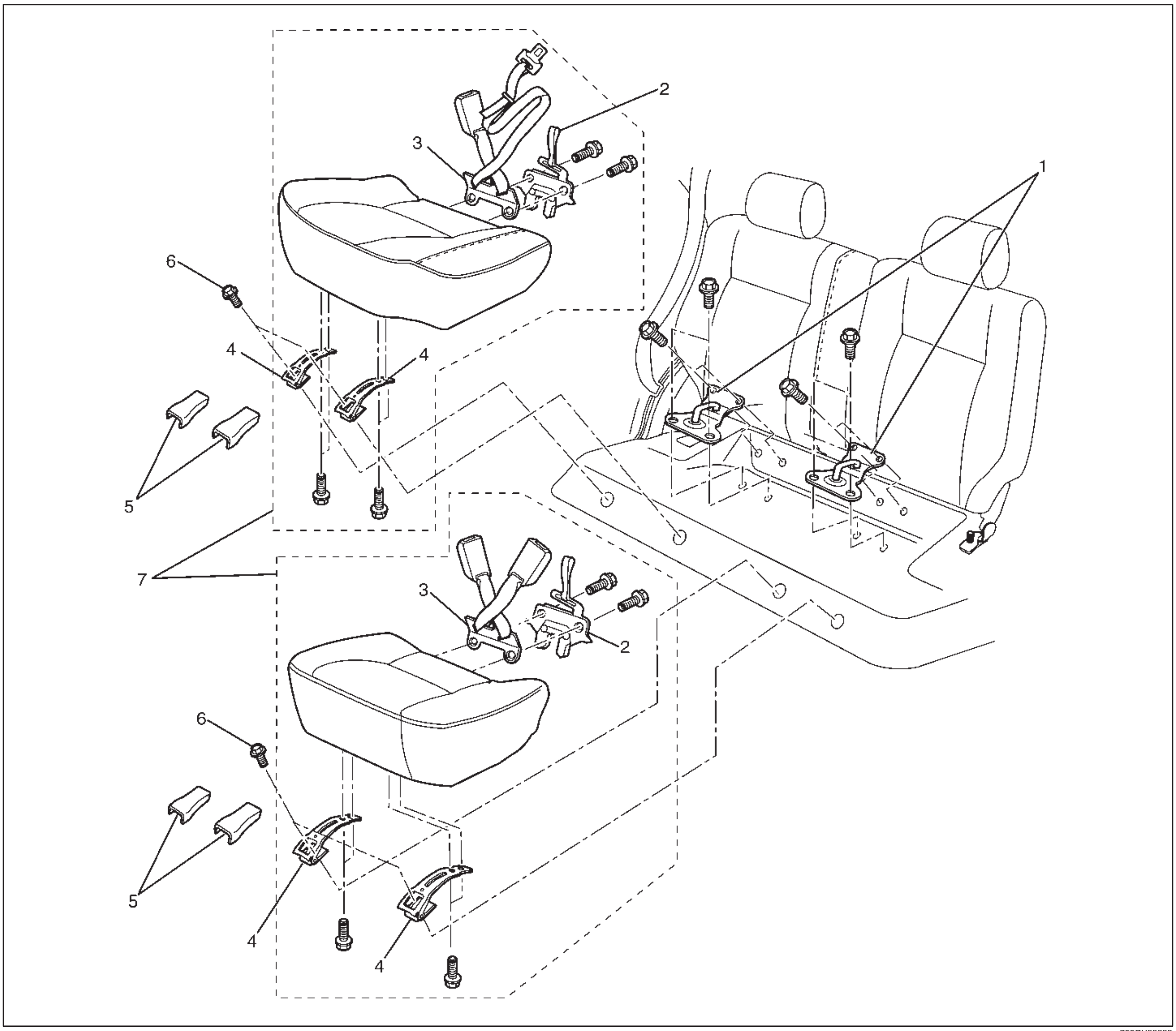
   Torque: 46 N·m (34 lb ft)

2. Tighten the front seat assembly fixing bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

Rear Seat Assembly (LWB)

Rear Seat Cushion Assembly and Associated Parts



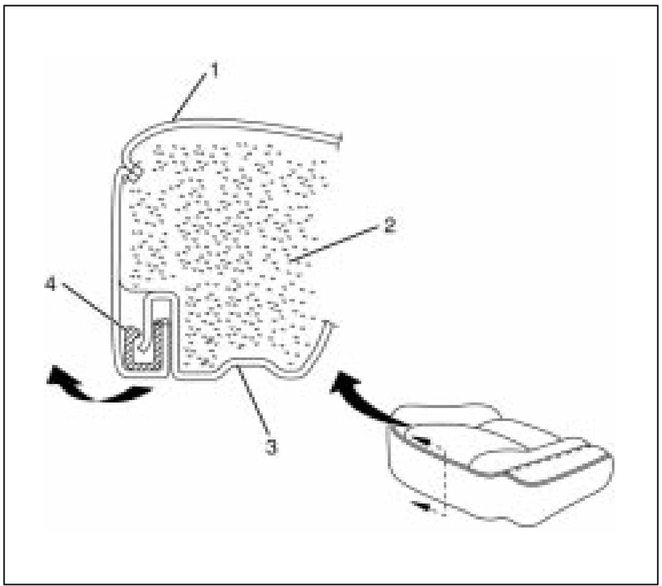
Legend

(1) Rear Seat Lock Striker
(2) Rear Seat Lock Assembly
(3) Rear Seat Belt Buckle Assembly
(4) Seat Cushion Hinge
(5) Hinge Cover
(6) Seat Cushion Fixing Bolt
(7) Rear Seat Cushion Assembly

Removal

1. Remove the hinge covers.
2. Remove the seat cushion fixing bolts.
3. Remove the seat cushion assembly.
   - Pull on the strap of the rear seat lock assembly to release the seat lock.
4. Remove the seat cushion hinges.

5. Remove the rear cushion trim cover (1) and rear seat cushion pad (2).
   - Remove cushion trim cover from rear cushion frame (3) with prying the plastic retainers (4).



755RX028

6. Remove the rear seat lock assembly and rear seat belt buckle assembly.
7. Remove the rear seat lock strikers.
   - Remove the four bolts at each striker.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the rear seat lock assembly and rear seat belt buckle assembly fixing bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

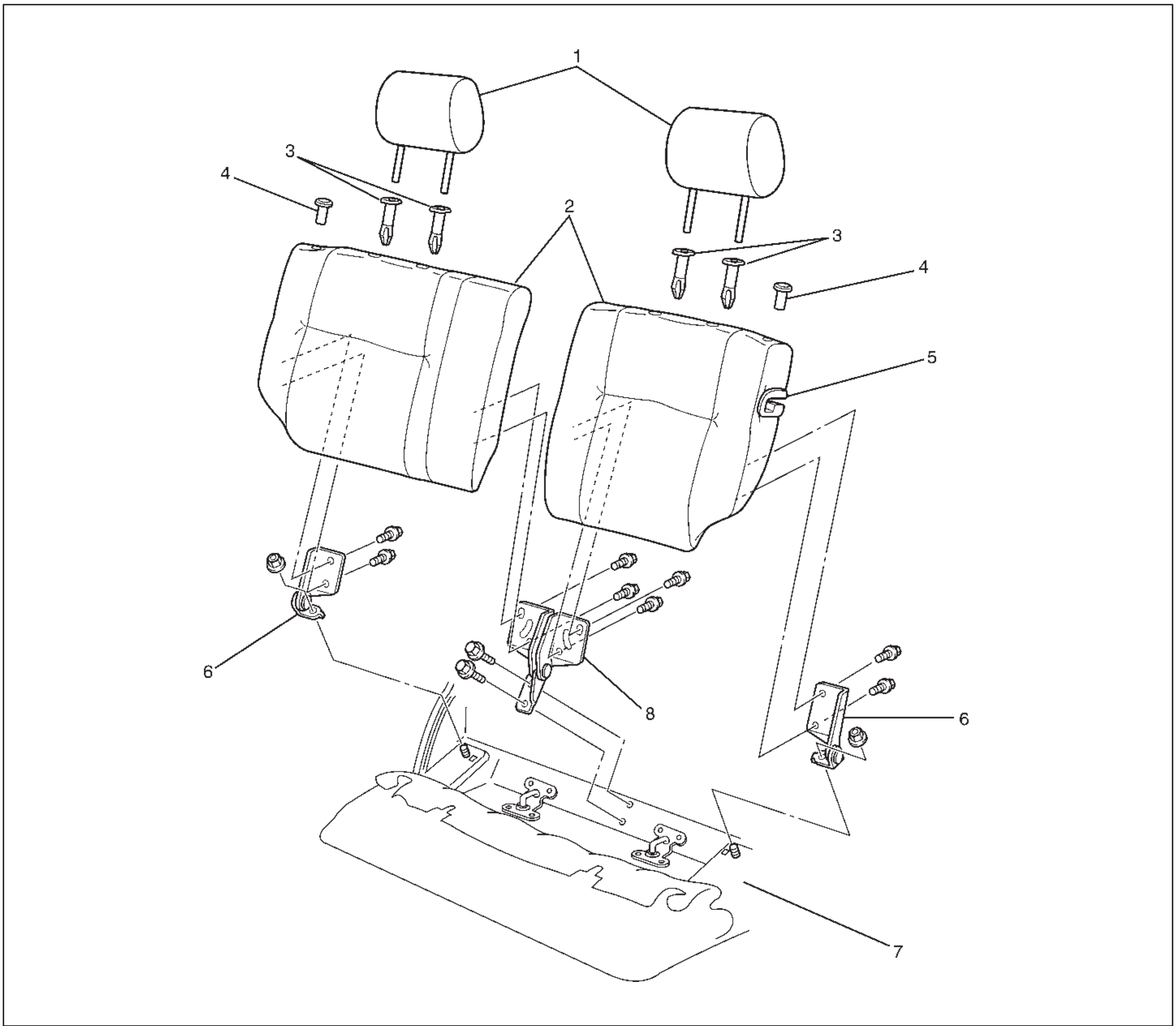
2. Tighten the rear seat lock striker fixing bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

3. Tighten the seat cushion hinge fixing bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

Rear Seat Back Assembly and Associated Parts



Legend

(1) Headrest
(2) Seat Back Assembly
(3) Guide Holder
(4) Release Knob
(5) Seat Lock Cover
(6) Side Hinge
(7) Body Floor Panel
(8) Center Hinge

Removal

1. Pull on the release knob and fold the seat back assembly forward.
2. Remove the luggage floor carpets.
   - Remove the carpet fixing nine clips at each from the backside of the seat back assembly.
3. Remove the seat back assembly.
   - Remove the four fixing bolts at each seat back.
4. Remove the seat lock covers.
5. Remove the headrests.
6. Remove the release knobs.
   - Turn the knob counterclockwise to remove it.
7. Remove the trim covers.
8. Remove the guide holders.
9. Remove the side hinges.
   - Remove the one fixing nut at each side hinge.

10. Remove the center hinge.
    - Remove the two fixing bolts.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the center hinge fiixng bolts to the specified torque.

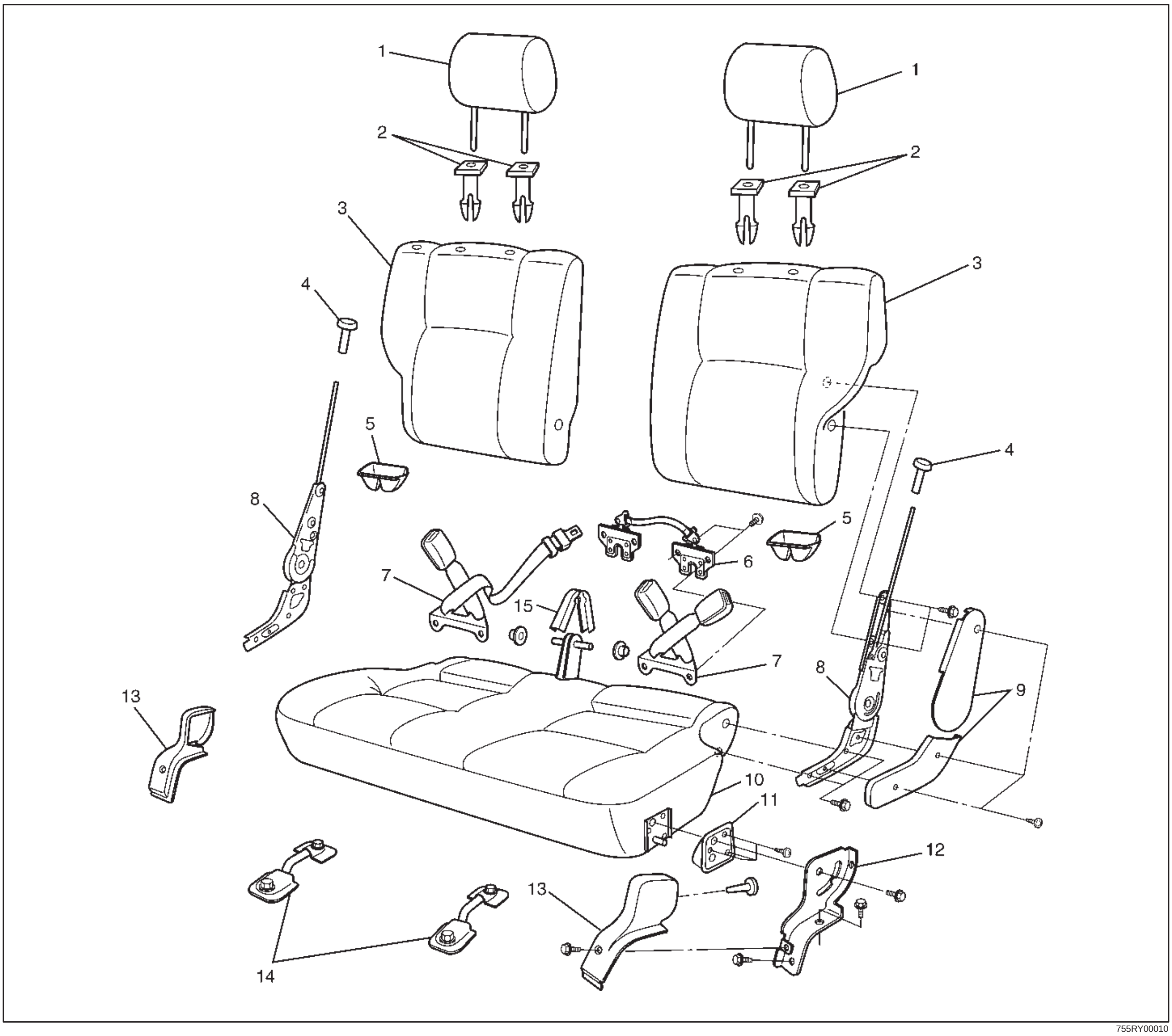
   Torque: 39 N·m (29 lb ft)

2. Tighten the side hinge fixing nuts to the specified torque.

   Torque: 29 N·m (22 lb ft)

Rear Seat Assembly (SWB)

Rear Seat Assembly and Associated Parts



Legend

(1) Headrest
(2) Guide Holder
(3) Rear Seat Back Assembly
(4) Release Knob
(5) Seat Lock Cover
(6) Seat Lock Assembly
(7) Rear Seat Belt Buckle Assembly
(8) Reclining Device
(9) Device Cover
(10) Rear Seat Cushion Assembly
(11) Support Cover
(12) Rear Seat Leg
(13) Rear Seat Leg Cover
(14) Rear Floor Lock Striker
(15) Free Hinge Cover

Removal

1. Fold the rear seat backs forward.
   - Pull up on the left and right release knobs.
2. Remove the rear seat leg covers.
   - Remove the one screw and clip from each.
3. Remove the rear seat assembly.
   - Remove the two sets of two fixing bolts from left and right sides, then pull on the seat lock strap to release the seat lock.
4. Remove the device covers (left and right).
   - Remove the three screws from each.
5. Remove the release knobs (left and right).
6. Remove the rear seat back assemblies (left and right).
   - Remove the two sets of two reclining device fixing bolts from the sides of the seat backs.
7. Remove the headrests.
8. Remove the trim covers.
9. Remove the guide holders.
10. Remove the reclining devices.
    - Remove the two sets of two fixing bolts from the sides of the seat cushions.
11. Remove the rear seat legs (left and right).
12. Remove the support covers (left and right).
    - Remove the three screws from each.
13. Remove the seat lock covers (left and right).
14. Remove the seat lock assemblies and the rear seat belt buckle assemblies (left and right).
    - Remove the two sets of two fixing bolts.
15. Remove the free hinge cover.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Tighten the seat lock assemblies and the rear seatbelt buckle assemblies to the specified torque.

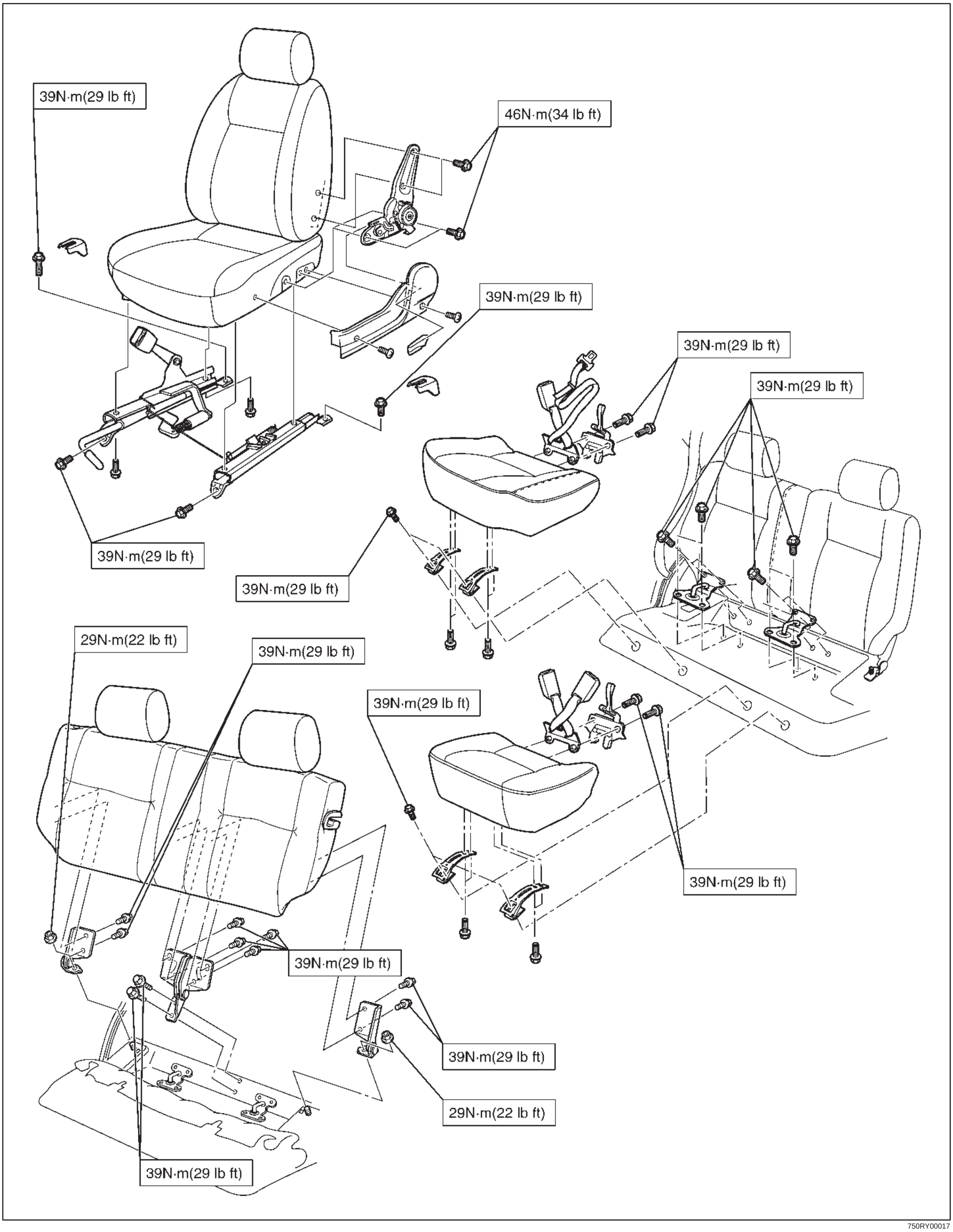
   Torque: 39 N·m (29 lb ft)
2. Tighten the reclining devices to the specified torque.

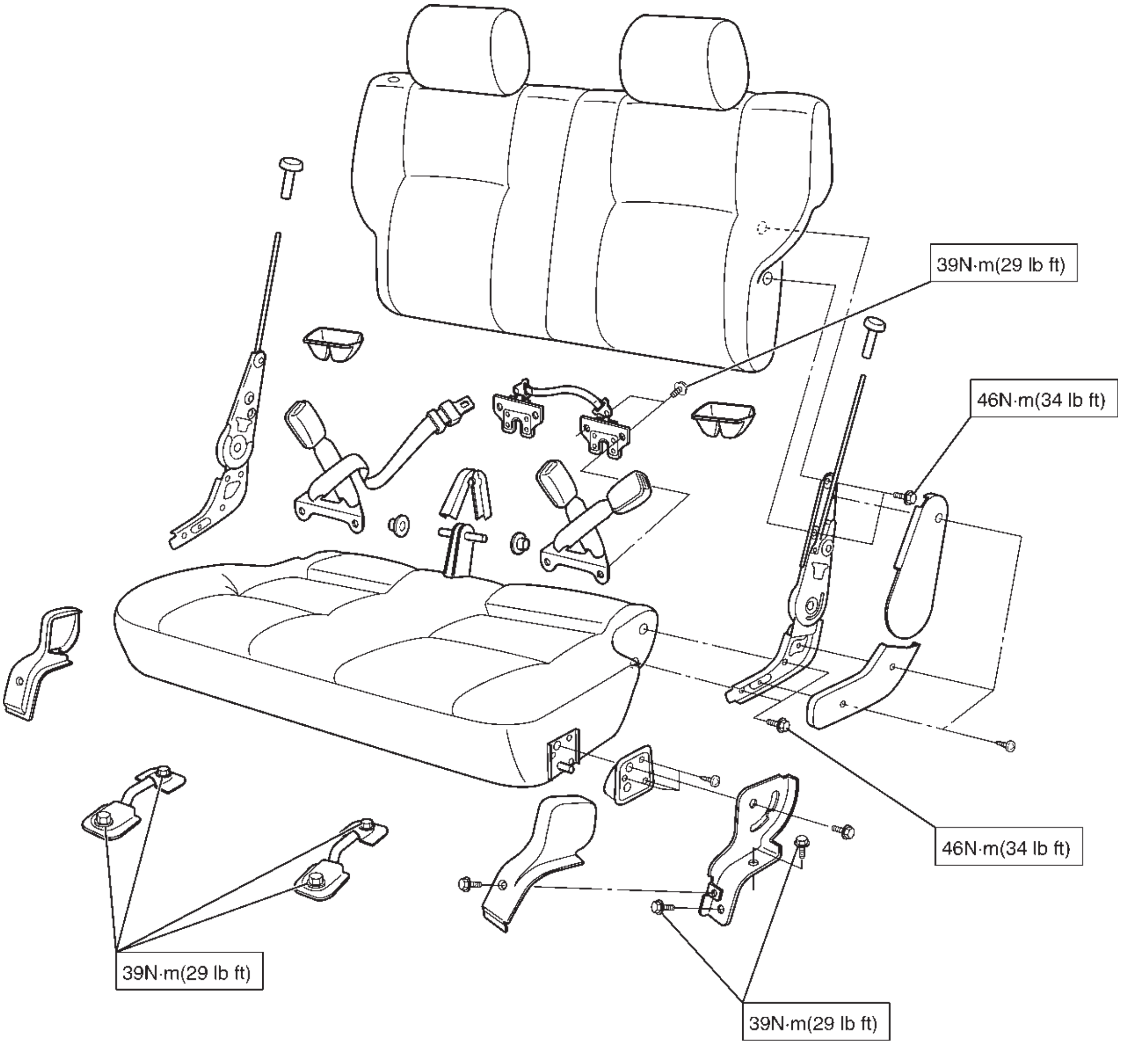
   Torque: 46 N·m (34 lb ft)
3. Tighten the rear seat assembly fixing bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

Main Data and Specifications

Torque Specifications




39N·m(29 lb ft)
46N·m(34 lb ft)
46N·m(34 lb ft)
39N·m(29 lb ft)
39N·m(29 lb ft)
755RY00011

RODEO

BODY AND ACCESSORIES

SECURITY AND LOCKS

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

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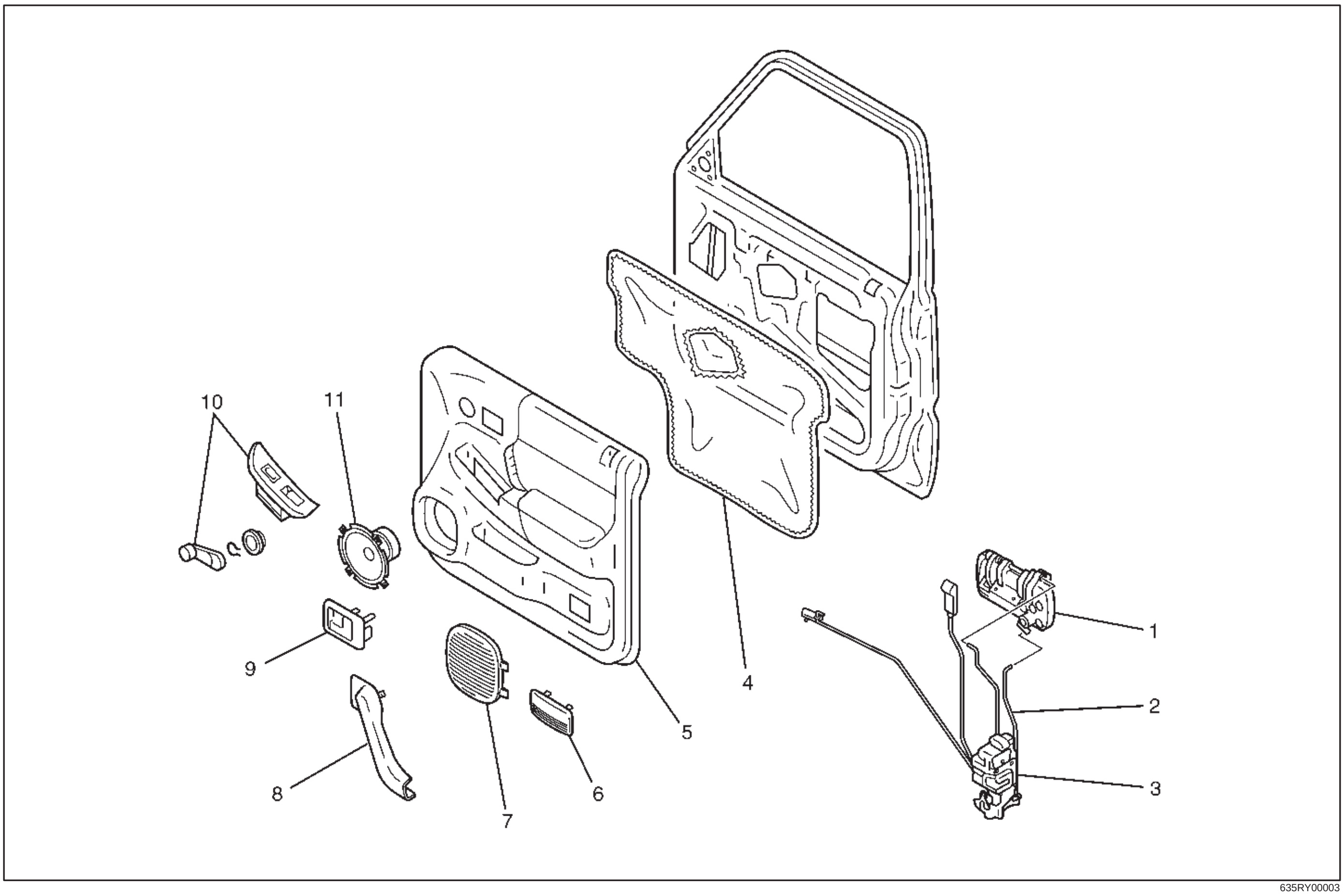
Front Door Lock Assembly

Front Door Lock Assembly and Associated Parts

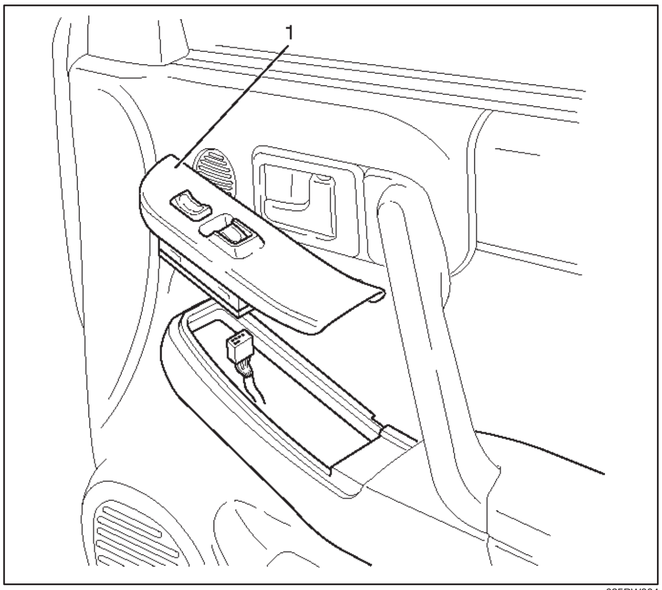


Legend

(1) Outside Handle
(2) Door Locking Link
(3) Door Lock Assembly
(4) Waterproof Sheet
(5) Door Trim Panel
(6) Courtesy Light Lens
(7) Speaker Grille
(8) Grip Cover
(9) Inside Handle
(10) Power Window Switch/Window Regulator Handle
(11) Speaker Assembly

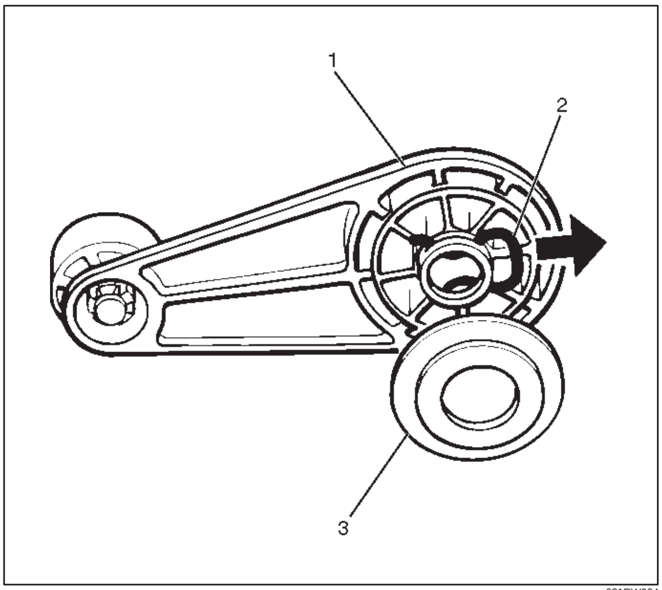
Removal

1. Disconnect the battery ground cable.
2. Remove the power window switch (1)/regulator handle.
   - Pry out the power window switch and remove the connectors.



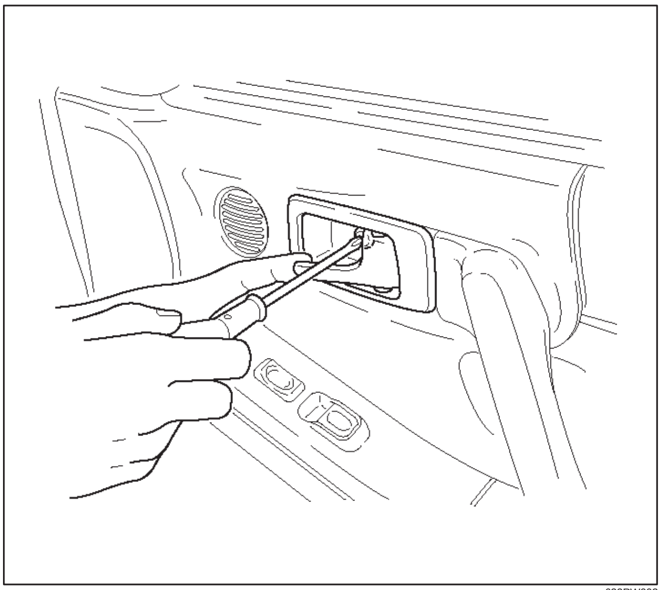
635RW004

   - To remove the regulator handle (1), remove the clip (2), at the root of the handle by using wire with hook.



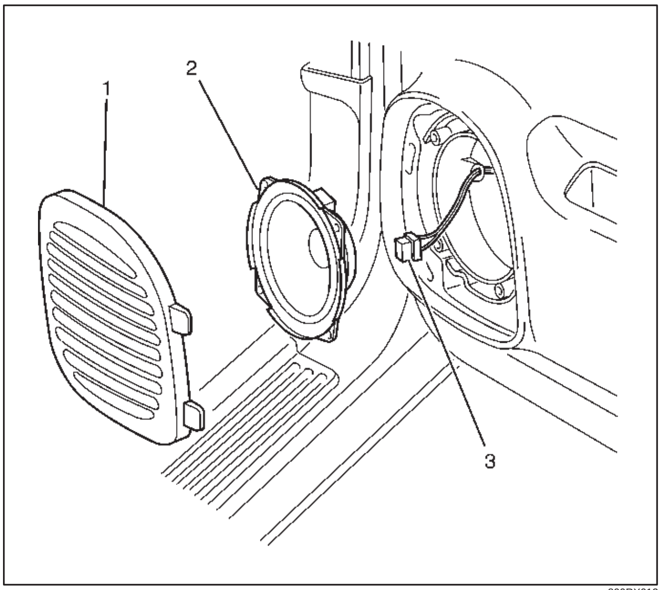
631RW004

3. Remove the screw while pulling the inside lever toward you and then remove the inside handle.



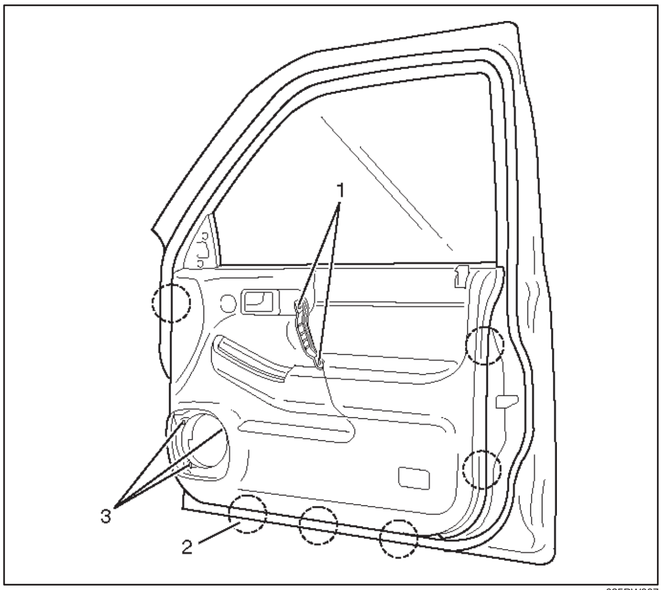
632RW003

4. Remove the speaker grille (1).
   - Pull out the front side of the grille.
5. Remove the speaker assembly (2).
   - Remove 4 screws and disconnect the speaker harness connector (3).



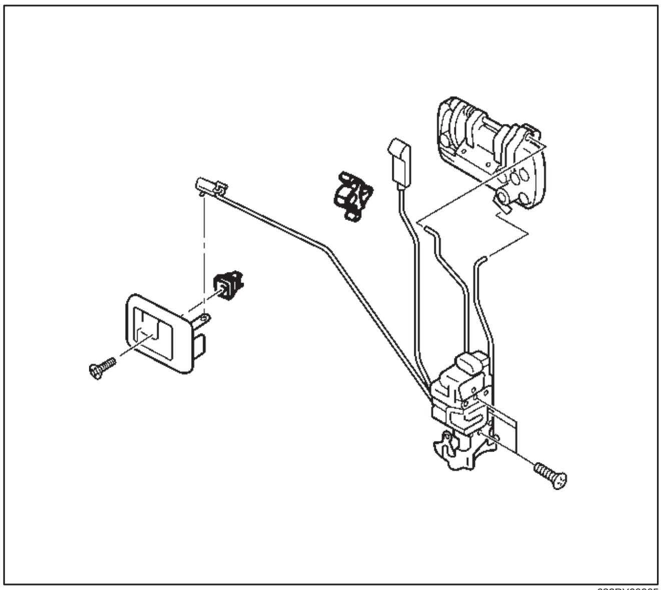
890RX012

6. Remove the courtesy light lens.
7. Remove the 5 screws (1), (3) and pull out the door trim panel at the 6 clip (2) positions.



635RW007

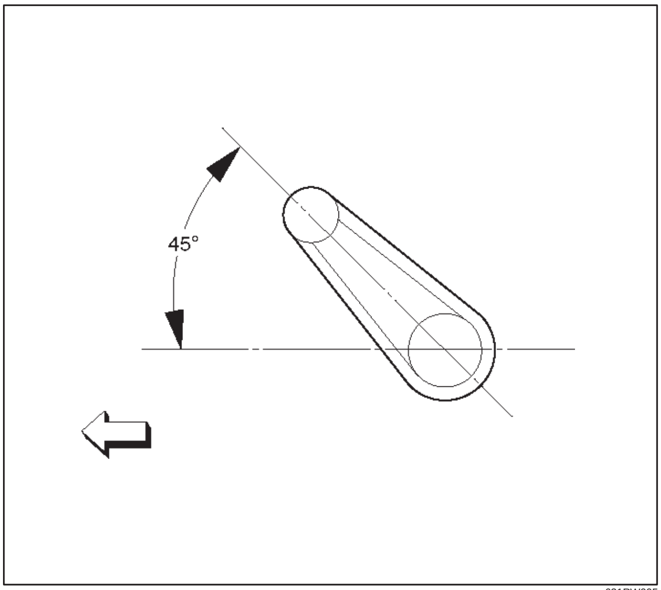
8. Remove the waterproof sheet.
   - Taking notice of the door harness, peel the waterproof sheet off the door panel carefully.
9. Raise the glass up to the uppermost position, and then remove the rear guide rail.
10. Disconnect the locking links then remove the door lock assembly fixing screws and door lock assembly.


632RY00005

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. Apply chassis grease to the lock assembly and striker moving surface.
2. Install the regulator handle as shown in the illustration, if equipped without power windows.



631RW005

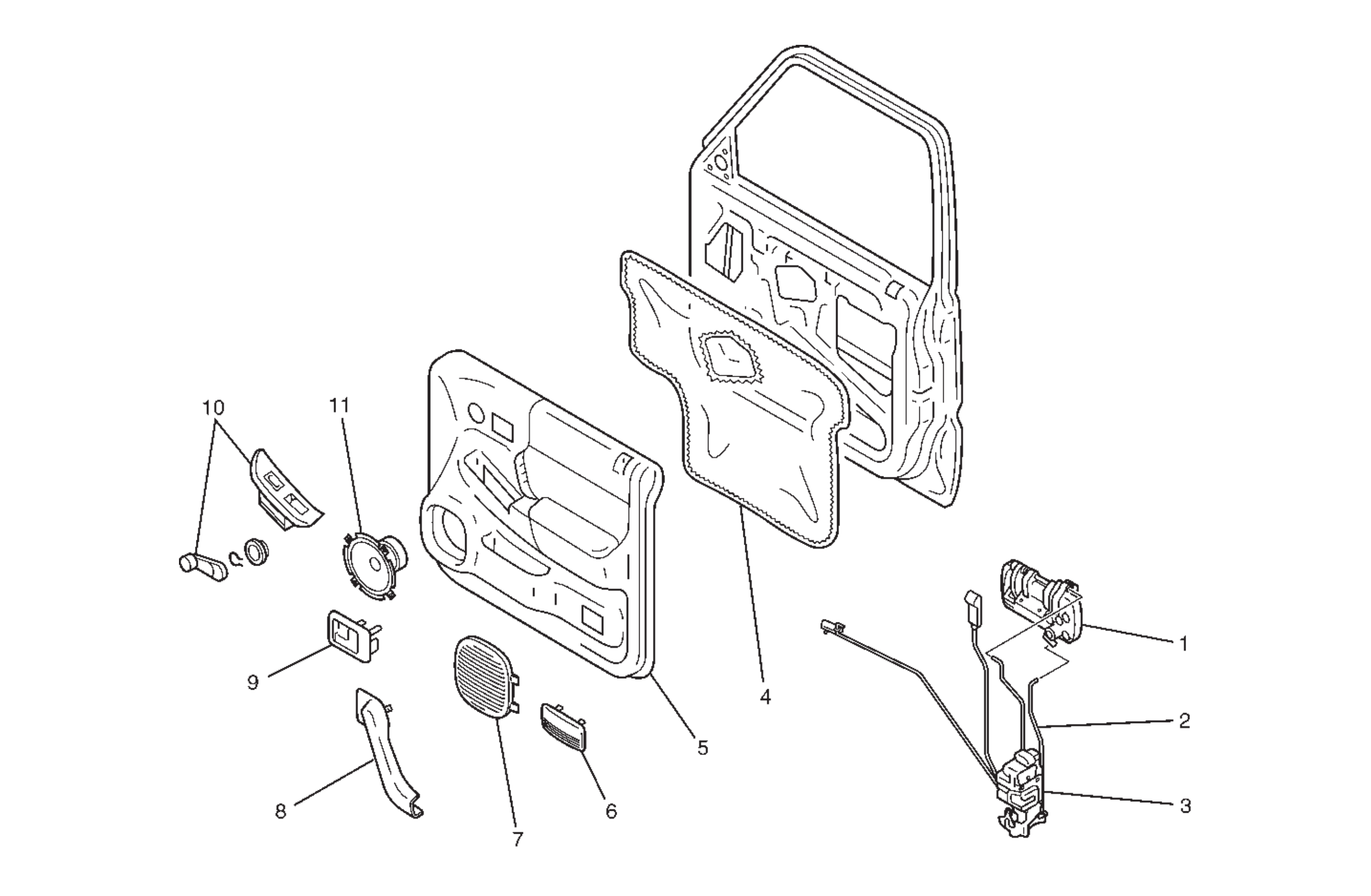
3. Tighten the door lock assembly fixing screws to the specified torque.

Torque 7 N·m (61 lb in)

4. Check that the door lock operates smoothly.

Front Outside Handle

Front Outside Handle and Associated Parts



Legend

(1) Outside Handle
(2) Door Locking Link
(3) Door Lock Assembly
(4) Waterproof Sheet
(5) Door Trim Panel
(6) Courtesy Light Lens
(7) Speaker Grille
(8) Grip Cover
(9) Inside Handle
(10) Power Window Switch/Window Regulator Handle
(11) Speaker Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel.
   - Refer to Front Door Lock Assembly in this section.
3. Remove the waterproof sheet.
   - Taking notice of the door harness, peel the waterproof sheet off the door panel carefully.
4. Disconnect the locking links and remove the outside handle.
5. Remove the fixing clip to remove the door lock cylinder.

Installation

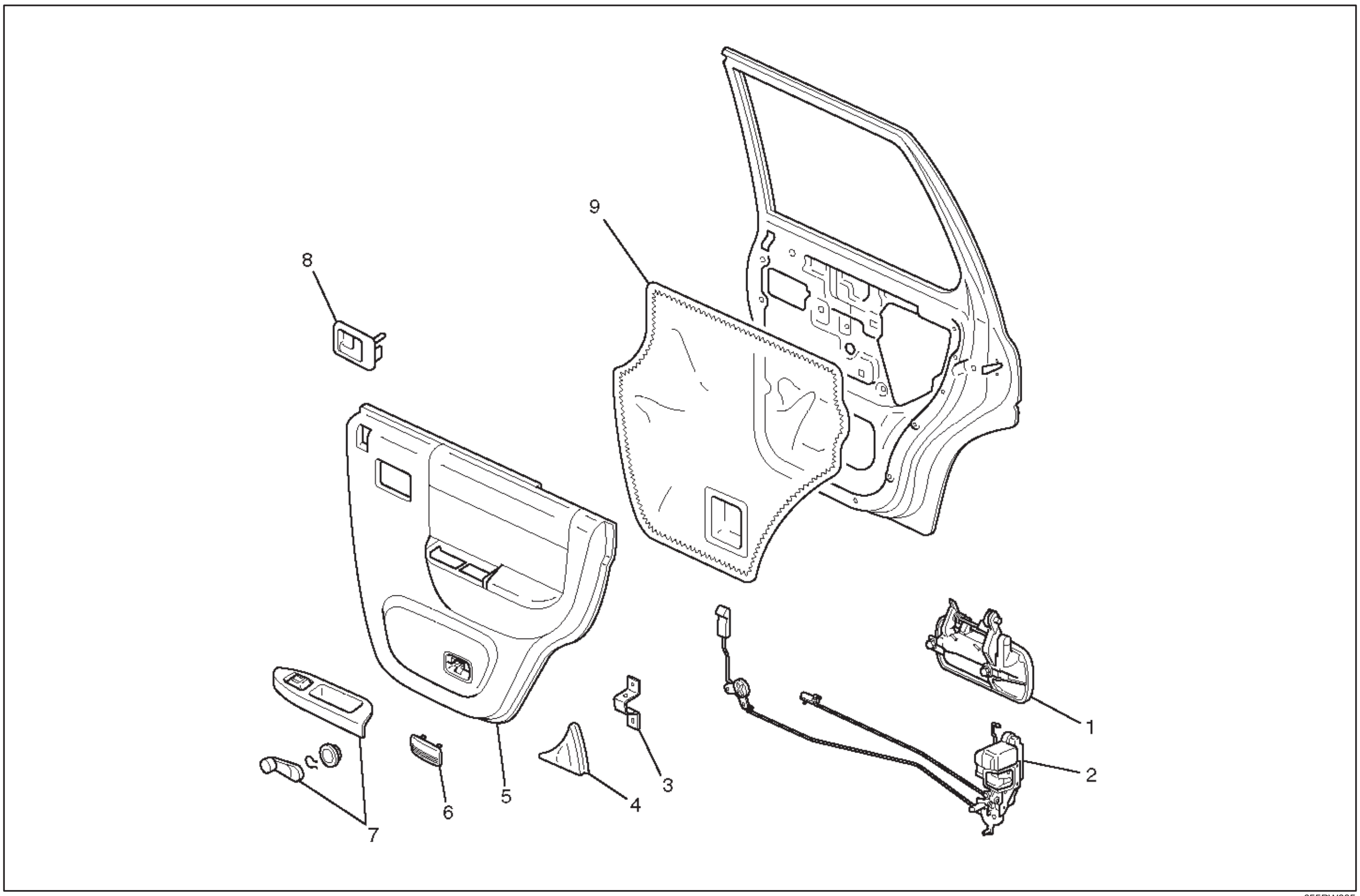
To install, follow the removal steps in the reverse order, noting the following points:

1. Be sure to install the door lock cylinder at a right angle to the outside handle.
2. Check for smooth outside handle and lock cylinder operation.
3. Tighten the outside handle fixing bolts to the specified torque.

Torque 9 N·m (78 lb in)

Rear Door Lock Assembly

Rear Door Lock Assembly and Associated Parts



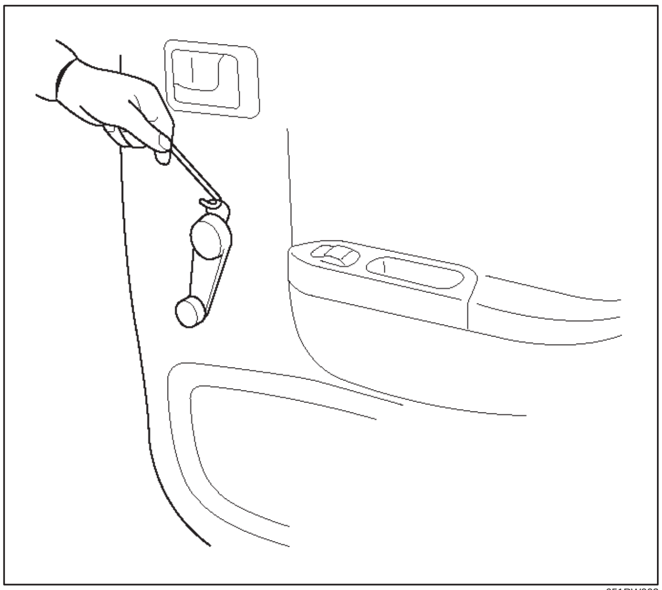
655RW005

Legend

(1) Outside Handle
(2) Door Lock Assembly
(3) Bracket
(4) Rear Corner Garnish
(5) Door Trim Panel
(6) Courtesy Light Lens
(7) Power Window Switch/Window Regulator Handle
(8) Inside Handle
(9) Waterproof Sheet

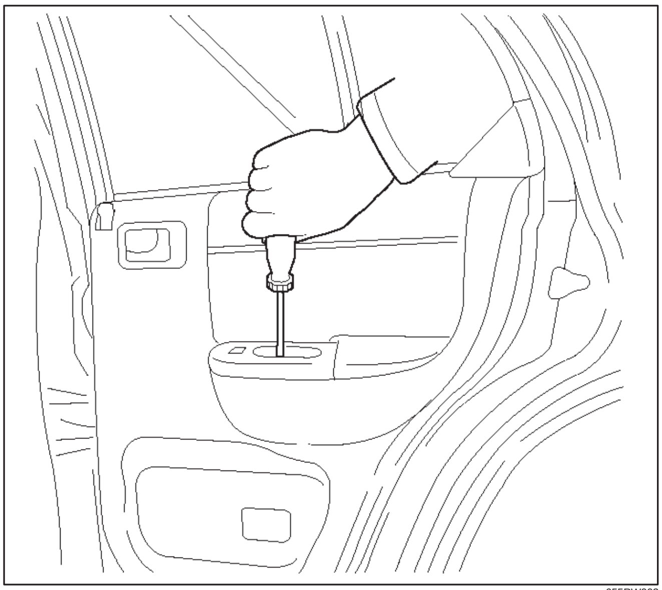
Removal

1. Disconnect the battery ground cable.
2. Remove the rear corner garnish.
3. Remove the courtesy light lens.
4. Remove the window regulator handle.
   - Remove the clip on the rear side of the regulator handle using a wire.



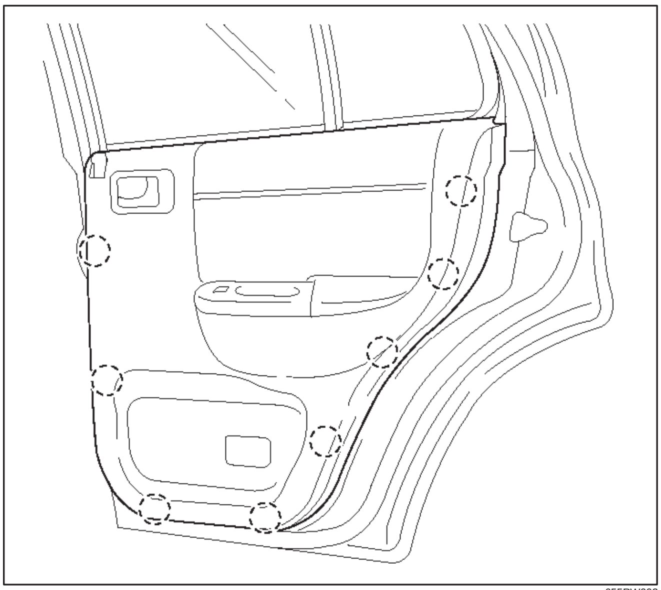
651RW003

5. Remove the screw while pulling the inside lever toward you and then remove the inside handle.
6. Remove the 2 screws at the pull case and courtesy light.



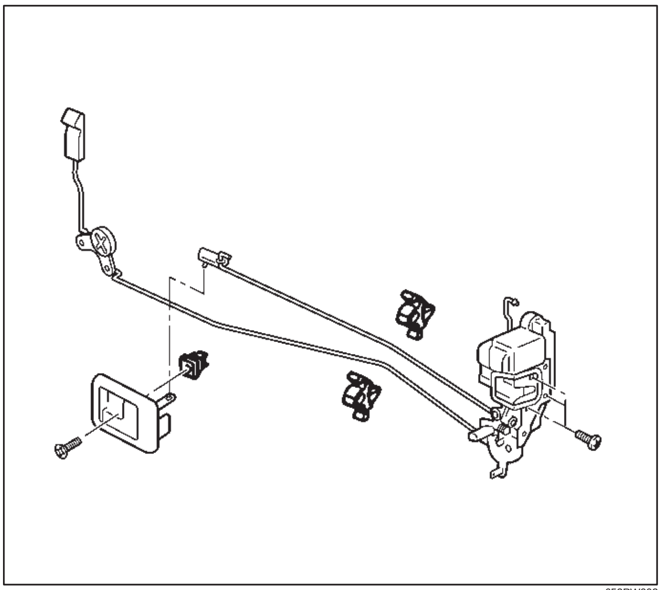
655RW003

7. Pull out the trim panel at the 8 clip positions.
   - Disconnect the power window switch connector and courtesy light connector.



655RW002

8. Remove the power window switch, if equipped.
9. Remove the bracket.
10. Remove the waterproof sheet.
    - Taking notice of the door harness, peel the waterproof sheet off the door panel carefully.
11. Disconnect the locking links and remove the door lock assembly fixing screws to remove the door lock assembly.



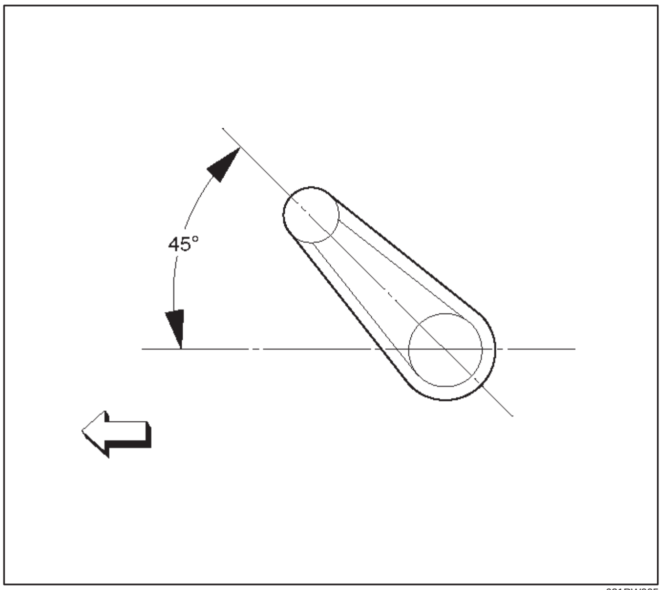
652RW002

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Apply chassis grease to the lock assembly and striker moving surface.

2. Install the regulator handle as shown in the illustration, if equipped without power windows.



631RW005

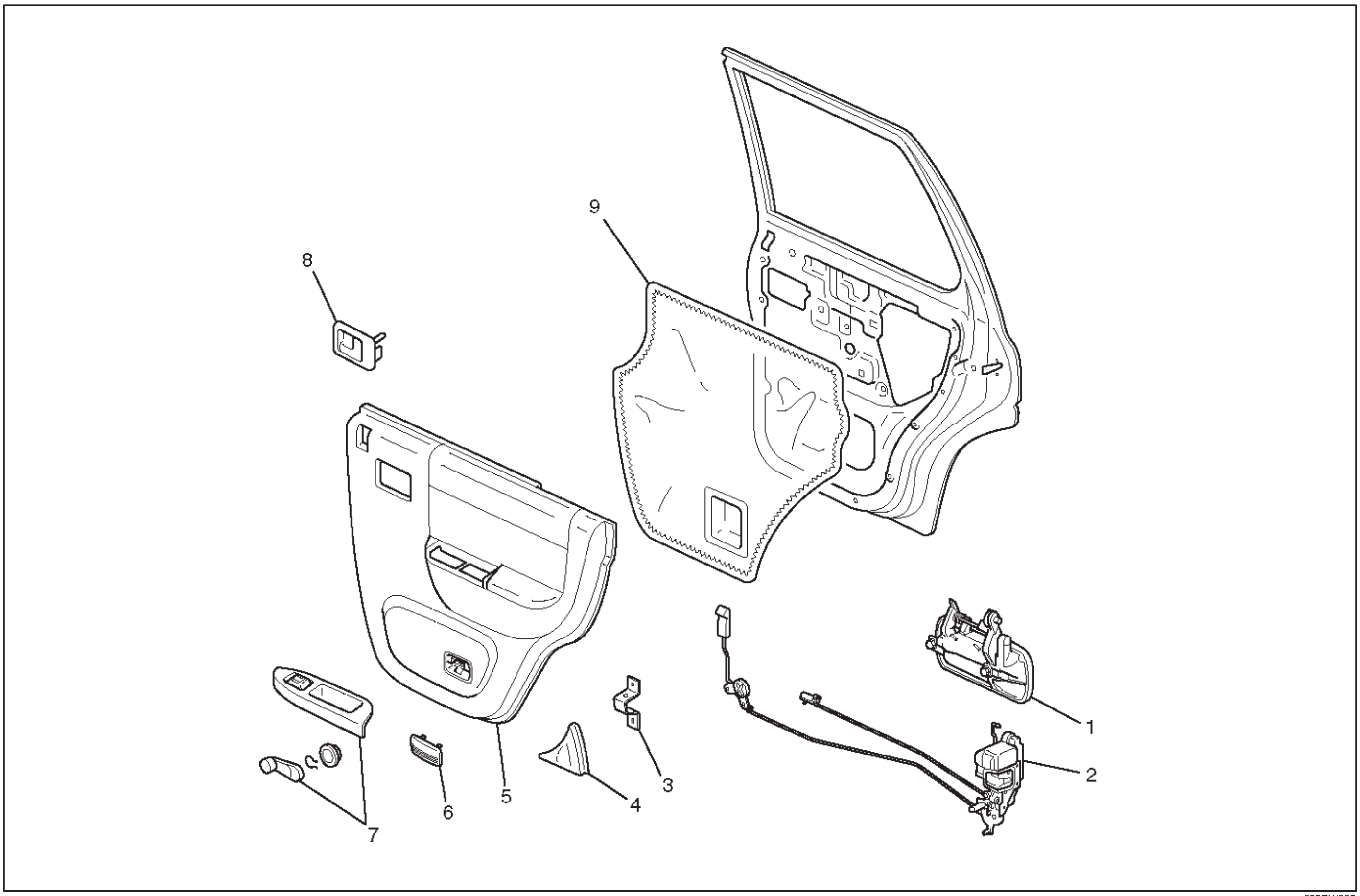
3. Tighten the door lock assembly fixing screws to the specified torque.

Torque 7 N·m (61 Ib in)

4. Check that the door lock operates smoothly.

Rear Outside Handle

Rear Outside Handle and Associated Parts



655RW005

Legend
- (1) Outside Handle
- (2) Door Lock Assembly
- (3) Bracket
- (4) Rear Corner Garnish
- (5) Door Trim Panel
- (6) Courtesy Light Lens
- (7) Power Window Switch/Window Regulator Handle
- (8) Inside Handle
- (9) Waterproof Sheet

Removal

1. Disconnect the battery ground cable.
2. Remove the door trim panel.
   - Refer to Rear Door Lock Assembly in this section.
3. Remove the waterproof sheet.
   - Taking notice of the door harness, peel the waterproof sheet off the door panel carefully.
4. Disconnect the locking link and remove fixing bolts to remove the outside handle.

Installation

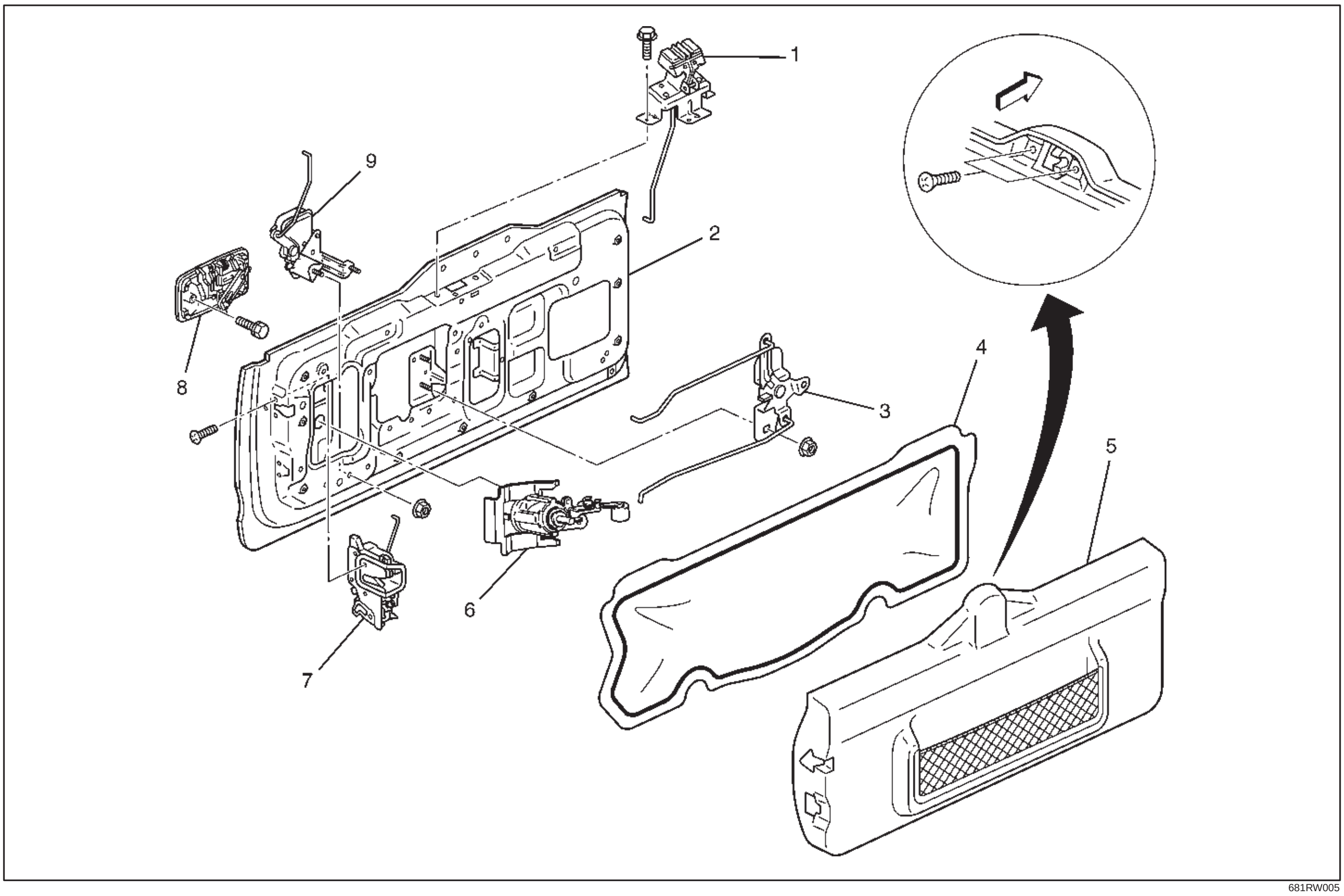
To install, follow the removal steps in the reverse order, noting the following points.

1. Check that the outside handle operates smoothly.
2. Tighten the outside handle fixing bolts to the specified torque.

Torque 9 N·m (78 lb in)

Tailgate Lock and Hatchgate Lock (LWB)

Tailgate Lock, Hatchgate Lock and Associated Parts

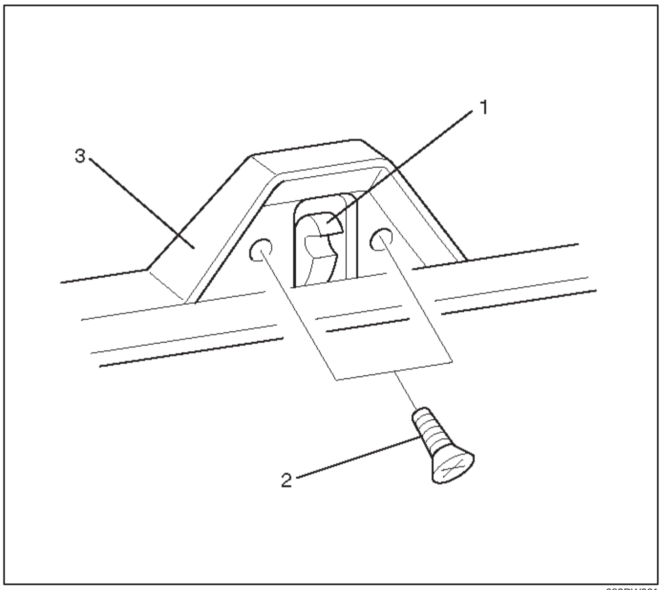


Legend

(1) Hatchgate Lock Assembly
(2) Tailgate Assembly
(3) Tailgate Lock Relay Lever
(4) Waterproof sheet
(5) Trim Cover Assembly
(6) Key Cylinder
(7) Tailgate Lock Assembly
(8) Ouside Handle
(9) Hatchgate Lock Actuator Assembly

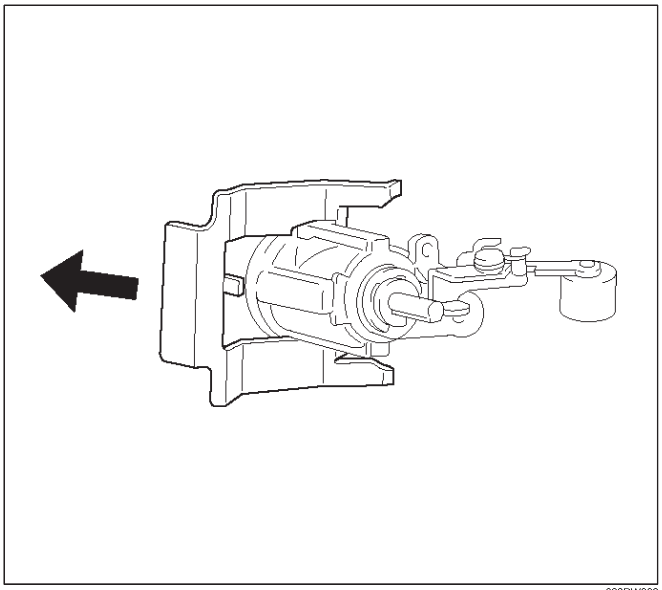
Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate trim cover assembly (3).
   - Remove the 2 screws (2) holding the hatchgate lock assembly (1) first, and pull up the trim cover while detaching the clips from tailgate panel.



683RW001

3. Remove the waterproof sheet.
   - Remove the waterproof sheet, taking special care so as not to break it.
4. Remove the hatchgate lock.
   - Disconnect the lock link and connector and remove the 3 fixing bolts.
5. Remove the key cylinder.
   - Disconnect the lock links.
   - Remove the key cylinder retaining clip with screw driver to remove the key cylinder.



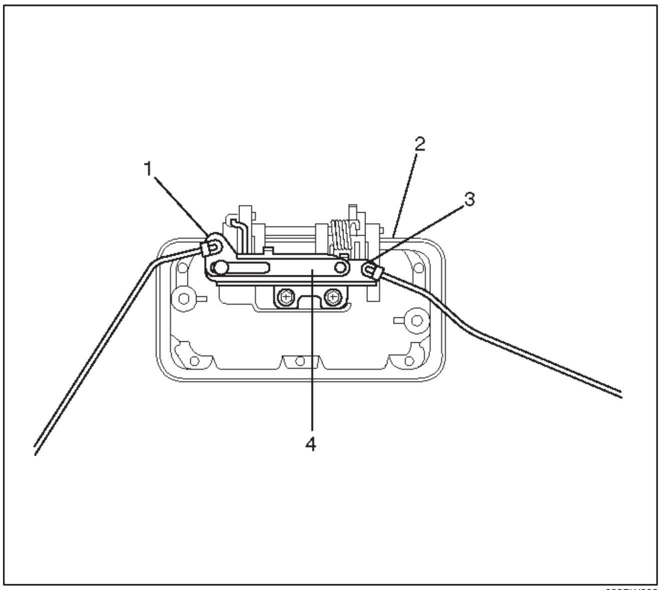
683RW002

6. Remove the hatchgate lock actuator assembly.
   - Disconnect the actuator harness connector.
   - Remove the 2 bolts holding hatchgate lock actuator assembly from inside.
7. Remove the outside handle.
   - Remove the 2 bolts holding the outside handle from inside.
8. Remove the tailgate lock assembly.
   - Remove the 3 screws holding the lock assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

1. When setting up links, pay attention to the position and direction of the links.



683RW003

Legend

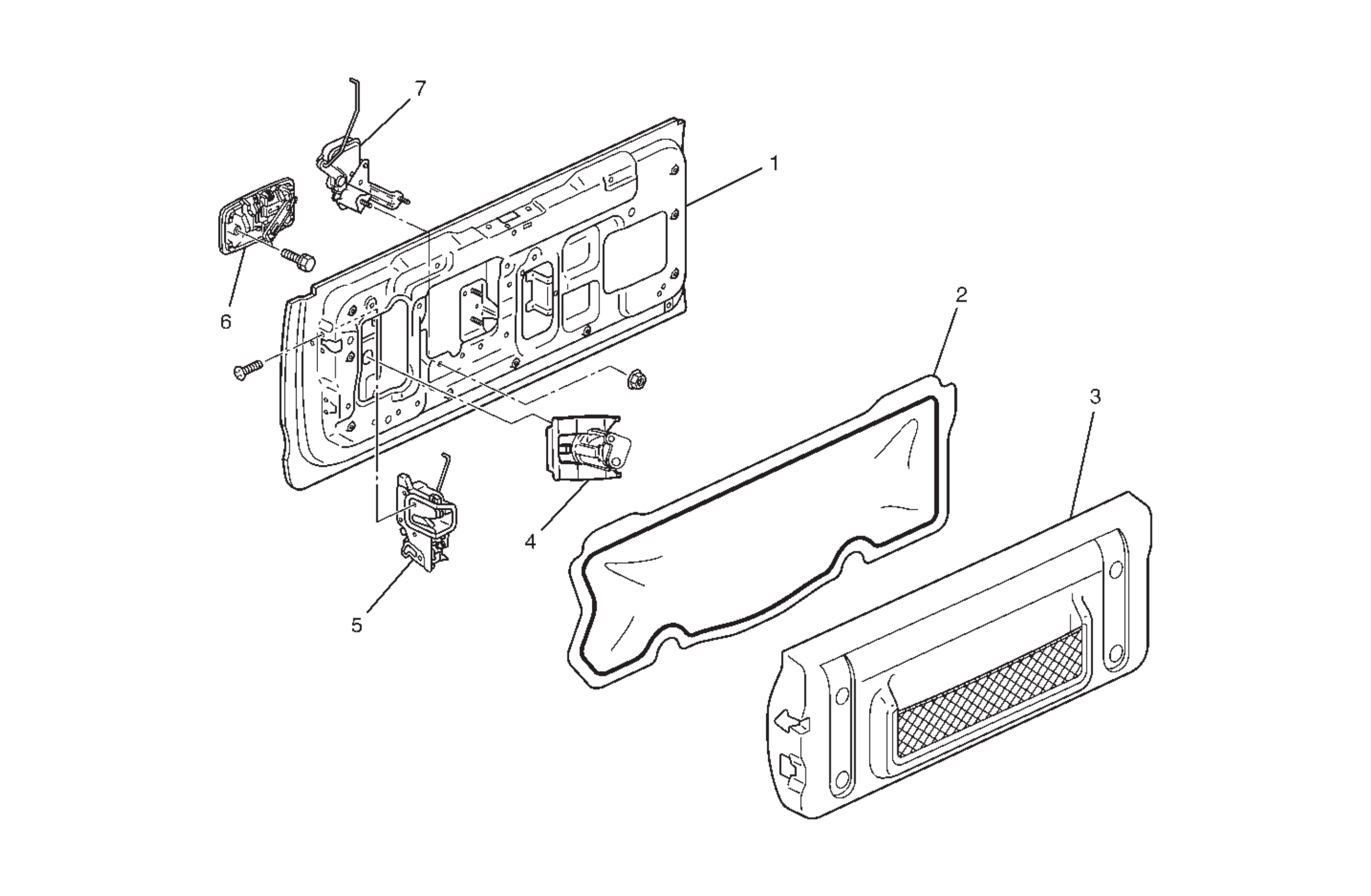
(1) Tailgate Lock Link
(2) Outside Handle
(3) Key Cylinder Link
(4) Cancel Mechanism

2. Apply chassis grease to the lock assembly and striker moving surface.
3. Check that the tailgate lock operates correctly after installing it.
4. Tighten the hatchgate lock assembly fixing bolts to the specified torque.

   Torque 7 N·m (61 lb in)

Tailgate Lock (SWB)

Tailgate Lock and Associated Parts



681RY00001

Legend

(1) Tailgate Assembly
(2) Waterproof sheet
(3) Trim Cover Assembly
(4) Key Cylinder
(5) Tailgate Lock Assembly
(6) Outside Handle
(7) Hatchgate Lock Actuator Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the tailgate glass assembly and tailgate glass stay.
   - Refer to Tailgate Glass (SWB) in Body Structure section.
3. Remove the tailgate trim cover assembly.
   - Remove the two screws fixing the trim cover assembly and pull up the trim cover after detaching the clips from tailgate panel.
4. Remove the waterproof sheet.
   - Remove the waterproof sheet, taking special care so as not to break it.
5. Remove the key cylinder.
   - Disconnect the lock links.
   - Remove the key cylinder retaining clip with screw driver to remove the key cylinder.
6. Remove the hatchgate lock actuator assembly.
   - Disconnect the actuator harness connector.
   - Remove the two nuts holding hatchgate lock actuator assembly from inside.
7. Remove the outside handle.
   - Disconnect the lock link.
   - Remove the two bolts holding the outside handle from inside.
8. Remove the tailgate lock assembly.
   - Remove the three screws holding the lock assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following points:

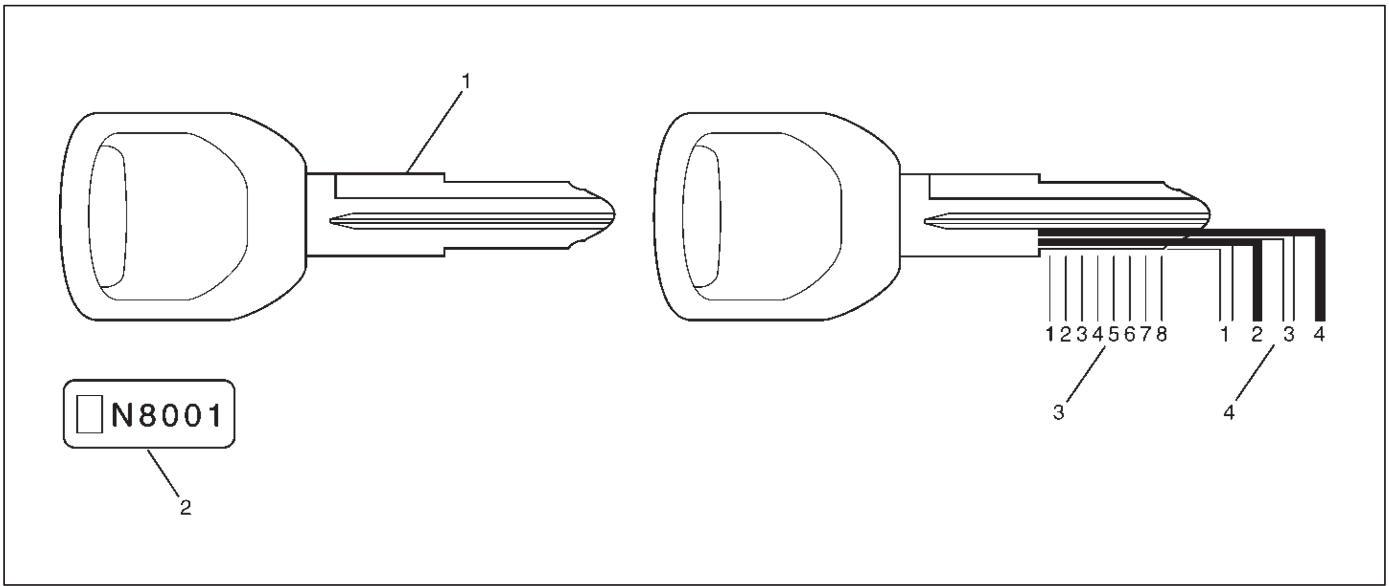
1. Apply chassis grease to the lock assembly and striker moving surface.
2. Tighten the hatchhgate lock assembly fixing screws to the specified torque.

   Torque 7 N·m (61 lb in)

3. Check that the tailgate lock operates correctly after installing it.

Key

Key Coding



730RX001

Legend

(1) Key (Actual size)
(2) Key Code Tag
(3) Position
(4) Level

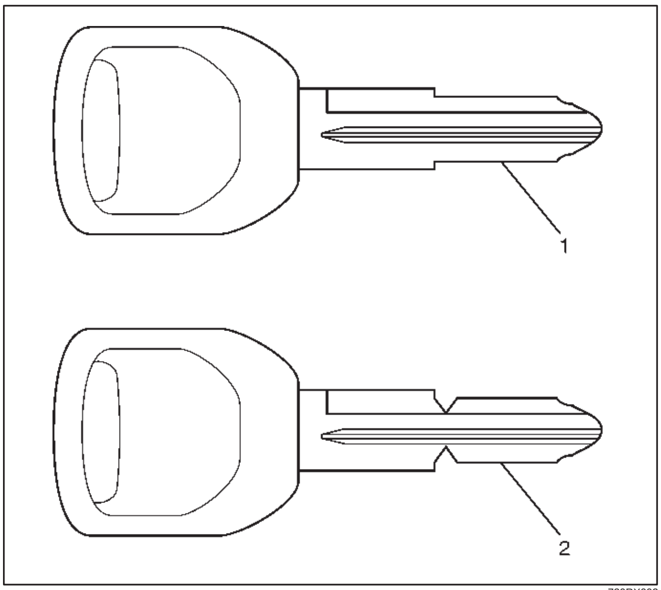
One key is used for the ignition, door, and tailgate lock cylinders. The keys are cut on both edges to make them reversible.

Key identification is obtained from the five character key code stamped on the key code tag. From this key code, the key code cutting combination can be determined from a code list (available to owners of key cutting equipment from suppliers).

If key codes are not available from records or tags, the key code can be obtained from the right hand door lock cylinder (if lock has not been replaced). Lock cylinders supplied by the factory as service parts are unmarked.

If the original key is available, the key code cutting combination can be determined by laying the key on the diagram shown in the figure.

Key Styles



730RX002

Legend

(1) Blank Key Style “A”
(2) Blank Key Style “B”

The keys come in styles A or B depending on the key code cutting combination. When the first position in the combination is a 1, 2 or 3, Style A is used. When the first position is a 4, Style B (factory pre–cut key) is used.

Power Door Lock System

General Description

The circuit consists of the door lock (& power window) switch, door lock actuator for the front and rear door, tailgate lock actuator and the door lock key switch.
The front door lock switch–LH is always provided with the battery voltage.
The key or the inside lock button on the both driver's and the front passenger's door can activate the lock mechanism of all the doors (including the tailgate).
When the driver's door lock switch or the front passenger's door lock switch is turned on, current flows for about one second to the door lock actuator of each door connected in parallel with the front door lock (& power window) switch–LH to activate the actuator to lock and unlock the doors.

Door Lock Key Switch

Removal and Installation

- Refer to the Front Door Lock Assembly removal and installation steps in this section.

Front Door Lock Actuator

Removal and Installation

- Refer to the Front Door Lock Assembly removal and installation steps in this section.

Rear Door Lock Actuator

Removal and Installation

- Refer to the Rear Door Lock Assembly removal and installation steps in this section.

Tailgate Lock Actuator

Removal and Installation

- Refer to the Tailgate Lock Assembly removal and installation steps in this section.

Anti–Theft System

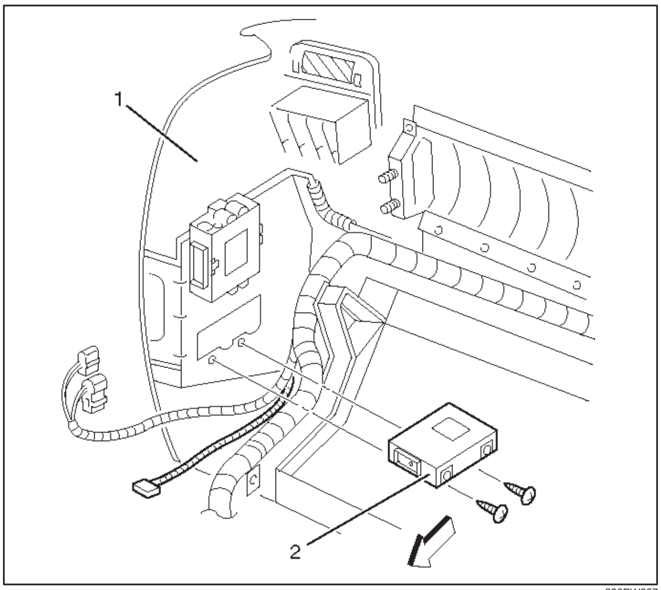
General Description

The circuit consists of the starter switch, anti–theft & keyless entry controller, anti–theft horn, front door and tailgate key switch (detect and tamper) switch, door lock actuator for each door, engine hood switch, clutch start switch (M/T), ANTI–THEFT indicator light and mode switch (A/T).
The system operates as follows: After locking the starter switch and removing the starter key (this sets the alarm), if the door is unlocked in any way other than with the proper key, the headlights start flashing, the horn sounds, and the starter circuit is disabled. (However, the engine hood and all the doors must be locked and closed.)
Once the system has been placed in the warning or alarm condition, it can be released only when the starter switch is shifted from "OFF" to "ACC" by the starter key, or when the lock of the front door or the tailgate is released (to activate the detect switch) by the starter key.

Anti–Theft & Keyless Entry Controller

Removal

1. Disconnect the battery ground cable.
2. Remove the instrument panel assembly (1).
   - Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the anti–theft & keyless entry controller (2).
   - Disconnect the connector.
   - Remove two fixing screws.



826RW007

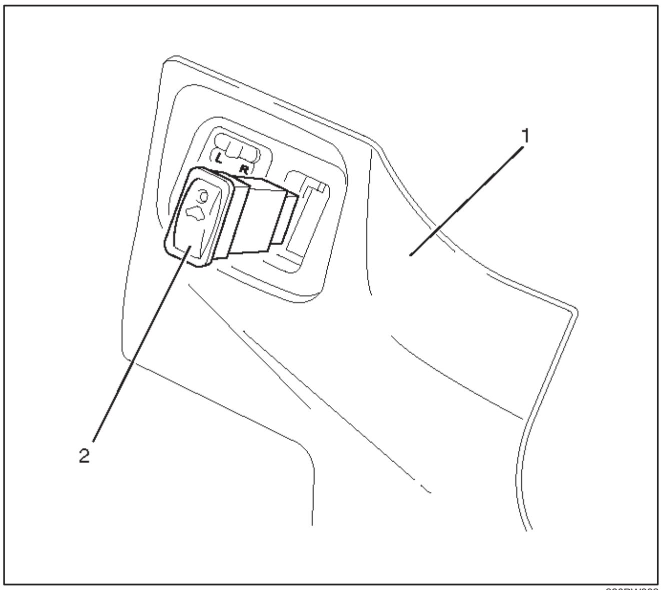
Installation

To install, follow the removal steps in the reverse order.

Anti–Theft Indicator

Removal

1. Disconnect the battery ground cable.
2. Remove the instrument panel driver lower cover assembly (1).
   - Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the anti–theft indicator (2).
   - To remove the indicator, push the lock from the back side of the instrument panel driver lower cover assembly.



826RW008

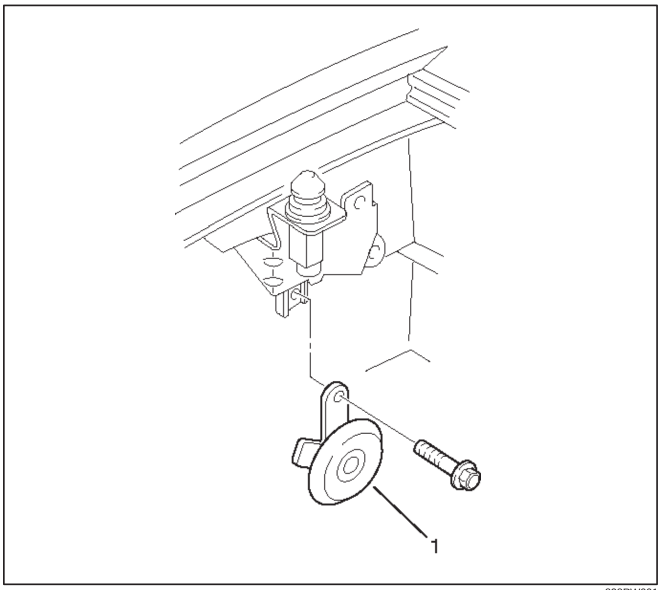
Installation

To install, follow the removal steps in the reverse order.

Anti–Theft Horn

Removal

1. Disconnect the battery ground cable.
2. Remove the anti–theft horn (1).
   - Disconnect the connector.
   - Remove a fixing bolt.



828RW001

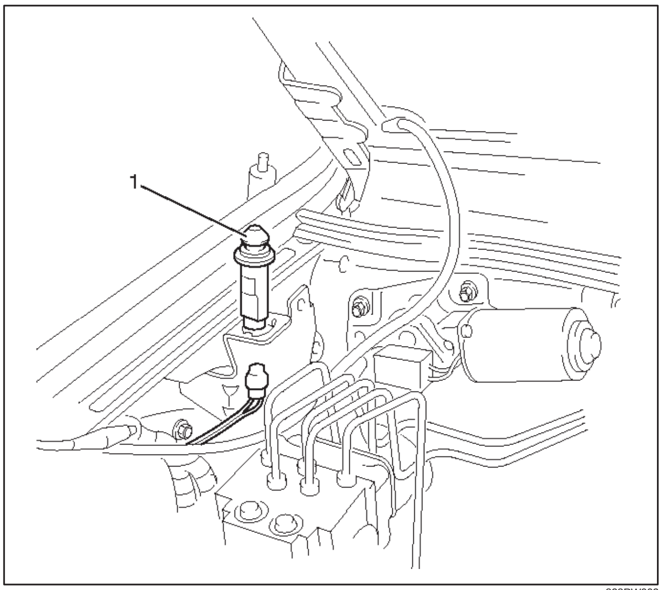
Installation

To install, follow the removal steps in the reverse order.

Engine Hood Switch

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector.
3. Remove the engine hood switch (1).



828RW002

Installation

To install, follow the removal steps in the reverse order.

Anti–theft & Keyless Entry Control Unit/Transmitter Replacement

Anti–theft & Keyless Entry Control Unit Replacement

1. Remove and install the control unit.
   - Refer to Anti–theft & Keyless Entry Control Unit Removal and Installation in this section.
2. Register ID code.
   - Refer to ID Code Registration in this section.
3. Check that the keyless entry system works normally.

Transmitter Replacement

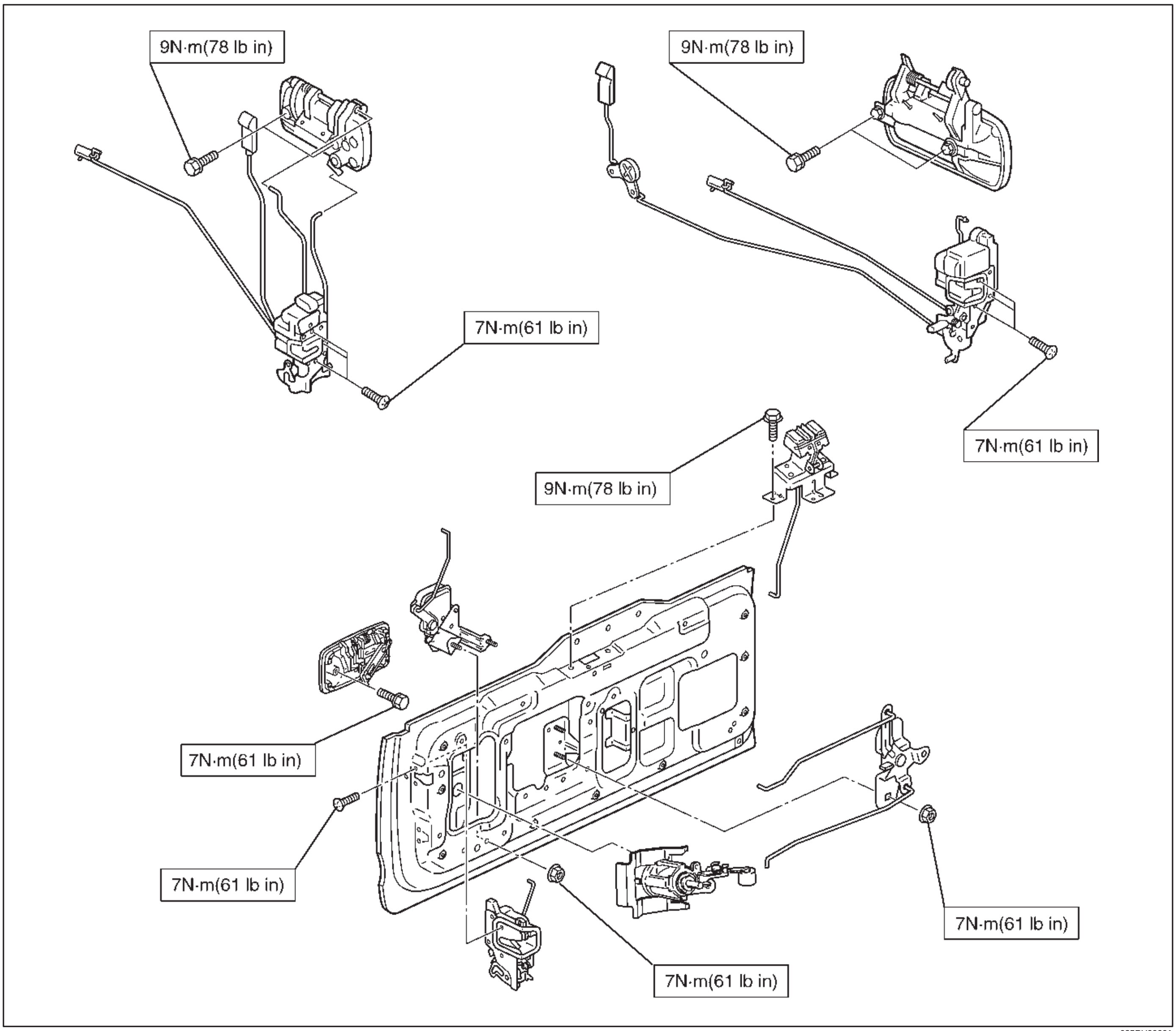
1. Prepare a new transmitter.
2. Regiter ID code.
   - Refer to ID Code Registration in this section.
3. Check that the keyless entry system works normally.

Transmitter Battery Replacement

1. Remove a screw to remove the cover.
2. Remove the batteries.
3. Set the new batteries into the transmitter.
4. Install the cover to the transmitter.
5. Check that the keyless entry system works normally.

Main Data and Specifications

Torque Specifications



635RY00001

RODEO

BODY AND ACCESSORIES

SUNROOF/CONVERTIBLE TOP

CONTENTS

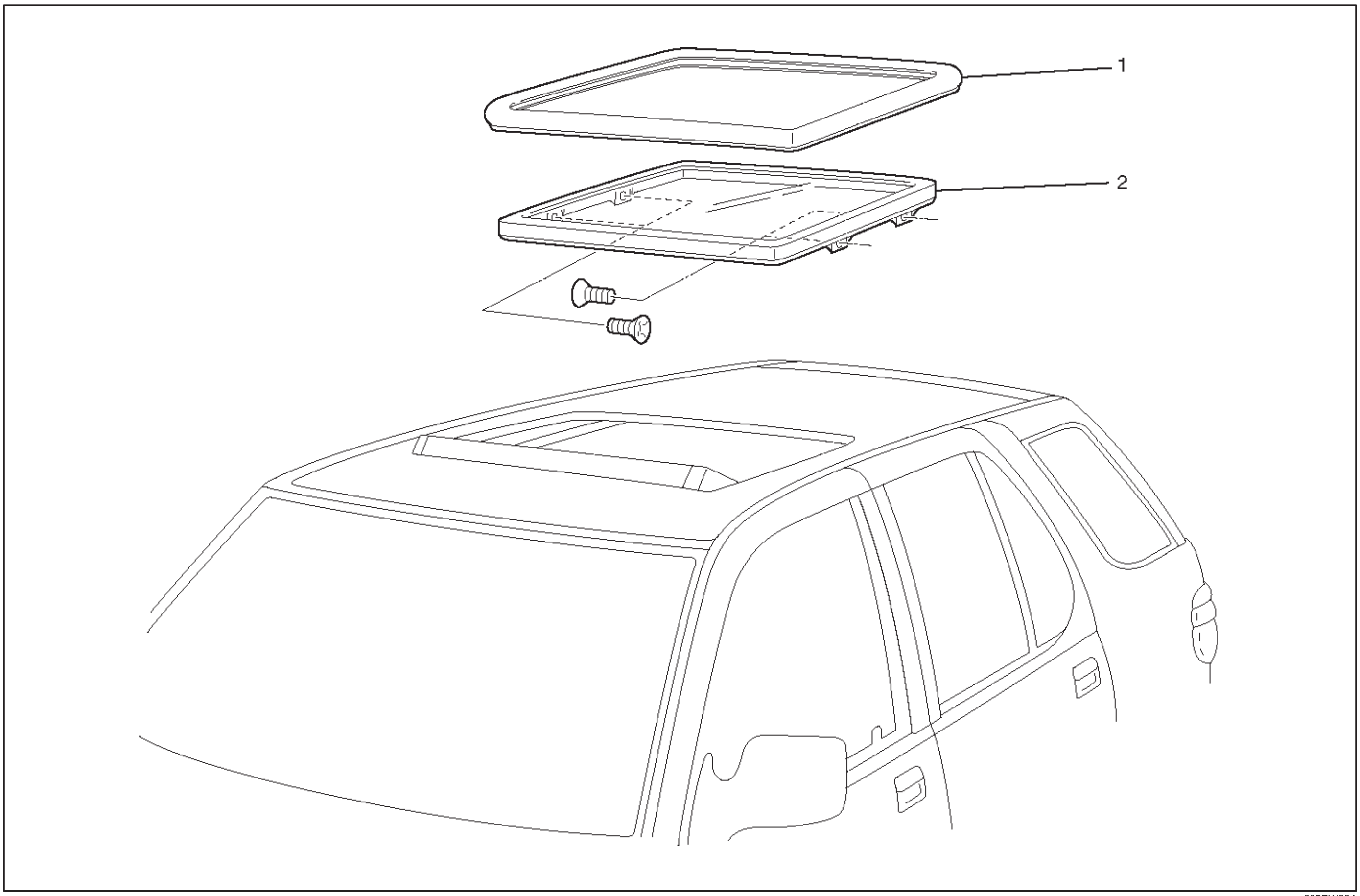
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Sunroof Glass (LWB)

Sunroof Glass and Associated Parts

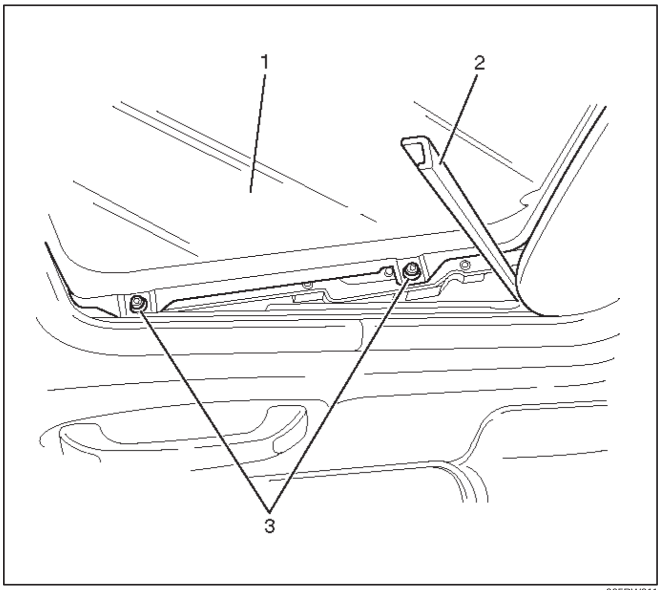


665RW004

Legend
(1) Sunroof Weatherstrip
(2) Sunroof Glass

Removal

1. Tilt the sunroof and open the sunshade.
2. Disconnect the battery ground cable.
3. Pull out the front of sight shield (2).
4. Remove four sunroof glass fixing Torx screws (3) to remove the sunroof glass (1).



665RW011

Installation

1. Be sure to install the sunroof weatherstrip so that the joint of the weatherstrip is on the rear side of the vehicle.
2. Temporary install the glass to the sunroof frame.
3. Open and shut the sunroof four to five times to position correctly the sunroof weatherstrip and the glass in the longitudinal and latitudinal setting positions.
4. Adjust the setting position to flush the surface between the roof panel and weatherstrip of sunroof glass.
5. Tighten the sunroof glass fixing screws to the specified torque.

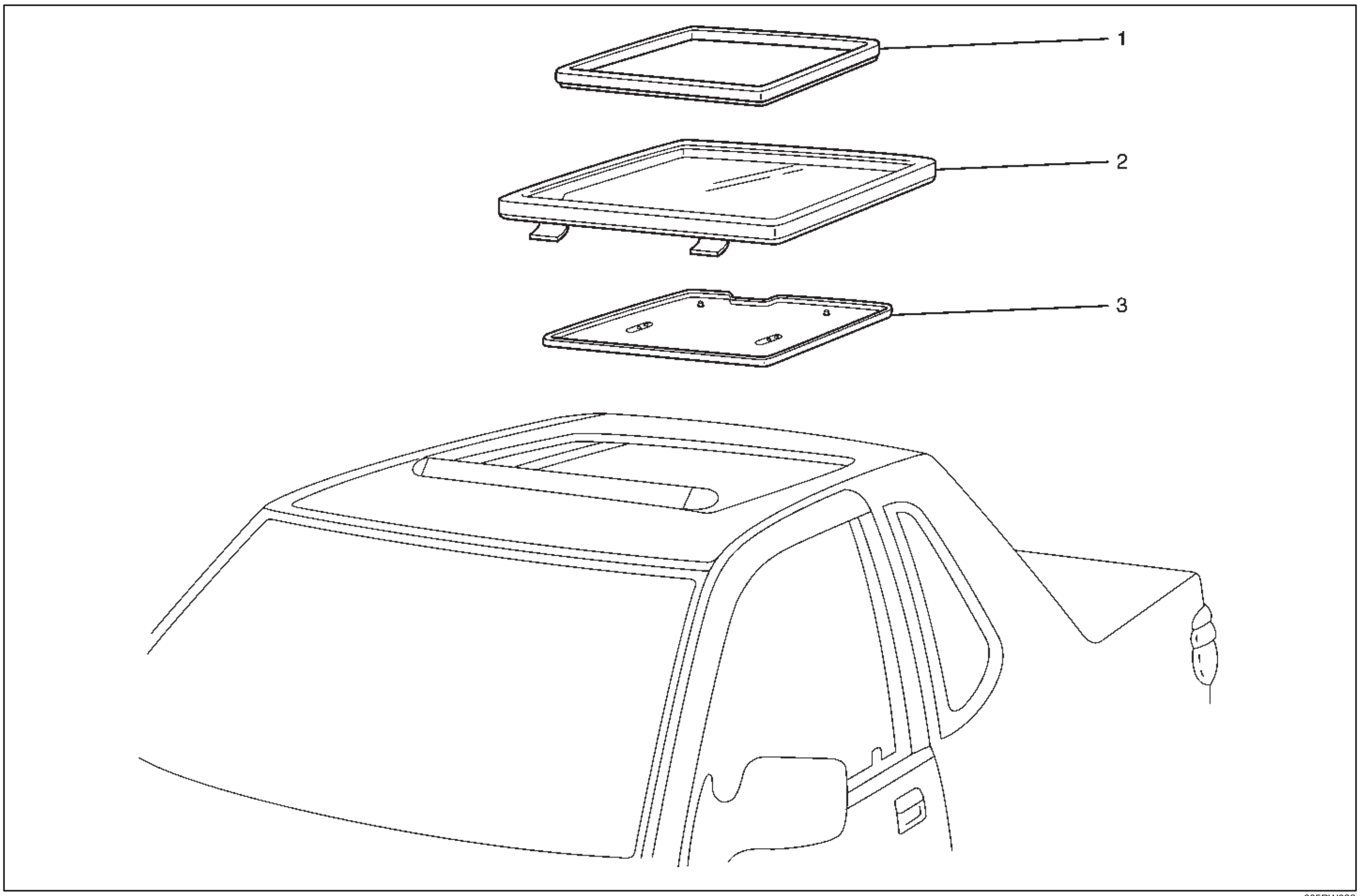
Torque: 4 N·m (35 lb in)

6. After the sunroof glass is installed, recheck the roof panel and sunroof glass for vertical install position.

   If out of standard, adjust with fixing screws.

Sunroof Glass (SWB)

Sunroof Glass and Associated Parts



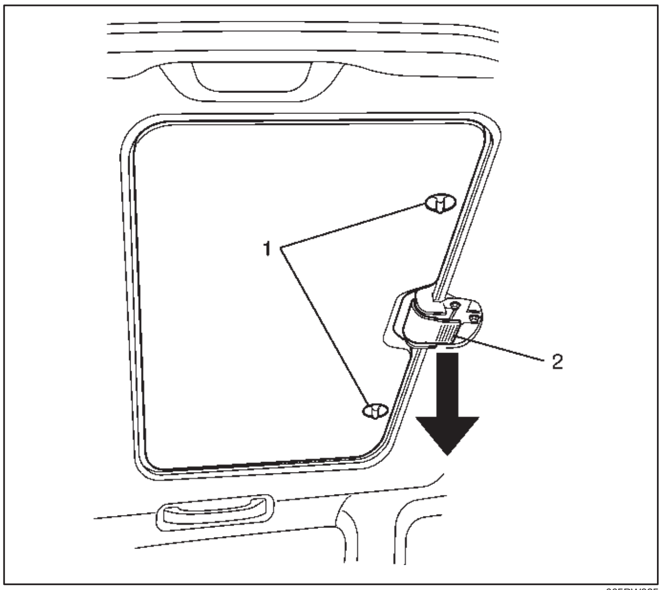
665RW028

Legend

(1) Sunroof Weather Strip
(2) Sunroof Glass Assembly
(3) Sunshade Assembly

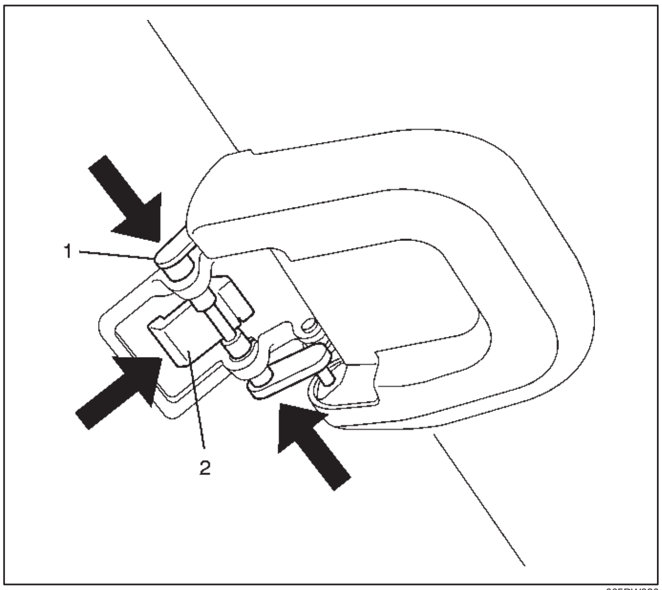
Removal

1. Disconnect the battery ground cable.
2. Remove the sunshade assembly.
   - Turn the knobs (1) 90 degrees and pull it out at angle. Then pull the sunroof handle (2) to disengage the lock.



665RW025

3. Remove the sunroof glass assembly.
   - Push the safety lever (2) behind the handle and push in on the hinge pins (1) from the left and right to disengage them. Raise the rear end of the sunroof glass assembly at an angle pull it free.



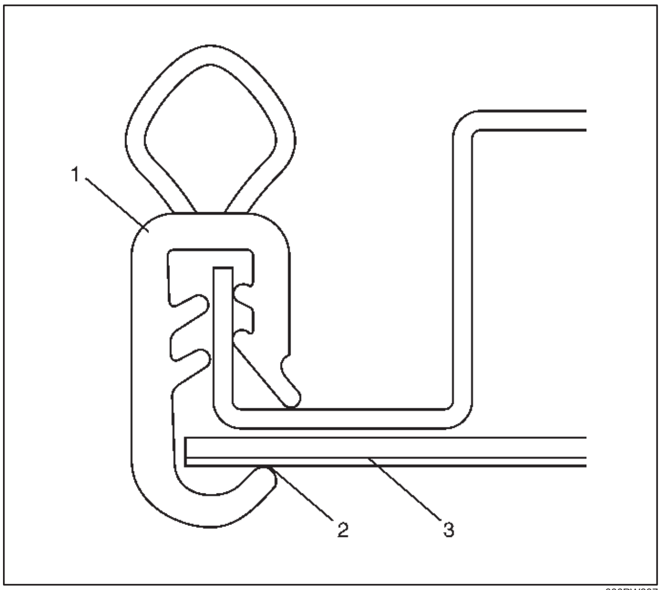
665RW026

4. Remove the sunroof handle cover and sunroof handle plate.
   - Remove the screw form the cover and the three fixing nuts form the plate.
5. Remove the weather strip.
6. Remove the headlining.
   - Refer to Headlining in Exterior/Interior Trim section.

Installation

To install, follow the removal steps in the reverse order, nothing the following points.

1. When attaching the sunroof weather strip (1), make sure that the lip (2) securely overlaps the headlining (3).
   - Assemble with the positioning marks centered toward the rear of the vehicle.



666RW007

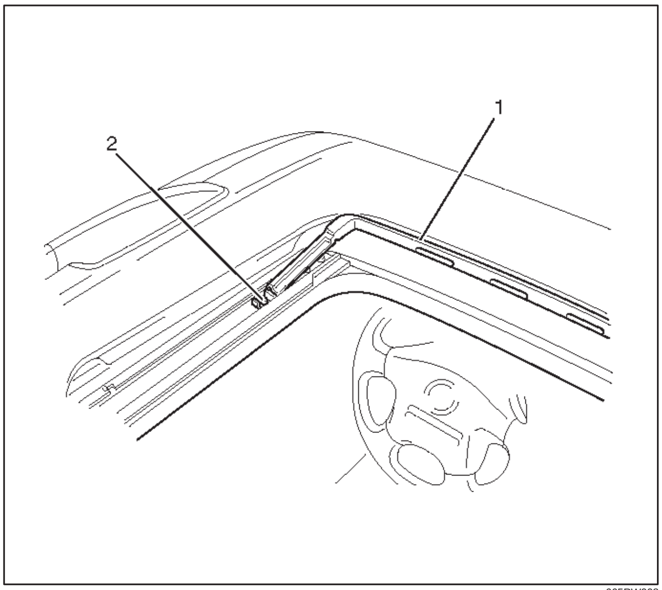
2. Tighten the sunroof handle plate fixing nuts to the specified torque.

Torque: 8 N·m (69 lb in)

Sunroof Deflector (LWB)

Removal

1. Open the sunroof.
   - Let a 5 mm drill go through two blind rivets (2) to disengage riveted portions.
2. Remove the sunroof deflector (1).



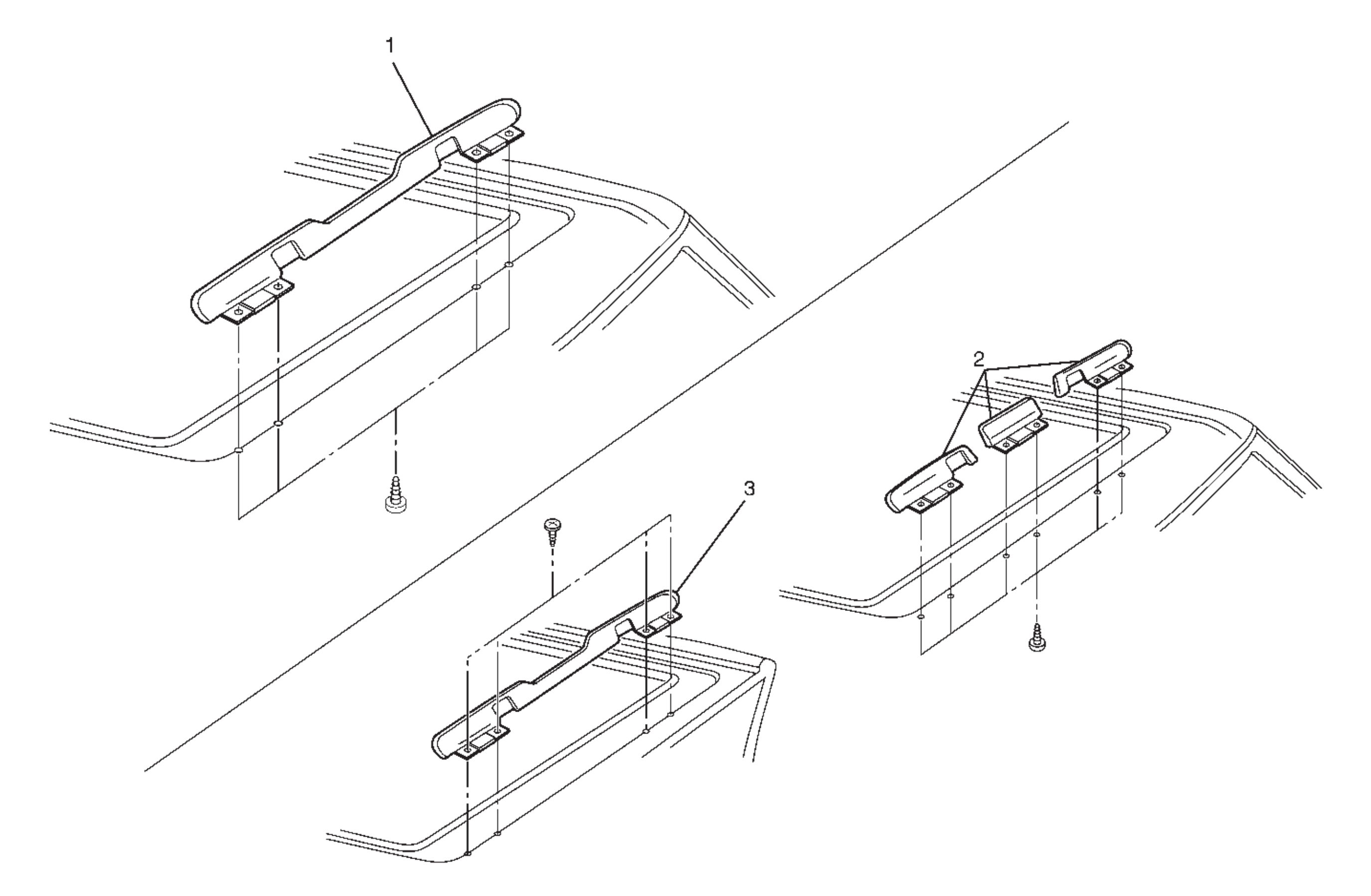
665RW008

Installation

To install, follow the removal steps in the reverse order.

Sunroof Deflector (SWB)

Parts Location



Legend

(1) Sunroof Deflector Assembly (Soft Top)
(2) Front Sunroof Deflector Assembly (Resin Top)
(3) Rear Sunroof Deflector Assembly (Resin Top)

Removal

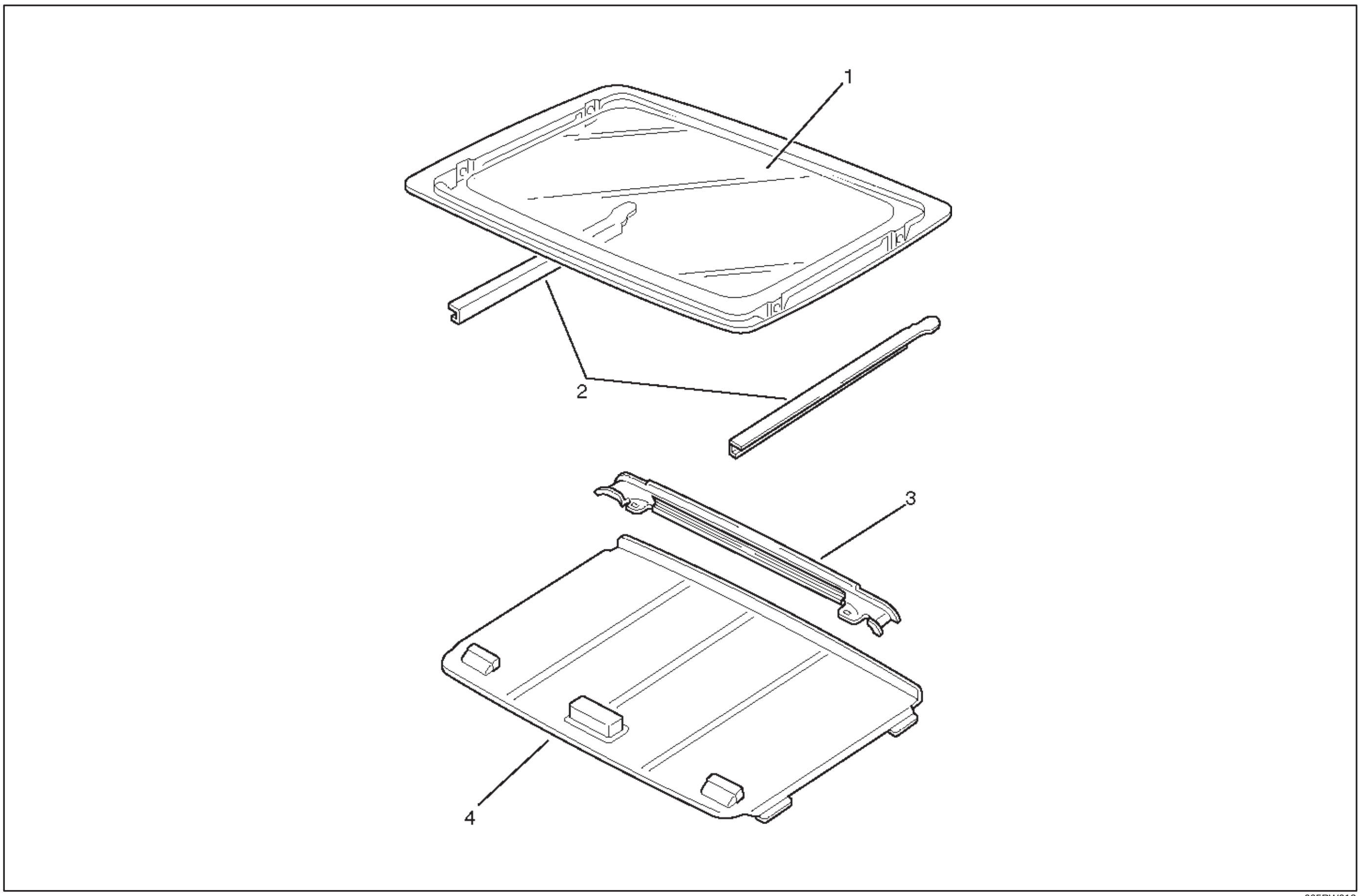
1. Disconnect the battery ground cable.
2. Remove the sunroof glass.
   - Refer to Sunroof Glass in this section.
3. Remove the headlining (Front roof side).
   - Refer to Headlining in Exterior/Interior Trim section.
4. Remove the sunroof deflector.
   - Remove the fixing screws.

Installation

To install, follow the removal steps in the reverse order.

Sunshade (LWB)

Disassembled View

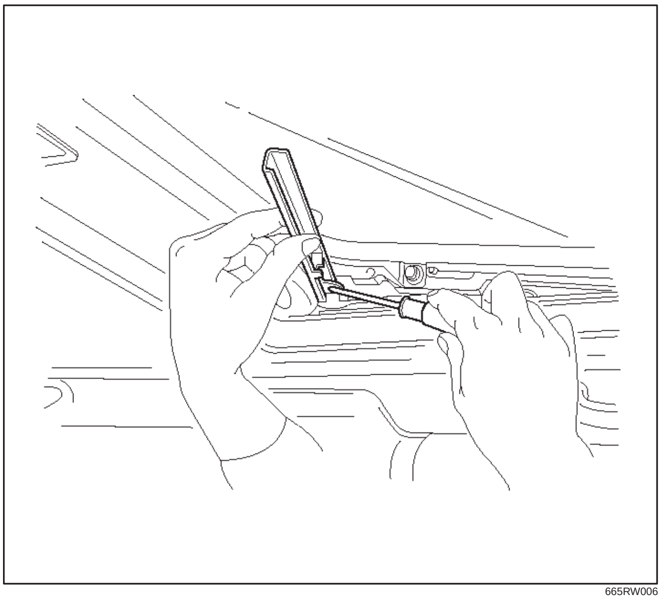


665RW012

Legend
(1) Sunroof Glass
(2) Sight Shield
(3) Sunshade Stopper
(4) Sunshade

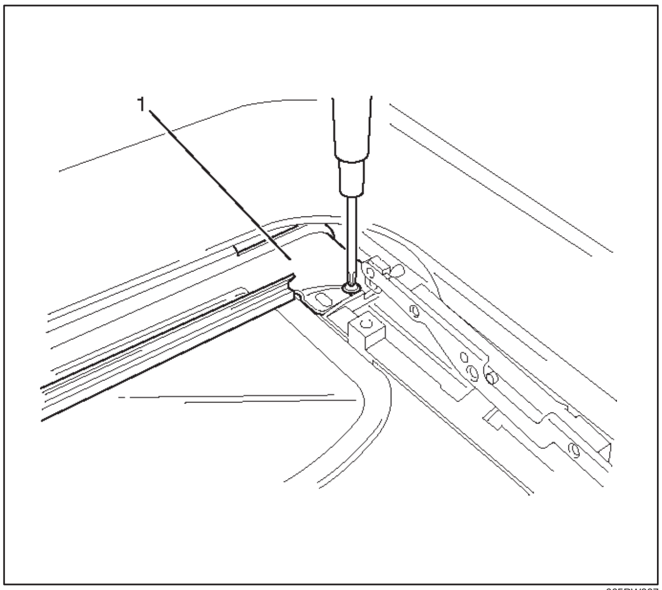
Removal

1. Tilt the sunroof.
2. Disconnect the battery ground cable.
3. Remove the sunroof glass.
   - Refer to Sunroof Glass in this section.
4. Pull the sight shield upward using screwdriver.



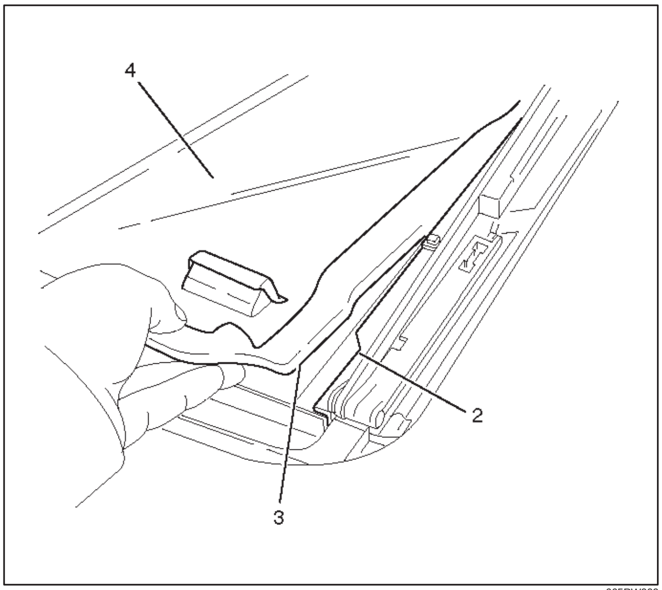
665RW006

5. Remove 2 sunshade stopper fixing screws and remove sunshade stopper (1).



665RW007

6. Pull out the sunshade (4) up to the guide rail edge. Lift the front of sunshade and clear the projection (3) of sunshade through the notch (2) of guide rail edge, then draw the sunshade out of the roof.



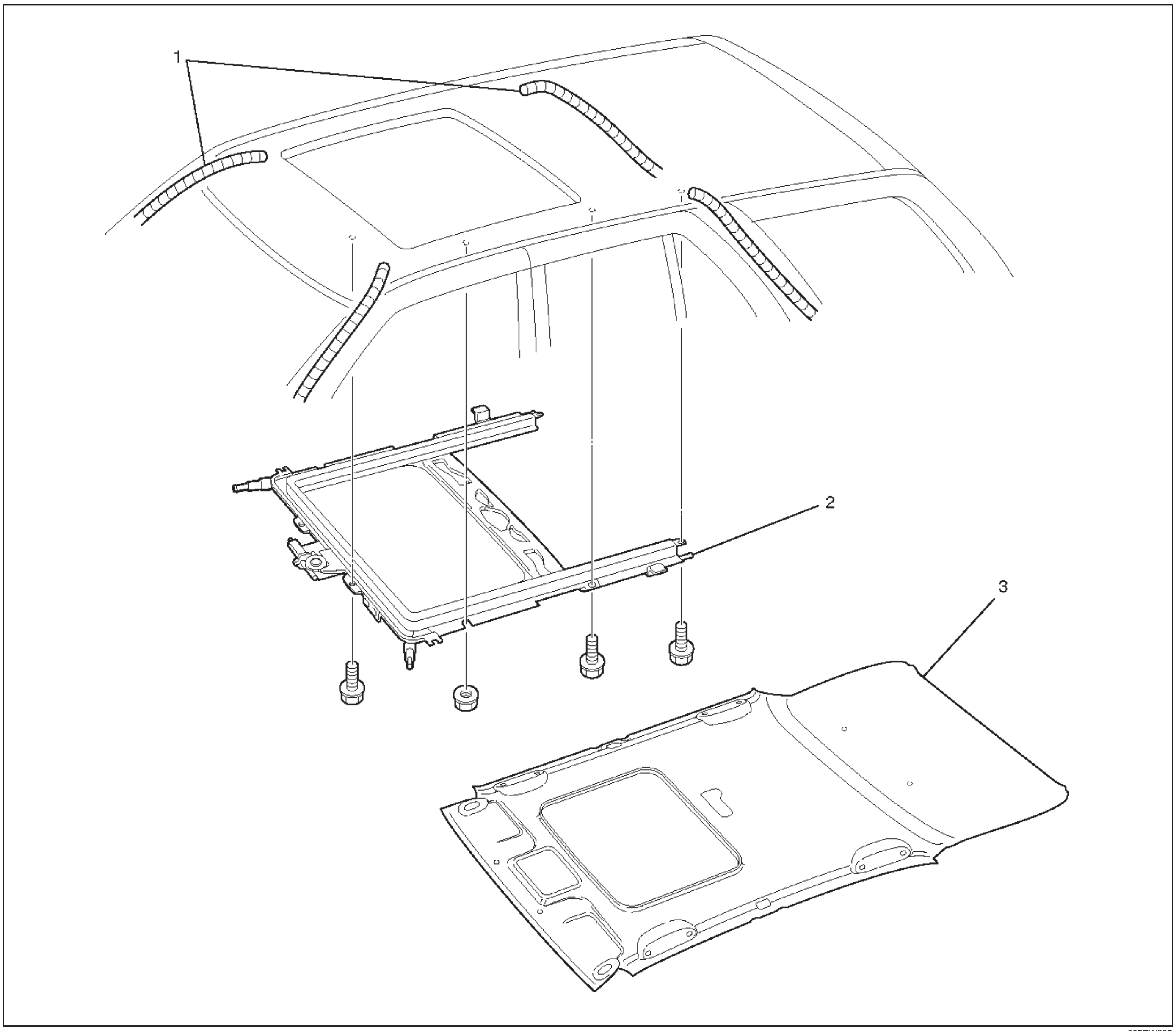
665RW009

Installation

To install, follow the removal steps in the reverse order.

Sunroof Frame Complete Assembly (LWB)

Sunroof Frame Complete Assembly and Associated Parts

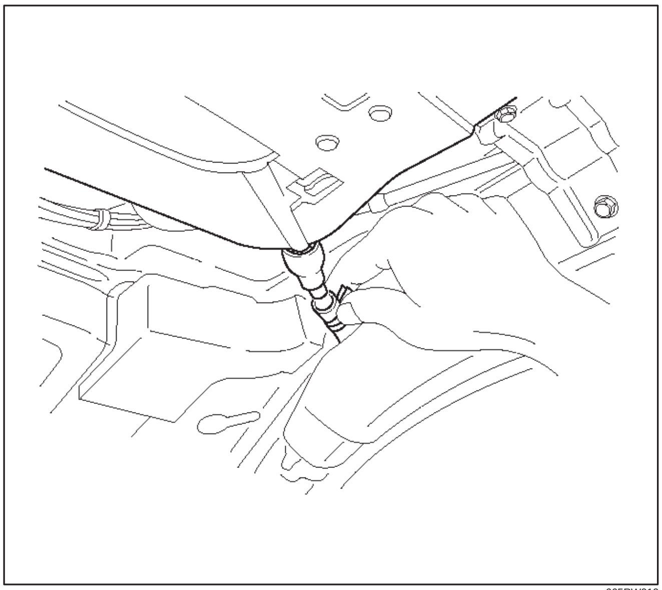


Legend
(1) Sunroof Drain Hose
(2) Sunroof Frame Complete Assembly
(3) Headlining

Removal

1. Disconnect the battery ground cable.
2. Remove the headlining.
   - Refer to Headlining in Exterior/Interior Trim section.

3. Disconnect the sunroof drain hose at the sunroof frame side as shown in the figure.



665RW010

4. Disconnect the sunroof harness connection.
5. Remove two sunroof frame complete assembly fixing nuts (front side) and six fixing bolts from the frame complete assembly, and then remove the sunroof frame complete assembly.

NOTE: Be sure to remove the frame complete assembly while supporting it.

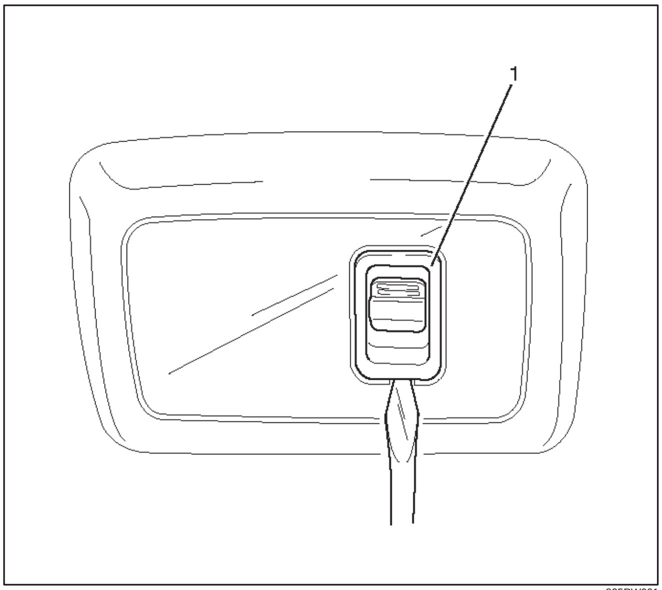
Installation

1. Install the sunroof frame complete assembly.
2. After installing the frame complete assembly, loosen the sunroof glass fixing nuts and adjust the sunroof glass setting position.
   - Refer to Sunroof Glass in this section.
3. Install the sunroof drain hose.
4. Install the headlining.
   - Refer to Headlining in Exterior/Interior Trim section.

Sunroof Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the sunroof switch (1).
   - Remove the switch by pushing the spring with the tip of a screwdriver.
   - Disconnect the switch connector.



825RW091

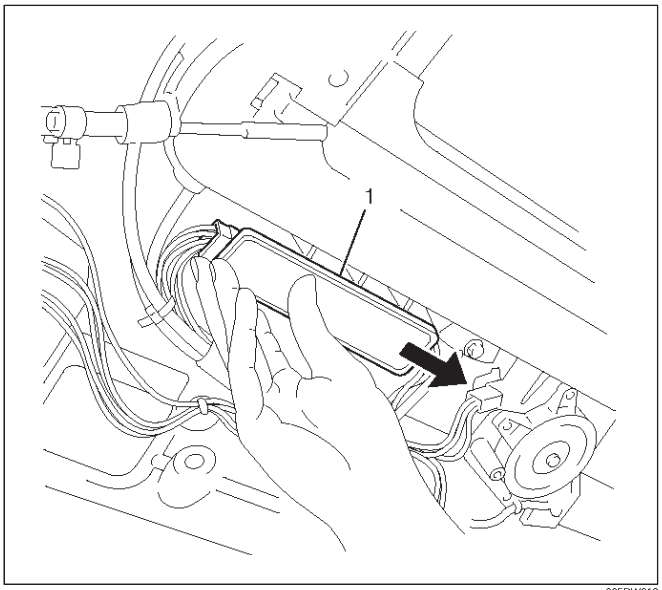
Installation

To install, follow the removal steps in the reverse order.

Sunroof Control Unit

Removal

1. Disconnect the battery ground cable.
2. Remove the headlining (2).
   - Refer to Headlining in Exterior/Interior Trim section.
3. Remove the sunroof control unit (1).
   - Disconnect two connectors.
   - Remove two screws.



665RW013

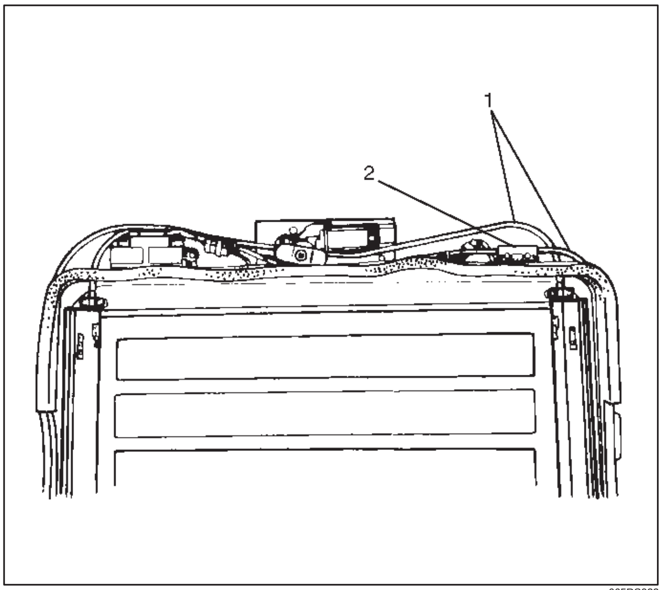
Installation

To install, follow the removal steps in the reverse order.

Safety Stop Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the sunroof drive unit assembly (1) to remove the safety stop switch (2).
   - Refer to Sunroof Frame Complete Assembly in this section.



665RS022

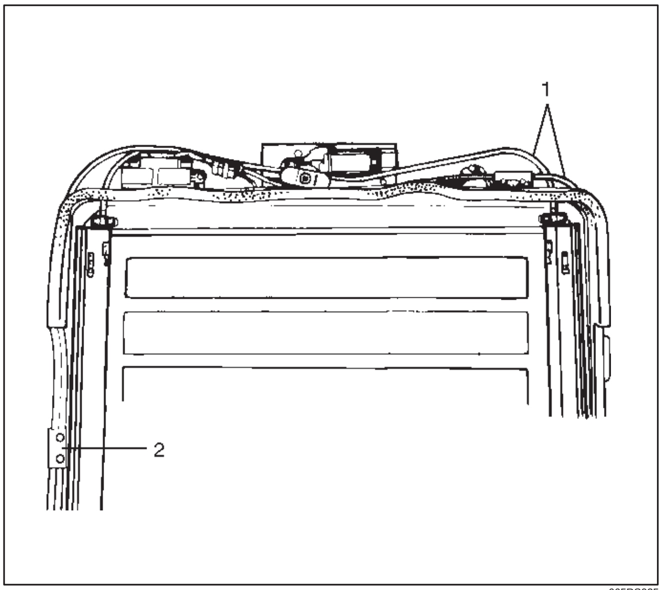
Installation

To install, follow the removal steps in the reverse order.

Limit Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the sunroof drive unit assembly (1) to remove the limit switch (2).
   - Refer to Sunroof Frame Complete Assembly in this section.



665RS025

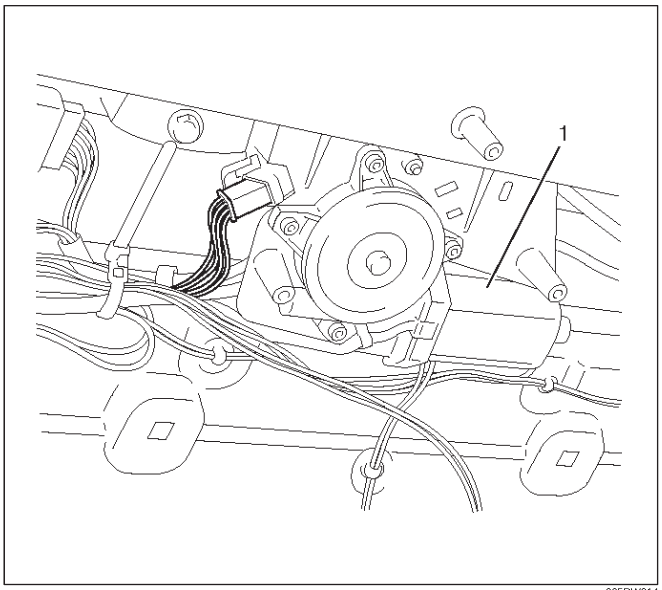
Installation

To install, follow the removal steps in the reverse order.

Sunroof Motor

Removal

1. Disconnect the battery ground cable.
2. Remove the headlining (2).
   - Refer to Headlining in Exterior/Interior Trim section.
3. Remove the sunroof motor (1).
   - Disconnect the connector.
   - Remove three nuts and two screws.



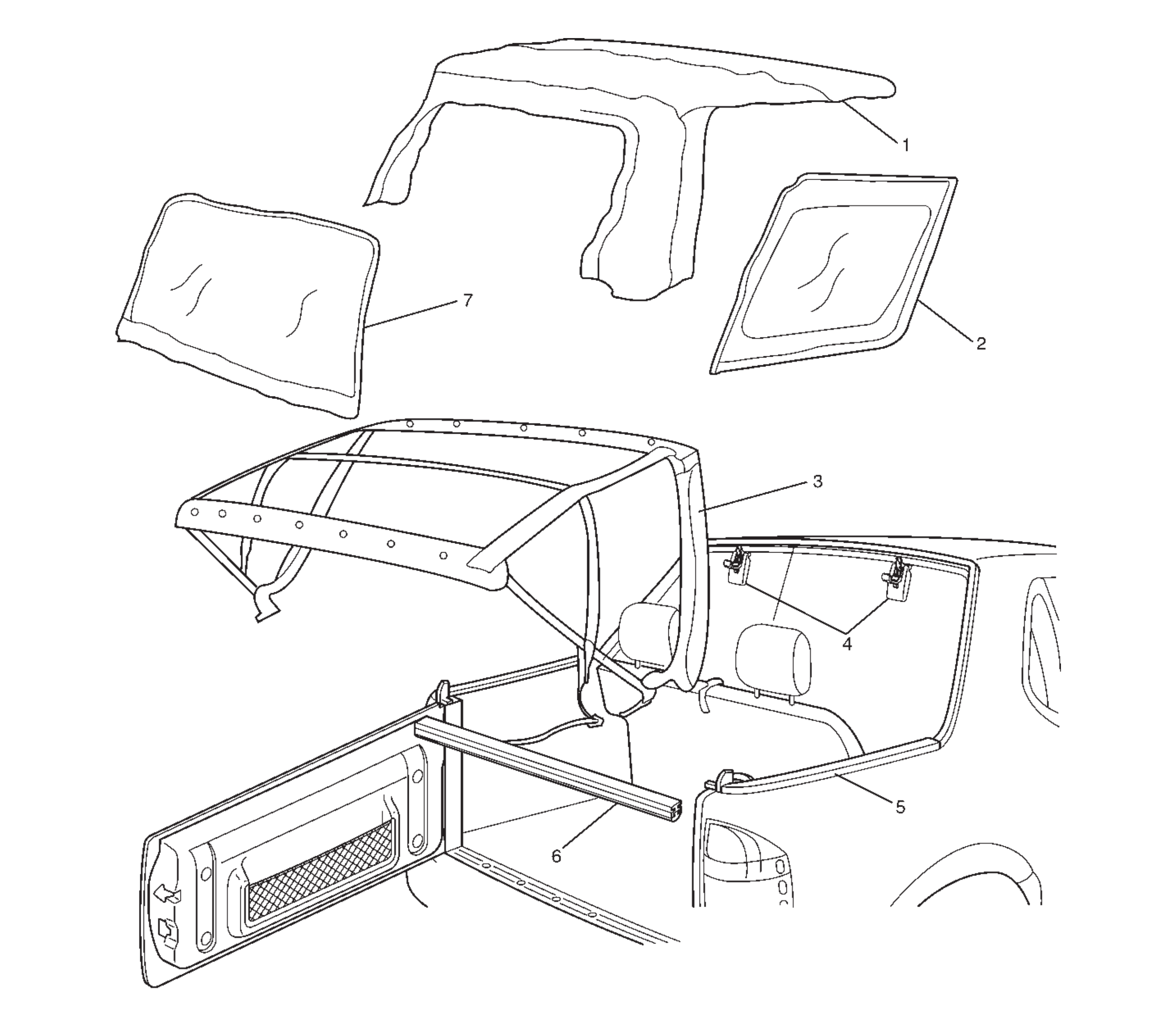
665RW014

Installation

To install, follow the removal steps in the reverse order.

Soft Top Assembly

Soft Top Assembly and Associated Parts



Legend

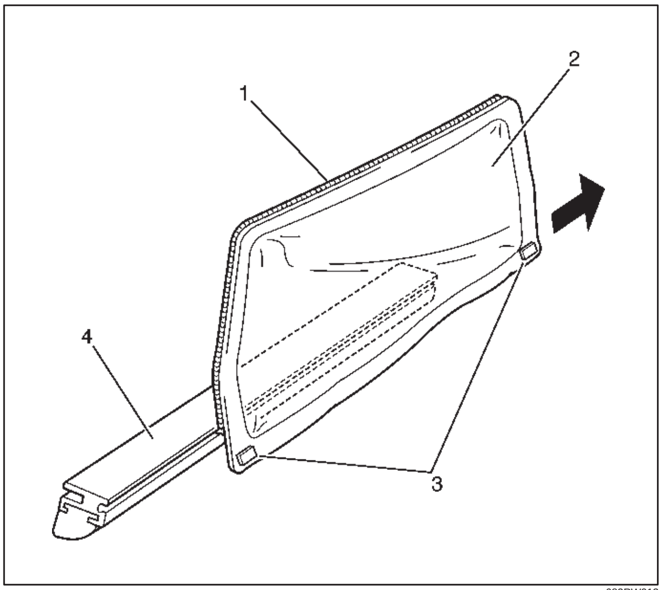
(1) Tarpaulin Assembly
(2) Quarter Window Assembly
(3) Tarpaulin Frame Assembly
(4) Soft Top Latch Assembly
(5) Quarter Moulding Assembly
(6) Support Bar Assembly
(7) Back Window Assembly

Removal

1. Remove the quarter window assembly (LH & RH).
   - Peel off the velcro fasteners and unzip the zippers.
2. Remove the back window assembly (2).
   - Peel off the velcro fasteners (3), unzip the zipper (1) and pull the back window assembly toward the rear together with the support bar assembly (4). Then slide the back window out to the side.

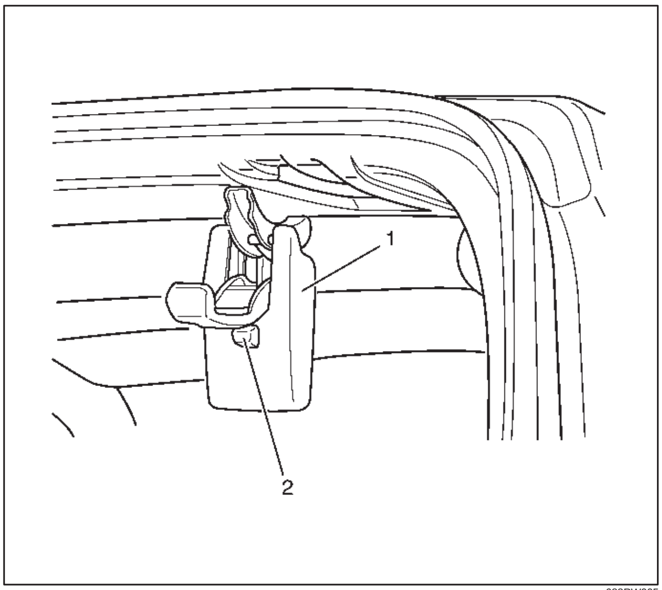
NOTE: After removing the side windows and back window, be careful not to bend then or place other objects on top of them as this could scratch or crack them.

Exercise caution when handling and storing the windows.



682RW013

3. Press the lock botton (2) of the soft top latch assembly (1) and lower the lock knob to disengage the lock. Then remove the hooks of the tarpaulin frame assembly (LH & RH).



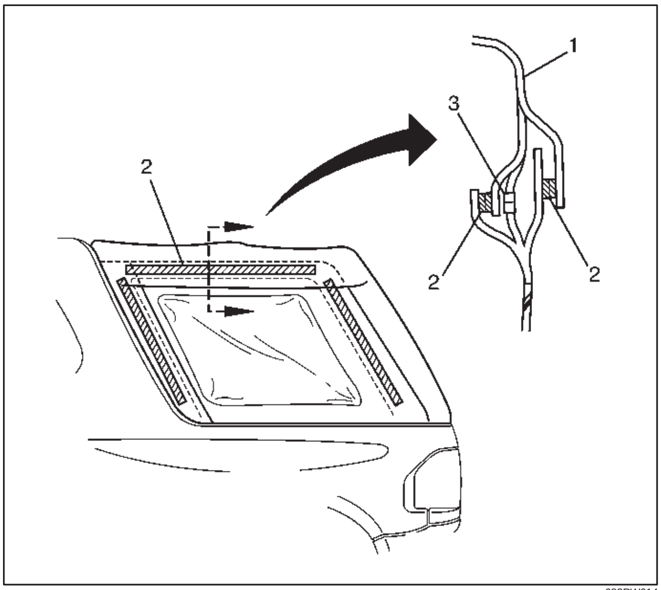
688RW005

4. Remove the tarpautin assembly.
   - Disengage the 14 hocks.
5. Remove the tarpautin frame assembly.
   - Remove the four fixing bolts.

Installation

To install, follow the removal steps in the reverse order, noting the following point.

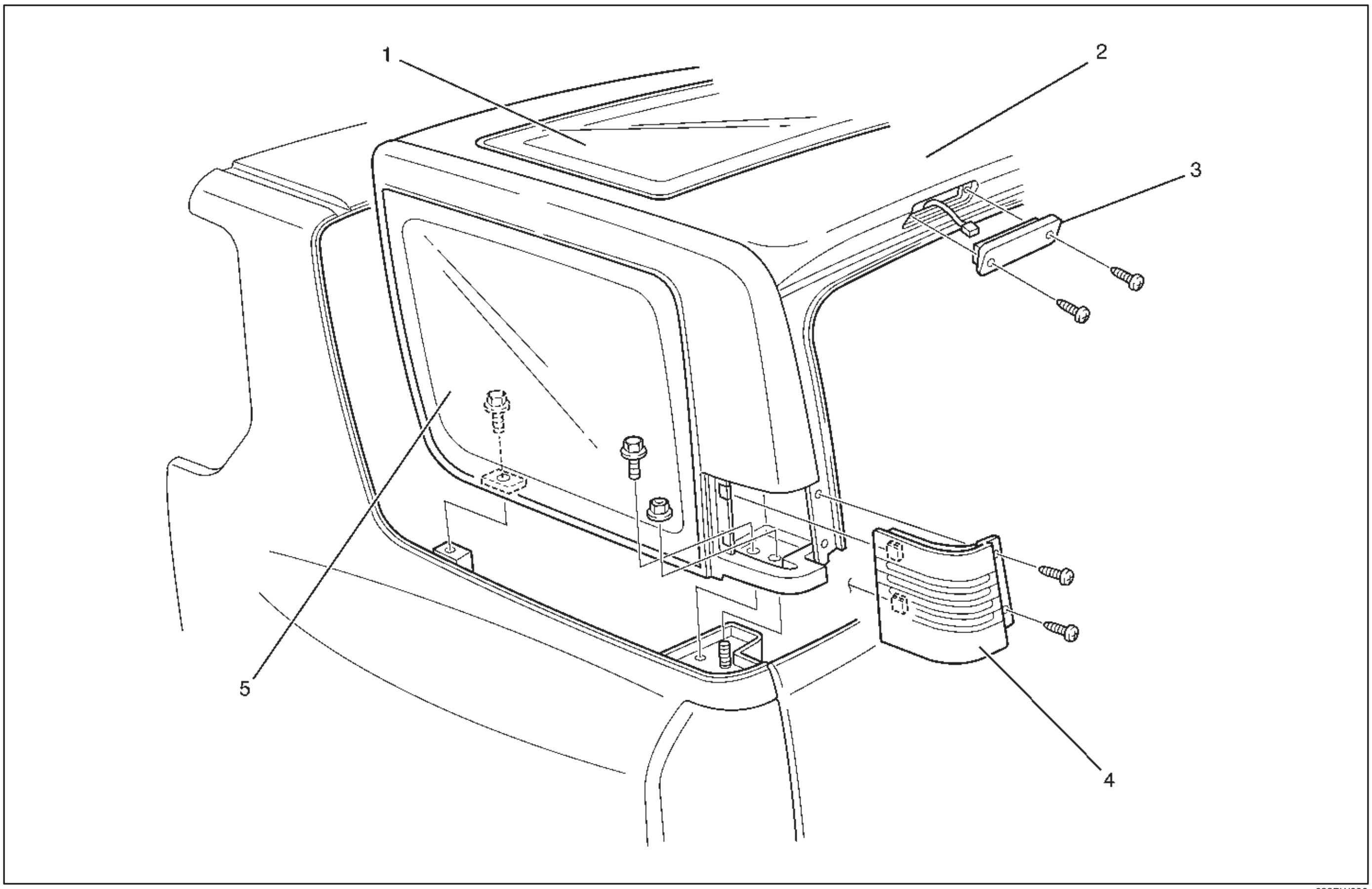
1. After securely covering the zippers (3) with the flaps (1), smooth out the fastener tape (2) with your hands so that there are on folds or turned up portions of the flaps.



682RW014

Resin Top Assembly

Resin Top Assembly and Associated Parts

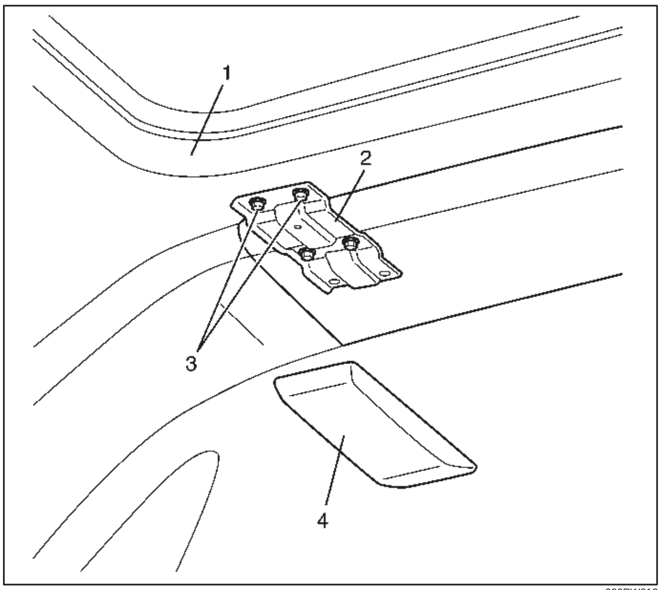


688RW006

Legend
(1) Rear Sun Roof Assembly
(2) Resin Top Assembly
(3) High Mount Stoplight
(4) Air Outlet Grille Assembly
(5) Rear Quarter Glass

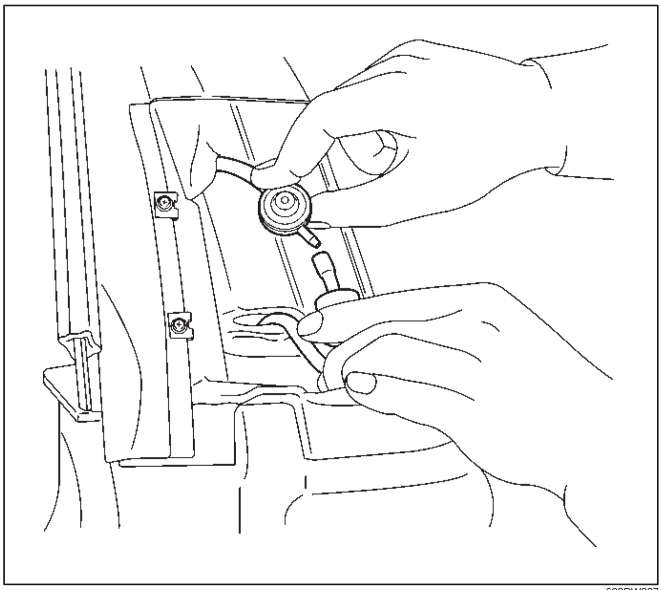
Removal

1. Disconnect the battery ground cable.
2. Remove the rear sun roof glass.
   - Refer to Sun Roof Glass in this section.
3. Remove the sun roof deflector.
   - Remove the four fixing screws.
4. Remove the rear roof bracket covers (4) and remove the both sets of two bolts (3) on the resin top sides of the rear roof brackets (2).



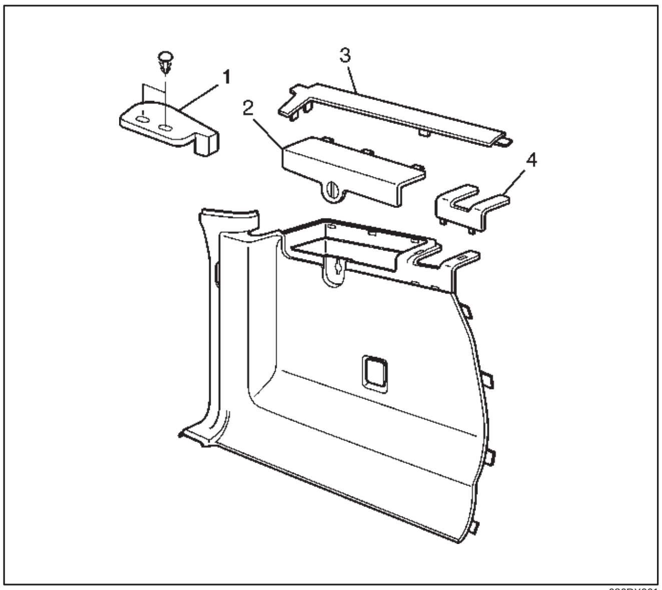
666RW010

5. Remove the air outlet grille assembly (LH & RH).
   - Remove the two screws and pull the grille assemblies off toward the rear.
6. Remove the luggage light assembly and disconnect the connector.
7. Remove the high mount stoplight assembly and disconnect the connector.
8. Disconnect the rear washer hose (Right side, inside air outlet grille assembly).



688RW007

9. Disconnect the harness connector for the resin top (Left side, behind the luggage side trim).
   - Remove the canopy cover (1), the luggage side lid (2) and luggage side upper cover (3). Then pull out the harness and disconnect the connector.



686RX001

10. Remove the resin top assembly.
    - Remove the two fixing bolts each and nut each from the left and right sides, then lift the resin top up and off.

Installation

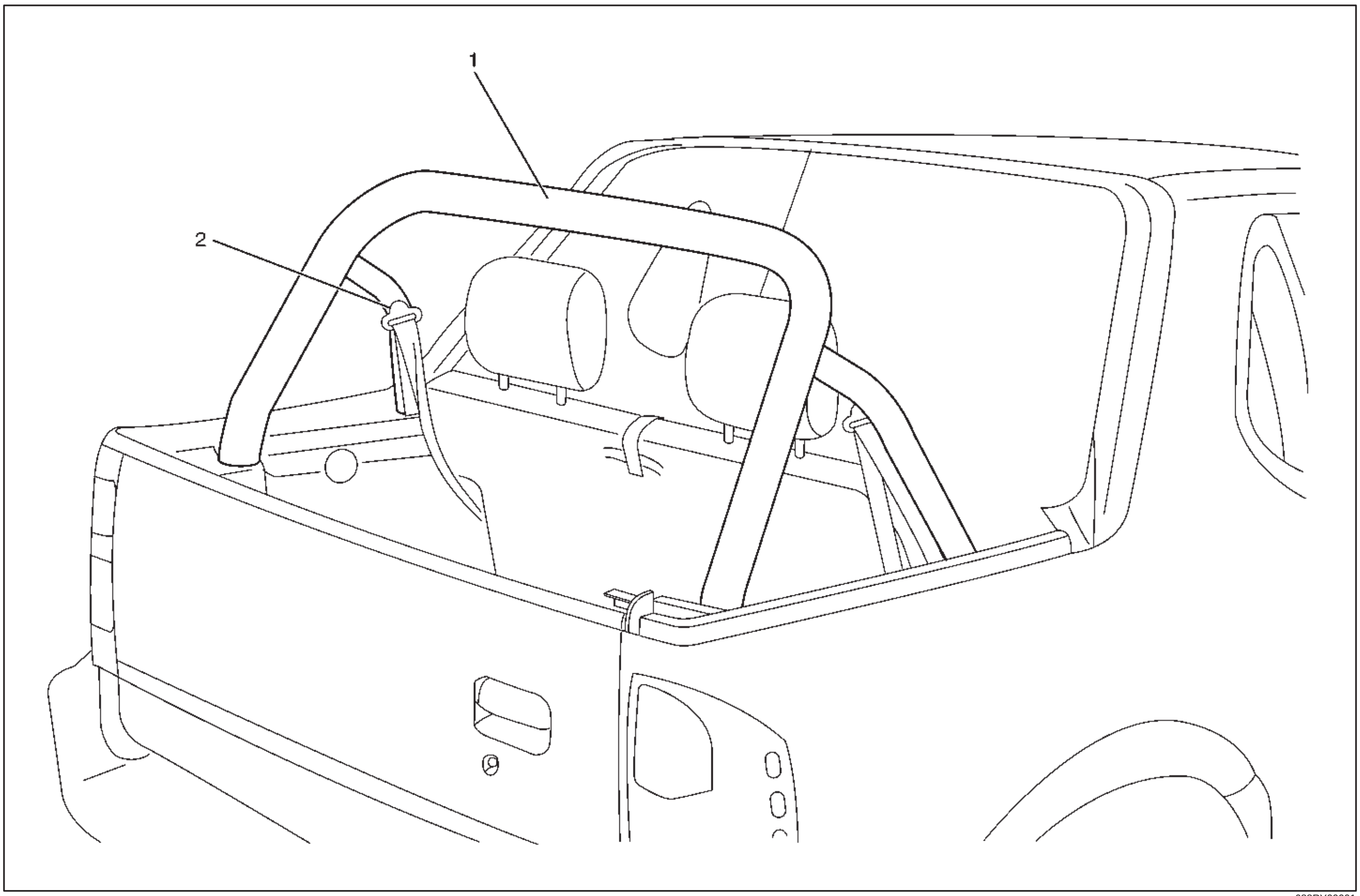
To install, follow the removal steps in the reverse order, noting the following points.

1. Removing and mounting the resin top should always be performed by two persons.
2. Tighten the resin top fixing bolts and nuts to the specified torque.

Torque: 15 N·m (11 lb ft)

Seat Belt Cross Bar Assembly

Seat Belt Cross Bar Assembly and Associated Parts

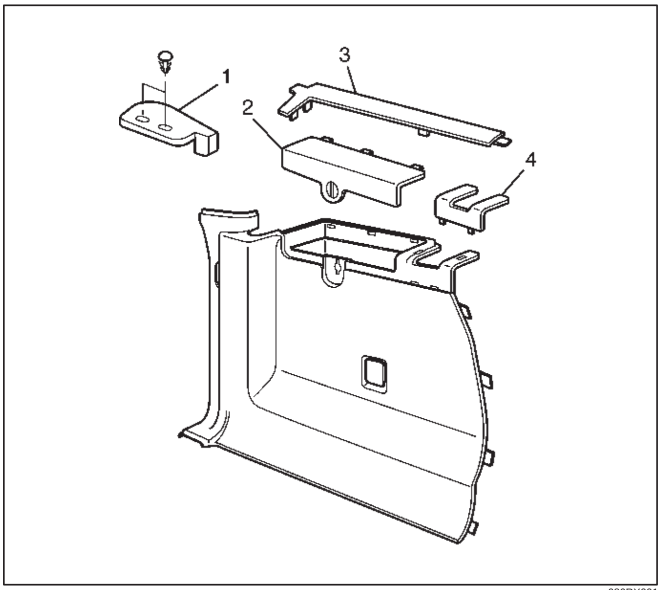


688RY00001

Legend
(1) Seat Belt Cross Bar Assembly
(2) Rear Seat Belt Assembly

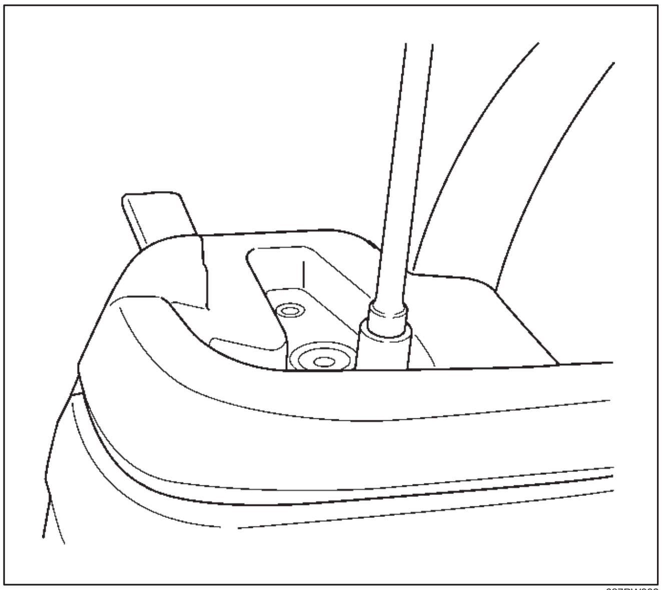
Removal

1. Disconnect the battery ground cable.
2. Remove the soft top assembly or resin top Assembly.
   - Refer to Soft Top assembly or Resin Top Assembly in this section.
3. Remove the luggage side lid (2).
4. Remove the luggage side upper cover (3).
5. Remove the luggage side front cover (4).
6. Remove the canopy cover (1) (Resin top model).
   - Remove the two fixing clips.



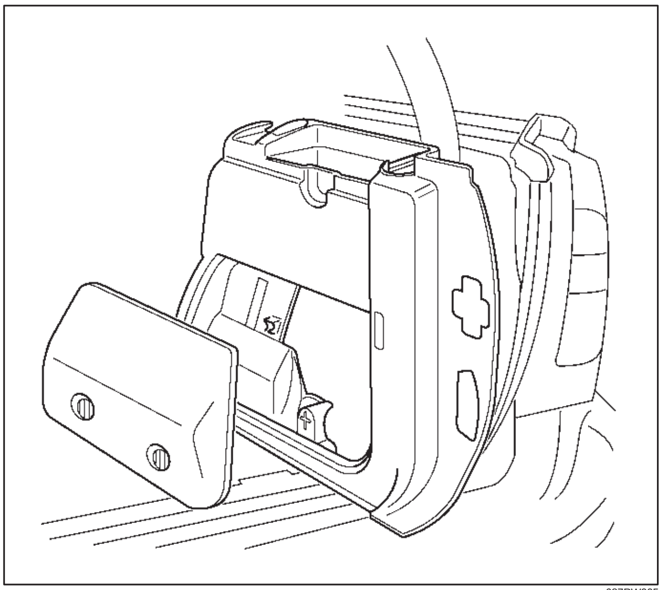
686RX001

7. Remove the left and right quarter side moldings (Soft top model).
   - Remove the six bolts and six screws.



687RW002

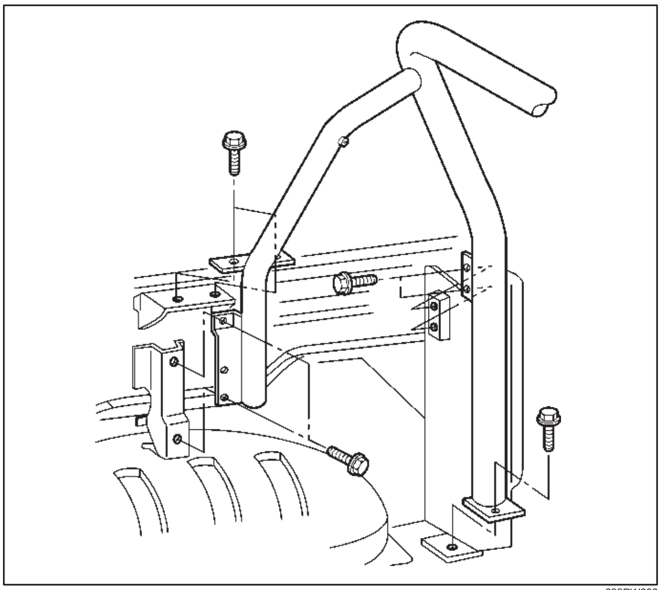
8. Remove the weather strip.
9. Remove the rear end floor trim cover.
   - Remove the five fixing screws.
10. Remove the right luggage side trim cover.
    - Remove the jack & tool lid and take out the tools. Then remove the fixing screw and pull the clips out from the body panel.



687RW005

- To remove the left luggage side trim cover, disconnect the accessory socket connector.

11. Remove the rear seat belt assembly.
    - Refer to Rear Seat Belt in Restraints section.
12. Remove the seat belt cross bar assembly.
    - Remove the two sets of seven fixing bolts on the left and right sides. Note that on the soft top model, two sets of the fixing bolts are also used to secure the tarpaulin frame assembly in place, and that on the resin top model, one set of the fixing bolts are also used to secure the resin top in place.



688RW009

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Tighten the rear seat belt anchor bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

2. Tighten the seat belt cross bar assembly fixing bolts to the specified torque.

   Torque: 19 N·m (14 lb ft)

Main Data and Specifications

Torque Specification

Application	N·m	lb ft	lb in
Sunroof Glass Fixing Screws (LWB)	4	—	35
Sunroof Handle Plate Fixing Nuts (SWB)	8	—	69
Resin Top Assembly Fixing Bolts and Nuts	15	11	—
Rear Seat Belt Anchor Bolts	39	29	—
Seat Belt Cross Bar Assembly Fixing Bolts	19	14	—

RODEO

BODY AND ACCESSORIES

EXTERIOR / INTERIOR TRIM

CONTENTS

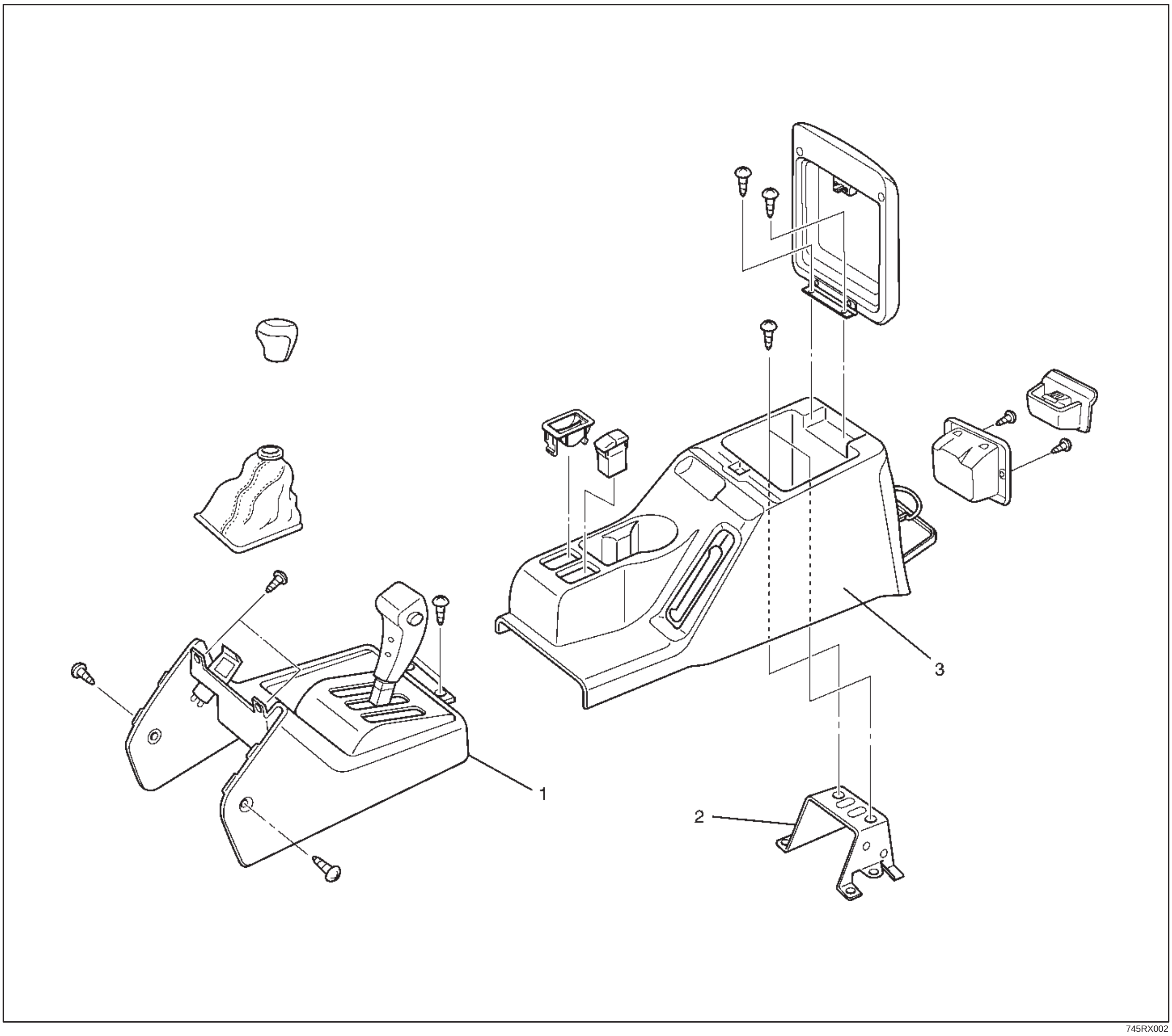
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Consoles

Consoles and Associated Parts



Legend
(1) Front Console
(2) Console Brackets
(3) Rear Console Assembly

Removal

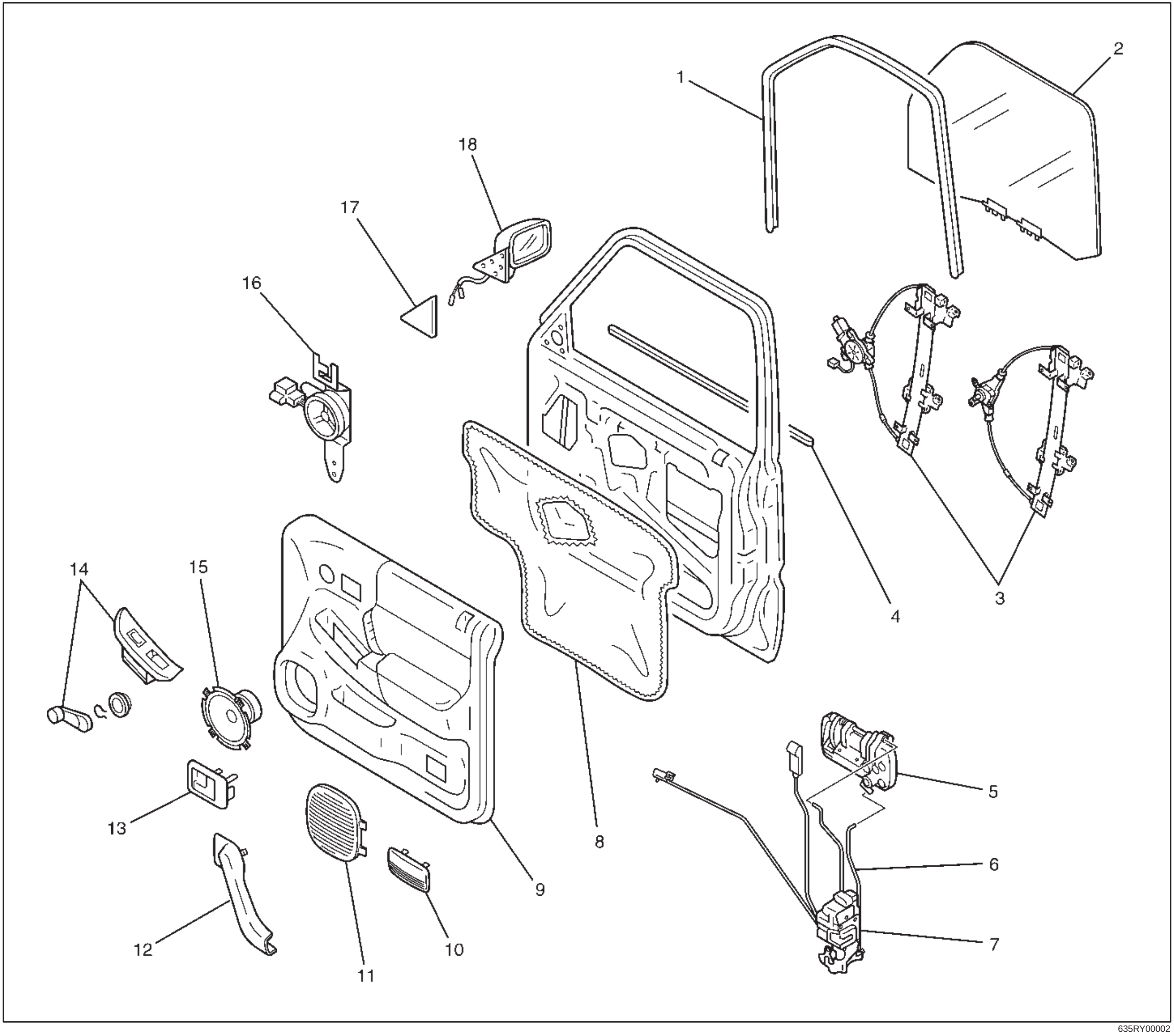
1. Disconnect the battery ground cable.
2. Remove the shift knob (M/T) / transfer knob (4×4).
3. Remove the rear console assembly.
   - Open the rear console lid and remove two screws.
   - Disconnect the switch connector.
4. Remove the front console assembly.
   - Remove six fixing screws and disconnect the accessory socket connectors.

Installation

To install, follow the removal steps in the reverse order.

Front Door Trim Panel

Front Door Trim Panel and Associated Parts

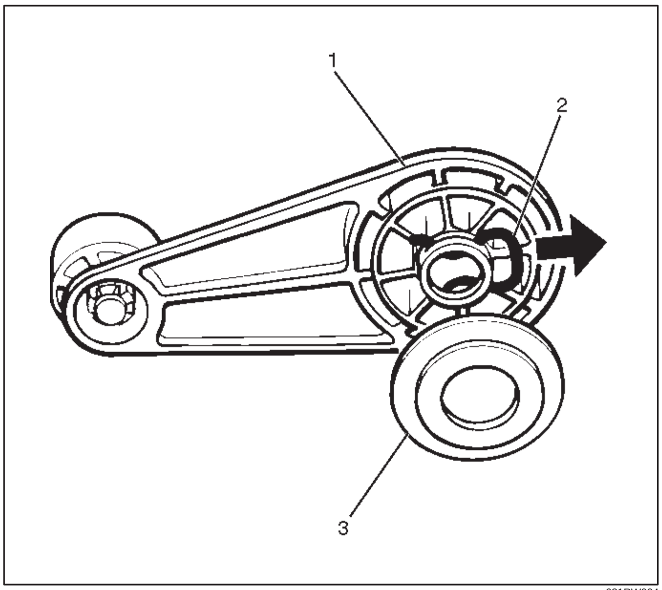


Legend

(1) Glass Run
(2) Glass
(3) Window Regulator/Power Window Regulator
(4) Outer Waste Seal
(5) Outside Handle
(6) Door Lock Cylinder
(7) Door Lock Assembly/Door Lock Actuator
(8) Waterproof Sheet
(9) Door Trim Panel
(10) Courtesy Light Lens
(11) Speaker Grill
(12) Grip Cover
(13) Inside Handle
(14) Power Window Switch/Window Regulator Handle
(15) Speaker Assembly
(16) Tweeter
(17) Door Mirror Cover
(18) Door Mirror Assembly

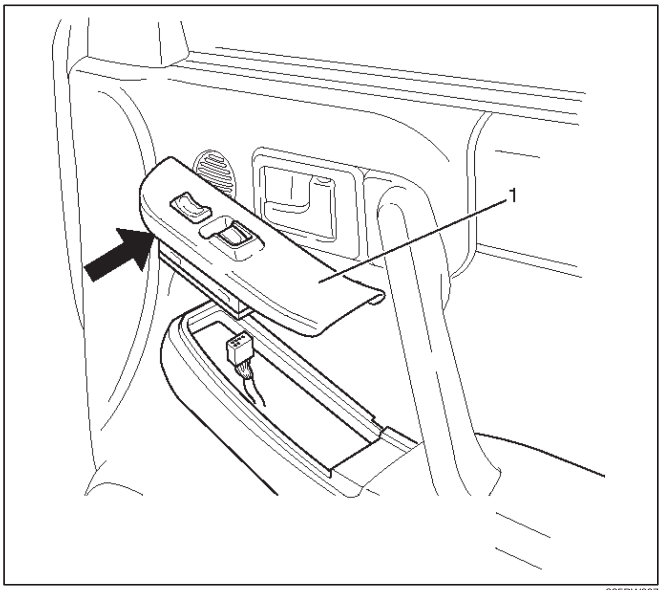
Removal

1. Disconnect the battery ground cable.
2. Remove the door mirror assembly.
   - Refer to Door Mirror Assembly in this section.
3. Remove the regulator handle (1).
   - Pull the hook (2) out and remove the regulator handle.



631RW004

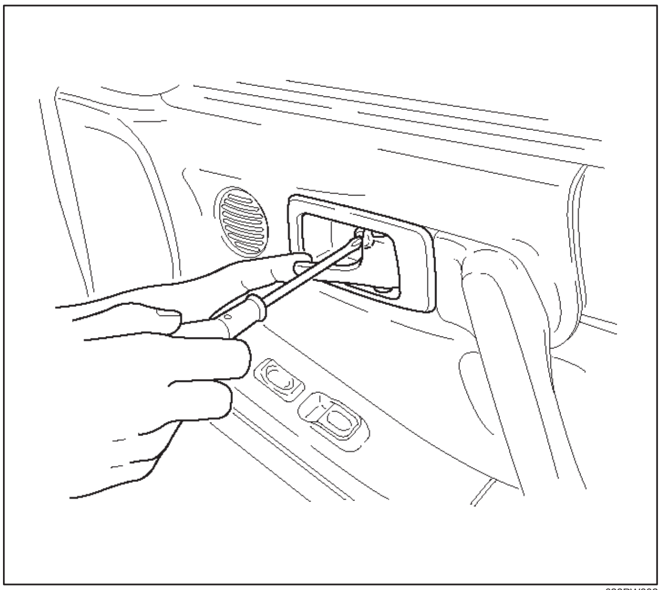
4. Remove the power window switch (1).
   - Pry the power window switch out and disconnect the switch connector.



825RW097

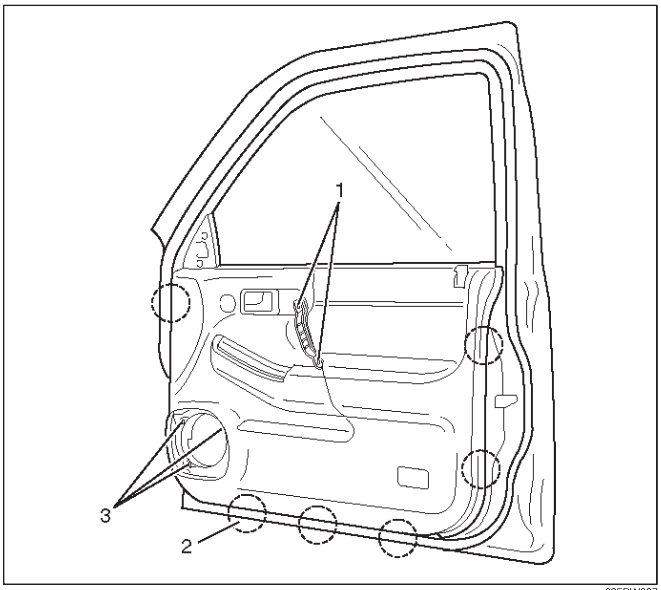
5. Remove the speaker cover.
6. Remove the front speaker.
   - Remove the front speaker fixing screws in order to disconnect the speaker connector.
7. Remove the inside handle fixing screw.

CAUTION: Take care not to apply excessive force on the inside handle link, lest this link is elongated, which could make it impossible to operate the door with the inside handle.



632RW003

8. Remove the door trim panel.
   - Remove 5 fixing screws (1), (3) in order to take off 6 clips (2) from the door panel.



635RW007

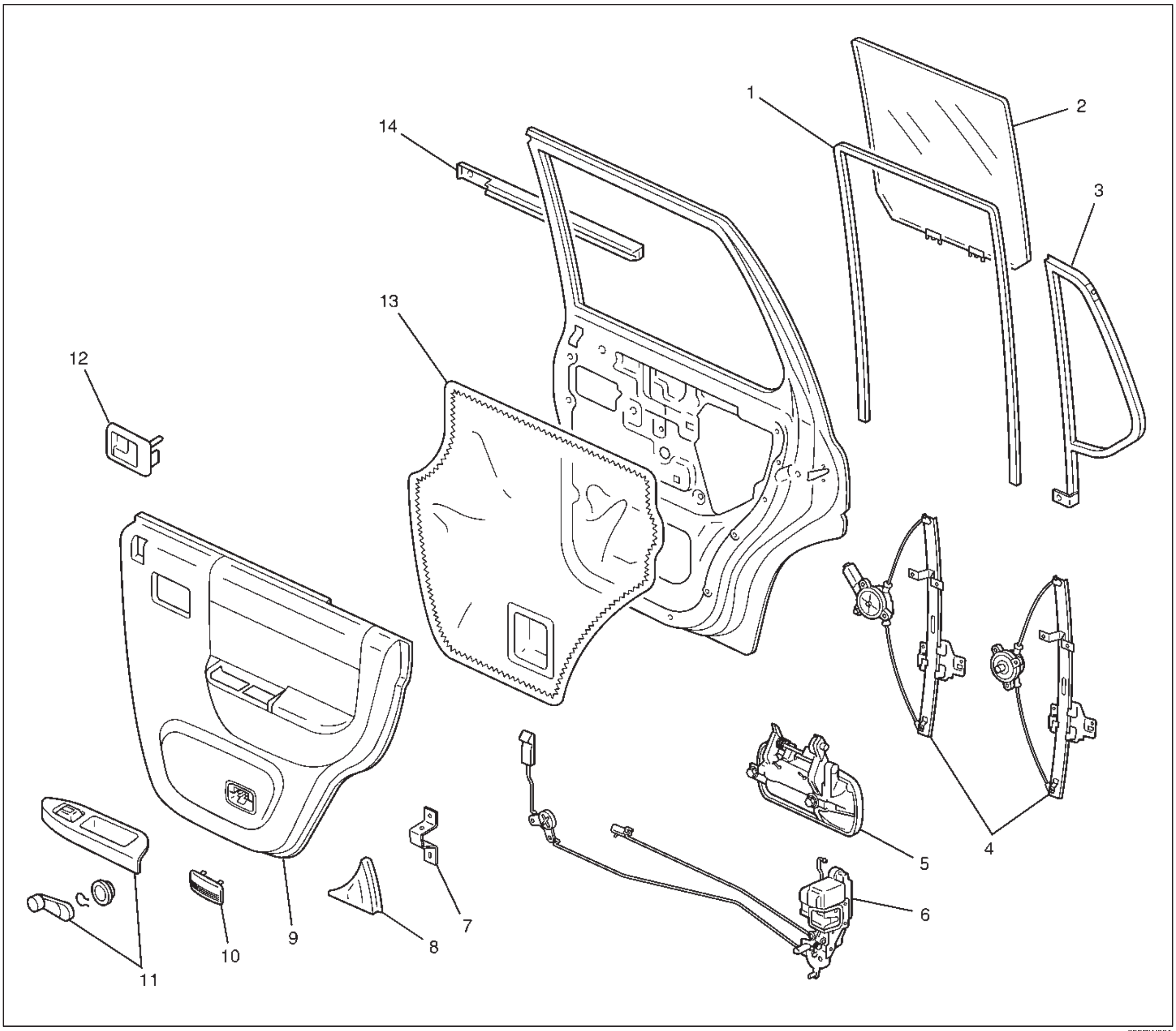
   - Disconnect the tweeter and courtesy light connectors to lift the door trim panel and unlock the engagement of the waist seal section. Then, pass the inside handle through the mounting hole of the trim panel, and detach the trim panel.
9. Remove the inside handle.
10. Remove the tweeter.

Installation

To install, follow the removal steps in the reverse order.

Rear Door Trim Panel

Rear Door Trim Panel and Associated Parts



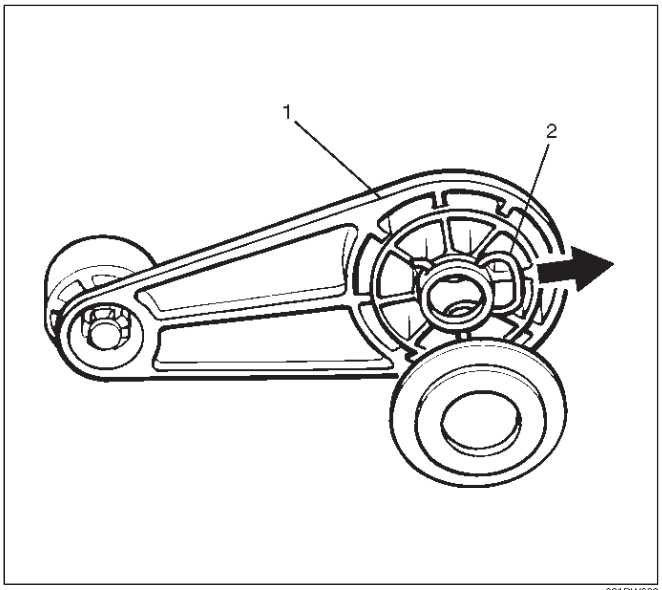
655RW001

Legend

(1) Glass Run
(2) Glass
(3) Fix Window Glass
(4) Window Regulator/Power Window Regulator
(5) Outside Handle
(6) Door Lock Assembly
(7) Bracket
(8) Rear Door Corner Garnish
(9) Door Trim Panel
(10) Courtesy Light Lens
(11) Power Window Switch/Window Regulator Handle
(12) Inside Handle
(13) Waterproof Sheet
(14) Outer Waste Seal

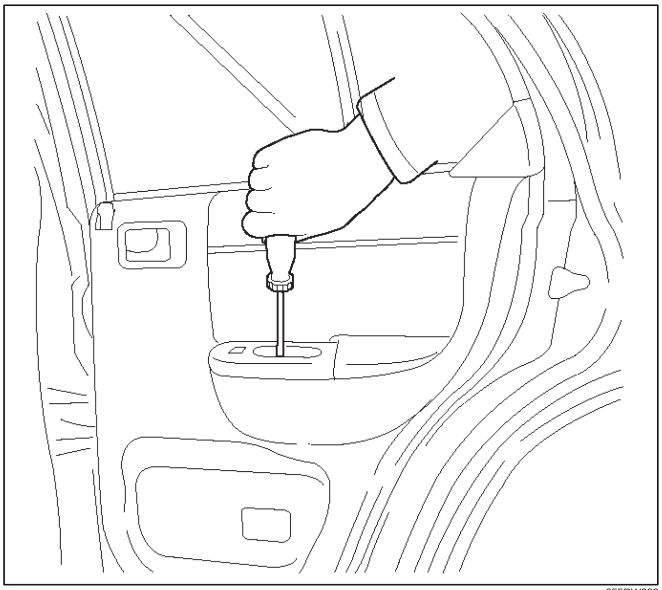
Removal

1. Disconnect the battery ground cable.
2. Remove the regulator handle(1).
   - Pull the hook(2) out and remove the regulator handle.



631RW002

3. Remove the one screw from the pullcase.

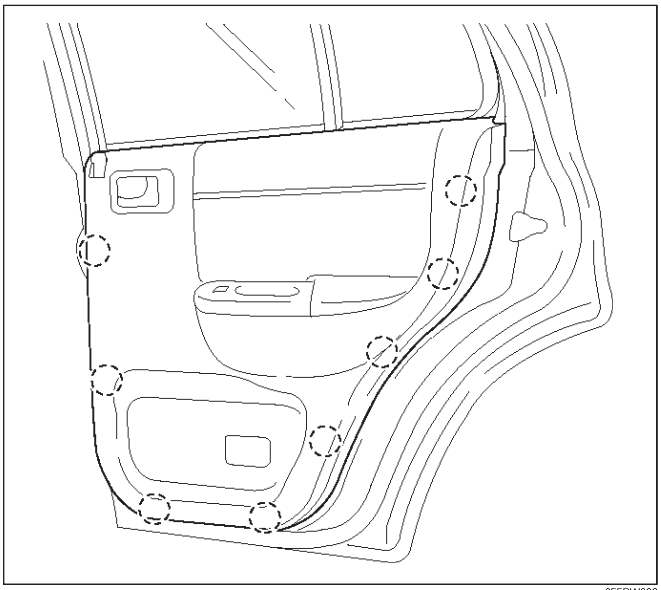


655RW003

4. Remove the inside handle fixing screw.

CAUTION: Take care not to apply excessive force on the inside handle link, lest this link be elongated, which could make it impossible to operate the door with the inside handle.

5. Remove the rear door corner garnish.
6. Remove the door trim panel.
   - Pull out the eight clip positions from the door panel.



655RW002

- Disconnect the power window switch and courtesy light connectors to lift the trim panel and unlock the engagement of the waist seal section, then pass the inside lever through the mounting hole of the trim panel, and detach the trim panel.

7. Remove the inside handle.
8. Remove the power window switch.
   - Remove the fixing screws of switch from backside of rear door trim.

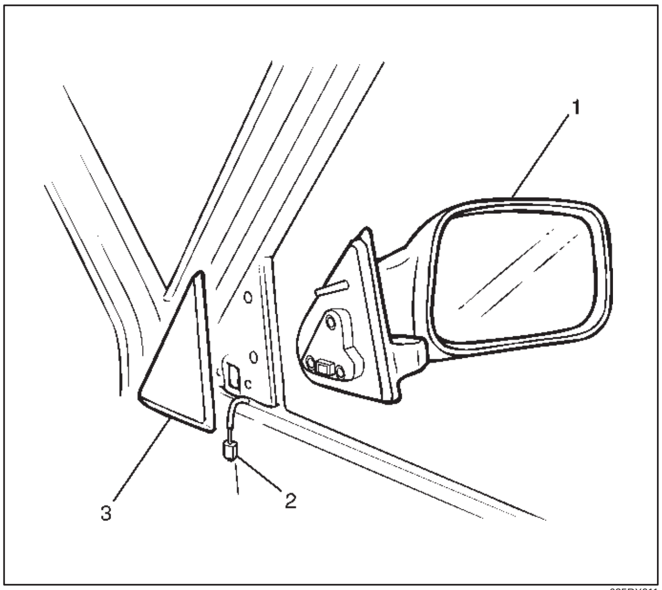
Installation

To install, follow the removal steps in the reverse order.

Door Mirror Assembly

Removal

1. Disconnect the battery ground cable.
2. Remove the door mirror cover (3).
3. Remove the door mirror assembly (1).
   - Remove the three bolts and disconnect the connector (2).



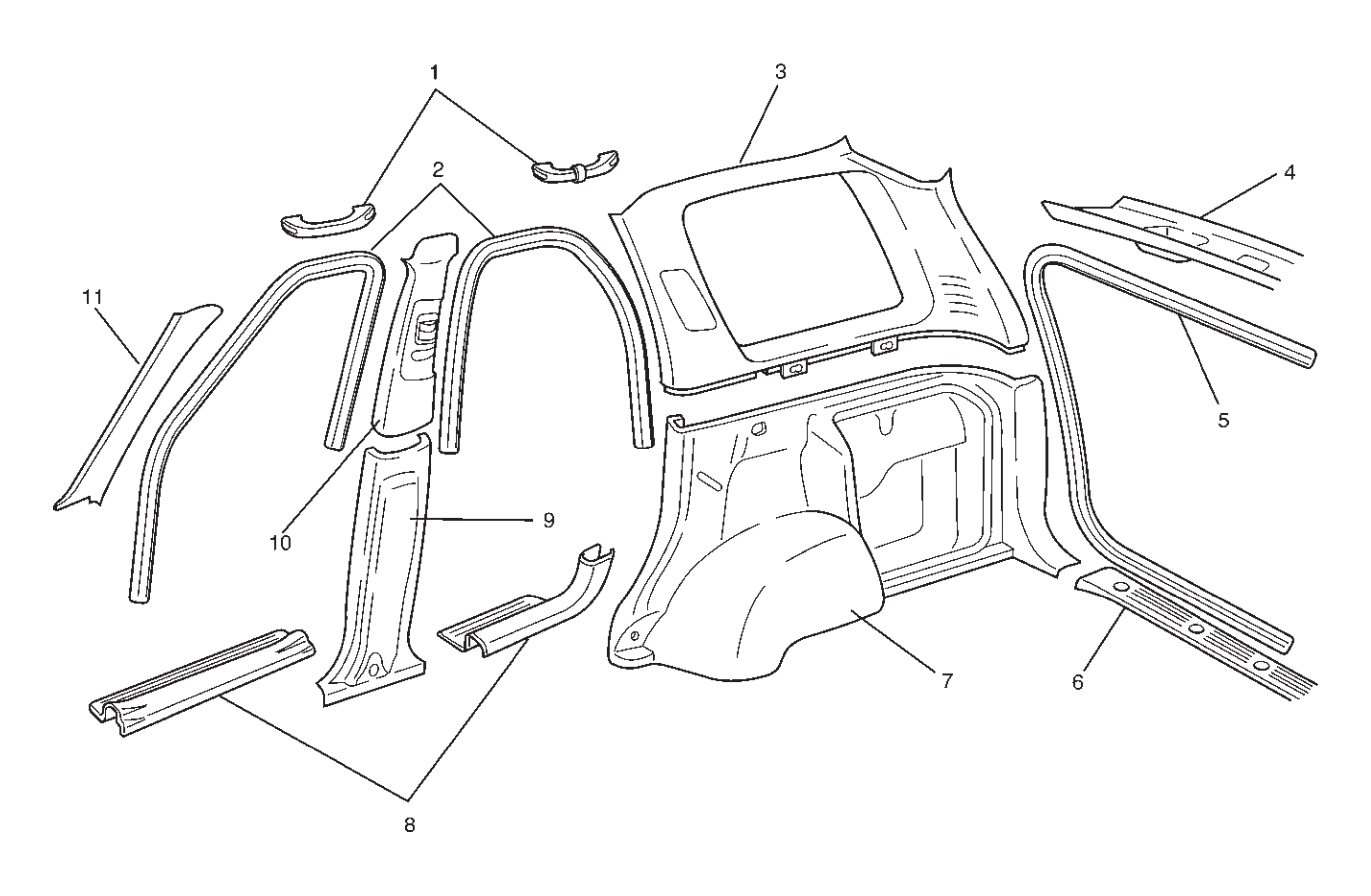
635RX011

Installation

To install, follow the removal steps in the reverse order.

Interior Trim Panels (LWB)

Interior Trim Panels and Associated Parts



643RY00001

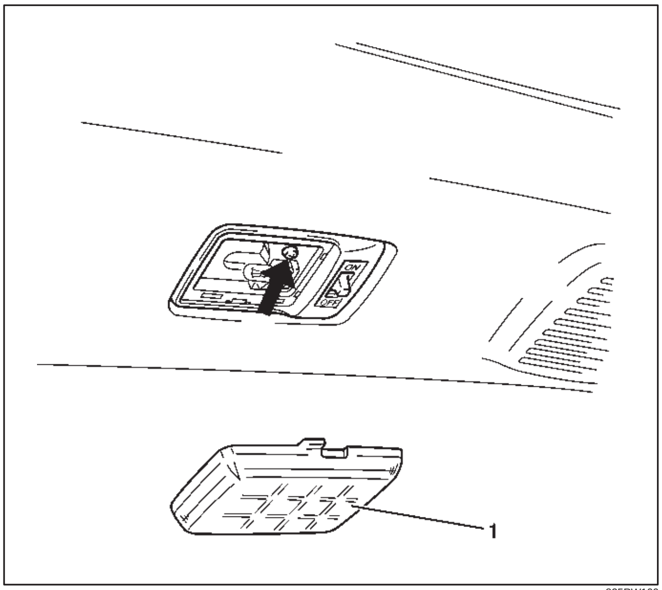
Legend

(1) Assist Grip (Front & Rear)
(2) Door Finisher (Front & Rear)
(3) Upper Quarter Trim Cover
(4) Rear Roof Trim Cover
(5) Tailgate Weather Strip
(6) Rear End Floor Trim Cover
(7) Lower Quarter Trim Cover
(8) Sill Plate (Front & Rear)
(9) Lower Center Pillar Trim Cover
(10) Upper Center Pillar Trim Cover
(11) Front Pillar Trim Cover

Removal

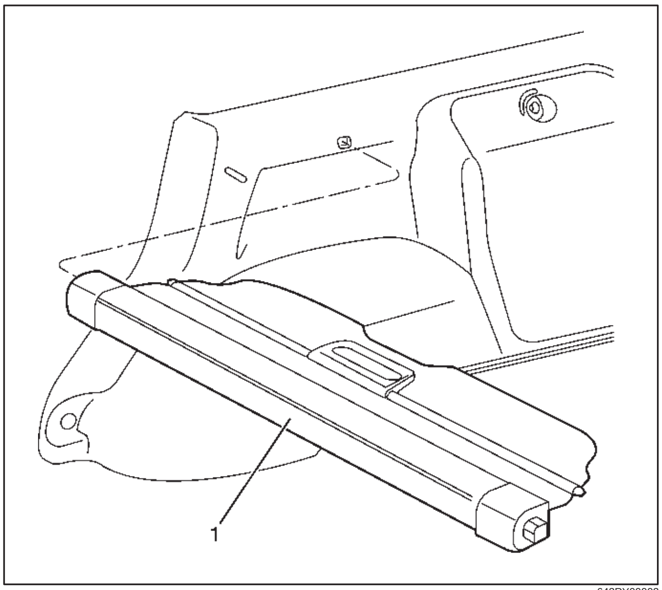
1. Disconnect the battery ground cable.
2. Remove the sill plates (Front & Rear).
3. Remove the dash side trim cover.
4. Remove the lower center pillar trim cover.
   - Remove the lower anchor bolt cover and lower anchor bolt from the front seat belt.
   - Pry the trim cover clips free from the body panel.
5. Remove the door finishers (Front & Rear).
6. Remove the upper center pillar trim cover.
   - Pry the trim cover clips free from the body panel.
7. Remove the front pillar trim cover.
   - Ply the trim cover clips free from the body panel.
8. Remove the tailgate weather strip.
9. Remove the rear end floor trim cover.
   - Remove the five fixing screws.

10. Remove the luggage room light.
    - Remove the luggage room light lens (1) and the fixing screw.
    - Disconnect the luggage room light connector.



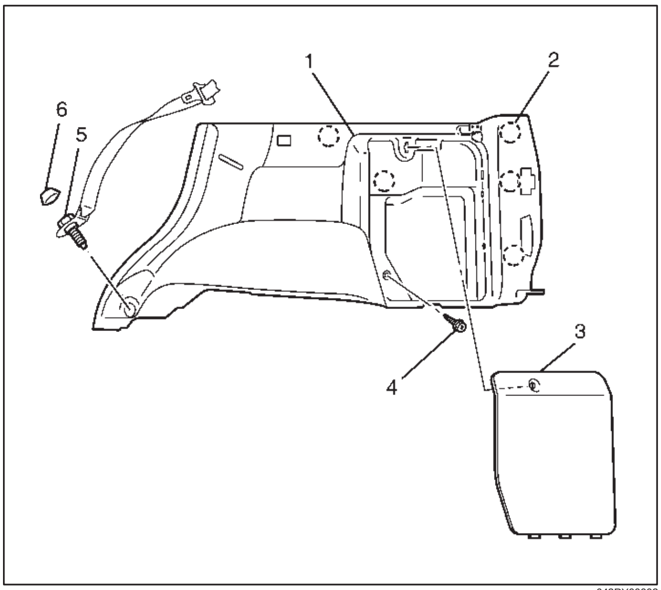
825RW100

11. Remove the rear roof trim cover.
    - Pry the trim cover clips free from the body panel.
12. Remove the tonneau cover assembly (1).



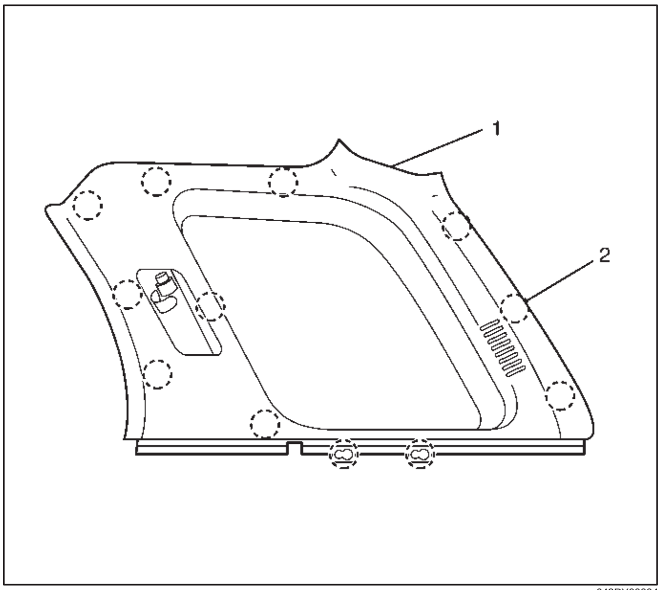
643RY00002

13. Remove the lower anchor bolt cover (6) and the lower anchor bolt (5) from the rear seat belt.
14. Remove the lower quarter trim cover (1).
    - Remove the tool box lid (3) and fixing screw (4).
      Pry the five (RH) or six (LH) clip positions (2) free from the body panel.
    - Disconnect the accessory socket connector (LH side).



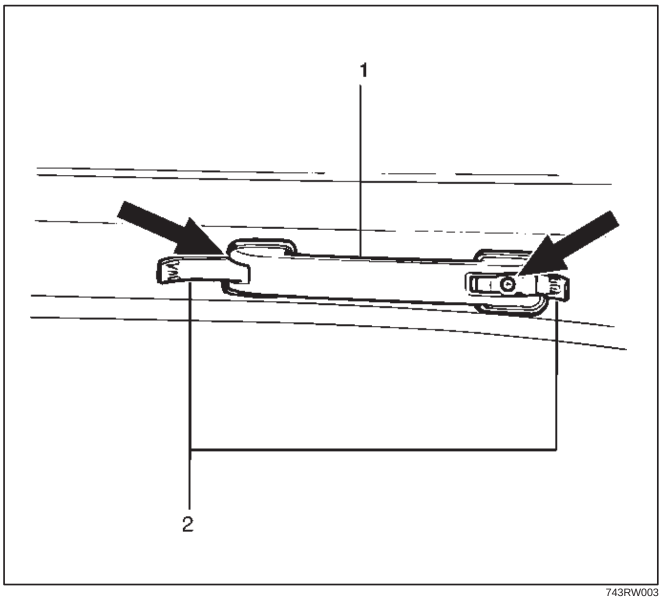
643RY00003

15. Remove the upper quarter trim cover (1).
    - Pry the twelve clip positions (2) free from the body panel.



643RY00004

16. Remove the front pillar assist grip (1) (Front & Rear).
    - Open the both sides of the assist grip cover (2) and remove the fixing screws and the front pillar assist grip.



Installation

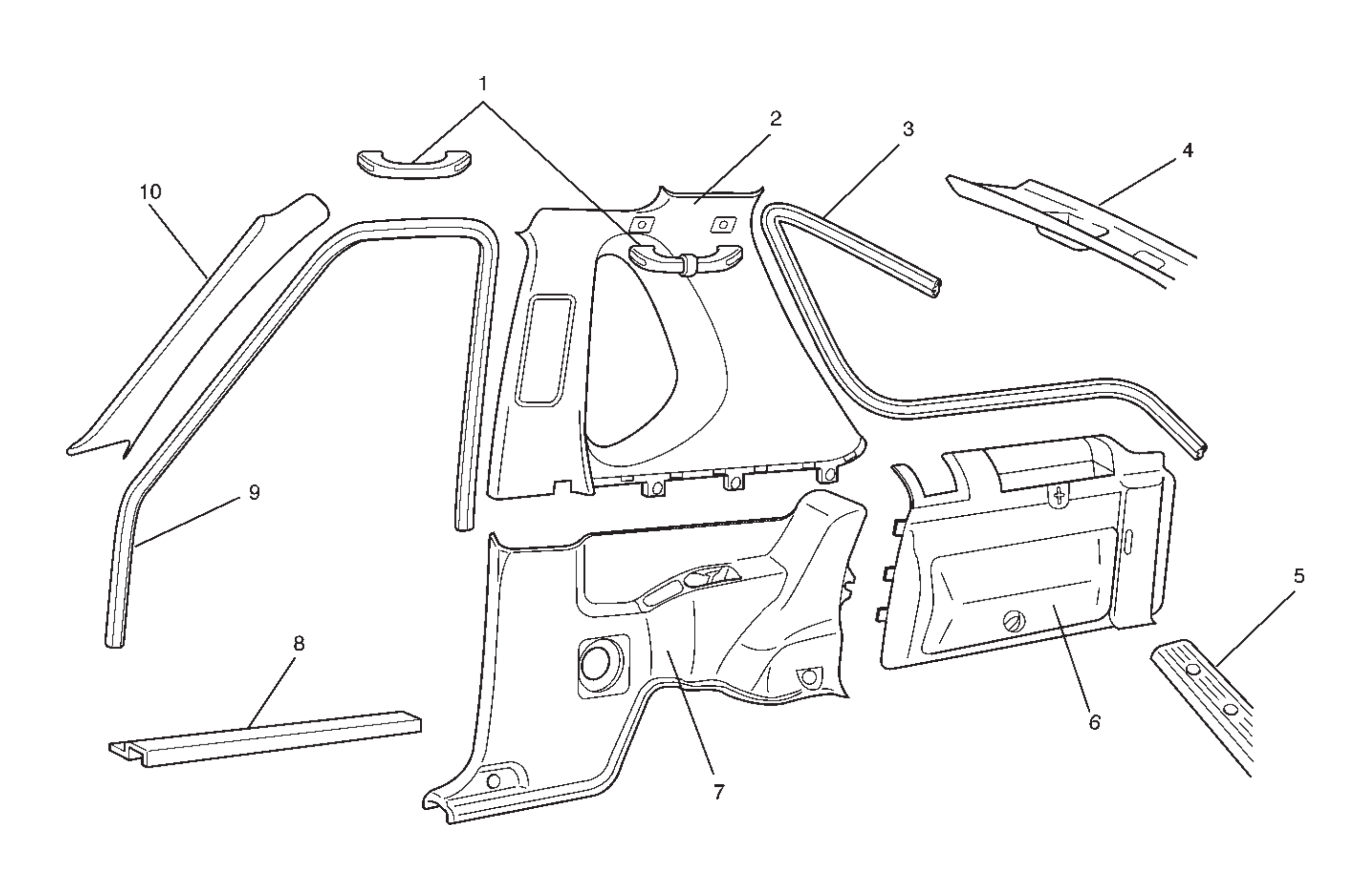
To install, follow the removal steps in the reverse order, noting the following point:

1. Tighten the seat belt anchor bolt to the specified torque.

   Torque: 39 N·m (29 lb ft)

Interior Trim Panels (SWB)

Interior Trim Panels and Associated Parts



643RW010

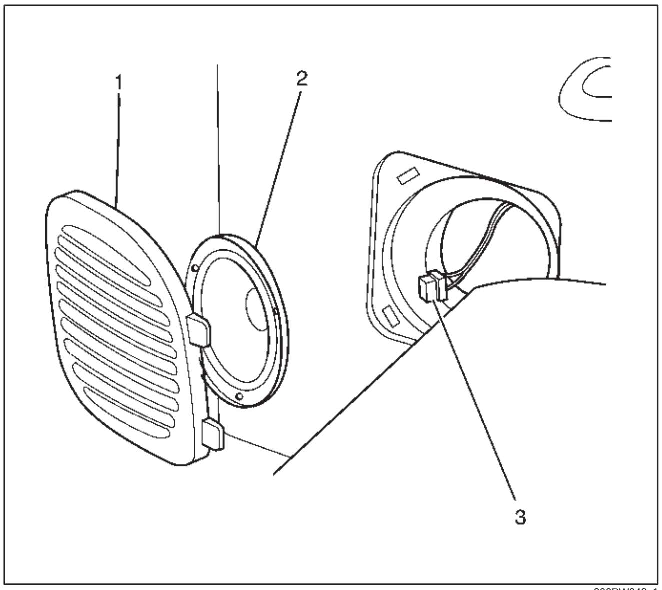
Legend

(1) Assist Grip (Front & Rear)
(2) Upper Quarter Trim Cover
(3) Weather Strip
(4) Rear Roof Trim Cover
(5) Rear End Floor Trim Cover
(6) Luggage Side Trim Cover
(7) Lower Quarter Trim Cover
(8) Sill Plate
(9) Door Seal Finisher
(10) Front Pillar Trim Cover

Removal

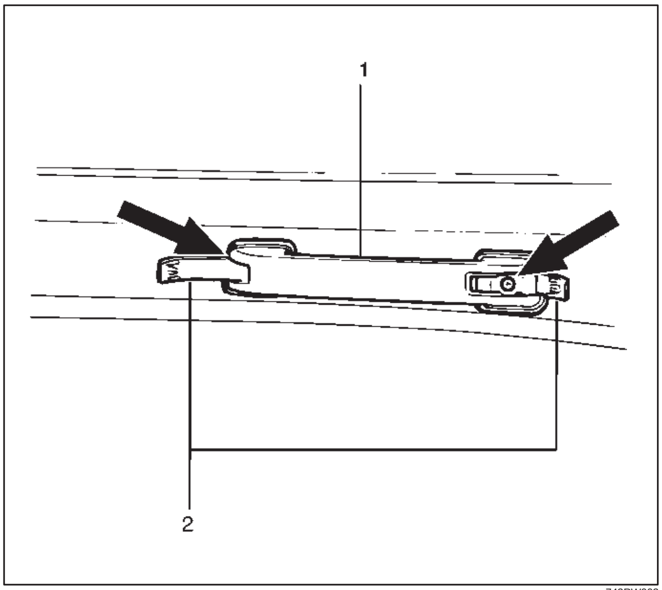
1. Disconnect the battery ground cable.
2. Remove the soft top assembly or resin top assembly.
   - Refer to Soft Top Assembly or Resin Top Assembly in Sun Roof/Convertible Top section.
3. Remove the rear seat assembly.
   - Refer to Rear Seat Assembly in Seats section.
4. Remove the weather strip.
5. Remove the luggage sid trim cover.
   - Refer to Seat Belt Cross Bar Assembly in Sun Roof/Convertible Top section.
6. Remove the sill plate.
7. Remove the dash side trim cover.

8. Remove the rear speaker assembly.
   - Disengage the front portion of the speaker grille (1) and pull it forward and off.
   - Remove the three fixing screws securing the speaker (2) in place and disconnect the connector (3).



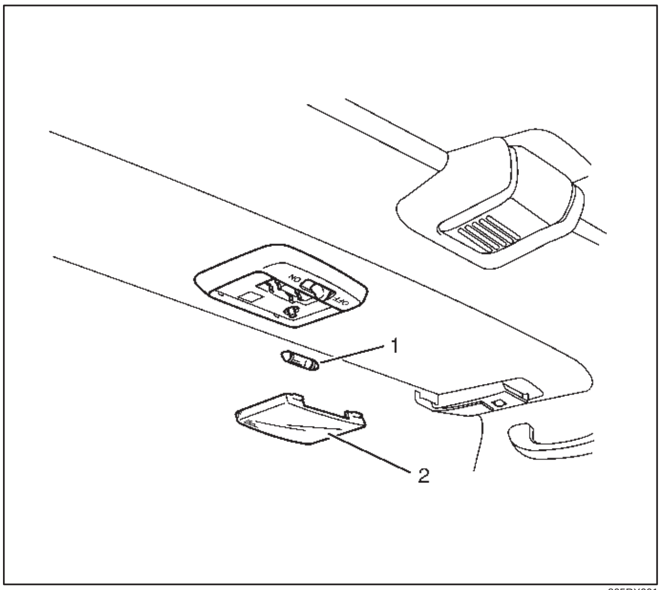
890RW048–1

9. Remove the front and rear seat belt lower anchor bolts.
10. Remove the lower quarter trim cover.
    - Disengage the clips from the body panel by twisting them free.
11. Remove the assist grips (1) (Front & Rear).
    - Open the both sides of the assist grip cover (2) and remove the fixing screws.



743RW003

12. Remove the door seal finisher.
13. Remove the dome light.
    - Remove the dome light lens (2) and the fixing screws.
    - Disconnect the dome light connector.



805RX001

14. Remove the rear roof bracket (Resin top model) or the soft top latch (Soft top model).
15. Remove the rear roof trim cover.
16. Remove the upper quarter trim cover.
17. Remove the front pillar trim cover.

Installation

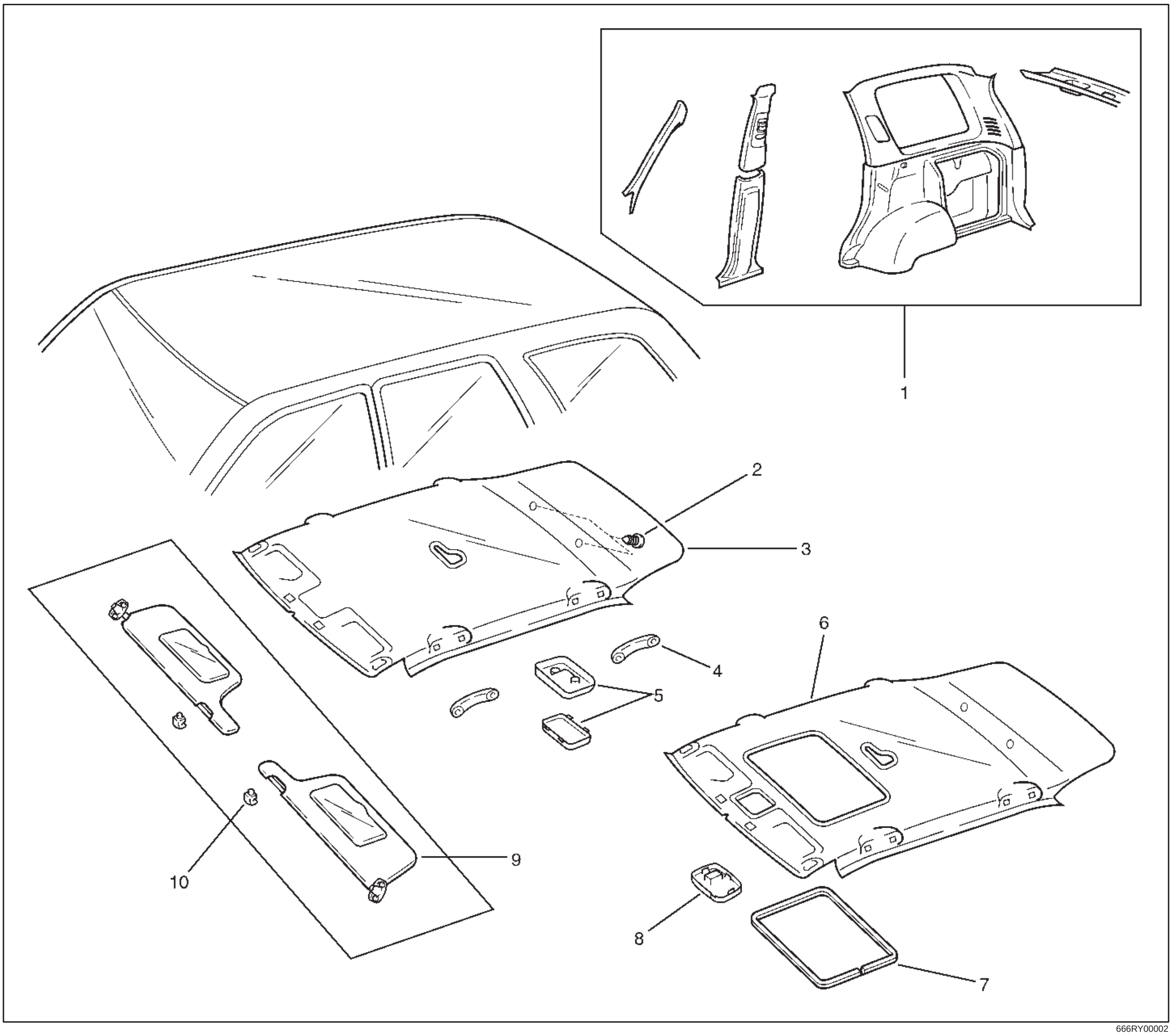
To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the front and rear seat belt anchor bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

Headlining (LWB)

Parts Location



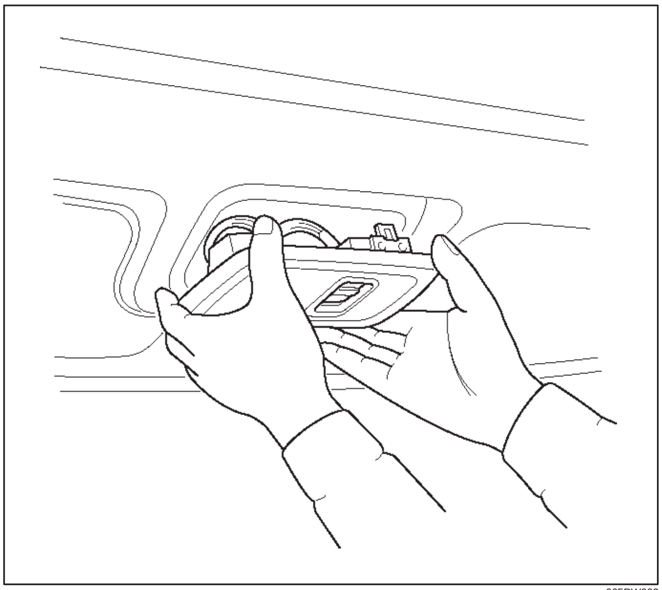
Legend

(1) Interior Trim Panels
(2) Clip
(3) Headlining (Without Sunroof)
(4) Assist Grip
(5) Dome Light
(6) Headlinng (With Sun Roof)
(7) Sunroof Finisher (With Sunroof)
(8) Sunroof Switch (With Sunroof)
(9) Sunvisors
(10) Sunvisor Holder

Removal

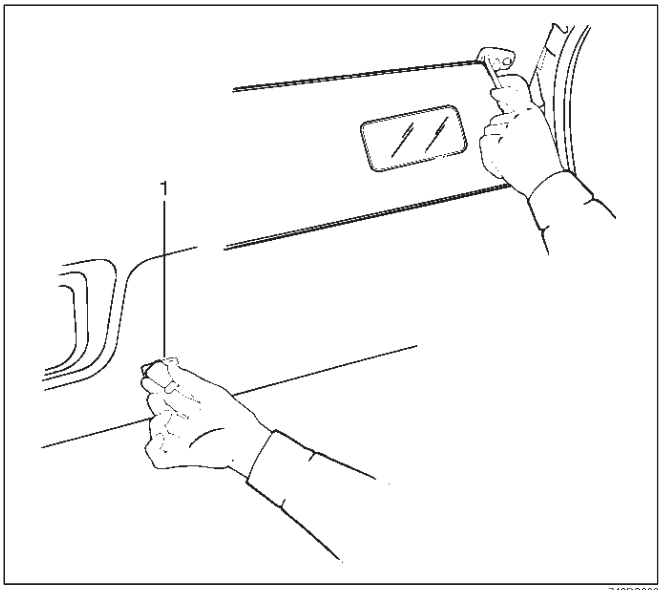
1. Disconnect the battery ground cable.
2. Remove the interior trim panels.
   - Refer to Interior Trim Panels (LWB) in this section.
3. Remove the dome light.
   - Remove the dome light lens and the fixing screws.
   - Disconnect the dome light connectors.

4. Remove the sunroof switch (With sunroof).
   - Pry the clip positions free from the sunroof switch bracket and disconnect the connector.
   - Disconnect the vanity mirror illumination connector. (if so equipped)



665RW002

5. Remove the sunvisors.
   - Remove the fixing screws and pull out the sunvisor holder (1) to remove it.



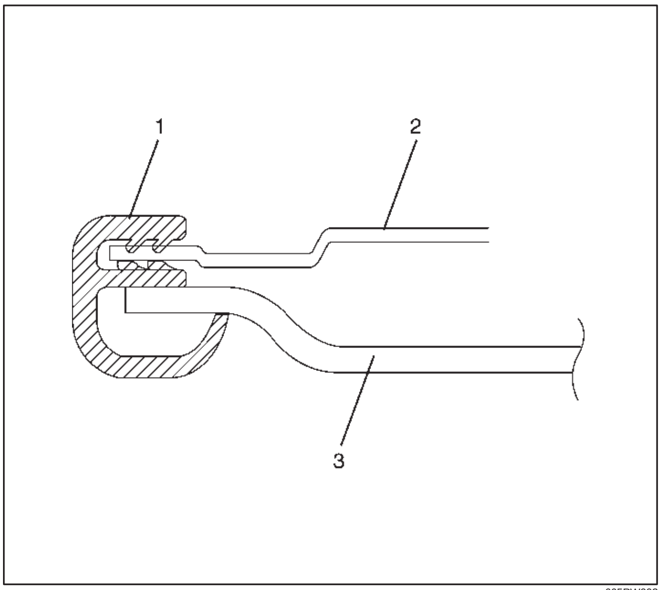
743RS006

6. Remove the sunroof finisher (With sunroof).
7. Remove the headlining.
   - Remove the headlining fixing clips.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Install the headlining so that the fixing clips will not come off.
2. To install the sunroof finisher (1), first fit it in at one place with the headlining (3) close to the sunroof frame complete (2), then install the entire finisher tightly by hitting it with a plastic hammer, not allowing it to move up.

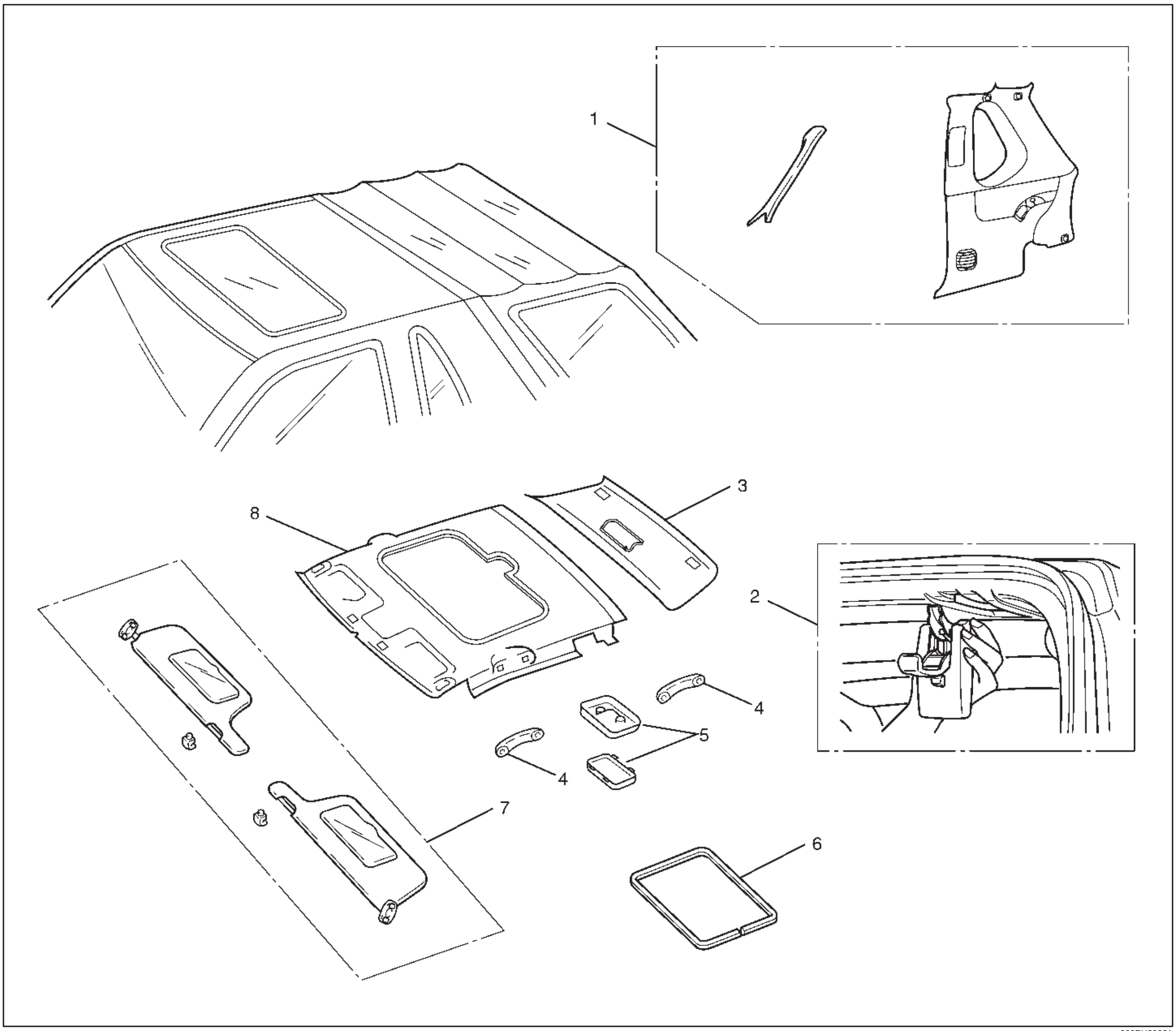


665RW003

Headlining (SWB)

Parts Location

This illustration is based on the Soft top model.

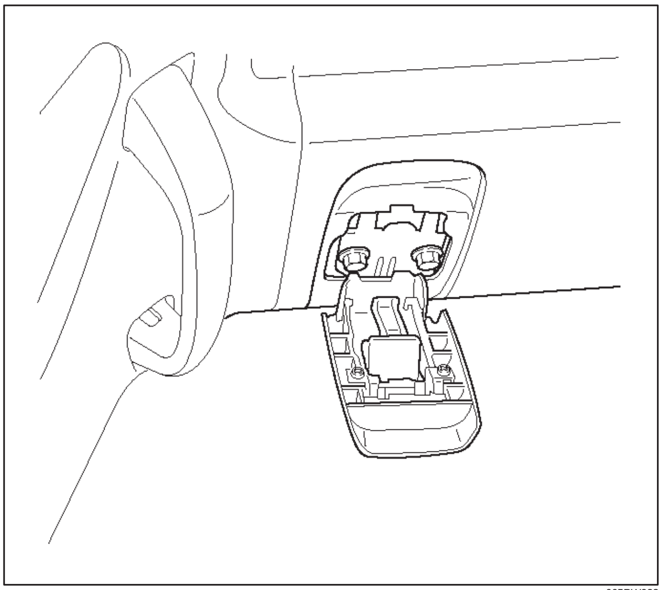


Legend

(1) Interior Trim Panels
(2) Soft Top Latch
(3) Rear Roof Trim Cover
(4) Assist Grip
(5) Dome Light
(6) Sunroof Finisher
(7) Sunvisors
(8) Headlining

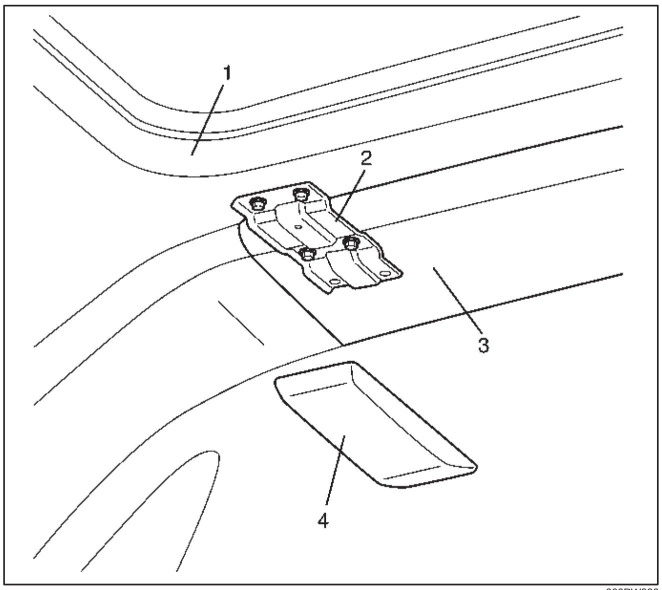
Removal

1. Disconnect the battery ground cable.
2. Remove the soft top latch (Soft top model).
   - Remove two bolts.



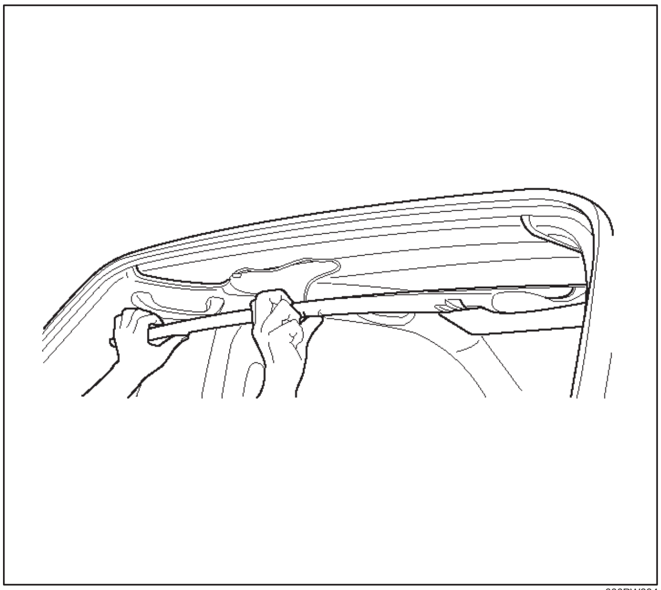
665RW023

   - Remove the rear roof bracket cover (4), rear roof bracket (2) connecting with resin top (1) and rear roof trim cover (3) by removing four fixing bolts (Resin top model).



666RW006

3. Remove the dome light lenz.
4. Remove the dome light.
   - Remove the fixing screws.
   - Disconnect the dome light connector.
5. Remove the rear roof trim cover.



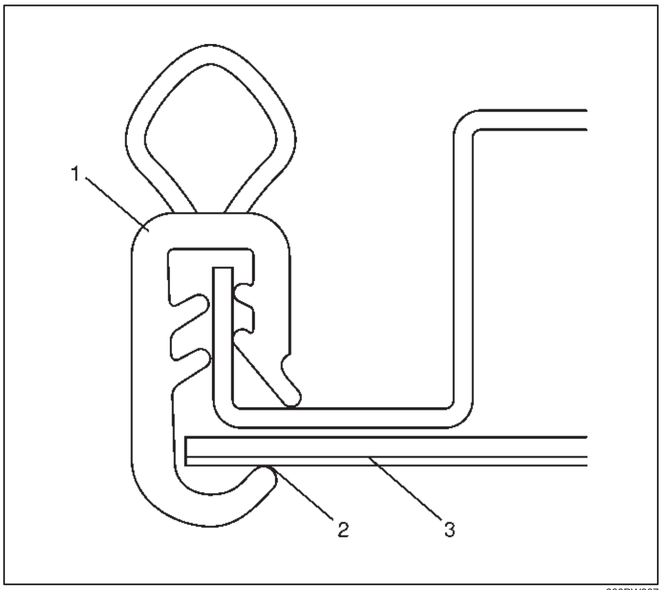
666RW004

6. Remove the interior trim panels.
   - Refer to Interior Trim Panels (SWB) in Exterior/Interior Trim section.
7. Remove the sunroof glass assembly.
   - Refer to Sunroof Glass in Sunroof/Convertible Top section.
8. Remove the sun roof handle cover and sunroof handle plate.
   - Remove the screw from the cover and the three fixing nuts from the plate.
9. Remove the sunvisor.
   - Remove the sunvisor fixing screws and the sunvisor holder.
10. Remove the sunroof finisher.
11. Remove the headlining.

Installation

To install, follow the removal steps in the reverse order, noting the following point.

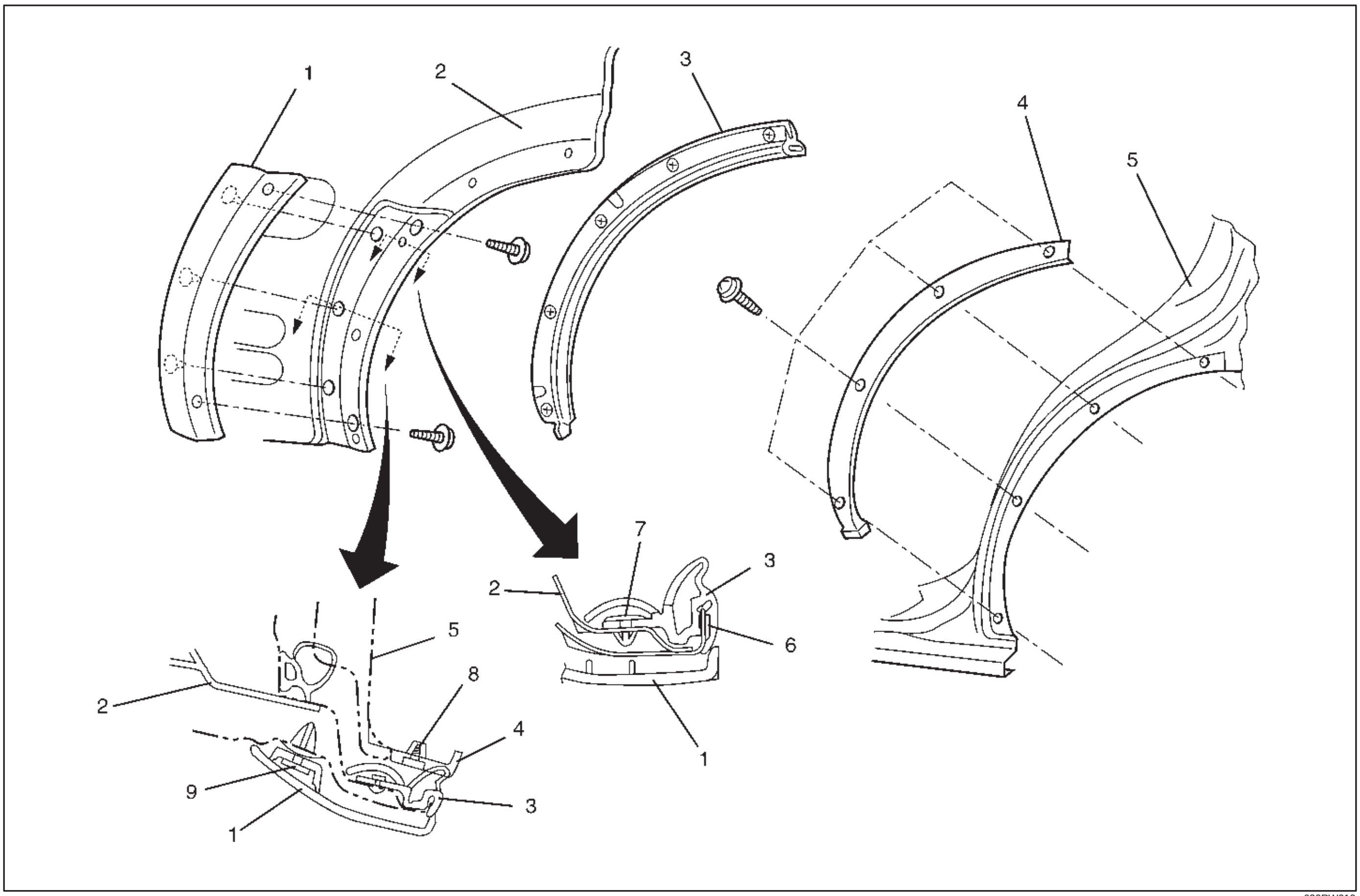
1. In case of installing sunroof finisher (1), fit the lip (2) to the headlining surely.



666RW007

Wheel Arch Protector (LWB)

Wheel Arch Protector and Associated Parts



Legend

(1) Wheel Arch Protector
(2) Rear Door Panel
(3) Rear Door Wheel Arch Seal
(4) Wheel Arch Cover
(5) Body Panel
(6) Double Sided Adhesive Tape
(7) Clip
(8) Screw Grommet
(9) Clip

Removal

1. Remove the wheel arch cover.
   - Remove the four fixing screws.
2. Remove the wheel arch protector.
   - Remove the two fixing screws from the back side of the rear door panel and pull out the clips at three positions.
3. Remove the rear door wheel arch seal.
   - After disengaging five clips, peel off the double sided adhesive tape.

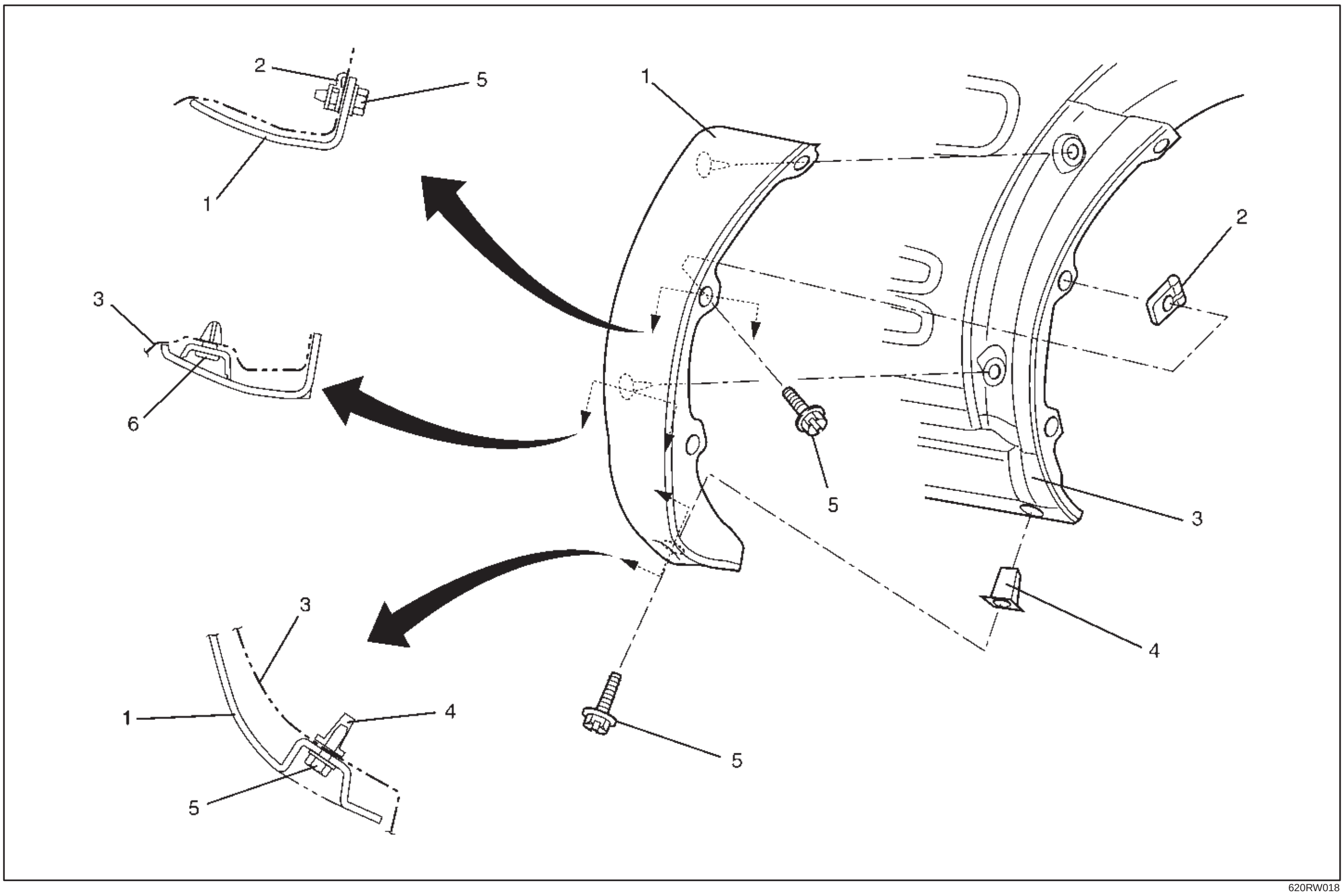
Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Use a new double sided adhesive tape whenever installing the rear door wheel arch seal.
   Using a white gasoline, clean the places in advance where a double sided adhesive tape is affixed.

Wheel Arch Protector (SWB)

Wheel Arch Protector and Associated Parts



Legend

(1) Wheel Arch Protector
(2) Spire Nut
(3) Quarter Outer Panel
(4) Screw Grommet
(5) Screw
(6) Clip

Removal

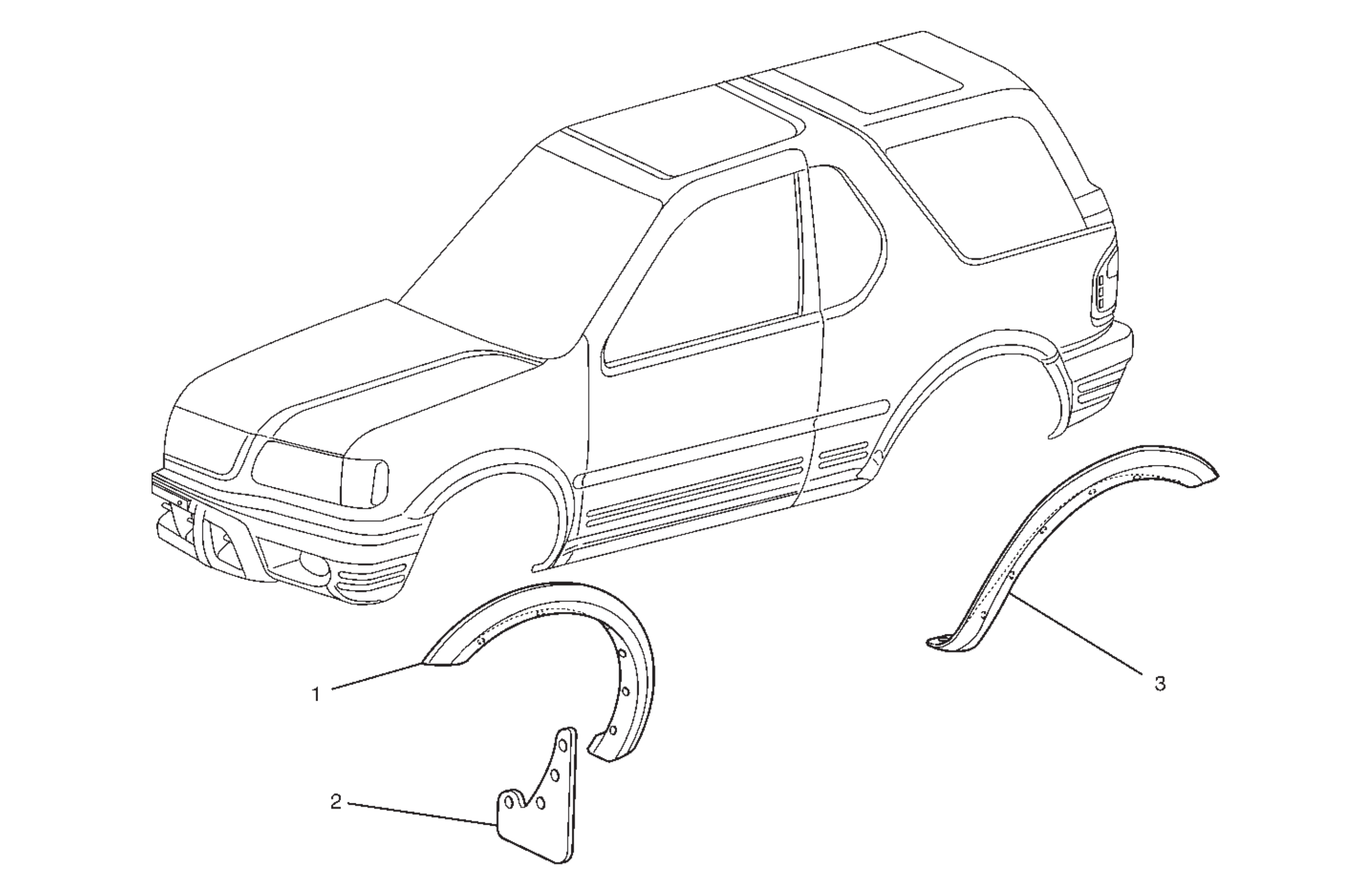
1. Remove the wheel arch protecter.
   - Remove the four fixing screws and pull out the clips at two positions.

Installation

To install, follow the removal steps in the reverse order.

Wheel Arch Molding (SWB)

Wheel Arch Molding and Associated Parts

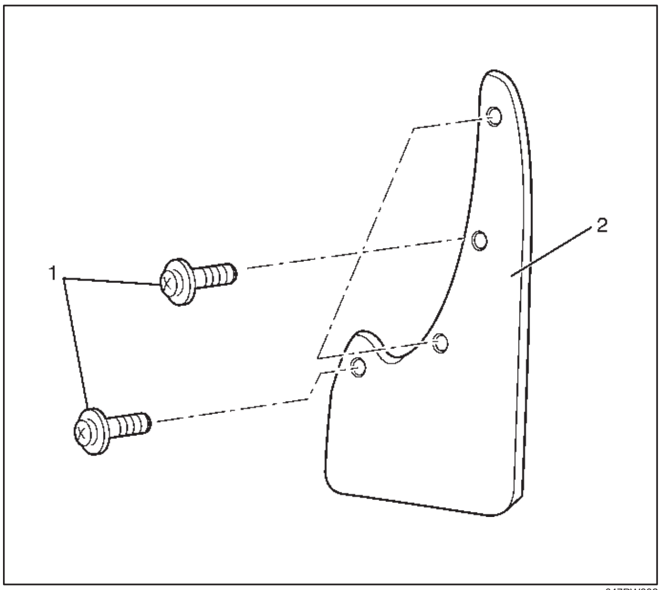


620RY00002

Legend
(1) Front Wheel Arch Molding
(2) Front Mud Flap
(3) Rear Wheel Arch Molding

Removal

1. Remove the front mud flap (2).
   - Remove the four fixing screws (1).
     (Three of four screws are fixed together with molding.)

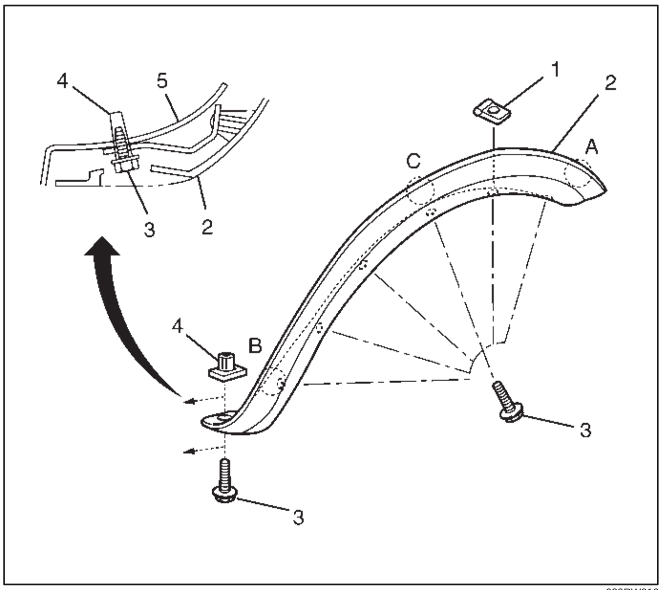


647RW002

2. Remove the front wheel arch molding.
   - Remove the three fixing screws and pull out the clips at three positions from the fender panel.
3. Remove the rear wheel arch molding.
   - Remove the seven fixing screws and pull out the clips at three positions from the quarter outer panel.

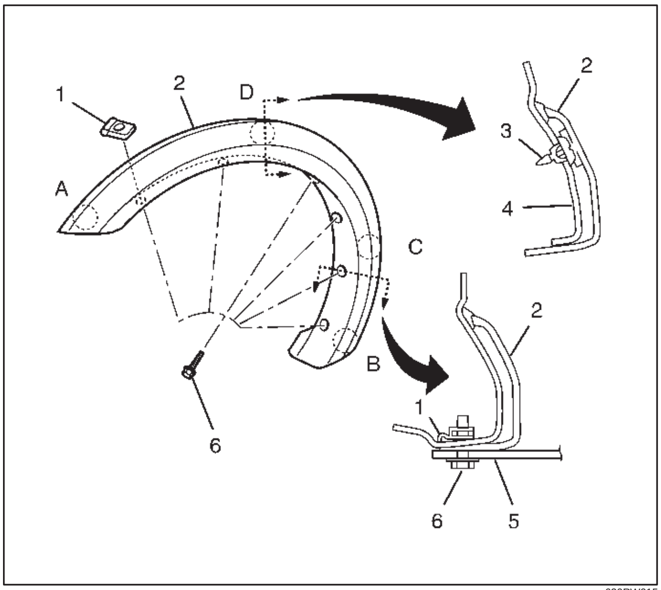
Installation

1. Install the rear wheel arch molding (2).
   - Install the six spire nuts (1) and one screw grommet (4) to the body panel (5).
   - Put the three clips of the rear wheel arch molding into the body panel in order of A, B and C.
   - Install the seven fixing screws (3).



620RW016

2. Install the front wheel arch molding (2).
   - Install the six spire nuts (1) to the body panel (4).
   - Put the four clips (3) of the front wheel arch molding into the body in order of A, B, C and D.
3. Install the six fixing screws (6).
   (Three of six screws are fixed together with the front mud flap.)

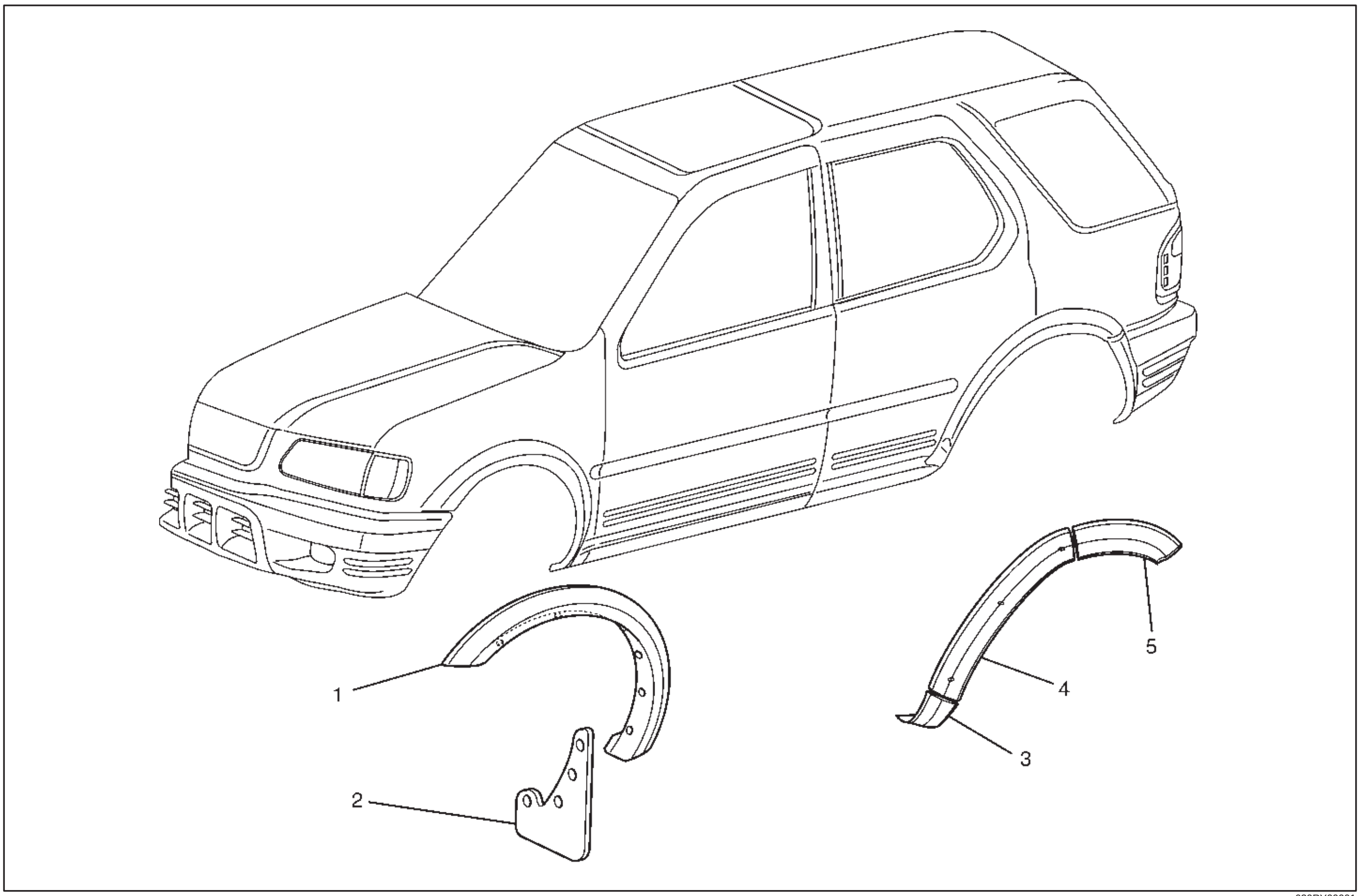


620RW015

4. Install the front mud flap.

Wheel Arch Molding (LWB)

Wheel Arch Molding and Associated Parts



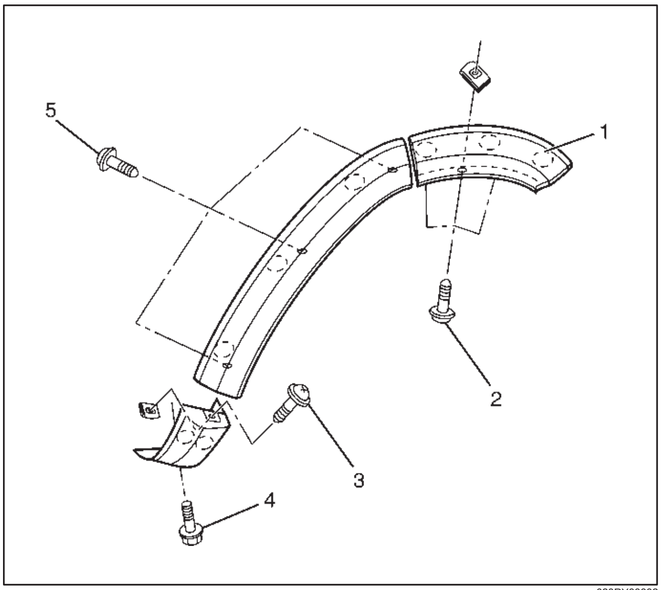
620RY00001

Legend

(1) Front Wheel Arch Molding
(2) Front Mud Flap
(3) Rocker Wheel Arch Extension
(4) Rear Wheel Arch Molding
(5) Quarter Panel Wheel Arch Molding

Removal

1. Remove the front mud flap and front wheel arch molding.
   - Refer to Wheel Arch Molding (SWB) in this section.
2. Remove the rocker wheel arch extension.
   - Remove the fixing bolt (4) and screw (3). Pull out the extension with the two clips (1) from the rocker outer panel.
3. Remove the quarter panel wheel arch molding.
   - Remove the three fixing screws (2) and pull out the molding with the three clips (1) from the quarter outer panel.
4. Remove the rear wheel arch molding.
   - Remove the three fixing screws (5) of the back of the door panel and pull out the molding with the three clips (1) from the door outer panel.



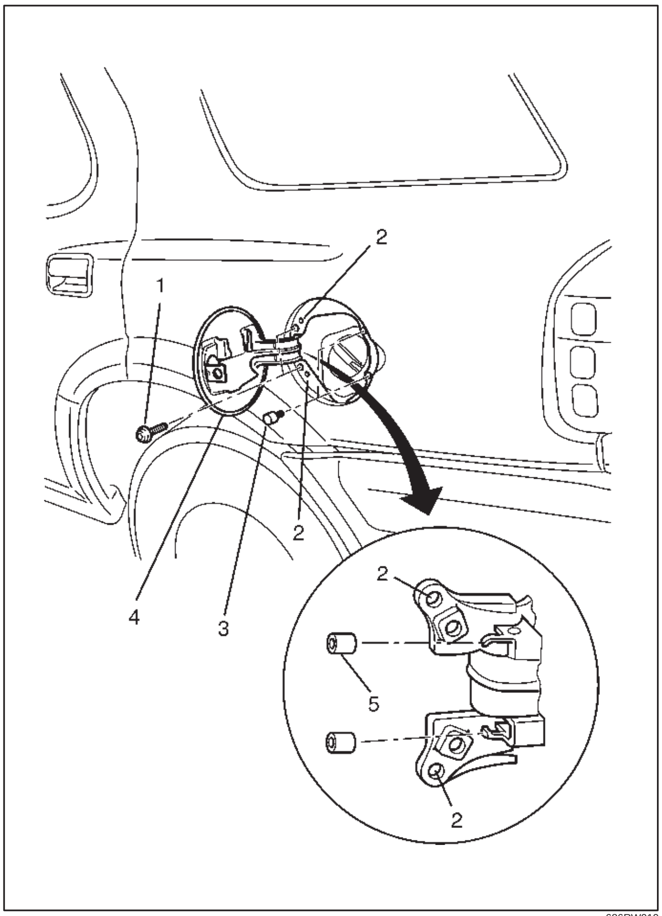
620RY00003

Installation

To install, follow the removal steps in the reverse order.

Fuel Filler Door

Parts Location



686RW010

Legend

(1) Fuel Filler Door Fixing Screw
(2) Basic Hole
(3) Fuel Filler Door Buffer
(4) Fuel Filler Door
(5) Fuel Filler Door Hinge Buffer

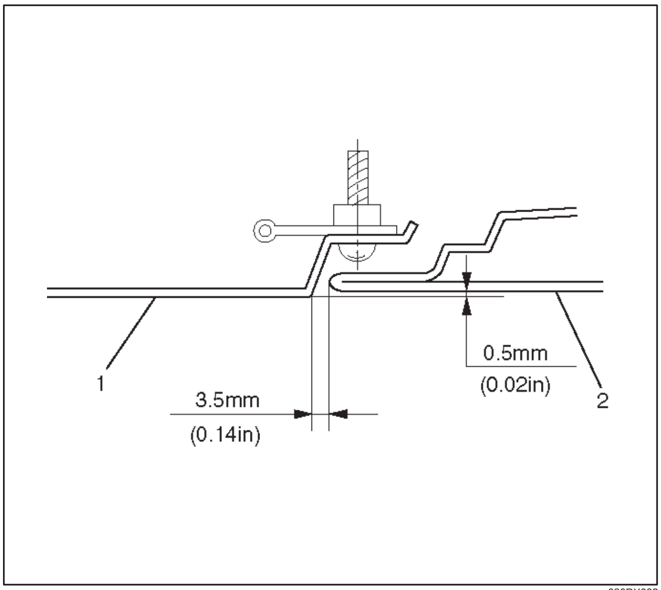
Removal

1. Open the fuel filler door.
2. Remove the fuel filler door.
   - Remove the two fixing screws.
3. Pull out the fuel filler door buffer.
4. Pull out the fuel filler hinge buffer.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

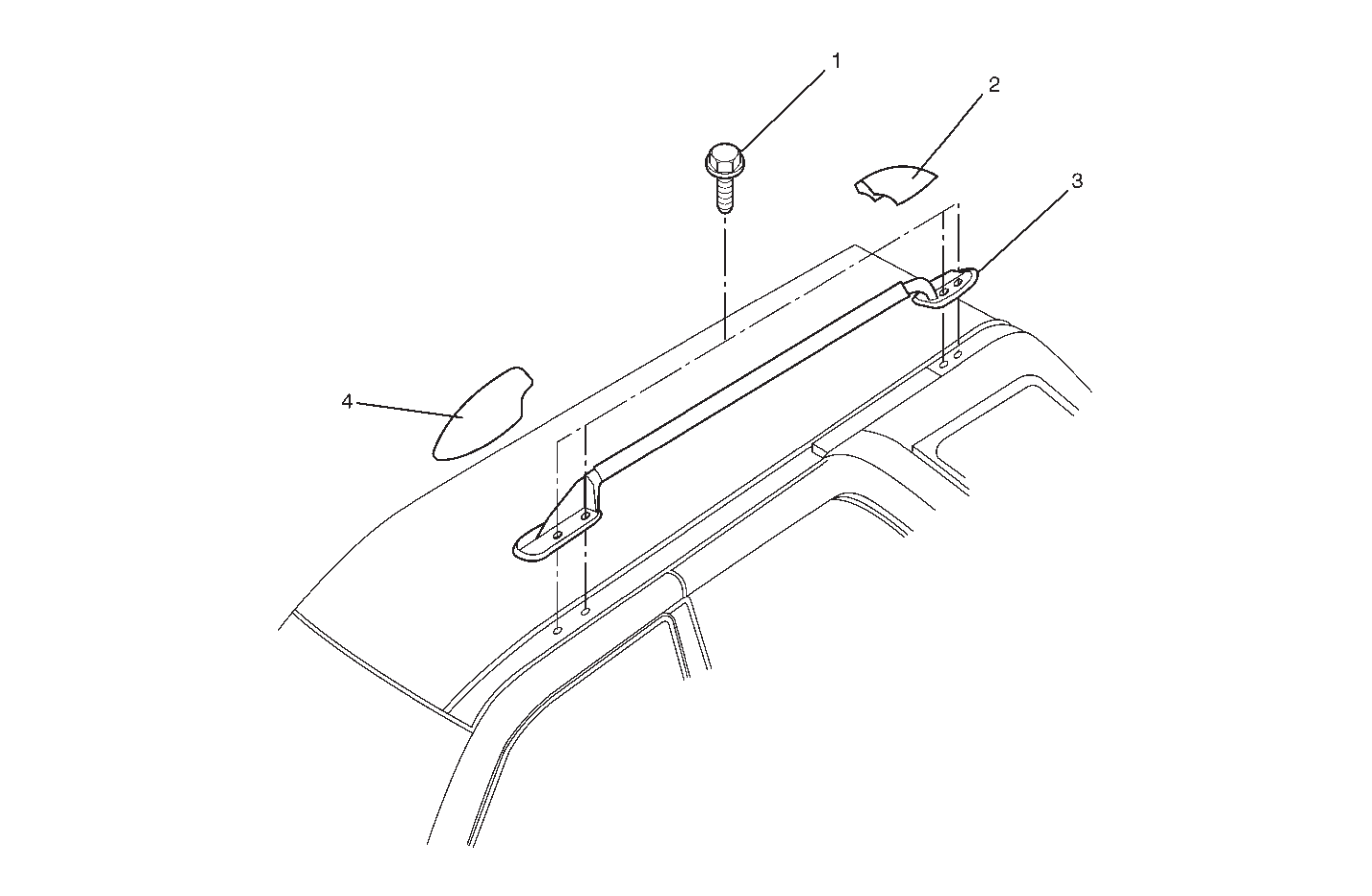
1. Install the fuel filler door to match the basic hole.
2. Adjust the clearance between quarter outer panel (1) and fuel filler door (2).



686RX003

Roof Rail

Parts Location



660RY00011

Legend
(1) Roof Rail Fixing Bolt
(2) Rear Roof Rail Cover
(3) Roof Rail Sub Assembly
(4) Front Roof Rail Cover

Removal

1. Remove the front and rear of roof rail cover.
   - Pry the roof rail covers.
2. Remove the roof rail sub assembly.
   - Remove the four fixing bolts at each roof rail.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Tighten the roof rail sub assembly fixing bolts to the specified torque.

Torque 8 N·m (69 lb in)

Power Door Mirror System

General Description

The system consists of the starter switch, door mirror switch, rear defogger/mirror defogger switch and door mirrors on both sides.

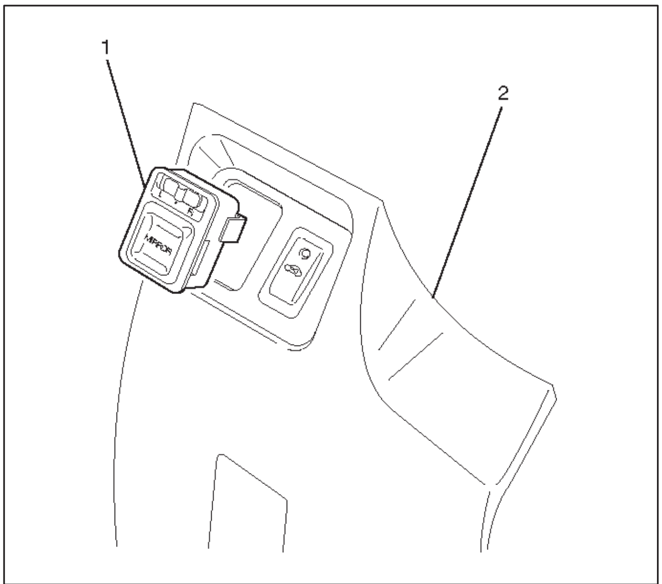
When the door mirror switch is operated with the starter switch at either “ACC” or “ON” position, the motor in the door mirror (on either side) rotates to allow the horizontal and vertical adjustment of mirror angles.

When the rear defogger/mirror defogger switch is turned “ON” (with the starter switch at “ON” position), the heaters in both left and right mirrors and the rear windshield glass are active defog both mirrors and rear windshield glass at the same time.

Door Mirror Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the instrument panel lower cover (2).
   Refer to the instrument panel assembly in Body Structure section.
3. Remove the door mirror switch (1).



825RW094

Rear Defogger/Mirror Defogger Switch

Refer to the Rear Defogger/Mirror switch removal and installation steps in Lighting System section.

Door Mirrors

Refer to the Door mirrors removal and installation steps in Exterior/Interior Trim section.

Power Window System

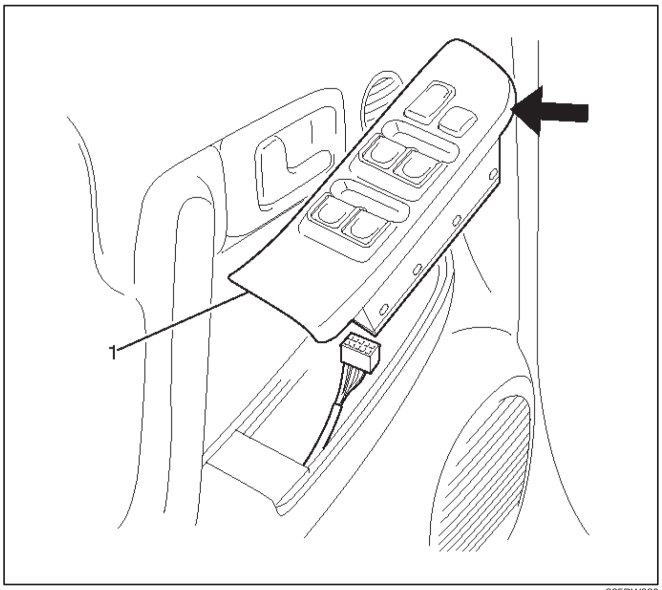
General Description

The power window system consists of power window switches and power window motors on driver and passenger sides and power window relay. With the starter switch in "ON" position, the battery voltage is supplied through power window relay to the power window switches on driver and passenger sides. Selection of up or down switch changes the motor rotating direction to open or close the window.
When the lock switch on the switch panel on the driver side is pressed, the power window switch is in open state. As a result, the power source to the other switches are cut off, and the power window motors do not run.

Power Window Switch Driver Seat Side

Removal

1. Disconnect the battery ground cable.
2. Remove the switch (1).
   - Pull out the switch by pushing the spring with the tip of a screwdriver.
   - Disconnect the connector.



825RW080

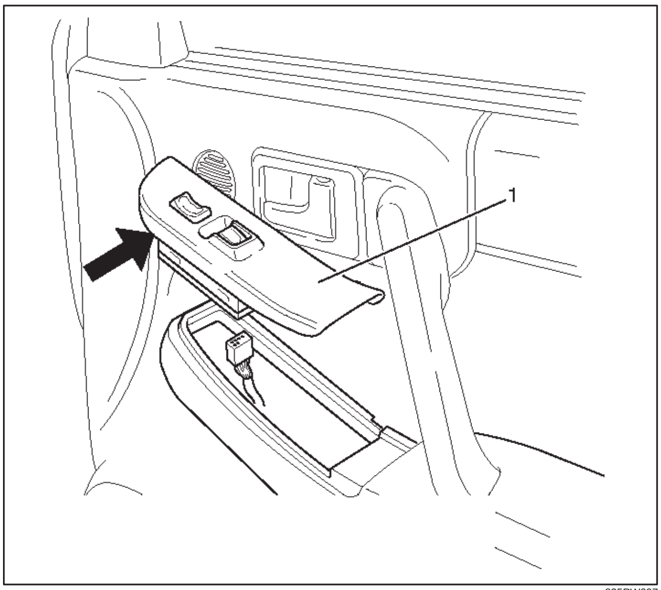
Installation

To install, follow the removal steps in the reverse order.

Front Passenger Seat Side

Removal

1. Disconnect the battery ground cable.
2. Remove the switch (1).
   - Pull out the switch by pushing the spring with the tip of a screwdriver.
   - Disconnect the connector.



825RW097

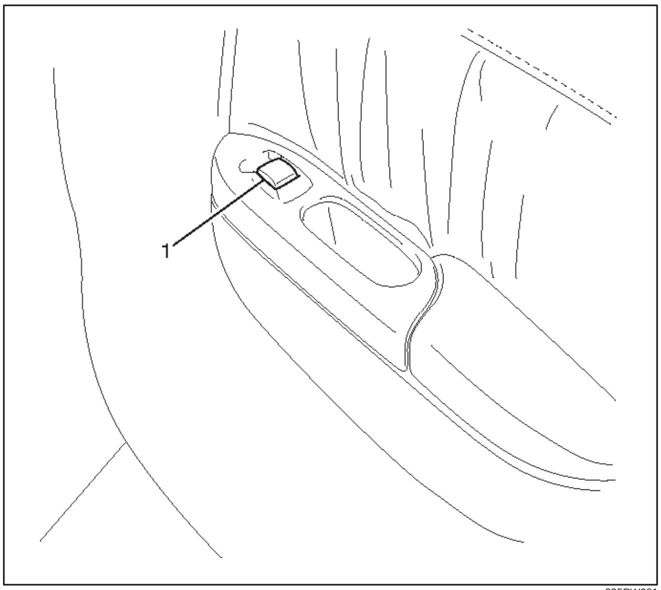
Installation

To install, follow the removal steps in the reverse order.

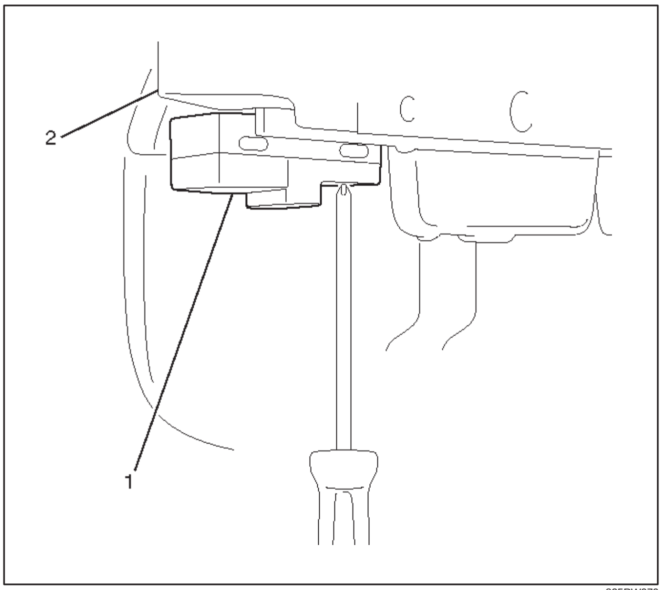
Rear-Left and Right Sides

Removal

1. Disconnect the battery ground cable.
2. Remove the rear door trim pad (2).
   - Refer to the Rear Door Trim Pad removal steps in Exterior/Interior Trim section.
   - Disconnect the rear power window switch (1) connector.
3. Remove the rear power window switch (1).
   - Remove the switch fixing screw from the back side of the rear door trim (2).



825RW081



825RW079

Installation

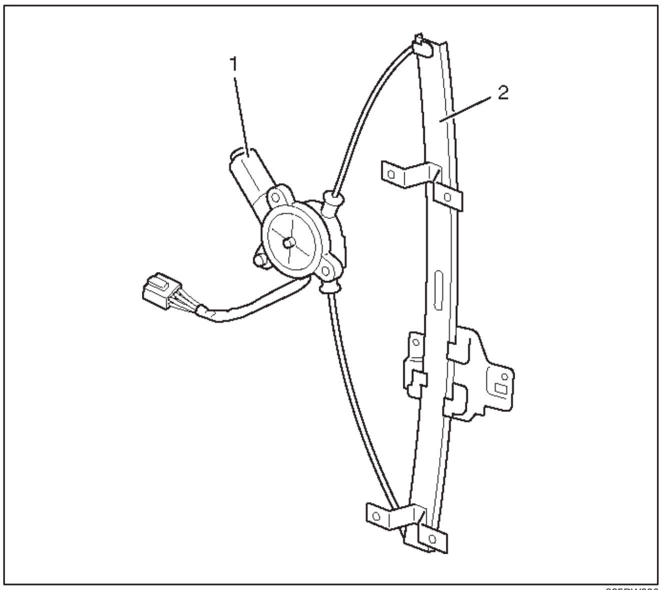
To install, follow the removal steps in the reverse order.

Power Window Motor

Driver Seat Side

Removal

1. Disconnect the battery ground cable.
2. Remove the window regulator assembly (2).
   - Refer to the Window Regulator and Glass removal steps in Body Structure section.
3. Remove the power window motor (1).
   - Remove three screws.



825RW096

Installation

To install, follow the removal steps in the reverse order.

Front Passenger Seat Side

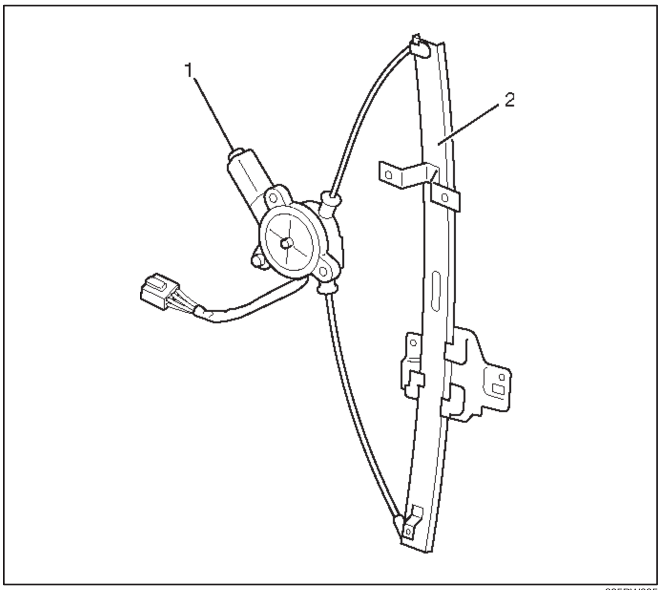
Removal and Installation

Refer to the Front Window Motor — Driver Seat side removal and installation steps in this section.

Rear-Left Side

Removal

1. Disconnect the battery ground cable.
2. Remove the rear window regulator assembly (2).
   - Refer to the Rear Window Regulator and Glass removal steps in Body Structure section.
3. Remove the power window motor (1).
   - Remove three screws.



825RW095

Installation

To install, follow the removal steps in the reverse order.

Rear-Right Side

Removal and Installation

Refer to the Rear Power Window Motor — Left Side removal and installation steps in this section.

Main Data and Specifications

Torque Specifications

Application	N·m	lb ft	lb in
Front & Rear Seat Belt Anchor Bolts	39	29	—
Roof Rail Fixing Bolts	8	—	69

RODEO

RESTRAINTS

SEAT BELT SYSTEM

CONTENTS

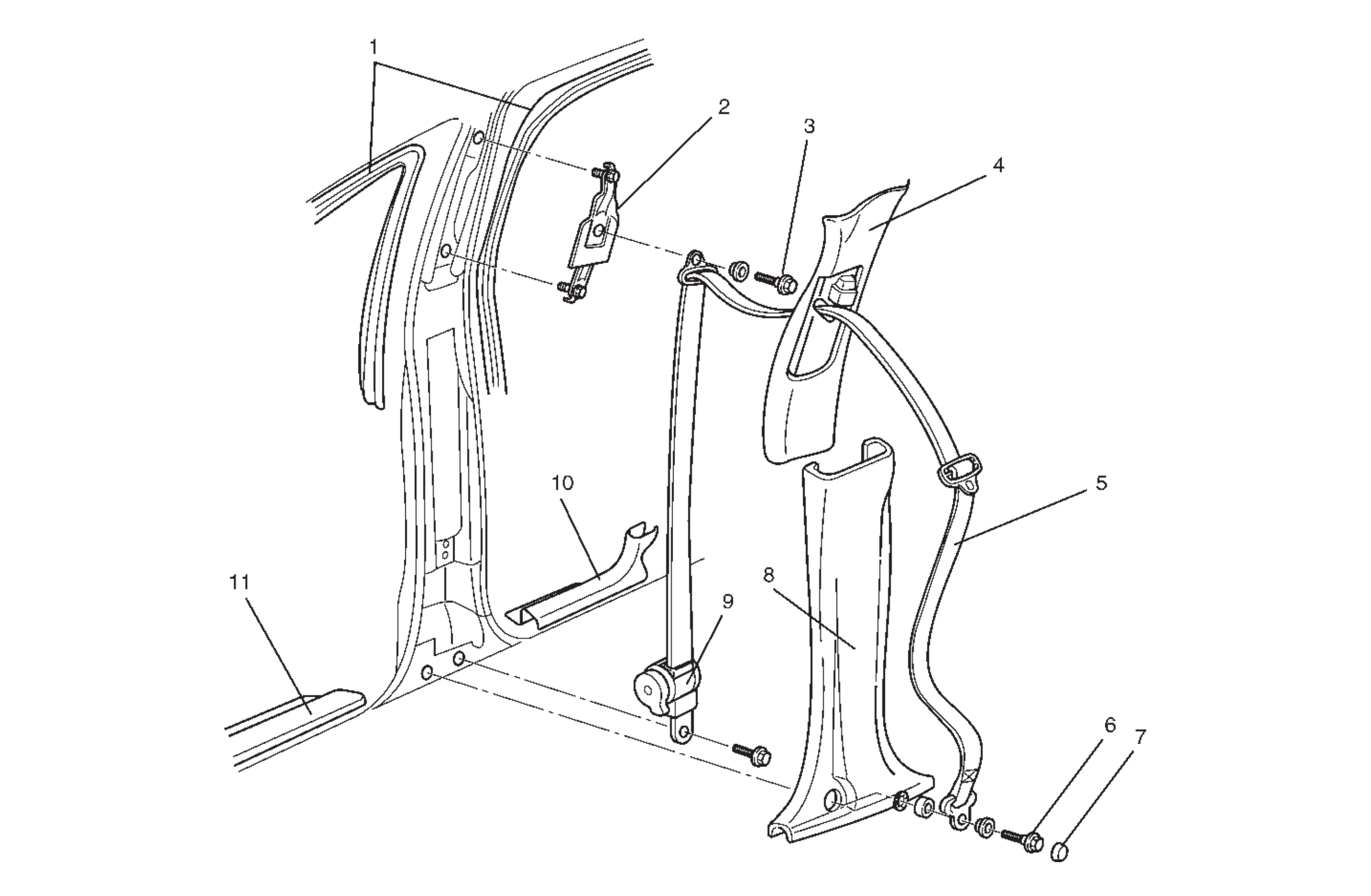
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Front Seat Belt (LWB)

Front Seat Belt and Associated Parts



Legend

- (1) Door Seal Finisher (Front & Rear)
- (2) Adjustable Shoulder Anchor Assembly
- (3) Seat Belt Upper Anchor Bolt
- (4) Center Pillar Upper Trim Cover
- (5) Front Seat Belt Assembly
- (6) Seat Belt Lower Anchor Bolt
- (7) Cap
- (8) Center Pillar Lower Trim Cover
- (9) Retractor
- (10) Rear Sill Plate
- (11) Front Sill Plate

Removal

1. Disconnect the battery ground cable.
2. Remove the sill plate (Front & Rear).
3. Remove the cap and seat belt lower anchor bolt.
4. Remove the center pillar lower trim cover.
5. Remove the door seal finisher (Front & Rear).
6. Remove the center pillar upper trim cover.
7. Remove the seat belt upper anchor bolt.
8. Remove the retractor fixing bolt.
9. Remove the seat belt assembly.
10. Remove the adjustable shoulder anchor assembly.
    - Remove the two fixing bolts.

Inspection

If any of the following abnormalities is found, replace on an assembly basis.

- Deform and malfunction of adjustable shoulder anchor.
- No smooth move of upper/lower anchors in the circumferential direction.
- Damaged and/or deformed through ring.
- Damaged and/or deformed tongue.
- Damaged and/or frayed of webbing.
- Deformed retractor bracket.
- Seat belt not rewound up.
- Resistance or abnormal sound when seat belt is wound out and rewound.
- Retractor abnormality.

Inspection of retractor

1. ELR (Emergency Locking Retractor) lock inclining angle check.
   - When the retractor is moved gently from its installing position, make sure it is not locked within 15° in any directions, and it remains locked at 45° or larger.
2. ELR lock check.
   - When the seat belt is drawn slowly with the retractor installed, make sure it is not locked. And when it is drawn quickly, make sure it is locked.
3. ALR (Automatic Locking Retractor)/ELR check (Except for driver's seat).
   - When rewound after winding out the seat belt, make sure the seat belt cannot be taken out. After rewinding, make sure it has returned to its normal operation.

CAUTION: Do not disassemble the retractor.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

CAUTION: When changing the front seat belt, confirm the part No. and change the seat belt in same part No.

1. Tighten the adjustable shoulder anchor assembly fixing bolts to the specified torque.

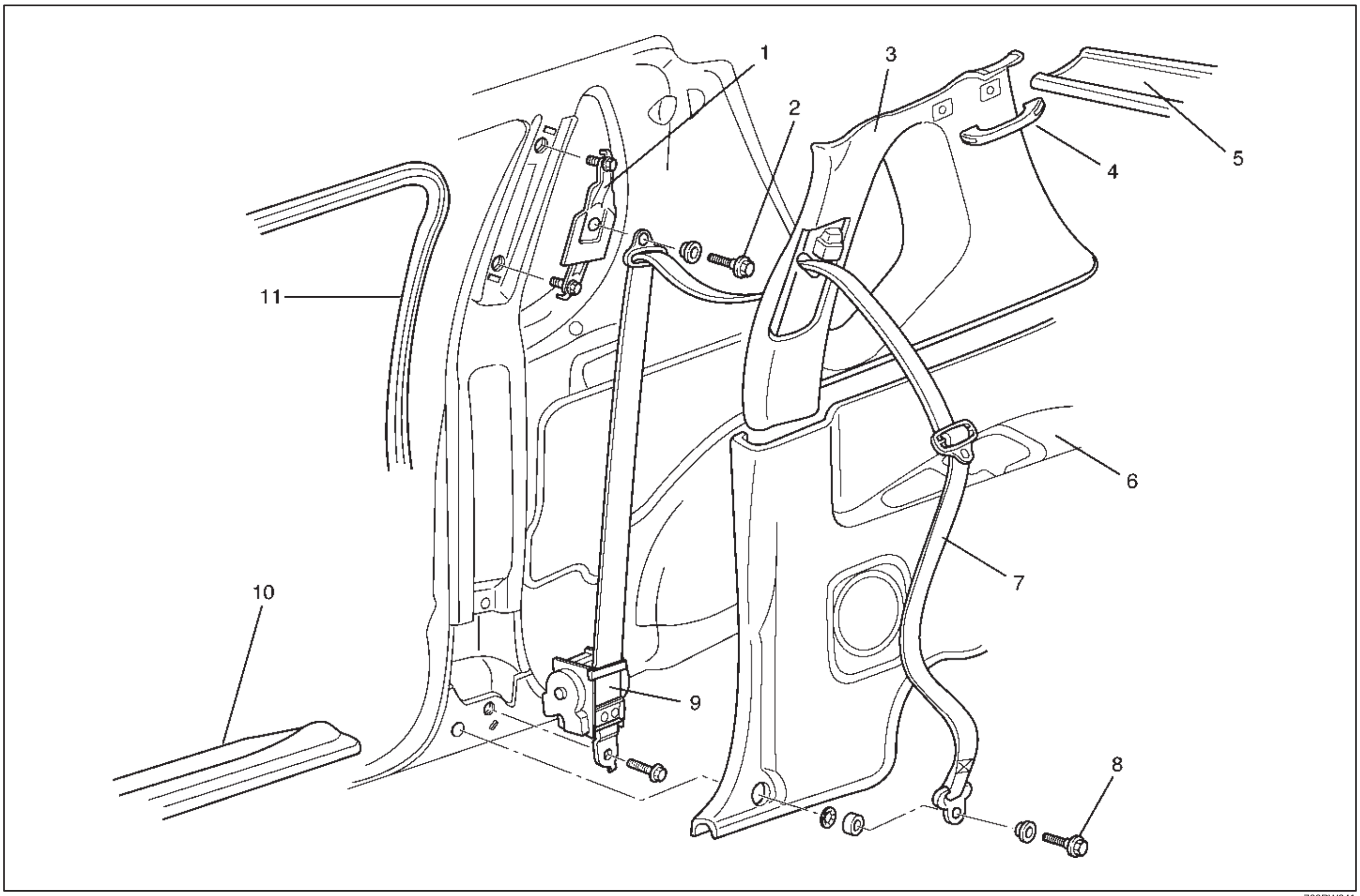
   Torque: 39 N·m (29 lb ft)

2. Tighten the seat belt anchor bolts (Upper & Lower) and the retractor fixing bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

Front Seat Belt (SWB)

Front Seat Belt and Associated Parts



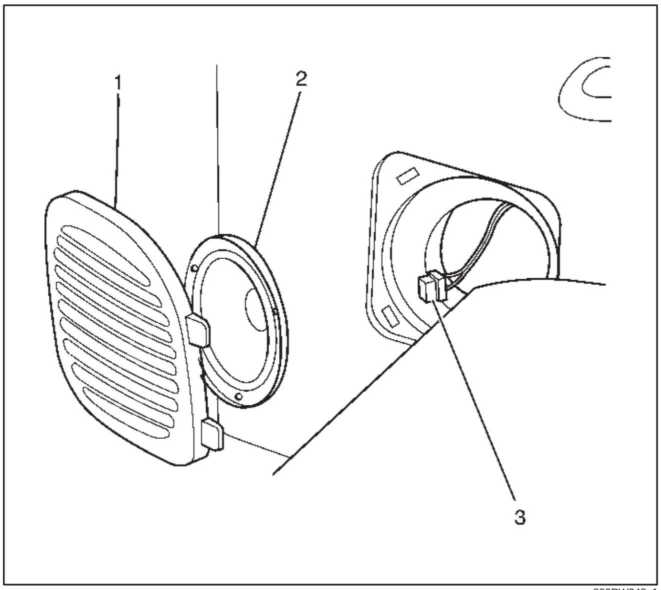
760RW041

Legend

(1) Adjustable Shoulder Anchor Assembly
(2) Seat Belt Upper Anchor Bolt
(3) Quarter Upper Trim Cover
(4) Assist Grip
(5) Rear Roof Trim Cover
(6) Quarter Lower Trim Cover
(7) Front Seat Belt Assembly
(8) Seat Belt Lower Anchor Belt
(9) Retractor
(10) Sill Plate
(11) Door Seal Finisher

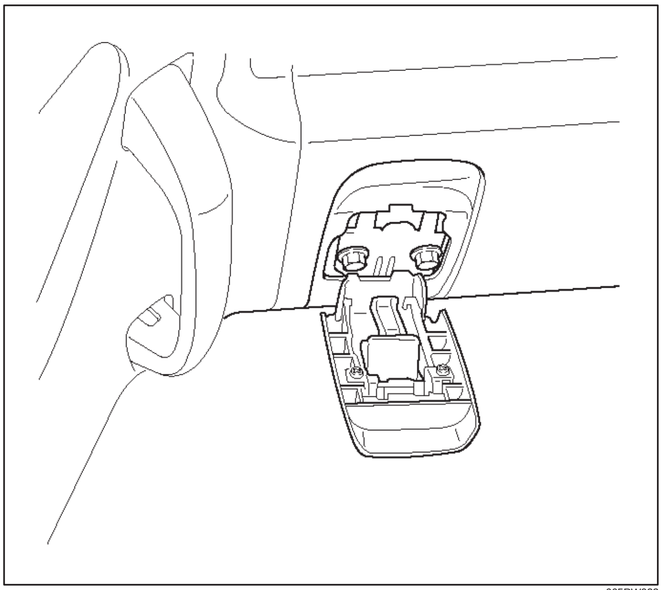
Removal

1. Disconnect the battery ground cable.
2. Remove the rear seat assembly.
   - Refer to Rear Seat Assembly in Seats section.
3. Remove the soft top assembly or resin top assembly.
   - Refer to Soft Top Assembly or Resin Top Assembly in Sunroof/Convertible Top section.
4. Remove the luggage side trim cover.
   - Refer to Rear Seat Belt (SWB) in this section.
5. Remove the sill plate.
6. Remove the seat belt lower anchor bolt (Front & Rear).
7. Remove the rear speaker (2).
   - Remove the speaker grille (1) and remove the speaker fixing screws.
   - Disconnect the connector (3).

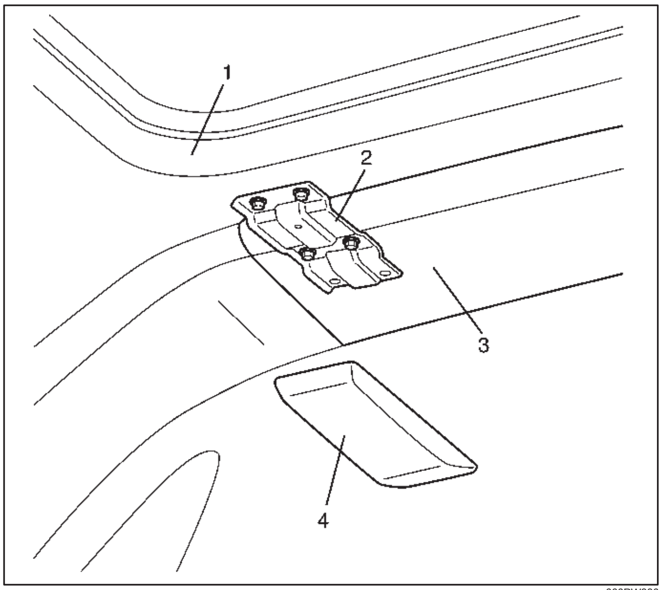


890RW048–1

8. Remove the quarter lower trim cover.
   - Pry the trim cover retainers free from the body panel.
9. Remove the dome light.
   - Remove the dome light lens and the fixing screws.
   - Disconnect the dome light connector.
10. Remove the soft top latch (Soft top model).
    - Remove two bolts.



11. Remove the rear roof bracket (2) (Resin top model).
    - Remove the rear roof bracket cover (4) and remove rear roof bracket connecting with resin top (1) and rear roof trim cover (3) by removing four fixing bolts.



12. Remove the rear roof trim cover.
13. Remove the assist grip.
14. Remove the door seal finisher.
15. Remove the quarter upper trim cover.
16. Remove the seat belt upper anchor bolt.
17. Remove the retractor fixing bolt.
18. Remove the seat belt assembly.
19. Remove the adjustable shoulder anchor assembly.
    - Remove two bolts.

Inspection

If any of the following abnormalities is found, replace on an assembly basis.

- Deform and malfunction of adjustable shoulder anchor.
- No smooth move of upper/lower anchors in the circumferential direction.
- Damaged and/or deformed through ring.
- Damaged and/or deformed tongue.
- Damaged and/or frayed of webbing.
- Deformed retractor bracket.
- Seat belt not rewound up.
- Resistance or abnormal sound when seat belt is wound out and rewound.
- Retractor abnormality.

Inspection of retractor

1. ELR (Emergency Locking Retractor) lock inclining angle check.
   - When the retractor is moved gently from its installing position, make sure it is not locked within 15° in any directions, and it remains locked at 45° or larger.
2. ELR lock check.
   - When the seat belt is drawn slowly with the retractor installed, make sure it is not locked. And when it is drawn quickly, make sure it is locked.
3. ALR (Automatic Locking Retractor)/ELR check (Except for driver's seat).
   - When rewound after winding out the seat belt, make sure the seat belt cannot be taken out. After rewinding, make sure it has returned to its normal operation.

CAUTION: Do not disassemble the retractor.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

CAUTION: When changing the front seat belt, confirm the part No. and change the seat belt in same part No.

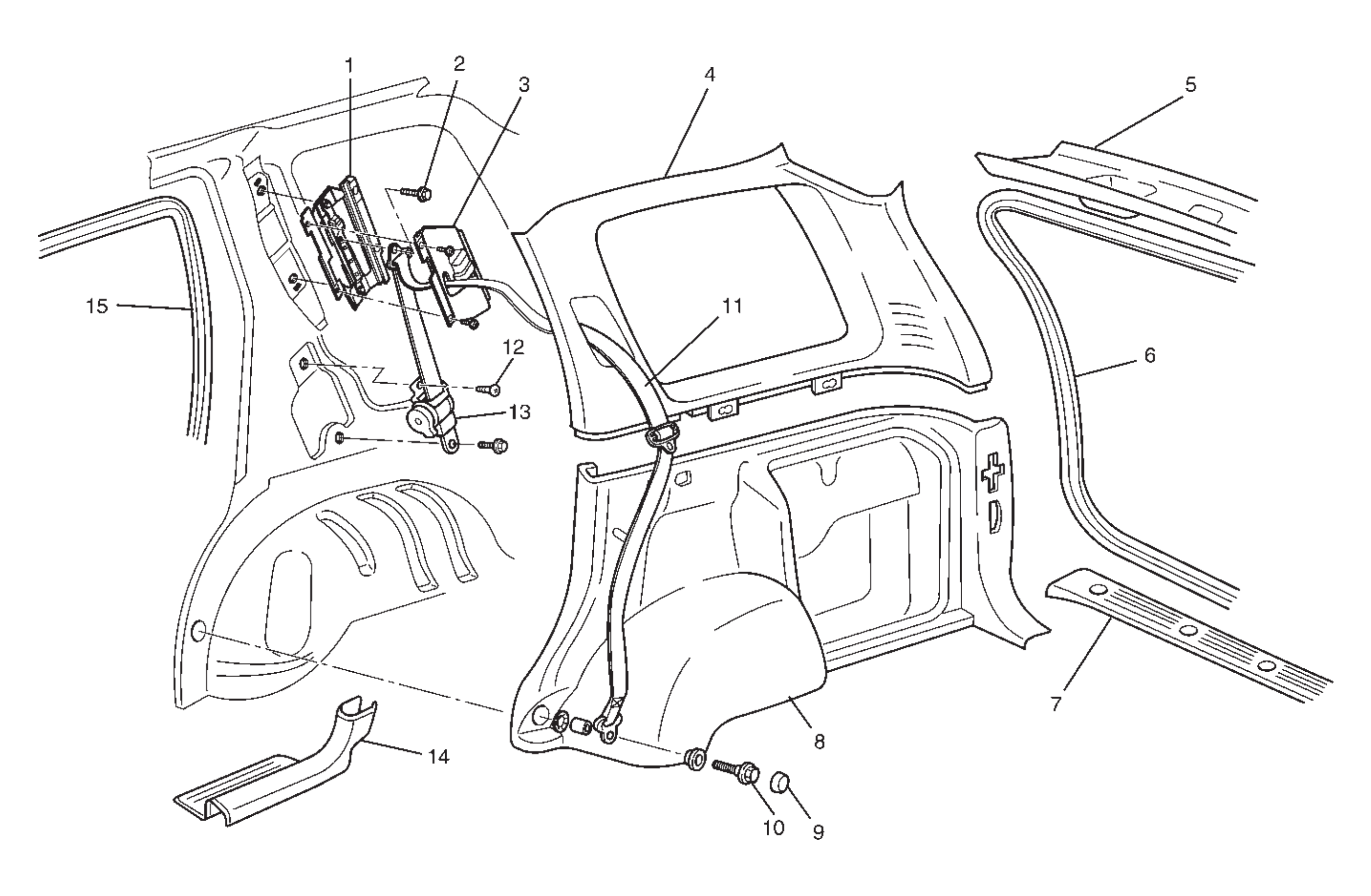
1. Tighten the adjustable shoulder anchor assembly and retractor fixing bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)
2. Tighten the seat belt anchor bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

Rear Seat Belt (LWB)

Rear Seat Belt and Associated Parts



755RY00014

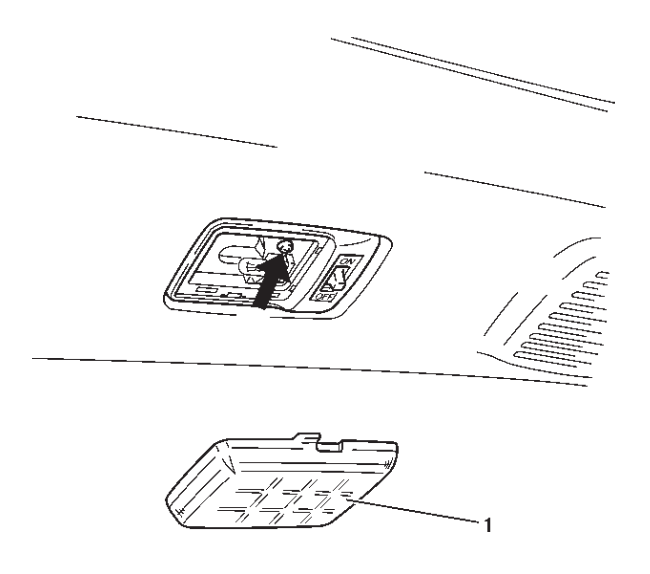
Legend

(1) Adjustable Shoulder Anchor Assembly
(2) Seat Belt Upper Anchor Bolt
(3) Slider Plate Trim Assembly
(4) Upper Quarter Trim Cover
(5) Rear Roof Trim Cover
(6) Tailgate Weather Strip
(7) Rear End Floor Trim Cover
(8) Lower Quater Trim Cover
(9) Cap
(10) Seat Belt Lower Anchor Bolt
(11) Rear Seat Belt Assembly
(12) Screw
(13) Retractor
(14) Rear Sill Plate
(15) Rear Door Seal Finisher

Removal

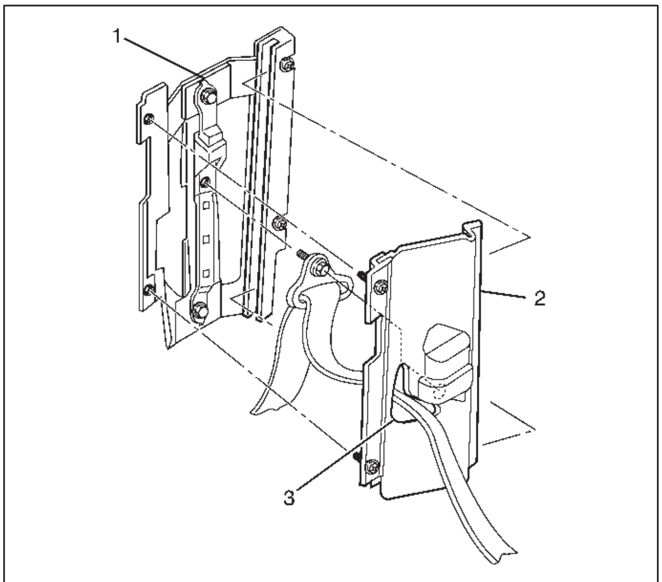
1. Disconnect the battery ground cable.
2. Remove the tailgate weather strip.
3. Remove the rear end floor trim cover.

4. Remove the luggage room light.
   - Remove the luggage room light lens (1) and the fixing screw.
   - Disconnect the luggage room light connector.



825RW100

5. Remove the rear roof trim cover.
   - Pry the trim cover clips free from the body panel.
6. Remove the rear sill plate.
7. Remove the cap and the lower anchor bolt (5).
8. Remove the quarter trim cover.
   - Refer to Interior Trim Panel (LWB) in Exterior/Interior Trim section.
9. Remove the slider plate trim assembly (2).
   - Remove the two fixing screws from the adjustable shoulder anchor (1).
   - Pull out the seat belt through the hole (3) on the slider plate trim.



755RW069

10. Remove the seat belt upper anchor bolt.
11. Remove the retractor.
12. Remove the rear seat belt assembly.
13. Remove the adjustable shoulder anchor assembly.
    - Remove the two fixing bolts.

Inspection

If any of the following abnormalities is found, replace on an assembly basis.

- Deform and malfunction of adjustable shoulder anchor.
- No smooth move of upper/lower anchors in the circumferential direction.
- Damaged and/or deformed through ring.
- Damaged and/or deformed tongue.
- Damaged and/or frayed of webbing.
- Deformed retractor bracket.
- Seat belt not rewound up.
- Resistance or abnormal sound when seat belt is wound out and rewound.
- Retractor abnormality.

Inspection of retractor

1. ELR (Emergency Locking Retractor) lock inclining angle check.
   - When the retractor is moved gently from its installing position, make sure it is not locked within 15° in any directions, and it remains locked at 45° or larger.
2. ELR lock check.
   - When the seat belt is drawn slowly with the retractor installed, make sure it is not locked. And when it is drawn quickly, make sure it is locked.
3. ALR (Automatic Locking Retractor)/ELR check (Except for driver's seat).
   - When rewound after winding out the seat belt, make sure the seat belt cannot be taken out. After rewinding, make sure it has returned to its normal operation.

CAUTION: Do not disassemble the retractor.

Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the adjustable shoulder anchor assembly fixing bolts to the specified torque.

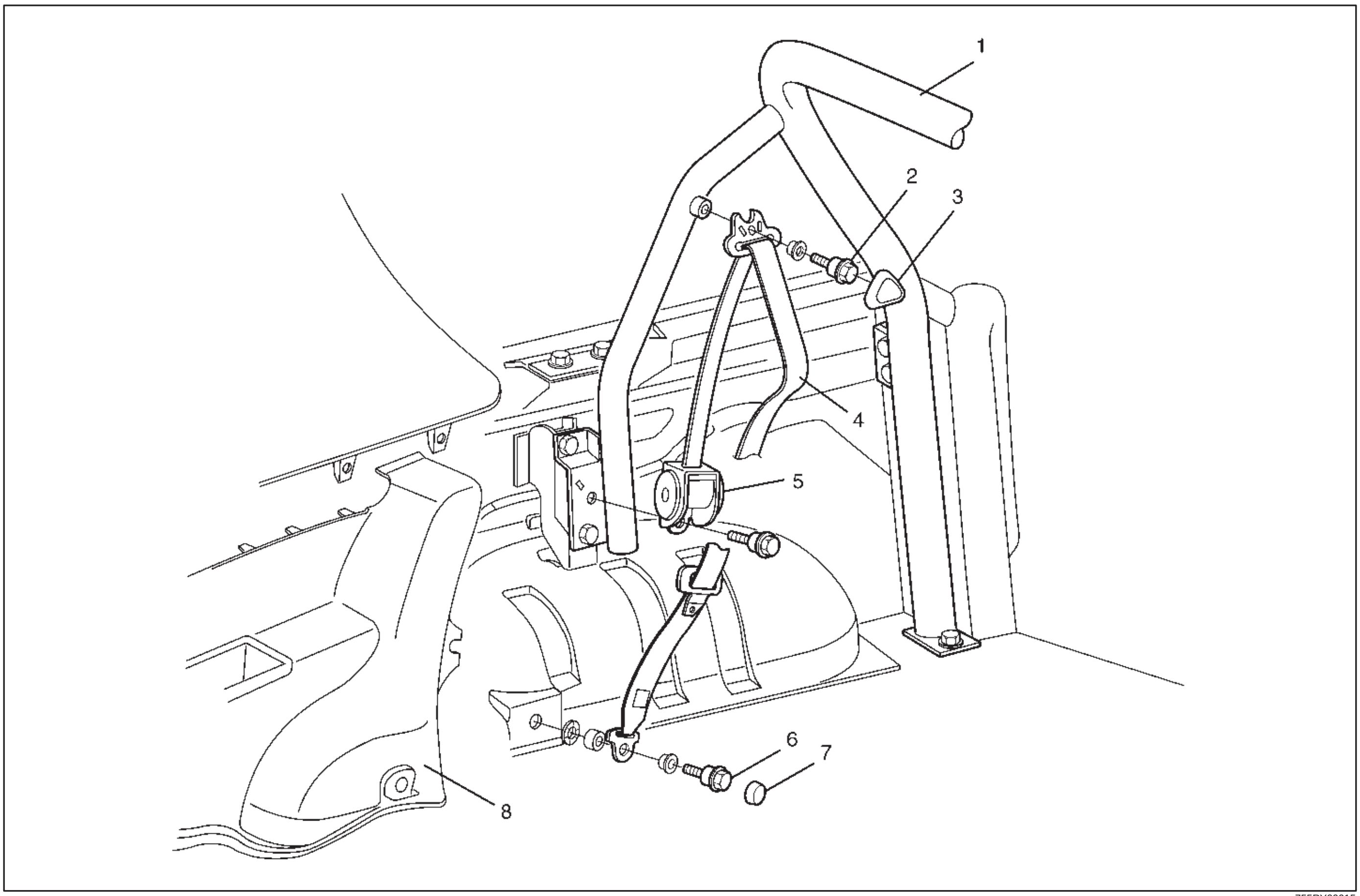
   Torque: 39 N·m (29 lb ft)

2. Tighten the seat belt anchor bolts (Upper & Lower) and the retractor fixing bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

Rear Seat Belt (SWB)

Rear Seat Belt and Associated Parts



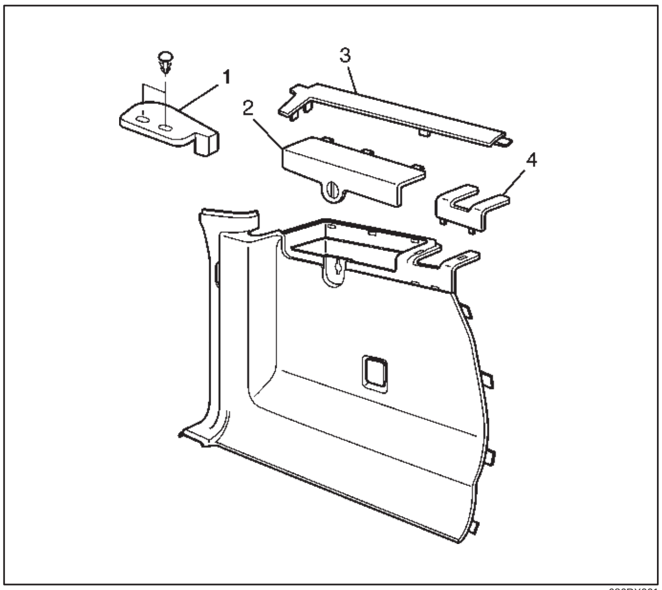
Legend

(1) Seat Belt Cross Bar Assembly
(2) Seat Belt Upper Anchor Bolt
(3) Shoulder Anchor Cover
(4) Rear Seat Belt Assembly
(5) Retractor
(6) Seat Belt Lower Anchor Bolt
(7) Cap
(8) Quarter Lower Trim Cover

Removal

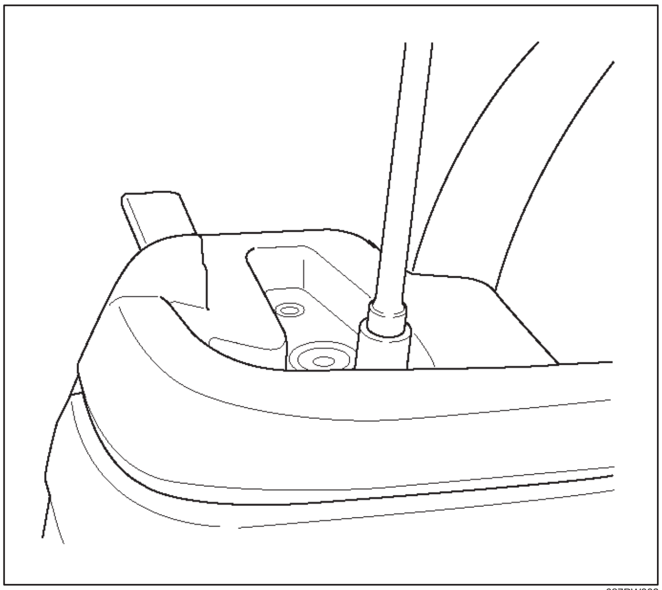
1. Disconnect the battery ground cable.
2. Remove the luggage side lid (2).
3. Remove the luggage side front cover (4).
4. Remove the luggage side upper cover (3).

5. Remove the canopy cover (1) (Resin top model).
   - Remove two fixing clips.

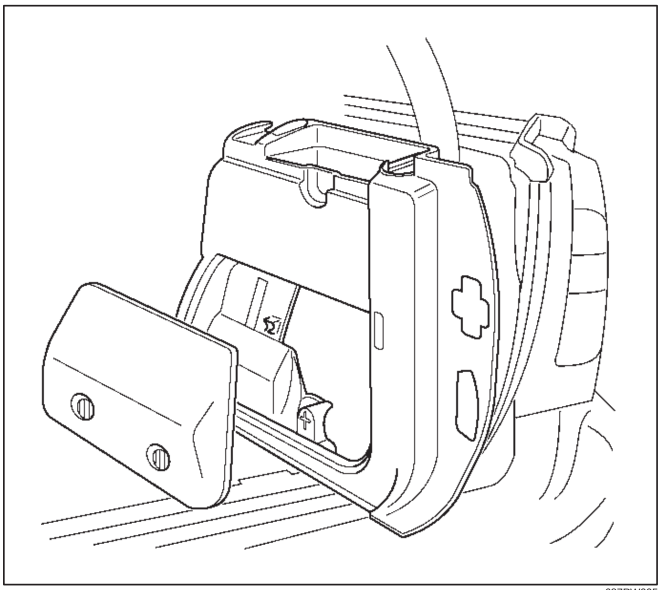


686RX001

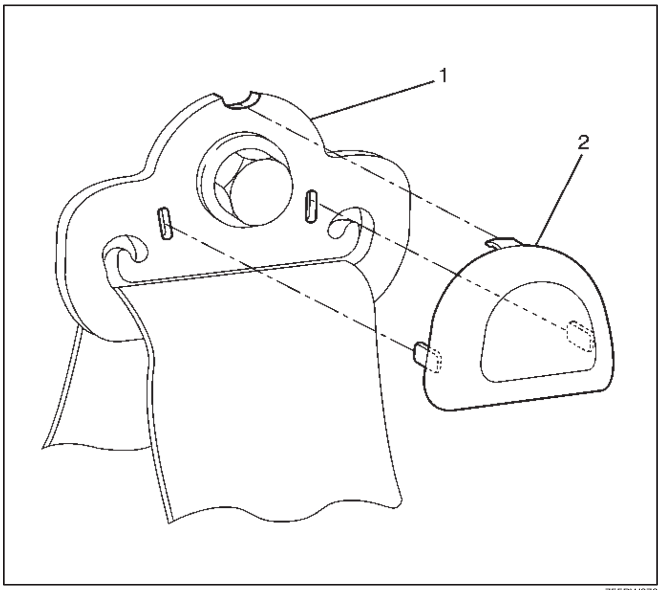
   - Remove the three bolts and three screws, and then remove quarter side molding (Soft top model).


687RW002

6. Remove the tailgate weather strip.
7. Remove the rear end floor trim cover.
8. Remove the luggage side trim cover (RH).
   - Remove the jack & tool lid and remove the tool.
   - Remove fixing screw and pry the trim cover retainers free from the body panel.


687RW005

9. Remove the luggage side trim cover (LH).
   - Remove fixing screw and pry the trim cover retainers free from the body panel.
   - Disconnect the accessory socket connectors.
10. Remove the cap and seat belt lower anchor bolt.
11. Remove the shoulder anchor cover (2).
    - Release the hooked portion of cover from the shoulder anchor (1).



755RW070

12. Remove the seat belt upper anchor bolt.
13. Remove the retractor.
14. Remove the rear seat belt assembly.

Inspection

If any of the following abnormalities is found, replace on an assembly basis.

- No smooth move of upper/lower anchors in the circumferential direction.
- Damaged and/or deformed through ring.
- Damaged and/or deformed tongue.
- Damaged and/or frayed of webbing.
- Deformed retractor bracket.
- Seat belt not rewound up.
- Resistance or abnormal sound when seat belt is wound out and rewound.
- Retractor abnormality.

Inspection of retractor

1. ELR (Emergency Locking Retractor) lock inclining angle check.
   - When the retractor is moved gently from its installing position, make sure it is not locked within 15° in any directions, and it remains locked at 45° or larger.
2. ELR lock check.
   - When the seat belt is drawn slowly with the retractor installed, make sure it is not locked. And when it is drawn quickly, make sure it is locked.
3. ALR (Automatic Locking Retractor)/ELR check (Except for driver's seat).
   - When rewound after winding out the seat belt, make sure the seat belt cannot be taken out. After rewinding, make sure it has returned to its normal operation.

CAUTION: Do not disassemble the retractor.

Installation

To install, follow the removal steps in the reverse order, noting the following points.

1. Align the projection of the retractor to the square hole of the seat belt cross bar assembly bracket.
2. Tighten the retractor fixing bolts to the specified torque.

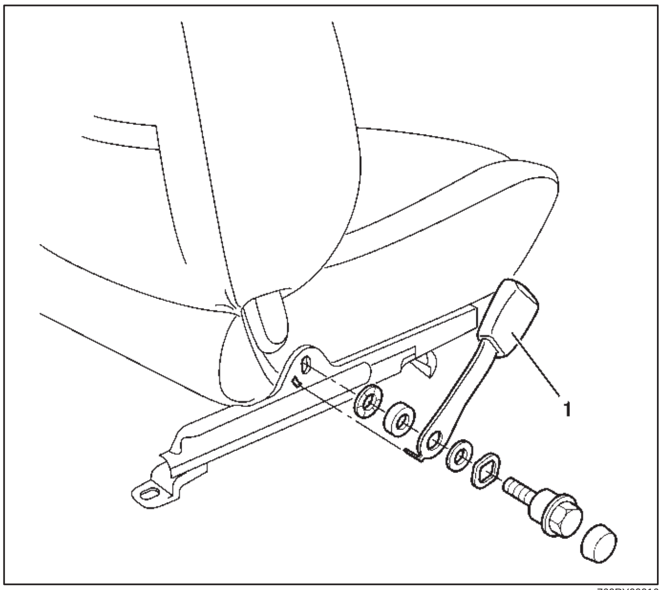
   Torque: 39 N·m (29 lb ft)
3. Tighten the seat belt anchor bolt to the specified torque.

   Torque: 39 N·m (29 lb ft)

Front Seat Buckle Assembly

Removal

1. Disconnect the battery ground cable.
2. Disconnect the seat belt warning connector (driver's side) and remove a clip.
3. Remove the front seat buckle assembly (1).



760RY00016

Installation

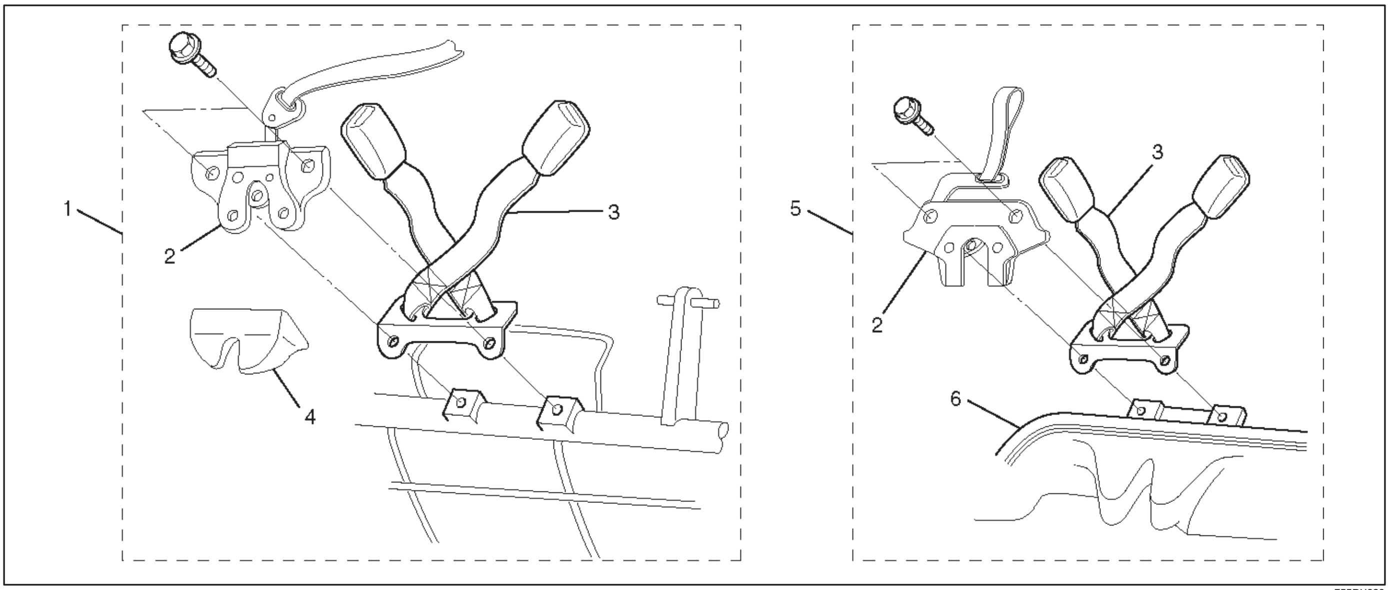
To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the buckle anchor bolt to the specified torque.

   Torque: 39 N·m (29 lb ft)

Rear Center Seat Belt / Buckle Assembly

Rear Center Seat Belt / Buckle Assembly and Associated Parts



Legend

(1) SWB
(2) Rear Seat Lock Assembly
(3) Rear Seat Belt Buckle Assembly
(4) Seat Lock Cover
(5) LWB
(6) Rear Cushion Frame Assembly

Removal

1. Remove the seat lock cover (SWB).
2. Remove the rear cushion frame assembly (LWB).
   - Refer to Rear Seat Assembly in Seats section.
3. Remove the rear seat lock assembly and rear seat belt buckle assembly.

Installation

To install, follow the removal steps in the reverse order, noting the following point.

1. Tighten the rear seat lock assembly and rear seat belt buckle assembly fixing bolts to the specified torque.

   Torque: 39 N·m (29 lb ft)

NOTE: Removal and installation procedure of rear center seat belt assembly same as rear seat belt buckle assembly procedures.

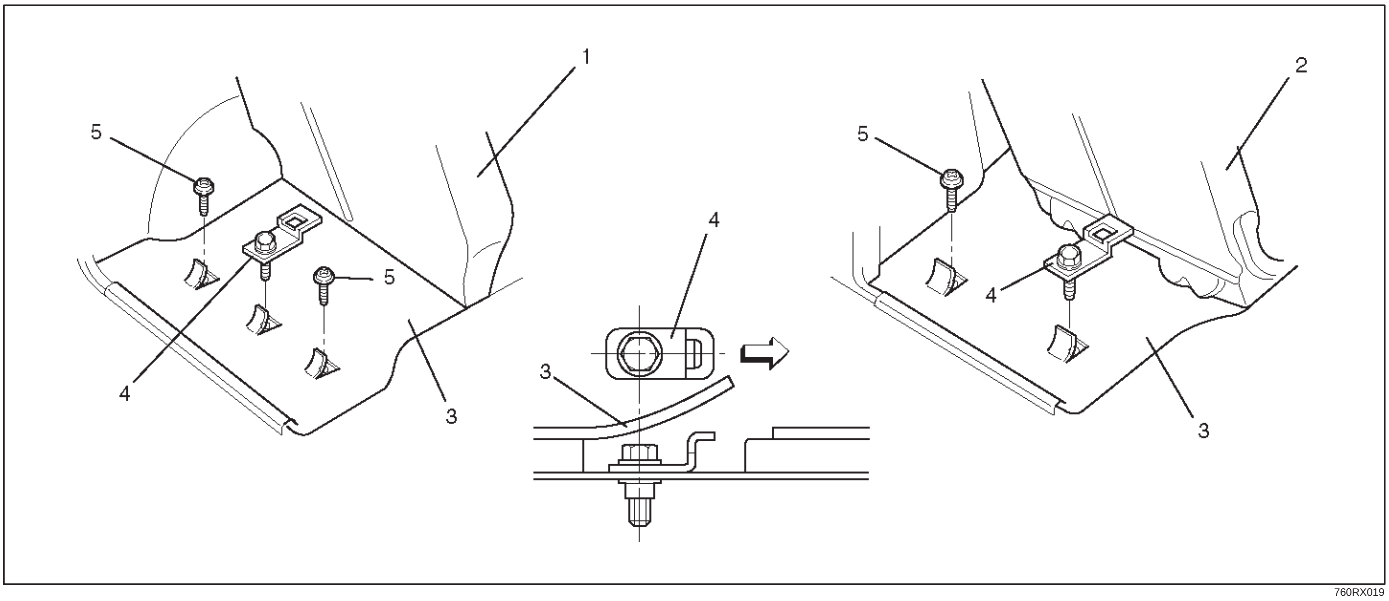
Child Seat Tether Anchor Bracket (Child Restraint)

General Description

Plastic plug is provided at two or three places on the luggage floor panel.
LWB
Remove the center plug fom the floor panel.

SWB
Remove the right plug from the floor panel.
Install the bracket to the hole where the plug is removed.
Alternatively, the bracket may be installed in the right-hand or left-hand plug hole.

Child Seat Tether Anchor Bracket and Associated Parts



Legend
(1) Rear Seat (LWB)
(2) Rear seat (SWB)
(3) Luggage Floor carpet
(4) Child Seat Tether Anchor Bracket
(5) Tether Anchor Plug

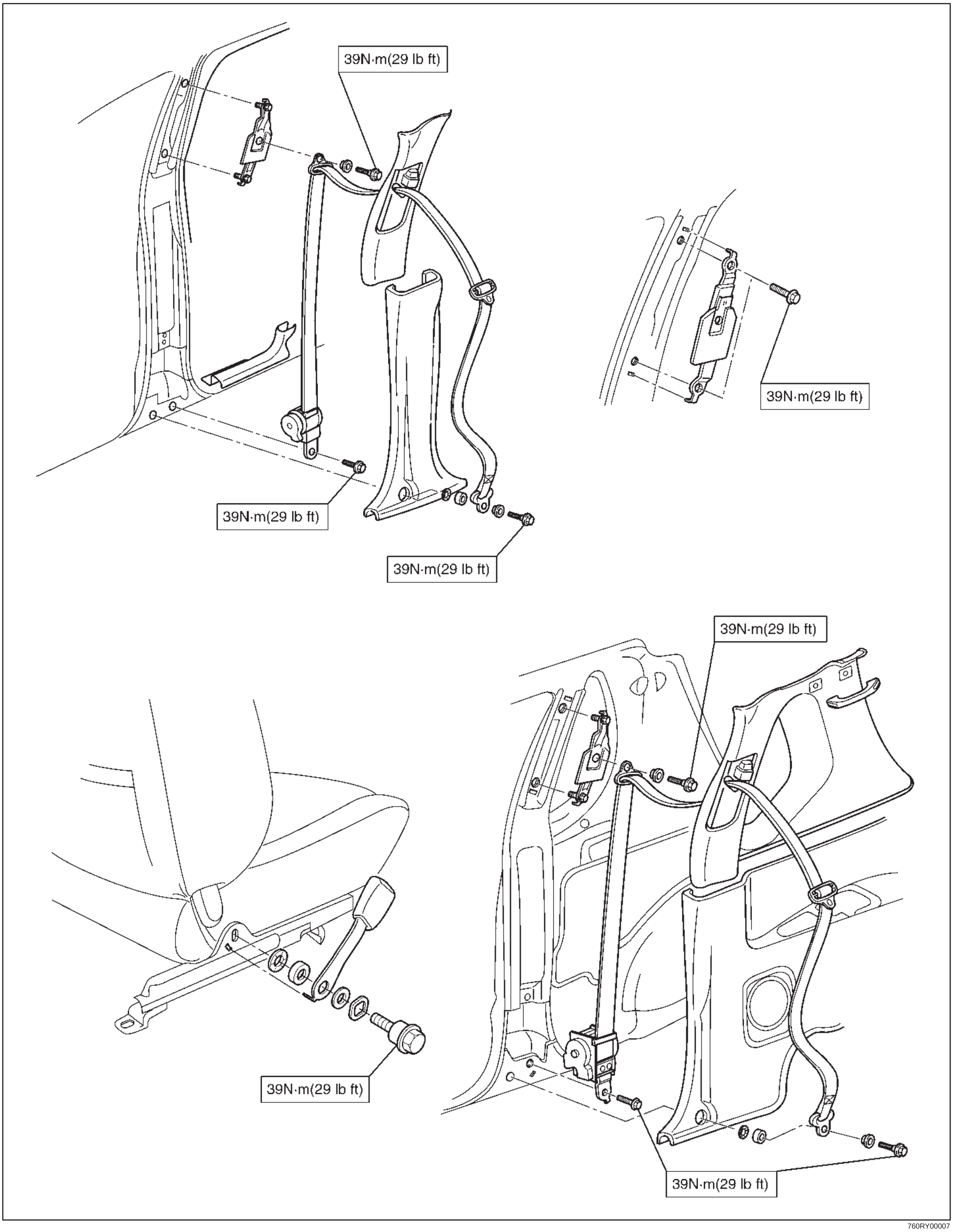
Installation

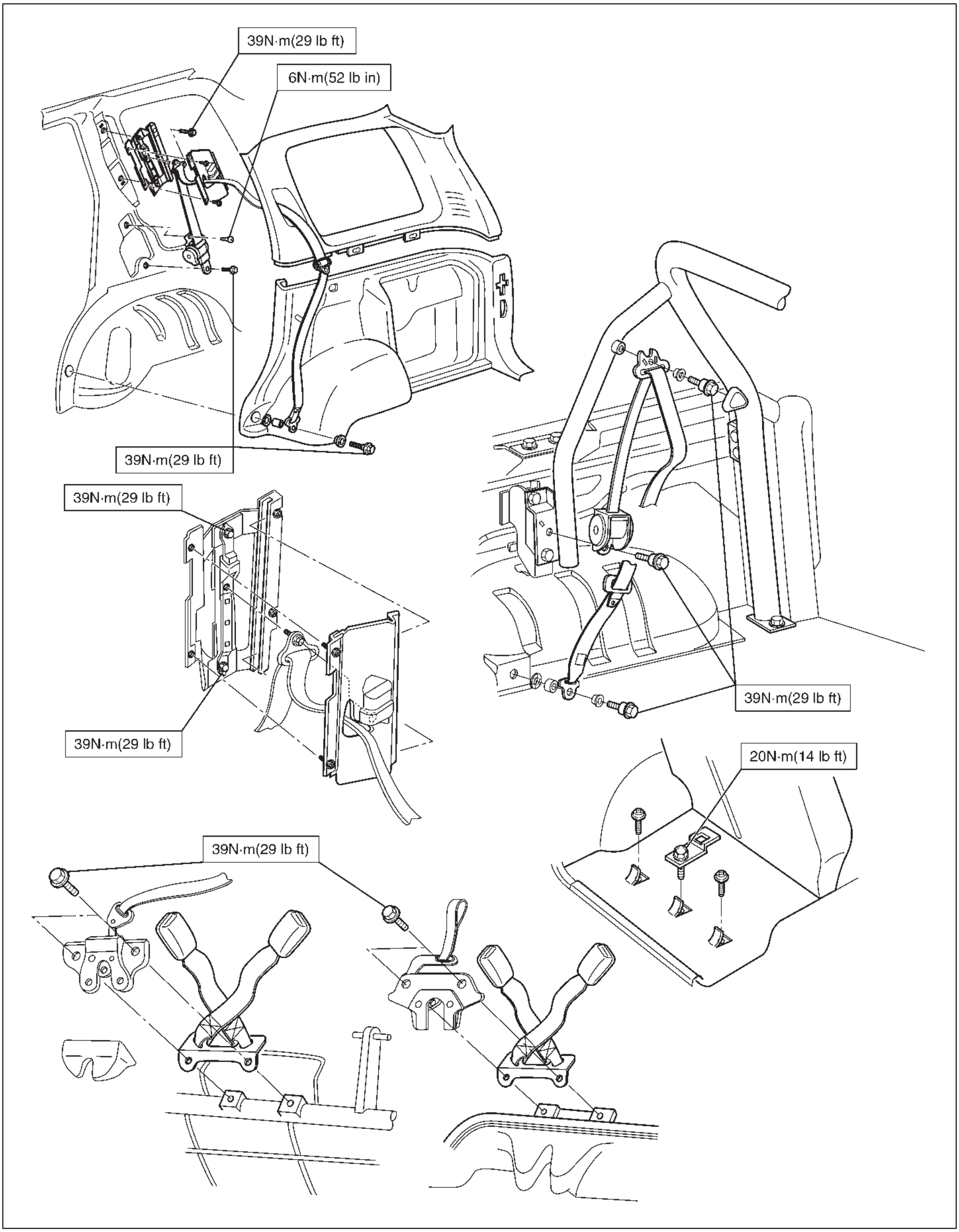
1. Turn the plug counterclockwise to remove it.
2. Install the bracket such that its tether belt hook hole is facing toward the front of the vehicle.
3. Tighten the fixing bolt to the specified torque.

Torque: 20 N·m (14 lb ft)

Main Data and Specifications

Torque Specifications




39N·m(29 lb ft)
6N·m(52 lb in)
39N·m(29 lb ft)
39N·m(29 lb ft)
39N·m(29 lb ft)
39N·m(29 lb ft)
20N·m(14 lb ft)
39N·m(29 lb ft)

755RY00012

RODEO

RESTRAINTS

SUPPLEMENTAL RESTRAINT SYSTEM (SRS)

CONTENTS

Service Precaution

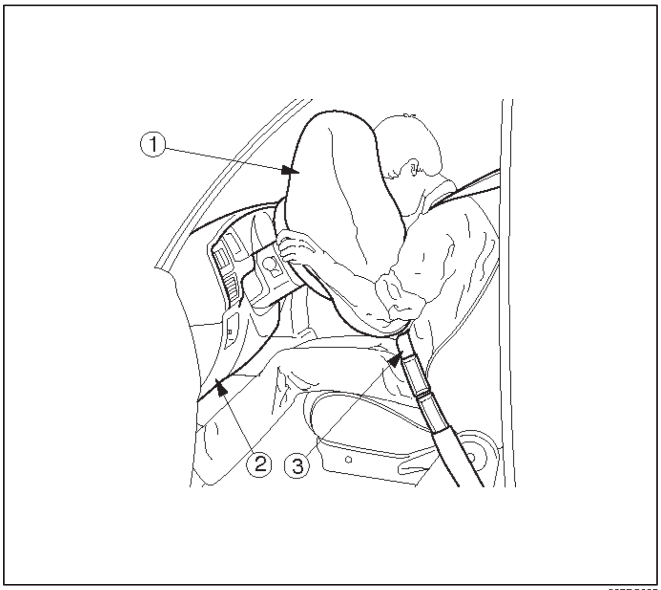
WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

CAUTION: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. If the above conditions are not followed, parts or system damage could result.

Restraint Devices

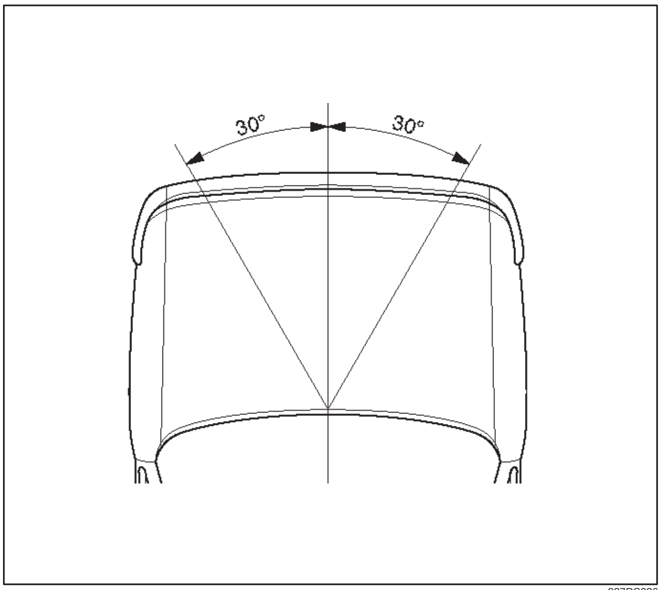


827RS035

Legend
(1) Deployed Air Bag
(2) Knee Bolster
(3) Seat Belt

The Supplemental Restraint System (SRS) helps supplement the protection offered by the driver and front passenger seat belts by deploying an air bag from the center of the steering wheel and from the top of the right side of the instrument panel.

The air bag deploys when the vehicle is involved in a frontal crash of sufficient force up to 30 degrees off the centerline of the vehicle. To further absorb the crash energy there is a knee bolster located beneath the instrument panel for both the driver and passenger, and the steering column is collapsible.

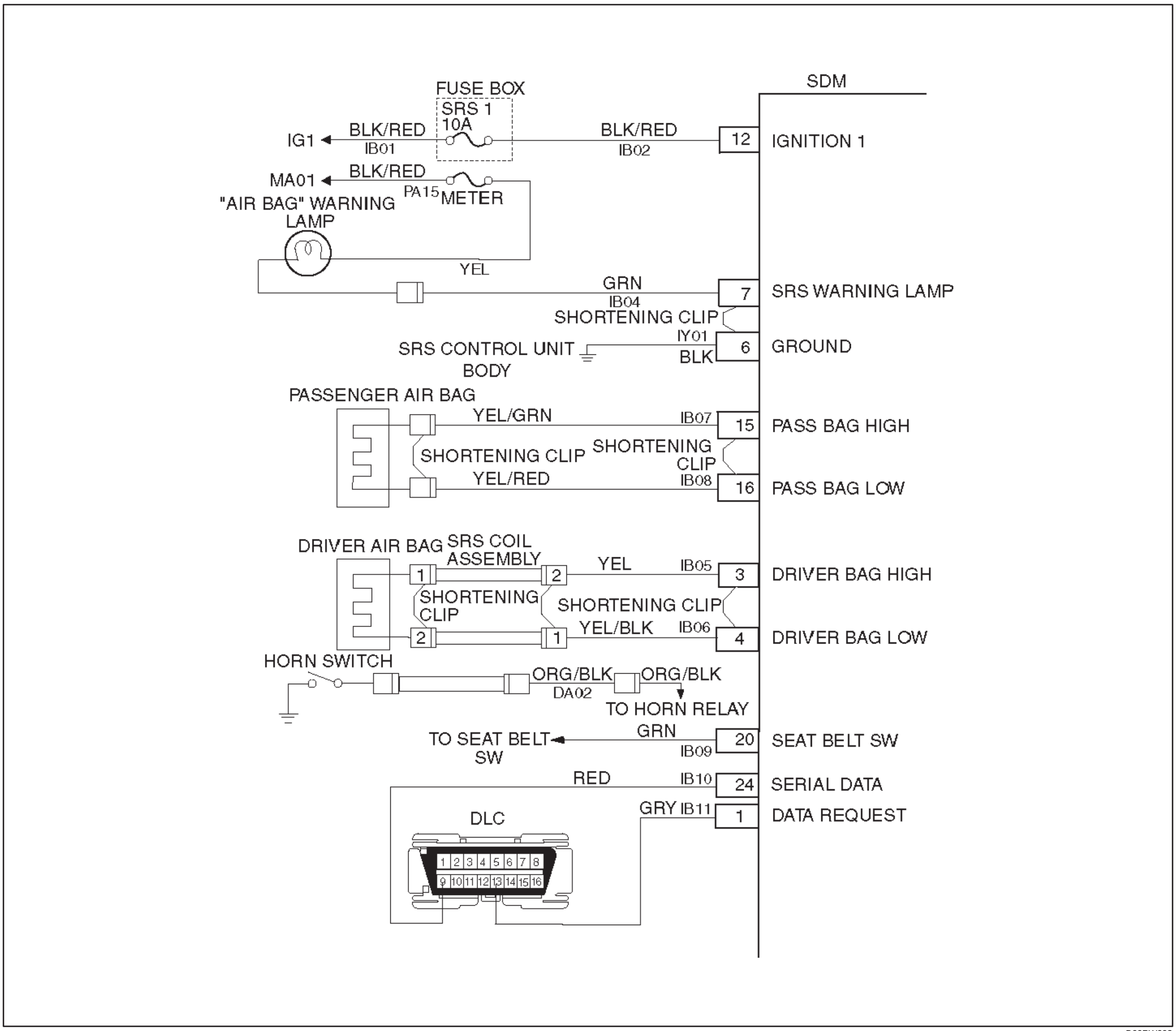


827RS036

System Description

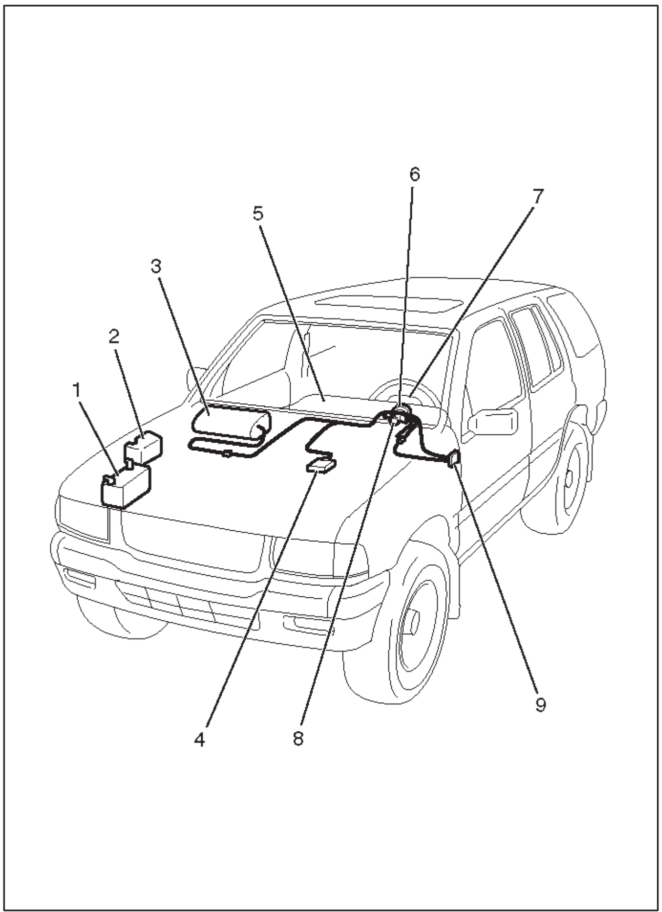
The SRS consists of the Sensing and Diagnostic Module (SDM), the driver air bag assembly, the SRS coil assembly, the passenger air bag assembly, and the “AIR BAG“ warning lamp in the instrument cluster. The SDM, SRS coil assembly (driver side only), driver air bag assembly, passenger air bag assembly and connector wire make up the deployment loops. The function of the deployment loops is to supply current through air bag assembly, which will cause deployment of the air bags in the event of a frontal crash of sufficient force, up to 30 degrees off the centerline of the vehicle. The air bag assemblies are only supplied enough current to deploy when the SDM detects vehicle velocity changes severe enough to warrant deployment.

The SDM contains a sensing device which converts vehicle velocity change to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the air bag assembly deploying the air bags.



D09RW002

SRS Component and Wiring Location View



Legend

(1) Battery
(2) Relay & Fuse Box
(3) Passenger Air Bag Assembly
(4) SDM
(5) Meter Assembly
(6) SRS Coil Assembly
(7) Driver Air Bag Assembly
(8) Starter Switch
(9) Fuse Box, SRS–1

Component Description

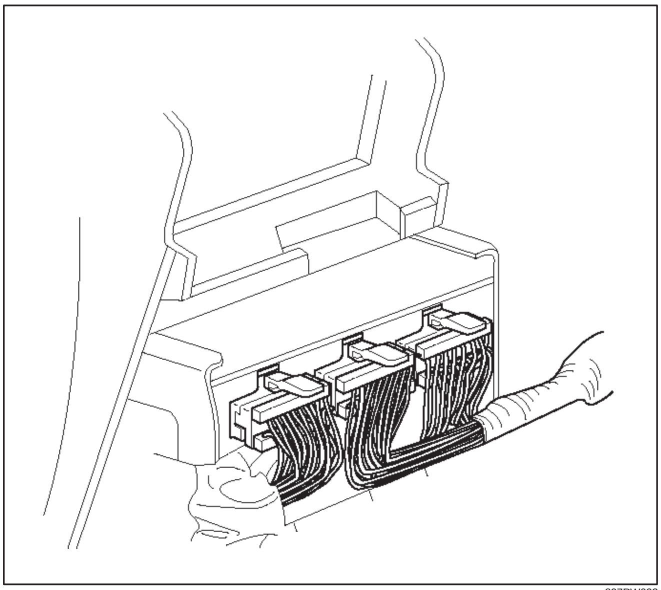
SDM (Sensing and Diagnostic Module)

WARNING: DURING SERVICE PROCEDURES, BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTED TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

The Sensing and Diagnostic Module (SDM) is designed to perform the following functions in the SRS:

1. Energy Reserve — The SDM maintains 24–Volt Loop Reserve (24VLR) energy supply to provide deployment energy when ignition voltage is lost in a frontal crash.
2. Frontal Crash Detection — The SDM monitors vehicle velocity changes to detect frontal crashes which are severe enough to warrant deployment.
3. Air Bag Deployment — When a frontal crash of sufficient force is detected, the SDM will cause enough current to flow through the air bag assembly to deploy the air bag.
4. Malfunction Detection — The SDM performs diagnostic monitoring of SRS electrical components and sets a diagnostic trouble code when a malfunction is detected.
5. Frontal Crash Recording — The SDM records information regarding SRS status during frontal crash.
6. Malfunction Diagnosis — The SDM displays SRS diagnostic trouble codes and system status information through the use of a scan tool.
7. Driver Notification — The SDM warns the vehicle driver of SRS malfunctions by controlling the “Air Bag” warning lamp.

The SDM is connected to the SRS wiring harness by a 24–pin connector. This harness connector uses a shorting clip across certain terminals in the contact area. This shorting clip connects the “AIR BAG” warning lamp to ground when the SDM harness connector is disconnected or CPA (Connector Position Assurance) is not inserted even if completely connected. This will cause the “AIR BAG” warning lamp to come “ON” steady whenever the ignition switch is at the ON or START positions with the SDM disconnected.

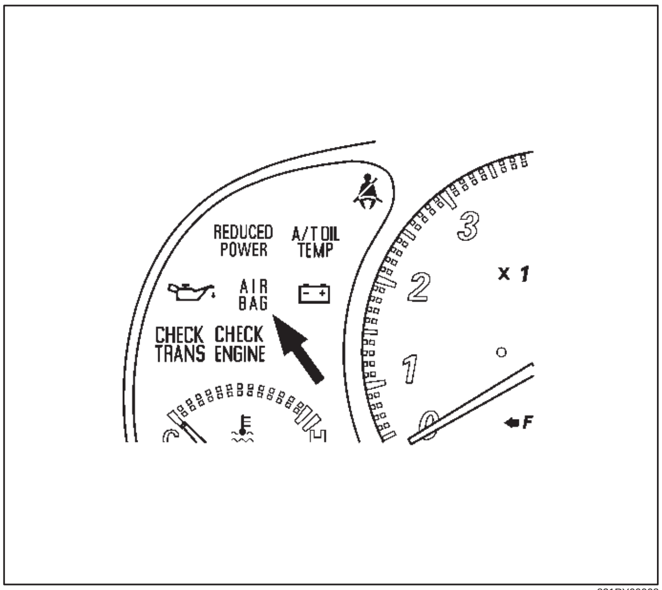


“Air Bag” Warning Lamp

Ignition voltage is applied to the “AIR BAG” warning lamp when the ignition switch is at the ON or START positions. The SDM controls the lamp by providing ground with a lamp driver. The “AIR BAG” warning lamp is used in the SRS to do the following:

1. Verify lamp and SDM operation by flashing SEVEN (7) times when the ignition switch is first turned “ON”.
2. Warn the vehicle driver of SRS electrical system malfunctions which could potentially affect the operation of the SRS. These malfunctions could result in nondeployment in case of a frontal crash or deployment for conditions less severe than intended.

The “AIR BAG” warning lamp is the key to driver notification of SRS malfunctions. For proper lamp operation, refer to the “SRS Diagnostic System Check” in this section.



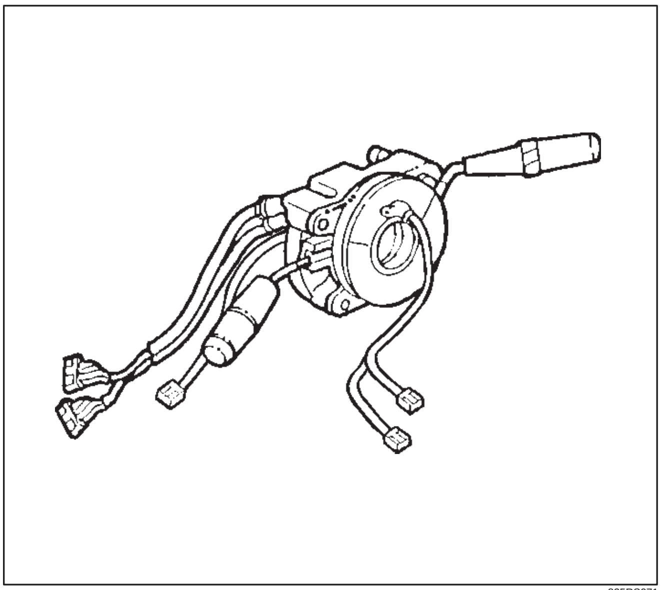
821RY00008

SRS Coil Assembly

The SRS coil assembly consists of two current carrying coils. This is attached to the steering column and allow rotation of the steering wheel while maintaining continuous contact of the driver deployment loop to the driver air bag assembly.

There is a shorting clip on the yellow 2–pin connector near the base of steering column which connects the SRS coil to the SRS wiring harness.

The shorting clip shorts to the SRS coil and driver air bag assembly when the yellow 2–pin connector is disconnected. The circuit to the driver air bag assembly is shorted in this way to help prevent unwanted deployment of the air bag when servicing the steering column or other SRS components.


825RS071

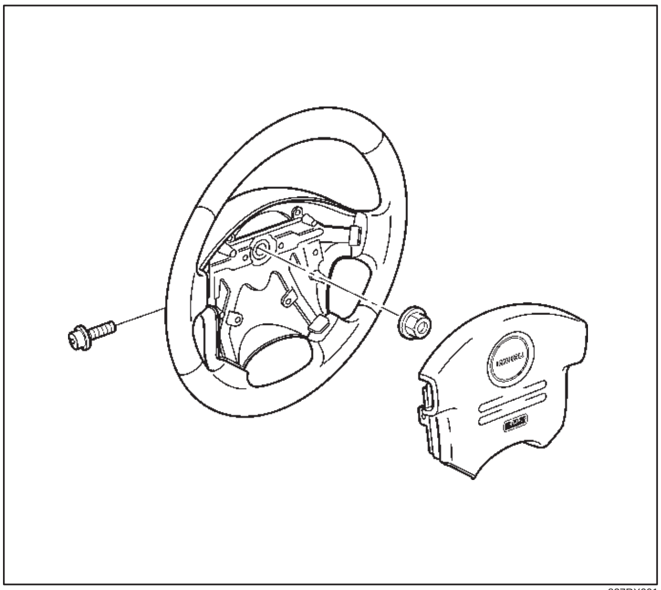
Air Bag Assemblies

The air bag assembly consist of an inflatable air bag assembly and an inflator (a canister of gas–generating material and an initiating device). When the vehicle is in a frontal crash of sufficient force.

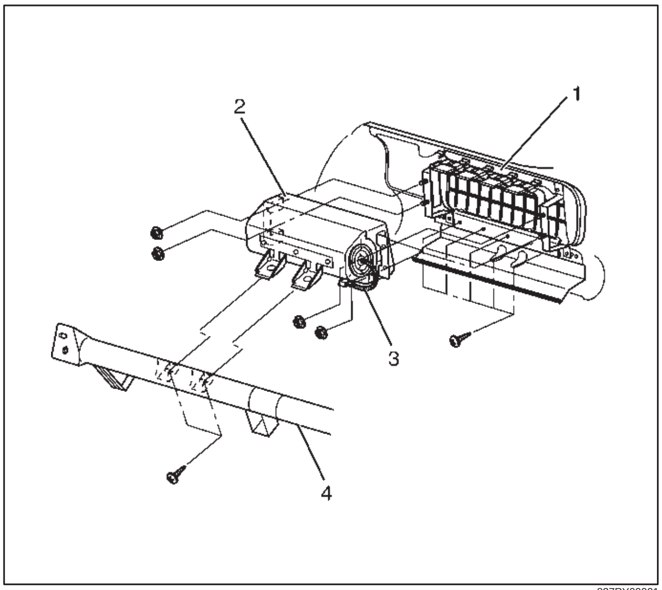
The SDM causes current flow through the deployment loops. Current passing through the inflator ignites the material in the air bag assembly. The gas produced from this reaction rapidly inflates the air bag assembly.

There is a shorting clip on the driver air bag assembly connector which connects the SRS coil assembly. The shorting clip shorts across the driver air bag assembly circuits when driver air bag assembly connector is disconnected.

The circuit to the driver air bag assembly is shorted in this way to help prevent unwanted deployment of the air bag when servicing the driver air bag assembly, the steering column or other SRS components.


827RX001

There is a shorting clip on the passenger air bag assembly connector which connects to the SRS harness. The shorting clip shorts across the passenger air bag assembly circuit when the passenger air bag assembly connector is disconnected. The circuit to the passenger air bag assembly is shorted in this way to help prevent unwanted deployment of the air bag when servicing the passenger air bag assembly, the instrument panel or other SRS components.



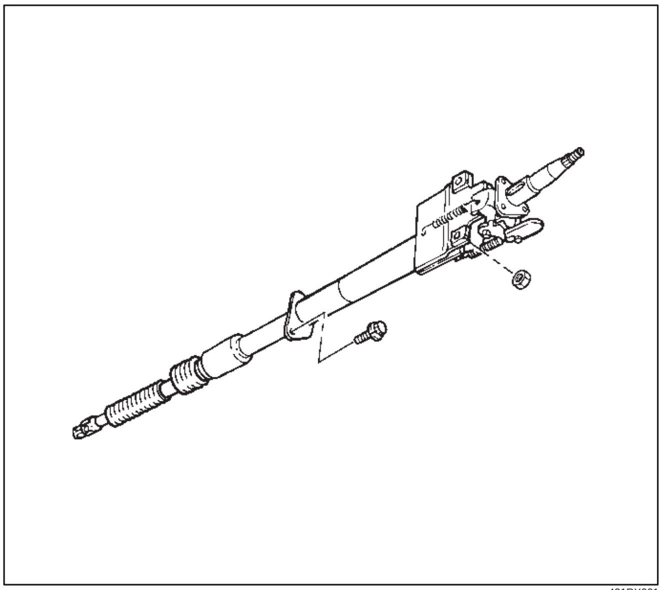
827RY00001

Legend

(1) Passenger Air Bag Door
(2) Passenger Air Bag Assembly
(3) Passenger Air Bag Harness
(4) Cross Beam

Steering Column

The steering column absorbs energy and is designed to compress in a frontal crash to decrease the chance of injury to the driver.



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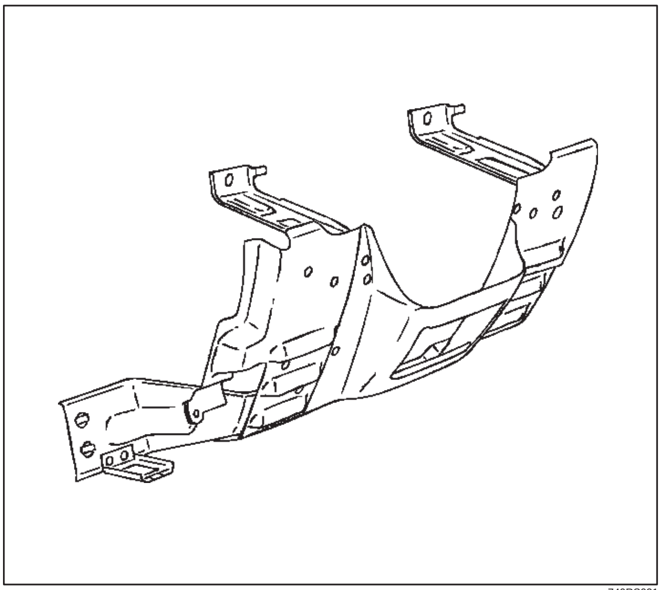
Knee Bolster

The knee bolsters are used to absorb energy to protec knees and control the forward movement of the vehicle's front seat occupants during a frontal crash, by limiting leg movement.



740RS021

Definition

Air Bag
An inflatable cloth cushion designed to deploy in certain frontal crashes. It supplements the protection offered by the seat belts by distributing the impact load more evenly over the vehicle occupant's head and torso.

Asynchronous
Performed in a nonperiodic fashion, (i. e., no defined time or interval).

(B+)
Battery voltage, (B+) The voltage available at the battery at the time of the indicated measurement. With the key "ON" and the engine not running, the system voltage will likely be between 12 and 12.5 volts. At idle the voltage may be 14 to 16 volts. The voltage could be as low as 10 volts during engine cranking.

Bulb Check
The SDM will cause the "AIR BAG" warning lamp to flash seven times and then go "OFF" whenever the ignition switch transitions to the ON position from any other ignition switch position and no malfunctions are detected.

"CONTINUOUS MONITORING"
Tests performed by the SDM on the SRS every 100 milliseconds while "Ignition 1" voltage is in the normal operating voltage range at the SDM.

Data Link Connector (DLC)
Formerly "DLC" a connector which allows communication with an external computer, such as a scan tool.

Datum Line
A base line parallel to the plane of the underbody or frame from which all vertical measurements originate.

Deploy
To inflate the air bag.

Deployment Loops
The circuits which supply current to the air bag assemblies to deploy the air bag.

Diagnostic Trouble Code (DTC)
Formerly “Code”, a numerical designator used by the SDM to indicate specific SRS malfunctions.

Driver Current Source
An output of the SDM which applies current into the driver air bag assembly circuit during the “Initiator Assembly Resistance Test”.

Driver Air Bag Assembly
An assembly located in the steering wheel hub consisting of an inflatable bag, an inflator and an initiator.

EEPROM
Electronically Erasable Programmable Read Only Memory. Memory which retains its contents when power is removed from the SDM.

Ignition Cycle
The voltage at the SDM “Ignition 1” inputs, with ignition switch “ON”, is within the normal operating voltage range for at least ten seconds before turning ignition switch “OFF”.

Ignition 1
A battery voltage (B+) circuit which is only powered with the ignition switch in the ON, or START positions.

Initiator
The electrical component inside the air bag assembly which, when sufficient current flows, sets off the chemical reaction that inflates the air bag.

“Initiator Assembly Resistance Test”
Tests performed once each ignition cycle when no malfunctions are detected during “Turn–ON” or “Continuous Monitoring.” This test checks for the correct SDM configuration for the vehicle, shorts to “Ignition 1” in the deployment loops, high resistance or opens in the “Driver Side High”, “Driver Side Low”, “Passenger Side High” and “Passenger Side Low” circuits and measures the resistance of the inflator assembly consisting of: 1) Initiators, 2) SRS coil assembly (driver side only), 3) Connectors and associated wiring.

Normal Operating Voltage Range
The voltage measured between the SDM “Ignition 1” terminals and “Ground” terminals is between 9 and 16 volts.

Passenger Current Source
An output of the SDM which applies current into the passenger air bag assembly circuit during the “Initiator Assembly Resistance Test”.

Passenger Air Bag Assembly
An assembly located in the right side of the instrument panel consisting of an inflatable bag, an inflator and an initiator.

Scan Tool
An external computer used to read diagnostic information from onboard computers via the data link connector.

SDM
Sensing and Diagnostic Module which provides reserve energy to the deployment loops, deploys the air bags when required and performs diagnostic monitoring of all SRS components.

Serial Data
Information representing the status of the SRS.

SRS
Supplemental Restraint System.

SRS Coil Assembly
An assembly of two current–carrying coils in the driver deployment loop that allows the rotation of the steering wheel while maintaining the continuous contact of the driver deployment loop to the driver air bag assembly.

SRS Wiring Harness
The wires and connectors that electrically connect the components in the SRS.

“Turn–ON”
Test which the SDM performs on the SRS once during each ignition cycle immediately after “Ignition 1” voltage is applied to the SDM and before “Continuous Monitoring”.

Diagnosis

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY–POWERED OR AC–POWERED VOLTMETER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NON–POWERED PROVE–TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

Diagnostic Trouble Codes

The “SRS Diagnostic System Check” must always be the starting point of any SRS diagnosis. The “SRS Diagnostic System Check” checks for proper “AIR BAG” warning lamp operation and checks for SRS diagnostic trouble codes using the scan tool.

1. Current diagnostic trouble codes – Malfunctions that are presently being detected. Current diagnostic trouble codes are stored in RAM (Random Access Memory).
2. History diagnostic trouble codes – All malfunctions detected since the last time the history memory was cleared. History diagnostic trouble codes are stored in EEPROM.

Scan Tool Diagnostics

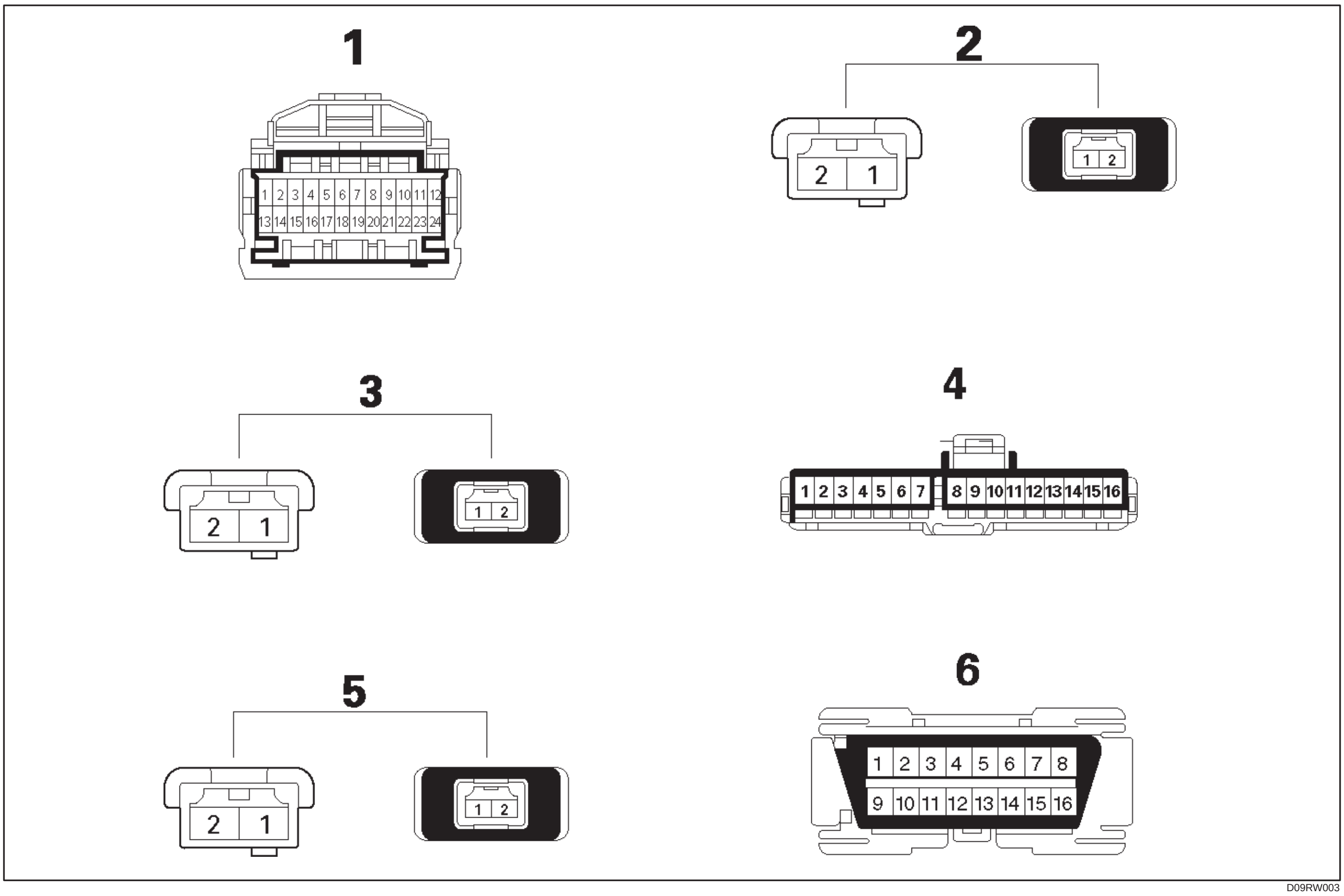
A scan tool is used to read current and history diagnostic trouble codes and to clear all diagnostic trouble codes after a repair is completed. The scan tool must be updated to communicate with the SRS through a replaceable cartridge before it can be used for SRS diagnostics. To use the scan tool, connect it to the data link connector and turn the ignition switch “ON”. The scan tool reads serial data from the SDM “Serial Data” line terminal “24” to the data link connector terminal “9”.

Use of Special Tools

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY–POWERED OR AC–POWERED VOLTMETER, OHMMETER, ETC, OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NON POWERED PROVE–TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT. YOU SHOULD BE FAMILIAR WITH THE TOOLS LISTED IN THIS SECTION UNDER THE HANDLING SRS SPECIAL TOOLS.

You should be able to measure voltage and resistance. You should be familiar with proper use of a scan tool such as the Tech 2 Diagnostic Computer, SRS Driver/Passenger Load Tool J–41433, Connector Test Adapter Kit J–35616–A, and the DVM (Digital Multimeter) J–39200.

SRS Connector Body Face Views



Legend

(1) SDM
(2) Driver Air Bag Assembly
(3) Passenger Air Bag Assembly
(4) “Air Bag” Warning Lamp
(5) SRS Coil Assembly
(6) DLC

Repairs and Inspections Required After an Accident

NOTE: If any SRS components are damaged, they must be replaced. If SRS component mounting points are damaged, they must be replaced.

- Never use SRS parts from another vehicle. This does not include remanufactured parts purchased from an authorized dealer; they may be used for SRS repairs.
- Do not attempt to service the SDM, the SRS coil assembly, or the air bag assembly. Service of these items is by replacement only.
- Verify the part number of replacement air bag assembly.

CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label from ’00 model as follows.

Light blue color for driver air bag assembly.

Light blue color for passenger air bag assembly.

Use only the air bag assembly for Rodeo (UE) models.

CAUTION: Proper operation of the sensors and Supplemental Restraint System (SRS) requires that any repairs to the vehicle structure return it to the original production configuration. Deployment requires, at a minimum, replacement of the SDM, air bag assembly and dimensional inspection of the steering column. Any visible damage to the SDM mounting bracket (s) requires replacement, and the steering column must be dimensionally inspected, whether deployment occurred or not.

Accident With Deployment – Component Replacement and Inspections

Certain SRS components must be replaced or inspected for damage after a frontal crash involving air bag deployment. Those components are:

- Air bag assembly
- SDM

CAUTION: Refer to "SDM Replacement Guidelines" below for important information on SDM replacement in both deployment and non deployment crashes.

- SRS coil assembly—Inspect wiring and connector for any signs of scorching, melting, or damage due to excessive heat. Replace if damaged. Refer to SRS coil assembly in this section.

Accident With or Without Deployment—Component Inspection

Certain SRS and restraint system components must be inspected after any crash, whether the air bag deployed or not. Those components are:

- Steering column—Dimensionally inspect per "Checking Steering Column for Accident Damage" in 3 of this workshop manual.
- Knee bolsters and mounting points— Inspect for any distortion, bending, cracking, or other damage.
- I/P steering column reinforcement plate— Inspect for any distortion, bending, cracking, or other damage.
- I/P braces—Inspect for any distortion, bending, cracking, or other damage.
- Seat belts and mounting points—Refer to "Seat Belts" in 10 of this workshop manual.

SDM Replacement Guidelines

SDM replacement policy requires replacement of SDM, after crash involving air bag deployment when "SRS Warning Lamp" turn "ON", "SRS Diagnosis" should be done according to "Section 9J1".

Wiring Damage

If any SRS wire harness is damaged, it should be replaced. Don't repair SRS. It is replace only.

SRS Connector (Plastic Body And Terminal Metal Pin) Damage

If any connector or terminal in the SRS wire harness (except pigtails) is damaged, it should be replaced.

SRS Wire Pigtail Damage

If the wiring pigtail (a wire or wires attached directly to the device, not by a connector) is damaged, the entire component (with pigtail) must be replaced. Examples of "pigtail" components are the driver air bag assembly, the passenger air bag assembly, and the SRS coil assembly.

On–Vehicle Service

Service Precautions

WARNING: WHEN PERFORMING SERVICE ON OR AROUND SRS COMPONENTS OR SRS WIRING, FOLLOW THE PROCEDURES LISTED BELOW TO TEMPORARILY DISABLE THE SRS. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY OR OTHERWISE UNNEEDED SRS REPAIRS.

The SDM in Driver—Passenger SRS can maintain sufficient voltage to cause a deployment for up to 15 seconds after the ignition switch is turned "OFF", the battery is disconnected, or the fuse powering the SDM is removed.

Many of the service procedures require removal of the "SRS–1" fuse, and disconnection of the air bag assembly from the deployment loop to avoid an accidental deployment. If the air bag assembly is disconnected from the deployment loop as noted in the "Disabling the SRS" procedure that follows, service can begin immediately without waiting for the 15 second time period to expire.

Disabling The SRS

Removal

Turn the ignition switch to "lock" and remove key.

1. Remove SRS fuse SRS–1, from left dash side lower fuse block or disconnect battery.
2. Disconnect yellow 2–pin connector at the base of steering column.
3. Remove glove box assembly, Refer to "Passenger Air Bag Assembly Replacement" in section 9J–28.
4. Disconnect yellow 2–pin connector behind the glove box assembly.

CAUTION: With the "SRS–1" fuse removed and ignition switch "ON", "AIR BAG" warning lamp will be "ON". This is normal operation and does not indicate an SRS malfunction.

Enabling The SRS

Installation

CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label from ’00 model as follows.

Light blue color for driver air bag assembly.

Light blue color for passenger air bag assembly.

Use only the air bag assembly for Rodeo (UE) models.

Turn ignition switch to “LOCK” and remove key.

1. Connect yellow 2–pin connector passenger air bag assembly.
2. Install glove box assembly, refer to “Passenger Air Bag Assembly Replacement” in section 9J–28.
3. Connect yellow 2–pin connector at the base of steering column.
4. Install “AIR BAG” fuse SRS–1 to left dash side lower fuse block or connect battery.

Turn ignition switch to “ON” and verify that the “AIR BAG” warning lamp flashes seven times and then turns “OFF” If it does not operate as described, perform the “SRS Diagnostic System Check” in section 9J1–3.

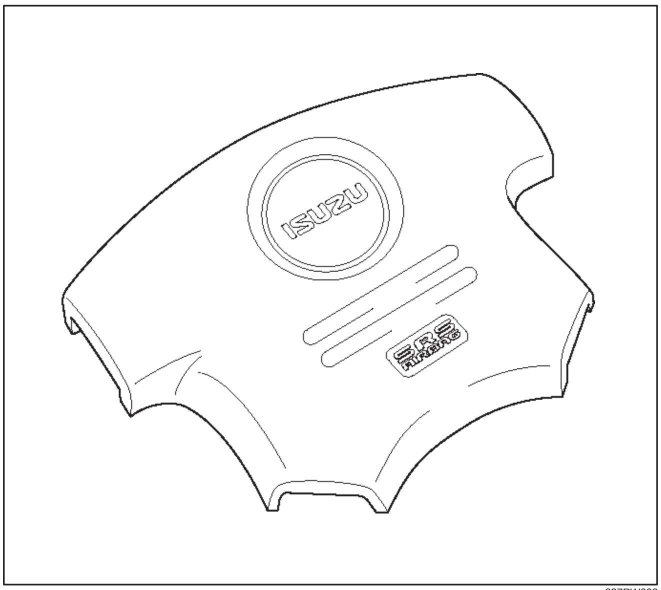
Handling / Installation / Diagnosis

1. Air bag assembly should not be subjected to temperatures above 93˚C (200˚F).
2. Air bag assembly, and SDM should not be used if they have been dropped from a height of 100 centimeters (3.28 feet).
3. When a SDM is replaced, it must be oriented with the arrow on the sensor pointing toward the front of the vehicle. It is very important for the SDM to be located flat on the mounting surface, parallel to the vehicle datum line. It is important that the SDM mounting surface is free of any dirt or other foreign material.
4. Do not apply power to the SRS unless all components are connected or a diagnostic chart requests it, as this will set a diagnostic trouble code.
5. The “SRS Diagnostic System Check” must be the starting point of any SRS diagnostics. The “SRS Diagnostic System Check” will verify proper “AIR BAG” warning lamp operation and will lead you to the correct chart to diagnose any SRS malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacement.

Air Bag Assembly Handling / Shipping / Scrapping

Live (Undeployed) Air Bag Assembly

Special care is necessary when handling and storing a live (undeployed) air bag assembly. The rapid gas generation produced during deployment of the air bag could cause the air bag assembly, or an object in front of the air bag assembly, to be thrown through the air in the unlikely event of an accidental deployment.



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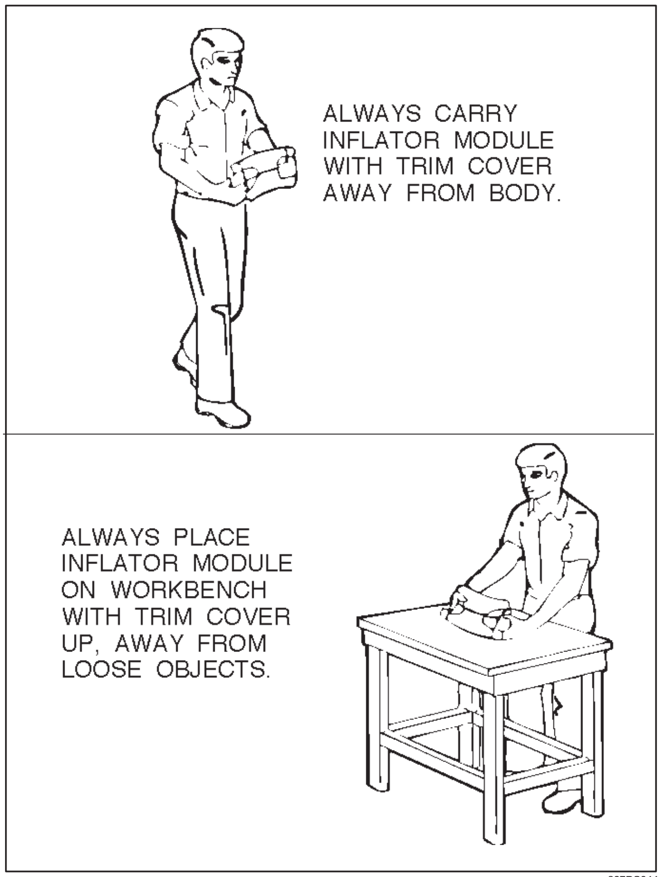
WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG OPENING IS POINTED AWAY FROM YOU. IN CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. NEVER CARRY THE AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF THE MODULE.



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Air Bag Assembly Shipping Procedure For Live (Undeployed) Air Bag Assemblies

Service personnel should refer to the latest Service Bulletins for proper SRS air bag assembly shipping procedures.

Deployed Air Bag Assembly

You should wear gloves and safety glasses. After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present.

Air Bag Assembly Scrapping Procedure

During the course of a vehicle's useful life, certain situations may arise which will necessitate the disposal of a live (undeployed) air bag assembly. This information covers proper procedures for disposing of a live air bag assembly.
Before a live air bag assembly can be disposed of, it must be deployed. Alive air bag assembly must not be disposed of through normal refuse channels.

WARNING: FAILURE TO FOLLOW PROPER SUPPLEMENTAL RESTRAINT SYSTEM (SRS) AIR BAG ASSEMBLY DISPOSAL PROCEDURES CAN RESULT IN AIR BAG DEPLOYMENT WHICH MAY CAUSE PERSONAL INJURY. AN UNDPLOYED AIR BAG ASSEMBLY MUST NOT BE DISPOSED OF THROUGH NORMAL REFUSE CHANNELS. THE UNDEPLOYED AIR BAG ASSEMBLY CONTAINS SUBSTANCES THAT CAN CAUSE SEVERE ILLNESS OR PERSONAL INJURY IF THE SEALED CONTAINER IS DAMAGED DURING DISPOSAL. DISPOSAL IN ANY MANNER INCONSISTENT WITH PROPER PROCEDURES MAY BE A VIOLATION OF FEDERAL, STATE, AND / OR LOCAL LAW.

In situations which require deployment of a live air bag assembly module, deployment may be accomplished inside or outside the vehicle. The method employed depends upon the final disposition of the particular vehicle, as noted in "Deployment Outside Vehicle" and "Deployment Inside Vehicle" in this section.

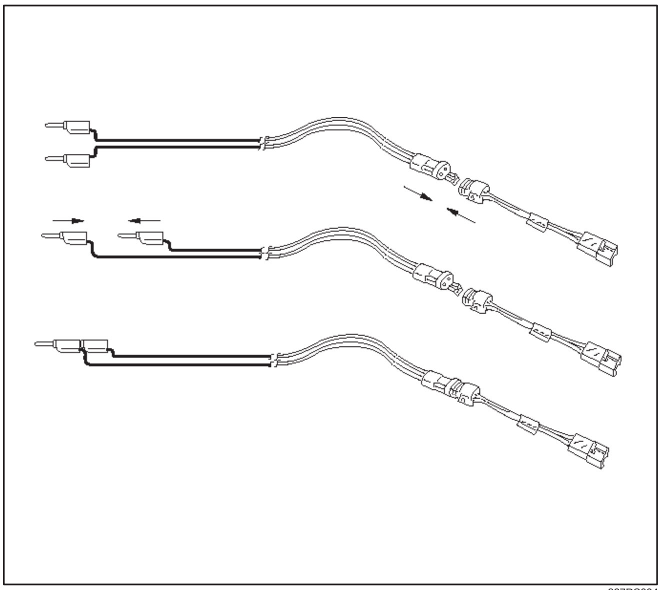
Deployment Outside Vehicle (Driver Air Bag Assembly)

Deployment outside the vehicle is proper when the vehicle is to be returned to service. This includes, for example, situations in which the vehicle will be returned to useful service after a functionally or cosmetically deficient air bag assembly is replaced. Deployment and disposal of a malfunctioning air bag assembly is, of course, subject to any required retention period.
For deployment of a live (undeployed) air bag assembly outside the vehicle, the deployment procedure must be followed exactly. Always wear safety glasses during this deployment procedure until a deployed air bag assembly is scrapped or until an undeployed air bag assembly is shipped. Before performing the procedures you should be familiar with servicing the SRS and with proper handling of the air bag assembly. Procedures should be read fully before they are performed.
The following procedure requires use of J–41434 SRS deployment harness with appropriate pigtail adapter. Do not attempt procedure without J–41434 adapter.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT HARNESS TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT HARNESS TO THE DRIVER AIR BAG ASSEMBLY. DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

NOTE: This information applies only to driver air bag assembly . Refer to "Deployment Outside Vehicle (Passenger Air Bag Assembly)" in this section for information on passenger air bag assembly scrapping.

1. Turn ignition switch to "LOCK", remove key and put on safety glasses.
2. Inspect J–41434 SRS Deployment Harness and appropriate pigtail adapter for damage. If harness or pigtail adapter is damaged, discard and obtain a replacement.
3. Short the two SRS deployment harness leads together by fully seating one banana plug into the other. SRS deployment harness shall remain shorted and not be connected to a power source until the air bag is to be deployed.



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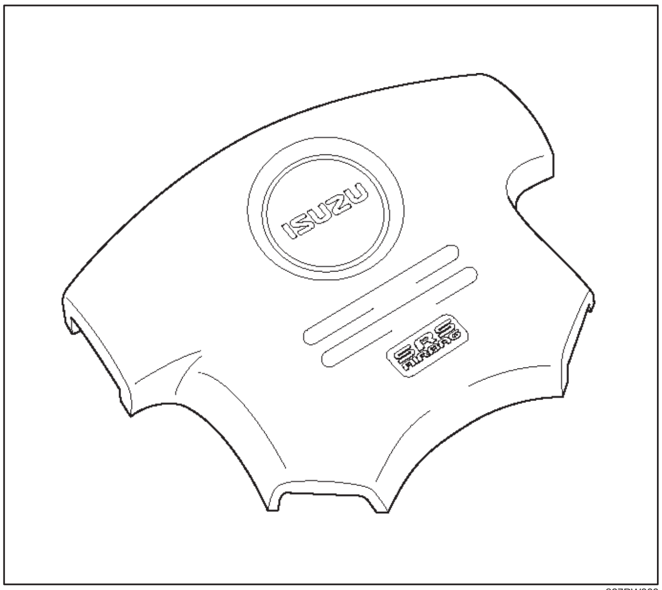
4. Connect the appropriate pigtail adapter to the SRS deployment harness.
5. Remove the driver air bag assembly from vehicle. Refer to Inflator Module Removal in this Section 9J–3.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE AIR BAG ASSEMBLY UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE AIR BAG AND TRIM COVER UP AND AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

6. Place the driver air bag assembly on a work bench or other surface away from all loose or flammable objects with its trim cover facing up, away from the surface.



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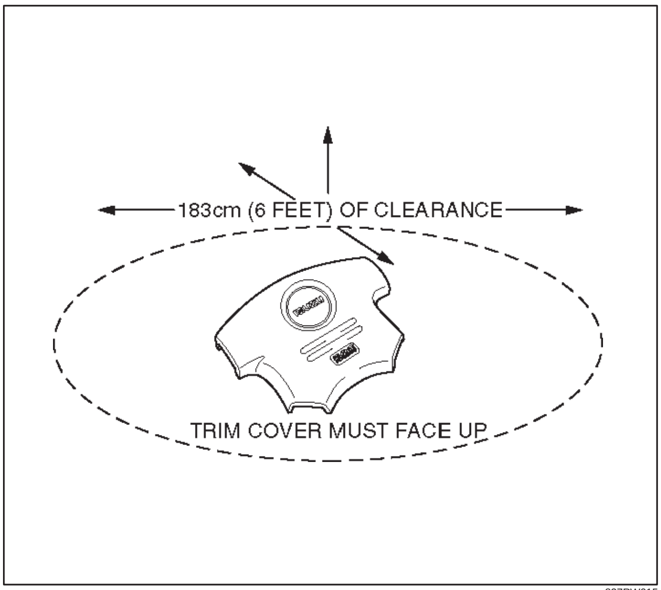
7. Clear a space on the ground about 183 cm (six feet) in diameter where the driver air bag assembly is to be deployed. A paved, outdoor location where there is no activity is preferred. If an outdoor location is not available, a space on the shop floor where there is no activity and sufficient ventilation is recommended. Ensure no loose or flammable objects are within the deployment area.



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8. Place the driver air bag assembly, with its trim cover facing up, on the ground in the space just cleared.
9. Stretch the SRS deployment harness and pigtail adapter from the driver air bag assembly to its full length.
10. Place a power source near the shorted end of the SRS deployment harness. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
11. Connect the driver air bag assembly to the pigtail adapter on the SRS deployment harness. Deployment harness shall remain shorted and not be connected to a power source until the air bag is to be deployed. The driver air bag assembly will immediately deploy the air bag when a power source is connected to it.

NOTE: Ensure that the pigtail adapter is firmly seated into the driver air bag assembly connector. Failure to fully seat the connectors may leave the shorting bar located in the driver air bag assembly connector functioning (shorted) and may result in non deployment of the driver air bag assembly.

12. Verify that the area around the driver air bag assembly is clear of all people and loose or flammable objects.
13. Verify that the driver air bag assembly is resting with its trim cover facing up.
14. Notify all people in the immediate area that you intend to deploy the driver air bag. The deployment will be accompanied by a substantial noise which may startle the uninformed.
15. Separate the two banana plugs on the SRS deployment harness.

NOTE: When the air bag deploys, the driver air bag assembly may jump about 30 cm (one foot) vertically. This is a normal reaction of the driver air bag to the force of the rapid gas expansion inside the air bag.

NOTE: When the air bag deploys, the rapid gas expansion will create a substantial noise. Notify all people in the immediate area that you intend to deploy the driver air bag.

WARNING: DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT HARNESS TO THE POWER SOURCE SHOULD ALWAYS BE THE LAST STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY.

16. Connect the SRS deployment harness wires to the power source to immediately deploy the driver air bag. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
17. Disconnect the SRS deployment harness from the power source.
18. Short the two SRS deployment harness leads together by fully seating one banana plug into the other.
19. In the unlikely event that the driver air bag assembly did not deploy after following these procedures, proceed immediately with Steps 24 through 26. If the driver air bag assembly did deploy, proceed with Steps 20 through 23.
20. Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed driver air bag assembly. After the driver air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This power consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with the atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment.

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE AIR BAG ASSEMBLY WILL BE VERY HOT. ALLOW THE INFLATOR MODULE TO COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE DEPLOYED AIR BAG ASSEMBLY NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN FIRE OR PERSONAL INJURY.

AFTER A DRIVER AIR BAG ASSEMBLY HAS BEEN DEPLOYED, THE METAL CANISTER AND SURROUNDING AREAS OF THE DRIVER AIR BAG ASSEMBLY WILL BE VERY HOT. DO NOT TOUCH THE METAL AREAS OF THE DRIVER AIR BAG ASSEMBLY FOR ABOUT TEN MINUTES AFTER DEPLOYMENT. IF THE DEPLOYED DRIVER AIR BAG ASSEMBLY MUST BE MOVED BEFORE IT IS COOL, WEAR GLOVES AND HANDLE BY THE AIR BAG OR TRIM COVER.

21. Disconnect the pigtail adapter from the driver air bag assembly as soon after deployment as possible. This will prevent damage to the pigtail adapter or SRS deployment harness due to possible contact with the hot driver air bag assembly canister. The pigtail adapter can be reused. They should, however, be inspected for damage after each deployment and replaced if necessary.
22. Dispose of the deployed driver air bag assembly through normal refuse channels after it has cooled for at least 30 minutes.
23. Wash your hands with mild soap and water afterward.

NOTE: The remaining steps are to be followed in the unlikely event that the driver air bag assembly did not deploy after following these procedures.

24. Ensure that the SRS deployment harness has been disconnected from the power source and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
25. Disconnect the pigtail adapter from the driver air bag assembly.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE INFLATOR MODULE UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG AND TRIM COVER UP AND AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

26. Temporarily store the driver air bag assembly with its trim cover facing up, away from the surface upon which it rests.

Deployment Outside Vehicle (Passenger Air Bag Assembly)

WARNING: FAILURE TO FOLLOW PROPER SRS AIR BAG ASSEMBLY DISPOSAL PROCEDURES CAN RESULT IN AIR BAG DEPLOYMENT WHICH MAY CAUSE PERSONAL INJURY. UNDEPLOYED AIR BAG ASSEMBLIES MUST NOT BE DISPOSED OF THROUGH NORMAL REFUSE CHANNELS. THE UNDEPLOYED AIR BAG ASSEMBLY CONTAINS SUBSTANCES THAT CAN CAUSE SEVERE ILLNESS OR PERSONAL INJURY IF THE SEALED CONTAINER IS DAMAGED DURING DISPOSAL. DISPOSAL IN ANY MANNER INCONSISTENT WITH PROPER PROCEDURES MAY BE A VIOLATION OF FEDERAL, STATE AND/OR LOCAL LAWS.

Deployment out of the vehicle is proper when the vehicle is to be returned to service. This includes, for example, situations in which a functionally or cosmetically deficient air bag assembly is replaced. Deployment and disposal of an air bag assembly is, of course, subject to any required retention period.

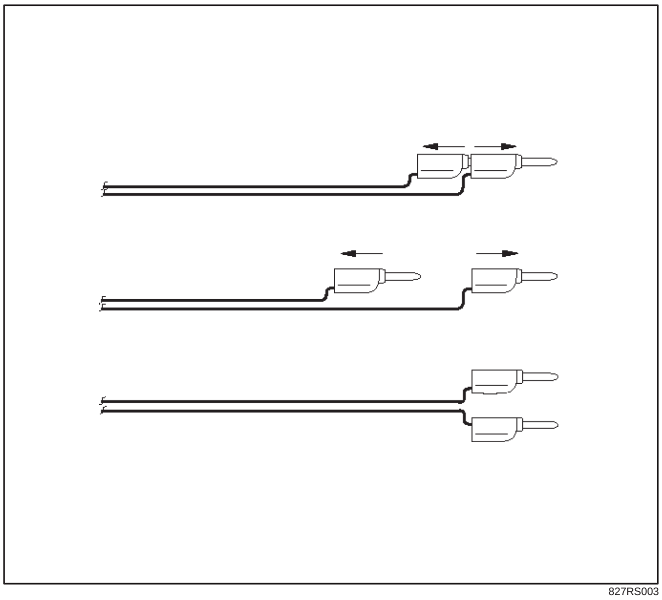
For deployment of a live air bag assembly out of the vehicle, the deployment procedure must be followed exactly. ALWAYS wear safety glasses during this

deployment procedure until the deployed air bag assembly is scrapped. Before performing the procedures, you should be familiar with servicing the SRS system and with proper handling of the air bag assembly. Procedures should be read fully before they are performed.
The following procedure requires use of J–42986 SRS Deployment Harness with the appropriate pigtail adapter. The procedure also requires the use of J–41497 Passenger Side SRS Module Deployment Fixture. Do not attempt this procedure without J–42986 and fixture J–41497.

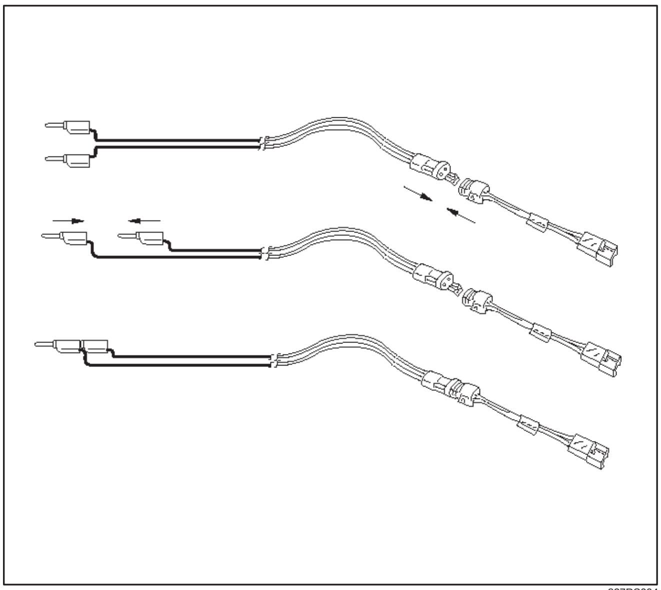
WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT HARNESS TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT HARNESS TO THE AIR BAG ASSEMBLY. DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

NOTE: This information applies only to passenger air bag assembly. Information for disposing of a live driver air bag assembly can be found in “Deployment Outside Vehicle” (Driver Air Bag Assembly) in this section.

1. Turn ignition switch to “LOCK” remove key, and put on safety glasses.
2. Inspect J–41434 SRS Deployment Harness and appropriate pigtail adapter for damage. If harness or pigtail is damaged, discard and obtain a replacement.
3. Short the two SRS Deployment Harness leads together by fully seating one banana plug into the other. The SRS Deployment Harness shall remain shorted and not be connected to a power source until the air bag is to be deployed.



4. Connect the appropriate pigtail adapter to the SRS Deployment Harness



5. Remove passenger air bag assembly from vehicle. Refer to “Passenger Air Bag Assembly Removal ” in this Section.
6. Clear a space on the ground approximately 185 cm (six feet) in diameter where the fixture with attached air bag assembly is to be placed for deployment. A paved outdoor location where there is no activity is preferred. If an outdoor location is not available, a space on the shop floor where is no activity and sufficient ventilation is recommended. Ensure that no loose or flammable objects are within the deployment area.
7. Place the J–41497 on the bench vice. This is necessary to provide sufficient stabilization of the fixture during deployment.
8. Attach the passenger air bag assembly in the J–41497. Air bag assembly must be mounted such that the bag will deploy upward. SECURELY HAND–TIGHTEN ALL FASTENERS PRIOR TO DEPLOYMENT.
9. Stretch the SRS Deployment Harness and pigtail adapter from the air bag assembly to its full length.
10. Place a power source near the shorted end of the SRS deployment harness. (Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.)
11. Connect the air bag assembly to the pigtail adapter on the SRS deployment harness. The SRS Deployment Harness shall remain shorted and not be connected to a power source until the air bag is to be deployed. The air bag assembly will immediately deploy the air bag when a power source is connected to it.

NOTE: Ensure that the pigtail adapter is firmly seated into the air bag assembly connector. Failure to fully seat the connectors may leave the shorting bar located in the air bag assembly connector functioning (shorting the deployment circuit) and may result in non deployment of the air bag assembly.

12. Verify that the area around the passenger air bag assembly is clear of all people and loose or flammable objects.

13. Verify that the passenger air bag assembly is firmly and properly in J–41497.
14. Notify all people in the immediate area of your intention to deploy the passenger air bag assembly. The deployment will be accompanied by a substantial noise which may startle the uninformed.
15. Separate the two banana plugs on the SRS deployment harness.

NOTE: When air bag deploys, the rapid gas expansion will create a substantial noise. Notify all people in the immediate area that you intend to deploy the air bag assembly.

WARNING: DEPLOYMENT HARNESS SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT HARNESS TO THE POWER SOURCE SHOULD ALWAYS BE THE LAST STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED MAY RESULT IN PERSONAL INJURY.

16. Connect the SRS deployment harness wires to the power source to immediately deploy the air bag assembly. Recommended application : 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
17. Disconnect the SRS deployment harness from the power source.
18. Short the two SRS deployment harness leads together by fully seating one banana plug into the other.
19. In the unlikely event that the passenger air bag assembly did not deploy after following these procedures, proceed immediately with Steps 24 through 26. If the passenger air bag assembly deployed as intended, proceed with Steps 20 through 23.
20. Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed air bag assembly. After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide quickly reacts with the atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present for very long after deployment.

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE AIR BAG ASSEMBLY WILL BE HOT. ALLOW THE AIR BAG ASSEMBLY TO COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE DEPLOYED INFLATOR MODULE NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN FIRE OR PERSONAL INJURY. AFTER AN AIR BAG ASSEMBLY HAS BEEN DEPLOYED, THE METAL CANISTER AND SURROUNDING AREAS OF THE AIR BAG ASSEMBLY WILL BE HOT. DO NOT TOUCH THE METAL AREAS OF THE AIR BAG ASSEMBLY FOR ABOUT THIRTY MINUTES AFTER DEPLOYMENT. IF THE DEPLOYED AIR BAG ASSEMBLY MUST BE MOVED BEFORE IT IS COOL, WEAR GLOVES AND HANDLE BY THE AIR BAG ITSELF.

21. Disconnect the pigtail adapter from the air bag assembly as soon after deployment as possible to avoid damage to the pigtail adapter or SRS deployment harness from contacting the hot air bag assembly canister. The pigtail adapter and SRS deployment harness are designed to be reused. They should, however, be inspected for damage after each deployment and replaced if necessary.
22. Dispose of the deployed air bag assembly through normal refuse channels after it has cooled for at least 30 minutes.
23. Wash your hands with mild soap and water afterward.

NOTE: The remaining steps are to be followed in the unlikely event that the air bag assembly did not deploy after following the above procedures.

24. Ensure that the SRS deployment harness has been disconnected from the the power source and that its two banana plugs have been shorted together by fully seating one banana plug into the other.
25. Disconnect the pigtail adapter from the air bag assembly.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE AIR BAG ASSEMBLY UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG UP AND AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES MAY RESULT IN PERSONAL INJURY.

26. Temporarily store the air bag assembly with the bag facing up, away from the surface upon which it rests.

Deployment Inside Vehicle (Vehicle Scrapping Procedure)

Deployment inside vehicle is proper when the vehicle is to be destroyed or salvaged for component parts. This includes, but is not limited to, the following situations:

1. The vehicle has completed its useful life.
2. The vehicle has been damaged beyond repair in a non deployment type accident.
3. The vehicle has been stripped or damaged beyond repair in a theft.
4. The vehicle will be salvaged for component parts to be used on a vehicle with a different Vehicle Identification Number (VIN) as opposed to being rebuilt as same VIN. Never use SRS components from another vehicle.

WARNING: FAILURE TO FOLLOW PROPER SRS AIR BAG ASSEMBLY DISPOSAL PROCEDURES CAN RESULT IN AIR BAG DEPLOYMENT WHICH MAY CAUSE PERSONAL INJURY. UNDEPLOYED AIR BAG ASSEMBLIES MUST NOT BE DISPOSED OF THROUGH NORMAL REFUSE CHANNELS. THE UNDEPLOYED AIR BAG ASSEMBLY CONTAINS SUBSTANCES THAT CAN CAUSE SEVERE ILLNESS OR PERSONAL INJURY IF THE SEALED CONTAINER IS DAMAGED DURING DISPOSAL. DISPOSAL IN ANY MANNER INCONSISTENT WITH PROPER PROCEDURES MAY BE A VIOLATION OF FEDERAL, STATE AND/OR LOCAL LAWS.

1. Turn ignition switch to “LOCK”, remove key and put on safety glasses.
2. Remove all loose objects from front seats.
3. Disconnect SRS coil assembly, yellow 2–pin connector located at the base of the steering column.
4. Cut the SRS coil assembly yellow 2–pin harness connector from the vehicle leaving at least 16 cm (six inches) of wire at the connector.
5. Strip 13 mm (1/2 inch) of insulation from yellow–green and yellow–black wire lead of the connector.
6. Cut two 900 cm (30 feet) deployment wires from 0.8 mm^2 (18 gauge) or thicker multi–strand wire. These wires will be used to fabricate the driver deployment harness.
7. Strip 13 mm (1/2 inch) of insulation from both ends of the wires cut in the previous step.
8. Short the wires by twisting together one end from each. Deployment wires shall remain shorted and not be connected to a power source until the air bag is to be deployed.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT WIRES TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT WIRES TO THE AIR BAG ASSEMBLY LEADS. DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. WEAR SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

9. Twist together one connector wire lead to one deployment wire. The connection should be mechanically secure.
10. Bend twisted connection made in the previous step flat and wrap tightly with electrical tape to insulate and secure.
11. Twist together, bend and tape the remaining connector wire lead to the remaining deployment wire.
12. Connect the deployment harness to the driver air bag assembly, yellow 2–pin connector at the base of the steering column. Route deployment harness out the driver side of the vehicle.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED.

THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT.

CONNECTING THE DEPLOYMENT WIRES TO THE POWER SOURCE SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE.

FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

13. Disconnect passenger air bag assembly, yellow 2–pin connector located behind glove box assembly.
14. Cut the passenger air bag assembly harness connector from the vehicle leaving at least 16 cm (six inches) of wire at the connector.
15. Strip 13 mm (1/2 inch) of insulation from yellow–green and yellow–red wire lead of the connector.
16. Cut two 900 cm (30 feet) deployment wires from 0.8 mm^2 (18 gauge) or thicker multi–strand wire. These wires will be used to fabricate the passenger deployment harness.
17. Strip 13 mm (1/2 inch) of insulation from both ends of the wires cut in the previous step.
18. Short the wires by twisting together one end from each. Deployment wires shall remain shorted and not be connected to a power source until the air bag is to be deployed.

WARNING: FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY. NEVER CONNECT DEPLOYMENT WIRES TO ANY POWER SOURCE BEFORE CONNECTING DEPLOYMENT WIRES TO THE AIR BAG ASSEMBLY LEADS. DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN SAFETY GLASSES THROUGHOUT THIS ENTIRE DEPLOYMENT AND DISPOSAL PROCEDURE.

19. Twist together one connector wire lead to one deployment wire. The connection should be mechanically secure.
20. Bend twisted connection made in the previous step flat and wrap tightly with electrical tape to insulate and secure.
21. Twist together, bend and tape the remaining connector wire lead to the remaining deployment wire.
22. Connect the deployment harness to the passenger air bag assembly, yellow 2–pin connector located behind the glove box assembly. Route deployment harness out the passenger side of the vehicle.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE

DEPLOYMENT WIRES SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

23. Verify that the inside of the vehicle and the area surrounding the vehicle are clear of all people and loose or flammable objects.
24. Stretch the driver and passenger deployment harness to their full length.
25. Completely cover windshield area and front door window openings with a drop cloth, blanket or similar item. This reduces the possibility of injury due to possible fragmentation of the vehicle's glass or interior.
26. Notify all people in the immediate area that you intend to deploy the air bags. The deployment will be accompanied by a substantial noise which may startle the uninformed.
27. Separate the two ends of the driver deployment harness wires.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT WIRES TO THE POWER SOURCE SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

NOTE: When the air bag deploys, the rapid gas expansion will create a substantial noise. Notify all people in the immediate area that you intend to deploy the air bags.

28. Connect the driver deployment harness wires to a power source to immediately deploy the driver air bag assembly. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested.
29. Separate the two ends of the passenger deployment harness wires.

WARNING: DEPLOYMENT WIRES SHALL REMAIN SHORTED AND NOT BE CONNECTED TO A POWER SOURCE UNTIL THE AIR BAG IS TO A POWER SOURCE UNTIL THE AIR BAG IS TO BE DEPLOYED. THE AIR BAG ASSEMBLY WILL IMMEDIATELY DEPLOY THE AIR BAG WHEN A POWER SOURCE IS CONNECTED TO IT. CONNECTING THE DEPLOYMENT WIRES TO THE POWER SOURCE SHOULD ALWAYS BE THE FINAL STEP IN THE AIR BAG ASSEMBLY DEPLOYMENT PROCEDURE. FAILURE TO FOLLOW PROCEDURES IN THE ORDER LISTED COULD RESULT IN PERSONAL INJURY.

30. Connect the passenger deployment harness wires to a power source to immediately deploy the passenger air bag assembly. Recommended application: 12 volts minimum, 2 amps minimum. A vehicle battery is suggested. Put on a pair of shop gloves and safety gasses to protect your hands and eyes from possible irritation and heat when handling the deployed air bag assembly. After an air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment.

WARNING: SAFETY PRECAUTIONS MUST BE OBSERVED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE METAL SURFACES OF THE AIR BAG ASSEMBLY WILL BE VERY HOT. ALLOW THE AIR BAG ASSEMBLY TO COOL BEFORE HANDLING ANY METAL PORTION OF IT. DO NOT PLACE THE HOT DEPLOYED AIR BAG ASSEMBLY NEAR ANY FLAMMABLE OBJECTS. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN FIRE OR PERSONAL INJURY.

After an air bag assembly has been deployed, the metal canister and surrounding areas of the air bag assembly will be very hot. Do not touch the metal areas of the air bag assembly for about 30 minutes after deployment. If the deployed air bag assembly must be moved before it is cool, wear gloves and handle by the air bag or trim cover.

31. Short the driver deployment harness wires by twisting together one end from each. Repeat this procedure for the passenger deployment harness.
32. Carefully remove drop cloth from vehicle and clean off any fragments or discard drop cloth entirely.
33. Disconnect driver deployment harness and passenger deployment harness from vehicle and discard.
34. In the unlikely event that either or both of the air bag assemblies did not deploy after following these procedures, proceed immediately with Steps 36 through 37. If the air bag assembly deployed, proceed to step 35.
35. With both air bags deployed, the vehicle may be scrapped in the same manner as a non–SRS equipped vehicle.

NOTE: The remaining steps are to be followed in the unlikely event that the air bag assembly did not deploy after following these procedures.

36. Remove the undeployed air bag assembly (s) from the vehicle. For driver air bag assembly refer to in the "Passenger Air Bag Assembly Removal" in this section 9J–28.

WARNING: WHEN STORING A LIVE AIR BAG ASSEMBLY OR WHEN LEAVING A LIVE AIR BAG

ASSEMBLY UNATTENDED ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN PERSONAL INJURY.

37. Temporarily store the air bag assembly with the air bag opening facing up, away from the surface upon which it rests.

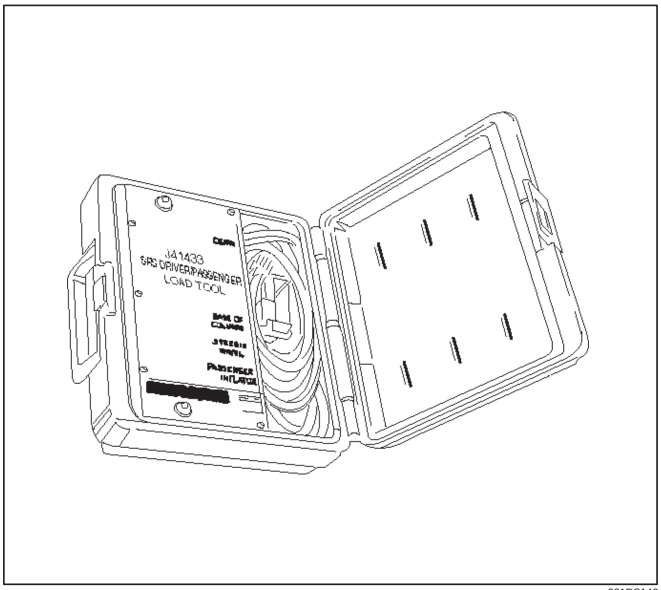
Deployed Air Bag Assembly Handling

Put on a pair of shop gloves and safety glasses to protect your hands and eyes from possible irritation and heat when handling the deployed air bag assembly.

After the air bag assembly has been deployed, the surface of the air bag may contain a powdery residue. This powder consists primarily of cornstarch (used to lubricate the bag as it inflates) and by products of the chemical reaction. Sodium hydroxide dust (similar to lye soap) is produced as a by product of the deployment reaction. The sodium hydroxide then quickly reacts with atmospheric moisture and is converted to sodium carbonate and sodium bicarbonate (baking soda). Therefore, it is unlikely that sodium hydroxide will be present after deployment.

Special Tools

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY–POWERED OR AC–POWERED VOLTMETER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NON POWERED PROBE–TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.



901RS146

J–41433 SRS Driver/Passenger Load Tool

The SRS Driver/Passenger Load Tool J–41433 is used only when called for in this section. It is used as a diagnostic aid and safety device to prevent inadvertent air bag assembly deployment.

The load tool has four yellow connectors attached to its case.

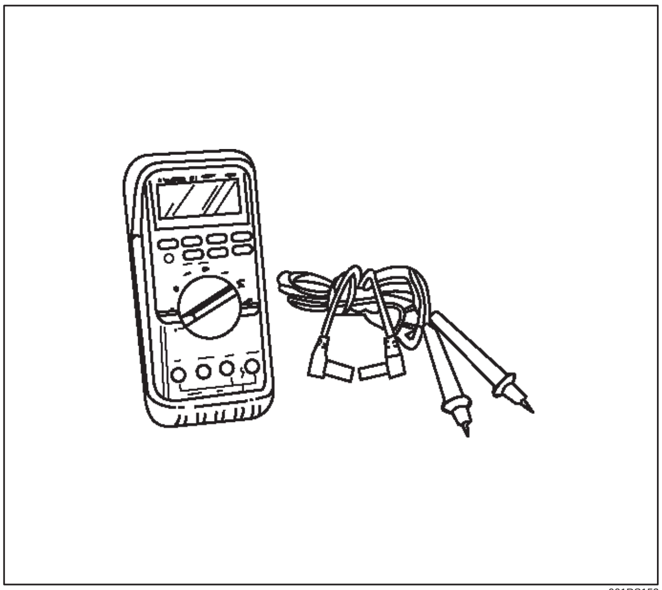
The three small connectors are electrically functional and serve as resistive load substitutions.

No more than two connectors are used at any time. One of the small connectors is used to substitute for the load of the driver air bag assembly when it is connected at the top of the column to the SRS coil assembly. Another small connector is used to substitute for the load of the driver air bag assembly and the SRS coil assembly when it is connected at the base of the column to the SRS wiring harness. The third small connector is used to substitute for the load of the passenger air bag assembly when connected to the passenger air bag assembly harness connector.

By substituting the resistance of the load tool when called for, a determination can be made as to whether an inflator circuit component is causing system malfunction and which component is causing the malfunction. The load tool should be used only when specifically called for in the diagnostic procedures.

J–39200 DVM

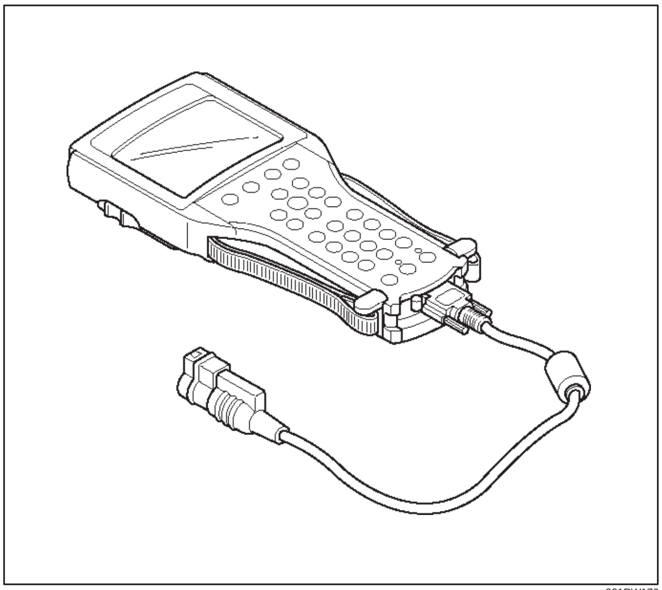
The J–39200 DVM is the preferred DVM for use in SRS diagnosis and repair. However, J–34029–A may be used if J–39200 is not available. No other DVMs are approved for SRS diagnosis and repair.



901RS153

Scan Tool

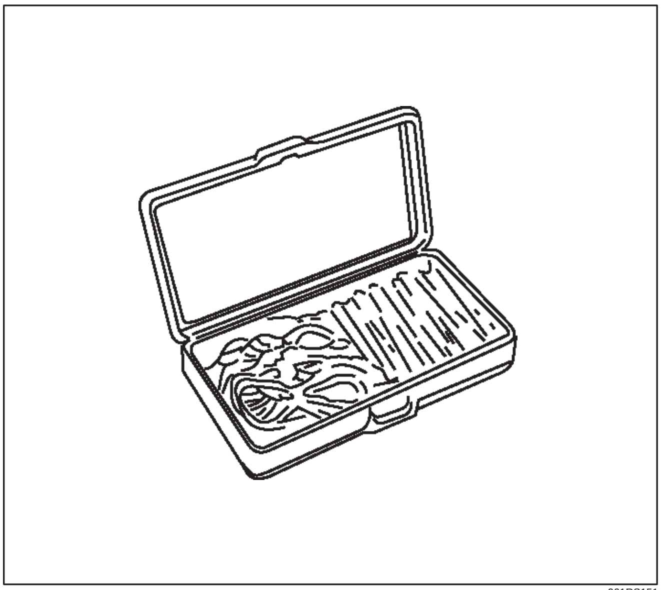
The Tech 2 is used to read and clear SRS Diagnostic Trouble Codes (DTCs). Refer to the Tech 2 Operator's Manual for specific information on how to use the Tech 2.



901RW176

J–35616–A Connector Test Adapter Kit

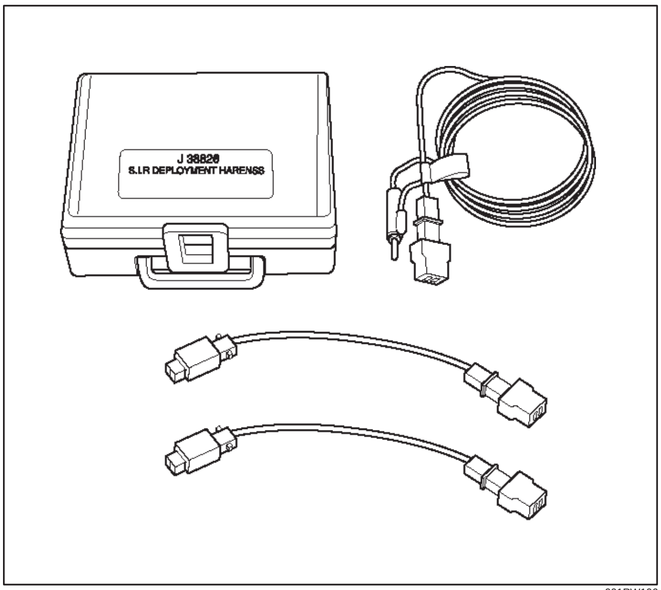
The J–35616–A Connector Test Adapter Kit must be used whenever a diagnostic procedure requests checking or probing a terminal. Using the appropriate adapter will ensure that no damage to the terminal will occur from the DVM prove, such as spreading or bending. The adapter will also give an idea of whether contact tension is sufficient, helping to find an open or intermittent open due to poor terminal contact.



901RS151

J–42986 SRS Deployment Tool

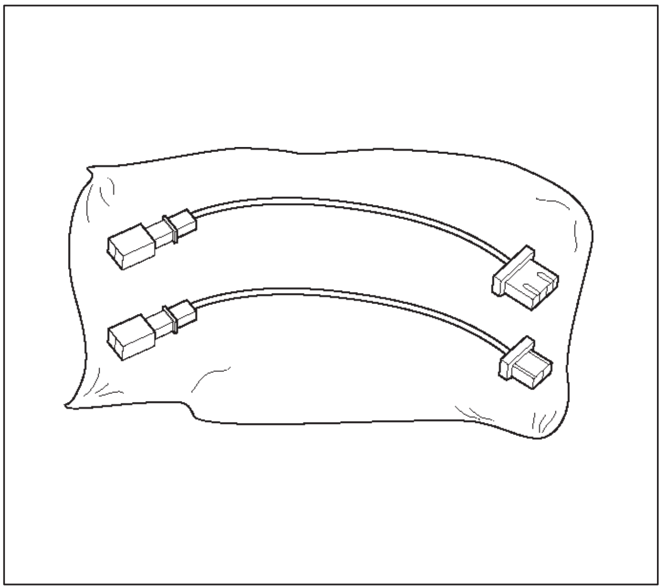
The J–42986 SRS Deployment Tool must be used for deployment of the undeployed air bag.



901RW106

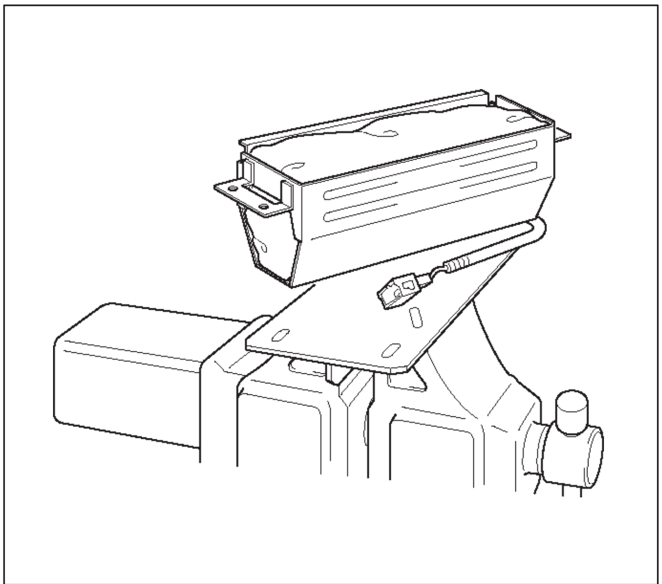
J–42987 SRS Adapter For Load Tool

The J–42987 SRS Adapter be used for connect previous load tool to new SRS system when inspect SRS system harness.


901RW107

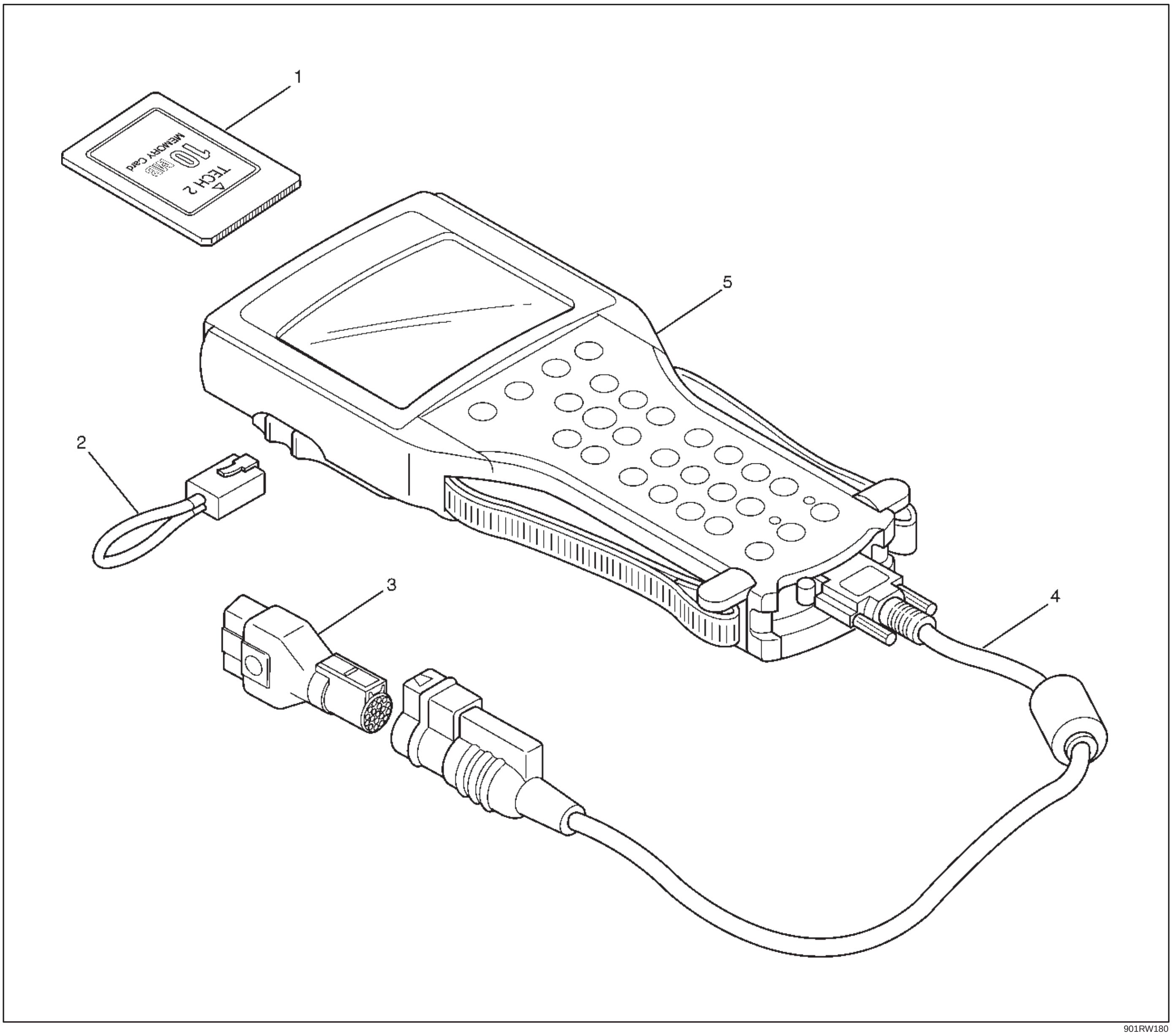
J–41497 SRS Deployment Fixture

The J–41497 SRS Deployment Fixture must be used for deployment of the undeployed passenger side air bag.


901RW088

Tech 2 Scan Tool

From 1998 RODEO (UE), dealer service departments are recommended to use Tech 2. Please refer to Tech 2 scan tool user guide.



901RW180

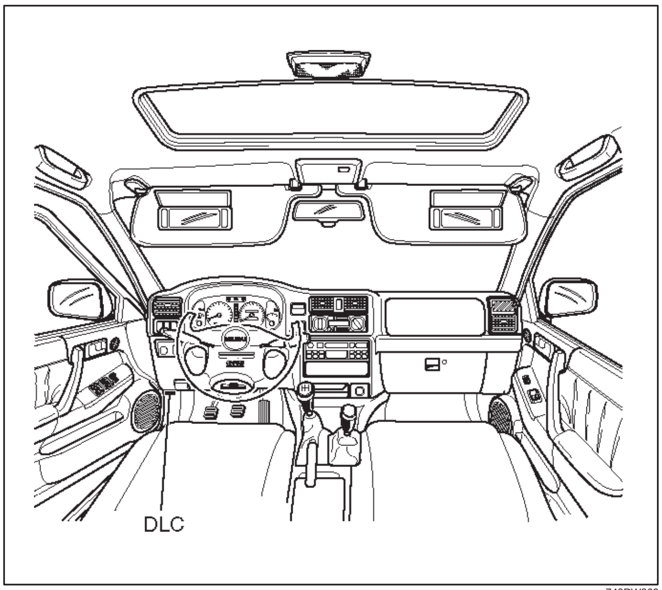
Legend

(1) PCMCIA Card
(2) RS 232 Loop Back Connector
(3) SAE 16/19 Adaptor
(4) DLC Cable
(5) Tech–2

Getting Started

- Before operating the Isuzu PCMCIA card with the Tech 2, the following steps must be performed:

1. The Isuzu 2000MY System PCMCIA card (1) inserts into the Tech 2 (5).
2. Connect the SAE 16/19 adapter (3) to the DLC cable (4).
3. Connect the DLC cable to the Tech 2 (5)
4. Make sure the vehicle ignition is off.
5. Connect the Tech 2 SAE 16/19 adapter to the vehicle DLC.



740RW060

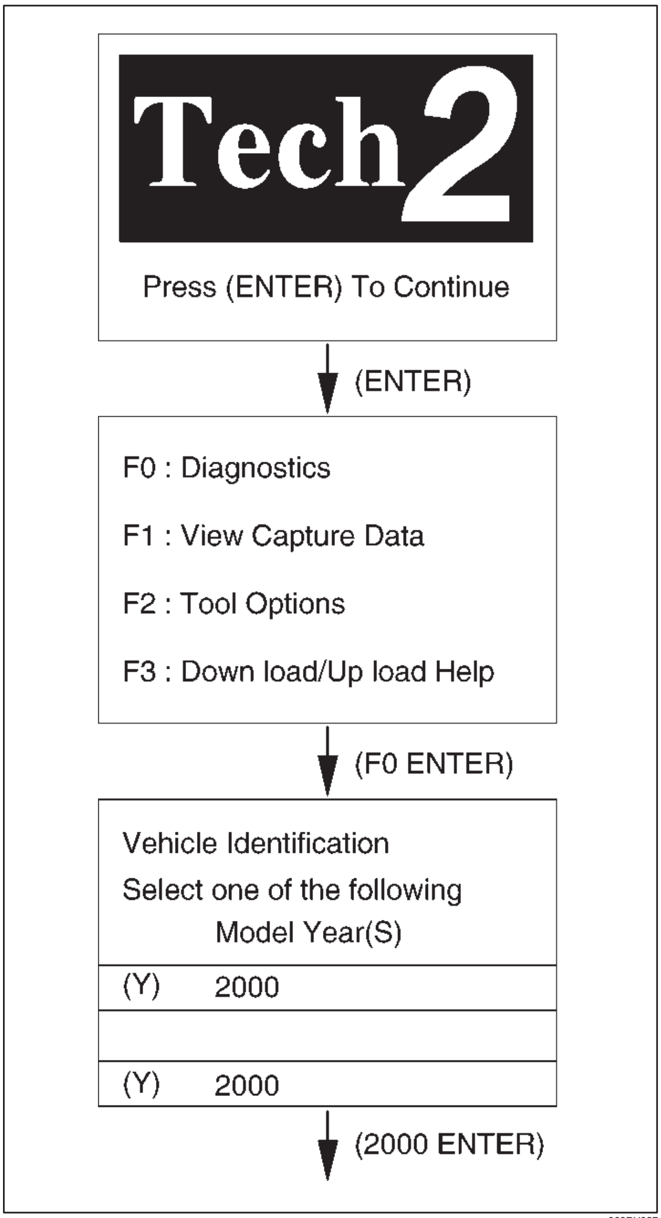
6. The vehicle ignition turns on.
7. Verify the Tech 2 power up display.

060RW009

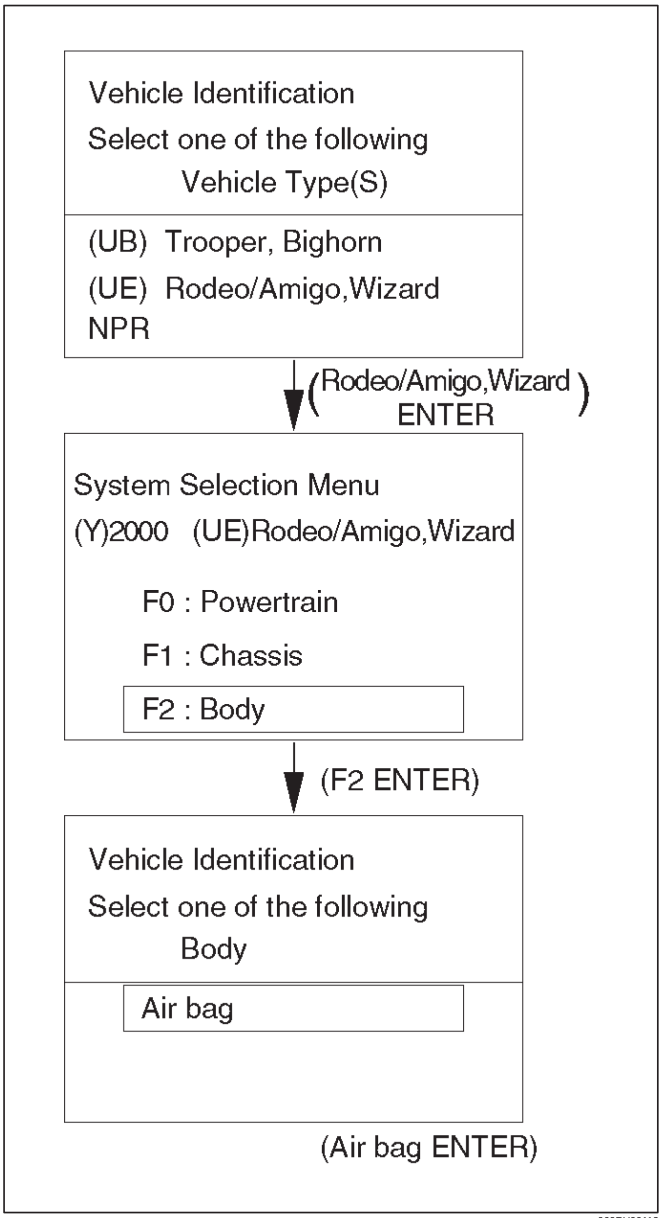
NOTE: The RS232 loop back connector is only to use for diagnosis of Tech 2 and refer to user guide of the Tech 2.

Operating Procedure

The power up screen is displayed when you power up the tester with the Isuzu systems PCMCIA card. Follow the operating procedure below.



060RY027

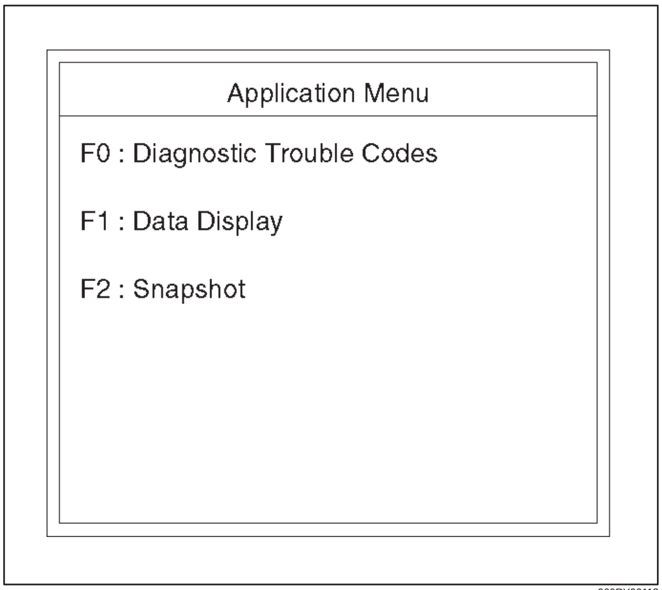


Vehicle Identification
Select one of the following
Vehicle Type(S)
(UB) Trooper, Bighorn
(UE) Rodeo/Amigo,Wizard
NPR
(Rodeo/Amigo,Wizard ENTER)
System Selection Menu
(Y)2000 (UE)Rodeo/Amigo,Wizard
F0 : Powertrain
F1 : Chassis
F2 : Body
(F2 ENTER)
Vehicle Identification
Select one of the following
Body
Air bag
(Air bag ENTER)

060RY00112

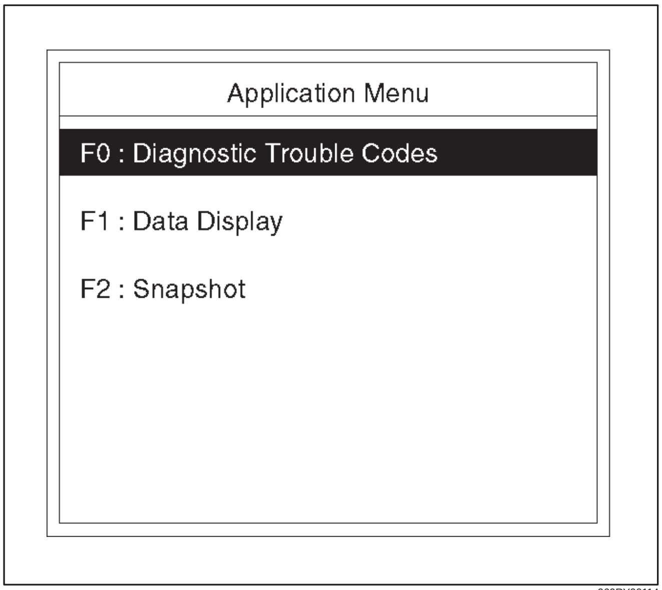
Menu

- The following table shows which functions are used for the available equipment versions.



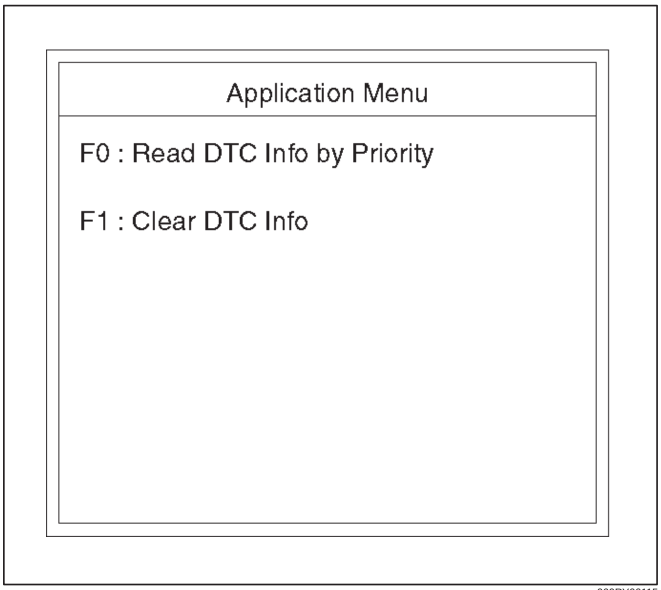
060RY00113

DTC Modes



060RY00114

- Read DTC info by Priority
- Clear Info

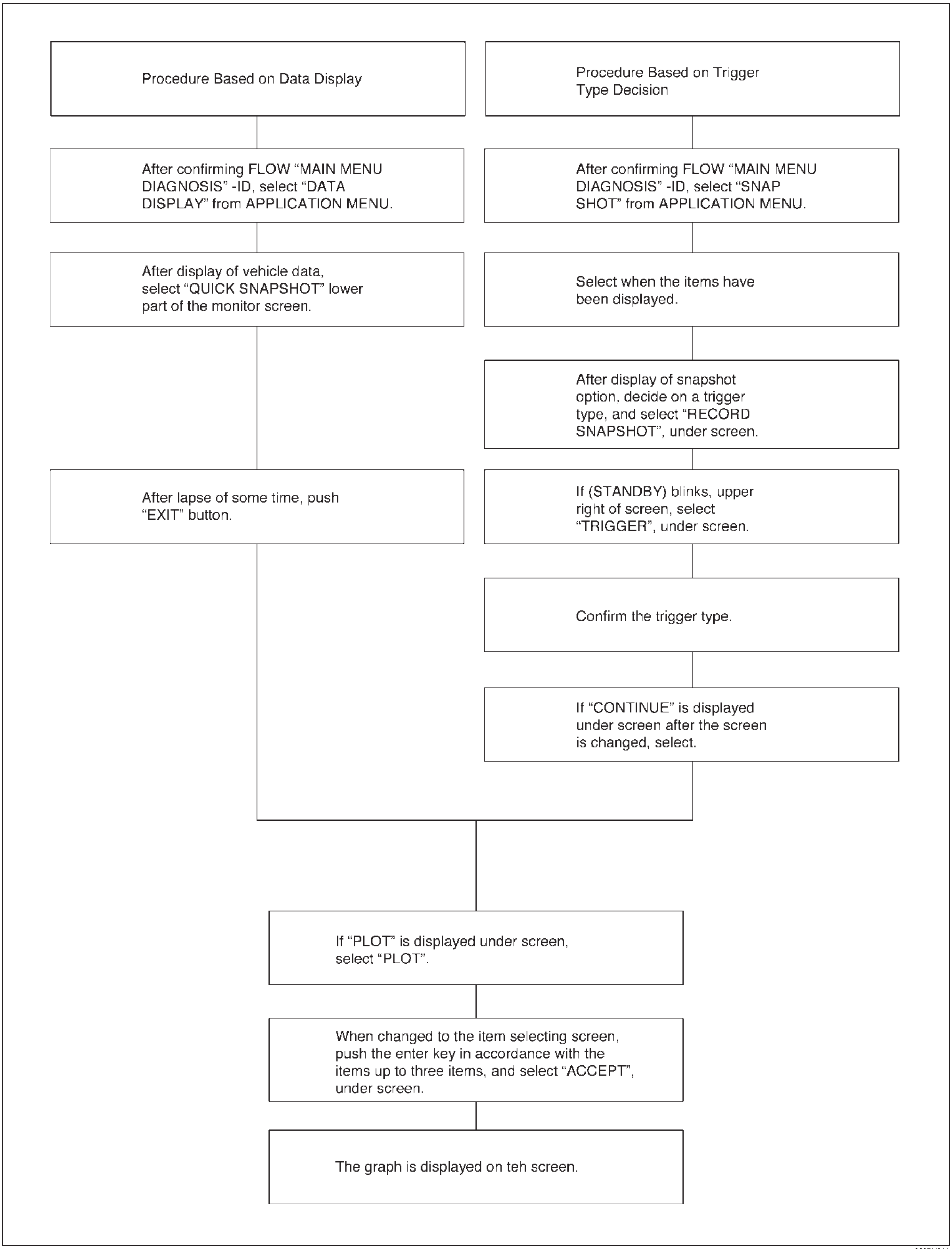


060RY00115

Plottong Snapshot Graph

This test selects several necessary items from the data list to plot graphs and makes data comparison on a long term basis. It is an effective test particularly in emission related evaluations.
For trouble diagnosis, you can collect graphic data (snap shot) directly from the vehicle.
You can replay the snapshot data as needed. Therefore, accurate diagnosis is possible, even though the vehicle is not available.

Plotting Graph Flow Chart (Plotting graph after obtaining vehicle information)



060RX041

Flow Chart for Snapshot Replay (Plotting Graph)

Press the enter-key in initial display.

↓

Select "VIEW CAPTURE DATA"

↓

If snapshot option is displayed, decide on a trigger type, and slect “REVIEW DATA” under screen.

↓

When the data triggered by vehicle is displayed, select the data.
(Plural display of data depending on the number of times of triggering.)

↓

data is displayed on the screen.
To see the graph, select “PLOT” under screen.

↓

Changed to the item selection screen, push the enter key up to three times, and select “ACCEPT” under screen.

↓

The graph is displayed on the screen.

060RX040

Service Precaution

CAUTION: When fasteners are removed, always reinstall them at the same location from which they were removed. If a fastener needs to be replaced, use the correct part number fastener for that application. If the correct part number fastener is not available, a fastener of equal size and strength (or stronger) may be used. Fasteners that are not reused, and those requiring thread locking compound will be called out. The correct torque value must be used when installing fasteners that require it. if the above conditions are not followed, parts or system damage could result.

WARNING: WHEN PERFORMING SERVICE ON OR AROUND SRS COMPONENTS OR SRS WIRING, FOLLOW THE PROCEDURES LISTED BELOW TO TEMPORARILY DISABLE THE SRS. FAILURE TO FOLLOW PROCEDURES COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY OR OTHERWISE UNNEEDED SRS REPAIRS.

The SDM in Driver–Passenger SRS can maintain sufficient voltage to cause a deployment for up to 15 seconds after the ignition switch is turned "OFF," the battery is disconnected, or the fuse powering the SDM is removed.

Many of the service procedures require removal of the "SRS–1" fuse, and disconnection of the air bag assembly from the deployment loop to avoid an accidental deployment. If the air bag assembly is disconnected from the deployment loop as noted in the "Disabling the SRS" procedure that follows, service can begin immediately without waiting for the 15 second time period to expire.

Disabling The SRS

Removal

Turn the ignition switch to "OFF" and turn the steering wheel so that the vehicle's wheels are pointing straight ahead.

1. Remove SRS fuse SRS–1, from left dash side lower fuse block or disconnect battery.
2. Disconnect yellow 2–pin connector at the base of steering column.
3. Remove glove box assembly; Refer to "Passenger Air Bag Assembly Replacement" in this section.
4. Disconnect passenger air bag assembly yellow 2–pin connector behind the glove box assembly.

CAUTION: With the "SRS–2" fuse removed and ignition switch "ON," the "AIR BAG" warning lamp will be "ON." This is normal operation and does not indicate an SRS malfunction.

Enabling The SRS

Installation

Turn ignition switch to "LOCK" and remove key.

1. Connect yellow 2–pin connector passenger air bag assembly.
2. Install glove box assembly, Refer to "Passenger Air Bag Assembly Replacement" in this section.
3. Connect yellow 2–pin connector at the base of the steering column.
4. Install "AIR BAG" fuse SRS–1 to left dash side lower fuse block or connect battery.

Turn ignition switch to "ON" and verify that the "AIR BAG" warning lamp flashes seven times and then turns "OFF" If it does not operate as described, perform the "SRS Diagnostic System Check" in section 9J–2.

Handling / Installation / Diagnosis

1. Air bag assembly should not be subjected to temperatures above 65˚C (150˚F).
2. Air bag assembly, and SDM should not be used if they have been dropped from a height of 100 centimeters (3.28 feet) or more.
3. When a SDM is replaced, it must be oriented with the arrow on the SDM pointing toward the front of the vehicle. It is very important for the SDM to be located flat on the mounting surface, parallel to the vehicle datum line. It is important that the SDM mounting surface is free of any dirt or other foreign material.
4. Do not apply power to the SRS unless all components are connected or a diagnostic chart requests it, as this will set a diagnostic trouble code.
5. The "SRS Diagnostic System Check" must be the starting point of any SRS diagnostics. The "SRS Diagnostic System Check" will verify proper "AIR BAG" warning lamp operation and will lead you to the correct chart to diagnose any SRS malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis, and incorrect parts replacements.

Inspections Required After An Accident

CAUTION: Certain SRS components must be replaced after a frontal crash involving air bag deployment.

In all types of accidents regardless of "Air Bag" deployment, visually inspect all of the following components and replace as required:

— Driver air bag assembly
— Passenger air bag assembly
— Steering wheel
— SRS coil assembly
— Steering column
— Knee bolster and instrument panel mounting attachments
— Driver seat and belt
— Passenger seat and belt
— SDM

SDM always should be checked according to "SDM Replacement Guidelines".

CAUTION: Refer to "SDM replacement Guidelines" below for important information on SDM replacement in both deployment and non–deployment crashes.

Inspect SRS coil assembly wiring and steering wheel for any signs of scorching, meting, or damage due to excessive heat. If coil assembly wire or steering wheel is damaged, replace them. The steering column and wheel must be dimensionally checked to determine if they are damaged. Refer to in this Section 9J–3 of this manual.

Never use SRS parts from another vehicle. This does not include remanufactured parts purchased from an authorized Retailer; they may be used for SRS repairs.

Do not attempt to repair the SDM, the SRS harness, the SRS coil assembly, the air bag assembly, the steering wheel, or the steering column. Service of these items is replacement only. Verify replacement part numbers.

CAUTION: Proper operation of the SDM and Supplemental Restraint System (SRS) requires that any repairs to the vehicle structure return it to its original production configuration.

Sensing and Diagnostic Module (SDM)

Service Precautions

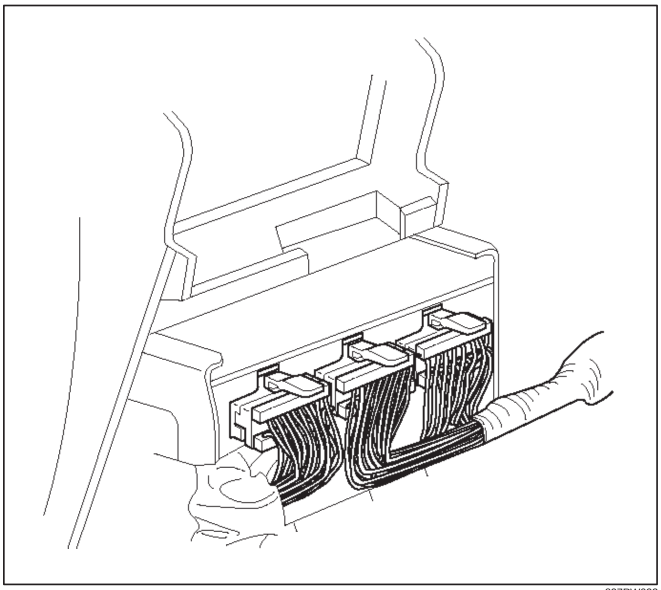
WARNING: DURING SERVICE PROCEDURES, BE VERY CAREFUL WHEN HANDLING SDM. NEVER STRIKE OR JAR SDM. UNDER SOME CIRCUMSTANCES, IT COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY OR IMPROPER OPERATION OF THE SUPPLEMENTAL RESTRAINT SYSTEM (SRS). SDM MOUNTING BRACKET BOLTS MUST BE CAREFULLY TORQUED TO ASSURE PROPER OPERATION. NEVER POWER UP THE SRS WHEN SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

WARNING: PROPER OPERATION OF THE SENSING AND DIAGNOSTIC MODULE (SDM) REQUIRES THE SDM TO BE RIGIDLY ATTACHED TO THE VEHICLE STRUCTURE AND THAT THE ARROW ON THE SENSOR BE POINTING TOWARD THE FRONT OF THE VEHICLE.

SDM is specifically calibrated and is keyed to the SDM location SRS wiring harness. Caution should be used to ensure proper location of the SDM. The keying of the SDM to its location and wiring harness connectors should never be modified in the field.

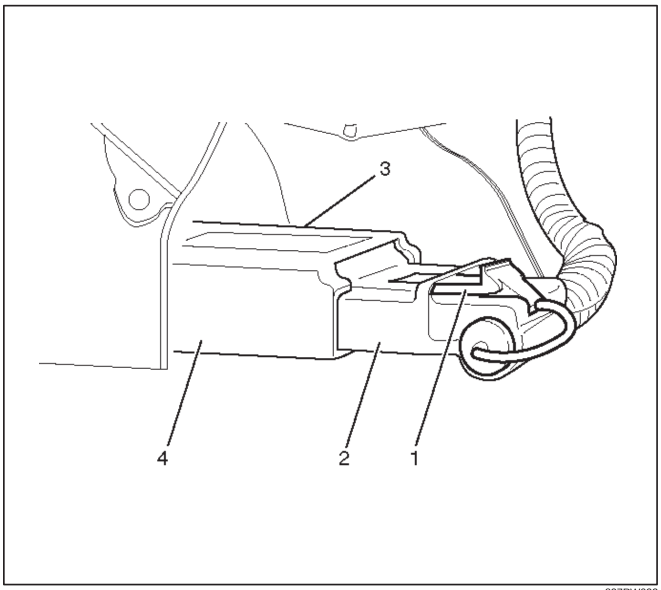
Removal

1. Disable the SRS. (Refer to “Disable the SRS” in this manual)
2. Remove dressing panel around the radio and disconnect cigar lighter harness.
3. Remove the transfer sift lever knob.
4. Remove the center console.
5. Remove three connector from PCM.
6. Remove PCM with bracket.(Fixed four bolts)
7. Remove right side stay between instrument panel and floor.
8. Remove driver and passenger seat.
9. Turn over carpet to rear side.
10. Remove air conditioning duct for rear seat. (Transform the duct during removing it)



827RW023

11. Pull CPA (1) (Connector Position Assurance–red color) out and push connector lock down to disconnect the SDM harness connector (2).
12. Remove the three SDM fixing bolts (4) and remove SDM (3).



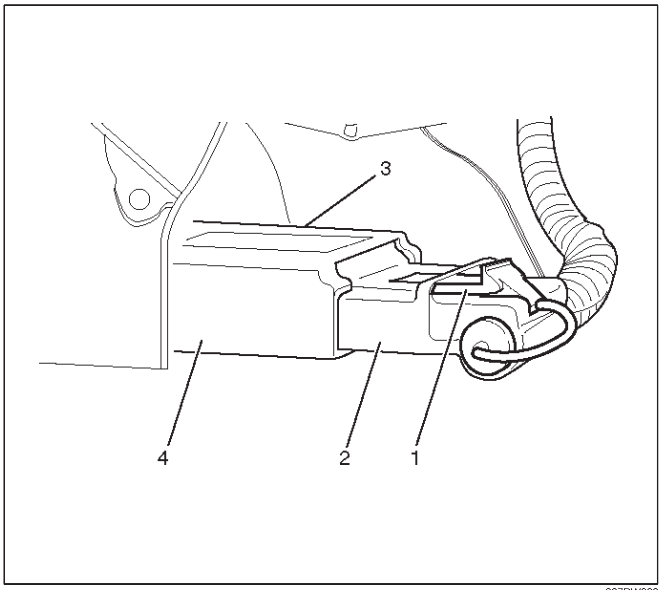
827RW022

Installation

1. Install the SDM (3) on bracket and fixing bolts (4) and tighten the fixing bolts to the specified torque.

Torque: 10 N·m ± 3 N·m (87 lb in ± 26 lb in)

2. Connect the SDM harness connector (2) and after that, put CPA into connector (1).



827RW022

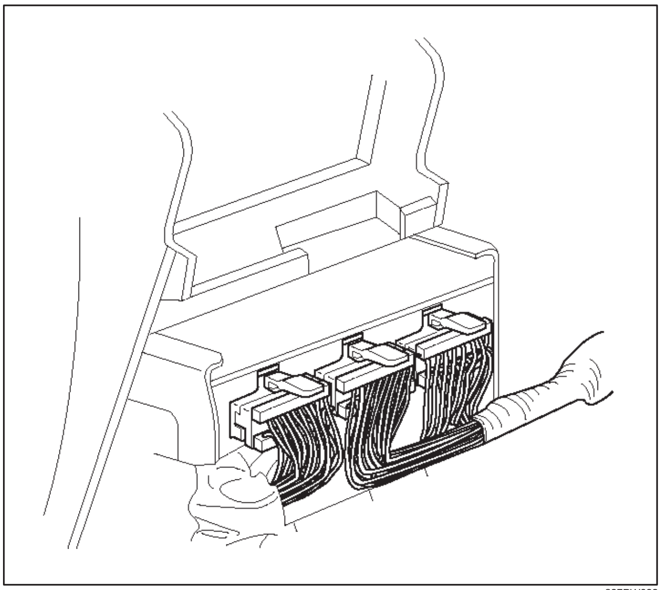
3. Install air conditioning duct for rear seat to normal position.
4. Return carpet normal position.
5. Install right side stay between instrument panel and floor, tighten to the specified torque.

Torque: 10 N·m ± 3 N·m (87 lb in ± 26 lb in)

6. Install PCM with bracket and tighten to the specified torque.

Torque: 10 N·m ± 3 N·m (87 lb in ± 26 lb in)

7. Reconnect three connector to PCM.
8. Install the center console.
9. Install the transfer shift lever knob.
10. Install the dressing panel around the radio and reconnect cigar lighter harness.
11. Enable the SRS. (Refer to “Enabling the SRS” in this manual)


827RW023

Driver Air Bag Assembly

Service Precautions

WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

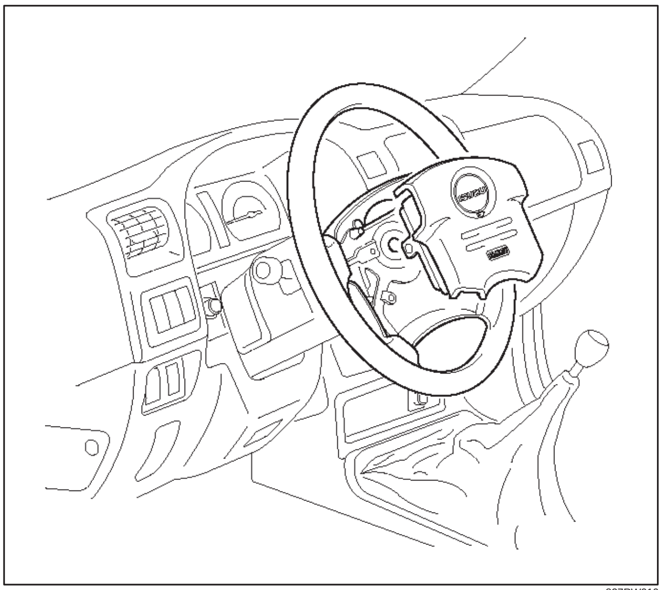
WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

Removal

1. Disable the SRS. (Refer to “Disabling the SRS” in this section.)
2. Remove air bag assembly from steering wheel by removing two bolts. Lift air bag assembly out of steering wheel.

3. Disconnect connector and remove air bag assembly.



827RW010

Installation

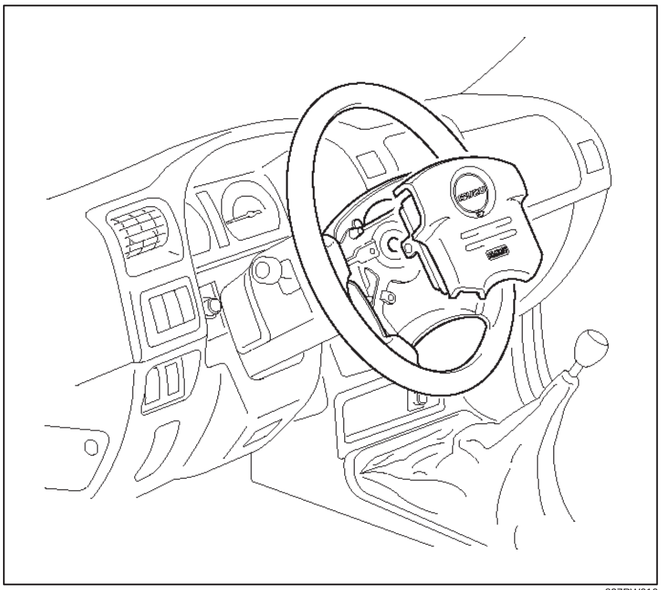
1. Connect air bag to wiring harness connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.

2. Install air bag into steering wheel and tighten bolts to specified sequence as shown in figure.

Torque: 8.8 N·m (78 lb in)

CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.
The air bag assembly has identification colors on the bar code label from ’00 model as follows.
Light blue color for driver air bag assembly.
Light blue color for passenger air bag assembly.
Use only the air bag assembly for “UE”.



827RW010

3. Enable the SRS. (Refer to “Enabling the SRS” in this section.)

Steering Wheel

Service Precautions

WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

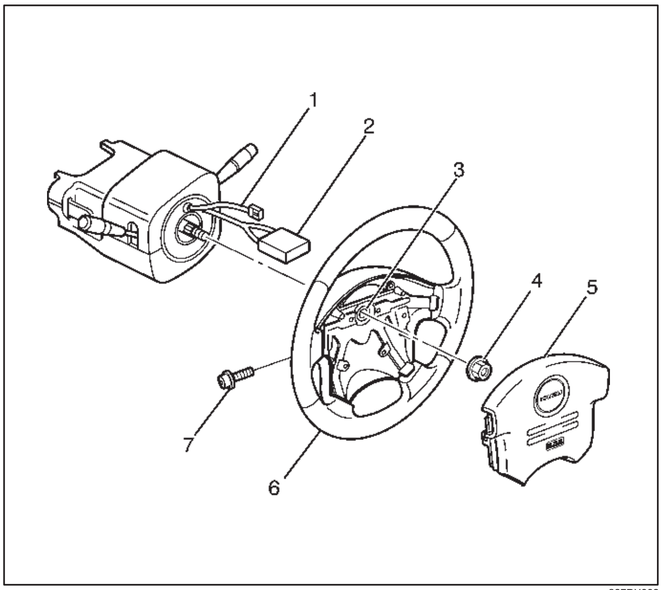
NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

Removal

1. Disable the SRS. (Refer to “Disabling the SRS” in this section.)
2. Remove the air bag assembly (5) from steering wheel (6) by removing two bolts (7). Lift air bag assembly out of steering wheel.
3. Disconnect connector (2) and remove air bag assembly.
4. Disconnect horn lead (1)
5. Remove steering wheel attachment nut (4).

6. Move the tires to the straight ahead position before removing the steering wheel. Install steering wheel puller onto steering wheel and remove steering wheel with J–29752.
7. Apply a setting mark (3) across the steering wheel and shaft so parts can be reassembled in their original position.
8. Feed wiring through the wheel and remove wheel.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



827RX002

Installation

1. Install the steering wheel and align the setting marks (3).
2. Tighten the steering wheel fixing nut (4) to the specified torque.

   Torque: 34 N·m (25 lb ft)
3. Connect horn lead (1).
4. Connect air bag to wiring harness connector (2).

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.

5. Install air bag into steering wheel and tighten bolts (7) to specified sequence as show in figure.

   Torque: 8.8 N·m (78 lb in)

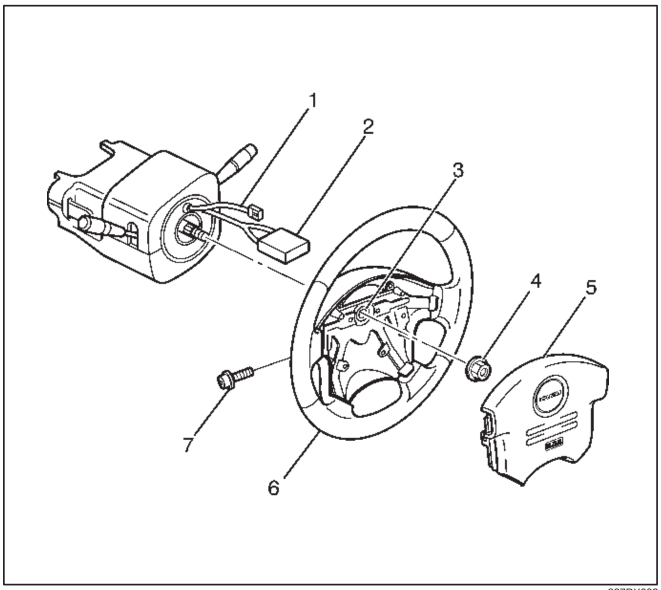
CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label from ’00 model as follows.

Light blue color for driver air bag assembly.

Light blue color for passenger air bag assembly.

Use only the air bag assembly for “UE”.



827RX002

6. Enable the SRS. (Refer to “Enabling The SRS” in this section.)

SRS Coil Assembly

Service Precaution

WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

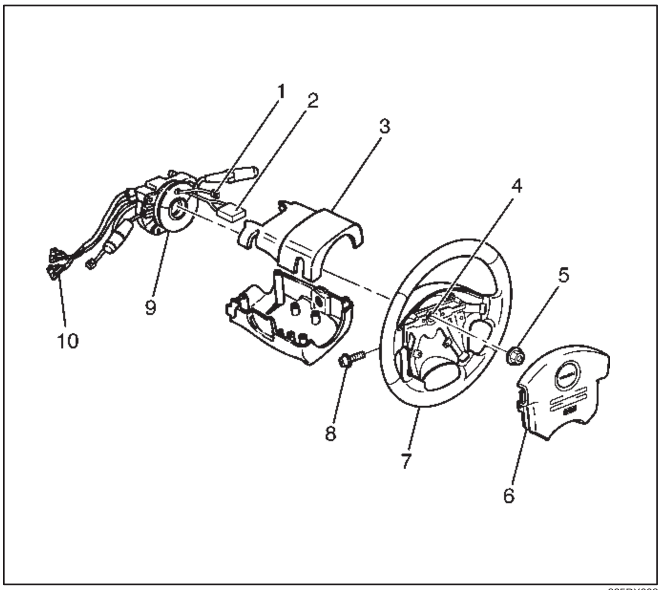
Removal

1. Disable the SRS. (Refer to “Disabling the SRS” in this section.)
2. Remove the air bag assembly (6) from steering wheel (7) by removing two bolts (8). Lift air bag assembly out of steering wheel.
3. Disconnect the 2–pin yellow connector (2) and remove air bag assembly.
4. Disconnect horn lead connector (1).
5. Remove the steering wheel attachment nut (5).
6. Move the tires to the straight ahead position before removing the steering wheel and remove wheel with J–29752.
7. Apply a setting mark (4) across the steering wheel and shaft so parts can be reassembled in their original position.
8. Feed wiring though the wheel and remove wheel.
9. Remove the steering lower cover.
10. Remove the driver knee bolster assembly.
11. Remove the steering column cover (3).
12. Disconnect the wiring harness connectors (10) located at the base of steering column.

CAUTION: Never apply force to the steering wheel in the direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

13. Remove the combination switch assembly with SRS coil (9).

NOTE: SRS coil is a part of combination switch assembly, which cannot be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.



825RX008

Installation

1. Install the combination switch assembly with SRS coil (9).
2. Connect the wiring harness connectors (10) located at the base of steering column.
3. Turn the SRS coil clockwise to full, return about 3 turns and align the neutral mark.

NOTE: Whenever installing the new combination switch with SRS coil, be sure to tear off the lock pin for aligning the neutral position before it is installed to the base of steering column.

CAUTION: When turning the SRS coil clockwise to full, stop turning if resistance is felt. Forced further turning may damage the cable in the SRS coil.

4. Install the steering column cover (3).

CAUTION: When installing the steering column cover, be sure to through each harness as illustrated so that the harnesses starter switch, combination switch and SRS coil may not catch wiring.

5. Install the driver knee bolster assembly.
6. Install the steering lower cover.

7. Install the steering wheel and align the setting marks (4).
8. Tighten the steering wheel fixing nut (5) to the specified torque.

Torque: 34 N·m (25 lb ft)

9. Connect horn lead (1).
10. Connect air bag to wiring harness connector (2).

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.

11. Install Air Bag (6) into steering wheel and tighten bolts (8) to specified sequence as figure.

Torque: 8.8 N·m (78 lb in)

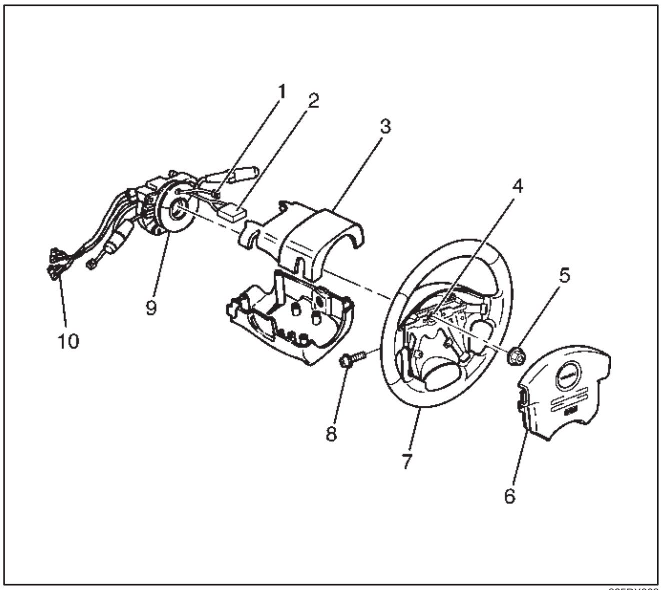
CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label from '00 model as follows.

Light blue color for driver air bag assembly.

Light blue color for passenger air bag assembly.

Use only the air bag assembly for "UE".



825RX008

12. Enable the SRS. (Refer to "Enabling The SRS" in this section.)

Steering Column

Service Precaution

WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

Removal

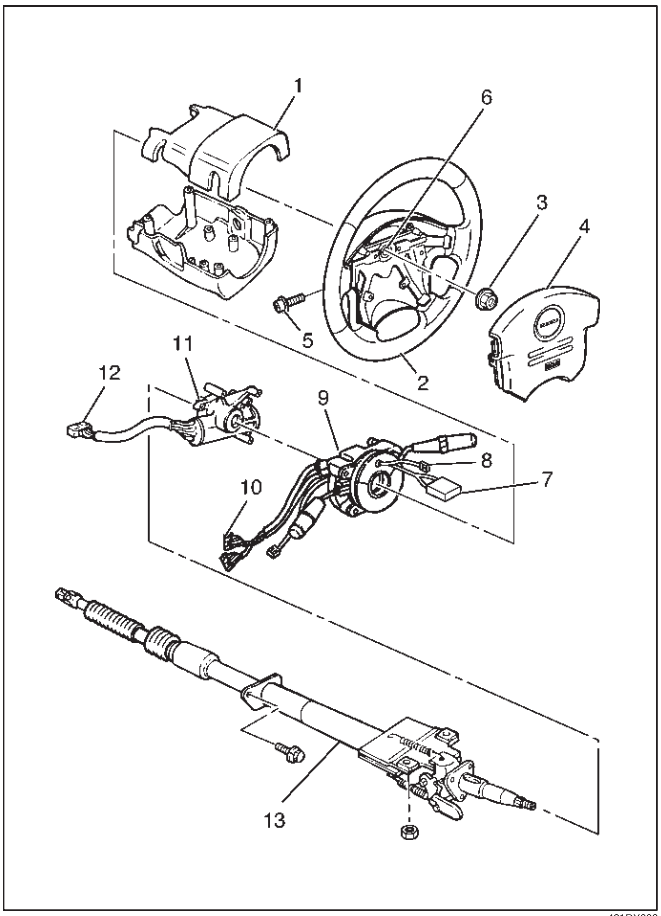
1. Disable the SRS. (Refer to “Disabling The SRS” in this section.)
2. Remove the air bag assembly (4) from steering wheel (2) by removing two bolts (5). Lift air bag assembly out of steering wheel.
3. Disconnect the 2–pin yellow connector (7) and remove air bag assembly.
4. Disconnect horn lead connector (8).
5. Remove the steering wheel attachment nut (3).
6. Move the tires to the straight ahead position before removing the steering wheel and removing wheel with J–29752.
7. Apply a setting mark (6) across the steering wheel and shaft so parts can be reassembled in their original position.
8. Feed wiring though the wheel and remove wheel.
9. Remove the steering lower cover.
10. Remove the driver knee bolster assembly.
11. Remove the steering column cover (1).
12. Disconnect the wiring harness connectors (10) located at the base of steering column.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

13. Remove the combination switch assembly with SRS coil (9).

NOTE: SRS coil is a part of combination switch assembly, which cannot be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.

14. Remove the snap ring.
15. Remove the cushion rubber.
16. Disconnect shift lock cable (A/T only)
17. Disconnect the starter switch harness connector (12) located base of steering column.
18. Remove steering lock cylinder assembly (11).
19. Apply a setting mark across the universal joint and steering shaft to reassemble the parts in their original position.
20. Remove steering column assembly (13).



431RX002

Installation

1. Install the steering column assembly (13) and align the setting marks on the universal joint and steering shaft made during removal.
2. Tighten the steering column fixing bolts (dash panel side) to the specified torque.

   Torque: 20 N·m (14 lb ft)
3. Tighten the steering column fixing nuts (Cross beam) to the specified torque.

   Torque: 20 N·m (14 lb ft)
4. Tighten the universal joint to the specified torque.

   Torque: 31 N·m (23 lb ft)
5. Install steering lock cylinder assembly (11).
6. Connect shift lock cable (For A/T)
7. Install cushion rubber.
8. Install snap ring.
9. Install the combination switch assembly with SRS coil (9).
10. Connect the wiring harness connector (10) located on the base of steering column.
11. Turn the SRS coil clockwise to full, return about 3 turns and align the neutral mark.

CAUTION: When turning the SRS coil clockwise to full, stop turning if resistance is felt. Further forced turning may damage the cable in the SRS coil.

12. Install steering column cover (1).

CAUTION: When installing the steering column cover, be sure to wire (through each harness) as illustrated so that the harnesses starter switch, combination switch and SRS coil may not catch wiring.

13. Install the steering wheel (2) and align the setting marks (6).
14. Tighten the steering wheel fixing nut (3) to the specified torque.

   Torque: 34 N·m (25 lb ft)
15. Connect horn lead (8).
16. Connect air Bag wiring harness connector (7).

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of air bag to prevent lead wire from being pinched.

17. Install air bag into steering wheel and tighten bolts (5) to specified sequence as shown in figure.

   Torque: 8.8 N·m (78 lb in)

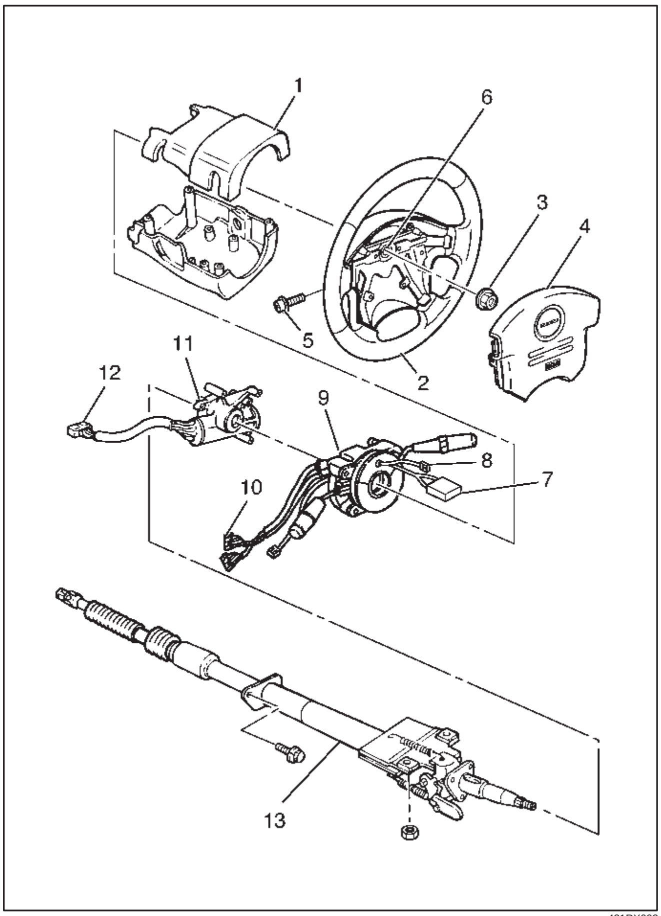
CAUTION: Never use the air bag assembly from another vehicle and difference model year air bag assembly.

The air bag assembly has identification colors on the bar code label from ’00 model as follows.

Light blue color for driver air bag assembly.

Light blue color for passenger air bag assembly.

Use only the air bag assembly for “UE”.



431RX002

18. Enable the SRS (Refer to “Enabling The SRS” in this section.)

Passenger Air Bag Assembly

Service Precaution

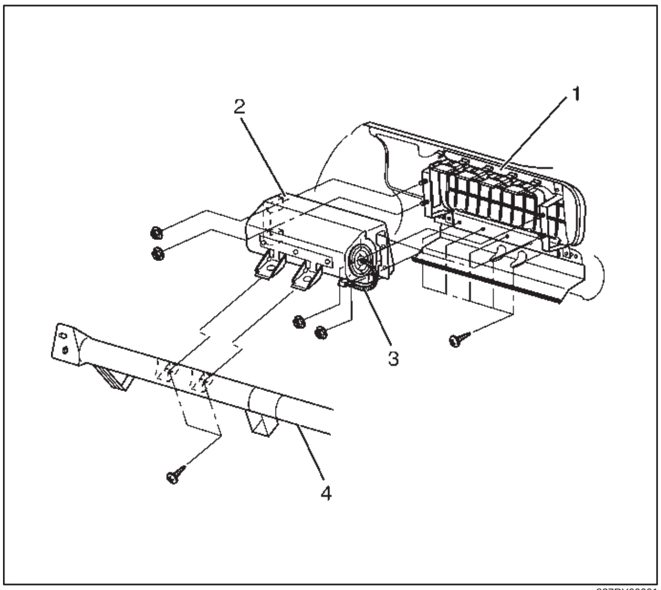
WARNING: SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY. AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY–PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WARNING: WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE. NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

NOTE: In the event deployment has occurred, inspect coil assembly wire for any signs of scorching, melting or any other damage due to excessive heat. If the coil has been damaged, replace it.

Removal

1. Disable the SRS. (Refer to “Disabling the SRS” in this section.)
2. Remove glove box assembly.
3. Disconnect passenger air bag assembly harness connector.
4. Remove air bag assembly fixing bolts and nuts.
5. Remove passenger air bag assembly from glove box opening of instrument panel.



Legend
(1) Passenger Air Bag Door
(2) Passenger Air Bag Assembly
(3) Passenger Air Bag Harness
(4) Cross Beam

Installation

1. Install passenger air bag assembly from glove box opening of instrument panel.
2. Install air bag assembly fixing nuts and bolts, and tighten to specified torque.

Torque: 7.8 N·m (69 lb in)

3. Connect air bag assembly harness connector.
4. Install glove box assembly.
5. Enable the SRS (Refer to “Enabling the SRS” in this section.)

RODEO

RESTRAINTS

SRS CONTROL SYSTEM

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Diagnostic Information

Diagnostic Procedures

WARNING: WHEN FASTENERS ARE REMOVED, ALWAYS REINSTALL THEN AT THE SAME LOCATION FROM WHICH THEY WERE REMOVED. IF A FASTENER NEEDS TO BE REPLACED, USE THE CORRECT PART NUMBER FASTENER FOR THAT APPLICATION. IF THE CORRECT PART NUMBER FASTENER IS NOT AVAILABLE, A FASTENER OF EQUAL SIZE AND STRENGTH (OR STRONGER) MAY BE USED. FASTENERS THAT ARE NOT REUSED, AND THOSE REQUIRING THREAD LOCKING COMPOUND WILL BE CALLED OUT. THE CORRECT TORQUE VALUE MUST BE USED WHEN INSTALLING FASTENERS THAT REQUIRE IT. IF THE ABOVE CONDITIONS ARE NOT FOLLOWED, PARTS OR SYSTEM DAMAGE COULD RESULT.

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS, DO NOT USE ELECTRICAL TEST EQUIPMENT SUCH AS A BATTERY–POWERED OR AC–POWERED VOLTMETER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN THAT SPECIFIED IN THIS MANUAL. DO NOT USE A NONPOWERED, PROBE–TYPE TESTER. INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

The diagnostic procedures used in this section are designed to aid in finding and repairing SRS problems. Outlined below are the steps to find and repair SRS problems quickly and effectively. Failure to carefully follow these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts Replacement.

1. **Perform The "SRS Diagnostic System Check."**

The "SRS Diagnostic System Check" should always be the starting point of any SRS diagnostics. The "SRS Diagnostic System Check" checks for proper "AIR BAG" warning lamp operation and checks for SRS trouble codes using both "Flash Code" and "Scan Tool" Methods.

2. **Refer To The Proper Diagnostic Chart As Directed By The "SRS Diagnostic System Check."**

The "SRS Diagnostic System Check" will lead you to the correct chart to diagnose any SRS problems. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts Replacement.

3. **Repeat the "SRS Diagnostic System Check" After Any Repair Or Diagnostic Procedures Have Been Performed.**

Performing the "SRS Diagnostic System Check" after all repair or diagnostic procedures will assure that the repair has been made correctly and that no other conditions exist.

Diagnostic Codes

The Sensing and Diagnostic Module (SDM) maintains a history record of all diagnostic codes that have been detected since the SRS codes were last cleared during service.

1. Active Codes—Faults that are presently detected this ignition cycle. Active codes are stored in RAM (Random Access Memory).
2. History Codes—All faults detected since the last time the history fault memory was cleared. History codes are stored in EEPROM. (Electronically Erasable Programmable Read only Memory)

How To Read Trouble Codes

All codes (Active and history) can be read (or cleared) by using a scan tool or equivalent.
If a DTC is not available, have the vehicle serviced by dealer.

How To Clear Trouble Codes

Trouble codes can only be cleared by using a scan tool. If a scan tool is not available then inform the owner of the stored codes and suggest that the codes are cleared upon the next visit to a dealership.

Scan Tool Diagnostics

A scan tool can be used to read current and history codes and to clear all history codes after a repair is complete. The scan tool must be updated to communicate with the SRS through a replaceable cartridge for SRS diagnostics. To use the scan tool, connect it to the DLC and turn the ignition switch "ON". Then follow the manufacturer's directions for communication with the SRS. The scan tool reads serial data from the SDM "Serial Data" output (terminal 24) to the DLC.

Basic Knowledge Required

Before using this section of the Service Manual, there is some basic knowledge which will be required. Without this knowledge, you will have trouble using the diagnostic procedures in this section. Use care to prevent harm or unwanted deployment. Read all cautions in the service manual and on warning labels attached to SRS components.

Basic Electrical Circuits

You should understand the basic theory of electricity including series and parallel circuits, and understand the voltage drops across series resistors. You should know the meaning of voltage (volts), current (amps), and resistance (ohms). You should understand what happens in a circuit with an open or a shorted wire. You should be able to read and understand a wiring diagram.

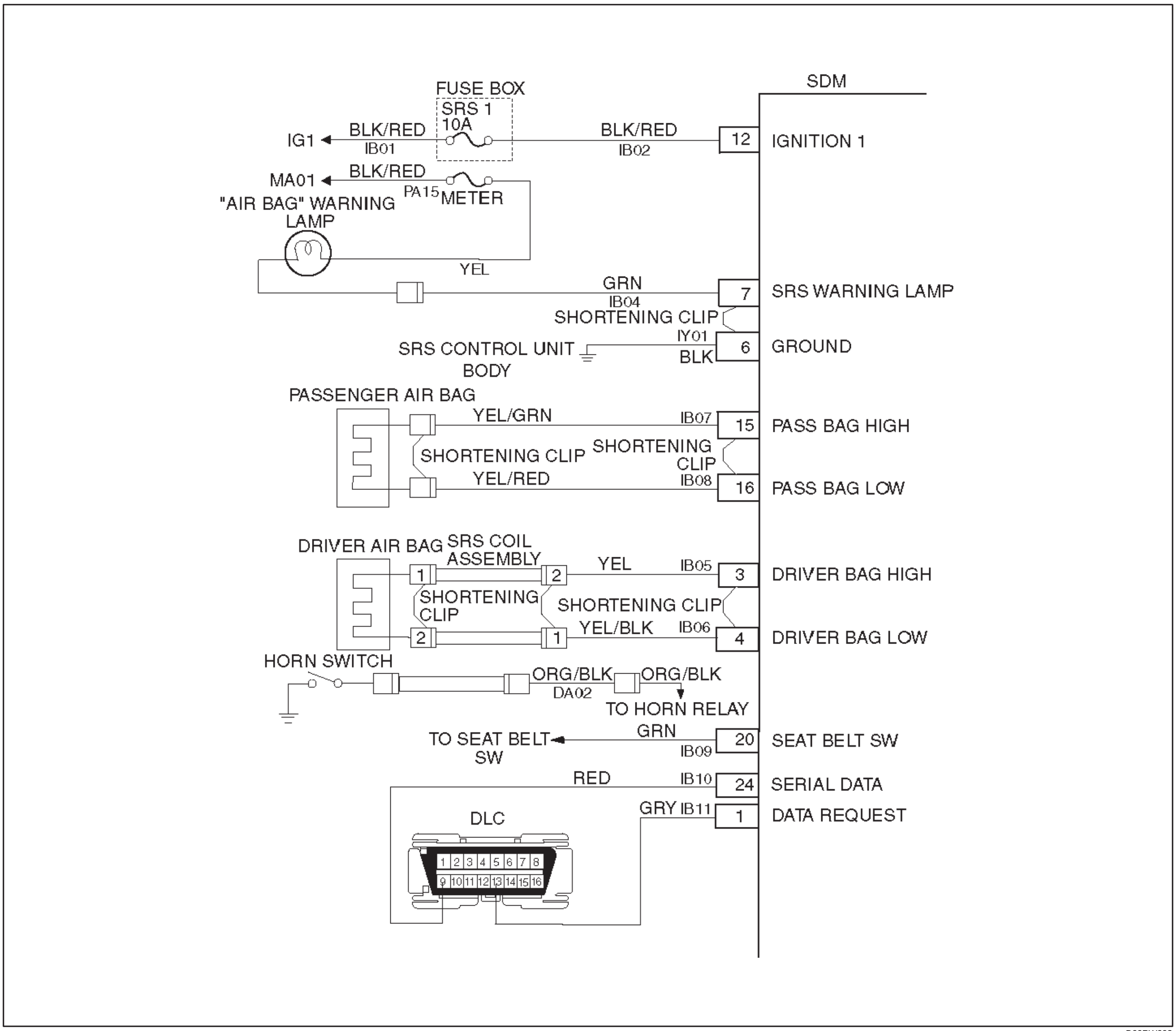
"Flash Code" Diagnostics

Flash code diagnostics can be used to read current codes and to determine if history codes are present but cannot be used to clear codes or read history codes. Flash code diagnostics is enabled by grounding by terminal 13 shorting to terminal 4 of the DLC with the ignition switch "ON". Grounding terminal 13 of the DLC pulls the "Diagnostics Request" input (Terminal 1) of the SDM low and signals the SDM to enter the flash code diagnostic display mode.

The SDM displays the trouble codes by flashing the warning lamp. Each code that is displayed will consist of a number of flashes which represents the tens digit, a 1.2 second pause, following by a number of flashes which represents the ones digit of the code. Each code is displayed one time before moving on to the next code. After all of the codes have been displayed, the entire code sequence will continually by repeated until ground is removed from terminal 13 of the DLC.

Two special codes exist when reading in the flash code mode (Flash Code 12 and Flash Code 13). "Flash Code 12" will always be the first code displayed when the flash code mode is enabled Code 12 is not an indication of a SRS problem but an indication that the flash code mode has been enabled. If there are no current or history codes present, the SDM will display code 12 until ground is removed from the DLC at terminal 13. "Flash Code 13" will be displayed if there are history codes. To read the history codes, a scan tool must be used.

System Schematic



D09RW002

SRS Diagnostic System Check

The diagnostic procedures used in this section are designed to find and repair SRS malfunctions. To get the best results, it is important to use the diagnostic charts and follow the sequence listed below:

A. Perform the "SRS Diagnostic System Check."

The "SRS Diagnostic System Check" must be the starting point of any SRS diagnostics. The "SRS Diagnostic System Check" checks for proper "AIR BAG" warning lamp operation, the ability of the SDM to communicate through the "Serial Data" line and whether SRS diagnostic trouble codes exist.

B. Refer to the proper diagnostic chart as directed by the "SRS Diagnostic System Check."

The "SRS Diagnostic System Check" will lead you to the correct chart to diagnose any SRS malfunctions. Bypassing these procedures may result in extended diagnostic time, incorrect diagnosis and incorrect parts replacement.

C. Repeat the "SRS Diagnostic System Check" after any repair or diagnostic procedures have been performed.

Performing the "SRS Diagnostic System Check" after all repair or diagnostic procedures will ensure that the repair has been made correctly and that no other malfunctions exist

Circuit Description

When the ignition switch is first turned "ON", "ignition 1" voltage is applied from the "SRS–1" fuse to the SDM at the "ignition 1" input terminals "12". The SDM responds by flashing the "AIR BAG" warning lamp seven times while performing tests on the SRS.

Notes On System Check Chart:

Number(s) below refer to step number(s) on the "SRS Diagnostic System Check" chart.

1. The "AIR BAG" warning lamp should flash seven times after ignition is first turned "ON."
2. After the "AIR BAG" warning lamp flashes seven times, it should turn "OFF."
3. Improper operation of the "AIR BAG" warning lamp is indicated. This test differentiates a warning lamp stays "ON" condition from a warning lamp does not come "ON" condition.
4. This test checks for the proper operation of the "Serial Data" line. This test will also determine whether history diagnostic trouble codes are stored and, if so, identify them.
5. This test checks for proper operation of the "Serial Data" line. This test will also identify the stored diagnostic trouble codes and whether they are current or history.

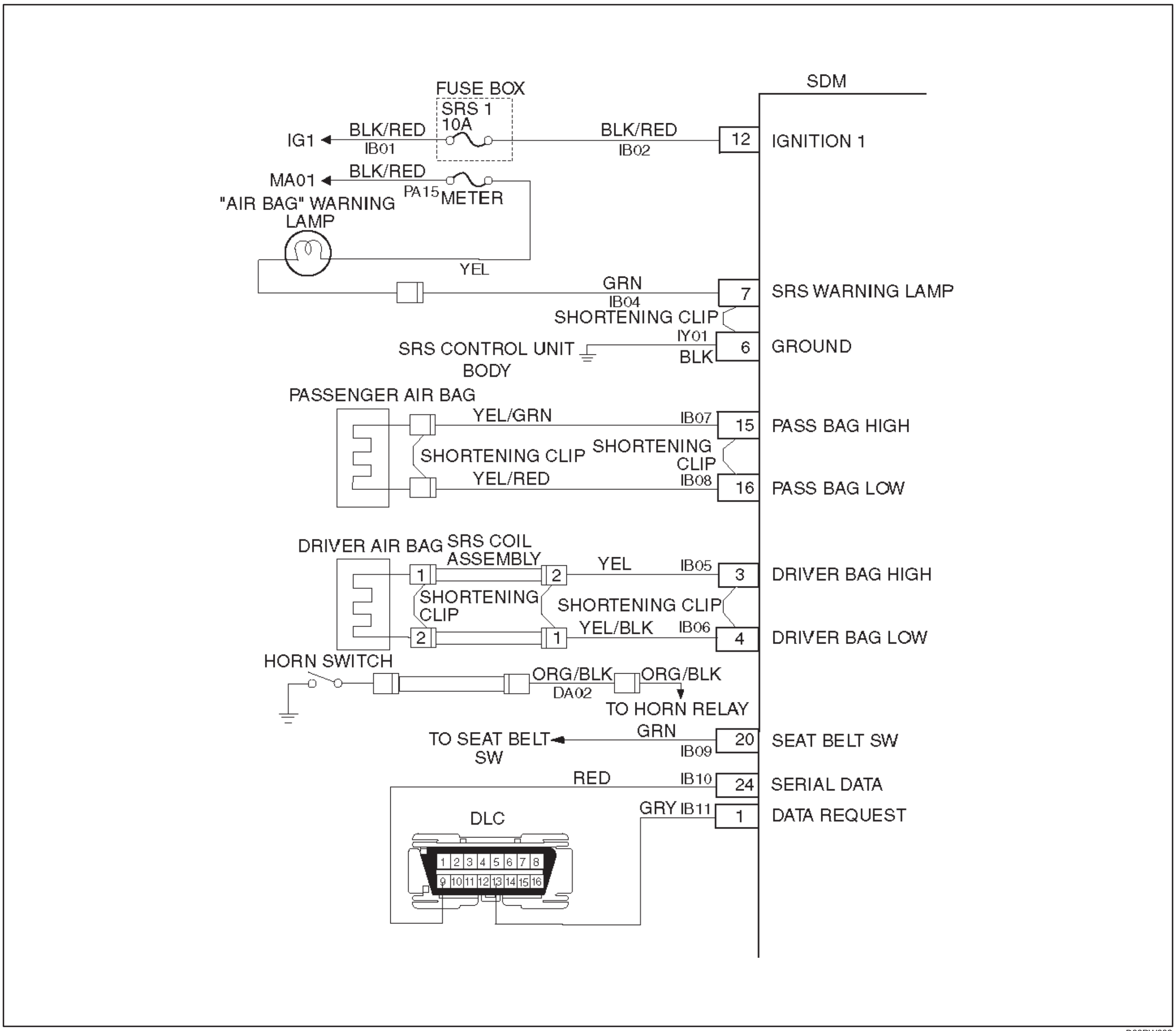
Diagnostic Aids:

The order in which diagnostic trouble codes are diagnosed is very important. Failure to diagnose the diagnostic trouble codes in the order specified may result in extended diagnostic time, incorrect diagnosis and incorrect parts Replacement.

SRS Diagnostic System Check

Step	Action	Yes	No
1	Confirm the “AIR BAG” warning lamp when ignition switch is turned “ON.” Does the “AIR BAG” warning lamp flash seven (7) times?	Go to Step 2	Go to Step 3
2	Confirm the “AIR BAG” warning lamp after it flashed 7 times. Does the “AIR BAG” warning lamp go “OFF”?	Go to Step 4	Go to Step 5
3	Confirm the “AIR BAG” warning lamp when ignition switch is turned “ON.” Does the “AIR BAG” warning lamp come “ON” steady?	Go to Chart B.	Go to Chart C.
4	1. Ignition switch “OFF.” 2. Connect a scan tool to data link connector. 3. Follow direction given in the scan tool instruction manual. 4. Ignition switch “ON.” 5. Request the SRS diagnostic trouble code display recode all history diagnostic trouble code(s) specify as such, on repair order. Is diagnostic trouble code(s) displayed?	Ignition switch “OFF.” When DTC 71 is set, go to DTC 71 chart. For all other history codes refer to “Diagnostics Aids” for that specific DTC. A history DTC indicates the malfunction has been repaired or is intermittent.	SRS is functional and free of malfunctions, no further diagnosis is required. If scan tool indicates “No Data Received,” refer to chassis electrical section.
5	1. Ignition switch “OFF.” 2. Connect a scan tool to data link connector. 3. Follow directions as given in the scan tool instruction manual. 4. Ignition switch “ON.” 5. Request the SRS diagnostic trouble code display, recode all diagnostic trouble code(s), specifying as current or history on repair order. Is diagnostic trouble code(s) displayed?	Ignition switch “OFF.” When DTC 53 is set, go to DTC 53 chart. When DTC 51 is set, go to DTC 51 chart. When DTC 19 is set, go to DTC 19 chart. When DTC 25 is set, go to DTC 25 chart. Diagnose remaining current DTCs from lowest to highest.When only history DTCs exist, Refer to “Diagnostics Aids” for that specific DTC. A history DTC indicates the malfunction has been repaired or is intermittent.	If scan tool indicates “No Data Received,” refer to chassis electrical section.

Chart A SDM Integrity Check



D09RW002

Circuit Description:

When the SDM recognizes “ignition 1” voltage, applied to terminals “12”, is greater than 9 volts, the “AIR BAG” warning lamp is flashed 7 times to verify operation. At this time the SDM performs “Turn–ON” tests followed by “Continuous Monitoring” tests. When a malfunction is detected, the SDM sets a current diagnostic trouble code and illuminates the “AIR BAG” warning lamp. The SDM will clear current diagnostic trouble codes and move them to a history file when the malfunction is no longer detected and/or the ignition switch is cycled, except for DTCs 51, 53 and 71. DTC 71 can only be cleared using a scan tool “Clear Codes” command in case that the malfunction on DTC 71 has been solved and no DTCs 51 and 53 were remained. DTCs 51, 53 and 71 can not be cleared after a “Clear Codes” command is issued.

Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

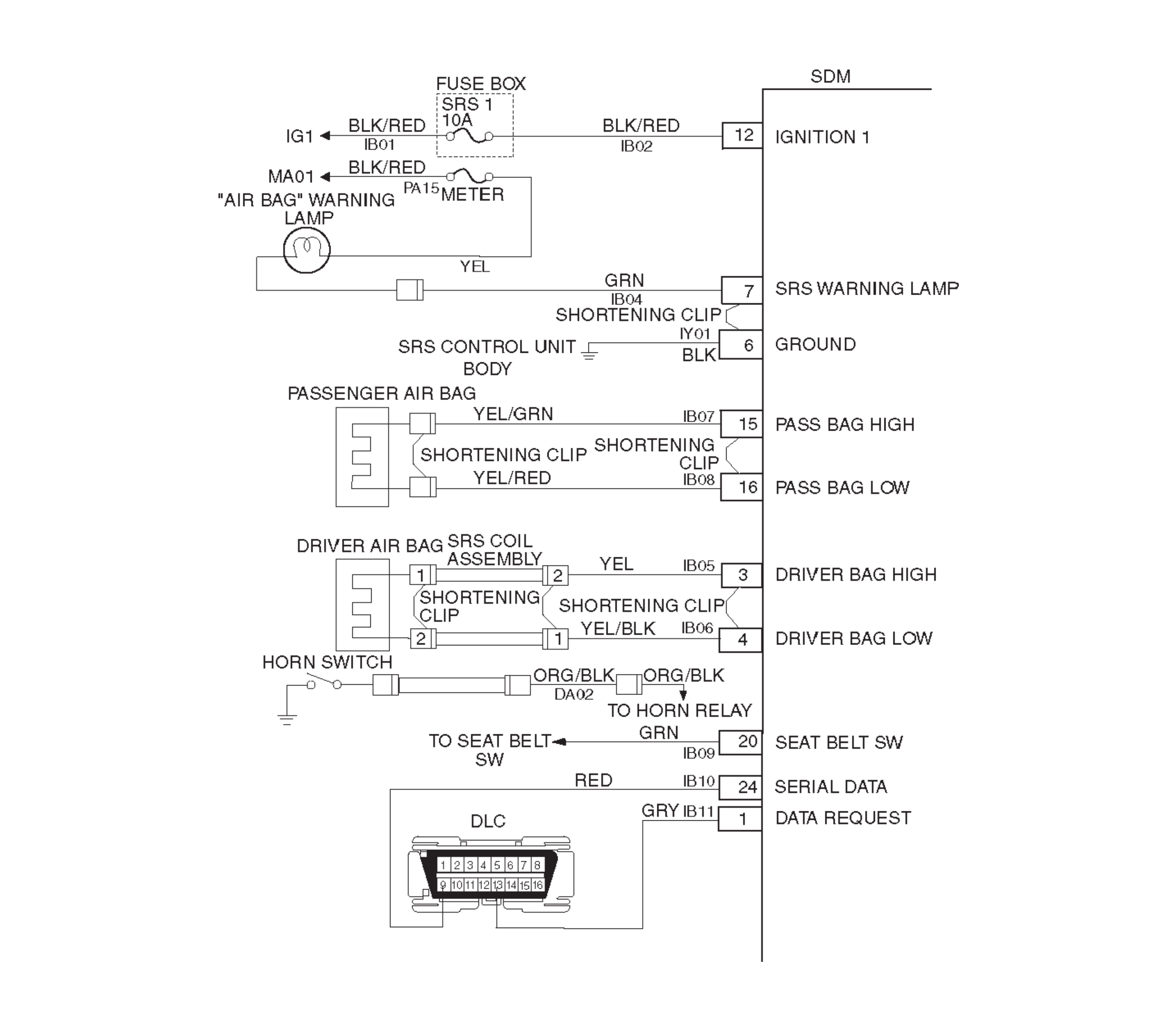
1. This test Confirm s a current malfunction. If no current malfunction is occurring (history DTC set) the “Diagnostic Aids” for the appropriate diagnostic trouble code should be referenced. The SDM should not be replaced for a history diagnostic trouble code.
2. This test checks for a malfunction introduced into the SRS during the diagnostic process. It is extremely unlikely that a malfunctioning SDM would cause a new malfunction to occur during the diagnostic process.
3. When all circuitry outside the SDM has been found to operate properly, as indicated by the appropriate diagnostic chart, then and only then should the SDM be replaced.

Chart A SDM Integrity Check

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

Step	Action	Yes	No
1	1. This chart assumes that the “SRS Diagnostic System Check” and either a symptom chart or a diagnostic trouble code chart diagnosis have been performed When all circuitry outside the SDM has been found to operate properly, as indicated by the appropriate diagnostic chart, and the symptom or DTC remains current, the following diagnostic procedures must be performed to verify the need for SDM Replacement. 2. Ignition switch “OFF.” 3. Reconnect all SRS components, ensure all components are properly mounted. 4. Ensure the ignition switch has been “OFF” for at least 15 seconds. 5. Confirm “AIR BAG” warning lamp as ignition switch is turned “ON.” Does warning lamp flash 7 times then go “OFF”?	The symptom or DTC is no longer occurring. Clear SRS diagnostic trouble codes. Repeat the “SRS Diagnostic System Check.”	Go to Step 2
2	Using a scan tool, request diagnostic trouble code display. Is the same symptom or DTC occurring as was when the “SRS Diagnostic System Check ” was first performed?	Ignition switch “OFF.” Go to the appropriate chart for the indicated malfunction.	Go to Step 3
3	1. Clear “SRS Diagnostic Trouble Codes.” 2. Ignition switch “OFF” for at least two minutes. 3. Confirm “AIR BAG” warning lamp as ignition switch is turned “ON.” Does warning lamp flash 7 times then go “OFF”?	SRS is functional and free of malfunctions. No further diagnosis is required. Go to Step 4	Ignition switch “OFF.” Replace SDM. Go to Step 4
4	Reconnect all SRS components, ensure all components are properly mounted. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to Step 4

Chart B "AIR BAG" Warning Lamp Comes "ON" Steady



D09RW002

Circuit Description:

When the ignition switch is first turned "ON", "ignition 1" voltage is applied from the "MA01" meter fuse to "AIR BAG", warning lamp which is connected to "SRS warning lamp", terminal "7". The "SRS–1" fuses apply system voltage to the "ignition 1" inputs, terminals "12". The SDM responds by flashing the "AIR BAG" warning lamp 7 times. If "ignition 1" voltage is less than 9 volts, the "AIR BAG" warning lamp will come "ON" solid with no DTCs set.

Chart Test Description:

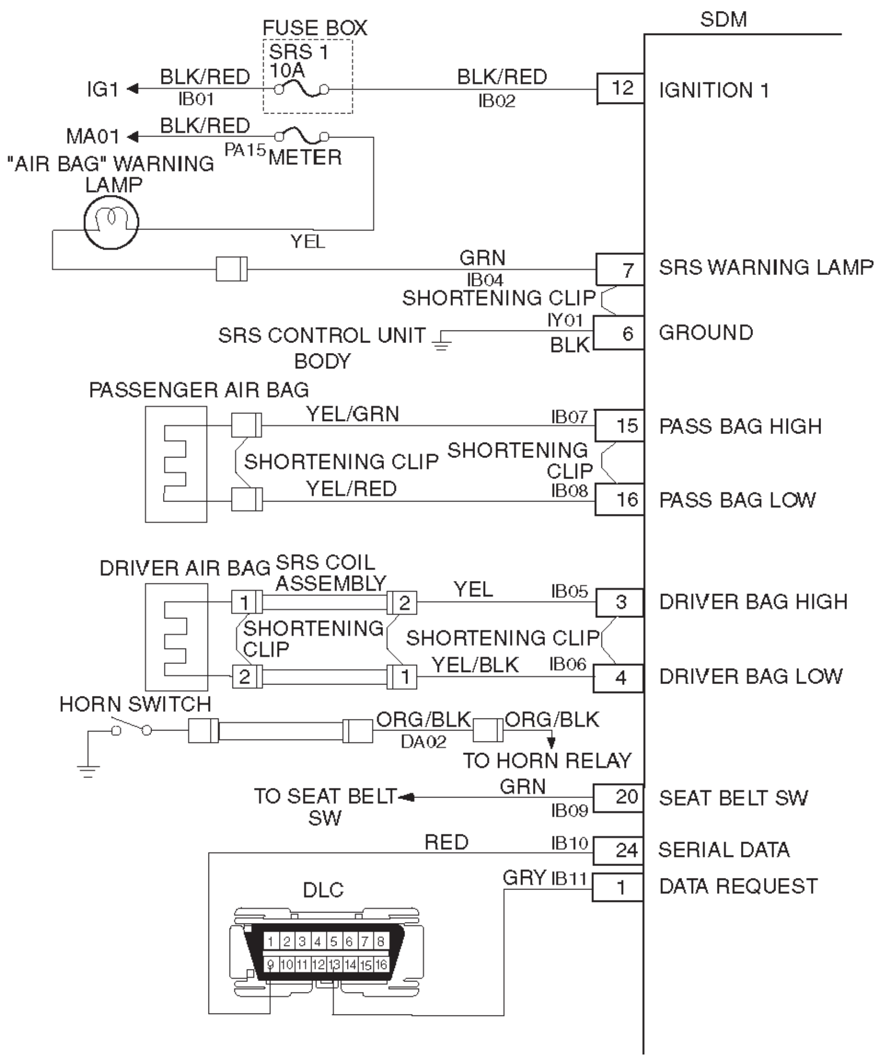
Number (s) below refer to step number (s) on the diagnostic chart.

2. This test checks for an open in the "ignition 1" circuit to the SDM.
3. This test checks for the voltage of "ignition 1."
4. This test determines whether the malfunction is a short to ground in CKT IB04 – GRN.

Chart B "AIR BAG" Warning Lamp Comes "ON" Steady

Step	Action	Yes	No
1	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch "OFF." 3. Connect scan tool to data link connector, Follow directions as given in the scan tool instruction manual. 4. Ignition switch "ON." 5. Request SRS diagnostic trouble code display. Does scan tool indicate "No Data Received"?	Go to Step 2	Go to Step 3
2	1. Ignition switch "OFF." 2. Inspect SDM harness connector connection to SDM. Is it securely connected to the SDM?	Ignition switch "OFF." Replace SDM. Go to Step 5	Connect SDM securely to de–activate shorting clip in SDM harness connector. Go to Step 5
3	Using scan tool, request SRS data list. Is "ignition" more than 9 volts?	Go to Step 4	Ignition switch "OFF." Replace SDM. Go to Step 5
4	1. Ignition switch "OFF." 2. Disconnect SRS coil and passenger air bag assemblies. Yellow 2–pin connectors located at base of steering column and behind the glove box assembly. 3. Disconnect SDM. 4. Measure resistance from SDM harness connector terminal "6" to ground. Does J–39200 display "0L" (infinite)?	Go to Chart A.	Replace SRS harness. Go to Step 5
5	Reconnect all SRS components, ensure all components are properly mounted. Was this step finished?	Repeat the "SRS Diagnostic System Check."	Go to Step 5

Chart C “AIR BAG” Warning Lamp Does Not Comes “ON” Steady



D09RW002

Circuit Description:

When the ignition switch is first turned “ON”, “ignition 1” voltage is applied from the “MA01” meter fuse to the “AIR BAG” warning lamp which is connected to “SRS warning lamp”, terminal “7”. The “SRS–1” fuse apply system voltage to the “ignition 1” inputs, terminals “12”. The SDM responds by flashing the “AIR BAG” warning lamp seven times. If “ignition 1” voltage is more than 16 volts, the “AIR BAG” warning lamp will be still “OFF” solid with no DTCs set.

Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

1. This test decides whether power is available to SDM warning lamp power feed circuit.
2. This test determines whether the voltage is present in the warning lamp circuit.
3. This test determines if the malfunction is in the instrument cluster.
4. This test checks for open in the warning lamp circuitry.
5. This test isolates the IB04–GRN circuit and checks for a short in the IB04–GRN circuit to B+.
8. This test checks for a short from the SDM warning lamp power feed circuit to ground.
9. This test determines whether the short to ground is due to a short in the wiring.

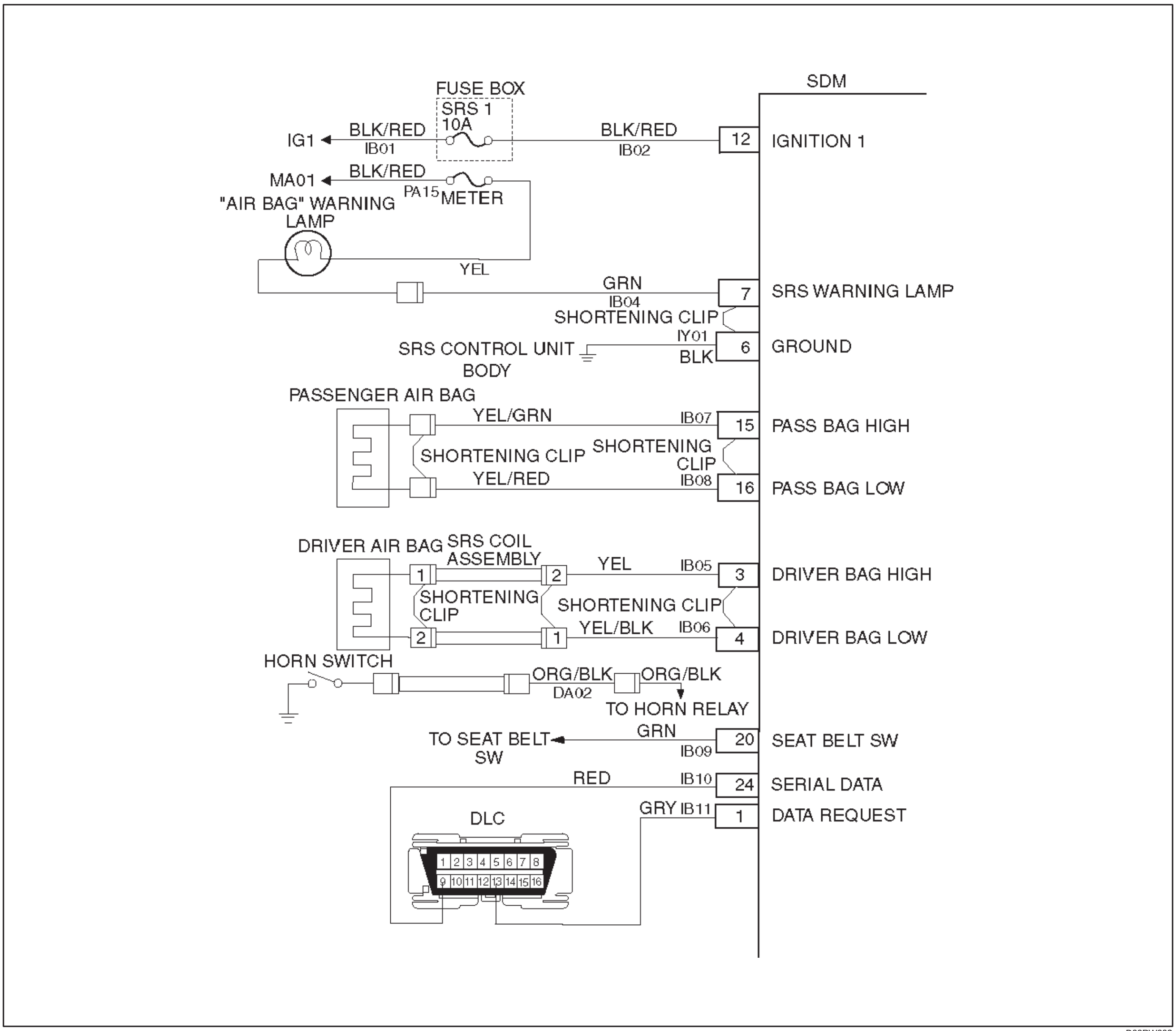
Chart C “AIR BAG” Warning Lamp Does Not Comes “ON” Steady

Step	Action	Yes	No
1	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch “OFF.” 3. Remove and inspect “MA01” meter fuse to the “AIR BAG” warning lamp. Is fuse good?	Go to Step 2	Go to Step 7
2	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag assemblies. Yellow 2–pin connectors located at base of steering column and behind the glove box assembly. 3. Disconnect SDM. 4. Ignition switch “ON.” 5. Measure voltage on SDM harness connector from terminal “7” to terminal “6” (ground). Is system voltage present on terminal “7”?	Go to Step 4	Go to Step 3
3	1. Ignition switch “OFF.” 2. Remove instrument meter cluster. 3. Check for proper connection to instrument cluster at IB04–GRN terminal. 4. If OK, then remove and inspect “AIR BAG” bulb. Is bulb good?	Go to Step 5	Replace bulb. Go to Step 6
4	1. Ignition switch “OFF.” 2. Disconnect instrument meter cluster harness connector. 3. Ignition switch “ON.” 4. Measure voltage on SDM harness connector from terminal “7” to terminal “6” (ground). Is voltage 1 volt or less?	Go to Chart A.	Replace SRS harness. Go to Step 6
5	1. Install bulb. 2. Measure resistance from instrument meter cluster harness connector IB04–GRN terminal to SDM harness connector terminal “7”. Is resistance 5.0 ohms or less?	Service instrument meter cluster. Go to Step 6	Replace SRS harness. Go to Step 6
6	Reconnect all SRS components, ensure all components are properly mounted. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to Step 6
7	Were you sent here from chart C?	Go to Step 8	Go to Step 1
8	1. Replace “MA01” meter fuse. 2. Ignition switch “ON” wait 10 seconds then ignition switch “OFF.” 3. Remove and inspect “MA01” meter fuse. Is fuse good?	Install “MA01” meter fuse. Go to Step 10	Go to Step 9

Chart C “AIR BAG” Warning Lamp Does Not Comes “ON” Steady (Cont’d)

Step	Action	Yes	No
9	1. Disconnect SRS coil and passenger air bag assemblies. Yellow 2–pin connectors located at base of steering column and behind the glove box assembly. 2. Disconnect SDM. 3. Replace “MA01” meter fuse. 4. Ignition switch “ON” wait to 10 seconds. 5. Ignition switch “OFF”. 6. Remove and inspection “MA01” meter fuse. Is fuse good?	Install “MA01” meter fuse. Go to Chart A.	Replace SRS harness. Replace“MA01” meter fuse. Go to Step 10
10	Reconnect all SRS components, ensure all components are properly mounted. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to Step 10

DTC 15 Passenger Deployment Loop Resistance High



D09RW002

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests "ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the "Resistance Measurement Test". "Passenger Bag Low" terminal "16" is grounded through a resister and the passenger current source connected to "Passenger Bag High" terminal "15" allows a known amount of current to flow. By monitoring the voltage difference between "Passenger Bag High" and "Passenger Bag Low" the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED connector terminal contact.

DTC Will Set When:

The combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED, and connector terminal contact is above a specified value. This test is run once each ignition cycle during the "Resistance Measurement Test" when:

1. No "higher priority faults" are detected during "Turn–ON."
2. "Ignition 1" voltage is in the specified value.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned "OFF."

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2–pin connector.
4. This test checks for proper contact and/or corrosion of the yellow 2–pin connector terminals.
5. The test checks for a malfunctioning passenger air bag assembly.
6. This test determines whether the malfunction is due to high resistance in the wiring.

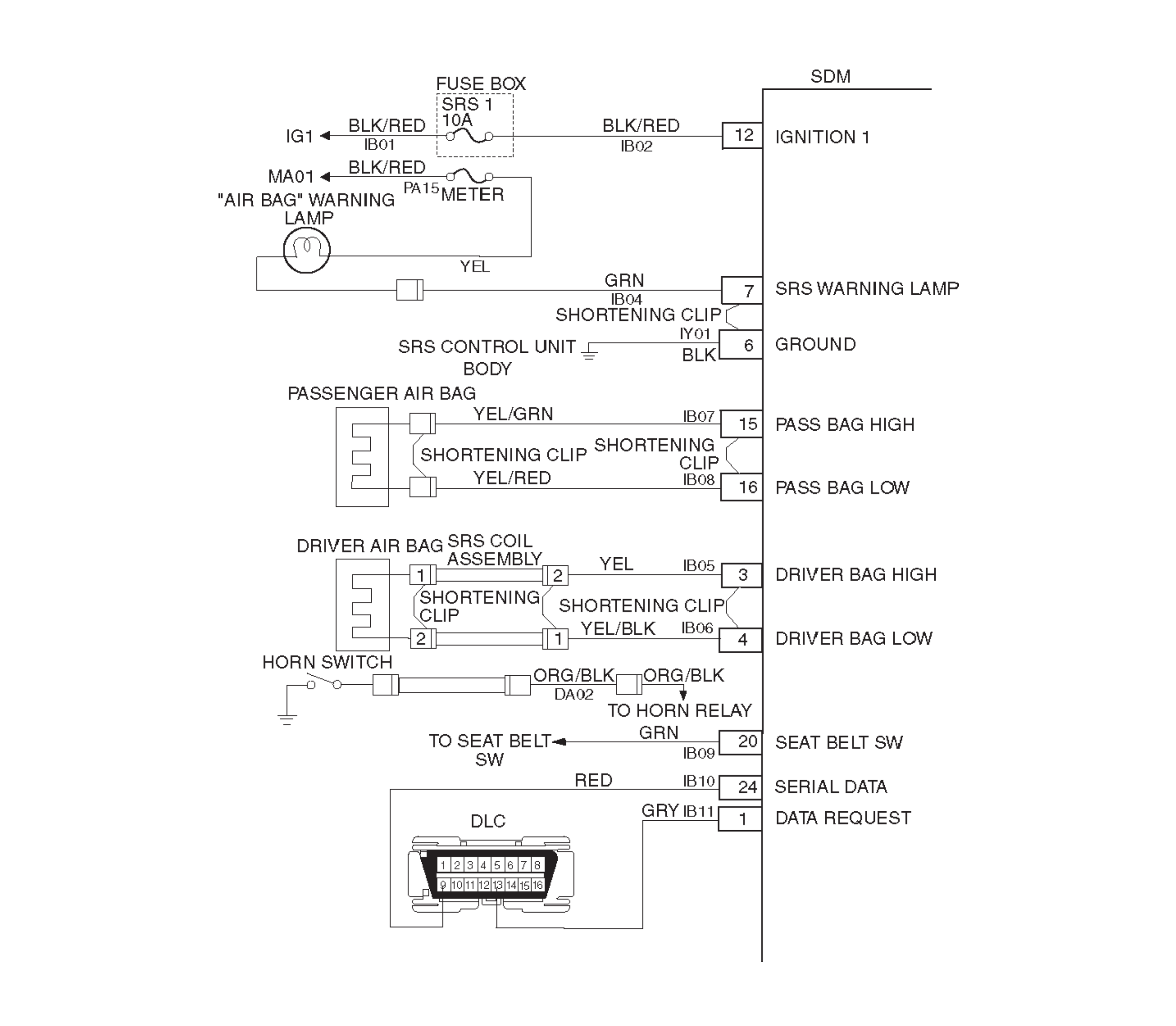
Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at the passenger air bag assembly harness connector terminals “1” and “2”, SDM terminal “15” and “16”, or a poor wire to terminal connection in CKTs IB07–YEL/GRN and IB08–YEL/RED. This test for this diagnostic trouble code is only run while the “AIR BAG” warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool “Clear Codes” command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 15 Passenger Deployment Loop Resistance High

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Use scan tool data list function, read and record the passenger deployment loop resistance. Is passenger resist more than 2.9 ohms?	Go to Step 3	Go to Chart A.
3	1. Ignition switch “OFF.” 2. Make sure the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly is seated properly. Is the yellow 2–pin connector connected properly?	Go to Step 4	Seat passenger air bag assembly yellow 2–pin connector properly. Go to Step 7
4	1. Disconnect and inspect the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly. 2. If OK, reconnect the passenger air bag assembly 2–pin connector. 3. Ignition switch “ON.” Is DTC 15 current?	Go to Step 5	Ignition switch “OFF.” Go to Step 7
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag 2–pin connectors located at the base of the steering column and behind the glove box assembly. 3. Connect J–41433 SRS driver / passenger load tool and appropriate adapters to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 15 current?	Go to Step 6	Ignition switch “OFF.” Replace the passenger air bag assembly. Go to Step 7
6	1. Ignition switch “OFF.” 2. There has been an increase in the total circuit resistance of the passenger inflator deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTs IB07–YEL/GRN and IB08–YEL/RED, and SDM connector terminal “15” and “16” to locate the root cause. Was a fault found?	Replace SRS harness. Go to Step 7	Go to Chart A.
7	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to Step 7

DTC 16 Passenger Deployment Loop Resistance Low



D09RW002

Circuit Description:

When the ignition switch is turned "ON", the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests "ignition 1", and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. The SDM then proceeds with the "Resistance Measurement Test". "Passenger Bag Low" terminal "16" is grounded through a resistor and the passenger current source connected to "Passenger Bag High" terminal "15" allows a known amount of current to flow. By monitoring the voltage difference between "Passenger Bag High" and "Passenger Bag Low", the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED connector terminal contact.

DTC Will Set When:

The combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED, and connector terminal contact is above a specified value. This test is run once each ignition cycle during the "Resistance Measurement Test" when:

1. No "higher priority faults" are detected during "Turn–ON",
2. "Ignition 1" voltage is in the specified value.

Action Taken:

SDM turns "ON" the "AIR BAG" warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned "OFF."

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies connection of the yellow 2–pin connector.
4. This test cheeks for proper operation of the shorting clip in the yellow 2–pin connector.
5. The test checks for a malfunction passenger air bag assembly.
6. This test determines whether the malfunctioning is due to shorting in the wiring.

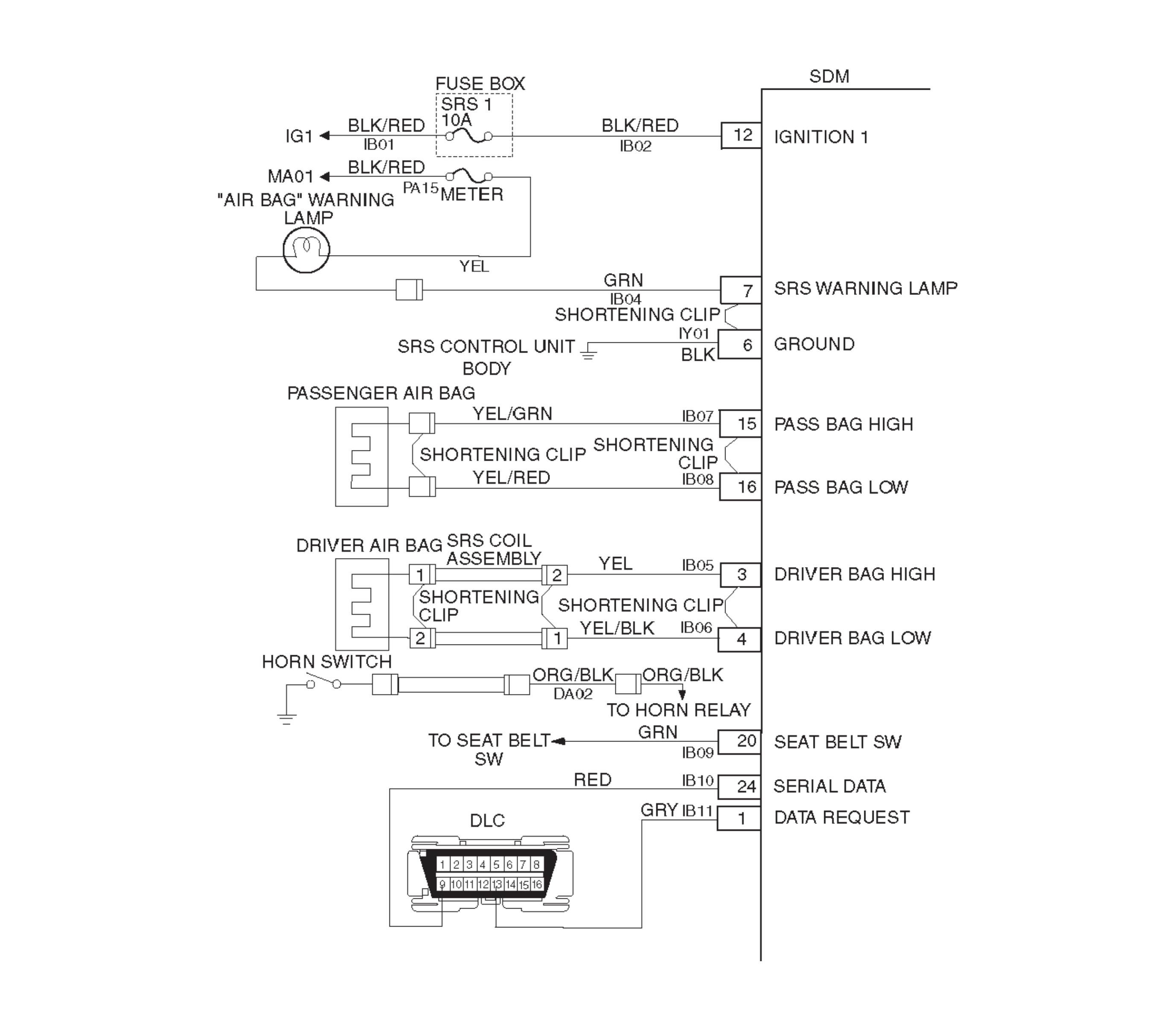
Diagnostic Aids:

An intermittent condition is likely to be caused by a short between CKTs IB07–YEL/GRN and IB08–YEL/RED, or a malfunctioning shorting clip on the passenger air bag assembly which would require replacement of the air bag assembly. The test for this diagnostic trouble code is only run while “AIR BAG” warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool “Clear Codes” command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 16 Passenger Deployment Loop Resistance Low

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Using scan tool data list function, read and record the passenger deployment loop resistance. Is passenger resist. less than 1.4 ohms?	Go to Step 3	Go to Chart A.
3	1. Ignition switch “OFF.” 2. Make sure the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly is seated properly. Is the yellow 2–pin connector connected properly?	Go to Step 4	Seat passenger air bag assembly yellow 2–pin connector properly. Go to Step 7
4	1. Disconnect and inspect the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly. 2. If OK, reconnect the passenger air bag assembly 2–pin connector. 3. Ignition switch “ON.” Us DTC 16 current?	Go to Step 5	Ignition switch “OFF.”Go to Step 7
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag 2–pin connectors located at the base of the steering column and behind the glove box assembly. 3. Connect J–41433 SRS driver / passenger load tool and appropriate adapters to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 16 current?	Go to Step 6.	Ignition switch “OFF.” Replace the passenger air bag assembly. Go to Step 7
6	1. Ignition switch “OFF.” 2. There has been a decrease in the total circuit resistance of the passenger inflator deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTs IB07–YEL/GRN and IB08–YEL/RED, and SDM connector terminal “15” and “16” to locate the root cause. Was a fault found?	Replace SRS harness. Go to Step 7	Go to Chart A.
7	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to Step 7

DTC 17 Passenger Deployment Loop Open



D09RW002

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges. During “Continuous Monitoring” diagnostics, a fixed amount of current is flowing in the deployment loop. This produces proportional voltage drops in the loop. By monitoring the voltage difference between “Passenger Bag High” and “Passenger Bag Low”, the SDM calculates the combined resistance of the passenger air bag assembly, harness wiring CKTs IB07–YEL/GRN and IB08–YEL/RED, and connector terminal contact.

DTC Will Set When:

The voltage difference between “Passenger Bag High” terminal “15” and “Passenger Bag Low” terminal “16” is above or equal to a specified value for 500 milliseconds during “Continuous Monitoring”.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The voltage difference between “Passenger Bag High” terminal “15” and “Passenger Bag Low” terminal “16” is below a specified value for 500 milliseconds during “Continuous Monitoring”.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.

3. This test verifies proper connection of the yellow 2–pin connector.
4. This test cheeks for proper contact and/or corrosion of the shorting clip in the yellow 2–pin connector terminals.
5. The test checks for a malfunctioning passenger air bag assembly.
6. This test determines whether there is an open in the wiring.

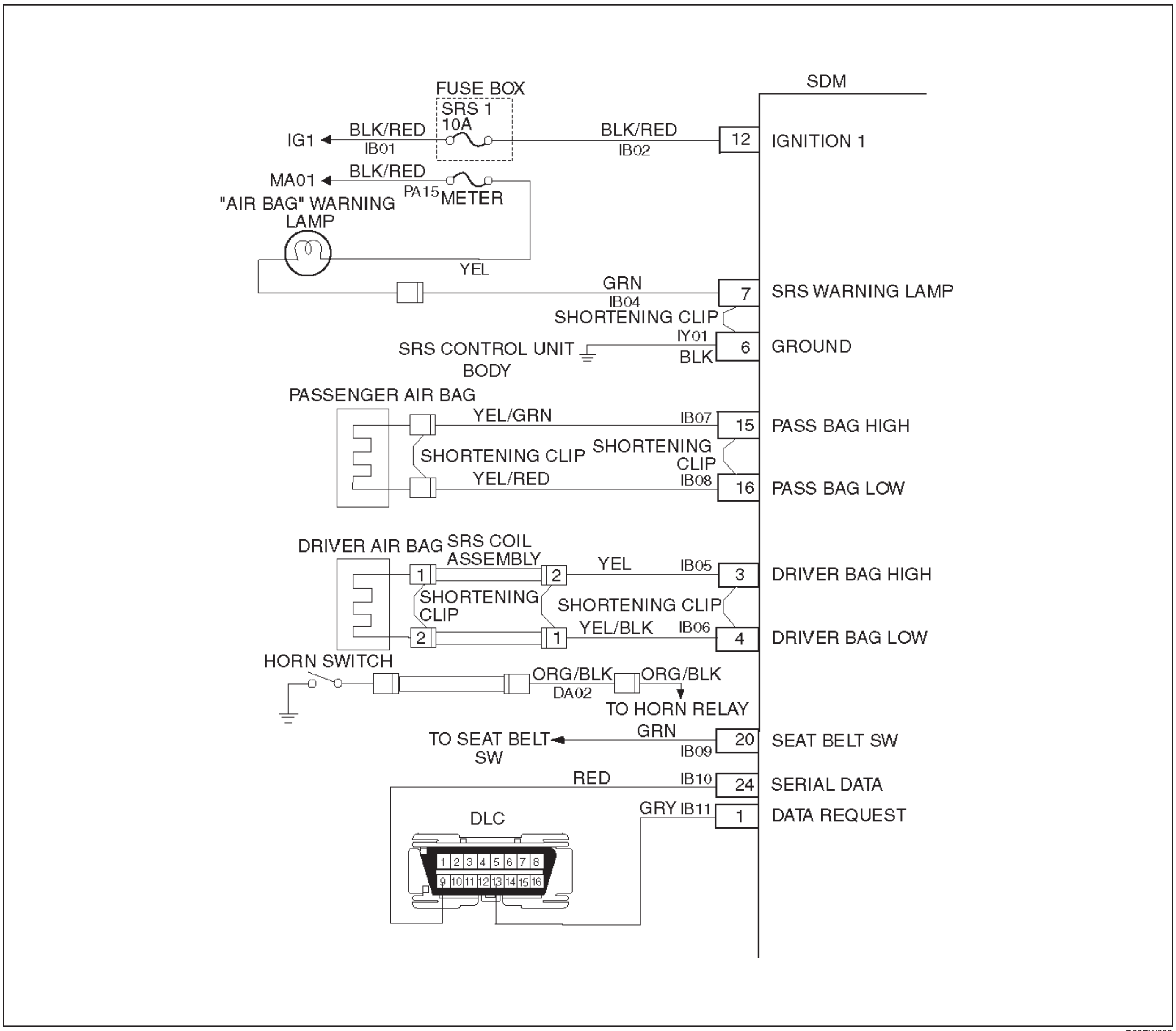
Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at the passenger air bag assembly harness connector terminals “1” and “2,” SDM terminals “15” and “16,” or an open in CKT IB07–YEL/GRN and IB08–YEL/RED.

DTC 17 Passenger Deployment Loop Open

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Using scan tool data list function, read and record the passenger differential voltage. Is passenger differential voltage. more than 4.0 volts?	Go to Step 3	Go to Chart A.
3	1. Ignition switch “OFF.” 2. Make sure the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly is seated properly. Is the yellow 2–pin connector connected properly?	Go to Step 4	Seat passenger air bag assembly yellow 2–pin connector properly. Go to Step 7
4	1. Disconnect and inspect the passenger air bag assembly yellow 2–pin connector located behind the glove box assembly. 2. If OK, reconnected the passenger air bag assembly yellow 2–pin connector. 3. Ignition switch “ON.” Is DTC 17 current?	Go to Step 5	Ignition switch “OFF.” Go to Step 7
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag assembly yellow 2–pin connectors located at the base of the steering column and behind the glove box assembly. 3. Connect J–41433 SRS driver / passenger load tool and appropriate adapters to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 17 current?	Go to Step 6	Ignition switch “OFF.” Replace the passenger air bag assembly. Go to Step 7
6	1. Ignition switch “OFF.” 2. There has been an open circuit in the passenger inflator deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTs IB07–YEL/GRN and IB08–YEL/RED, and SDM connector terminal “15” and “16” to locate the root cause. Was a fault found?	Replace SRS harness. Go to Step 7	Go to Chart A.
7	1. Reconnect all components ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to Step 7

DTC 18 Passenger Deployment Loop Short To Ground



Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.

The SDM monitors the voltages at “Driver Bag Low” terminal “4” and “Passenger Bag Low” terminal “16” to detect short to ground in the air bag assembly circuits.

DTC Will Set When:

Neither of the two air bag assemblies is open.

“Ignition 1” is within the normal operating voltage range. Once these conditions are met and the voltage at “Passenger Bag Low” is below a specified value, DTC 18 will set. This test is run once each ignition cycle and “Continuous Monitoring”.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

This malfunction is no longer occurring and the ignition switch is turned “OFF”.

DTC Chart Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart:

2. This test determines whether the SDM is malfunctioning.
3. This test isolates the malfunction to one side of the passenger air bag assembly yellow 2–pin connector behind glove box compartment.
4. This test determines whether the malfunction is in CKT IB07–YEL/GRN.

5. This test determines whether the malfunction is in CKT IB08–YEL/RED.

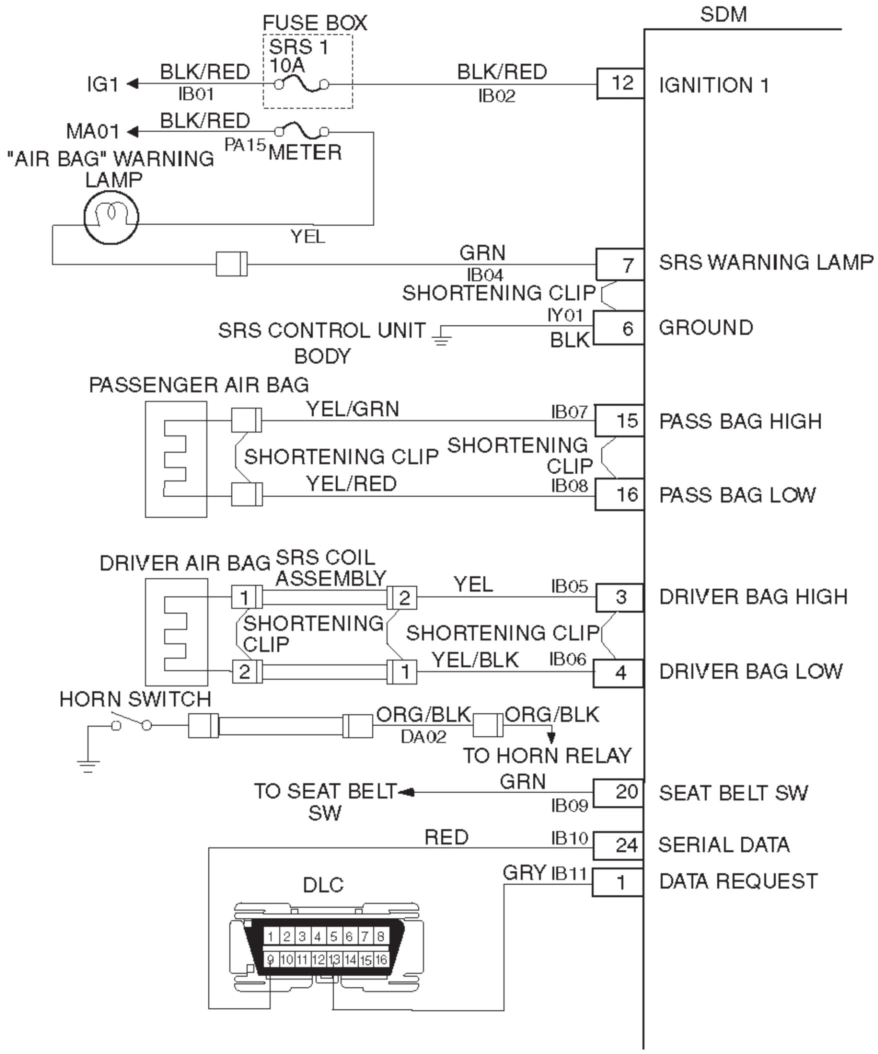
Diagnostic Aids:

An intermittent condition is likely to be caused by a short to ground in the passenger air bag assembly circuit. Inspect CKTs IB07–YEL/GRN and IB08–YEL/RED carefully for cutting or chafing. If the wiring pigtail of the passenger air bag assembly is damaged, the component must be replaced.

DTC 18 Passenger Deployment Loop Short To Ground

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check."
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch "OFF." 3. Connect scan tool data link connector. Follow directions as given in the scan tool operator's manual. 4. Ignition switch "ON." 5. Read passenger sense LO. Is passenger sense LO less than 1.5 volts?	Go to Step 3	Go to Chart A.
3	1. Ignition switch "OFF." 2. Disconnect passenger air bag assembly yellow 2–pin connector behind the glove box assembly.. 3. Leave driver air bag assembly connected. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to passenger air bag assembly harness connector. 4. Ignition switch "ON." Is DTC 18 current?	Go to Step 4	Ignition switch "OFF." Replace passenger air bag assembly. Go to Step 6
4	1. Ignition switch "OFF." 2. Disconnect SRS driver / passenger load tool. 3. Measure resistance on SDM harness connector from terminal "15" to terminal "6" (ground). Does J–39200 display "0L" (infinite)?	Go to Step 5	Replace SRS harness. Go to Step 6
5	Measure resistance on SDM harness connector from terminal "6" "16" to terminal (ground). Does J–39200 display "0L" (infinite)?	Go to Chart A.	Replace SRS harness. Go to Step 6
6	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the "SRS Diagnostic System Check."	Go to Step 6

DTC 19 Passenger Deployment Loop Short To Voltage



D09RW002

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.

The SDM monitors the voltages at “Driver Bag Low” terminal “4” and “Passenger Bag Low” terminal “16” to detect short to B+ in the air bag assembly circuits.

DTC Will Set When:

“Ignition 1” is within the normal operating voltage range. Once these conditions are met and the voltage at “Passenger Bag Low” is above a specified value, DTC 19 will set. This test is run once each ignition cycle and “Continuous Monitoring”.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets DTC 19 and also DTC 71.

DTC Will Clear When:

The SDM is replaced.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test isolates the malfunction to one side of the passenger air bag assembly yellow 2–pin connector behind glove box compartment.
4. This test determines whether the malfunction is in CKT IB07–YEL/GRN.

5. This test determines whether the malfunction is in CKT IB08–YEL/RED.

Diagnostic Aids:

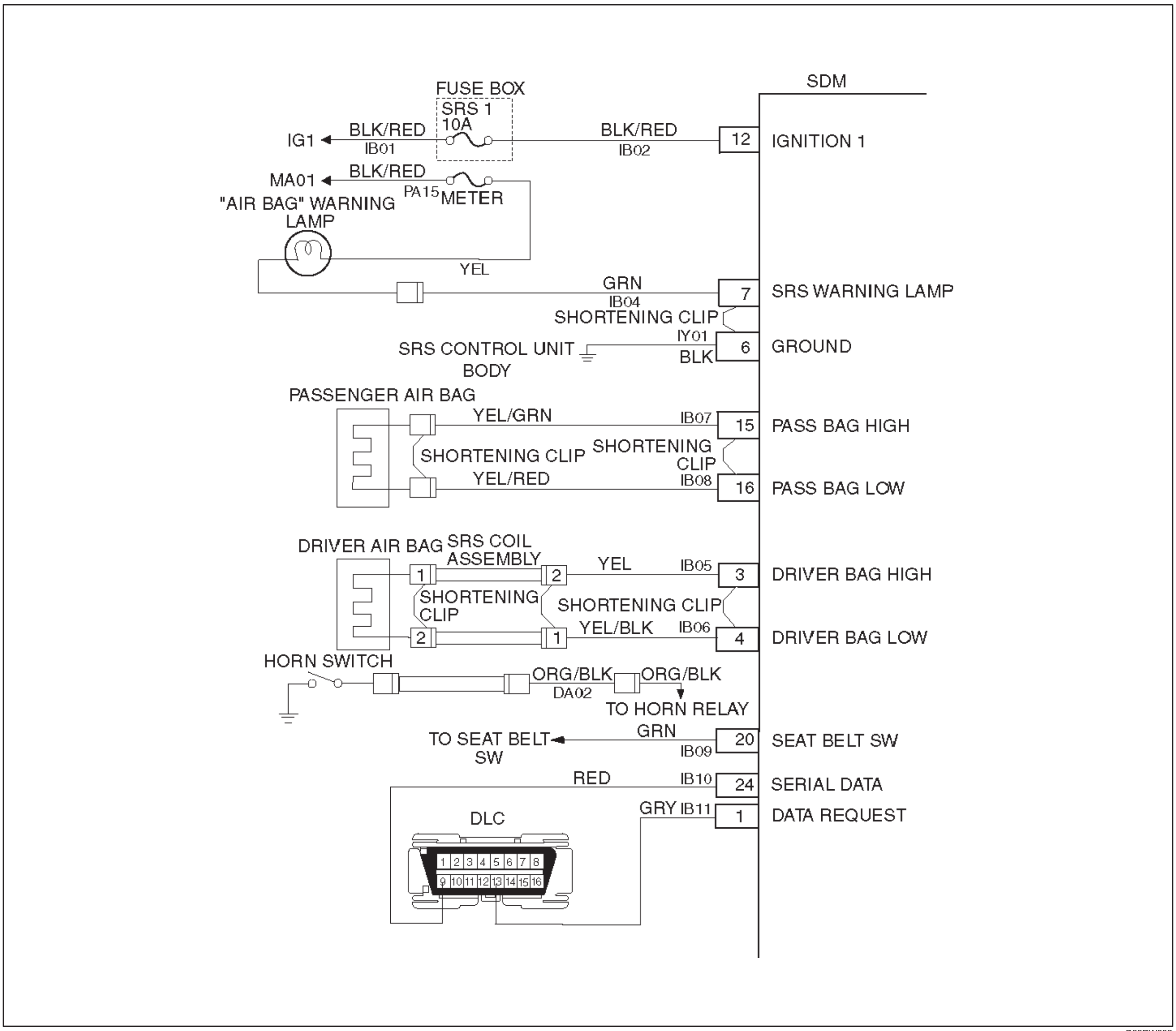
An intermittent condition is likely to be caused by a short to B+ in the passenger air bag assembly circuit. Inspect CKTs IB07–YEL/GRN and IB08–YEL/RED carefully for cutting or chafing. If the wiring pigtail of the passenger air bag assembly is damaged, the component must be replaced. A careful inspection of CKT IB07–YEL/GRN and IB08–YEL/RED, including the passenger air bag assembly pigtail is essential to ensure that the replacement SDM will not be damaged.

DTC 19 Passenger Deployment Loop Short To Voltage

CAUTION: When DTC 19 has been set, it is necessary to replace the SDM. Setting DTC 19 and 25 or 51 or 53 will also cause DTC 71 to set. When a scan tool "CLEAR CODES" command is issued and the malfunction is no longer present, DTC 71 will remain current. Ensure that the short to voltage condition is repaired prior to installing a replacement SDM to avoid damaging the SDM.

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check."
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch "OFF." 3. Connect scan tool data link connector. Follow directions as given in the scan tool operator's manual. 4. Ignition switch "ON." 5. Read passenger sense LO. Is passenger sense LO more than 3.5 volts?	Go to Step 3	Go to Chart A.
3	1. Ignition switch "OFF." 2. Disconnect passenger air bag assembly yellow 2–pin connector behind the glove box assembly. 3. Leave driver air bag assembly connected. 4. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to passenger air bag assembly harness connector. 5. Ignition switch "ON." Is passenger sense LO more than 3.5 volts?	Go to Step 4	Ignition switch "OFF." Replace passenger air bag assembly. Go to Step 6
4	1. Ignition switch "OFF." 2. Disconnect SDM. 3. Disconnect SRS driver / passenger load tool. 4. Measure resistance on SDM harness connector from terminal "15" to terminal "12" (IGNITION 1). Does J–39200 display "0L" (infinite)?	Go to Step 5	Replace SRS harness. Go to Step 6
5	Measure resistance on SDM harness connector from terminal "16" to terminal "12" (IGNITION 1). Does J–39200 display "0L" (infinite)?	Go to Chart A.	Replace SRS harness. Go to Step 6
6	1. Reconnect all components, ensure all component are properly mounted. 2. Ignition switch "ON." Is passenger sense LO less than 3.5 volts?	Ignition switch "OFF."Replace SDM.Go to Step 7	Go to Chart A.
7	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the "SRS Diagnostic System Check."	Go to Step 7

DTC 21 Driver Deployment Loop Resistance High



D09RW002

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.

The SDM then proceeds with the “Resistance Measurement Test” “Driver Bag Low” terminal “4” is grounded through a current sink and the driver current source connected to “Driver Bag High” terminal “3” allows a known amount of current to flow. By monitoring the voltage difference between “Driver Bag High” and “Driver Bag Low”, the SDM calculates the combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK, and connector terminal contact.

DTC Will Set When:

The combined resistance of the driver air bag assembly, SRS Coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK, and connector terminal contact is above a specified value. This test run once each ignition cycle during the “Resistance Measurement Test” when:

No “higher priority faults” are detected during “Turn–ON”

“Ignition 1” voltage is in the specified value.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets DTC 21.

DTC Will Clear When:

The ignition switch is turned “OFF”.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2–pin connector at the base of the steering column.
4. This test checks for proper contact and/or corrosion of the 2–pin connector terminals at the base of steering column.
5. This test isolate the malfunction to one side of the SRS coil assembly yellow 2–pin connector located at the base of the steering column.
6. This test determines whether the malfunction is due to high resistance in the wiring.
7. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

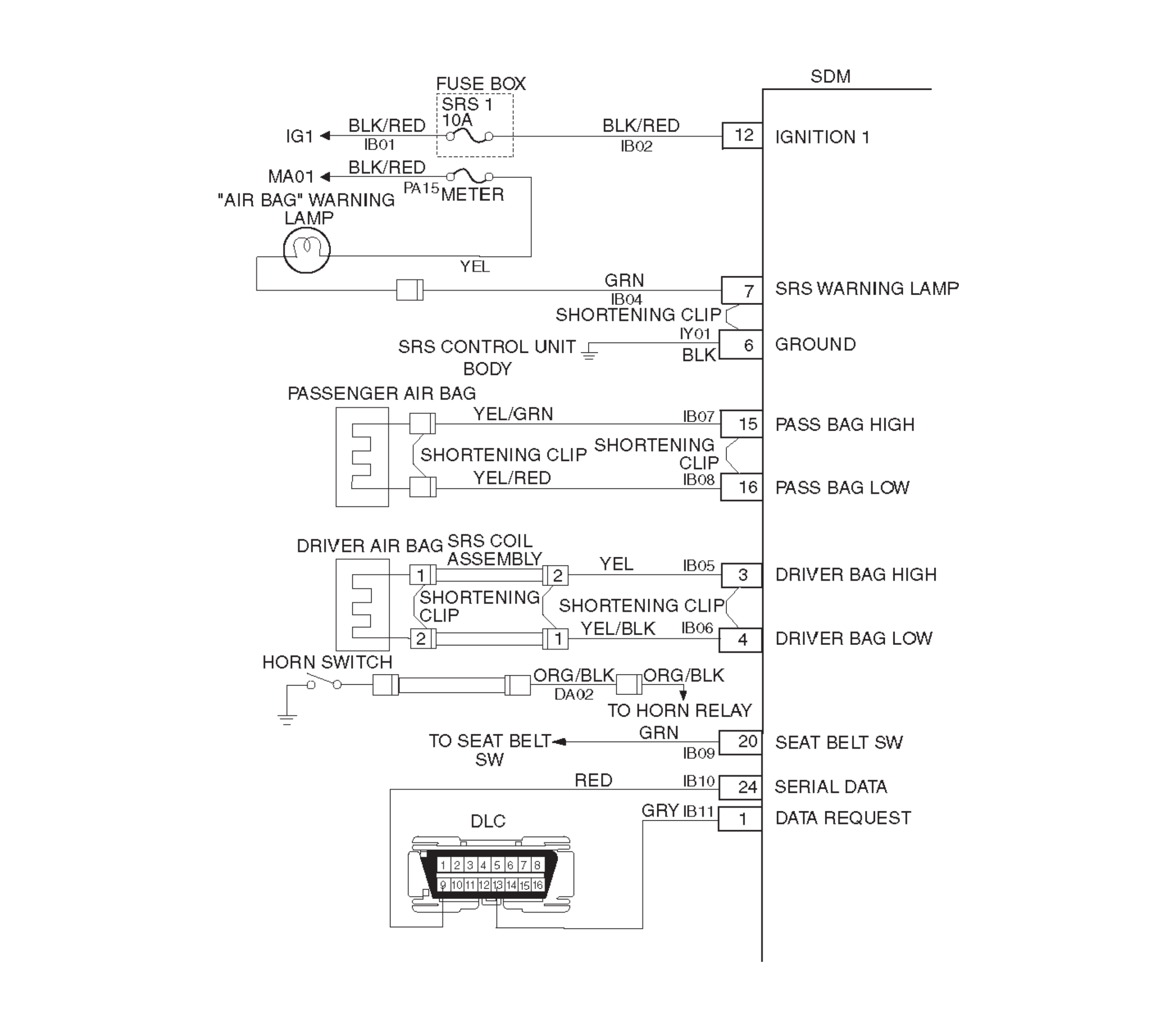
Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at terminals “1” and “2” of the SRS coil 2–pin connector at the base of the steering column, terminal “1” and “2” of the driver air bag assembly 2–pin connector at the top of the steering column, SDM terminals “3” and “4” or a poor wire to terminal connection in CKT IB05–YEL or IB06–YEL/BLK. The test for this diagnostic trouble code is only run while the “AIR BAG” warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool “Clear Codes” command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 21 Driver Deployment Loop Resistance High

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Use scan tool data list function, read and record the driver deployment loop resistance. Is driver deployment loop resistance more than 4.4 ohms?	Go to Step 3	Go to Chart A.
3	1. Ignition switch “OFF.” 2. Disconnect driver air bag assembly yellow 2–pin connector located at base of steering column is seated properly. Is the 2–pin connector connected properly?	Go to Step 4	Seat SRS coil assembly 2–pin connector properly.Go to Step 8
4	1. Disconnect and inspect the SRS coil assembly yellow 2–pin connector located base of steering column. 2. If OK, reconnect the SRS coil assembly yellow 2–pin connector. 3. Ignition switch “ON.” Is DTC 21 current?	Go to Step 5	Ignition switch “OFF.” Go to Step 8
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag assembly yellow 2–pin connectors located at the base of steering column and behind the glove box assembly. 3. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 21 current?	Go to Step 6	Go to Step 7
6	1. Ignition switch “OFF.” 2. There has been a increase in the total circuit resistance of the driver deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTs IB05–YEL/IB06–GRN and YEL/BLK, and SDM connector terminal “3” and “4” to locate the root cause. Was a fault found?	Replace SRS harness. Go to Step 8	Go to Chart A.
7	1. Ignition switch “OFF.” Disconnect SRS driver / passenger load tool from SRS coil assembly harness connector. Connect SRS driver / passenger load tool J–41433 on the top of steering column. Reconnect SRS coil assembly harness connector as the base of steering column. Ignition switch “ON.” Is DTC 21 current?	Ignition switch “OFF.” Replace SRS COIL ASSEMBLY. Refer to in this section 9J–24. Go to Step 8	Ignition switch “OFF.” Replace driver air bag assembly. Go to Step 8
8	Reconnect all components, ensure all component are properly mounted. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to Step 8.

DTC 22 Driver Deployment Loop Resistance Low



D09RW002

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.The SDM then proceeds with the “Resistance Measurement Test” “Driver Bag Low” terminal “4” is grounded through a current sink and the driver current source connected to “Driver Bag High” terminal “3” allows a known amount of current to flow. By monitoring the voltage difference between “Driver Bag High” and “Driver Bag Low” the SDM calculates the combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK and connector terminal contact.

DTC Will Set When:

The combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK and connector terminal contact is above a specified value. This test is run once each ignition cycle during the “Resistance Measurement Test” when:

1. No “higher priority faults” are detected during “Turn–ON”
2. “Ignition 1” voltage is in the specified value.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets DTC 22.

DTC Will Clear When:

The ignition switch is turned “OFF.”

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the malfunction is in the SDM.
3. This test verifies proper connection of the yellow 2–pin connector at the base of the steering column.
4. This test checks for proper operation of the shorting clip in the yellow 2–pin connector.
5. This test isolate the malfunction to one side of the SRS coil assembly yellow 2–pin connector located at the base of steering column.
6. This test determines whether the malfunction is due to shorting in the wiring.
7. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

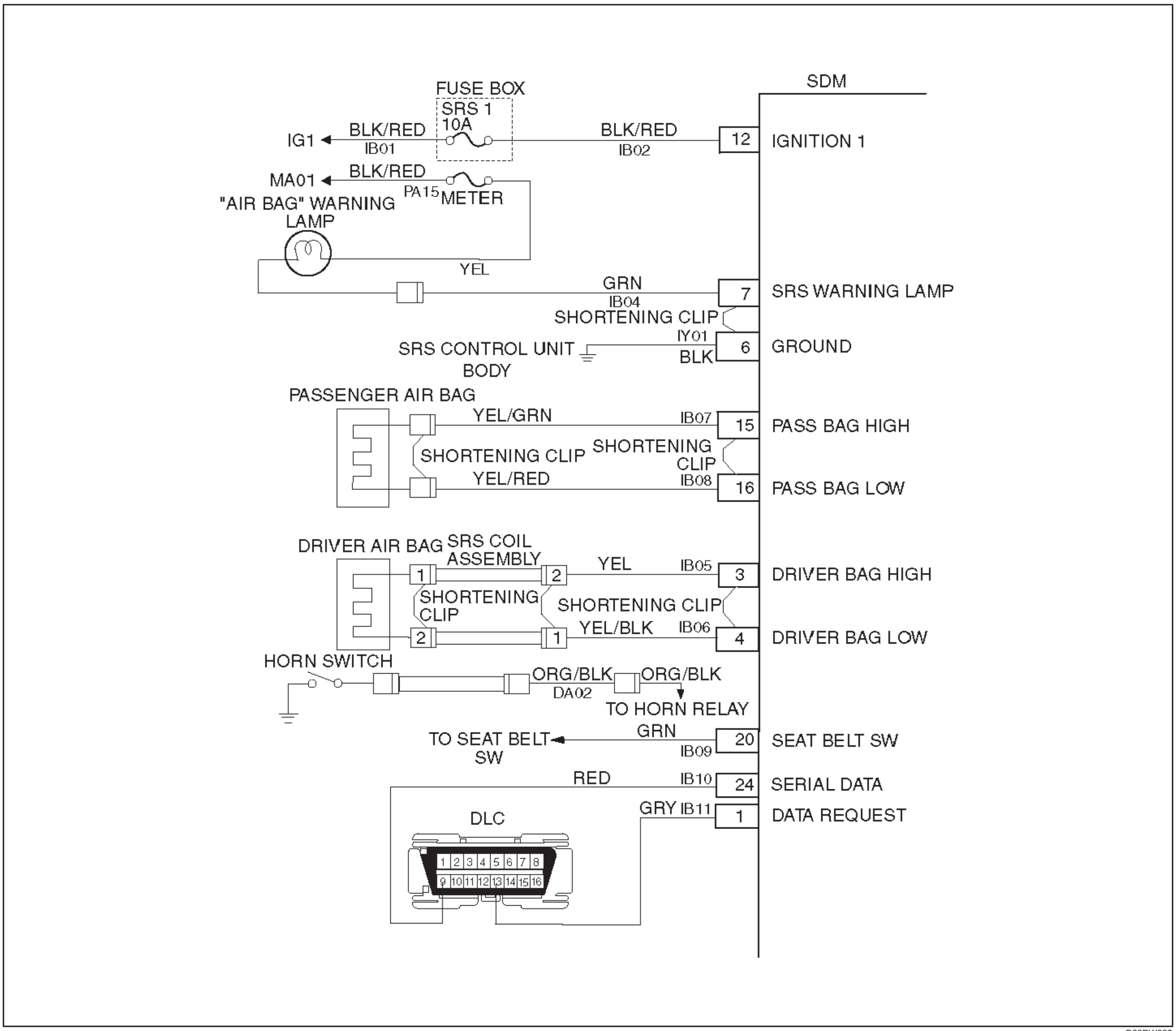
Diagnostic Aids:

An intermittent condition is likely to be caused by a short between CKT IB05–YEL or IB06–YEL/BLK or a malfunctioning shorting clip on the driver air bag assembly or SRS coil assembly which would require replacement of the component. The test for this diagnostic trouble code is only run while the “AIR BAG” warning lamp is performing the bulb check, unless DTC 17 or DTC 26 is detected. When a scan tool “Clear Codes” command is issued and the malfunction is still present, the DTC will not reappear until the next ignition cycle.

DTC 22 Driver Deployment Loop Resistance Low

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Use scan tool data list function, read and record the driver deployment loop resistance. Is driver resist. less than 1.9 ohms?	Go to Step 3	Go to Chart A.
3	1. Ignition switch “OFF.” 2. Make sure the SRS coil assembly yellow 2–pin connector located at the base of steering column is seated properly. Is the 2–pin connector connected properly?	Go to Step 4	Seat driver air bag assembly 2–pin connector properly. Go to Step 8
4	1. Disconnect and inspect the SRS coil assembly yellow 2–pin connector located base of steering column. 2. If OK, reconnect the driver air bag assembly yellow 2–pin connector. 3. Ignition switch “ON.” Is DTC 22 current?	Go to Step 5	Ignition switch “OFF.” Go to Step 8
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag 2–pin connectors located at the base of steering column and behind the glove box assembly. 3. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 22 current?	Go to Step 6	Go to Step 7
6	1. Ignition switch “OFF.” 2. There has been a decrease in the total circuit resistance of the driver deployment loop. 3. Use the high resolution ohmmeter mode of the DVM while checking CKTs IB05–YEL and IB06–YEL/BLK, and SDM connector terminal “3” and “4” to locate the root cause. Was a fault found?	Replace SRS harness. Go to Step 8	Go to Chart A.
7	1. Ignition switch “OFF.” 2. Disconnect SRS driver / passenger load tool from SRS coil assembly harness connector. 3. Connect SRS driver / passenger load tool J–41433 to the top of steering column. 4. Reconnect SRS coil assembly harness connector as the base of steering column. 5. Ignition switch “ON.” Is DTC 22 current?	Ignition switch “OFF.” Replace SRS coil assembly. Refer to in this section 9J–24. Go to Step 8	Ignition switch “OFF.” Replace driver air bag assembly. Go to Step 8
8	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to Step 8

DTC 24 Driver Deployment Loop Short To Ground



D09RW002

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.

The SDM monitors the voltage at “Driver Bag Low” terminal “4” and “Passenger Bag Low” terminal “16” to detect shorts to ground in the air bag assembly circuits.

DTC Will Set When:

Neither of the two air bag assemblies is open.

“Ignition 1” is within the normal operating voltage range. This test is run once each ignition cycle and “Continuous Monitoring”. Once these conditions are met and the voltage at “Driver Bag Low” is below a specified value, DTC 24 will set.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The malfunction is no longer occurring and the ignition is turned “OFF.”

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the SDM is malfunctioning
3. This test isolates the malfunction to one side of the SRS coil assembly yellow 2–pin connector at the base of the steering column.
4. This test determines whether the malfunction is in CKT IB05–YEL.

5. This test determines whether the malfunction is in CKT IB06–YEL/BLK.
6. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

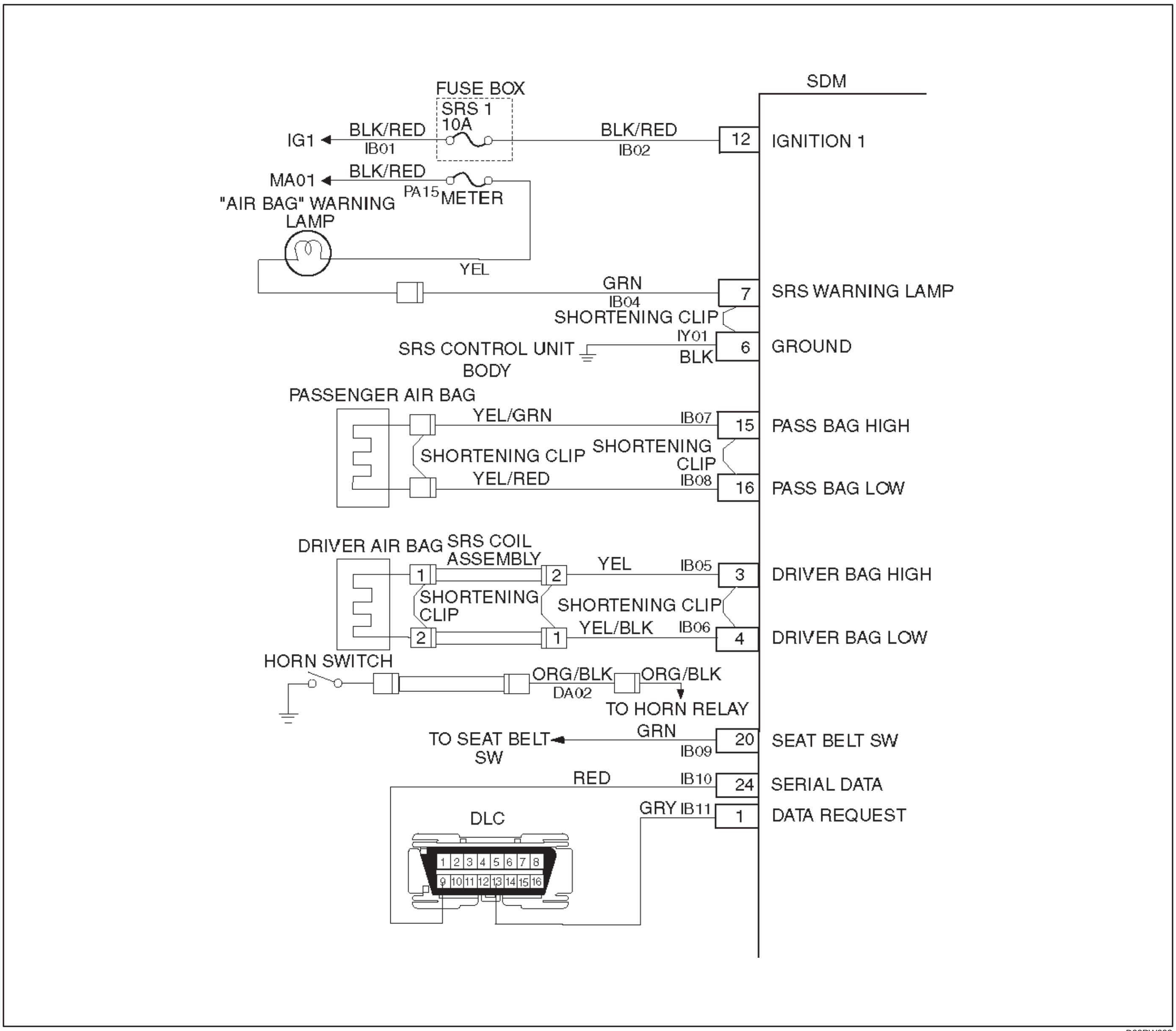
Diagnostic Aids:

An intermittent condition is likely to be caused by a short to ground in the driver air bag assembly circuit. Inspect CKTs IB05–YEL and IB06–YEL/BLK carefully for cutting or chafing.

DTC 24 Driver Deployment Loop Short To Ground

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch “OFF.” 3. Connect scan tool data link connector. Follow directions as given in the scan tool operator’s manual. Ignition switch “ON.” 4. Read driver sense LO. Is driver sense LO less than 1.5 volts?	Go to Step 3	Go to Chart A.
3	1. Ignition switch “OFF.” 2. Disconnect SRS coil assembly yellow 2–pin connector located at base of the steering column. Leave passenger air bag assembly connected. 3. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to SRS coil assembly harness connector. 4. Ignition switch “ON.” Is DTC 24 current?	Go to Step 4	Go to Step 6
4	1. Ignition switch “OFF.” 2. Disconnect SDM. 3. Disconnect SRS driver / passenger load tool. 4. Measure resistance on SDM harness connector “3” to terminal “6” (ground). Does J–39200 display “0L” (infinite)?	Go to Step 5	Replace SRS harness. Go to Step 7
5	Measure resistance on SDM harness connector from terminal “4” to terminal “6” (ground). Does J–39200 display “0L” (infinite)?	Go to Chart A.	Replace SRS harness. Go to Step 7
6	1. Ignition switch “OFF.” 2. Disconnect SRS driver / passenger load tool J–41433 from SRS coil assembly harness connector. 3. Connect SRS driver / passenger load tool J–41433 and appropriate adapter J–35616–A to driver air bag assembly harness connector. Located top of the steering column. 4. Reconnect SRS coil assembly harness connector as the base of steering column. 5. Ignition switch “ON.” Is DTC 24 current?	Ignition switch “OFF.” Replace SRS coil assembly. Refer to in this section 9J–24. Go to Step 7	Ignition switch “OFF.” Replace driver air bag assembly. Go to Step 7
7	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to Step 7

DTC 25 Driver Deployment Loop Short To Voltage



D09RW002

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.

The SDM monitors the voltage at “Driver Bag Low” terminal “4” and “Passenger Bag Low” terminal “16” to detect shorts to B+ in the air bag assembly circuits.

DTC Will Set When:

“Ignition 1” is in the normal operating voltage range. This test is run once each ignition cycle and “Continuous Monitoring”. Once these conditions are met and the voltage at “Driver Bag Low” is above a specified value, DTC 25 will set.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets DTC 25 and also DTC 71

DTC Will Clear When:

The SDM is replaced.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

2. This test determines whether the SDM is malfunctioning.
3. This test isolates the malfunction to one side of the SRS coil assembly yellow 2–pin connector at the base of steering column.
4. This test determines whether the malfunction is in CKT IB05–YEL.
5. This test determines whether the malfunction is in CKT IB06–YEL/BLK.

6. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

Diagnostic Aids:

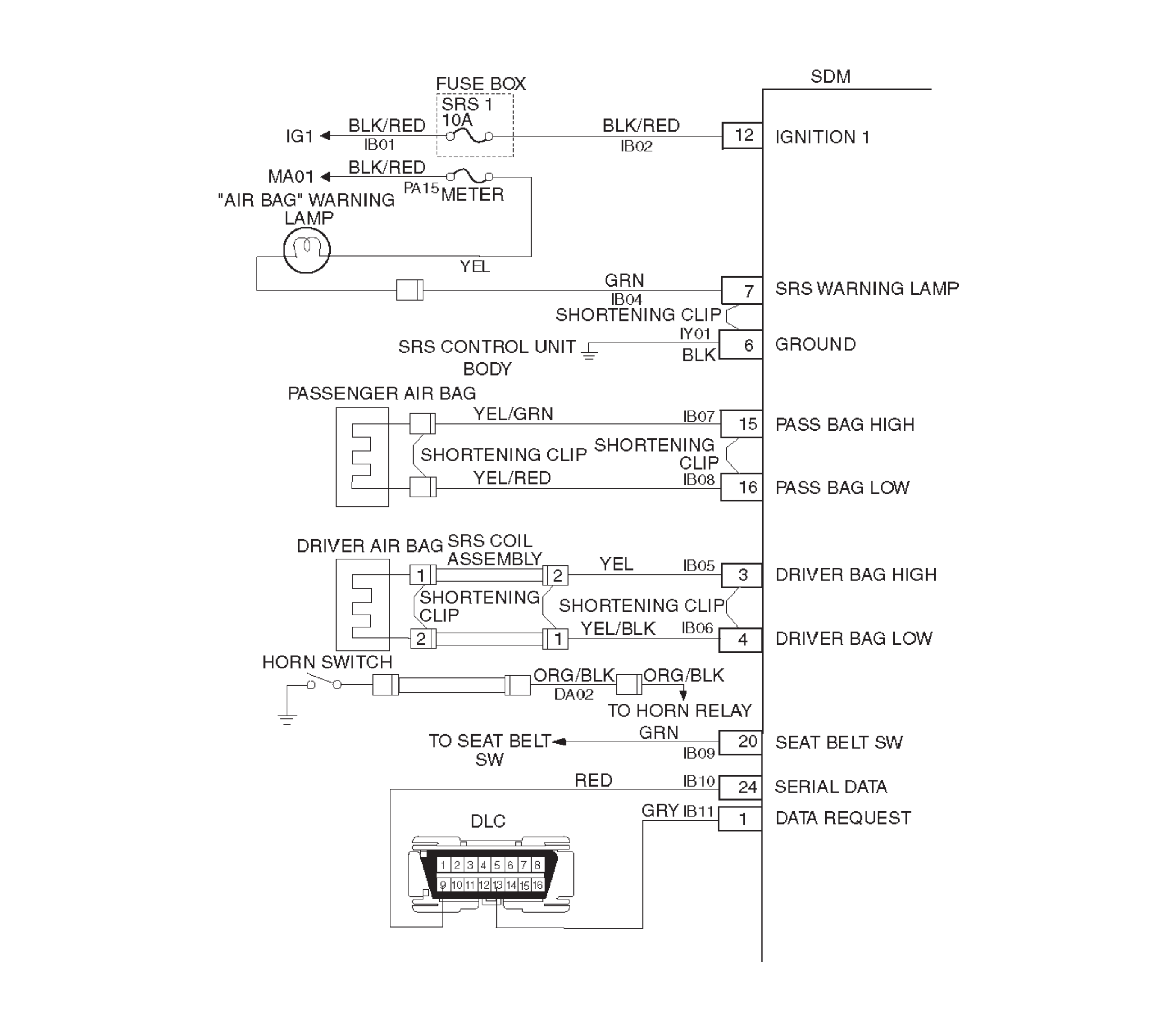
An intermittent condition is likely to be caused by a short to B+ in the driver air bag assembly circuit. Inspect CKTs IB05–YEL and IB06–YEL/BLK carefully for cutting or chafing. If the wiring pigtail of the driver air bag assembly and SRS coil assembly is damaged, the components must be replaced. A careful inspection of CKT IB05–YEL and IB06–YEL/BLK, including the SRS coil assembly and driver air bag assembly is essential to ensure that the replacement SDM will not be damaged.

DTC 25 Driver Deployment Loop Short To Ignition

CAUTION: When DTC 25 has been set, it is necessary to replace the SDM. Setting DTC 25 will also cause DTC 71 to set. When a scan tool "CLEAR CODES" command is issued and the malfunction is no longer present, DTC 71 will remain current. Ensure that the short to voltage condition is repaired prior to installing a replacement SDM to avoid damaging the SDM.

Step	Action	Yes	No
1	Was the "SRS Diagnostic System Check" performed?	Go to Step 2	Go to the "SRS Diagnostic System Check."
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Ignition switch "OFF." 3. Connect scan tool data link connector. Follow directions as given in the scan tool operator's manual. 4. Ignition switch "ON." 5. Read driver sense LO. Is driver sense LO more than 3.5 volts?	Go to Step 3	Go to Chart A.
3	1. Ignition switch "OFF." 2. Disconnect SRS coil assembly yellow 2–pin connector at the base of the steering column. Leave passenger air bag assembly connected. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to SRS coil assembly harness connector. 3. Ignition switch "ON." Is driver sense LO more than 3.5 volts?	Go to Step 4	Go to Step 6
4	1. Ignition switch "OFF." 2. Disconnect SDM. 3. Disconnect SRS drive / passenger load tool. 4. Measure resistance on SDM harness connector from terminal "3" to terminal "12" (Ignition 1). Does J–39200 display "0L" (infinite)?	Go to Step 5	Replace SRS harness. Go to Step 7
5	Measure resistance on SDM harness connector from terminal "4" to terminal "12" (Ignition 1). Does J–39200 display "0L" (infinite)?	Go to Chart A.	Replace SRS harness. Go to Step 7
6	1. Ignition switch "OFF." 2. Connect SRS driver / passenger load tool J–41433 and appropriate adapter J–35616–A to driver air bag assembly harness connector located of top of the steering column. 3. Reconnect SRS coil assembly harness connector as the base of steering column. 4. Ignition switch "ON." Is driver sense LO more than 3.5 volts?	Ignition switch "OFF." Replace SRS coil assembly. Go to Step 7	Ignition switch "OFF." Replace driver air bag assembly. Go to Step 7
7	1. Reconnect all components, ensure all components are properly mounted. 2. Ignition switch "ON." Is passenger sense LO less than 3.5 volts?	Replace SDM. Go to Step 8	Go to Chart A.
8	1. Reconnect all components, ensure all components are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the "SRS Diagnostic System Check."	Go to Step 8

DTC 26 Driver Deployment Loop Open



D09RW002

Circuit Description:

When the ignition switch is turned “ON”, the SDM will perform tests to diagnose critical malfunctions within itself. Upon passing these tests, “ignition 1”, and deployment loop voltages are measured to ensure they are within their respective normal voltage ranges.

During “Continuous Monitoring” diagnostics, a fixed amount of current is following in the deployment loop. This produces proportional voltage drops in the loop. By monitoring the voltage difference between “Driver Bag High” and “Driver Bag Low”, the SDM calculates the combined resistance of the driver air bag assembly, SRS coil assembly, harness wiring CKTs IB05–YEL and IB06–YEL/BLK, and connector terminal contact.

DTC Will Set When:

The voltage difference between “Driver Bag High” terminal “3” and “Driver Bag Low” terminal “4” is above or equal to a specified value for 500 milliseconds during “Continuous Monitoring.”

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The voltage difference between “Driver Bag High” terminal “3” and “Driver Bag Low” terminal “4” is below a specified value for 500 milliseconds during “Continuous Monitoring.”

DTC Chart Test Description:

Number(s) below refer to circled number(s) on the diagnostic chart:

1. This test determines whether the malfunction is in the SDM.

2. This test verifies proper connection of the yellow 2–pin connector at the base of the steering column.
3. This test checks for proper contact and/or corrosion of the yellow 2–pin connector at the base of the steering column.
4. This test isolates the malfunction to one side of the SRS coil assembly yellow 2–pin connector located at the base of steering column.
5. This test determines whether the open is in the wiring.
6. This test determines whether the malfunction is in the SRS coil assembly or the driver air bag assembly.

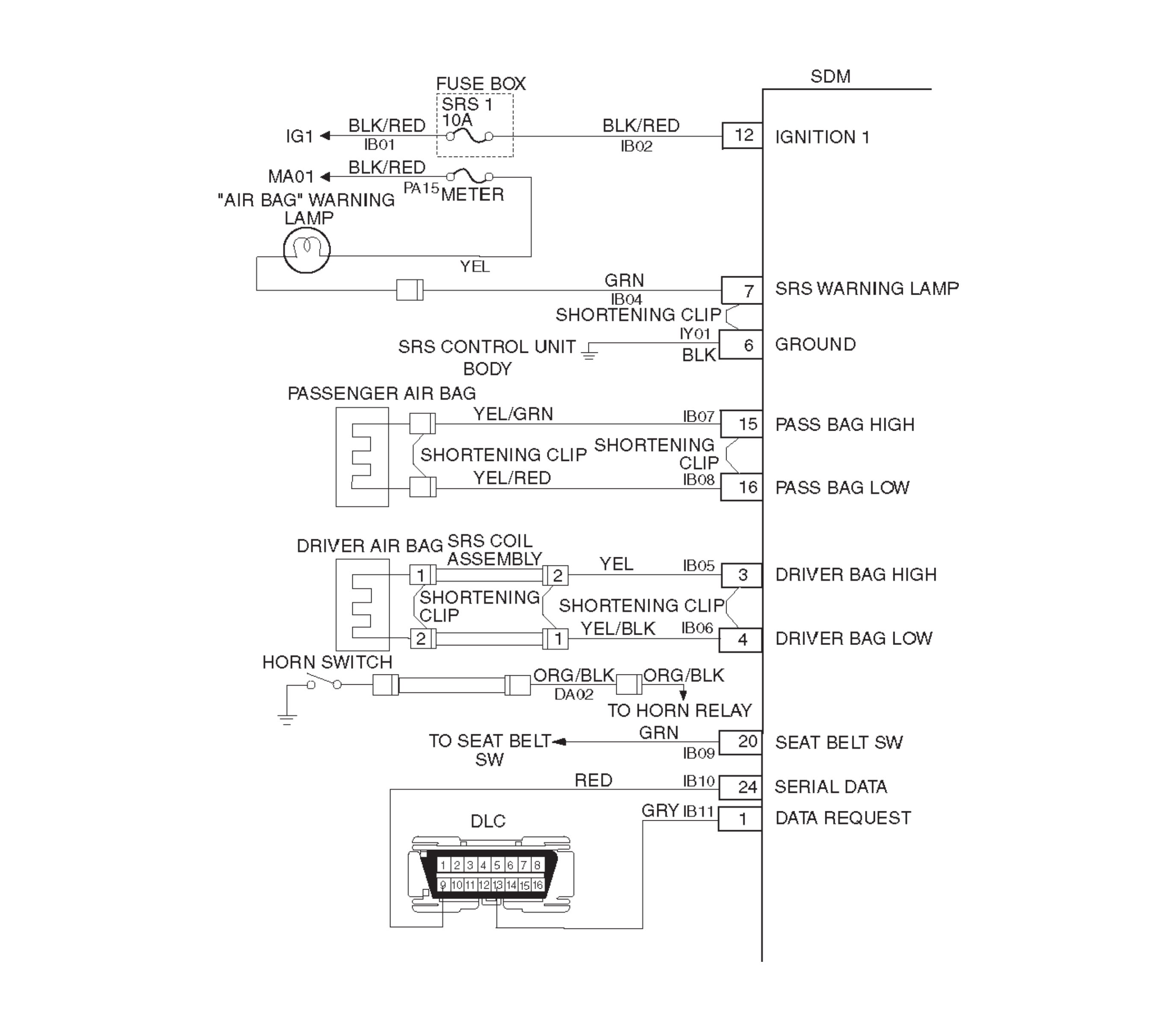
Diagnostic Aids:

An intermittent condition is likely to be caused by a poor connection at the driver air bag assembly harness 2–pin connector terminals “1” and “2” at the top of the steering column, SRS coil assembly harness 2–pin connection terminals “1” and “2”, SDM terminals “3” and “4”, or an open in CKTs IB05–YEL and IB06–YEL/BLK.

DTC 26 Driver Deployment Loop Open

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check.”
2	1. When measurements are requested in this chart use J–39200 DVM with correct terminal adapter from J–35616–A. 2. Use scan tool data list function, read and record the driver differential voltage. Is driver differential voltage more than 4.0 volts?	Go to Step 3	Go to Chart A.
3	1. Ignition switch “OFF.” 2. Make sure the SRS coil assembly yellow 2–pin connector located at the base of steering column is seated properly. Is the yellow 2–pin connector connected properly?	Go to Step 4	Seat driver air bag assembly 2–pin connector. Go to Step 8
4	1. Disconnect and inspect the SRS coil assembly yellow 2–pin connector located base of steering column. 2. If OK, reconnect the SRS coil assembly yellow 2–pin connector. 3. Ignition switch “ON”. Is DTC 26 current?	Go to Step 5	Ignition switch “OFF.” Go to Step 8
5	1. Ignition switch “OFF.” 2. Disconnect SRS coil and passenger air bag assembly, yellow 2–pin connectors located at the base of steering column and behind the glove box assembly. 3. Connect SRS driver / passenger load tool J–41433 and appropriate adapter to SRS coil and passenger air bag assembly harness connectors. 4. Ignition switch “ON.” Is DTC 26 current?	Go to Step 6	Go to Step 7
6	1. Ignition switch “OFF.” 2. There has been an open circuit in the driver deployment loop. Use the high resolution ohmmeter mode of the DVM while checking CKTs IB05 YEL and IB06 YEL/BLK, and SDM connector terminal “3” AND “4” to locate the root cause. Was a fault found?	Replace SRS harness. Go to Step 8	Go to Chart A.
7	1. Ignition switch “OFF.” 2. Disconnect SRS driver / passenger load tool from SRS coil assembly harness connector. 3. Connect SRS driver / passenger load tool J–41433 on steering column. 4. Reconnect SRS coil assembly harness connector as the base of steering column. 5. Ignition switch “ON.” Is DTC 26 current?	Ignition switch “OFF.” Replace SRS coil assembly, refer to in this section 9J–3. Go to Step 8	Ignition switch “OFF.” Replace driver air bag assembly. Go to Step 8
8	1. Reconnect all components, ensure all component are properly mounted. 2. Clear diagnostic trouble codes. Was this step finished?	Repeat the “SRS Diagnostic System Check.”	Go to Step 8

DTC 51 Deployment Event Commanded



D09RW002

Circuit Description:

The SDM contains a sensing device which converts vehicle velocity changes to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the air bag assembly deploying the air bags and causing DTC 51 to set.

DTC Will Set When:

The SDM detects a frontal crash, up to 30 degrees off the centerline of the vehicle, of sufficient force to warrant deployment of the air bags.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp records “Crash Data”, and sets a diagnostic trouble code.

DTC Will Clear When:

The SDM is replaced.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

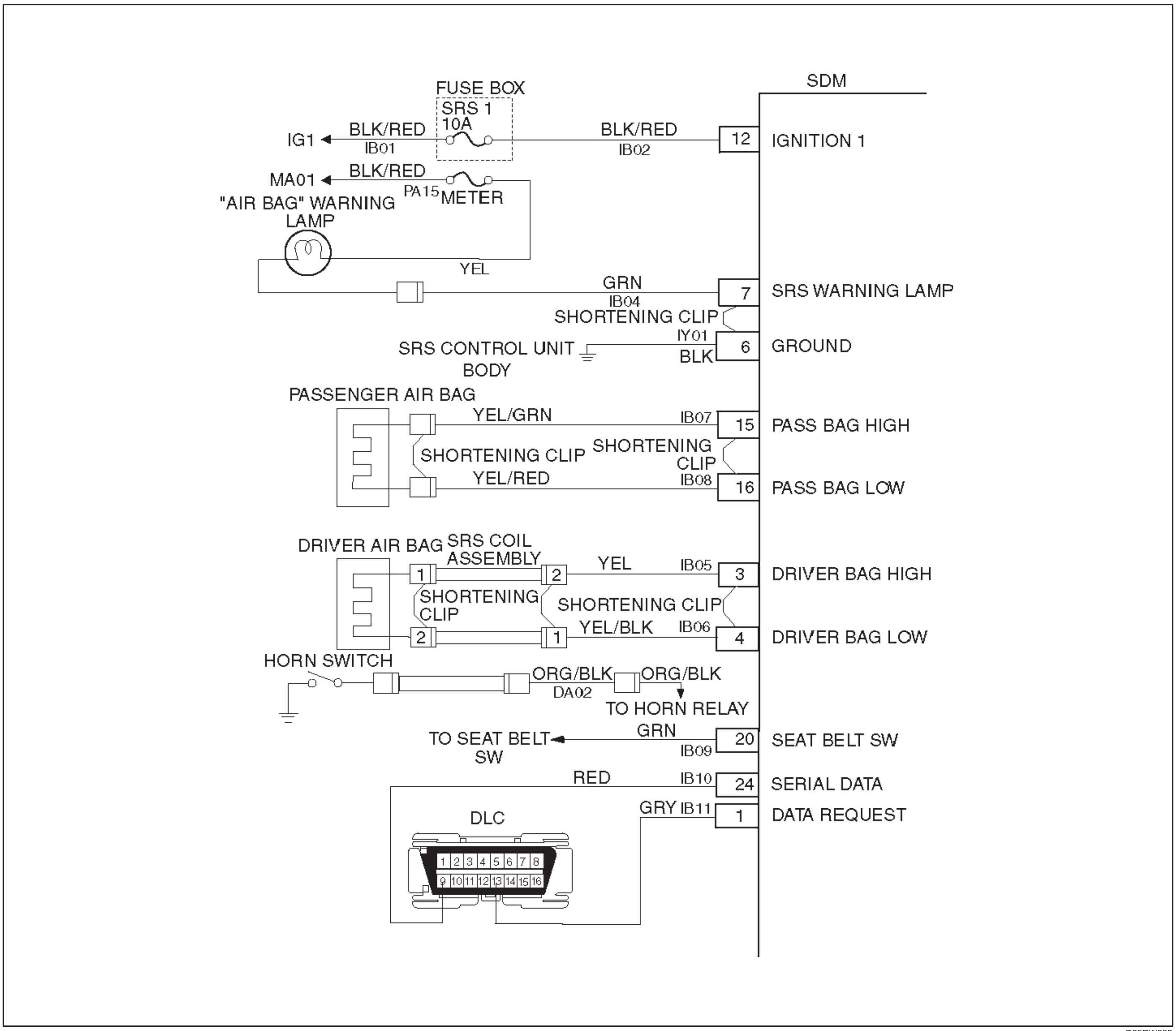
2. If air bag assembly (s) has not deployed, DTC 51 may have falsely set.
3. If DTC 51 has set with no signs of frontal impact, the diagnostic trouble code has falsely set.

DTC 51 Deployment Event Commanded

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check.”
2	Ignition switch “OFF.” Have air bag assemblies deployed?	Replace components and perform inspections as directed in “repairs and inspections required after an accident” in this section. Clear diagnostic trouble codes. Repeat the “SRS Diagnostic System Check.”	Go to Step 3
3	Inspect front of vehicle and undercarriage for signs of impact. Were signs of impact found?	Replace components and perform inspections as directed in “repairs and inspections required after an accident” in this section. Clear diagnostic trouble codes. Repeat the “SRS Diagnostic System Check.”	Ignition switch “OFF.” Replace SDM. Reconnect all SRS system components, ensure all components are properly mounted.Repeat the “SRS Diagnostic System Check.”

DTC 53 Deployment Commanded With Deployment Loop Fault Or Energy Reserves Out Of Range



D09RW002

Circuit Description:

The SDM contains a sensing drive which converts vehicle velocity changes to an electrical signal. The electrical signal generated is processed by the SDM and then compared to a value stored in memory. When the generated signal exceeds the stored value, the SDM will cause current to flow through the air bag assembly deploying the air bags. DTC 53 is set accompanying with DTC 51 when a deployment occurs while an air bag assembly circuit fault is present that could possible result in a no deployment situation in one or both air bag assemblies.

DTC Will Set When:

The SDM detects a frontal crash, up to 30 degrees off the centerline of the vehicle, of sufficient force to warrant deployment of the air bags and an inflator circuit fault is present.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp records “Crash Data”, and sets a diagnostic trouble code.

DTC Will Clear When:

The SDM is replaced. If DTC 53 is set, one or more DTCs will be set in addition to DTC 53. Malfunction(s) setting DTC(s) (other than DTC 71) must be repaired so that DTC(s) will not be set when a new SDM is installed.

DTC Chart Test Description:

Number(s) below refer to step number(s) on the diagnostic chart:

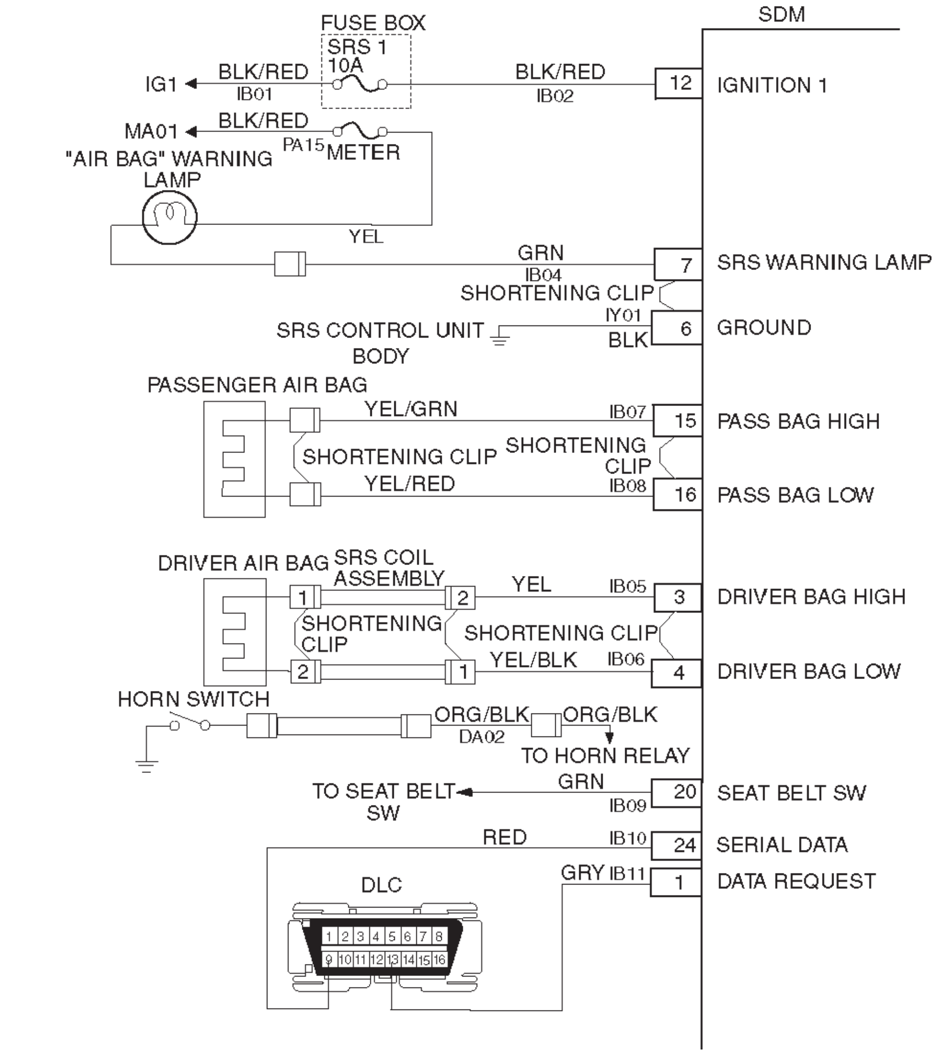
2. If air bag assembly has not deployed, DTC 53 may have falsely set.
3. If DTC 53 has set with no signs of frontal impact, the diagnostic trouble code has falsely set.

DTC 53 Deployment Commanded With Deployment Loop Fault Or Energy Reserves Out Of Range

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check.”
2	Ignition switch “OFF.” Have air bag assemblies deployed?	Replace components and perform inspections as directed in “repairs and inspections required after an accident” in this section. Clear diagnostic trouble codes. Repeat the “SRS Diagnostic System Check.”	Go to Step 3
3	Inspect front of vehicle and undercarriage for signs of impact. Were signs of impact found?	Replace components and perform inspections as directed in “repairs and inspections required after an accident” in this section. Clear diagnostic trouble codes. Repeat the “SRS Diagnostic System Check.”	Ignition switch “OFF.” Replace SDM. Reconnect all SRS system components, ensure all components are properly mounted. Repeat the “SRS Diagnostic System Check.”

DTC 61 Warning Lamp Circuit Failure



D09RW002

Circuit Description:

When the ignition switch is turned “ON”, battery voltage is applied to the “AIR BAG” warning lamp and to the “ignition 1” input terminal “12”. The SDM responds by flashing the “AIR BAG” warning lamp seven times. The SDM monitors the lamp driver output by comparing the output state at “SRS warning lamp” terminal “7” to the microprocessor commanded state. When “ignition 1” is in the specified value, and the output state Does not match the commanded state of the lamp driver for 500 milliseconds, DTC 61 is set.

DTC Will Set When:

“Ignition 1” voltage is in the specified value and the output state at the “SRS warning lamp” terminal does not match the commanded state of the lamp driver for 500 milliseconds. This test is run every 100 milliseconds during “Continuous Monitoring” tests and once per each ignition cycle at the beginning.

Action Taken:

SDM attempts to turn “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

The ignition switch is turned “OFF.”

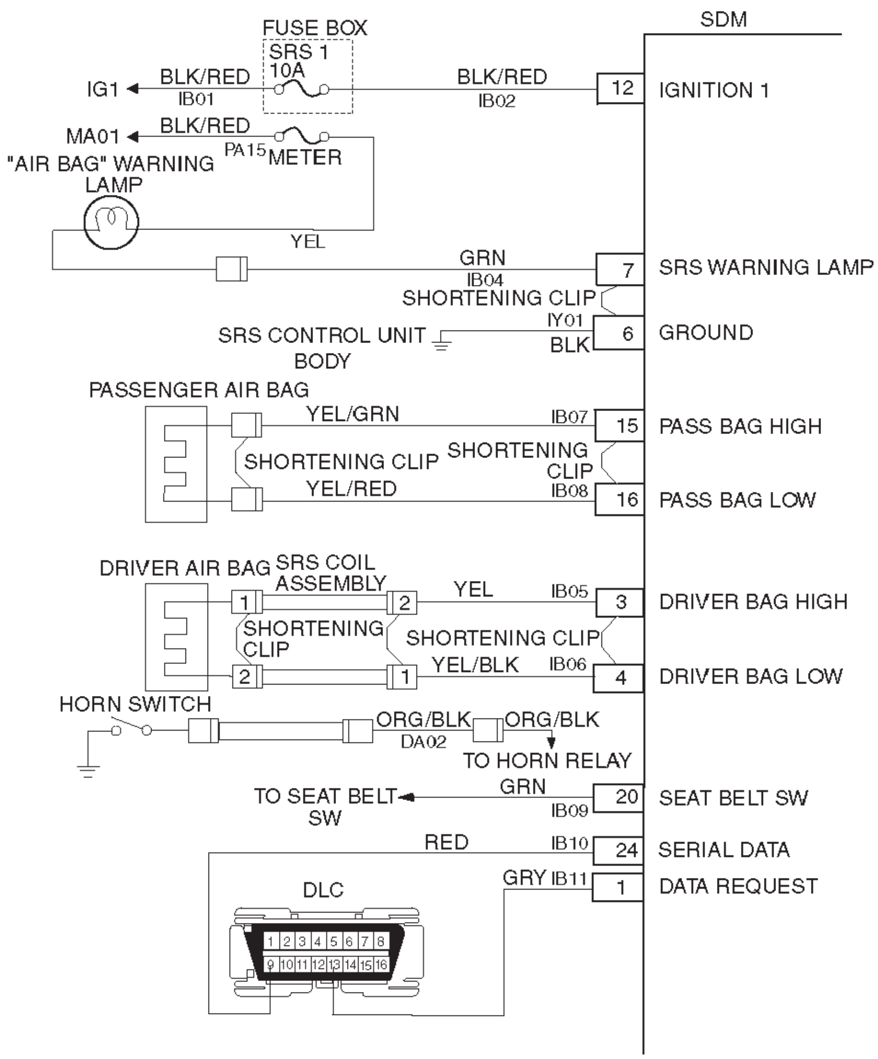
Diagnostic Aids:

Refer to Charts B and C to diagnose warning lamp circuit malfunctions.

DTC 61 Warning Lamp Circuit Failure

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check.”
2	1. Malfunctions within the “AIR BAG” warning lamp circuitry will set this diagnostic trouble code. 2. These malfunctions are addressed in the “SRS Diagnostic System Check” via Chart B and Chart C. 3. Failure to properly perform the “SRS Diagnostic System Check” may result in misdiagnosis. 4. Ignition switch “ON.” 5. Clear SRS diagnostic trouble codes. Is DTC 61 SET?	Ignition switch “OFF.” Go to Chart A.	Repeat the “SRS Diagnostic System Check.”

DTC 71 Internal SDM Fault



D09RW002

Circuit Description:

DTC 71 is an indication of a potential internal SDM malfunction and will set if any of the following conditions are detected:

1) Deployment or microprocessor energy reserve failure.
2) EEPROM failure.
3) ROM failure.
4) RAM failure.
5) Calibration check sum failure.
6) Deployment switch faults.
7) Accelerometer fault.
8) Arming sensor fault.
9) Diagnostic current faults.
10) DTC 19
11) DTC 25
12) DTC 51
13) DTC 53

DTC Will Set When:

Any of the above indicated malfunctions are detected by the SDM. The malfunctions described above are tested mainly during “Continuous Monitoring” and some ones run each ignition cycle.

Action Taken:

SDM turns “ON” the “AIR BAG” warning lamp and sets a diagnostic trouble code.

DTC Will Clear When:

A scan tool “Clear Codes” commanded is received by the SDM. Some of the indicated malfunctions will only allow the “AIR BAG” warning lamp to go out.
But when DTC 19, 25, 51, 53 are also set, SDM is Replaced.

DTC 71 Internal SDM Fault

WARNING: DURING SERVICE PROCEDURES. BE VERY CAREFUL WHEN HANDLING A SENSING AND DIAGNOSTIC MODULE (SDM). NEVER STRIKE OR JAR THE SDM. NEVER POWER UP THE SRS WHEN THE SDM IS NOT RIGIDLY ATTACHED TO THE VEHICLE. ALL SDM AND MOUNTING BRACKET FASTENERS MUST BE CAREFULLY TORQUED AND THE ARROW MUST BE POINTING TOWARD THE FRONT OF THE VEHICLE TO ENSURE PROPER OPERATION OF THE SRS. THE SDM COULD BE ACTIVATED WHEN POWERED WHILE NOT RIGIDLY ATTACHED TO THE VEHICLE WHICH COULD CAUSE DEPLOYMENT AND RESULT IN PERSONAL INJURY.

CAUTION: When DTC 19 or 25 or 51 or 53 has been set it is necessary to Replace the SDM. Setting DTC 19 and 25 or 51 or 53 will also cause DTC 71 to set. When a scan tool “CLEAR CODES” command is issued and the malfunction is no longer present, DTC 51 or 53 and DTC 71 will remain current. Ensure that the short to voltage condition DTC 19, 25 is repaired prior to installing a Replacement SDM to avoid damaging the SDM.

Step	Action	Yes	No
1	Was the “SRS Diagnostic System Check” performed?	Go to Step 2	Go to the “SRS Diagnostic System Check.”
2	Confirm SRS “Diagnostic System Check.” Is DTC 19 or 25 or 51 or 53 also set (current or history)? (Refer to notice above).	Go to DTC 19 if DTC 19 is set. Go to DTC 25 if DTC 25 is set. Go to DTC 51 if DTC 51 is set. Go to DTC 53 if DTC 53 is set.	Ignition switch “OFF.” Replace SDM. Repeat the “SRS Diagnostic System Check.”

RODEO

CONTROL SYSTEM

CRUISE CONTROL SYSTEM

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The cruise control keeps the vehicle running at a fixed speed until a signal canceling this fixed speed is received. When the main switch “AUTO CRUISE” is turned on with the vehicle in the running mode, the battery voltage is applied to the PCM. When a signal from the control switch is input to the PCM while the vehicle is in this state, the cruise control system is activated. Also, while the system is operating, the “AUTO CRUISE” indicator light in the meter assembly lights up.

1 . SET/COAST Switch Function

1. **Set Function:** When the SET/COAST switch is pressed and released with the main switch on, the speed at which the vehicle is running at that moment is stored in the memory, and the vehicle automatically runs at the speed stored.
2. **Coast–Down Function:** When the SET/COAST switch is kept on while the vehicle is running, the vehicle decelerates during that time. The speed at which vehicle is running when the control switch is turned off is stored in the memory, and the vehicle automatically returns to the stored speed.
3. **Tap–Down Function:** When the SET/COAST switch is turned on and off instantaneously while the vehicle is running, the vehicle decelerates a mile for each on/off operation. The vehicle speed at which the vehicle was running when the SET/COAST was turned off last is stored in the memory, and the vehicle automatically returns to this stored speed.

2 . RESUME/ACCEL Switch Function

1. **Resume Function:** When the RESUME, ACCEL switch is turned on/off after the system is temporarily deactivated by pressing the brake or clutch pedal while the vehicle is running, the vehicle resumes, the speed stored before the system was released.
2. **Accelerate Function:** When the RESUME/ACCEL switch is kept on after the system is released completely, the vehicle accelerates its speed during that time. The vehicle speed at which the vehicle was running when the switch was turned off is stored in the memory, and the vehicle automatically returns to this speed.
3. **Tap–Up Function:** When the RESUME/ACCEL switch is turned on and off instantaneously while the vehicle is running, the vehicle accelerates a mile for each on/off operation. The vehicle speed at which the vehicle was running when the switch was turned off last is stored in the memory, and the vehicle automatically returns to this stored speed.

3 . CANCEL Function

1. **Temporary Cancellation:**
   - When the cancel switch is turned on.
   - When the brake pedal is pressed.
   - When the clutch pedal is pressed. (M/T)
   - When the select lever is shifted to any position other than “D”, “3”, “2” or “L”. (A/T)
   - When the vehicle speed has decreased about 12.5 mph (20 km/h) or more than the stored speed.
2. **Complete Cancellation:**
   - When the starter switch or the main switch is turned off.
   - When the failsafe function is activated.
   - When the vehicle speed gets lower than 20 mph (32 km/h).

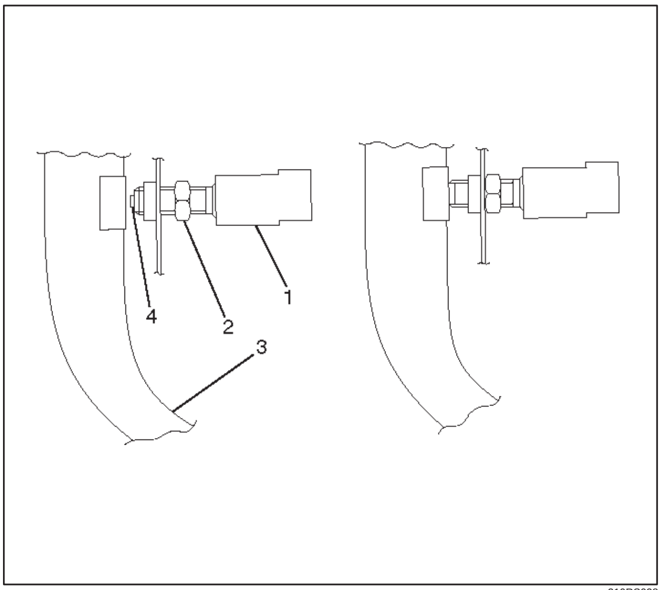
Brake Switch

Removal and Installation

Refer to the Brake Pedal Replacement in Brake section.

Adjustment

1. Check that the brake pedal (3) is fully returned by pedal return spring.
2. Disconnect the switch connector.
3. Loosen the lock nut (2).
4. Rotate the brake switch (1) by hand until push rod disappears from brake switch tip (4).
5. Return the brake switch by a half turn.
6. Tighten the lock nut.
7. Connect the switch connector.



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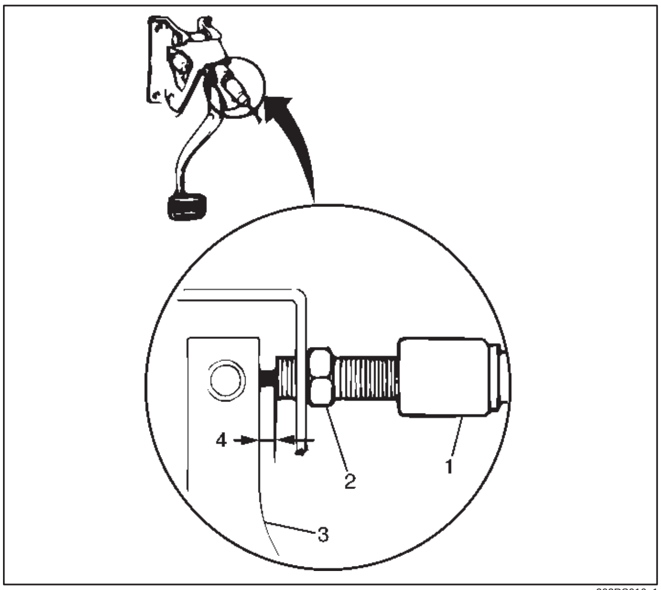
Clutch Switch

Removal and Installation

Refer to the Clutch Control removal and installation steps in Clutch section.



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Adjustment

1. Turn the clutch switch (1) until the switch plunger is fully retracted against the clutch pedal arm.
2. Adjust clutch switch by backing it out half a turn and measure the clearance (4) between the clutch pedal arm (3) and the clutch switch.
3. Lock the lock nut(2).
4. Connect clutch switch connector.

Clutch Switch (bolt) and Clutch Pedal Clearance

0.5 – 1.5 mm (0.020 – 0.059 in)

Powertrain Control Module (PCM)

Removal and Installation

Refer to Powertrain Control Module (PCM) in Engine section.

Mode Switch

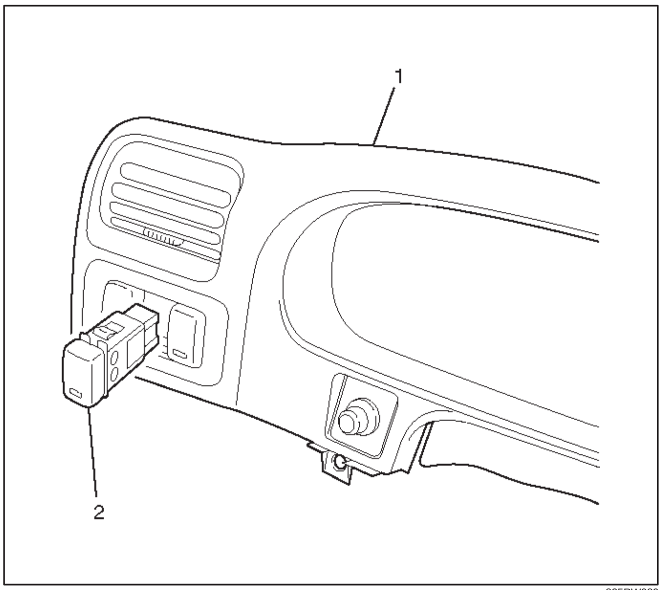
Removal and Installation

Refer to the Mode Switch removal and installation steps in Automatic Transmission section.

Cruise Control Main Switch

Removal

1. Disconnect the battery ground cable.
2. Remove the meter cluster assembly (1).
   - Refer to the Instrument Panel Assembly in Body Structure section.
3. Remove the rear defogger switch (2).
   - Disconnect the switch connector.
   - To remove the switch, push the lock from the back side of the instrument panel cluster assembly.



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Installation

To install, follow the removal steps in the reverse order.

Cruise Control Switch (Combination Switch)

Removal and Installation

Refer to the Lighting Switch (Combination Switch) removal and installation steps in Lighting System section.

Diagnosis

Cruise control system is controlled by the PCM as well as 6VE1 engine and automatic transmission. DTC codes are stored in the PCM if troubles occur in the circuit. DTC codes categorized “type D” are shown only by the Tech 2 scan tool. The following chart only shows some typical DTCs for cruise control system. Refer to PCM Diagnostic Trouble Codes in Driveability and Emissions for entire DTC diagnosis.

DTC	TROUBLE PART	DTC TYPE	MAJOR CONDITION OF TROUBLE	DIAGNOSIS PERIOD
P0565	CRUISE MAIN CIRCUIT	D	● THE SWITCH CONTACT REMAINS ON FOR 15 SECONDS OR MORE. ● NOISES ARE GENERATED BY THE POOR SWITCH CONTACT 60 TIMES WITHIN 1 SECOND.	DIAGNOSIS IS ENABLED IN 130 SECONDS AFTER THE SWITCH OPERATED.
P0566	CRUISE CANCEL CIRCUIT	D	● THE SWITCH CONTACT REMAINS ON FOR 40 SECONDS OR MORE. ● NOISES ARE GENERATED BY THE POOR SWITCH CONTACT 100 TIMES WITHIN 1.6 SECONDS.	DIAGNOSIS IS ENABLED IN 120 SECONDS AFTER THE SWITCH OPERATED.
P0567	CRUISE RESUME CIRCUIT	D	● THE SWITCH CONTACT REMAINS ON FOR 50 SECONDS OR MORE. ● NOISES ARE GENERATED BY THE POOR SWITCH CONTACT 100 TIMES WITHIN 1.6 SECONDS.	DIAGNOSIS IS ENABLED IN 110 SECONDS AFTER THE SWITCH OPERATED.
P0568	CRUISE SET CIRCUIT	D	● THE SWITCH CONTACT REMAINS ON FOR 120 SECONDS OR MORE. ● NOISES ARE GENERATED BY THE POOR SWITCH CONTACT 100 TIMES WITHIN 1.6 SECONDS.	DIAGNOSIS IS ENABLED IN 125 SECONDS AFTER THE SWITCH OPERATED.

DTC: Diagnostic Trouble Code

NOTE: The DTCs are detected while the engine is running

AMIGO(UA)

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AMIGO

GENERAL INFORMATION

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General Information

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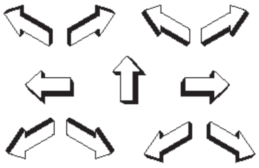
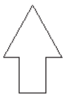
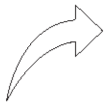
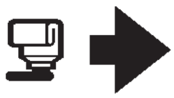
General Repair Instruction

1. If a floor jack is used, the following precautions are recommended.
   Park vehicle on level ground, “block” front or rear wheels, set jack against the recommended lifting points (see “Lifting Instructions” in this section), raise vehicle and support with chassis stands and then perform the service operations.
2. Before performing service operations, disconnect ground cable from the battery to reduce the chance of cable damage and burning due to short circuiting.
3. Use a cover on body, seats and floor to protect them against damage and contamination.
4. Brake fluid and anti–freeze solution must be handled with reasonable care, as they can cause paint damage.
5. The use of proper tools and recommended essential and available tools, where specified, is important for efficient and reliable performance of service repairs.
6. Use genuine Isuzu parts.
7. Used cotter pins, plastic clips, gaskets, O–rings, oil seals, lock washers and self–locking nuts should be discarded and new ones should be installed, as normal function of the parts cannot be maintained if these parts are reused.
8. To facilitate proper and smooth reassembly operation, keep disassembled parts neatly in groups. Keeping fixing bolts and nuts separate is very important, as they vary in hardness and design depending on position of installation.
9. Clean the parts before inspection or reassembly. Also clean oil ports, etc. using compressed air, and make certain they are free from restrictions.
10. Lubricate rotating and sliding faces of the parts with oil or grease before installation.
11. When necessary, use a sealer on gaskets to prevent leakage.
12. Carefully observe all specifications for bolt and nut torques.
13. When removing or replacing parts that require refrigerant to be discharged from the air conditioning system, be sure to use the Vehicle Refrigerant Recovery and Recycling Equipment (VRRRE) to recover and recycle Refrigerant–134a.
14. When a service operation is completed, make a final check to be sure the service has been done properly and the problem has been corrected.
15. SUPPLEMENTAL RESTRAINT SYSTEM
    The vehicle is equipped with a Supplemental Restraint System (SRS) – Air Bags. This system is not to be serviced without consulting the appropriate service information. Consult Section 9J “SRS System” if work is to be done on the front of the vehicle such as bumper, sheet metal, seats, wiring, steering wheel or column. Also review SRS system information if any arc welding is to be done on the vehicle. The SRS system equipped vehicle can be identified by:
    1. “AIR BAG” warning light on the instrument cluster.
    2. A Code “K” or “M” for fifth digit of Vehicle Identification Number.

Illustration Arrows

Arrows are designed for specific purposes to aid your understanding of technical illustrations.

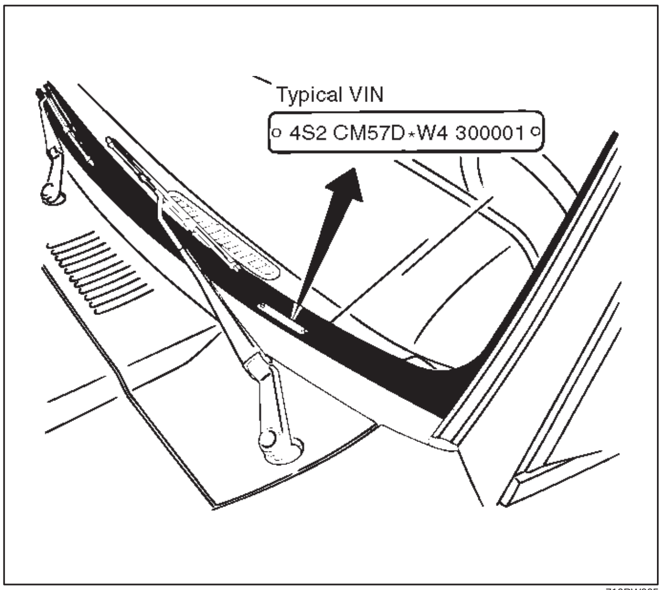
Arrow Type	Application
	Front of vehicle
	Up Side
	Task Related
	View Detail
	View Angle
	Dimension (1:2)
	Sectioning (1:3)

Arrow Type	Application
	● Ambient/Clean air flow ● Cool air flow
	● Gas other than ambient air ● Hot air flow
	● Ambient air mixed with another gas ● Can indicate temperature change
	Motion or direction
	Lubrication point oil or fluid
	Lubrication point grease
	Lubrication point jelly

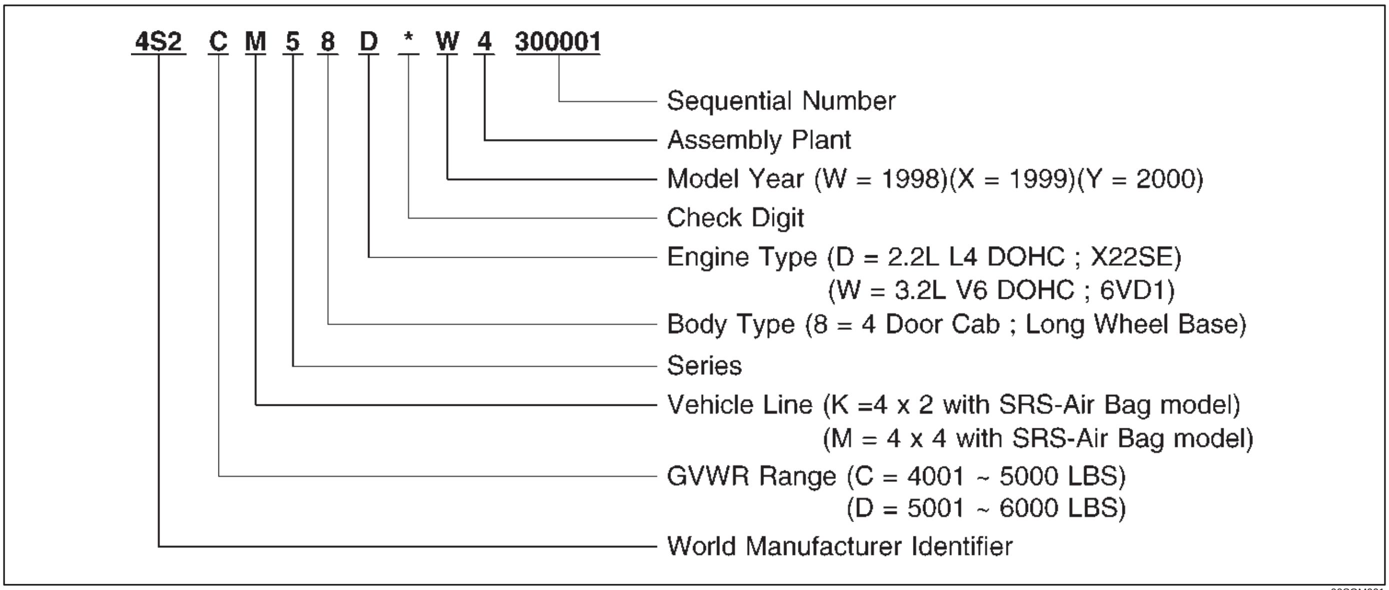
Identification

Vehicle Identification Number (VIN)

This is the legal identification of the vehicle. it is located on the left bottom of the windshield. It can be easily seen through the windshield from outside the vehicle.



710RW005

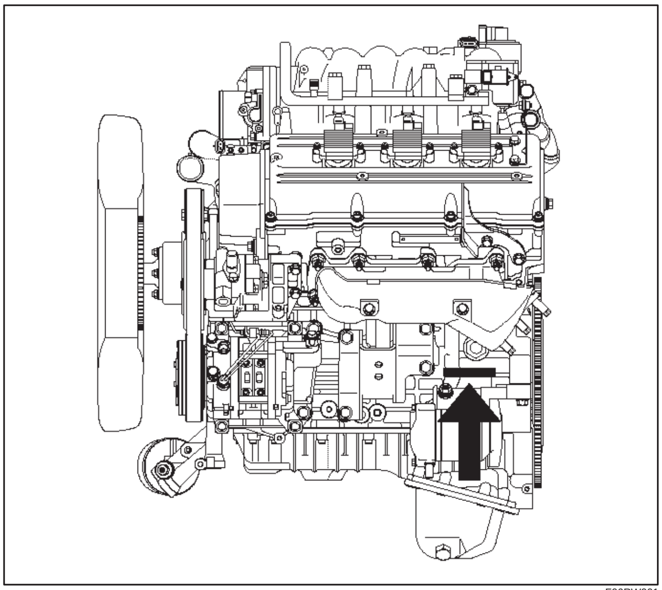


00SGM001

Engine Serial Number

- **6VD1 Engine**

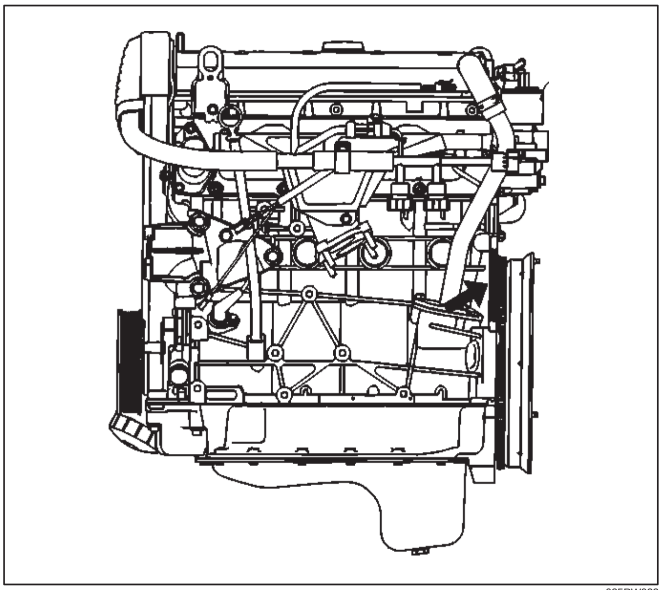
The gasoline engine serial number is stamped on the left rear lower area of the cylinder block above the starter.



F06RW001

- **X22SE Engine**

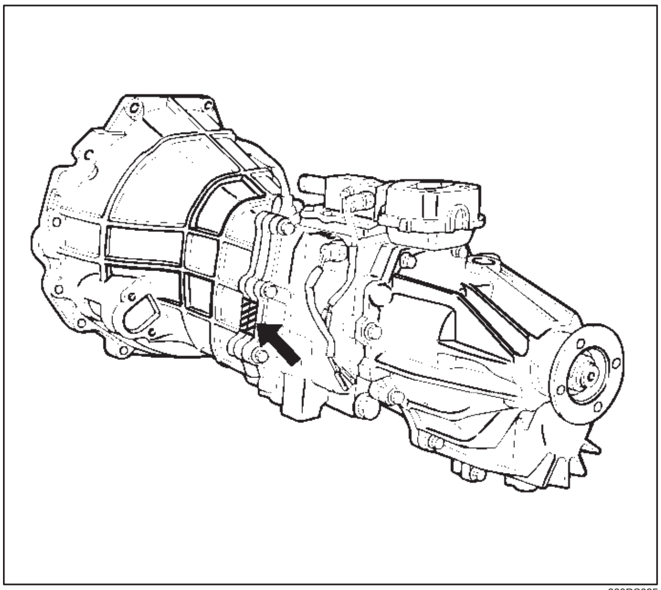
The gasoline engine serial number is stamped on the rear end raised area of the cylinder block left side.



035RW022

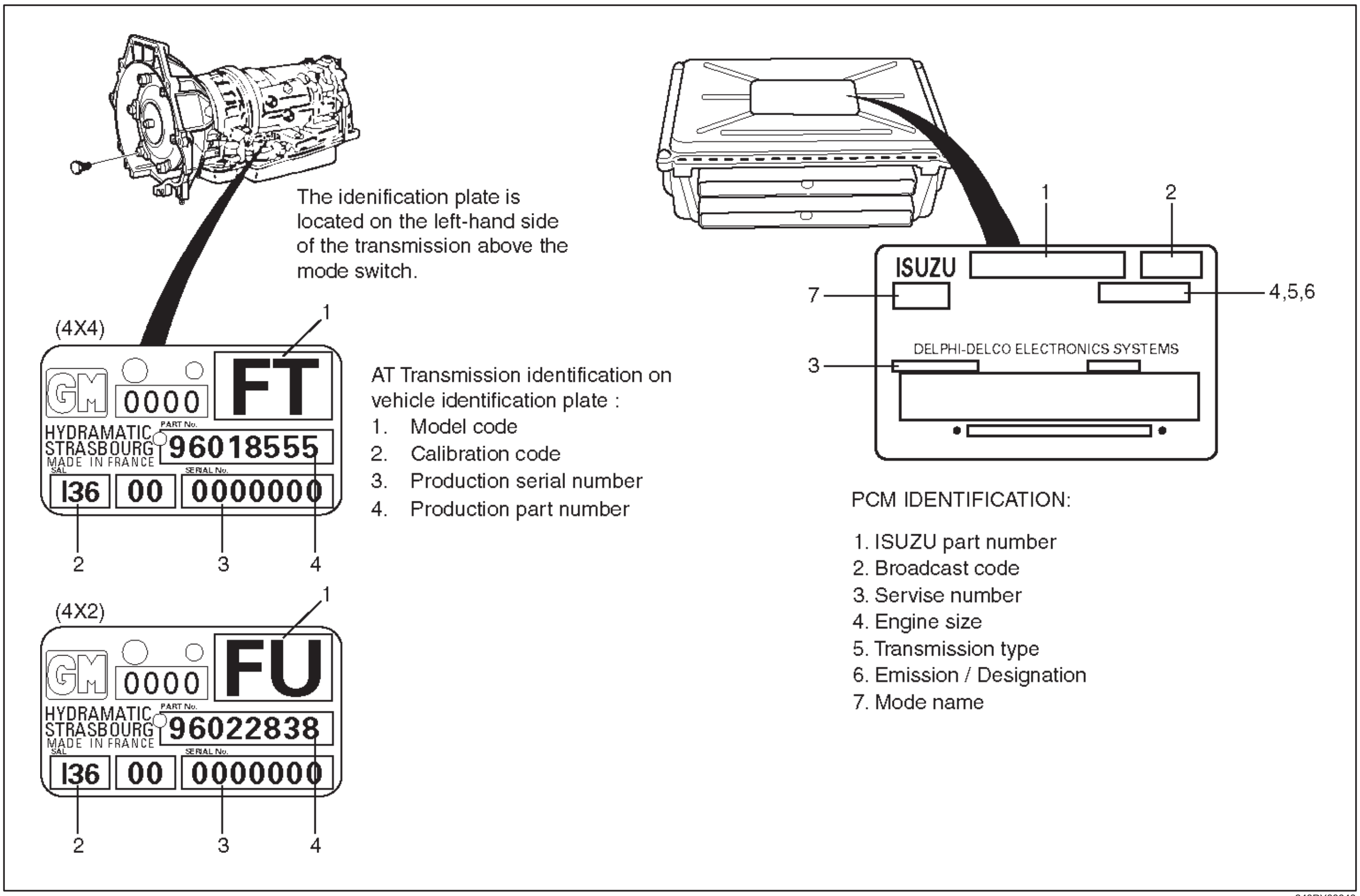
Transmission Serial Number

Manual : Stamped on the left side of the transmission intermediate plate.



220RS025

Automatic : Stamped on the identification plate, located on the left side of the transmission above the mode switch.



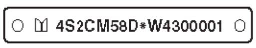
240RY00040

Theft Prevention Standard

The 8 major components listed below will be marked with 17 digit VIN at the stage of production. In addition its service parts will be marked with manufacturer's trade mark, "R" mark and "DOT" mark.

Reference Figure No.	COMPONENT		INDICATION	
			PRODUCTION	SERVICE PARTS
0A-10	ENGINE	1– 6VD1 – X22SE	VIN plate	R DOT Mark stamping
0A-11	TRANSMISSION	2– Manual transmission	VIN plate	R DOT Mark stamping
		– Automatic transmission	VIN plate	R DOT Mark label
0A-11	BODY	3– Engine hood 4– Front door 5– Fender 6– Front bumper 7– Back door 8– Rear bumper	VIN label	R DOT Mark label

Anti Theft Stamping/Plate/Label

	STAMPING/PLATE	LABEL
PRODUCTION	Example 	Example 
SERVICE PARTS	R DOT	R DOT

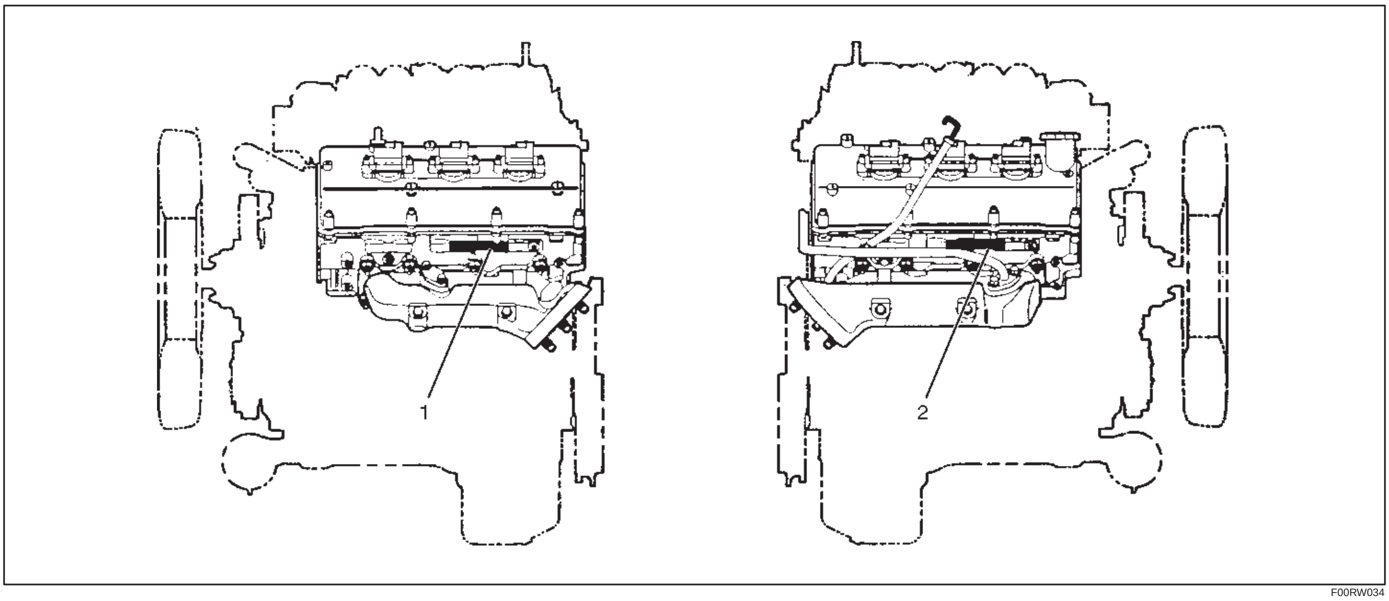
Anti Theft Stamping/Label/Plate Location

The stamping, label and plate locations are indicated by arrows in the illustration below.

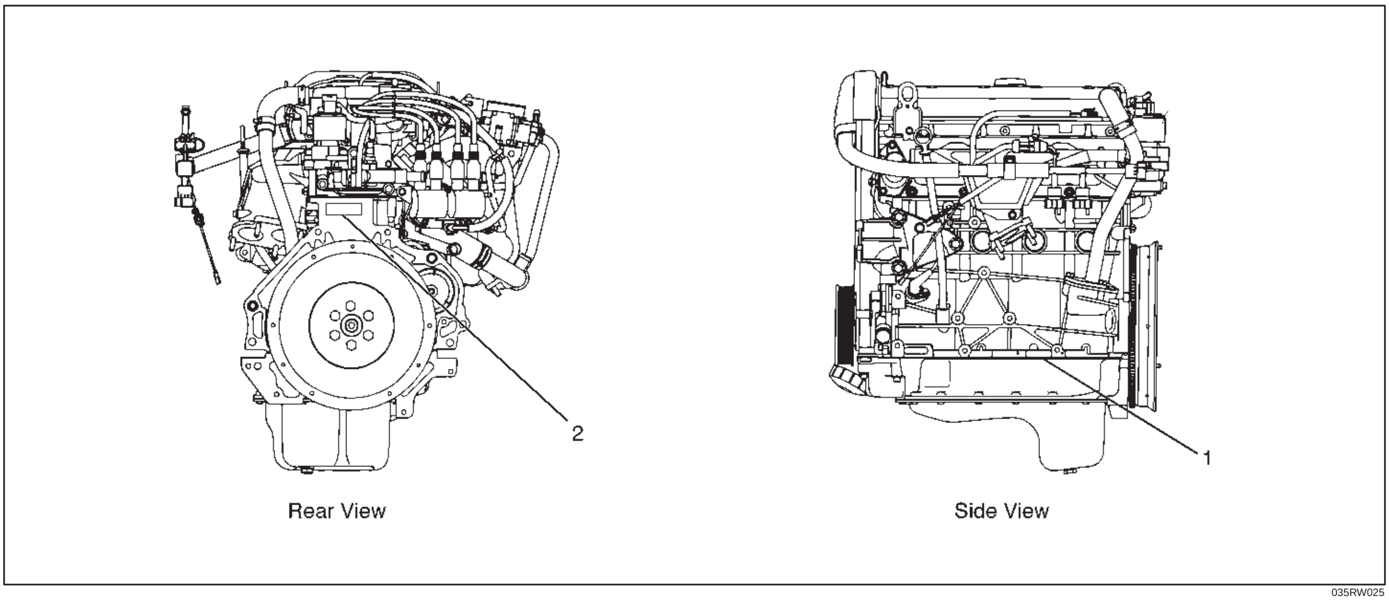
NOTE:

1. VIN plate locations for production.
2. Stamping locations for service parts.

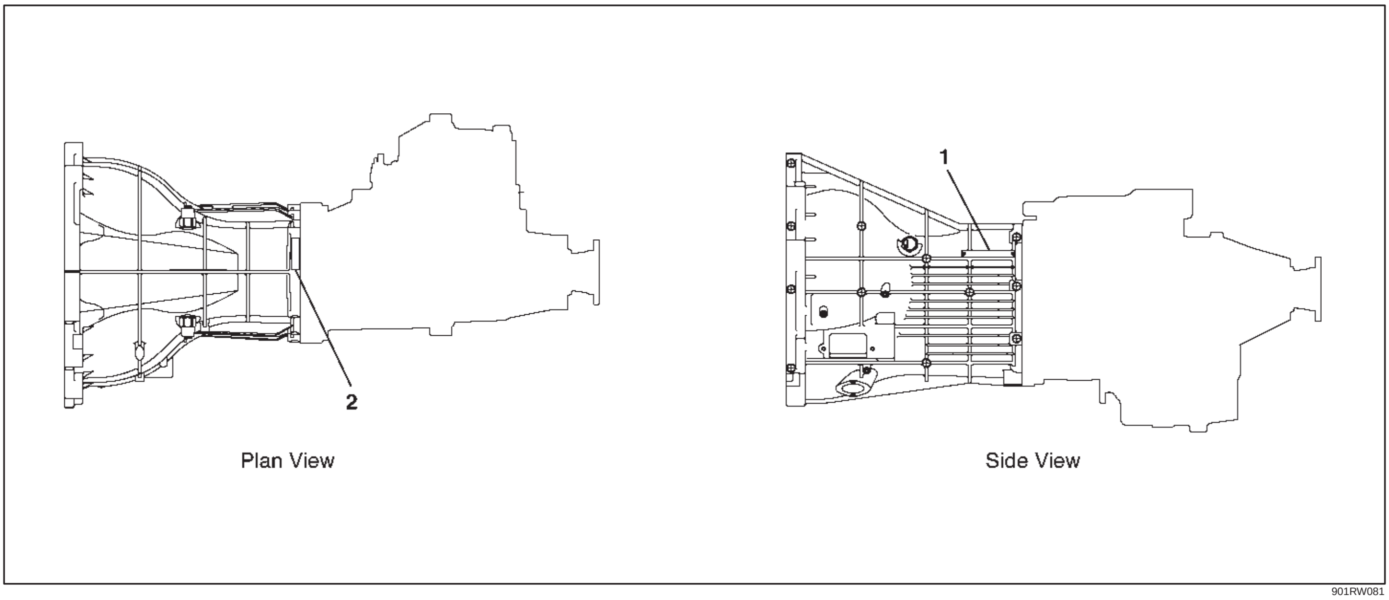
Engine (6VD1)



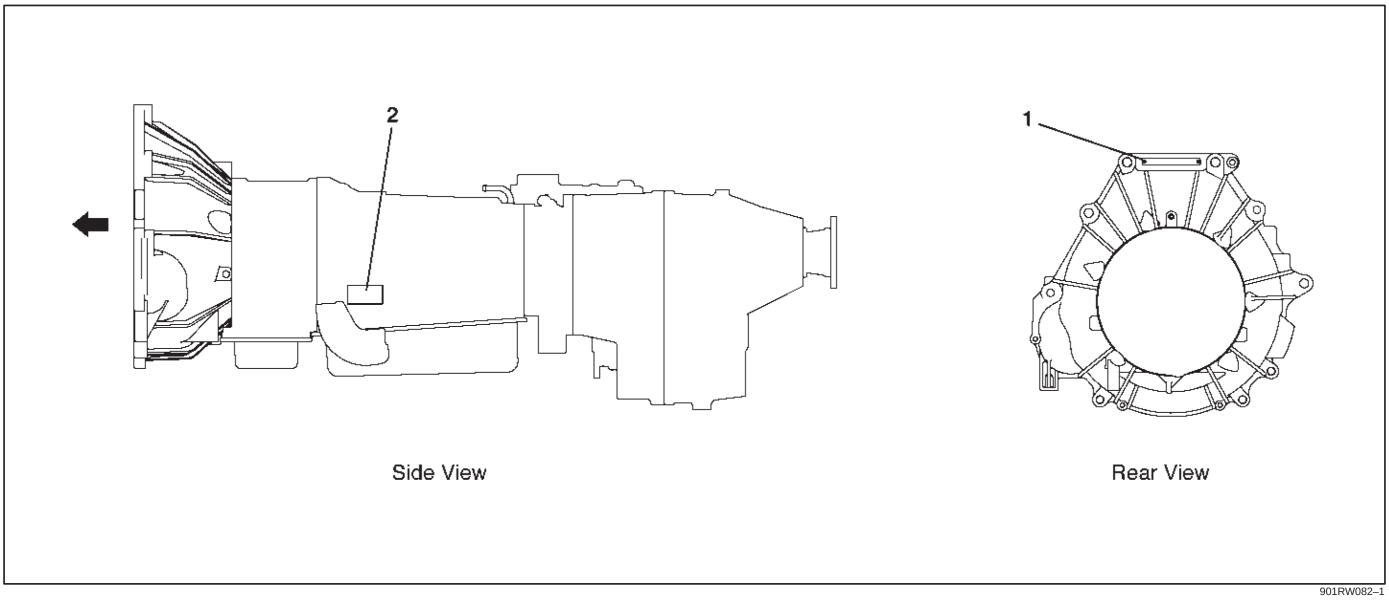
Engine (X22SE)



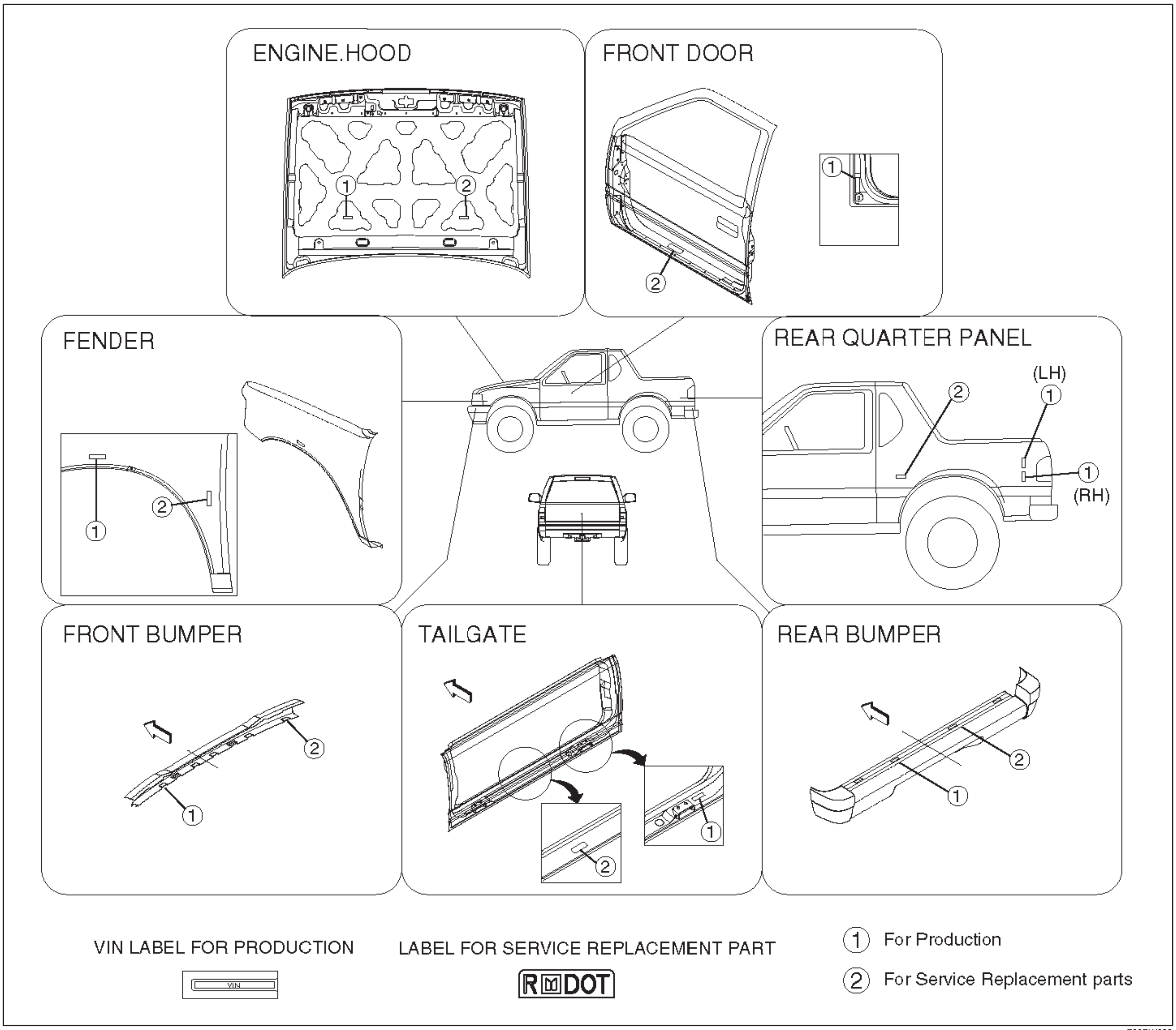
Manual Transmission (MUA)



Automatic Transmission (THM)



Body



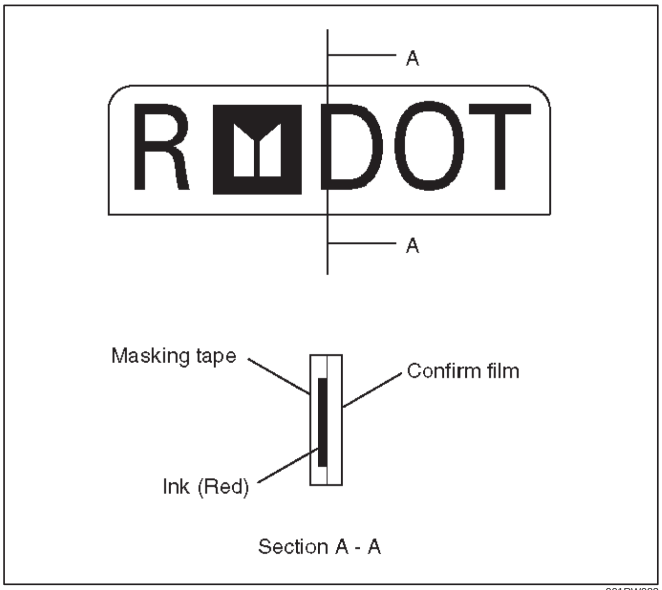
F00RW033

Body Label Instructions

Do not peel off the masking tape until completion of paint work when replacing these parts, as the tape is affixed on the label attached to service parts for body of the anti–theft component.

NOTE: Be sure to pull off the masking tape after paint work has been completed.

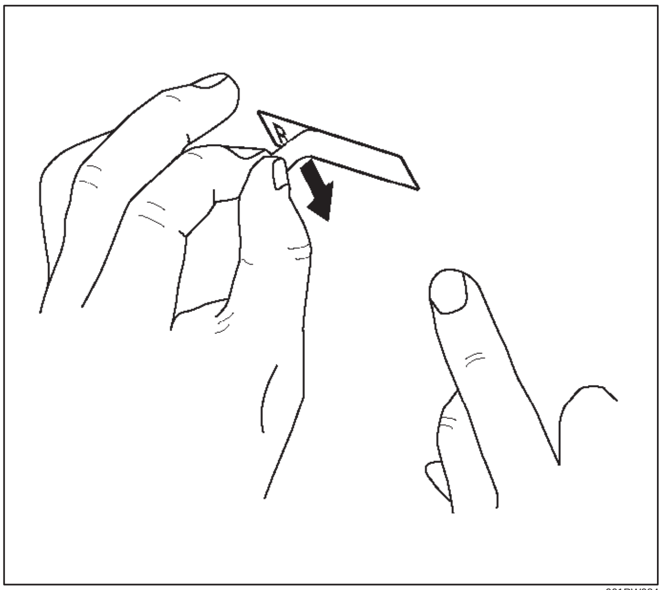
Do not attempt to remove this label for any reason.



901RW083

Precautions in pulling off the masking tape

1. Use only your finger nail or a similar blunt instrument to peel off the masking tape. Use of a sharp object will damage the underlying anti–theft label.
2. Be careful not to damage the paint around the label.



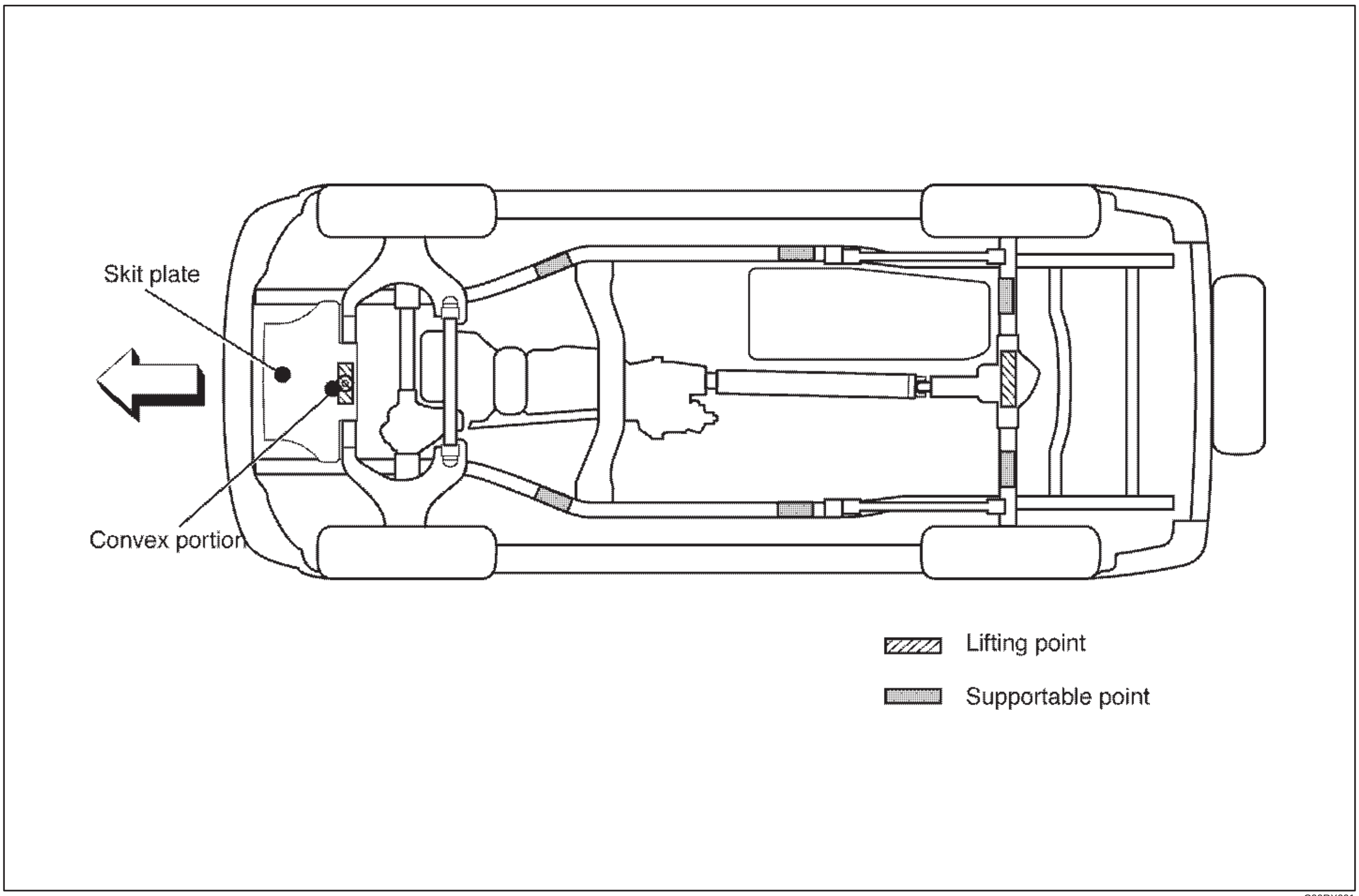
901RW084

Lifting Instructions

CAUTION:

- **If a lifting device other than the original jack is used, it is most important that the device be applied only to the correct lifting points. Raising the vehicle from any other point may result in serious damage.**
- **When jacking or lifting a vehicle at the frame side rail or other prescribed lift points, be certain that lift pads do not contact the catalytic converter, brake pipes or cables, or fuel lines. Such contact may result in damage or unsatisfactory vehicle performance.**

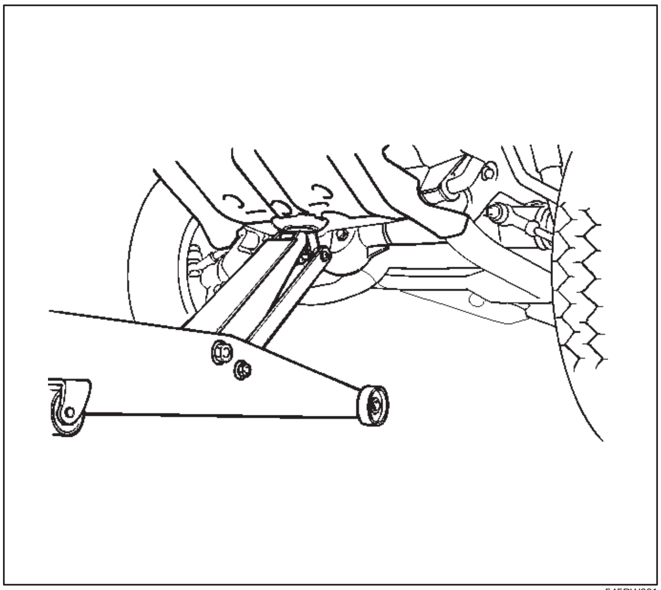
Lifting Points and Supportable Point Locations



C00RX001

Lifting Point: Front

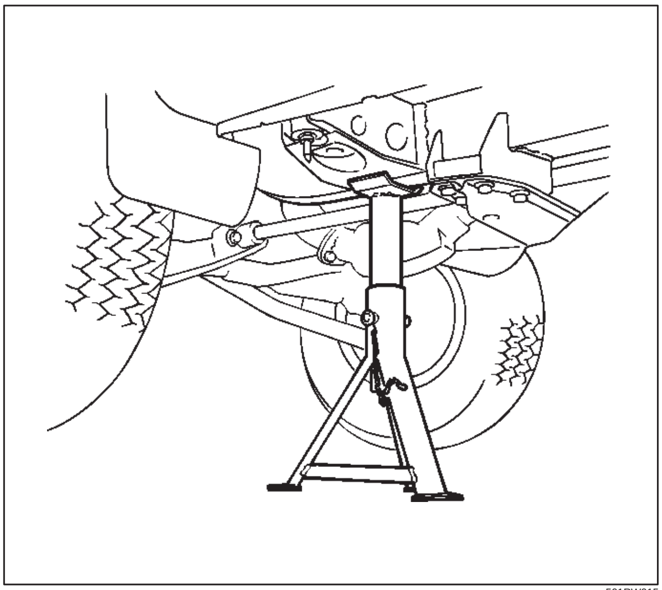
- When using a floor jack, lift on the Convex portion of the skid plate.



545RW001

Supportable Point: Front

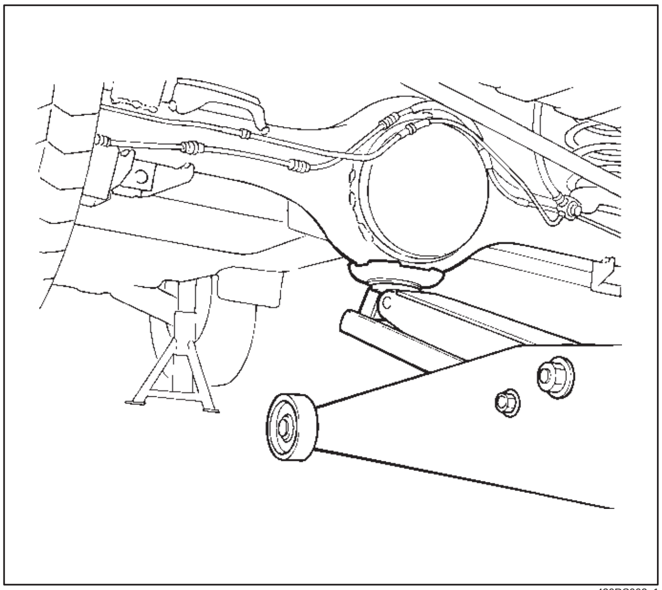
- Position the chassis stands at the bottom of the frame sidemember, behind the front wheel.



501RW015

Lifting Point: Rear

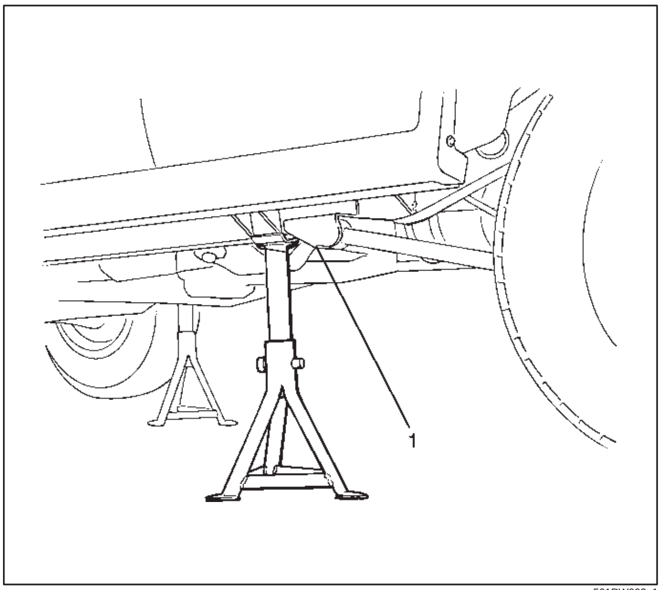
- Position the floor jack at the center of the rear axle case when lifting the vehicle.



420RS002–1

Supportable Point: Rear

- Position the chassis stands at the bottom of the frame sidemember, just in front of the trailing link bracket.



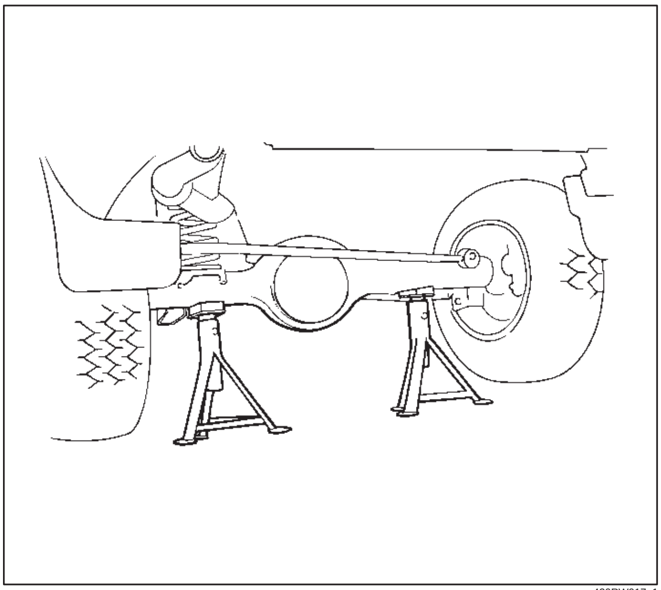
501RW002–1

Legend

(1) Trailing Link Bracket

Supportable Point: Rear

- Position the chassis stands at the bottom of the rear axle case.



420RW017–1

Standard Bolts Torque Specifications

The torque values given in the following table should be applied where a particular torque is not specified.

Strength Class	4.8	8.8		9.8
		Refined	Non-Refined	
Bolt Identification				
	 No mark			
Bolt Diameter × Pitch (mm)				
M 6X1.0	4 – 8 N·m (3 – 6 lb ft)	5 – 10 N·m (4 – 7 lb ft)		–
M 8X1.25	8 – 18 N·m (6 – 13 lb ft)	12 – 23 N·m (9 – 17 lb ft)		17 – 30 N·m (12 – 22 lb ft)
M 10X1.25	21 – 34 N·m (15 – 25 lb ft)	28 – 46 N·m (20 – 34 lb ft)		37 – 63 N·m (27 – 46 lb ft)
* M10X1.5	20 – 33 N·m (14 – 25 lb ft)	28 – 45 N·m (20 – 33 lb ft)		36 – 60 N·m (27 – 44 lb ft)
M12X1.25	49 – 74 N·m (36 – 54 lb ft)	61 – 91 N·m (45 – 67 lb ft)		76 – 114 N·m (56 – 84 lb ft)
* M12X1.75	45 – 69 N·m (33 – 51 lb ft)	57 – 84 N·m (42 – 62 lb ft)		72 – 107 N·m (53 – 79 lb ft)
M14X1.5	77 – 115 N·m (56 – 85 lb ft)	93 – 139 N·m (69 – 103 lb ft)		114 – 171 N·m (84 – 126 lb ft)
* M14X2.0	72 – 107 N·m (53 – 79 lb ft)	88 – 131 N·m (65 – 97 lb ft)		107 – 160 N·m (79 – 118 lb ft)
M16X1.5	104 – 157 N·m (77 – 116 lb ft)	135 – 204 N·m (100 – 150 lb ft)		160 – 240 N·m (118 – 177 lb ft)
* M16X2.0	100 – 149 N·m (74 – 110 lb ft)	130 – 194 N·m (95 – 143 lb ft)		153 – 230 N·m (113 – 169 lb ft)
M18X1.5	151 – 226 N·m (111 – 166 lb ft)	195 – 293 N·m (144 – 216 lb ft)		230 – 345 N·m (169 – 255 lb ft)
M20X1.5	206 – 310 N·m (152 – 229 lb ft)	270 – 405 N·m (199 – 299 lb ft)		317 – 476 N·m (234 – 351 lb ft)
M22X1.5	251 – 414 N·m (185 – 305 lb ft)	363 – 544 N·m (268 – 401 lb ft)		425 – 637 N·m (313 – 469 lb ft)
M24X2.0	359 – 539 N·m (265 – 398 lb ft)	431 – 711 N·m (318 – 524 lb ft)		554 – 831 N·m (409 – 613 lb ft)

The asterisk * indicates that the bolts are used for female–threaded parts that are made of soft materials such as casting, etc.

Abbreviations Charts

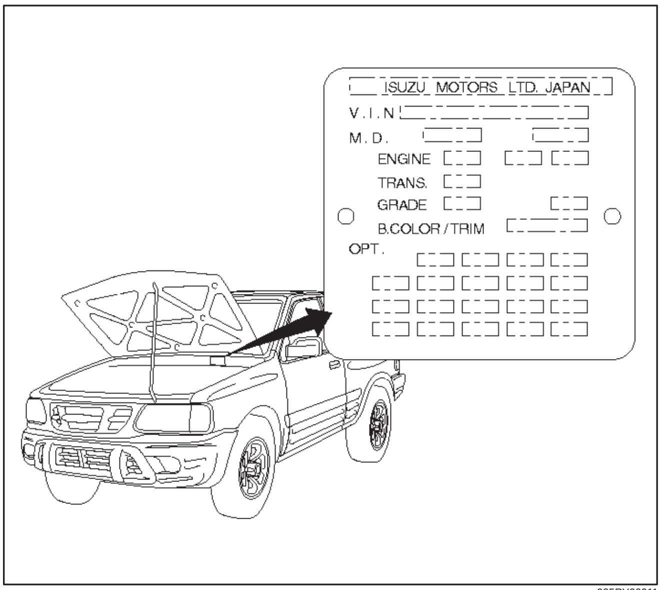
List of automotive abbreviations which may be used in this manual

A — Ampere(s)
ABS — Antilock Brake System
AC — Alternating Current
A/C — Air Conditioning
ACCEL — Accelerator
ACC — Accessory
ACL — Air Cleaner
Adj — Adjust
A/F — Air Fuel Ratio
AIR — Secondary Air Injection System
Alt — Altitude
AMP — Ampere(s)
ANT — Antenna
ASM — Assembly
A/T — Automatic Transmission/Transaxle
ATDC — After Top Dead Center
ATF — Automatic Transmission Fluid
Auth — Authority
Auto — Automatic
BARO — Barometric Pressure
Bat — Battery
B+ — Battery Positive Voltage
Bbl — Barrel
BHP — Brake Horsepower
BPT — Backpressure Transducer
BTDC — Before Top Dead Center
° C — Degrees Celsius
CAC — Charge Air Cooler
Calif — California
cc — Cubic Centimeter
CID — Cubic Inch Displacement
CKP — Crankshaft Position
CL — Closed Loop
CLCC — Closed Loop Carburetor Control
CMP — Camshaft Position
CO — Carbon Monoxide
Coax — Coaxial
Conn — Connector
Conv — Converter
Crank — Crankshaft
Cu. In. — Cubic Inch
CV — Constant Velocity
Cyl — Cylinder(s)
DI — Distributor Ignition
Diff — Differential
Dist — Distributor
DLC — Data Link Connector
DOHC — Double Overhead Camshaft
DTC — Diagnostic Trouble Code
DTM — Diagnostic Test Mode
DTT — Diagnostic Test Terminal
DVM — Digital Voltmeter (10 meg.)
DVOM — Digital Volt Ohmmeter
EBCM — Electronic Brake Control Module
ECM — Engine Control Module
ECT — Engine Coolant Temperature
EEPROM — Electronically Erasable Programmable Read Only Memory
EGR — Exhaust Gas Recirculation
EI — Electronic Ignition
ETR — Electronically Tuned Receiver
EVAP — Evaporation Emission
Exh — Exhaust
° F — Degrees Fahrenheit
Fed — Federal (All States Except Calif.)
FF — Front Drive Front Engine
FL — Fusible Link
FLW — Fusible Link Wire
FP — Fuel Pump
FRT — Front
ft — Foot
FWD — Front Wheel Drive
4WD — Four Wheel Drive
4 x 4 — Four Wheel Drive
4 A/T — Four Speed Automatic Transmission/Transaxle
Gal — Gallon
GEN — Generator
GND — Ground
Gov — Governor
g — Gram
Harn — Harness
HC — Hydrocarbons
HD — Heavy Duty
Hg — Hydrargyrum (Mercury)
HiAlt — High Altitude
HO2S — Heated Oxygen Sensor
HVAC — Heater–Vent–Air–Conditioning
IAC — Idle Air Control
IAT — Intake Air Temperature
IC — Integrated Circuit / Ignition Control
ID — Identification / Inside Diameter
IGN — Ignition
INJ — Injection
IP — Instrument Panel
IPC — Instrument Panel Cluster
Int — Intake
ISC — Idle Speed Control
J/B — Junction Block
kg — Kilograms
km — Kilometers
km/h — Kilometer per Hour
kPa — Kilopascals
kV — Kilovolts (thousands of volts)
kW — Kilowatts
KS — Knock Sensor
L — Liter
lb ft — Foot Pounds
lb in — Inch Pounds
LF — Left Front
LH — Left Hand
LR —Left Rear
LS — Left Side
LWB — Long Wheel Base
L–4 — In–Line Four Cylinder Engine
MAF — Mass Air Flow
MAN — Manual
MAP — Manifold Absolute Pressure
Max — Maximum
MC — Mixture Control
MFI — Multiport Fuel Injection
MIL — Malfunction Indicator Lamp
Min — Minimum
mm — Millimeter
MPG — Miles Per Gallon
MPH — Miles Per Hour
M/T — Manual Transmission/Transaxle
MV — Millivolt

N — Newtons
NA — Natural Aspirated
NC — Normally Closed
N·M — Newton Meters
NO — Normally Open
NOX — Nitrogen, Oxides of
OBD — On-Board Diagnostic
OD — Outside Diameter
O/D — Over Drive
OHC — Overhead Camshaft
OL — Open Loop
O2 — Oxygen
O2S — Oxygen Sensor
PAIR — Pulsed Secondary Air Injection System
P/B — Power Brakes
PCM — Powertrain Control Module
PCV — Positive Crankcase Ventilation
PRESS — Pressure
PROM — Programmable Read Only Memory
PNP — Park/Neutral Position
P/S — Power Steering
PSI — Pounds per Square Inch
PSP — Power Steering Pressure
Pt. — Pint
Pri — Primary
PWM — Pulse Width Modulate
Qt. — Quart
REF — Reference
RF — Right Front
RFI — Radio Frequency Interference
RH — Right Hand
RPM — Revolutions Per Minute
RPM Sensor — Engine Speed Sensor
RPO — Regular Production Option
RR — Right Rear
RS — Right Side
RTV — Room Temperature Vulcanizing
RWAL — Rear Wheel Antilock Brake
RWD — Rear Wheel Drive
SAE — Society of Automotive Engineers
Sec — Secondary
SFI — Sequential Multiport Fuel Injection
SI — System International
SIR — Supplemental Inflatable Restraint System
SOHC — Single Overhead Camshaft
Sol — Solenoid
SPEC — Specification
Speedo — Speedometer
SRS — Supplemental Restraint System
ST — Start / Scan Tool
Sw — Switch
SWB — Short Wheel Base
SYN — Synchronize
Tach — Tachometer
TB — Throttle Body
TBI — Throttle Body Fuel Injection
TCC — Torque Converter Clutch
TCM — Transmission Control Module
TDC — Top Dead Center
Term — Terminal
TEMP — Temperature
TOD— Torque On Demand
TP — Throttle Position
TRANS — Transmission/Transaxle
TURBO — Turbocharger
TVRS — Television & Radio Suppression
TVV — Thermal Vacuum Valve
TWC — Three Way Catalytic Converter
3 A/T — Three Speed Automatic Transmission/Transaxle
2WD — Two Wheel Drive
4 x 2 — Two Wheel Drive
U–joint — Universal Joint
V — Volt(s)
VAC — Vacuum
VIN — Vehicle Identification Number
VRRRE — Vehicle Refrigerant Recovery and Recycling Equipment
V–ref — ECM Reference Voltage
VSS — Vehicle Speed Sensor
VSV — Vacuum Switch Valve
V–6 — Six Cylinder “V” Engine
V–8 — Eight Cylinder ”V” Engine
W — Watt(s)
w/ — With
w/b — Wheel Base
w/o — Without
WOT — Wide Open Throttle

Service Parts Identification Plate

The Vehicle Information Plate (Service Parts ID plate) is provided on all vehicle models.
It is located on the center dash wall inside the engine compartment. The plate lists the VIN (Vehicle Identification Number), paint information and all production options and special equipment on the vehicle when it was shipped from the factory.



905RY00011

AMIGO

GENERAL INFORMATION

Maintenance and Lubrication

CONTENTS

Maintenance Schedule List

Normal Vehicle Use

The maintenance instructions in this Maintenance Schedule are based on the assumption that the vehicle will be used as designed:

- to carry passengers and cargo within the limitations specified on the tire placard located on the inside of the glove compartment door;
- to be driven on reasonable road surfaces within legal operating limits;
- to be driven on a daily basis, as a general rule, for at least several miles/kilometers;
- to be driven on unleaded fuel

Unusual or severe operating conditions will require more frequent vehicle maintenance, as specified in the following sections.

Severe Driving Conditions

If the vehicle is usually operated under any of the severe driving conditions listed below, it is recommended that the applicable maintenance services be performed at the specified interval shown in the chart below.

Severe driving conditions:

- Towing a trailer, using a camper or car top carrier.
- Repeated short trips of less than 8 Km (5 miles) with outside temperature remaining below freezing.
- Extensive idling and/or low speed driving for long distances, such as police, taxi or door–to–door delivery use.
- Operating on dusty, rough, muddy or salt spread roads.

ITEMS	INTERVAL
CHANGE ENGINE OIL AND OIL FILTER	Every 3,000 miles (4,800 km) or 3 months
CHANGE AUTOMATIC TRANSMISSION FLUID	Every 20,000 miles (32,000 km)
CHANGE REAR AXLE OIL	Every 15,000 miles (24,000 km)
REPLACE TIMING BELT	Every 75,000 miles (120,000 km)
REPLACE AIR CLEANER FILTER	See explanation of service, page 0B–5
CHANGE POWER STEERING FLUID	Every 30,000 miles (48,000 km)

Mileage Only Items

MILEAGE ONLY ITEMS

IN THOUSANDS OF MILES (USE ODOMETER READING) (x 1000 miles)

	MILEAGE ONLY ITEMS	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	DESCRIPTION
1	*(1) CHANGE FRONT AND *(1) REAR AXLE OIL		■		■				■				■				■	
2	CHANGE MANUAL TRANSMISSION (M/T model) AND TRANSFER CASE OIL(4WD model)		■		■				■				■				■	
3	*(1) CHECK AND ADJUST OR CHANGE AUTOMATIC TRANSMISSION FLUID (IF NECESSARY)																■	
4	CHECK AUTOMATIC TRANSMSSION FLUID LEAKAGE		■		■		■		■		■		■		■		■	
5	CHECK AND ADJUST VALVE CLEARANCE(V6-3.2L engine)	If noisy															■	
6	REPLACE AIR CLEANER ELEMENT				■				■				■				■	
7	REPLACE SPARK PLUGS	Every 100,000 miles.																
8	CHANGE ENGINE COOLANT				■				■				■				■	
9	*(2) REPLACE TIMING BELT	Every 100,000 miles.																
10	ROTATE TIRES	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
11	REPACK FRONT WHEEL BEARINGS GREASE				■				■				■				■	
12	CLEAN RADIATOR CORE AND A/C CONDENSER								■								■	
13	CHECK SPARK PLUG WIRES (I4- 2.2L engine)								■								■	

*(1) : Under sever driving conditions, additional maintenance is required. Refer to "Severe driving conditions".

*(2) : Replacement of the timing belt is recommended at every 100,000 miles (160,000km)

SHADED AREA INDICATES SERVICE TO BE PERFORMED.

UEROM2

Mileage/Months

MILEAGE/MONTHS

IN THOUSANDS OF MILES (USE ODOMETER READING) (x 1000 miles)

	MILEAGE/MONTHS whichever comes first	Max Months \ Max Miles	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	DESCRIPTION
1	CHECK ENGINE COOLANT LEVEL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
2	CHECK BRAKE FLUID LEVEL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
3	* (2) CHECK CLUTCH FLUID LEVEL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
4	CHECK FLUID LEAKS	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
5	* (1) CHANGE ENGINE OIL	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
6	* (1) REPLACE ENGINE OIL FILTER	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
7	CHECK COOLING AND HEATER HOSES	12		■		■		■		■		■		■		■		■	
8	CHECK EXHAUST SYSTEM	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
9	CHECK FUEL LINE AND FUEL TANK/CAP	12								■								■	
10	CHECK ENGINE DRIVE BELTS	24				■				■				■				■	
11	CHECK TIRES AND WHEELS	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
12	CHECK STEERING OPERATION	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
13	CHECK BRAKE LINES AND HOSES	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
14	CHECK DRUM AND DISC BRAKES	12		■		■		■		■		■		■		■		■	
15	CHECK PARKING BRAKE	12		■		■		■		■		■		■		■		■	

* (1) : Under severe driving conditions, additional maintenance is required. Refer to "Severe driving conditions".

* (2) : Manual Transmission model

SHADED AREA INDICATES SERVICE TO BE PERFORMED.

UEROM3

Mileage/Months

MILEAGE/MONTHS

IN THOUSANDS OF MILES (USE ODOMETER READING) (x 1000 miles)

	MILEAGE/MONTHS whichever comes first	Max Months \ Max Miles	7.5	15	22.5	30	37.5	45	52.5	60	67.5	75	82.5	90	97.5	105	112.5	120	DESCRIPTION
16	ADJUST BRAKE PEDAL PLAY	12		■		■		■		■		■		■		■		■	
17	LUBE ACCELERATOR LINKAGE	6	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
18	LUBE BODY AND CHASSIS	6	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
19	CHECK FRONT AND REAR PROPELLER SHAFT	6	■		■	■	■		■	■	■		■	■	■		■	■	
20	* (2) CHECK CLUTCH LINES AND HOSE	12				■				■				■				■	
21	* (2) LUBE CLUTCH PEDAL SPRING, BUSHING AND CLEVIS PIN	6		■		■		■		■		■		■		■		■	
22	* (2) CHECK CLUTCH PEDAL FREE PLAY	12		■		■		■		■		■		■		■		■	
23	CHECK PROPELLER SHAFT FLANGE TORQUE	12	■		■		■		■		■		■		■		■		
24	CHECK STARTER SAFETY SWITCH	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
25	* (4) CHECK THROTTLE LINKAGE	12		■		■		■		■		■		■		■		■	
26	CHECK SUSPENSION&STEERING	12	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	
27	* (4) CHECK AUTO CRUISE CONTROL LINKAGE AND HOSE	12		■		■		■		■		■		■		■		■	
28	LUBE KEY LOCK CYLINDER	12		■		■		■		■		■		■		■		■	
29	* (3) CHECK SHIFT ON THE FLY SYSTEM GEAR FLUID	12		■		■		■		■		■		■		■		■	
30	* (1) CHECK POWER STEERING FLUID LEVEL	6	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	■	

SHADED AREA INDICATES SERVICE TO BE PERFORMED.

* (1) : Under severe driving conditions, additional maintenance is required. Refer to "Severe driving conditions".
* (2) : Manual Transmission model
* (3) : 4 Wheel Drive model
* (4) : I4-2.2L Engine model

UEROM4

Explanation of Complete Vehicle Maintenance Schedule

Brief explanations of the services listed in the preceding Maintenance Schedule are presented below.
Replace all questionable parts and note any necessary repairs as you perform these maintenance procedures.

Front and Rear Axle Lubricant Replacement

Check the lubricant level after every 7,500 miles (12,000 km) of operation and add lubricant to level of filler hole if necessary.
Replace the front and rear axle lubricant at 15,000 miles (24,000 km) and 30,000 miles (48,000 km) and after every 30,000 miles (48,000 km) of operation thereafter.

Manual Transmission Lubricant Replacement

Check the lubricant level after every 7,500 miles (12,000 km) of operation and add lubricant to level of filler hole if necessary.
Replace the transmission lubricant at 15,000 miles (24,000 km) and 30,000 miles (48,000 km) and after every 30,000 miles (48,000 km) of operation thereafter.

Transfer Case Lubricant Replacement

Check the lubricant level after every 7,500 miles (12,000 km) of operation and add lubricant to level of filler hole if necessary.
Replace the transfer case lubricant at 15,000 miles (24,000 km) and 30,000 miles (48,000 km) and after every 30,000 miles (48,000 km) of operation thereafter.

Air Cleaner Element Replacement

Replace the air cleaner under normal operating conditions every 30,000 miles (48,000 km).
Operation of the vehicle in dusty areas will necessitate more frequent replacement.

Spark Plug Replacement

Replace the plugs at 100,000 miles (160,000 km) intervals with the type specified at the end of this section.

Cooling System Service

Drain, flush and refill system with new engine coolant. Refer to “Recommended Fluids and Lubricants” in this section, or ENGINE COOLING (SEC.6B).

Timing Belt Replacement

Replacement of the timing belt is recommended at every 100,000 miles (160,000 km).
Failure to replace the timing belt may result in serious damage to the engine.

Valve Clearance Adjustment (V6, 3.2L ENG)

Incorrect valve clearance will result in increased engine noise and reduced engine output.
Retorque the camshaft bracket bolts before checking and adjusting the valve clearance.
Check and adjust the valve clearance if noise occurs.

Tire Rotation

Rotate tires every 7,500 miles (12,000 km).

Spark Plug Wire Inspection

Check the spark plug wires at 60,000 mile (96,000 km) intervals.

Front Wheel Bearings Lubricant Replacement

Clean and repack the front wheel bearings at 30,000 miles (48,000 km) intervals.
Refer to DRIVE SHAFT SYSTEM (SEC. 4C).

Radiator Core and Air Conditioning Condenser Cleaning

Clean the front of the radiator core and air conditioning condenser, at 60,000 miles (96,000 km) intervals.

Fluid Level Check

A fluid loss in any system (except windshield washer) may indicate a problem. Repair the system at once.

Engine oil level

Check level and add if necessary. The best time to check the engine oil level is when the oil is warm. After stopping the engine with the vehicle on a level surface, wait a few minutes for the oil to drain back to the oil pan. Pull out the oil level indicator (dipstick). Wipe it clean and push the oil level indicator back down all the way. Pull out the oil level indicator, keeping the tip down, and look at the oil level on it.

Add oil, if needed, to keep the oil level above the “ADD” mark and between the “ADD” and “FULL” marks in the operating range area. Avoid overfilling the engine since this may cause engine damage. Push the oil level indicator back down all the way after taking the reading. If you check the oil level when the oil is cold, do not run the engine first. The cold oil will not drain back to the pan fast enough to give a true oil level.

Engine coolant level and condition

Check engine coolant level in the coolant reservoir and add engine coolant if necessary. Inspect the engine coolant and replace it if dirty or rusty.

Windshield washer fluid level

Check washer fluid level in the reservoir and add if necessary.

Power steering system reservoir level

Check and keep at the proper level.

Brake master cylinder reservoir level

Check fluid. Keep fluid at proper level. A low fluid level can indicate worn disc brake pads which may need to be serviced.

Hydraulic clutch system

Check fluid level in the reservoir. Add fluid as required.

Battery fluid level

Check fluid level in the battery.

Fluid Leak Check

Check for fuel, water, oil or other fluid leaks by looking at the surface beneath the vehicle after it has been parked for a while. Water dripping from the air conditioning system after use is normal. If you notice gasoline fumes or fluid at any time, locate the source and correct it at once.

Engine Oil and Oil Filter Replacement

Always use API SE, SF, SG, SH or ILSAC GF–1 quality oils of the proper viscosity.
When choosing an oil, consider the range of temperatures the car will be operated in before the next oil change. Then, select the recommended oil viscosity from the chart.
Always change the oil and the oil filter as soon as possible after driving in a dust storm.

Engine Cooling System Inspection

Inspect the coolant/anti–freeze. If the coolant is dirty or rusty, drain, flush and refill with new coolant. Keep coolant at the proper mixture for proper freeze protection, corrosion inhibitor level and best engine operating temperature. Inspect hoses and replace if cracked, swollen or deteriorated. Tighten the hose clamps if equipped with screw–type clamps. Clean outside of radiator and air conditioning condenser. Wash filler cap and neck. To help ensure proper operation, a pressure test of both the cooling system and the cap is also recommended.

Exhaust System Inspection

Visually inspect the exhaust pipes, muffler, heat shields and hangers for cracks, deterioration, or damage.
Be alert to any changes in the sound of the exhaust system or any smell of fumes. These are signs the system may be leaking or overheating. Repair the system at once, if these conditions exist. (See also “Engine Exhaust Gas Safety” and “Three Way Catalytic Converter” in the Owner’s manual.)

Fuel Cap, Fuel Lines, and Fuel Tank Inspection

Inspect the fuel tank, the fuel cap and the fuel lines every 60,000 miles (96,000 km) for damage which could cause leakage.
Inspect the fuel cap and the gasket for correct sealing and physical damage. Replace any damaged parts.

Drive Belt Inspection

Check the serpentine belt driving for cracks, fraying, wear, and correct tension every 30,000 miles (48,000 km). Replace as necessary.

Wheel Alignment, Balance and Tires Operation

Uneven or abnormal tire wear, or a pull right or left on a straight and level road may show the need for a wheel alignment. A vibration of the steering wheel or seat at normal highway speeds means a wheel balancing is needed. Check tire pressure when the tires are “cold” (include the spare).
Maintain pressure as shown in the tire placard, which is located on the driver’s door lock pillar.

Steering System Operation

Be alert for any changes in steering action. An inspection or service is needed when the steering wheel is harder to turn or has too much free play, or if there are unusual sounds when turning or parking.

Brake Systems Operation

Watch for the “BRAKE” light coming on. Other signs of possible brake trouble are such things as repeated pulling to one side when braking, unusual sounds when braking or between brake applications, or increased brake pedal travel. If you note one of these conditions, repair the system at once.
For convenience, the following should be done when wheels are removed for rotation: Inspect lines and hoses for proper hookup, bindings, leaks, crack, chafing etc. Inspect disc brake pads for wear and rotors for surface condition.
Inspect other brake parts, including parking brake drums, linings etc., at the same time. Check parking brake adjustment.
Inspect the brakes more often if habit or conditions result in frequent braking.

Parking Brake and Transmission Park Mechanism Operation

Park on a fairly steep hill and hold the vehicle with the parking brake only. This checks holding ability. On automatic transmission vehicles, shifting from “P” position to the other positions cannot be made unless the brake pedal is depressed when the key switch is in the “ON” position or the engine is running.

WARNING: BEFORE CHECKING THE STARTER SAFETY SWITCH OPERATION BELOW, BE SURE TO HAVE ENOUGH ROOM AROUND THE VEHICLE. THEN FIRMLY APPLY BOTH THE PARKING BRAKE AND THE REGULAR BRAKE. DO NOT USE THE ACCELERATOR PEDAL. IF THE ENGINE STARTS, BE READY TO TURN OFF THE KEY PROMPTLY. TAKE THESE PRECAUTIONS BECAUSE THE VEHICLE COULD MOVE WITHOUT WARNING AND POSSIBLY CAUSE PERSONAL INJURY OR PROPERTY DAMAGE.

Front (4WD only) and Rear Propeller Shaft

Lubricate center-package of double cardan joint with chemtool. HVLC Ep-2 or equivalent at the intervals shown in the maintenance schedule. Check propeller shaft flange-to-pinion bolts for proper torque of 63 N·m (46 ft.lbs.) for front and rear propeller shaft.

Starter Safety Switch Operation (Automatic Transmission)

Check by trying to start the engine in each gear while setting the parking brake and the foot brake. The starter should crank only in “P” (Park) or “N” (Neutral).

Starter Safety Switch Operation (Manual Transmission)

To check, place the shift lever in “Neutral”, push the clutch pedal halfway and try to start. The starter should not crank. The starter should crank only when the clutch pedal is fully depressed.

Accelerator Linkage Lubrication

Lubricate the accelerator pedal fulcrum pin with chassis grease.

Steering and Suspension Inspection

Inspect the front and rear suspension and steering system for damaged, loose or missing parts or signs of wear. Inspect power steering lines and hoses for proper hookup, binding, leaks, cracks, chafing, etc.

Body and Chassis Lubrication

Lubricate the key lock cylinders, the hood latch, the hood and door hinges, the door check link, the parking cable guides, the underbody contact points, and the linkage.

Automatic Transmission Fluid Replacement

Under harsh operating conditions, such as constant driving in heavy city traffic during hot weather, or in hilly or mountainous terrain, change the transmission fluid and service the sump filter after every 20,000 miles (32,000 km) of operation.
More over, the remaining life percentage of ATF can be estimated by using TECH–II as an auxiliary tool to judge the right time for ATF replacement.
The remaining life percentage is calculated from ATF’S heat history. When it is close to 0%, ATF replacement is recommended.

Auto Cruise Control Inspection

Check to see if the clearance between cruise link and accelerator link is normal. Also check that the connected properly.

Clutch Lines and Hoses Inspection

Check lines and hoses for proper attachment, binding, leaks, cracks, chafing, deterioration, etc. Any questionable parts should be replaced or repaired at once. When abrasion or wear is evident on lines or hoses, the cause must be corrected.

Clutch Control Lubrication

Lubricate the clutch pedal bushing, the clevis pin, and pedal spring every 15,000 miles (24,000 km) or 6 months. If a squeaking noise arises from around the bushing or the clevis pin at the clutch pedal arm when the clutch pedal is depressed, lubricate them.

Clutch Pedal Free Play Inspection

Note the clutch pedal free play. It should be 5 – 15 mm (0.2 – 0.6 in). Adjust clutch control when there is little or no free play.

Accelerator Linkage Inspection

Inspect for interference, binding, and damaged or missing parts. Check accelerator pedal for smooth operation and even pedal effort. Replace parts as needed.

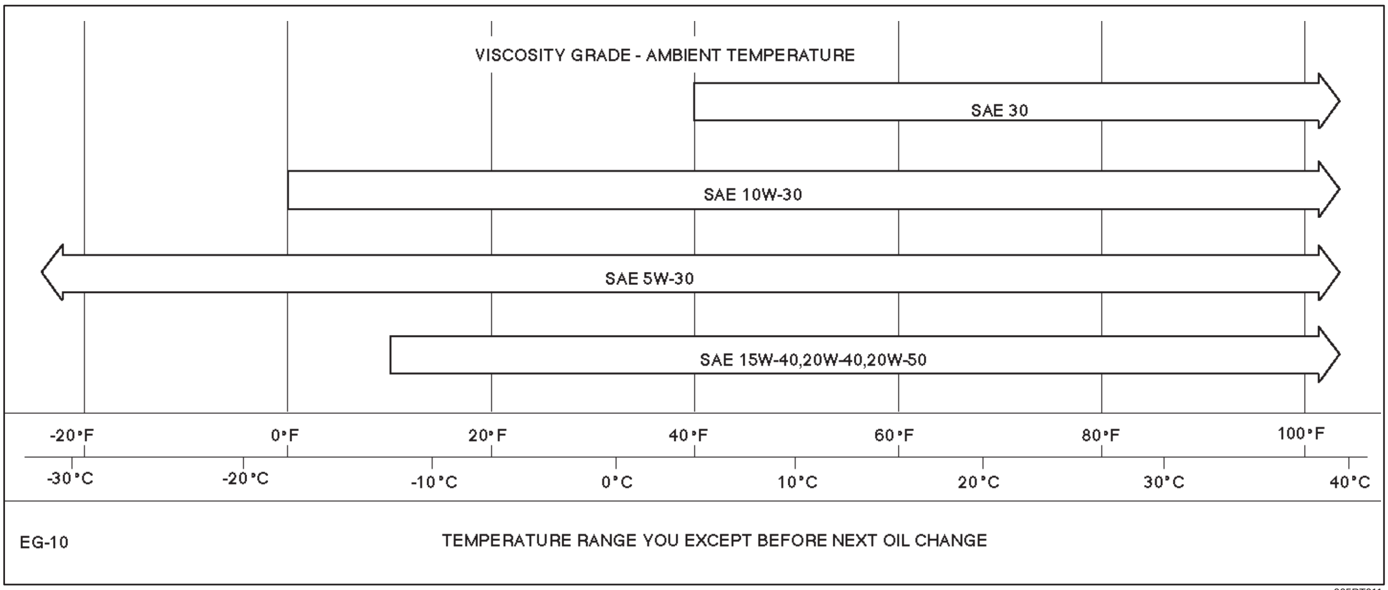
Recommended Fluids and Lubricants

USAGE	FLUID/LUBRICANT
Engine	API SE, SF, SG, SH or ILSAC GF-1 Engine oil (See oil chart on the following page for proper viscosity)
Engine coolant	Mixture of water and good quality ethylene glycol base type antifreeze.
Brake system	DOT-3 hydraulic brake fluid.
Power steering system	DEXRON® III Automatic transmission fluid.
Automatic transmission & T5 Type Manual Transmission	DEXRON® -III Automatic transmission fluid.
MUA Type Manual transmission & Transfer case	Engine oil (See oil chart on following page for proper viscosity)
Rear axle and front axle	GL-5 gear lubricant (Standard differential) GL-5 Limited slip differential gear lubricant together with limited slip differential lubricant additive (Part No. 8-01052-358-0) or equivalent (If equipped with optional limited slip differential) (See oil chart in this section for proper viscosity)
Clutch system a. Pivot points b. Clutch fork joint c. Master cylinder	 Chassis grease Chassis grease DOT-3 hydraulic brake fluid
Hood latch assembly a. Pivots and spring anchor b. Release pawl	 Engine oil Chassis grease
Hood and door hinges	Engine oil
Chassis lubrication	Chassis grease
Parking brake cables	Chassis grease
Front wheel bearings	Multipurpose grease
Shift on the fly system	GL-5 gear lubricant (SAE 75W-90)
Body door hinge pins and linkage, fuel door hinge, rear compartment lid hinges	Engine oil
Windshield washer solvent	Washer fluid
Key lock cylinder	Synthetic light weight engine oil (SAE 5W-30)
Accelerator linkage	Chassis grease

Lubricant Viscosity Chart

Lubricants should be carefully selected according to the lubrication chart. It is also important to select viscosity of lubricants according to the ambient temperature by referring to the following table.

Oil Viscosity Chart for Gasoline Engine



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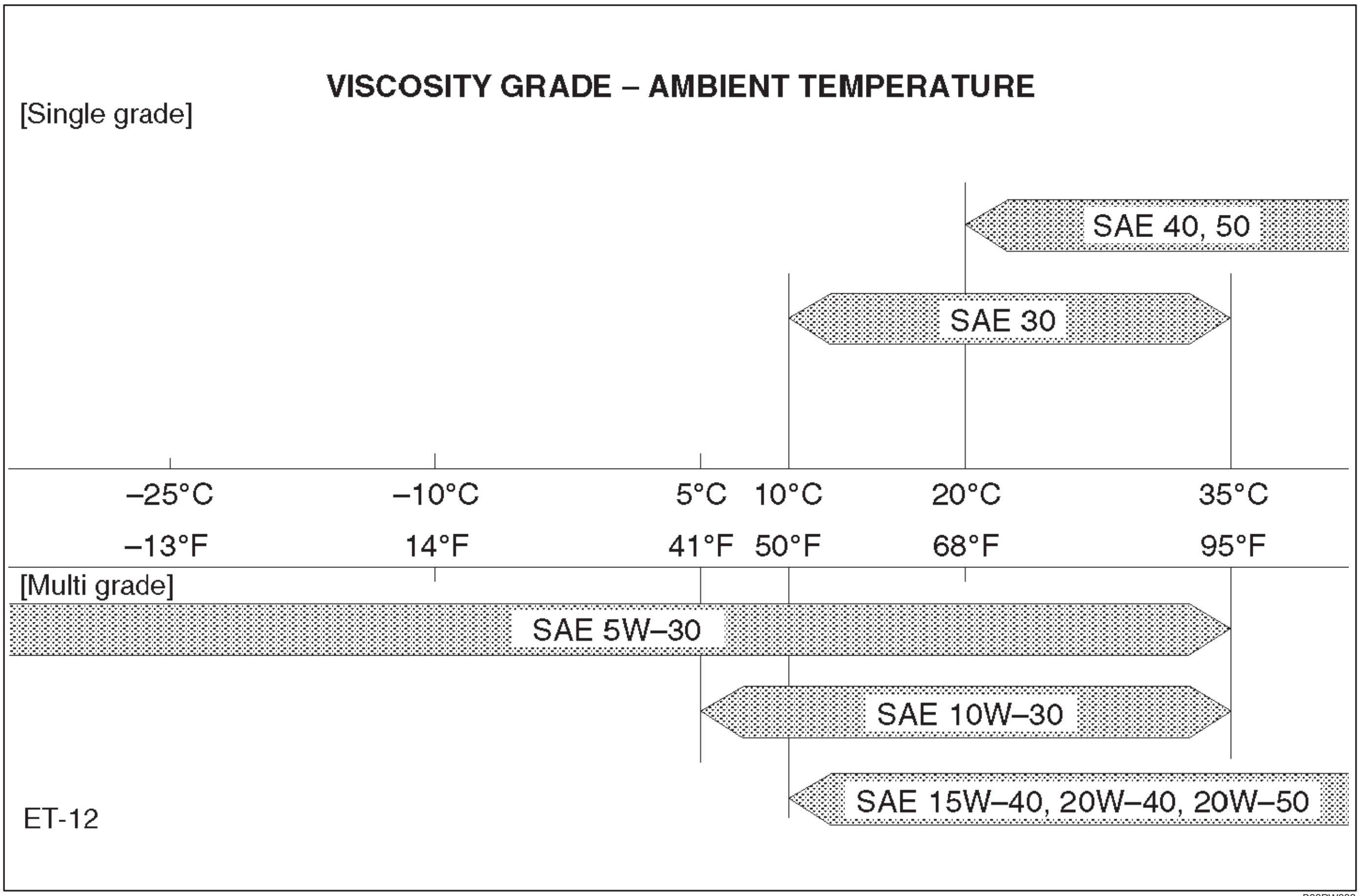
Oil Viscosity Chart for Manual Transmission and Transfer Case



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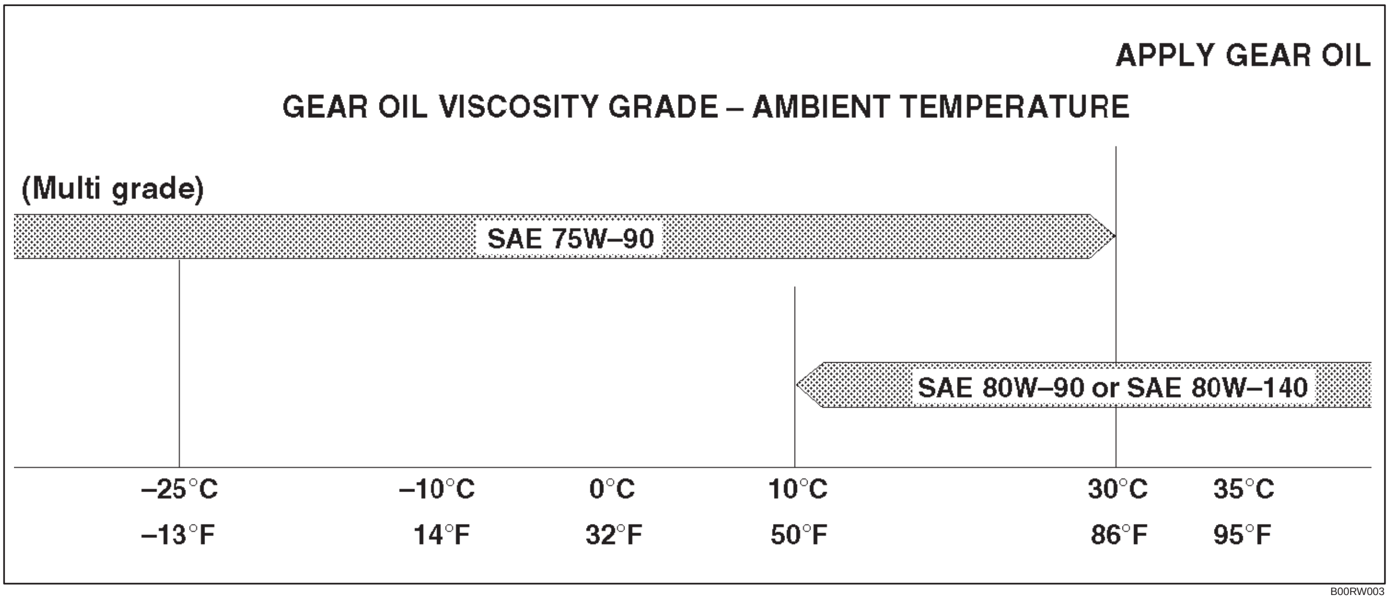
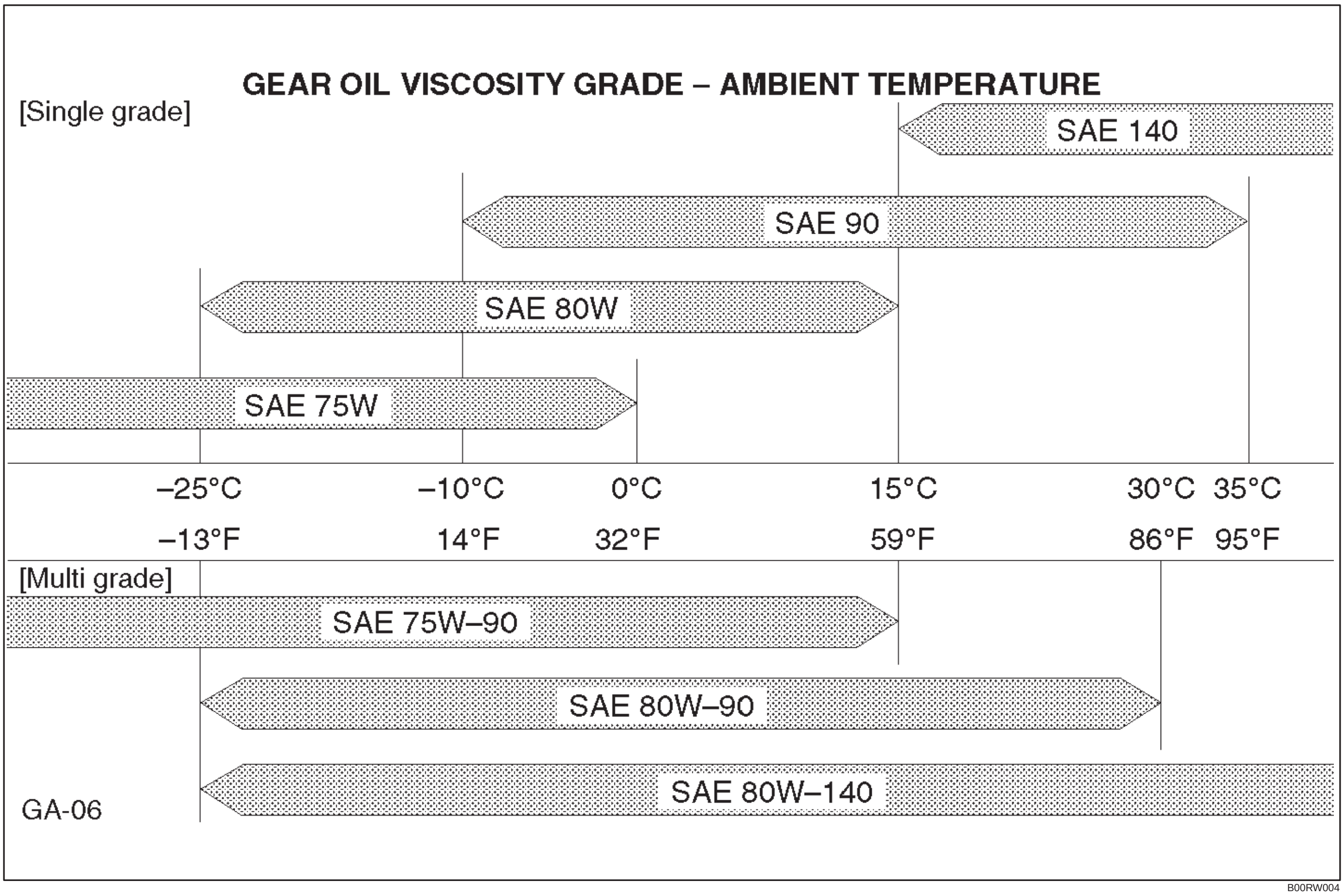
Oil Viscosity Chart for Front Axle



Oil Viscosty Chart for Rear Axle



Recommended Liquid Gasket

Type	Brand Name	Manufacturer	Remarks
RTV* Silicon Base	Three Bond 1207B Three Bond 1207C Three Bond 1215 Three Bond 1280 Three Bond 1281	Three Bond Three Bond Three Bond Three Bond Three Bond	For Engine Repairs For Axle Case Repairs T/M Repairs T/M
Water Base	Three Bond 1141E	Three Bond	For Engine Repairs
Solvent	Three Bond 1104 Belco Bond 4 Belco Bond 401 Belco Bond 402	Three Bond Isuzu Isuzu Isuzu	For Engine Repairs
Anaerobic	LOCTITE 515 LOCTITE 518 LOCTITE 17430	Loctite Loctite Loctite	All

* RTV: Room Temperature Vulcaning

NOTE:

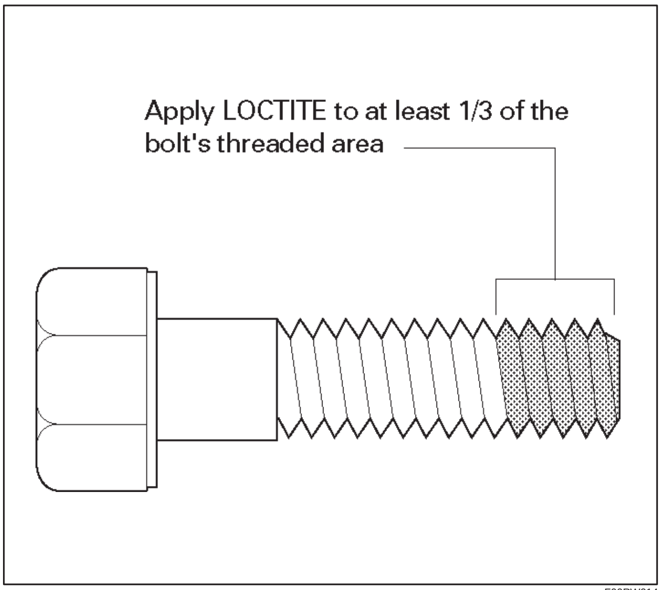
1. It is very important that the liquid gaskets listed above or their exact equivalent be used on the vehicle.
2. Be careful to use the specified amount of liquid gasket.
   Follow the manufacturer's instructions at all times.
3. Be absolutely sure to remove all lubricants and moisture from the connecting surfaces before applying the liquid gasket.
   The connecting surfaces must be perfectly dry.
4. Do not apply LOCTITE 17430, LOCTITE 515 and LOCTITE 518 between two metal surfaces having a clearance of greater than 0.25 mm (0.01 in). Poor adhesion will result.

Recommended Thread Locking Agents

LOCTITE Type	LOCTITE Color
LOCTITE 242	Blue
LOCTITE 262	Red
LOCTITE 271	Red

Application Steps

1. Completely remove all lubricant and moisture from the bolts and the female-threaded surfaces of the parts to be joined.
   The surfaces must be perfectly dry.
2. Apply LOCTITE to the bolts.



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3. Tighten the bolts to the specified torque.
   After tightening, be sure to keep the bolts free from vibration and torque for at least an hour until LOCTITE hardens.

NOTE: When the application procedures are specified in this manual, follow them.

Maintenance Service Data

Service Data and Specifications

ENGINE	Valve clearance (cold): only V6–3.2L ENG	Intake 0.28±0.05 mm (0.011±0.002 in) Exhaust 0.3±0.05 mm (0.012±0.002 in)
	Spark plug type	K16PR-P11/PK16PR11/RC10PYP4
	Spark plug gap	1.05 mm (0.04 in)
CLUTCH	Clutch pedal free play	5-15 mm (0.20-0.59 in)
BRAKE	Brake pedal free play	6-10 mm (0.24-0.39 in)
	Parking brake travel	6-7 notches
WHEEL ALIGNMENT	Toe-in (Front)	0±2 mm (0±0.08 in)
	Toe-in (Rear)	0±5 mm (0±0.2 in)
	Camber (Front)	0˚±30’
	Camber (Rear)	0˚±1˚
	Caster (Front)	2˚ 30’±45’
	Toe–Axis (Rear)	±1˚
PROPELLER SHAFT	Flange torque	63 N·m (46 lb ft)
WHEEL AND TIRES	Size	P245/70R16
	Wheel nut torque	118 N·m (87 lb ft)
	Tire inflation pressure (Front)	180 kPa (20 psi)
	* Tire inflation pressure (Rear)	180 kPa (20 psi)

* Unless otherwise specified on tire information label on the vehicle.

Approximate Capacities

	Items		Metric Measure	U.S. Measure
Fuel tank			80 L	21.1 Gal.
* Crankcase (V6–3.2L ENGINE)	Oil Change with Filter		4.7 L	5.0 Qt
	Oil Change without Filter		4.0 L	4.2 Qt
* Crankcase (L4–2.2L ENGINE)	Oil Change with Filter		4.5 L	4.8 Qt
	Oil Change without Filter		4.2 L	4.4 Qt
Coolant	M/T (V6–3.2L ENG)		11.0 L	11.6 Qt
	M/T (L4–2.2L ENG)		6.9 L	7.3 Qt
	A/T (V6–3.2L ENG)		11.1 L	11.7 Qt
Transmission	Manual		2.95 L	3.1 Qt
	Automatic		8.6 L	9.1 Qt
Transfer			1.45 L	1.5 Qt
Axle	Rear		1.77 L	1.87 Qt
	Front	V6–3.2L ENG	1.25 L	1.33 Qt
		L4–2.2L ENG	1.05 L	1.12 Qt
Shift on the fly system			0.12 L	0.13 Qt
Power steering			1.0 L	1.1 Qt
Air conditioning (R-134a)			0.6 L	1.32 Qt

*Crankcase capacities shown are approximate refill capacities. After refill, recheck oil level.

AMIGO

STEERING

POWER-ASSISTED STEERING SYSTEM

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Diagnosis

Since the problems in steering, suspension, wheels and tires involve several systems, they must all be considered when diagnosing a complaint. To identify the symptom, always road test the vehicle first. Proceed with the following preliminary inspections and correct any defects which are found.

1. Inspect tires for proper pressure and uneven wear.
2. Raise vehicle on a hoist, then inspect front and rear suspension and steering linkage for loose or damaged parts.
3. Spin the front wheels. Inspect for out-of-round tires, out-of-balance tires, loose and/or rough wheel bearings.

General Diagnosis

Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
	Parts in power steering valve defective.	Replace power steering unit.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.

Condition	Possible cause	Correction
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
	Excessive wheel run–out.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial run–out of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering unit.	Tighten steering unit.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.
	Parts in power steering valve defective.	Replace power steering unit.
Hard Steering	Bind in steering linkage ball studs, upper or lower end ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to “Power steering system diagnosis”
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering unit or linkage.	Retighten or repair.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower end ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.

Condition	Possible cause	Correction
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering unit.	Retighten mounting bolt.
	Faulty steering unit.	Replace steering unit.
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Improper wheel alignment.	Adjust wheel alignment.
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.

Power Steering System

There is some noise in all power steering systems. One of the most common is a hissing sound when the steering wheel is fully turned and the car is not moving. This noise will be most evident when the steering wheel is operated while the brakes are applied. There is no relationship between this noise and steering performance. Do not replace the valve unless the “hissing” noise is extremely objectionable. A replacement valve will also have a slight noise, and is not always a cure for the condition.

Condition	Possible cause	Correction
Rattle or Chucking Noise	Pressure hose touching other parts of vehicle.	Adjust hose position. Do not bend tubing by hand.
	Tie rod ends loose.	Tighten or replace tie rod end.
	Loose steering unit mounting.	Tighten steering unit mounting.
Poor Return of Steering Wheel to Center	Improper front wheel alignment.	Adjust front wheel alignment.
	Wheel bearing worn.	Replace front wheel bearing.
	Tie rod end binding.	Replace tie rod end.
	Ball joint binding.	Replace ball joint.
	Tight or frozen steering shaft bearing.	Replace steering assembly.
	Sticky or plugged steering unit valve.	Flush or replace steering unit.
	Entry of air in the power steering system.	Bleed the system.
Momentary Increase In Effort When Turning Wheel Fast To Right or Left	High internal leakage.	Repair steering gear.
	Power steering fluid level low.	Replenish fluid.
Steering Wheel Surges or Jerks When Turning Especially During Parking	Insufficient pump pressure.	Repair pump assembly.
	Sticky steering unit valve.	Flush or replace steering unit.
	Power steering fluid level low.	Replenish fluid.
Excessive Wheel Kick Back or Loose Steering	Air in system.	Bleed hydraulic system.
	Tie rod end loose.	Tighten tie rod end.
	Wheel bearing worn.	Replace wheel bearing.
Hard Steering or Lack or Power Assist	Sticky steering unit valve.	Flush or replace steering unit.
	Insufficient pump pressure.	Repair pump assembly.
	Excessive internal pump leakage.	Repair pump assembly.
	Excessive internal steering gear leakage.	Repair steering gear.
	Power steering fluid level low.	Replenish fluid.

Power Steering Pump

Foaming milky power steering fluid, low fluid level, and possible low pressure can be caused by air in the fluid, or loss of fluid due to internal pump leakage. Check for leak and correct. Bleed the system. Extremely cold temperatures will cause air bubbles in the system if the fluid level is low. If the fluid level is correct and the pump still foams, remove the pump from the vehicle and check housing for cracks. If the housing is cracked, replace the pump housing.

Condition	Possible cause	Correction
Low Pressure Due to Steering Pump	Relief valve sticking or inoperative.	Replace relief valve.
	Side plate not flat against cam ring.	Replace side plate.
	Extreme wear of cam ring.	Replace cam ring.
	Scored side plate or rotor.	Replace side plate or rotor.
	Vanes sticking in rotor slots.	Repair or replace vanes and rotor.
	Cracked or broken side plate.	Replace side plate.
	High internal leakage.	Repair internal leakage.
Low Pressure Due to Steering Gear	Scored housing bore.	Replace housing.
Growling Noise In Steering Pump	Excessive back pressure in hoses or steering unit caused by restriction.	Repair steering unit or pump.
	Scored side plate or rotor.	Replace side plate or rotor.
	Worn cam ring.	Replace cam ring.
Groaning Noise In Steering Pump	Air in the fluid.	Bleed hydraulic system.
	Low fluid level.	Replenish fluid.
	Pump mounting loose.	Tighten mounting bolt.
Rattling Noise In Steering Pump	Vanes sticking in rotor slots.	Repair or replace vanes and rotor.
	Vane improperly installed.	Repair rotor and vane.
Swishing Noise In Steering Pump	Damaged relief valve.	Replace relief valve.
Whining Noise In Steering Pump	Scored side plate and vanes.	Replace side plate and vanes.

Steering Column Lock System

Condition	Possible cause	Correction
Will Not Unlock	Damaged lock cylinder.	Replace lock cylinder.
	Damaged park lock cable.	Replace park lock cable.
Will Not Lock	Lock spring broken or worn.	Replace lock cylinder.
	Damaged lock cylinder.	Replace lock cylinder.
	Ignition switch stuck.	Repair or replace ignition switch.
	Park lock cable damaged.	Replace park lock cable.
Key Cannot be Removed in “OFF-LOCK”	Ignition switch is not set correctly.	Correct ignition switch.
	Damaged lock cylinder.	Replace lock cylinder.
	Faulty shift lock mechanism.	Repair or replace the shift lock mechanism.

Column

Condition	Possible cause	Correction
Noise in Column	Universal joint loose.	Tighten joint.
	Shaft lock snap ring not seated.	Place snap ring in proper position.

Turn Signal Switch

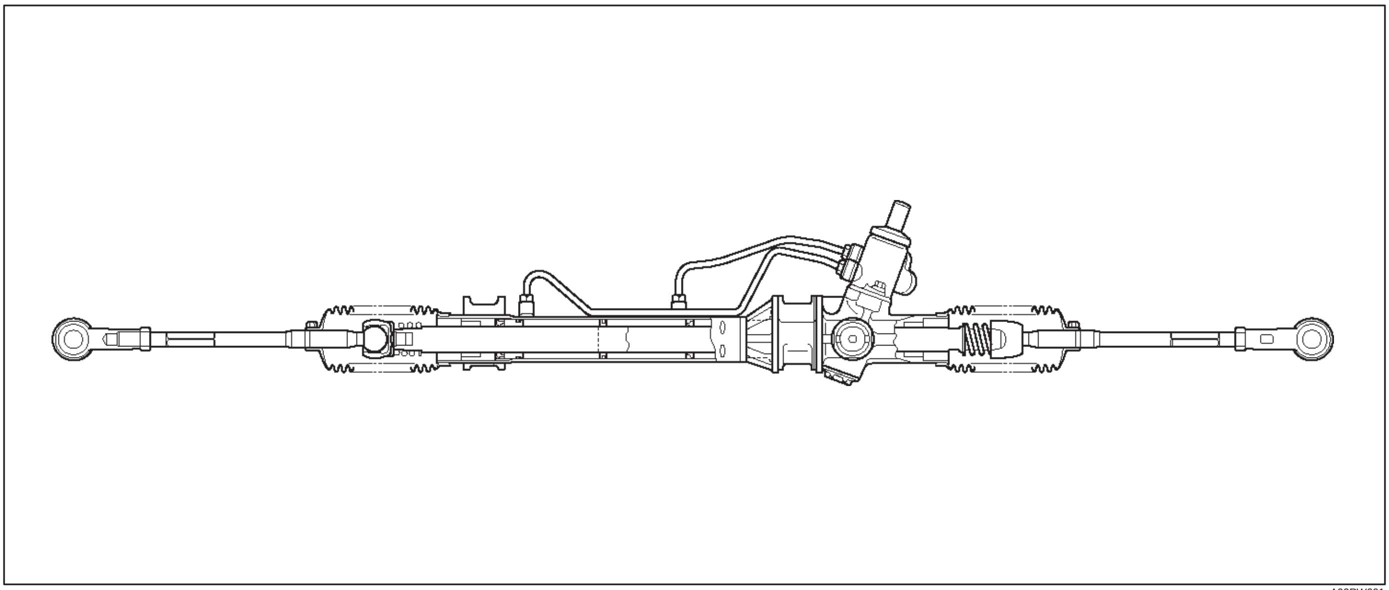
This diagnosis covers mechanical problems only. Refer to Turn Signal Switch in Electrical section for electrical diagnosis.

Condition	Possible cause	Correction
Turn Signal Will Not Stay In Turn Position	Foreign material or loose parts preventing movement of yoke.	Repair or replace signal switch.
	Broken or missing detent or canceling spring.	Replace signal switch.
Turn Signal Will Not Cancel	Loose switch mounting screws.	Tighten mounting screws.
	Switch or anchor bosses broken.	Replace turn signal switch.
	Broken, missing or out of position detent, return or canceling spring.	Replace turn signal switch.
	Worn canceling cam.	Replace turn signal switch.
Turn Signal Difficult To Operate	Turn signal switch arm loose.	Tighten arm screw.
	Broken or distorted yoke.	Replace turn signal switch.
	Loose or misplaced springs.	Replace turn signal switch.
	Foreign parts and/or material.	Repair turn signal switch.
	Loose turn signal switch mounting screws.	Tighten mounting screws.
Turn Signal Will Not Indicate Lane Change	Broken lane change pressure pad or spring hanger.	Replace turn signal switch.
	Broken, missing or misplaced lane change spring.	Replace turn signal switch.
	Base of wire damaged.	Replace turn signal switch.
Hazard Switch Cannot Be Turned Off	Foreign material between hazard switch to turn signal switch body.	Repair or replace hazard switch.
No Turn Signal Lights	Electrical failure in chassis harness.	Refer to Electrical section.
	Inoperative turn signal flasher unit.	Replace flasher unit.
	Loose chassis harness connector.	Repair loose connector.
Front or Rear Turn Signal Lights Not Flashing	Burned-out or damaged turn signal bulb.	Replace bulb.
	High resistance connection to ground at bulb socket.	Repair bulb socket.
	Loose chassis harness connector.	Repair loose connector.

General Description

The hydraulic power steering system consists of a pump, an oil reservoir, a steering unit, a pressure hose and a return hose.

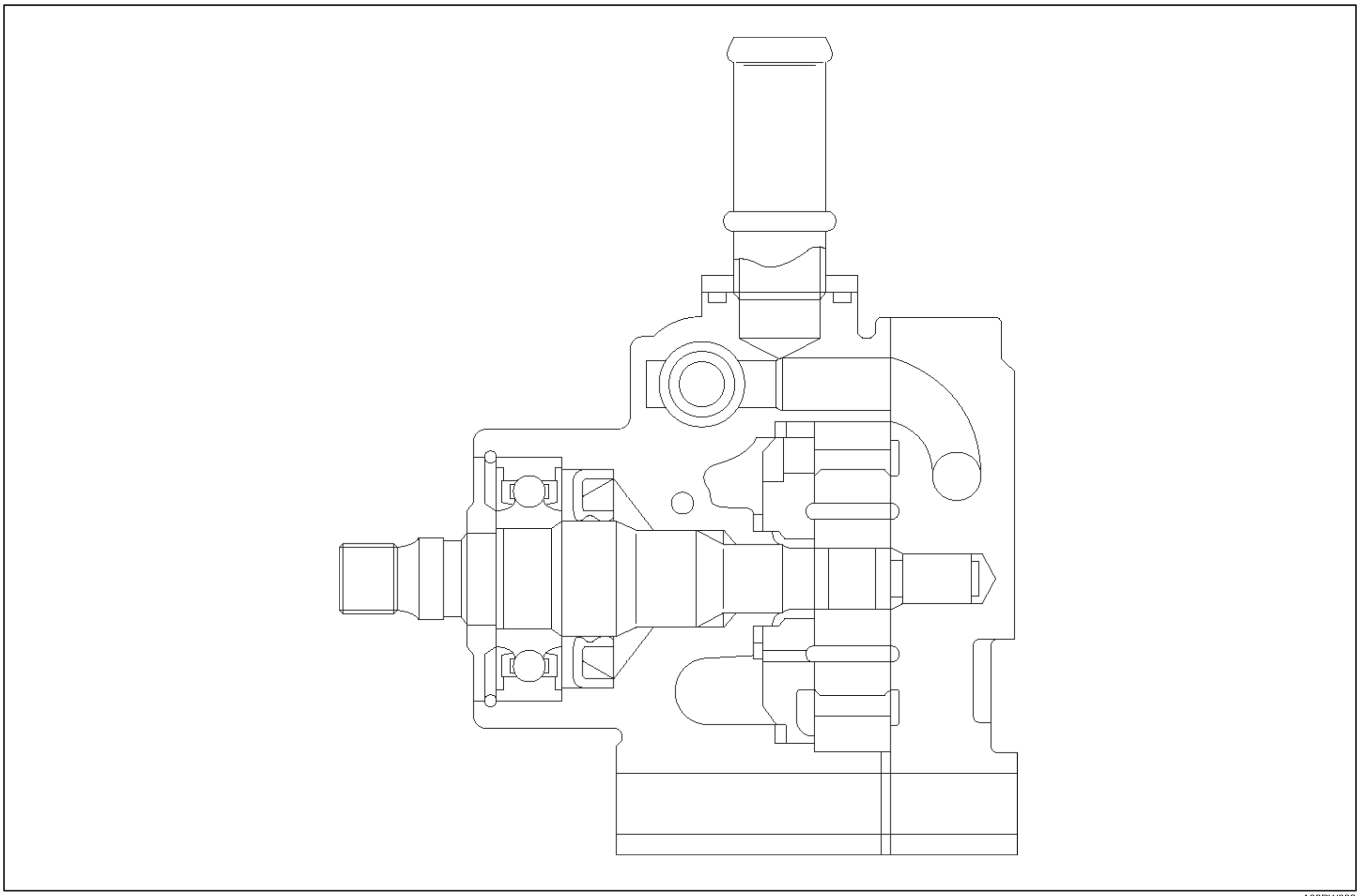
Power Steering Unit



A02RW001

The power steering unit is rack and pinion type.
The toe–in angle can be adjusted by turning the rod on each side.
The steering housing cannot be disassembled.

Hydraulic Pump



A02RW003

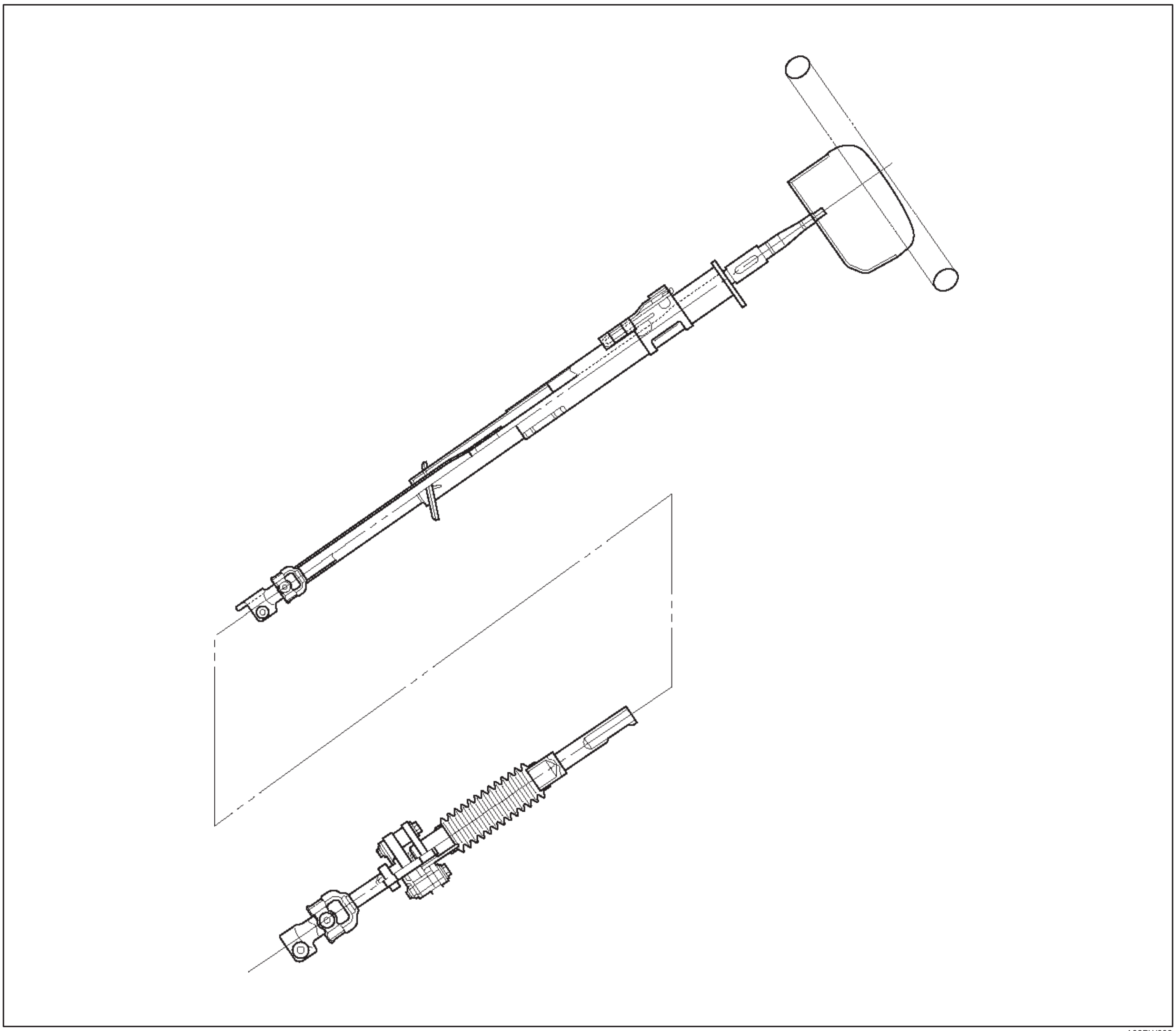
The hydraulic pump is vane-type design. The submerged pump has housing and internal parts that are inside the reservoir and operate submerged in oil. There are two bore openings at the rear of the pump housing. The larger opening contains the cam ring, pressure plate, thrust plate, rotor and vane assembly, and end plate. The smaller opening contains the pressure line union, flow control valve and spring.

The flow control orifice is part of the pressure line union. The pressure relief valve inside the flow control valve limits the pump pressure.

Pressure Switch

When hydraulic pressure reaches 3430 kPa (500 psi), the pressure switch closes causing the Engine Control Module (ECM) to actuate the idle air control valve, which increases the engine rpm to prevent the overload-induced engine speed slow down. The switch opens when hydraulic pressure drops to 2940 kPa (430 psi).

Steering Column



A02RW002

WARNING: TO AVOID DEPLOYMENT WHEN TROUBLE-SHOOTING THE SRS SYSTEM, DO NOT USE ELECTRICAL TEST EQUIPMENT, SUCH AS BATTERY-POWERED OR A/C-POWERED VOLT-METER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN SPECIFIED IN THIS MANUAL. DO NOT USE A NON-POWERED PROBE-TYPE TESTER. INSTRUCTION IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

When servicing a vehicle equipped with Supplemental Restraint System, pay close attention to all WARNINGS and CAUTIONS.

For detailed explanation about SRS, refer to Restraints section.

The steering column has three important features in addition to the steering function:

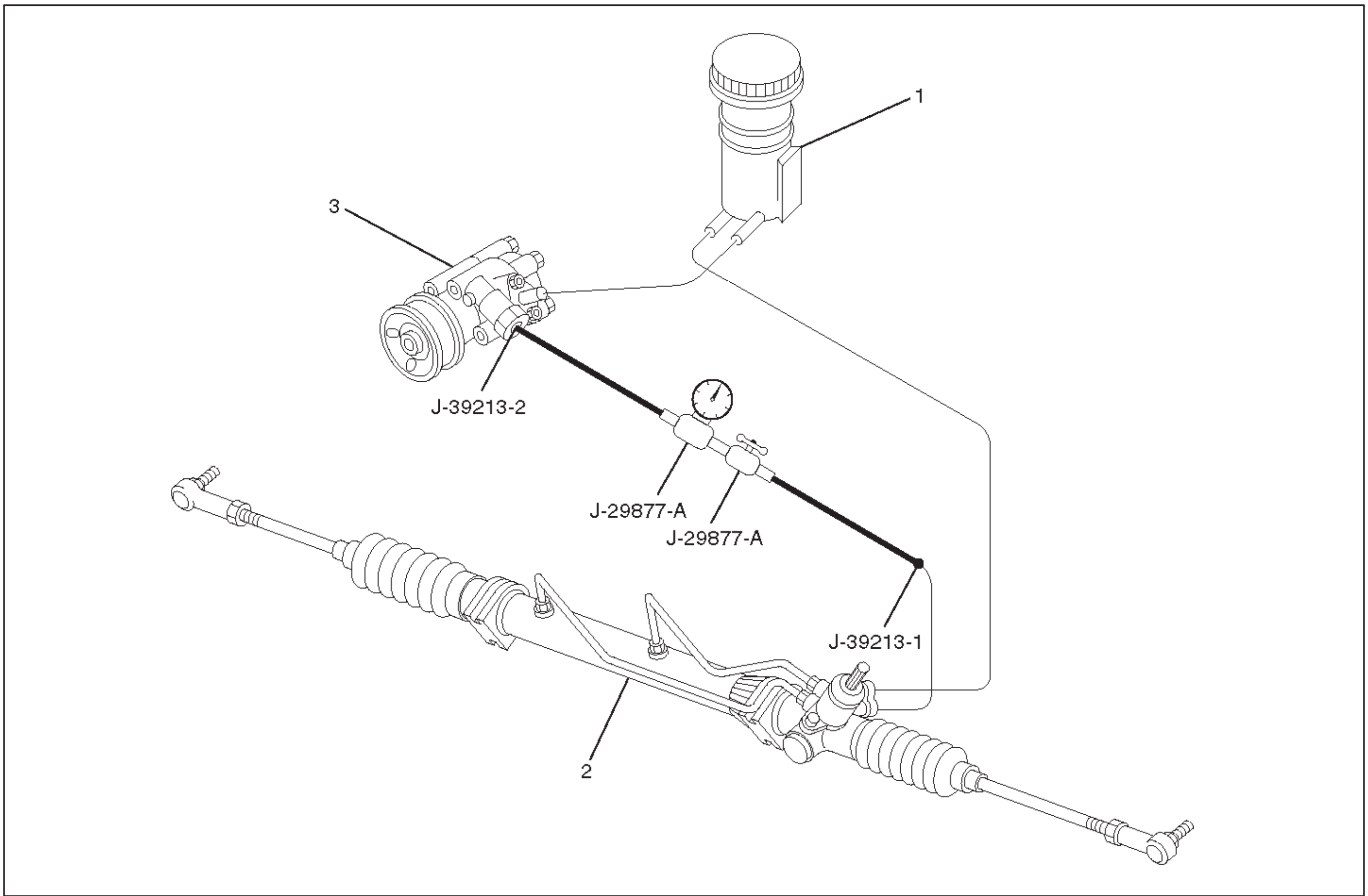
1. The column is energy absorbing, designed to compress in a front-end collision to minimize the possibility of injury to the driver of the vehicle.
2. The ignition switch and lock are mounted conveniently on the column.
3. With the column mounted lock, the ignition and steering operation can be locked to prevent theft of the vehicle.

The column can be disassembled and reassembled. However, to insure the energy absorbing action, use only the specified screws, bolts and nuts as designated, and tighten them to the specified torque.

Handle the column with care when it is removed from the vehicle. A sharp blow on the end of steering shaft or shift lever, or dropping the assembly could shear or loosen the fasteners that maintain column rigidity.

Power Steering System Test

Test Procedure



Legend

(1) Fluid Reservoir
(2) Power Steering Unit
(3) Power Steering Pump

Test of fluid pressure in the power steering system is performed to determine whether or not the oil pump and power steering unit are functioning normally.

The power steering system test is used to identify and isolate hydraulic circuit difficulties. Prior to performing this test, the following inspections and corrections, if necessary, must be made.

- Inspect pump reservoir for proper fluid level.
- Inspect pump belt for proper tension.
- Inspect pump driver pulley condition.

1. Place a container under the pump to catch the fluid when disconnecting or connecting the hoses.
2. With the engine NOT running, disconnect the pressure hose at the power steering pump and install power steering tester J-29877-A. The gage must be between the shutoff valve and pump. Open the shutoff valve.
3. Check the fluid level. Fill the reservoir with power steering fluid, to the “Full” mark. Start the engine, then turn the steering wheel and momentarily hold it against a stop (right or left). Turn the engine off and check the connections at tester for leakage.

4. Bleed the system. Refer to Bleeding the Power Steering System in this section.
5. Start the engine and check the fluid level. Add power steering fluid if required. When the engine is at normal operating temperature, increase engine speed to 1500 rpm.

CAUTION: Do not leave shutoff valve fully closed for more than 5 seconds, as the pump could become damaged internally.

6. Fully close the shutoff valve. Record the highest pressures.
   - If the pressure recorded is within 9300–9800 kPa (1350–1420 psi), the pump is functioning within its specifications.
   - If the pressure recorded is higher than 9800 kPa (1420 psi), the valve in the pump is defective.
   - If the pressure recorded is lower than 9300 kPa (1350 psi), the valve or the rotating group in the pump is defective.
7. If the pump pressures are within specifications, leave the valve open and turn (or have someone else turn) the steering wheel fully in both directions. Record the highest pressures and compare with the maximum pump pressure recorded in step 6. If this pressure cannot be built in either side of the power steering unit, the power steering unit is leaking internally and must be replaced.
8. Shut the engine off, remove the testing gauge.
9. Reconnect the pressure hose, check the fluid level and make the needed repairs.
10. If the problem still exists, the steering and front suspension must be thoroughly examined.

Maintenance

The hydraulic system should be kept clean and fluid level in the reservoir should be checked at regular intervals and fluid added when required. Refer to Recommended Fluids and Lubricants in General Information section for the type of fluid to be used and the intervals for filling.

If the system contains some dirt, flush it as described in this section. If it is exceptionally dirty, the pump must be completely disassembled before further usage. (The steering unit cannot be disassembled.)

All tubes, hoses, and fittings should be inspected for leakage at regular intervals. Fittings must be tight. Make sure the clips, clamps and supporting tubes and hoses are in place and properly secured.

Power steering hoses and lines must not be twisted, kinked or tightly bent. Air in the system will cause spongy action and noisy operation. When a hose is disconnected or when fluid is lost, for any reason, the system must be bled after refilling. Refer to Bleeding the Power Steering System in this section.

- Inspect belt for tightness.
- Inspect pulley for looseness or damage. The pulley should not wobble with the engine running.
- Inspect hoses so they are not touching any other parts of the vehicle.
- Inspect fluid level and fill to the proper level.

Fluid Level

1. Run the engine until the power steering fluid reaches normal operating temperature, about 55˚C (130˚F), then shut the engine off.
2. Check the level of fluid in the reservoir.
3. If the fluid level is low, add power steering fluid as specified in General Information to the proper level and install the receiver cap.
4. When checking the fluid level after the steering system has been serviced, air must be bled from the system. Refer to Bleeding the Power Steering System in this section.

Bleeding The Power Steering System

When a power steering pump or unit has been installed, or an oil line has been disconnected, the air that has entered the system must be bled out before the vehicle is operated. If air is allowed to remain in the power steering fluid system, noisy and unsatisfactory operation of the system may result.

Bleeding Procedure

When bleeding the system, and any time fluid is added to the power steering system, be sure to use only power steering fluid as specified in General Information.

1. Fill the pump fluid reservoir to the proper level and let the fluid settle for at least two minutes.
2. Start the engine and let it run for a few seconds. Do not turn the steering wheel. Then turn the engine off.
3. Add fluid if necessary.
4. Repeat the above procedure until the fluid level remains constant after running the engine.
5. Raise and support the front end of the vehicle so that the wheels are off the ground.
6. Start the engine. Slowly turn the steering wheel right and left, lightly contacting the wheel stops.
7. Add power steering fluid if necessary.
8. Lower the vehicle, set the steering wheel at the straight forward position after turning it to its full steer positions 2 or 3 times, and stop the engine.
9. Check the fluid level and refill as required.
10. If the fluid is extremely foamy, allow the vehicle to set a few minutes, then repeat the above procedure.

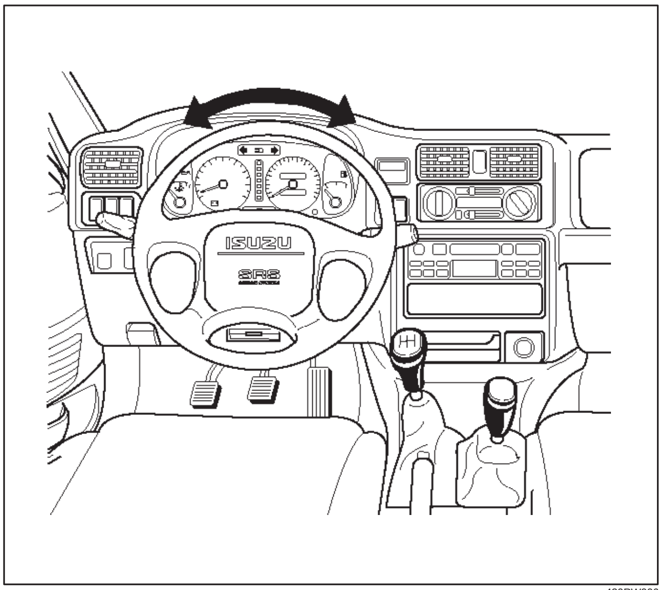
Flushing The Power Steering System

1. Raise and support the front end of the vehicle off the ground until the wheels are free to turn.
2. Remove the fluid return line at the pump inlet connector and plug the connector port on the pump. Position the line toward a large container to catch the draining fluid.
3. While running the engine at idle, fill the reservoir with new power steering fluid. Turn the steering wheel in both directions. Do not contact or hold the steering wheel to the wheel stops. This will cause the pump to go to pressure relief mode, which may cause a sudden fluid overflow at the reservoir.

4. Install all the lines and hoses. Fill the system with new power steering fluid and bleed the system as described in Bleeding The Power Steering System. Operate the engine for about 15 minutes.

   Remove the pump return line at the pump inlet and plug the connection on the pump. While refilling the reservoir, check the draining fluid for contamination. If foreign material is still evident, replace all lines, disassemble and clean or replace the power steering system components. Do not re-use any drained power steering fluid.

Steering Wheel Free Play Inspection



430RW006

1. With the tires in the straight-ahead position, check the amount of steering wheel play by turning the wheel in both directions until the tires begin to move.

NOTE: The wheel free play should be checked with the engine running.

Free play: 0 – 30 mm (0 – 1.18 in)

2. Also check the steering wheel for play and looseness in the mount by moving it back and forth and sideways. When test driving, check for hard steering, steering shimmy and tendency to pull to one side.

Front End Alignment Inspection and Adjustment

General Description

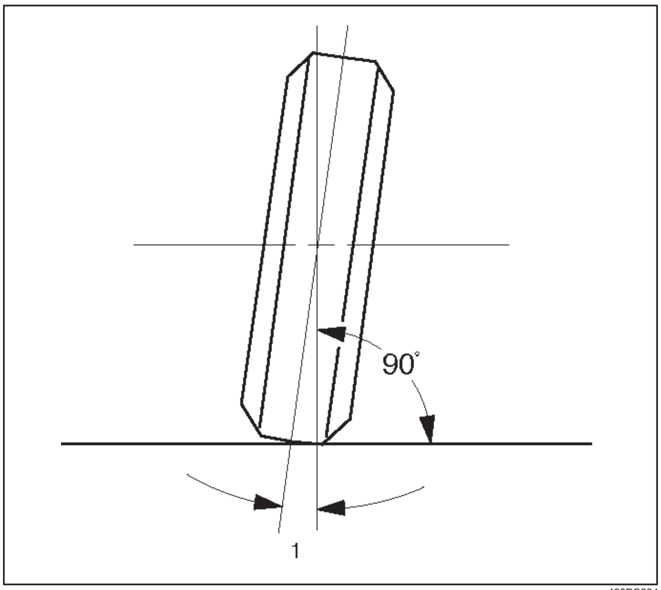
“Front End Alignment” refers to the angular relationship between the front wheels, the front suspension attaching parts and the ground.

Proper front end alignment must be maintained in order to insure efficient steering, good directional stability and to prevent abnormal tire wear.

The most important factors of front end alignment are wheel toe-in, wheel camber and axle caster.

Camber:

This illustration shows view from the front of the vehicle.

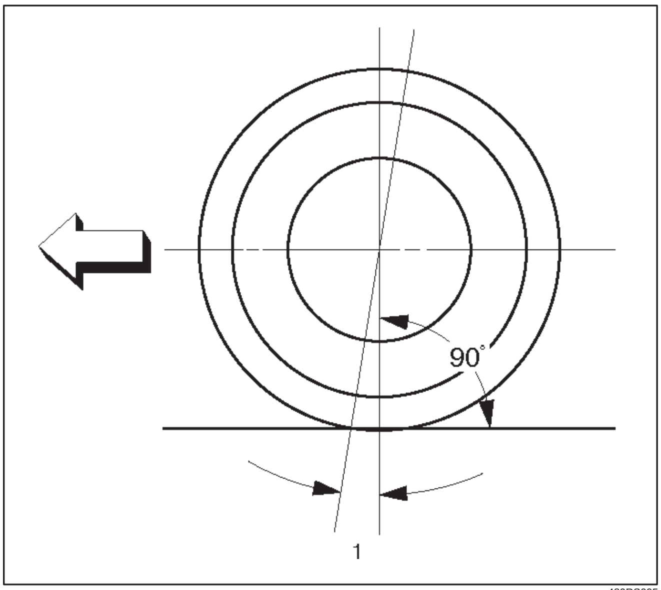


480RS004

Camber is the vertical tilting inward or outward of the front wheels. When the wheels tilt outward at the top, the camber is positive (+). When the wheels tilt inward at the top, the camber is negative (-). The amount of tilt measured in degrees from the vertical is called the camber angle (1). If camber is extreme or unequal between the wheels, improper steering and excessive tire wear will result. Negative camber causes wear on the inside of the tire, while positive camber causes wear to the outside.

Caster:

This illustration shows view from the side of the vehicle.

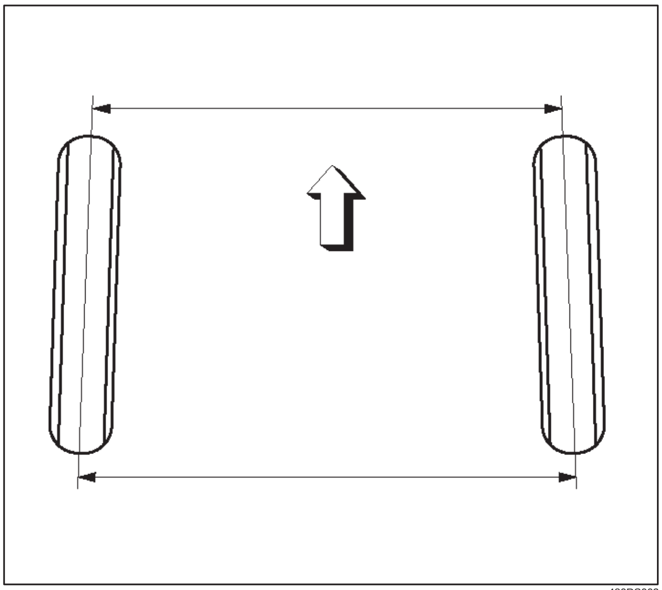


480RS005

Caster (1) is the vertical tilting of the wheel axis either forward or backward (when viewed from the side of the vehicle). A backward tilt is positive (+) and a forward tilt is negative (-). On the short and long arm type suspension you cannot see a caster angle without a special instrument, but if you look straight down from the top of the upper control arm to the ground, the ball joints do not line up (fore and aft) when a caster angle other than 0 degree is present. With a positive angle, the lower ball joint would be slightly ahead (toward the front of the vehicle) of the upper ball joint center line.

Toe-in:

This illustration shows view from the top of the vehicle.



480RS003

Toe-in is the measured amount the front wheels are turn in. The actual amount of toe-in is normally a fraction of a degree. Toe-in is measured from the center of the tire treads or from the inside of the tires. The purpose of toe-in is to insure parallel rolling of the front wheels and to offset any small deflections of the wheel support system which occurs when the vehicle is rolling forward. Incorrect toe-in results in excessive toe-in and unstable steering. Toe-in is the last alignment to be set in the front end alignment procedure.

Inspection

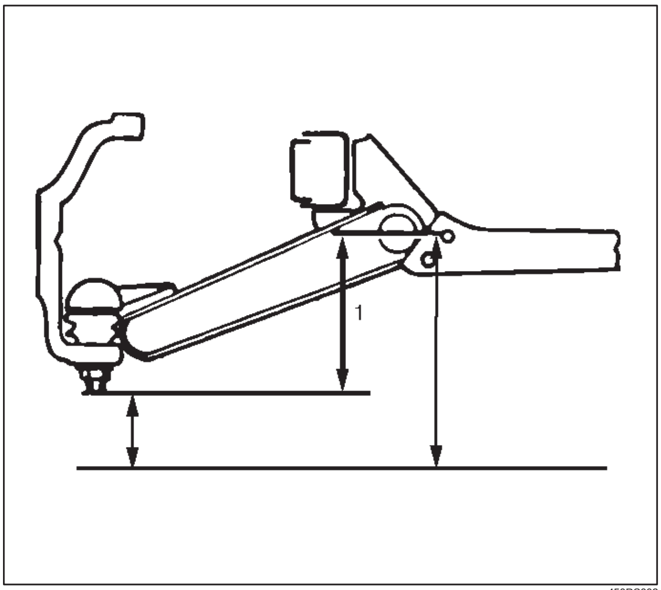
Before making any adjustments affecting caster, camber or toe-in, the following front end inspection should be made.

1. Inspect the tires for proper inflation pressure. Refer to Main Data and Specifications in Wheel and Tire System section.
2. Make sure that the vehicle is unladen condition (With no passenger or loading).
3. Make sure that the spare tire is installed at the normal position.
4. Inspect the front wheel bearings for proper adjustment. Refer to Front Hub and Disc Overhaul in Suspension section.
5. Inspect the ball joints and tie rod ends. If excessive looseness is noted, correct before adjusting. Refer to Steering Linkage in this section.
6. Inspect the wheel and tires for run-out. Refer to Wheel Replacement in Wheel and Tire System section.
7. Inspect the trim height. If not within specifications, the correction must be made before adjusting caster.
8. Inspect the steering unit for looseness at the frame.
9. Inspect shock absorbers for leaks or any noticeable noise. Refer to Shock Absorber in Suspension section.
10. Inspect the control arms or stabilizer bar attachment for looseness. Refer to Suspension section .
11. Inspect the front end alignment using alignment equipment. Follow the manufacturer's instructions.
12. Park the vehicle must be on a level surface.

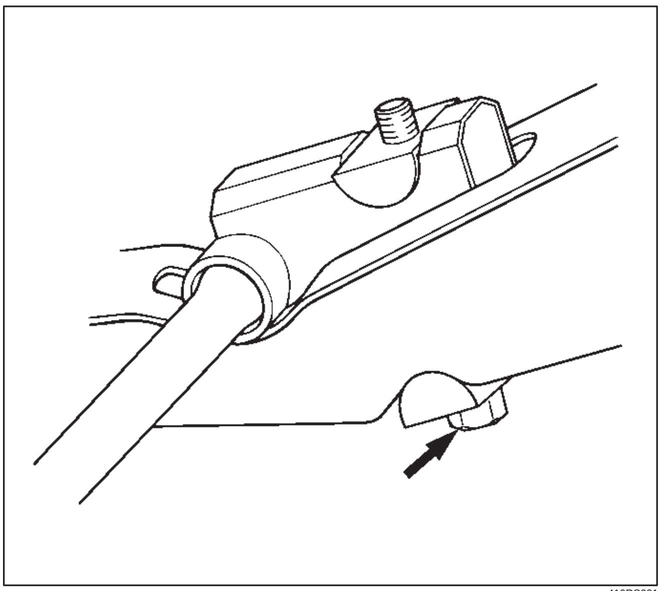
Trim Height Adjustment

Adjust the trim height (1) by means of the adjusting bolt on the height control arms.

CAUTION: When adjusting front end alignment, be sure to begin with trim height first, as it may change other adjusted alignments.



450RS003



410RS001

1. Check and adjust the tire inflation pressures.
2. Park the vehicle on a level ground and move the front of the vehicle up and down several times to settle the suspension.
3. Make necessary adjustment with the adjusting bolt on the height control arms.

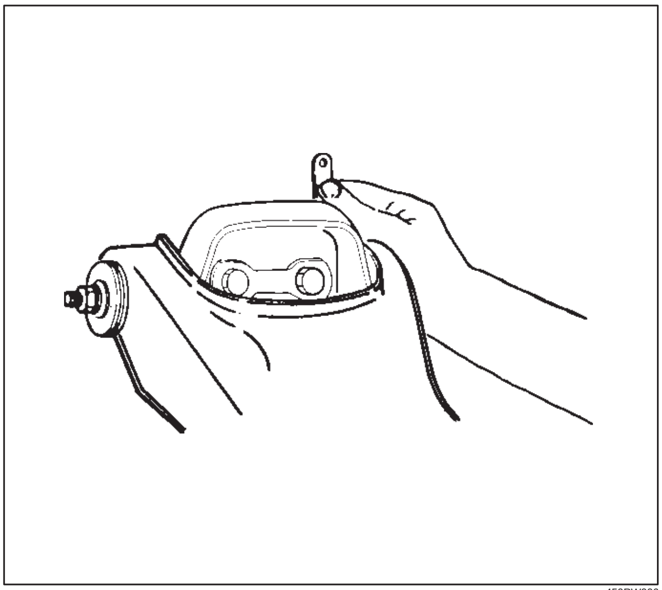
Trim height: 119 ± 5 mm (4.69 ± 0.2 in)

Caster Adjustment

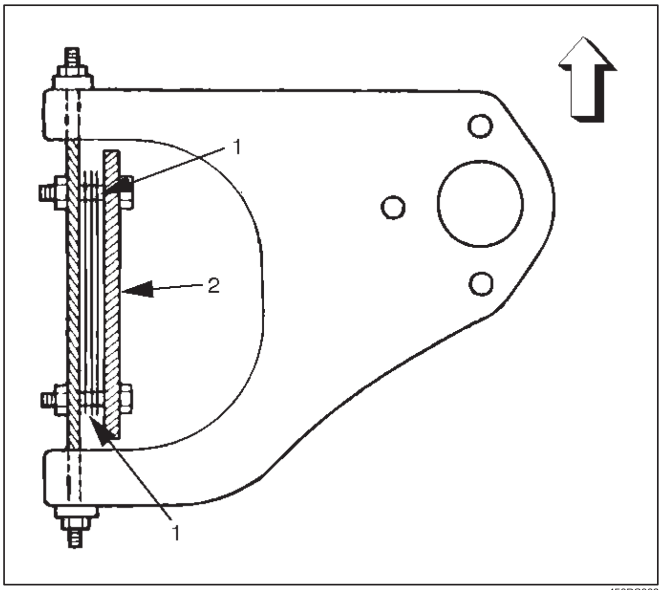
The caster angle can be adjusted by means of the caster shims (1) installed between the chassis frame (2) and fulcrum pins.

Caster angle: 2°30’ ± 45’

CAUTION: Left and right side must be equal within 30’.



450RW006



450RS002

NOTE: Difference of the caster shim front/rear thickness should be 3.6 mm (0.142 in) or less. Overall thickness of caster shim and camber shim should be 10.8 mm (0.425 in) or less.

Tighten the fulcrum pin bolt to the specified torque.

Torque: 152 N·m 112 (lb ft)

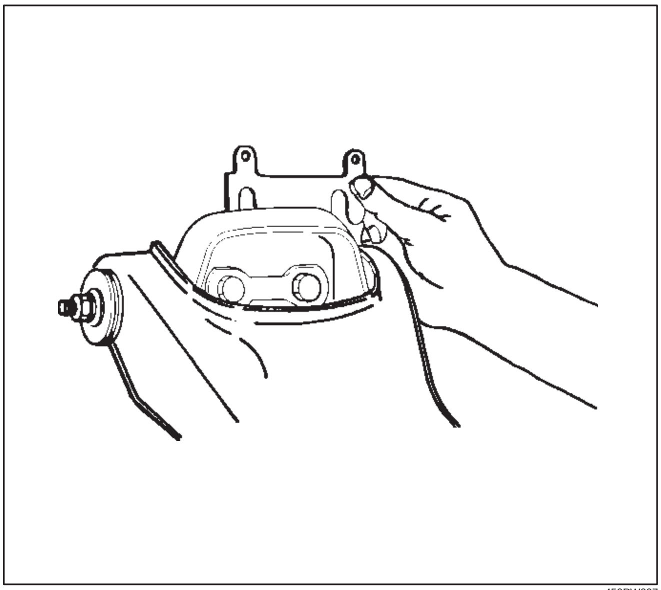
Camber Adjustment

The camber angle can be adjusted by means of the camber shims (2) installed in position between the chassis frame (1) and fulcrum pins

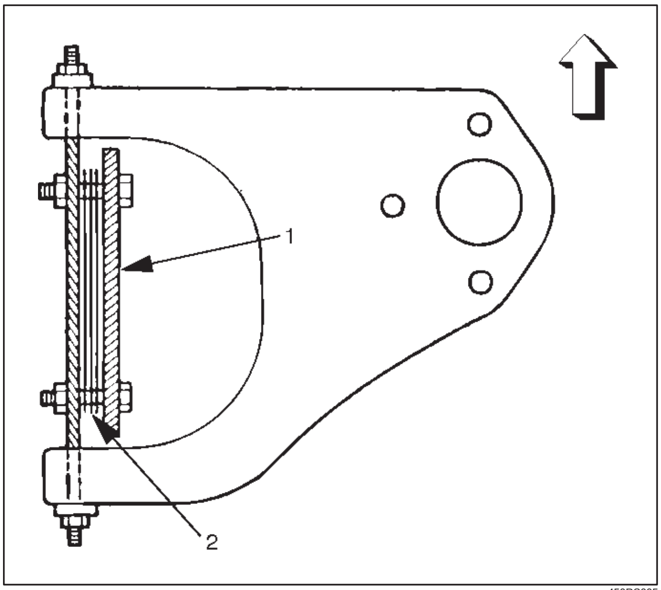
Camber angle: 0° ± 30’

King pin inclination: 12°30’ ± 30’

CAUTION: Left and right side must be equal within 30’.



450RW007



450RS005

NOTE: Overall thickness of caster shim and camber shim should be 10.8 mm (0.425 in) or less.

Tighten the fulcrum pin bolt to the specified torque.

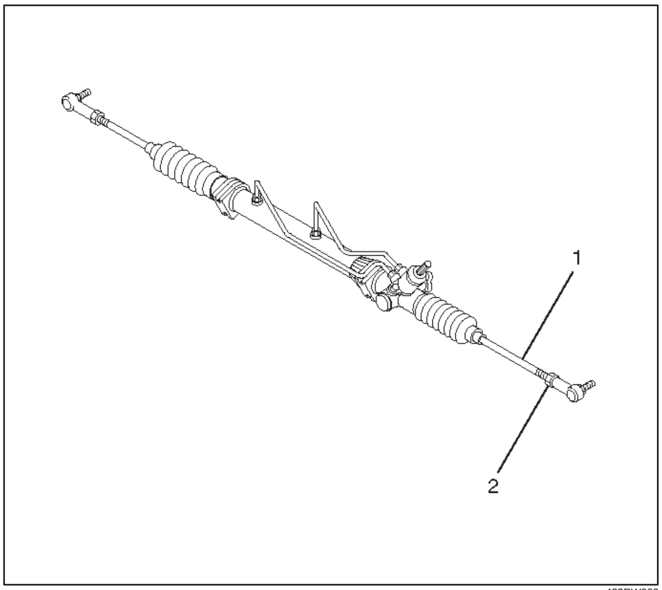
Torque: 152 N·m (112 lb ft)

	Position of shims		Camber angle	Caster angle
	Front side	Rear side		
Caster shim	When added	When removed	Decreases	Decreases
	When removed	When added	Increases	Increases
	—	When removed	Unchanged	Decreases
	—	When added	Unchanged	Increases
Camber shim	When added		Decreases	Unchanged
	When removed		Increases	Unchanged

Toe-in Adjustment

1. To adjust the toe-in angle, loosen the lock nuts (2) on the tie rod (1) and turn the tie rod. Turn both rods the same amount, to keep the steering wheel centered .

Toe-in: 0 ± 2 mm (0 ± 0.08 in)



433RW003

2. Tighten the lock nut to the specified torque.

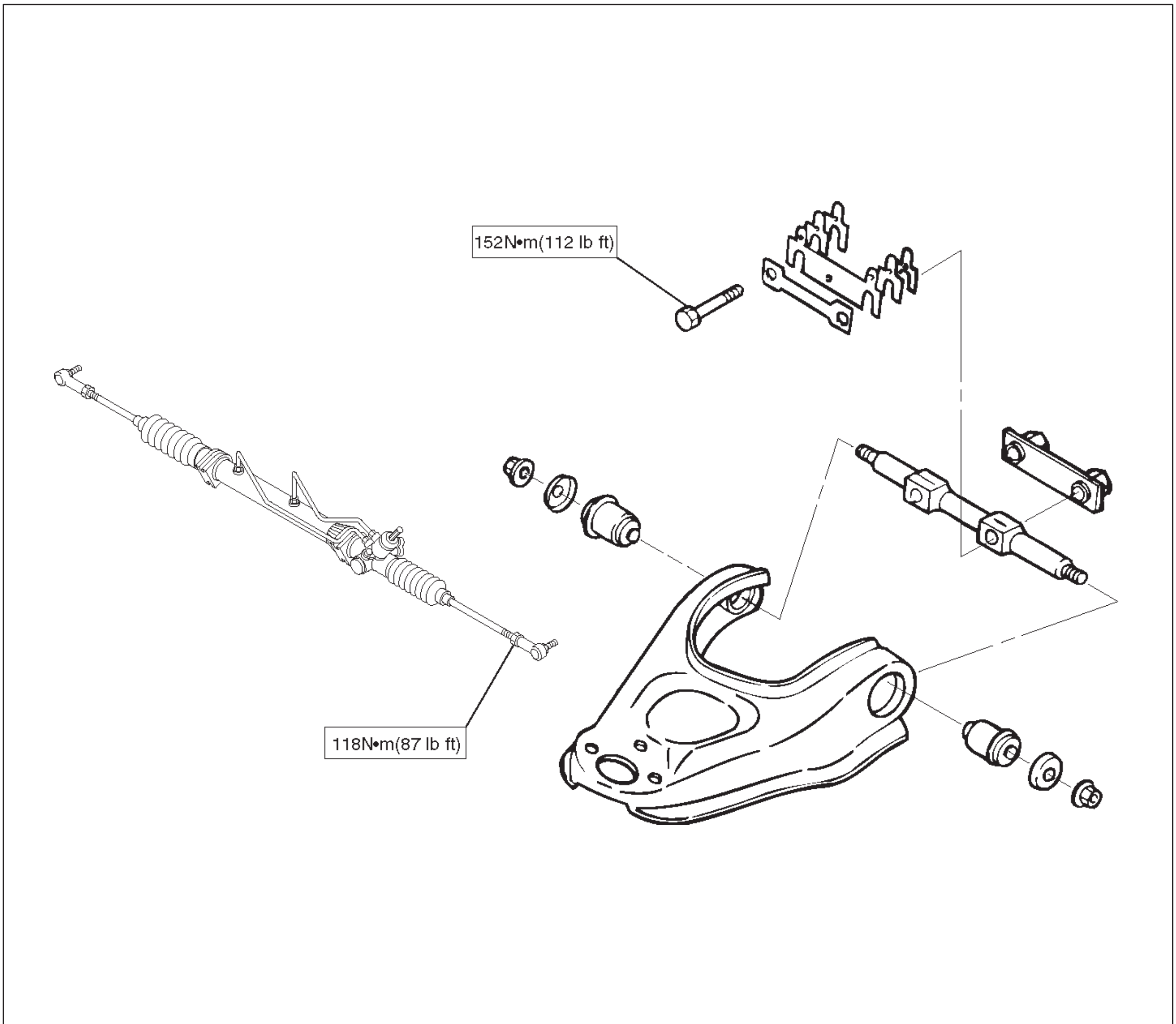
Torque: 118 N·m (87 lb ft)

Main Data and Specifications

General Specification

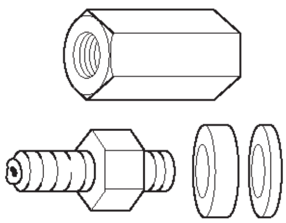
Caster		2°30’ ± 45’
Camber		0° ± 30’
King pin inclination		12°30’ ± 30’
Toe-in		0 ± 2 mm (0 ± 0.08 in)
Max. steering angle	inside	32.6° (+0°30’ to –2°30’)
	outside	31.8°

Torque Specification



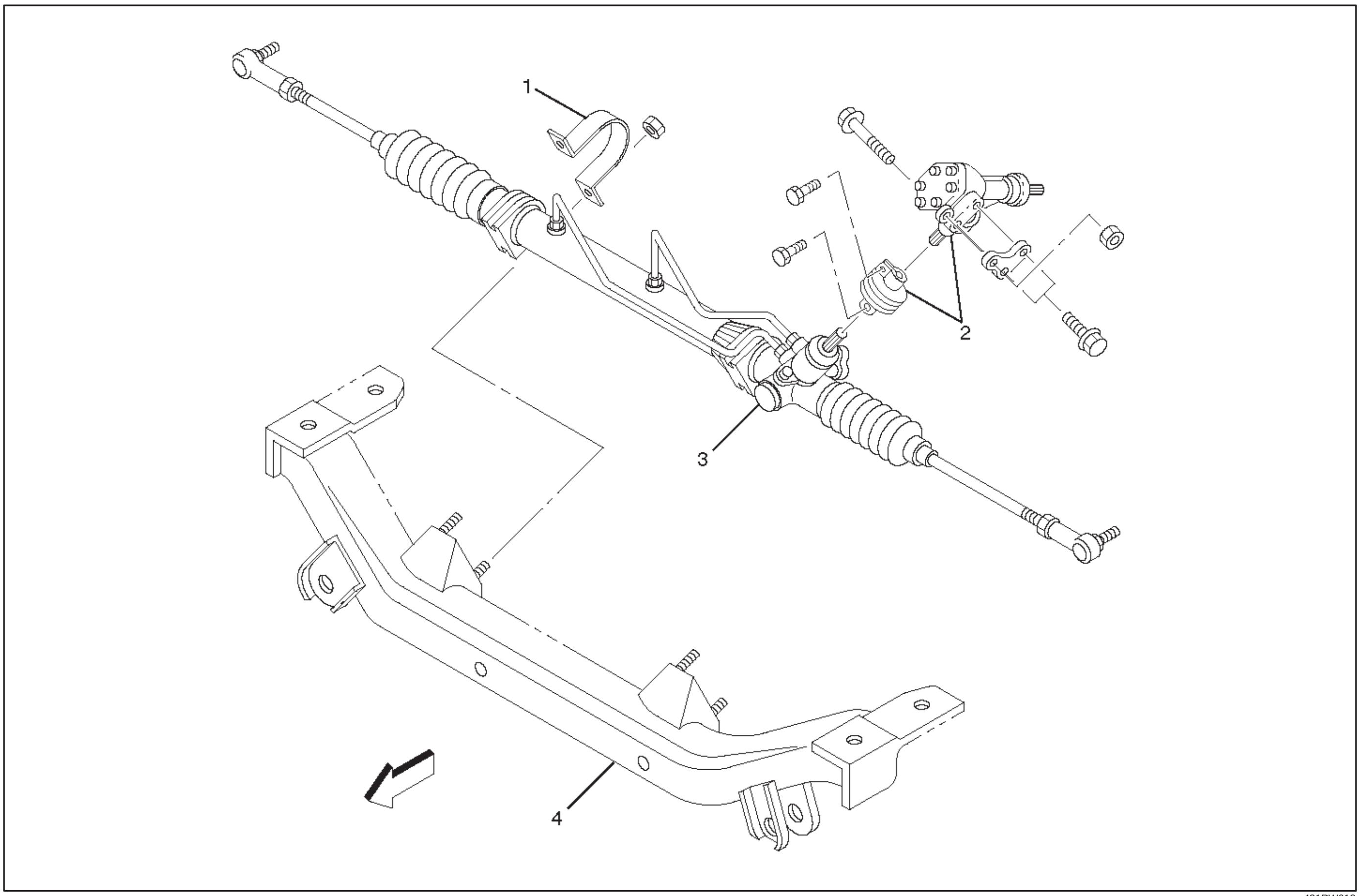
E02RW005

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS276	**J–29877–A** Tester; Power steering
 901RS278	**J–39213** Adapter; Power steering tester

Power Steering Unit

Power Steering Unit and Associated Parts



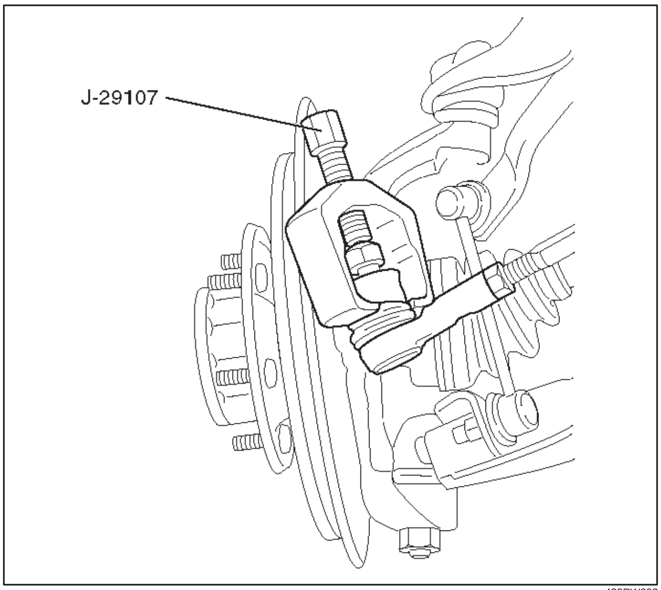
431RW013

Legend

(1) Bracket
(2) Transfer Gear Assembly
(3) Power Steering Unit Assembly
(4) Crossmember

Removal

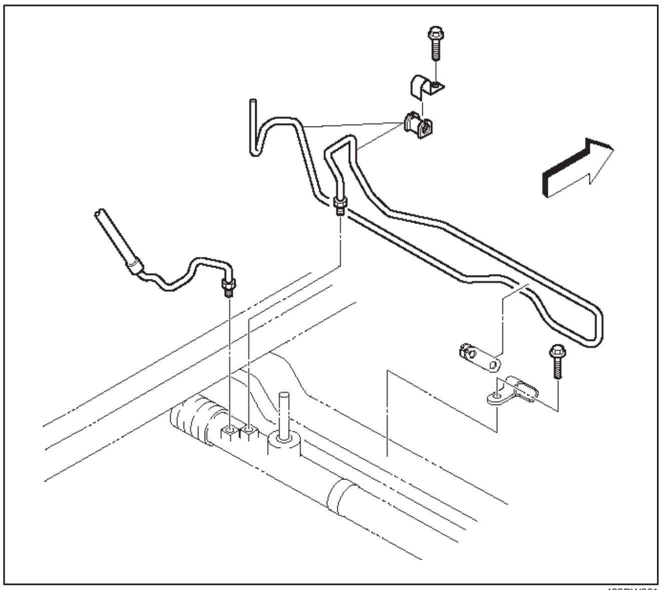
1. Remove the stone guard.
2. Remove the transfer gear assembly.
   Make a setting mark across the coupling flange and steering unit to ensure reassembly of the parts in the original position.
3. Drain power steering fluid.
4. Remove the tie rod end assembly from knuckle.
   Use tie rod end remover J–29107.



433RW002

5. Disconnect the feed line and return line from steering unit.
   Remove the clips on the crossmember and frame.
   Wire the power steering line to frame.

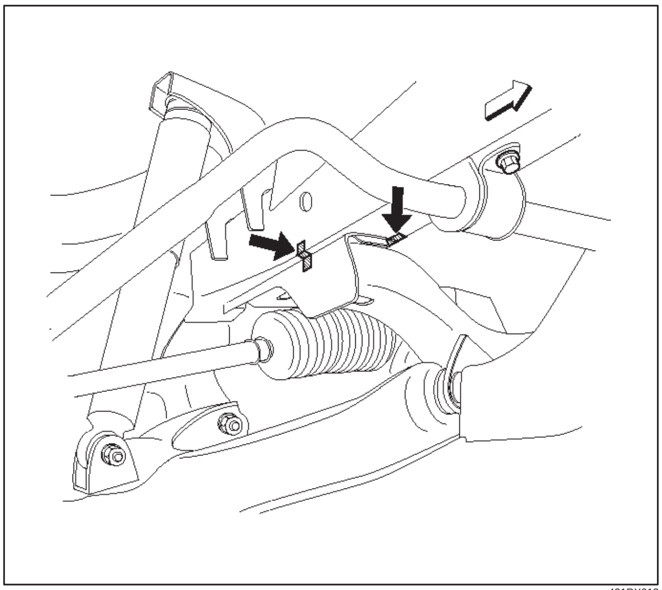
NOTE: Take care to prevent foreign matter from entry when disconnect the power steering line.



435RW001

4×4 model:

1. Remove the torsion bar. Refer to Front Suspension in Suspension section.
2. Remove the lower control arm bolt (Frame side).
   Refer to Front Suspension in Suspension section.
3. Apply a setting mark across the crossmember and frame so parts can be reassembled in their original position.



431RX013

4. Remove the crossmember fixing bolt.
5. Remove the power steering unit with the crossmember.
6. Remove the power steering unit.

4×2 model:

1. Remove the power steering unit from the crossmember.

Installation (4×2 Model)

1. Install power steering unit to crossmember.
   Tighten fixing bolt to specified torque.

   Torque: 116 N·m (85 lb ft)
2. Connect the feed line and return line.

   Torque: 25 N·m (18 lb ft)
3. Install tie–rod end assembly to knuckle.

   Torque: 118 N·m (87 lb ft)
4. Install transfer gear assembly.
   Align the setting marks made at removal.

   Torque: 31 N·m (23 lb ft)
5. Install the stone guard.
6. Bleed the system.
   Refer to Bleeding the Power Steering System in this section.

Installation (4×4 Model)

1. Install power steering unit to crossmember.
   Tighten fixing bolt to specified torque.

   Torque: 116 N·m (85 lb ft)
2. Install power steering unit with crossmember to frame by aligning the setting marks made when removing.
   Tighten crossmember mounting bolt to specified torque.

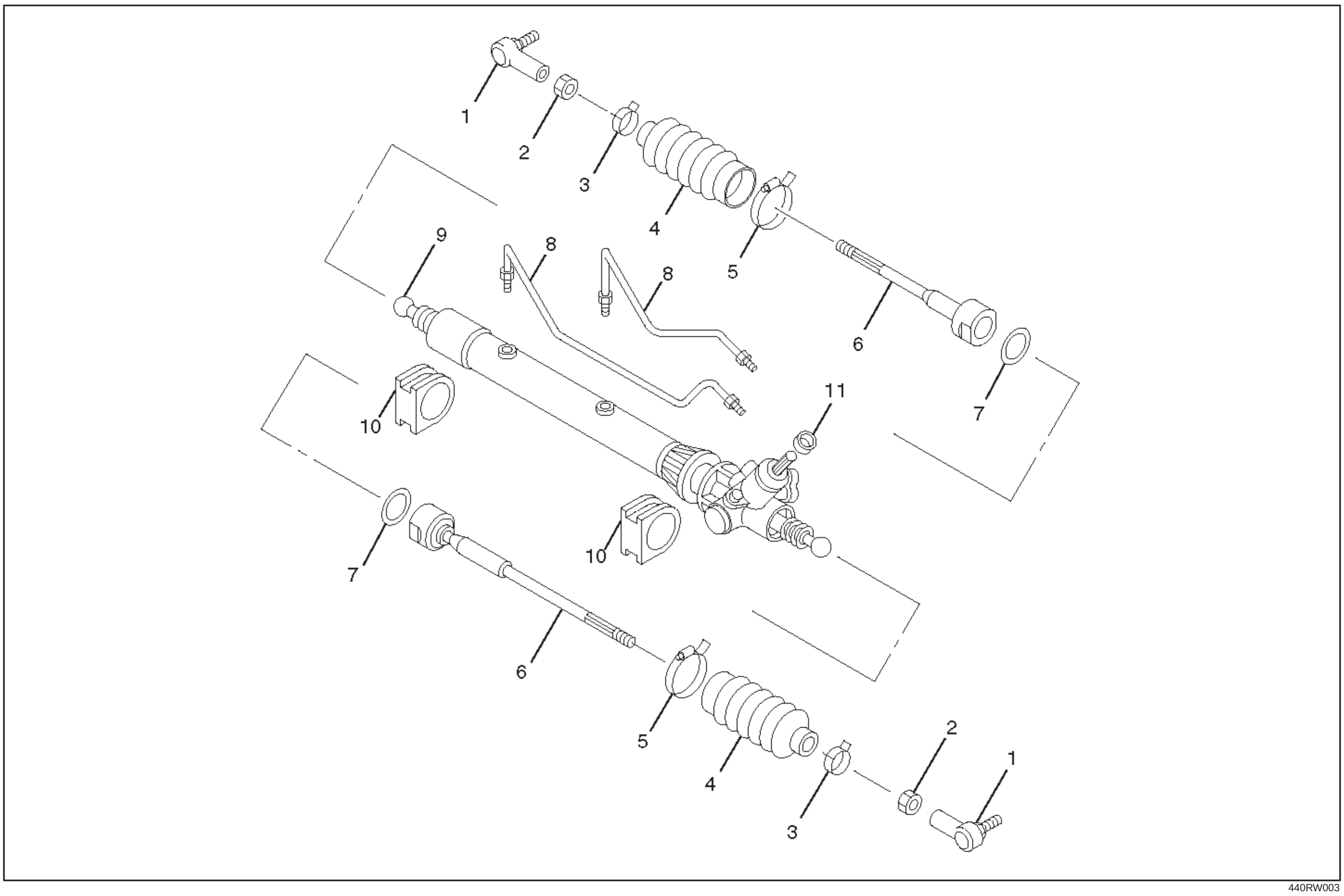
   Torque: 190 N·m (140 lb ft)
3. Install lower control arm bolt.
   Refer to Front Suspension in Suspension section.
4. Install torsion bar.
   Refer to Front Suspension in Suspension section.
5. Connect the feed line and return line.

   Torque: 25 N·m (18 lb ft)
6. Install tie–rod end assembly to knuckle.

   Torque: 118 N·m (87 lb ft)
7. Install transfer gear assembly.
   Align the setting marks made at removal.

   Torque: 31 N·m (23 lb ft)
8. Install the stone guard.
9. Bleed the system.
   Refer to Bleeding the Power Steering System in this section.

Power Steering Unit Disassembled View



Legend

(1) Tie-rod End
(2) Lock Nut
(3) Clip
(4) Bellows
(5) Band
(6) Tie-rod Assembly
(7) Tab Washer
(8) Oil Line
(9) Valve Housing Assembly
(10) Mounting Rubber
(11) Dust Cover

Disassembly

NOTE: The valve housing is made of aluminum and care should be exercised when clamping in a vise, etc. to prevent distortion or damage.

1. Loosen lock nut and remove tie–rod end.
2. Remove clip and band, then remove bellows.
3. Remove tie-rod assembly.
   To remove, move the boot toward the tie-rod end, then remove tab washer.
4. Remove oil line, mounting rubber and dust cover.

Inspection and Repair

Inspect the following parts for wear, damage or any abnormal conditions.

Tie-rod End

If looseness or play is found when checked by moving the end of ball joint at tie-rod end, replace tie-rod end.

Tie-rod Assembly

If the resistance is insufficient or play is felt when checked by moving the ball on the tie-rod, replace the tie-rod assembly.

Rubber Parts

If wear or damage is found through inspection, replace with new ones.

Reassembly

1. Install mounting rubber and dust cover (If removed).
2. Install oil line.

   Torque: 13 N· m (113 lb in)
3. Install tie-rod assembly with tab washer.
   Apply grease to ball joint, install tie-rod and tab washer, then tighten to specified torque.

   Torque: 83 N·m (61 lb ft)

   After tightening, bend tab washer against width across flat of inner ball joint.

4. Apply a thin coat of grease to the shaft for smooth installation. Then install bellows.
5. Install band and clip.
6. Install tie-rod end and tighten lock nut.

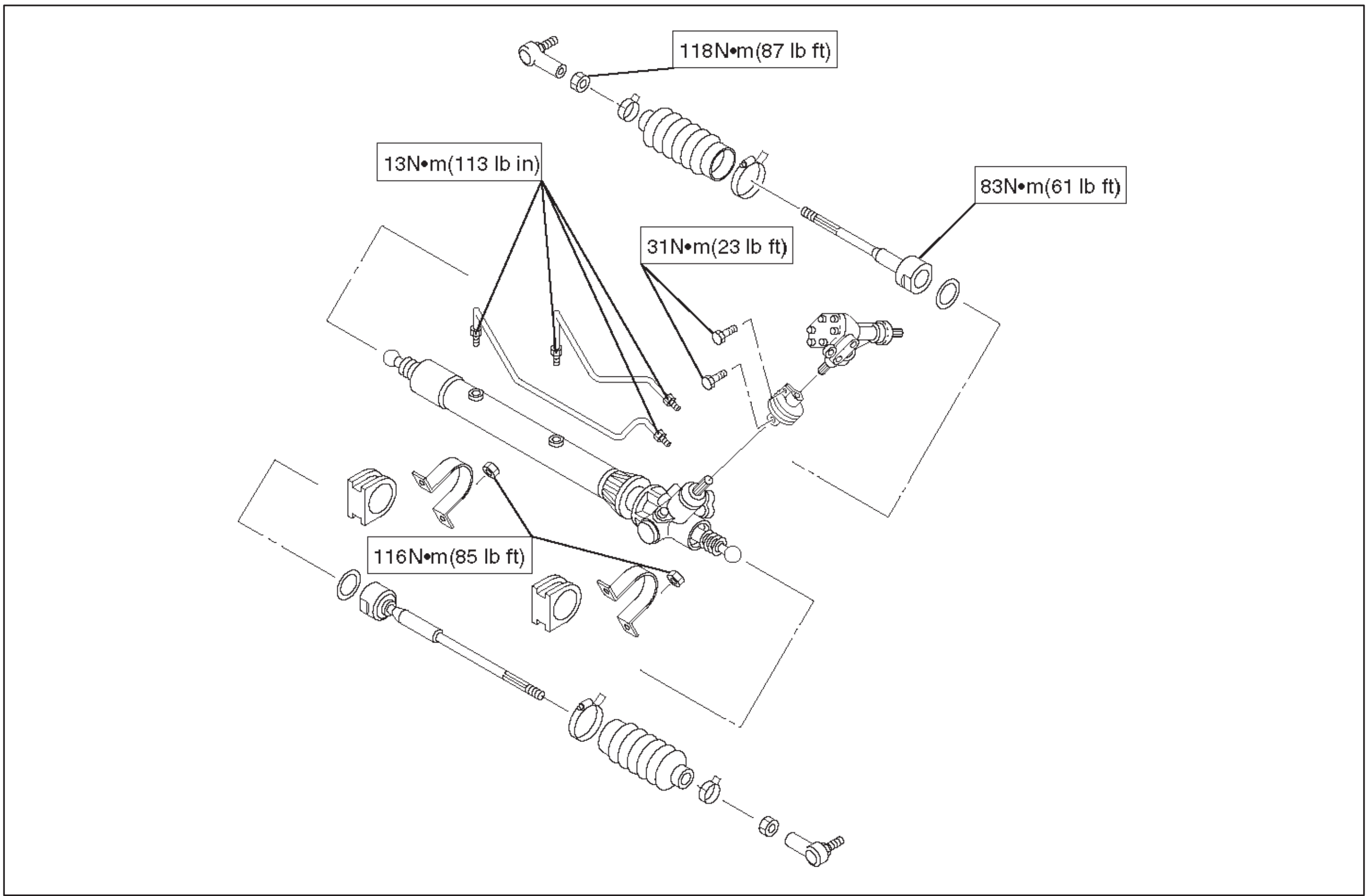
Torque: 118 N·m (87 lb ft)

Main Data and Specifications

General Specifications

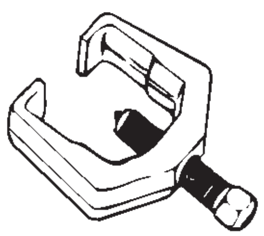
Power Steering unit	Type	Rack and pinion
	Rack stroke	152 mm (5.98 in)
	Lock to lock	3.64

Torque Specifications



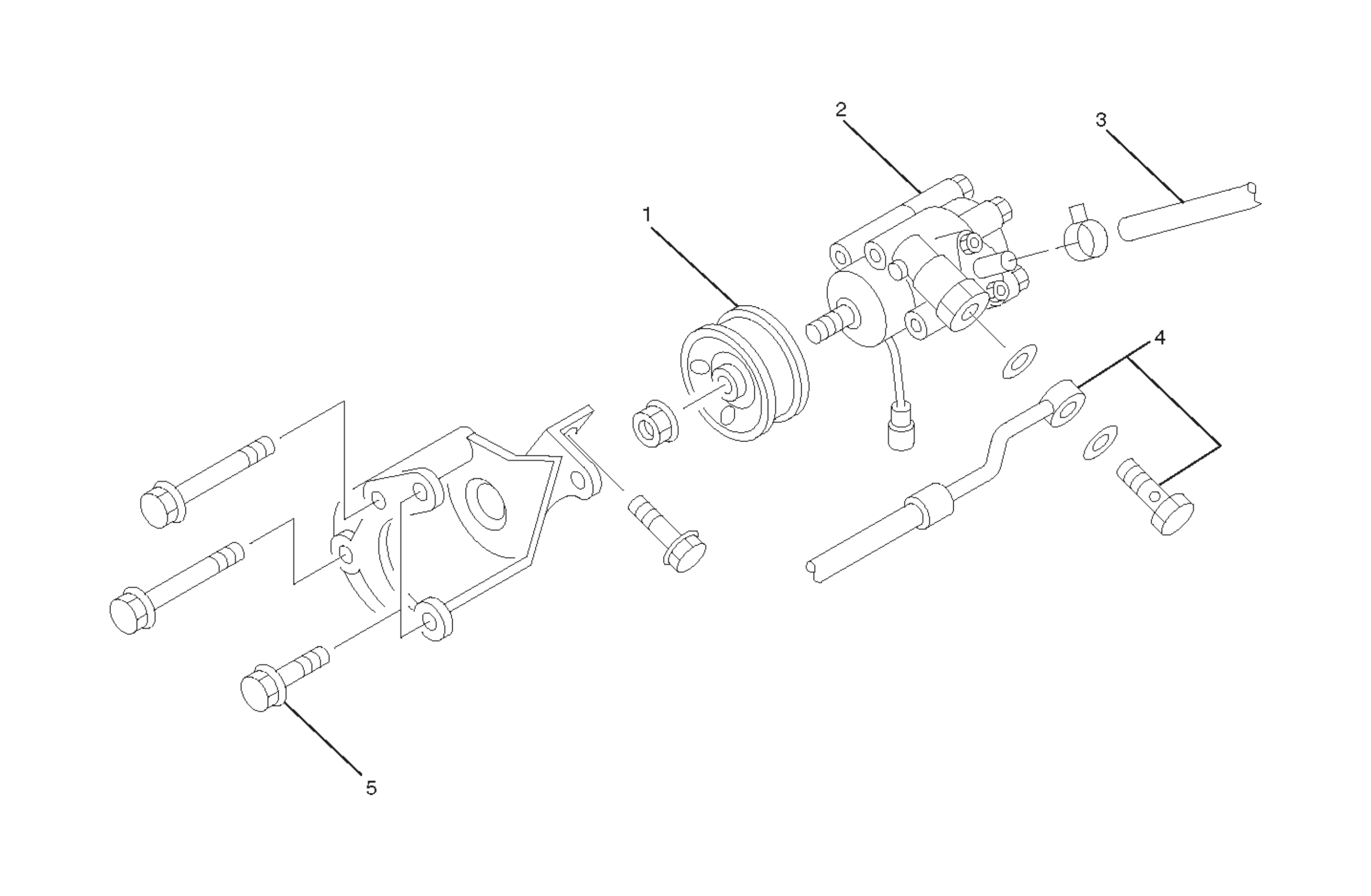
E02RW004

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS279	**J–29107** Tie rod end remover

Power Steering Pump

Power Steering Pump and Associated Parts



436RW001

Legend

(1) Pulley
(2) Pump Assembly
(3) Hose, Suction
(4) Hose, Flexible
(5) Bolt

Removal

1. Remove the drive belt.
2. Remove the pulley.
3. Place a drain pan below the pump.
4. Disconnect the suction hose.
5. Disconnect the flexible hose.
6. Remove the power steering fixing bolt and remove the pump assembly.

Installation

1. Install the pump assembly to the pump braket, tighten the fixing bolt to the specified torque.

   Torque: 46 N·m (34 lb ft)

2. Install the flexible hose.
   Tighten the eye bolt to specified torque.

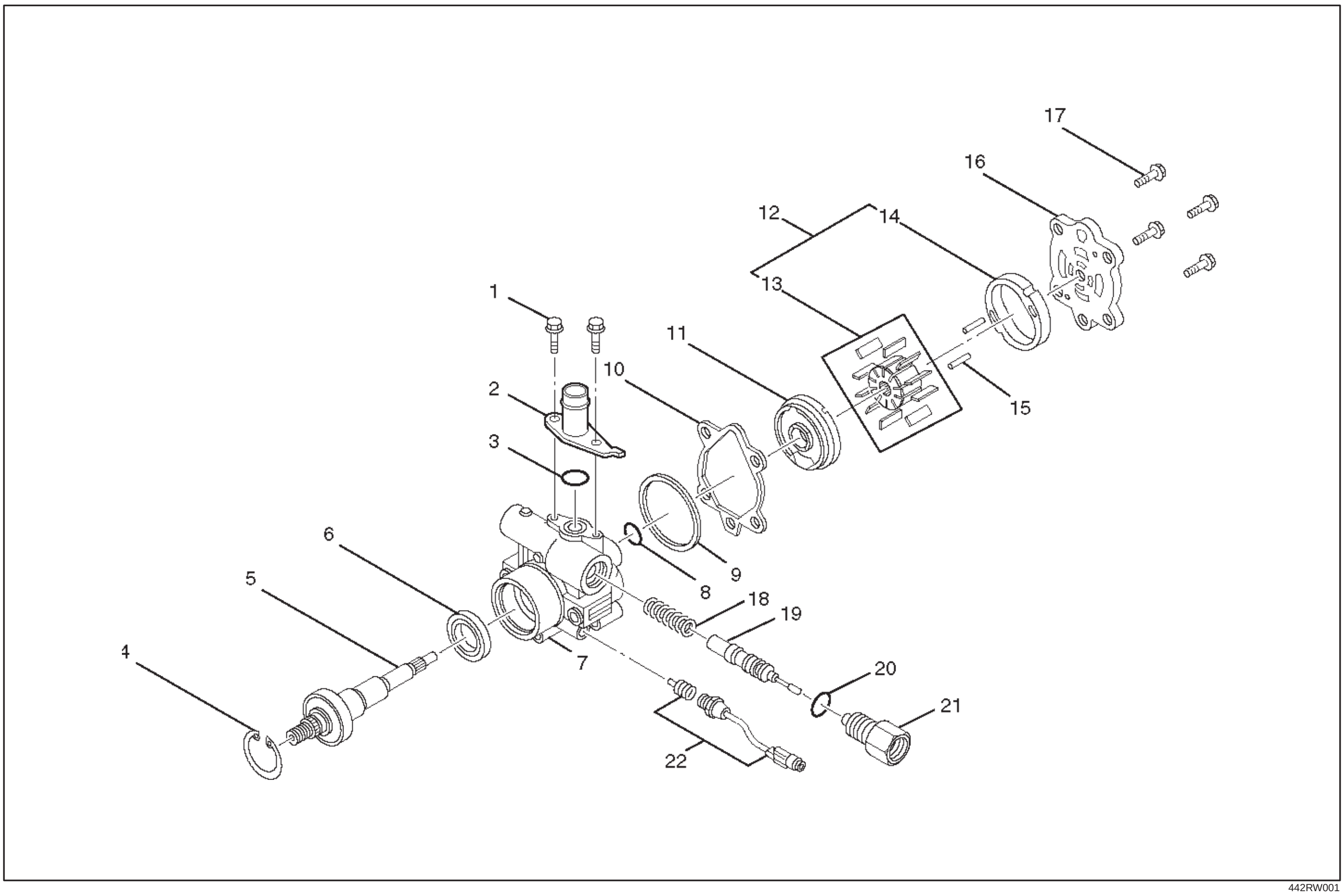
   Torque: 54 N·m (40 lb ft)

3. Install the pulley and tighten the nut to the specified torque.

   Torque: 78 N·m (58 lb ft)

4. Install the drive belt.
5. Connect the suction hose, then fill and bleed system.
   Refer to Bleeding the Power Steering System in this section.

Power Steering Pump Disassembled View



Legend

(1) Bolt
(2) Suction Pipe
(3) O-ring
(4) Retaining Ring
(5) Shaft Assembly
(6) Oil Seal
(7) Front Housing
(8) O-ring
(9) O-ring
(10) Gasket
(11) Side Plate
(12) Pump Cartridge Assembly
(13) Rotor and Vane
(14) Cam
(15) Pin
(16) Rear Housing
(17) Bolt
(18) Spring
(19) Relief Valve
(20) O-ring
(21) Connector
(22) Pressure Switch

Disassembly

1. Clean the oil pump with solvent (plug the discharge and suction ports to prevent the entry of solvent).
   Be careful not to expose the oil seal of shaft assembly to solvent.
2. Remove the bolt, suction pipe and O-ring.
3. Remove the connector, O-ring, relief valve and spring.
4. Remove the pressure switch assembly.
5. Remove the retaining ring.
6. Remove the shaft assembly.
7. Remove the oil seal.

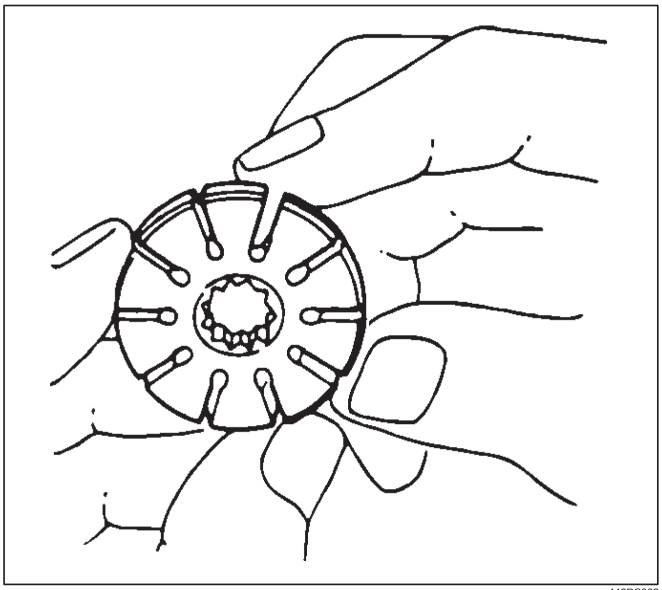
CAUTION: When removing the oil seal, be careful not to damage the housing.

8. Remove the bolt, rear housing and gasket.
9. Remove the pump cartridge assembly from the front housing.
10. Remove two O-rings.

Inspection and Repair

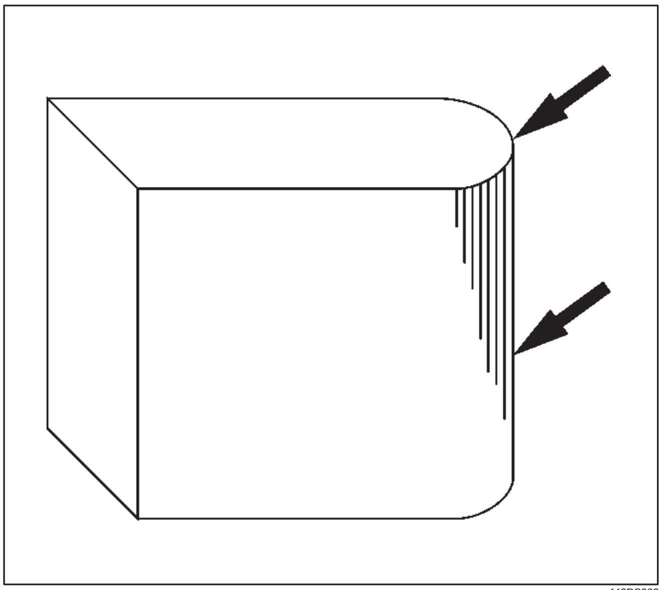
Make all necessary adjustments, repairs, and part replacements if wear, damage, or other problems are discovered during inspection.

Rotor


442RS002

Check that the groove in the vane is free from excessive wear and that the vane slides smoothly. When part replacement becomes necessary, the pump cartridge should be replaced as a subassembly.

Vane


442RS003

Sliding faces of the vane should be free from wear. (Particularly the curved face at the tip that contact with the cam should be free from wear and distortion). When part replacement becomes necessary, the pump cartridge should be replaced as a subassembly.

Cam

The inner face of the arm should have a uniform contact pattern without a sign of step wear. When part replacement becomes necessary, the pump cartridge should be replaced as a subassembly.

Side Plate

The sliding faces of parts must be free from step wear (more than 0.01 mm), which can be felt by the finger nail. The parts with minor scores may be reused after lapping the face.

Relief Valve

The sliding face of the valve must be free from burrs and damage. The parts with minor scores may be reused after smoothing with emery cloth (#800 or finer).

Shaft

Oil seal sliding faces must be free from a step wear which can be felt by the finger nail. Needle bearing fitting face must be free from damage and wear.

O-ring, Oil Seal, Retaining Ring

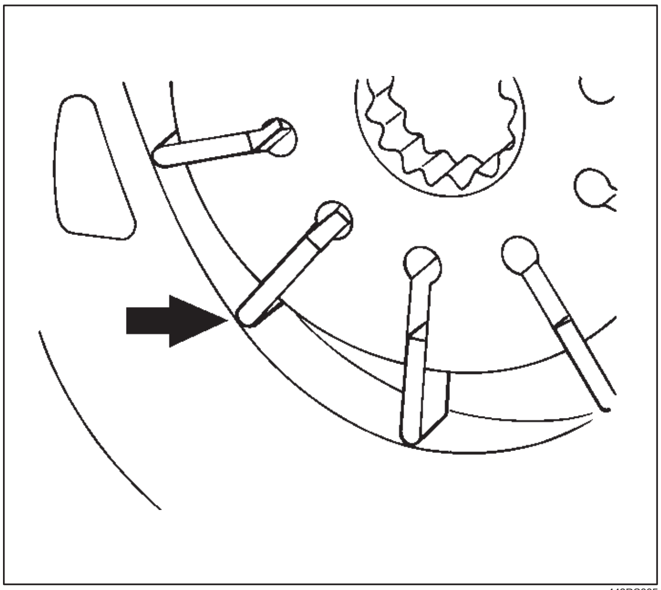
Be sure to discard used parts, and always use new parts for installation. Prior to installation, lubricate all seals and rings with power steering fluid.

Reassembly

1. Install oil seal to front housing. Be sure to discard used oil seal, and always use new parts for installation.

CAUTION: When installing the oil seal, be careful not to damage the oil seal contacting surface of the housing.

2. Install shaft assembly.
3. Install retaining ring.
4. Install the vanes to roter with curved face in contact with the inner wall of cam.

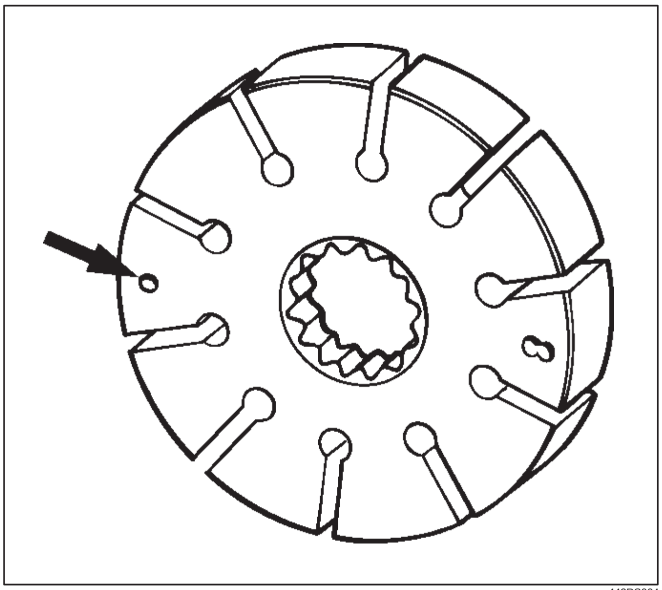

442RS005

5. Install roter and vanes to cam.
6. Install pin to cam.
7. Install two new O-rings to front housing. Be sure to discard used O-ring.

8. Install side plate.

CAUTION: When installing side plate, becareful not to damage its inner surface. Damaged side plate may cause poor pump performance, pump seizure or oil leakage.

9. Install pump cartridge assembly to front housing.
   Install the rotor with punch mark facing the front housing.



442RS004

10. Install rear housing with a new gasket. Be sure to discard used gasket. Then install bolt and tighten it to specified torque.

    Torque: 18 N·m (13 lb ft)

11. Install suction pipe with a new O-ring. Be sure to discard used O-ring. Then install bolt and tighten it to specified torque.

    Torque: 16 N·m (12 lb ft)

12. Install relief valve and spring.
13. Install connector with a new O-ring. Be sure to discard used O-ring. Tighten the connector to specified torque.

    Torque: 74 N·m (54 lb ft)

14. Install pressure switch assembly and tighten it to specified torque.

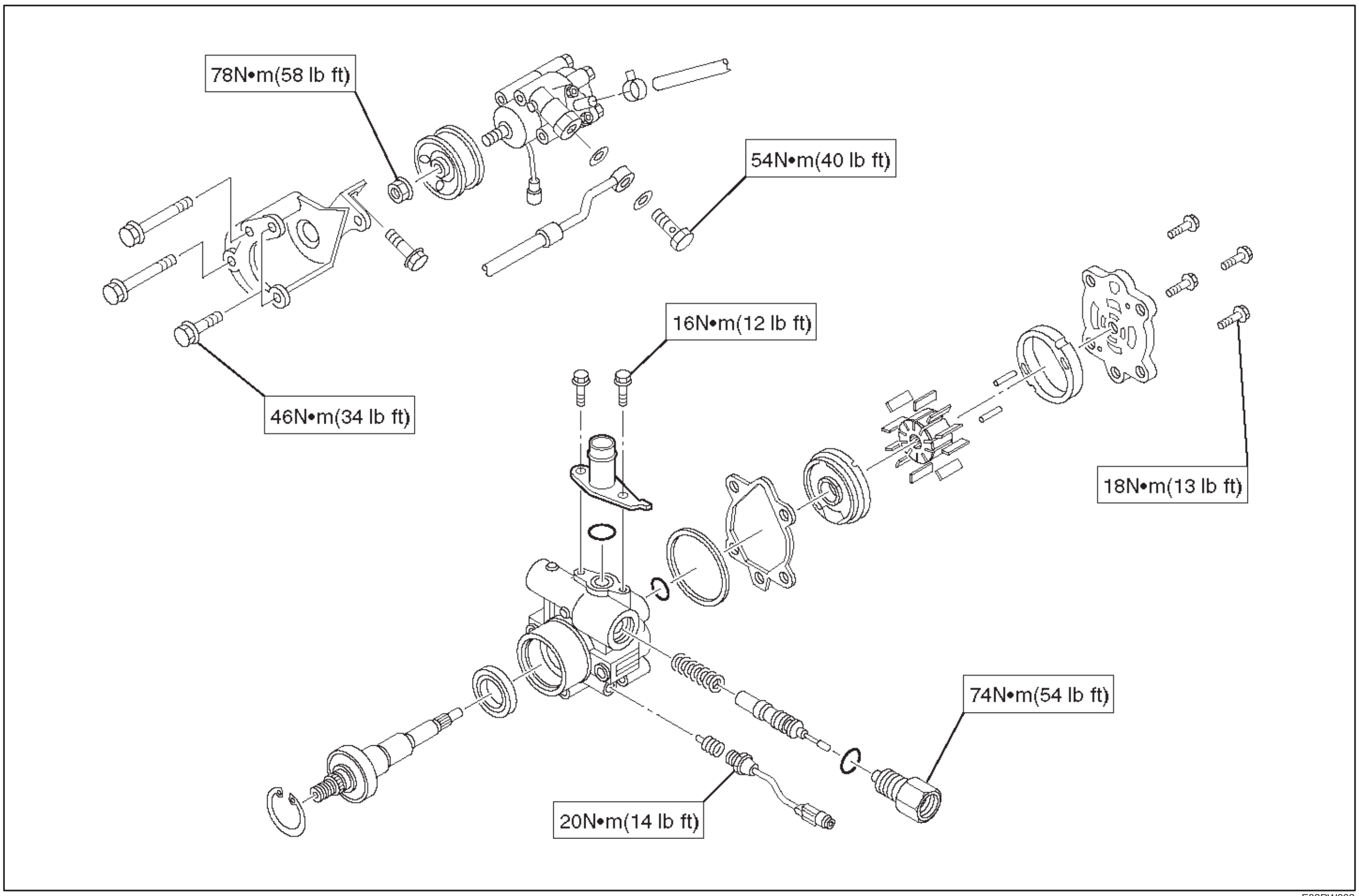
    Torque: 20 N·m (14 lb ft)

Main Data and Specifications

General Specifications

Oil pump	Type	Vane
	Operating fluid	ATF DEXRON®–III

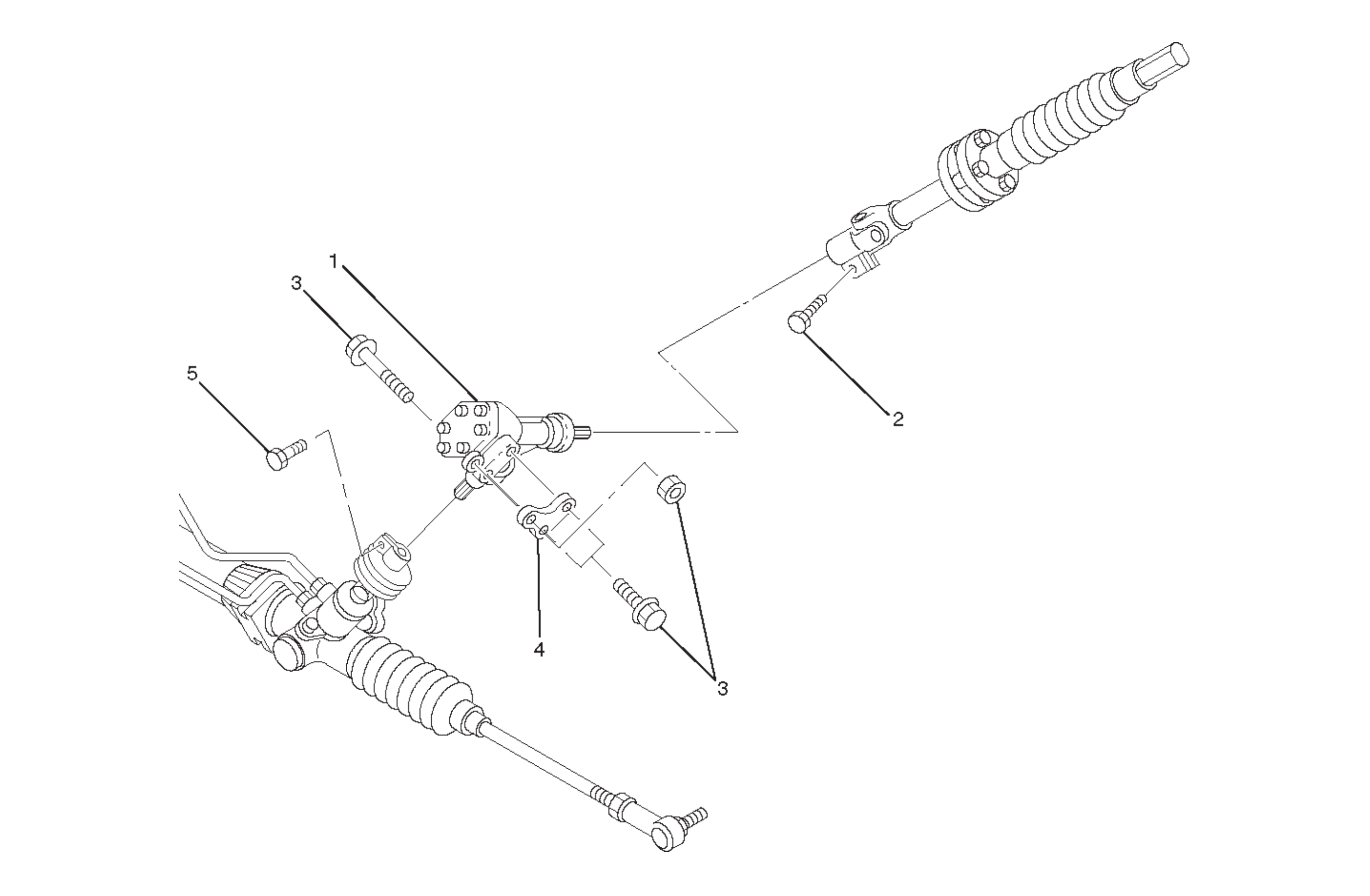
Torque Specifications



E02RW003

Transfer Gear Assembly

Transfer Gear Assembly and Associated Parts



Legend

(1) Transfer Gear Assembly
(2) Bolt, Universal Joint (Steering Shaft Side)
(3) Fixing Bolt Nut
(4) Shim
(5) Bolt, Universal Joint (Steering Unit Side)

Removal

1. Remove universal joint bolt (steering shaft side).
2. Remove universal joint bolt (steering unit side).
3. Loosen fixing bolt and nut and remove transfer gear assembly with shim.

Inspection and Repair

The transfer gear assembly cannot be disassembled. If damage or abnormal condition are found, replace to new ones.

Installation

1. Install transfer gear assembly with shim and tighten bolt and nut to the specified torque.

Torque: 54 N·m (40 lb ft)

2. Connect universal joint (both side) and tighten the bolt to the specified torque.

Torque: 31 N·m (23 lb ft)

Supplemental Restraint System Steering Wheel & Column

Service Precaution

This steering wheel and column repair section covers the Supplemental Restraint System (SRS) steering column. The following repair procedures are specific to SRS components. When servicing a vehicle equipped with Supplemental Restraint System, pay close attention to all WARNINGS and CAUTIONS.

For detailed explanation about SRS, refer to Restraints section.

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

SAFE HANDLING OF INFLATOR MODULES REQUIRES FOLLOWING THE PROCEDURES DESCRIBED BELOW FOR BOTH LIVE AND DEPLOYED MODULES.

SAFETY PRECAUTIONS MUST BE FOLLOWED WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY (AIR BAG). AFTER DEPLOYMENT, THE AIR BAG ASSEMBLY (AIR BAG) SURFACE MAY CONTAIN A SMALL AMOUNT OF SODIUM HYDROXIDE, A BY-PRODUCT OF THE DEPLOYMENT REACTION, THAT IS IRRITATING TO THE SKIN AND EYES. MOST OF THE POWDER ON THE AIR BAG ASSEMBLY (AIR BAG) IS HARMLESS. AS A PRECAUTION, WEAR GLOVES AND SAFETY GLASSES WHEN HANDLING A DEPLOYED AIR BAG ASSEMBLY, AND WASH YOUR HANDS WITH MILD SOAP AND WATER AFTERWARDS.

WHEN CARRYING A LIVE AIR BAG ASSEMBLY, MAKE SURE THE BAG AND TRIM COVER ARE POINTED AWAY FROM YOU. NEVER CARRY AN AIR BAG ASSEMBLY BY THE WIRES OR CONNECTOR ON THE UNDERSIDE OF MODULE. IN THE CASE OF AN ACCIDENTAL DEPLOYMENT, THE BAG WILL THEN DEPLOY WITH MINIMAL CHANCE OF INJURY. WHEN PLACING A LIVE AIR BAG ASSEMBLY ON A BENCH OR OTHER SURFACE, ALWAYS FACE THE BAG AND TRIM COVER UP, AWAY FROM THE SURFACE.

NEVER REST A STEERING COLUMN ASSEMBLY ON THE STEERING WHEEL WITH THE AIR BAG ASSEMBLY FACE DOWN AND COLUMN VERTICAL. THIS IS NECESSARY SO THAT A FREE SPACE IS PROVIDED TO ALLOW THE AIR BAG ASSEMBLY TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY COULD RESULT.

TO AVOID DEPLOYMENT WHEN TROUBLESHOOTING THE SRS SYSTEM, DO NOT USE ELECTRICAL TEST EQUIPMENT, SUCH AS BATTERY-POWERED OR A/C-POWERED VOLT-METER, OHMMETER, ETC., OR ANY TYPE OF ELECTRICAL EQUIPMENT OTHER THAN SPECIFIED IN THIS MANUAL. DO NOT USE A NON-POWERED PROBE-TYPE TESTER.

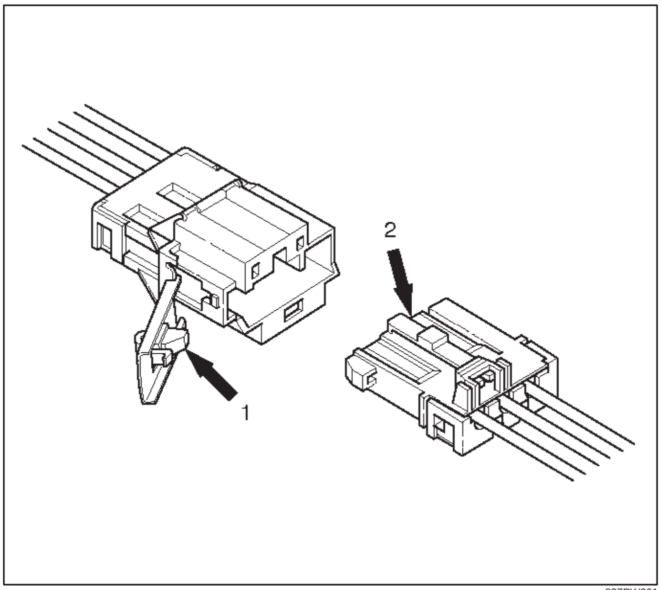
INSTRUCTIONS IN THIS MANUAL MUST BE FOLLOWED CAREFULLY, OTHERWISE PERSONAL INJURY MAY RESULT.

SRS Connectors

CAUTION: Double-lock type yellow color connectors are used for supplemental restraint system-air bag circuit.

When removing the cable harness, disconnect the connector by unlocking at two places, outside (1) and inside (2). In such a case, do not pull the wires. Otherwise, wire disconnection may occur.

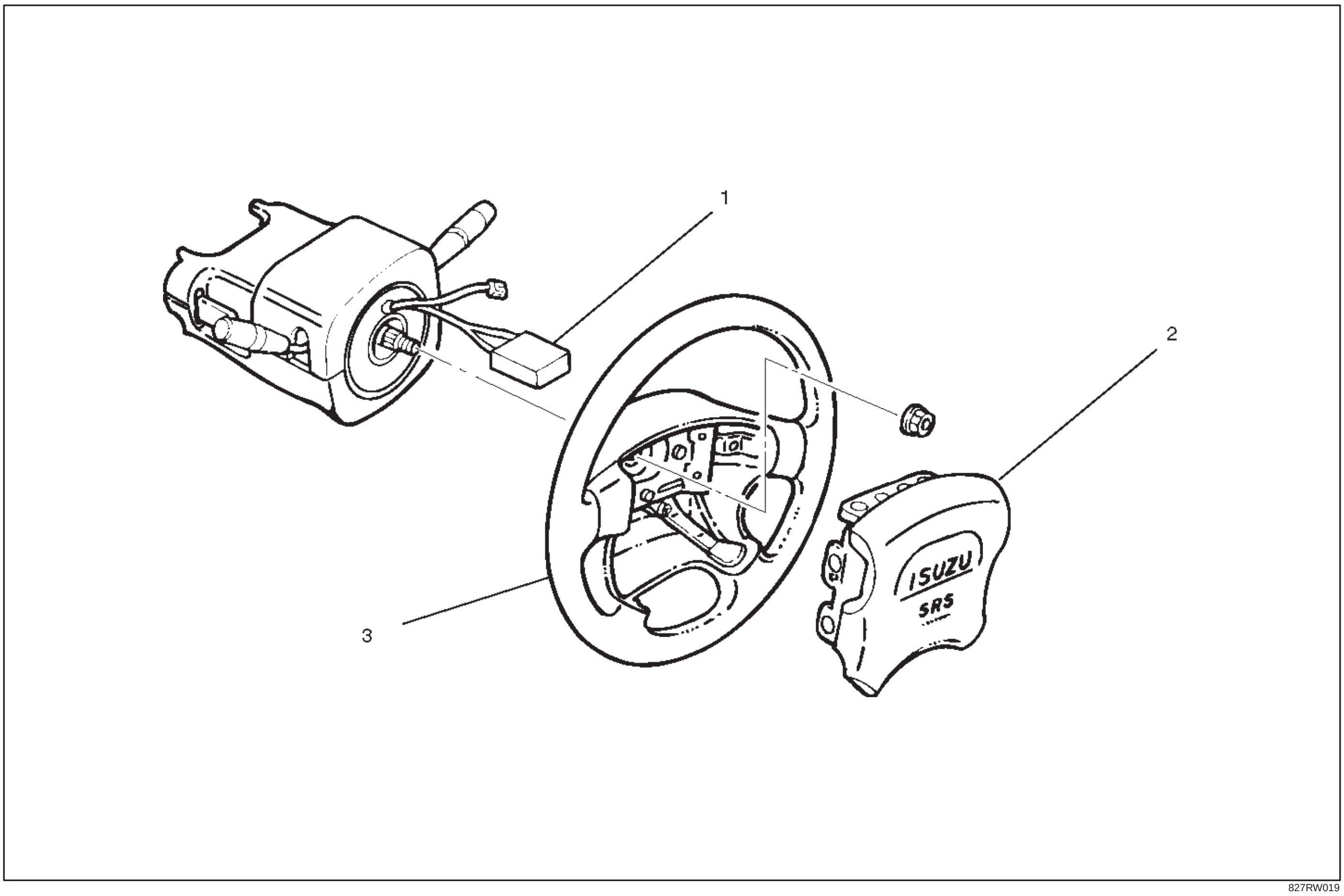
When connect the double lock type SRS connector, insert the connector completely and lock at outside. Imperfect locking may cause malfunction of SRS circuit.



827RW001

Inflator Module

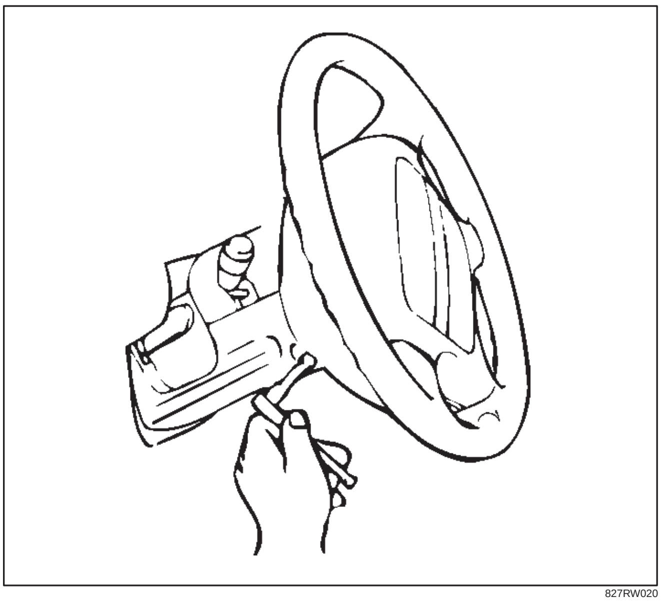
Inflator Module and Associated Parts



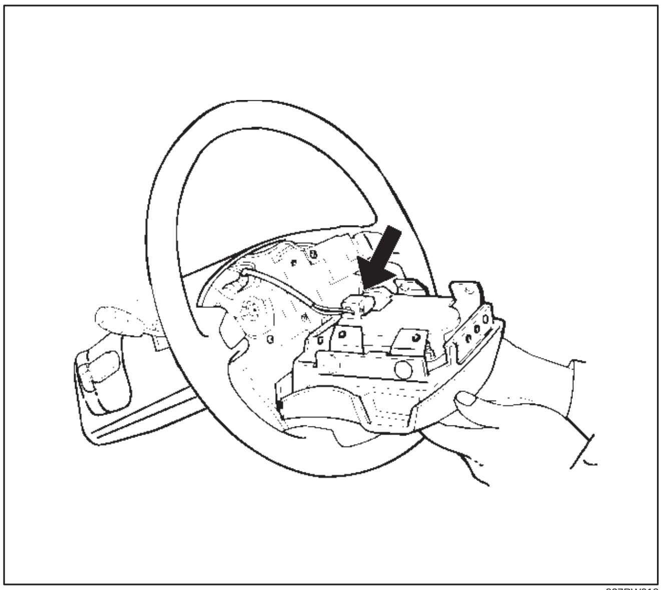
Legend
(1) Module Connector
(2) Inflator Module
(3) Fixing Bolt

Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.
5. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly .



6. Disconnect the yellow 2-way SRS connector located behind the inflator module.

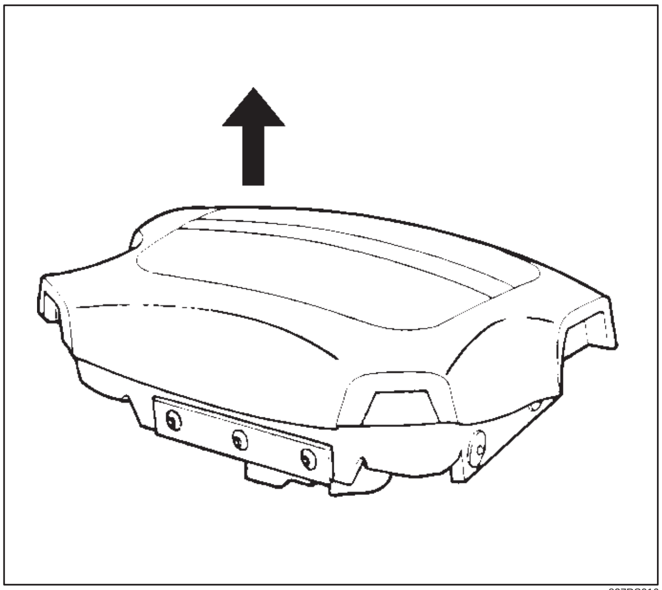


827RW018

7. Remove inflator module.

Inspection and Repair

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT .



827RS016

The inflator module consists of a cover, air bag, inflator, and retainer. Inspect the inflator module mainly for the following:

- Check for holes, cracks, severe blemishes and deformation on the cover.
- Check that the retainer is not deformed.
- Check for defects such as damage and breakage in the lead wire for the igniter.

If an abnormality is found as the result of the inspection, replace the inflator module with a new one.

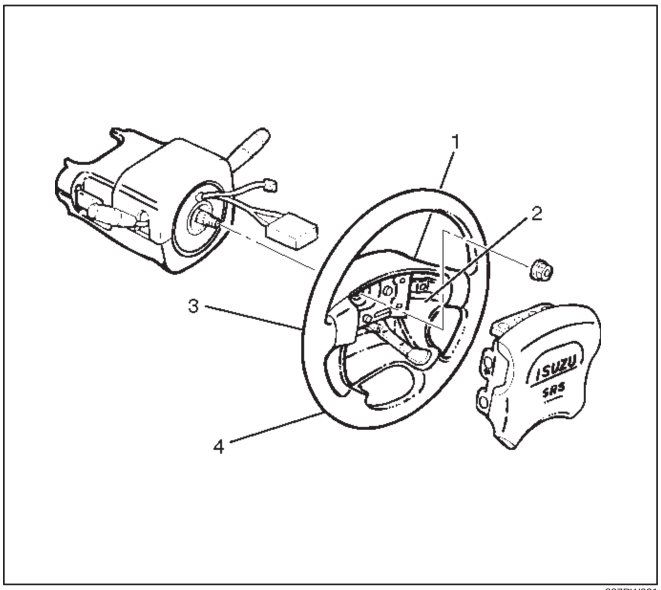
Installation

1. Install inflator module.
2. Support the module and carefully connect the module connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

3. Secure the module with one bolt to relieve weight on the wire connector and tighten bolts to specified sequence as illustrated.

Torque: 8 N·m (69 lb in)

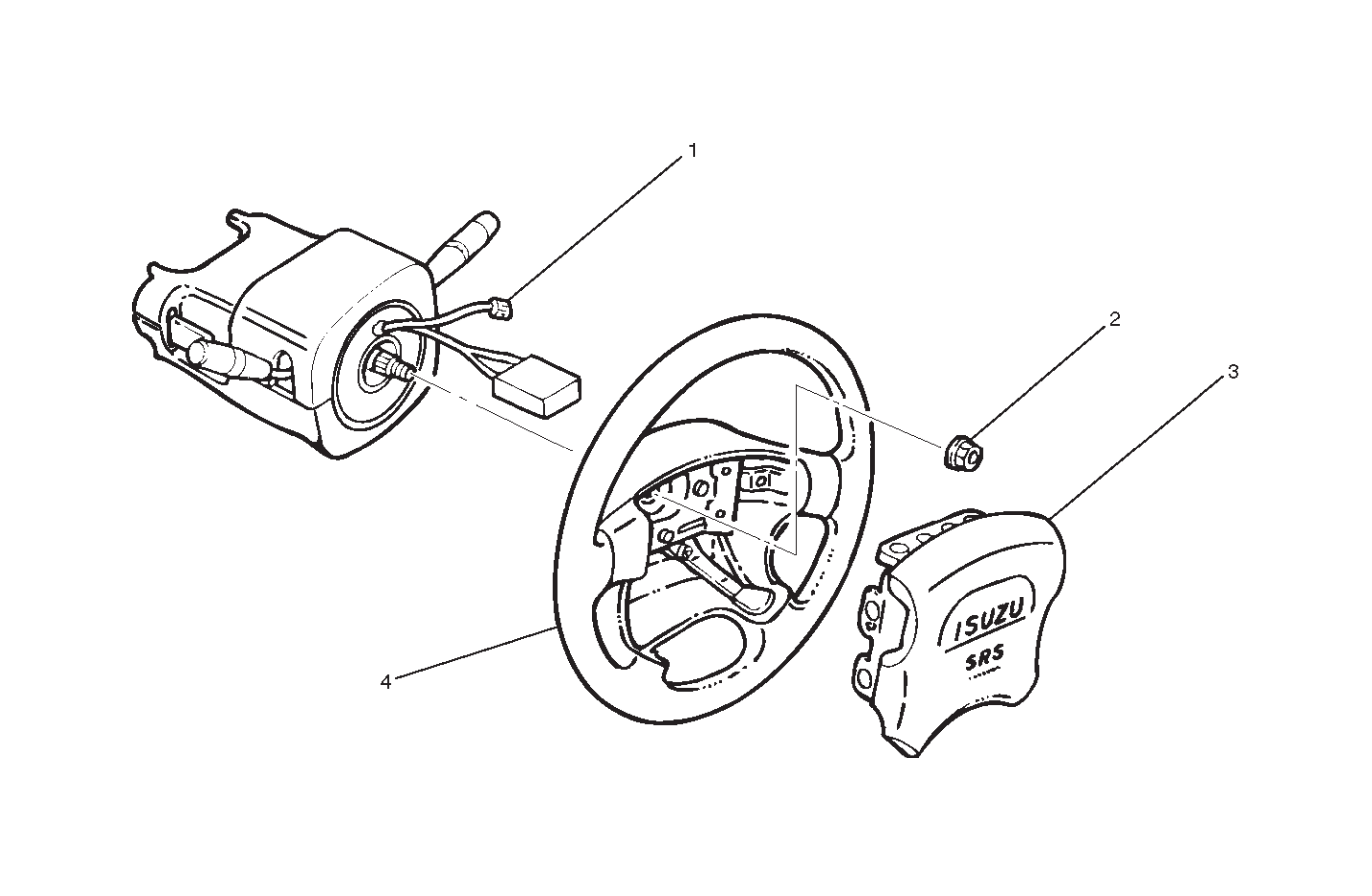


827RW021

4. Connect the yellow 2-way SRS connector located under the steering column.
5. Connect the battery “–” terminal cable.
6. Set ignition to “ON” while watching warning light. Light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

Steering Wheel

Steering Wheel and Associated Parts



827RW017

Legend

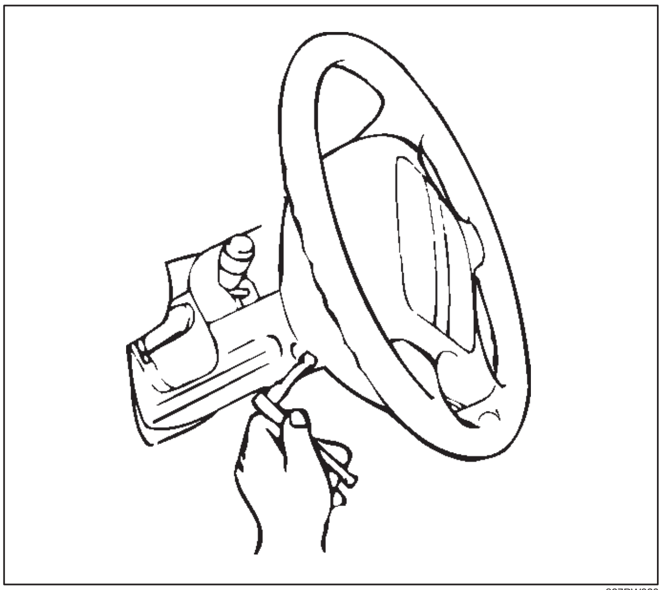
(1) Horn Lead
(2) Steering Wheel Fixing Nut
(3) Inflator Module
(4) Steering Wheel

CAUTION: Once the steering column is removed from the vehicle, the column is extremely susceptible to damage. Dropping the column assembly on its end could collapse the steering shaft or loosen the slide block which maintains column rigidity. Leaning on the column assembly could cause the jacket to bend or deform. Any of the above damage could impair the column's collapsible design. If it is necessary to remove the steering wheel, use only the specified steering wheel puller. Under no conditions should the end of the shaft be hammered upon, as hammering could loosen slide block which maintains column rigidity.

Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

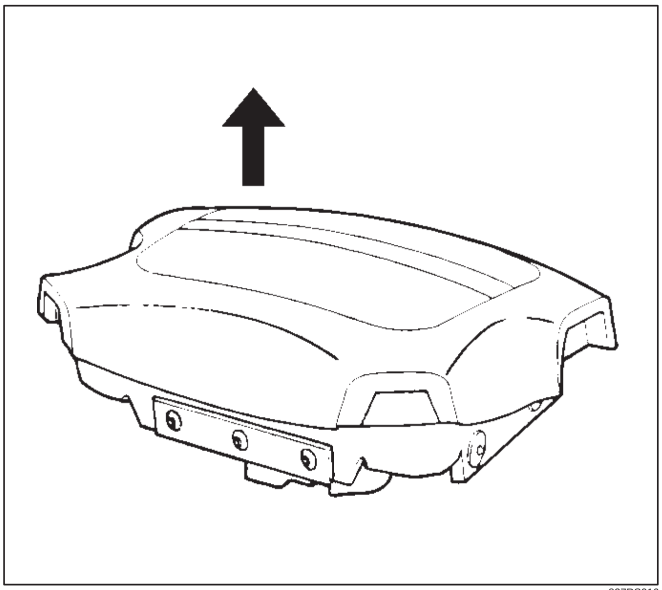
5. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.



827RW020

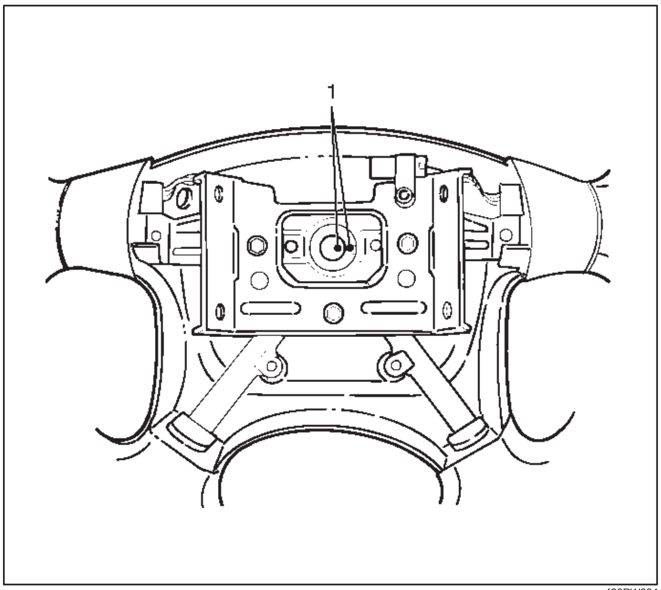
6. Disconnect the yellow 2-way SRS connector located behind the inflator module.

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



827RS016

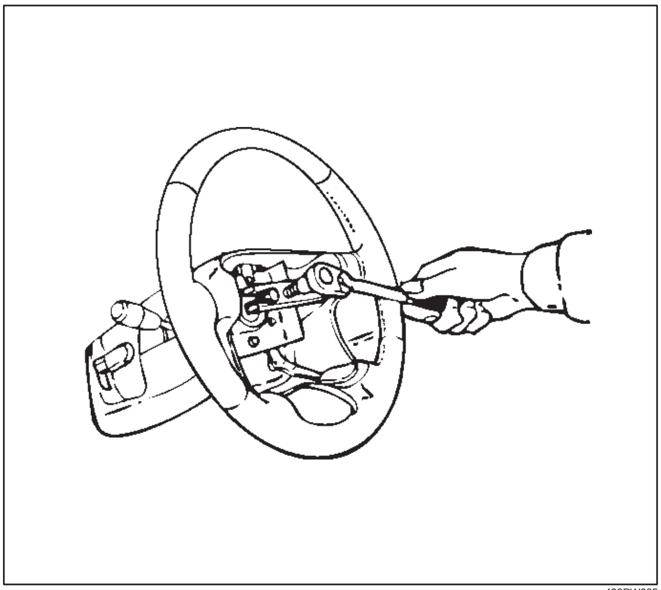
7. Disconnect horn lead.
8. Remove steering wheel fixing nut.
9. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position, then remove steering wheel.



430RW004

10. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



430RW005

Installation

1. Install steering wheel by aligning the setting marks made when removing.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

2. Tighten the steering wheel fixing nut to the specified torque.

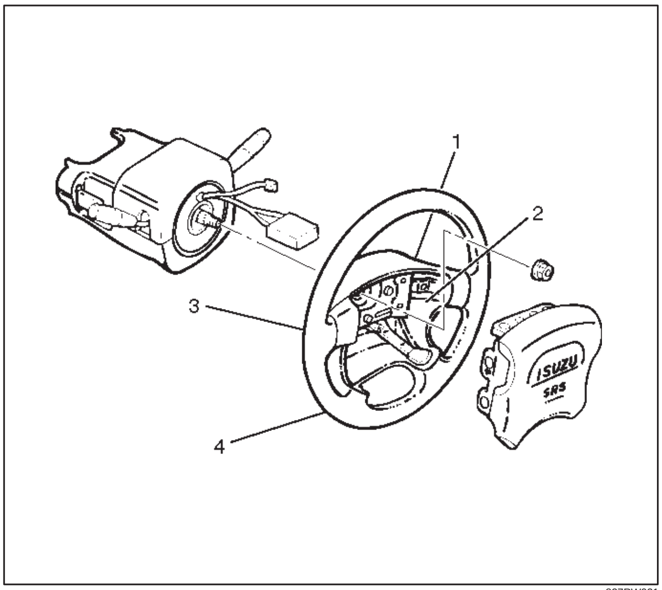
   Torque: 34 N·m (25 lb ft)

3. Connect horn lead.
4. Support the module and carefully connect the module connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinches.

- Secure the module with one bolt to relieve weight on the wire connector.
- Tighten bolts to specified sequence as illustrated.

Torque: 8 N·m (69 lb in)

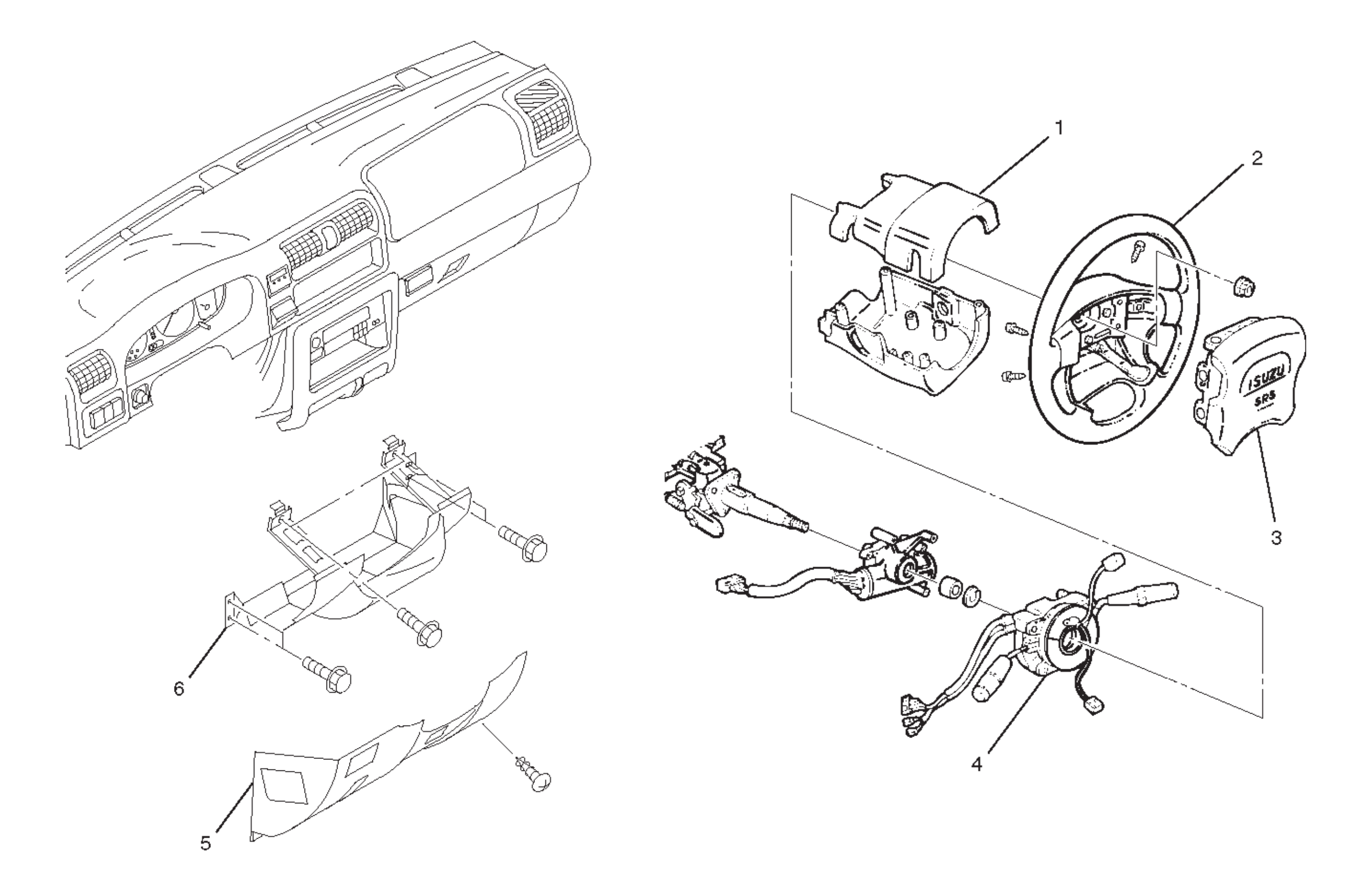


827RW021

5. Connect the yellow 2-way SRS connector located under the steering column.
6. Connect the battery "–" terminal cable.
7. Turn the ignition switch to "ON" while watching warning light. Light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

Combination Switch

Combination Switch and Associated Parts



431RW012

Legend

(1) Steering Column Cover
(2) Steering Wheel
(3) Inflator Module
(4) Combination Switch and SRS Coil Assembly
(5) Steering Lower Cover
(6) Driver Knee Bolster (reinforcement)

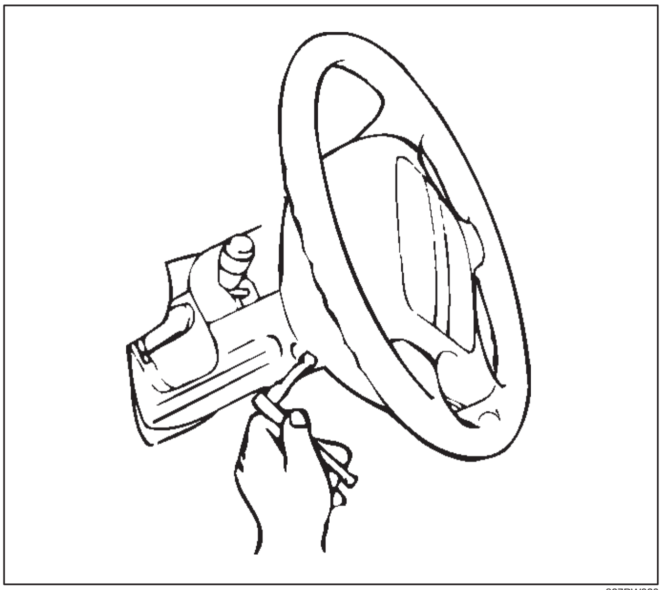
Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

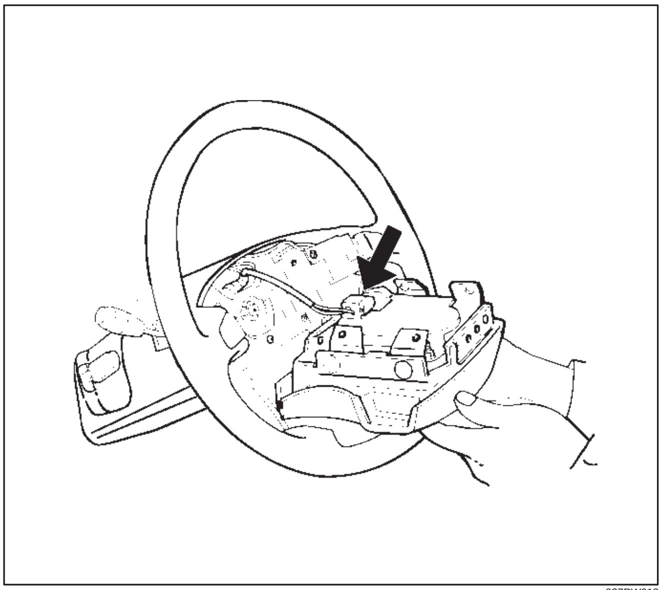
CAUTION: The wheels of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering wheel. Failure to do so will cause the coil assembly to become uncentered which will cause damage to the coil assembly.

5. Remove the engine hood opening lever, then remove steering lower cover.
6. Remove the driver knee bolster (reinforcement).

7. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly. Disconnect the yellow 2-way SRS connector located behind the inflator module, then remove inflator module.

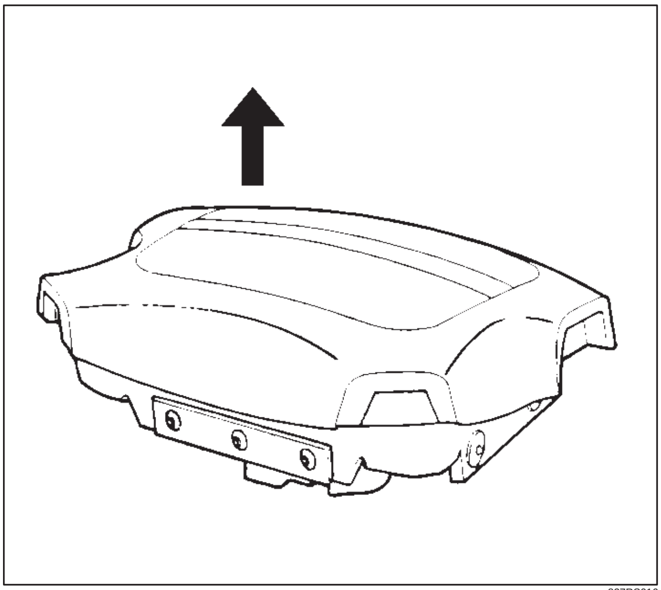


827RW020



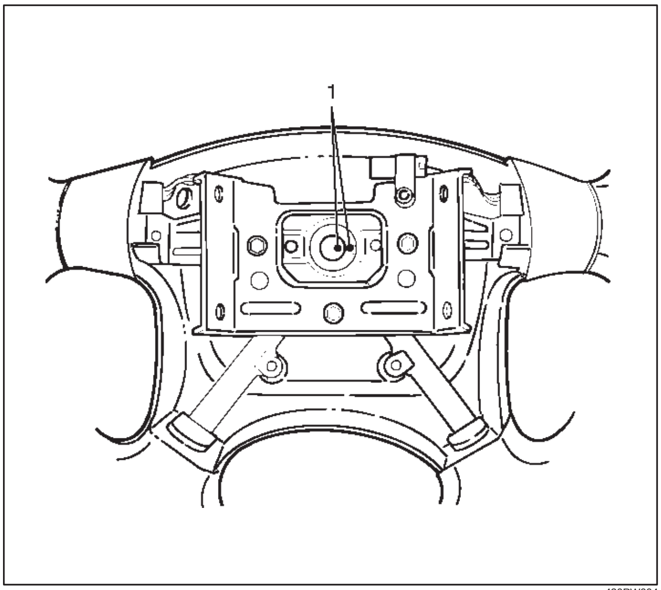
827RW018

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



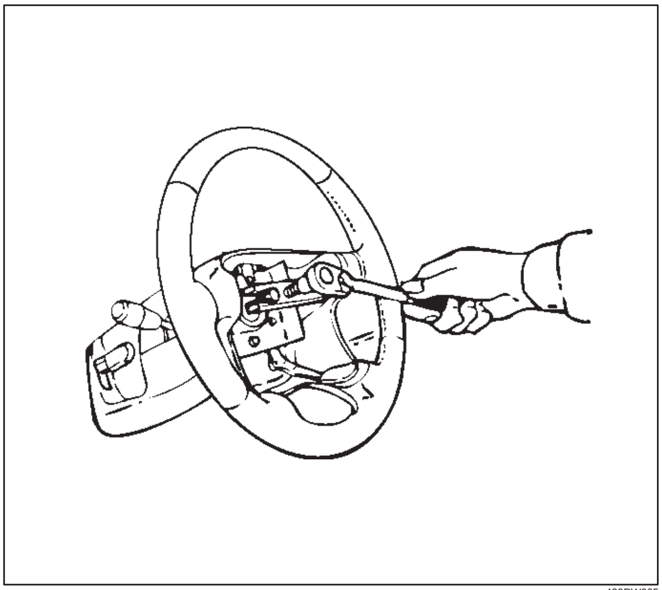
827RS016

8. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.



430RW004

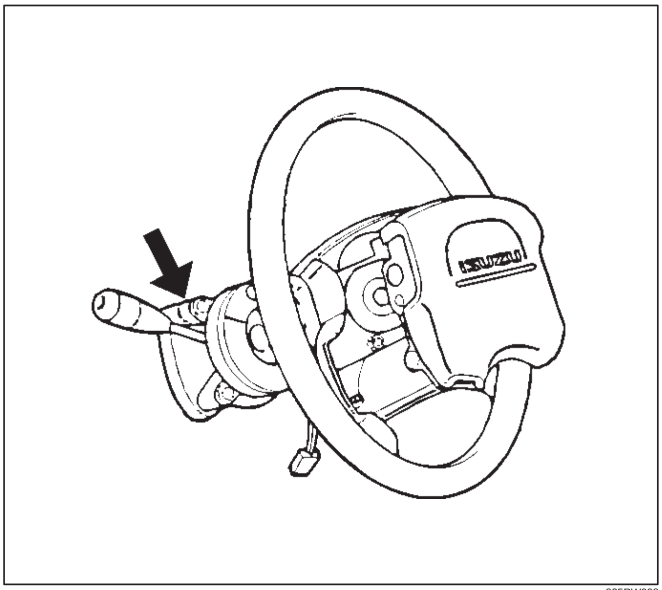
CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



430RW005

9. Remove steering column cover.
10. Disconnect the wiring harness connectors located under the steering column then remove combination switch and SRS coil assembly.

NOTE: The SRS coil is a part of the combination switch assembly, which can not be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.

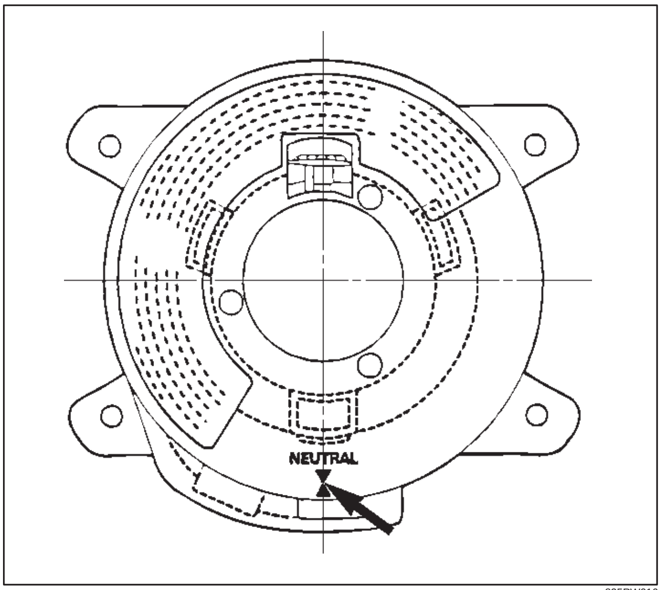


825RW098

Installation

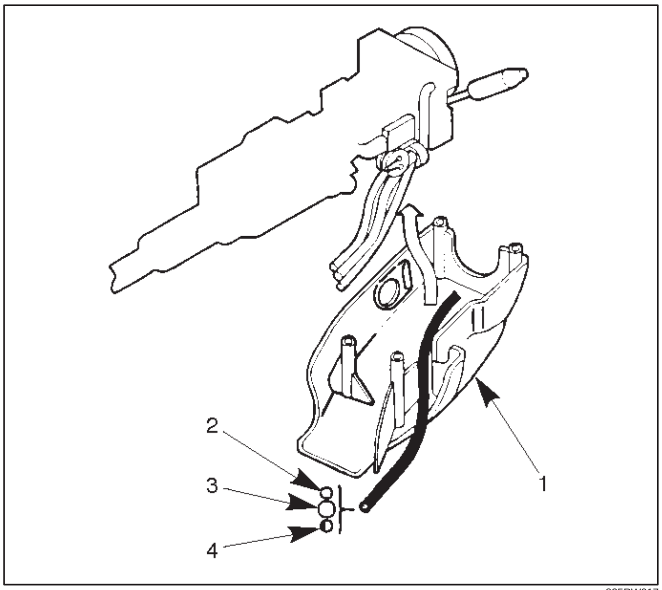
1. Install combination switch and SRS coil assembly. After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2-way connector located under the steering column. Then turn the SRS coil counter clockwise to full, return about 3 turns and align the neutral mark.

CAUTION: When turning the SRS coil counter clockwise to full, stop turning if resistance is felt. Forced further turning may damage to the cable in the SRS coil.



825RW016

2. When installing the steering column cover, be sure to route each wire harness as illustrated so that the harnesses do not catch on any moving parts.



825RW017

Legend

(1) Steering Column Cover
(2) Starter Switch Harness
(3) Combination Switch Harness
(4) Inflator Module Harness

3. Align the setting marks made when removing then install steering wheel.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

4. Tighten the steering wheel fixing nut to the specified torque.

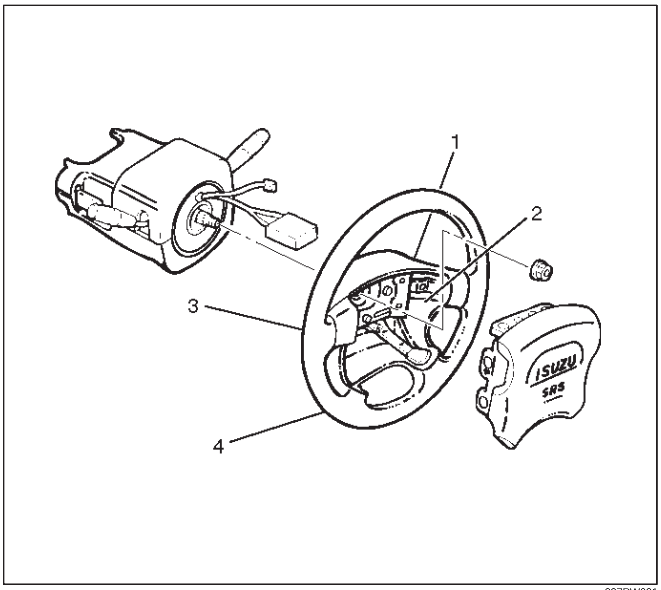
Torque: 34 N·m (25 lb ft)

5. Support the inflator module and carefully connect the module connector.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

6. Secure the module with one bolt to relieve weight on the wire connector.
7. Tighten bolts to specified sequence as illustrated.

Torque: 8 N·m (69 lb in)

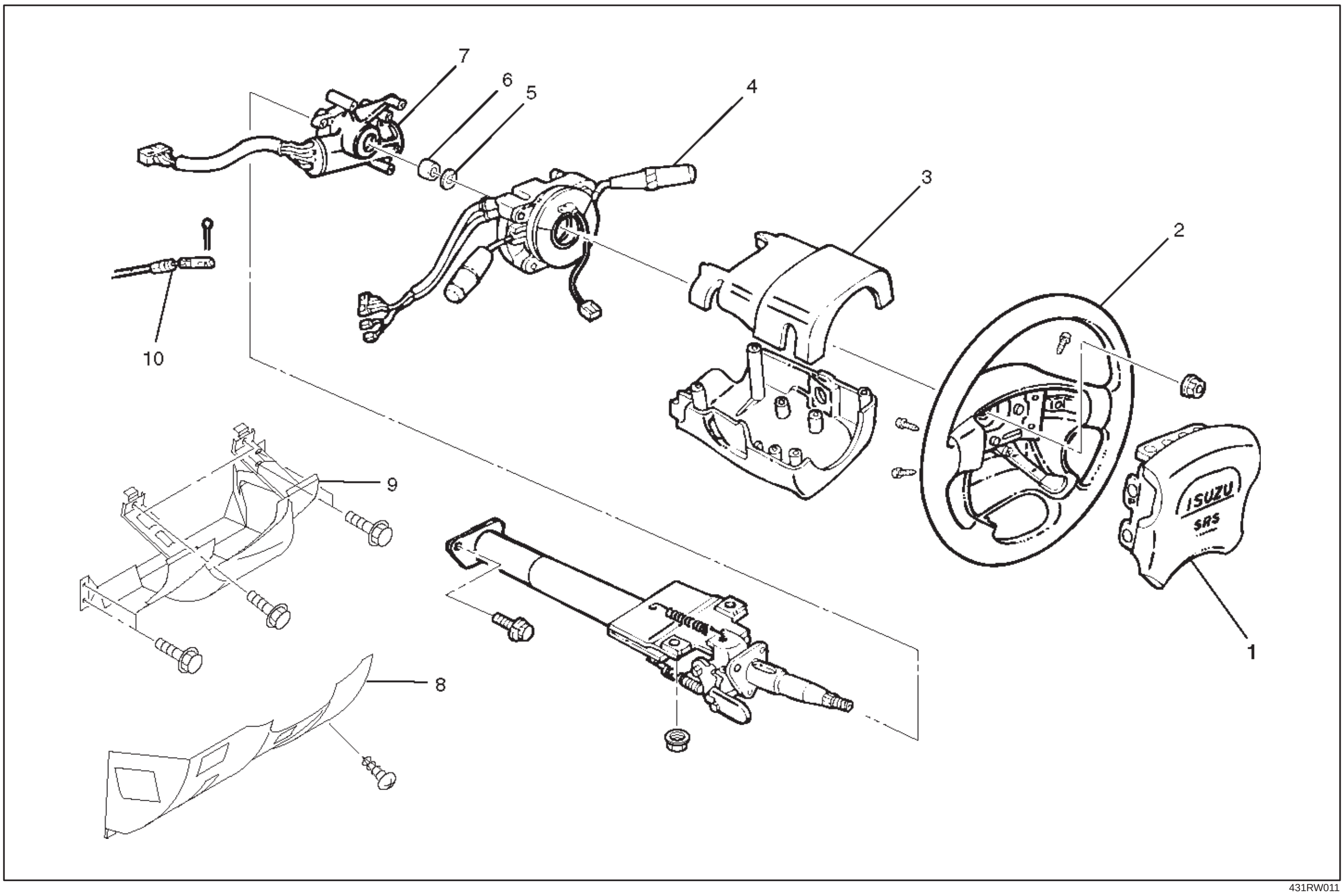


827RW021

8. Install driver knee bolster (reinforcement).
9. Install steering lower cover then Install the engine hood opening lever.
10. Connect the wiring harness connectors.
11. Connect the battery “-” terminal cable.
12. Turn the ignition switch to “ON” while watching warning light and check the light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

Lock Cylinder

Lock Cylinder and Associated Parts



Legend

(1) Inflator Module
(2) Steering Wheel
(3) Steering Column Cover
(4) Combination Switch and SRS Coil Assembly
(5) Snap Ring
(6) Cushion Rubber
(7) Lock Cylinder Assembly
(8) Steering Lower Cover
(9) Driver Knee Bolster (reinforcement)
(10) Shift Lock Cable (for A/T)

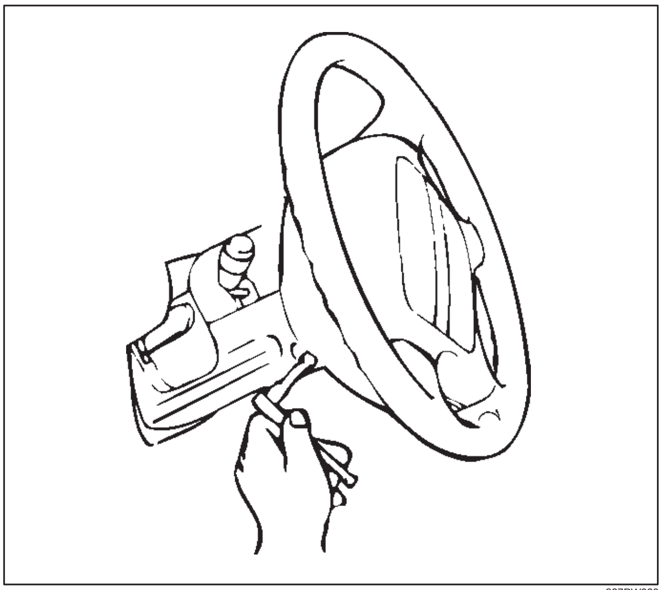
Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

CAUTION: The wheels of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering wheel. Failure to do so will cause the coil assembly to become uncentered which will cause damage to the coil assembly.

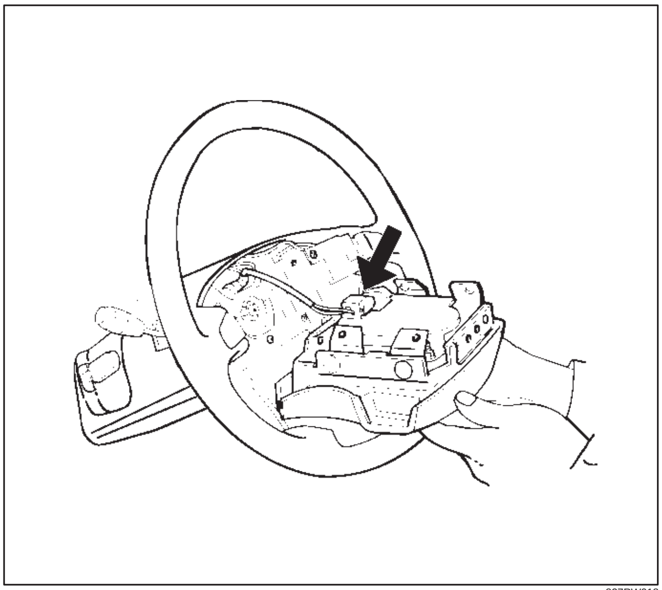
5. Remove the engine hood opening lever and steering lower cover.
6. Remove driver knee bolster (reinforcement).

7. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.



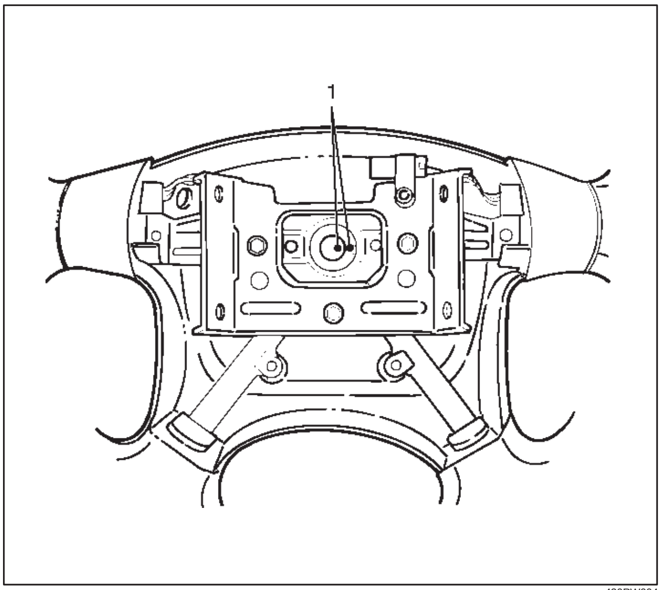
827RW020

8. Disconnect the yellow 2-way SRS connector located behind the inflator module.



827RW018

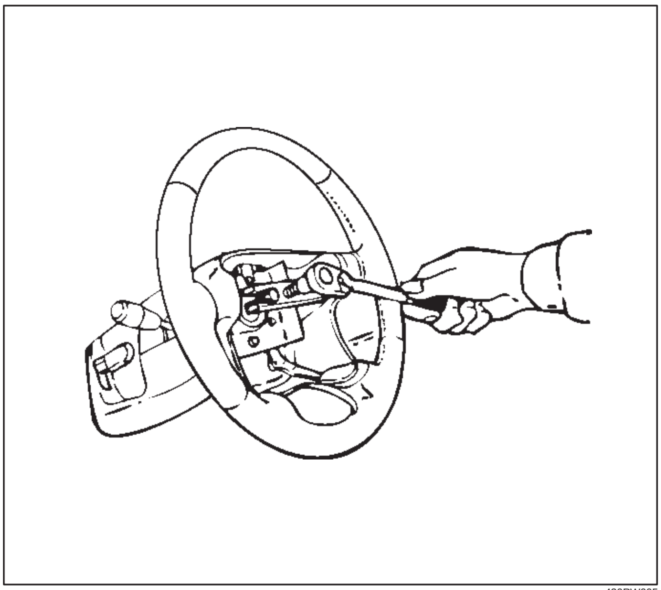
9. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position.



430RW004

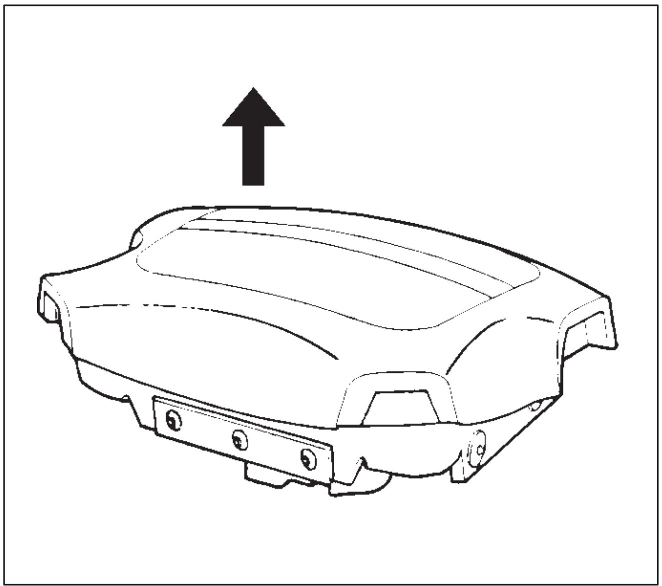
10. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.



430RW005

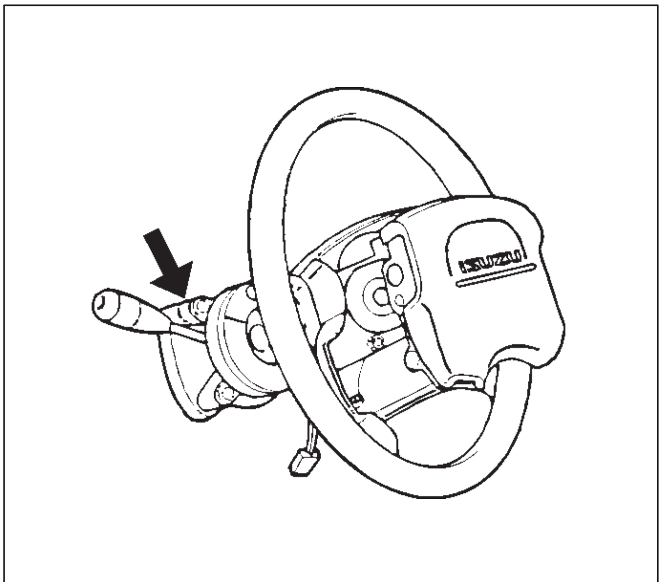
WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.



827RS016

11. Remove steering column cover.
12. Disconnect the wiring harness connectors located under the steering column.
13. Remove the combination switch assembly with SRS coil.

NOTE: The SRS coil is a part of the combination switch assembly, which can not be replaced separately. Therefore, be sure not to remove the SRS coil from the combination switch assembly.



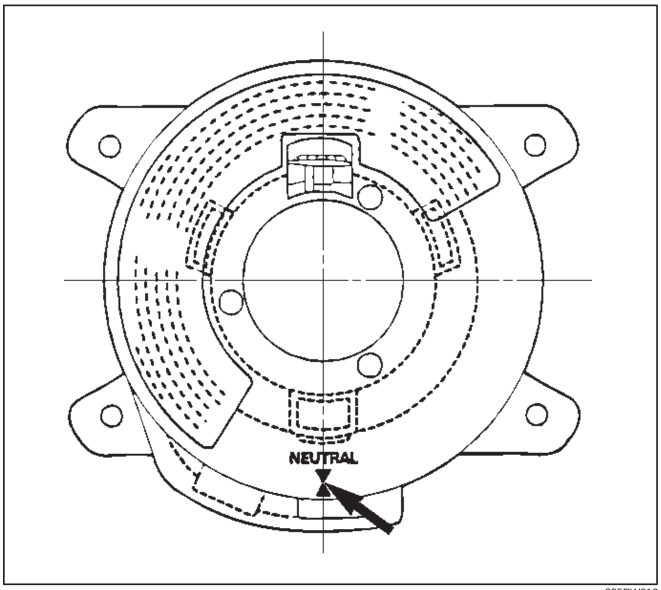
825RW098

14. Remove snap ring.
15. Remove cushion rubber.
16. Remove shift lock cable (for A/T).
17. Disconnect the starter switch harness connector located under the steering column then remove lock cylinder assembly.

Installation

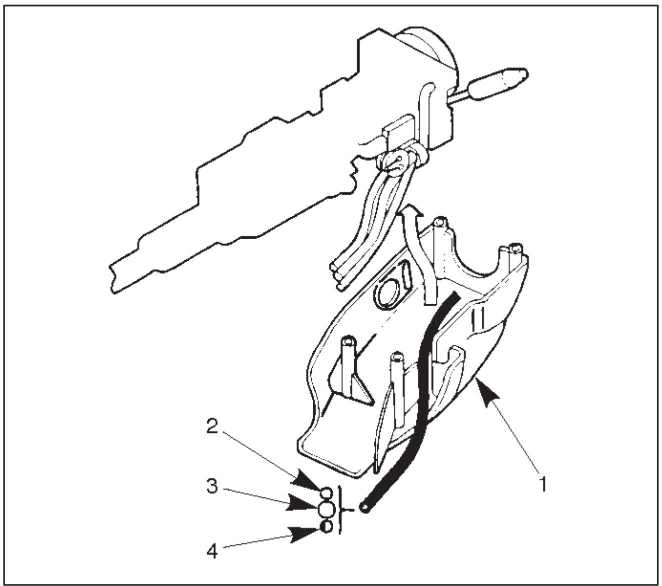
1. Install lock cylinder assembly.
2. Install shift lock cable (for A/T).
3. Install cushion rubber.
4. Install snap ring.
5. Install Combination switch and SRS coil assembly. After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2-way connector located under the steering column.
6. Turn the SRS coil counter clockwise to full, return about 3 turns and align the neutral mark.

CAUTION: When turning the SRS coil counter clockwise to full, stop turning if resistance is felt. Forced further turning may damage the cable in the SRS coil.



825RW016

7. When installing the steering column cover, be sure to wire (through each harness) as illustrated so that the harnesses starter switch, combination switch and SRS coil may not catch wiring.



825RW017

Legend

(1) Steering Column Cover
(2) Starter Switch Harness
(3) Combination Switch Harness
(4) Inflator Module Harness

8. Install steering wheel by aligning the setting marks made during removal.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

9. Tighten the steering wheel fixing nut to the specified torque.

Torque: 34 N·m (25 lb ft)

10. Support inflator module and carefully connect the module connector, then install inflator module.

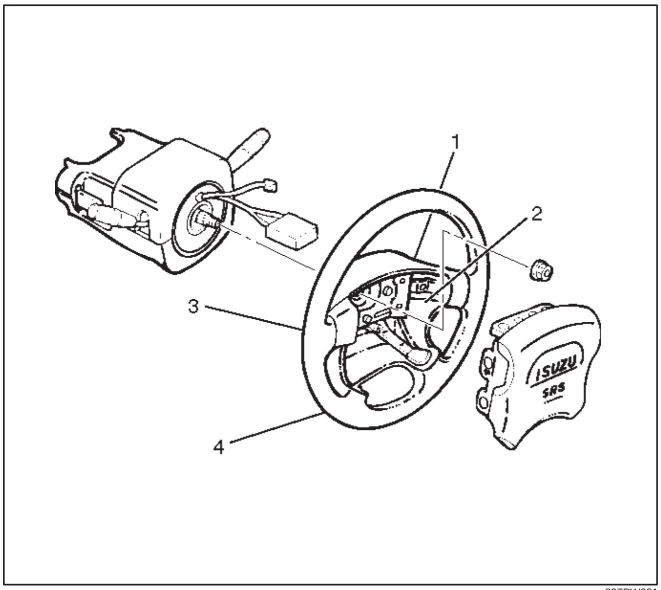
NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

11. Secure the inflator module with one bolt to relieve weight on the wire connector.

12. Tighten fixing bolts to specified sequence as illustrated.

Torque: 8 N·m (69 lb in)

13. Install driver knee bolster (reinforcement).



827RW021

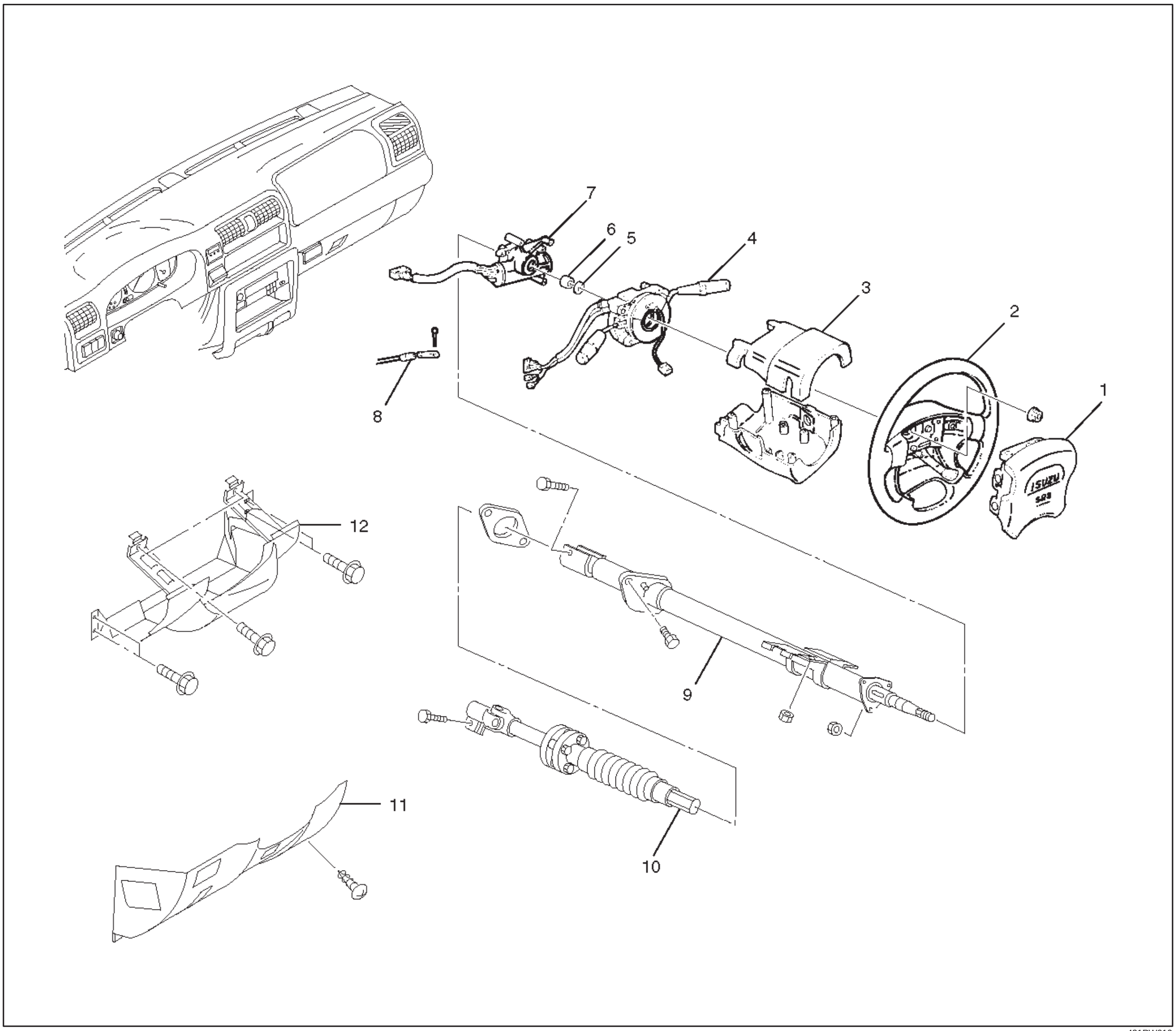
14. Install steering lower cover, then install the engine hood opening lever.
15. Connect the yellow 2-way SRS connector located under the steering column.
16. Connect the battery “–” terminal cable.

System Inspection

Turn the ignition switch to “ON” while watching warning light.
The light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

Steering Column

Steering Column and Associated Parts



Legend

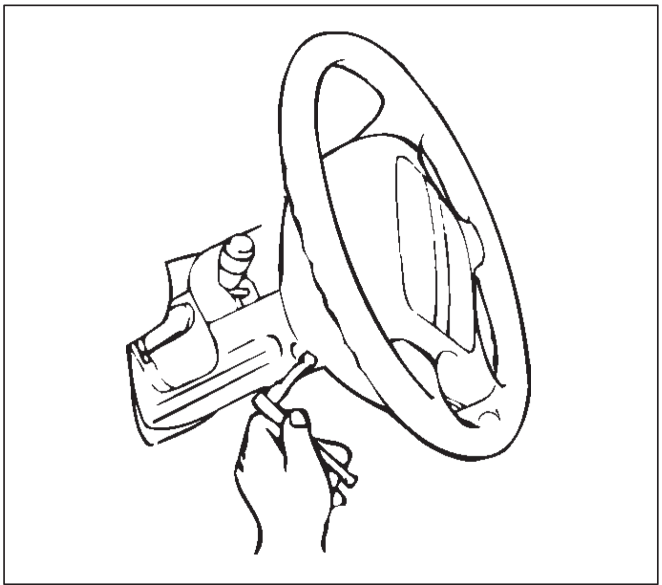
- (1) Inflator Module
- (2) Steering Wheel
- (3) Steering Column Cover
- (4) Combination Switch and SRS Coil Assembly
- (5) Snap Ring
- (6) Cushion Rubber
- (7) Lock Cylinder Assembly
- (8) Shift Lock Cable (For A/T)
- (9) Steering Column Assembly
- (10) Second Steering Shaft
- (11) Steering Lower Cover
- (12) Driver Knee Bolster (reinforcement)

Removal

1. Turn the steering wheel so that the vehicle's wheels are pointing straight ahead.
2. Turn the ignition switch to "LOCK".
3. Disconnect the battery "–" terminal cable, and wait at least 5 minutes.
4. Disconnect the yellow 2-way SRS connector located under the steering column.

CAUTION: The wheel of the vehicle must be straight ahead and the steering column in the "LOCK" position before disconnecting the steering column from the steering gear. Failure to do so will cause the SRS coil assembly to become uncentered which will cause damage to the SRS coil assembly.

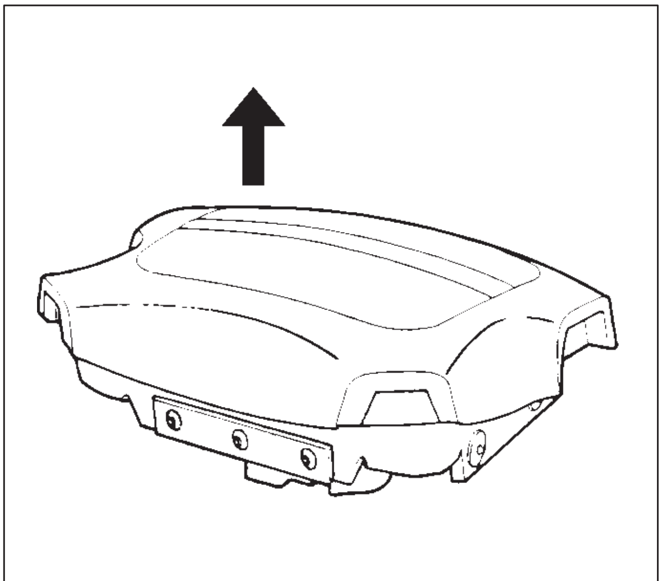
5. Remove the engine hood opening lever, then remove steering lower cover.
6. Remove driver knee bolster (reinforcement).
7. Loosen the inflator module fixing bolt from behind the steering wheel assembly using a TORX® driver or equivalent until the inflator module can be released from steering assembly.



827RW020

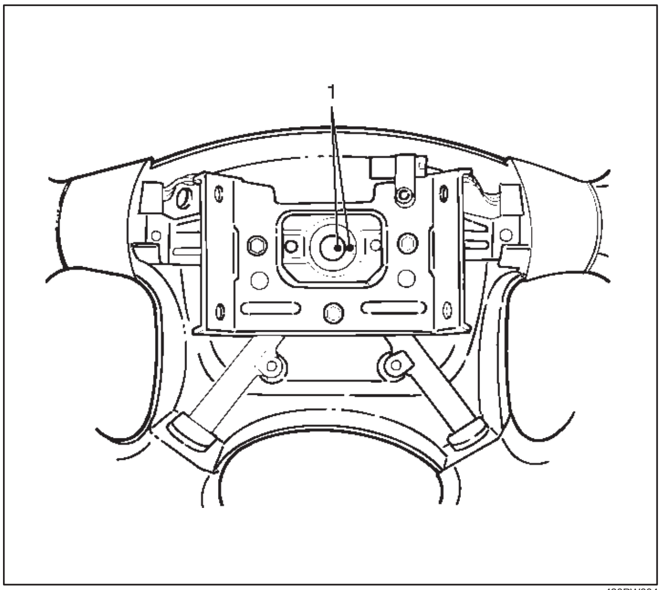
8. Disconnect the yellow 2-way SRS connector located behind the inflator module.
9. Remove inflator module.

WARNING: THE INFLATOR MODULE SHOULD ALWAYS BE CARRIED WITH THE TRIM COVER AWAY FROM YOUR BODY AND SHOULD ALWAYS BE LAID ON A FLAT SURFACE WITH THE URETHANE SIDE UP. THIS IS NECESSARY BECAUSE A FREE SPACE IS PROVIDED TO ALLOW THE AIR CUSHION TO EXPAND IN THE UNLIKELY EVENT OF ACCIDENTAL DEPLOYMENT. OTHERWISE, PERSONAL INJURY MAY RESULT.

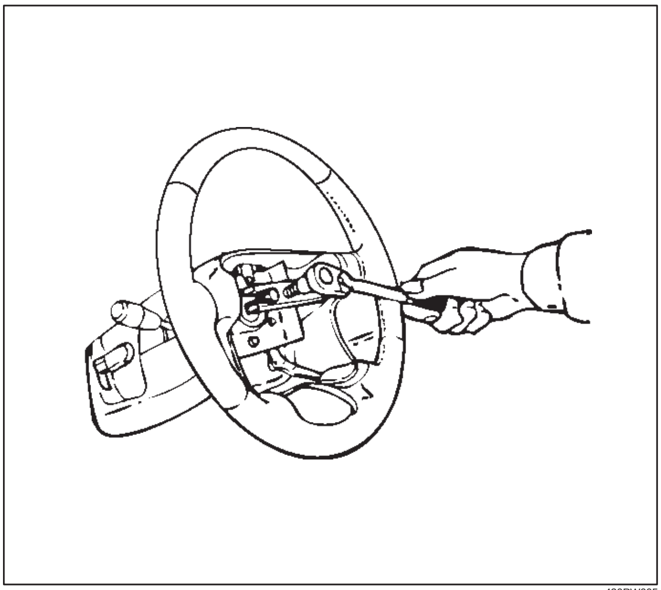


827RS016

10. Apply a setting mark (1) across the steering wheel and shaft so parts can be reassembled in their original position. Move the front wheels to the straight ahead position, then use steering wheel remover J–29752 to remove the steering wheel.



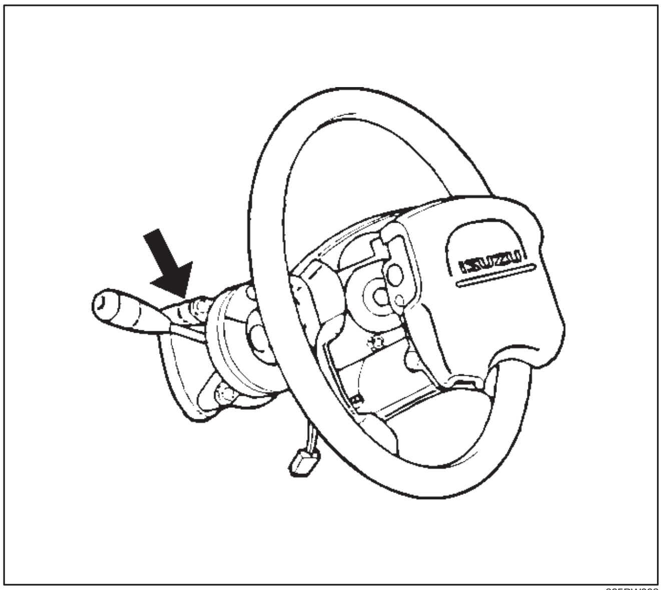
430RW004



430RW005

11. Remove steering column cover.
12. Disconnect the wiring harness connectors located under the steering column.
13. Remove the combination switch assembly with SRS coil.

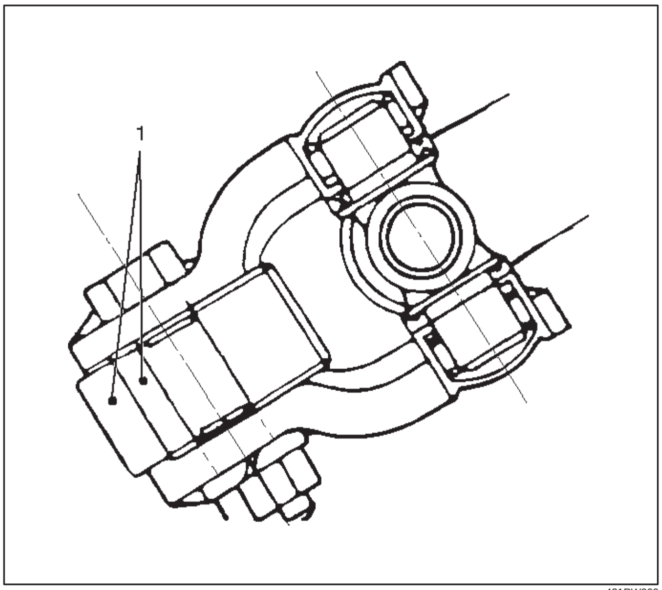
NOTE: SRS coil is a part of combination switch assembly, which can not be replaced singly. Therefore, be sure not to remove the SRS coil from the combination switch assembly.



825RW098

14. Remove snap ring.
15. Remove cushion rubber.
16. Remove shift lock cable (For A/T).
17. Disconnect the starter switch harness connector located under the steering column, then remove lock cylinder assembly.
18. Apply a setting mark (1) across the universal joint and second steering shaft to reassemble the parts in their original position, then remove steering column assembly and second shaft.

NOTE: A setting mark can be easily made if the shaft is withdrawn a little by loosening the steering shaft universal joint.



431RW009

Installation

1. Install steering column assembly and second steering shaft.
2. Align the setting marks on the universal joint and second steering shaft made during removal.
3. Tighten the steering column fixing bolt (dash panel) to the specified torque.

   Torque: 19 N·m (14 lb ft)

4. Tighten the steering column fixing bolt (pedal bracket) to the specified torque.

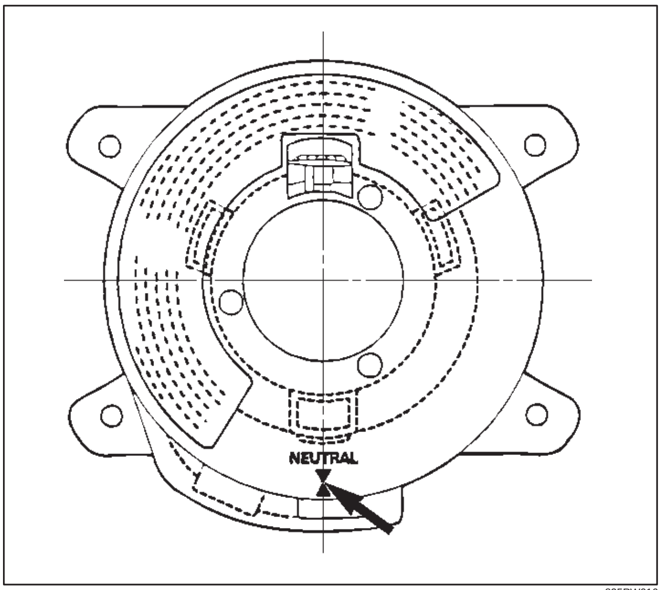
   Torque: 20 N·m (14 lb ft)

5. Tighten the universal joint to the specified torque.

   Torque: 31 N·m (23 lb ft)

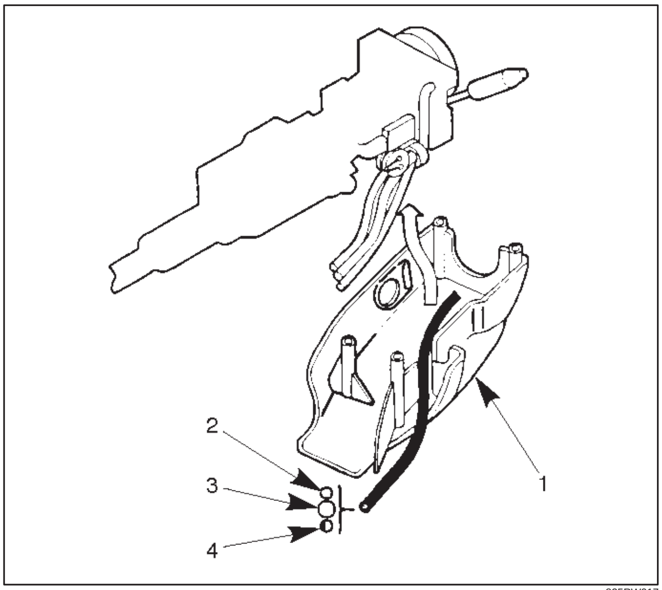
6. Install lock cylinder assembly.
7. Install shift lock cable (For A/T).
8. Install cushion rubber.
9. Install snap ring.
10. Install combination switch and SRS coil assembly. After installation of combination switch assembly, connect the combination switch wiring harness connector and the SRS 2-way connector located under the steering column.
11. Turn the SRS coil counter clockwise to full, return about 3 turns and align the neutral mark.

CAUTION: When turning the SRS coil counter clockwise to full, stop turning if resistance is felt. Forced further turning may damage to the cable in the SRS coil.



825RW016

12. When installing the steering column cover, be sure to route each wire harness as illustrated so that the harnesses do not catch any moving parts.



825RW017

Legend

(1) Steering Column Cover
(2) Starter Switch Harness
(3) Combination Switch Harness
(4) Inflator Module Harness

13. Install steering wheel and align the setting marks made when removing.

CAUTION: Never apply force to the steering wheel in direction of the shaft by using a hammer or other impact tools in an attempt to remove the steering wheel. The steering shaft is designed as an energy absorbing unit.

14. Tighten the steering wheel fixing nut to the specified torque.

Torque: 34 N·m (25 lb ft)

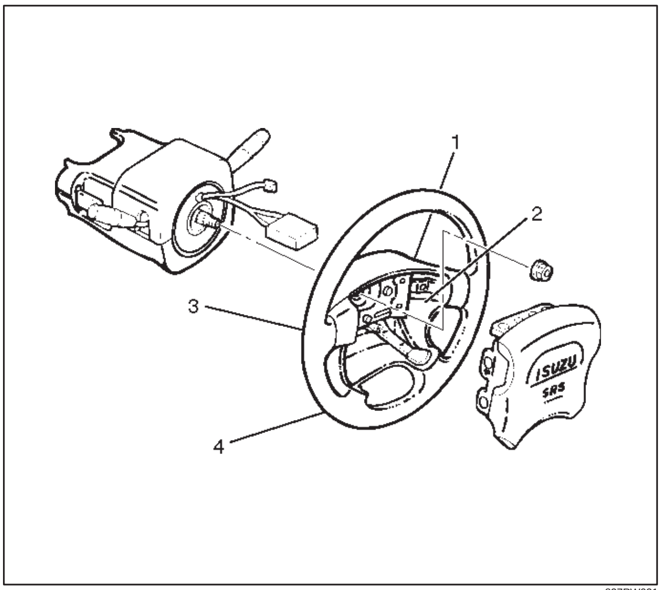
15. Support the module and carefully connect the module connector then install inflator module.

NOTE: Pass the lead wire through the tabs on the plastic cover (wire protector) of inflator to prevent lead wire from being pinched.

16. Secure the module with one bolt to relieve weight on the wire connector.

17. Tighten bolts to specified sequence as illustrated.

Torque: 8 N·m (69 lb in)



827RW021

18. Install driver knee bolster (reinforcement).
19. Install steering lower cover.
20. Install the engine hood opening lever.
21. Connect the yellow 2-way SRS connector located under the steering column.
22. Connect the battery "–" terminal cable.

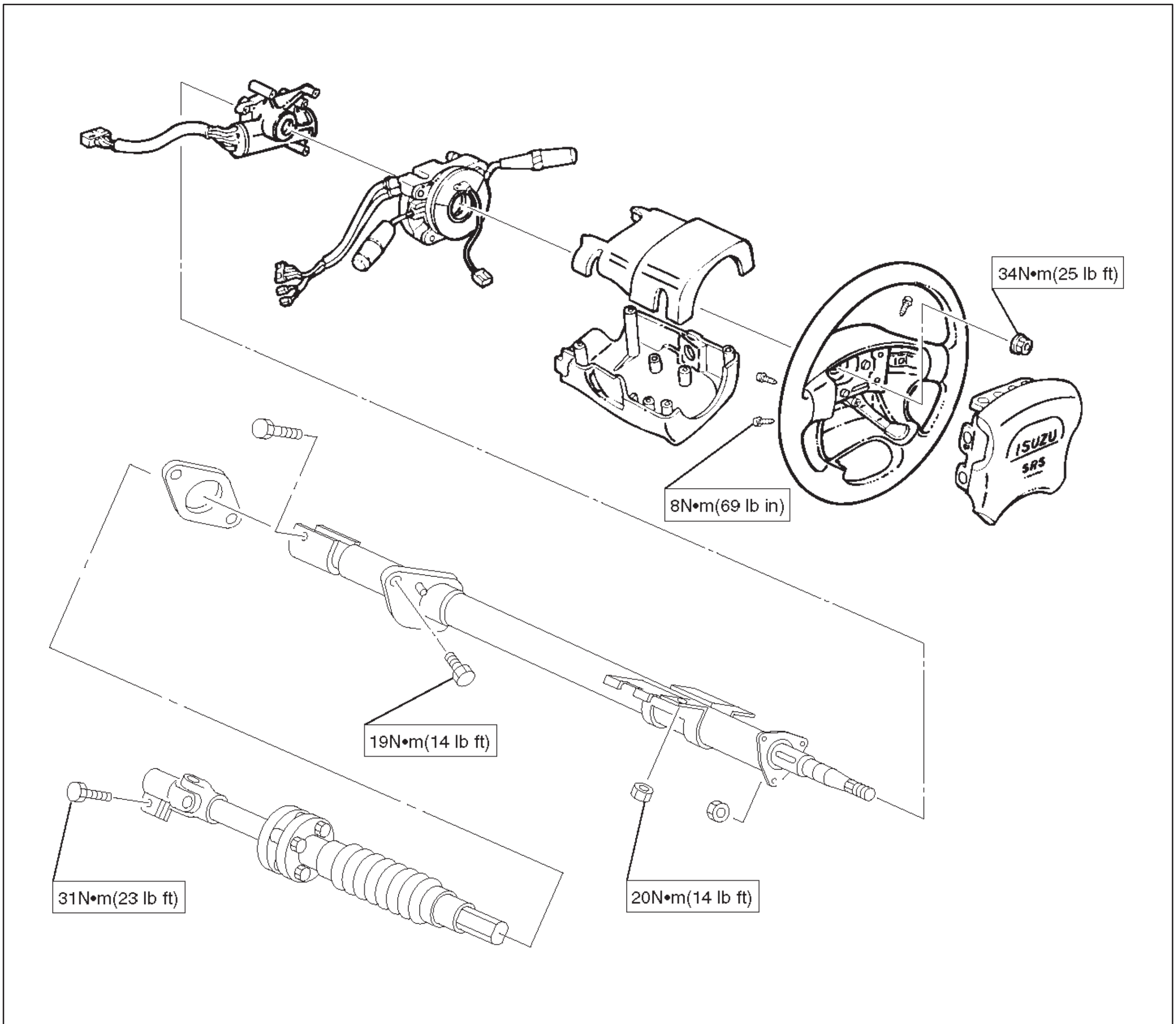
System Inspection

Turn the ignition switch to "ON" while watching warning light.
The light should flash 7 times and then go off. If lamp does not operate correctly, refer to Restraints section.

Supplemental Restraint System Steering Wheel & Column and Associated Parts

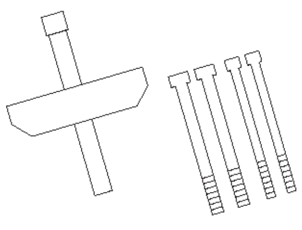
Main Data and Specifications

Torque Specifications



E02RW002

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS294	**J–29752** Steering wheel remover

AMIGO

SUSPENSION

FRONT SUSPENSION

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The front suspension is designed to allow each wheel to compensate for changes in the road surface level without greatly affecting the opposite wheel. Each wheel is independently connected to the frame by a steering knuckle, ball joint assemblies, and upper and lower control arms. The front wheels are held in proper relationship to each other by two tie-rods which are connected to steering arms on the knuckles, and to a steering unit.

All models have a front suspension system consisting of control arms, stabilizer bar, shock absorber and a torsion bar. The front end of the torsion bar is attached to the lower control arm. The rear of the torsion bar is mounted into a height control arm at the crossmember. Vehicle trim height is controlled by adjusting this arm.

Shock absorbers are mounted between the brackets on the frame and the lower control arms. The lower portion of each shock absorber is attached to the lower control arm. The upper portion of each shock absorber extends through a frame bracket and is secured with two rubber bushings, two retainers and a nut.

Ball joint assemblies are bolted to the outer end of the upper and lower control arm and are attached to the steering knuckle.

The inner ends of the upper control arm have pressed in bushings. Bolts, passing through the bushing, attach the control arm to the frame. The inner ends of the lower control arm are attached to the frame by bolts passing through the bushings.

Side roll of the front suspension is controlled by a spring steel stabilizer bar. It is mounted in rubber bushings, which are held to the frame by brackets. The ends of the stabilizer bar are connected to the lower control arms by links.

Diagnosis

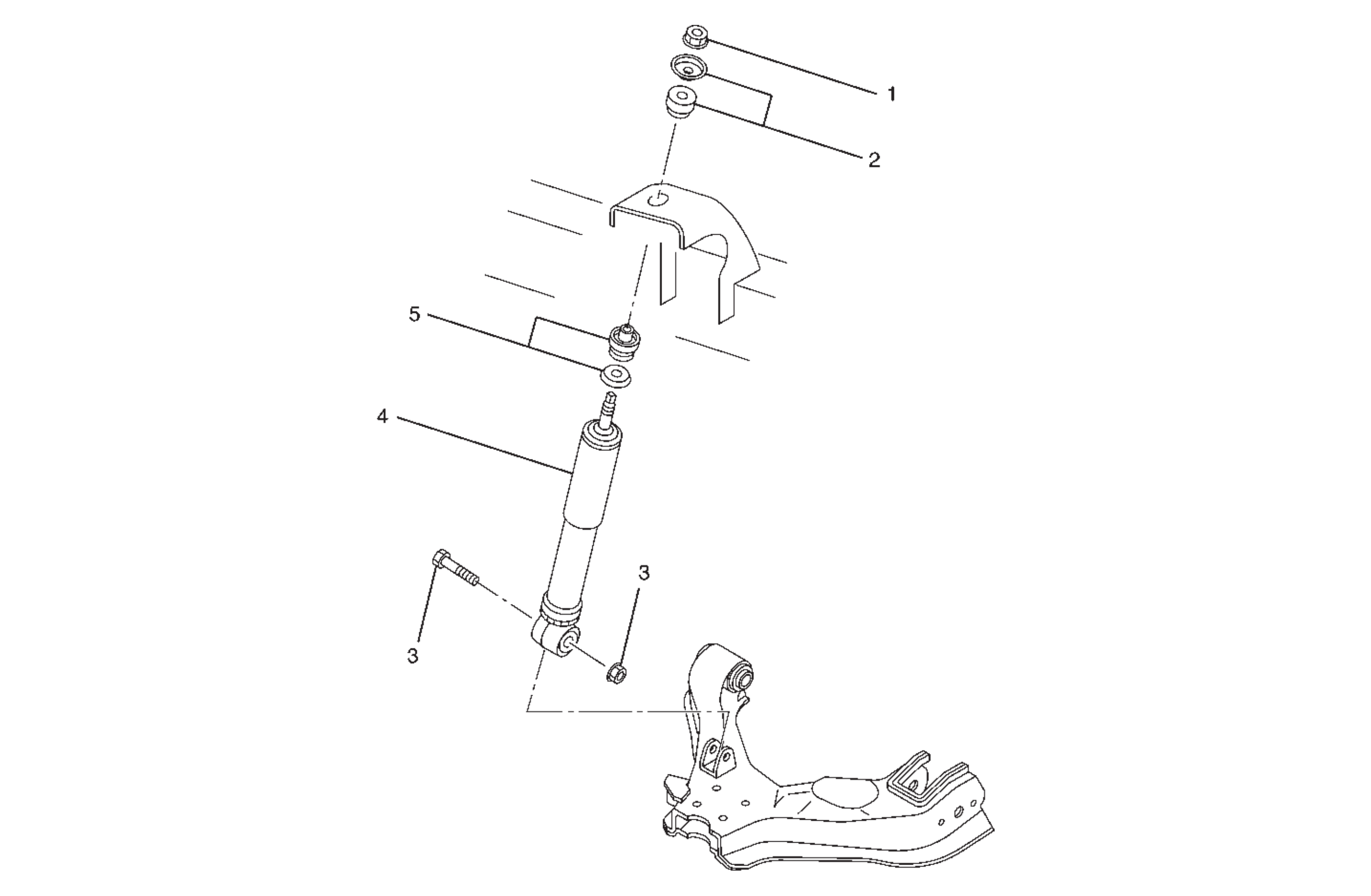
Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
	Parts in power steering valve defective.	Replace power steering unit.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.

Condition	Possible cause	Correction
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
	Excessive wheel runout.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial runout of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering unit.	Tighten steering unit.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.
	Parts in power steering valve defective.	Replace power steering unit.
Hard Steering	Bind in steering linkage ball studs, upper or lower ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to Steering section.
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering unit or linkage.	Retighten or repair.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.

Condition	Possible cause	Correction
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering unit.	Retighten mounting bolt.
	Faulty steering unit.	Replace steering unit.
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Improper wheel alignment.	Adjust wheel alignment.
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.
Low or Uneven Trim Height	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
	Incorrect springs.	Adjust or replace torsion bar.
Suspension Bottoms	Vehicle overloaded.	Reduce load.
	Faulty shock absorber.	Replace shock absorber.
	Incorrect, broken or sagging springs.	Replace springs.
Body Leans	Loose stabilizer bar.	Tighten stabilizer bar bolts or replace bushings.
	Faulty shock absorber, struts or mounting.	Replace shock absorber.
	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
Cupped Tires	Worn wheel bearings.	Replace wheel bearing.
	Excessive tire or wheel run out.	Replace tire or wheel.
	Worn ball joints.	Replace ball joints.
	Tire out of balance.	Adjust tire balance.

Shock Absorber

Shock Absorber and Associated Parts



Legend

(1) Nut
(2) Rubber Bushing and Washer
(3) Bolt and Nut
(4) Shock Absorber
(5) Rubber Bushing and Washer

Removal

1. Raise the vehicle and support it with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel Replacement in this section.
3. Remove bolt and nut.
4. Remove nut.
5. Remove rubber bushing and washer.
6. Remove shock absorber.
7. Remove rubber bushing and washer.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts :

- Shock absorber
- Rubber bushing

Installation

1. Install rubber bushing and washer.
2. Install shock absorber.
3. Install rubber bushing and washer.
4. Install nut, then tighten it to the specified torque.

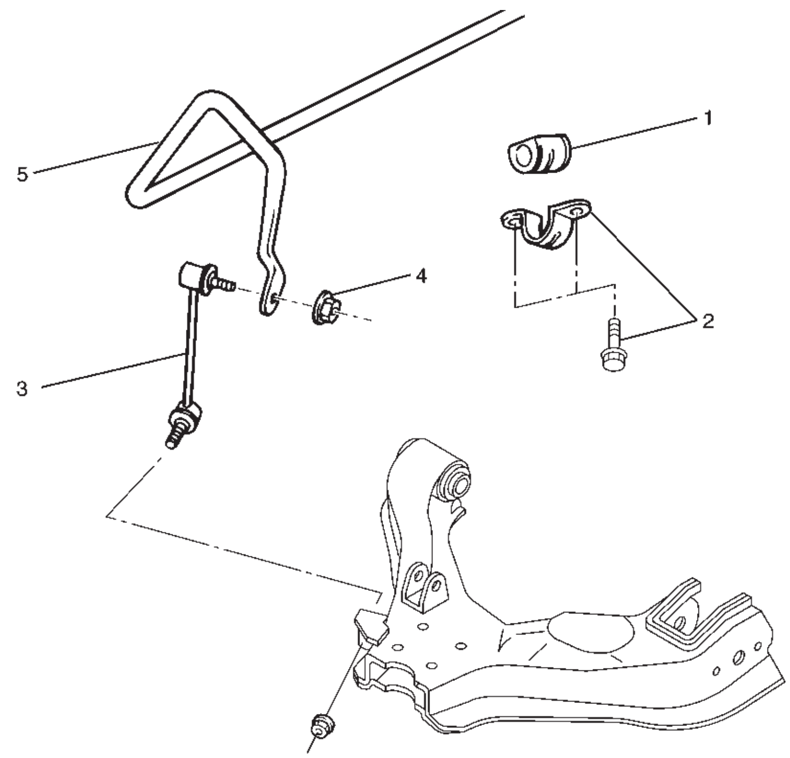
   Torque: 20 N·m (14 lb ft)

5. Install bolt and nut, then tighten to the specified torque.

   Torque: 93 N·m (69 lb ft)

Stabilizer Bar

Stabilizer Bar and Associated Parts



410RW007

Legend

(1) Rubber Bushing
(2) Bracket
(3) Link
(4) Nut
(5) Stabilizer Bar

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove the stone guard.
3. Remove wheel and tire assembly. Refer to Wheel Replacement in this section.
4. Remove nut.

CAUTION: Be careful not to break the ball joint boot.

5. Remove link.
6. Remove bracket.
7. Remove stabilizer bar.
8. Remove rubber bushing.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts :

- Stabilizer bar
- Rubber bushing
- Link ball joint

Installation

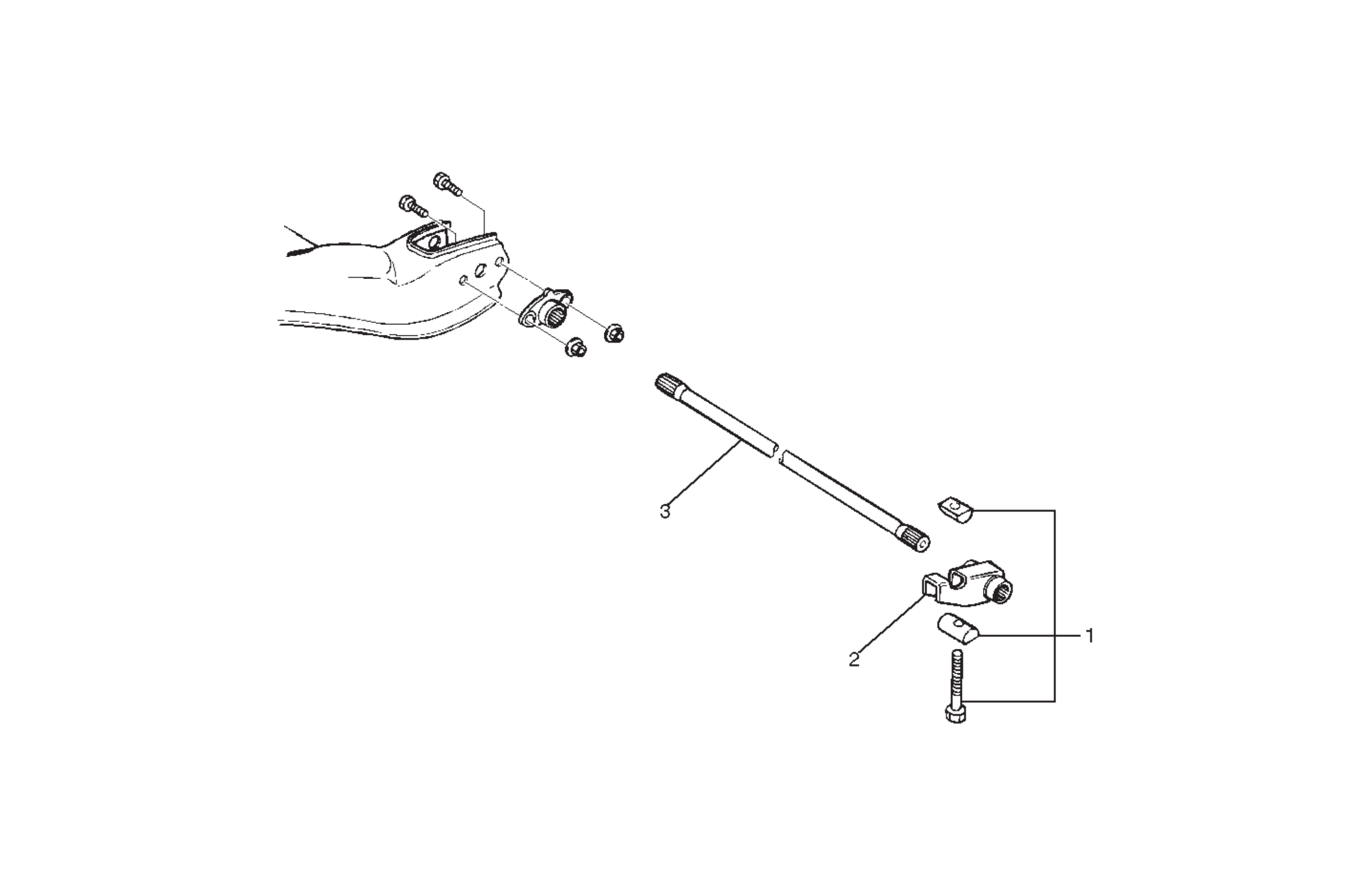
1. Install rubber bushing.
2. Install stabilizer bar.
3. Install bracket, then tighten it to the specified torque.

   Torque: 25 N·m (18 lb ft)
4. Install link.
5. Install nut, then tighten it to the specified torque.

   Torque: 50 N·m (37 lb ft)

Torsion Bar

Torsion Bar and Associated Parts



410RS003

Legend

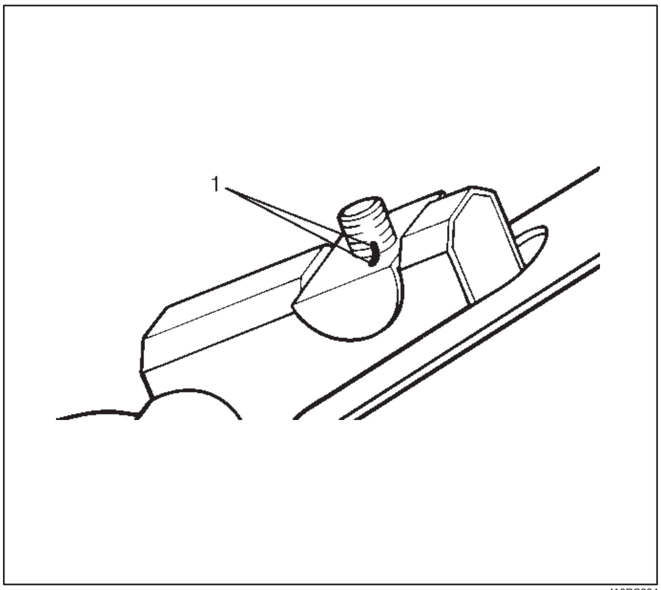
(1) Adjust Bolt, End Piece and Seat

(2) Height Control Arm

(3) Torsion Bar

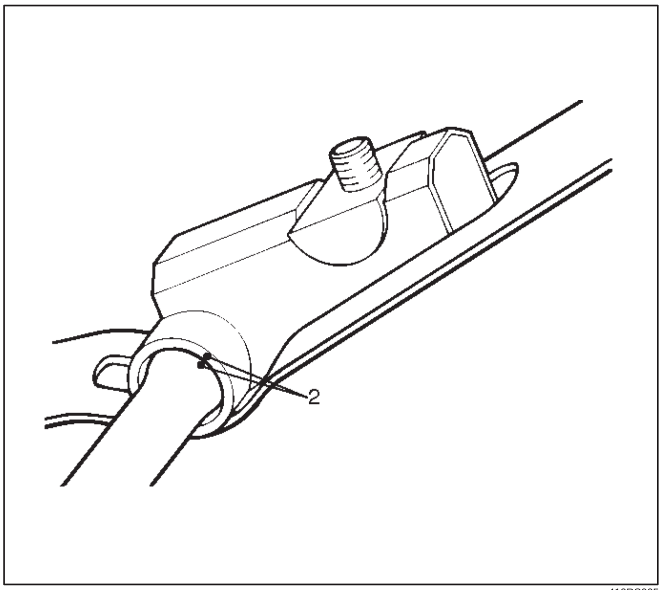
Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Apply the setting marks(1) to the adjust bolt and end piece, then remove adjust bolt, end piece and seat.



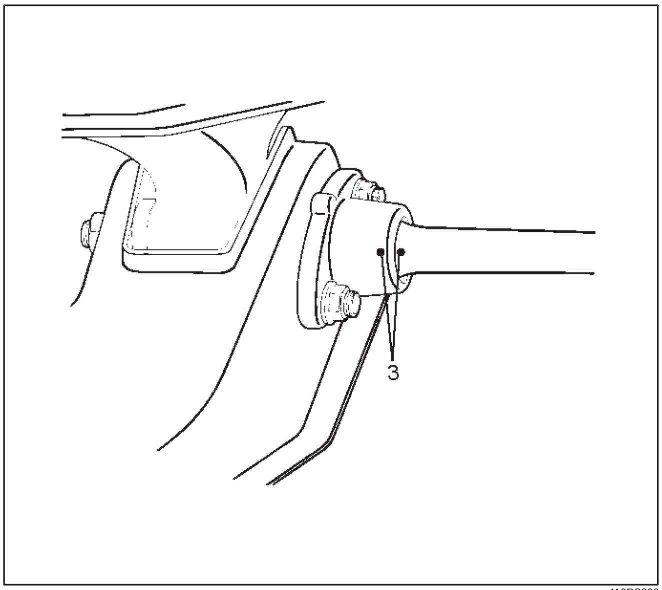
410RS004

3. Apply the setting marks(2) to the height control arm and torsion bar, then remove height control arm.



410RS005

4. Apply the setting marks(3) to the torsion bar and lower control arm, then remove torsion bar.



410RS006

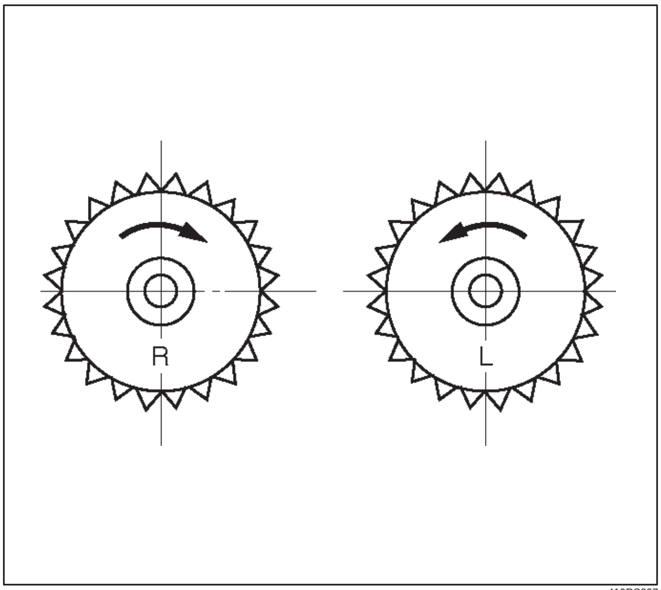
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

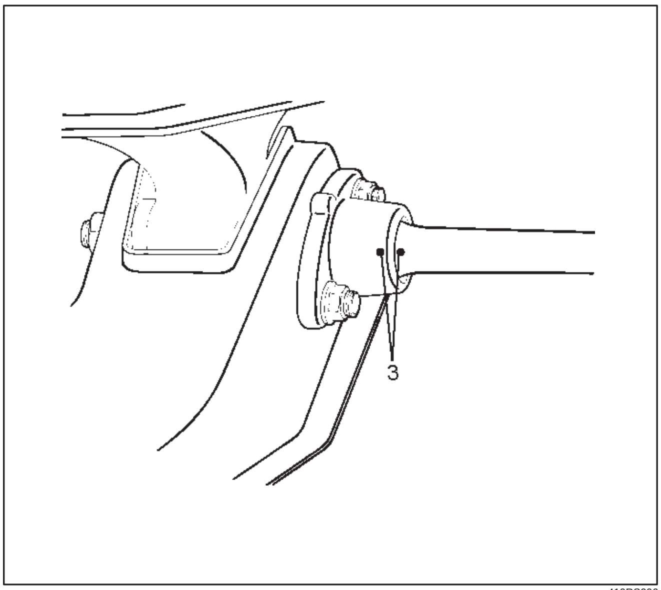
- Torsion bar
- Height control arm
- Adjust bolt
- Rubber seat

Installation

1. Apply grease to the serrated portions, then install torsion bar. Make sure the bars are on their correct respective sides and align the setting marks(3).

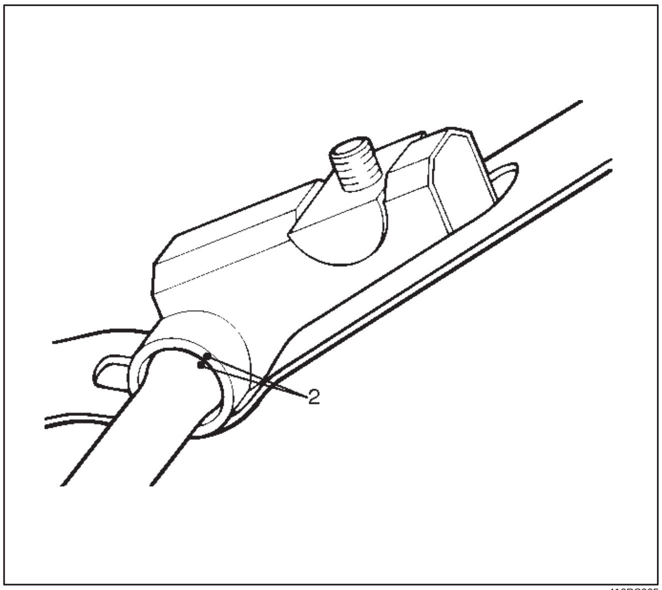


410RS007



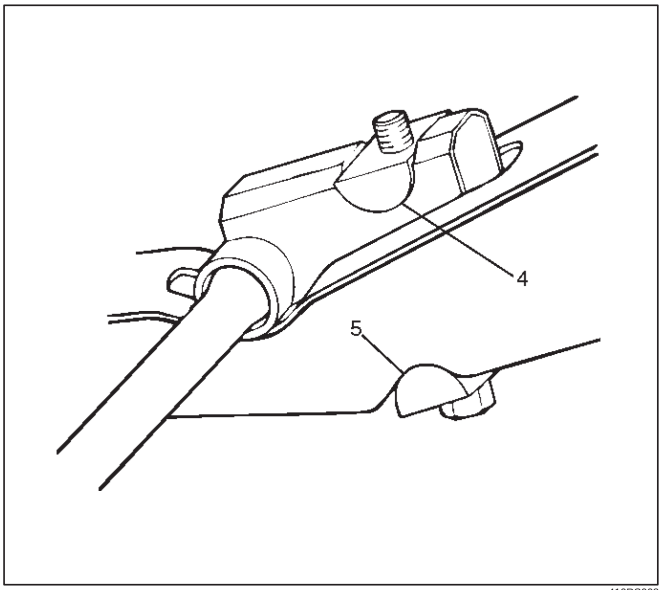
410RS006

2. Apply grease to the portion that fits into the bracket then install height control arm and align the setting marks(2).



410RS005

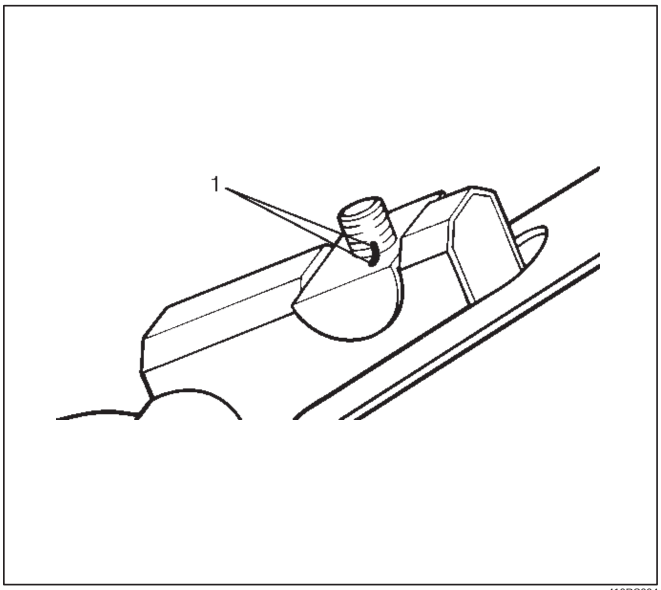
3. Apply grease to the bolt portion of the end piece(4). Apply grease to the portion of the seat(5) that fits into the bracket.



410RS008

4. Apply grease to the serrated portions.
5. Install adjust bolt and seat, then turn the adjust bolt to the setting mark(1) applied during disassembly.

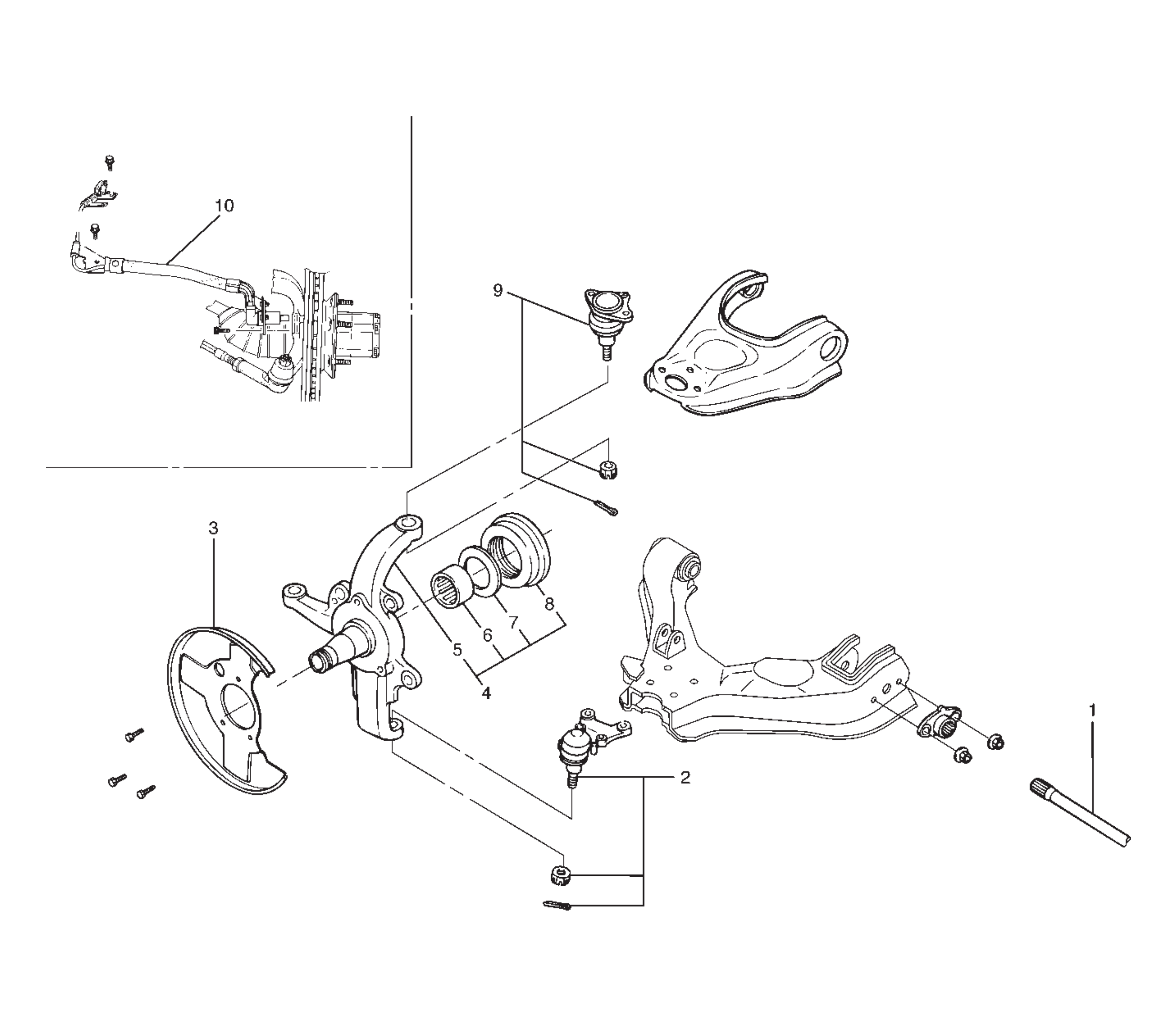
NOTE: Adjust the trim height. Refer to Front End Alignment Inspection and Adjustment in Steering section.



410RS004

Knuckle

Knuckle and Associated Parts



Legend

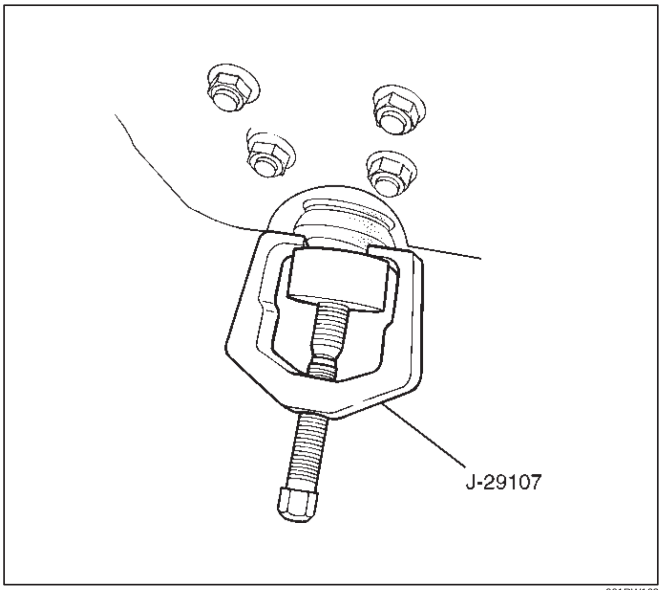
(1) Torsion Bar
(2) Lower Ball Joint
(3) Back Plate
(4) Knuckle Assembly
(5) Knuckle
(6) Needle Bearing
(7) Thrust Washer
(8) Oil Seal
(9) Upper Ball Joint
(10) Wheel Speed Sensor

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel in this section.
3. Remove the brake caliper. Refer to Disc Brakes in Brake section.
4. Remove the hub assembly. Refer to Front Hub and Disk in this section.
5. Remove tie–rod end from the knuckle. Refer to Power Steering Unit in Steering section.
6. Remove the speed sensor from the knuckle.
7. Loosen torsion bar by height control arm adjust bolt, then remove torsion bar. Refer to Torsion Bar in this section.
8. Remove wheel speed sensor.

9. Remove back plate.
10. Remove lower ball joint by using remover J–29107.

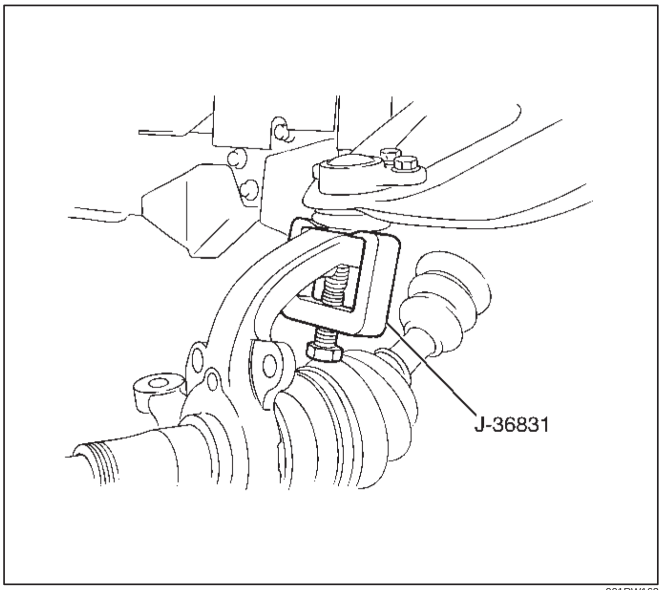
CAUTION: Be careful not to damage the ball joint boot.



901RW163

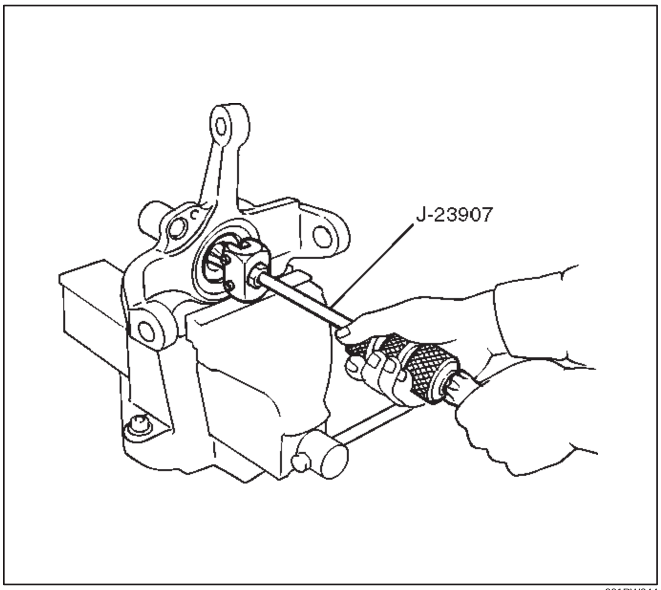
11. Remove upper ball joint by using remover J–36831.

CAUTION: Be careful not to damage the ball joint boot.



901RW162

12. Remove knuckle assembly.
13. Remove oil seal (Except 2WD model).
14. Remove washer (Except 2WD model).
15. Remove needle bearing by using remover J–23907 (Except 2WD model).



901RW044

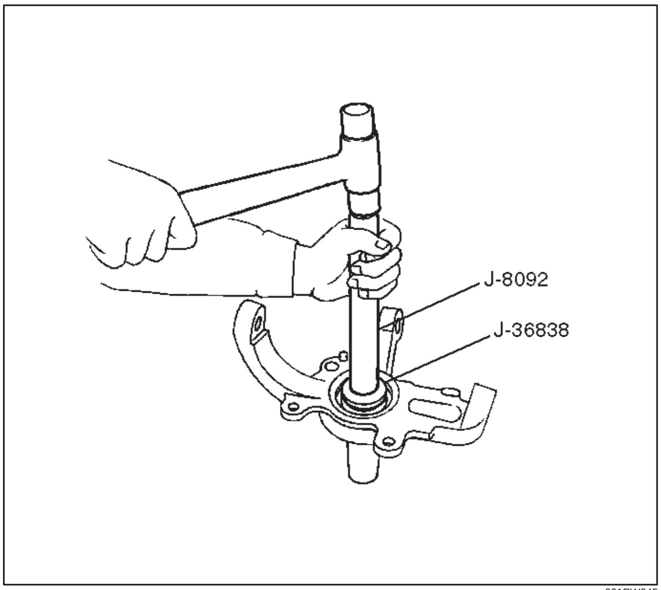
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- Knuckle
- Knuckle arm
- Needle bearing
- Thrust washer

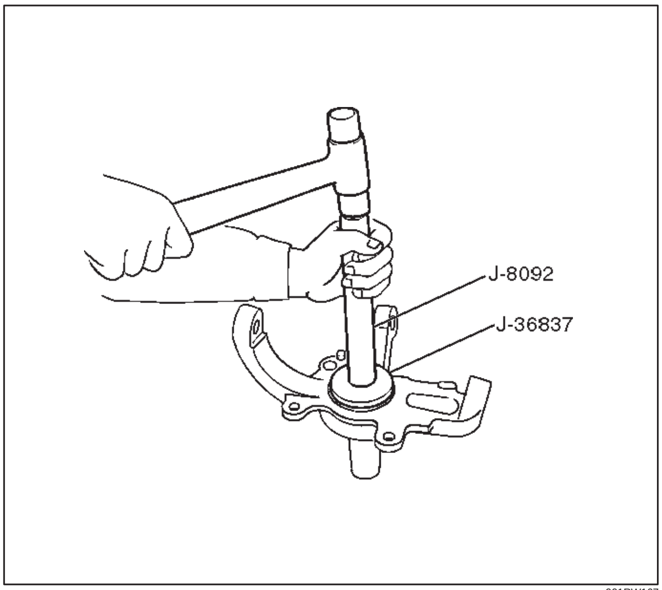
Installation

1. Apply appropriate amount of multipurpose type grease to the new bearing (Approx. 5 g) and install needle bearing by using installer J–36838 and J–8092 (Except 2WD model).



901RW045

2. Apply multipurpose type grease to the thrust washer, and install washer with chamfered side facing knuckle (Except 2WD model).
3. Use a new oil seal, and apply multipurpose type grease to the area surrounded by the lip (approx. 2 g). Then use installer J–36837 and J–8092 to install oil seal. After fitting the oil seal to the installer, drive it to the knuckle using a hammer or bench press until the tool front face contacts with the thrust washer (Except 2WD model).



901RW167

4. Install knuckle assembly.
5. Install upper ball joint and tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

TorqUA00 N·m (72 lb ft)

6. Install lower ball joint and tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

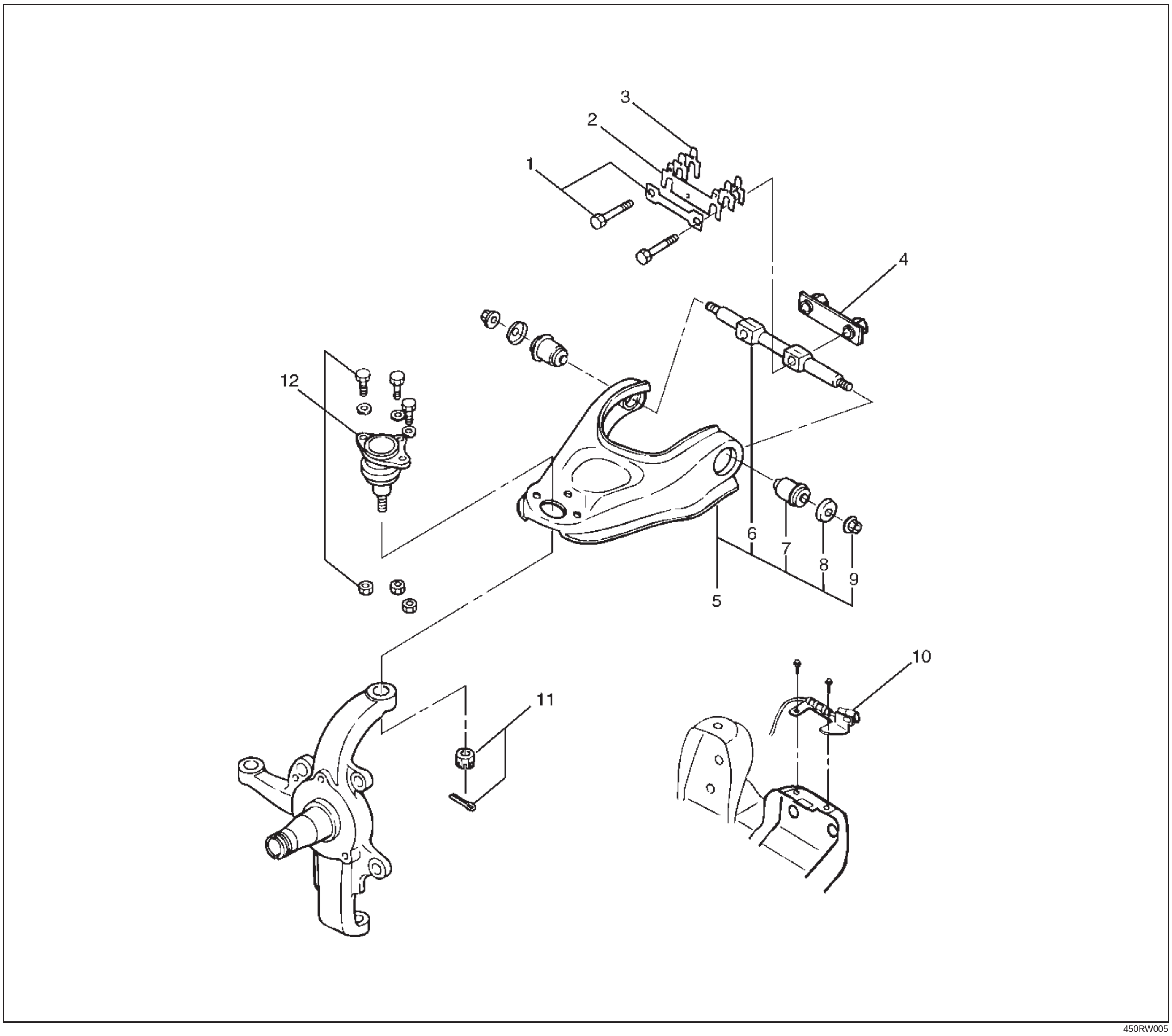
Torque: 147 N·m (108 lb ft)

7. Install back plate.
8. Install wheel speed sensor.
9. Install torsion bar, refer to Torsion Bar in this section.

NOTE: Adjust the trim height. Refer to Front End Alignment Inspection and Adjustment in Steering.

Upper Control Arm

Upper Control Arm and Associated Parts



Legend

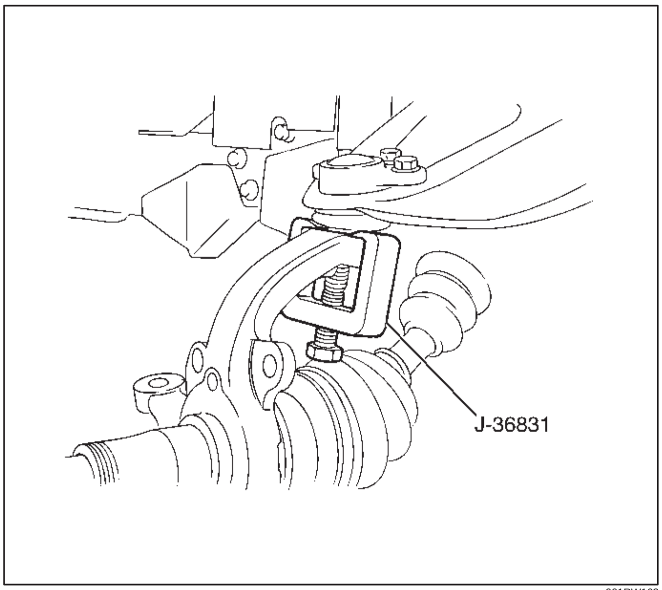
(1) Bolt and Plate
(2) Camber Shims
(3) Caster Shims
(4) Nut Assembly
(5) Upper Control Arm Assembly
(6) Fulcrum Pin
(7) Bushing
(8) Plate
(9) Nut
(10) Speed Sensor Cable
(11) Nut and Cotter Pin
(12) Upper Ball Joint

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel in this section.
3. Remove the brake caliper and disconnect brake pipe. Refer to Disc Brakes in Brake section.
4. Support lower control arm with a jack.
5. Remove speed sensor cable.

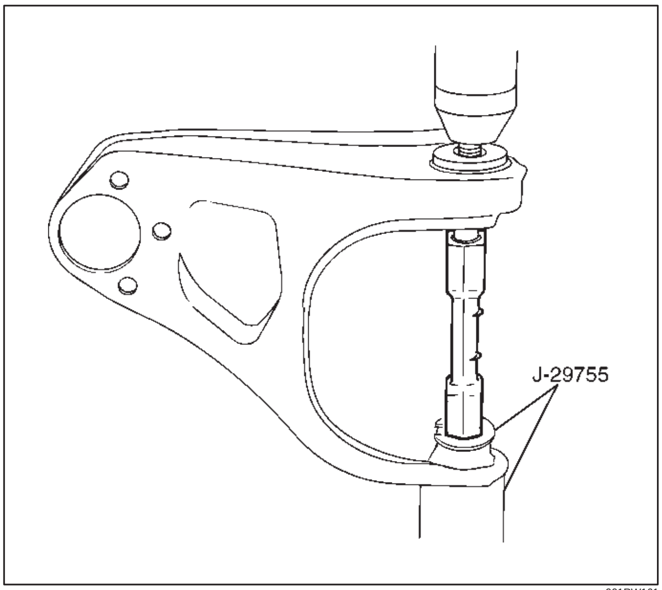
6. Remove nut and cotter pin then use remover J–36831.

CAUTION: Be careful not to damage the ball joint boot.

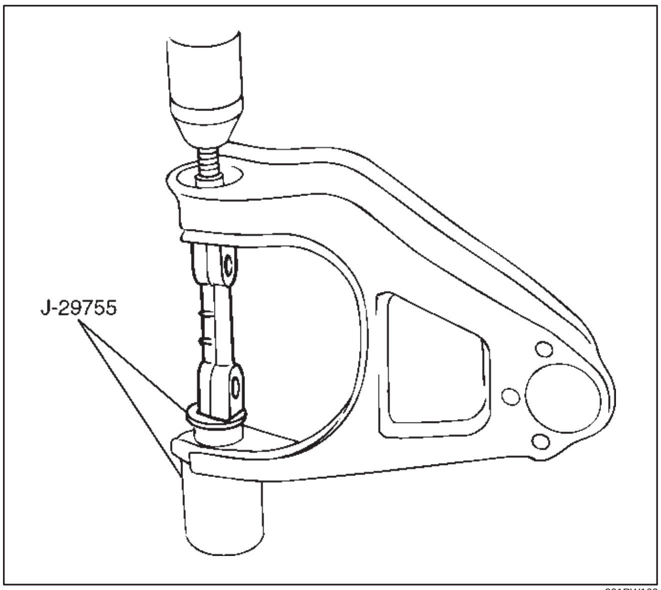


901RW162

7. Remove upper ball joint.
8. Remove bolt and plate.
9. Remove nut assembly.
10. Remove camber shims and note the positions and number of shims.
11. Remove caster shims and note the positions and number of shims.
12. Remove upper control arm assembly.
13. Remove nut.
14. Remove plate.
15. Remove bushing by using remover J–29755.



901RW161



901RW160

16. Remove fulcrum pin.

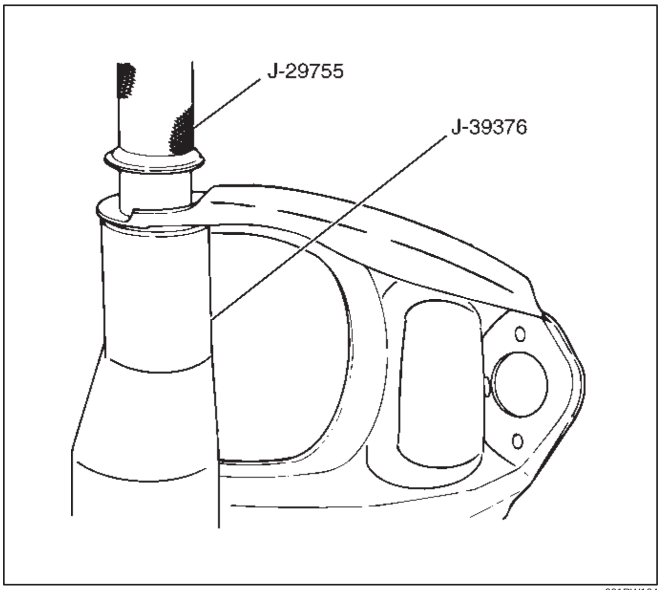
Inspection and Repair

Make necessary parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.
Check the following parts:

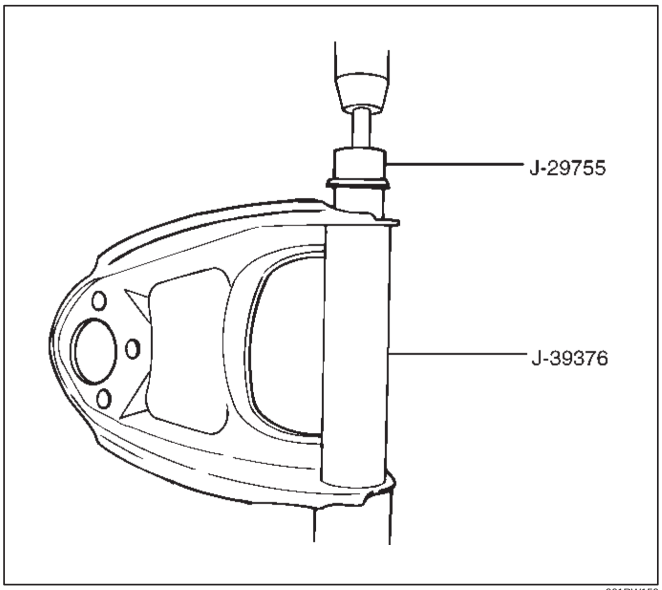
- Upper control arm
- Bushing
- Fulcrum pin

Installation

1. Install fulcrum pin.
2. Install bushing by using installer J–29755 and J–39376.



901RW164



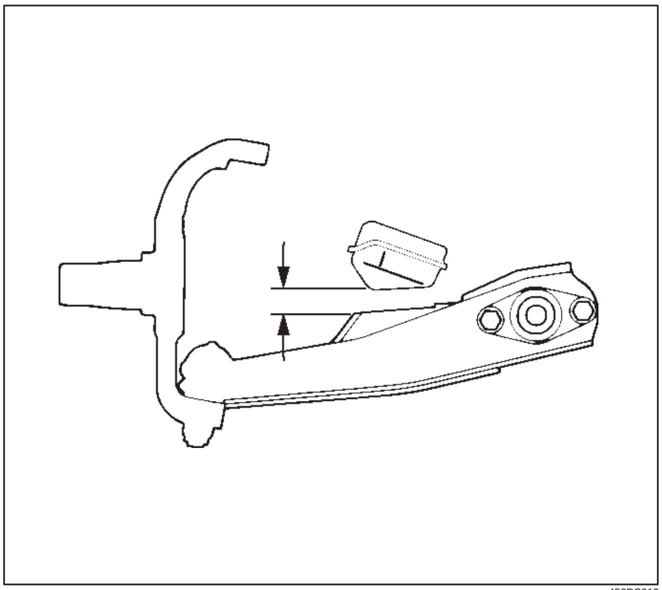
901RW159

3. Install plate.
4. Install nut and tighten fulcrum pin nut finger–tight.

NOTE: Torque fulcrum pin nut after adjusting buffer clearance.

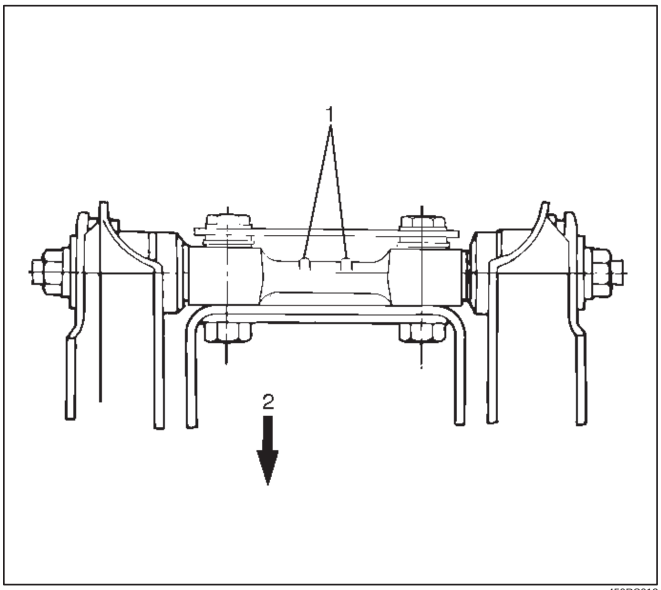
Buffer clearance: 22 mm (0.87 in)

Torque: 108 N·m (80 lb ft)



450RS012

5. Install upper control arm assembly with the fulcrum pin projections turned inward.

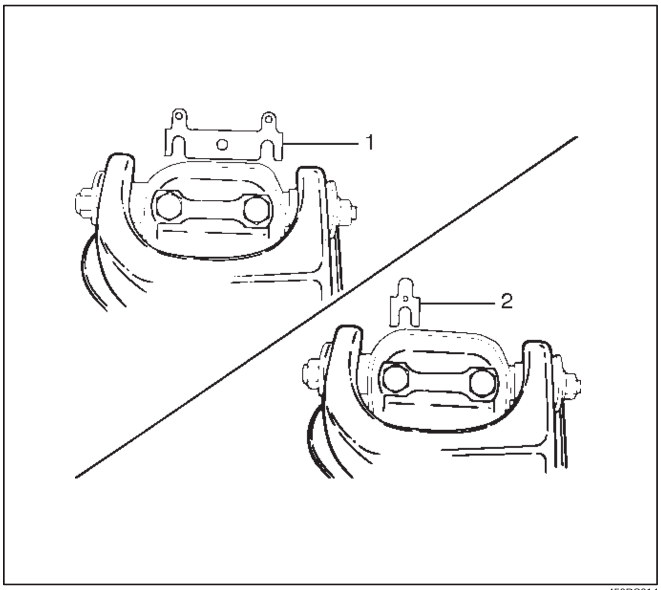


450RS013

Legend

(1) Projection
(2) Outward

6. Install the caster shims(2) between the chassis frame and fulcrum pin.
7. Install the camber shims(1) between the chassis frame and fulcrum pin.



450RS014

8. Install nut assembly.
9. Install bolt and plate, then tighten the bolt to the specified torque.

Torque: 152 N·m (112 lb ft)

10. Install upper ball joint and tighten it to the specified torque.

Torque: 57 N·m (42 lb ft)

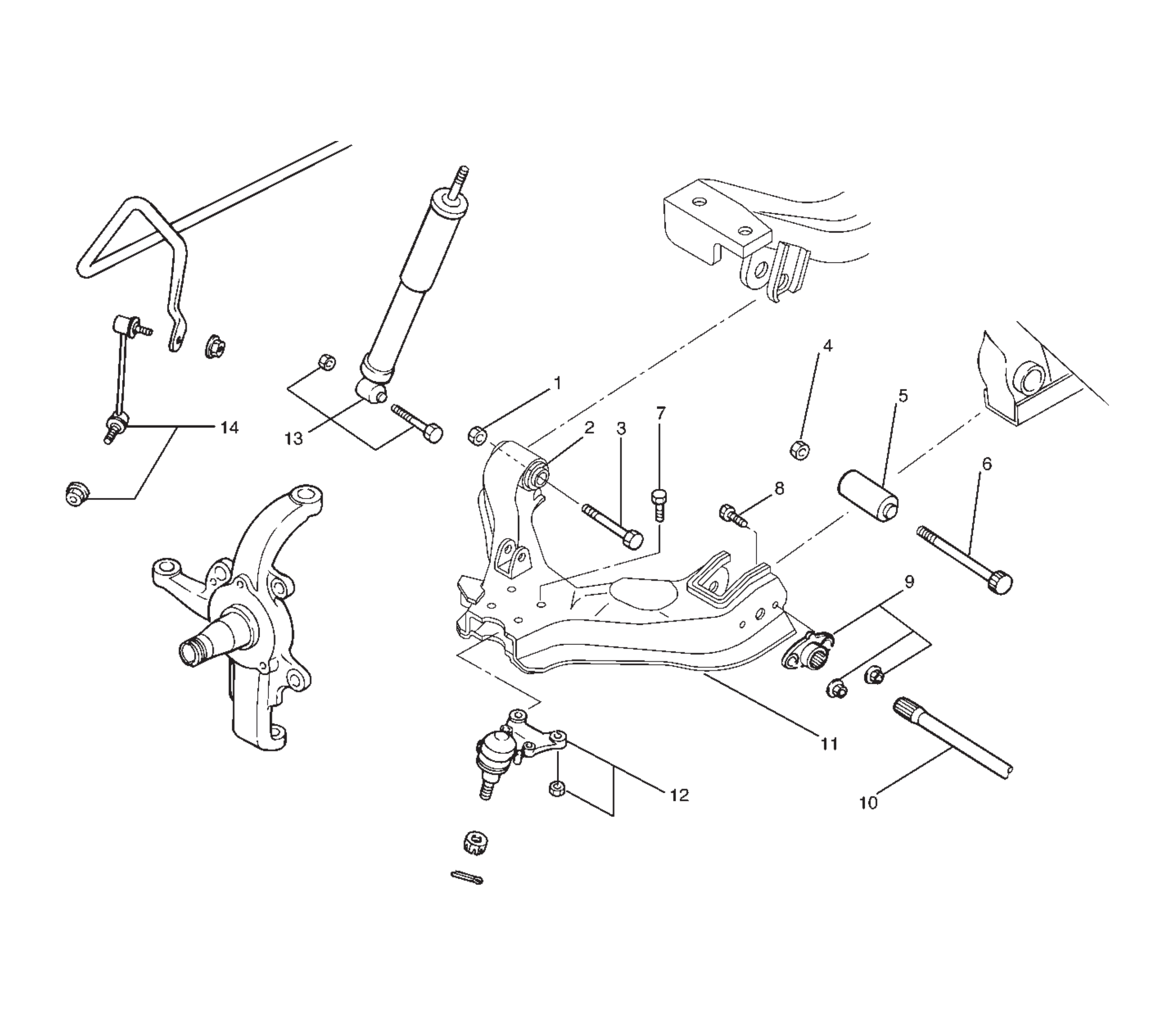
11. Install nut and cotter pin then tighten the nut to the specified torque, with just enough additional torque to align cotter pin holes. Install new cotter pin.

TorqUA00 N·m (72 lb ft)

12. Install speed sensor cable.

Lower Control Arm

Lower Control Arm and Associated Parts



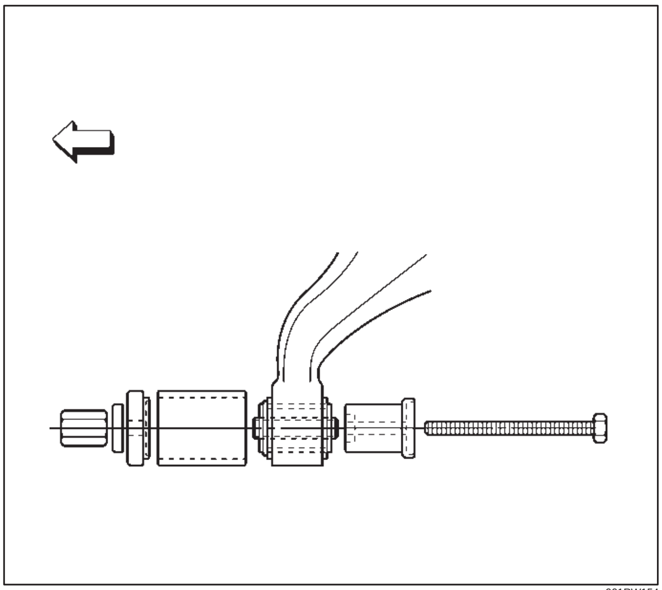
Legend

(1) Nut, Front
(2) Bush, Front
(3) Bolt, Front
(4) Nut, Rear
(5) Bush, Rear
(6) Bolt, Rear
(7) Bolt, Lower Ball Joint
(8) Bolt, Torsion Bar Arm
(9) Torsion Bar Arm Bracket
(10) Torsion Bar
(11) Lower Control Arm
(12) Lower Ball Joint
(13) Shock Absorber
(14) Stabilizer Link

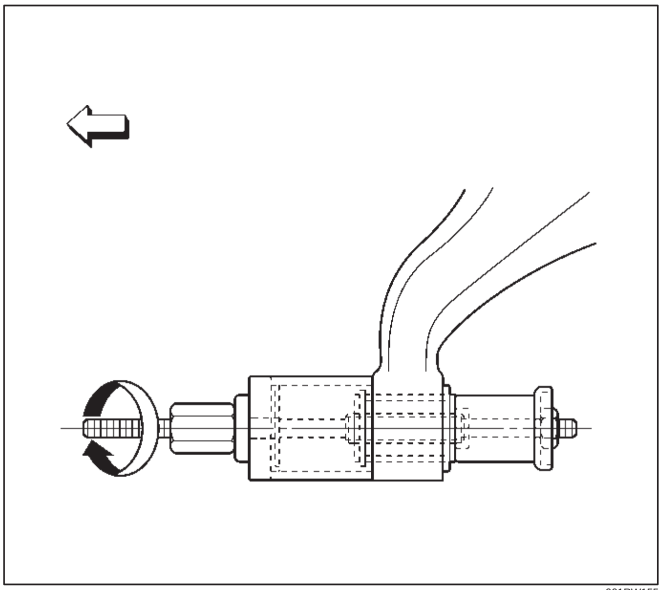
Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel in this section.
3. Remove the tie-rod end from the knuckle. Refer to Power Steering Unit in Steering section.
4. Remove the retaining ring from the front axle driving shaft to release the shaft from hub(Except 2WD model). Refer to Front Hub and Disc in Driveline/Axle section.
5. Support lower control arm with a jack.

6. Remove front nut.
7. Remove rear nut.
8. Remove torsion bar, refer to Torsion Bar in this section.
9. Remove torsion bar arm bracket.
10. Disconnect the stabilizer link at the lower control arm.
11. Remove the shock absorber lower end from the lower control arm.
12. Remove the lower ball joint from the lower control arm.
13. Remove front bolt.
14. Remove rear bolt.
15. Remove lower control arm.
16. Remove torsion bar arm bolt.
17. Remove lower ball joint bolt.
18. Remove front bushing by using remover J–36833.

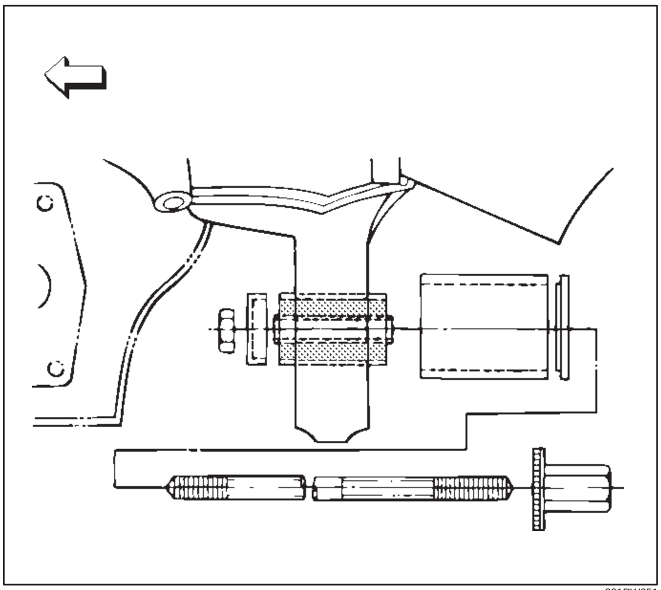


901RW154

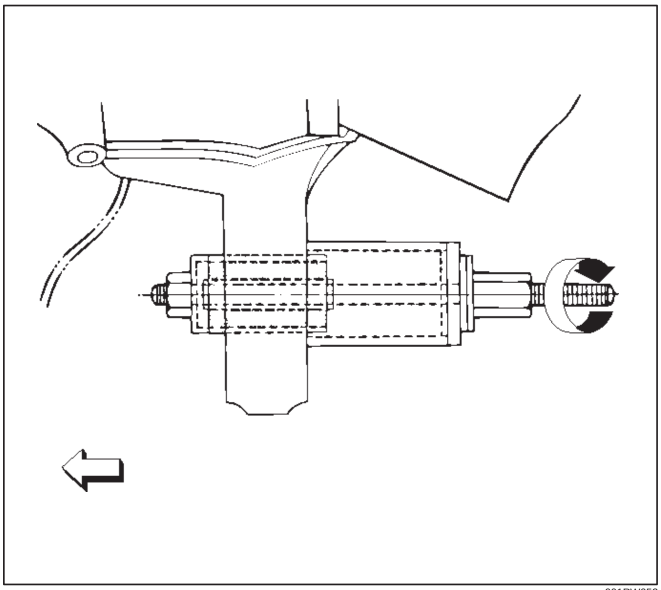


901RW155

19. Remove rear bushing by using remover J–36834.



901RW051



901RW052

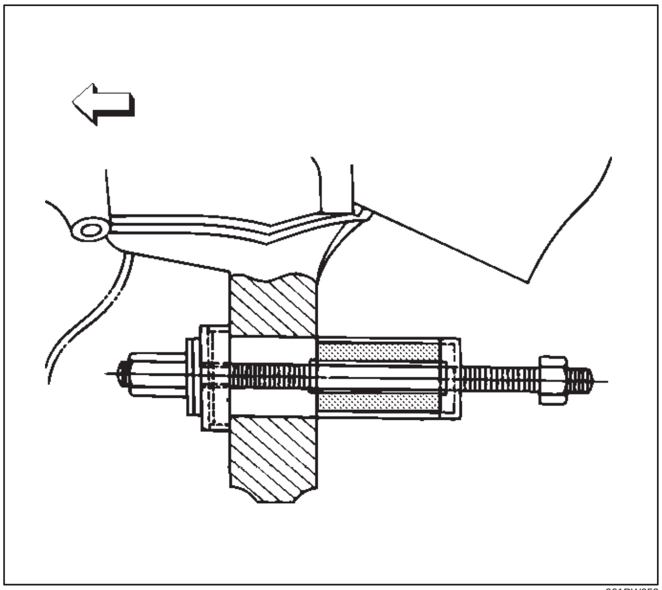
Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- Lower control arm
- Bushing

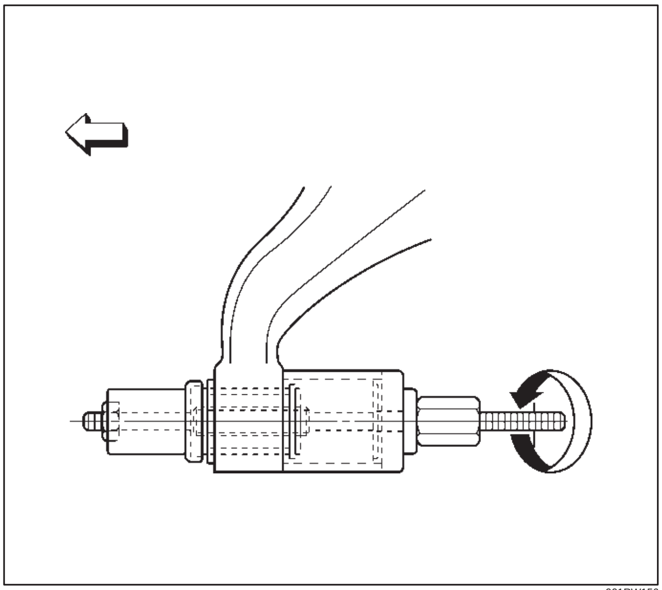
Installation

1. Install rear bushing by using installer J–36834.



901RW053

2. Install front bushing by using installer J–36833.



901RW156

3. Install lower ball joint bolt.
4. Install torsion bar arm bolt.
5. Install lower control arm.
6. Install rear bolt.
7. Install front bolt.
8. Install lower ball joint and tighten it to the specified torque.

   Torque: 116 N·m (85 lb ft)

9. Install shock absorber and tighten it to the specified torque.

   Torque: 93 N·m (69 lb ft)

10. Install stabilizer link and tighten it to the specified torque.

    Torque: 50 N·m (37 lb ft)

11. Install torsion bar arm bracket and tighten it to the specified torque.

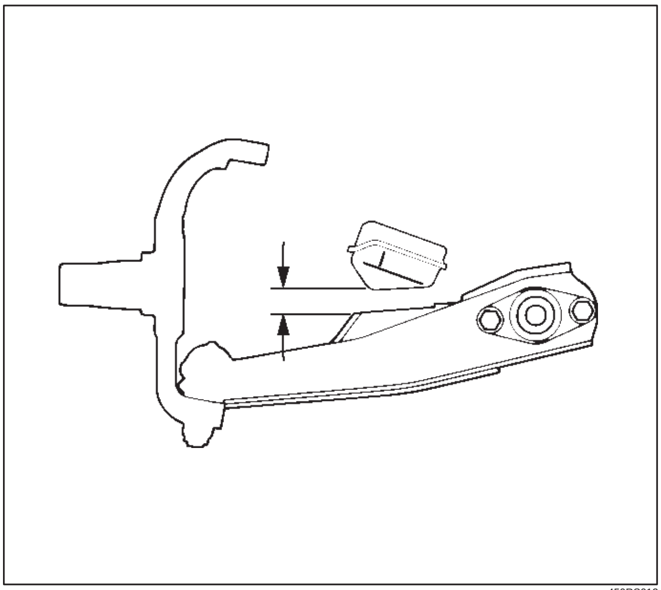
    Torque: 116 N·m (85 lb ft)

12. Install Torsion bar, refer to Torsion Bar in this section.
13. Install rear nut and tighten lower link nut finger–tight.

NOTE: Torque lower control arm nut after adjusting buffer clearance.

Buffer clearance: 22 mm (0.87 in)

Torque: 235 N·m (174 lb ft)



450RS012

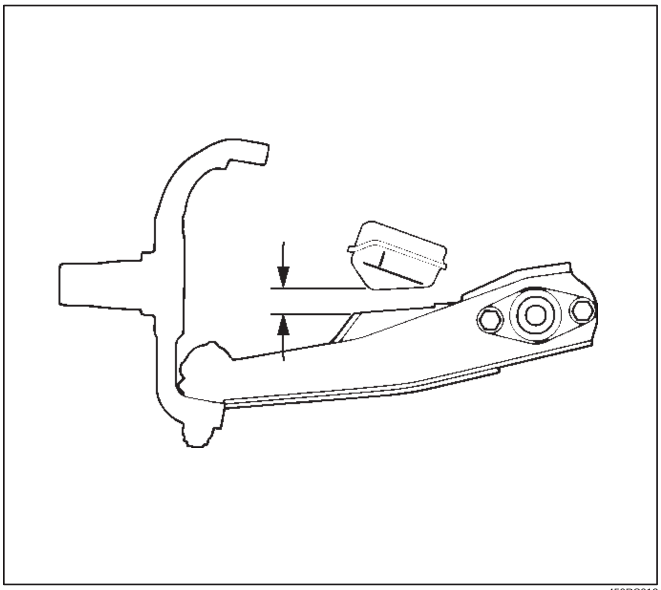
14. Install front nut then tighten lower link nut finger-tight.

NOTE: Torque lower control arm nut after adjusting buffer clearance .

Buffer clearance: 22 mm (0.87 in)

Torque: 190 N·m (140 lb ft)

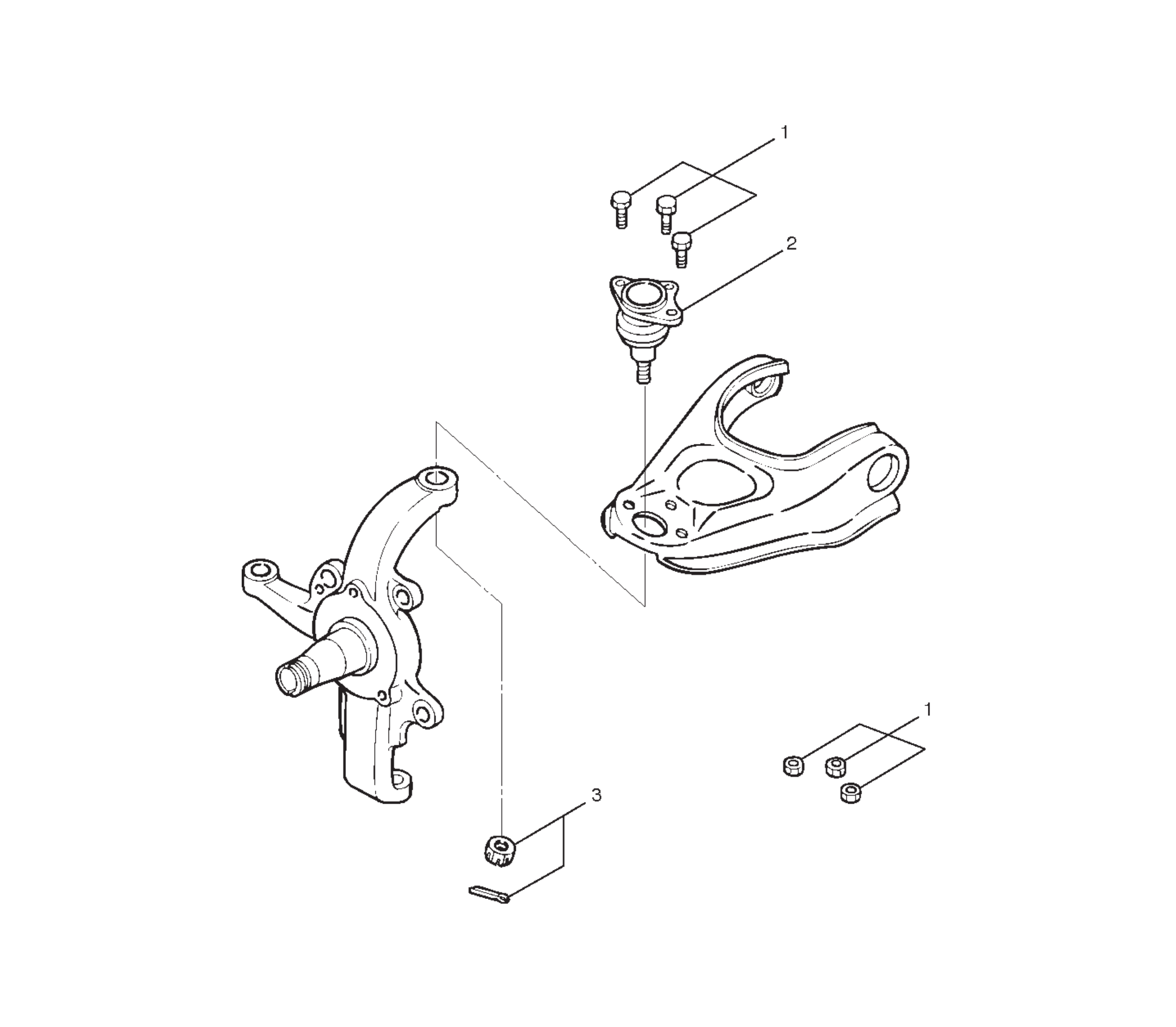
NOTE: Adjust the trim height. Refer to Front End Alignment Inspection and Adjustment in Steering section.



450RS012

Upper Ball Joint

Upper Ball Joint and Associated Parts



Legend

(1) Bolt and Nut

(2) Upper Ball Joint

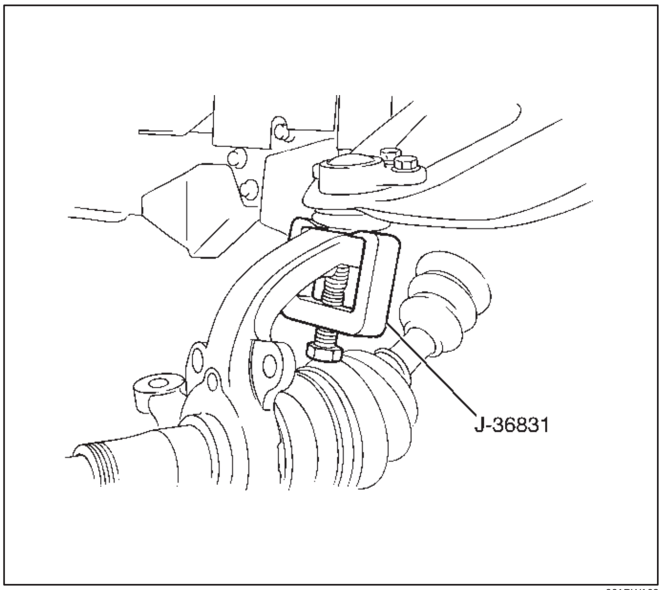
(3) Nut and Cotter Pin

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove the speed sensor from the knuckle.

3. Remove upper ball joint nut and cotter pin, then use remover J–36831 to remove the upper ball joint from the knuckle.

CAUTION: Be careful not to damage the ball joint boot.



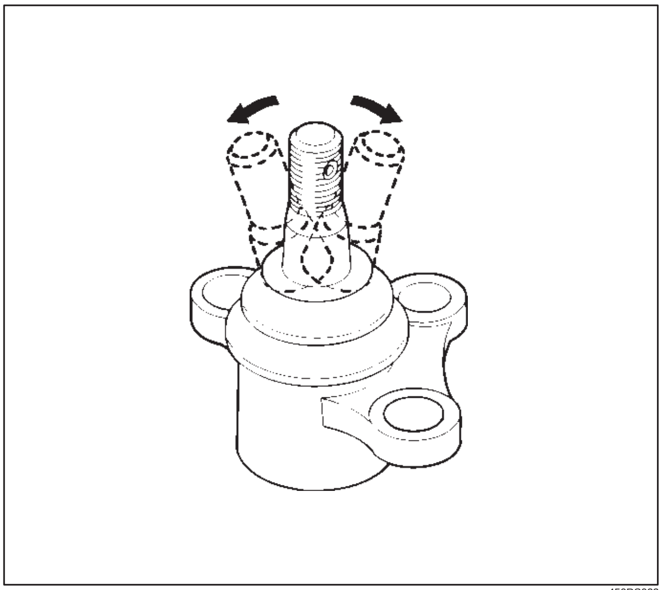
901RW162

4. Remove bolt and nut.
5. Remove upper ball joint.

Inspection and Repair

Make necessary parts replacement if wear, damage, corrosion or any other abnormal conditions are found through inspection.

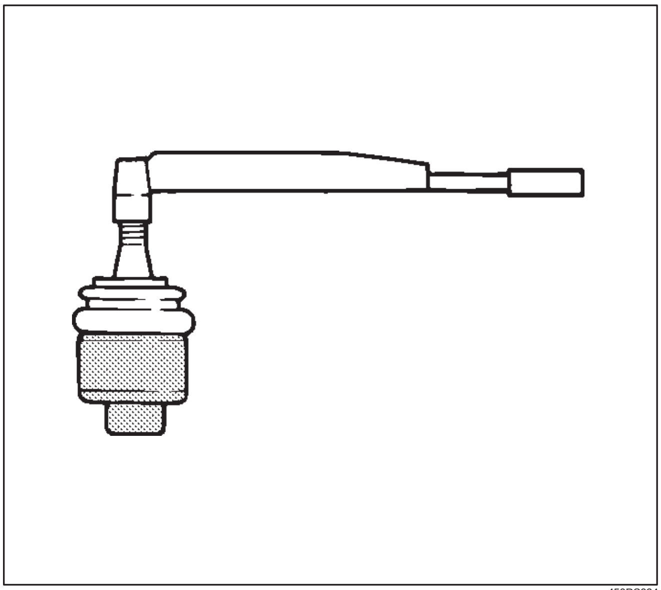
- Inspect the lower end boot for damage or grease leak. Move the ball joint as shown in the figure to confirm its normal movement.
- Inspect screw/taper area of ball for damage.
- If any defects are found by the above inspections, replace the ball joint assembly with new one.



450RS023

- After moving the ball joint 4 or 5 times, attach nut then measure the preload.

Starting torque: 0.5 –3.2 N·m (0.4–2.4 lb ft)



450RS024

If the above limits specified are exceeded, replace the ball joint assembly.

Installation

1. Install upper ball joint.
2. Install bolt and nut, then tighten them to the specified torque.

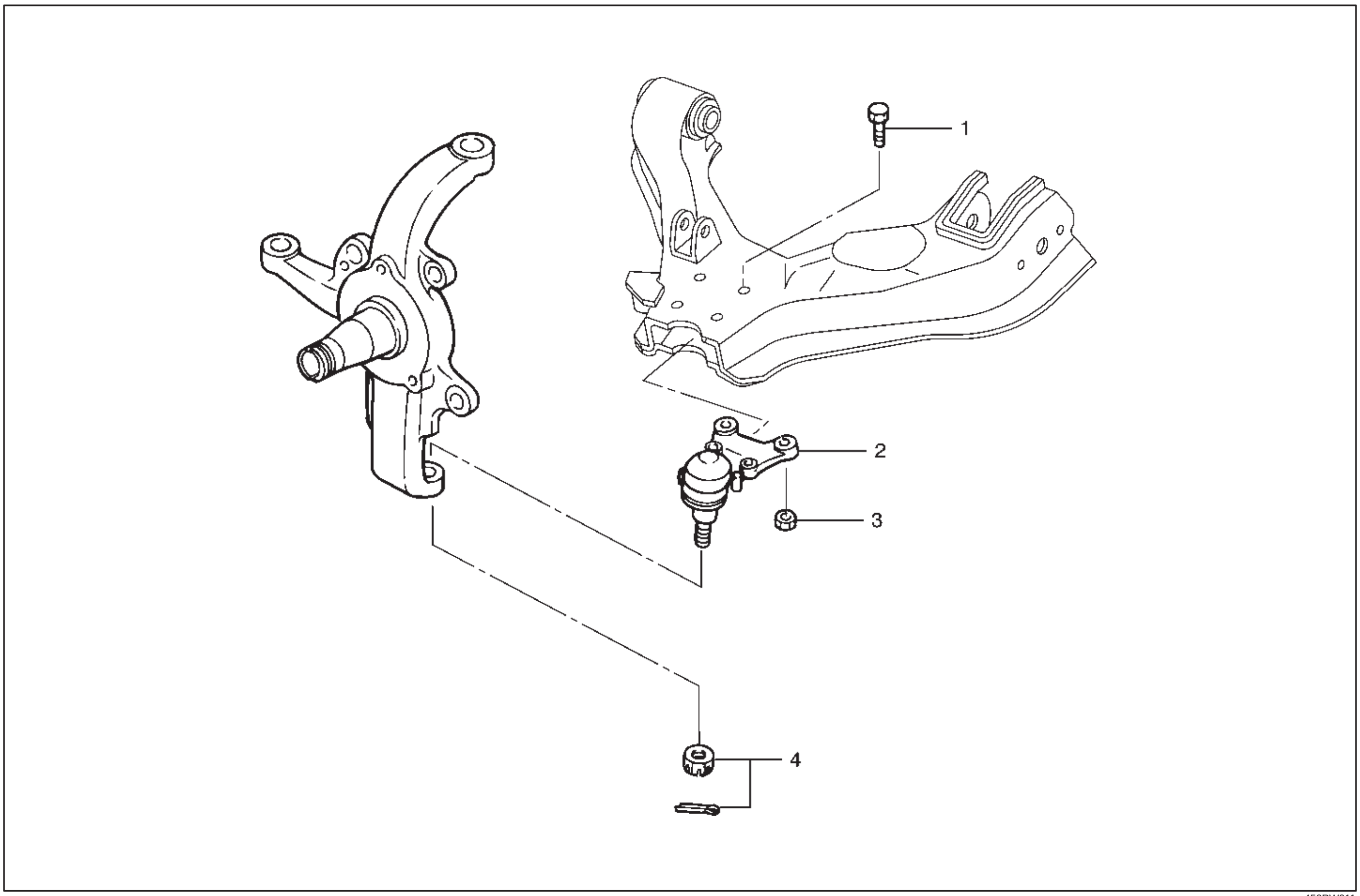
Torque: 57 N·m (42 lb ft)

3. Install nut and cotter pin, then tighten the nut to the specified torque with just enough additional torque to align cotter pin holes. Install new cotter pin.

TorqUA00 N·m (72 lb ft)

Lower Ball Joint

Lower Ball Joint and Associated Parts



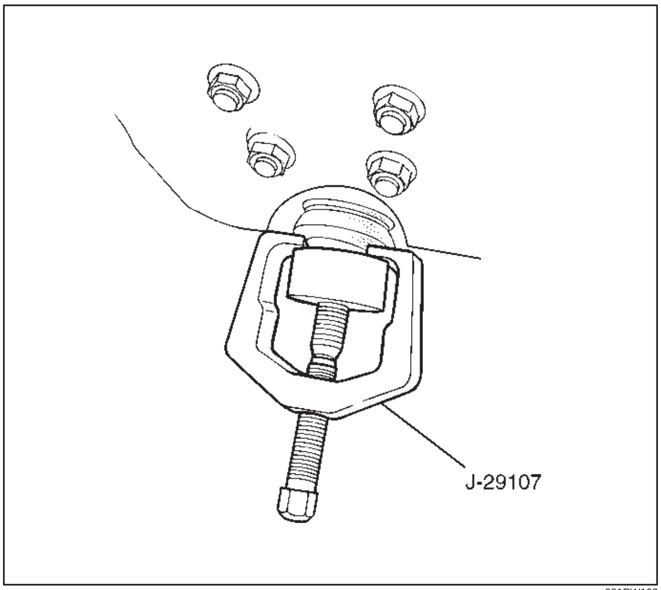
450RW011

Legend
(1) Bolt
(2) Lower Ball Joint
(3) Nut
(4) Nut and Cotter Pin

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel in this section.
3. Remove the tie-rod end from the knuckle. Refer to Power Steering Unit in Steering section.
4. Remove the retaining ring from the front axle driving shaft to release the shaft from hub(Except 2WD model). Refer to Front Hub and Disc in Driveline/Axle section.
5. Support lower control arm with a jack.
6. Remove lower ball joint nut and cotter pin, then use remover J–29107 to remove the lower ball joint from the knuckle.

CAUTION: Be careful not to damage the ball joint boot.



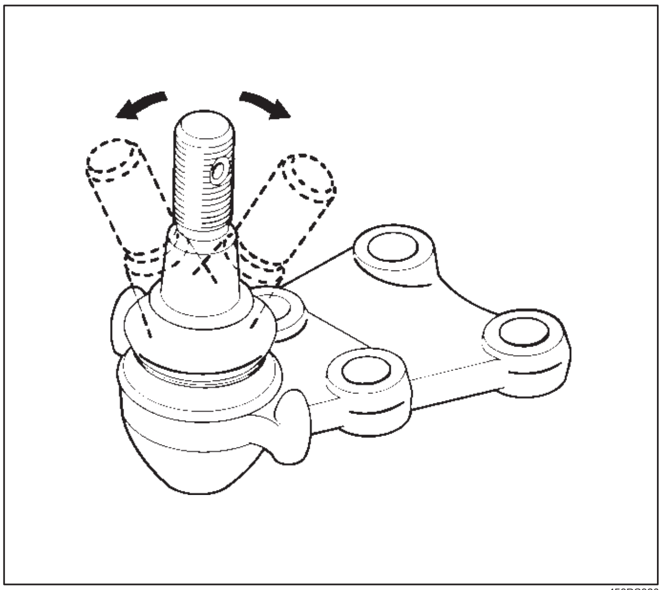
901RW163

7. Remove nut.
8. Remove bolt.
9. Remove lower ball joint.

Inspection and Repair

Make necessary parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

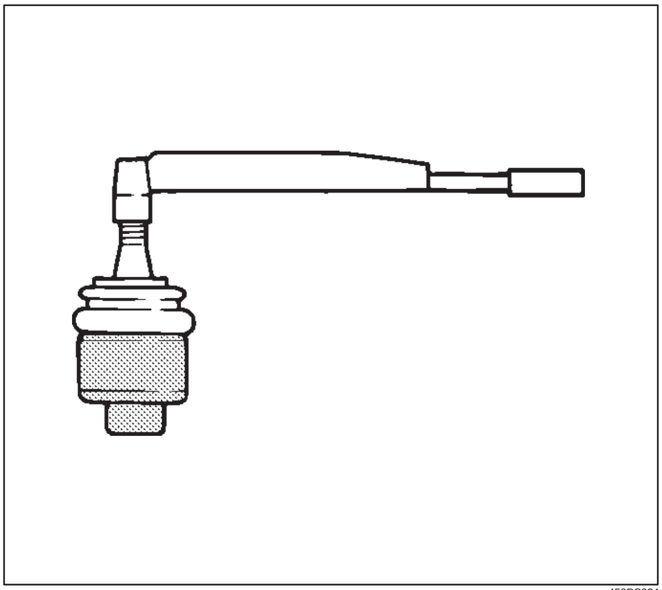
- Inspect the lower end boot for damage or grease leak. Move the ball joint as shown in the figure to confirm its normal movement .
- Inspect screw/taper area of ball for damage.
- If any defects are found by the above inspections, replace the ball joint assembly with new one.



450RS026

- After moving the ball joint 4 or 5 times, attach nut the measure the preload.

Starting torque: 0.5–6.4 N·m (0.4–4.7 lb ft)



450RS024

- If the above limits specified are exceeded, replace the ball joint assembly.

Installation

1. Install lower ball joint.
2. Install bolt.
3. Install nut and tighten it to the specified torque.

Torque: 116 N·m (85 lb ft)

4. Install ball joint nut, then tighten it to the specified torque with just enough additional torque to align cotter pin holes. Install new cotter pin.

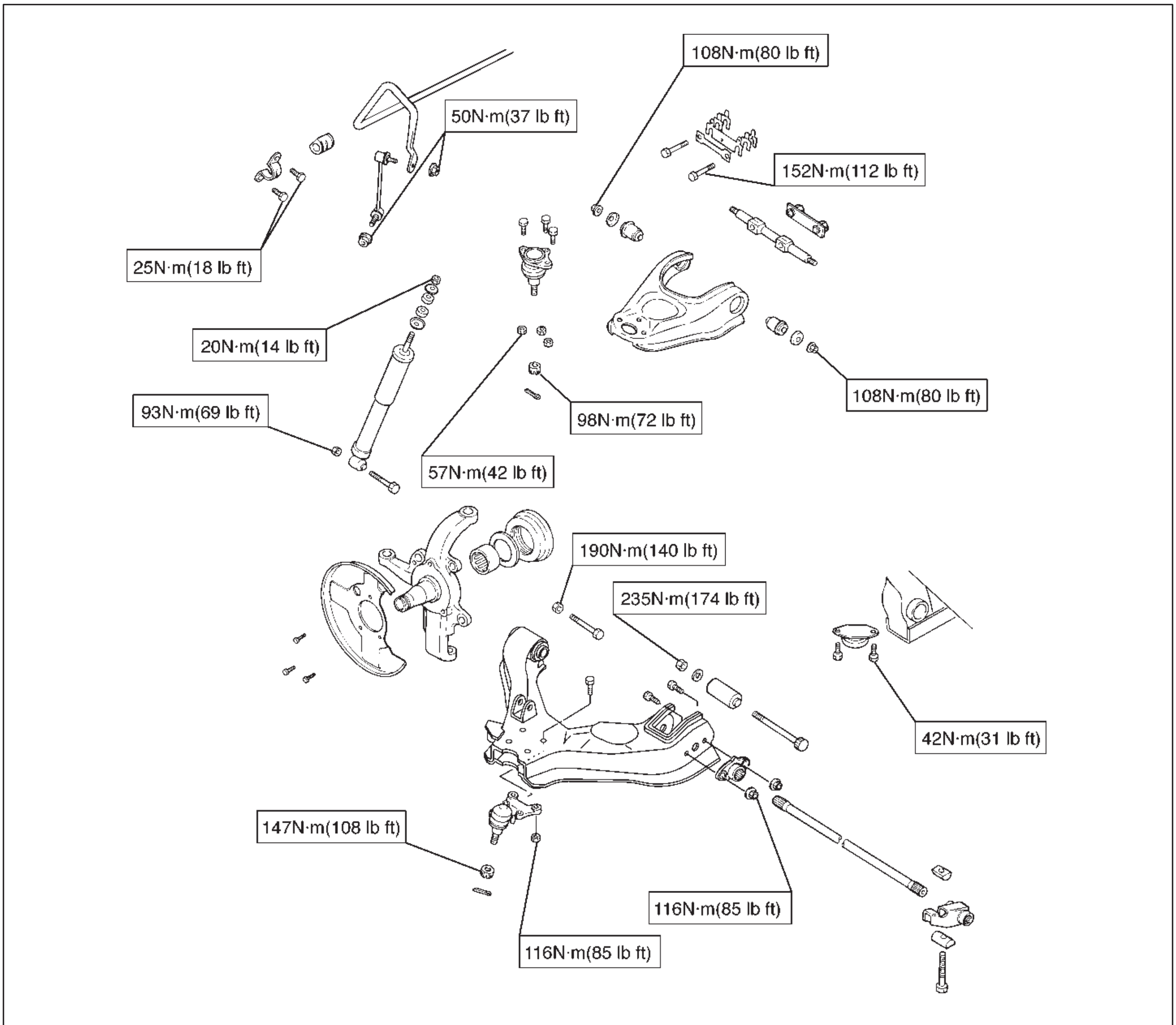
Torque: 147 N·m (108 lb ft)

Main Data and Specifications

General Specifications

Front suspension	Type	Independent wishbone arms, torsion bar spring with stabilizer bar.
Torsion bar spring	Length	1142 mm (45.0 in)
	Diameter	27.0 mm (1.06 in)
Front shock absorber	Type	Hydraulic, double acting, telescopic
	Piston diameter	30.0 mm (1.18 in)
	Stroke	125.0 mm (4.92 in)
	Compressed length	255.0 mm (10.04 in)
	Extended length	380.0 mm (14.96 in)
Stabilizer bar	Diameter	25.0 mm (0.98 in)

Torque Specifications



E03RX001

Special Tools

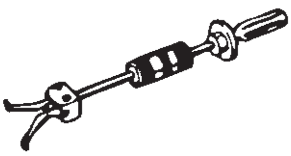
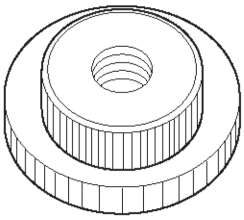
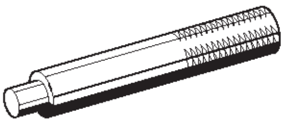
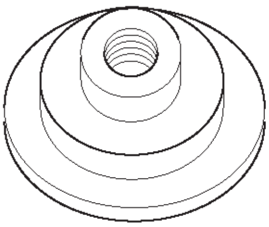
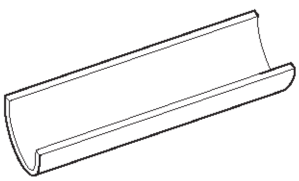
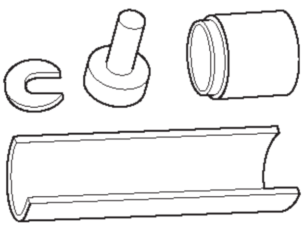
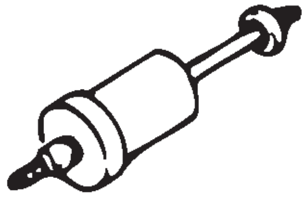
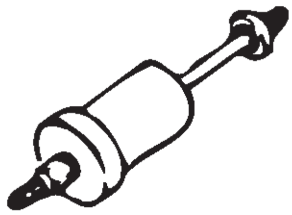
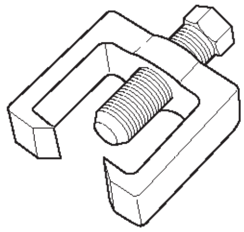
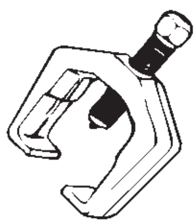
ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS283	**J–23907** Remover;Needle bearing
 901RS284	**J–36838** Installer; Needle bearing
 901RS285	**J–8092** Grip
 901RS162	**J–36837** Installer; Oil seal
 901RS286	**J–39376** Installer; Upper arm bushing
 901RS287	**J–29775** Remover and Installer Upper arm bushing

ILLUSTRATION	**TOOL NO.** TOOL NAME
 901RS288	**J–36833** Remover and Installer kit; Lower arm front bushing
 901RS289	**J–36834** Remover and Installer kit; Lower arm rear bushing
 901RS290	**J–36831** Ball joint remover
 901RS279	**J–29107** Tie-rod end remover

AMIGO

SUSPENSION

REAR SUSPENSION

CONTENTS

Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

The rear suspension is a 5-link, coil spring type suspension with a stabilizer bar, consisting of two trailing links, two upper links, lateral rod, shock absorber, and stabilizer. In this suspension, the links are specially arranged to enable the rear axle to move freely, thereby expanding suspension stroke, reducing friction, and improving lateral rigidity and roll control. All these result in improved stability, riding comfort, and rough road maneuverability.

Each link connects the axle housing with the frame through a runner bushing. The axle housing is supported by the trailing links and upper links longitudinally and by the lateral rod latitudinally.

Diagnosis

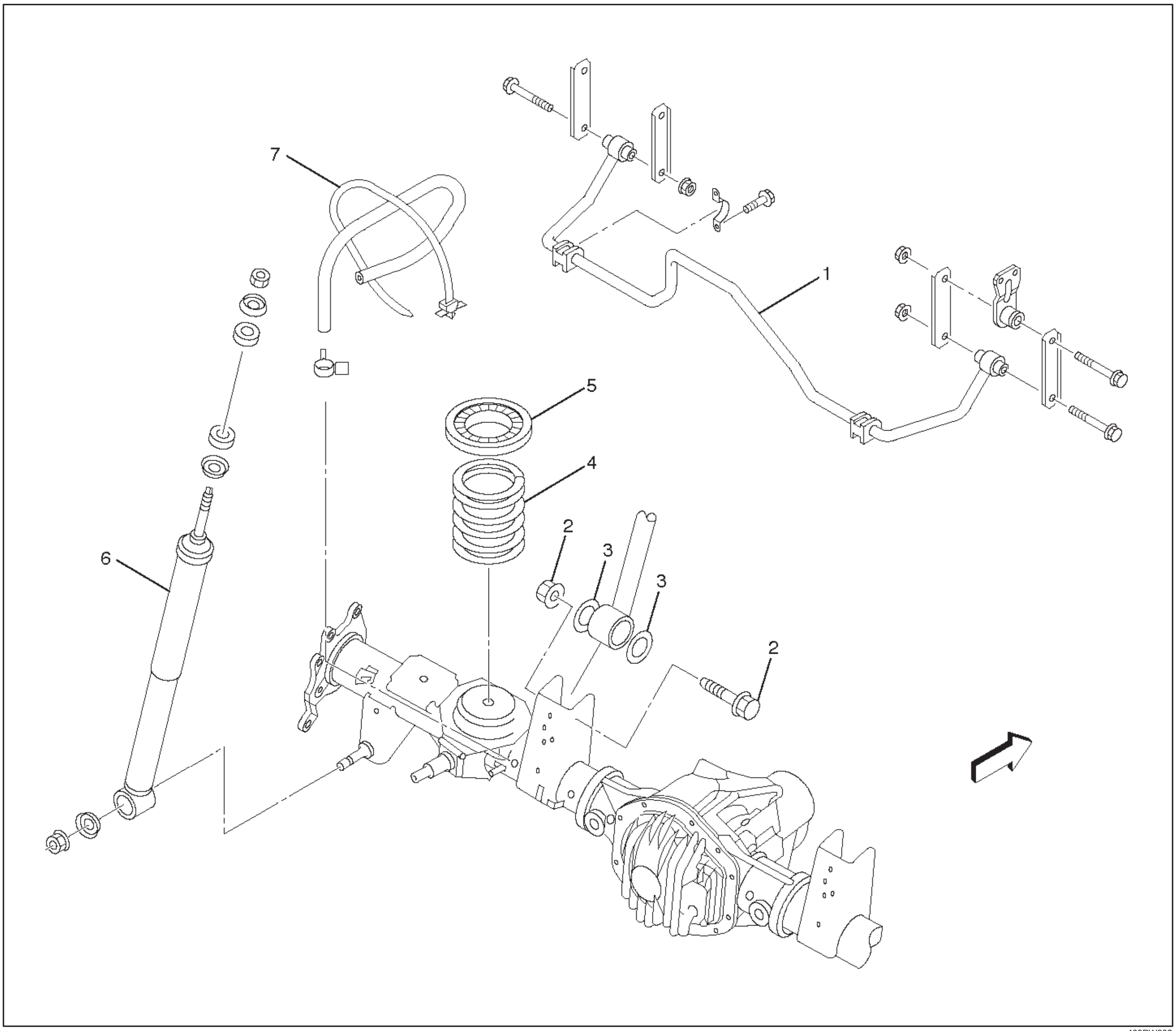
Condition	Possible cause	Correction
Vehicle Pulls	Mismatched or uneven tires.	Replace tire.
	Tires not adequately inflated.	Adjust tire pressure.
	Broken or sagging springs.	Replace spring.
	Radial tire lateral force.	Replace tire.
	Improper wheel alignment.	Adjust wheel alignment.
	Brake dragging in one wheel.	Repair brake.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension part(s).
	Faulty shock absorbers.	Replace shock absorber.
	Parts in power steering valve defective.	Replace power steering unit.
Abnormal or Excessive Tire Wear	Sagging or broken spring.	Replace spring.
	Tire out of balance.	Balance or replace tire.
	Improper wheel alignment.	Check front end alignment.
	Faulty shock absorber.	Replace shock absorber.
	Hard driving.	Replace tire.
	Overloaded vehicle.	Replace tire and reduce load.
	Tires not rotated periodically.	Replace or rotate tire.
	Worn or loose road wheel bearings.	Replace wheel bearing.
	Wobbly wheel or tires.	Replace wheel or tire.
	Tires not adequately inflated.	Adjust the pressure.
Wheel Hop	Blister or bump on tire.	Replace tire.
	Improper shock absorber operation.	Replace shock absorber.
Shimmy, Shake or Vibration	Tire or wheel out of balance.	Balance wheels or replace tire/or wheel.
	Loose wheel bearings.	Replace wheel bearing.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
	Excessive wheel runout.	Repair or replace wheel and/or tire.
	Blister or bump on tire.	Replace tire.
	Excessive loaded radial runout of tire/wheel assembly.	Replace tire or wheel.
	Improper wheel alignment.	Check wheel alignment.
	Loose or worn steering linkage.	Tighten or replace steering linkage.
	Loose steering unit.	Tighten steering unit.
	Tires not adequately inflated.	Adjust tire pressure.
	Loose, bent or broken front or rear suspension parts.	Tighten or replace the appropriate suspension parts.
	Faulty shock absorber.	Replace shock absorber.
	Hub bearing preload misadjustment.	Adjust preload.
	Parts in power steering valve defective.	Replace power steering unit.

Condition	Possible cause	Correction
Hard Steering	Bind in steering linkage ball studs, upper or lower ball joint.	Replace ball joint.
	Improper wheel alignment.	Check wheel alignment.
	Tire not adequately inflated.	Inflate tires to proper pressure.
	Bind in steering column or shaft.	Repair or replace.
	Improper power steering system operation.	Repair or replace. Refer to Steering section.
Too Much Play In Steering	Wheel bearings worn.	Replace wheel bearings.
	Loose steering unit or linkage.	Retighten or repair.
	Worn or loose steering shaft universal joint.	Retighten or replace steering shaft.
	Worn steering linkage ball joints.	Replace ball joints.
	Worn upper or lower end ball joints.	Replace ball joints.
Poor Steering Wheel Returnability	Bind in steering linkage ball joints.	Replace ball joints.
	Bind in upper or lower ball joints.	Replace ball joints.
	Bind in steering column and shaft.	Repair or replace.
	Bind in steering gear.	Check and repair steering gear.
	Improper wheel alignment.	Adjust wheel alignment.
	Tires not adequately inflated.	Adjust pressure.
	Loose steering wheel nut.	Retighten.
	Worn wheel bearing.	Replace.
Abnormal Noise	Worn, sticky or loose upper or lower ball joint, steering linkage ball joints or drive axle joints.	Replace.
	Faulty shock absorbers.	Replace.
	Worn upper or lower control arm bushing.	Replace.
	Loose stabilizer bar.	Retighten bolts or replace bushings.
	Loose wheel nuts.	Tighten nuts. Check for elongated wheel nut holes. Replace wheel if required.
	Loose suspension bolts or nuts.	Retighten suspension bolts or nuts.
	Broken or otherwise damaged wheel bearings.	Replace wheel bearing.
	Broken suspension springs.	Replace spring.
	Loose steering unit.	Retighten mounting bolt.
	Faulty steering unit.	Replace steering unit.
Wandering or Poor Steering Stability	Mismatched or unevenly worn tires.	Replace tire or inflate tires to proper pressure.
	Loose steering linkage ball joints.	Replace ball joints.
	Faulty shock absorbers.	Replace shock absorber.
	Loose stabilizer bar.	Tighten or replace stabilizer bar or bushings.
	Broken or sagging springs.	Replace spring (pairs).
	Improper wheel alignment.	Adjust wheel alignment.

Condition	Possible cause	Correction
Erratic Steering When Braking	Worn wheel bearings.	Replace wheel bearings.
	Broken or sagging springs.	Replace spring (pairs).
	Leaking caliper.	Repair or replace caliper.
	Warped discs.	Replace brake disc.
	Badly worn brake pads.	Replace brake pads.
	Tires are inflated unequally.	Inflate tires to proper pressure.
Low or Uneven Trim Height	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
	Incorrect springs.	Adjust or replace torsion bar.
Suspension Bottoms	Vehicle overloaded.	Reduce load.
	Faulty shock absorber.	Replace shock absorber.
	Incorrect, broken or sagging springs.	Replace springs.
Body Leans	Loose stabilizer bar.	Tighten stabilizer bar bolts or replace bushings.
	Faulty shock absorber, struts or mounting.	Replace shock absorber.
	Broken or sagging springs.	Replace springs (In pairs).
	Vehicle overloaded.	Reduce load.
Cupped Tires	Worn wheel bearings.	Replace wheel bearing.
	Excessive tire or wheel run out.	Replace tire or wheel.
	Worn ball joints.	Replace ball joints.
	Tire out of balance.	Adjust tire balance.

Coil Spring

Coil Spring and Associated Parts



Legend

(1) Stabilizer Bar
(2) Upper Link Fixing Bolt and Nut
(3) Rubber Plate
(4) Coil Spring
(5) Insulator
(6) Shock Absorbar
(7) Breather Hose

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Support the rear axle case with a jack.
3. Disconnect brake hose at the crossmember.
4. Remove breather hose.
5. Remove upper link fixing bolt, nut and rubber plate on the rear axle case (left-side only).
6. Disconnect the stabilizer bar at the stabilizer link.
7. Remove the shock absorber from the axle case.
8. Remove spring insulator.
9. Remove the insulator and coil spring while lowering the rear axle case.

CAUTION: Be sure not to let the brake hose, parking brake cable, and breather hose extend to their full length.

Inspection and Repair

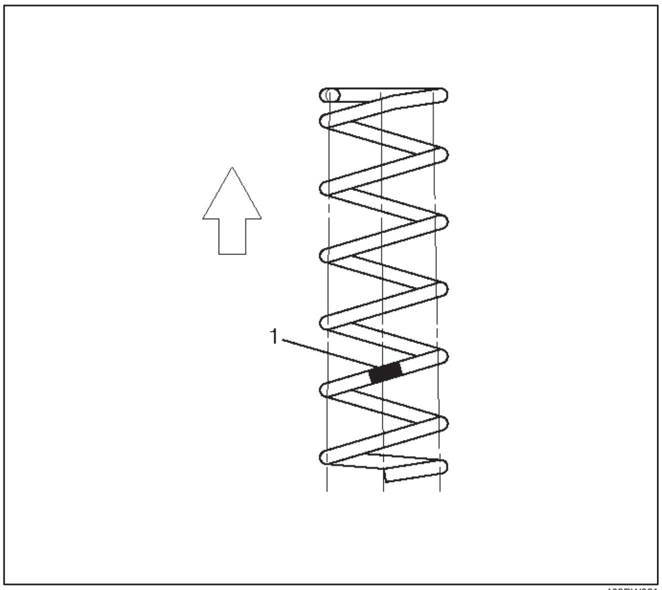
Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

Check the following parts:

- Coil spring
- Insulator

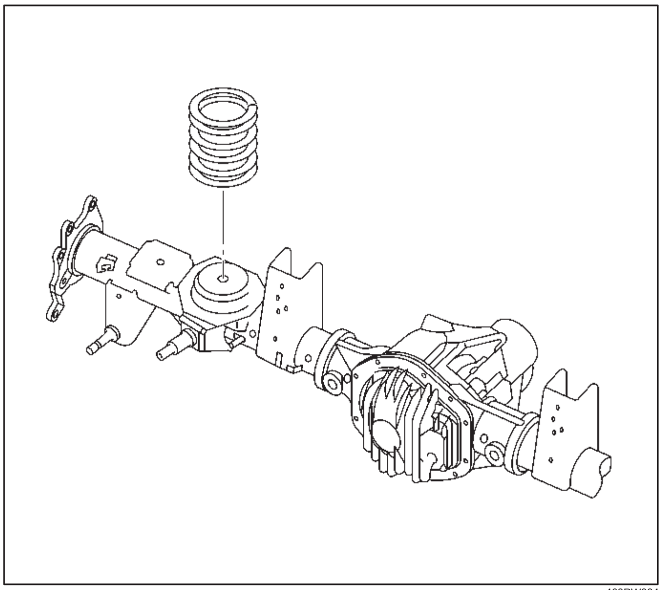
Installation

1. Install coil spring and make sure that the coil spring is installed in the proper position. Paint mark(1) should be downward.



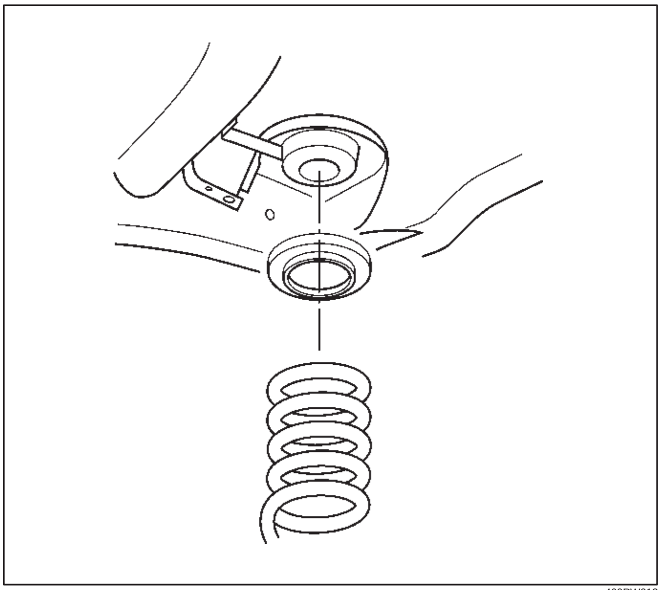
460RW001

2. Fit the end of the coil spring to the coil spring seat and mount the coil spring on the rear axle case.



460RW004

3. Install the insulator on the coil spring. Jack up the axle case gently with the top of the coil spring set to the spring seat on the frame side.



460RW013

4. Install shock absorber and tighten the nut lightly, then retighten it to the specified torque after the vehicle is at curb height.

NOTE: When mounting shock absorber, be sure not to use grease on bushings or any other nearby part.

Torque: 78 N·m (58 lb ft)

5. Install stabilizer bar.

Torque: 31 N·m (23 lb ft)

6. Install upper link with rubber plate and tighten fixing bolt.

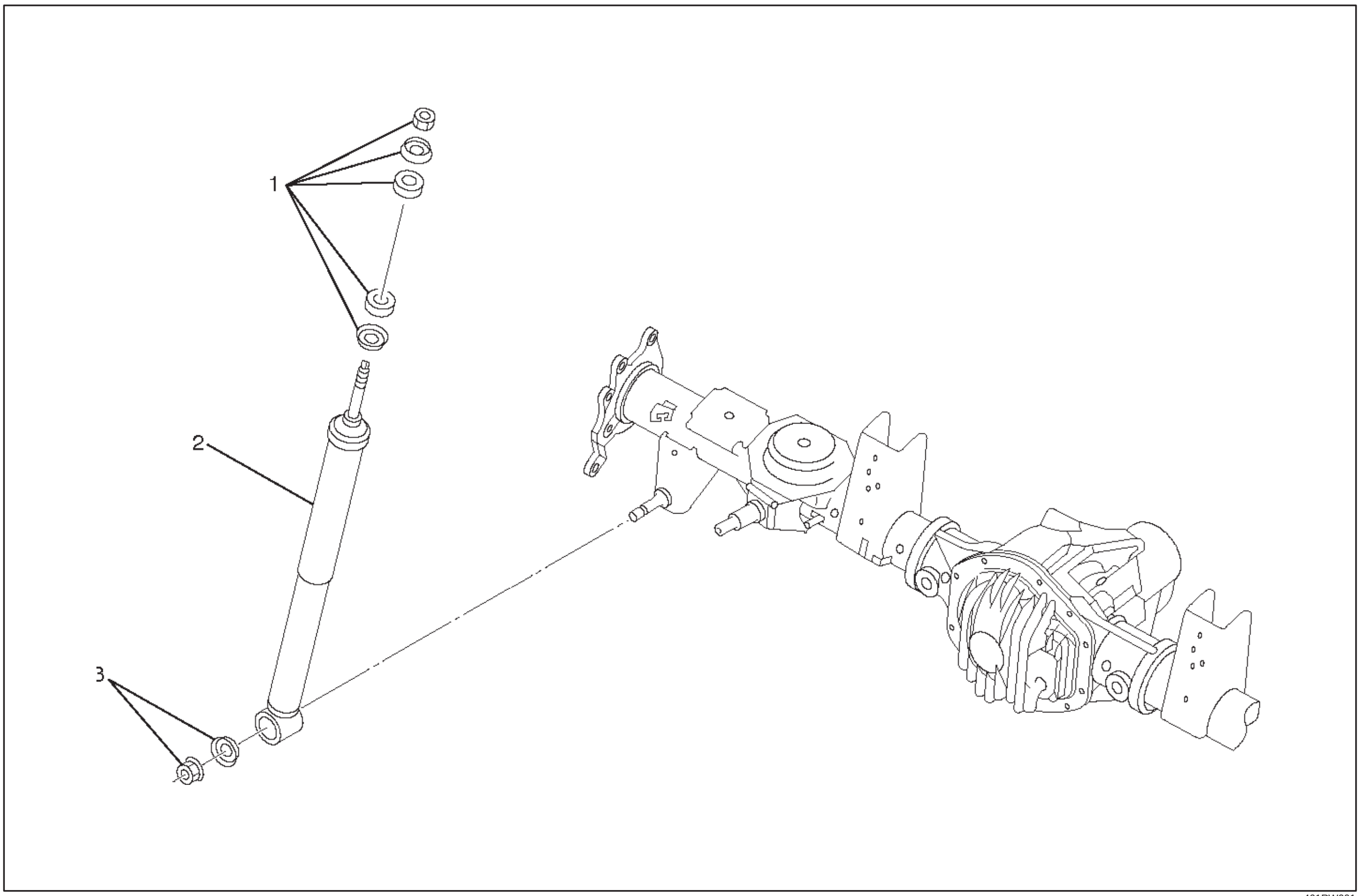
Torque: 137 N·m (101 lb ft)

7. Install breather hose.
8. Connect brake hose and bleed the brake system.

   Refer to Bleeding the Brake Hydraulic System in Brake section.

Shock Absorber

Shock Absorber and Associated Parts



Legend
(1) Nut, Bush and Washer
(2) Shock Absorber
(3) Nut and Washer

Removal

1. Remove shock absorber fixing nut, bush and washer (upper side).
2. Remove shock absorber fixing nut and washer (lower side).
3. Remove shock absorber.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- Shock absorber
- Rubber bushing

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

Installation

1. Install shock absorber. When mounting shock absorber, be sure not to use grease on bushings or any other nearby part.
2. Install nut and washer (lower side), then tighten the nut lightly. Retighten to the bolt and nut specified torque after the vehicle is at curb height.

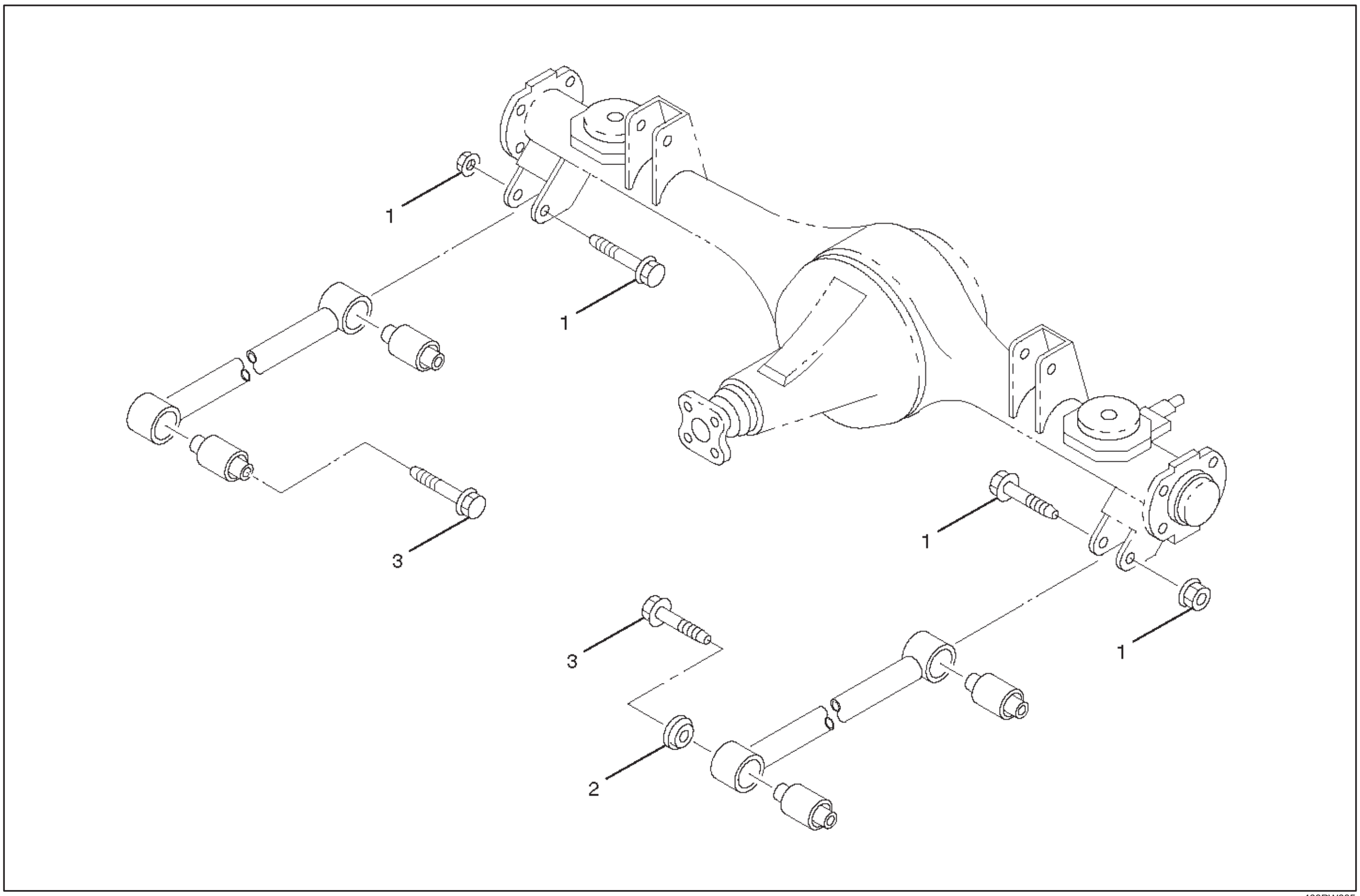
Torque: 78 N·m (58 lb ft)

3. Install nut, bush and washer (upper side), then tighten the nut lightly. Retighten to the nut specified torque after the vehicle is at curb height.

Torque: 20 N·m (14 lb ft)

Trailing Link

Trailing Link and Associated Parts



460RW005

Legend
(1) Bolt and Nut (Axle side)
(2) Protector (Left side only)
(3) Bolt (Frame side)

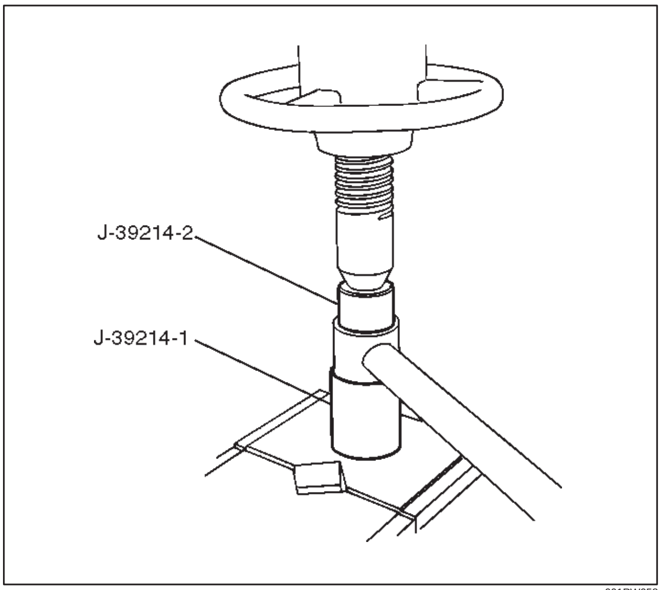
Removal

1. Remove the parking brake cable from the trailing link.
2. Remove the trailing link fixing bolt, nut and protector.
3. Remove trailing link.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

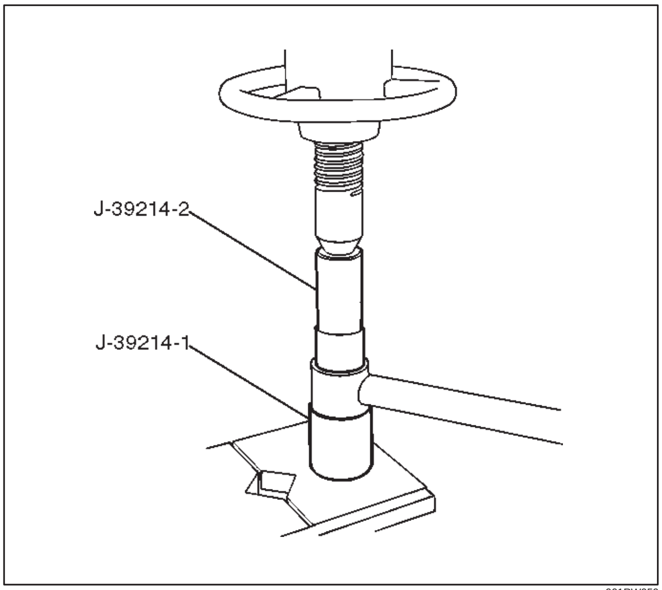
1. Trailing link
2. Rubber bushing
   - Remove the rubber bushing by using remover J–39214.



901RW058

- Install the rubber bushing by using installer J–39214.

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

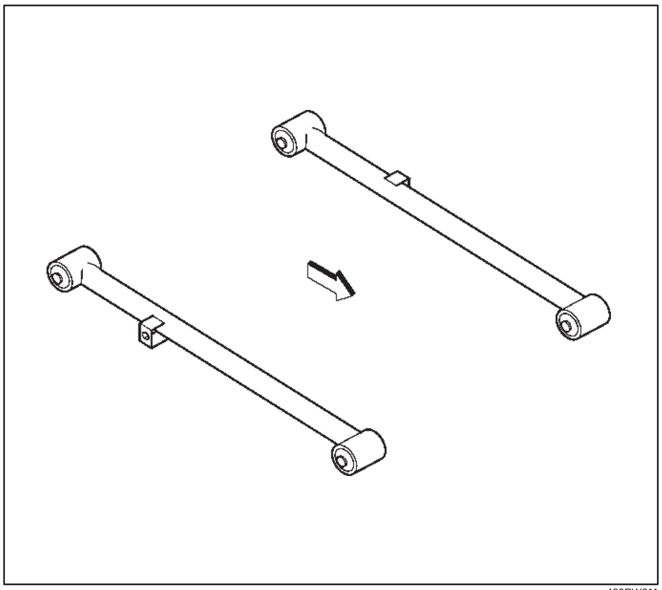


901RW059

Installation

1. Install trailing link. Make sure that the trailing link is in its correct position.

NOTE: When mounting trailing link, be sure not to use grease on bushings or any other nearby part.


460RW011

2. Install bolt, nut and protector. Tighten the bolts and nuts lightly, then retighten them to the specified torque after the vehicle is at curb height.

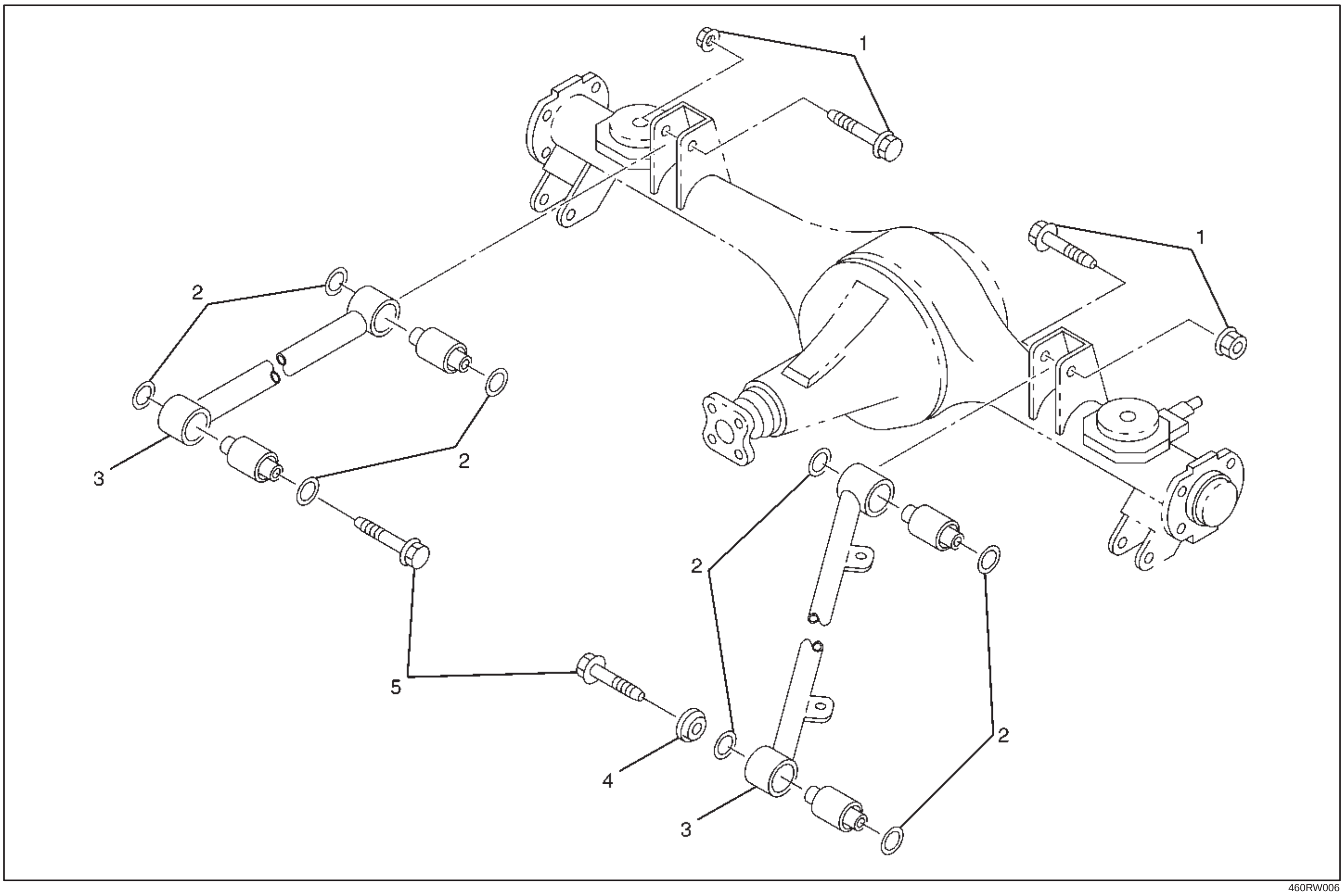
Torque: 137 N·m (101 lb ft)

3. Install parking brake cable.

CAUTION: The parking brake cable should not be overstrained or slackened.

Upper Link

Upper Link and Associated Parts



Legend

(1) Bolt and Nut (Axle side)
(2) Rubber Plate
(3) Upper Link
(4) Protector (Left side only)
(5) Bolt (Frame side)

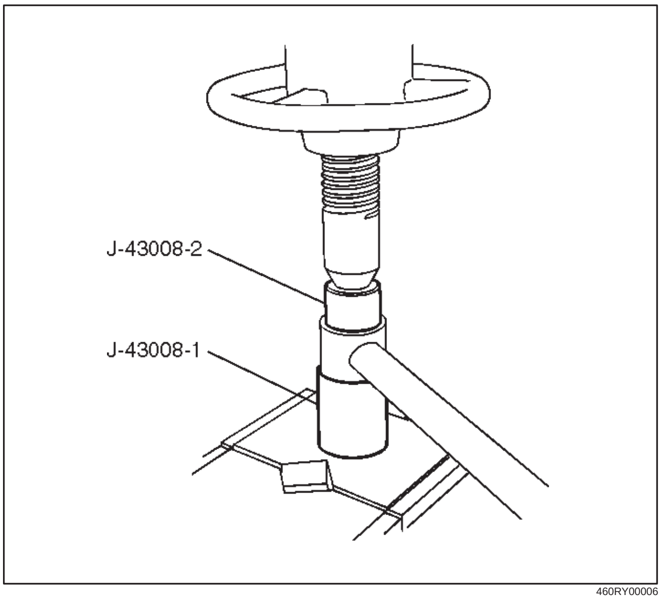
Removal

1. Remove fuel tank. Refer to Engine Fuel in Engine section.
2. Remove the speed sensor cable from the upper link.
3. Remove bolt, nut, rubber plate and protector.
4. Remove upper link.

Inspection and Repair

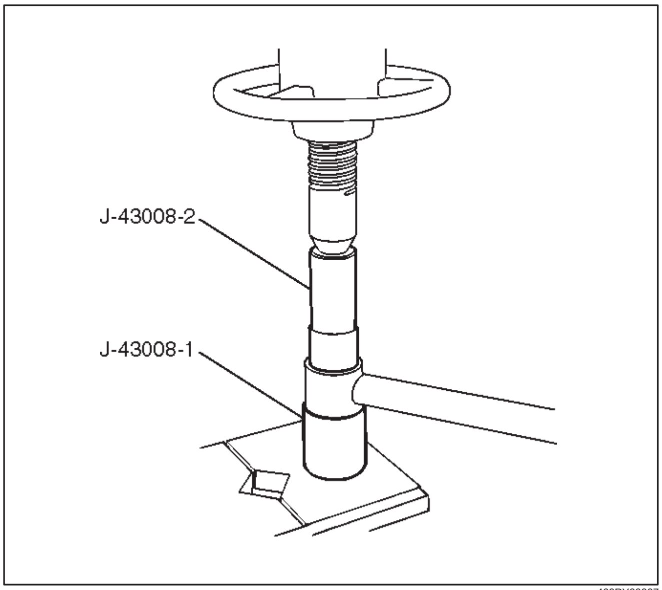
Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

1. Upper link
2. Rubber bushing
   - Remove the rubber bushing by using remover J–43008.



- Install the rubber bushing by using to installer J–43008.

NOTE: When mounting rubber bushings, be sure not to use grease on bushings or any other nearby part.

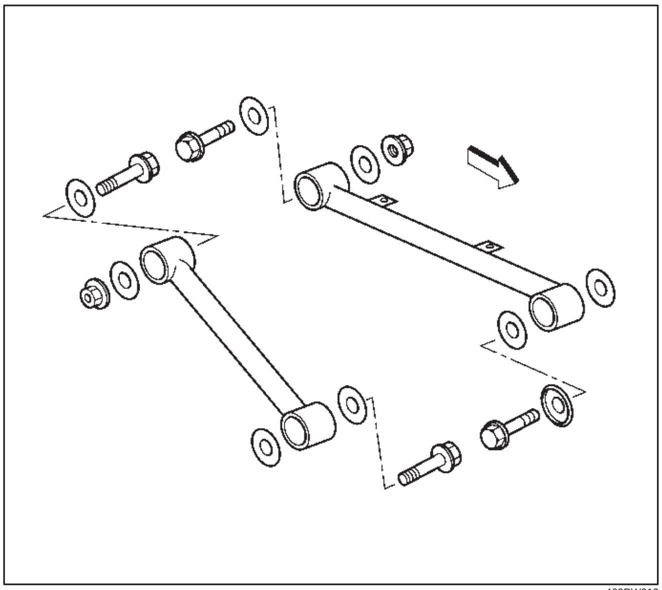


460RY00007

Installation

1. Install upper link. Make sure that the upper link is in its correct position.

NOTE: When mounting upper link, be sure not to use grease bushings or any other nearby part.



460RW012

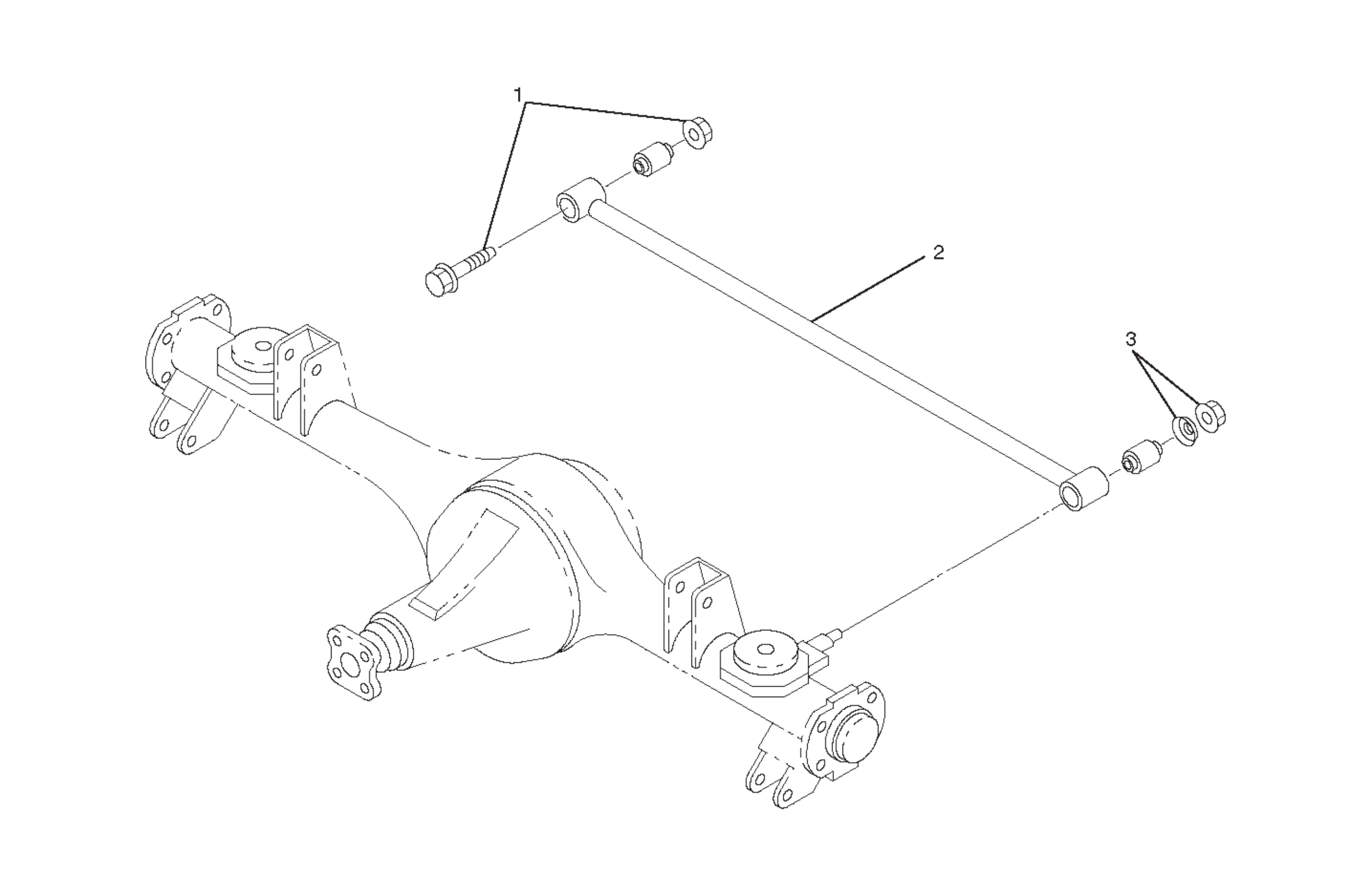
2. Install bolt, nut, rubber plate and protector. Tighten the bolts and nuts lightly, then retighten them to the specified torque after the vehicle is at curb height.

   Torque: 137 N·m (101 lb ft)

3. Install speed sensor cable.
4. Install fuel tank.

Lateral Rod

Lateral Rod and Associated Parts



460RW007

Legend

(1) Bolt and Nut (Frame side)
(2) Lateral Rod
(3) Nut and Washer (Axle side)

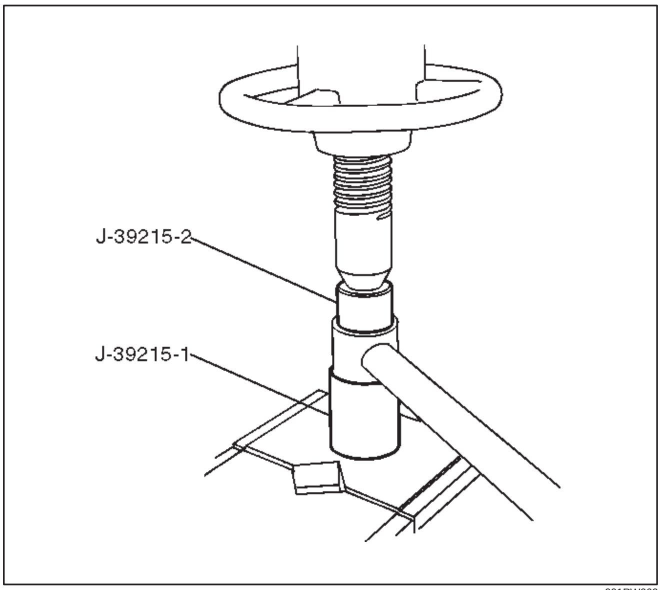
Removal

1. Remove nut and washer.
2. Remove bolt and nut.
3. Remove lateral rod.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.

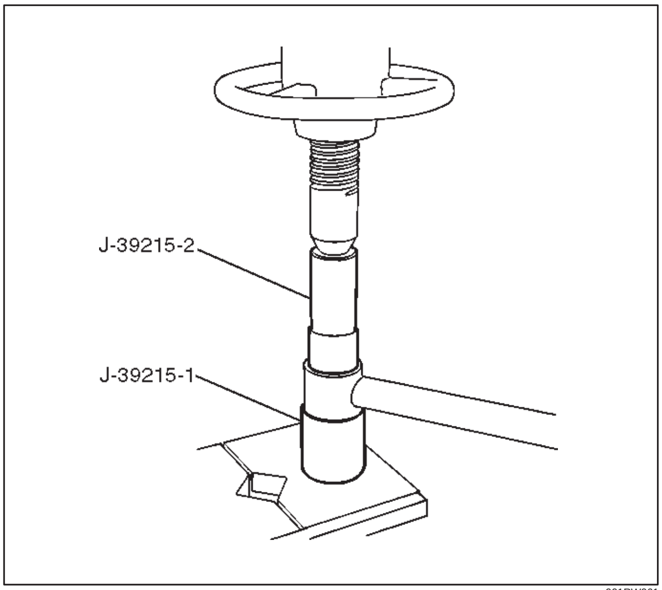
1. Lateral rod
2. Rubber bushing (Frame side)
   - Remove the rubber bushing (Frame side) by using remover J–39214.



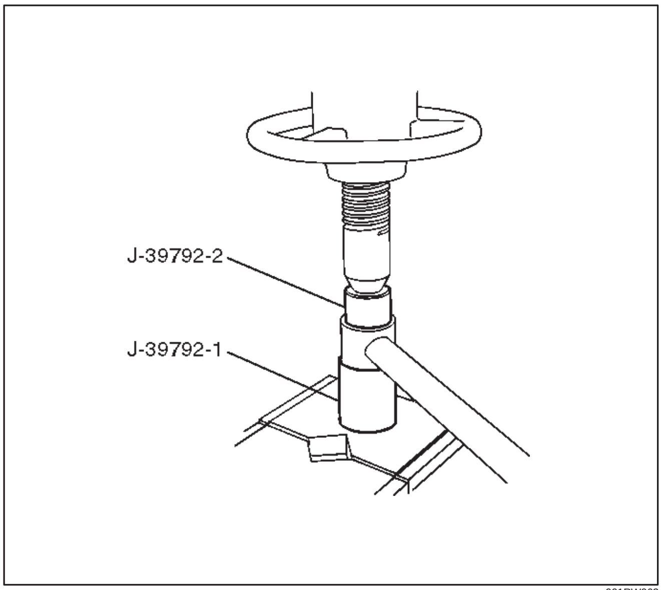
901RW060

- Install the rubber bushing (Frame side) by using Installer J–39215.

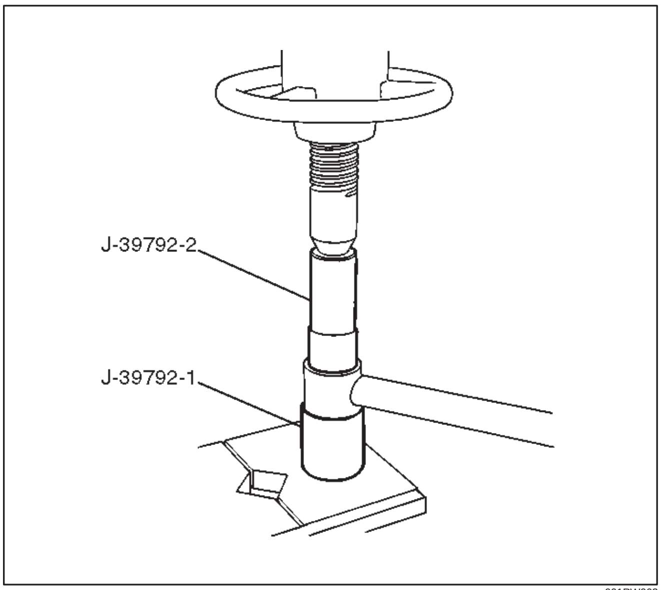
NOTE: When mounting rubber bushings, do not use grease on bushings or any other nearby parts.



3. Rubber bushing (Axle side)
   - Remove the rubber bushing (Axle side) by using remover J–39792.



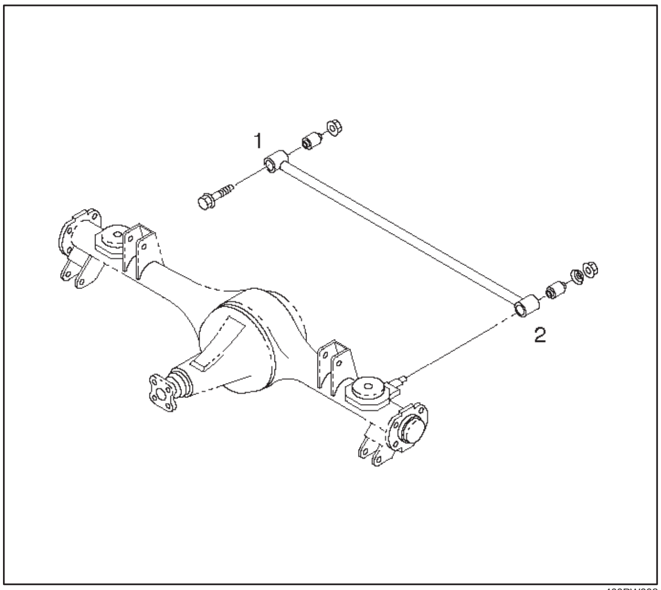
- Install the rubber bushing (Axle side) by using installer J–39792.



Installation

1. Install lateral rod and make sure that the lateral rod is in its correct position.

NOTE: When mounting lateral rod, be sure not to use grease on bushings or any other nearby part.



Legend

(1) Frame Side
(2) Axle Side

2. Install bolt and nut. Tighten the bolt and nut lightly, then retighten them to the specified torque after the vehicle is at curb height.

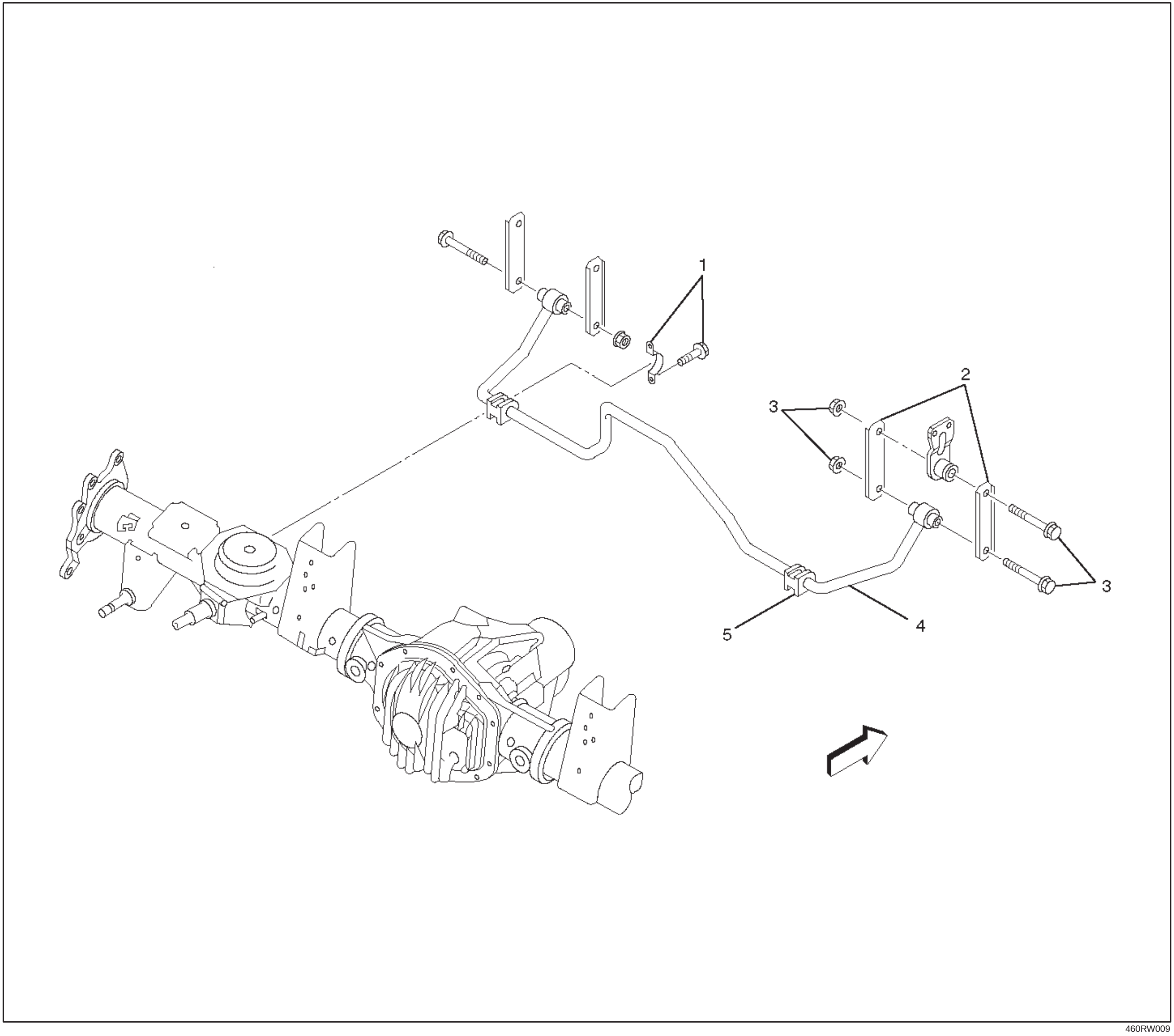
Torque: 137 N·m (101 lb ft)

3. Install nut and washer. Tighten the nut lightly, then retighten the nut to the specified torque after the vehicle is at curb height.

Torque: 78 N·m (58 lb ft)

Stabilizer Bar

Stabilizer Bar and Associated Parts



Legend

(1) Bracket
(2) Link
(3) Bolt and Nut
(4) Stabilizer Bar
(5) Rubber Bushing

Removal

1. Raise the vehicle and support the frame with suitable safety stands.
2. Remove wheel and tire assembly. Refer to Wheel in this section.
3. Remove bolt and nut.
4. Remove link.

CAUTION: Be careful not to damage the ball joint boot.

5. Remove bracket.
6. Remove rubber bushing.

Inspection and Repair

Make necessary correction or parts replacement if wear, damage, corrosion or any other abnormal condition are found through inspection.
Check the following parts:

- Stabilizer bar
- Rubber bushing
- Link

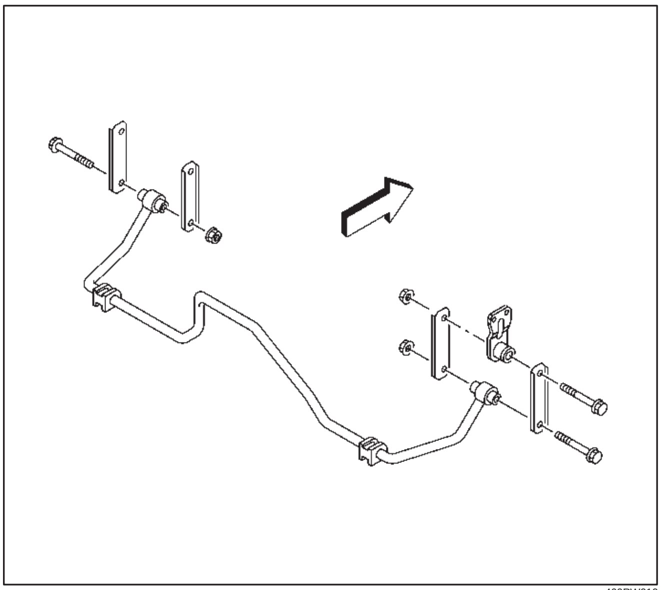
Installation

1. Install rubber bushing.
2. Install bracket to axle housing and tighten to the specified torque.

Torque: 25 N·m (19 lb ft)

3. Install link.
4. Install bolt and nut, then tighten the nut to the specified torque.

Torque: 31 N·m (27 lb ft)



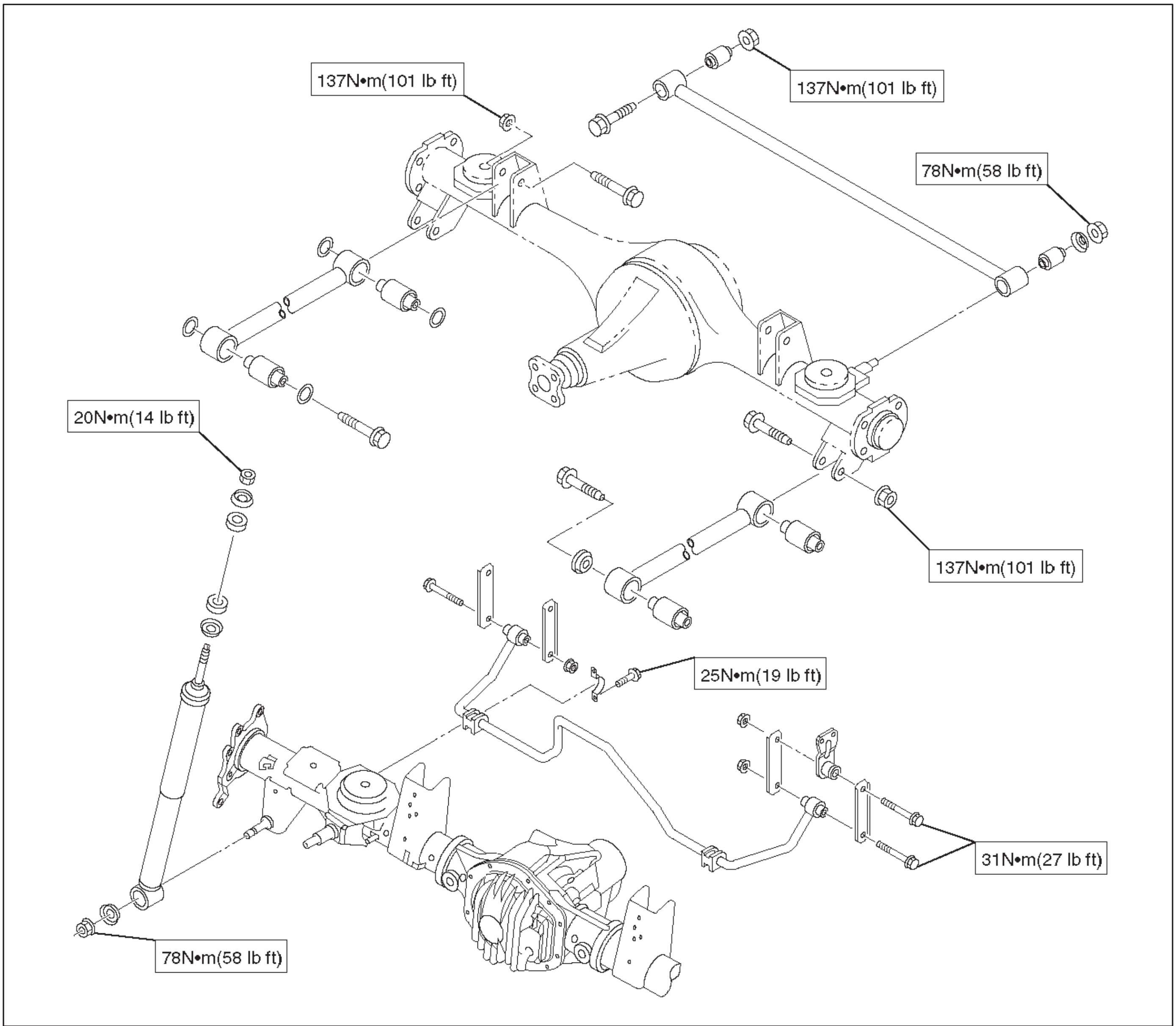
460RW010

Main Data and Specifications

General Specifications

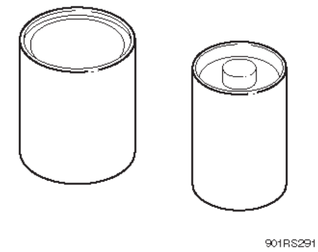
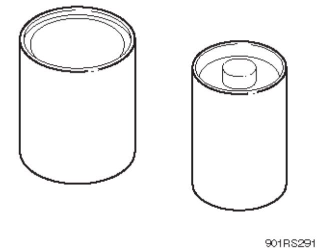
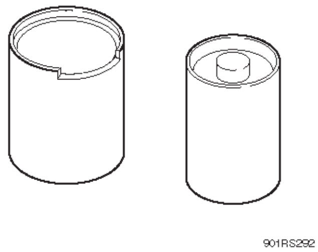
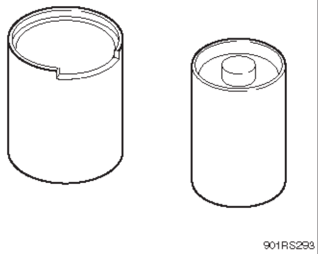
Rear suspension	Type	5–Link, coil spring type with stabilizer bar.
Coil spring	Free length	374.5mm (14.74in)
	Spring diameter	12.3mm (0.48in)
	Coil diameter (inner)	105mm (4.13in)
	Effective No. of turns	6.23
	Total No. of turns	7.73
Shock absorber	Type	Hydraulic, double acting, telescopic
	Piston diameter	30mm (1.18in)
	Stroke	175mm (6.89in)
	Extended length	473.5mm (18.64in)
	Compressed length	298.5mm (11.75in)
Stabilizer bar	Diameter	19mm (0.71in)

Torque Specifications



E03RW003

Special Tools

ILLUSTRATION	**TOOL NO.** TOOL NAME
	**J–39214** Remover and Installer; Trailing link bushing
	**J–43008** Remover and Installer; Upper link bushing
	**J–39792** Remover and Installer; Lateral rod bushing (axle side)
	**J–39215** Remover and Installer; Lateral rod bushing

AMIGO

SUSPENSION

INTELLIGENT SUSPENSION SYSTEM

CONTENTS

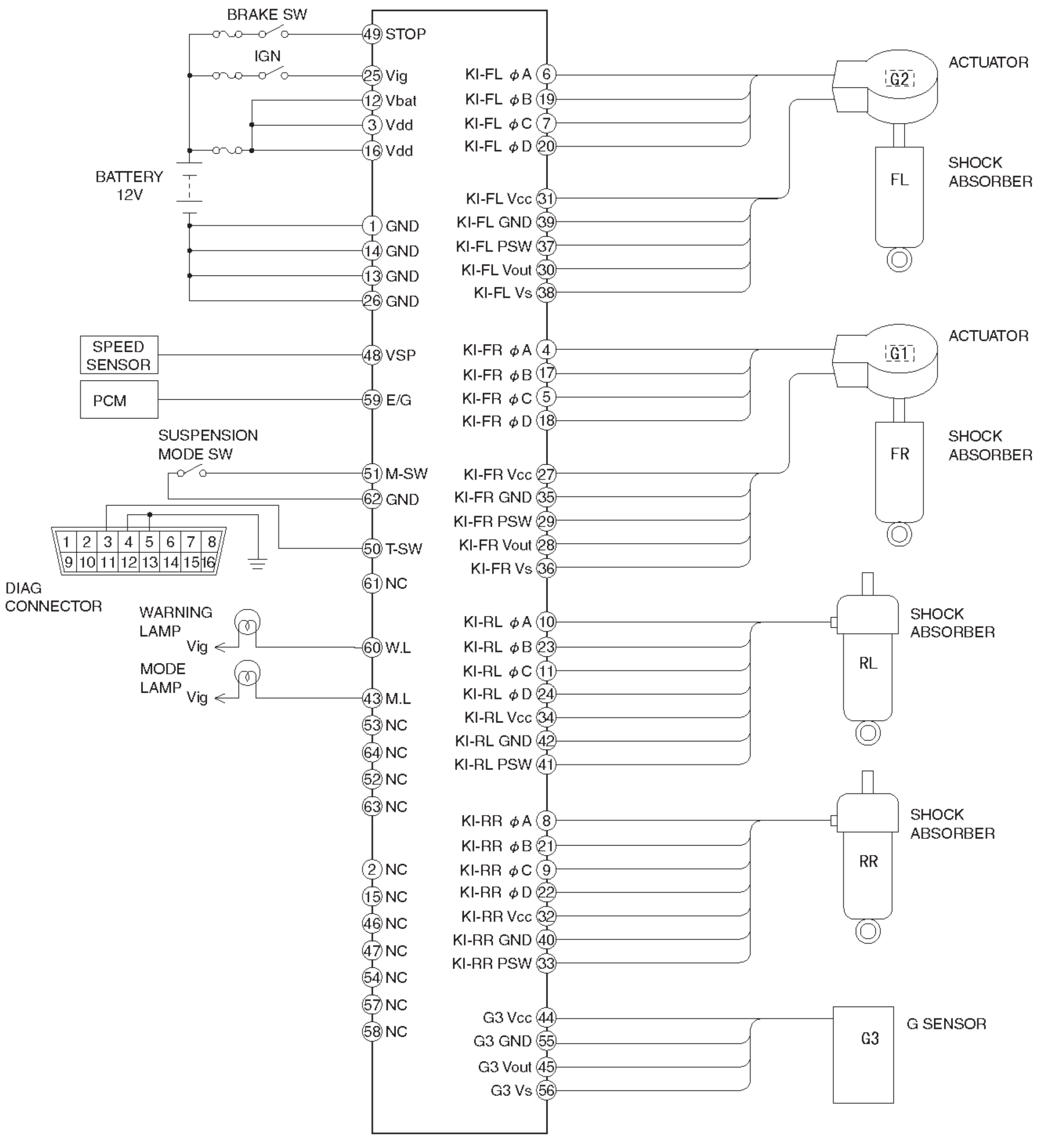
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM (SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED, do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

General Description

Intellignet suspension system uses a microcomputer as a control unit to judge running conditions including engine revolution from Powertrain Control Module, vehicle speed from vehicle speed sensor, a brake switch signal, and vertical and horizontal G-sensor signal, then sets optimum damping force so that best running stability can be achieved.
In addition two ride modes (i.e. “COMFORT” and “SPOPT”) can be selected according to the driver’s preference.



CONTROL UNIT PIN ASSIGNMENT

1	2	3	4	5	6	7	8	9	10	11	12	13	27	28	29	30	31	32	33	34	43	44	45	46	47	48	49	50	51	52	53
14	15	16	17	18	19	20	21	22	23	24	25	26	35	36	37	38	39	40	41	42	54	55	56	57	58	59	60	61	62	63	64

C03RY00003

PIN ASSIGNMENT TABLE

PIN No.	NAME	PIN No.	NAME	PIN No.	NAME	PIN No.	NAME
1	GND	17	KI-FR B	33	KI-RR PSW	49	STOP
2	NC	18	KI-FR D	34	KI-RL Vcc	50	T-SW
3	Vdd	19	KI-FL B	35	KI-FR GND	51	M-SW
4	KI-FR A	20	KI-FL D	36	KI-FR Vs	52	NC
5	KI-FR C	21	KI-RR B	37	KI-FL PSW	53	NC
6	KI-FL A	22	KI-RR D	38	KI-FL Vs	54	NC
7	KI-FL C	23	KI-RL B	39	KI-FL GND	55	G3 GND
8	KI-RR A	24	KI-RL D	40	KI-RR GND	56	G3 Vs
9	KI-RR C	25	Vig	41	KI-RL PSW	57	NC
10	KI-RL A	26	GND	42	KI-RL GND	58	NC
11	KI-RL C	27	KI-FR Vcc	43	M.L	59	E/G
12	Vbat	28	KI-FR Vout	44	G3 Vcc	60	W.L
13	GND	29	KI-FR PSW	45	G3 Vout	61	NC
14	GND	30	KI-FL Vout	46	NC	62	GND
15	NC	31	KI-FL Vcc	47	NC	63	NC
16	Vdd	32	KI-RR Vcc	48	VSP	64	NC

NC: NO CONNECTION

System Components

Control Unit, 3 Vertical G-sensors, Horizontal G-sensor, 4 Actuators, 4 Adjustable Damping Force Shock Absorbers, and Warning Lamp.

Control Unit

The Control Unit consists of Adjustable Damping Force Shock Absorber control circuits, fault detector, and a fail-safe. It drives the actuator according to the signal from each sensor.
The Control Unit has a self-diagnosing function which can indicate faulty circuits during diagnosis.
The Control Unit is mounted in the center of the instrument panel.

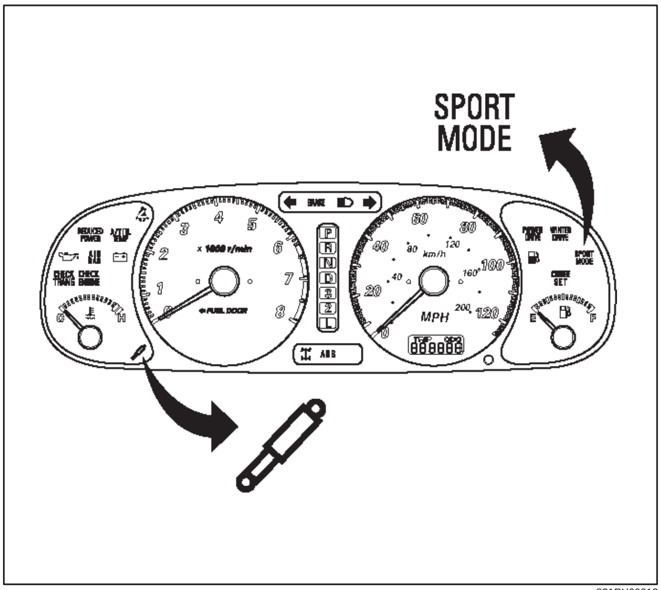
Actuator

Front actuators installed on front shock absorbers and rear actuator installed inside rear shock absorbers control damping force of shock absorber by the Control Unit signal.

Adjustable Damping Force Shock Absorber

This type shock absorber is used in front and rear intelligent suspension. According to running condition the Control Unit changes shock absorber damping force and obtains good running stability.

Warning Lamp



821RY00013

Vehicles equipped with the Intelligent Suspension have an amber warning lamp in the instrument panel. The warning lamp will illuminate if a malfunction in the Intelligent Suspension System is detected by the Control Unit. In case of an important electronic malfunction, the Control Unit will turn“ON” the warning lamp.

Vertical G-Sensor

Front G-sensors installed inside front actuators and the rear G-sensor installed on the rear left frame side detect the vehicle vertical gravity and send a signal to the Control Unit.

Horizontal G-Sensor

The G-sensor installed inside the Control Unit detects the vehicle turning speed and sends a signal to the Control Unit.

Acronyms and Abbreviations

Several acronyms and abbreviations are commonly used throughout this section:

BATT
Battery

DLC
Data Link Connector

DTC
Diagnostic Trouble Code

FL
Front Left

FR
Front Right

GND
Ground

HARN
Harness

IG
Ignition

PCM
Powertrain Control Module

RL
Rear Left

RR
Rear Right

SW
Switch

W/L
Warning Lamp

General Diagnosis

General Information

Intelligent Suspension System troubles can be classified into two types, those which can be detected by the warning lamp and those which can be detected as a vehicle abnormality by the driver.
In either case, locate the fault in accordance with the“BASIC DIAGNOSTIC FLOWCHART” and repair.
Please refer to Section 3 for the diagnosis of mechanical troubles such as abnormal noise, vehicle pulls, excessive tire wear, wheel hop and shimmy, shake or vibration.

Service Precautions

Required Tools and Items:

- Box Wrench
- Special Tool

Some diagnosis procedures in this section require the installation of a special tool.

J-39200 High Impedance Multimeter

When circuit measurements are requested, use a circuit tester with high impedance.

Computer System Service Precautions

The Intelligent Suspension System interfaces directly with the Control Unit which is a control computer that is similar in some regards to the Powertrain Control Module. These modules are designed to withstand normal current draws associated with vehicle operation. However care must be taken to avoid overloading any of the Control Unit circuits. In testing for opens or shorts, do not ground or apply voltage to any of the circuits unless instructed to do so by the appropriate diagnostic procedure. These circuits should only be tested with a high impedance multimeter (J-39200) or special tools as described in this section. Power should never be removed or applied to any control module with the ignition in the “ON” position.Before removing or connecting battery cables, fuses or connectors, always turn the ignition switch to the“OFF” position.

General Service Precautions

The following are general precautions which should be observed when servicing and diagnosing the Intelligent Suspension System and/or other vehicle systems. Failure to observe these precautions may result in Intelligent Suspension System damage.

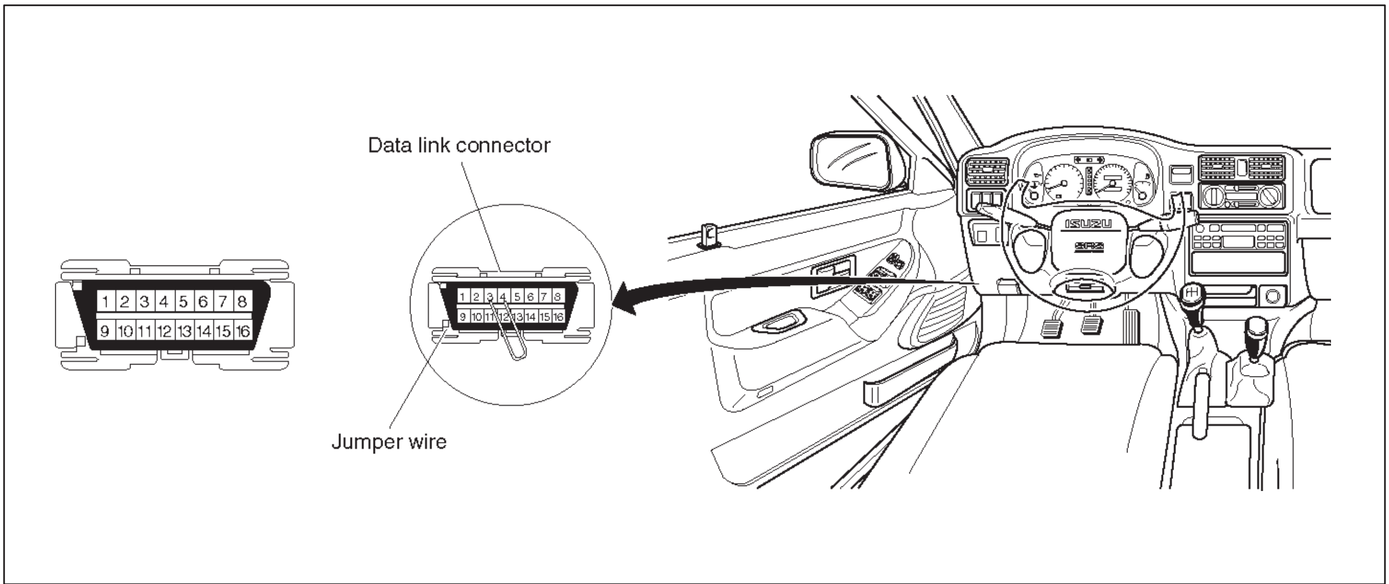
- If welding work is to be performed on the vehicle using an electric arc welder, the Control Unit connectors should be disconnected before the welding operation begins.
- The Control Unit connectors should never be connected or disconnected with the ignition“ON”.

Parts Handling

Be careful when handling the actuator, control unit, or G-sensor. They should not be dropped or thrown, because the semi-conductor G-sensor tip damage may result.

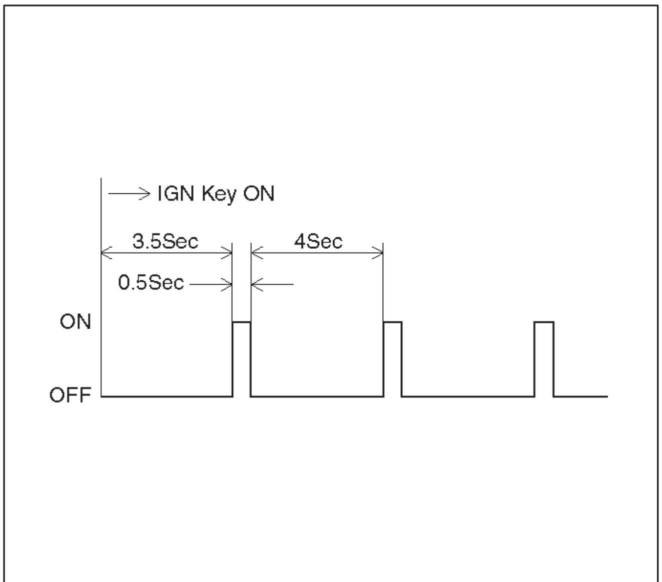
FLASHING CODES

1. ON BOARD DIAGNOSIS (SELF-DIAGNOSIS)
   1. The Control Unit conducts a self-test of most of the wiring and components in the system each time the key is turned ON. If a fault is detected the Control Unit will store a Diagnostic Trouble Code (DTC) in memory. It's a number that corresponds to a specific problem.
   2. When the problem detected is important: the warning lamp turns on until the fault is repaired and the Control Unit memory is cleared.
2. DIAGNOSTIC TROUBLE CODES (DTC)
   1. DTC can be displayed by the Control Unit by shorting together terminals 3 and 4 or 5 of the Diagnosis Connector (C-34) located left side of instrument panel.



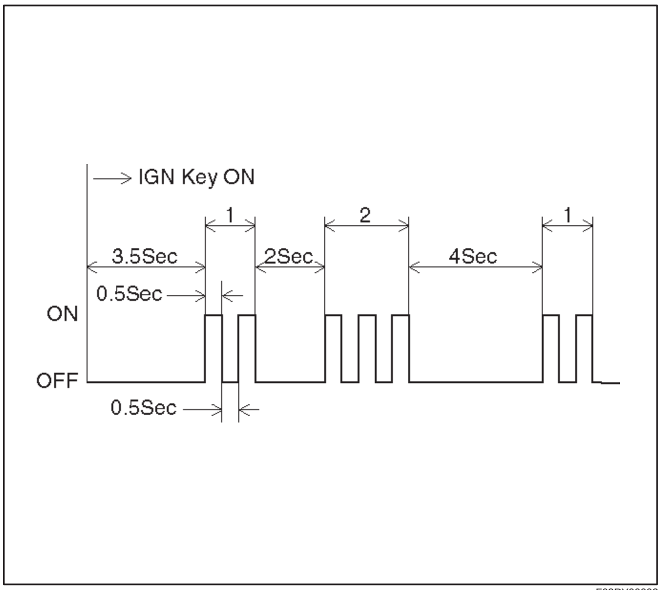
350RY00004

Normal



F03RY00001

Abnormal



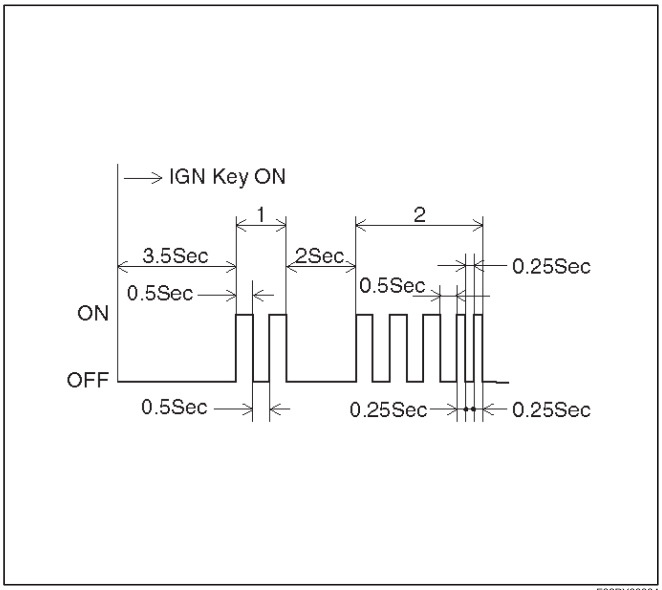
F03RY00002

Legend

(1) Diagnostic Trouble Code 2

(2) Diagnostic Trouble Code 3

It depends below in the case that the code that also, shows a malfunction place is added.



F03RY00004

Legend

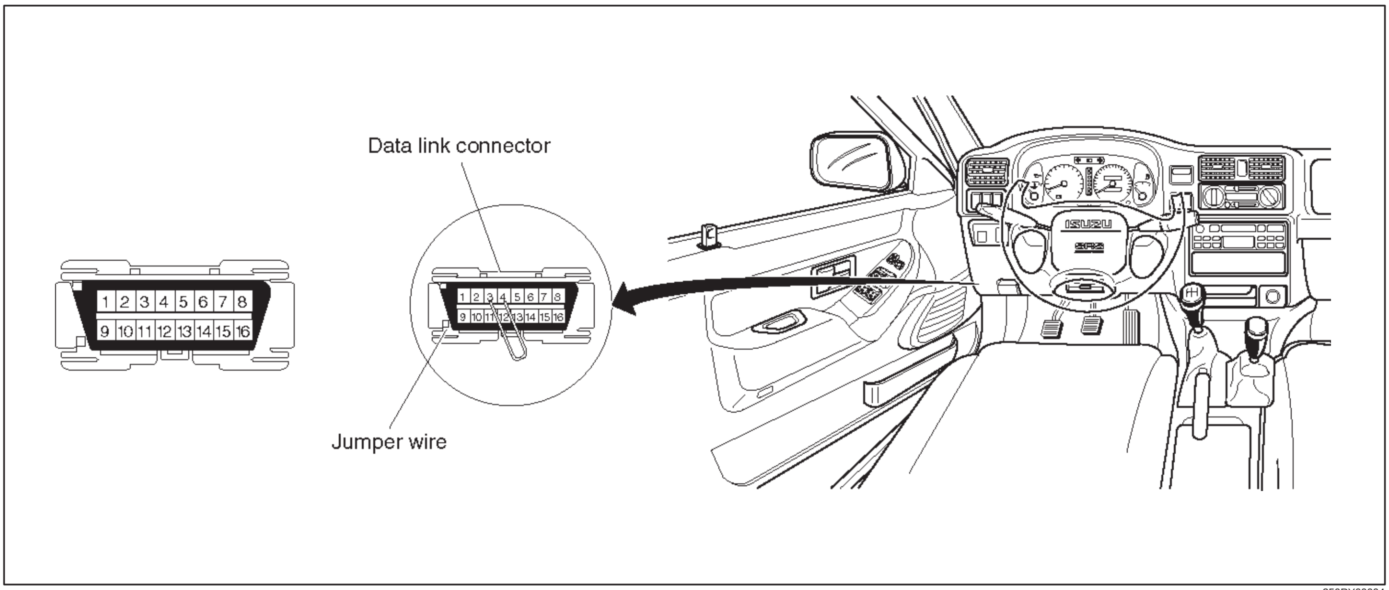
1. Diagnostic Trouble Code 2
2. Diagnostic Trouble Code 3 + Position Code 2
   Position Code

1: Actuator Front RH, G-sensor Front RH

2: Actuator Front LH, G-sensor Front LH

3: Actuator Rear RH, G-sensor Rear

4: Actuator Rear LH, Lateral G-sensor



350RY00004

2. IF a code is flashed, wait until the lamp is flashing.
3. Conduct brake switch ON/OFF 6 or more times on condition that one operation is within 2 seconds.
4. After this, the warning lamp will be OFF for 3.5 seconds and then will flash each DTC.
   1. When there are more than 9 flashes this means that the indicator is constantly flashing, OFF for 4 seconds ON for 0.5 seconds. In this case there is no DTC stored in memory.
   2. When there are less than 9 flashes you will see DTC of a digit and when all codes have been displayed they are displayed again beginning from the first one.
   3. The DTCs are displayed in lower number order.

CLEAR DTC

Remark: If you clear the DTC (Diagnosis Trouble Codes) you will not be able to read any codes recorded during the last Trouble.

Remark: To be able to use the DTC again to identify a problem you will need to reproduce the fault or the problem. This may require a new test drive or just turning the ignition on (this depends on the nature of the fault).

1. Short the Diagnosis Connector C-34 terminal 3 to terminal 4 or 5 (ground).

- IF it is flashing and the flash is 0.5 seconds ON and 4 seconds OFF without interruption, this means that there is no DTC. The DTCs are already cleared.

INTERMITTENT CONDITIONS

If the Warning Lamp flashes a diagnostic trouble code as intermittent, or if after a test drive a DTC does not reappear though the detection conditions for this DTC are present: the problem is most likely a faulty electrical connection or loose wiring. Terminals and grounds should always be the prime suspect. Intermittents rarely occur inside sophisticated electronic components such as the Control Unit.

Use the DTC information to understand which wires and sensors are involved.

When an intermittent problem is encountered, check suspect circuits for:

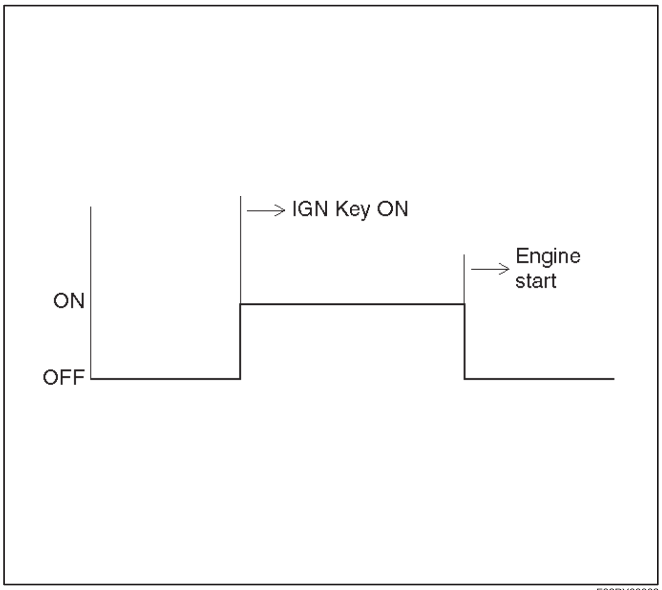
1. Poor terminal to wire connection.
2. Terminals not fully seated in the connector body (backed out).
3. Improperly formed or damaged terminals.
4. Loose, dirty, or corroded ground connections:

   HINT: Any time you have an intermittent in more than one circuit, check whether the circuits share a common ground connection.
5. Pinched or damaged wires.
6. Electro-Magnetic Interference (EMI):

   HINT: Check that all wires are properly routed away from spark plug wires, distributor wires, coil, and generator. Also check for improperly installed electrical options, such as lights, 2-way radios, etc.

BULB CHECK

When the starter switch is turned on in the normal state, the Control Unit turns on the Warning Lamp to check the bulb. After the engine starts, the Warning Lamp turns off.



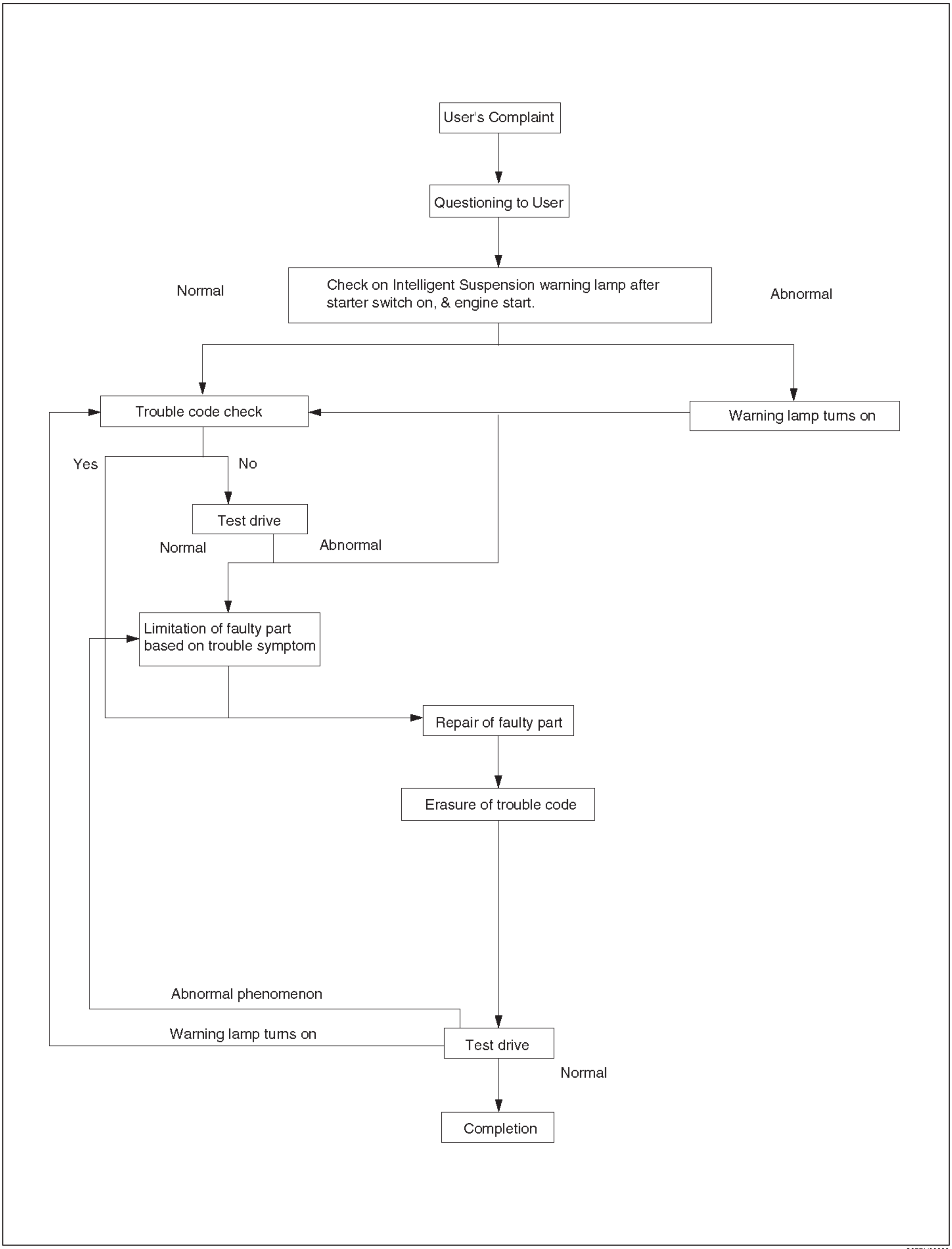
F03RY00003

DTC CHECK

1. Diagnosis Trouble Codes (DTC) have been identified by FLASHING CODES.
2. You have written the list of the DTC. The order of the malfunctions has no meanings for this Control Unit. Usually only one or two malfunctions should be set for a given problem.
3. Check directly the DTCs you identified. The DTC are sorted by number:

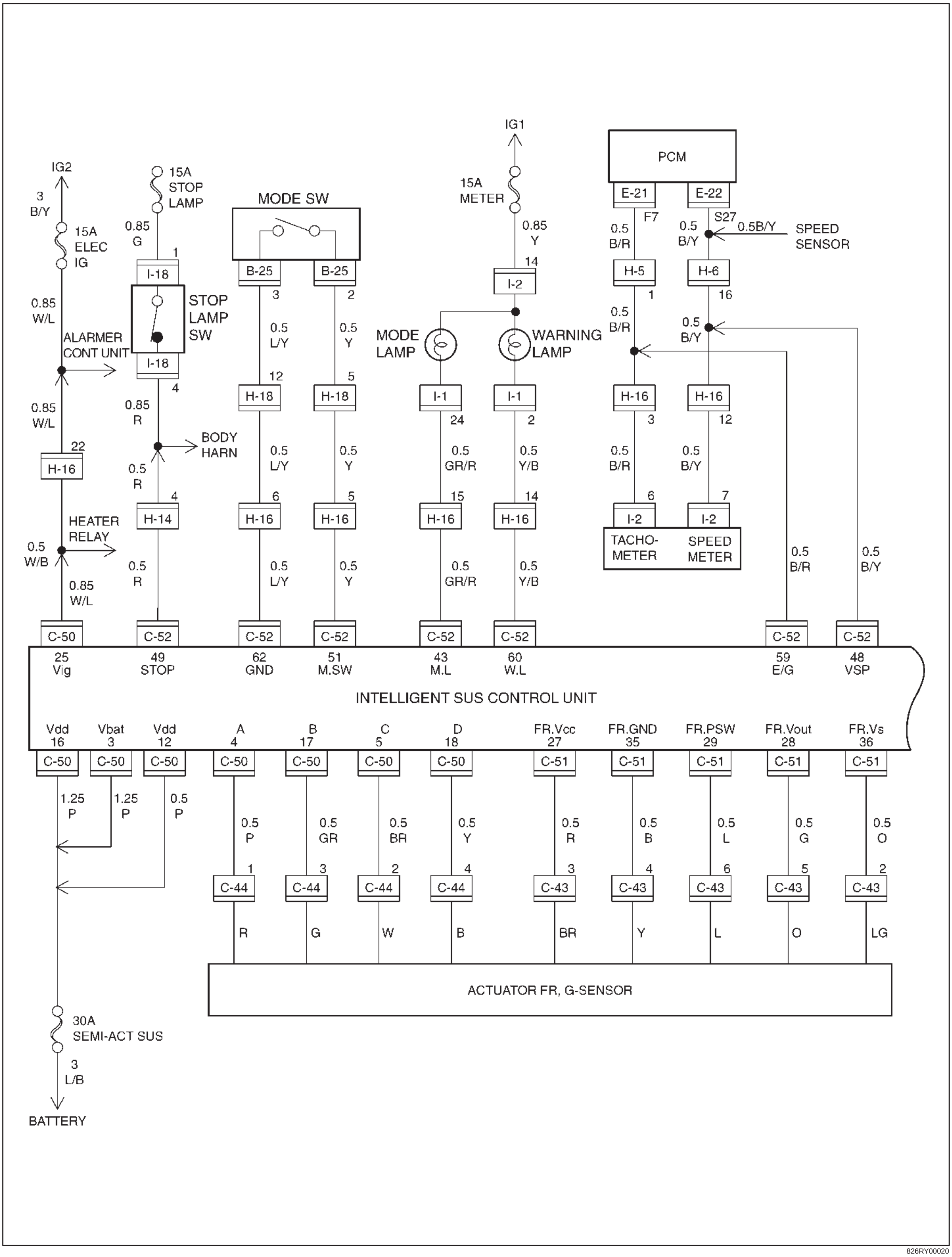
   DIAGNOSTIC TROUBLE CODES.

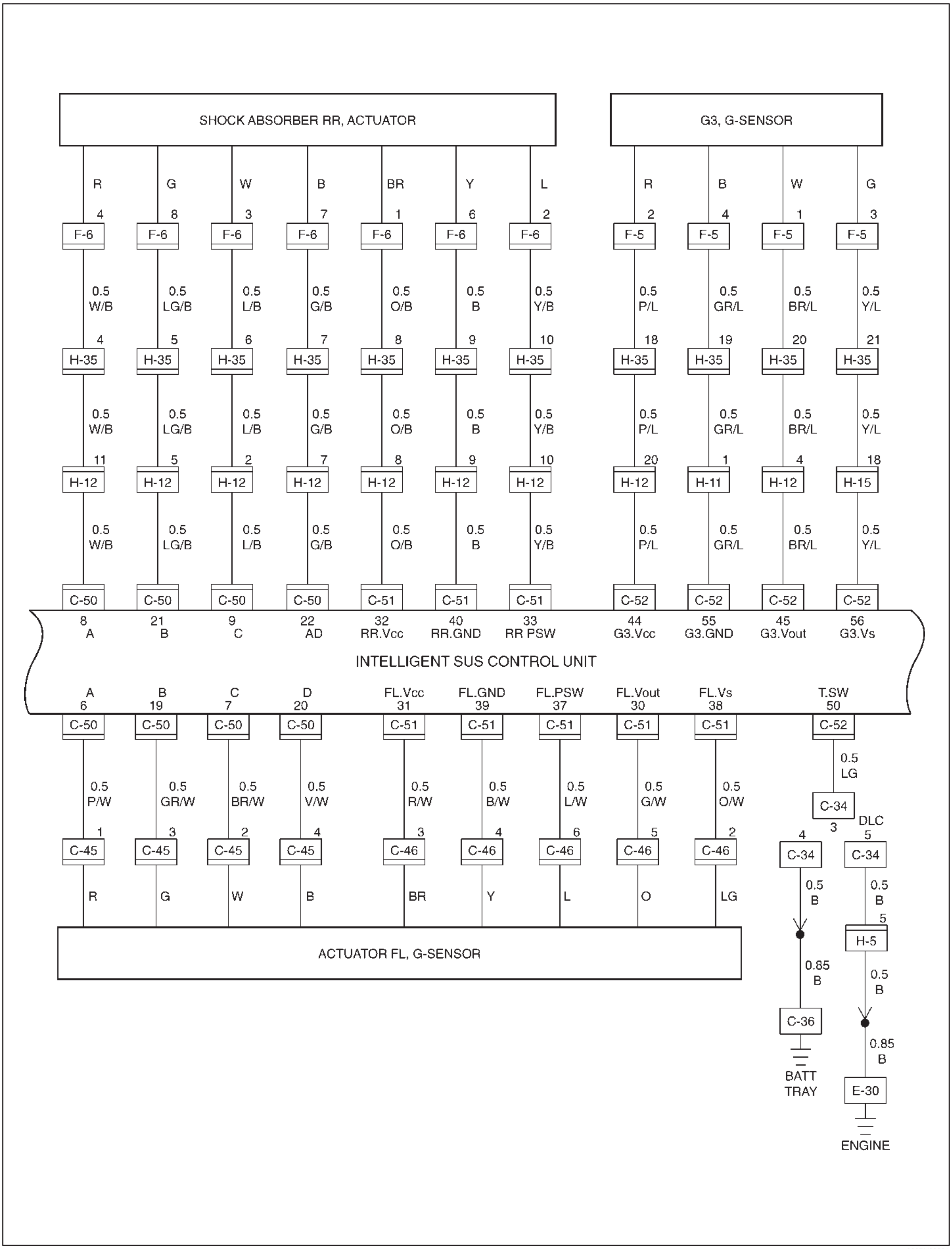
Basic Diagnosis Flow



C07RY00022

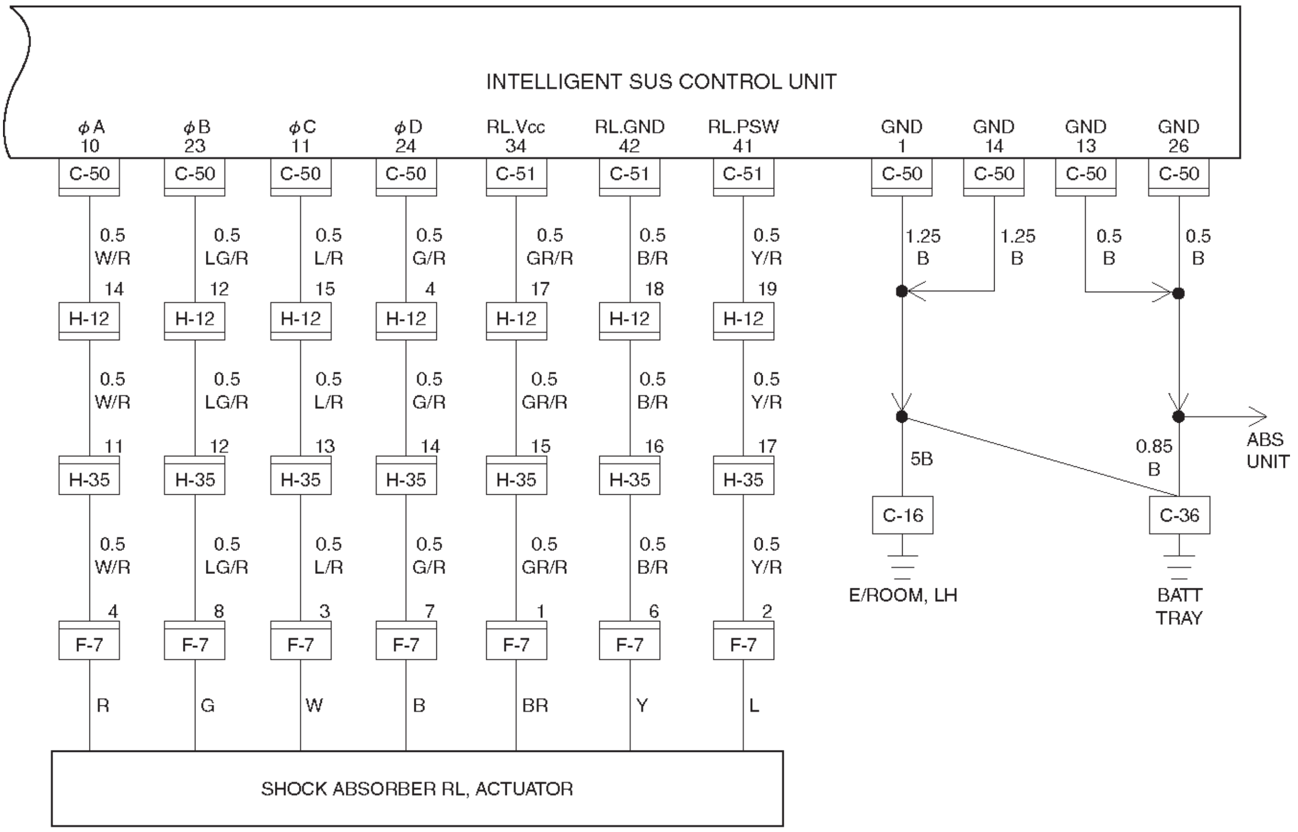
Circuit Diagram





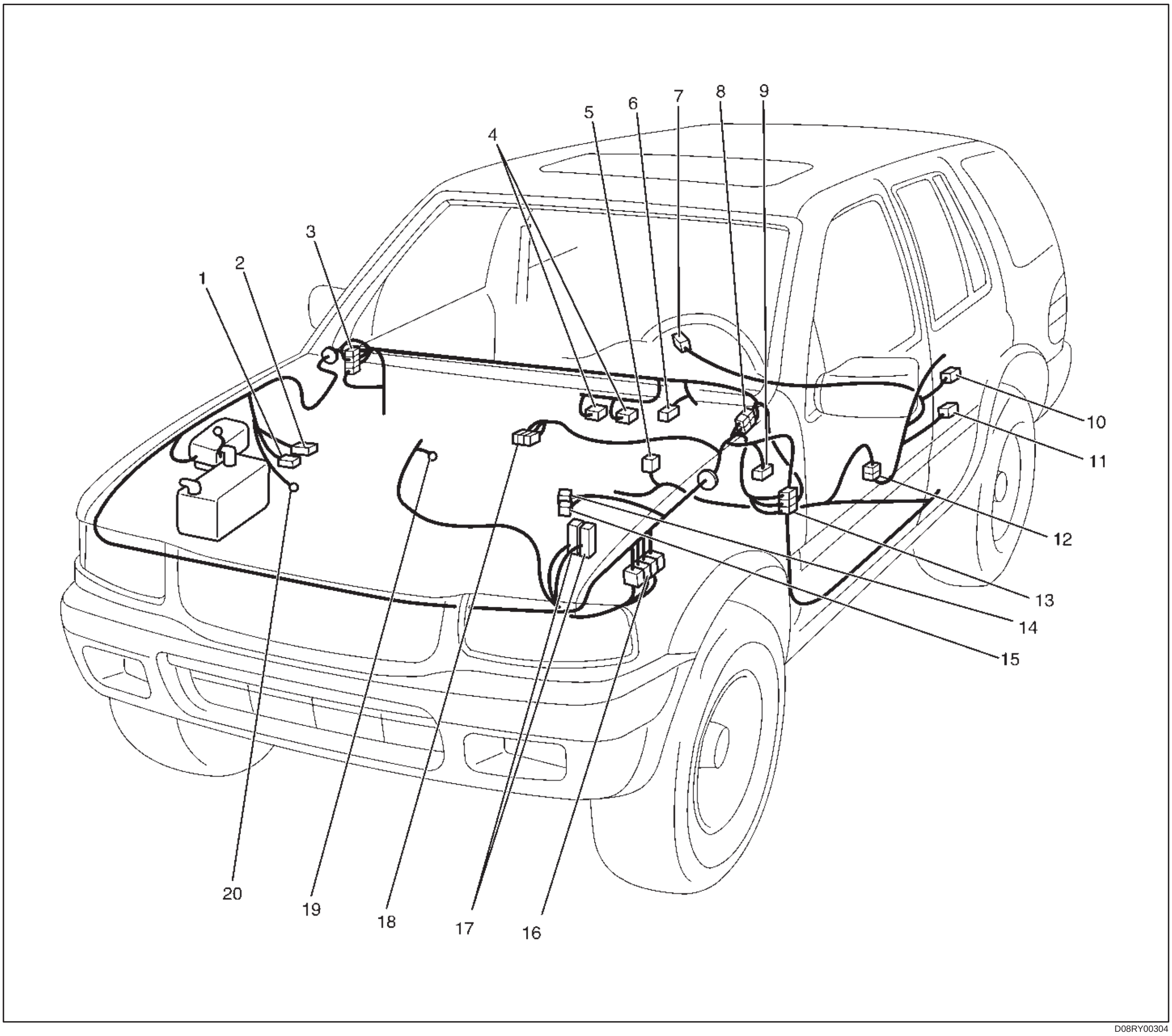
SHOCK ABSORBER RR, ACTUATOR
G3, G-SENSOR
R G W B BR Y L
R B W G
F-6
F-5
H-35
H-12
H-11
H-15
C-50
C-51
C-52
0.5 W/B
0.5 LG/B
0.5 L/B
0.5 G/B
0.5 O/B
0.5 B
0.5 Y/B
0.5 P/L
0.5 GR/L
0.5 BR/L
0.5 Y/L
8 A
21 B
9 C
22 AD
32 RR.Vcc
40 RR.GND
33 RR PSW
44 G3.Vcc
55 G3.GND
45 G3.Vout
56 G3.Vs
INTELLIGENT SUS CONTROL UNIT
A 6
B 19
C 7
D 20
FL.Vcc 31
FL.GND 39
FL.PSW 37
FL.Vout 30
FL.Vs 38
T.SW 50
0.5 P/W
0.5 GR/W
0.5 BR/W
0.5 V/W
0.5 R/W
0.5 B/W
0.5 L/W
0.5 G/W
0.5 O/W
0.5 LG
C-45
C-46
C-34
DLC
R G W B BR Y L O LG
ACTUATOR FL, G-SENSOR
0.85 B
H-5
C-36
BATT TRAY
E-30
ENGINE

826RY00021


INTELLIGENT SUS CONTROL UNIT
φA 10
φB 23
φC 11
φD 24
RL.Vcc 34
RL.GND 42
RL.PSW 41
GND 1
GND 14
GND 13
GND 26
C-50
C-51
0.5 W/R
0.5 LG/R
0.5 L/R
0.5 G/R
0.5 GR/R
0.5 B/R
0.5 Y/R
1.25 B
0.5 B
H-12
H-35
F-7
R
G
W
B
BR
Y
L
5B
0.85 B
ABS UNIT
C-16
C-36
E/ROOM, LH
BATT TRAY
SHOCK ABSORBER RL, ACTUATOR

D03RY00006

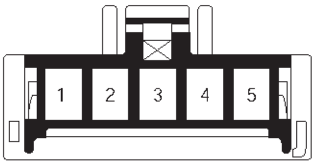
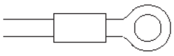
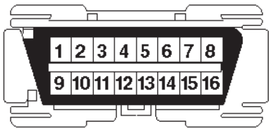
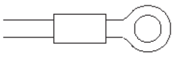
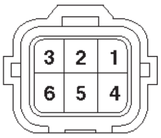
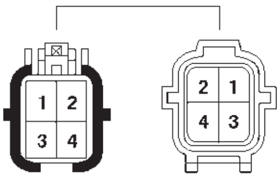
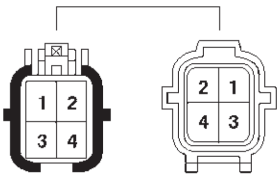
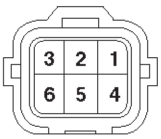
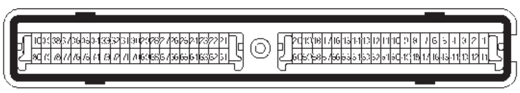
Parts Location

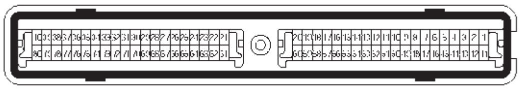
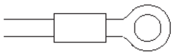
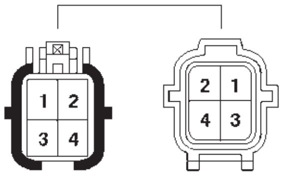
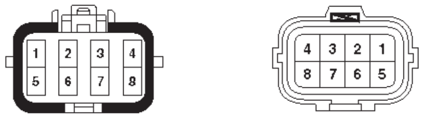
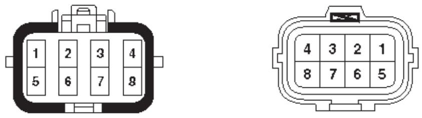
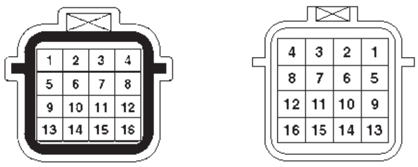
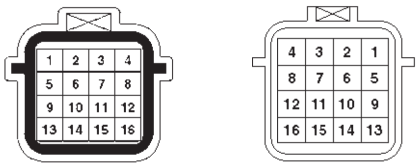
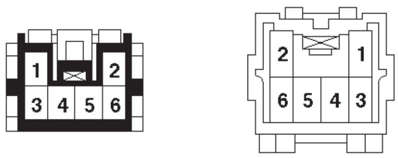
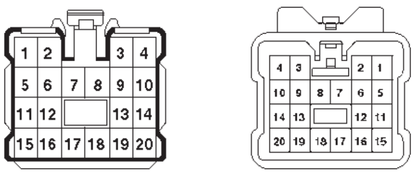


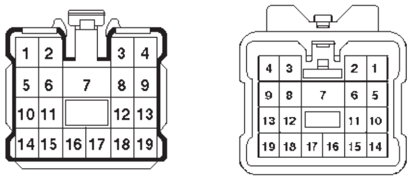
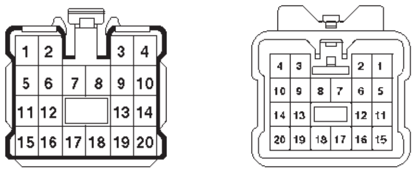
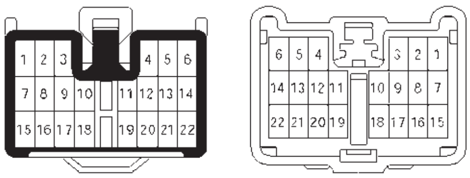
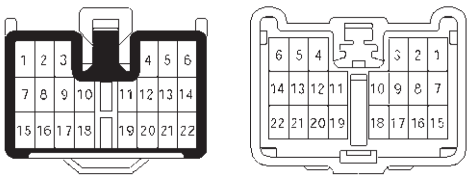
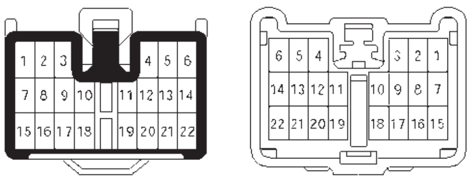
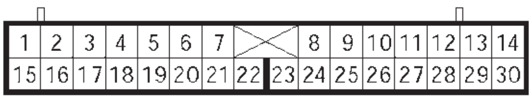
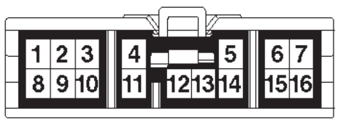
Legend

- (1) C–44
- (2) C–43
- (3) H–12, H–13, H–14, H–18
- (4) I–1, I–2
- (5) B–25
- (6) I–18
- (7) F–6
- (8) H–31, H–32
- (9) C–34
- (10) F–7
- (11) F–5
- (12) H–35
- (13) H–15, H–16, H–17
- (14) C–46
- (15) C–45
- (16) H–5, H–6, H–7
- (17) E–21, E–22
- (18) C–50, C–51, C–52
- (19) E–30
- (20) C–36

Connector List

No.	Connector face
B-25	
C-16	
C–34	
C-36	
C-43	
C-44	
C–45	
C–46	
E–21	

No.	Connector face
E–22	
E–30	
F–5	
F–6	
F–7	
H-5	
H-6	
H-11	
H-12	

No.	Connector face
H–14	
H–15	
H–16	
H–18	
H–35	
I–1	
I–2	
I–18	

Diagnostic Trouble Code (DTC) Identification

DTC No.	DTC NAME	CODE MEMORY	WARNING LAMP	NOTE
2	Actuator Coil Over Current	Yes	OFF	Stop drive circuit.
3	Actuator Coil/Position Sensor Open Circuit or Short	Yes	ON	Control stop in condition that actuator position fixed on R.
4	G–Sensor Open Circuit or Short	Yes	ON	Control stop in condition that actuator position fixed on R.
5	Vehicle Speed Sensor Open Circuit or Short	Yes	OFF	Control gain fixed on K3.
6	Stop Lamp Switch Open Circuit, Short or Contact Point Trouble	Yes	OFF	Drive control stop.
7	Engine Speed Signal Open Circuit or Short	Yes	OFF	Normal control.
9	Control Unit Abnormality	Yes	OFF	Control stop or normal drive circuit fixed on R mode.

DTC2 Actuator Coil Over Current

Circuit Description

The A, B, C, and D are the actuator motor coil terminals. DC 12V driving voltage is applied between terminals A and C and terminals B and D so that the shock absorber oil valves are rotated at every 7.5˚ step feed.

Diagnostic Aids

- Inspect the wiring for poor electrical connections between the control unit 24 way connector and the actuator connectors. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.
  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

DTC2 Actuator Coil Over Current

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the actuator connectors C–45, C–44, F–7, and F–6. 3. Measure the resistance between the actuator side connector C–44 terminals 1 and 2. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the actuator side connector C–44 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the actuator FR.	—	Go to *Step 4*	—
4	1. Measure the resistance between the actuator side connector C–45 terminals 1 and 2. Does the resistance indicate within the specified value?	6.4–7.2Ω	Go to *Step 5*	Go to *Step 6*
5	1. Measure the resistance between the actuator side connector C–45 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4–7.2Ω	Go to *Step 7*	Go to *Step 6*
6	Replace the actuator FL.	—	Go to *Step 7*	—
7	1. Measure the resistance between the shock absorber side connector F–6 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4–7.2Ω	Go to *Step 8*	Go to *Step 9*
8	1. Measure the resistance between the shock absorber side connector F–6 terminals 7 and 8. Does the resistance indicate within the specified value?	6.4–7.2Ω	Go to *Step 10*	Go to *Step 9*
9	Replace the rear shock absorber RR.	—	Go to *Step 10*	—

DTC2 Actuator Coil Over Current (Cont'd)

Step	Action	Value(s)	Yes	No
10	1. Measure the resistance between the shock absorber side connector F–7 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4–7.2Ω	Go to *Step 11*	Go to *Step 12*
11	1. Measure the resistance between the shock absorber side connector F–7 terminals 7 and 8. Does the resistance indicate within the specified value?	6.4–7.2Ω	Go to *Step 13*	Go to *Step 12*
12	Replace the rear shock absorber RL.	—	Go to *Step 16*	—
13	If all steps are correct, check the continuity between the control unit connector C–50 terminal 1 and connector terminal C50–4, C50–17, C50–5, C50–18, C50–6, C50–19, C50–7, C50–20, C50–8, C50–21, C50–9, C50–22, C50–10, C50–23, C50–11, and C50–24. Is there continuity?	—	Go to *Step 15*	Go to *Step 16*
14	Repair the circuit.	—	Go to *Step 16*	—
15	Replace the control unit.	—	Go to *Step 16*	—
16	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *"Basic Diagnosis Flow".*	Go to *Step 16*

DTC3 Actuator Coil/Position Sensor Open Circuit or Short

Circuit Description

The A, B, C, and D are the actuator motor coil terminals. DC 12V driving voltage is applied between terminals A and C and terminals B and D so that the shock absorber oil valves are rotated at every 7.5° step feed.
The PSW is actuator position signal and detects relative angles between the piston–rod and the control-rod. The actuator outputs the PSW to the control unit.

Diagnostic Aids

- Inspect the wiring for poor electrical connections between the control unit 16 way connector and the actuator connectors. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.
  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

DTC3 Actuator Coil/Position Sensor Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the actuator connectors C–50, C–45, C–44, F–7, and F–6. Is the continuity between the connector C–44 terminals 1 and 2?	—	Go to *Step 2*	Go to *Step 3*
2	Is the continuity between the connector C–44 terminals 3 and 4?	—	Go to *Step 4*	Go to *Step 3*
3	Replace the actuator FR.	—	Go to *Step 4*	—
4	Is the continuity between the connector C–45 terminals 1 and 2?	—	Go to *Step 5*	Go to *Step 6*
5	Is the continuity between the connector C–45 terminals 3 and 4?	—	Go to *Step 7*	Go to *Step 6*
6	Replace the actuator FL.	—	Go to *Step 7*	—
7	Is the continuity between the connector F–6 terminals 3 and 4?	—	Go to *Step 8*	Go to *Step 9*
8	Is the continuity between the connector F–6 terminals 7 and 8?	—	Go to *Step 10*	Go to *Step 9*
9	Replace the rear shock absorber RR.	—	Go to *Step 10*	—
10	Is the continuity between the connector F–7 terminals 3 and 4?	—	Go to *Step 11*	Go to *Step 12*
11	Is the continuity between the connector F–7 terminals 7 and 8?	—	Go to *Step 13*	—
12	Replace the rear shock absorber RL.	—	Go to *Step 13*	—
13	Is the continuity between the connector C–44 terminal 1 and connector C–50 terminal 4?	—	Go to *Step 14*	Go to *Step 15*
14	Is the continuity between the connector C–44 terminal 3 and connector C–50 terminal 17?	—	Go to *Step 16*	Go to *Step 15*
15	Repair the circuit.	—	Go to *Step 16*	—
16	Is the continuity between the connector C–44 terminal 2 and connector C–50 terminal 5?	—	Go to *Step 17*	Go to *Step 18*

DTC3 Actuator Coil/Position Sensor Open Circuit or Short (Cont'd)

Step	Action	Value(s)	Yes	No
17	Is the continuity between the connector C–44 terminals 4 and connector C–50 terminal 18?	—	Go to *Step 19*	Go to *Step 18*
18	Repair the circuit.	—	Go to *Step 19*	—
19	Is the continuity between the connector C–45 terminal 1 and connector C–50 terminal 6?	—	Go to *Step 20*	Go to *Step 21*
20	Is the continuity between the connector C–45 terminal 3 and connector C–50 terminal 19?	—	Go to *Step 22*	Go to *Step 21*
21	Repair the circuit.	—	Go to *Step 22*	—
22	Is the continuity between the connector C–45 terminal 2 and connector C–50 terminal 7?	—	Go to *Step 23*	Go to *Step 24*
23	Is the continuity between the connector C–45 terminal 4 and connector C–50 terminal 20?	—	Go to *Step 25*	Go to *Step 24*
24	Repair the circuit.	—	Go to *Step 25*	—
25	Is the continuity between the connector F–6 terminal 4 and connector C–50 terminal 8?	—	Go to *Step 26*	Go to *Step 27*
26	Is the continuity between the connector F–6 terminal 8 and connector C–50 terminal 21?	—	Go to *Step 28*	Go to *Step 27*
27	Repair the circuit.	—	Go to *Step 28*	—
28	Is the continuity between the connector F–6 terminal 3 and connector C–50 terminal 9?	—	Go to *Step 29*	Go to *Step 30*
29	Is the continuity between the connector F–6 terminal 7 and connector C–50 terminal 22?	—	Go to *Step 31*	Go to *Step 30*
30	Repair the circuit.	—	Go to *Step 31*	—
31	Is the continuity between the connector F–7 terminal 4 and connector C–50 terminal 10?	—	Go to *Step 32*	Go to *Step 33*
32	Is the continuity between the connector F–7 terminal 8 and connector C–50 terminal 23?	—	Go to *Step 34*	Go to *Step 33*
33	Repair the circuit.	—	Go to *Step 34*	—
34	Is the continuity between the connector F–7 terminal 3 and connector C–50 terminal 11?	—	Go to *Step 35*	Go to *Step 36*
35	Is the continuity between the connector F–7 terminal 7 and connector C–50 terminal 24?	—	Go to *Step 37*	Go to *Step 36*
36	Repair the circuit.	—	Go to *Step 37*	—
37	1. Disconnect the terminals C–51, C–43, C–46, F–6, and F–7. Is the continuity between the connector–terminal C51–29 and C43–6, C51–37 and C46–6, C51–33 and F6–2, C51–41 and F7–2?	—	Go to *Step 38*	Go to *Step 41*

DTC3 Actuator Coil/Position Sensor Open Circuit or Short (Cont'd)

Step	Action	Value(s)	Yes	No
38	Is the continuity between the connector C–50 terminal 1 (GND) and the connector C–51 terminals 29, 33, 37, and 41?	—	Go to *Step 41*	Go to *Step 39*
39	Is there the continuity between connector-terminal C51–27 and C51–35, C51–31 and C51–39, C51–32 and C51–40, and C51–34 and C51–42?	—	Go to *Step 41*	Go to *Step 40*
40	Is there the continuity between connector C–50 terminal 1 and connector C–51 terminals 27, 31, 32, and 34?	—	Go to *Step 41*	Go to *Step 42*
41	Repair the circuit.	—	Go to *Step 44*	—
42	1. If all steps are correct, replace following units one by one in the following order. Give a test drive and if normal, reinstall it. 1) actuator FR, 2) actuator FL, rear shock absorber, 3) RR and 4) RL. Does the DTC3 remain?	—	Go to *Step 43*	Go to *Step 44*
43	Replace the control unit.	—	Go to *Step 44*	—
44	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *"Basic Diagnosis Flow".*	Go to *Step 44*

DTC4 G-Sensor Open Circuit or Short

Circuit Description

The G-sensor sends the voltage (Vout) corresponding to the vehicle vertical gravity to the control unit.
The control unit supplies DC 5V power (Vcc) to each G-sensor.
The control unit watches the G-sensor operation through Vcc signal.

Diagnostic Aids

- Inspect the wiring for poor electrical connections between the control unit connectors and the actuator connectors. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.

  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

DTC4 G-Sensor Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the connectors C–51, C–52, C–43, C–46, and F–5. Is there the continuity between the connector-terminal C51–28 and C43–5, C51–30 and C46–5, and C52–45 and F5–1?	—	Go to *Step 2*	Go to *Step 5*
2	Is the continuity between the connector-terminal C51–27 and C43–1, C51–31 and C46–1, and C52–44 and F5–2?	—	Go to *Step 3*	Go to *Step 5*
3	Is there the continuity between the connector-terminal C51–36 and C43–2, C51–38 and C46–2, and C52–56 and F5–3?	—	Go to *Step 4*	Go to *Step 5*
4	1. Disconnect the connectors C–50, C–51, and C–52. Is there the continuity between the connector-terminal C51–28 and C51–35, C51–30 and C51–39, C52–45 and C52–55, C51–27 and C51–35, C51–31 and C51–39, C52–44 and C52–55, C51–32 and C51–40, C51–34 and C51–42, C51–36 and C51–35, C51–38 and C51–39, and C52–56 and C52–55?	—	Go to *Step 5*	Go to *Step 7*
5	Repair the circuit.	—	Go to *Step 6*	—
6	Replace following units one by one in the following order. Give a test drive and if normal, reinstall it. 1) G3-sensor 2) Actuator FL 3) Actuator FR 4) Control Unit	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear th DTC. Was this step finished?	—	Go to *“Basic Diagnosis Flow.”*	Go to *Step 7*

DTC5 Vehicle Speed Sensor Open Circuit or Short

Circuit Description

Output speed information is provided to the control unit by the vehicle speed sensor. The vehicle speed sensor produces a pulsing AC voltage. The AC voltage level and number of pulses increases as the speed of the vehicle increases. The control unit then converts the pulsing voltage to vehicle speed.

Diagnostic Aids

- Inspect the wiring for poor electrical connections between the control unit 22 way connector and the speed sensor connectors. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.

  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.

DTC5 Vehicle Speed Sensor Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	1. Jack up and support the rear axle on the stand. 2. Change the transfer mode to 2WD, using the 4WD push button switch on instrument panel. 3. Shift the transmission lever in a forward position and rotate the rear wheels. Does the speedo-meter operate?	—	Go to *Step 2*	Go to *Step 3*
2	1. Open the throttle and rev up engine speed. 2. Using a volt meter, measure the voltage between the meter B connector I–2 terminals 7 and 16 (GND). Does the voltage change alternately at the specified values?	0V and 12V	Go to *Step 7*	Go to *Step 5*
3	1. Turn off the starter switch and disconnect the control connectors C–50 and C–52. 2. Check the continuity between the vehicle speed sensor connector terminal 3 and meter B connector I–2 terminal 7. Is there continuity?	—	Go to *Step 4*	Go to *Step 6*
4	1. Check the continuity between the control unit connector C–50 terminal 1 and control unit connector C–52 terminal 48. Is there continuity?	—	Go to *Step 5*	Go to *Step 6*
5	Repair or replace the vehicle speed sensor.	—	Go to *Step 8*	—
6	Repair the circuit between the vehicle speed sensor connector terminal 3 and the meter B connector I–2 terminal 7 or the circuit between the control unit connector C–52 terminal 48 and the speed sensor connector terminal 3.	—	Go to *Step 8*	—
7	Repair the circuit between the connector H–6 terminal 16 and the control unit connector C–52 terminal 48 or replace the control unit.	—	Go to *Step 8*	—
8	1. Reconnect all components, ensure all components are properly mounted. 2. Clear th DTC. Was this step finished?	—	Go to *“Basic Diagnosis Flow.”*	Go to *Step 8*

DTC6 Stop Lamp Switch Open Circuit or Short

Circuit Description

The brake switch is used to indicate brake pedal status. The normally opened brake switch signal voltage circuit is opened.
Brake switch supplies a B+ signal on circuit RED to the control unit when the brakes are applied. The control unit uses this signal to work dive control when the brakes are applied.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the control unit and brake switch. Look for possible bent, backed out, deformed or damaged terminals. Check for weak terminal tension as well. Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check customer driving habits and/or unusual driving conditions (i.e. stop and go, highway).
- Check brake switch for proper mounting and adjustment.

DTC6 Stop Lamp Switch Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	1. With the engine "off", turn the ignition switch "on". If ABS code is set, check applicable fuse. 2. Apply then release the brake pedal. Is the brake lamp turned on with the brake pedal applied, and then turned off when the brake pedal is released?	—	Go to *Diagnostic Aids*	Go to *Step 2*
2	1. Connect the test light to ground. 2. Back probe ignition feed circuit terminal I18–1 at the brake switch. Is the test light "on"?	—	Go to *Step 3*	Go to *Step 4*
3	1. Connect the test light to ground. 2. Back probe circuit terminal I18–4 at the brake switch. Is the test light "off"?	—	Go to *Step 7*	Go to *Step 5*
4	Repair the open in battery feed circuit terminal I18–1 to the brake switch. If fuse is open, check circuit terminal I18–4 for a short to ground. Is the test light "off"?	—	Go to *Step 13*	—
5	Disconnect brake switch connector I–18 and ignition switch "on".	—	Go to *Step 8*	Go to *Step 6*
6	Check the brake switch short (I18–1 and I18–4).	—	Go to *Step 9*	Go to *Step 10*
7	Check circuit terminal I18–4 for a short to voltage. Ignition switch "on".	—	Go to *Step 8*	Go to *Step 10*
8	1. Disconnect the control unit connector C–52. 2. Check circuit terminal I18–4 for a short to voltage. Was a problem found?	—	Go to *Step 13*	Go to *Step 10*

DTC6 Stop Lamp Switch Open Circuit or Short (Cont'd)

Step	Action	Value(s)	Yes	No
9	Replace the brake switch. Is the replacement complete?	—	Go to *Step 13*	—
10	1. Turn the ignition "off". 2. Reconnect the control unit connector C–52 Turn the ignition "on". Is the brake lamp turned on with the brake applied, then turned off with the brake pedal released?	—	Go to *Diagnostic Aids*	Go to *Step 11*
11	Check the control unit for faulty or intermittent connections. Was a problem found and corrected?	—	Go to *Step 13*	Go to *Step 12*
12	Replace the control unit. Is the replacement complete?	—	Go to *Step 13*	—
13	1. After the repair is complete, clear the DTC. The switch signal must indicate 0 volts for 1 seconds with the brake pedal applied. 2. Conduct a test drive. 3. Review the DTC. Has the last test failed or is the current DTC displayed?	—	Begin diagnosis again Go to *Step 1*	Go to *Repair verified*

DTC7 Engine Speed Signal Open Circuit or Short

Circuit Description

PCM (Powertrain Control Module) converts signals from the crankshaft position sensor into the engine speed signals (pulse) and sends these to the control unit and tachometer.

Diagnostic Aids

- Inspect the wiring for poor electrical connections at the control unit connector. Look for possible bent, backed out, deformed, or damaged terminals. Check for weak terminal tension as well.

  Also check for a chafed wire that could short to bare metal or other wiring. Inspect for a broken wire inside the insulation.
- When diagnosing for a possible intermittent short or open condition, move the wiring harness while observing test equipment for a change.
- Check harness routing for a potential short to ground in circuit BLK/RED.

DTC7 Engine Speed Signal Open Circuit or Short

Step	Action	Value(s)	Yes	No
1	NOTE: Confirm that DTC P0336 or P0337 does not exist. If either exists, warning lamps, “CHECK ENGINE” and “CHECK TRANS” are turned on. Repair the engine, referring to Section 6E “Driveability and Emission”. 1. Turn on the starter switch. 2. Start the engine. 3. Open the throttle and rev up engine speed. Does the tachometer operate according to engine speed?	—	Go to *Step 3*	Go to *Step 2*
2	Repair the tachometer, referring to Section 8D Wiring System in Body and Accessories.	—	Go to *Step 6*	—
3	1. Turn off the starter switch. 2. Check continuity between the control unit connector C–52 terminal 59 and PCM connector E–21 terminal F7. Is there continuity ?	—	Go to *Step 4*	Go to *Step 5*
4	Replace the control unit.	—	Go to *Step 6*	—
5	Repair the circuit.	—	Go to *Step 6*	—
6	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. 3. Conduct a test drive. Has the last test failed or does the current DTC exist?	—	Begin diagnosis again Go to *Step 1*	Repair verified

DTC9 Control Unit Abnormality

Replace the control unit.

DTC9–1 Control Unit Blown Fuse for FR Actuator

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the actuator connector C–44. 3. Measure the resistance between the actuator side connector C–44 terminals 1 and 2. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the actuator side connector C–44 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the actuator FR.	—	Go to *Step 7*	—
4	1. If all steps are correct, check the continuity between the control unit connector C–50 terminal 1 and connector-terminal C50–4, C50–17, C50–5, C50–18. Is there continuity?	—	Go to *Step 5*	Go to *Step 6*
5	Repair the circuit.	—	Go to *Step 7*	—
6	Replace the control unit.	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *“Basic Diagnosis FLow”.*	Go to *Step 7*

DTC9–2 Control Unit Blown Fuse for FL Actuator

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the actuator connector C–45. 3. Measure the resistance between the actuator side connector C–45 terminals 1 and 2. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the actuator side connector C–45 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the actuator FL.	—	Go to *Step 7*	—
4	1. If all steps are correct, check the continuity between the control unit connector C–50 terminal 1 and connector-terminal C50–6, C50–19, C50–7, C50–20. Is there continuity?	—	Begin diagnosis again Go to *Step 5*	Go to *Step 6*
5	Repair the circuit.	—	Go to *Step 7*	—
6	Replace the control unit.	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *“Basic Diagnosis FLow”.*	Go to *Step 7*

DTC9–3 Control Unit Blown Fuse for RR Shock Absorber

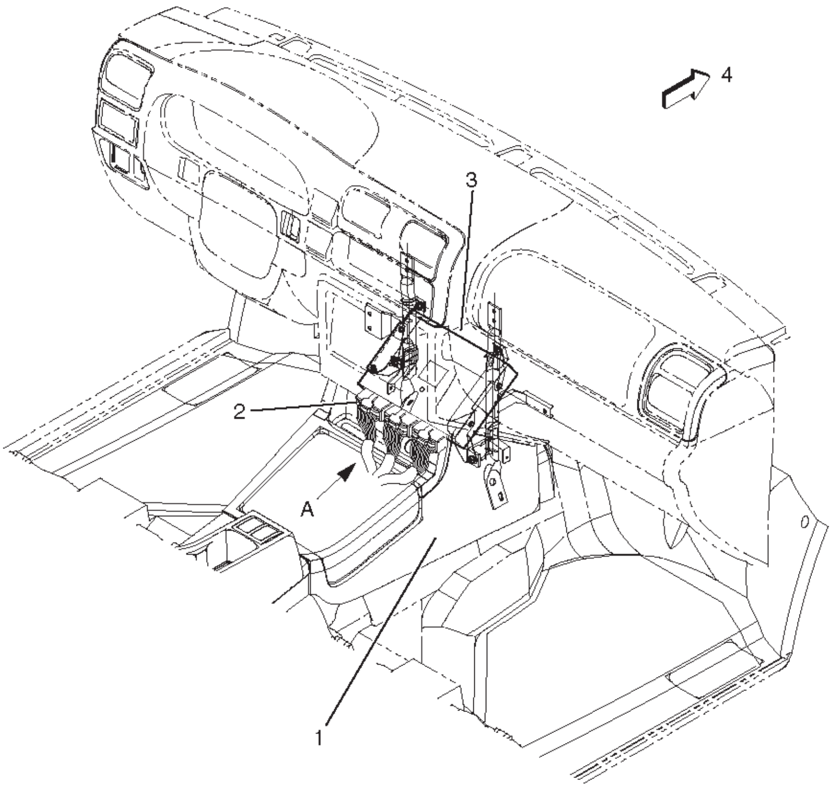
Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the shock absorber connector F–6. 3. Measure the resistance between the shock absorber side connector F–6 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the shock absorber side connector F–6 terminals 7 and 8. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the shock absorber RR.	—	Go to *Step 7*	—
4	1. If all steps are correct, check the continuity between the control unit connector C–50 terminal 1 and connector-terminal C50–8, C50–21, C50–9, C50–22. Is there continuity?	—	Begin diagnosis again Go to *Step 5*	Go to *Step 6*
5	Repair the circuit.	—	Go to *Step 7*	—
6	Replace the control unit.	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *“Basic Diagnosis FLow”.*	Go to *Step 7*

DTC9–4 Control Unit Blown Fuse for RL Shock Absorber

Step	Action	Value(s)	Yes	No
1	1. Turn off the starter switch. 2. Disconnect the shock absorber connector F–7. 3. Measure the resistance between the shock absorber side connector F–7 terminals 3 and 4. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 2*	Go to *Step 3*
2	1. Measure the resistance between the shock absorber side connector F–7 terminals 7 and 8. Does the resistance indicate within the specified value?	6.4– 7.2Ω	Go to *Step 4*	Go to *Step 3*
3	Replace the shock absorber RL.	—	Go to *Step 7*	—
4	1. If all steps are correct, check the continuity between the control unit connector C–50 terminal 1 and connector-terminal C50–10, C50–23, C50–11, C50–24. Is there continuity?	—	Begin diagnosis again Go to *Step 5*	Go to *Step 6*
5	Repair the circuit.	—	Go to *Step 7*	—
6	Replace the control unit.	—	Go to *Step 7*	—
7	1. Reconnect all components, ensure all components are properly mounted. 2. Clear the DTC. Was this step finished?	—	Go to *“Basic Diagnosis FLow”.*	Go to *Step 7*

Control Unit

Control Unit and Associated Parts



828RY00001

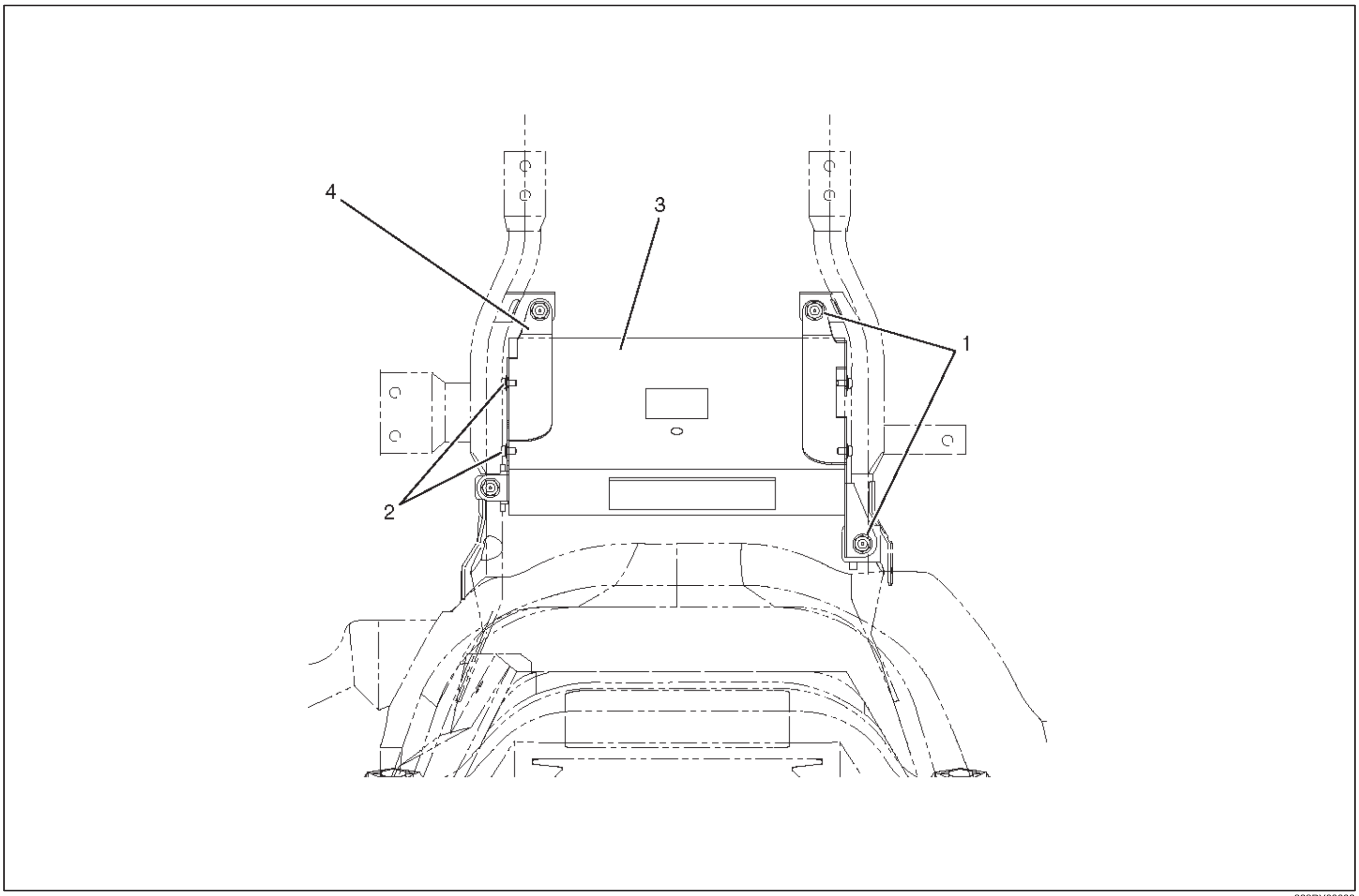
Legend

(1) Front Console
(2) Connector
(3) Control Unit
(4) Front

Removal

1. Disconnect the battery ground cable.
2. Remove the front console assembly.
   Refer to *Consoles in Body and Accessories section.*
3. Disconnect the connector from the control unit.

View A



Legend

(1) Nut
(2) Screw
(3) Control Unit
(4) Bracket

4. Remove 4 nuts.
5. Disconnect the control unit with brackets.
6. Remove 4 screws.
7. Disconnect the control unit from brackets.

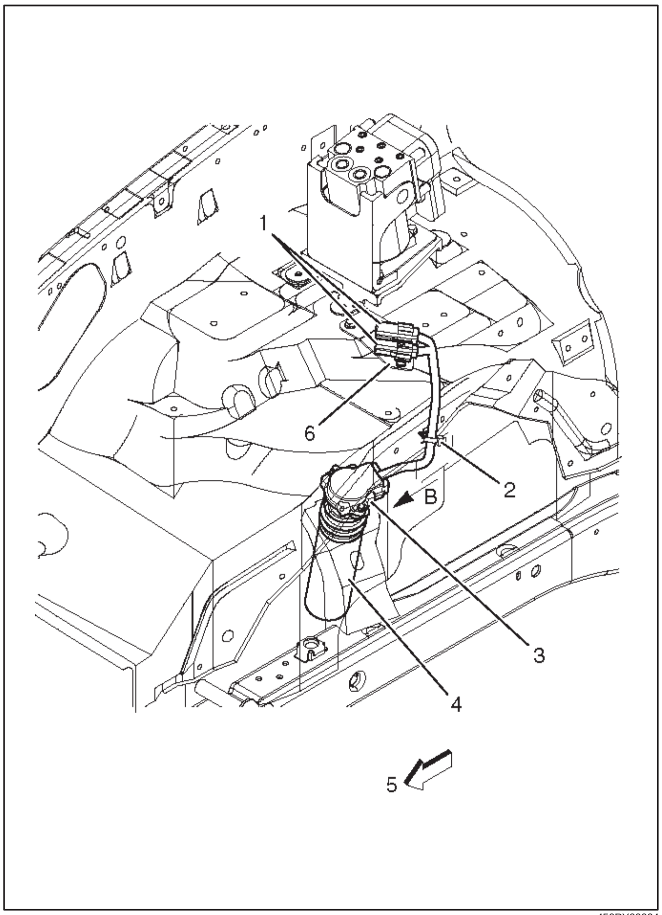
Installation

To install, follow the removal steps in the reverse order, noting the following points.
Torque:
Nut (1) 8N·m (69 lb in)

Front Actuator

Front Actuator and Associated Parts

RH

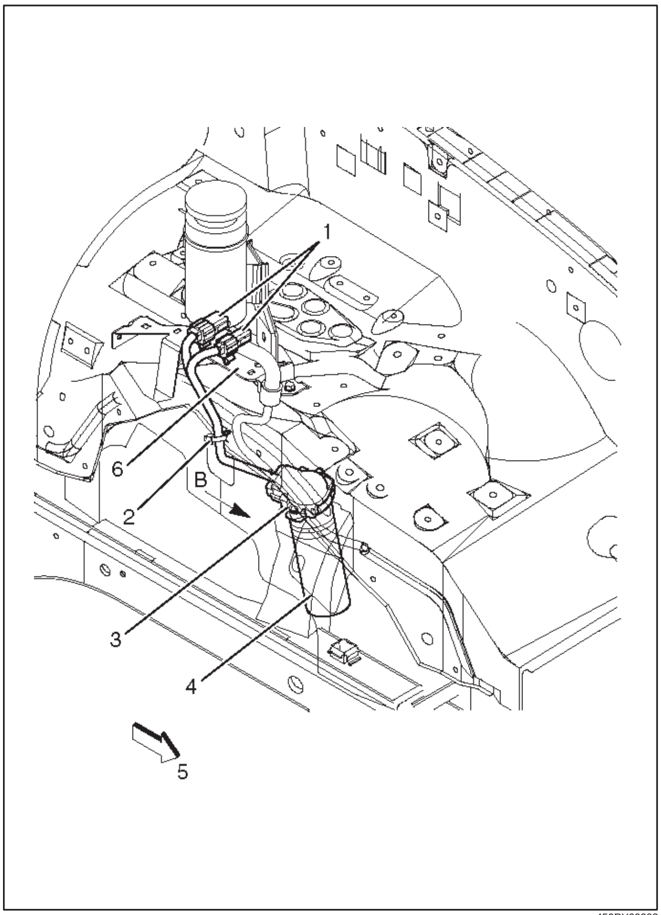


450RY00004

Legend

(1) Connector
(2) Clip
(3) Actuator
(4) Shock Absorber
(5) Front
(6) Bracket

LH



450RY00003

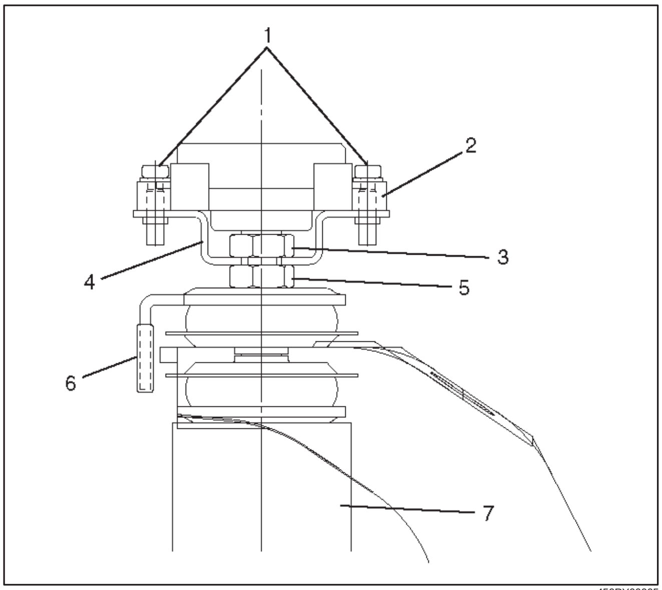
Legend

(1) Connector
(2) Clip
(3) Actuator
(4) Shock Absorber
(5) Front
(6) Bracket

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector from the harness and remove the connector from the bracket.
3. Remove the clip.

View B



Legend

(1) Screw
(2) Actuator
(3) Nut
(4) Bracket
(5) Nut
(6) Washer
(7) Shock Absorber

1. Removal 2 screws.
2. Disconnect the actuator.
3. Remove the nut.
4. Disconnect bracket.
5. Remove the nut.
6. Disconnect the washer.
7. Remove the shock absorber.
   Refer to *Shock Absorber in this section.*

Inspection and Repair

Refer to *shock Abosorber in this section.*

Installation

1. Install the shock absorber.
   Refer to *Shock Absorber in this section.*
2. Install the washer and nut (5), then tighten it to the specified torque.
   Torque: 37 N· m (27 lbft)
3. Install the bracket and nut (3), then tighten it to the specified torque.
   Torque: 37 N· m (27 lbft)
4. Fit the top of the shock absorber rod in the connection part of the actuator.

NOTE:

The mating section is width fitting across flats.

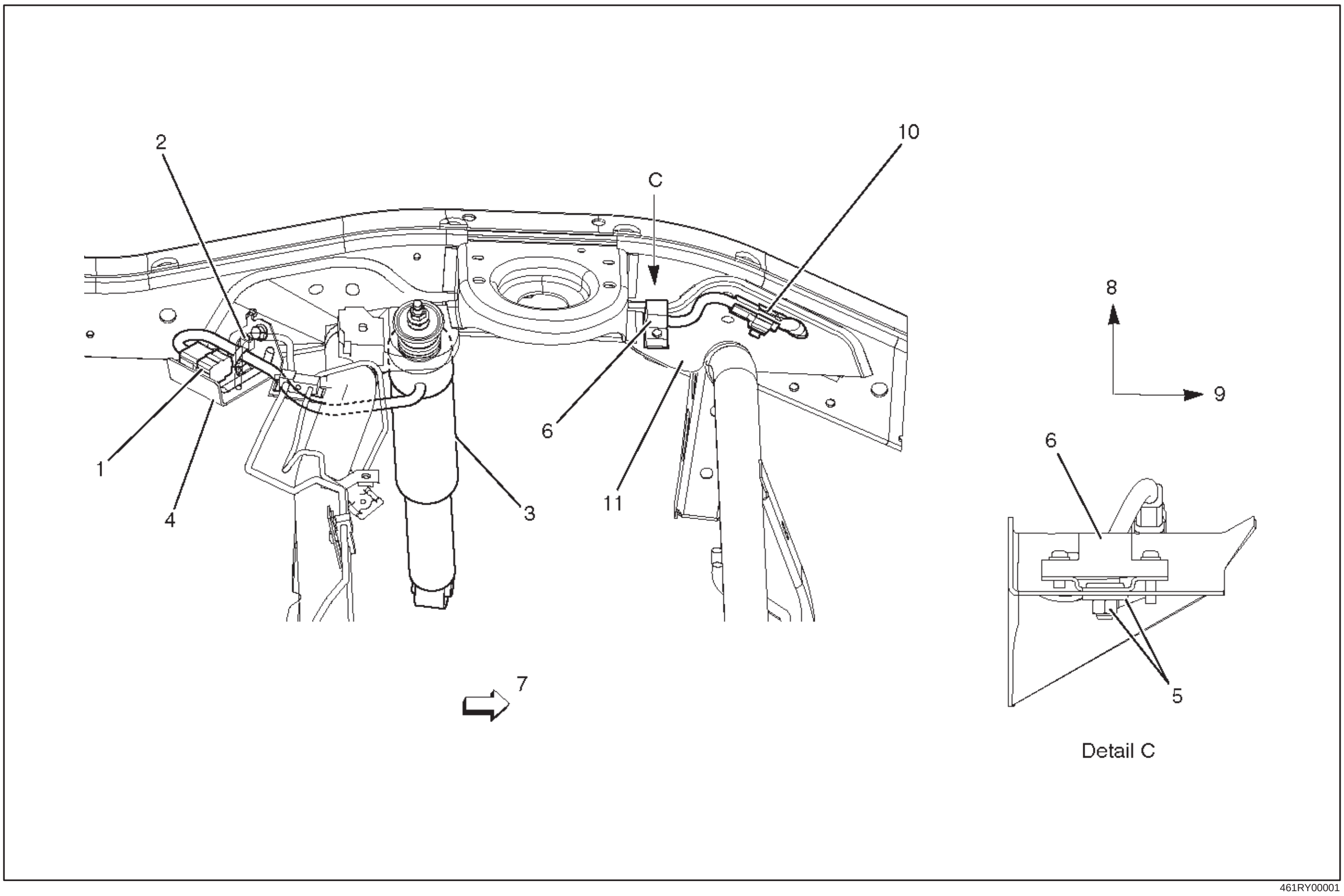
If these normally fit, the distance between the actuator lower face and the bracket upper face is about 1 mm.

5. Install 2 screws then tighten it to the specified torque.
   3 N· m (26 lbft)
6. Connect the connector to the harness and insert the connector to the bracket.
7. Connect the actuator harness with the clip.
8. Connect the battery ground cable.

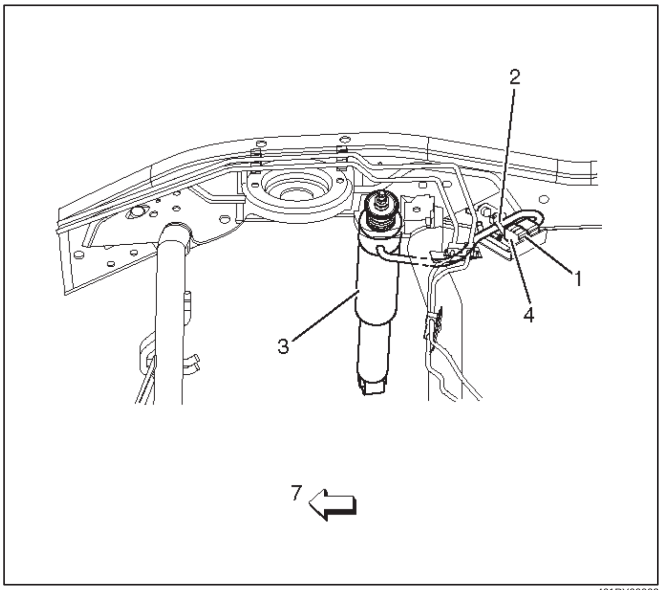
Rear Shock Absorber

Rear Shock Absorber and Associated Parts

LH



RH



461RY00002

Legend

(1) Connector
(2) Clip
(3) Rear Shock Absorber
(4) Bracket
(5) Nut and Washer
(6) G-Sensor
(7) Front
(8) Upper
(9) Right
(10) Connector
(11) Gusset

Removal

1. Disconnect the battery ground cable.
2. Disconnect the connector (1) from the harness and remove the connector (1) from the bracket.
3. Remove the clip.
4. Remove the rear shock absorber.
   Refer to *Shock Absorber in this section.*
5. Disconnect the connector (10) from the harness and remove the connector (10) from the gusset.
6. Remove the nut and washer.
7. Disconnect the G-sensor.

Inspection and Repair

Refer to Shock Absorber in this section.

Installation

1. Set the G-sensor on the gusset.
2. Install the washer and nut, then tighten it to the specified torque.
   Torque: 41 N· m (30 lbin)
3. Connect the connector (10) to the harness and insert the connector (10) to the gusset.
4. Install the rear shock absorber.
   Refer to *Shock Absorber in this section.*
5. Connect the connector (1) to the harness and insert the connector (1) to the bracket.
6. Insert the clip to the bracket.
7. Connect the battery ground cable.

AMIGO

DRIVELINE/AXLE

DIFFERENTIAL (FRONT)

CONTENTS

Main Data And Specifications

General Specifications

Axle tube Type		It consists of the duct, a cast iron housing and the axle tube.
Gear type		Hypoid
Gear ratio	(to 1)	4.100 (6VD1 with A/T) 4.300 (6VD1 with M/T)
Differential type		Two pinion
Oil capacity	liter (US qt)	1.25 (1.33) (Differential) 0.12 (0.13) (Actuator Housing: Shift on the fly)
Type of lubricant		GL–5 (75W–90)
Axle shaft type		Constant velocity joint (Birfield joint type and double offset joint)
Hub locking Type		Rigid

AMIGO

DRIVELINE/AXLE

DIFFERENTIAL (REAR)

CONTENTS

Main Data And Specifications

General Specifications

Rear axle	
Type	Salisbury, Semi–floating
Rear axle Size	226 mm (8.9 in)
Gear type	Hypoid
Gear ratio (to 1)	4.100 (6VD1 with A/T) 4.300 (6VD1 with M/T) 4.777 (X22SE with M/T)
Differential type	Two pinion
Lubricant Grade	GL–5: (Standard differential)
	GL–5, LSD: (Limited slip differential)
Locking Differential Lubricant	80W90 GL–5 (USE Limited Slip Differential Gear Lubricant or Friction Modifier Organic Additive)
Capacity	1.77 liter (1.87 US qt)

AMIGO

DRIVELINE/AXLE

Drive Shaft System

CONTENTS

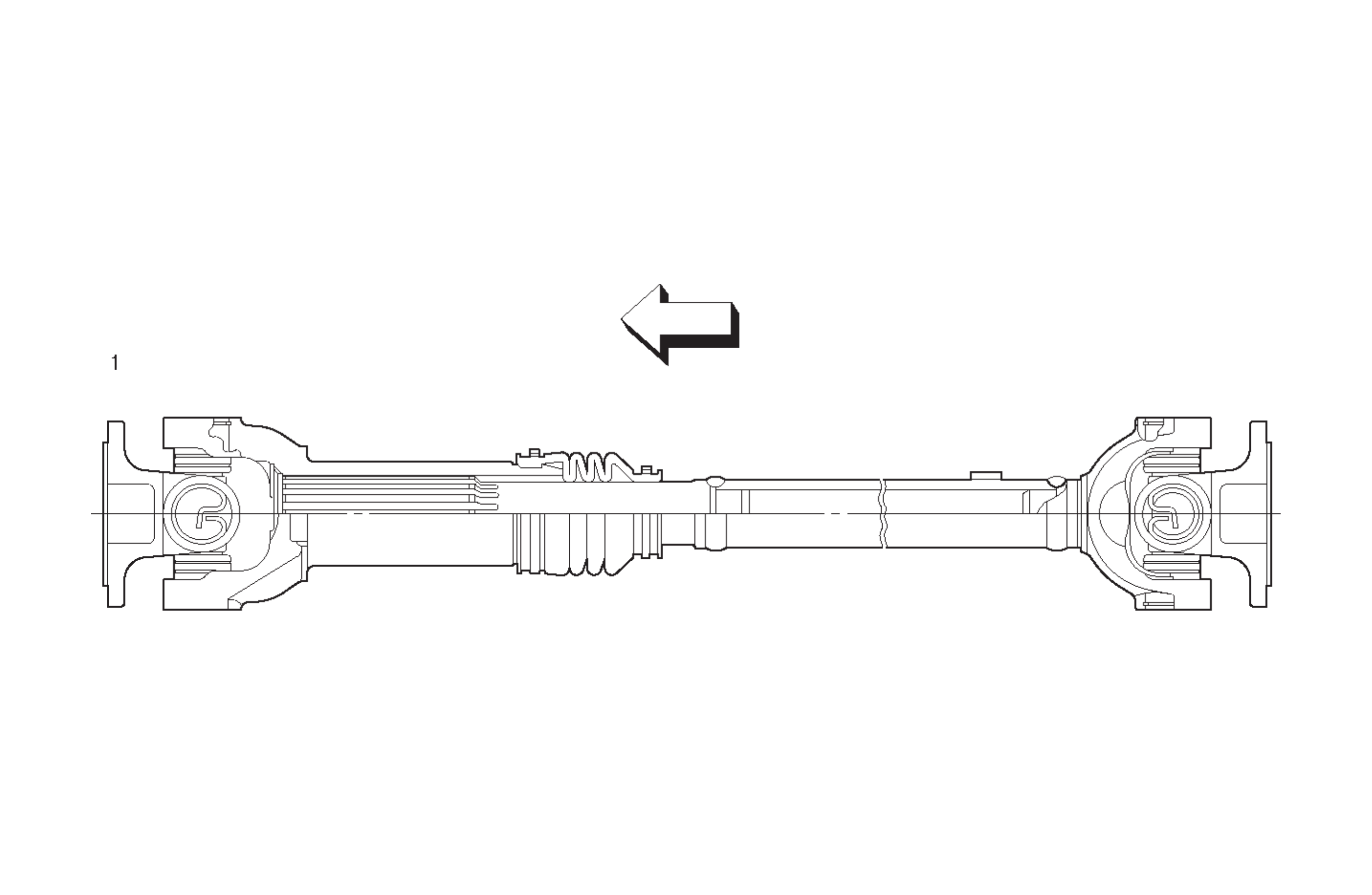
Service Precaution

WARNING: THIS VEHICLE HAS A SUPPLEMENTAL RESTRAINT SYSTEM(SRS). REFER TO THE SRS COMPONENT AND WIRING LOCATION VIEW IN ORDER TO DETERMINE WHETHER YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING. WHEN YOU ARE PERFORMING SERVICE ON OR NEAR THE SRS COMPONENTS OR THE SRS WIRING, REFER TO THE SRS SERVICE INFORMATION. FAILURE TO FOLLOW WARNINGS COULD RESULT IN POSSIBLE AIR BAG DEPLOYMENT, PERSONAL INJURY, OR OTHERWISE UNNEEDED SRS SYSTEM REPAIRS.

CAUTION: Always use the correct fastener in the proper location. When you replace a fastener, use ONLY the exact part number for that application. ISUZU will call out those fasteners that require a replacement after removal. ISUZU will also call out the fasteners that require thread lockers or thread sealant. UNLESS OTHERWISE SPECIFIED , do not use supplemental coatings (Paints, greases, or other corrosion inhibitors) on threaded fasteners or fastener joint interfaces. Generally, such coatings adversely affect the fastener torque and the joint clamping force, and may damage the fastener. When you install fasteners, use the correct tightening sequence and specifications. Following these instructions can help you avoid damage to parts and systems.

Front Propeller Shaft

General Description



Legend

(1) Single Cardan Joint Type (for 6VD1)

Propeller Shaft

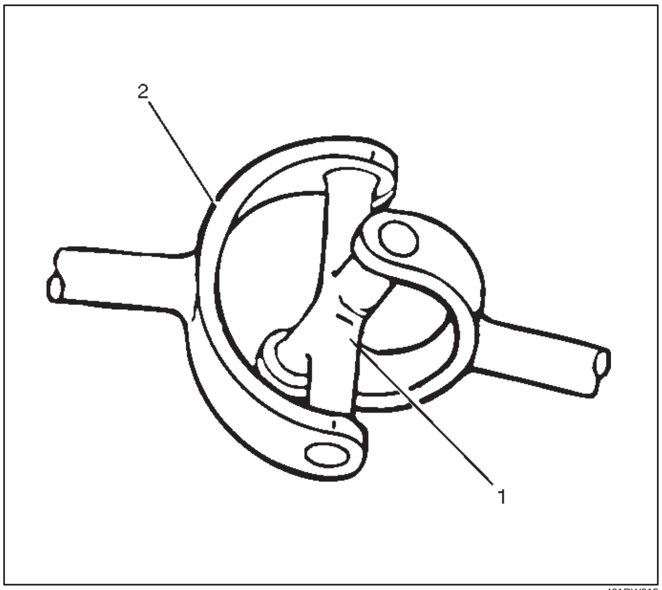
Torque is transmitted from the transmission to the front axle through one propeller shaft and universal joint assembles. All propeller shafts are the balanced tubular type. A splined slip joint is provided in some drivelines.

- Since the propeller shaft is total balanced carefully, welding or any other modification are not permitted.
- Alignment marks should be applied to each propeller shaft before removal.
- Be sure vehicle is stopped, engine is not running, brake is secured and vehicle is secured to prevent injury.
- Be careful not to grip the propeller shaft tube too tightly in the bise as this will be cause deformation.

Phasing

The propeller shaft is designed and built with the yoke lugs (ears) in line with each other. This design produces the smoothest running shaft possible, called phasing.Vibration can be caused by an out–of–phase propeller shaft.The propeller shaft will absorb vibrations from speeding up and slowing down each time the universal joint goes around.This vibration would be the same as a person snapping rope and watching the ”wave” reaction flow to the end.A propeller shaft working in phase would be similar to two persons snapping a rope at the same time, and watching the ”waves” meet and cancel each other out.In comparison, this would be the same as the universal joints on a propeller shaft.A total cancellation of vibration produces a smooth flow of power in the driveline.It is very important to apply a reference mark to the propeller shaft before removal, to assure installation alignment.

Universal Joint



401RW015

Legend

(1) Spider
(2) Yoke

A universal joint consists of two Y-shaped yokes connected by a crossmember called a spider.

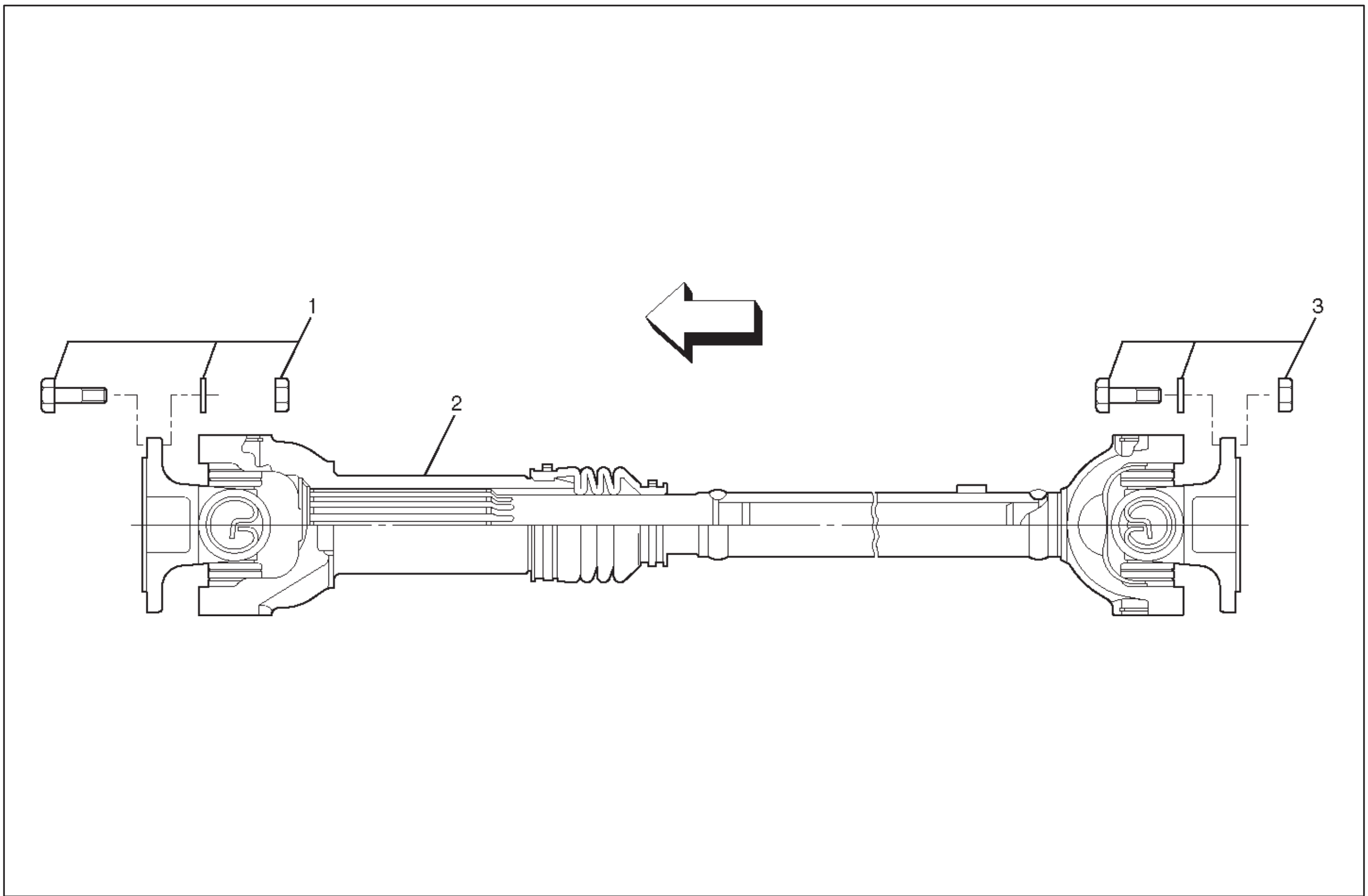
The spider is shaped like a cross. Universal joints are designed to handle the effects of various loadings and front or rear axle windup during acceleration. Within the designed angle variations, the universal joint will operate efficiently and safely. When the design angle is changed or exceeded the operationallife of the joint may decrease.

The bearings used in universal joints are of the needle roller type. The needle rollers are held in place on the trunnions by round bearing cups. The bearing cups are held in the yokes by snap rings.

Diagnosis of Propeller Shaft and Universal Joint

Condition	Possible cause	Correction
Universal Joint Noise.	Worn universal joint bearings.	Replace.
	Improper lubrication.	Lubricate as directed.
	Loose flange bolts.	Tighten to specifications.
Ping, Snap, or Click in Drive Line (Usually Heard on Initial Load after the Transmission is in Forward or Reverse Gear)	Loose bushing bolts on the rear springs or upper and lower control arms.	Tighten the bolts to specified torque.
	Loose or out-of-phase end yoke.	Remove end yoke, turn 180 degrees from its original position, lubricate the splines and reinstall. Tighten the bolts and pinion nut to specified torque.
Knocking or Clanking Noise in the Driveline when in High or Neutral Gear at 16km/h(10mph)	Worn or damaged universal joint	Replace the universal joint.
Squeak	Lack of lubricant.	Lubricate joints and splines. Also check for worn or brinelled parts.
Shudder on Acceleration (Low Speed)	Loose or missing bolts at the flanges.	Replace or tighten bolts to specified torque.
	Incorrectly set front joint angle.	Install shim under the transmission support mount to change the front joint angle.
	Worn universal joint.	Replace.
Vibration	Incorrect shaft runout.	Replace.
	Shaft out of balance.	Adjust.
	Transmission rear housing bushing, transfer case housing bushing worn.	Replace.
	Yoke spline jammed.	Replace.

Front Propeller Shaft and Associated Parts



401RW093

Legend

(1) Bolt, Nut and Washer (Front Axle Side)

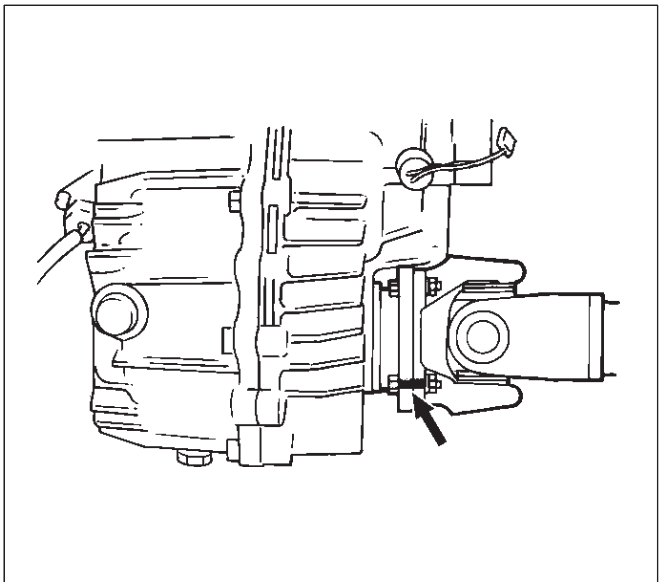
(2) Front Propeller Shaft (Single Cardan Type)

(3) Bolt, Nut and Washer (Transfer Side)

Removal

1. Raise the vehicle on a hoist.

NOTE: Apply alignment marks on the flange at the front propeller shaft both front and rear side.



401RS020

2. Remove bolt, nut and washer (Front axle side).
3. Remove bolt, nut and washer (Transfer side).
4. Remove front propeller shaft.

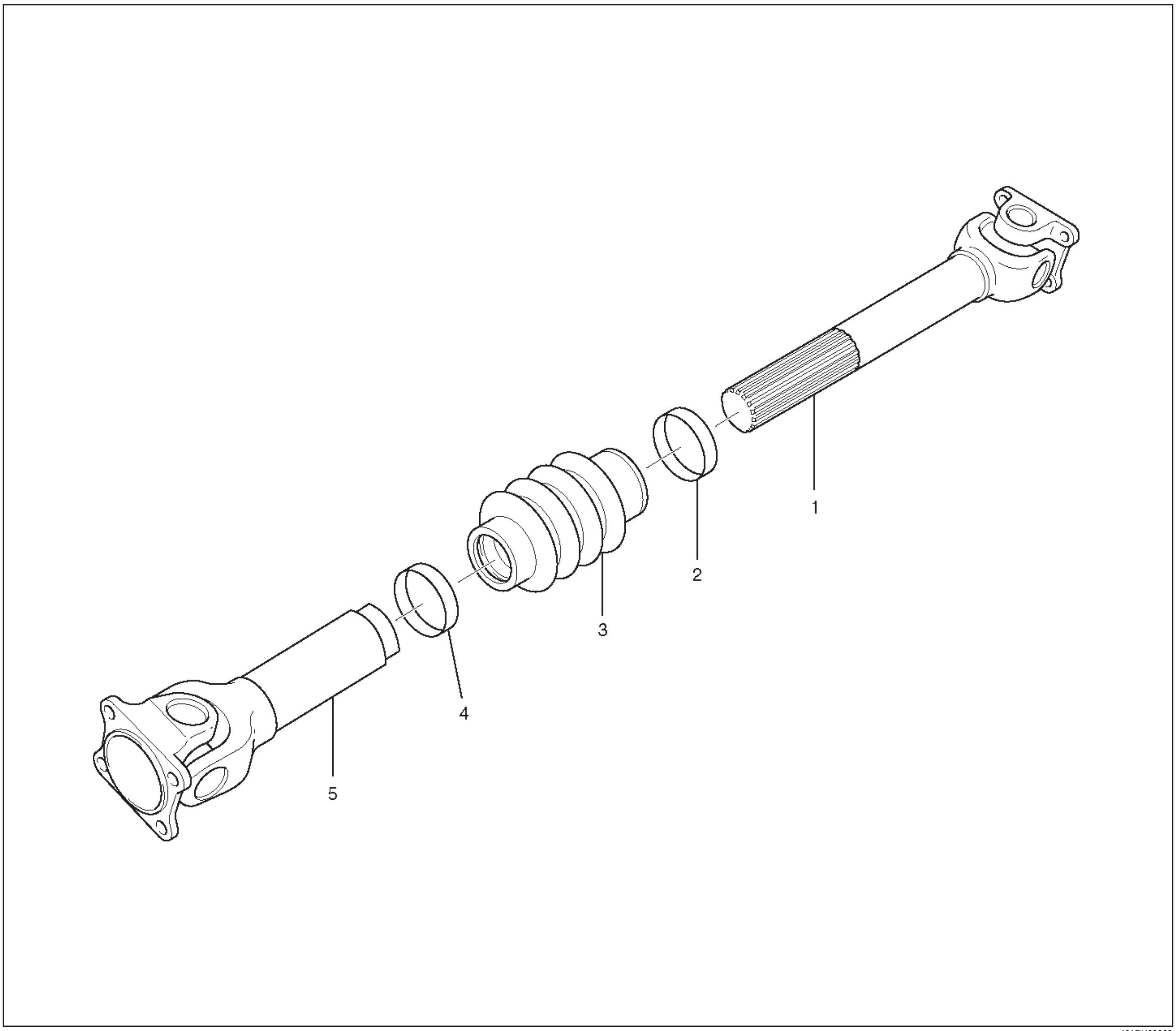
Installation

NOTE: Never install the shaft assembly backwards. Never insert bar between yoke lugs when tightening or removing bolts. Completely remove the black paint from the connecting surface of flange coupling on each end of propeller shaft. Clean so that no foreign matter will be caught in between.

1. Align the mark which is applied at removal. Install front propeller shaft and tighten the bolts to the specified torque.

Torque: 63 N·m (46 lb ft)

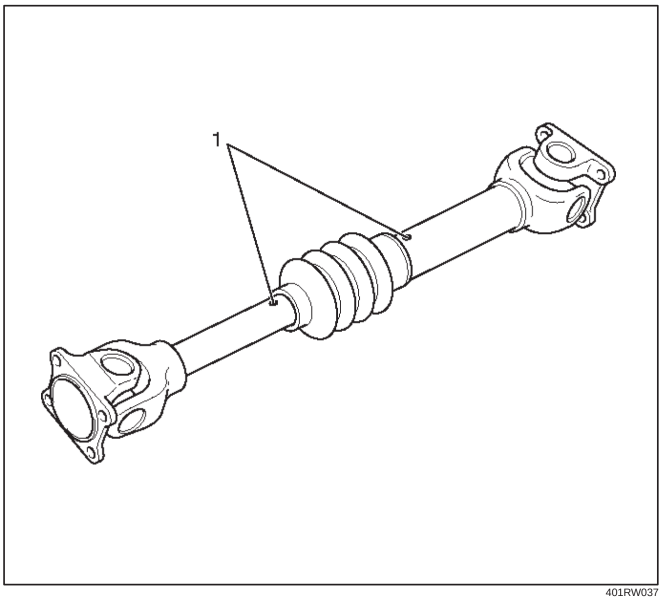
Slip Joint Disassembly



Legend

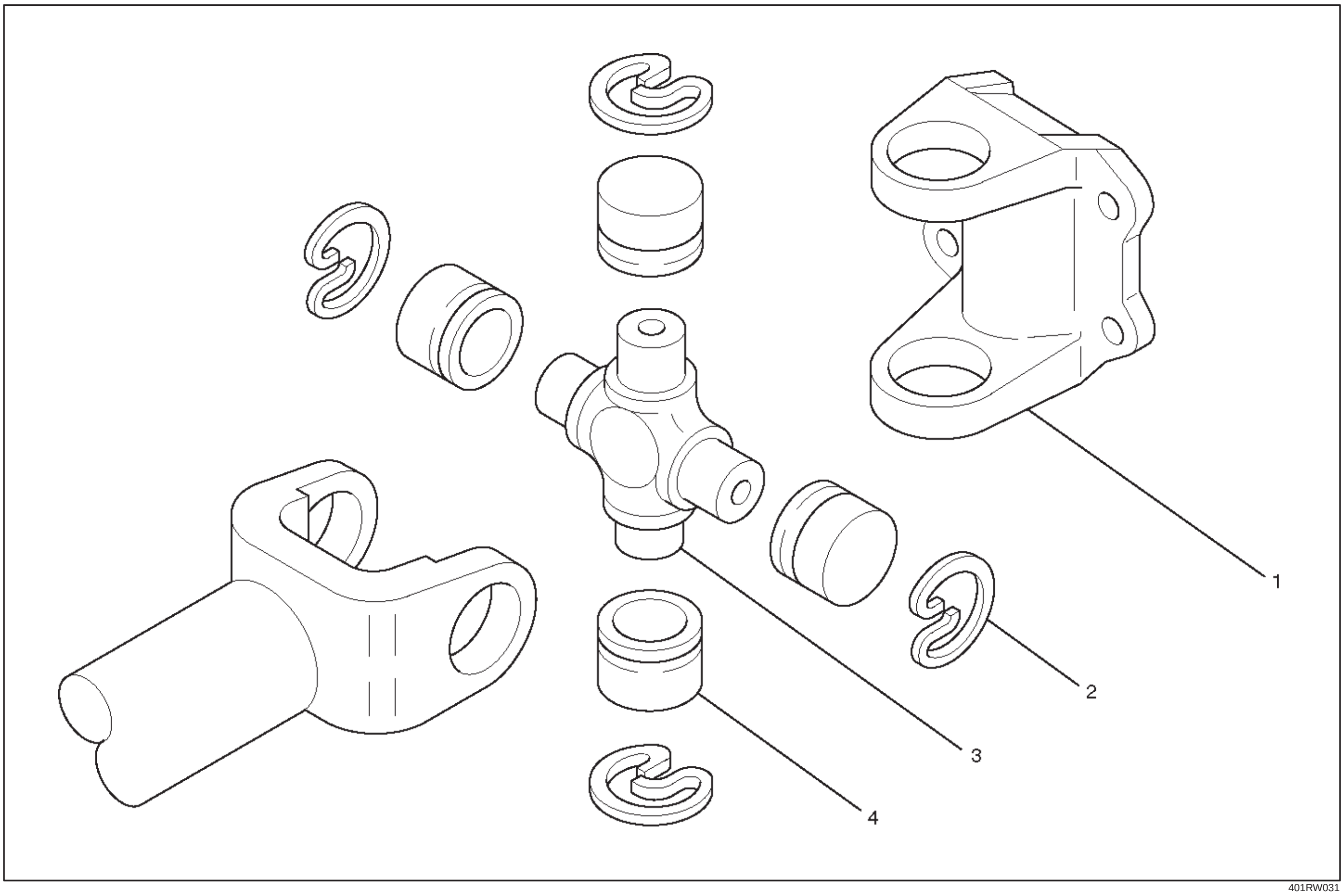
(1) Spline Yoke Assembly
(2) Clamp
(3) Boot
(4) Clamp
(5) Tube Assembly

1. Lay the shaft horizontally on a bench and secure.
2. Indicate the original assembled position (1) by marking the phasing of the shaft prior to disassembly.



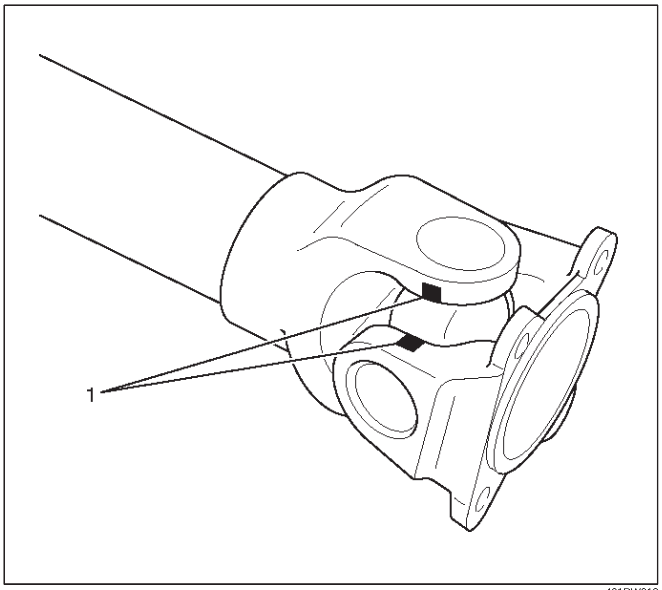
3. Using the flat blade of a screwdriver, pry the loose end of the boot clamp upwards and away from the propeller shaft boot. Be careful not to damage the boot.
4. When boot clamps becomes loose, remove by hand.
5. Repeat for the other boot clamp.
6. Remove the spline yoke assembly from the tube assembly, by securing the boot with one hand and pulling on the spline yoke.
7. Remove the boot from the tube assembly.

Universal Joint Disassembly(Single Cardan Type)



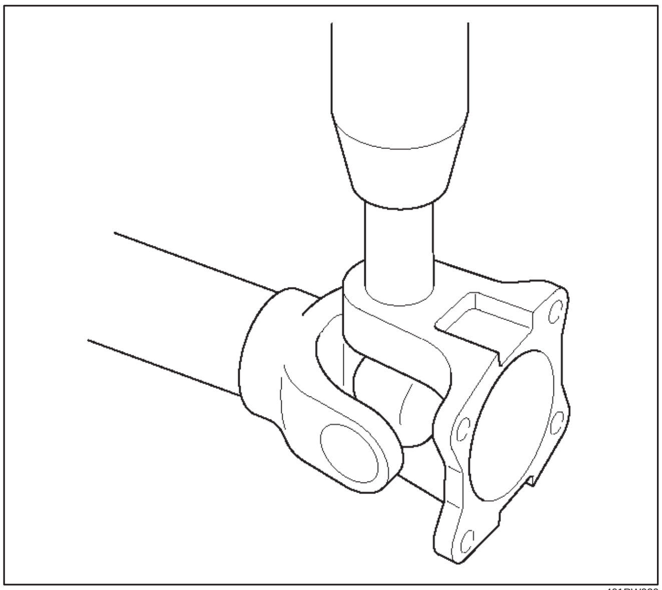
Legend
(1) Flange Yoke
(2) Snap Ring
(3) Spider
(4) Needle Roller Bearing

1. Using a soft drift, tap the outside of the bearing cup assembly to loosen snap ring. Tap bearing only hard enough to break assembly away from snap ring.
   Remove snap ring from yoke. Turn joint over, tap bearing away from snap ring, then remove opposite snap ring.
   Apply alignment marks (1) on the yokes of the universal joint, then remove snap ring.



401RW018

2. Set the yoke in the arbor press with a piece of tube stock beneath it.
   Place a solid plug on the upper bearing assembly and press it through to release the lower bearing assembly.

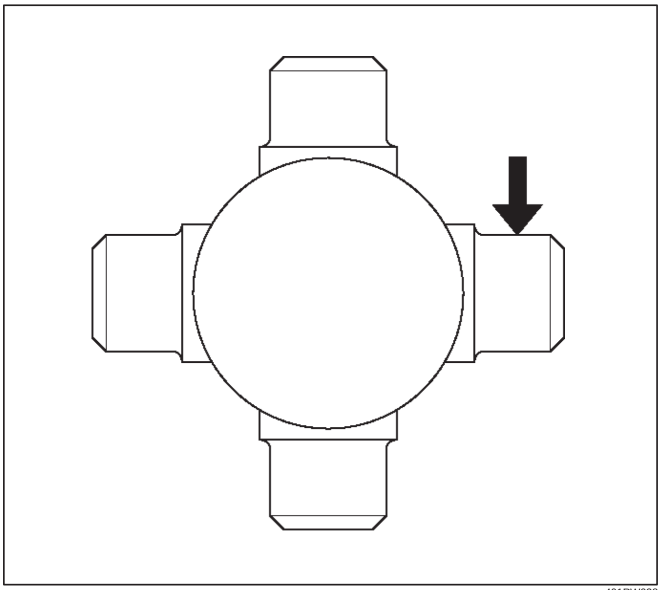


401RW020

3. If the bearing assembly will not pull out by hand after pressing, tap the base of the lug near the bearing assembly to dislodge it.
4. To remove the opposite bearing, turn the yoke over and straighten the spider in the open hole. Then carefully press on the end of the spider so the remaining bearing moves straight out of the bearing spider hole. If the spider or bearing are cocked, the bearing will score the walls of the spider hole and ruin the yoke.
5. Repeat this procedure on the remaining bearing to remove the spider from the yoke.
6. Make sure of proper position for reinstallation by applying setting marks, then remove spider .

Spider pin for wear

Spider pin should be smooth and free from fretting or galling. Visible signs of needle presence is normal, but wear should not be felt.



401RW038

Propeller shaft runout

Support the propeller shaft on V-blocks (2) and check for runout by holding the probe of a dial indicator (1) in contact with the shaft.

Static runout limit:

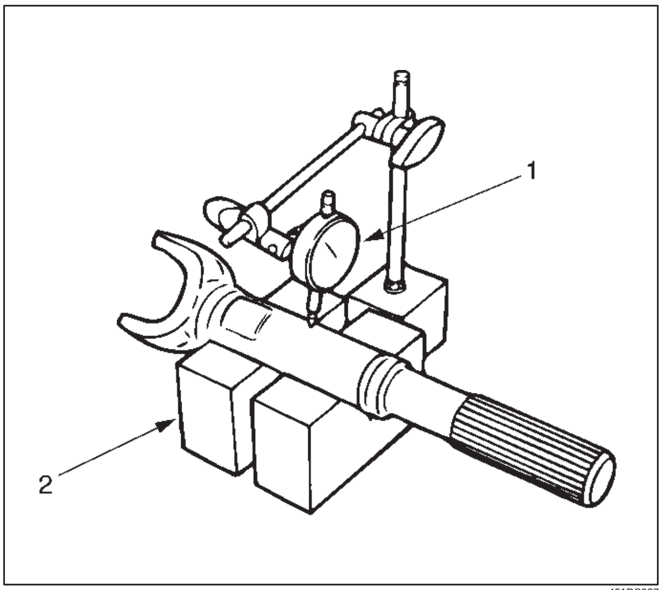
0.13 mm (0.005 in)
TIR on the neck of the slip tube shaft (with a boot).

0.25 mm (0.010 in)
TIR on the ends of the tubing 3 inch from the welds.

0.38 mm (0.015 in)
TIR at the linear center of the tube.

0.38 mm (0.015 in)
TIR for the full length of tube with 30” or less of tubing.

(TIR : Total Indicator Reading)



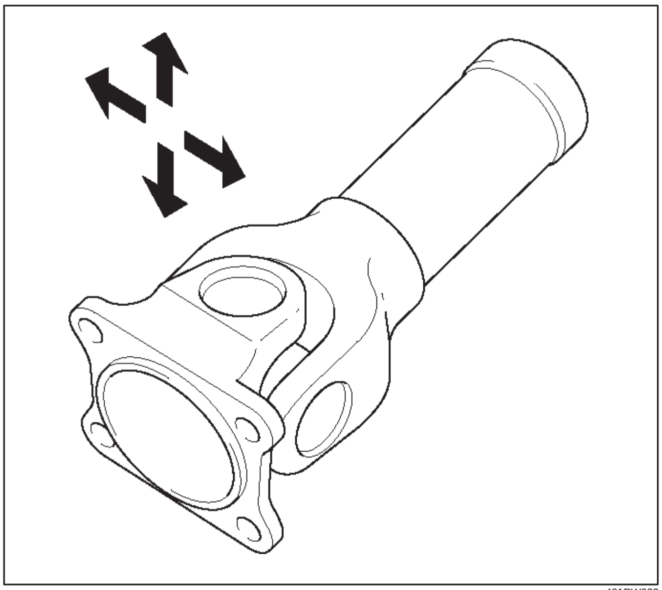
401RS027

Spline

The nylon-coated spline should be free from nicks and dings and the underlying steel spline should not be visible. After cleaning the nylon coating spline, the coating should exhibit only a slight indication of wear.
Grease volume is approximately 10 grams of grease in total. Grease should be evenly applied to both the female and the male slip splines using a small brush. After assembly of the slip joint, the sliding joint should be fully worked from the full collapsed to the full extended position.

Play in the universal joint

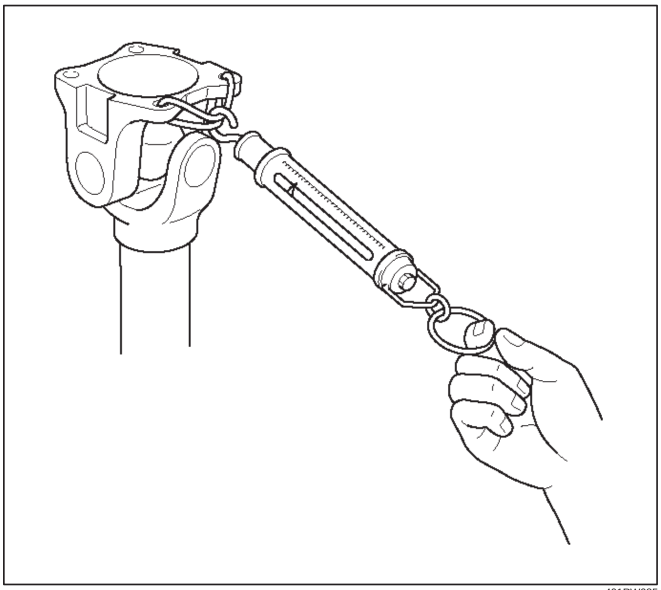
Limit: Less than 0.15 mm (0.006 in)



401RW023

Preload of the universal joint

Preload should be 0 to 24.9 kg(0 to11.3 lb). Joints should rotate smoothly and freely and should exhibit no rough or ratchety movement.



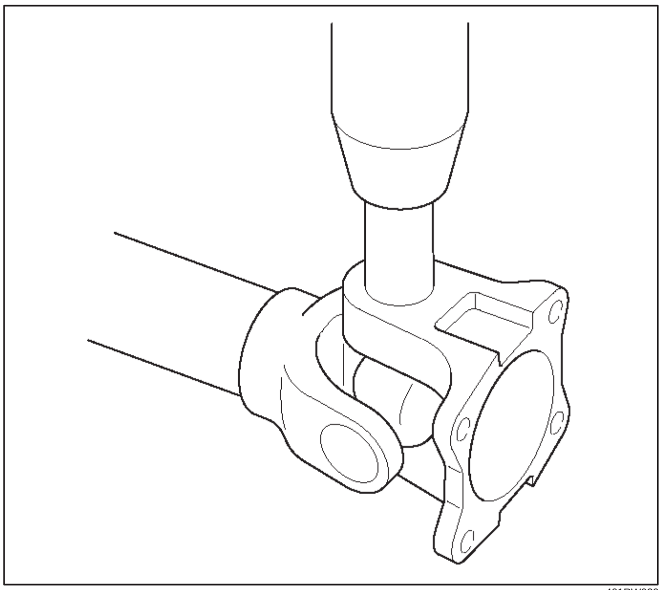
401RW085

Boot

Check the boot for crack or damage. If necessary, replace the boot.
If abnormal condition are found on the boot, inspect the grease for mixing of foreign material.
If the grease is good condition, and slip joint works well, replace the boot, replenish grease, and reassemble the slip joint.
If the foreign material is found in the grease, check the spline for wear and damage.

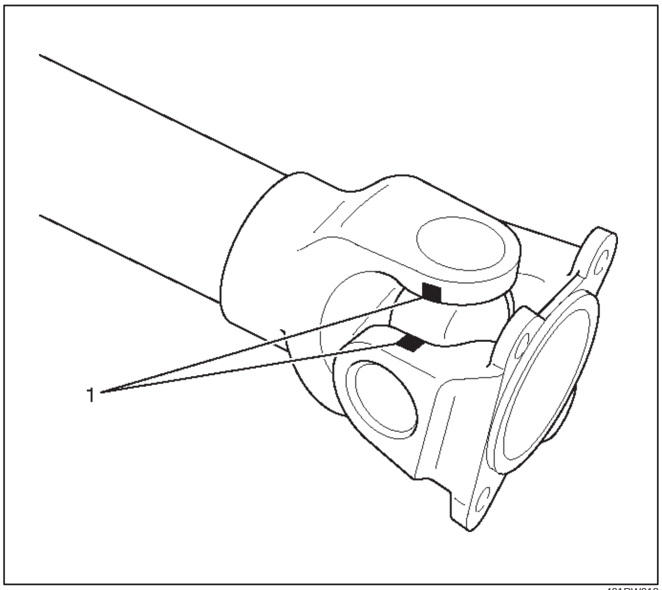
Universal Joint Reassembly(Single Cardan Type)

1. Install spider to flange yoke. Be sure to install the spider by aligning the setting marks made during disassembly.
2. Pack the four grease cavities of the spider with a high quality, extreme pressure N.L.G.I. Grade 2 grease. Do not add additional grease to the bearing cup assembly.
3. Move one end of the spider to cause a trunnion to project through the spider hole beyond the outer machined face of the yoke lug. Place a bearing over the trunnion diameter and align it to the spider hole. Using an arbor press, hold the trunnion in alignment with the spider hole and place a solid plug on the upper bearing. Press the bearing into the spider hole enough to install a snap ring.



401RW020

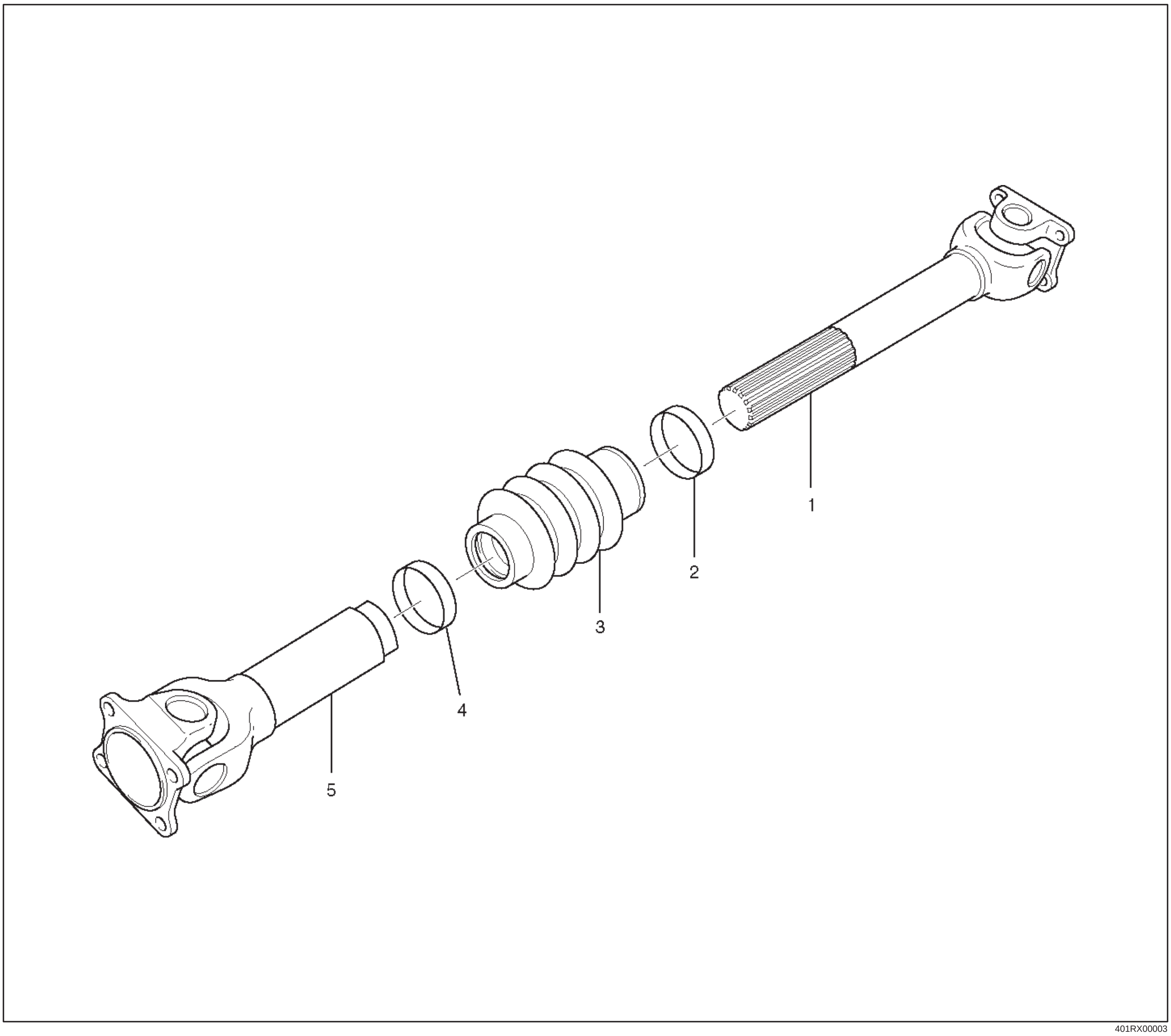
4. Install a snap ring.
   Be sure the snap rings are properly seated in the grooves.
5. Repeat steps 3 and 4 to install the opposite bearing. If the joint is stiff, strike the yoke ears with a soft hammer to seat needle bearings.
6. Align setting marks (1) and join the yokes.



401RW018

7. Install snap ring.

Slip Joint Reassembly



Legend

(1) Spline Yoke shaft
(2) Clamp
(3) Boot
(4) Clamp
(5) Tube Assembly

1. Apply grease evenly to both the female and male splines.
2. Apply a small amount of grease by finger to the outer lips of the boot.
3. Slide the boot (smaller diameter side) onto the spline yoke shaft being careful not to damage the spline coating or boot.
4. Insert the spline yoke shaft into the tube assembly being careful to maintain proper phasing. The spider holes should be in line and as per originally marked prior to disassembly.
5. Position boot onto tube and yoke shaft in final position over boot grooves.
6. Attach boot clamps and secure using pliers.
7. Be sure clamp is properly seated and secure.

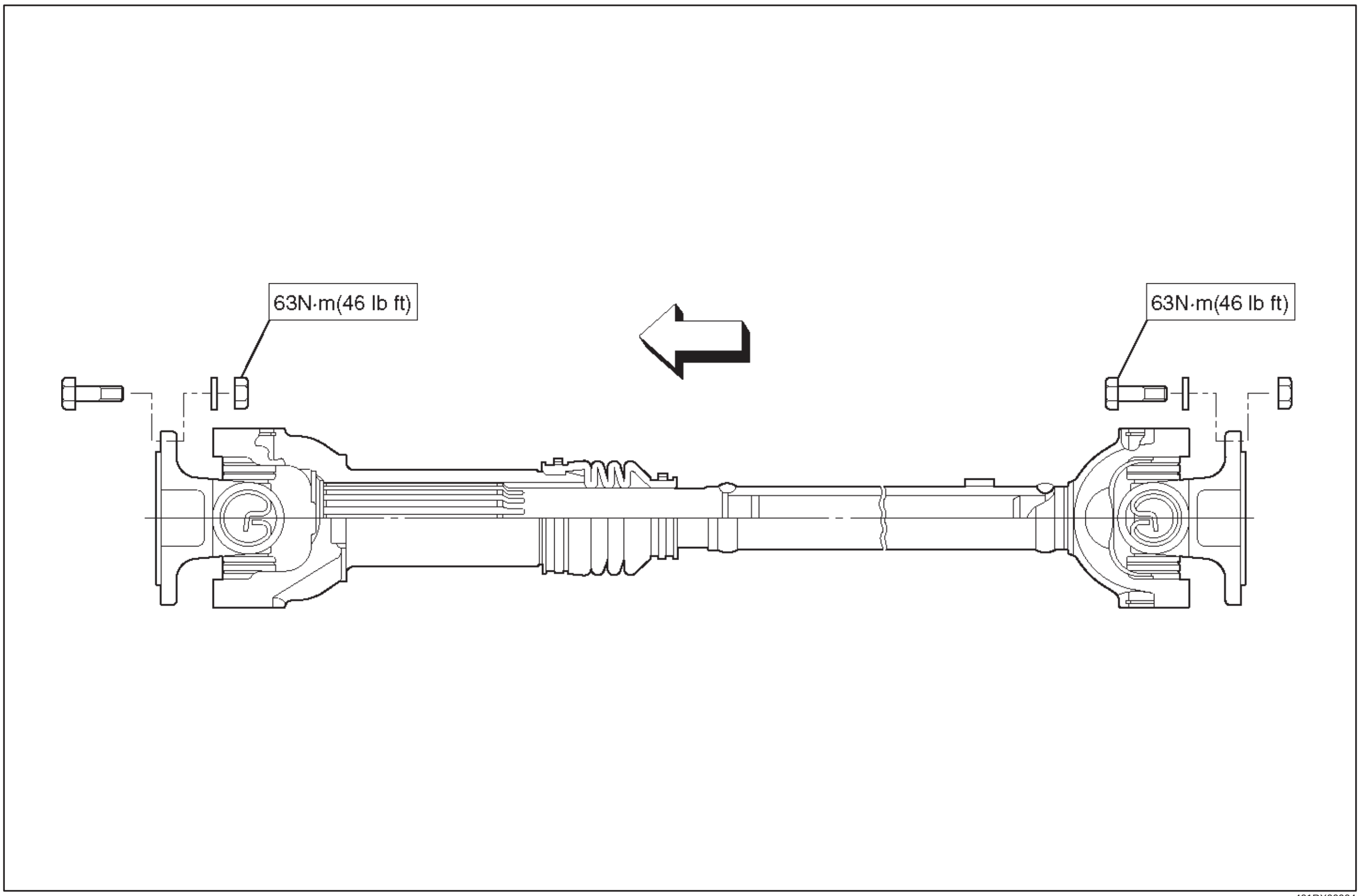
CAUTION: Use new clamp which is the same parts as original. Do not use other clamp to avoid bad balancing of shaft or the grease leakage.

Main Data And Specifications

General Specifications

Engine	6VD1
Length (between flange surfaces at installed)	453.2 mm (18.37 in)

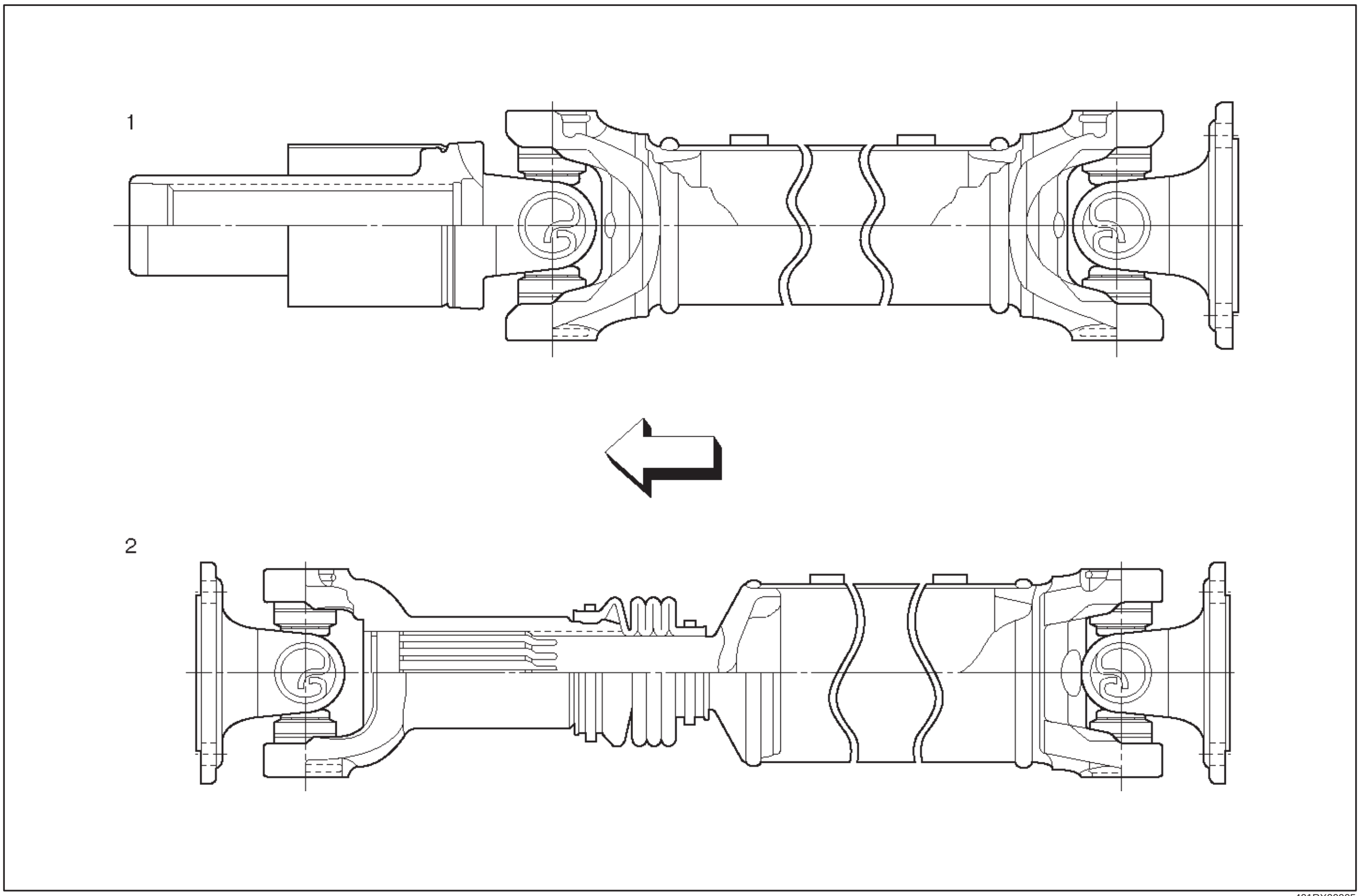
Torque Specifications



401RX00004

Rear Propeller Shaft

General Description



401RX00005

Legend

(1) For X22SE 4×2 Model
(2) For 6VD1 Model and X22SE 4×4 Model

Propeller Shaft

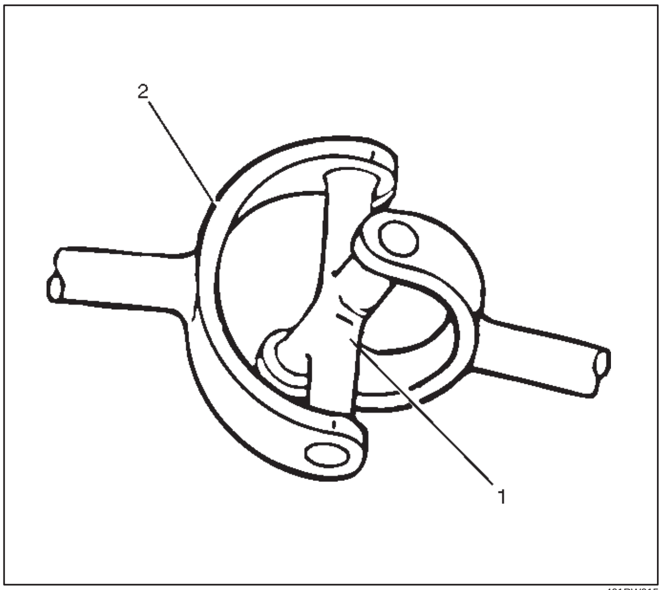
Torque is transmitted from the transmission to the rear axle through one propeller shaft and universal joint assemblies. All propeller shafts are the balanced tubular type. A splined slip joint is provided in some drivelines.

- Since the propeller shaft is total balanced carefully, welding or any other modification are not permitted.
- Alignment marks should be applied to each propeller shaft before removal.
- Be sure vehicle is stopped, engine is not running, brake is secured and vehicle is secured to prevent injury.
- Be careful not to grip the propeller shaft tube too tightly in the bise as this will be cause deformation.

Phasing

The propeller shaft is designed and built with the yoke lugs (ears) in line with each other.This design produces the smoothest running shaft possible, called phasing.Vibration can be caused by an out-of-phase propeller shaft.The propeller shaft will absorb vibrations from speeding up and slowing down each time the universal joint goes around. This vibration would be the same as a person snapping a rope and watching the ”wave” reaction flow to the end.A propeller shaft working in phase would be similar to two persons snapping a rope at the same time, and watching the ”waves” meet and cancel each other out.In comparison, this would be the same as the universal joints on a propeller shaft.A total cancellation of vibration produces a smooth flow of power in the driveline.It is very important to apply a reference mark to the propeller shaft before removal, to assure installation alignment.

Universal Joint



401RW015

Legend

(1) Spider
(2) Yoke

A universal joint consists of two Y-shaped yokes connected by a crossmember called a spider.

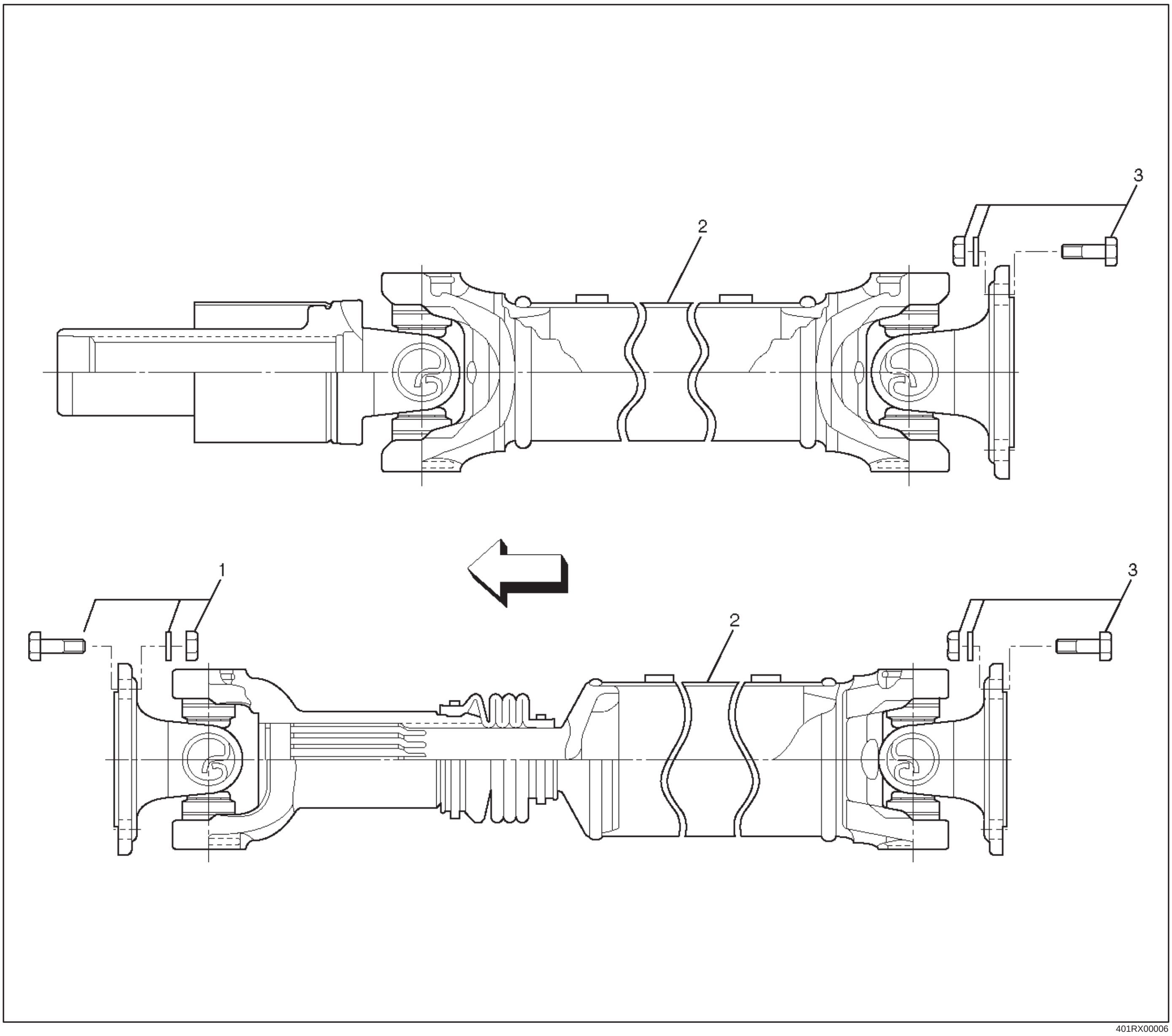
The spider is shaped like a cross. Universal joints are designed to handle the effects of various loadings and front or rear axle windup during acceleration. Within the designed angle variations, the universal joint will operate efficiently and safely. When the design angle is changed or exceeded the operationallife of the joint may decrease.

The bearings used in universal joints are of the needle roller type. The needle rollers are held in place on the trunnions by round bearing cups. The bearing cups are held in the yokes by snap rings.

Diagnosis of Propeller Shaft and Universal Joint

Condition	Possible cause	Correction
Leak at the Front Slip Yoke (An Occasional Drop of Lubricant Leaking from the Splined Yoke is Normal)	Rough surface on splined yoke; burred nicked or worn.	Replace the seal. Minor burrs can be Smoothed by careful use of crocus cloth or fine stone honing. Replace the yoke if badly burred.
	Defective transmission rear oil seal.	Replace the transmission rear oil seal and replenish the transmission oil.
Universal Joint Noise.	Worn universal joint bearings.	Replace.
	Improper lubrication.	Lubricate as directed.
	Loose flange bolts.	Tighten to specifications.
Ping, Snap, or Click in Drive Line (Usually Heard on Initial Load after the Transmission is in Forward or Reverse Gear)	Loose bushing bolts on the rear springs or upper and lower control arms.	Tighten the bolts to specified torque.
	Loose or out-of-phase end yoke.	Remove end yoke, turn 180 degrees from its original position, lubricate the splines and reinstall. Tighten the bolts and pinion nut to specified torque.
Squeak	Lack of lubricant.	Lubricate joints and splines. Also check for worn or brinelled parts.
Shudder on Acceleration (Low Speed)	Loose or missing bolts at the flanges.	Replace or tighten bolts to specified torque.
	Incorrectly set front joint angle.	Install shim under the transmission support mount to change the front joint angle.
	Worn universal joint.	Replace.
Vibration	Incorrect shaft runout.	Replace.
	Shaft out of balance.	Adjust.
	Transmission rear housing bushing, transfer case housing bushing worn.	Replace.
	Yoke spline jammed.	Replace.

Rear Propeller Shaft and Associated Parts



Legend

(1) Bolt, Nut and Washer (Transfer Side)

(2) Rear Propeller Shaft

(3) Bolt, Nut and Washer (Rear Axle Side)

Removal

1. Raise the vehicle on a hoist.

NOTE: Apply alignment marks on the flange at the rear propeller shaft both front and rear side.

2. Remove transfer side bolt, nut and washer (4×4 model only).
3. Remove rear axle side bolt, nut and washer.
4. Remove rear propeller shaft.

NOTE: Plug the hole of the transmission rear end to prevent oil leakage (4×2 model only).

Installation

NOTE: Never install the shaft assembly backwards.

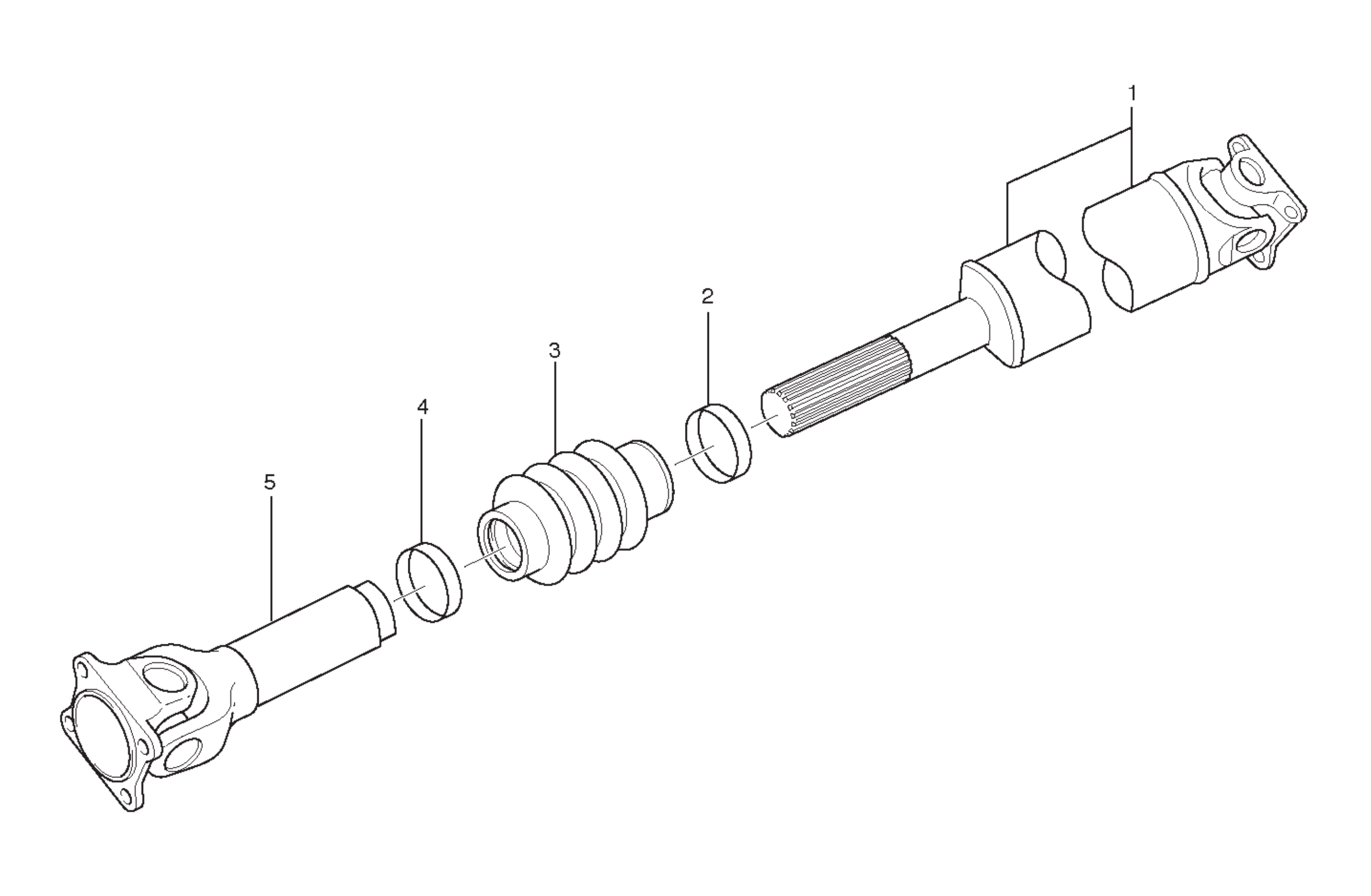
Never insert bar between yoke lugs when tightening or removing bolts.

Completely remove the dust or foreign matter from the connecting surface of flange coupling on each end of the propeller shaft.

1. Align the mark which is applied at removal.
2. Install rear propeller shaft and tighten the bolts to the specified torque.

Torque: 63 N·m(46 lb ft)

Slip Joint Disassembly (6VD1 Model Only)

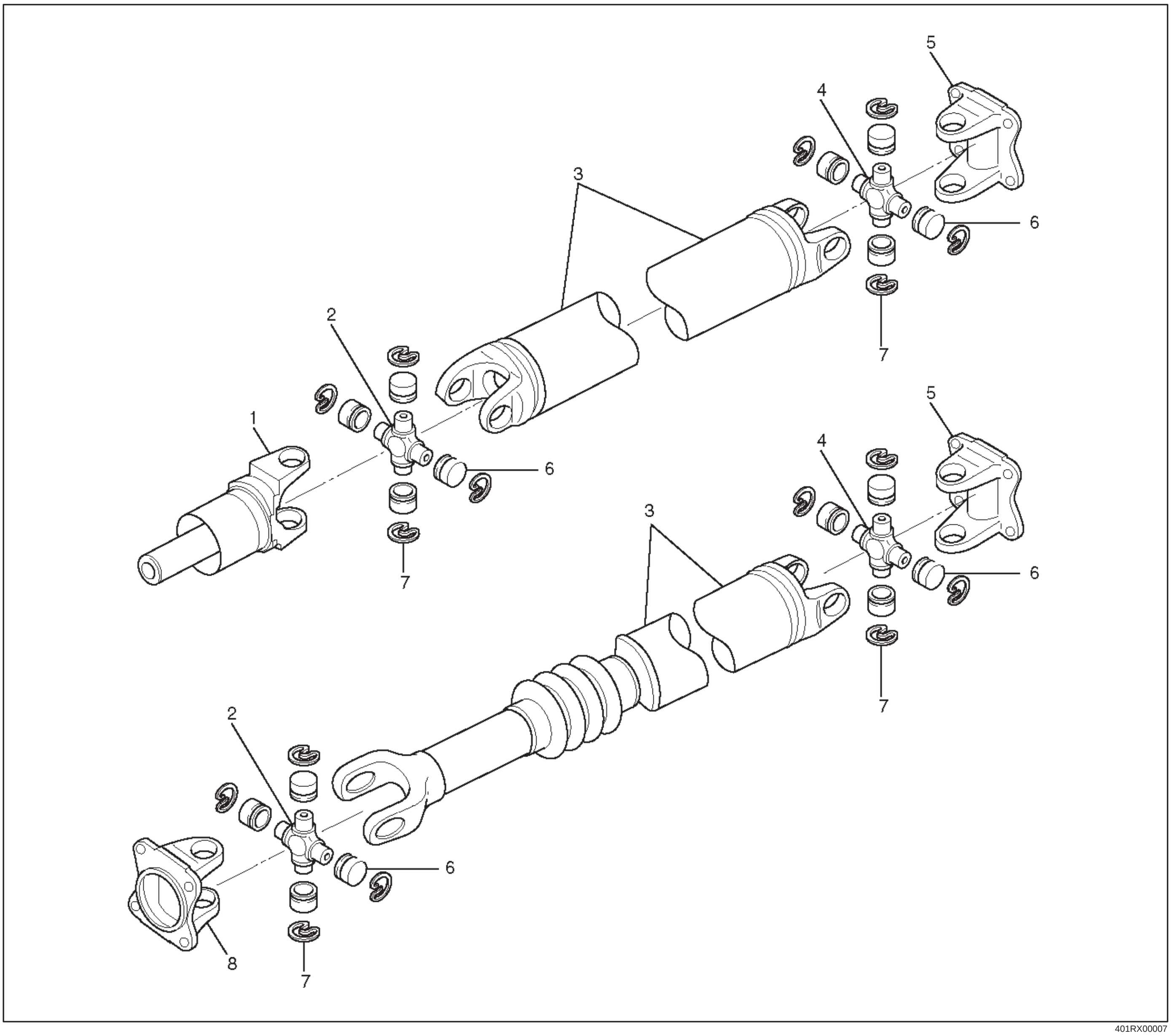


401RW081

Legend
(1) Spline Yoke and Universal Joint Assembly
(2) Clamp
(3) Boot
(4) Clamp
(5) Tube and Universal Joint Assembly

1. Lay the shaft horizontally on a bench and secure.
2. Indicate the original assembled position by marking the phasing of the shaft prior to disassembly.
3. Using the flat blade of a screwdriver, pry the loose end of the boot clamp upwards and away from the propeller shaft boot. Be careful not to damage the boot.
4. When boot clamps becomes loose, remove by hand.
5. Repeat for the other boot clamp.
6. Remove the spline yoke assembly from the tube assembly, by securing the boot with one hand and pulling on the spline yoke.
7. Remove the boot from the tube assembly.

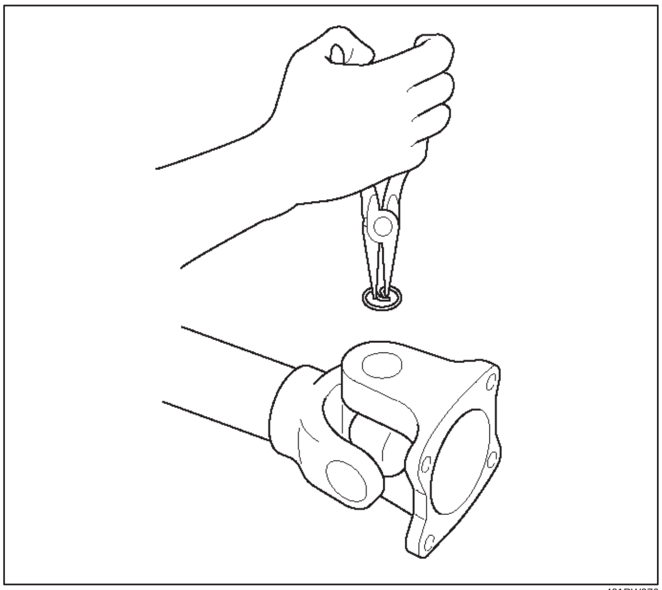
Universal Joint Disassembly



Legend

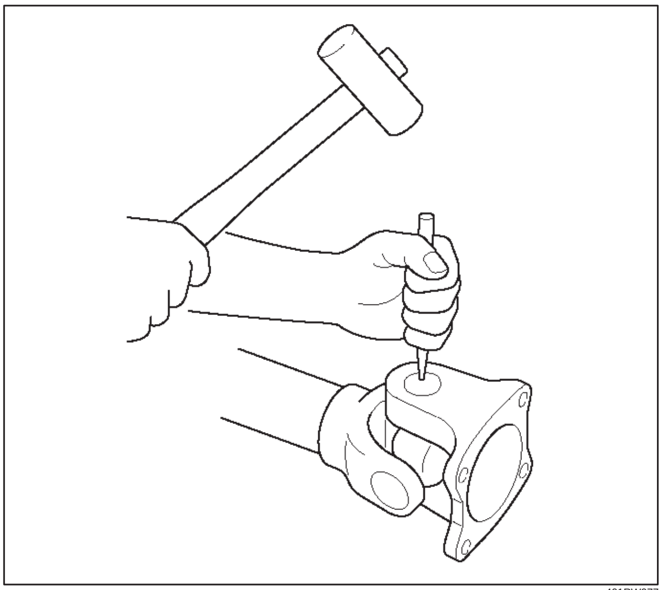
(1) Spline Yoke (X22SE 4×2 model)
(2) Spider
(3) Propeller Shaft Assembly
(4) Spider
(5) Flange Yoke
(6) Bearing
(7) Snap Ring
(8) Flange Yoke (6VD1 model)

1. Apply alignment marks on the yokes of the universal joint, then remove the snap ring.



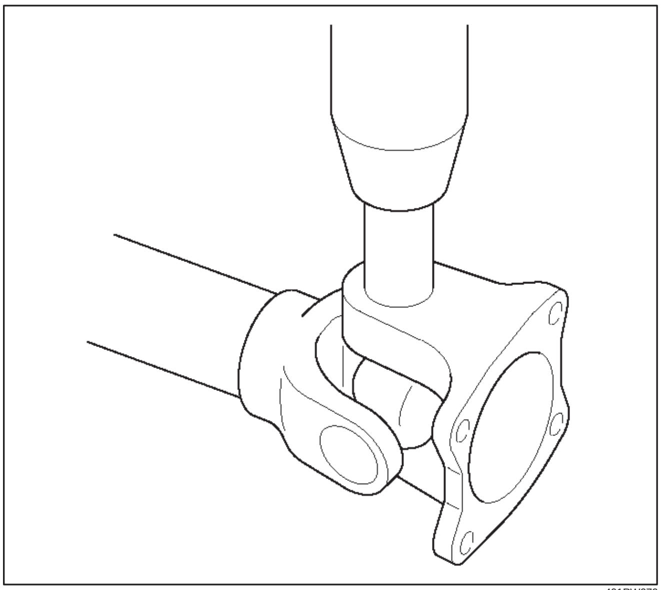
401RW076

If the snap ring is stuck in position, remove paint from the hole in the yoke or tap around the edge of the bearing lightly with a soft drift.



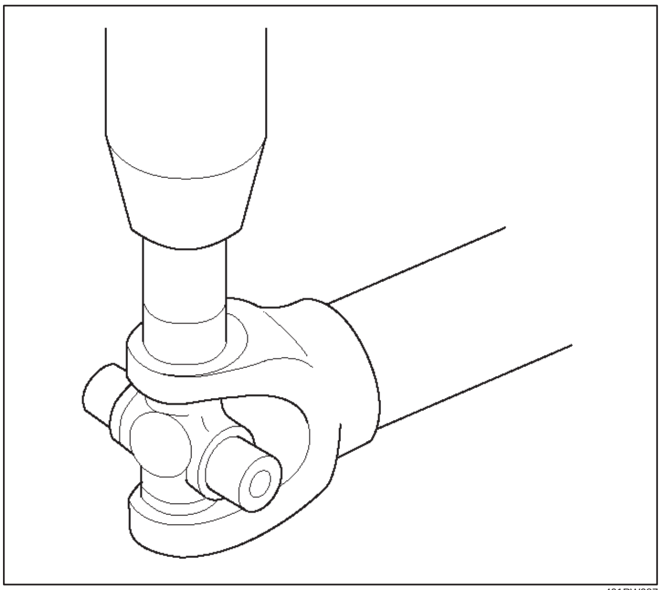
401RW077

2. Set the yoke in the arbor press with a piece of tube stock beneath it.
   Place a solid plug on the upper bearing and press it through to release the lower bearing.



401RW079

3. If the bearing will not pull out by hand after pressing, tap the base of the lug near the bearing to dislodge it.
4. To remove the opposite bearing, turn the yoke over and straighten the spider in the open spider hole. Then carefully press on the end of the spider so the remaining bearing moves straight out of the bearing spider hole. If the spider or bearing are cocked, the bearing will score the walls of the spider hole and ruin it.



401RW087

5. Repeat this procedure on the remaining bearing to remove the spider from the yoke.

Inspection

- Propeller shaft for runout.

Static runout limit : 0.13 mm(0.005 in)

TIR on the neck of the slip tube shaft (with a boot).

0.25 mm(0.010 in)

TIR on the ends of the tubing 3 inch from the welds.

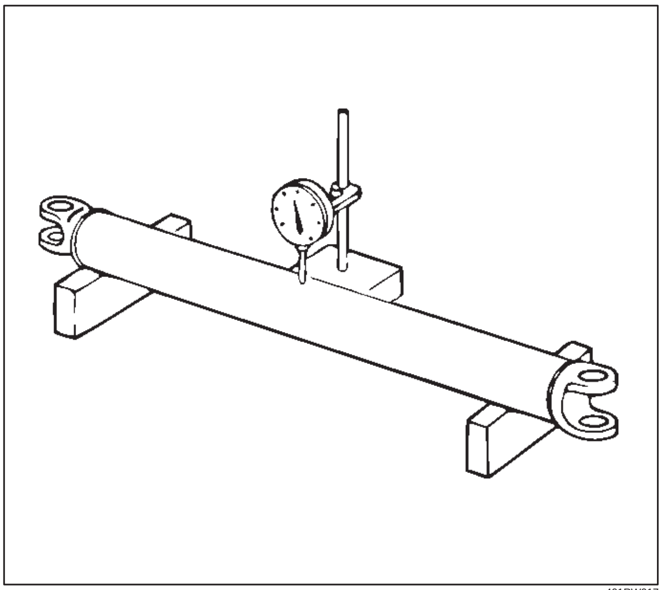
0.38 mm(0.015 in)

TIR at the linear center of the tube.

0.38 mm(0.015 in)

TIR for the full length of tube with 30” or less of tubing.

TIR: Total Indicator Reading)



401RW017

- Play in universal joint.

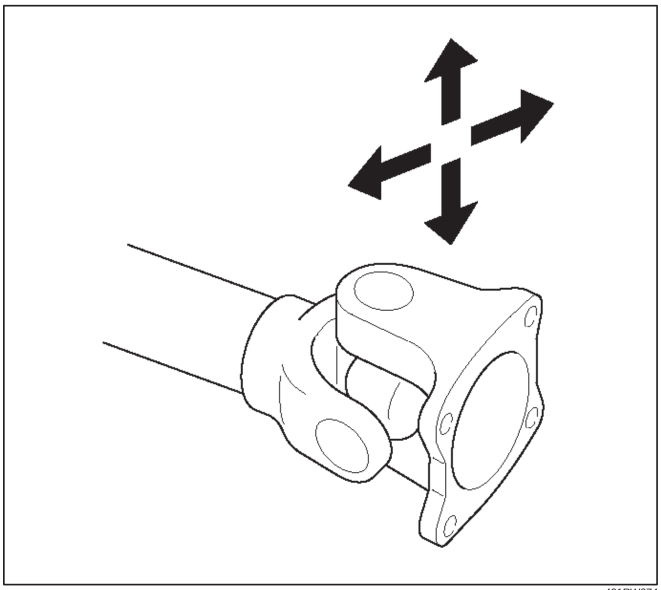
Limit: Less than 0.15 mm(0.006 in)

- Spider pin should be smooth and free from fretting or galling.
  Visible signs of needle presence is normal, but wear should not be felt.
- Inspect boot.
  Check the boot for crack or damage. If necessary, replace the boot.

  If abnormal condition are found on the boot, inspect the grease for mixing of foreign material.

  If the grease is good condition, and slip joint works well, replace the boot, rplenish grease, and reassemble the slip joint.

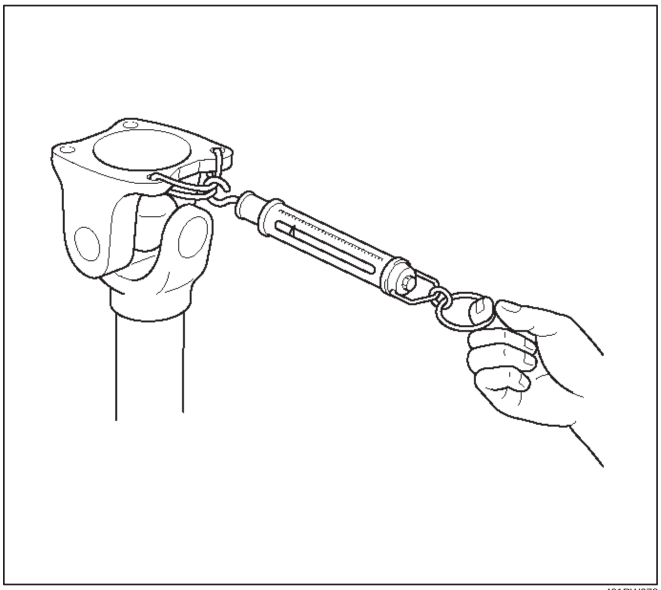
  If the foreign material is found in the grease, check the spline for wear and damage.



401RW074

- Preload of the universal joint.
  Preload should be 0 to 24.9 kg (0 to 11.3 lb).

  Joints should rotate smoothly and freely and should exhibit no rough or ratchety movement.



401RW078

- Inspect splines for wear.
  The nylon-coated spline should be free from nicks and dings and the underlying steel spline should not be visible.

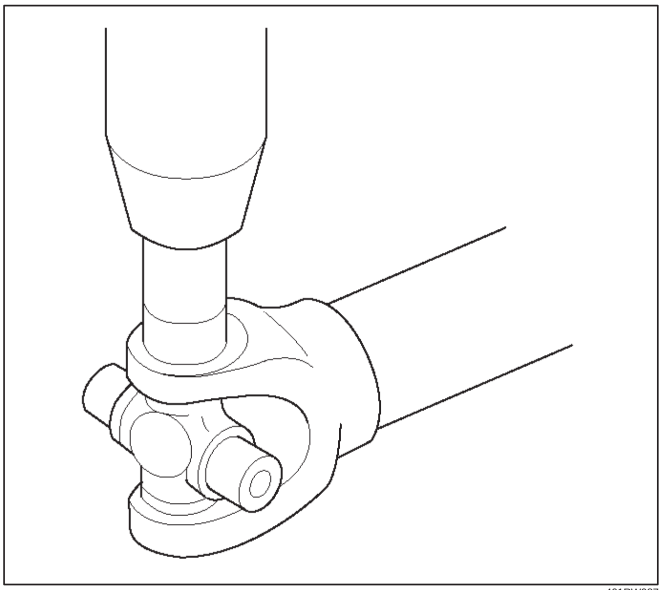
  After cleaning the nylon coating spline, the coating should exhibit only slight indicator of wear.

  Grease volume is approximately 10 grams of grease in total. Grease should be evenly applied to both the female and the male slip splines using a small brush. After assembly of the slip joint, the sliding joint should be fully worked from the full collapsed to the full extended position.

Universal Joint Reassembly

1. Pack the four grease cavities of the spider with a high quality, extreme pressure N.L.G.I. Grade 2 grease. Do not add additional grease to bearing cup assembly.
2. Move one end of the spider to cause a trunnion to project through the spider hole beyond the outer machined face of the yoke lug. Place a bearing over the trunnion diameter and align it to the spider hole.

   Using an arbor press, hold the trunnion in alignment with the spider hole and place a solid plug on the upper bearing. Press the bearing into the spider hole enough to install snap ring.



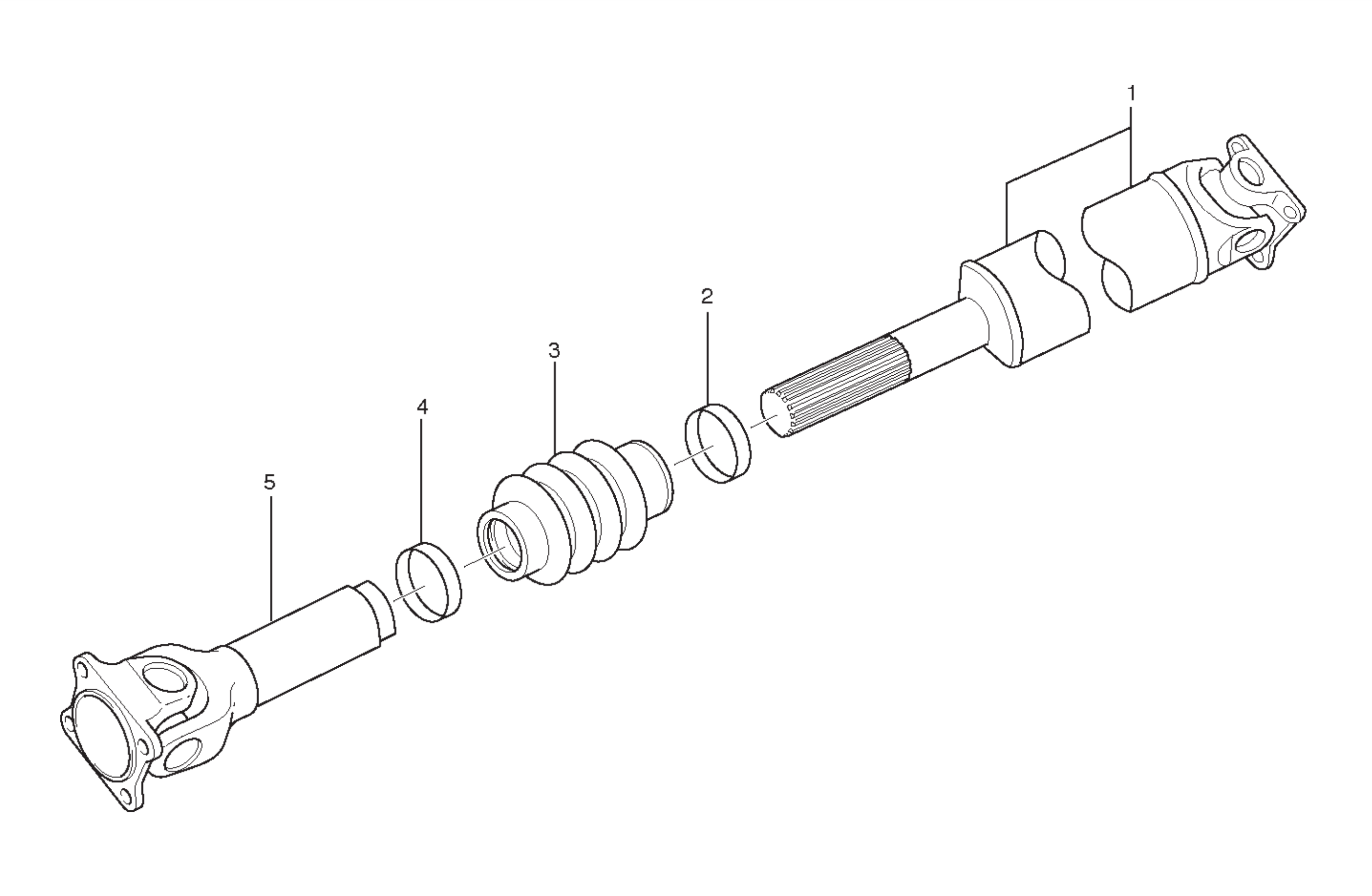
401RW087

3. Install a snap ring.

NOTE: Be sure the snap rings are properly seated in the grooves.

4. Repeat steps 2 and 3 to install the opposite bearing. If the joint is stiff, strike the yoke ears with a soft hammer to seat the bearing.
5. Align the setting marks and join the yokes.

Slip Joint Reassembly (6VD1 Model Only)



Legend

(1) Spline Yoke and Universal Joint Assembly
(2) Clamp
(3) Boot
(4) Clamp
(5) Tube and Universal Joint Assembly

1. Apply grease evenly to both the female and male splines.
2. Apply a small amount of grease by finger to the outer lips of the boot.
3. Slide the boot (smaller diameter side) onto the spline yoke shaft being careful not to damage the spline coating or boot.
4. Insert the spline yoke shaft into the tube assembly being careful to maintain proper phasing. The spider holes should be in line and as per originally marked prior to disassembly.
5. Position boot onto tube and yoke shaft in final position.
6. Attach boot clamps and secure using pliers.
7. Be sure clamp is properly seated and secure.

CAUTION: Use new clamp which is the same parts as original. Do not use other clamp to avoid bad balancing of shaft or the grease leakage.

Main Data and Specifications

General Specifications

	2WD Model		4WD Model	
Engine	X22SE	6VD1	6VD1	
Transmission	M/T	A/T	M/T	A/T
Type (See illustration)	1	2	2	2
Length (between two spiders center)	1076.4 mm (42.38 in)	1106 mm (43.54 in)	970.2 mm (38.20 in)	805 mm (31.69 in)
Universal joint type	Cardan type			

Torque Specifications